CRETE SEMICONDUCTORS

Power Bipolar Transistors

Data Handbook SC06
CD-ROM included
1999

PHILIPS

Let's make things better.

http://www.semiconductors.philips.com

QUALITY ASSURED

Our quality system focuses on the continuing high quality of our components and the best possible service for our customers. We have a three-sided quality strategy: we apply a system of total quality control and assurance; we operate customer-oriented dynamic improvement programmes; and we promote a partnering relationship with our customers and suppliers.

PRODUCT SAFETY

In striving for state-of-the-art perfection, we continuously improve components and processes with respect to environmental demands. Our components offer no hazard to the environment in normal use when operated or stored within the limits specified in the data sheet.

Some components unavoidably contain substances that, if exposed by accident or misuse, are potentially hazardous to health. Users of these components are informed of the danger by warning notices in the data sheets supporting the components. Where necessary the warning notices also indicate safety precautions to be taken and disposal instructions to be followed. Obviously users of these components, in general the set-making industry, assume responsibility towards the consumer with respect to safety matters and environmental demands.

All used or obsolete components should be disposed of according to the regulations applying at the disposal location. Depending on the location, electronic components are considered to be 'chemical', 'special' or sometimes 'industrial' waste. Disposal as domestic waste is usually not permitted.

Power Bipolar Transistors

CONTENTS

	Page
PREFACE	3
INDEX	5
SELECTION GUIDE	9
GENERAL	17
APPLICATION INFORMATION	39
DEVICE DATA (in alphanumeric sequence	41)
PACKAGE OUTLINES	753
LEADFORM OPTIONS	763
MOUNTING INSTRUCTIONS	767
DATA HANDBOOK SYSTEM	781

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

PREFACE

Dear Customer

We are pleased to introduce this new Philips Semiconductors data handbook SC06. This data book contains a complete overview of the Philips Semiconductors' product offering in high-voltage, npn power transistors for switching applications in CRT horizontal deflection and electronic lighting.

We would like to draw your attention to our new range of horizontal deflection transistors (BU45xx) and lighting transistors (BUJxxx), setting new standards for high performance and cost-effectiveness. These products represent Philips Semiconductors' continued commitment to innovation in products that meet the requirements of these essential applications.

For further information, visit our Internet site at http://www.semiconductors.philips.com

INDEX

Types added to the range since the last issue of Handbook SC06 are shown in bold print.

TYPE NUMBER	PAGE
BU505	42
BU505D	42
BU505F	47
BU505DF	47
BU506	54
BU506D	54
BU506F	59
BU506DF	59
BU508AF	65
BU508AW	70
BU508AX	74
BU508DF	79
BU508DW	84
BU508DX	89
BU1506DX	94
BU1507AX	99
BU1507DX	103
BU1508AX	107
BU1508DX	112
BU1706A	117
BU1706AB	122
BU1706AX	127
BU2506DF	132
BU2506DX	137
BU2507AF	142
BU2507AX	146
BU2507DF	150
BU2507DX	154
BU2508AF	158
BU2508AW	163
BU2508AX	168
BU2508DF	173
BU2508DW	178
BU2508DX	183
BU2515AF	188
BU2515AX	192
BU2515DF	196
BU2515DX	201

TYPE NUMBER	PAGE
BU2520AF	206
BU2520AW	212
BU2520AX	217
BU2520DF	223
BU2520DW	228
BU2520DX	232
BU2522AF	237
BU2522AW	242
BU2522AX	247
BU2522DF	252
BU2522DX	257
BU2523AF	262
BU2523AX	266
BU2523DF	270
BU2523DX	275
BU2525AF	280
BU2525AW	285
BU2525AX	290
BU2525DF	295
BU2525DW	300
BU2525DX	305
BU2527AF	310
BU2527AW	315
BU2527AX	320
BU2527DF	325
BU2527DX	330
BU2530AL	335
BU2530AW	339
BU2532AL	343
BU2532AW	347
BU2708AF	351
BU2708AX	356
BU2708DF	361
BU2708DX	366
BU2720AF	371
BU2720AX	376
BU2720DF	381
BU2720DX	386

TYPE NUMBER	PAGE
BU2722AF	391
BU2722AX	396
BU2725AF	401
BU2725AX	406
BU2725DF	411
BU2725DX	416
BU2727AF	421
BU2727AW	426
BU2727AX	431
BU4506AF	436
BU4506AX	438
BU4506AZ	440
BU4506DF	442
BU4506DX	444
BU4506DZ	446
BU4507AF	448
BU4507AX	453
BU4507AZ	458
BU4507DF	463
BU4507DX	465
BU4507DZ	467
BU4508AF	469
BU4508AX	474
BU4508AZ	479
BU4508DF	484
BU4508DX	486
BU4508DZ	488
BU4515AF	490
BU4515AX	492
BU4515DF	494
BU4515DX	496
BU4522AF	498
BU4522AX	503
BU4522DF	508
BU4522DX	510
BU4523AF	512
BU4523AW	517
BU4523AX	522

TYPE NUMBER	PAGE
BU4523DF	527
BU4523DW	529
BU4523DX	531
BU4525AF	533
BU4525AL	537
BU4525AW	539
BU4525AX	543
BU4525DF	547
BU4525DL	549
BU4525DW	551
BU4525DX	553
BU4530AL	555
BU4530AW	557
BU4540AL	559
BU4540AW	561
BU4550AL	563
BUJ101A	565
BUJ101AX	567
BUJ103A	569
BUJ103AX	574

TYPE NUMBER	PAGE
BUJ105A	579
BUJ105AX	583
BUJ106A	587
BUJ106AX	591
BUJ202A	595
BUJ202AX	597
BUJ204A	599
BUJ204AX	604
BUJ205A	609
BUJ205AX	611
BUJ301A	613
BUJ301AX	615
BUJ303A	617
BUJ303AX	622
BUJ304A	627
BUJ304AX	629
BUJ403A	633
BUJ403AX	638
BUT11	643
BUT11A	643

TYPE NUMBER	PAGE
BUT11AF	650
BUT11AI	656
BUT11AX	658
BUT11APX	664
BUT11F	670
BUT12A	676
BUT12AI	684
BUT18A	689
BUT18AF	689
BUT211	702
BUW11AF	707
BUW13F	714
BUW85	723
BUX84	731
BUX85	731
BUX85F	739
BUX86P	744
BUX87P	744
PHE13005	748

SELECTION GUIDES

	Page
Selection guide	10
Internet WWW home page	14
Philips Fax-on-Demand System	15

HORIZONTAL DEFLECTION TRANSISTORS

V_{CESM} (V)	I_C (DC) (A)	I_C sat. (A)	t_f max. (µs)	LEADED PACKAGES								TYPICAL APPLICATIONS
				SOT82	SOT78 (TO220AB)	SOT186	SOT186A (isolated TO220AB)	SOT199	SOT399 (TOP3D)	SOT429 (TO247)	SOT430 (TOP3L)	
1500	2.5	2	0.9		BU505 BU505D	BU505F BU505DF						TV1/TV2
1500	5	3	0.5				BU1506DX	BU2506DF	BU2506DX			TV2
1500	5	3	0.7		BU506 BU506D	BU506F BU506DF						TV1/TV2
1500	8	4	0.5				BU1507AX BU1507DX	BU2507AF BU2507DF	BU2507AX BU2507DX			TV2
1500	8	4.5	0.6				BU1508AX BU1508DX	BU2508AF BU2508DF	BU2508AX BU2508DX	BU2508AW BU2508DW		TV2/Monitor1
1500	8	4.5	1					BU508AF BU508DF	BU508AX BU508DX	BU508AW BU508DW		TV2
1500	9	4.5	0.4					BU2515AF BU2515DF	BU2515AX BU2515DX			TV2/Monitor3
1500	10	6	0.25					BU2522AF BU2522DF	BU2522AX BU2522DX	BU2522AW		TV2/Monitor4
1500	10	6	0.5					BU2520AF BU2520DF	BU2520AX BU2520DX	BU2520AW BU2520DW		TV2/Monitor3
1500	11	5.5	0.3					BU2523AF BU2523DF	BU2523AX BU2523DX			TV2/Monitor5
1500	12	6	0.2					BU2527AF BU2527DF	BU2527AX BU2527DX	BU2527AW BU2527DW		Monitor6
1500	12	8	0.35					BU2525AF BU2525DF	BU2525AX BU2525DX	BU2525AW BU2525DW		TV2/Monitor5
1500	16	7	0.1							BU2532AW	BU2532AL	TV3/Monitor6
1500	16	9	0.25							BU2530AW	BU2530AL	TV3/Monitor6
1700	8	4	0.52					BU2708AF BU2708DF	BU2708AX BU2708DX			TV2
1700	10	4.5	0.25					BU2722AF	BU2722AX			TV2

V_{CESM} (V)	I_C (DC) (A)	I_C sat. (A)	t_f max. (µs)	LEADED PACKAGES								TYPICAL APPLICATIONS
				SOT82	SOT78 (TO220AB)	SOT186	SOT186A (isolated TO220AB)	SOT199	SOT399 (TOP3D)	SOT429 (TO247)	SOT430 (TOP3L)	
1700	10	5.5	0.9					BU2720AF BU2720DF	BU2720AX BU2720DX			TV2
1700	12	5	0.25					BU2727AF	BU2727AX	BU2727AW		Monitor4
1700	12	7	0.8					BU2725AF BU2725DF	BU2725AX BU2725DX			TV2

NEW RANGE OF BU45XX HORIZONTAL DEFLECTION TRANSISTORS

V_{CESM} (V)	I_C (DC) (A)	I_C sat. (A)	t_f max. (µs)	LEADED PACKAGES								TYPICAL APPLICATIONS
				SOT82	SOT78 (TO220AB)	SOT186	SOT186A (isolated TO220AB)	SOT199	SOT399 (TOP3D)	SOT429 (TO247)	SOT430 (TOP3L)	
1500	5	3	0.5				BU4506AZ	BU4506AF	BU4506AX			TV2
1500	8	4	0.45				BU4507AZ	BU4507AF	BU4507AX			TV2/Monitor1
1500	8	5	0.48				BU4508AZ	BU4508AF	BU4508AX			TV2/Monitor1
1500	9	6	0.5					BU4515AF	BU4515AX			TV2/Monitor2
1500	10	7	0.4					BU4522AF	BU4522AX			TV2/Monitor3
1500	11	8	0.4					BU4523AF	BU4523AX	BU4523AW		TV2/Monitor5
1500	12	9	0.55					BU4525AF	BU4525AX			TV2
1500	14	9	0.55							BU4525AW	BU4525AL	Monitor5
1500	16	10	0.4							BU4530AW	BU4530AL	TV3/Monitor6
1500	20	8	0.1							BU4540AW	BU4540AL	TV3/Monitor7
1500	25	8	0.1								BU4550AL	TV3/Monitor7

LIGHTING TRANSISTORS

V_{CESM} (V)	I_C (DC) (A)	I_C sat. (A)	t_f max. (µs)	LEADED PACKAGES								SURFACE MOUNT	TYPICAL APPS.
				SOT82	SOT78 (TO220AB)	SOT186	SOT186A (isolated TO220AB)	SOT199	SOT399 (TOP3D)	SOT429 (TO247)	SOT430 (TOP3L)	SOT404 (D^2-PAK)	
700	1	0.5	0.15		BUJ101A		BUJ101AX						L1/L2
700	4	2	0.15		BUJ103A		BUJ103AX						L1/L2
700	4	2	0.2		PHE13005								L1/L2
700	6	4	0.2		BUJ105A		BUJ105AX						L1
700	8	6	0.2		BUJ106A		BUJ106AX						L1
800	0.5	–	0.28	BUX86P									L1
800	2	1	0.4		BUX84								L1
850	2	1	0.2		BUJ202A		BUJ202AX						L1
850	4	2	0.15		BUJ204A		BUJ204AX						L1
850	5	3	0.1		BUT211								L1
850	5	3	0.8		BUT11	BUT11F							L1
850	6	4	0.2		BUJ205A		BUJ205AX						L1
850	8	6	0.8			BUT12F							L1
850	15	10	0.8					BUW13F					L1
1000	0.5	–	0.28	BUX87P									L1
1000	0.5	0.2	0.16		BUJ301A		BUJ301AX						L1
1000	2	1	0.4	BUW85	BUX85	BUX85F							L1
1000	5	2.5	0.15		BUT11A1		BUT11AX						L1
1000	5	2.5	0.8		BUT11A	BUT11AF		BUW11AF					L1
1000	5	3	0.15		BUJ303A		BUJ303AX						L1
1000	5	3.5	0.16				BUT11APX						TV2
1000	6	4	0.2		BUJ304A		BUJ304AX						L1
1000	6	4	0.8		BUT18A	BUT18AF							L1
1000	8	5	0.3		BUT12AI								L1
1000	8	5	0.8		BUT12A	BUT12AF							L1
1200	6	3	0.3		BUJ403A		BUJ403AX						L1
1750	5	1.5	0.6		BU1706A		BU1706AX					BU1706AB	L1

Key to Typical Applications column[1]

TV1	monochrome TV	Monitor4	15" - 17" monitor
TV2	colour TV	Monitor5	17" monitor
TV3	high definition TV (HDTV)	Monitor6	17" - 19" monitor
Monitor1	14" monitor	Monitor7	19" - 21" monitor
Monitor2	14" - 15" monitor	L1	HF electronic ballast
Monitor3	15" monitor	L2	compact fluorescent lamp (CFL)

1. Many of these products can also be used for other applications.

Internet World Wide Web Home Page

WHAT IS IT?

Welcome to our place in cyberspace.

Explore our Web pages and take a look at our product offering of advance High-performance Applications and Products.

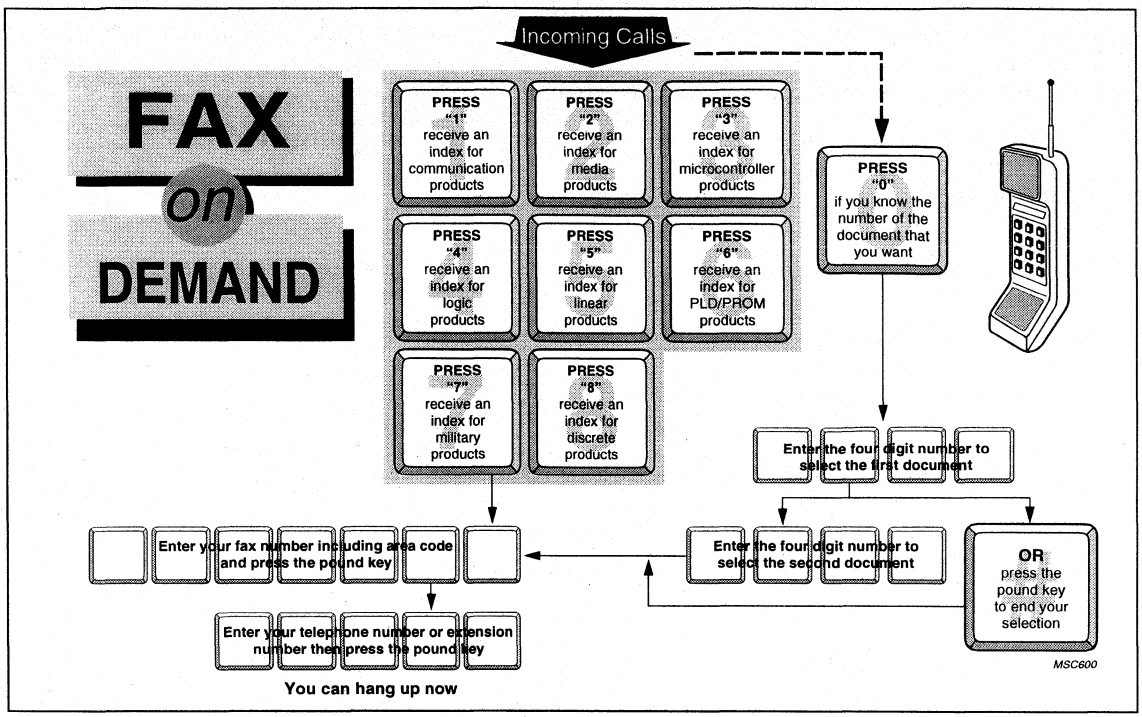
In addition, we offer you the latest information on Products, News, Support, Employment and Offices.

HOW TO REACH US

For access to the Philips Semiconductors Home Page go to the World Wide Web location:

http://www.semiconductors.philips.com/

FAX-on-DEMAND System



WHAT IS IT?

The FAX-on-DEMAND system is a computer facsimile system that allows customers to receive selected documents by fax automatically.

HOW DOES IT WORK?

To order a document, you simply enter the document number. This number can be obtained by asking for an index of available documents to be faxed to you the first time you call the system.

Our system has a selection of the latest product data sheets from Philips with varying page counts. As you know, it takes approximately one minute to FAX one page. This isn't bad if the number of pages is less than 10. But if the document is 37 pages long, be ready for a long transmission!

Philips Semiconductors also maintains product information on the World-Wide-Web. Our home page can be located at:

http://www.semiconductors.philips.com

WHO DO I CONTACT IF I HAVE A QUESTION ABOUT FAX-ON-DEMAND?

Contact your local Philips sales office.

FAX-ON-DEMAND PHONE NUMBERS

United Kingdom, Ireland	44-181-730-5020
France	33-1-40-996060
Italy	39-167-295502
North America	1-800-282-2000

LOCATIONS SOON TO BE IN OPERATION

- Hong Kong
- Japan
- The Netherlands.

GENERAL

	page
Quality	18
Pro electron type numbering system	19
Rating systems	23
Letter symbols	24
Transistor ratings	27
Transistor safe operating area (SOAR)	30

TOTAL QUALITY MANAGEMENT

Philips Semiconductors is a Quality Company, renowned for the high quality of our products and service. We keep alive this tradition by constantly aiming towards one ultimate standard, that of zero defects. This aim is guided by our Total Quality Management (TQM) system, the basis of which is described in the following paragraphs.

Quality assurance

Based on ISO 9000 standards, customer standards such as Ford TQE and IBM MDQ. Our factories are certified to ISO 9000 by external inspectorates.

Partnerships with customers

PPM co-operations, design-in agreements, ship-to-stock, just-in-time and self-qualification programmes, and application support.

Partnerships with suppliers

Ship-to-stock, statistical process control and ISO 9000 audits.

Quality improvement programme

Continuous process and system improvement, design improvement, complete use of statistical process control, realization of our final objective of zero defects, and logistics improvement by ship-to-stock and just-in-time agreements.

ADVANCED QUALITY PLANNING

During the design and development of new products and processes, quality is built-in by advanced quality planning. Through failure-mode-and-effect analysis the critical parameters are detected and measures taken to ensure good performance on these parameters. The capability of process steps is also planned in this phase.

PRODUCT CONFORMANCE

The assurance of product conformance is an integral part of our quality assurance (QA) practice. This is achieved by:

- Incoming material management through partnerships with suppliers.
- In-line quality assurance to monitor process reproducibility during manufacture and initiate any necessary corrective action. Critical process steps are 100% under statistical process control.
- Acceptance tests on finished products to verify conformance with the device specification. The test results are used for quality feedback and corrective actions. The inspection and test requirements are detailed in the general quality specifications.
- Periodic inspections to monitor and measure the conformance of products.

PRODUCT RELIABILITY

With the increasing complexity of Original Equipment Manufacturer (OEM) equipment, component reliability must be extremely high. Our research laboratories and development departments study the failure mechanisms of semiconductors. Their studies result in design rules and process optimization for the highest built-in product reliability. Highly accelerated tests are applied to the products reliability evaluation. Rejects from reliability tests and from customer complaints are submitted to failure analysis, to result in corrective action.

CUSTOMER RESPONSES

Our quality improvement depends on joint action with our customer. We need our customer's inputs and we invite constructive comments on all aspects of our performance. Please contact our local sales representative.

RECOGNITION

The high quality of our products and services is demonstrated by many Quality Awards granted by major customers and international organizations.

DISCRETE SEMICONDUCTORS

Basic type number

This type designation code applies to discrete semiconductor devices (not integrated circuits), multiples of such devices, semiconductor chips and Darlington transistors.

FIRST LETTER

The first letter gives information about the material for the active part of the device.

A Germanium or other material with a band gap of 0.6 to 1 eV

B Silicon or other material with a band gap of 1 to 1.3 eV

C Gallium arsenide (GaAs) or other material with a band gap of 1.3 eV or more

R Compound materials, e.g. cadmium sulphide.

SECOND LETTER

The second letter indicates the function for which the device is primarily designed. The same letter can be used for multi-chip devices with similar elements.

In the following list low power types are defined by $R_{th\ j\text{-}mb} > 15$ K/W and power types by $R_{th\ j\text{-}mb} \leq 15$ K/W.

A Diode; signal, low power

B Diode; variable capacitance

C Transistor; low power, audio frequency

D Transistor; power, audio frequency

E Diode; tunnel

F Transistor; low power, high frequency

G multiple of dissimilar devices/miscellaneous devices; e.g. oscillators. Also with special third letter, see under "Serial number/special third letter"

H Diode; magnetic sensitive

L Transistor; power, high frequency

N Photocoupler

P Radiation detector; e.g. high sensitivity photo-transistor; with special third letter

Q Radiation generator; e.g. LED, laser; with special third letter

R Control or switching device; e.g. thyristor, low power; with special third letter

S Transistor; low power, switching

T Control and switching device; e.g. thyristor, power; with special third letter

U Transistor; power, switching

W Surface acoustic wave device

X Diode; multiplier, e.g. varactor, step recovery

Y Diode; rectifying, booster

Z Diode; voltage reference or regulator, transient suppressor diode; with special third letter.

SERIAL NUMBER/SPECIAL THIRD LETTER

The number comprises three figures running from 100 to 999 for devices primarily intended for consumer equipment, or one letter (Z, Y, X, etc.) and two figures running from 10 to 99 for devices primarily intended for industrial or professional equipment.(1) The letter has no fixed meaning, except in the following cases:

A For triacs, after second letter 'R' or 'T'

F For emitters and receivers in fibre-optic communication, after second letter 'G', 'P' or 'Q'. When the second letter is 'G', the first letter should be defined in accordance with the material of the main optical device.

L For lasers in non-fibre-optic applications, after second letter 'G' or 'Q'. When the second letter is 'G', the first letter should be defined in accordance with the material of the main optical device.

O For opto-triacs, after second letter 'R'

T For 3-state bicolour LEDs, after second letter 'Q'

W For transient voltage suppressor diodes, after second letter 'Z'.

EXAMPLES OF BASIC TYPE NUMBERS

AA112	Germanium, low power signal diode (consumer type)
ACY32	Germanium, low power AF transistor (industrial type)
BD232	Silicon, power AF transistor (consumer type)
CQY17	GaAs, light-emitting diode (industrial type)
RPY84	CdS, photo-conductive cell (industrial type).

Version letter(s)

One or two letters may be added to the basic type number to indicate minor electrical or mechanical variants of the basic type. The letters never have a fixed meaning, except that the letter 'R' indicates reverse polarity and the letter 'W' indicates a surface mounted device (SMD).

(1) When the supply of these serial numbers is exhausted, the serial number may be expanded to three figures for industrial types and four figures for consumer types.

Suffix

Sub-classification can be used for devices supplied in a wide range of variants, called associated types. The following sub-coding suffixes are in use:

VOLTAGE REFERENCE AND VOLTAGE REGULATOR DIODES

One letter and one number, preceded by a hyphen (-). The letter, if required, indicates the nominal tolerance of the Zener voltage.

A 1%

B 2%

C 5%

D 10%

E 20%.

In the case of a 3% tolerance, the letter 'F' is used.

The number denotes the typical operating (Zener) voltage, related to the nominal current rating for the entire range. The letter 'V' is used in place of the decimal point.

Example: BZY74-C6V3 or -C10.

TRANSIENT VOLTAGE SUPPRESSOR DIODES

One number, preceded by a hyphen (-). The number indicates the maximum recommended continuous reversed (stand-off) voltage, V_R. The letter 'V' is used in place of the decimal point.

Example: BZW70-9V1 or –39.

The letter 'B' may be used immediately after the last number, to indicate a bidirectional suppressor diode.

Example: BZW10-15B.

CONVENTIONAL AND CONTROLLED AVALANCHE RECTIFIER DIODES AND THYRISTORS

One number, preceded by a hyphen (-). The number indicates the rated maximum repetitive peak reverse voltage, V_{RRM}, or the rated repetitive peak off-state voltage, V_{DRM}, whichever is the lower. Reversed polarity with respect to the case is indicated by the letter 'R' immediately after the number.

Example: BYT-100 or -100R.

RADIATION DETECTORS

One number, preceded by a hyphen (-). The number indicates the depletion layer in micrometres (μm). The resolution is indicated by a version letter.

Example: BPX10-2A.

ARRAY OF RADIATION DETECTORS AND GENERATORS

One number, preceded by a hyphen (-). The number indicates the number of basic devices assembled into the array.

Examples: BPW50-6, BPW50-9, BPW50-12.

HIGH FREQUENCY POWER TRANSISTORS

One number, preceded by a hyphen (-). The number indicates the supply voltage.

Example: BLU80-24.

INTEGRATED CIRCUITS

Basic type number

This type designation code applies to semiconductor monolithic, semiconductor multi-chip, thin film, thick film and hybrid integrated circuits. The basic type number comprises three letters followed by a serial number.

FIRST AND SECOND LETTERS

Digital family circuits

The first two letters identify the family.(1)

Solitary circuits

The first letter divides solitary circuits into:

S Solitary digital circuits

T Analog circuits

U Mixed analog/digital circuits.

The second letter is a serial letter without any further significance except 'H' which stands for hybrid circuits.(2)

Microprocessors

The first two letters identify microprocessors and related circuits:

MA Microcomputer or central processing unit

MB Slice processor (functional slice of microprocessor)

(1) A logic family is an assembly of digital circuits designed to be interconnected and defined by its base electrical characteristics, such as supply voltage, power consumption, propagation delay, noise immunity.

(2) The first letter 'S' should be used for all solitary memories, to which, in the event of hybrids, the second letter 'H' should be added, for example, SH for bubble memories.

MD Related memories

ME Other related circuits such as interfaces, clocks, peripheral controllers, etc.

Charge-transfer devices and switched capacitors

The first two letters identify:

NH Hybrid circuits

NL Logic circuits

NM Memories

NS Analog signal processing using switched capacitors

NT Analog signal processing using charge-transfer devices

NX Imaging devices

NY Other related circuits.

THIRD LETTER

The third letter indicates the operating ambient temperature range:

A temperature range not specified below

B 0 to + 70 °C

C –55 to +125 °C

D –25 to + 70 °C

E –25 to + 85 °C

F –40 to + 85 °C

G –55 to + 85 °C.

If a device has another temperature range, the letter 'A' or a letter indicating a narrower temperature may be used, for example, the range of 0 to +75 °C can be indicated by 'A' or 'B'. Should two devices with the same basic type number both have temperature ranges other than those specified, one would use the letter 'A' and the other the letter 'X'.

Serial number

This may be a four-digit number assigned by Pro Electron, or the serial number (which may be a combination of figures and letters) of an existing company type designation of the manufacturer.

Version letter

A single version letter may be added to the basic type number. This indicates a minor variant of the basic type or the package. The version letter has no fixed meaning except for 'Z' which means customized wiring. The following letters are recommended for package variants:

C Cylindrical

D Ceramic dual in-line (CERDIL, CERDIP)

F Flat pack (two leads)

G Flat pack (four leads)

H Quad flat pack (QFP)

L Chip on tape (foil)

P Plastic dual in-line (DIL)

Q Quad in-line (QUIL)

T Mini pack (SOL, SO, VSO)

U Uncased chip.

Two-letter suffix

A two-letter suffix may be used instead of a single package version letter to give more information. To avoid confusion with serial numbers that end with a letter, a hyphen should precede the suffix.

FIRST LETTER (GENERAL SHAPE)

C Cylindrical

D Dual in-line (DIL)

E Power DIL (with external heatsink)

F Flat pack (leads on two sides)

G Flat pack (leads on four sides)

H Quad flat pack (QFP)

K Diamond (TO-3 family)

M Multiple in-line (except dual, triple and quad)

Q Quad in-line (QUIL)

R Power QUIL (with external heatsink)

S Single in-line (SIL)

T Triple in-line

W Leaded chip carrier (LCC)

X Leadless chip carrier (LLCC)

Y Pin grid array (PGA).

SECOND LETTER (MATERIAL)

C Metal-ceramic

G Glass-ceramic

M Metal

P Plastic.

Examples

PCF1105WP: digital IC; PC family; operating temperature range −40 to +85 °C; serial number 1105; plastic leaded chip carrier.

GMB74LS00A-DC: digital IC; GM family; operating temperature range 0 to +70 °C; company number 74LS00A; ceramic DIL package.

TDA1000P: analog IC; operating temperature range non-standard; serial number 1000; plastic DIL package.

SAC2000: solitary digital circuit; operating temperature range −55 to +125 °C; serial number 2000.

RATING SYSTEMS

The rating systems described are those recommended by the IEC in its publication number 134.

Definitions of terms used

CHARACTERISTIC

A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

RATING

A value that establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms. Limiting conditions may be either maxima or minima.

RATING SYSTEM

The set of principles upon which ratings are established and which determine their interpretation. The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

Absolute maximum rating system

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type, as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout the life of the device, no absolute maximum value for the intended service is exceeded with any device, under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

Design maximum rating system

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout the life of the device, no design maximum value for the intended service is exceeded with a bogey electronic device, under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

Design centre rating system

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS

The letter symbols for transistors and signal diodes detailed in this section are based on IEC publication number 148.

Letter symbols for currents, voltages and powers

BASIC LETTERS

I, i current

V, v voltage

P, p power.

Upper-case letter symbols are used to represent all values except instantaneous values that vary with time, these are represented by lower-case letters.

SUBSCRIPTS

A, a	anode terminal
(AV), (av)	average value
B, b	base terminal
C, c	collector terminal
D, d	drain terminal
E, e	emitter terminal
F, f	forward
G, g	gate terminal
K, k	cathode terminal
M, m	peak value
O, o	as third subscript: the terminal not mentioned is open-circuit
R, r	as first subscript: reverse. As second subscript: repetitive. As third subscript: with a specified resistance between the terminal not mentioned and the reference terminal
(RMS), (rms)	root-mean-square value
S, s	as first or second subscript: source terminal (FETs only). As second subscript: non-repetitive (not FETs). As third subscript: short circuit between the terminal not mentioned and the reference terminal.
X, x	specified circuit
Z, z	replaces R to indicate the actual working voltage, current or power of voltage reference and voltage reference diodes.

No additional subscript is used for DC values.

Upper-case subscripts are used for the indication of:

- Continuous (DC) values (without signal), e.g. I_B
- Instantaneous total values, e.g. i_B
- Average total values, e.g. $I_{B(AV)}$
- Peak total values, e.g. I_{BM}
- Root-mean-square total values, e.g. $I_{B(RMS)}$.

Lower-case subscripts are used for the indication of values applying to the varying component alone:

- Instantaneous values, e.g. i_b
- Root-mean-square values, e.g. $I_{b(rms)}$
- Peak values, e.g. I_{bm}
- Average values, e.g. $I_{b(av)}$.

If more than one subscript is used, the subscript for which both styles exist are either all upper-case or all lower-case.

ADDITIONAL RULES FOR SUBSCRIPTS

Transistor currents

If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}.

Diode currents

To indicate a forward current (conventional current flow into the anode terminal), the subscript F or f should be used. For a reverse current (conventional current flow out of the anode terminal), the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$.

Transistor voltages

If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}.

Diode voltages

To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used. For a reverse voltage (anode negative with respect to cathode), the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}.

Supply voltages or currents

Supply voltages or supply currents are indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}.

If it is necessary to indicate a reference terminal, this should be done by a third subscript.

Example: V_{CCE}.

Subscripts for devices with more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal, followed by a number. In the case of multiple subscripts, hyphens may be necessary to avoid confusion.

Examples:

I_{B2} continuous (DC) current flowing into the second base terminal

$V_{B2\text{-}E}$ continuous (DC) voltage between the terminals of second base and emitter terminals.

Subscripts for multiple devices

For multiple unit devices, the subscripts are modified by a number preceding the letter subscript. In the case of multiple subscripts, hyphens may be necessary to avoid confusion.

Examples:

I_{2C} continuous (DC) current flowing into the collector terminal of the second unit

$V_{1C\text{-}2C}$ continuous (DC) voltage between the collector terminals of the first and second units.

Application of the rules

Fig.1 represents a transistor collector current as a function of time. It comprises a continuous (DC) current and a varying component.

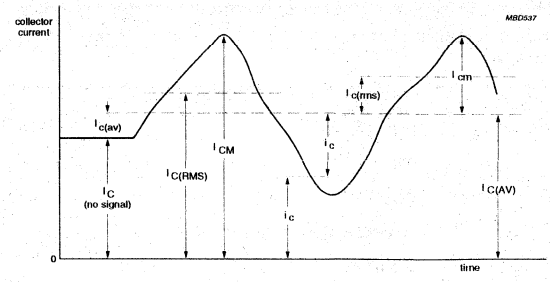


Fig.1 Collector current as a function of time.

Letter symbols for electrical parameters

DEFINITION

For the purpose of this publication, the term 'electrical parameter' applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

BASIC LETTERS

The following list comprises the most important basic letters used for electrical parameters of semiconductor devices.

B, b susceptance (imaginary part of an admittance)

C capacitance

G, g conductance (real part of an admittance)

H, h hybrid parameter

L inductance

R, r resistance (real part of an impedance)

X, x reactance (imaginary part of an impedance)

Y, y admittance

Z, z impedance.

Upper-case letters are used for the representation of:

- Electrical parameters of external circuits and of circuits in which the device forms only a part
- All inductances and capacitances.

Lower-case letters are used for the representation of electrical parameters inherent in the device, with the exception of inductances and capacitances.

SUBSCRIPTS

General subscripts

The following list comprises the most important general subscripts used for electrical parameters of semiconductor devices.

F, f	forward (forward transfer)
I, i (or 1)	input
L, l	load
O, o (or 2)	output
R, r	reverse (reverse transfer)
S, s	source.

Examples: Z_s, h_f, h_F.

The upper-case variant of a subscript is used for the designation of static (DC) values.

Examples:

h_{FE}	static value of forward current transfer ratio in common-emitter configuration (DC current gain)
R_E	DC value of the external emitter resistance.

The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript is used for the designation of small-signal values.

Examples:

h_{fe}	small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration
$Z_e = R_e + jX_e$	small-signal value of the external impedance.

If more than one subscript is used, subscripts for which both styles exist are either all upper-case or all lower-case.

Examples: h_{FE}, y_{RE}, h_{fe}.

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer.

Examples: h_i (or h_{11}), h_o (or h_{22}), h_f (or h_{21}), h_r (or h_{12}).

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E}).

DISTINCTION BETWEEN REAL AND IMAGINARY PARTS

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

Examples: $Z_i = R_i + jX_i$, $y_{fe} = g_{fe} + jb_{fe}$.

If such symbols do not exist, or if they are not suitable, the following notation is used:

Examples:

Re (h_{ib}) etc. for the real part of h_{ib}

Im (h_{ib}) etc. for the imaginary part of h_{ib}.

TRANSISTOR RATINGS

Voltage ratings

COLLECTOR TO BASE

V_{CBmax} The maximum permissible instantaneous voltage between collector and base terminals. The collector voltage is negative with respect to base in pnp transistors and positive with respect to base in npn types.

V_{CBmax} ($I_E = 0$) The maximum permissible instantaneous voltage between collector and base terminals when the emitter terminal is open-circuit.

EMITTER TO BASE

V_{EBmax} The maximum permissible instantaneous voltage between emitter and base terminals. The emitter voltage is negative with respect to base in pnp transistors and positive with respect to base in npn types.

V_{EBmax} ($I_C = 0$) The maximum permissible instantaneous voltage between emitter and base terminals when the collector terminal is open-circuit.

COLLECTOR TO EMITTER

V_{CEmax} The maximum permissible instantaneous voltage between collector and emitter terminals. The collector voltage is negative with respect to emitter in pnp transistors and positive with respect to emitter in npn types. This rating is very dependent on circuit conditions and collector current, and it is necessary to refer to the curve of V_{CE} versus I_C for the appropriate circuit condition in order to obtain the correct rating.

V_{CEmax} (Cut-off) The maximum permissible instantaneous voltage between collector and emitter terminals when the emitter current is reduced to zero by means of a reverse emitter base voltage, i.e. the base voltage is normally positive with respect to emitter for pnp transistors and negative with respect to emitter for npn types. The term '(Cut-off)' is sometimes replaced by $V_{BE} > x$ V, or $R_B/R_E \leq y$, which are equivalent conditions under which the transistor may be cut off.

V_{CEmax} ($I_C = x$ mA) The maximum permissible instantaneous voltage between collector and emitter terminals when the collector current is at a high value, often the maximum rated value.

V_{CEmax} ($I_B = 0$) The maximum permissible instantaneous voltage between collector and emitter terminals when the base terminal is open-circuit or when a very high resistance is in series with the base terminal. Special care must be taken to ensure that thermal runaway due to excessive collector leakage current does not occur in this condition.

Due to the current dependency of V_{CE} it is usual to present this information as a voltage rating chart, a curve of collector current as a function of collector-to-emitter voltage (see Fig.1). The permissible area of operation under all conditions of base drive (provided the dissipation rating is not exceeded) is shown as area 1 and operation under certain specified conditions is shown as area 2.

To assist in determining the rating in area 2, further curves can relate the voltage rating to external circuit conditions, for example: R_B/R_E, R_B, Z_{Bg}, V_{BE}, I_B or V_{BB}/R_B. An example of this type of curve is given in Fig.2 with V_{CE} as a function of R_B/R_E for two values of collector current.

It should be noted that when R_E is shunted by a capacitor, during switching, the collector voltage V_{CE} must be restricted to a value that does not rely on the effect of R_E.

In the case of an inductive load, when an energy rating is given, it may be safe to operate outside the rated area provided the specified energy rating is not exceeded.

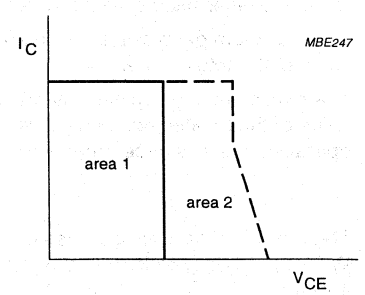


Fig.1 Graph of permissible operating areas.

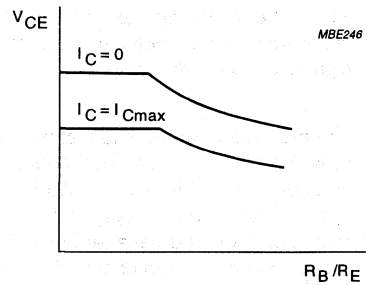


Fig.2 Graph showing effect of collector current on permissible operating areas.

Current ratings

COLLECTOR

I_{Cmax} The maximum permissible collector current. Without further qualification, the DC value is implied.

$I_{C(AV)max}$ The maximum permissible average value of the total collector current.

I_{CM} The maximum permissible instantaneous value of the total collector current.

Emitter

I_{Emax} The maximum permissible emitter current. Without further qualification, the DC value is implied.

$I_{E(AV)max}$ The maximum permissible average value of the total emitter current.

$I_{ER(AV)max}$ The maximum permissible average value of the total emitter current when operating in the reverse emitter-base breakdown region.

I_{EM} The maximum permissible instantaneous value of the total emitter current.

I_{ERM} The maximum permissible instantaneous value of the total emitter current when operating in the reverse breakdown region.

BASE

I_{Bmax} The maximum permissible base current. Without further qualification, the DC value is implied.

$I_{B(AV)max}$ The maximum permissible average value of the total base current.

$I_{BR(AV)max}$ The maximum permissible average value of the total base current when operating in the reverse breakdown region.

I_{BM} The maximum permissible instantaneous value of the total base current. The rating also includes the switch-off current.

I_{BRM} The maximum permissible instantaneous value of the total reverse current allowable in the reverse breakdown region.

Power ratings

The total maximum permissible continuous power dissipation in the transistor, $P_{tot\ max}$, includes collector-base dissipation and emitter-base dissipation. Under steady state conditions, the total power is given as:

$P_{tot} = V_{CE} \times I_C + V_{BE} \times I_B$.

In order to distinguish between 'steady state' and 'pulse' conditions, the terms 'steady state power (P_S)' and 'pulse power (P_P)' can be used. The permissible total power dissipation is dependent on temperature; this relationship is shown in Fig.3.

The temperature may be the ambient, the case or the mounting base temperature. Where a cooling clip or heatsink is attached to the device, the allowable power dissipation is also dependent on the efficiency of the heatsink.

The efficiency of this clip or heatsink is measured in terms of its thermal resistance ($R_{th\ h}$) normally expressed in degrees Kelvin per Watt (K/W). For mounting-base rated devices, the added effect of the contact resistance ($R_{th\ i}$) must be taken into account.

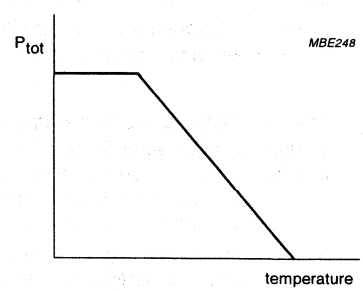


Fig.3 Permissible total power dissipation.

The effect of heatsinks of various thermal and contact resistance is often included in the graph of permissible total power dissipation.

The relationship between maximum power dissipation, ambient temperature and thermal heatsink resistance is given by:

$$P_{tot} = \frac{T_j - T_{amb}}{R_{th\,j-a}}$$

where $R_{th\,j\text{-}a}$ is the thermal resistance from the transistor junction to the ambient. For case rated or mounting-base rated devices, the thermal resistance $R_{th\,j}$ is made up of the thermal resistance junction to case or mounting-base ($R_{th\,j\text{-}mb}$), the contact thermal resistance ($R_{th\,i}$) and the heatsink thermal resistance ($R_{th\,h}$).

For the calculation of pulse power operation, the maximum pulse power is obtained using a graph as shown in Fig.4

The general expression from which the maximum pulse power dissipation can be calculated is:

$$P_p = \frac{T_j - T_{amb} - P_S \times R_{th\,j-a}}{Z_{in\,t} + d\,(R_{th\,c-a})}$$

where $Z_{th\,t}$ and δ are given in Fig.4 and $R_{th\,c-a}$ is the thermal resistance between case and ambient for a case rated device.

For a mounting-base rated device, it is equal to $R_{th\,h} + R_{th\,i}$ and is zero for a free-air rated device because the effect of the temperature rise of the case over the ambient for a pulse train is already included in $Z_{th\,t}$.

Temperature ratings

$T_{j\,max}$ The maximum permissible junction temperature which is used as the basis for the calculation of power ratings. Unless otherwise stated, the continuous value is implied.

$T_{j\,max}$ (continuous operation): indicates the maximum permissible continuous value.

$T_{j\,max}$ (intermittent operation): indicates the maximum permissible instantaneous junction temperature usually allowed for a total duration of 200 hours.

T_{mb} The temperature of the surface in contact with the heatsink. This is confined to devices where a flange or stud for fixing onto a heatsink forms an integral part of the package.

T_{case} The temperature of the package. This is confined to devices that may have a clip-on cooling fin attachment.

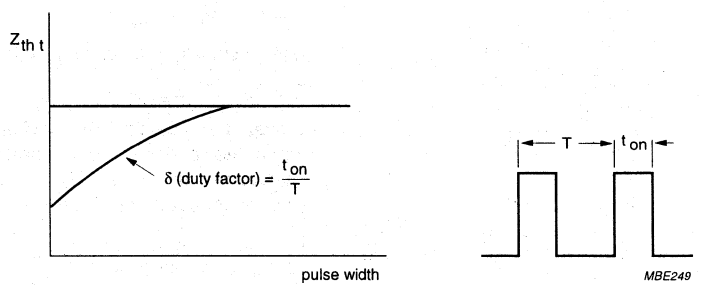


Fig.4 Pulse power operation.

TRANSISTOR SAFE OPERATING AREA (SOAR)

There are two main limiting factors which affect the power handling ability of a transistor; the average junction temperature and the second breakdown. To indicate these limitations, the data sheets contain safe operating area curves specific to the type and, for reliable operation of the transistor, the I_C/V_{CE} limits shown by these curves must never be exceeded. The following advice on SOAR will enable design engineers to make optimum use of the information in the data sheets.

Average junction temperature

Heat dissipation in the collector-base junction flows through the thermal resistance $R_{th\ j\text{-}mb}$ between junction and mounting base, see Fig.6.

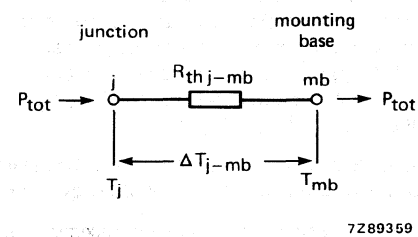


Fig.6 Heat transport in a transistor with power dissipation constant with time.

For steady-state (DC) operation the junction temperature will increase to:

$T_j = T_{mb} + P_{tot} R_{th\ j\text{-}mb}$

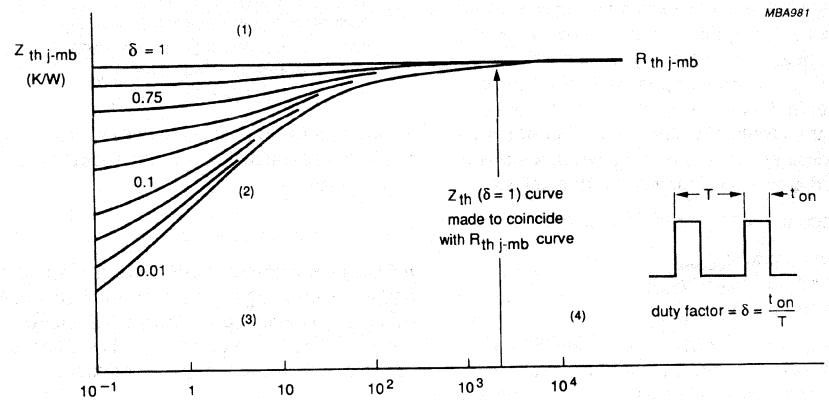
and for pulse operation the junction temperature will be:

$T_j = T_{mb} + P_{tot} Z_{th\ j\text{-}mb}$.

During pulse operation the junction has no time to be fully heated and will wholly or partly cool during the interval between pulses. For this reason a higher dissipation is permitted, see Fig.7.

This curve may be represented by absolute values ($Z_{th\ j\text{-}mb}$) or as normalized thermal impedance (NTI), where:

$$NTI = \frac{Z_{th\ j\text{-}mb}}{R_{th\ j\text{-}mb}}$$



(1) DC line.
(2) Single pulse line.
(3) Pulse conditions.
(4) Steady-state conditions.

Fig.7 A typical family of $Z_{th\ j\text{-}mb}$ curves for a power transistor.

Maximum allowable dissipation

Total power dissipation in a transistor is given by:

$P_{tot} = I_C V_{CE} + I_B V_{BE}$

The second term can usually be disregarded, so

$P_{tot} \approx I_C V_{CE}$.

The maximum allowable power dissipation is limited to the maximum allowable junction temperature for the constant power curves (P_{tot}) and by second breakdown curves, see Fig.8.

Constant power curves

Calculation of P_{tot} can be as follows:

for steady-state (DC) conditions

$$P_{tot} = \frac{T_{j\,max} - T_{mb}}{R_{th\ j\text{-}mb}};$$

for pulsed conditions

$$P_{tot} = \frac{T_{j\,max} - T_{mb}}{Z_{th\ j\text{-}mb}}.$$

The maximum power dissipation ($P_{tot\ max}$ DC) mostly specified in a data sheet is for a given mounting base temperature, this is usually T_{mb} = 25 °C but may be much higher.

The maximum power dissipation cannot be referred to the mounting base for transistors in fully isolated envelopes (SOT186, SOT199 and SOT227 (ISOTOP)). For these, the data sheets specify a given heatsink temperature (T_h) which may be calculated as follows:

for steady-state (DC) conditions

$$P_{tot} = \frac{T_{j\,max} - T_h}{R_{th\ j\text{-}mb}};$$

for pulsed conditions

$$P_{tot} = \frac{T_{j\,max} - T_h}{Z_{th\ j\text{-}mb}}.$$

The temperature specified in a data sheet is usually T_h = 25 °C but may be much higher. The total thermal resistance/impedance includes the transfer resistance from the case to heatsink under specific mounting conditions.

Second breakdown curves

In the forward biased condition, second breakdown is a thermally-triggered avalanche effect which, once started, will destroy the transistor. The mechanism can be understood by considering the device as a large number of elemental transistors in parallel, some of which will have a lower forward voltage drop than others. Current will tend to gather in these, raising their temperature and further lowering their forward voltage drop. Current will concentrate still further, leading to local overheating and eventually a short circuit between emitter and collector.

This effect can occur under various conditions:

forward biased up to V_{CEOmax}
forward biased with $V_{CE} > V_{CEOmax}$
reverse biased up to V_{CESmax}.

In the data sheets, safe operating area curves for the first condition are given for every power transistor; curves showing extensions for the safe operating area for the other two conditions are specified only for power switching transistors.

Forward biased safe operation area up to V_{CEOmax}

Four operating limits form the boundaries of the forward biased safe operating area up to V_{CEOmax}:

maximum collector current, I_C or I_{CM}
maximum collector-emitter voltage, V_{CEOmax}
maximum power dissipation, P_{tot}
second breakdown limit, S/B_{sat}.

Forward biased SOAR curves are specified for both DC and pulse operation to cover the widest range of applications.

IN STEADY STATE CONDITIONS

A DC forward biased SOAR curve plotted on a log-log grid is shown in Fig.8. The right-hand boundary is formed by V_{CEOmax} which extends up to a collector current of 300 mA, above this point as I_{Cmax} is increased V_{CE} must be reduced to prevent second breakdown.

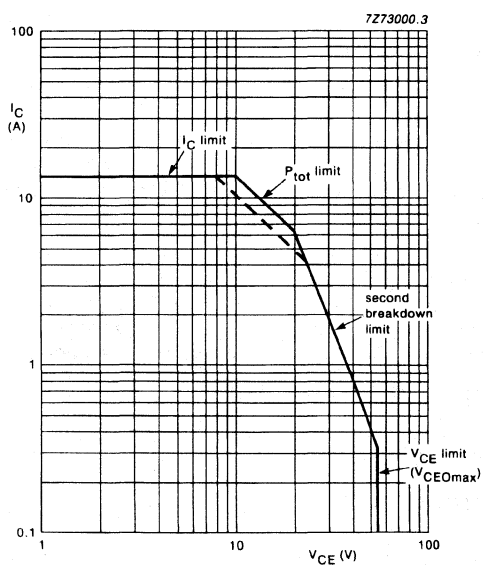


Fig.8 A typical DC SOAR graph with boundaries defined.

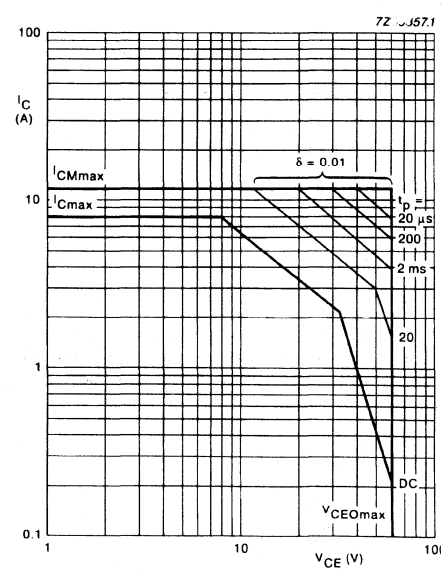


Fig.9 Graph showing maximum collector current and collector-emitter voltage for DC and pulsed conditions.

The upper boundary is formed by I_{Cmax}, which extends to where the product of I_{Cmax} and V_{CE} equals the maximum power dissipation. From this point I_C must be reduced as V_{CE} is increased, thus forming the constant power curve of the maximum power dissipation boundary.

This maximum power dissipation boundary will normally intersect the second breakdown boundary at some point. However, for values of T_{mb} above the T_{mb} specified, $P_{tot\ max}$ must be reduced (as shown by the broken line in Fig.8), so that the boundary of maximum power dissipation intersects the second breakdown boundary at a lower point.

IN PULSED CONDITIONS

With the exception of DC forward biased SOAR, data sheets for power transistors contain a set of curves that apply under specific pulse conditions, normally at a duty factor of $\delta = 0.01$ and at pulse lengths of 20 ms or less. An example of the forward biased SOAR extension for single-shot and repetitive pulsed operation is shown in Fig.9.

The curves for pulsed conditions shown in Fig.9 are derived from the DC curve with the aid of the thermal impedance curves shown in Fig.7.

All curves apply to the temperature stated in the data sheet (T_{mb} or T_h). Derating must be applied for the allowable P_{tot} at any T_{mb} or T_h up to $T_{j\ max}$, an example of a power derating curve is shown in Fig.10. The second breakdown curve is valid for all temperatures up to $T_{j\ max}$ unless an I_{SB} (second breakdown current) derating curve is specified, in which case derating has to be applied.

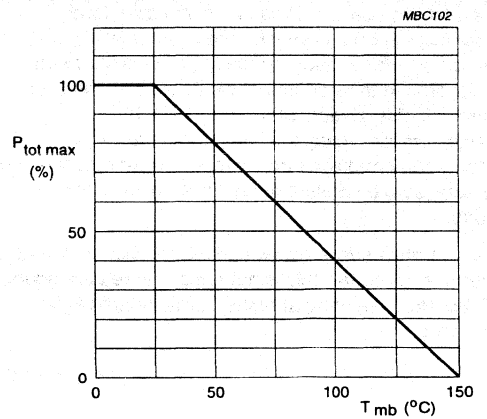
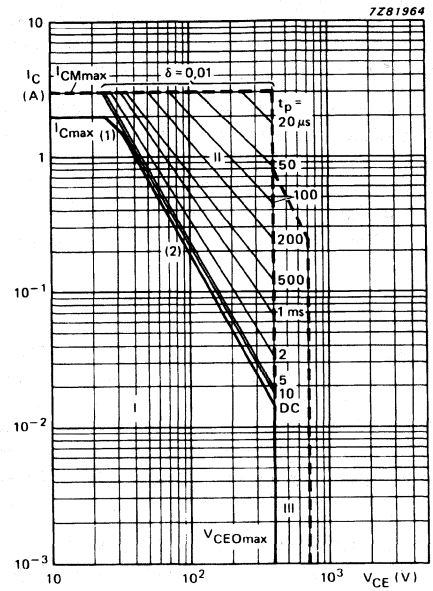


Fig.10 Power derating curve: maximum allowable power dissipation as a function of mounting base temperature.

Forward biased safe operating area with $V_{CE} > V_{CEOmax}$

For switching power transistors in inductive load applications such as flyback converters, the collector-emitter voltage normally exceeds the rated V_{CEOmax} limit in the non-inductive stage. The collector current will rise steeply at turn-on while the collector-emitter voltage is still greater than V_{CEOmax}. Under these conditions the collector current must be held at a safe level by means of load line shaping or similar circuits.

Figure 11 shows forward biased SOAR with an extension for turn-on (area III); this is not temperature dependent and therefore derating at higher temperatures is not necessary.



I	Region of permissible DC operation.
II	Permissible extension for repetitive pulse operation.
III	Area of permissible operation during turn-on in single-transistor converters, provided $R_{BE} \leq 100\ \Omega$ and $t_p \leq 6.0\ \mu s$.
(1)	$P_{tot\ max}$ and $P_{tot\ peak}$ maximum lines.
(2)	Second breakdown limits.

Fig.11 Safe operating area at $T_{amb} \leq 25$ °C.

Reversed biased safe operating area up to V_{CESmax}

Most inductively loaded transistors operate with their base to emitter junction reverse biased. At turn-off, the inductive loading causes the collector to emitter voltage to rise steeply to a high level while the collector continues to conduct. Under these conditions the collector voltage must be held to a safe level by means of a clamping, snubbing or similar circuit.

The SOAR extension for this reverse biased operation is shown in the relevant data sheets in a graph as in Fig.12. This turn-off extension is not temperature dependent and so derating at higher temperatures is not necessary.

Using data sheet SOAR information

Select a power transistor for a particular function or application using the following criteria from QUICK REFERENCE DATA:

collector current, I_C or I_{CM}
collector voltage, V_{CEO} or V_{CES}
maximum allowable dissipation, P_{tot}
maximum allowable junction temperature, T_j
required gain, h_{FE}
required speed, t_f or f_T.

Determine the following parameters for the intended application:

duty factor, δ
maximum operating ambient temperature, T_{amb}
maximum operational, worst-case average dissipation, P_{WC}.

Calculate the thermal resistance of the heatsink, $R_{th\ h\text{-}a}$:

for directly mounted devices

$$R_{th\ h\text{-}a} = \frac{T_j - T_{mb}}{P_{WC}} - \left(R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h}\right)$$

or for fully isolated devices

$$R_{th\ h\text{-}a} = \frac{T_j - T_{mb}}{P_{WC}} - R_{th\ j\text{-}mb}.$$

Calculate the mounting base temperature, T_{mb} or T_h:

for directly mounted devices

$T_{mb} = T_{amb} + P_{WC}(R_{th\ h\text{-}a} + R_{th\ mb\text{-}h})$

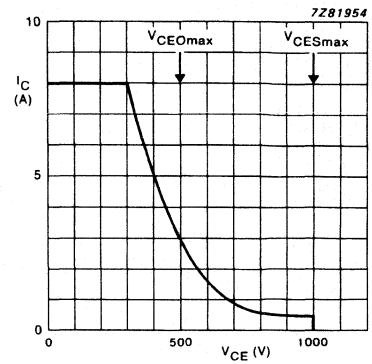


Fig.12 Reversed biased area of permissible operation during turn-off, providing that $T_{mb} \leq 100$ °C; $V_{BEoff} = 5$ V; $I_C/I_B \geq 5$.

or for fully isolated devices

$T_h = T_{amb} + P_{WC} \times R_{th\ h\text{-}a}$.

Use the data sheet SOAR curves, thermal impedance and derating to construct a safe operating area for the device (this can be adapted to the conditions for the application, e.g. T_{mb}, pulse time, duty factor).

Measure the I_C/V_{CE} locus in the application and check that it does not exceed the previously-constructed SOAR graph. In switching applications check also the extensions for turn-on and turn-off.

If the SOAR of the preferred transistor does not fit the requirements, select the nearest suitable device or modify the application circuit.

APPLICATION INFORMATION

APPLICATION INFORMATION

Application information for high voltage and switching NPNpower transistors, and other Philips Semiconductors power products, is published in the *Power Semiconductors Applications Handbook*. The ordering code for this publication is: 9398 652 85011.

The *Applications Handbook* contains information-processing the theory of power transistors in typical applications such as SMPS and TV deflection circuits. Examples are included to support the theory.

DEVICE DATA

in alphanumeric sequence

Silicon diffused power transistors BU505; BU505D

DESCRIPTION

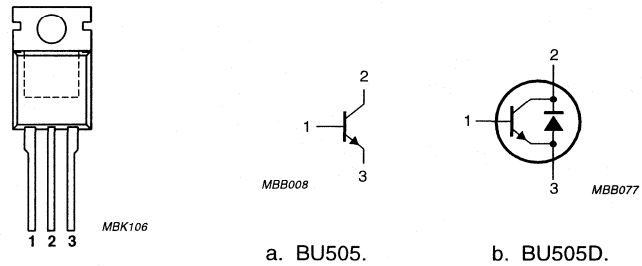
High-voltage, high-speed switching NPN power transistor in a TO-220AB package. The BU505D has an integrated efficiency diode.

APPLICATIONS

- Horizontal deflection circuits of colour television receivers.

PINNING

PIN	DESCRIPTION
1	base
2	collector; connected to mounting base
3	emitter



a. BU505. b. BU505D.

Fig.1 Simplified outline (TO-220AB) and symbols.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$	–	1500	V
V_{CEO}	collector-emitter voltage	open base	–	700	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 2$ A; $I_B = 900$ mA	–	1	V
V_F	diode forward voltage (BU505D)	$I_F = 2$ A	–	1.8	V
I_{Csat}	collector saturation current		–	2	A
I_C	collector current (DC)	see Fig.3	–	2.5	A
I_{CM}	collector current (peak value)	see Fig.3	–	4	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.4	–	75	W
t_f	fall time	inductive load; see Fig.7	0.9	–	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	1.67	K/W

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$	–	1500	V
V_{CEO}	collector-emitter voltage	open base	–	700	V
I_{Csat}	collector saturation current		–	2	A
I_C	collector current (DC)	see Fig.3	–	2.5	A
I_{CM}	collector current (peak value)	see Fig.3	–	4	A
I_B	base current (DC)		–	2	A
I_{BM}	base current (peak value)		–	4	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.4	–	75	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

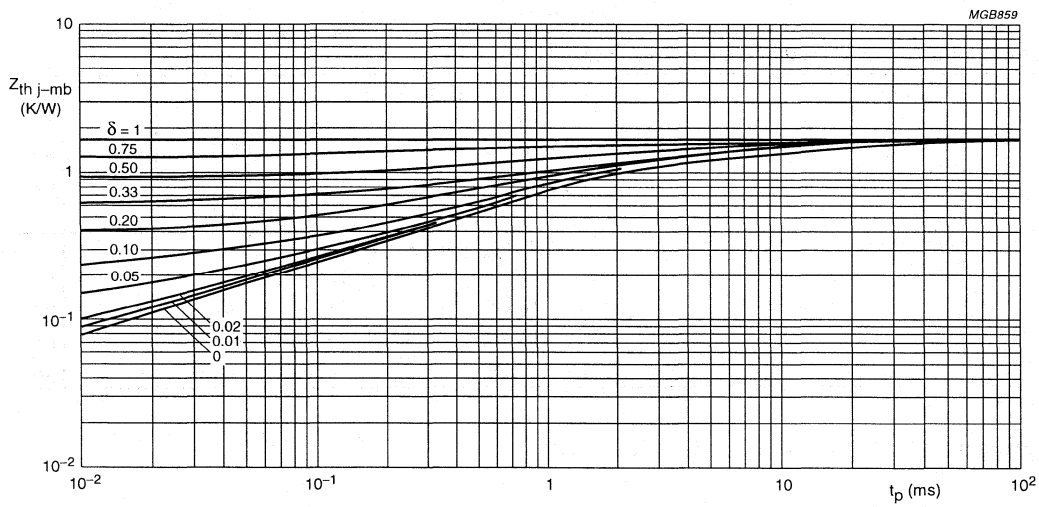


Fig.2 Transient thermal impedance.

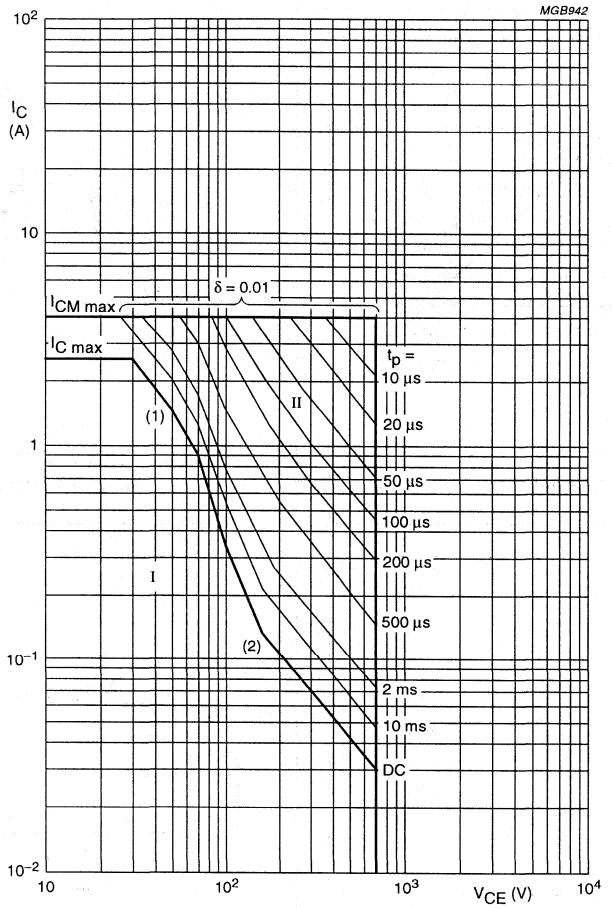
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	see Figs 5 and 6	700	–	–	V
V_{CEsat}	collector-emitter saturation voltage	I_C = 2 A; I_B = 900 mA	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 2 A; I_B = 900 mA	–	–	1.3	V
V_{EBO}	emitter-base voltage	I_E = 10 mA; I_C = 0	–	6	–	V
V_F	diode forward voltage (BU505D)	I_F = 2 A	–	–	1.8	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESmax}$; V_{BE} = 0; note 1	–	–	0.15	mA
		$V_{CE} = V_{CESmax}$; V_{BE} = 0; T_j = 125 °C; note 1	–	–	1	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 100 mA	6	13	30	
f_T	transition frequency	V_{CE} = 5 V; I_C = 100 mA; f = 5 MHz	–	7	–	MHz
C_c	collector capacitance	V_{CB} = 10 V; $I_E = i_e$ = 0; f = 1 MHz	–	65	–	pF
Switching times in horizontal deflection circuit (see Fig.7)						
t_s	storage time	I_{CM} = 2 A; $I_{B(end)}$ = 900 mA; V_{dr} = –4 V				
		L_B = 10 μH	–	6.5	–	μs
		L_B = 15 μH	–	7.5	–	μs
		L_B = 25 μH	–	9.5	–	μs
t_f	fall time	I_{CM} = 2 A; $I_{B(end)}$ = 900 mA; V_{dr} = –4 V				
		L_B = 10 μH	–	0.9	–	μs
		L_B = 15 μH	–	0.9	–	μs
		L_B = 25 μH	–	0.85	–	μs

Note

1. Measured with a half-sinewave voltage (curve tracer).



T_{mb} = 25 °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

(1) $P_{tot\ max}$ and $P_{tot\ peak\ max}$ lines.

(2) Second breakdown limits.

Fig.3 Forward bias SOAR.

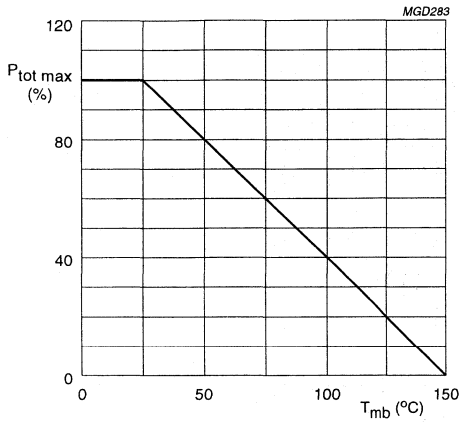


Fig.4 Power derating curve.

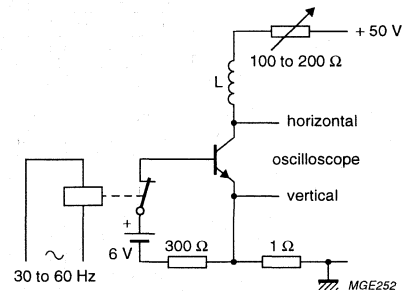


Fig.5 Test circuit for collector-emitter sustaining voltage.

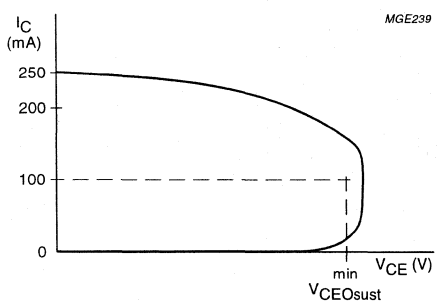


Fig.6 Oscilloscope display for collector-emitter sustaining voltage.

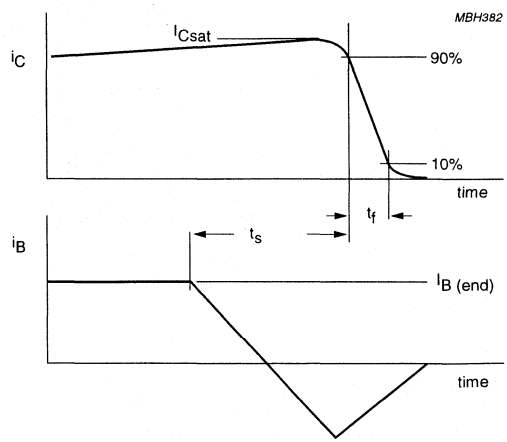


Fig.7 Switching time waveforms.

Silicon diffused power transistors BU505F; BU505DF

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a SOT186 package with electrically isolated mounting base. The BU505DF has an integrated efficiency diode.

APPLICATIONS

- Horizontal deflection circuits of colour television receivers.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter
mb	mounting base; electrically isolated from all pins

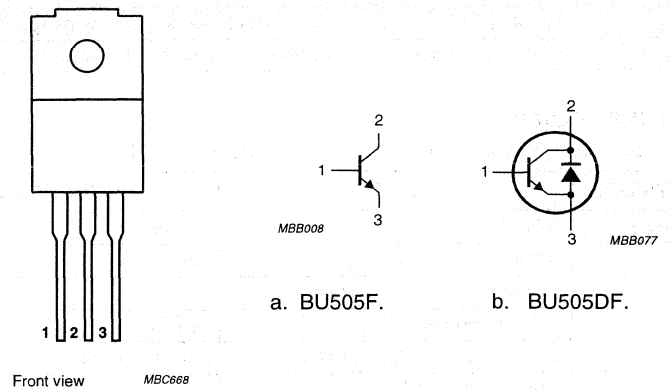


Fig.1 Simplified outline (SOT186) and symbols.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$	–	1500	V
V_{CEO}	collector-emitter voltage	open base	–	700	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 2$ A; $I_B = 900$ mA; see Fig.8	–	1	V
V_F	diode forward voltage (BU505DF)	$I_F = 2$ A	–	1.8	V
I_{Csat}	collector saturation current		–	2	A
I_C	collector current (DC)	see Figs 4 and 5	–	2.5	A
I_{CM}	collector current (peak value)	see Figs 4 and 5	–	4	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.2	–	20	W
t_f	fall time	inductive load; see Fig.10	0.7	–	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}h}$	thermal resistance from junction to external heatsink	note 1	6.35	K/W
		note 2	3.85	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient		55	K/W

Notes

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
2. Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

ISOLATION CHARACTERISTICS

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
V_{isolM}	isolation voltage from all terminals to external heatsink (peak value)	–	1500	V
C_{isol}	isolation capacitance from collector to external heatsink	12	–	pF

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$	–	1500	V
V_{CEO}	collector-emitter voltage	open base	–	700	V
I_{Csat}	collector saturation current		–	2	A
I_C	collector current (DC)	see Figs 4 and 5	–	2.5	A
I_{CM}	collector current (peak value)	see Figs 4 and 5	–	4	A
I_B	base current (DC)		–	2	A
I_{BM}	base current (peak value)		–	4	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.2	–	20	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

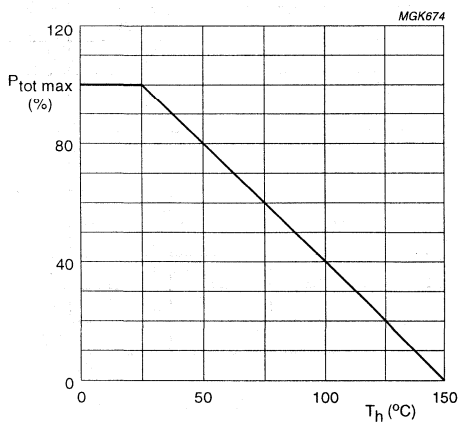
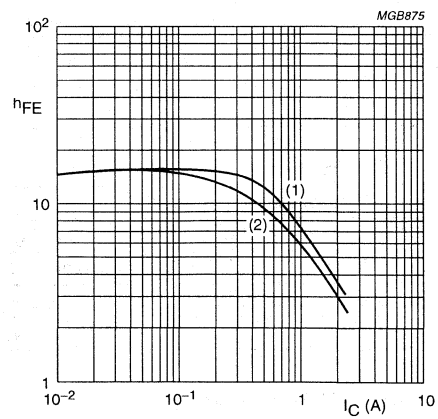


Fig.2 Power derating curve.



$T_j = 25$ °C.
(1) $V_{CE} = 5$ V.
(2) $V_{CE} = 1$ V.

Fig.3 DC current gain; typical values.

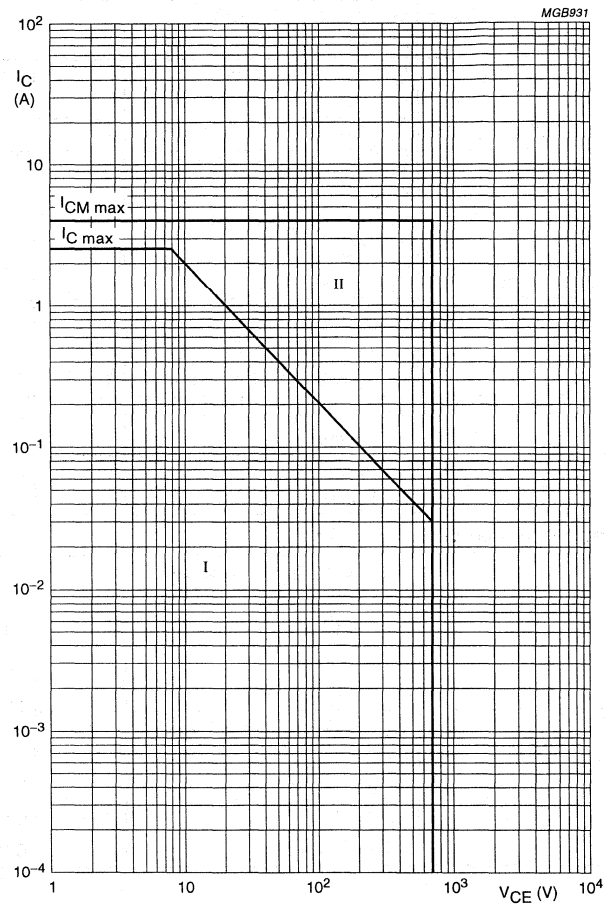
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	I_C = 0.1 A; I_B = 0; L = 25 mH; see Figs 6 and 7	700	–	–	V
V_{CEsat}	collector-emitter saturation voltage	I_C = 2 A; I_B = 900 mA; see Fig.8	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 2 A; I_B = 900 mA; see Fig.9	–	–	1.3	V
V_F	diode forward voltage (BU505DF)	I_F = 2 A	–	–	1.8	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESmax}$; V_{BE} = 0; note 1	–	–	0.15	mA
		$V_{CE} = V_{CESmax}$; V_{BE} = 0; T_j = 125 °C; note 1	–	–	1	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0	–	–	1	mA
h_{FE}	DC current gain	see Fig.3				
		V_{CE} = 5 V; I_C = 2 A	2.22	–	–	
		V_{CE} = 5 V; I_C = 100 mA	6	13	30	
f_T	transition frequency	V_{CE} = 5 V; I_C = 100 mA; f = 1 MHz	–	7	–	MHz
C_c	collector capacitance	V_{CB} = 10 V; $I_E = i_e$ = 0; f = 1 MHz	–	65	–	pF
Switching times in horizontal deflection circuit (see Fig.5)						
t_s	storage time	I_{CM} = 2 A; $I_{B(end)}$ = 900 mA; V_{dr} = –4 V				
		L_B = 10 μH	–	6.5	–	μs
		L_B = 15 μH	–	7.5	–	μs
		L_B = 25 μH	–	9.5	–	μs
t_f	fall time	I_{CM} = 2 A; $I_{B(end)}$ = 900 mA; V_{dr} = –4 V				
		L_B = 10 μH	–	0.9	–	μs
		L_B = 15 μH	–	0.9	–	μs
		L_B = 25 μH	–	0.85	–	μs

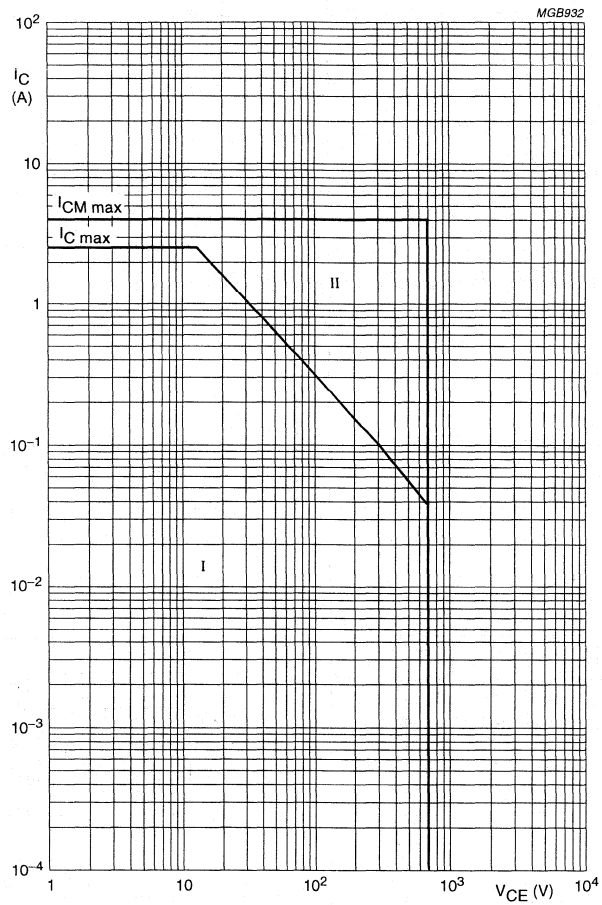
Note

1. Measured with a half-sinewave voltage (curve tracer).



Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
T_h = 25 °C.
I - Region of permissible DC operation.
II - Permissible extension for repetitive pulse operation.

Fig.4 Forward bias SOAR.



Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

T_h = 25 °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

Fig.5 Forward bias SOAR.

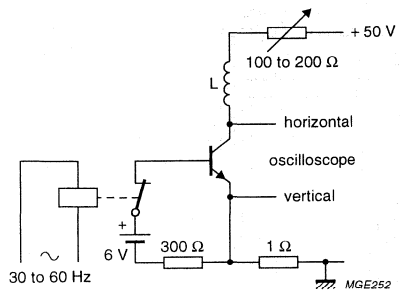


Fig.6 Test circuit for collector-emitter sustaining voltage.

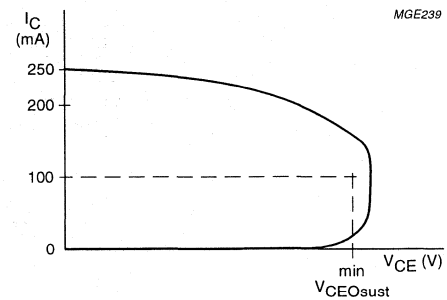
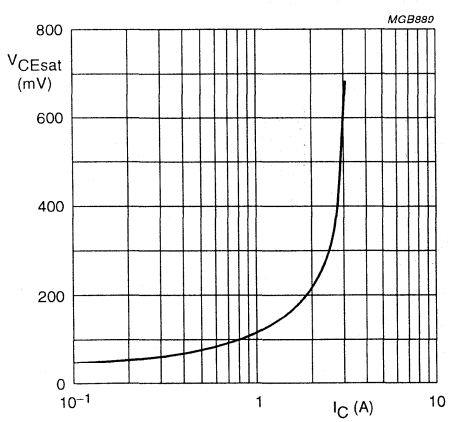
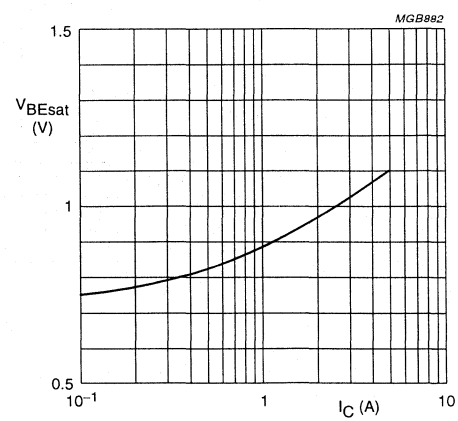


Fig.7 Oscilloscope display for collector-emitter sustaining voltage.



$I_C/I_B = 2$; $T_j = 25$ °C.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



$I_C/I_B = 2$; $T_j = 25$ °C.

Fig.9 Base-emitter saturation voltage as a function of collector current; typical values.

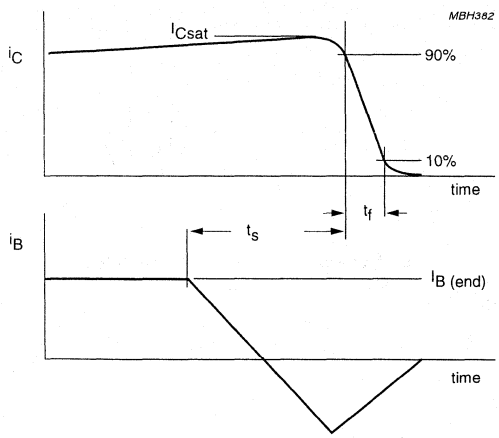


Fig.10 Switching time waveforms.

Silicon diffused power transistors — BU506; BU506D

DESCRIPTION

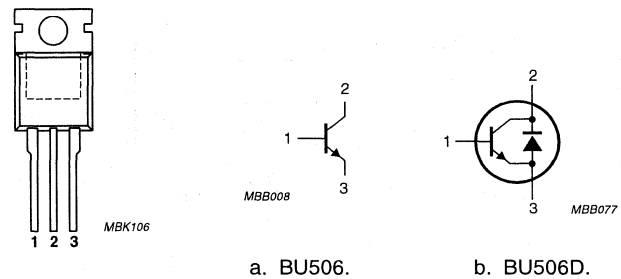
High-voltage, high-speed, switching NPN power transistor in a TO-220AB package. The BU506D has an integrated efficiency diode.

APPLICATIONS

- Horizontal deflection circuits of colour television receivers
- Line-operated switch-mode applications.

PINNING

PIN	DESCRIPTION
1	base
2	collector; connected to mounting base
3	emitter



a. BU506. b. BU506D.

Fig.1 Simplified outline (TO-220AB) and symbols.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$	–	1500	V
V_{CEO}	collector-emitter voltage	open base	–	700	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 3$ A; $I_B = 1.33$ A; see Fig.6	–	1	V
V_F	diode forward voltage (BU506D)	$I_F = 3$ A; see Fig.10	1.5	–	V
I_{Csat}	collector saturation current		–	3	A
I_C	collector current (DC)	see Fig.2	–	5	A
I_{CM}	collector current (peak value)	see Fig.2	–	8	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.3	–	100	W
t_f	fall time	inductive load; see Fig.9	0.7	–	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	1.25	K/W

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$	–	1500	V
V_{CEO}	collector-emitter voltage	open base	–	700	V
I_{Csat}	collector saturation current		–	3	A
I_C	collector current (DC)	see Fig.2	–	5	A
I_{CM}	collector current (peak value)	see Fig.2	–	8	A
I_B	base current (DC)		–	3	A
I_{BM}	base current (peak value)		–	5	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.3	–	100	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

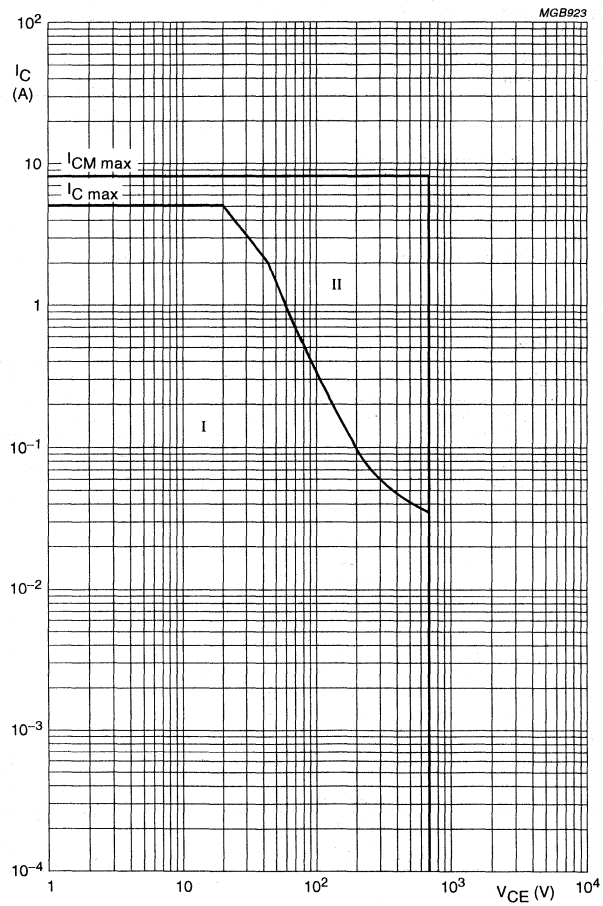
CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	see Figs 4 and 5	700	–	–	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 3$ A; $I_B = 1.33$ A; see Fig.6	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 3$ A; $I_B = 1.33$ A; see Fig.7	–	–	1.3	V
V_F	diode forward voltage (BU506D)	$I_F = 3$ A; see Fig.10	–	1.5	2.2	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESmax}$; $V_{BE} = 0$; note 1	–	–	0.5	mA
		$V_{CE} = V_{CESmax}$; $V_{BE} = 0$; $T_j = 125$ °C; note 1	–	–	1	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 6$ V; $I_C = 0$	–	–	10	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 100$ mA; see Fig.8	6	13	30	
Switching times in horizontal deflection circuit (see Fig.9)						
t_s	storage time	$I_{CM} = 3$ A; $I_{B(end)} = 1$A; $L_B = 12$ µH	–	6.5	–	µs
t_f	fall time	$I_{CM} = 3$ A; $I_{B(end)} = 1$A; $L_B = 12$ µH	–	0.7	–	µs

Note

1. Measured with a half-sinewave voltage (curve tracer).



T_{mb} = 25 °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

Fig.2 Forward bias SOAR.

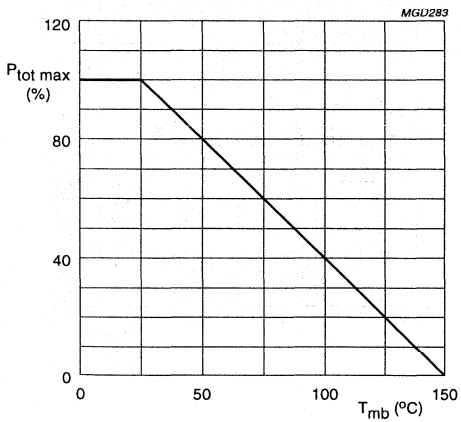


Fig.3 Power derating curve.

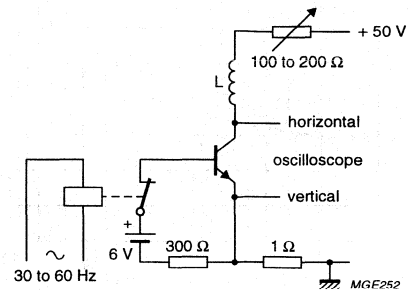


Fig.4 Test circuit for collector-emitter sustaining voltage.

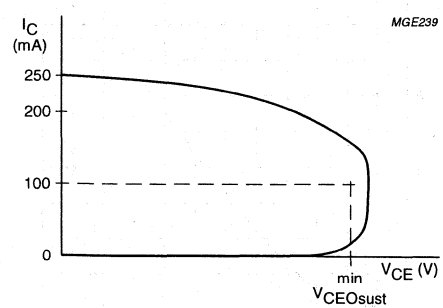
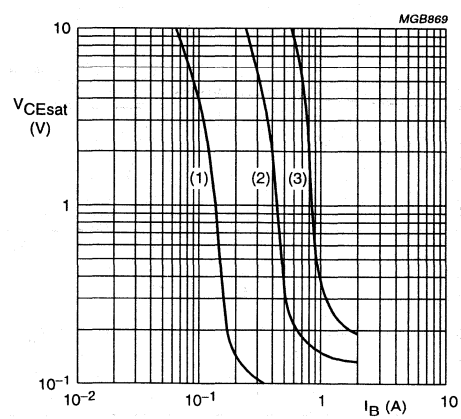
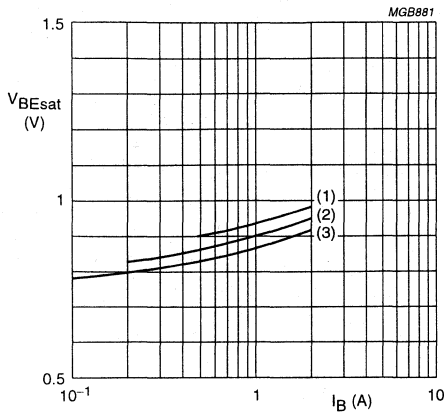


Fig.5 Oscilloscope display for collector-emitter sustaining voltage.



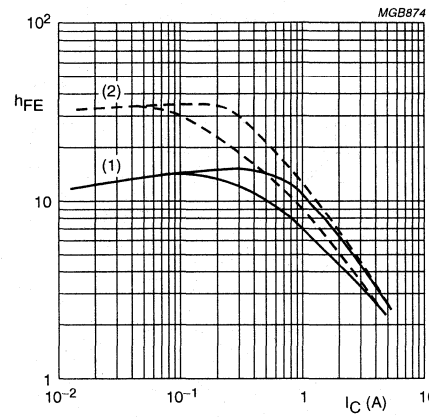
(1) I_C = 1 A.
(2) I_C = 2 A.
(3) I_C = 3 A.
T_{mb} = 25 °C.

Fig.6 Collector-emitter saturation voltage as a function of base current; typical values.



(1) I_C = 3 A.
(2) I_C = 2 A.
(3) I_C = 1 A.
T_{mb} = 25 °C.

Fig.7 Base-emitter saturation voltage as a function of base current; typical values.



(1) V_{CE} = 1 V; T_j = 25 °C.
(2) V_{CE} = 5 V; T_j = 125 °C.

Fig.8 DC current gain; typical values.

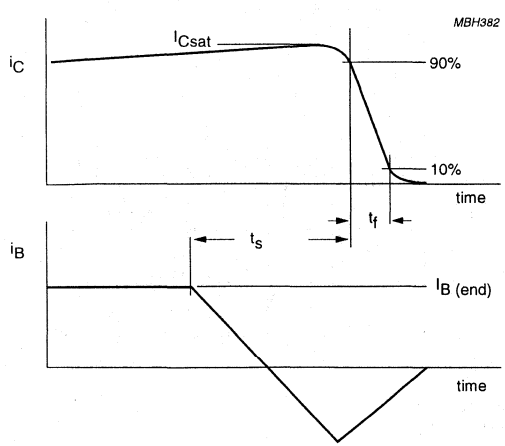
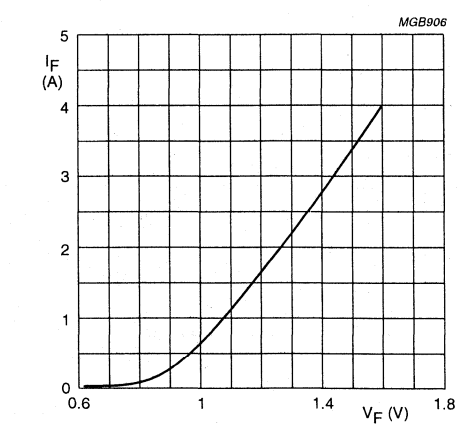


Fig.9 Switching time waveforms.



T_{mb} = 25 °C.

Fig.10 Diode forward voltage.

Silicon diffused power transistors BU506F; BU506DF

DESCRIPTION

High-voltage, high-speed switching NPN power transistor in a SOT186 package. The BU506DF has an integrated efficiency diode.

APPLICATIONS

- Horizontal deflection circuits of colour television receivers
- Line-operated switch-mode applications.

PINNING

PIN(1)	DESCRIPTION
1	base
2	collector
3	emitter

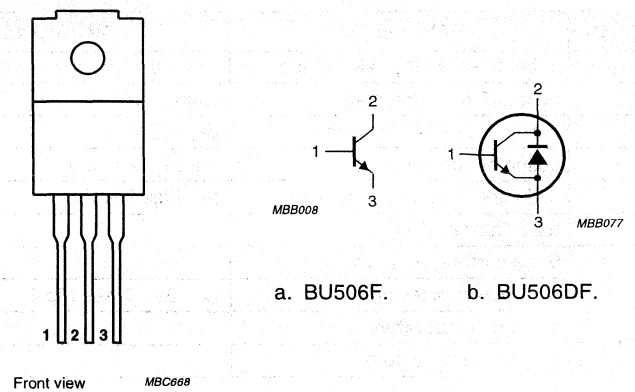


Fig.1 Simplified outline (SOT186) and symbols.

Note

1. All pins electrically isolated from mounting base.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$	–	1500	V
V_{CEO}	collector-emitter voltage	open base	–	700	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 3$ A; $I_B = 1.33$ A; see Figs 7 and 8	–	1	V
V_F	diode forward voltage (BU506DF)	$I_F = 3$ A	1.5	2.2	V
I_{Csat}	collector saturation current		–	3	A
I_C	collector current (DC)	see Figs 2 and 3	–	5	A
I_{CM}	collector current (peak value)	see Figs 2 and 3	–	8	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.4	–	20	W
t_f	fall time	inductive load; see Fig.11	0.7	–	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}h}$	thermal resistance from junction to external heatsink	note 1	6.35	K/W
		note 2	3.85	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient		55	K/W

Notes

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
2. Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$	–	1500	V
V_{CEO}	collector-emitter voltage	open base	–	700	V
I_{Csat}	collector saturation current	$V_{CE} = 5$ V	–	3	A
I_C	collector current (DC)	see Figs 2 and 3	–	5	A
I_{CM}	collector current (peak value)	see Figs 2 and 3	–	8	A
I_B	base current (DC)		–	3	A
I_{BM}	base current (peak value)		–	5	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.4	–	20	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

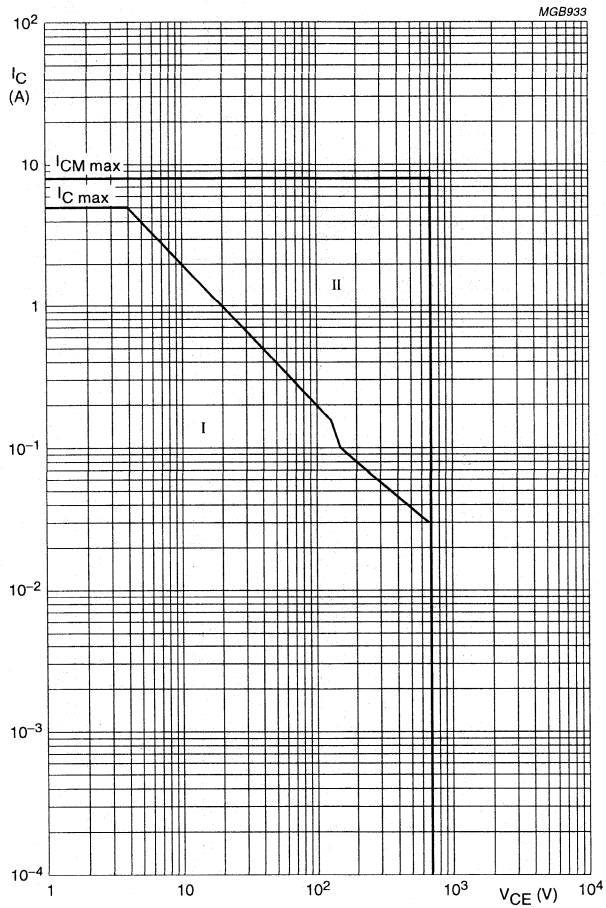
ISOLATION CHARACTERISTICS

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
V_{isolM}	isolation voltage from all terminals to external heatsink (peak value)	–	1500	V
C_{isol}	isolation capacitance from collector to external heatsink	12	–	pF

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	$I_C = 100$ mA; $I_B = 0$; L = 25 mH; see Figs 5 and 6	700	–	–	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 3$ A; $I_B = 1.33$ A; see Figs 7 and 8	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 3$ A; $I_B = 1.33$ A; see Fig.9	–	–	1.3	V
V_F	diode forward voltage (BU506DF)	$I_F = 3$ A	–	1.5	2.2	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESmax}$; $V_{BE} = 0$	–	–	0.5	mA
		$V_{CE} = V_{CESmax}$; $V_{BE} = 0$; $T_j = 125$ °C	–	–	1	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 6$ V; $I_C = 0$	–	–	10	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 3$ A; see Fig.10	2.25	–	–	
		$V_{CE} = 5$ V; $I_C = 100$ mA; see Fig.10	6	13	30	
Switching times in horizontal deflection circuit (see Fig.11)						
t_s	storage time	$I_{Csat} = 3$ A; $L_B = 12$ µH; $I_{B(end)} = 1$ A; $dI_B/dt = -0.33$ A/µs	–	6.5	–	µs
t_f	fall time	$I_{Csat} = 3$ A; $L_B = 12$ µH; $I_{B(end)} = 1$ A; $dI_B/dt = -0.33$ A/µs	–	0.7	–	µs



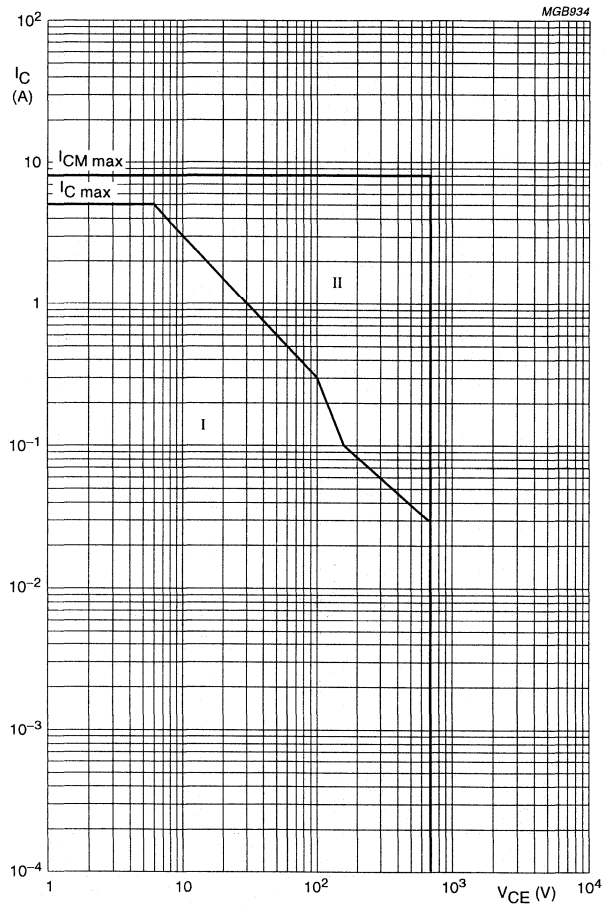
Mounted **without** heatsink compound and 30 ±5 N force on centre of package.

T_{mb} = 25 °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

Fig.2 Forward bias SOAR (no heatsink compound).



Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

T_{mb} = 25 °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

Fig.3 Forward bias SOAR (with heatsink compound).

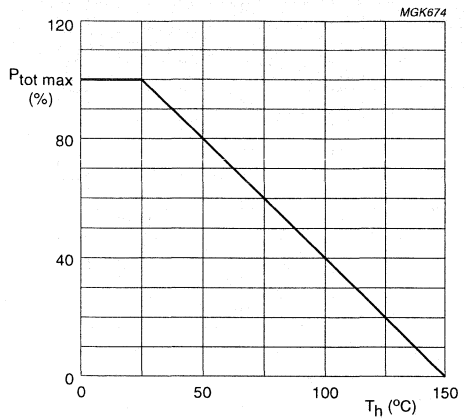


Fig.4 Power derating curve.

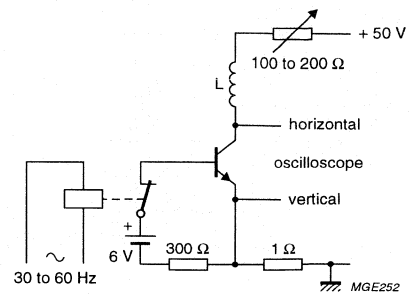


Fig.5 Test circuit for collector-emitter sustaining voltage.

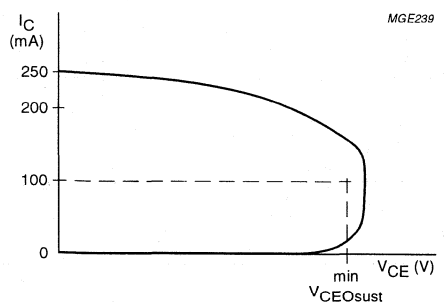
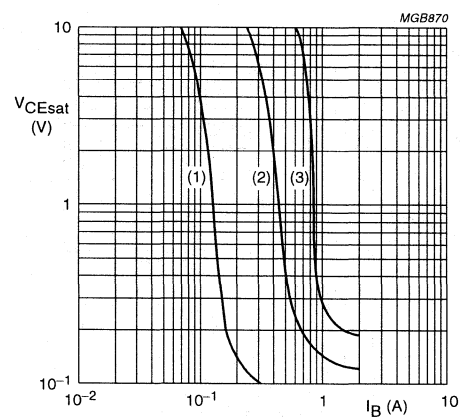
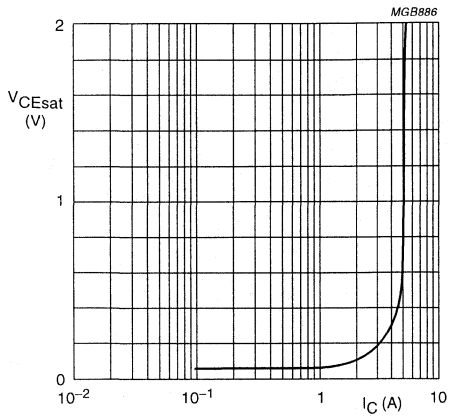


Fig.6 Oscilloscope display for collector-emitter sustaining voltage.



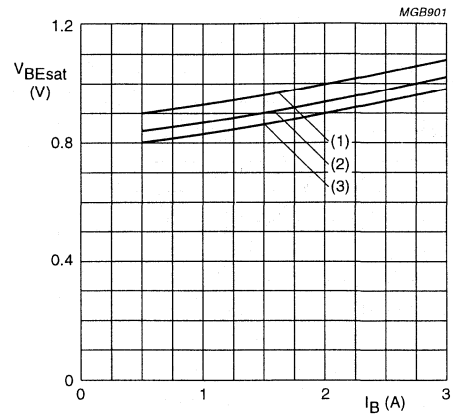
T_j = 25 °C.
(1) I_C = 1 A.
(2) I_C = 2 A.
(3) I_C = 3 A.

Fig.7 Collector-emitter saturation voltage as a function of base current; typical values.



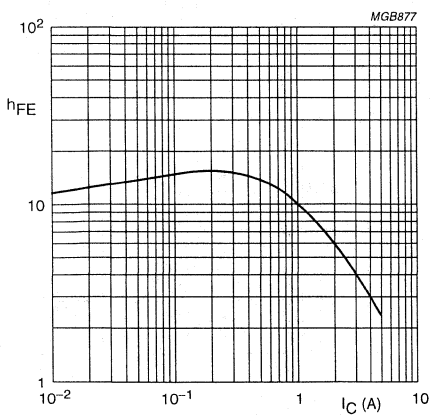
$I_C/I_B = 2$; $T_j = 25$ °C.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



$T_j = 25$ °C.
(1) $I_C = 3$ A.
(2) $I_C = 2$ A.
(3) $I_C = 1$ A.

Fig.9 Base-emitter saturation voltage as a function of base current; typical values.



$V_{CE} = 5$ V; $T_j = 25$ °C.

Fig.10 DC current gain; typical values.

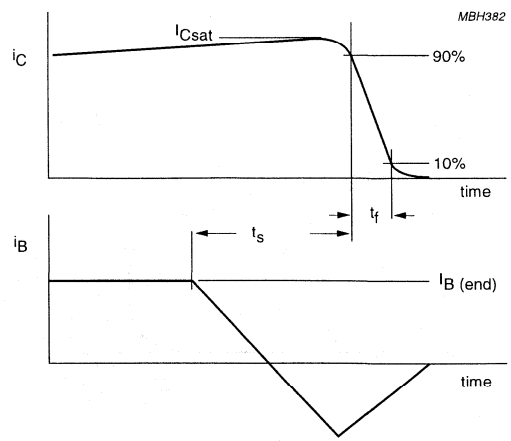


Fig.11 Switching time waveforms.

Silicon Diffused Power Transistor — BU508AF

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistors in a fully isolated SOT199 envelope, primarily for use in horizontal deflection circuits of colour television receivers.

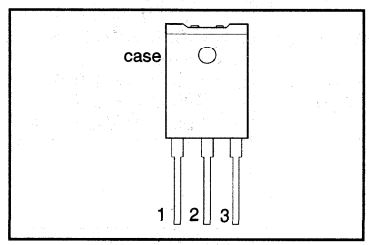
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	34	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.6 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	4.5	-	A
t_f	Fall time	I_{Csat} = 4.5 A; f = 16kHz	0.7	-	µs

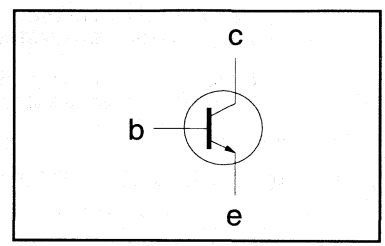
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	34	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 ˚C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	10	mA
V_{CEOsus}	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4.5 A; I_B = 1.6 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	6	13	30	-

DYNAMIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
f_T	Transition frequency at f = 5 MHz	I_C = 0.1 A;V_{CE} = 5 V	7	-	MHz
C_C	Collector capacitance at f = 1MHz	V_{CB} = 10 V	125	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A;L_c 1 mH;C_{fb} = 4 nF $I_{B(end)}$ = 1.4 A; L_B = 6 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 2.25 A			
t_s	Turn-off storage time		6.5	-	µs
t_f	Turn-off fall time		0.7	-	µs

1 Measured with half sine-wave voltage (curve tracer).

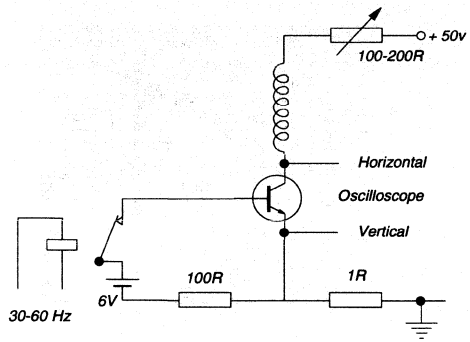


Fig.1. Test circuit for $V_{CEOsust}$.

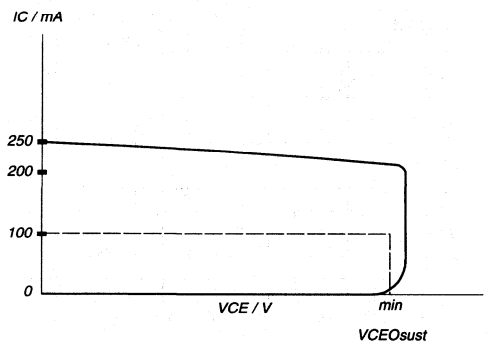


Fig.2. Oscilloscope display for $V_{CEOsust}$.

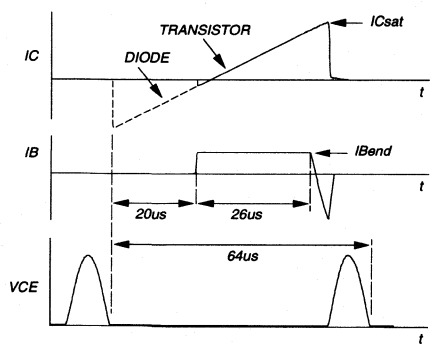


Fig.3. Switching times waveforms.

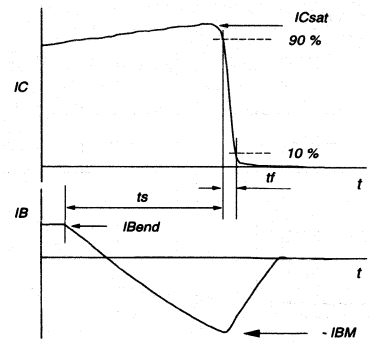


Fig.4. Switching times definitions.

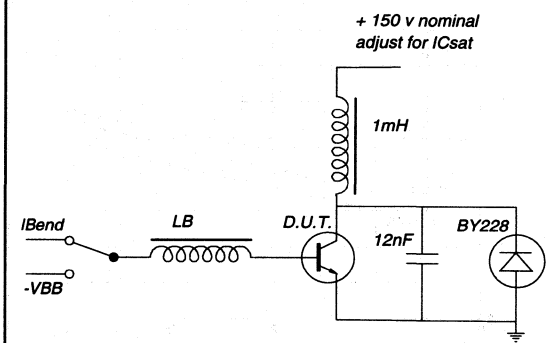


Fig.5. Switching times test circuit.

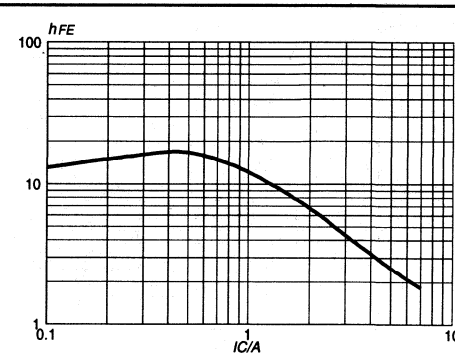


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

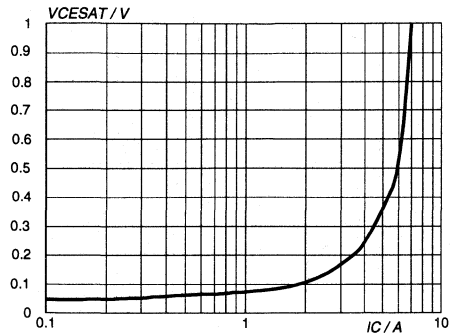


Fig.7. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

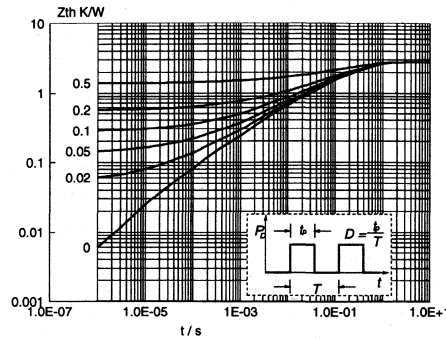


Fig.10. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

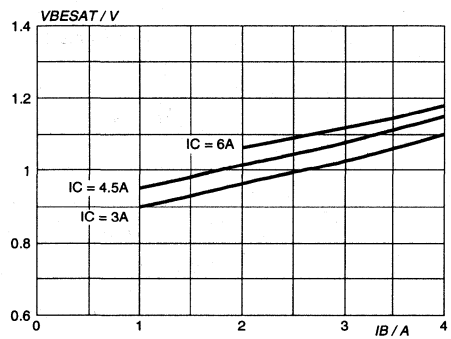


Fig.8. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

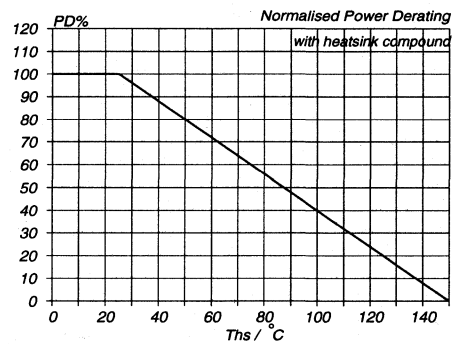


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\ 25^\circ C} = f(T_{hs})$

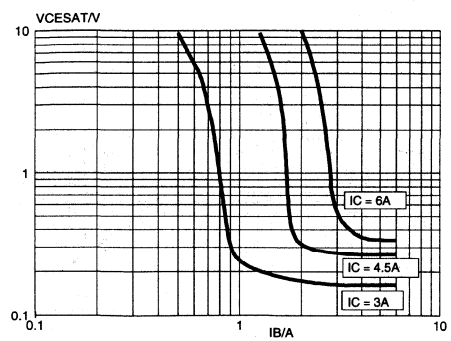


Fig.9. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

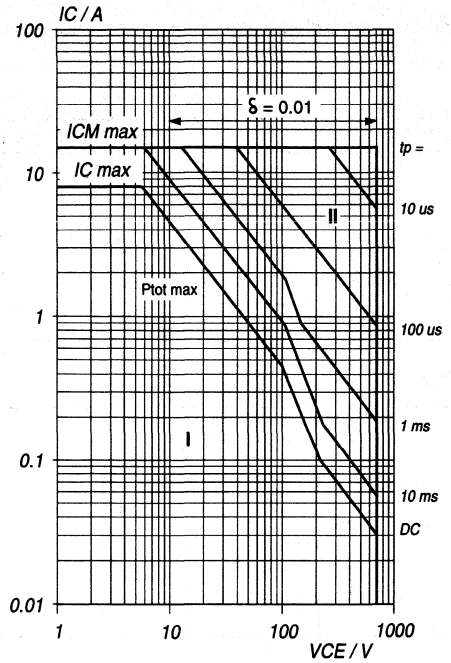


Fig.12. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

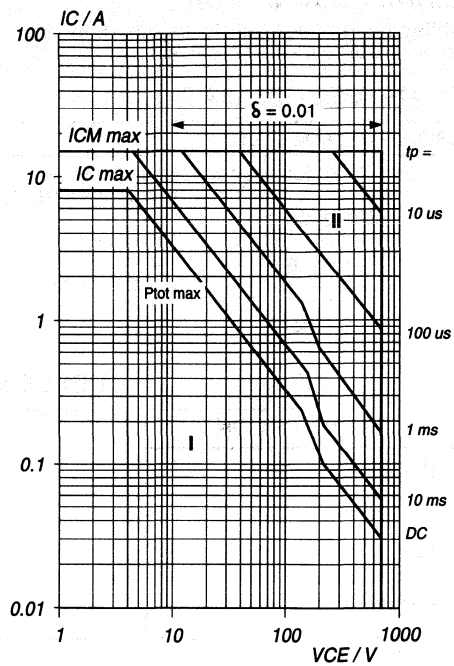


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU508AW

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistors in a plastic envelope, primarily for use in horizontal deflection circuits of colour television receivers.

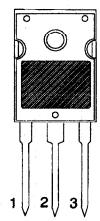
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.6 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	4.5	-	A
t_f	Fall time	I_{Csat} = 4.5 A; f = 16kHz	0.7	-	µs

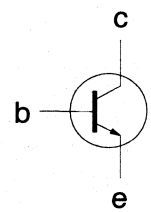
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	10	mA
V_{CEOsus}	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4.5 A; I_B = 1.6 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 2.0 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	6	13	30	-

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
f_T	Transition frequency at f = 5 MHz	I_C = 0.1 A;V_{CE} = 5 V	7	-	MHz
C_C	Collector capacitance at f = 1MHz	V_{CB} = 10 V	125	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A;L_c= 1 mH;C_{fb} = 4 nF $I_{B(end)}$ = 1.4 A; L_B = 6 µH; -V_{BB} = -4 V;			
t_s	Turn-off storage time		6.5	-	µs
t_f	Turn-off fall time		0.7	-	µs

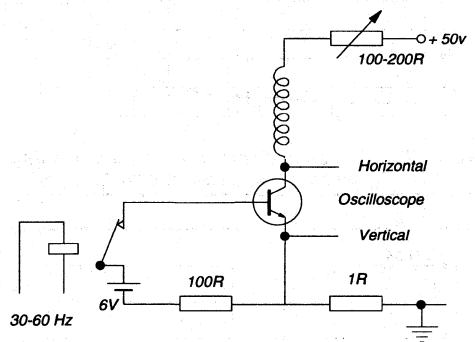


Fig.1. Test circuit for $V_{CEOsust}$.

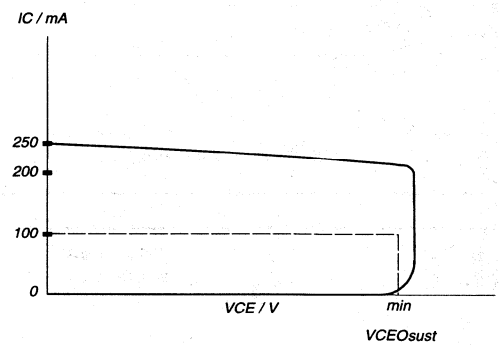


Fig.2. Oscilloscope display for $V_{CEOsust}$.

1 Measured with half sine-wave voltage (curve tracer).

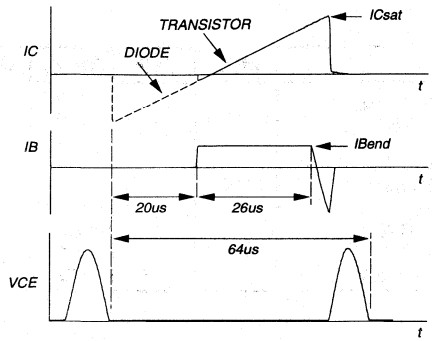


Fig.3. Switching times waveforms.

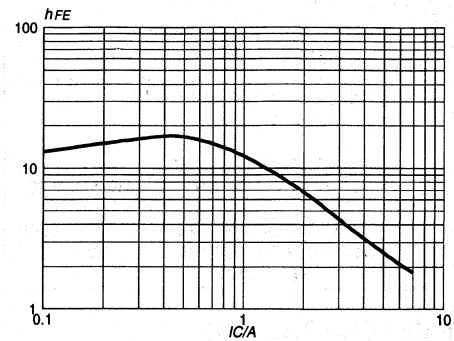


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

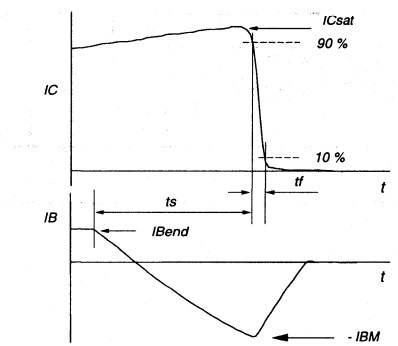


Fig.4. Switching times definitions.

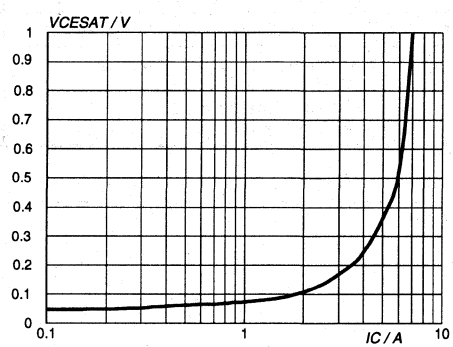


Fig.7. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

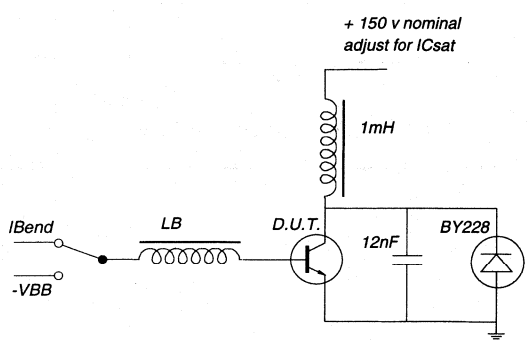


Fig.5. Switching times test circuit.

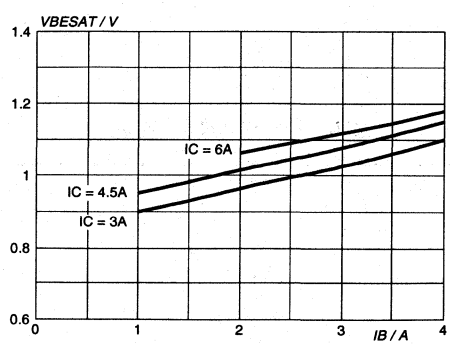


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

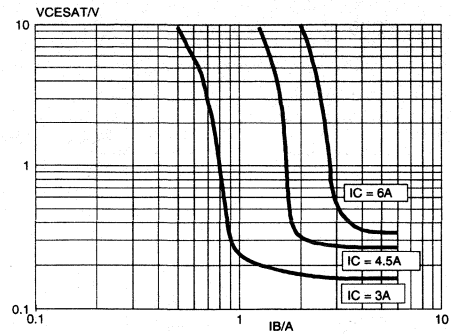


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

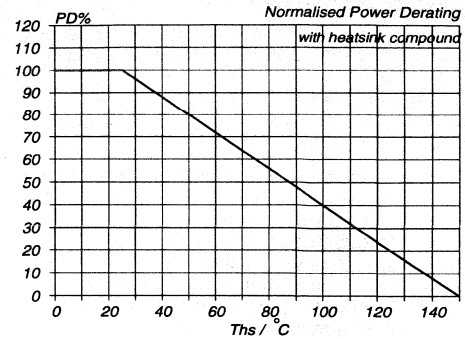


Fig.11. Normalised power dissipation. $PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

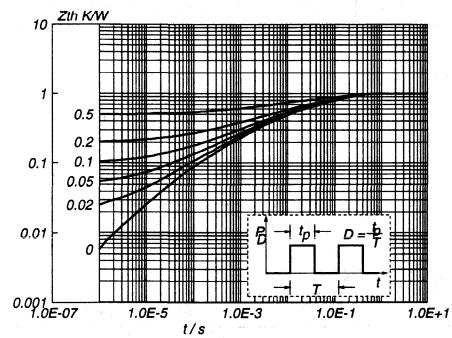


Fig.10. Transient thermal impedance. $Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

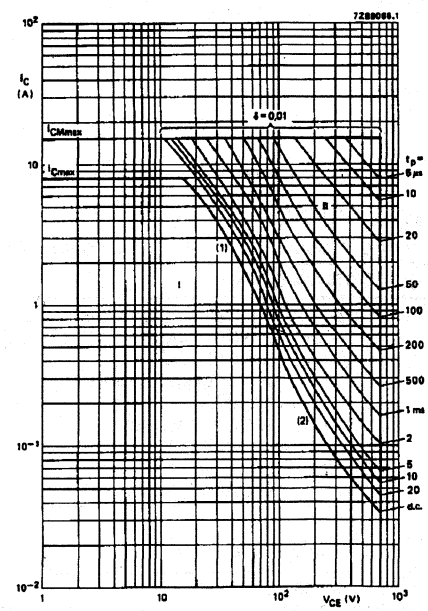


Fig.12. Forward bias safe operating area. $T_{mb} < 25^\circ C$
(1) $P_{tot\,max}$ line.
(2) Second-breakdown limit (independent of temperature).
I Region of permissible DC operation.
II Permissible extension for repetitive operation.

Silicon Diffused Power Transistor — BU508AX

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistors in a fully isolated SOT399 envelope, primarily for use in horizontal deflection circuits of colour television receivers.

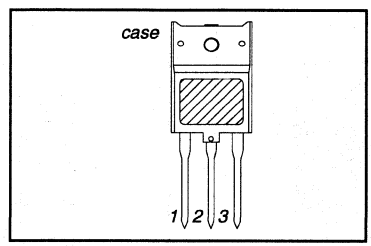
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.6 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	4.5	-	A
t_f	Fall time	I_{Csat} = 4.5 A; f = 16kHz	0.7	-	µs

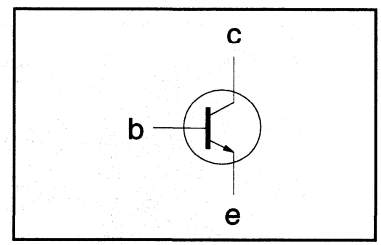
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	10	mA
V_{CEOsus}	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4.5 A; I_B = 1.6 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	6	13	30	-

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
f_T	Transition frequency at f = 5 MHz	I_C = 0.1 A;V_{CE} = 5 V	7	-	MHz
C_C	Collector capacitance at f = 1MHz	V_{CB} = 10 V	125	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A;L_c 1 mH;C_{fb} = 4 nF $I_{B(end)}$ = 1.4 A; L_B = 6 µH; -V_{BB} = -4 V; -I_{BM} = 2.25 A			
t_s	Turn-off storage time		6.5	-	µs
t_f	Turn-off fall time		0.7	-	µs

1 Measured with half sine-wave voltage (curve tracer).

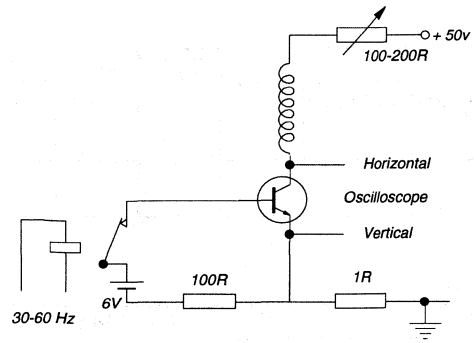


Fig.1. Test circuit for $V_{CEOsust}$.

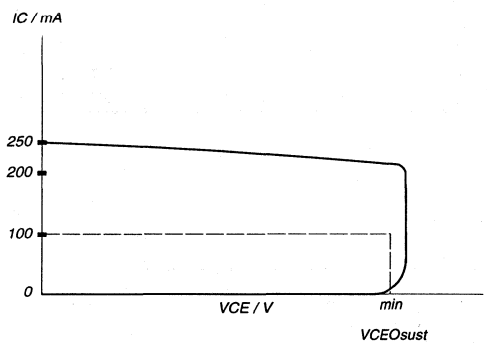


Fig.2. Oscilloscope display for $V_{CEOsust}$.

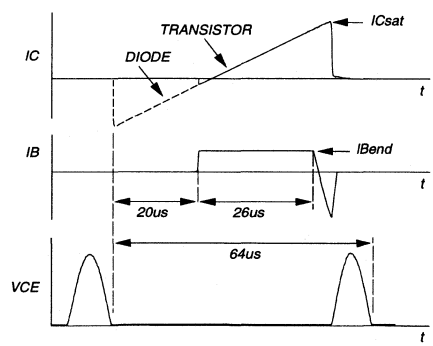


Fig.3. Switching times waveforms.

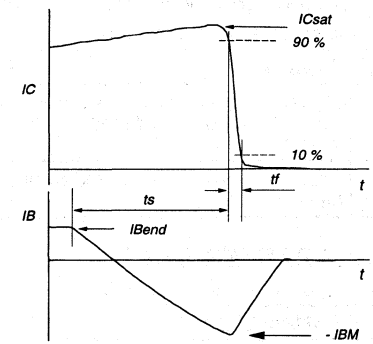


Fig.4. Switching times definitions.

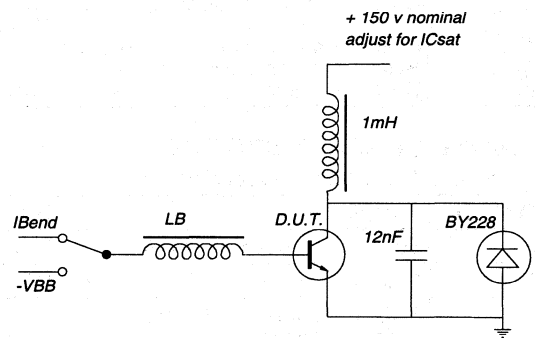


Fig.5. Switching times test circuit.

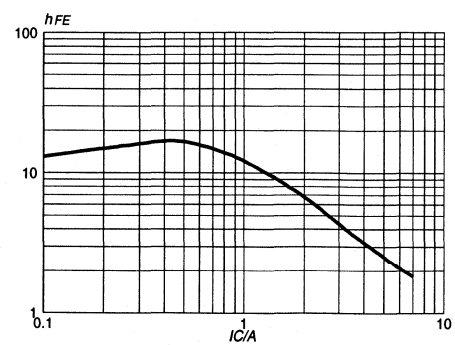


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

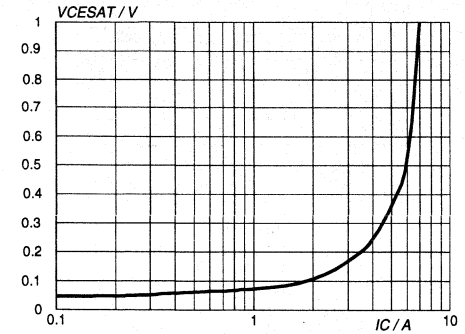


Fig.7. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

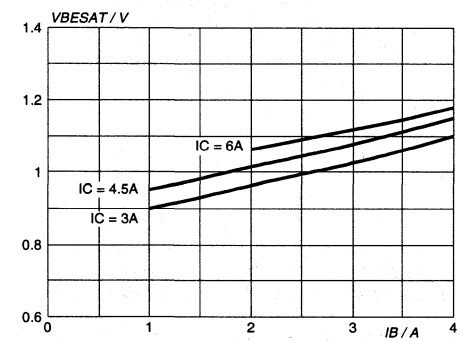


Fig.8. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

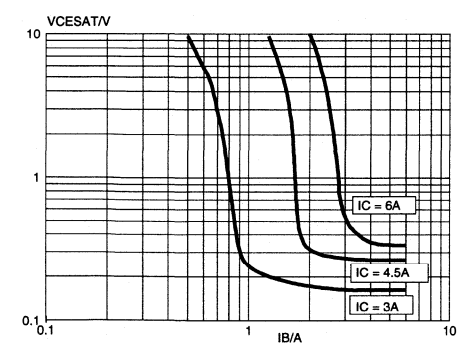


Fig.9. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

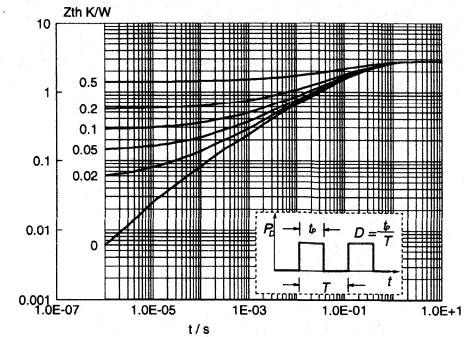


Fig.10. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

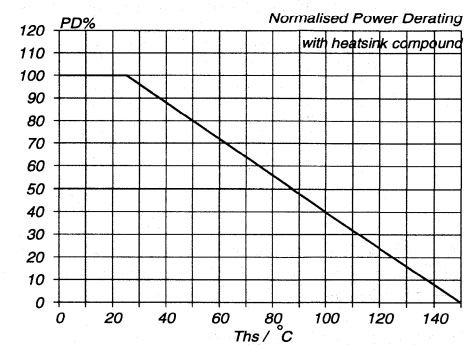


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\ 25^\circ C} = f(T_{hs})$

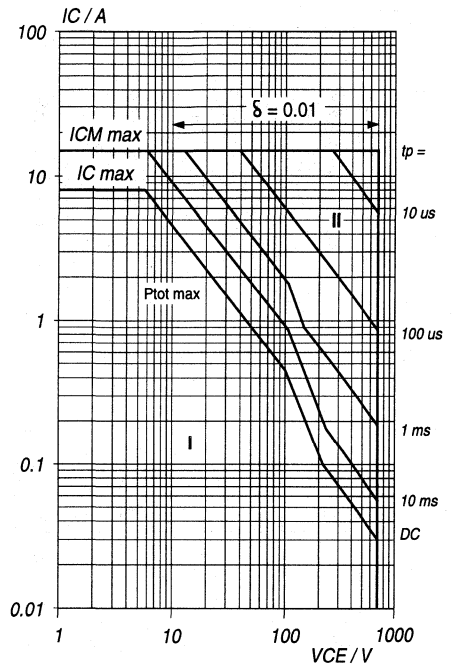


Fig.12. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

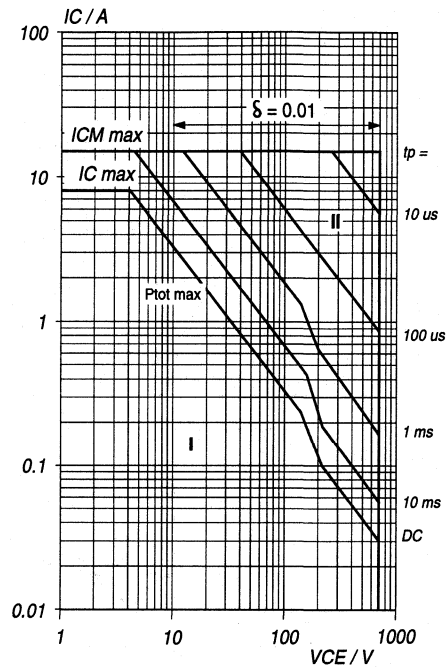


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU508DF

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistors in a fully isolated SOT199 envelope with integrated efficiency diode, primarily for use in horizontal deflection circuits of colour television receivers.

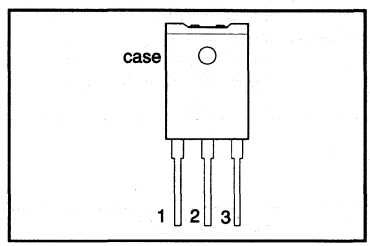
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	34	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.6 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4.5	-	A
V_F	Diode forward voltage	I_F = 4.5 A	1.6	2.0	V
t_f	Fall time	I_{Csat} = 4.5 A; f = 16kHz	0.7	-	µs

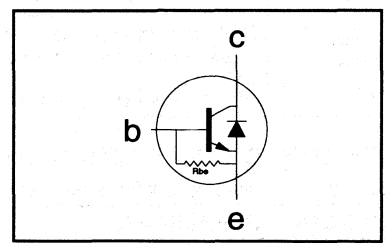
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	34	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4.5 A; I_B = 1.6 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 2.0 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	6	13	30	
V_F	Diode forward voltage	I_F = 4.5 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
f_T	Transition frequency at f = 5 MHz	I_C = 0.1 A;V_{CE} = 5 V	7	-	MHz
C_C	Collector capacitance at f = 1MHz	V_{CB} = 10 V	125	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A;L_c 1 mH;C_{fb} = 4 nF $I_{B(end)}$ = 1.4 A; L_B = 6 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 2.25 A			
t_s	Turn-off storage time		6.5	-	µs
t_f	Turn-off fall time		0.7	-	µs

1 Measured with half sine-wave voltage (curve tracer).

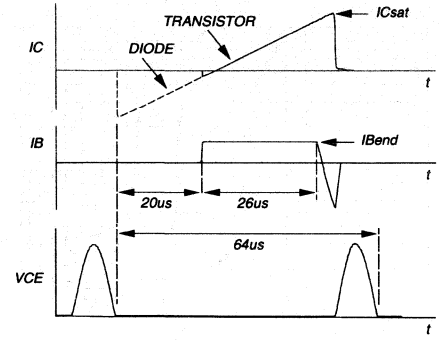


Fig.1. Switching times waveforms.

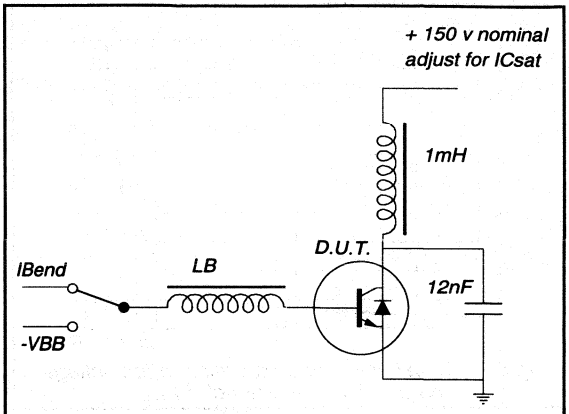


Fig.3. Switching times test circuit

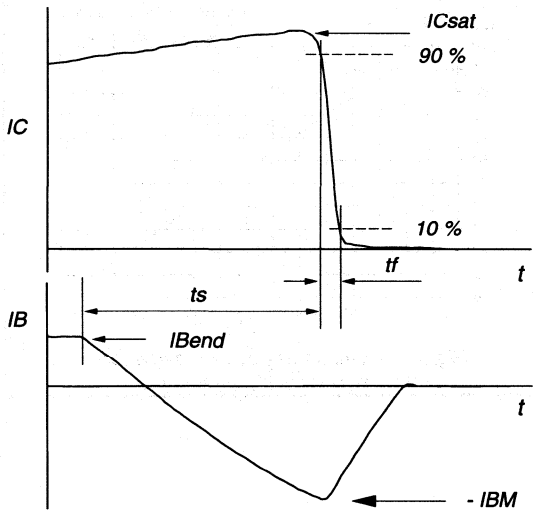


Fig.2. Switching times definitions.

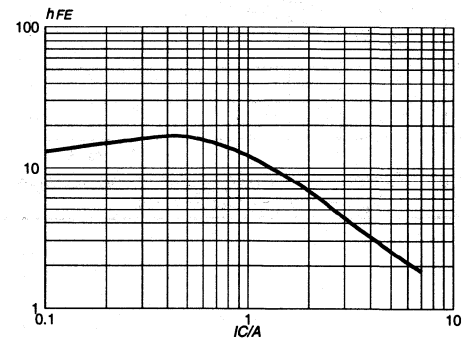


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

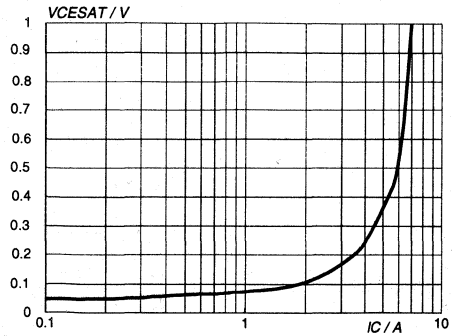


Fig.5. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

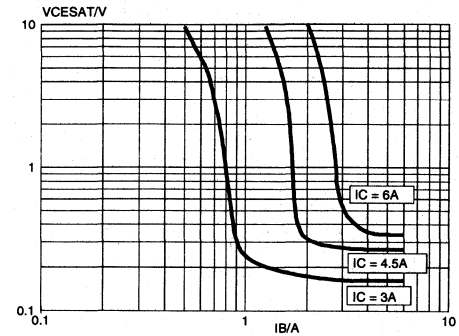


Fig.7. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

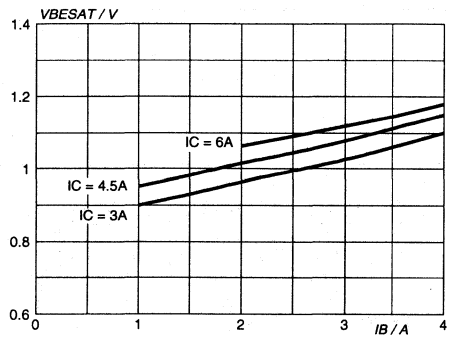


Fig.6. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

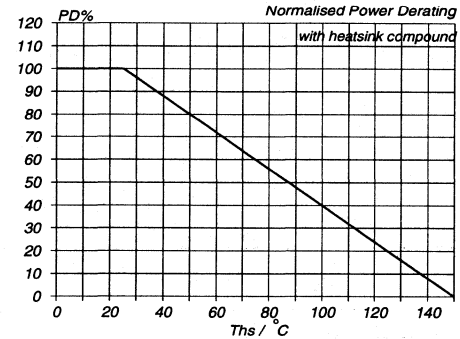


Fig.8. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

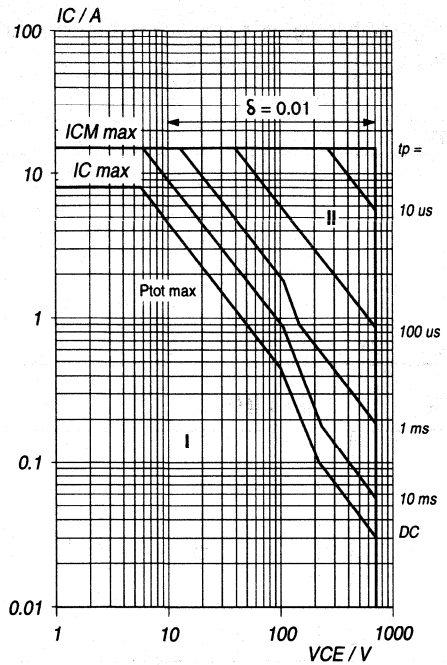


Fig.9. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

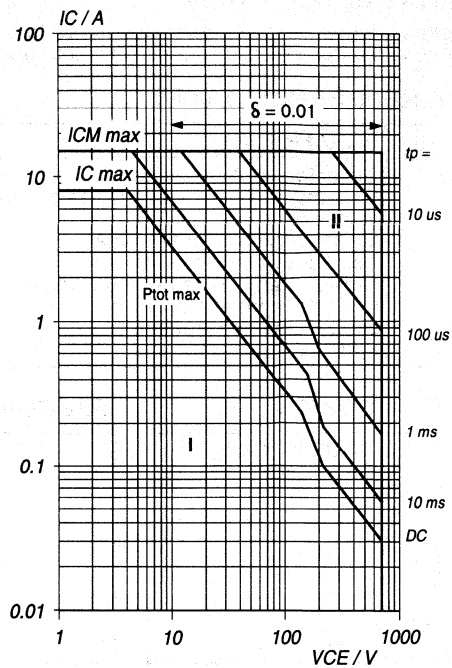


Fig.10. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU508DW

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistors in a plastic envelope with integrated efficiency diode, primarily for use in horizontal deflection circuits of colour television receivers.

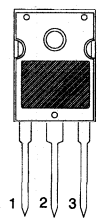
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.6 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4.5	-	A
V_F	Diode forward voltage	I_F = 4.5 A	1.6	2.0	V
t_f	Fall time	I_{Csat} = 4.5 A; f = 16kHz	0.7	-	µs

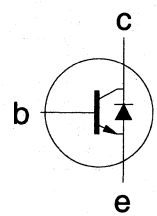
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4.5 A; I_B = 1.6 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	6	13	30	
V_F	Diode forward voltage	I_F = 4.5 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
f_T	Transition frequency at f = 5 MHz	I_C = 0.1 A;V_{CE} = 5 V	7	-	MHz
C_C	Collector capacitance at f = 1MHz	V_{CB} = 10 V	125	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A;L_c= 1 mH;C_{fb} = 4 nF $I_{B(end)}$ = 1.4 A; L_B = 6 µH; -V_{BB} = -4 V;			
t_s	Turn-off storage time		6.5	-	µs
t_f	Turn-off fall time		0.7	-	µs

1 Measured with half sine-wave voltage (curve tracer).

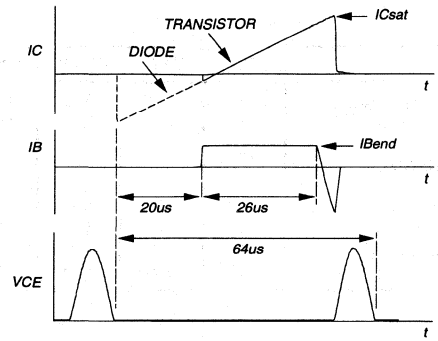


Fig.1. Switching times waveforms.

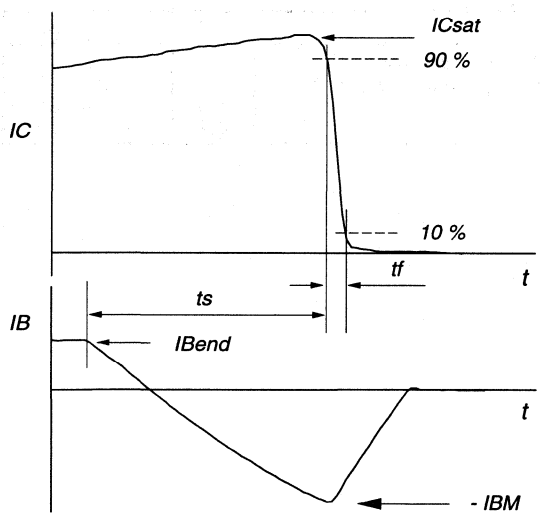


Fig.2. Switching times definitions.

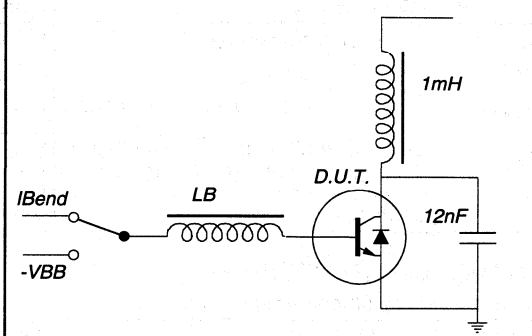


Fig.3. Switching times test circuit

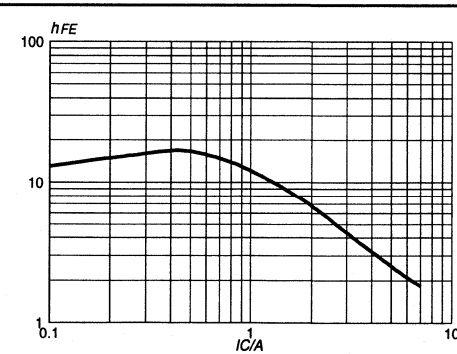


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

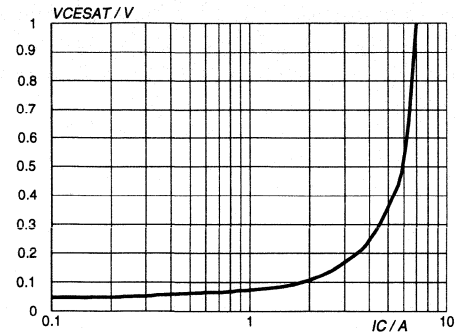


Fig.5. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

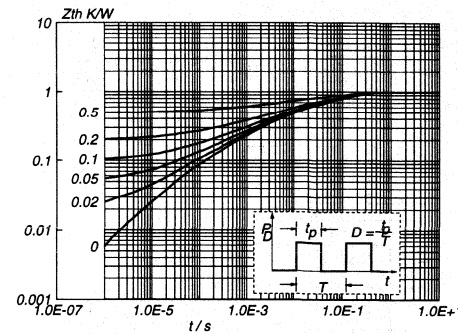


Fig.8. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

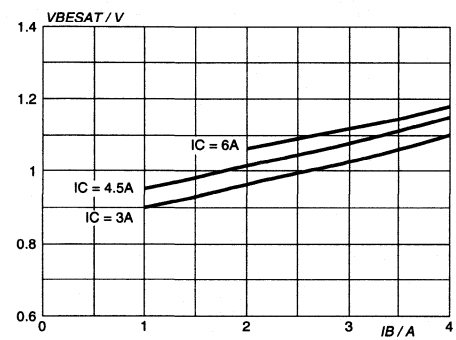


Fig.6. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

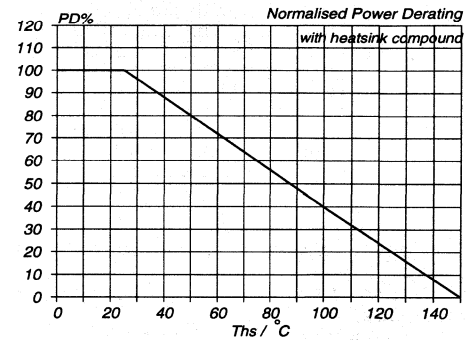


Fig.9. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\ 25^\circ C} = f(T_{hs})$

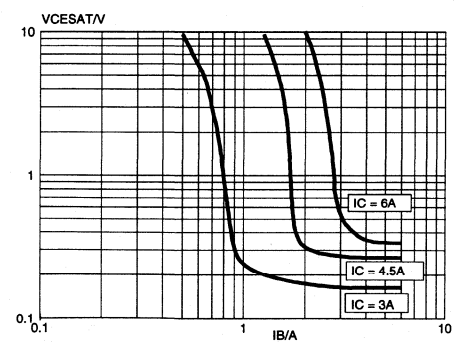


Fig.7. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

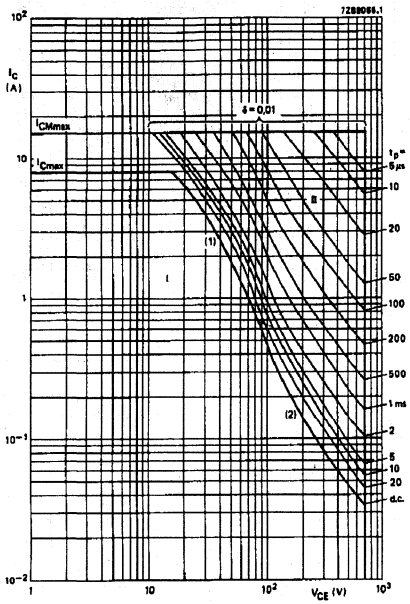


Fig.10. Forward bias safe operating area. T_{hs} < 25˚C
(1) $P_{tot\,max}$ line.
(2) Second-breakdown limits (independent of temperature).
I Region of permissible DC operation.
II Permissible extension for repetitive pulse operation.

Silicon Diffused Power Transistor — BU508DX

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistors in a fully isolated SOT399 envelope with integrated efficiency diode, primarily for use in horizontal deflection circuits of colour television receivers.

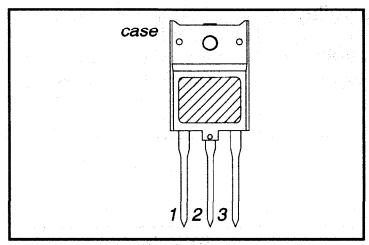
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.6 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4.5	-	A
V_F	Diode forward voltage	I_F = 4.5 A	1.6	2.0	V
t_f	Fall time	I_{Csat} = 4.5 A; f = 16kHz	0.7	-	µs

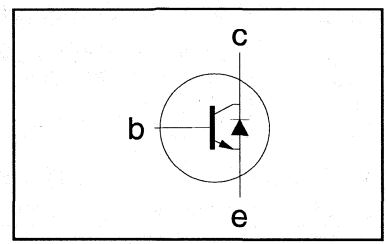
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4.5 A; I_B = 1.6 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.6 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	6	13	30	
V_F	Diode forward voltage	I_F = 4.5 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
f_T	Transition frequency at f = 5 MHz	I_C = 0.1 A;V_{CE} = 5 V	7	-	MHz
C_C	Collector capacitance at f = 1MHz	V_{CB} = 10 V	125	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A;L_c 1 mH;C_{fb} = 4 nF $I_{B(end)}$ = 1.4 A; L_B = 6 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 2.25 A			
t_s	Turn-off storage time		6.5	-	µs
t_f	Turn-off fall time		0.7	-	µs

1 Measured with half sine-wave voltage (curve tracer).

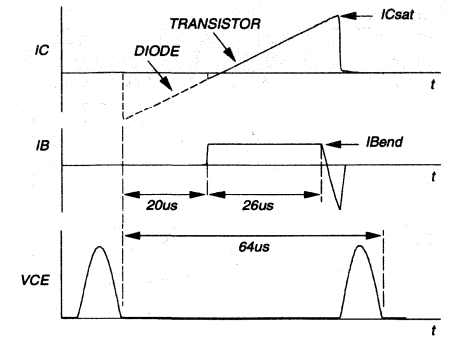


Fig.1. Switching times waveforms.

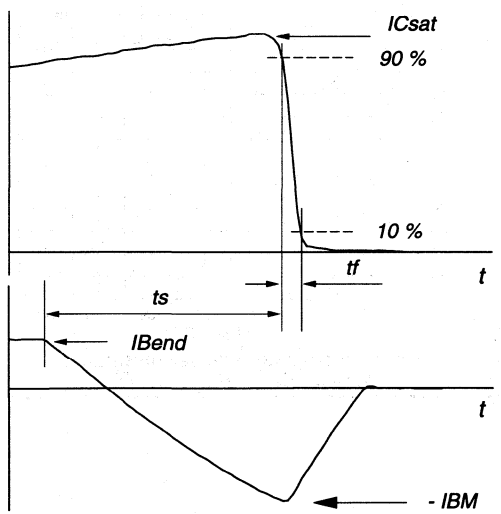


Fig.2. Switching times definitions.

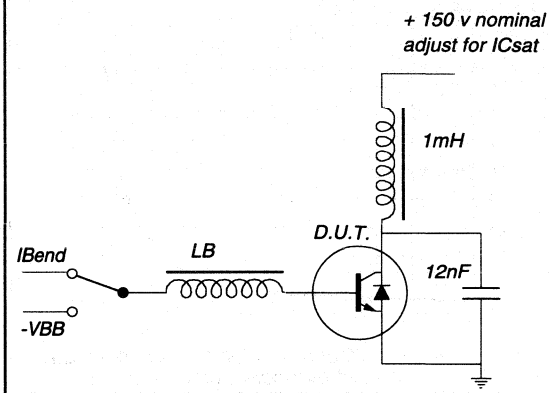


Fig.3. Switching times test circuit

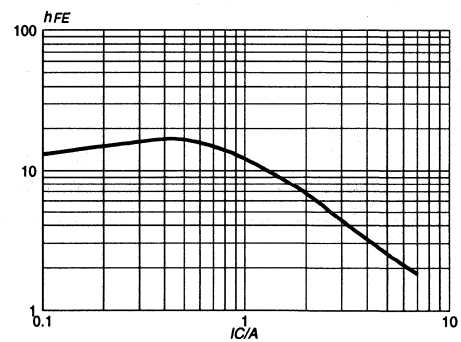


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

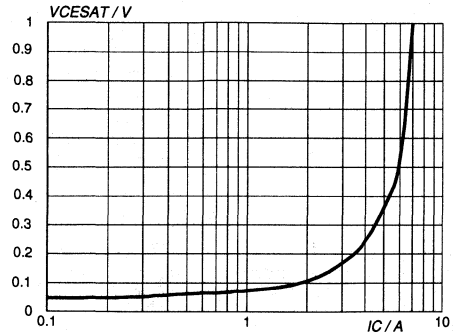


Fig.5. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

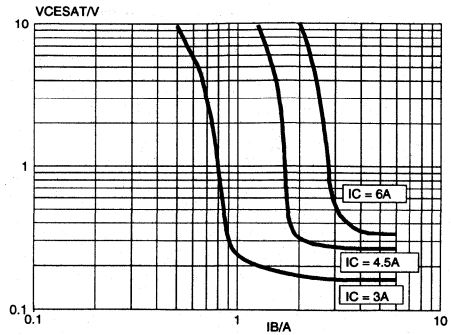


Fig.7. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

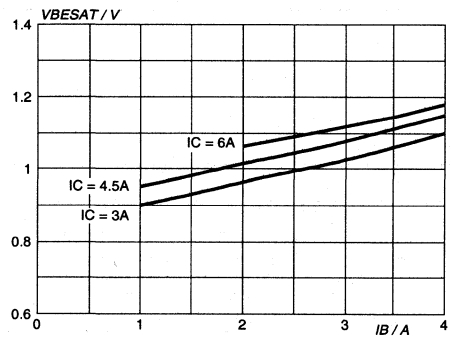


Fig.6. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

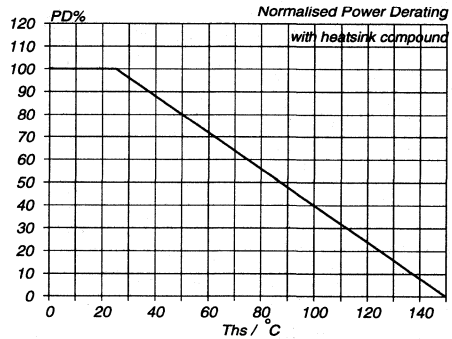


Fig.8. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

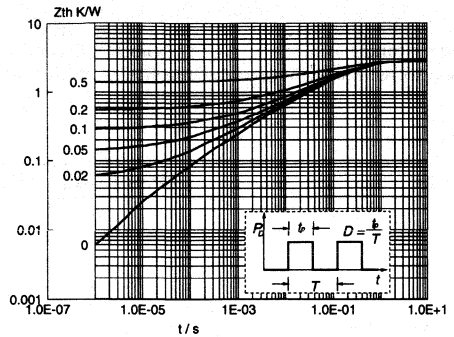


Fig.9. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

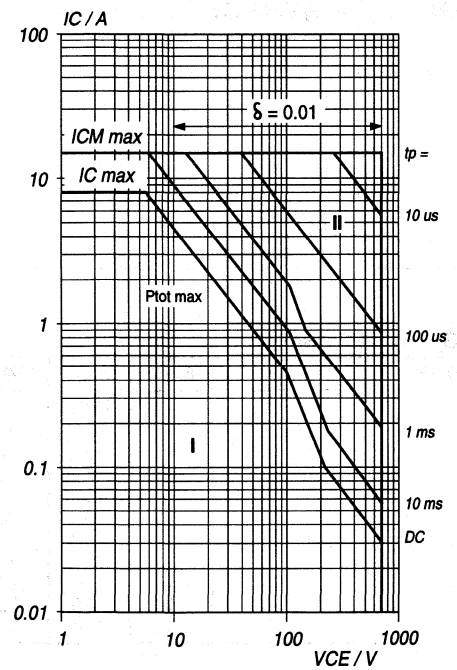


Fig.10. Forward bias safe operating area. $T_{hs} = 25^{\circ}C$
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

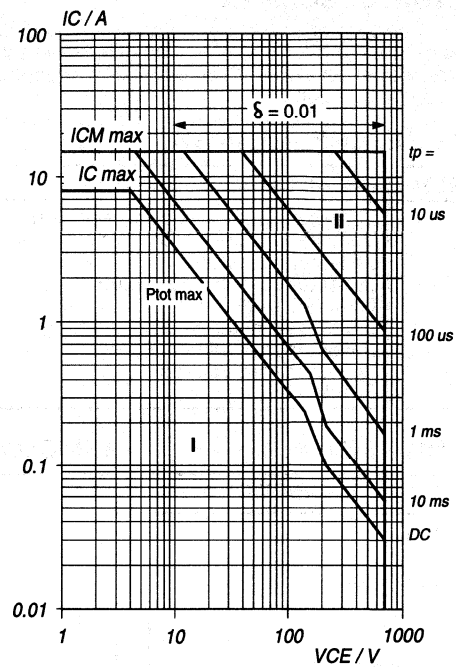


Fig.11. Forward bias safe operating area. $T_{hs} = 25^{\circ}C$
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU1506DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

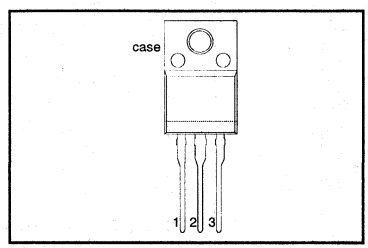
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.79 A	-	5.0	V
I_{Csat}	Collector saturation current		3.0	-	A
V_F	Diode forward voltage	I_F = 3.0 A	1.6	2.0	V
t_f	Fall time	I_{CM} = 3.0 A; $I_{B(end)}$ = 0.67 A	0.25	0.5	µs

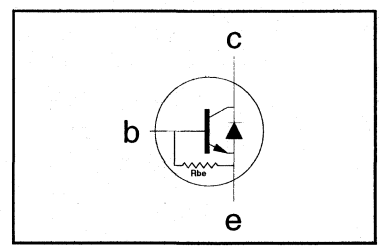
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	8	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	32	W
T_{stg}	Storage temperature		-40	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	4.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	90	-	180	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	55	-	Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.79 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.79 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 0.3 A; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 3.0 A; V_{CE} = 5 V	3.8	5.5	7.5	
V_F	Diode forward voltage	I_F = 3.0 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	47	-	pF
	Switching times (line deflection circuit)	I_{CM} = 3.0 A; L_C = 1.35 mH; C_{FB} = 9.4 nF; $I_{B(end)}$ = 0.67 A; L_B = 8 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.45 A/µs)			
t_s	Turn-off storage time		4.5	6.0	µs
t_f	Turn-off fall time		0.25	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

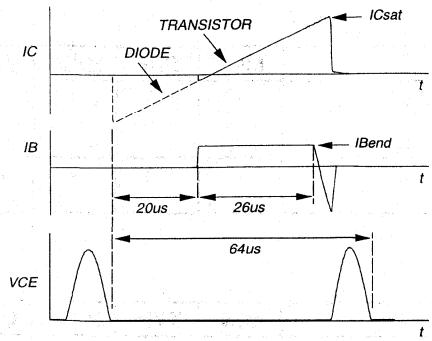


Fig.1. Switching times waveforms.

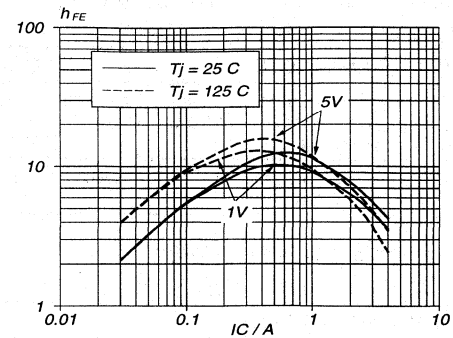


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

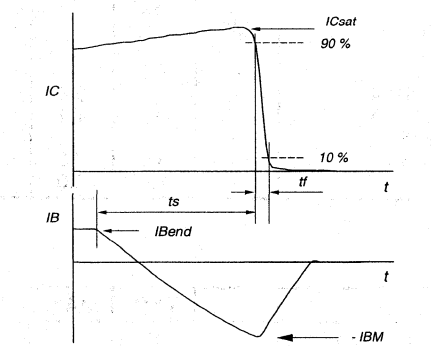


Fig.2. Switching times definitions.

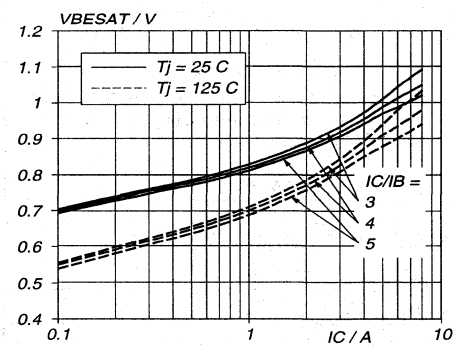


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

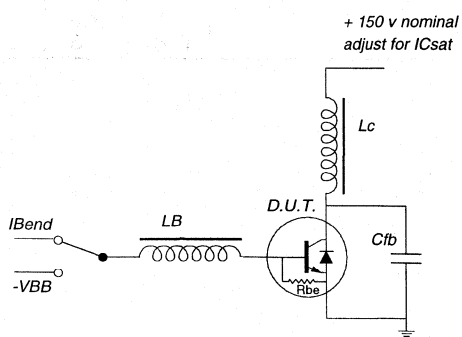


Fig.3. Switching times test circuit.

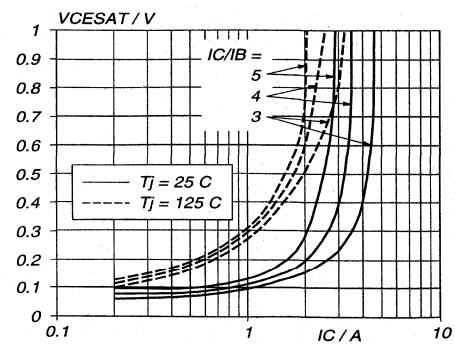


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

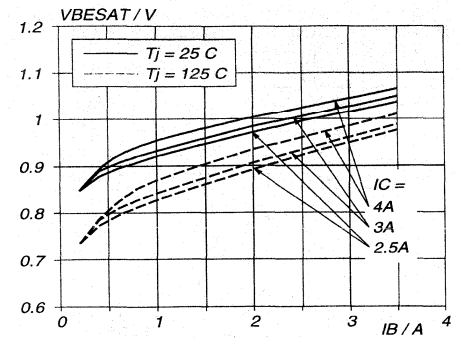


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

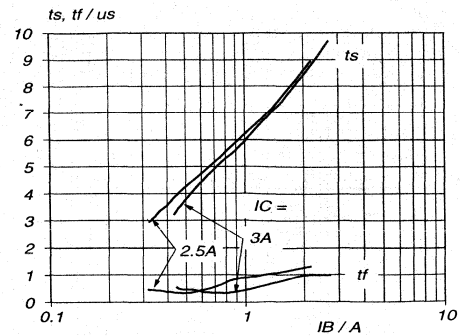


Fig.10. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$

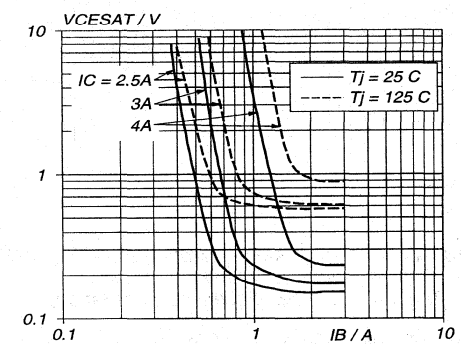


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

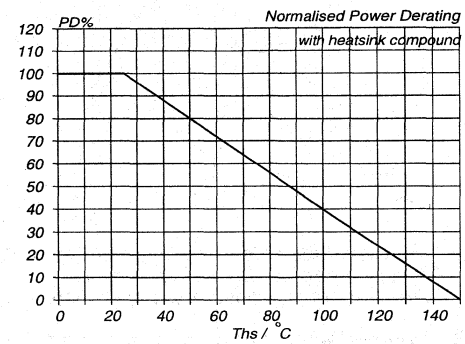


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

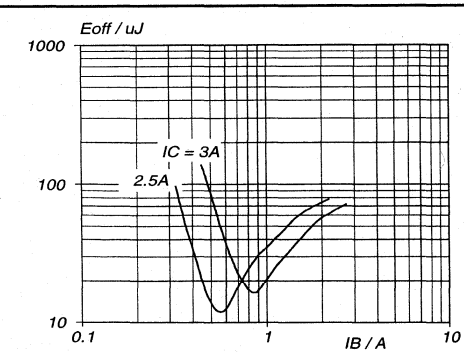


Fig.9. Typical turn-off losses. $T_j = 85^\circ C$
$Eoff = f(I_B)$; parameter I_C

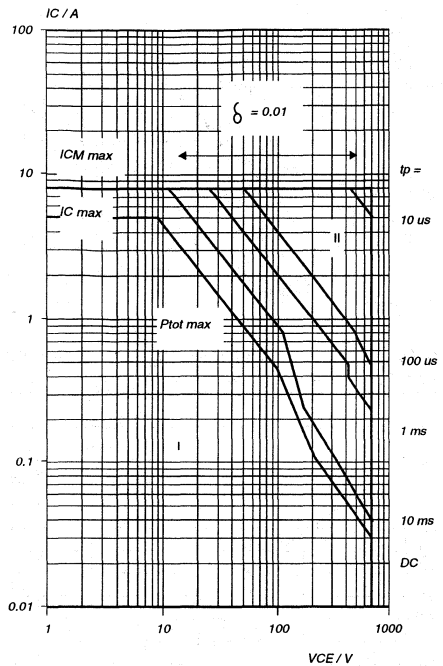


Fig.12. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

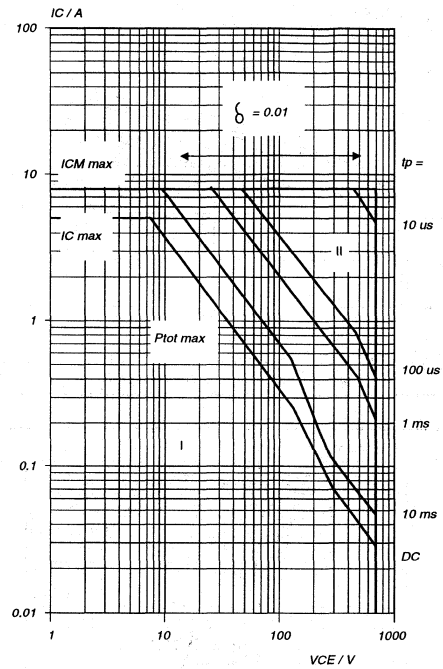


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU1507AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

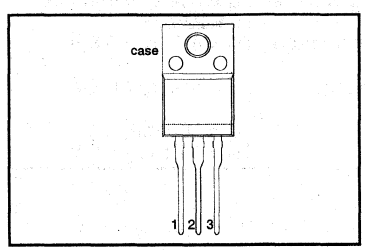
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.95 A	-	1.0	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.25	0.5	µs

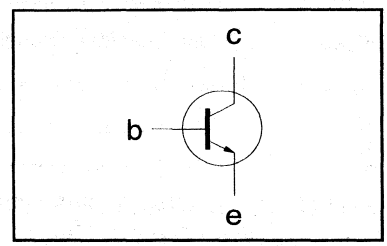
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$ T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 0.8 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	17	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	5.0	7.0	9.0	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4 A; $I_{B(end)}$ = 0.7 A; L_B = 6 µH; $-V_{BB}$ = 4 V			
t_s	Turn-off storage time		5.0	6.0	µs
t_f	Turn-off fall time		0.25	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

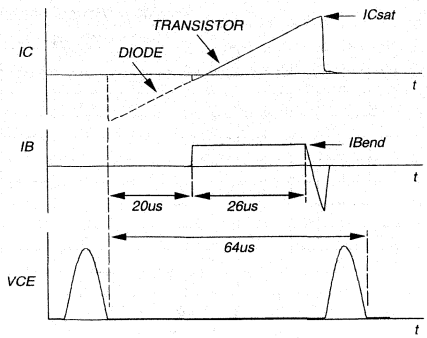


Fig.1. Switching times waveforms.

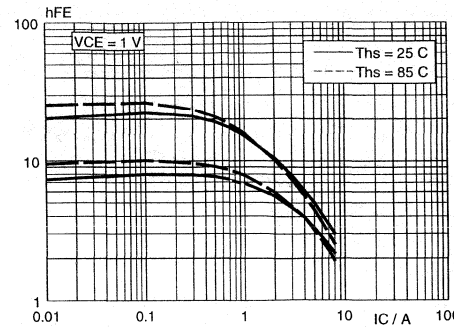


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

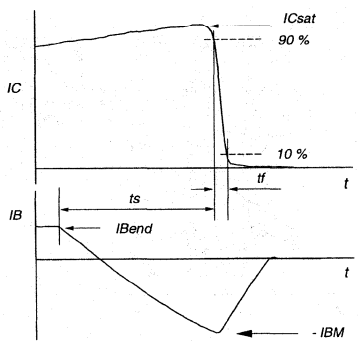


Fig.2. Switching times definitions.

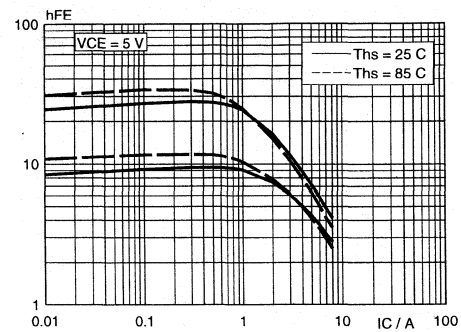


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

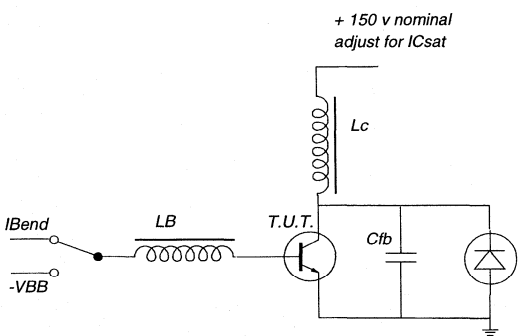


Fig.3. Switching times test circuit.

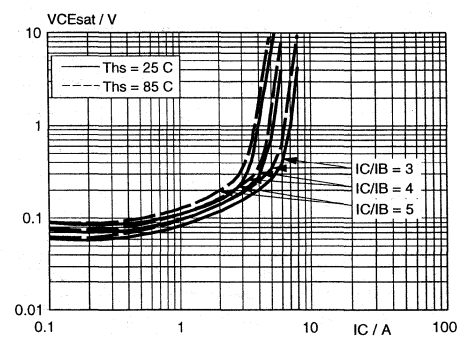


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

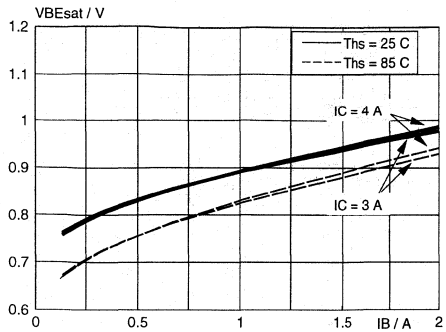


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

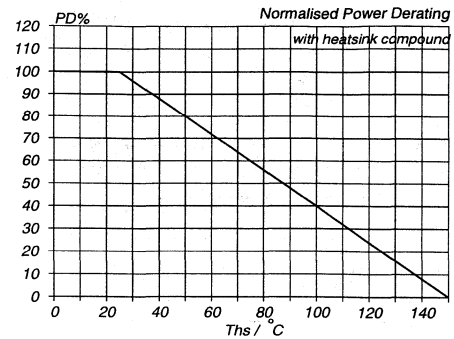


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

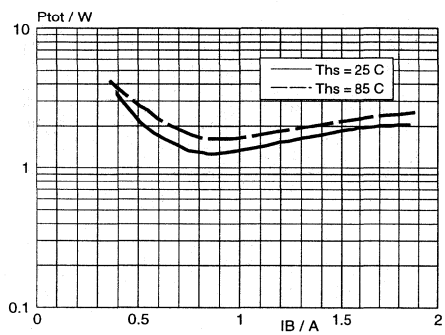


Fig.8. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 4$ A; f = 16 kHz

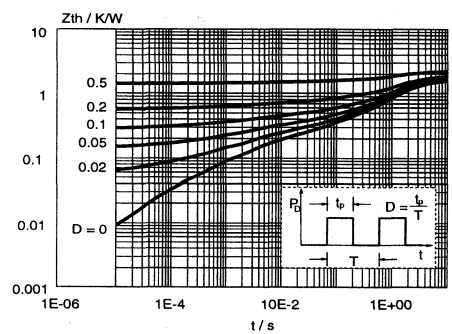


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

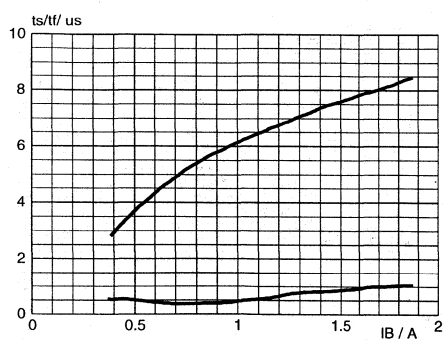


Fig.9. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; $I_C = 4.0$ A; $T_j = 85^\circ C$; f = 16 kHz

Silicon Diffused Power Transistor — BU1507DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

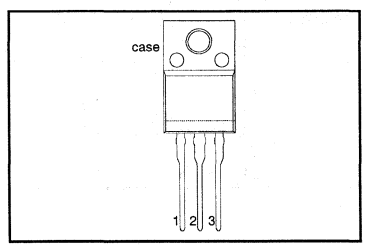
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
V_F	Diode forward voltage	I_F = 4 A	1.7	2.0	V
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.25	0.5	µs

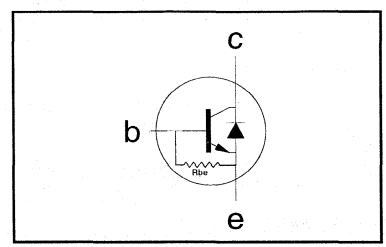
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	35	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65% ; clean and dustfree	-		1500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	12	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	160	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 0.8 A		-	5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	14	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	5	7	9	
V_F	Diode forward voltage	I_F = 4 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4 A; $I_{B(end)}$ = 0.7 A; L_B = 6 μH; $-V_{BB}$ = 4 V			
t_s	Turn-off storage time		5.0	6.0	μs
t_f	Turn-off fall time		0.25	0.5	μs

2 Measured with half sine-wave voltage (curve tracer).

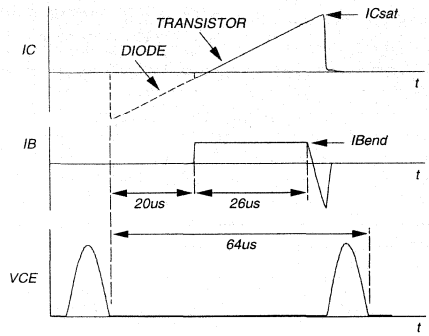


Fig.1. Switching times waveforms.

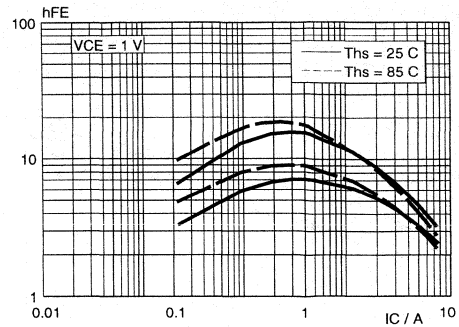


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

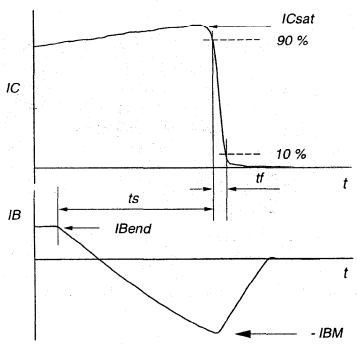


Fig.2. Switching times definitions.

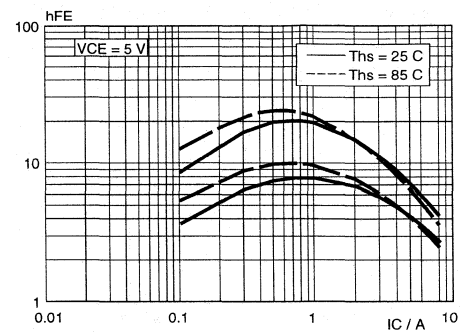


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

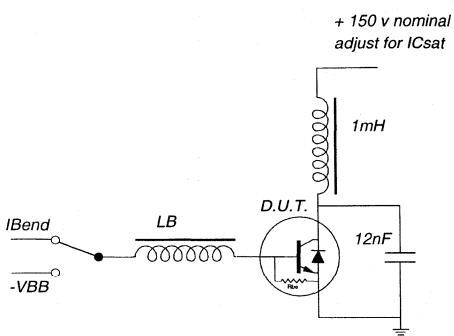


Fig.3. Switching times test circuit.

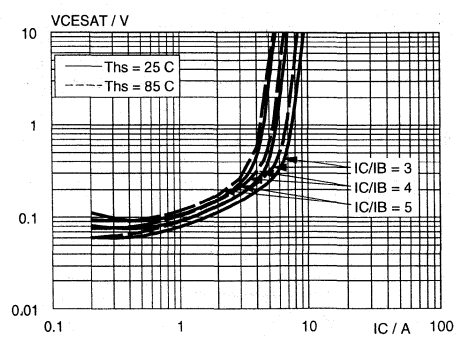


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

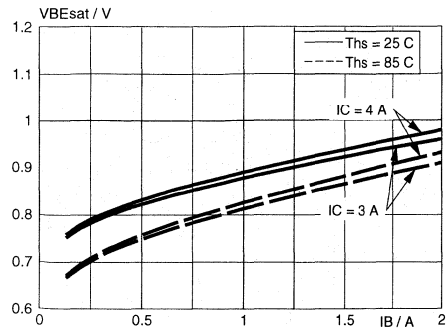


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

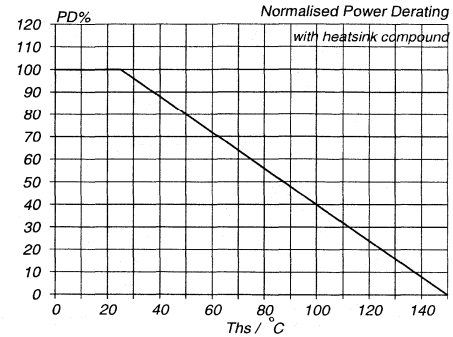


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

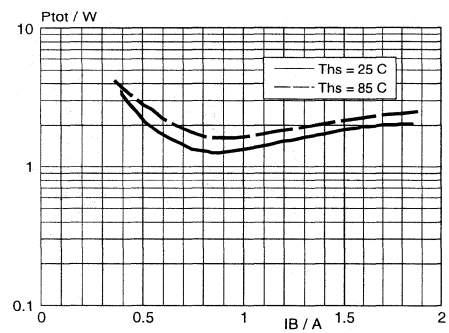


Fig.8. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 4$ A; f = 16 kHz

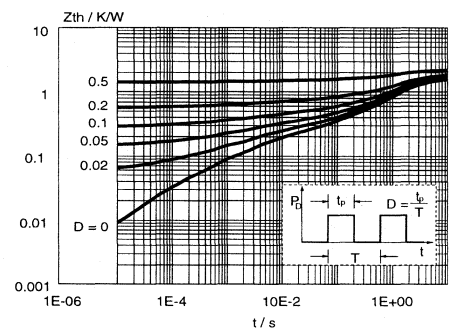


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

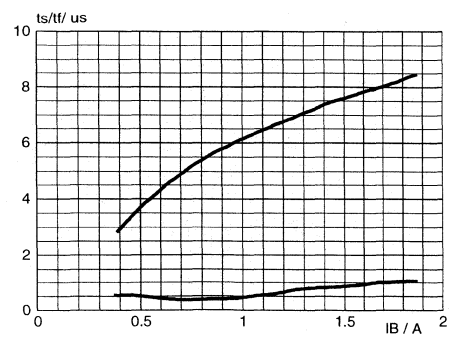


Fig.9. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; $I_C = 4.0$ A; $T_j = 85^\circ C$; f = 16 kHz

Silicon Diffused Power Transistor — BU1508AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

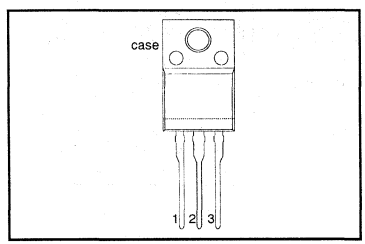
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	35	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.1 A	-	1.0	V
I_{Csat}	Collector saturation current		4.5	-	A
t_f	Fall time	I_{CM} = 4.5 A; $I_{B(end)}$ = 1.1 A	0.4	0.6	µs

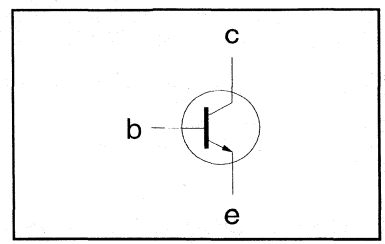
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	35	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.6	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.1 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.7 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4.0	5.5	7.0	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (line deflection circuit)	I_{CM} = 4.5 A; $I_{B(end)}$ = 1.1 A; L_B = 6 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/µs)			
t_s	Turn-off storage time		5.0	6.0	µs
t_f	Turn-off fall time		0.4	0.6	µs

2 Measured with half sine-wave voltage (curve tracer).

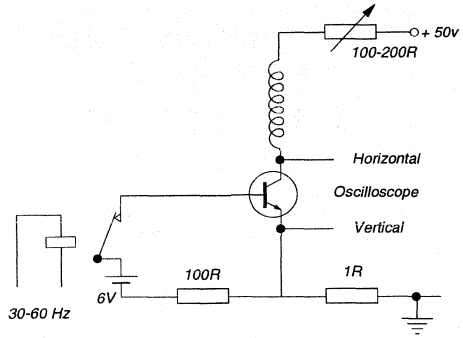


Fig.1. Test circuit for $V_{CEOsust}$.

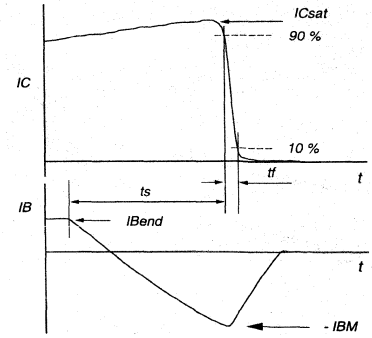


Fig.4. Switching times definitions.

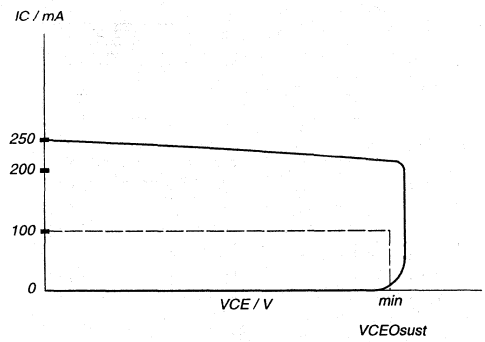


Fig.2. Oscilloscope display for $V_{CEOsust}$.

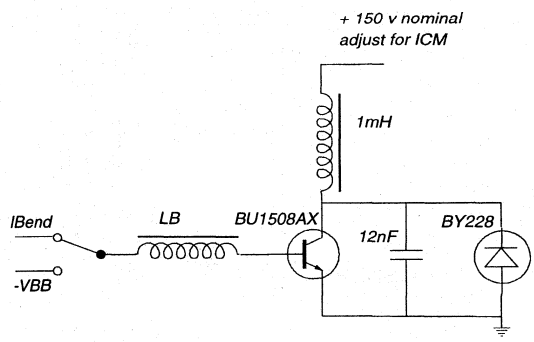


Fig.5. Switching times test circuit (BU1508AX).

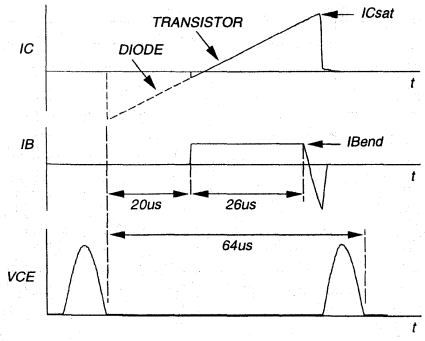


Fig.3. Switching times waveforms.

