PHILIPS

Data handbook

Electronic components and materials

Semiconductors

Part 10 September 1981

WIDEBAND TRANSISTORS AND WIDEBAND HYBRID IC MODULES

SEMICONDUCTORS

PART 10 - SEPTEMBER 1981

WIDEBAND TRANSISTORS AND WIDEBAND HYBRID IC MODULES

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, sub-assemblies and materials; it is made up of four series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS	RED
INTEGRATED CIRCUITS	PURPLE
COMPONENTS AND MATERIALS	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

SEMICONDUCTORS (RED SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	**March 1980**	**S1 03-80** **(SC1b 05-77)**	**Diodes** Small-signal germanium diodes, small-signal silicon diodes, special diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes
Part 2	**May 1980**	**S2 05-80** **(SC1a 08-78)**	**Power diodes, thyristors, triacs** Rectifier diodes, voltage regulator diodes (> 1,5 W), rectifier stacks, thyristors, triacs
Part 3	**April 1980**	**S3 04-80** **(SC2 11-77, partly)** **(SC3 01-78, partly)**	**Small-signal transistors**
Part 4	**September 1981**	**S4 09-81** **(SC2 06-79)**	**Low-frequency power transistors**
Part 4a	**December 1978**	**SC4a12-78**	**Transmitting transistors and modules**
Part 5	**October 1980**	**S5 10-80** **(SC3 01-78, partly)**	**Field-effect transistors**
Part 7	**December 1980**	**S7 12-80** **(SC4c 07-78)**	**Microminiature semiconductors for hybrid circuits**
Part 8	**April 1980**	**S8 06-81** **(SC4b 09-78)**	**Devices for optoelectronics** Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices
Part 10	**September 1981**	**S10 09-81** **(SC3 01-78, partly)**	**Wideband transistors and wideband hybrid IC modules**

INTEGRATED CIRCUITS (PURPLE SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code. Books with the purple cover will replace existing red covered editions as each is revised.

Part 1	**May 1980**	**IC1 05-80** **(SC5b 03-77)**	**Bipolar ICs for radio and audio equipment**
Part 2	**May 1980**	**IC2 05-80** **(SC5b 03-77)**	**Bipolar ICs for video equipment**
Part 5a	**November 1976**	**SC5a 11-76**	**Professional analogue integrated circuits**
Part 4	**October 1980**	**IC4 10-80** **(SC6 10-77)**	**Digital integrated circuits** LOCMOS HE4000B family
Part 6b	**August 1979**	**SC6b 08-79**	**ICs for digital systems in radio and television receivers**
Signetics integrated circuits			Bipolar and MOS memories 1979 Bipolar and MOS microprocessors 1978 Analogue circuits 1979 Logic - TTL 1978

COMPONENTS AND MATERIALS (GREEN SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	July 1979	CM1 07-79	**Assemblies for industrial use** PLC modules, high noise immunity logic FZ/30 series, NORbits 60-series, 61-series, 90-series, input devices, hybrid integrated circuits, peripheral devices.
Part 2	June 1981	C2 06-81 (CM3a 09-78)	**FM tuners, television tuners, video modulators, surface acoustic wave filters**
Part 3	January 1981	C3 01-81 (CM3b 10-78)	**Loudspeakers**
Part 4a	November 1978	CM4a 11-78	**Soft Ferrites** Ferrites for radio, audio and television, beads and chokes, Ferroxcube potcores and square cores, Ferroxcube transformer cores
Part 4b	February 1979	CM4b 02-79	**Piezoelectric ceramics, permanent magnet materials**
Part 6	May 1981	C6 05-81 (CM6 04-77)	**Electric motors and accessories** Permanent magnet synchronous motors, stepping motors, direct current motors
Part 7a	January 1979	CM7a 01-79	**Assemblies** Circuit blocks 40-series and CSA70 (L), counter modules 50-series, input/output devices
Part 8	June 1979	CM8 06-79	**Variable mains transformers**
Part 9	August 1979	CM9 08-79	**Piezoelectric quartz devices** Quartz crystal units, temperature compensated crystal oscillators
Part 10	October 1980	C10 10-80	**Connectors**
Part 11	December 1979	CM11 12-79	**Non-linear resistors** Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)
Part 12	November 1979	CM12 11-79	**Variable resistors and test switches**
Part 13	December 1979	CM13 12-79	**Fixed resistors**
Part 14	April 1980	C14 04-80 (CM2b 02-78)	**Electrolytic and solid capacitors**
Part 15	May 1980	C15 05-80 (CM2b 02-78)	**Film capacitors, ceramic capacitors, variable capacitors**

ELECTRON TUBES (BLUE SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	**February 1980**	**T1 02-80 (ET1a 12-75)**	**Tubes for r.f. heating**
Part 2	**April 1980**	**T2 04-80 (ET1b 08-77)**	**Transmitting tubes for communications**
Part 2b	**May 1978**	**ET2b 05-78**	**Microwave semiconductors and components** Gunn, Impatt and noise diodes, mixer and detector diodes, backward diodes, varactor diodes, Gunn oscillators, sub-assemblies, circulators and isolators.
Part 3	**June 1980**	**T3 06-80 (ET2a 11-77)**	**Klystrons, travelling-wave tubes, microwave diodes**
Part 3	**January 1975**	**ET3 01-75**	**Special Quality tubes, miscellaneous devices**
Part 4	**September 1980**	**T4 09-80 (ET2a 11-77)**	**Magnetrons**
Part 5	**August 1981**	**T5 08-81**	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications.
Part 6	**July 1980**	**T6 07-80 (ET6 01-77)**	**Geiger-Müller tubes**
Part 7a	**March 1977**	**ET7a 03-77**	**Gas-filled tubes** Thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes.
Part 7b	**May 1979**	**ET7b 05-79**	**Gas-filled tubes** Segment indicator tubes, indicator tubes, switching diodes, dry reed contact units.
Part 8	**July 1979**	**ET8 07-79**	**Picture tubes and components** Colour TV picture tubes, black and white TV picture tubes, monitor tubes, components for colour television, components for black and white television.
Part 9	**June 1980**	**T9 06-80 (ET9 03-78)**	**Photo and electron multipliers** Photomultiplier tubes, phototubes, single channel electron multipliers, channel electron multiplier plates.
Part 10	**May 1981**	**T10 05-81 (ET5b 12-78)**	**Camera tubes and accessories, image intensifiers**

INDEX OF TYPE NUMBERS

Data Handbooks S1 to S10

The inclusion of a type number in this publication does not necessarily imply its availability.

type no.	book	section	type no.	book	section	type no.	book	section
AA119	S1	PC	BAS21	S7	Mm	BB110G	S1	T
AAZ13	S1	GB	BAT17	S7	Mm	BB119	S1	T
AAZ15	S1	GB	BAT18	S7	Mm	BB204B	S1	T
AAZ17	S1	GB	BAV10	S1	WD	BB204G	S1	T
AAZ18	S1	GB	BAV18	S1	WD	BB212	S1	T
BA182	S1	T	BAV19	S1	WD	BB405B	S1	T
BA220	S1	WD	BAV20	S1	WD	BB405G	S1	T
BA221	S1	WD	BAV21	S1	WD	BBY31	S7	Mm
BA223	S1	T	BAV45	S1	Sp	BBY40	S7	Mm
BA243	S1	T	BAV70	S7	Mm	BC107	S3	Sm
BA244	S1	T	BAV99	S7	Mm	BC108	S3	Sm
BA280	S1	T	BAW56	S7	Mm	BC109	S3	Sm
BA314	S1	Vrg	BAW62	S1	WD	BC140	S3	Sm
BA315	S1	Vrg	BAX12	S1	WD	BC141	S3	Sm
BA316	S1	WD	BAX12A	S1	WD	BC146	S3	Sm
BA317	S1	WD	BAX13	S1	WD	BC147	S3	Sm
BA318	S1	WD	BAX14A	S1	WD	BC148	S3	Sm
BA379	S1	T	BAX16	S1	WD	BC149	S3	Sm
BA482	S1	T	BAX17	S1	WD	BC157	S3	Sm
BA483	S1	T	BAX18A	S1	WD	BC158	S3	Sm
BAS11	S1	WD	BB105B	S1	T	BC159	S3	Sm
BAS16	S7	Mm	BB105G	S1	T	BC160	S3	Sm
BAS17	S7	Mm	BB106	S1	T	BC161	S3	Sm
BAS19	S7	Mm	BB109G	S1	T	BC177	S3	Sm
BAS20	S7	Mm	BB110B	S1	T	BC178	S3	Sm

GB = Germanium gold bonded diodes
Mm = Microminiature semiconductors for hybrid circuits
PC = Germanium point contact diodes
Sm = Small-signal transistors
Sp = Special diodes
T = Tuner diodes
Vrg = Voltage regulator diodes
WD = Silicon whiskerless diodes

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
Sm = Small-signal transistors

P = Low-frequency power transistors

FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
Sm = Small-signal transistors

type no.	book	section	type no.	book	section	type no.	book	section
BF569	S7	Mm	BFQ43	SC4a	Tra	BFT93;R	S7	Mm
BF579	S7	Mm	BFQ51	S10	WBT	BFW10	S5	FET
BF622	S7	Mm	BFQ52	S10	WBT	BFW11	S5	FET
BF623	S7	Mm	BFQ53	S10	WBT	BFW12	S5	FET
BF660;R	S7	Mm	BFQ63	S10	WBT	BFW13	S5	FET
BF767	S7	Mm	BFQ68	S10	WBT	BFW16A	S10	WBT
BF819	S4	P	BFR29	S5	FET	BFW17A	S10	WBT
BF857	S4	P	BFR30	S7	Mm	BFW30	S10	WBT
BF858	S4	P	BFR31	S7	Mm	BFW61	S5	FET
BF859	S4	P	BFR49	S10	WBT	BFW92	S10	WBT
BF869	S4	P	BFR53;R	S7	Mm	BFW93	S10	WBT
BF870	S4	P	BFR54	S3	Sm	BFX29	S3	Sm
BF871	S4	P	BFR64	S10	WBT	BFX30	S3	Sm
BF872	S4	P	BFR65	S10	WBT	BFX34	S3	Sm
BF926	S3	Sm	BFR84	S5	FET	BFX84	S3	Sm
BF936	S3	Sm	BFR90	S10	WBT	BFX85	S3	Sm
BF939	S3	Sm	BFR90A	S10	WBT	BFX86	S3	Sm
BF960	S5	FET	BFR91	S10	WBT	BFX87	S3	Sm
BF967	S3	Sm	BFR91A	S10	WBT	BFX88	S3	Sm
BF970	S3	Sm	BFR92;R	S7	Mm	BFX89	S10	WBT
BF979	S3	Sm	BFR93;R	S7	Mm	BFY50	S3	Sm
BF981	S5	FET	BFR94	S10	WBT	BFY51	S3	Sm
BFQ10	S5	FET	BFR95	S10	WBT	BFY52	S3	Sm
BFQ11	S5	FET	BFR96	S10	WBT	BFY55	S3	Sm
BFQ12	S5	FET	BFR96S	S10	WBT	BFY90	S10	WBT
BFQ13	S5	FET	BFS17;R	S7	Mm	BGY22	SC4a	Tra
BFQ14	S5	FET	BFS18;R	S7	Mm	BGY22A	SC4a	Tra
BFQ15	S5	FET	BFS19;R	S7	Mm	BGY23	SC4a	Tra
BFQ16	S5	FET	BFS20;R	S7	Mm	BGY23A	SC4a	Tra
BFQ17	S7	Mm	BFS21	S5	FET	BGY32	SC4a	Tra
BFQ18A	S7	Mm	BFS21A	S5	FET	BGY33	SC4a	Tra
BFQ19	S7	Mm	BFS22A	SC4a	Tra	BGY35	SC4a	Tra
BFQ22	S10	WBT	BFS23A	SC4a	Tra	BGY36	SC4a	Tra
BFQ22S	S10	WBT	BFS28	S5	FET	BGY50	S10	WBM
BFQ23	S10	WBT	BFT24	S10	WBT	BGY51	S10	WBM
BFQ24	S10	WBT	BFT25;R	S7	Mm	BGY52	S10	WBM
BFQ32	S10	WBT	BFT44	S3	Sm	BGY53	S10	WBM
BFQ33	S10	WBT	BFT45	S3	Sm	BGY54	S10	WBM
BFQ34	S10	WBT	BFT46	S7	Mm	BGY55	S10	WBM
BFQ42	SC4a	Tra	BFT92;R	S7	Mm	BGY56	S10	WBM

FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
Sm = Small-signal transistors
Tra = Transmitting transistors and modules
WBM = Wideband hybrid IC modules
WBT = Wideband transistors

Mm = Microminiature semiconductors for hybrid circuits
PDT = Photodiodes or transistors
Sm = Small-signal transistors
Th = Thyristors
Tra = Transmitting transistors and modules
WBM = Wideband hybrid IC modules

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
R = Rectifier diodes
Sm = Small-signal transistors
Th = Thyristors
Tri = Triacs

* = series
D = Displays
FET = Field-effect transistors
GB = Germanium gold bonded diodes
I = Infrared devices
LED = Light-emitting diodes
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
PC = Germanium point contact diodes
Ph = Photoconductive devices

PhC = Photocouplers
R = Rectifier diodes
Sm = Small-signal transistors
St = Rectifier stacks
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WBM = Wideband hybrid IC modules
WBT = Wideband transistors
WD = Silicon whiskerless diodes

INDEX

A = Accessories
DH = Diecast heatsinks
FET = Field-effect transistors
HE = Heatsink extrusions
I = Infrared devices
PDT = Photodiodes or transistors
Sm = Small-signal transistors
Tra = Transmitting transistors and modules

GENERAL

Type designation
Rating systems
Letter symbols
s-parameters

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices — as opposed to integrated circuits —, multiples of such devices and semiconductor chips.

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

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

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with 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.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15$ °C/W)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15$ °C/W)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15$ °C/W)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15$ °C/W)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15$ °C/W)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15$ °C/W)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15$ °C/W)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15$ °C/W)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter **W**)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

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

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   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 is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

GENERAL

Type designation
Rating systems
Letter symbols
s-parameters

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices – as opposed to integrated circuits –, multiples of such devices and semiconductor chips.

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

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

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with 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.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15\ ^oC/W$)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^oC/W$)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15\ ^oC/W$)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^oC/W$)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15\ ^oC/W$)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15\ ^oC/W$)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15\ ^oC/W$)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15\ ^oC/W$)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter **W**)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

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

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   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 is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

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.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which 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.

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
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 life, 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 life, no design maximum value for the intended service is exceeded with a bogey 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 FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
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 circuited
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)	R.M.S. value
S, s	As first or second subscript: Source terminal (for FETS only) As second subscript: Non-repetitive (not for 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 regulator diodes.

Note: No additional subscript is used for d.c. values.

Upper-case subscripts shall be used for the indication of:

a) continuous (d.c.) values (without signal)
Example I_B

b) instantaneous total values
Example i_B

c) average total values
Example $I_{B(AV)}$

d) peak total values
Example I_{BM}

e) root-mean-square total values
Example $I_{B(RMS)}$

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

a) instantaneous values
Example i_b

b) root-mean-square values
Example $I_{b(rms)}$

c) peak values
Example I_{bm}

d) average values
Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: 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}

Diodes: 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, $I_{f(rms)}$

Subscripts for voltages

Transistors: 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}

Diodes: 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}

Subscripts for supply voltages or supply currents

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

Examples: V_{CC}, I_{EE}

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

Example : V_{CCE}

Subscripts for devices having 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 misunderstanding.

Examples: I_{B2} = continuous (d.c.) current flowing into the second base terminal

V_{B2-E} = continuous (d.c.) voltage between the terminals of second base and emitter

Subscripts for multiple devices

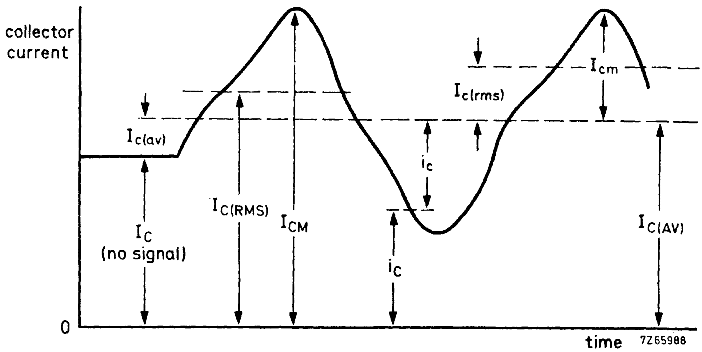
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{2C} = continuous (d.c.) current flowing into the collector terminal of the second unit

V_{1C-2C} = continuous (d.c.) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (d.c.) current and a varying component.



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 is a list of 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 shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of 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 shall be used for the designation of static (d.c.) values.

Examples : h_{FE} = static value of forward current transfer ratio in common-emitter configuration (d.c. current gain)

R_E = d.c. value of the external emitter resistance.

Note: 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 shall be 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

Note: If more than one subscript is used, subscripts for which both styles exist shall either be 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.

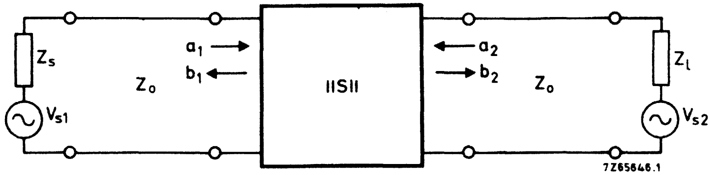
Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

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

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

SCATTERING PARAMETERS

In distinction to the conventional h, y and z-parameters, s-parameters relate to travelling wave conditions. The figure below shows a two-port network with the incident and reflected waves a_1, b_1, a_2 and b_2.



$$a_1 = \frac{V_{i1}}{\sqrt{Z_o}} \qquad a_2 = \frac{V_{i2}}{\sqrt{Z_o}} \qquad ^{1)}$$

$$b_1 = \frac{V_{r1}}{\sqrt{Z_o}} \qquad b_2 = \frac{V_{r2}}{\sqrt{Z_o}}$$

Z_o = characteristic impedance of the transmission line in which the two-port is connected.

V_i = incident voltage

V_r = reflected (generated) voltage

The four-pole equations for s-parameters are:

$$b_1 = s_{11}a_1 + s_{12}a_2$$

$$b_2 = s_{21}a_1 + s_{22}a_2$$

Using the subscripts i for 11, r for 12, f for 21 and o for 22, it follows that:

$$s_i = s_{11} = \left.\frac{b_1}{a_1}\right|_{a_2 = 0}$$

$$s_r = s_{12} = \left.\frac{b_1}{a_2}\right|_{a_1 = 0}$$

$$s_f = s_{21} = \left.\frac{b_2}{a_1}\right|_{a_2 = 0}$$

$$s_o = s_{22} = \left.\frac{b_2}{a_2}\right|_{a_1 = 0}$$

1) The squares of these quantities have the dimension of power.

The s-parameters can be named and expressed as follows:

$s_i = s_{11}$ = Input reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the input, under the conditions $Z_l = Z_o$ and $V_{s2} = 0$.

$s_r = s_{12}$ = Reverse transmission coefficient.
The complex ratio of the generated wave at the input and the incident wave at the output, under the conditions $Z_s = Z_o$ and $V_{s1} = 0$.

$s_f = s_{21}$ = Forward transmission coefficient.
The complex ratio of the generated wave at the output and the incident wave at the input, under the conditions $Z_l = Z_o$ and $V_{s2} = 0$

$s_o = s_{22}$ = Output reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the output, under the conditions $Z_s = Z_o$ and $V_{s1} = 0$.

WIDEBAND TRANSISTORS

Type number survey
Selection guide
Soldering recommendations SOT-37
Soldering recommendations SOT-48
and SOT-122
Accessories

	polarity			RATINGS			CHARACTERISTICS (typical values unless otherwise specified)							
	n-p-n	p-n-p	envelope	V_{CEO} V	I_C mA	P_{tot} mW	f_T GHz	F dB	at f MHz	G_{UM} dB	at f MHz	V_o* (d_{im} = −60 dB) mV	I_C mA	V_{CE} V
BFQ22	•		TO-72	12	35	150	5	1,9	500	16	500		30	5
BFQ22S	•		TO-72	12	35	150	5	1,9	500	16	500	300	30	5
BFQ23		•	SOT-37	12	35	180	5	2,4	500	16,5	500	300	30	5
BFQ24		•	TO-72	12	35	150	5	2,4	500	15	500	300	30	5
BFQ32		•	SOT-37	15	75	500	4,2	3,75	500	14	500	500	50	10
BFQ33	•		SOT-100	7	20	140	12	2,5	2000	13	2000		14	5
BFQ34	•		SOT-122	18	150	2250	3,9	8	500	16,3	500	1200	120	15
BFQ51		•	SOT-37	15	25	180	5	2,7	500	19	500	150	14	10
BFQ52		•	TO-72	15	25	150	5	2,7	500	17	500	150	14	10
BFQ53	•		TO-72	15	25	150	5	2,4	500	18	500	150	14	10
BFQ63	•		TO-72	15	75	250	4,5	< 3,0	200	11,5	500	500	50	10
BFQ68	•		SOT-122	18	300	4500	4	–	–	13	800	1600	240	15
BFR49	•		SOT-100	15	25	180	5	2,5	1000	17	1000		14	10
BFR64	•		SOT-48	25	200	3500	1	6	200					
BFR65	•		SOT-48	25	400	5000	> 1	–	–					
BFR90	•		SOT-37	15	25	180	5	2,4	500	19,5	500	150	14	10
BFR90A	•		SOT-37	15	25	180	5	1,8	800	20	500	150	14	10
BFR91	•		SOT-37	12	35	180	5	1,9	500	18	500	300	30	5
BFR91A	•		SOT-37	12	35	300	6	1,6	800	14	800	425	30	8
BFR94	•		SOT-48	25	150	3500	3,5	5	500	13,5	500	700	90	20
BFR95	•		TO-39	25	150	1500	3,5	9	200			1000	80	18
BFR96	•		SOT-37	15	75	500	5	3,3	500	15,2	500	500	50	10
BFR96S	•		SOT-37	15	100	700	5	4	800	11,5	800	700	70	10
BFT24	•		SOT-37	5	2,5	30	2,3	3,8	500	17	500			
BFW16A	•		TO-39	25	150	1500	1,2	< 6	200					
BFW17A	•		TO-39	25	150	1500	1,1	–	–					
BFW30	•		TO-72	10	50	250	1,6	< 5	500			100	30	6
BFW92	•		SOT-37	15	25	190	1,6	4	500					
BFW93	•		SOT-37	10	50	190	1,7	< 5	500	10,5	800	100	30	5
BFX89	•		TO-72	15	25	200	1,2	3,3	200					
BFY90	•		TO-72	15	25	200	1,4	2,5	200					
2N918	•		TO-72	15	50	200	> 0,9	< 6	60	36	200			

* Typical reference value.

This table shows the preferred types of n-p-n transistors and their complements for wideband applications. It shows the types in sequence of linear output voltage capability in each type of envelope. The values of V_o are only given as a typical reference.

For detailed information see relevant data sheet.

envelope	polarity n-p-n	polarity p-n-p	I_C (mA) / V_{CE} (V) / V_o* (mV)		14 / 10 / 150	30 / 5 / 300	30 / 8 / 425	50 / 10 / 500	70 / 10 / 700	80 / 10 / 700	120 / 15 / 1200	240 / 15 / 1600
SOT-23	•			BFT25	BFR92	BFR93						
	•				BFR92A	BFR93A	BFR93A					
		•			BFT92	BFT93						
SOT-37	•			BFT24	BFR90	BFR91		BFR96	BFR96S			
	•				BFR90A	BFR91A	BFR91A					
		•			BFQ51	BFQ23		BFQ32				
SOT-89	•							BFQ19		BFQ18A		
SOT-122	•										BFQ34	BFQ68
TO-72	•				BFQ53	BFQ22S		BFQ63				
		•			BFQ52	BFQ24						

* Typical output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone).

SOLDERING RECOMMENDATIONS SOT-37

Transistors in SOT-37 envelopes may be mounted with leads flat (Fig. 1) or bent (Figs 2 and 3). Different soldering procedures apply for the different styles of mounting.

FLAT-LEAD MOUNTING

Soldering by hand

Avoid putting any force on the leads during or just after soldering.

Solder the three leads one at a time, *not* simultaneously.

Proceed from one lead to the adjacent lead, *not* to the opposite one.

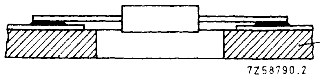


Fig. 1

Solder temperature	max.	300 °C
Soldering time	max.	5 s
Solder-to-case distance	min.	2 mm

BENT-LEAD MOUNTING

If leads are bent, all three may be soldered simultaneously if desired.

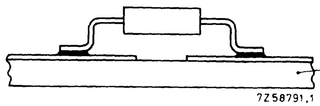


Fig. 2

Solder temperature	max.	300 °C
Soldering time	max.	10 s

DIP OR WAVE SOLDERING

When dip or wave soldering, the maximum allowable temperature of the solder is 260 °C. This temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted up to the lead projections, but the temperature of the body must not exceed the specified storage maximum.

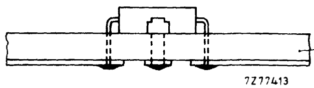


Fig. 3

Solder temperature	max.	260 °C
Soldering time	max.	5 s

RECOMMENDATIONS FOR MOUNTING ¼" CAPSTAN ENVELOPES

A brass nut is supplied with each transistor for securing it to a heatsink.

Screw thread, diameter and nuts:

stud diameter	thread	maximum diameter of threaded stud	nut thickness
¼"	8-32UNC-2A(B)	4,14 mm	3,5 mm SOT-48 5,0 mm SOT-122

To ensure optimum heat transfer and to avoid damage to the threaded stud of the transistor the following recommendations should be observed:

1. Diameter of the mounting hole in the heatsink 4,15 + 0,05; −0 mm (max. 4,2 mm).
2. Heatsink surfaces at the mounting hole to be flat, parallel, and free of burrs or oxydation.
3. Torque on nut: minimum 0,75 Nm (7,5 kgcm), maximum 0,85 Nm (8,5 kgcm).
4. Recommended distance from the top surface of the heatsink to surface of printed-circuit board: 2,9 + 0; −0,2 mm.

Tension in the transistor leads sets the limit on spacing between heatsink and printed-circuit board; in general, the leads can withstand more pull in the downward direction than in the upward direction.

Solder the leads to the connection pads with resin-cored tin-lead solder, using an iron of normal temperature. Soldering iron temperatures as high as 350 °C are safely tolerable; the transistor can withstand an interior temperature of 250 °C for about ten minutes.

The leads may be tinned, if required, by dipping them into a solder bath at about 230 °C; each lead may be dipped up to its full length. A flux of the quality of Super-Safe is recommended; after tinning, surplus flux should be rinsed away with tap water.

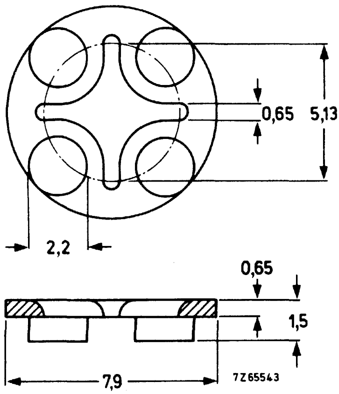
DISTANCE DISCS

MECHANICAL DATA

Dimensions in mm

Fig. 1 **56245** for **TO-5** or **TO-39.**

Insulating material;

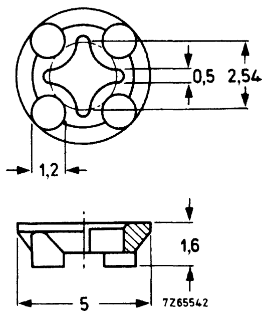


TEMPERATURE

Maximum permissible temperature T max. 100 °C

Fig. 2 **56246** for **TO-18** or **TO-72.**

Insulating material.



TEMPERATURE

Maximum permissible temperature T max. 100 °C

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

P-N-P complement is BFQ24.

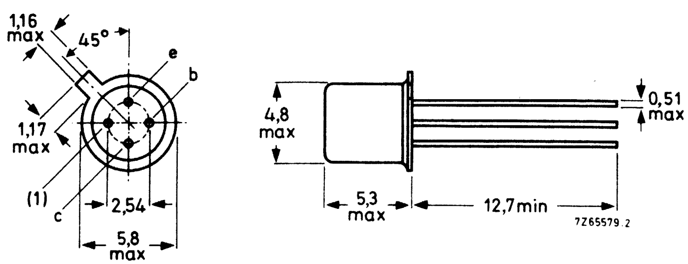
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V	C_{re}	typ.	0,7	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
Maximum unilateral power gain (see page 2) I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	16,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	35	mA
Collector current (peak value) at f > 1 MHz	I_{CM}	max.	50	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,9	K/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,6	K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50	nA
D.C. current gain (note 1) $I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	> typ.	25 50	
Transition frequency (notes 1 and 2) $I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	5	GHz
Collector capacitance (note 2) $I_E = I_e = 0$; $V_{CB} = 5$ V; f = 1 MHz	C_c	typ.	1,1	pF
Emitter capacitance $I_C = I_c = 0$; $V_{EB} = 0,5$ V; f = 1 MHz	C_e	typ.	2,5	pF
Feedback capacitance (note 2) $I_C = 0$; $V_{CE} = 5$ V; f = 1 MHz; T_{amb} = 25 °C	C_{re}	typ.	0,7	pF
Noise figure at optimum source impedance (note 2) $I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	16,0	dB

Notes

1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

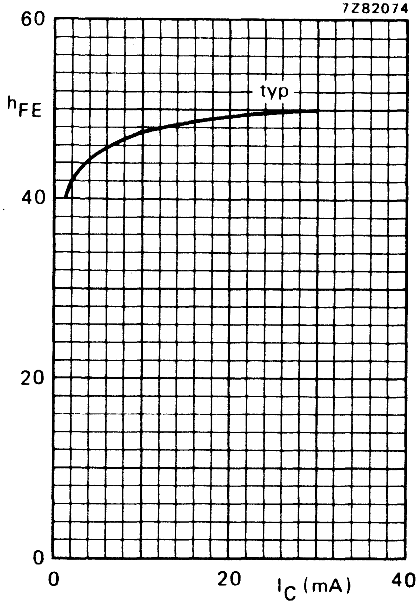


Fig. 2 V_{CE} = 5 V; T_j = 25 °C.

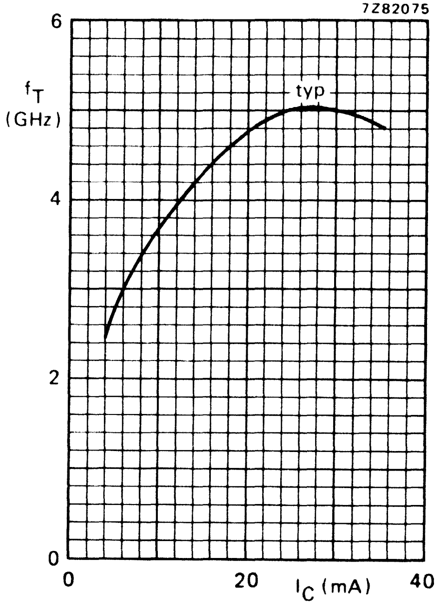


Fig. 3 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

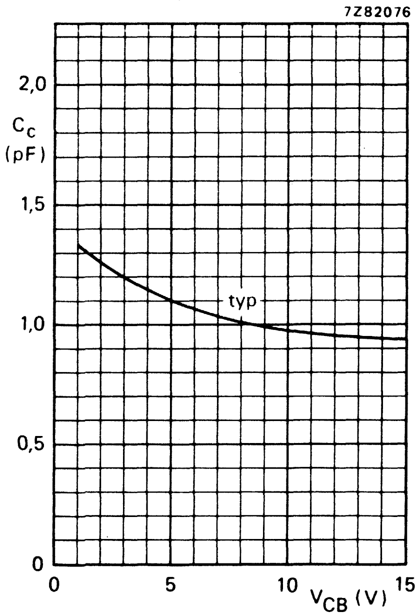


Fig. 4 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor has extremely high power gain and good low noise performance.

P-N-P complement is BFQ24.

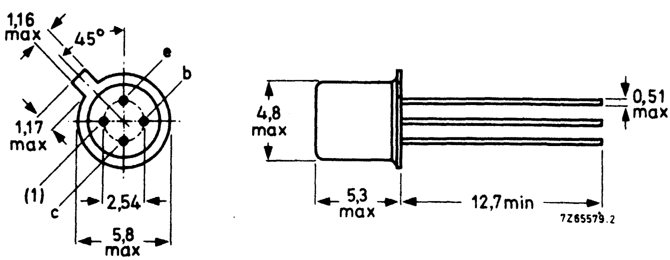
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V	C_{re}	typ.	0,65	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
Maximum unilateral power gain (see page 2) I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	16,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) Shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	35	mA
Collector current (peak value) at $f > 1$ MHz	I_{CM}	max.	50	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}	−65 to + 200		°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE (note 1)

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	900	K/W
From junction to case	$R_{th\ j\text{-}c}$	=	600	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; V_{CB} = 5 V	I_{CBO}	<	50	nA
D.C. current gain (note 2)				
I_C = 10 mA; V_{CE} = 5 V	h_{FE}		50 to 150	
Transition frequency (notes 2 and 3)				
I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	5	GHz
Feedback capacitance (note 3)				
I_C = 0; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	C_{re}	typ.	0,65	pF
Noise figure at optimum source impedance (note 3)				
I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
I_C = 10 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	F	<	2,5	dB

Maximum unilateral power gain (note 3)

s_{re} assumed to be zero

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

I_C = 10 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	>	21,0	dB
I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	16,0	dB

Notes

1. K/W is SI unit for °C/W.
2. Measured under pulse conditions.
3. Shield lead grounded.

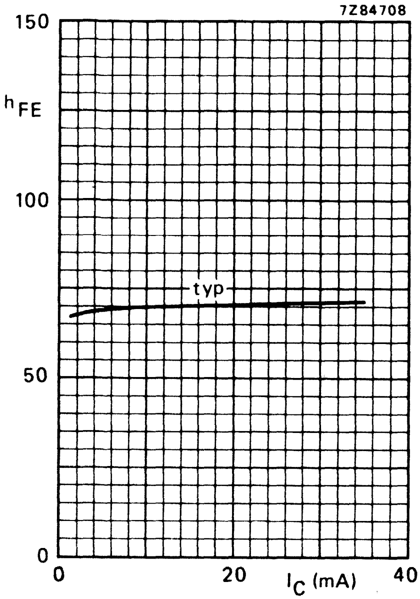


Fig. 2.

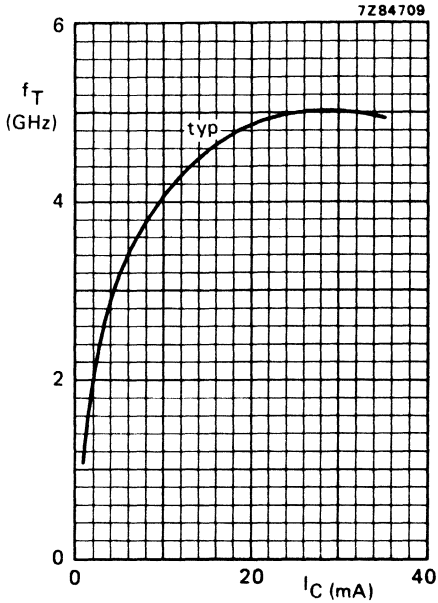


Fig. 3.

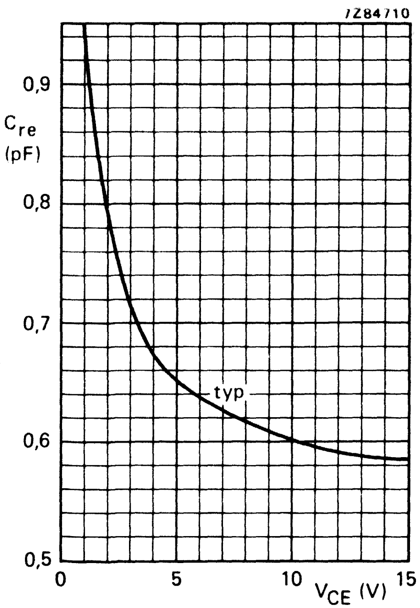


Fig. 4.

Conditions for Figs 2, 3 and 4:

Fig. 2 V_{CE} = 5 V; T_j = 25 °C.

Fig. 3 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

Fig. 4 I_C = 0; f = 1 MHz; T_{amb} = 25 °C; shield lead grounded.

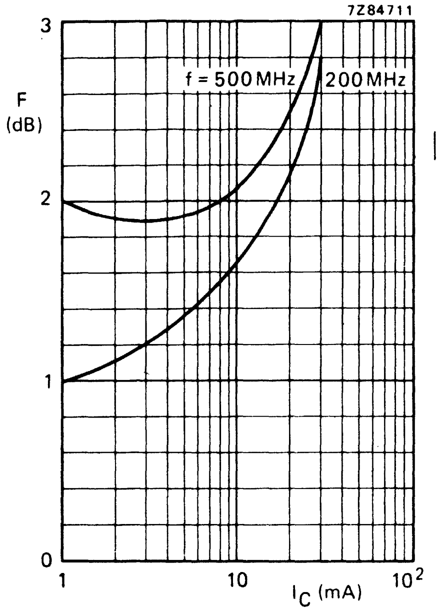


Fig. 5 V_{CE} = 5 V; Z_S = optimum; T_{amb} = 25 °C; typical values; shield lead grounded.

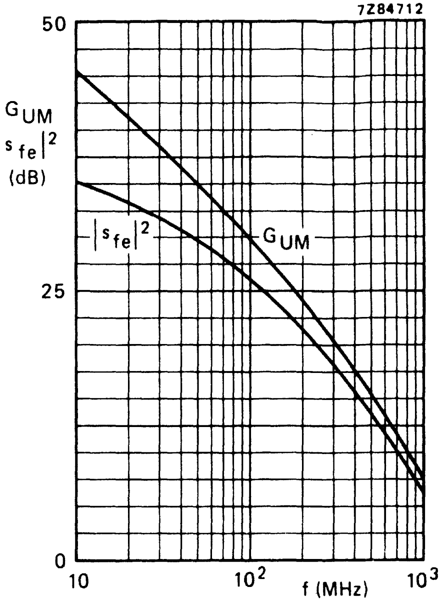


Fig. 6 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C; typical values; shield lead grounded.

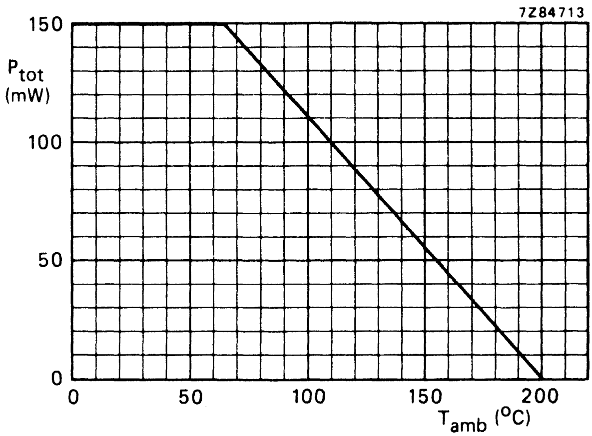


Fig. 7 Power derating curve versus ambient temperature.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

N-P-N complements are BFR91 and BFR91A.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 500 MHz	F	typ.	2,4	dB

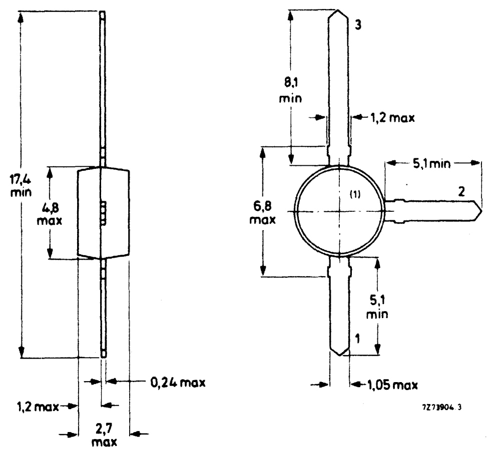
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2 V
Collector current (d.c.)	$-I_C$	max.	35 mA
Collector current (peak value) at f > 1 MHz	$-I_{CM}$	max.	50 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,5 °C/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0; -V_{CB} = 5$ V	$-I_{CBO}$	<	50 nA	
D.C. current gain $-I_C = 30$ mA; $-V_{CE} = 5$ V	h_{FE}	>	20	*
Transition frequency f = 500 MHz; $-I_C = 30$ mA; $-V_{CE} = 5$ V	f_T	typ.	5 GHz	*
Collector capacitance f = 1 MHz; $I_E = I_e = 0; -V_{CB} = 5$ V	C_c	typ.	0,85 pF	
Emitter capacitance f = 1 MHz; $I_C = I_c = 0; -V_{EB} = 0,5$ V	C_e	typ.	1,8 pF	
Feedback capacitance f = 1 MHz; $-I_C = 2$ mA; $-V_{CE} = 5$ V	C_{re}	typ.	0,8 pF	
Noise figure at optimum source impedance $-I_C = 2$ mA; $-V_{CE} = 5$ V; f = 500 MHz	F	typ.	2,4 dB	

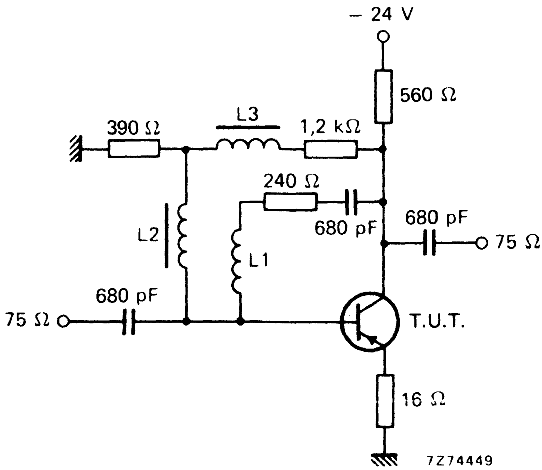
Maximum unilateral power gain
s_{re} assumed to be zero
$-I_C = 30$ mA; $-V_{CE} = 5$ V; f = 500 MHz

$$10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)} = G_{UM} \quad \text{typ.} \quad 16,5 \text{ dB}$$

* Measured under pulse conditions.

Intermodulation distortion* (see Fig. 2)

$-I_C$ = 30 mA; $-V_{CE}$ = 5 V; R_L = 75 Ω; VSWR < 2
$V_p = V_o$ = 300 mV at f_p = 495,25 MHz
$V_q = V_o$ − 6 dB at f_q = 503,25 MHz
$V_r = V_o$ − 6 dB at f_r = 505,25 MHz
Measured at $f_{(p+q-r)}$ = 493,25 MHz — d_{im} typ. −60 dB



L1: 4 turns Cu wire (0,35); winding pitch 1 mm; internal diameter 4 mm.
L2 and L3: 5 μH (code number 3122 108 20150)

Fig. 2 Intermodulation distortion test circuit.

* Measured under pulse conditions.

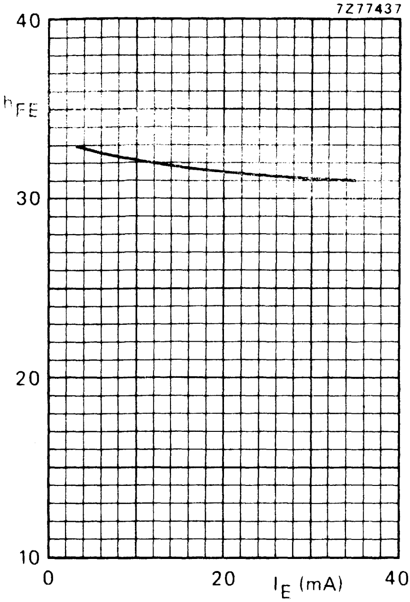


Fig. 3 Typical values; V_{CB} = 4 V.

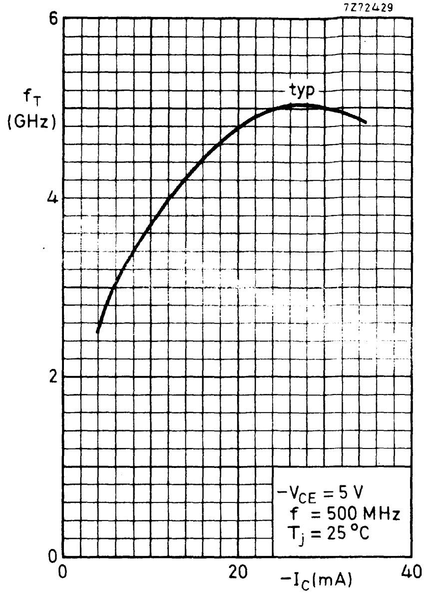


Fig. 4.

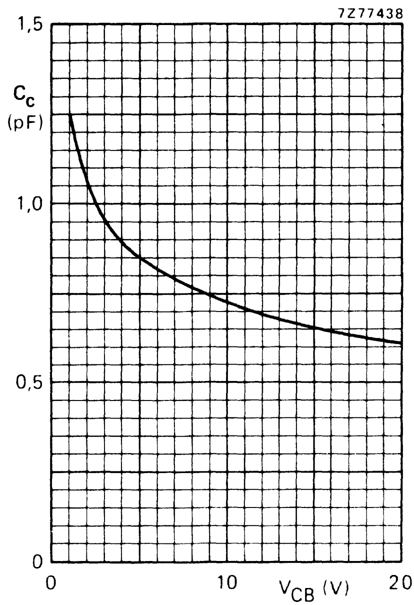


Fig. 5 Typical values; f = 1 MHz.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complement is BFQ22S.

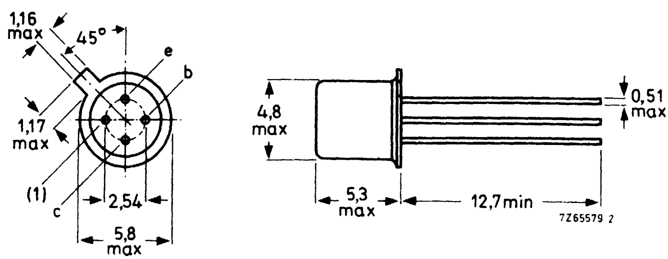
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB
Maximum unilateral power gain (see page 2) $-I_C$ = 30 mA; $-V_{CE}$ = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	15,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2 V
Collector current (d.c.)	$-I_C$	max.	35 mA
Collector current (peak value) at f > 1 MHz	$-I_{CM}$	max.	50 mA
→ Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150 mW
Storage temperature	T_{stg}		−65 to +200 °C
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,9 K/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,6 K/mW

→ CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 5$ V	$-I_{CBO}$	<	50 nA
D.C. current gain (note 1) $-I_C = 30$ mA; $-V_{CE} = 5$ V	h_{FE}	> typ.	20 50
Transition frequency (notes 1 and 2) $-I_C = 30$ mA; $-V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	5 GHz
Collector capacitance (note 3) $I_E = I_e = 0$; $-V_{CB} = 5$ V; f = 1 MHz	C_c	typ.	1,2 pF
Emitter capacitance $I_C = I_c = 0$; $-V_{EB} = 0,5$ V; f = 1 MHz	C_e	typ.	2,5 pF
Feedback capacitance (note 2) $I_C = 0$; $-V_{CE} = 5$ V; f = 1 MHz; $T_{amb} = 25$ °C	C_{re}	typ.	0,8 pF
Noise figure at optimum source impedance (note 2) $-I_C = 2$ mA; $-V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	2,4 dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM}\text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

$-I_C = 30$ mA; $-V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	15,0 dB

Notes
1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

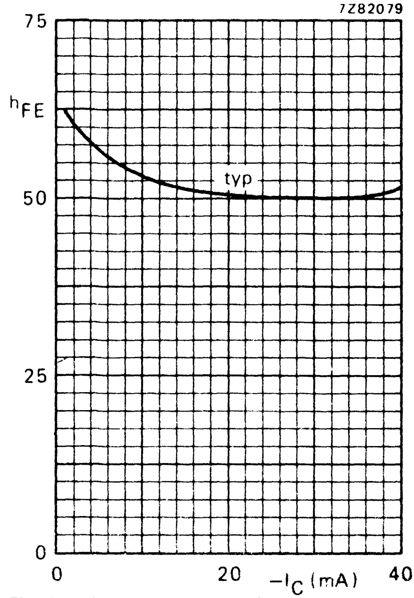


Fig. 2 $-V_{CE} = 5$ V; $T_j = 25$ °C.

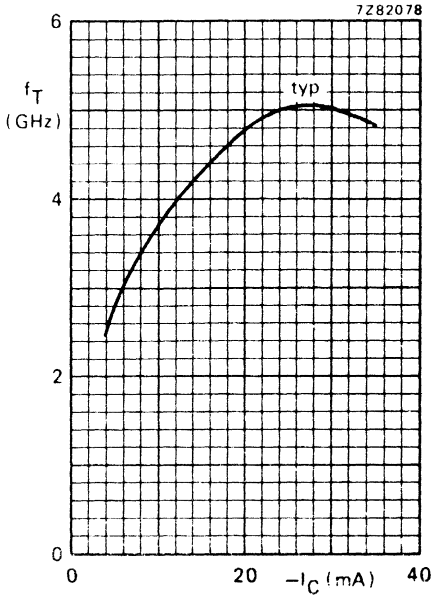


Fig. 3 $-V_{CE} = 5$ V; f = 500 MHz; $T_j = 25$ °C; shield lead grounded.

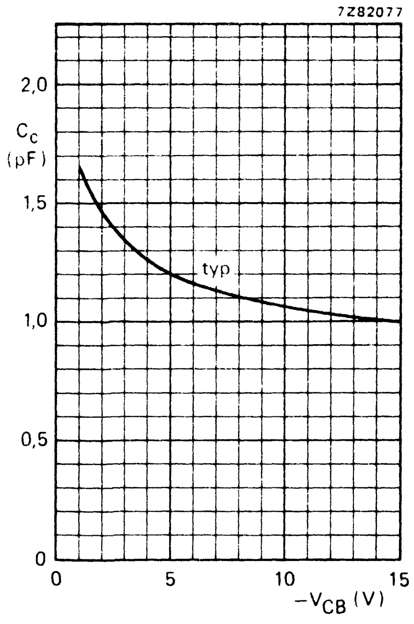


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; $T_j = 25$ °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package.

It is intended for use in u.h.f. applications such as broadband aerial amplifiers (30 MHz to 860 MHz) and in microwave amplifiers such as radar systems, spectrum analysers etc.

The BFQ32 offers a high transition frequency and a low intermodulation distortion figure over a wide current range.

QUICK REFERENCE DATA

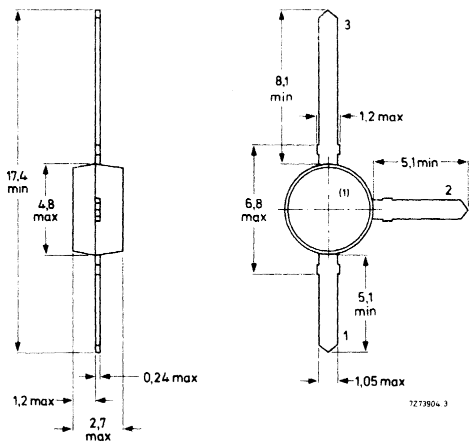
Collector-base voltage (open emitter)	$-V_{CBO}$	max	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max	15	V
Collector current (d.c.)	$-I_C$	max	75	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max	500	mW
Junction temperature	T_j	max	175	°C
Transition frequency at f = 500 MHz $-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	>	3,6	GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	C_{re}	<	1,4	pF
Noise figure at optimum source impedance $-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ	3,75	dB
Intermodulation distortion at T_{amb} = 25 °C $-I_C$ = 50 mA; $-V_{CE}$ = 10 V; R_L = 75 Ω; V_o = 500 mV $f_{(p+q-r)}$ = 493,25 MHz (see page 4)	d_{im}	typ	−60	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max	3	V
Collector current (d.c.)	$-I_C$	max	75	mA
Collector current (peak value); f > 1 MHz	$-I_{CM}$	max	150	mA
Total power dissipation up to T_{amb} = 60 °C mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	P_{tot}		500	mW
Storage temperature	T_{stg}	−65 to + 175		°C
Junction temperature	T_j	max	175	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,23	°C/mW

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 10$ V	$-I_{CBO}$	<	100	nA
D.C. current gain * $-I_C = 50$ mA; $-V_{CE} = 10$ V	h_{FE}	>	20	
$-I_C = 75$ mA; $-V_{CE} = 10$ V	h_{FE}	>	20	
Transition frequency at f = 500 MHz * $-I_C = 50$ mA; $-V_{CE} = 10$ V	f_T	> typ	3,6 4,2	GHz GHz
$-I_C = 75$ mA; $-V_{CE} = 10$ V	f_T	> typ	4,0 4,6	GHz GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ	1,3	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $-V_{EB} = 0,5$ V	C_e	typ	6	pF
Feedback capacitance at f = 1 MHz $-I_C = 10$ mA; $-V_{CE} = 10$ V	C_{re}	< typ	1,4 1,25	pF pF

* Measured under pulse conditions.

Noise figure at optimum source impedance			
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 500 MHz	F	typ	3,75 dB
Maximum unilateral power gain (s_{re} assumed to be zero)			
G_{UM} (in dB) $= 10 \log \frac{\lvert s_{fe} \rvert^2}{(1-\lvert s_{ie} \rvert^2)(1-\lvert s_{oe} \rvert^2)}$			
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 500 MHz	G_{UM}	typ	14 dB
Intermodulation distortion (see fig. 1)			
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; R_L = 75 Ω			
$V_p = V_o$ = 500 mV at f_p = 495,25 MHz			
$V_q = V_o$ −6 dB at f_q = 503,25 MHz			
$V_r = V_o$ −6 dB at f_r = 505,25 MHz			
Measured at $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ	−60 dB

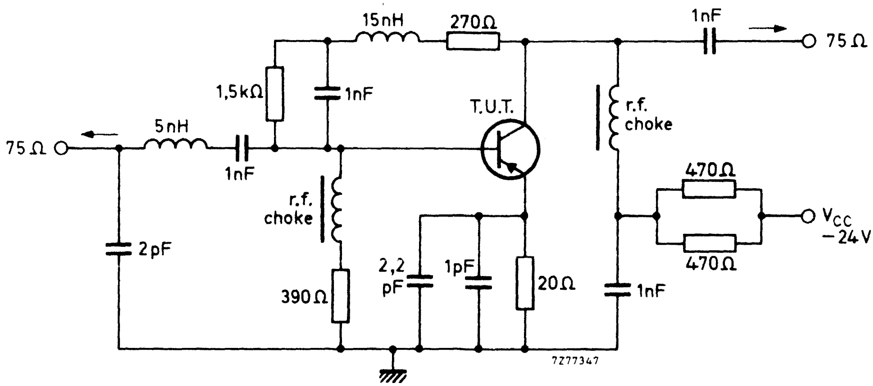
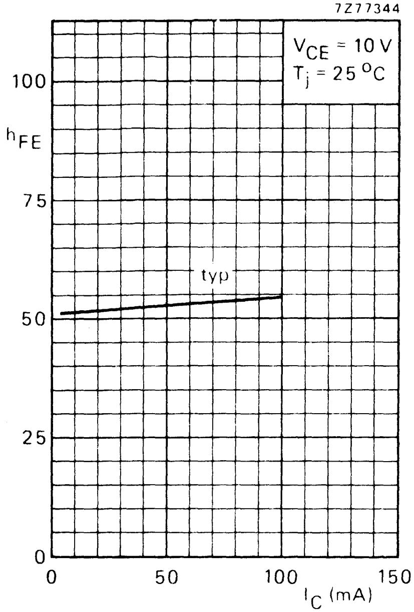
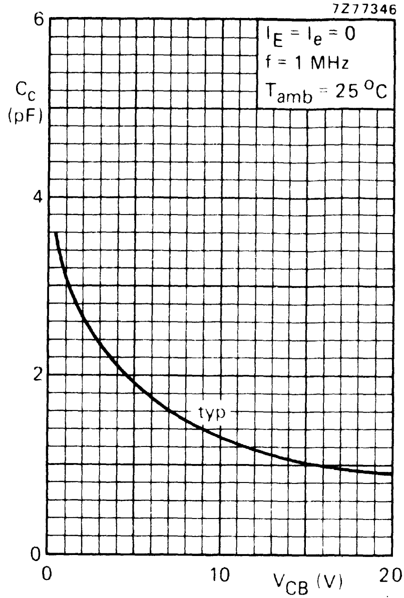
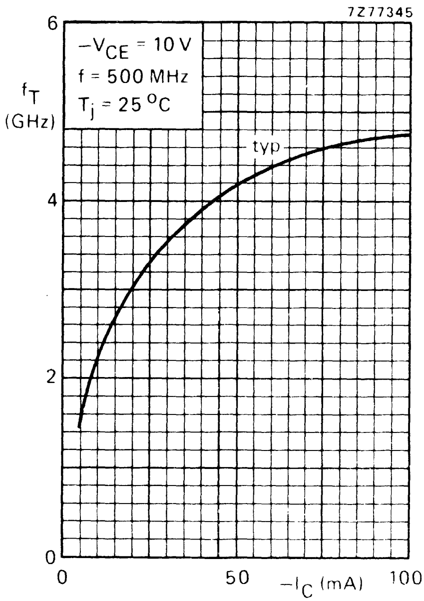


Fig. 1 Intermodulation test circuit.


7Z77344
VCE = 10 V
Tj = 25 °C
hFE
100
75
50
25
0
typ
0
50
100
150
IC (mA)


7Z77346
IE = Ie = 0
f = 1 MHz
Tamb = 25 °C
Cc
(pF)
6
4
2
0
typ
0
10
VCB (V)
20


7Z77345
−VCE = 10 V
f = 500 MHz
Tj = 25 °C
fT
(GHz)
6
4
2
0
typ
0
50
−IC (mA)
100

N-P-N MICROWAVE TRANSISTOR

The BFQ33 is a small-signal silicon planar epitaxial transistor in a miniature hermetically sealed micro-stripline encapsulation, featuring an extremely high transition frequency and very low noise up to high frequencies.

It is primarily intended for use in microwave amplifier applications.

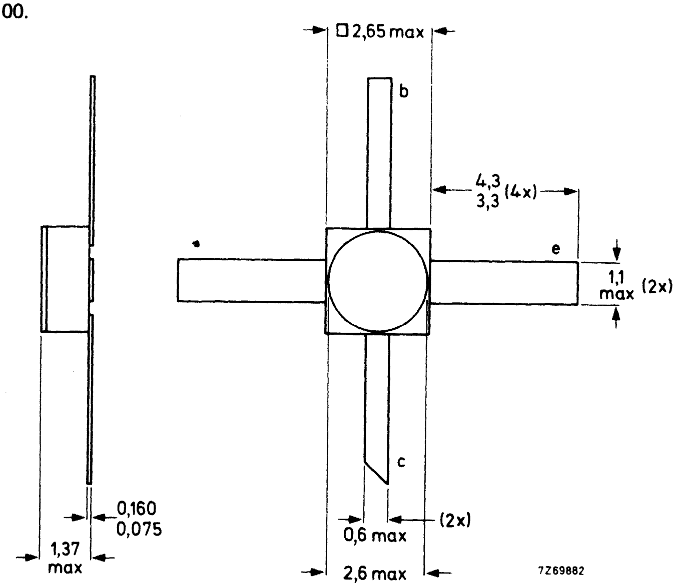
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	9	V
Collector-emitter voltage (open base)	V_{CEO}	max.	7	V
Collector current (d.c.)	I_C	max.	20	mA
Total power dissipation up to T_{amb} = 80 °C	P_{tot}	max.	140	mW
Transition frequency at f = 1,5 GHz I_C = 14 mA; V_{CE} = 5 V	f_T	typ.	12	GHz
Noise figure at optimum source impedance I_C = 5 mA; V_{CE} = 5 V; f = 2 GHz	F	typ.	2,5	dB
Maximum unilateral power gain (see page 3) I_C = 14 mA; V_{CE} = 5 V; f = 2 GHz; T_{amb} = 25 °C	G_{UM}	typ.	13,7	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-100.



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	9	V
→ Collector-emitter voltage (open base)	V_{CEO}	max.	7	V
→ Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	20	mA
→ Total power dissipation up to T_{amb} = 80 °C	P_{tot}	max.	140	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	500	K/W*

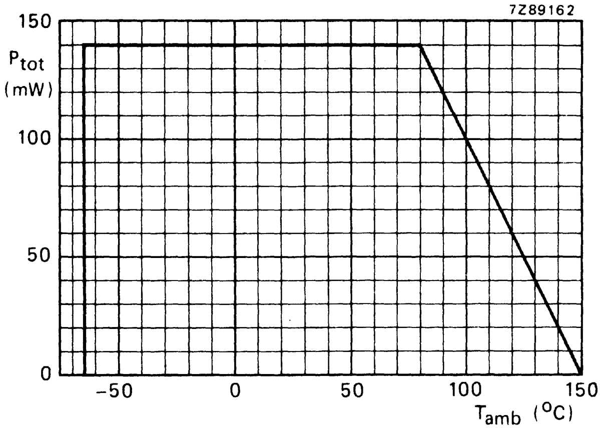


Fig. 2 Power derating curve versus ambient temperature.

* K/W is SI unit for °C/W.

DEVELOPMENT SAMPLE DATA

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50 nA	
D.C. current gain *				
$I_C = 14$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0,45 pF	←
Feedback capacitance at f = 1 MHz				
$I_C = 0$; $V_{CE} = 5$ V	C_{re}	typ.	0,2 pF	←
Transition frequency at f = 1,5 GHz*				
$I_C = 14$ mA; $V_{CE} = 5$ V	f_T	typ.	12 GHz	←
Noise figure at optimum source impedance				
$I_C = 5$ mA; $V_{CE} = 5$ V; f = 2 GHz	F	typ.	2,5 dB	
$I_C = 5$ mA; $V_{CE} = 5$ V; f = 4 GHz	F	typ.	3,8 dB	

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 14$ mA; $V_{CE} = 5$ V; f = 2 GHz	G_{UM}	typ.	13,7 dB	←
$I_C = 14$ mA; $V_{CE} = 5$ V; f = 4 GHz	G_{UM}	typ.	7,4 dB	←

s-parameters (common emitter)

$I_C = 14$ mA; $V_{CE} = 5$ V; $R_S = R_L = 50\ \Omega$; f = 2 GHz				←
Input reflection coefficient	s_{ie}	typ.	0,18/−155°	
Reverse transmission coefficient	s_{re}	typ.	0,10/ +49°	
Forward transmission coefficient	s_{fe}	typ.	4,3 / +75°	
Output reflection coefficient	s_{oe}	typ.	0,43/ −56°	
$I_C = 14$ mA; $V_{CE} = 5$ V; $R_S = R_L = 50\ \Omega$; f = 4 GHz				
Input reflection coefficient	s_{ie}	typ.	0,19/+171°	
Reverse transmission coefficient	s_{re}	typ.	0,14/ +34°	
Forward transmission coefficient	s_{fe}	typ.	2,0 / +48°	
Output reflection coefficient	s_{oe}	typ.	0,50/ −89°	

* Measured under pulse conditions.

Conditions for Figs 3 and 4:
V_{CE} = 5 V; I_C = 14 mA;
T_{amb} = 25 °C.

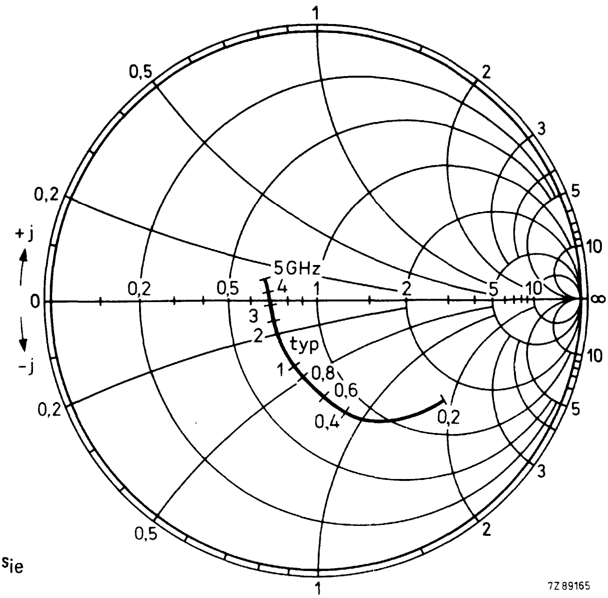


Fig. 3 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

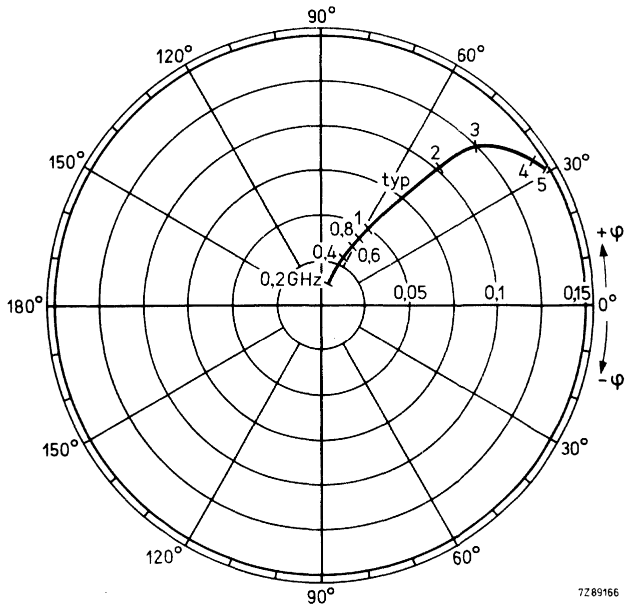


Fig. 4 Reverse transmission coefficient s_{re}.

Conditions for Figs 5 and 6:
V_{CE} = 5 V; I_C = 14 mA;
T_{amb} = 25 °C.

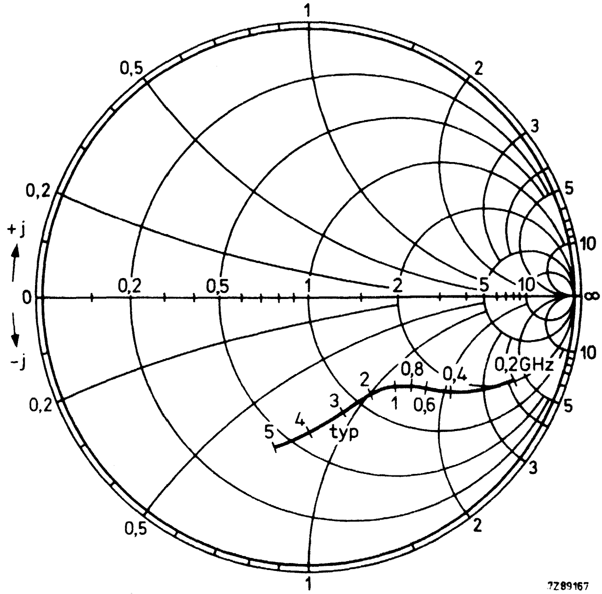


Fig. 5 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

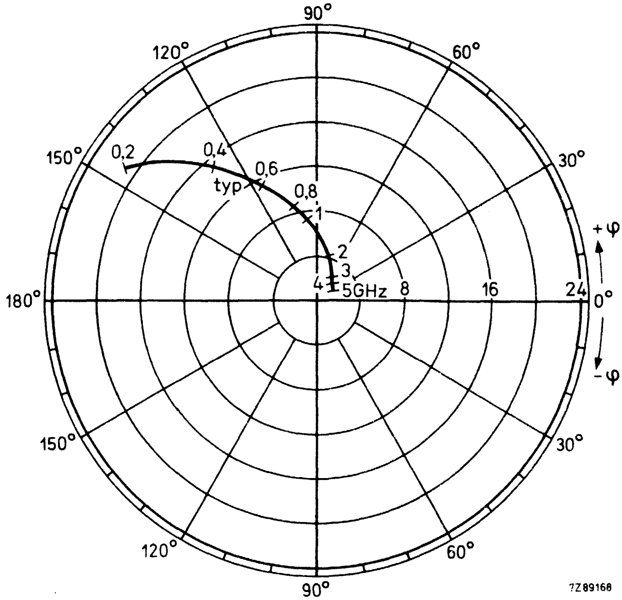


Fig. 6 Forward transmission coefficient s_{fe}.