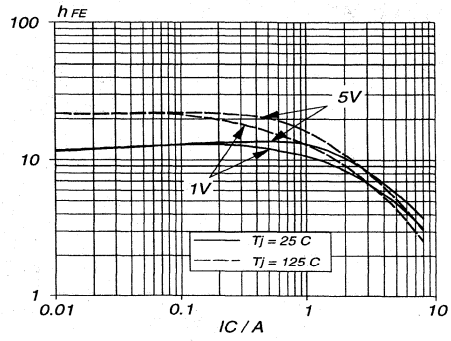


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

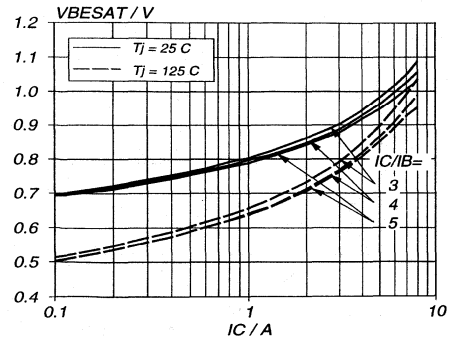


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_C)$; parameter I_C/I_B

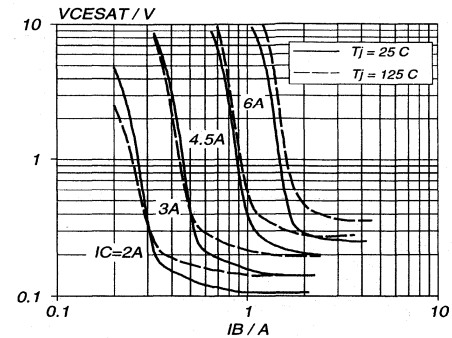


Fig.10. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

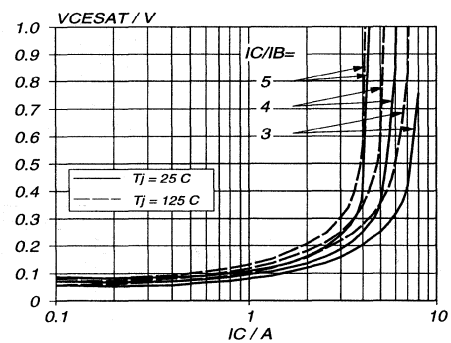


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

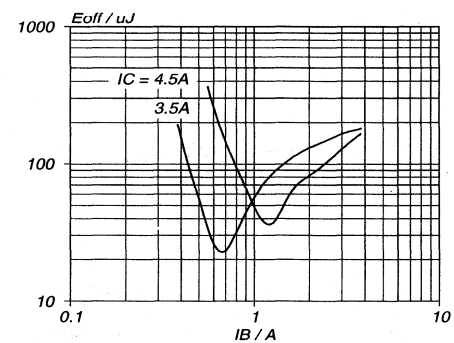


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$
Eoff = $f(I_B)$; parameter I_C

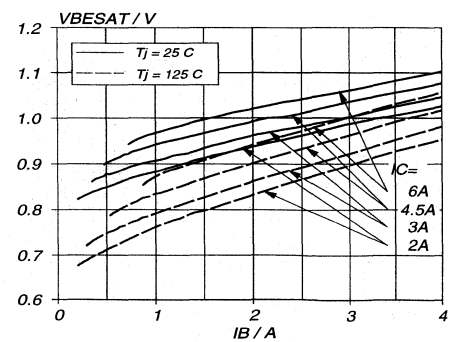


Fig.9. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

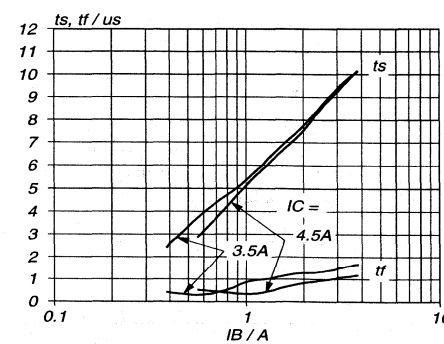


Fig.12. Typical collector storage and fall time.
ts = $f(I_B)$; tf = $f(I_B)$; parameter I_C; $T_j = 85^\circ C$

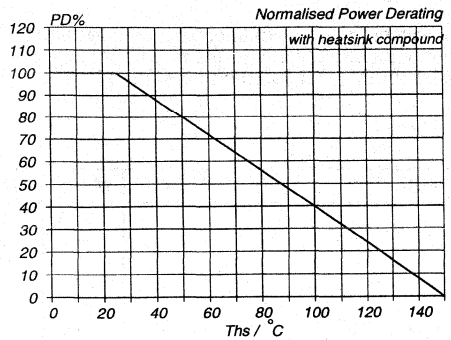


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

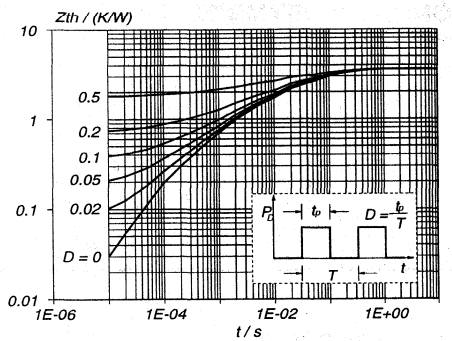


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

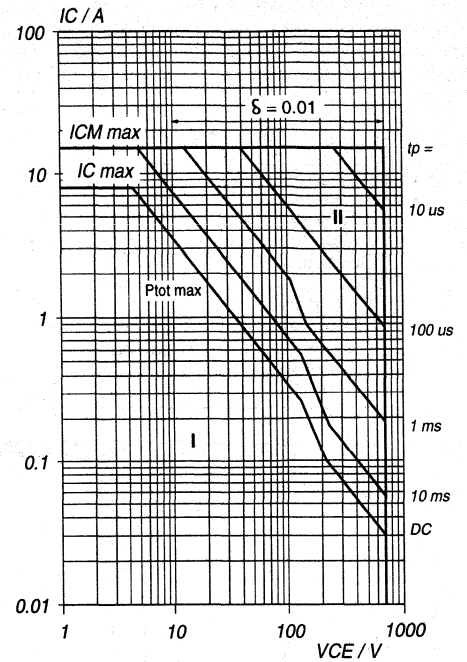


Fig.15. Forward bias safe operating area. $T_{hs} = 25^\circ C$
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU1508DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

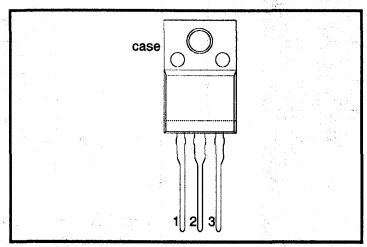
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	35	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.1 A	-	1.0	V
I_{Csat}	Collector saturation current		4.5	-	A
V_F	Diode forward voltage	I_F = 4.5 A	1.6	-	V
t_f	Fall time	I_{CM} = 4.5 A; $I_{B(end)}$ = 1.1 A	0.4	0.6	µs

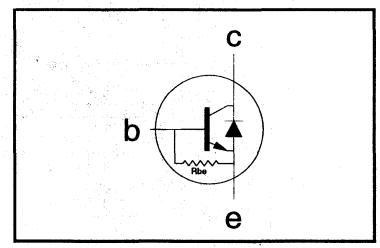
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	35	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.6	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; Tj = 125°C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	140	-	390	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	33	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.1 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.7 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4	5.5	7.0	
V_F	Diode forward voltage	I_F = 4.5 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (line deflection circuit). Fig.1, Fig.2 and Fig.3.	I_{CM} = 4.5 A; $I_{B(end)}$ = 1.1 A; L_B = 6 μH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/μs)			
t_s	Turn-off storage time		5.0	6.0	μs
t_f	Turn-off fall time		0.4	0.6	μs

2 Measured with half sine-wave voltage (curve tracer).

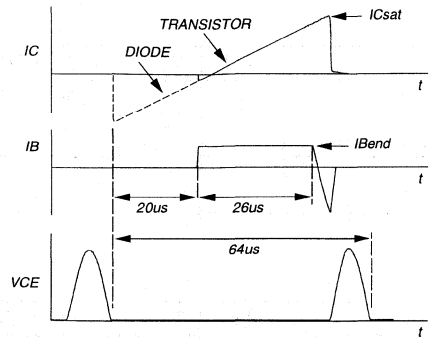


Fig.1. Switching times waveforms.

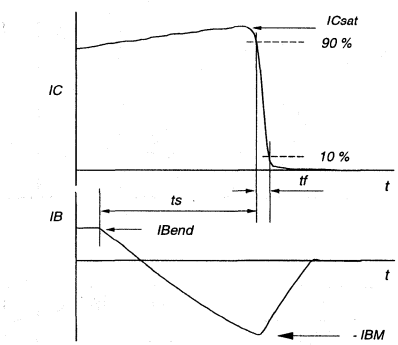


Fig.2. Switching times definitions.

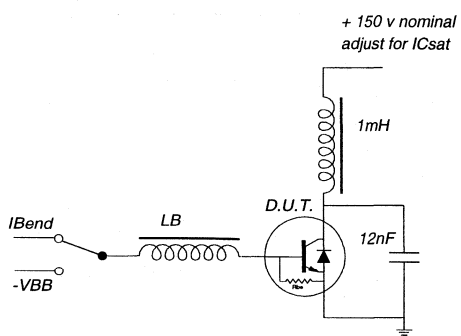


Fig.3. Switching times test circuit.

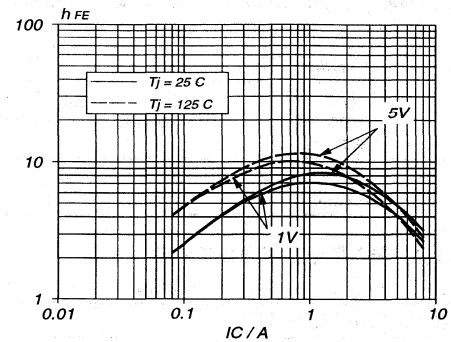


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

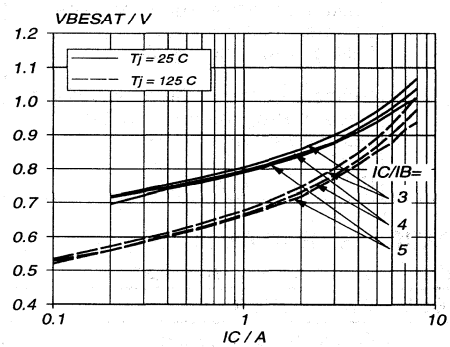


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

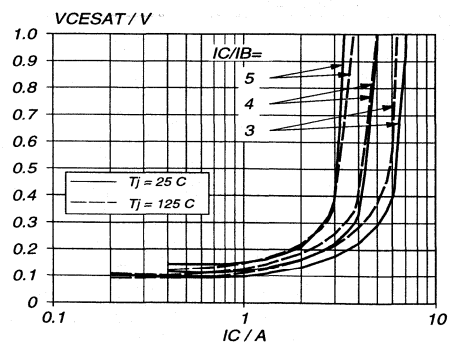


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

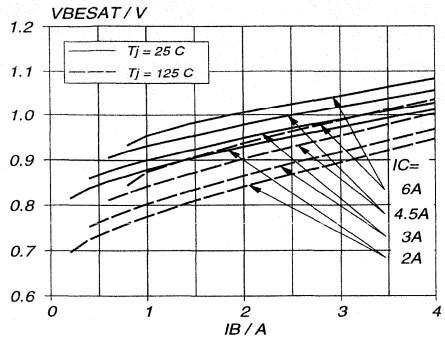


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

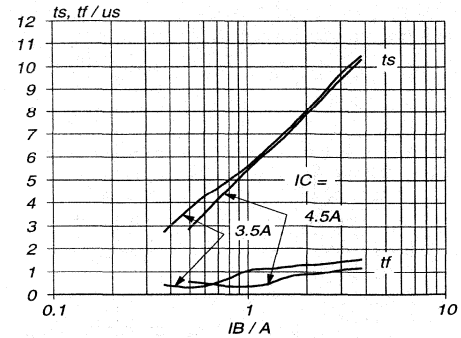


Fig.10. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$

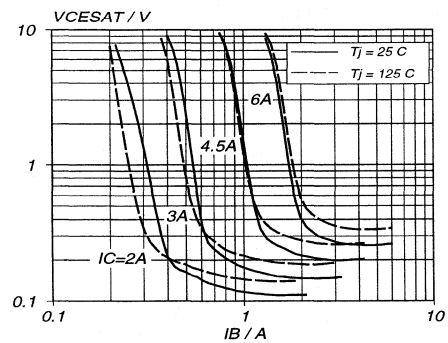


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

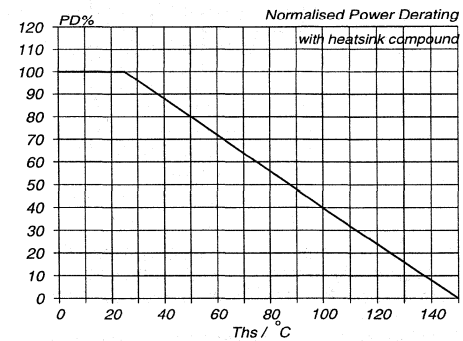


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

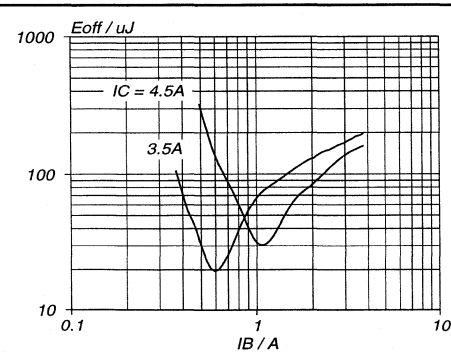


Fig.9. Typical turn-off losses. $T_j = 85^\circ C$
$Eoff = f(I_B)$; parameter I_C

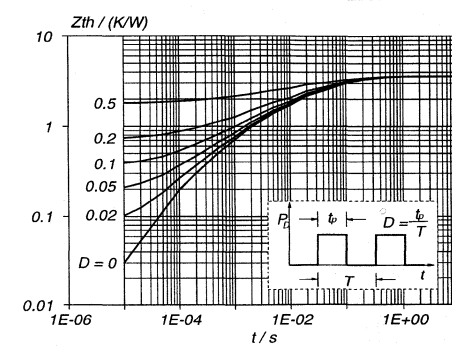


Fig.12. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

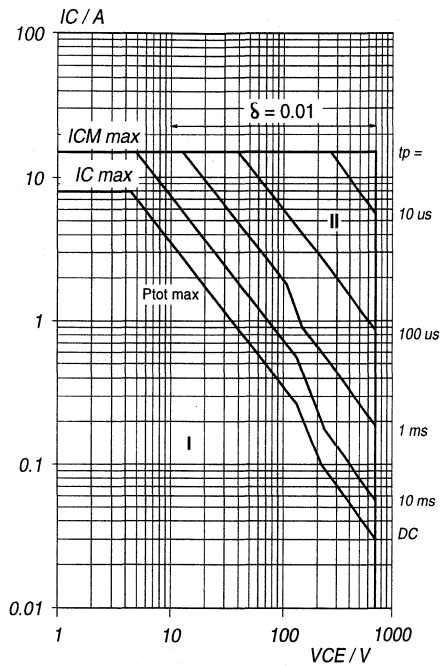


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU1706A

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in high frequency electronic lighting ballast applications.

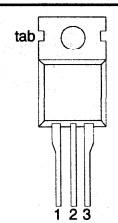
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1750	V
V_{CEO}	Collector-emitter voltage (open base)		-	850	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1.5 A; I_B = 0.3 A	-	1.0	V
I_{Csat}	Collector saturation current		1.5	-	A
t_f	Fall time	I_{CM} = 1.5 A; $I_{B(on)}$ = 0.3 A	0.25	0.6	µs

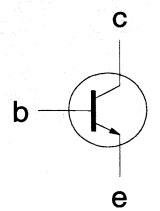
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1750	V
V_{CEO}	Collector-emitter voltage (open base)		-	850	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{B(AV)}$	Reverse base current	average over any 20ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.25	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = 1500 V	-	-	20	µA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 12 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	750	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1.5 A; I_B = 0.3 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 1.5 A; I_B = 0.3 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 10 V	8	-	-	
h_{FE}		I_C = 400 mA; V_{CE} = 3 V	12	18	35	
h_{FE}		I_C = 1.5 A; V_{CE} = 1 V	5	7	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 1.5 A; I_{Bon} = $-I_{Boff}$ = 0.3 A			
t_{on}	Turn-on time		1.1	1.5	µs
t_s	Turn-off storage time		5	6.5	µs
t_f	Turn-off fall time		0.75	1.0	µs
	Switching times (inductive load)	I_{Con} = 1.5 A; I_{Bon} = 0.3 A; L_B = 1 µH; $-V_{BB}$ = 5 V			
t_s	Turn-off storage time		2.0	3.0	µs
t_f	Turn-off fall time		0.25	0.6	µs
	Switching times (inductive load)	I_{Con} = 1.5 A; I_{Bon} = 0.3 A; L_B = 1 µH; $-V_{BB}$ = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		2.2	3.3	µs
t_f	Turn-off fall time		0.2	0.7	µs

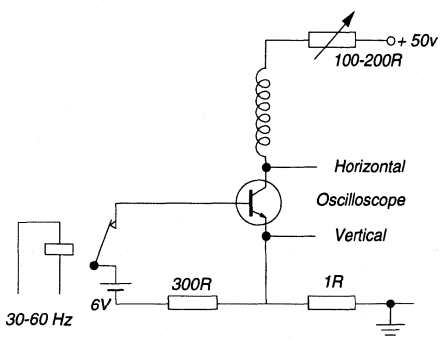


Fig.1. Test circuit for $V_{CEOsust}$.

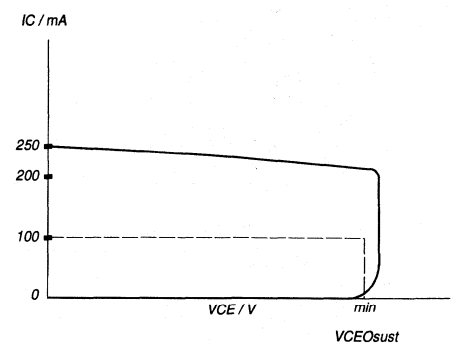


Fig.2. Oscilloscope display for $V_{CEOsust}$.

1 Measured with half sine-wave voltage (curve tracer).

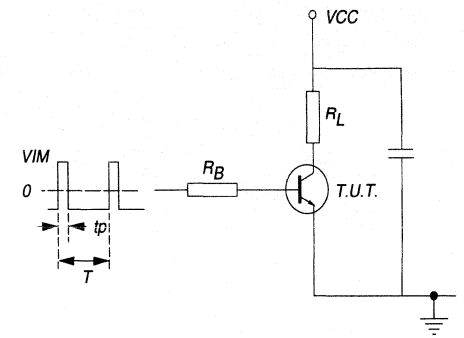


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; tp = 20 µs; δ = tp / T = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

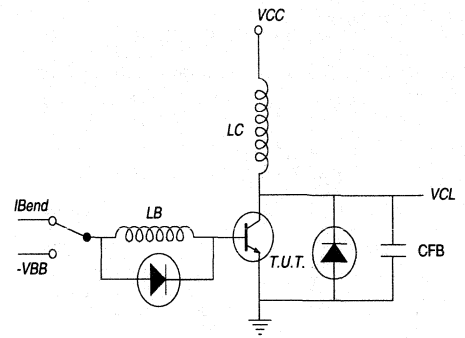


Fig.6. Test Circuit RBSOA.
V_{CC} = 150 V; $-V_{BB}$ = 5 V; L_C = 2 mH; V_{CL} ≤ 1500 V;
L_B = 1 µH

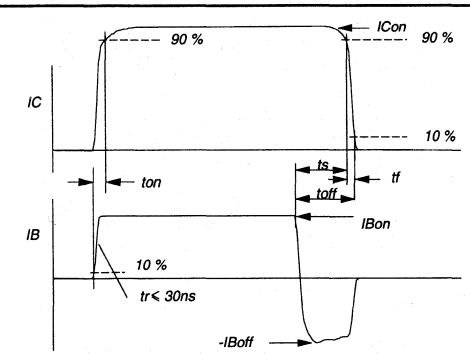


Fig.4. Switching times waveforms with resistive load.

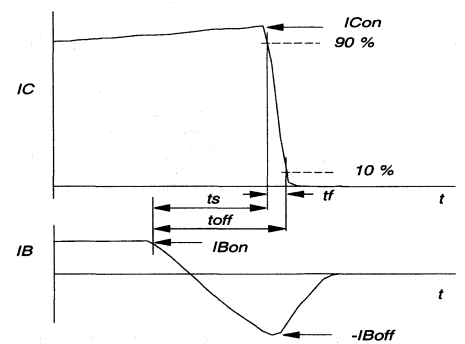


Fig.7. Switching times waveforms with inductive load.

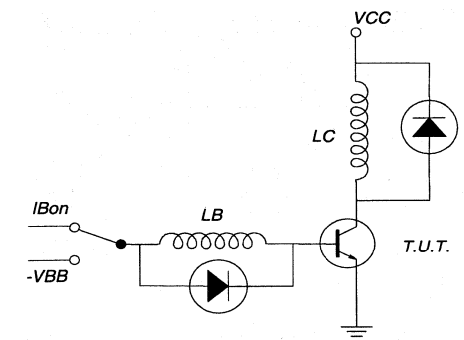


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_B = 1 uH

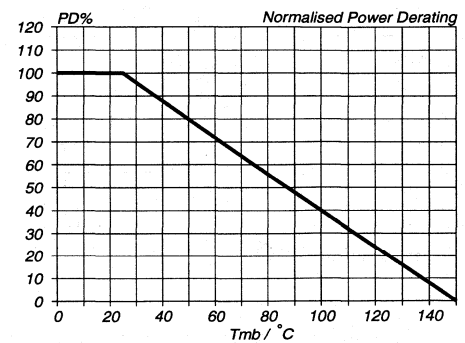


Fig.8. Normalised power dissipation.
PD% = 100·PD/PD $_{25\,°C}$ = f (T_{mb})

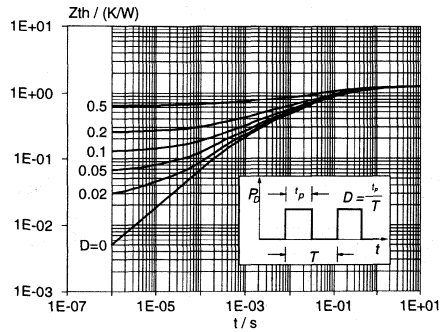


Fig.9. Transient thermal impedance.
$Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

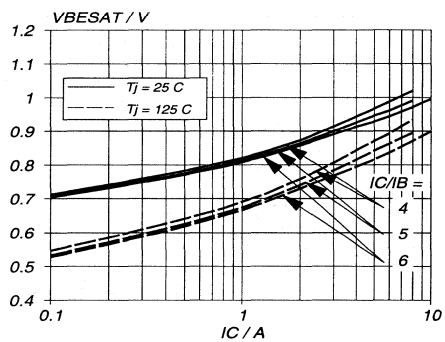


Fig.10. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_C)$; parameter I_C/I_B

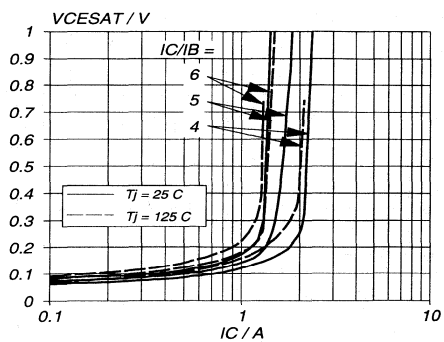


Fig.11. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

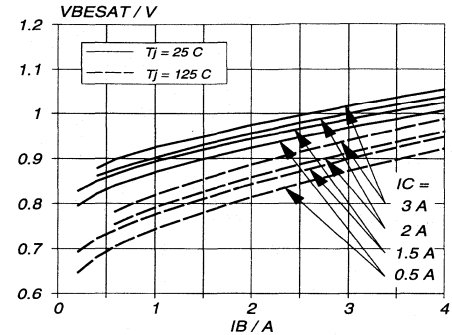


Fig.12. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

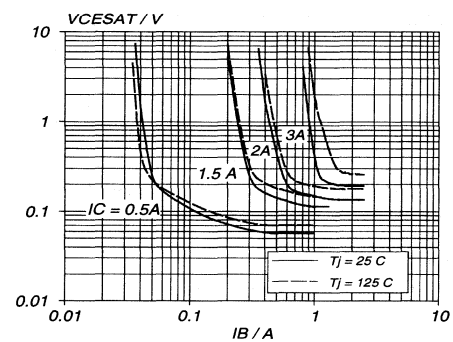


Fig.13. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_B)$; parameter I_C

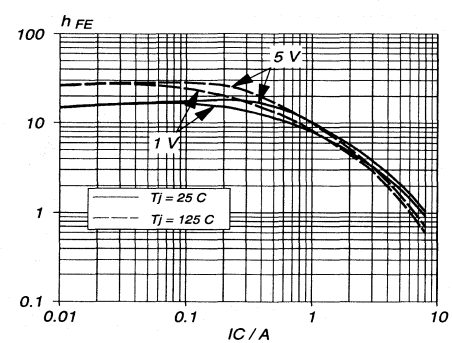


Fig.14. Typical DC current gain.
$h_{FE} = f(I_C)$; parameter V_{CE}

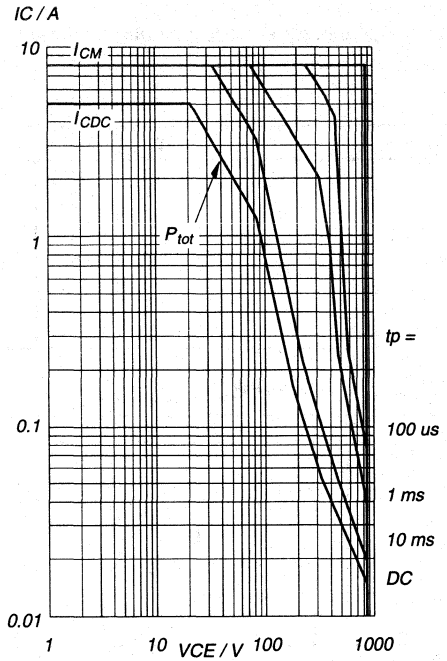


Fig.15. Forward bias safe operating area. T_{mb} = 25 °C

I Region of permissible DC operation.
II Extension for repetitive pulse operation.
NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

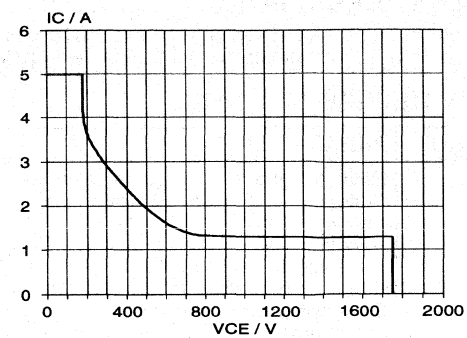


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU1706AB

GENERAL DESCRIPTION

High-voltage, high-speed switching npn transistor in a plastic envelope suitable for surface mounting, intended for use in high frequency electronic lighting ballast applications.

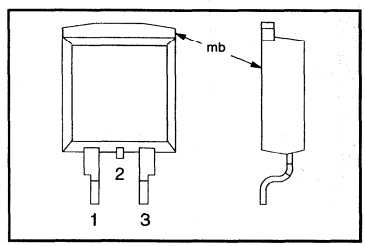
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1750	V
V_{CEO}	Collector-emitter voltage (open base)		-	850	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1.5 A; I_B = 0.3 A	-	1.0	V
I_{Csat}	Collector saturation current		1.5	-	A
t_f	Fall time	I_{CM} = 1.5 A; $I_{B(on)}$ = 0.3 A	0.25	0.6	µs

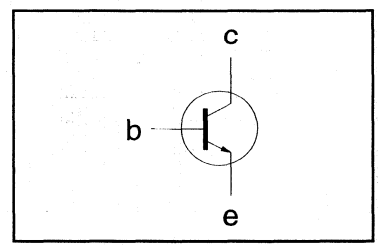
PINNING - SOT404

PIN	DESCRIPTION
1	base
2	collector
3	emitter
mb	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1750	V
V_{CEO}	Collector-emitter voltage (open base)		-	850	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{B(AV)}$	Reverse base current	average over any 20ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Thermal resistance junction to mounting base		-	1.25	K/W
$R_{th\ j\text{-}a}$	Thermal resistance junction to ambient	minimum footprint, FR4 board	55	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = 1500 V	-	-	20	µA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 12 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	750	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1.5 A; I_B = 0.3 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 1.5 A; I_B = 0.3 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 10 V	8	-	-	
h_{FE}		I_C = 400 mA; V_{CE} = 3 V	12	18	35	
h_{FE}		I_C = 1.5 A; V_{CE} = 1 V	5	7	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 1.5 A; I_{Bon} = $-I_{Boff}$ = 0.3 A			
t_{on}	Turn-on time		1.1	1.5	µs
t_s	Turn-off storage time		5	6.5	µs
t_f	Turn-off fall time		0.75	1.0	µs
	Switching times (inductive load)	I_{Con} = 1.5 A; I_{Bon} = 0.3 A; L_B = 1 µH; $-V_{BB}$ = 5 V			
t_s	Turn-off storage time		2.0	3.0	µs
t_f	Turn-off fall time		0.25	0.6	µs
	Switching times (inductive load)	I_{Con} = 1.5 A; I_{Bon} = 0.3 A; L_B = 1 µH; $-V_{BB}$ = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		2.2	3.3	µs
t_f	Turn-off fall time		0.2	0.7	µs

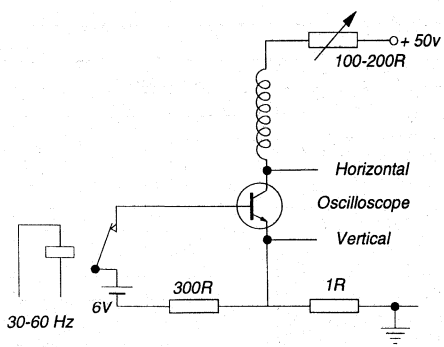


Fig.1. Test circuit for $V_{CEOsust}$.

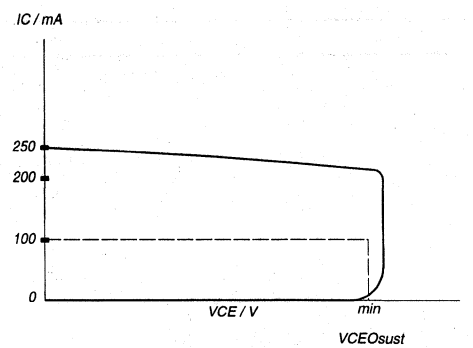


Fig.2. Oscilloscope display for $V_{CEOsust}$.

1 Measured with half sine-wave voltage (curve tracer).

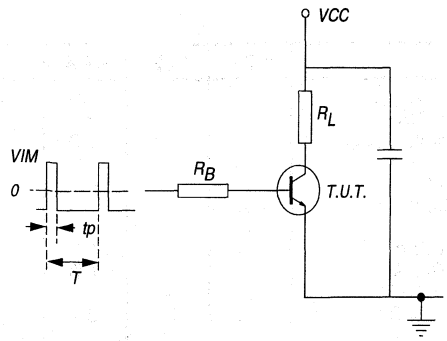


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; tp = 20 µs; δ = tp / T = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

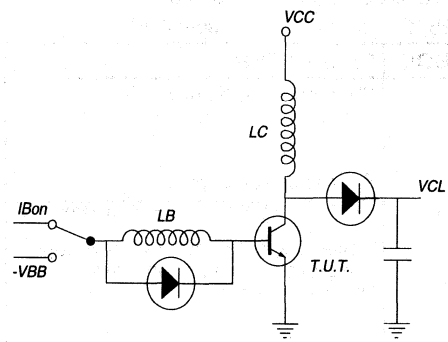


Fig.6. Test Circuit RBSOA.
V_{CC} = 150 V; $-V_{BB}$ = 5 V; L_C = 2 mH; V_{CL} ≤ 1500 V;
L_B = 1 µH

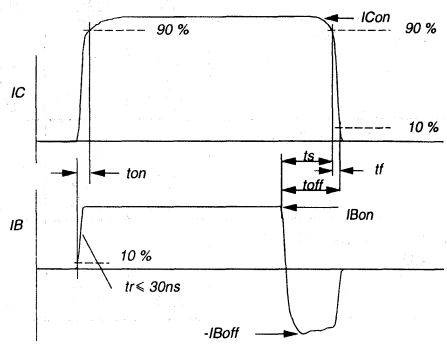


Fig.4. Switching times waveforms with resistive load.

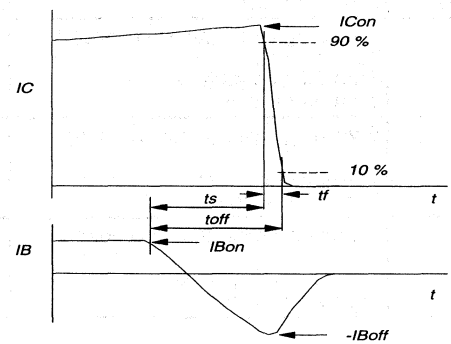


Fig.7. Switching times waveforms with inductive load.

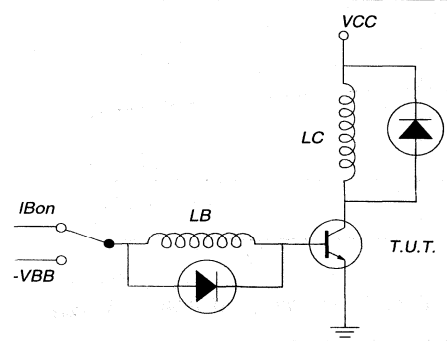


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_B = 1 uH

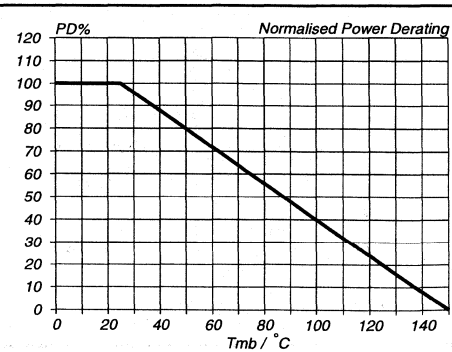


Fig.8. Normalised power dissipation.
PD% = 100·PD/PD $_{25\,°C}$ = f (T_{mb})

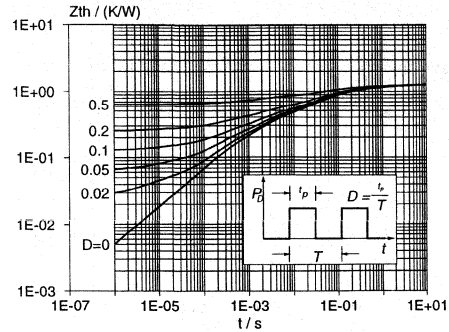


Fig.9. Transient thermal impedance.
$Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

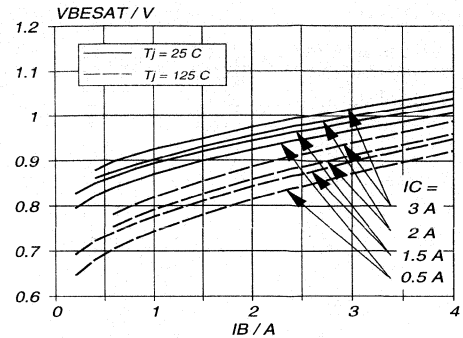


Fig.12. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

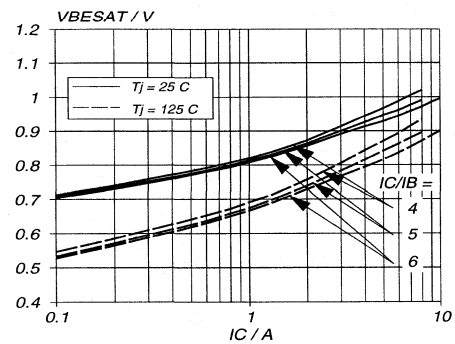


Fig.10. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_C)$; parameter I_C/I_B

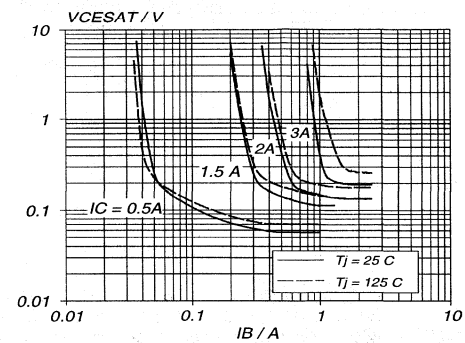


Fig.13. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_B)$; parameter I_C

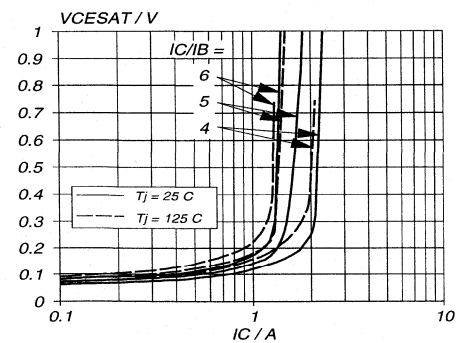


Fig.11. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

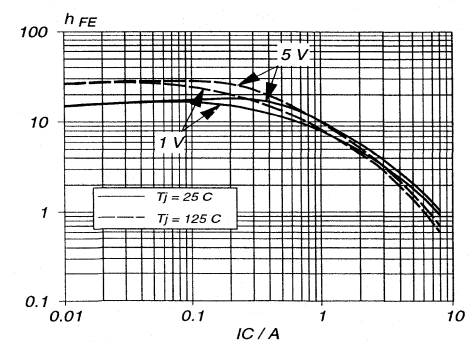


Fig.14. Typical DC current gain.
$h_{FE} = f(I_C)$; parameter V_{CE}

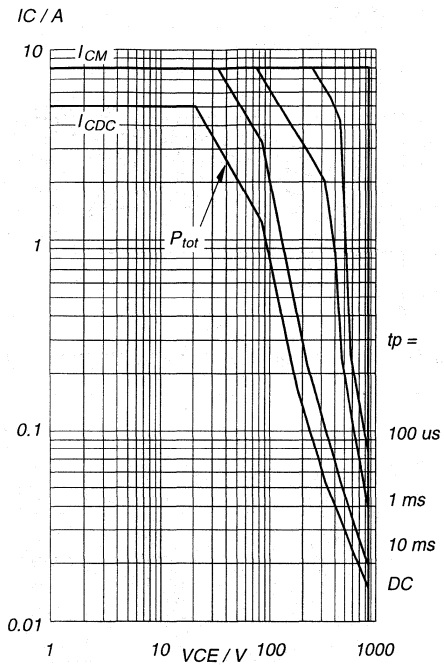


Fig.15. Forward bias safe operating area. T_{mb} = 25 °C

I Region of permissible DC operation.
II Extension for repetitive pulse operation.
NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

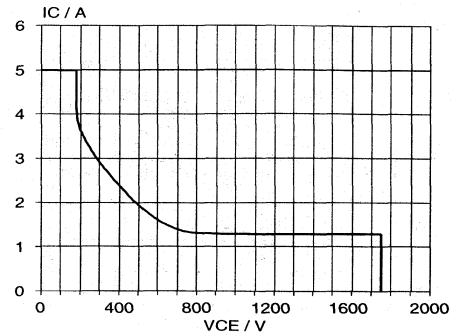


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU1706AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications.

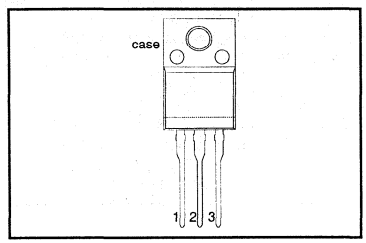
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1750	V
V_{CEO}	Collector-emitter voltage (open base)		-	850	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1.5 A; I_B = 0.3 A	-	1.0	V
I_{Csat}	Collector saturation current		1.5	-	A
t_f	Fall time	I_{CM} = 1.5 A; $I_{B(on)}$ = 0.3 A	0.25	0.6	µs

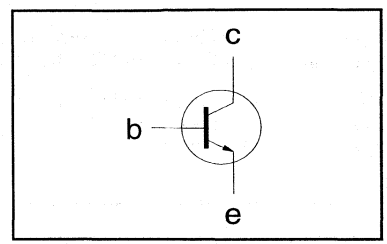
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1750	V
V_{CEO}	Collector-emitter voltage (open base)		-	850	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{B(AV)}$	Reverse base current	average over any 20ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
T_{stg}	Storage temperature		-40	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	4.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = 1500 V	-	-	20	µA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 12 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	750	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1.5 A; I_B = 0.3 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	i_C = 1.5 A; I_B = 0.3 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 10 V	8	-	-	
h_{FE}		I_C = 400 mA; V_{CE} = 3 V	12	18	35	
h_{FE}		I_C = 1.5 A; V_{CE} = 1 V	5	7	-	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 1.5 A; I_{Bon} = -I_{Boff} = 0.3 A			
t_{on}	Turn-on time		1.1	1.5	µs
t_s	Turn-off storage time		5	6.5	µs
t_f	Turn-off fall time		0.75	1.0	µs
	Switching times (inductive load)	I_{Con} = 1.5 A; I_{Bon} = 0.3 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		2.0	3.0	µs
t_f	Turn-off fall time		0.25	0.6	µs
	Switching times (inductive load)	I_{Con} = 1.5 A; I_{Bon} = 0.3 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		2.2	3.3	µs
t_f	Turn-off fall time		0.2	0.7	µs

1 Measured with half sine-wave voltage (curve tracer).

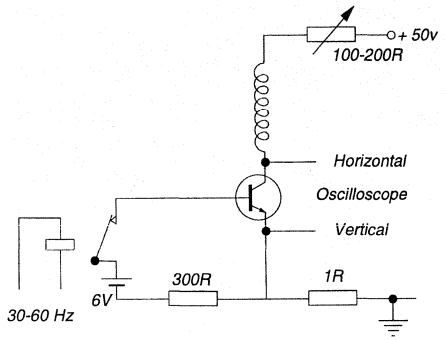


Fig.1. Test circuit for $V_{CEOsust}$.

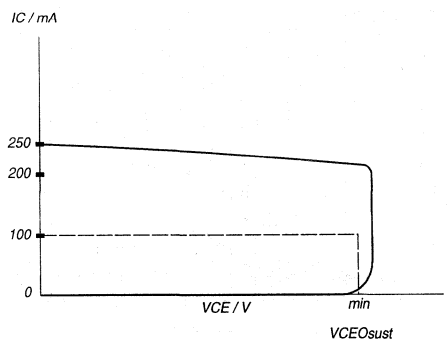


Fig.2. Oscilloscope display for $V_{CEOsust}$.

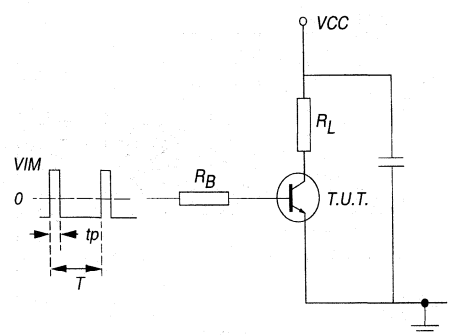


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; tp = 20 µs; δ = tp / T = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

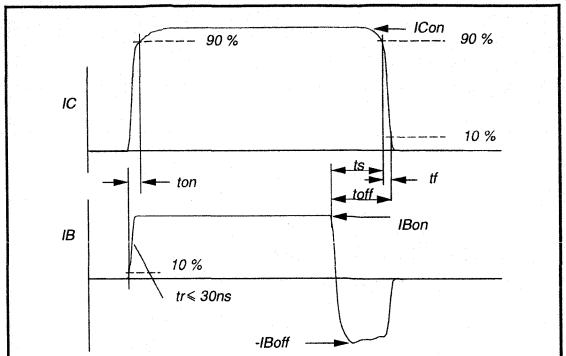


Fig.4. Switching times waveforms with resistive load.

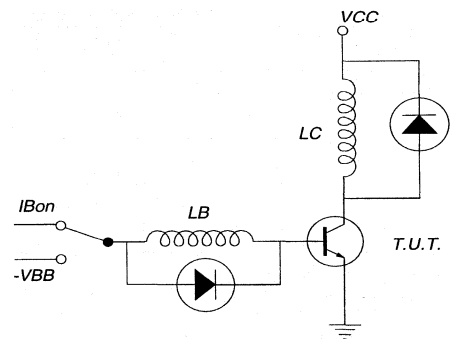


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_B = 1 uH

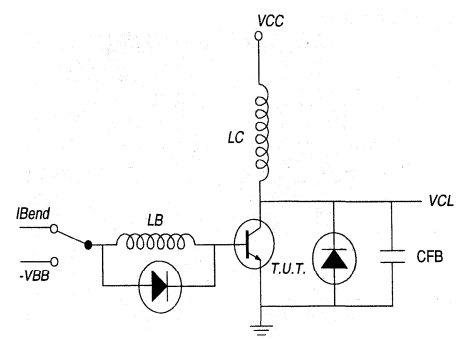


Fig.6. Test Circuit RBSOA.
V_{CC} = 150 V; $-V_{BB}$ = 5 V; L_C = 2 mH; V_{CL} ≤ 1500 V;
L_B = 1 µH

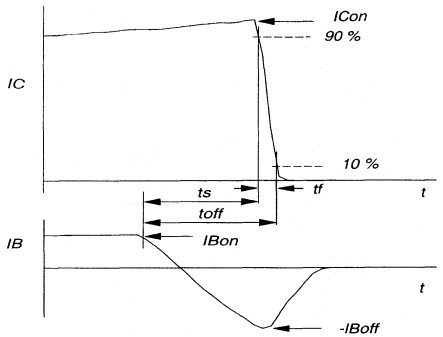


Fig.7. Switching times waveforms with inductive load.

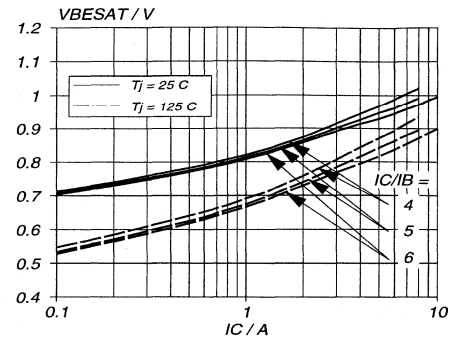


Fig.10. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_C)$; parameter I_C/I_B

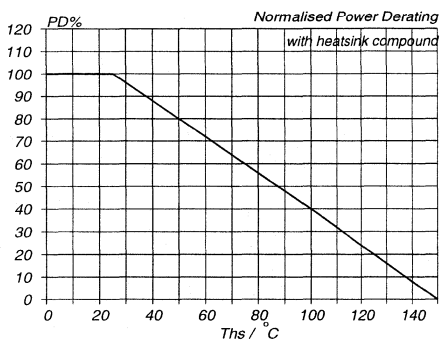


Fig.8. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD_{25\,^\circ C} = f(T_{hs})$

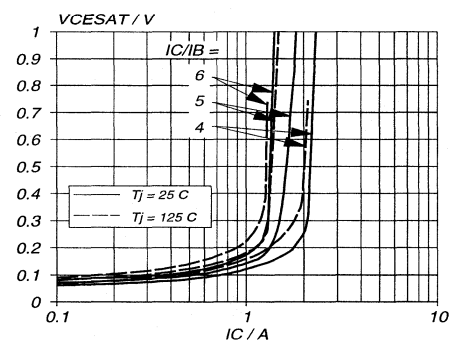


Fig.11. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

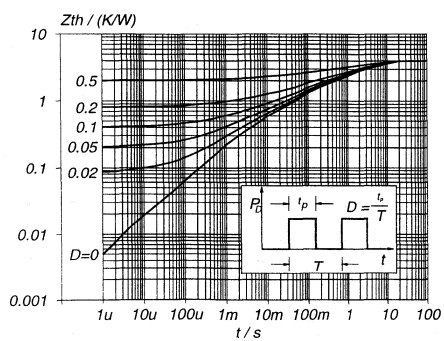


Fig.9. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

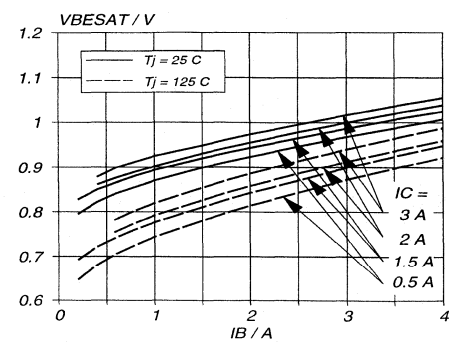


Fig.12. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

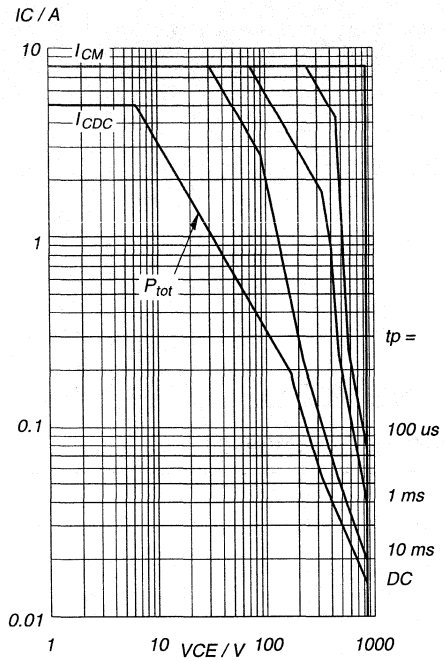


Fig.13. Forward bias safe operating area. T_{hs} = 25 °C

I Region of permissible DC operation.
II Extension for repetitive pulse operation.
NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

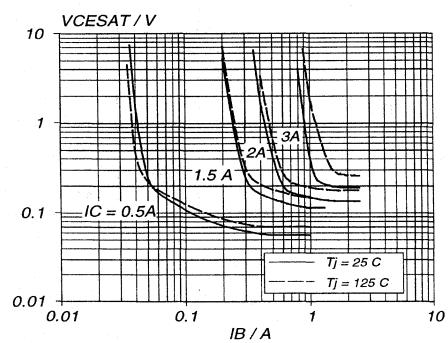


Fig.14. Typical collector-emitter saturation voltage. $V_{CEsat} = f(I_B)$; parameter I_C

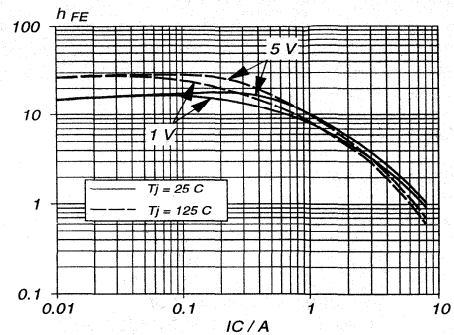


Fig.15. Typical DC current gain. $h_{FE} = f(I_C)$; parameter V_{CE}

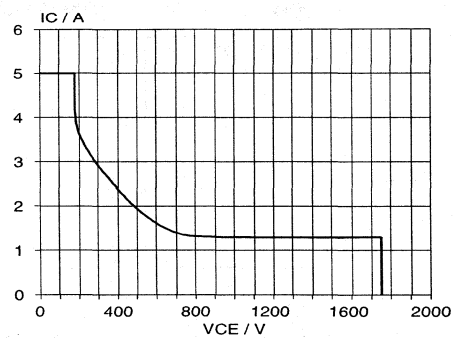


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2506DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

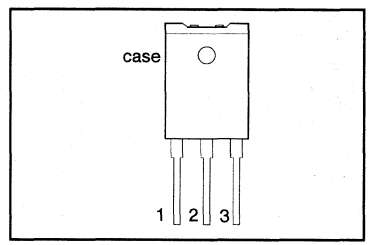
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.79 A	-	5.0	V
I_{Csat}	Collector saturation current		3.0	-	A
V_F	Diode forward voltage	I_F = 3.0 A	1.6	2.0	V
t_f	Fall time	I_{Csat} = 3.0 A; $I_{B(end)}$ = 0.67 A	0.25	0.5	µs

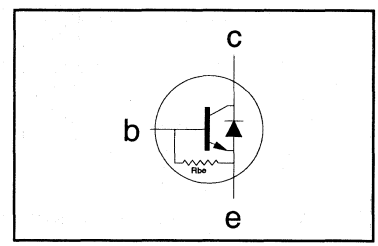
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	32	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	95	-	208	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	55	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.79 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.79 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 0.3 A; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 3.0 A; V_{CE} = 5 V	3.8	5.5	7.5	
V_F	Diode forward voltage	I_F = 3.0 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	47	-	pF
	Switching times (line deflection circuit)	I_{Csat} = 3.0 A; L_C = 1.35 mH; C_{FB} = 9.4 nF; $I_{B(end)}$ = 0.67 A; L_B = 8 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.45 A/µs)			
t_s	Turn-off storage time		4.5	6.0	µs
t_f	Turn-off fall time		0.25	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

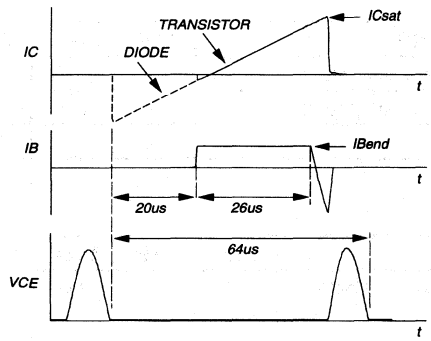


Fig.1. Switching times waveforms.

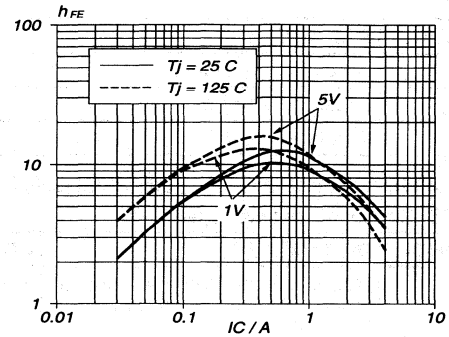


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

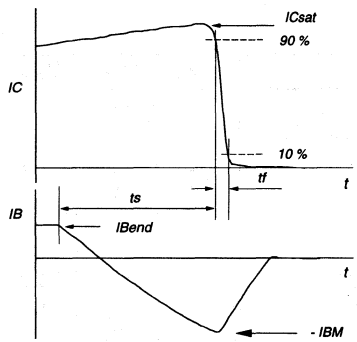


Fig.2. Switching times definitions.

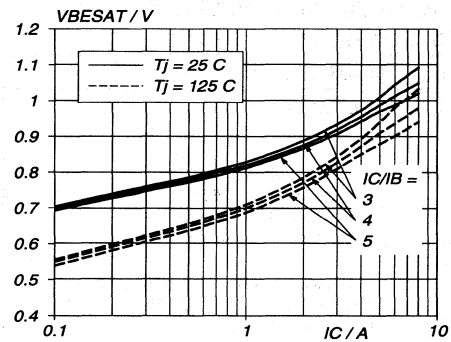


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

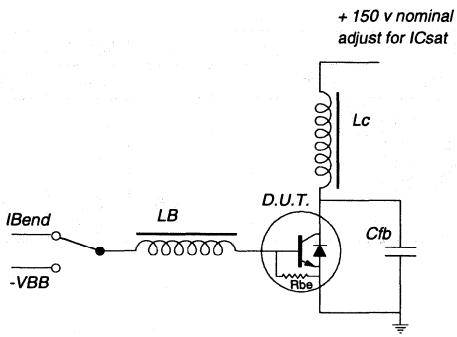


Fig.3. Switching times test circuit.

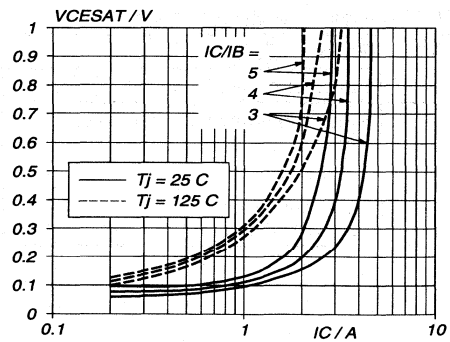


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

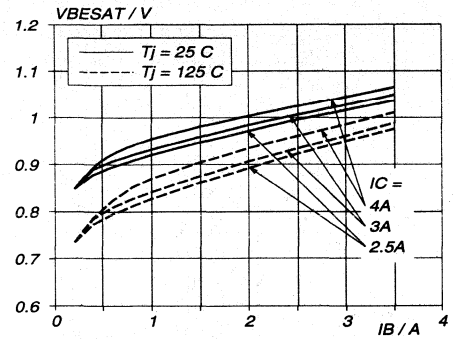


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

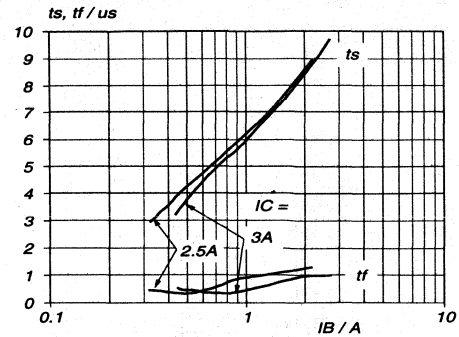


Fig.10. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$

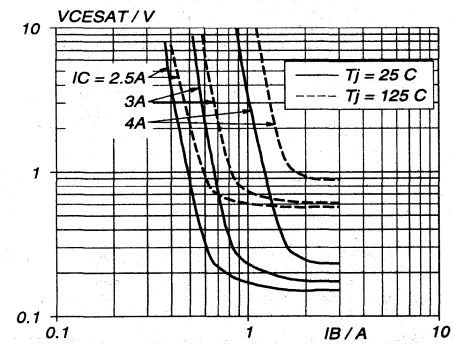


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

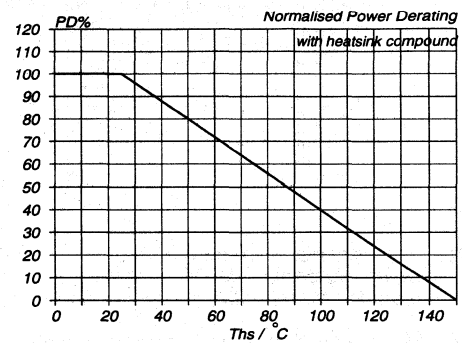


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

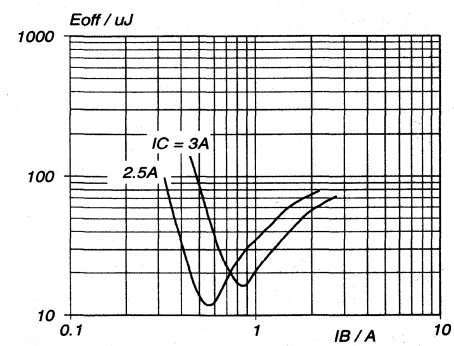


Fig.9. Typical turn-off losses. $T_j = 85^\circ C$
$Eoff = f(I_B)$; parameter I_C

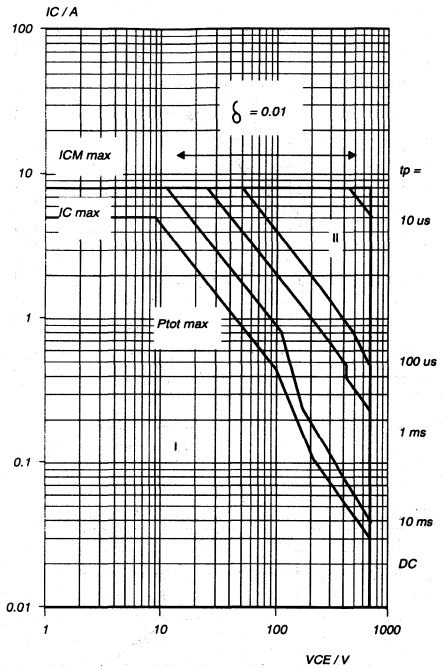


Fig.12. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

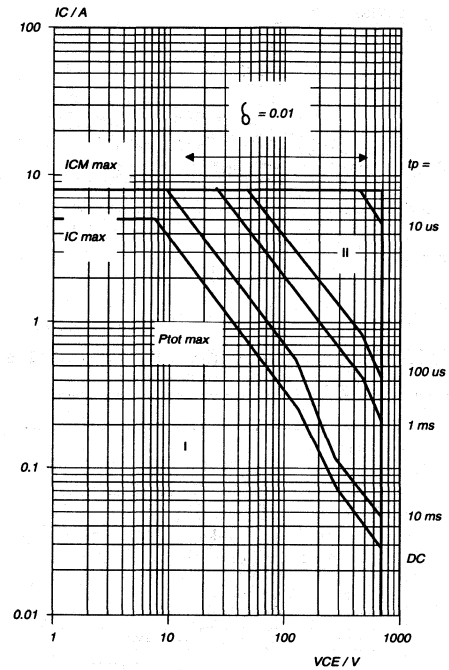


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU2506DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

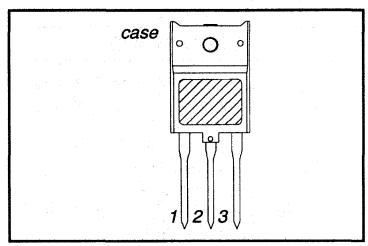
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.79 A	-	5	V
I_{Csat}	Collector saturation current		3.0	-	A
V_F	Diode forward voltage	I_F = 3.0 A	1.6	2.0	V
t_f	Fall time	I_{Csat} = 3.0 A; $I_{B(end)}$ = 0.67 A	0.25	0.5	µs

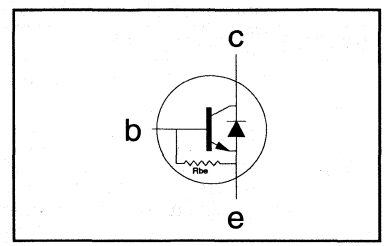
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	32	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	136	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	55	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.79 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.79 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 0.3 A; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 3.0 A; V_{CE} = 5 V	3.8	5.5	7.5	
V_F	Diode forward voltage	I_F = 3.0 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	47	-	pF
	Switching times (line deflection circuit)	I_{Csat} = 3.0 A; L_C = 1.35 mH; C_{FB} = 9.4 nF; $I_{B(end)}$ = 0.67 A; L_B = 8 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.45 A/µs)			
t_s	Turn-off storage time		4.5	6.0	µs
t_f	Turn-off fall time		0.25	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

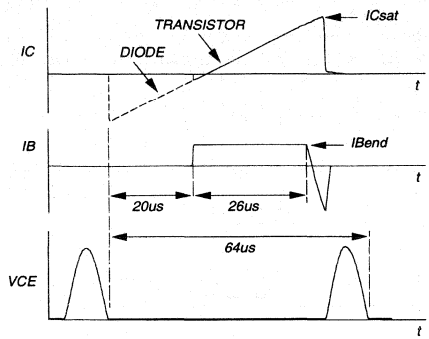


Fig.1. Switching times waveforms.

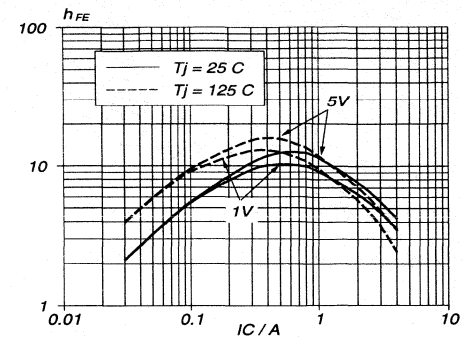


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

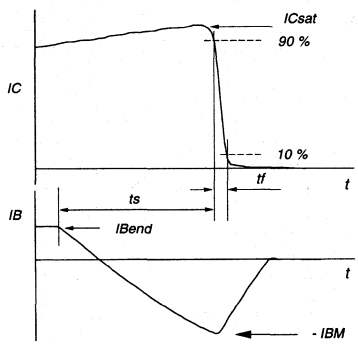


Fig.2. Switching times definitions.

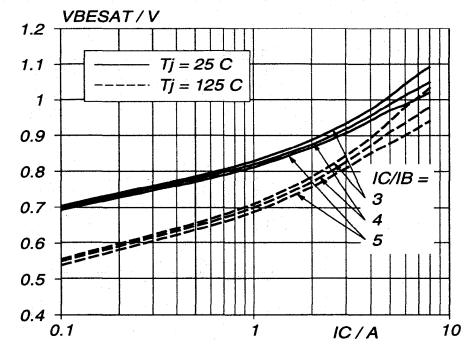


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

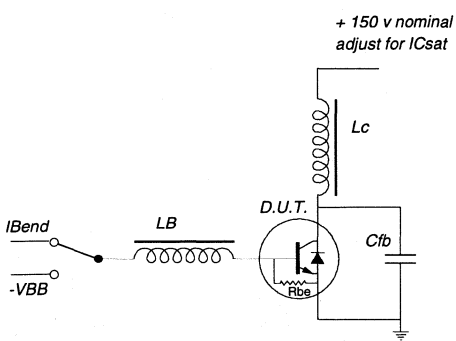


Fig.3. Switching times test circuit.

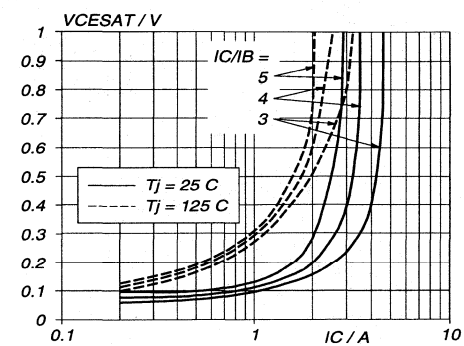


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

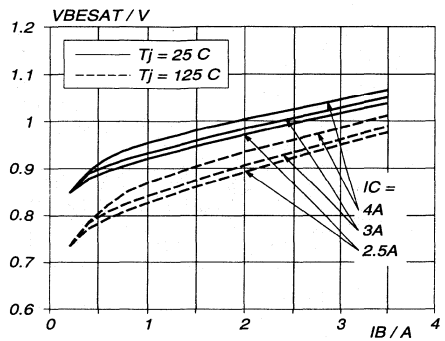


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

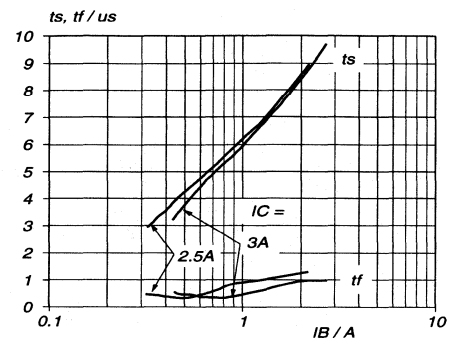


Fig.10. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$

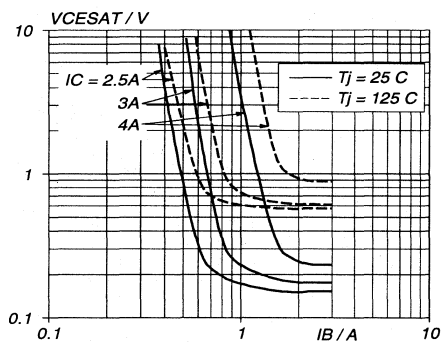


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

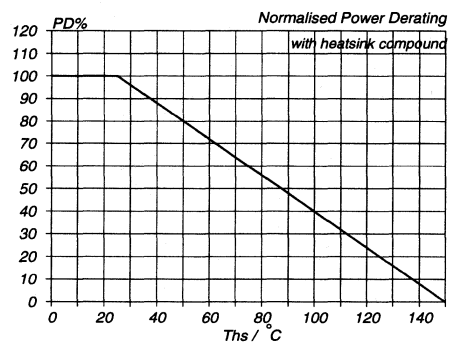


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

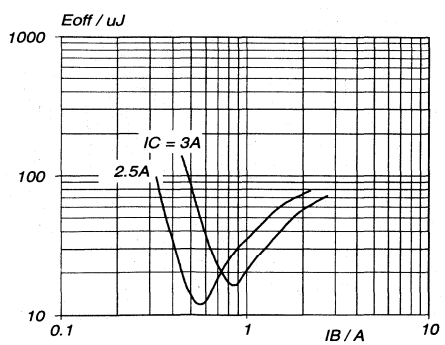


Fig.9. Typical turn-off losses. $T_j = 85^\circ C$
$Eoff = f(I_B)$; parameter I_C

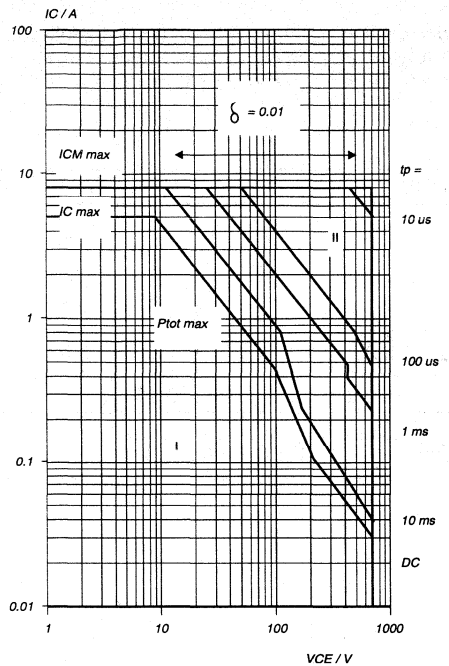


Fig.12. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

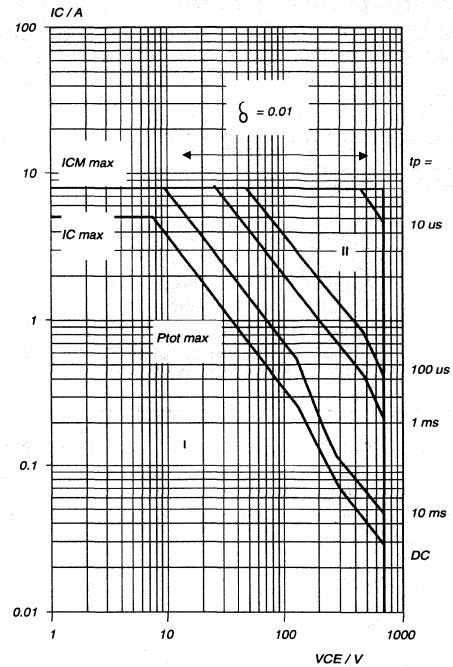


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU2507AF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

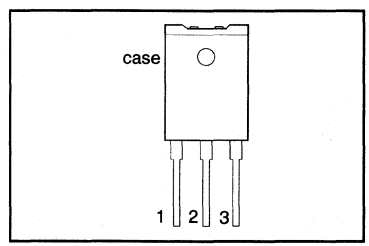
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.95 A	-	1.0	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.25	0.5	µs

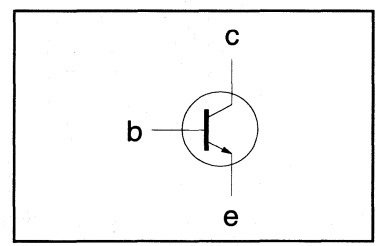
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$ T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 0.8 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	17	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	5.0	7.0	9.0	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4 A; $I_{B(end)}$ = 0.7 A; L_B = 6 µH; $-V_{BB}$ = 4 V			
t_s	Turn-off storage time		5.0	6.0	µs
t_f	Turn-off fall time		0.25	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

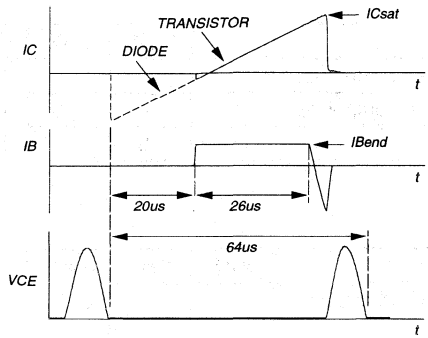


Fig.1. Switching times waveforms.

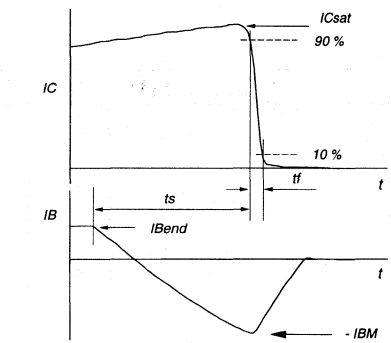


Fig.2. Switching times definitions.

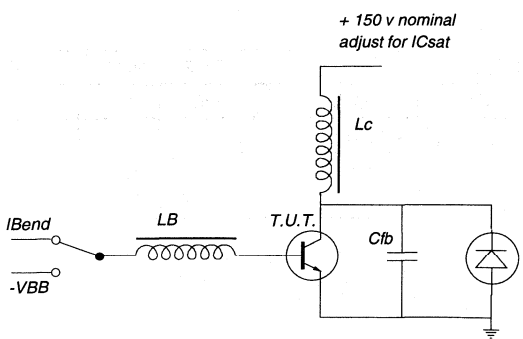


Fig.3. Switching times test circuit.

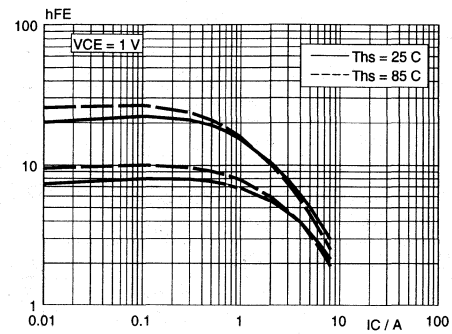


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

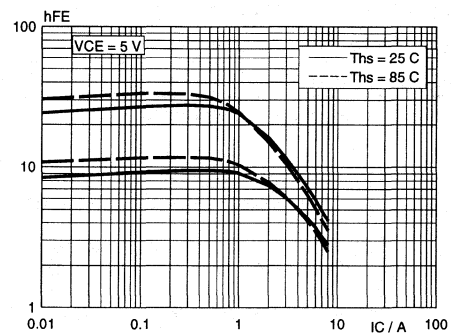


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

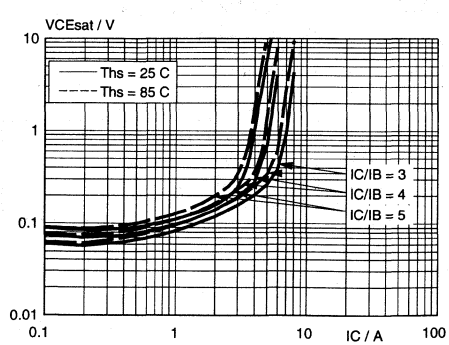


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

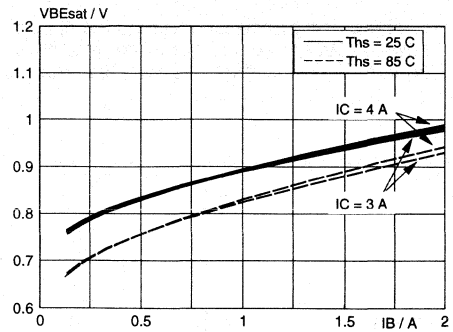


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

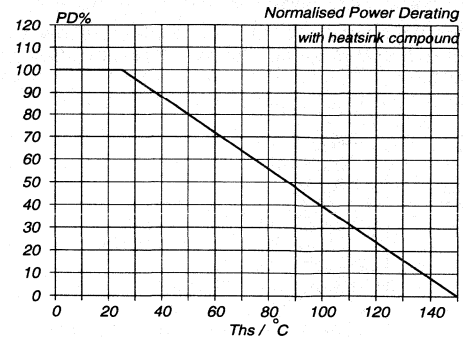


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

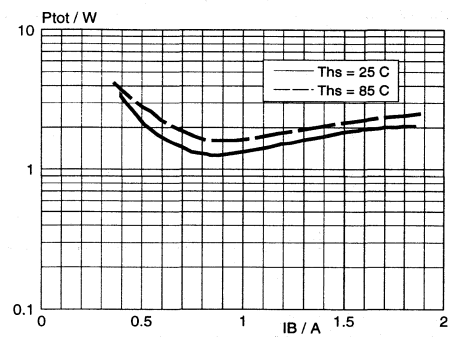


Fig.8. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 4$ A; f = 16 kHz

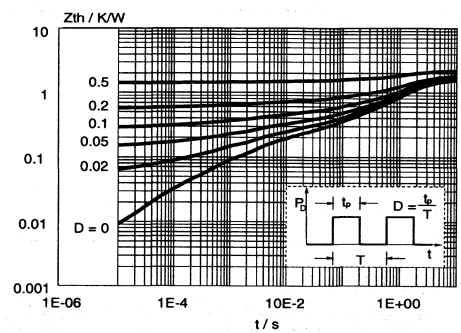


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

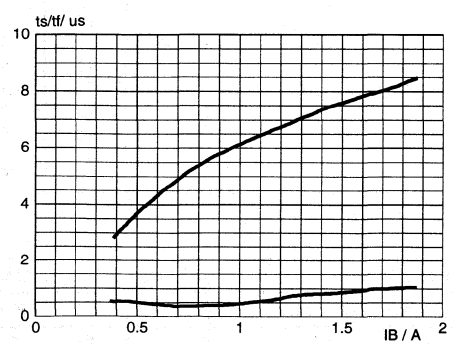


Fig.9. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; $I_C = 4.0$ A; $T_j = 85^\circ C$; f = 16 kHz

Silicon Diffused Power Transistor — BU2507AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

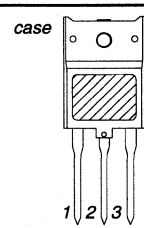
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.25	0.5	µs

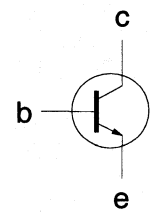
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$ T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 0.8 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	17	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	5.0	7.0	9.0	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4 A; $I_{B(end)}$ = 0.7 A; L_B = 6 µH; $-V_{BB}$ = 4 V			
t_s	Turn-off storage time		5.0	6.0	µs
t_f	Turn-off fall time		0.25	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

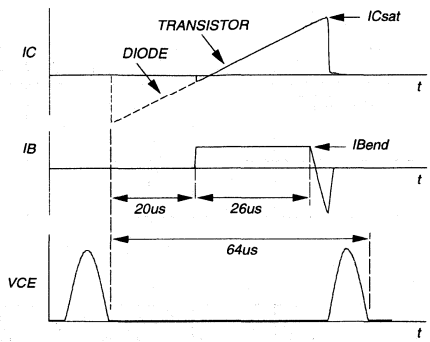


Fig.1. Switching times waveforms.

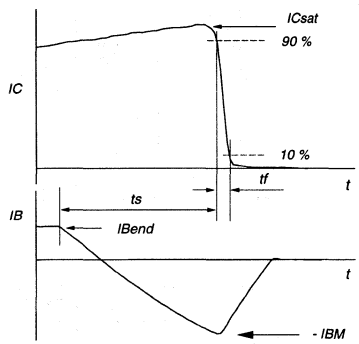


Fig.2. Switching times definitions.

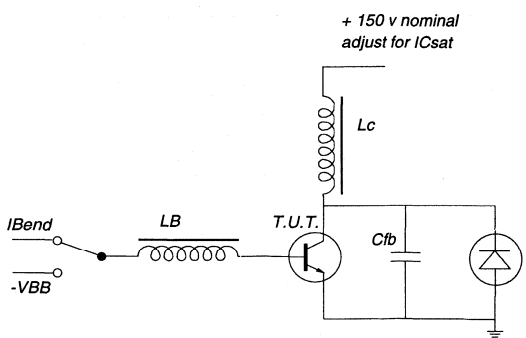


Fig.3. Switching times test circuit.

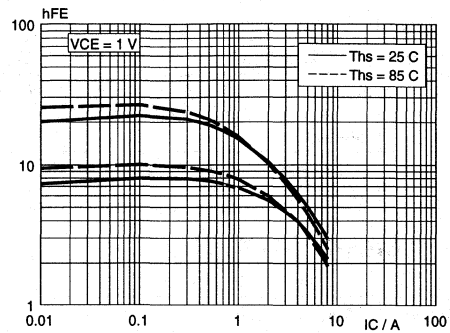


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

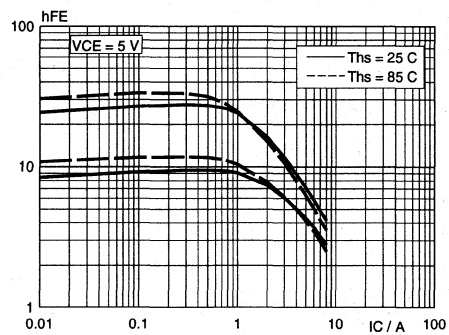


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

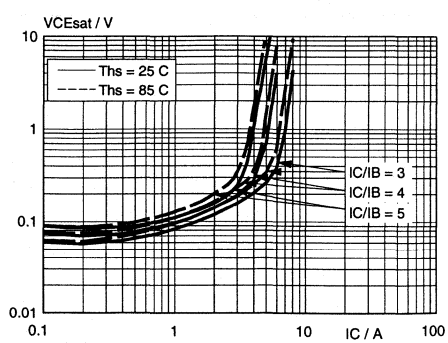


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

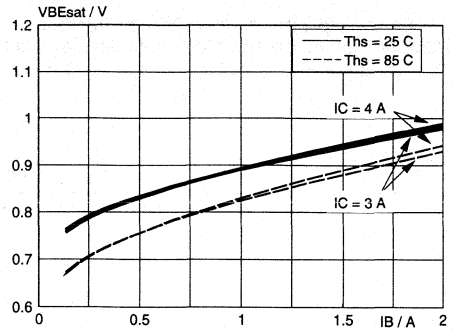


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

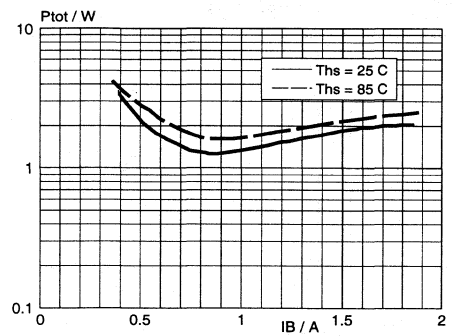


Fig.8. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 4$ A; f = 16 kHz

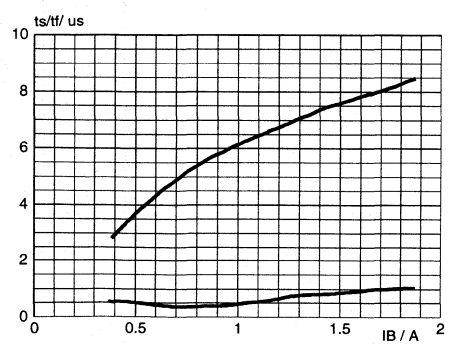


Fig.9. Typical collector storage and fall time.
ts = f (I_B); tf = f (I_B); I_C = 4.0 A; T_j = 85˚C; f = 16 kHz

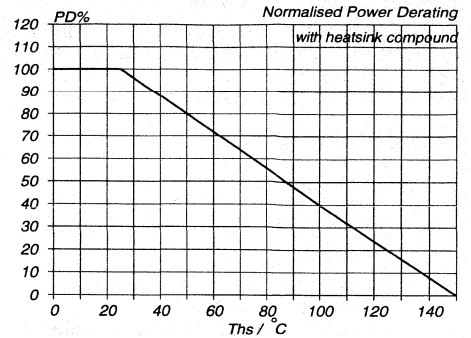


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

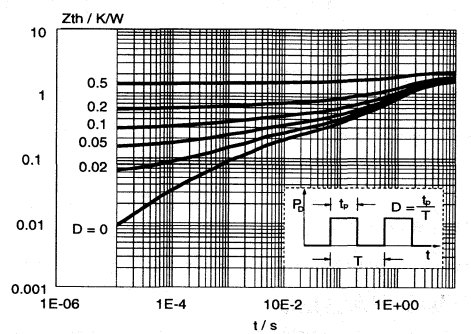


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

Silicon Diffused Power Transistor — BU2507DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

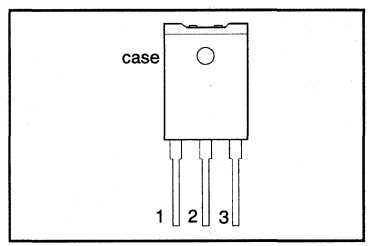
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
V_F	Diode forward voltage	I_F = 4 A	1.7	2.0	V
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.25	0.5	µs

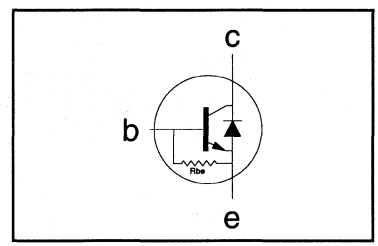
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	160	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 0.8 A	-	-	5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	14	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	5	7	9	
V_F	Diode forward voltage	I_F = 4 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4 A; $I_{B(end)}$ = 0.7 A; L_B = 6 µH; $-V_{BB}$ = 4 V			
t_s	Turn-off storage time		5.0	6.0	µs
t_f	Turn-off fall time		0.25	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

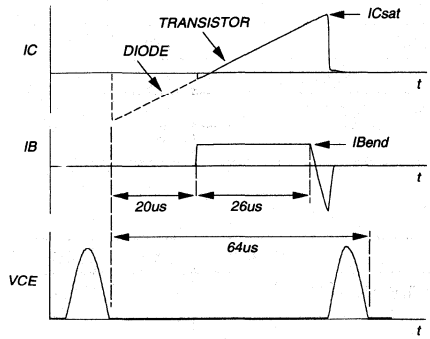


Fig.1. Switching times waveforms.

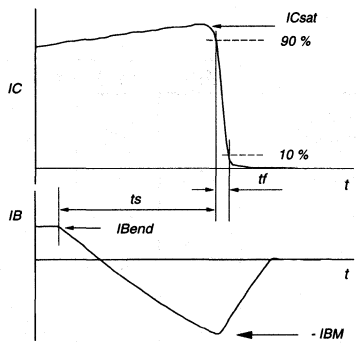


Fig.2. Switching times definitions.

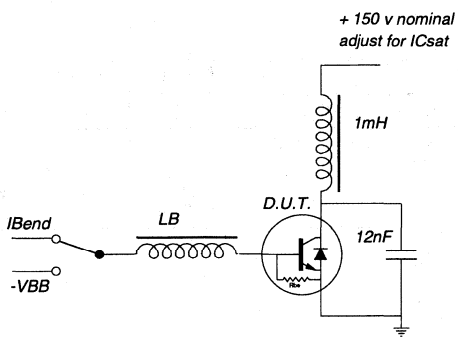


Fig.3. Switching times test circuit.

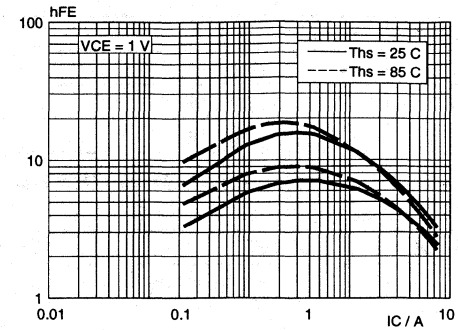


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

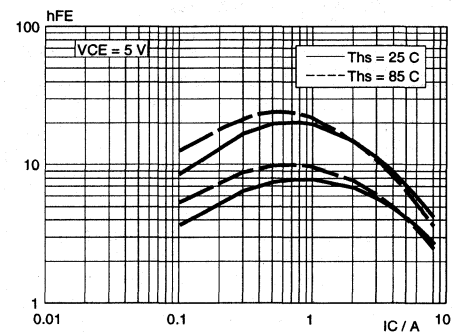


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

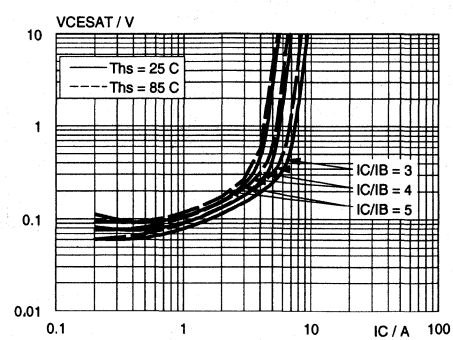


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

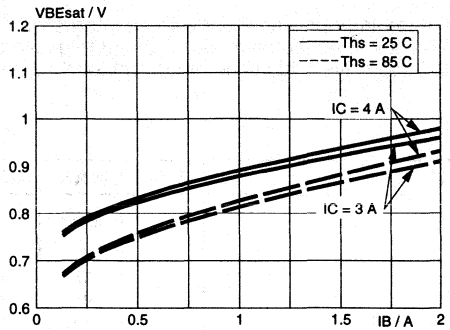


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

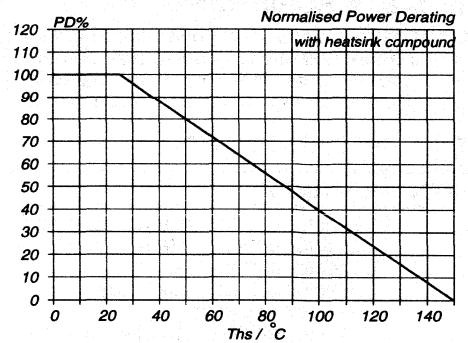


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

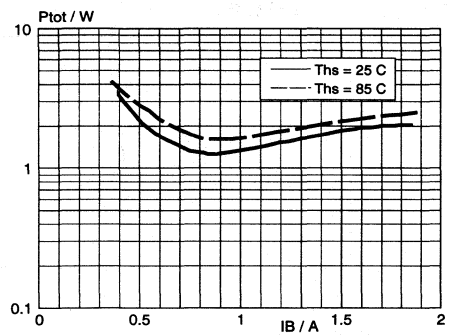


Fig.8. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 4$ A; $f = 16$ kHz

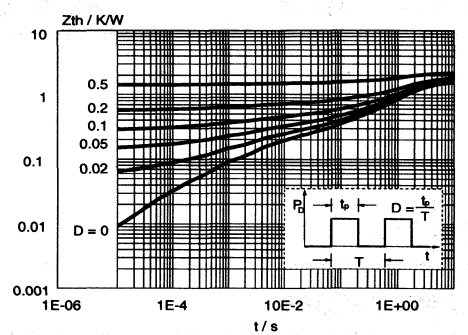


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

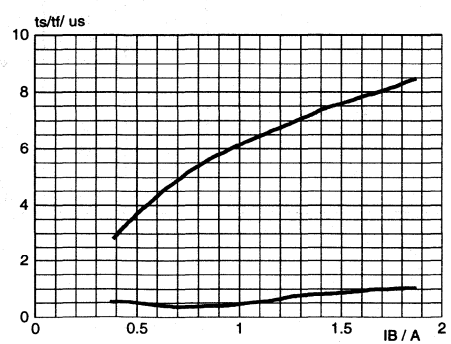


Fig.9. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; $I_C = 4.0$ A; $T_j = 85^\circ C$; $f = 16$ kHz

Silicon Diffused Power Transistor — BU2507DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

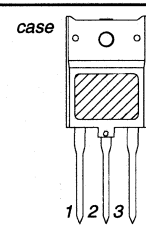
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
V_F	Diode forward voltage	I_F = 4 A	1.7	2.0	V
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.25	0.5	µs

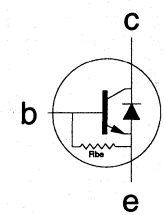
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	160	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 0.8 A		-	5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	14	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	5	7	9	
V_F	Diode forward voltage	I_F = 4 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4 A; $I_{B(end)}$ = 0.7 A; L_B = 6 μH; $-V_{BB}$ = 4 V			
t_s	Turn-off storage time		5.0	6.0	μs
t_f	Turn-off fall time		0.25	0.5	μs

2 Measured with half sine-wave voltage (curve tracer).

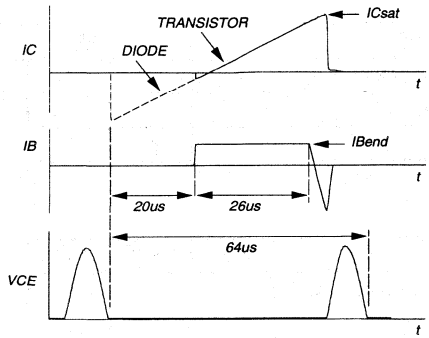


Fig.1. Switching times waveforms.

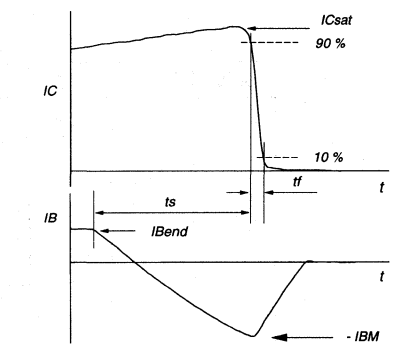


Fig.2. Switching times definitions.

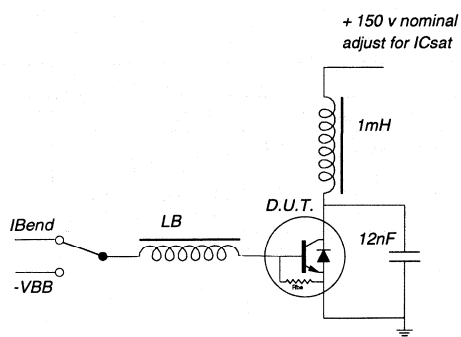


Fig.3. Switching times test circuit.

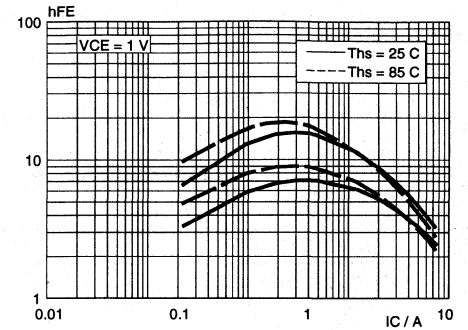


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

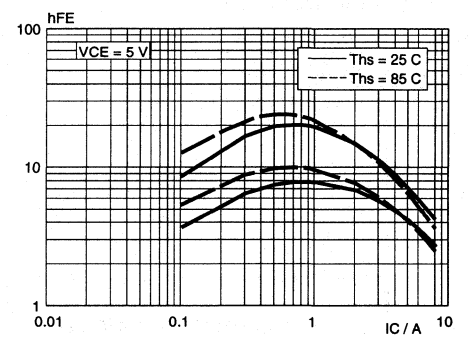


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

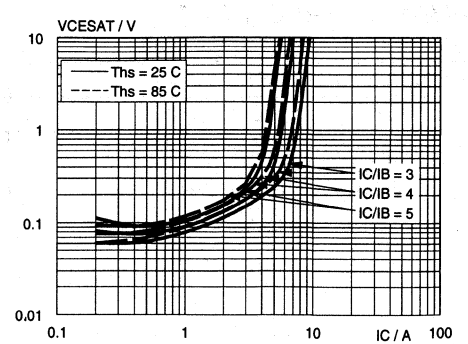


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

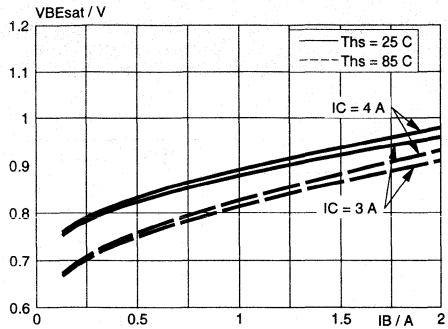


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

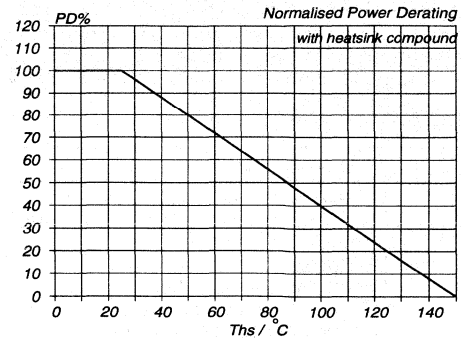


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

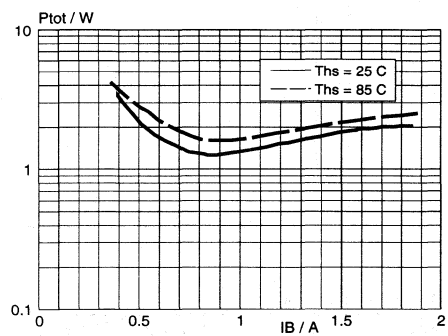


Fig.8. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 4$ A; f = 16 kHz

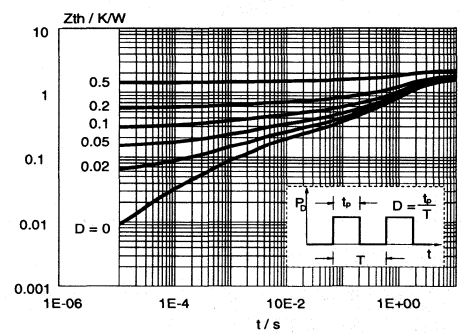


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

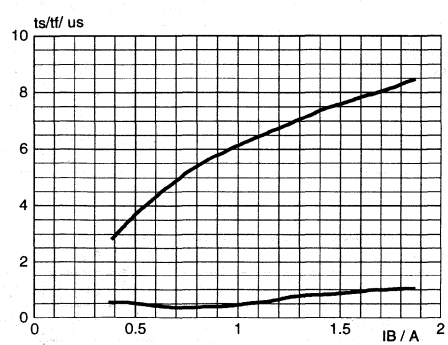


Fig.9. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; $I_C = 4.0$ A; $T_j = 85^\circ C$; f = 16 kHz

Silicon Diffused Power Transistor — BU2508AF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

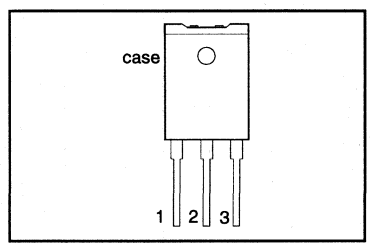
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.1 A	-	1	V
I_{Csat}	Collector saturation current		4.5	-	A
t_f	Fall time	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A	0.4	0.6	µs

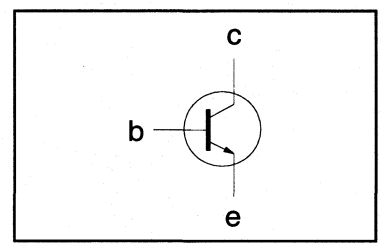
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4.5 A; I_B = 1.1 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.7 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4	5.5	7.0	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A; L_B = 6 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/µs)			
t_s	Turn-off storage time		5.0	6.0	µs
t_f	Turn-off fall time		0.4	0.6	µs
	Switching times (38 kHz line deflection circuit)	I_{Csat} = 4.0 A; $I_{B(end)}$ = 0.9 A; L_B = 6 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/µs)			
t_s	Turn-off storage time		4.7	5.7	µs
t_f	Turn-off fall time		0.25	0.35	µs

2 Measured with half sine-wave voltage (curve tracer).

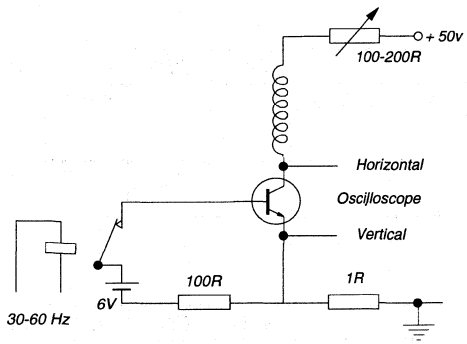


Fig.1. Test circuit for $V_{CEOsust}$.

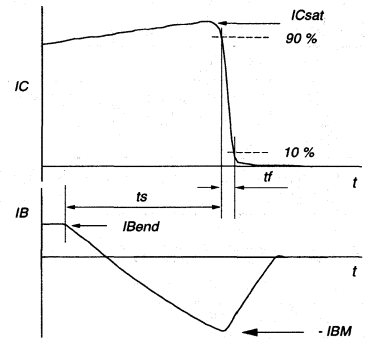


Fig.4. Switching times definitions.

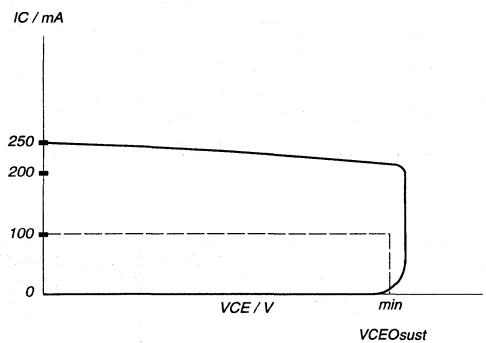


Fig.2. Oscilloscope display for $V_{CEOsust}$.

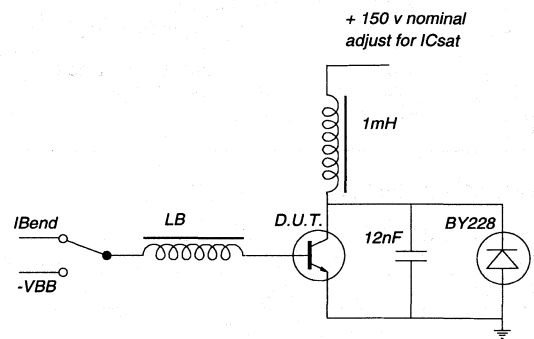


Fig.5. Switching times test circuit.

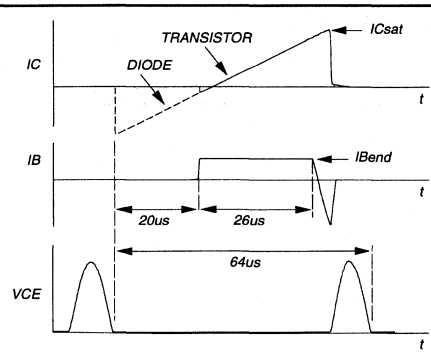


Fig.3. Switching times waveforms.

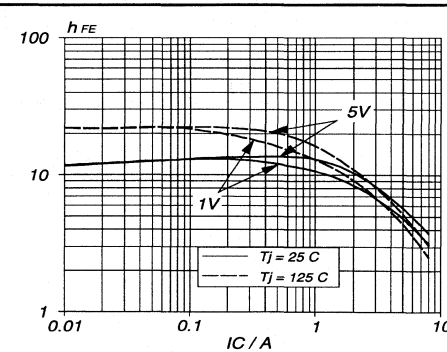


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

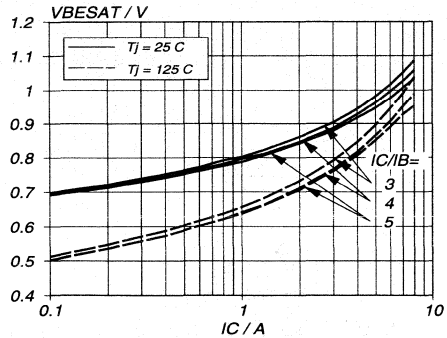


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

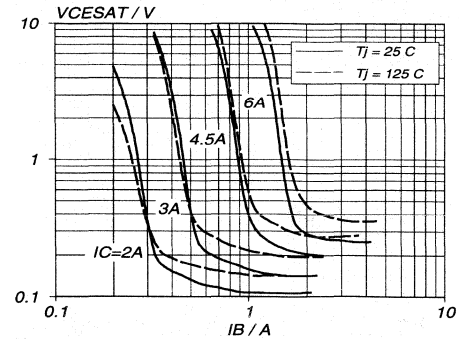


Fig.10. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

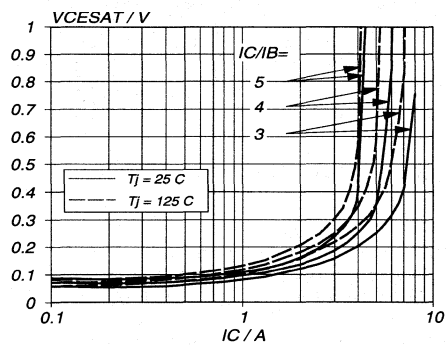


Fig.8. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

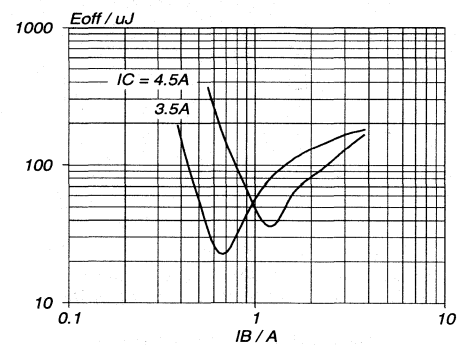


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$ $Eoff = f(I_B)$; parameter I_C; f = 16 kHz

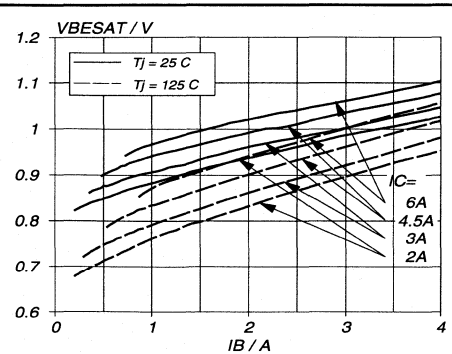


Fig.9. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

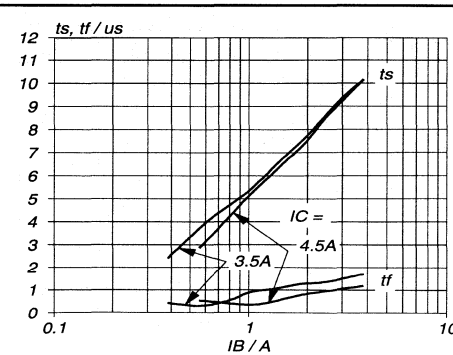


Fig.12. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

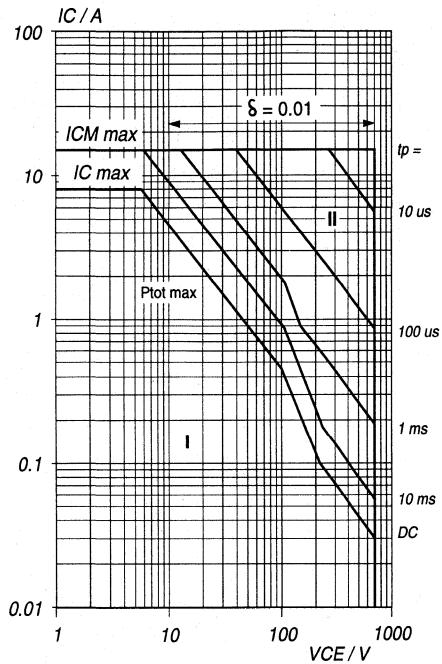


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Fig.15. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

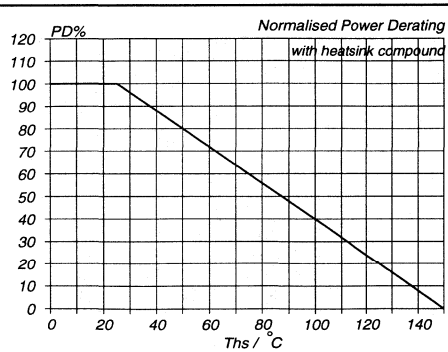


Fig.14. Normalised power dissipation.
$PD\% = 100 \cdot P_D / P_{D\,25^\circ C} = f(T_{hs})$

Silicon Diffused Power Transistor — BU2508AW

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

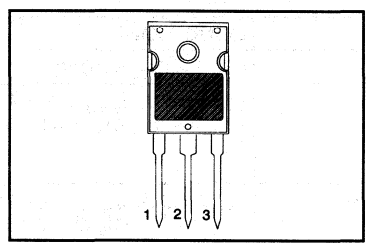
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.12 A	-	1.0	V
I_{Csat}	Collector saturation current	f=16kHz	4.5	-	A
t_f	Fall time	I_{Csat} = 4.5 A;f=16kHz	0.4	0.6	µs

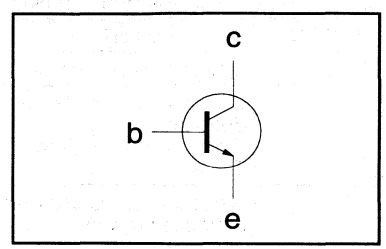
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.12 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.7 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4	5.5	7.0	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A; L_B = 6 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/µs)			
t_s	Turn-off storage time		5.0	6.0	µs
t_f	Turn-off fall time		0.4	0.6	µs
	Switching times (38 kHz line deflection circuit)	I_{Csat} = 4.0 A; $I_{B(end)}$ = 0.9 A; L_B = 6 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/µs)			
t_s	Turn-off storage time		4.7	5.7	µs
t_f	Turn-off fall time		0.25	0.35	µs

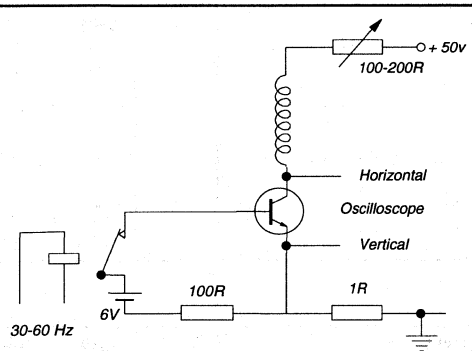


Fig.1. Test circuit for V_{CEO}sust.

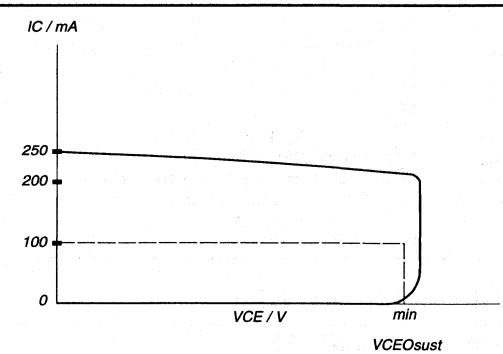


Fig.2. Oscilloscope display for V_{CEO}sust.

2 Measured with half sine-wave voltage (curve tracer).

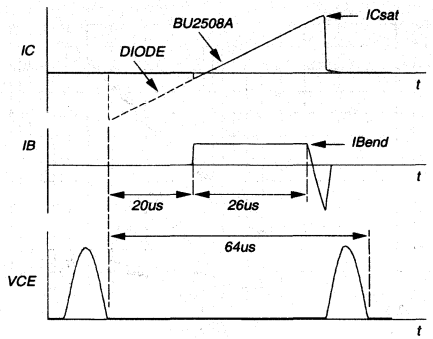


Fig.3. Switching times waveforms.

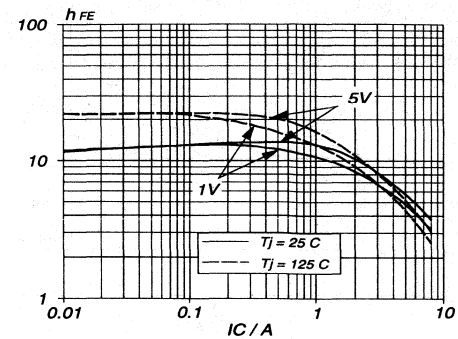


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

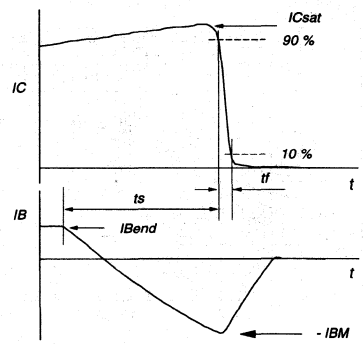


Fig.4. Switching times definitions.

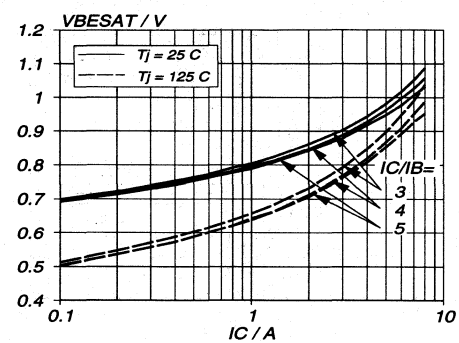


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

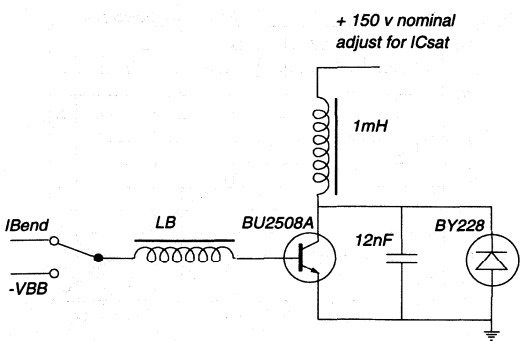


Fig.5. Switching times test circuit (BU2508A).

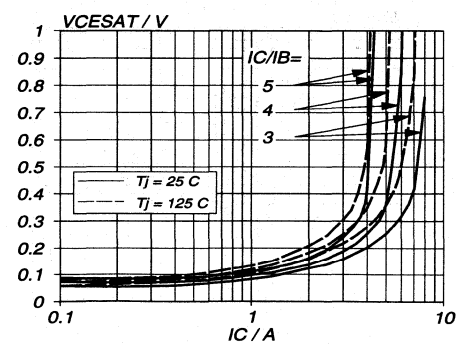


Fig.8. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

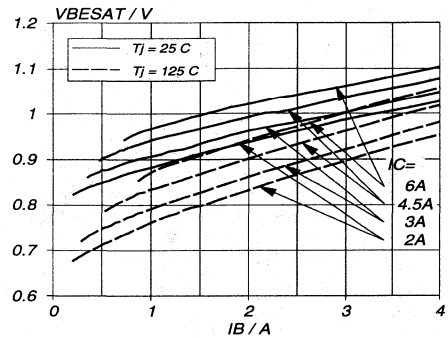


Fig.9. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

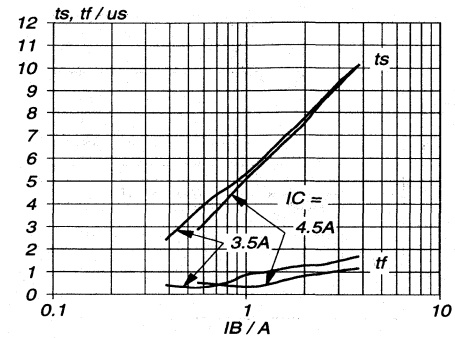


Fig.12. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; $f = 16$ kHz

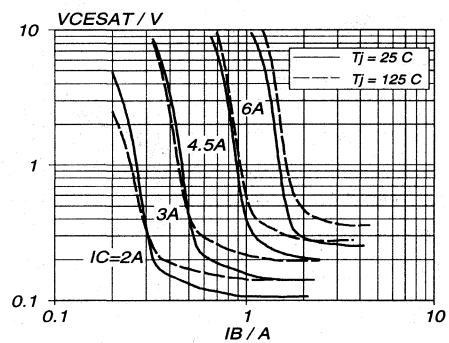


Fig.10. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

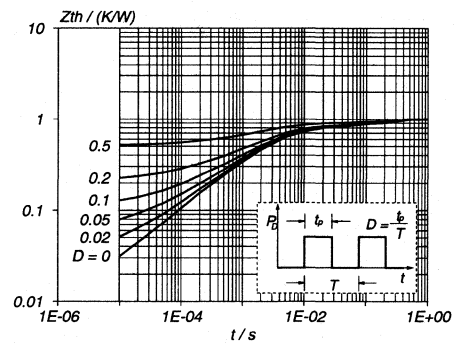


Fig.13. Transient thermal impedance. $Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

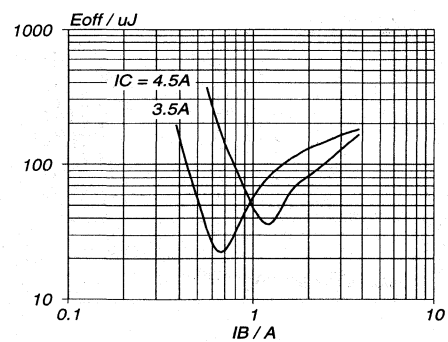


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$ $Eoff = f(I_B)$; parameter I_C; $f = 16$ kHz

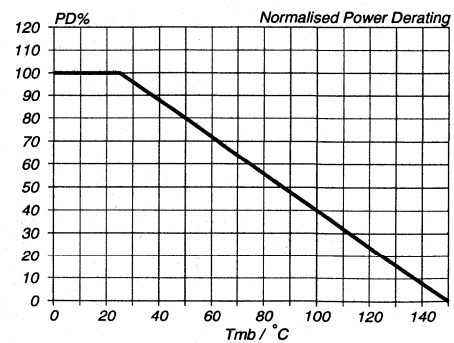


Fig.14. Normalised power dissipation. $PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

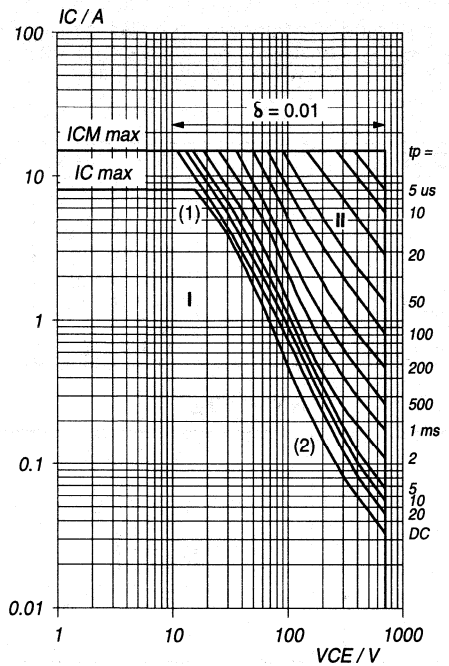


Fig.15. Forward bias safe operating area. T_{mb} = 25˚C
(1) *P_{tot} max line.*
(2) *Second-breakdown limits (independent of temperature).*
I *Region of DC operation.*
II *Extension for repetitive pulse operation.*

Silicon Diffused Power Transistor — BU2508AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

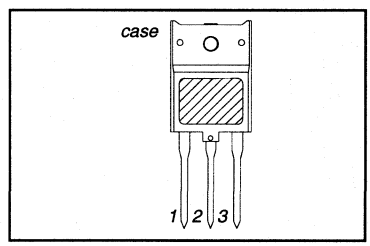
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.1 A	-	1.0	V
I_{Csat}	Collector saturation current		4.5	-	A
t_f	Fall time	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A	0.4	0.6	µs

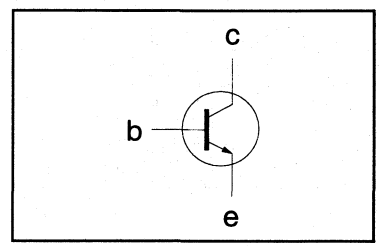
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.1 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.7 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4	5.5	7.0	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A; L_B = 6 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/µs)			
t_s	Turn-off storage time		5.0	6.0	µs
t_f	Turn-off fall time		0.4	0.6	µs
	Switching times (38 kHz line deflection circuit)	I_{Csat} = 4.0 A; $I_{B(end)}$ = 0.9 A; L_B = 6 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/µs)			
t_s	Turn-off storage time		4.7	5.7	µs
t_f	Turn-off fall time		0.25	0.35	µs

2 Measured with half sine-wave voltage (curve tracer).

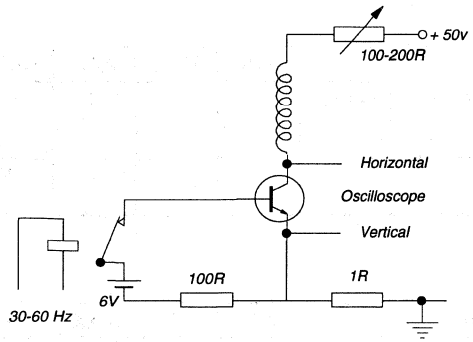


Fig.1. Test circuit for $V_{CEOsust}$.

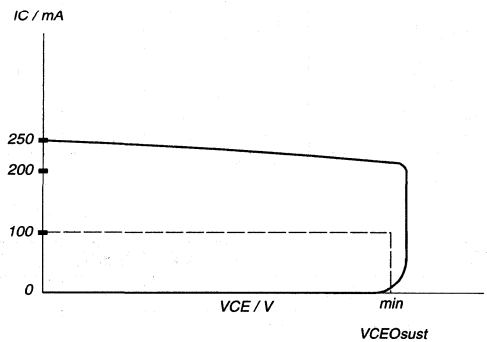


Fig.2. Oscilloscope display for $V_{CEOsust}$.

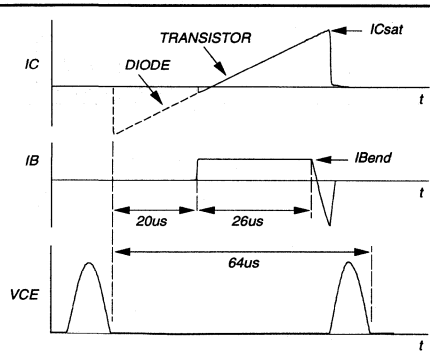


Fig.3. Switching times waveforms.

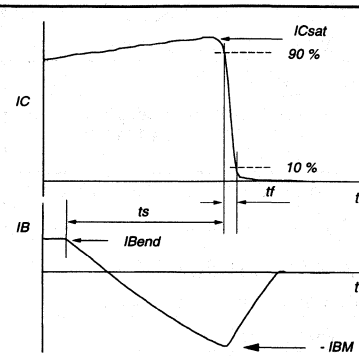


Fig.4. Switching times definitions.

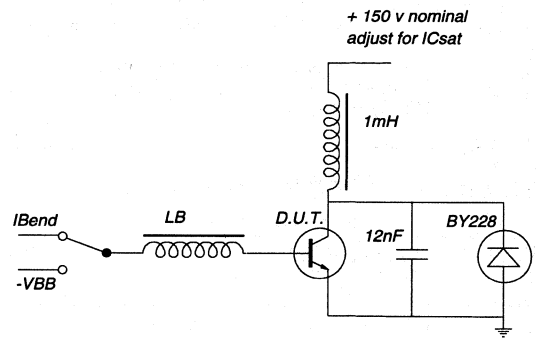


Fig.5. Switching times test circuit.

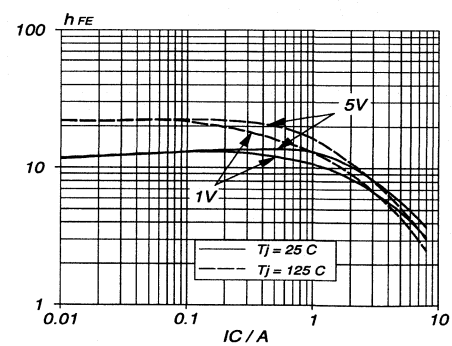


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

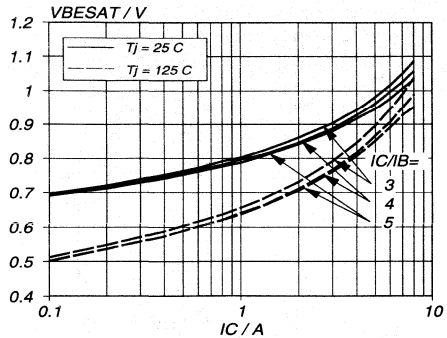


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_C)$; parameter I_C/I_B

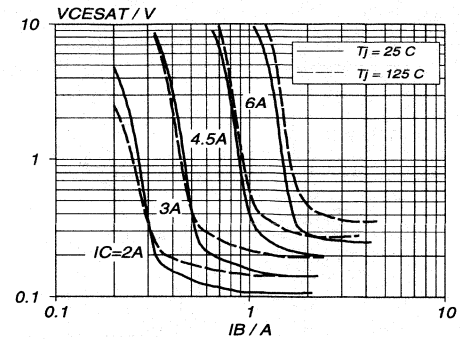


Fig.10. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

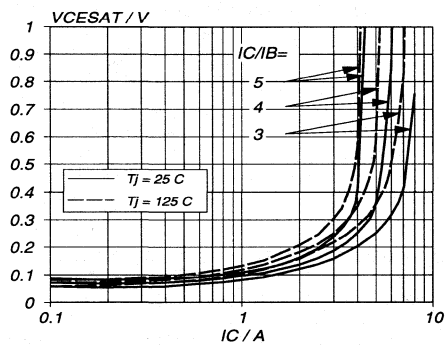


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

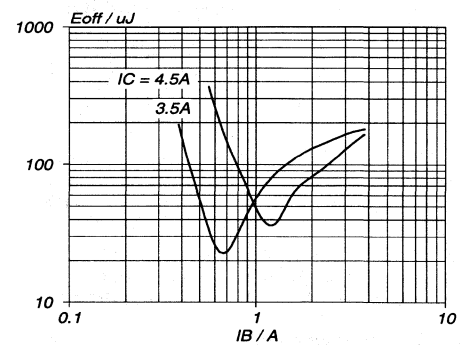


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$
Eoff = $f(I_B)$; parameter I_C; f = 16 kHz

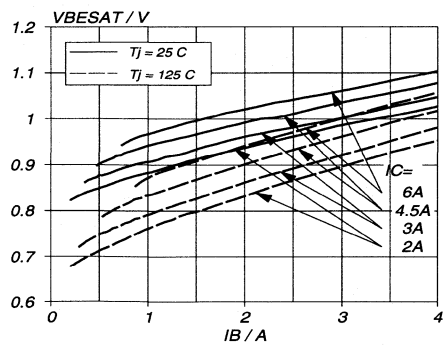


Fig.9. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

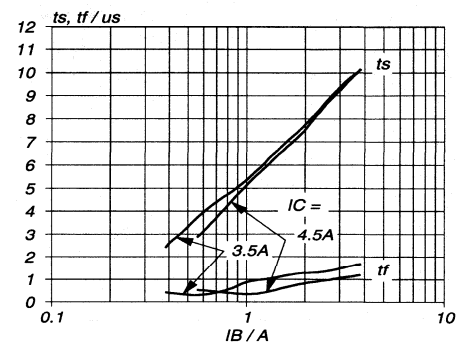


Fig.12. Typical collector storage and fall time.
ts = $f(I_B)$; tf = $f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

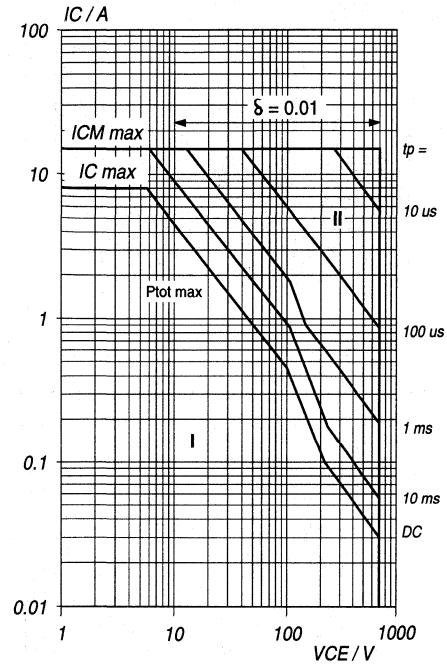


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

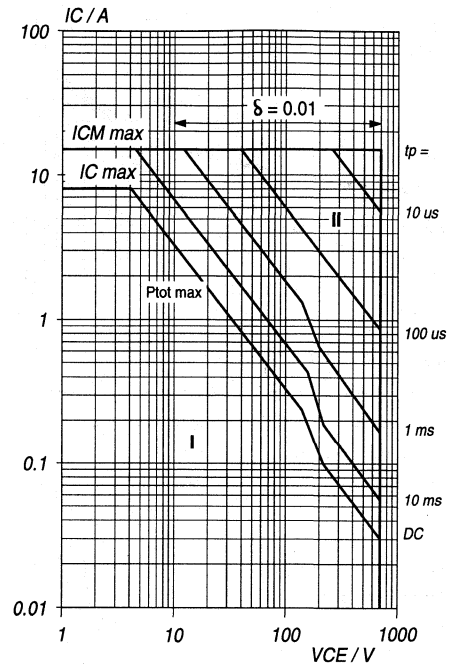


Fig.15. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

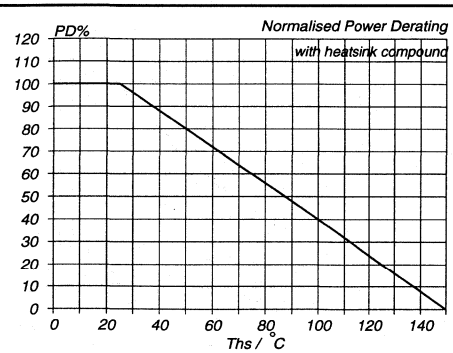


Fig.14. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25˚C} = f(T_{hs})$

Silicon Diffused Power Transistor — BU2508DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

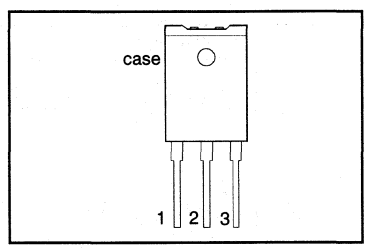
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.12 A	-	1.0	V
I_{Csat}	Collector saturation current		4.5	-	A
V_F	Diode forward voltage	I_F = 4.5 A	1.6	2.0	V
t_f	Fall time	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A	0.4	0.6	µs

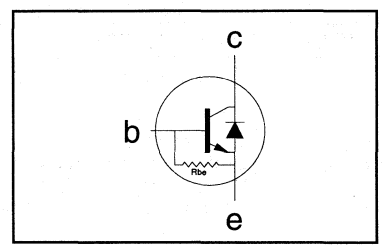
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	227	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	33	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.12 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.7 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4	5.5	7.0	
V_F	Diode forward voltage	I_F = 4.5 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A; L_B = 6 μH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/μs)			
t_s	Turn-off storage time		5.0	6.0	μs
t_f	Turn-off fall time		0.4	0.6	μs
	Switching times (38 kHz line deflectioin circuit)	I_{Csat} = 4.0 A; $I_{B(end)}$ = 0.9 A; L_B = 6 μH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/μs)			
t_s	Turn-off storage time		4.7	5.7	μs
t_f	Turn-off fall time		0.25	0.35	μs

2 Measured with half sine-wave voltage (curve tracer).

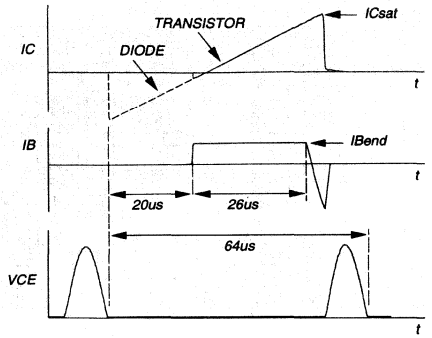


Fig.1. 16kHz Switching times waveforms.

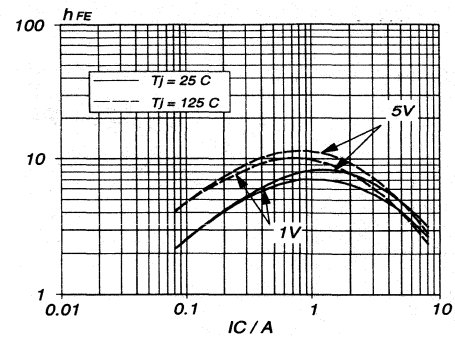


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

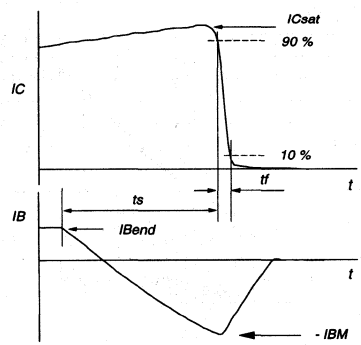


Fig.2. Switching times definitions.

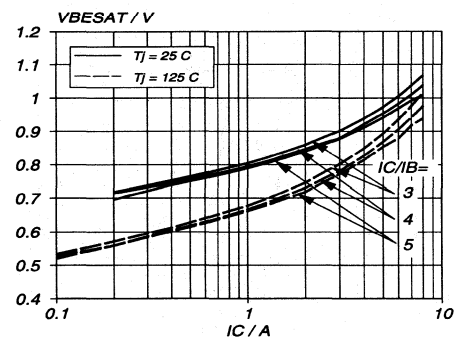


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

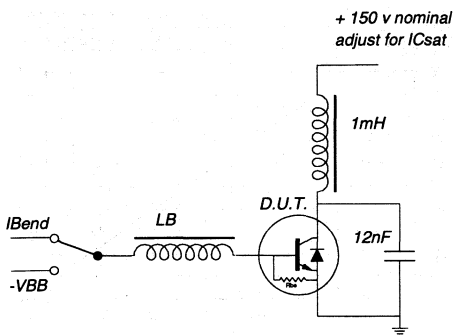


Fig.3. 16kHz Switching times test circuit.

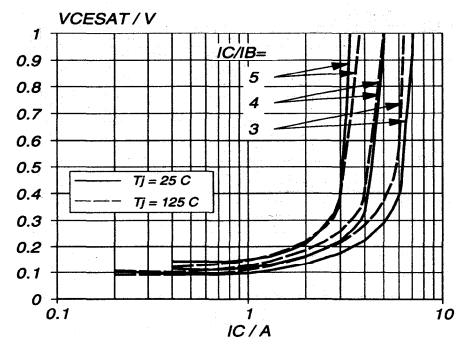


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

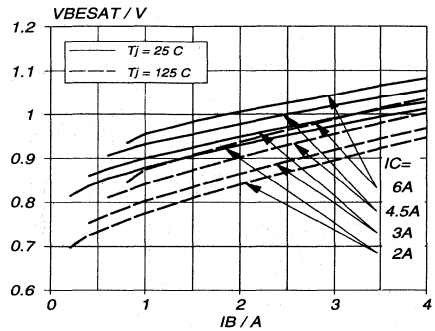


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

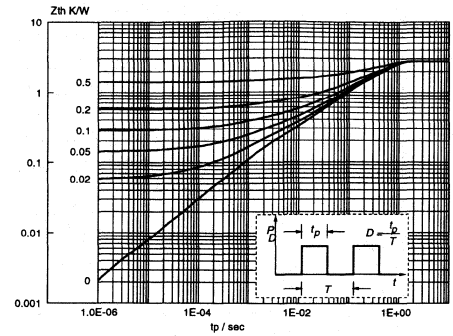


Fig.10. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

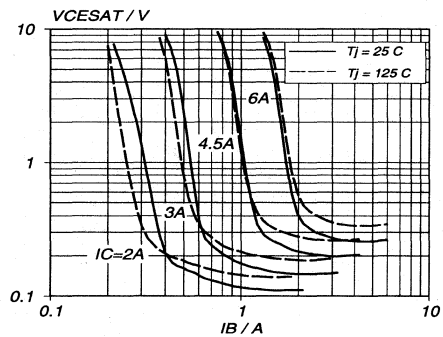


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

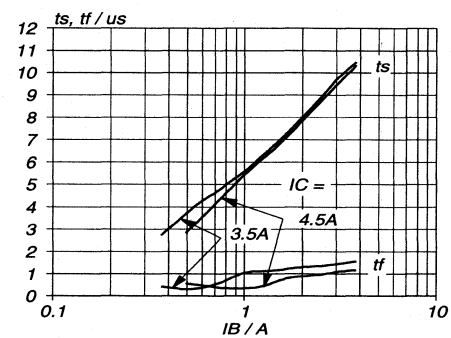


Fig.11. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; $f = 16$ kHz

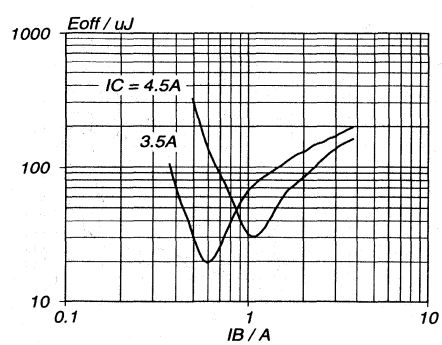


Fig.9. Typical turn-off losses. $T_j = 85^\circ C$
$Eoff = f(I_B)$; parameter I_C; $f = 16$ kHz

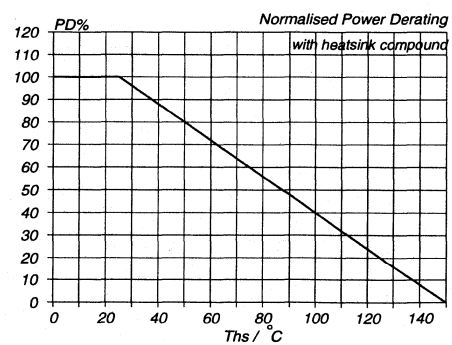


Fig.12. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

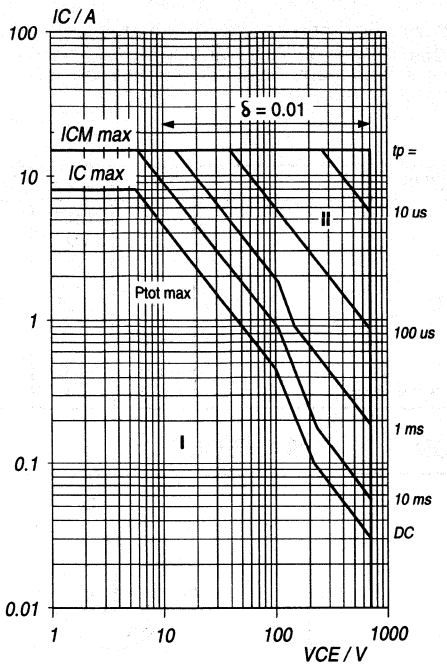


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

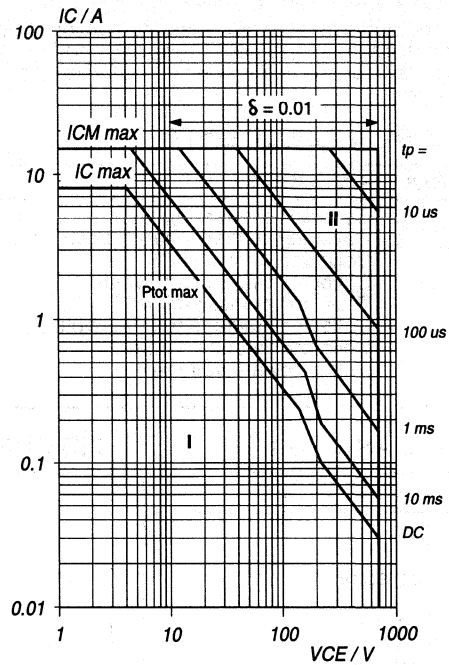


Fig.14. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU2508DW

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

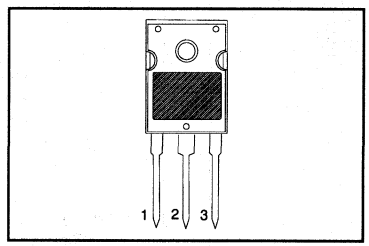
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.12 A	-	1.0	V
I_{Csat}	Collector saturation current	f=16kHz	4.5	-	A
V_F	Diode forward voltage	I_F = 4.5 A	1.6	2.0	V
t_f	Fall time	I_{Csat} = 4.5 A; f=16kHz	0.4	0.6	µs

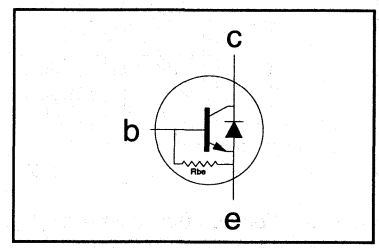
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	140	-	390	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	33	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.12 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.7 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4	5.5	7.0	
V_F	Diode forward voltage	I_F = 4.5 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A; L_B = 6 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/µs)			
t_s	Turn-off storage time		5.0	6.0	µs
t_f	Turn-off fall time		0.4	0.6	µs
	Switching times (38 kHz line deflection circuit)	I_{Csat} = 4.0 A; $I_{B(end)}$ = 0.9 A; L_B = 6 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/µs)			
t_s	Turn-off storage time		4.7	5.7	µs
t_f	Turn-off fall time		0.25	0.35	µs

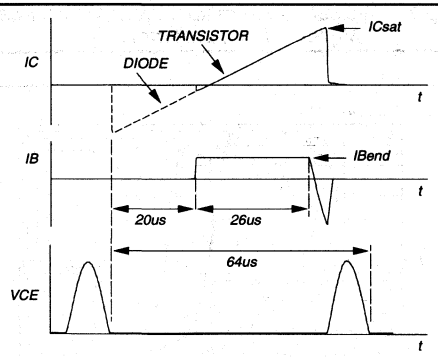


Fig.1. Switching times waveforms.

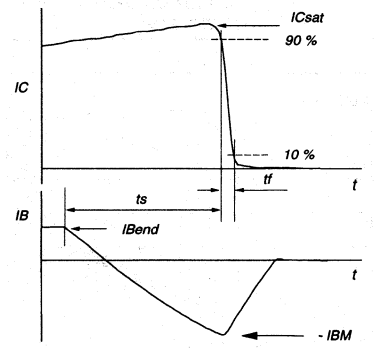


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

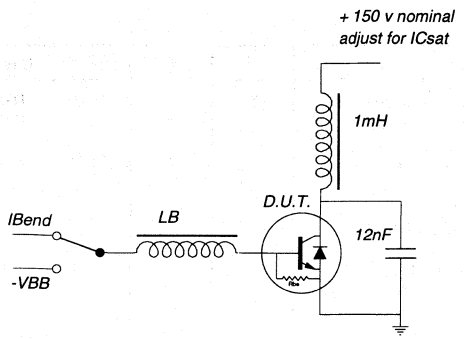


Fig.3. Switching times test circuit.

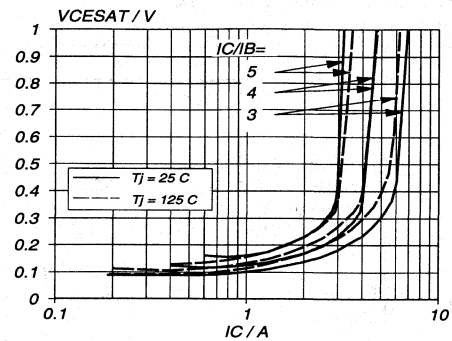


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

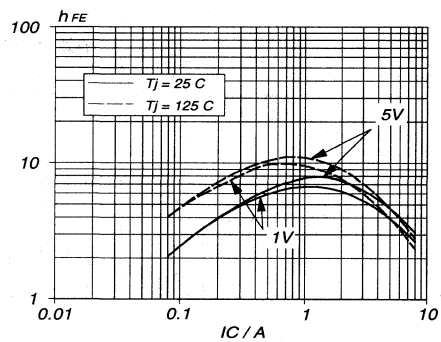


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

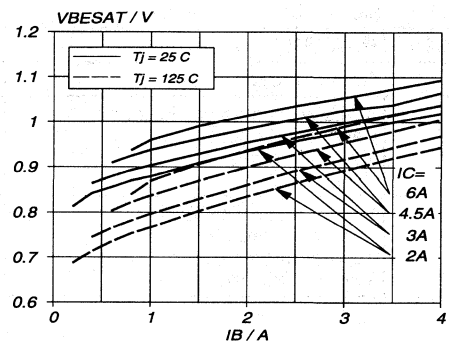


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

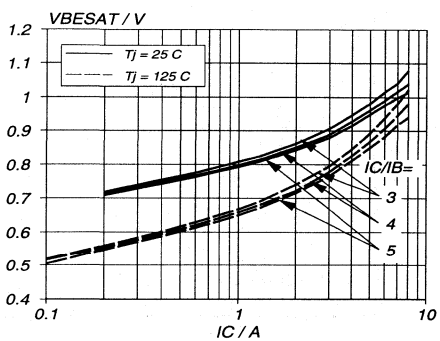


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

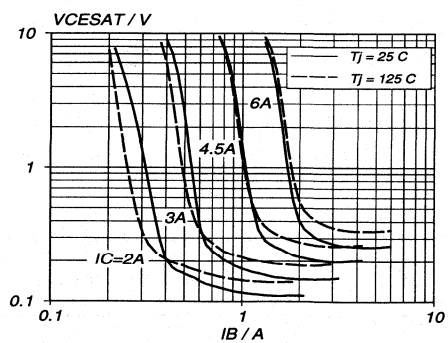


Fig.8. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

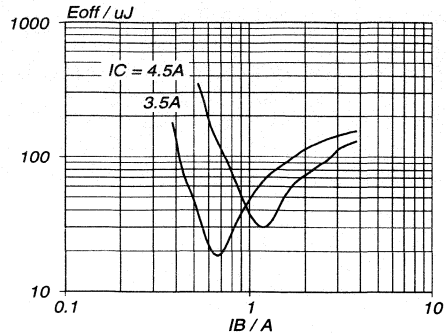


Fig.9. Typical turn-off losses. T_j = 85˚C
Eoff = f (I_B); parameter I_C; f = 16 kHz

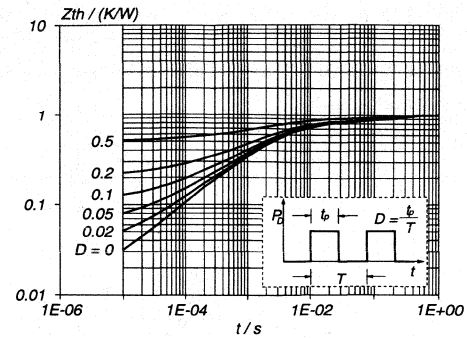


Fig.11. Transient thermal impedance.
$Z_{th\ j\text{-}mb}$ = f(t); parameter D = t_p/T

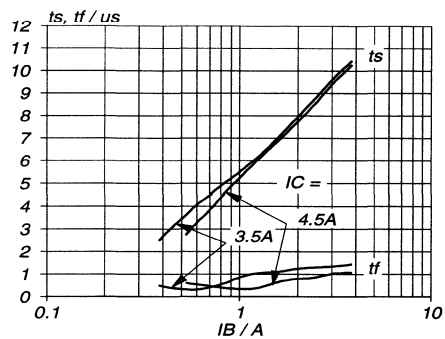


Fig.10. Typical collector storage and fall time.
ts = f (I_B); tf = f (I_B); parameter I_C; T_j = 85˚C; f = 16 kHz

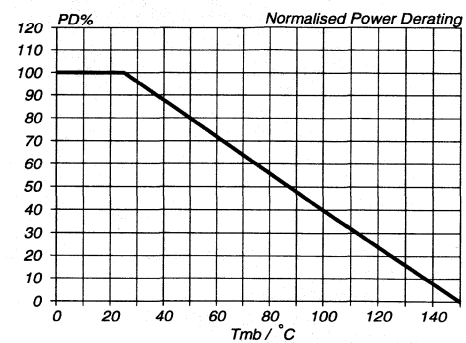


Fig.12. Normalised power dissipation.
PD% = 100·P_D/$P_{D\ 25˚C}$ = f (T_{mb})

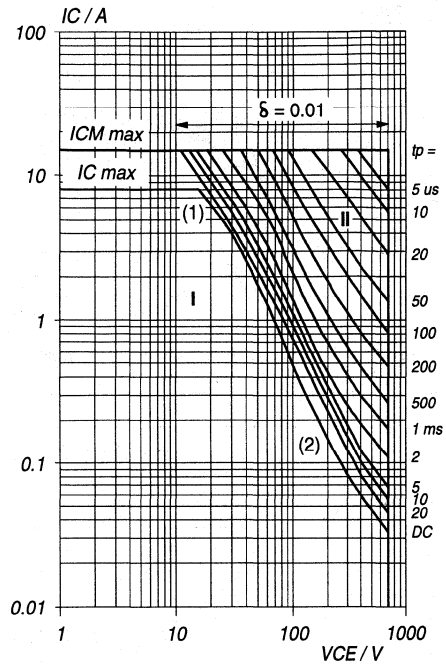


Fig.13. Forward bias safe operating area. T_{mb} = 25˚C
(1) *P_{tot} max line.*
(2) *Second-breakdown limits (independent of temperature).*
I *Region of DC operation.*
II *Extension for repetitive pulse operation.*

Silicon Diffused Power Transistor — BU2508DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

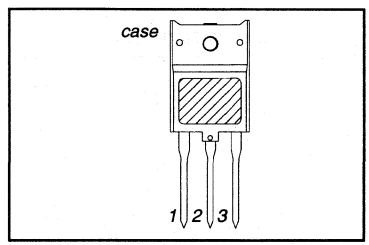
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.12 A	-	1.0	V
I_{Csat}	Collector saturation current		4.5	-	A
V_F	Diode forward voltage	I_F = 4.5 A	1.6	2.0	V
t_f	Fall time	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A	0.4	0.6	µs

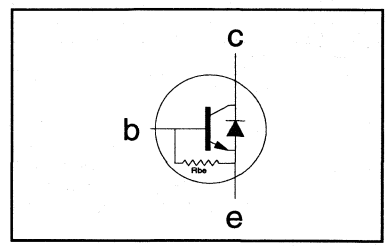
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	100	mA
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	227	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	33	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	700	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4.5 A; I_B = 1.12 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.7 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4	5.5	7.0	
V_F	Diode forward voltage	I_F = 4.5 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A; $I_{B(end)}$ = 1.1 A; L_B = 6 μH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/μs)			
t_s	Turn-off storage time		5.0	6.0	μs
t_f	Turn-off fall time		0.4	0.6	μs
	Switching times (38 kHz line deflection circuit)	I_{Csat} = 4.0 A; $I_{B(end)}$ = 0.9 A; L_B = 6 μH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.6 A/μs)			
t_s	Turn-off storage time		4.7	5.7	μs
t_f	Turn-off fall time		0.25	0.35	μs

2 Measured with half sine-wave voltage (curve tracer).

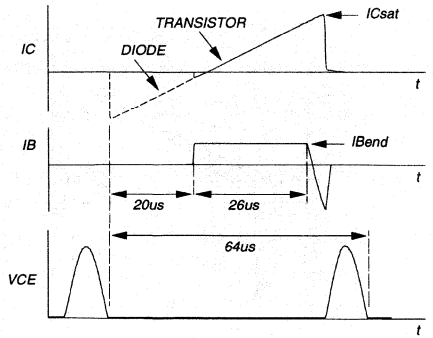


Fig.1. 16kHz Switching times waveforms.

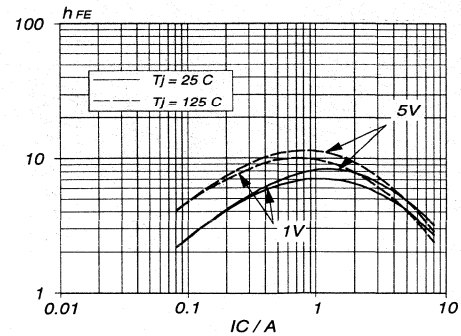


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

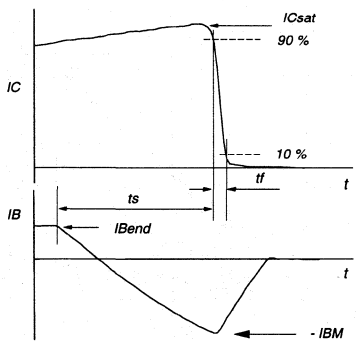


Fig.2. Switching times definitions.

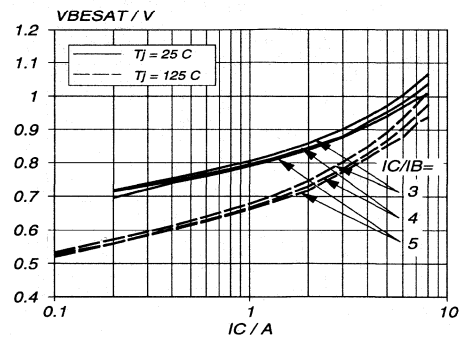


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

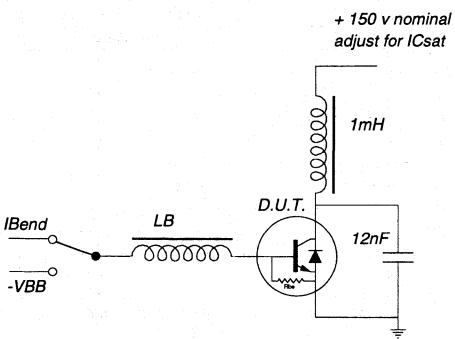


Fig.3. 16kHz Switching times test circuit.

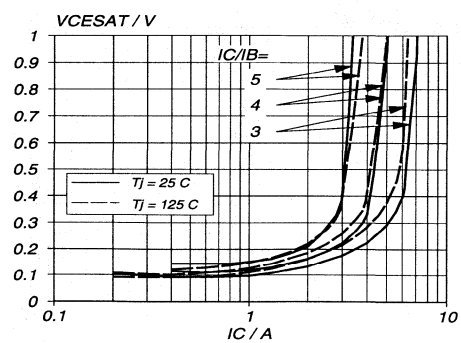


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

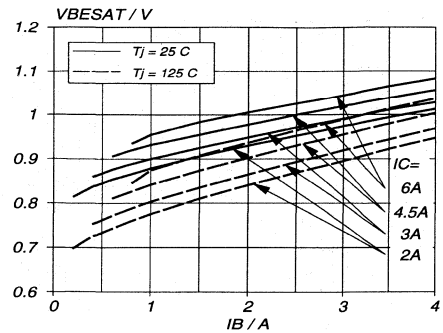


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

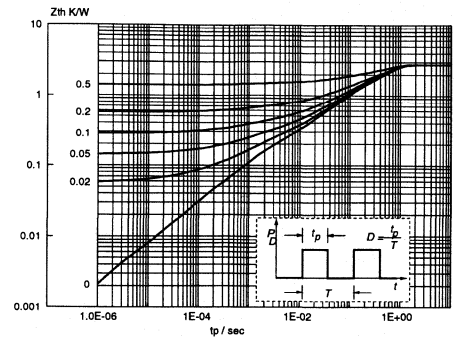


Fig.10. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

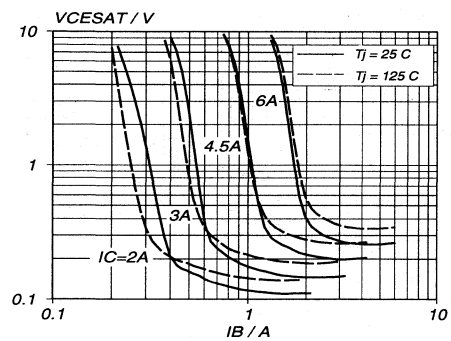


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

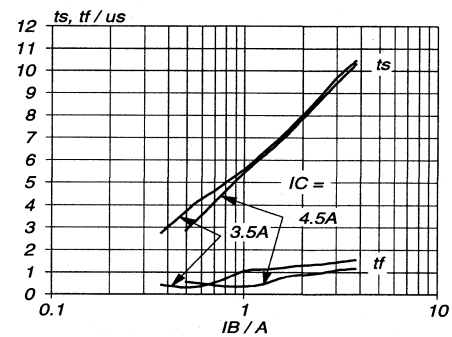


Fig.11. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

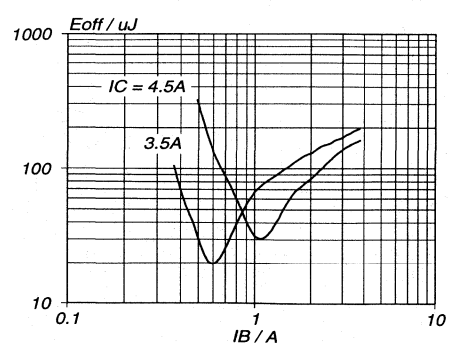


Fig.9. Typical turn-off losses. $T_j = 85^\circ C$
$Eoff = f(I_B)$; parameter I_C; f = 16 kHz

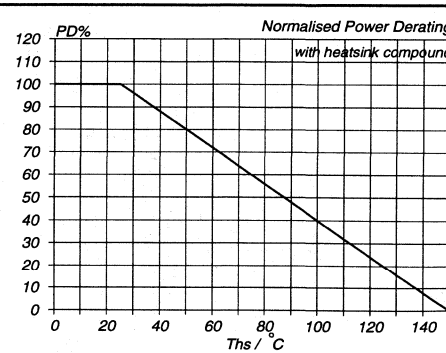


Fig.12. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\ 25^\circ C} = f(T_{hs})$

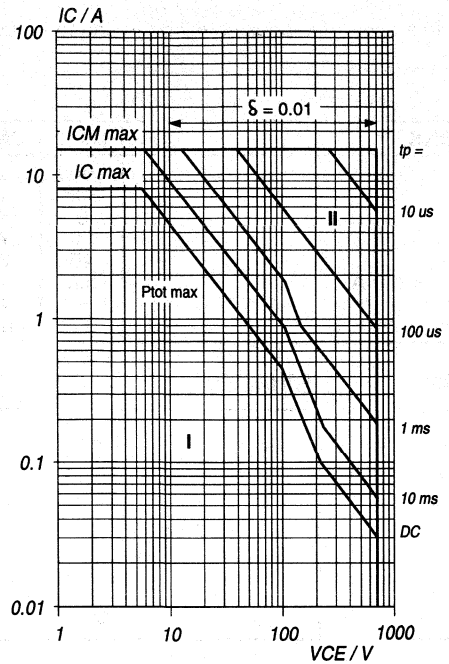


Fig.13. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

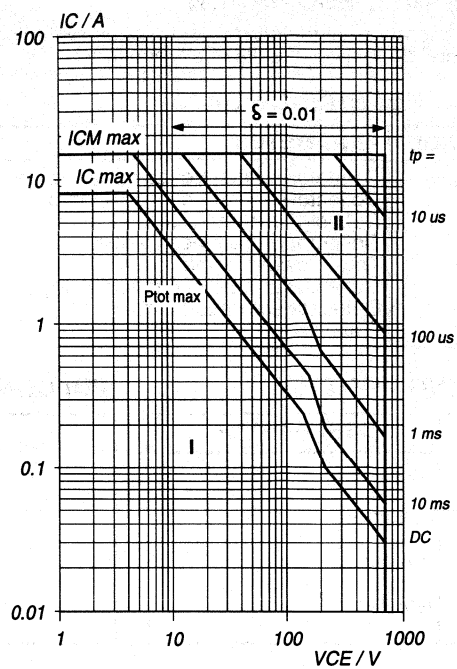


Fig.14. Forward bias safe operating area. T_{hs} = 25˚C
I Region of permissible DC operation.
II Extension for repetitive pulse operation.

NB: *Mounted without heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BU2515AF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of pc monitors.

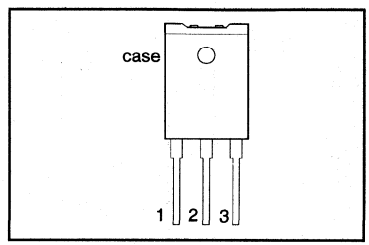
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 56 kHz	4.5	-	A
t_f	Fall time	I_{Csat} = 4.5 A; f = 56 kHz	0.2	0.4	µs

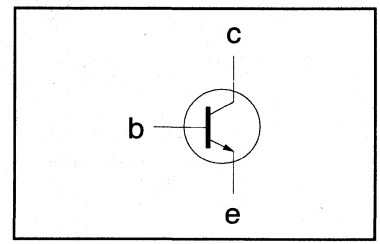
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
I_B	Base current (DC)		-	5	A
I_{BM}	Base current peak value		-	7.5	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	125	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 5 V	-	17.2	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 5 V	5	8.2	10.8	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (56 kHz line deflection circuit)	I_{Csat} = 4.5 A; L_C = 250 µH; C_{fb} = 4 nF; $I_{B(end)}$ =0.65 A; L_B = 1.5 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 2.7 A			
t_s	Turn-off storage time		2.2	3.0	µs
t_f	Turn-off fall time		0.2	0.4	µs

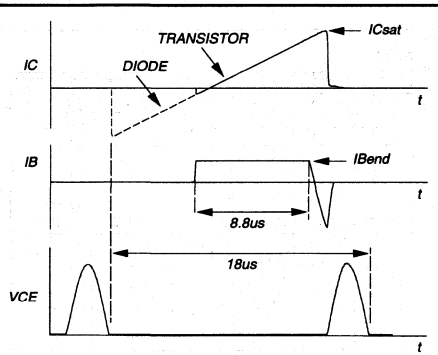


Fig.1. Switching times waveforms.

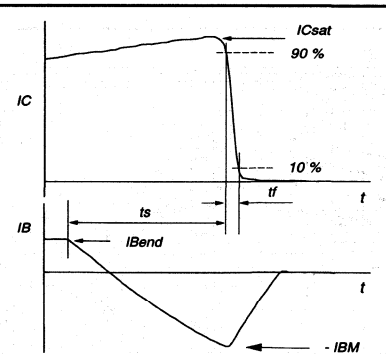


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

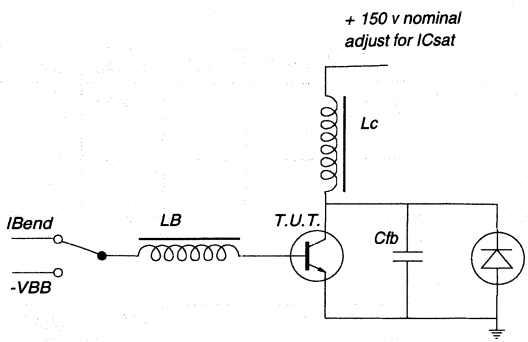


Fig.3. Switching times test circuit.

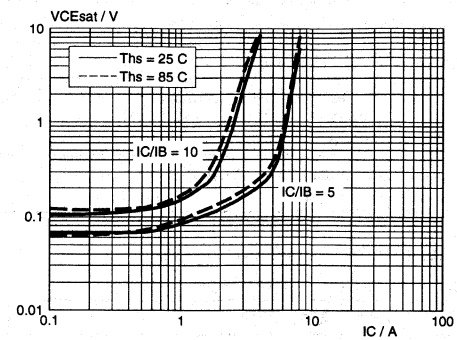


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

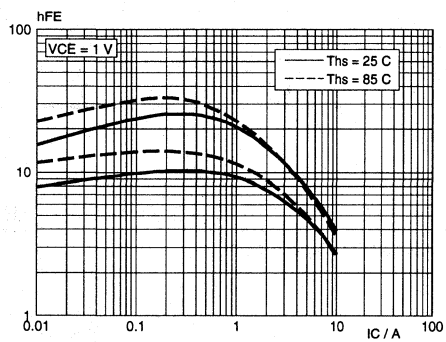


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

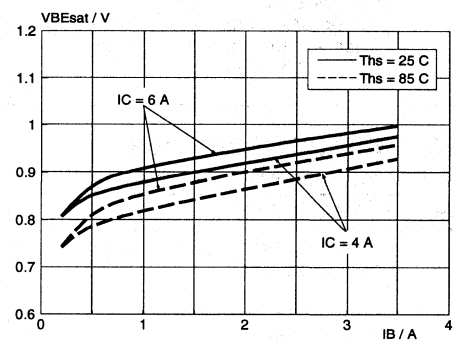


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

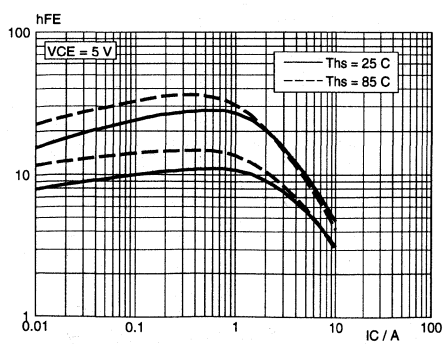


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

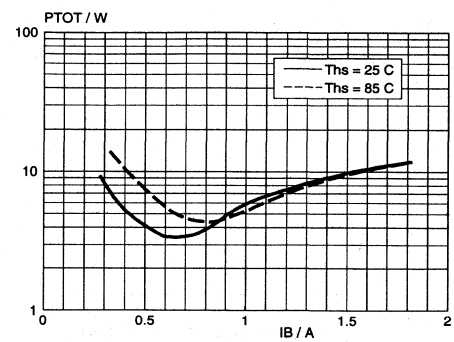


Fig.8. Typical losses. $P_{TOT} = f(I_B)$; $I_C = 4.5$ A; $f = 56$ kHz

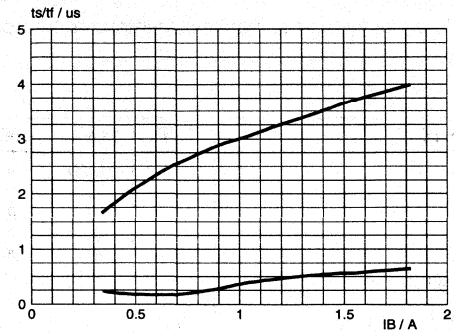


Fig.9. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; $I_C = 4.5$ A; $T_j = 85$˚C; f = 56 kHz

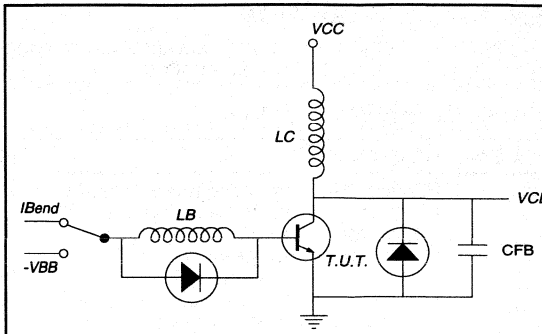


Fig.12. Test Circuit RBSOA. $V_{CC} = 150$ V;
$-V_{BB} = 1 - 5$ V;
$L_C = 1.5$ mH; $V_{CL} = 1450$ V; $L_B = 0.3 - 2\,\mu$H;
$C_{FB} = 0.5 - 8$ nF; $I_{B(end)} = 0.65 - 1.3$ A

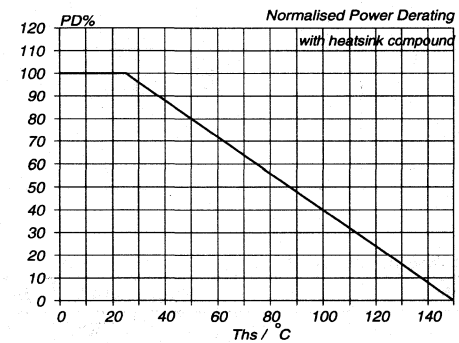


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

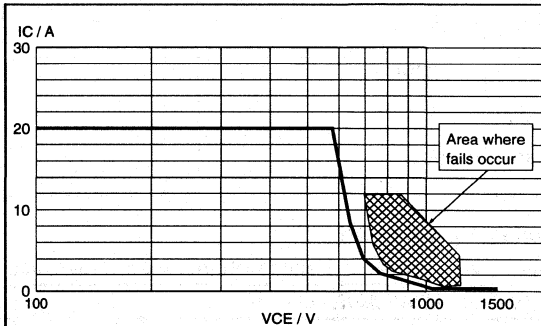


Fig.13. Reverse bias safe operating area. $T_j \leq T_{jmax}$

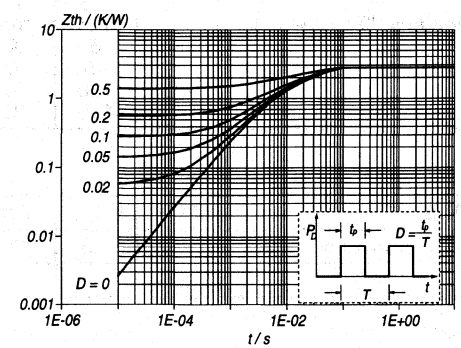


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

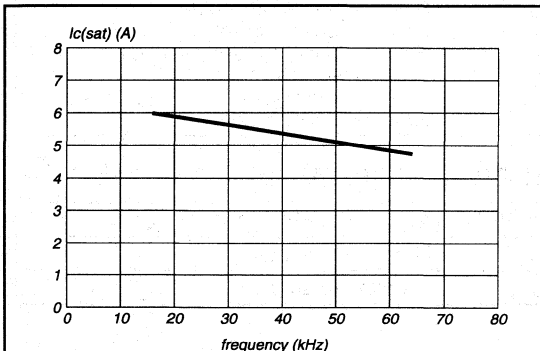


Fig.14. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU2515AX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of pc monitors.

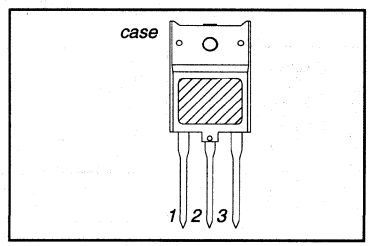
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 56 kHz	4.5	-	A
t_f	Fall time	I_{Csat} = 4.5 A; f = 56 kHz	0.2	0.4	µs

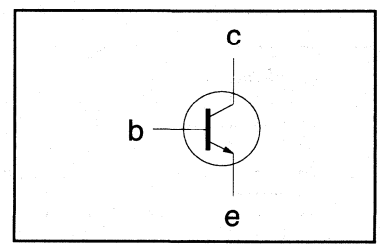
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
I_B	Base current (DC)		-	5	A
I_{BM}	Base current peak value		-	7.5	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	125	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

SOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 5 V	-	17.2	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 5 V	5	8.2	10.8	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (56 kHz line deflection circuit)	I_{Csat} = 4.5 A; L_C = 250 µH; C_{fb} = 4 nF; $I_{B(end)}$ =0.65 A; L_B = 1.5 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 2.7 A			
t_s	Turn-off storage time		2.2	3.0	µs
t_f	Turn-off fall time		0.2	0.4	µs

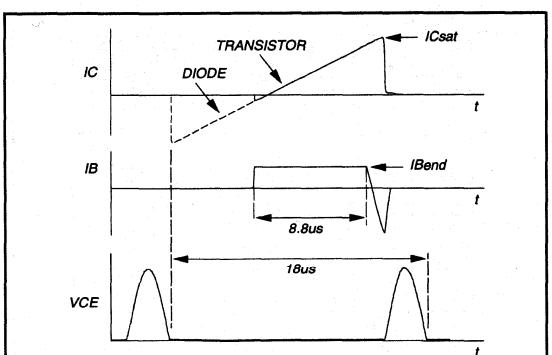


Fig.1. Switching times waveforms.

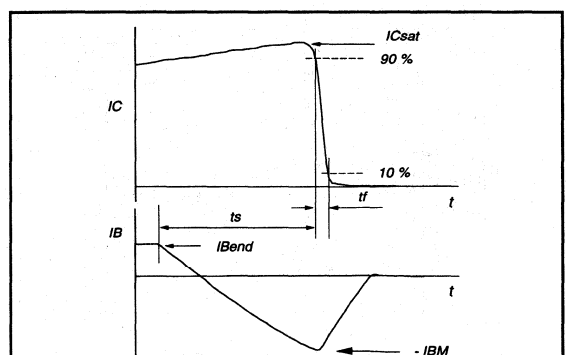


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

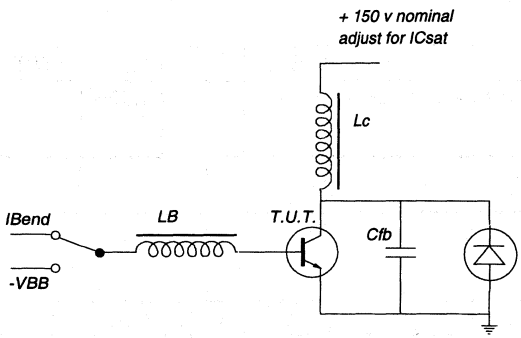


Fig.3. Switching times test circuit.

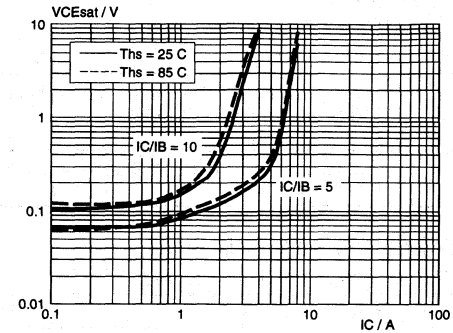


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

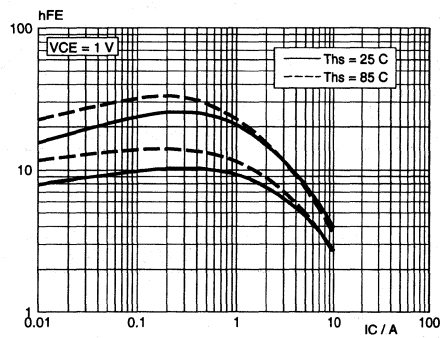


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

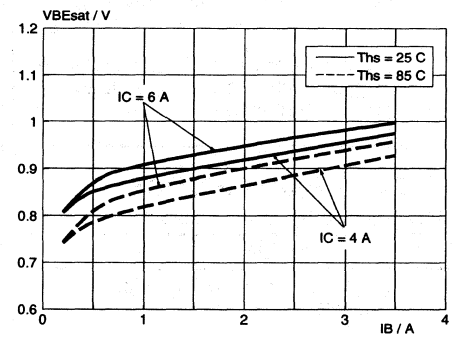


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

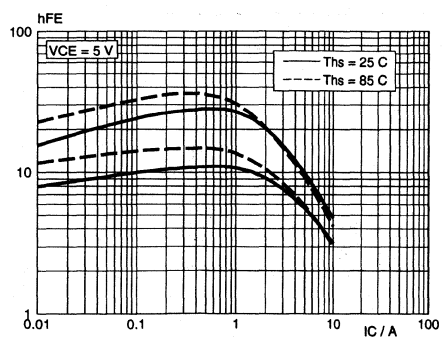


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

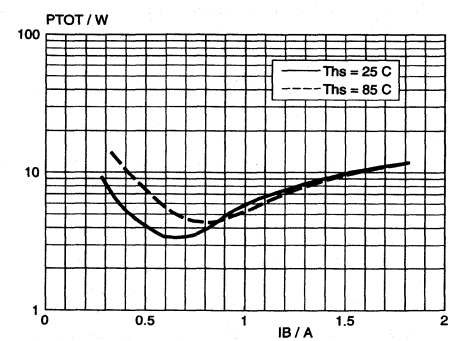


Fig.8. Typical losses. $P_{TOT} = f(I_B)$; $I_C = 4.5$ A; $f = 56$ kHz

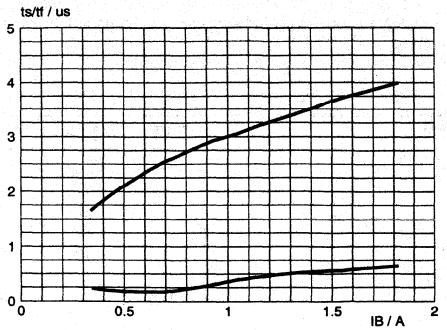


Fig.9. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; $I_C = 4.5$ A; $T_j = 85$°C; f = 56 kHz

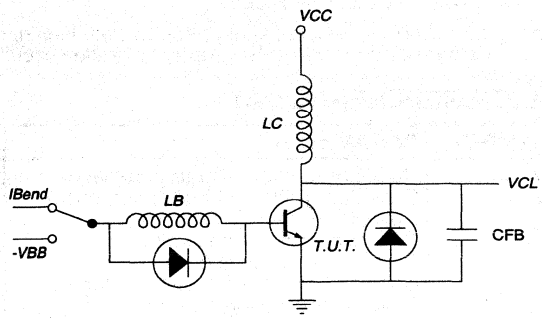


Fig.12. Test Circuit RBSOA. $V_{CC} = 150$ V;
$-V_{BB} = 1 - 5$ V;
$L_C = 1.5$ mH; $V_{CL} = 1450$ V; $L_B = 0.3 - 2$ µH;
$C_{FB} = 0.5 - 8$ nF; $I_{B(end)} = 0.65 - 1.3$ A

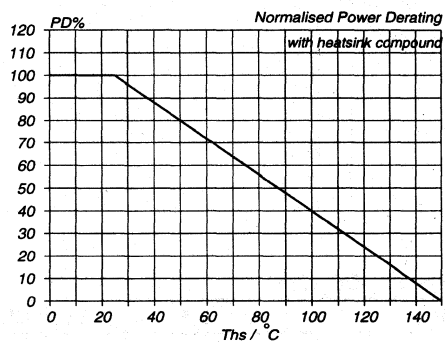


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25°C} = f(T_{mb})$

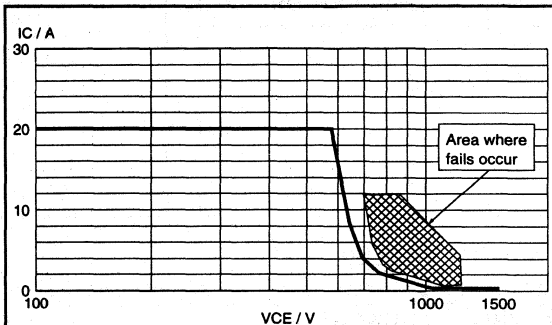


Fig.13. Reverse bias safe operating area. $T_j \leq T_{jmax}$

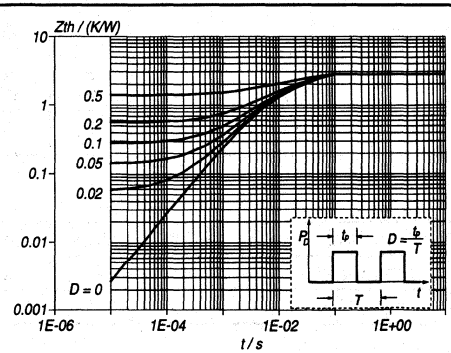


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

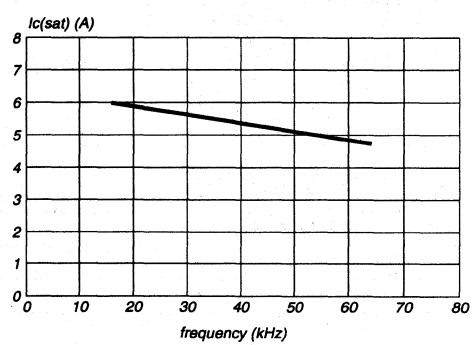


Fig.14. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU2515DF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a full plastic envelope intended for use in horizontal deflection circuits of pc monitors.

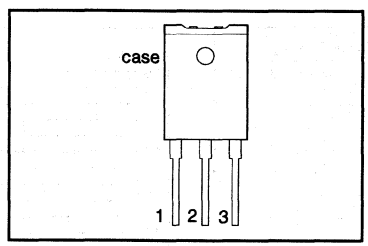
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 56 kHz	4.5	-	A
V_F	Diode forward voltage	I_F = 4.5 A	-	2.2	V
t_f	Fall time	I_{Csat} = 4.5 A; f = 56 kHz	0.2	0.4	µs

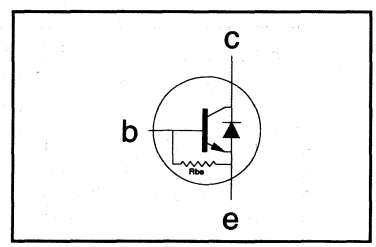
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
I_B	Base current (DC)		-	5	A
I_{BM}	Base current peak value		-	7.5	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	125	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	130	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
R_{be}	Base-emitter resistance	V_{EB} = 6 V	-	46	-	Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 5 V	5	8	10.2	
V_F	Diode forward voltage	I_F = 4.5 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (56 kHz line deflection circuit)	I_{Csat} = 4.5 A; L_C = 250 µH; C_{fb} = 4 nF; $I_{B(end)}$ = 0.65 A; L_B = 1.5 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 2.7 A			
t_s	Turn-off storage time		2.2	3.0	µs
t_f	Turn-off fall time		0.2	0.4	µs
V_{fr}	Anti-parallel diode forward recovery voltage	I_F = 4.5 A; dI_F/dt = 50 A/µs	17	-	V
t_{fr}	Anti-parallel diode forward recovery time	V_F = 5 V	360	-	ns

2 Measured with half sine-wave voltage (curve tracer).

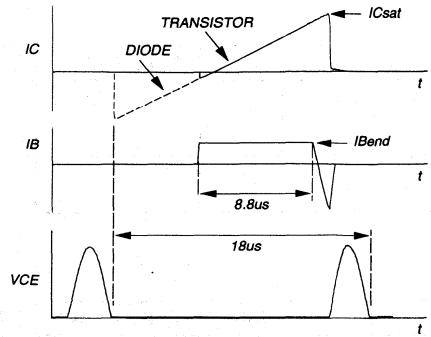


Fig.1. Switching times waveforms.

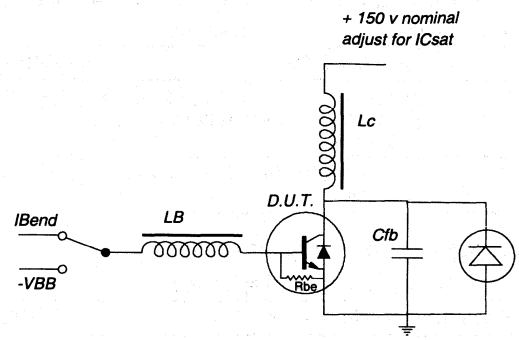


Fig.4. Switching times test circuit.

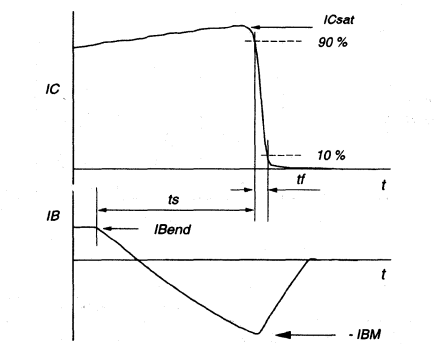


Fig.2. Switching times definitions.

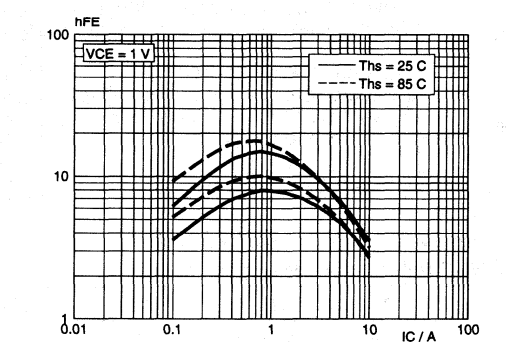


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

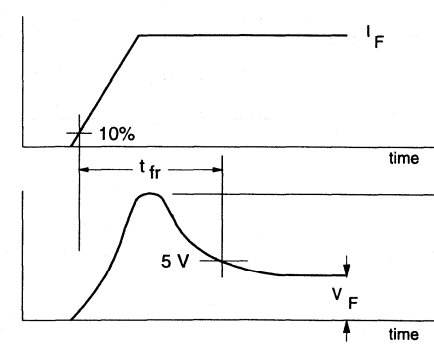


Fig.3. Definition of anti-parallel diode V_{fr} and t_{fr}.

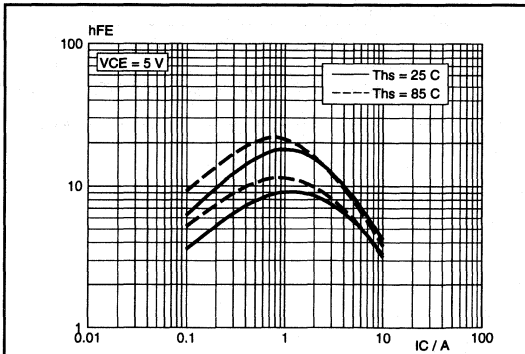


Fig.6. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

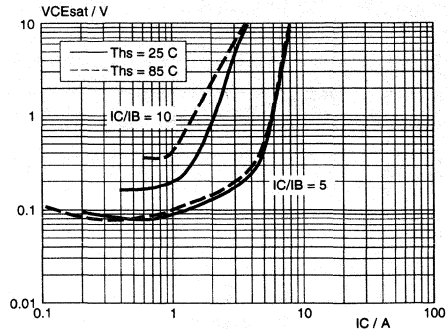


Fig.7. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

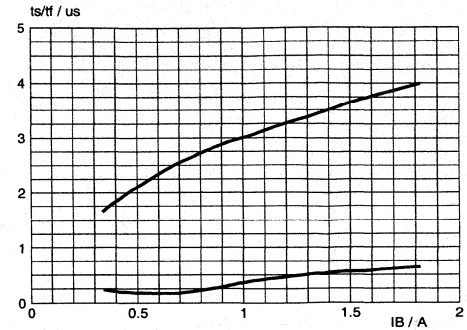


Fig.10. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; $I_C = 4.5$ A; $T_j = 85$˚C; f = 56 kHz

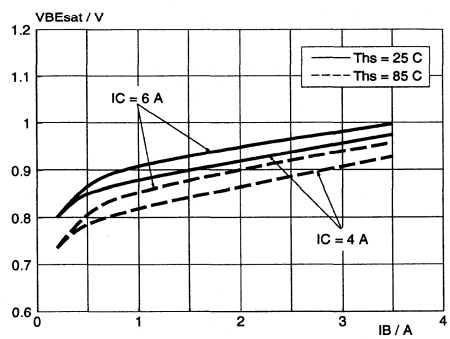


Fig.8. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

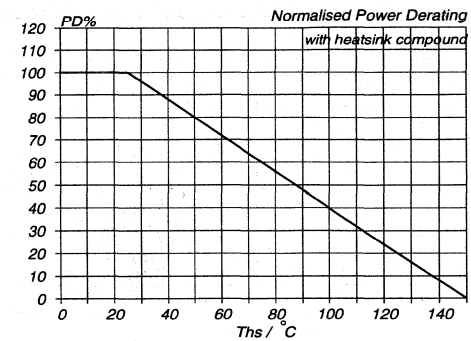


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25˚C} = f(T_{mb})$

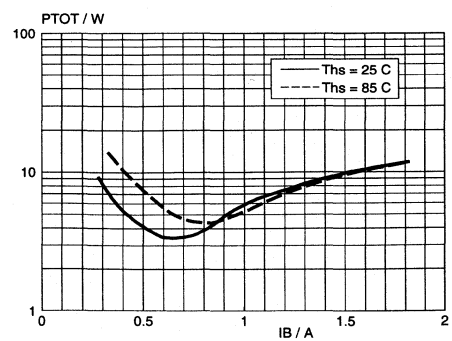


Fig.9. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 4.5$ A; f = 56 kHz

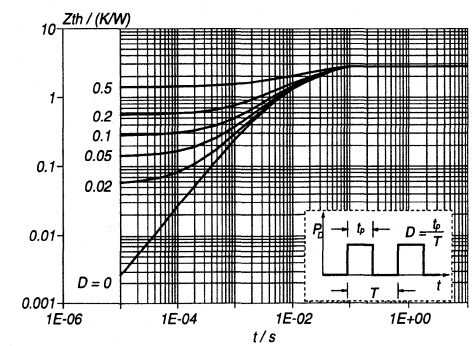


Fig.12. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

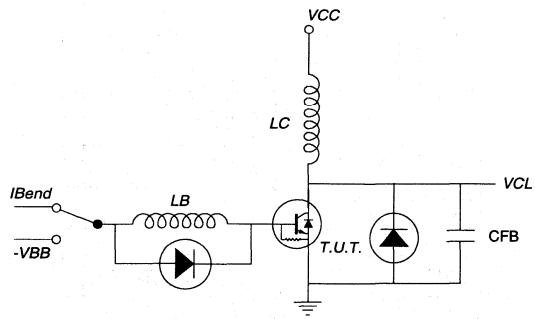


Fig.13. Test Circuit RBSOA. V_{CC} = 150 V; $-V_{BB}$ = 1 - 5 V; L_C = 1.5 mH; V_{CL} = 1450 V; L_B = 0.3 - 2 µH; C_{FB} = 0.5 - 8 nF; $I_{B(end)}$ = 0.65 - 1.3 A

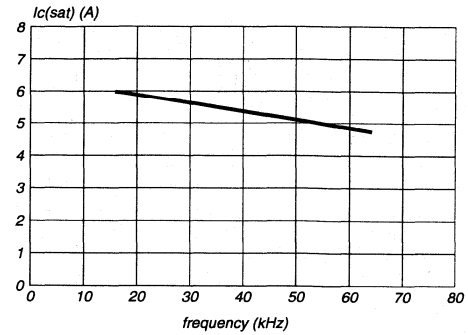


Fig.15. I_{Csat} during normal running vs. frequency of operation for optimum performance

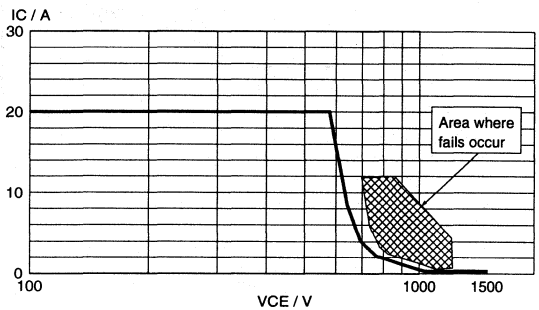


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2515DX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a full plastic envelope intended for use in horizontal deflection circuits of pc monitors.

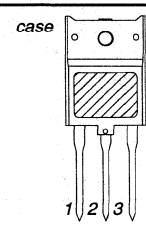
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 56 kHz	4.5	-	A
V_F	Diode forward voltage	I_F = 4.5 A	-	2.2	V
t_f	Fall time	I_{Csat} = 4.5 A; f = 56 kHz	0.2	0.4	µs

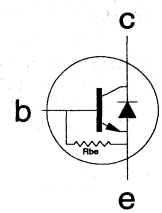
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
I_B	Base current (DC)		-	5	A
I_{BM}	Base current peak value		-	7.5	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	125	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	130	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
R_{be}	Base-emitter resistance	V_{EB} = 6 V	-	46	-	Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 0.9 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 5 V	5	8	10.2	
V_F	Diode forward voltage	I_F = 4.5 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (56 kHz line deflection circuit)	I_{Csat} = 4.5 A; L_C = 250 µH; C_{fb} = 4 nF; $I_{B(end)}$ = 0.65 A; L_B = 1.5 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 2.7 A			
t_s	Turn-off storage time		2.2	3.0	µs
t_f	Turn-off fall time		0.2	0.4	µs
V_{fr}	Anti-parallel diode forward recovery voltage	I_F = 4.5 A; dI_F/dt = 50 A/µs	17	-	V
t_{fr}	Anti-parallel diode forward recovery time	V_F = 5 V	360	-	ns

2 Measured with half sine-wave voltage (curve tracer).

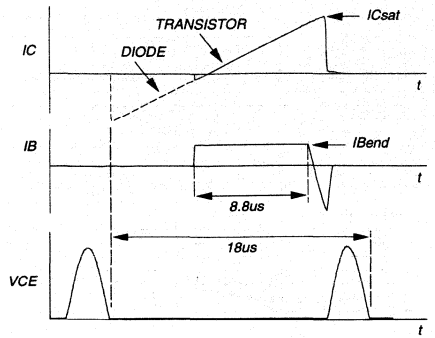


Fig.1. Switching times waveforms.

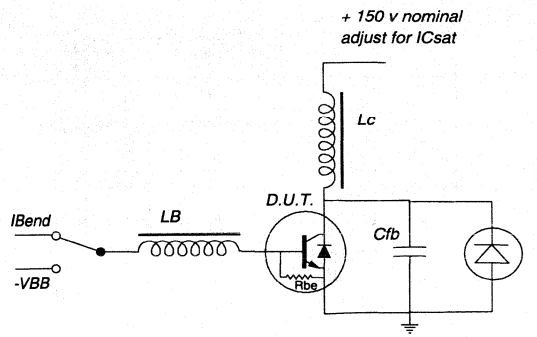


Fig.4. Switching times test circuit.

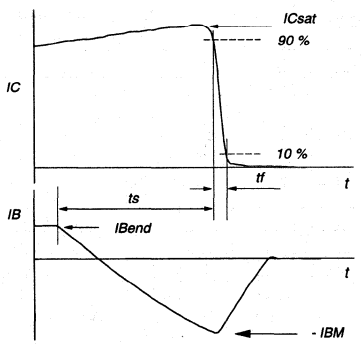


Fig.2. Switching times definitions.

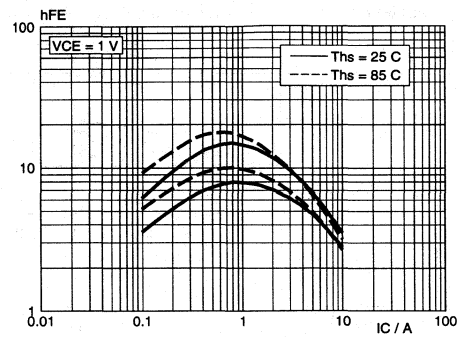


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

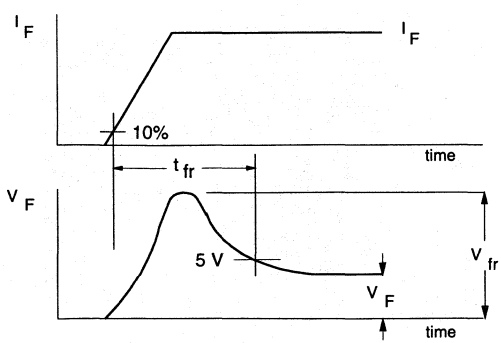


Fig.3. Definition of anti-parallel diode V_{fr} and t_{fr}.

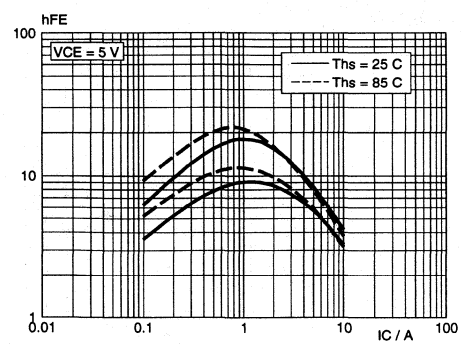


Fig.6. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

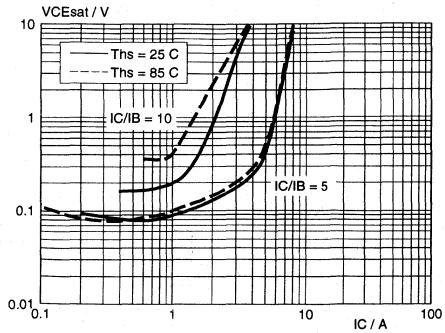


Fig.7. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

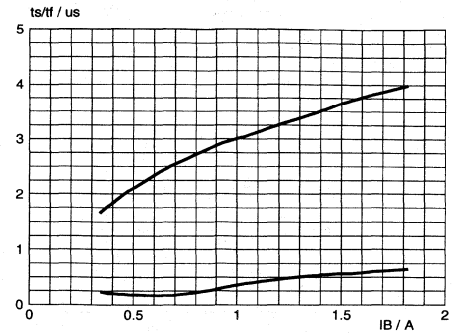


Fig.10. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; $I_C = 4.5$ A; $T_j = 85^\circ C$; f = 56 kHz

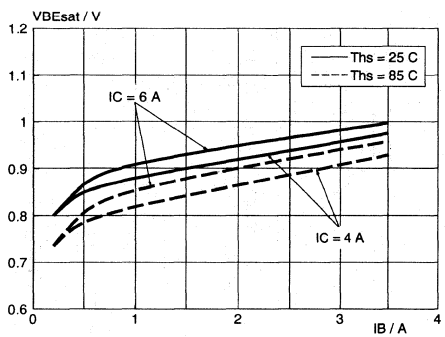


Fig.8. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

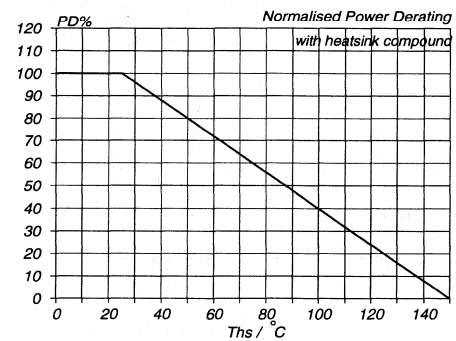


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

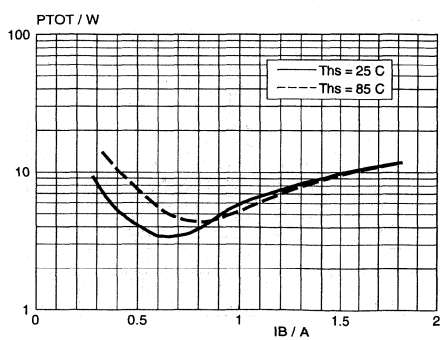


Fig.9. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 4.5$ A; f = 56 kHz

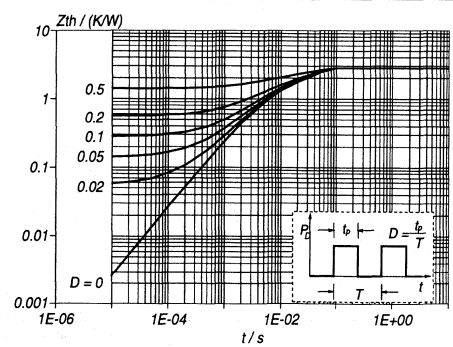


Fig.12. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

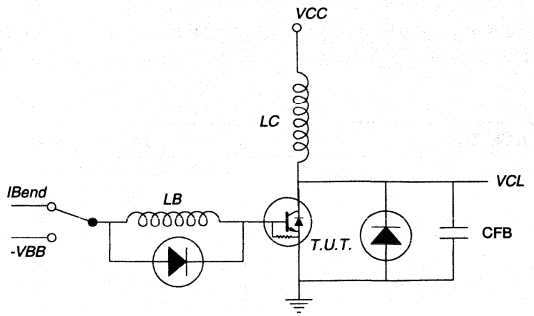


Fig.13. Test Circuit RBSOA. V_{CC} = 150 V; $-V_{BB}$ = 1 - 5 V; L_C = 1.5 mH; V_{CL} = 1450 V; L_B = 0.3 - 2 µH; C_{FB} = 0.5 - 8 nF; $I_{B(end)}$ = 0.65 - 1.3 A

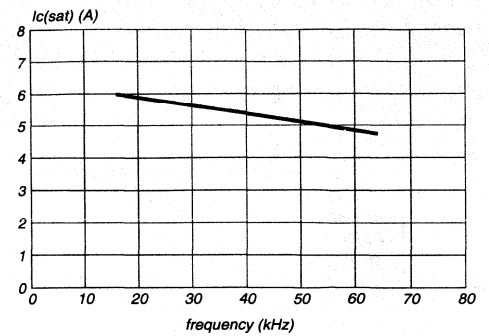


Fig.15. I_{Csat} during normal running vs. frequency of operation for optimum performance

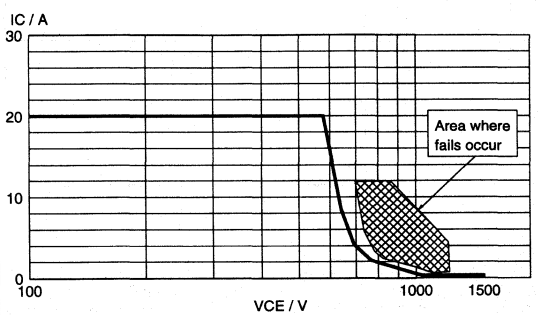


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2520AF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

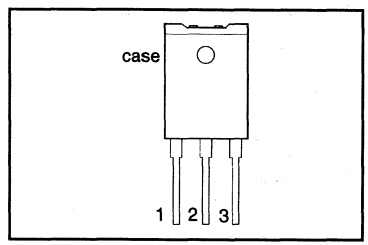
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current		6.0	-	A
t_f	Fall time	I_{Csat} = 6.0 A; $I_{B(end)}$ = 0.85 A	0.2	0.35	µs

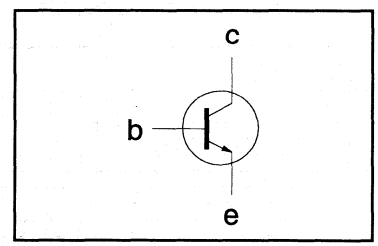
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	9.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (32 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 330 µH; C_{fb} = 9 nF; $I_{B(end)}$ = 0.85 A; L_B = 3.45 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 1.2 A / µs)			
t_s	Turn-off storage time		3.0	4.0	µs
t_f	Turn-off fall time		0.2	0.35	µs
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 650 µH; C_{fb} = 19 nF; $I_{B(end)}$ = 1.0 A; L_B = 5.3 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.8 A / µs)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.35	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

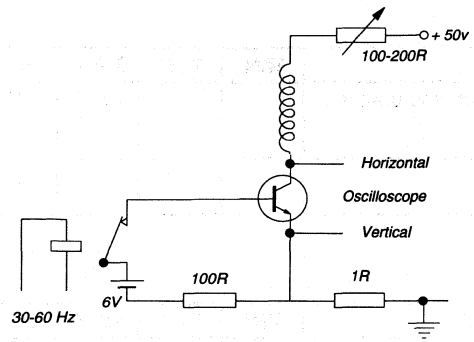


Fig.1. Test circuit for $V_{CEOsust}$.

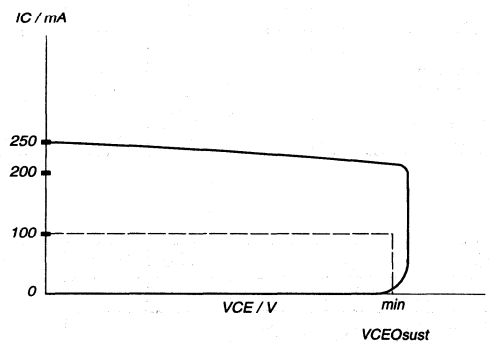


Fig.2. Oscilloscope display for $V_{CEOsust}$.

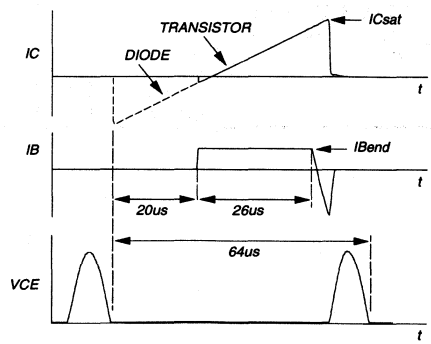


Fig.3. Switching times waveforms (16 kHz).

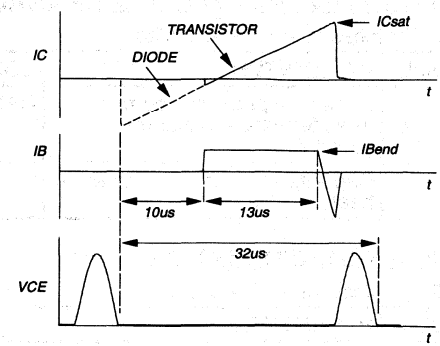


Fig.4. Switching times waveforms (32 kHz).

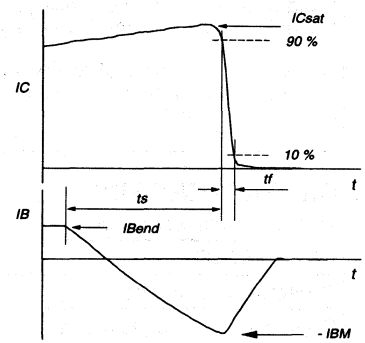


Fig.5. Switching times definitions.

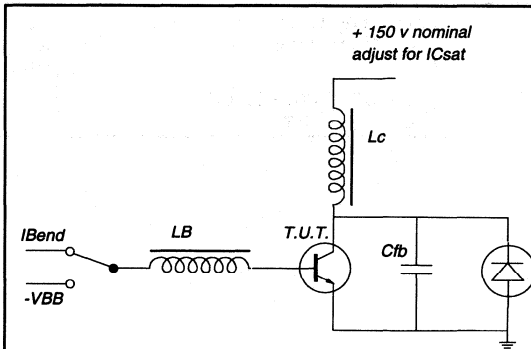


Fig.6. Switching times test circuit.

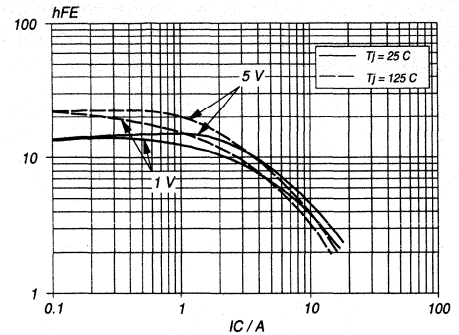


Fig.7. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

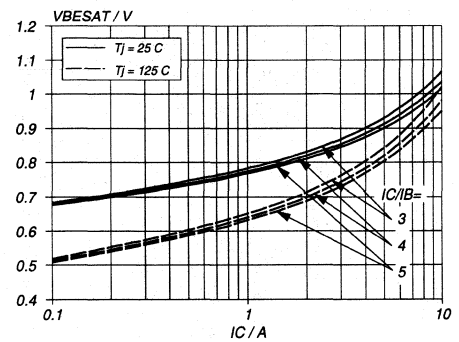


Fig.10. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

Fig.11. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

Fig.12. Typical turn-off losses. $T_j = 85^\circ C$ $Eoff = f(I_B)$; parameter I_C; parameter frequency

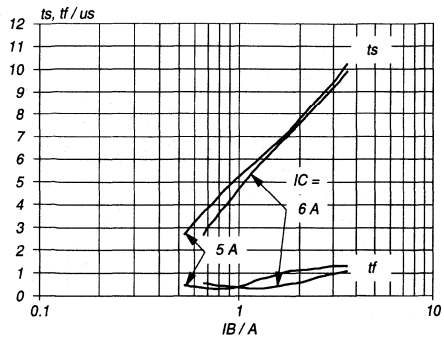


Fig.13. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

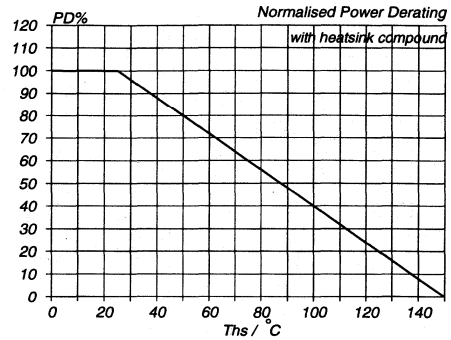


Fig.15. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

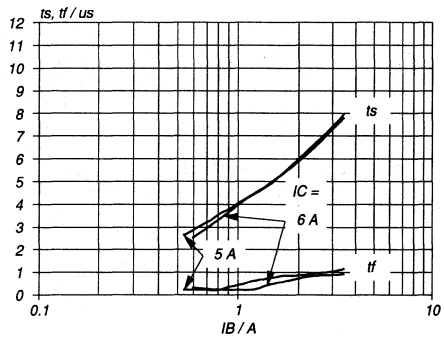


Fig.14. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 32 kHz

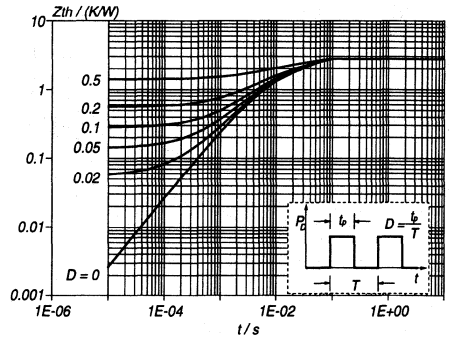


Fig.16. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

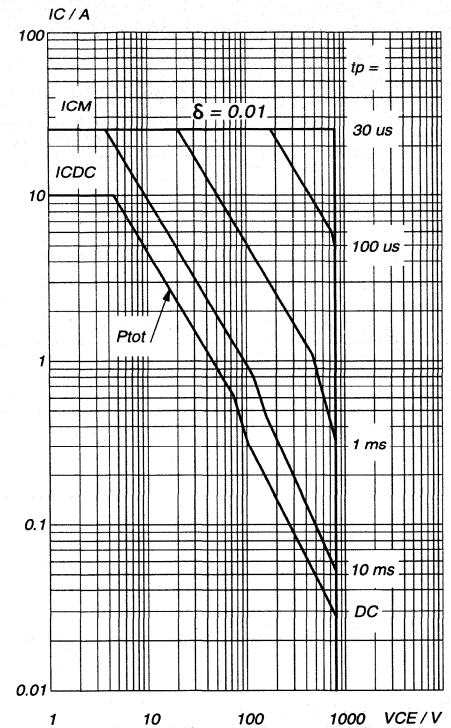


Fig.17. Forward bias safe operating area. T_{hs} = 25 ˚C
I_{CDC} & I_{CM} = f(V_{CE}); I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2520AW

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

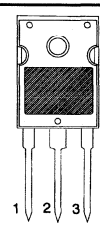
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current		6	-	A
t_f	Fall time	I_{Csat} = 6.0 A; $I_{B(end)}$ = 0.85 A	0.2	0.35	µs

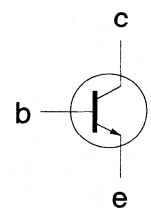
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	9.5	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (32 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 330 µH; C_{fb} = 9 nF; $I_{B(end)}$ = 0.85 A; L_B = 3.45 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 1.2 A/µs)			
t_s	Turn-off storage time		3.0	4.0	µs
t_f	Turn-off fall time		0.2	0.35	µs
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 650 µH; C_{fb} = 19 nF; $I_{B(end)}$ = 1.0 A; L_B = 5.3 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.8 A / µs)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.35	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

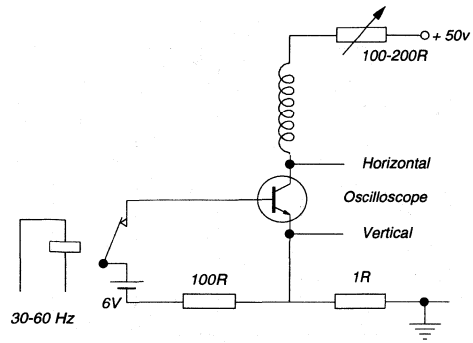


Fig.1. Test circuit for V_{CEO}sust.

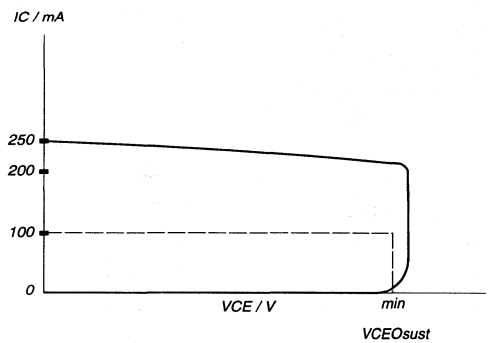


Fig.2. Oscilloscope display for V_{CEO}sust.

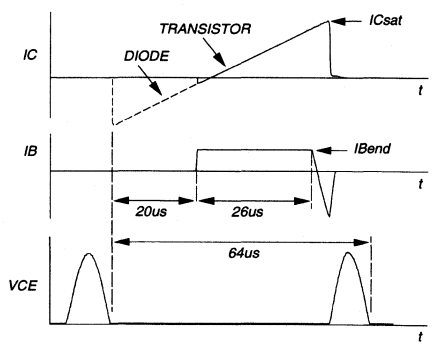


Fig.3. Switching times waveforms (16 kHz).

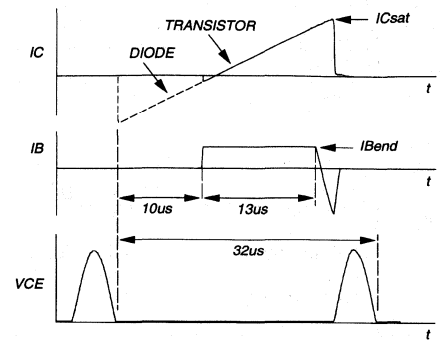


Fig.4. Switching times waveforms (32 kHz).

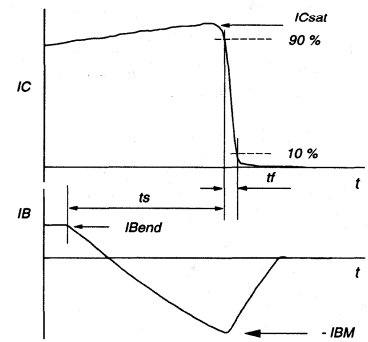


Fig.5. Switching times definitions.

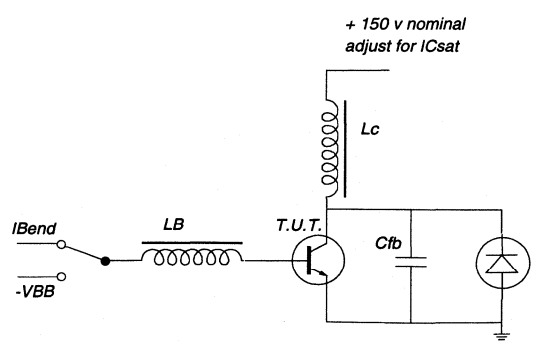


Fig.6. Switching times test circuit (BU2520A).

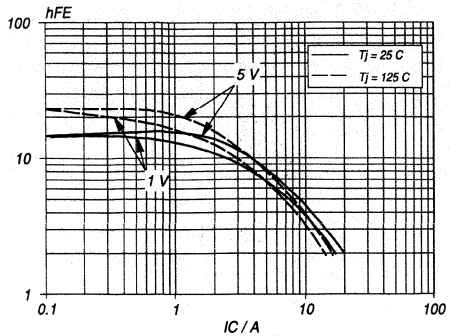


Fig.7. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

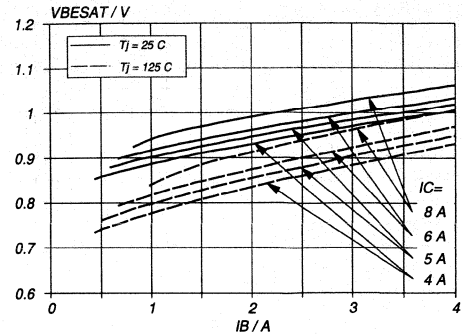


Fig.10. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

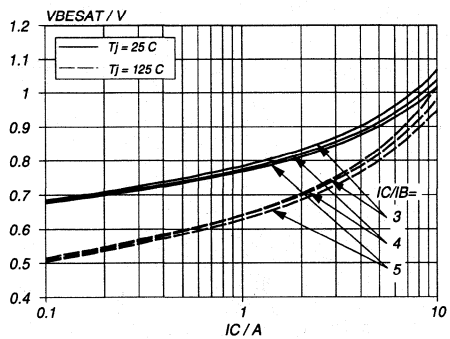


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

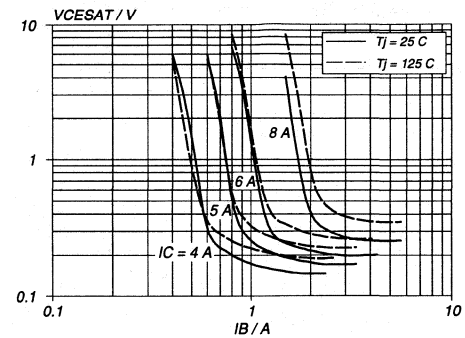


Fig.11. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

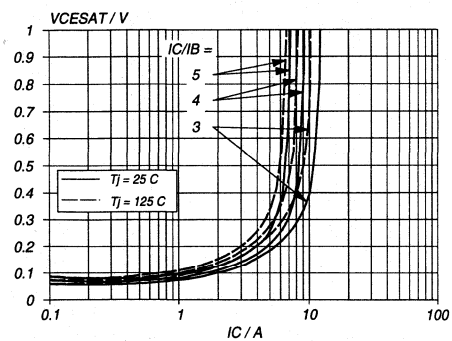


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

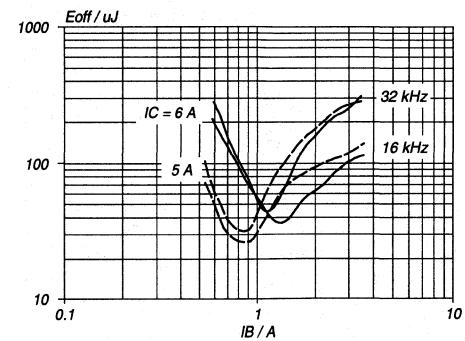


Fig.12. Typical turn-off losses. $T_j = 85^\circ C$ $Eoff = f(I_B)$; parameter I_C; parameter frequency

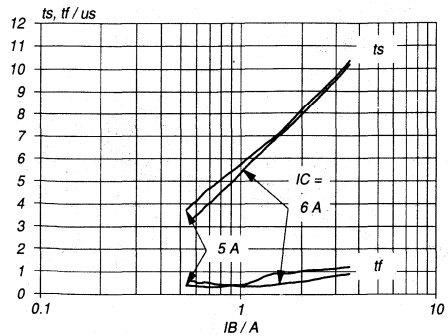


Fig.13. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

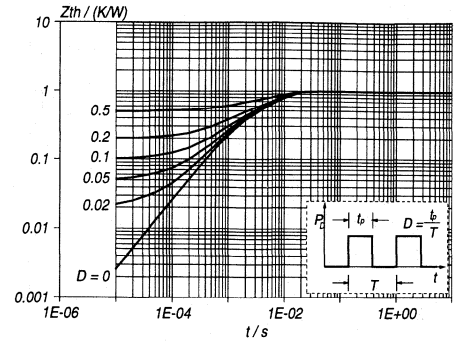


Fig.16. Transient thermal impedance.
$Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

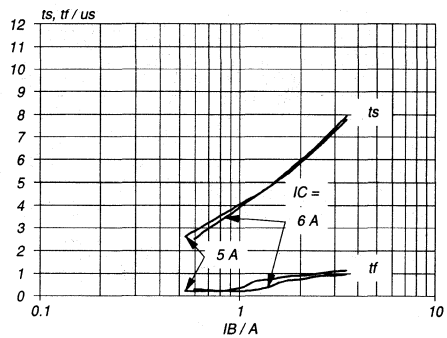


Fig.14. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 32 kHz

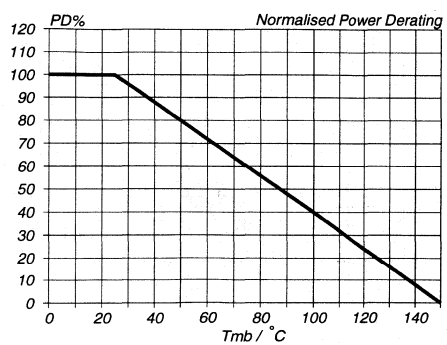


Fig.15. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\ 25^\circ C} = f(T_{mb})$

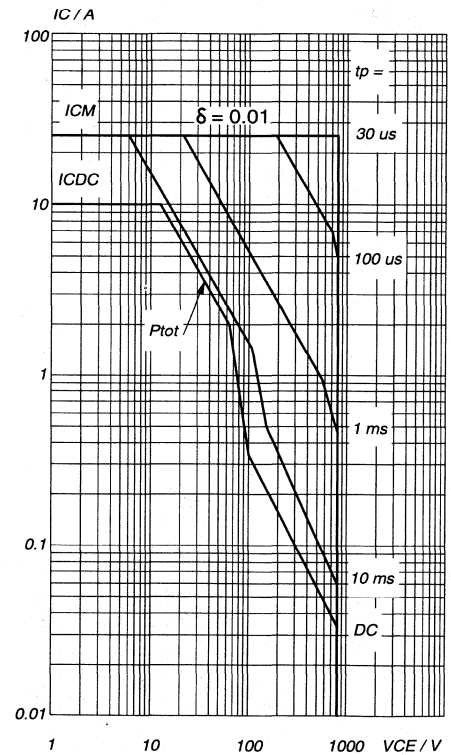


Fig.17. Forward bias safe operating area. $T_{mb} = 25\ ^\circ C$
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.

Silicon Diffused Power Transistor — BU2520AX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

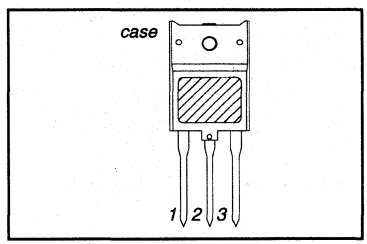
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current		6.0	-	A
t_f	Fall time	I_{Csat} = 6.0 A; $I_{B(end)}$ = 0.85 A	0.2	0.35	µs

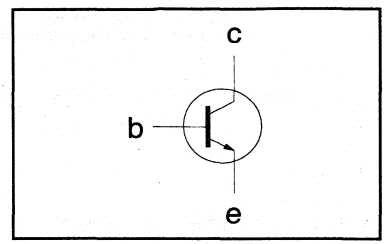
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	9.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (32 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 330 µH; C_{fb} = 9 nF; $I_{B(end)}$ = 0.85 A; L_B = 3.45 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 1.2 A / µs)			
t_s	Turn-off storage time		3.0	4.0	µs
t_f	Turn-off fall time		0.2	0.35	µs
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 650 µH; C_{fb} = 19 nF; $I_{B(end)}$ = 1.0 A; L_B = 5.3 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.8 A / µs)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.35	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

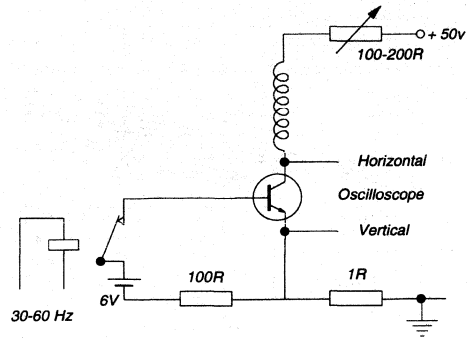


Fig.1. Test circuit for $V_{CEOsust}$.

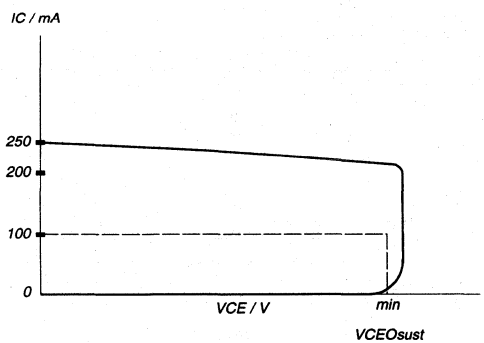


Fig.2. Oscilloscope display for $V_{CEOsust}$.

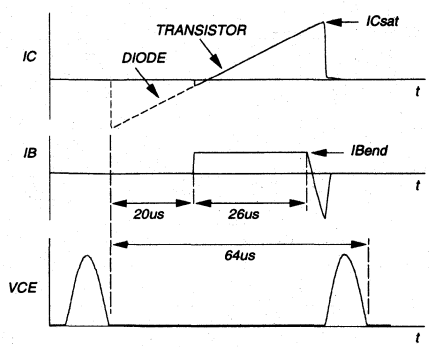


Fig.3. Switching times waveforms (16 kHz).

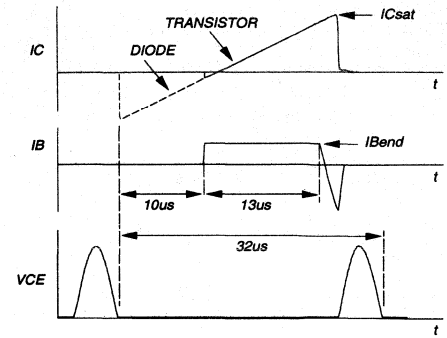


Fig.4. Switching times waveforms (32 kHz).

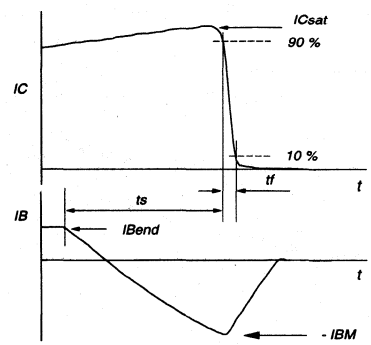


Fig.5. Switching times definitions.

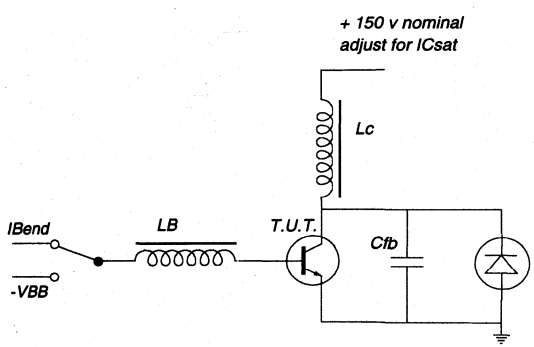


Fig.6. Switching times test circuit.

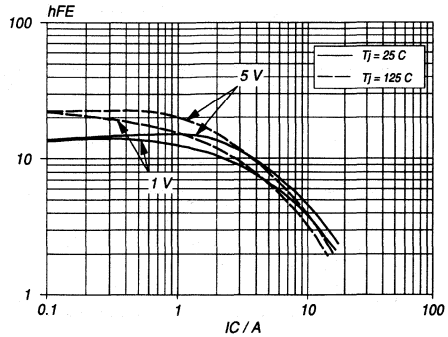


Fig.7. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

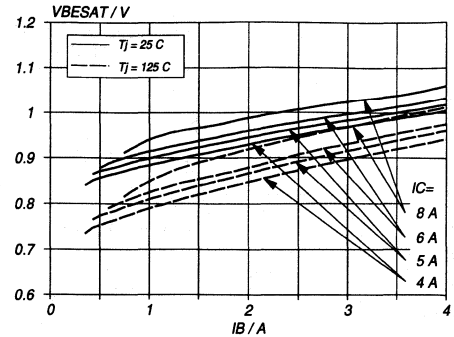


Fig.10. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

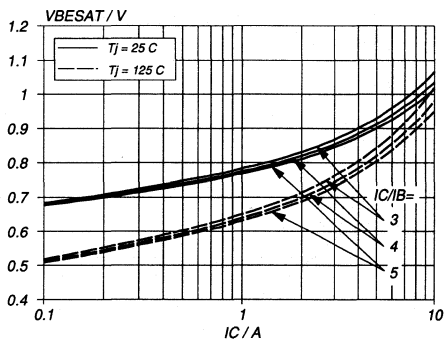


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

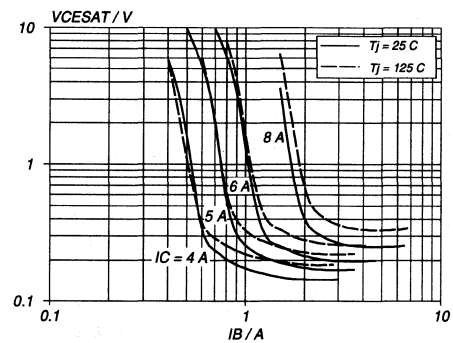


Fig.11. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

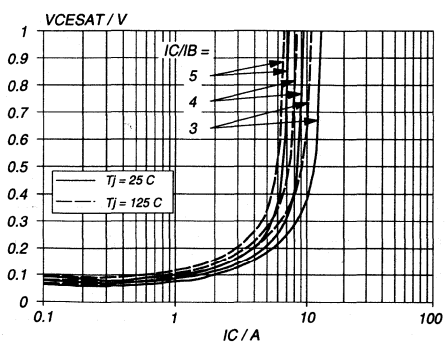


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

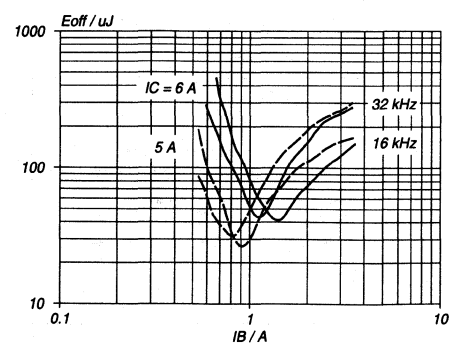


Fig.12. Typical turn-off losses. $T_j = 85^\circ C$ $Eoff = f(I_B)$; parameter I_C; parameter frequency

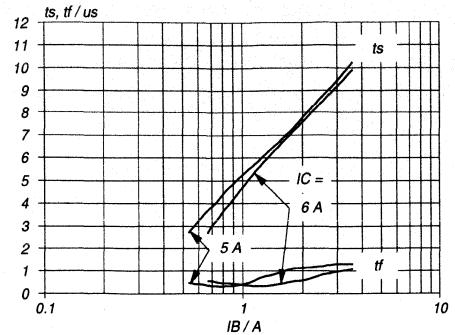


Fig.13. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85°C$; $f = 16$ kHz

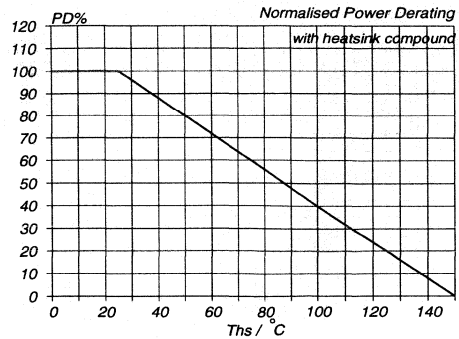


Fig.15. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25°C} = f(T_{hs})$

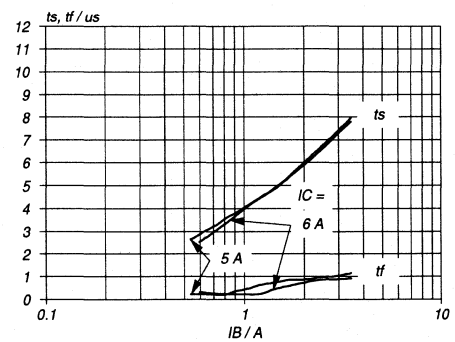


Fig.14. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85°C$; $f = 32$ kHz

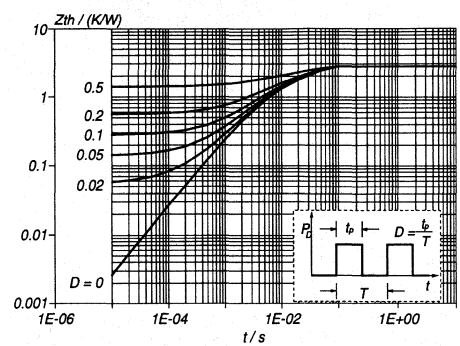


Fig.16. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

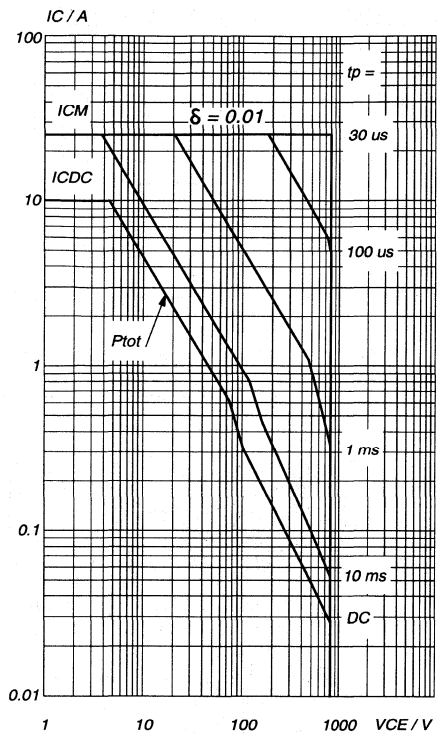


Fig.17. Forward bias safe operating area. T_{hs} = 25 ˚C
I_{CDC} & I_{CM} = f(V_{CE}); I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2520DF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a full plastic envelope intended for use in horizontal deflection circuits of large screen colour television receivers.

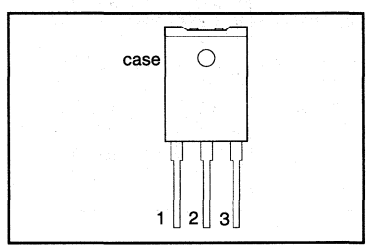
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emmiter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current		6	-	A
V_F	Diode forward voltage	I_F = 6.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 6.0 A; $I_{B(end)}$ = 1.0 A	0.35	0.5	µs

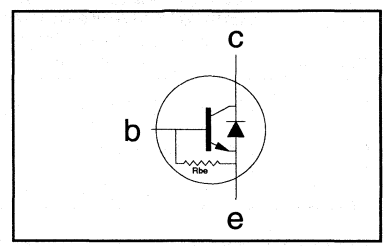
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	100	-	300	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	9.5	
V_F	Diode forward voltage	I_F = 6 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 650 µH; C_{fb} = 19 nF; $I_{B(end)}$ = 1.0 A; L_B = 5.3 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.8 A / µs)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.35	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

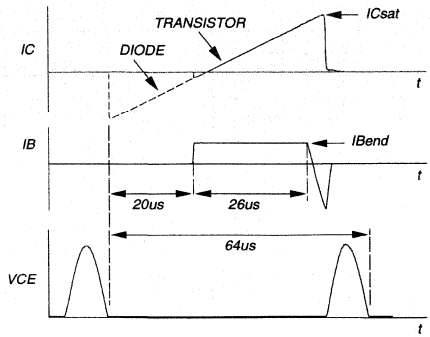


Fig.1. Switching times waveforms (16 kHz).

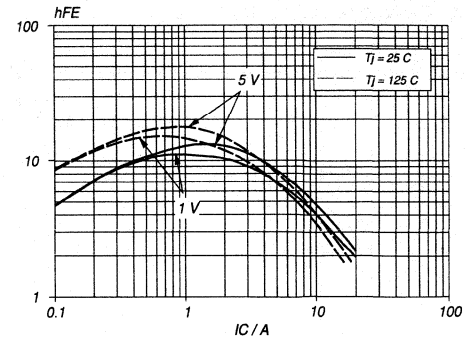


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

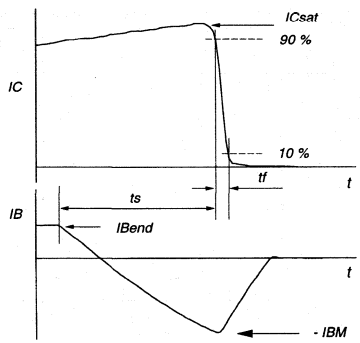


Fig.2. Switching times definitions.

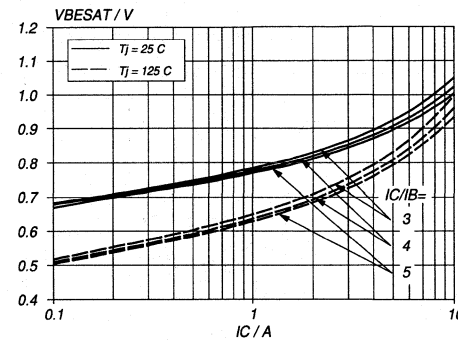


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

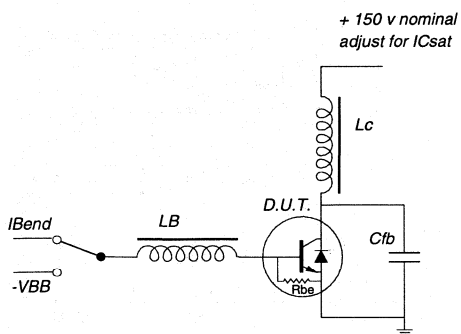


Fig.3. Switching times test circuit.

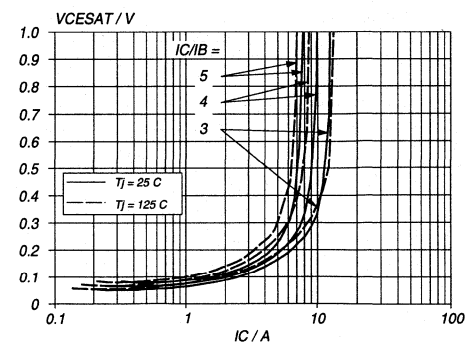


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

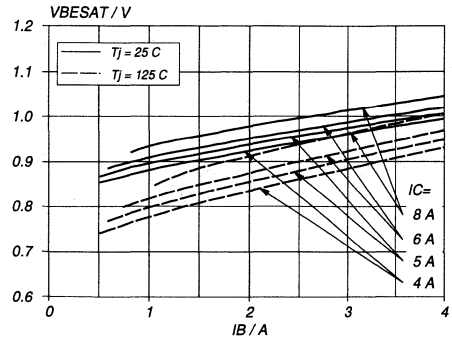


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

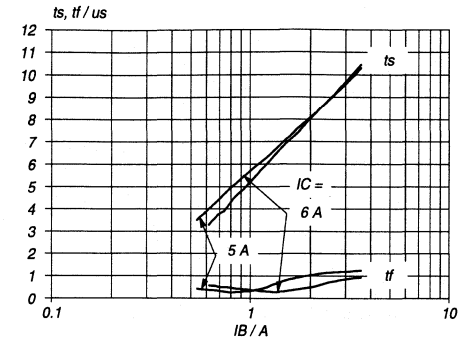


Fig.10. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

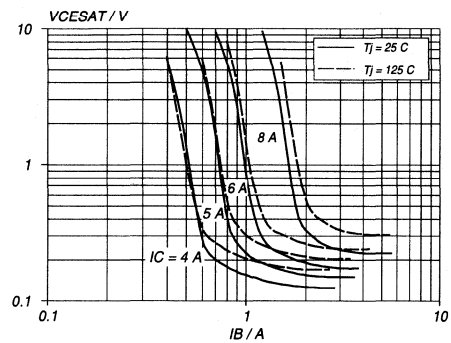


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

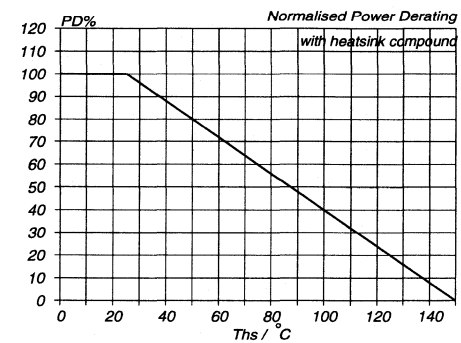


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

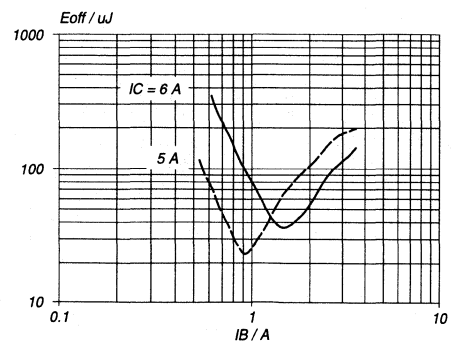


Fig.9. Typical turn-off losses. $T_j = 85^\circ C$
Eoff = f (I_B); parameter I_C; parameter frequency

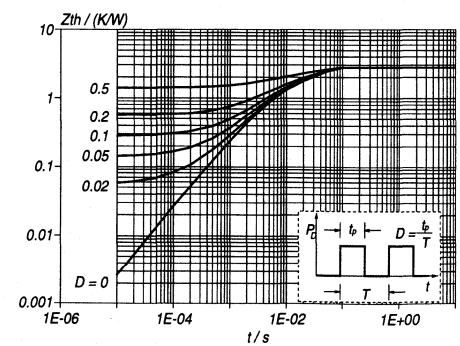


Fig.12. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

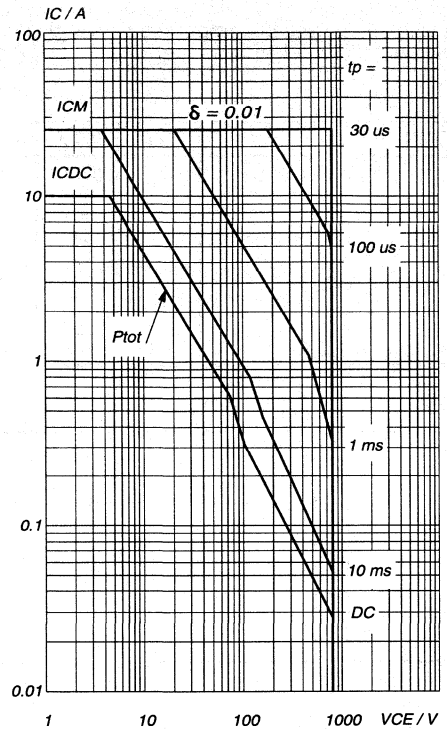


Fig.13. Forward bias safe operating area. T_{hs} = 25 °C
I_{CDC} & I_{CM} = f(V_{CE}); I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2520DW

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic envelope intended for use in horizontal deflection circuits of large screen colour television receivers.

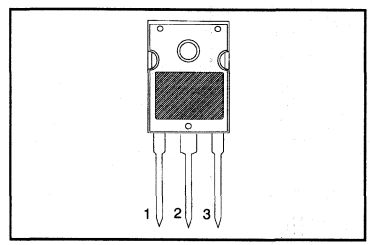
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current		6	-	A
V_F	Diode forward voltage	I_F = 6.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 6.0 A; $I_{B(end)}$ = 1.0 A	0.35	0.5	µs

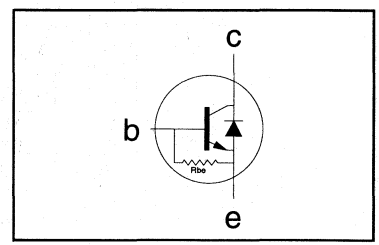
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	100	-	300	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	9.5	
V_F	Diode forward voltage	I_F = 6 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 650 µH; C_{fb} = 19 nF; $I_{B(end)}$ = 1.0 A; L_B = 5.3 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.8 A / µs)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.35	0.5	µs

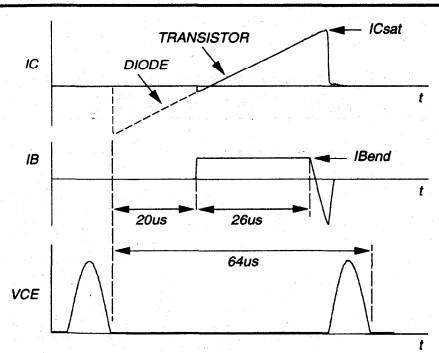


Fig.1. Switching times waveforms (16 kHz).

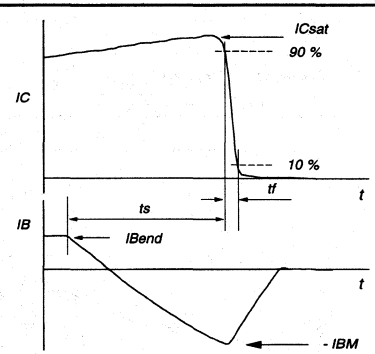


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

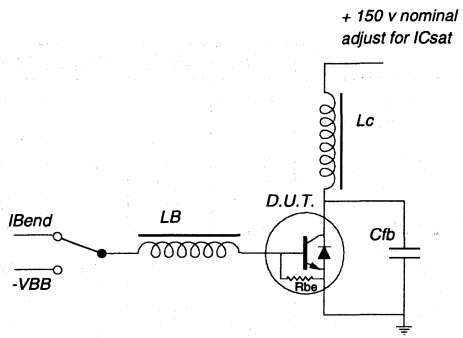


Fig.3. Switching times test circuit.

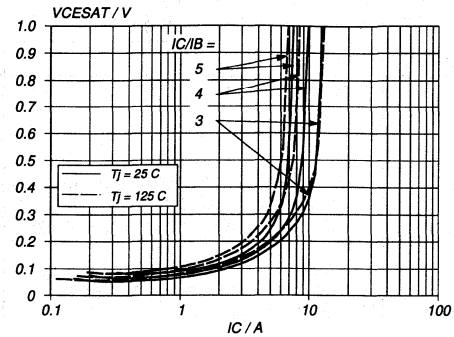


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

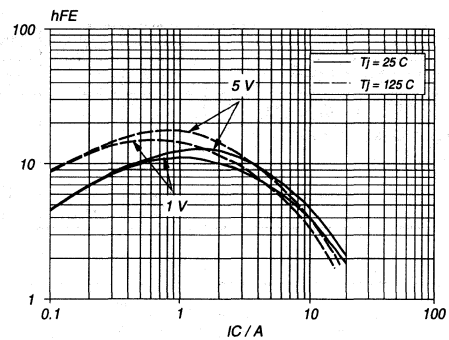


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

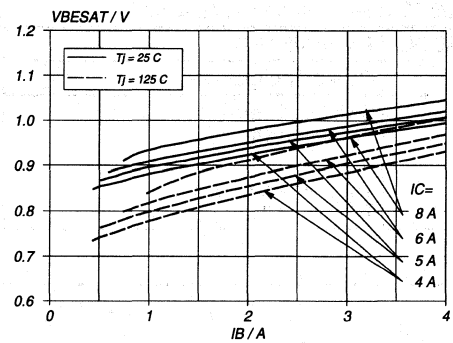


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

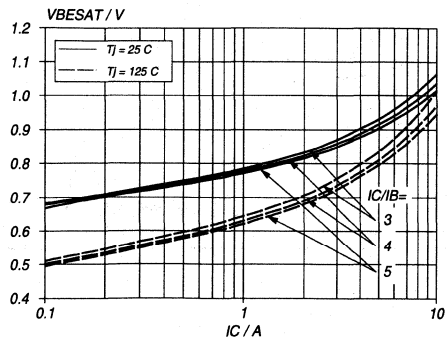


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

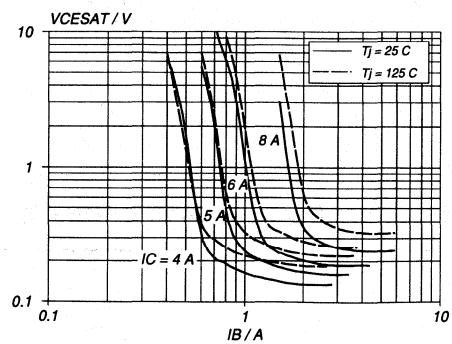


Fig.8. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

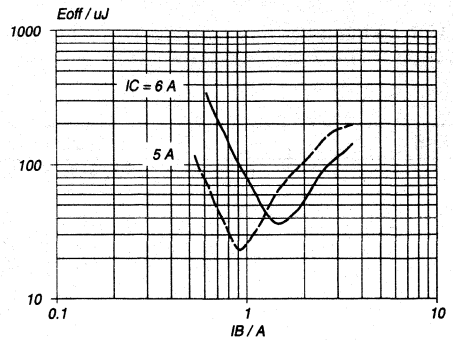


Fig.9. Typical turn-off losses. T_j = 85˚C
Eoff = f (I_B); parameter I_C; parameter frequency

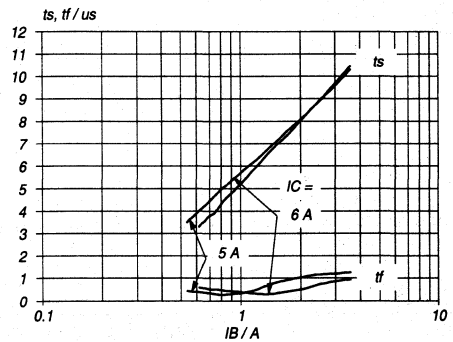


Fig.10. Typical collector storage and fall time.
ts = f (I_B); tf = f (I_B); parameter I_C; T_j = 85˚C; f = 16 kHz

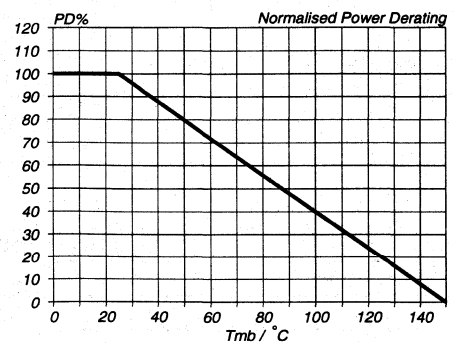


Fig.11. Normalised power dissipation.
PD% = 100·P_D/$P_{D\,25˚C}$ = f (T_{mb})

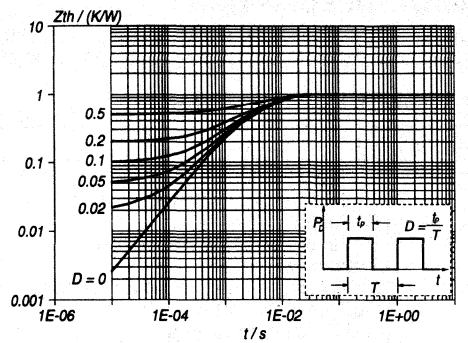


Fig.12. Transient thermal impedance.
$Z_{th\,j\text{-}mb}$ = f(t); parameter D = t_p/T

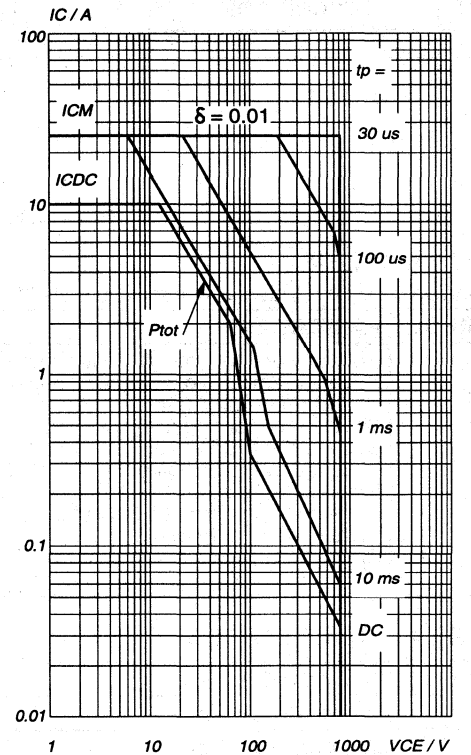


Fig.13. Forward bias safe operating area. T_{mb} = 25 ˚C
I_{CDC} & I_{CM} = f(V_{CE}); I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.

Silicon Diffused Power Transistor — BU2520DX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a full plastic envelope intended for use in horizontal deflection circuits of large screen colour television receivers.

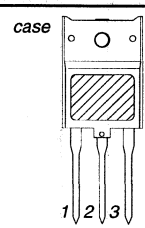
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current		6	-	A
V_F	Diode forward voltage	I_F = 6.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 6.0 A; $I_{B(end)}$ = 1.0 A	0.35	0.5	µs

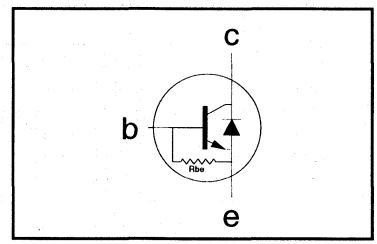
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	100	-	300	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	9.5	
V_F	Diode forward voltage	I_F = 6 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 650 µH; C_{fb} = 19 nF; $I_{B(end)}$ = 1.0 A; L_B = 5.3 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 0.8 A / µs)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.35	0.5	µs

2 Measured with half sine-wave voltage (curve tracer).

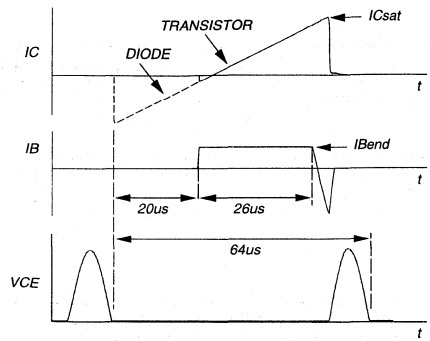


Fig.1. Switching times waveforms (16 kHz).

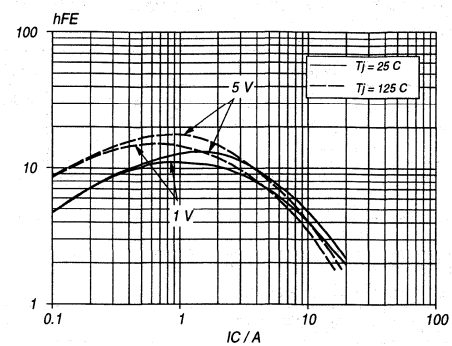


Fig.4. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

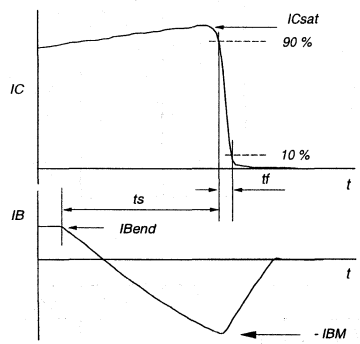


Fig.2. Switching times definitions.

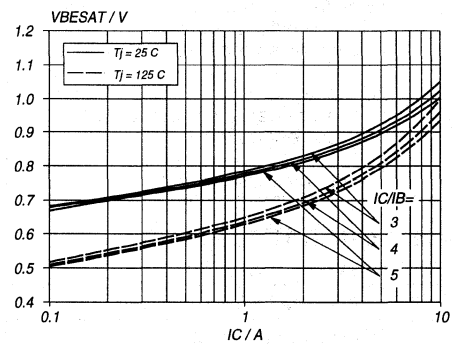


Fig.5. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

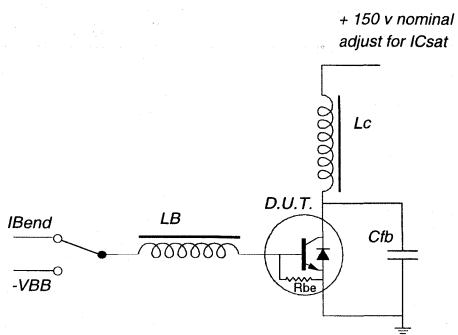


Fig.3. Switching times test circuit.

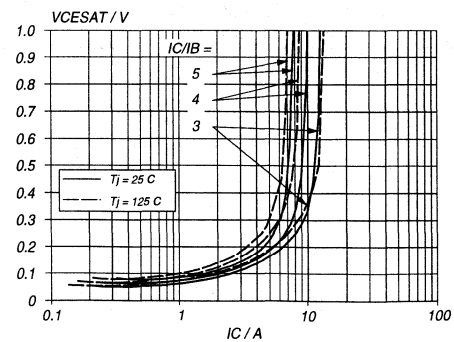


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

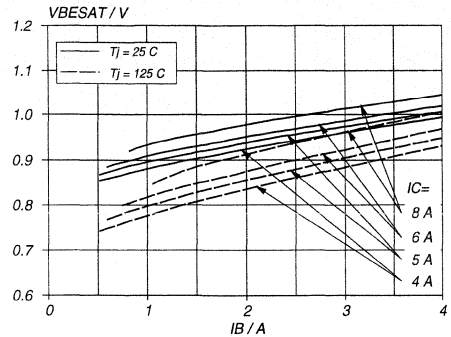


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

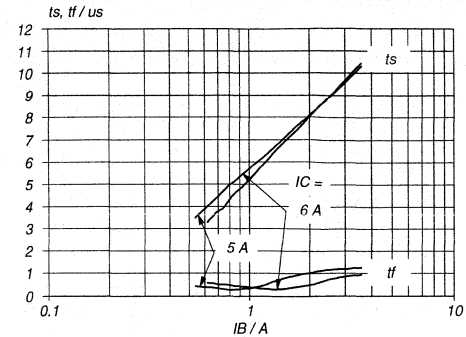


Fig.10. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

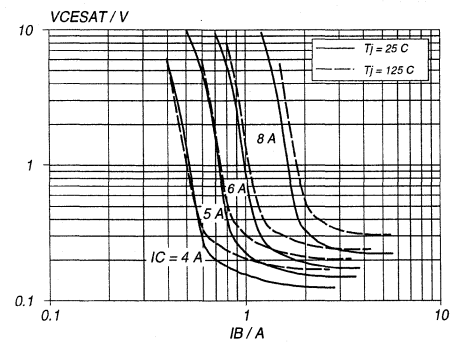


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

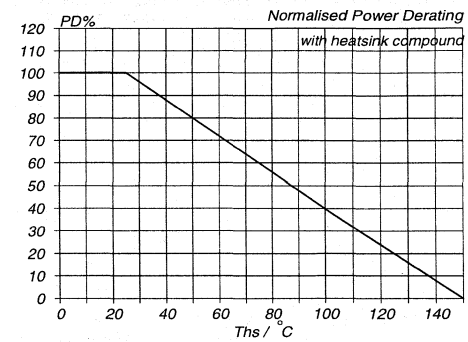


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

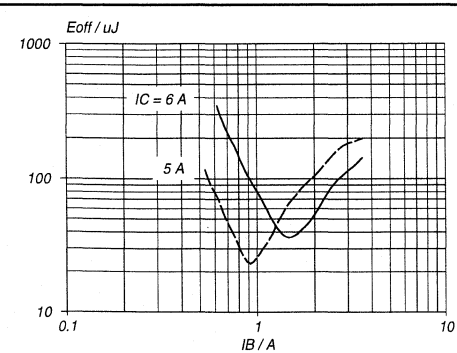


Fig.9. Typical turn-off losses. $T_j = 85^\circ C$
$Eoff = f(I_B)$; parameter I_C; parameter frequency

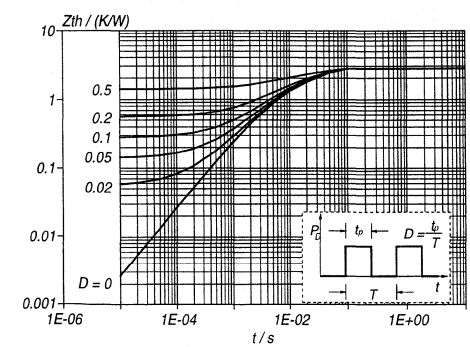


Fig.12. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

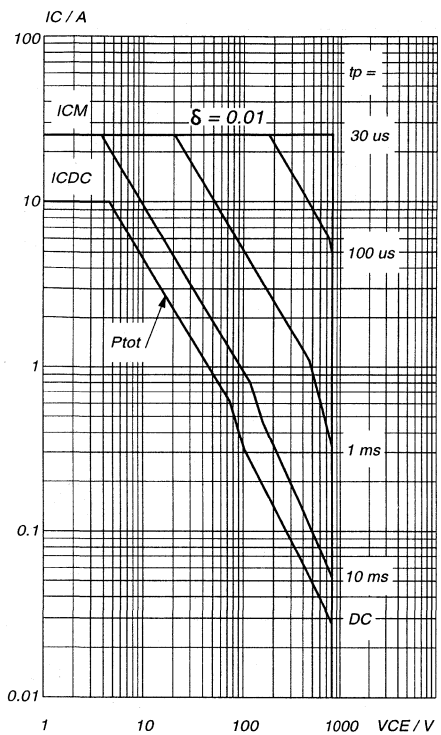


Fig.13. Forward bias safe operating area. T_{hs} = 25 °C
I_{CDC} & I_{CM} = f(V_{CE}); I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2522AF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance and is suitable for use in horizontal deflection circuits of pc monitors.

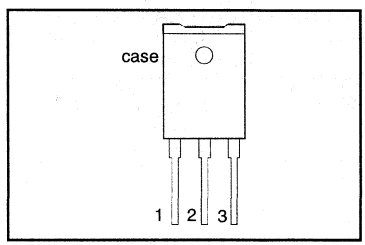
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	6.0	-	A
t_f	Fall time	I_{Csat} = 6.0 A; f = 64 kHz	0.16	0.22	µs

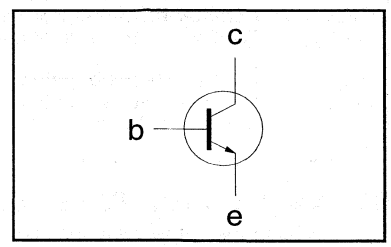
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.25	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	0.25	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	10	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	8	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.7 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ 3.33 A /µs			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.12	0.25	µs

2 Measured with half sine-wave voltage (curve tracer).

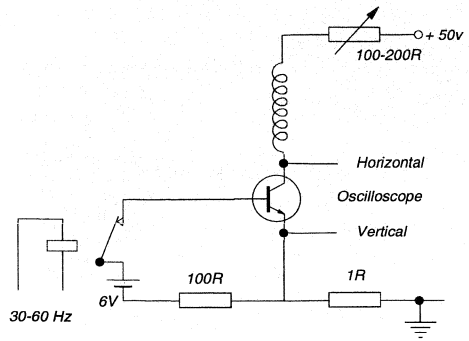


Fig.1. Test circuit for $V_{CEOsust}$.

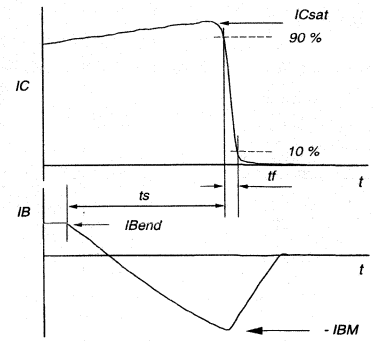


Fig.4. Switching times definitions.

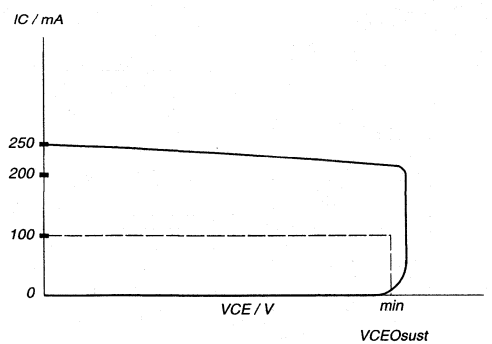


Fig.2. Oscilloscope display for $V_{CEOsust}$.

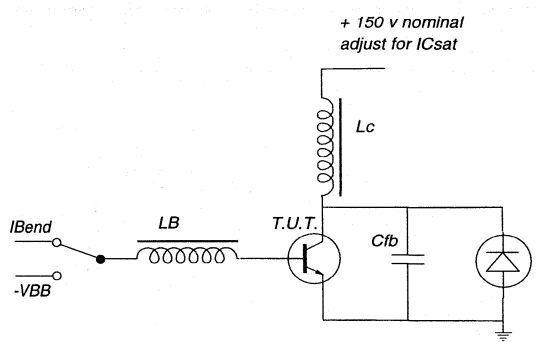


Fig.5. Switching times test circuit.

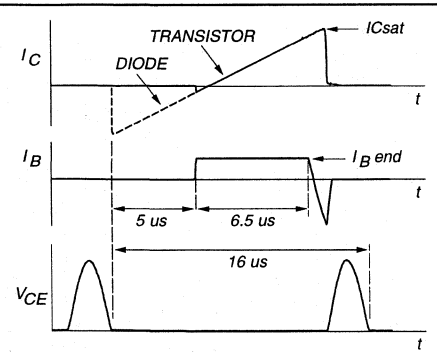


Fig.3. Switching times waveforms (64 kHz).

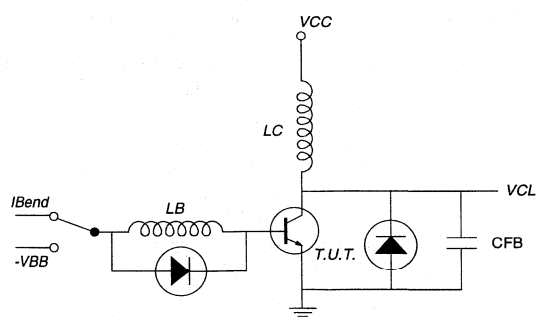


Fig.6. Test Circuit RBSOA. V_{CC} = 140 V; $-V_{BB}$ = 4 V; L_C = 100 - 400 µH; $V_{CL} \leq$ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1.6 - 2 A

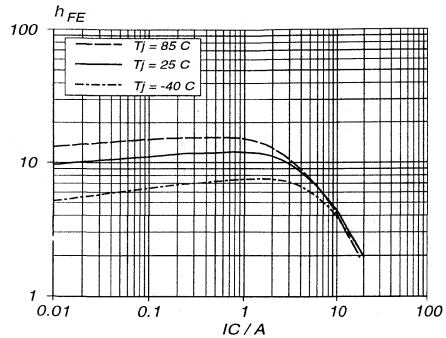


Fig.7. Typical DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

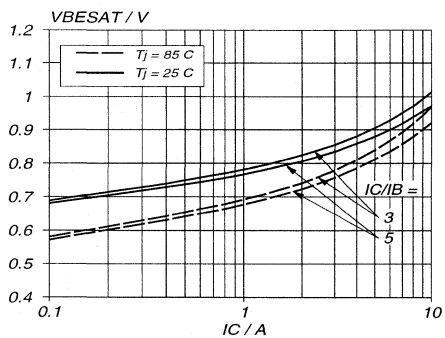


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

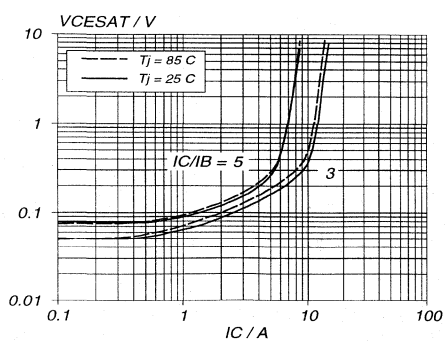


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

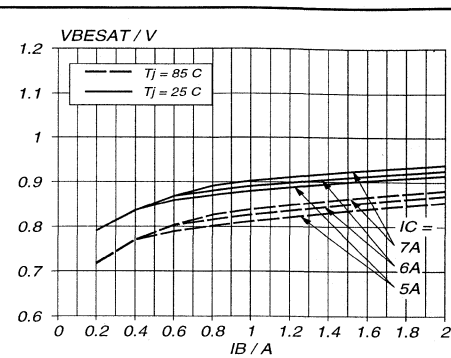


Fig.10. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

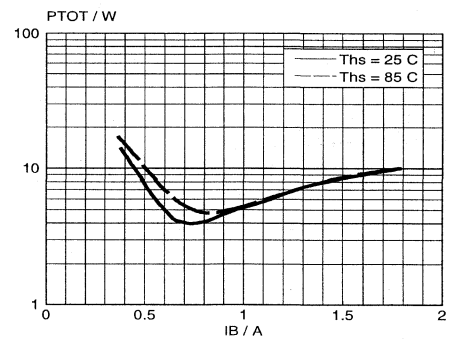


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$ $P_{off} = f(I_B)$; parameter $I_C = 6$ A; f = 64 kHz

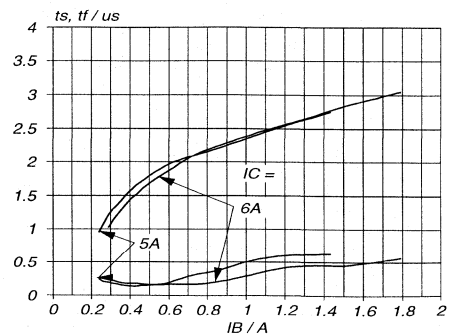


Fig.12. Typical collector storage and fall time. $t_s = f(I_B)$; $t_f = f(I_B)$; parameter $I_C = 6$A; $T_j = 85^\circ C$; f = 64 kHz

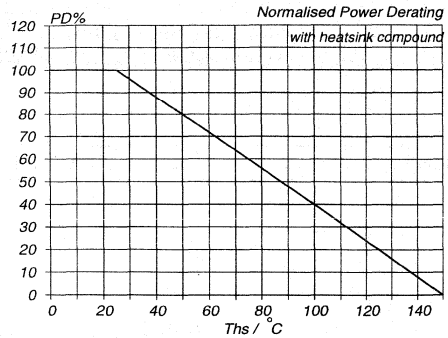


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f\,(T_{hs})$

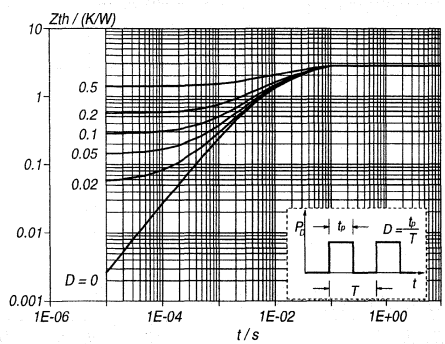


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

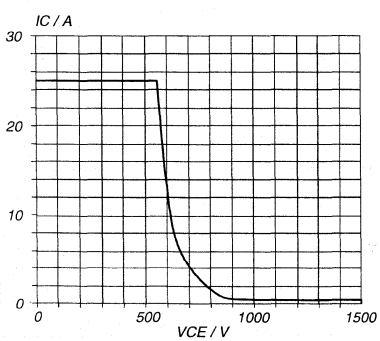


Fig.15. Reverse bias safe operating area. $T_j \leq T_{jmax}$

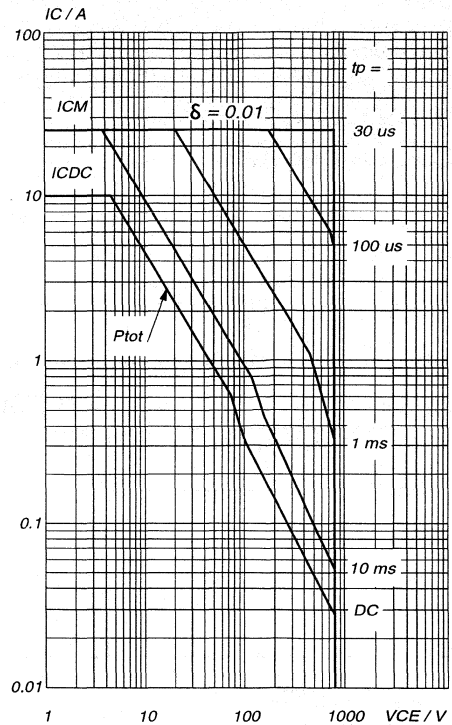


Fig.16. Forward bias safe operating area. $T_{hs} = 25\ ^\circ C$
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor

BU2522AW

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance and is suitable for use in horizontal deflection circuits of pc monitors.

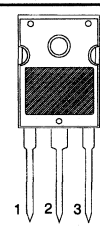
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	6.0	-	A
t_f	Fall time	I_{Csat} = 6.0 A; f = 64 kHz	0.12	0.25	µs

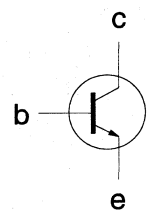
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	with heatsink compound	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.25	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	0.25	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	10	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	8	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.7 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ = 3.33A/µs)			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.12	0.25	µs

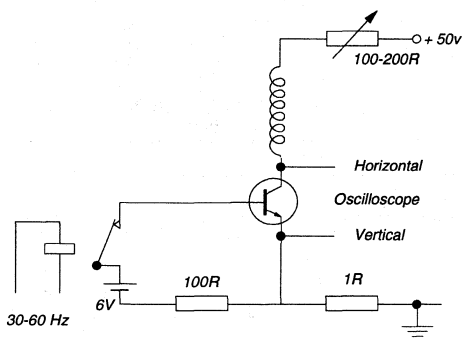


Fig.1. Test circuit for $V_{CEOsust}$.

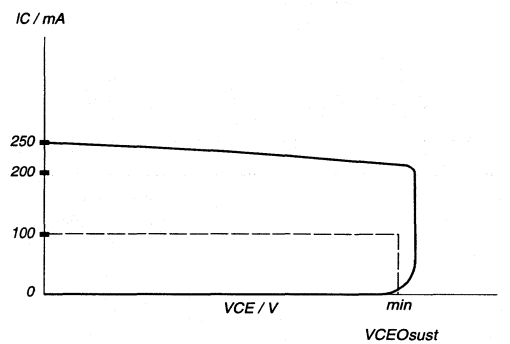


Fig.2. Oscilloscope display for $V_{CEOsust}$.

2 Measured with half sine-wave voltage (curve tracer).

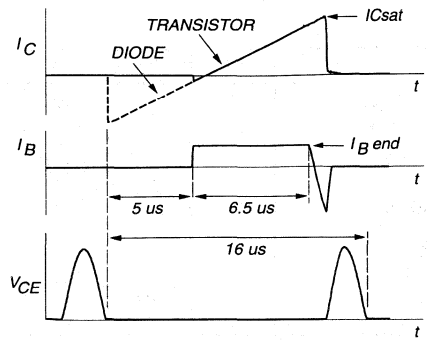


Fig.3. Switching times waveforms (64 kHz).

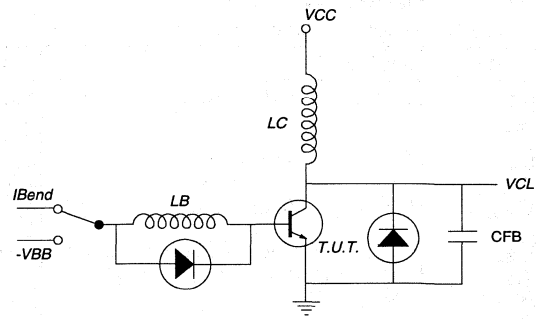


Fig.6. Test Circuit RBSOA. V_{CC} = 140 V; $-V_{BB}$ = 4 V; L_C = 100 - 400 µH; $V_{CL} \leq$ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1.6 - 2 A

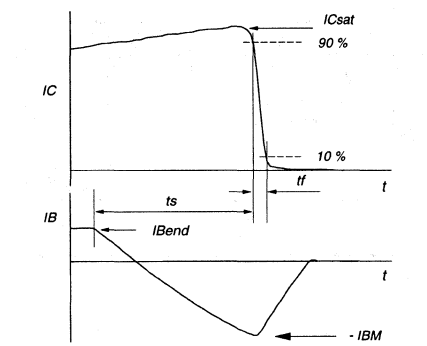


Fig.4. Switching times definitions.

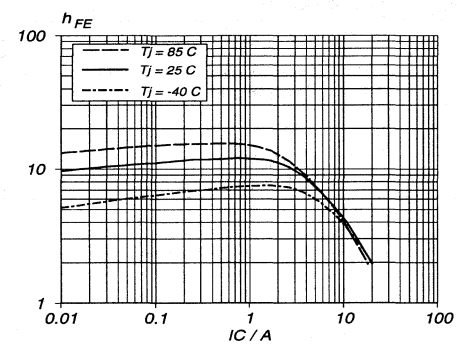


Fig.7. Typical DC current gain. $h_{FE} = f(I_C)$ V_{CE} = 5 V

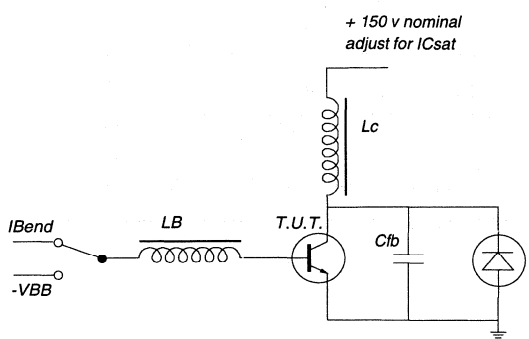


Fig.5. Switching times test circuit.

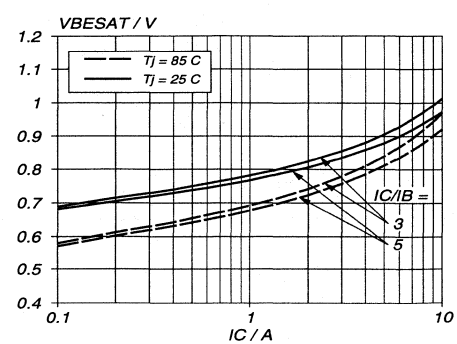


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

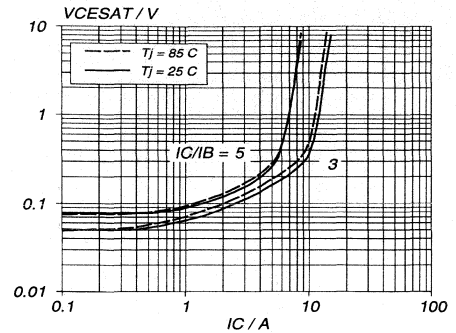


Fig.9. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

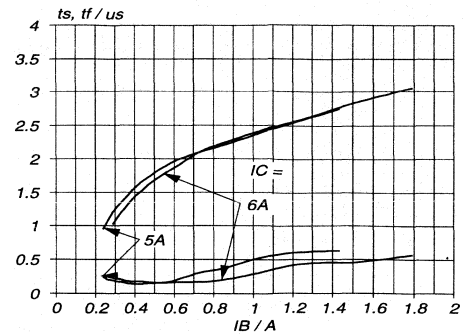


Fig.12. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85°C$; f = 64 kHz

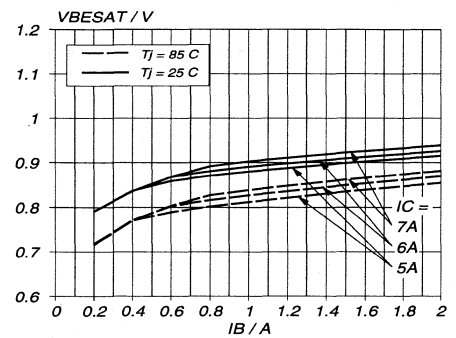


Fig.10. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

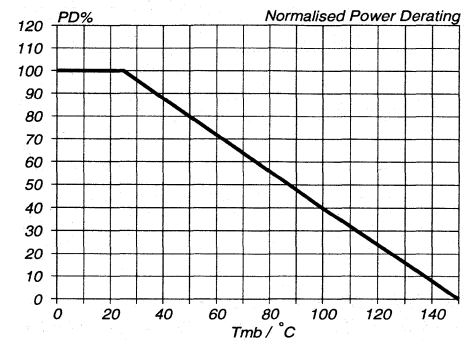


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25°C} = f(T_{mb})$

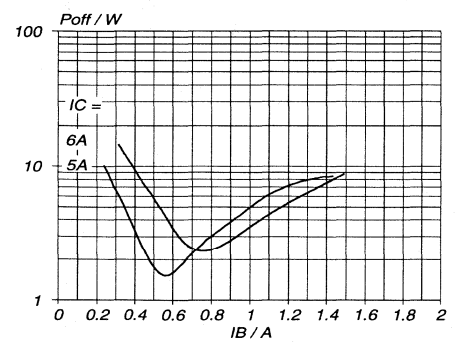


Fig.11. Typical turn-off losses. $T_j = 85°C$
$Poff = f(I_B)$; parameter I_C; f = 64 kHz

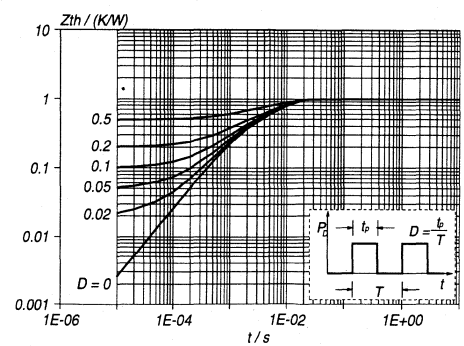


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}mb} = f(t)$; parameter $D = t_p/T$

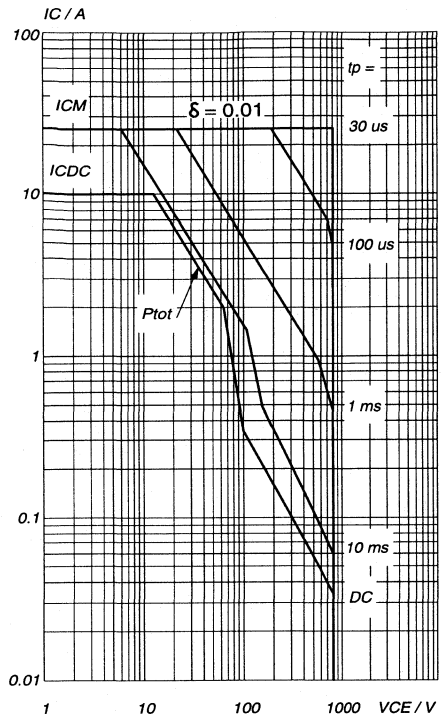


Fig.15. Forward bias safe operating area. T_{mb} = 25 °C
I_{CDC} & I_{CM} = f(V_{CE}); I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.

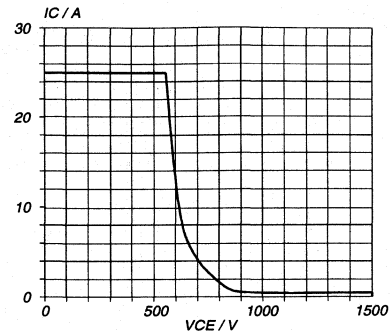


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2522AX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance and is suitable for use in horizontal deflection circuits of pc monitors.

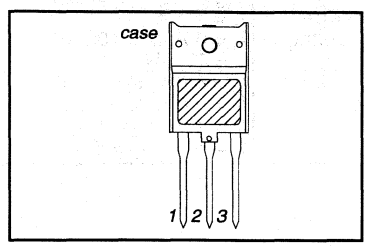
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	6.0	-	A
t_f	Fall time	I_{Csat} = 6.0 A; f = 64 kHz	0.16	0.22	µs

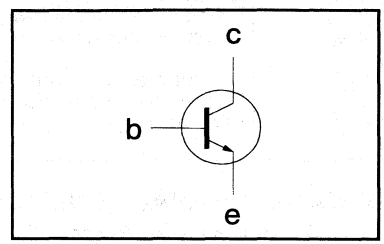
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.25	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	0.25	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	10	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	8	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.7 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$= 3.33A /µs)			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.12	0.25	µs

2 Measured with half sine-wave voltage (curve tracer).

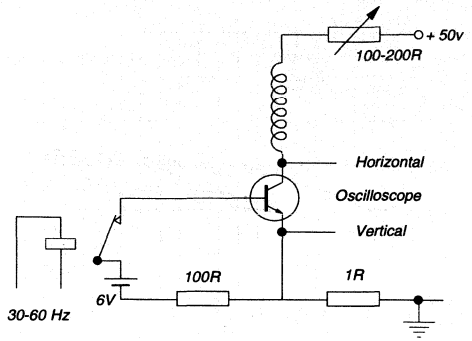


Fig.1. Test circuit for $V_{CEOsust}$.

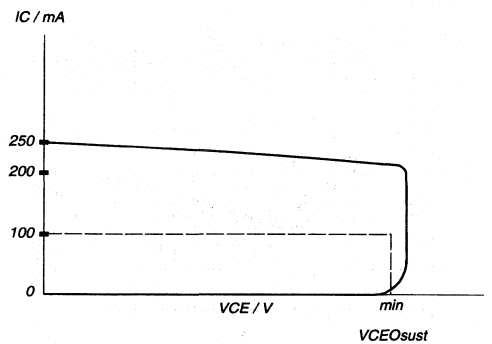


Fig.2. Oscilloscope display for $V_{CEOsust}$.

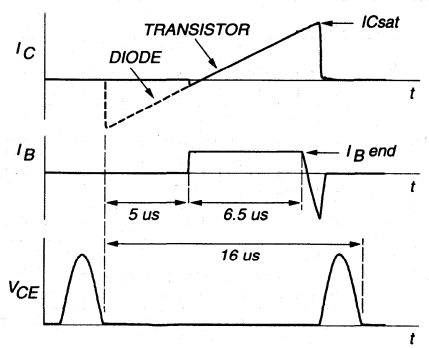


Fig.3. Switching times waveforms (64 kHz).

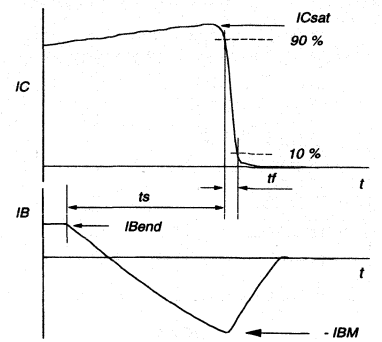


Fig.4. Switching times definitions.

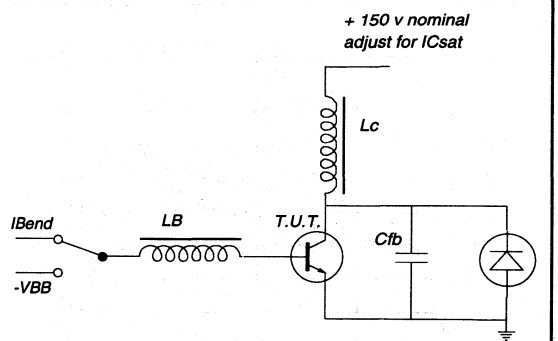


Fig.5. Switching times test circuit.

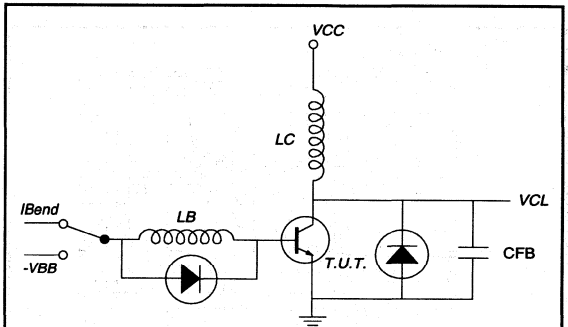


Fig.6. Test Circuit RBSOA. V_{CC} = 140 V; $-V_{BB}$ = 4 V; L_C = 100 - 400 µH; $V_{CL} \leq$ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1.6 - 2 A

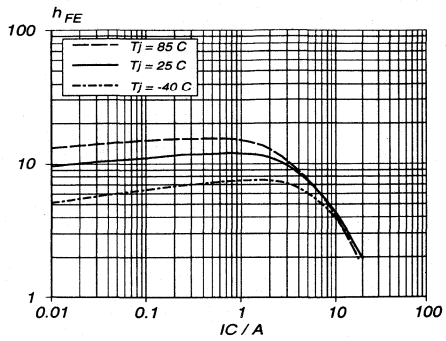


Fig.7. Typical DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

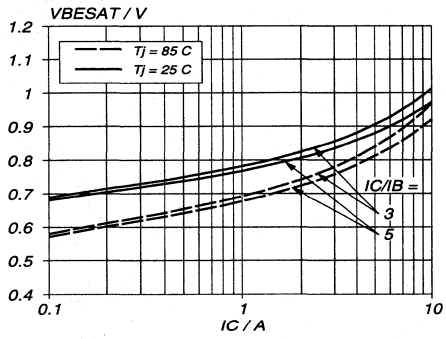


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

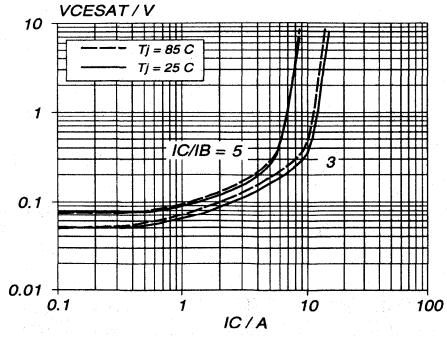


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

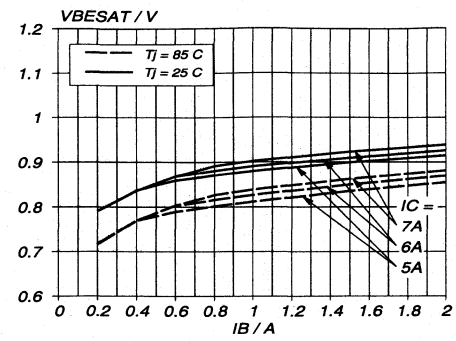


Fig.10. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

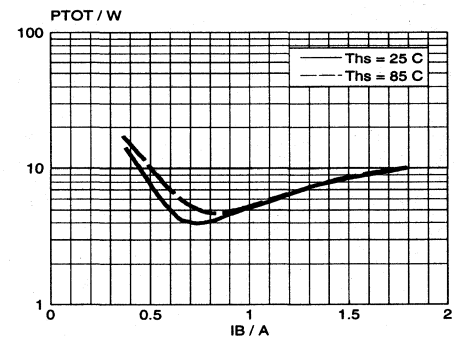


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$ $P_{off} = f(I_B)$; parameter $I_C = 6$ A; f = 64 kHz

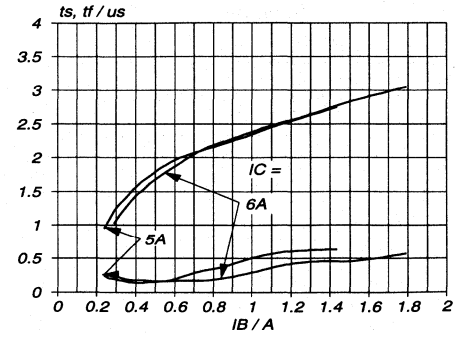


Fig.12. Typical collector storage and fall time. $t_s = f(I_B)$; $t_f = f(I_B)$; parameter $I_C = 6$A; $T_j = 85^\circ C$; f = 64 kHz

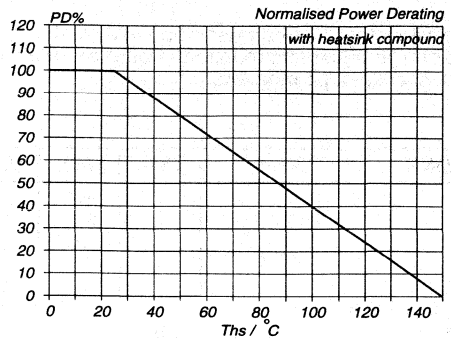


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

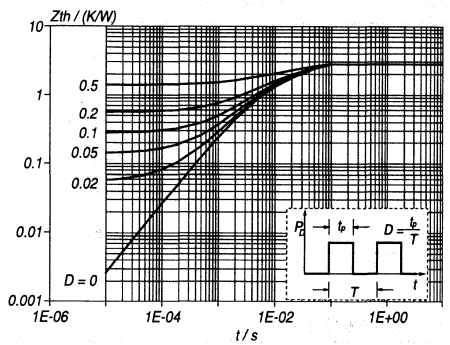


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

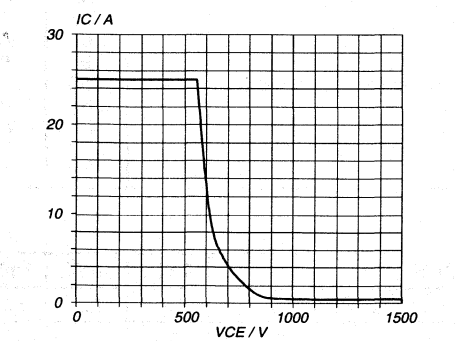


Fig.15. Reverse bias safe operating area. $T_j \leq T_{jmax}$

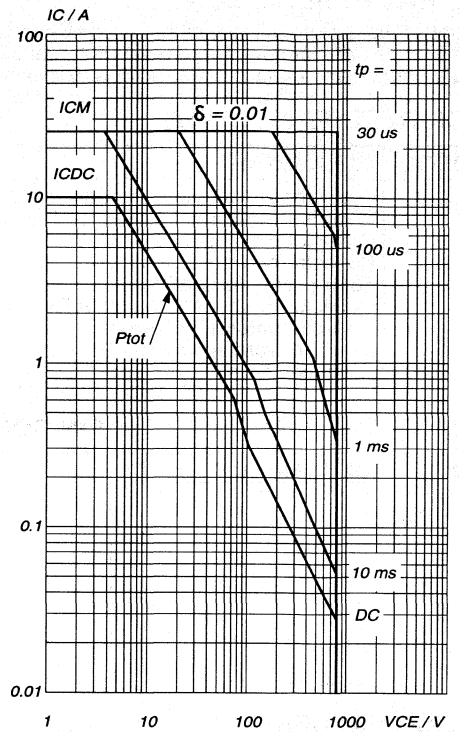


Fig.16. Forward bias safe operating area. $T_{hs} = 25\ ^\circ C$
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2522DF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance and is suitable for use in horizontal deflection circuits of pc monitors.

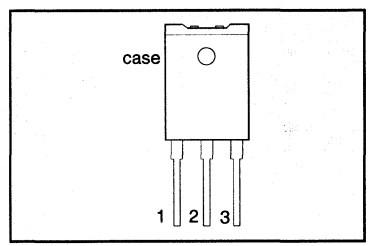
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	6	-	A
V_F	Diode forward voltage	I_F = 6.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 6.0 A; f = 64 kHz	0.12	0.25	µs

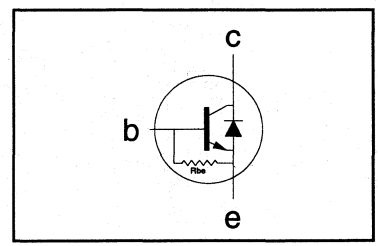
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	150	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	10	
V_F	Diode forward voltage	I_F = 6 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (64 kHz line deflection circuit)	I_{CM} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.7 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ = 3.33 A / µs)			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.12	0.25	µs

2 Measured with half sine-wave voltage (curve tracer).

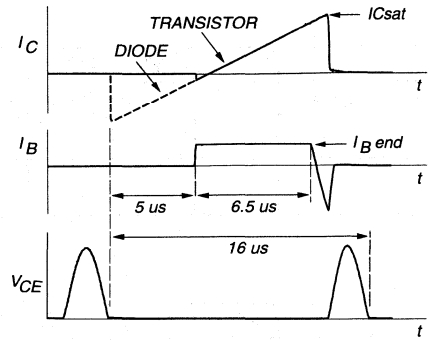


Fig.1. Switching times waveforms (64 kHz).

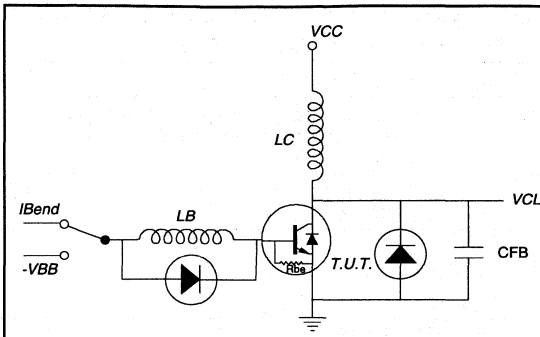


Fig.4. Test Circuit RBSOA. V_{CC} = 140 V; -V_{BB} = 4 V; L_C = 100 - 400 µH; V_{CL} ≤ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1.6 - 2 A

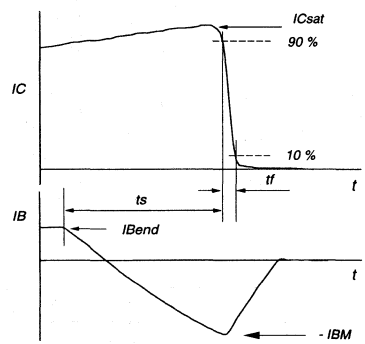


Fig.2. Switching times definitions.

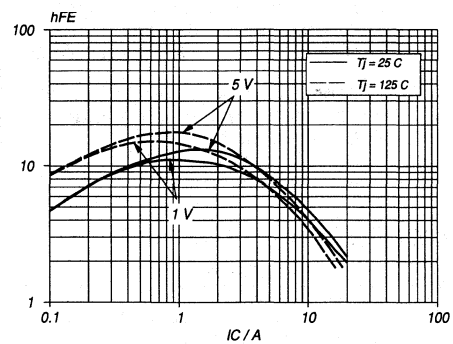


Fig.5. Typical DC current gain. h_{FE} = f (I_C) parameter V_{CE}

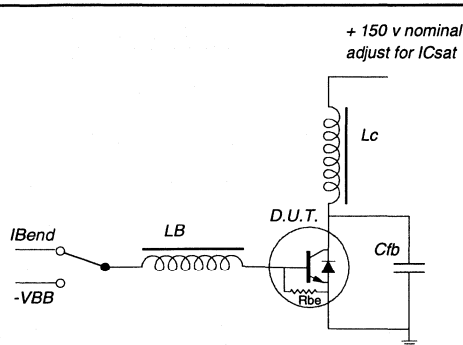


Fig.3. Switching times test circuit.

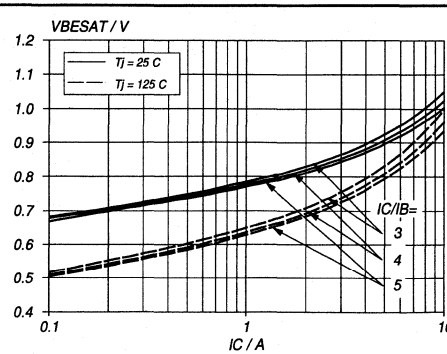


Fig.6. Typical base-emitter saturation voltage. V_{BE}sat = f (I_C); parameter I_C/I_B

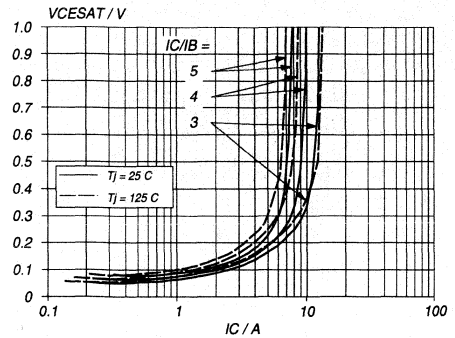


Fig.7. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

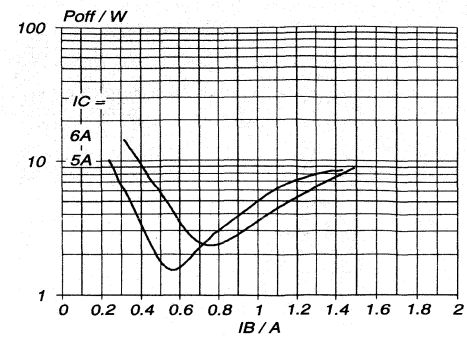


Fig.10. Typical turn-off losses. $T_j = 85^\circ C$ $Poff = f(I_B)$; parameter I_C; f = 64 kHz

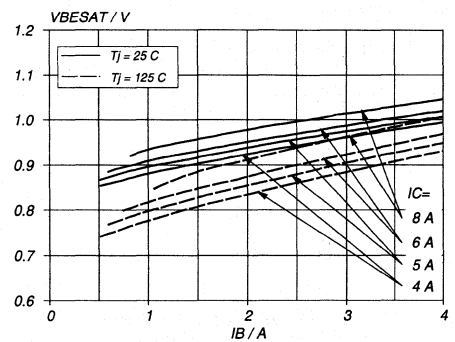


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

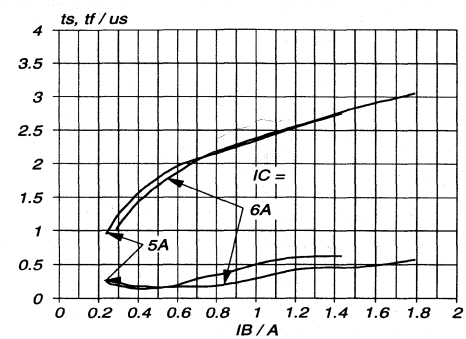


Fig.11. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 64 kHz

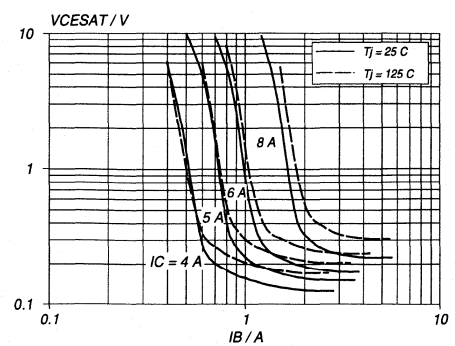


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

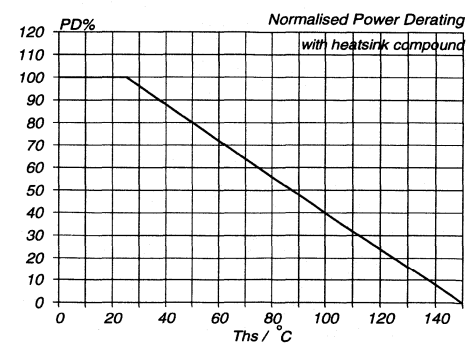


Fig.12. Normalised power dissipation. $PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

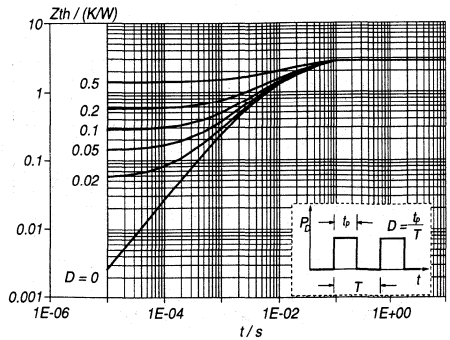


Fig.13. Transient thermal impedance. $Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

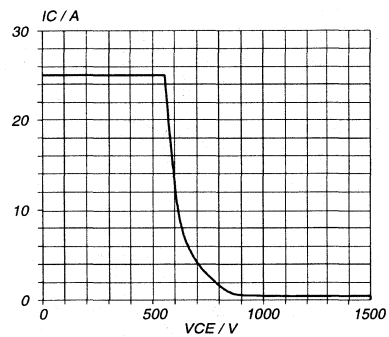


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

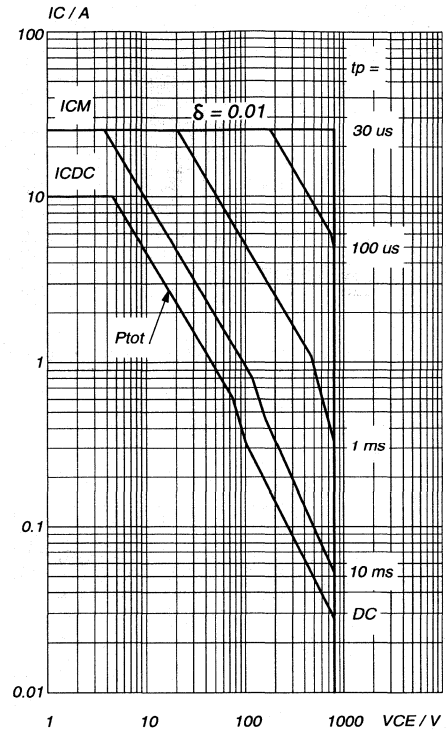


Fig.15. Forward bias safe operating area. T_{hs} = 25 ˚C I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p Second-breakdown limits independant of temperature. Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2522DX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance and is suitable for use in horizontal deflection circuits of pc monitors.

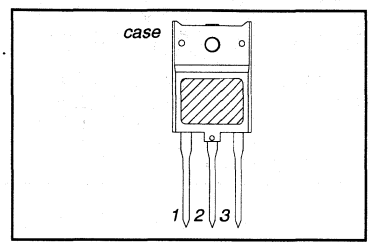
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	6	-	A
V_F	Diode forward voltage	I_F = 6.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 6.0 A; f = 64 kHz	0.12	0.25	µs

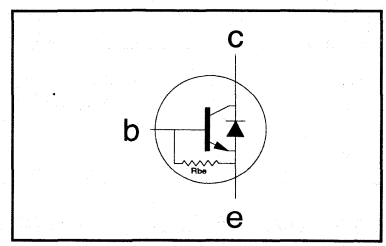
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	150	-	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	10	
V_F	Diode forward voltage	I_F = 6 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	115	-	pF
	Switching times (64 kHz line deflection circuit)	I_{CM} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.7 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ = 3.33 A / µs)			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.12	0.25	µs

2 Measured with half sine-wave voltage (curve tracer).

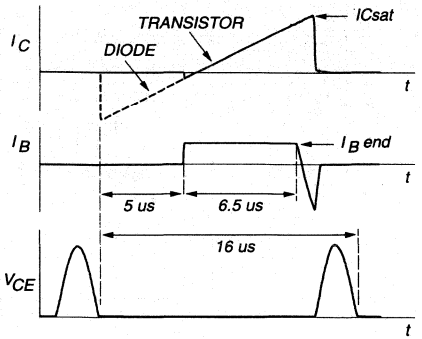


Fig.1. Switching times waveforms (64 kHz).

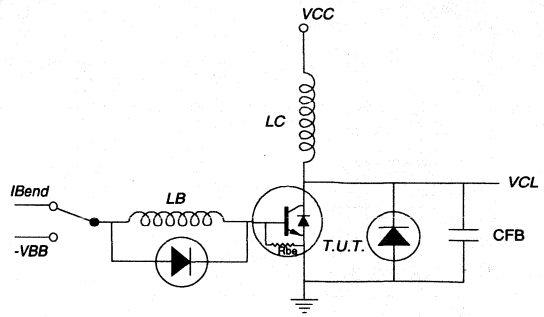


Fig.4. Test Circuit RBSOA. V_{CC} = 140 V; -V_{BB} = 4 V; L_C = 100 - 400 µH; V_{CL} ≤ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1.6 - 2 A

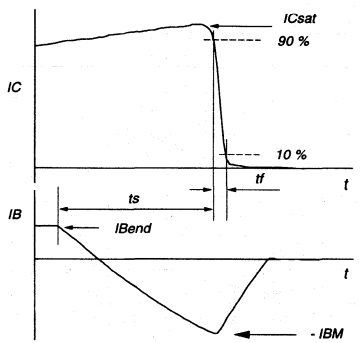


Fig.2. Switching times definitions.

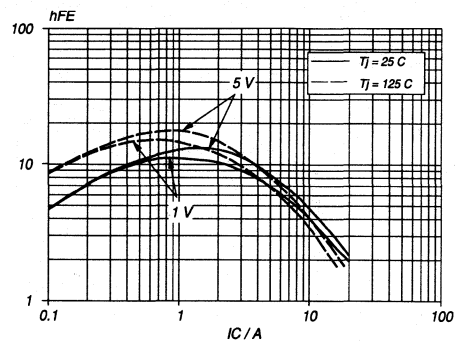


Fig.5. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

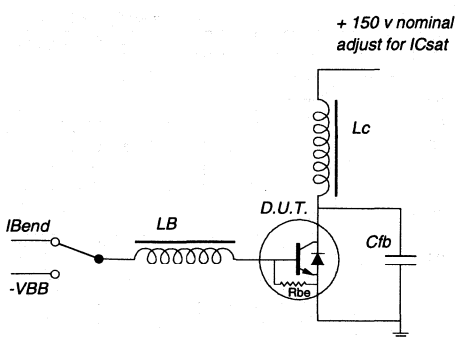


Fig.3. Switching times test circuit.

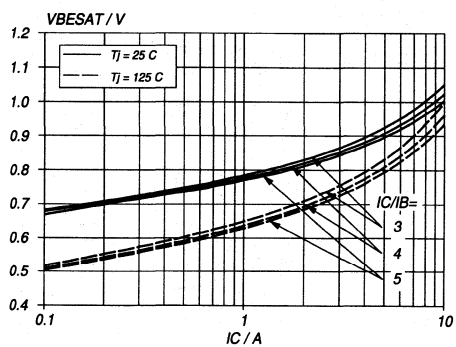


Fig.6. Typical base-emitter saturation voltage. V_{BE}sat = f (I_C); parameter I_C/I_B

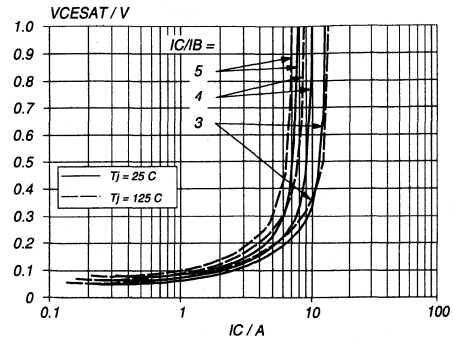


Fig.7. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

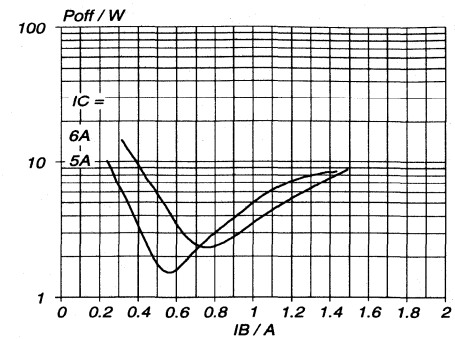


Fig.10. Typical turn-off losses. $T_j = 85^\circ C$ $Poff = f(I_B)$; parameter I_C; f = 64 kHz

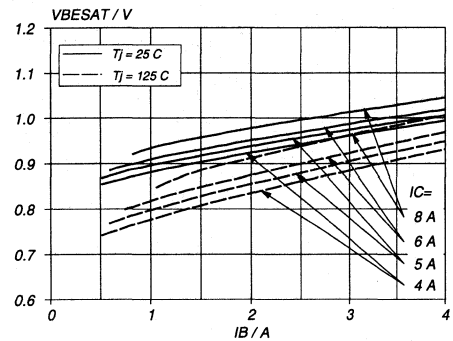


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

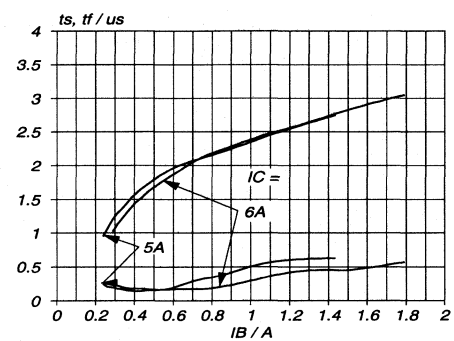


Fig.11. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 64 kHz

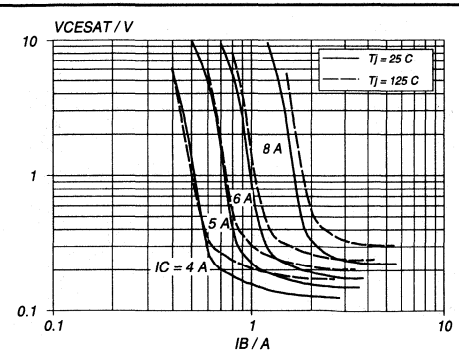


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

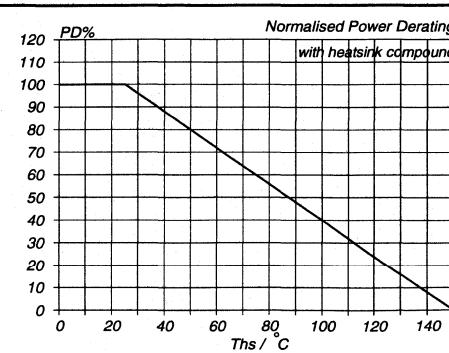


Fig.12. Normalised power dissipation. $PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

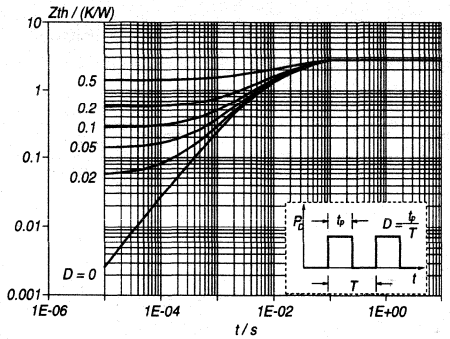


Fig.13. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

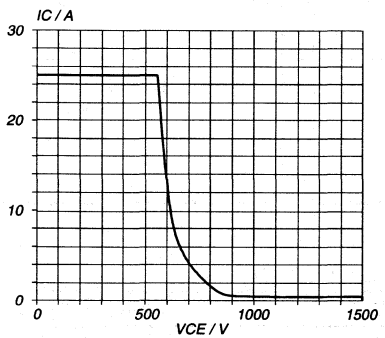


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

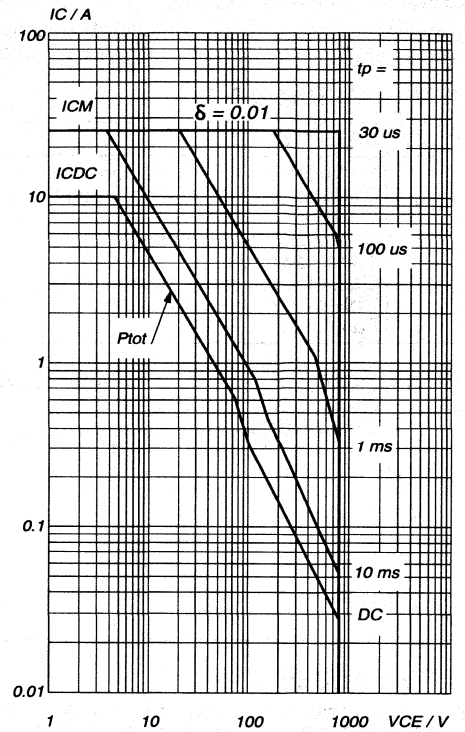


Fig.15. Forward bias safe operating area. $T_{hs} = 25$ °C
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor

BU2523AF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of HDTV receivers and pc monitors.

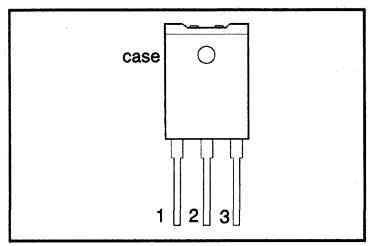
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	5.5	-	A
t_f	Fall time	I_{Csat} = 5.5 A; f = 64 kHz	0.15	0.3	µs

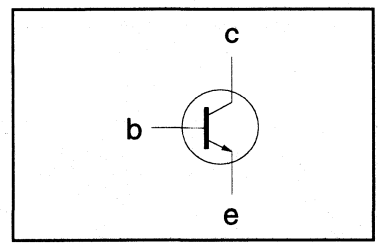
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	175	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	14	-	
h_{FE}		I_C = 5.5 A; V_{CE} = 5 V	5	8	10.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 5.5 A; L_C = 200 µH; C_{fb} = 4 nF; V_{CC} 145 V; $I_{B(end)}$ = 0.56 A; L_B = 0.4 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 3.3 A			
t_s	Turn-off storage time		1.5	2.0	µs
t_f	Turn-off fall time		0.15	0.3	µs

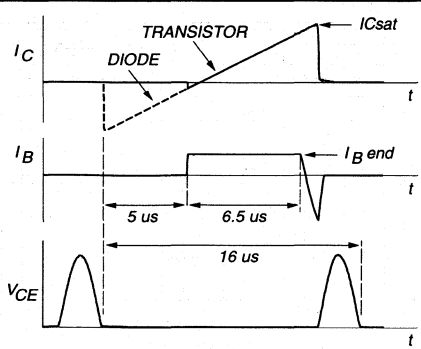


Fig.1. Switching times waveforms.

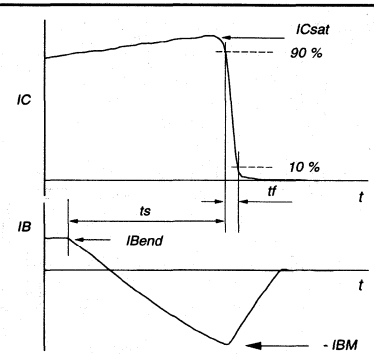


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

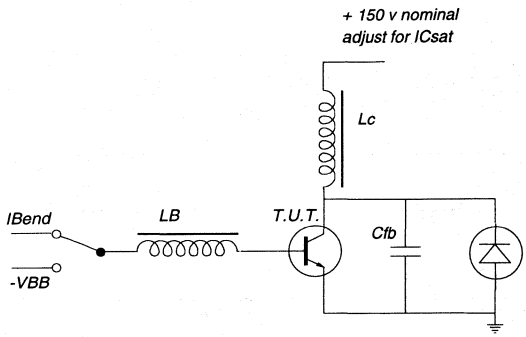


Fig.3. Switching times test circuit.

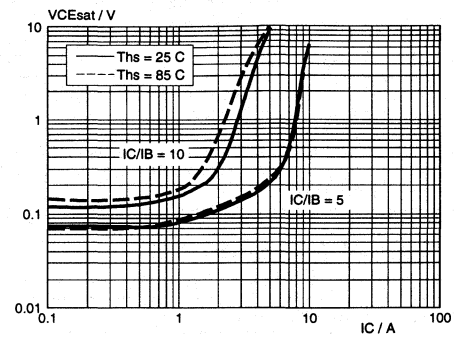


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

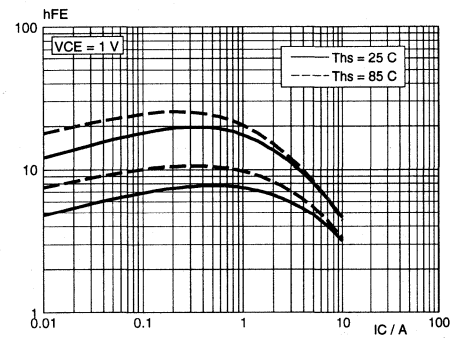


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

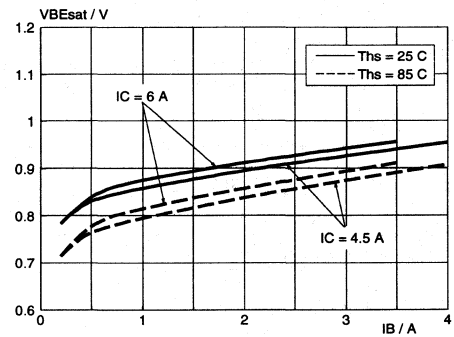


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

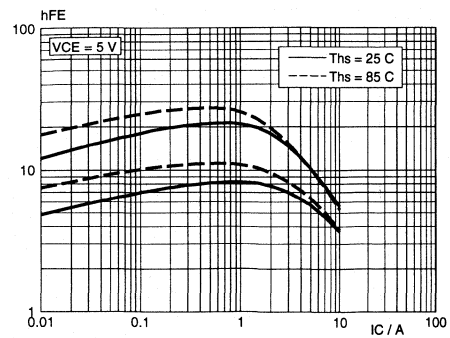


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

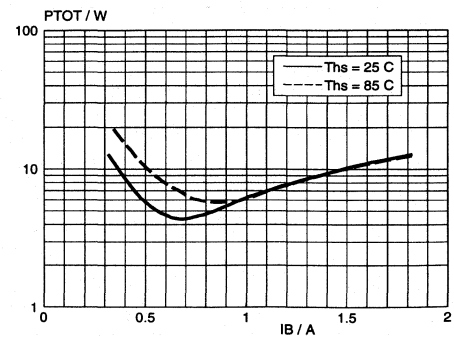


Fig.8. Typical losses. $P_{TOT} = f(I_B)$; I_C =5.5 A; f = 64 kHz

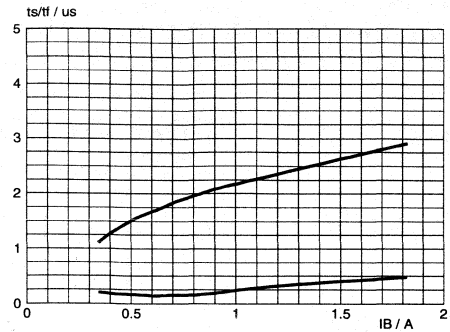


Fig.9. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; $I_C = 5.5$ A; $T_j = 85$°C; f = 64 kHz

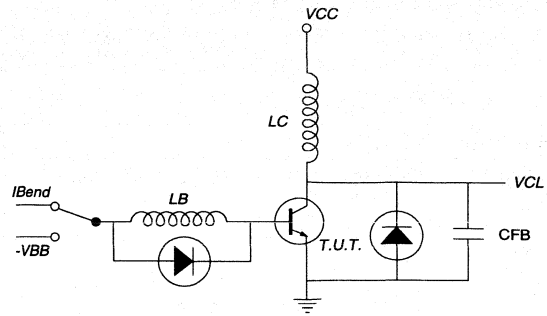


Fig.12. Test Circuit RBSOA. $V_{CC} = 150$ V; $-V_{BB} = 1 - 5$ V; $L_C = 1.5$ mH; $V_{CL} = 1450$ V; $L_B = 0.3 - 2$ µH; $C_{FB} = 0.5 - 8$ nF; $I_{B(end)} = 0.55 - 1.1$ A

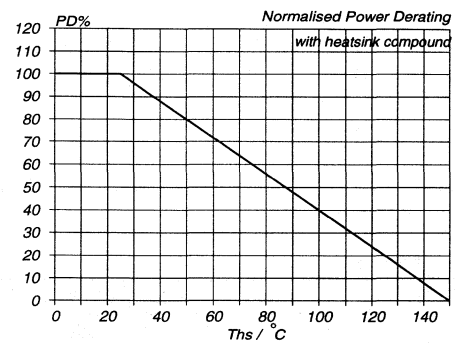


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25°C} = f(T_{mb})$

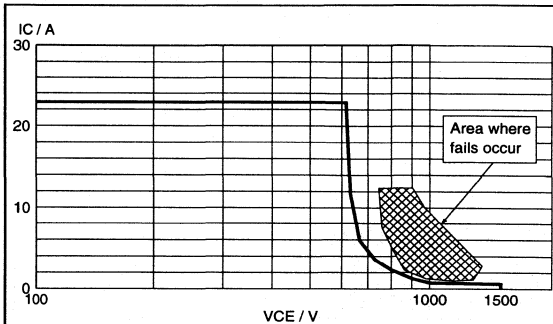


Fig.13. Reverse bias safe operating area. $T_j \leq T_{jmax}$

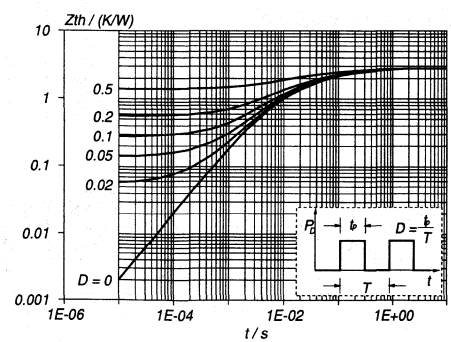


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

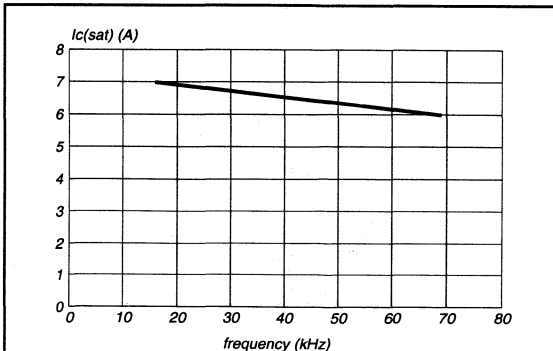


Fig.14. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU2523AX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of HDTV receivers and pc monitors.

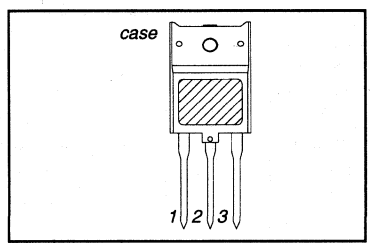
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	5.5	-	A
t_f	Fall time	I_{Csat} = 5.5 A; f = 64 kHz	0.15	0.3	µs

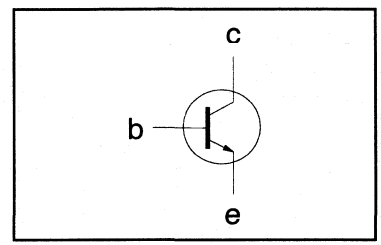
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	175	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	0.80	0.88	0.97	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	14	-	
h_{FE}		I_C = 5.5 A; V_{CE} = 5 V	5	8	10.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 5.5 A; L_C = 200 µH; C_{fb} = 4 nF; V_{CC} 145 V; $I_{B(end)}$ = 0.56 A; L_B = 0.4 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 3.3 A			
t_s	Turn-off storage time		1.5	2.0	µs
t_f	Turn-off fall time		0.15	0.3	µs

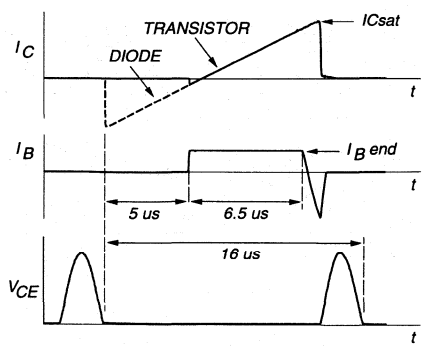


Fig.1. Switching times waveforms.

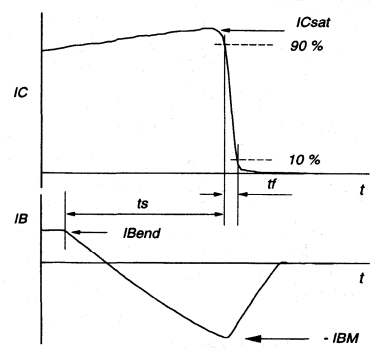


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

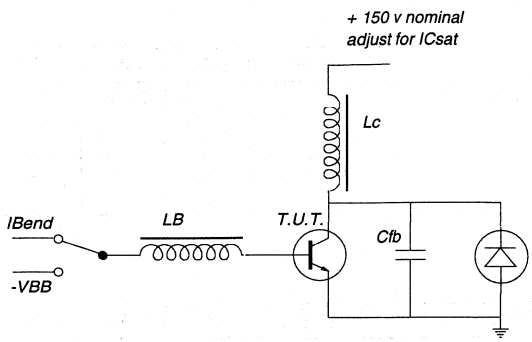


Fig.3. Switching times test circuit.

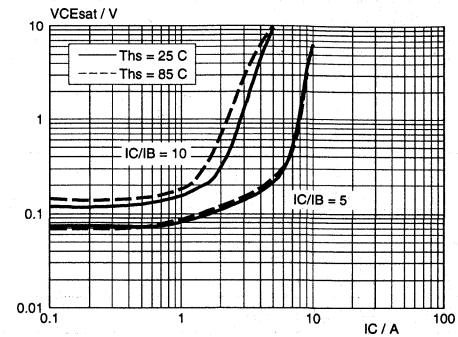


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

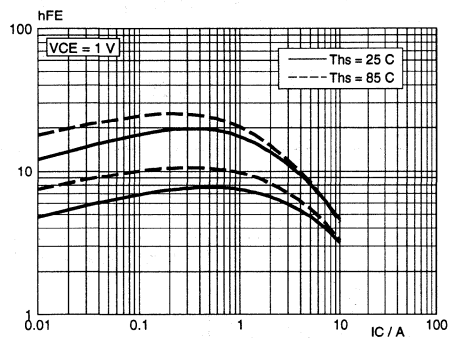


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

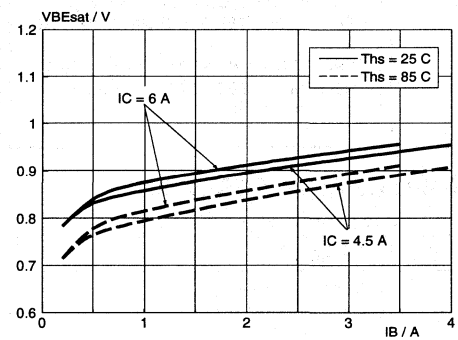


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

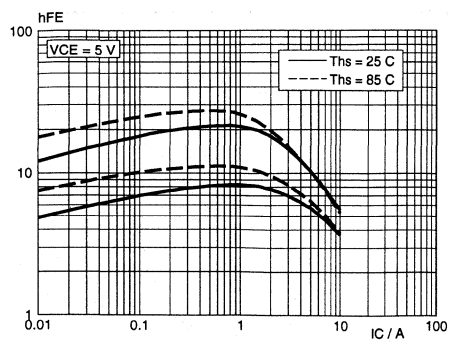


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

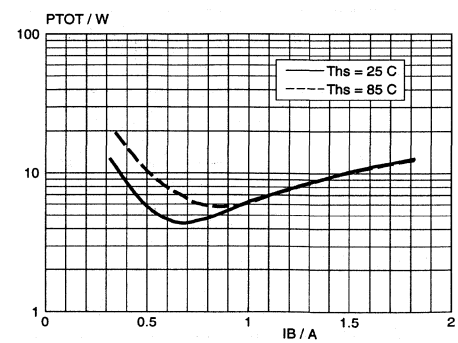


Fig.8. Typical losses. $P_{TOT} = f(I_B)$; I_C =5.5 A; f = 64 kHz

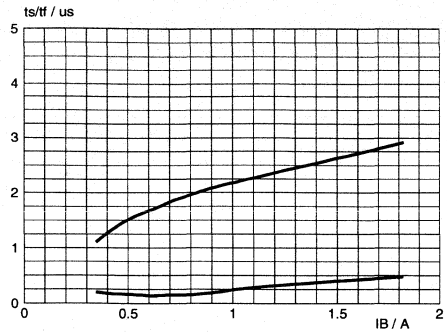


Fig.9. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; $I_C = 5.5$ A; $T_j = 85$°C; f = 64 kHz

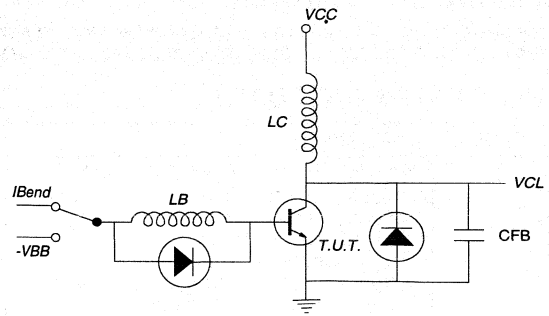


Fig.12. Test Circuit RBSOA. $V_{CC} = 150$ V; $-V_{BB} = 1 - 5$ V; $L_C = 1.5$ mH; $V_{CL} = 1450$ V; $L_B = 0.3 - 2$ µH; $C_{FB} = 0.5 - 8$ nF; $I_{B(end)} = 0.55 - 1.1$ A

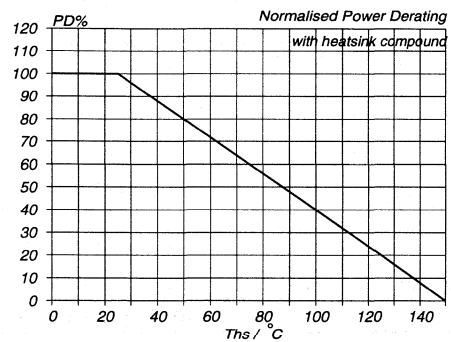


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25°C} = f(T_{mb})$

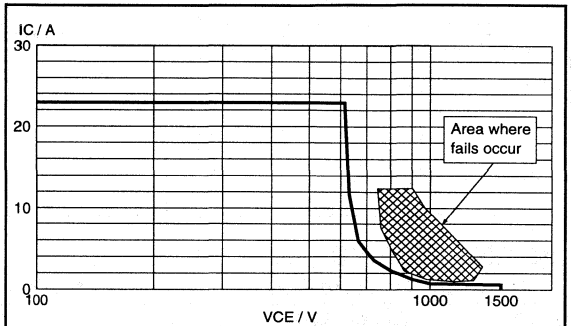


Fig.13. Reverse bias safe operating area. $T_j \leq T_{jmax}$

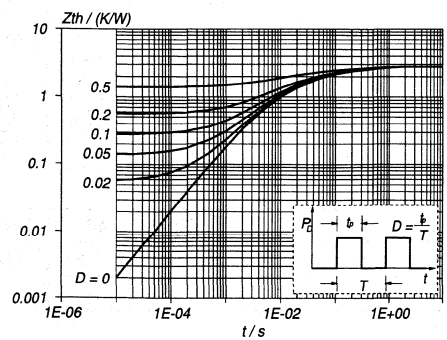


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

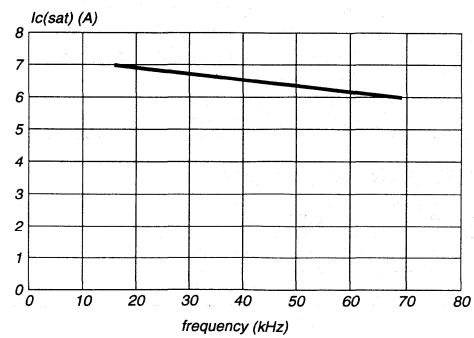


Fig.14. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU2523DF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a full plastic envelope intended for use in horizontal deflection circuits of HDTV receivers and pc monitors.

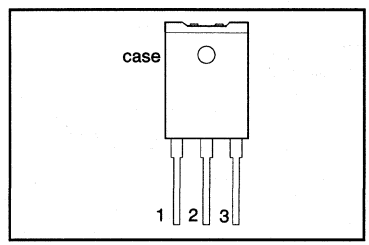
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	5.5	-	A
V_F	Diode forward voltage	I_F = 5.5 A	-	2.2	V
t_f	Fall time	I_{Csat} = 5.5 A; f = 64 kHz	0.15	0.3	µs

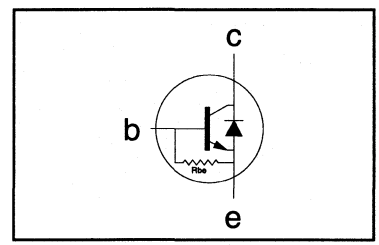
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	175	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	80	130	170	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	46	-	Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 5.5 A; V_{CE} = 5 V	5	7.5	10.8	
V_F	Diode forward voltage	I_F = 5.5 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 5.5 A; L_C = 200 µH; C_{fb} = 4 nF; V_{CC} = 145 V; $I_{B(end)}$ = 0.56 A; L_B = 0.4 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 3.3 A			
t_s	Turn-off storage time		1.5	2	µs
t_f	Turn-off fall time		0.15	0.3	µs
V_{fr}	Anti-parallel diode forward recovery voltage	I_F = 5.5 A; dI_F/dt = 50 A/µs	16.5	-	V
t_{fr}	Anti-parallel diode forward recovery time	V_F = 5 V	375	-	ns

2 Measured with half sine-wave voltage (curve tracer).

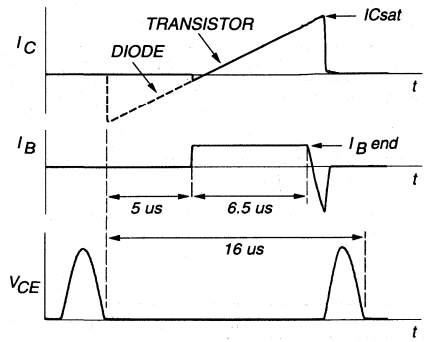


Fig.1. Switching times waveforms.

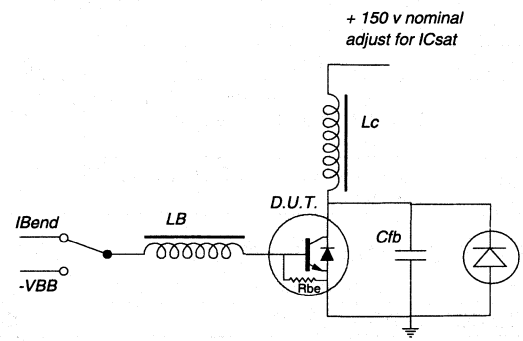


Fig.4. Switching times test circuit.

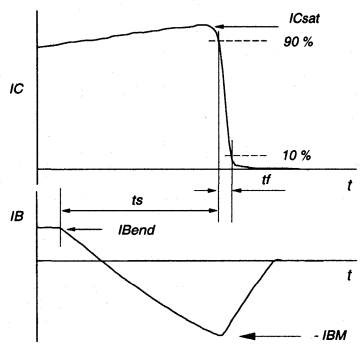


Fig.2. Switching times definitions.

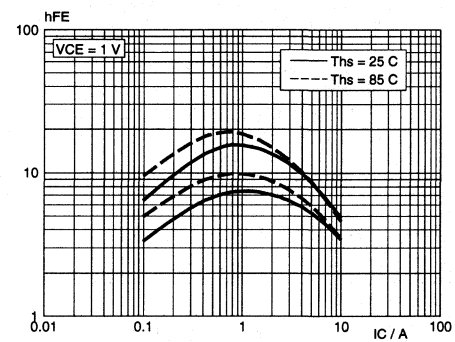


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

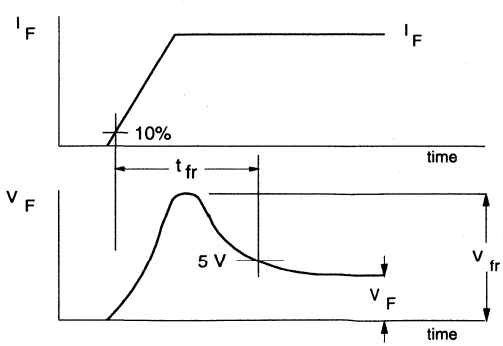


Fig.3. Definition of anti-parallel diode V_{fr} and t_{fr}.

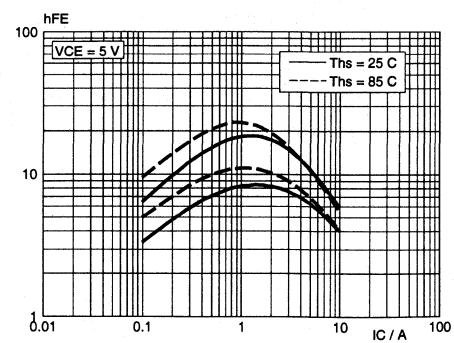


Fig.6. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

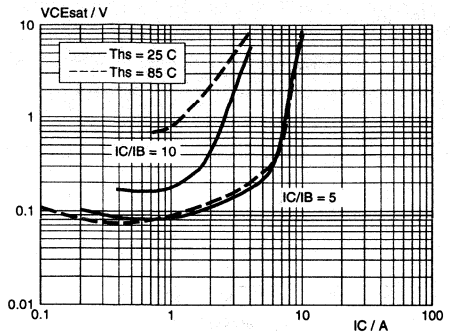


Fig.7. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

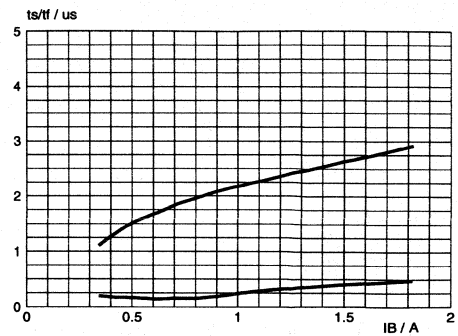


Fig.10. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; $I_C = 5.5$ A; $T_j = 85$°C; f = 64 kHz

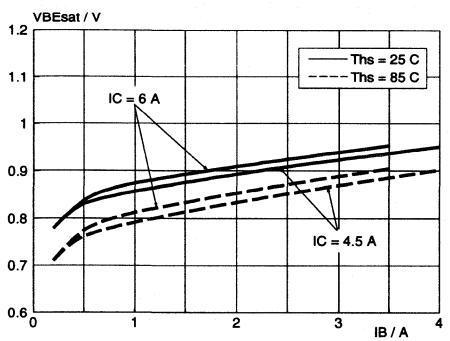


Fig.8. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

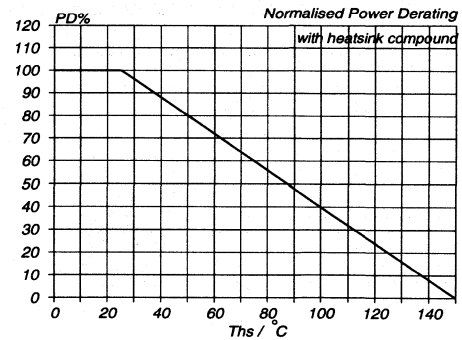


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25°C} = f(T_{mb})$

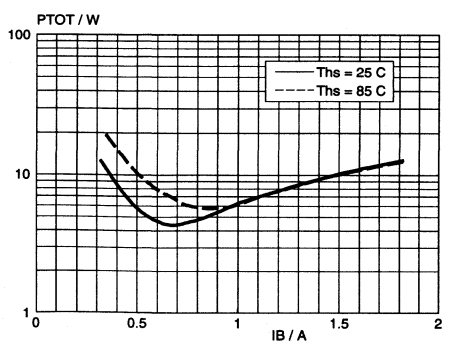


Fig.9. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 5.5$ A; f = 64 kHz

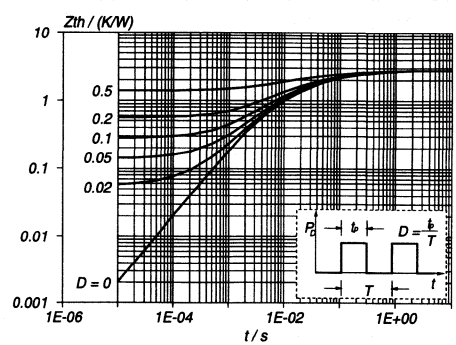


Fig.12. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

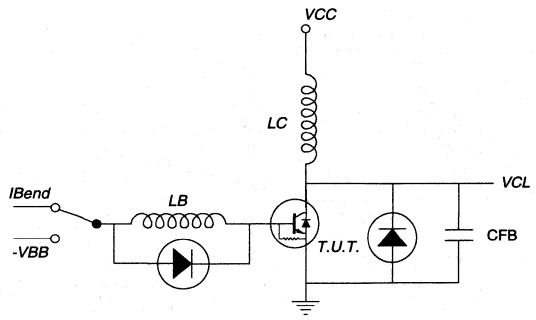


Fig.13. Test Circuit RBSOA. V_{CC} = 150 V; $-V_{BB}$ = 1 - 5 V; L_C = 1.5 mH; V_{CL} = 1450 V; L_B = 0.3 - 2 µH; C_{FB} = 0.5 - 8 nF; $I_{B(end)}$ = 0.55 - 1.1 A

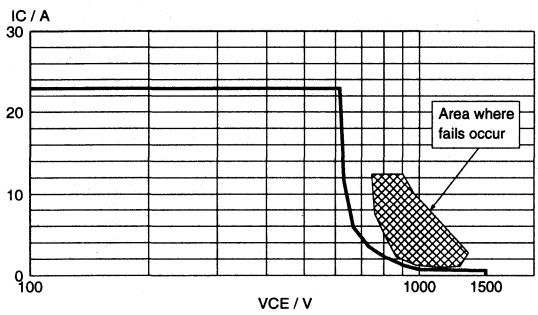


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

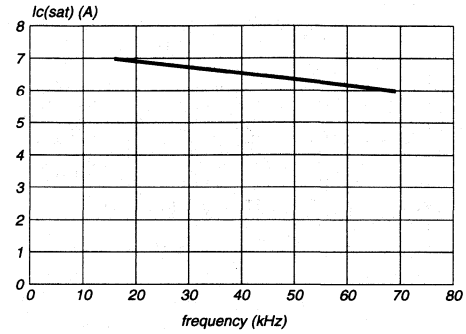


Fig.15. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU2523DX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a full plastic envelope intended for use in horizontal deflection circuits of HDTV receivers and pc monitors.

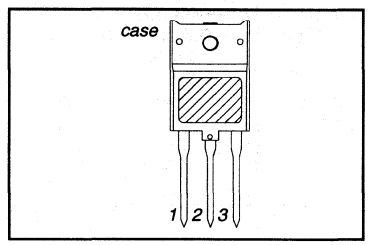
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	5.5	-	A
V_F	Diode forward voltage	I_F = 5.5 A	-	2.2	V
t_f	Fall time	I_{Csat} = 5.5 A; f = 64 kHz	0.15	0.3	µs

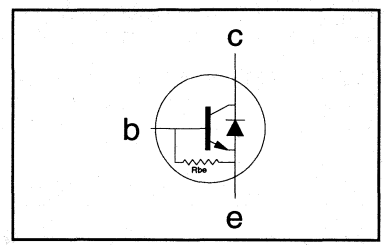
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	175	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	80	130	170	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	46	-	Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.5 A; I_B = 1.1 A		-	1.0	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 5.5 A; V_{CE} = 5 V	5	7.5	10.8	
V_F	Diode forward voltage	I_F = 5.5 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 5.5 A; L_C = 200 µH; C_{fb} = 4 nF; V_{CC} = 145 V; $I_{B(end)}$ = 0.56 A; L_B = 0.4 µH; $-V_{BB}$ = -4 V; $-I_{BM}$ = 3.3 A			
t_s	Turn-off storage time		1.5	2	µs
t_f	Turn-off fall time		0.15	0.3	µs
V_{fr}	Anti-parallel diode forward recovery voltage	I_F = 5.5 A; dI_F/dt = 50 A/µs	16.5	-	V
t_{fr}	Anti-parallel diode forward recovery time	V_F = 5 V	375	-	ns

2 Measured with half sine-wave voltage (curve tracer).

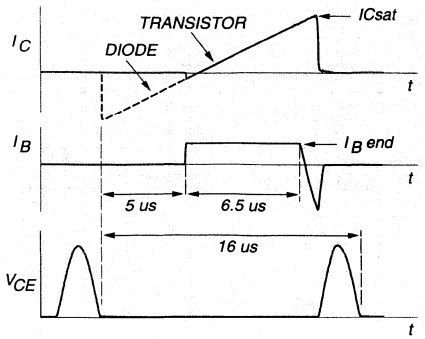


Fig.1. Switching times waveforms.

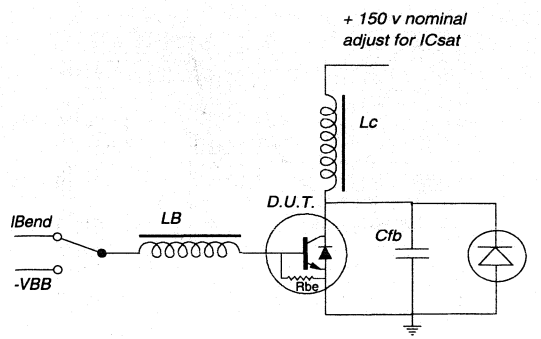


Fig.4. Switching times test circuit.

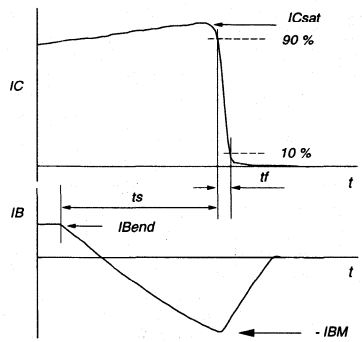


Fig.2. Switching times definitions.

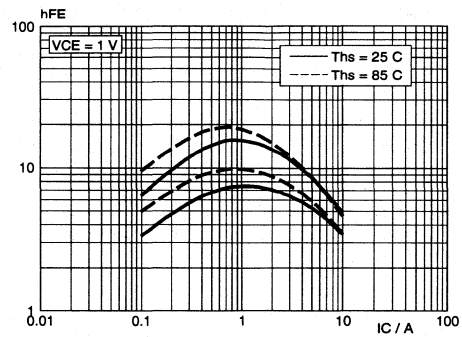


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

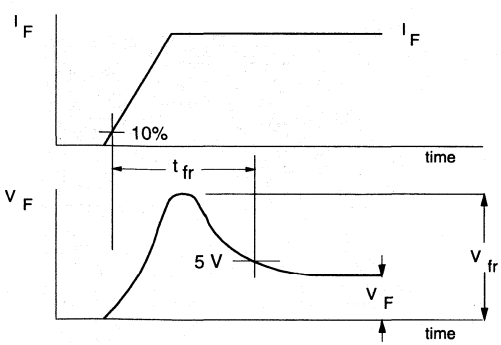


Fig.3. Definition of anti-parallel diode V_{fr} and t_{fr}.

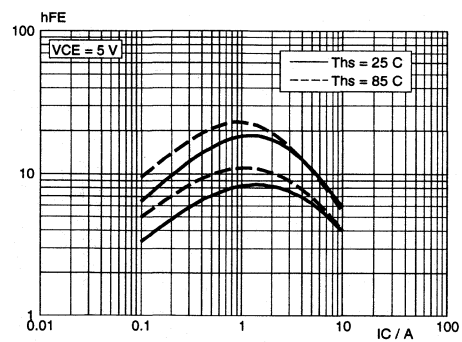


Fig.6. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

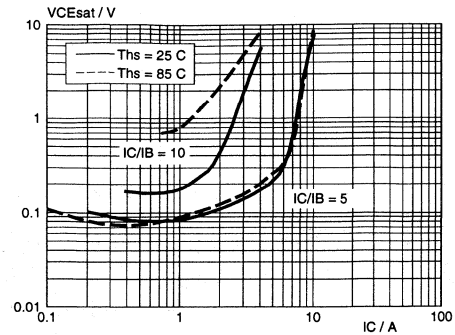


Fig.7. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

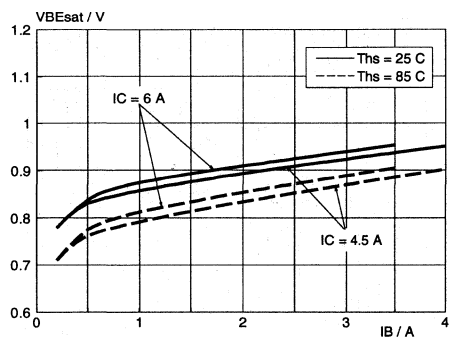


Fig.8. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

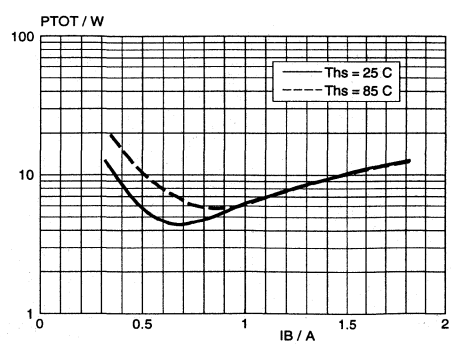


Fig.9. Typical losses.
$P_{TOT} = f(I_B)$; $I_C = 5.5$ A; f = 64 kHz

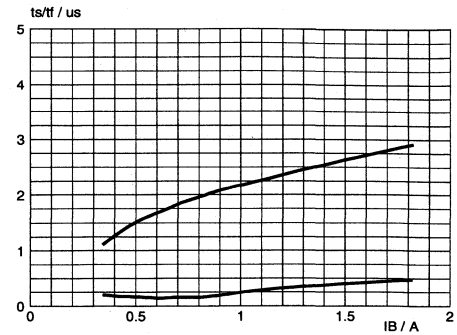


Fig.10. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; $I_C = 5.5$ A; $T_j = 85$°C; f = 64 kHz

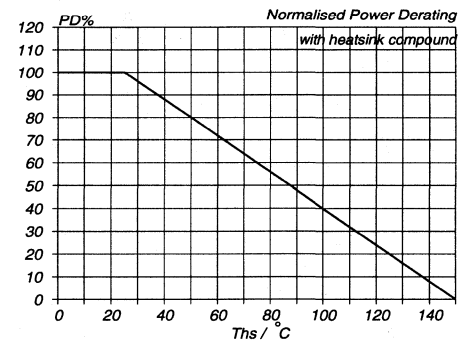


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25°C} = f(T_{mb})$

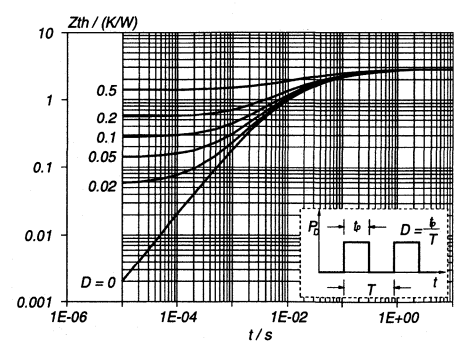


Fig.12. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

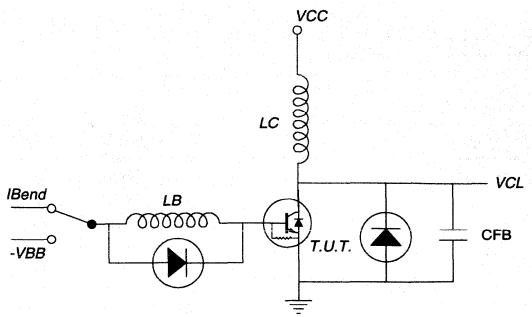


Fig.13. Test Circuit RBSOA. V_{CC} = 150 V; $-V_{BB}$ = 1 - 5 V; L_C = 1.5 mH; V_{CL} = 1450 V; L_B = 0.3 - 2 µH; C_{FB} = 0.5 - 8 nF; $I_{B(end)}$ = 0.55 - 1.1 A

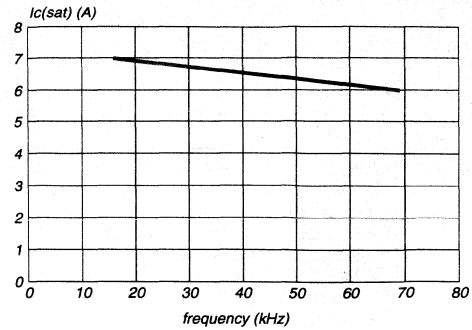


Fig.15. I_{Csat} during normal running vs. frequency of operation for optimum performance

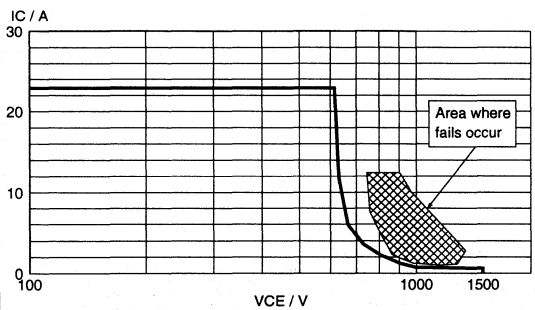


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2525AF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

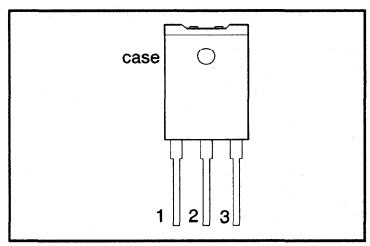
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	5.0	V
I_{Csat}	Collector saturation current		8.0	-	A
t_f	Fall time	I_{Csat} = 8.0 A; $I_{B(end)}$ = 1.1 A	0.2	0.35	µs

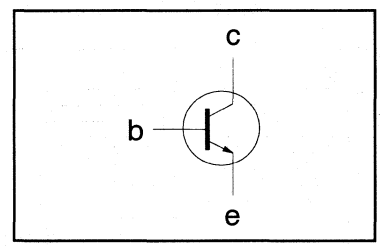
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	5	7	9.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (32 kHz line deflection circuit)	I_{Csat} = 8.0 A; L_C = 260 µH; C_{fb} = 13 nF; $I_{B(end)}$ = 1.1 A; L_B = 2.5 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 1.6 A/µs)			
t_s	Turn-off storage time		3.0	4.0	µs
t_f	Turn-off fall time		0.2	0.35	µs

2 Measured with half sine-wave voltage (curve tracer).

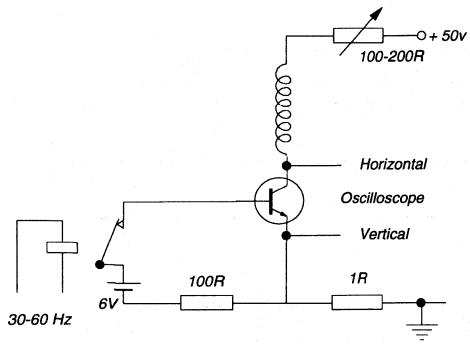


Fig.1. Test circuit for $V_{CEOsust}$.

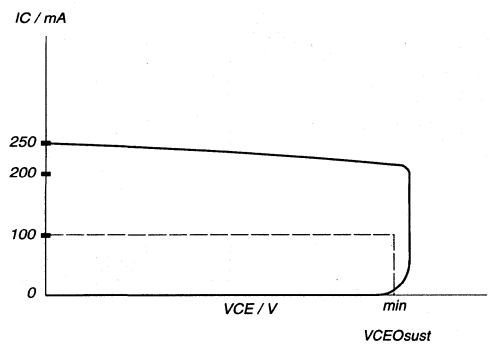


Fig.2. Oscilloscope display for $V_{CEOsust}$.

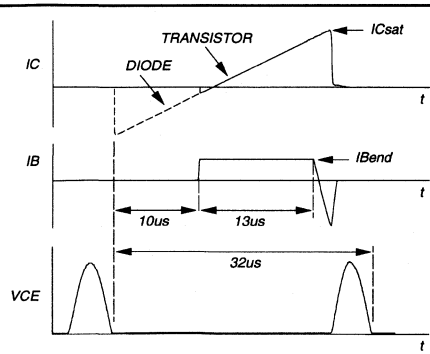


Fig.3. Switching times waveforms.

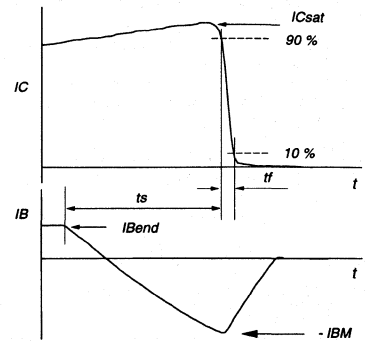


Fig.4. Switching times definitions.

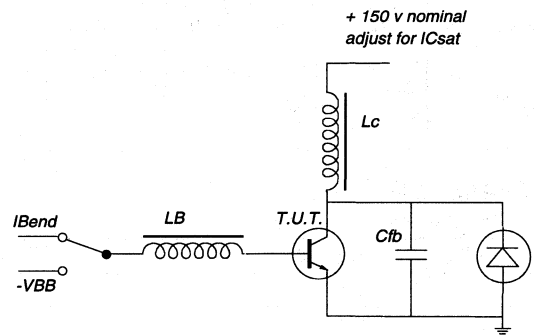


Fig.5. Switching times test circuit.

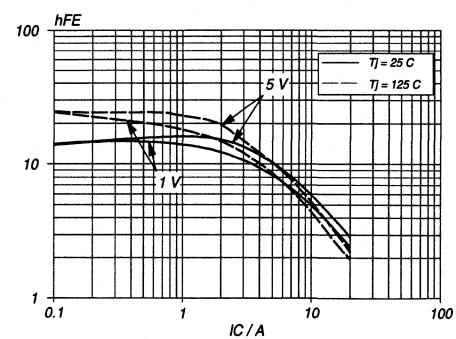


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

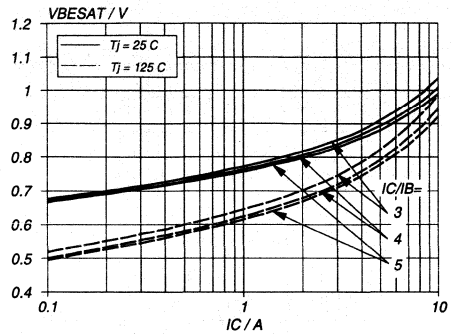


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

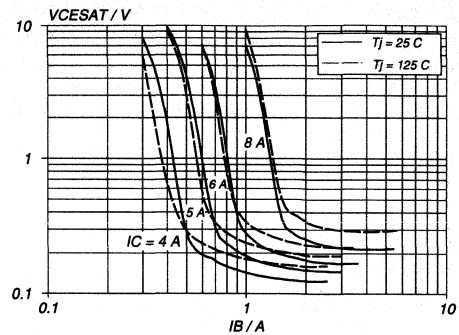


Fig.10. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

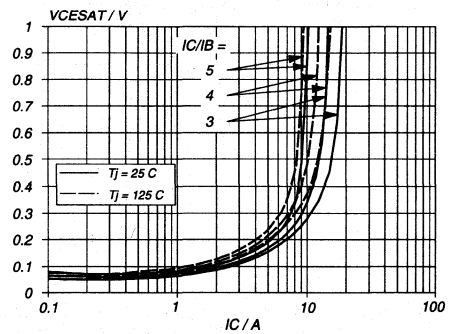


Fig.8. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

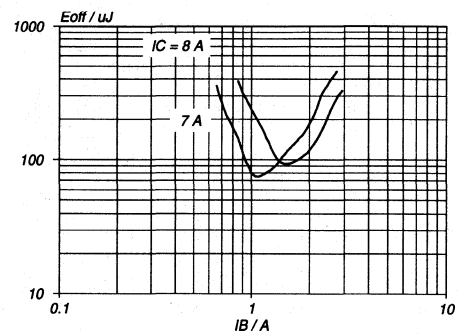


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$ $Eoff = f(I_B)$; parameter I_C; f = 32 kHz

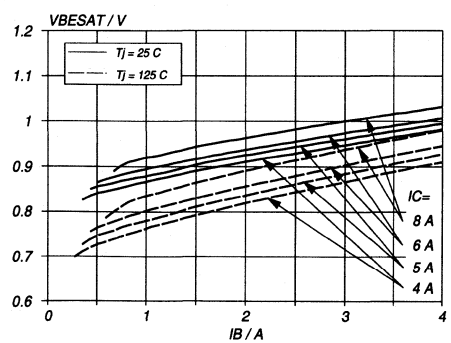


Fig.9. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

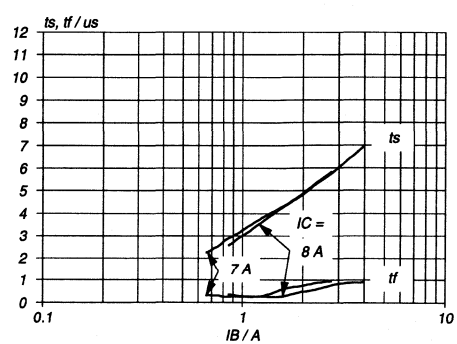


Fig.12. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 32 kHz

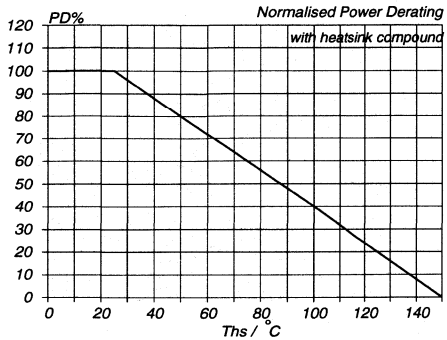


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

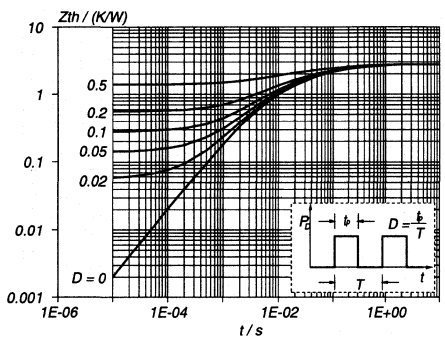


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

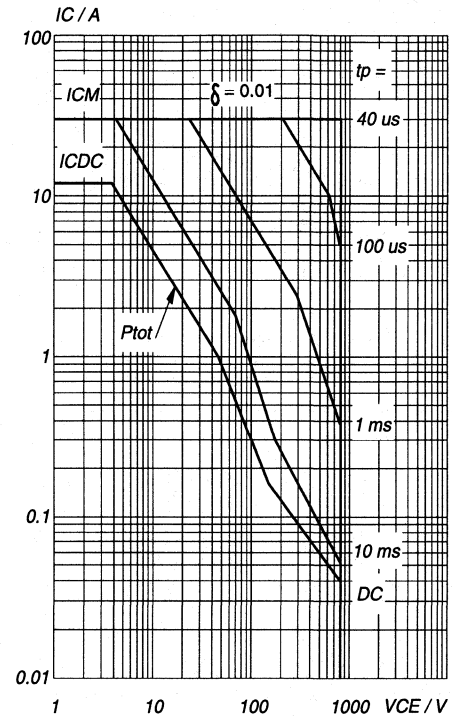


Fig.15. Forward bias safe operating area. $T_{hs} = 25\ ^\circ C$
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2525AW

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

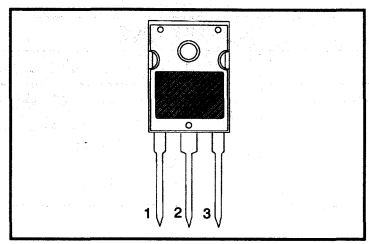
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	$I_C = 8.0$ A; $I_B = 1.6$ A	-	5.0	V
I_{Csat}	Collector saturation current		8	-	A
t_f	Fall time	$I_{Csat} = 8.0$ A; $I_{B(end)} = 1.1$ A	0.2	0.35	µs

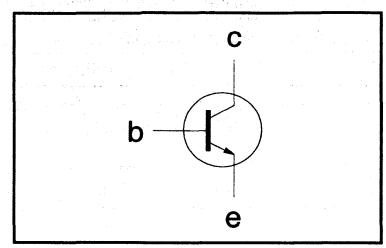
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$ V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	5	7	9.5	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (32 kHz line deflection circuit)	I_{Csat} = 8.0 A; L_C = 260 µH; C_{fb} = 13 nF; $I_{B(end)}$ = 1.1 A; L_B = 2.5 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 1.6 A/µs)			
t_s	Turn-off storage time		3.0	4.0	µs
t_f	Turn-off fall time		0.2	0.35	µs

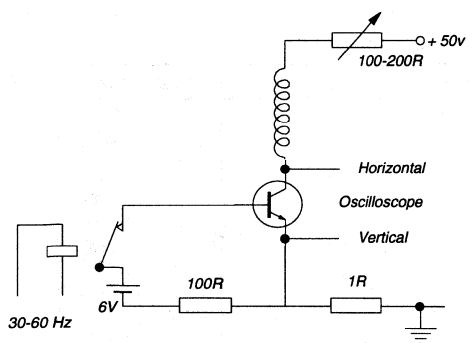


Fig.1. Test circuit for V_{CEO}sust.

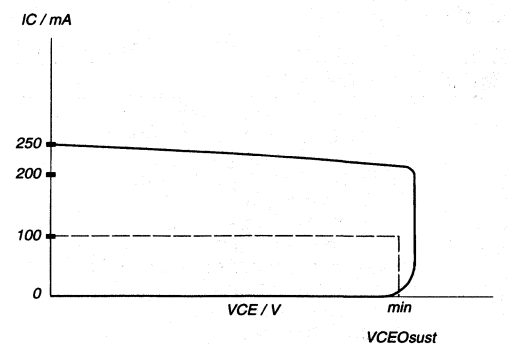


Fig.2. Oscilloscope display for V_{CEO}sust.

2 Measured with half sine-wave voltage (curve tracer).

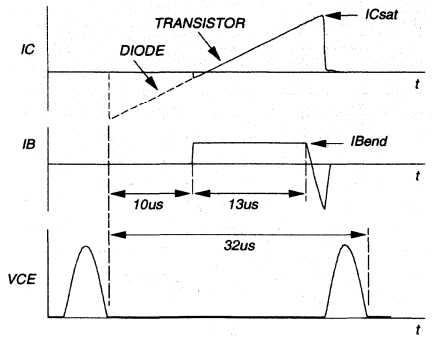


Fig.3. Switching times waveforms.

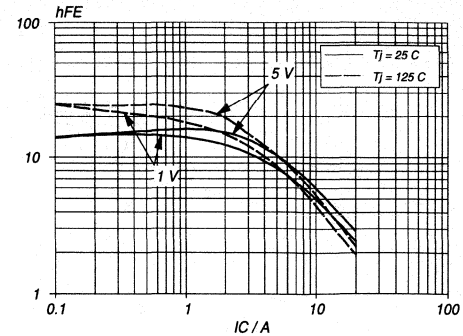


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

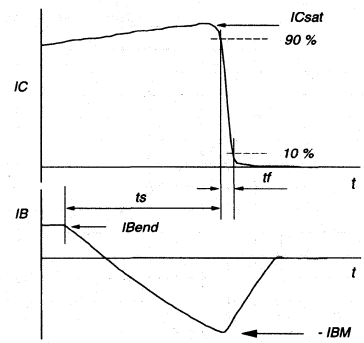


Fig.4. Switching times definitions.

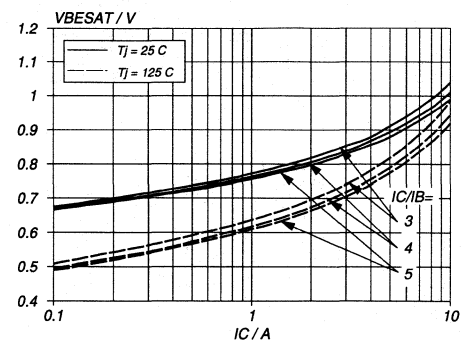


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

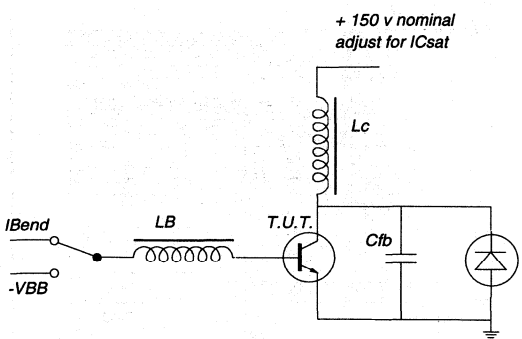


Fig.5. Switching times test circuit (BU2525A).

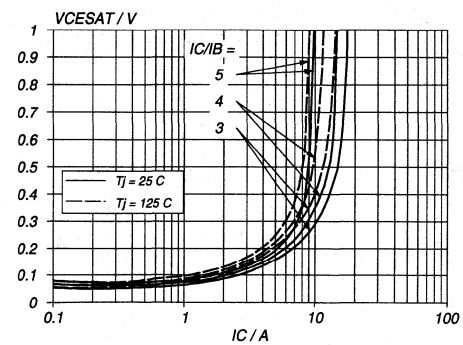


Fig.8. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

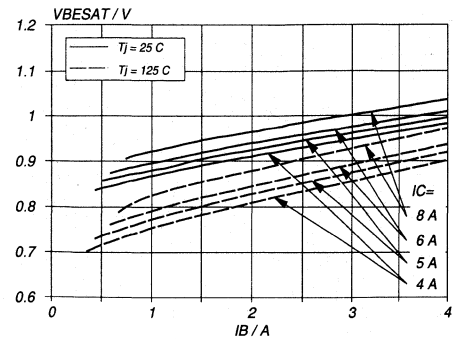


Fig.9. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

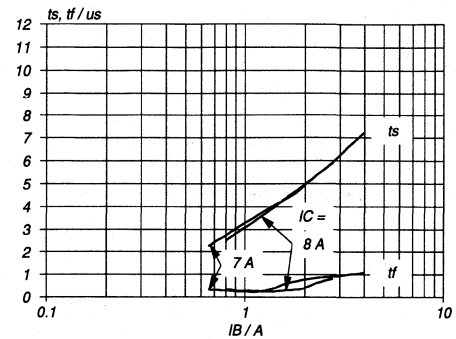


Fig.12. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 32 kHz

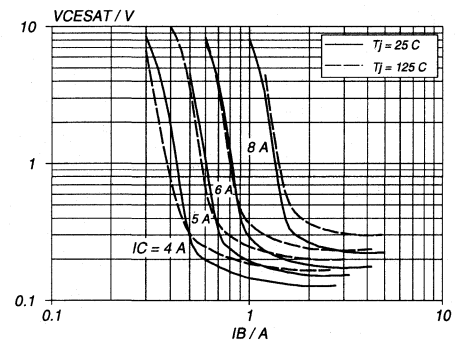


Fig.10. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

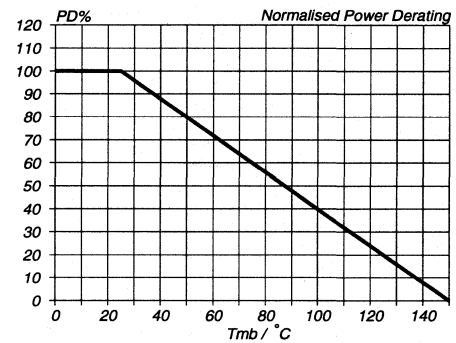


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

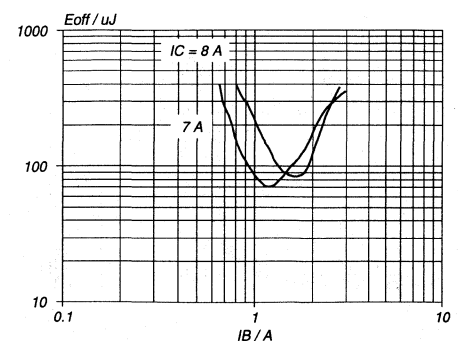


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$
$Eoff = f(I_B)$; parameter I_C; f = 32 kHz

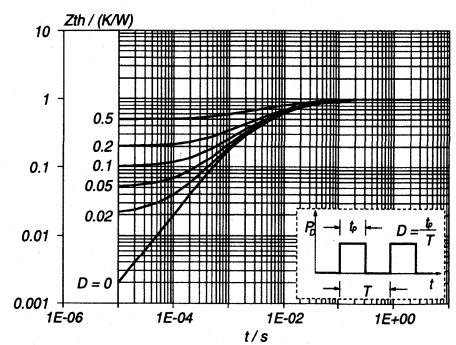


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}mb} = f(t)$; parameter $D = t_p/T$

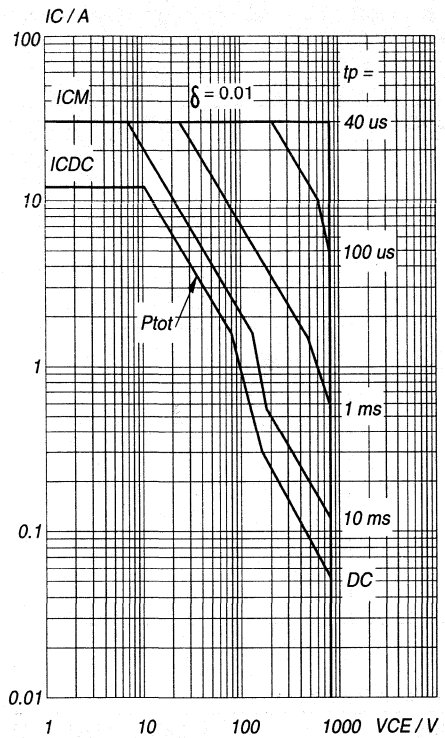


Fig.15. Forward bias safe operating area. T_{mb} = 25 ˚C
I_{CDC} & I_{CM} = f(V_{CE}); I_{CM} single pulse; parameter t_p;
Second-breakdown limits independant of temperature.