DEVELOPMENT SAMPLE DATA

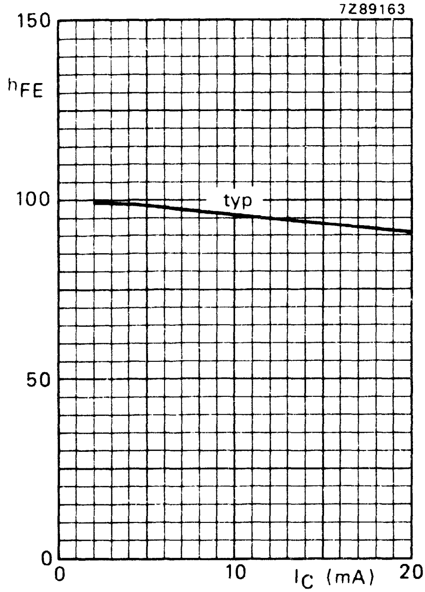


Fig. 7 V_{CE} = 5 V; T_j = 25 °C.

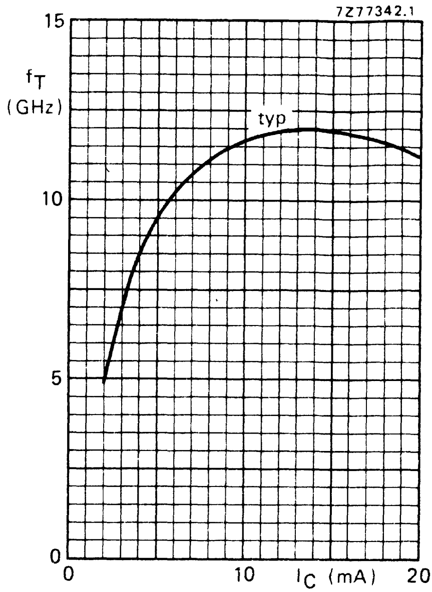


Fig. 8 V_{CE} = 5 V; f = 1,5 GHz; T_j = 25 °C.

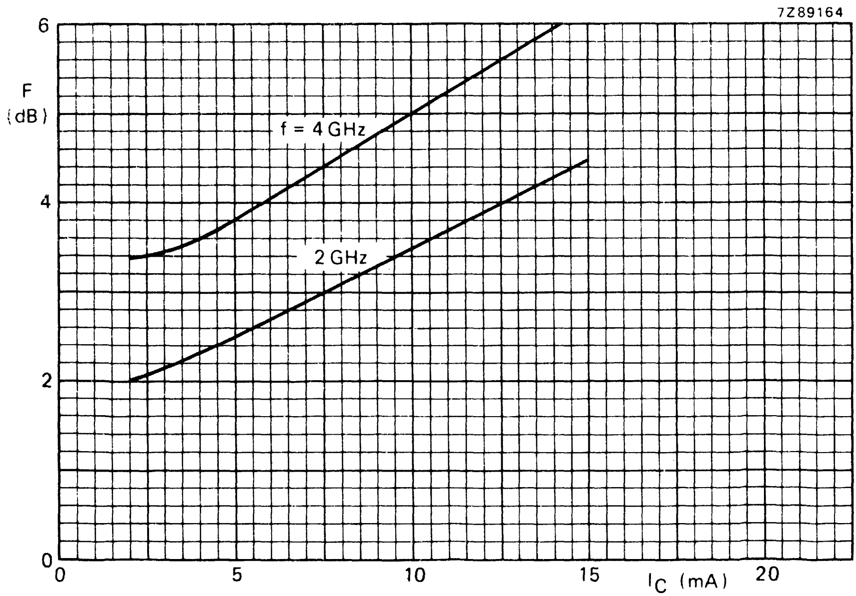


Fig. 9 V_{CE} = 5 V; Z_S = optimum; T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor primarily intended for driver and final stages in MATV system amplifiers. This device is also suitable for use in low power band IV and V equipment. Diffused emitter ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap. All leads are isolated from the stud.

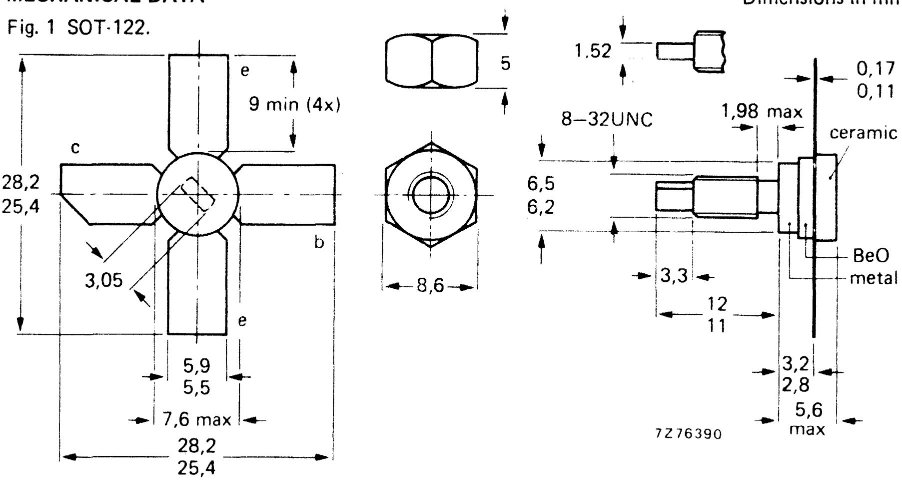
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation (d.c.) up to T_{mb} = 125 °C	P_{tot}	max.	2,25	W
Operating junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 150 mA; V_{CE} = 15 V; T_j = 25 °C	f_T	>	3,5	GHz
Output voltage at d_{im} = −60 dB (see Figs 2 and 4) I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	1,2	V

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base) (see Fig. 3)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation (d.c.) up to T_{mb} = 125 °C (see Fig. 3)	P_{tot}	max.	2,25	W
Storage temperature	T_{stg}	–65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	15,0	K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W*

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; V_{CB} = 15 V	I_{CBO}	<	100	μA
D.C. current gain**				
I_C = 75 mA; V_{CE} = 15 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 15 V	h_{FE}	>	25	
Transition frequency at f = 500 MHz**				
I_C = 75 mA; V_{CE} = 15 V	f_T	>	3,0	GHz
		typ.	3,5	GHz
I_C = 150 mA; V_{CE} = 15 V	f_T	>	3,5	GHz
		typ.	4,0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; V_{CB} = 15 V	C_c	typ.	2,0	pF
		<	2,75	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; V_{EB} = 0,5 V	C_e	typ.	11	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 15 V	C_{re}	typ.	1,0	pF
		<	1,35	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF
Noise figure measured in MATV test circuit (see Fig. 2)				
I_C = 120 mA; V_{CE} = 15 V; f = 500 MHz	F	typ.	8	dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

→ I_C = 120 mA; V_{CE} = 15 V; f = 500 MHz	G_{UM}	typ.	16,3	dB

* K/W is SI unit for °C/W.

** Measured under pulse conditions.

Output voltage at d_{im} = −60 dB (see Figs 2 and 4)
(DIN 45004B, par. 6.3: 3-tone)
I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz
measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 1,2 V

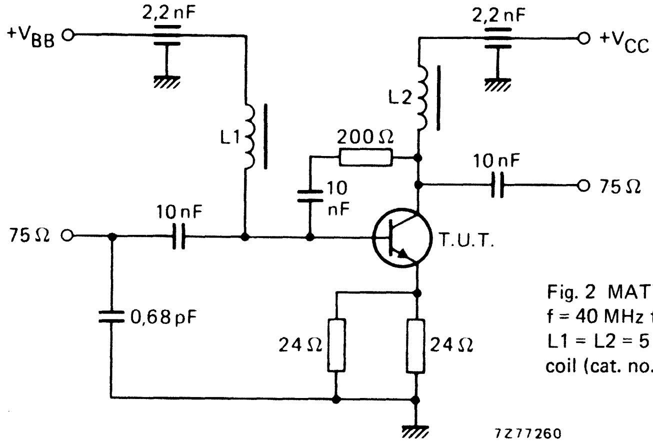


Fig. 2 MATV test circuit
f = 40 MHz to 860 MHz.
L1 = L2 = 5 μH Ferroxcube coil (cat. no. 3122 108 20153).

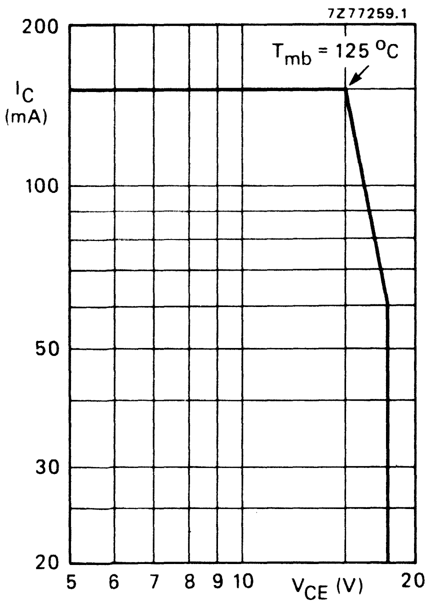


Fig. 3 D.C. SOAR.

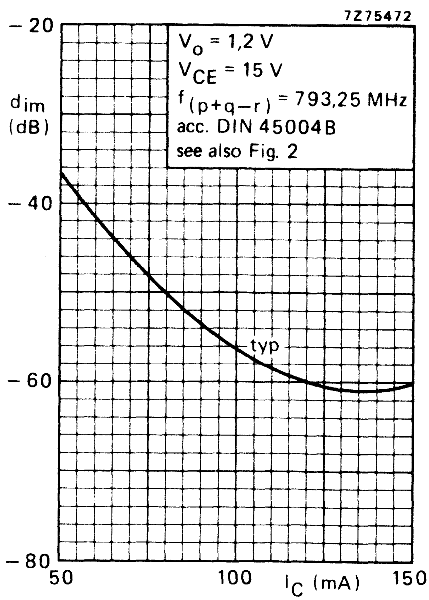


Fig. 4.

→ **s-parameters** (common emitter) at V_{CE} = 7,5 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
50	40	0,47/ −72°	0,02/64°	30,5/147°	0,85/ −34°
	200	0,55/−154°	0,06/52°	11,3/101°	0,36/ −84°
	500	0,54/+ 177°	0,08/58°	4,9/ 78°	0,25/−104°
	800	0,52/+ 160°	0,12/58°	3,2/ 63°	0,25/−113°
	1000	0,50/+ 150°	0,15/57°	2,6/ 54°	0,26/−118°
	1200	0,48/+ 142°	0,18/54°	2,2/ 46°	0,28/−122°
75	40	0,45/ −76°	0,02/64°	32,1/144°	0,83/ −36°
	200	0,54/−156°	0,05/53°	11,6/100°	0,35/ −90°
	500	0,54/+ 176°	0,08/59°	5,0/ 78°	0,24/−112°
	800	0,51/+ 160°	0,13/59°	3,3/ 63°	0,24/−121°
	1000	0,49/+ 150°	0,16/57°	2,7/ 55°	0,24/−124°
	1200	0,46/+ 142°	0,18/54°	2,3/ 47°	0,26/−128°
100	40	0,44/ −79°	0,02/63°	33,0/145°	0,82/ −37°
	200	0,54/−157°	0,06/54°	11,8/100°	0,35/ −93°
	500	0,53/+ 175°	0,09/60°	5,1/ 78°	0,23/−117°
	800	0,51/+ 159°	0,13/59°	3,3/ 64°	0,23/−126°
	1000	0,49/+ 150°	0,16/57°	2,7/ 55°	0,24/−129°
	1200	0,46/+ 142°	0,19/54°	2,3/ 47°	0,26/−131°
120	40	0,43/ −81°	0,02/63°	33,5/145°	0,82/ −38°
	200	0,54/−157°	0,05/55°	11,9/ 99°	0,35/ −95°
	500	0,53/+ 175°	0,09/60°	5,1/ 77°	0,23/−119°
	800	0,51/+ 159°	0,13/59°	3,3/ 63°	0,23/−128°
	1000	0,48/+ 149°	0,16/56°	2,7/ 55°	0,24/−131°
	1200	0,46/+ 141°	0,19/53°	2,3/ 47°	0,25/−132°
150	40	0,43/ −82°	0,02/63°	33,6/145°	0,81/ −39°
	200	0,54/−158°	0,05/55°	11,8/ 99°	0,34/ −96°
	500	0,53/+ 175°	0,09/60°	5,1/ 77°	0,23/−121°
	800	0,51/+ 159°	0,13/59°	3,3/ 63°	0,23/−129°
	1000	0,49/+ 149°	0,16/56°	2,7/ 55°	0,24/−132°
	1200	0,47/+ 141°	0,19/53°	2,3/ 47°	0,25/−134°

s-parameters (common emitter) at V_{CE} = 15 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
50	40	0,48/ −65°	0,02/62°	31,0/148°	0,83/ −30°
	200	0,53/−149°	0,04/52°	12,0/102°	0,37/ −73°
	500	0,52/+ 179°	0,08/58°	5,2/ 78°	0,25/ −89°
	800	0,50/+ 162°	0,12/59°	3,4/ 64°	0,26/ −99°
	1000	0,47/+ 152°	0,14/57°	2,8/ 55°	0,28/−104°
	1200	0,45/+ 144°	0,17/55°	2,3/ 47°	0,31/−109°
75	40	0,46/ −68°	0,02/62°	32,9/148°	0,82/ −32°
	200	0,52/−151°	0,04/53°	12,5/101°	0,36/ −79°
	500	0,51/+ 178°	0,08/59°	5,4/ 78°	0,24/ −97°
	800	0,48/+ 161°	0,12/59°	3,5/ 64°	0,24/−106°
	1000	0,46/+ 152°	0,15/57°	2,8/ 56°	0,26/−110°
	1200	0,44/+ 144°	0,17/55°	2,4/ 48°	0,28/−114°
100	40	0,47/ −69°	0,02/62°	33,9/147°	0,81/ −34°
	200	0,51/−151°	0,04/54°	12,6/101°	0,35/ −82°
	500	0,50/+ 178°	0,08/59°	5,5/ 78°	0,23/−101°
	800	0,48/+ 161°	0,12/59°	3,5/ 64°	0,23/−109°
	1000	0,45/+ 152°	0,15/57°	2,9/ 56°	0,25/−113°
	1200	0,43/+ 144°	0,18/54°	2,4/ 48°	0,27/−117°
120	40	0,47/ −69°	0,02/62°	34,6/146°	0,81/ −34°
	200	0,51/−151°	0,04/54°	12,7/101°	0,35/ −83°
	500	0,50/+ 178°	0,08/60°	5,5/ 78°	0,23/−103°
	800	0,48/+ 161°	0,12/59°	3,5/ 64°	0,23/−112°
	1000	0,45/+ 152°	0,15/57°	2,9/ 56°	0,24/−115°
	1200	0,43/+ 144°	0,18/54°	2,4/ 48°	0,26/−118°
150	40	0,49/ −70°	0,02/61°	34,8/146°	0,80/ −35°
	200	0,52/−152°	0,04/54°	12,6/100°	0,34/ −84°
	500	0,50/+ 178°	0,08/60°	5,4/ 78°	0,23/−103°
	800	0,48/+ 162°	0,12/59°	3,5/ 64°	0,23/−111°
	1000	0,46/+ 152°	0,15/57°	2,8/ 55°	0,24/−114°
	1200	0,44/+ 144°	0,18/54°	2,4/ 48°	0,27/−117°

Conditions for Figs 5 and 6:
V_{CE} = 15 V; I_C = 120 mA;
T_{amb} = 25 °C.

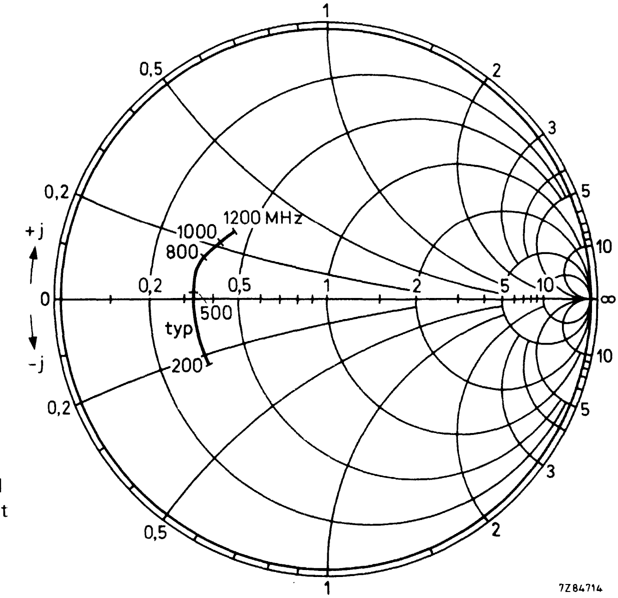


Fig. 5 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

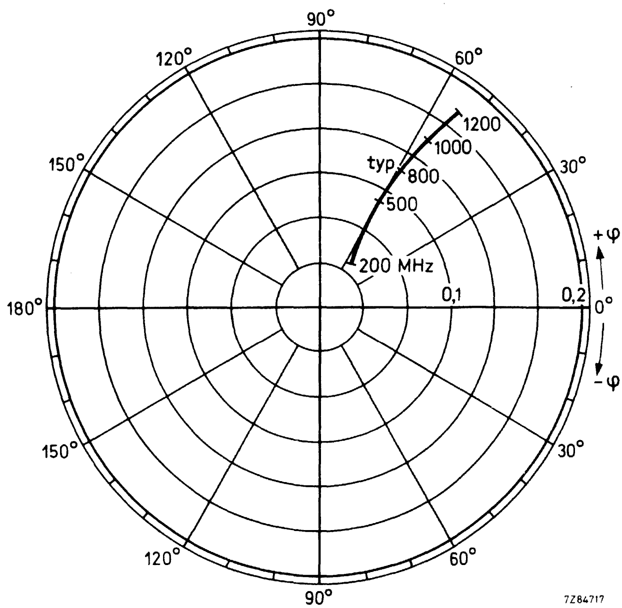


Fig. 6 Reverse transmission coefficient s_{re}.

Conditions for Figs 7 and 8:
V_{CE} = 15 V; I_C = 120 mA;
T_{amb} = 25 °C.

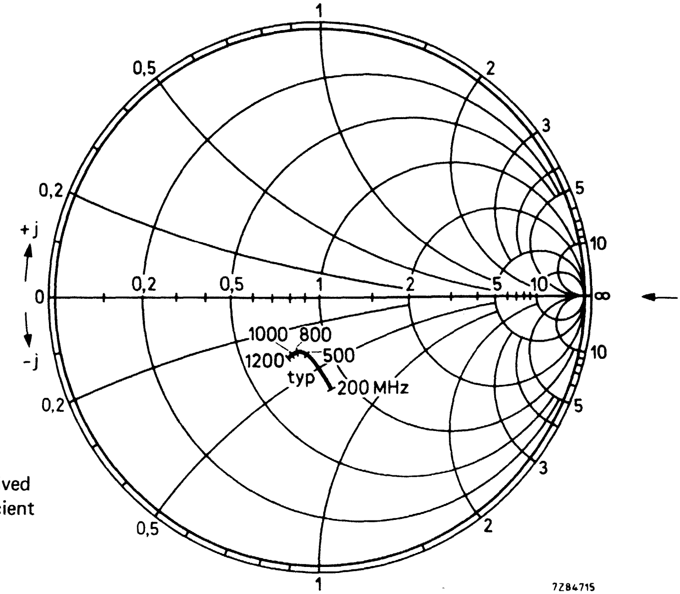


Fig. 7 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

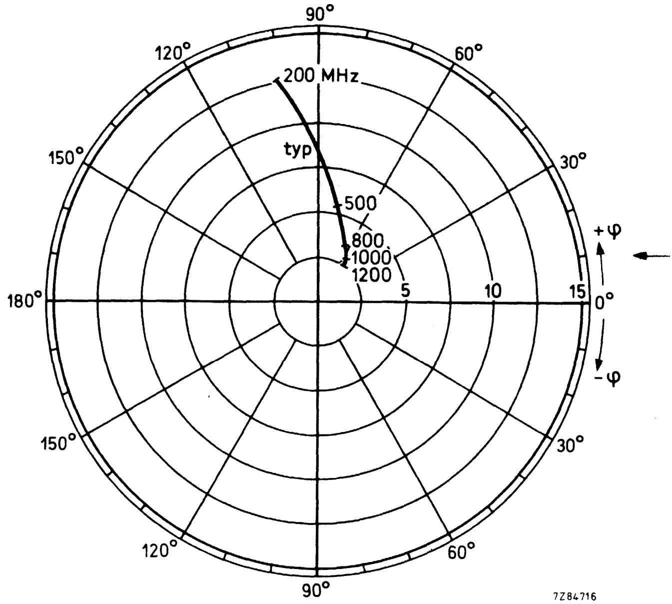


Fig. 8 Forward transmission coefficient s_{fe}.

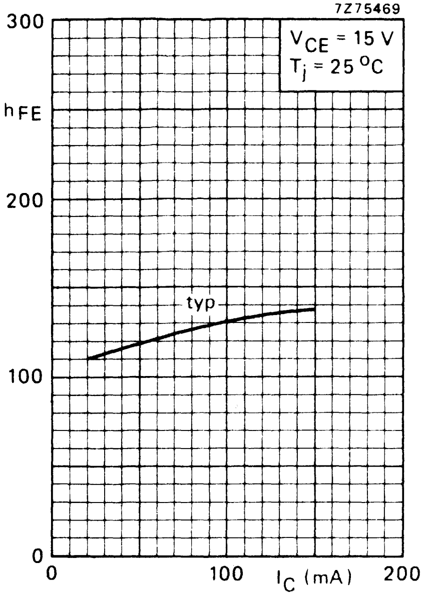


Fig. 9.

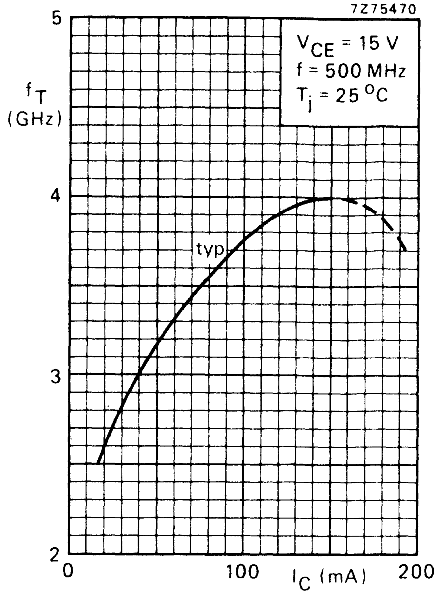


Fig. 10.

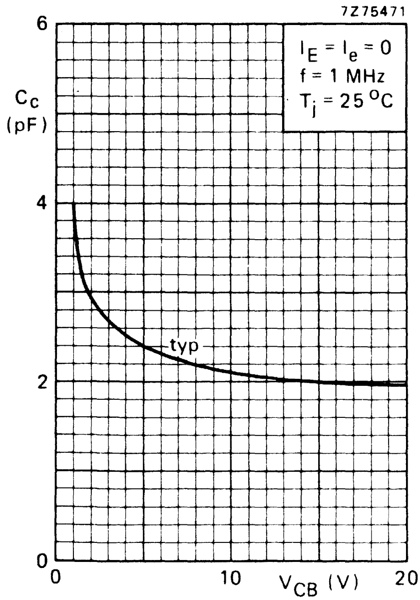


Fig. 11.

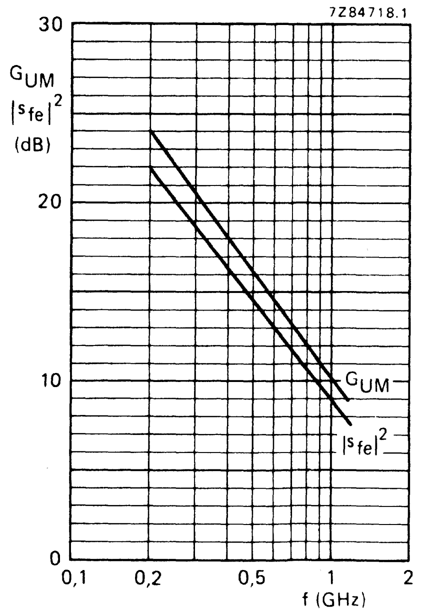


Fig. 12 V_{CE} = 15 V; I_C = 120 mA; T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complements are BFR90 and BFR90A.

QUICK REFERENCE DATA

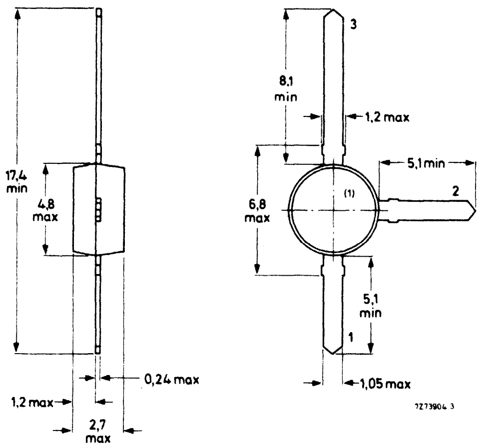
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,7	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Collector current (peak value) at $f > 1$ MHz	$-I_{CM}$	max.	35	mA
Total power dissipation up to $T_{amb} = 60\ ^oC$	P_{tot}	max.	180	mW
Storage temperature	T_{stg}		−65 to +150	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,5	K/mW

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current $I_E = 0; -V_{CB} = 10$ V	$-I_{CBO}$	<	50	nA
D.C. current gain* $-I_C = 14$ mA; $-V_{CE} = 10$ V	h_{FE}	>	20	
Transition frequency at f = 500 MHz* $-I_C = 14$ mA; $-V_{CE} = 10$ V	f_T	typ.	5	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0; -V_{CB} = 10$ V	C_c	typ.	0,65	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0; -V_{EB} = 0,5$ V	C_e	typ.	1,2	pF
Feedback capacitance at f = 1 MHz $I_C = 0; -V_{CE} = 10$ V; $T_{amb} = 25\ ^oC$	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance $-I_C = 2$ mA; $-V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	F	typ.	2,7	dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	19,0	dB

* Measured under pulse conditions.

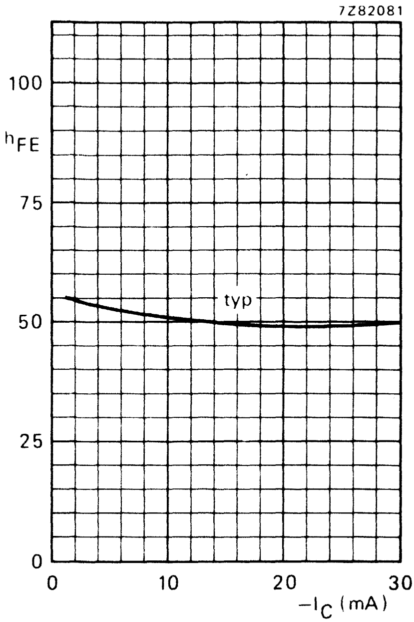


Fig. 2 $-V_{CE}$ = 10 V; T_j = 25 °C.

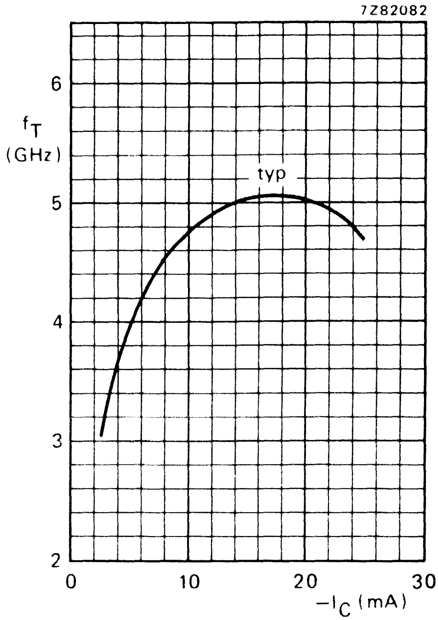


Fig. 3 $-V_{CE}$ = 10 V; f = 500 MHz; T_j = 25 °C.

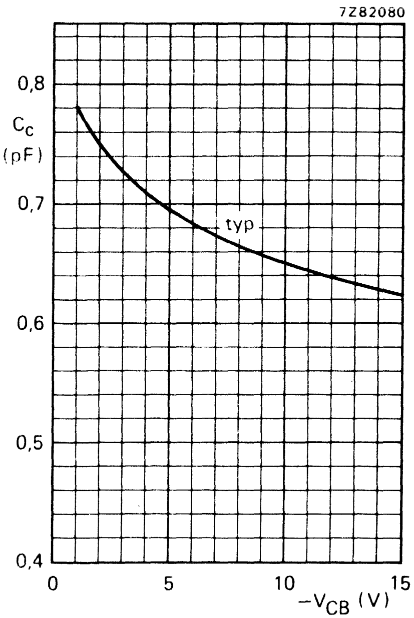


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complement is BFQ53.

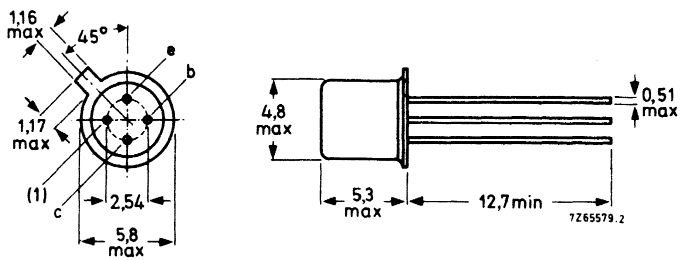
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,5	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,7	dB
Maximum unilateral power gain (see page 2) $-I_C$ = 14 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	17,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Collector current (peak value) at $f > 1$ MHz	$-I_{CM}$	max.	35	mA
Total power dissipation up to $T_{amb} = 65\ ^oC$	P_{tot}	max.	150	mW
Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,9	K/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,6	K/mW

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 10$ V	$-I_{CBO}$	<	50	nA
D.C. current gain (note 1) $-I_C = 14$ mA; $-V_{CE} = 10$ V	h_{FE}	> typ.	20 50	
Transition frequency (notes 1 and 2) $-I_C = 14$ mA; $-V_{CE} = 10$ V; f = 500 MHz	f_T	typ.	5	GHz
Collector capacitance (note 3) $I_E = I_e = 0$; $-V_{CB} = 10$ V; f = 1 MHz	C_c	typ.	0,85	pF
Emitter capacitance $I_C = I_c = 0$; $-V_{EB} = 0,5$ V; f = 1 MHz	C_e	typ.	1,2	pF
Feedback capacitance (note 2) $I_C = 0$; $-V_{CE} = 10$ V; f = 1 MHz; $T_{amb} = 25\ ^oC$	C_{re}	typ.	0,5	pF
Noise figure at optimum source impedance (note 2) $-I_C = 2$ mA; $-V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	F	typ.	2,7	dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$-I_C = 14$ mA; $-V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	17,0	dB

Notes

1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

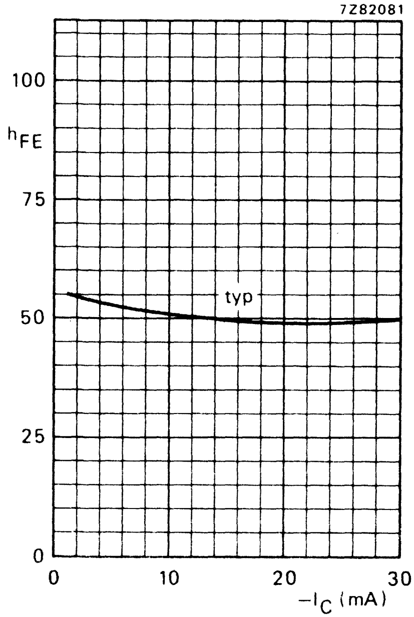


Fig. 2 $-V_{CE}$ = 10 V; T_j = 25 ^oC.

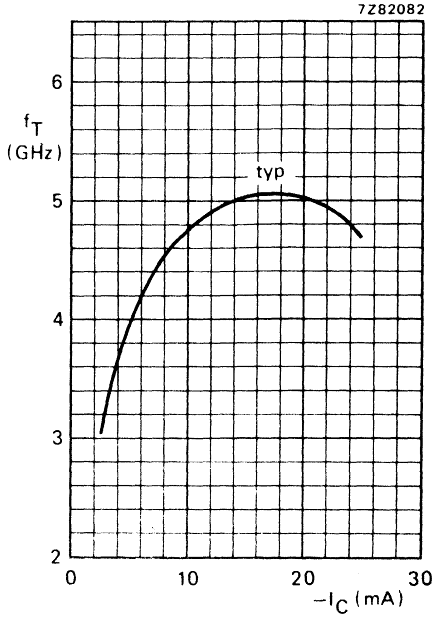


Fig. 3 $-V_{CE}$ = 10 V; f = 500 MHz; T_j = 25 ^oC; shield lead grounded.

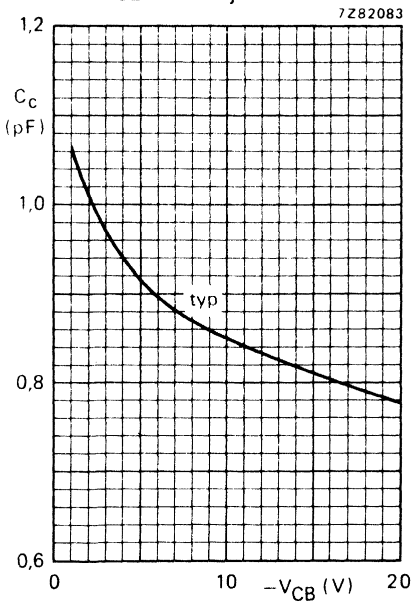


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 ^oC; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

P-N-P complement is BFQ52.

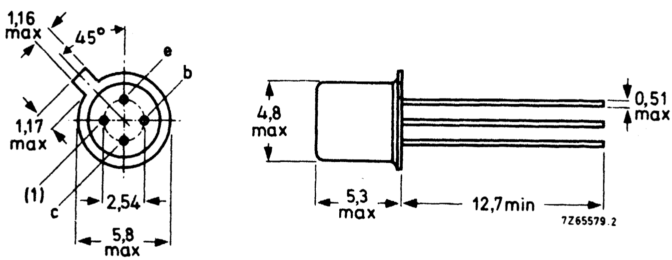
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB
Maximum unilateral power gain (see page 2) I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	18,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value) at $f > 1$ MHz	I_{CM}	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,9	K/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,6	K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 10 V	I_{CBO}	<	50	nA
D.C. current gain (note 1) I_C = 14 mA; V_{CE} = 10 V	h_{FE}	> typ.	25 50	
Transition frequency (notes 1 and 2) I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz	f_T	typ.	5	GHz
Collector capacitance (note 3) $I_E = I_e = 0$; V_{CB} = 10 V; f = 1 MHz	C_c	typ.	0,75	pF
Emitter capacitance $I_C = I_c = 0$; V_{EB} = 0,5 V; f = 1 MHz	C_e	typ.	1,2	pF
Feedback capacitance (note 2) $I_C = 0$; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance (note 2) I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM}\ (\text{in dB}) = \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	18,0	dB

Notes
1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

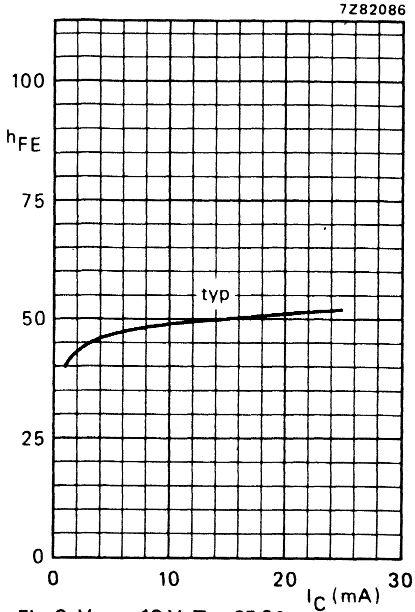


Fig. 2 V_{CE} = 10 V; T_j = 25 °C.

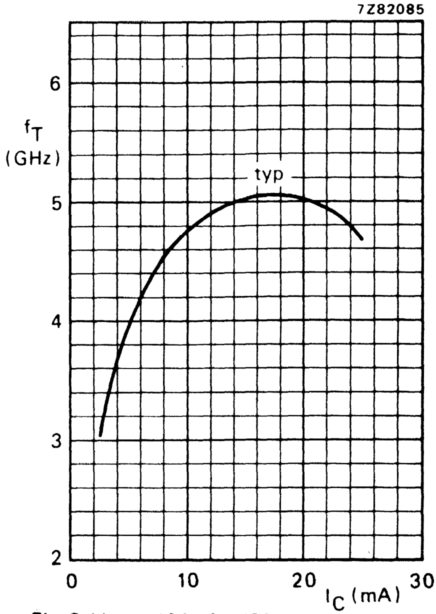


Fig. 3 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

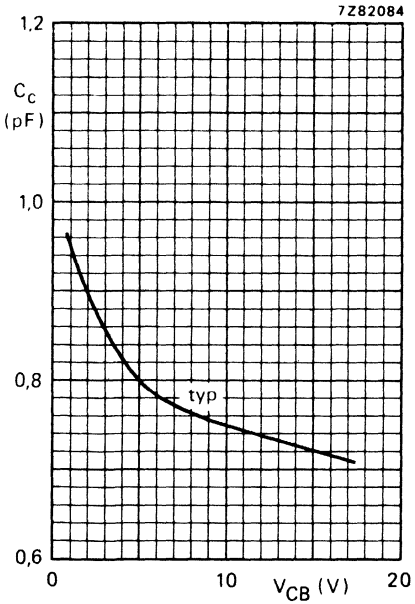


Fig. 4 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features the combination of high power gain, high transition frequency and low noise up to high frequencies.

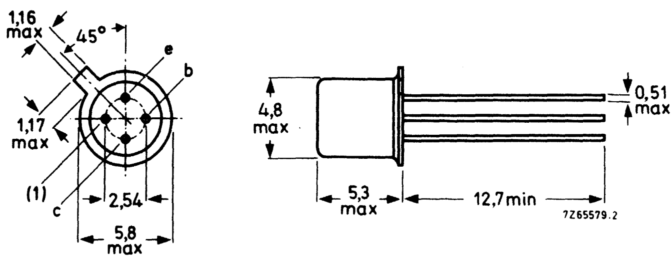
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	75	mA
Total power dissipation up to T_{amb} = 50 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 5 V	f_T	typ.	4,5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	1,0	pF
Noise figure at optimum source impedance I_C = 10 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	F	<	3,0	dB
Maximum unilateral power gain (see page 2) I_C = 20 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	>	17,5	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3 V
Collector current (d.c.)	I_C	max.	75 mA
Collector current (peak value) at f > 1 MHz	I_{CM}	max.	150 mA
Total power dissipation up to T_{amb} = 50 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to + 200 °C
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	600 K/W
From junction to case	$R_{th\ j\text{-}c}$	=	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	100 nA
D.C. current gain (note 1) $I_C = 20$ mA; $V_{CE} = 5$ V	h_{FE}	> <	50 150
Transistion frequency (notes 1 and 2) $I_C = 50$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	4,5 GHz
Collector capacitance (note 3) $I_C = 0$; $V_{CB} = 5$ V; f = 1 MHz	C_{cb}	typ.	1,3 pF
Feedback capacitance (note 2) $I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz; T_{amb} = 25 °C	C_{re}	typ. <	1,0 pF 1,4 pF
Noise figure at optimum source impedance (note 2) $I_C = 10$ mA; $V_{CE} = 5$ V; f = 200 MHz; T_{amb} = 25 °C	F	<	3,0 dB
$I_C = 10$ mA; $V_{CE} = 5$ V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,3 dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM}\text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 20$ mA; $V_{CE} = 5$ V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	>	17,5 dB
$I_C = 50$ mA; $V_{CE} = 5$ V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	11,5 dB

Notes

1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead and emitter lead connected to bridge earth.

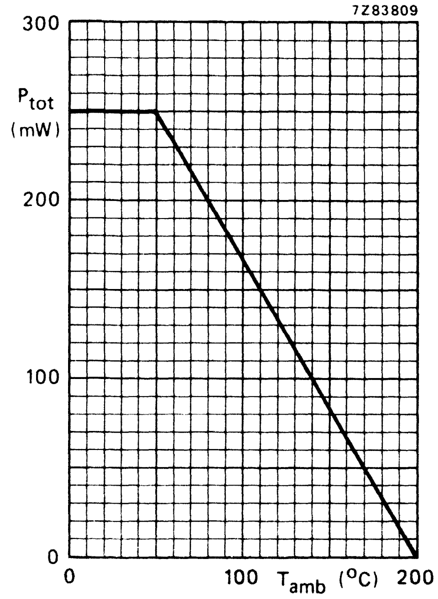


Fig. 2 Maximum permissible power dissipation in free air as a function of ambient temperature.

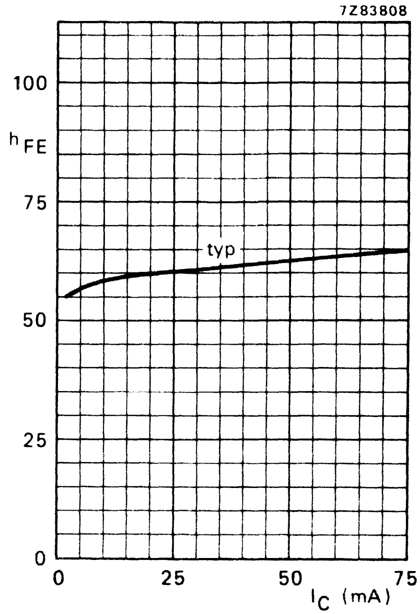


Fig. 3 V_{CE} = 5 V; T_j = 25 °C.

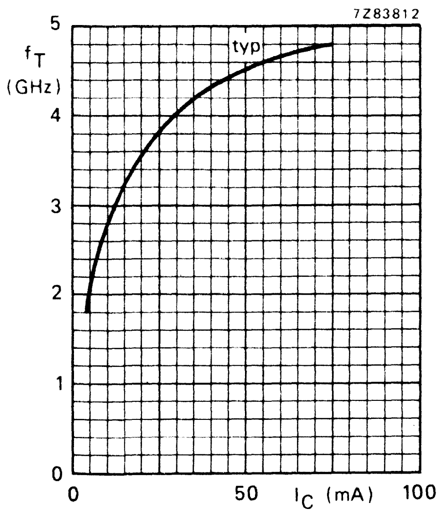


Fig. 4 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

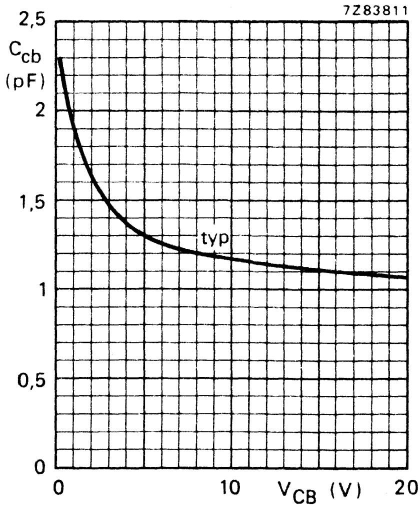


Fig. 5 I_C = 0; f = 1 MHz; T_j = 25 °C; shield lead and emitter lead connected to bridge earth.

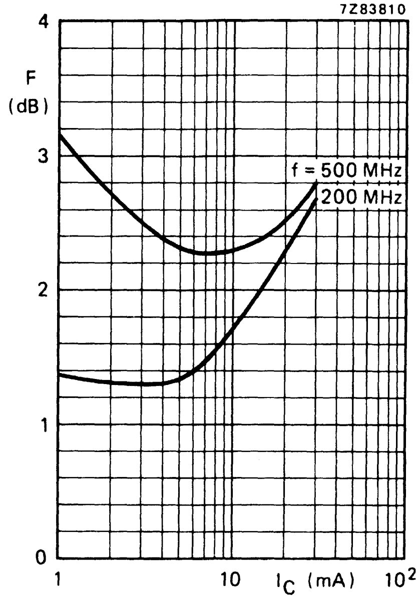


Fig. 6 V_{CE} = 5 V; Z_S = optimum; T_{amb} = 25 °C; typical values.

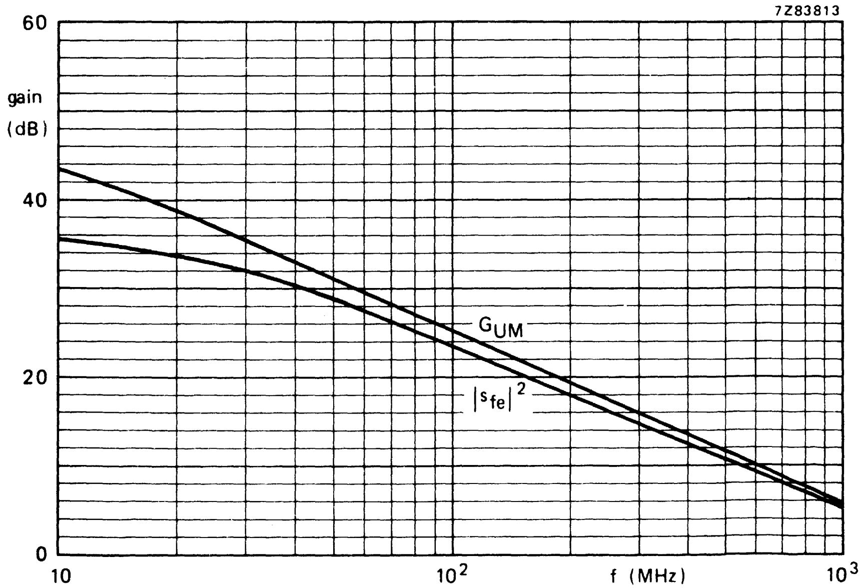


Fig. 7 V_{CE} = 5 V; I_C = 50 mA; T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor primarily intended for final stages in MATV system amplifiers. This device is also suitable for use in low power band IV and V equipment. Diffused emitter ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Collector current (d.c.)	I_C	max.	300	mA
Total power dissipation up to T_{mb} = 110 °C	P_{tot}	max.	4,5	W
Operating junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 240 mA; V_{CE} = 15 V	f_T	typ.	4	GHz
Output voltage at d_{im} = −60 dB (see Figs 2 and 12) I_C = 240 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	1,6	V

MECHANICAL DATA

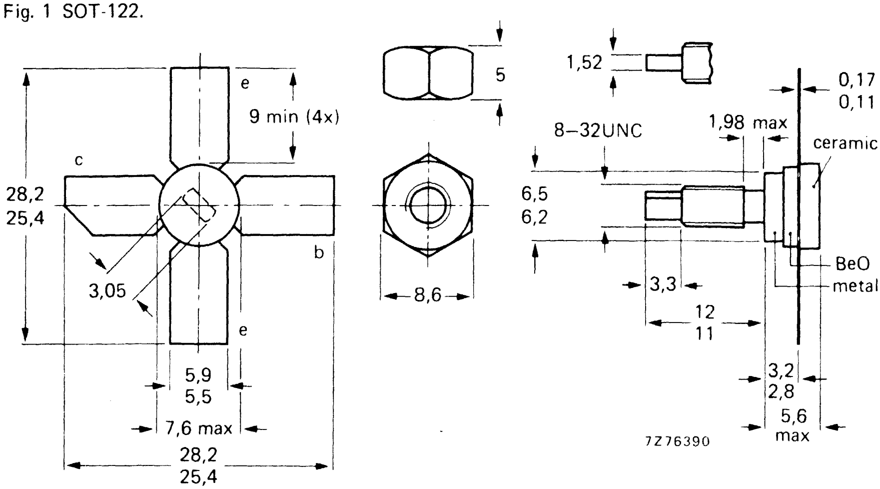
SOT-122 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2 V
Collector current (d.c.)	I_C	max.	300 mA
Total power dissipation up to T_{mb} = 110 °C (see Fig. 7)	P_{tot}	max.	4,5 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	20,0 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

$T_{amb} = 25\ ^oC$

Collector cut-off current $I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	50 μA
D.C. current gain* $I_C = 240$ mA; $V_{CE} = 15$ V	h_{FE}	>	25
Transition frequency at f = 500 MHz* $I_C = 240$ mA; $V_{CE} = 15$ V	f_T	typ.	4 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	3,8 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	20 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 15$ V	C_{re}	typ.	2,3 pF
Collector-stud capacitance**	C_{cs}	typ.	0,8 pF
Maximum unilateral power gain (s_{re} assumed to be zero) G_{UM} (in dB) = $10 \log \frac{\lvert s_{fe} \rvert^2}{(1-\lvert s_{ie} \rvert^2)(1-\lvert s_{oe} \rvert^2)}$ $I_C = 240$ mA; $V_{CE} = 15$ V; f = 800 MHz	G_{UM}	typ.	13 dB
Output voltage at $d_{im} = -60$ dB (see Figs 2 and 12) (DIN 45004B, par. 6.3: 3-tone) $I_C = 240$ mA; $V_{CE} = 15$ V; $R_L = 75\ \Omega$ $V_p = V_o$ at $d_{im} = -60$ dB; $f_p = 795,25$ MHz $V_q = V_o - 6$ dB ; $f_q = 803,25$ MHz $V_r = V_o - 6$ dB ; $f_r = 805,25$ MHz measured at $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	1,6 V

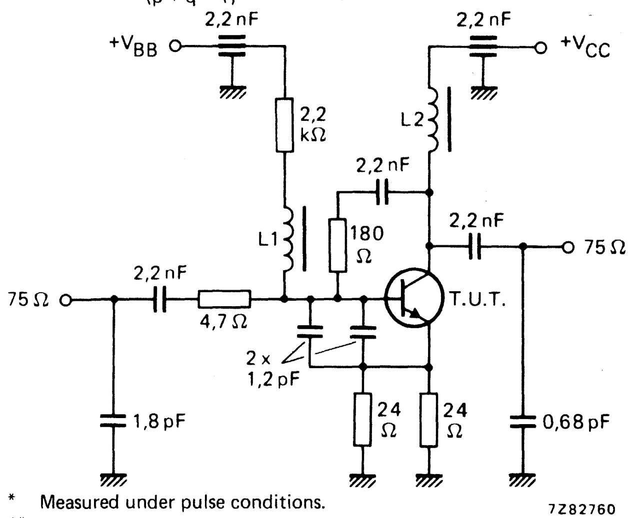


Fig. 2 Intermodulation distortion MATV test circuit. Power gain at f = 40 MHz to 860 MHz is typical 7 dB.

L1 = L2 = 5 μH micro choke.

* Measured under pulse conditions.

** Measured with emitter and base grounded.

s-parameters (common emitter) at V_{CE} = 7,5 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
	40	0,66/−135,7°	0,02/41,1°	30,4/124,0°	0,64/ −79,0°
	100	0,77/−164,0°	0,03/33,6°	14,8/101,2°	0,45/−125,3°
	200	0,80/−176,3°	0,03/44,1°	7,7/ 89,1°	0,39/−147,9°
50	500	0,80/ 170,2°	0,06/55,3°	3,1/ 70,3°	0,38/−159,5°
	800	0,78/ 157,0°	0,09/60,5°	2,0/ 57,2°	0,42/−165,6°
	1000	0,78/ 152,4°	0,11/61,8°	1,6/ 48,1°	0,43/−167,6°
	1200	0,75/ 142,7°	0,13/59,9°	1,4/ 41,1°	0,46/−171,2°
	40	0,67/−146,1°	0,02/40,9°	33,5/121,5°	0,64/ −90,4°
	100	0,78/−167,5°	0,02/37,2°	15,6/100,4°	0,49/−134,4°
	200	0,80/−178,3°	0,03/47,0°	8,1/ 89,2°	0,45/−155,5°
100	500	0,79/ 168,9°	0,06/60,4°	3,4/ 72,0°	0,43/−170,5°
	800	0,77/ 156,1°	0,09/62,0°	2,2/ 59,5°	0,44/−174,5°
	1000	0,77/ 151,5°	0,11/61,9°	1,8/ 51,5°	0,44/−178,5°
	1200	0,74/ 141,8°	0,14/59,4°	1,5/ 44,0°	0,46/−178,5°
	40	0,68/−149,0°	0,02/40,8°	34,3/120,6°	0,64/ −94,6°
	100	0,78/−168,8°	0,02/38,8°	15,9/100,0°	0,50/−138,0°
	200	0,80/−179,0°	0,03/49,0°	8,2/ 89,2°	0,47/−158,2°
150	500	0,79/ 168,5°	0,06/61,6°	3,4/ 72,5°	0,45/−173,2°
	800	0,77/ 155,8°	0,09/62,5°	2,2/ 60,3°	0,46/−177,1°
	1000	0,76/ 151,2°	0,12/62,1°	1,8/ 52,5°	0,46/ 177,1°
	1200	0,73/ 141,6°	0,14/59,1°	1,5/ 45,1°	0,47/ 177,1°
	40	0,68/−150,7°	0,02/40,5°	34,7/120,0°	0,64/ −97,3°
	100	0,78/−169,7°	0,02/39,6°	15,9/ 99,7°	0,51/−140,4°
	200	0,80/−179,8°	0,03/50,1°	8,2/ 89,0°	0,49/−159,8°
200	500	0,79/ 168,2°	0,06/62,1°	3,4/ 72,6°	0,47/−174,8°
	800	0,77/ 155,6°	0,09/62,6°	2,2/ 60,5°	0,47/−178,6°
	1000	0,76/ 150,9°	0,12/62,1°	1,8/ 52,9°	0,46/ 175,5°
	1200	0,73/ 141,4°	0,14/59,0°	1,5/ 45,3°	0,47/ 174,6°
	40	0,69/−151,9°	0,02/40,1°	34,6/119,4°	0,63/ −99,4°
	100	0,79/−170,3°	0,02/39,9°	15,8/ 99,5°	0,52/−141,8°
	200	0,80/ 180,0°	0,03/51,0°	8,1/ 88,9°	0,49/−160,9°
250	500	0,80/ 168,0°	0,06/62,5°	3,4/ 72,6°	0,47/−175,6°
	800	0,78/ 155,4°	0,09/62,8°	2,2/ 60,6°	0,48/−179,5°
	1000	0,77/ 150,8°	0,12/62,1°	1,8/ 53,0°	0,47/ 174,5°
	1200	0,73/ 141,3°	0,14/58,9°	1,5/ 45,6°	0,47/ 173,9°
	40	0,69/−152,9°	0,02/39,7°	34,4/118,9°	0,62/−101,2°
	100	0,79/−170,8°	0,02/40,1°	15,5/ 99,2°	0,52/−143,2°
	200	0,80/ 179,6°	0,03/51,5°	8,0/ 88,8°	0,50/−161,7°
300	500	0,80/ 167,9°	0,06/62,8°	3,4/ 72,5°	0,48/−176,2°
	800	0,78/ 155,3°	0,09/62,9°	2,2/ 60,5°	0,48/+179,8°
	1000	0,77/ 150,6°	0,12/62,1°	1,8/ 53,0°	0,47/ 173,9°
	1200	0,74/ 141,1°	0,14/59,1°	1,5/ 45,5°	0,48/ 173,4°

s-parameters (common emitter) at V_{CE} = 15 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
	40	0,63/−132,3°	0,02/41,8°	33,5/126,6°	0,62/ −72,9°
	100	0,75/−161,1°	0,02/34,0°	16,4/103,0°	0,41/−115,2°
	200	0,78/−174,8°	0,03/40,7°	8,6/ 90,1°	0,34/−139,4°
50	500	0,78/ 169,9°	0,06/56,8°	3,6/ 71,4°	0,34/−153,8°
	800	0,77/ 157,5°	0,08/60,9°	2,3/ 57,6°	0,37/−157,4°
	1000	0,74/ 150,3°	0,10/61,8°	1,9/ 48,8°	0,40/−160,3°
	1200	0,73/ 143,2°	0,12/61,0°	1,5/ 41,2°	0,42/−162,9°
	40	0,63/−140,5°	0,02/41,6°	36,4/125,0°	0,61/ −82,0°
	100	0,76/−164,8°	0,02/37,3°	17,5/102,3°	0,44/−126,8°
	200	0,78/−176,8°	0,03/46,7°	9,1/ 90,3°	0,39/−149,8°
100	500	0,77/ 168,8°	0,06/60,3°	3,8/ 72,6°	0,38/−164,2°
	800	0,76/ 156,7°	0,09/62,1°	2,4/ 60,0°	0,39/−168,6°
	1000	0,73/ 149,6°	0,11/61,7°	2,0/ 51,2°	0,40/−170,8°
	1200	0,72/ 142,6°	0,13/60,2°	1,7/ 44,6°	0,42/−172,6°
	40	0,64/−143,2°	0,02/41,1°	37,6/123,9°	0,60/ −86,5°
	100	0,76/−166,0°	0,02/38,3°	17,9/101,8°	0,45/−131,0°
	200	0,78/−177,5°	0,03/48,1°	9,3/ 90,2°	0,41/−153,1°
150	500	0,77/ 168,2°	0,06/61,2°	3,9/ 73,1°	0,40/−167,7°
	800	0,76/ 156,3°	0,09/62,2°	2,5/ 60,6°	0,40/−172,0°
	1000	0,72/ 149,2°	0,11/61,5°	2,0/ 52,2°	0,41/−174,6°
	1200	0,72/ 142,2°	0,13/59,5°	1,7/ 45,3°	0,42/−176,1°
	40	0,65/−144,0°	0,02/40,6°	38,5/122,8°	0,60/ −90,2°
	100	0,76/−166,7°	0,02/39,0°	18,0/101,2°	0,46/−133,7°
	200	0,78/−177,9°	0,03/49,1°	9,3/ 89,9°	0,42/−155,2°
200	500	0,77/ 168,0°	0,06/61,6°	3,9/ 73,3°	0,41/−169,7°
	800	0,76/ 156,1°	0,09/62,3°	2,5/ 60,9°	0,41/−174,0°
	1000	0,72/ 149,1°	0,11/61,5°	2,1/ 52,8°	0,42/−175,7°
	1200	0,71/ 142,1°	0,13/59,2°	1,7/ 45,8°	0,42/−177,3°
	40	0,66/−144,9°	0,02/40,7°	38,6/122,1°	0,60/ −91,6°
	100	0,76/−167,0°	0,02/39,2°	18,0/100,8°	0,46/−135,4°
	200	0,78/−178,1°	0,03/49,5°	9,3/ 89,7°	0,43/−156,2°
250	500	0,77/ 167,8°	0,06/62,0°	3,9/ 73,2°	0,42/−170,3°
	800	0,76/ 156,1°	0,09/62,4°	2,5/ 61,0°	0,41/−174,8°
	1000	0,72/ 148,9°	0,11/61,5°	2,0/ 52,6°	0,41/−177,2°
	1200	0,72/ 141,8°	0,14/58,8°	1,7/ 45,7°	0,41/−178,3°
	40	0,67/−145,2°	0,02/40,1°	38,7/121,3°	0,59/ −93,3°
	100	0,77/−167,3°	0,02/39,0°	17,9/100,3°	0,46/−136,5°
	200	0,79/−178,2°	0,03/49,6°	9,2/ 89,4°	0,43/−156,8°
300	500	0,78/ 167,7°	0,06/62,0°	3,9/ 72,9°	0,42/−170,6°
	800	0,76/ 156,1°	0,09/62,4°	2,5/ 60,8°	0,41/−174,7°
	1000	0,73/ 148,8°	0,11/61,4°	2,0/ 52,5°	0,41/−177,4°
	1200	0,72/ 142,0°	0,14/59,2°	1,7/ 45,7°	0,42/+177,4°

Conditions for Figs 3 and 4:
V_{CE} = 15 V; I_C = 240 mA;
T_{amb} = 25 °C.

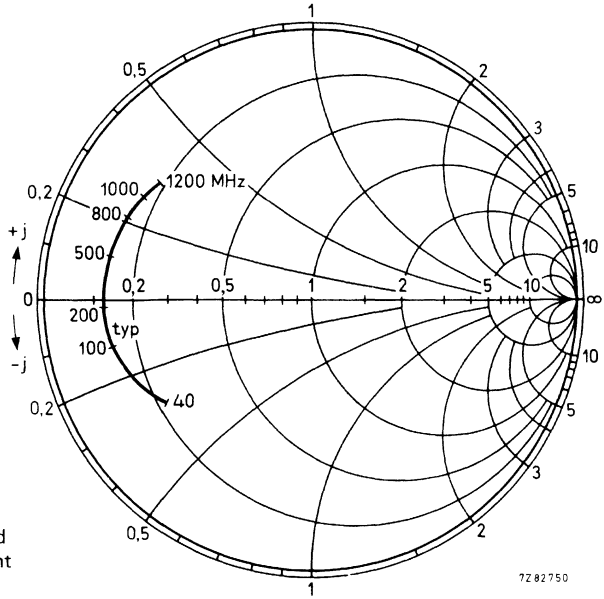


Fig. 3 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

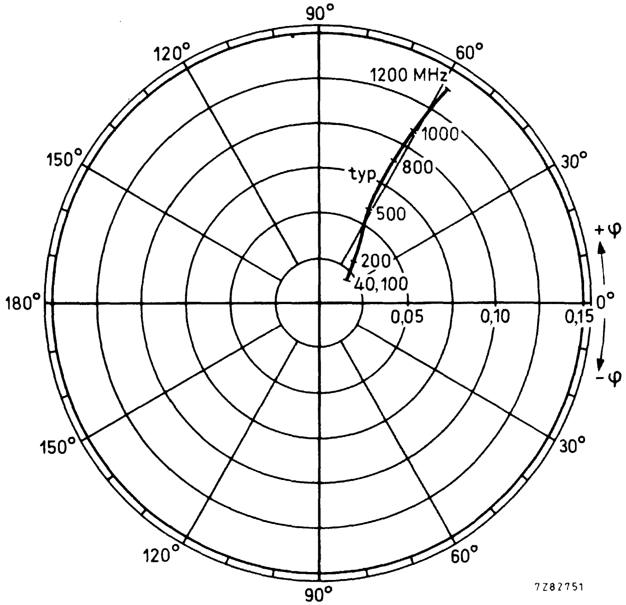


Fig. 4. Reverse transmission coefficient s_{re}.

Conditions for Figs 5 and 6:
V_{CE} = 15 V; I_C = 240 mA;
T_{amb} = 25 °C.

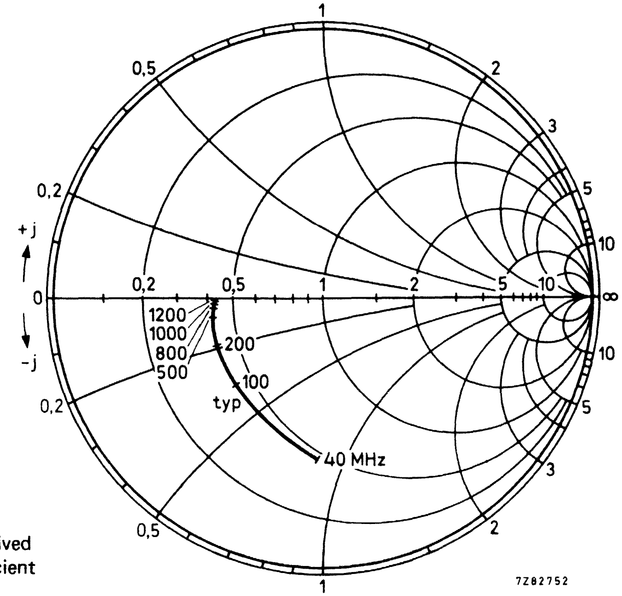


Fig. 5 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

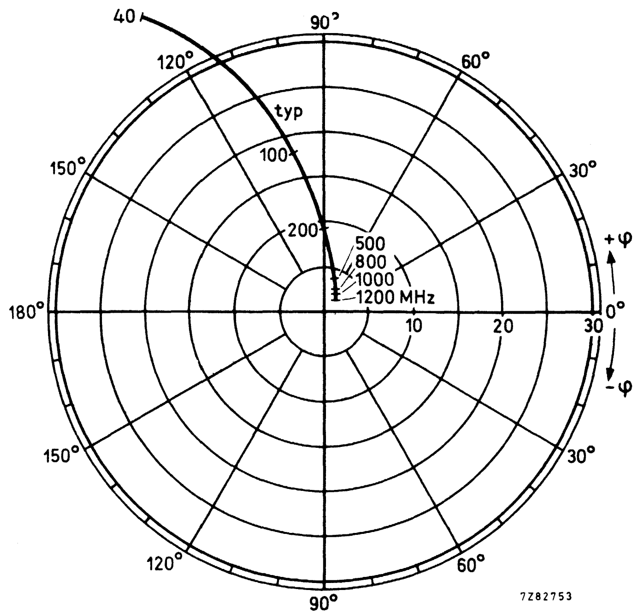


Fig. 6 Forward transmission coefficient s_{fe}.

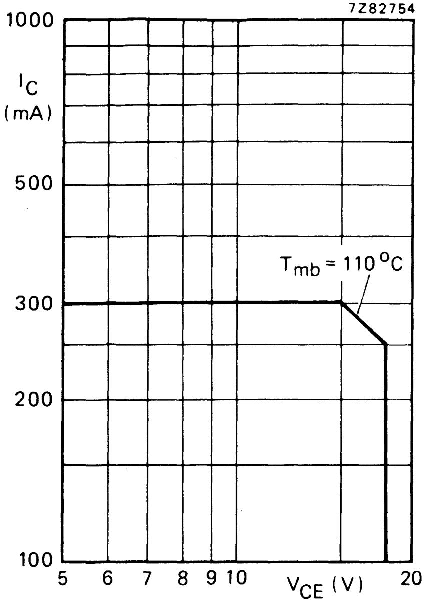


Fig. 7 D.C. SOAR.

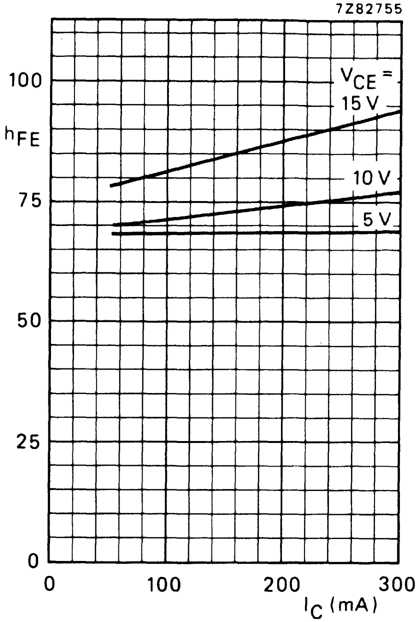


Fig. 8 T_j = 25 °C; typical values.