Silicon Diffused Power Transistor — BU2525AX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

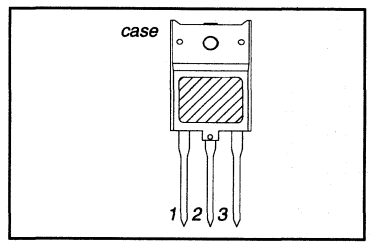
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	5.0	V
I_{Csat}	Collector saturation current		8.0	-	A
t_f	Fall time	I_{Csat} = 8.0 A; $I_{B(end)}$ = 1.1 A	0.2	0.35	µs

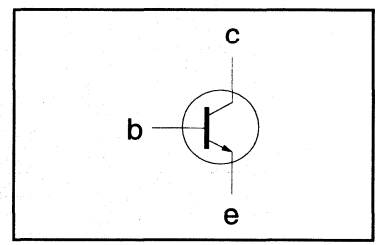
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	13	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	5	7	9.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (32 kHz line deflection circuit)	I_{Csat} = 8.0 A; L_C = 260 µH; C_{fb} = 13 nF; $I_{B(end)}$ = 1.1 A; L_B = 2.5 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 1.6 A/µs)			
t_s	Turn-off storage time		3.0	4.0	µs
t_f	Turn-off fall time		0.2	0.35	µs

2 Measured with half sine-wave voltage (curve tracer).

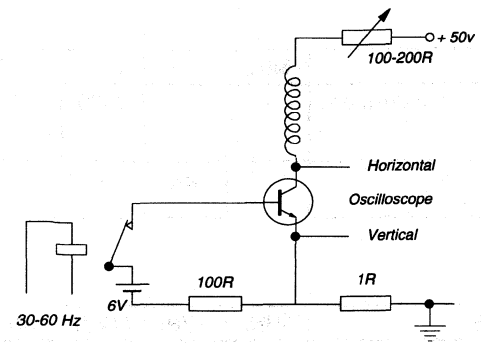


Fig.1. Test circuit for $V_{CEOsust}$.

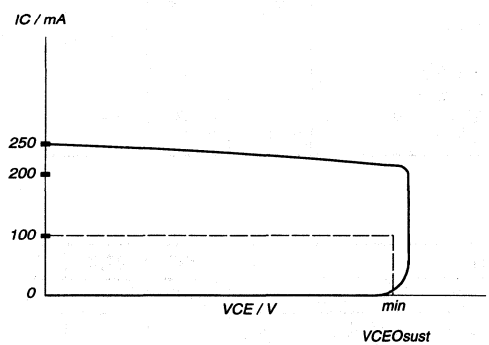


Fig.2. Oscilloscope display for $V_{CEOsust}$.

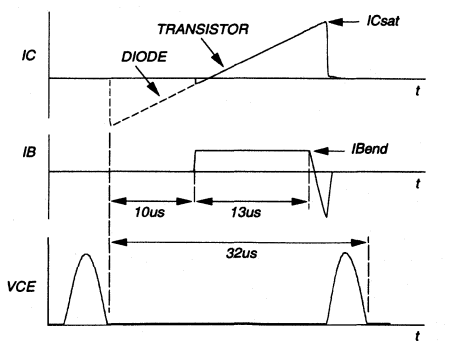


Fig.3. Switching times waveforms.

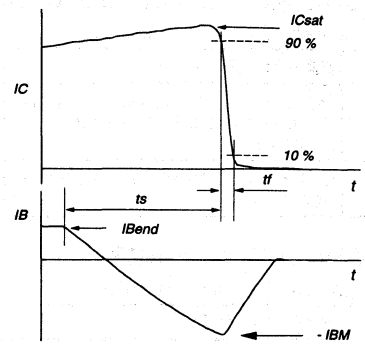


Fig.4. Switching times definitions.

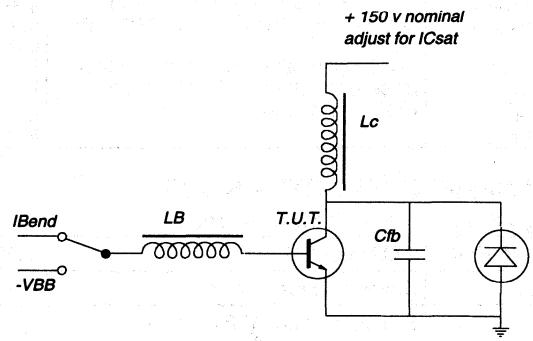


Fig.5. Switching times test circuit.

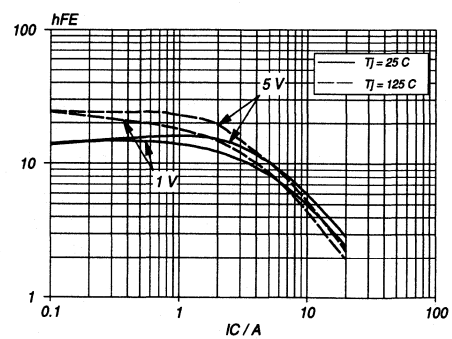


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

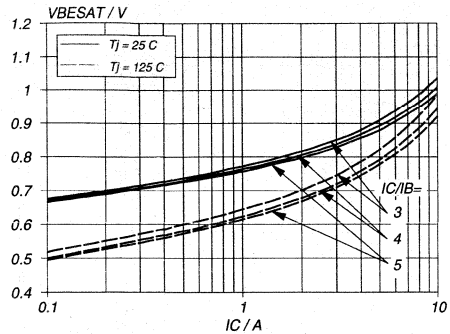


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_C)$; parameter I_C/I_B

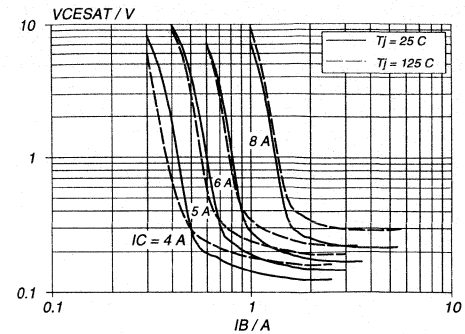


Fig.10. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

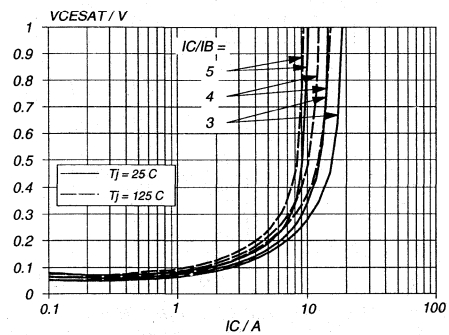


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

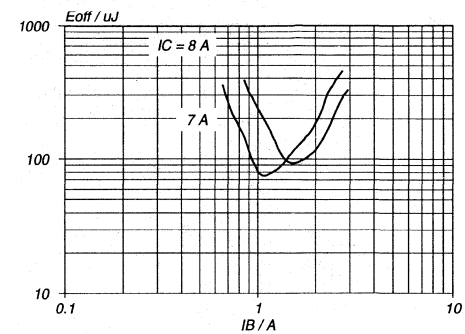


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$
$Eoff = f(I_B)$; parameter I_C; f = 32 kHz

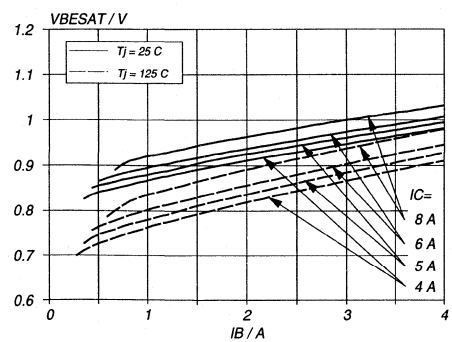


Fig.9. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

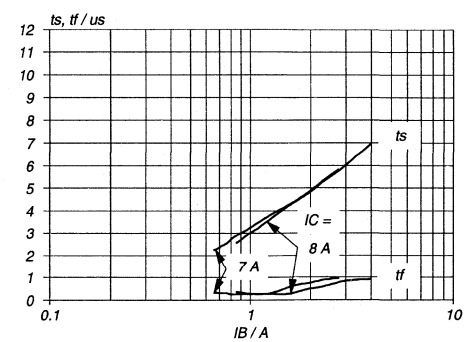


Fig.12. Typical collector storage and fall time.
$ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 32 kHz

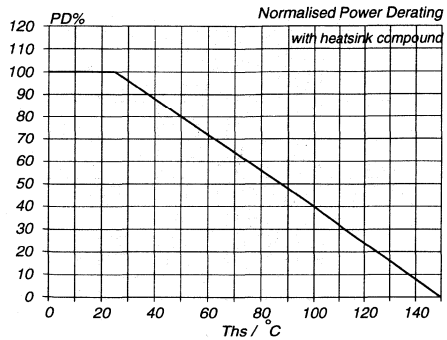


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

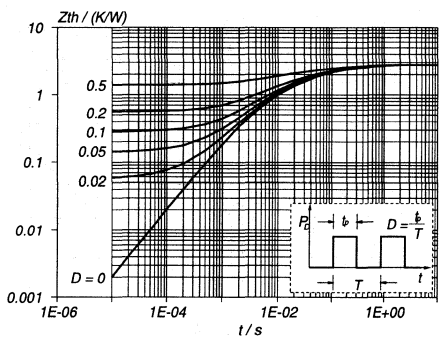


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

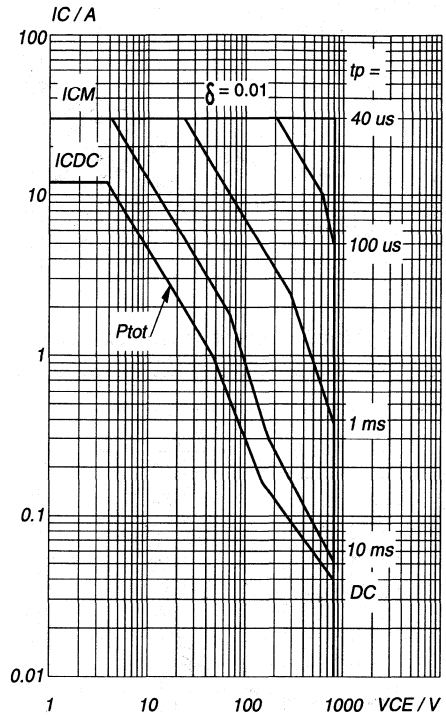


Fig.15. Forward bias safe operating area. $T_{hs} = 25\ ^\circ C$
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2525DF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

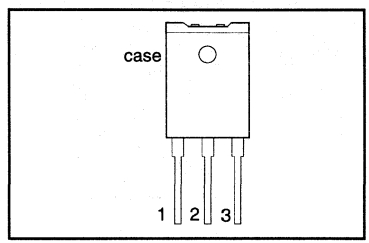
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	5.0	V
I_{Csat}	Collector saturation current		8.0	-	A
t_s	Storage time	I_{Csat} = 8.0 A; $I_{B(end)}$ = 1.1 A	3.0	4.0	µs

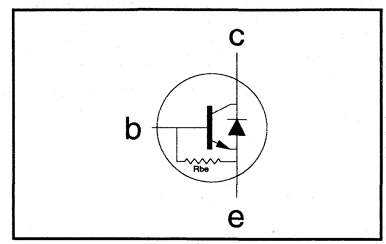
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	9	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	72	110	218	mA
R_{eb}	Base-emitter resistance	V_{EB} = 6.0 V	-	55	-	Ω
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B=0A ;I_c = 100mA L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	11	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	5	7	9.5	
V_F	Diode forward voltage	I_F = 8 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (32 kHz line deflection circuit)	I_{Csat} = 8.0 A; L_C = 260 µH; C_{fb} = 13 nF; $I_{B(end)}$ = 1.1 A; L_B = 2.5 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 1.6 A/µs)			
t_s	Turn-off storage time		3.0	4.0	µs
t_f	Turn-off fall time		0.2	0.35	µs
V_{fr}	Anti-parallel diode forward recovery voltage	I_F = 8 A; dI_F/dt = 50 A/µs	16	-	V
t_{fr}	Anti-parallel diode forward recovery time	V_F = 5 V	410	-	ns

2 Measured with half sine-wave voltage (curve tracer).

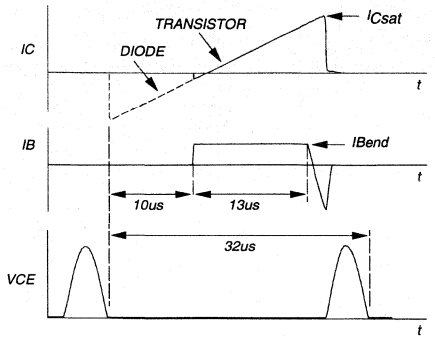


Fig.1. Switching times waveforms.

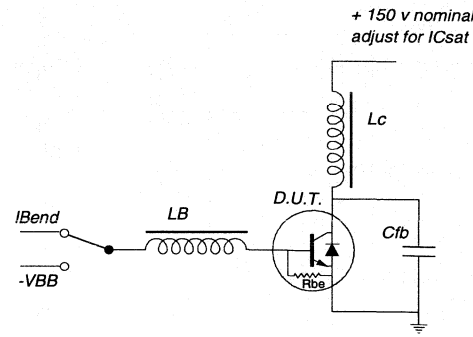


Fig.4. Switching times test circuit.

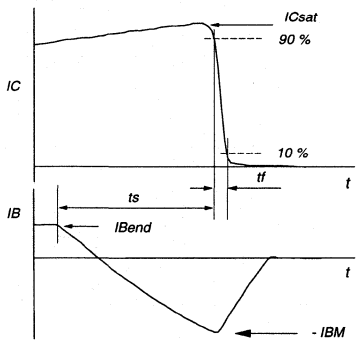


Fig.2. Switching times definitions.

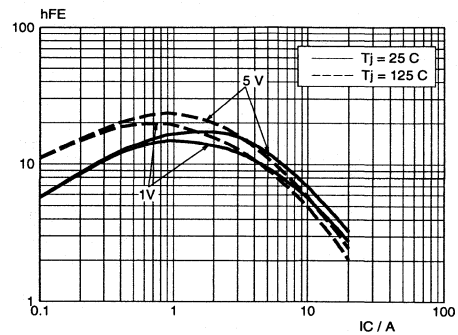


Fig.5. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

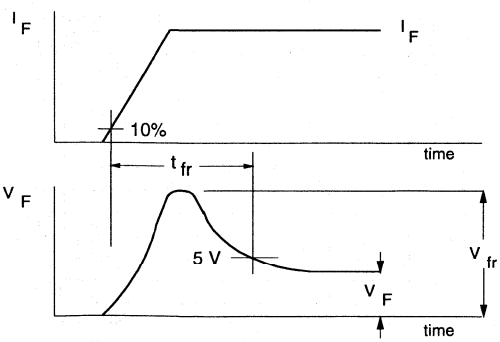


Fig.3. Definition of anti-parallel diode V_{fr} and t_{fr}

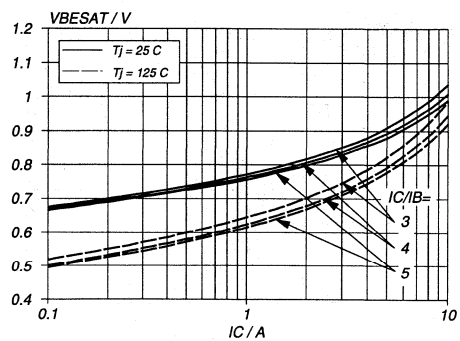


Fig.6. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

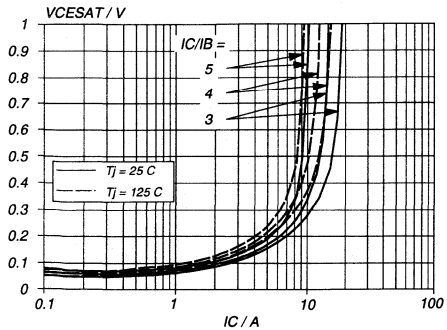


Fig.7. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

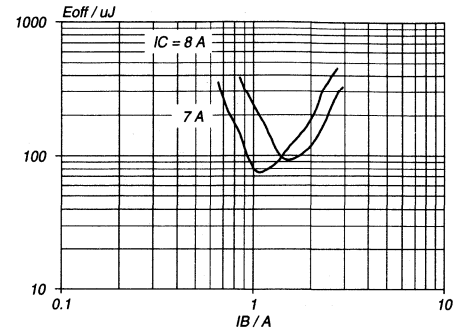


Fig.10. Typical turn-off losses. $T_j = 85^\circ C$ $Eoff = f(I_B)$; parameter I_C; f = 32 kHz

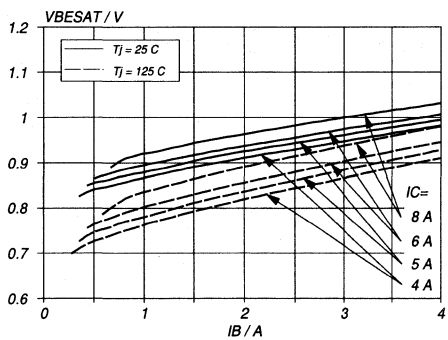


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

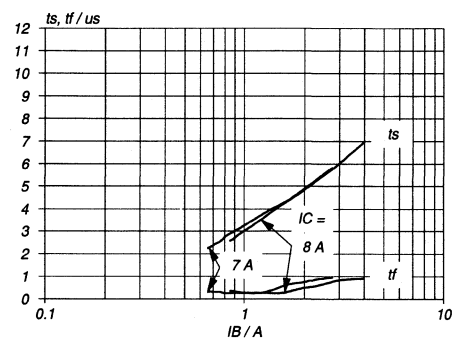


Fig.11. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 32 kHz

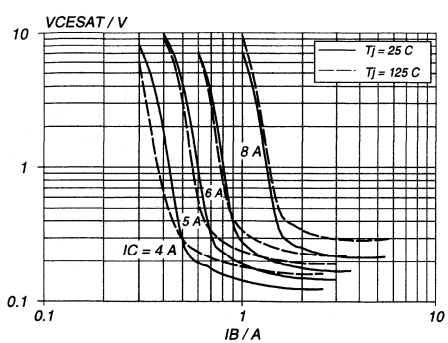


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

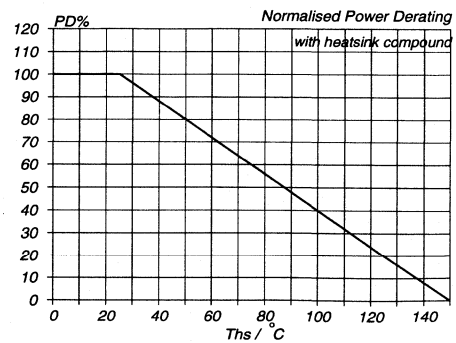


Fig.12. Normalised power dissipation. $PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

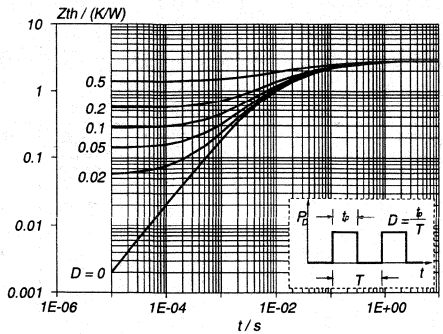


Fig.13. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

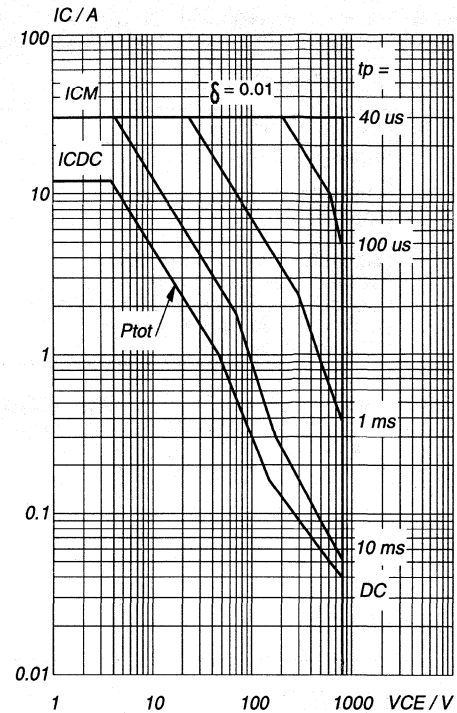


Fig.14. Forward bias safe operating area. T_{hs} = 25 ˚C
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2525DW

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with integrated damper diode in a plastic envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

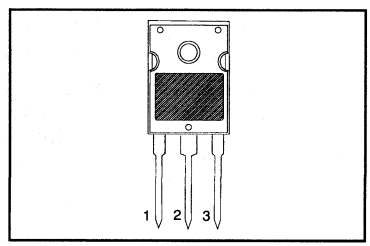
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	$I_C = 8.0$ A; $I_B = 1.6$ A	-	5.0	V
I_{Csat}	Collector saturation current		8	-	A
t_s	Storage time	$I_{Csat} = 8.0$ A; $I_{B(end)} = 1.1$ A	3.0	4.0	µs

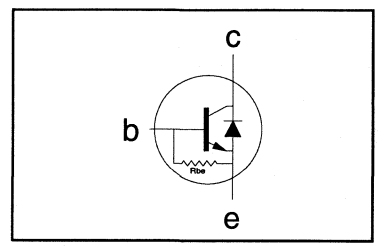
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$ V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	9	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	72	110	218	mA
R_{EB}	Base-emitter resistance	V_{EB} = 6.0 V	-	55	-	Ω
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector emitter-sustaining voltage	I_B = 0A;I_C = 100mA; L= 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	11	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	5	7	9.5	
V_F	Diode forward voltage	I_F = 8 A		1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (32 kHz line deflection circuit)	I_{Csat} = 8.0 A; L_C = 260 µH; C_{fb} = 13 nF; $I_{B(end)}$ = 1.1 A; L_B = 2.5 µH; -V_{BB} = 4 V; (-dI_B/dt = 1.6 A/µs)			
t_s	Turn-off storage time		3.0	4.0	µs
t_f	Turn-off fall time		0.2	0.35	µs
V_{fr}	Anti-parallel diode forward recovery voltage	I_F = 8 A; dI_F/dt = 50 A/µs	16		V
t_{fr}	Anti-parallel diode forward recovery time	V_F = 5 V	410		ns

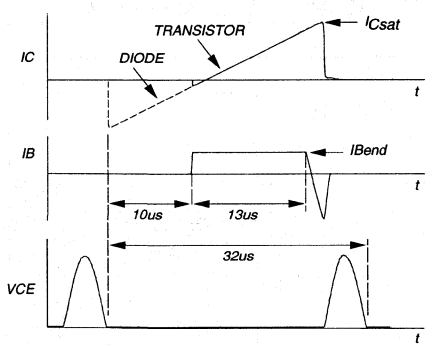


Fig.1. Switching times waveforms.

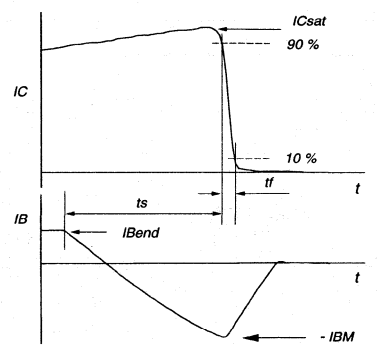


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

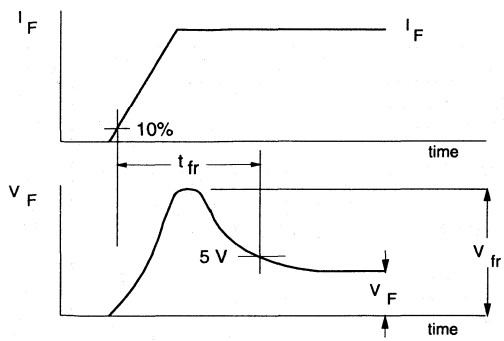


Fig.3. Definition of anti-parallel diode V_{fr} and t_{fr}

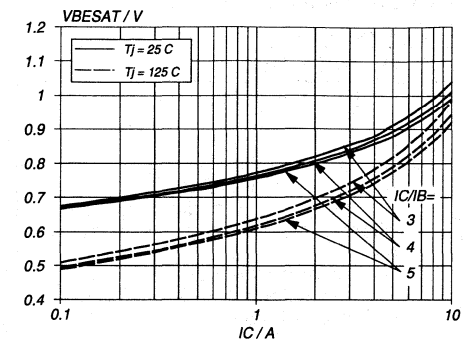


Fig.6. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

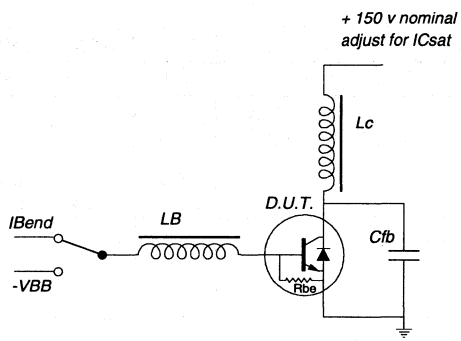


Fig.4. Switching times test circuit

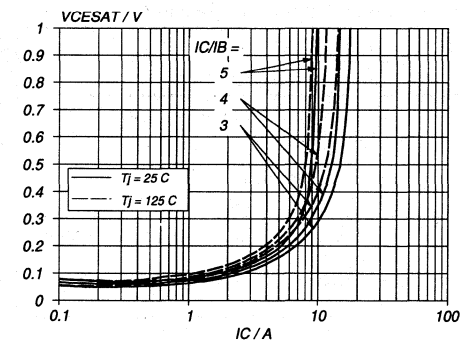


Fig.7. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

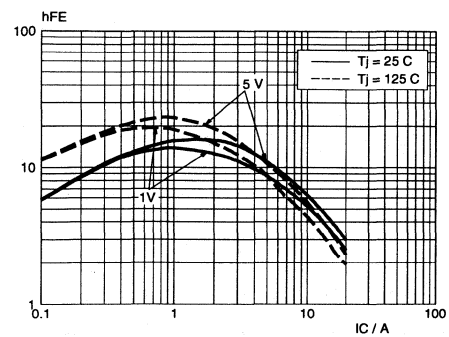


Fig.5. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

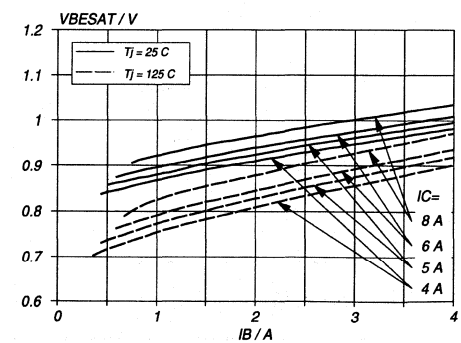


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

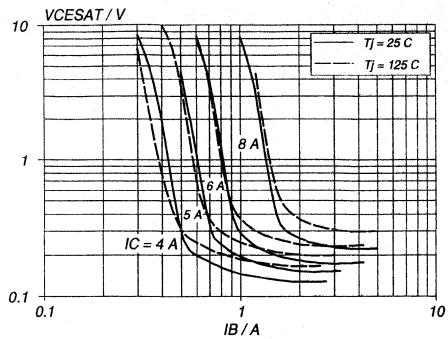


Fig.9. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

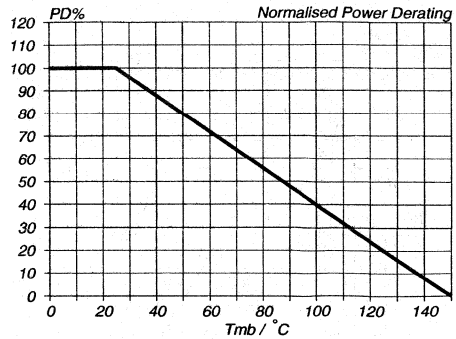


Fig.12. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

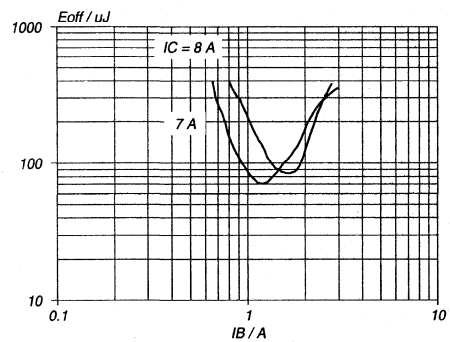


Fig.10. Typical turn-off losses. $T_j = 85^\circ C$
Eoff = f (I_B); parameter I_C; f = 32 kHz

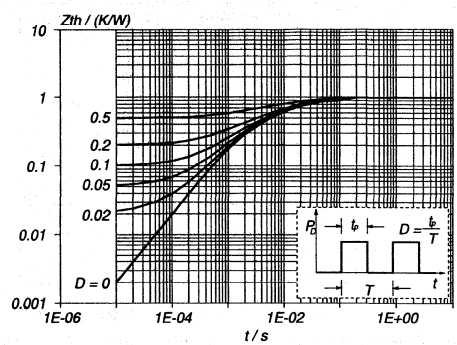


Fig.13. Transient thermal impedance.
$Z_{th\,j\text{-}mb} = f(t)$; parameter $D = t_p/T$

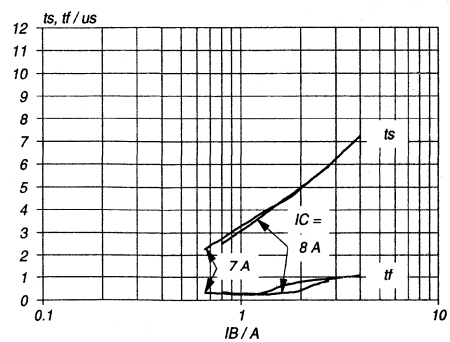


Fig.11. Typical collector storage and fall time.
ts = f (I_B); tf = f (I_B); parameter I_C; $T_j = 85^\circ C$; f = 32 kHz

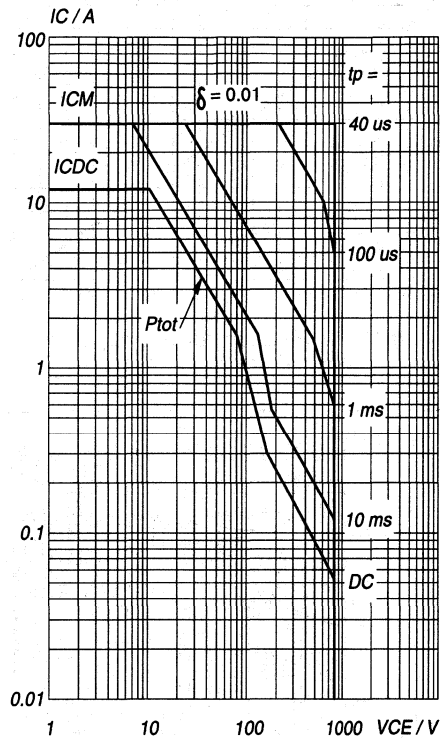


Fig.14. Forward bias safe operating area. T_{mb} = 25 °C
I_{CDC} & I_{CM} = f(V_{CE}); I_{CM} single pulse; parameter t_p;
Second-breakdown limits independant of temperature.

Silicon Diffused Power Transistor — BU2525DX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

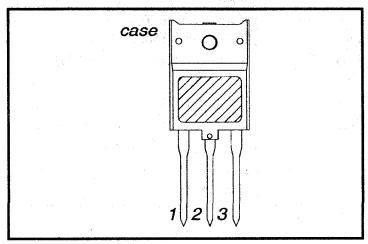
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	5.0	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_{Csat}	Collector saturation current		8.0	-	A
t_s	Storage time	I_{Csat} = 8.0 A; $I_{B(end)}$ = 1.1 A	3.0	4.0	µs

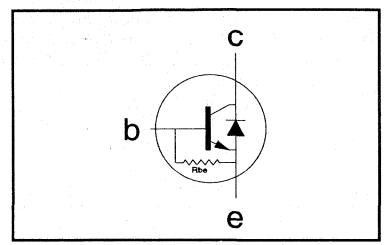
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	9	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	72	110	218	mA
R_{EB}	Base-emitter resistance	V_{EB} = 6.0 V	-	55	-	Ω
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector emitter sustaining voltage	I_B = O A;I_C = 1OO mA; L= 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	11	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	5	7	9.5	
V_F	Diode forward voltage	I_F = 8 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (32 kHz line deflection circuit)	I_{Csat} = 8.0 A; L_C = 260 µH; C_{fb} = 13 nF; $I_{B(end)}$ = 1.1 A; L_B = 2.5 µH; $-V_{BB}$ = 4 V; ($-dI_B/dt$ = 1.6 A/µs)			
t_s	Turn-off storage time		3.0	4.0	µs
t_f	Turn-off fall time		0.2	0.35	µs
V_{fr}	Anti-parallel diode forward recovery voltage	I_F = 8 A; dI_F/dt = 50 A/µs	16	-	V
t_{fr}	Anti-parallel diode forward recovery time	V_F = 5 V	410	-	ns

2 Measured with half sine-wave voltage (curve tracer).

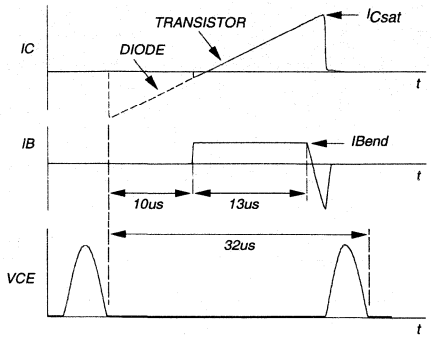


Fig.1. Switching times waveforms.

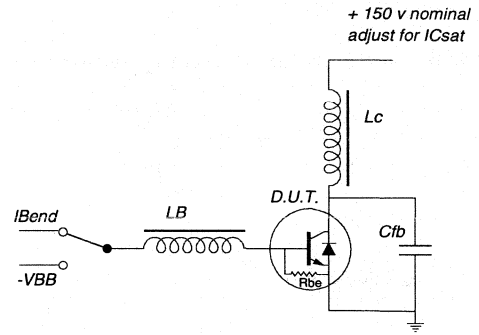


Fig.4. Switching times test circuit.

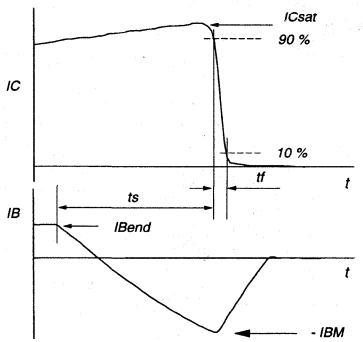


Fig.2. Switching times definitions.

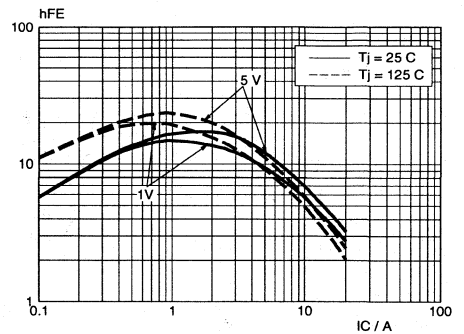


Fig.5. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

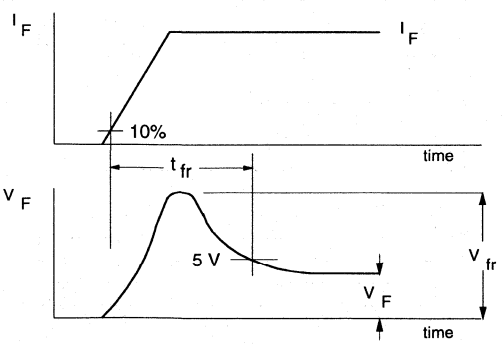


Fig.3. Definition of anti-parallel diode V_{fr} and t_{fr}

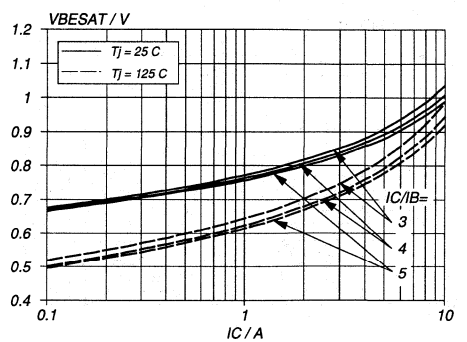


Fig.6. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

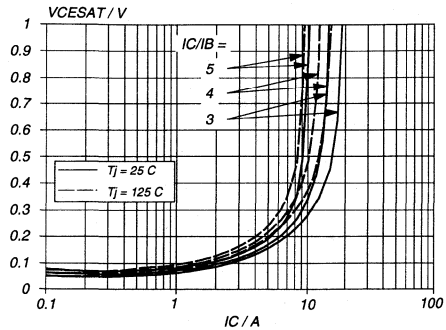


Fig.7. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

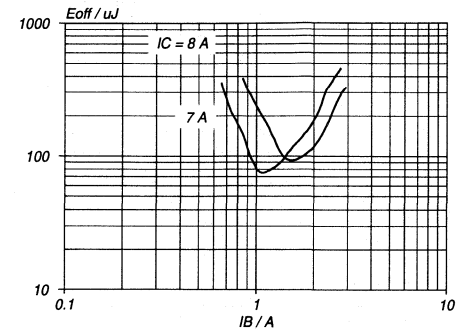


Fig.10. Typical turn-off losses. $T_j = 85^\circ C$ $Eoff = f(I_B)$; parameter I_C; f = 32 kHz

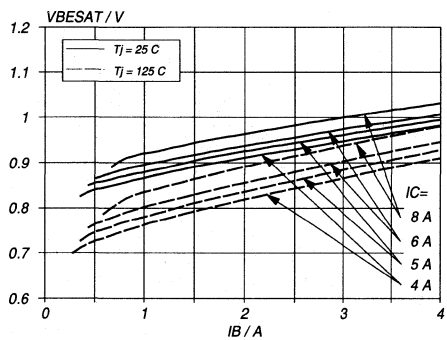


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

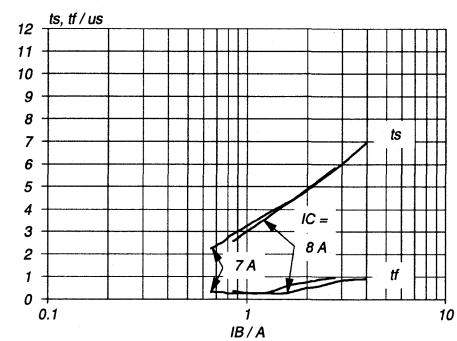


Fig.11. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 32 kHz

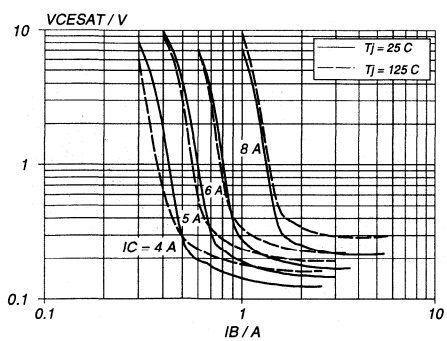


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

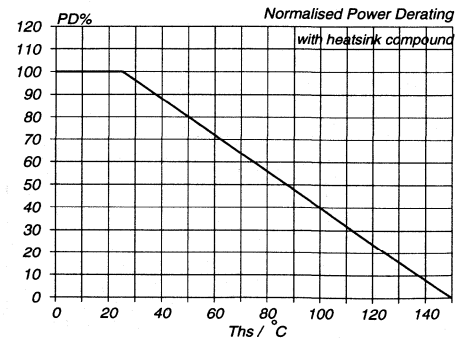


Fig.12. Normalised power dissipation. $PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

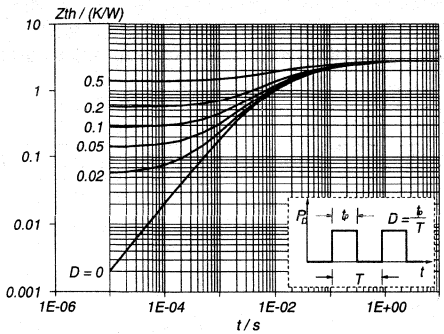


Fig.13. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

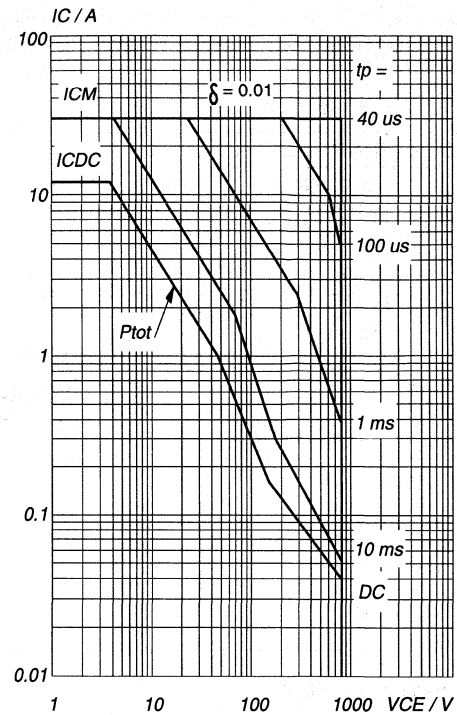


Fig.14. Forward bias safe operating area. T_{hs} = 25 °C
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2527AF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance and is suitable for operation up to 64 kHz.

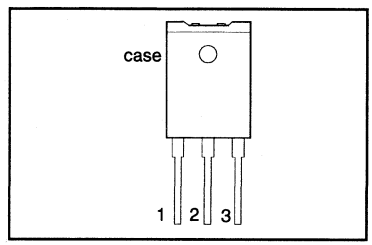
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current		6.0	-	A
t_s	Storage time	I_{Csat} = 6.0 A; $I_{B(end)}$ = 0.55 A	1.7	2.0	µs

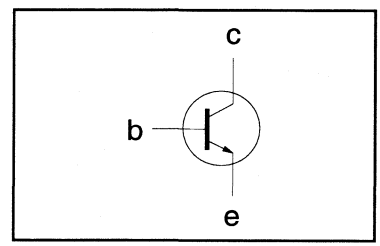
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.25	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	0.25	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	10	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	9	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.55 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ = 3.33 A/µs)			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.1	0.2	µs

2 Measured with half sine-wave voltage (curve tracer).

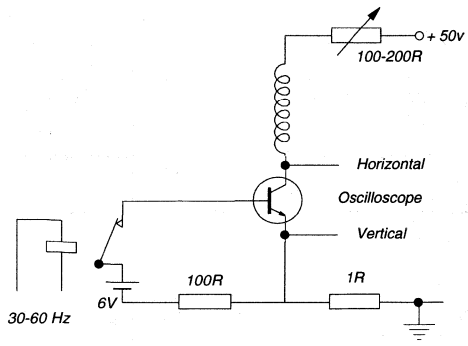


Fig.1. Test circuit for $V_{CEOsust}$.

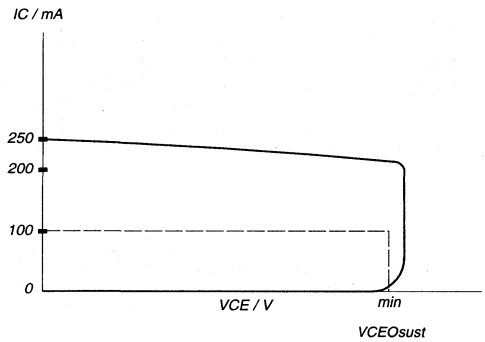


Fig.2. Oscilloscope display for $V_{CEOsust}$.

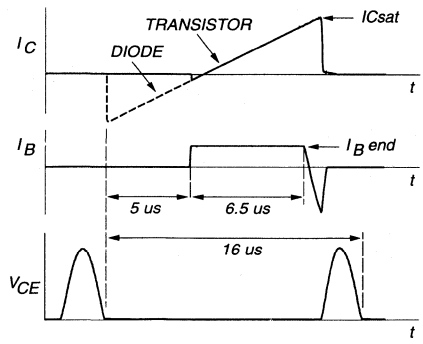


Fig.3. Switching times waveforms.

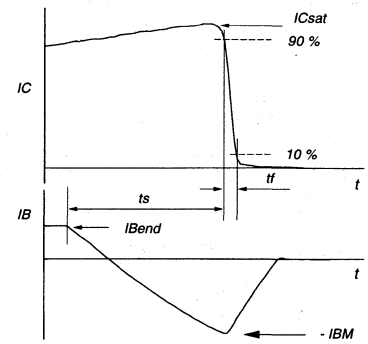


Fig.4. Switching times definitions.

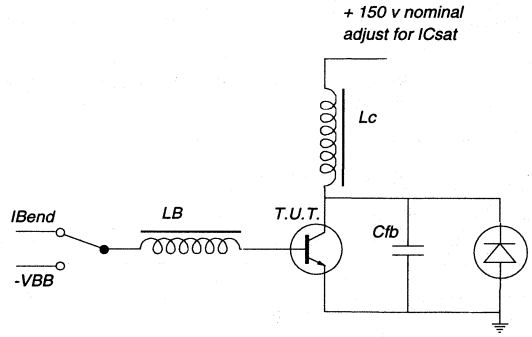


Fig.5. Switching times test circuit.

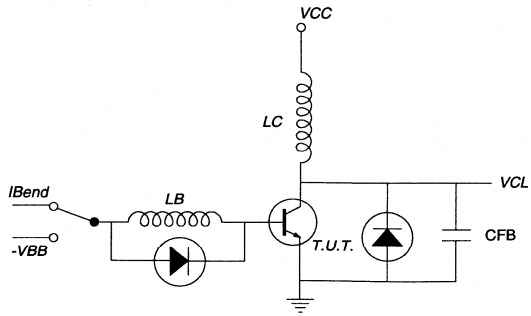


Fig.6. Test Circuit RBSOA. V_{CC} = 140 V; $-V_{BB}$ = 4 V; L_C = 100 - 200 µH; $V_{CL} \leq$ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1 - 2 A

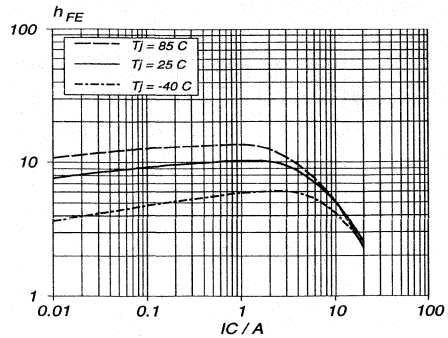


Fig.7. Typical DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

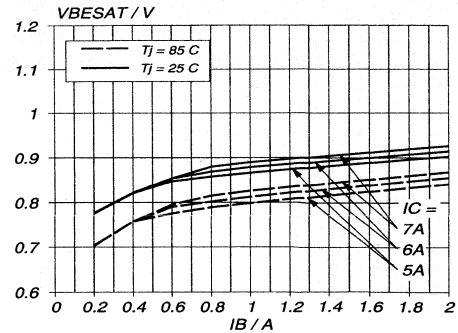


Fig.10. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

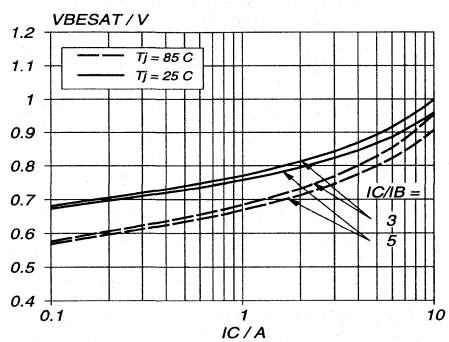


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

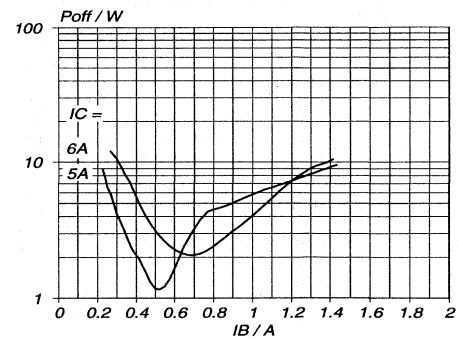


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$ $Poff = f(I_B)$; parameter I_C; f = 64 kHz

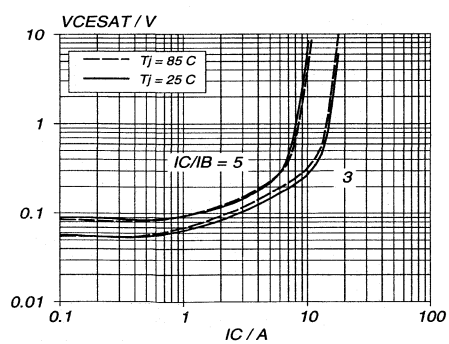


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

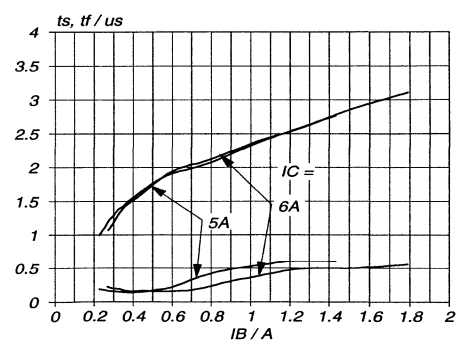


Fig.12. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 64 kHz

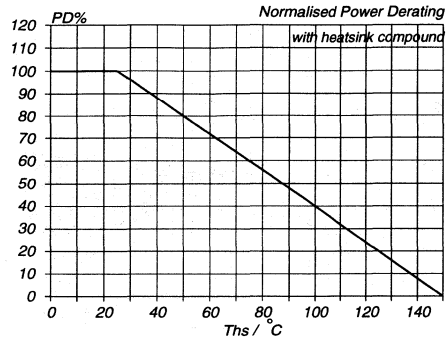


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

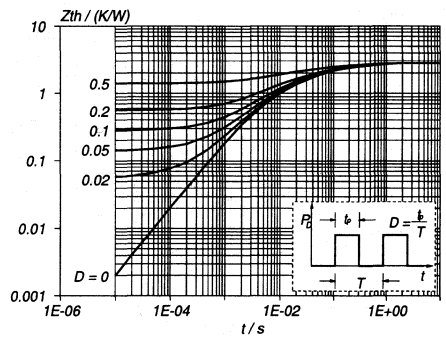


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

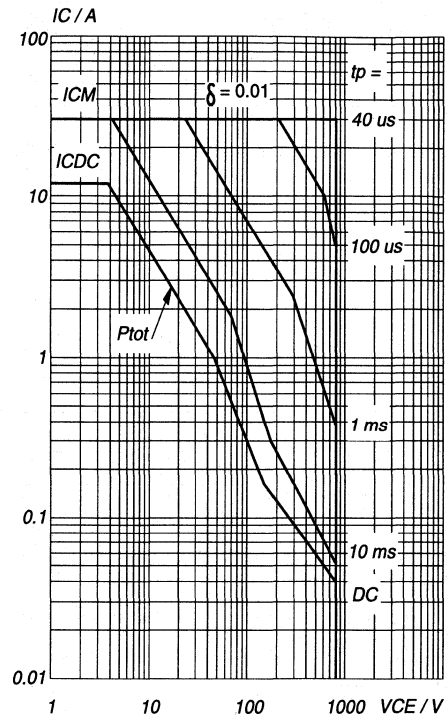


Fig.15. Forward bias safe operating area. $T_{hs} = 25\ ^\circ C$
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

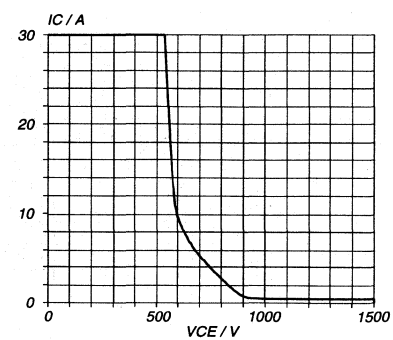


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2527AW

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance and is suitable for operation up to 64 kHz.

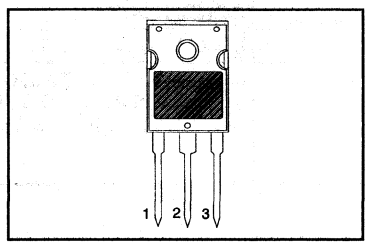
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current		6.0	-	A
t_s	Storage time	I_{csat} = 6.0 A; $I_{B(end)}$ = 0.55 A	1.7	2.0	µs

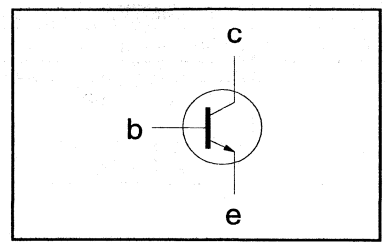
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.25	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	0.25	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	10	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	9	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (64 kHz line deflection circuit)	I_{CM} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.55 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ = 3.33 A/µs)			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.1	0.2	µs

2 Measured with half sine-wave voltage (curve tracer).

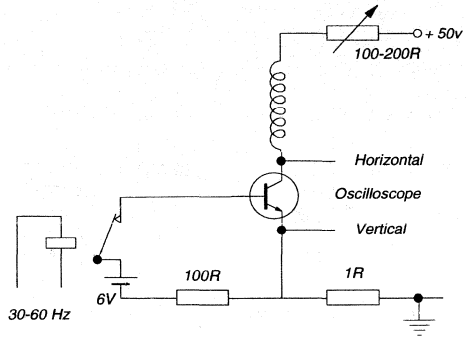


Fig.1. Test circuit for $V_{CEOsust}$.

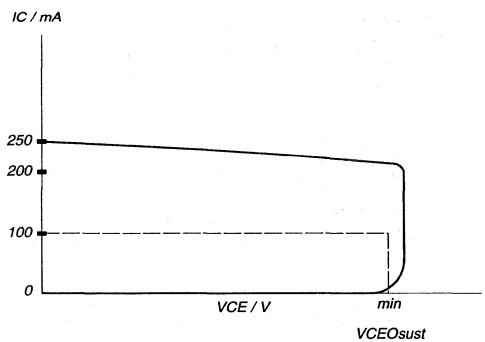


Fig.2. Oscilloscope display for $V_{CEOsust}$.

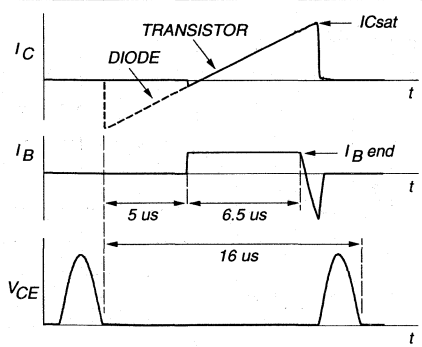


Fig.3. Switching times waveforms.

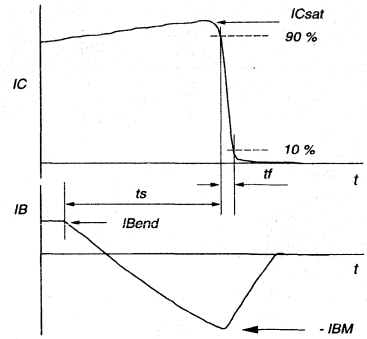


Fig.4. Switching times definitions.

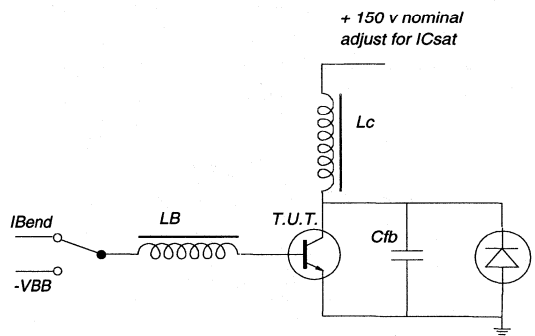


Fig.5. Switching times test circuit.

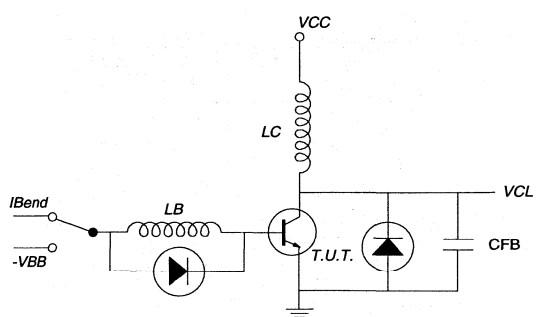


Fig.6. Test Circuit RBSOA. V_{CC} = 140 V; $-V_{BB}$ = 4 V; L_C = 100 - 200 µH; $V_{CL} \leq$ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1 - 2 A

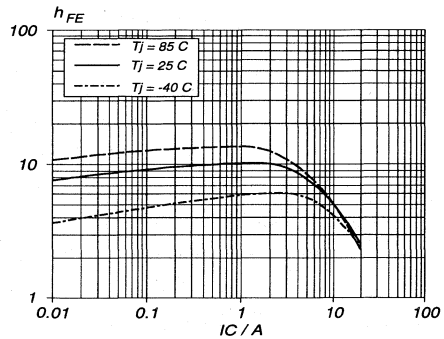


Fig.7. Typical DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

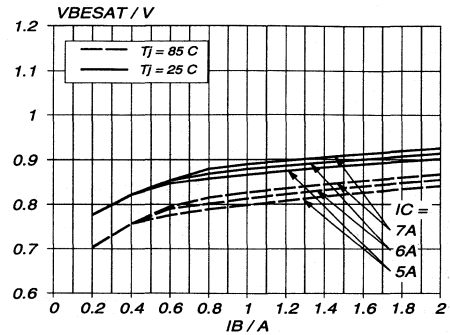


Fig.10. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

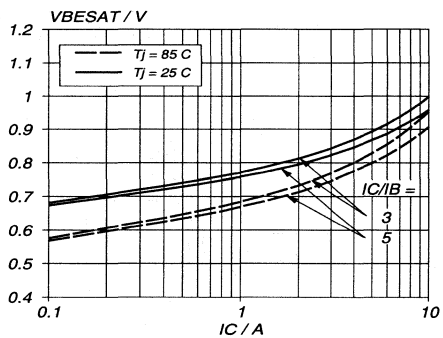


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

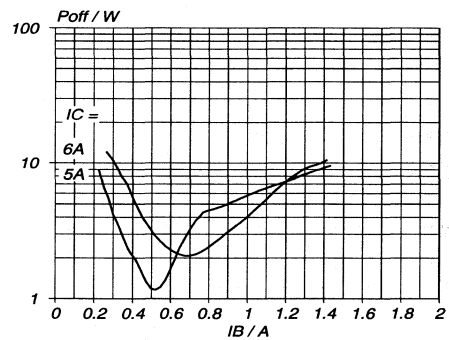


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$ $Poff = f(I_B)$; parameter I_C; f = 64 kHz

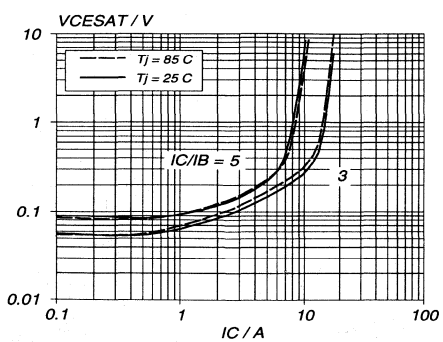


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

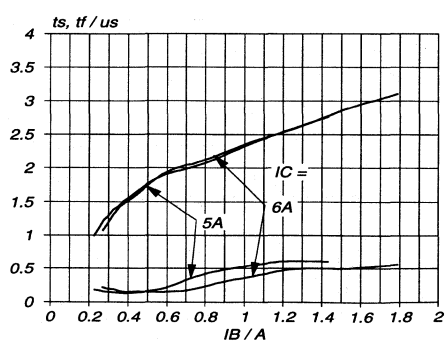


Fig.12. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 64 kHz

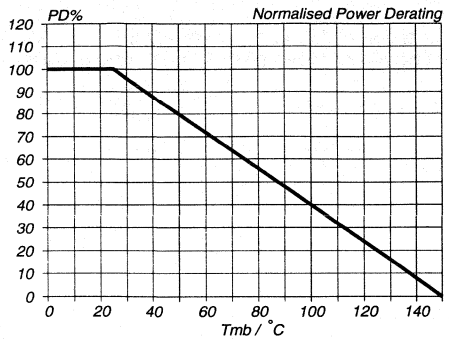


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25°C} = f(T_{mb})$

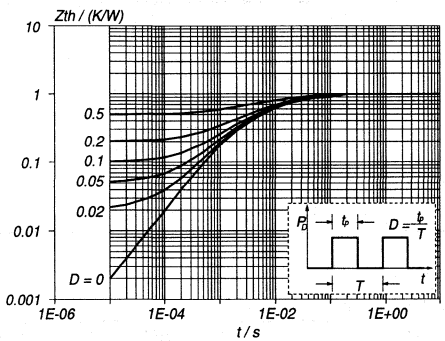


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}mb} = f(t)$; parameter $D = t_p/T$

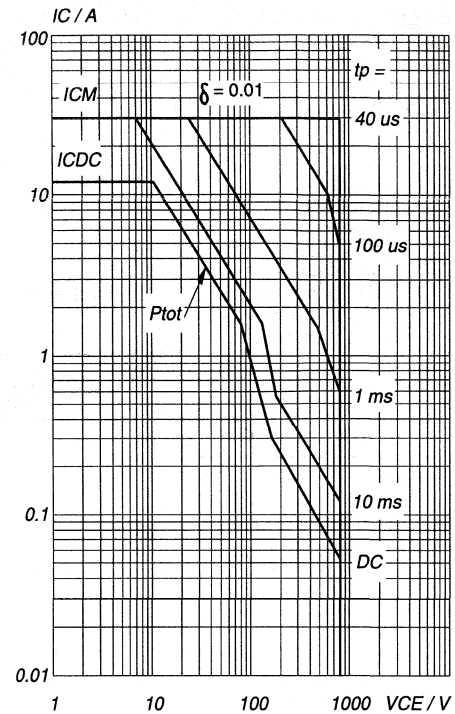


Fig.15. Forward bias safe operating area. $T_{mb} = 25$ °C
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.

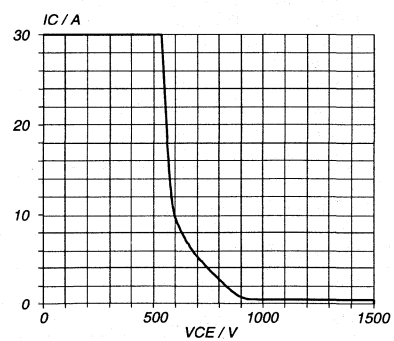


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2527AX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance and is suitable for operation up to 64 kHz.

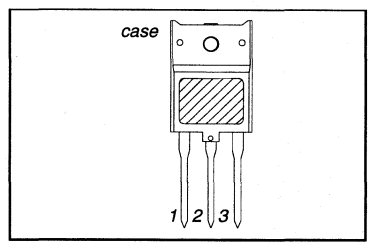
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	5.0	V
I_{Csat}	Collector saturation current		6.0	-	A
t_s	Storage time	I_{Csat} = 6.0 A; $I_{B(end)}$ = 0.55 A	1.7	2.0	µs

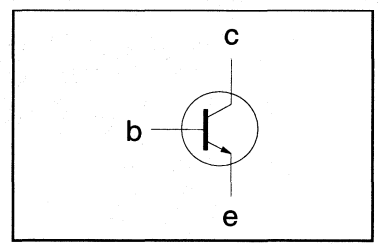
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.25	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	0.25	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.2 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	6	10	21	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	5	7	9	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.55 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ = 3.33 A/µs)			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.1	0.2	µs

2 Measured with half sine-wave voltage (curve tracer).

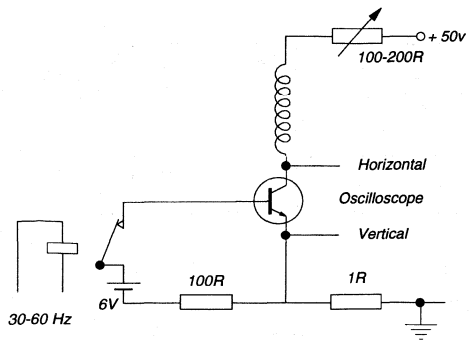


Fig.1. Test circuit for $V_{CEOsust}$.

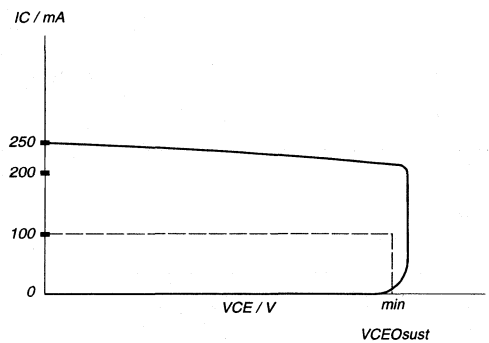


Fig.2. Oscilloscope display for $V_{CEOsust}$.

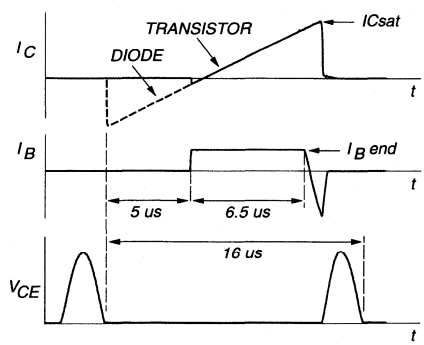


Fig.3. Switching times waveforms.

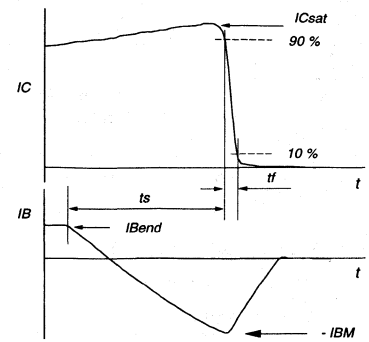


Fig.4. Switching times definitions.

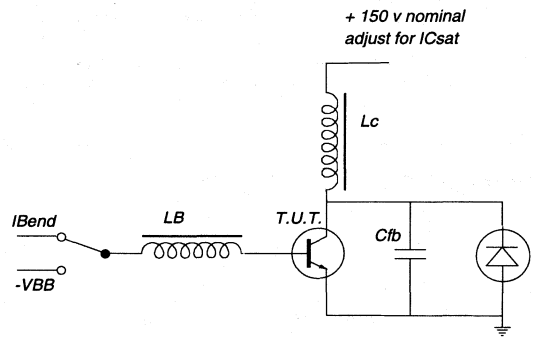


Fig.5. Switching times test circuit.

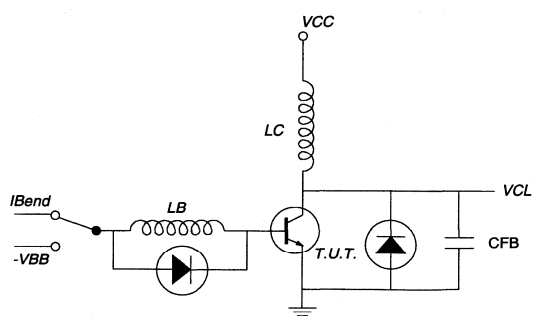


Fig.6. Test Circuit RBSOA. V_{CC} = 140 V; $-V_{BB}$ = 4 V; L_C = 100 - 200 µH; $V_{CL} \leq$ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1 - 2 A

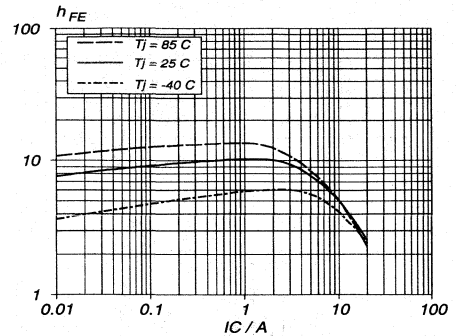


Fig.7. Typical DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

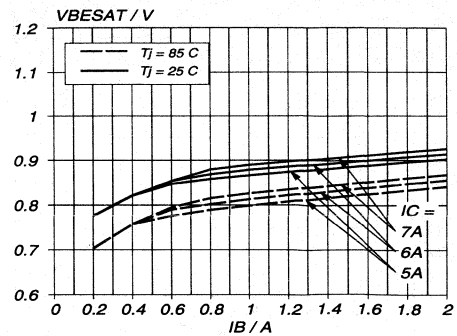


Fig.10. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

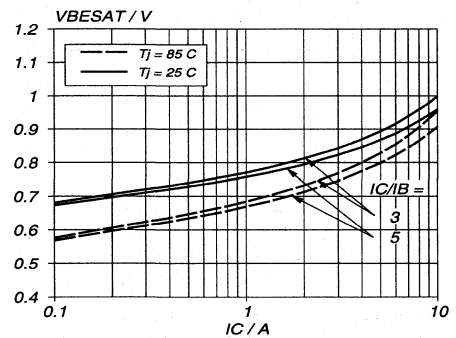


Fig.8. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

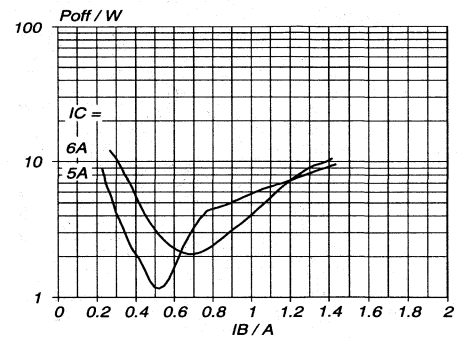


Fig.11. Typical turn-off losses. $T_j = 85°C$ $Poff = f(I_B)$; parameter I_C; f = 64 kHz

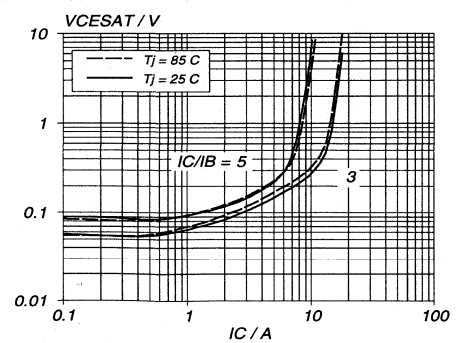


Fig.9. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

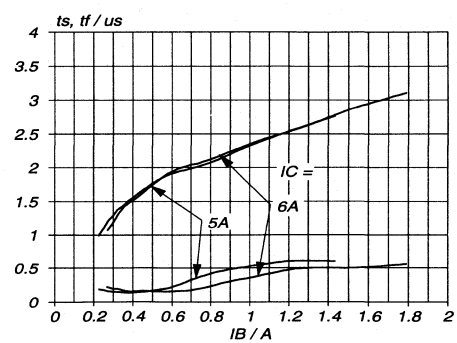


Fig.12. Typical collector storage and fall time. $ts = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85°C$; f = 64 kHz

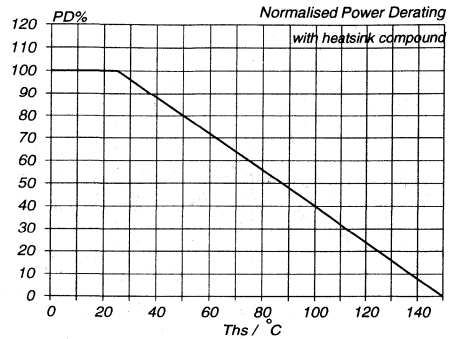


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

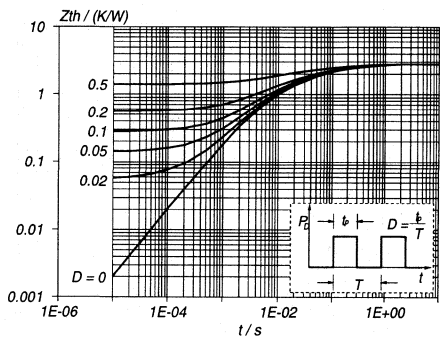


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

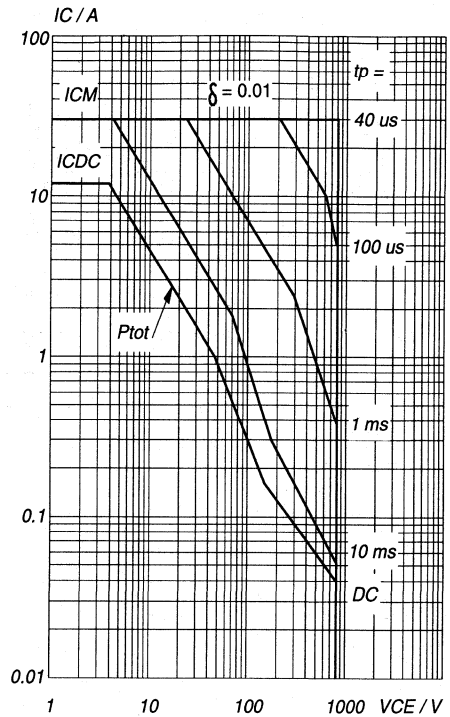


Fig.15. Forward bias safe operating area. $T_{hs} = 25\ ^\circ C$
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

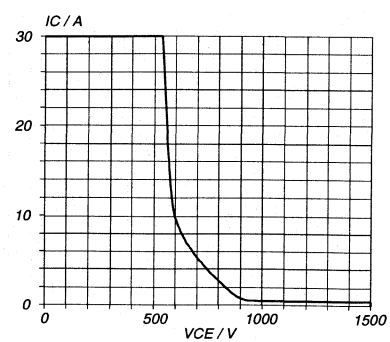


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2527DF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance.

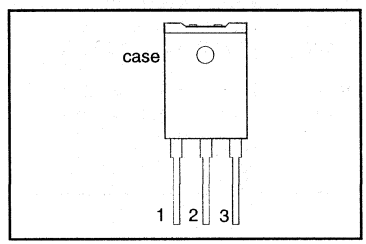
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	6.0	-	A
t_s	Storage time	I_{Csat} = 6.0 A; f = 64 kHz	1.7	2.0	µs

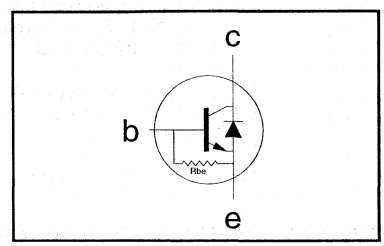
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	110	-	mA
R_{EB}	Base-emitter resistance	V_{EB} = 6.0 V	-	55	-	Ω
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A;I_C = 100mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	11	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	5	7	10	
V_F	Diode forward voltage	I_F = 8 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.55 A; L_B = 0.6 µH; -V_{BB} = 4 V;-I_{BM} = 3.6 A			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.1	0.2	µs
V_{fr}	Anti-parallel diode forward recovery voltage	I_F = 8 A; dI_F/dt = 50 A/µs	16	-	V
t_{fr}	Anti-parallel diode forward recovery time	V_F = 5 V	410	-	ns

2 Measured with half sine-wave voltage (curve tracer).

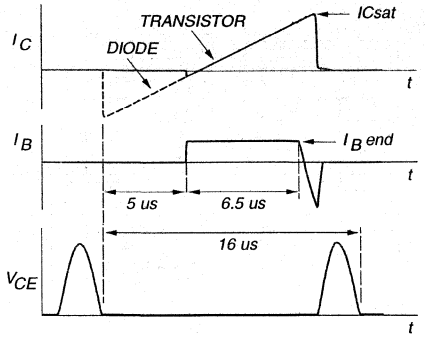


Fig.1. Switching times waveforms.

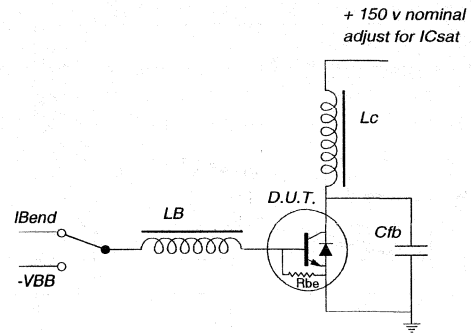


Fig.4. Switching times test circuit.

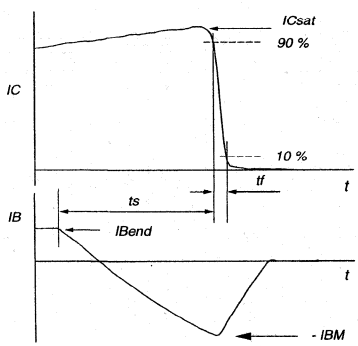


Fig.2. Switching times definitions.

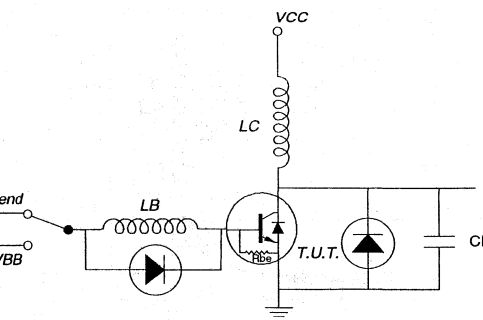


Fig.5. Test Circuit RBSOA. V_{CC} = 140 V; -V_{BB} = 4 V; L_C = 100 - 200 µH; $V_{CL} \leq$ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1 - 2 A

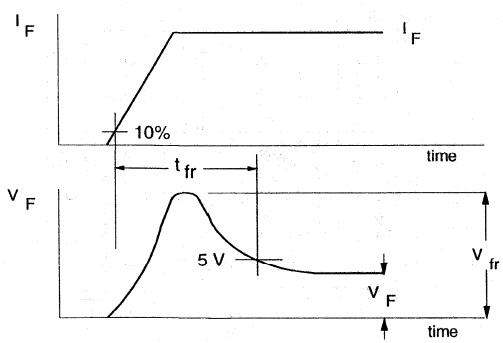


Fig.3. Definition of anti-parallel diode V_{fr} and t_{fr}

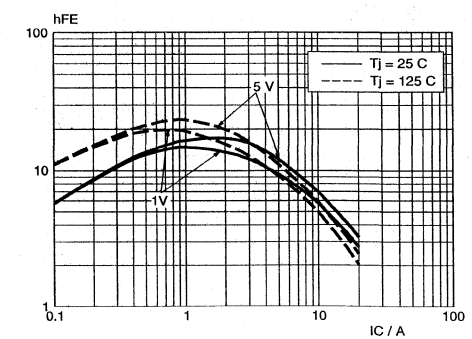


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

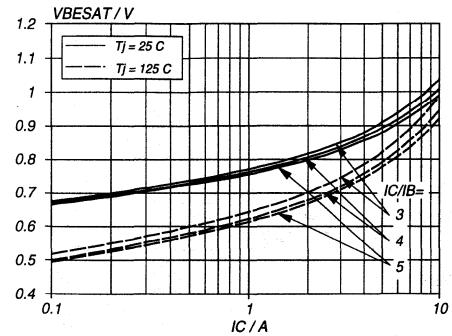


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_C)$; parameter I_C/I_B

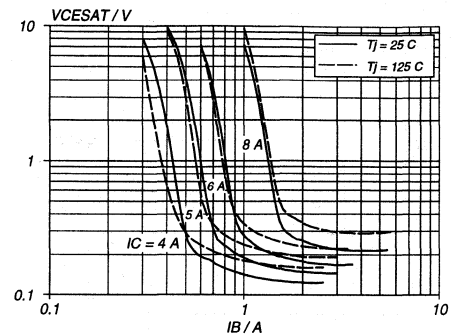


Fig.10. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_B)$; parameter I_C

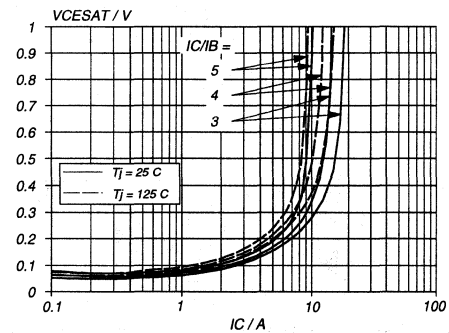


Fig.8. Typical collector-emitter saturation voltage.
$V_{CE}sat = f(I_C)$; parameter I_C/I_B

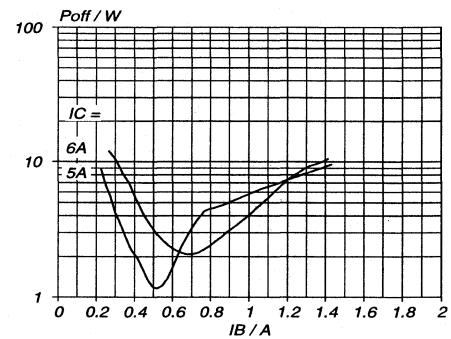


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$
$E_{off} = f(I_B)$; parameter I_C; f = 64 kHz

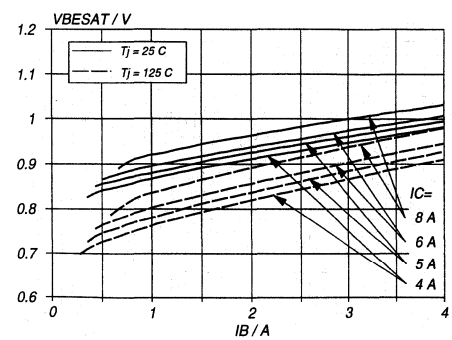


Fig.9. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

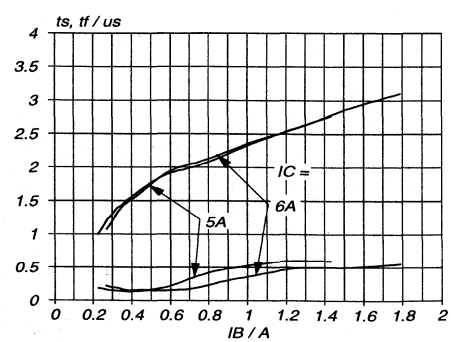


Fig.12. Typical collector storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 64 kHz

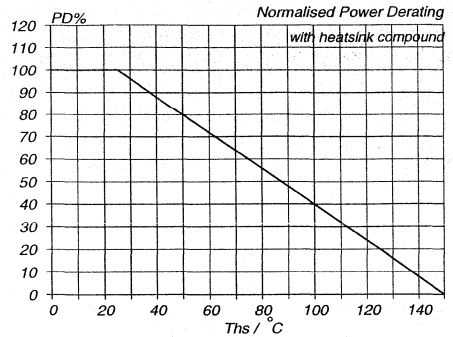


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

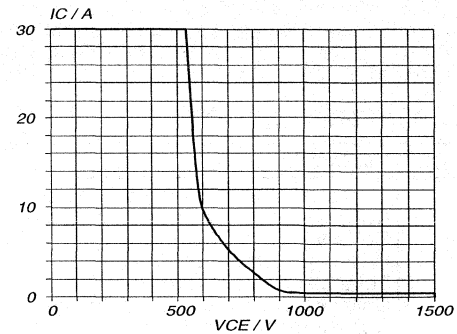


Fig.15. Reverse bias safe operating area. $T_j \leq T_{jmax}$

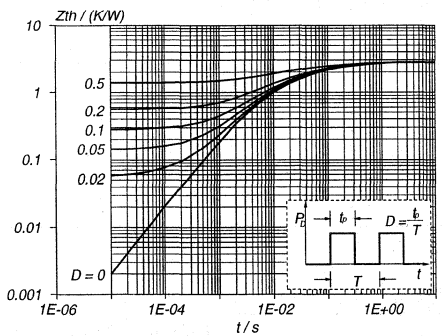


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

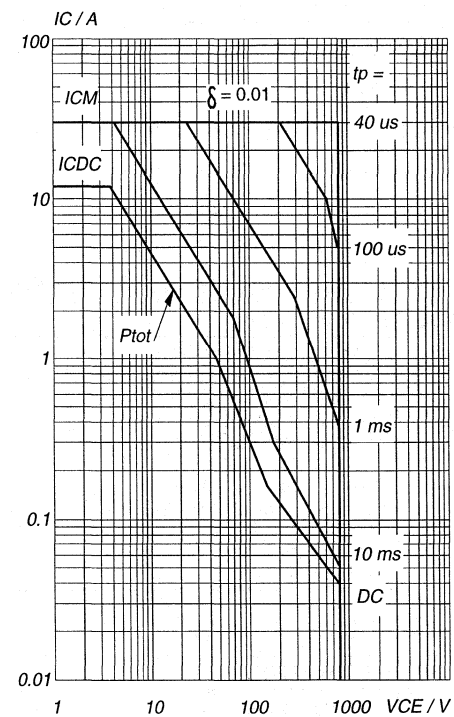


Fig.16. Forward bias safe operating area. $T_{hs} = 25\ ^\circ C$
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2527DX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor with integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Features improved RBSOA performance.

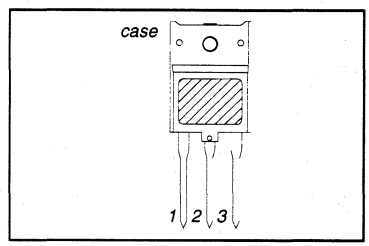
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	6.0	-	A
t_s	Storage time	I_{Csat} = 6.0 A; f = 64 kHz	1.7	2.0	µs

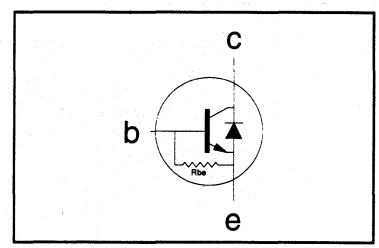
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	110	-	mA
R_{EB}	Base-emitter resistance	V_{EB} = 6.0 V	-	55	-	Ω
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8.0 A; I_B = 1.6 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	11	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	5	7	10	
V_F	Diode forward voltage	I_F = 8 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 6.0 A; L_C = 170 µH; C_{fb} = 5.4 nF; $I_{B(end)}$ = 0.55 A; L_B = 0.6 µH; $-V_{BB}$ = 4 V;$-I_{BM}$ = 3.6 A			
t_s	Turn-off storage time		1.7	2.0	µs
t_f	Turn-off fall time		0.1	0.2	µs
V_{fr}	Anti-parallel diode forward recovery voltage	I_F = 8 A; dI_F/dt = 50 A/µs	16	-	V
t_{fr}	Anti-parallel diode forward recovery time	V_F = 5 V	410	-	ns

2 Measured with half sine-wave voltage (curve tracer).

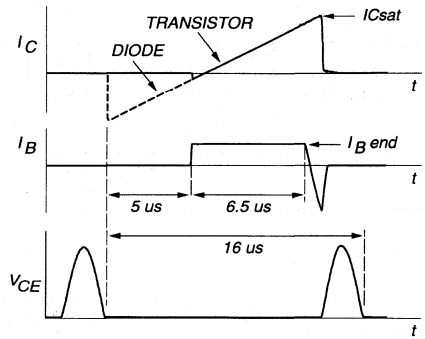


Fig.1. Switching times waveforms.

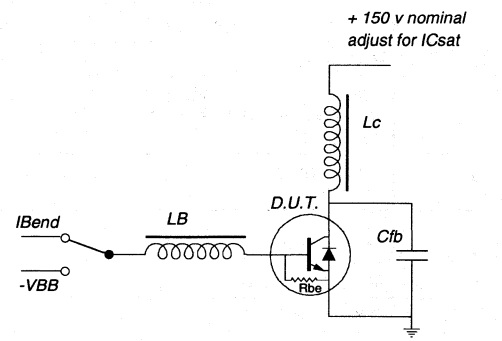


Fig.4. Switching times test circuit.

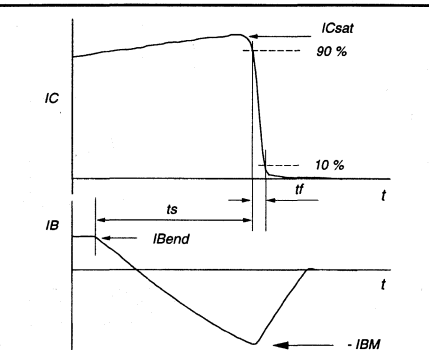


Fig.2. Switching times definitions.

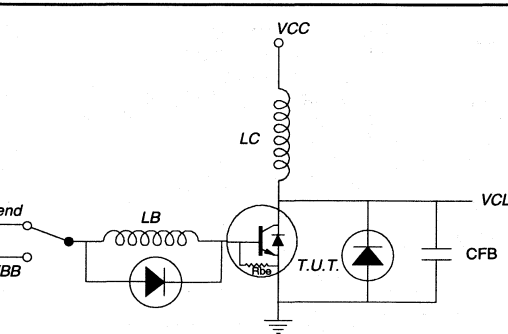


Fig.5. Test Circuit RBSOA. V_{CC} = 140 V; $-V_{BB}$ = 4 V; L_C = 100 - 200 µH; $V_{CL} \leq$ 1500 V; L_B = 3 µH; C_{FB} = 1 - 2.2 nF; I_B(end) = 1 - 2 A

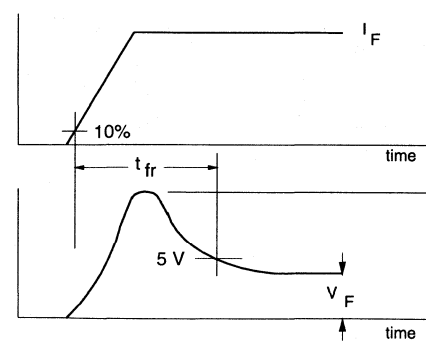


Fig.3. Definition of anti-parallel diode V_{fr} and t_{fr}

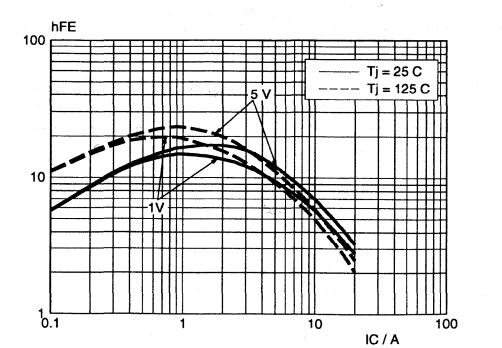


Fig.6. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

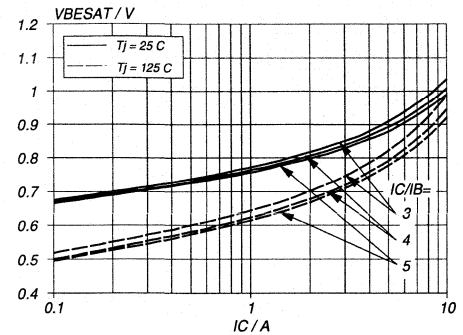


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_C)$; parameter I_C/I_B

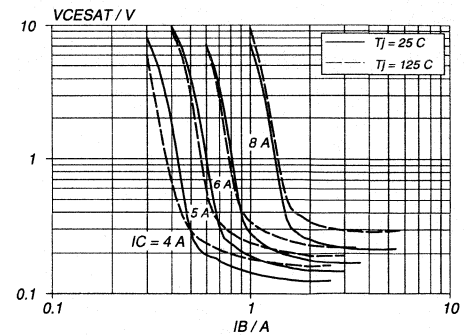


Fig.10. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_B)$; parameter I_C

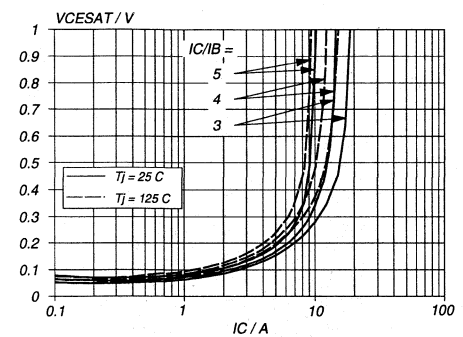


Fig.8. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

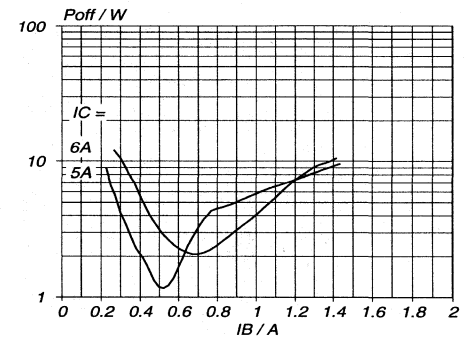


Fig.11. Typical turn-off losses. $T_j = 85^\circ C$ Eoff = $f(I_B)$; parameter I_C; f = 64 kHz

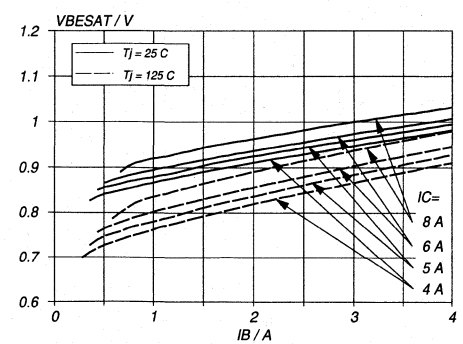


Fig.9. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

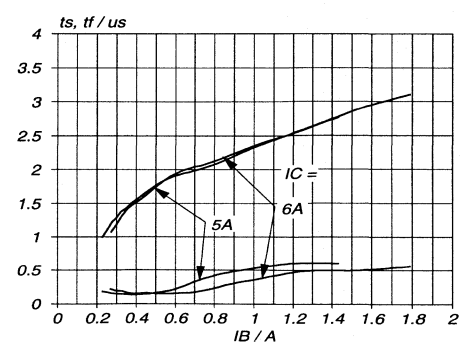


Fig.12. Typical collector storage and fall time. ts = $f(I_B)$; tf = $f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 64 kHz

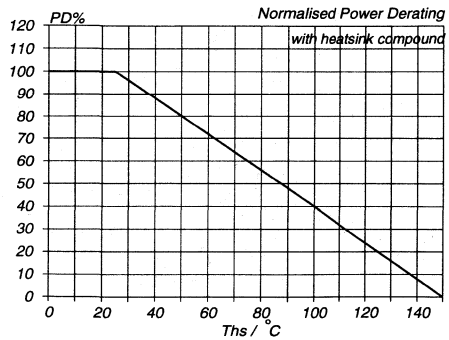


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{hs})$

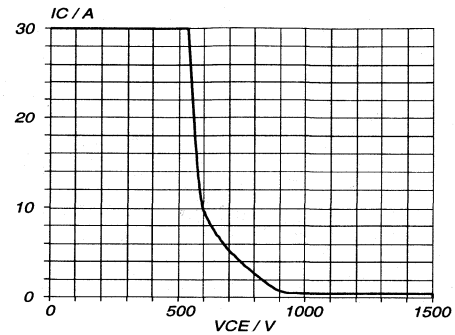


Fig.15. Reverse bias safe operating area. $T_j \leq T_{jmax}$

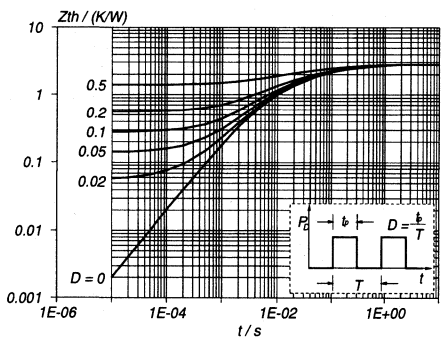


Fig.14. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

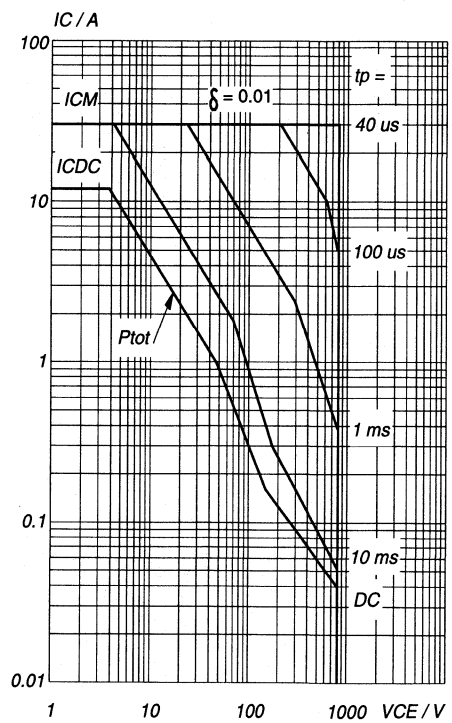


Fig.16. Forward bias safe operating area. $T_{hs} = 25\ ^\circ C$
I_{CDC} & $I_{CM} = f(V_{CE})$; I_{CM} single pulse; parameter t_p
Second-breakdown limits independant of temperature.
Mounted with heatsink compound.

Silicon Diffused Power Transistor — BU2530AL

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

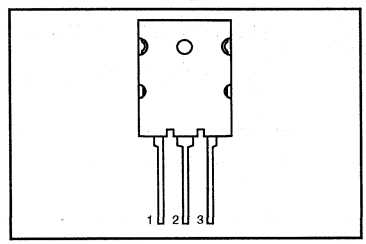
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	$I_C = 9.0$ A; $I_B = 1.64$ A	-	5.0	V
I_{Csat}	Collector saturation current		9	-	A
t_s	Storage time	$I_{Csat} = 9.0$ A; $I_{B(end)} = 1.3$ A	3.5	4.5	µs

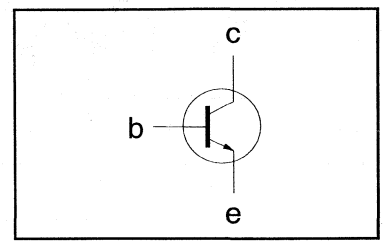
PINNING - SOT430

PIN	DESCRIPTION
1	base
2	collector
3	emitter
heat sink	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$ V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	15	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Base-emitter breakdown voltage	I_B = 1 mA	7.5	14	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 1.64 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A; I_B = 1.64 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	17	-	
h_{FE}		I_C = 9 A; V_{CE} = 5 V	5.5	8	10	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (32 kHz line deflection dynamic test circuit).	I_{Csat} = 9.0 A; L_C = 200 µH; C_{fb} = 13 nF; V_{CC} = 138 V; $I_{B(end)}$ = 1.3 A; $-I_{BM}$ = 4.5 A; $-V_{BB}$ = 4 V; L_B = 1 µH			
t_s	Turn-off storage time		3.5	4.5	µs
t_f	Turn-off fall time		0.14	0.25	µs

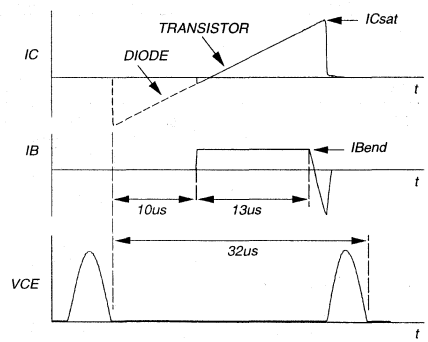


Fig.1. Switching times waveforms.

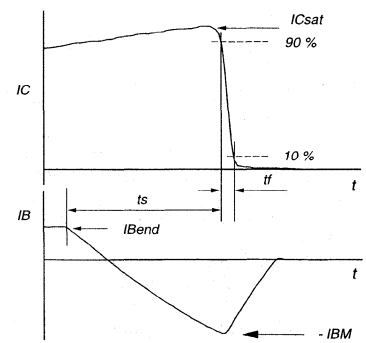


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

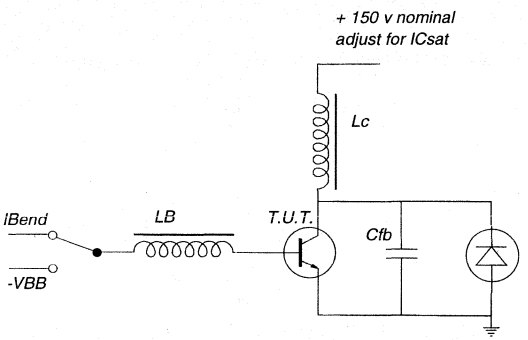


Fig.3. Switching times test circuit.

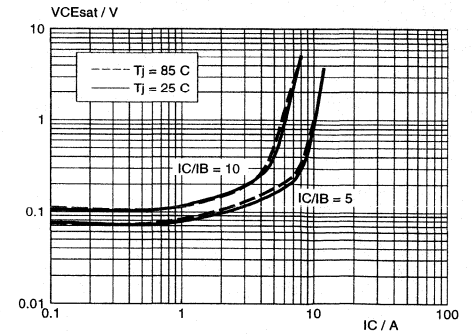


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

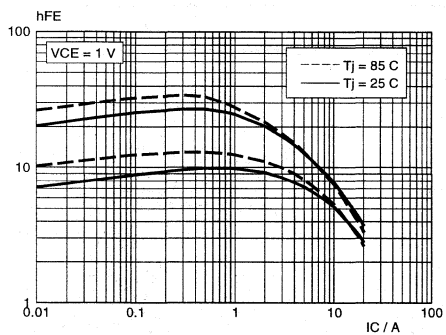


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

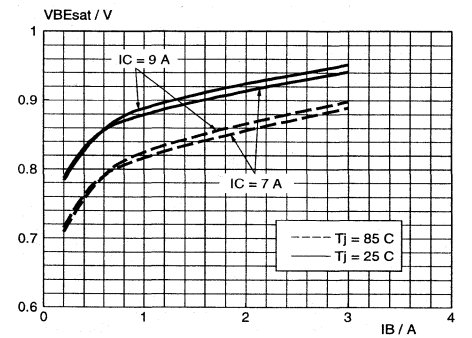


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

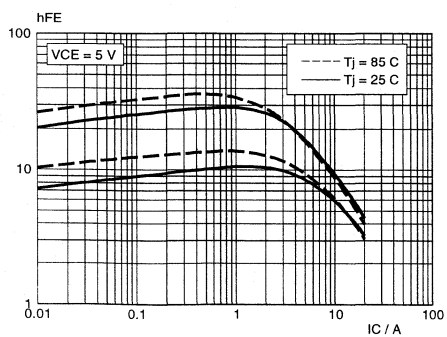


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

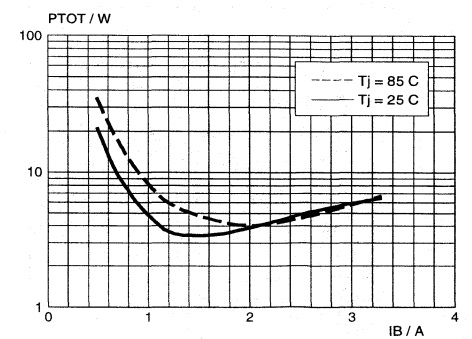


Fig.8. Typical turn-off losses. $P_{TOT} = f(I_B)$; parameter I_C; f = 32 kHz

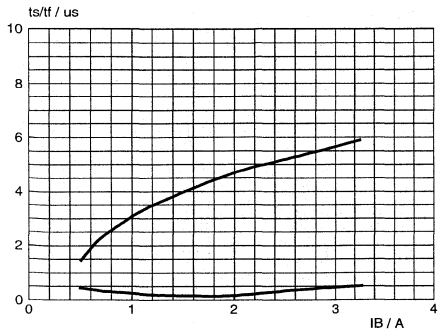


Fig.9. Typical collector storage and fall time.
ts = f (I_B); tf = f (I_B); parameter I_C; T_j = 85˚C; f = 32 kHz

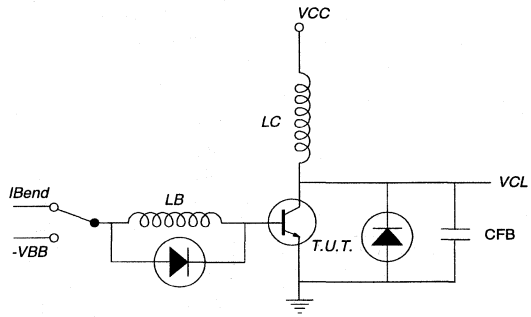


Fig.12. Test Circuit RBSOA. V_{CC} = 150 V;
$-V_{BB}$ = 1 - 5 V;
L_C = 1.5 mH; V_{CL} = 1450 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 10 nF; $I_{B(end)}$ = 1.3 - 2.6 A

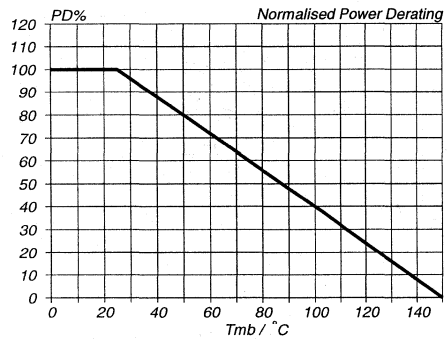


Fig.10. Normalised power dissipation.
PD% = 100·P_D/$P_{D\ 25˚C}$ = f (T_{mb})

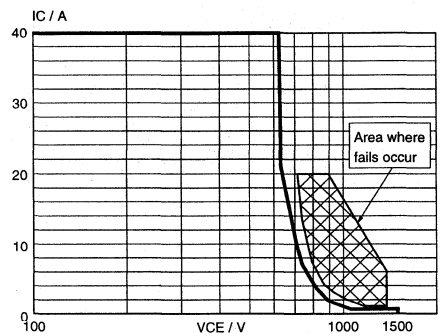


Fig.13. Reverse bias safe operating area. $T_j \leq T_{jmax}$

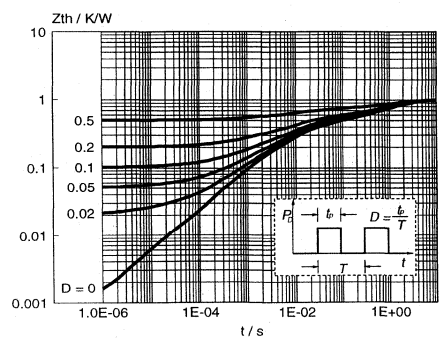


Fig.11. Transient thermal impedance.
$Z_{th\ j\text{-}mb}$ = f(t); parameter D = t_p/T

Silicon Diffused Power Transistor — BU2530AW

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of large screen colour television receivers up to 32 kHz.

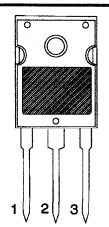
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	$I_C = 9.0$ A; $I_B = 1.64$ A	-	5.0	V
I_{Csat}	Collector saturation current		9	-	A
t_s	Storage time	$I_{Csat} = 9.0$ A; $I_{B(end)} = 1.3$ A	3.5	4.5	µs

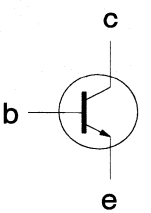
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$ V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	15	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Base-emitter breakdown voltage	I_B = 1 mA	7.5	14	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 1.64 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A; I_B = 1.64 A	0.825	0.91	1.0	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	9	17	27	
h_{FE}		I_C = 9 A; V_{CE} = 5 V	5.5	8	10	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (32 kHz line deflection dynamic test circuit).	I_{Csat} = 9.0 A; L_C = 200 µH; C_{fb} = 13 nF; V_{CC} = 138 V; $I_{B(end)}$ = 1.3 A; $-I_{BM}$ = 4.5 A; $-V_{BB}$ = 4 V; L_B = 1 µH			
t_s	Turn-off storage time		3.5	4.5	µs
t_f	Turn-off fall time		0.14	0.25	µs

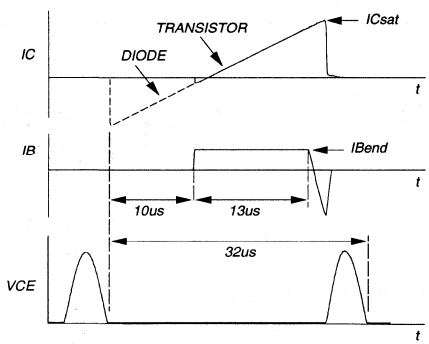


Fig.1. Switching times waveforms.

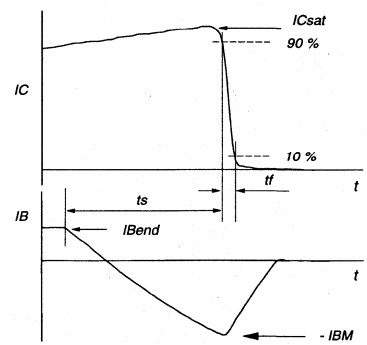


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

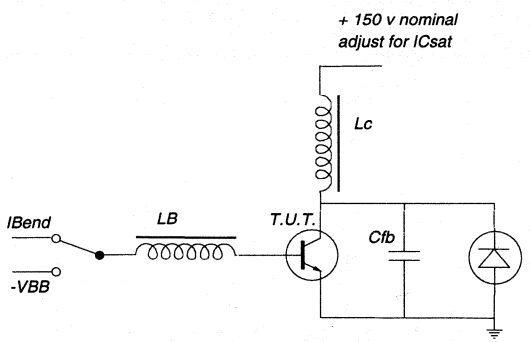


Fig.3. Switching times test circuit.

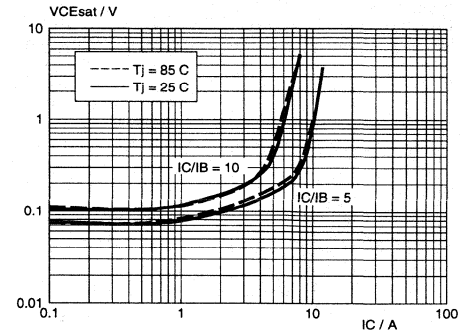


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

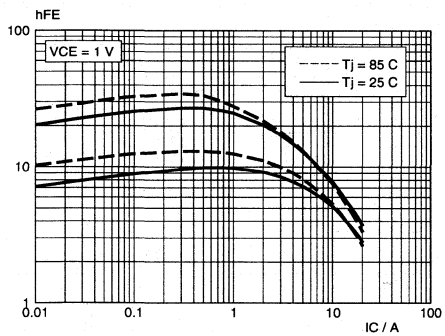


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

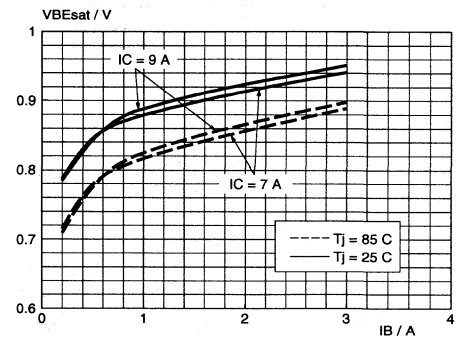


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

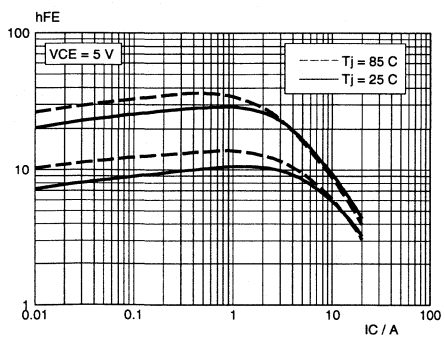


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

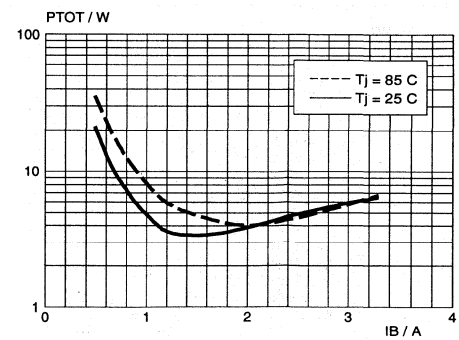


Fig.8. Typical turn-off losses. $P_{TOT} = f(I_B)$; parameter I_C; f = 32 kHz

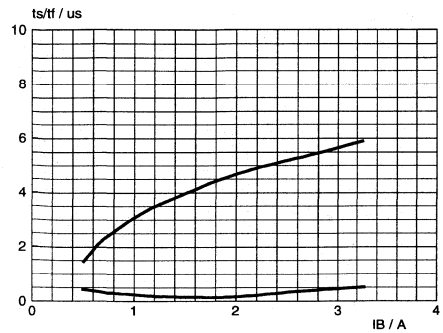


Fig.9. Typical collector storage and fall time.
ts = f (I_B); tf = f (I_B); parameter I_C; T_j = 85˚C; f = 32 kHz

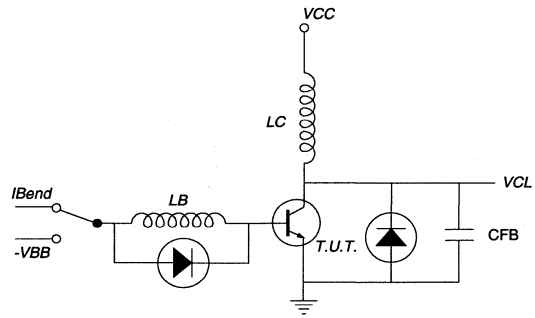


Fig.12. Test Circuit RBSOA. V_{CC} = 150 V;
-V_{BB} = 1 - 5 V;
L_C = 1.5 mH; V_{CL} = 1450 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 10 nF; $I_{B(end)}$ = 1.3 - 2.6 A

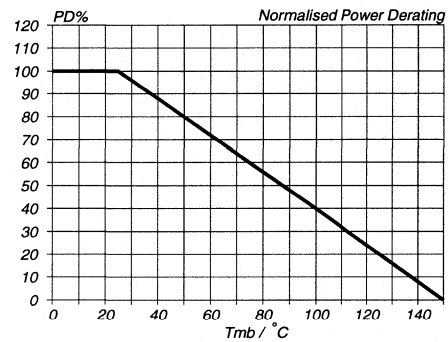


Fig.10. Normalised power dissipation.
PD% = 100·P_D/$P_{D\,25˚C}$ = f (T_{mb})

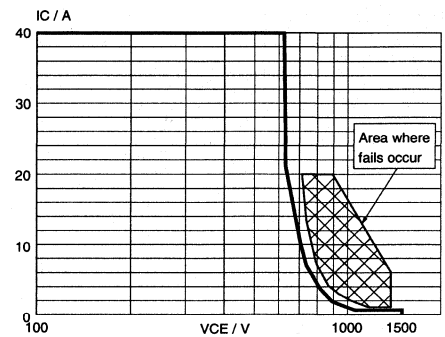


Fig.13. Reverse bias safe operating area. $T_j \leq T_{jmax}$

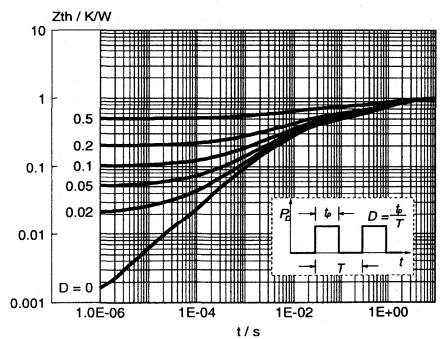


Fig.11. Transient thermal impedance.
$Z_{th\,j\text{-}mb}$ = f(t); parameter D = t_p/T

Silicon Diffused Power Transistor — BU2532AL

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of high resolution monitors up to 82 kHz.

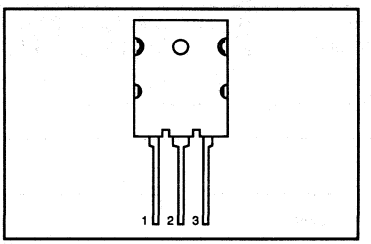
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	$I_C = 7.0$ A; $I_B = 1.17$ A	-	5.0	V
I_{Csat}	Collector saturation current		7	-	A
t_s	Storage time	$I_{Csat} = 7.0$ A; $I_{B(end)} = 1$ A	1.4	1.8	µs

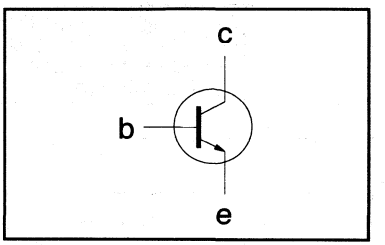
PINNING - SOT430

PIN	DESCRIPTION
1	base
2	collector
3	emitter
heat sink	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$ V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	15	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Base-emitter breakdown voltage	I_B = 1 mA	7.5	14	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.17 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7.0 A; I_B = 1.17 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	17	-	
h_{FE}		I_C = 7 A; V_{CE} = 5 V	6	9	12.5	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (82 kHz line deflection dynamic test circuit).	I_{Csat} = 7.0 A; L_C = 100 µH; C_{fb} = 3 nF; V_{CC} = 138 V; $I_{B(end)}$ = 1.0 A			
t_s	Turn-off storage time		1.4	1.8	µs
t_f	Turn-off fall time		0.06	0.1	µs

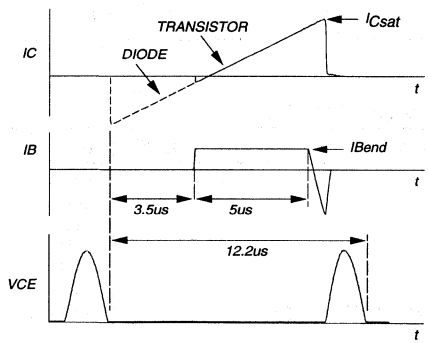


Fig.1. Switching times waveforms.

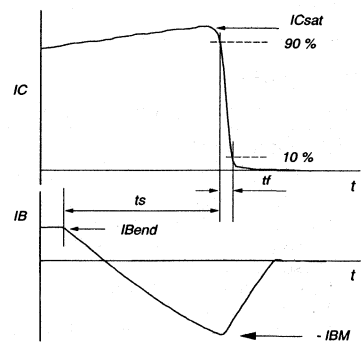


Fig.2. Switching times definitions.

2 Measured with half sine-wave voltage (curve tracer).

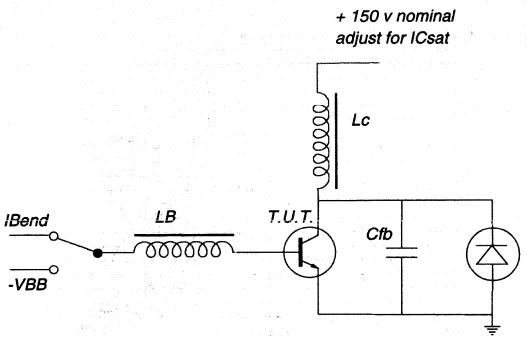


Fig.3. Switching times test circuit.

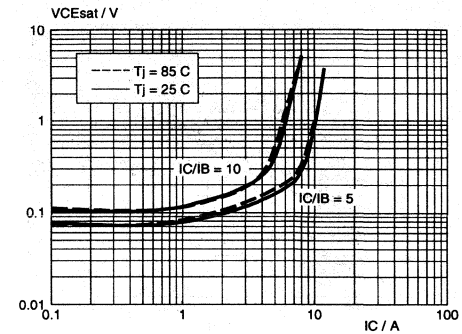


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

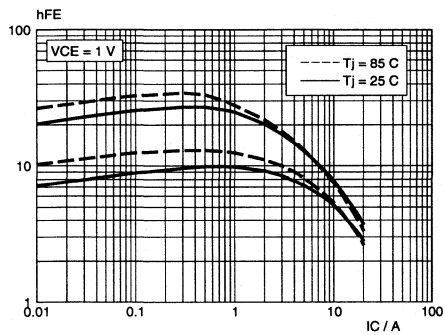


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

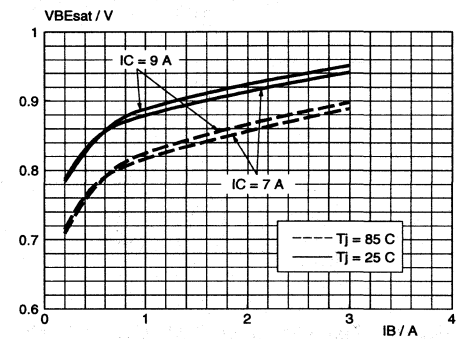


Fig.7. Typical base-emitter saturation voltage. $V_{BE}sat = f(I_B)$; parameter I_C

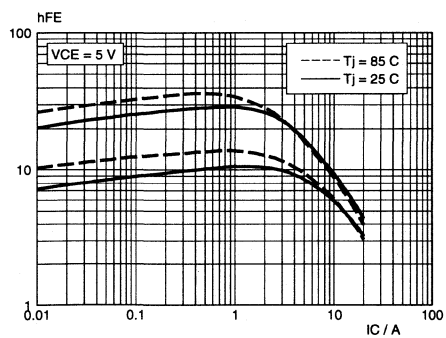


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

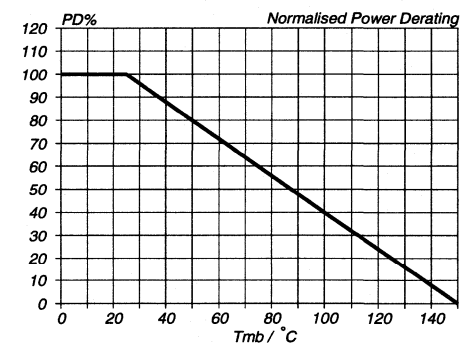


Fig.8. Normalised power dissipation. $PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

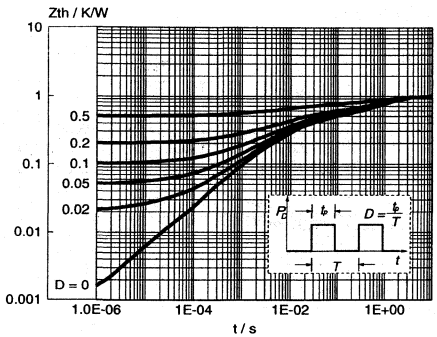


Fig.9. Transient thermal impedance. $Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

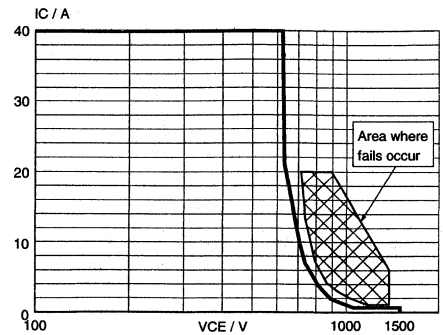


Fig.11. Reverse bias safe operating area. $T_j \leq T_{jmax}$

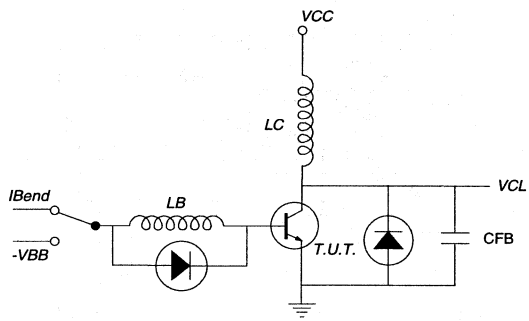


Fig.10. Test Circuit RBSOA. V_{CC} = 150 V; $-V_{BB}$ = 1 - 5 V; L_C = 1.5 mH; V_{CL} = 1450 V; L_B = 0.3 - 2 µH; C_{FB} = 1 - 10 nF; $I_{B(end)}$ = 1.0 - 2.0 A

Silicon Diffused Power Transistor — BU2532AW

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of high resolution monitors.

QUICK REFERENCE DATA

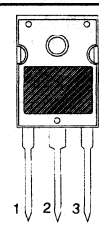
SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.17 A	-	5.0	V
I_{Csat}	Collector saturation current	f = 82 kHz	7	-	A
t_s	Storage time	I_{Csat} = 7.0 A; f = 82 kHz	1.4	1.8	µs

OBJECTIVE
See Philips Semiconductors for design-in information

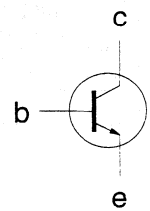
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	15	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Base-emitter breakdown voltage	I_B = 1 mA	7.5	14	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.17 A	-	-	5.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7.0 A; I_B = 1.17 A	0.80	0.88	0.97	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	9	17	27	
h_{FE}		I_C = 7 A; V_{CE} = 5 V	6	9	12.5	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (82 kHz line deflection dynamic test circuit).	I_{Csat} = 7.0 A; L_C = 100 µH; C_{fb} = 3 nF; V_{CC} = 138 V; $I_{B(end)}$ = 1.0 A			
t_s	Turn-off storage time		1.4	1.8	µs
t_f	Turn-off fall time		0.06	0.1	µs

2 Measured with half sine-wave voltage (curve tracer).

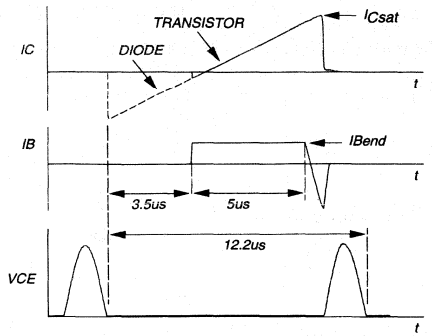


Fig.1. Switching times waveforms.

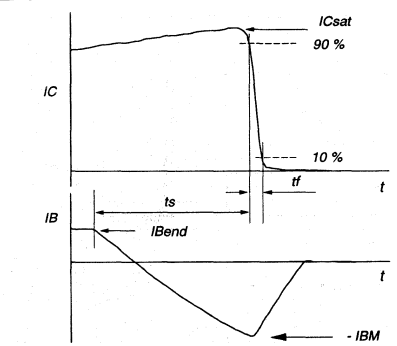


Fig.2. Switching times definitions.

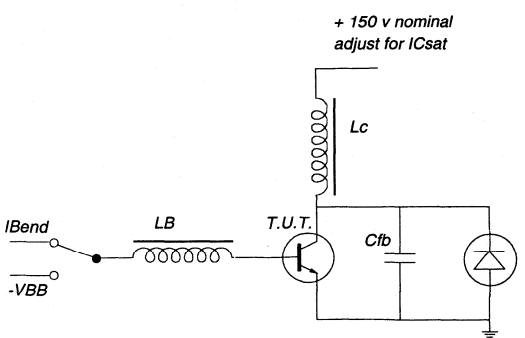


Fig.3. Switching times test circuit.

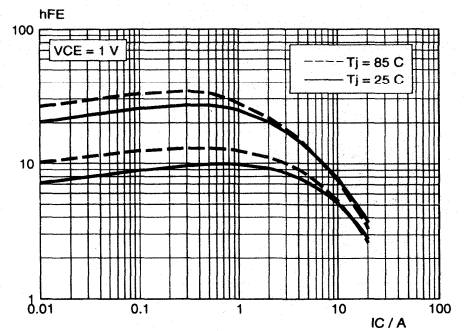


Fig.4. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 1$ V

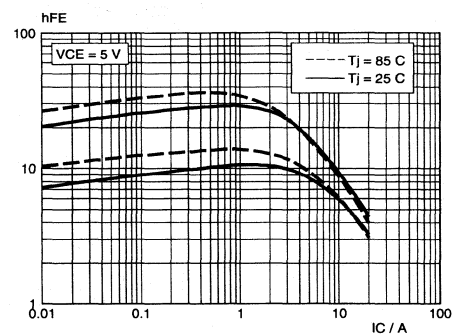


Fig.5. High and low DC current gain. $h_{FE} = f(I_C)$ $V_{CE} = 5$ V

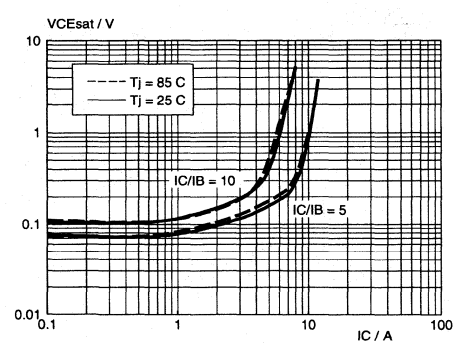


Fig.6. Typical collector-emitter saturation voltage. $V_{CE}sat = f(I_C)$; parameter I_C/I_B

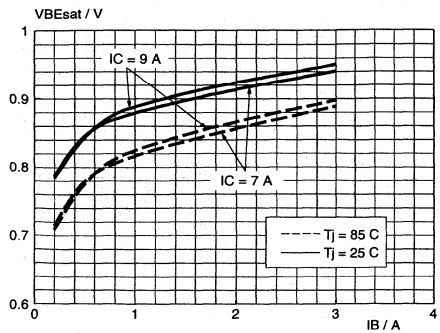


Fig.7. Typical base-emitter saturation voltage.
$V_{BE}sat = f(I_B)$; parameter I_C

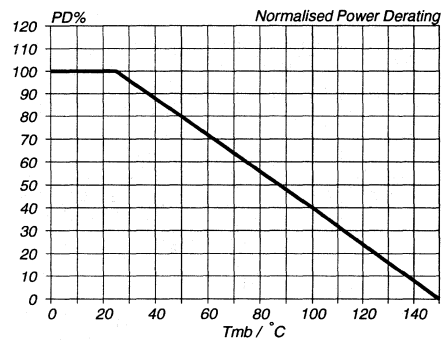


Fig.8. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C} = f(T_{mb})$

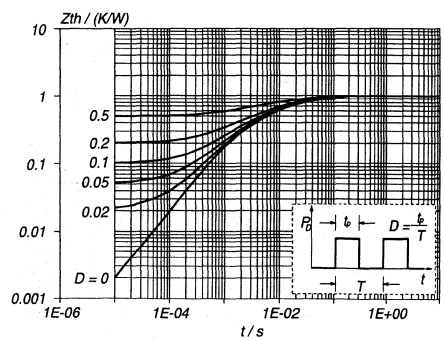


Fig.9. Transient thermal impedance.
$Z_{th\,j\text{-}mb} = f(t)$; parameter $D = t_p/T$

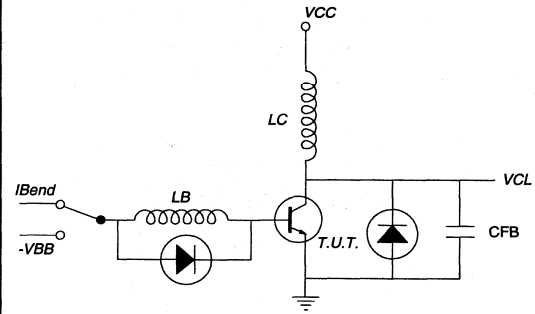


Fig.10. Test Circuit RBSOA. V_{CC} = 150 V; $-V_{BB}$ = 1 - 5 V; L_C = 1.5 mH; V_{CL} = 1450 V; L_B = 0.3 - 2 µH; C_{FB} = 1 - 10 nF; $I_{B(end)}$ = 1.0 - 2.0 A

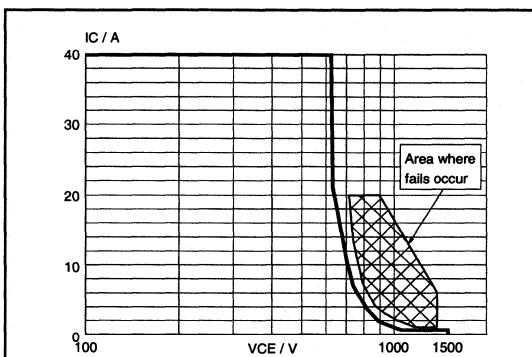


Fig.11. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2708AF

GENERAL DESCRIPTION

High voltage, high speed switching npn transistor in a plastic full-pack envelope. Intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations, resulting in a low worst-case dissipation. Designed to withstand V_{CES} pulses up to 1700 V.

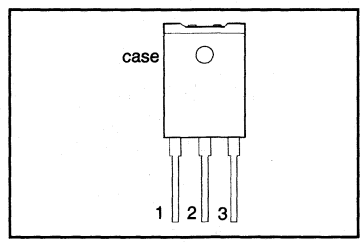
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	4	-	A
t_s	Storage time	I_{Csat} = 4 A; f = 16 kHz	4.8	5.5	µs

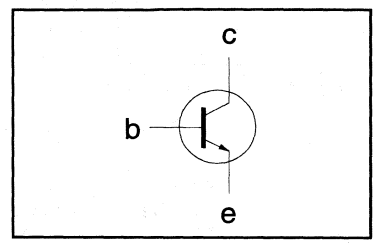
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	-	70	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	900	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	0.83	0.91	1.00	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	21	-	
h_{FE}		I_C = 4 A; V_{CE} = 1 V	3	6	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (line deflection circuit 16 kHz)	I_{Csat} = 4 A; $I_{B(end)}$ = 0.8 A; $-I_{BM}$ = I_{CM}/2; L_B = 6 µH; $-V_{BB}$ = 4 V; L_C = 1 mH; C_{FB} = 12.2 nF			
t_s	Turn-off storage time		4.8	5.5	µs
t_f	Turn-off fall time		0.4	0.52	µs

2 Measured with half sine-wave voltage (curve tracer).

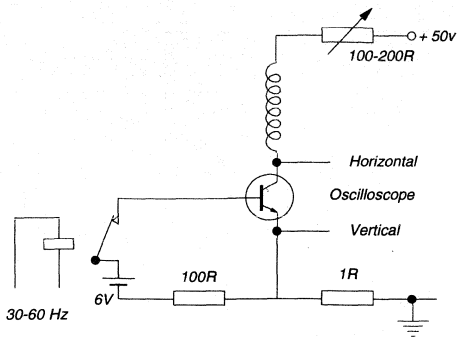


Fig.1. Test circuit for $V_{CEOsust}$.

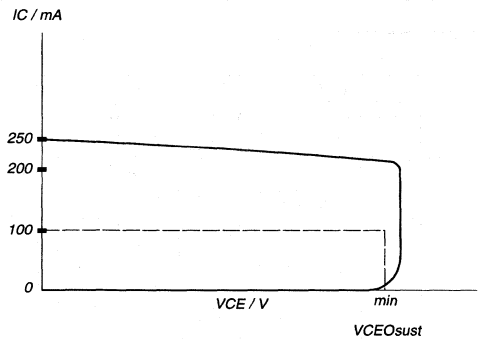


Fig.2. Oscilloscope display for $V_{CEOsust}$.

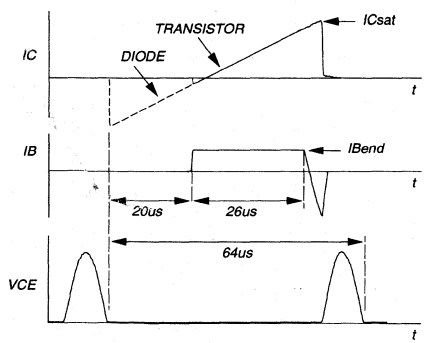


Fig.3. Switching times waveforms.

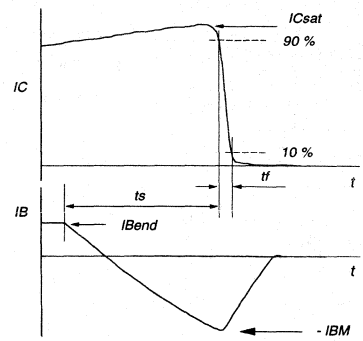


Fig.4. Switching times definitions.

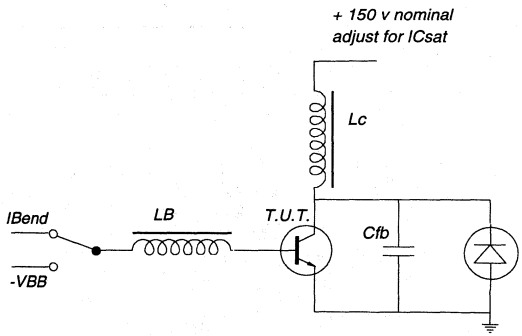


Fig.5. Switching times test circuit.

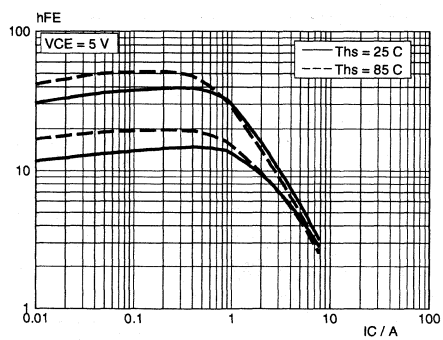


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

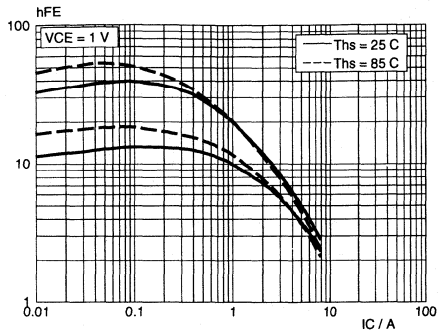


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

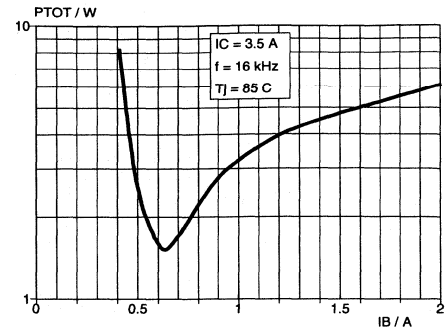


Fig.10. Limit P_{tot}; $T_j = 85°C$
$P_{tot} = f(I_{B(end)})$; $I_C = 3.5$ A; f = 16 kHz

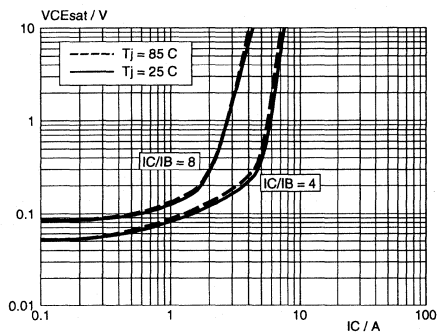


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

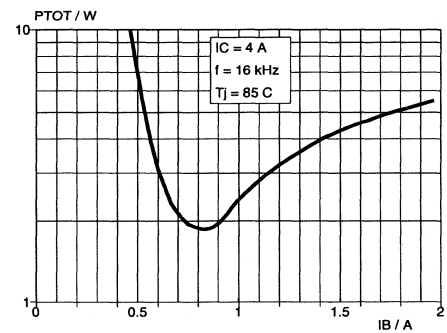


Fig.11. Limit P_{tot}; $T_j = 85°C$
$P_{tot} = f(I_{B(end)})$; $I_C = 4.0$ A; f = 16 kHz

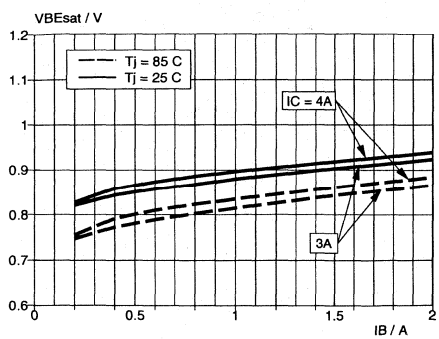


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

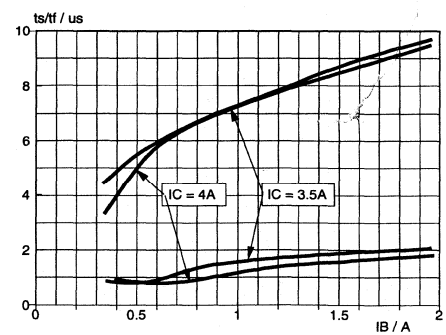


Fig.12. Limit storage and fall time.
$t_s = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85°C$; f = 16 kHz

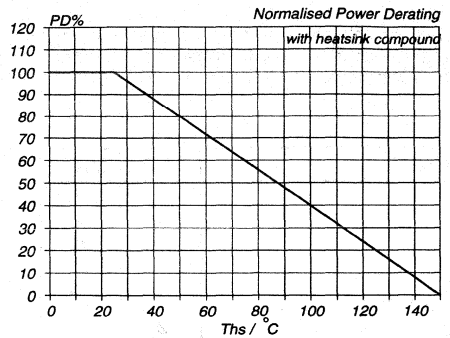


Fig.13. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

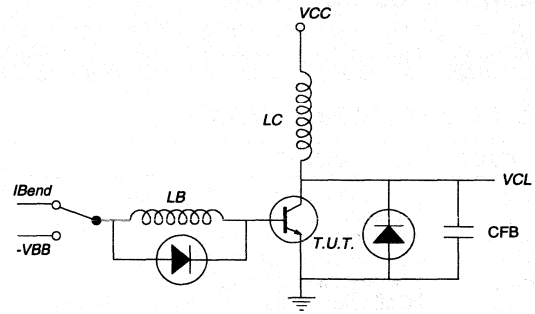


Fig.15. Test Circuit RBSOA. V_{CC} = 150 V;
$-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 4 nF; $I_{B(end)}$ = 0.8 - 4 A

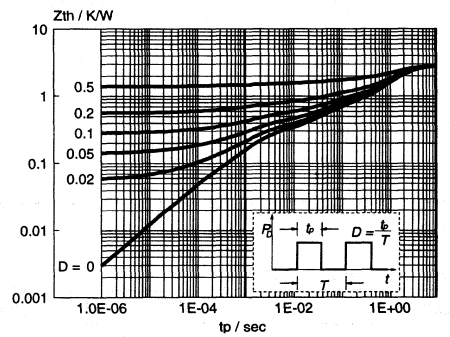


Fig.14. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

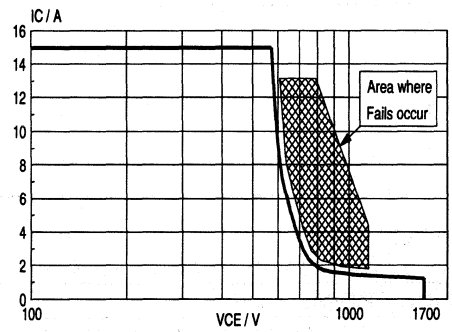


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2708AX

GENERAL DESCRIPTION

High voltage, high speed switching npn transistor in a plastic full-pack envelope. Intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations, resulting in a low worst-case dissipation. Designed to withstand V_{CES} pulses up to 1700 V.

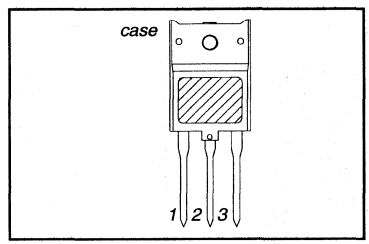
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	4	-	A
t_s	Storage time	I_{Csat} = 4 A; f = 16 kHz	4.8	5.5	µs

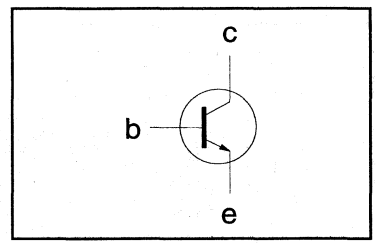
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 ˚C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	-	70	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	900	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	0.83	0.91	1.00	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	21	-	
h_{FE}		I_C = 4 A; V_{CE} = 1 V	3	6	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (line deflection circuit 16 kHz)	I_{Csat} = 4 A; $I_{B(end)}$ = 0.8 A; $-I_{BM}$ = I_{CM}/2; L_B = 6 µH; $-V_{BB}$ = 4 V; L_C = 1 mH; C_{FB} = 12.2 nF			
t_s	Turn-off storage time		4.8	5.5	µs
t_f	Turn-off fall time		0.4	0.52	µs

2 Measured with half sine-wave voltage (curve tracer).

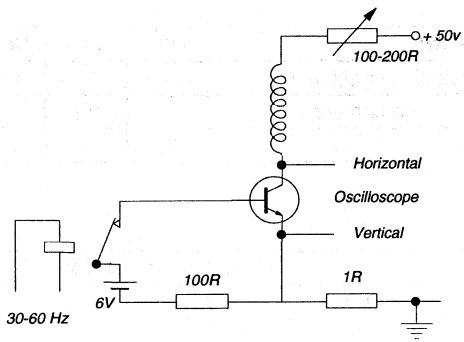


Fig.1. Test circuit for $V_{CEOsust}$.

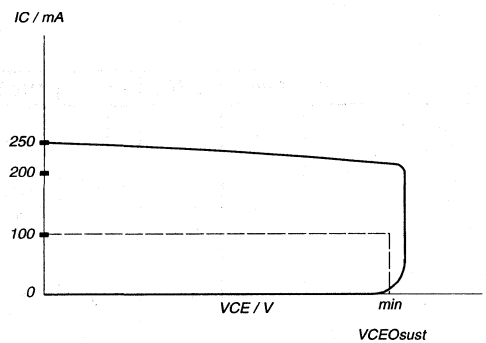


Fig.2. Oscilloscope display for $V_{CEOsust}$.

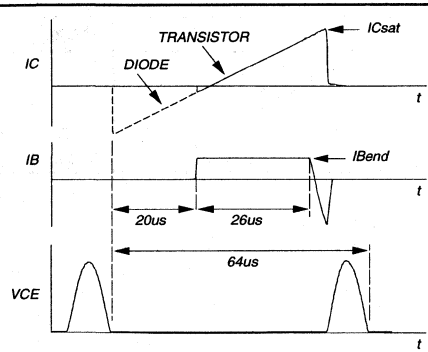


Fig.3. Switching times waveforms.

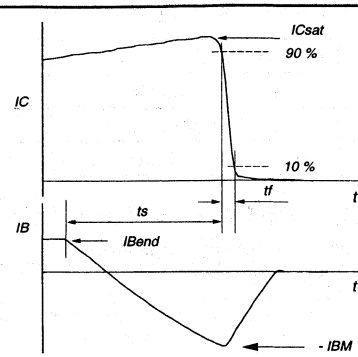


Fig.4. Switching times definitions.

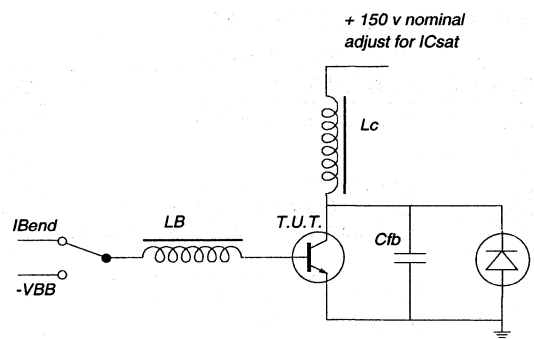


Fig.5. Switching times test circuit.

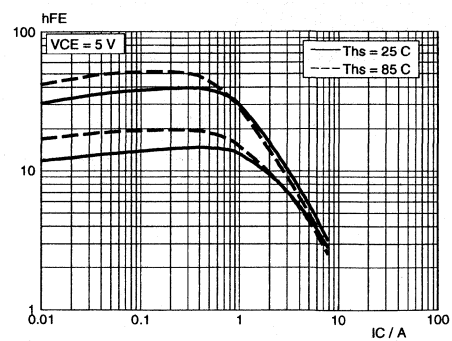


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

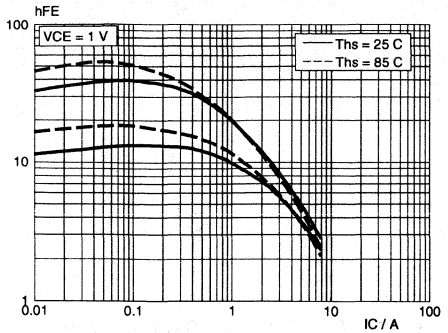


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

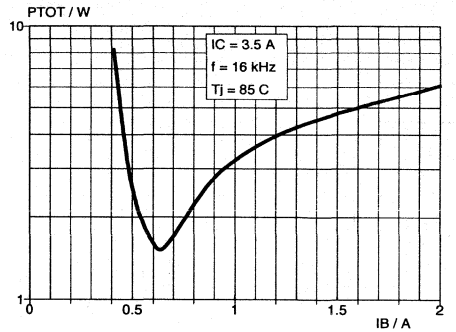


Fig.10. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 3.5$ A; f = 16 kHz

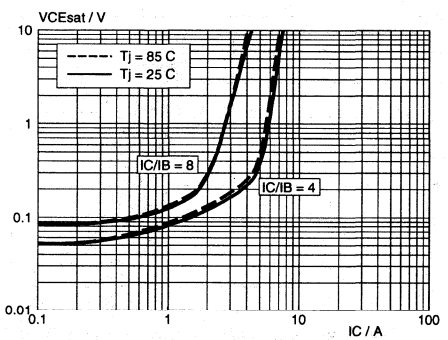


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

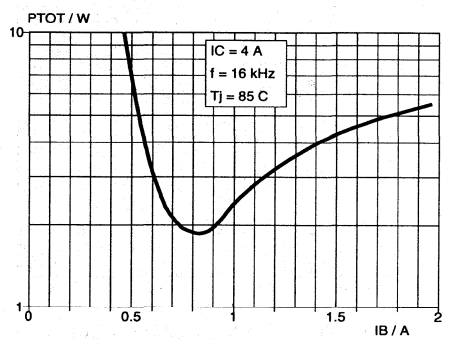


Fig.11. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 4.0$ A; f = 16 kHz

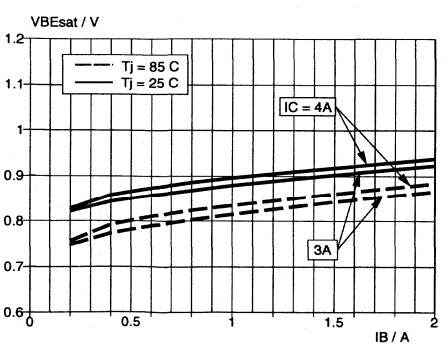


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

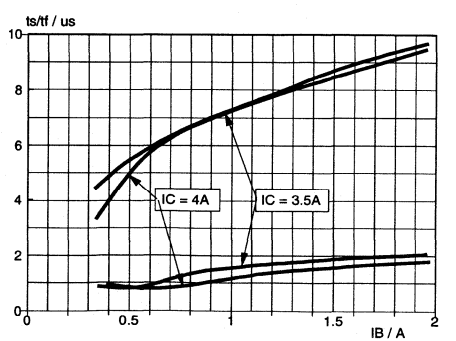


Fig.12. Limit storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

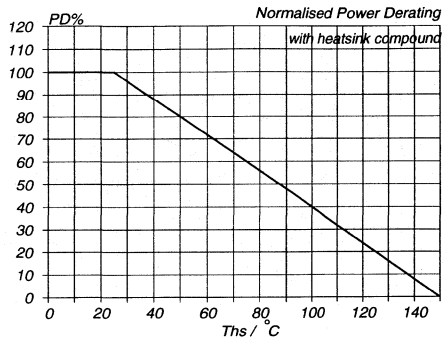


Fig.13. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

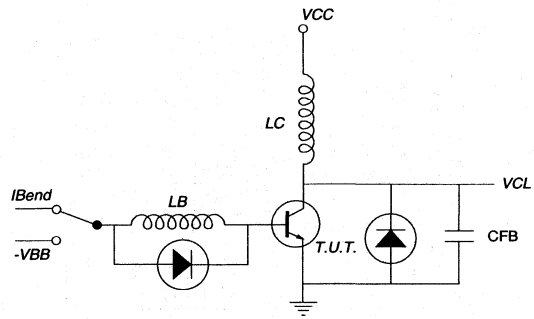


Fig.15. Test Circuit RBSOA. V_{CC} = 150 V;
$-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 4 nF; $I_{B(end)}$ = 0.8 - 4 A

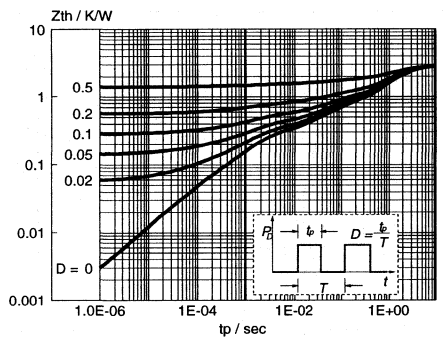


Fig.14. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

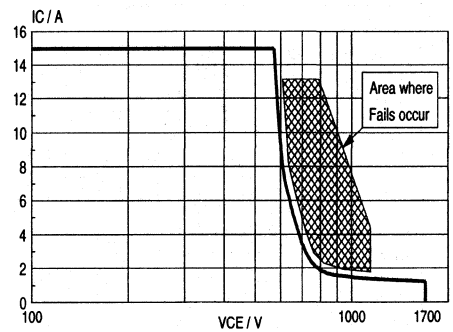


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2708DF

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor with integrated damper diode in a plastic full-pack envelope. Intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a low worst case dissipation. Designed to withstand V_{CES} pulses up to 1700V.

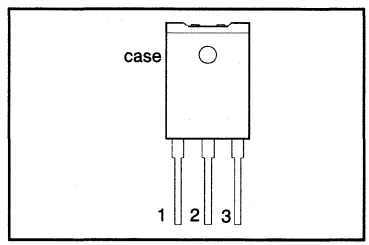
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	4.0	-	A
V_F	Diode forward voltage	I_F = 4.0 A	1.6	-	V
t_s	Storage time	I_{Csat} = 4 A; f = 16 kHz	4.8	5.5	µs

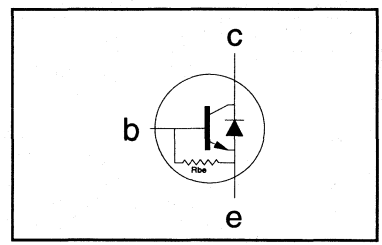
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{BE}	Base-emitter resistance	V_{EB} = 7.5 V		45		Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	0.83	0.91	1.00	V
V_F	Diode forward voltage	I_F = 4 A		1.6		V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	15	-	
h_{FE}		I_C = 4 A; V_{CE} = 1 V	3	6	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (line deflection circuit 16 kHz)	I_{Csat} = 4 A; L_C = 1 mH; C_{FB} = 12.2 nF; V_{CC} = 120 V; $I_{B(end)}$ = 0.8 A; L_B = 6 µH; $-V_{BB}$ = 4 V; $-I_{BM}$ = $I_{CM}/2$			
t_s	Turn-off storage time		4.8	5.5	µs
t_f	Turn-off fall time		0.4	0.52	µs

2 Measured with half sine-wave voltage (curve tracer).

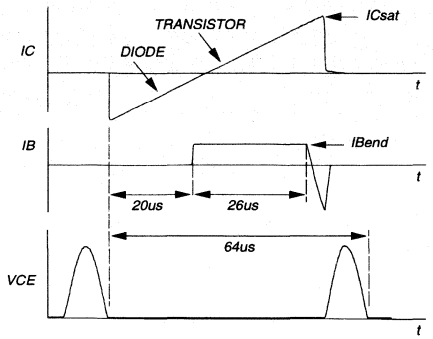


Fig.1. Switching times waveforms.

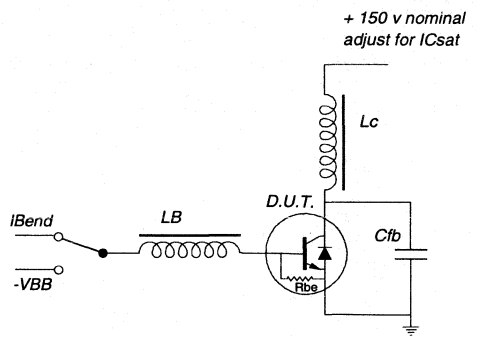


Fig.3. Switching times test circuit.

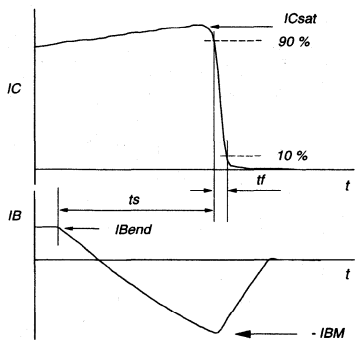


Fig.2. Switching times definitions.

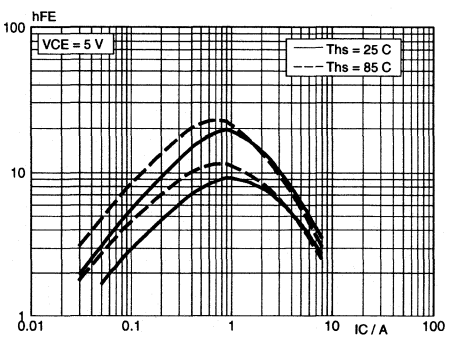


Fig.4. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

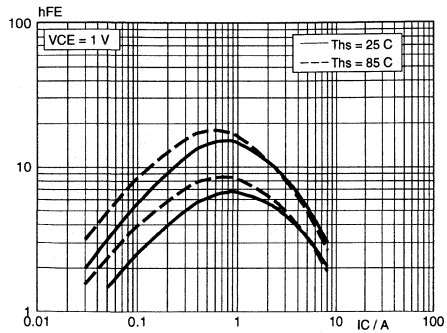


Fig.5. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

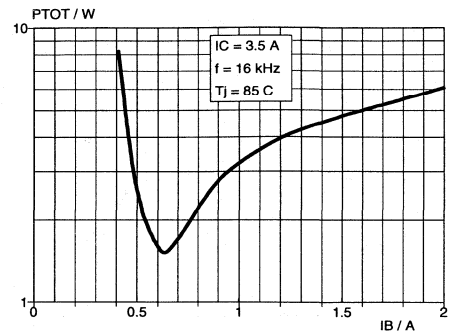


Fig.8. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 3.5$ A; f = 16 kHz

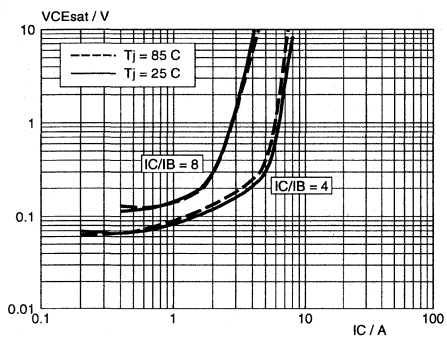


Fig.6. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

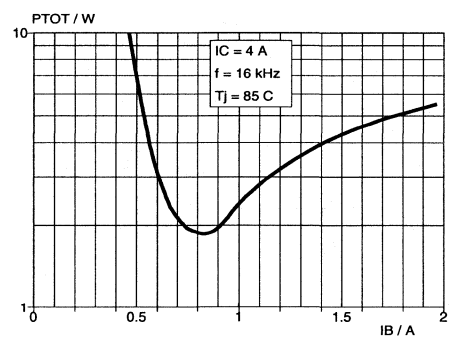


Fig.9. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 4.0$ A; f = 16 kHz

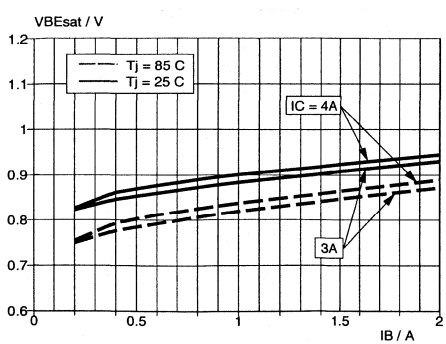


Fig.7. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

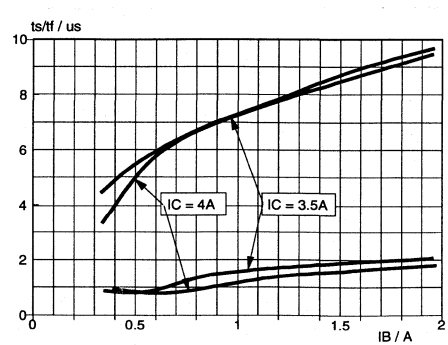


Fig.10. Limit storage and fall time.
$t_s = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

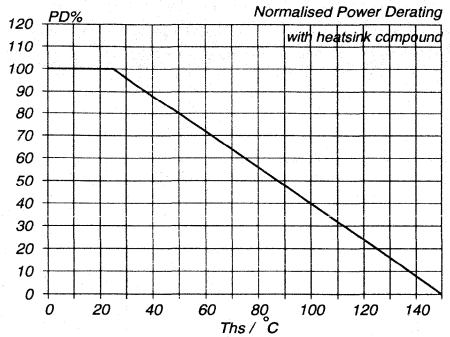


Fig.11. Normalised power dissipation.
PD% = 100·PD/PD 25°C = f (T_{hs})

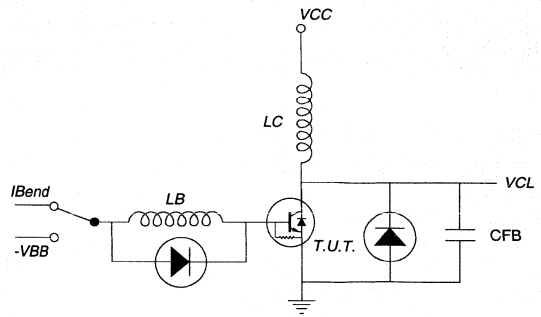


Fig.13. Test Circuit RBSOA. V_{CC} = 150 V;
$-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 4 nF; $I_{B(end)}$ = 0.8 - 4 A

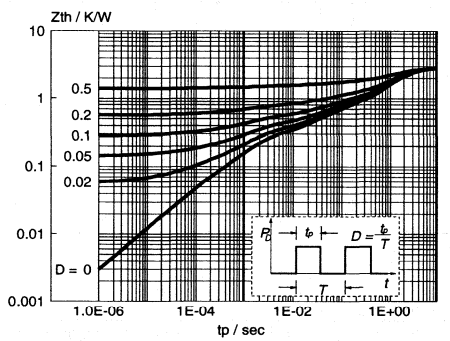


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

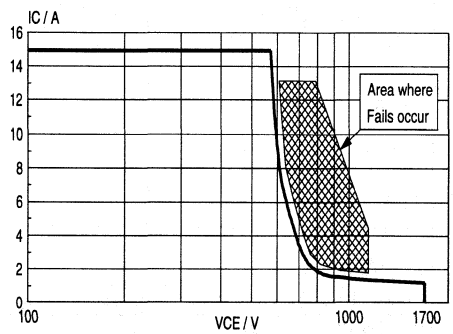


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2708DX

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor with integrated damper diode in a plastic full-pack envelope. Intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a low worst case dissipation. Designed to withstand V_{CES} pulses up to 1700V.

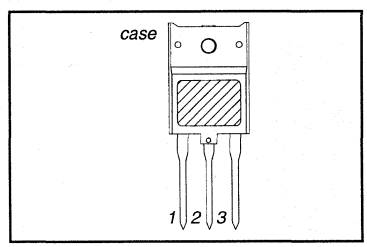
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	4.0	-	A
V_F	Diode forward voltage	I_F = 4.0 A	1.6	-	V
t_s	Storage time	I_{Csat} = 4 A; f = 16 kHz	4.8	5.5	µs

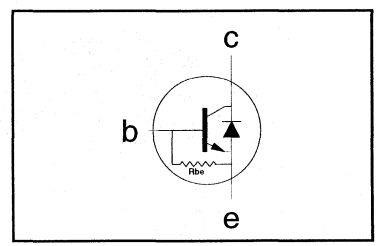
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{BE}	Base-emitter resistance	V_{EB} = 7.5 V		45		Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1.33 A	0.83	0.91	1.00	V
V_F	Diode forward voltage	I_F = 4 A		1.6		V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	15	-	
h_{FE}		I_C = 4 A; V_{CE} = 1 V	3	6	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (line deflection circuit 16 kHz)	I_{Csat} = 4 A; L_C = 1 mH; C_{FB} = 12.2 nF; V_{CC} = 120 V; $I_{B(end)}$ = 0.8 A; L_B = 6 µH; $-V_{BB}$ = 4 V; $-I_{BM}$ = I_{CM}/2			
t_s	Turn-off storage time		4.8	5.5	µs
t_f	Turn-off fall time		0.4	0.52	µs

2 Measured with half sine-wave voltage (curve tracer).

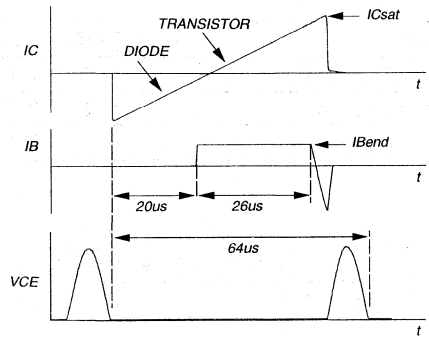


Fig.1. Switching times waveforms.

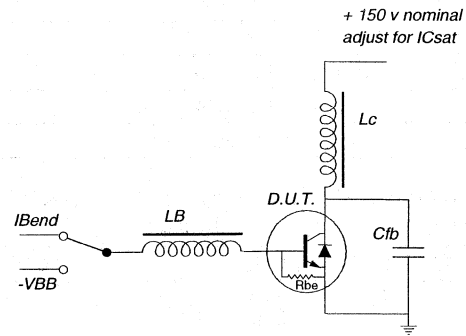


Fig.3. Switching times test circuit.

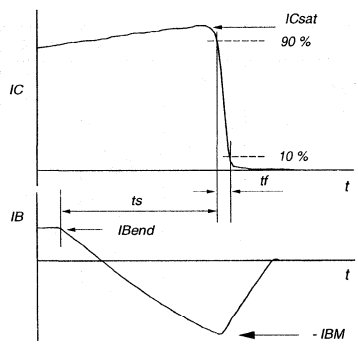


Fig.2. Switching times definitions.

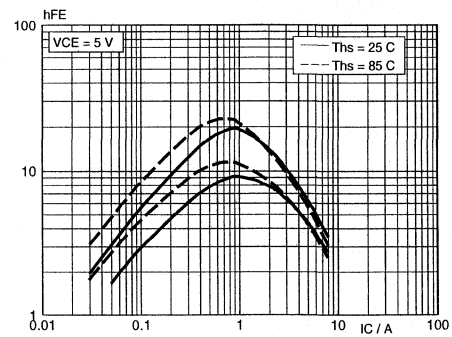


Fig.4. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

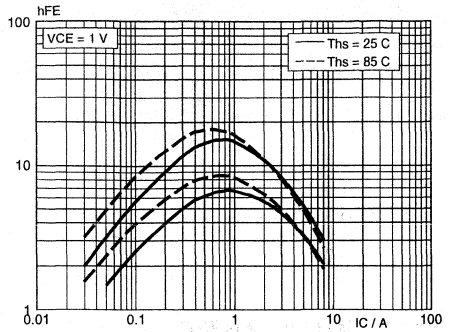


Fig.5. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

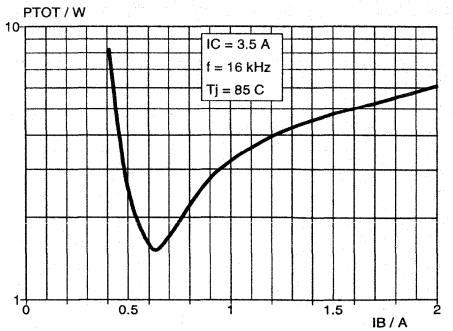


Fig.8. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 3.5$ A; f = 16 kHz

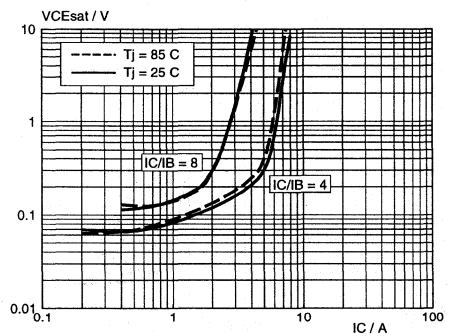


Fig.6. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

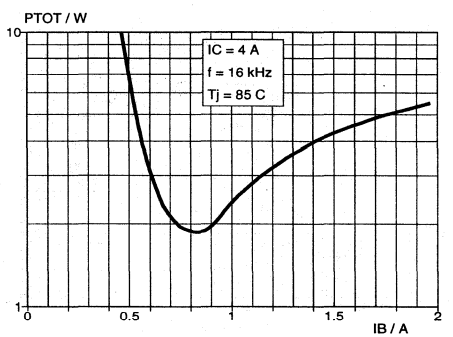


Fig.9. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 4.0$ A; f = 16 kHz

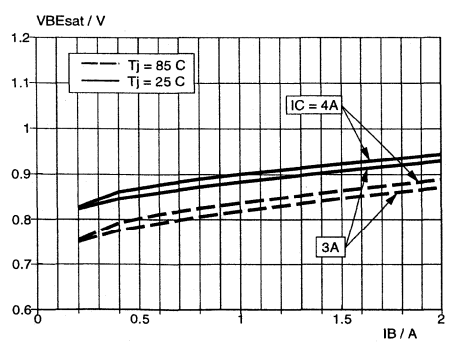


Fig.7. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

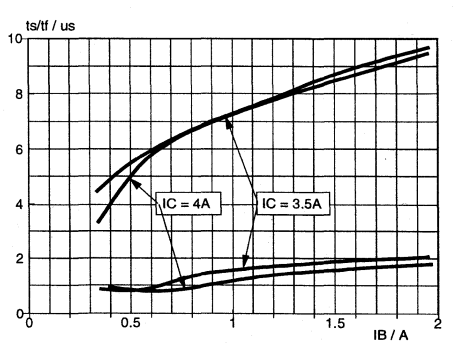


Fig.10. Limit storage and fall time.
$t_s = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

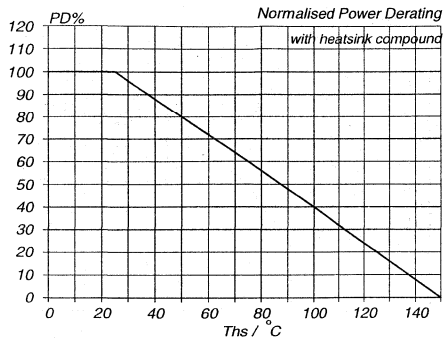


Fig.11. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

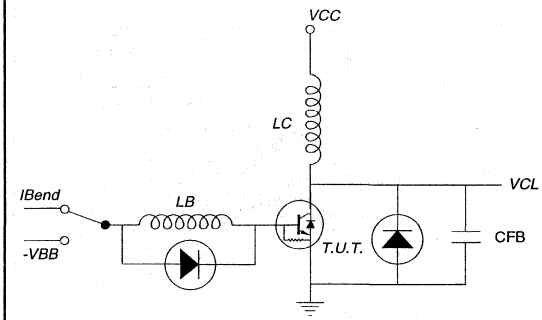


Fig.13. Test Circuit RBSOA. V_{CC} = 150 V;
$-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 4 nF; $I_{B(end)}$ = 0.8 - 4 A

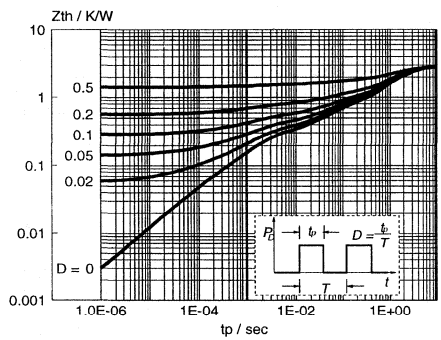


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

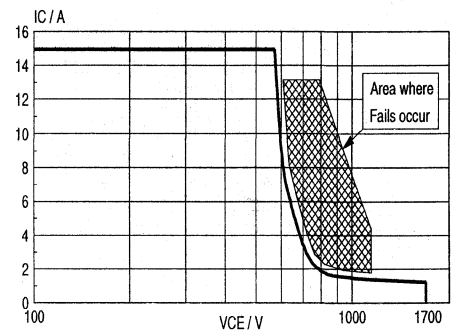


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2720AF

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Designed to withstand V_{CES} pulses up to 1700V.

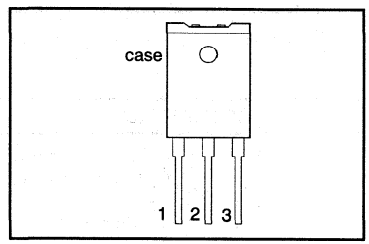
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	5.5	-	A
t_s	Storage time	I_{Csat} = 5.5 A; f = 16 kHz	7.4	8.5	µs

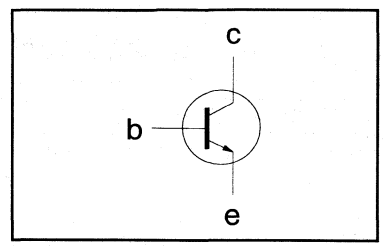
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	14	A
I_{BM}	Base current peak value		-	20	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	900	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	22	-	
h_{FE}		I_C = 5.5 A; V_{CE} = 1 V	4	5.5	7.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.5 A; L_C = 750 µH; C_{fb} = 15.5 nF; V_{CC} = 125 V; $I_{B(end)}$ = 1.2 A; L_B = 6 µH; $-V_{BB}$ = 4 V; $-I_{BM}$ = I_{CM}/2;			
t_s	Turn-off storage time		7.4	8.5	µs
t_f	Turn-off fall time		0.7	0.9	µs

2 Measured with half sine-wave voltage (curve tracer).

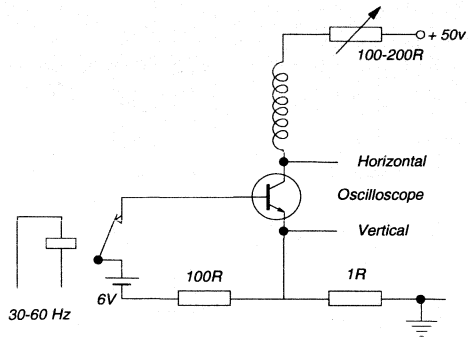


Fig.1. Test circuit for $V_{CEOsust}$.

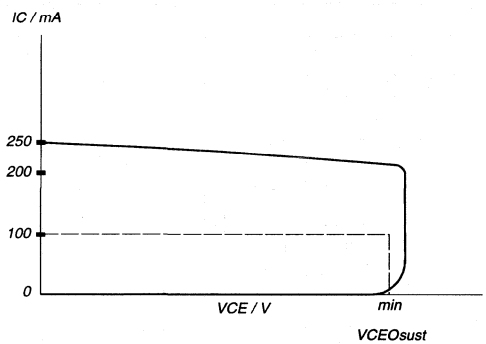


Fig.2. Oscilloscope display for $V_{CEOsust}$.

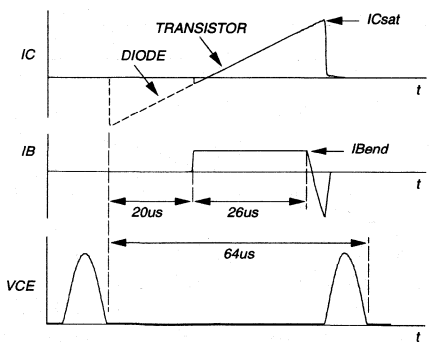


Fig.3. Switching times waveforms.

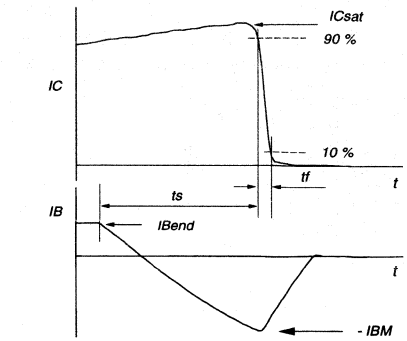


Fig.4. Switching times definitions.

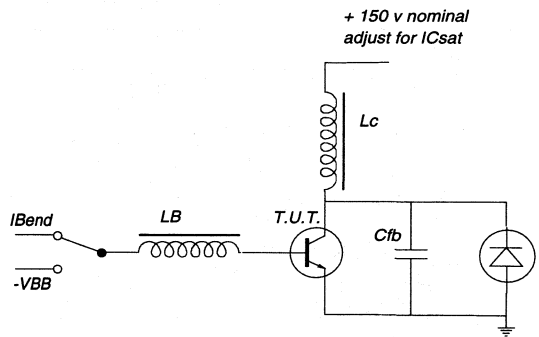


Fig.5. Switching times test circuit.

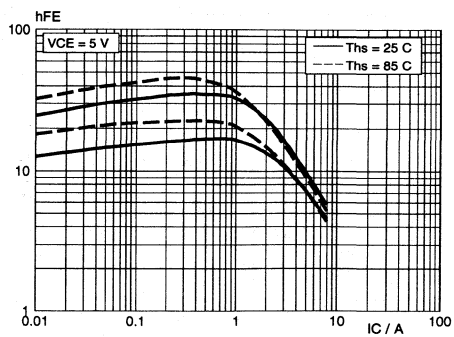


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

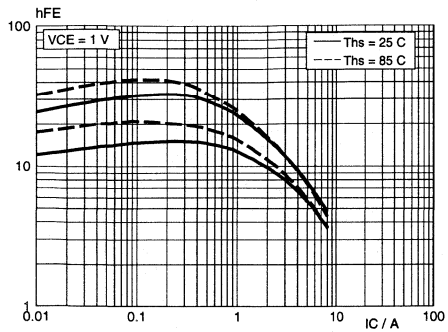


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

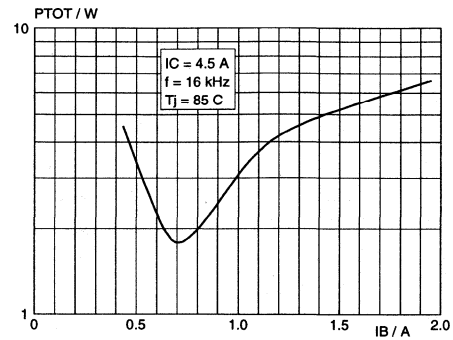


Fig.10. Limit P_{tot}; $T_j = 85°C$
$P_{tot} = f(I_{B(end)})$; $I_C = 4.5$ A; f = 16 kHz

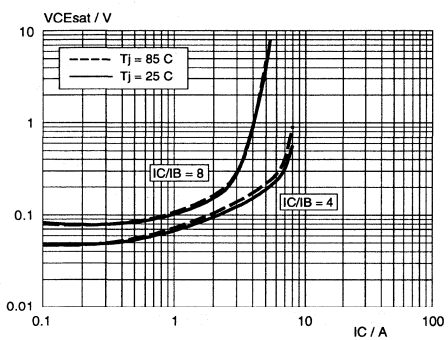


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

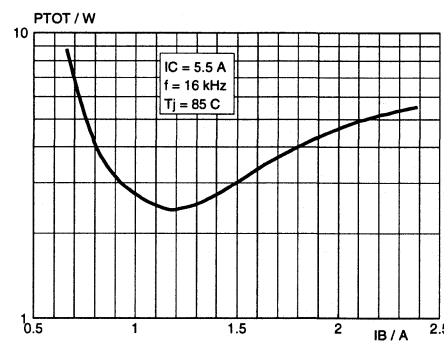


Fig.11. Limit P_{tot}; $T_j = 85°C$
$P_{tot} = f(I_{B(end)})$; $I_C = 5.5$ A; f = 16 kHz

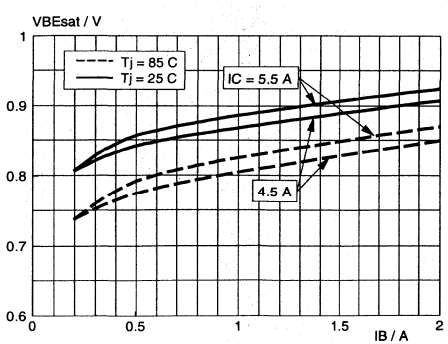


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

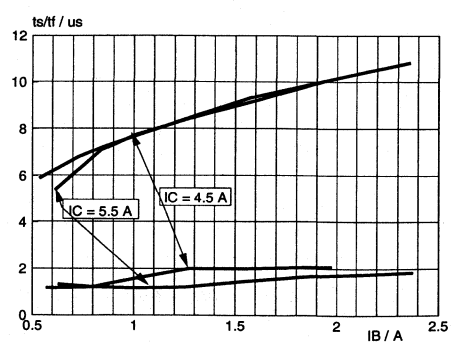


Fig.12. Limit storage and fall time.
$t_s = f(I_B)$; tf = f (I_B); Parameter I_C; $T_j = 85°C$; f = 16 kHz

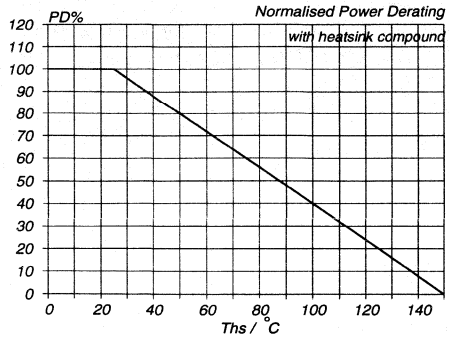


Fig.13. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

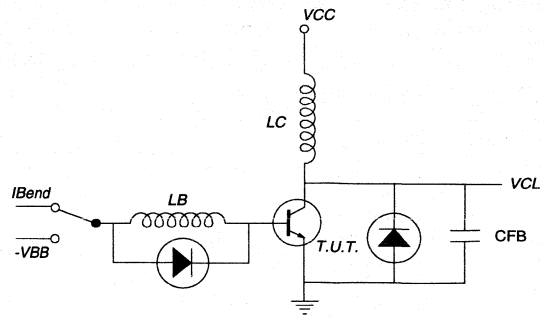


Fig.15. Test Circuit RBSOA. V_{CC} = 150 V;
$-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 4 nF; $I_{B(end)}$ = 0.8 - 4 A

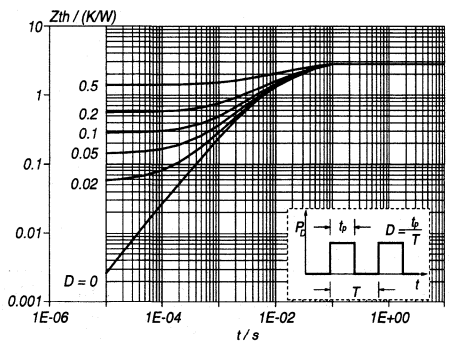


Fig.14. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

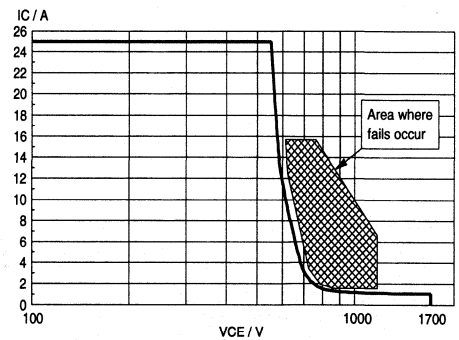


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2720AX

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Designed to withstand V_{CES} pulses up to 1700V.

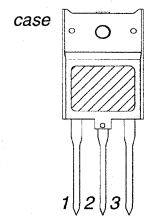
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	5.5	-	A
t_s	Storage time	I_{Csat} = 5.5 A; f = 16 kHz	7.4	8.5	µs

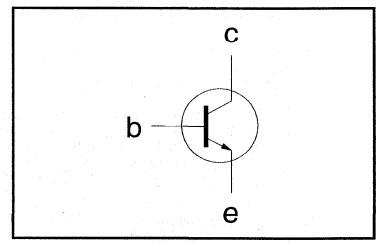
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	14	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	900	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	22	-	
h_{FE}		I_C = 5.5 A; V_{CE} = 1 V	4	5.5	7.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.5 A; L_C = 750 µH; C_{fb} = 15.5 nF; V_{CC} = 125 V; $I_{B(end)}$ = 1.2 A; L_B = 6 µH; $-V_{BB}$ = 4 V; $-I_{BM}$ = I_{CM}/2;			
t_s	Turn-off storage time		7.4	8.5	µs
t_f	Turn-off fall time		0.7	0.9	µs

2 Measured with half sine-wave voltage (curve tracer).

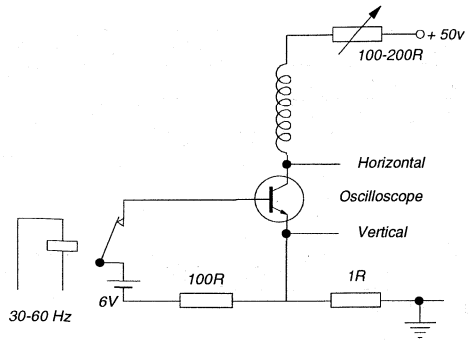


Fig.1. Test circuit for $V_{CEOsust}$.

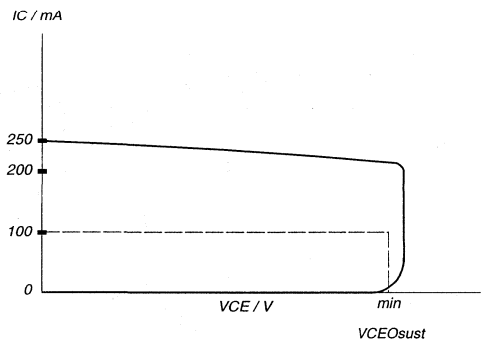


Fig.2. Oscilloscope display for $V_{CEOsust}$.

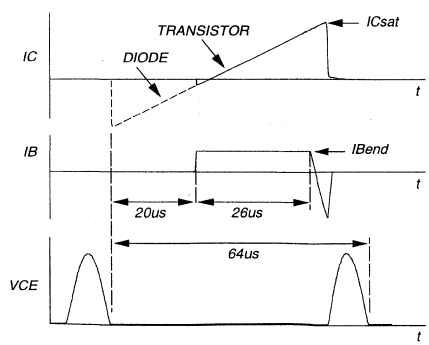


Fig.3. Switching times waveforms.