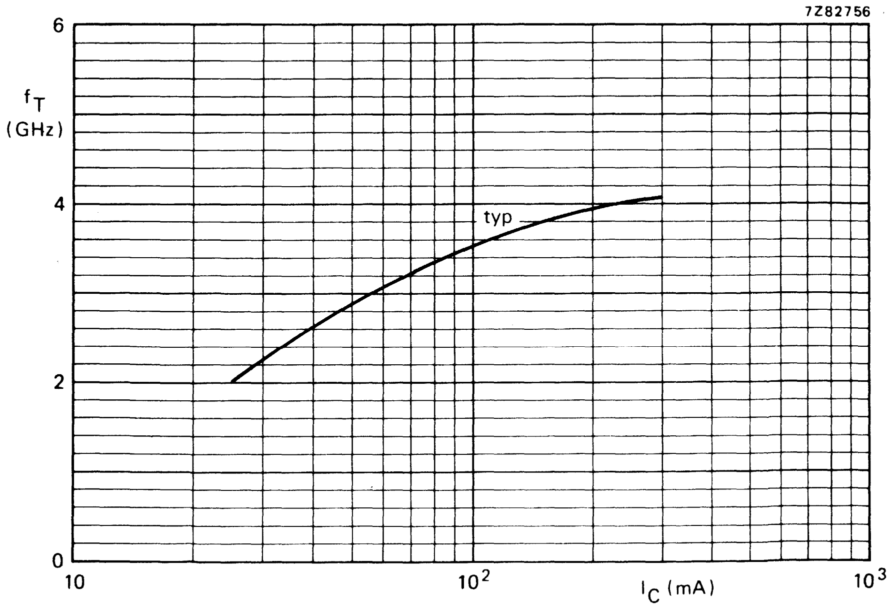


Fig. 9 V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C.

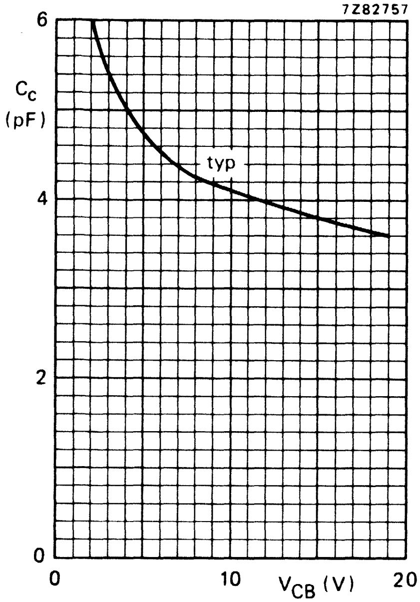


Fig. 10.

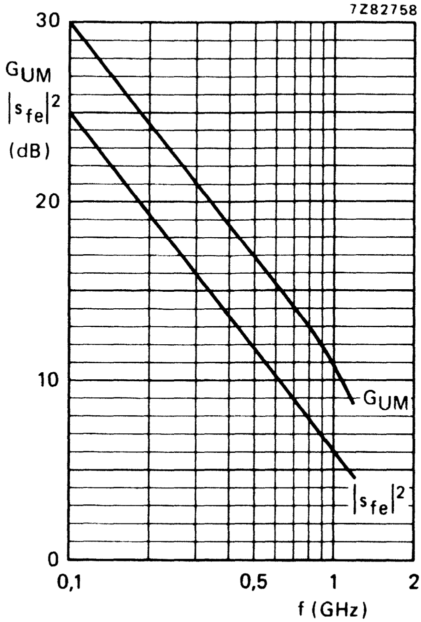


Fig. 11.

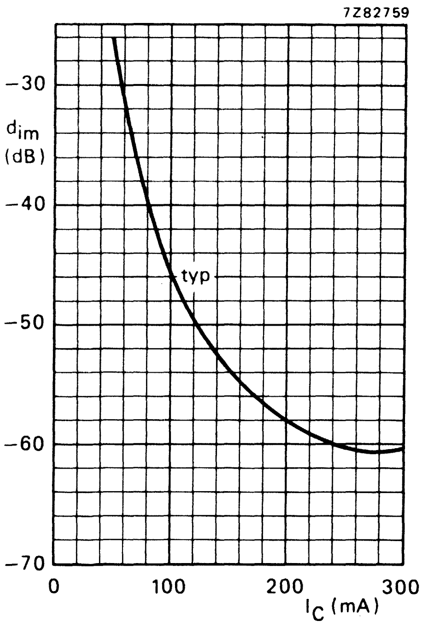


Fig. 12.

Conditions for Figs 10, 11 and 12:

Fig. 10 $I_E = I_e = 0$; $T_{amb} = 25$ °C.

Fig. 11 $V_{CE} = 15$ V; $I_C = 240$ mA; $T_{amb} = 25$ °C; typical values.

Fig. 12 $V_{CE} = 15$ V; $V_o = 1{,}6$ V; $f_{(p+q-r)} = 793{,}25$ MHz; $T_{amb} = 25$ °C; measured in MATV test circuit (see Fig. 2).

N-P-N SILICON MICROWAVE TRANSISTOR

The BFR49 is a microwave transistor featuring a high transition frequency and low noise. A miniature ceramic encapsulation is used for compatibility with stripline and microwave circuits. It is suitable for amplifiers up to S-band frequencies in instrumentation and microwave systems.

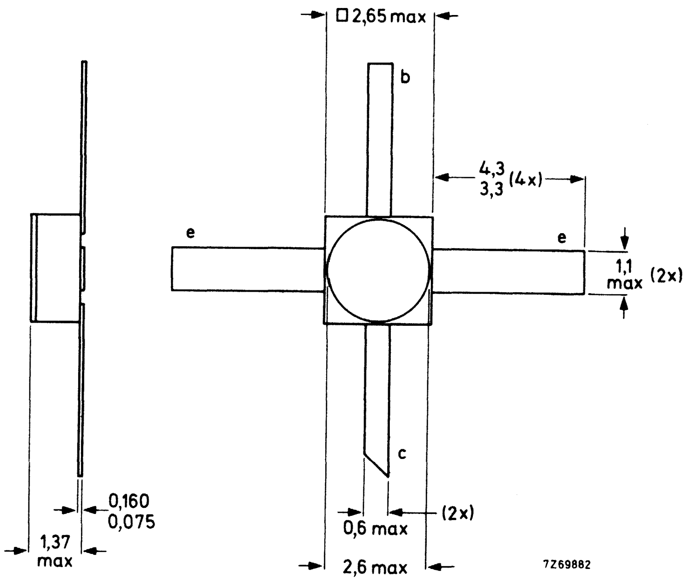
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max	20	V
Collector-emitter voltage (open base)	V_{CEO}	max	15	V
Collector current (d.c.)	I_C	max	25	mA
Total power dissipation up to T_{amb} = 110 °C	P_{tot}	max	180	mW
Transition frequency I_C = 14 mA; V_{CE} = 10 V	f_T	typ	5	GHz
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 10 V; f = 1 GHz	F	typ	2,5	dB
Transducer power gain I_C = 14 mA; V_{CE} = 10 V; f = 1 GHz	$\|s_{fe}\|^2$	typ	15,5	dB

MECHANICAL DATA

Dimensions in mm

SOT-100



RATINGS

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

Collector-base voltage (open emitter; I_C = 10 μA)	V_{CBO}	max	20	V
Collector-emitter voltage (open base; I_C = 10 mA)	V_{CEO}	max	15	V
Emitter-base voltage (open collector; I_E = 10 μA)	V_{EBO}	max	2	V
Collector current (d.c.)	I_C	max	25	mA
Total power dissipation up to T_{amb} = 110 °C	P_{tot}	max	180	mW
Storage temperature	T_{stg}	−65 to + 200		°C
Junction temperature	T_j	max	200	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,5	°C/mW

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

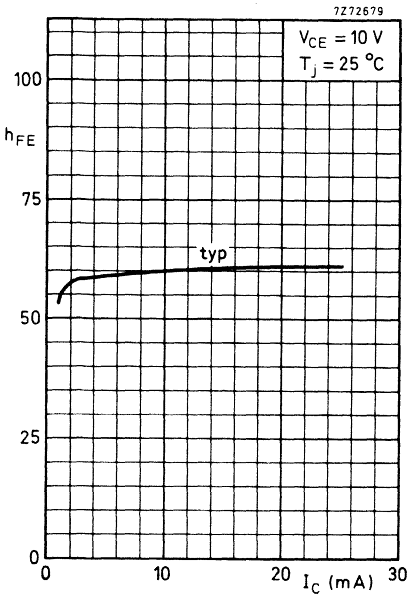
Collector cut-off current I_E = 0; V_{CB} = 10 V	I_{CBO}	<	50	nA
D.C. current gain * I_C = 14 mA; V_{CE} = 10 V	h_{FE}	>	25	
Transition frequency * I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz	f_T	typ	5	GHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ	0,35	pF
Emitter capacitance at f = 1 MHz $I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	typ	1,1	pF
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 10 V	C_{re}	typ	0,3	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 10 V; f = 1 GHz	F	typ	2,5	dB
I_C = 2 mA; V_{CE} = 10 V; f = 4 GHz	F	typ	6,5	dB

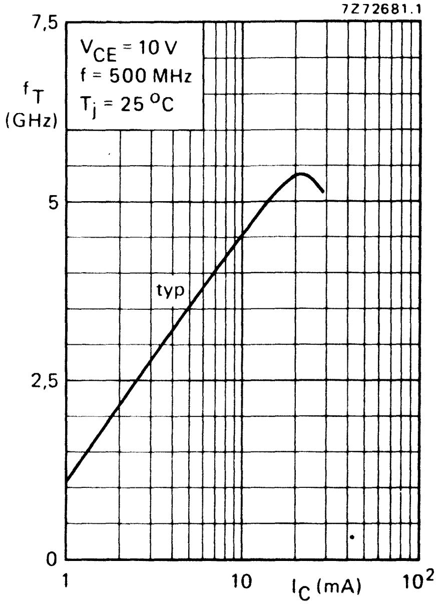
Maximum unilateral power gain (s_{re} assumed to be zero)

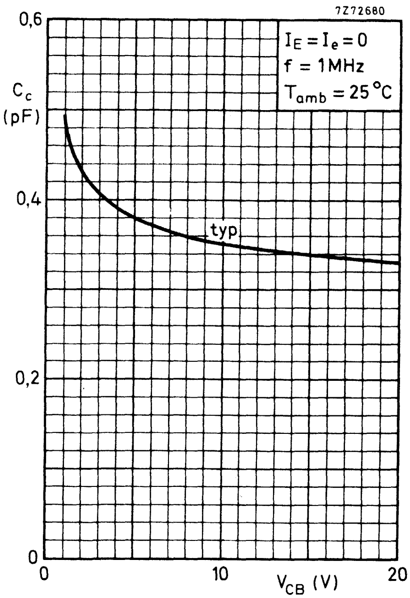
$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

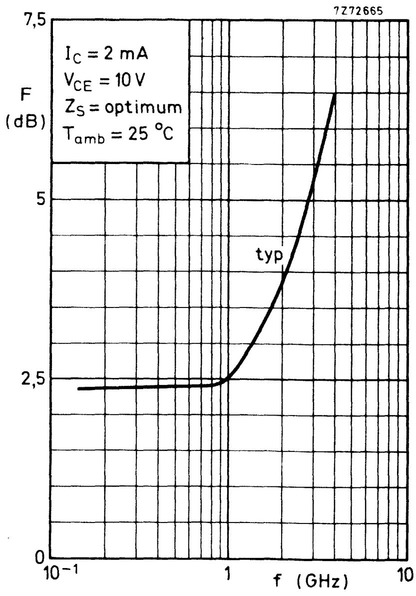
I_C = 14 mA; V_{CE} = 10 V; f = 1 GHz	G_{UM}	typ	17,0	dB
I_C = 14 mA; V_{CE} = 10 V; f = 4 GHz	G_{UM}	typ	6,5	dB
Transducer power gain I_C = 14 mA; V_{CE} = 10 V; f = 1 GHz	$\lvert s_{fe}\rvert^2$	typ	15,5	dB
I_C = 14 mA; V_{CE} = 10 V; f = 4 GHz	$\lvert s_{fe}\rvert^2$	typ	3,5	dB

* Measured under pulse conditions.

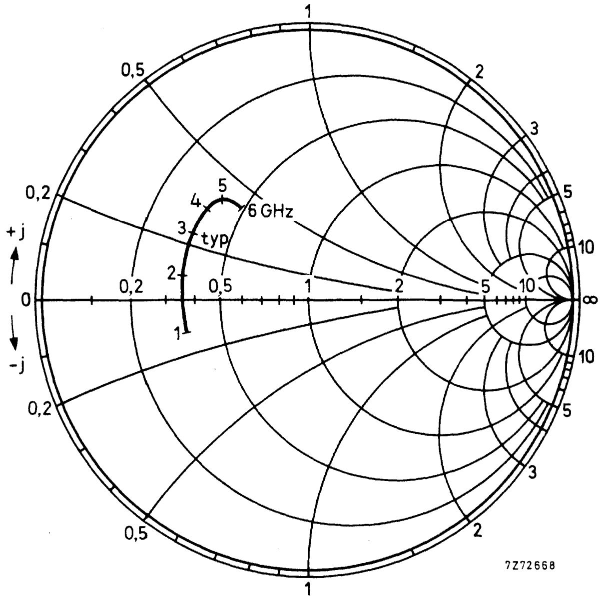

7Z72679
V_{CE} = 10 V
T_j = 25 °C
100
h_{FE}
75
typ
50
25
0
0
10
20
I_C (mA)
30


7Z72681.1
7,5
V_{CE} = 10 V
f = 500 MHz
T_j = 25 °C
f_T
(GHz)
5
typ
2,5
0
1
10
I_C (mA)
10^2


7Z72680
0,6
$I_E = I_e = 0$
f = 1MHz
T_{amb} = 25 °C
C_c
(pF)
0,4
typ
0,2
0
0
10
V_{CB} (V)
20

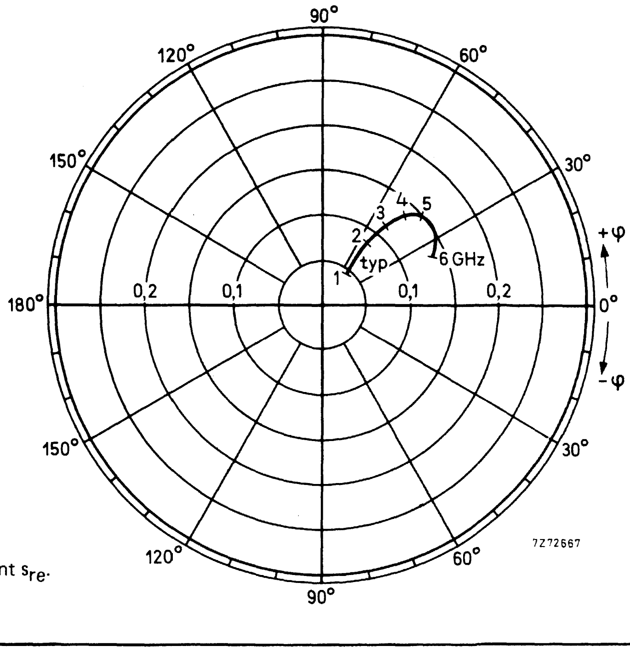

7Z72665
7,5
I_C = 2 mA
V_{CE} = 10 V
Z_S = optimum
T_{amb} = 25 °C
F
(dB)
5
typ
2,5
0
10^{-1}
1
f (GHz)
10

V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C



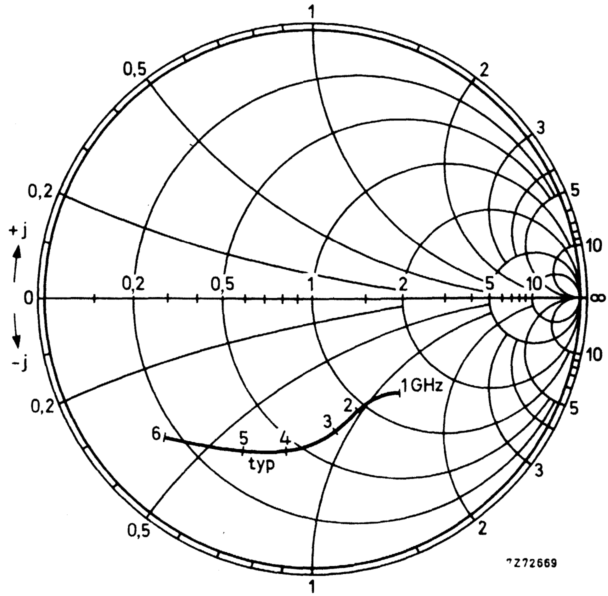
Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C



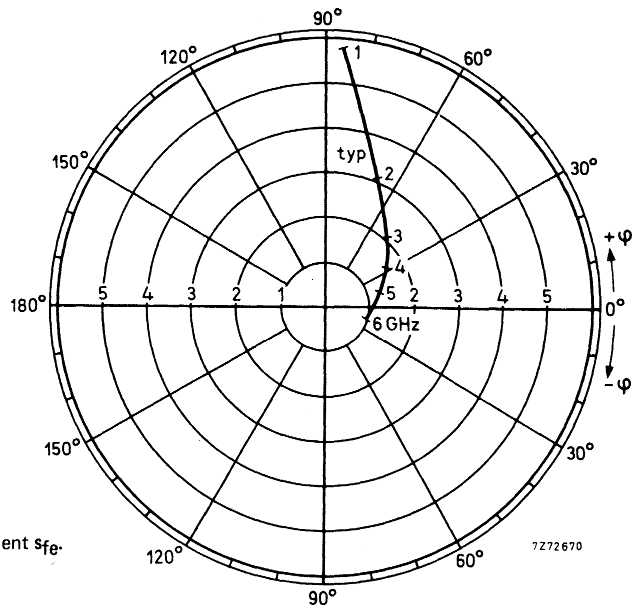
Reverse transmission coefficient s_{re}.

V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C

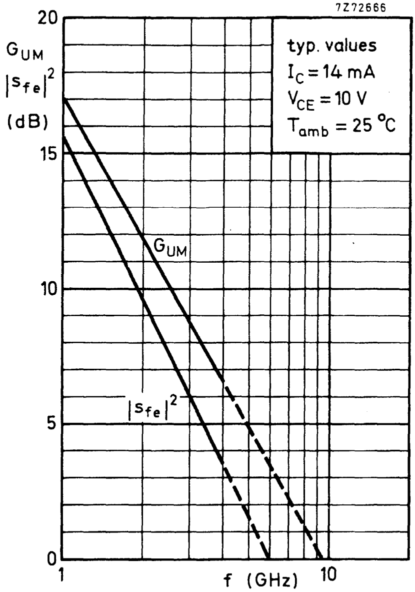


Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}.


7Z72666
20
15
10
5
0
1
10
f (GHz)
G_{UM}
$|s_{fe}|^2$
(dB)
typ. values
$I_C = 14$ mA
$V_{CE} = 10$ V
$T_{amb} = 25$ °C
G_{UM}
$|s_{fe}|^2$

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a capstan envelope. The transistor has extremely good intermodulation properties and high power gain.
The device is primarily intended for:

a Final and driver stages of channel and band aerial amplifiers with high output power for band I, II, III and IV/V (40-860 MHz).
b Final and driver stages of wideband amplifiers (40-230 MHz).
c Final stages of the wideband vertical amplifier in high-speed oscilloscopes.
d Frequency multiplier and oscillator circuits.

QUICK REFERENCE DATA

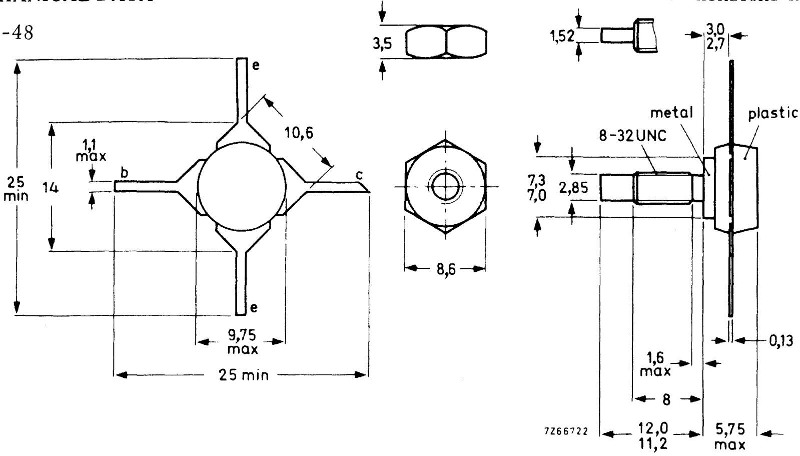
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (peak value)	I_{CM}	max.	500	mA
Total power dissipation up to T_{mb} = 60 °C; f ≥ 1 MHz	P_{tot}	max.	3,5	W
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz				
I_C = 75 mA; V_{CE} = 20 V	f_T	>	1200	MHz
Output power at f = 200 MHz				
I_C = 70 mA; V_{CE} = 20 V; d_{im} = −30 dB	P_o	typ.	150	mW
Power gain at f = 200 MHz				
I_C = 70 mA; V_{CE} = 20 V	G_p	typ.	16	dB

MECHANICAL DATA See page 2.

MECHANICAL DATA

Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V	1)
Collector-emitter voltage (R_{BE} = 10 Ω; peak value)	V_{CERM}	max.	40	V	2)
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V	2)
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V	3)

Currents

Collector current (d.c.)	I_C	max.	200	mA
Collector current (peak value) f > 1 MHz	I_{CM}	max.	500	mA

Power dissipation (f > 1 MHz; see SOAR)

Total power dissipation up to T_{mb} = 60 °C	P_{tot}	max.	3,5	W

Temperatures

Storage temperature	T_{stg}	-40 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	25	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,5	°C/W

1) at I_C = 100 μA. 2) at I_C = 10 mA. 3) at I_E = 100 μA.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	10	μA
Saturation voltage				
I_C = 100 mA; I_B = 10 mA	V_{CEsat}	<	0,75	V
D.C. current gain				
I_C = 50 mA; V_{CE} = 5 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 5 V	h_{FE}	>	25	
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 20 V	C_c	<	4,5	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 20 V; T_{mb} = 25 °C	C_{re}	typ.	1,7	pF
Noise figure at f = 200 MHz				
I_C = 40 mA; V_{CE} = 20 V; R_S = 75 Ω; T_{mb} = 25 °C	F	typ.	6	dB
Transition frequency at f = 500 MHz				
I_C = 15 mA; V_{CE} = 20 V	f_T	typ.	1000	MHz
I_C = 75 mA; V_{CE} = 20 V	f_T	>	1200	MHz
I_C = 150 mA; V_{CE} = 20 V	f_T	typ.	1200	MHz
Output power at f = 200 MHz; T_{mb} = 25 °C				
I_C = 70 mA; V_{CE} = 20 V; VSWR at output < 2 f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB measured at $f_{(2q-p)}$ = 208 MHz (channel 9)	P_o	> typ.	130 150	mW mW
Output power at f = 800 MHz; T_{mb} = 25 °C				
I_C = 70 mA; V_{CE} = 20 V; VSWR at output < 2 f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB measured at $f_{(2q-p)}$ = 806 MHz (channel 62)	P_o	> typ.	70 90	mW mW
Power gain (not neutralized) T_{mb} = 25 °C				
I_C = 70 mA; V_{CE} = 20 V; f = 200 MHz	G_p	> typ.	15 16	dB dB
I_C = 70 mA; V_{CE} = 20 V; f = 800 MHz	G_p	typ.	6,5	dB

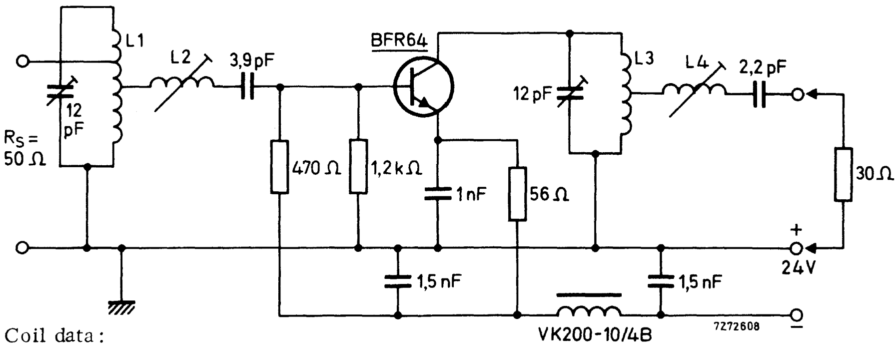
CHARACTERISTICS (continued)

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{mb} = 25 °C

   I_C = 70 mA; V_{CE} = 20 V; VSWR at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 208 MHz (channel 9)

Test circuit:



Coil data:

L1 = 3 turns silver-plated Cu wire (1, 4 mm); winding pitch 2, 7 mm; int. dia. 8 mm; taps at 0, 5 turn and 1, 5 turns from earth.
L2 = 5, 5 turns silver-plated Cu wire (1, 4 mm); winding pitch 2, 2 mm; int. dia. 8 mm
L3 = 3 turns silver-plated Cu wire (1, 4 mm); winding pitch 3, 3 mm; int. dia. 8 mm
L4 = 5, 5 turns silver-plated Cu wire (1, 4 mm); winding pitch 2, 2 mm; int. dia. 11 mm

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h. f. output current-voltage clipping.
The maximum undistorted output power is realized, if

a. Current and voltage clipping take place concurrently.
   This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

   in which V_{CEK} is the high-frequency knee voltage.

b. The h.f. collector current is as small as possible.
   This is so if $-C_L = +C_{oe}$,
   in which C_{oe} is the output capacitance of the transistor at short-circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 220\ \Omega$; $C_L = -4$ pF.

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 220 Ω resistor in parallel with a 4 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (VSWR = 1).
   After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band-pass curve.
   The VSWR of the output will then, in most cases, be ≤ 2 over the whole channel.
   Corrections can be made by tuning L2; this will not disturb the band-pass curve.

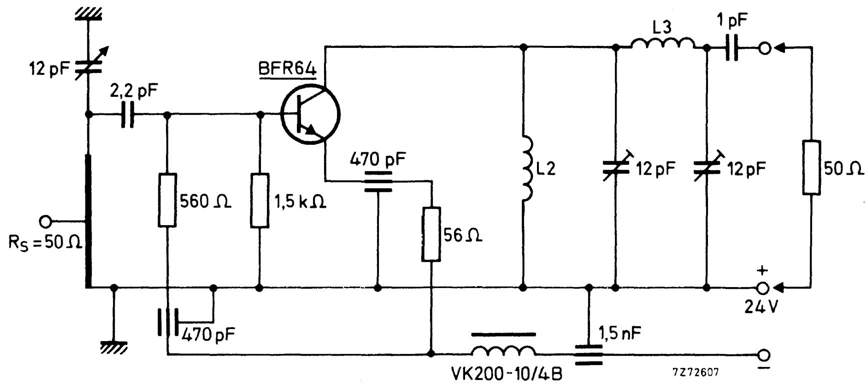
CHARACTERISTICS (continued)

Intermodulation characteristics

2. Output power at f = 800 MHz; T_{mb} = 25 °C

I_C = 70 mA; V_{CE} = 20 V; VSWR at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (channel 62)

Test circuit:



Coil data:

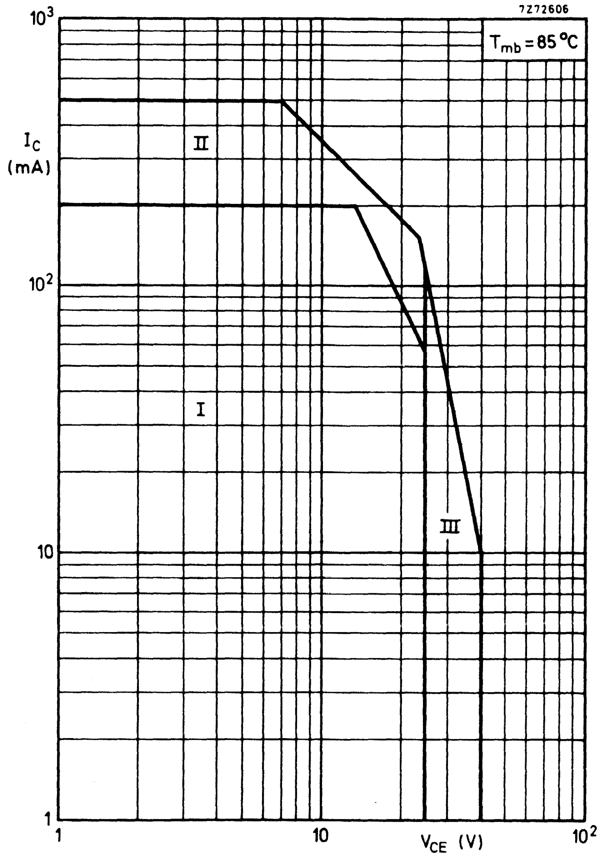
L1 = 25 mm x 7 mm x 0,85 mm silver-plated Cu strip
Tap of the input at 5 mm from earth.
L2 = 13 turns enamelled Cu wire (0,6 mm); int. dia. 8 mm
L3 = 1,5 turns Cu wire (1,3 mm); int. dia. 8 mm

Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

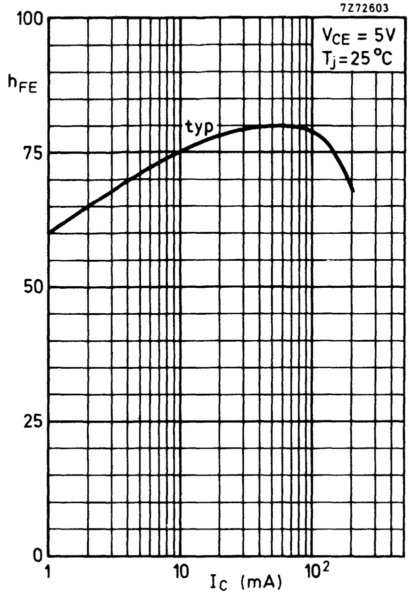
$$P_o = \frac{I_C(V_{CE} - V_{CEK})}{2} = 480 \text{ mW}.$$

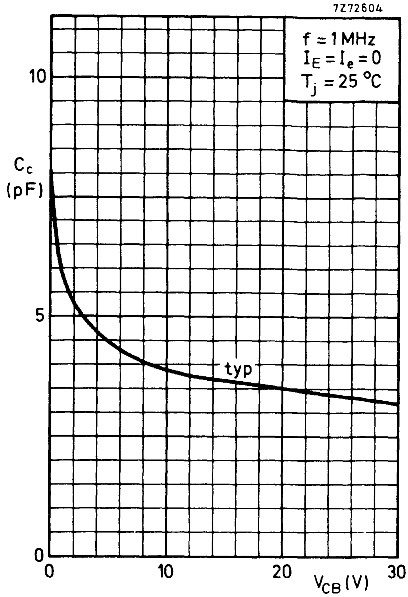
The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 480 mW. With this adjusting method, care must be taken that the transistor is not damaged by second breakdown (the voltage swing may not exceed the rated V_{CER} value). Therefore as soon as clipping occurs, the increase of the input signal should be stopped until the clipping has been eliminated. After this adjustment has been made no further change may be made in the output circuit. Adjust the input circuit for maximum power gain and good band-pass curve. The VSWR of the output is then ≤ 2 over the whole channel.

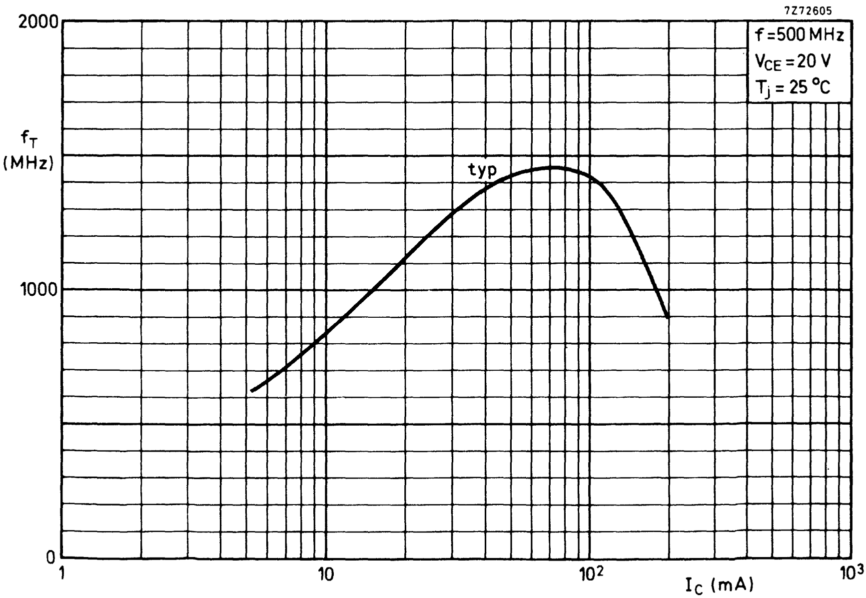


Safe Operating Area with the transistor forward biased

I Region of permissible d.c. operation
II Permissible extension for repetitive pulse operation; $f > 1$ MHz
III Repetitive pulse operation in this region is allowable, provided $R_{BE} < 10\ \Omega$ and $f > 1$ MHz


7Z72603
V_{CE} = 5V
T_j = 25 °C
100
h_{FE}
75
50
25
0
typ
1
10
10^2
I_C (mA)


7Z72604
f = 1 MHz
$I_E = I_e = 0$
T_j = 25 °C
10
C_c
(pF)
5
0
typ
0
10
20
30
V_{CB} (V)


7Z72605
f = 500 MHz
V_{CE} = 20 V
T_j = 25 °C
2000
f_T
(MHz)
1000
0
typ
1
10
10^2
10^3
I_C (mA)

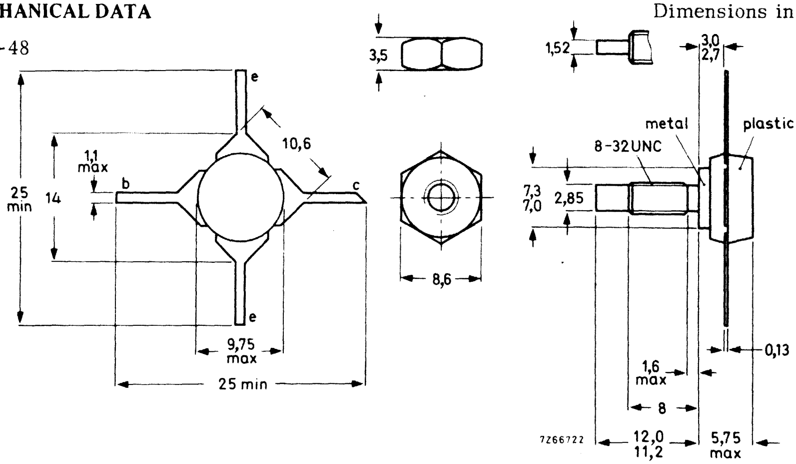
SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter silicon transistor in a capstan envelope. The transistor has extremely good intermodulation properties and high power gain.
The device is primarily intended for channel amplifiers in aerial amplifier systems as well as other applications where an excellent f_T linearity and higher signal handling capabilities than available in existing devices are required.

QUICK REFERENCE DATA				
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (peak value)	I_{CM}	max.	1000	mA
Junction temperature	T_j	max.	200	^oC
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	15	$^oC/W$
Transition frequency at f = 500 MHz I_C = 200 mA; V_{CE} = 20 V	f_T	>	1200	MHz
Output power at f = 200 MHz I_C = 200 mA; V_{CE} = 20 V; d_{im} = −30 dB	P_o	typ.	450	mW
Power gain at f = 200 MHz I_C = 200 mA; V_{CE} = 20 V	G_p	typ.	19	dB

MECHANICAL DATA Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

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

Voltages				
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (R_{BE} = 10 Ω; peak value)	V_{CERM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3.5	V
Currents				
Collector current (d.c.)	I_C	max.	400	mA
Collector current (peak value) f > 1 MHz	I_{CM}	max.	1000	mA
Power dissipation				
Total power dissipation up to T_{mb} = 125 °C See also page 6	P_{tot}	max.	5	W
Temperatures				
Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	15	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.5	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage				
open emitter, I_C = 1 mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage				
R_{BE} = 10 Ω, I_C = 5 mA	$V_{(BR)CER}$	>	40	V
open base, I_C = 5 mA	$V_{(BR)CEO}$	>	25	V
Emitter-base voltage				
open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	3.5	V
Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100	µA
Saturation voltage				
I_C = 200 mA; I_B = 20 mA	V_{CEsat}	<	0.75	V
D.C. current gain				
I_C = 200 mA; V_{CE} = 20 V	h_{FE}	>	30	
I_C = 400 mA; V_{CE} = 20 V	h_{FE}	>	20	
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 20 V	C_c	<	10	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 20 V; T_{mb} = 25 °C	C_{re}	typ.	3.5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF
Transition frequency at f = 500 MHz				
I_C = 200 mA; V_{CE} = 20 V	f_T	>	1200	MHz
I_C = 400 mA; V_{CE} = 20 V	f_T	>	1000	MHz
Output power at f = 200 MHz; T_{mb} = 25 °C				
I_C = 200 mA; V_{CE} = 20 V; V.S.W.R. at output < 2 f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB measured at $f_{(2q-p)}$ = 208 MHz (channel 9)	P_o	typ.	450	mW
Power gain (not neutralized) T_{mb} = 25 °C				
I_C = 200 mA; V_{CE} = 20 V; f = 200 MHz	G_p	>	15	dB
		typ.	19	dB
I_C = 200 mA; V_{CE} = 20 V; f = 800 MHz	G_p	typ.	4.5	dB

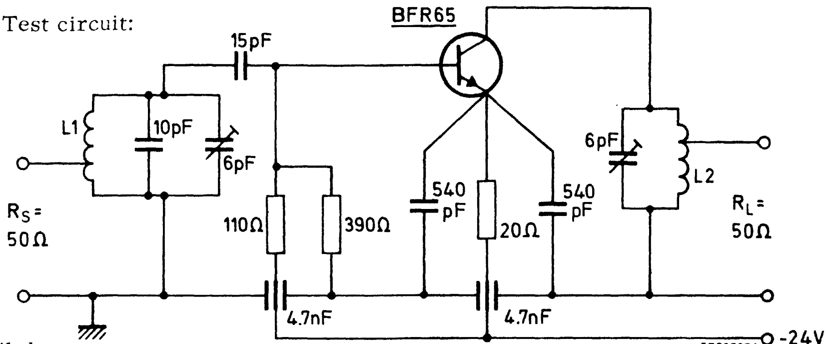
CHARACTERISTICS (continued)

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{mb} = 25 °C

   I_C = 200 mA; V_{CE} = 20 V; V.S.W.R. at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 208 MHz (channel 9)

   Test circuit:



Coil data:

L1 = 1 turn silver plated Cu wire (1.4 mm); int. diam. 8 mm; tap at 0.75 turn from earth.
L2 = 3 turns silver plated Cu wire (1.4 mm); int. diam. 8 mm; winding pitch 2.7 mm; tap at 2.5 turns from earth.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current − voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

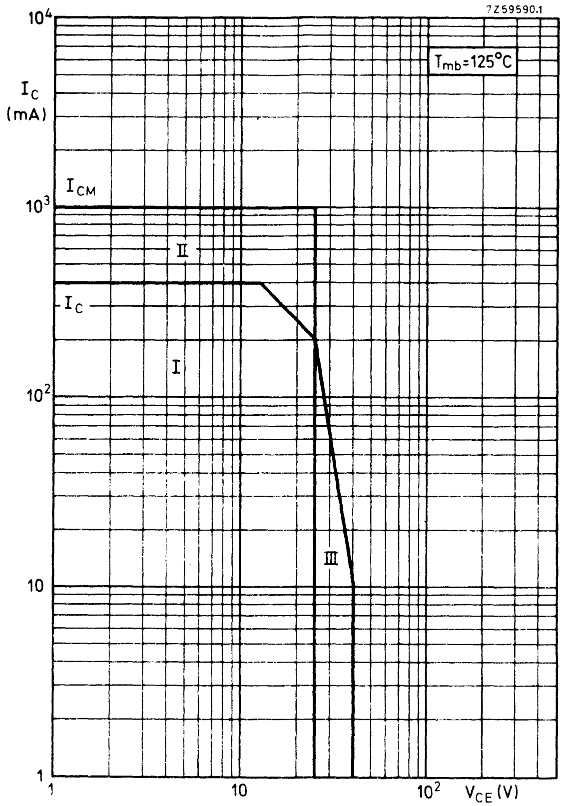
in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 91\ \Omega$; $C_L = -6.8$ pF.

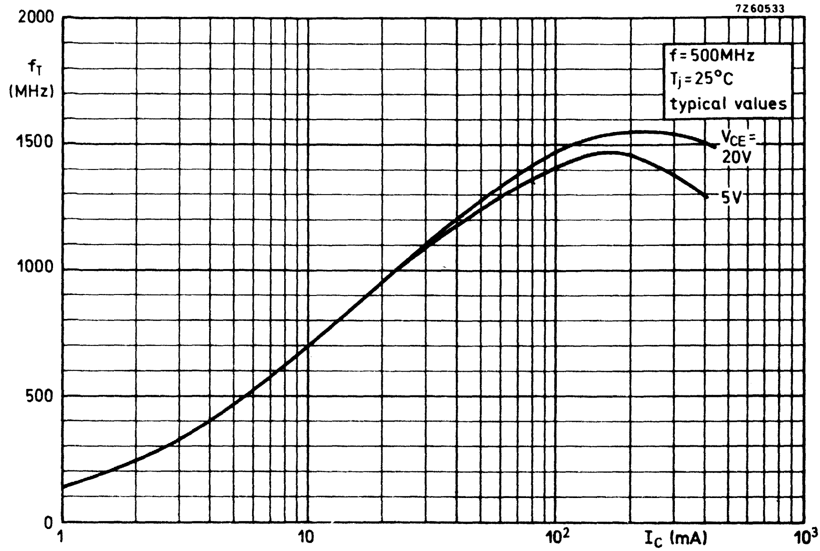
Adjustment procedure

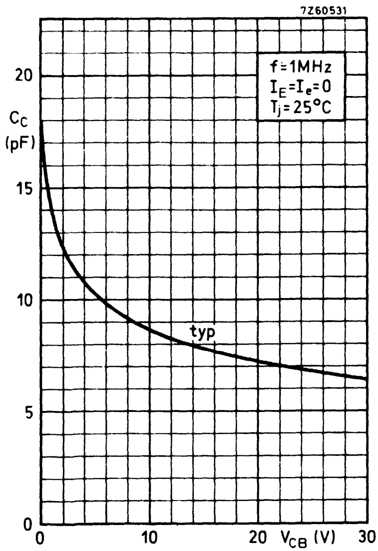
1. Remove the transistor and connect a dummy consisting of a 91 Ω resistor in parallel with a 6.8 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1)
After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.

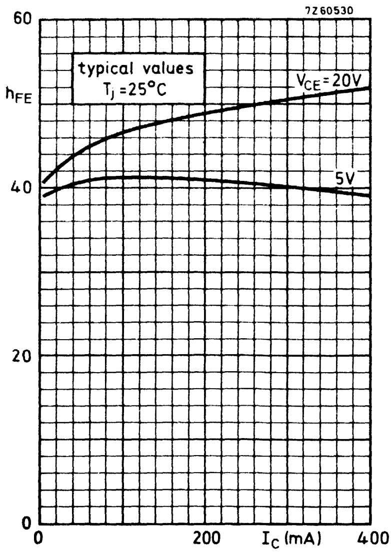


Safe Operating Area with the transistor forward biased

I Region of permissible d.c. operation
II Permissible extension for repetitive pulse operation; $f > 1\,MHz$
III Repetitive pulsed operation in this region is allowable, provided $f > 1\,MHz$; $R_{BE} < 10\,\Omega$


7Z60533
2000
f_T
(MHz)
1500
1000
500
0
1
10
10^2
I_C (mA)
10^3
f = 500MHz
T_j = 25°C
typical values
V_{CE} =
20V
5V


7Z60531
f = 1MHz
I_E = I_e = 0
T_j = 25°C
20
C_c
(pF)
15
10
5
0
typ
0
10
20
V_{CB} (V)
30


7Z60530
60
h_{FE}
40
20
0
typical values
T_j = 25°C
V_{CE} = 20V
5V
0
200
I_C (mA)
400

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.
The transistor features low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz				
I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz				
I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,4	pF
Noise figure at optimum source impedance				
I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB
Max. unilateral power gain (see page 3)				
I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	19,5	dB
Intermodulation distortion at T_{amb} = 25 °C				
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; V_o = 150 mV				
$f_{(p+q-r)}$ = 493,25 MHz (see page 4)	d_{im}	typ.	−60	dB

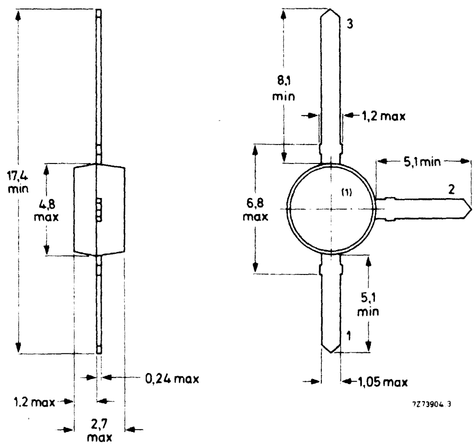
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V

Current

Collector current (d.c.)	I_C	max.	25	mA

Power dissipation

Total power dissipation up to $T_{amb} = 60\ ^oC$	P_{tot}	max.	180	mW

Temperatures

Storage temperature	T_{stg}		-65 to +150	^oC
Junction temperature	T_j	max.	150	^oC

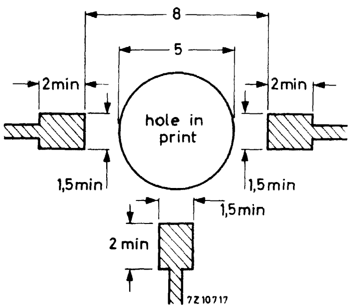
THERMAL RESISTANCE

From junction to ambient in free air

mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm — $R_{th\ j\text{-}a}$ = 0,5 $^oC/mW$

*) Requirements for glas-fibre print

(dimensions in mm)



CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10\ V$	I_{CBO}	<	50	nA
D.C. current gain [1]				
$I_C = 14\ mA$; $V_{CE} = 10\ V$	h_{FE}	> typ.	40 90	
Transition frequency at f = 500 MHz [1]				
$I_C = 14\ mA$; $V_{CE} = 10\ V$	f_T	typ.	5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10\ V$	C_c	typ.	0,5	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0{,}5\ V$	C_e	typ.	1,2	pF
Feedback capacitance at f = 1 MHz				
$I_C = 0$; $V_{CE} = 10\ V$; $T_{amb} = 25\ ^oC$	C_{re}	typ.	0,4	pF
Noise figure at optimum source impedance				
$I_C = 2\ mA$; $V_{CE} = 10\ V$; f = 500 MHz; $T_{amb} = 25\ ^oC$	F	typ.	2,4	dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 14\ mA$; $V_{CE} = 10\ V$; f = 500 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	19,5	dB

[1]) Measured under pulse conditions.

CHARACTERISTICS (continued)

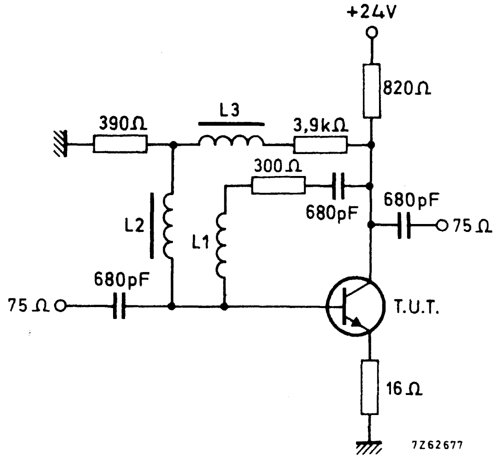
Intermodulation distortion at T_{amb} = 25 °C

I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; V.S.W.R. < 2

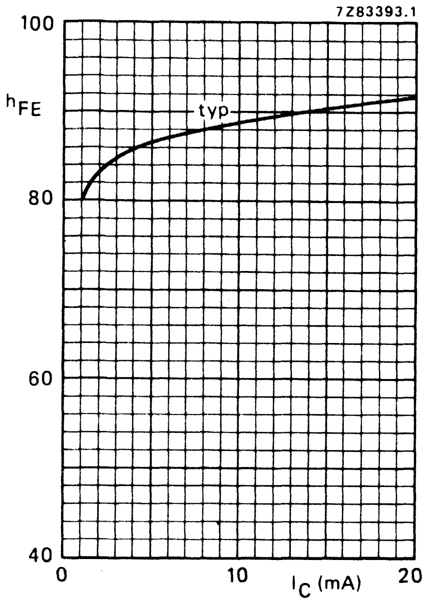
$V_p = V_o$ = 150 mV at f_p = 495, 25 MHz
$V_q = V_o$ − 6 dB at f_q = 503, 25 MHz
$V_r = V_o$ − 6 dB at f_r = 505, 25 MHz

Measured at $f_{(p+q-r)}$ = 493, 25 MHz | d_{im} | typ. | −60 | dB

Intermodulation test circuit:



L1 = 4 turns Cu wire (0,35 mm); winding pitch 1 mm; int. diam. 4 mm
L2 and L3 5 μH (code number: 3122 108 20150)



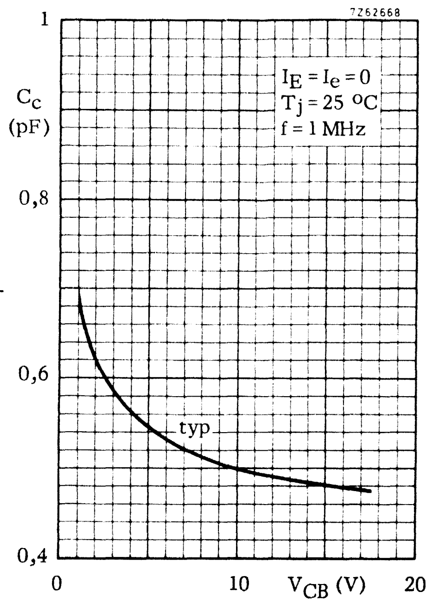
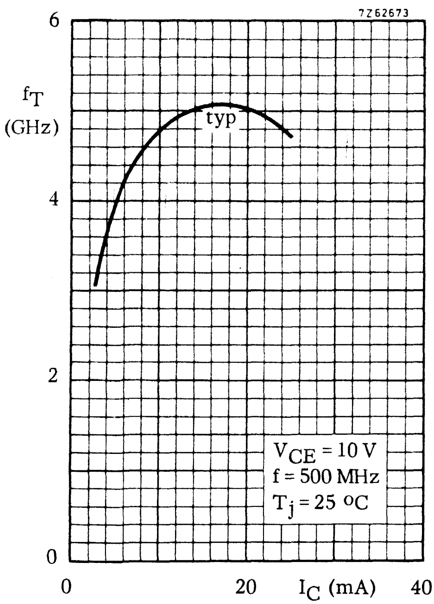
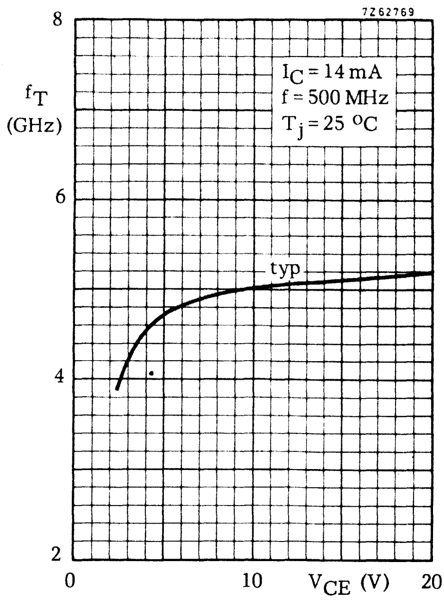
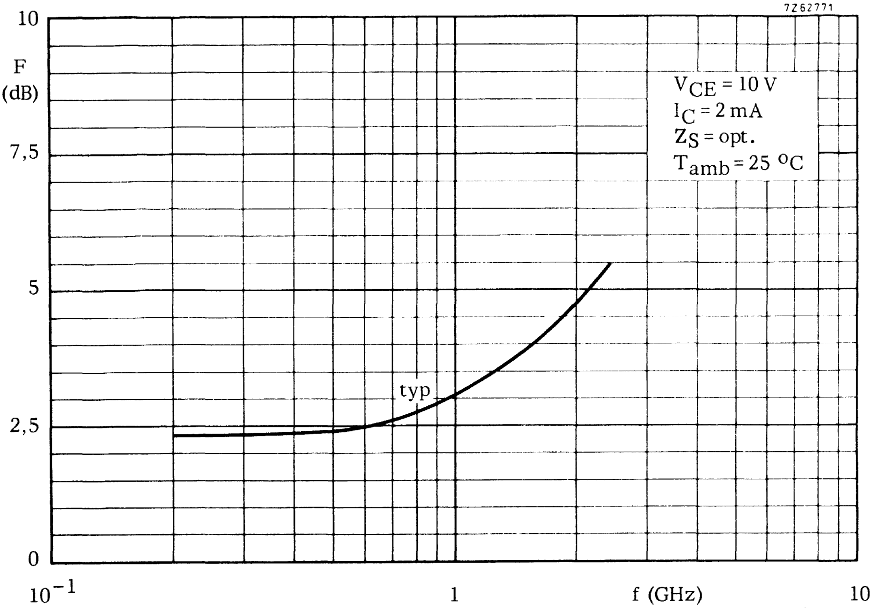
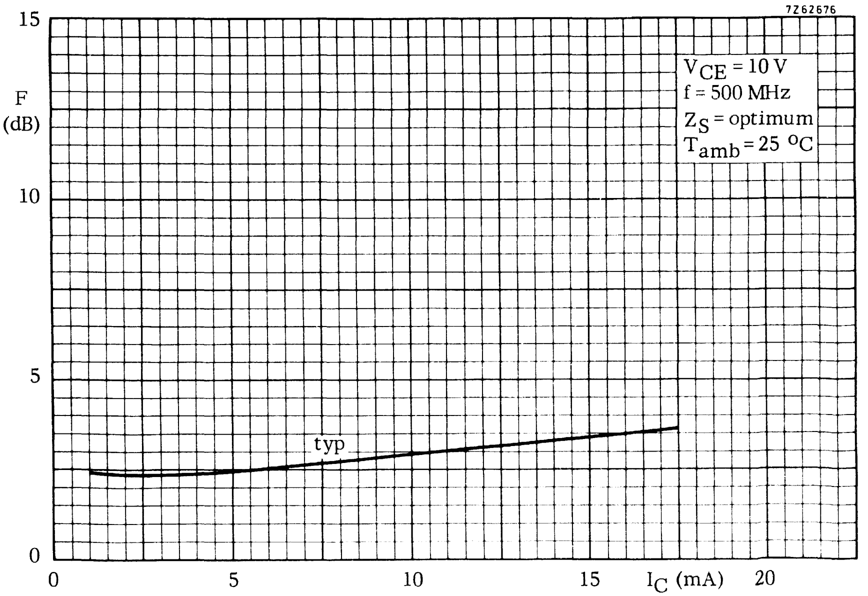


Fig. 4 $V_{CE} = 10$ V; $T_j = 25\ ^oC$.






7Z62771
F
(dB)
10
7,5
5
2,5
0
V_{CE} = 10 V
I_C = 2 mA
Z_S = opt.
T_{amb} = 25 °C
typ
10^{-1}
1
f (GHz)
10


7Z62676
F
(dB)
15
10
5
0
V_{CE} = 10 V
f = 500 MHz
Z_S = optimum
T_{amb} = 25 °C
typ
0
5
10
15
I_C (mA)
20

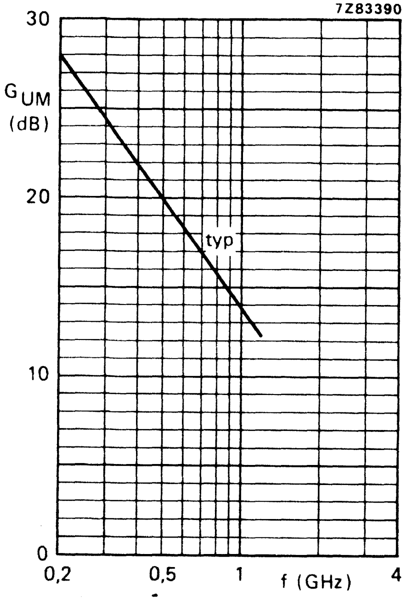
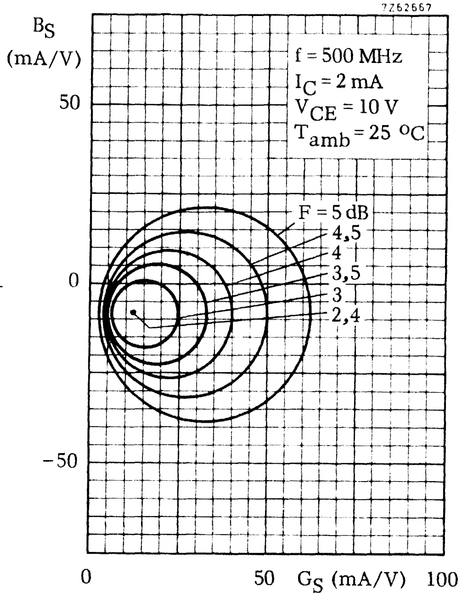


Fig. 10 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

circles of constant noise figure



SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package primarily intended for use in v.h.f. and u.h.f. wideband amplifiers.

Features of this product:

- low noise;
- low intermodulation distortion;
- high power gain;
- gold metallization.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open-base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,35	pF
Noise figure at R_S = 60 Ω I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	F	typ.	1,8	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	150	mV

MECHANICAL DATA

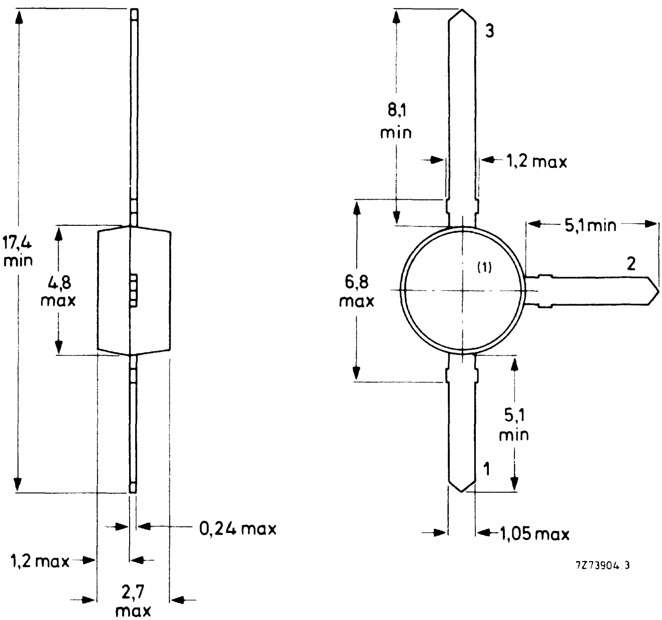
SOT-37 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2) of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	500	K/W*

* K/W is SI unit for °C/W.

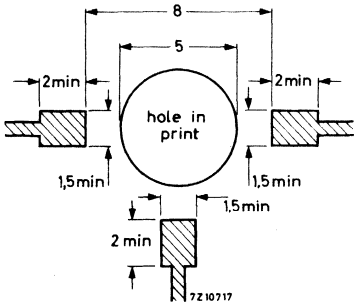


Fig. 2 Requirements for fibre-glass print. (Dimensions in mm.)

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 10 V	I_{CBO}	<	50 nA
D.C. current gain * I_C = 14 mA; V_{CE} = 10 V	h_{FE}	> typ.	40 90
Transition frequency at f = 500 MHz * I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	0,6 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; V_{EB} = 0,5 V	C_e	typ.	1,2 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,35 pF
Noise figure at T_{amb} = 25 °C I_C = 4 mA; V_{CE} = 10 V; R_S = 60 Ω; f = 800 MHz	F	typ.	1,8 dB
I_C = 4 mA; V_{CE} = 10 V; $Z_S = Z_{Sopt}$; f = 2 GHz	F	typ.	3,6 dB

* Measured under pulse conditions.

s-parameters (common emitter)

V_{CE} V	I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
5	2	40	0,91/ −7,7°	0,01/84°	6,8/173°	1,00/ −2,7°
		200	0,79/ −37,3°	0,03/71°	6,5/143°	0,93/−12,5°
		500	0,52/ −81,0°	0,06/59°	4,6/116°	0,80/−22,5°
		800	0,34/−114,5°	0,08/58°	3,3/ 97°	0,73/−27,0°
		1000	0,26/−137,6°	0,09/59°	2,8/ 87°	0,70/−30,0°
		1200	0,22/−165,0°	0,10/61°	2,4/ 79°	0,67/−33,0°
5	5	40	0,80/ −11,7°	0,01/81°	14,4/169°	0,99/ −4,5°
		200	0,59/ −51,0°	0,03/68°	11,2/134°	0,85/−17,0°
		500	0,29/ −95,0°	0,05/66°	6,3/103°	0,70/−22,0°
		800	0,16/−130,0°	0,07/69°	4,2/ 88°	0,64/−26,0°
		1000	0,12/−162,0°	0,09/70°	3,4/ 81°	0,63/−28,0°
		1200	0,12/+ 158,0°	0,10/71°	2,9/ 74°	0,61/−31,0°
5	10	40	0,67/ −16,7°	0,01/80°	23,3/164°	0,97/ −6,6°
		200	0,39/ −63,0°	0,02/70°	14,5/122°	0,76/−18,0°
		500	0,15/−109,0°	0,05/73°	7,0/ 96°	0,64/−20,0°
		800	0,09/−152,0°	0,07/75°	4,6/ 84°	0,60/−24,0°
		1000	0,07/+ 155,0°	0,09/75°	3,7/ 77°	0,59/−26,0°
		1200	0,10/+ 124,0°	0,11/74°	3,1/ 72°	0,58/−29,0°
5	14	40	0,58/ −20,0°	0,01/79°	28,3/160°	0,96/ −7,8°
		200	0,30/ −71,0°	0,02/72°	15,5/117°	0,72/−18,0°
		500	0,11/−119,0°	0,05/75°	7,2/ 93°	0,62/−19,0°
		800	0,07/−177,0°	0,07/77°	4,6/ 82°	0,59/−23,0°
		1000	0,08/+ 138,0°	0,09/76°	3,8/ 76°	0,58/−25,0°
		1200	0,12/+ 118,0°	0,11/76°	3,2/ 71°	0,57/−28,0°
5	20	40	0,49/ −25,0°	0,01/78°	32,9/157°	0,94/ −9,0°
		200	0,22/ −82,0°	0,02/74°	15,9/112°	0,69/−17,0°
		500	0,09/−143,0°	0,05/78°	7,1/ 91°	0,61/−18,0°
		800	0,08/+ 160,0°	0,07/78°	4,5/ 80°	0,59/−22,0°
		1000	0,10/+ 130,0°	0,09/78°	3,7/ 75°	0,58/−24,0°
		1200	0,14/+ 115,0°	0,11/77°	3,1/ 69°	0,57/−28,0°
5	30	40	0,36/ −38,9°	0,01/76°	31,2/151°	0,90/−10,3°
		200	0,18/−122,0°	0,02/75°	14,0/106°	0,66/−14,0°
		500	0,15/−175,0°	0,05/80°	6,1/ 88°	0,61/−16,0°
		800	0,17/+ 148,0°	0,07/80°	3,9/ 78°	0,59/−21,0°
		1000	0,19/+ 131,0°	0,09/79°	3,1/ 72°	0,59/−24,0°
		1200	0,23/+ 119,0°	0,11/79°	2,7/ 67°	0,57/−28,0°

s-parameters (common emitter)

V_{CE} V	I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
		40	0,91/ −7,5°	0,01/84°	7,0/173°	1,00/ −2,6°
		200	0,81/ −36,0°	0,03/72°	6,3/149°	0,94/−12,0°
10	2	500	0,54/ −78,0°	0,06/59°	4,6/118°	0,82/−21,0°
		800	0,35/−110,0°	0,08/58°	3,4/ 98°	0,74/−26,0°
		1000	0,27/−132,0°	0,08/59°	2,8/ 89°	0,72/−29,0°
		1200	0,22/−159,0°	0,09/61°	2,5/ 80°	0,69/−0,32°
		40	0,81/ −11,1°	0,01/82°	14,4/169°	0,99/ −4,3°
		200	0,61/ −48,0°	0,03/69°	11,1/135°	0,86/−16,0°
10	5	500	0,31/ −90,0°	0,05/66°	6,4/105°	0,71/−22,0°
		800	0,17/−120,0°	0,07/69°	4,3/ 90°	0,66/−25,0°
		1000	0,11/−148,0°	0,08/70°	3,5/ 82°	0,64/−27,0°
		1200	0,10/+ 167,0°	0,10/71°	3,0/ 76°	0,63/−30,0°
		40	0,70/ −15,2°	0,01/80°	23,0/164°	0,97/ −6,1°
		200	0,42/ −58,0°	0,02/70°	14,8/124°	0,78/−17,0°
10	10	500	0,17/ −95,0°	0,05/73°	7,3/ 97°	0,65/−20,0°
		800	0,07/−104,0°	0,07/75°	4,7/ 85°	0,62/−23,0°
		1000	0,04/−174,0°	0,09/75°	3,9/ 79°	0,61/−25,0°
		1200	0,07 + 120,0°	0,10/75°	3,3/ 73°	0,59/−28,0°
		40	0,63/ −18,0°	0,01/79°	28,2/161°	0,96/ −7,2°
		200	0,34/ −63,0°	0,02/72°	15,9/119°	0,74/−17,0°
10	14	500	0,13/ −98,0°	0,05/75°	7,5/ 95°	0,63/−19,0°
		800	0,05/−136,0°	0,07/77°	4,8/ 83°	0,61/−22,0°
		1000	0,04/+ 133,0°	0,09/76°	3,9/ 77°	0,60/−25,0°
		1200	0,08/+ 108,0°	0,10/76°	3,3/ 72°	0,58/−28,0°

Output voltage at d_{im} = –60 dB (see Figs 3 and 15)
(DIN 45004B, par. 6.3: 3-tone)
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = –60 dB; f_p = 795,25 MHz
$V_q = V_o$ –6 dB ; f_q = 803,25 MHz
$V_r = V_o$ –6 dB ; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 150 mV

Second harmonic distortion (see Figs 3 and 16)
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C
V_p = 60 mV at f_p = 250 MHz
V_q = 60 mV at f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz — d_2 typ. –50 dB

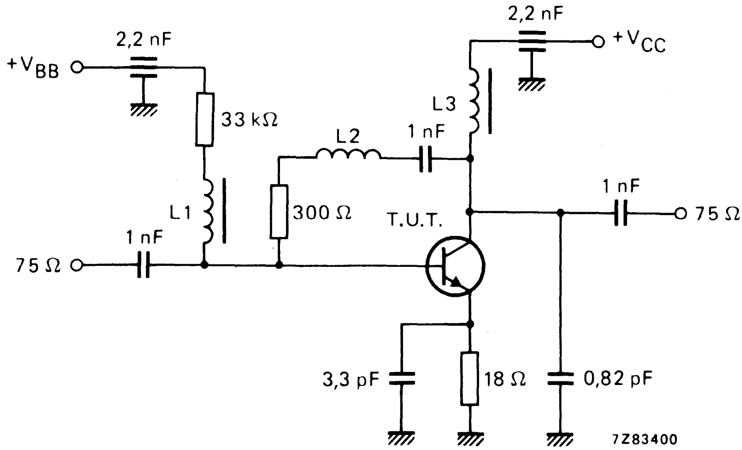


Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro choke
L2 = 3 turns Cu wire (0,4 mm); internal diameter 3 mm; winding pitch 1 mm

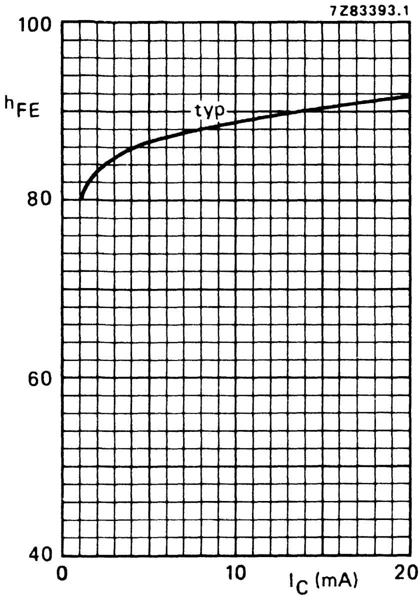


Fig. 4 V_{CE} = 10 V; T_j = 25 °C.

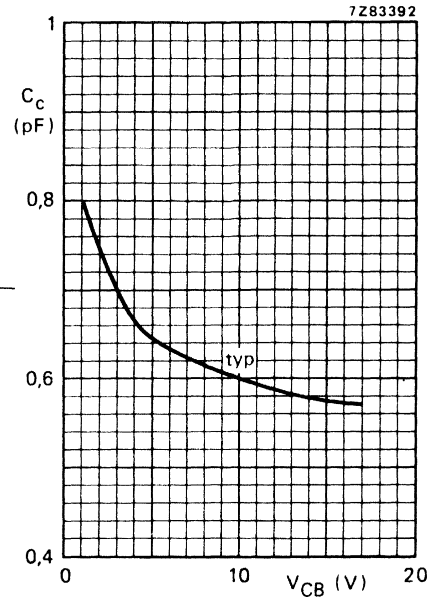


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

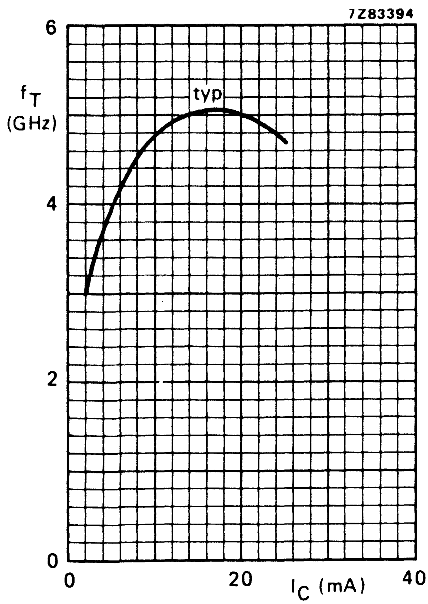


Fig. 6 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

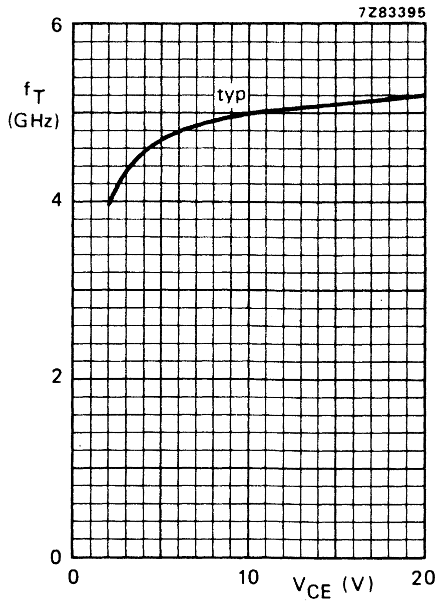


Fig. 7 I_C = 14 mA; f = 500 MHz; T_j = 25 °C.

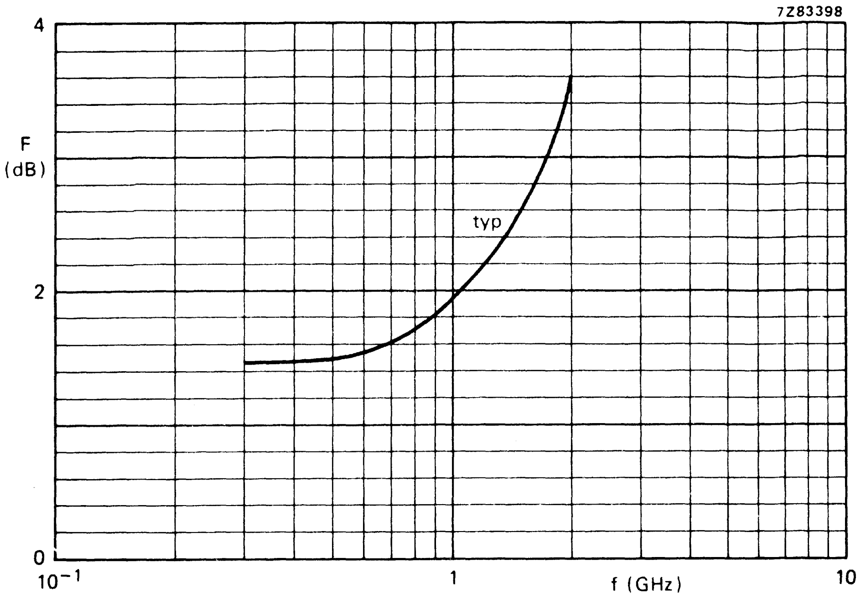


Fig. 8 V_{CE} = 10 V; I_C = 4 mA; Z_S = optimum; T_{amb} = 25 °C.

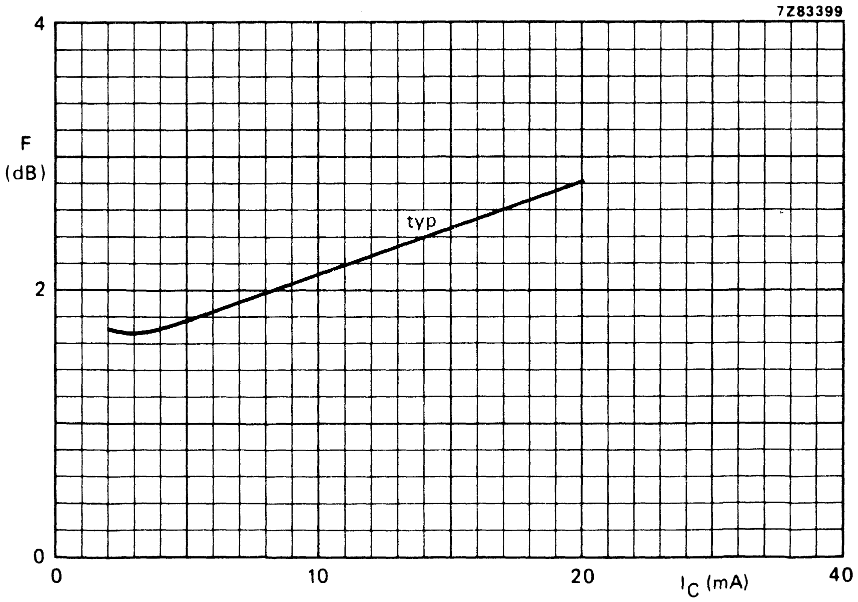


Fig. 9 V_{CE} = 10 V; f = 800 MHz; Z_S = optimum; T_{amb} = 25 °C.

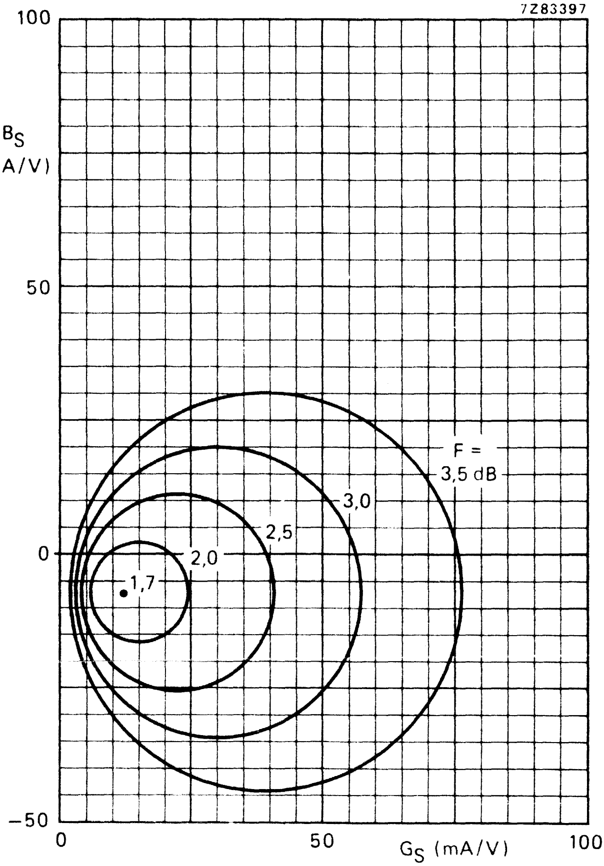


Fig. 10 Circles of constant noise figure.
V_{CE} = 10 V; I_C = 4 mA; f = 800 MHz; T_{amb} = 25 °C;
typical values.

Conditions for Figs 11 and 12:
V_{CE} = 10 V; I_C = 14 mA;
T_{amb} = 25 °C.

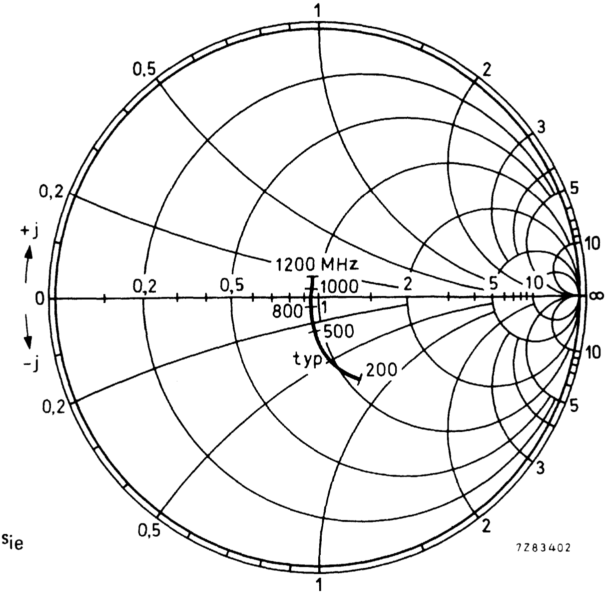


Fig. 11 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

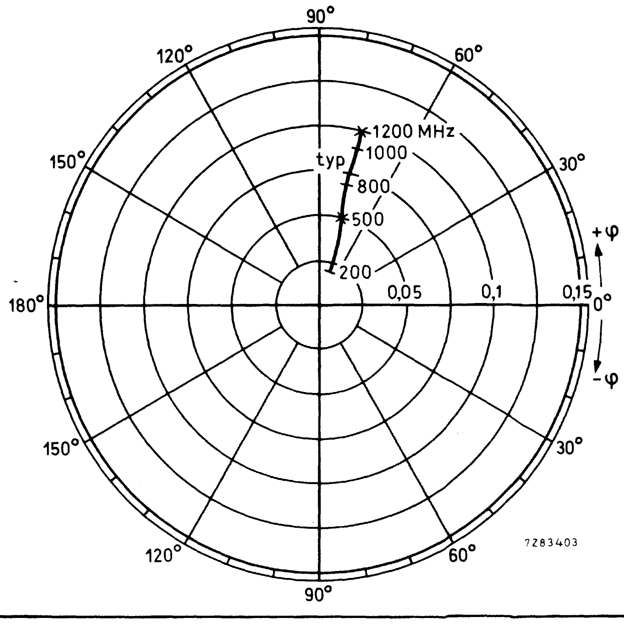


Fig. 12 Reverse transmission coefficient s_{re}.

Conditions for Figs 13 and 14:
V_{CE} = 10 V; I_C = 14 mA;
T_{amb} = 25 °C.

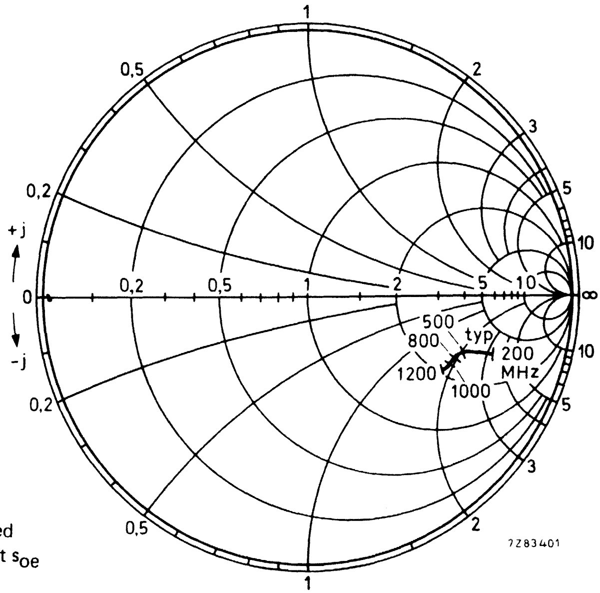


Fig. 13 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

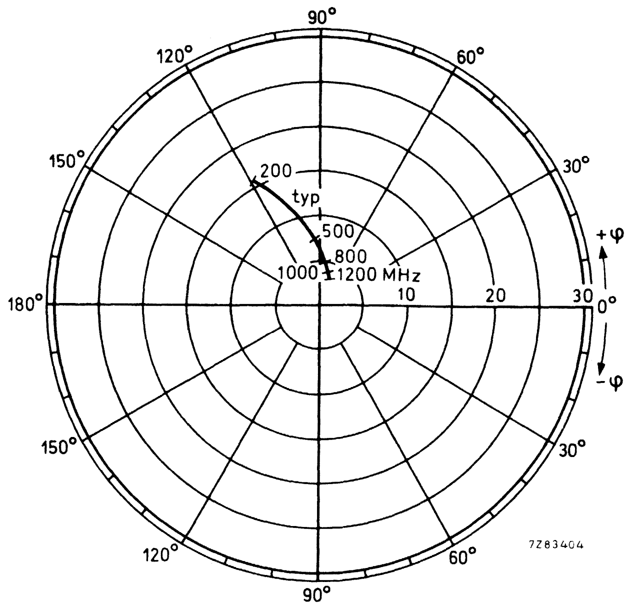


Fig. 14 Forward transmission coefficient s_{fe}.

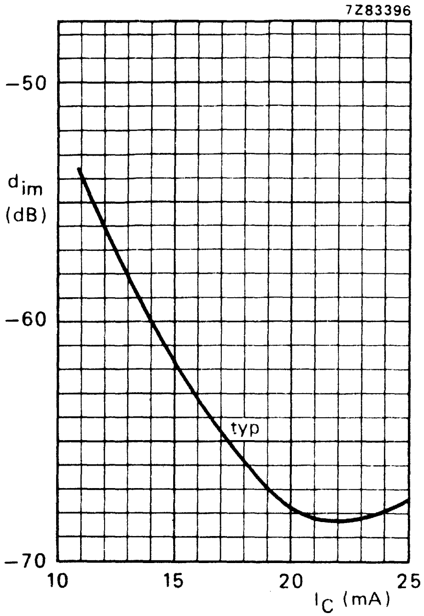


Fig. 15.

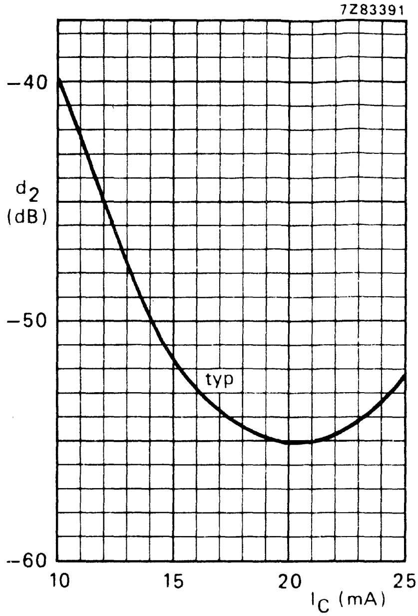


Fig. 16.

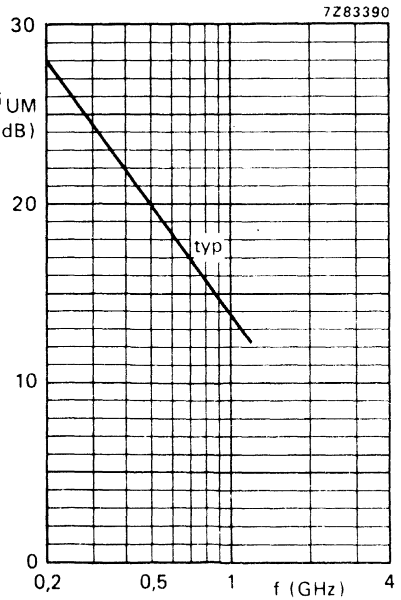


Fig. 17 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

Fig. 15 V_{CE} = 10 V; V_o = 43,5 dBmV = 150 mV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C; measured in MATV test circuit (see Fig. 3).

Fig. 16 V_{CE} = 10 V; V_o = 60 mV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; measured in MATV test circuit (see Fig. 3).

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.
The transistor features very low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
Max. unilateral power gain (see page 3) I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	18	dB
Intermodulation distortion at T_{amb} = 25 °C I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V_o = 300 mV $f_{(p+q-r)}$ = 493,25 MHz (see page 4)	d_{im}	typ.	−60	dB

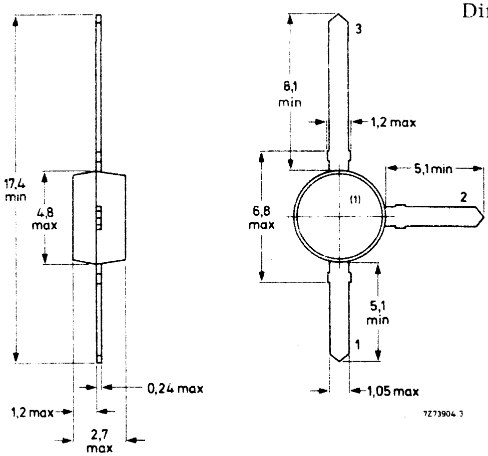
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V

Current

Collector current (d.c.)	I_C	max.	35	mA

Power dissipation

Total power dissipation up to T_{amb} = 60 ^oC	P_{tot}	max.	180	mW

Temperatures

Storage temperature	T_{stg}	-65 to +150		^oC
Junction temperature	T_j	max.	150	^oC

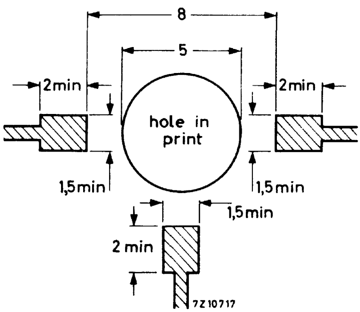
THERMAL RESISTANCE

From junction to ambient in free air

mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm — $R_{th\ j-a}$ = 0,5 $^oC/mW$

*) Requirements for glass-fibre print

(dimensions in mm)



CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current					
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50	nA	
D.C. current gain [1]					
$I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	> typ.	40 90		←
Transition frequency at f = 500 MHz [1]					
$I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	5	GHz	
Collector capacitance at f = 1 MHz					
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,7	pF	
Emitter capacitance at f = 1 MHz					
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	2,5	pF	←
Feedback capacitance at f = 1 MHz					
$I_C = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0,8	pF	←
Noise figure at optimum source impedance					
$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	1,9	dB	

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	18	dB	←

[1]) Measured under pulse conditions.

CHARACTERISTICS (continued)

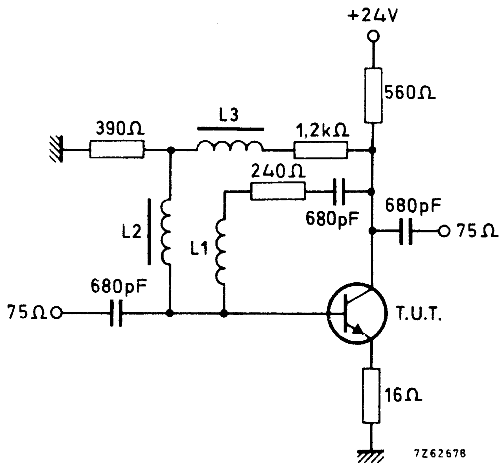
Intermodulation distortion at T_{amb} = 25 °C

I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V.S.W.R. < 2

$V_p = V_o$ = 300 mV at f_p = 495,25 MHz
$V_q = V_o$ −6 dB at f_q = 503,25 MHz
$V_r = V_o$ −6 dB at f_r = 505,25 MHz

Measured at $f_{(p+q-r)}$ = 493,25 MHz — d_{im} typ. −60 dB

Intermodulation test circuit:



L1 = 4 turns Cu wire (0,35); winding pitch 1 mm; int. diam. 4 mm
L2 and L3 5 μH (code number: 3122 108 20150)

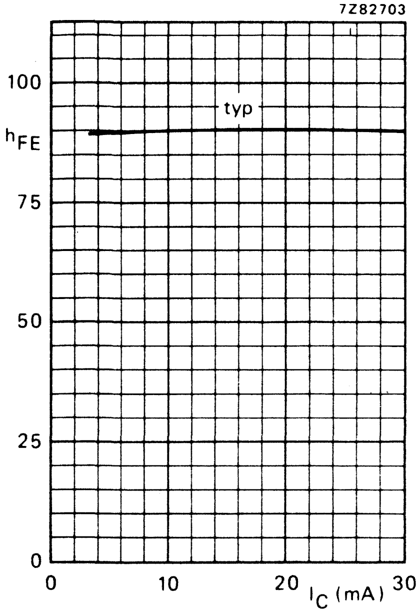
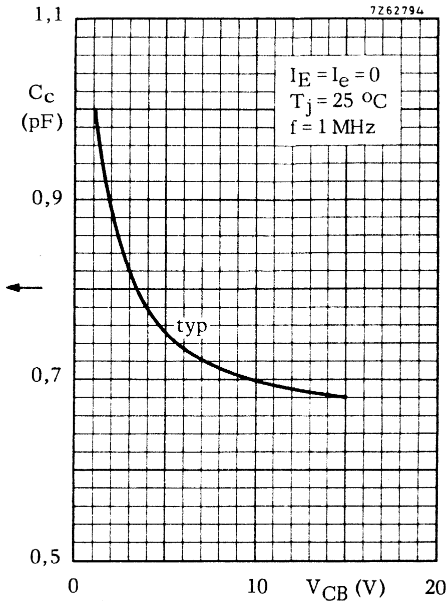
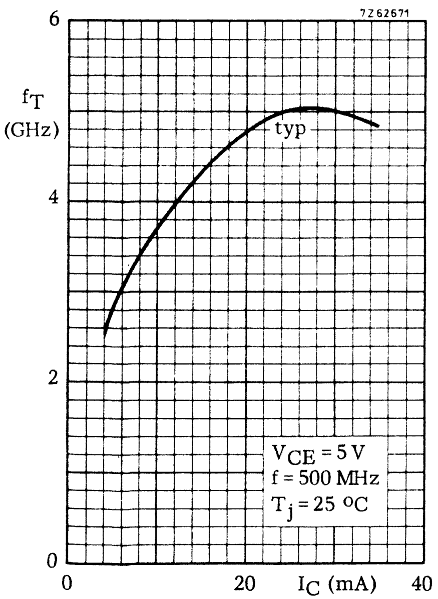
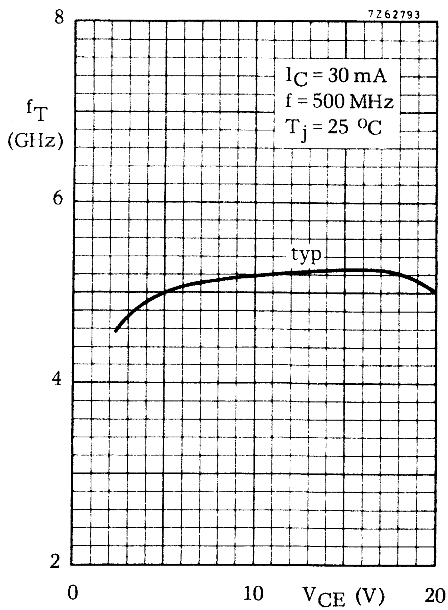
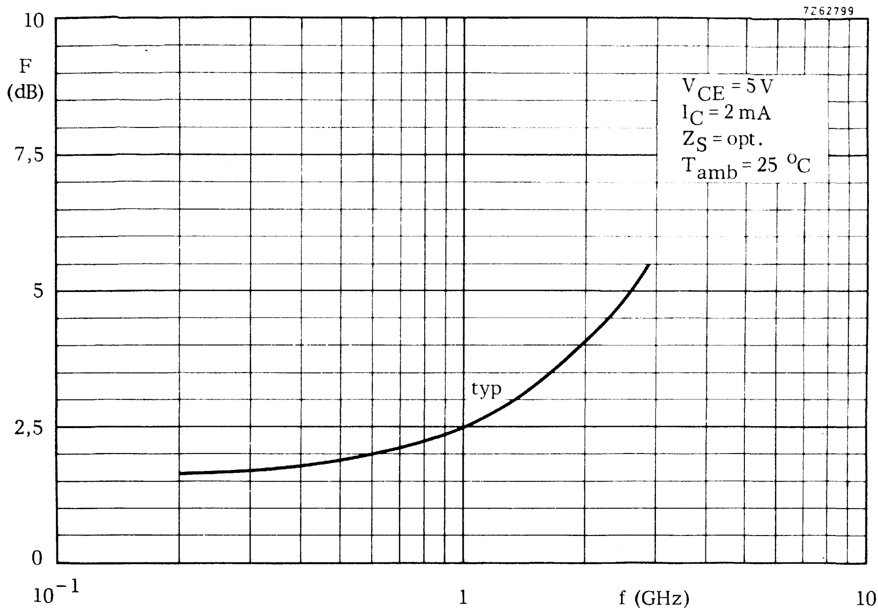


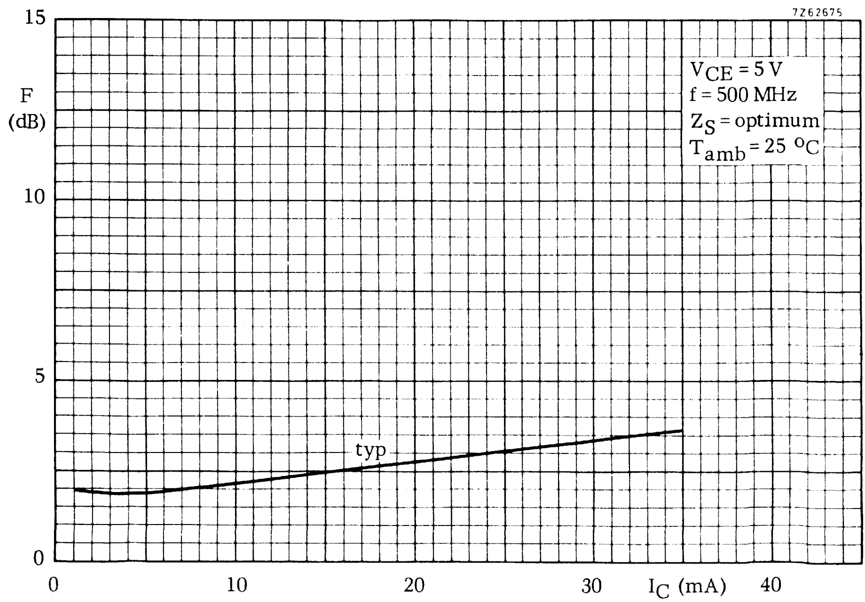
Fig. 4 V_{CE} = 5 V; T_j = 25 °C.








7Z62799
10
F
(dB)
7,5
5
2,5
0
V_{CE} = 5 V
I_C = 2 mA
Z_S = opt.
T_{amb} = 25 °C
typ
10^{-1}
1
f (GHz)
10


7Z62675
15
F
(dB)
10
5
0
V_{CE} = 5 V
f = 500 MHz
Z_S = optimum
T_{amb} = 25 °C
typ
0
10
20
30
I_C (mA)
40

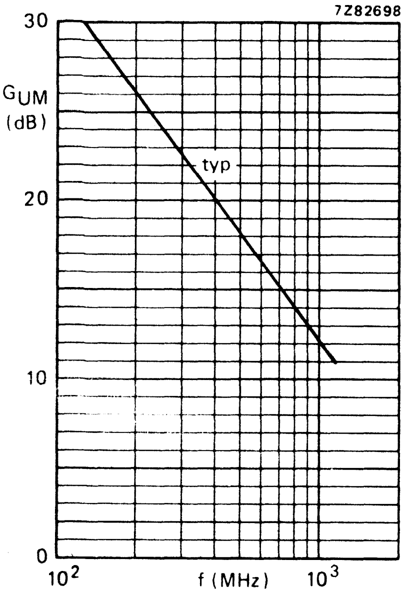
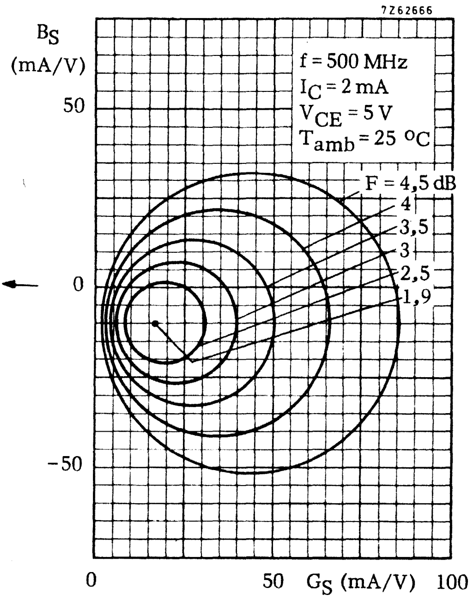


Fig. 10 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C.

circles of constant noise figure



SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package primarily intended for use in u.h.f. and microwave amplifiers.

Features of this product:

- low noise;
- very low intermodulation distortion;
- high power gain;
- gold metallization.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	6	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,6	pF
Noise figure at optimum source impedance I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz	F	typ.	1,6	dB
Maximum unilateral power gain I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	14	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	425	mV

MECHANICAL DATA

SOT-37 (see Fig. 1).

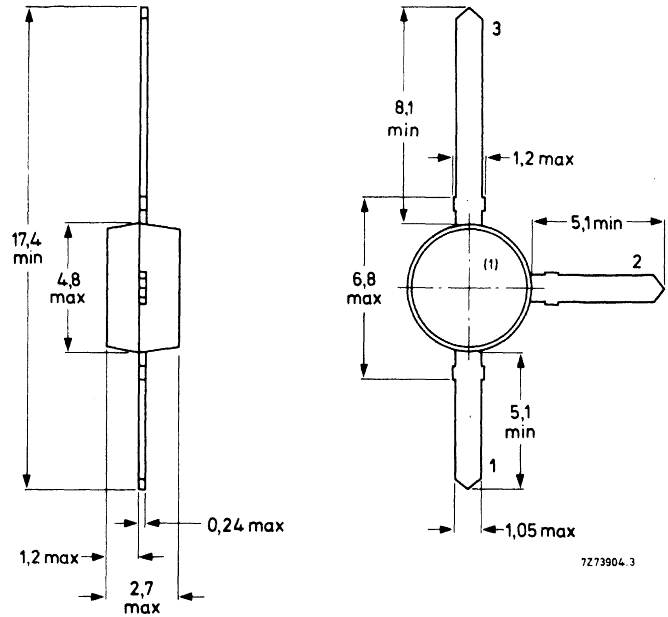
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	15 V
Collector-emitter voltage (open base)	V_{CEO}	max.	12 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0 V
Collector current (d.c.)	I_C	max.	35 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}	–65 to +	150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air
mounted on a fibre-glass print (see Fig. 2)
of 40 mm x 25 mm x 1 mm — $R_{th\ j\text{-}a}$ = 300 K/W *

* K/W is SI unit for °C/W.

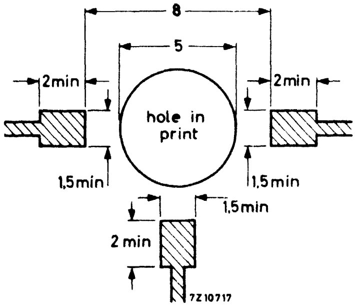


Fig. 2 Requirements for fibre-glass print. (Dimensions in mm.)

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50 nA
D.C. current gain*			
$I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	>	40
		typ.	90
Transition frequency at f = 500 MHz*			
$I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	6 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0,9 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c = 0$; $V_{EB} = 0{,}5$ V	C_e	typ.	2,5 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0,6 pF
Noise figure at optimum source impedance			
$I_C = 4$ mA; $V_{CE} = 8$ V; f = 800 MHz	F	typ.	1,6 dB
$I_C = 30$ mA; $V_{CE} = 8$ V; f = 800 MHz	F	typ.	2,3 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	14 dB

* Measured under pulse conditions.

Output voltage at d_{im} = −60 dB (see Figs 3 and 14)
(DIN 45004B, par. 6.3: 3-tone)
I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 425 mV

Output voltage at d_2 = −50 dB (see Figs 3 and 15)
I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_2 = −50 dB; f_p = 250 MHz
$V_q = V_o$ at d_2 = −50 dB; f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz — V_o typ. 200 mV

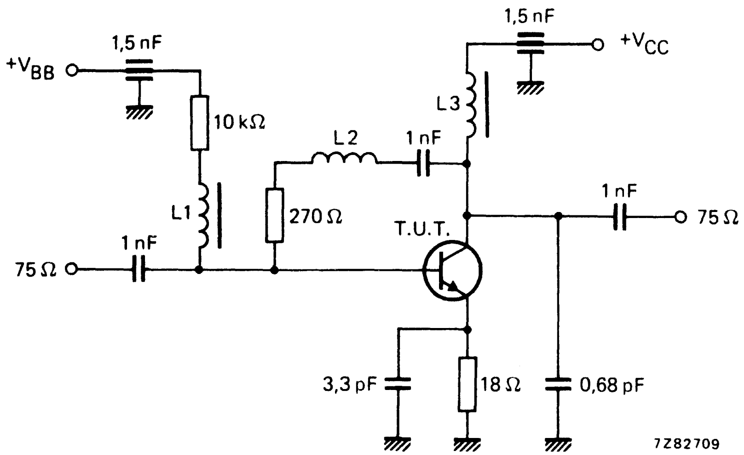


Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro choke
L2 = 3 turns Cu wire (0,4 mm); internal diameter 3 mm; winding pitch 1 mm

s-parameters (common emitter) at V_{CE} = 8 V.

The figures given in the tables below can also be used for operation at V_{CE} = 5 V. Only slight differences for the s-parameters may occur.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
	40	0,89/ −12,9°	0,01/75°	9,5/166°	0,97/ −6,1°
	100	0,85/ −30,7°	0,03/70,6°	8,7/155°	0,94/−13,5°
	200	0,75/ −57,1°	0,05/61,5°	7,4/138°	0,87/−22,5°
2	500	0,48/−113°	0,08/50,9°	4,4/106°	0,72/−34,2°
	800	0,37/−153°	0,09/51,9°	3,0/ 86,3°	0,64/−40,0°
	1000	0,34/−178°	0,10/55,0°	2,6/ 77,0°	0,61/−47,8°
	1200	0,34/+ 159°	0,11/58,5°	2,2/ 68,0°	0,58/−53,9°
	40	0,79/ −18,4°	0,01/74°	17,8/162°	0,94/ −9,1°
	100	0,71/ −42,1°	0,03/67,1°	15,2/146°	0,87/−19,5°
	200	0,57/ −72,8°	0,04/60,0°	11,5/126°	0,75/−28,7°
5	500	0,31/−127°	0,07/60,1°	5,8/ 98,2°	0,59/−36,1°
	800	0,25/−168°	0,09/63,6°	3,8/ 82,0°	0,54/−41,0°
	1000	0,25/+ 165°	0,11/65,2°	3,2/ 74,4°	0,51/−46,7°
	1200	0,26/+ 141°	0,13/66,1°	2,7/ 66,7°	0,49/−52,2°
	40	0,67/ −25,3°	0,01/71°	27,9/156°	0,90/−12,8°
	100	0,55/ −55,1°	0,02/65,1°	21,8/136°	0,78/−25,6°
	200	0,40/ −88,2°	0,04/62,4°	14,7/116°	0,62/−33,4°
10	500	0,20/−141°	0,06/68,3°	6,7/ 93,0°	0,51/−35,9°
	800	0,16/+ 177°	0,09/70,0°	4,3/ 79,3°	0,48/−40,3°
	1000	0,18/+ 151°	0,12/69,7°	3,5/ 72,5°	0,46/−44,2°
	1200	0,21/+ 130°	0,14/68,9°	3,0/ 65,1°	0,43/−50,7°
	40	0,51/ −34,7°	0,01/69°	39,7/149°	0,84/−17,4°
	100	0,38/ −70,5°	0,02/65,8°	27,7/126°	0,66/−29,5°
20	200	0,26/−104°	0,03/68,0°	16,8/109°	0,51/−32,5°
	500	0,16/−158°	0,06/74,0°	7,3/ 89,3°	0,45/−33,4°
	800	0,14/+ 155°	0,10/73,6°	4,6/ 77,5°	0,42/−39,1°
	1000	0,17/+ 133°	0,12/72,3°	3,8/ 71,2°	0,41/−43,6°
	1200	0,21/+ 115°	0,14/70,5°	3,2/ 64,4°	0,39/−51,0°
	40	0,46/ −36,5°	0,01/73°	43,3/150°	0,87/−16,9°
	100	0,32/ −73,7°	0,02/69,2°	29,1/124°	0,66/−27,2°
	200	0,20/−109°	0,03/72,0°	17,1/106°	0,50/−28,1°
30	500	0,14/−174°	0,06/75,6°	7,4/ 87,2°	0,41/−31,7°
	800	0,15/+ 143°	0,10/74,7°	4,8/ 74,9°	0,39/−41,0°
	1000	0,17/+ 124°	0,12/72,9°	3,9/ 70,5°	0,38/−42,8°
	1200	0,21/+ 111°	0,15/71,0°	3,3/ 63,8°	0,37/−51,0°

Conditions for Figs 4 and 5:
V_{CE} = 8 V; I_C = 30 mA;
T_{amb} = 25 °C.

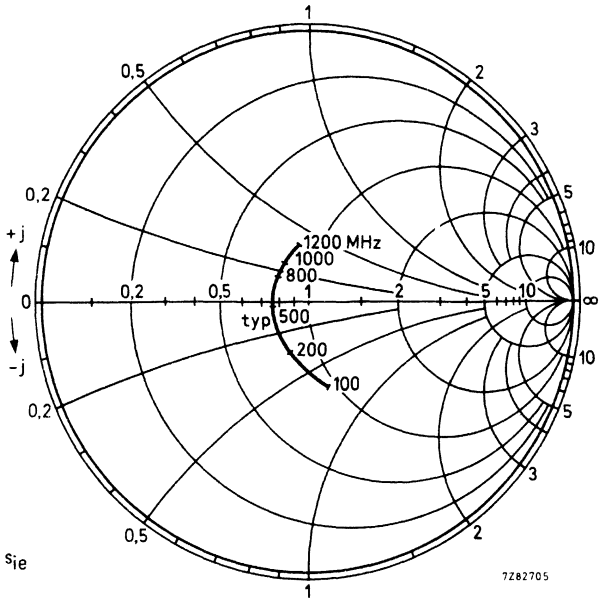


Fig. 4 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

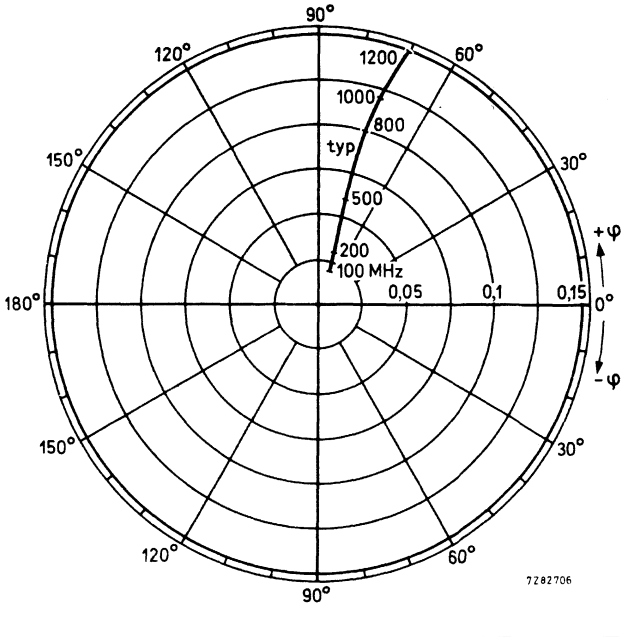


Fig. 5 Reverse transmission coefficient s_{re}.

Conditions for Figs 6 and 7:
V_{CE} = 8 V; I_C = 30 mA;
T_{amb} = 25 °C.

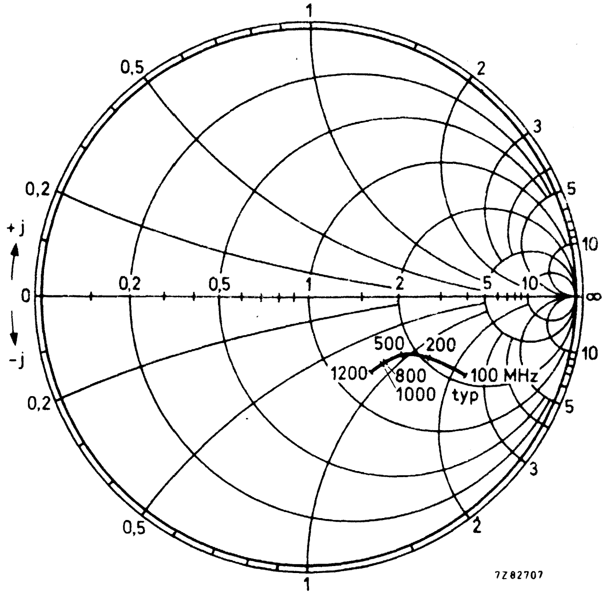


Fig. 6 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

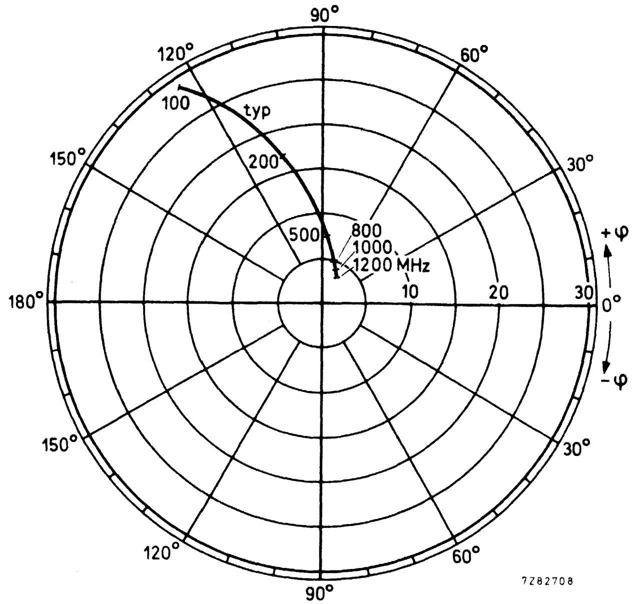


Fig. 7 Forward transmission coefficient s_{fe}.

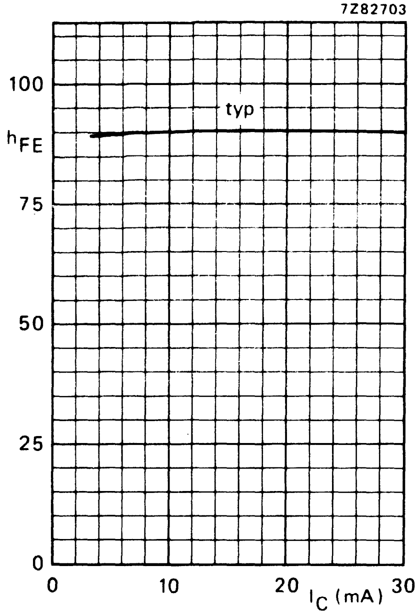


Fig. 8 V_{CE} = 5 V; T_j = 25 °C.

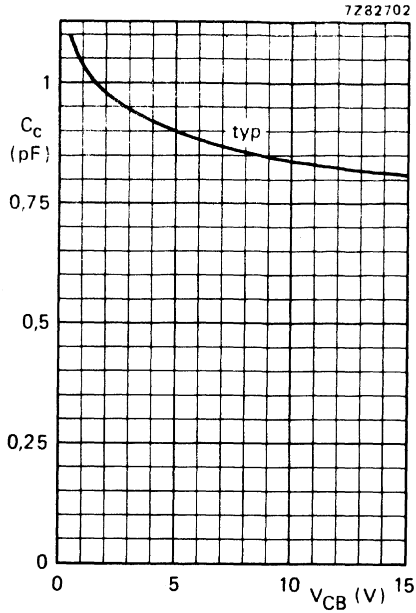


Fig. 9 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

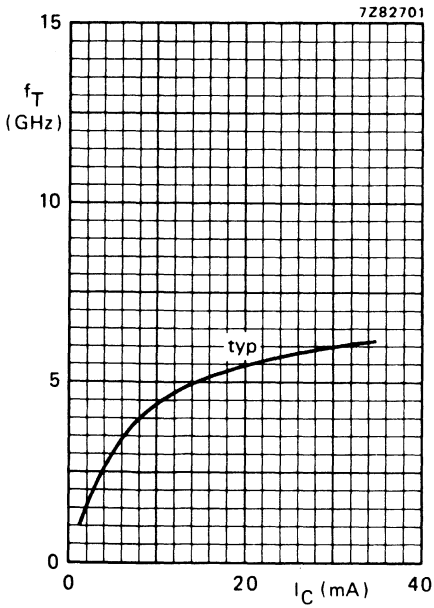


Fig. 10 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

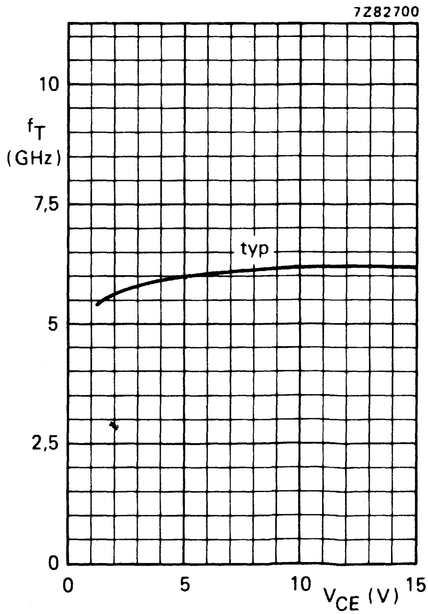


Fig. 11 I_C = 30 mA; f = 500 MHz; T_j = 25 °C.

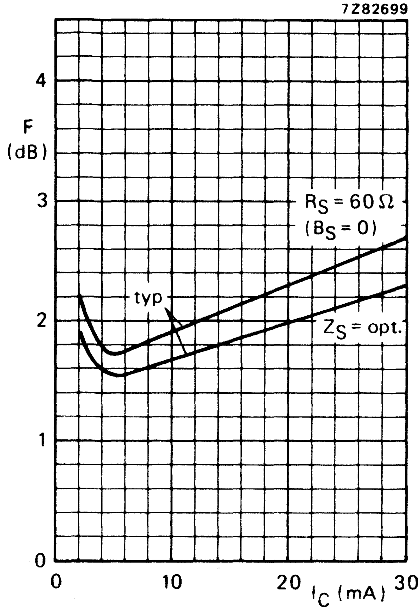


Fig. 12 $V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25\ ^oC$.

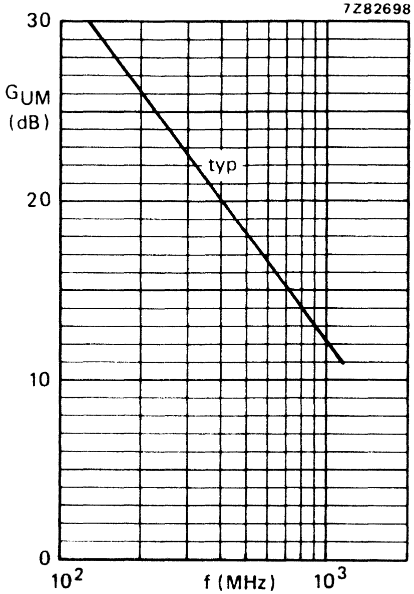


Fig. 13 $V_{CE} = 8$ V; $I_C = 30$ mA; $T_{amb} = 25\ ^oC$.

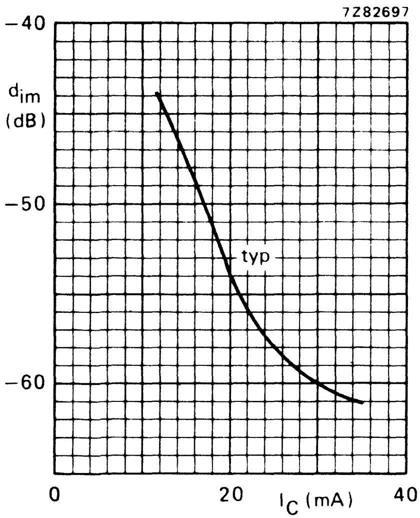


Fig. 14 $V_{CE} = 8$ V; $V_o = 425$ mV = 52,6 dBmV; $f_{(p+q-r)} = 793{,}25$ MHz; $T_{amb} = 25\ ^oC$; measured in MATV test circuit (see Fig. 3).

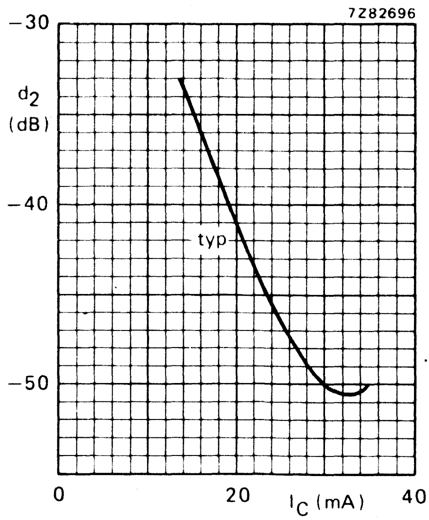


Fig. 15 $V_{CE} = 8$ V; $V_o = 200$ mV = 46 dBmV; $f_{(p+q)} = 810$ MHz; $T_{amb} = 25\ ^oC$; measured in MATV test circuit (see Fig. 3).

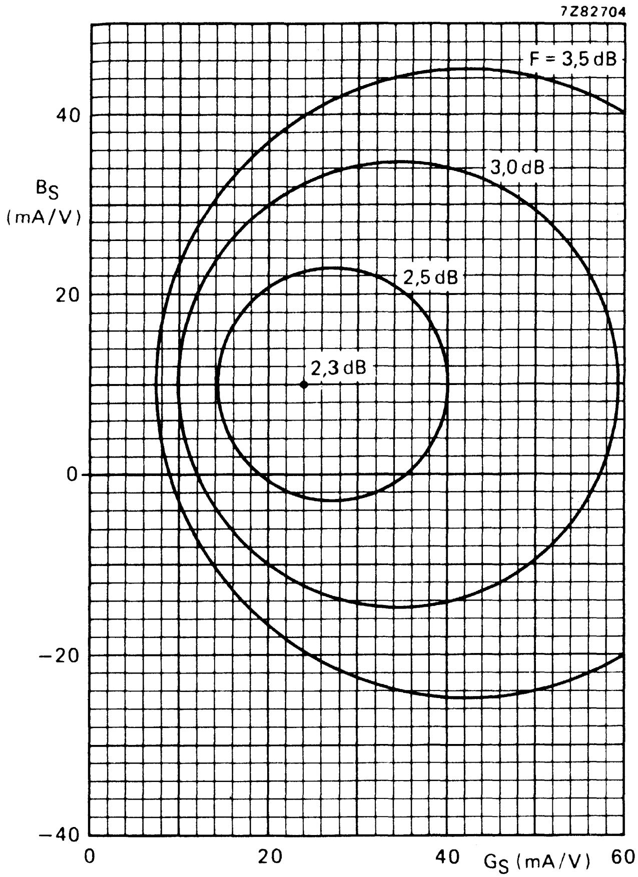


Fig. 16 Circles of constant noise figure.
V_{CE} = 8 V; I_C = 30 mA; f = 800 MHz;
T_{amb} = 25 ^oC; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N resistance-stabilized transistor in a SOT-48 capstan envelope featuring extremely low cross modulation, intermodulation and second harmonic distortion. Thanks to its high transition frequency it has a high power gain in conjunction with good wideband properties and low noise up to high frequencies.
It is primarily intended for CATV and MATV applications.

QUICK REFERENCE DATA

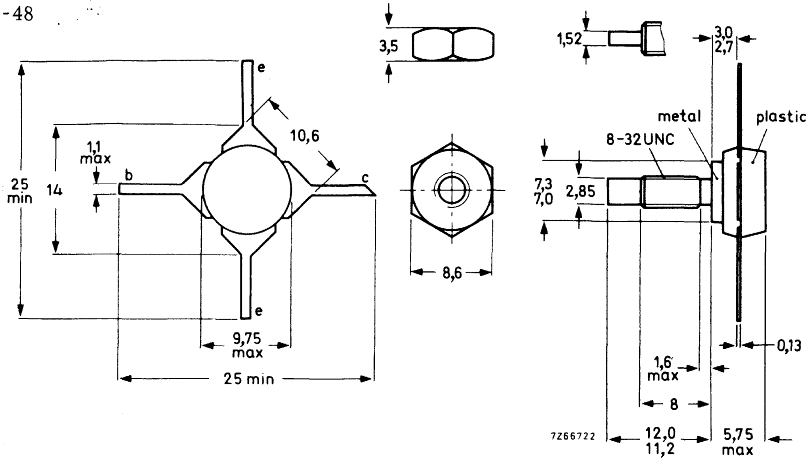
Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_h = 145 °C; f > 1 MHz	P_{tot}	max.	3,5	W
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 90 mA; V_{CE} = 20 V	f_T	typ.	3,5	GHz
Cross modulation distortion (channel 13) I_C = 90 mA; V_{CE} = 20 V; V_o = 48 dBmV	d_{cm}	typ. <	-61 -57	dB dB
I_C = 90 mA; V_{CE} = 20 V; V_o = 32 dBmV	d_{cm}	typ. <	-93 -89	dB dB
Intermodulation distortion at $f_{(p+q-r)}$ = 194,25 MHz I_C = 90 mA; V_{CE} = 20 V; V_o = 60 dBmV	d_{im}	typ.	-63	dB
Broadband power gain I_C = 90 mA; V_{CE} = 20 V	G_p	> typ.	10 11	dB dB
Noise figure at f = 200 MHz I_C = 90 mA; V_{CE} = 20 V	F	typ. <	8 10	dB dB
2nd harmonic distortion at $f_p + f_q$ = 210 MHz I_C = 90 mA; V_{CE} = 20 V; V_o = 48 dBmV	d_2	<	-56	dB

MECHANICAL DATA (see page 2)

MECHANICAL DATA

Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0, 75 Nm
(7, 5 kg cm)
max. 0, 85 Nm
(8, 5 kg cm)

Diameter of clearance hole in heatsink: max. 4, 17 mm.
Mountinghole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (R_{BE} = 10 Ω)	V_{CER}	max.	35	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V

Currents

Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value); f > 1 MHz	I_{CM}	max.	300	mA

Power dissipation

Total power dissipation (d.c.) up to T_h = 160 °C	P_{tot}	max.	2, 5	W
Total power dissipation up to T_h = 145 °C; f > 1 MHz	P_{tot}	max.	3, 5	W

Temperatures

Storage temperature	T_{stg}		-65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	15	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0, 6	°C/W

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current					
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	50	μA	
D.C. current gain					
$I_C = 50$ mA; $V_{CE} = 20$ V	h_{FE}	>	30		1)
$I_C = 150$ mA; $V_{CE} = 20$ V	h_{FE}	>	30		1)
Transition frequency at f = 500 MHz					
$I_C = 90$ mA; $V_{CE} = 20$ V	f_T	typ.	3,5	GHz	1)
$I_C = 150$ mA; $V_{CE} = 20$ V	f_T	typ.	3,5	GHz	1)
Collector capacitance at f = 1 MHz					
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	typ.	3,5	pF	
Emitter capacitance at f = 1 MHz					
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	12	pF	
Feedback capacitance at f = 1 MHz					
$I_C = 10$ mA; $V_{CE} = 20$ V	C_{re}	typ.	1,3	pF	
Collector-stud capacitance at f = 1 MHz	C_{cs}	typ.	2	pF	
Noise figure at optimum source impedance					
$I_C = 90$ mA; $V_{CE} = 20$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	5	dB	1)

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

$I_C = 90$ mA; $V_{CE} = 20$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	13,5	dB	

1) Measured under pulse conditions.

CHARACTERISTICS (continued)

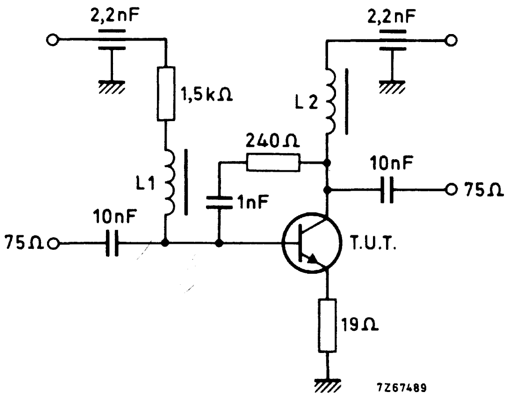
Intermodulation distortion at T_{amb} = 25 °C

I_C = 90 mA; V_{CE} = 20 V; R_L = 75 Ω

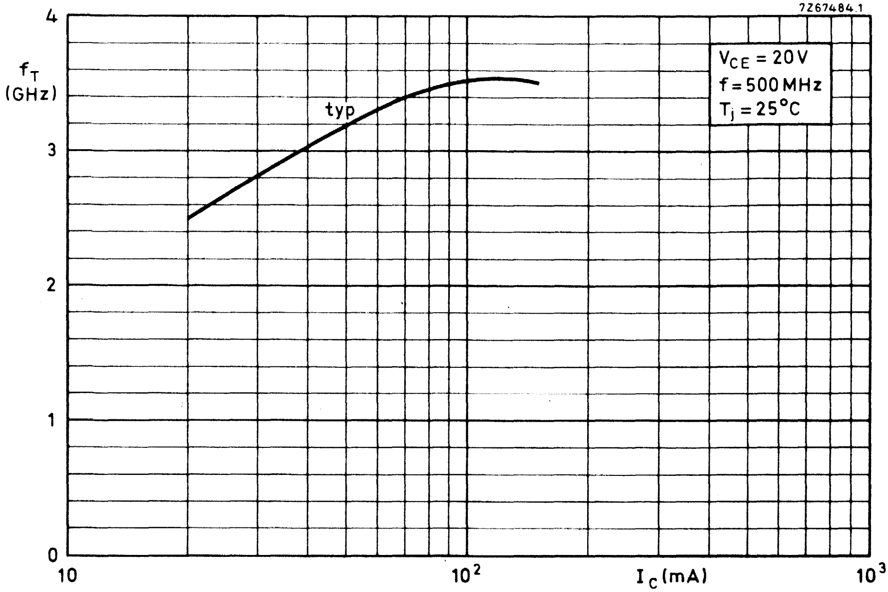
$V_p = V_o$ = 700 mV at f_p = 495, 25 MHz
$V_q = V_o$ −6 dB at f_q = 503, 25 MHz
$V_r = V_o$ −6 dB at f_r = 505, 25 MHz

Measured at $f_{(p+q-r)}$ = 493, 25 MHz — d_{im} typ. −60 dB

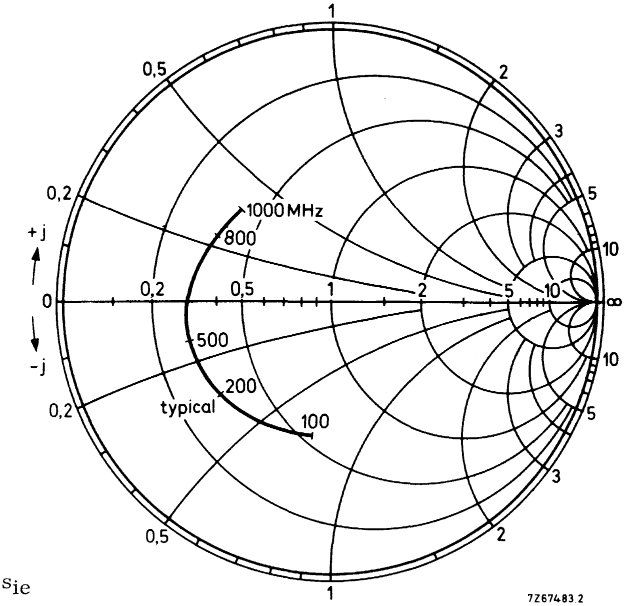
MATV test circuit



L1 = L2 = 5 μH ferroxcube coil (code number: 3122 108 20153)

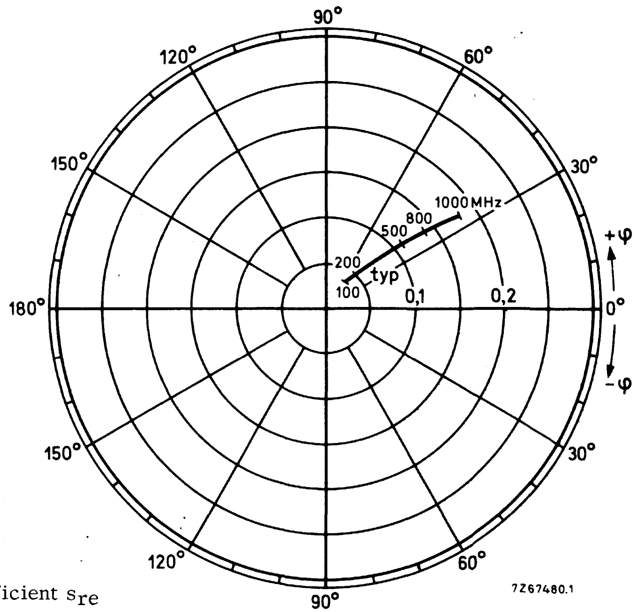

7Z67484.1
f_T (GHz)
4
3
2
1
0
10
10^2
I_C (mA)
10^3
typ
$V_{CE} = 20 V$
$f = 500 MHz$
$T_j = 25°C$

V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 °C



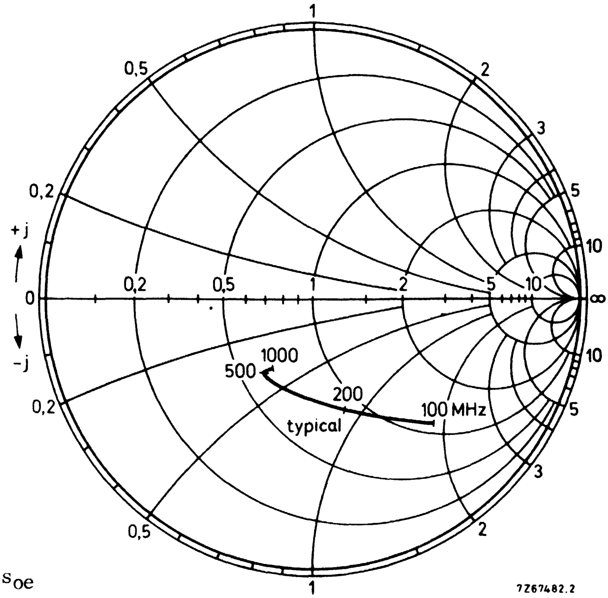
Input reflection coefficient s_{ie}

V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 °C



Reverse transmission coefficient s_{re}

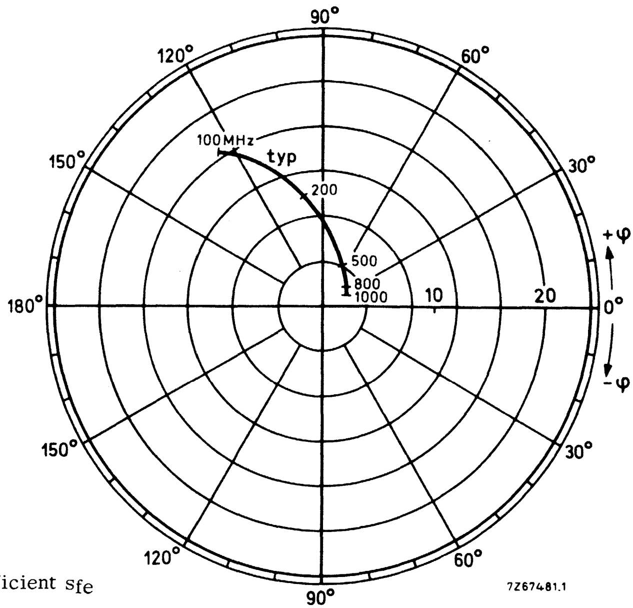
V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 ^oC



Output reflection coefficient s_{oe}

7Z67482.2

V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 ^oC



Forward transmission coefficient s_{fe}

7Z67481.1

APPLICATION INFORMATION (see page 9) T_{amb} = 25 °C unless otherwise specified

Cross modulation distortion (channel 13) [1)]

I_C = 90 mA; V_{CE} = 20 V; V_o = 48 dBmV	d_{cm}	typ.	−61	dB
		<	−57	dB
I_C = 90 mA; V_{CE} = 20 V; V_o = 32 dBmV	d_{cm}	typ.	−93	dB
		<	−89	dB

Intermodulation distortion

I_C = 90 mA; V_{CE} = 20 V; R_L = 75 Ω

$V_p = V_o$ = 60 dBmV at f_p = 196,25 MHz
$V_q = V_o$ −6 dB at f_q = 203,25 MHz
$V_r = V_o$ −6 dB at f_r = 205,25 MHz

Measured at $f_{(p+q-r)}$ = 194,25 MHz	d_{im}	typ.	−63	dB

Broadband power gain

I_C = 90 mA; V_{CE} = 20 V	G_p	>	10	dB
		typ.	11	dB

Noise figure

I_C = 90 mA; V_{CE} = 20 V; f = 200 MHz	F	typ.	8	dB
		<	10	dB

2^{nd} harmonic distortion

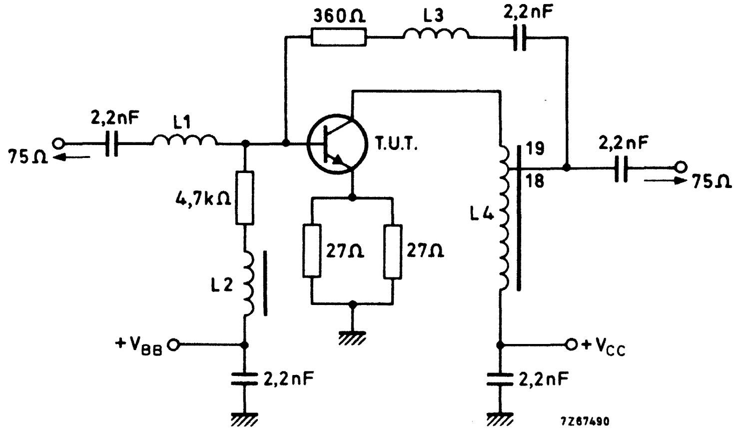
I_C = 90 mA; V_{CE} = 20 V

f_p = 66 MHz; f_q = 144 MHz; $f_p + f_q$ = 210 MHz; V_o = 48 dBmV	d_2	<	−56	dB

1) In 12-channel measuring equipment; channel 13 unmodulated.
V_o = output level/signal, according to NCTA measuring standard.