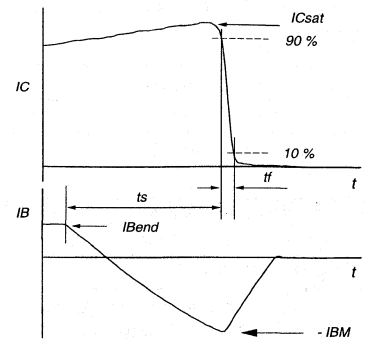


Fig.4. Switching times definitions.

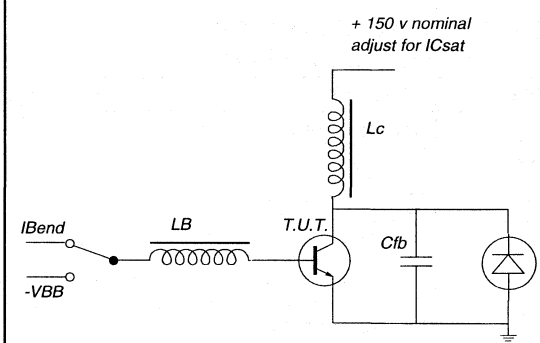


Fig.5. Switching times test circuit.

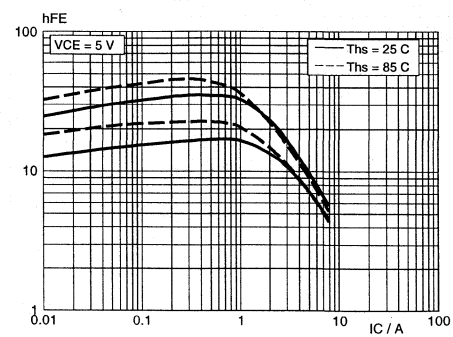


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

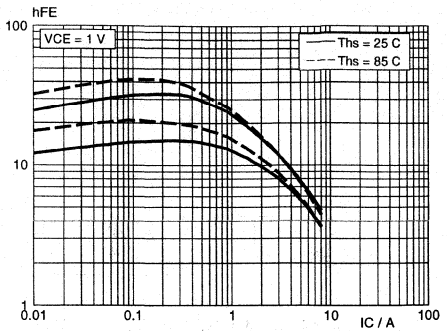


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

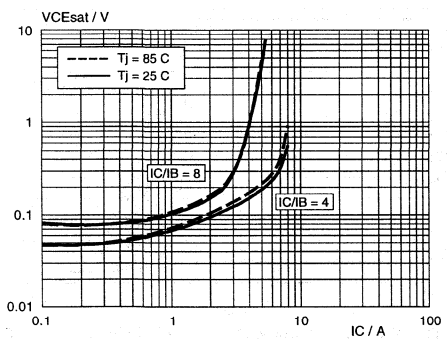


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

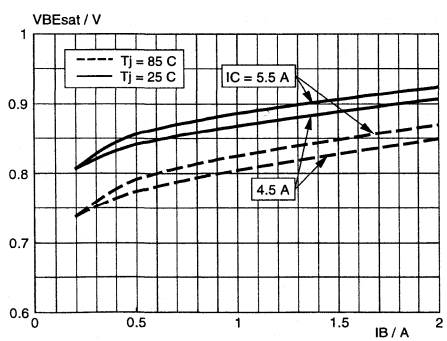


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

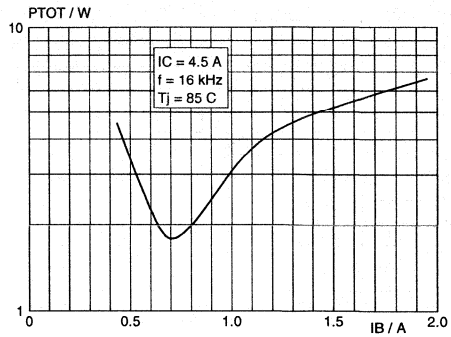


Fig.10. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 4.5$ A; f = 16 kHz

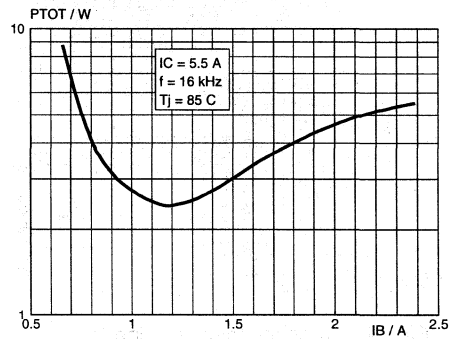


Fig.11. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 5.5$ A; f = 16 kHz

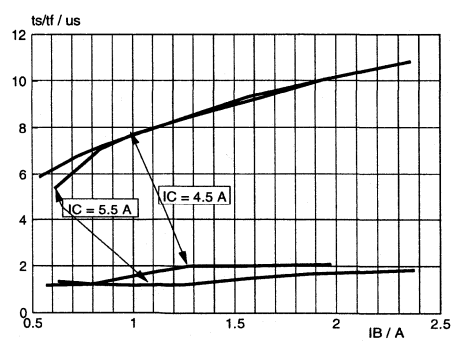


Fig.12. Limit storage and fall time.
$t_s = f(I_B)$; $tf = f(I_B)$; Parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

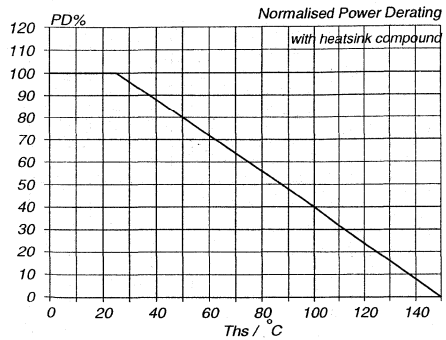


Fig.13. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

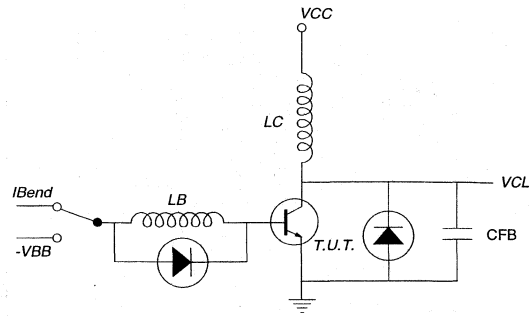


Fig.15. Test Circuit RBSOA. V_{CC} = 150 V;
$-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 4 nF; $I_{B(end)}$ = 0.8 - 4 A

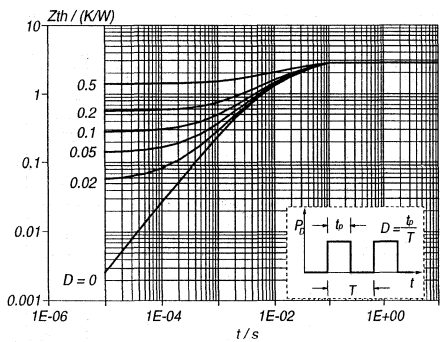


Fig.14. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

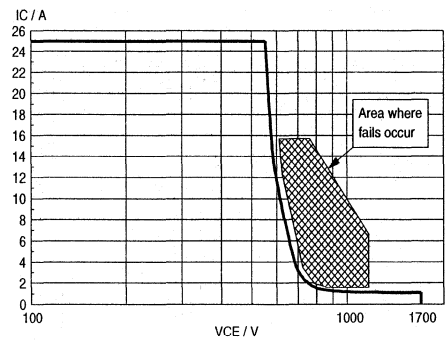


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2720DF

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Designed to withstand V_{CES} pulses up to 1700V.

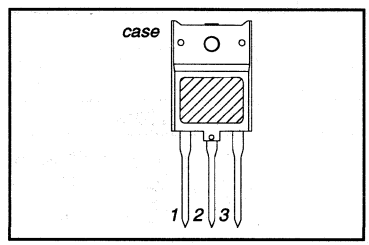
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	5.5	-	A
t_s	Storage time	I_{Csat} = 5.5 A; f = 16 kHz	7.4	8.5	µs

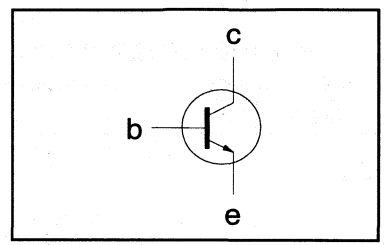
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	14	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	900	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	22	-	
h_{FE}		I_C = 5.5 A; V_{CE} = 1 V	4	5.5	7.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.5 A; L_C = 750 µH; C_{fb} = 15.5 nF; V_{CC} = 125 V; $I_{B(end)}$ = 1.2 A; L_B = 6 µH; $-V_{BB}$ = 4 V; $-I_{BM}$ = I_{CM}/2;			
t_s	Turn-off storage time		7.4	8.5	µs
t_f	Turn-off fall time		0.7	0.9	µs

2 Measured with half sine-wave voltage (curve tracer).

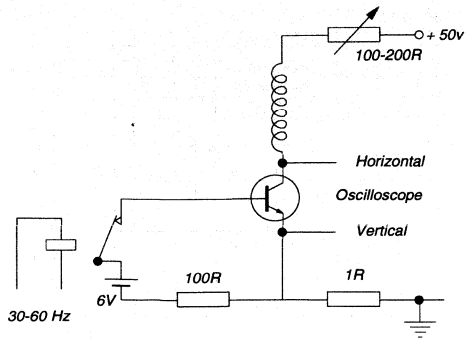


Fig.1. Test circuit for $V_{CEOsust}$.

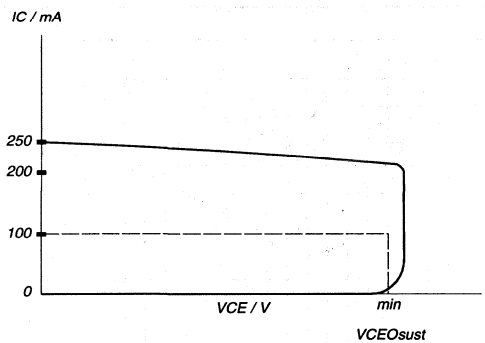


Fig.2. Oscilloscope display for $V_{CEOsust}$.

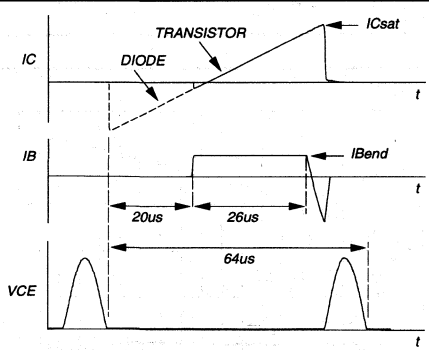


Fig.3. Switching times waveforms.

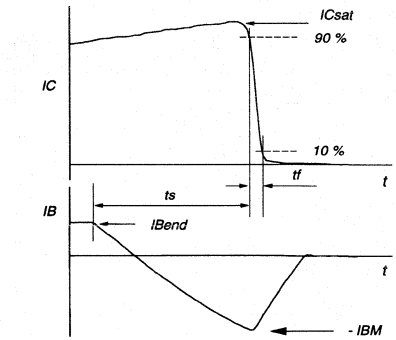


Fig.4. Switching times definitions.

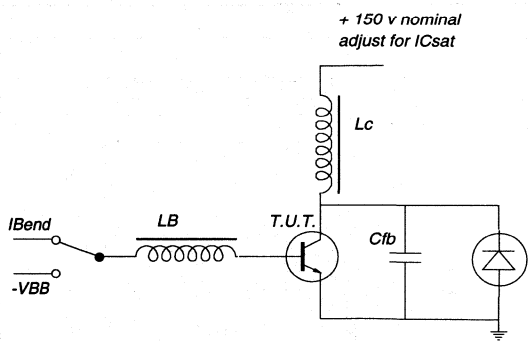


Fig.5. Switching times test circuit.

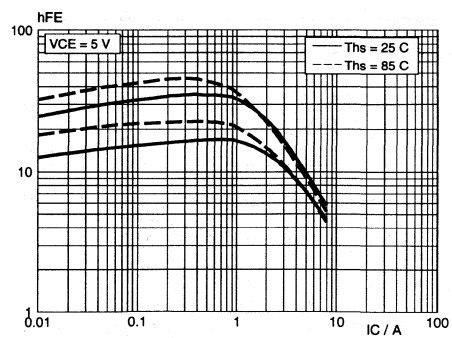


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

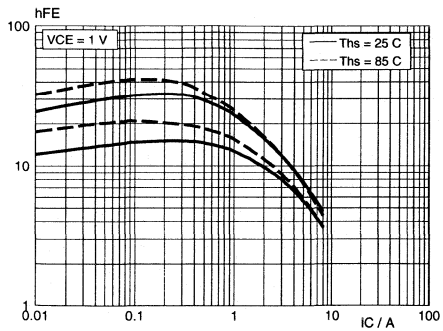


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

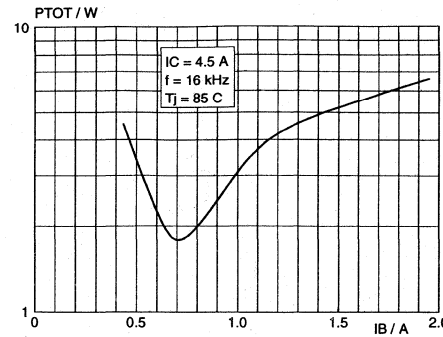


Fig.10. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 4.5$ A; f = 16 kHz

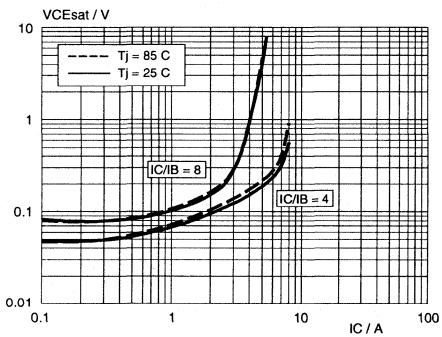


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

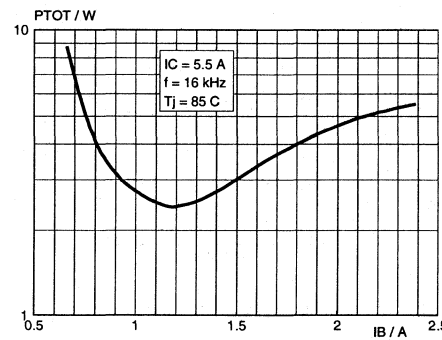


Fig.11. Limit P_{tot}; $T_j = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 5.5$ A; f = 16 kHz

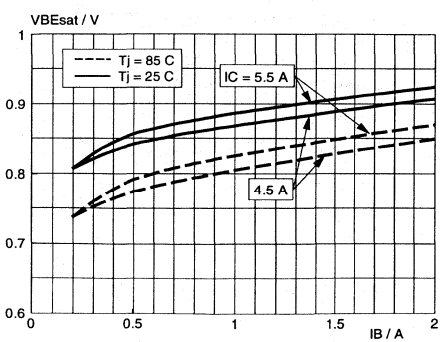


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

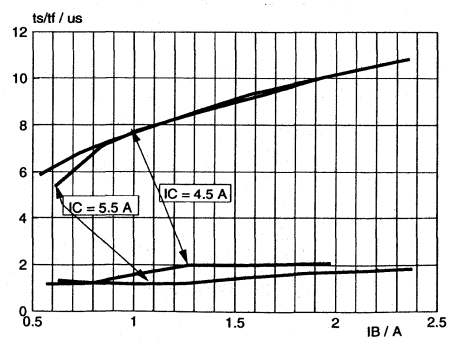


Fig.12. Limit storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; Parameter I_C; $T_j = 85^\circ C$; f = 16 kHz

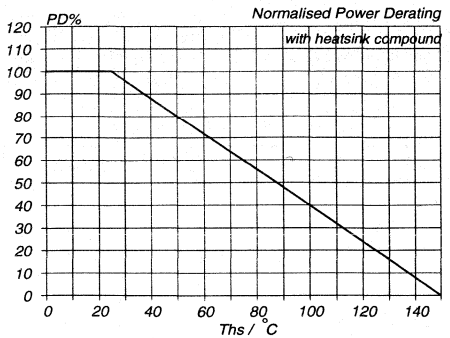


Fig.13. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

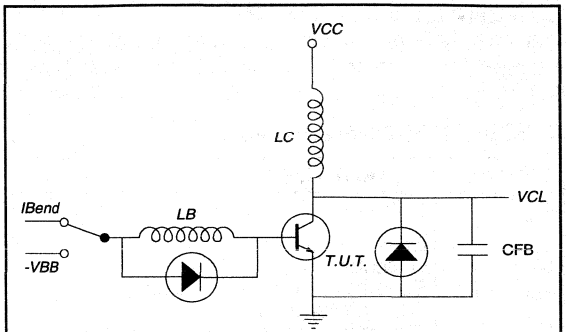


Fig.15. Test Circuit RBSOA. V_{CC} = 150 V;
$-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 4 nF; $I_{B(end)}$ = 0.8 - 4 A

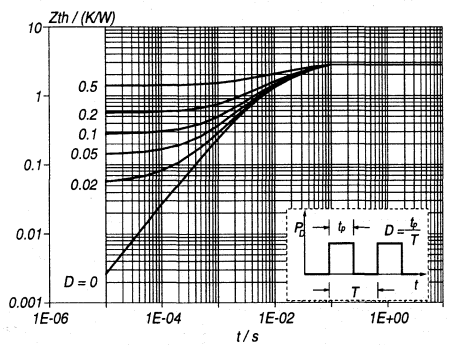


Fig.14. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

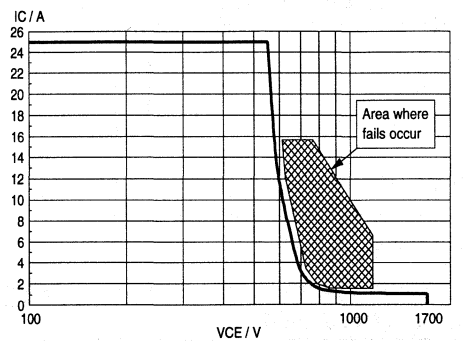


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2720DX

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor with integrated damper diode in a plastic full-pack envelope. Intended for use in horizontal deflection circuits of colour television receivers. Designed to withstand V_{CES} pulses up to 1700V.

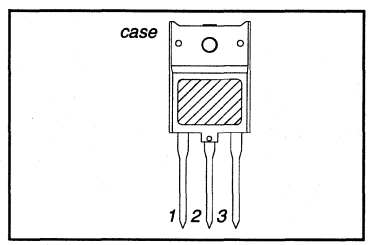
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	5.5	-	A
t_s	Storage time	I_{Csat} = 5.5 A; f = 16kHz	7.4	8.5	µs

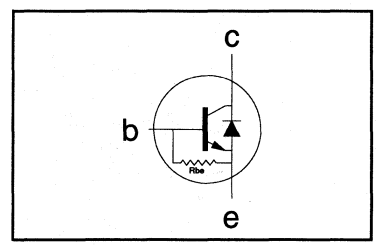
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	14	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{BE}	Base-emitter resistance	V_{EB} = 6 V		65		Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.5 A; I_B = 1.38 A	-	-	1.0	V
V_F	Diode forward voltage	I_F = 5.5 A		1.6		V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V		19		
h_{FE}		I_C = 5.5 A; V_{CE} = 1 V	4	5.5	7.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.5 A; L_C = 750 µH; C_{fb} = 15.5 nF; V_{CC} = 125 V; $I_{B(end)}$ = 1.2 A; L_B = 6 µH; $-V_{BB}$ = 4 V; $-I_{BM}$ = I_{CM}/2			
t_s	Turn-off storage time		7.4	8.5	µs
t_f	Turn-off fall time		0.7	0.9	µs

2 Measured with half sine-wave voltage (curve tracer).

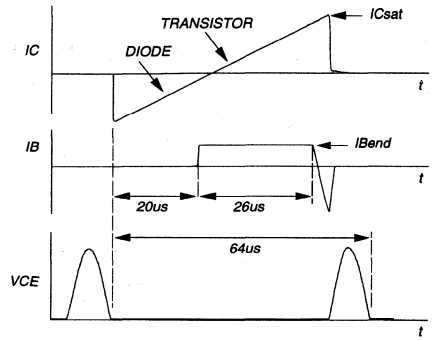


Fig.1. Switching times waveforms.

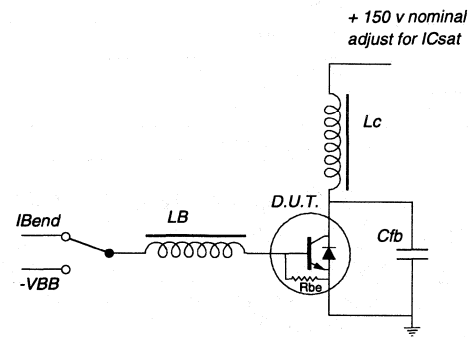


Fig.3. Switching times test circuit.

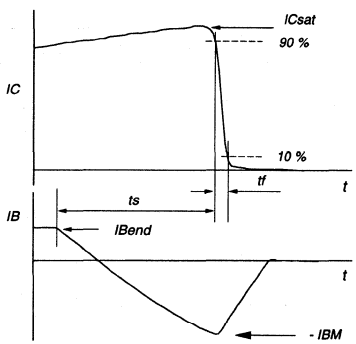


Fig.2. Switching times definitions.

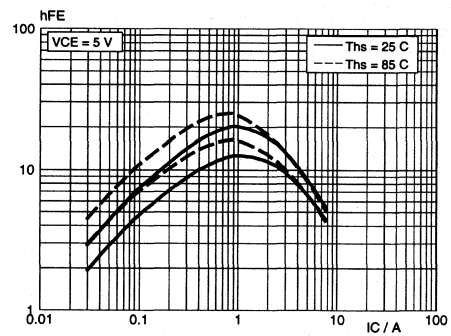


Fig.4. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

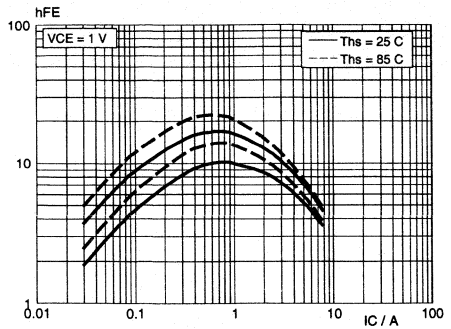


Fig.5. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

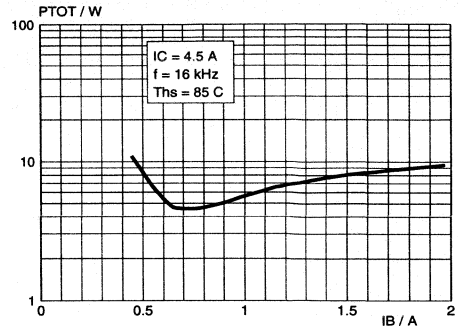


Fig.8. Limit P_{tot}; $T_{hs} = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 4.5$ A; f = 16 kHz

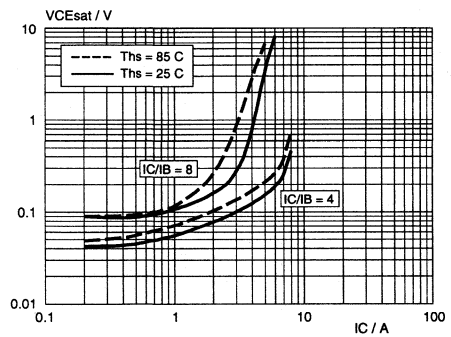


Fig.6. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

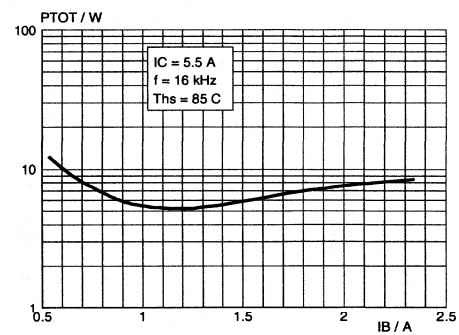


Fig.9. Limit P_{tot}; $T_{hs} = 85^\circ C$
$P_{tot} = f(I_{B(end)})$; $I_C = 5.5$ A; f = 16 kHz

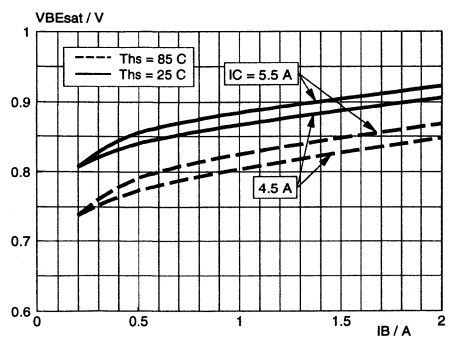


Fig.7. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

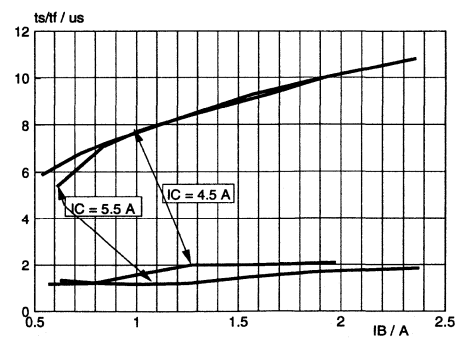


Fig.10. Limit storage and fall time.
$t_s = f(I_B)$; $tf = f(I_B)$; parameter I_C; $T_{hs} = 85^\circ C$; f = 16 kHz

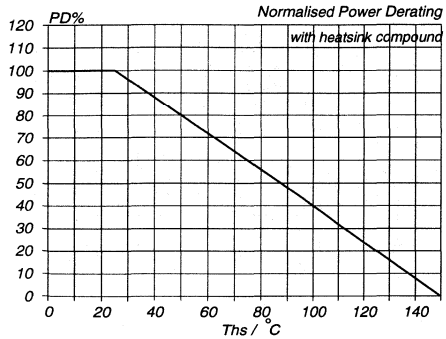


Fig.11. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

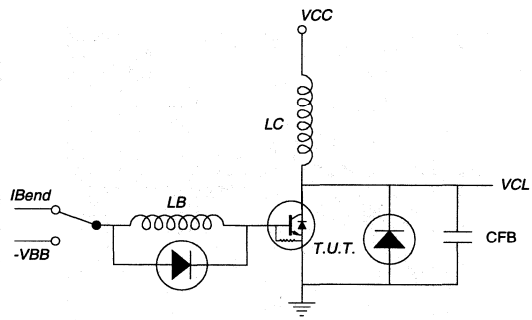


Fig.13. Test Circuit RBSOA. V_{CC} = 150 V;
$-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 1 - 3 µH;
C_{FB} = 1 - 4 nF; $I_{B(end)}$ = 1.2 - 4 A

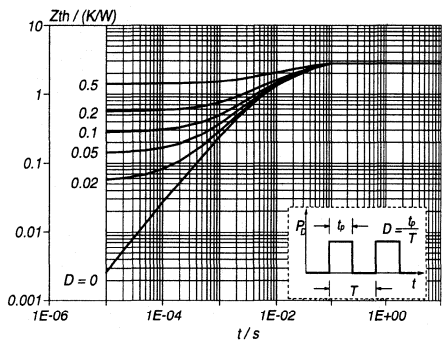


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

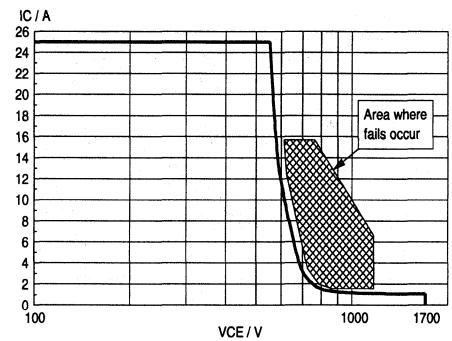


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2722AF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Designed to withstand V_{CES} pulses up to 1700 V.

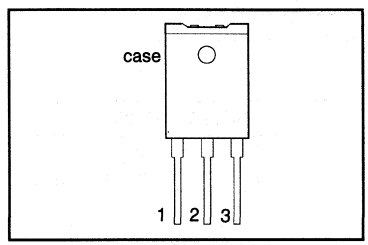
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.0 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	4.5	-	A
t_s	Storage time	I_{Csat} = 4.5 A; f = 64 kHz	2.9	3.5	µs

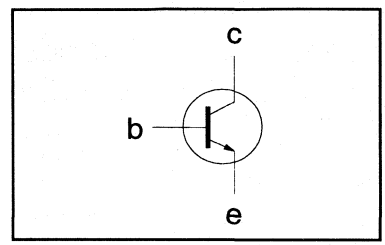
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	14	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	900	-	V
	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.0 A	-	-	1.0	V
V_{CEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.0 A	-	-	1.0	V
V_{BEsat}						
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	22	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4.5	7	10	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 4.5 A; L_C = 300 µH; C_{fb} = 2.5 nF; V_{CC} = 160 V; $I_{B(end)}$ = 1.0 A; L_B = 2.0 µH; $-V_{BB}$ = 4 V; $-I_{BM}$ = 2.7 A			
t_s	Turn-off storage time		2.9	3.5	µs
t_f	Turn-off fall time		0.19	0.25	µs

2 Measured with half sine-wave voltage (curve tracer).

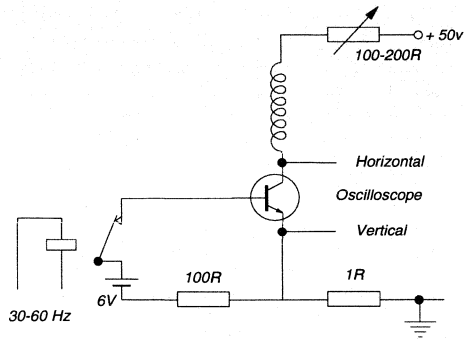


Fig.1. Test circuit for $V_{CEOsust}$.

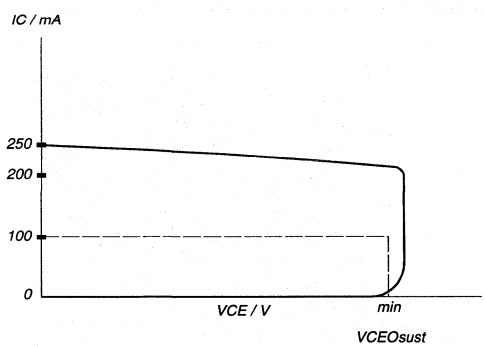


Fig.2. Oscilloscope display for $V_{CEOsust}$.

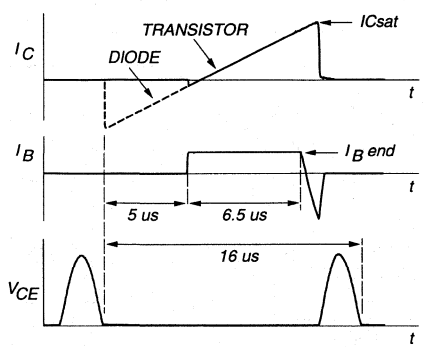


Fig.3. Switching times waveforms (64 kHz).

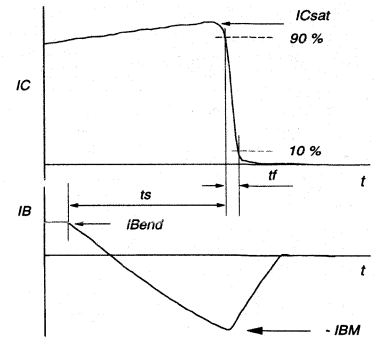


Fig.4. Switching times definitions.

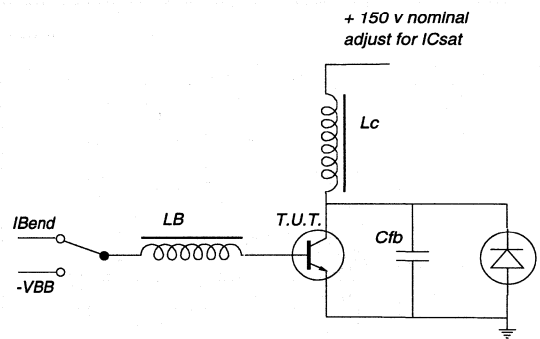


Fig.5. Switching times test circuit.

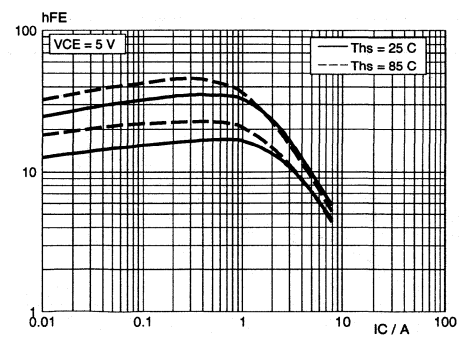


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

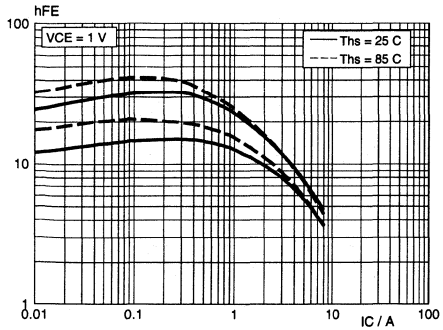


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

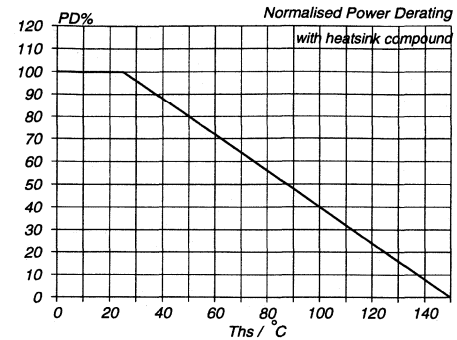


Fig.10. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

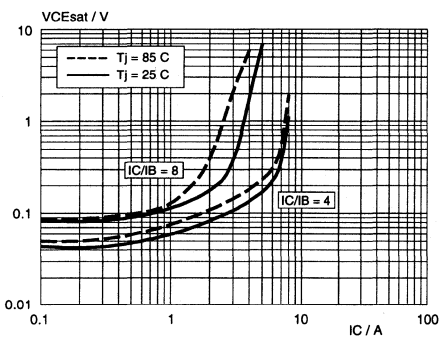


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

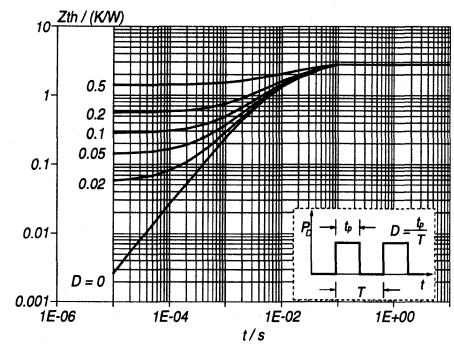


Fig.11. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

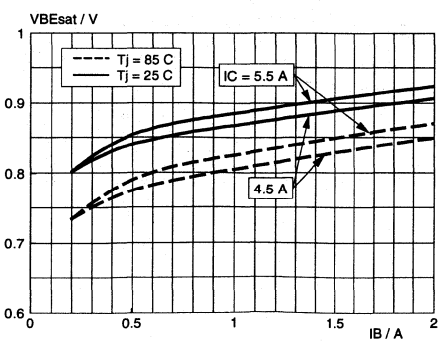


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

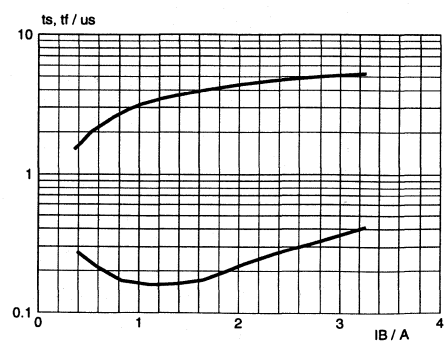


Fig.12. Typical storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; I_C = 4.5 A; f = 64 kHz; T_{hs} = 85 ˚C

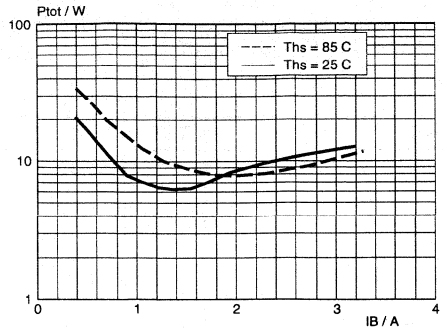


Fig.13. Typical power dissipation.
$P_{tot} = f(I_B)$; $I_C = 4.5$ A; f = 64 kHz; Parameter T_{hs}

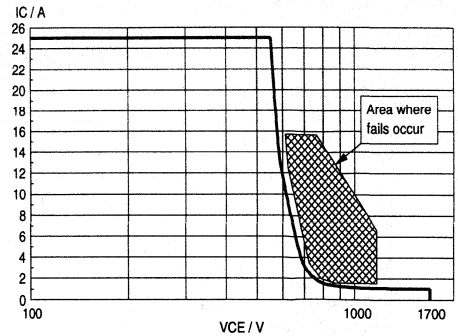


Fig.15. Reverse bias safe operating area. $T_j \leq T_{jmax}$

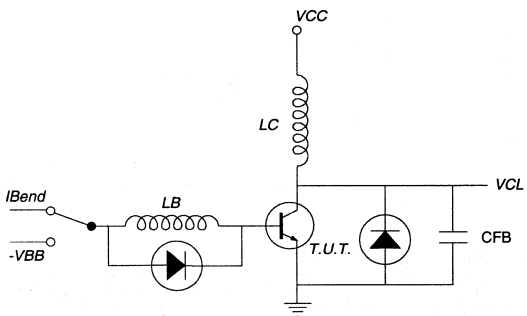


Fig.14. Test Circuit RBSOA. $V_{CC} = 150$ V;
$-V_{BB} = 1 - 4$ V;
$L_C = 1$ mH; $V_{CL} = 1500$ V; $L_B = 1 - 3$ µH;
$C_{FB} = 1 - 4$ nF; $I_{B(end)} = 0.8 - 4$ A

Silicon Diffused Power Transistor — BU2722AX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Designed to withstand V_{CES} pulses up to 1700 V.

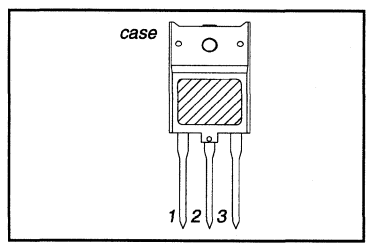
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.0 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	4.5	-	A
t_s	Storage time	I_{Csat} = 4.5 A; f = 64 kHz	2.9	3.5	µs

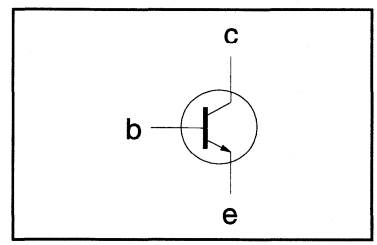
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	14	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	150	mA
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 ˚C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	900	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.5 A; I_B = 1.0 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.5 A; I_B = 1.0 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	22	-	
h_{FE}		I_C = 4.5 A; V_{CE} = 1 V	4.5	7	10	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 4.5 A; L_C = 300 µH; C_{fb} = 2.5 nF; V_{CC} = 160 V; $I_{B(end)}$ = 1.0 A; L_B = 2.0 µH; $-V_{BB}$ = 4 V; $-I_{BM}$ = 2.7 A			
t_s	Turn-off storage time		2.9	3.5	µs
t_f	Turn-off fall time		0.19	0.25	µs

2 Measured with half sine-wave voltage (curve tracer).

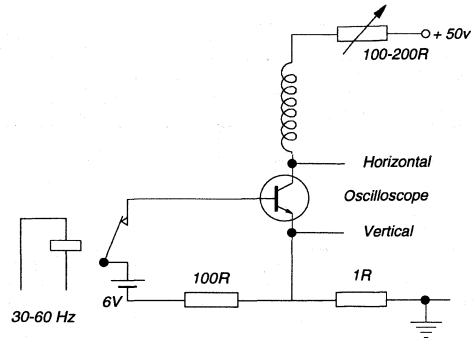


Fig.1. Test circuit for $V_{CEOsust}$.

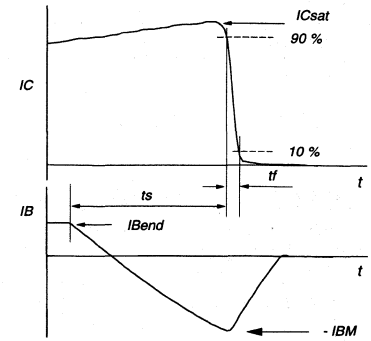


Fig.4. Switching times definitions.

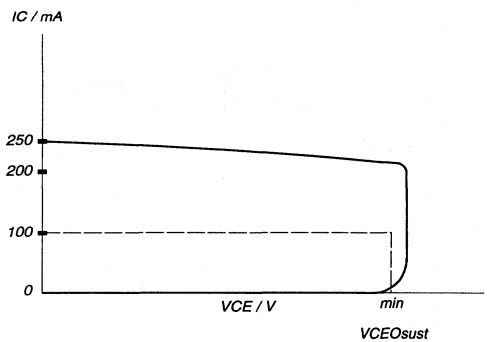


Fig.2. Oscilloscope display for $V_{CEOsust}$.

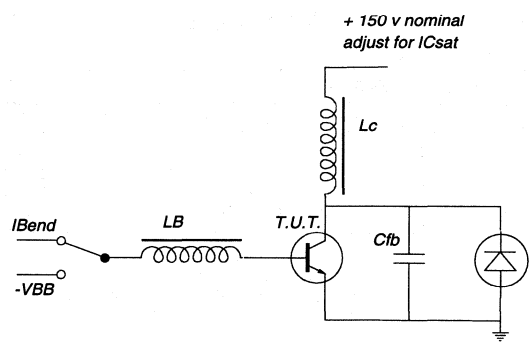


Fig.5. Switching times test circuit.

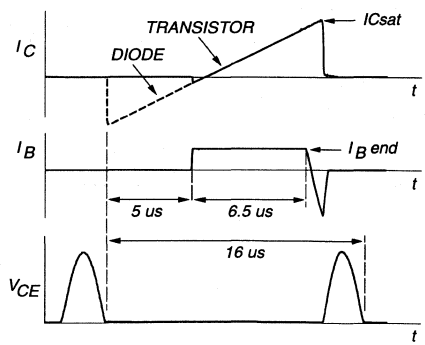


Fig.3. Switching times waveforms (64 kHz).

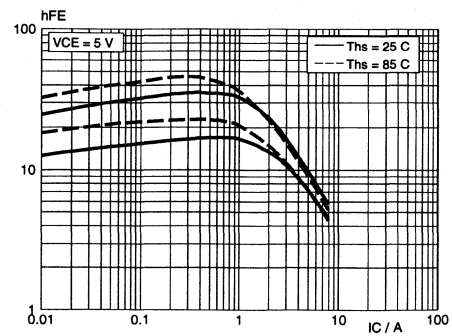


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

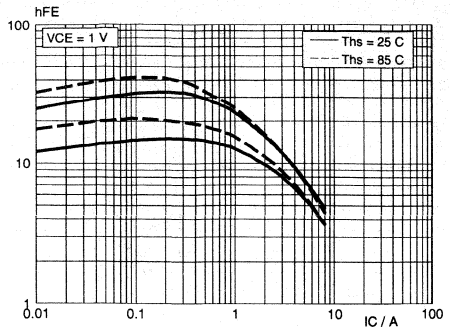


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

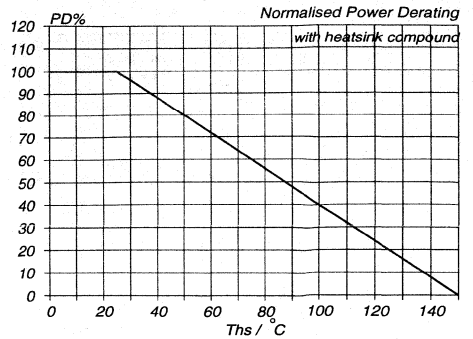


Fig.10. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

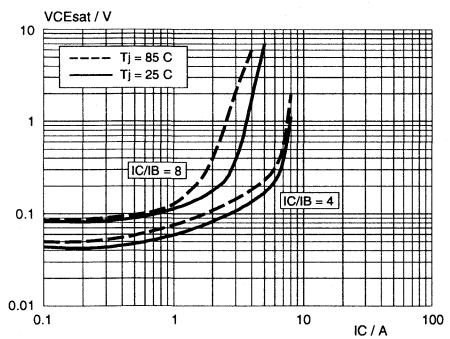


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

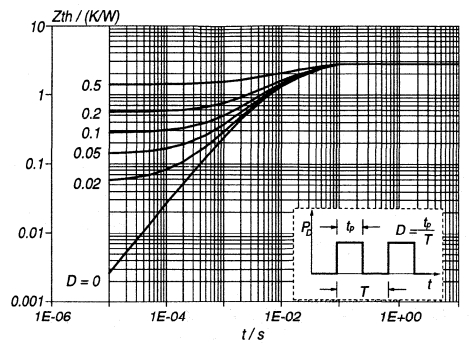


Fig.11. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

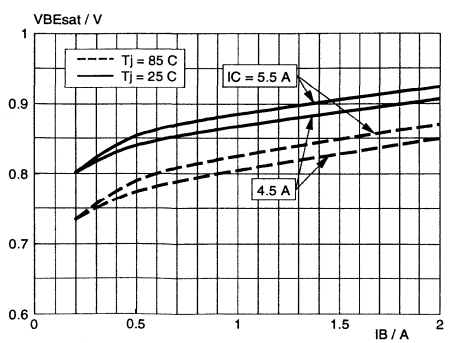


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

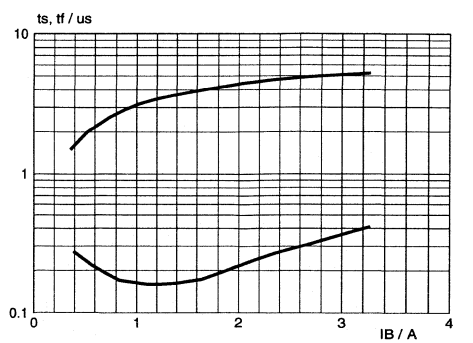


Fig.12. Typical storage and fall time.
$t_s = f(I_B)$; $t_f = f(I_B)$; I_C = 4.5 A; f = 64 kHz; T_{hs} = 85 ˚C

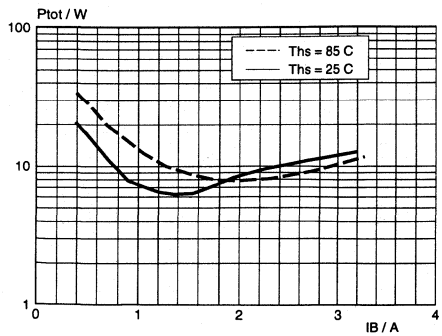


Fig.13. Typical power dissipation.
$P_{tot} = f(I_B)$; $I_C = 4.5$ A; f = 64 kHz; Parameter T_{hs}

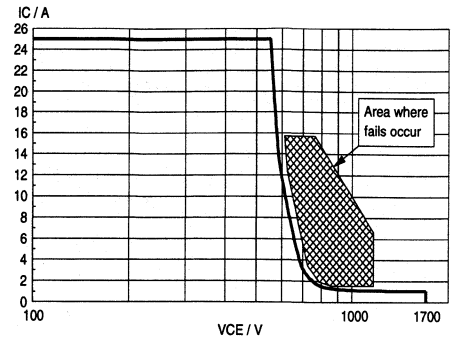


Fig.15. Reverse bias safe operating area. $T_j \leq T_{jmax}$

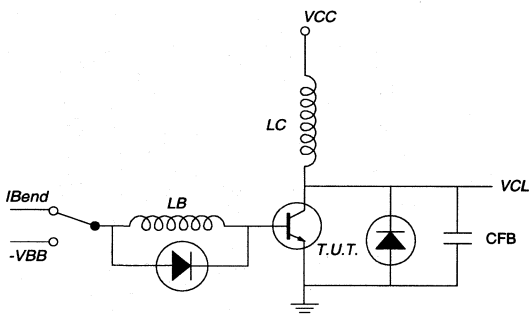


Fig.14. Test Circuit RBSOA. $V_{CC} = 150$ V;
$-V_{BB} = 1 - 4$ V;
$L_C = 1$ mH; $V_{CL} = 1500$ V; $L_B = 1 - 3$ µH;
$C_{FB} = 1 - 4$ nF; $I_{B(end)} = 0.8 - 4$ A

Silicon Diffused Power Transistor — BU2725AF

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Designed to withstand V_{CES} pulses up to 1700V.

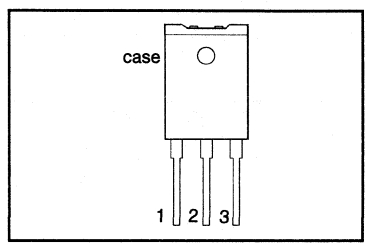
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	7.0	-	A
t_s	Storage time	I_{Csat} = 7.0 A; f = 16 kHz	5.8	6.5	µs

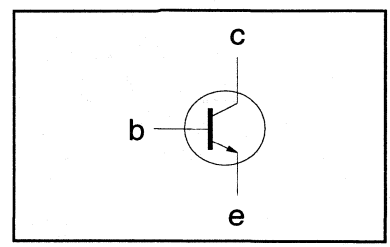
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	12	A
I_{BM}	Base current peak value		-	20	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	9	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 0.1 A; V_{CE} = 5 V	-	22	-	
h_{FE}		I_C = 7 A; V_{CE} = 1 V	4	6	8.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 7.0 A; L_C = 650 µH; C_{fb} = 18 nF; V_{CC} = 162 V; $I_{B(end)}$ = 1.5 A; L_B = 2 µH; $-V_{BB}$ = 4 V;			
t_s	Turn-off storage time		5.8	6.5	µs
t_f	Turn-off fall time		0.6	0.8	µs

2 Measured with half sine-wave voltage (curve tracer).

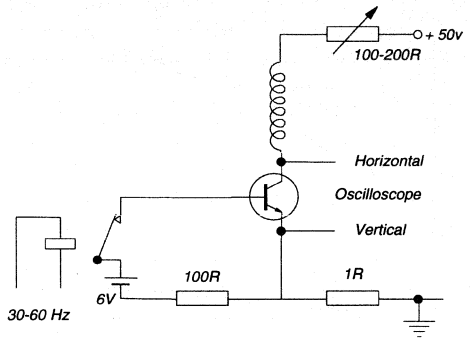


Fig.1. Test circuit for $V_{CEOsust}$.

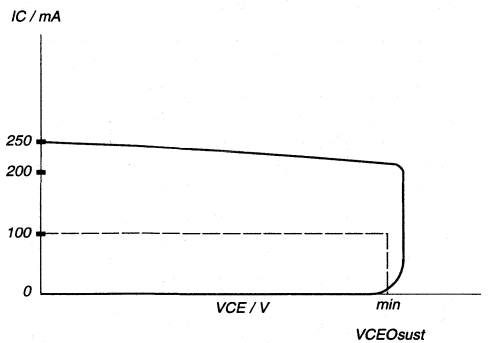


Fig.2. Oscilloscope display for $V_{CEOsust}$.

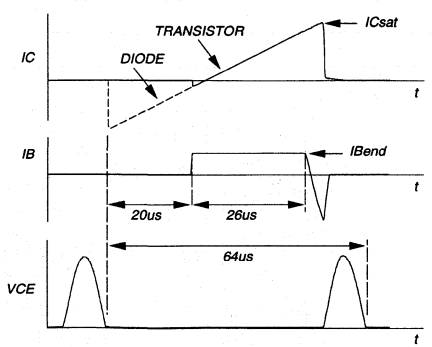


Fig.3. Switching times waveforms (16 kHz).

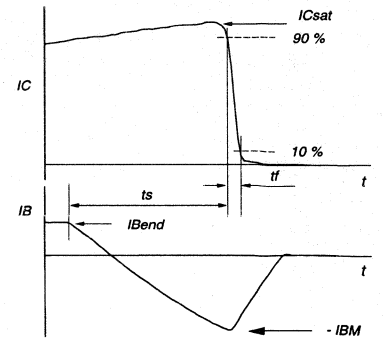


Fig.4. Switching times definitions.

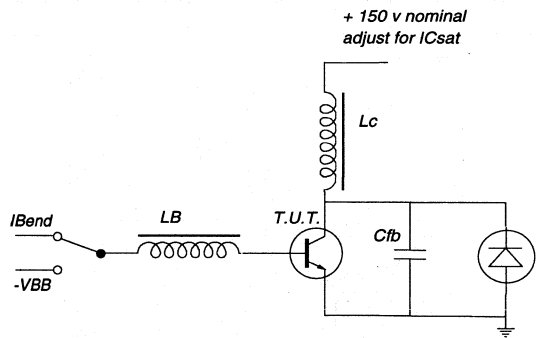


Fig.5. Switching times test circuit.

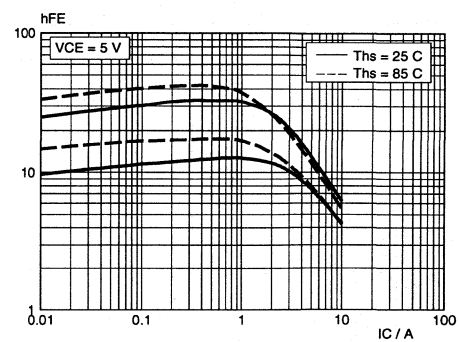


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

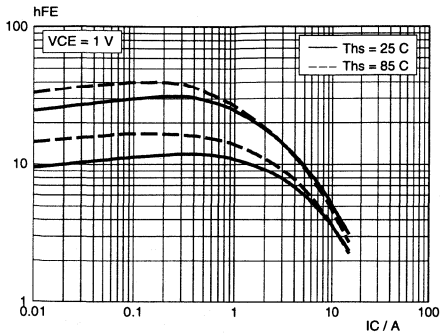


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

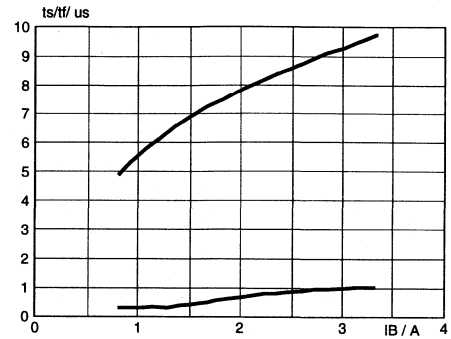


Fig.10. Limit storage and fall time.
$t_s = f(I_B)$; $tf = f(I_B)$; $T_{hs} = 85^\circ C$; f = 16 kHz

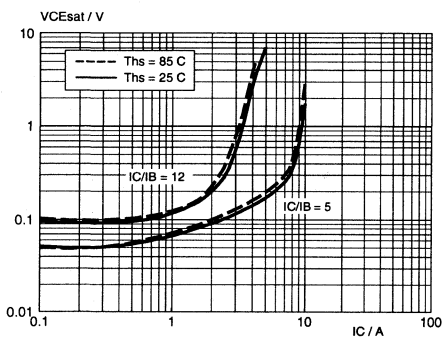


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

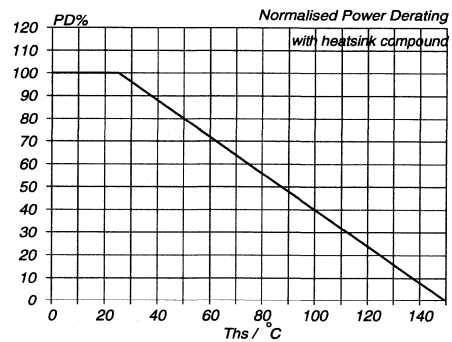


Fig.11. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD\ 25^\circ C = f(T_{hs})$

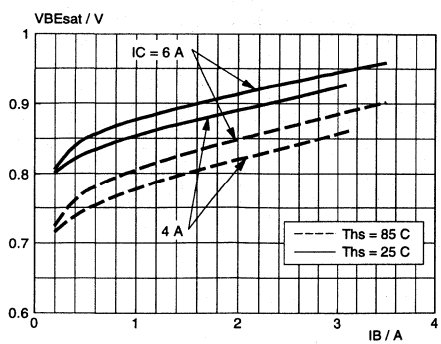


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

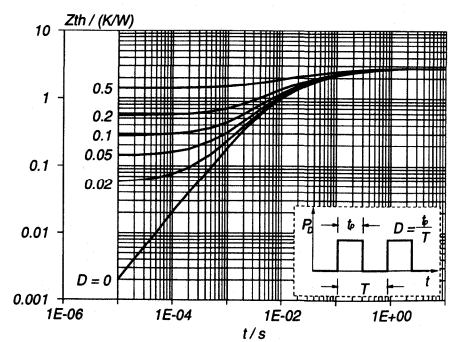


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

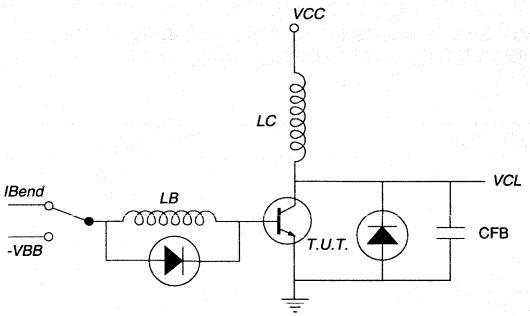


Fig.13. Test Circuit RBSOA.
V_{CC} = 150 V; $-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 0.5 - 2 µH;
C_{FB} = 1 - 3 nF; $I_{B(end)}$ = 0.8 - 4 A

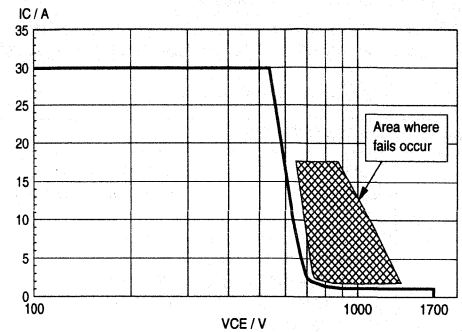


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2725AX

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Designed to withstand V_{CES} pulses up to 1700V.

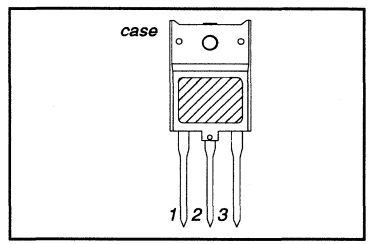
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	7.0	-	A
t_s	Storage time	I_{Csat} = 7.0 A; f = 16kHz	5.8	6.5	µs

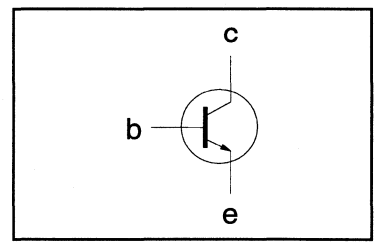
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	12	A
I_{BM}	Base current peak value		-	20	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	9	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 ˚C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 0.1 A; V_{CE} = 5 V	-	22	-	
h_{FE}		I_C = 7 A; V_{CE} = 1 V	4	6	8.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 7.0 A; L_C = 650 µH; C_{fb} = 18 nF; V_{CC} = 162 V; $I_{B(end)}$ = 1.5 A; L_B = 2 µH; $-V_{BB}$ = 4 V;			
t_s	Turn-off storage time		5.8	6.5	µs
t_f	Turn-off fall time		0.6	0.8	µs

2 Measured with half sine-wave voltage (curve tracer).

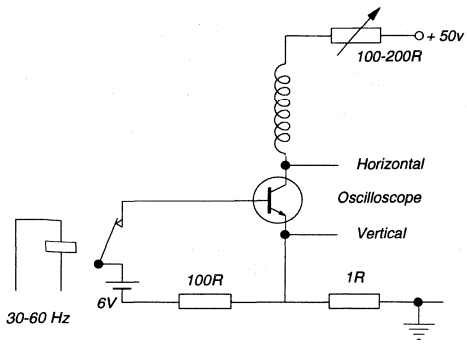


Fig.1. Test circuit for $V_{CEOsust}$.

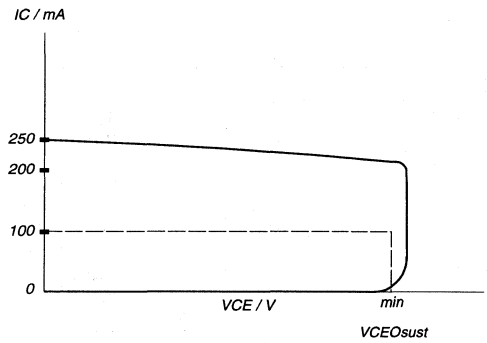


Fig.2. Oscilloscope display for $V_{CEOsust}$.

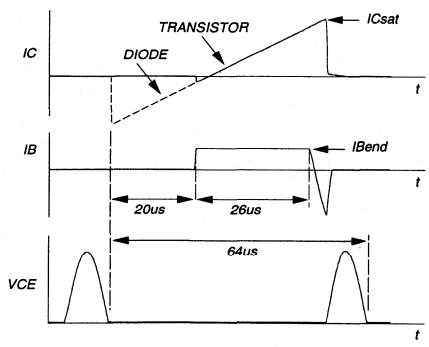


Fig.3. Switching times waveforms (16 kHz).

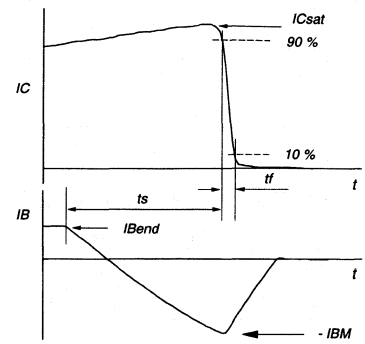


Fig.4. Switching times definitions.

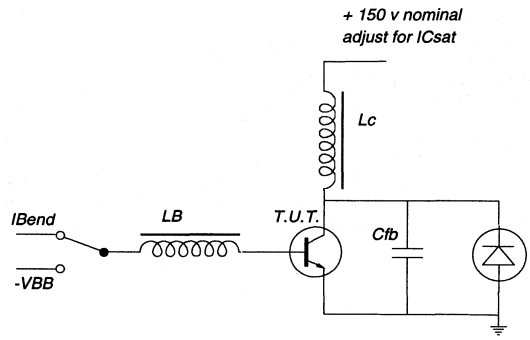


Fig.5. Switching times test circuit.

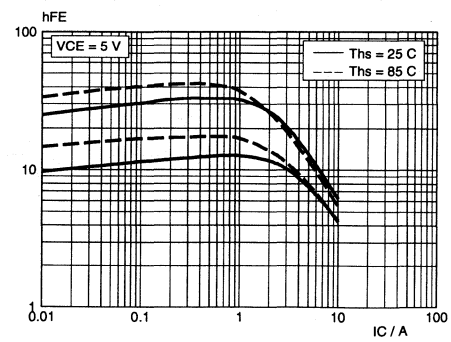


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

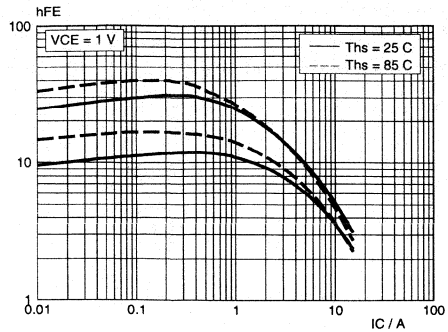


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

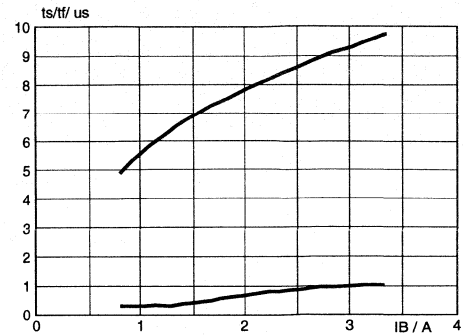


Fig.10. Limit storage and fall time.
$t_s = f(I_B)$; $tf = f(I_B)$; $T_{hs} = 85^\circ C$; f = 16 kHz

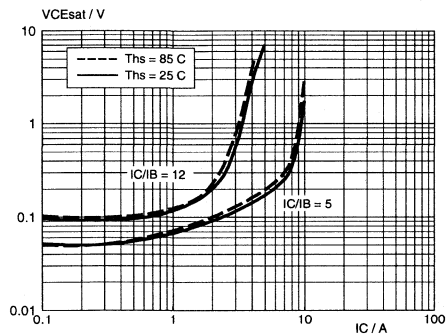


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

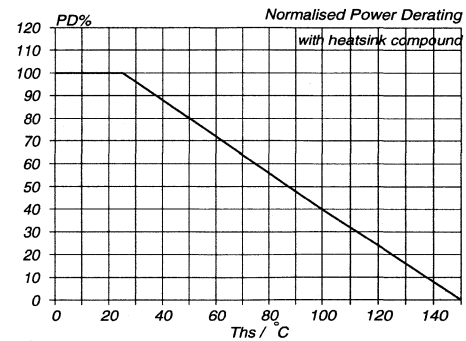


Fig.11. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

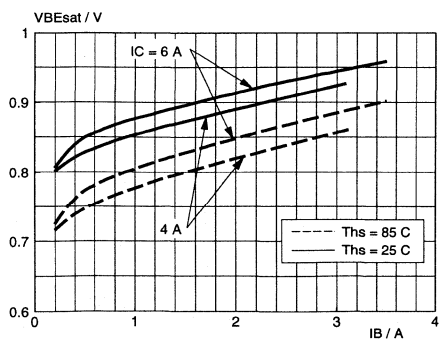


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

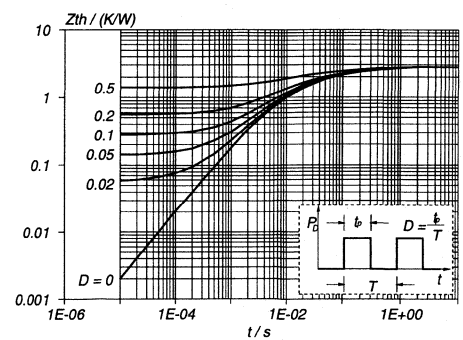


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

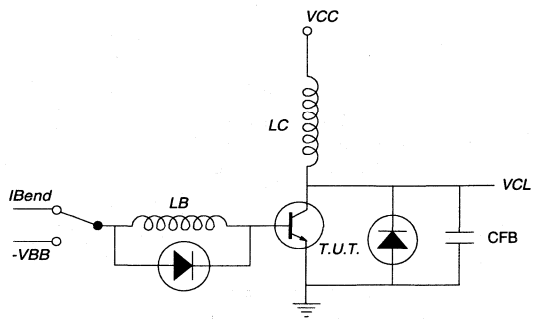


Fig.13. Test Circuit RBSOA.
V_{CC} = 150 V; $-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 0.5 - 2 µH;
C_{FB} = 1 - 3 nF; $I_{B(end)}$ = 0.8 - 4 A

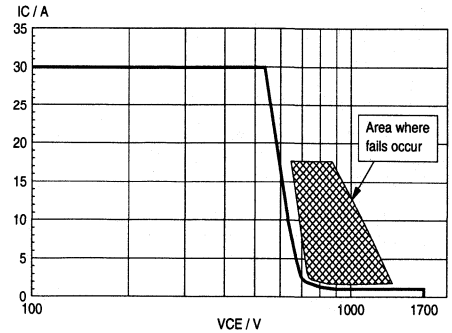


Fig.14. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2725DF

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Designed to withstand V_{CES} pulses up to 1700V.

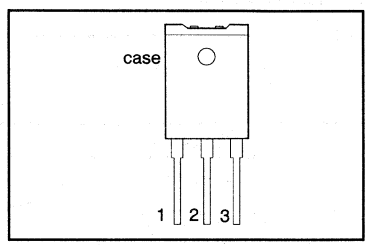
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	7.0	-	A
t_s	Storage time	I_{Csat} = 7.0 A; f = 16 kHz	1.5	2	µs

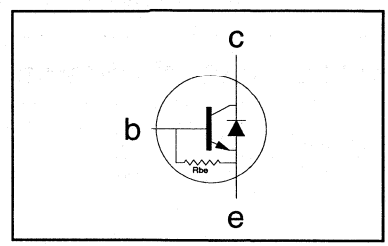
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	12	A
I_{BM}	Base current peak value		-	20	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	9	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	110	-	mA
B_{VEBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
R_{EB}	Base-emitter resistance	V_{EB} = 7.5 V		70		Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	0.78	0.86	0.95	V
V_F	Diode forward voltage	I_F = 7 A		1.4	2.2	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	19	-	
h_{FE}		I_C = 7 A; V_{CE} = 1 V	3.8	5.8	7.8	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 7.0 A; L_C = 650 µH; C_{fb} = 18 nF; V_{CC} = 162 V; $I_{B(end)}$ = 1.3 A; L_B = 2 µH; $-V_{BB}$ = 4 V;			
t_s	Turn-off storage time		1.5	2	µs
t_f	Turn-off fall time		0.14	0.3	µs

2 Measured with half sine-wave voltage (curve tracer).

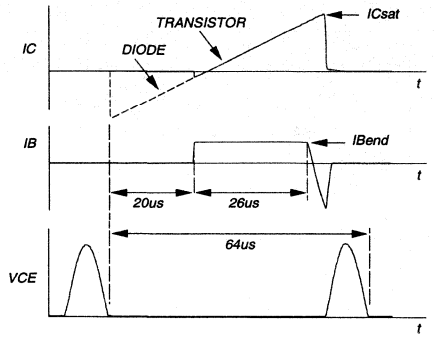


Fig.1. Switching times waveforms (16 kHz).

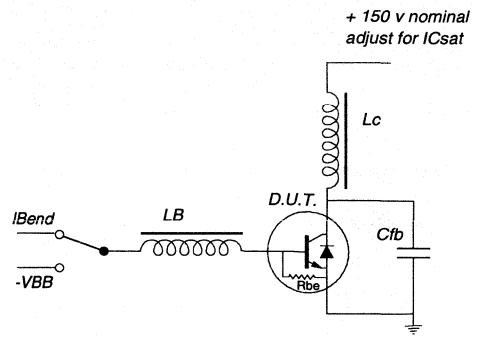


Fig.3. Switching times test circuit.

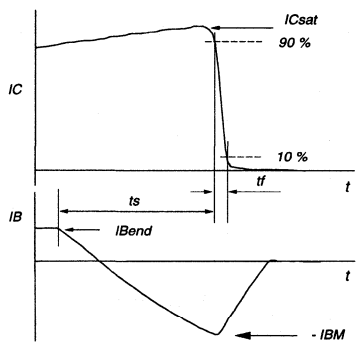


Fig.2. Switching times definitions.

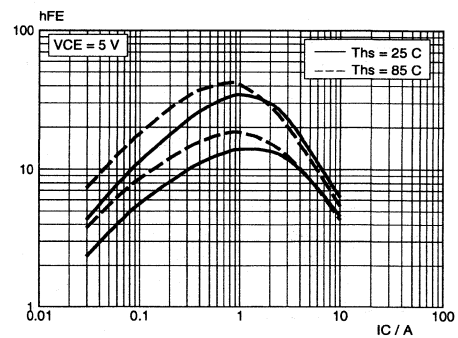


Fig.4. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

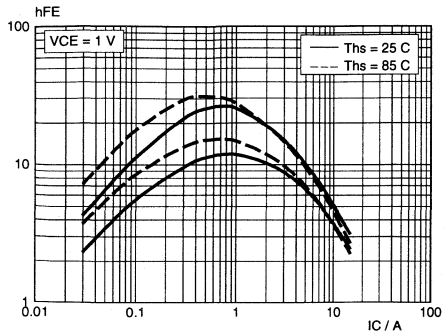


Fig.5. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

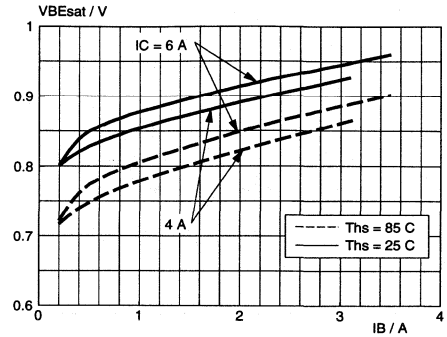


Fig.7. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

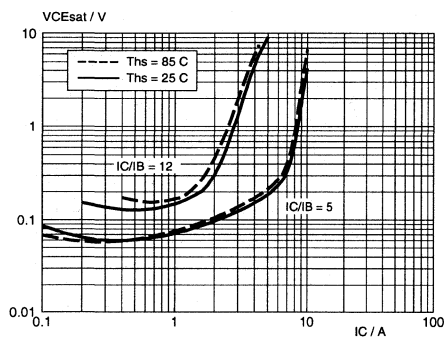


Fig.6. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

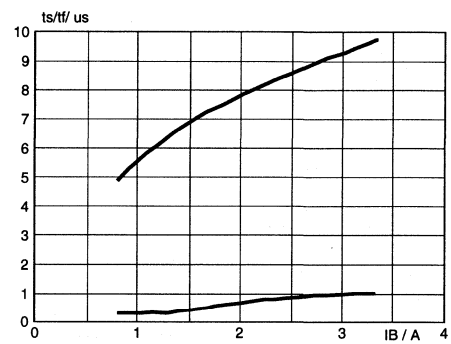


Fig.8. Limit storage and fall time.
$t_s = f(I_B)$; $tf = f(I_B)$; $T_{hs} = 85°C$; f = 16 kHz

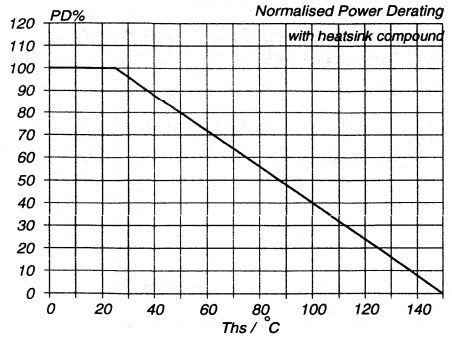


Fig.9. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

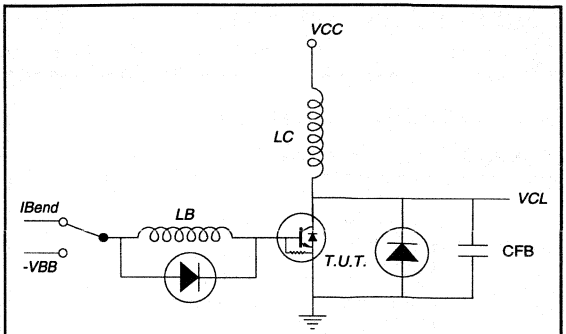


Fig.11. Test Circuit RBSOA.
V_{CC} = 150 V; $-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 0.5 - 2 µH;
C_{FB} = 1 - 3 nF; $I_{B(end)}$ = 0.8 - 4 A

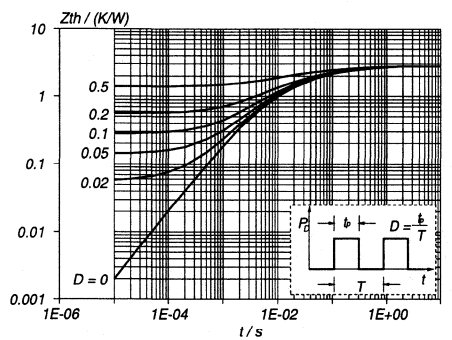


Fig.10. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

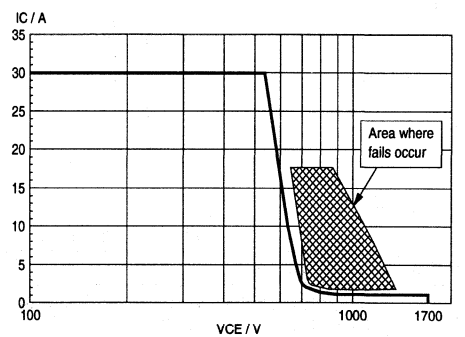


Fig.12. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor

BU2725DX

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Designed to withstand V_{CES} pulses up to 1700V.

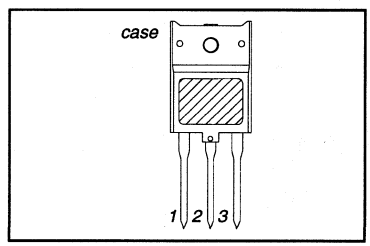
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	7.0	-	A
t_s	Storage time	I_{Csat} = 7.0 A; f = 16kHz	1.5	2	µs

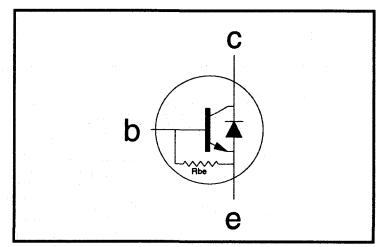
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	12	A
I_{BM}	Base current peak value		-	20	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	9	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	110	-	mA
B_{VEBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
R_{EB}	Base-emitter resistance	V_{EB} = 7.5 V		70		Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7.0 A; I_B = 1.75 A	0.78	0.86	0.95	V
V_F	Diode forward voltage	I_F = 7 A		1.4	2.2	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	19	-	
h_{FE}		I_C = 7 A; V_{CE} = 1 V	3.8	5.8	7.8	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 7.0 A; L_C = 650 µH; C_{fb} = 18 nF; V_{CC} = 162 V; $I_{B(end)}$ = 1.3 A; L_B = 2 µH; $-V_{BB}$ = 4 V;			
t_s	Turn-off storage time		1.5	2	µs
t_f	Turn-off fall time		0.14	0.3	µs

2 Measured with half sine-wave voltage (curve tracer).

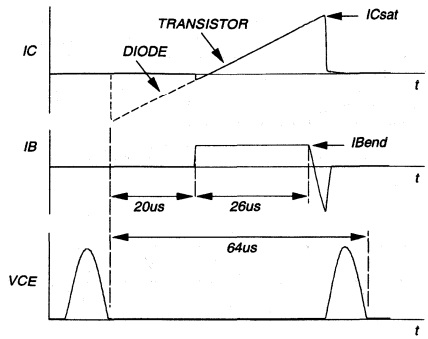


Fig.1. Switching times waveforms (16 kHz).

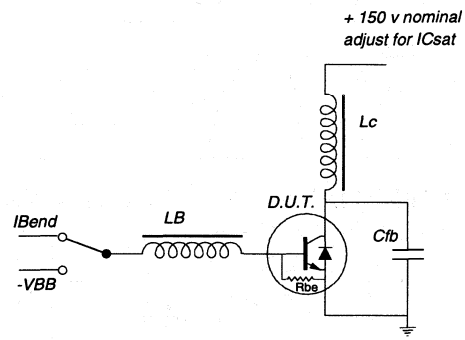


Fig.3. Switching times test circuit.

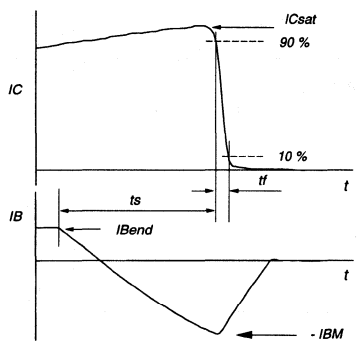


Fig.2. Switching times definitions.

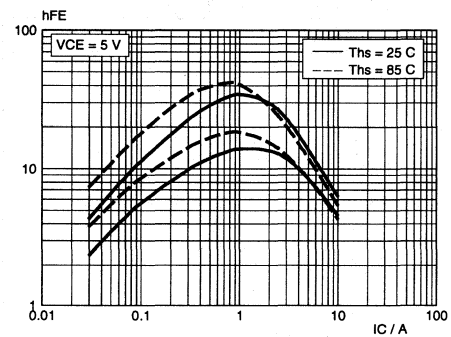


Fig.4. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

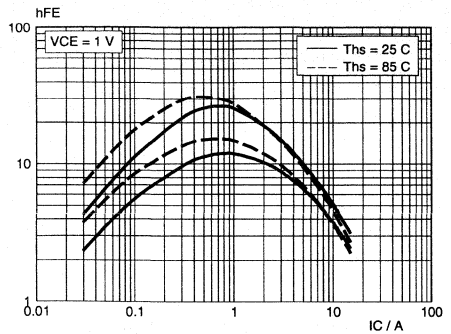


Fig.5. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

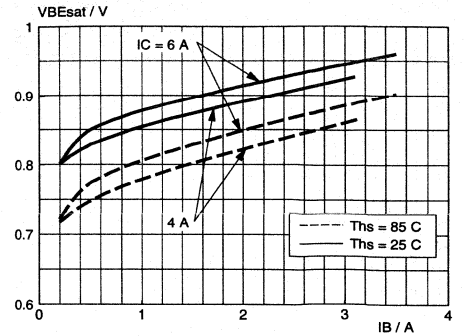


Fig.7. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

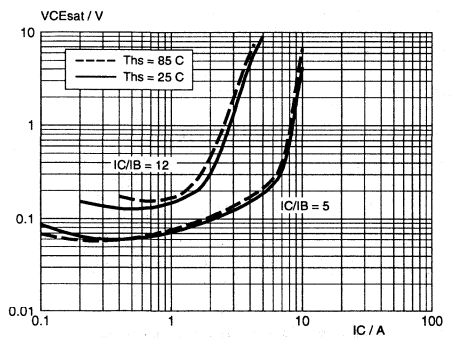


Fig.6. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

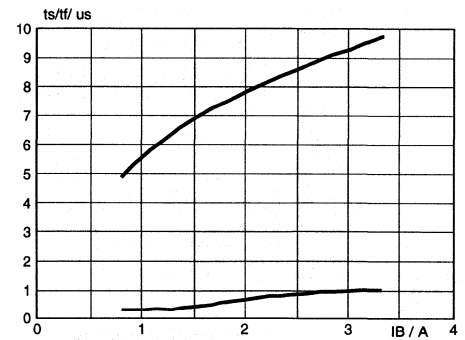


Fig.8. Limit storage and fall time.
$t_s = f(I_B)$; $tf = f(I_B)$; $T_{hs} = 85°C$; f = 16 kHz

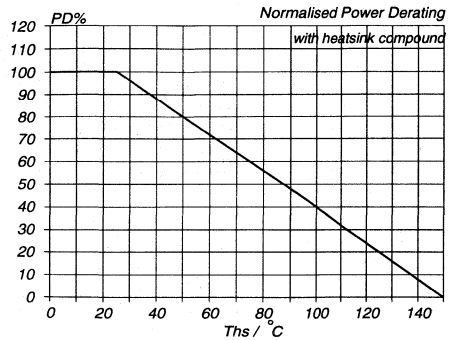


Fig.9. Normalised power dissipation.
PD% = 100·PD/PD 25˚C = f (T_{hs})

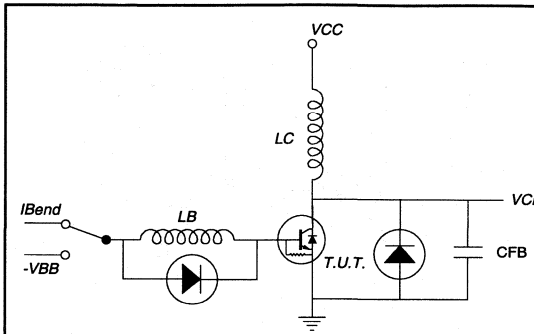


Fig.11. Test Circuit RBSOA.
V_{CC} = 150 V; $-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 0.5 - 2 µH;
C_{FB} = 1 - 3 nF; $I_{B(end)}$ = 0.8 - 4 A

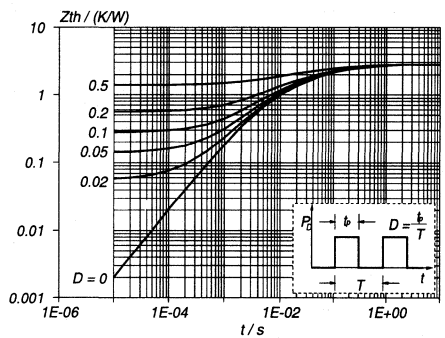


Fig.10. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

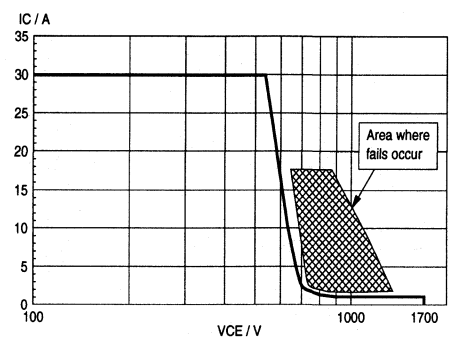


Fig.12. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2727AF

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Designed to withstand V_{CES} pulses up to 1700V.

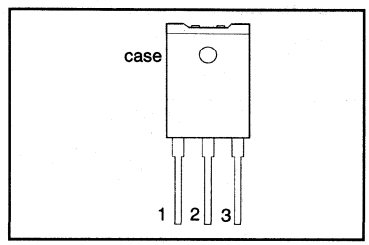
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 0.91 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	5.0	-	A
t_s	Storage time	I_{Csat} = 5.0 A; f = 64 kHz	2.5	3.0	µs

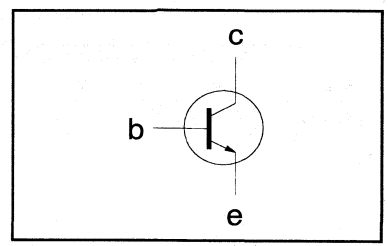
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	12	A
I_{BM}	Base current peak value		-	25	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 0.91 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.0 A; I_B = 0.91 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 0.1 A; V_{CE} = 5 V	-	22	-	
h_{FE}		I_C = 5 A; V_{CE} = 1 V	5.5	8	11	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 5.0 A; L_C = 260 µH; C_{fb} = 4.8 nF; V_{CC} = 180 V; $I_{B(end)}$ = 0.9 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ = 3.33 A/µs)			
t_s	Turn-off storage time		2.5	3.0	µs
t_f	Turn-off fall time		0.30	0.39	µs

2 Measured with half sine-wave voltage (curve tracer).

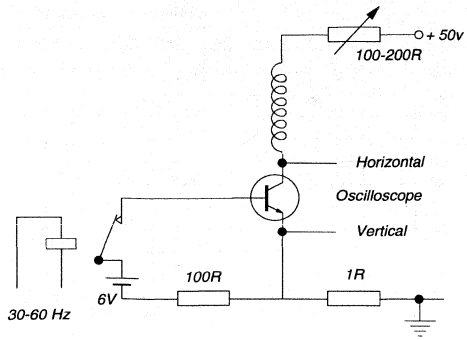


Fig.1. Test circuit for $V_{CEOsust}$.

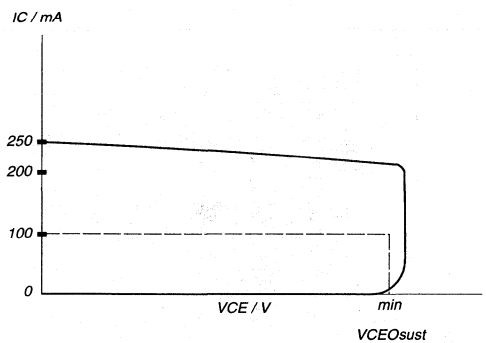


Fig.2. Oscilloscope display for $V_{CEOsust}$.

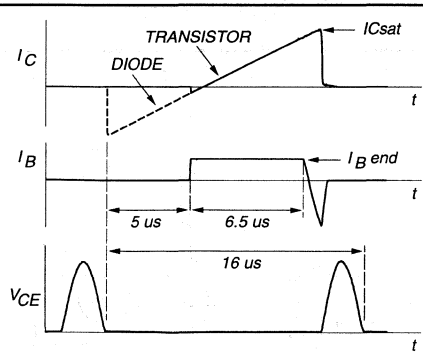


Fig.3. Switching times waveforms (64 kHz).

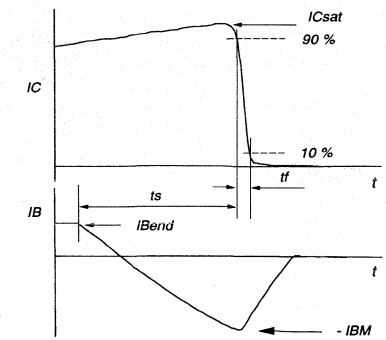


Fig.4. Switching times definitions.

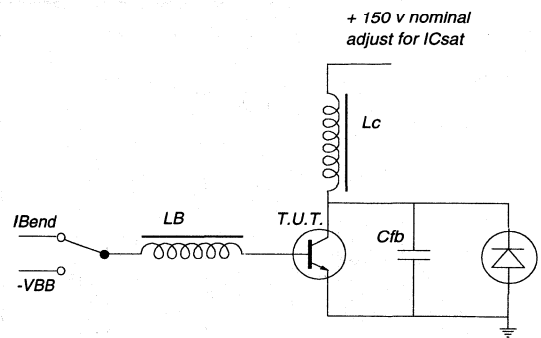


Fig.5. Switching times test circuit.

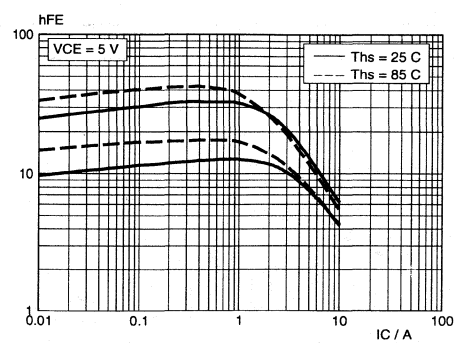


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

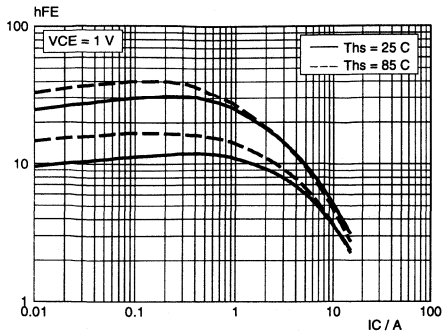


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

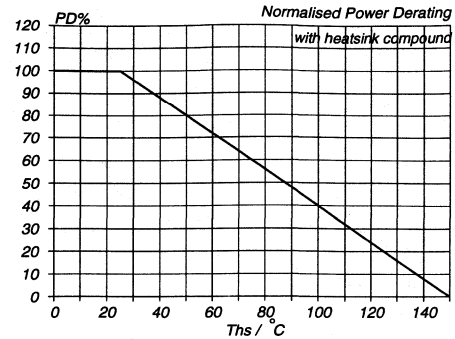


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD\ 25^{\circ}C = f(T_{hs})$

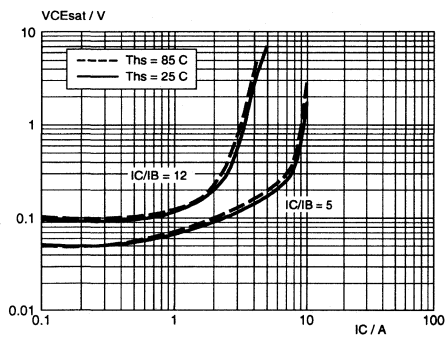


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

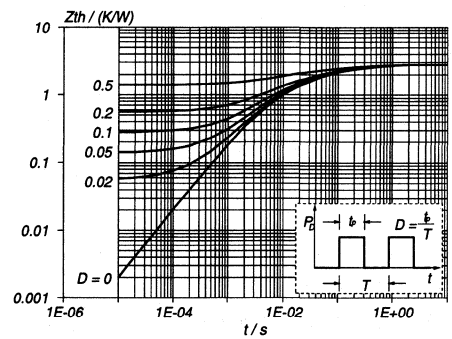


Fig.11. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

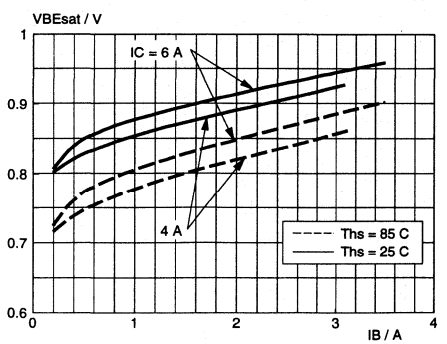


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

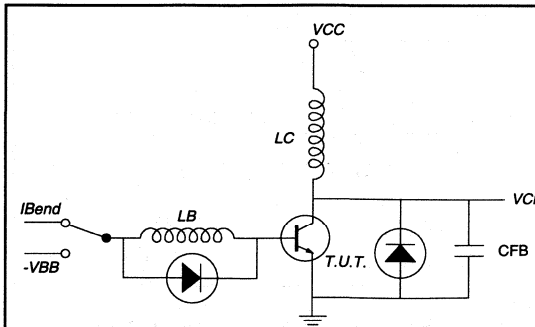


Fig.12. Test Circuit RBSOA.
$V_{CC} = 150$ V; $-V_{BB} = 1 - 4$ V;
$L_C = 1$ mH; $V_{CL} = 1500$ V; $L_B = 0.5 - 2$ µH;
$C_{FB} = 1 - 3$ nF; $I_{B(end)} = 0.8 - 4$ A

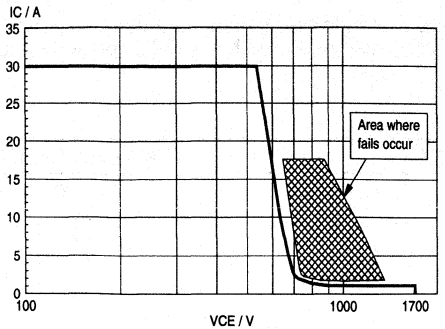


Fig.13. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2727AW

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of high resolution monitors, suitable for operation up to 64 kHz. Designed to withstand V_{CES} pulses up to 1700V.

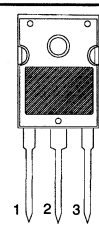
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 0.91 A	-	1.0	V
I_{Csat}	Collector saturation current		5.0	-	A
t_s	Storage time	I_{CM} = 5.0 A; $I_{B(end)}$ = 0.9 A	2.2	tbf	µs

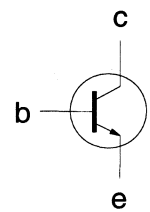
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	12	A
I_{BM}	Base current peak value		-	25	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	25	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 0.91 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.0 A; I_B = 0.91 A	0.78	0.86	0.95	V
h_{FE}	DC current gain	I_C = 0.1 A; V_{CE} = 5 V	12	22	35	
h_{FE}		I_C = 5 A; V_{CE} = 1 V	5.5	8	11	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (64 kHz line deflection circuit)	I_{CM} = 5.0 A; L_C = 260 µH; C_{fb} = 4.8 nF; V_{CC} = 180 V; $I_{B(end)}$ = 0.9 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ = 3.33 A/µs)			
t_s	Turn-off storage time		2.2	tbf	µs
t_f	Turn-off fall time		tbf	tbf	µs

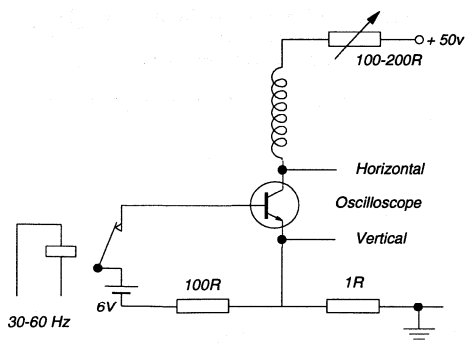


Fig.1. Test circuit for $V_{CEOsust}$.

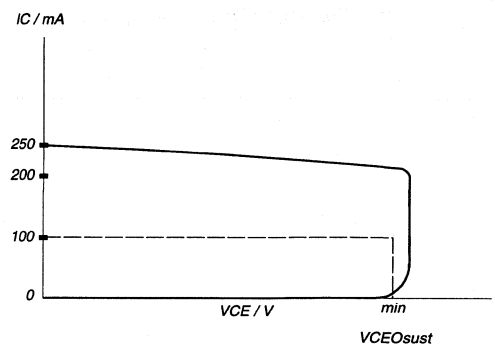


Fig.2. Oscilloscope display for $V_{CEOsust}$.

2 Measured with half sine-wave voltage (curve tracer).

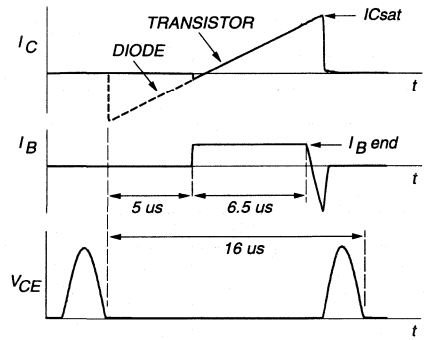


Fig.3. Switching times waveforms (64 kHz).

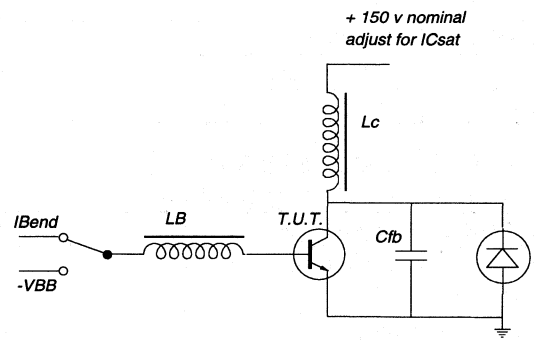


Fig.5. Switching times test circuit.

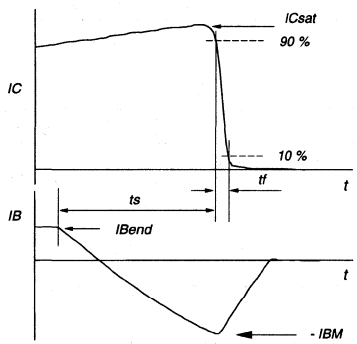


Fig.4. Switching times definitions.

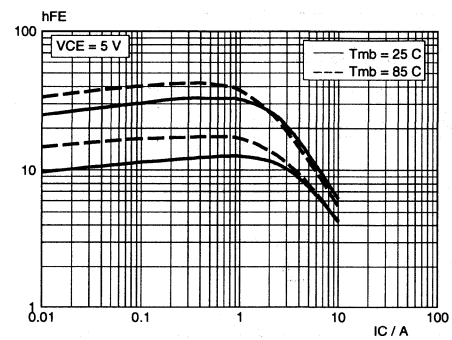


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{mb}
(Low and high gain)

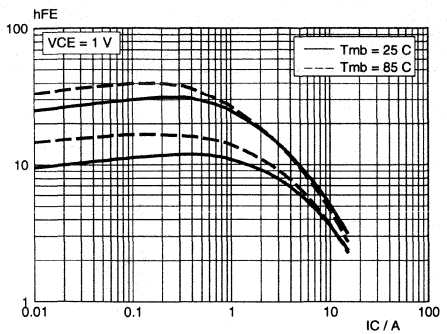


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{mb}
(Low and high gain)

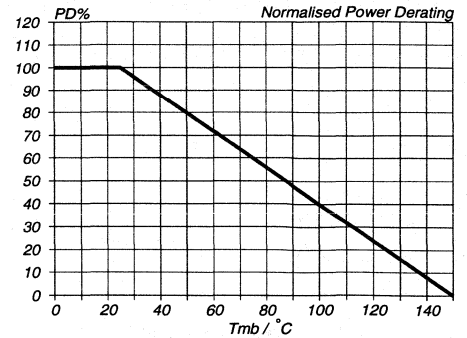


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD\ 25^{\circ}C = f(T_{mb})$

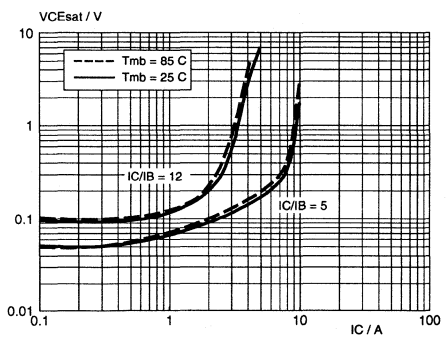


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

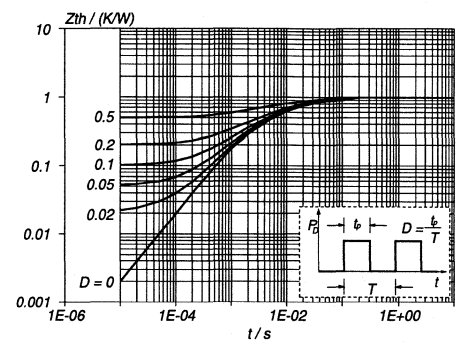


Fig.11. Transient thermal impedance.
$Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

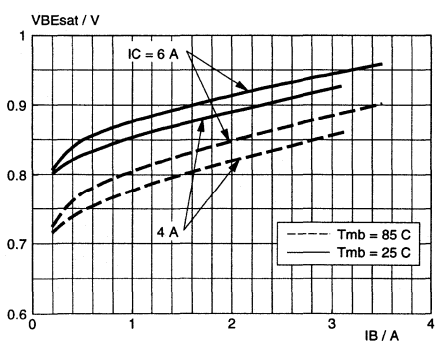


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

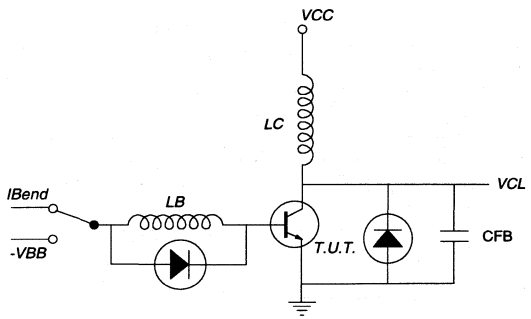


Fig.12. Test Circuit RBSOA.
V_{CC} = 150 V; $-V_{BB}$ = 1 - 4 V;
L_C = 1 mH; V_{CL} = 1500 V; L_B = 0.5 - 2 µH;
C_{FB} = 1 - 3 nF; $I_{B(end)}$ = 0.8 - 4 A

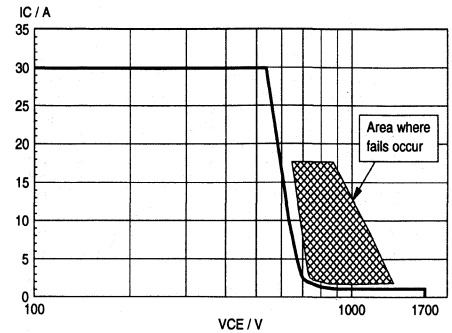


Fig.13. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU2727AX

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of high resolution monitors. Designed to withstand V_{CES} pulses up to 1700V.

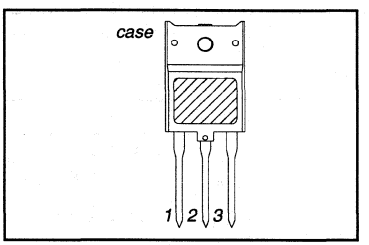
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 0.91 A	-	1.0	V
I_{Csat}	Collector saturation current	f = 64 kHz	5.0	-	A
t_s	Storage time	I_{Csat} = 5.0 A; f = 64kHz	2.5	3.0	µs

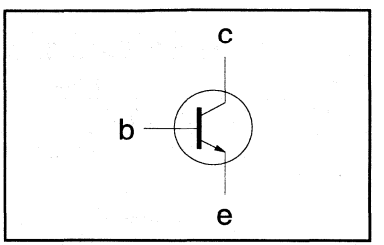
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1700	V
V_{CEO}	Collector-emitter voltage (open base)		-	825	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	12	A
I_{BM}	Base current peak value		-	20	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
$-I_{BM}$	Reverse base current peak value [1]		-	9	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

ESD LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (250 pF, 1.5 kΩ)	-	10	kV

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	825	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 0.91 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.0 A; I_B = 0.91 A	-	-	1.0	V
h_{FE}	DC current gain	I_C = 0.1 A; V_{CE} = 5 V	-	22	-	
h_{FE}		I_C = 5 A; V_{CE} = 1 V	5.5	8	11	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 5.0 A; L_C = 260 µH; C_{fb} = 4.8 nF; V_{CC} = 180 V; $I_{B(end)}$ = 0.9 A; L_B = 0.6 µH; $-V_{BB}$ = 2 V; ($-dI_B/dt$ = 3.33 A/µs)			
t_s	Turn-off storage time		2.5	3.0	µs
t_f	Turn-off fall time		0.30	0.39	µs

2 Measured with half sine-wave voltage (curve tracer).

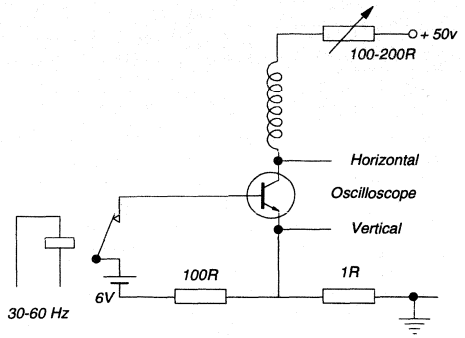


Fig.1. Test circuit for $V_{CEOsust}$.

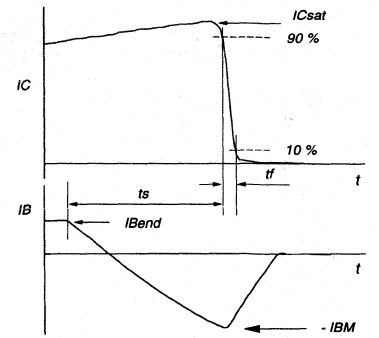


Fig.4. Switching times definitions.

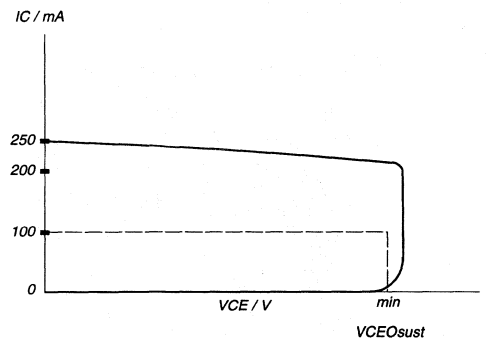


Fig.2. Oscilloscope display for $V_{CEOsust}$.

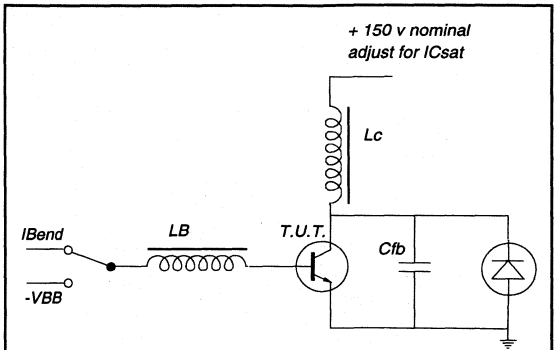


Fig.5. Switching times test circuit.

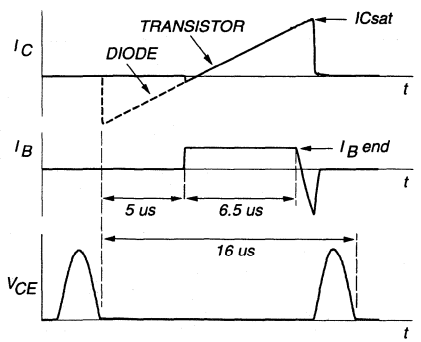


Fig.3. Switching times waveforms (64 kHz).

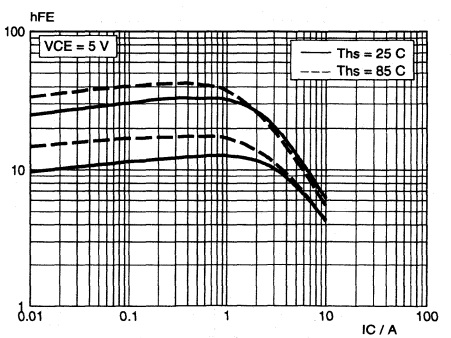


Fig.6. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

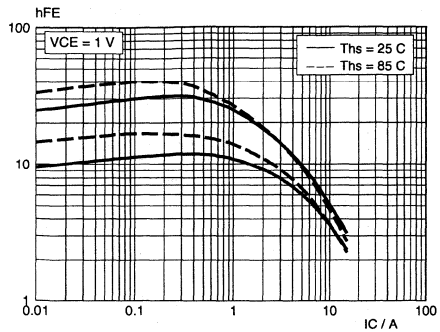


Fig.7. DC current gain. $h_{FE} = f(I_C)$
Parameter T_{hs}
(Low and high gain)

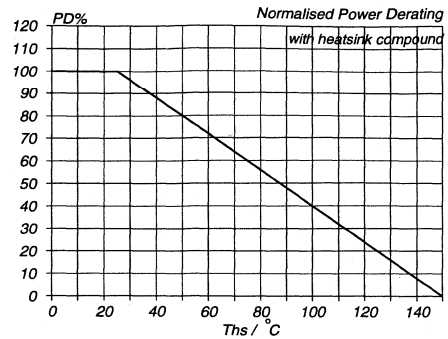


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD\ 25°C = f(T_{hs})$

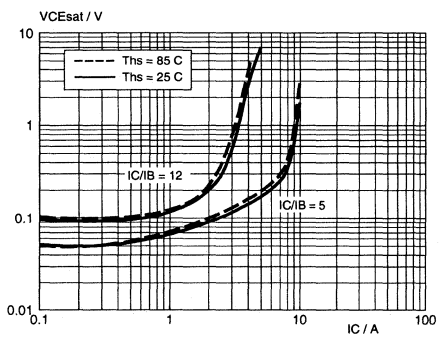


Fig.8. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

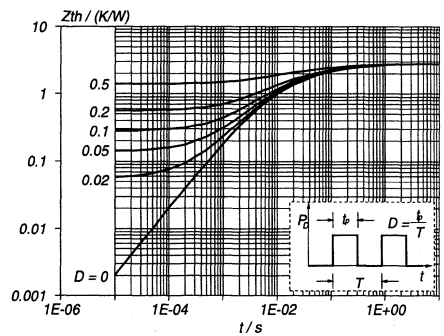


Fig.11. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

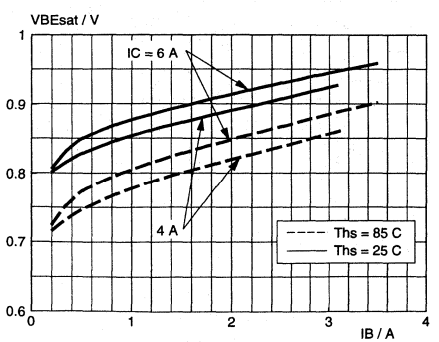


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

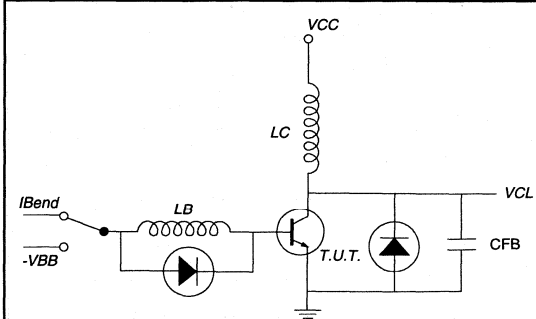


Fig.12. Test Circuit RBSOA.
$V_{CC} = 150$ V; $-V_{BB} = 1 - 4$ V;
$L_C = 1$ mH; $V_{CL} = 1500$ V; $L_B = 0.5 - 2$ µH;
$C_{FB} = 1 - 3$ nF; $I_{B(end)} = 0.8 - 4$ A

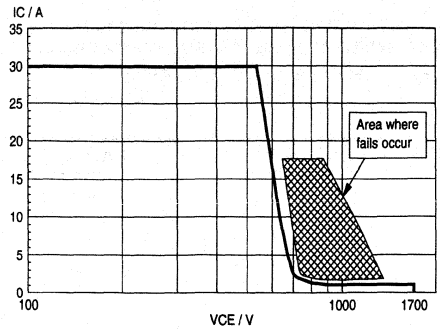


Fig.13. Reverse bias safe operating area. $T_j \leq T_{jmax}$

Silicon Diffused Power Transistor — BU4506AF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for Design-in information

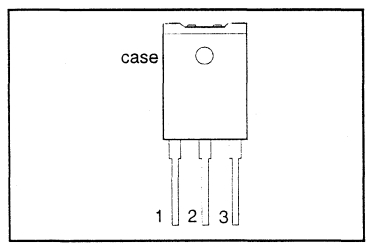
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3 A; I_B = 0.75 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	3.0	-	A
t_f	Fall time	I_{Csat} = 3.0 A;f = 16 kHz	t.b.f	t.b.f	µs

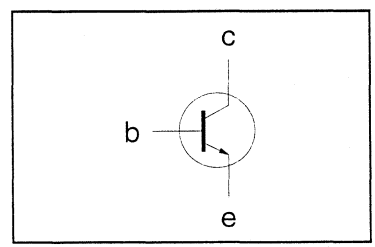
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{BM}$	Reverse base current peak value [1]		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	32	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	t.b.f	-	1.1	V
h_{FE}	DC current gain	I_C = 0.3 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 3 A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	47	-	pF
	Switching times (line deflection circuit)	I_{Csat} = 3.0 A; I_{B1} = 0.6 A; (I_{B2} = -1.5 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4506AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See the semiconductors for Design-in information

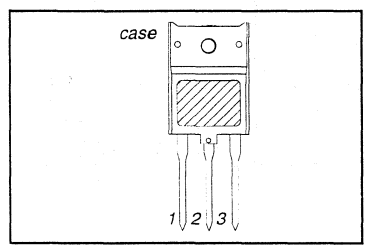
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	3	V
I_{Csat}	Collector saturation current	f = 16kHz	3.0	-	A
t_f	Fall time	I_{Csat} = 3.0 A; f = 16kHz	t.b.f	t.b.f	µs

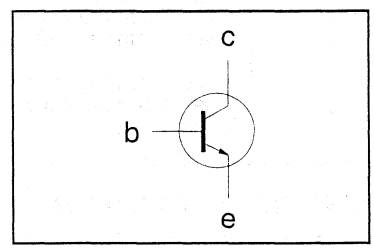
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{BM}$	Reverse base current peak value [1]		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	32	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	t.b.f	-	1.1	V
h_{FE}	DC current gain	I_C = 0.3 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 3A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	47	-	pF
	Switching times (line deflection circuit)	I_{Csat} = 3.0 A; I_{B1} = 0.6 A; (I_{B2} = -1.5 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4506AZ

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for design-in information

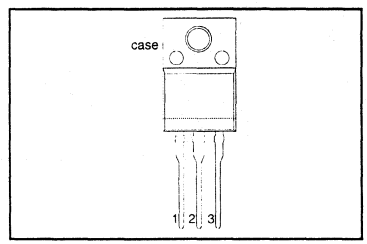
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	3	V
I_{Csat}	Collector saturation current	f = 16 kHz	3.0	-	A
t_f	Fall time	I_{Csat} = 3.0 A;f = 16 kHz	t.b.f	t.b.f	µs

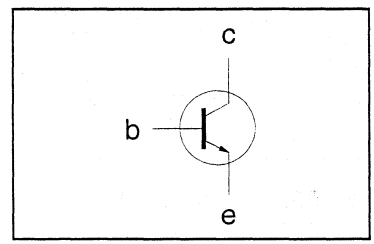
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{BM}$	Reverse base current peak value [1]		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	32	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.9	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	t.b.f	-	1.1	V
h_{FE}	DC current gain	I_C = 0.3 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 3A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	47	-	pF
	Switching times (line deflection circuit)	I_{Csat} = 3.0 A; I_{B1} = 0.6 A; I_{B2} = -1.5 A;			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4506DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with integrated diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for Design-in information

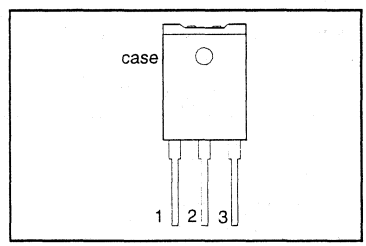
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3 A; I_B = 0.75 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	3.0	-	A
V_F	Diode forward voltage	I_F = 3.0 A	-	2.0	V
t_f	Fall time	I_{Csat} = 3.0 A;f = 16 kHz	t.b.f	t.b.f	µs

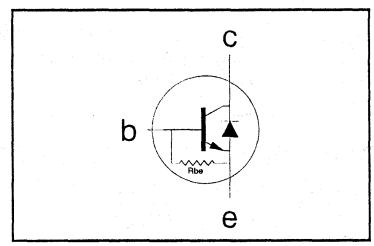
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{BM}$	Reverse base current peak value [1]		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	32	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	30	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 0.3 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 3 A; V_{CE} = 5 V	4.2	5.35	7.3	
V_F	Diode forward voltage	I_F = 3.0 A	-	-	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	47	-	pF
	Switching times (16kHz line deflection circuit)	I_{Csat} = 3.0 A; I_{B1} = 0.6 A; (I_{B2} = -1.5 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4506DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE Design-in information
See Philips Semiconductors for

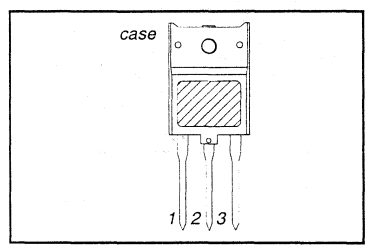
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	3	V
I_{Csat}	Collector saturation current	f = 16kHz	3.0	-	A
V_F	Diode forward voltage	I_F = 3.0 A	-	2.0	V
t_f	Fall time	I_{Csat} = 3.0 A; f = 16kHz	t.b.f	t.b.f	µs

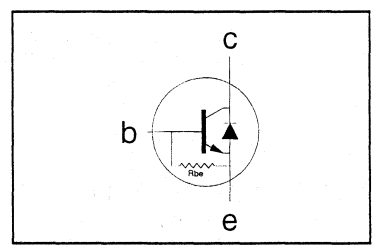
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{BM}$	Reverse base current peak value [1]		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	32	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	30	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 0.3 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 3A; V_{CE} = 5 V	4.2	5.8	7.3	
V_F	Diode forward voltage	I_F = 3.0 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	47	-	pF
	Switching times 16kHz (line deflection circuit)	I_{Csat} = 3.0 A; I_{B1} = 0.6 A; (I_{B2} = -1.5 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4506DZ

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope with integrated damper diode intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for Design-in information

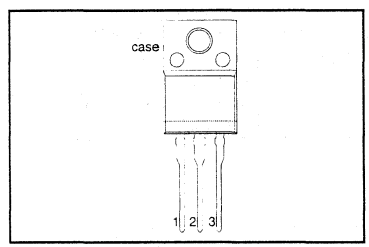
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	3	V
I_{Csat}	Collector saturation current	f = 16 kHz	3.0	-	A
V_F	Diode forward voltage	I_F = 3.0 A	-	2.0	V
t_f	Fall time	I_{Csat} = 3.0 A;f = 16 kHz	t.b.f	t.b.f	µs

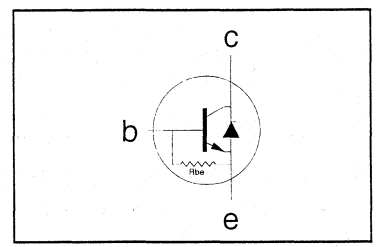
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
$-I_{BM}$	Reverse base current peak value [1]		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	32	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.9	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	30	-	Ω
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 0.3 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 3A; V_{CE} = 5 V	4.2	5.35	7.3	
V_F	Diode forward voltage	I_F = 3.0 A	-	1.6	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	47	-	pF
	Switching times (line deflection circuit)	I_{Csat} = 3.0 A; I_{B1} = 0.6 A; I_{B2} = -1.5 A;			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4507AF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

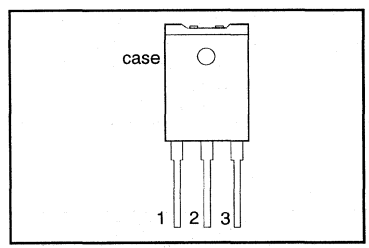
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
		f = 56kHz	4	-	A
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.3	0.45	µs
		I_{Csat} = 4 A; f = 56kHz	0.21	-	µs

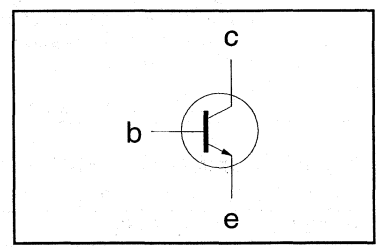
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	-	100	µA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 1 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1 A	0.84	0.92	1.01	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	4.2	5.7	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.0 A; I_{B1} = 0.8 A (I_{B2} = -2.0 A)			
t_s	Turn-off storage time		3.8	4.6	µs
t_f	Turn-off fall time		0.30	0.45	µs
	Switching times (56 kHz line deflection circuit)	I_{Csat} = 4.0 A; I_{B1} = 0.8 A (I_{B2} = -2.1 A)			
t_s	Turn-off storage time		2.4	-	µs
t_f	Turn-off fall time		0.21	-	µs

2 Measured with half sine-wave voltage (curve tracer).

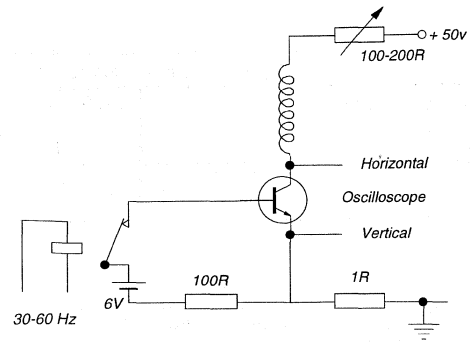


Fig.1. Test circuit for $V_{CEOsust}$.

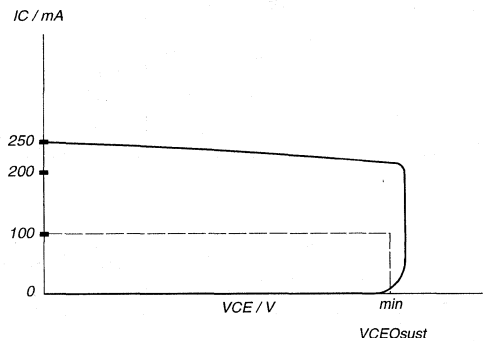


Fig.2. Oscilloscope display for $V_{CEOsust}$.

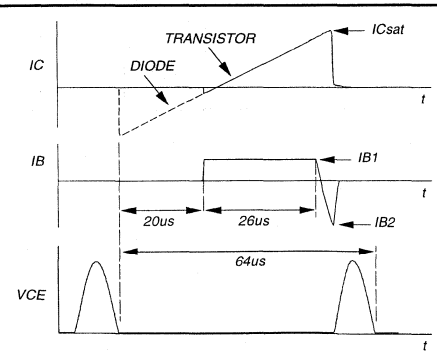


Fig.3. Switching times waveforms (16 kHz).

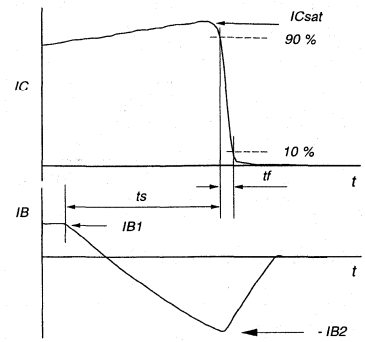


Fig.4. Switching times definitions.

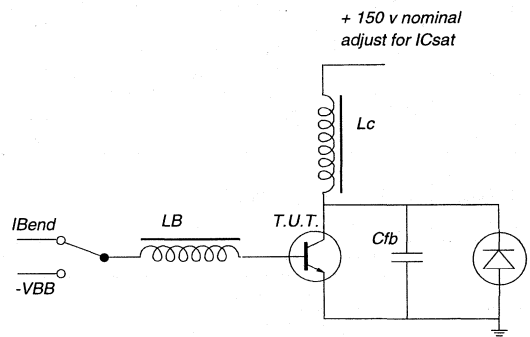


Fig.5. Switching times test circuit.

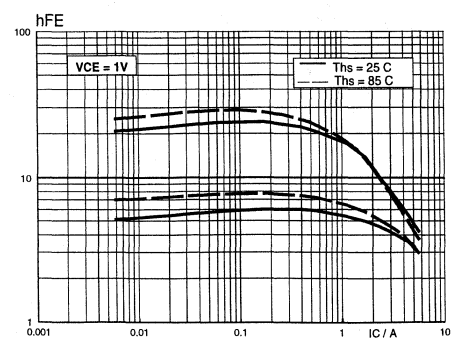


Fig.6. High and low DC current gain.

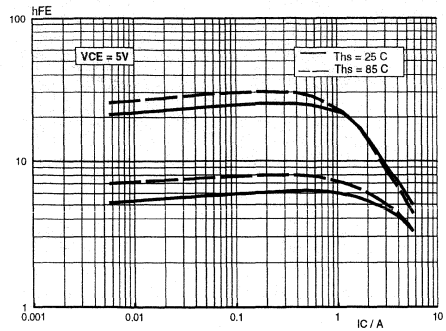


Fig.7. High and low DC current gain.

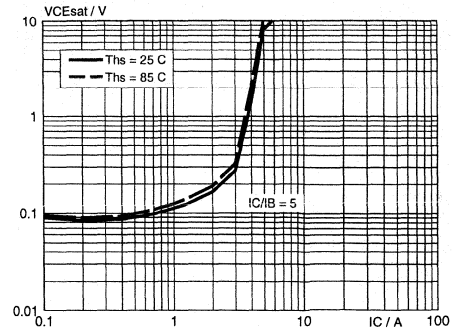


Fig.10. Typical collector-emitter saturation voltage.

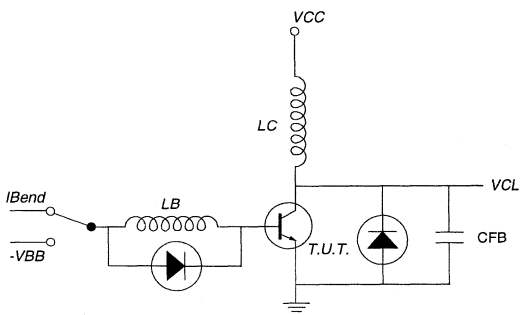


Fig.8. Test Circuit RBSOA.

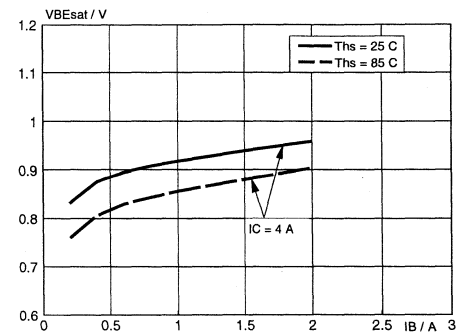


Fig.11. Typical base-emitter saturation voltage.

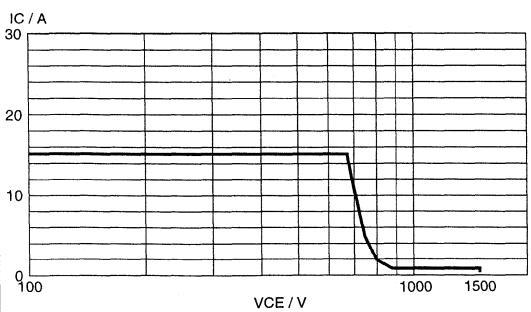


Fig.9. Reverse bias safe operating area. $T_j \leq T_{jmax}$

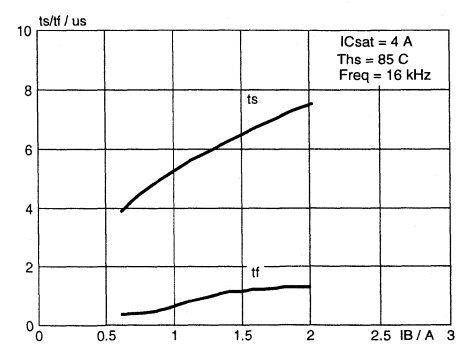


Fig.12. Typical collector storage and fall time. I_C =4 A; T_j = 85˚C; f = 16kHz

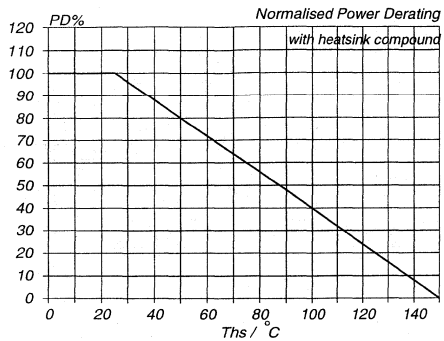


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D / P_{D\,25^\circ C}$

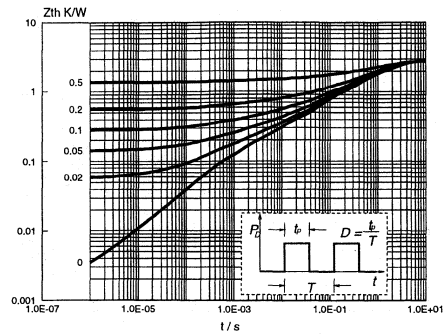


Fig.14. Transient thermal impedance.

Silicon Diffused Power Transistor — BU4507AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

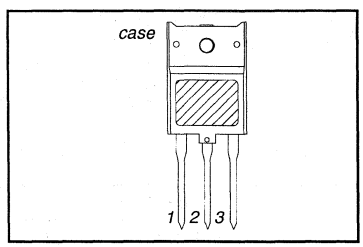
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
		f = 56kHz	4	-	A
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.3	0.45	µs
		I_{Csat} = 4 A; f = 56kHz	0.21	-	µs

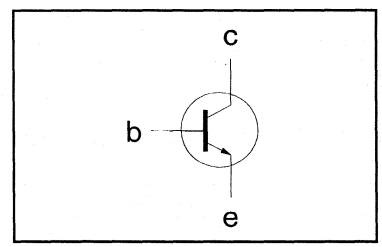
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$ T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	-	100	µA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 1 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1 A	0.84	0.92	1.01	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	4.2	5.7	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.0 A; I_{B1} = 0.8 A (I_{B2} = -2.0 A)			
t_s	Turn-off storage time		3.8	4.6	µs
t_f	Turn-off fall time		0.30	0.45	µs
	Switching times (56 kHz line deflection circuit)	I_{Csat} = 4.0 A; I_{B1} = 0.8 A (I_{B2} = -2.1 A)			
t_s	Turn-off storage time		2.4	-	µs
t_f	Turn-off fall time		0.21	-	µs

2 Measured with half sine-wave voltage (curve tracer).

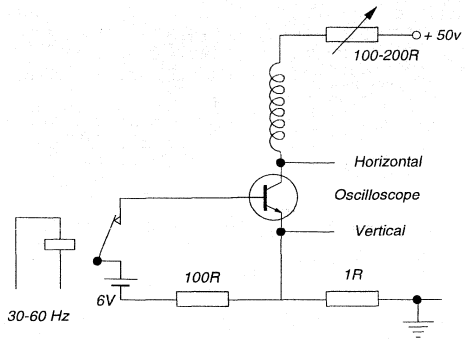


Fig.1. Test circuit for $V_{CEOsust}$.

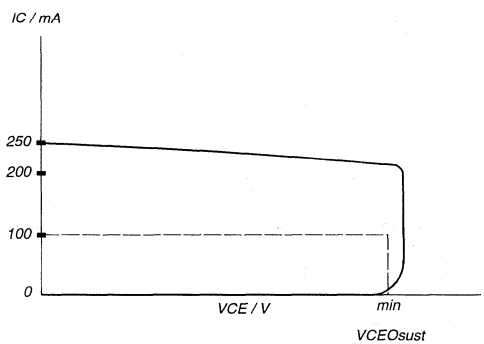


Fig.2. Oscilloscope display for $V_{CEOsust}$.

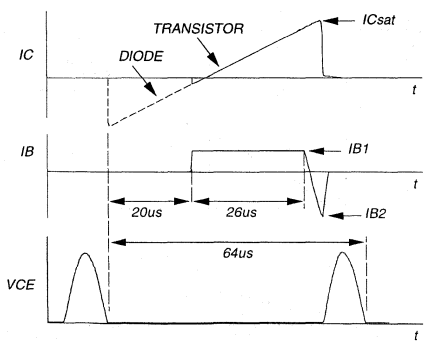


Fig.3. Switching times waveforms (16 kHz).

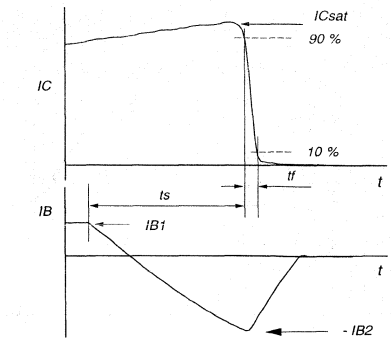


Fig.4. Switching times definitions.

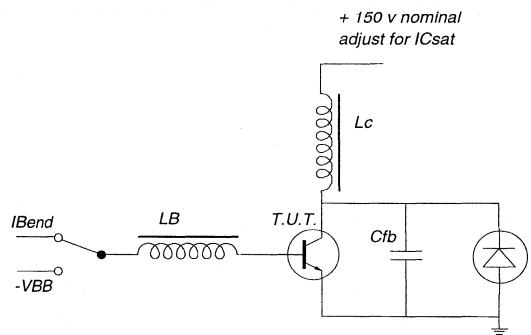


Fig.5. Switching times test circuit.

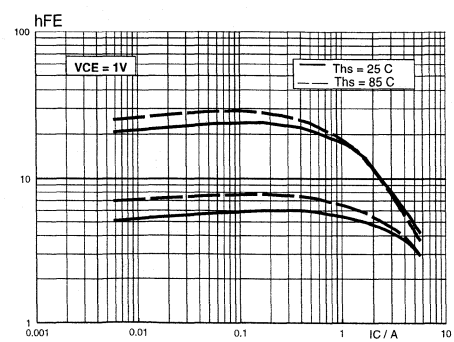


Fig.6. High and low DC current gain.

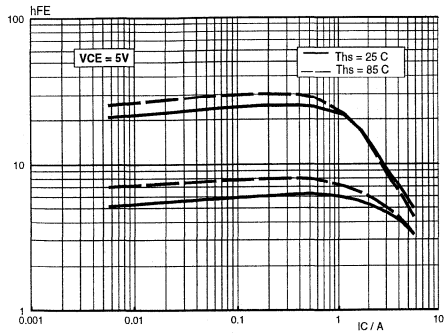


Fig.7. High and low DC current gain.

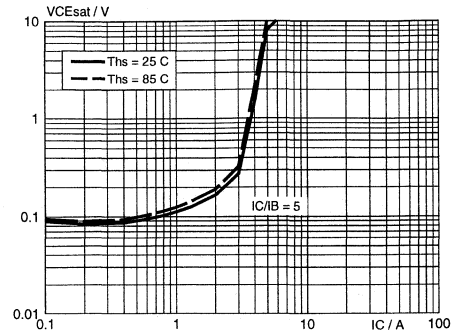


Fig.10. Typical collector-emitter saturation voltage.

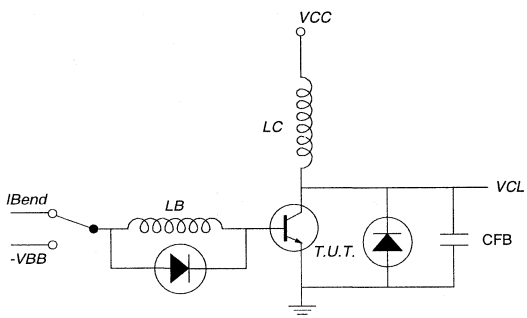


Fig.8. Test Circuit RBSOA.

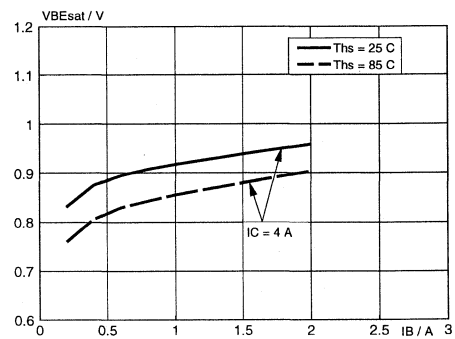


Fig.11. Typical base-emitter saturation voltage.

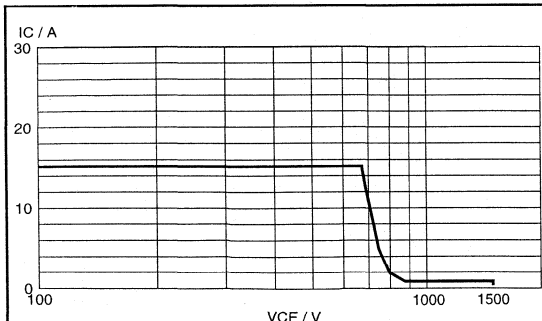


Fig.9. Reverse bias safe operating area. $T_j \leq T_{jmax}$

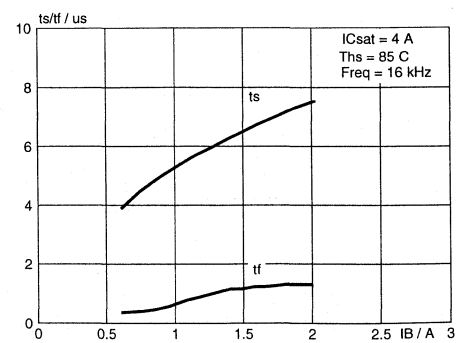


Fig.12. Typical collector storage and fall time. I_C =4 A; T_j = 85°C; f = 16kHz

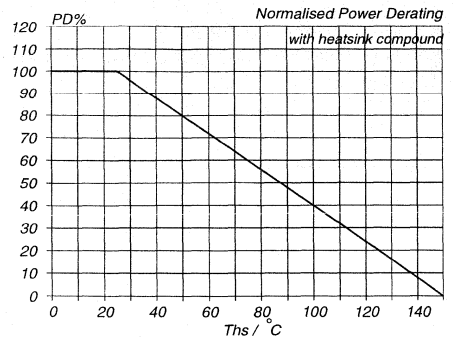


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D / P_{D\,25^\circ C}$

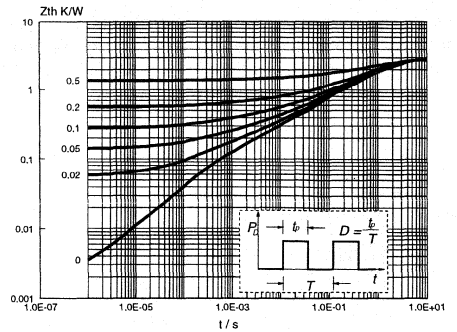


Fig.14. Transient thermal impedance.

Silicon Diffused Power Transistor — BU4507AZ

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

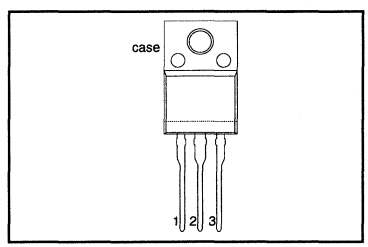
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
		f = 56kHz	4	-	A
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.3	0.45	µs
		I_{Csat} = 4 A; f = 56kHz	0.21	-	µs

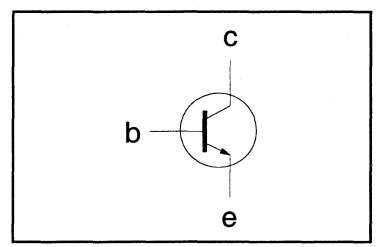
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	32	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	4	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$ T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	-	100	µA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 1 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1 A	0.84	0.92	1.01	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	4.2	5.7	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.0 A;I_{B1} = 0.8 A (I_{B2} = -2.0 A)			
t_s	Turn-off storage time		3.8	4.6	µs
t_f	Turn-off fall time		0.30	0.45	µs
	Switching times (56 kHz line deflection circuit)	I_{Csat} = 4.0 A;I_{B1} = 0.8 A (I_{B2} = -2.1 A)			
t_s	Turn-off storage time		2.4	-	µs
t_f	Turn-off fall time		0.21	-	µs

2 Measured with half sine-wave voltage (curve tracer).

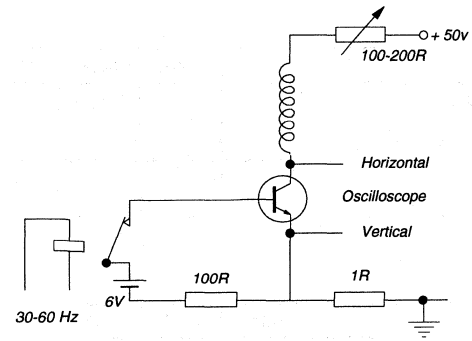


Fig.1. Test circuit for $V_{CEOsust}$.

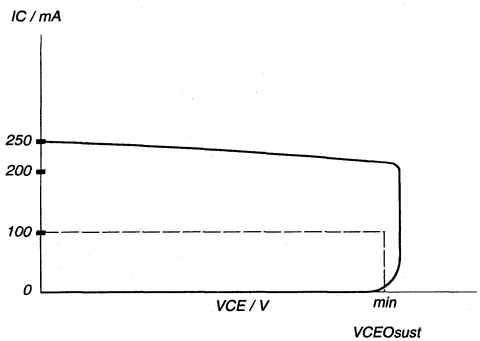


Fig.2. Oscilloscope display for $V_{CEOsust}$.

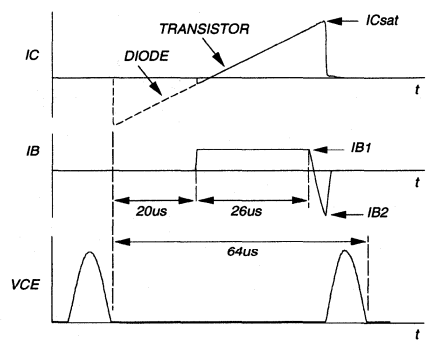


Fig.3. Switching times waveforms (16 kHz).

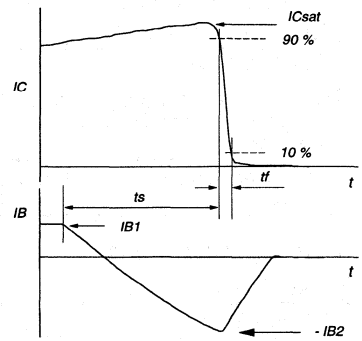


Fig.4. Switching times definitions.

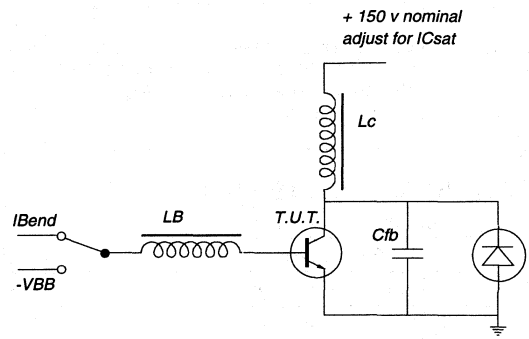


Fig.5. Switching times test circuit.

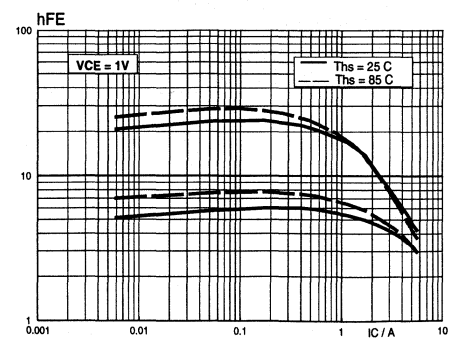


Fig.6. High and low DC current gain.

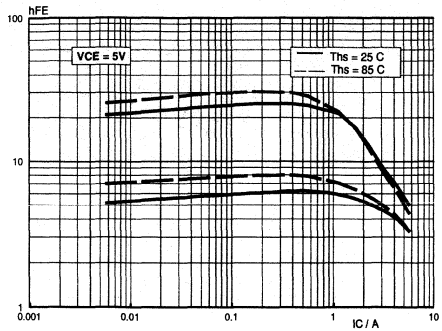


Fig.7. High and low DC current gain.

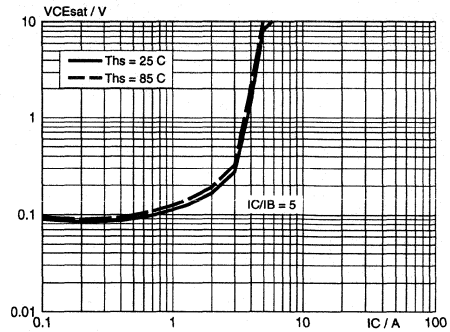


Fig.10. Typical collector-emitter saturation voltage.

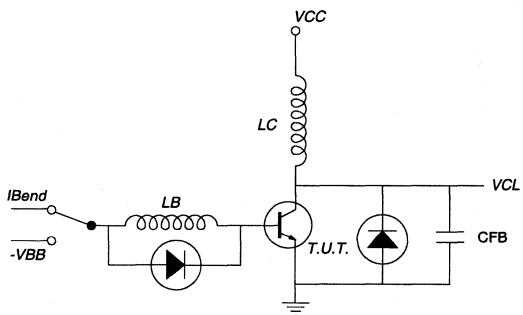


Fig.8. Test Circuit RBSOA.

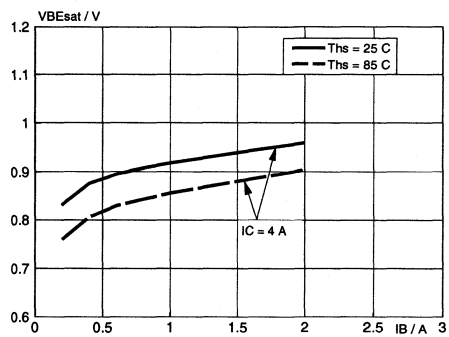


Fig.11. Typical base-emitter saturation voltage.

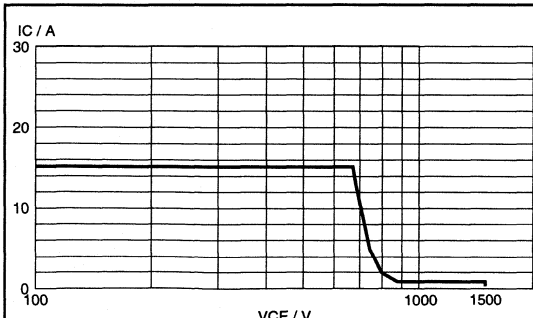


Fig.9. Reverse bias safe operating area. $T_j \leq T_{jmax}$

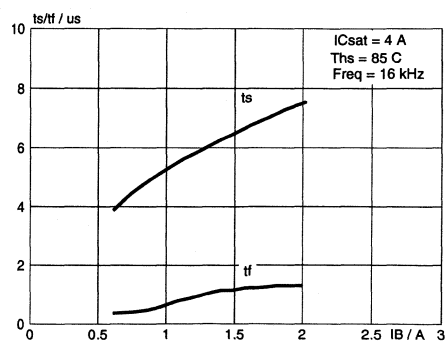


Fig.12. Typical collector storage and fall time. I_C =4 A; T_j = 85˚C; f = 16kHz

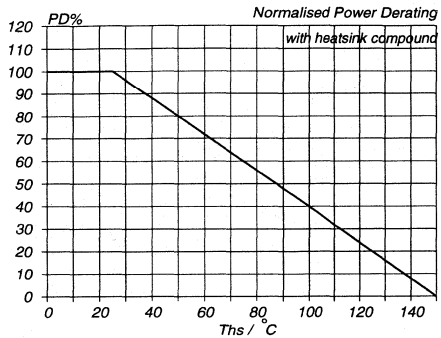


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D / P_{D\,25^\circ C}$

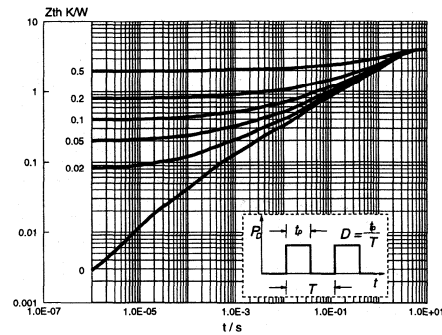


Fig.14. Transient thermal impedance.

Silicon Diffused Power Transistor — BU4507DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope with an integrated damper diode intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

QUICK REFERENCE DATA

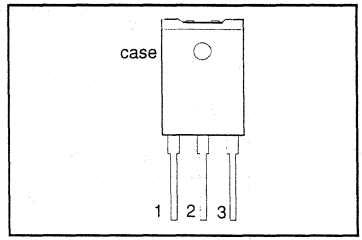
OBJECTIVE
See Philips Semiconductors for design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.0 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	5	-	A
		f = 56kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 4 A	1.7	2.0	V
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.3	0.45	µs
		f = 56kHz	t.b.f	t.b.f	µs

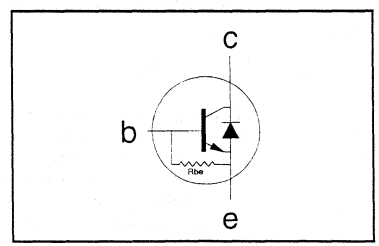
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$ T_j = 125 °C	-	-	2.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 1.0 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1.0 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}	Diode forward voltage	I_C = 4 A; V_{CE} = 5 V	4.2	5.7	7.3	
V_F		I_F = 4 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4 A; I_{B1} = 0.8 A;(I_{B2} = -2 A)			
t_s	Turn-off storage time		3.8	4.6	µs
t_f	Turn-off fall time		0.30	0.45	µs
	Switching times (56 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	-	µs
t_f	Turn-off fall time		t.b.f	-	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4507DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and computer monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE Design-in information
See Philips Semiconductors TM

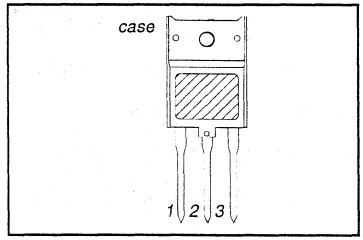
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.0 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
		f = 56kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 4 A	1.7	2.0	V
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.3	0.45	µs
		f = 56kHz	t.b.f	t.b.f	µs

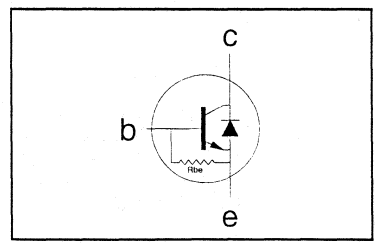
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$ T_j = 125 °C	-	-	2.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 1.0 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1.0 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	4.2	5.7	7.3	
V_F	Diode forward voltage	I_F = 4 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4 A; I_{B1} = 0.8 A;(I_{B2} = -2 A)			
t_s	Turn-off storage time		3.8	4.6	µs
t_f	Turn-off fall time		0.30	0.45	µs
	Switching times (56 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	-	µs
t_f	Turn-off fall time		t.b.f	-	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor BU4507DZ

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for design-in information

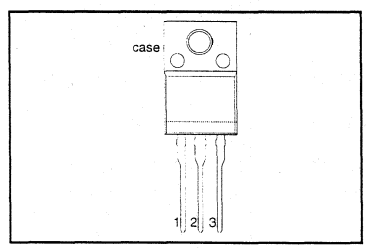
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	35	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 1.0 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	4	-	A
		f = 56kHz	4	-	A
V_F	Diode forward voltage	I_F = 4 A	1.7	2.0	V
t_f	Fall time	I_{Csat} = 4 A; f = 16kHz	0.3	0.45	µs
		f = 56kHz	t.b.f	-	µs

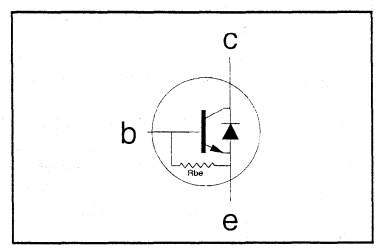
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	35	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.7	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$ T_j = 125 °C	-	-	2.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4 A; I_B = 1.0 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 1.0 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 4 A; V_{CE} = 5 V	4.2	5.7	7.3	
V_F	Diode forward voltage	I_F = 4 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	68	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4 A; I_{B1} = 0.8 A;(I_{B2} = -2 A)			
t_s	Turn-off storage time		3.8	4.6	µs
t_f	Turn-off fall time		0.30	0.45	µs
	Switching times (56 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	-	µs
t_f	Turn-off fall time		t.b.f	-	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4508AF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers an p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

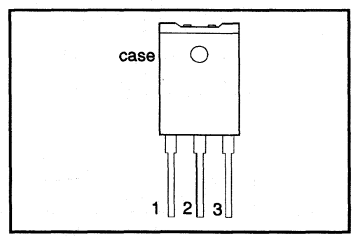
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	5.0	-	A
		f = 64kHz	4.0	-	A
t_f	Fall time	I_{Csat} = 5A; f = 16kHz	0.35	0.48	µs
		I_{Csat} = 4A; f = 64kHz	0.17	-	µs

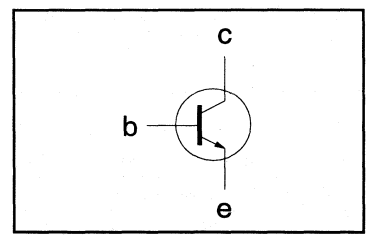
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	100	uA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 5.0 A; I_B = 1.25 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 5.0 A; V_{CE} = 5 V	4.2	5.7	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.0 A; I_{B1} = 1.0 A;(I_{B2} = -2.5 A)			
t_s	Turn-off storage time		3.2	4.3	µs
t_f	Turn-off fall time		0.35	0.48	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 4 A; I_{B1} = 0.8 A;(I_{B2} = -2.0 A)			
t_s	Turn-off storage time		1.9	-	µs
t_f	Turn-off fall time		0.17	-	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor BU4508AF

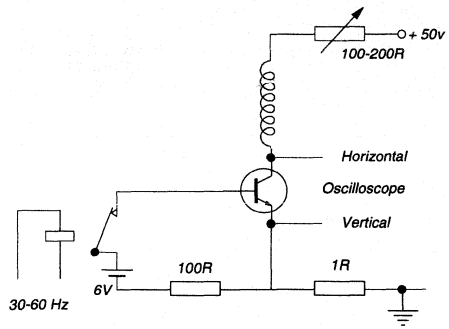


Fig.1. Test circuit for $V_{CEOsust}$.

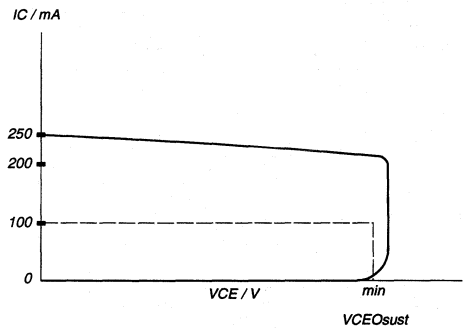


Fig.2. Oscilloscope display for $V_{CEOsust}$.

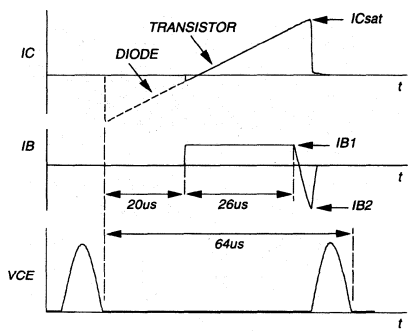


Fig.3. Switching times waveforms (16 kHz).

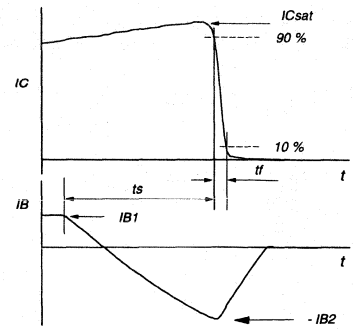


Fig.4. Switching times definitions.

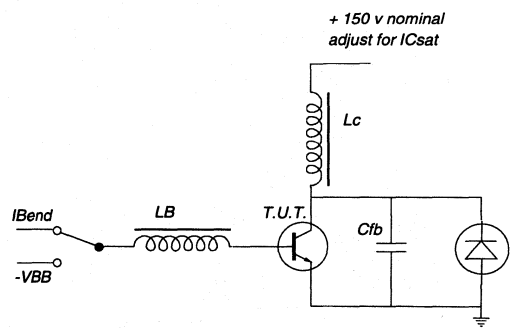


Fig.5. Switching times test circuit.

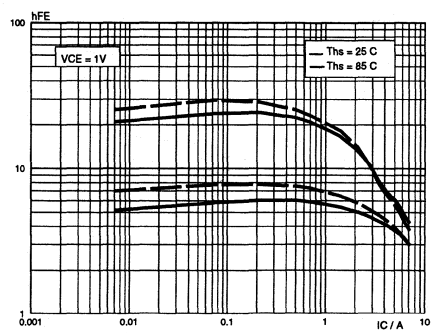


Fig.6. High and low DC current gain.

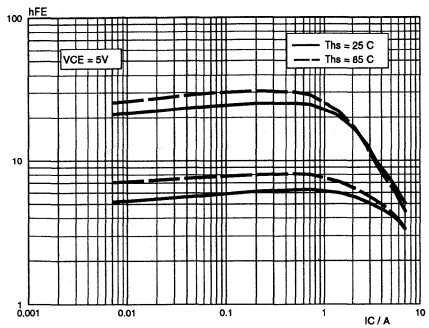


Fig.7. High and low DC current gain.

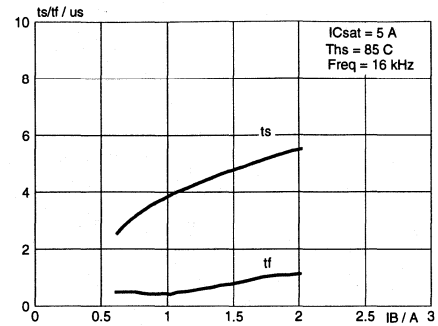


Fig.10. Typical collector storage and fall time. I_C =5 A; T_j = 85˚C; f = 16kHz

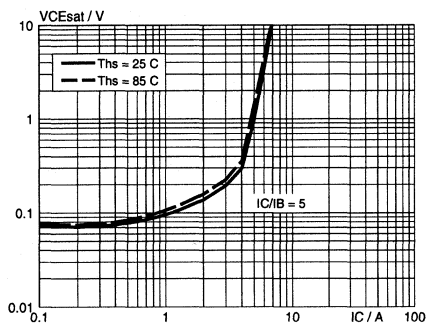


Fig.8. Typical collector-emitter saturation voltage.

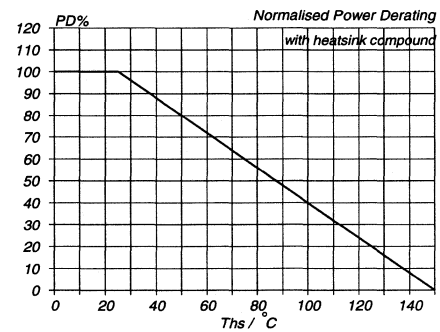


Fig.11. Normalised power dissipation. PD% = 100·P_D/$P_{D\,25˚C}$

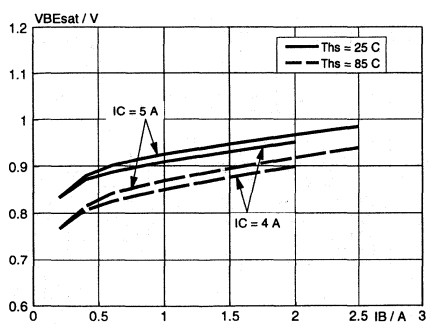


Fig.9. Typical base-emitter saturation voltage.

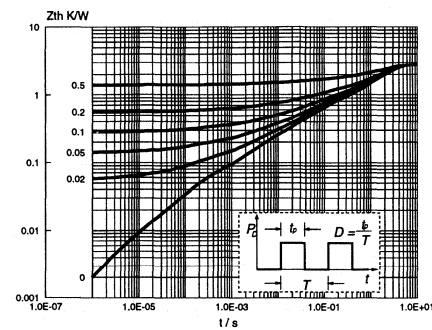


Fig.12. Transient thermal impedance.

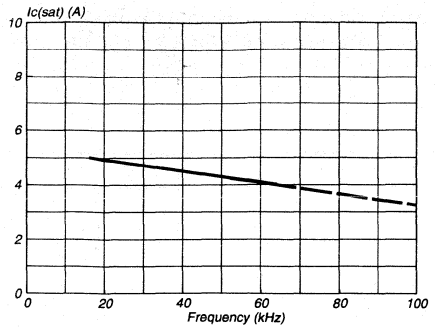


Fig.13. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU4508AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers an p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

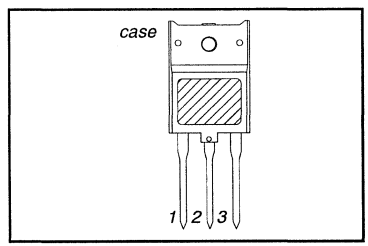
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	5.0	-	A
		f = 64kHz	4.0	-	A
t_f	Fall time	I_{Csat} = 5A; f = 16kHz	0.35	0.48	µs
		I_{Csat} = 4A; f = 64kHz	0.17	-	µs

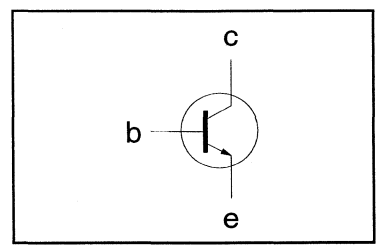
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	100	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 5.0 A; I_B = 1.25 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 5.0 A; V_{CE} = 5 V	4.2	5.7	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.0 A; I_{B1} = 1.0 A (I_{B2} = -2.5 A)			
t_s	Turn-off storage time		3.2	4.3	µs
t_f	Turn-off fall time		0.35	0.48	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 4.0 A; I_{B1} = 0.8 A (I_{B2} = -2.0 A)			
t_s	Turn-off storage time		1.9	-	µs
t_f	Turn-off fall time		0.17	-	µs

2 Measured with half sine-wave voltage (curve tracer).

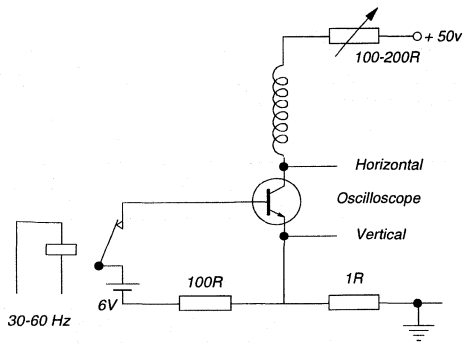


Fig.1. Test circuit for $V_{CEOsust}$.

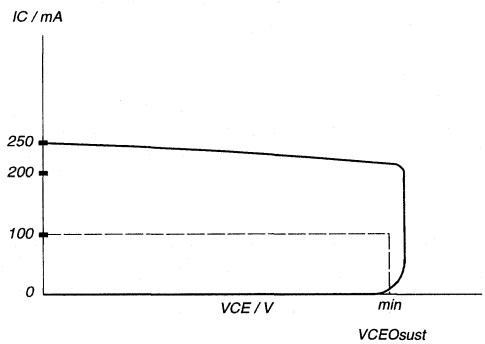


Fig.2. Oscilloscope display for $V_{CEOsust}$.

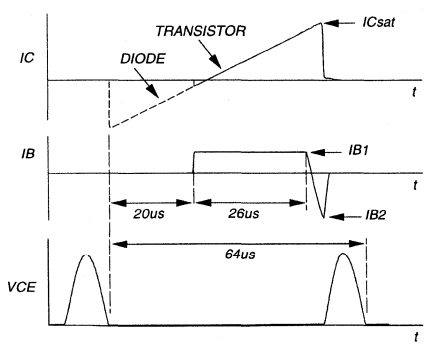


Fig.3. Switching times waveforms (16 kHz).

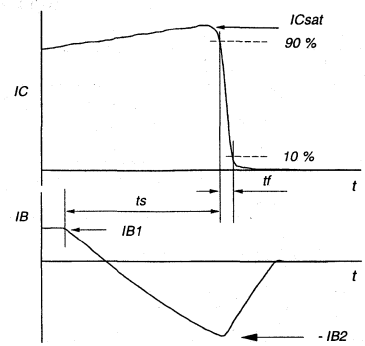


Fig.4. Switching times definitions.

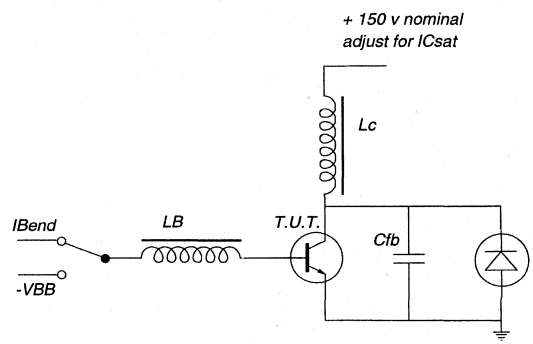


Fig.5. Switching times test circuit.

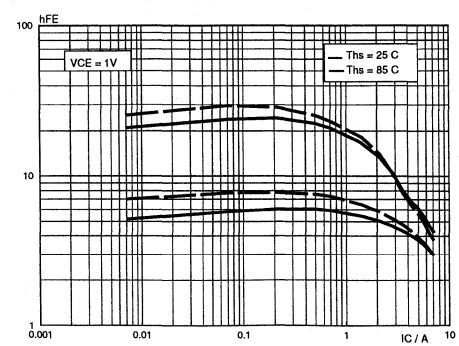


Fig.6. High and low DC current gain.

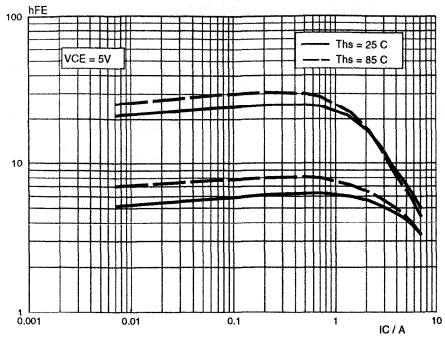


Fig.7. High and low DC current gain.

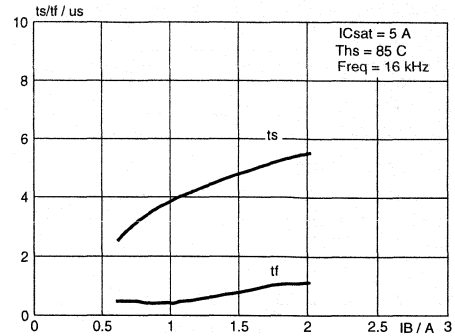


Fig.10. Typical collector storage and fall time.
I_C =5 A; T_j = 85°C; f = 16kHz

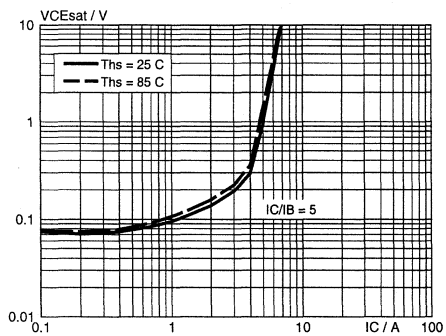


Fig.8. Typical collector-emitter saturation voltage.

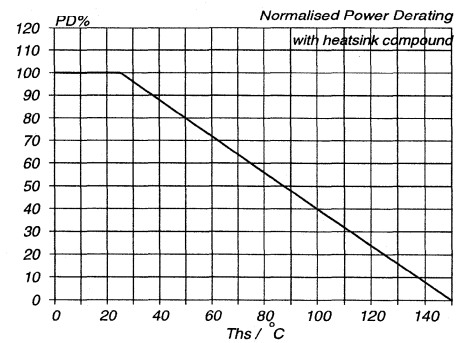


Fig.11. Normalised power dissipation.
PD% = 100·P_D/$P_{D\,25°C}$

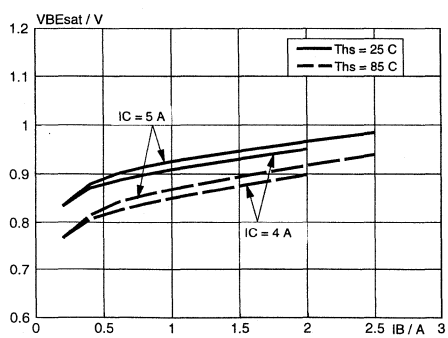


Fig.9. Typical base-emitter saturation voltage.

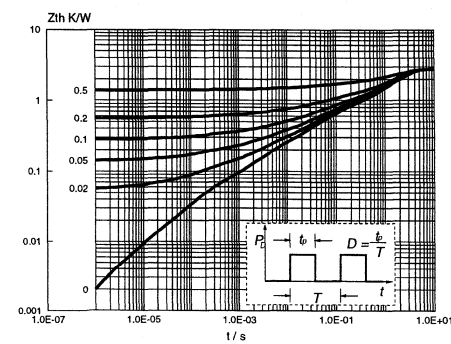


Fig.12. Transient thermal impedance.

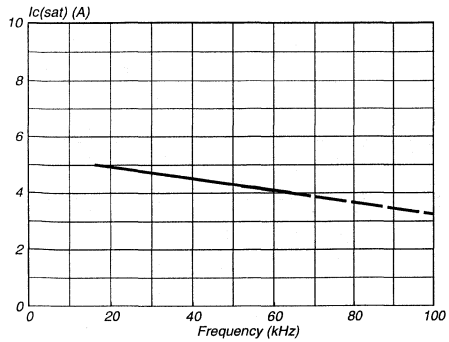


Fig.13. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU4508AZ

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

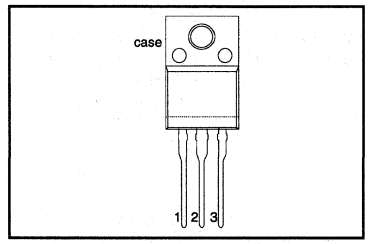
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f= 16 kHz	5.0	-	A
		f= 64 kHz	4.0	-	A
t_f	Fall time	I_{Csat} = 5.0 A; f= 16 kHz	0.35	0.48	µs
		I_{Csat} = 4.0 A; f= 64 kHz	0.17	-	µs

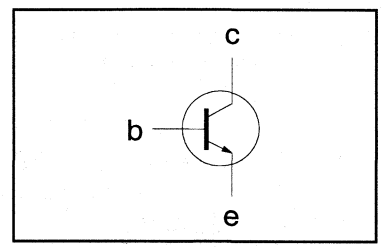
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	32	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	With heatsink compound	-	4.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	100	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 5.0 A; I_B = 1.25 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 5.0 A; V_{CE} = 5 V	4.2	5.7	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.0 A; I_{B1} = 1.0 A; (I_{B2} = -2.5 A)			
t_s	Turn-off storage time		3.2	4.3	µs
t_f	Turn-off fall time		0.35	0.48	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 4.0 A; I_{B1} = 0.8 A; (I_{B2} = -2.0 A)			
t_s	Turn-off storage time		1.9	-	µs
t_f	Turn-off fall time		0.17	-	µs

2 Measured with half sine-wave voltage (curve tracer).

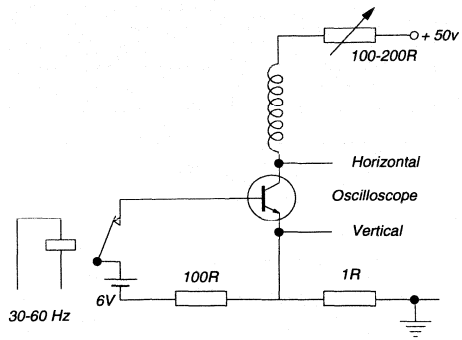


Fig.1. Test circuit for $V_{CEOsust}$.

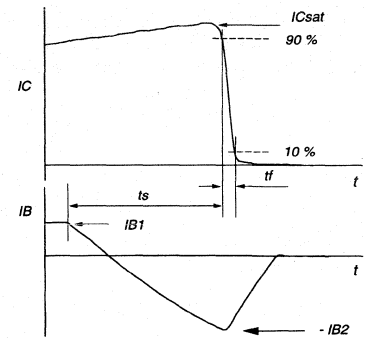


Fig.4. Switching times definitions.

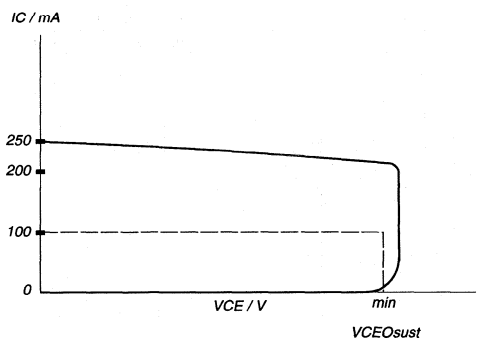


Fig.2. Oscilloscope display for $V_{CEOsust}$.

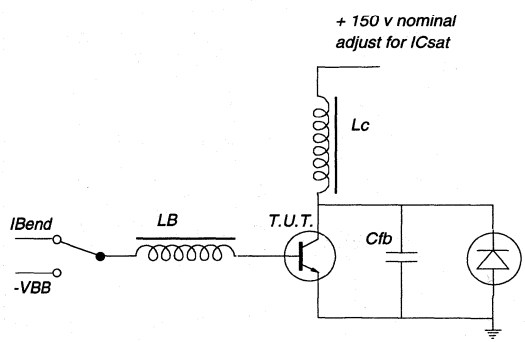


Fig.5. Switching times test circuit.

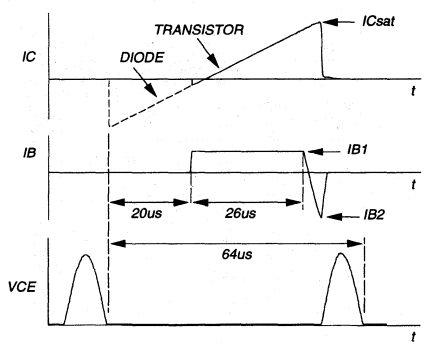


Fig.3. Switching times waveforms (16 kHz).

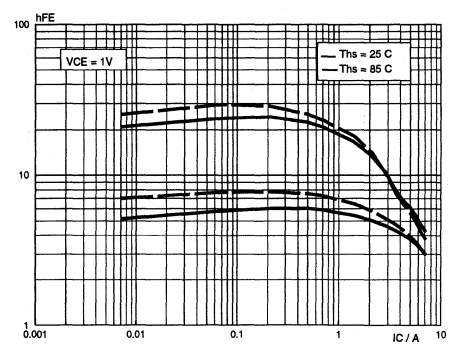


Fig.6. High and low DC current gain.

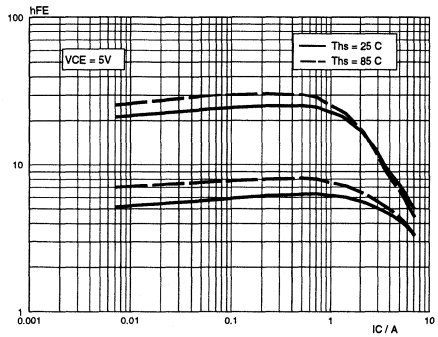


Fig.7. High and low DC current gain.

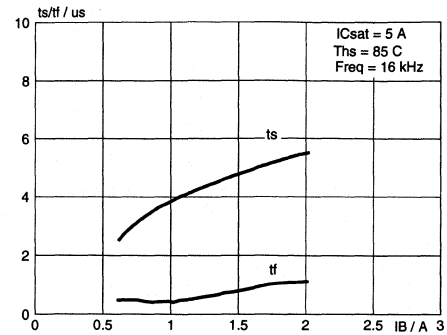


Fig.10. Typical collector storage and fall time. I_C =5 A; T_j = 85˚C; f = 16kHz

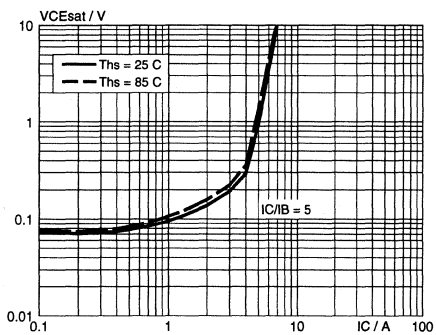


Fig.8. Typical collector-emitter saturation voltage.

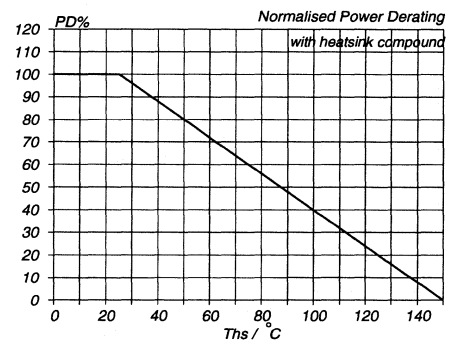


Fig.11. Normalised power dissipation. PD% = 100·P_D/$P_{D\,25˚C}$

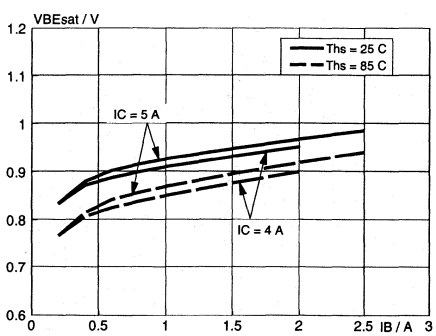


Fig.9. Typical base-emitter saturation voltage.

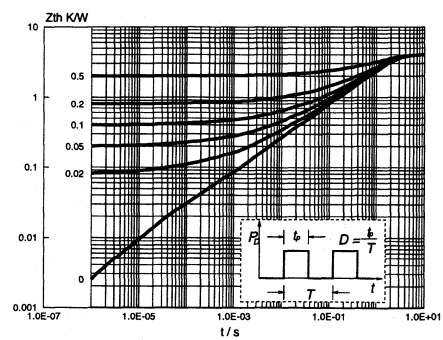


Fig.12. Transient thermal impedance.

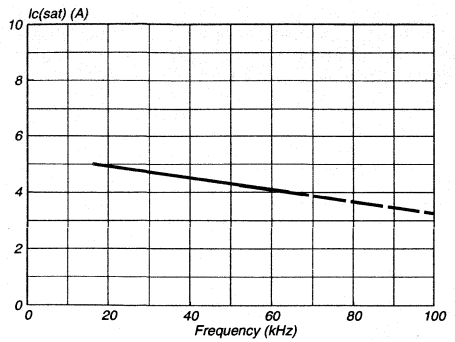


Fig.13. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU4508DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers an p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for design-in information

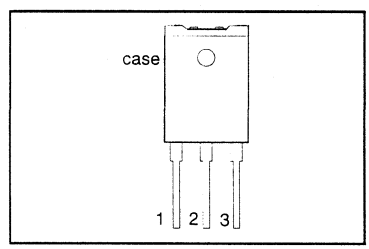
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	5.0	-	A
		f = 64kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 5 A	1.7	2.0	V
t_f	Fall time	I_{Csat} = 5A; f = 16kHz	0.35	0.48	µs
		f = 64kHz	t.b.f	t.b.f	µs

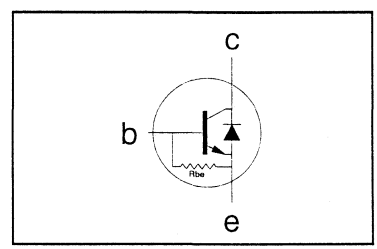
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 5.0 A; I_B = 1.25 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 5.0 A; V_{CE} = 5 V	4.2	5.7	7.3	
V_F	Diode forward voltage	I_F = 5 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.0 A; I_{B1} = 1.0 A;(I_{B2} = -2.5 A)			
t_s	Turn-off storage time		3.2	4.3	µs
t_f	Turn-off fall time		0.35	0.48	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4508DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers an p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE specification. See Philips Semiconductors for design-in information

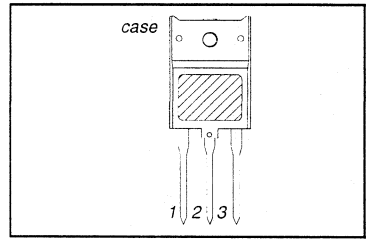
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	5.0	-	A
		f = 64kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 5 A	-	2.0	V
t_f	Fall time	I_{Csat} = 5A; f = 16kHz	0.35	0.48	µs
		f = 64kHz	t.b.f	t.b.f	µs

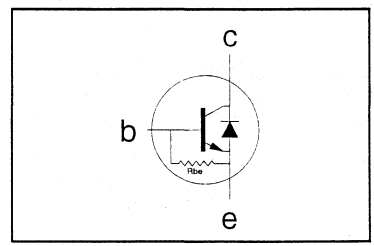
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 5.0 A; I_B = 1.25 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 5.0 A; V_{CE} = 5 V	4.2	5.7	7.3	
V_F	Diode forward voltage	I_F = 5 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.0 A;I_{B1} = 1.0 A (I_{B2} = -2.5 A)			
t_s	Turn-off storage time		3.2	4.3	µs
t_f	Turn-off fall time		0.35	0.48	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4508DZ

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for Design-in information

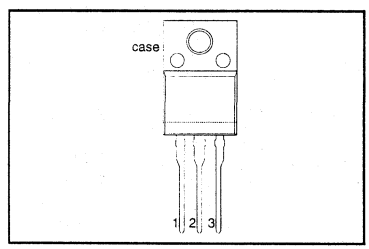
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f= 16 kHz	5.0	-	A
		f= 64 kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 5 A	-	2.0	V
t_f	Fall time	I_{Csat} = 5 A; f = 16kHz	0.35	0.48	µs
		f = 64kHz	t.b.f	t.b.f	µs

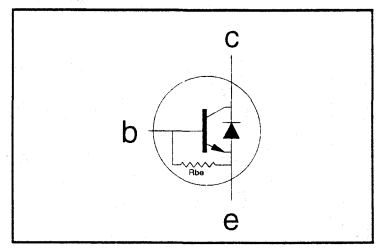
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	15	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
$-I_{BM}$	Reverse base current peak value [1]		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	4.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 5.0 A; I_B = 1.25 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 5.0 A; V_{CE} = 5 V	4.2	5.7	7.3	
V_F	Diode forward voltage	I_F = 5 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 5.0 A; I_{B1} = 1.0 A; (I_{B2} = -2.5 A)			
t_s	Turn-off storage time		3.2	4.3	µs
t_f	Turn-off fall time		0.35	0.48	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4515AF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for design-in information

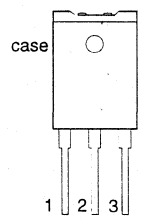
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6 A; I_B = 1.5 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	6	-	A
		f = 64 kHz	5	-	A
t_f	Fall time	I_{Csat} = 6 A; f = 16 kHz	t.b.f	t.b.f	µs
		I_{Csat} = 5 A; f = 64 kHz	t.b.f	t.b.f	µs

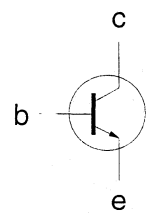
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
I_B	Base current (DC)		-	5	A
I_{BM}	Base current peak value		-	7.5	A
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A;I_C = 100 mA; L = 25mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6 A; I_B = 1.5 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6 A; I_B = 1.5 A	t.b.f	-	1.0	V
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6 A;IB_1 = 1.2 A;(I_{B2} = -3.0 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 5 A;IB_1 = 1 A;(I_{B2} = -3.0 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4515AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for design-in information

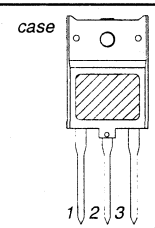
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6 A; I_B = 1.5 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	6	-	A
		f = 64 kHz	5	-	A
t_f	Fall time	I_{Csat} = 6 A; f = 16 kHz	t.b.f	t.b.f	µs
		I_{Csat} = 5 A; f = 64 kHz	t.b.f	t.b.f	µs

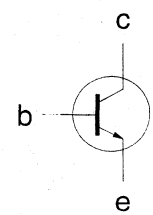
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
I_B	Base current (DC)		-	5	A
I_{BM}	Base current peak value		-	7.5	A
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 6 A; I_B = 1.5 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6 A; I_B = 1.5 A	t.b.f	-	1.0	V
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 6 A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6 A;I_{B1} =1.2 A;(I_{B2} =-3.0 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = 5 A;I_{B1} =1 A;(I_{B2} =-3.0 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4515DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers an p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See current Philips Semiconductors for design-in information

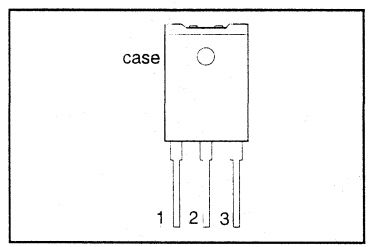
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	6.0	-	A
		f = 64kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 6 A	1.7	2.0	V
t_f	Fall time	I_{Csat} = 6A; f = 16kHz	t.b.f	t.b.f	µs
		f = 64kHz	t.b.f	t.b.f	µs

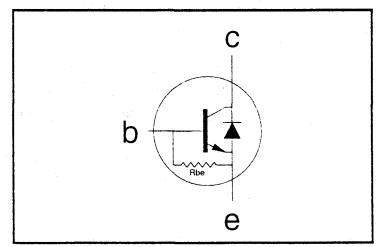
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
I_B	Base current (DC)		-	5	A
I_{BM}	Base current peak value		-	7.5	A
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 ˚C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 6.0 A; I_B = 1.5 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.5 A	t.b.f	t.b.f	t.b.f	V
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 6.0 A; V_{CE} = 5 V	4.2	5.70	7.3	
V_F	Diode forward voltage	I_F = 6 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6.0 A;I_{B1} = 1.2 A (I_{B2} = -3.0 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4515DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers an p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors Objective for Design-in information

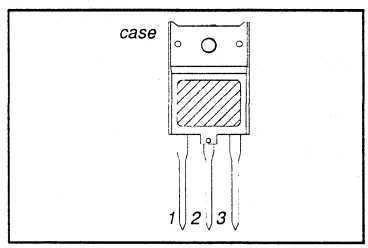
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16kHz	6.0	-	A
		f = 64kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 6 A	1.7	2.0	V
t_f	Fall time	I_{Csat} = 6A; f = 16kHz	t.b.f	t.b.f	µs
		f = 64kHz	t.b.f	t.b.f	µs

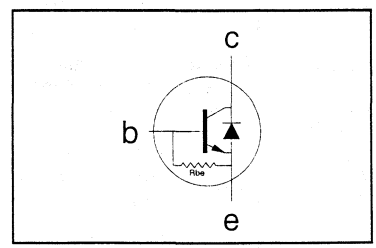
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	9	A
I_{CM}	Collector current peak value		-	20	A
I_B	Base current (DC)		-	5	A
I_{BM}	Base current peak value		-	7.5	A
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	45	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 6.0 A; I_B = 1.5 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6.0 A; I_B = 1.5 A	t.b.f	t.b.f	t.b.f	V
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 6.0 A; V_{CE} = 5 V	4.2	5.7	7.3	
V_F	Diode forward voltage	I_F = 6 A	-	1.7	2.0	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	80	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 6.0 A; I_{B1} = 1.2 A (I_{B2} = -3.0 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (64 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4522AF

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour TV receivers and PC monitors.