APPLICATION INFORMATION (continued)

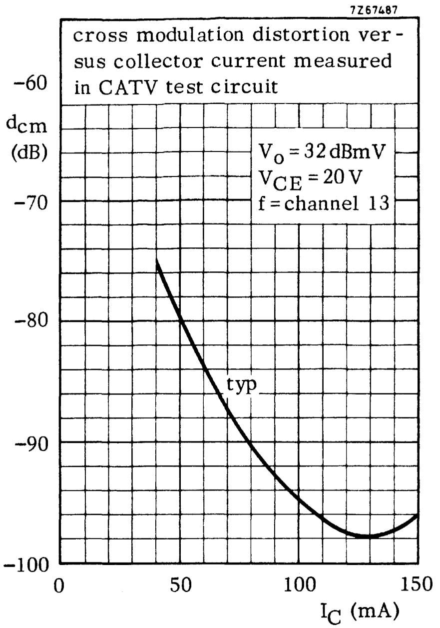
CATV test circuit

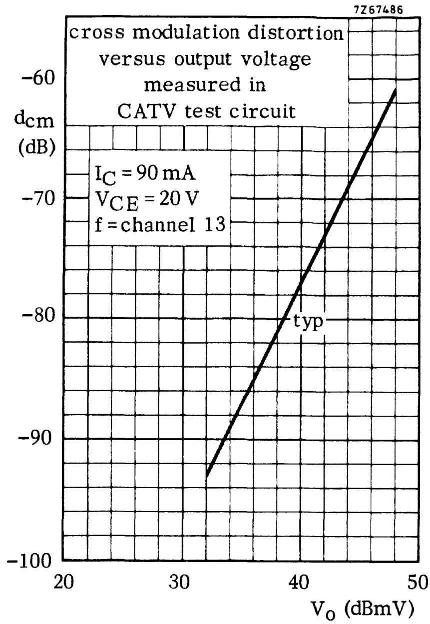


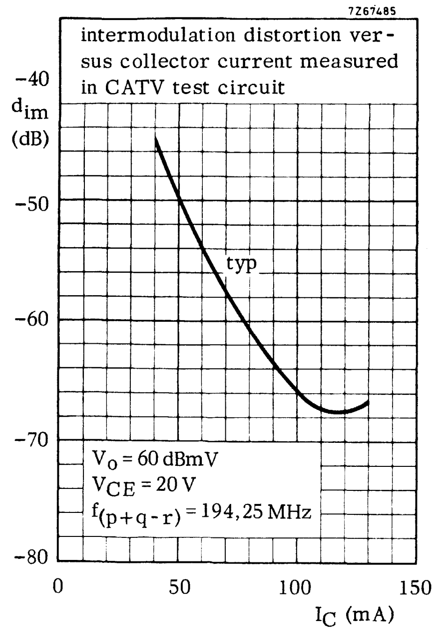
Frequency range 40 to 300 MHz (flatness gain ±0, 2 dB)			
Return losses input and output		<	−16 dB
Power gain	G_p	typ.	11 dB

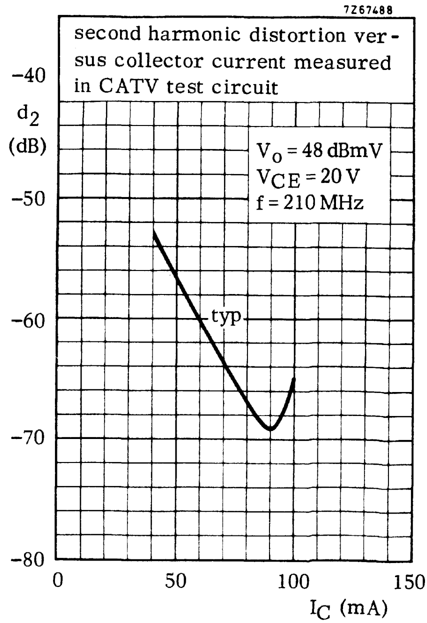
L1 = 2 turns closely wound enamelled Cu wire (0, 7 mm); int. diam. 3 mm
L2 = 5 μH ferroxcube coil (code number 3122 108 20153)
L3 = 5 turns closely wound enamelled Cu wire (0, 7 mm); int. diam. 4, 7 mm
L4 = 19 turns enamelled Cu wire (0, 3 mm) on ferroxcube core (code no. 4322 020 91001)

APPLICATION INFORMATION (continued)









SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N resistance stabilized transistor in a TO-39 metal envelope.

Due to very linear characteristics the transistor features low cross modulation, intermodulation and second harmonic distortion. Thanks to its high transition frequency it has a high power gain combined with excellent wideband properties and low noise up to high frequencies.

The BFR95 is primarily intended for CATV and MATV applications.

QUICK REFERENCE DATA

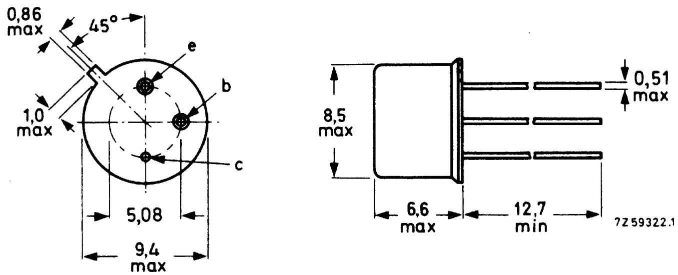
Collector-base voltage (open emitter)	V_{CBO}	max.	30 V
Collector-emitter voltage (open base)	V_{CEO}	max.	25 V
Collector current (d.c.)	I_C	max.	150 mA
Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1,5 W
Junction temperature	T_j	max.	200 °C
Transition frequency at f = 500 MHz I_C = 80 mA; V_{CE} = 20 V	f_T	typ.	3,5 GHz
Cross modulation distortion (channel 13) I_C = 80 mA; V_{CE} = 18 V; V_o = 48 dBmV	d_{cm}	typ. <	−61 dB −57 dB
I_C = 80 mA; V_{CE} = 18 V; V_o = 32 dBmV	d_{cm}	typ. <	−93 dB −89 dB
Intermodulation distortion at $f_{(p+q-r)}$ = 194,25 MHz I_C = 80 mA; V_{CE} = 18 V; V_o = 60 dBmV	d_{im}	typ.	−64 dB
Broadband power gain I_C = 80 mA; V_{CE} = 18 V	G_p	> typ.	8 dB 9 dB
Noise figure at f = 200 MHz I_C = 80 mA; V_{CE} = 18 V	F	typ. <	9 dB 10 dB
Second harmonic distortion at $f_{(p+q)}$ = 210 MHz I_C = 80 mA; V_{CE} = 18 V; V_o = 48 dBmV	d_2	typ.	−62 dB

MECHANICAL DATA see page 2.

MECHANICAL DATA

Fig. 1 TO-39 Dimensions in mm

Collector connected to case



Maximum lead diameter guaranteed only for 12,7 mm.
Accessories: 56245 (distance disc).

RATINGS

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

Collector-base voltage (open emitter) note 1	V_{CBO}	max.	30 V
Collector-emitter voltage (R_{BE} = 10 Ω) note 2	V_{CER}	max.	35 V
Collector-emitter voltage (open base) note 2	V_{CEO}	max.	25 V
Emitter-base voltage (open collector) note 3	V_{EBO}	max.	3 V
Collector current (d.c.)	I_C	max.	150 mA
Collector current (peak value); f > 1 MHz	I_{CM}	max.	300 mA
Total power dissipation			
up to T_{amb} = 25 °C	P_{tot}	max.	0,7 W
up to T_{mb} = 125 °C	P_{tot}	max.	1,5 W
Storage temperature	T_{stg}	−65 to + 200 °C	
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE (note 4)

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	250 K/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	50 K/W

Notes

1. At I_C = 100 μA.
2. At I_C = 10 mA.
3. At I_E = 100 μA.
4. K/W is SI unit for °C/W.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	50 μA
D.C. current gain (note 1)			
I_C = 50 mA; V_{CE} = 20 V	h_{FE}	>	30
I_C = 150 mA; V_{CE} = 20 V	h_{FE}	>	30
Transition frequency at f = 500 MHz (note 1)			
I_C = 80 mA; V_{CE} = 20 V	f_T	typ.	3,5 GHz
I_C = 150 mA; V_{CE} = 20 V	f_T	typ.	3,5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; V_{CB} = 20 V	C_c	typ.	3,5 pF
Feedback capacitance at f = 1 MHz			
I_C = 10 mA; V_{CE} = 20 V	C_{re}	typ.	1,6 pF

APPLICATION INFORMATION (see also test circuit on page 4)

Measuring conditions: I_C = 80 mA; V_{CE} = 18 V; T_{amb} = 25 °C

Cross modulation (channel 13) (note 2)			
V_o = 48 dBmV	d_{cm}	typ.	−61 dB
		<	−57 dB
V_o = 32 dBmV	d_{cm}	typ.	−93 dB
		<	−89 dB
Intermodulation distortion			
$V_p = V_o$ = 60 dBmV at f_p = 196,25 MHz			
$V_q = V_o$ −6 dB at f_q = 203,25 MHz			
$V_r = V_o$ −6 dB at f_r = 205,25 MHz			
Measured at $f_{(p+q-r)}$ = 194,25 MHz	d_{im}	typ.	−64 dB
Broadband power gain	G_p	>	8 dB
		typ.	9 dB
Noise figure at f = 200 MHz	F	typ.	9 dB
		<	10 dB
2nd harmonic distortion at $f_{(p+q)}$ = 210 MHz			
f_p = 66 MHz; f_q = 144 MHz; V_o = 48 dBmV	d_2	typ.	−62 dB
		<	−56 dB

Notes

1. Measured under pulse conditions.
2. In 12-channel measuring equipment; channel 13 unmodulated.
   V_o = output level/signal, in accordance with NCTA measuring standard.

APPLICATION INFORMATION

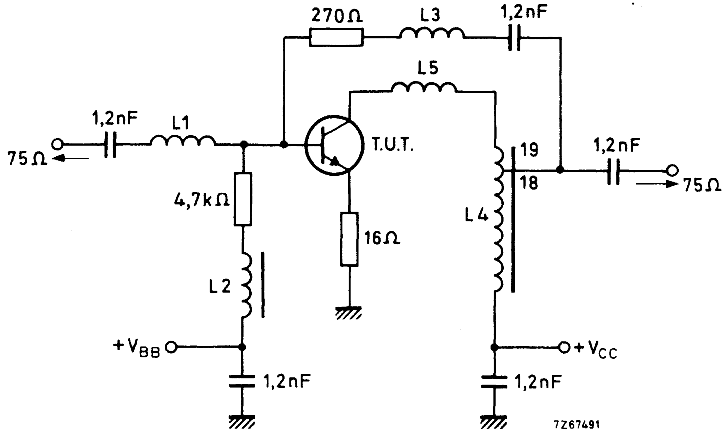


Fig. 2 CATV test circuit.
Frequency range 40 to 300 MHz
Power gain G_p typ. 9 dB

L1 = 2 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 3 mm
L2 = 5 μH Ferroxcube coil (cat. no. 3122 108 20153)
L3 = 3 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 4,7 mm
L4 = 19 turns enamelled Cu wire (0,3 mm) on Ferroxcube core (cat. no. 4322 020 91001)
L5 = 2 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 3 mm.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers, etc.
The transistor features very low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	75	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	500	mW
Junction temperature	T_j	max.	175	°C
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	<	1,4	pF
Noise figure at optimum source impedance I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	3,3	dB
Max. unilateral power gain (see page 3) I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	15,2	dB
Intermodulation distortion at T_{amb} = 25 °C I_C = 50 mA; V_{CE} = 10 V; R_L = 75 Ω; V_o = 500 mV $f_{(p+q-r)}$ = 493,25 MHz (see page 4)	d_{im}	typ.	-60	dB

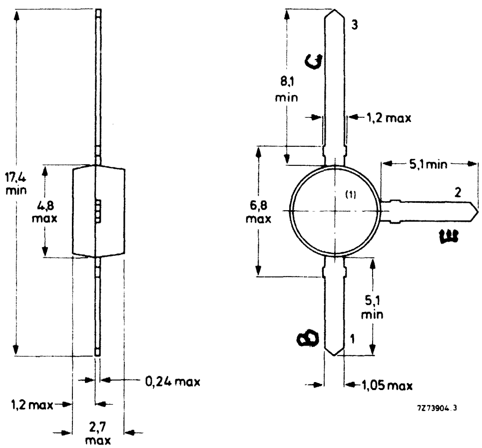
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

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

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,0	V

Currents

Collector current (d.c.)	I_C	max.	75	mA
Collector current (peak value); f > 1 MHz	I_{CM}	max.	150	mA

Power dissipation

Total power dissipation up to T_{amb} = 60 °C mounted on a fibre-glass print of 40 mm x 35 mm x 1,5 mm	P_{tot}	max.	500	mW

Temperatures

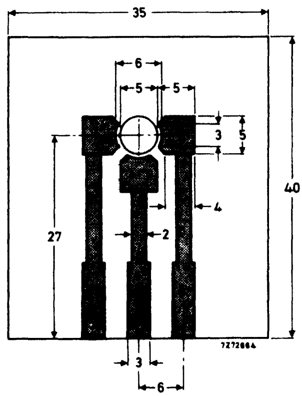
Storage temperature	T_{stg}		-65 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 35 mm x 1,5 mm	$R_{th\ j\text{-}a}$	=	0,23 °C/mW

Requirements for fibre-glass print

Dimensions in mm



Single-sided 35 µm Cu-clad epoxy fibre-glass print, thickness 1,5 mm.
Tracks are fully tin-lead plated.

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	100	nA
D.C. current gain [1]				
$I_C = 50$ mA; $V_{CE} = 10$ V	h_{FE}	>	25	
		typ.	50	
$I_C = 75$ mA; $V_{CE} = 10$ V	h_{FE}	>	25	
		typ.	52	
Transition frequency at f = 500 MHz [1]				
$I_C = 50$ mA; $V_{CE} = 10$ V	f_T	>	4,0	GHz
		typ.	5,0	GHz
$I_C = 75$ mA; $V_{CE} = 10$ V	f_T	>	4,4	GHz
		typ.	5,5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	1,3	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	**6,5**	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	C_{re}	typ.	1,0	pF
		<	1,4	pF
Noise figure at optimum source impedance				
$I_C = 50$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	3,3	dB
$I_C = 50$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	F	typ.	3,8	dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 50$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	**15,2**	dB

[1] Measured under pulse conditions.

CHARACTERISTICS (continued)

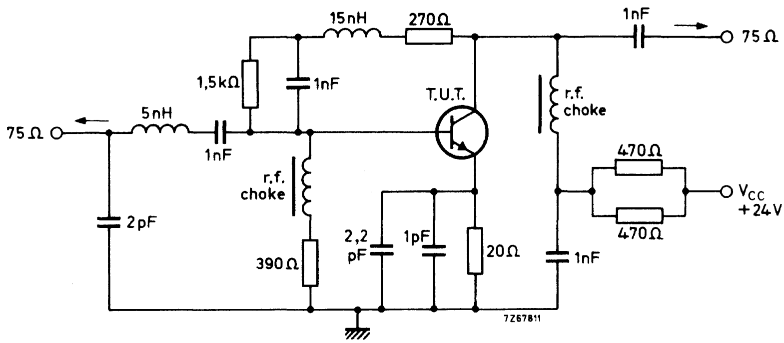
Intermodulation distortion at T_{amb} = 25 °C

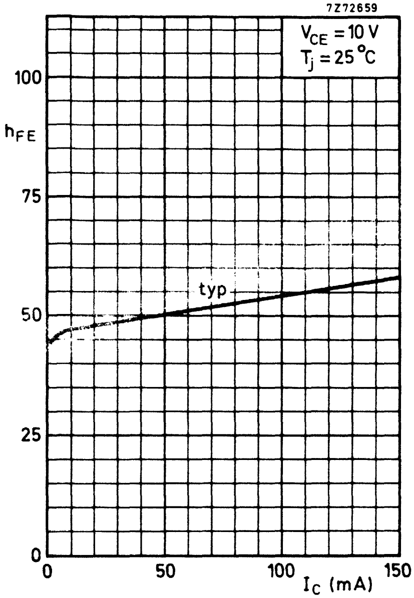
I_C = 50 mA; V_{CE} = 10 V; R_L = 75 Ω

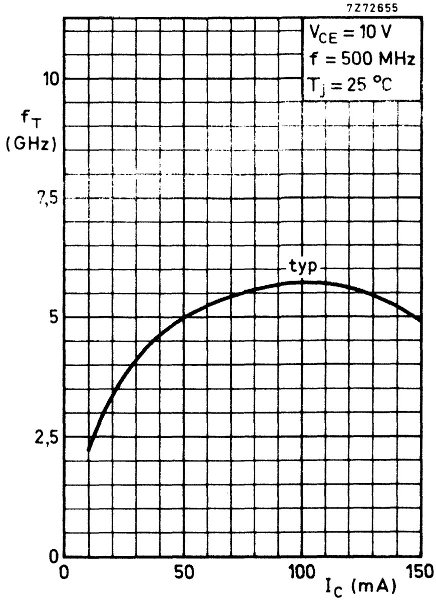
$V_p = V_o$ = 500 mV at f_p = 495,25 MHz
$V_q = V_o$ − 6 dB at f_q = 503,25 MHz
$V_r = V_o$ − 6 dB at f_r = 505,25 MHz

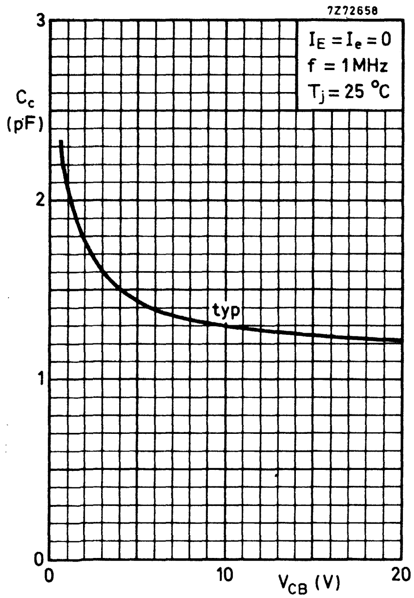
Measured at $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ.	−60	dB

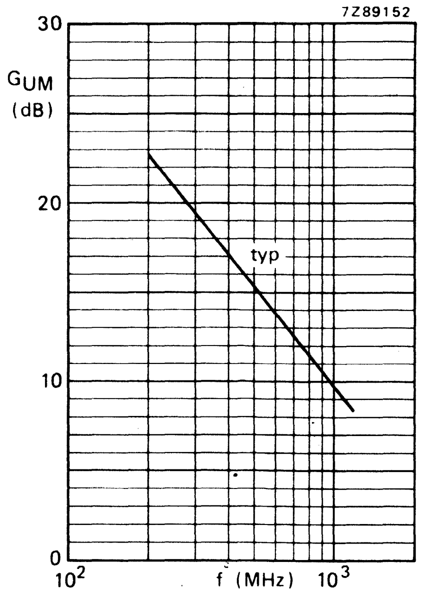
Intermodulation test circuit:





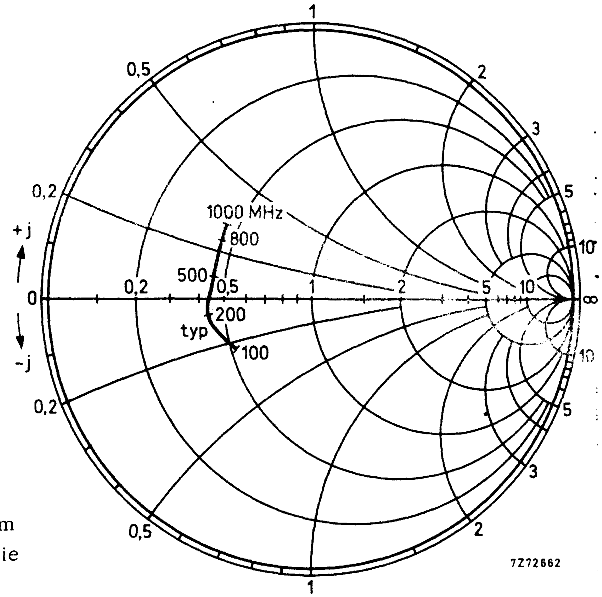






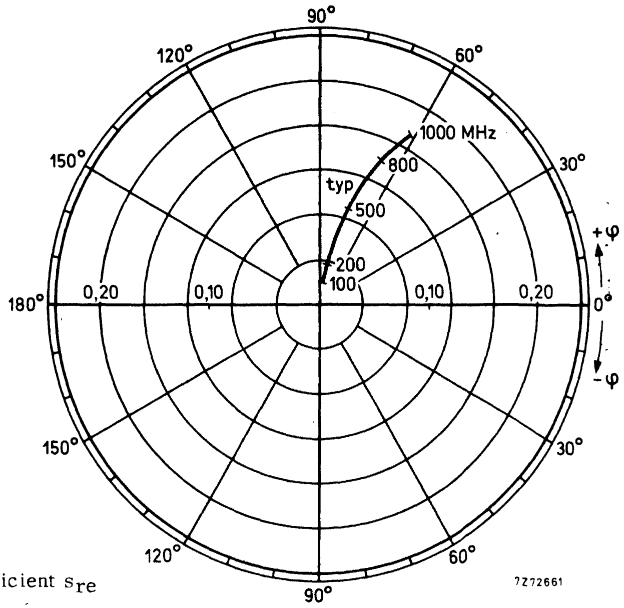
V_{CE} = 10 V; I_C = 50 mA; T_{amb} = 25 °C.

V_{CE} = 10 V
I_C = 50 mA
T_{amb} = 25 °C



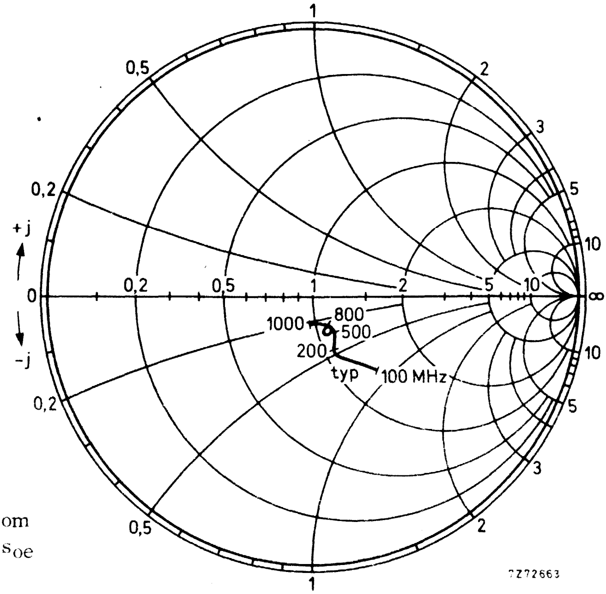
Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50

V_{CE} = 10 V
I_C = 50 mA
T_{amb} = 25 °C



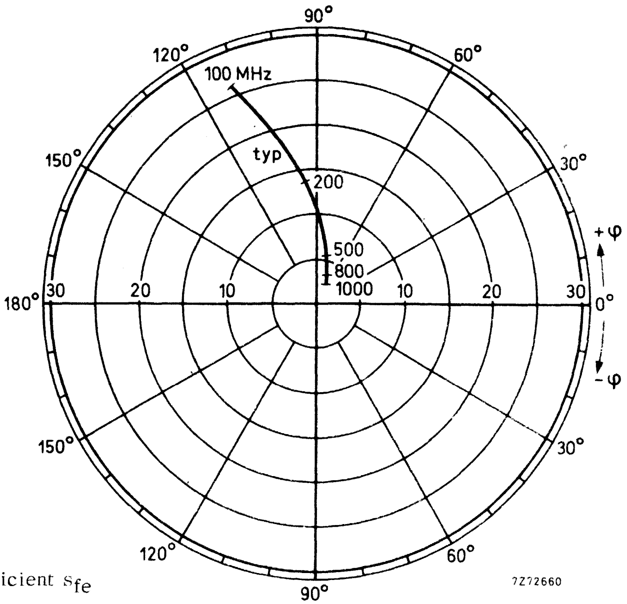
Reverse transmission coefficient s_{re}

V_{CE} = 10 V
I_C = 50 mA
T_{amb} = 25 °C

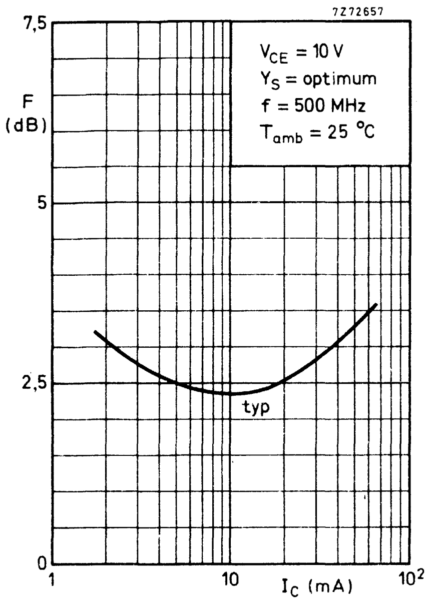


Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50

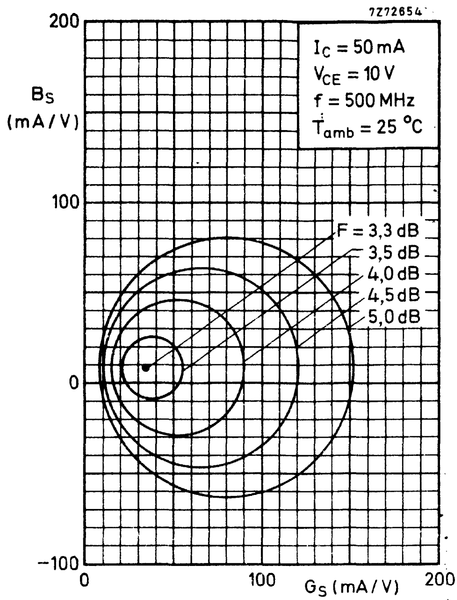
V_{CE} = 10 V
I_C = 50 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}



circles of constant noise figure



SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a plastic T-package, primarily intended for MATV applications. The device features excellent output voltage capabilities.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	700	mW
Junction temperature	T_j	max.	175	°C
Transition frequency at f = 500 MHz I_C = 70 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	1	pF
Noise figure at optimum source impedance I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	F	typ.	4,0	dB
Maximum unilateral power gain I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	11,5	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	700	mV

MECHANICAL DATA

SOT-37 (see Fig. 1).

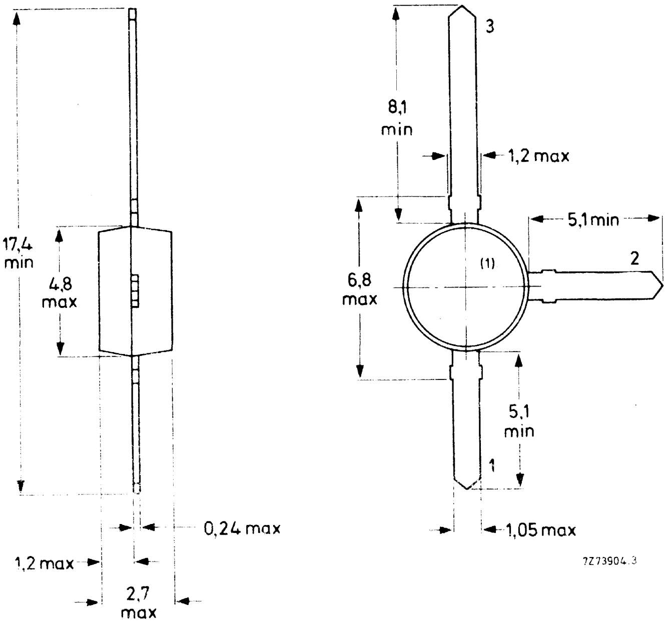
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,0 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 70 °C mounted on a fibre-glass print (see Fig. 2) of 50 mm x 50 mm x 1,5 mm	P_{tot}	max.	700 mW
Storage temperature	T_{stg}	–65 to + 175 °C	
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2) of 50 mm x 50 mm x 1,5 mm	$R_{th\ j\text{-}a}$	=	150 K/W*

* K/W is SI unit for °C/W.

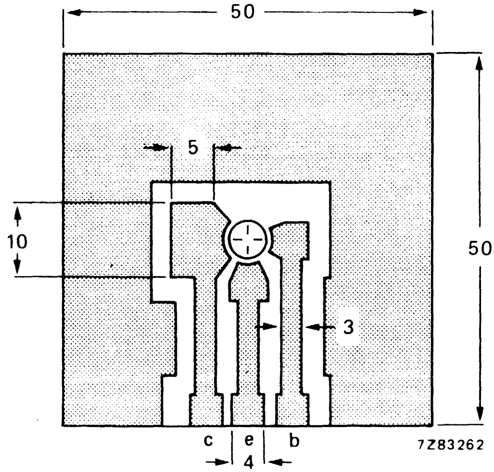


Fig. 2 Requirements for fibre-glass print. (Dimensions in mm.)
Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	100 nA
D.C. current gain*			
$I_C = 70$ mA; $V_{CE} = 10$ V	h_{FE}	>	25
Transition frequency at f = 500 MHz			
$I_C = 70$ mA; $V_{CE} = 10$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	1,5 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c = 0$; $V_{EB} = 0{,}5$ V	C_e	typ.	6,5 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	C_{re}	typ.	1 pF
Noise figure at optimum source impedance			
$I_C = 70$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	F	typ.	4,0 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

$I_C = 70$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	11,5 dB

* Measured under pulse conditions.

s-parameters (common emitter) at V_{CE} = 5 V

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
5	40	0,75/ −41,5°	0,026/+ 69,1°	15,1/+ 155,2°	0,93/ −17,4°
	200	0,62/−128,1°	0,064/+ 41,9°	7,1/+ 106,9°	0,53/ −43,3°
	500	0,55/−174,6°	0,087/+ 47,0°	3,2/ + 79,8°	0,40/ −53,2°
	800	0,56/+ 158,7°	0,115/+ 56,5°	2,1/ + 65,0°	0,39/ −63,2°
	1000	0,58/+ 146,7°	0,135/+ 59,2°	1,7/ + 56,6°	0,39/ −72,5°
	1200	0,61/+ 135,5°	0,159/+ 61,7°	1,4/ + 48,9°	0,39/ −83,0°
10	40	0,60/ −59,1°	0,022/+ 64,1°	24,3/+ 147,2°	0,86/ −26,6°
	200	0,54/−146,1°	0,050/+ 49,4°	9,1/+ 100,7°	0,38/ −54,7°
	500	0,50/+ 175,8°	0,087/+ 59,3°	3,9/ + 78,6°	0,27/ −62,8°
	800	0,52/+ 152,4°	0,129/+ 63,7°	2,5/ + 65,8°	0,27/ −72,2°
	1000	0,53/+ 141,0°	0,157/+ 63,9°	2,1/ + 58,0°	0,27/ −80,7°
	1200	0,56/+ 130,7°	0,186/+ 63,3°	1,7/ + 51,2°	0,27/ −90,9°
30	40	0,39/−105,6°	0,015/+ 60,7°	39,6/+ 133,3°	0,69/ −44,1°
	200	0,44/−168,4°	0,041/+ 65,9°	11,1/ + 94,3°	0,23/ −78,2°
	500	0,46/+ 165,1°	0,094/+ 70,3°	4,7/ + 77,3°	0,16/ −88,4°
	800	0,48/+ 145,4°	0,146/+ 69,2°	3,0/ + 66,5°	0,16/ −98,3°
	1000	0,51/+ 135,6°	0,175/+ 66,6°	2,5/ + 60,1°	0,16/−109,3°
	1200	0,53/+ 126,2°	0,206/+ 64,2°	2,1/ + 54,0°	0,17/−119,7°
50	40	0,37/−129,3°	0,013/+ 63,4°	44,6/+ 127,8°	0,62/ −51,4°
	200	0,43/−174,7°	0,040/+ 71,5°	11,5/ + 92,5°	0,19/ −89,2°
	500	0,45/+ 162,4°	0,095/+ 72,7°	4,8/ + 76,8°	0,14/−101,5°
	800	0,48/+ 143,4°	0,151/+ 70,1°	3,1/ + 66,5°	0,14/−111,5°
	1000	0,50/+ 134,3°	0,182/+ 67,4°	2,5/ + 60,4°	0,14/−121,5°
	1200	0,52/+ 124,9°	0,215/+ 64,8°	2,1/ + 54,6°	0,15/−130,7°
70	40	0,38/−141,7°	0,011/+ 65,1°	46,9/+ 124,9°	0,57/ −55,8°
	200	0,43/−177,6°	0,040/+ 73,7°	11,6/ + 91,6°	0,18/ −96,3°
	500	0,46/+ 161,2°	0,095/+ 73,9°	4,9/ + 76,5°	0,13/−109,5°
	800	0,49/+ 143,1°	0,150/+ 70,6°	3,1/ + 66,4°	0,13/−120,7°
	1000	0,49/+ 133,5°	0,186/+ 67,7°	2,5/ + 60,2°	0,14/−126,2°
	1200	0,52/+ 124,1°	0,218/+ 65,0°	2,1/ + 54,6°	0,15/−135,3°

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
5	40	0,77/ −38,9°	0,023/+ 69,1°	15,2/+ 156,2°	0,93/ −15,4°
	200	0,62/−124,0°	0,059/+ 43,1°	7,4/+ 108,3°	0,57/ −38,0°
	500	0,54/−172,5°	0,081/+ 48,0°	3,4/ + 80,8°	0,45/ −46,8°
	800	0,55/+ 159,9°	0,106/+ 57,8°	2,2/ + 65,9°	0,43/ −57,1°
	1000	0,56/+ 147,2°	0,126/+ 61,5°	1,8/ + 57,5°	0,43/ −64,9°
	1200	0,58/+ 135,9°	0,150/+ 64,4°	1,5/ + 50,1°	0,42/ −74,7°
10	40	0,62/ −54,5°	0,020/+ 64,9°	24,5/+ 148,7°	0,87/ −23,5°
	200	0,53/−142,3°	0,046/+ 49,6°	9,6/+ 102,0°	0,42/ −47,8°
	500	0,48/+ 177,6°	0,080/+ 59,4°	4,2/ + 79,4°	0,31/ −54,2°
	800	0,50/+ 153,2°	0,118/+ 64,0°	2,7/ + 66,4°	0,31/ −63,5°
	1000	0,52/+ 142,3°	0,143/+ 64,1°	2,2/ + 59,1°	0,31/ −70,0°
	1200	0,54/+ 131,8°	0,168/+ 64,3°	1,8/ + 52,4°	0,30/ −79,5°
30	40	0,41/ −94,4°	0,014/+ 62,2°	40,9/+ 135,0°	0,72/ −39,2°
	200	0,42/−164,6°	0,039/+ 65,5°	11,8/ + 95,1°	0,25/ −64,5°
	500	0,42/+ 167,0°	0,087/+ 70,4°	4,9/ + 77,9°	0,19/ −71,1°
	800	0,45/+ 146,6°	0,136/+ 69,3°	3,2/ + 67,1°	0,18/ −79,1°
	1000	0,47/+ 136,6°	0,166/+ 67,2°	2,6/ + 60,6°	0,18/ −83,8°
	1200	0,49/+ 126,3°	0,196/+ 65,0°	2,2/ + 54,6°	0,17/ −95,1°
50	40	0,36/−114,4°	0,012/+ 62,7°	46,5/+ 129,6°	0,63/ −45,7°
	200	0,40/−171,0°	0,038/+ 70,4°	12,3/ + 93,1°	0,20/ −71,4°
	500	0,41/+ 163,9°	0,090/+ 72,4°	5,1/ + 77,1°	0,16/ −79,7°
	800	0,44/+ 144,7°	0,140/+ 70,1°	3,3/ + 66,7°	0,15/ −86,0°
	1000	0,47/+ 135,3°	0,168/+ 67,3°	2,7/ + 60,8°	0,14/ −95,3°
	1200	0,49/+ 125,2°	0,197/+ 65,0°	2,3/ + 55,2°	0,14/−106,6°
70	40	0,35/−125,4°	0,012/+ 63,6°	49,1/+ 125,7°	0,58/ −49,5°
	200	0,40/−173,7°	0,038/+ 72,7°	12,4/ + 92,0°	0,18/ −74,8°
	500	0,41/+ 162,6°	0,091/+ 73,2°	5,2/ + 76,7°	0,15/ −82,0°
	800	0,44/+ 144,1°	0,143/+ 70,2°	3,3/ + 66,4°	0,14/ −87,4°
	1000	0,46/+ 134,6°	0,175/+ 67,3°	2,7/ + 60,2°	0,13/ −95,3°
	1200	0,48/+ 124,1°	0,200/+ 64,8°	2,3/ + 54,6°	0,13/−109,5°

Output voltage at d_{im} = –60 dB (see Figs 3 and 5)
(DIN45004B, par. 6.3: 3-tone)
I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = –60 dB; f_p = 795,25 MHz
$V_q = V_o$ –6 dB; f_q = 803,25 MHz
$V_r = V_o$ –6 dB; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 700 mV

Second harmonic distortion (see Figs 3 and 6)
I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ = 316 mV = 50 dBmV; f_p = 250 MHz
$V_q = V_o$ = 316 mV = 50 dBmV; f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz — d_2 typ. –52 dB

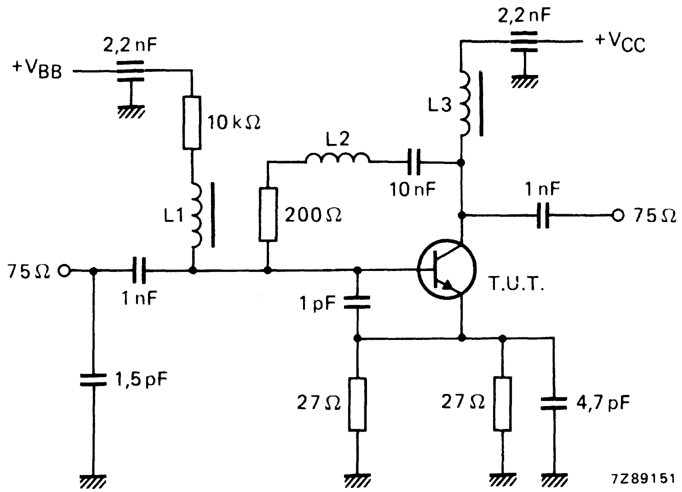


Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro choke
L2 = 1½ turns Cu wire (0,4 mm); internal diameter 3,0 mm; winding pitch 1 mm

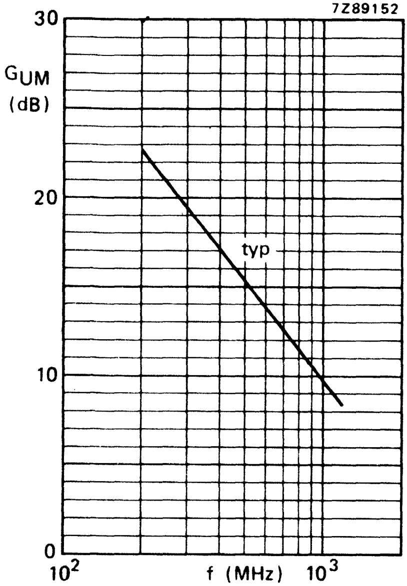


Fig. 4 V_{CE} = 10 V; I_C = 70 mA; T_{amb} = 25 °C.

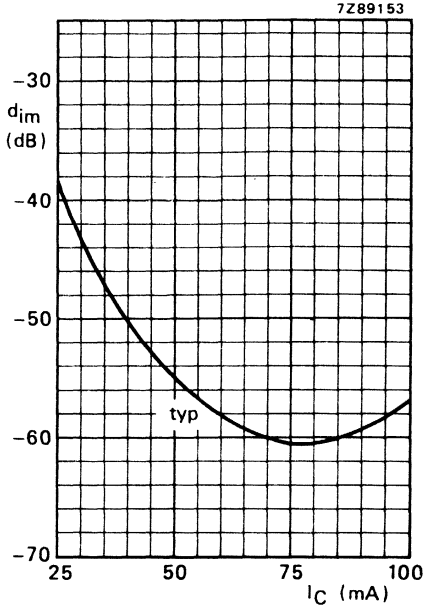


Fig. 5.

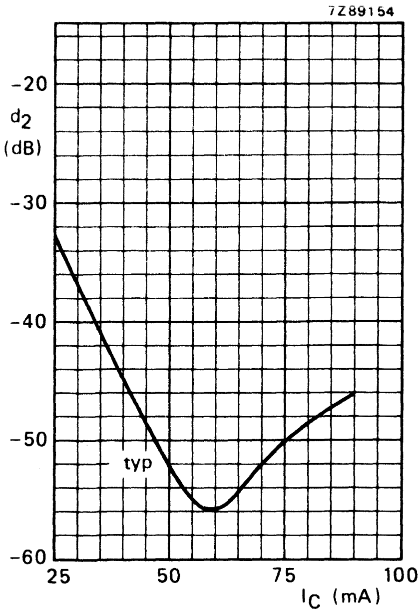


Fig. 6.

Intermodulation distortion (Fig. 5) and second harmonic distortion (Fig. 6) are measured in MATV circuit (see Fig. 3).

Fig. 5 V_{CE} = 10 V; V_o = 700 mV = 56,9 dBmV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C.

Fig. 6 V_{CE} = 10 V; V_o = 316 mV = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

Conditions for Figs 7 and 8:
V_{CE} = 10 V; I_C = 70 mA;
T_{amb} = 25 °C.

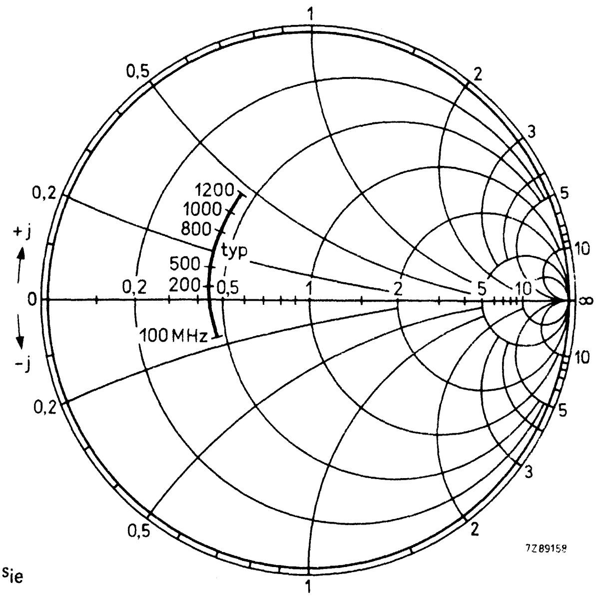


Fig. 7 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

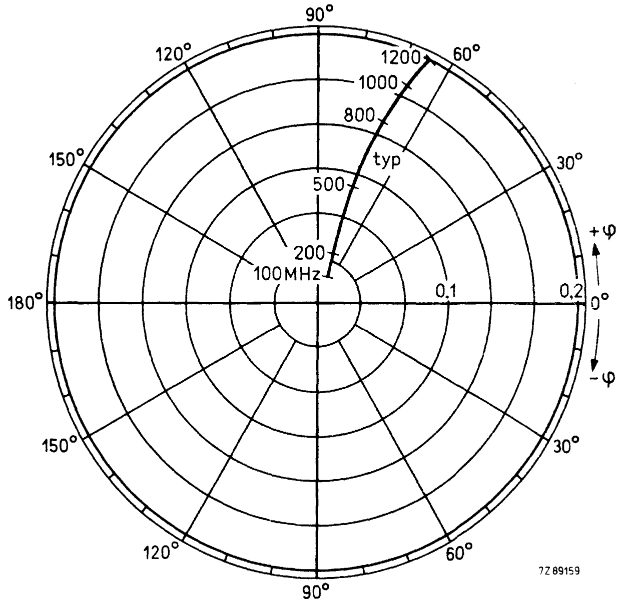


Fig. 8 Reverse transmission coefficient s_{re}.

Conditions for Figs 9 and 10:
$V_{CE} = 10\ V$; $I_C = 70\ mA$;
$T_{amb} = 25\ ^oC$.

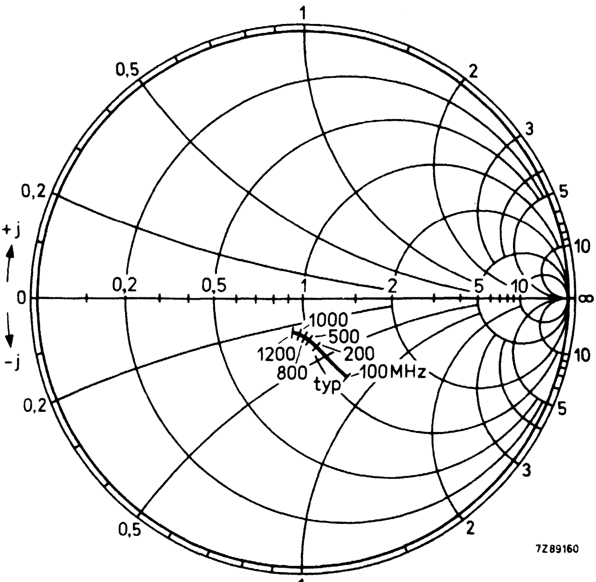


Fig. 9 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

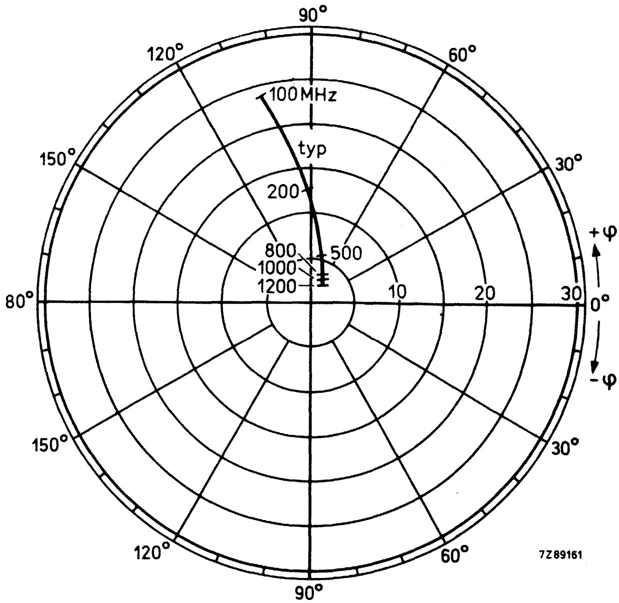


Fig. 10 Forward transmission coefficient s_{fe}.

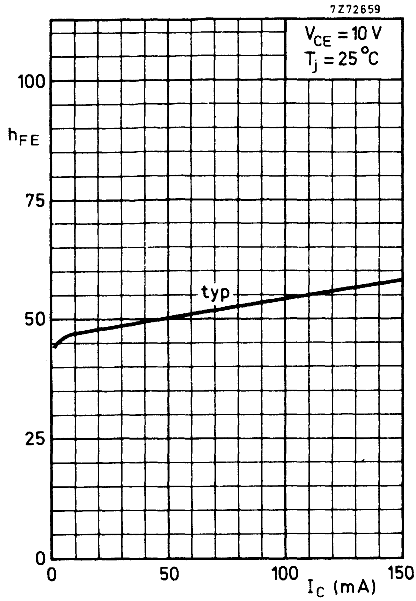


Fig. 11.

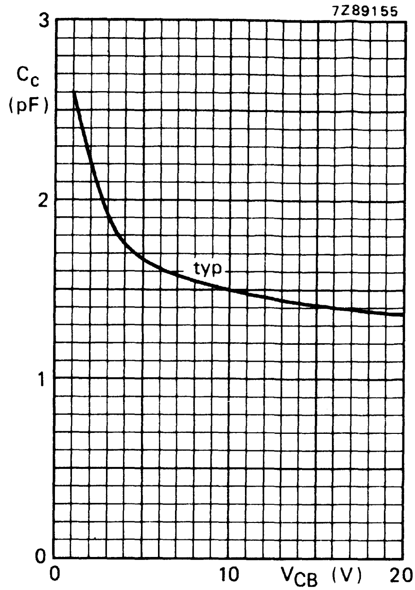


Fig. 12 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

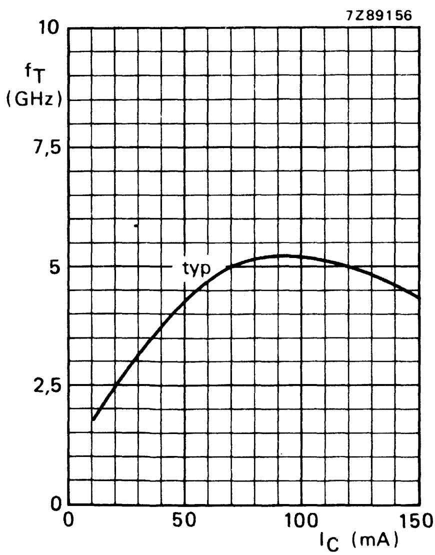


Fig. 13 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

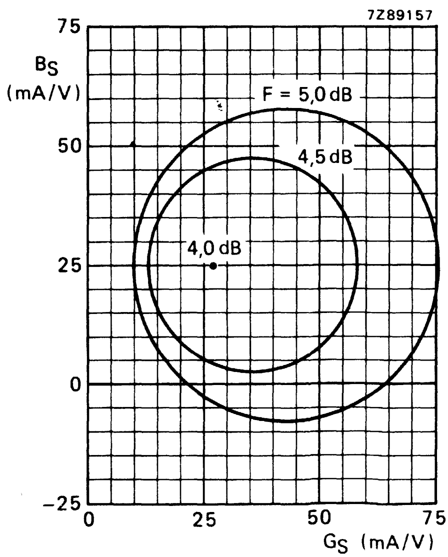


Fig. 14 Circles of constant noise figure.
V_{CE} = 10 V; I_C = 70 mA; f = 800 MHz;
T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. low power amplifiers such as in pocket phones, paging systems, etc.
The transistor features low current consumption (100 μA - 1 mA); thanks to its high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA				
Collector-base voltage (open emitter)	V_{CBO}	max.	8	V
Collector-emitter voltage (open base)	V_{CEO}	max.	5	V
Collector current (d.c.)	I_C	max.	2,5	mA
Total power dissipation up to T_{amb} = 135 °C	P_{tot}	max.	30	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 1 mA; V_{CE} = 1 V	f_T	typ.	2.3	GHz
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C	C_{re}	<	0.4	pF
Noise figure at optimum source impedance I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	3.8	dB
Max. unilateral power gain (see page 3) I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	17	dB

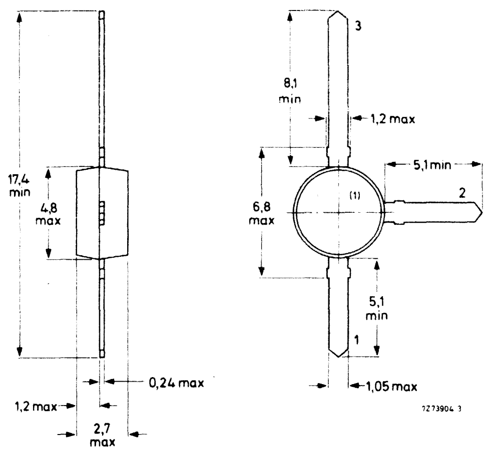
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	8	V
Collector-emitter voltage (open base)	V_{CEO}	max.	5	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V

Current

Collector current (d.c.)	I_C	max.	2,5	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	5,0	mA

Power dissipation

Total power dissipation up to T_{amb} = 135 °C	P_{tot}	max.	30	mW

Temperatures

Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

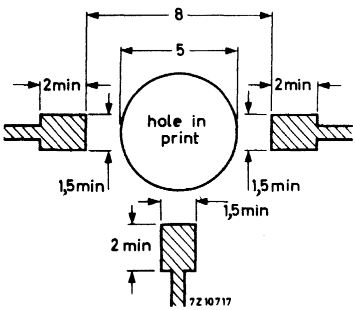
THERMAL RESISTANCE

From junction to ambient in free air

mounted on a glass-fibre print *)
of 40 mm x 25 mm x 1 mm — $R_{th\ j\text{-}a}$ = 0,5 °C/mW

*) Requirements for glass-fibre print

(dimensions in mm)



CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

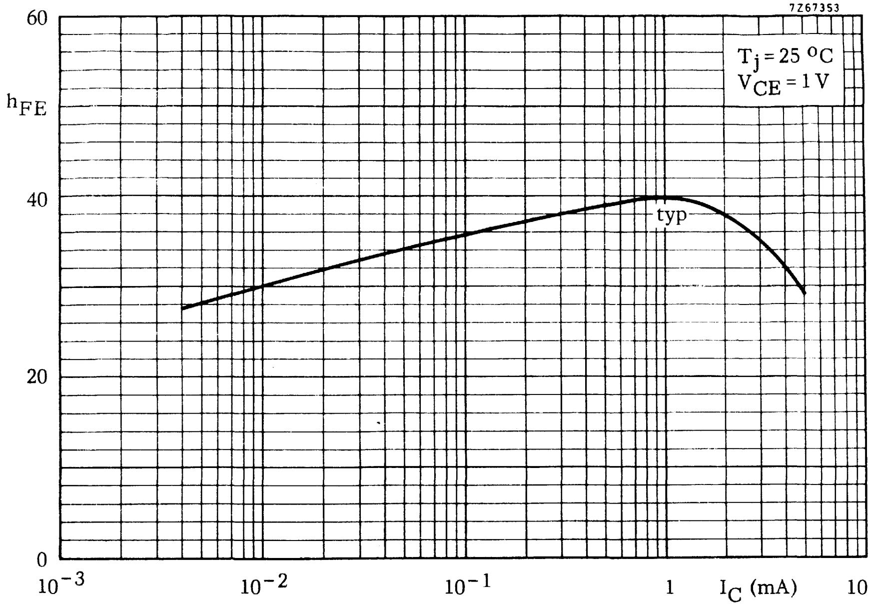
Collector cut-off current				
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50	nA
D.C. current gain 1)				
$I_C = 10\ \mu A$; $V_{CE} = 1$ V	h_{FE}	>	20	
		typ.	30	
$I_C = 1$ mA; $V_{CE} = 1$ V	h_{FE}	>	20	
		typ.	40	
Saturation voltages				
$I_C = 10\ \mu A$; $I_B = 1\ \mu A$	V_{CEsat}	<	200	mV
	V_{BEsat}	<	750	mV
$I_C = 1$ mA; $I_B = 0.1$ mA	V_{CEsat}	<	175	mV
	V_{BEsat}	<	900	mV
Transition frequency at f = 500 MHz 1)				
$I_C = 1$ mA; $V_{CE} = 1$ V	f_T	>	1,2	GHz
		typ.	2,3	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 0.5$ V	C_c	<	0.55	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0$	C_e	<	0.45	pF
Feedback capacitance at f = 1 MHz				
$I_C = 1$ mA; $V_{CE} = 1$ V; $T_{amb} = 25\ ^oC$	C_{re}	<	0.4	pF
Noise figure at optimum source impedance				
$I_C = 0.1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	F	typ.	5,5	dB
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	F	typ.	3,8	dB

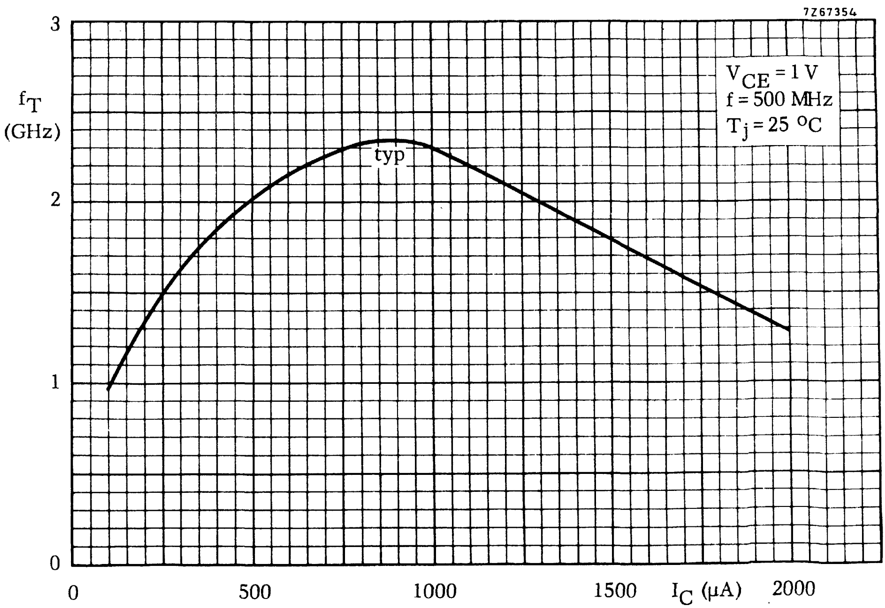
Max. unilateral power gain (s_{re} assumed to be zero)

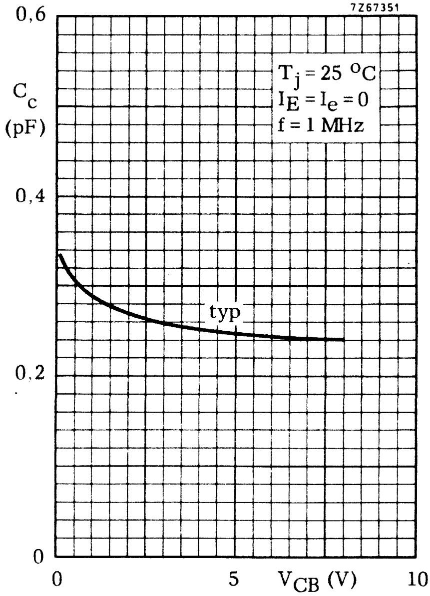
$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

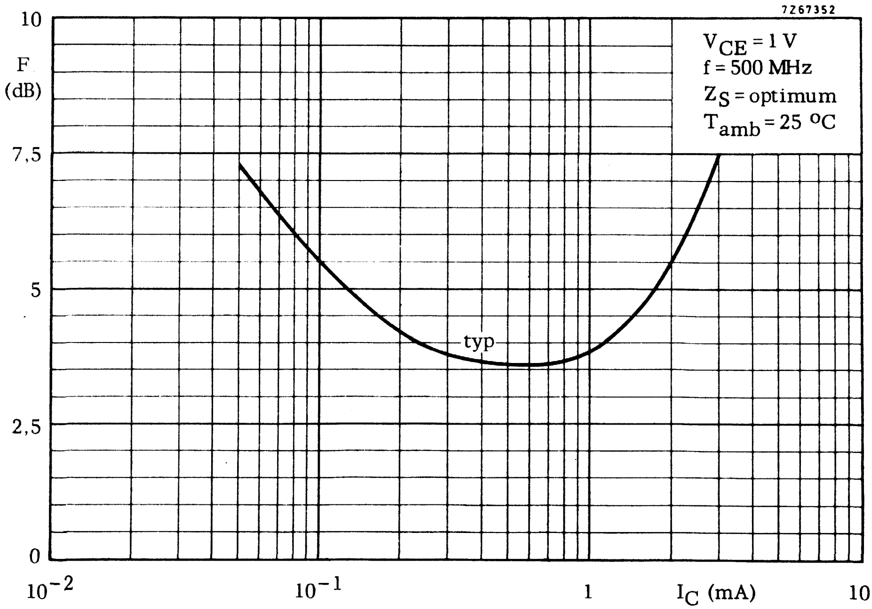
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 200 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	24	dB
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	17	dB
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 800 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	11	dB

1) Measured under pulse conditions.

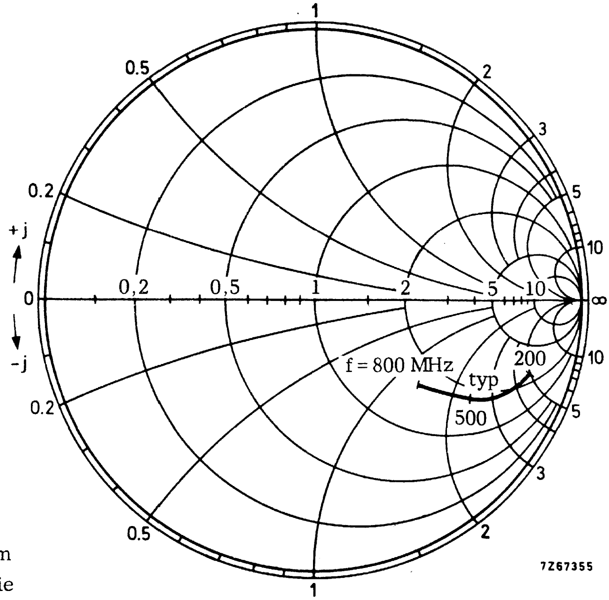

7Z67353
$T_j = 25\ ^oC$
$V_{CE} = 1\ V$
h_{FE}
60
40
20
0
typ
10^{-3}
10^{-2}
10^{-1}
1
I_C (mA)
10


7Z67354
$V_{CE} = 1\ V$
f = 500 MHz
$T_j = 25\ ^oC$
f_T
(GHz)
3
2
1
0
typ
0
500
1000
1500
I_C (μA)
2000


7Z67351
0,6
0,4
0,2
0
C_c
(pF)
$T_j = 25\ ^oC$
$I_E = I_e = 0$
f = 1 MHz
typ
0
5
V_{CB} (V)
10

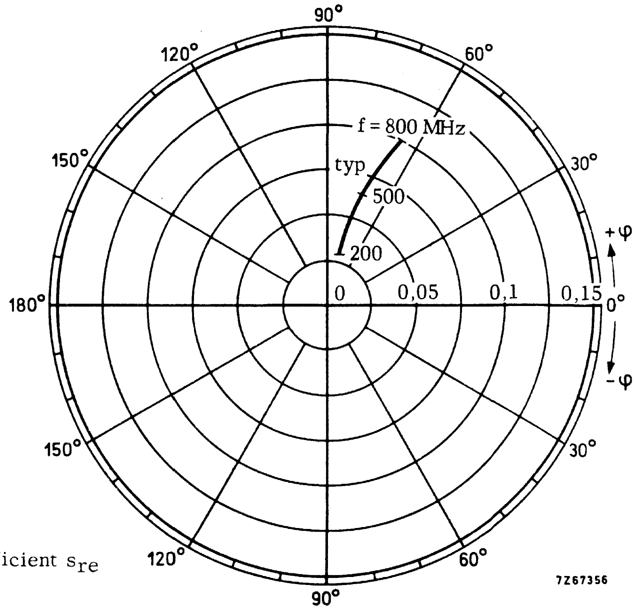

7Z67352
10
7,5
5
2,5
0
F
(dB)
$V_{CE} = 1\ V$
f = 500 MHz
Z_S = optimum
$T_{amb} = 25\ ^oC$
typ
10^{-2}
10^{-1}
1
I_C (mA)
10

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



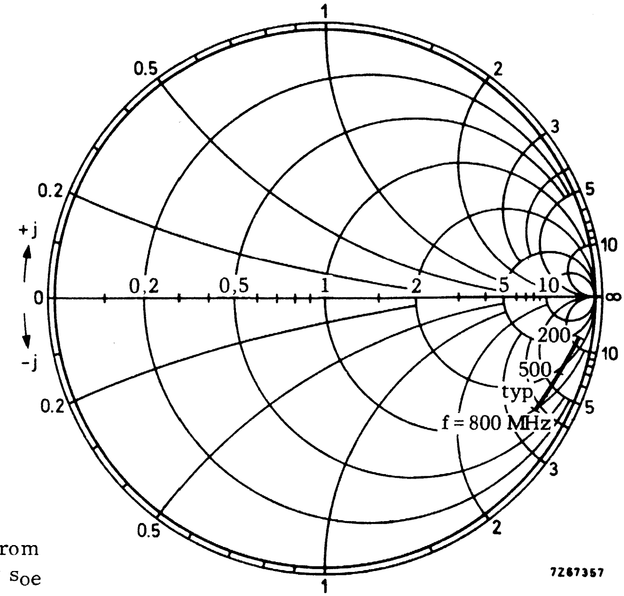
Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



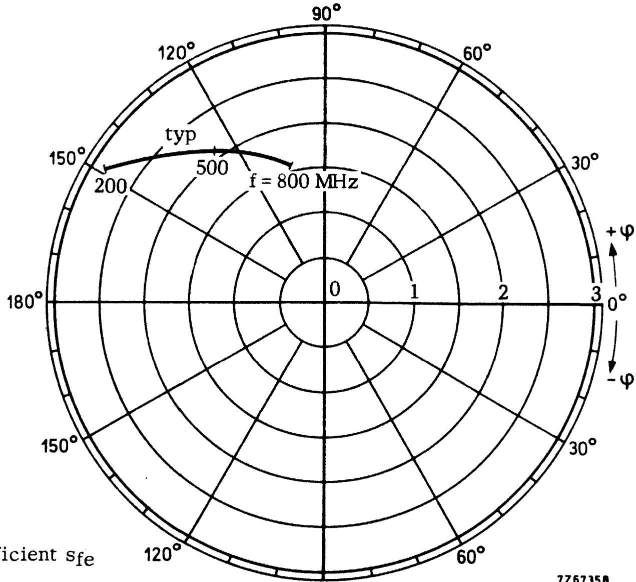
Reverse transmission coefficient s_{re}

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 ^oC



Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 ^oC



Forward transmission coefficient s_{fe}

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a TO-39 metal envelope, with the collector connected to the case. The transistor has extremely good intermodulation properties and a high power gain. It is a ruggedized version of the BFW16, which it succeeds. It is primarily intended for:

- Final and driver stages of channel and band aerial amplifiers with high output power for bands I, II, III and IV/V (40–860 MHz).
- Final stage of the wideband vertical amplifier in high speed oscilloscopes.