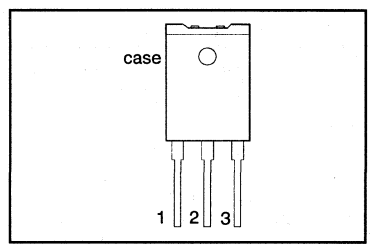
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	-	3.0	V
I_{Csat}	Collector saturation current (Fig 17)	f = 16 kHz	7	-	A
		f = 64 kHz	6	-	A
t_f	Fall time	I_{Csat} = 7 A; f = 16 kHz	285	400	ns
		I_{Csat} = 6 A; f = 64 kHz	170	230	ns

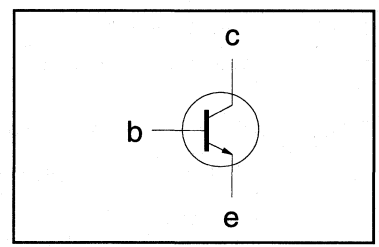
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	10	-	
h_{FE}		I_C = 7 A; V_{CE} = 5 V	4.2	5.8	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	f = 16 kHz; I_{Csat} = 7 A; I_{B1} = 1.4 A; (I_{B2} = -3.5 A)			
t_s	Turn-off storage time		3.5	4.3	µs
t_f	Turn-off fall time		285	400	ns
	Switching times (64 kHz line deflection circuit)	f = 64 kHz; I_{Csat} = 6 A; I_{B1} = 1.2 A; (I_{B2} = -3.6 A)			
t_s	Turn-off storage time		2.3	2.7	µs
t_f	Turn-off fall time		170	230	ns

2 Measured with half sine-wave voltage (curve tracer).

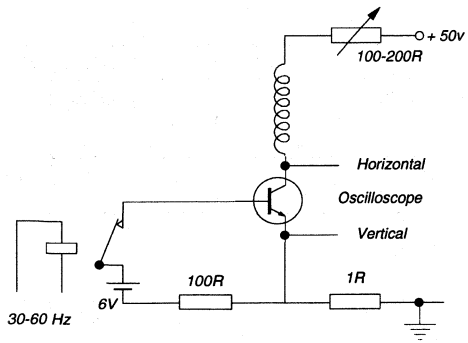


Fig.1. Test circuit for $V_{CEOsust}$.

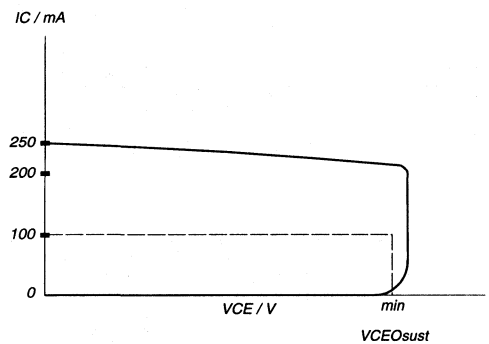


Fig.2. Oscilloscope display for $V_{CEOsust}$.

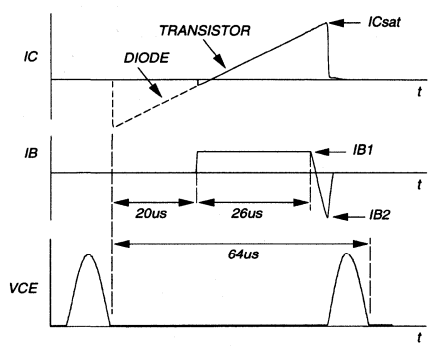


Fig.3. Switching times waveforms (16 kHz).

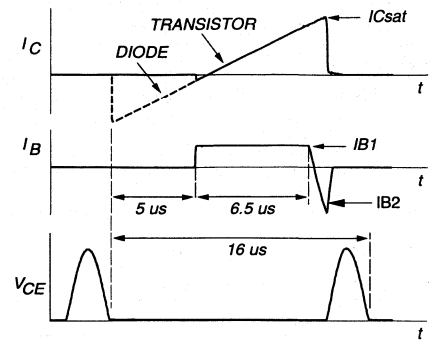


Fig.4. Switching times waveforms (64 kHz).

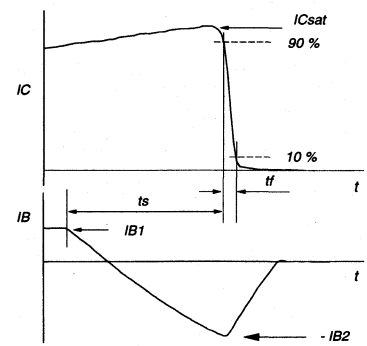


Fig.5. Switching times definitions.

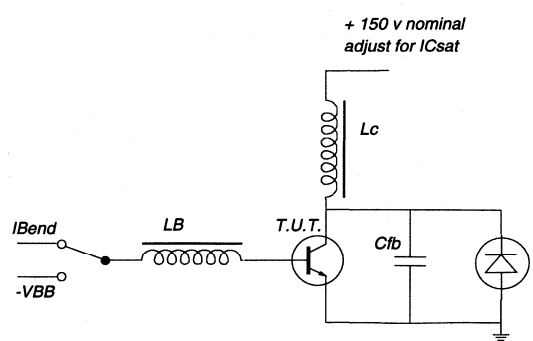


Fig.6. Switching times test circuit.

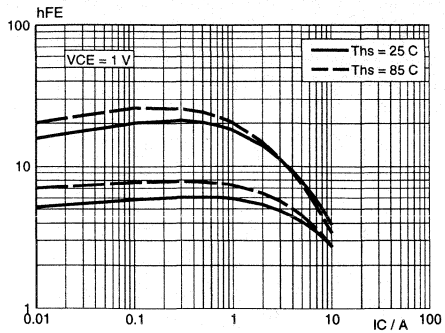


Fig.7. High and low DC current gain.

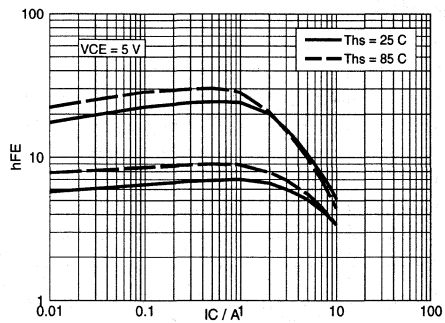


Fig.8. High and low DC current gain.

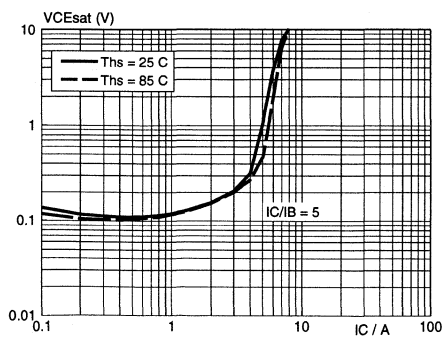


Fig.9. Typical collector-emitter saturation voltage.

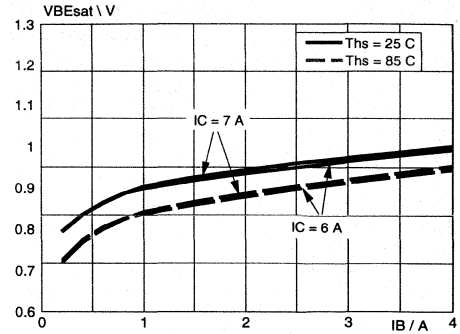


Fig.10. Typical base-emitter saturation voltage.

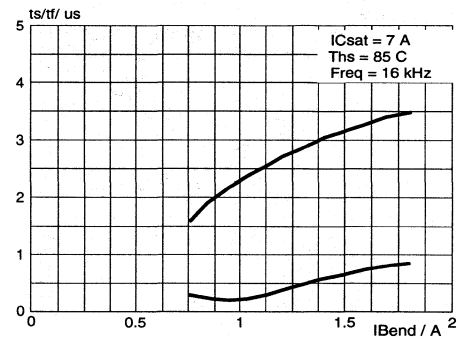


Fig.11. Typical collector storage and fall time.
I_C =7 A; T_j = 85˚C; f = 16kHz

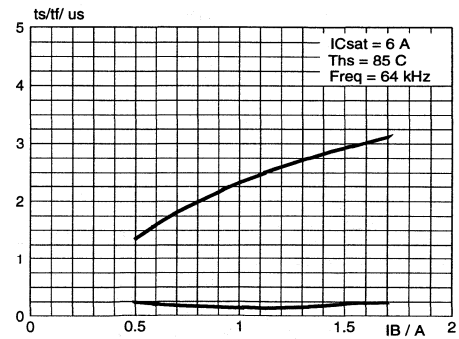


Fig.12. Typical collector storage and fall time.
I_C = 6 A; T_j = 85˚C; f = 64 kHz

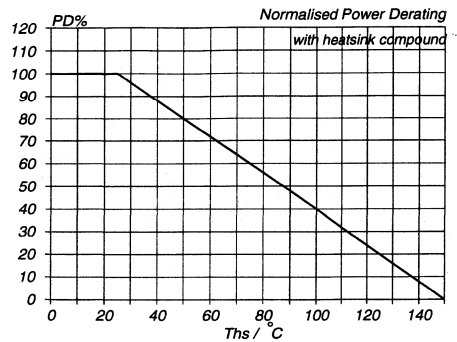


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D / P_{D\,25^\circ C}$

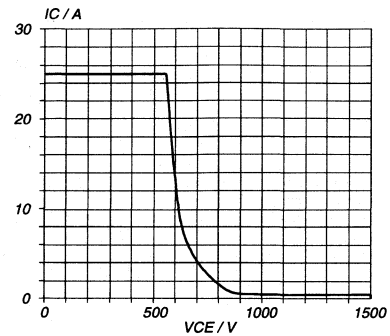


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

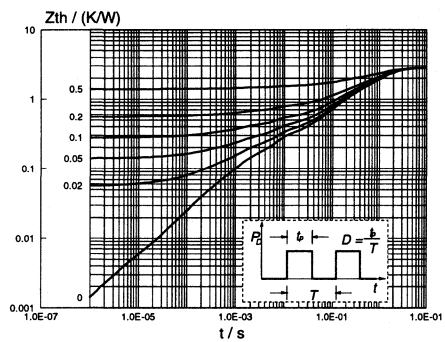


Fig.14. Transient thermal impedance.

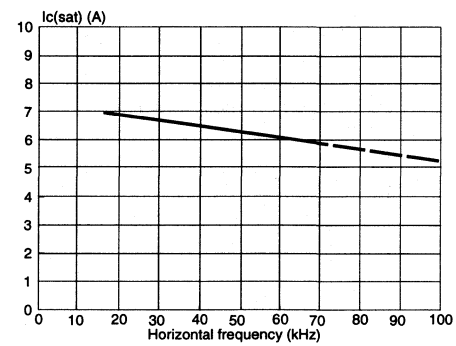


Fig.17. I_{Csat} during normal running vs. frequency of operation for optimum performance

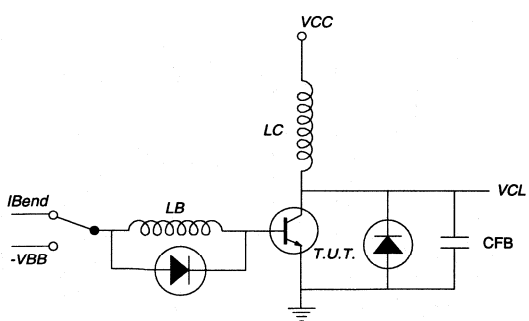


Fig.15. Test Circuit RBSOA.

Silicon Diffused Power Transistor — BU4522AX

GENERAL DESCRIPTION

New generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour TV receivers and PC monitors.

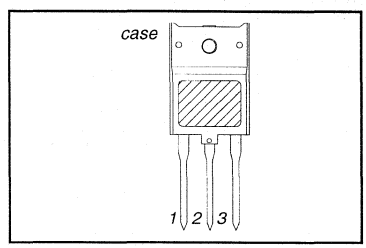
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	-	3.0	V
I_{Csat}	Collector saturation current (Fig 17)	f = 16 kHz	7	-	A
		f = 64 kHz	6	-	A
t_f	Fall time	I_{Csat} = 7 A; f = 16 kHz	285	400	ns
		I_{Csat} = 6 A; f = 64 kHz	170	230	ns

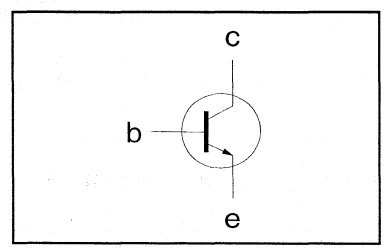
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	10	-	
h_{FE}		I_C = 7 A; V_{CE} = 5 V	4.2	5.8	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	f = 16 kHz; I_{Csat} = 7 A; I_{B1} = 1.4 A; (I_{B2} = -3.5 A)			
t_s	Turn-off storage time		3.5	4.3	µs
t_f	Turn-off fall time		285	400	ns
	Switching times (64 kHz line deflection circuit)	f = 64 kHz; I_{Csat} = 6 A; I_{B1} = 1.2 A; (I_{B2} = -3.6 A)			
t_s	Turn-off storage time		2.3	2.7	µs
t_f	Turn-off fall time		170	230	ns

2 Measured with half sine-wave voltage (curve tracer).

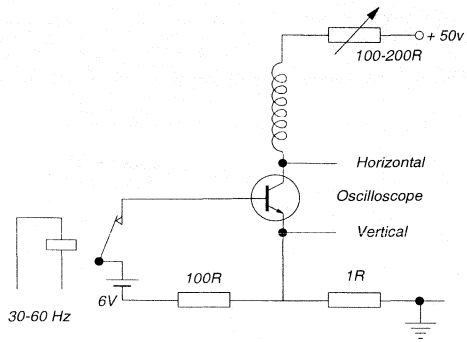


Fig.1. Test circuit for $V_{CEOsust}$.

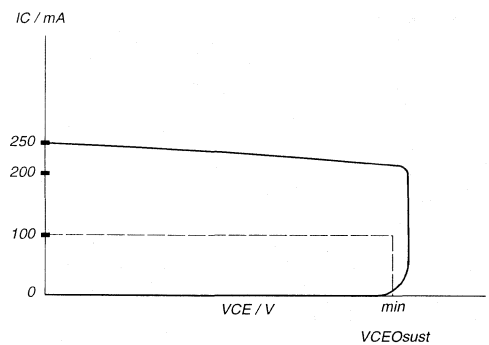


Fig.2. Oscilloscope display for $V_{CEOsust}$.

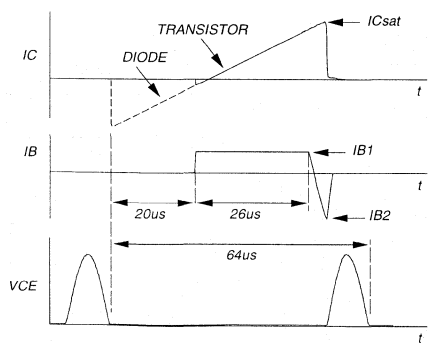


Fig.3. Switching times waveforms (16 kHz).

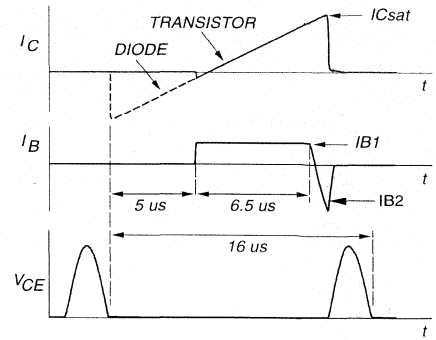


Fig.4. Switching times waveforms (64 kHz).

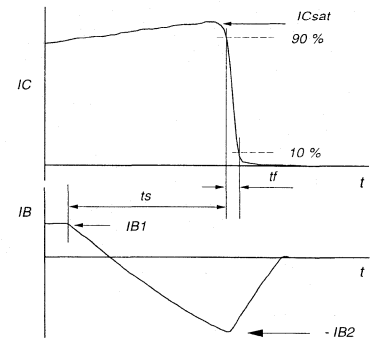


Fig.5. Switching times definitions.

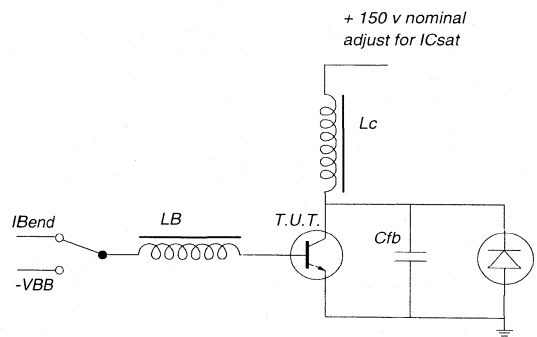


Fig.6. Switching times test circuit.

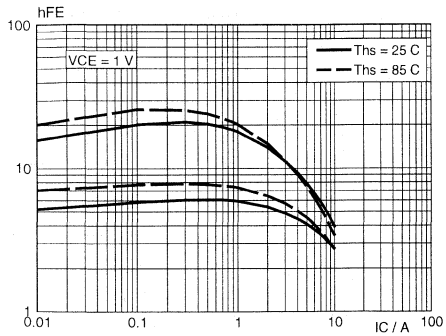


Fig.7. High and low DC current gain.

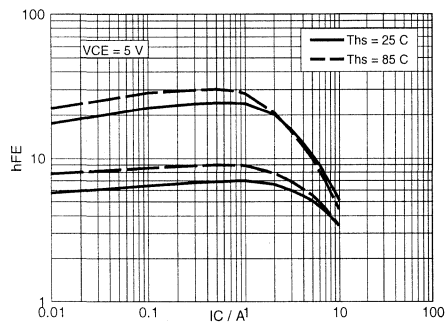


Fig.8. High and low DC current gain.

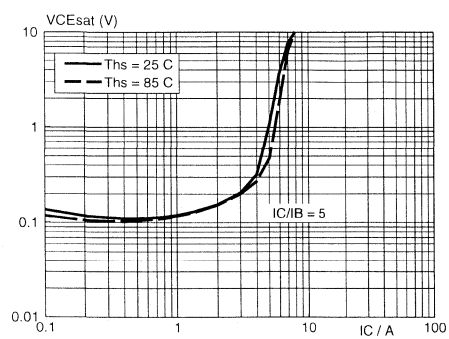


Fig.9. Typical collector-emitter saturation voltage.

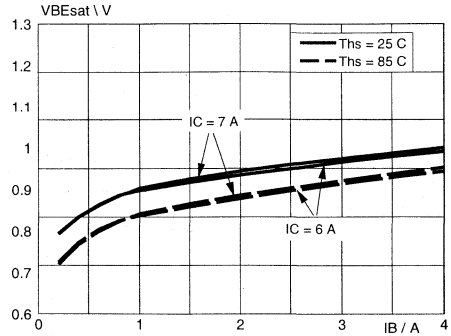


Fig.10. Typical base-emitter saturation voltage.

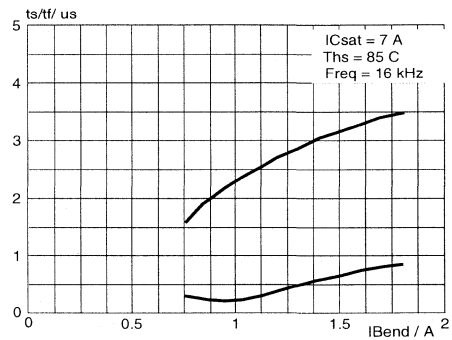


Fig.11. Typical collector storage and fall time.
I_C =7 A; T_j = 85˚C; f = 16kHz

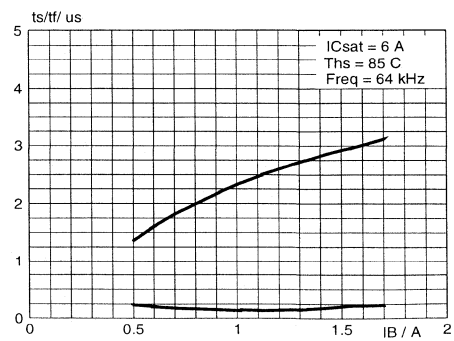


Fig.12. Typical collector storage and fall time.
I_C = 6 A; T_j = 85˚C; f = 64 kHz

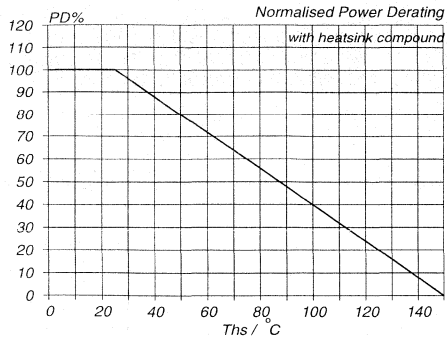


Fig.13. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C}$

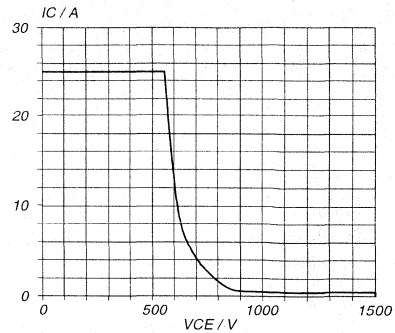


Fig.16. Reverse bias safe operating area. $T_j \leq T_{jmax}$

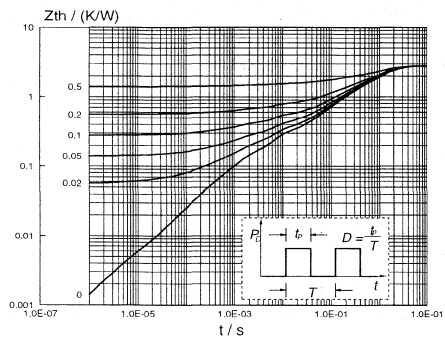


Fig.14. Transient thermal impedance.

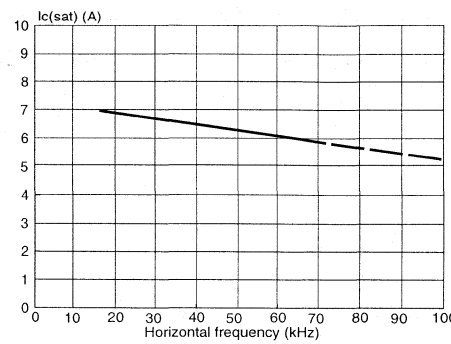


Fig.17. I_{Csat} during normal running vs. frequency of operation for optimum performance

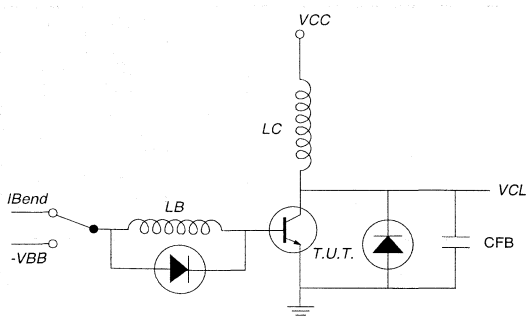


Fig.15. Test Circuit RBSOA.

Silicon Diffused Power Transistor — BU4522DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE Design-in information
See Philips Semiconductors for

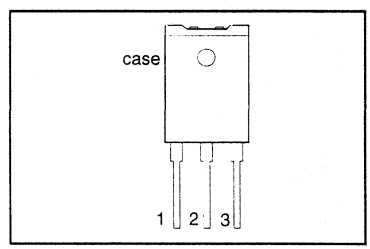
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	-	3.0	V
I_{Csat}	Collector saturation current (Fig 17)	f = 16 kHz	7	-	A
		f = 64 kHz	6	-	A
V_F	Diode forward voltage	I_F = 7.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 7 A; f = 16 kHz	285	400	ns
		f = 64 kHz	t.b.f	t.b.f	ns

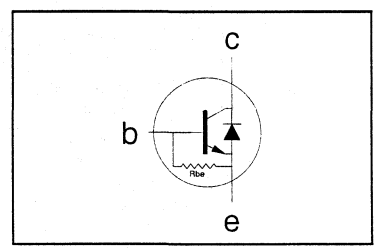
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 ˚C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	10	-	
h_{FE}		I_C = 7 A; V_{CE} = 5 V	4.2	5.8	7.3	
V_F	Diode forward voltage	I_F = 7 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	f = 16 kHz; I_{Csat} = 7 A; I_{B1} = 1.4 A; (I_{B2} = -3.5 A)			
t_s	Turn-off storage time		3.5	4.3	µs
t_f	Turn-off fall time		285	400	ns
	Switching times (64 kHz line deflection circuit)	f = 64 kHz;			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	ns

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4522DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE design-in information
See Philips Semiconductors for

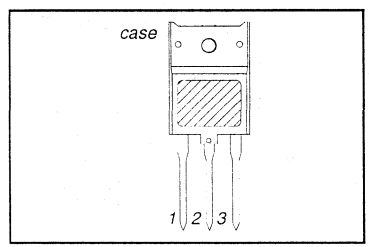
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	-	3.0	V
I_{Csat}	Collector saturation current (Fig 17)	f = 16 kHz	7	-	A
		f = 64 kHz	6	-	A
V_F	Diode forward voltage	I_F = 7.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 7 A; f = 16 kHz	285	400	ns
		f = 64 kHz	t.b.f	t.b.f	ns

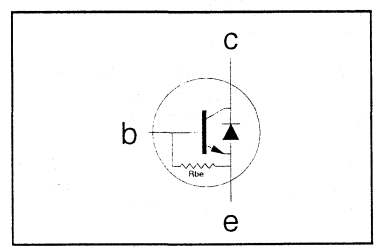
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	10	A
I_{CM}	Collector current peak value		-	25	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
$-I_{BM}$	Reverse base current peak value [1]		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 7 A; I_B = 1.75 A	0.85	0.94	1.03	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	10	-	
h_{FE}		I_C = 7 A; V_{CE} = 5 V	4.2	5.8	7.3	
V_F	Diode forward voltage	I_F = 7 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	f = 16 kHz; I_{Csat} = 7 A; I_{B1} = 1.4 A; (I_{B2} = -3.5 A)			
t_s	Turn-off storage time		3.5	4.3	µs
t_f	Turn-off fall time		285	400	ns
	Switching times (64 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	ns

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4523AF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

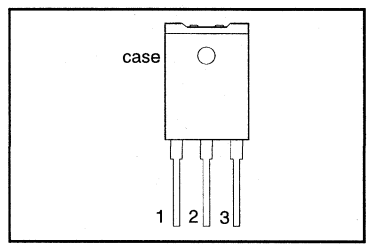
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	8	-	A
		f = 70 kHz	6.5	-	A
t_f	Fall time	I_{Csat} = 8 A; f = 16 kHz	0.3	0.4	µs
		I_{Csat} = 6.5 A; f = 70 kHz	0.14	-	µs

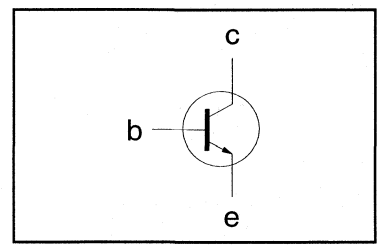
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	-	100	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	12.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8 A; I_B = 2 A	0.85	0.95	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	14	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	4.2	5.8	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 8.0 A; I_{B1} = 1.6 A (I_{B2} = -4 A)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.3	0.4	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = 6.5 A; I_{B1} = 1.3 A (I_{B2} = -3.9 A)			
t_s	Turn-off storage time		2.3	-	µs
t_f	Turn-off fall time		0.14	-	µs

2 Measured with half sine-wave voltage (curve tracer).

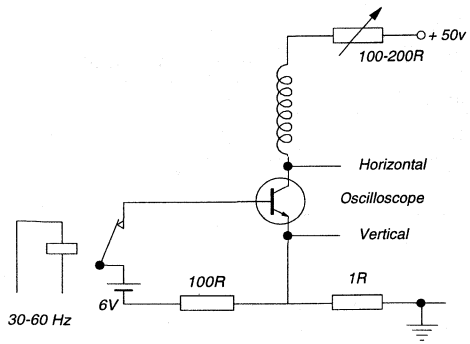


Fig.1. Test circuit for $V_{CEOsust}$.

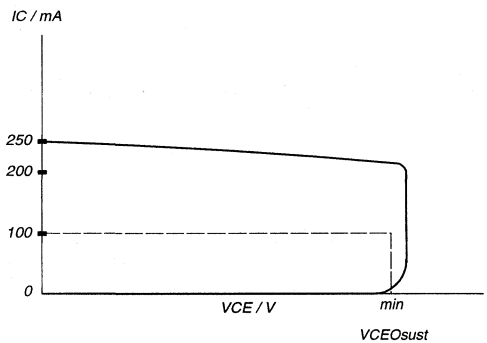


Fig.2. Oscilloscope display for $V_{CEOsust}$.

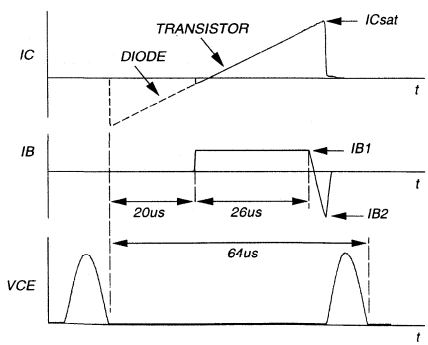


Fig.3. Switching times waveforms (16 kHz).

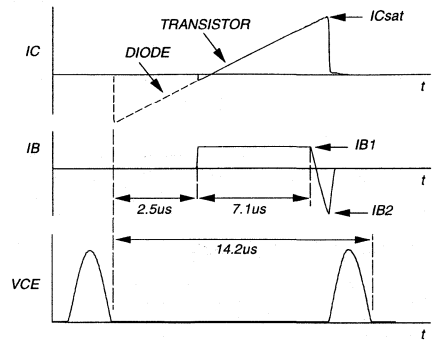


Fig.4. Switching times waveforms (70 kHz).

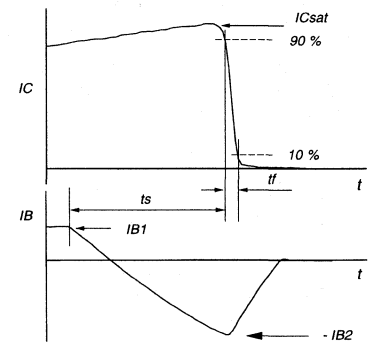


Fig.5. Switching times definitions.

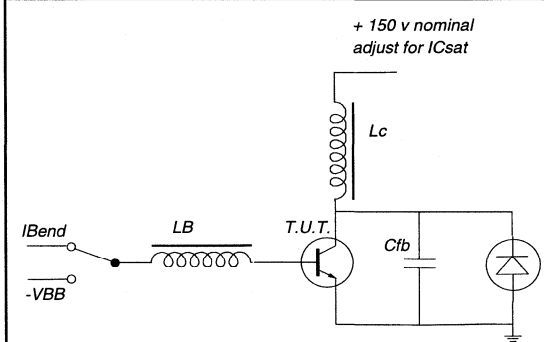


Fig.6. Switching times test circuit.

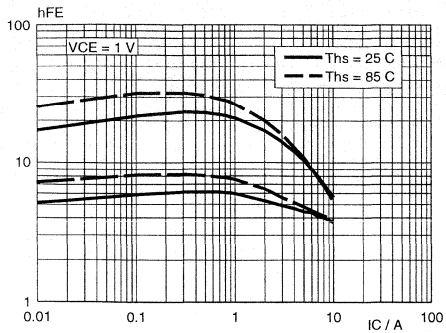


Fig.7. High and low DC current gain.

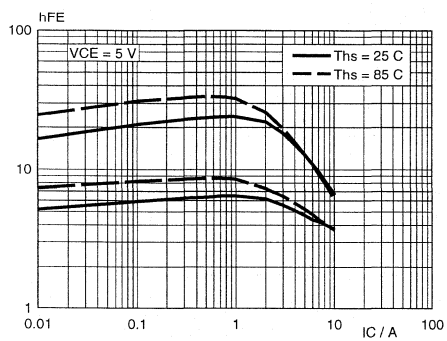


Fig.8. High and low DC current gain.

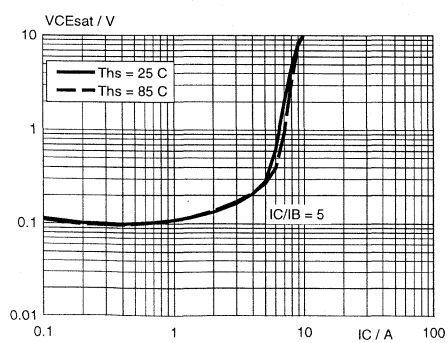


Fig.9. Typical collector-emitter saturation voltage.

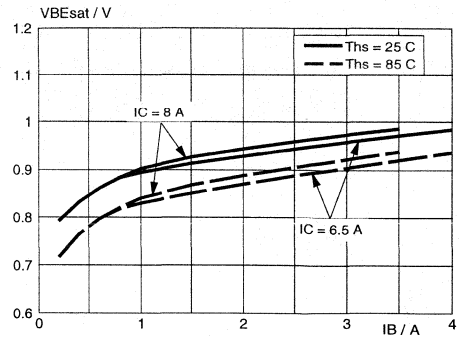


Fig.10. Typical base-emitter saturation voltage.

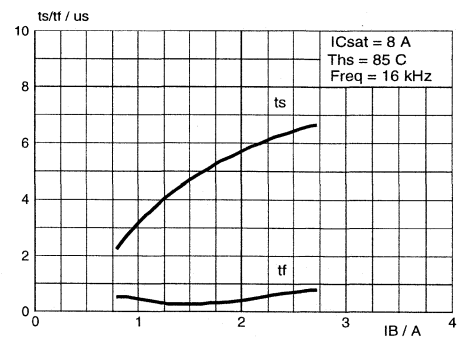


Fig.11. Typical collector storage and fall time.
I_C =8 A; T_j = 85˚C; f = 16kHz

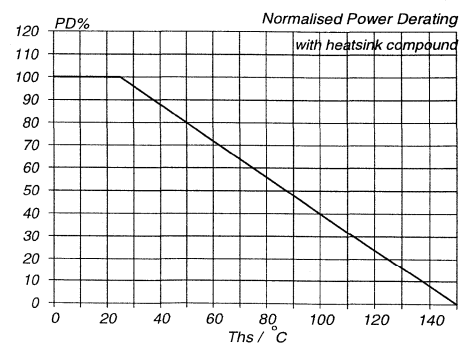


Fig.12. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\ 25^\circ C}$

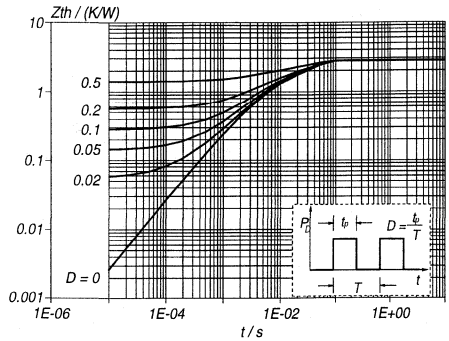


Fig.13. Transient thermal impedance.

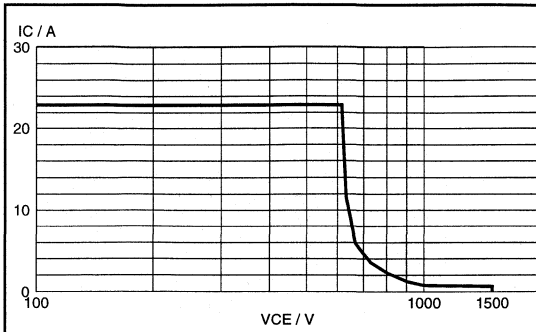


Fig.15. Reverse bias safe operating area. $T_j \leq T_{jmax}$

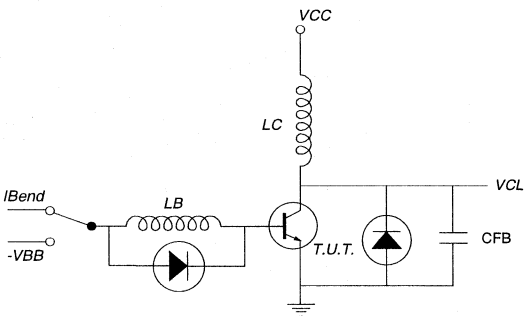


Fig.14. Test Circuit RBSOA.

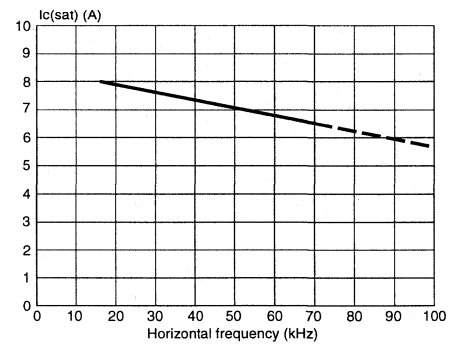


Fig.16. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU4523AW

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

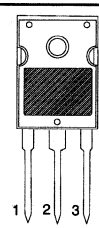
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	3.0	V
I_{Csat}	Collector saturation current.	f = 16 kHz	8	-	A
		f = 70 kHz	6.5	-	A
t_f	Fall time	I_{Csat} = 8 A; f = 16 kHz	0.3	0.4	µs
		I_{Csat} = 6.5 A; f = 70 kHz	0.14	-	µs

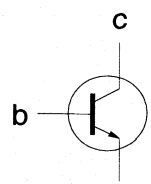
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	-	100	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	12.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8 A; I_B = 2 A	0.85	0.95	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	14	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	4.2	5.8	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 8.0 A; I_{B1} = 1.6 A (I_{B2} = -4.0 A)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.30	0.40	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = 6.5 A; I_{B1} = 1.3 A (I_{B2} = -3.9 A)			
t_s	Turn-off storage time		2.3	-	µs
t_f	Turn-off fall time		0.14	-	µs

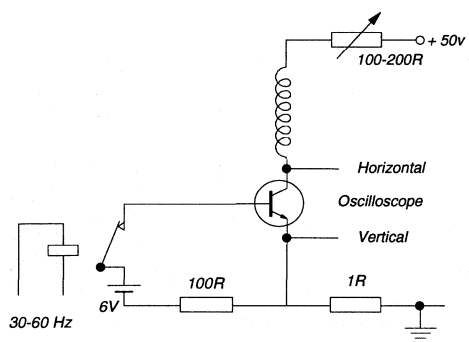


Fig.1. Test circuit for $V_{CEOsust}$.

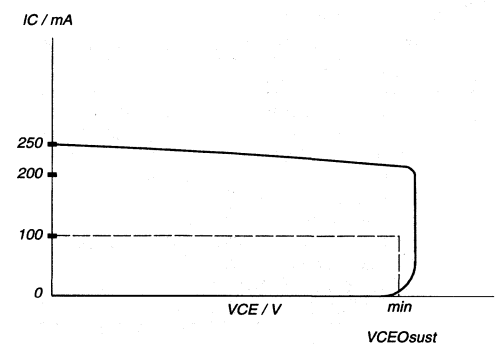


Fig.2. Oscilloscope display for $V_{CEOsust}$.

2 Measured with half sine-wave voltage (curve tracer).

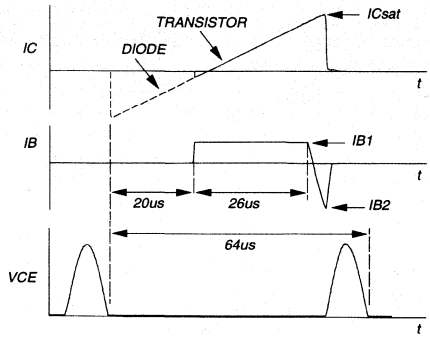


Fig.3. Switching times waveforms (16 kHz).

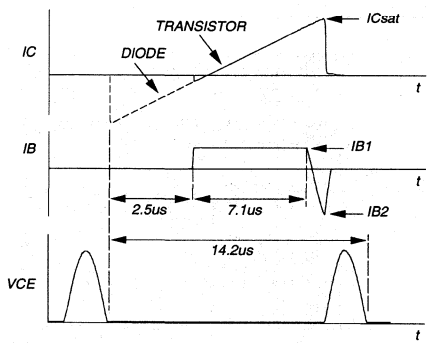


Fig.4. Switching times waveforms (70 kHz).

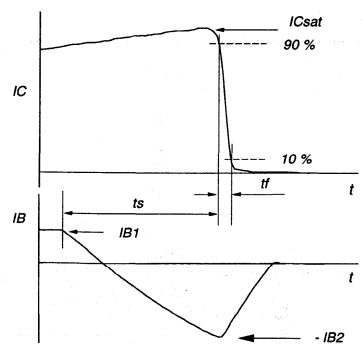


Fig.5. Switching times definitions.

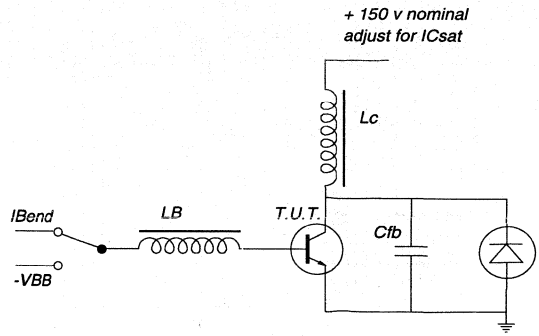


Fig.6. Switching times test circuit.

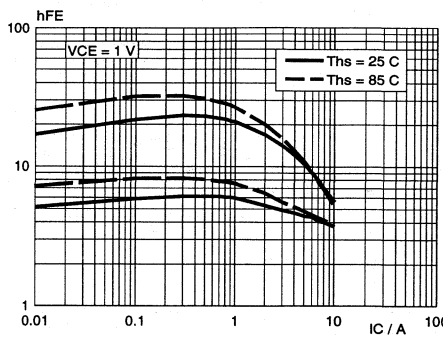


Fig.7. High and low DC current gain.

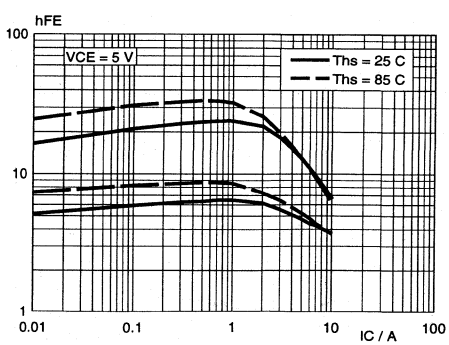


Fig.8. High and low DC current gain.

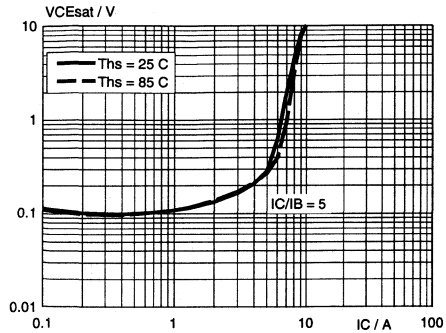


Fig.9. Typical collector-emitter saturation voltage.

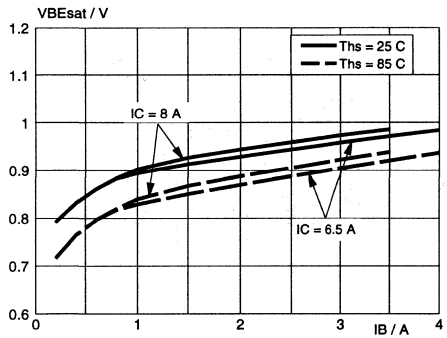


Fig.10. Typical base-emitter saturation voltage.

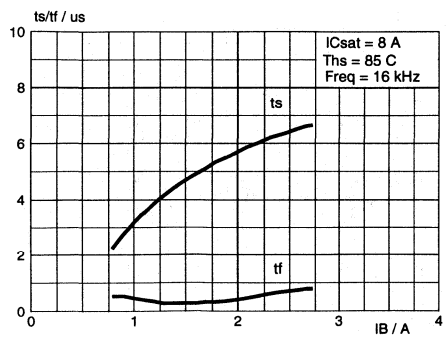


Fig.11. Typical collector storage and fall time.
I_C =8 A; T_j = 85˚C; f = 16kHz

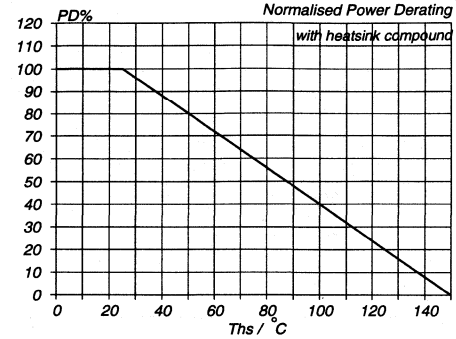


Fig.12. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C}$

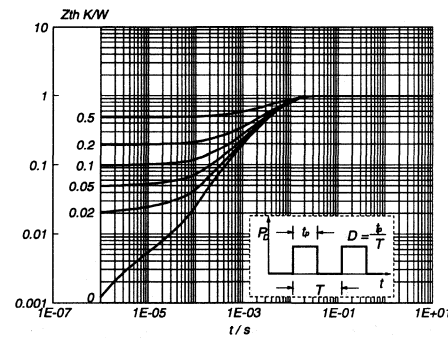


Fig.13. Transient thermal impedance.

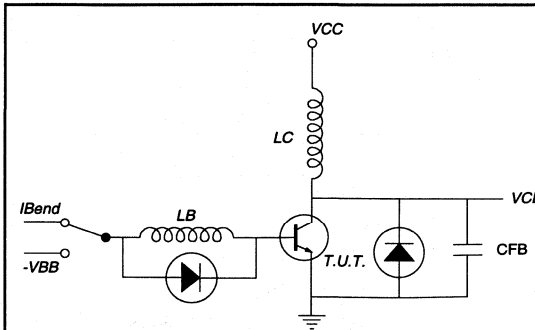


Fig.14. Test Circuit RBSOA.

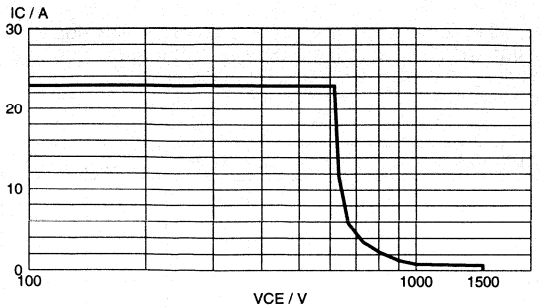


Fig.15. Reverse bias safe operating area. $T_j \leq T_{jmax}$

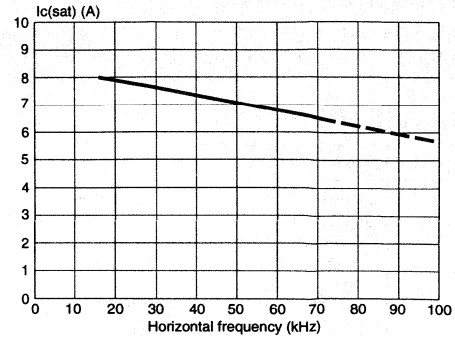


Fig.16. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU4523AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

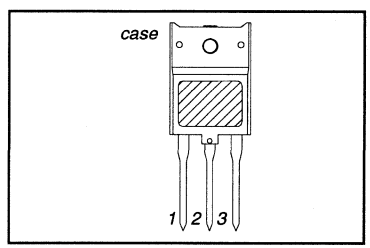
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	8	-	A
		f = 70 kHz	6.5	-	A
t_f	Fall time	I_{Csat} = 8 A; f = 16 kHz	0.3	0.4	µs
		I_{Csat} = 6.5 A; f = 70 kHz	0.14	-	µs

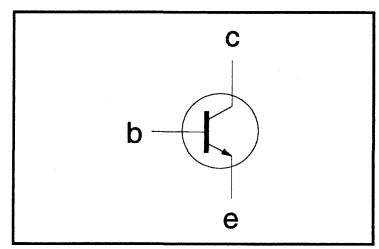
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6 V; I_C = 0 A	-	-	100	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	12.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8 A; I_B = 2 A	0.85	0.95	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	14	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	4.2	5.8	7.3	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 8.0 A; I_{B1} = 1.6 A (I_{B2} = -4.0 A)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.30	0.40	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = 6.5 A; I_{B1} = 1.3 A (I_{B2} = -3.9 A)			
t_s	Turn-off storage time		2.3	-	µs
t_f	Turn-off fall time		0.14	-	µs

2 Measured with half sine-wave voltage (curve tracer).

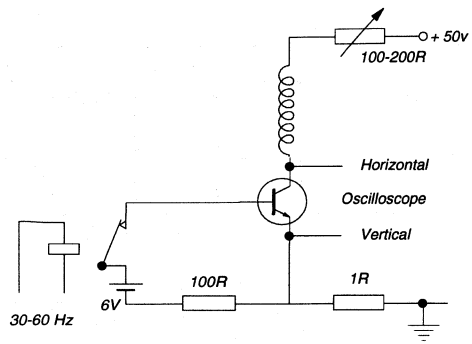


Fig.1. Test circuit for $V_{CEOsust}$.

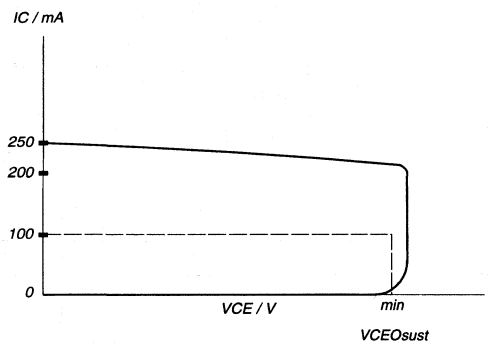


Fig.2. Oscilloscope display for $V_{CEOsust}$.

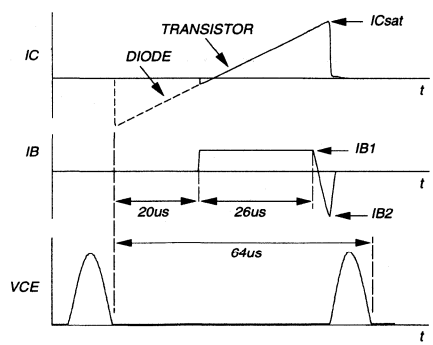


Fig.3. Switching times waveforms (16 kHz).

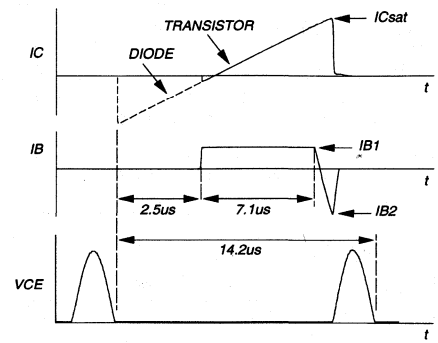


Fig.4. Switching times waveforms (70 kHz).

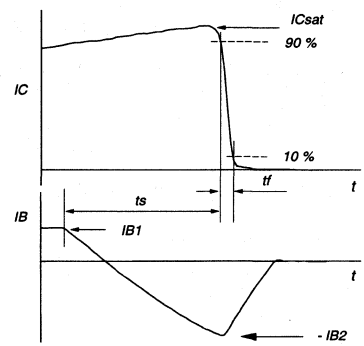


Fig.5. Switching times definitions.

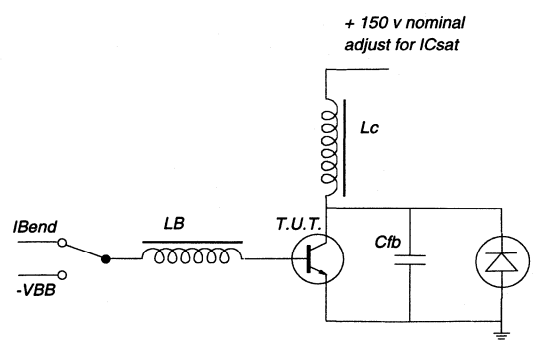


Fig.6. Switching times test circuit.

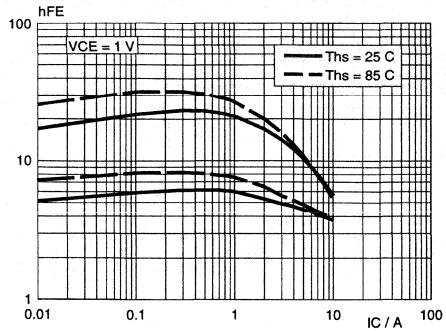


Fig.7. High and low DC current gain.

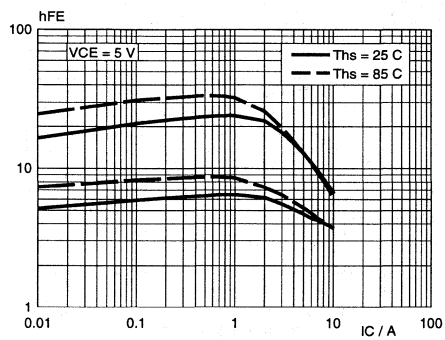


Fig.8. High and low DC current gain.

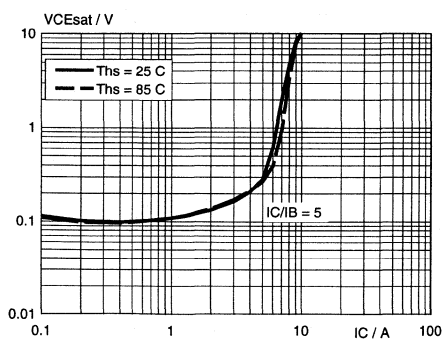


Fig.9. Typical collector-emitter saturation voltage.

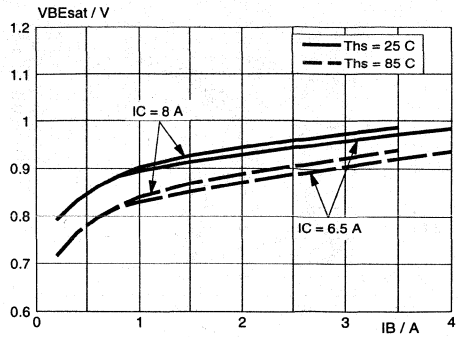


Fig.10. Typical base-emitter saturation voltage.

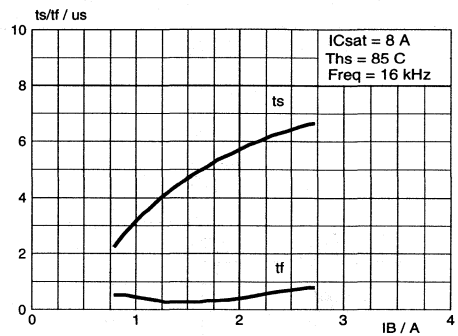


Fig.11. Typical collector storage and fall time.
I_C =8 A; T_j = 85˚C; f = 16kHz

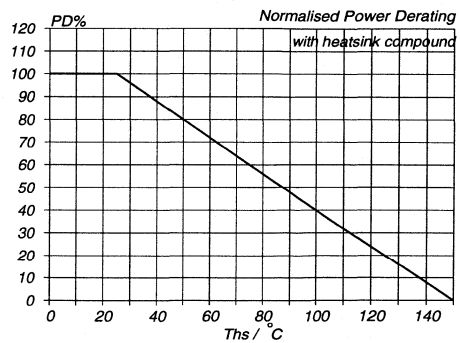


Fig.12. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C}$

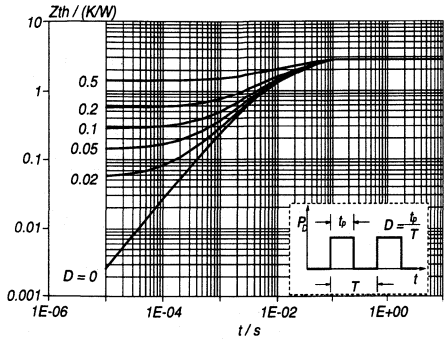


Fig.13. Transient thermal impedance.

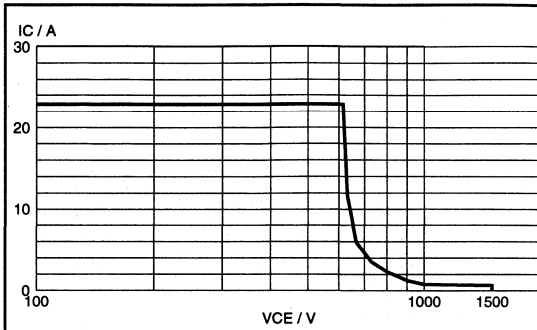


Fig.15. Reverse bias safe operating area. $T_j \leq T_{jmax}$

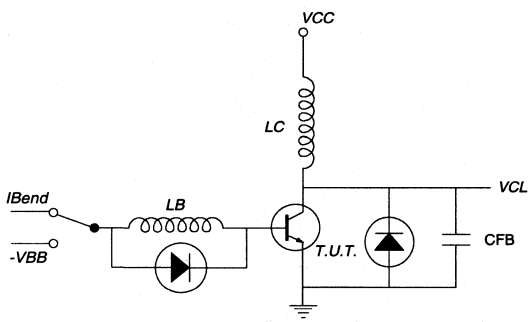


Fig.14. Test Circuit RBSOA.

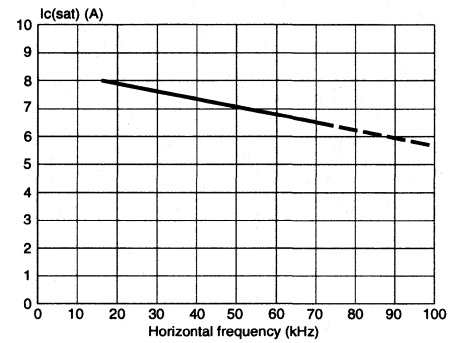


Fig.16. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU4523DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope with an integrated damper diode intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

QUICK REFERENCE DATA

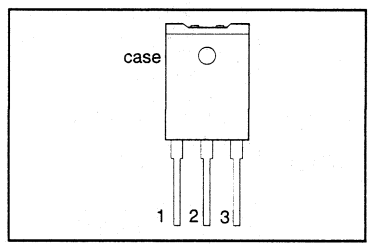
OBJECTIVE SPECIFICATION
See Philips Semiconductors for Design-in Information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	8	-	A
		f = 70 kHz	6.5	-	A
V_F	Diode forward voltage	I_F = 8.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 8 A; f = 16 kHz	0.3	0.4	µs
		f = 70 kHz	t,b,f	t.b.f	µs

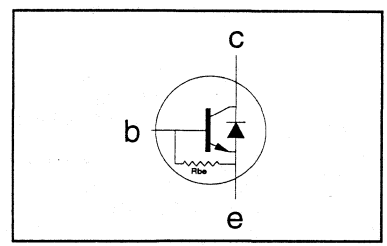
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	12.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	46	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8 A; I_B = 2 A	0.85	0.95	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	4.2	5.8	7.3	
V_F	Diode forward voltage	I_F = 8.0 A	-		2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 8.0 A;I_{B1} = 1.6 A (I_{B2} = -4 A)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.3	0.4	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4523DW

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope with an integrated damper diode intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

QUICK REFERENCE DATA

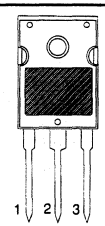
PRELIMINARY
See Philips Semiconductors for Design-in Information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	3.0	V
I_{Csat}	Collector saturation current.	f = 16 kHz	8	-	A
		f = 70 kHz	6.5	-	A
V_F	Diode forward voltage	I_F = 8.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 8 A; f = 16 kHz	0.3	0.4	µs
		f = 70 kHz	t.b.f	t.b.f	µs

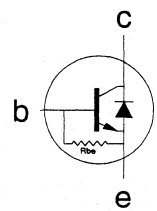
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	with heatsink compound	-	1	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	12.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	46	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8 A; I_B = 2 A	0.85	0.95	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 8 A; V_{CE} = 5 V	4.2	5.8	7.3	
V_F	Diode forward voltage	I_F = 8.0 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 8.0 A; I_{B1} = 1.6 A (I_{B2} = -4.0 A)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.30	0.40	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4523DX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope with an integrated damper diode intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

QUICK REFERENCE DATA

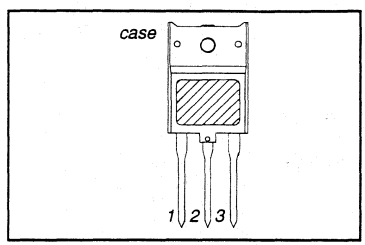
OBJECTIVE Information
See Philips Semiconductors for Design-in

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	8	-	A
		f = 70 kHz	6.5	-	A
V_F	Diode forward voltage	I_F = 8 A	-	2.2	V
t_f	Fall time	I_{Csat} = 8 A; f = 16 kHz	0.3	0.4	µs
		f = 70 kHz	t.b.f	t.b.f	µs

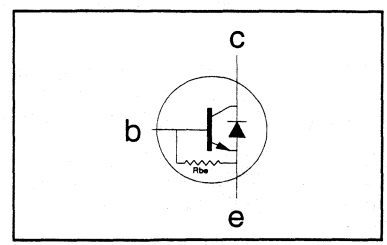
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	11	A
I_{CM}	Collector current peak value		-	29	A
I_B	Base current (DC)		-	7	A
I_{BM}	Base current peak value		-	10	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	12.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	46	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 8 A; I_B = 2 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 8 A; I_B = 2 A	0.85	0.95	1.1	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V		t.b.f		
h_{FE}		I_C = 8 A; V_{CE} = 5 V	4.2	5.8	7.3	
V_F	Diode forward voltage	I_F = 8 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 8.0 A; I_{B1} = 1.6 A (I_{B2} = -4.0 A)			
t_s	Turn-off storage time		4.5	5.5	µs
t_f	Turn-off fall time		0.30	0.40	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4525AF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

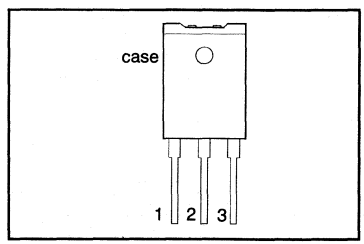
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	9.0	-	A
		f = 70 kHz	7.0	-	A
t_f	Fall time	I_{Csat} = 9.0 A;f = 16 kHz	0.4	0.55	µs
		I_{Csat} = 7.0 A;f = 70 kHz	0.15	-	µs

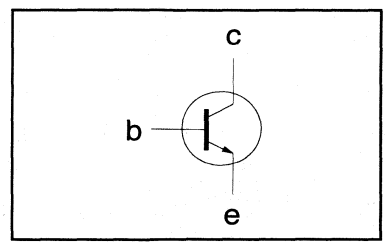
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	100	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	0.96	1.01	1.06	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 9.0 A; V_{CE} = 5 V	4.2	5.8	7.6	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 9.0 A;I_{B1} = 1.8 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		3.7	4.5	µs
t_f	Turn-off fall time		0.4	0.55	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = 7.0 A;I_{B1} = 1.4 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		2	-	µs
t_f	Turn-off fall time		0.15	-	µs

2 Measured with half sine-wave voltage (curve tracer).

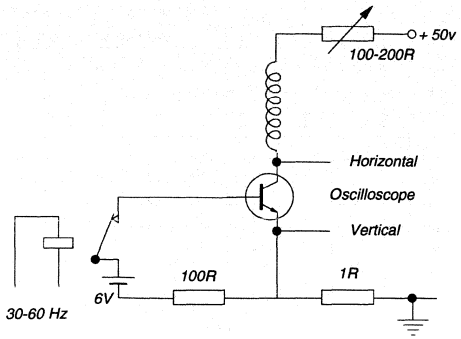


Fig.1. Test circuit for $V_{CEOsust}$.

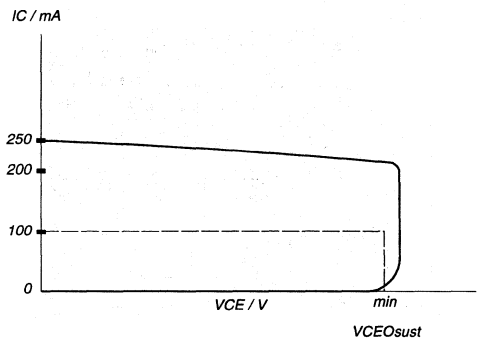


Fig.2. Oscilloscope display for $V_{CEOsust}$.

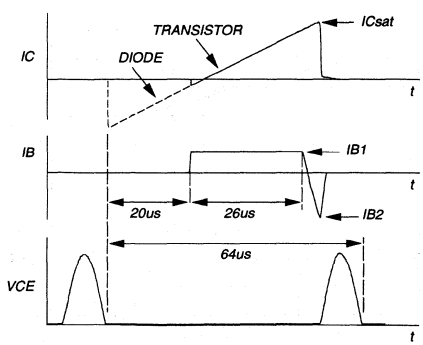


Fig.3. Switching times waveforms (16 kHz).

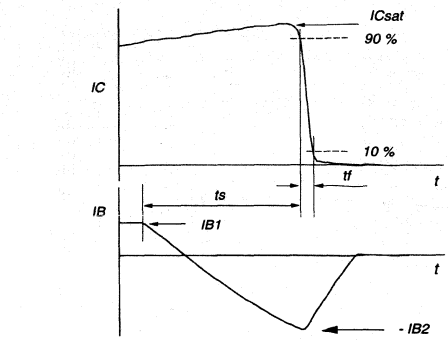


Fig.4. Switching times definitions.

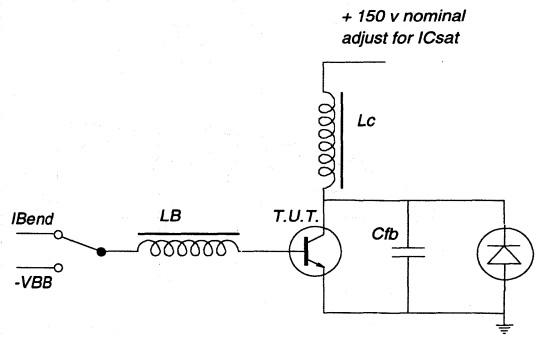


Fig.5. Switching times test circuit.

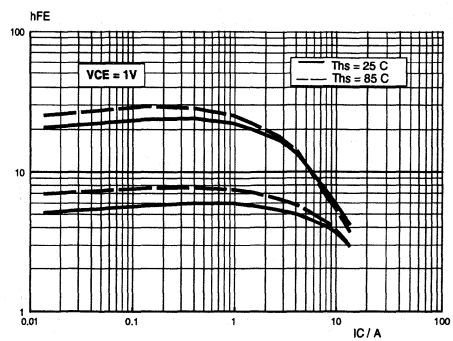


Fig.6. High and low DC current gain.

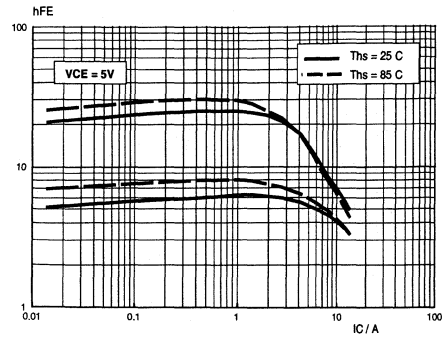


Fig.7. High and low DC current gain.

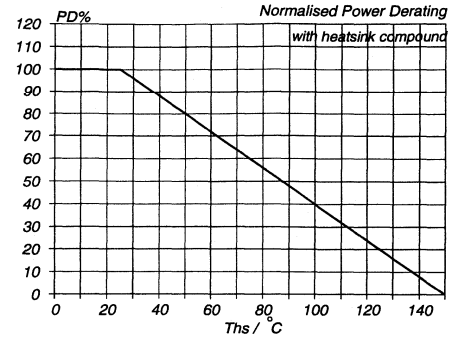


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C}$

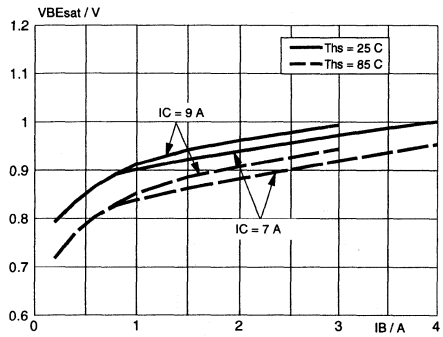


Fig.8. Typical base-emitter saturation voltage.

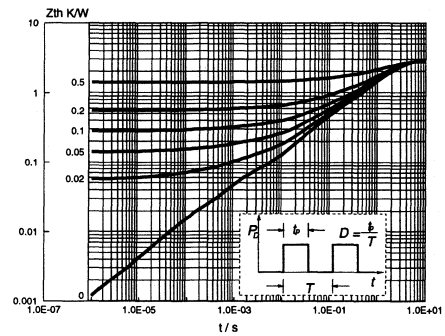


Fig.11. Transient thermal impedance.

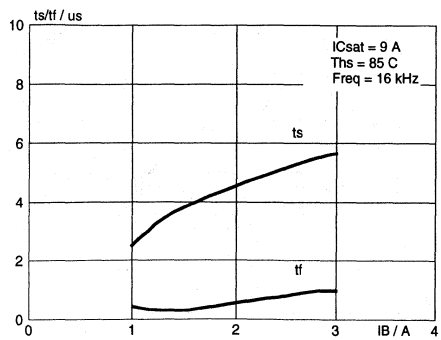


Fig.9. Typical collector storage and fall time.
I_C =9 A; T_j = 85˚C; f = 16kHz

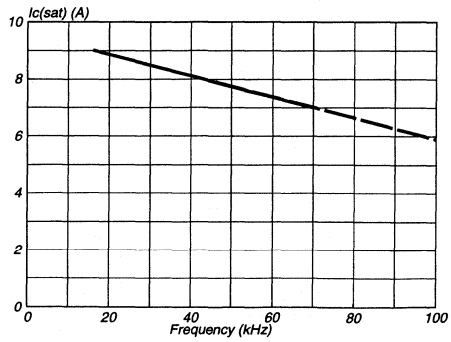


Fig.12. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU4525AL

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers an p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

QUICK REFERENCE DATA

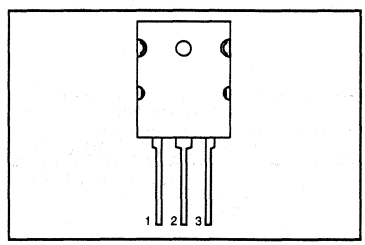
SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25A	-	3.0	V
I_{Csat}	Collector saturation current	f= 16 kHz	8.0	-	A
		f= 70 kHz	7.5	-	A
t_f	Fall time	I_{Csat} = 9.0 A; f = 16 kHz	t.b.f	t.b.f	µs
		I_{Csat} = 7.5 A; f = 70 kHz	t.b.f	t.b.f	µs

Preliminary JEDEC type
See Philips Semiconductors for Design-in information

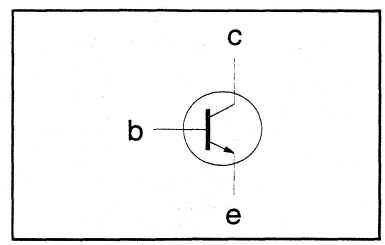
PINNING - SOT430

PIN	DESCRIPTION
1	base
2	collector
3	emitter
heat sink	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

[1] Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{BE} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25 A;	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25 A;	t.b.f	-	1.1	V
h_{FE}	DC current gain	I_C = 1A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 9 A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 9.0 A; I_{B1} = 1.8 A; (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (70kHz line deflection circuit)	I_{Csat} = 7.5 A; I_{B1} = 1.5 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4525AW

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

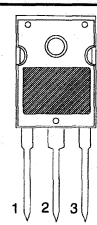
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	14	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	9.0	-	A
		f = 70 kHz	7.0	-	A
t_f	Fall time	I_{Csat} = 9.0 A;f = 16 kHz	0.4	0.55	µs
		I_{Csat} = 7.0 A;f = 70 kHz	0.15	-	µs

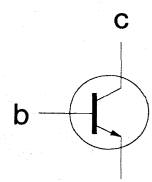
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	14	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	1	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	100	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	0.96	1.01	1.06	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 9.0 A; V_{CE} = 5 V	4.2	5.8	7.6	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 9.0 A;I_{B1} = 1.8 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		3.7	4.5	µs
t_f	Turn-off fall time		0.4	0.55	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = 7.0 A;I_{B1} = 1.4 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		2	-	µs
t_f	Turn-off fall time		0.15	-	µs

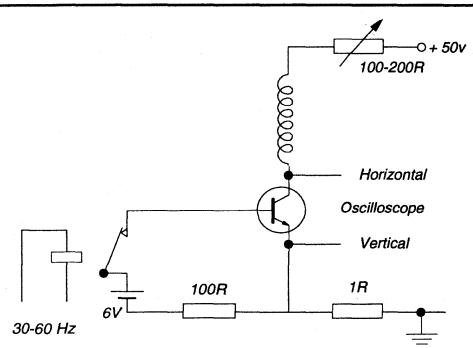


Fig.1. Test circuit for $V_{CEOsust}$.

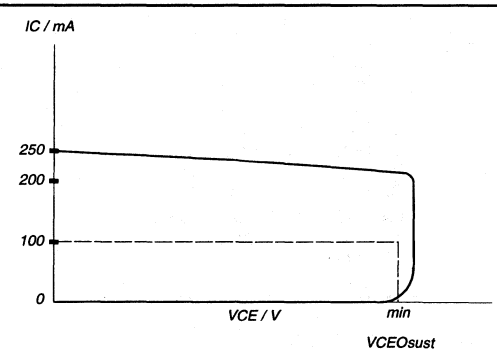


Fig.2. Oscilloscope display for $V_{CEOsust}$.

2 Measured with half sine-wave voltage (curve tracer).

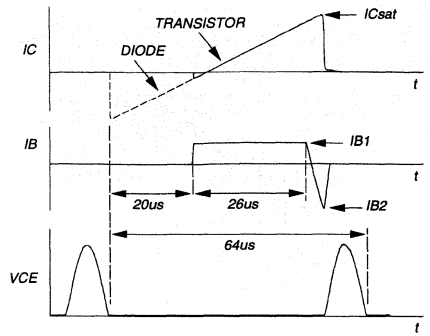


Fig.3. Switching times waveforms (16 kHz).

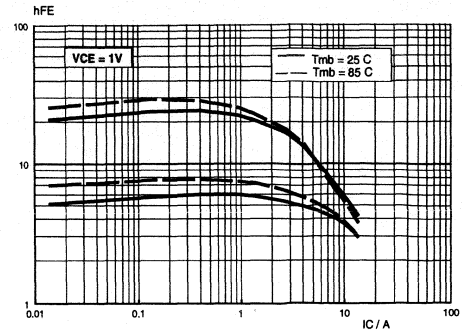


Fig.6. High and low DC current gain.

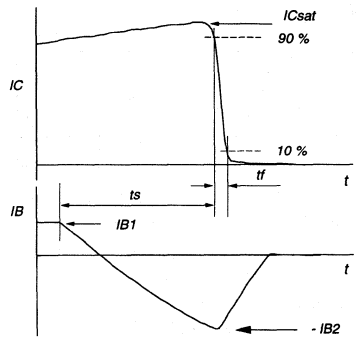


Fig.4. Switching times definitions.

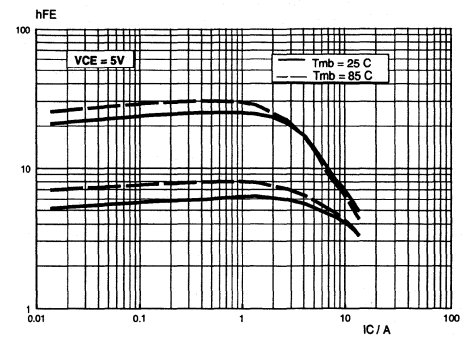


Fig.7. High and low DC current gain.

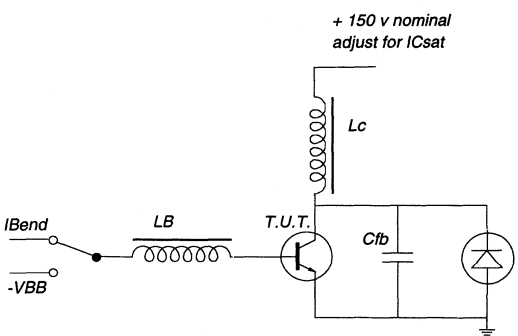


Fig.5. Switching times test circuit.

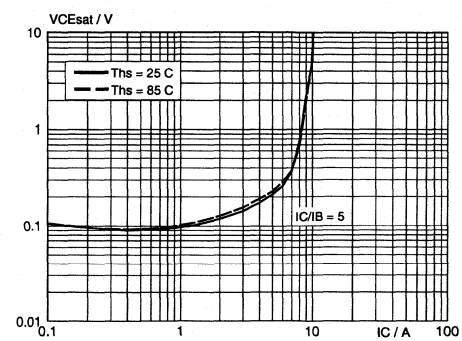


Fig.8. Typical collector-emitter saturation voltage.

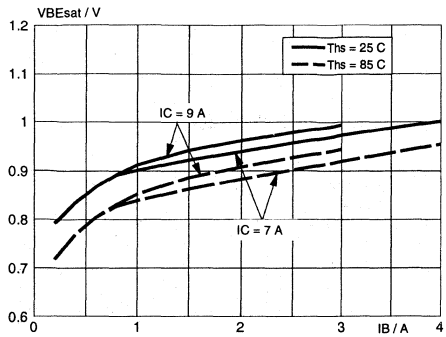


Fig.9. Typical base-emitter saturation voltage.

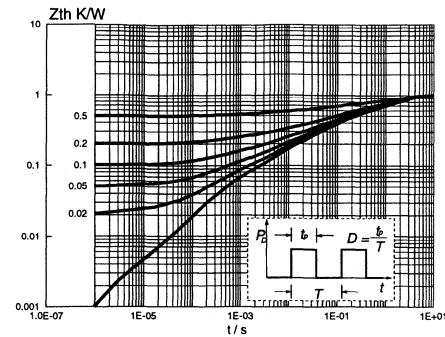


Fig.12. Transient thermal impedance.

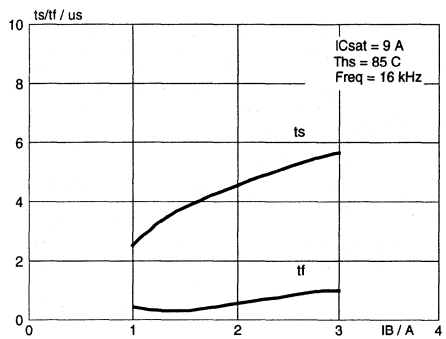


Fig.10. Typical collector storage and fall time. I_C =9 A; T_j = 85˚C; f = 16kHz

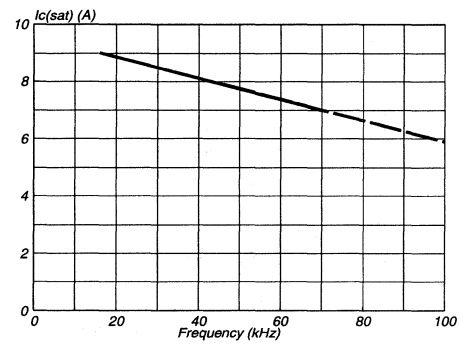


Fig.13. I_{Csat} during normal running vs. frequency of operation for optimum performance

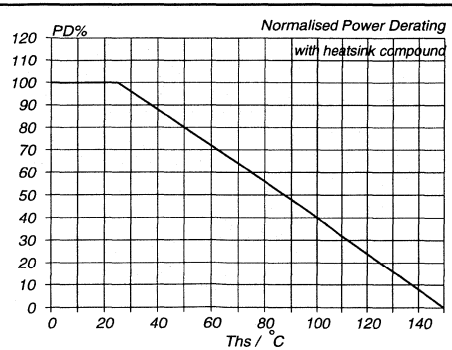


Fig.11. Normalised power dissipation. PD% = 100·P_D/$P_{D\,25˚C}$

Silicon Diffused Power Transistor — BU4525AX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

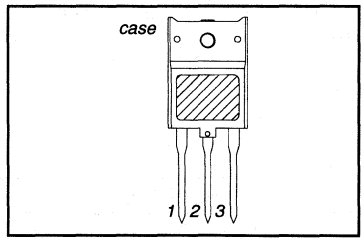
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	9.0	-	A
		f = 70 kHz	7.0	-	A
t_f	Fall time	I_{Csat} = 9.0 A;f = 16 kHz	0.4	0.55	µs
		I_{Csat} = 7.0 A;f = 70 kHz	0.15	-	µs

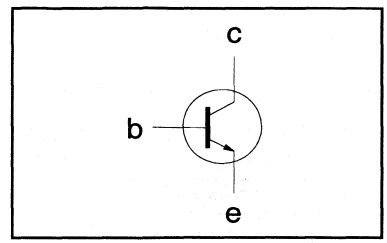
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

1 Turn-off current.

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0 A	-	-	100	µA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 1 mA	7.5	13.5	-	V
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	0.96	1.01	1.06	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 9.0 A; V_{CE} = 5 V	4.2	5.8	7.6	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 9.0 A;I_{B1} = 1.8 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		3.7	4.5	µs
t_f	Turn-off fall time		0.4	0.55	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = 7.0 A;I_{B1} = 1.4 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		2	-	µs
t_f	Turn-off fall time		0.15	-	µs

2 Measured with half sine-wave voltage (curve tracer).

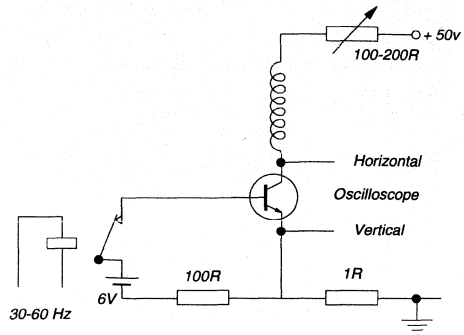


Fig.1. Test circuit for $V_{CEOsust}$.

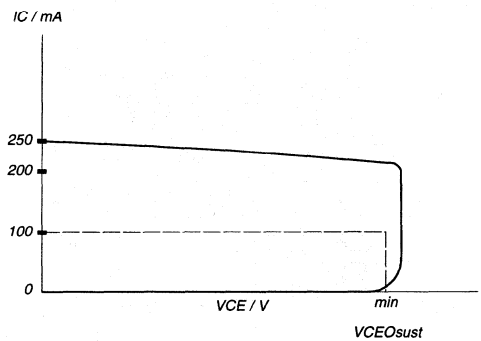


Fig.2. Oscilloscope display for $V_{CEOsust}$.

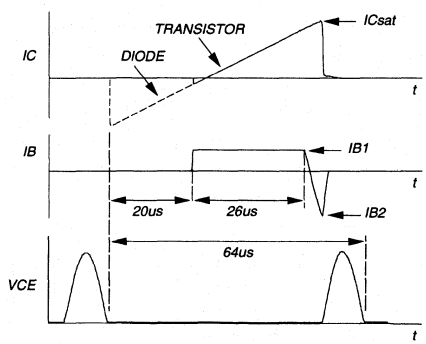


Fig.3. Switching times waveforms (16 kHz).

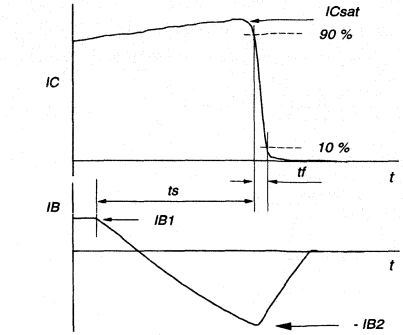


Fig.4. Switching times definitions.

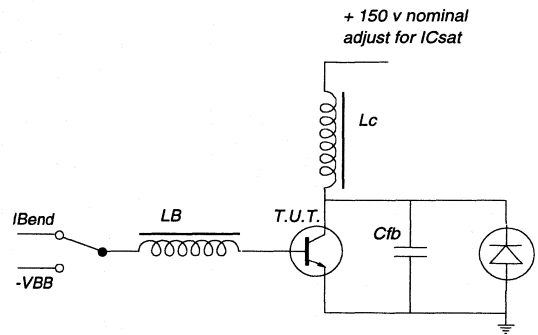


Fig.5. Switching times test circuit.

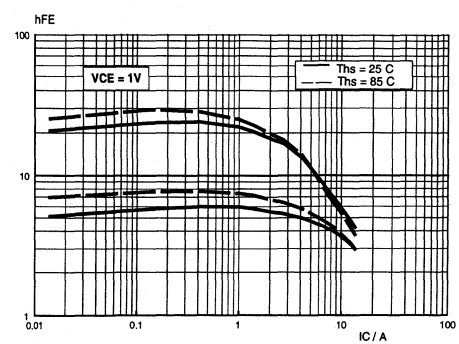


Fig.6. High and low DC current gain.

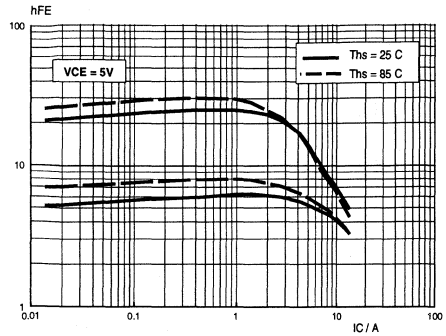


Fig.7. High and low DC current gain.

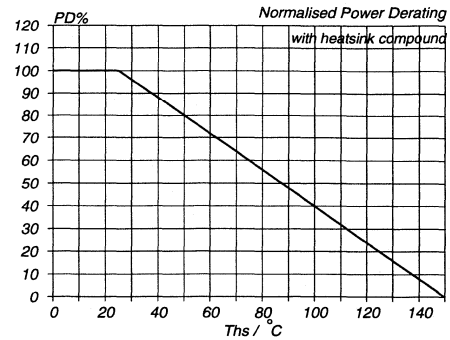


Fig.10. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25^\circ C}$

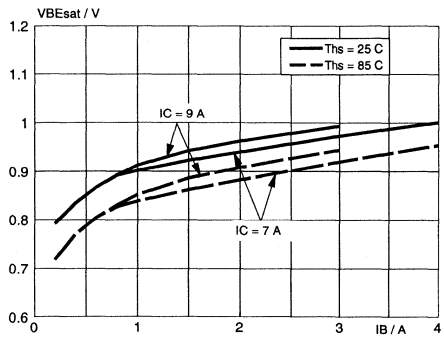


Fig.8. Typical base-emitter saturation voltage.

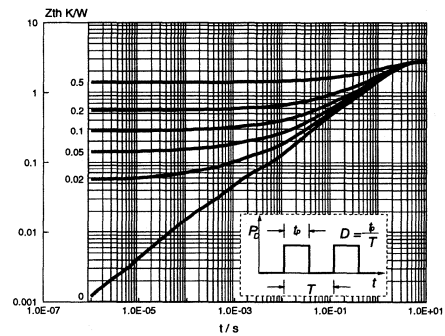


Fig.11. Transient thermal impedance.

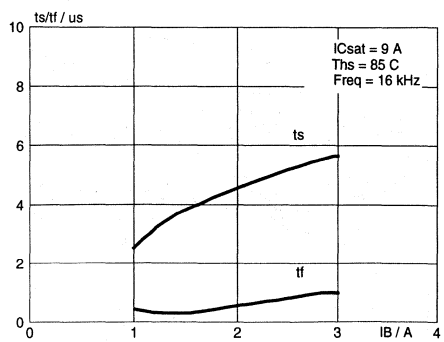


Fig.9. Typical collector storage and fall time.
I_C =9 A; T_j = 85˚C; f = 16kHz

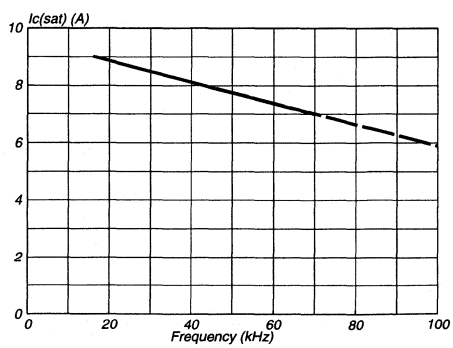


Fig.12. I_{Csat} during normal running vs. frequency of operation for optimum performance

Silicon Diffused Power Transistor — BU4525DF

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope with integrated damper diode intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

QUICK REFERENCE DATA

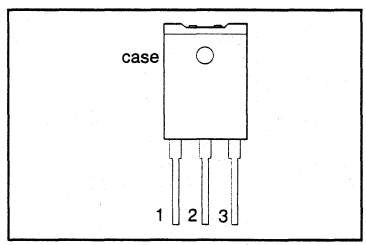
OBJECTIVE
See Philips Semiconductors for Design-in Information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	9.0	-	A
		f = 70 kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 9.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 9.0 A;f = 16 kHz	0.4	0.55	µs
		f = 70 kHz	t.b.f	t.b.f	µs

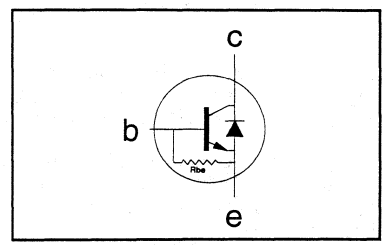
PINNING - SOT199

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	0.96	1.01	1.06	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 9.0 A; V_{CE} = 5 V	4.2	5.8	7.6	
V_F	Diode forward voltage	I_F = 9 A	-		2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 9.0 A;I_{B1} = 1.8 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		3.7	4.5	µs
t_f	Turn-off fall time		0.4	0.55	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4525DL

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope with integrated damper diode intended intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

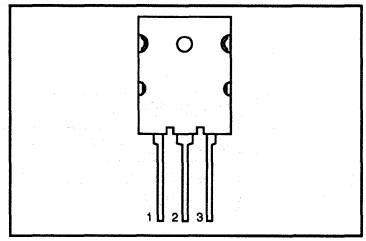
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	14	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25 A	-	3.0	V
V_F	Diode forward voltage	I_F = 9.0 A	-	2.2	V
I_{Csat}	Collector saturation current	f = 16 kHz	9.0	-	A
		f = 70 kHz	t.b.f	-	A
t_f	Fall time	I_{Csat} = 9.0 A;f = 16 kHz	0.4	0.55	µs
		f = 70 kHz	t.b.f	t.b.f	µs

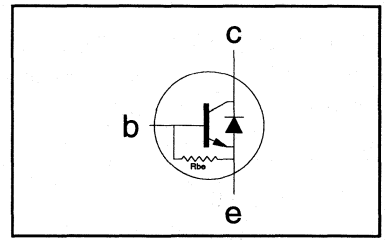
PINNING - SOT430

PIN	DESCRIPTION
1	base
2	collector
3	emitter
heat sink	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	14	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	1	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	0.96	1.01	1.06	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	12	-	
h_{FE}		I_C = 9.0 A; V_{CE} = 5 V	4.2	5.8	7.6	
V_F	Diode forward voltage	I_F = 9 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 9.0 A;I_{B1} = 1.8 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		3.7	4.5	µs
t_f	Turn-off fall time		0.4	0.55	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4525DW

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope with an integrated damper diode intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

QUICK REFERENCE DATA

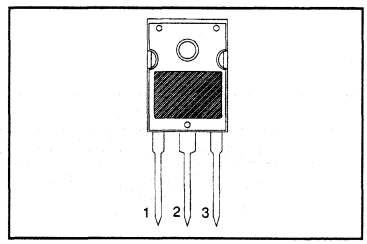
PRELIMINARY See Philips Semiconductors for Design-in Information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	14	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	9.0	-	A
		f = 70 kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 9.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 9.0 A;f = 16 kHz	0.4	0.55	µs
		f = 70 kHz	t.b.f	t.b.f	µs

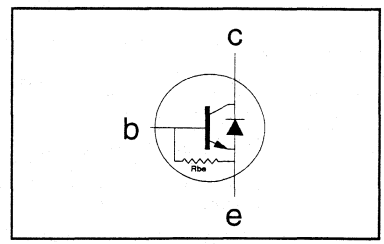
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	14	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	1	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	0.96	1.01	1.06	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 9.0 A; V_{CE} = 5 V	4.2	5.8	7.6	
V_F	Diode forward voltage	I_F = 9 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 9.0 A;I_{B1} = 1.8 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		3.7	4.5	µs
t_f	Turn-off fall time		0.4	0.55	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t,b,f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4525DX

OBJECTIVE Information
See Philips Semiconductors for Design-in Information

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope with an integrated damper diode intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

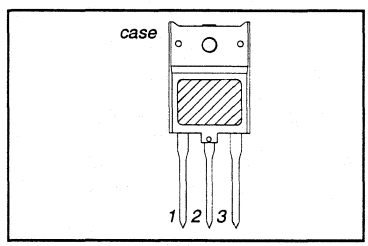
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	45	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A; I_B = 2.25 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 16 kHz	9.0	-	A
		f = 70 kHz	t.b.f	-	A
V_F	Diode forward voltage	I_F = 9.0 A	-	2.2	V
t_f	Fall time	I_{Csat} = 9.0 A;f = 16 kHz	0.4	0.55	µs
		f = 70 kHz	t.b.f	t.b.f	µs

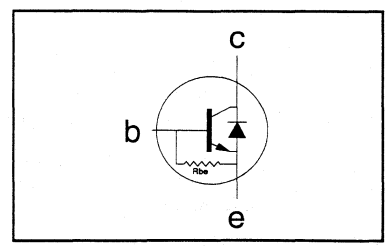
PINNING - SOT399

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	12	A
I_{CM}	Collector current peak value		-	30	A
I_B	Base current (DC)		-	8	A
I_{BM}	Base current peak value		-	12	A
$-I_{BM}$	Reverse base current peak value [1]		-	7	A
P_{tot}	Total power dissipation	$T_{hs} \leq$ 25 °C	-	45	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65 % ; clean and dustfree	-	-	2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	22	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
BV_{EBO}	Emitter-base breakdown voltage	I_B = 600 mA	7.5	13.5	-	V
R_{be}	Base-emitter resistance	V_{EB} = 7.5 V	-	50	-	Ω
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	800	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 9.0 A;I_B = 2.25A	0.96	1.01	1.06	V
h_{FE}	DC current gain	I_C = 1.0 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 9.0 A; V_{CE} = 5 V	4.2	5.8	7.6	
V_F	Diode forward voltage	I_F = 9 A	-	-	2.2	V

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
C_c	Collector capacitance	I_E = 0 A; V_{CB} = 10 V; f = 1 MHz	145	-	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 9.0 A;I_{B1} = 1.8 A (I_{B2} = -4.5 A)			
t_s	Turn-off storage time		3.7	4.5	µs
t_f	Turn-off fall time		0.4	0.55	µs
	Switching times (70 kHz line deflection circuit)	I_{Csat} = t.b.f			
t_s	Turn-off storage time		t.b.f	t,b,f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4530AL

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

QUICK REFERENCE DATA

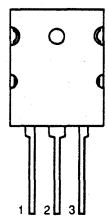
SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	$I_C = 10$ A; $I_B = 2.5$A	-	3.0	V
I_{Csat}	Collector saturation current	f = 32 kHz	10	-	A
		f = 90 kHz	8	-	A
t_f	Fall time.	$I_{Csat} = 10.0$ A; f = 32 kHz	t.b.f	t.b.f	µs
		$I_{Csat} = 8.0$ A; f = 90 kHz	t.b.f	t.b.f	µs

OBJECTIVE
See Philips Semiconductors for Design-in information

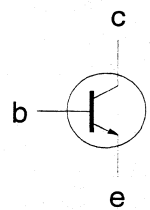
PINNING - SOT430

PIN	DESCRIPTION
1	base
2	collector
3	emitter
heat sink	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$ V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	15	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Base-emitter breakdown voltage	I_B = 1 mA	7.5	14	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 10 A; I_B = 2.5 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 10 A; I_B = 2.5 A	t.b.f	-	1.0	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 10 A; V_{CE} = 5 V	4.2	t.b.f	6.5	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (32 kHz line deflection dynamic test circuit).	I_{Csat} = 10.0 A; I_{B1} = 2 A; (I_{B2} = -5 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (90 kHz line deflection dynamic test circuit).	I_{Csat} = 8 A; I_{B1} = 1.6 A;(I_{B2} = -4.8 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor BU4530AW

OBJECTIVE
See Philips Semiconductors for Design-in information

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

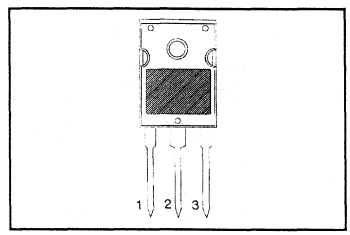
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	$I_C = 10.0$ A; $I_B = 2.5$ A	-	3.0	V
I_{Csat}	Collector saturation current	f = 32 kHz	10	-	A
		f = 90 kHz	8	-	A
t_f	Fall time	$I_{Csat} = 10.0$ A; f = 32 kHz	t.b.f	t.b.f	µs
		$I_{Csat} = 8$ A; f = 90 kHz	t.b.f	t.b.f	µs

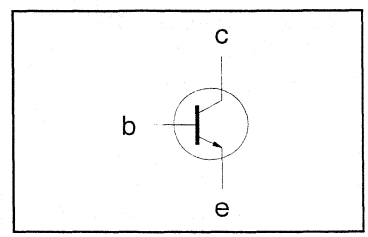
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0$ V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	16	A
I_{CM}	Collector current peak value		-	40	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	15	A
$-I_{BM}$	Reverse base current peak value [1]		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Base-emitter breakdown voltage	I_B = 1 mA	7.5	14	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 10.0 A; I_B = 2.5 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 10.0 A; I_B = 2.5 A	t.b.f	-	1.0	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 10 A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (32 kHz line deflection dynamic test circuit).	I_{Csat} = 10.0 A;I_{B1} = 2A;(I_{B2} = -5A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (90 kHz line deflection dynamic test circuit).	I_{Csat} = 8 A;I_{B1} = 1.6A;(I_{B2} = -4.8A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor BU4540AL

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See Philips Semiconductors for design-in information

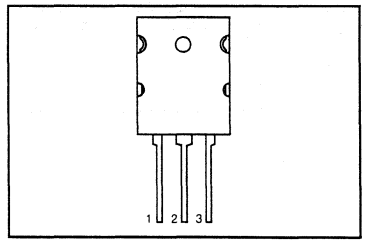
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	25	A
I_{CM}	Collector current peak value		-	40	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 16.0 A; I_B = 4 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 32kHz	16	-	A
		f = 110kHz	8	-	A
t_f	Storage time	I_{Csat} = 16 A; f = 32kHz	t.b.f	t.b.f	µs
		I_{Csat} = 8 A; f = 110kHz	t.b.f	t.b.f	µs

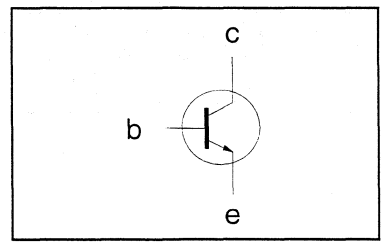
PINNING - SOT430

PIN	DESCRIPTION
1	base
2	collector
3	emitter
heat sink	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	25	A
I_{CM}	Collector current peak value		-	40	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	15	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Base-emitter breakdown voltage	I_B = 1 mA	7.5	14	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 16 A; I_B = 4 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 16 A; I_B = 4 A	t.b.f	-	1.0	V
h_{FE}	DC current gain	I_C = 1A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 16 A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (32 kHz line deflection dynamic test circuit).	I_{Csat} = 16 A;I_{B1} = 3.2 A; (I_{B2} = -8A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (110 kHz line deflection dynamic test circuit).	I_{Csat} = 8 A;I_{B1} = 1.6 A; (I_{B2} = -4.8A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4540AW

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE
See application notes for design-in information

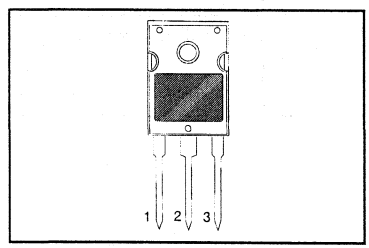
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	25	A
I_{CM}	Collector current peak value		-	40	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 16 A; I_B = 4 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 32kHz	16	-	A
		f = 110kHz	8	-	A
t_f	fall time	I_{Csat} = 16 A; f = 32kHz	t.b.f	t.b.f	µs
		I_{Csat} = 8 A; f = 110kHz	t.b.f	t.b.f	µs

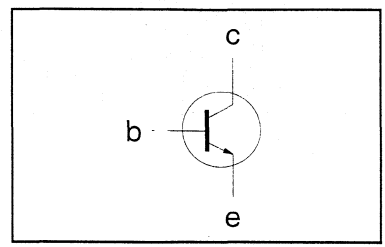
PINNING - SOT429

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	25	A
I_{CM}	Collector current peak value		-	40	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	15	A
$-I_{BM}$	Reverse base current peak value [1]		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	45	-	K/W

1 Turn-off current.

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Base-emitter breakdown voltage	I_B = 1 mA	7.5	14	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 16 A; I_B = 4 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 16 A; I_B = 4 A	t.b.f	-	1.0	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 16 A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (32 kHz line deflection dynamic test circuit).	I_{Csat} = 16 A;I_{B1} =3.2 A;(I_{B2} = -8 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (110 kHz line deflection dynamic test circuit).	I_{Csat} = 8 A;I_{B1} =1.6 A;(I_{B2} = -4.8 A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BU4540AL

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full pack envelope intended for use in horizontal deflection circuits of colour television receivers and p.c monitors. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

OBJECTIVE specification for design-in information
See Philips Semiconductors for updates

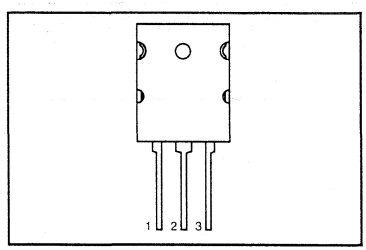
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	25	A
I_{CM}	Collector current peak value		-	40	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 16.0 A; I_B = 4 A	-	3.0	V
I_{Csat}	Collector saturation current	f = 32kHz	16	-	A
		f = 110kHz	8	-	A
t_f	Storage time	I_{Csat} = 16 A; f = 32kHz	t.b.f	t.b.f	µs
		I_{Csat} = 8 A; f = 110kHz	t.b.f	t.b.f	µs

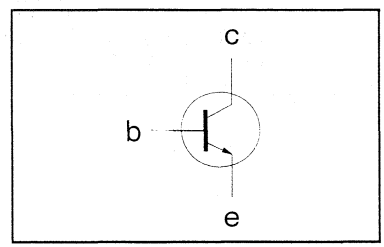
PINNING - SOT430

PIN	DESCRIPTION
1	base
2	collector
3	emitter
heat sink	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1500	V
V_{CEO}	Collector-emitter voltage (open base)		-	800	V
I_C	Collector current (DC)		-	25	A
I_{CM}	Collector current peak value		-	40	A
I_B	Base current (DC)		-	10	A
I_{BM}	Base current peak value		-	15	A
$-I_{B(AV)}$	Reverse base current	average over any 20 ms period	-	200	mA
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	125	W
T_{stg}	Storage temperature		-55	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base	-	-	1.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [2]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7.5 V; I_C = 0 A	-	-	1.0	mA
BV_{EBO}	Base-emitter breakdown voltage	I_B = 1 mA	7.5	14	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 20 A; I_B = 5 A	-	-	3.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 20 A; I_B = 5 A	t.b.f	-	1.0	V
h_{FE}	DC current gain	I_C = 1A; V_{CE} = 5 V	-	t.b.f	-	
h_{FE}		I_C = 20 A; V_{CE} = 5 V	4.2	5.35	6.5	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (32 kHz line deflection dynamic test circuit).	I_{Csat} = 20 A;I_{B1} = 4 A; (I_{B2} = -10A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs
	Switching times (130 kHz line deflection dynamic test circuit).	I_{Csat} = 8 A;I_{B1} = 1.6 A; (I_{B2} = -4.8A)			
t_s	Turn-off storage time		t.b.f	t.b.f	µs
t_f	Turn-off fall time		t.b.f	t.b.f	µs

2 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor

BUJ101A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

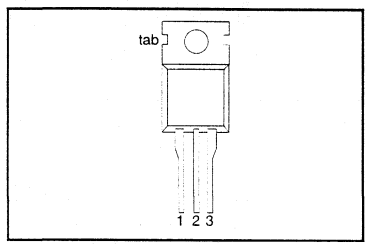
OBJECTIVE
See Philips Semiconductors for Design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	700	V
V_{CBO}	Collector-Base voltage (open emitter)		-	700	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	0.5	A
I_{CM}	Collector current peak value		-	1	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	42	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 0.2 A;I_B = 20 mA	-	1.0	V
t_f	Fall time	Ic=0.2A,I_{B1}=20mA	40	100	ns

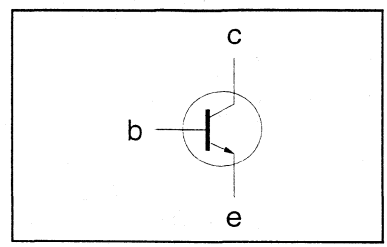
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	700	V
V_{CEO}	Collector to emitter voltage (open base)		-	400	V
V_{CBO}	Collector to base voltage (open emitter)		-	700	V
I_C	Collector current (DC)		-	0.5	A
I_{CM}	Collector current peak value		-	1	A
I_B	Base current (DC)		-	0.2	A
I_{BM}	Base current peak value		-	0.3	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	42	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	3.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	100	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.1	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	1.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 5 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 0.1 A; I_B = 10 mA	-	-	0.8	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 0.2 A; I_B =20 mA	-	-	1.0	V
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	10	-	32	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 0.2 A; I_{Bon} = -I_{Boff} = 20 mA; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	0.5	µs
t_s	Turn-off storage time		-	3	µs
t_f	Turn-off fall time		-	0.3	µs
	Switching times (inductive load)	I_{Con} = 0.2 A; I_{Bon} = 20m A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		40	100	ns
	Switching times (inductive load)	I_{Con} = 0.2 A; I_{Bon} = 20m A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.8	µs
t_f	Turn-off fall time		-	200	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BUJ101AX

OBJECTIVE
See Philips Semiconductors for Design-in information

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

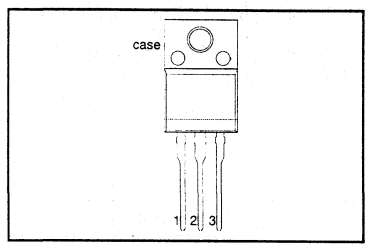
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	700	V
V_{CBO}	Collector-Base voltage (open emitter)		-	700	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	0.5	A
I_{CM}	Collector current peak value		-	1	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	26	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 0.2 A;I_B =20m A	-	1.0	V
t_f	Fall time	Ic=0.2A,I_{B1}=20mA	40	100	ns

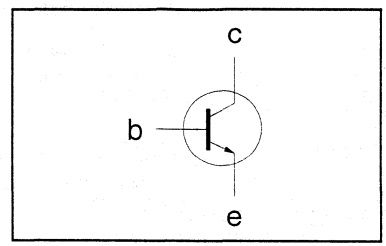
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	700	V
V_{CEO}	Collector to emitter voltage (open base)		-	400	V
V_{CBO}	Collector to base voltage (open emitter)		-	700	V
I_C	Collector current (DC)		-	0.5	A
I_{CM}	Collector current peak value		-	1	A
I_B	Base current (DC)		-	0.2	A
I_{BM}	Base current peak value		-	0.3	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	26	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	4.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65% ; clean and dustfree	-		1500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	12	-	pF

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.1	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	1.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 5 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 0.1 A; I_B = 10 mA	-	-	0.8	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 0.2 A; I_B = 20 mA	-	-	1.0	V
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	10	-	32	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 0.2 A; I_{Bon} = -I_{Boff} = 20 mA; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	0.5	µs
t_s	Turn-off storage time		-	3.5	µs
t_f	Turn-off fall time		-	0.3	µs
	Switching times (inductive load)	I_{Con} = 0.2 A; I_{Bon} = 20 mA; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		40	100	ns
	Switching times (inductive load)	I_{Con} = 0.2 A; I_{Bon} = 20 mA; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.8	µs
t_f	Turn-off fall time		-	200	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BUJ103A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

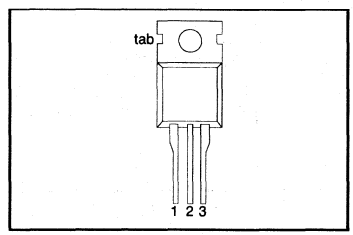
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	700	V
V_{CBO}	Collector-Base voltage (open emitter)		-	700	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)	2	-	4	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	80	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A;I_B = 0.6 A	0.25	1.0	V
h_{FEsat}		I_C = 3.0 A; V_{CE} = 5 V	12.5	-	
t_f	Fall time	Ic=2A,I_{B1}=0.4A	33	80	ns

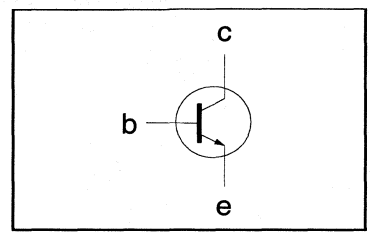
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	700	V
V_{CEO}	Collector to emitter voltage (open base)		-	400	V
V_{CBO}	Collector to base voltage (open emitter)		-	700	V
I_C	Collector current (DC)		-	4	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	80	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.56	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{CBO}	Collector cut-off current [1]	V_{CBO} = $V_{CESMmax}$ (700V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$ (400V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7 V; I_C = 0 A	-	-	0.1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 10 mA; L = 25 mH	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.6 A	-	0.25	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.6 A	-	0.97	1.5	V
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	10	17	32	
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	12	20	32	
h_{FEsat}		I_C = 2.0 A; V_{CE} = 5 V	13.5	16	20	
		I_C = 3.0 A; V_{CE} = 5 V	-	12.5	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4V;			
t_{on}	Turn-on time		0.52	0.6	µs
t_s	Turn-off storage time		2.7	3.2	µs
t_f	Turn-off fall time		0.3	0.43	µs
	Switching times (inductive load)	I_{Con} = 2 A; I_{Bon} = 0.4 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.2	1.4	µs
t_f	Turn-off fall time		33	80	ns
	Switching times (inductive load)	I_{Con} = 2 A; I_{Bon} = 0.4 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.8	µs
t_f	Turn-off fall time		-	200	ns

1 Measured with half sine-wave voltage (curve tracer).

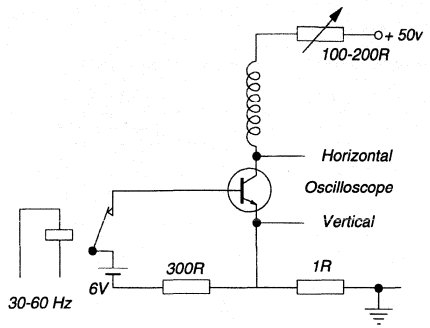


Fig.1. Test circuit for $V_{CEOsust}$.

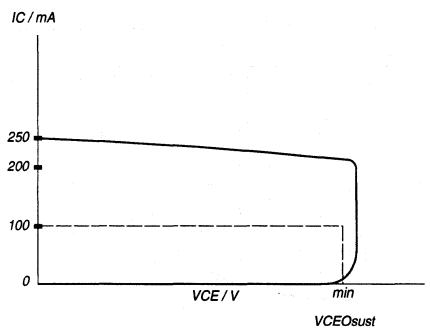


Fig.2. Oscilloscope display for $V_{CEOsust}$.

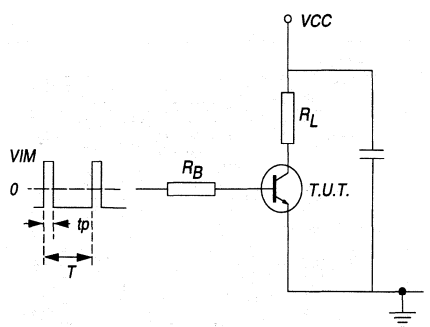


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

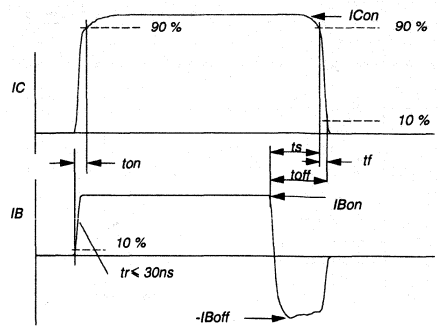


Fig.4. Switching times waveforms with resistive load.

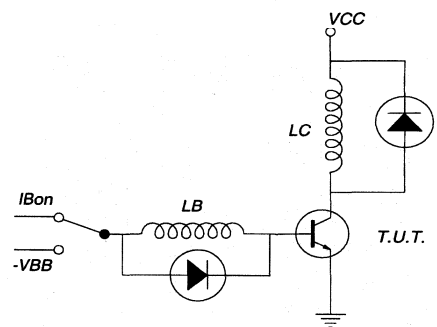


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

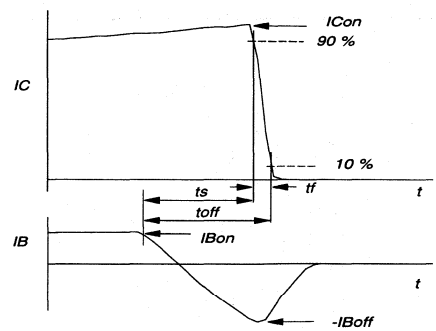


Fig.6. Switching times waveforms with inductive load.

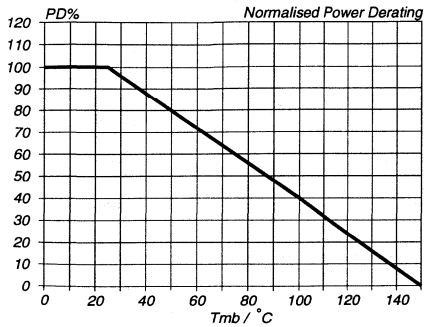


Fig.7. Normalised power dissipation.
PD% = 100·PD/PD $_{25°C}$ = f (T_{mb})

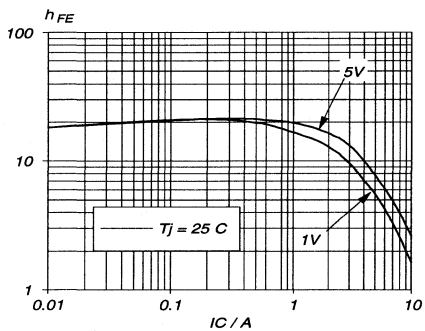


Fig.8. Typical DC current gain. h_{FE} = f(I_C)
parameter V_{CE}

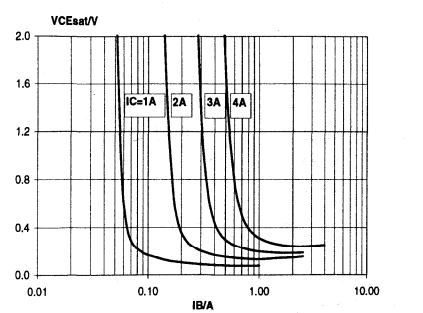


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IB); T_j=25˚C.

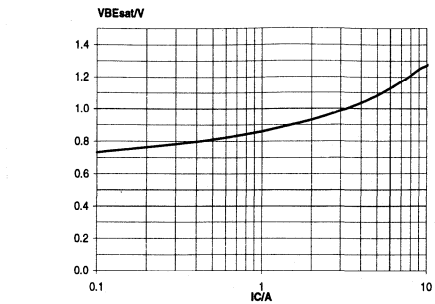


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, V_{BEsat} = f(IC); at IC/IB =4.

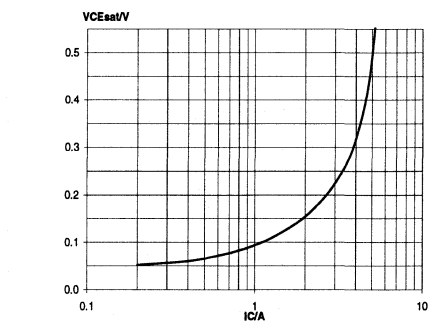


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IC); at IC/IB =4.

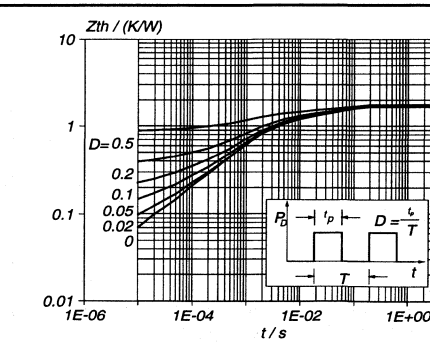


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}mb}$ = f(t); parameter D = t_p/T

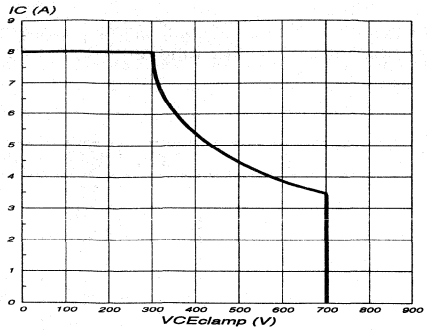


Fig.13. Reverse bias safe operating area $T_j \leq T_{jmax}$

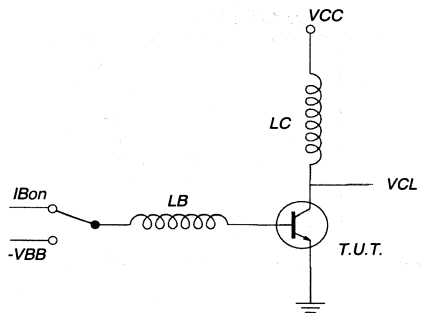


Fig.14. Test Circuit for reverse bias safe operating area.

$V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$; $L_B = 1\mu H$; $L_c = 200\mu H$

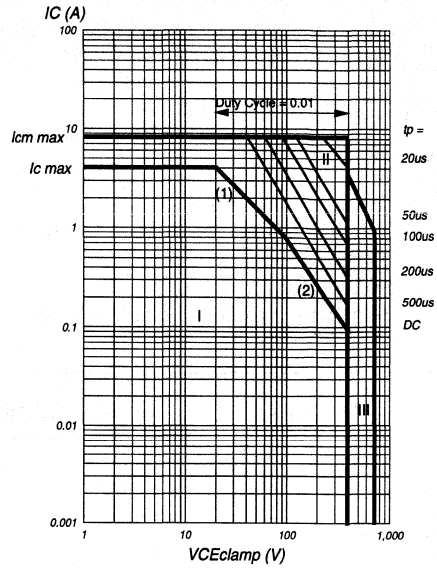


Fig.15. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1)	*P_{tot} max and P_{tot} peak max lines.*
(2)	*Second breakdown limits.*
I	*Region of permissible DC operation.*
II	*Extension for repetitive pulse operation.*
III	*Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.*
NB:	*Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BUJ103AX

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

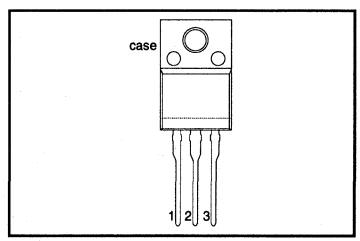
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	700	V
V_{CBO}	Collector-Base voltage (open emitter)		-	700	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	4	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	26	W
V_{CEsat}	Collector-emitter saturation voltage		0.25	1.0	V
h_{FEsat}	DC current gain	I_C = 3 A; V_{CE} = 5 V	12.5	-	
t_f	Fall time	Ic=2A,I_{B1}=0.4A	33	80	ns

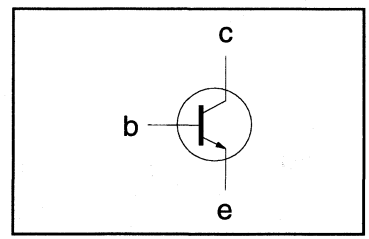
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	700	V
V_{CEO}	Collector to emitter voltage (open base)		-	400	V
V_{CBO}	Collector to base voltage (open emitter)		-	700	V
I_C	Collector current (DC)		-	4	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	26	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	4.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{CBO}	Collector cut-off current [1]	V_{CBO} = $V_{CESMmax}$(700V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$(400V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7 V; I_C = 0 A	-	-	0.1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 10 mA; L = 25 mH	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.6 A	-	0.25	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.6 A	-	0.97	1.5	V
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	10	17	32	
h_{FE}		I_C = 0.5 A; V_{CE} = 5 V	12	20	32	
h_{FEsat}	DC current gain	I_C = 2 A; V_{CE} = 5 V	13.5	16	20	
		I_C = 3 A; V_{CE} = 5 V	-	12.5	-	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.52	0.6	µs
t_s	Turn-off storage time		2.7	3.2	µs
t_f	Turn-off fall time		0.3	0.43	µs
	Switching times (inductive load)	I_{Con} = 2 A; I_{Bon} = 0.4 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.2	1.33	µs
t_f	Turn-off fall time		33	80	ns
	Switching times (inductive load)	I_{Con} = 2 A; I_{Bon} = 0.4 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.8	µs
t_f	Turn-off fall time		-	200	ns

1 Measured with half sine-wave voltage (curve tracer).

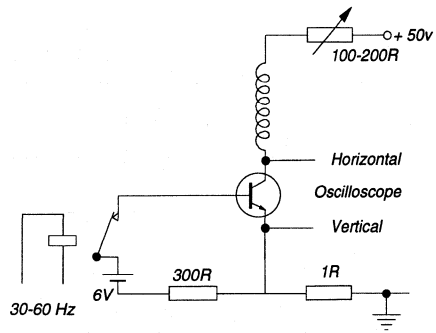


Fig.1. Test circuit for $V_{CEOsust}$.

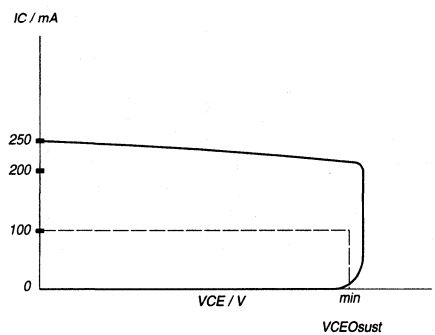


Fig.2. Oscilloscope display for $V_{CEOsust}$.

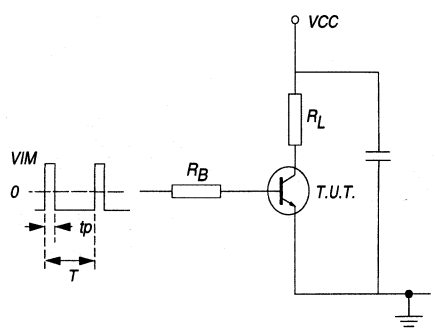


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

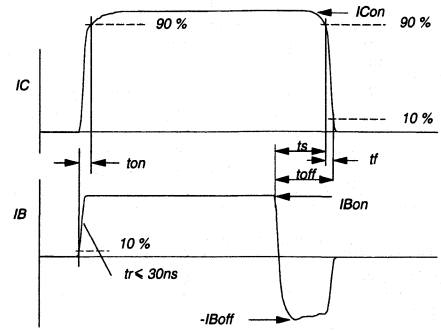


Fig.4. Switching times waveforms with resistive load.

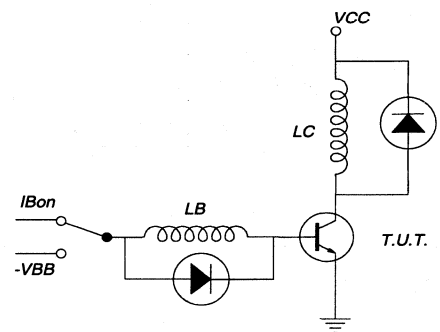


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

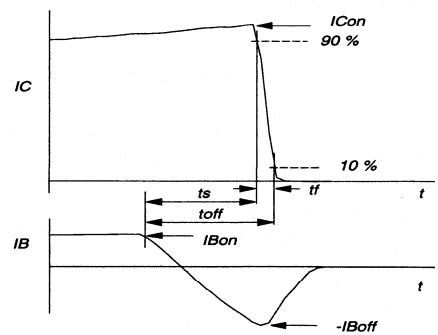


Fig.6. Switching times waveforms with inductive load.

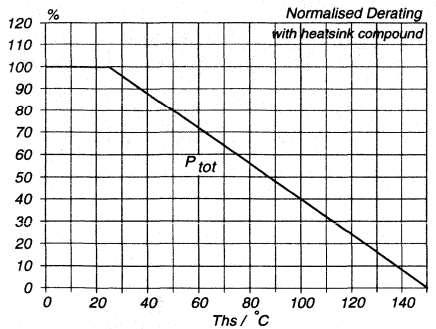


Fig.7. Normalised power dissipation.
PD% = 100·PD/PD $_{25°C}$ = f (T_{hs})

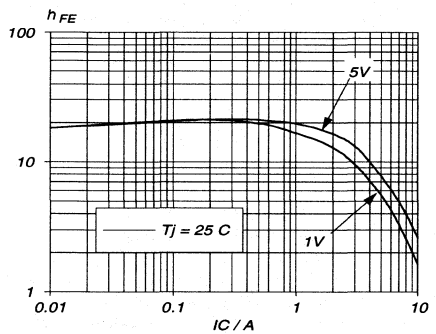


Fig.8. Typical DC current gain. h_{FE} = f(I_C)
parameter V_{CE}

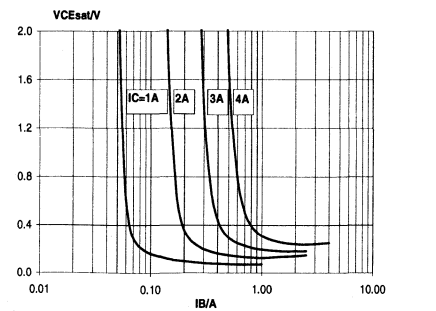


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IB); T_j=25˚C.

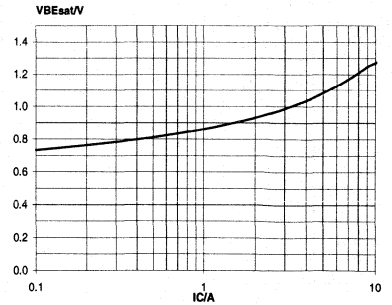


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, V_{BEsat} = f(IC); at IC/IB =4.

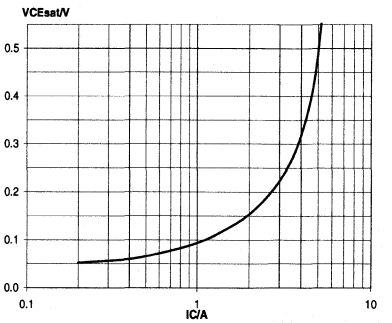


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IC); at IC/IB =4.

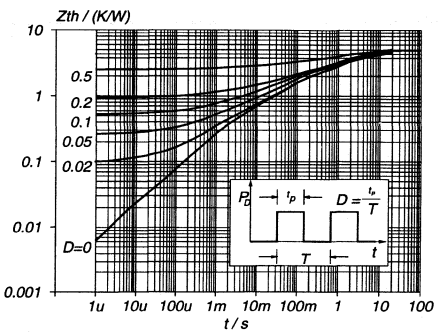


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

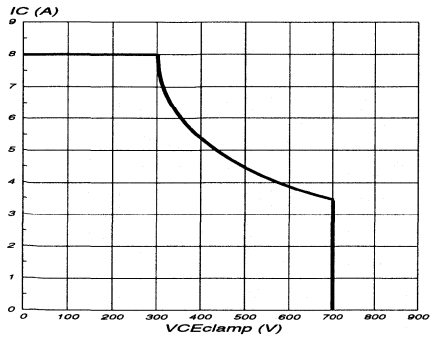


Fig.13. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

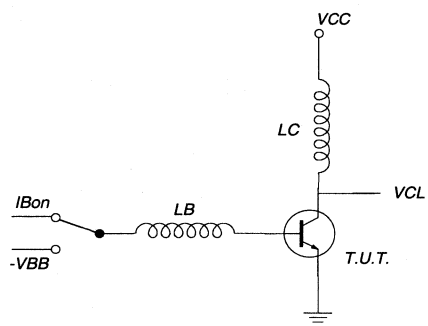


Fig.14. Test circuit for reverse bias safe operating area.
$V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$; $L_B = 1\mu H$; $L_c = 200\mu H$

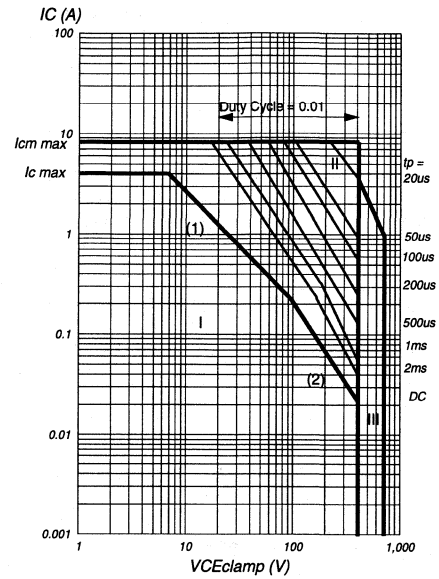


Fig.15. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1)	*P_{tot} max and P_{tot} peak max lines.*
(2)	*Second breakdown limits.*
I	*Region of permissible DC operation.*
II	*Extension for repetitive pulse operation.*
III	*Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.*
NB:	*Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor BUJ105A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

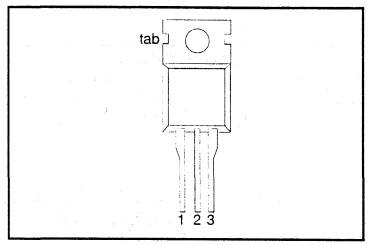
PRELIMINARY See also Philips Semiconductors for Design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	700	V
V_{CBO}	Collector-Base voltage (open emitter)		-	700	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ ˚C	-	80	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A;I_B = 0.75 A	0.2	1.0	V
h_{FEsat}		I_C = 4.0 A; V_{CE} = 5 V	12	-	
t_f	Fall time	Ic=2.5A,I_{B1}=0.5A	45	150	ns

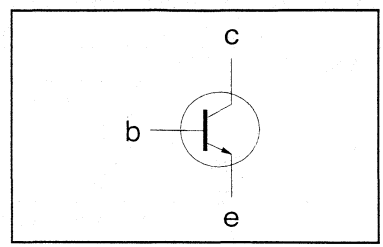
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	700	V
V_{CEO}	Collector to emitter voltage (open base)		-	400	V
V_{CBO}	Collector to base voltage (open emitter)		-	700	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ ˚C	-	80	W
T_{stg}	Storage temperature		-65	150	˚C
T_j	Junction temperature		-	150	˚C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.56	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	4.0	mA
I_{CBO}	Collector cut-off current	V_{CBO} = $V_{CESMmax}$ (700V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$ (400V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0A;I_B = 0.75 A	-	0.2	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A;I_B =0.75 A	-	1.0	1.5	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	17	35	
h_{FE}		I_C = 100 mA; V_{CE} = 5 V	10	19	35	
h_{FEsat}		I_C = 4.0 A; V_{CE} = 5 V	-	12	-	
		I_C = 5.0 A; V_{CE} = 5 V	-	10	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.5	1	µs
t_s	Turn-off storage time		3.2	4	µs
t_f	Turn-off fall time		0.3	0.8	µs
	Switching times (inductive load)	I_{Con} = 2.5A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.3	2.5	µs
t_f	Turn-off fall time		45	150	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		2.5	3.2	µs
t_f	Turn-off fall time		80	200	ns

1 Measured with half sine-wave voltage (curve tracer).

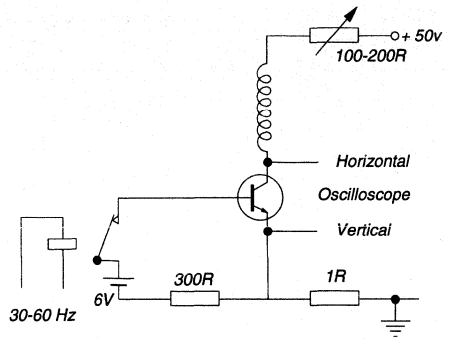


Fig.1. Test circuit for $V_{CEOsust}$.

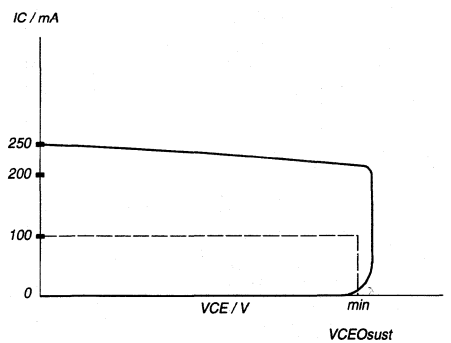


Fig.2. Oscilloscope display for $V_{CEOsust}$.

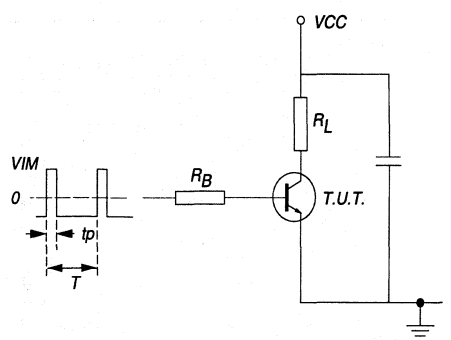


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

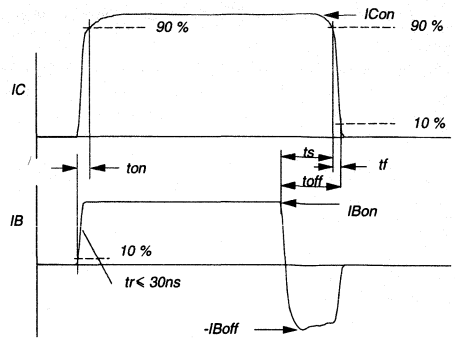


Fig.4. Switching times waveforms with resistive load.

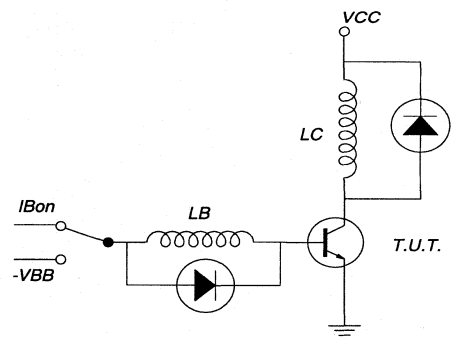


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

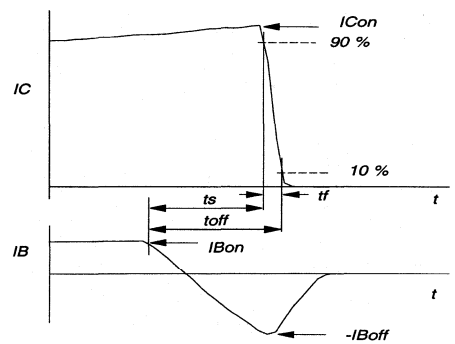


Fig.6. Switching times waveforms with inductive load.

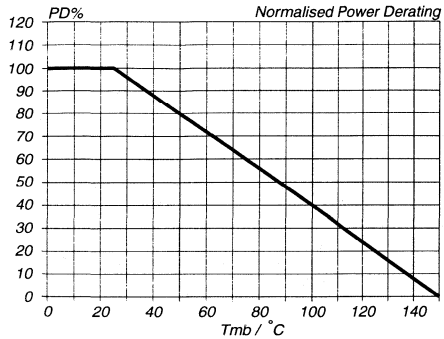


Fig.7. Normalised power dissipation.
PD% = 100·PD/PD $_{25°C}$ = f (T_{mb})

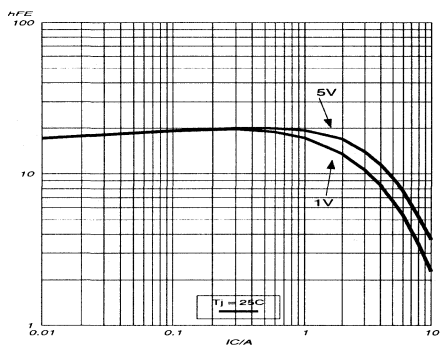


Fig.8. Typical DC current gain. h_{FE} = f(I_C)
parameter V_{CE}

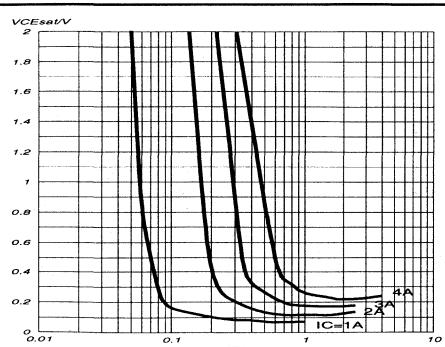


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IB); T_j=25˚C.

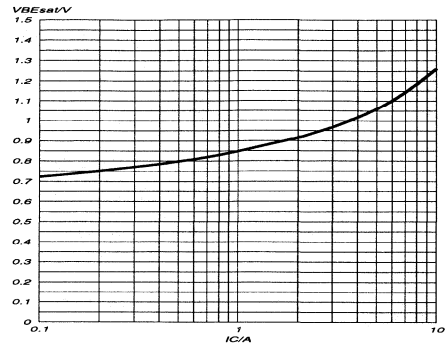


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, V_{BEsat} = f(IC); at IC/IB =4.

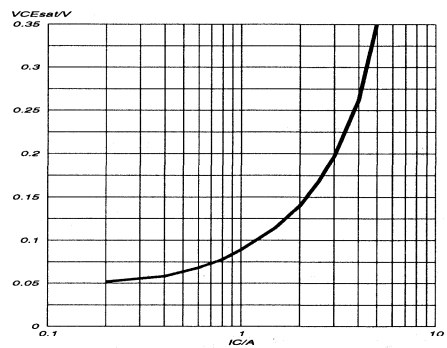


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IC); at IC/IB =4.

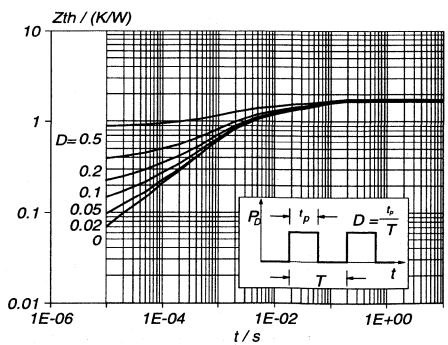


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}mb}$ = f(t); parameter D = t_p/T

Silicon Diffused Power Transistor — BUJ105AX

PRELIMINARY
See Philips Semiconductors for Design-in information

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

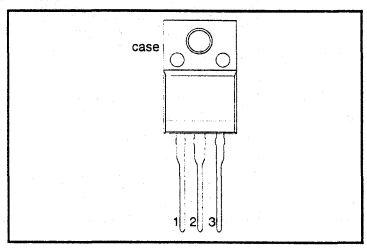
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	700	V
V_{CBO}	Collector-Base voltage (open emitter)		-	700	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	26	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.75 A	0.2	1.0	V
h_{FEsat}		I_C = 4.0 A; V_{CE} = 5 V	12	-	
t_f	Fall time	Ic=2.5A, I_{B1}=0.5A	45	150	ns

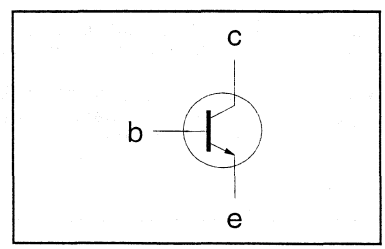
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	700	V
V_{CEO}	Collector to emitter voltage (open base)		-	400	V
V_{CBO}	Collector to base voltage (open emitter)		-	700	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	26	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	4.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	4.0	mA
I_{CBO}	Collector cut-off current	V_{CBO} = $V_{CESMmax}$ (700V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$ (400V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0A;I_B = 0.75 A	-	0.2	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0A;I_B = 0.75 A	-	1.0	1.5	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	17	35	
h_{FE}		I_C = 100 mA; V_{CE} = 5 V	10	19	35	
h_{FEsat}		I_C = 4.0 A; V_{CE} = 5 V	-	12	-	
		I_C = 5.0 A; V_{CE} = 5 V	-	10	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.5	1	µs
t_s	Turn-off storage time		3.2	4	µs
t_f	Turn-off fall time		0.3	0.8	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.3	2.5	µs
t_f	Turn-off fall time		45	150	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		2.5	3.2	µs
t_f	Turn-off fall time		80	200	ns

1 Measured with half sine-wave voltage (curve tracer).

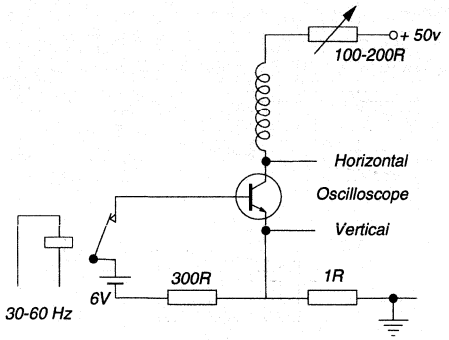


Fig.1. Test circuit for $V_{CEOsust}$.

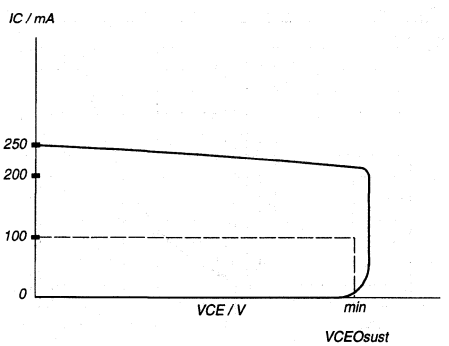


Fig.2. Oscilloscope display for $V_{CEOsust}$.

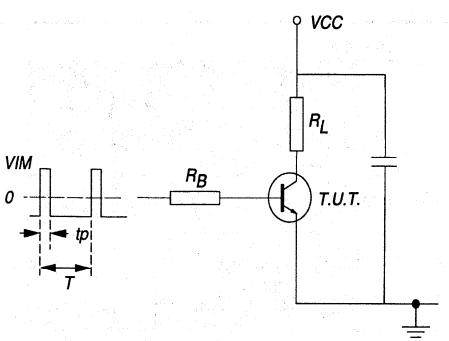


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

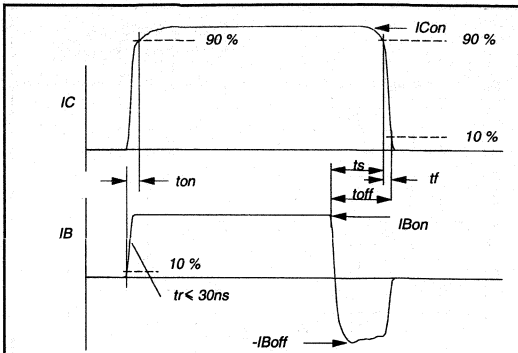


Fig.4. Switching times waveforms with resistive load.

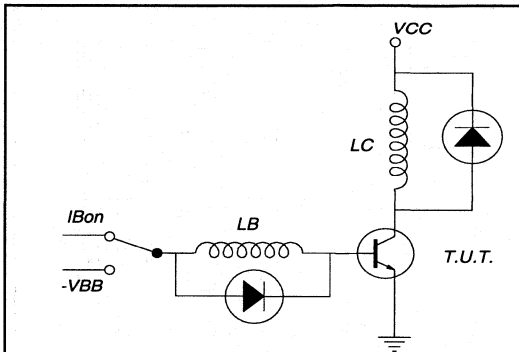


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

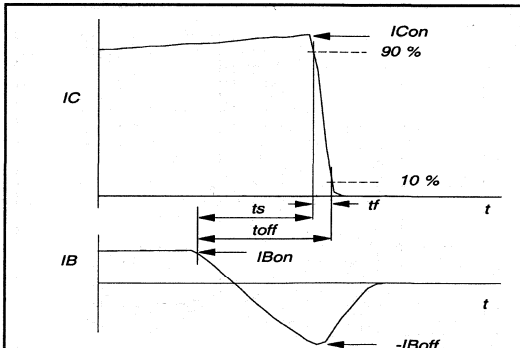


Fig.6. Switching times waveforms with inductive load.

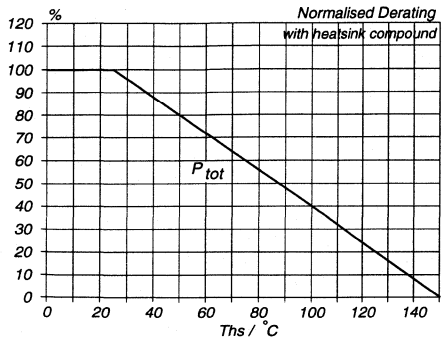


Fig.7. Normalised power dissipation.
PD% = 100·PD/PD $_{25°C}$ = f (T_{hs})

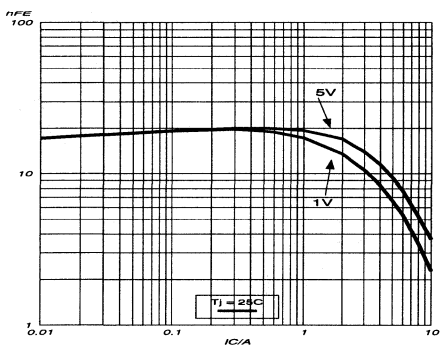


Fig.8. Typical DC current gain. h_{FE} = f(I_C)
parameter V_{CE}

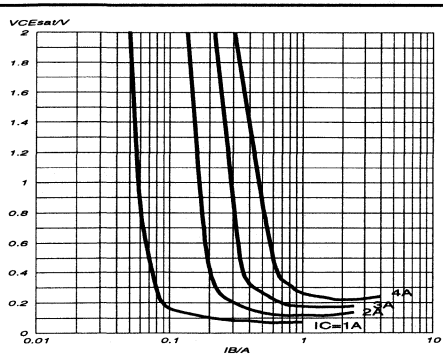


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IB); T_j=25˚C.

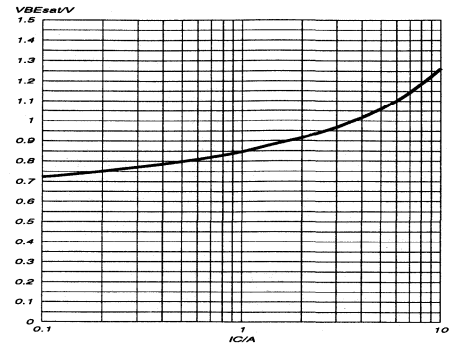


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, V_{BEsat} = f(IC); at IC/IB =4.

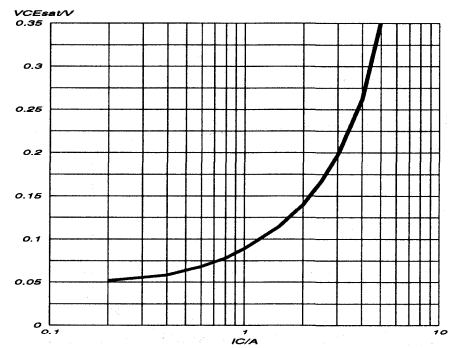


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IC); at IC/IB =4.

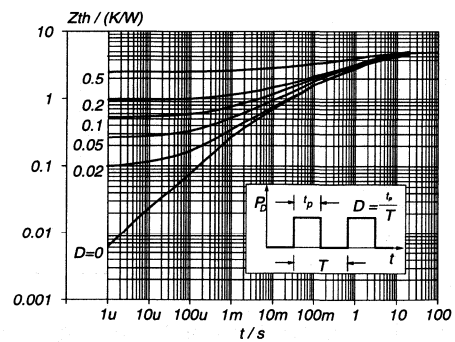


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

Silicon Diffused Power Transistor BUJ106A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

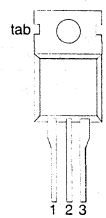
PRELIMINARY
See Philips Semiconductors for Design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	700	V
V_{CBO}	Collector-Base voltage (open emitter)		-	700	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	12	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	80	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.0 A;I_B = 1.0 A	0.22	1.0	V
h_{FEsat}		I_C = 6.0 A; V_{CE} = 5 V	10	-	
t_f	Fall time	Ic=2.5A,I_{B1}=0.5A	50	150	ns

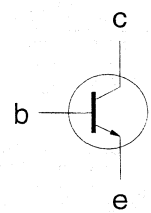
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	700	V
V_{CEO}	Collector to emitter voltage (open base)		-	400	V
V_{CBO}	Collector to base voltage (open emitter)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	12	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	80	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.56	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	4.0	mA
I_{CBO}	Collector cut-off current	V_{CBO} = $V_{CESMmax}$ (700V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$ (400V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.0 A; I_B = 1.0 A	-	0.22	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.0 A; I_B = 1.0 A	-	1.0	1.5	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	18	35	
h_{FE}		I_C = 100 mA; V_{CE} = 5 V	10	20	35	
h_{FEsat}		I_C = 5.0 A; V_{CE} = 5 V	-	12	-	
		I_C = 6.0 A; V_{CE} = 5 V	-	10	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.4	1	µs
t_s	Turn-off storage time		3.7	4	µs
t_f	Turn-off fall time		0.3	0.8	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.5	2.5	µs
t_f	Turn-off fall time		50	150	ns
	Switching times (inductive load)	I_{Con} = 2.5A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		2.5	3.2	µs
t_f	Turn-off fall time		80	200	ns

1 Measured with half sine-wave voltage (curve tracer).

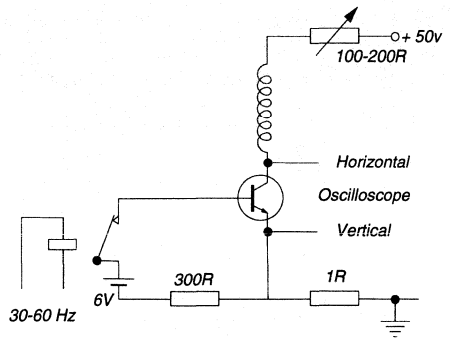


Fig.1. Test circuit for $V_{CEOsust}$.

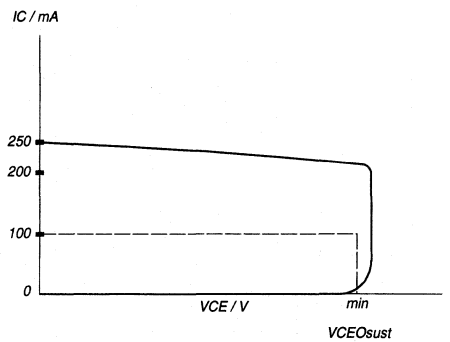


Fig.2. Oscilloscope display for $V_{CEOsust}$.

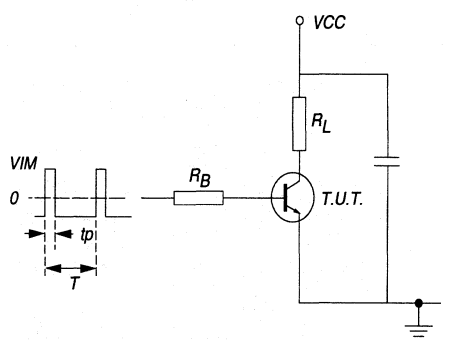


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

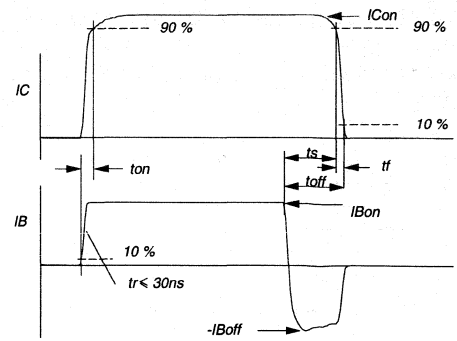


Fig.4. Switching times waveforms with resistive load.

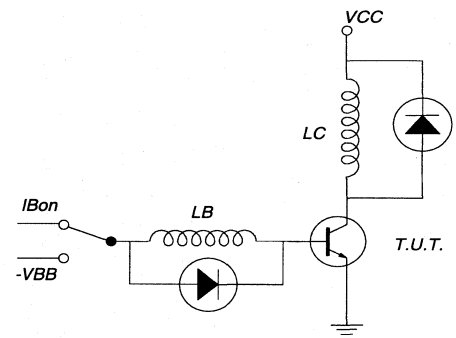


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

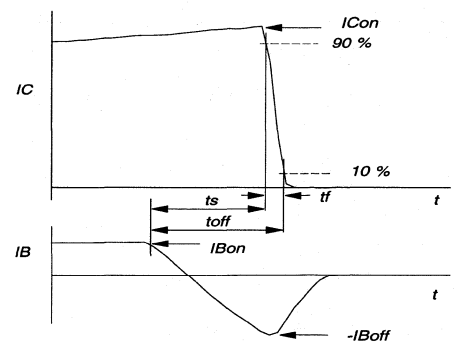


Fig.6. Switching times waveforms with inductive load.

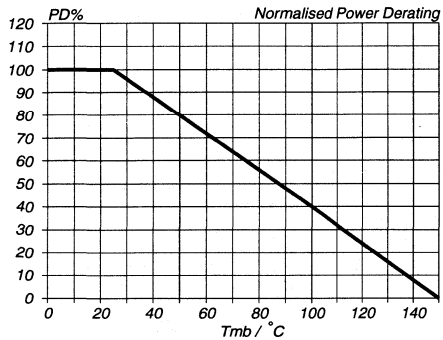


Fig.7. Normalised power dissipation.
PD% = 100·PD/PD $_{25°C}$ = f (T_{mb})

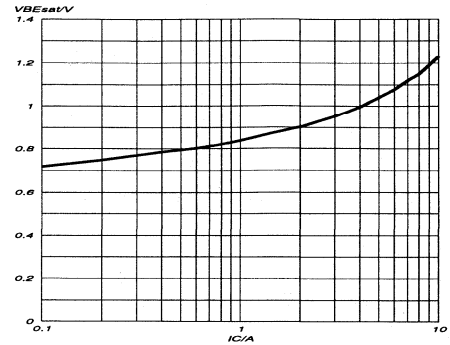


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, V_{BEsat} = f(IC); at IC/IB =4.

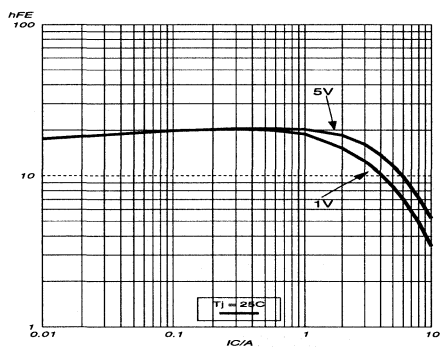


Fig.8. Typical DC current gain. h_{FE} = f(I_C)
parameter V_{CE}

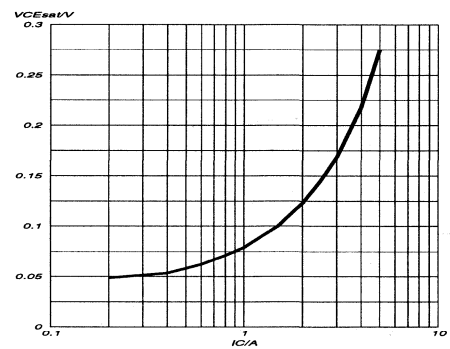


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IC); at IC/IB =4.

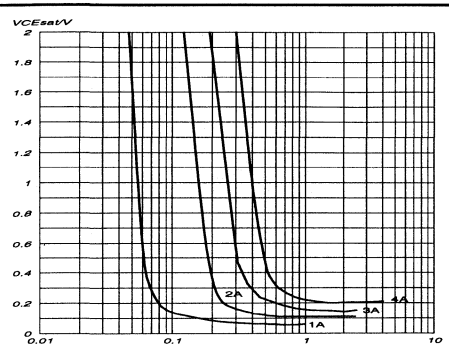


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IB); T_j=25°C.

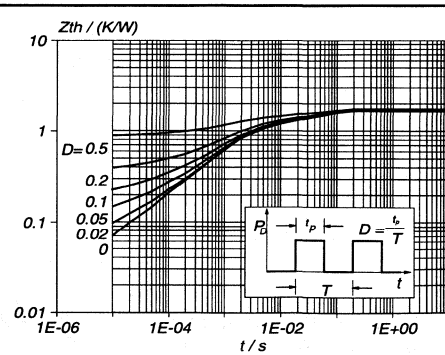


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}mb}$ = f(t); parameter D = t_p/T

Silicon Diffused Power Transistor BUJ106AX

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

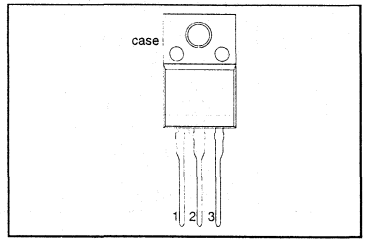
PRELIMINARY
See Philips Semiconductors for Design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	700	V
V_{CBO}	Collector-Base voltage (open emitter)		-	700	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	12	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	26	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.0 A; I_B = 1.0 A	0.22	1.0	V
h_{FEsat}		I_C = 6.0 A; V_{CE} = 5 V	10	-	
t_f	Fall time	Ic=2.5A, I_{B1}=0.5A	50	150	ns

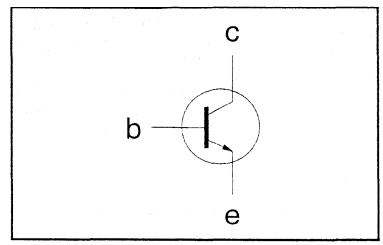
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	700	V
V_{CEO}	Collector to emitter voltage (open base)		-	400	V
V_{CBO}	Collector to base voltage (open emitter)		-	700	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	12	A
I_B	Base current (DC)		-	6	A
I_{BM}	Base current peak value		-	9	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	26	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	4.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	4.0	mA
I_{CBO}	Collector cut-off current	V_{CBO} = $V_{CESMmax}$ (700V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$ (400V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.0 A;I_B = 1.0 A	-	0.22	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4.0 A;I_B = 1.0 A	-	1.0	1.5	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	18	35	
h_{FE}		I_C = 100 mA; V_{CE} = 5 V	10	20	35	
h_{FEsat}		I_C = 5.0 A; V_{CE} = 5 V	-	12	-	
		I_C = 6.0 A; V_{CE} = 5 V	-	10	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.4	1	µs
t_s	Turn-off storage time		3.7	4	µs
t_f	Turn-off fall time		0.3	0.8	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.5	2.5	µs
t_f	Turn-off fall time		50	150	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		2.5	3.2	µs
t_f	Turn-off fall time		80	200	ns

1 Measured with half sine-wave voltage (curve tracer).

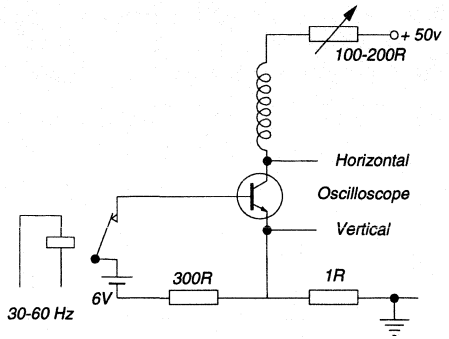


Fig.1. Test circuit for $V_{CEOsust}$.

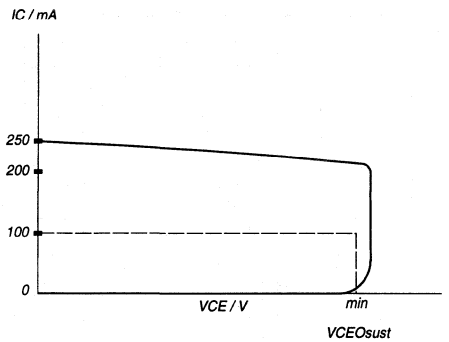


Fig.2. Oscilloscope display for $V_{CEOsust}$.

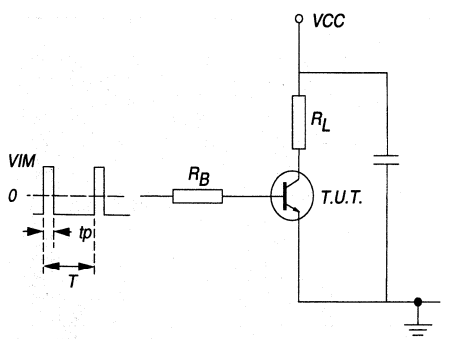


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

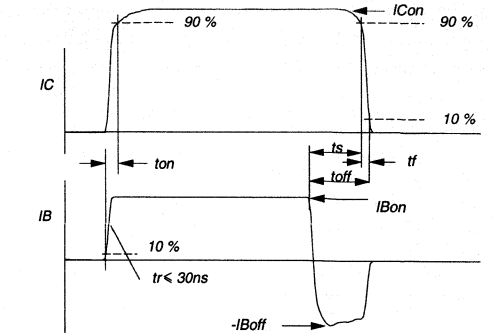


Fig.4. Switching times waveforms with resistive load.

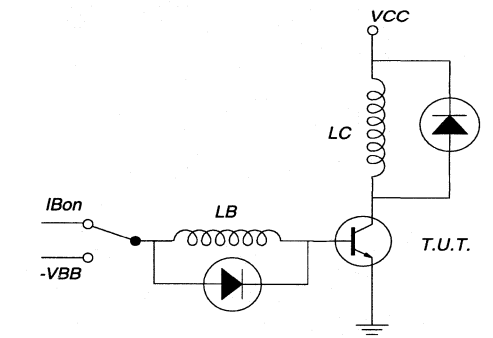


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

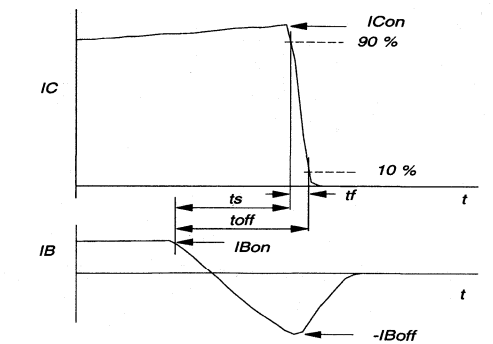


Fig.6. Switching times waveforms with inductive load.

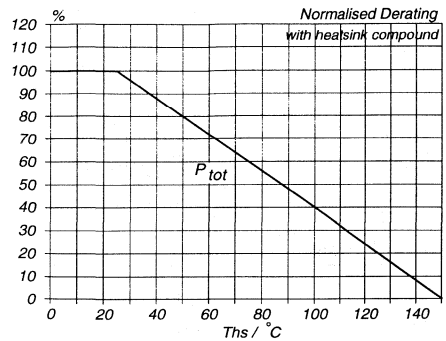


Fig.7. Normalised power dissipation.
PD% = 100·PD/PD $_{25°C}$ = f (T_{hs})

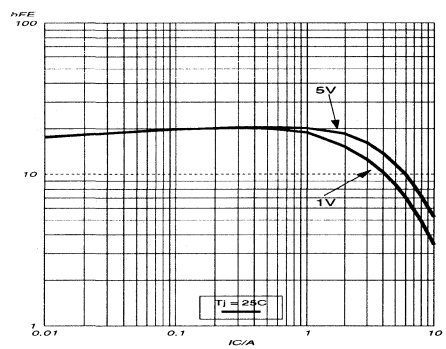


Fig.8. Typical DC current gain. h_{FE} = f(I_C)
parameter V_{CE}

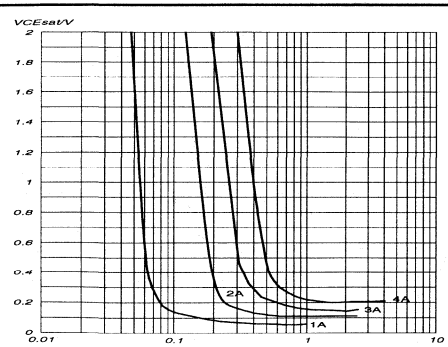


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IB); T_j=25˚C.

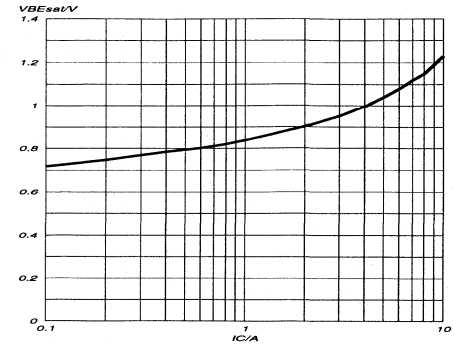


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, V_{BEsat} = f(IC); at IC/IB =4.

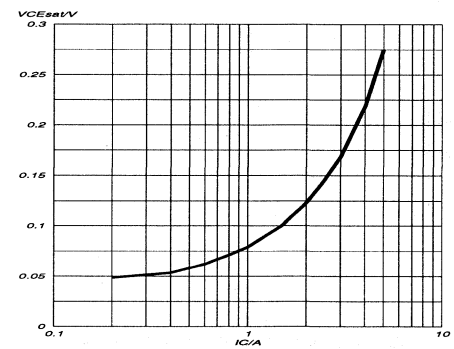


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IC); at IC/IB =4.

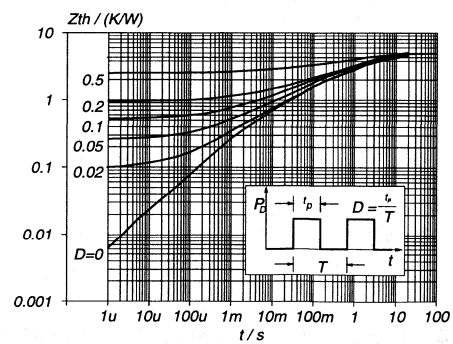


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

Silicon Diffused Power Transistor — BUJ202A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

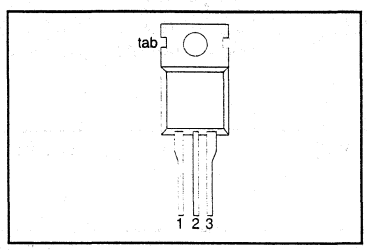
OBJECTIVE
See Philips Semiconductors for Design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CBO}	Collector-Base voltage (open emitter)		-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	2	A
I_{CM}	Collector current peak value		-	3	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	40	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1.0 A; I_B = 0.2 A	-	1.0	V
t_f	Fall time	Ic=1A, I_{B1}=0.2A	88	150	ns

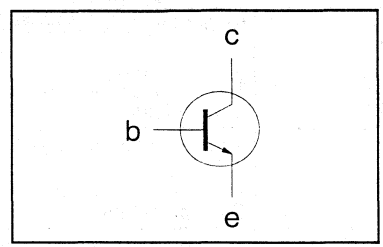
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector to emitter voltage (open base)		-	450	V
V_{CBO}	Collector to base voltage (open emitter)		-	850	V
I_C	Collector current (DC)		-	2	A
I_{CM}	Collector current peak value		-	3	A
I_B	Base current (DC)		-	0.75	A
I_{BM}	Base current peak value		-	1	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	40	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	2.5	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	70	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.2	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	1.5	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 5 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1 A; I_B = 0.2 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 1 A; I_B = 0.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	-	35	
		I_C = 100 mA; V_{CE} = 5 V	14	-	35	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 1.0 A; I_{Bon} = -I_{Boff} = 0.2 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	0.5	µs
t_s	Turn-off storage time		-	3.5	µs
t_f	Turn-off fall time		-	1.4	µs
	Switching times (inductive load)	I_{Con} = 1.0 A; I_{Bon} = 0.2 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.4	µs
t_f	Turn-off fall time		88	150	ns
	Switching times (inductive load)	I_{Con} = 1.0 A; I_{Bon} = 0.2 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		-	200	ns

MECHANICAL DATA

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor BUJ202AX

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

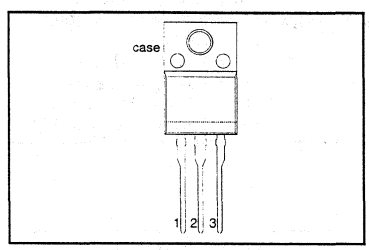
OBJECTIVE See specification for design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CBO}	Collector-Base voltage (open emitter)		-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	2	A
I_{CM}	Collector current peak value		-	3	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	18	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1.0 A;I_B = 0.2 A	-	1.0	V
t_f	Fall time	Ic=1A,I_{B1}=0.2A,I_{B2}=0.2A	88	150	ns

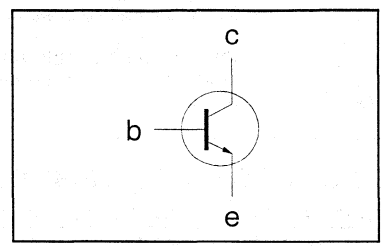
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector to emitter voltage (open base)		-	450	V
V_{CBO}	Collector to base voltage (open emitter)		-	850	V
I_C	Collector current (DC)		-	2	A
I_{CM}	Collector current peak value		-	3	A
I_B	Base current (DC)		-	0.75	A
I_{BM}	Base current peak value		-	1	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	18	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	7.2	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65% ; clean and dustfree	-		1500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	12	-	pF

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.2	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	1.5	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 5 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1 A; I_B = 0.2 A	-	-	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 1 A; I_B = 0.2 A	-	-	1.1	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	-	35	
		I_C = 100 mA; V_{CE} = 5 V	14	-	35	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 1.0 A; I_{Bon} = -I_{Boff} = 0.2 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	0.5	µs
t_s	Turn-off storage time		-	3.5	µs
t_f	Turn-off fall time		-	1.4	µs
	Switching times (inductive load)	I_{Con} = 1.0 A; I_{Bon} = 0.2 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.4	µs
t_f	Turn-off fall time		88	150	ns
	Switching times (inductive load)	I_{Con} = 1.0 A; I_{Bon} = 0.2 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		-	200	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BUJ204A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

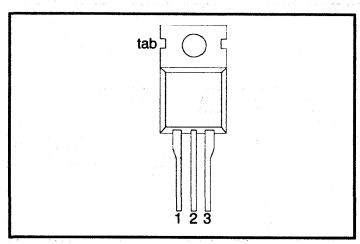
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CBO}	Collector-Base voltage (open emitter)		-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
V_{CEsat}	Collector-emitter saturation voltage		0.29	1.5	V
h_{FEsat}	DC current gain	I_C = 4 A; V_{CE} = 5 V	12	-	
t_f	Fall time	Ic=2.5A,I_{B1}=0.5A	88	150	ns

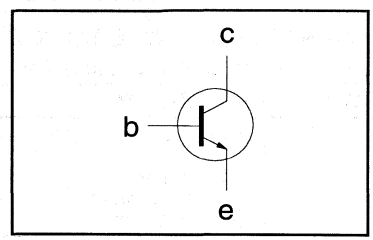
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector to emitter voltage (open base)		-	450	V
V_{CBO}	Collector to base voltage (open emitter)		-	850	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.25	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{CBO}	Collector cut-off current [1]	V_{CBO} = $V_{CESMmax}$(850V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$(450V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	0.1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	0.29	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	1.01	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	19	35	
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	14	25	35	
h_{FEsat}	DC current gain	I_C = 2.5 A; V_{CE} = 5 V	14.5	17	19.5	
		I_C = 4 A; V_{CE} = 5 V	-	12	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.57	0.8	µs
t_s	Turn-off storage time		3.4	4	µs
t_f	Turn-off fall time		0.34	0.47	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.37	1.5	µs
t_f	Turn-off fall time		88	150	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.6	µs
t_f	Turn-off fall time		-	200	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor BUJ204A

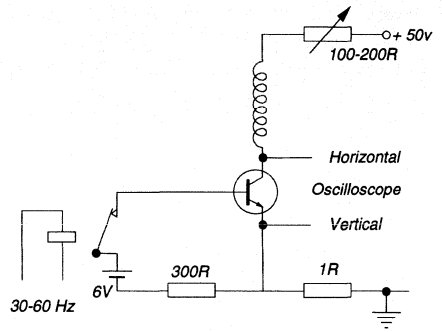


Fig.1. Test circuit for $V_{CEOsust}$.

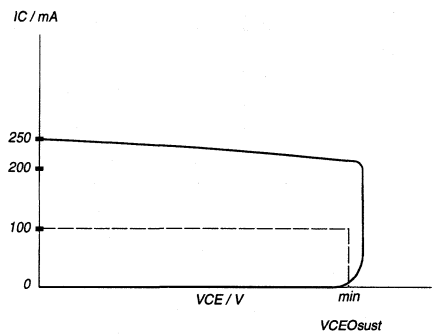


Fig.2. Oscilloscope display for $V_{CEOsust}$.

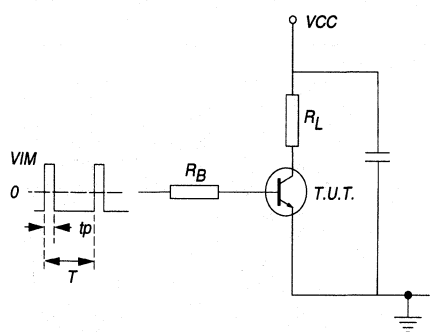


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

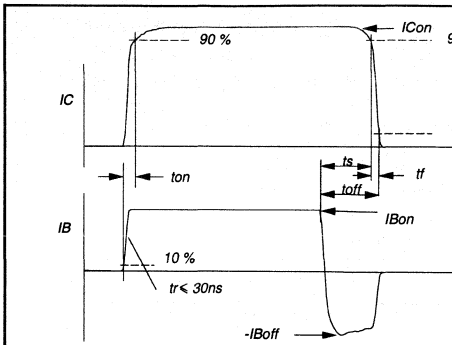


Fig.4. Switching times waveforms with resistive load.

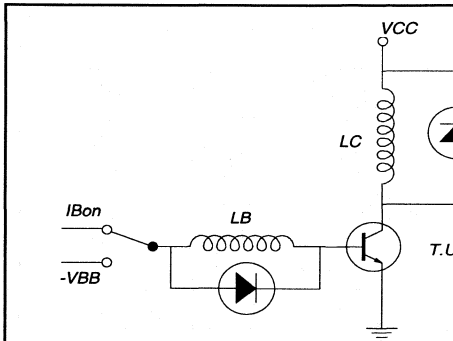


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

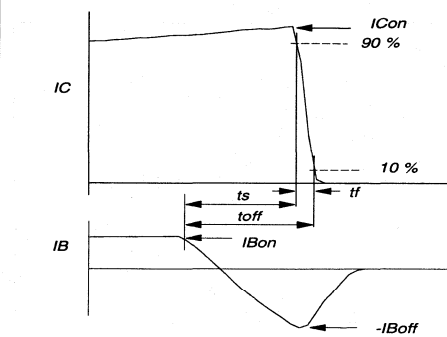


Fig.6. Switching times waveforms with inductive load.

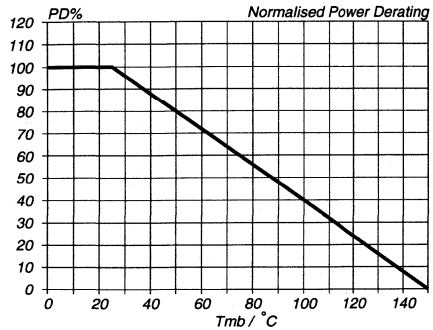


Fig.7. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD_{25^\circ C} = f(T_{mb})$

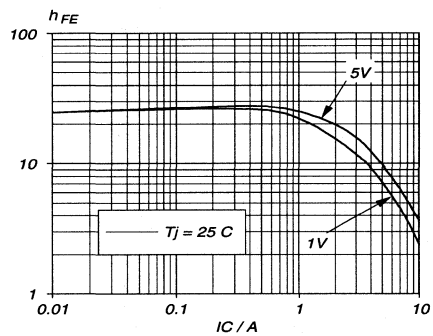


Fig.8. Typical DC current gain. $h_{FE} = f(I_C)$
parameter V_{CE}

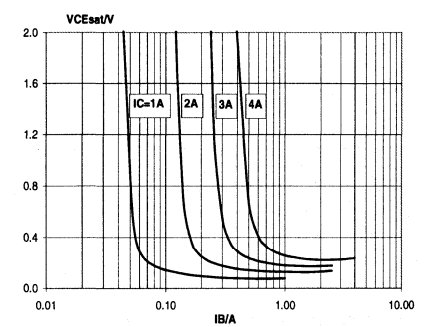


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IB)$; T_j=25˚C.

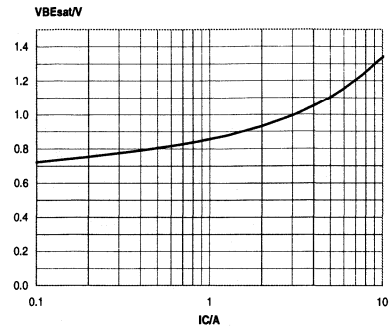


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, $V_{BEsat} = f(IC)$; at IC/IB =4.

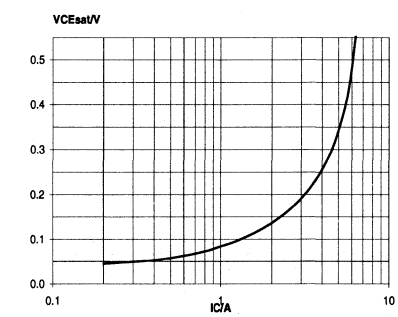


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IC)$; at IC/IB =4.

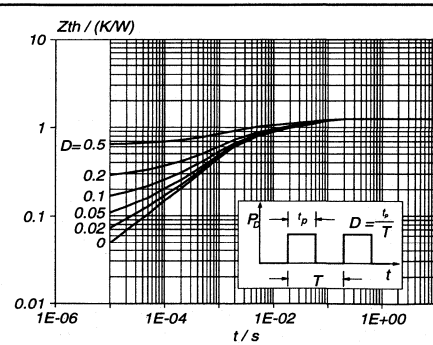


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

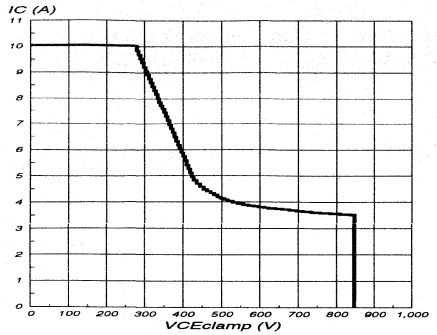


Fig.13. Reverse bias safe operating area $T_j \leq T_{jmax}$

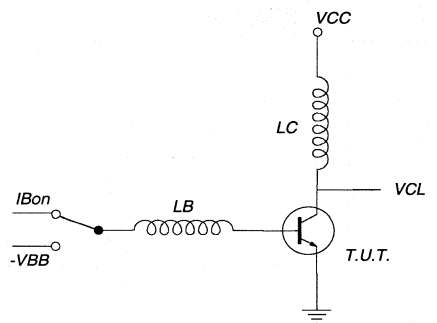


Fig.14. Test Circuit for reverse bias safe operating area.

$V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$;
$L_B = 1\mu H$; $L_c = 200\mu H$

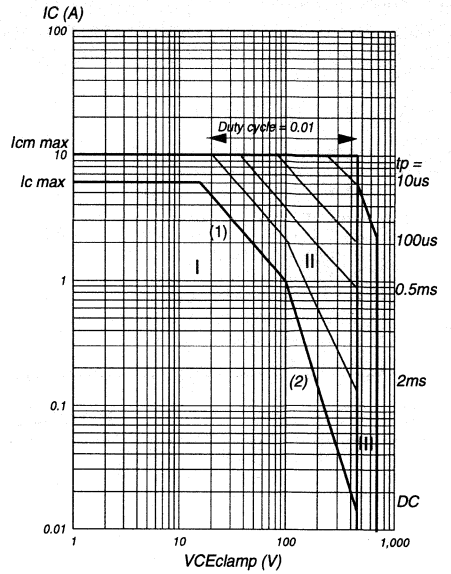


Fig.15. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1)	P_{tot} max and P_{tot} peak max lines.
(2)	Second breakdown limits.
I	Region of permissible DC operation.
II	Extension for repetitive pulse operation.
III	Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.
NB:	Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

Silicon Diffused Power Transistor — BUJ204AX

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

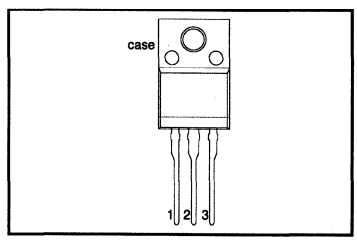
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CBO}	Collector-Base voltage (open emitter)		-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage		0.29	1.5	V
h_{FEsat}	DC current gain	I_C = 4 A; V_{CE} = 5 V	12	-	
t_f	Fall time	Ic=2.5A,I_{B1}=0.5A	88	150	ns

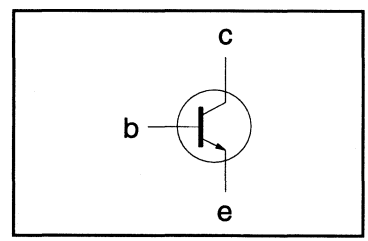
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector to emitter voltage (open base)		-	450	V
V_{CBO}	Collector to base voltage (open emitter)		-	850	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{CBO}	Collector cut-off current [1]	V_{CBO} = $V_{CESMmax}$(850V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$(450V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	0.1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	0.29	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	1.01	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	19	35	
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	14	25	35	
h_{FEsat}	DC current gain	I_C = 2.5 A; V_{CE} = 5 V	14.5	17	19.5	
		I_C = 4 A; V_{CE} = 5 V	-	12	-	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.57	0.8	µs
t_s	Turn-off storage time		3.4	4	µs
t_f	Turn-off fall time		0.34	0.47	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.37	1.5	µs
t_f	Turn-off fall time		88	150	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.6	µs
t_f	Turn-off fall time		-	200	ns

1 Measured with half sine-wave voltage (curve tracer).

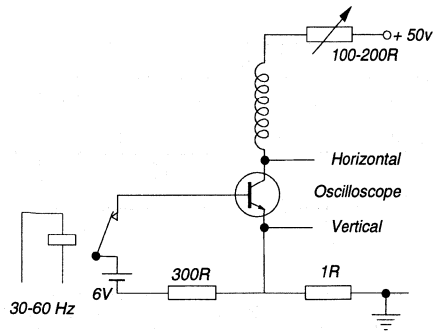


Fig.1. Test circuit for $V_{CEOsust}$.

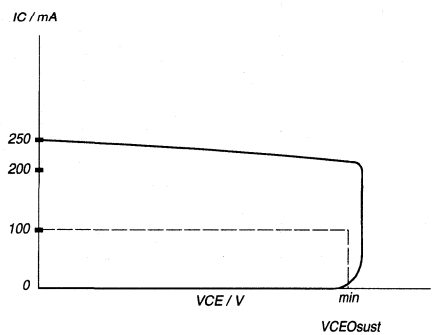


Fig.2. Oscilloscope display for $V_{CEOsust}$.

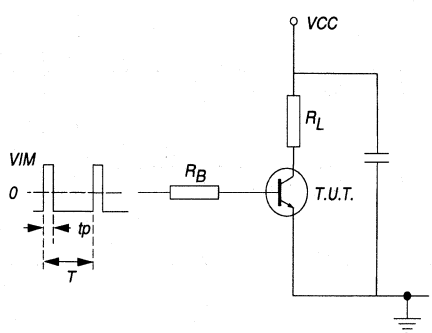


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

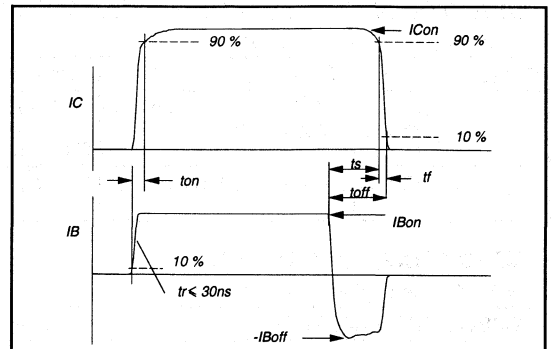


Fig.4. Switching times waveforms with resistive load.

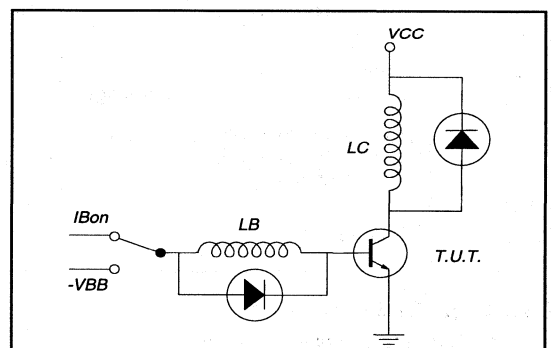


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

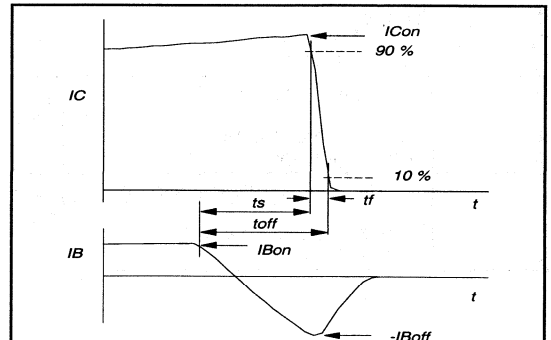


Fig.6. Switching times waveforms with inductive load.