QUICK REFERENCE DATA

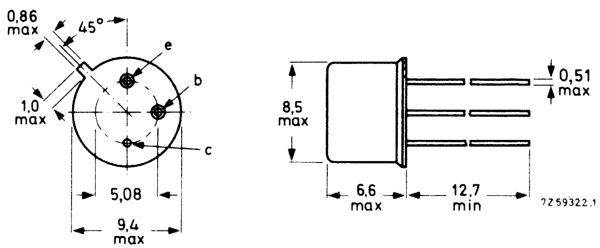
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40		V
Collector-emitter voltage (open base)	V_{CEO}	max.	25		V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300		mA
Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	200		°C
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 15 V	C_{re}	typ.	1,7		pF
Transition frequency I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	f_T	typ.	1,2		GHz
			f = 200	800	MHz
Power gain (not neutralized) I_C = 70 mA; V_{CE} = 18 V	G_p	typ.	16	6,5	dB
Output power d_{im} = −30 dB; VSWR at output < 2; I_C = 70 mA; V_{CE} = 18 V	P_o	typ.	150	90	mW

MECHANICAL DATA

Dimensions in mm

Collector connected to case

Fig. 1 TO-39.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

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

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$) peak value	V_{CERM}	max.	40	V [1]
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V [1]
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V

Currents

Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300	mA

Power dissipation

Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1.5	W

Temperatures

Storage temperature	T_{stg}		-65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

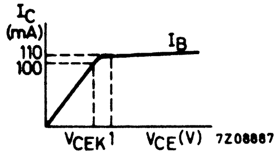
From junction to ambient in free air	$R_{th\ j-a}$	=	250	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	50	°C/W
From mounting base to heatsink mounted with top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb-h}$	=	1.2	°C/W

[1] I_C = 10 mA.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V; T_j = 150 °C	I_{CBO}	<	20	μA
Knee voltage				
I_C = 100 mA; I_B = value for which I_C = 110 mA at V_{CE} = 1 V	V_{CEK}	<	0.75	V



D.C. current gain				
I_C = 50 mA; V_{CE} = 5 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 5 V	h_{FE}	>	25	
Transition frequency				
I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	f_T	typ.	1.2	GHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 15 V	C_c	<	4	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 15 V; T_{amb} = 25 °C	C_{re}	typ.	1.7	pF
Noise figure at f = 200 MHz				
I_C = 30 mA; V_{CE} = 15 V; R_S = 75 Ω; T_{amb} =25 °C	F	<	6	dB

Power gain (not neutralized)		f = 200	800	MHz
I_C = 70 mA; V_{CE} = 18 V; T_{amb} = 25 °C	G_p	typ. 16	6.5	dB

CHARACTERISTICS (continued)

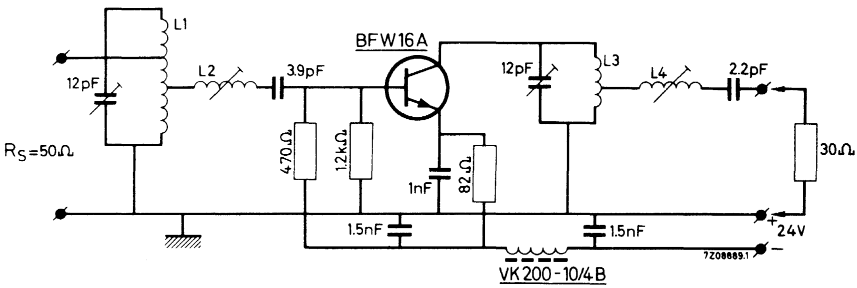
Intermodulation characteristics

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 70 mA; V_{CE} = 18 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9)

P_o	>	130	mW
	typ.	150	mW

Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
   This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

   in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
   This is so if $-C_L = +C_{oe}$,
   in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 220\ \Omega$; $C_L = -5.6$ pF.

C_{oe} is found by 4 pF of the transistor and 1.6 pF by the mounting system concerning of a borium nitride washer between the envelope of the transistor and the chassis. See also page 10, note 1.

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 220 Ω resistor in parallel with a 5.6 pF capacitor between the collector and emitter connections of the output circuit.

2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.

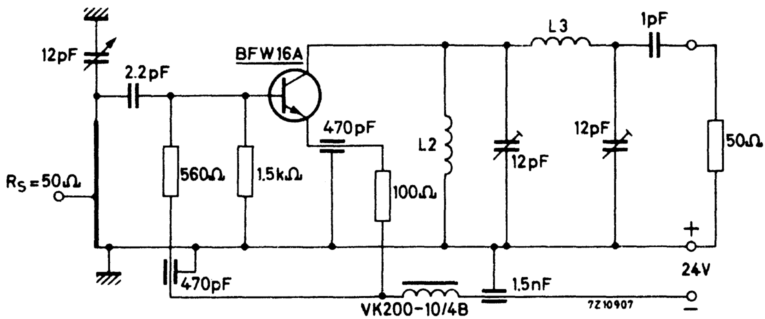
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
   The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
   Corrections can be made by tuning L2; this will not disturb the band pass curve.

CHARACTERISTICS (continued)

Intermodulation characteristics

2. Output power at f = 800 MHz; T_{amb} = 25 °C
   I_C = 70 mA; V_{CE} = 18 V; V.S.W.R. at output < 2
   f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) — P_o > 70 mW, typ. 90 mW

   Test circuit:



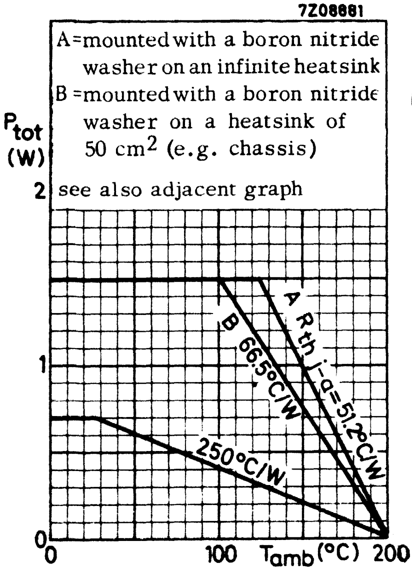
Coil data:
L1 = 25 mm x 7 mm x 0.85 mm silver plated Cu strip
Tap of the input at 5 mm from earth.
L2 = 13 turns enamelled Cu wire (0.6 mm); int. diam. 8 mm
L3 = 1.5 turns Cu wire (1.3 mm); int. diam. 8 mm

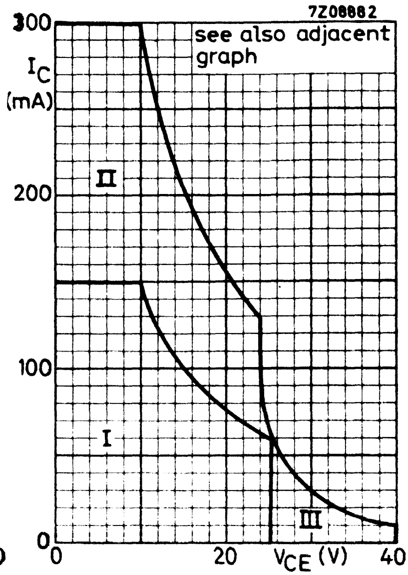
Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C(V_{CE} - V_{CEK})}{2} = 480 \text{ mW}.$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 480 mW.
With this adjusting method care must be taken, that the transistor is not destructed by second breakdown (the voltage swing may not exceed the rated V_{CER} value). Therefore as soon as clipping occurs, the increase of the input signal should be stopped until the clipping has been eliminated. After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve. The V.S.W.R. of the output is then ≤ 2 over the whole channel.

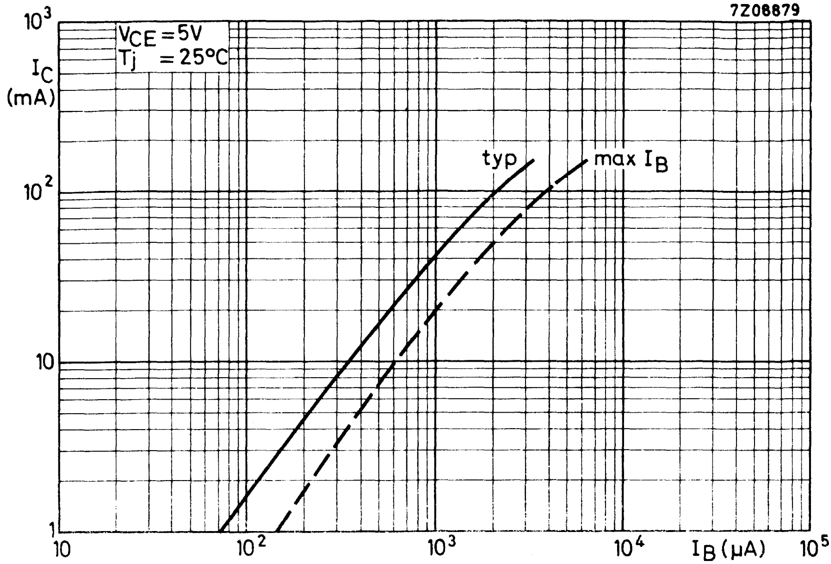


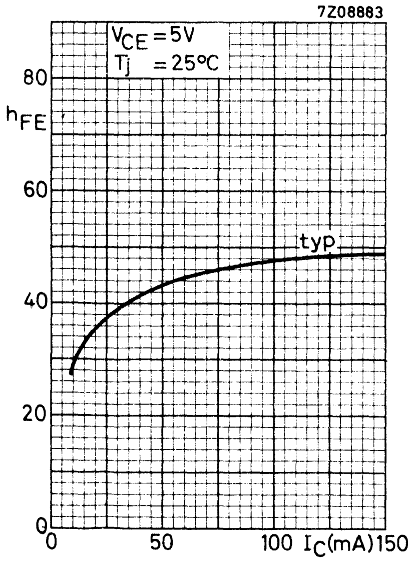


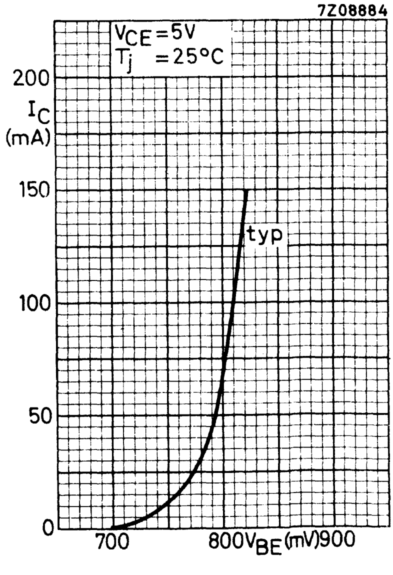
I = Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

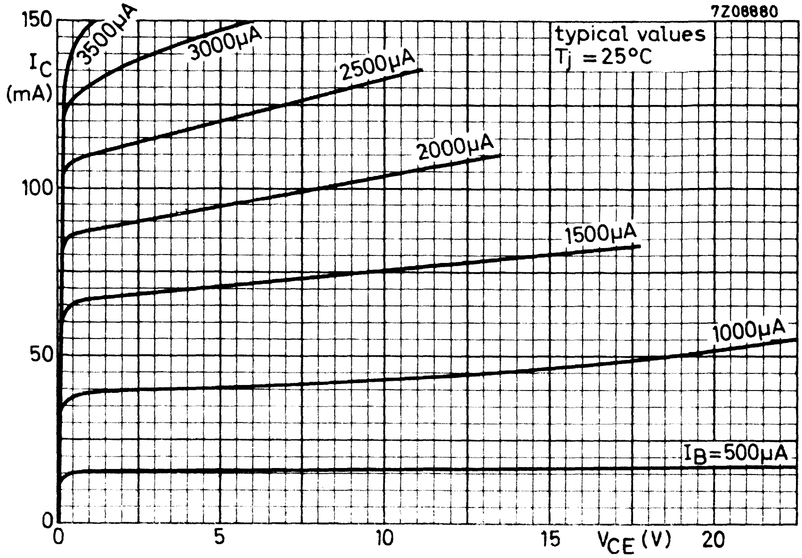
II = Additional region of operation at f ≥ 1 MHz.

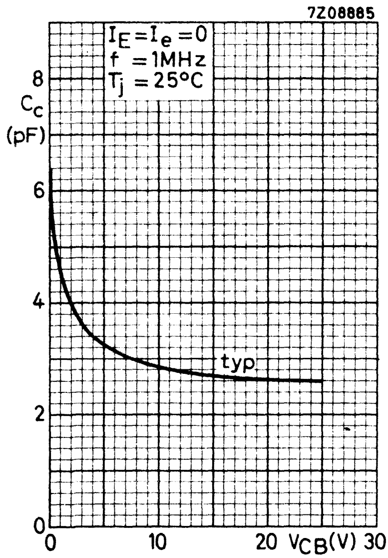
III = Operating under pulsed conditions is allowed, provided the transistor is cut-off with $R_{BE} \leq 50\ \Omega$ and f ≥ 1 MHz.

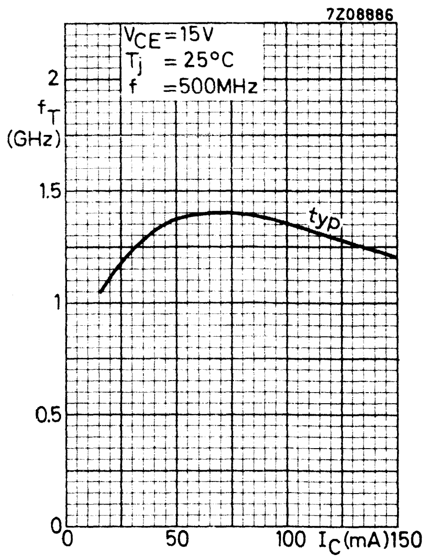

7Z08879
V_{CE} = 5V
T_j = 25°C
I_C (mA)
typ
max I_B
I_B (μA)


7Z08883
V_{CE} = 5V
T_j = 25°C
h_{FE}
typ
I_C (mA)


7Z08884
V_{CE} = 5V
T_j = 25°C
I_C (mA)
typ
V_{BE} (mV)


7Z08880
typical values
Tj = 25°C
IC
(mA)
150
100
50
0
3500μA
3000μA
2500μA
2000μA
1500μA
1000μA
IB=500μA
0
5
10
15
VCE (V)
20


7Z08885
IE=Ie=0
f = 1MHz
Tj = 25°C
Cc
(pF)
8
6
4
2
0
typ
0
10
20
VCB(V)
30


7Z08886
VCE=15V
Tj = 25°C
f = 500MHz
fT
(GHz)
2
1.5
1
0.5
0
typ
0
50
100
IC(mA)
150

APPLICATION INFORMATION

Performance of channel- and band amplifiers 1)

Frequency range	channel 4 61-68	channel 9 202-209	channel 55 742-750	band I 47-68	band II 87.5-108	band III 174-230	MHz
Transistor used in							
final stage	BFW16A	BFW16A	BFW16A	BFW16A	BFW16A	BFW16A	
driver stage		BFW16A	BFW16A			BFW16A	
second stage			BFY90				
first stage	BFY90	BFY90	BFY90	BFY90	BFY90	BFY90	
Output power at							
$d_{im} = -30$ dB	150 2)	150 2)	100				mW
$d_{im} = -50$ dB					30		mW
$d_{im} = -60$ dB				10		10	mW
Power gain	50	44	26.5	51	43	39	dB
Noise figure	7	6	8	6.0-6.5	6.5	6.5	dB
V.S.W.R. over the whole channel or band							
for the input	< 2	< 2	< 2	< 2	< 2	< 2	
for the output	< 2	< 2	< 2	< 2	< 2	< 2	
Load impedance	30	30	50	30	30	30	Ω
Source impedance	60	60	50	60	60	60	Ω

1) Application information bulletins of all these amplifiers and a study of intermodulation are available on request.

2) $V_o = 2.2$ V over $R_L = 30\ \Omega$ or
$V_o = 3$ V over $R_L = 60\ \Omega$.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a TO-39 metal envelope, with the collector connected to the case. The transistor has extremely good intermodulation properties and a high power gain. It is a ruggedized version of the BFW17, which it succeeds. It is primarily intended for final and driver stages of channel and band aerial amplifiers with high output power for bands I, II and III (40–230 MHz).

QUICK REFERENCE DATA

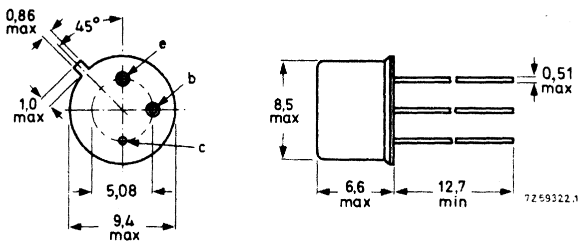
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300	mA
Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	200	°C
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 15 V	C_{re}	typ.	1,7	pF
Transition frequency I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	f_T	typ.	1,1	GHz
Power gain (not neutralized) I_C = 70 mA; V_{CE} = 18 V; f = 200 MHz	G_p	typ.	16	dB
Output power d_{im} = −30 dB; VSWR at output < 2; I_C = 70 mA; V_{CE} = 18 V	P_o	typ.	150	mW

MECHANICAL DATA

Dimensions in mm

Collector connected to case

Fig. 1 TO-39.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

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

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V	
Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$) peak value	V_{CERM}	max.	40	V	[1]
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V	[1]
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V	

Currents

Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300	mA

Power dissipation

Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1.5	W

Temperatures

Storage temperature	T_{stg}		-65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	250	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	50	°C/W
From mounting base to heatsink mounted with top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$	=	1.2	°C/W

[1] I_C = 10 mA.

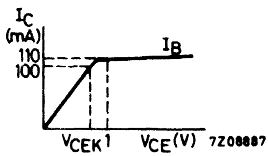
CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current

$I_E = 0$; $V_{CB} = 20$ V; $T_j = 150$ °C	I_{CBO}	<	20	μA

Knee voltage

$I_C = 100$ mA; I_B = value for which $I_C = 110$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain

$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 150$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	

Transition frequency

$I_C = 150$ mA; $V_{CE} = 15$ V; f = 500 MHz	f_T	typ.	1.1	GHz

Collector capacitance at f = 1 MHz

$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	<	4	pF

Feedback capacitance at f = 1 MHz

$I_C = 10$ mA; $V_{CE} = 15$ V; $T_{amb} = 25$ °C	C_{re}	typ.	1.7	pF

Power gain (not neutralized)

$I_C = 70$ mA; $V_{CE} = 18$ V; f = 200 MHz; $T_{amb} = 25$ °C	G_p	typ.	16	dB

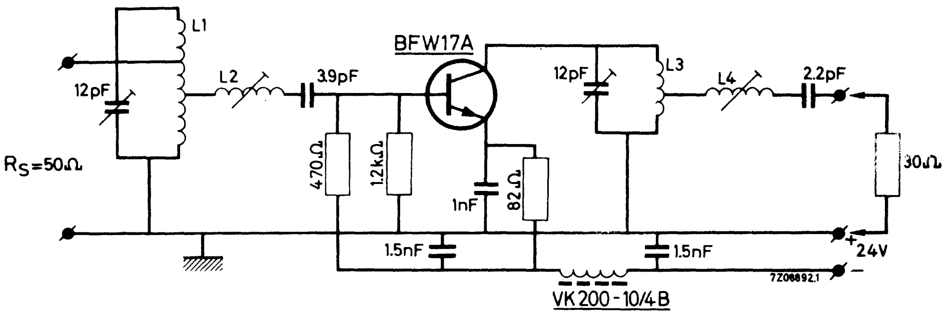
CHARACTERISTICS (continued)

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{amb} = 25 °C

   I_C = 70 mA; V_{CE} = 18 V; V.S.W.R. at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) | P_o | typ. 150 | mW

   Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
   This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C}$$

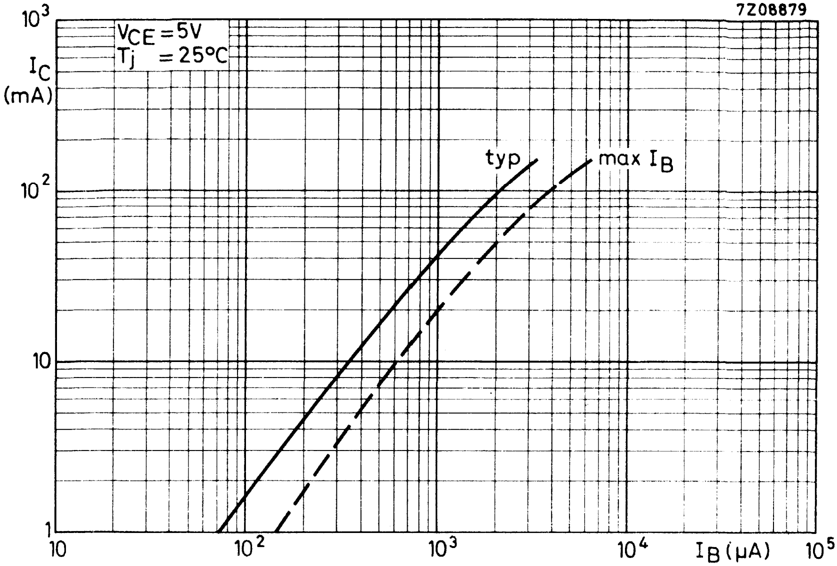
   in which V_{CEK} is the high frequency knee voltage.

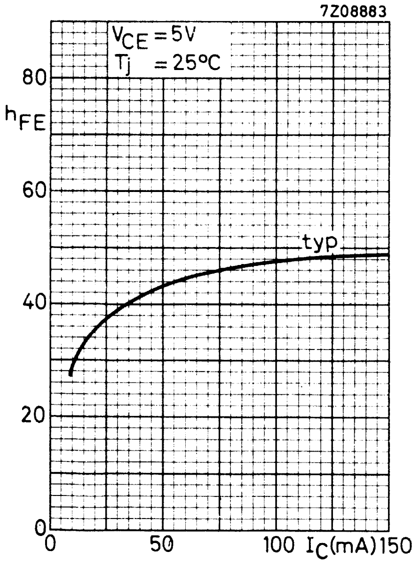
b. The h.f. collector current is as small as possible.
   This is so if $-C_L = +C_{oe}$,
   in which C_{oe} is the output capacitance of the transistor at short circuited input.

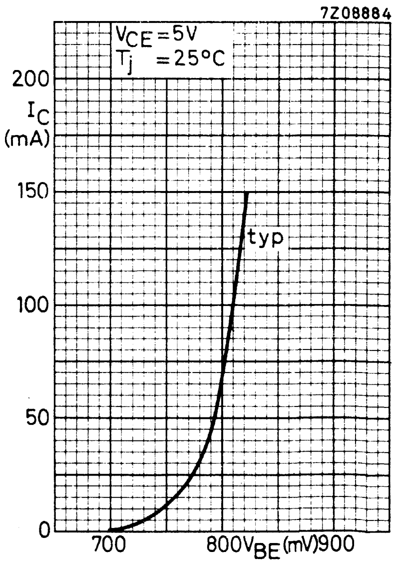
For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 220\ \Omega$; $C_L = -5.6$ pF.
C_{oe} is found by 4 pF of the transistor and 1.6 pF by the mounting system concerning of a borium nitride washer between the envelope of the transistor and the chassis.

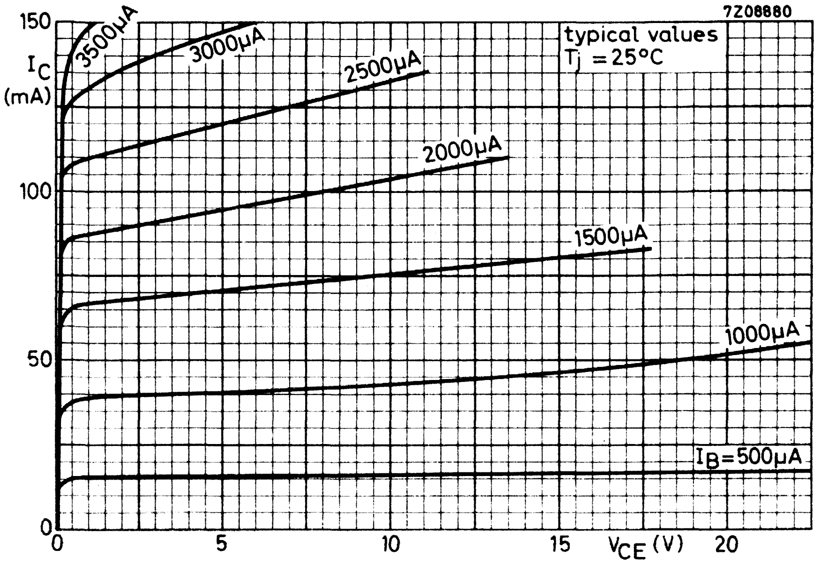
Adjustment procedure

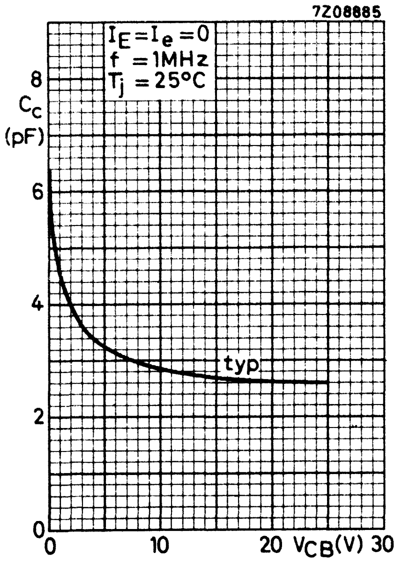
1. Remove the transistor and connect a dummy consisting of a 220 Ω resistor in parallel with a 5.6 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
   The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
   Corrections can be made by tuning L2; this will not disturb the band pass curve.

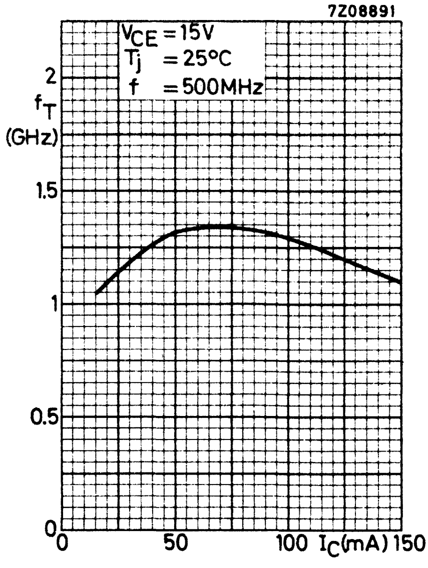

7Z08879
10^3
I_C (mA)
$V_{CE} = 5V$
$T_j = 25°C$
typ
max I_B
10^2
10
1
10
10^2
10^3
10^4
I_B (μA)
10^5

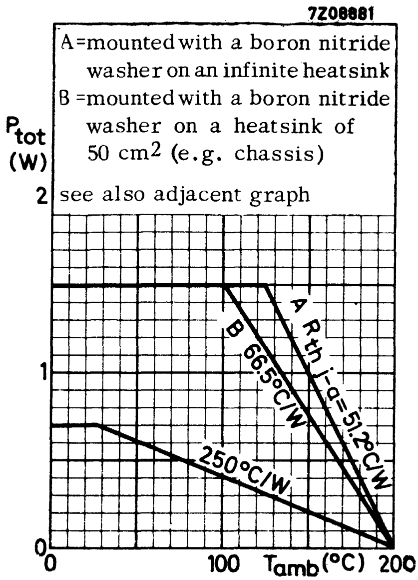

7Z08883
$V_{CE} = 5V$
$T_j = 25°C$
80
h_{FE}
60
typ
40
20
0
0
50
100
I_C (mA)
150

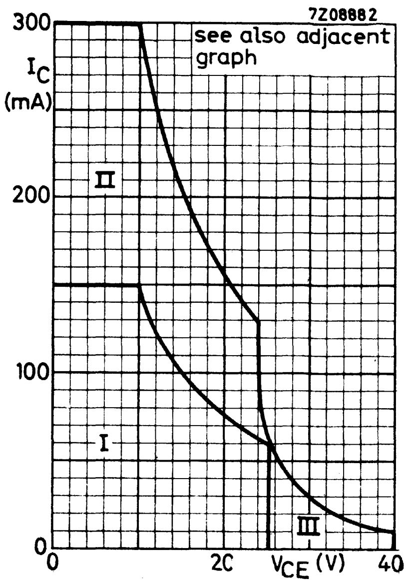

7Z08884
$V_{CE} = 5V$
$T_j = 25°C$
200
I_C (mA)
150
typ
100
50
0
700
800
V_{BE} (mV)
900


7Z08880
typical values
T_j = 25°C
I_C (mA)
150
100
50
0
3500μA
3000μA
2500μA
2000μA
1500μA
1000μA
I_B=500μA
0
5
10
15
V_{CE} (V)
20


7Z08885
$I_E = I_e = 0$
f = 1MHz
T_j = 25°C
C_c (pF)
8
6
4
2
0
typ
0
10
20
V_{CB}(V)
30


7Z08891
V_{CE} = 15V
T_j = 25°C
f = 500MHz
f_T (GHz)
2
1.5
1
0.5
0
0
50
100
I_C(mA)
150





I = Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

II = Additional region of operation at f ≥ 1 MHz

III = Operating under pulsed conditions is allowed, provided the transistor is cut-off with $R_{BE} \leq 50\ \Omega$ and f ≥ 1 MHz.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a TO-72 metal envelope, with insulated electrodes and a shield lead connected to the case. The transistor has very low intermodulation distortion and very high power gain. It is primarily intended for:
- Wideband vertical amplifiers in high speed oscilloscopes.
- Wideband aerial amplifiers (40–860 MHz).
- Television distribution amplifiers.

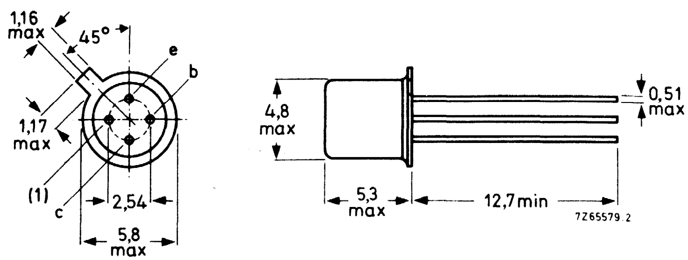
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	200	°C
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V	C_{re}	typ.	0,8	pF
Transition frequency I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1,6	GHz
Power gain (not neutralized)			f = 200 | 800	MHz
I_C = 30 mA; V_{CE} = 5 V	G_p	typ.	21 | 7,5	dB
Intermodulation distortion I_C = 30 mA; V_{CE} = 6 V; R_L = 37,5 Ω; V_o = 100 mV at f_p = 183 MHz; V_o = 100 mV at f_q = 200 MHz; measured at $f_{(2q-p)}$ = 217 MHz	d_{im}	typ.	−60	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (distance disc).

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

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	20	V
Collector-emitter voltage (open base)				
I_C = 10 mA	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V

Currents

Collector current (d.c.)	I_C	max.	50	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA

Power dissipation

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW

Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	0.7	°C/mW
From junction to case	$R_{th\ j-c}$	=	0.5	°C/mW

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current

$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA

D.C. current gain

$I_C = 25$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	

Transition frequency [1]

$I_C = 50$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1.6	GHz

Collector capacitance at f = 1 MHz [2]

$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	<	1.5	pF

Feedback capacitance at f = 1 MHz [1]

$I_C = 2$ mA; $V_{CE} = 5$ V	C_{re}	typ.	0.8	pF

Noise figure [1]

$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz; $R_S = 50\ \Omega$	F	<	5	dB

Power gain (not neutralized) [1]

$I_C = 30$ mA; $V_{CE} = 5$ V; $T_{amb} = 25\ ^oC$

	f = 200	800	MHz
G_p	> 19		dB
	typ. 21	7.5	dB

Intermodulation distortion [1]

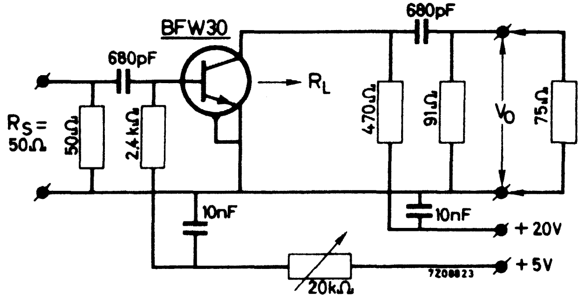
$I_C = 30$ mA; $V_{CE} = 6$ V; $R_L = 37.5\ \Omega$; $T_{amb} = 25\ ^oC$

$V_o = 100$ mV at $f_p = 183$ MHz

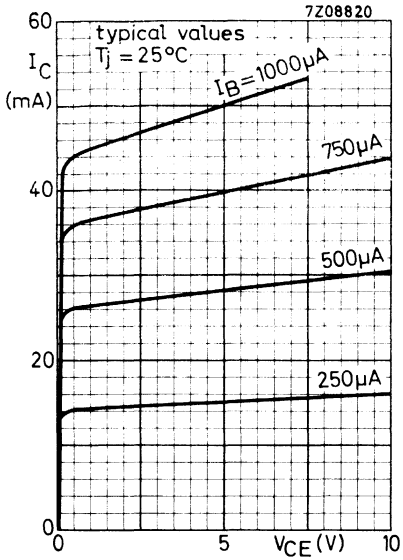
$V_o = 100$ mV at $f_q = 200$ MHz

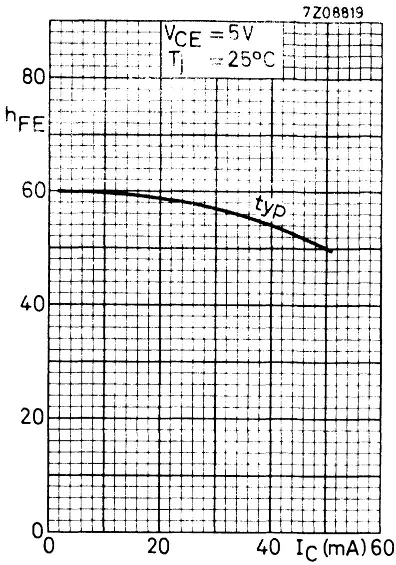
measured at $f_{(2q-p)} = 217$ MHz d_{im} typ. −60 dB

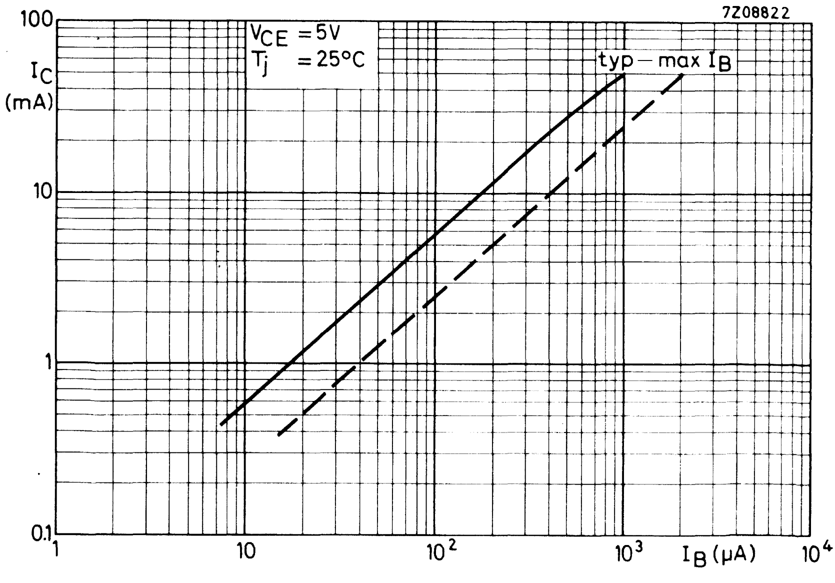
Test circuit

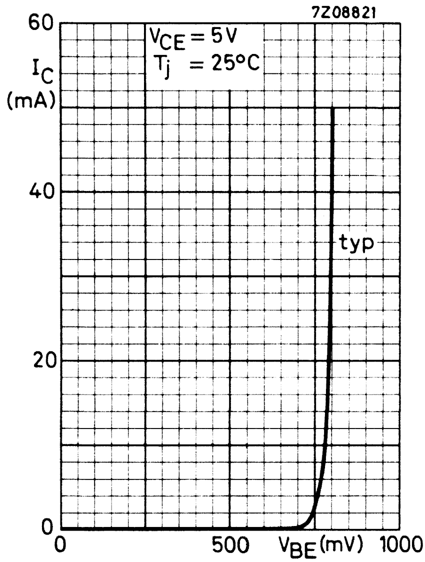


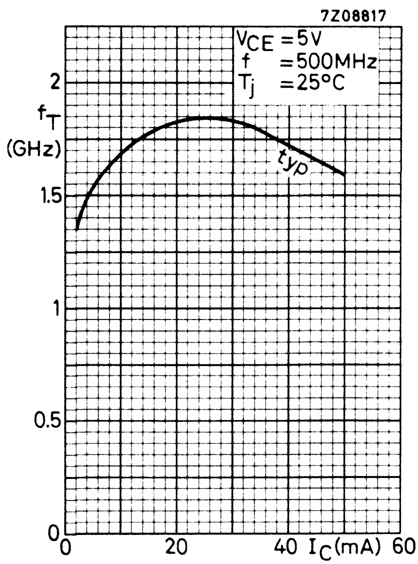
1) Shield lead grounded.
2) Shield lead not connected.

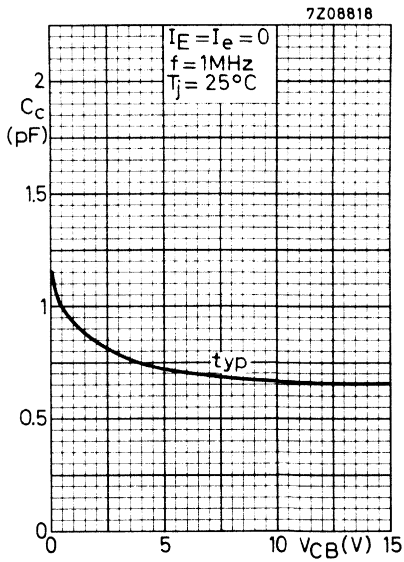

7Z08820
typical values
Tj = 25°C
IB = 1000µA
750µA
500µA
250µA
IC
(mA)
60
40
20
0
0
5
VCE (V)
10


7Z08819
VCE = 5V
Tj = 25°C
hFE
80
60
40
20
0
typ
0
20
40
IC (mA) 60


7Z08822
VCE = 5V
Tj = 25°C
typ — max IB
IC
(mA)
100
10
1
0.1
1
10
10²
10³
IB (µA)
10⁴


7Z08821
60
I_C
(mA)
$V_{CE} = 5V$
$T_j = 25°C$
40
typ
20
0
0
500
V_{BE}(mV)
1000


7Z08817
$V_{CE} = 5V$
f = 500MHz
$T_j = 25°C$
2
f_T
(GHz)
typ
1.5
1
0.5
0
0
20
40
I_C(mA)
60


7Z08818
$I_E = I_e = 0$
f = 1MHz
$T_j = 25°C$
2
C_c
(pF)
1.5
1
typ
0.5
0
0
5
10
V_{CB}(V)
15

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic T-package. It has a low noise over a wide current range, a very high power gain and good intermodulation properties.
It is primarily intended for:
- Wideband aerial amplifiers (40 - 860 MHz)
- Channel and band aerial amplifiers for band I, II, III and IV/V (40 - 860 MHz)
- Television distribution amplifiers
- Low noise wideband vertical amplifier in high speed oscilloscopes

QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	25		V
Collector-emitter voltage (open base)	V_{CEO}	max.	15		V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50		mA
Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 500 MHz I_C = 25 mA; V_{CE} = 5 V	f_T	typ.	1,6		GHz
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V	C_{re}	typ.	0,6		pF
Noise figure at f = 500 MHz I_C = 2 mA; V_{CE} = 5 V	F	typ.	4		dB
		f =	200	800	MHz
Power gain (not neutralized) I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	G_p	typ.	23	11	dB
Output power at d_{im} = −30 dB VSWR at output < 2; I_C = 10 mA; V_{CE} = 10 V	P_o	typ.	8	8	mW

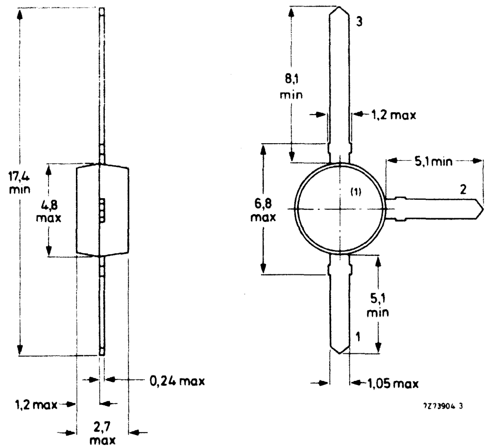
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

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

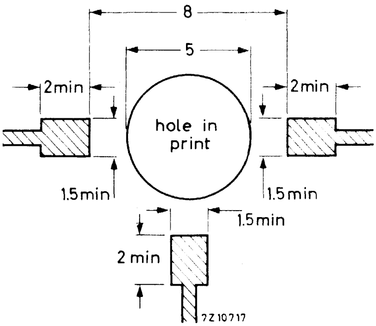
Voltages				
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V [1]
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V
Currents				
Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50	mA
Power dissipation				
Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190	mW
Temperatures				
Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm — $R_{th\ j\text{-}a}$ = 0.4 °C/mW

*) Requirements for glass-fibre print

(dimensions in mm)

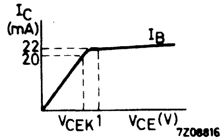


1) At I_C = 10 mA

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA
Knee voltage [1]				
$I_C = 20$ mA; I_B = value for which				
$I_C = 22$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain				
$I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}	> / <	20 / 150	
$I_C = 25$ mA; $V_{CE} = 1$ V [1]	h_{FE}	>	20	
Transition frequency at f = 500 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V	f_T	typ.	1.0	GHz
$I_C = 25$ mA; $V_{CE} = 5$ V [1]	f_T	typ.	1.6	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0.7	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	typ.	1.5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0.6	pF
Noise figure at f = 500 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 50\ \Omega$; $T_{amb} = 25$ °C	F	typ.	4.0	dB

			f = 200	800	MHz
Power gain (not neutralized)					
$I_C = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	G_p	typ.	23	11	dB

[1] Measured under pulse conditions.

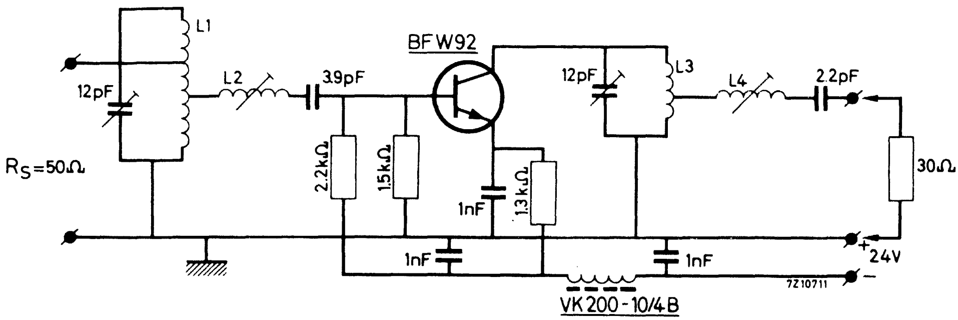
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 10 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) P_o typ. 8 mW

Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
R_L = 820 Ω; C_L = −1.0 pF

Adjustment procedure

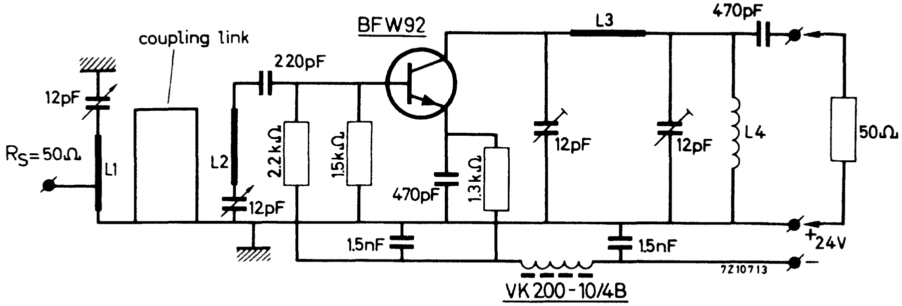
1. Remove the transistor and connect a dummy consisting of a 820 Ω resistor in parallel with a 1.0 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
Corrections can be made by tuning L2; this will not disturb the band pass curve.

CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics

2. Output power at f = 800 MHz; T_{amb} = 25 °C

I_C = 10 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o typ. 8 mW



Coil data:
L1 = 24 mm x 6 mm x 0.5 mm silver plated Cu strip.
Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated Cu strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated Cu strip.
L4 = 4 turns enamelled Cu wire (0.5mm); winding pitch 1.5mm; int. diam. 4mm
Coupling link: 42 mm silver plated Cu wire (1 mm).

Basis of adjustment.

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C (V_{CE} - V_{CEK})}{2} = 40 \text{ mW}$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 40 mW.
After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output is then ≤ 2 over the whole channel.

CHARACTERISTICS (continued)

Intermodulation characteristics

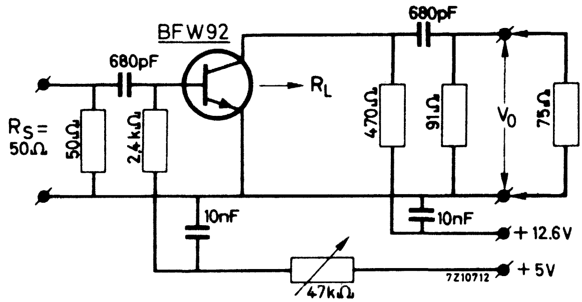
3. Intermodulation distortion

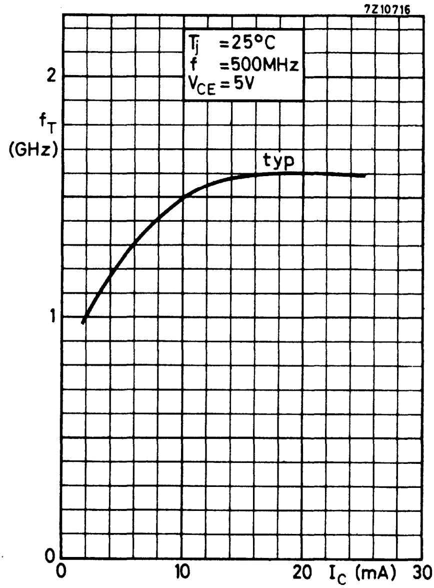
I_C = 10 mA; V_{CE} = 6 V; R_L = 37.5Ω; T_{amb} = 25 °C

V_0 = 100 mV at f_p = 183 MHz

V_0 = 100 mV at f_q = 200 MHz
measured at $f_{(2q-p)}$ = 217 MHz d_{im} typ. −45 dB

Test circuit:




7Z10716
T_j = 25°C
f = 500MHz
V_{CE} = 5V
f_T
(GHz)
2
1
0
typ
0
10
20
I_C (mA)
30

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
The device is intended for use in v.h.f. - u.h.f. applications, primarily wideband aerial amplifiers 40 - 800 MHz.
It is intended for mounting on miniature printed-circuit boards.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	18	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA
Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190	mW
Junction temperature	T_j	max.	150	°C
Feedback capacitance at f = 1 MHz				
I_C = 2 mA; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,6	pF
Transition frequency at f = 500 MHz				
I_C = 50 mA; V_{CE} = 5 V	f_T	typ.	1,7	GHz
Max. unilateral power gain (see page 3)				
I_C = 30 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	typ.	22	dB
I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	10,5	dB
Intermodulation distortion at T_{amb} = 25 °C				
I_C = 30 mA; V_{CE} = 5 V; R_L = 37,5 Ω				
V_O = 100 mV at f_p = 183 MHz				
V_O = 100 mV at f_q = 200 MHz				
measured at $f_{(2q-p)}$ = 217 MHz	d_{im}	typ.	−60	dB

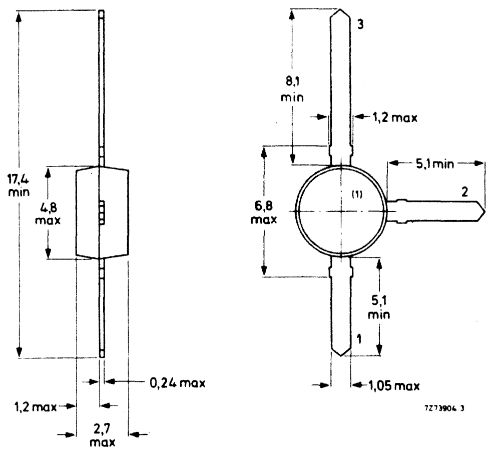
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	18	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V

Currents

Collector current (d.c.)	I_C	max.	50	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA

Power dissipation

Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190	mW

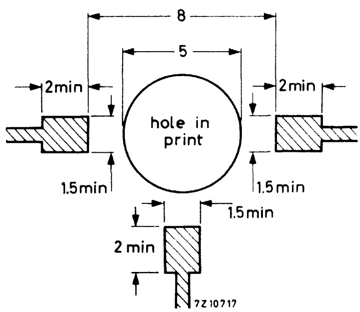
Temperatures

Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a glass-fibre print of 40 mm x 25 mm x 1 mm	$R_{th\ j-a}$	=	0.4	°C/mW

Requirements for glass-fibre print (dimensions in mm)



CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA
D.C. current gain [1]				
$I_C = 25$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Transition frequency at f = 500 MHz [1]				
$I_C = 50$ mA; $V_{CE} = 5$ V	f_T	typ.	1.7	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0.7	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	typ.	1.5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0.6	pF
Noise figure at f = 500 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $G_S = 20$ mA/V; B_S is tuned; $T_{amb} = 25$ °C	F	<	5	dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 5$ V; f = 200 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	22	dB
$I_C = 30$ mA; $V_{CE} = 5$ V; f = 800 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	10.5	dB

1) Measured under pulse conditions.

CHARACTERISTICS (continued)

Intermodulation distortion at $T_{amb} = 25\ ^{o}C$

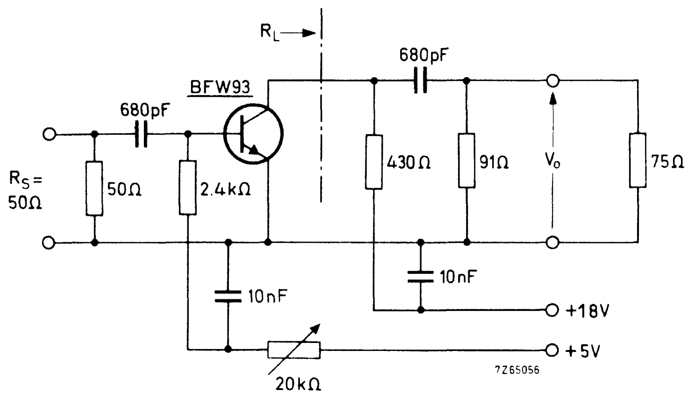
$I_C = 30$ mA; $V_{CE} = 5$ V; $R_L = 37.5\ \Omega$

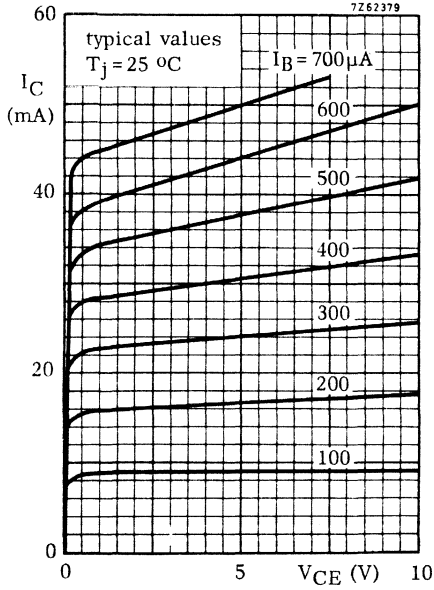
$V_o = 100$ mV at $f_p = 183$ MHz

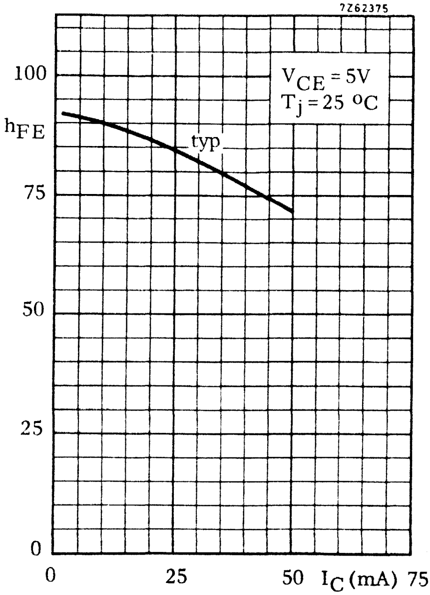
$V_o = 100$ mV at $f_q = 200$ MHz

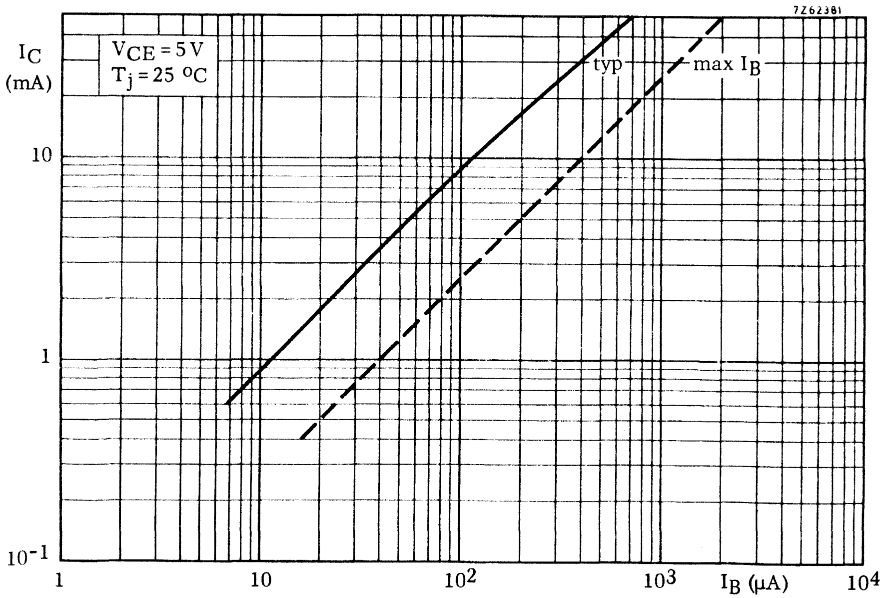
measured at $f_{(2q-p)} = 217$ MHz $\quad d_{im} \quad$ typ. -60 dB

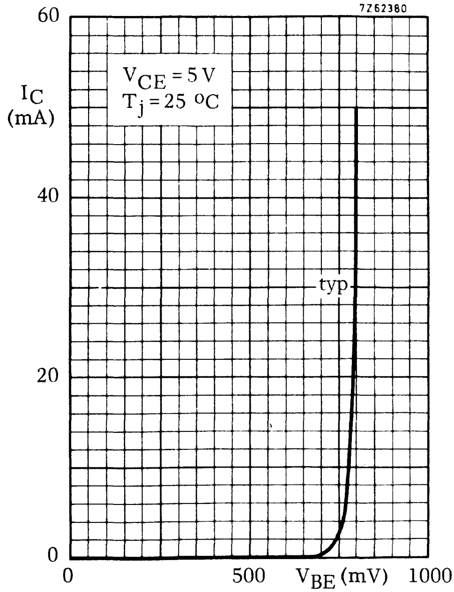
Test circuit:

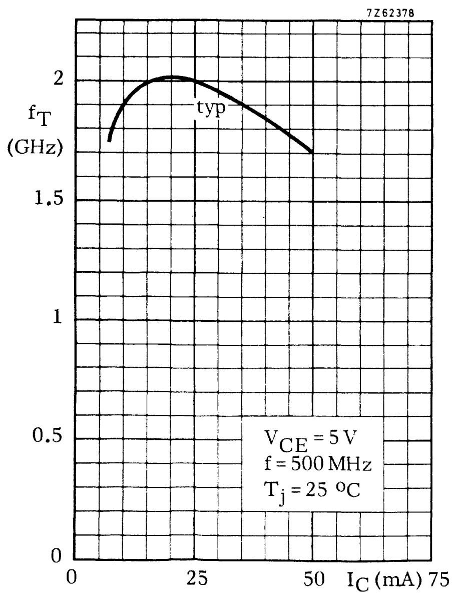


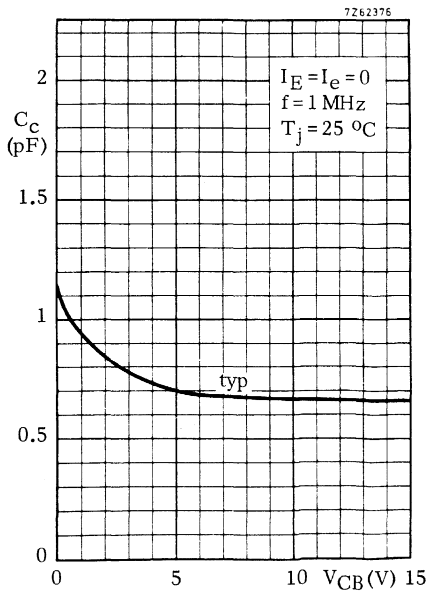

7Z62379
typical values
Tj = 25 oC
IB = 700μA
600
500
400
300
200
100
IC
(mA)
60
40
20
0
0
5
VCE (V)
10


7Z62375
VCE = 5V
Tj = 25 oC
hFE
typ
100
75
50
25
0
0
25
50
IC (mA)
75

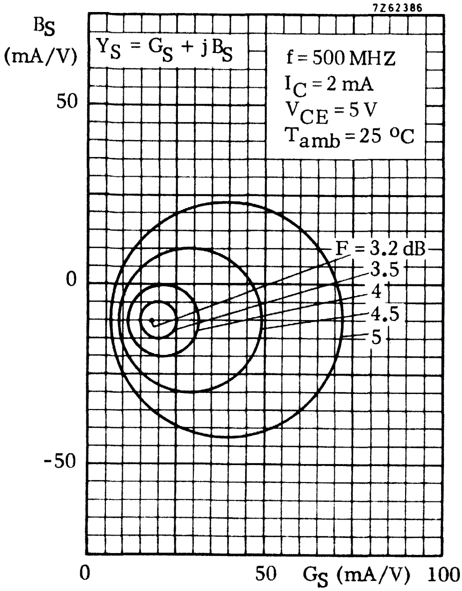

7Z62381
VCE = 5 V
Tj = 25 oC
IC
(mA)
typ
max IB
10
1
10-1
1
10
102
103
IB (μA)
104

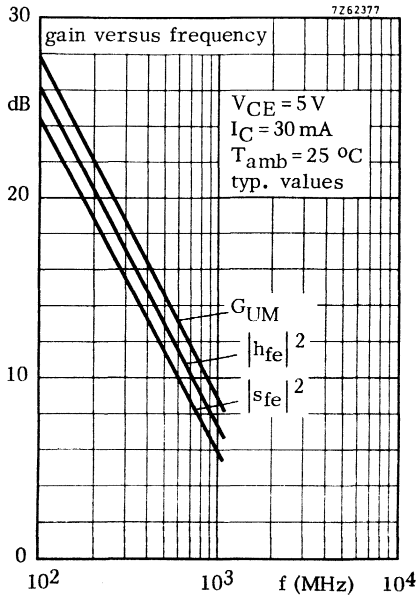

7Z62380
60
40
20
0
I_C
(mA)
V_{CE} = 5 V
T_j = 25 °C
typ
0
500
V_{BE} (mV)
1000

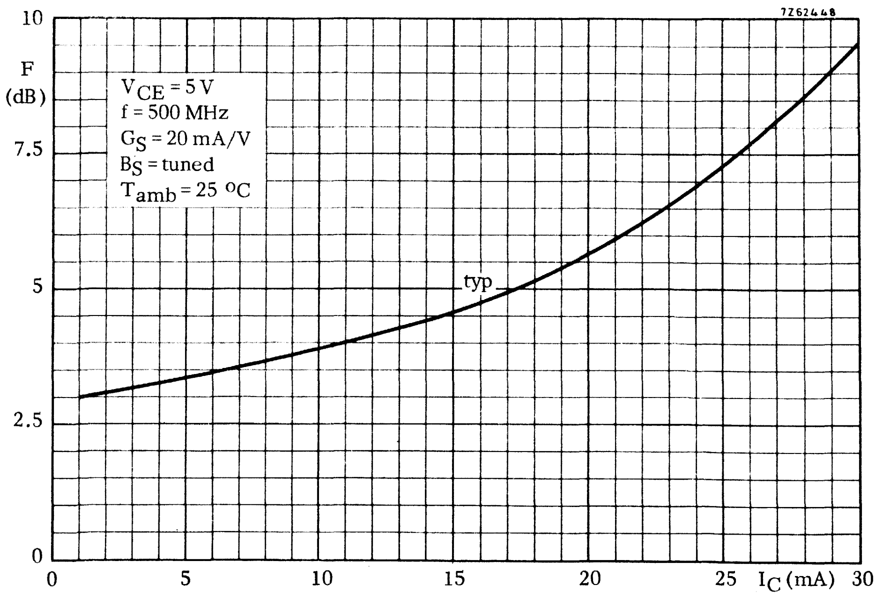

7Z62378
2
1.5
1
0.5
0
f_T
(GHz)
typ
V_{CE} = 5 V
f = 500 MHz
T_j = 25 °C
0
25
50
I_C (mA) 75


7Z62376
2
1.5
1
0.5
0
C_c
(pF)
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
typ
0
5
10
V_{CB} (V) 15

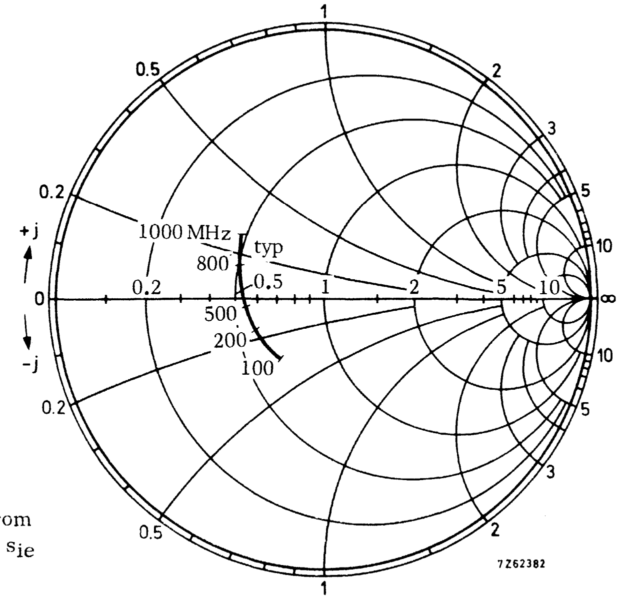
circles of constant noise figure





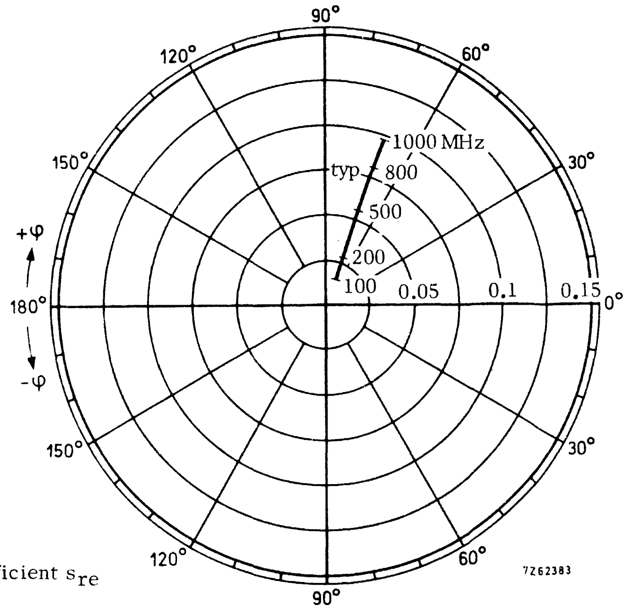


V_{CE} = 5 V
I_C = 30 mA
T_{amb} = 25 °C



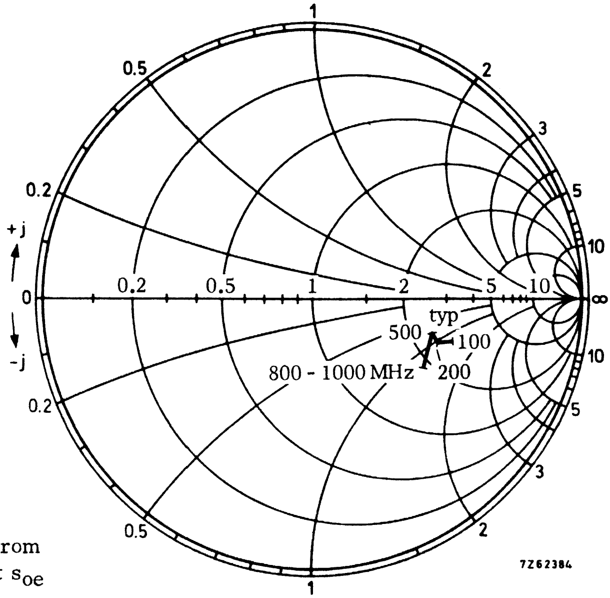
Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50

V_{CE} = 5 V
I_C = 30 mA
T_{amb} = 25 °C



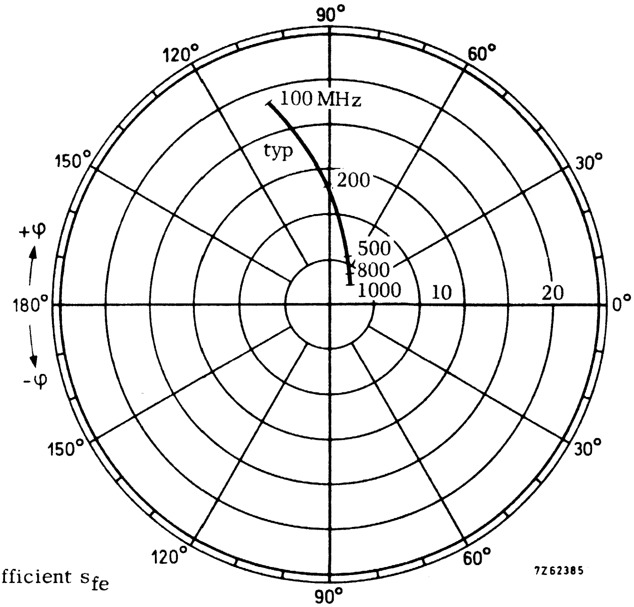
Reverse transmission coefficient s_{re}

V_{CE} = 5 V
I_C = 30 mA
T_{amb} = 25 °C



Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50

V_{CE} = 5 V
I_C = 30 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope, with insulated electrodes and a shield lead connected to the case. The transistor has a low noise, a very high power gain and good intermodulation properties. It is primarily intended for:

- Channel aerial amplifiers for bands I, II, III and IV/V (40–860 MHz).
- Wideband aerial amplifiers (40–860 MHz).

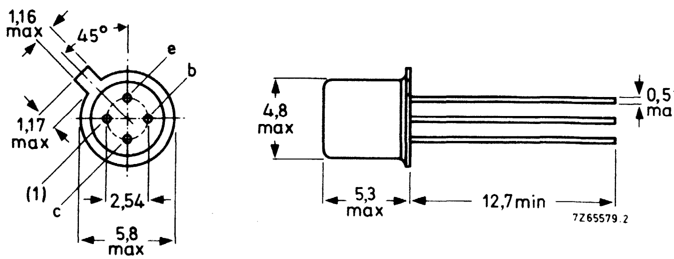
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.		30	V
Collector-emitter voltage (open base)	V_{CEO}	max.		15	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.		50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		200	mW
Junction temperature	T_j	max.		200	°C
Transition frequency I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.		1,2	GHz
Feedback capacitance I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz	C_{re}	typ.		0,6	pF
			f = 200	800	MHz
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V	F	typ.	3,3	7	dB
Power gain (not neutralized) I_C = 8 mA; V_{CE} = 10 V	G_p	typ.	22	7	dB
Output power d_{im} = −30 dB; VSWR at output < 2; I_C = 8 mA; V_{CE} = 10 V	P_o	typ.	6	6	mW

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (distance disc).