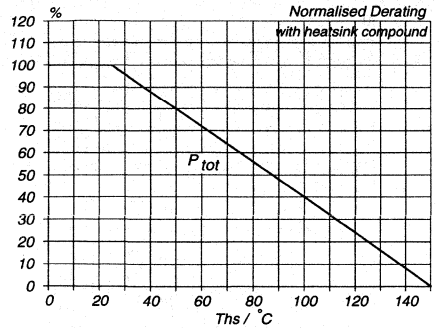


Fig.7. Normalised power dissipation.
PD% = 100·PD/PD $_{25^\circ C}$ = f (T_{hs})

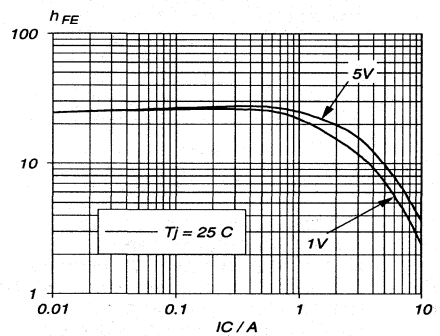


Fig.8. Typical DC current gain. h_{FE} = f(I_C)
parameter V_{CE}

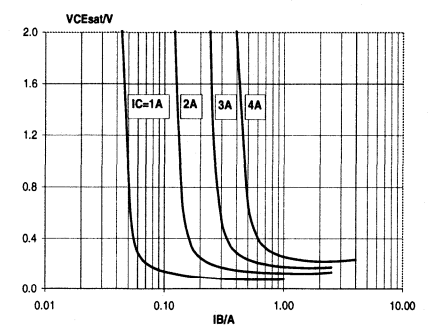


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IB); T_j=25˚C.

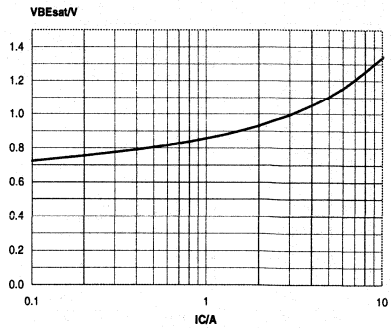


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, V_{BEsat} = f(IC); at IC/IB =4.

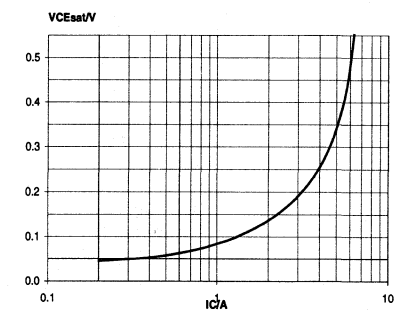


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IC); at IC/IB =4.

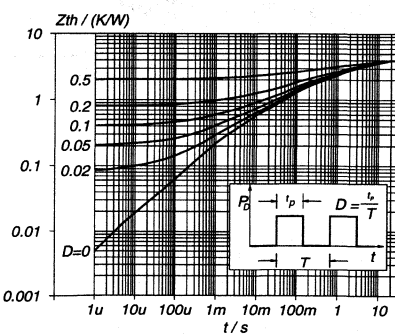


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

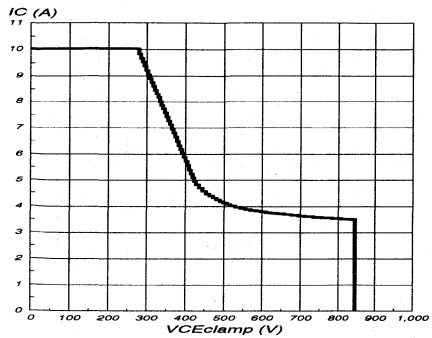


Fig.13. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

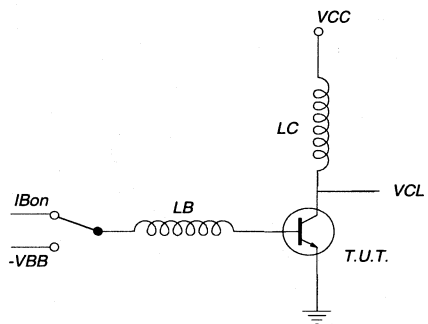


Fig.14. Test circuit for reverse bias safe operating area.

$V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$; $L_B = 1\mu H$; $L_c = 200\mu H$

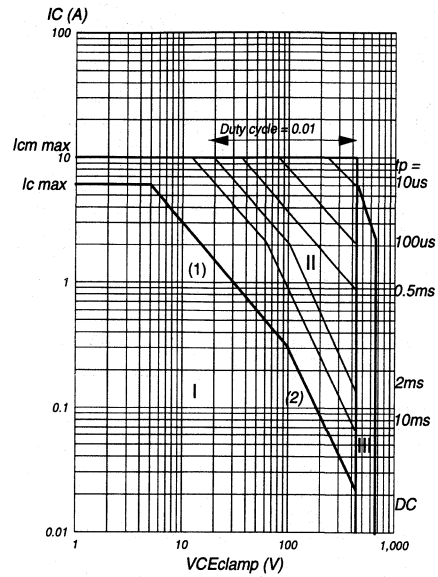


Fig.15. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1) P_{tot} max and P_{tot} peak max lines.
(2) Second breakdown limits.
I Region of permissible DC operation.
II Extension for repetitive pulse operation.
III Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.
NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

Silicon Diffused Power Transistor BUJ205A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

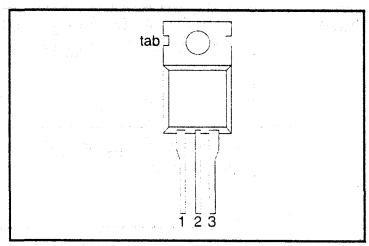
OBJECTIVE
See Philips Semiconductors for design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CBO}	Collector-Base voltage (open emitter)		-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	12	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.0 A	-	1.5	V
t_f	Fall time	Ic=6A, I_{B1}=1.2A	-	300	µs

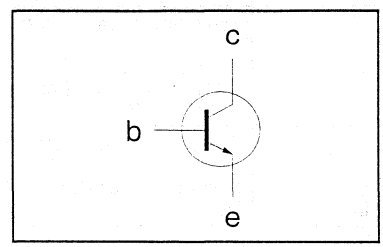
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector to emitter voltage (open base)		-	450	V
V_{CBO}	Collector to base voltage (open emitter)		-	850	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	12	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	125	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	3	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5 A; I_B = 1.0 A	-	-	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6 A; I_B = 1.2 A	-	-	1.5	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	-	35	
		I_C = 1.0A; V_{CE} = 5 V	10	-	35	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 6.0 A; I_{Bon} = -I_{Boff} = 1.2 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	1.0	µs
t_s	Turn-off storage time		-	4	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times (inductive load)	I_{Con} = 6.0 A; I_{Bon} = 1.2 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		-	300	ns
	Switching times (inductive load)	I_{Con} = 6.0 A; I_{Bon} = 1.2 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	2.5	µs
t_f	Turn-off fall time		-	300	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BUJ205AX

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in the plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

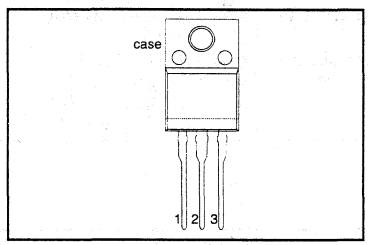
SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CBO}	Collector-Base voltage (open emitter)		-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	12	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5.0 A; I_B = 1.0 A	-	1.5	V
t_f	Fall time	I_C=6A, I_{B1}=1.2A	-	300	µs

See Philips Semiconductors for Design-in Information

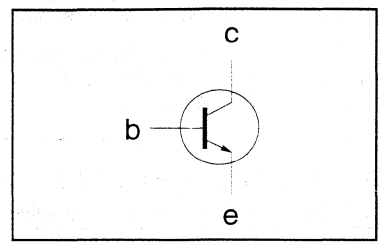
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector to emitter voltage (open base)		-	450	V
V_{CBO}	Collector to base voltage (open emitter)		-	850	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	12	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	32	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	3	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5 A; I_B = 1.0 A	-	-	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 6 A; I_B = 1.2 A	-	-	1.5	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	-	35	
		I_C = 1.0A; V_{CE} = 5 V	10	-	35	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 6.0 A; I_{Bon} = -I_{Boff} = 1.2 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	1.0	µs
t_s	Turn-off storage time		-	4	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times (inductive load)	I_{Con} = 6.0 A; I_{Bon} = 1.2 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		-	300	ns
	Switching times (inductive load)	I_{Con} = 6.0 A; I_{Bon} = 1.2 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	2.5	µs
t_f	Turn-off fall time		-	300	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BUJ301A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

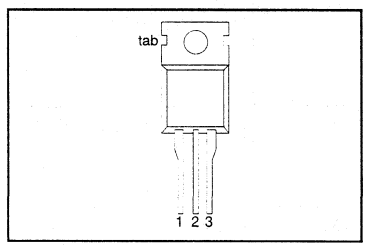
OBJECTIVE
See Philips Semiconductors for design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CBO}	Collector-Base voltage (open emitter)		-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	500	V
I_C	Collector current (DC)		-	0.5	A
I_{CM}	Collector current peak value		-	1	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	42	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 0.2 A;I_B = 20 mA	-	1.0	V
t_f	Fall time	Ic=0.2A,I_{B1}=20mA	145	160	ns

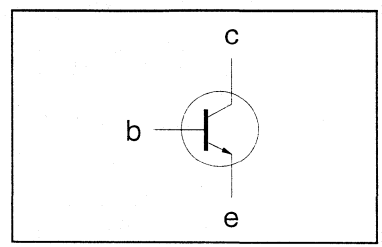
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector to emitter voltage (open base)		-	500	V
V_{CBO}	Collector to base voltage (open emitter)		-	1000	V
I_C	Collector current (DC)		-	0.5	A
I_{CM}	Collector current peak value		-	1	A
I_B	Base current (DC)		-	0.2	A
I_{BM}	Base current peak value		-	0.3	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	42	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	3.0	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	100	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.1	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	1.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 5 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	500	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 0.1 A; I_B = 10 mA	-	-	0.8	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 0.2 A; I_B =20 mA	-	-	1.0	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	-	35	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 0.2 A; I_{Bon} = -I_{Boff} = 20 mA; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	1.0	µs
t_s	Turn-off storage time		-	4	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times (inductive load)	I_{Con} = 0.2 A; I_{Bon} = 20m A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		145	160	ns
	Switching times (inductive load)	I_{Con} = 0.2 A; I_{Bon} = 20m A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.8	µs
t_f	Turn-off fall time		-	200	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BUJ301AX

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

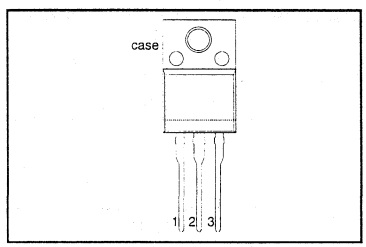
OBJECTIVE specification for design-in information
See Philips Semiconductors

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CBO}	Collector-Base voltage (open emitter)		-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	500	V
I_C	Collector current (DC)		-	0.5	A
I_{CM}	Collector current peak value		-	1	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 0.2 A;I_B =20m A	-	1.0	V
t_f	Fall time	Ic=0.2A,I_{B1}=20mA	145	160	ns

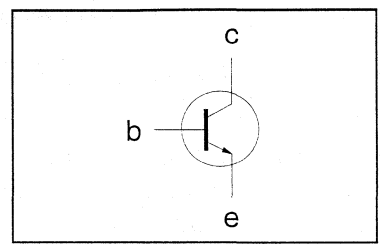
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector to emitter voltage (open base)		-	500	V
V_{CBO}	Collector to base voltage (open emitter)		-	1000	V
I_C	Collector current (DC)		-	0.5	A
I_{CM}	Collector current peak value		-	1	A
I_B	Base current (DC)		-	0.2	A
I_{BM}	Base current peak value		-	0.3	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	32	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65% ; clean and dustfree	-		1500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	12	-	pF

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	0.1	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	1.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 5 V; I_C = 0 A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	500	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 0.1 A;I_B = 10 mA	-	-	0.8	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 0.2 A;I_B = 20 mA	-	-	1.0	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	-	35	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 0.2 A; I_{Bon} = -I_{Boff} = 20 mA; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	1.0	µs
t_s	Turn-off storage time		-	4.0	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times (inductive load)	I_{Con} = 0.2 A; I_{Bon} = 20 mA; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		145	160	ns
	Switching times (inductive load)	I_{Con} = 0.2 A; I_{Bon} = 20 mA; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.8	µs
t_f	Turn-off fall time		-	200	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BUJ303A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

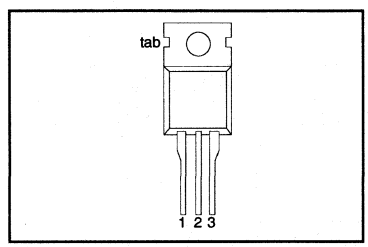
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CBO}	Collector-Base voltage (open emitter)		-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	500	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A	0.25	1.5	V
h_{FEsat}	DC current gain	I_C = 3 A; V_{CE} = 5 V	12	-	
t_f	Fall time	I_C=2.5 A,I_{B1}=0.5 A	145	160	ns

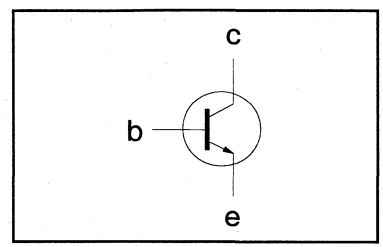
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector to emitter voltage (open base)		-	500	V
V_{CBO}	Collector to base voltage (open emitter)		-	1000	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.25	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}, I_{CBO}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{CEO}	Collector cut-off current [1]	V_{CEO} = $V_{CEOMmax}$(500V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	0.1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	500	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A	-	0.25	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A	-	0.97	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	22	35	
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	14	25	35	
h_{FEsat}	DC current gain	I_C = 2.5 A; V_{CE} = 5 V	10	13.5	17	
		I_C = 3 A; V_{CE} = 5 V	-	12	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.5	0.7	µs
t_s	Turn-off storage time		3.3	4	µs
t_f	Turn-off fall time		0.33	0.45	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.4	1.6	µs
t_f	Turn-off fall time		145	160	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		1.7	1.9	µs
t_f	Turn-off fall time		160	200	ns

1 Measured with half sine-wave voltage (curve tracer).

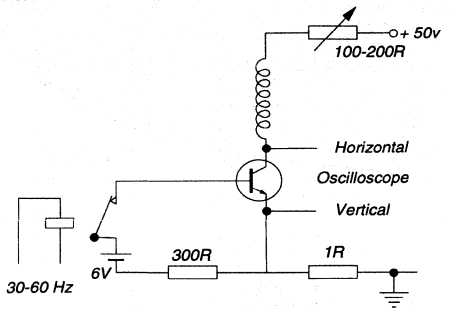


Fig.1. Test circuit for $V_{CEOsust}$.

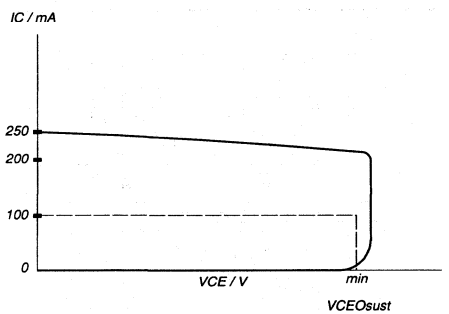


Fig.2. Oscilloscope display for $V_{CEOsust}$.

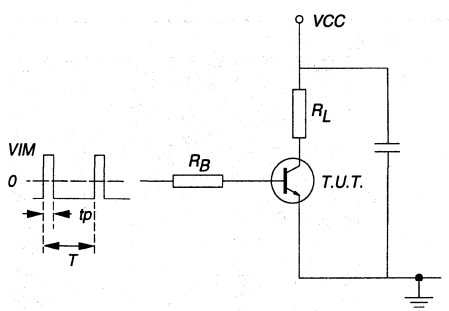


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

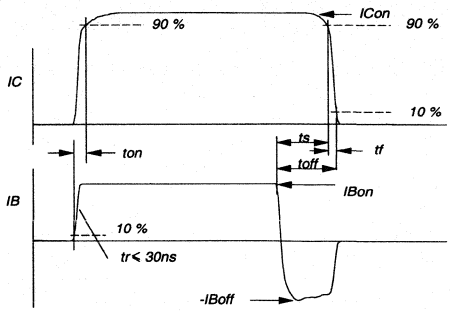


Fig.4. Switching times waveforms with resistive load.

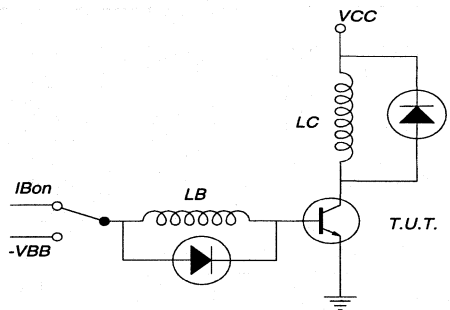


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

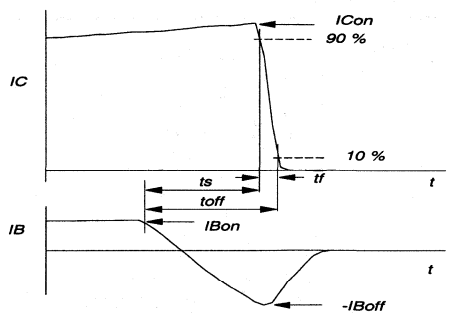


Fig.6. Switching times waveforms with inductive load.

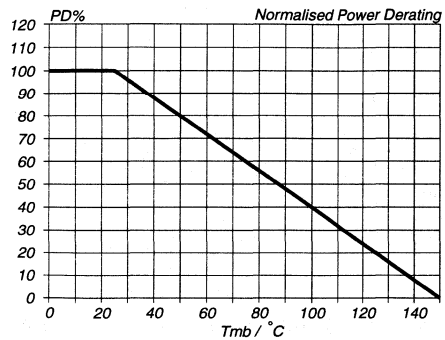


Fig.7. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD_{25^\circ C} = f(T_{mb})$

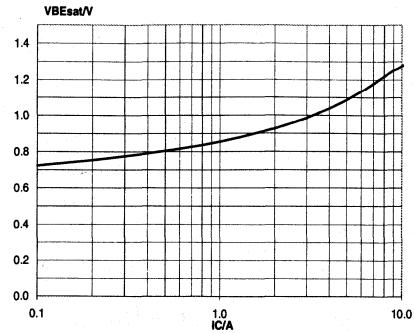


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, $V_{BEsat} = f(IC)$; at IC/IB =4.

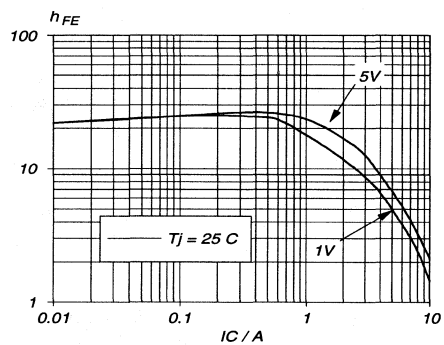


Fig.8. Typical DC current gain. $h_{FE} = f(I_C)$
parameter V_{CE}

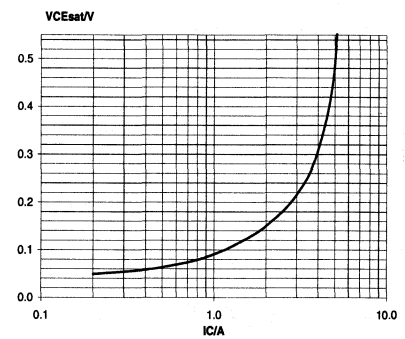


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IC)$; at IC/IB =4.

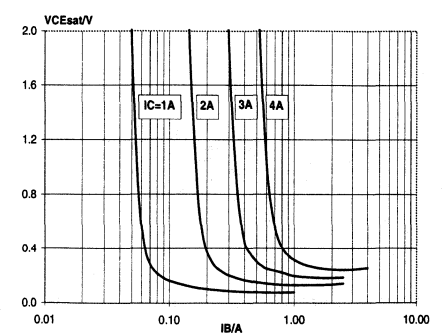


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IB)$; T_j=25˚C.

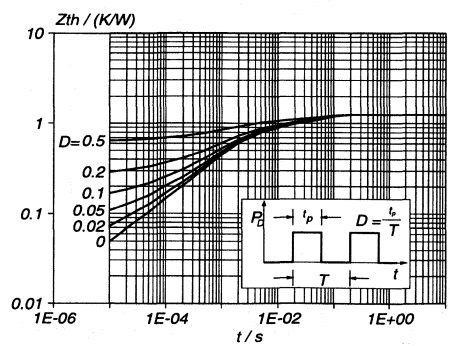


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

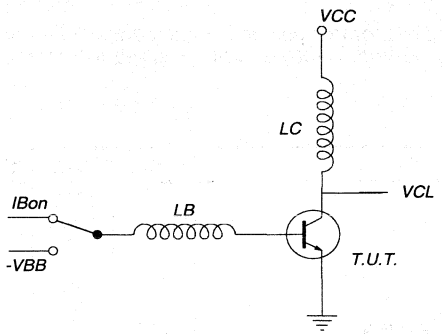


Fig.13. Test Circuit for reverse bias safe operating area.
$V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$; $L_B = 1\mu H$; $L_c = 200\mu H$

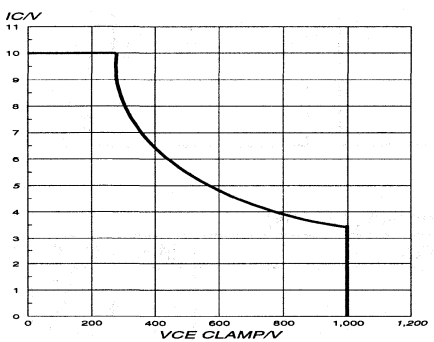


Fig.14. Reverse bias safe operating area $T_j \leq T_{jmax}$

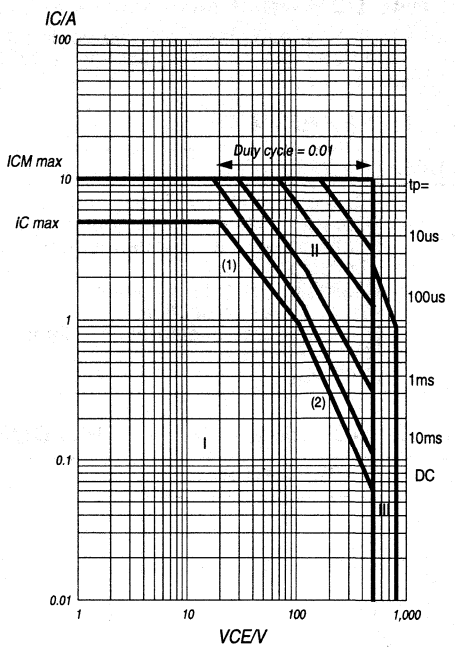


Fig.15. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1)	*P_{tot} max and P_{tot} peak max lines.*
(2)	*Second breakdown limits.*
I	*Region of permissible DC operation.*
II	*Extension for repetitive pulse operation.*
III	*Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.*
NB:	*Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

Silicon Diffused Power Transistor — BUJ303AX

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

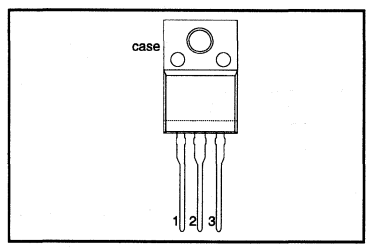
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CBO}	Collector-Base voltage (open emitter)		-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	500	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A	0.25	1.5	V
h_{FEsat}	DC current gain	I_C = 3 A; V_{CE} = 5 V	12	-	
t_f	Fall time	I_C=2.5 A,I_{B1}=0.5 A	145	160	ns

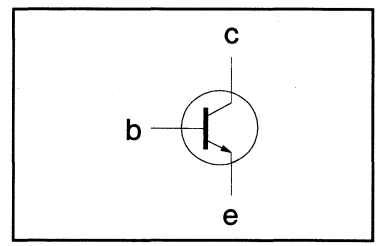
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector to emitter voltage (open base)		-	500	V
V_{CBO}	Collector to base voltage (open emitter)		-	1000	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}, I_{CBO}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{CEO}	Collector cut-off current [1]	V_{CEO} = $V_{CEOMmax}$(500V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	0.1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	500	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 3 A; I_B = 0.6 A	-	0.25	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A	-	0.97	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	22	35	
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	14	25	35	
h_{FEsat}	DC current gain	I_C = 2.5 A; V_{CE} = 5 V	10	13.5	17	
		I_C = 3 A; V_{CE} = 5 V	-	12	-	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.5	0.7	µs
t_s	Turn-off storage time		3.3	4	µs
t_f	Turn-off fall time		0.33	0.45	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.4	1.6	µs
t_f	Turn-off fall time		145	160	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		1.7	1.9	µs
t_f	Turn-off fall time		160	200	ns

1 Measured with half sine-wave voltage (curve tracer).

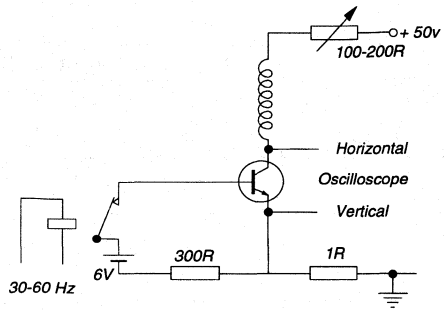


Fig.1. Test circuit for $V_{CEOsust}$.

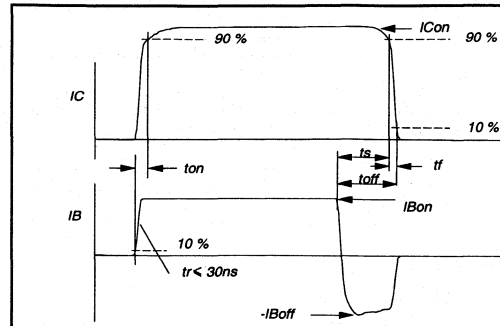


Fig.4. Switching times waveforms with resistive load.

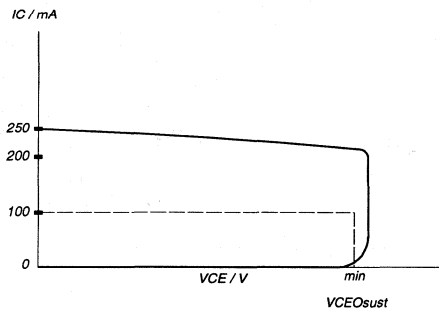


Fig.2. Oscilloscope display for $V_{CEOsust}$.

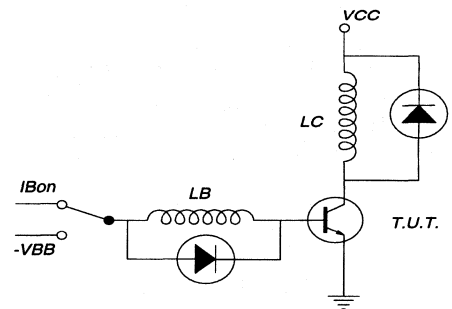


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

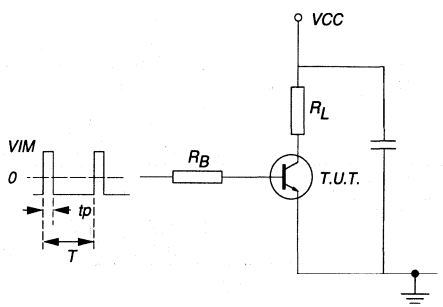


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

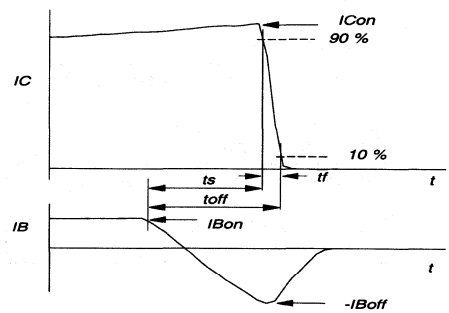


Fig.6. Switching times waveforms with inductive load.

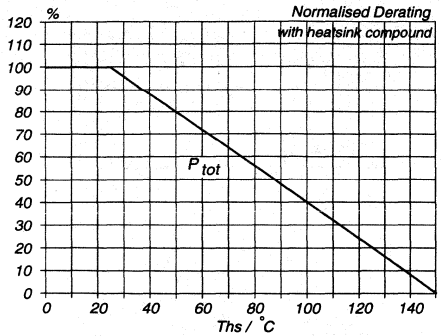


Fig.7. Normalised power dissipation.
PD% = 100·PD/PD $_{25°C}$ = f (T_{hs})

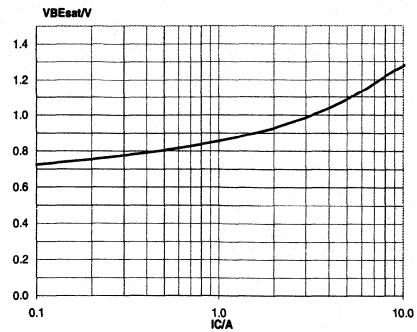


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, V_{BEsat} = f(IC); at IC/IB =4.

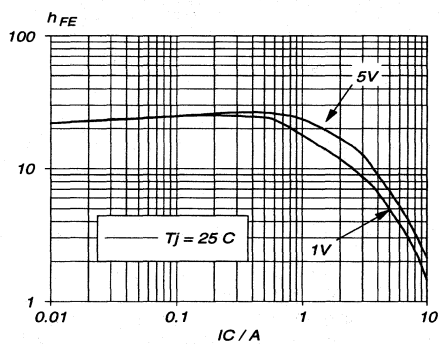


Fig.8. Typical DC current gain. h_{FE} = f(I_C)
parameter V_{CE}

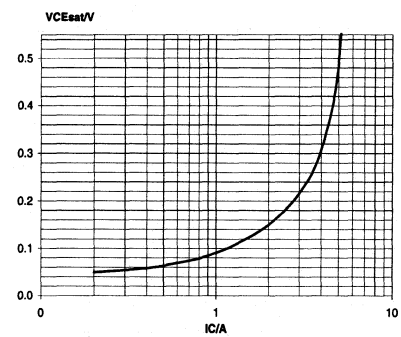


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IC); at IC/IB =4.

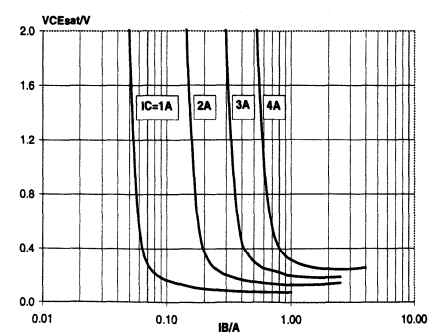


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IB); T_j=25˚C.

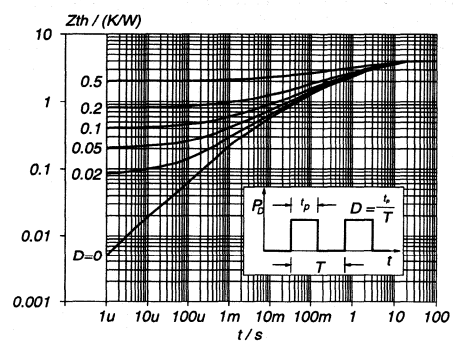


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs}$ = f(t); parameter D = t_p/T

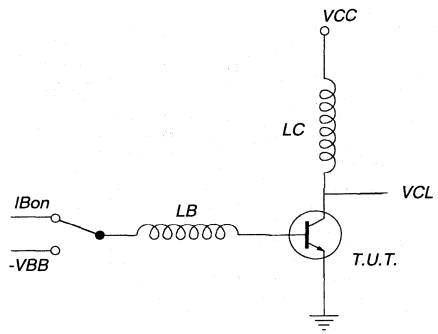


Fig.13. Test circuit for reverse bias safe operating area.
$V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$; $L_B = 1\mu H$; $L_c = 200\mu H$

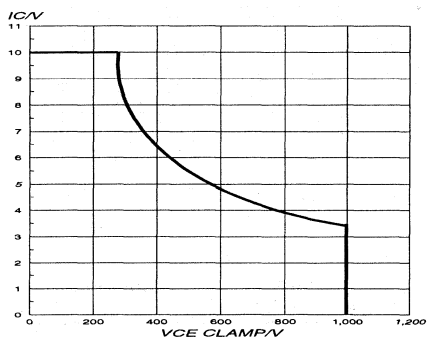


Fig.14. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

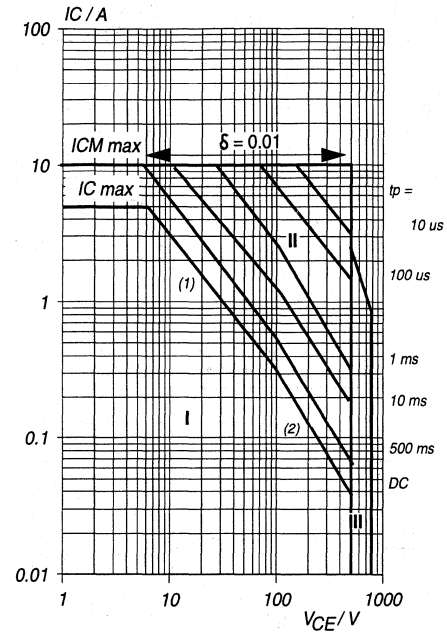


Fig.15. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1) P_{tot} max and P_{tot} peak max lines.
(2) Second breakdown limits.
I Region of permissible DC operation.
II Extension for repetitive pulse operation.
III Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.
NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

Silicon Diffused Power Transistor — BUJ304A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

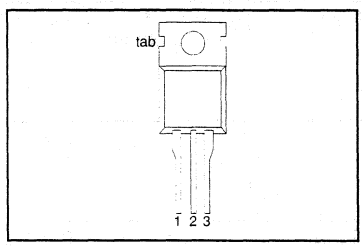
OBJECTIVE Design-in information
See Philips Semiconductors for Design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CBO}	Collector-Base voltage (open emitter)		-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	500	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	12	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	110	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4.0 A; I_B = 0.8 A	-	1.5	V
t_f	Fall time	Ic=4A, I_{B1}=0.8A	-	250	ns

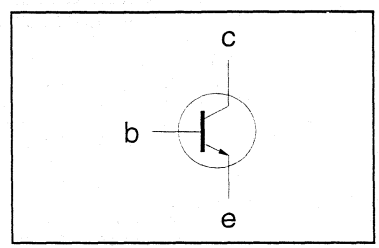
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector to emitter voltage (open base)		-	500	V
V_{CBO}	Collector to base voltage (open emitter)		-	1000	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	12	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	40	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.15	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	500	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	-	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	10	-	35	
		I_C = 1.0A; V_{CE} = 5 V	10	-	35	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 4.0 A; I_{Bon} = -I_{Boff} = 0.8 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	1.0	µs
t_s	Turn-off storage time		-	4	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times (inductive load)	I_{Con} = 4.0 A; I_{Bon} = 0.8 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		-	250	ns
	Switching times (inductive load)	I_{Con} = 4.0 A; I_{Bon} = 0.8 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	2.5	µs
t_f	Turn-off fall time		-	350	ns

MECHANICAL DATA

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BUJ304AX

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

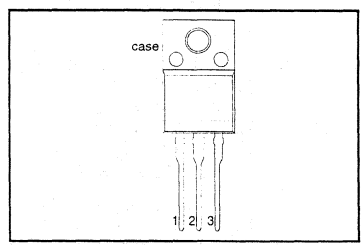
PRELIMINARY Design-in information See Philips Semiconductors for

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CBO}	Collector-Base voltage (open emitter)		-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	500	V
I_C	Collector current (DC)		-	7	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	35	W
V_{CEsat}	Collector-emitter saturation voltage		0.2	1.5	V
h_{FEsat}	DC current gain	I_C = 4 A; V_{CE} = 5 V	12	-	
t_f	Fall time	Ic=2A,I_{B1}=0.4A,I_{B2}=0.8A	80	250	ns

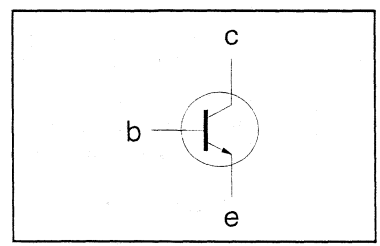
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector to emitter voltage (open base)		-	500	V
V_{CBO}	Collector to base voltage (open emitter)		-	1000	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	35	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	0.39	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{CBO}	Collector cut-off current	V_{CBO} = $V_{CESMmax}$(1000V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$(500V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	0.1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	500	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A	-	0.2	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A	-	0.9	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	18	35	
h_{FE}		I_C = 2.5A; V_{CE} = 5 V	14	15	35	
h_{FEsat}	DC current gain	I_C = 2.5 A; V_{CE} = 5 V	12	16	21	
		I_C = 4 A; V_{CE} = 5 V	-	12	-	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	1.0	µs
t_s	Turn-off storage time		-	4	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.4	µs
t_f	Turn-off fall time		80	150	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		-	250	ns

1 Measured with half sine-wave voltage (curve tracer).

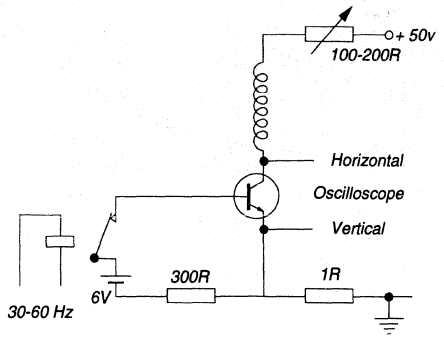


Fig.1. Test circuit for $V_{CEOsust}$.

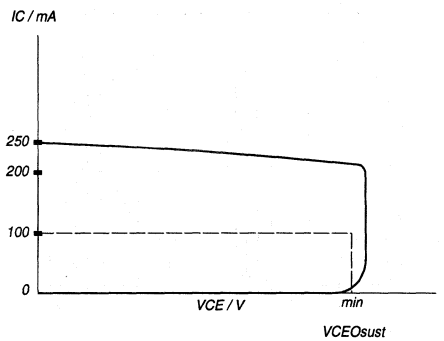


Fig.2. Oscilloscope display for $V_{CEOsust}$.

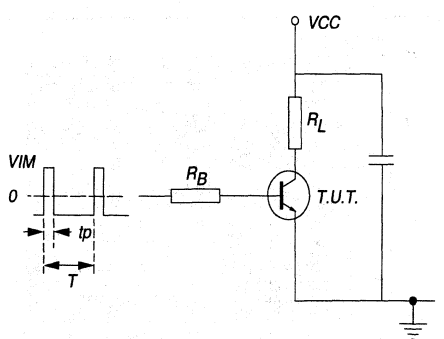


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

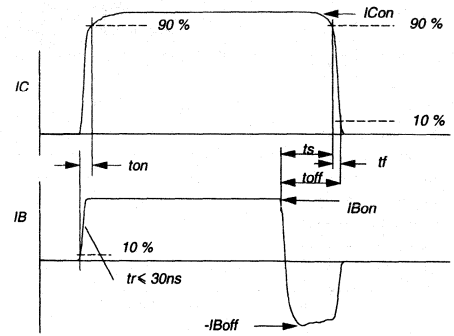


Fig.4. Switching times waveforms with resistive load.

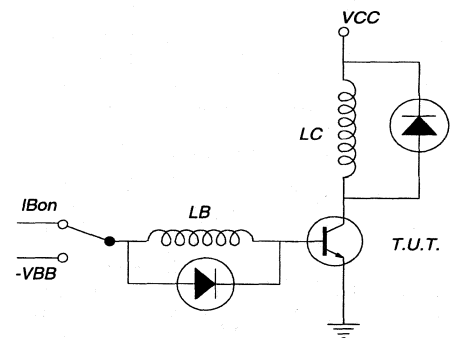


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

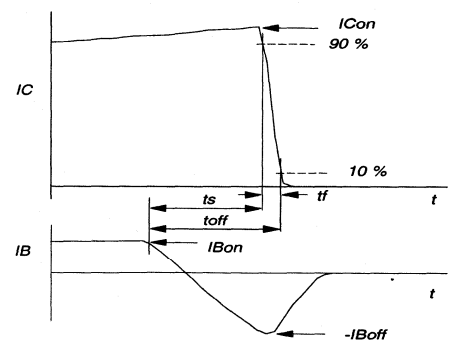


Fig.6. Switching times waveforms with inductive load.

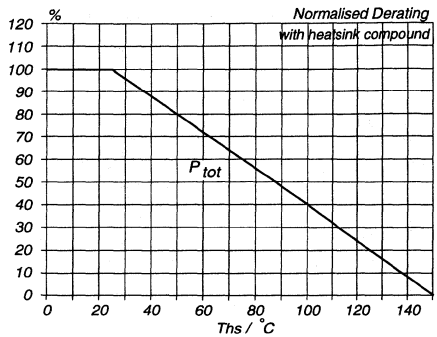


Fig.7. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD_{25^\circ C} = f(T_{hs})$

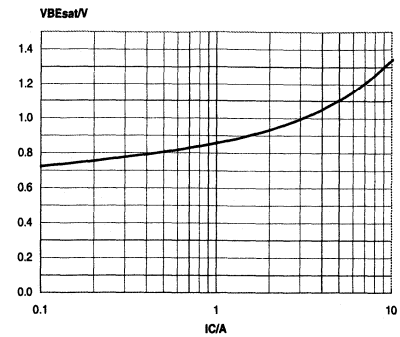


Fig.9. Base-Emitter saturation voltage.
Solid lines = typ values, $V_{BEsat} = f(IC)$; at IC/IB =4.

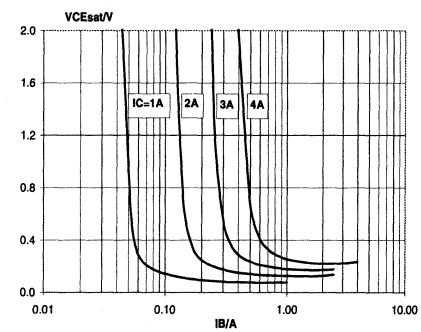


Fig.8. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IB)$; T_j=25˚C.

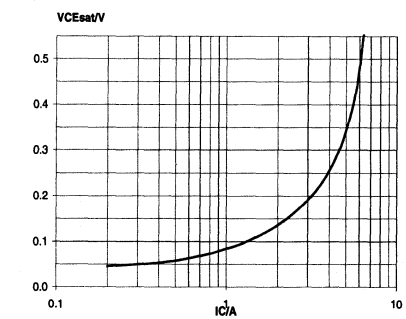


Fig.10. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IC)$; at IC/IB =4.

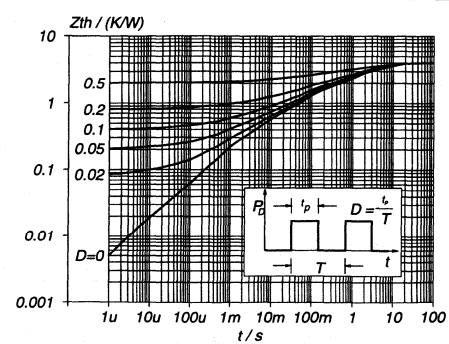


Fig.11. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

Silicon Diffused Power Transistor — BUJ403A

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

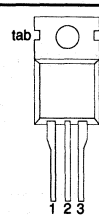
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1200	V
V_{CBO}	Collector-Base voltage (open emitter)		-	1200	V
V_{CEO}	Collector-emitter voltage (open base)		-	550	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 2 A; I_B = 0.4 A	0.15	1.0	V
h_{FEsat}	DC current gain	I_C = 3 A; V_{CE} = 5 V	15.5	-	
t_f	Fall time	Ic=2.5A,I_{B1}=0.5A	170	300	ns

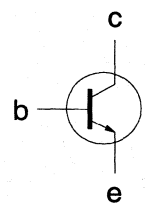
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	1200	V
V_{CEO}	Collector to emitter voltage (open base)		-	550	V
V_{CBO}	Collector to base voltage (open emitter)		-	1200	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.25	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{CBO}	Collector cut-off current [1]	V_{CBO} = $V_{CESMmax}$(1200V)V_{CEO} =	-	-	0.1	mA
I_{CEO}		$V_{CEOMmax}$(550V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7 V; I_C = 0 A	-	-	0.1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 10 mA; L = 25 mH	550	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 2.0 A; I_B = 0.4 A	-	0.15	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 2.0 A; I_B = 0.4 A	-	0.91	1.5	V
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	13	25	-	
h_{FE}		I_C = 500 mA;V_{CE} = 5 V	20	30	47	
h_{FEsat}	DC current gain	I_C = 2.0 A; V_{CE} = 5 V	13	18.5	25	
h_{FEsat}		I_C = 3.0 A; V_{CE} = 5 V	-	15.5	-	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	0.5	µs
t_s	Turn-off storage time		-	3	µs
t_f	Turn-off fall time		-	0.3	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		170	300	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		-	1.8	µs
t_f	Turn-off fall time		-	300	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor BUJ403A

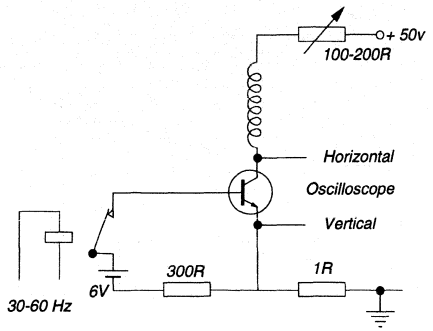


Fig.1. Test circuit for $V_{CEOsust}$.

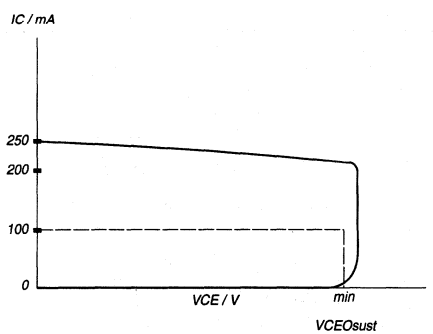


Fig.2. Oscilloscope display for $V_{CEOsust}$.

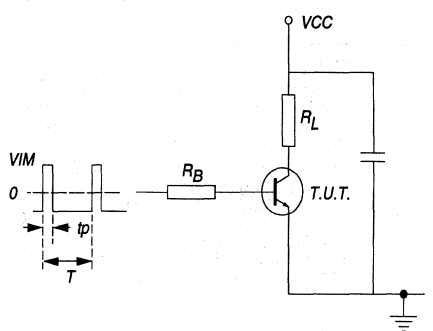


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; δ = t_p / T = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

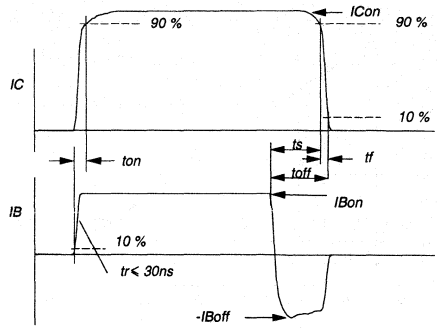


Fig.4. Switching times waveforms with resistive load.

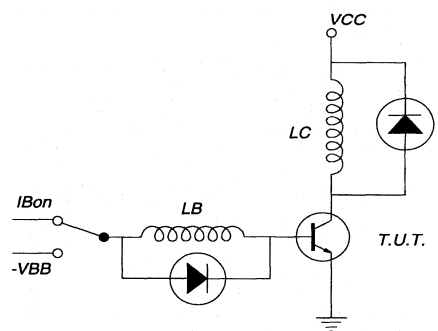


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; -V_{BE} = 5 V; L_C = 200 uH; L_B = 1 uH

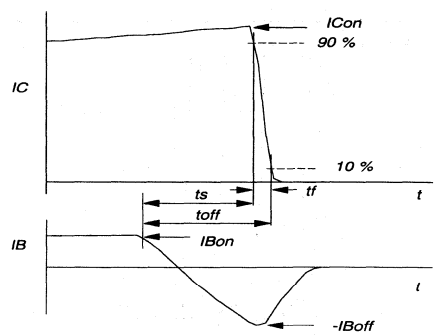


Fig.6. Switching times waveforms with inductive load.

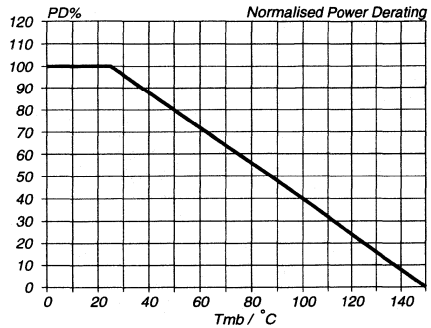


Fig.7. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD_{25^\circ C} = f(T_{mb})$

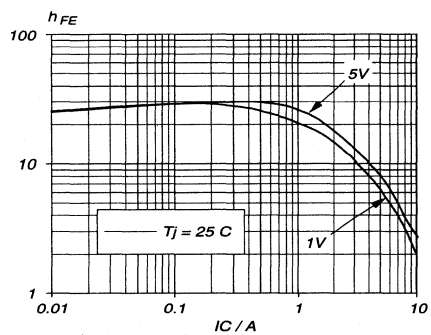


Fig.8. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

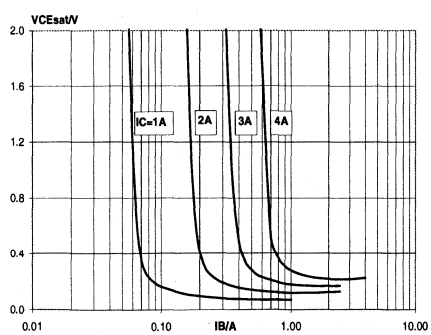


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IB)$; T_j=25˚C.

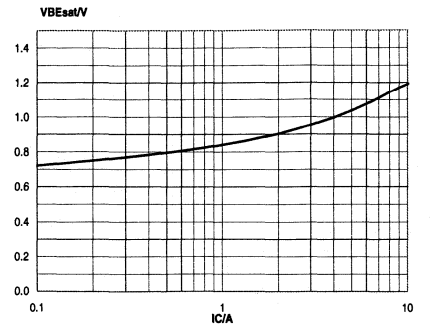


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, $V_{BEsat} = f(IC)$; at IC/IB =4.

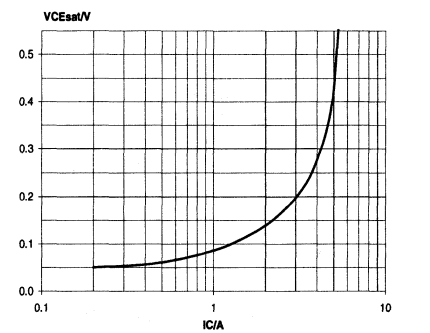


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IC)$; at IC/IB =4.

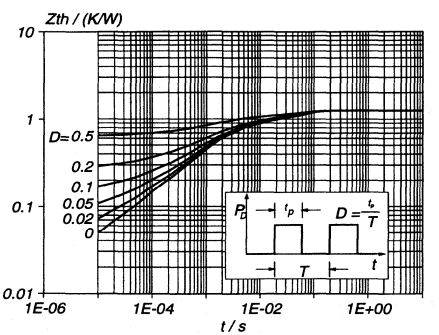


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

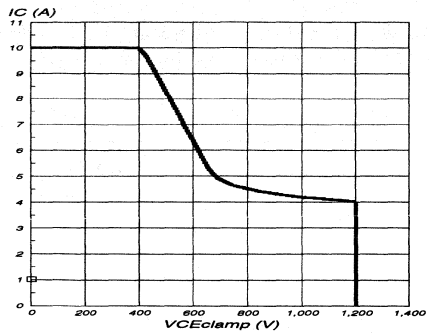


Fig.13. Reverse bias safe operating area $T_j \leq T_{jmax}$

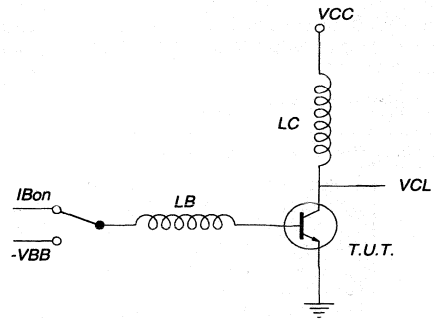


Fig.14. Test Circuit for reverse bias safe operating area.

$V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$; $L_B = 1\mu H$; $L_c = 200\mu H$

Silicon Diffused Power Transistor — BUJ403AX

GENERAL DESCRIPTION

High-voltage, high-speed planar-passivated npn power switching transistor in a plastic full-pack envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

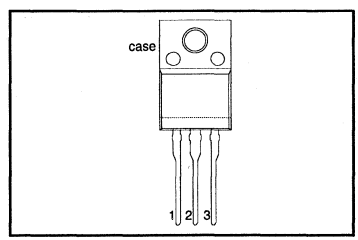
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1200	V
V_{CBO}	Collector-Base voltage (open emitter)		-	1200	V
V_{CEO}	Collector-emitter voltage (open base)		-	550	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 2 A; I_B = 0.4 A	0.15	1.0	V
h_{FEsat}	DC current gain	I_C = 3 A; V_{CE} = 5 V	15.5	-	
t_f	Fall time	Ic=2.5A,I_{B1}=0.5A	170	300	ns

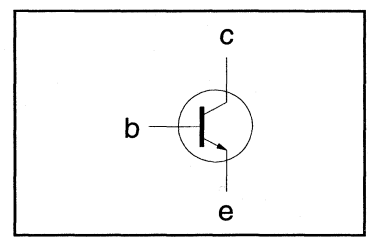
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	1200	V
V_{CEO}	Collector to emitter voltage (open base)		-	550	V
V_{CBO}	Collector to base voltage (open emitter)		-	1200	V
I_C	Collector current (DC)		-	6	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	3	A
I_{BM}	Base current peak value		-	5	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 ˚C	-	-	2.0	mA
I_{CBO}	Collector cut-off current [1]	V_{CBO} = $V_{CESMmax}$(1200V)	-	-	0.1	mA
I_{CEO}		V_{CEO} = $V_{CEOMmax}$(550V)	-	-	0.1	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 7 V; I_C = 0 A	-	-	0.1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 10 mA; L = 25 mH	550	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 2.0 A; I_B = 0.4 A	-	0.15	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 2.0 A; I_B = 0.4 A	-	0.91	1.5	V
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	13	25		
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	20	30	47	
h_{FEsat}	DC current gain	I_C = 2 A; V_{CE} = 5 V	13	18.5	25	
h_{FEsat}		I_C = 3.0 A; V_{CE} = 5 V	-	15.5	-	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		-	0.5	µs
t_s	Turn-off storage time		-	3	µs
t_f	Turn-off fall time		-	0.3	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		-	1.5	µs
t_f	Turn-off fall time		170	300	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 ˚C			
t_s	Turn-off storage time		-	1.8	µs
t_f	Turn-off fall time		-	300	ns

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor BUJ403AX

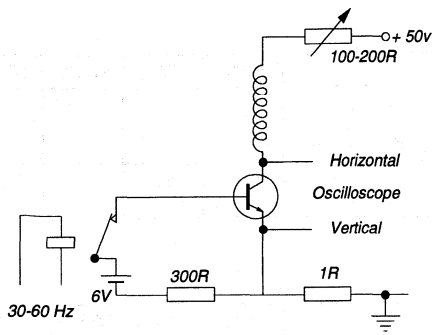


Fig.1. Test circuit for $V_{CEOsust}$.

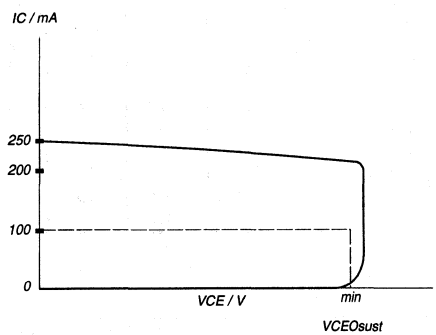


Fig.2. Oscilloscope display for $V_{CEOsust}$.

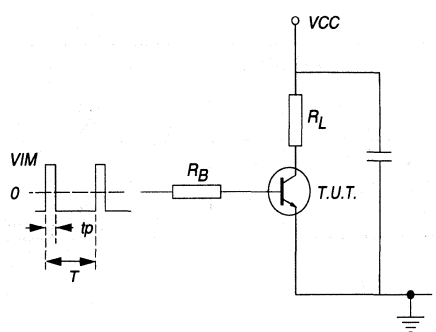


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

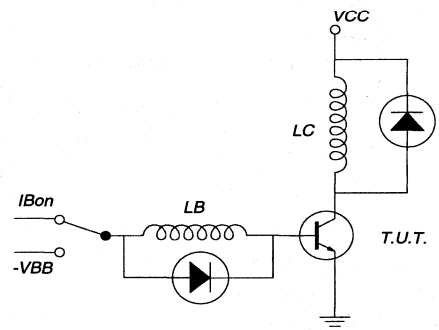


Fig.4. Switching times waveforms with resistive load.

Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

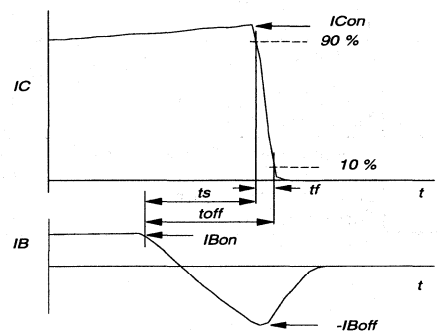


Fig.6. Switching times waveforms with inductive load.

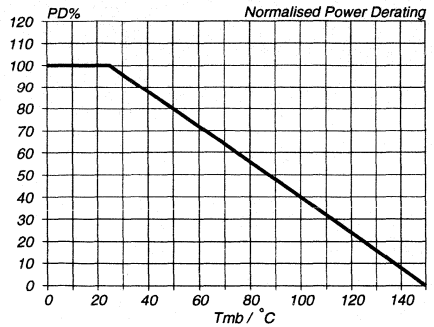


Fig.7. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD_{25^\circ C} = f(T_{hs})$

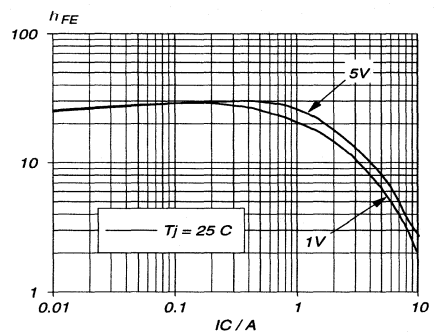


Fig.8. Typical DC current gain. $h_{FE} = f(I_C)$
parameter V_{CE}

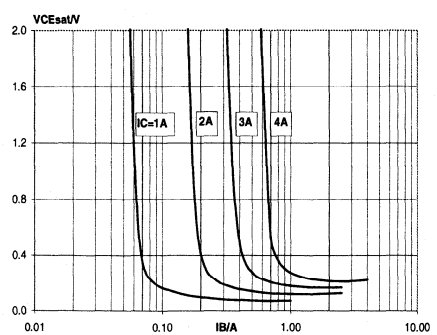


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IB)$; T_j=25˚C.

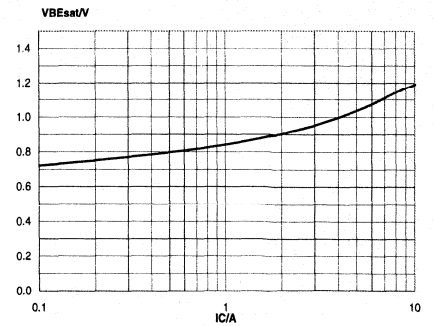


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, $V_{BEsat} = f(IC)$; at IC/IB =4.

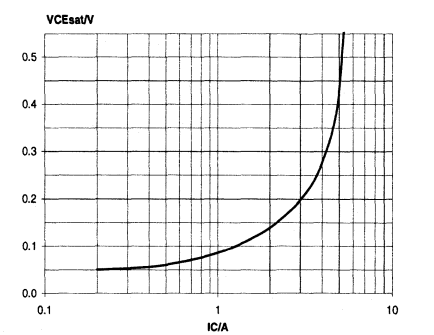


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, $V_{CEsat} = f(IC)$; at IC/IB =4.

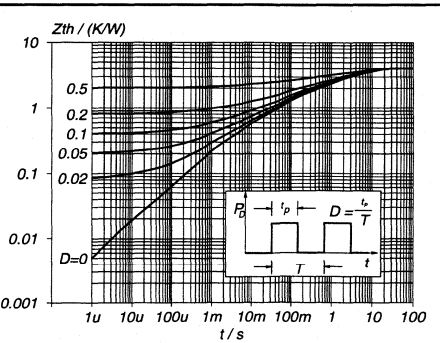


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

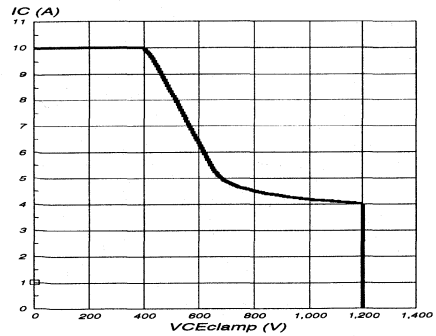


Fig.13. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

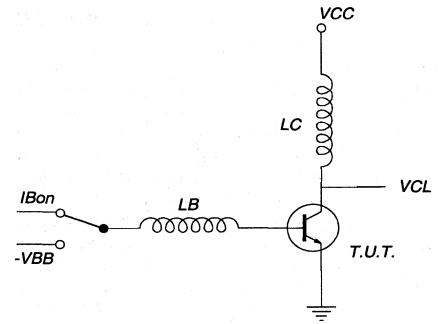


Fig.14. Test circuit for reverse bias safe operating area.
$V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$; $L_B = 1\mu H$; $L_c = 200\mu H$

Silicon diffused power transistors BUT11; BUT11A

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a TO-220AB package.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems.

PINNING

PIN	DESCRIPTION
1	base
2	collector; connected to mounting base
3	emitter

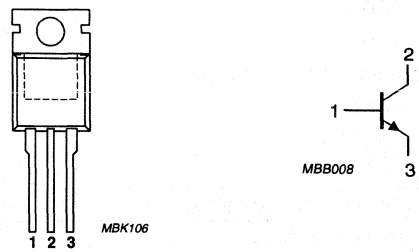


Fig.1 Simplified outline (TO-220AB) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$		
	BUT11		850	V
	BUT11A		1000	V
V_{CEO}	collector-emitter voltage	open base		
	BUT11		400	V
	BUT11A		450	V
V_{CEsat}	collector-emitter saturation voltage	see Figs 7 and 9	1.5	V
I_C	collector current (DC)	see Figs 2 and 4	5	A
I_{CM}	collector current (peak value)	see Fig. 4	10	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.3	100	W
t_f	fall time	resistive load; see Figs 11 and 12	0.8	µs

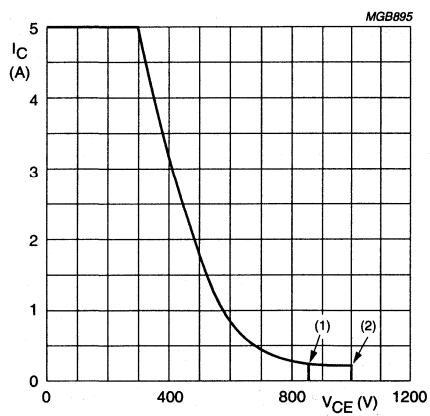
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	1.25	K/W

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUT11		–	850	V
	BUT11A		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUT11		–	400	V
	BUT11A		–	450	V
I_C	collector current (DC)	see Figs 2 and 4	–	5	A
I_{CM}	collector current (peak value)	$t_p < 2$ ms; see Fig. 4	–	10	A
I_B	base current (DC)		–	2	A
I_{BM}	base current (peak value)	$t_p < 2$ ms	–	4	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.3	–	100	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C



(1) BUT11.
(2) BUT11A.

Fig.2 Reverse bias SOAR.

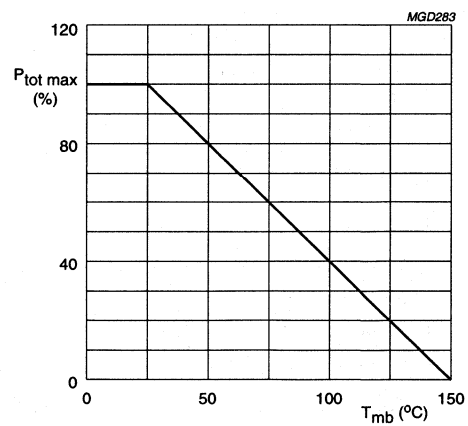


Fig.3 Power derating curve.

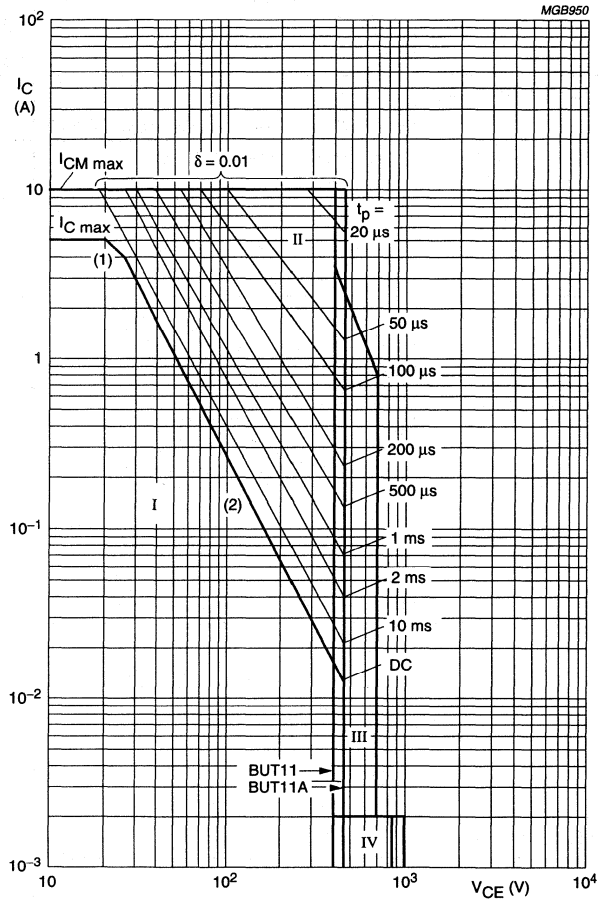
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	I_C = 100 mA; I_{Boff} = 0; L = 25 mH; see Figs 5 and 6				
	BUT11		400	–	–	V
	BUT11A		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage					
	BUT11	I_C = 3 A; I_B = 600 mA; see Figs 7 and 9	–	–	1.5	V
	BUT11A	I_C = 2.5 A; I_B = 500 mA; see Figs 7 and 9	–	–	1.5	V
V_{BEsat}	base-emitter saturation voltage					
	BUT11	I_C = 3 A; I_B = 0.6 A; see Fig.7	–	–	1.3	V
	BUT11A	I_C = 2.5 A; I_B = 0.5 A; see Fig.7	–	–	1.3	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESMmax}$; V_{BE} = 0; note 1	–	–	1	mA
		$V_{CE} = V_{CESMmax}$; V_{BE} = 0; T_j = 125 °C; note 1	–	–	2	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 9 V; I_C = 0	–	–	10	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 5 mA; see Fig.10	10	18	35	
		V_{CE} = 5 V; I_C = 500 mA; see Fig.10	10	20	35	
Switching times resistive load (see Fig.12)						
t_{on}	turn-on time					
	BUT11	I_{Con} = 3 A; $I_{Bon} = -I_{Boff}$ = 600 mA	–	–	1	µs
	BUT11A	I_{Con} = 2.5 A; $I_{Bon} = -I_{Boff}$ = 500 mA	–	–	1	µs
t_s	storage time					
	BUT11	I_{Con} = 3 A; $I_{Bon} = -I_{Boff}$ = 600 mA	–	–	4	µs
	BUT11A	I_{Con} = 2.5 A; $I_{Bon} = -I_{Boff}$ = 500 mA	–	–	4	µs
t_f	fall time					
	BUT11	I_{Con} = 3 A; $I_{Bon} = -I_{Boff}$ = 600 mA	–	–	0.8	µs
	BUT11A	I_{Con} = 2.5 A; $I_{Bon} = -I_{Boff}$ = 500 mA	–	–	0.8	µs
Switching times inductive load (see Fig.14)						
t_s	storage time					
	BUT11	I_{Con} = 3 A; I_{Bon} = 600 mA	–	1.1	1.4	µs
		I_{Con} = 3 A; I_{Bon} = 600 mA; T_j = 100 °C	–	1.2	1.5	µs
	BUT11A	I_{Con} = 2.5 A; I_{Bon} = 500 mA	–	1.1	1.4	µs
		I_{Con} = 2.5 A; I_{Bon} = 500 mA; T_j = 100 °C	–	1.2	1.5	µs
t_f	fall time					
	BUT11	I_{Con} = 3 A; I_{Bon} = 600 mA	–	80	150	ns
		I_{Con} = 3 A; I_{Bon} = 600 mA; T_j = 100 °C	–	140	300	ns
	BUT11A	I_{Con} = 2.5 A; I_{Bon} = 500 mA	–	80	150	ns
		I_{Con} = 2.5 A; I_{Bon} = 500 mA; T_j = 100 °C	–	140	300	ns

Note

1. Measured with a half-sinewave voltage (curve tracer).



$T_{mb} \leq 25$ °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

III - Area of permissible operation during turn-on in single transistor converters, provided $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6$ µs.

IV - Repetitive pulse operation in this region is permissible provided $V_{BE} \leq 0$ and $t_p \leq 5$ ms.

(1) $P_{tot\ max}$ and $P_{tot\ peak\ max}$ lines.

(2) Second breakdown limits.

Fig.4 Forward bias SOAR.

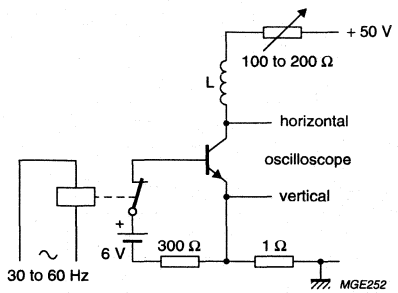


Fig.5 Test circuit for collector-emitter sustaining voltage.

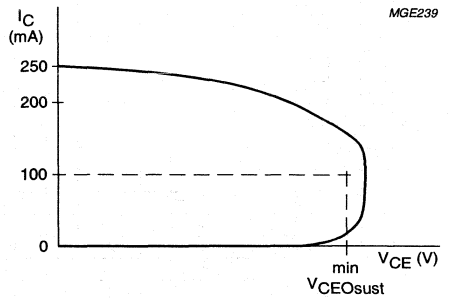
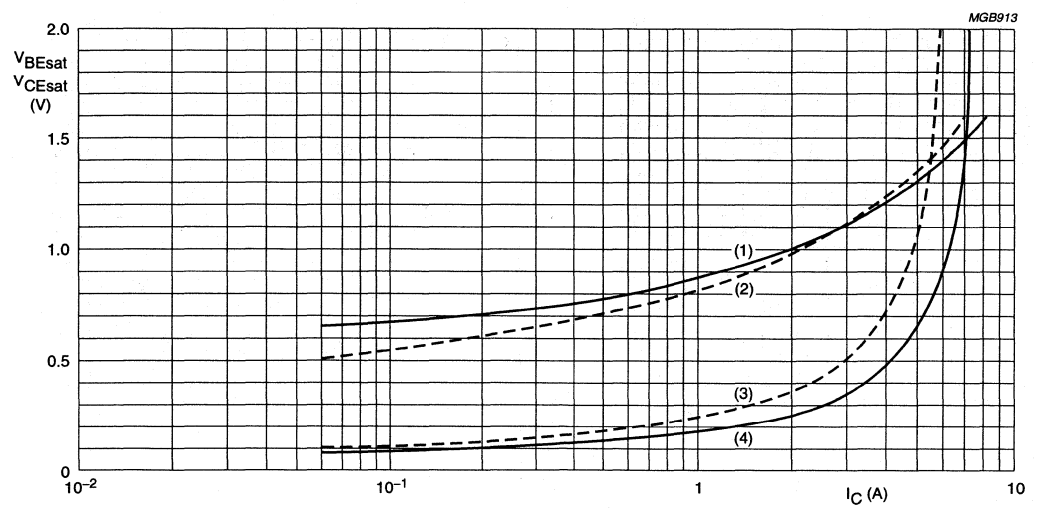


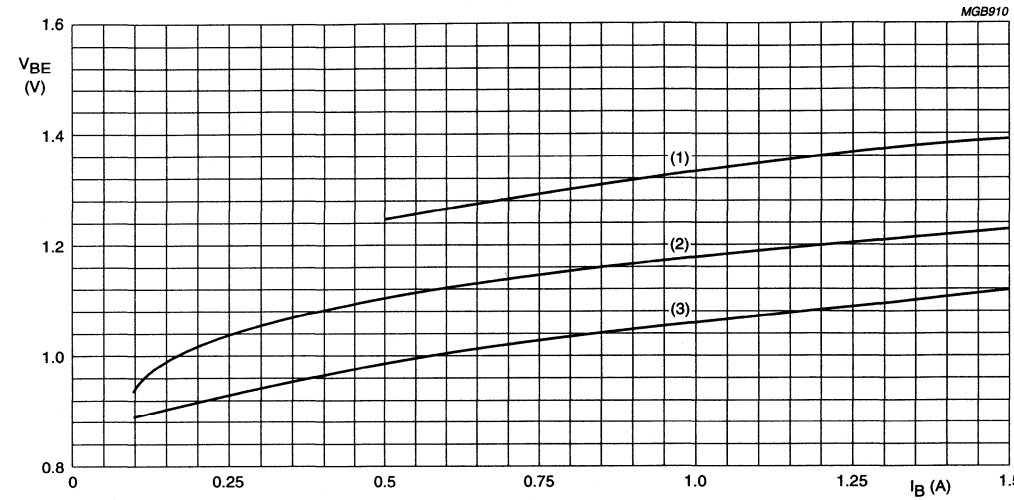
Fig.6 Oscilloscope display for collector-emitter sustaining voltage.



$I_C/I_B = 5$.

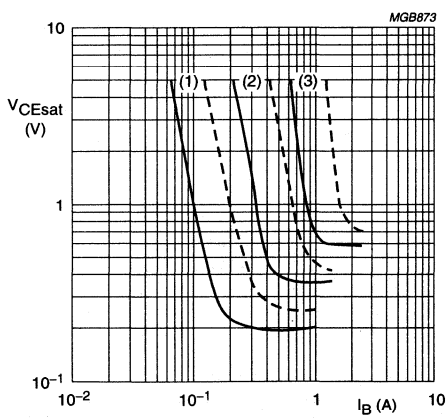
(1) V_{BE}; $T_j = 25$ °C.
(2) V_{BE}; $T_j = 100$ °C.
(3) V_{CE}; $T_j = 100$ °C.
(4) V_{CE}; $T_j = 25$ °C.

Fig.7 Base-emitter and collector-emitter saturation voltages as functions of collector current; typical values.



T_j = 25 °C.
(1) I_C = 5 A.
(2) I_C = 3 A.
(3) I_C = 1.5 A.

Fig.8 Base-emitter voltage as a function of base current.



(1) I_C = 1.5 A.
(2) I_C = 3 A.
(3) I_C = 5 A.
T_j = 25 °C; solid line: typical values; dotted line: maximum values.

Fig.9 Collector-emitter saturation voltage as a function of base current.

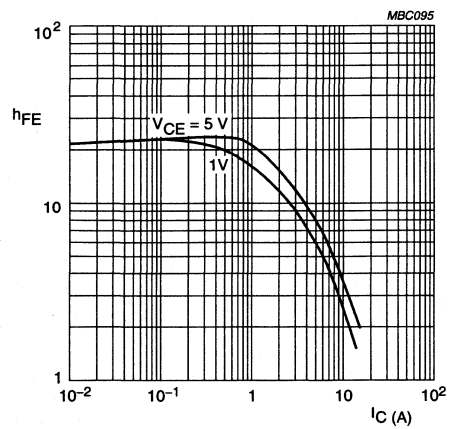
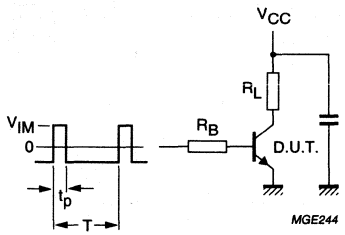


Fig.10 DC current gain; typical values.



V_{CC} = 250 V; t_p = 20 µs; V_{IM} = −6 to +8 V; t_p/T = 0.01.
The values of R_B and R_L are selected in accordance with I_{Con} and I_{Bon} requirements.

Fig.11 Test circuit resistive load.

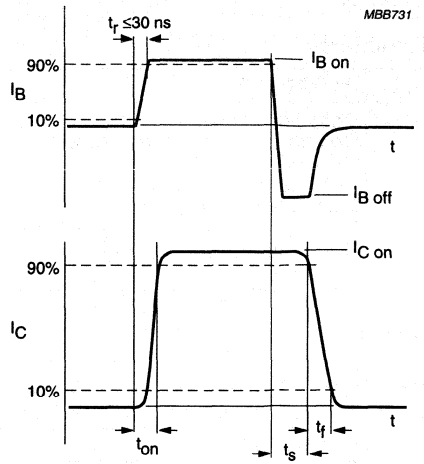
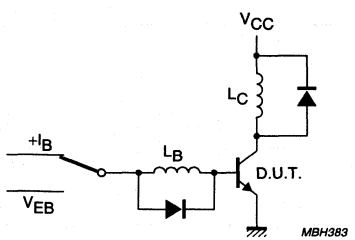


Fig.12 Switching time waveforms with resistive load.



V_{CC} = 300 V; V_{EB} = 5 V; L_B = 1 µH.

Fig.13 Test circuit inductive load.

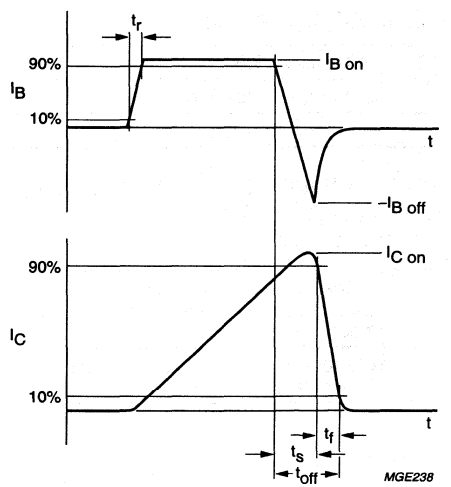


Fig.14 Switching time waveforms with inductive load.

GENERAL DESCRIPTION

High-voltage, high-speed glass-passivated npn power transistor in a SOT186 envelope with electrically insulated mounting base,intended for use in converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	20	W
V_{CEsat}	Collector-emitter saturation voltage		-	1.5	V
I_{Csat}	Collector saturation current		2.5	-	A
t_f	Fall time		800	-	ns

[INCLUDE]

LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	20	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65% ; clean and dustfree	-		1500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	12	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 2.5 A; I_B = 0.5 A	-	-	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 2.5 A; I_B = 0.5 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	18	35	
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	10	20	35	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A			
t_{on}	Turn-on time		-	1	µs
t_s	Turn-off storage time		-	4	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.1	1.4	µs
t_f	Turn-off fall time		80	150	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		1.2	1.5	µs
t_f	Turn-off fall time		140	300	ns

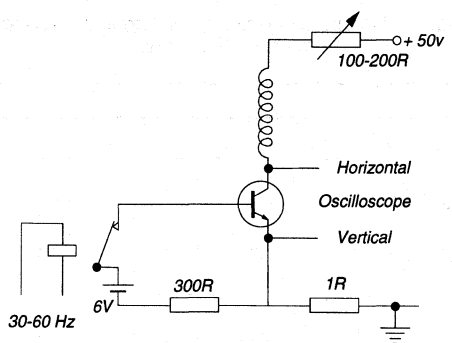


Fig.1. Test circuit for $V_{CEOsust}$.

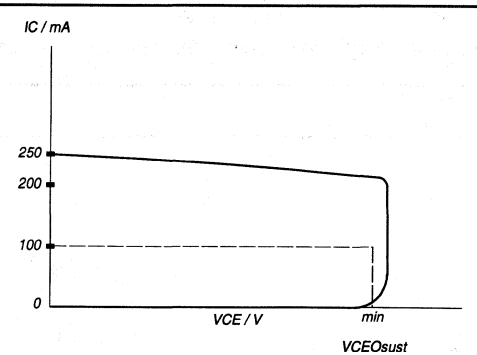


Fig.2. Oscilloscope display for $V_{CEOsust}$.

1 Measured with half sine-wave voltage (curve tracer).

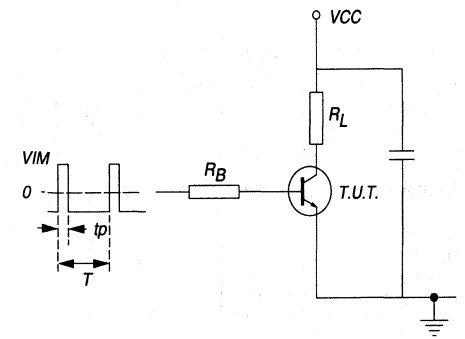


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T = 0.01$. R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

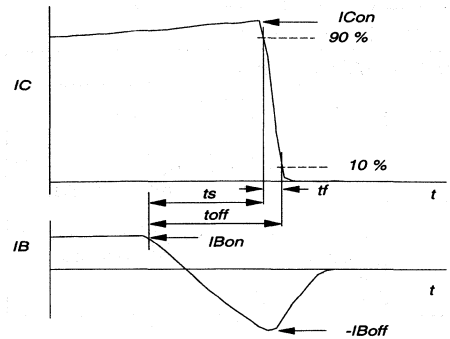


Fig.6. Switching times waveforms with inductive load.

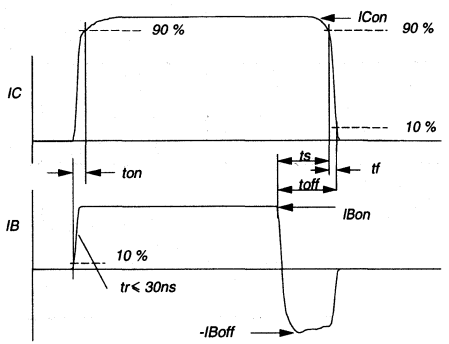


Fig.4. Switching times waveforms with resistive load.

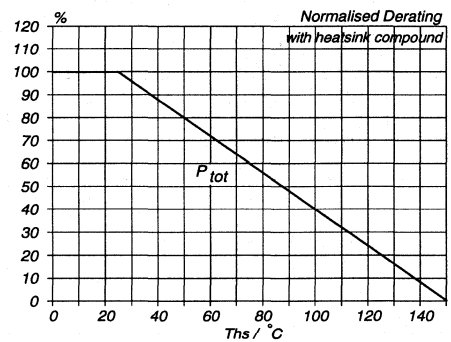


Fig.7. Normalised power derating and second breakdown curves.

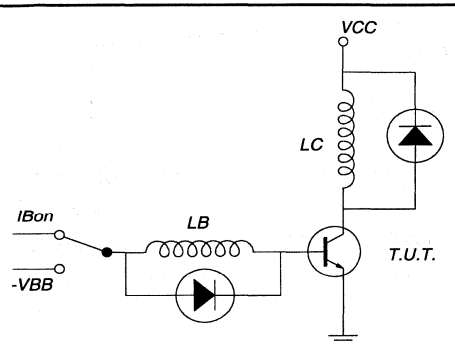


Fig.5. Test circuit inductive load. V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

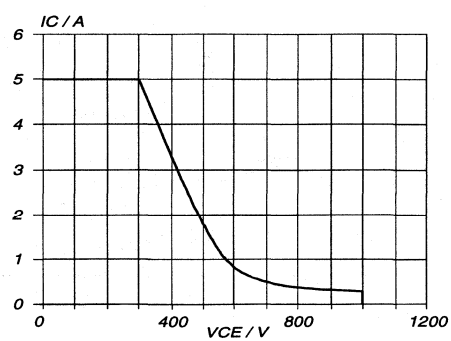


Fig.8. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

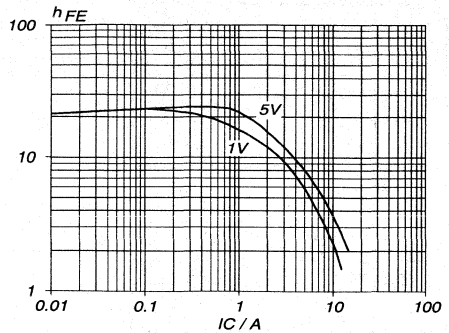


Fig.9. Typical DC current gain.
$h_{FE} = f(I_C)$; parameter V_{CE}

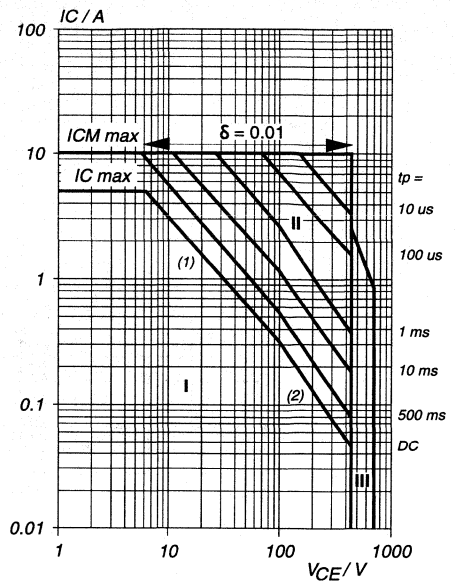


Fig.10. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1)	*P_{tot} max and P_{tot} peak max lines.*
(2)	*Second breakdown limits.*
I	*Region of permissible DC operation.*
II	*Extension for repetitive pulse operation.*
III	*Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.*
NB:	*Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

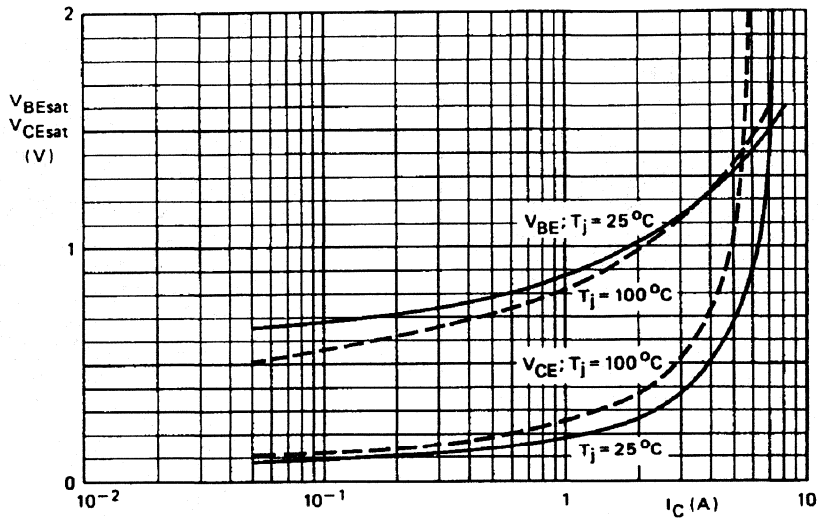


Fig.11. Typical base-emitter and collector-emitter saturation voltages.
$V_{BEsat} = f(I_C)$; $V_{CEsat} = f(I_C)$; $I_C/I_B = 5$

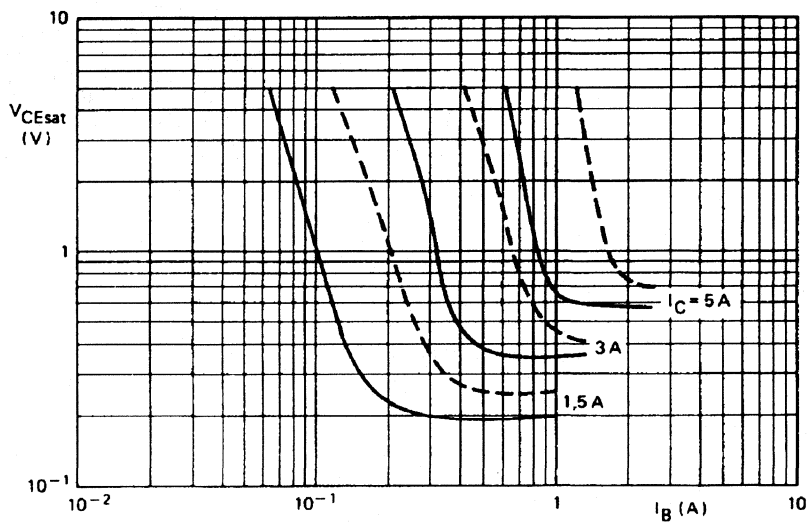


Fig.12. Collector-emitter saturation voltage. Solid lines = typ values, dotted lines = max values. $V_{CEsat} = f(I_B)$; parameter I_C

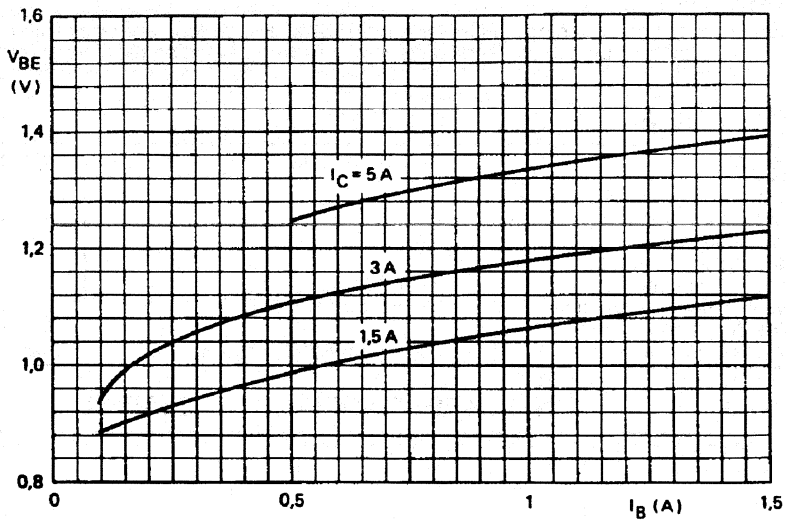


Fig.13. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

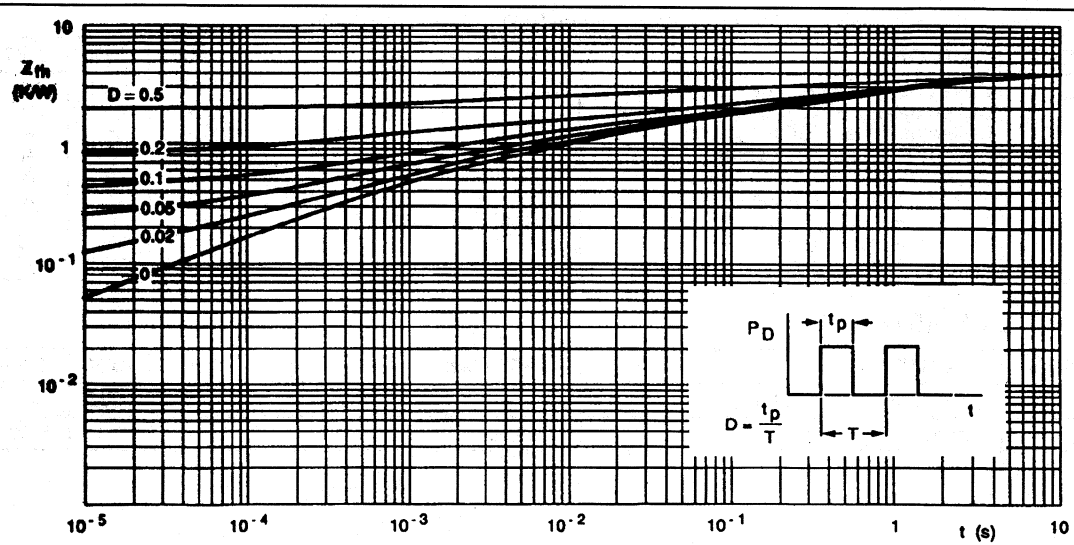


Fig.14. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

Silicon Diffused Power Transistor — BUT11AI

GENERAL DESCRIPTION

Enhanced performance, high speed switching npn transistor in TO220AB envelope specially suited for high frequency electronic lighting ballast applications and converters, inverters, switching regulators, motor control systems etc.

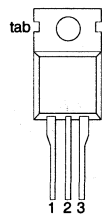
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 2.5 A; I_B = 0.33 A	-	1.5	V
I_{Csat}	Collector Saturation current		2.5		A
t_f	Inductive fall time	I_{Con} = 2.5 A; I_{Bon} = 0.5 A	0.08	0.15	µs

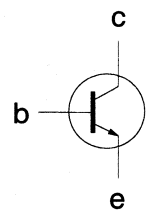
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	100	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.25	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	-	60	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9.0 V; I_C = 0 A	-	-	10.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 2.5 A; I_B = 0.33 A	-	-	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 2.5 A; I_B = 0.33 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	20	35	
h_{FE}		I_C = 0.5 A; V_{CE} = 5 V	14	22	35	
h_{FEsat}		I_C = 2.5 A; V_{CE} = 5 V	9	13	17	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times resistive load	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; $-I_{Boff}$ = 0.5 A			
t_{on}	Turn-on time		0.6 3.4 0.6	1.0	µs
t_s	Turn-off storage time		-	4.0	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times inductive load	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; $-V_{BB}$ = 5 V			
t_s	Turn-off storage time		1.1	1.4	µs
t_f	Turn-off fall time		80	150	ns
		I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; $-V_{BB}$ = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		1.2	1.5	µs
t_f	Turn-off fall time		140	300	ns

[INCLUDE]

1 Measured with half sine-wave voltage (curve tracer).

Silicon Diffused Power Transistor — BUT11AX

GENERAL DESCRIPTION

High-voltage, high-speed glass-passivated npn power transistor in a plastic full-pack envelope intended for use in converters, inverters, switching regulators, motor control systems, etc.

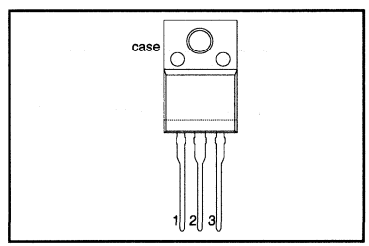
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage		-	1.5	V
I_{Csat}	Collector saturation current		2.5	-	A
t_f	Fall time		150	-	ns

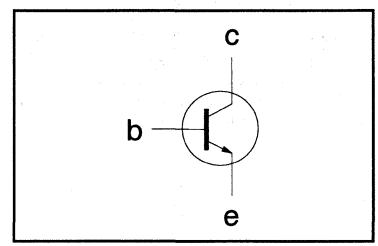
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 2.5 A; I_B = 0.5 A	-	-	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 2.5 A; I_B = 0.5 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	18	35	
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	10	20	35	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A			
t_{on}	Turn-on time		0.6	-	µs
t_s	Turn-off storage time		3.5	-	µs
t_f	Turn-off fall time		0.6	-	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.5	-	µs
t_f	Turn-off fall time		150	-	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		1.8	-	µs
t_f	Turn-off fall time		170	-	ns

1 Measured with half sine-wave voltage (curve tracer).

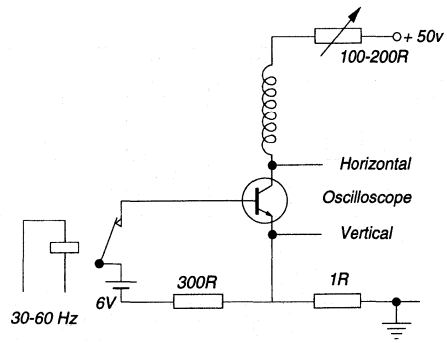


Fig.1. Test circuit for $V_{CEOsust}$.

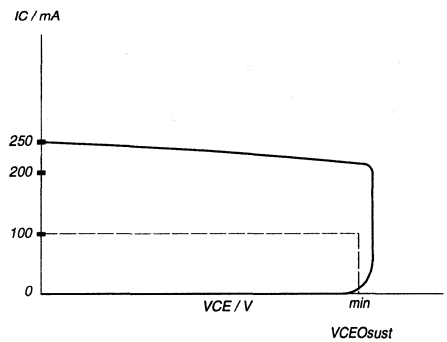


Fig.2. Oscilloscope display for $V_{CEOsust}$.

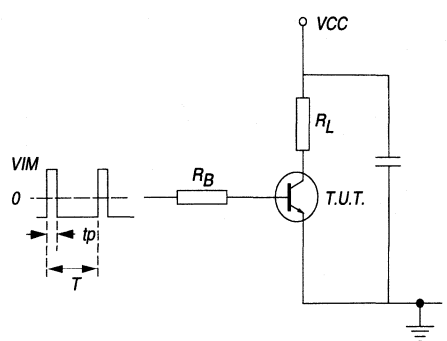


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

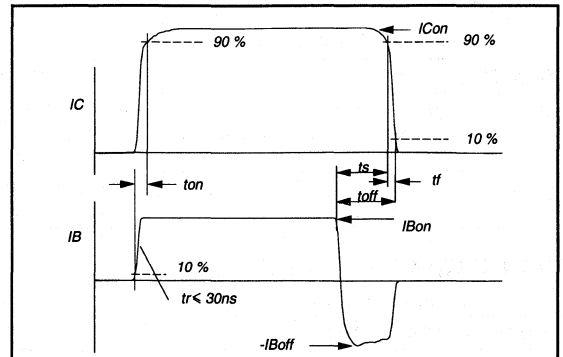


Fig.4. Switching times waveforms with resistive load.

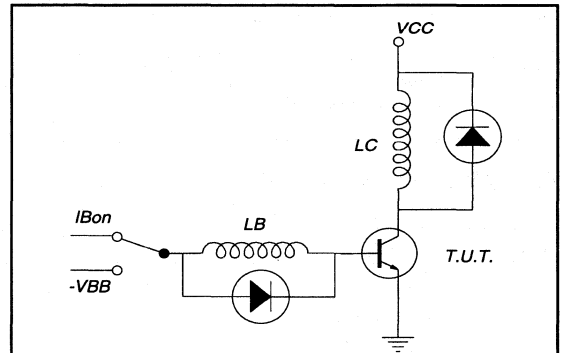


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

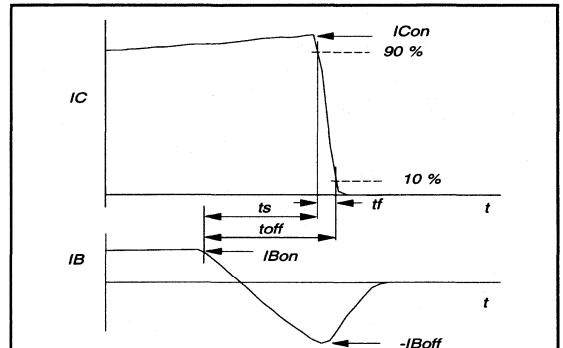


Fig.6. Switching times waveforms with inductive load.

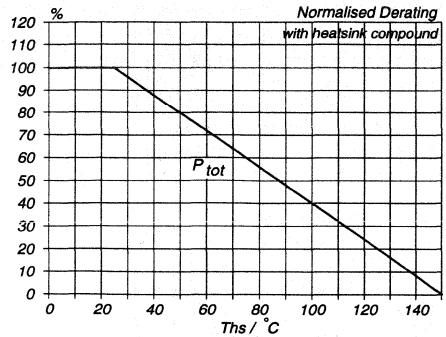


Fig.7. Normalised power derating and second breakdown curves.

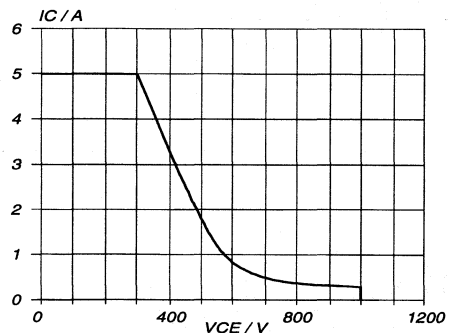


Fig.8. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

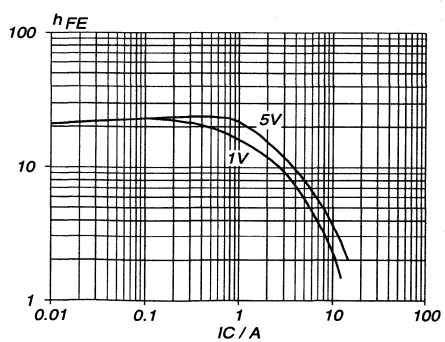


Fig.9. Typical DC current gain.
$h_{FE} = f(I_C)$; parameter V_{CE}

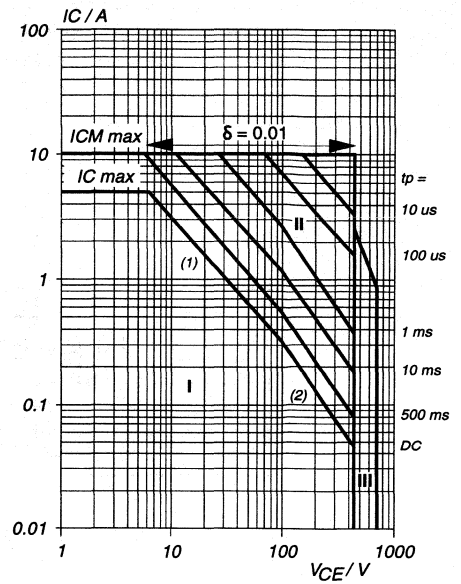


Fig.10. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1)	P_{tot} max and P_{tot} peak max lines.
(2)	Second breakdown limits.
I	Region of permissible DC operation.
II	Extension for repetitive pulse operation.
III	Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.
NB:	Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

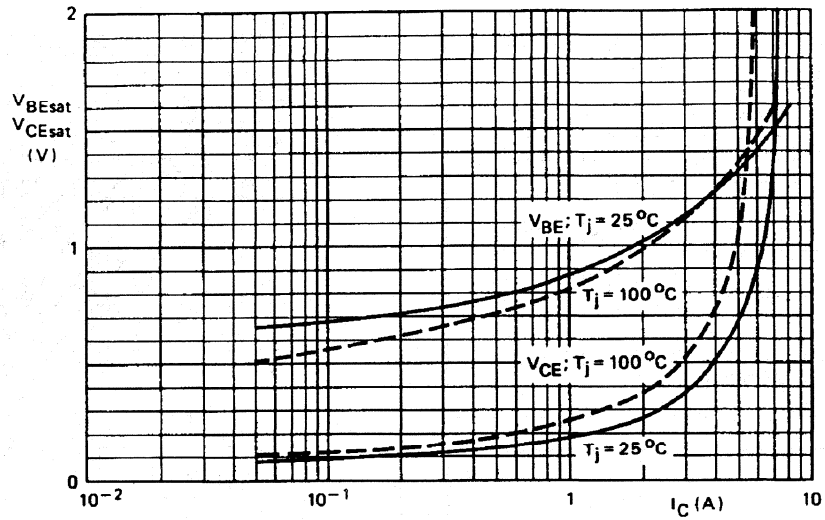


Fig.11. Typical base-emitter and collector-emitter saturation voltages.
$V_{BEsat} = f(I_C)$; $V_{CEsat} = f(I_C)$; $I_C/I_B = 5$

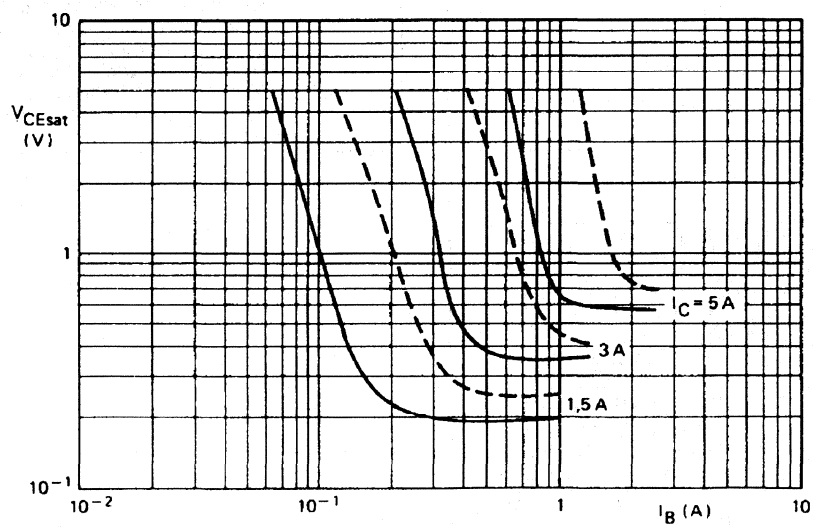


Fig.12. Collector-emitter saturation voltage. Solid lines = typ values, dotted lines = max values. $V_{CEsat} = f(I_B)$; parameter I_C

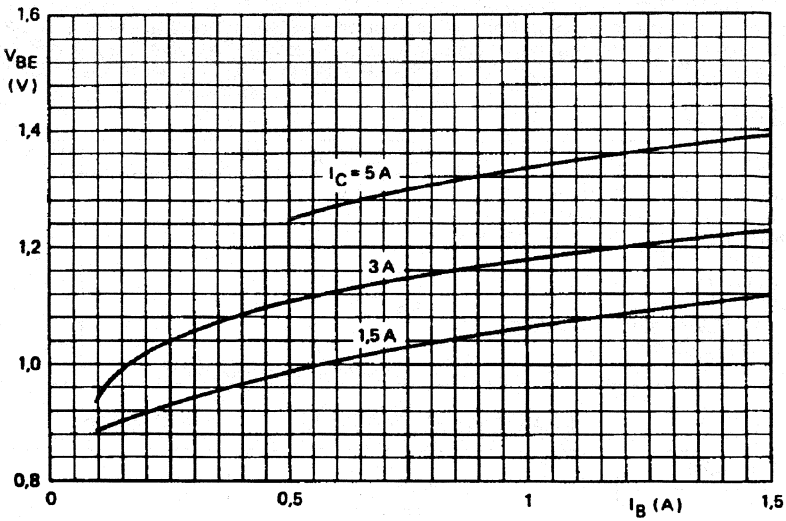


Fig.13. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

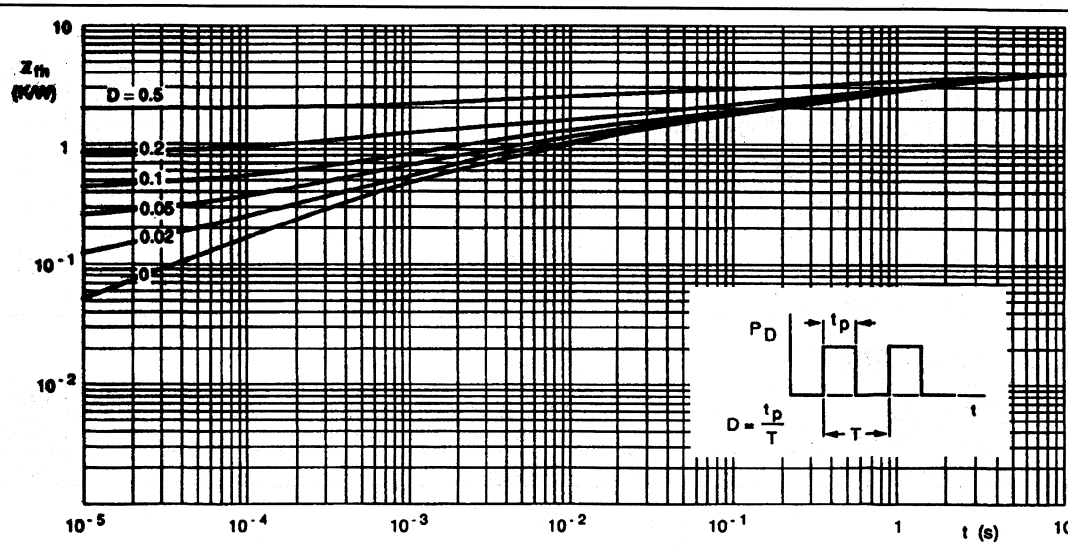


Fig.14. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

Silicon Diffused Power Transistor — BUT11APX

GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

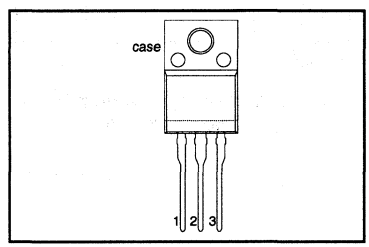
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CBO}	Collector-Base voltage (open emitter)		-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
V_{CEsat}	Collector-emitter saturation voltage		-	1.5	V
I_{Csat}	Collector saturation current		3.5	-	A
t_f	Fall time	I_{Csat}=2.5A,I_{B1}=0.5A,I_{B2}=0.8A	145	160	ns

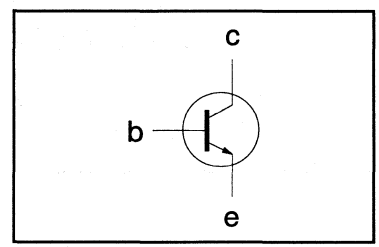
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector to emitter voltage (open base)		-	450	V
V_{CBO}	Collector to base voltage (open emitter)		-	1000	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	32	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 3.0 A; I_B = 0.6 A	-	0.25	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 2.5 A; I_B = 0.33 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	22	35	
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	14	25	35	
h_{FEsat}		I_C = 2.5 A; V_{CE} = 5 V	10	13.5	17	
h_{FEsat}		I_C = 3.5 A; V_{CE} = 5 V	8	10	12	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Csat} = 2.5 A; I_{B1} = -I_{B2} = 0.5 A; R_L = 75 ohms; V_{BB2} = 4 V;			
t_{on}	Turn-on time		0.5	0.7	µs
t_s	Turn-off storage time		3.3	4	µs
t_f	Turn-off fall time		0.33	0.45	µs
	Switching times (inductive load)	I_{Csat} = 2.5 A; I_{B1} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.4	1.6	µs
t_f	Turn-off fall time		145	160	ns
	Switching times (inductive load)	I_{Csat} = 2.5 A; I_{B1} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		1.7	1.9	µs
t_f	Turn-off fall time		160	200	ns

1 Measured with half sine-wave voltage (curve tracer).

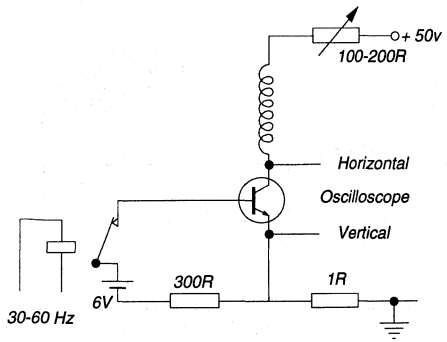


Fig.1. Test circuit for $V_{CEOsust}$.

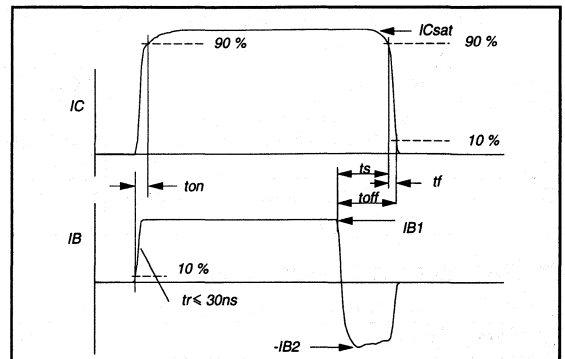


Fig.4. Switching times waveforms with resistive load.

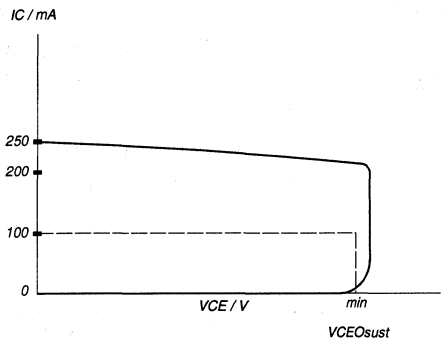


Fig.2. Oscilloscope display for $V_{CEOsust}$.

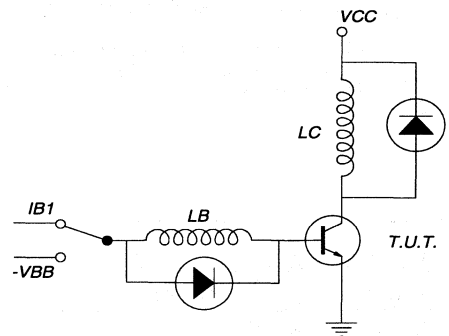


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

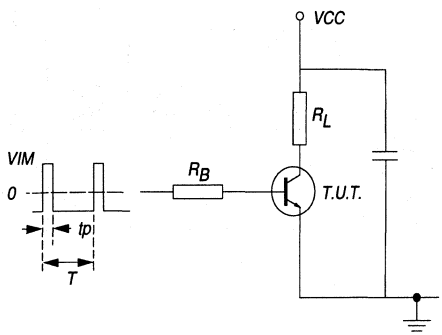


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

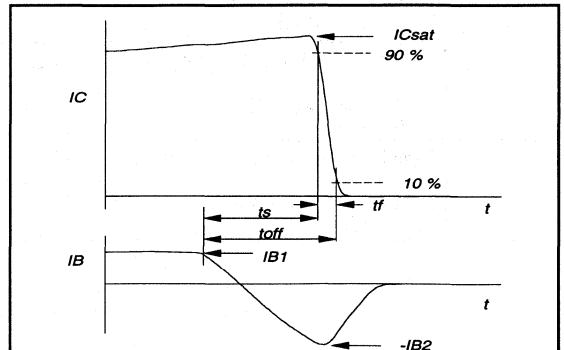


Fig.6. Switching times waveforms with inductive load.

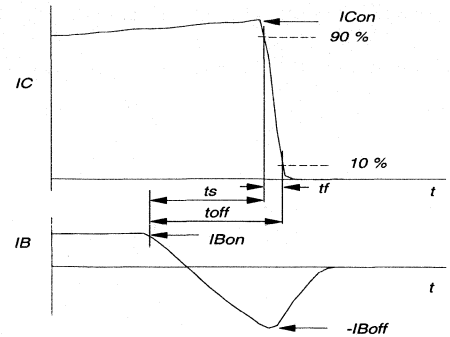


Fig.7. Switching times waveforms with inductive load.

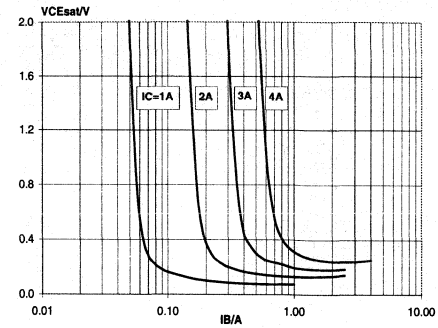


Fig.10. Collector-Emitter saturation voltage. Solid lines = typ values, $V_{CEsat} = f(IB)$; T_j=25˚C.

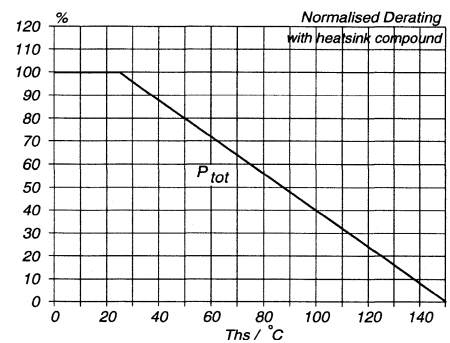


Fig.8. Normalised power dissipation. PD% = 100·PD/PD $_{25˚C}$ = f (T_{hs})

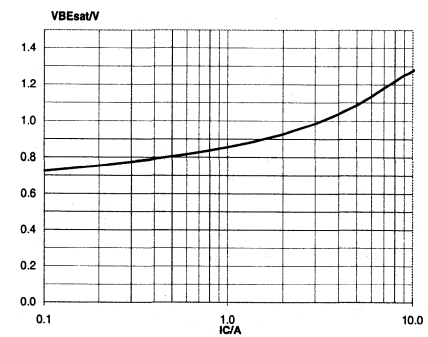


Fig.11. Base-Emitter saturation voltage. Solid lines = typ values, $V_{BEsat} = f(IC)$; at IC/IB =4.

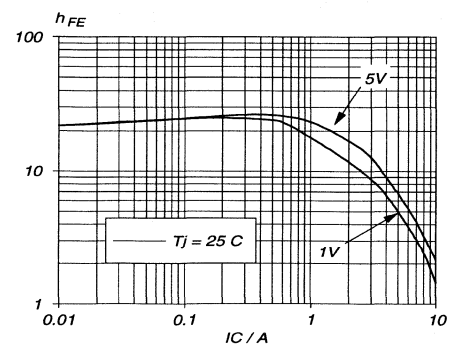


Fig.9. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

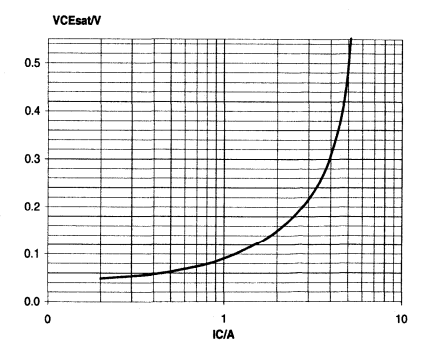


Fig.12. Collector-Emitter saturation voltage. Solid lines = typ values, $V_{CEsat} = f(IC)$; at IC/IB =4.

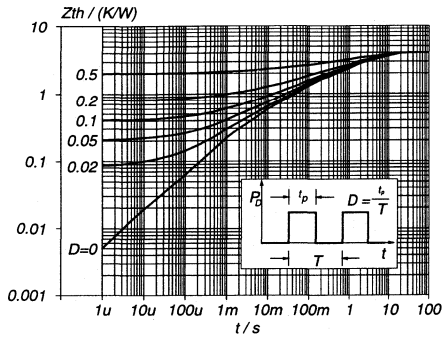


Fig.13. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

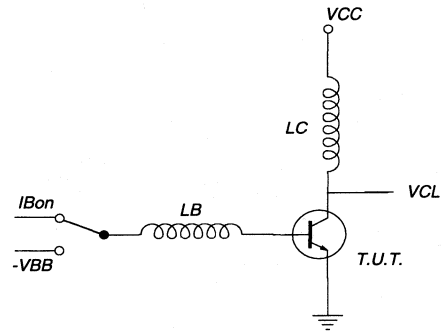


Fig.15. Test circuit RBSOA. $V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$; $L_B = 1\mu H$; $L_c = 200\mu H$

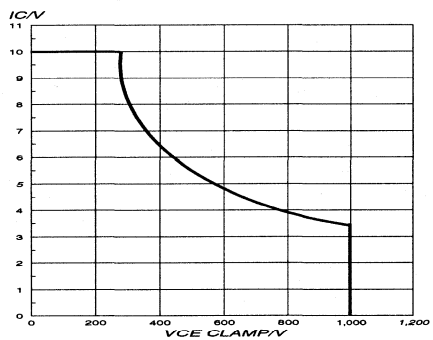


Fig.14. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

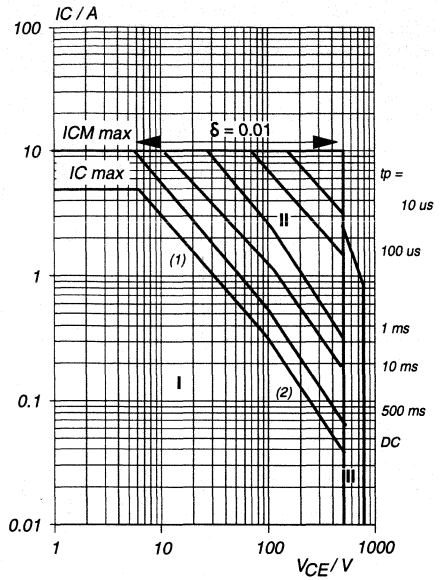


Fig.16. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1)	*P_{tot} max and P_{tot} peak max lines.*
(2)	*Second breakdown limits.*
I	*Region of permissible DC operation.*
II	*Extension for repetitive pulse operation.*
III	*Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.*
NB:	*Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.*

GENERAL DESCRIPTION

High-voltage, high-speed glass-passivated npn power transistor in a SOT186 envelope with electrically insulated mounting base,intended for use in converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	20	W
V_{CEsat}	Collector-emitter saturation voltage		-	1.5	V
I_{Csat}	Collector saturation current		-	3	A
t_f	Fall time		-	800	ns

[INCLUDE]

LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	20	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	55	-	K/W

ISOLATION LIMITING VALUE & CHARACTERISTIC

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65% ; clean and dustfree	-		1500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	12	-	pF

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 3.0 A; I_B = 0.6 A	-	-	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.6 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	10	18	35	
h_{FE}		I_C = 500 mA; V_{CE} = 5 V	10	20	35	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.5 A; I_{Bon} = -I_{Boff} = 0.5 A			
t_{on}	Turn-on time		-	1	µs
t_s	Turn-off storage time		-	4	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V			
t_s	Turn-off storage time		1.1	1.4	µs
t_f	Turn-off fall time		80	150	ns
	Switching times (inductive load)	I_{Con} = 2.5 A; I_{Bon} = 0.5 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		1.2	1.5	µs
t_f	Turn-off fall time		140	300	ns

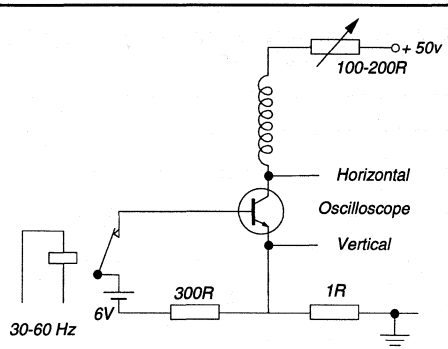


Fig.1. Test circuit for $V_{CEOsust}$.

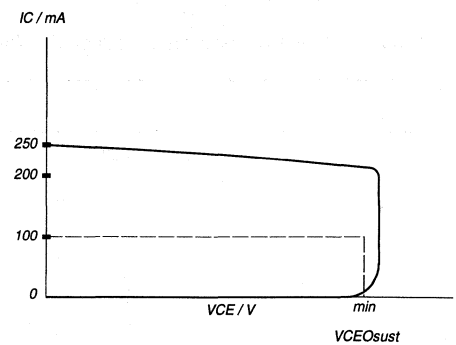


Fig.2. Oscilloscope display for $V_{CEOsust}$.

1 Measured with half sine-wave voltage (curve tracer).

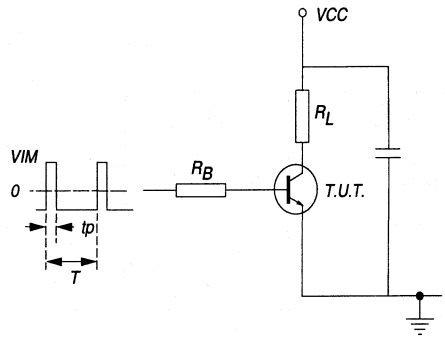


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V V_{CC} = 250 V; t_p = 20 µs; δ = t_p / T = 0.01. R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

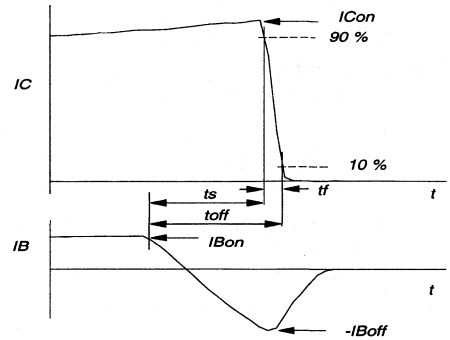


Fig.6. Switching times waveforms with inductive load.

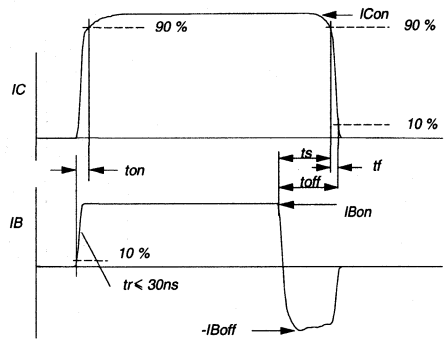


Fig.4. Switching times waveforms with resistive load.

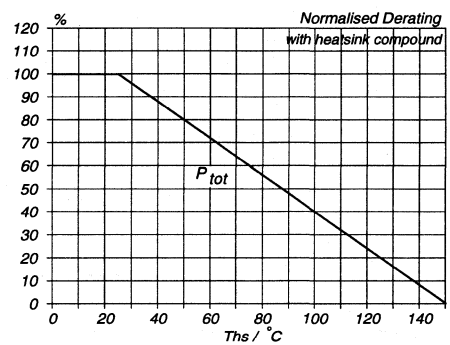


Fig.7. Normalised power derating and second breakdown curves.

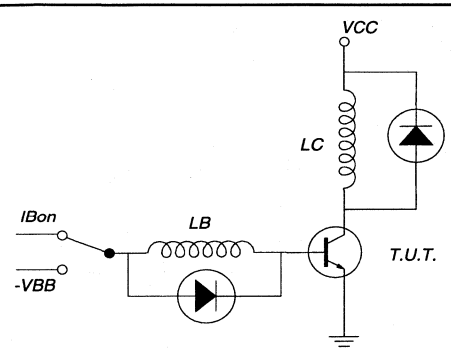


Fig.5. Test circuit inductive load. V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

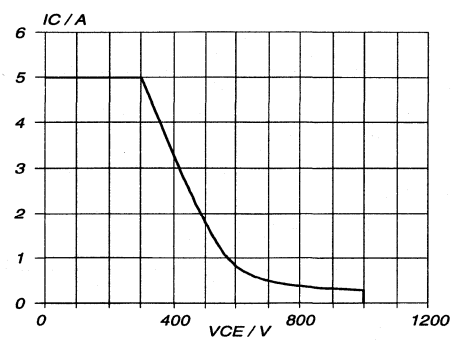


Fig.8. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

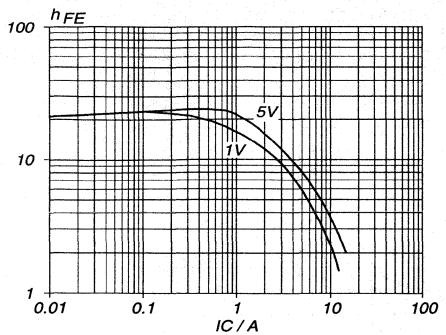


Fig.9. Typical DC current gain.
$h_{FE} = f(I_C)$; parameter V_{CE}

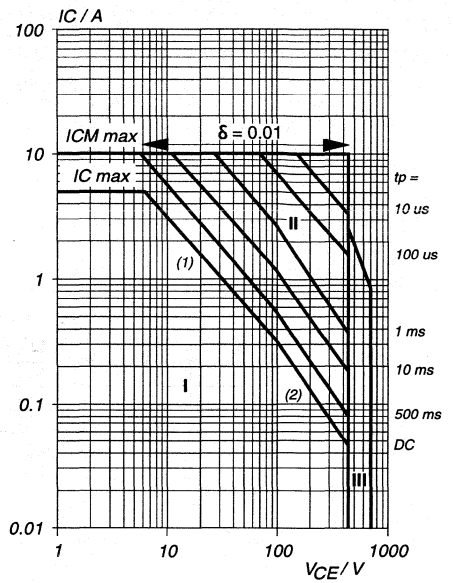


Fig.10. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1)	P_{tot} max and P_{tot} peak max lines.
(2)	Second breakdown limits.
I	Region of permissible DC operation.
II	Extension for repetitive pulse operation.
III	Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6\ \mu s$.
NB:	Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

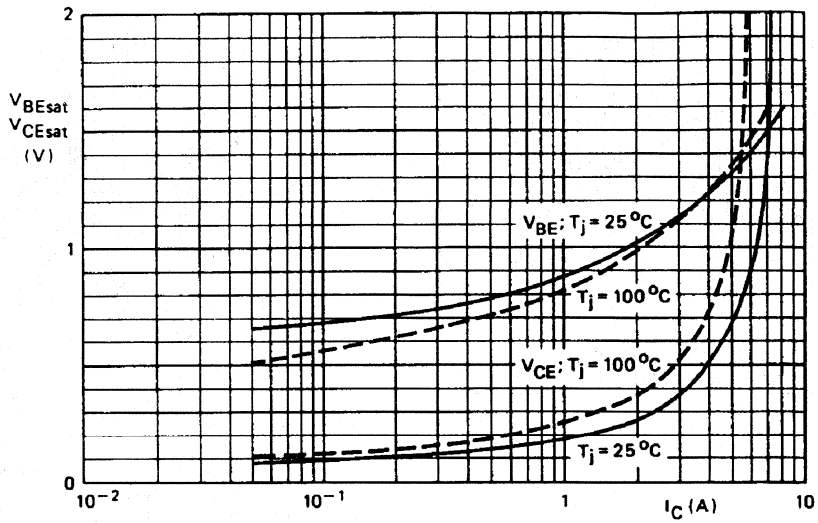


Fig.11. Typical base-emitter and collector-emitter saturation voltages.
$V_{BEsat} = f(I_C)$; $V_{CEsat} = f(I_C)$; $I_C/I_B = 5$

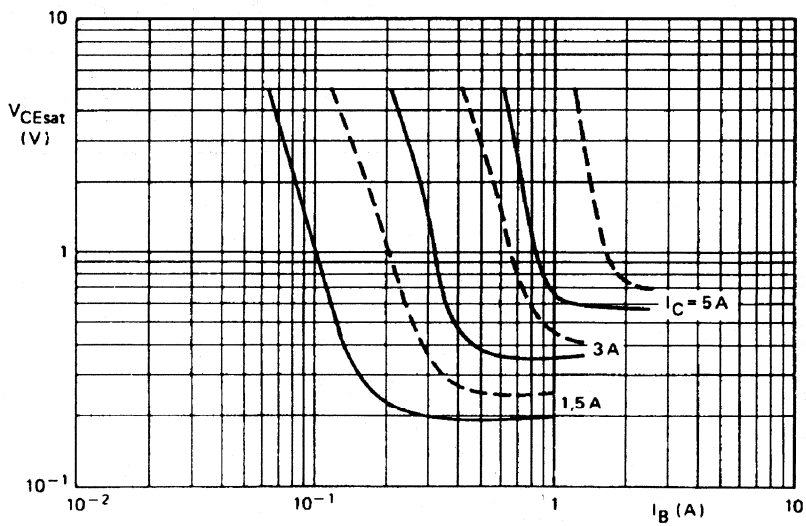


Fig.12. Collector-emitter saturation voltage. Solid lines = typ values, dotted lines = max values. $V_{CEsat} = f(I_B)$; parameter I_C

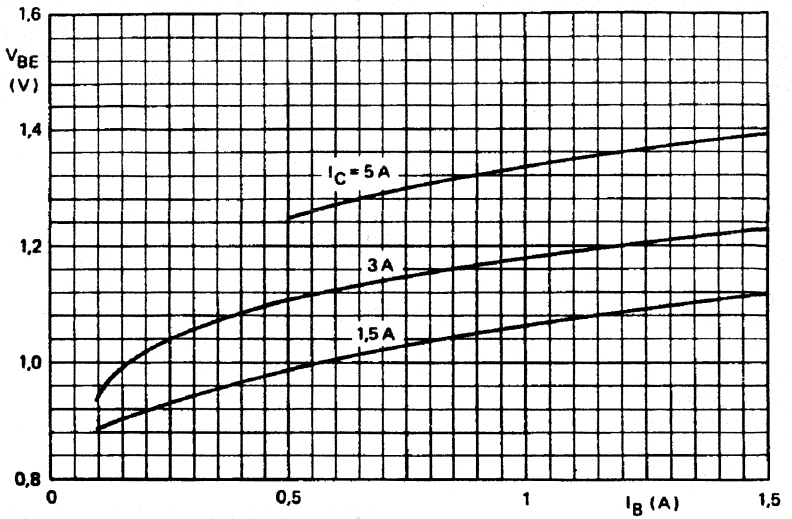


Fig.13. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

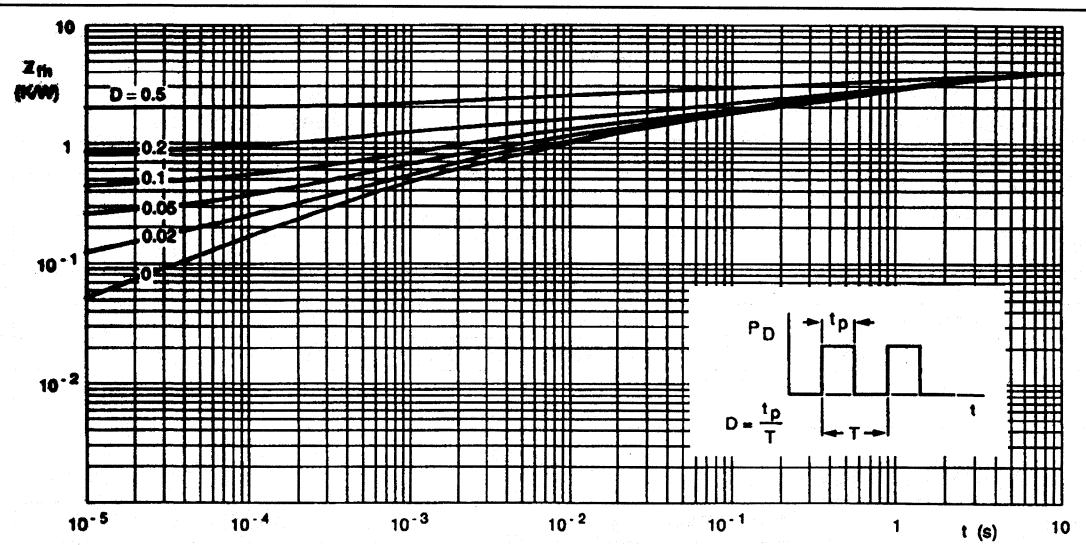


Fig.14. Transient thermal impedance.
$Z_{th\ j\text{-}hs} = f(t)$; parameter $D = t_p/T$

Silicon diffused power transistors BUT12; BUT12A

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a TO-220AB package.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems.

PINNING

PIN	DESCRIPTION
1	base
2	collector; connected to mounting base
3	emitter

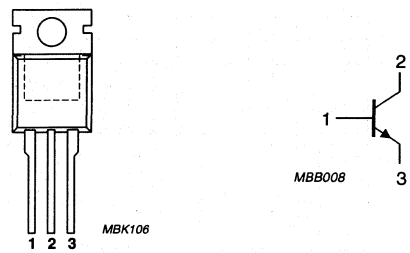


Fig.1 Simplified outline (TO-220AB) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$		
	BUT12		850	V
	BUT12A		1000	V
V_{CEO}	collector-emitter voltage	open base		
	BUT12		400	V
	BUT12A		450	V
V_{CEsat}	collector-emitter saturation voltage	see Fig.8	1.5	V
I_{Csat}	collector saturation current			
	BUT12		6	A
	BUT12A		5	A
I_C	collector current (DC)	see Figs 3 and 4	8	A
I_{CM}	collector current (peak value)	see Fig. 4	20	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.2	125	W
t_f	fall time	resistive load; see Figs 12 and 13	0.8	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	1	K/W

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUT12		–	850	V
	BUT12A		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUT12		–	400	V
	BUT12A		–	450	V
I_{Csat}	collector saturation current				
	BUT12		–	6	A
	BUT12A		–	5	A
I_C	collector current (DC)	see Figs 3 and 4	–	8	A
I_{CM}	collector current (peak value)	see Fig. 4	–	20	A
I_B	base current (DC)		–	4	A
I_{BM}	base current (peak value)		–	6	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.2	–	125	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

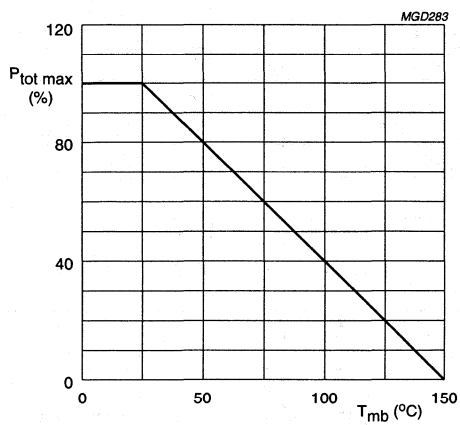
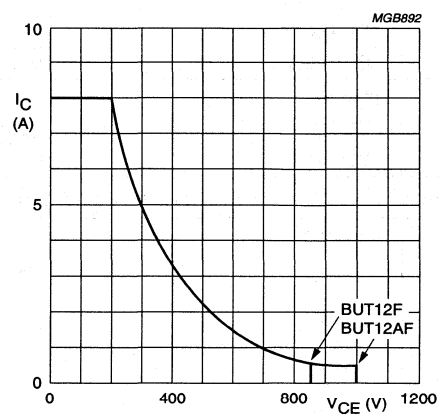


Fig.2 Power derating curve.



$V_{BE} = -1$ to -5 V; $T_c = 100$ °C.

Fig.3 Reverse bias SOAR.

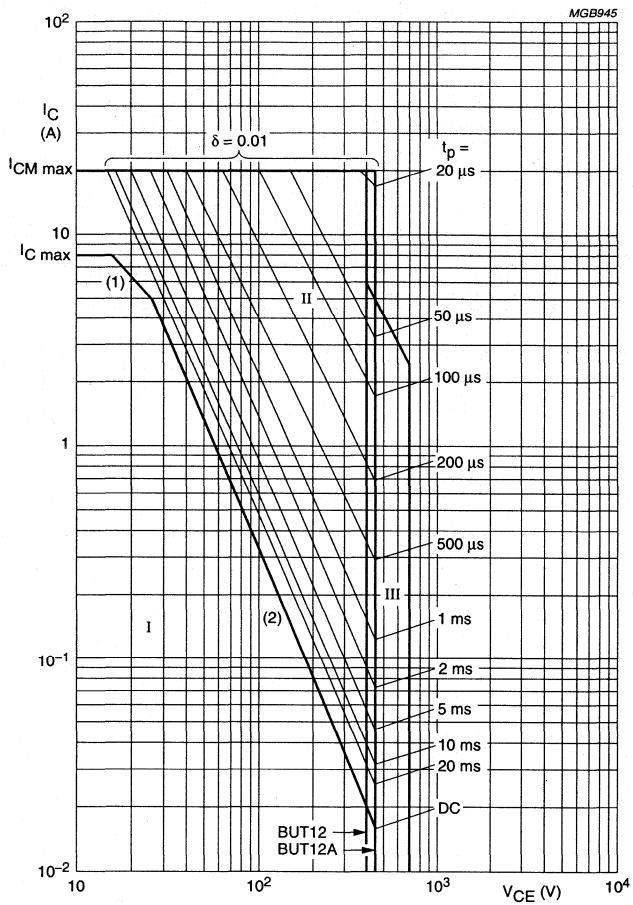
CHARACTERISTICS

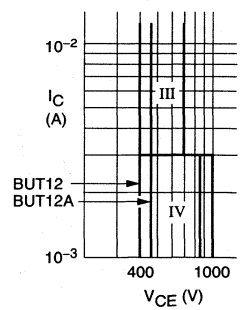
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	I_C = 100 mA; I_{Boff} = 0; L = 25 mH; see Figs 6 and 7				
	BUT12		400	–	–	V
	BUT12A		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage					
	BUT12	I_C = 6 A; I_B = 1.2 A; see Figs 8 and 10	–	–	1.5	V
	BUT12A	I_C = 5 A; I_B = 1 A; see Figs 8 and 10	–	–	1.5	V
V_{BEsat}	base-emitter saturation voltage					
	BUT12	I_C = 6 A; I_B = 1.2 A; see Fig.8	–	–	1.5	V
	BUT12A	I_C = 5 A; I_B = 1 A; see Fig.8	–	–	1.5	V
I_{CES}	collector-emitter cut-off current	V_{CE} = V_{CESmax}; V_{BE} = 0; note 1	–	–	1	mA
		V_{CE} = V_{CESmax}; V_{BE} = 0; T_j = 125 °C; note 1	–	–	3	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 9 V; I_C = 0	–	–	10	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 10 mA; see Fig.11	10	18	35	
		V_{CE} = 5 V; I_C = 1 A; see Fig.11	10	20	35	
Switching times resistive load (see Figs 12 and 13)						
t_{on}	turn-on time					
	BUT12	I_{Con} = 6 A; I_{Bon} = $-I_{Boff}$ = 1.2 A	–	–	1	µs
	BUT12A	I_{Con} = 5 A; I_{Bon} = $-I_{Boff}$ = 1 A	–	–	1	µs
t_s	storage time					
	BUT12	I_{Con} = 6 A; I_{Bon} = $-I_{Boff}$ = 1.2 A	–	–	4	µs
	BUT12A	I_{Con} = 5 A; I_{Bon} = $-I_{Boff}$ = 1 A	–	–	4	µs
t_f	fall time					
	BUT12	I_{Con} = 6 A; I_{Bon} = $-I_{Boff}$ = 1.2 A	–	–	0.8	µs
	BUT12A	I_{Con} = 5 A; I_{Bon} = $-I_{Boff}$ = 1 A	–	–	0.8	µs
Switching times inductive load (see Figs 14 and 15)						
t_s	storage time					
	BUT12	I_{Con} = 6 A; I_{Bon} = 1.2 A; V_{CL} = 250 V; T_c = 100 °C	–	1.9	2.5	µs
	BUT12A	I_{Con} = 5 A; I_{Bon} = 1 A; V_{CL} = 300 V; T_c = 100 °C	–	1.9	2.5	µs
t_f	fall time					
	BUT12	I_{Con} = 6 A; I_{Bon} = 1.2 A; V_{CL} = 250 V; T_c = 100 °C	–	200	300	ns
	BUT12A	I_{Con} = 5 A; I_{Bon} = 1 A; V_{CL} = 300 V; T_c = 100 °C	–	200	300	ns

Note

1. Measured with a half-sinewave voltage (curve tracer).





T_{mb} < 25 °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

(1) $P_{tot\ max}$ and $P_{tot\ peak\ max}$ lines.

(2) Second breakdown limits.

Fig.4 Forward bias SOAR.

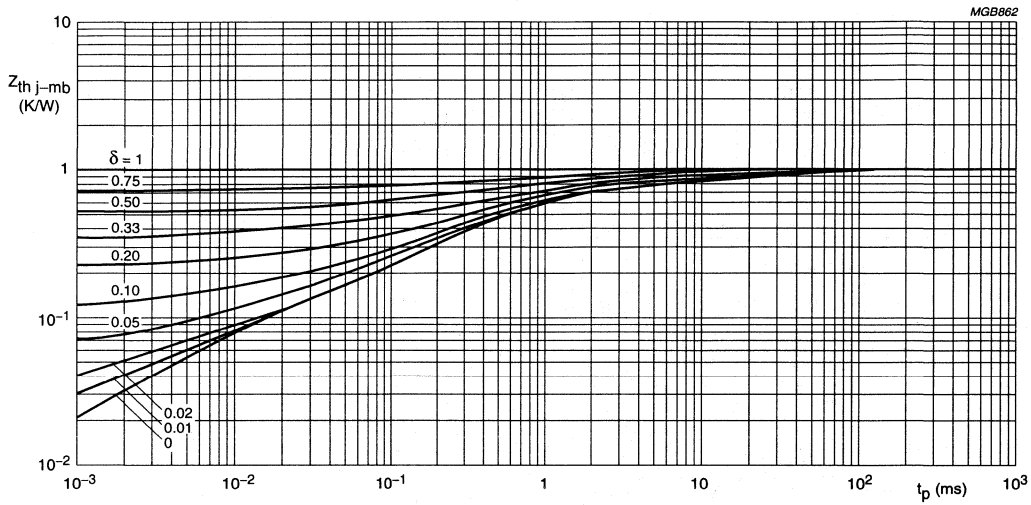


Fig.5 Transient thermal impedance.

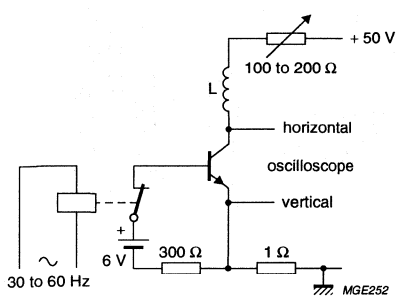


Fig.6 Test circuit for collector-emitter sustaining voltage.

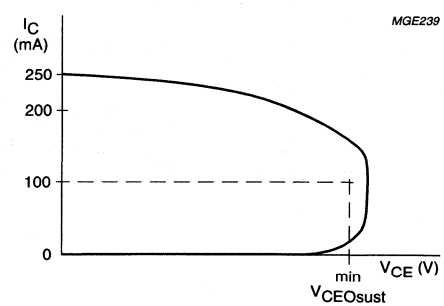
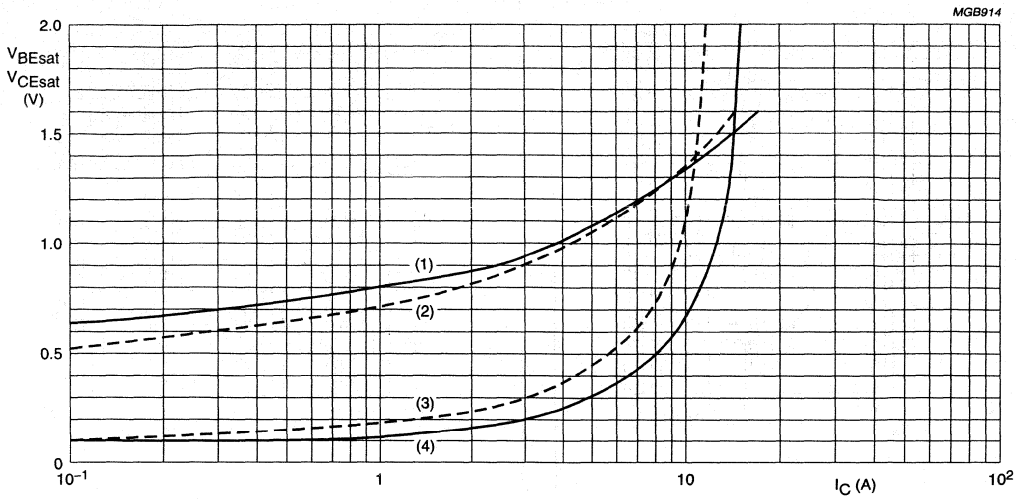


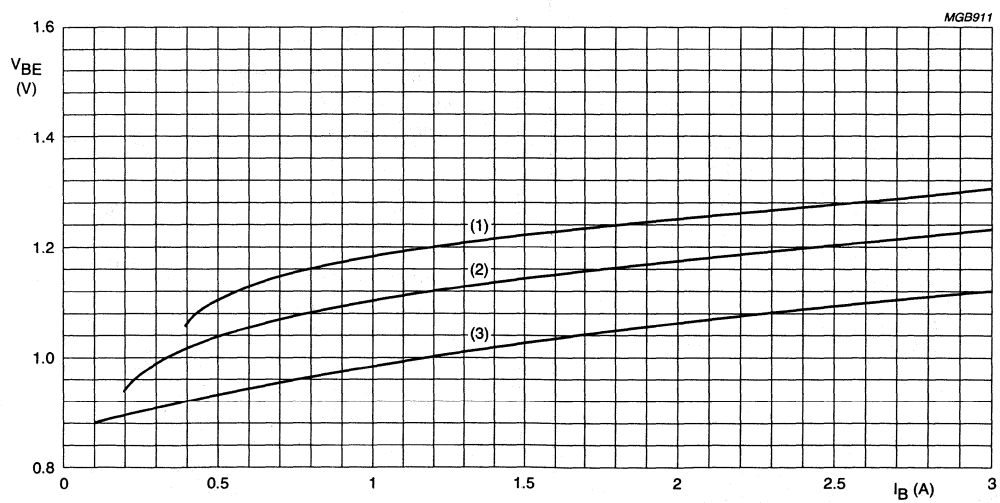
Fig.7 Oscilloscope display for collector-emitter sustaining voltage.



$I_C/I_B = 5$.

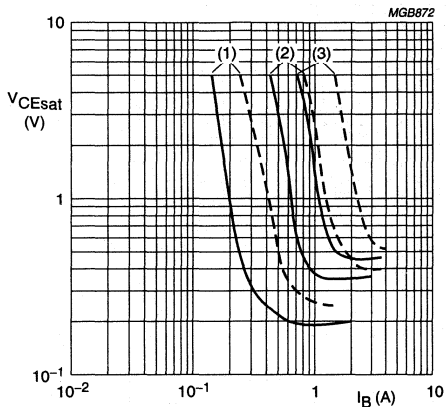
(1) V_{BE}; $T_j = 25$ °C.
(2) V_{BE}; $T_j = 100$ °C.
(3) V_{CE}; $T_j = 100$ °C.
(4) V_{CE}; $T_j = 25$ °C.

Fig.8 Base-emitter and collector-emitter saturation voltages as functions of collector current; typical values.



$T_j = 25$ °C.
(1) $I_C = 8$ A.
(2) $I_C = 6$ A.
(3) $I_C = 3$ A.

Fig.9 Base-emitter voltage as a function of base current; typical values.



(1) $I_C = 3$ A.
(2) $I_C = 6$ A.
(3) $I_C = 8$ A.
$T_j = 25$ °C; solid line: typical values; dotted line: maximum values.

Fig.10 Collector-emitter saturation voltage as a function of base current.

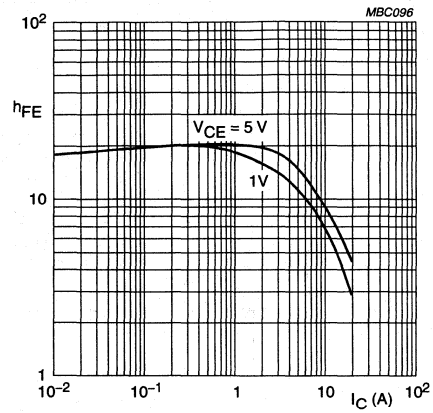
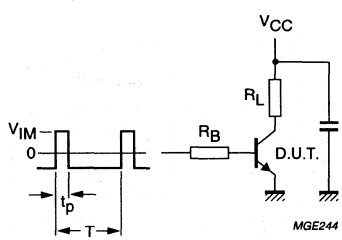
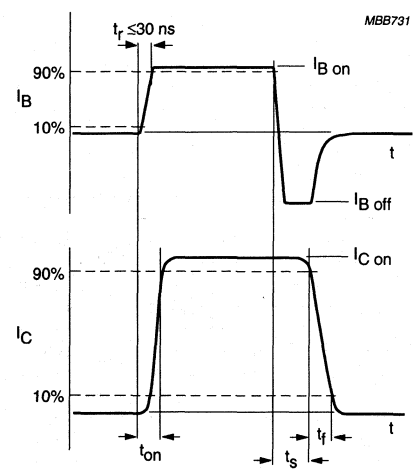


Fig.11 DC current gain; typical values.



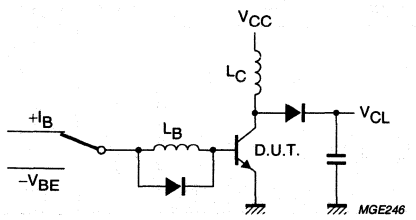
$V_{CC} = 250$ V; $t_p = 20$ µs; $V_{IM} = -6$ to +8 V; $t_p/T = 0.01$.
The values of R_B and R_L are selected in accordance with I_{Con} and I_{Bon} requirements.

Fig.12 Test circuit resistive load.



$t_r \leq 20$ ns.

Fig.13 Switching time waveforms with resistive load.



V_{CL} = up to 1000 V; V_{CC} = 30 V; V_{BE} = −1 to −5 V; L_B = 1 μH; L_C = 200 μH.

Fig.14 Test circuit inductive load and reverse bias SOAR.

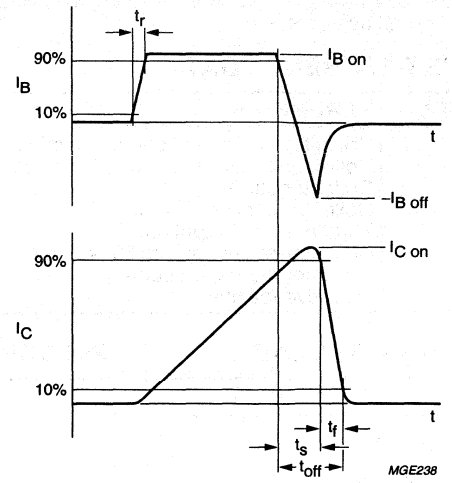


Fig.15 Switching time waveforms with inductive load.

Silicon Diffused Power Transistor — BUT12AI

GENERAL DESCRIPTION

Improved high-voltage, high-speed glass-passivated npn power transistor in a TO220AB envelope specially suited for use in overhead/high frequency lighting ballast applications and converters, inverters, switching regulators, motor control systems, etc.

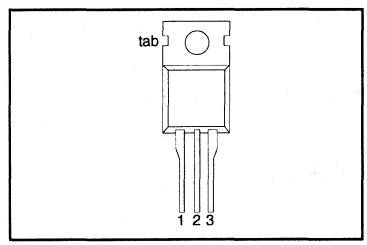
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	20	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	110	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 5 A; I_B = 0.86A	-	1.5	V
I_{Csat}	Collector saturation current		5	-	A
t_f	Inductive fall time	I_{Con} = 5 A; I_{Bon} = 1.0 A; $T_j \leq 100$°C		300	ns

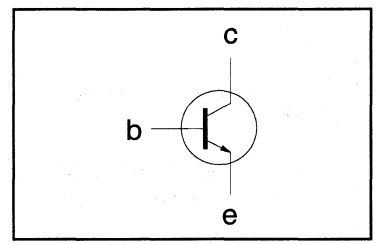
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)		-	8	A
I_{CM}	Collector current peak value		-	20	A
I_B	Base current (DC)		-	4	A
I_{BM}	Base current peak value		-	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	-	110	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	-	1.15	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	-	60	K/W

STATIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	3.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9 V; I_C = 0 A	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L = 25 mH	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 5 A; I_B = 0.86 A	-	-	1.5	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 5 A; I_B = 0.86 A	-	-	1.3	V
h_{FE}	DC current gain	I_C = 10mA; V_{CE} = 5 V	10	18	35	
h_{FE}		I_C = 1.0A; V_{CE} = 5 V	14	20	35	
h_{FEsat}		I_C = 5.0A; V_{CE} = 1.5 V	5.8	10	12.5	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} =5 A; I_{Bon} = -I_{Boff} = 1.0 A			
t_{on}	Turn-on time		-	1.0	µs
t_s	Turn-off storage time		-	4.0	µs
t_f	Turn-off fall time		-	0.8	µs
	Switching times (inductive load)	I_{Con} = 5 A; I_{Bon} = 1.0 A; L_B = 1 µH; -V_{BB} = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		1.9	2.5	µs
t_f	Turn-off fall time		150	300	ns

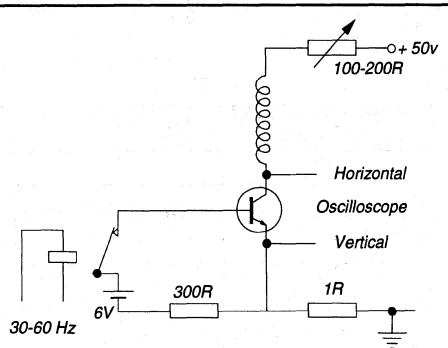


Fig.1. Test circuit for $V_{CEOsust}$.

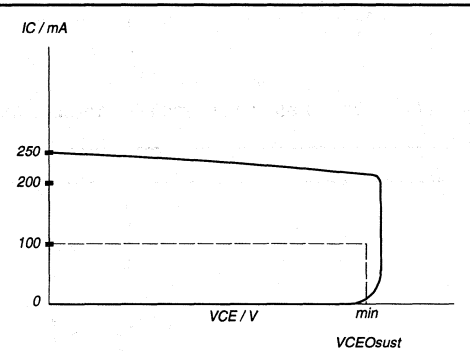


Fig.2. Oscilloscope display for $V_{CEOsust}$.

1 Measured with half sine-wave voltage (curve tracer).

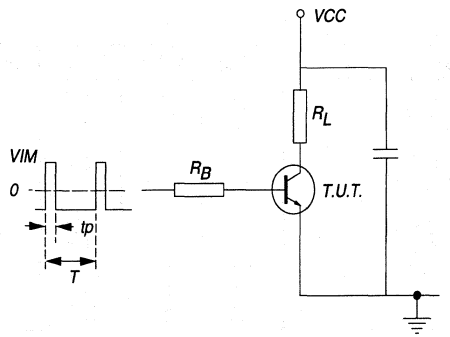


Fig.3. Test circuit resistive load. VIM = -6 to +8 V
V_{CC} = 250 V; tp = 20 µs; δ = tp / T = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

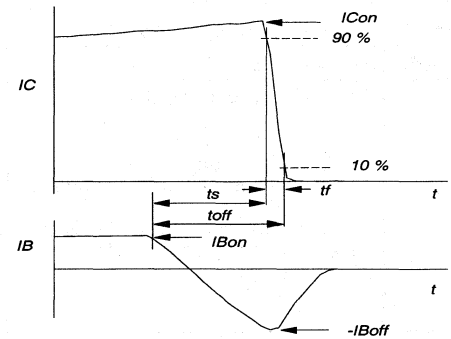


Fig.6. Switching times waveforms with inductive load.

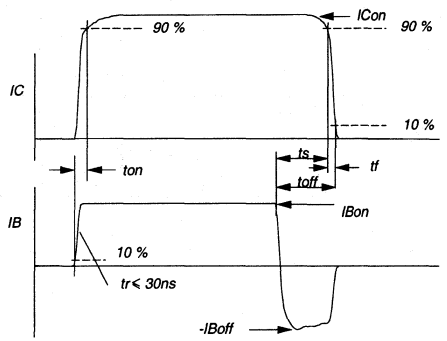


Fig.4. Switching times waveforms with resistive load.

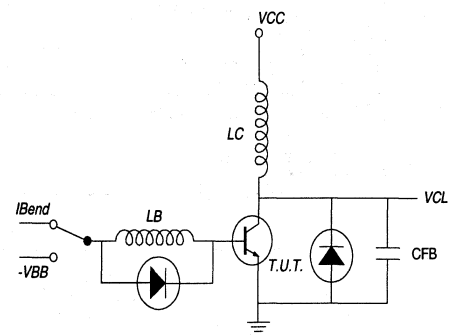


Fig.7. Test circuit RBSOA. V_{CC} = 150 V; $-V_{BB}$ = 5 V
L_C = 200 µH; V_{CL} ≤ 850 V; L_B = 1 µH

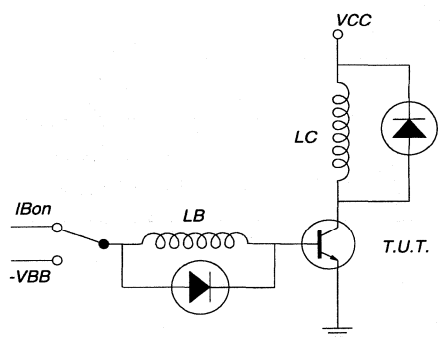


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_B = 1 uH

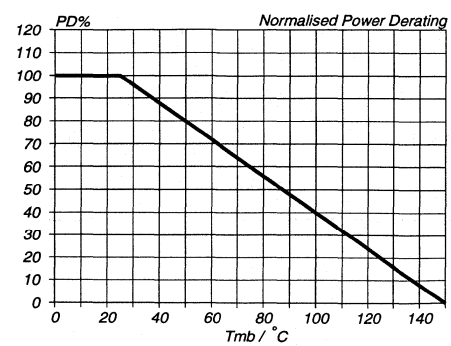


Fig.8. Normalised power dissipation.
PD% = 100·PD/PD $_{25°C}$ = f (T_{mb})

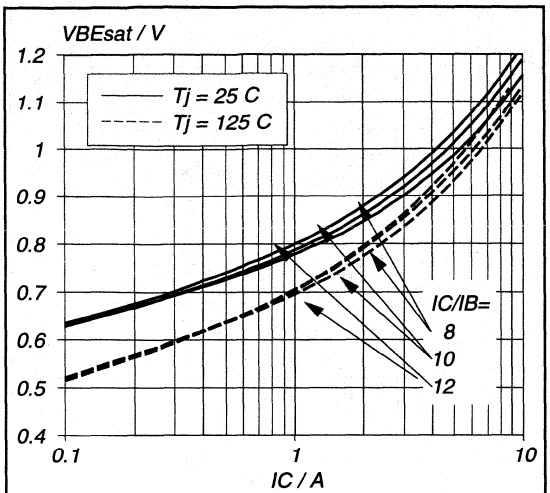


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_C)$; parameter I_C/I_B

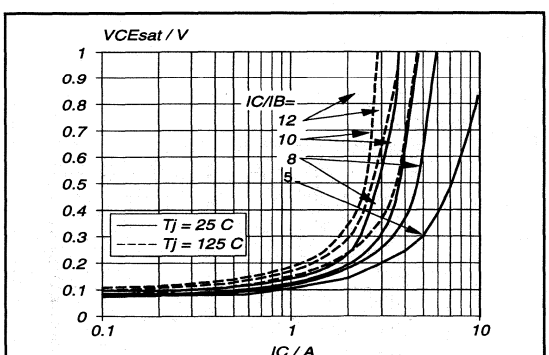


Fig.10. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

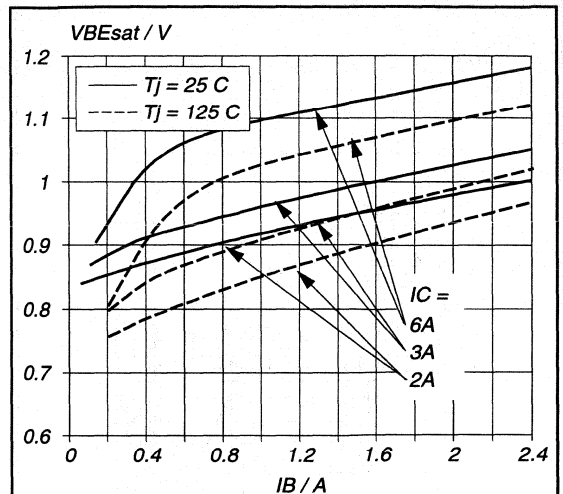


Fig.11. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

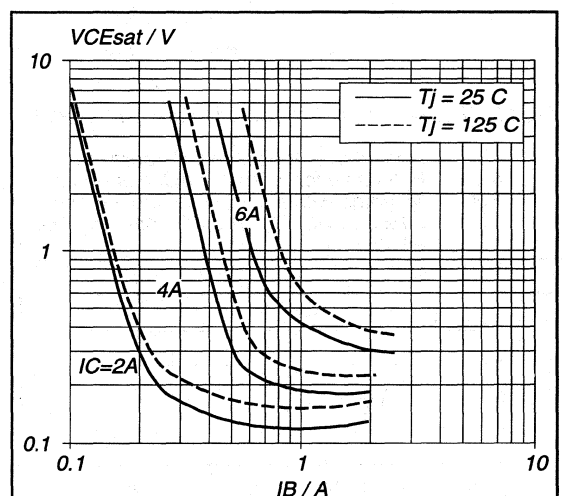


Fig.12. Typical collector-emitter saturation voltage.
VCEsat = f(IB); parameter IC

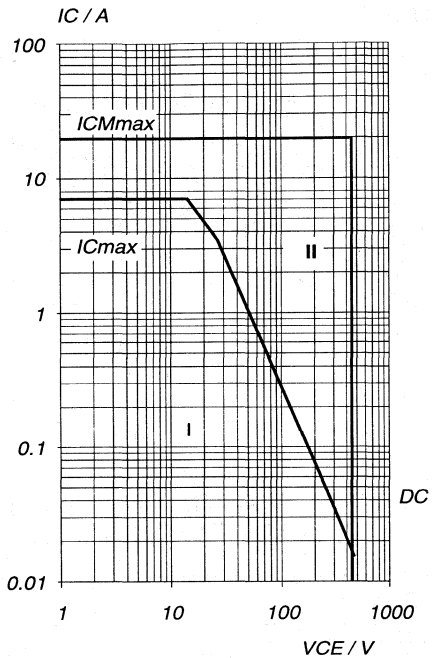


Fig.13. Forward bias safe operating area. T_{mb} = 25˚C

I Region of permissible DC operation.
II Extension for repetitive pulse operation.
NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

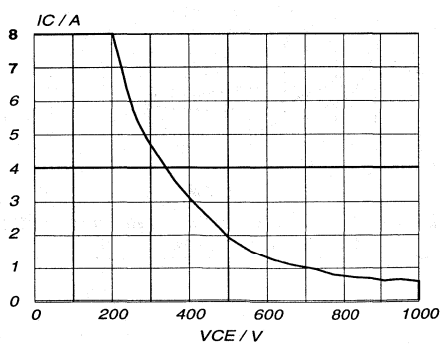


Fig.14. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

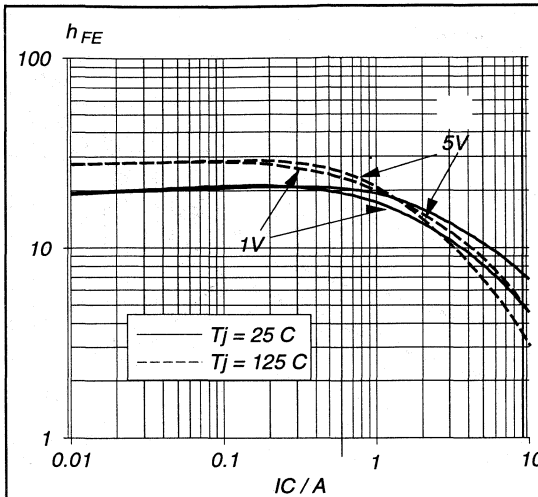


Fig.15. Typical DC current gain. hFE = f(IC) parameter VCE

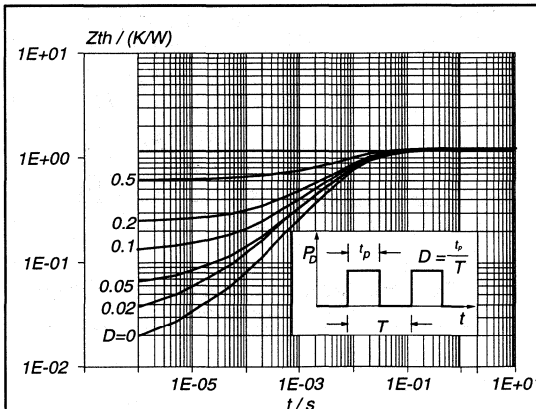


Fig.16. Transient thermal impedance. $Z_{th\,j\text{-}mb} = f(t)$; parameter $D = t_p/T$

Silicon diffused power transistors BUT18; BUT18A

DESCRIPTION

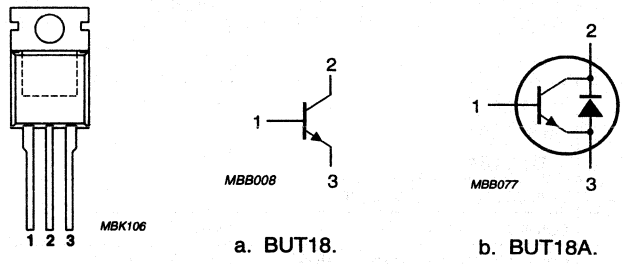
High-voltage, high-speed, glass-passivated NPN power transistor in a TO-220AB package.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems.

PINNING

PIN	DESCRIPTION
1	base
2	collector; connected to mounting base
3	emitter



a. BUT18. b. BUT18A.

Fig.1 Simplified outline (TO-220AB) and symbols.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$		
	BUT18		850	V
	BUT18A		1000	V
V_{CEO}	collector-emitter voltage	open base		
	BUT18		400	V
	BUT18A		450	V
V_{CEsat}	collector-emitter saturation voltage	see Fig.7	1.5	V
I_{Csat}	collector saturation current		4	A
I_C	collector current (DC)	see Fig.2	6	A
I_{CM}	collector current (peak value)	see Fig.2	12	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.4	110	W
t_f	fall time	resistive load; see Figs 10 and 11	0.8	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	1.15	K/W

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUT18		–	850	V
	BUT18A		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUT18		–	400	V
	BUT18A		–	450	V
I_{Csat}	collector saturation current		–	4	A
I_C	collector current (DC)	see Fig.2	–	6	A
I_{CM}	collector current (peak value)	see Fig.2	–	12	A
I_B	base current (DC)		–	3	A
I_{BM}	base current (peak value)		–	6	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.4	–	110	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

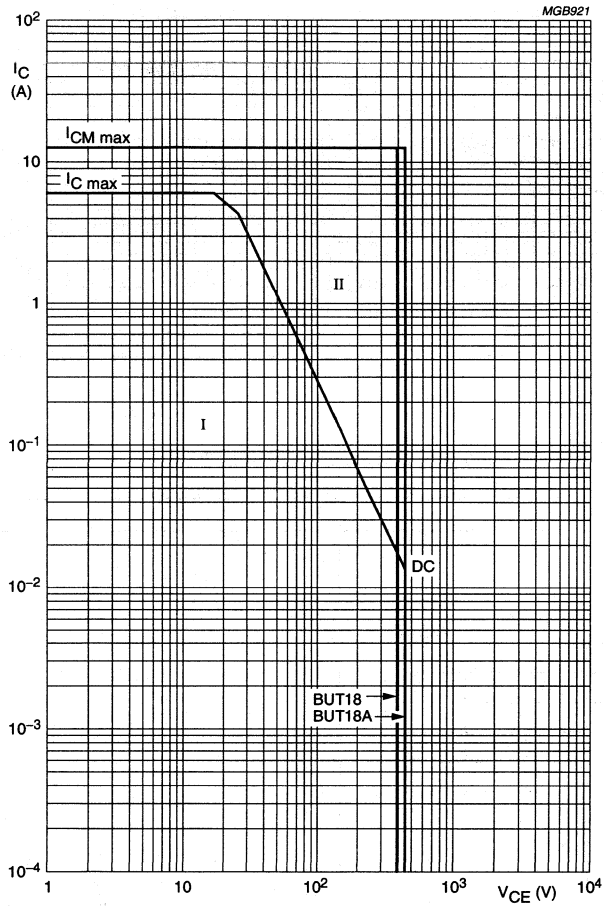
CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	$I_C = 0.1$ A; $I_{Boff} = 0$; L = 25 mH; see Figs 5 and 6				
	BUT18		400	–	–	V
	BUT18A		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 4$ A; $I_B = 0.8$ A; see Fig.7	–	–	1.5	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 4$ A; $I_B = 0.8$ A; see Fig.8	–	–	1.3	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESMmax}$; $V_{BE} = 0$; note 1	–	–	1	mA
		$V_{CE} = V_{CESMmax}$; $V_{BE} = 0$; $T_j = 125$ °C; note 1	–	–	2	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 9$ V; $I_C = 0$	–	–	10	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 10$ mA; see Fig.9	10	18	35	
		$V_{CE} = 5$ V; $I_C = 1$ A; see Fig.9	10	20	35	
Switching times resistive load (see Figs 10 and 11)						
t_{on}	turn-on time	$I_{Con} = 4$ A; $I_{Bon} = -I_{Boff} = 800$ mA	–	–	1	µs
t_s	storage time	$I_{Con} = 4$ A; $I_{Bon} = -I_{Boff} = 800$ mA	–	–	4	µs
t_f	fall time	$I_{Con} = 4$ A; $I_{Bon} = -I_{Boff} = 800$ mA	–	–	0.8	µs
Switching times inductive load (see Figs 10 and 13)						
t_s	storage time	$I_{Con} = 4$ A; $I_{Bon} = 800$ mA; $V_{CL} = 250$ V	–	1.6	2.5	µs
t_f	fall time	$I_{Con} = 4$ A; $I_{Bon} = 800$ mA; $V_{CL} = 250$ V	–	150	400	ns

Note

1. Measured with a half-sinewave voltage (curve tracer).



T_{mb} = 25 °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

Fig.2 Forward bias SOAR.

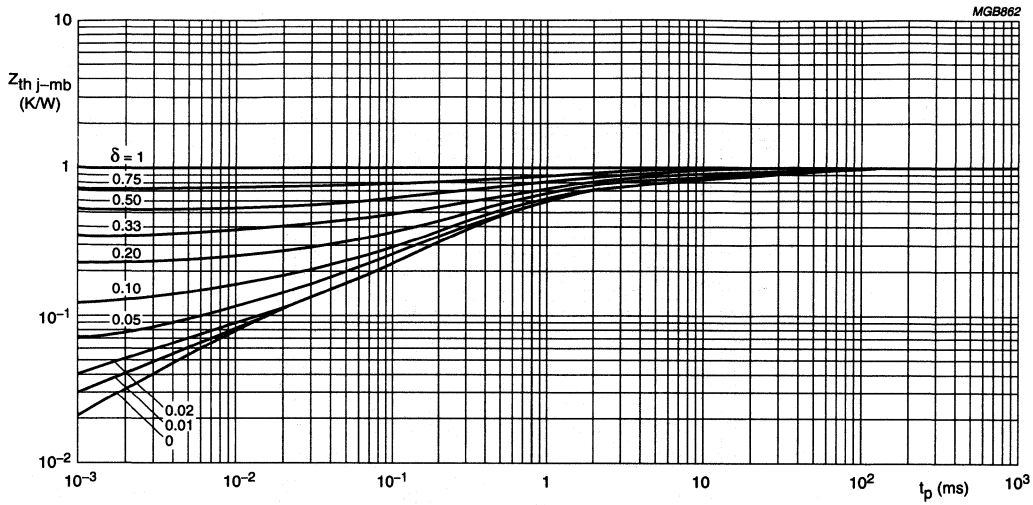


Fig.3 Transient thermal impedance.

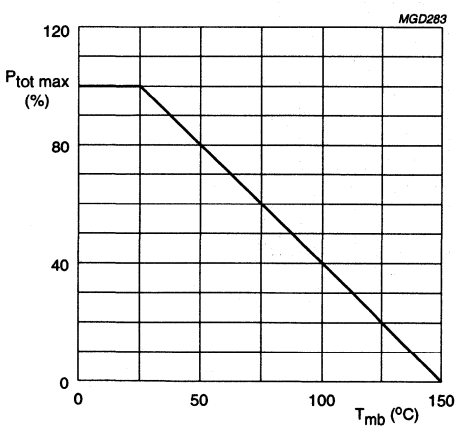


Fig.4 Power derating curve.

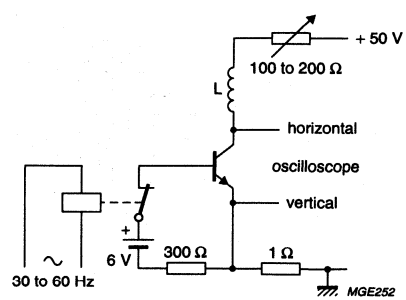


Fig.5 Test circuit for collector-emitter sustaining voltage.

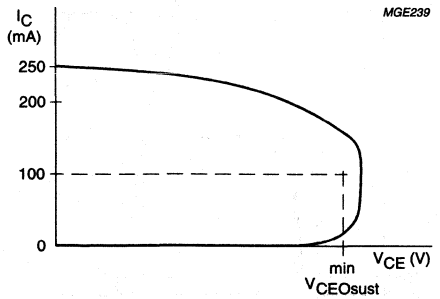
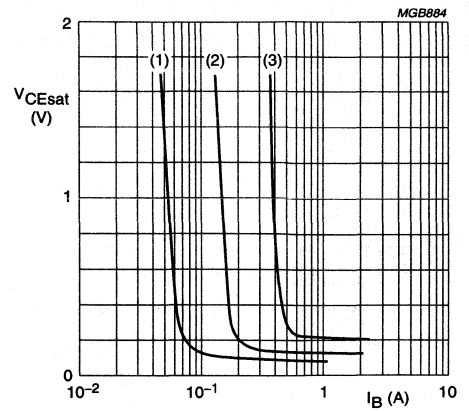
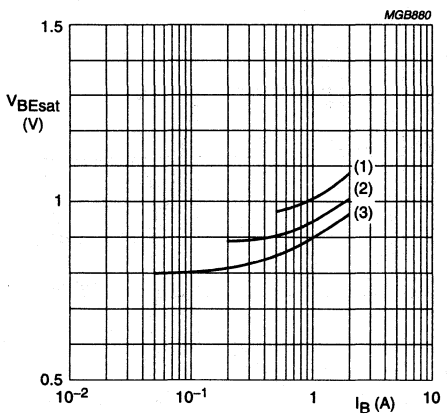


Fig.6 Oscilloscope display for collector-emitter sustaining voltage.



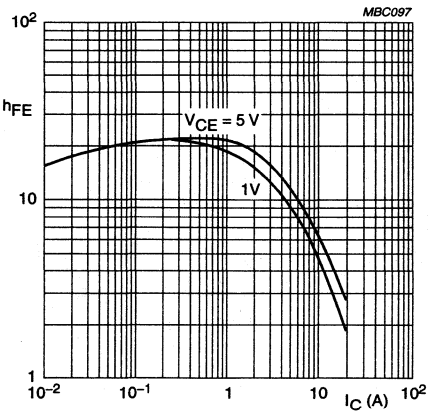
T_j = 25 °C.
(1) I_C = 1 A.
(2) I_C = 2 A.
(3) I_C = 4 A.

Fig.7 Collector-emitter saturation voltage as a function of base current.



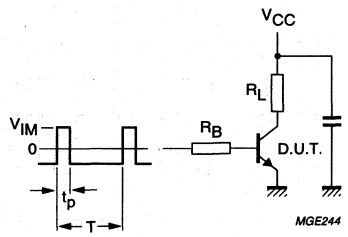
T_j = 25 °C.
(1) I_C = 4 A.
(2) I_C = 2 A.
(3) I_C = 1 A.

Fig.8 Base-emitter saturation voltage as a function of base current.



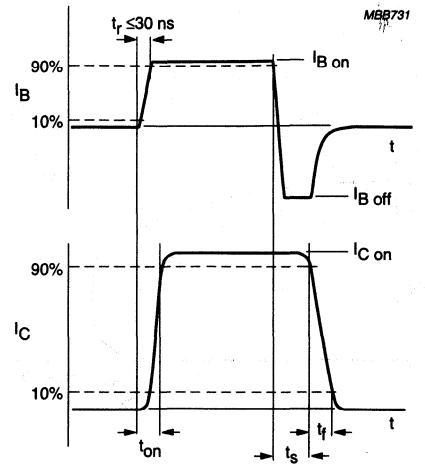
V_{CE} = 5 V; T_j = 25 °C.

Fig.9 DC current gain; typical values.



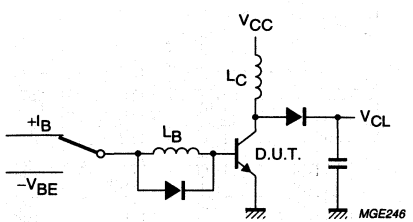
V_{CC} = 250 V; t_p = 20 µs; V_{IM} = −6 to +8 V; t_p/T = 0.01.
The values of R_B and R_L are selected in accordance with I_{Con} and I_{Bon} requirements.

Fig.10 Test circuit resistive load.



t_r ≤ 30 ns.

Fig.11 Switching time waveforms with resistive load.



V_{CL} = up to 1000 V; V_{CC} = 30 V; V_{BE} = −5 V; L_B = 1 µH (0 for reverse bias SOAR); L_C = 200 µH.

Fig.12 Test circuit inductive load and reverse bias SOAR.

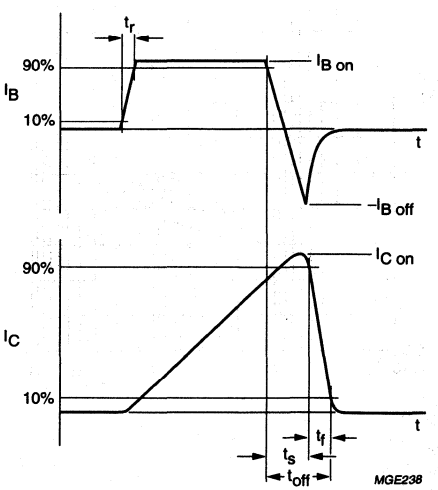


Fig.13 Switching times waveforms with inductive load.

Silicon diffused power transistors — BUT18F; BUT18AF

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a SOT186 package with electrically isolated mounting base.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter
mb	mounting base; electrically isolated from all pins

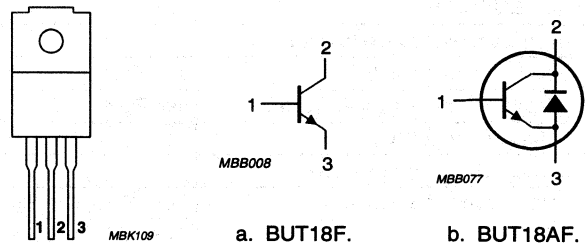


Fig.1 Simplified outline (SOT186) and symbols.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$		
	BUT18F		850	V
	BUT18AF		1000	V
V_{CEO}	collector-emitter voltage	open base		
	BUT18F		400	V
	BUT18AF		450	V
V_{CEsat}	collector-emitter saturation voltage	see Fig.7	1.5	V
I_{Csat}	collector saturation current		4	A
I_C	collector current (DC)	see Fig.4	6	A
I_{CM}	collector current (peak value)	see Fig.4	12	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.2	33	W
t_f	fall time	resistive load; see Figs 10 and 11	0.8	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}h}$	thermal resistance from junction to external heatsink	note 1	6.15	K/W
		note 2	3.65	K/W

Notes

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
2. Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUT18F		–	850	V
	BUT18AF		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUT18F		–	400	V
	BUT18AF		–	450	V
I_{Csat}	collector saturation current		–	4	A
I_C	collector current (DC)	see Fig.4	–	6	A
I_{CM}	collector current (peak value)	see Fig.4	–	12	A
I_B	base current (DC)		–	3	A
I_{BM}	base current (peak value)		–	6	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.2; note 1	–	20	W
		$T_h \leq 25$ °C; see Fig.2; note 2	–	33	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Notes

1. **Without** heatsink compound.
2. **With** heatsink compound.

ISOLATION CHARACTERISTICS

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
V_{isolM}	isolation voltage from all terminals to external heatsink (peak value)	–	1500	V
C_{isol}	isolation capacitance from collector to external heatsink	12	–	pF

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	$I_C = 100$ mA; $I_{Boff} = 0$; L = 25 mH; see Figs 3 and 6				
	BUT18F		400	–	–	V
	BUT18AF		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 4$ A; $I_B = 800$ mA; see Fig.7	–	–	1.5	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 4$ A; $I_B = 800$ mA; see Fig.8	–	–	1.3	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESMmax}$; $V_{BE} = 0$; note 1	–	–	1	mA
		$V_{CE} = V_{CESMmax}$; $V_{BE} = 0$; $T_j = 125$ °C; note 1	–	–	2	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 9$ V; $I_C = 0$	–	–	10	mA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 10 mA; see Fig.9	10	18	35	
		V_{CE} = 5 V; I_C = 1 A; see Fig.9	10	20	35	
Switching times resistive load (see Figs 10 and 11)						
t_{on}	turn-on time	I_{Con} = 4 A; I_{Bon} = $-I_{Boff}$ = 800 mA	–	–	1	µs
t_s	storage time	I_{Con} = 4 A; I_{Bon} = $-I_{Boff}$ = 800 mA	–	–	4	µs
t_f	fall time	I_{Con} = 4 A; I_{Bon} = $-I_{Boff}$ = 800 mA	–	–	0.8	µs
Switching times inductive load (see Figs 10 and 13)						
t_s	storage time	I_{Con} = 4 A; I_{Bon} = 800 mA	–	1.6	2.5	µs
t_f	fall time	I_{Con} = 4 A; I_{Bon} = 800 mA	–	150	400	ns

Note

1. Measured with a half-sinewave voltage (curve tracer).

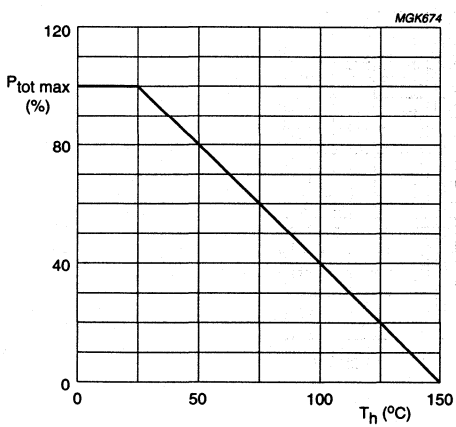


Fig.2 Power derating curve.