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

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	30	V
Collector-emitter voltage (peak value) $R_{BE} \leq 50\ \Omega$	V_{CERM}	max.	30	V [1])
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V [1])
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V

Currents

Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50	mA

Power dissipation

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0.88	°C/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0.58	°C/mW

[1]) I_C = 10 mA.

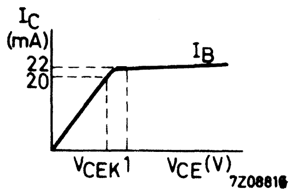
CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current

$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	10	nA

Knee voltage

$I_C = 20$ mA; I_B = value for which $I_C = 22$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain

$I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}	20 to 150	
$I_C = 25$ mA; $V_{CE} = 1$ V	h_{FE}	20 to 125	

Transition frequency [1]

$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1.0	GHz
$I_C = 25$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1.2	GHz

Collector capacitance at f = 1 MHz [2]

$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	<	1.7	pF

Feedback capacitance at f = 1 MHz [1]

$I_C = 2$ mA; $V_{CE} = 5$ V	C_{re}	typ.	0.6	pF

Noise figure [1]

$I_C = 2$ mA; $V_{CE} = 5$ V

f = 200 MHz; optimum source impedance	F	<	4	dB
f = 500 MHz; $R_S = 50\ \Omega$	F	<	6.5	dB
f = 800 MHz; optimum source impedance	F	typ.	7.0	dB

Power gain (not neutralized) [1]

			f = 200	800	MHz
$I_C = 8$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	G_p	>	19	–	dB
		typ.	22	7	dB

[1]) Shield lead grounded.
[2]) Shield lead not connected.

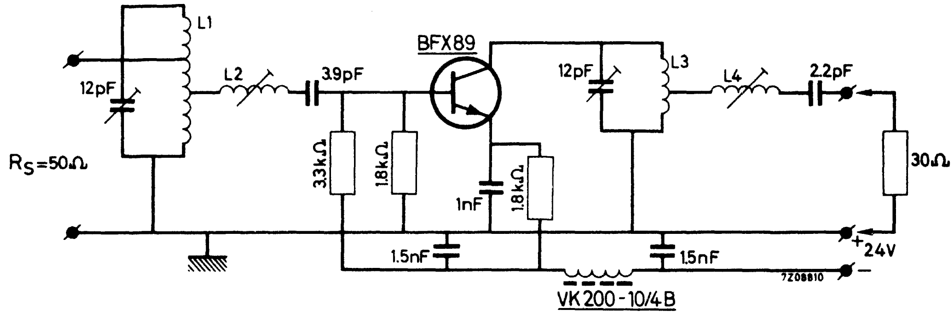
CHARACTERISTICS (continued)

Intermodulation characteristics [1]

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 8 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) — P_o typ. 6 mW

Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm) winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm) winding pitch 2.2 mm; int. diam. 11 mm.

[1]) Shield lead grounded.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of –30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
   This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

   in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
   This is so if $-C_L = +C_{oe}$,
   in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of –30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 1\ k\Omega$; $C_L = -1.8$ pF

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 1 kΩ resistor in parallel with a 1.8 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
   The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
   Corrections can be made by tuning L2; this will not disturb the band pass curve.

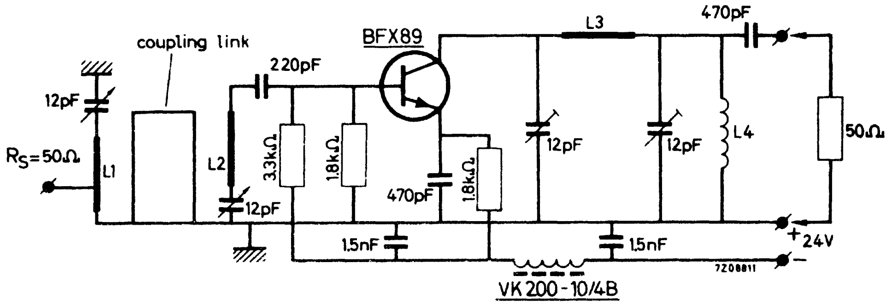
CHARACTERISTICS (continued)

Intermodulation characteristics [1])

2. Output power at f = 800 MHz; T_{amb} = 25 °C

I_C = 8 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o typ. 6 mW

Test circuit:



Coil data:

L1 = 24 mm x 6 mm x 0.5 mm silver plated Cu strip.
Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated Cu strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated Cu strip.
L4 = 4 turns enamelled Cu wire (0.5 mm); winding pitch 1.5 mm;
int. diam. 4 mm.
Coupling link: 42 mm silver plated Cu wire (1 mm).

Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C\,(V_{CE} - V_{CEK})}{2} = 35 \text{ mW}$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 35 mW.
After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output is then ≤ 2 over the whole channel.

[1]) Shield lead grounded

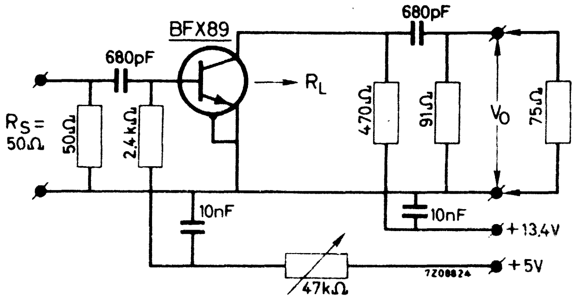
CHARACTERISTICS (continued)

Intermodulation characteristics [1])

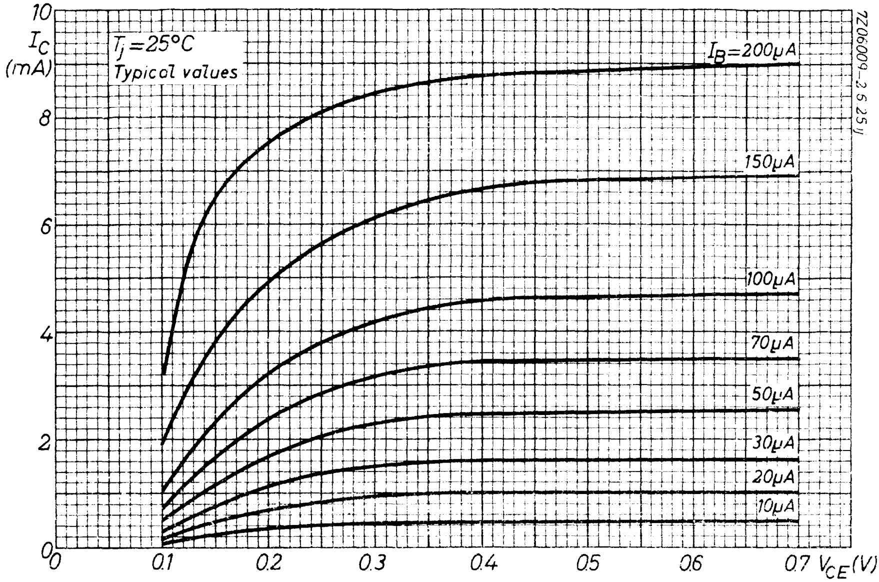
3. Intermodulation distortion

I_C = 8 mA; V_{CE} = 6 V; R_L = 37.5 Ω; T_{amb} = 25 °C
V_o = 100 mV at f_p = 183 MHz
V_o = 100 mV at f_q = 200 MHz
measured at $f_{(2q-p)}$ = 217 MHz $\qquad d_{im}$ typ. −40 dB

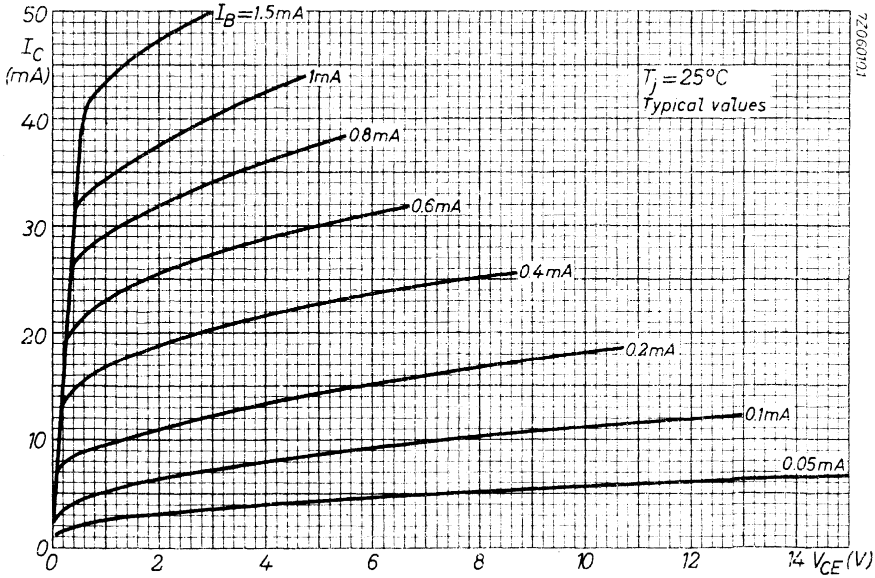
Test circuit:



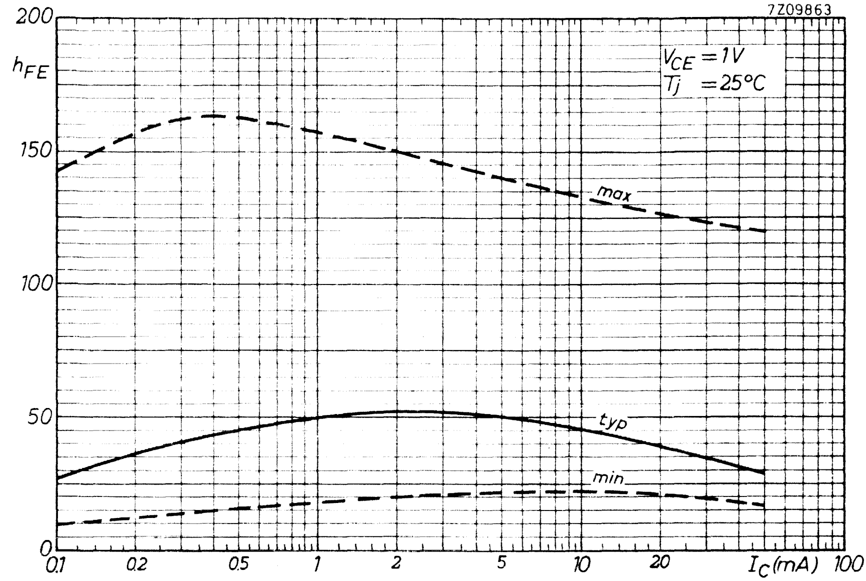
[1]) Shield lead grounded.

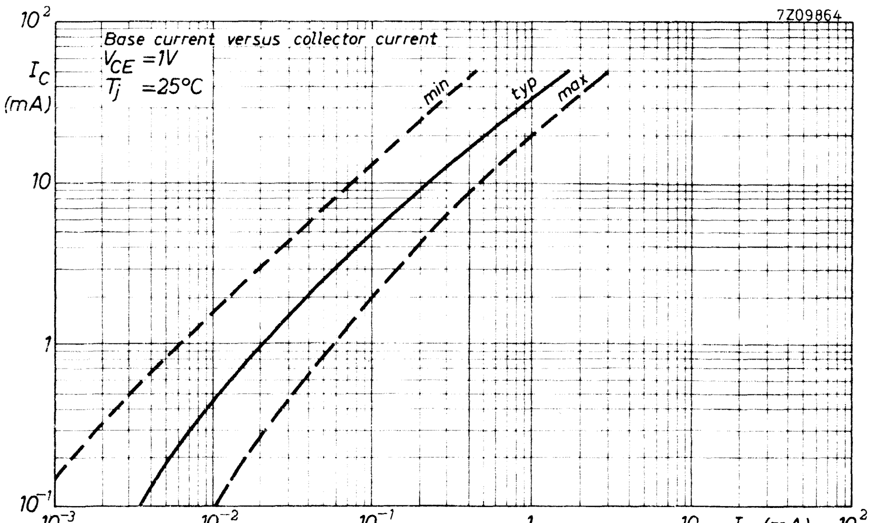


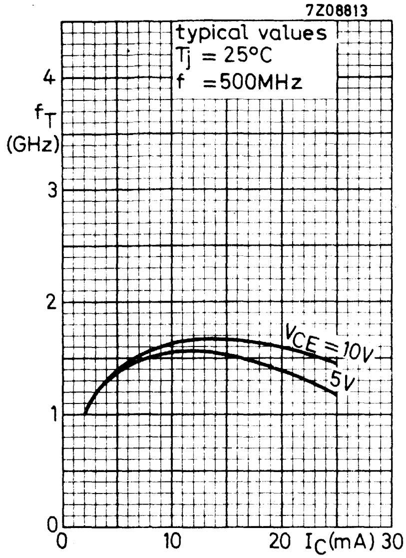
I_C (mA)
$T_j = 25°C$
Typical values
$I_B = 200\mu A$
150µA
100µA
70µA
50µA
30µA
20µA
10µA
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 V_{CE} (V)
0 2 4 6 8 10
7Z06009.2.5.25.1

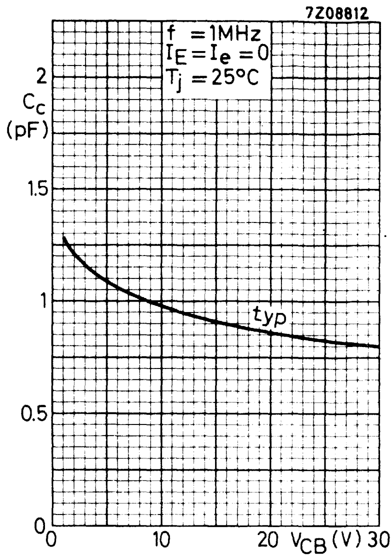


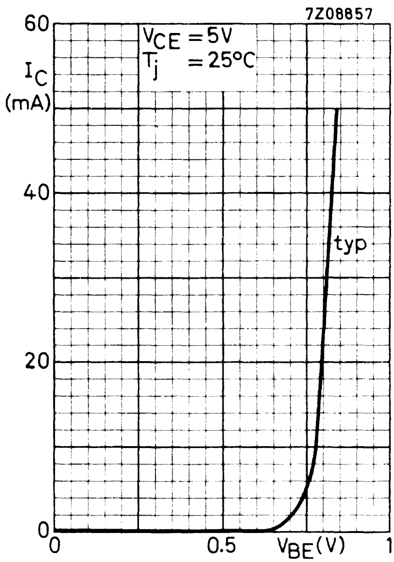
I_C (mA)
$I_B = 1.5mA$
1mA
0.8mA
0.6mA
0.4mA
0.2mA
0.1mA
0.05mA
$T_j = 25°C$
Typical values
0 2 4 6 8 10 12 14 V_{CE} (V)
0 10 20 30 40 50
7Z06010.1

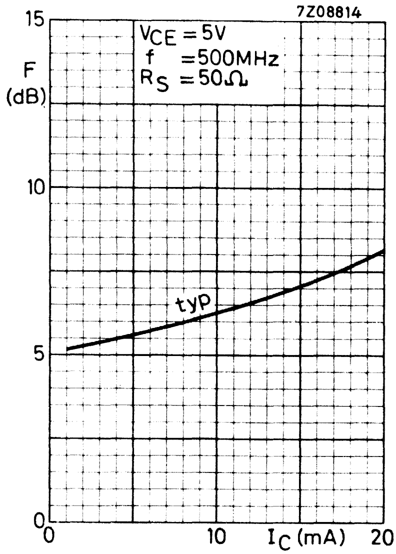

7Z09863
200
h_{FE}
150
100
50
0
V_{CE} = 1V
T_j = 25°C
max
typ
min
0.1
0.2
0.5
1
2
5
10
20
I_C(mA)
100

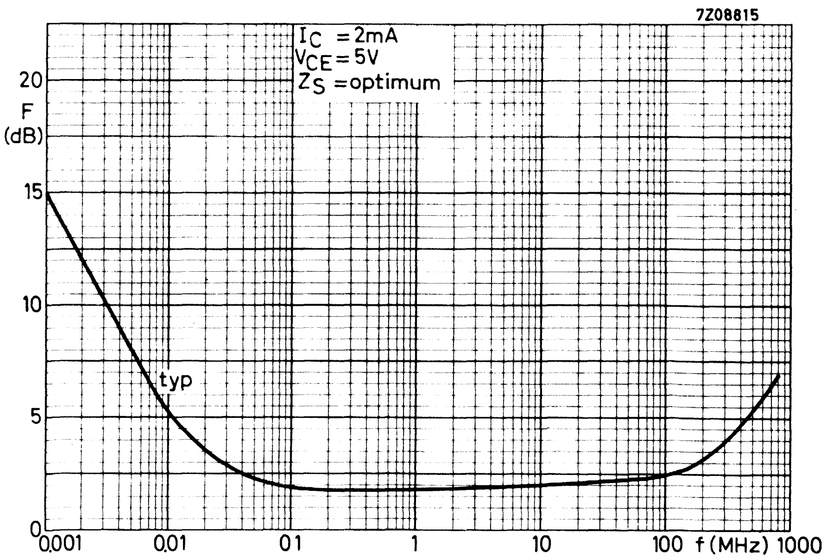

7Z09864
Base current versus collector current
V_{CE} = 1V
T_j = 25°C
10^2
I_C
(mA)
10
1
10^{-1}
min
typ
max
10^{-3}
10^{-2}
10^{-1}
1
10
I_B (mA)
10^2


7Z08813
typical values
T_j = 25°C
f = 500MHz
f_T
(GHz)
V_{CE} = 10V
5V
I_C (mA)


7Z08812
f = 1MHz
$I_E = I_e = 0$
T_j = 25°C
C_c
(pF)
typ
V_{CB} (V)


7Z08857
V_{CE} = 5V
T_j = 25°C
I_C
(mA)
typ
V_{BE} (V)


7Z08814
V_{CE} = 5V
f = 500MHz
R_S = 50Ω
F
(dB)
15
10
5
0
typ
0
10
I_C (mA)
20


7Z08815
I_C = 2mA
V_{CE} = 5V
Z_S = optimum
F
(dB)
20
15
10
5
0
typ
0,001
0,01
0,1
1
10
100
f (MHz)
1000

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case.

The transistor has very low noise over a wide current range, a very high power gain and excellent intermodulation properties.

It is primarily intended for:

- Channel- and band aerial amplifiers for band I, II, III and IV/V (40-860 MHz)
- Wide band aerial amplifiers (40-860 MHz)
- Television distribution amplifiers
- Low noise wide band vertical amplifier in high speed oscilloscopes

It is also suitable for military- and industrial applications, such as:

- R.F. amplifiers and mixers for communication equipment
- Microwave telephony link systems, wide band i.f. amplifiers
- Large bandwidth radar i.f. amplifiers

QUICK REFERENCE DATA

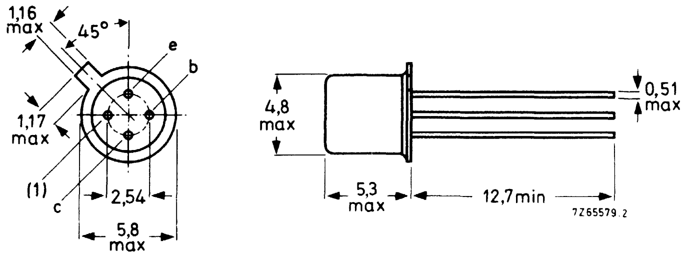
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.		30	V
Collector-emitter voltage (open base)	V_{CEO}	max.		15	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.		50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		200	mW
Junction temperature	T_j	max.		200	°C
Transition frequency I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.		1.4	GHz
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V	C_{re}	typ.		0.6	pF
Noise figure at optimum source impedance		f =	200	800	MHz
I_C = 2 mA; V_{CE} = 5 V	F	typ.	2.5	5.5	dB
Power gain (not neutralized) I_C = 14 mA; V_{CE} = 10 V	G_p	typ.	23	8	dB
Output power d_{im} = −30 dB; V.S.W.R. at output < 2 I_C = 14 mA; V_{CE} = 10 V	P_o	typ.	12	12	mW

MECHANICAL DATA see page 2.

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

→ Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	30	V
Collector-emitter voltage (peak value) $R_{BE} \leqslant 50\ \Omega$; $I_C = 10$ mA	V_{CERM}	max.	30	V
Collector-emitter voltage (open base); I_C = 10 mA	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5	V
Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Storage temperature	T_{stg}		−65 to + 200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	880	K/W*
From junction to case	$R_{th\ j\text{-}c}$	=	580	K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

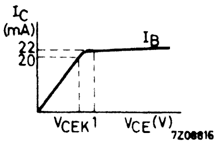
T_j = 25 °C unless otherwise specified

Collector cut-off current

$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	10	nA

Knee voltage

$I_C = 20$ mA; I_B = value for which $I_C = 22$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain

$I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}	25 to 150
$I_C = 25$ mA; $V_{CE} = 1$ V	h_{FE}	20 to 125

Transition frequency [1]

$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	>	1.0	GHz
		typ.	1.1	GHz
$I_C = 25$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	>	1.3	GHz
		typ.	1.4	GHz

Collector capacitance at f = 1 MHz [2]

$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	<	1.5	pF

Feedback capacitance at f = 1 MHz [1]

$I_C = 2$ mA; $V_{CE} = 5$ V	C_{re}	typ.	0.6	pF
		<	0.8	pF

Noise figure [1]

$I_C = 2$ mA; $V_{CE} = 5$ V

f = 100 kHz; optimum source resistance	F	<	4	dB
f = 200 MHz; optimum source impedance	F	<	3.5	dB
f = 500 MHz; $R_S = 50\ \Omega$	F	<	5	dB
f = 800 MHz; optimum source impedance	F	typ.	5.5	dB

Power gain (not neutralized) [1]

$I_C = 14$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C

		f = 200	800	MHz
G_p	>	21		dB
	typ.	23	8	dB

1) Shield lead grounded.

2) Shield lead not connected.

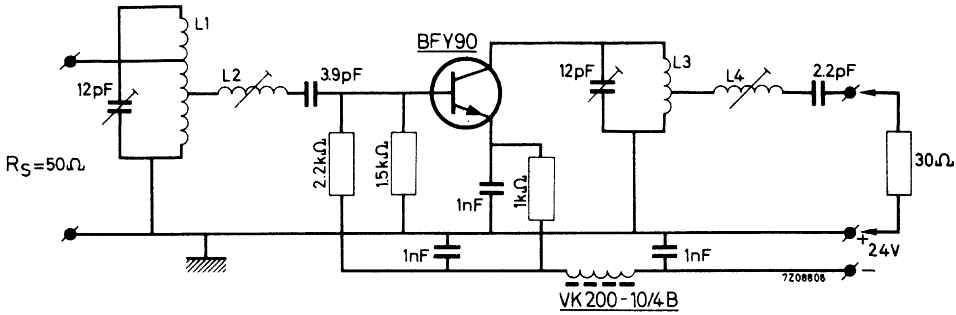
CHARACTERISTICS (continued)

Intermodulation characteristics [1])

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 14 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) — P_o > 10 mW; typ. 12 mW

Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

1) Shield lead grounded

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of –30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of –30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 560\ \Omega$; $C_L = -1.8$ pF

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 560 Ω resistor in parallel with a 1.8 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
Corrections can be made by tuning L2; this will not disturb the band pass curve.

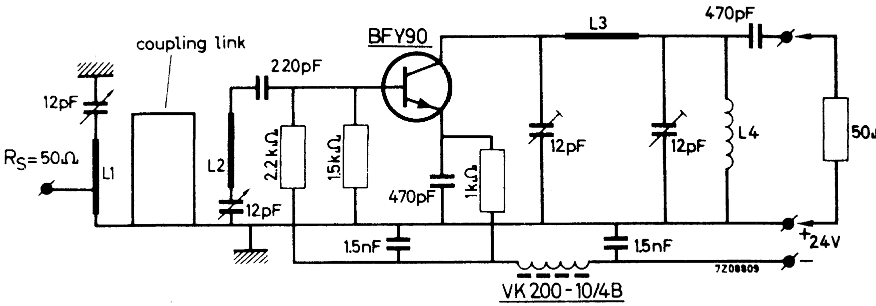
CHARACTERISTICS (continued)

Intermodulation characteristics [1]

2. Output power at f = 800 MHz; T_{amb} = 25 °C

I_C = 14 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o typ. 12 mW

Test circuit:



Coil data:

L1 = 24 mm x 6 mm x 0.5 mm silver plated Cu strip.
Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated Cu strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated Cu strip.
L4 = 4 turns enamelled Cu wire (0.5 mm); winding pitch 1.5 mm; int. diam. 4 mm
Coupling link: 42 mm silver plated Cu wire (1 mm).

Basis of adjustment.

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C\,(V_{CE} - V_{CEK})}{2} = 60 \text{ mW}$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 60 mW.
After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output is then ≤ 2 over the whole channel.

[1] Shield lead grounded

CHARACTERISTICS (continued)

Intermodulation characteristics [1]

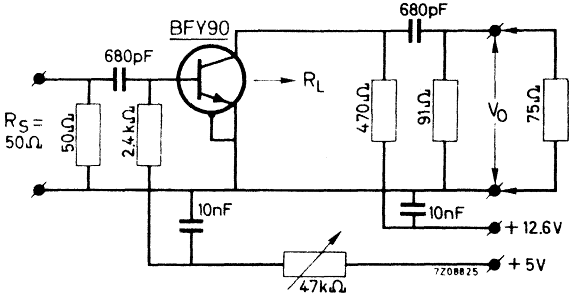
3. Intermodulation distortion

I_C = 14 mA; V_{CE} = 6 V; R_L = 37.5 Ω; T_{amb} = 25 °C

V_o = 100 mV at f_p = 183 MHz

V_o = 100 mV at f_q = 200 MHz
measured at $f_{(2q-p)}$ = 217 MHz — d_{im} typ. −50 dB

Test circuit:



y parameters at f = 500 MHz (common emitter) [1]

I_C = 2 mA; V_{CE} = 5 V

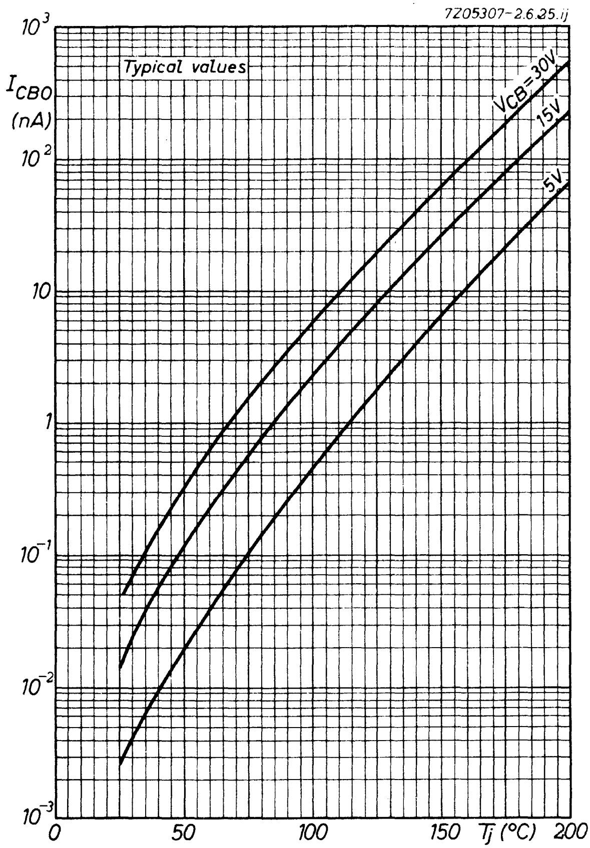
Input conductance	g_{ie}	typ.	16	$m\Omega^{-1}$
Input capacitance	C_{ie}	typ.	3.75	pF
Feedback admittance	$\|y_{re}\|$	typ.	1.55	$m\Omega^{-1}$
Phase angle of feedback admittance	φ_{re}	typ.	258°	
Transfer admittance	$\|y_{fe}\|$	typ.	45	$m\Omega^{-1}$
Phase angle of transfer admittance	φ_{fe}	typ.	285°	
Output conductance	g_{oe}	typ.	0.19	$m\Omega^{-1}$
Output capacitance	C_{oe}	typ.	1.9	pF

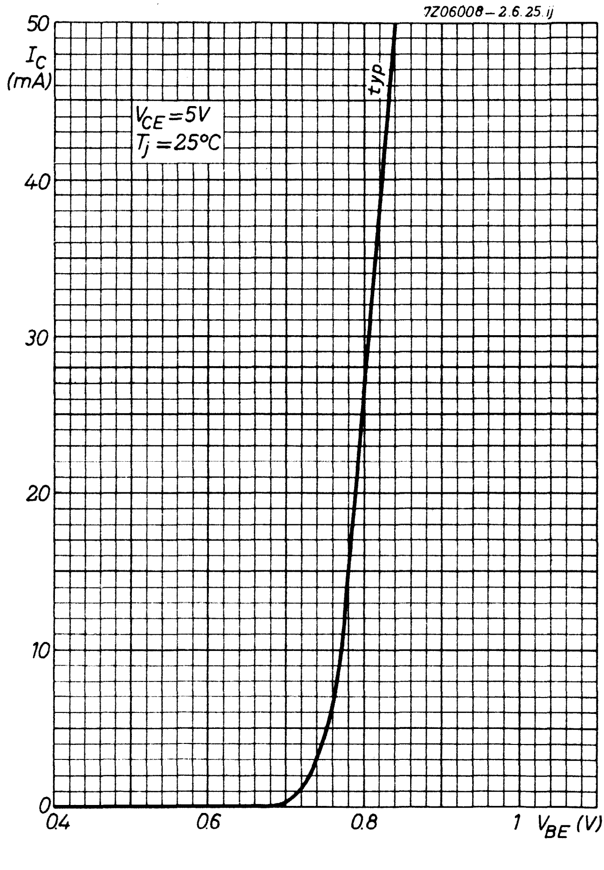
Maximum unilateralised power gain

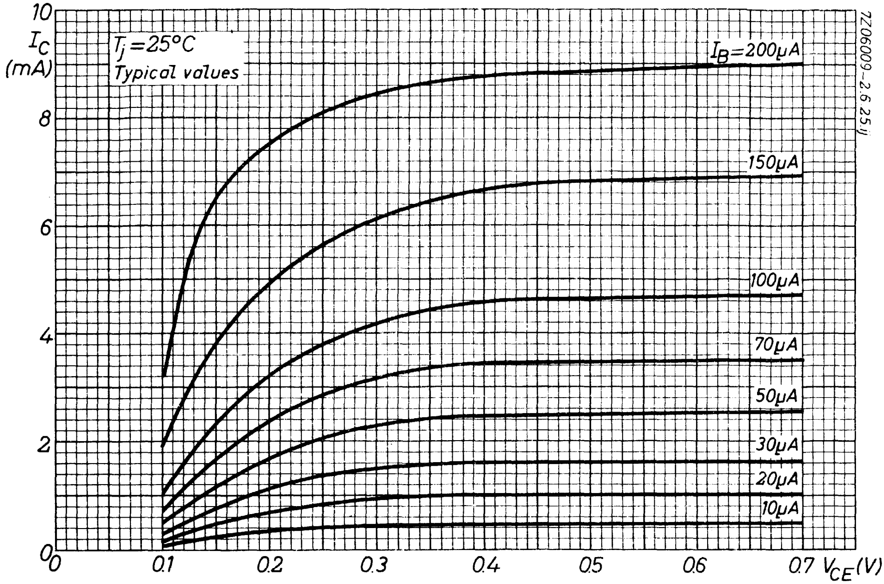
$$G_{UM} = \frac{|y_{fe}|^2}{4 g_{ie} g_{oe}}$$

I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz — G_{UM} typ. 22 dB

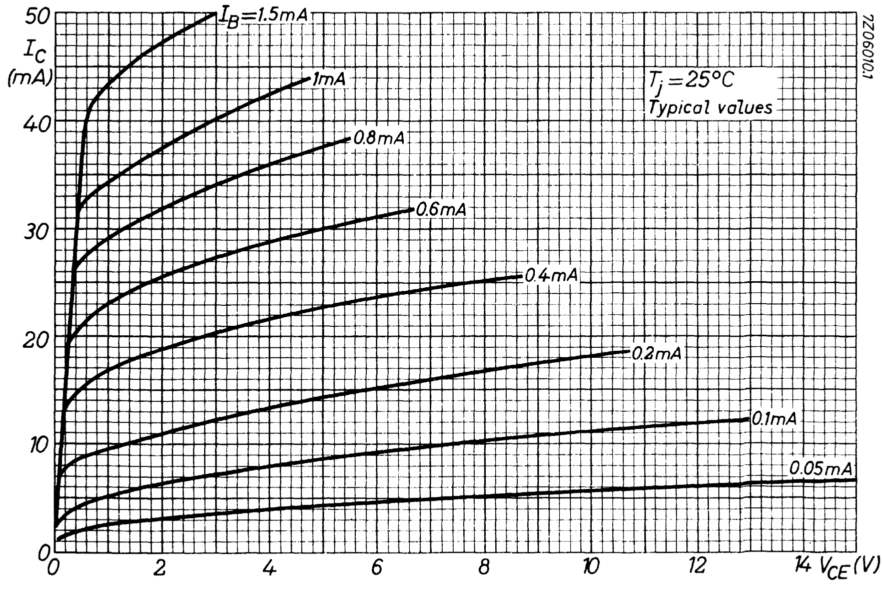
[1] Shield lead grounded


7Z05307-2.6.25.ij
Typical values
I_{CBO} (nA)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
V_{CB}=30V
15V
5V
0
50
100
150
T_j (°C)
200

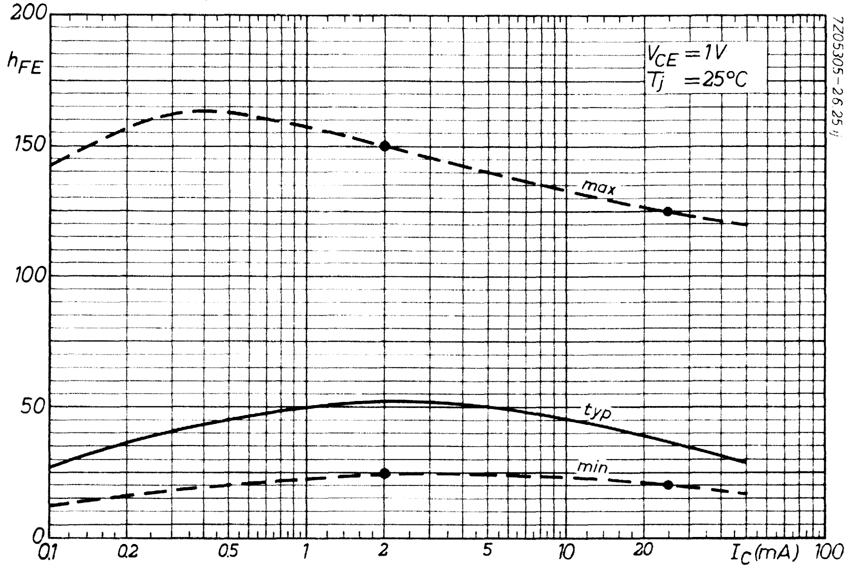

7Z06008 – 2.6.25.ij
50
I_C
(mA)
V_{CE} = 5V
T_j = 25°C
typ
40
30
20
10
0
0.4
0.6
0.8
1
V_{BE} (V)

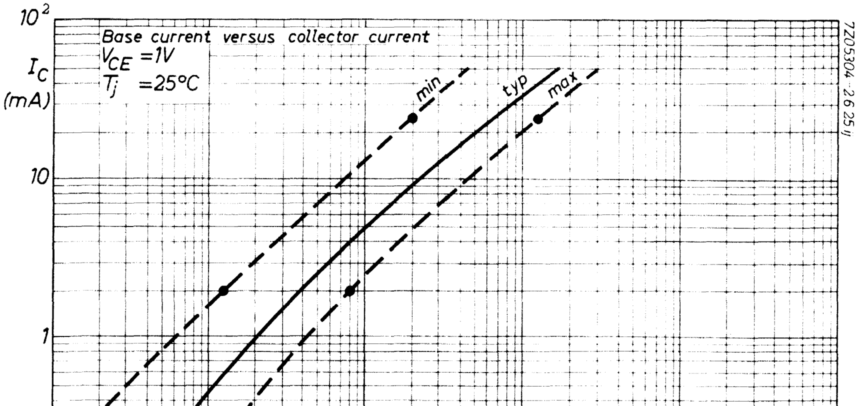


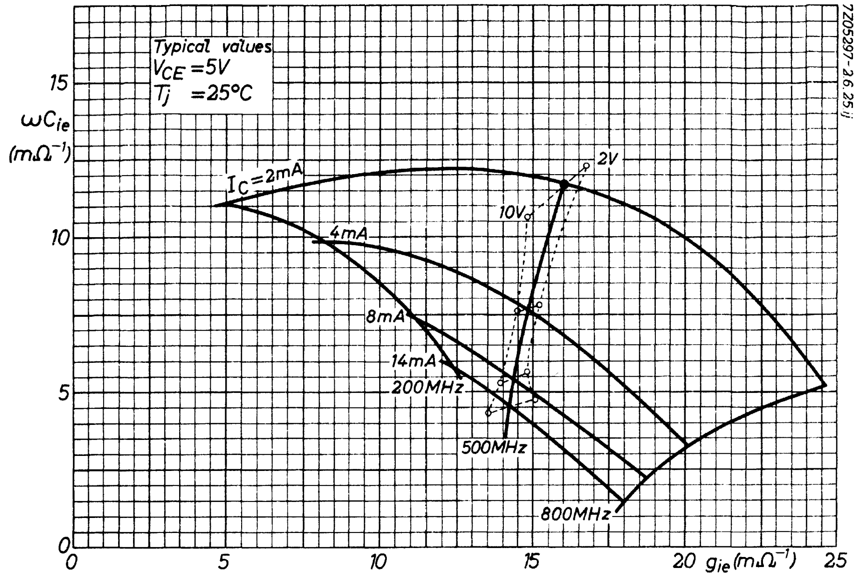
10
I_C (mA)
8
6
4
2
0
$T_j = 25°C$
Typical values
$I_B = 200 \mu A$
150μA
100μA
70μA
50μA
30μA
20μA
10μA
7Z06009-2.6 25.ij
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7 V_{CE} (V)

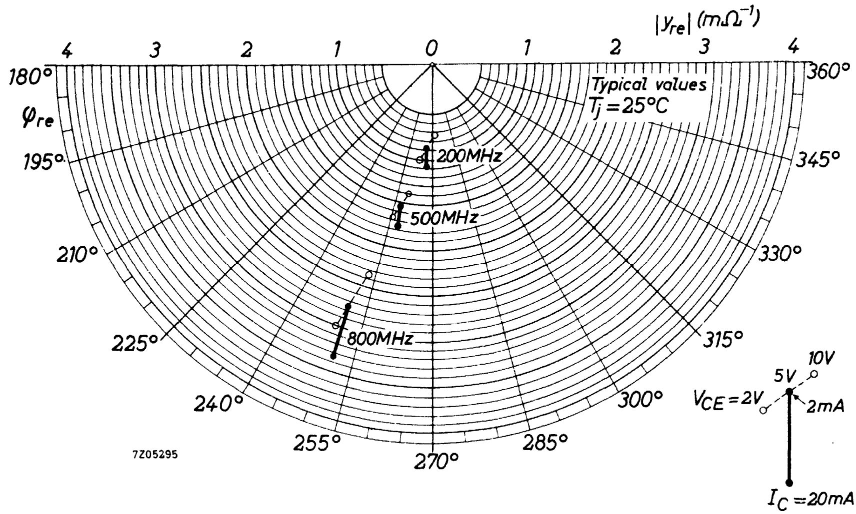


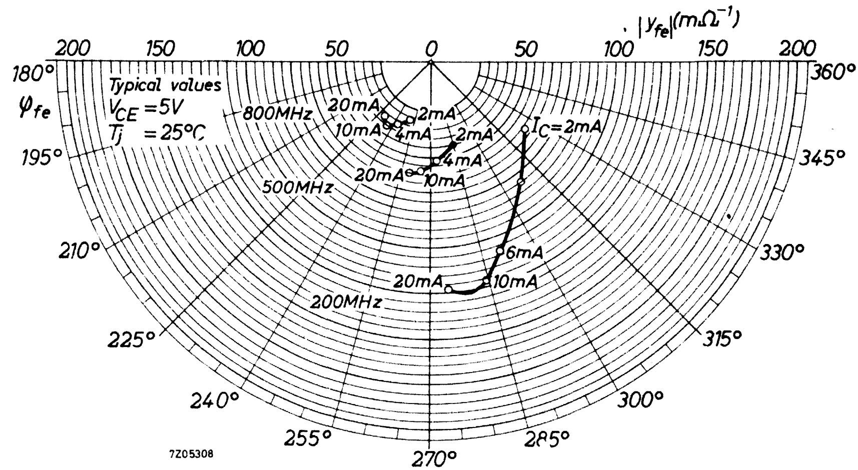
50
I_C (mA)
40
30
20
10
0
$I_B = 1.5 mA$
1mA
0.8mA
0.6mA
0.4mA
0.2mA
0.1mA
0.05mA
$T_j = 25°C$
Typical values
7Z06010.1
0
2
4
6
8
10
12
14 V_{CE} (V)

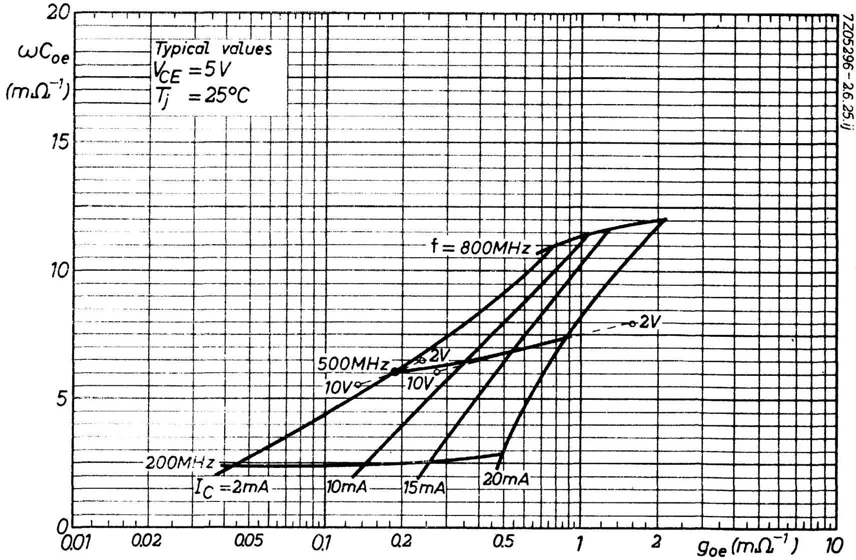

200
h_{FE}
150
100
50
0
0.1
0.2
0.5
1
2
5
10
20
I_C(mA)
100
V_{CE} = 1V
T_j = 25°C
max
typ
min
7Z05305 - 26 25 1j

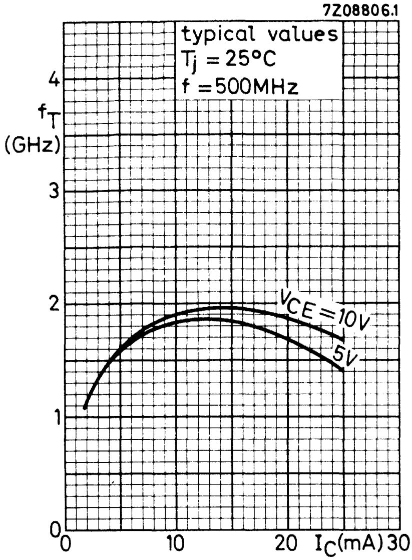

Base current versus collector current
V_{CE} = 1V
T_j = 25°C
10^2
I_C
(mA)
10
1
10^{-1}
10^{-3}
10^{-2}
10^{-1}
1
10
I_B (mA)
10^2
min
typ
max
7Z05304 - 26 25 1j

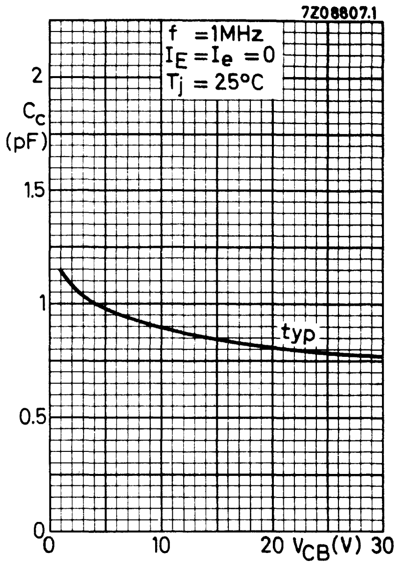

7Z05297-26.25.ij
Typical values
V_{CE} =5V
T_j =25°C
ωC_{ie}
($m\Omega^{-1}$)
I_C=2mA
4mA
8mA
14mA
200MHz
500MHz
800MHz
2V
10V
15
10
5
0
0
5
10
15
20
25
g_{ie} ($m\Omega^{-1}$)

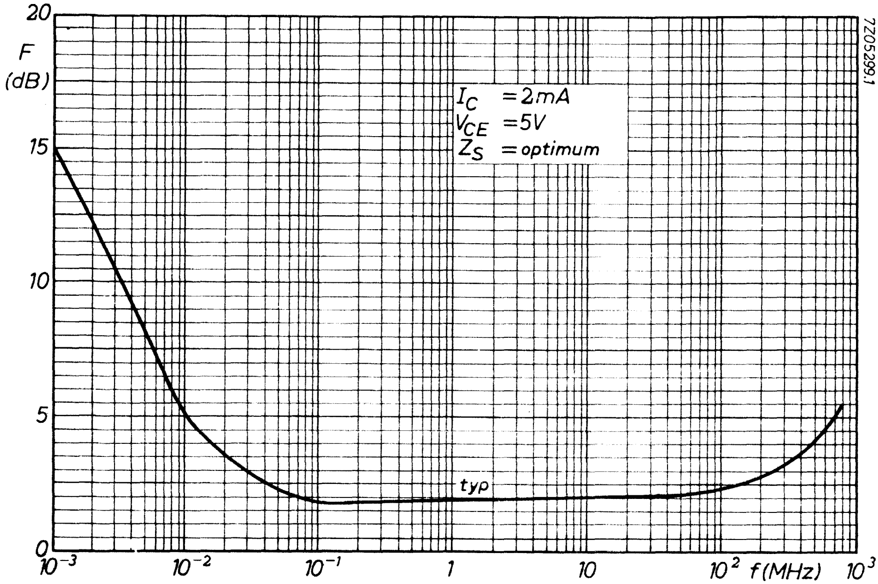

$|y_{re}|$ ($m\Omega^{-1}$)
4
3
2
1
0
1
2
3
4
180°
φ_{re}
195°
210°
225°
240°
255°
270°
285°
300°
315°
330°
345°
360°
Typical values
T_j=25°C
200MHz
500MHz
800MHz
7Z05295
10V
5V
V_{CE}=2V
2mA
I_C =20mA

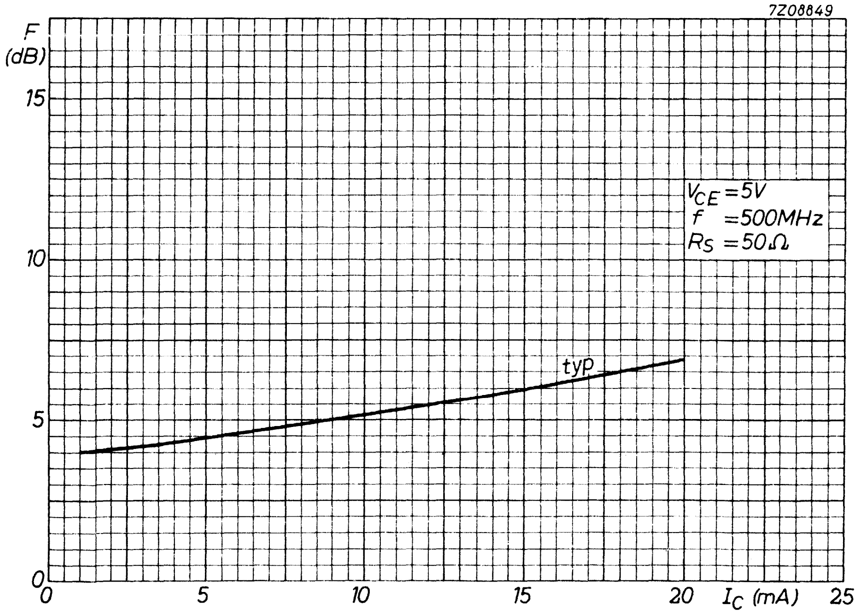

$|y_{fe}|(m\Omega^{-1})$
200 150 100 50 0 50 100 150 200
180° 195° 210° 225° 240° 255° 270° 285° 300° 315° 330° 345° 360°
φ_{fe}
Typical values
V_{CE} = 5V
T_j = 25°C
800MHz
500MHz
200MHz
20mA
10mA
4mA
2mA
I_C=2mA
6mA
7Z05308


ωC_{oe}
$(m\Omega^{-1})$
20 15 10 5 0
Typical values
V_{CE} = 5 V
T_j = 25°C
f = 800MHz
500MHz
200MHz
2V
10V
I_C = 2mA
10mA
15mA
20mA
0.01 0.02 0.05 0.1 0.2 0.5 1 2 10
g_{oe} $(m\Omega^{-1})$
7Z05296-2.6.25.1


7Z08806.1
typical values
$T_j = 25°C$
f = 500MHz
f_T (GHz)
$V_{CE} = 10V$
5V
I_C (mA)
0
1
2
3
4
10
20
30


7Z08807.1
f = 1MHz
$I_E = I_e = 0$
$T_j = 25°C$
C_c (pF)
typ
V_{CB} (V)
0
0.5
1
1.5
2
10
20
30


7Z05299.1
F
(dB)
20
15
10
5
0
I_C = 2mA
V_{CE} = 5V
Z_S = optimum
typ
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
f (MHz)
10^3


7Z08849
F
(dB)
15
10
5
0
V_{CE} = 5V
f = 500MHz
R_S = 50Ω
typ
0
5
10
15
20
I_C (mA)
25

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. The 2N918 is primarily intended for low power amplifiers and oscillators in the v.h.f. and u.h.f. ranges for industrial service.

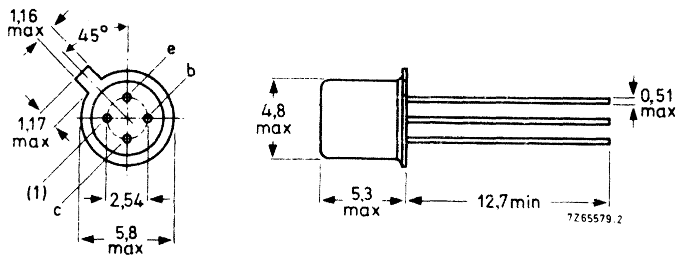
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	200	°C
Transition frequency I_C = 6 mA; V_{CE} = 10 V	f_T	>	900	MHz
Maximum unilateralized power gain I_C = 6 mA; V_{CE} = 12 V; f = 200 MHz	G_{UM}	typ.	36	dB
Noise figure at f = 60 MHz I_C = 1 mA; V_{CE} = 6 V; R_S = 400 Ω	F	<	6	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base) $I_C = 3$ mA	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V

Currents

Collector current (d.c.)	I_C	max.	50	mA

Power dissipation

Total power dissipation up to T_{amb} = 25 ^{o}C	P_{tot}	max.	200	mW

Temperatures

Storage temperature	T_{stg}		-65 to +200	^{o}C
Junction temperature	T_j	max.	200	^{o}C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0.88	^{o}C/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0.58	^{o}C/mW

CHARACTERISTICS T_j = 25 °C unless otherwise specified
All measurements taken with ungrounded shield lead

Collector cut-off current			
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	< 10	nA
$I_E = 0$; $V_{CB} = 15$ V; $T_j = 150$ °C	I_{CBO}	< 1	μA
Saturation voltages			
$I_C = 10$ mA; $I_B = 1$ mA	V_{CEsat}	< 0.4	V
	V_{BEsat}	< 1	V
D.C. current gain			
$I_C = 3$ mA; $V_{CE} = 1$ V	h_{FE}	> 20	
Collector capacitance at f = 140 kHz			
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	< 1.7	pF
$I_E = I_e = 0$; $V_{CB} = 0$	C_c	< 3.0	pF
Emitter capacitance at f = 140 kHz			
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	< 2.0	pF
Transition frequency			
$I_C = 6$ mA; $V_{CE} = 10$ V [1]	f_T	> 900	MHz
Noise figure at f = 60 MHz			
$I_C = 1$ mA; $V_{CE} = 6$ V; $R_S = 400\ \Omega$	F	< 6	dB
Oscillator power output at f = 500 MHz			
$-I_E = 8$ mA; $V_{CB} = 15$ V	P_o	> 30	mW
Maximum unilateralised power gain			
$G_{UM} = \dfrac{\lvert y_{fe}\rvert^2}{4 g_{ie} g_{oe}}$			
$I_C = 6$ mA; $V_{CE} = 12$ V; f = 200 MHz	G_{UM}	typ. 36	dB

[1] JEDEC registration: $I_C = 4$ mA; $V_{CE} = 10$ V, $f_T > 600$ MHz.

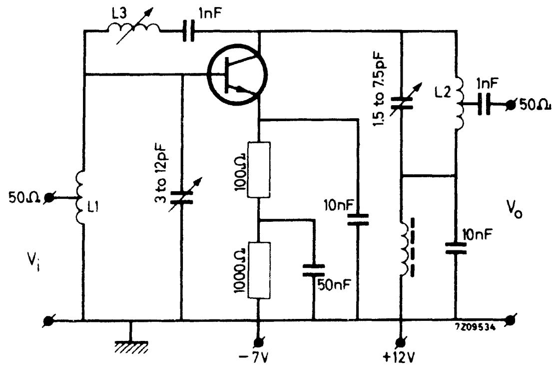
CHARACTERISTICS (continued) $T_j = 25\ ^oC$

Available power gain at f = 200 MHz

$I_C = 6$ mA	G_p	> 15	dB

Basic circuit for measuring the available neutralised power gain

Grounded shield lead



L1 = 3.5 turns tinned Cu wire, 1.3 mm
d = 8 mm; length = 11 mm

Tap at ≈ 2 turns from earth side

L2 = 8 turns tinned Cu wire, 1.3 mm
d = 3 mm; length = 22 mm

Tap at 1 turn from earth side

L3 = 0.4 to 0.65 μH

CATV AMPLIFIER MODULES (V.H.F.)

Selection guide

CATV AMPLIFIER MODULES

type number	frequency range MHz	power gain (dB) at f = 50 MHz	application	V_o (dBmV) at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone)
BGY50	40 – 300	12,5 ± 0,4	preamplifier	⩾ 61
BGY51			final amplifier	⩾ 63,5
BGY52	40 – 300	16,4 ± 0,4	preamplifier	⩾ 61
BGY53			final amplifier	⩾ 63,5
BGY54	40 – 300	17,0 ± 0,4	preamplifier	⩾ 61
BGY55			final amplifier	⩾ 63,5
BGY56	40 – 300	22,0 ± 0,6	preamplifier	⩾ 61,5
BGY57			final amplifier	⩾ 64
BGY58	40 – 300	33,0 ± 1,0	line extender	⩾ 64
BGY59	40 – 300	38,5 ± 1,0	line extender	⩾ 64
BGY60	40 – 300	33,3 ± 1,0	interstage amplifier (2 x 17 dB)	⩾ 64
BGY74	40 – 440	17,0 ± 0,4	preamplifier	⩾ 62,5
BGY75			final amplifier	⩾ 65

All modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

The BGY53 is the replacement type for the BGY37.

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY50	BGY51	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,2 to + 0,8	+ 0,2 to + 0,8	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,2	0,2	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at d_{im} = –60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	–68	–70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	7	8	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	–20 to + 90	°C

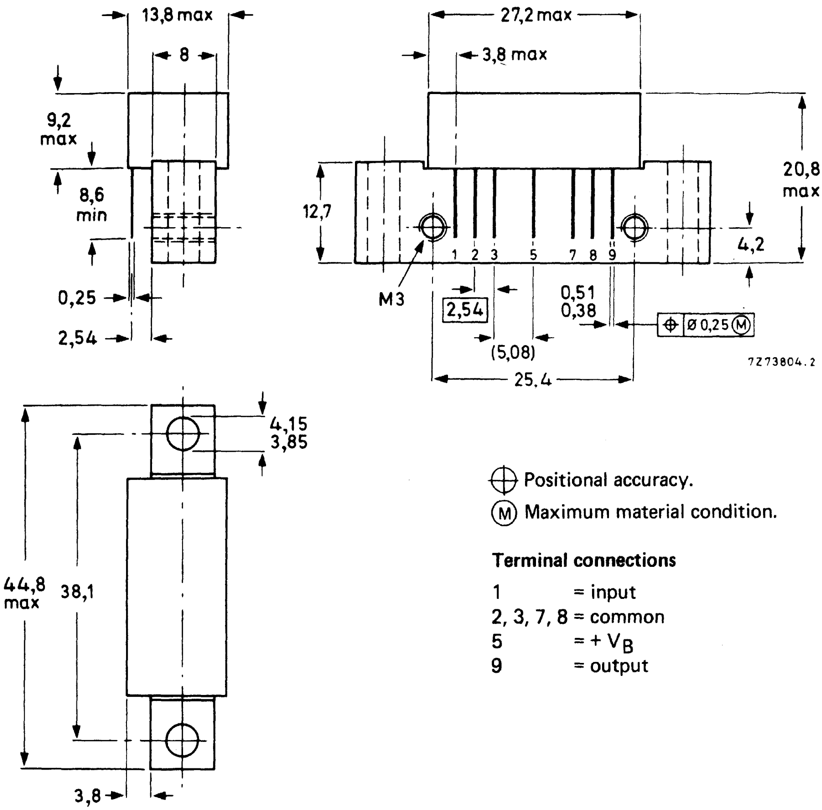
MECHANICAL DATA

SOT-115 (see page 2).

* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-115.



⊕ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

→ R.F. input voltage	V_i	max.	67 dBmV
Storage temperature	T_{stg}	–40 to +100	°C
Operating mounting base temperature	T_{mb}	–20 to +90	°C*

* With a heatsink ⩽ 4,7 K/W for the BGY51, and ⩽ 5,8 K/W for the BGY50 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W.)

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY50	BGY51	
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			+0,2 to +0,8	+0,2 to +0,8	dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	0,2	0,2	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		≥	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	61	63,5	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	≤	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	≤	7	8	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		≤	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY52	BGY53	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		16,4 ± 0,4	16,4 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,1	0,1	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	−20 to + 90	°C

MECHANICAL DATA

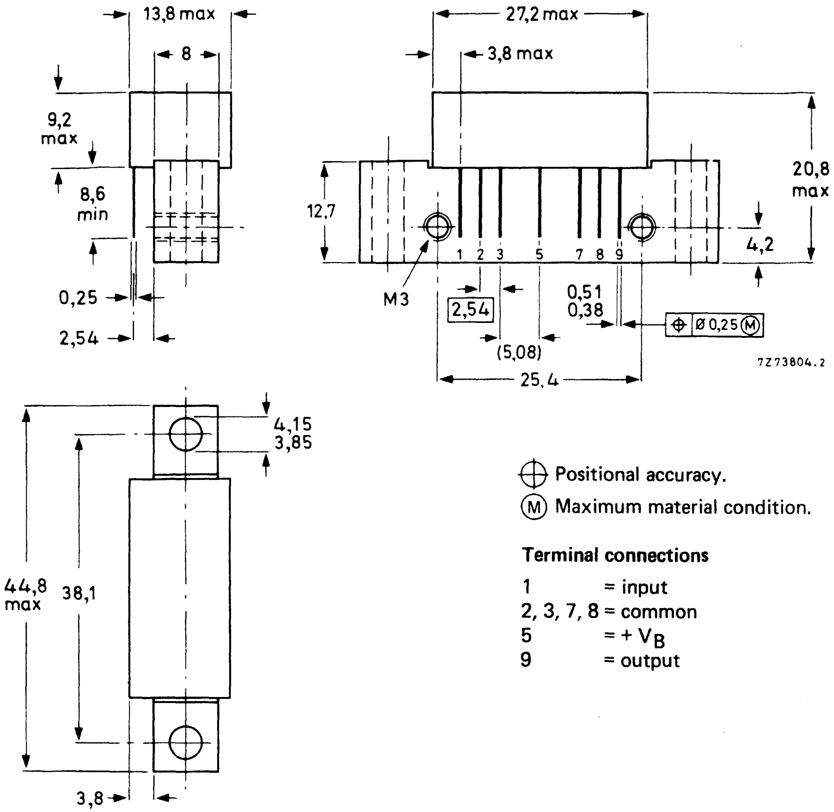
SOT-115 (see page 2).

* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



⌖ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

→ R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C *

* With a heatsink ≤ 4,7 K/W for the BGY53, and ≤ 5,8 K/W for the BGY52 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W.)

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY52	BGY53	
Power gain at f = 50 MHz	G_p		16,4 ± 0,4	16,4 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	0,1	0,1	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		≥	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	61	63,5	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	≤	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	≤	6	7	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		≤	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY54	BGY55	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,1	0,1	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	−20 to + 90	°C

MECHANICAL DATA

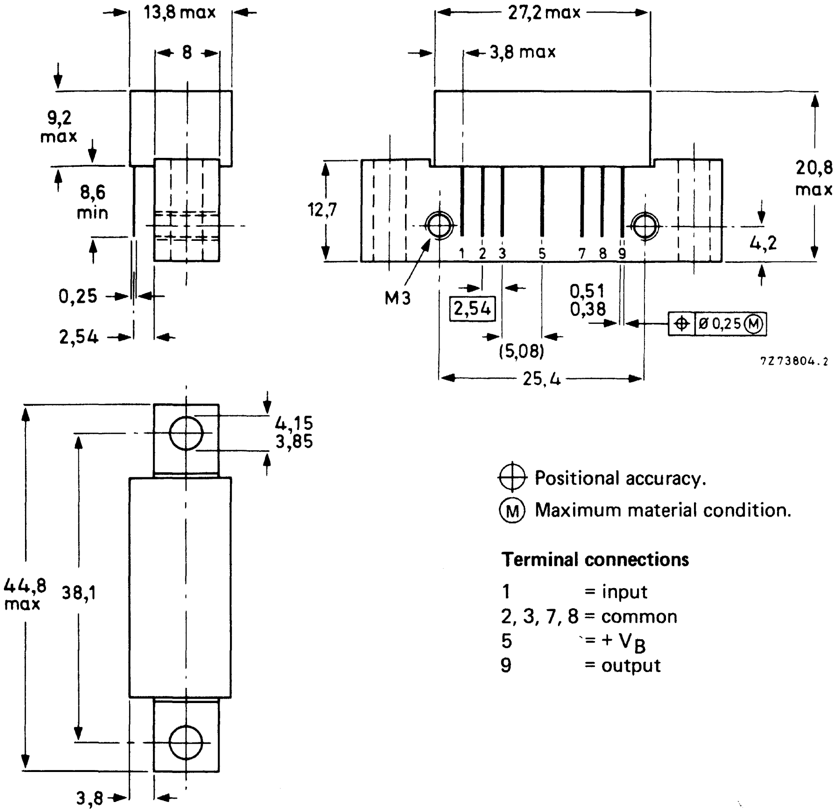
SOT-115 (see page 2).

* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



⊕ Positional accuracy.

(M) Maximum material condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C *

* With a heatsink ⩽ 4,7 K/W for the BGY55, and ⩽ 5,8 K/W for the BGY54 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W.)

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C			BGY54	BGY55	
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	0,1	0,1	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		≥	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	61	63,5	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	≤	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	≤	6	7	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		≤	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY56	BGY57	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		22,0 ± 0,6	22,0 ± 0,6	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,2	± 0,2	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	20	20	dB
Output voltage at d_{im} = –60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	61,5	64	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	–64	–66	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	–20 to + 90	°C

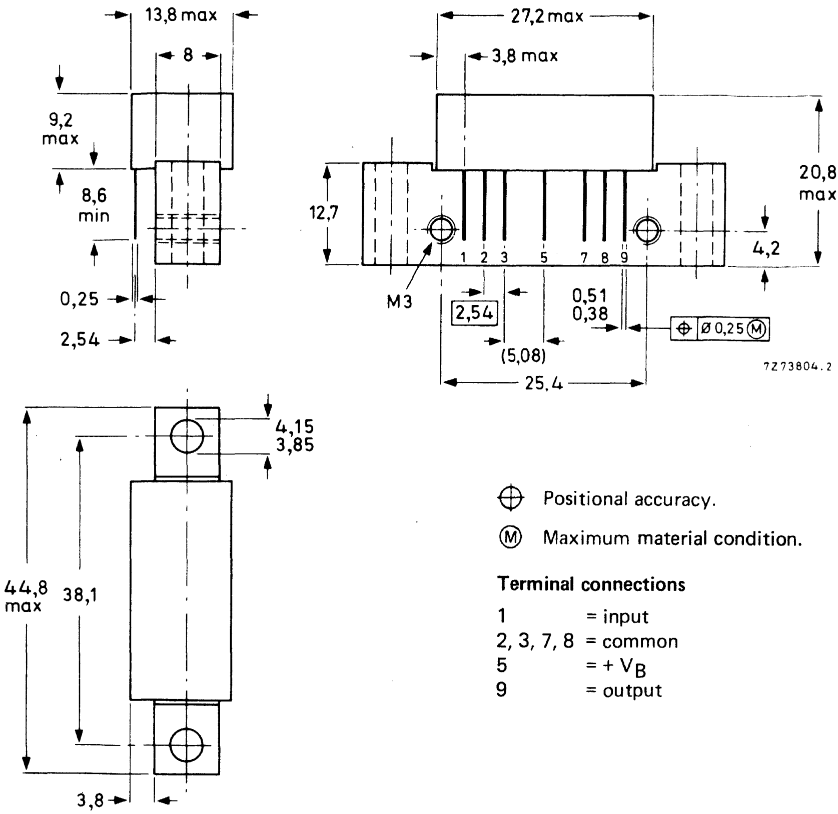
MECHANICAL DATA

SOT-115 (see page 2).

* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-115.



⊕ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

→ R.F. input voltage	V_i	max.	63 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C *

* With a heatsink ≤ 4,7 K/W for the BGY57, and ≤ 5,8 K/W for the BGY56 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W.)

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY56	BGY57	
Power gain at f = 50 MHz	G_p		22,0 ± 0,6	22,0 ± 0,6	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,2	± 0,2	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		⩾	20	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004 par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	61,5	64	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−64	−66	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier module intended for CATV systems.