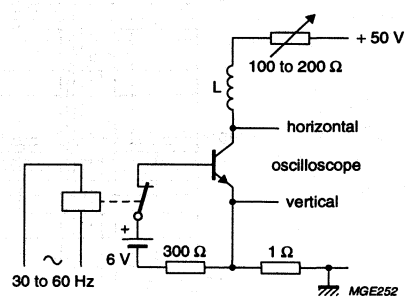
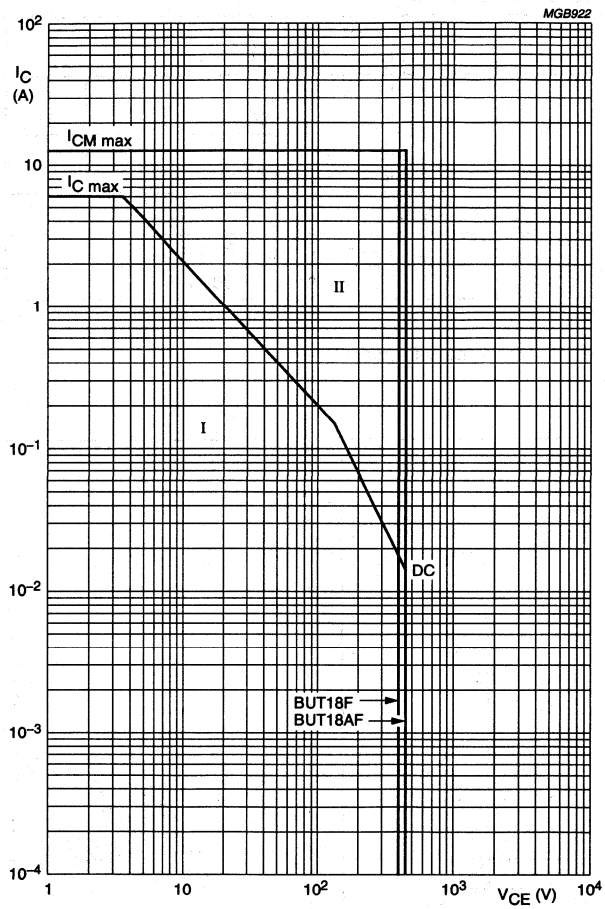


Fig.3 Test circuit for collector-emitter sustaining voltage.



Mounted **without** heatsink compound and 30 ±5 N force on centre of package.

T_{mb} < 25 °C

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

Fig.4 Forward bias SOAR.

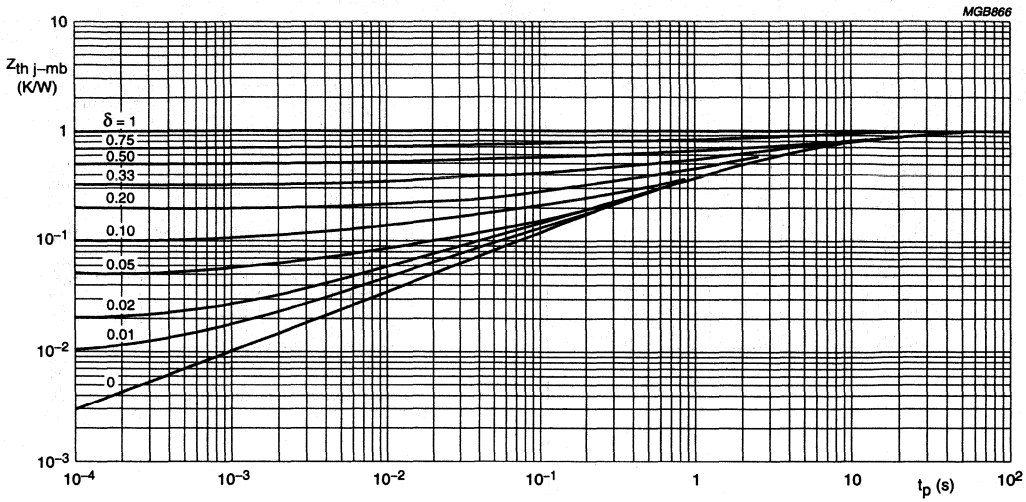


Fig.5 Transient thermal impedance.

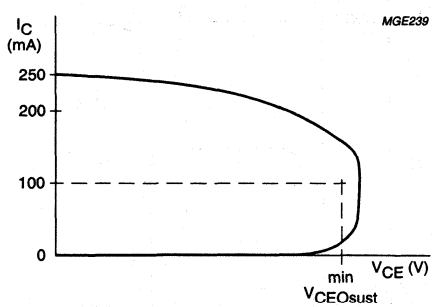
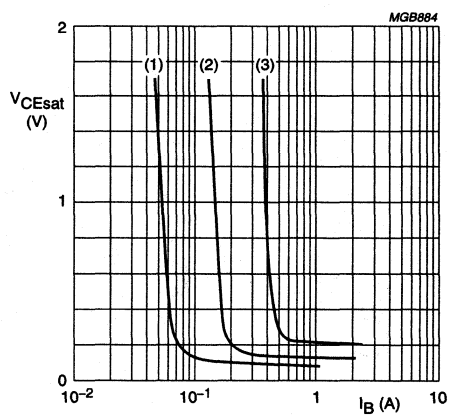
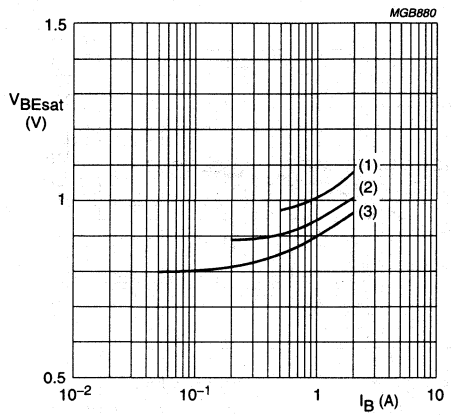


Fig.6 Oscilloscope display for collector-emitter sustaining voltage.



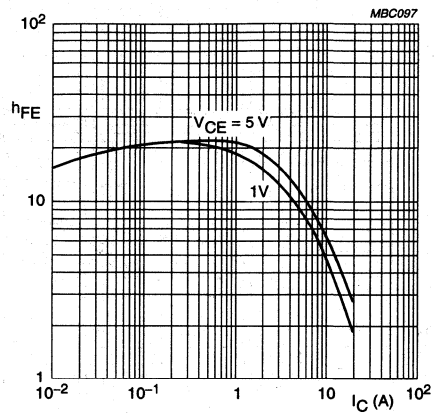
T_j = 25 °C.
(1) I_C = 1 A.
(2) I_C = 2 A.
(3) I_C = 4 A.

Fig.7 Collector-emitter saturation voltage as a function of base current.



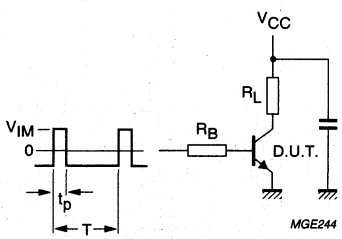
T_j = 25 °C.
(1) I_C = 4 A.
(2) I_C = 2 A.
(3) I_C = 1 A.

Fig.8 Base-emitter saturation voltage as a function of base current.



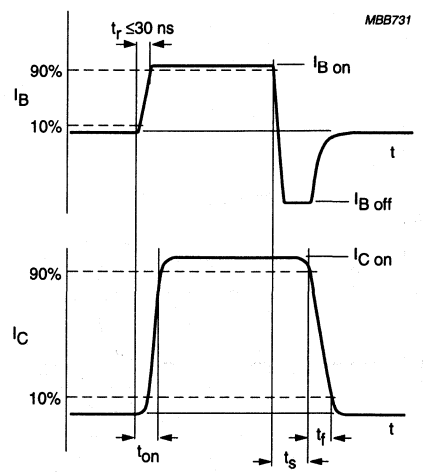
V_{CE} = 5 V; T_j = 25 °C.

Fig.9 DC current gain; typical values.



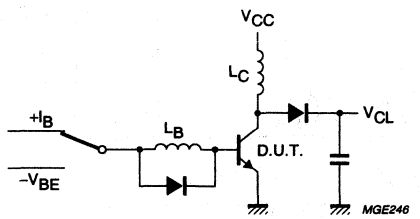
V_{CC} = 250 V; t_p = 20 µs; V_{IM} = −6 to +8 V; t_p/T = 0.01.
The values of R_B and R_L are selected in accordance with I_{Con} and I_{Bon} requirements.

Fig.10 Test circuit resistive load.



t_r ≤ 20 ns.

Fig.11 Switching times waveforms with resistive load.



V_{CL} = 300 V; V_{CC} = 30 V; V_{BE} = −5 V; L_B = 1 μH; L_C = 200 μH.

Fig.12 Test circuit inductive load.

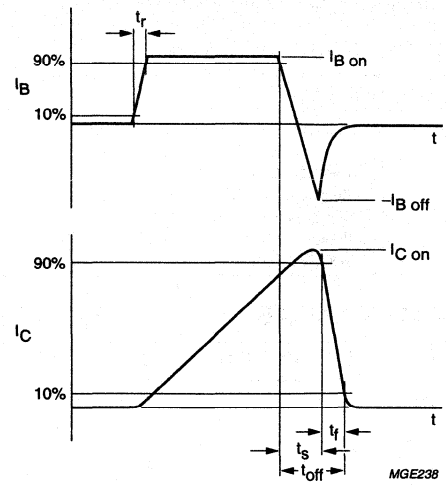


Fig.13 Switching time waveforms with inductive load.

Silicon Diffused Power Transistor — BUT211

GENERAL DESCRIPTION

Enhanced performance, new generation, high speed switching npn transistor in TO220AB envelope specially suited for high frequency electronic lighting ballast applications.

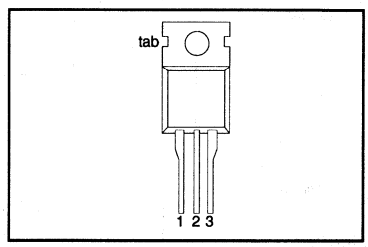
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	100	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.4 A	-	2.0	V
t_f	Inductive fall time	I_{Con} = 3.0 A; I_{Bon} = 0.3 A	-	0.1	µs

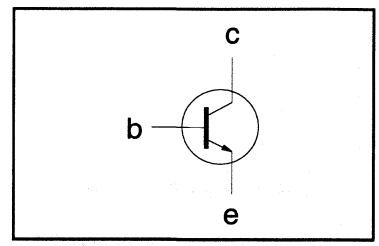
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	850	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
I_C	Collector current (DC)		-	5	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{mb} \leq$ 25 °C	-	100	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.25	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	-	60	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER		CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current [1]		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}			V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	2.0	mA
I_{EBO}	Emitter cut-off current		V_{EB} = 9.0 V; I_C = 0 A	-	-	10.0	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage		I_B = 0 A; I_C = 100 mA; L = 25 mH	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage		I_C = 3.0 A; I_B = 0.4 A	-	0.8	2.0	V
V_{BEsat}	Base-emitter saturation voltage		I_C = 3.0 A; I_B = 0.4 A	-	-	1.3	V
h_{FE}	DC current gain		I_C = 1.0 A; V_{CE} = 2 V	13	21	30	
h_{FE}			I_C = 3.0 A; V_{CE} = 2 V	7.5	11	-	
h_{FE}	Gain bands[2]	1	I_C = 1.0 A; V_{CE} = 2 V	13	-	20	
	(Acceptance limits)	2		18	-	25	
		3		23	-	30	

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times resistive load	I_{Con} = 3.0 A; I_{Bon} = 0.3 A; $-I_{Boff}$ = 0.6 A			
t_s	Turn-off storage time		1.5	2.0	µs
t_f	Turn-off fall time		0.5	0.8	µs
	Switching times inductive load	I_{Con} = 3.0 A; I_{Bon} = 0.3 A; L_B = 1 µH; $-V_{BB}$ = 5 V			
t_s	Turn-off storage time		1.0	1.2	µs
t_f	Turn-off fall time		60	100	ns
		I_{Con} = 3.0 A; I_{Bon} = 0.3 A; L_B = 1 µH; $-V_{BB}$ = 5 V; T_j = 100 °C			
t_s	Turn-off storage time		1.1	1.4	µs
t_f	Turn-off fall time		120	250	ns

1 Measured with half sine-wave voltage (curve tracer).

2 Gain Banding.

Product is divided into 3 gain bands for matching purposes.
The gain band is printed on the device.
All devices within a device rail will be from the same gain band.
However, a box may contain rails from more than one band.
Band quantities are shown on the box label.
It is not possible to order specific gain bands.

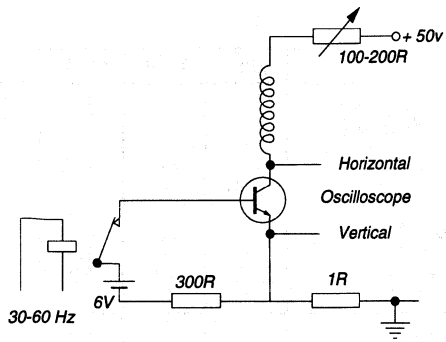


Fig.1. Test circuit for $V_{CEOsust}$.

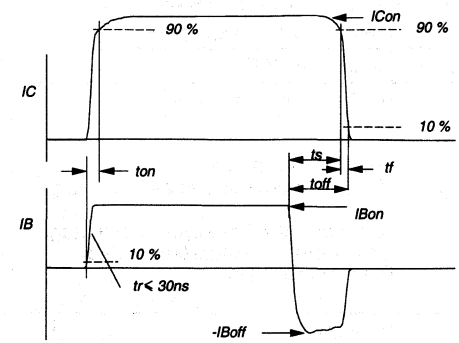


Fig.4. Switching times waveforms with resistive load.

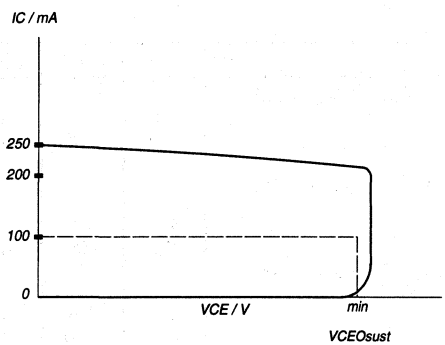


Fig.2. Oscilloscope display for $V_{CEOsust}$.

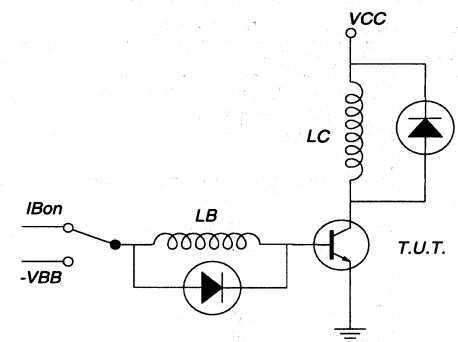


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_B = 1 uH

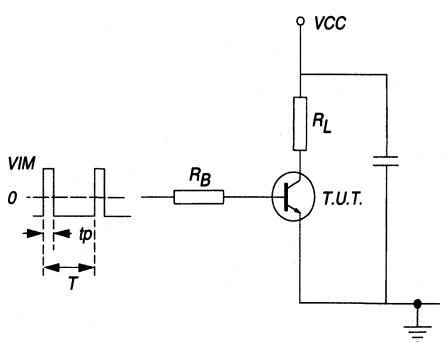


Fig.3. Test circuit resistive load. VIM = -6 to +8 V
V_{CC} = 250 V; tp = 20 µs; δ = tp / T = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

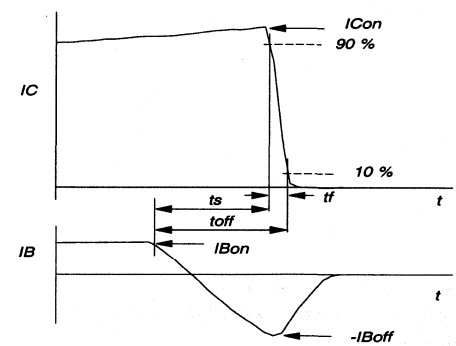


Fig.6. Switching times waveforms with inductive load.

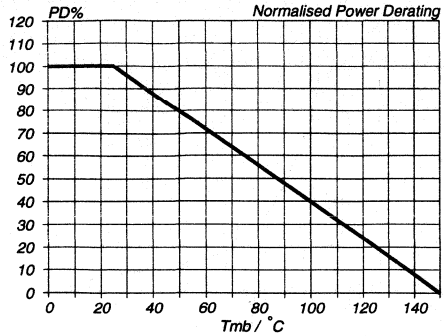


Fig.7. Normalised power dissipation.
$PD\% = 100 \cdot PD/PD_{25°C} = f(T_{mb})$

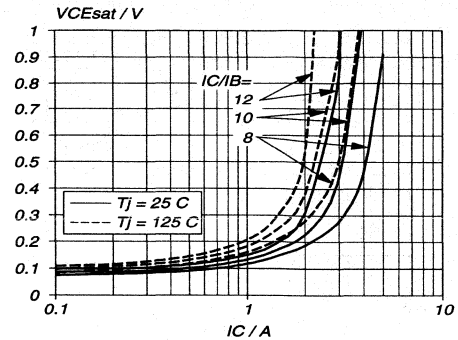


Fig.10. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_C)$; parameter I_C/I_B

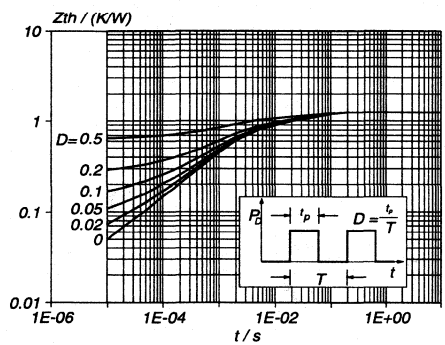


Fig.8. Transient thermal impedance.
$Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

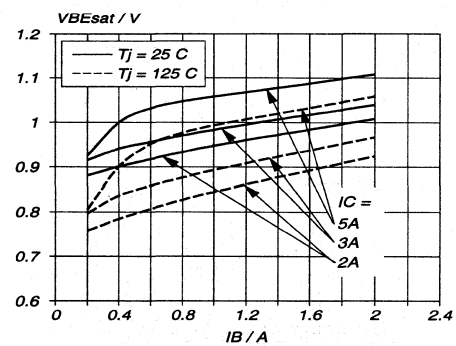


Fig.11. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_B)$; parameter I_C

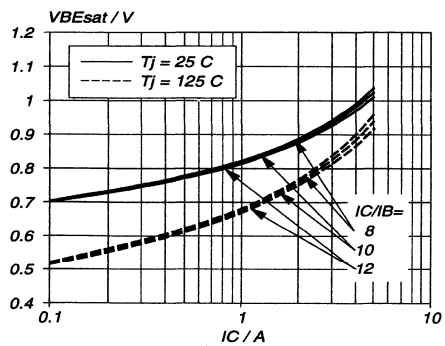


Fig.9. Typical base-emitter saturation voltage.
$V_{BEsat} = f(I_C)$; parameter I_C/I_B

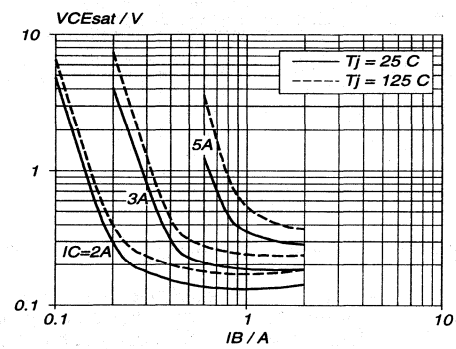


Fig.12. Typical collector-emitter saturation voltage.
$V_{CEsat} = f(I_B)$; parameter I_C

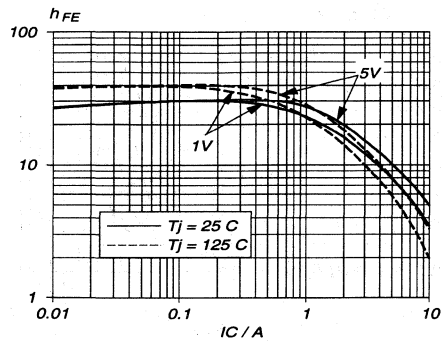


Fig.13. Typical DC current gain. $h_{FE} = f(I_C)$ parameter V_{CE}

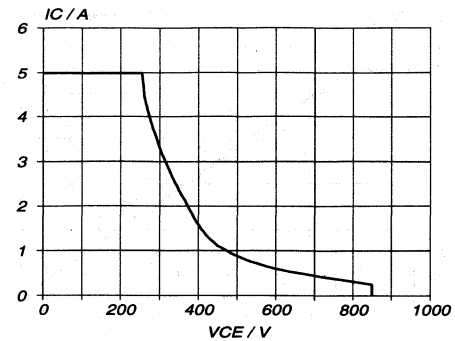


Fig.15. Reverse bias safe operating area. $T_j \leq T_{j\,max}$

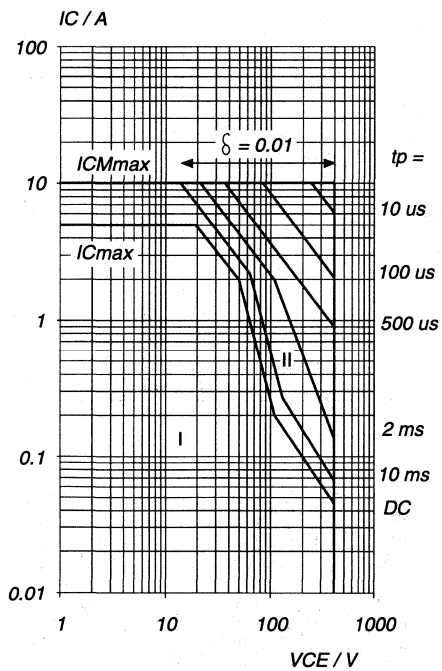


Fig.14. Forward bias safe operating area. $T_{mb} = 25^{\circ}C$

I Region of permissible DC operation.
II Extension for repetitive pulse operation.
NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

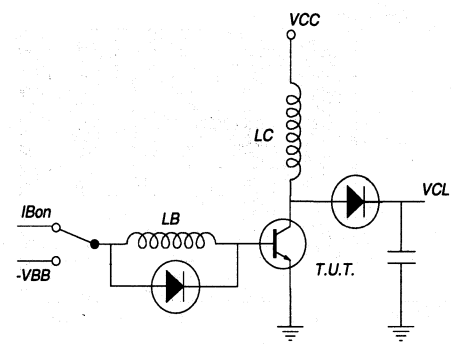


Fig.16. Test circuit RBSOA. $V_{CC} = 150$ V; $-V_{BB} = 5$ V $L_C = 200\ \mu H$; $V_{CL} \leq 850$ V; $L_B = 1\ \mu H$

Silicon diffused power transistors BUW11F; BUW11AF

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a SOT199 package.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter
mb	mounting base; electrically isolated

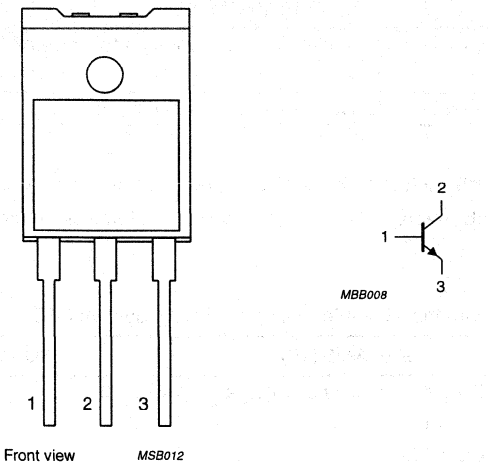


Fig.1 Simplified outline (SOT199) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$		
	BUW11F		850	V
	BUW11AF		1000	V
V_{CEO}	collector-emitter voltage	open base		
	BUW11F		400	V
	BUW11AF		450	V
V_{CEsat}	collector-emitter saturation voltage		1.5	V
I_{Csat}	collector saturation current			
	BUW11F		3	A
	BUW11AF		2.5	A
I_C	collector current (DC)	see Figs 2 and 4	5	A
I_{CM}	collector current (peak value)	t_p < 20 ms; see Fig.2	10	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.3	32	W
t_f	fall time	resistive load; see Figs 8 and 9	0.8	μs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}h}$	thermal resistance from junction to external heatsink	note 1	3.95	K/W
		note 2	3.05	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient		35	K/W

Notes

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
2. Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUW11F		–	850	V
	BUW11AF		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUW11F		–	400	V
	BUW11AF		–	450	V
I_{Csat}	collector saturation current				
	BUW11F		–	3	A
	BUW11AF		–	2.5	A
I_C	collector current (DC)	see Figs 2 and 4	–	5	A
I_{CM}	collector current (peak value)	$t_p < 20$ ms; see Fig.2	–	10	A
I_B	base current (DC)		–	2	A
I_{BM}	base current (peak value)	$t_p < 20$ ms	–	4	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.3; note 1	–	32	W
		$T_h \leq 25$ °C; see Fig.3; note 2	–	41	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Notes

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
2. Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

ISOLATION CHARACTERISTICS

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
V_{isolM}	isolation voltage from all terminals to external heatsink (peak value)	–	1500	V
C_{isol}	isolation capacitance from collector to external heatsink	–	21	pF

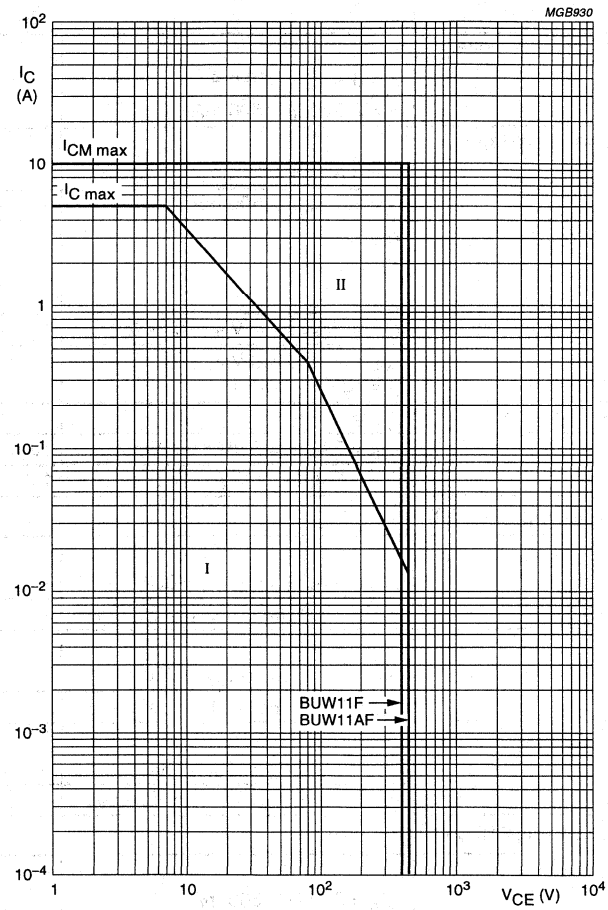
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	I_C = 100 mA; I_{Boff} = 0; L = 25 mH; see Figs 5 and 6				
	BUW11F		400	–	–	V
	BUW11AF		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage					
	BUW11F	I_C = 3 A; I_B = 600 mA	–	–	1.5	V
	BUW11AF	I_C = 2.5 A; I_B = 500 mA	–	–	1.5	V
V_{BEsat}	base-emitter saturation voltage					
	BUW11F	I_C = 3 A; I_B = 600 mA	–	–	1.4	V
	BUW11AF	I_C = 2.5 A; I_B = 500 mA	–	–	1.4	V
I_{Csat}	collector saturation current	V_{CE} = 1.5 V				
	BUW11F		–	–	3	A
	BUW11AF		–	–	2.5	A
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESMmax}$; V_{BE} = 0; note 1	–	–	1	mA
		$V_{CE} = V_{CESMmax}$; V_{BE} = 0; T_j = 125 °C; note 1	–	–	2	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 9 V; I_C = 0	–	–	10	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 5 mA; see Fig.7	10	18	35	
		V_{CE} = 5 V; I_C = 0.5 A; see Fig.7	10	20	35	
Switching times resistive load (Figs 8 and 9)						
t_{on}	turn-on time					
	BUW11F	I_{Con} = 3 A; $I_{Bon} = -I_{Boff}$ = 600 mA	–	–	1	µs
	BUW11AF	I_{Con} = 2.5 A; $I_{Bon} = -I_{Boff}$ = 500 mA	–	–	1	µs
t_s	storage time					
	BUW11F	I_{Con} = 3 A; $I_{Bon} = -I_{Boff}$ = 600 mA	–	–	4	µs
	BUW11AF	I_{Con} = 2.5 A; $I_{Bon} = -I_{Boff}$ = 500 mA	–	–	4	µs
t_f	fall time					
	BUW11F	I_{Con} = 3 A; $I_{Bon} = -I_{Boff}$ = 600 mA	–	–	0.8	µs
	BUW11AF	I_{Con} = 2.5 A; $I_{Bon} = -I_{Boff}$ = 500 mA	–	–	0.8	µs
Switching times inductive load (Figs 10 and 11)						
t_s	storage time					
	BUW11F	I_{Con} = 3 A; I_B = 600 mA; V_{CL} = 250 V; T_c = 100 °C	–	2	2.5	µs
	BUW11AF	I_{Con} = 2.5 A; I_B = 500 mA; V_{CL} = 300 V; T_c = 100 °C	–	2	2.5	µs
t_f	fall time					
	BUW11F	I_{Con} = 3 A; I_B = 600 mA; V_{CL} = 250 V; T_c = 100 °C	–	200	300	ns
	BUW11AF	I_{Con} = 2.5 A; I_B = 500 mA; V_{CL} = 300 V; T_c = 100 °C	–	200	300	ns

Note

1. Measured with a half-sinewave voltage (curve tracer).



Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
T_{mb} < 25 °C.
I - Region of permissible DC operation.
II - Permissible extension for repetitive pulse operation.

Fig.2 Forward bias SOAR.

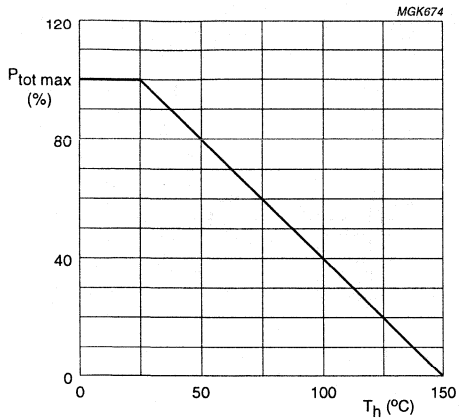
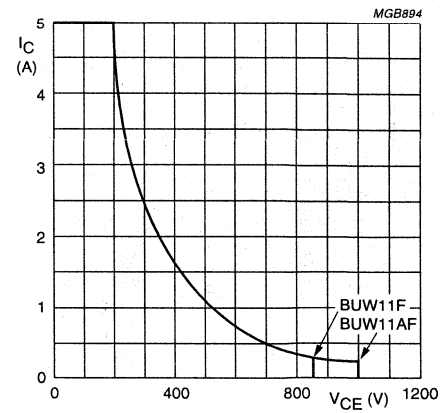


Fig.3 Power derating curve.



V_{BE} = −1 to −5 V; $T_c \leq 100$ °C.

Fig.4 Reverse bias SOAR.

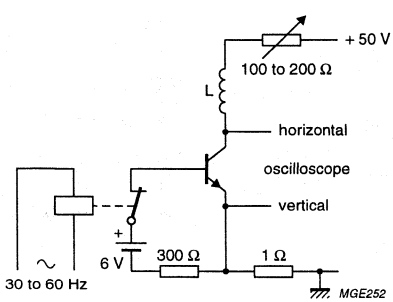


Fig.5 Test circuit for collector-emitter sustaining voltage.

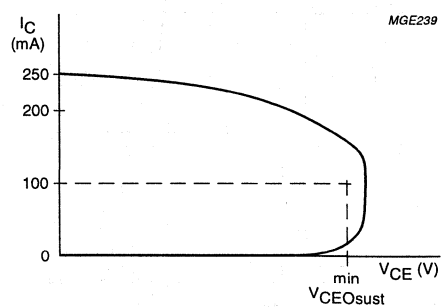
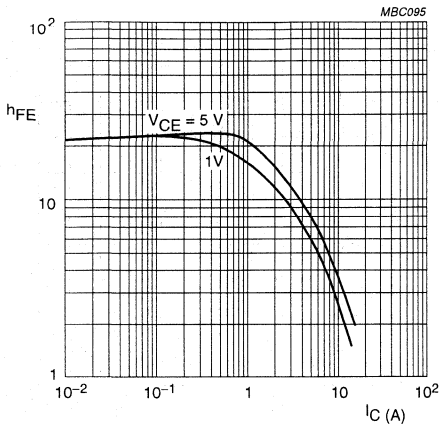
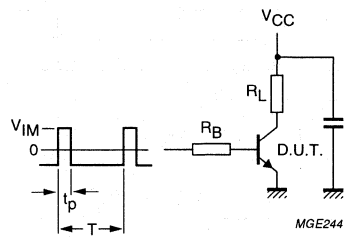


Fig.6 Oscilloscope display for collector-emitter sustaining voltage.



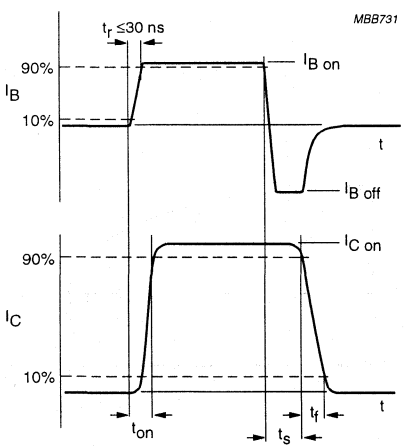
T_j = 125 °C.

Fig.7 DC current gain; typical values.



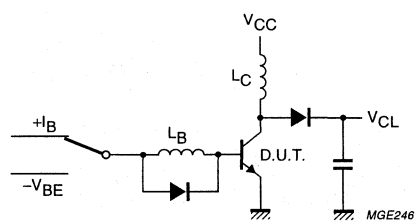
V_{CC} = 250 V; t_p = 20 µs; V_{IM} = −6 to +8 V; t_p/T = 0.01.
The values of R_B and R_L are selected in accordance with I_{Con} and I_{Bon} requirements.

Fig.8 Test circuit resistive load.



t_r ≤ 20 ns.

Fig.9 Switching time waveforms with resistive load.



V_{CL} = up to 1000 V; V_{CC} = 30 V; V_{BE} = −1 V to −5 V; L_B = 1 µH; L_C = 200 µH.

Fig.10 Test circuit inductive load and reverse bias SOAR.

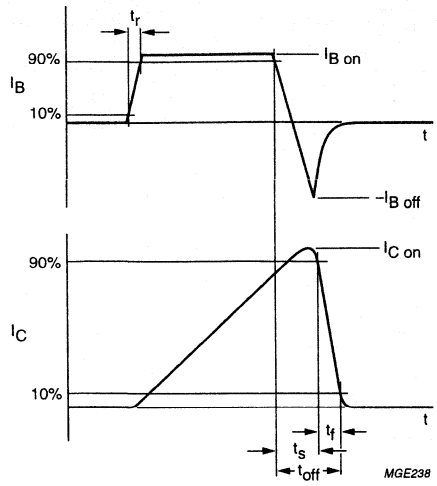


Fig.11 Switching time waveforms with inductive load.

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a SOT199 package.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter
mb	mounting base; electrically isolated

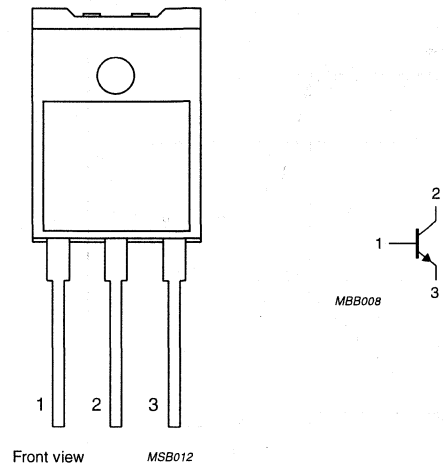


Fig.1 Simplified outline (SOT199) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$		
	BUW13F		850	V
	BUW13AF		1000	V
V_{CEO}	collector-emitter voltage	open base		
	BUW13F		400	V
	BUW13AF		450	V
V_{CEsat}	collector-emitter saturation voltage	see Figs 8 and 10	1.5	V
I_{Csat}	collector saturation current			
	BUW13F		10	A
	BUW13AF		8	A
I_C	collector current (DC)	see Figs 3 and 4	15	A
I_{CM}	collector current (peak value)	$t_p < 20$ ms; see Fig 4	30	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.2	37	W
t_f	fall time	resistive load; see Fig.13	0.8	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}h}$	thermal resistance from junction to external heatsink	note 1	3.4	K/W
		note 2	2.5	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient		35	K/W

Notes

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
2. Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUW13F		–	850	V
	BUW13AF		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUW13F		–	400	V
	BUW13AF		–	450	V
I_{Csat}	collector saturation current				
	BUW13F		–	10	A
	BUW13AF		–	8	A
I_C	collector current (DC)	see Figs 3 and 4	–	15	A
I_{CM}	collector current (peak value)	t_p < 20 ms; see Fig 4	–	30	A
I_B	base current (DC)		–	6	A
I_{BM}	base current (peak value)	t_p = –20 ms	–	9	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.2; note 1	–	37	W
		$T_h \leq 25$ °C; see Fig.2; note 2	–	50	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Notes

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
2. Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

ISOLATION CHARACTERISTICS

SYMBOL	PARAMETER	MAX.	UNIT
V_{isolM}	isolation voltage from all terminals to external heatsink (peak value); note 1	2000	V
C_{isol}	isolation capacitance from collector to external heatsink	21	pF

Note

1. Repetitive peak operation with RH ≤ 65% under clean and dust-free conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	I_C = 100 mA; I_{Boff} = 0; L = 25 mH; see Figs 6 and 7				
	BUW13F		400	–	–	V
	BUW13AF		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage					
	BUW13F	I_C = 10 A; I_B = 2 A; see Figs 8 and 10	–	–	1.5	V
	BUW13AF	I_C = 8 A; I_B = 1.6 A; see Figs 8 and 10	–	–	1.5	V
V_{BEsat}	base-emitter saturation voltage					
	BUW13F	I_C = 10 A; I_B = 2 A; see Fig.8	–	–	1.6	V
	BUW13AF	I_C = 8 A; I_B = 1.6 A; see Fig.8	–	–	1.6	V
I_{Csat}	collector saturation current	V_{CE} = 1.5 V				
	BUW13F		–	–	10	A
	BUW13AF		–	–	8	A
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESMmax}$; V_{BE} = 0; note 1	–	–	1	mA
		$V_{CE} = V_{CESMmax}$; V_{BE} = 0; T_j = 125 °C; note 1	–	–	4	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 9 V; I_C = 0	–	–	10	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 20 mA; see Fig.11	10	18	35	
		V_{CE} = 5 V; I_C = 1.5 A; see Fig.11	10	20	35	
Switching times resistive load (see Figs 12 and 13)						
t_{on}	turn-on time					
	BUW13F	I_{Con} = 10 A; $I_{Bon} = I_{Boff}$ = 2 A	–	–	1	µs
	BUW13AF	I_{Con} = 8 A; $I_{Bon} = I_{Boff}$ = 1.6 A	–	–	1	µs
t_s	storage time					
	BUW13F	I_{Con} = 10 A; $I_{Bon} = I_{Boff}$ = 2 A	–	–	4	µs
	BUW13AF	I_{Con} = 8 A; $I_{Bon} = I_{Boff}$ = 1.6 A	–	–	4	µs
t_f	fall time					
	BUW13F	I_{Con} = 10 A; $I_{Bon} = I_{Boff}$ = 2 A	–	–	0.8	µs
	BUW13AF	I_{Con} = 8 A; $I_{Bon} = I_{Boff}$ = 1.6 A	–	–	0.8	µs
Switching times inductive load (see Figs 14 and 15)						
t_s	storage time					
	BUW13F	I_{Con} = 10 A; I_B = 2 A; V_{CL} = 250 V; T_c = 100 °C	–	2.8	3.5	µs
	BUW13AF	I_{Con} = 8 A; I_B = 1.6 A; V_{CL} = 300 V; T_c = 100 °C	–	2.8	3.5	µs

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t_f	fall time					
	BUW13F	I_{Con} = 10 A; I_B = 2 A; V_{CL} = 250 V; T_c = 100 °C	–	200	300	ns
	BUW13AF	I_{Con} = 8 A; I_B = 1.6 A; V_{CL} = 300 V; T_c = 100 °C	–	200	300	ns

Note

1. Measured with a half-sinewave voltage (curve tracer).

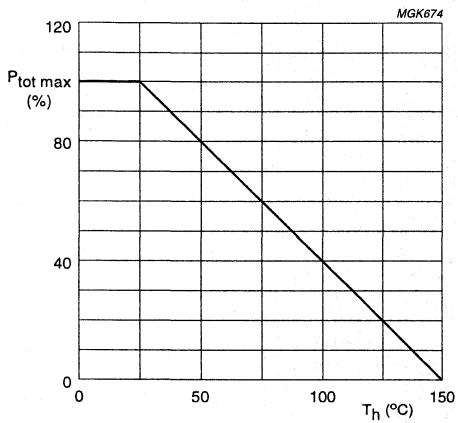
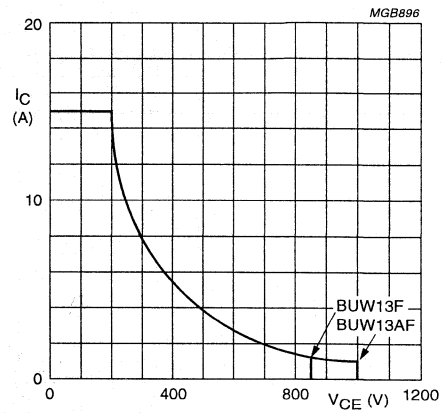
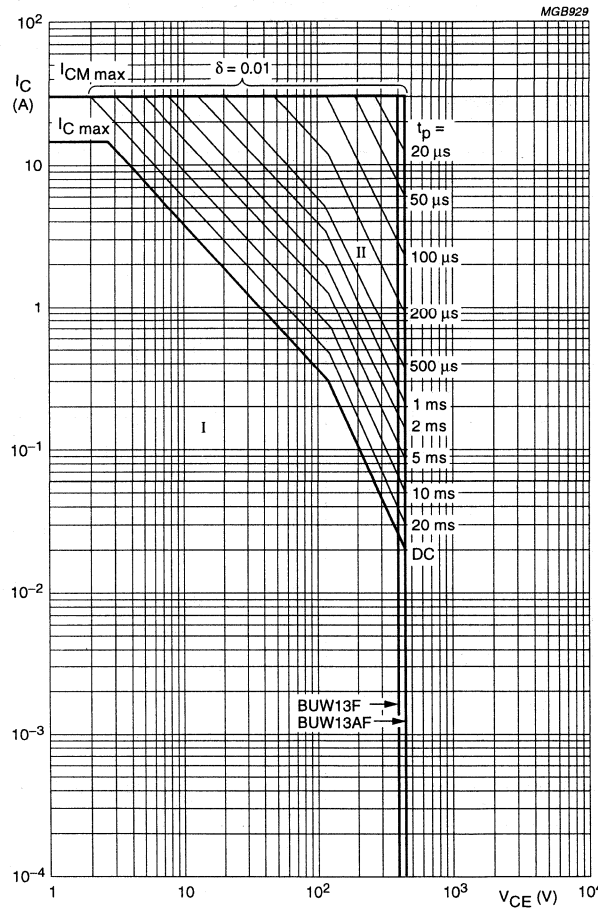


Fig.2 Power derating curve.



$T_c \leq 100$ °C; V_{BE} = −1 to −5 V.

Fig.3 Reverse bias SOAR.



T_{mb} = 25 °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

(1) $P_{tot\ max}$ and $P_{tot\ peak\ max}$ lines.

(2) Second breakdown limits (independent of temperature).

Fig.4 Forward bias SOAR.

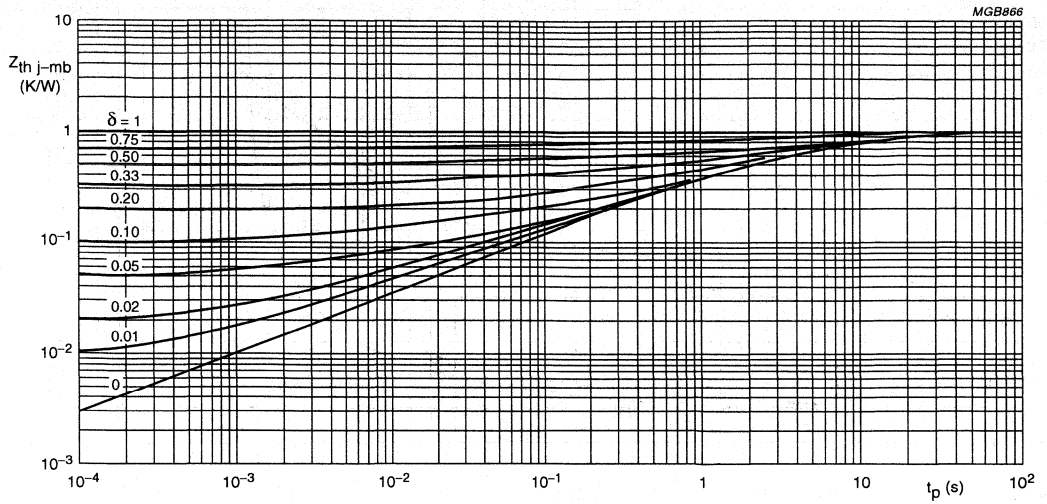


Fig.5 Transient thermal impedance.

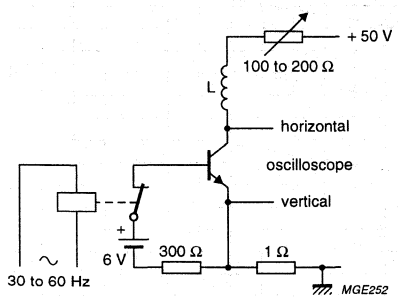


Fig.6 Test circuit for collector-emitter sustaining voltage.

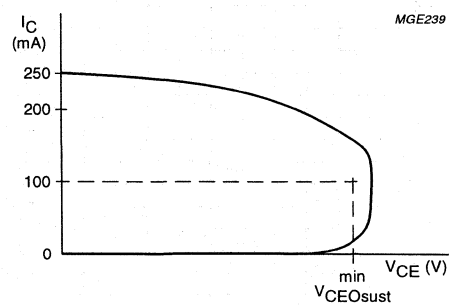
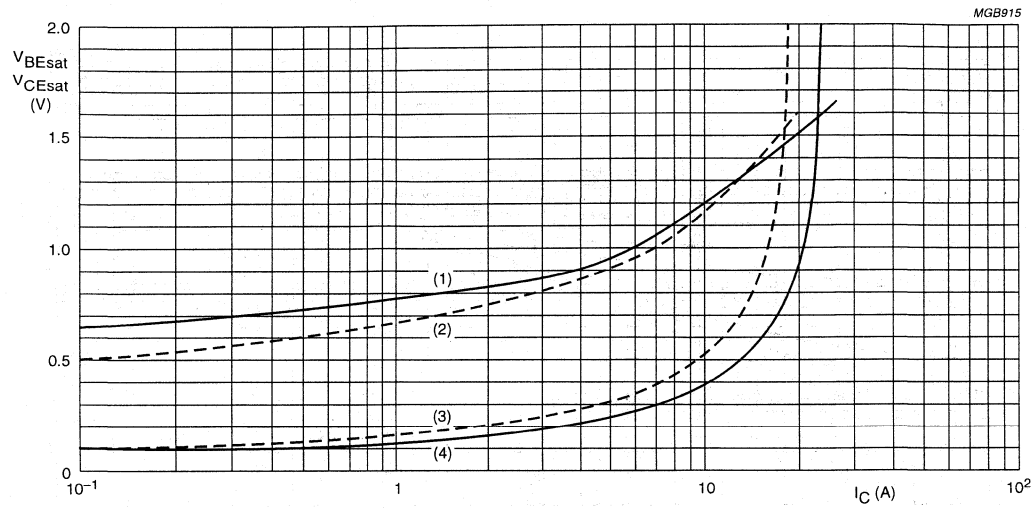
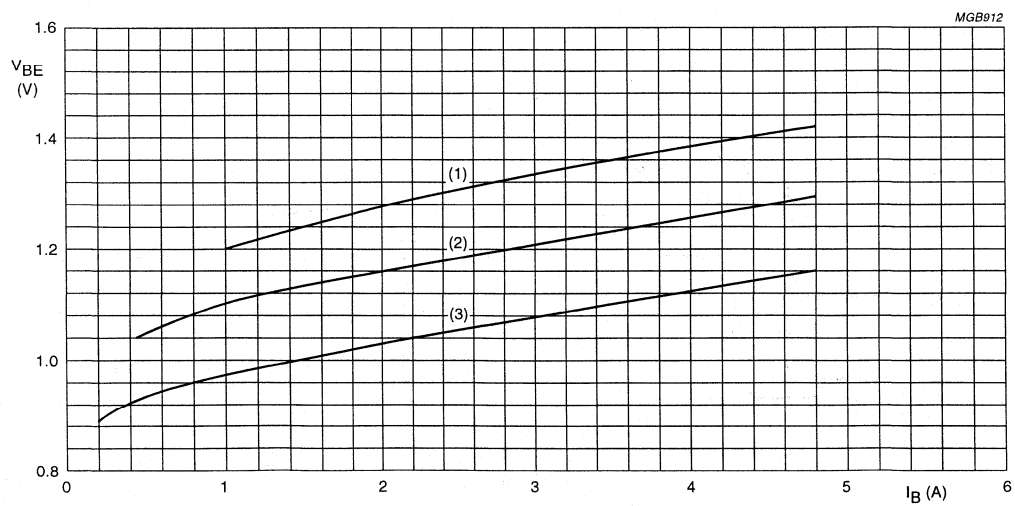


Fig.7 Oscilloscope display for collector-emitter sustaining voltage.



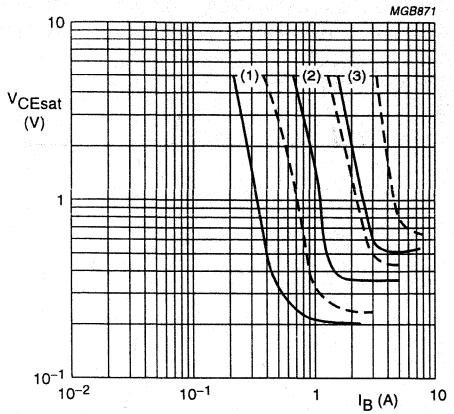
$I_C/I_B = 5$.
(1) V_{BE}; $T_j = 25$ °C.
(2) V_{BE}; $T_j = 100$ °C.
(3) V_{CE}; $T_j = 100$ °C.
(4) V_{CE}; $T_j = 25$ °C.

Fig.8 Base-emitter and collector-emitter saturation voltages as functions of collector current; typical values.



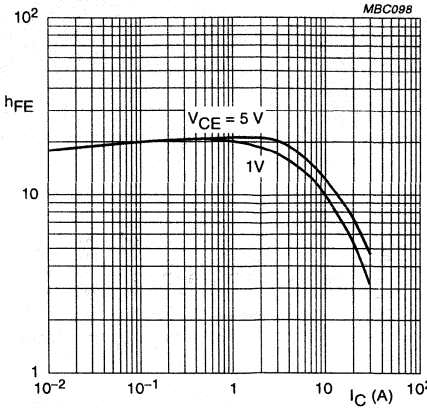
$T_j = 25$ °C.
(1) $I_C = 15$ A.
(2) $I_C = 10$ A.
(3) $I_C = 5$ A.

Fig.9 Base-emitter voltage as a function of base current; typical values.



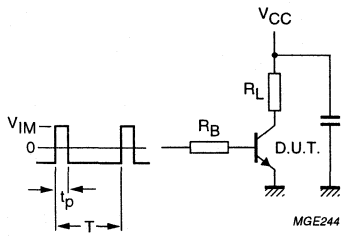
(1) $I_C = 5$ A.
(2) $I_C = 10$ A.
(3) $I_C = 15$ A.
$T_j = 25$ °C; solid line: typical values; dotted line: maximum values.

Fig.10 Collector-emitter saturation voltage as a function of base current.



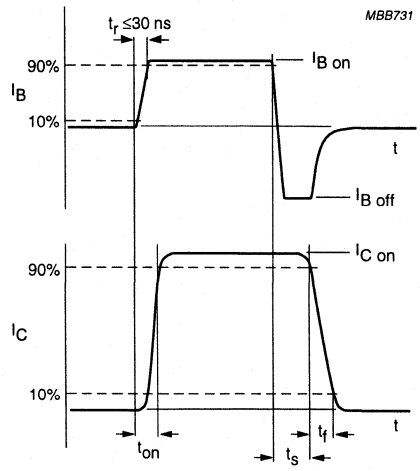
$T_j = 125$ °C.

Fig.11 DC current gain; typical values.



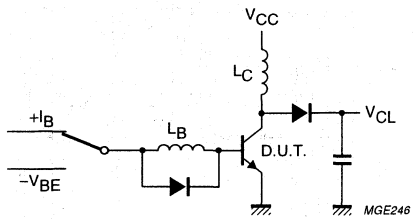
$V_{CC} = 250$ V; $t_p = 20$ µs; $V_{IM} = -6$ to +8 V; $t_p/T = 0.01$.
The values of R_B and R_L are selected in accordance with I_{Con} and I_{Bon} requirements.

Fig.12 Test circuit resistive load.



$t_r \leq 20$ ns.

Fig.13 Switching time waveforms with resistive load.



$V_{CL} \leq$ up to 1000 V; V_{CC} = 30 V; V_{BE} = −5 V; L_B = 1 μH; L_C = 200 μH.

Fig.14 Test circuit inductive load and reverse bias SOAR.

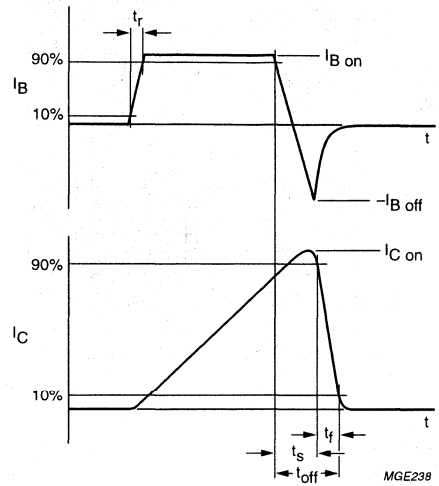


Fig.15 Switching time waveforms with inductive load.

Silicon diffused power transistors — BUW84; BUW85

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a SOT82 package.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems
- Switching applications.

PINNING

PIN	DESCRIPTION
1	base
2	collector; connected to mounting base
3	emitter

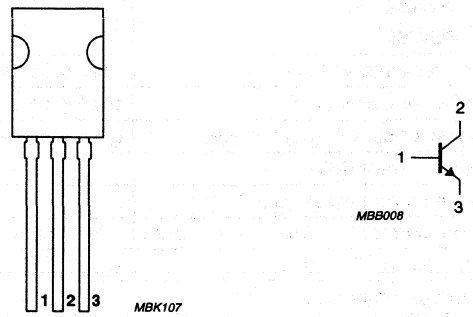


Fig.1 Simplified outline (SOT82) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUW84		–	800	V
	BUW85		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUW84		–	400	V
	BUW85		–	450	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 1$ A; $I_B = 200$ mA; see Fig.7	–	1	V
I_C	collector current (DC)	see Figs 4 and 5	–	2	A
I_{CM}	collector current (peak value)	see Figs 4 and 5	–	3	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.8	–	50	W
t_f	fall time	resistive load; see Fig.11	0.4	–	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	2.1	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient in free air	100	K/W

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUW84		–	800	V
	BUW85		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUW84		–	400	V
	BUW85		–	450	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)	see Figs 4 and 5	–	2	A
I_{CM}	collector current (peak value)	$t_p = 2$ ms; see Figs 4 and 5	–	3	A
I_B	base current (DC)		–	0.75	A
I_{BM}	base current (peak value)		–	1	A
I_{BM}	base current (reversed; peak value)	turn-off current	–	–1	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.8	–	50	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	$I_C = 100$ mA; $I_{Boff} = 0$; L = 25 mH; see Figs 2 and 3				
	BUW84		400	–	–	V
	BUW85		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.3$ A; $I_B = 30$ mA; see Fig.7	–	–	0.8	V
		$I_C = 1$ A; $I_B = 200$ mA; see Fig.7	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 1$ A; $I_B = 200$ mA	–	–	1.1	V
I_{CES}	collector-emitter cut-off current	$V_{CEM} = V_{CEMSmax}$; $V_{BE} = 0$; note 1	–	–	200	μA
		$V_{CEM} = V_{CEMSmax}$; $V_{BE} = 0$; $T_j = 125$ °C; note 1	–	–	1.5	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5$ V; $I_C = 0$	–	–	1	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 5$ A; see Fig.10	15	–	–	
		$V_{CE} = 5$ V; $I_C = 100$ mA; see Fig.10	20	50	100	
f_T	transition frequency	$V_{CE} = 10$ V; $I_C = 200$ mA; f = 1 MHz	–	20	–	MHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Switching times in horizontal deflection circuit (see Fig.11)						
t_{on}	turn-on time	I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V	–	0.2	0.5	µs
t_s	storage time	I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V	–	2	3.5	µs
t_f	fall time	I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V	–	0.4	–	µs
		I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V; T_{mb} = 95 °C	–	–	1.4	µs

Note

1. Measured with a half-sinewave voltage (curve tracer).

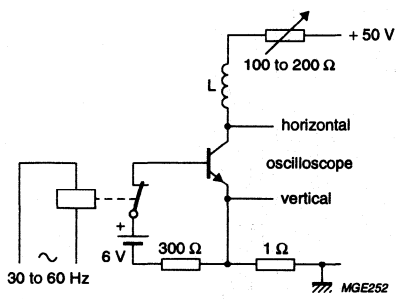


Fig.2 Test circuit for collector-emitter sustaining voltage.

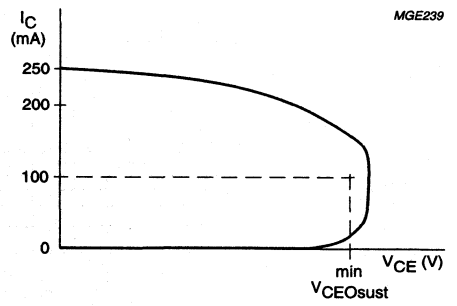
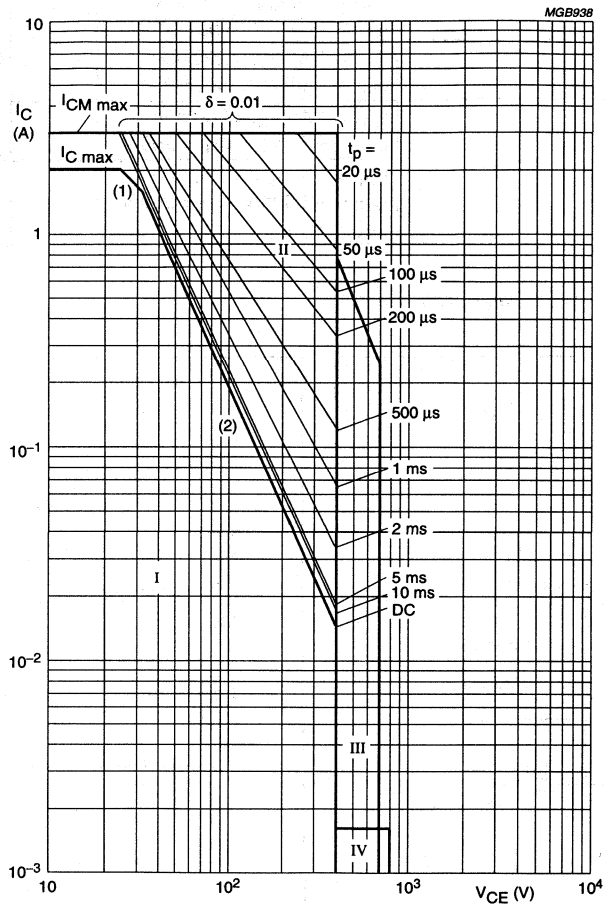


Fig.3 Oscilloscope display for collector-emitter sustaining voltage.



BUW84.

$T_{mb} \leq 25$ °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

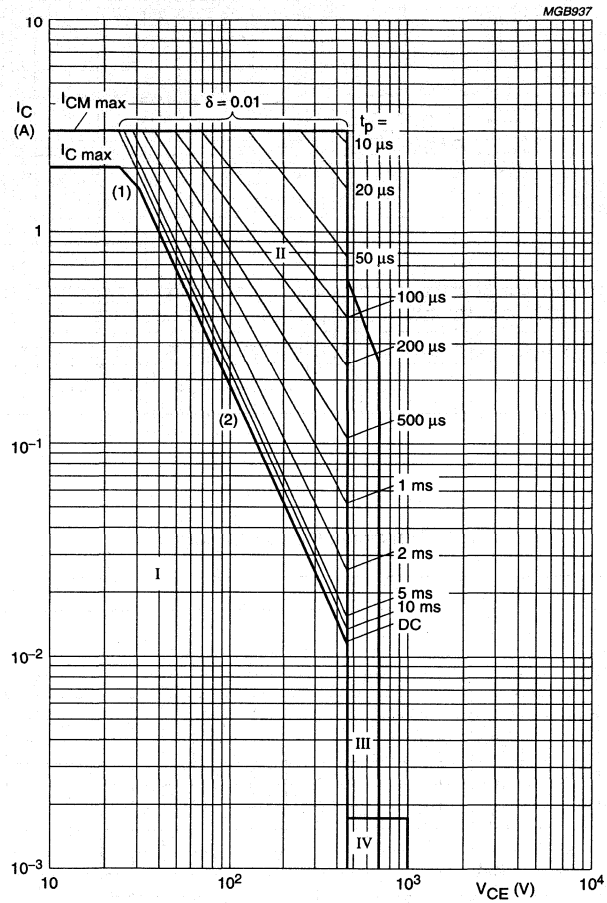
III - Area of permissible operation during turn-on in single transistor converters, provided $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6$ µs.

IV - Repetitive pulse operation in this region is permissible provided $V_{BE} \leq 0$ and $t_p \leq 2$ ms.

(1) $P_{tot\,max}$ line.

(2) Second breakdown limits.

Fig.4 Forward bias SOAR.



BUW85.

$T_{mb} \leq 25$ °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

III - Area of permissible operation during turn-on in single transistor converters, provided $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6\ \mu s$.

IV - Repetitive pulse operation in this region is permissible provided $V_{BE} \leq 0$ and $t_p \leq 2$ ms.

(1) $P_{tot\,max}$ line.

(2) Second breakdown limits.

Fig.5 Forward bias SOAR.

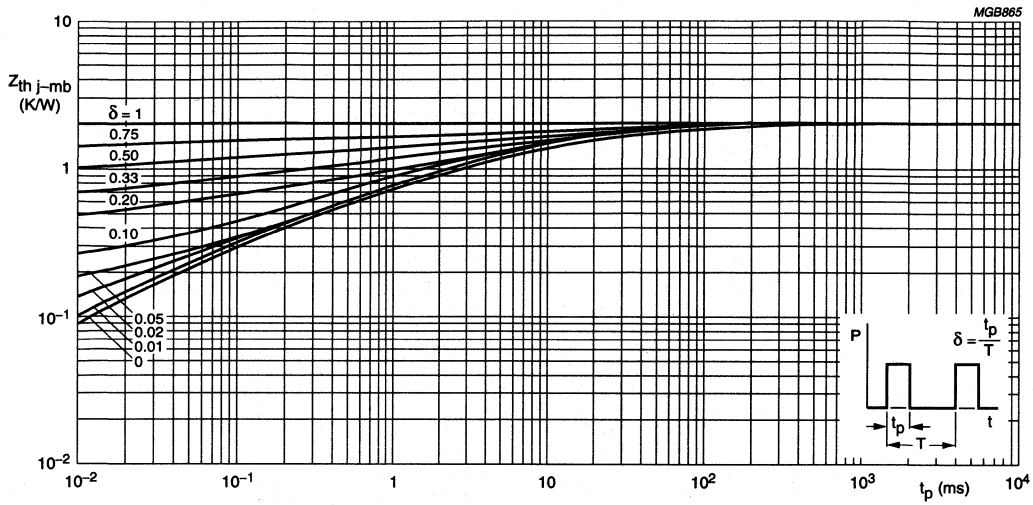
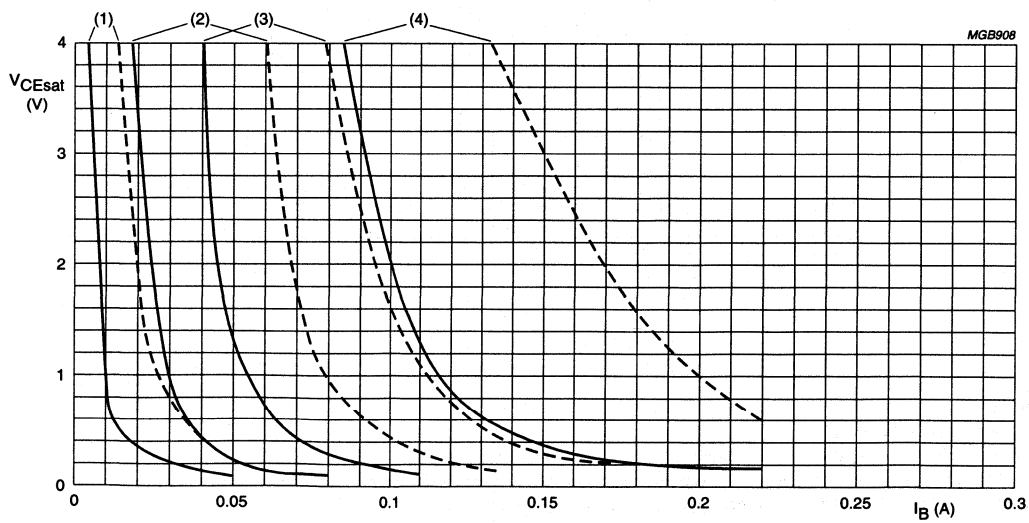


Fig.6 Transient thermal impedance.



(1) I_C = 0.3 A. (2) I_C = 0.5 A. (3) I_C = 0.7 A. (4) I_C = 1 A. T_j = 25 °C; solid line: typical values; dotted line: maximum values.

Fig.7 Collector-emitter saturation voltage as a function of base current; typical values.

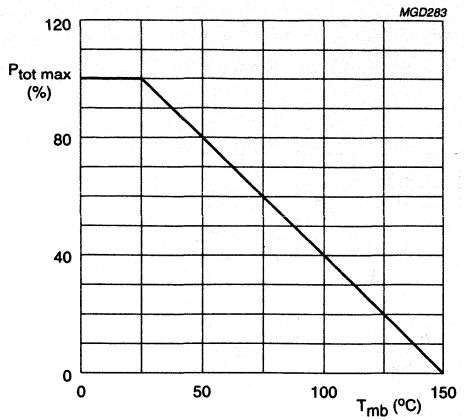
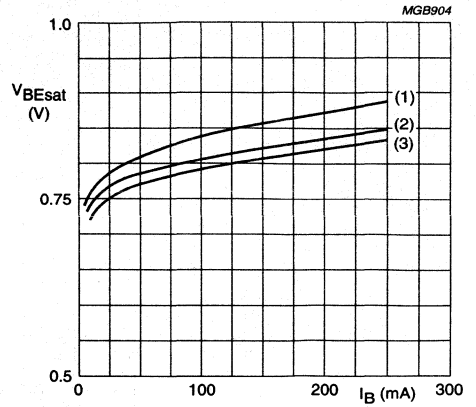


Fig.8 Power derating curve.



T_j = 25 °C.
(1) I_C = 1 A.
(2) I_C = 0.5 A.
(3) I_C = 0.3 A.

Fig.9 Base-emitter saturation voltage as a function of emitter current; typical values.

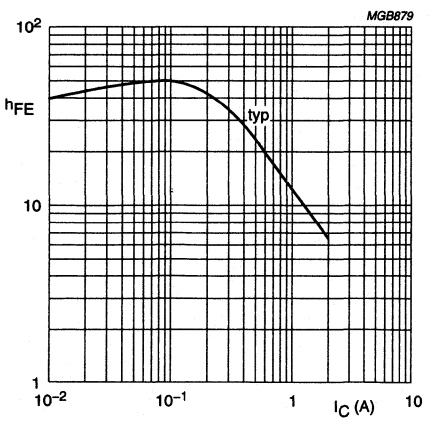


Fig.10 DC current gain; typical values.

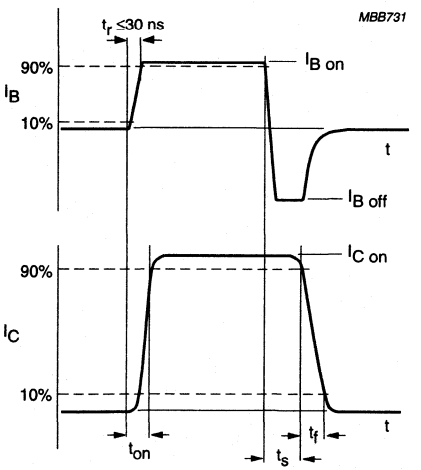


Fig.11 Switching time waveforms with resistive load.

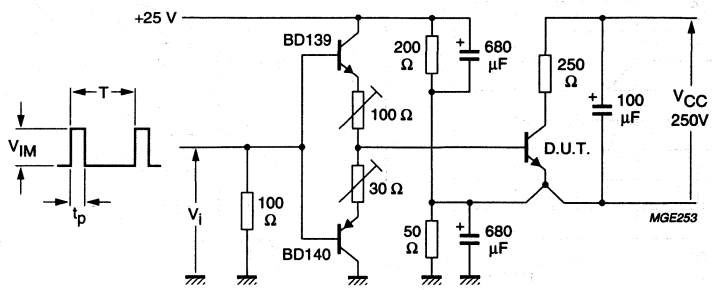


Fig.12 Test circuit resistive load.

Silicon diffused power transistors BUX84; BUX85

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a TO-220AB package.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems
- Switching applications.

PINNING

PIN	DESCRIPTION
1	base
2	collector; connected to mounting base
3	emitter

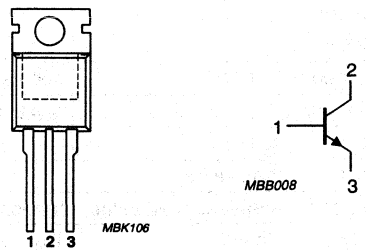


Fig.1 Simplified outline (TO-220AB) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUX84		–	800	V
	BUX85		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUX84		–	400	V
	BUX85		–	450	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 1$ A; $I_B = 200$ mA; see Fig.7	–	1	V
I_C	collector current (DC)	see Figs 4 and 5	–	2	A
I_{CM}	collector current (peak value)	see Figs 4 and 5	–	3	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.8	–	40	W
t_f	fall time	resistive load; see Fig.11	0.4	–	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	2.5	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient in free air	70	K/W

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUX84		–	800	V
	BUX85		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUX84		–	400	V
	BUX85		–	450	V
I_C	collector current (DC)	see Figs 4 and 5	–	2	A
I_{CM}	collector current (peak value)	$t_p = 2$ ms; see Figs 4 and 5	–	3	A
I_B	base current (DC)		–	0.75	A
I_{BM}	base current (peak value)		–	1	A
I_{BM}	base current (reversed; peak value)	turn-off current	–	–1	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Fig.8	–	40	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	$I_C = 100$ mA; $I_{Boff} = 0$; L = 25 mH; see Figs 2 and 3				
	BUX84		400	–	–	V
	BUX85		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.3$ A; $I_B = 30$ mA; see Fig.7	–	–	0.8	V
		$I_C = 1$ A; $I_B = 200$ mA; see Fig.7	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 1$ A; $I_B = 200$ mA; see Fig.9	–	–	1.1	V
I_{CES}	collector-emitter cut-off current	$V_{CEM} = V_{CEMSmax}$; $V_{BE} = 0$; note 1	–	–	200	μA
		$V_{CEM} = V_{CEMSmax}$; $V_{BE} = 0$; $T_j = 125$ °C; note 1	–	–	1.5	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5$ V; $I_C = 0$	–	–	1	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 5$ A; see Fig.10	15	–	–	
		$V_{CE} = 5$ V; $I_C = 100$ mA; see Fig.10	20	50	100	
f_T	transition frequency	$V_{CE} = 10$ V; $I_C = 200$ mA; f = 1 MHz	–	20	–	MHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Switching times in horizontal deflection circuit (see Fig.11)						
t_{on}	turn-on time	I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V	–	0.2	0.5	µs
t_f	fall time	I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V	–	0.4	–	µs
		I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V; T_{mb} = 95 °C	–	–	1.4	µs
t_s	storage time	I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V	–	2	3.5	µs

Note

1. Measured with a half-sinewave voltage (curve tracer).

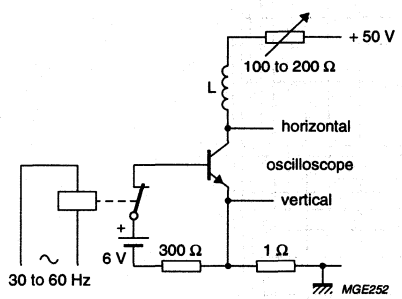


Fig.2 Test circuit for collector-emitter sustaining voltage.

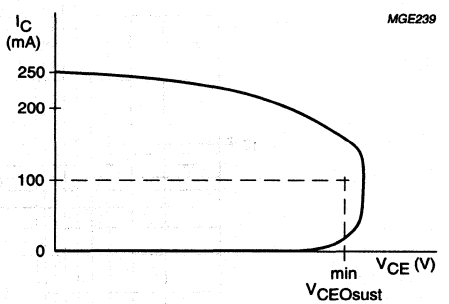
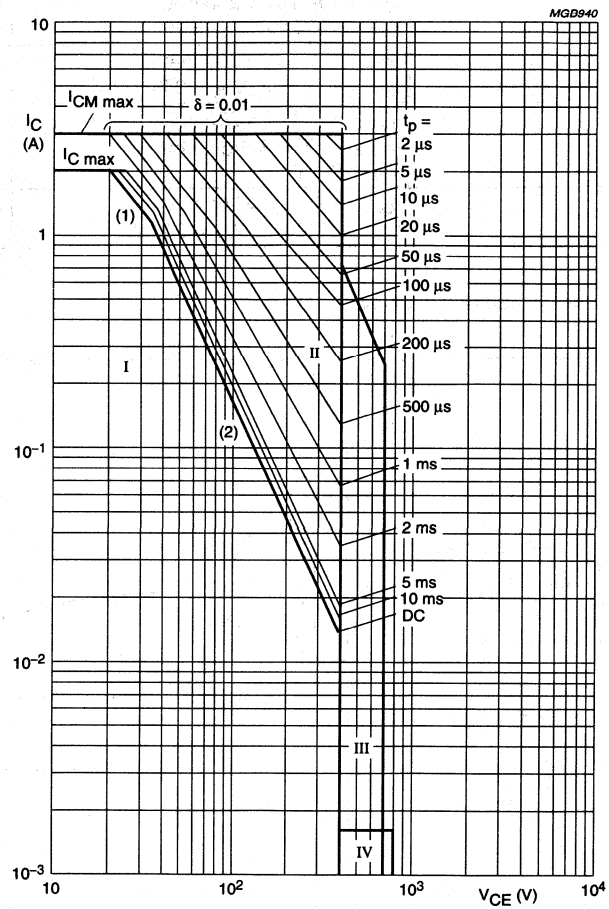


Fig.3 Oscilloscope display for collector-emitter sustaining voltage.



BUX84.

$T_{mb} \leq 50$ °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

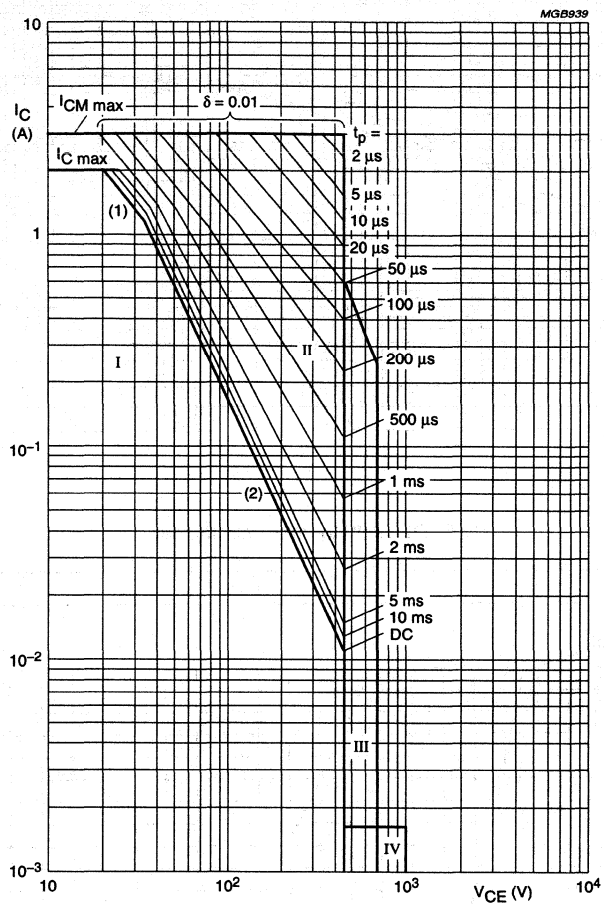
III - Area of permissible operation during turn-on in single transistor converters, provided $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6$ µs.

IV - Repetitive pulse operation in this region is permissible provided $V_{BE} \leq 0$ and $t_p \leq 2$ ms.

(1) $P_{tot\ max}$ and $P_{tot\ peak\ max}$ lines.

(2) Second breakdown limits.

Fig.4 Forward bias SOAR.



BUX85.

$T_{mb} \leq 50$ °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

III - Area of permissible operation during turn-on in single transistor converters, provided $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6$ µs.

IV - Repetitive pulse operation in this region is permissible provided $V_{BE} \leq 0$ and $t_p \leq 2$ ms.

(1) $P_{tot\ max}$ and $P_{tot\ peak\ max}$ lines.

(2) Second breakdown limits.

Fig.5 Forward bias SOAR.

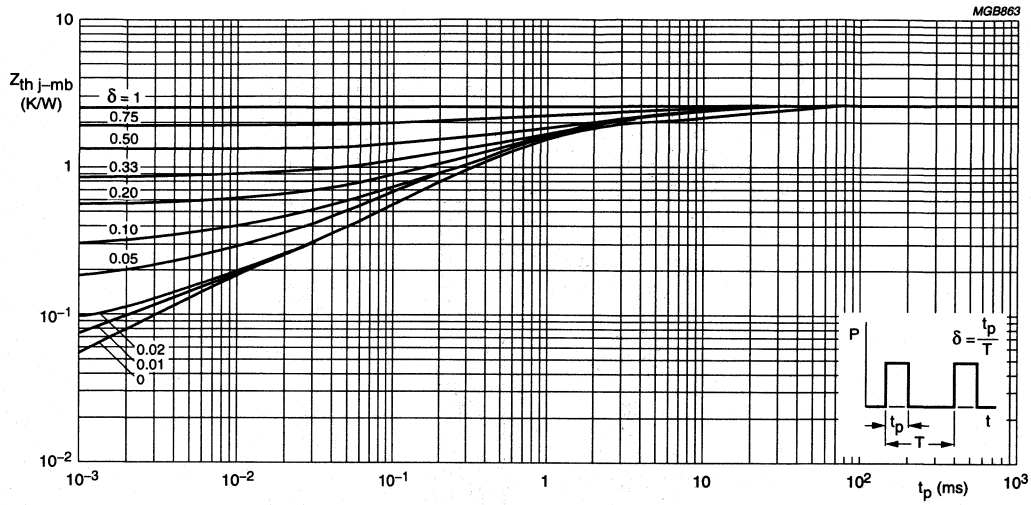
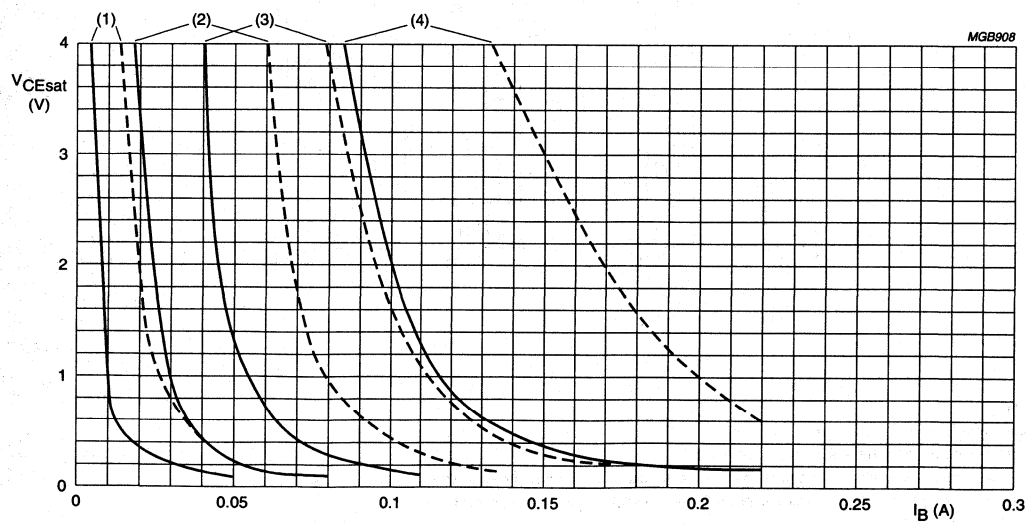


Fig.6 Transient thermal impedance.



(1) I_C = 0.3 A. (2) I_C = 0.5 A. (3) I_C = 0.7 A. (4) I_C = 1 A. T_j = 25 °C; solid line: typical values; dotted line: maximum values.

Fig.7 Collector-emitter saturation voltage as a function of base current; typical values.

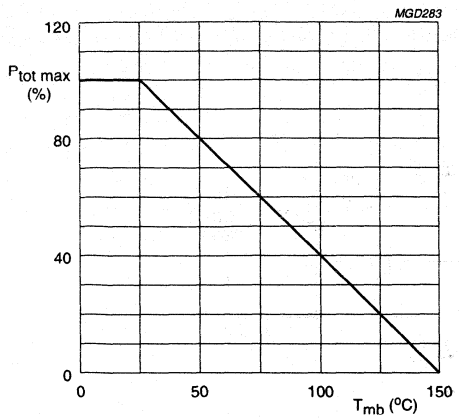
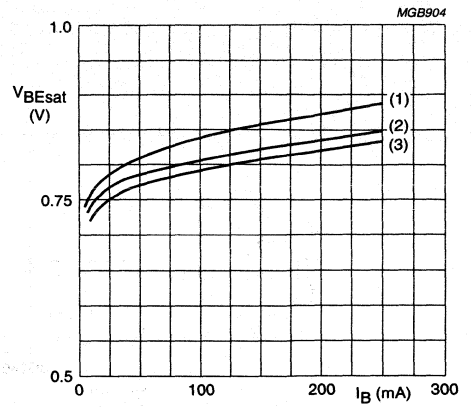


Fig.8 Power derating curve.



T_j = 25 °C.
(1) I_C = 1 A.
(2) I_C = 0.5 A.
(3) I_C = 0.3 A.

Fig.9 Base-emitter saturation voltage as a function of emitter current; typical values.

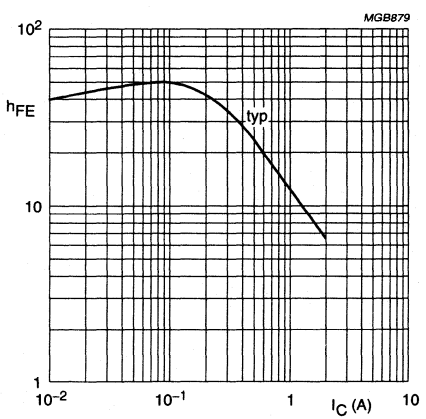


Fig.10 DC current gain; typical values.

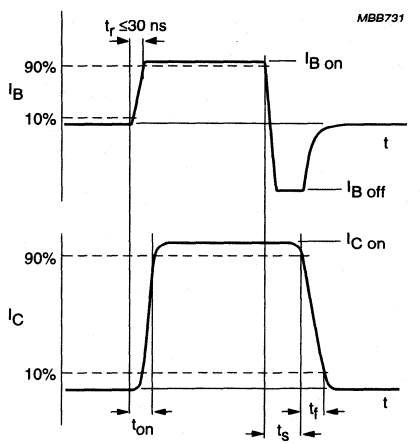
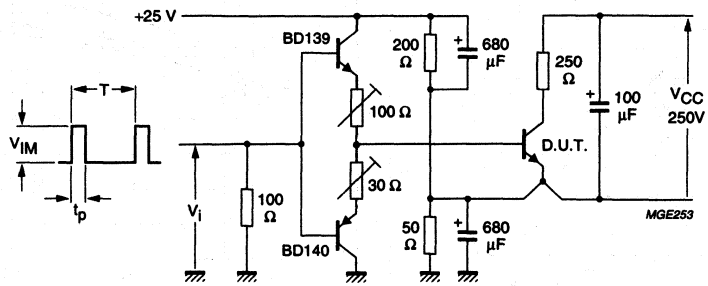


Fig.11 Switching time waveforms with resistive load.



t_p = 20 μs; T = 2 ms; V_{IM} = 15 V.

Fig.12 Test circuit resistive load.

Silicon diffused power transistors — BUX84F; BUX85F

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a SOT186 package with electrically isolated mounting base.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter
mb	mounting base; electrically isolated from all pins

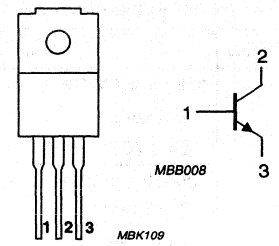


Fig.1 Simplified outline (SOT186) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUX84F		–	800	V
	BUX85F		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUX84F		–	400	V
	BUX85F		–	450	V
V_{CEsat}	collector-emitter saturation voltage	see Fig.4	–	1	V
I_{Csat}	collector saturation current		–	1	A
I_C	collector current (DC)		–	2	A
I_{CM}	collector current (peak value)		–	3	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C	–	18	W
t_f	fall time		0.4	–	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}h}$	thermal resistance from junction to external heatsink	note 1	7.2	K/W
		note 2	4.7	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient		55	K/W

Notes

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
2. Mounted **with** heatsink compound and 30 ±5 N force on centre of package.

ISOLATION CHARACTERISTICS

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
V_{isolM}	isolation voltage from all terminals to external heatsink (peak value)	–	1500	V
C_{isol}	isolation capacitance from collector to external heatsink	12	–	pF

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$			
	BUX84F		–	800	V
	BUX85F		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUX84F		–	400	V
	BUX85F		–	450	V
I_C	collector current (DC)		–	2	A
I_{CM}	collector current (peak value)		–	3	A
I_B	base current (DC)		–	0.75	A
I_{BM}	base current (peak value)		–	1	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; note 1	–	18	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	$I_C = 100$ mA; $I_{Boff} = 0$; L = 25 mH; see Figs 2 and 3				
	BUX84		400	–	–	V
	BUX85		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.3$ A; $I_B = 30$ mA; see Fig.4	–	–	0.8	V
		$I_C = 1$ A; $I_B = 200$ mA; see Fig.4	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 1$ A; $I_B = 200$ mA; see Fig.5	–	–	1.1	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESmax}$; $V_{BE} = 0$	–	–	0.2	mA
		$V_{CE} = V_{CESmax}$; $V_{BE} = 0$; $T_j = 125$ °C	–	–	1.5	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5$ V; $I_C = 0$	–	–	1	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 5$ A; see Fig.6	15	–	–	
		$V_{CE} = 5$ V; $I_C = 100$ mA; see Fig.6	20	50	100	
f_T	transition frequency	$V_{CE} = 10$ V; $I_C = 200$ mA; f = 1 MHz	–	20	–	MHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Switching times resistive load (see Fig.7)						
t_{on}	turn-on time	I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V	–	0.2	0.5	µs
t_s	storage time	I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V	–	2	3.5	µs
t_f	fall time	I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V	–	0.4	–	µs
		I_{Con} = 1 A; I_{Bon} = 200 mA; I_{Boff} = −400 mA; V_{CC} = 250 V; T_{mb} = 95 °C	–	–	1.4	µs

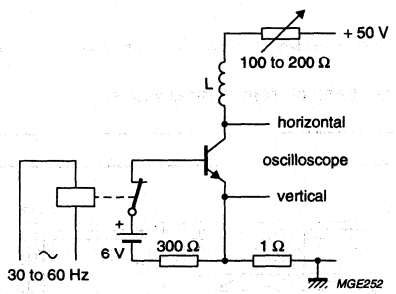


Fig.2 Test circuit for collector-emitter sustaining voltage.

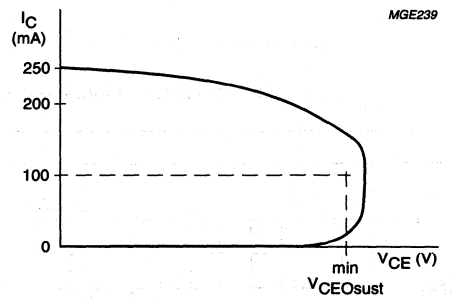
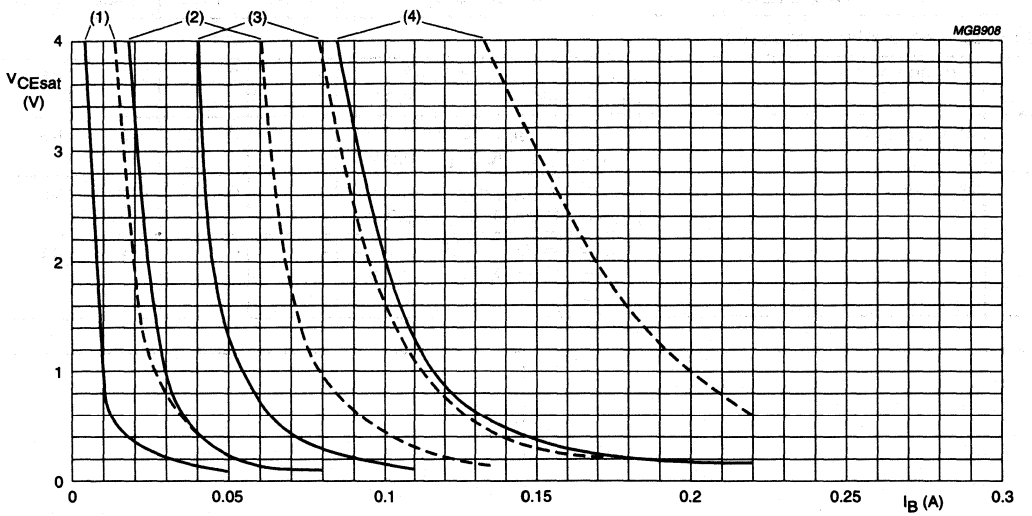
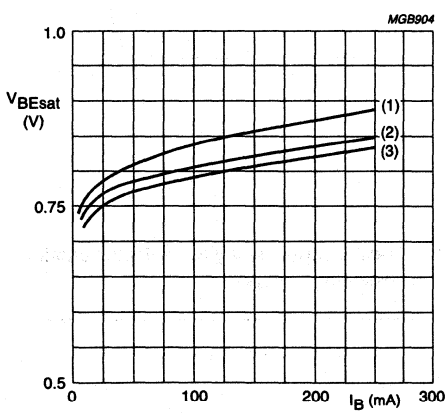


Fig.3 Oscilloscope display for collector-emitter sustaining voltage.



(1) I_C = 0.3 A. (2) I_C = 0.5 A. (3) I_C = 0.7 A. (4) I_C = 1 A. T_j = 25 °C; solid line: typical values; dotted line: maximum values.

Fig.4 Collector-emitter saturation voltage as a function of base current; typical values.



T_j = 25 °C.
(1) I_C = 1 A.
(2) I_C = 0.5 A.
(3) I_C = 0.3 A.

Fig.5 Base-emitter saturation voltage as a function of emitter current; typical values.

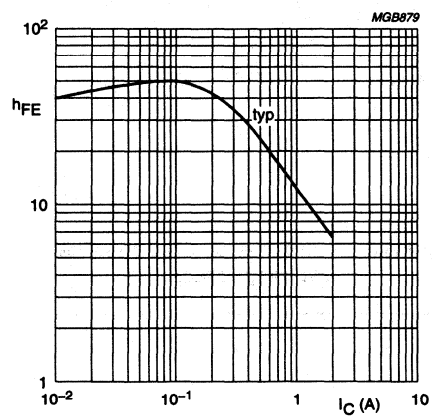


Fig.6 DC current gain; typical values.

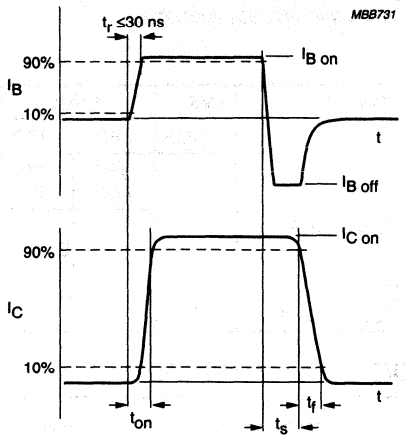
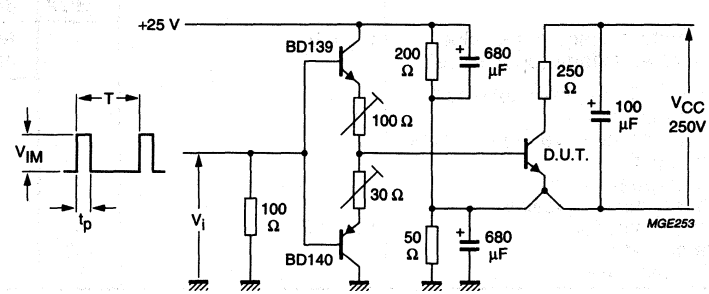


Fig.7 Switching time waveforms with resistive load.



t_p = 20 µs; T = 2 ms; V_{IM} = 15 V.

Fig.8 Test circuit resistive load.

Silicon Diffused Power Transistor

BUX86P
BUX87P

GENERAL DESCRIPTION

High voltage, high speed glass passivated npn power transistors in a SOT82 envelope intended for use in converters, inverters, switching regulators, motor control systems and switching applications.

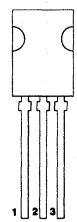
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.		UNIT
			BUX	86P	87P	
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	800	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	450	V
V_{CESAT}	Collector-emitter saturation voltage	I_C = 0.2 A; I_B = 20 mA	-	1		V
I_C	Collector current (DC)		-	0.5		A
I_{CM}	Collector current peak value		-	1		A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	42		W
t_f	Fall time	I_C = 0.2 A; $I_{B(on)}$ = 20 mA	0.28	-		µs

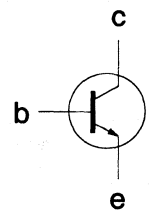
PINNING - SOT82

PIN	DESCRIPTION
1	emitter
2	collector
3	base

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.		UNIT
			BUX	86P	87P	
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0 V	-	800	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	450	V
V_{EBO}	Emitter-base voltage (open collector)		-	5		V
I_C	Collector current (DC)		-	0.5		A
I_{CM}	Collector current (peak value) t_p = 2 ms		-	1		A
I_B	Base current (DC)		-	0.2		A
I_{BM}	Base current (peak value)		-	0.3		A
$-I_{BM}$	Reverse base current (peak value)[1]		-	0.3		A
P_{tot}	Total power dissipation	$T_{mb} \leq 25$ °C	-	42		W
T_{stg}	Storage temperature		-40	150		°C
T_j	Junction temperature		-	150		°C

1 Turn-off current.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	3	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	100	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	-	-	100	µA
I_{CES}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	-	-	1.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 5 V; I_C = 0 A	-	-	1	mA
V_{CEsat}	Collector-emitter saturation voltages	I_C = 0.1 A; I_B = 10 mA	-	-	0.8	V
V_{CEsat}		I_C = 0.2 A; I_B = 20 mA	-	-	1	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 0.2 A; I_B = 20 mA	-	-	1	V
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V	26	50	125	
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_C = 100 mA; **BUX86P**	400	-	-	V
		I_{Boff} = 0; L = 25 mH **BUX87P**	450	-	-	V

DYNAMIC CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load).	I_C = 0.2 A; I_{Bon} = 20 mA; $-I_{Boff}$ = 40 mA; V_{CC} = 250 V			
t_{on}	Turn-on time		0.25	0.5	µs
t_s	Turn-off storage time		2	3.5	µs
t_f	Turn-off fall time		0.28	-	µs
t_f	Turn-off fall time	T_{mb} = 95 °C	-	1.3	µs

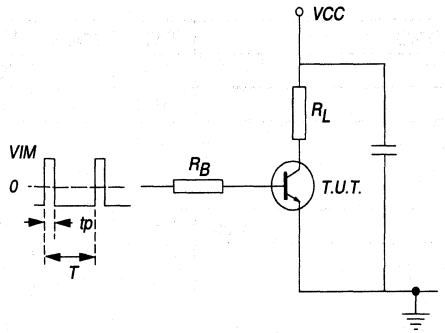


Fig.1. Test circuit resistive load. V_{IM} = -6 to +8 V V_{CC} = 250 V; tp = 20 µs; δ = tp / T = 0.01. R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

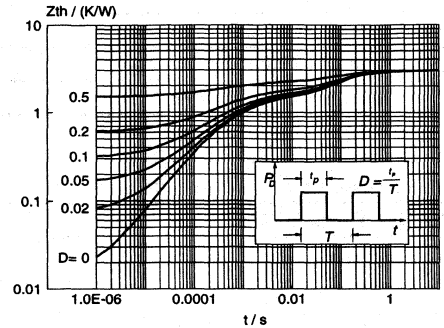


Fig.4. Transient thermal impedance. $Z_{th\ j\text{-}mb}$ = f(t); parameter D = t_p/T

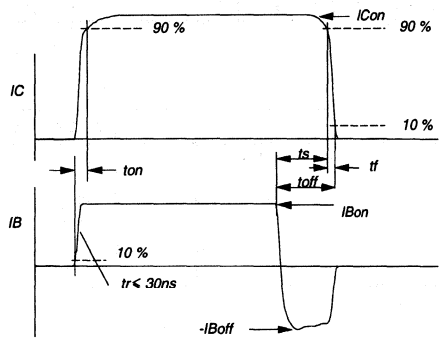


Fig.2. Switching times waveforms with resistive load.

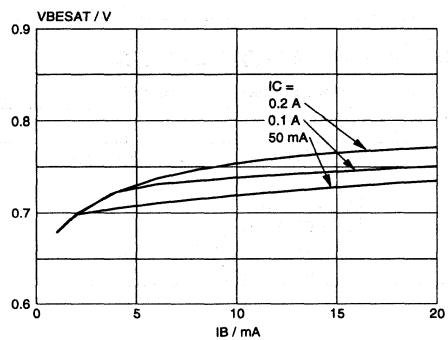


Fig.5. Typical base-emitter saturation voltage. V_{BEsat} = f(I_B); parameter I_C

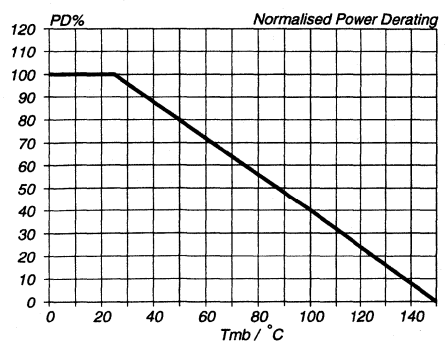


Fig.3. Normalised power dissipation. PD% = 100·PD/PD $_{25\ °C}$ = f (T_{mb})

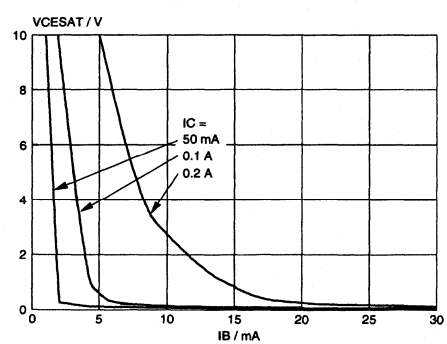


Fig.6. Typical collector-emitter saturation voltage. V_{CEsat} = f(I_B); parameter I_C

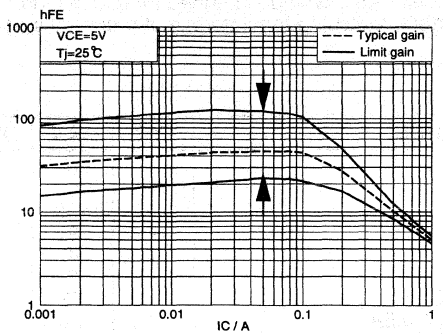


Fig.7. Typical DC current gain.
$h_{FE} = f(I_C)$; parameter V_{CE}.
Arrows indicate conditions protected by 100% test.

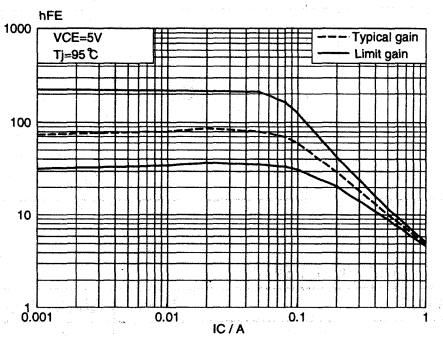


Fig.8. Typical DC current gain.
$h_{FE} = f(I_C)$; parameter V_{CE}

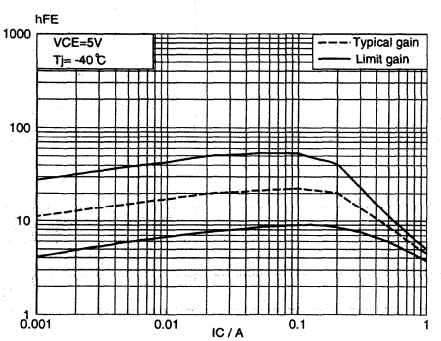


Fig.9. Typical DC current gain.
$h_{FE} = f(I_C)$; parameter V_{CE}

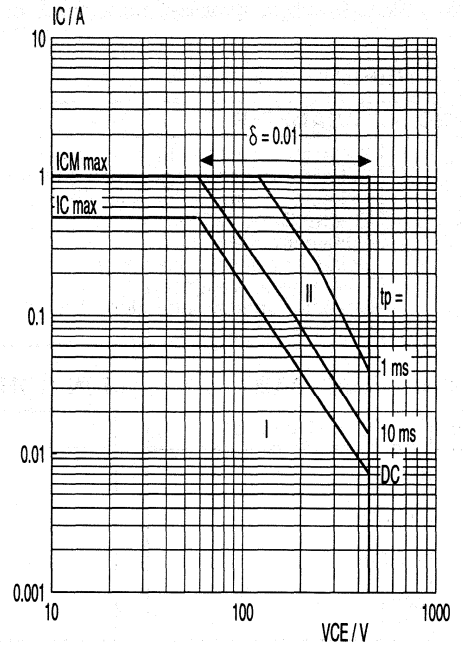


Fig.10. Forward bias safe operating area. T_{mb} = 25 °C

I Region of permissible DC operation.
II Extension for repetitive pulse operation.
NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

Silicon Diffused Power Transistor — PHE13005

GENERAL DESCRIPTION

The PHE13005 is a silicon npn power switching transistor in the TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

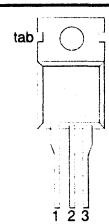
PRELIMINARY
See Philips Semiconductors for design-in information

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	V_{BE} = 0V	-	700	V
V_{CBO}	Collector-Base voltage (open emitter)		-	700	V
V_{CEO}	Collector-emitter voltage (open base)		-	400	V
V_{EBO}	Emitter-Base voltage (I_B = 0)		-	9	V
I_C	Collector current (DC)		-	4	A
I_{CM}	Collector current peak value		-	8	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25^\circ C$	-	75	W
V_{CEsat}	Collector-emitter saturation voltage	I_C = 2A; I_B = 0.5A	0.15	0.6	V
t_f	Fall time	I_C = 2A; I_{B1} = 0.4A; $V_{BE(OFF)}$ = 5V	0.16	0.9	µs

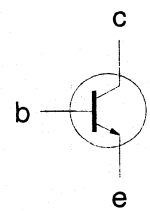
PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector to emitter voltage	V_{BE} = 0V	-	700	V
V_{CEO}	Collector to emitter voltage (open base)		-	400	V
V_{CBO}	Collector to base voltage (open emitter)		-	700	V
V_{EBO}	Emitter-Base voltage (I_B = 0)		-	9	V
I_C	Collector current (DC)		-	4	A
I_{CM}	Collector current peak value		-	8	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation	$T_{mb} \leq 25^\circ C$	-	75	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES8

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Junction to mounting base		-	1.67	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	60	-	K/W

STATIC CHARACTERISTICS

T_{mb} = 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current[1]	$V_{BE(off)}$ = -1.5V; V_{CE} = $V_{CESMmax}$	-	-	1.0	mA
I_{CES}		$V_{BE(off)}$ = -1.5V; V_{CE} = $V_{CESMmax}$; T_j = 100˚C	-	-	5.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 9V; I_C = 0A	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0A; I_C = 10mA	400	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1.0A; I_B = 0.2A	-	0.1	0.5	V
V_{CEsat}		I_C = 2.0A; I_B = 0.5A	-	0.2	0.6	V
V_{CEsat}		I_C = 4.0A; I_B = 1.0A	-	0.3	1.0	V
V_{BEsat}	Base-emitter saturation voltage	I_C = 1.0A; I_B = 0.2A	-	0.85	1.2	V
V_{BEsat}		I_C = 2.0A; I_B = 0.5A	-	0.92	1.6	V
h_{FE}	DC current gain	I_C = 1.0A; V_{CE} = 5V	10	20	60	
h_{FEsat}		I_C = 2.0A; V_{CE} = 5V	8	17	40	

DYNAMIC CHARACTERISTICS

T_{mb} = 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	I_{Con} = 2.0A; I_{Bon} = -I_{Boff} = 0.4A; R_L = 75Ω; V_{CC} = 250V			
t_s	Turn-off storage time		1.7	4	µs
t_f	Turn-off fall time		0.4	0.9	µs
	Switching times (inductive load)	I_{Con} = 2.0A; I_{Bon} = 0.4A; L_B = 1µH; -$V_{BE(off)}$ = 5V			
t_s	Turn-off storage time		0.6	4	µs
t_f	Turn-off fall time		0.1	0.9	µs
	Switching times (inductive load)	I_{Con} = 2.0A; I_{Bon} = 0.4A; L_B = 1µH; -$V_{BE(off)}$ = 5V; T_j = 100˚C			
t_s	Turn-off storage time		0.9	4	µs
t_f	Turn-off fall time		0.16	0.9	µs

1 Measured with half sine-wave voltage (curve tracer).

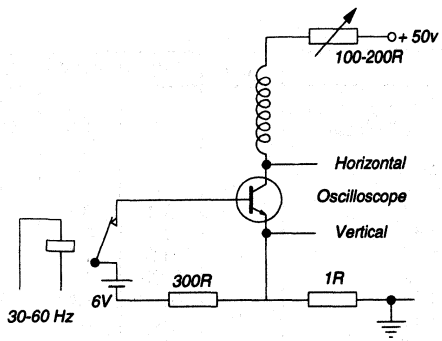


Fig.1. Test circuit for $V_{CEOsust}$.

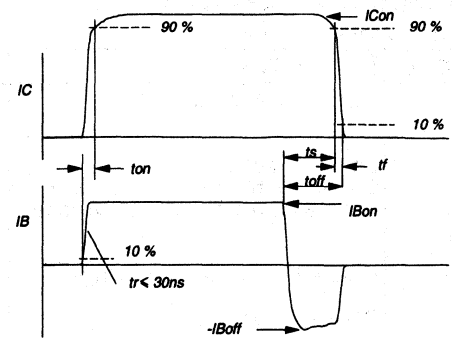


Fig.4. Switching times waveforms with resistive load.

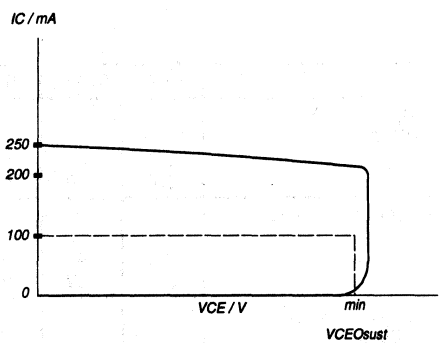


Fig.2. Oscilloscope display for $V_{CEOsust}$.

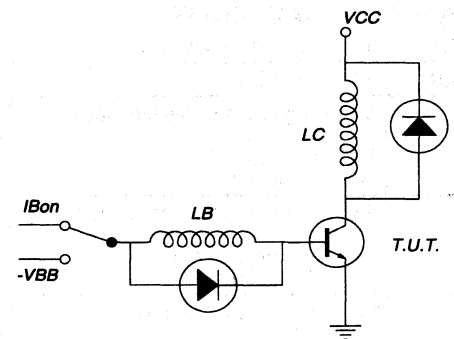


Fig.5. Test circuit inductive load.
V_{CC} = 300 V; $-V_{BE}$ = 5 V; L_C = 200 uH; L_B = 1 uH

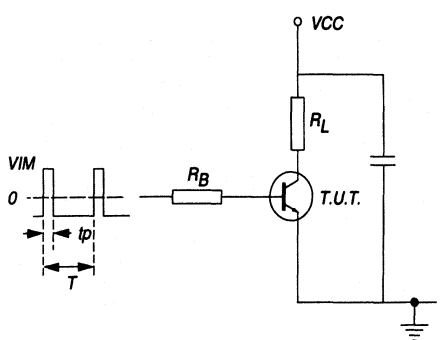


Fig.3. Test circuit resistive load. V_{IM} = -6 to +8 V
V_{CC} = 250 V; t_p = 20 µs; $\delta = t_p / T$ = 0.01.
R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

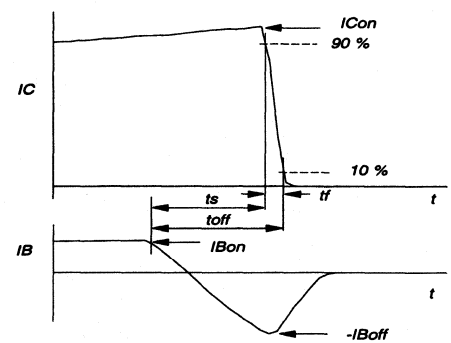


Fig.6. Switching times waveforms with inductive load.

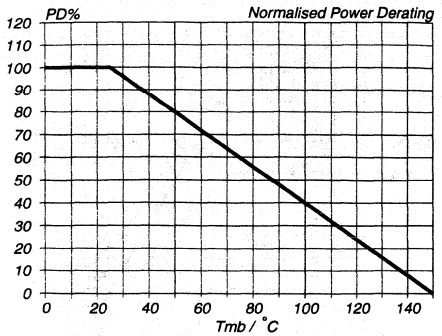


Fig.7. Normalised power dissipation.
PD% = 100·PD/PD $_{25°C}$ = f (T_{mb})

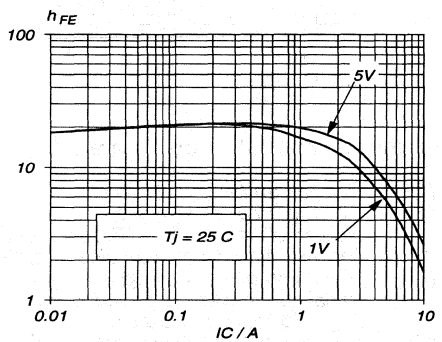


Fig.8. Typical DC current gain. h_{FE} = f(I_C)
parameter V_{CE}

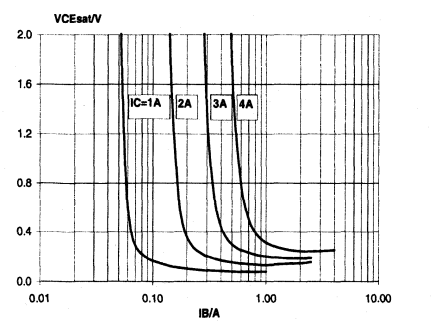


Fig.9. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IB); T_j=25˚C.

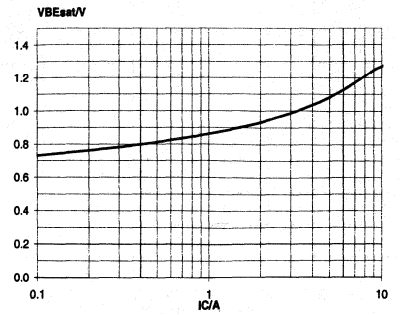


Fig.10. Base-Emitter saturation voltage.
Solid lines = typ values, V_{BEsat} = f(IC); at IC/IB =4.

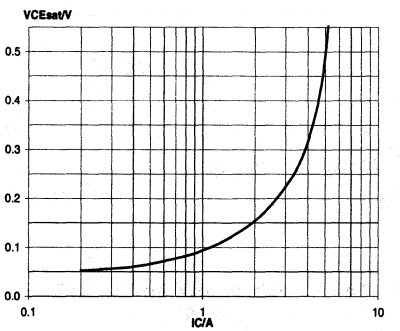


Fig.11. Collector-Emitter saturation voltage.
Solid lines = typ values, V_{CEsat} = f(IC); at IC/IB =4.

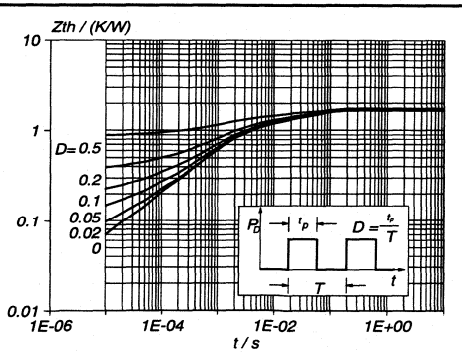


Fig.12. Transient thermal impedance.
$Z_{th\ j\text{-}mb}$ = f(t); parameter D = t_p/T

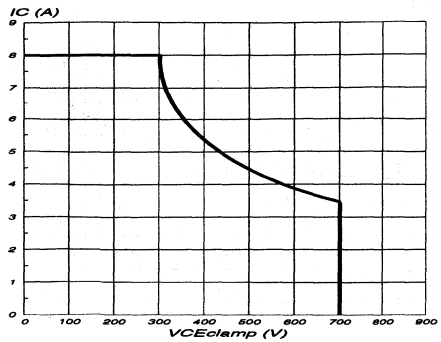


Fig.13. Reverse bias safe operating area $T_j \leq T_{jmax}$

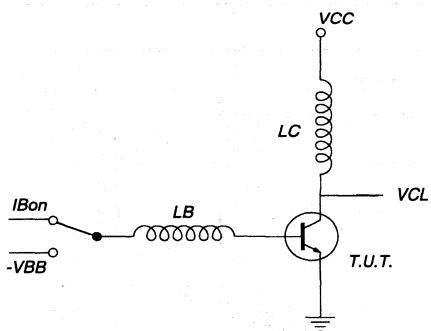


Fig.14. Test Circuit for reverse bias safe operating area.

$V_{cl} \leq 1000V$; $V_{cc} = 150V$; $V_{BB} = -5V$; $L_B = 1\mu H$; $L_c = 200\mu H$

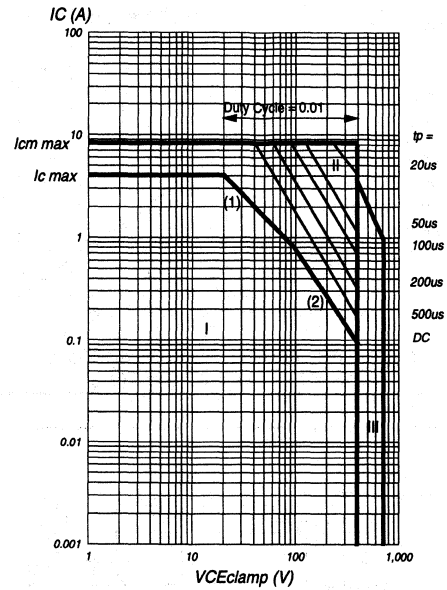


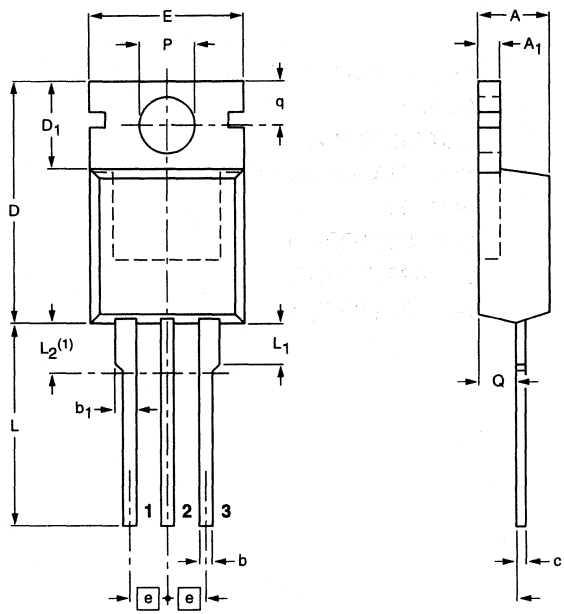
Fig.15. Forward bias safe operating area. $T_{hs} \leq 25$ °C

(1) P_{tot} max and P_{tot} peak max lines.
(2) Second breakdown limits.
I Region of permissible DC operation.
II Extension for repetitive pulse operation.
III Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\,\Omega$ and $t_p \leq 0.6\,\mu s$.
NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

PACKAGE OUTLINES

	Page
SOT78 (TO-220AB)	754
SOT82	755
SOT186(TO-220)	756
SOT186A (Isolated TO-220AB)	757
SOT199	758
SOT399 (TOP3D)	759
SOT429 (TO-247)	760
SOT430 (TOP3L)	761

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB **SOT78**



DIMENSIONS (mm are the original dimensions)

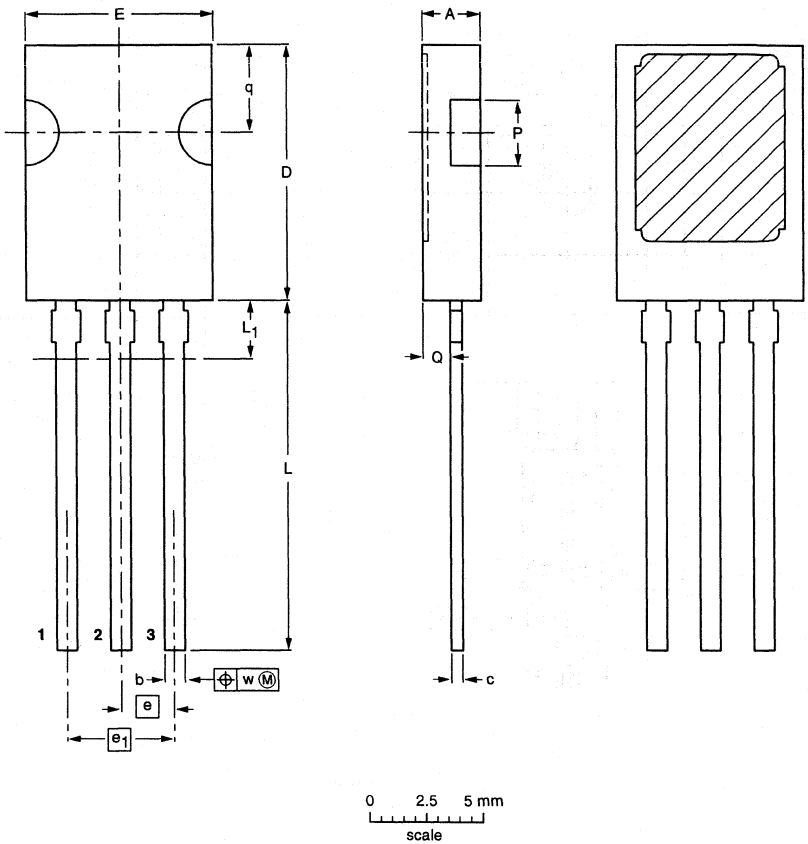
UNIT	A	A_1	b	b_1	c	D	D_1	E	e	L	L_1	L_2(1) max.	P	q	Q
mm	4.5 4.1	1.39 1.27	0.9 0.7	1.3 1.0	0.7 0.4	15.8 15.2	6.4 5.9	10.3 9.7	2.54	15.0 13.5	3.30 2.79	3.0	3.8 3.6	3.0 2.7	2.6 2.2

Note

1. Terminals in this zone are not tinned.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT78		TO-220AB				97-06-11

Plastic single-ended package; 3 leads (in-line) **SOT82**



DIMENSIONS (mm are the original dimensions)

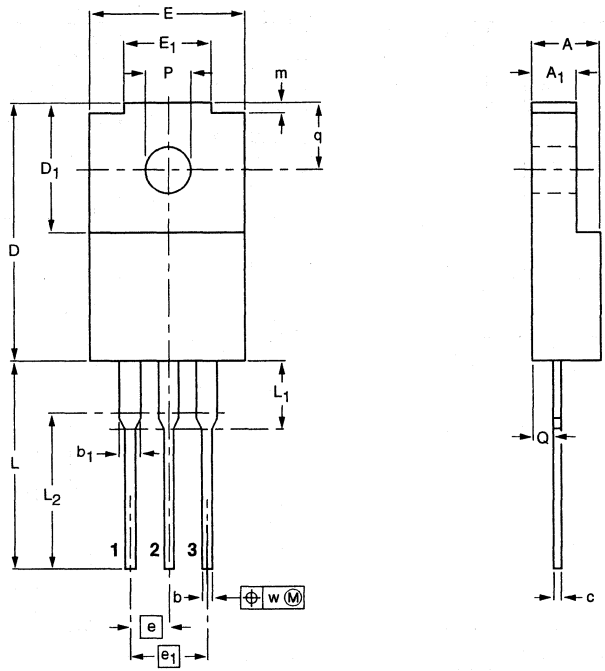
UNIT	A	b	c	D	E	e	e_1	L	L_1 (1) max.	P	Q	q	w
mm	2.8 2.3	0.88 0.65	0.58 0.47	11.1 10.5	7.8 7.2	2.29	4.58	16.5 15.3	2.54	3.1 2.5	1.5 0.9	3.9 3.5	0.254

Note

1. Terminal dimensions within this zone are uncontrolled to allow for body and terminal irregularities.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT82						97-06-11

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 lead TO-220 exposed tabs **SOT186**



0 5 10 mm
scale

DIMENSIONS (mm are the original dimensions)

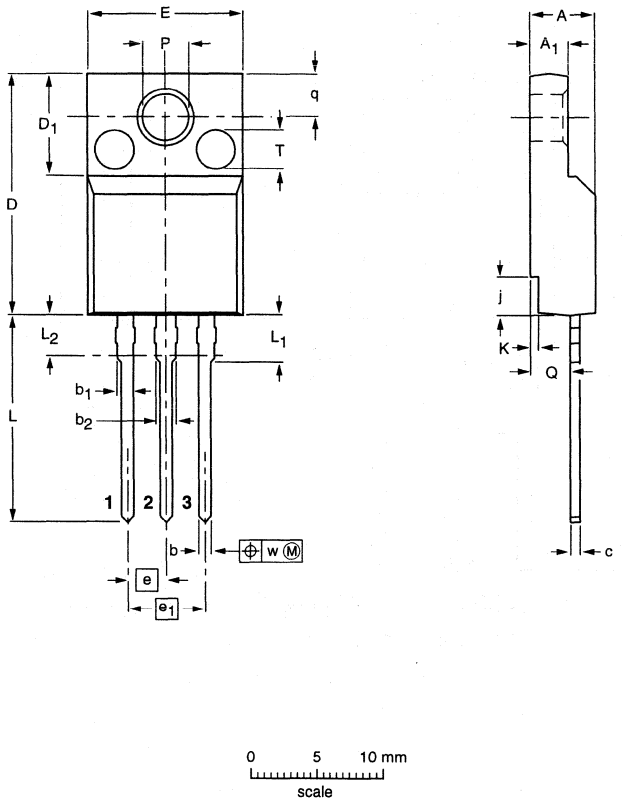
UNIT	A	A_1	b	b_1	c	D	D_1	E	E_1	e	e_1	L	L_1(1)	L_2	m	P	Q	q	w
mm	4.4 4.0	2.9 2.5	0.9 0.7	1.5 1.3	0.55 0.38	17.0 16.4	7.9 7.5	10.2 9.6	5.7 5.3	2.54	5.08	14.3 13.5	4.8 4.0	10	0.9 0.5	3.2 3.0	1.4 1.2	4.4 4.0	0.4

Note

1. Terminal dimensions within this zone are uncontrolled. Terminals in this zone are not tinned.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT186		TO-220				97-06-11

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 lead TO-220 **SOT186A**



DIMENSIONS (mm are the original dimensions)

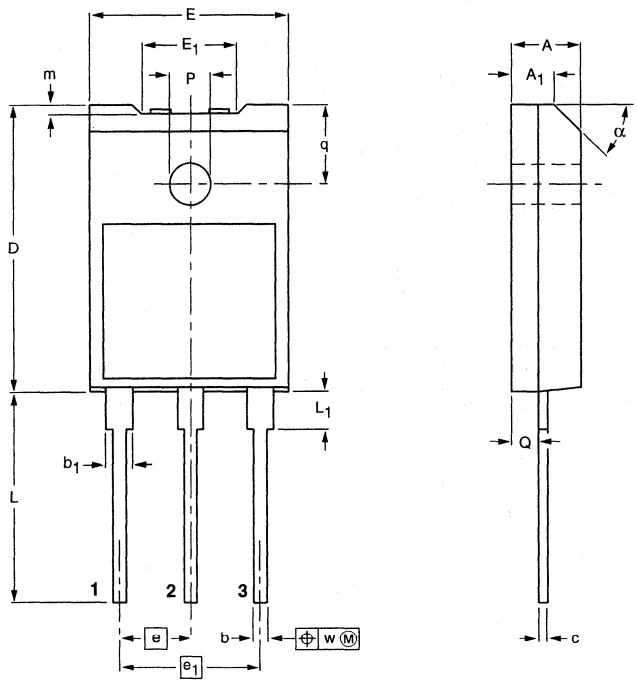
UNIT	A	A_1	b	b_1	b_2	c	D	D_1	E	e	e_1	j	K	L	L_1	L_2 (1) max.	P	Q	q	T (2)	w
mm	4.6 4.0	2.9 2.5	0.9 0.7	1.1 0.9	1.4 1.2	0.7 0.4	15.8 15.2	6.5 6.3	10.3 9.7	2.54	5.08	2.7 2.3	0.6 0.4	14.4 13.5	3.30 2.79	3	3.2 3.0	2.6 2.3	3.0 2.6	2.5	0.4

Notes

1. Terminal dimensions within this zone are uncontrolled. Terminals in this zone are not tinned.
2. Both recesses are Ø 2.5 × 0.8 max. depth

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT186A		TO-220				97-06-11

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3 leads (in-line) **SOT199**



0 5 10 mm
scale

DIMENSIONS (mm are the original dimensions)

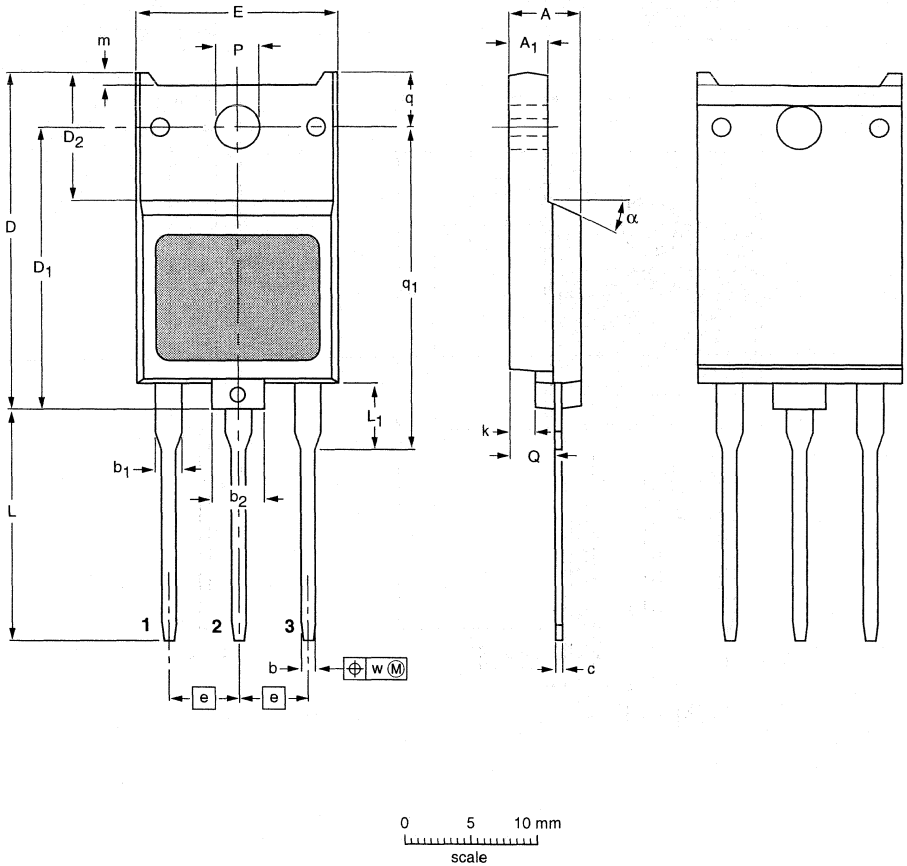
UNIT	A	A_1	b	b_1	c	D	E	E_1	e	e_1	L	L_1 (1)	m	P	Q	q	w	α
mm	5.2 4.8	3.4 3.0	1.2 1.0	2.1 1.9	0.6 0.5	21.5 20.5	15.3 14.7	7.8 6.8	5.45	10.9	16.5 15.7	3.7 3.3	0.8 0.6	3.3 3.1	2.1 1.9	6.2 5.8	0.4	45°

Note

1. Terminals in this zone are not tinned.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT199						97-06-27

Plastic single-ended through-hole package; mountable to heatsink; 1 mounting hole; 3 in-line leads SOT399



DIMENSIONS (mm are the original dimensions)

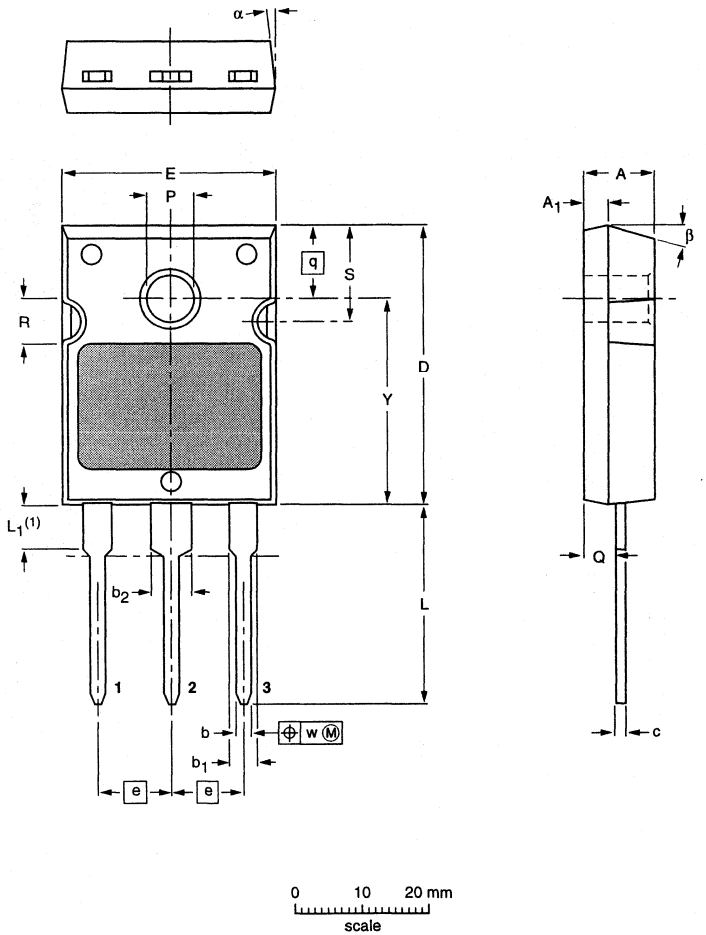
UNIT	A	A_1	b	b_1	b_2	c	D	D_1	D_2	E	e	k	L	L_1 (1)	m	P	Q	q	q_1	w	α
mm	5.8 4.8	3.3 2.7	1.2 0.9	2.2 1.8	4.7 4.2	0.9 0.6	27 26	22.5 21.5	10.2 9.9	16 15	5.45	2.2 1.8	19.1 18.1	5.4 4.8	0.8 0.6	3.4 3.1	3.4 3.2	4.7 4.3	25.7 25.1	0.4	27° 23°

Note

1. Tinning of terminals are uncontrolled within zone L_1.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT399						98-11-06

Plastic single-ended through-hole package; heatsink mounted; 1 mounting hole; 3-lead TO-247 **SOT429**



DIMENSIONS (mm are the original dimensions)

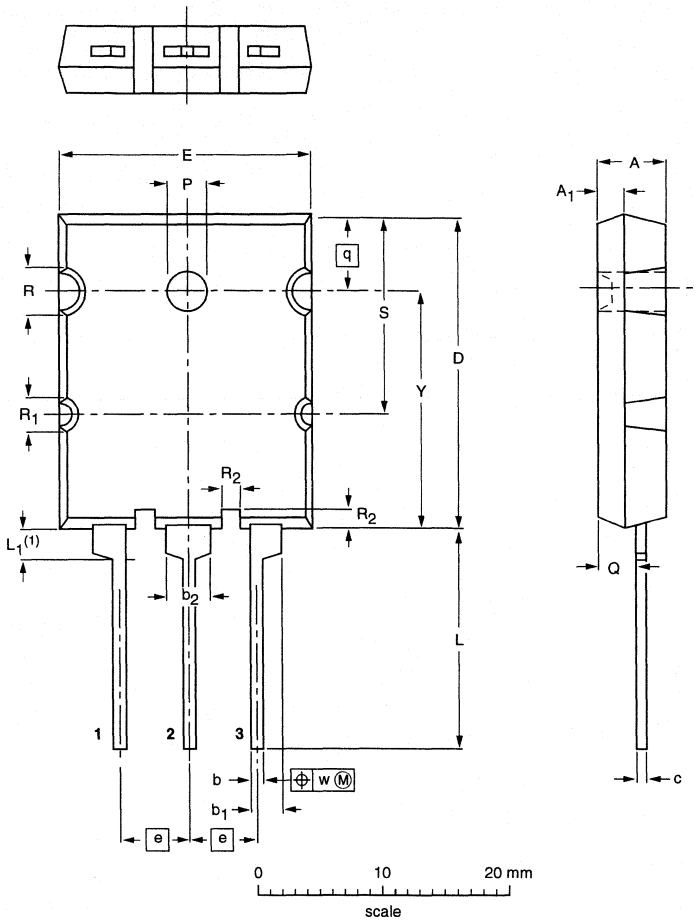
UNIT	A	A_1	b	b_1	b_2	c	D	E	e	L	L_1(1)	P	Q	q	R	S	w	Y	α	β
mm	5.3 4.7	1.9 1.7	1.2 0.9	2.2 1.8	3.2 2.8	0.9 0.6	21 20	16 15	5.45	16 15	4.0 3.6	3.7 3.3	2.6 2.4	5.3	3.5 3.3	7.5 7.1	0.4	15.7 15.3	6° 4°	17° 13°

Note

1. Tinning of terminals are uncontrolled within zone L_1.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT429		TO-247				98-04-07

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead JUMBO TO-247 **SOT430**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	b	b_1 max.	b_2 max.	c max.	D	E max.	e	L min.	L_1	P	Q max.	q	R	R_1	R_2	S	w	Y
mm	5.3	2.3	1.0 0.8	2.5	3.5	0.8	26.5 25.5	20.5	5.45	19.5	2.5	3.5 3.1	3.0	6.0	4.0	3.0	1.5	16	0.4	20.5 19.5

Note

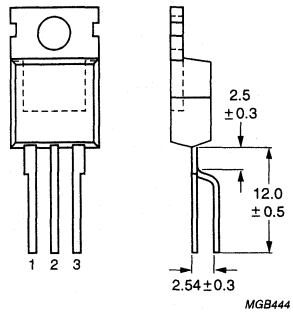
1. Terminals are uncontrolled within zone L_1.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT430						97-06-23

LEADFORM OPTIONS

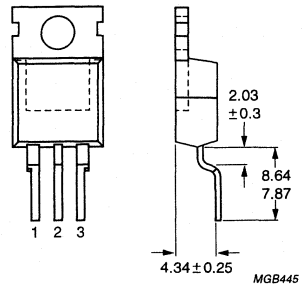
LEADFORM OPTIONS

- These options require a special part number before ordering.
- Contact your local Philips Semiconductors representative for pricing, minimum order quantities and part number.



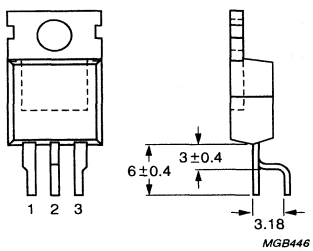
SOT78 (TO-220)

Fig.1 Leadform 78-02.



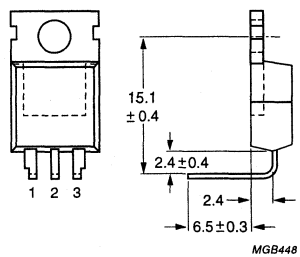
SOT78 (TO-220)

Fig.2 Leadform 78-05W.



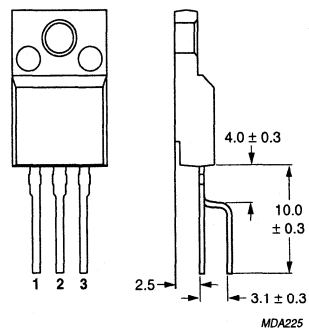
SOT78 (TO-220)

Fig.3 Leadform 78-13.



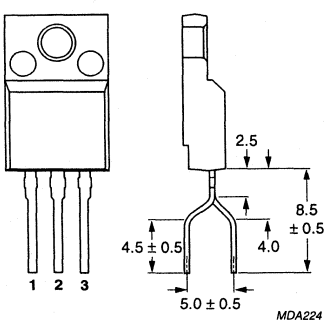
SOT78 (TO-220)

Fig.4 Leadform 78-15.



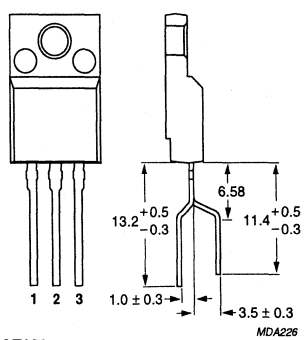
SOT186

Fig.5 Leadform 186A-02



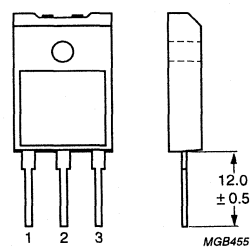
SOT186A

Fig.6 Leadform 186A-03



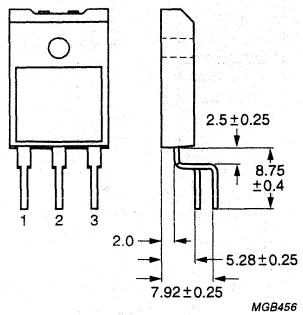
SOT186

Fig.7 Leadform 186A-04



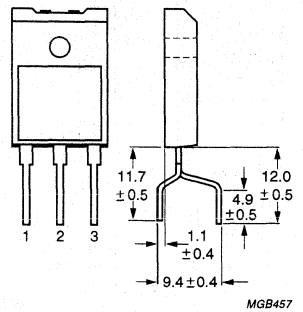
SOT199

Fig.8 Leadform 199-01.



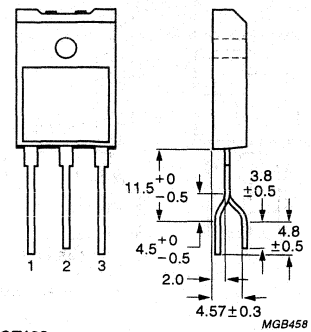
SOT199

Fig.9 Leadform 199-02.



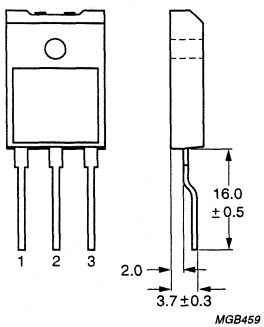
SOT199

Fig.10 Leadform 199-04.



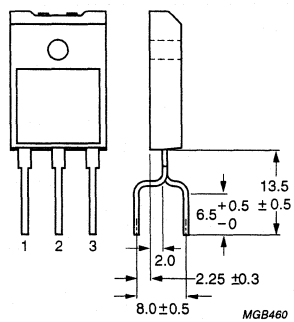
SOT199

Fig.11 Leadform 199-05.



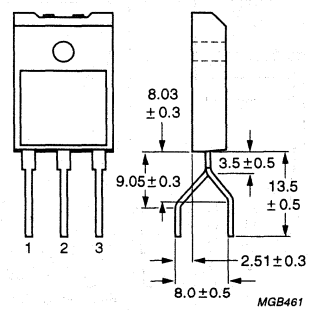
SOT199

Fig.12 Leadform 199-06.



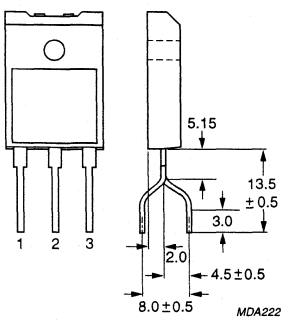
SOT199

Fig.13 Leadform 199-08.



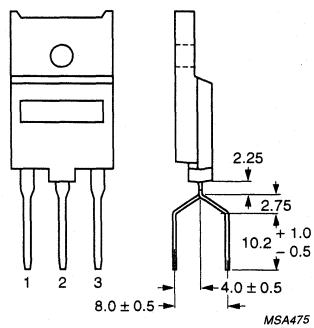
SOT199

Fig.14 Leadform 199-09.



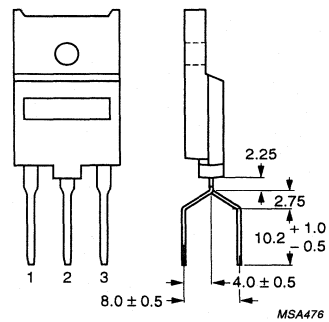
SO199T

Fig.15 Leadform 199-10



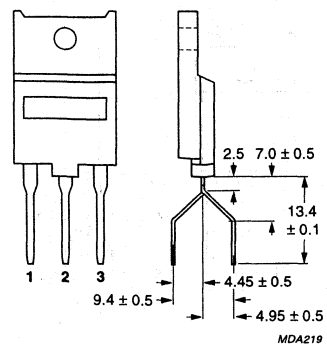
SOT399

Fig.16 Leadform 399-01



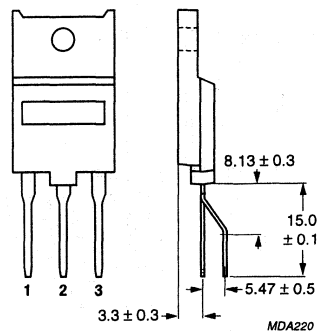
SOT399

Fig.17 Leadform 399-02.



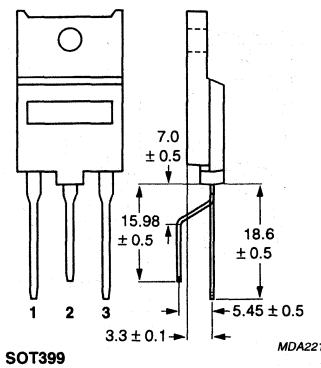
SOT399

Fig.18 Leadfrom 399-03



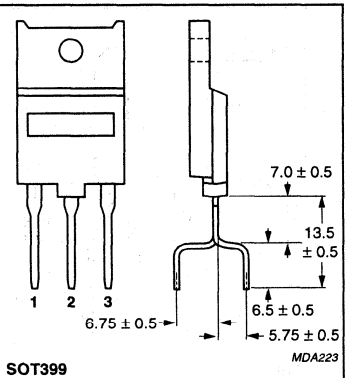
SOT399

Fig.19 Leadform 399-04



SOT399

Fig.20 Leadform 399-05



SOT399

Fig.21 Leadform 399-06

MOUNTING AND SOLDERING INSTRUCTIONS

	page
TO126/SOT82	768
SOT186/A; SOT78 (TO220AB)	772
SOT199/SOT429 (TO247)/SOT339 (TOP3D)	776

GENERAL DATA AND INSTRUCTIONS FOR TO126/SOT82

General rules

1. Fasten the device to the heatsink before soldering the leads.
2. Avoid stress to the leads.
3. Keep mounting tool (e.g. screwdriver) clear of the plastic body.

Mounting methods

CLIP MOUNTING

Mounting by means of spring clip offers:

1. A good thermal contact under the crystal area.
2. Safe insulation for mains and high voltage operation.

Minimum force for good heat transfer is 10 N.

Maximum force to avoid damaging the device is 80 N.

M2.5 AND M3 SCREW MOUNTING (TO126 ONLY)

The spacing washer should be inserted between screw head and body.

Minimum torque for good heat transfer is 0.4 Nm.

Maximum torque to avoid damaging the device is 0.6 Nm.

When the driven nut or screw is in direct contact with a toothed lock washer, the torques are as follows:

Minimum torque for good heat transfer is 0.55 Nm.

Maximum torque to avoid damaging the device is 0.8 Nm.

BODY MOUNTING (SOT82 ONLY)

A SOT82 envelope can be adhesive mounted or soldered into a hybrid circuit.

For soldering, a copper plate or an anodised aluminium plate with copper layer is recommended.

With adhesive mounting, a ceramic substrate may be used.

RIVET MOUNTING

It is not permitted to rivet mount the TO126 outline.

Heatsink requirements

Flatness in the mounting area: 0.02 mm maximum per 10 mm. Mounting holes must be deburred, for further information see clip and screw mounting instructions.

Heatsink compound

The thermal resistance from mounting base to heatsink ($R_{th\ mb\text{-}h}$) can be reduced by applying a metallic oxide compound between the contact surfaces. Values given are of thermal resistance using this type of compound. Dow Corning 340 Heat sink compound is recommended. For insulated mounting, the compound should be applied to the bottom of both device and insulator.

Thermal data for heatsink mounting methods

$R_{th\ mb\text{-}h}$	Thermal resistance from mounting base to heatsink	K/W			
Envelope	Mounting method	Clip		Screw	
		Direct	Insulated	Direct	Insulated
TO126	with heatsink compound	1.0	3.0	0.5	3.0
	without heatsink compound	3.0	6.0	1.0	6.0
SOT82	with heatsink compound	0.4	2.0	–	–
	without heatsink compound	2.0	5.0	–	–

Soldering

LEAD SOLDERING

For devices with a maximum junction temperature <150 °C.

DIP OR WAVE SOLDERING

Maximum permissible solder temperature is 260 °C at a distance from the body of >5 mm and for a total contact time with soldering bath or waves of <7 s.

HAND SOLDERING

Maximum permissible temperature is 275 °C at a distance from the body of >3 mm and for a total contact time with the soldering iron of <5 s.

Maximum permissible temperature is 250 °C at a distance from the body of >3 mm and for a total contact time with the soldering iron of <10 s.

The body of the device must not touch anything with a temperature >200 °C.

Avoid any force on body and leads during or after soldering; do not correct the position of the device or of its leads after soldering.

MOUNTING BASE SOLDERING

Recommended metal-alloy of solder paste (85% metal weight)
62% Sn / 36% Pb / 2% Ag or 60% Sn / 40% Pb.

Maximum soldering temperature <200 °C (mounting base temperature).
Soldering cycle duration including pre-heating <30 sec.

For good soldering and avoiding damage to the encapsulation pre-heating is recommended to a temperature <165 °C at a duration of <10 s.

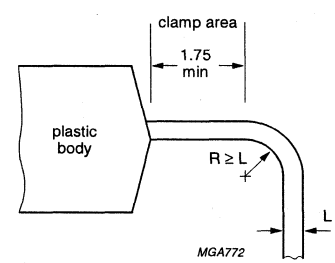
Lead bending

Maximum permissible tensile force on the body for 5 seconds is 20 N.

The leads can be bent, twisted or straightened. To keep forces within the above mentioned limits the leads should always be clamped rigidly near the body during bending. This is also to prevent damage to the seal of the leads within the plastic body.

Leads can be bent as near to the body as required, but adequate length should always be allowed for clamping. This is a minimum of 1.75 mm from the body to the start of a bend radius.

The internal radius of bend should never be less than the thickness of the lead. A minimum radius of at least 1.5 × lead thickness is preferred. See Fig.1. Surface cracks in the dip tin coating on the lead are common when a radius less than 1.5 × lead thickness is used. Although exposing the copper material, these cracks do not affect the mechanical strength of the lead.



Dimensions in mm.

Fig.1 Minimum lead bend radius.

Additional guide-lines

It is recommended that where a device is rigidly secured to a heatsink which is in turn rigidly secured to a PCB, that a bend is put in the leads to act as an expansion loop. This will prevent differential expansion of the mounting parts transferring stress to the soldering joint, as shown in Fig.2. This is only necessary where the device is mounted so rigidly that expansion forces are transmitted through the assembly.

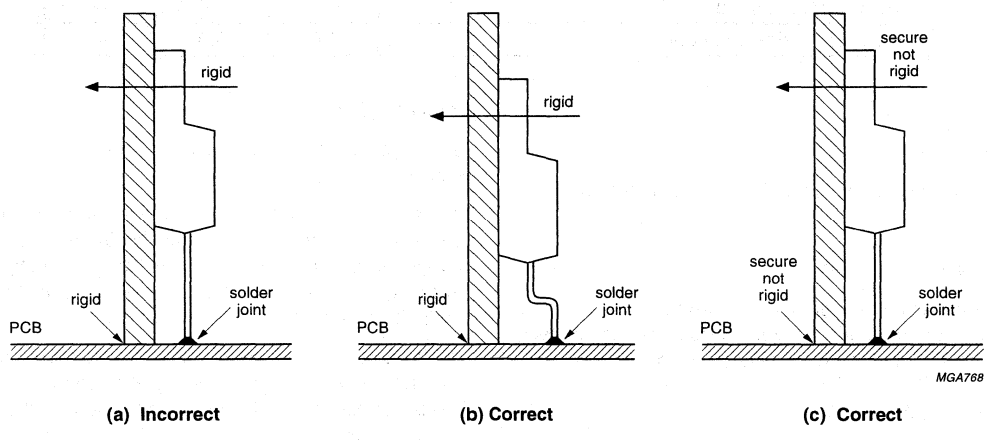


Fig.2 Printed circuit board and heatsink mounting.

INSTRUCTIONS FOR SCREW MOUNTING

Direct mounting with screw and spacing washer

THROUGH HEATSINK WITH NUT

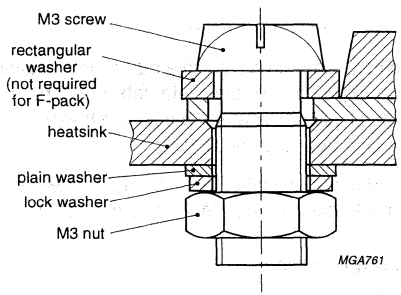


Fig.3 Assembly.

INTO TAPPED HEATSINK

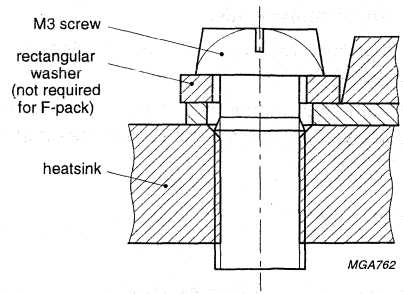
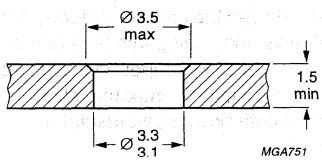
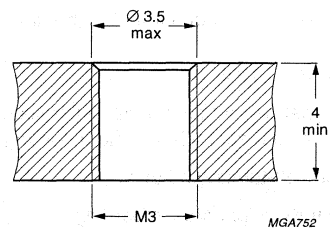


Fig.5 Assembly.



Dimensions in mm.

Fig.4 Heatsink requirements.



Dimensions in mm.

Fig.6 Heatsink requirements.

GENERAL DATA AND INSTRUCTIONS FOR TO220AB (SOT78)/SOT186/A

General rules

1. Fasten the device to the heatsink before soldering the leads.
2. Avoid stress to the leads.
3. Keep mounting tool (e.g. screwdriver) clear of the plastic body.
4. The rectangular washer may only touch the plastic part of the body; it should not exert any force on that part (screw mounting).

Mounting methods

CLIP MOUNTING

Mounting by means of spring clip offers:

1. A good thermal contact under the crystal area, and slightly lower thermal resistance than screw mounting.
2. Safe insulation for mains operation.

Minimum force for good heat transfer is 10 N.

Maximum force to avoid damaging the device is 80 N.

M3 SCREW MOUNTING

It is recommended that the rectangular spacing washer is inserted between screw head and mounting tab.

Do not use self-tapping screws.

Mounting torque for screw mounting:

For thread-forming screws these are final values.

Minimum torque for good heat transfer is 0.55 Nm.

Maximum torque to avoid damaging the device is 0.80 Nm.

When a nut or screw is driven directly against the tab, the torques are as follows:

Minimum torque for good heat transfer is 0.40 Nm.

Maximum torque to avoid damaging the device is 0.60 Nm.

RIVET MOUNTING NON-INSULATED

The device should not be pop-riveted to the heatsink. It is permissible to press-rivet the metal tab providing that eyelet rivets of soft material are used, and the press forces are slowly and carefully controlled.

This method is not permitted for full-pack envelopes because it will damage the plastic encapsulation.

Heatsink requirements

Flatness in the mounting area: 0.02 mm maximum per 10 mm. Mounting holes must be deburred, for further information see clip and screw mounting instructions.

Heatsink compound

The thermal resistance from mounting base to heatsink ($R_{th\ mb\text{-}h}$) can be reduces by applying a metallic oxide compound between the contact surfaces. Values given are of thermal resistance using this type of compound. Dow Corning 340 Heat sink compound is recommended. For insulated mounting, the compound should be applied to the bottom of both device and insulator.

Thermal data for heatsink mounting methods (TO220 only)

Typical figures, for exact figures see data for each device type.

$R_{th\ mb\text{-}h}$	Thermal resistance from mounting base to heatsink	K/W	
Mounting method		Clip	Screw
direct with heatsink compound		0.3	0.5
direct without heatsink compound		1.4	1.4
with heatsink compound and 0.1 mm maximum mica insulator		2.2	–
with heatsink compound and 0.25 mm maximum alumina insulator		0.8	–
with heatsink compound and 0.05 mm mica insulator			
insulated up to 500 V		–	1.4
insulated up to 800 V/1000 V		–	1.6
without heatsink compound and 0.05 mm mica insulator			
insulated up to 500 V		–	3.0
insulated up to 800 V/1000 V		–	4.5

Additional insulators are generally not required when mounting the full-pack outlines.

Soldering

Recommendation for devices with a maximum junction temperature rating <175 °C:

DIP OR WAVE SOLDERING

Maximum permissible solder temperature is 260 °C at a distance from the body of >5 mm and for a total contact time with soldering bath or waves of <7 s.

HAND SOLDERING

Maximum permissible temperature is 275 °C at a distance from the body of >3 mm and for a total contact time with the soldering iron of <5 s.

The body of the device must not touch anything with a temperature >200 °C.

It is not permitted to solder the metal tab of the device to a heatsink, otherwise the junction temperature rating will be exceeded.

Avoid any force on body and leads during or after soldering; do not correct the position of the device or of its leads after soldering.

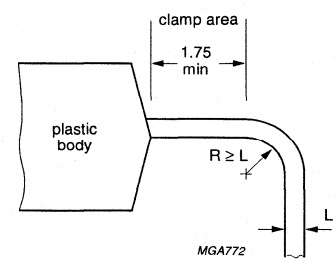
Lead bending

Maximum permissible tensile force on the body for 5 seconds is 20 N.

The leads can be bent, twisted or straightened. To keep forces within the above mentioned limits the leads should always be clamped rigidly near the body during bending. This is also to prevent damage to the seal of the leads within the plastic body.

Leads can be bent as near to the body as required, but adequate length should always be allowed for clamping. This is a minimum of 1.75 mm from the body to the start of a bend radius.

The internal radius of bend should never be less than the thickness of the lead. A minimum radius of at least 1.5 × lead thickness is preferred. See Fig.7. Surface cracks in the dip tin coating on the lead are common when a radius less than 1.5 × lead thickness is used. Although exposing the copper material, these cracks do not affect the mechanical strength of the lead. Lead forming by Philips is available as an option on all products supplied in these outlines.



Dimensions in mm.

Fig.7 Minimum lead bend radius.

Additional guide-lines

It is recommended that where a device is rigidly secured to a heatsink which is in turn rigidly secured to a PCB, that a bend is put in the leads to act as an expansion loop. This will prevent differential expansion of the mounting parts transferring stress to the soldering joint, as shown in Fig.8. This is only necessary where the device is mounted so rigidly that expansion forces are transmitted through the assembly.

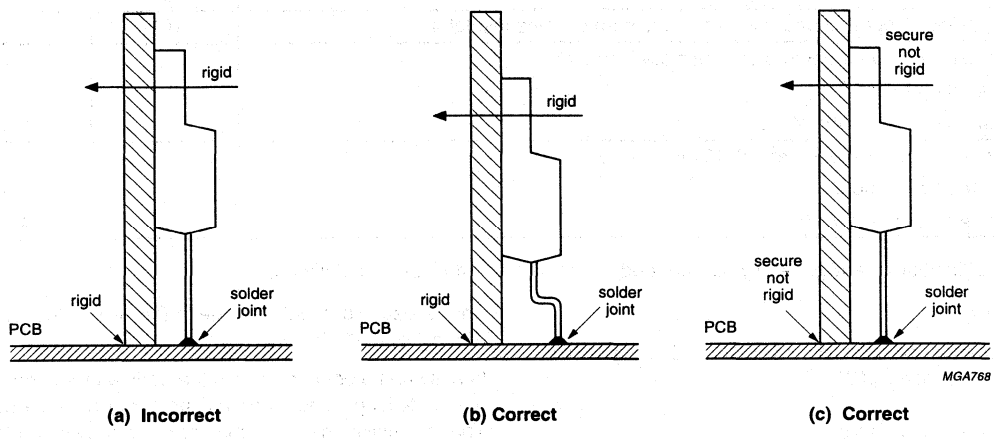


Fig.8 Printed circuit board and heatsink mounting.

INSTRUCTIONS FOR SCREW MOUNTING

Direct mounting with screw and spacing washer

THROUGH HEATSINK WITH NUT

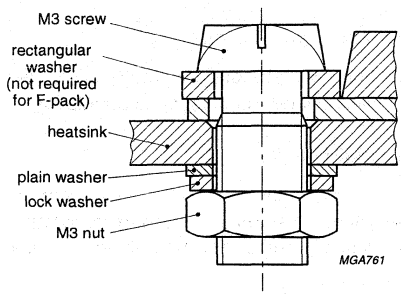


Fig.9 Assembly.

INTO TAPPED HEATSINK

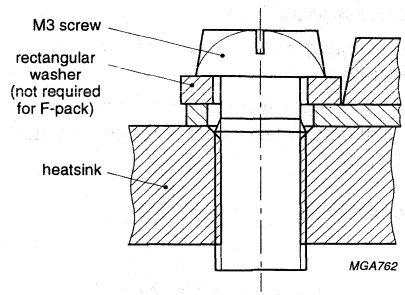
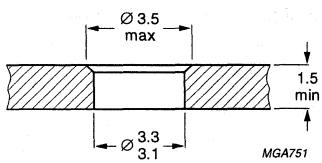
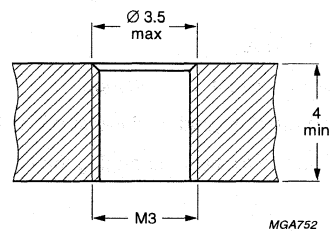


Fig.11 Assembly.



Dimensions in mm.

Fig.10 Heatsink requirements.



Dimensions in mm.

Fig.12 Heatsink requirements.

GENERAL DATA AND INSTRUCTIONS FOR SOT199/SOT429 (TO247)/TOP3D (SOT399)

General rules

1. Fasten the device to the heatsink before soldering the leads.
2. Avoid stress to the leads.
3. Keep mounting tool (e.g. screwdriver) clear of the plastic body.
4. The washer may only touch the plastic part of the body; it should not exert any force on that part (screw mounting).

Mounting methods

CLIP MOUNTING

Mounting by means of spring clip offers:

1. A good thermal contact under the crystal area.
2. Safe insulation for mains operation.

Minimum force for good heat transfer is 10 N.

Maximum force to avoid damaging the device is 80 N.

MOUNTING TORQUES

For M3 screw (insulated mounting):

Minimum torque for good heat transfer is 0.4 Nm.

Maximum torque to avoid damaging the device is 0.6 Nm.

For M4 screw (direct mounting only):

Minimum torque for good heat transfer is 0.4 Nm.

Maximum torque to avoid damaging the device is 1.0 Nm.

The M4 screw head should not touch the plastic part of the envelope.

RIVET MOUNTING NON-INSULATED

The device should not be pop-riveted to the heatsink because it will damage the plastic encapsulation.

Heatsink requirements

Flatness in the mounting area: 0.02 mm maximum per 10 mm. Mounting holes must be deburred, for further information see clip and screw mounting instructions.

Heatsink compound

The thermal resistance from mounting base to heatsink ($R_{th\ mb\text{-}h}$) can be reduced by applying a metallic oxide compound between the contact surfaces. Values given are of thermal resistance using this type of compound. Dow Corning 340 Heat sink compound is recommended. For insulated mounting, the compound should be applied to the bottom of both device and insulator.

Soldering

Recommendation for devices with a maximum junction temperature rating <175 °C:

DIP OR WAVE SOLDERING

Maximum permissible solder temperature is 260 °C at a distance from the body of >5 mm and for a total contact time with soldering bath or waves of <7 s.

HAND SOLDERING

Maximum permissible temperature is 275 °C at a distance from the body of >3 mm and for a total contact time with the soldering iron of <5 s.

The body of the device must not touch anything with a temperature >200 °C.

It is not permitted to solder the metal tab of the device to a heatsink, otherwise the junction temperature rating will be exceeded.

Avoid any force on body and leads during or after soldering; do not correct the position of the device or of its leads after soldering.

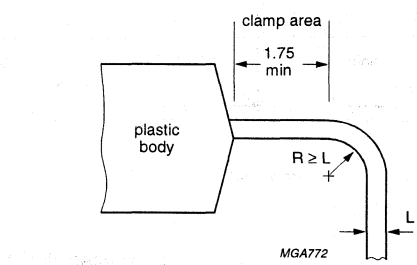
Lead bending

Maximum permissible tensile force on the body for 5 seconds is 20 N.

The leads can be bent, twisted or straightened. To keep forces within the above mentioned limits the leads should always be clamped rigidly near the body during bending. This is also to prevent damage to the seal of the leads within the plastic body.

Leads can be bent as near to the body as required, but adequate length should always be allowed for clamping. This is a minimum of 1.75 mm from the body to the start of a bend radius.

The internal radius of bend should never be less than the thickness of the lead. A minimum radius of at least 1.5 × lead thickness is preferred. See Fig.13. Surface cracks in the dip tin coating on the lead are common when a radius less than 1.5 × lead thickness is used. Although exposing the copper material, these cracks do not affect the mechanical strength of the lead. Lead forming by Philips is available as an option on all products supplied in these outlines.



Dimensions in mm.

Fig.13 Minimum lead bend radius.

Additional guide-lines

It is recommended that where a device is rigidly secured to a heatsink which is in turn rigidly secured to a PCB, that a bend is put in the leads to act as an expansion loop. This will prevent differential expansion of the mounting parts transferring stress to the soldering joint, as shown in Fig.14. This is only necessary where the device is mounted so rigidly that expansion forces are transmitted through the assembly.

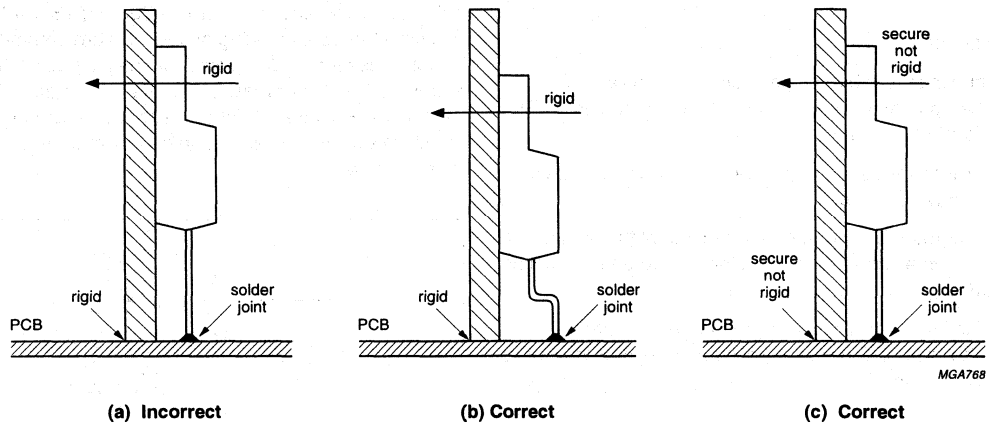


Fig.14 Printed circuit board and heatsink mounting.

INSTRUCTIONS FOR SCREW MOUNTING

Direct mounting through heatsink with nut

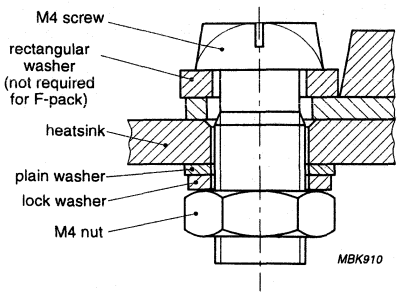
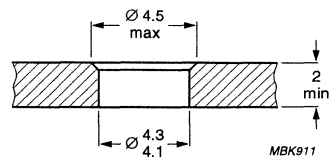


Fig.15 Assembly.

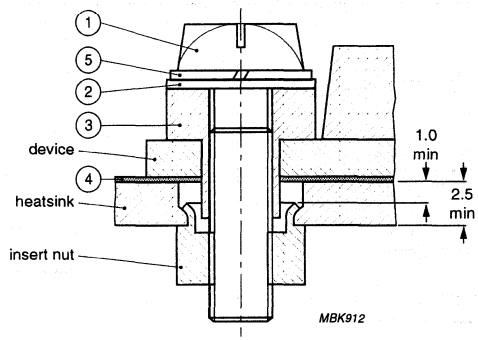


Dimensions in mm.

Fig.16 Heatsink requirements.

Where vibrations are to be expected the use of a lock washer or of a curved spring washer is recommended with a plain washer between aluminium heatsink and spring washer.

Insulated screw mounting with insert nut; up to 500 V



(1) M3 screw.
(2) Plain washer.
(3) Insulating bush.
(4) Mica insulator.
(5) Lock washer.

Fig.17 Assembly and heatsink requirements for 500 V insulation. See also Figs 15 and 16.

DATA HANDBOOK SYSTEM

DATA HANDBOOK SYSTEM

Philips Semiconductors data handbooks contain all pertinent data available at the time of publication and each is revised and reissued regularly.

Loose data sheets are sent to subscribers to keep them up-to-date on additions or alterations made during the lifetime of a data handbook.

Catalogues are available for selected product ranges (some catalogues are also on floppy discs).

Our data handbook titles are listed here.

Integrated circuits

Book	*Title*
IC01	Semiconductors for Radio, Audio and CD/DVD Systems
IC02	Semiconductors for Television and Video Systems
IC03	Semiconductors for Wired Telecom Systems
IC04	HE4000B Logic Family CMOS
IC05	Advanced Low-power Schottky (ALS) Logic
IC06	High-speed CMOS Logic Family
IC11	General-purpose/Linear ICs
IC12	I^2C Peripherals
IC13	Programmable Logic Devices (PLD)
IC14	8048-based 8-bit Microcontrollers
IC15	FAST TTL Logic Series
IC16	CMOS ICs for Clocks, Watches and Real Time Clocks
IC17	Semiconductors for Wireless Communications
IC18	Semiconductors for In-Car Electronics
IC19	ICs for Data Communications
IC20	80C51-based 8-bit Microcontrollers
IC22	Multimedia ICs
IC23	BiCMOS Bus Interface Logic
IC24	Low Voltage CMOS & BiCMOS Logic
IC25	16-bit 80C51XA Microcontrollers (eXtended Architecture)
IC26	Integrated Circuit Packages
IC27	Complex Programmable Logic Devices

Discrete semiconductors

Book	*Title*
SC01	Small-signal and Medium-power Diodes
SC03	Power Thyristors and Triacs
SC04	Small-signal Transistors
SC05	Video Transistors and Modules for Monitors
SC06	Power Bipolar Transistors
SC07	Small-signal Field-effect Transistors
SC11	Power Diodes
SC13	PowerMOS Transistors
SC14	RF Wideband Transistors
SC16	Wideband Hybrid Amplifier Modules for CATV
SC17	Semiconductor Sensors
SC18	Discrete Semiconductor Packages
SC19	RF & Microwave Power Transistors, RF Power Modules and Circulators/Isolators

MORE INFORMATION FROM PHILIPS SEMICONDUCTORS?

For more information about Philips Semiconductors data handbooks, catalogues and subscriptions contact your nearest Philips Semiconductors national organization, select from the **address list on the back cover of this handbook.** Product specialists are at your service and enquiries are answered promptly.

OVERVIEW OF PHILIPS COMPONENTS DATA HANDBOOKS

Our sister product division, Philips Components, also has a comprehensive data handbook system to support their products. Their data handbook titles are listed here.

Display components

Book	*Title*
DC01	Colour Television and Multimedia Tubes
DC02	Monochrome Monitor Tubes and Deflection Units
DC03	Television Tuners, Coaxial Aerial Input Assemblies
DC04	Colour Monitor and Multimedia Tubes
DC05	Wire Wound Components

Magnetic products

MA01	Soft Ferrites
MA03	Piezoelectric Ceramics Specialty Ferrites
MA04	Dry-reed Switches

Passive components

PA01	Electrolytic Capacitors
PA02	Varistors, Thermistors and Sensors
PA03	Potentiometers
PA04	Variable Capacitors
PA05	Film Capacitors
PA06	Ceramic Capacitors
PA06a	Surface Mounted Ceramic Multilayer Capacitors
PA06b	Leaded Ceramic Capacitors
PA08	Fixed Resistors
PA10	Quartz Crystals
PA11	Quartz Oscillators

MORE INFORMATION FROM PHILIPS COMPONENTS?

For more information contact your nearest Philips Components national organization shown in the following list.

Australia: North Ryde, Tel. +61 2 9805 4455, Fax. +61 2 9805 4466
Austria: Wien, Tel. +43 1 60 101 12 41, Fax. +43 1 60 101 12 11
Belarus: Minsk, Tel. +375 172 200 924/733, Fax. +375 172 200 773
Benelux: Eindhoven, Tel. +31 40 2783 749, Fax. +31 40 2788 399
Brazil: São Paolo, Tel. +55 11 821 2333, Fax. +55 11 829 1849
Canada: Scarborough, Tel. 1 416 292 5161, Fax. 1 416 754 6248
China: Shanghai, Tel. +86 21 6354 1088, Fax. +86 21 6354 1060
Denmark: Copenhagen, Tel. +45 32 883 333, Fax. +45 31 571 949
Finland: Espoo, Tel. 358 9 615 800, Fax. 358 9 615 80510
France: Suresnes, Tel. +33 1 4099 6161, Fax. +33 1 4099 6493
Germany: Hamburg, Tel. +49 40 2489-0, Fax. +49 40 2489 1400
Greece: Tavros, Tel. +30 1 4894 339/+30 1 4894 239, Fax. +30 1 4814 240
Hong Kong: Kowloon, Tel. +852 2784 3000, Fax. +852 2784 3003
India: Mumbai, Tel. +91 22 4930 311, Fax. +91 22 4930 966/4950 304
Indonesia: Jakarta, Tel. +62 21 794 0040, Fax. +62 21 794 0080
Ireland: Dublin, Tel. +353 1 7640 203, Fax. +353 1 7640 210
Israel: Tel Aviv. Tel. +972 3 6450 444, Fax. +972 3 6491 007
Italy: Milano, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557
Japan: Tokyo, Tel. +81 3 3740 5135, Fax. +81 3 3740 5035
Korea (Republic of): Seoul, Tel. +82 2 709 1472, Fax. +82 2 709 1480
Malaysia: Pulau Pinang, Tel. +60 3 750 5213, Fax. +60 3 757 4880
Mexico: El Paso, Tel. +52 915 772 4020, Fax. +52 915 772 4332
New Zealand: Auckland, Tel. +64 9 815 4000, Fax. +64 9 849 7811
Norway: Oslo, Tel. +47 22 74 8000, Fax. +47 22 74 8341
Pakistan: Karachi, Tel. +92 21 587 4641-49,
Fax. +92 21 577 035/+92 21 587 4546
Philippines: Manila, Tel. +63 2 816 6345, Fax. +63 2 817 3474
Poland: Warszawa, Tel. +48 22 612 2594, Fax. +48 22 612 2327
Portugal: Linda-A-Velha, Tel. +351 1 416 3160/416 3333,
Fax. +351 1 416 3174/416 3366
Russia: Moscow, Tel. +7 95 755 6918, Fax. +7 95 755 6919
Singapore: Singapore, Tel. +65 350 2000, Fax. +65 355 1758
South Africa: Johannesburg, Tel. +27 11 470 5911, Fax. +27 11 470 5494
Spain: Barcelona, Tel. +34 93 301 63 12, Fax. +34 93 301 42 43
Sweden: Stockholm, Tel. +46 8 5985 2000, Fax. +46 8 5985 2745
Switzerland: Zürich, Tel. +41 1 488 22 11, Fax. +41 1 481 7730
Taiwan: Taipei, Tel. +886 2 2134 2900, Fax. +886 2 2134 2929
Thailand: Bangkok, Tel. +66 2 745 4090, Fax. +66 2 398 0793
Turkey: Istanbul, Tel. +90 212 279 2770, Fax. +90 212 282 6707
United Kingdom: Dorking, Tel. +44 1306 512 000, Fax. +44 1306 512 345
United States:

- Ann Arbor, Tel. +1 734 996 9400, Fax. +1 734 761 2776
- Saugerties, Tel. +1 914 246 2811, Fax. +1 914 246 0487
- San Jose, Tel. +1 408 570 5600, Fax. +1 408 570 5700

Yugoslavia (Federal Republic of): Belgrade,
Tel. +381 11 625 344/373, Fax. +381 11 635 777

Internet:

- Display Components: www.dc.comp.philips.com
- Passive Components: www.passives.comp.philips.com

For all other countries apply to:
Philips Components, Marketing Communications, Building BF-1,
P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands,
Fax. +31-40-2724547

North American Sales Offices, Representatives and Distributors

PHILIPS SEMICONDUCTORS
811 East Arques Avenue
P.O. Box 3409
Sunnyvale, CA 94088-3409

ALABAMA
Huntsville
Philips Semiconductors
Phone: (256) 464-9101
(256) 464-0111

Elcom, Inc.
Phone: (256) 830-4001

ARIZONA
Scottsdale
Thom Luke Sales, Inc.
Phone: (602) 451-5400

Tempe
Philips Semiconductors
Phone: (602) 820-2225

CALIFORNIA
Calabasas
Philips Semiconductors
Phone: (818) 880-6304

Centaur Corporation
Phone: (818) 878-5800

Granite Bay
B.A.E. Sales, Inc.
Phone: (916) 652-6777

Irvine
Philips Semiconductors
Phone: (949) 453-0770

Centaur Corporation
Phone: (949) 261-2123

San Diego
Philips Semiconductors
Phone: (619) 560-0242

Centaur Corporation
Phone: (619) 278-4950

San Jose
B.A.E. Sales, Inc.
Phone: (408) 452-8133

Sunnyvale
Philips Semiconductors
Phone: (408) 991-3737

COLORADO
Englewood
Philips Semiconductors
Phone: (303) 792-9011

Thom Luke Sales, Inc.
Phone: (303) 649-9717

CONNECTICUT
Wallingford
JEBCO, Inc.
Phone: (203) 265-1318

FLORIDA
(Norcross, Georgia)
Elcom, Inc.
Phone: (770) 447-8200

GEORGIA
Norcross
Elcom, Inc.
Phone: (770) 447-8200

IDAHO
(Englewood, Colorado)
Thom Luke Sales, Inc.
Phone: (303) 649-9717

ILLINOIS
Itasca
Philips Semiconductors
Phone: (630) 250-0050

INDIANA
Kokomo
Philips Semiconductors
Phone: (765) 459-5355

Leo
Mohrfield Marketing, Inc.
Phone: (219) 627-5355

KANSAS
(Bloomington, Minnesota)
High Technology Sales, Inc.
Phone: (612) 844-9933

KENTUCKY
(Indianapolis, Indiana)
Mohrfield Marketing, Inc.
Phone: (317) 546-6969

MARYLAND
(Rockville Centre, New York)
S-J Associates, Inc.
Phone: (516) 536-4242

MASSACHUSETTS
Westford
Philips Semiconductors
Phone: (978) 692-6211

MICHIGAN
Farmington Hills
Philips Semiconductors
Phone: (248) 848-7600

Novi
Mohrfield Marketing, Inc.
Phone: (248) 380-8100

MINNESOTA
Bloomington
High Technology Sales, Inc.
Phone: (612) 844-9933

MISSOURI
(Bloomington, Minnesota)
High Technology Sales, Inc.
Phone: (612) 844-9933

NEBRASKA
(Bloomington, Minnesota)
High Technology Sales, Inc.
Phone: (612) 844-9933

NEW JERSEY
Toms River
Philips Semiconductors
Phone: (732) 505-1200
(732) 240-1479

NEW MEXICO
(Scottsdale, Arizona)
Thom Luke Sales, Inc.
Phone: (602) 451-5400

NEW YORK
Liverpool
JEBCO, Inc.
Phone: (315) 451-0800

Rockville Centre
S-J Associates, Inc.
Phone: (516) 536-4242

NORTH CAROLINA
Cary
Philips Semiconductors
Phone: (919) 462-1332
(919) 462-6361

Raleigh
Elcom, Inc.
Phone: (919) 743-5200

OHIO
Columbus
Mohrfield Marketing, Inc.
Phone: (614) 481-5451

Dayton
Mohrfield Marketing, Inc.
Phone: (937) 298-7322

Solon
Mohrfield Marketing, Inc.
Phone: (440) 349-2700

OKLAHOMA
(Richardson, Texas)
OM Associates, Inc.
Phone: (972) 690-6746

OREGON
Beaverton
Philips Semiconductors
Phone: (503) 627-0110

Cascade-Tech
Phone: (503) 645-9660

PENNSYLVANIA
Ambrioge
Mohrfield Marketing, Inc.
Phone: (724) 251-0576

(Mt. Laurel, New Jersey)
S-J Associates, Inc.
Phone: (609) 866-1234

TENNESSEE
Dandridge
Philips Semiconductors
Phone: (423) 397-5557

TEXAS
Austin
OM Associates, Inc.
Phone: (512) 794-9971

El Paso
OM Associates, Inc.
Phone: (915) 591-9123

Houston
Philips Semiconductors
Phone: (281) 999-1316

OM Associates, Inc.
Phone: (281) 376-6400

Richardson
Philips Semiconductors
Phone: (972) 644-1610

OM Associates, Inc.
Phone: (972) 690-6746

VIRGINIA
Falls Church
S-J Associates, Inc.
Phone: (703) 533-2233

WASHINGTON
Kirkland
Cascade-Tech
Phone: (425) 822-7299

WISCONSIN
Browndeer
High Technology Sales, Inc.
Phone: (414) 354-9029

CANADA
PHILIPS SEMICONDUCTORS CANADA, LTD.
Calgary, Alberta
Tech-Trek, Ltd.
Phone: (403) 291-6866

Kanata, Ontario
Tech-Trek, Ltd.
Phone: (613) 599-8787

Mississauga, Ontario
Tech-Trek, Ltd.
Phone: (905) 238-0366

Richmond, B.C.
Tech-Trek, Ltd.
Phone: (604) 276-8735

Ville St. Laurent, Quebec
Tech-Trek, Ltd.
Phone: (514) 337-7540

MEXICO
Guadalajara
Mepco Centralab, Inc./Philips
Phone: 8-011-52-3-122-2325

Monterrey
Mepco Centralab, Inc./Philips
Phone: 8-011-52-8-399-0164

El Paso, TX
Philips Components
Phone: (915) 772-4020

PUERTO RICO
(Norcross, Georgia)
Elcom, Inc.
Phone: (770) 447-8200

DISTRIBUTORS
Contact one of our local distributors:
Allied Electronics
Arrow Electronics, Inc.
Avnet EMG
Future Electronics
Marshall Industries

01/04/99

©Philips Electronics North America Corporation 1999 Printed in U.S.A.

Philips Semiconductors – a worldwide company

Argentina: see South America

Australia: 34 Waterloo Road, NORTH RYDE, NSW 2113, Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

Austria: Computerstr. 6, A-1101 WIEN, P.O. Box 213, Tel. +43 160 1010, Fax. +43 160 101 1210

Belarus: Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6, 220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

Belgium: see The Netherlands

Brazil: see South America

Bulgaria: Philips Bulgaria Ltd., Energoproject, 15th floor, 51 James Bourchier Blvd., 1407 SOFIA, Tel. +359 2 689 211, Fax. +359 2 689 102

Canada: PHILIPS SEMICONDUCTORS/COMPONENTS, Tel. +1 800 234 7381

China/Hong Kong: 501 Hong Kong Industrial Technology Centre, 72 Tat Chee Avenue, Kowloon Tong, HONG KONG, Tel. +852 2319 7888, Fax. +852 2319 7700

Colombia: see South America

Czech Republic: see Austria

Denmark: Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S, Tel. +45 32 88 2636, Fax. +45 31 57 0044

Finland: Sinikalliontie 3, FIN-02630 ESPOO, Tel. +358 9 615800, Fax. +358 9 61580920

France: 51 Rue Carnot, BP317, 92156 SURESNES Cedex, Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

Germany: Hammerbrookstraße 69, D-20097 HAMBURG, Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

Greece: No. 15, 25th March Street, GR 17778 TAVROS/ATHENS, Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

Hungary: see Austria

India: Philips INDIA Ltd, Band Box Building, 2nd floor, 254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025, Tel. +91 22 493 8541, Fax. +91 22 493 0966

Indonesia: PT Philips Development Corporation, Semiconductors Division, Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510, Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

Ireland: Newstead, Clonskeagh, DUBLIN 14, Tel. +353 1 7640 000, Fax. +353 1 7640 200

Israel: RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053, TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

Italy: PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3, 20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

Japan: Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

Korea: Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL, Tel. +82 2 709 1412, Fax. +82 2 709 1415

Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR, Tel. +60 3 750 5214, Fax. +60 3 757 4880

Mexico: 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905, Tel. +9-5 800 234 7381

Middle East: see Italy

Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB, Tel. +31 40 27 82785, Fax. +31 40 27 88399

New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND, Tel. +64 9 849 4160, Fax. +64 9 849 7811

Norway: Box 1, Manglerud 0612, OSLO, Tel. +47 22 74 8000, Fax. +47 22 74 8341

Pakistan: see Singapore

Philippines: Philips Semiconductors Philippines Inc., 106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI, Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

Poland: Ul. Lukiska 10, PL 04-123 WARSZAWA, Tel. +48 22 612 2831, Fax. +48 22 612 2327

Portugal: see Spain

Romania: see Italy

Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW, Tel. +7 095 755 6918, Fax. +7 095 755 6919

Singapore: Lorong 1, Toa Payoh, SINGAPORE 319762, Tel. +65 350 2538, Fax. +65 251 6500

Slovakia: see Austria

Slovenia: see Italy

South Africa: S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale, 2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000, Tel. +27 11 470 5911, Fax. +27 11 470 5494

South America: Al. Vicente Pinzon, 173, 6th floor, 04547-130 SÃO PAULO, SP, Brazil, Tel. +55 11 821 2333, Fax. +55 11 821 2382

Spain: Balmes 22, 08007 BARCELONA, Tel. +34 93 301 6312, Fax. +34 93 301 4107

Sweden: Kottbygatan 7, Akalla, S-16485 STOCKHOLM, Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

Switzerland: Allmendstrasse 140, CH-8027 ZÜRICH, Tel. +41 1 488 2741 Fax. +41 1 488 3263

Taiwan: Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1, TAIPEI, Taiwan Tel. +886 2 2134 2865, Fax. +886 2 2134 2874

Thailand: PHILIPS ELECTRONICS (THAILAND) Ltd., 209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260, Tel. +66 2 745 4090, Fax. +66 2 398 0793

Turkey: Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL, Tel. +90 212 279 2770, Fax. +90 212 282 6707

Ukraine: PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7, 252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes, MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

United States: 811 East Arques Avenue, SUNNYVALE, CA 94088-3409, Tel. +1 800 234 7381

Uruguay: see South America

Vietnam: see Singapore

Yugoslavia: PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD, Tel. +381 11 625 344, Fax.+381 11 635 777

For all other countries apply to: Philips Semiconductors, International Marketing & Sales Communications, Building BE-p, P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands, Fax. +31 40 27 24825

Internet: http://www.semiconductors.philips.com

© Philips Electronics N.V. 1998

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

SCH60

Printed in USA 135103/17M/05/pp783 Date of release: December 1998 Document order number: 9397 750 04895

Philips Semiconductors

PHILIPS

Let's make things better.