QUICK REFERENCE DATA

Frequency range	f		40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	Ω
Power gain at f = 50 MHz	G_p		33,0 ± 1,0	dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	64	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	320	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	°C

MECHANICAL DATA

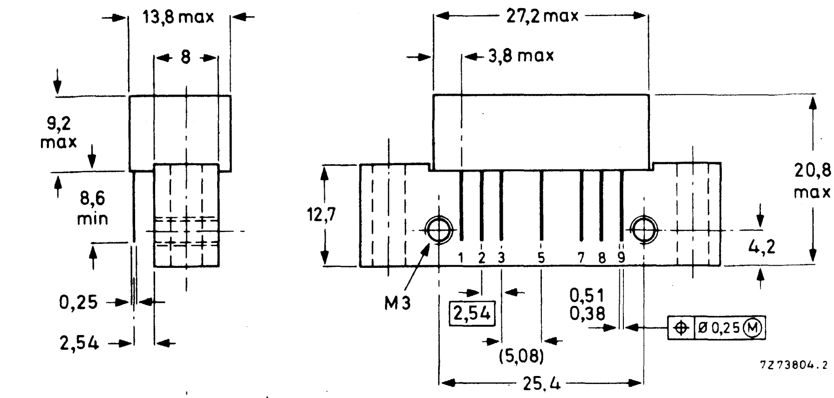
SOT-115 (see page 2).

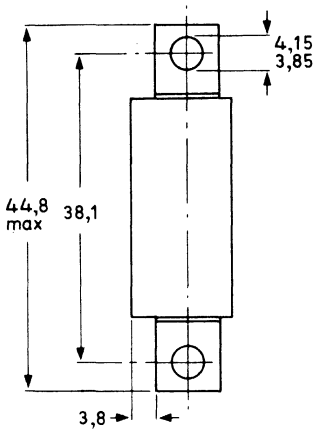
* The module is able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.





⊕ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

→ R.F. input voltage	V_i	max.	55 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C *

* With a heatsink ⩽ 3,2 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of + 65 °C is permissible.

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

Power gain at f = 50 MHz	G_p		33,0 ± 1,0 dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5 dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	± 0,3 dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		≥	20 dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	64 dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	≤	−68 dB
Noise figure f = 40 MHz to 300 MHz	F	≤	6 dB
Total d.c. current consumption	I_{tot}	typ. ≤	320 mA 340 mA ←

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULE

Hybrid amplifier module intended for CATV systems up to 300 MHz.

QUICK REFERENCE DATA

Frequency range	f		40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	Ω
Power gain at f = 50 MHz	G_p		38,5 ±1,0	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	20	dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6,3: 3-tone)	V_o	⩾	64	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption at V_B = +24 V	I_{tot}	typ.	320	mA
Operating mounting base temperature	T_{mb}		−20 to +90	°C

MECHANICAL DATA

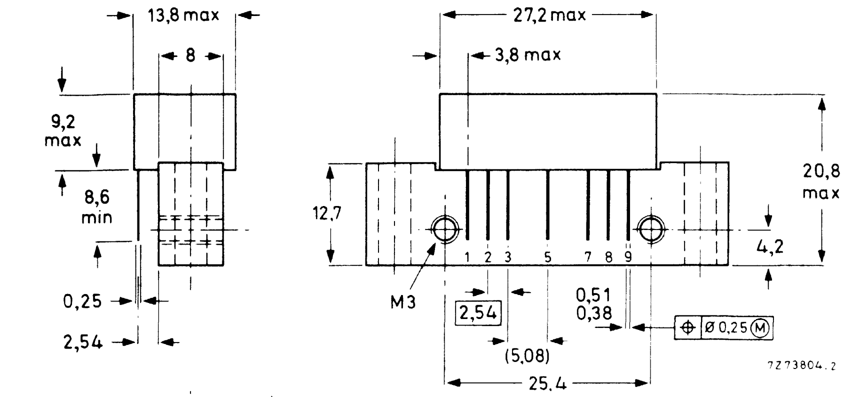
SOT-115 (see page 2).

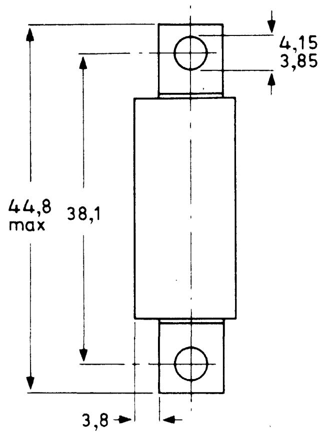
* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.





⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	53 dBmV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to + 90	°C*

* With a heatsink ⩽3,2 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of + 65 °C is permissible.

CHARACTERISTICS

Supply voltage $V_B = +24$ V; $T_{amb} = 25\ ^oC$

Power gain at f = 50 MHz	G_p		38,5 ± 1,0 dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0 dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3 dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 300 MHz		⩾	20 dB
Output voltage at $d_{im} = -60$ dB (DIN45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	64 dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−68 dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6 dB
Total d.c. current consumption	I_{tot}	typ. ⩽	320 mA 340 mA

DEVELOPMENT SAMPLE DATA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULE

Interstage hybrid amplifier module intended for CATV systems up to 300 MHz. The inputs and outputs of the stages have been terminated separately.

QUICK REFERENCE DATA for total amplifier unless otherwise specified

Frequency range	f		40 to 300		MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75		Ω
Power gain at f = 50 MHz	G_p		33,3 ± 1,0		dB
Slope cable equivalent f = 40 MHz to 300 MHz			+0,5 to +1,5		dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	±0,3		dB
			pre-stage	**final stage**	
Return losses at input and output f = 40 MHz to 300 MHz	s_{11}	⩾	20	18	dB
	s_{22}	⩾	18	20	dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6.3: 3-tone)	V_o	⩾	64		dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−66		dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6		dB
D.C. supply voltage	$+V_B$	=	24		V*
Total d.c. current consumption at V_B = +24 V	I_{tot}	typ.	320		mA
Operating mounting base temperature	T_{mb}		−20 to +90		°C

MECHANICAL DATA

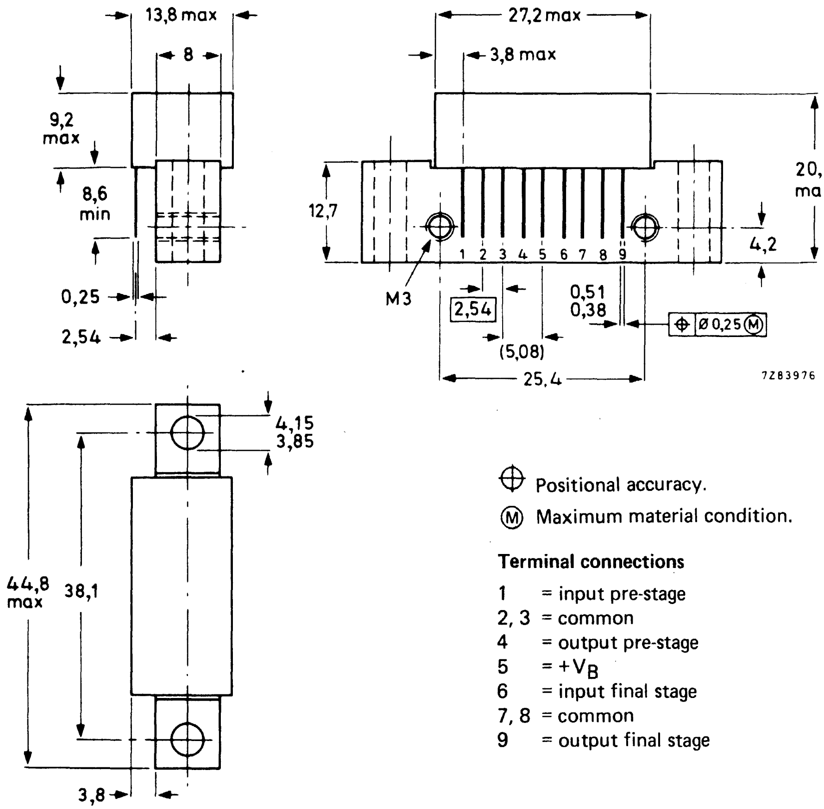
SOT-115 (see page 2).

* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



⊕ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1 = input pre-stage
2, 3 = common
4 = output pre-stage
5 = $+V_B$
6 = input final stage
7, 8 = common
9 = output final stage

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage total amplifier	V_i	max.	55 dB/mV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C*

* With a heatsink ≤ 3,2 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of +65 °C is permissible.

CHARACTERISTICS for total amplifier unless otherwise specified.

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

Power gain at f = 50 MHz	G_p		33,3 ± 1,0		dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5		dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	± 0,3		dB
			pre-stage	**final-stage**	
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz	s_{11}	≥	20	18	dB
	s_{22}	≥	18	20	dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	64		dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	≤	−66		dB
Noise figure f = 40 MHz to 300 MHz	F	≤	6		dB
Total d.c. current consumption	I_{tot}	typ.	320		mA
		≤	340		mA

DEVELOPMENT SAMPLE DATA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems up to 440 MHz.

QUICK REFERENCE DATA

			BGY74	BGY75	
Frequency range	f		40 to 440	40 to 440	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 440 MHz			0,5 to + 1,5	0,5 to + 1,5	dB
Flatness of frequency response f = 40 MHz to 440 MHz		⩽	± 0,1	± 0,1	dB
Return losses at input and output f = 40 MHz to 440 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6.3: 3-tone)	V_o	⩾	62,5	65	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 440 MHz	F	⩽	6	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V*
Total d.c. current consumption at V_B = +24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		−20 to +90	−20 to +90	°C

MECHANICAL DATA

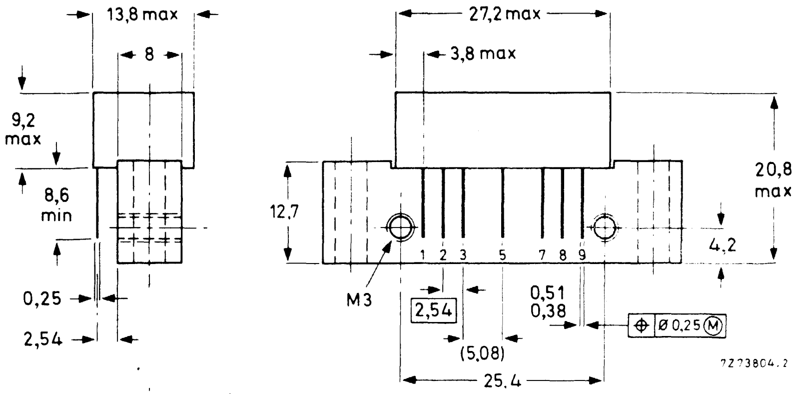
SOT-115 (see page 2).

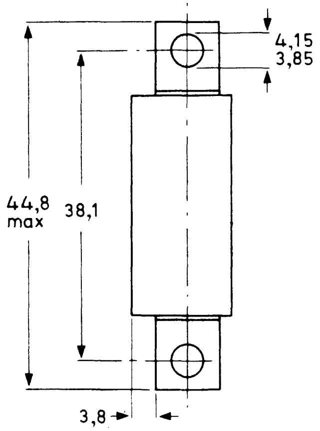
* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.





⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

Terminal connections

1	= input
2, 3, 7, 8	= common
5	= $+V_B$
9	= output

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C

* With a heatsink ⩽ 4,7 K/W for the BGY75, and ⩽ 5,8 K/W for the BGY74 a maximum ambient temperature of +65 °C is permissible. (K/W is SI unit for °C/W.)

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

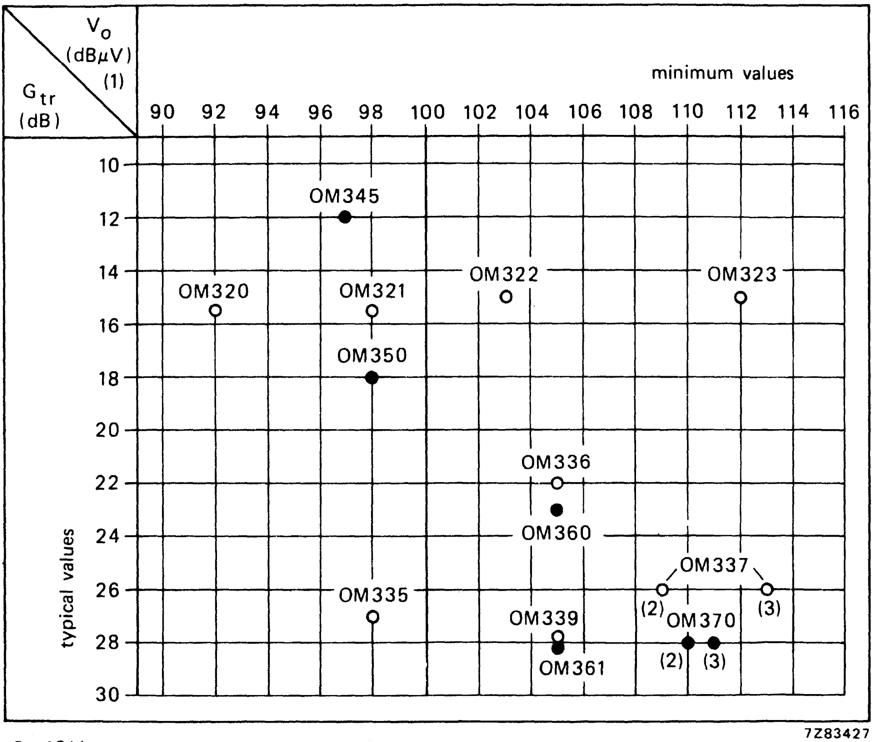
			BGY74	BGY75	
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 440 MHz			0,5 to + 1,5	0,5 to + 1,5	dB
Flatness of frequency response f = 40 MHz to 440 MHz		⩽	± 0,1	± 0,1	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 440 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	62,5	65	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 55,25 MHz $V_q = V_o$ = 50 dBmV; f_q = 211,25 MHz Measured at $f_{(p+q)}$ = 266,50 MHz	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 440 MHz	F	⩽	6	7	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

DEVELOPMENT SAMPLE DATA

WIDEBAND AMPLIFIERS (V.H.F. & U.H.F.)

Selection guide

HYBRID ICs FOR WIDE-BAND AMPLIFIERS



● 12 V types

○ 24 V types

(1) At −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone).

(2) UHF.

(3) VHF.

Fig. 1 Type/performance in matrix survey.

The matrix survey (Fig. 1) and the tables next page show both the 12 V and 24 V ranges.

Note that the modules are available in the combination of high gain- high output voltage.

Tables of VHF/UHF hybrid ICs for wide-band amplifiers

12 V supply voltage

	type	stages	gain (dB)	$V_{o(rms)}$ (dBμV) −60 dB IMD (note 1) min. values	noise figure (dB)	max. VSWR typ. values (note 2) input	max. VSWR typ. values (note 2) output	supply current (mA)
low medium	OM345	1	12	97	5,5	2,0	1,4	11,5
	OM350	2	18	98	6,0	1,5	1,9	18
medium output	OM360	3	23	105	7,0	1,3	1,5	55
	OM361	3	28	105	6,0	1,5	1,7	50
high output	OM370	3	28	111	7,0	2,3	1,9	105

24 V supply voltage

	type	stages	gain (dB)	$V_{o(rms)}$ (dBμV) −60 dB IMD (note 1) min. values	noise figure (dB)	max. VSWR typ. values (note 2) input	max. VSWR typ. values (note 2) output	supply current (mA)
low output	OM320	2	15,5	92	5,5	2,2	2,5	23
	OM321	2	15,5	98	6,0	2,5	2,0	33
	OM335	3	27	98	5,5	1,9	3,2	35
medium output	OM322	2	15	103	7,0	1,7	1,7	60
	OM336	3	22	105	7,0	1,4	1,6	65
	OM339	3	28	105	6,0	1,5	1,5	66
high output	OM323*	2	15	112	9,0	1,9	2,3	100
	OM337*	3	26	113	9,8	2,3	1,8	115

* Also available in A-version for external coil and output capacitor.

Notes

1. Measured at −60 dB intermodulation distortion to DIN 45004, par. 6.3: 3-tone, f = 470 MHz.
2. The typical maximum VSWR occurring in the frequency range 40-860 MHz, for a sample connected to a 75 Ω line.

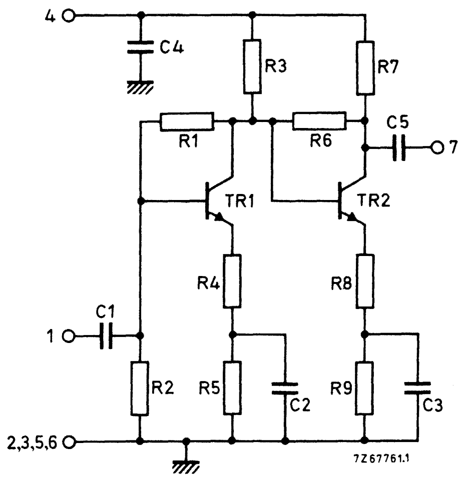
HYBRID VHF/UHF WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster amplifiers, as pre-amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	15,5	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	92	dBμV
Noise figure	F	typ.	5,5	dB
D.C. supply voltage	V_B	=	24	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



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

Operating ambient temperature	T_{amb}		−20 to +70	^oC
Storage temperature	T_{stg}		−40 to +125	^oC
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}$, V_{7M}	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	^oC
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f		40 to 860	MHz

Performance

Supply current	I_B	typ.	23	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		13 to 18	dB
		typ.	15,5	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,2	**
output	$VSWR_{(o)}$	typ.	2,5	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	30	dB
f = 860 MHz	$\|s_r\|^2$	typ.	24	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	92	dBμV
		typ.	94	dBμV
Noise figure	F	typ.	5,5	dB

s-parameters	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

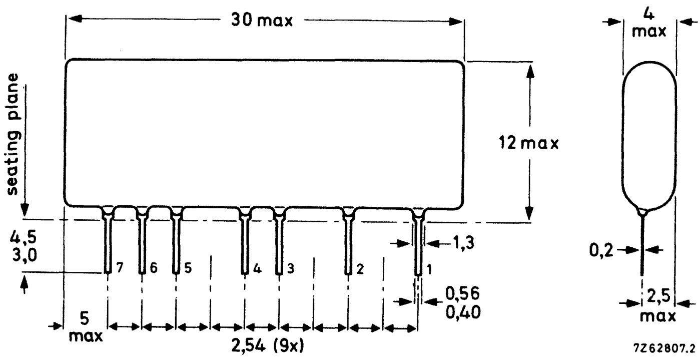
Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.



Terminal connections

1	= Input
2, 3, 5, 6	= Common
4	= Supply (+)
7	= Output

Soldering recommendations

Hand soldering

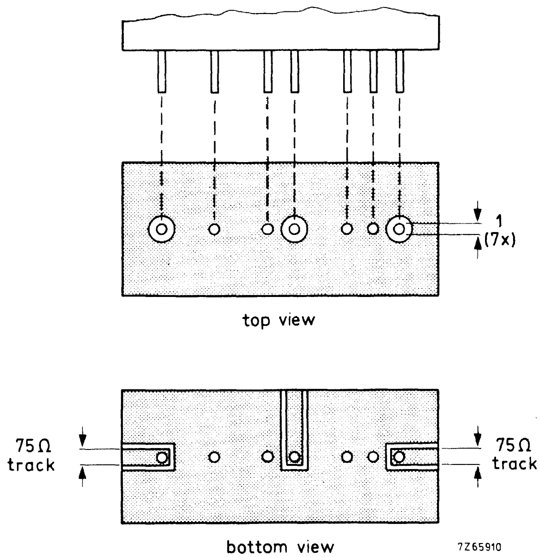
Maximum contact time for a soldering-iron temperature of 260 °C; up to seating plane: 5 s

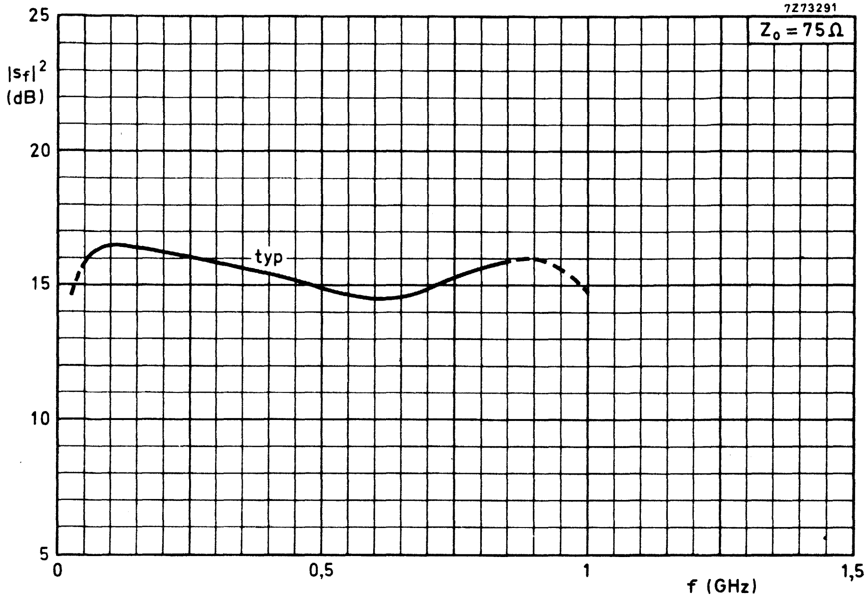
Dip or wave soldering

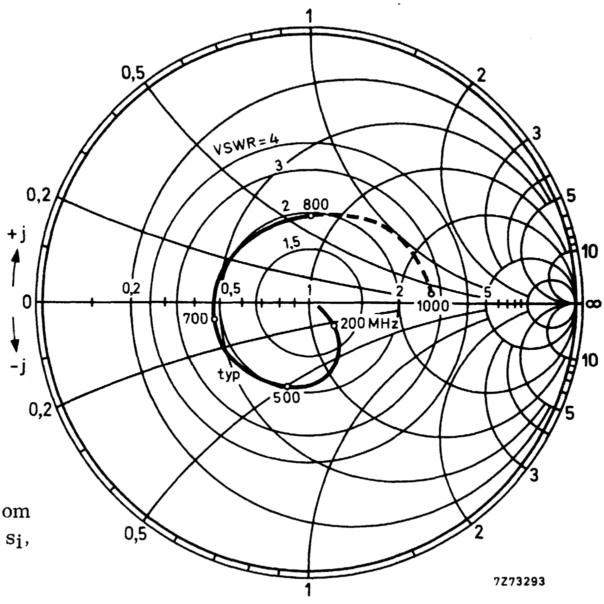
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

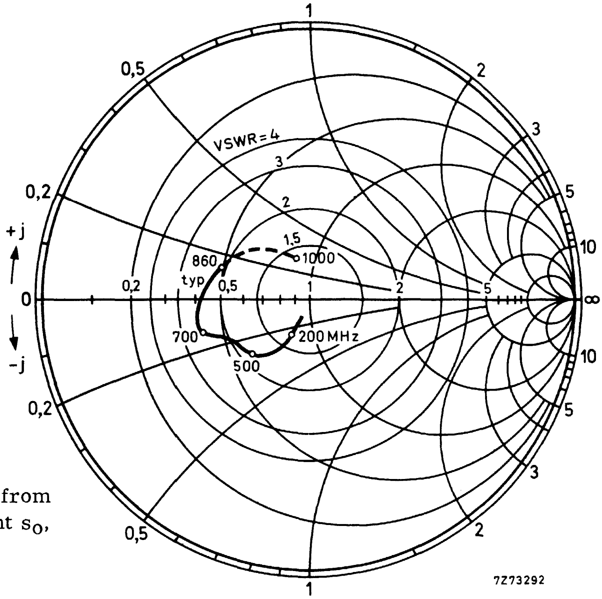
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.
Input and output should be connected to 75 Ω tracks.
The connections to the "common" pins should be as close to the seating plane as possible.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75.



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75.

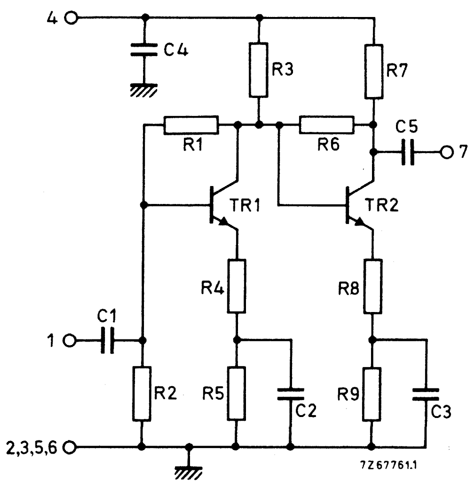
HYBRID VHF/UHF WIDE BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster-amplifiers, as pre-amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	15,5	dB
Flatness of frequency response	$\pm\Delta\ \|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	98	dBμV
Noise figure	F	typ.	6	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to + 70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}$, $-V_{7M}$	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	33	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		13 to 18	dB
		typ.	15,5	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,5	**
output	$VSWR_{(o)}$	typ.	2,0	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	30	dB
f = 860 MHz	$\|s_r\|^2$	typ.	26	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	98	dBμV
		typ.	100	dBμV
Noise figure	F	typ.	6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

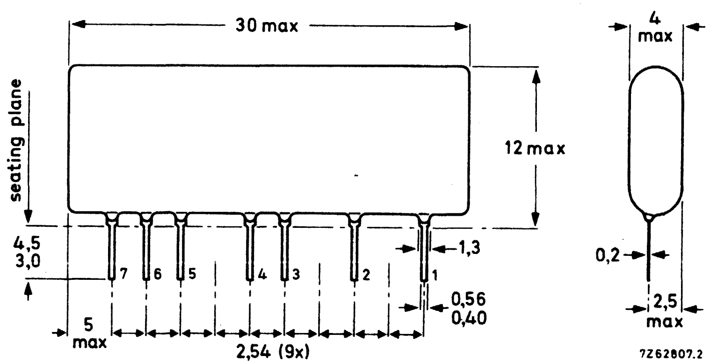
OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to + 70	°C
D.C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω

MECHANICAL DATA Dimensions in mm

Encapsulation

The device is resin coated.



Terminal connections

1	= Input
2, 3, 5, 6	= Common
4	= Supply (+)
7	= Output

Soldering recommendations

Hand soldering

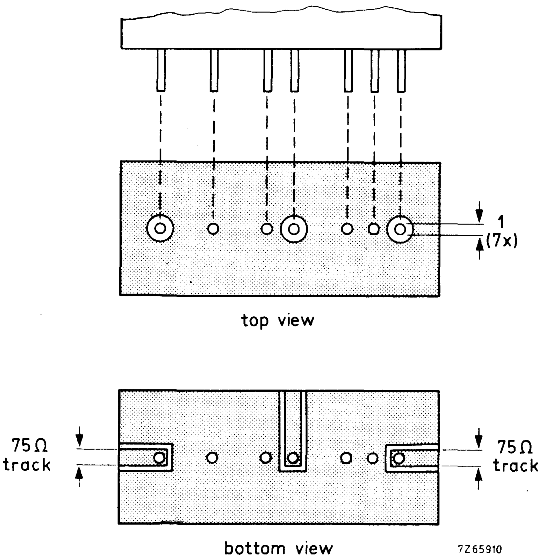
Maximum contact time for a soldering-iron temperature of 260 °C; up to seating plane: 5 s

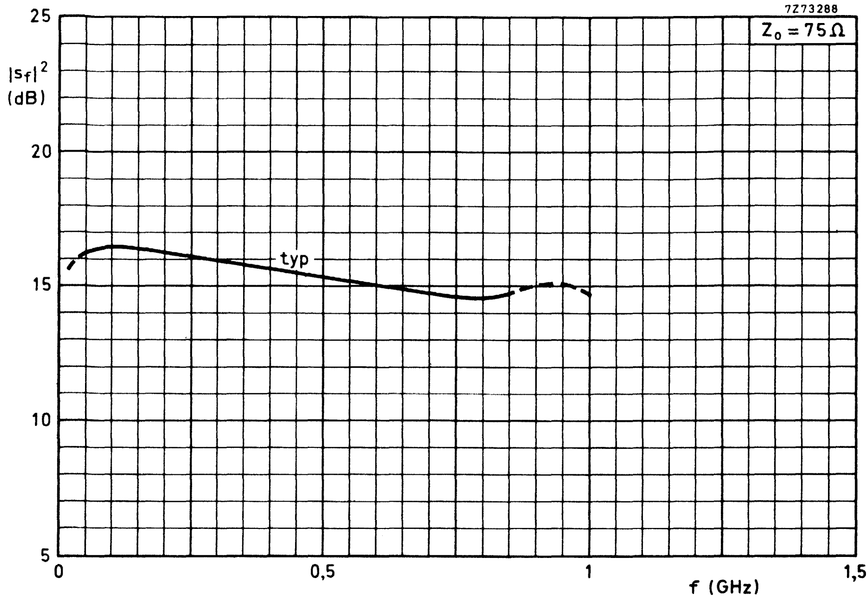
Dip or wave soldering

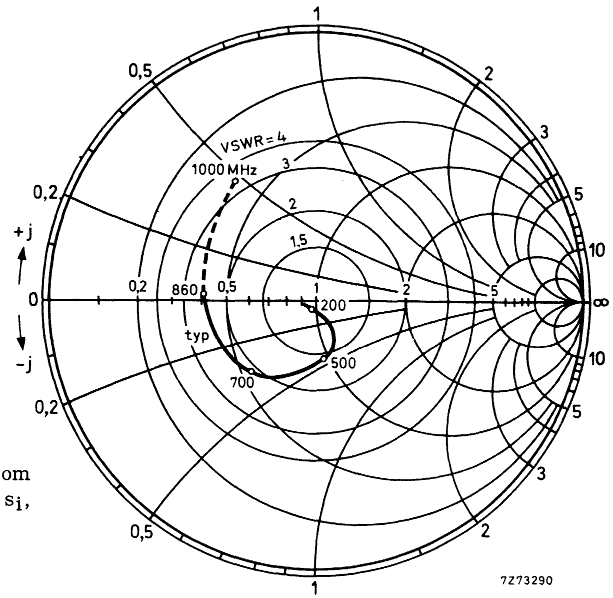
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

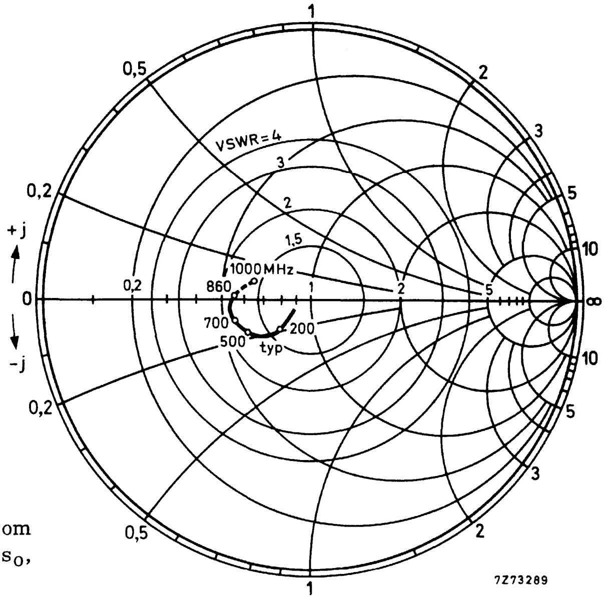
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.
Input and output should be connected to 75 Ω tracks.
The connections to the "common" pins should be as close to the seating plane as possible.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75.



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75.

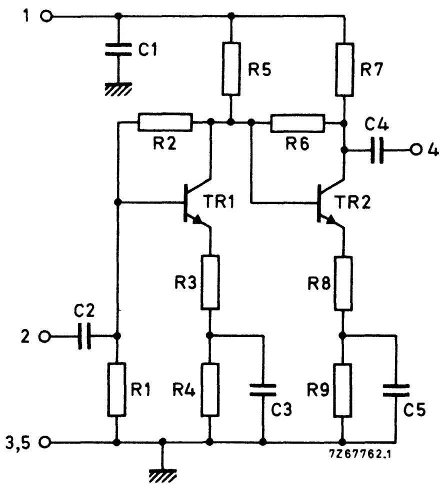
HYBRID VHF/UHF WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use as distribution amplifier in MATV and CATV systems and as general-purpose amplifier for v.h.f. and u.h.f. applications. Except for the encapsulation coating, the OM322 and OM175 have the same specification. OM322 will replace OM175.

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$		75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	15	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0,3	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	103	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 5-lead, resin coated body on metal base, see MECHANICAL DATA

CIRCUIT DIAGRAM



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Operating ambient temperature	T_{amb}		-20 to +70	°C
Operating mounting-base temperature	T_{mb}	max.	100	°C
Storage temperature	T_{stg}		-40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 2 and 4	V_{2M}, V_{4M}	max.	28	V
	$-V_{2M}$, $-V_{4M}$	max.	10	V
Peak incident powers on pins 2 and 4	P_{I2M}, P_{I4M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	60	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$		14 to 16	dB
		typ.	15	dB
Flatness of frequency response	$\pm\Delta \lvert s_f \rvert^2$	typ.	0,3	dB
		<	0,5	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,7	[1]
output	$VSWR_{(o)}$	typ.	1,7	[1]
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	31	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	25	dB
Output voltage at -60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	103	dBμV
		typ.	105	dBμV
Noise figure	F	typ.	7	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

[1]) Highest value, for a sample, occurring in the frequency range.

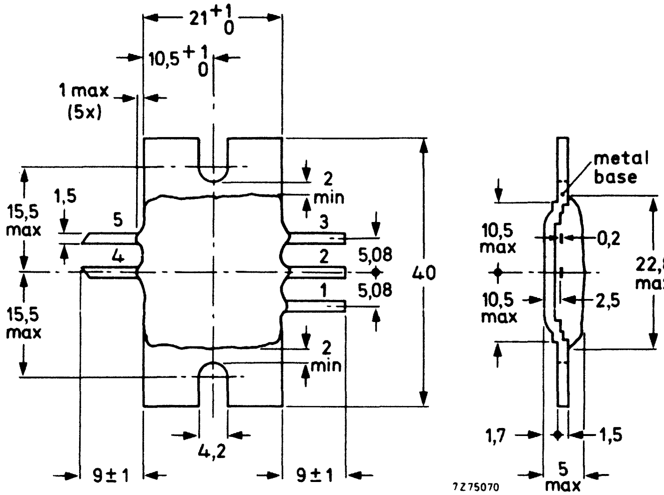
OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω

MECHANICAL DATA Dimensions in mm

Encapsulation

The device is resin coated and mounted on a metal mounting base.



Terminal connections

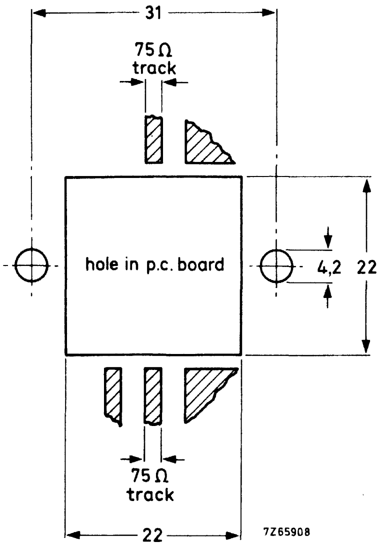
1 = Supply (+)
2 = Input
3 and 5 = Common (internally connected to metal base)
4 = Output

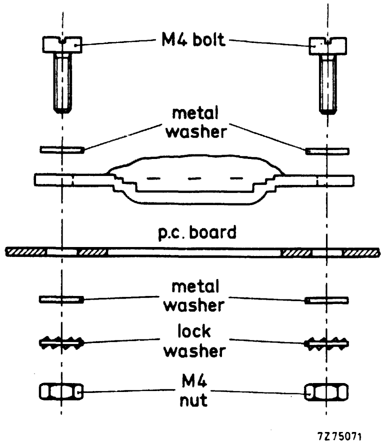
Soldering recommendations

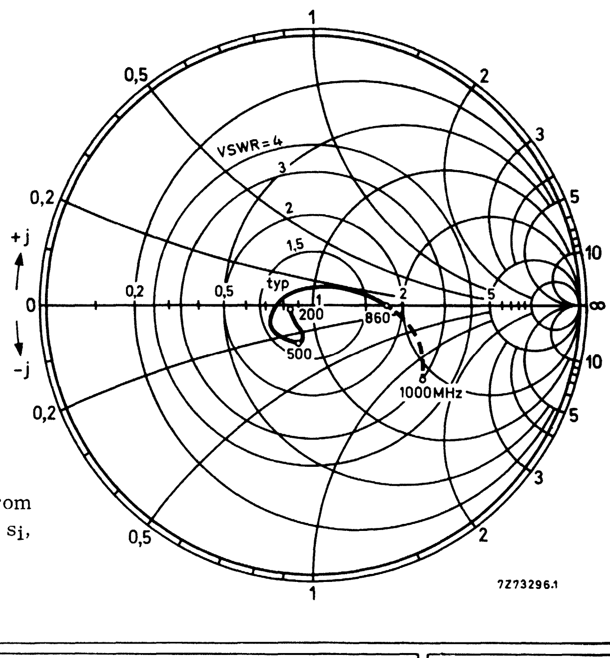
Maximum contact time for a soldering-iron temperature of 260 °C 5 s

Mounting recommendations

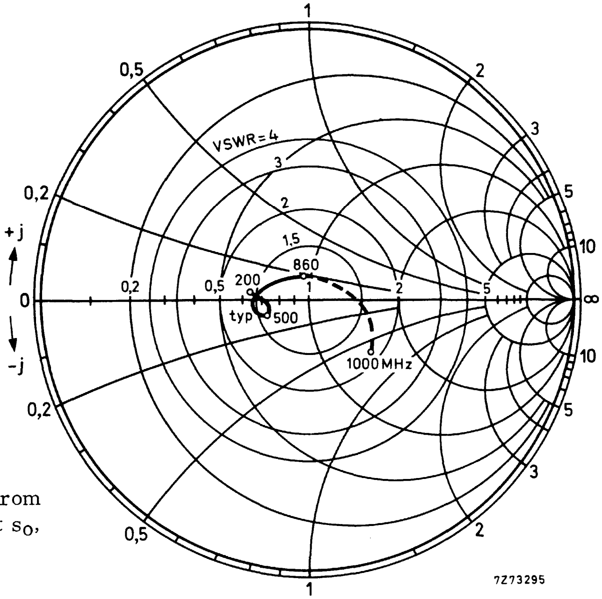
The module should preferably be mounted on a double-sided printed-circuit board, see the examples shown below. Input and output should be connected to 75 Ω tracks.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75

HYBRID V.H.F./U.H.F. WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use in MATV systems, and as general purpose amplifier for v.h.f. and u.h.f. applications requiring a high output level.
The OM323A needs an external collector-coil and blocking capacitor, whereas, the OM323 has these components built-in.

QUICK REFERENCE DATA

Frequency range	f		40 to 860 MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75 Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ	15 dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ	0,5 dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone); f = 470 MHz	$V_{o(rms)}$	typ	113 dBμV
Noise figure	F	typ	9 dB
D.C. supply voltage	V_B	=	24 V ± 10%
Operating mounting-base temperature	T_{mb}		−30 to +100 °C

ENCAPSULATION 9-pin, in-line, resin-coated body on a right-angled metal mounting tab, see MECHANICAL DATA

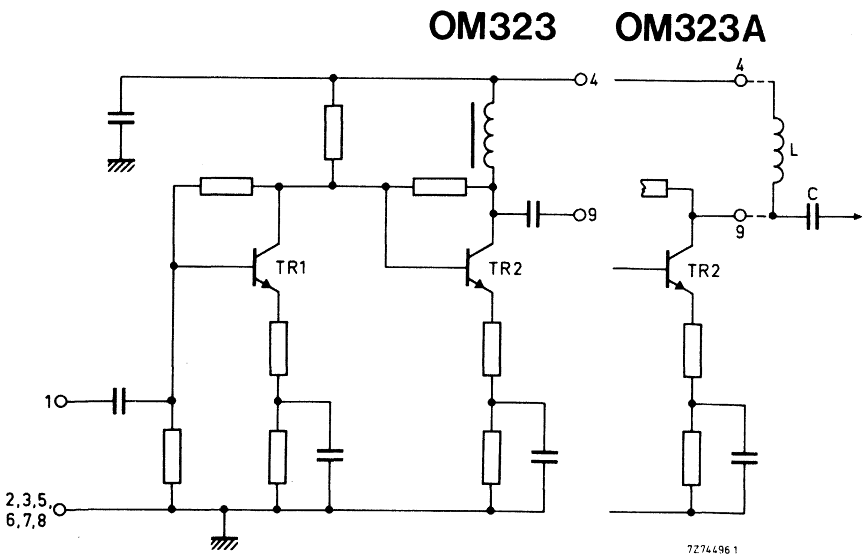


Fig. 1 Circuit diagram.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Operating mounting-base temperature	T_{mb}		−30 to +100	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max	28	V
Peak voltages on pin 1	V_{1M}	max	28	V
	$-V_{1M}$	max	24	V
Peak voltages on pin 9	V_{9M}	max	28	V
	$-V_{9M}$	max	4	V
Peak incident powers on pins 1 and 9	P_{I1M}, P_{I9M}	max	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.–U.H.F. test socket	catalogue no. 3504 110 01830 *			
Mounting base temperature	T_{mb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B		95 to 105	mA
		typ	100	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		14 to 17	dB
		typ	15	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ	0,5	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ	1,9	**
output	$VSWR_{(o)}$	typ	2,3	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ	29	dB
f = 650 MHz	$\|s_r\|^2$	typ	25,5	dB
f = 860 MHz	$\|s_r\|^2$	typ	24	dB

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

Output voltage				
at −60 dB intermodulation distortion				
(DIN45004, par. 6.3: 3-tone)		>	112	dBμV
f = 40–230 MHz	$V_{o(rms)}$	typ	114	dBμV
f = 470 MHz	$V_{o(rms)}$	typ	113	dBμV
f = 860 MHz	$V_{o(rms)}$	typ	112	dBμV
Noise figure				
channel 2	F	typ	8	dB
channel 65	F	typ	9	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

OPERATING CONDITIONS

Mounting-base temperature range	T_{amb}		−30 to +100	°C
D.C. supply voltage	V_B	=	24	V ± 10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

THERMAL DATA

a. The maximum permissible temperature at the mounting base is 100 °C.

b. When the mounting tab is screwed to a double-sided printed-circuit board with dimensions 37 mm x 51 mm, its temperature will be 57 °C above the temperature of the surrounding free air.

c. When a heatsink is fixed to the mounting tab and the pins are soldered into a double-sided printed-circuit board with dimensions 37 mm x 51 mm, the tab will reach the temperatures stated in the following table.

Notes

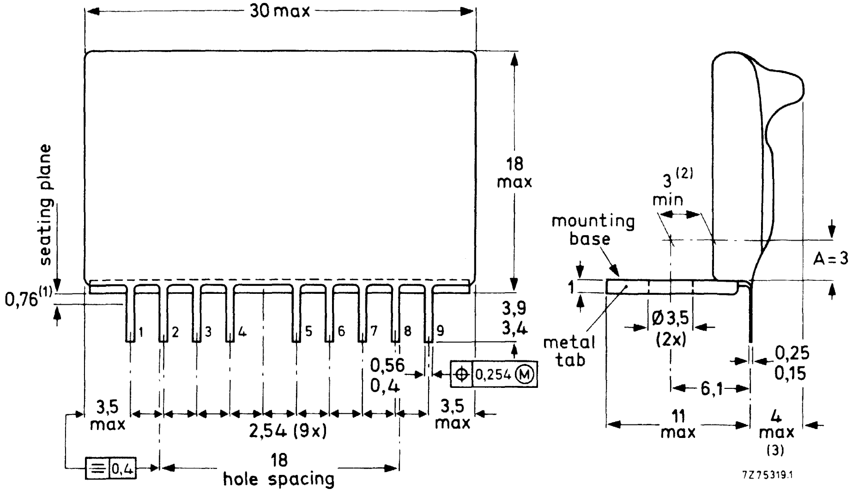
1. When the device is fixed only to a heatsink, not to a printed-circuit board, the values of the second column of the table should be increased by 2 °C and those of the third column decreased by 2 °C.
2. The user is free to realize proper cooling by using differently shaped sinks, or, preferably, by fixing the tab to any convenient part of the equipment (e.g. a wall of the metal cabinet).

heatsink data thickness 1 mm	$T_{mb} - T_{amb}$ °C	$T_{amb\ max}$ °C
Bright aluminium heatsink L-shaped bar, length 100 mm, height 165 mm	24	76
Blackened aluminium heatsink L-shaped bar; length 50 mm, height 70 mm	23	77

MECHANICAL DATA

Dimensions in mm

The amplifier is resin coated and has a metal mounting tab at a right angle to the encapsulation part.



(1) Tolerance applies within this zone.
(2) Distance applies within zone A.
(3) For the OM323A: 3 mm maximum.

Fig. 2 Encapsulation.

Terminal connections

1	= Input
2, 3, 5, 6, 7, 8	= Common, connected to mounting tab
4	= Supply (+)
9	= Output

Soldering recommendations

Hand soldering

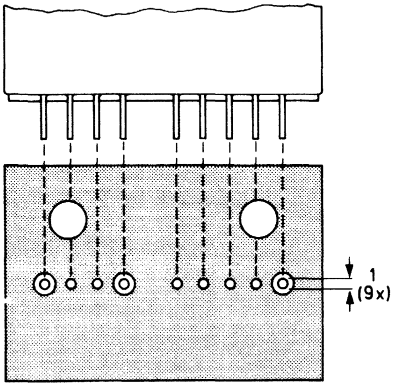
Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

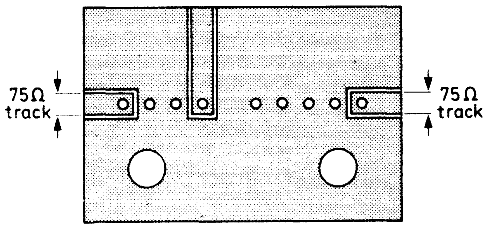
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on a double-sided printed-circuit board, see the following example. An example is also given of heatsink mounting.
Input and output should be connected to 75 Ω tracks.
The connections to the common pins should be as close to the seating plane as possible.

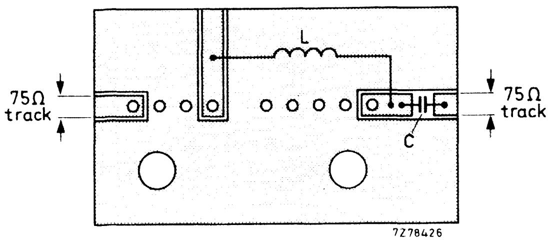


top view



OM323: bottom view

7Z75320



OM323A: bottom view

Fig. 3 Printed-circuit board holes and tracks for the OM323 and OM323A.

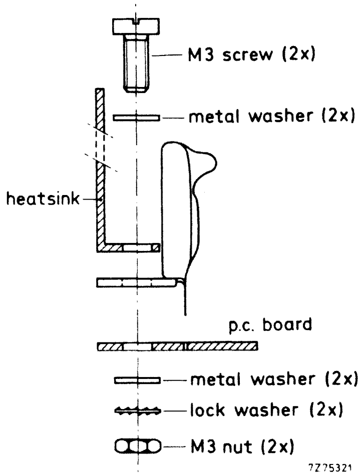


Fig. 4 Example of heatsink mounting.

L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

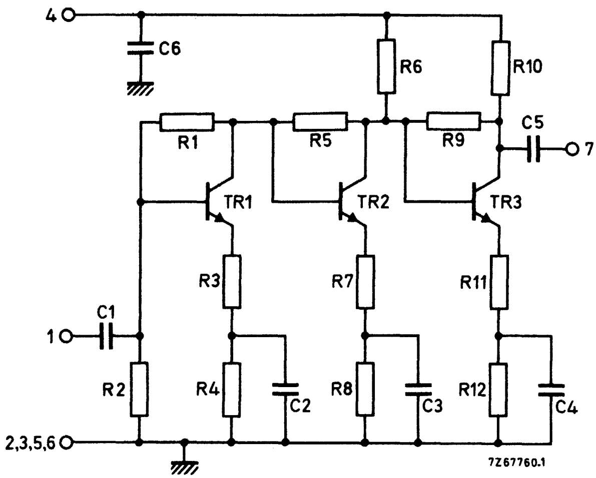
HYBRID VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster-amplifiers, as pre-amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	27	dB
Flatness of frequency response	$\pm\Delta \lvert s_f \rvert^2$	typ.	1,6	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	98	dBμV
Noise figure	F	typ.	5,5	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}$, $-V_{7M}$	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no.	3504 110 01840 *		
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	35	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		23 to 31	dB
		typ.	27	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,6	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,9	**
output	$VSWR_{(o)}$	typ.	3,2	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	46	dB
f = 860 MHz	$\|s_r\|^2$	typ.	40	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	98	dBμV
		typ.	101	dBμV
Noise figure	F	typ.	5,5	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

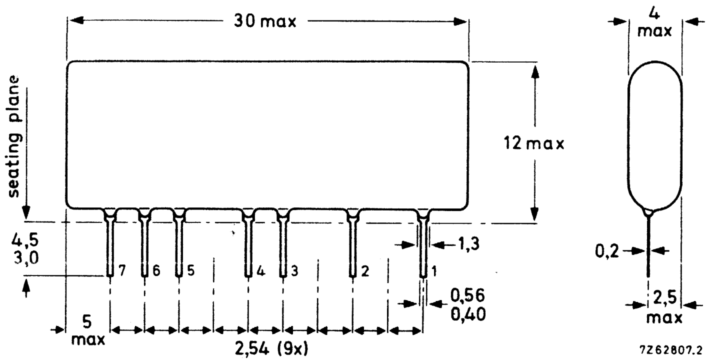
Ambient temperature range	T_{amb}		−20 to +70	^{o}C
D.C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.



Terminal connections

1	= Input
2, 3, 5, 6	= Common
4	= Supply (+)
7	= Output

Soldering recommendations

Hand soldering

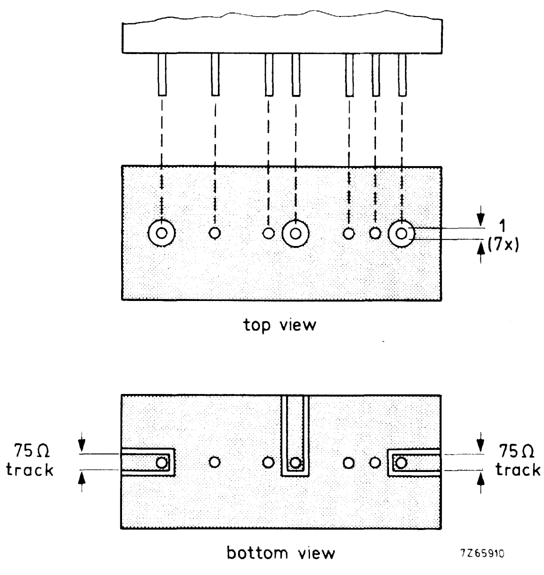
Maximum contact time for a soldering-iron temperature of 260 ^{o}C; up to seating plane: 5 s

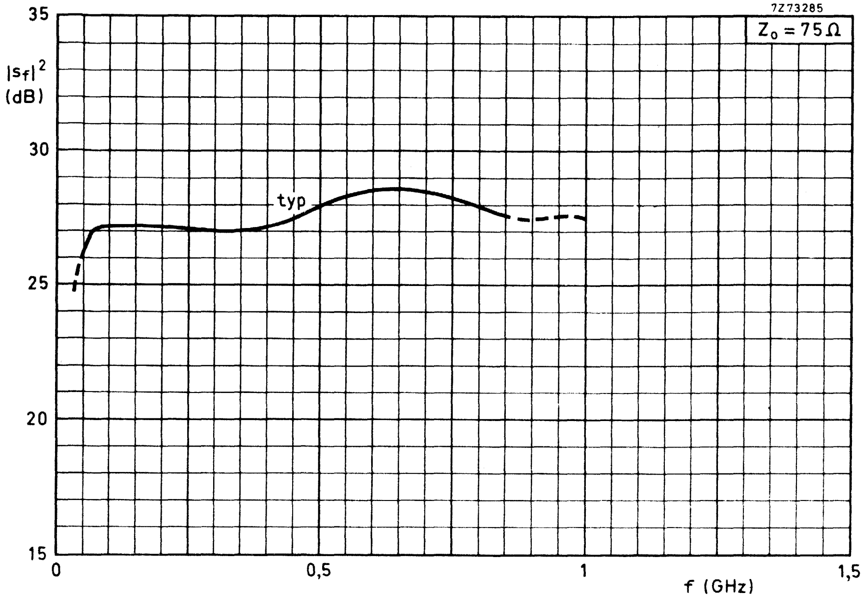
Dip or wave soldering

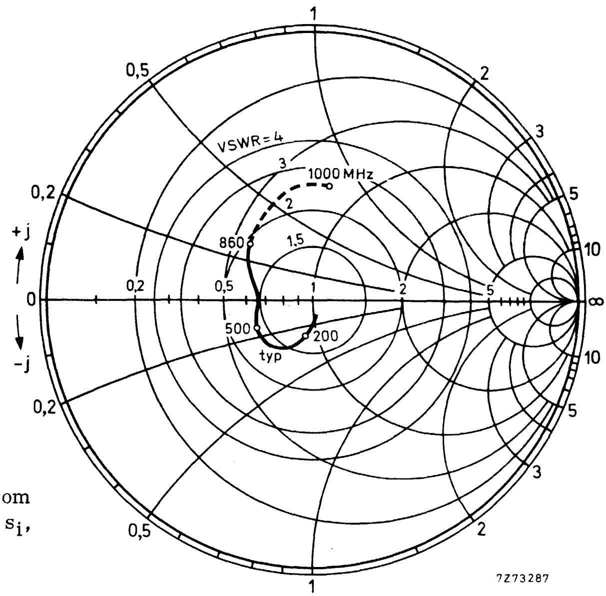
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

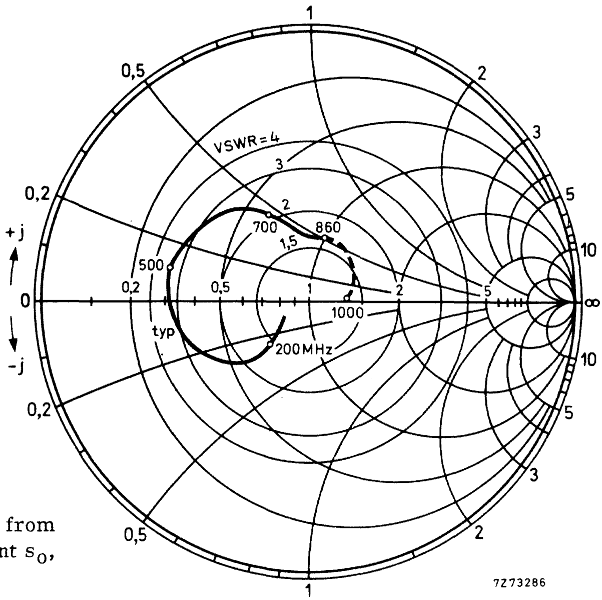
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.
Input and output should be connected to 75 Ω tracks.
The connections to the "common" pins should be as close to the seating plane as possible.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75.



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75.

HYBRID VHF/UHF WIDE-BAND AMPLIFIER

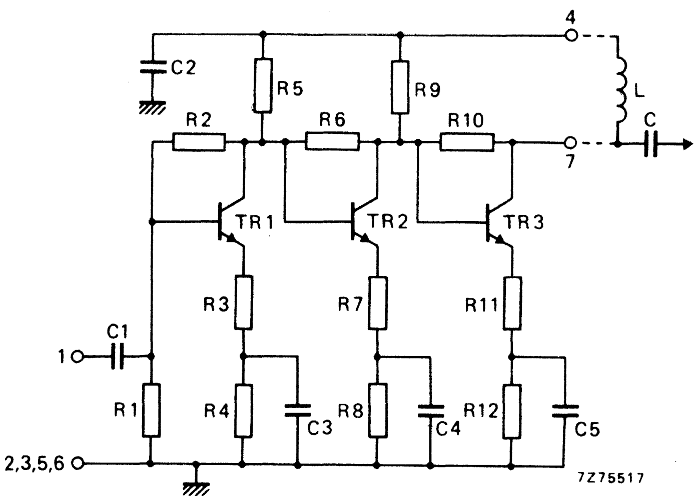
Three-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster-amplifiers, as preamplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	22	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,0	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in line, resin coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



RATINGS

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

Operating ambient temperature	T_{amb}	−20 to +70	°C
Storage temperature	T_{stg}	−40 to +125	°C
D.C. supply voltage	V_B	max. 28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max. 28	V
	$-V_{1M}, -V_{7M}$	max. 10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max. 100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *		
Ambient temperature	T_{amb}	= 25	°C
D.C. supply voltage	V_B	= 24	V
Source impedance and load impedance	R_s, R_ℓ	= 75	Ω
Characteristic impedance of h.f. connections	Z_o	= 75	Ω
Frequency range	f	= 40 to 860	MHz

Performance

Supply current	I_B	typ. 65	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	20 to 24	dB
		typ. 22	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ. 1,0	dB
Individual maximum v.s.w.r.			
input	$VSWR_{(i)}$	typ. 1,4	**
output	$VSWR_{(o)}$	typ. 1,6	**
Back attenuation			
f = 100 MHz	$\|s_r\|^2$	typ. 42	dB
f = 860 MHz	$\|s_r\|^2$	typ. 40	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	> 105	dBμV
		typ. 107	dBμV
Noise figure	F	typ. 7	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

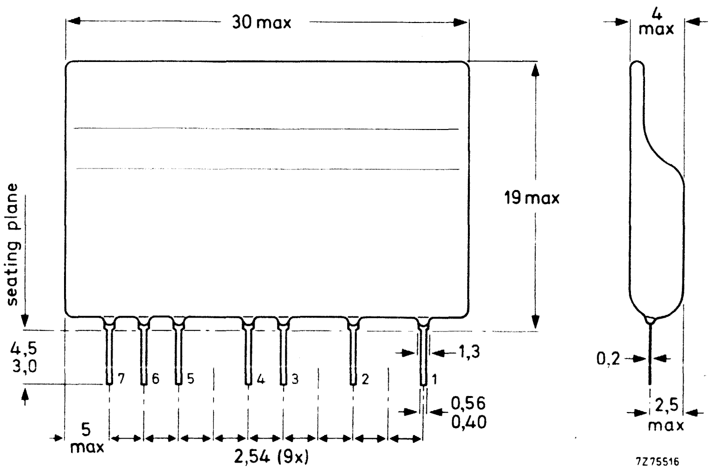
Ambient temperature range	T_{amb}	−20 to +70 °C
D.C. supply voltage	V_B	= 24 V ±10%
Frequency range	f	40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	= 75 Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.



Terminal connections

1 = Input
2, 3, 5, 6 = Common
4 = Supply (+)
7 = Output.

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

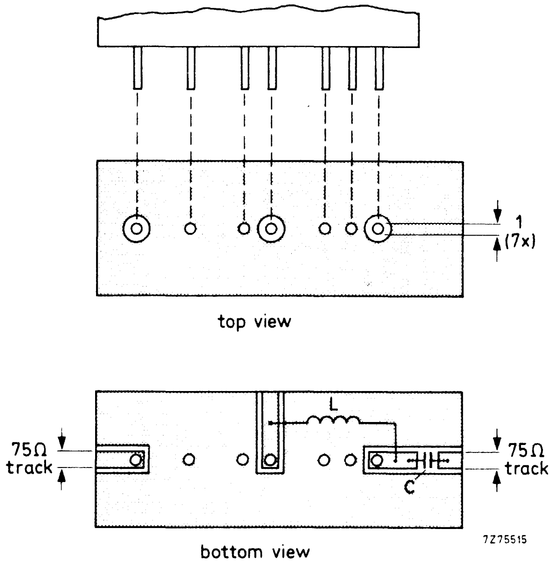
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

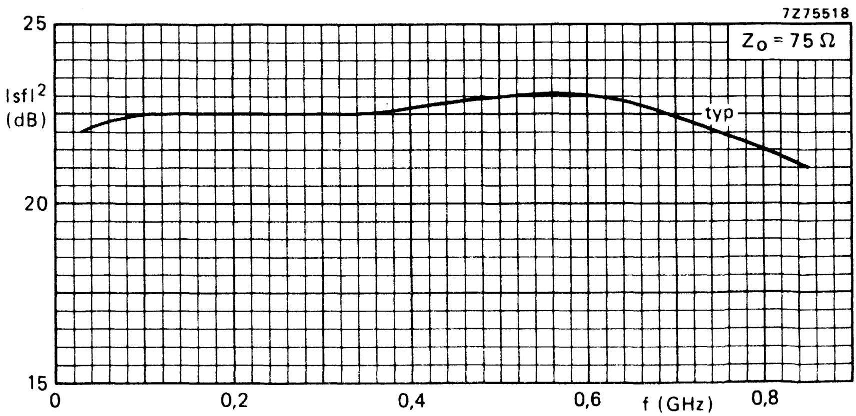
Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.

C > 220 pF ceramic capacitor.



HYBRID V.H.F./U.H.F. WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in the hybrid technique, designed for use in MATV systems, and as general purpose amplifier for v.h.f. and u.h.f. applications requiring a high output level.
The OM337A needs an external collector-coil and blocking capacitor, whereas, the OM337 has these components built-in.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	26	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone); f = 470 MHz	$V_{o(rms)}$	typ.	112	dBμV
Noise figure	F	typ.	9,8	dB
D.C. supply voltage	V_B	=	24	V ± 10%
Operating mounting-base temperature	T_{mb}		−30 to +100	°C

ENCAPSULATION 9-pin, in-line, resin-coated body on a right-angled metal mounting tab, see MECHANICAL DATA

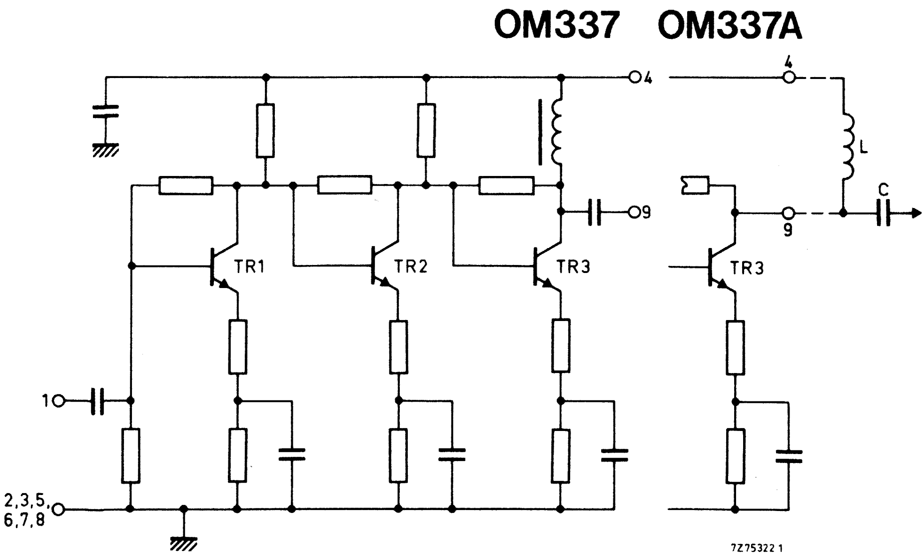


Fig. 1 Circuit diagram.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Operating mounting-base temperature	T_{mb}		−30 to +100	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pin 1	V_{1M}	max.	28	V
	$-V_{1M}$	max.	24	V
Peak voltages on pin 9	V_{9M}	max.	28	V
	$-V_{9M}$	max.	4	V
Peak incident powers on pins 1 and 9	P_{I1M}, P_{I9M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.—U.H.F. test socket	catalogue no. 3504 110 01830*			
Mounting base temperature	T_{mb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B		110 to 120	mA
		typ.	115	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		23 to 29	dB
		typ.	26	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,3	**
output	$VSWR_{(o)}$	typ.	1,8	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	44	dB
f = 650 MHz	$\|s_r\|^2$	typ.	41	dB
f = 860 MHz	$\|s_r\|^2$	typ.	43	dB

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

Output voltage				
at −60 dB intermodulation distortion				
(DIN45004, par. 6.3: 3-tone)				
f = 40–230 MHz	$V_{o(rms)}$	>	113	dBμV
		typ.	114	dBμV
f = 470 MHz	$V_{o(rms)}$	typ.	112	dBμV
f = 860 MHz	$V_{o(rms)}$	typ.	110	dBμV
Noise figure				
channel 2	F	typ.	7	dB
channel 65	F	typ.	9,8	dB

s-parameters:		
	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

OPERATING CONDITIONS

Mounting-base temperature range	T_{mb}		−30 to +100	°C
D.C. supply voltage	V_B	=	24	V ± 10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

THERMAL DATA

a. The maximum permissible temperature at the mounting base is 100 °C.

b. When the mounting tab is screwed to a double-sided printed-circuit board with dimensions 37 mm x 51 mm, its temperature will be 57 °C above the temperature of the surrounding free air.

c. When a heatsink is fixed to the mounting tab and the pins are soldered into a double-sided printed circuit board with dimensions 37 mm x 51 mm, the tab will reach the temperatures stated in the following table.

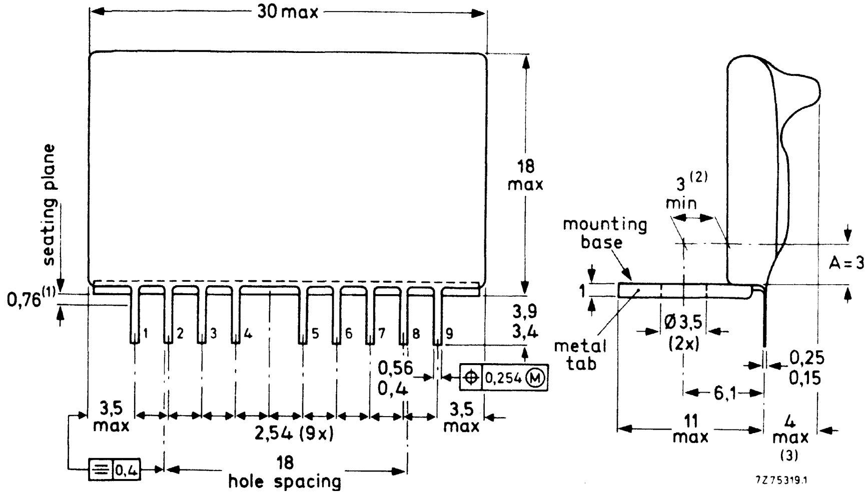
Notes:
1. When the device is fixed only to a heatsink, not to a printed-circuit board, the values of the second column of the table should be increased by 2 °C and those of the third column decreased by 2 °C.
2. The user is free to realize proper cooling by using differently shaped sinks, or, preferably, by fixing the tab to any convenient part of the equipment (e.g. a wall of the metal cabinet).

heatsink data thickness 1 mm	$T_{mb} - T_{amb}$ °C	$T_{amb\,max}$ °C
Bright aluminium heatsink		
L-shaped bar; length 100 mm, height 65 mm	27,5	72,5
Blackened aluminium heatsink		
L-shaped bar; length 50 mm, height 70 mm	26,5	73,5

MECHANICAL DATA

Dimensions in mm

The amplifier is resin coated and has a metal mounting tab at a right angle to the encapsulated part.



(1) Tolerance applies within this zone.
(2) Distance applies within zone A.
(3) For the OM337A: 3 mm maximum.

Fig. 2 Encapsulation.

Terminal connections

1	= Input
2, 3, 5, 6, 7, 8	= Common, connected to mounting tab
4	= Supply (+)
9	= Output

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on a double-sided printed-circuit board, see the following example. An example is also given of heatsink mounting.
Input and output should be connected to 75 Ω tracks.
The connections to the common pins should be as close to the seating plane as possible.

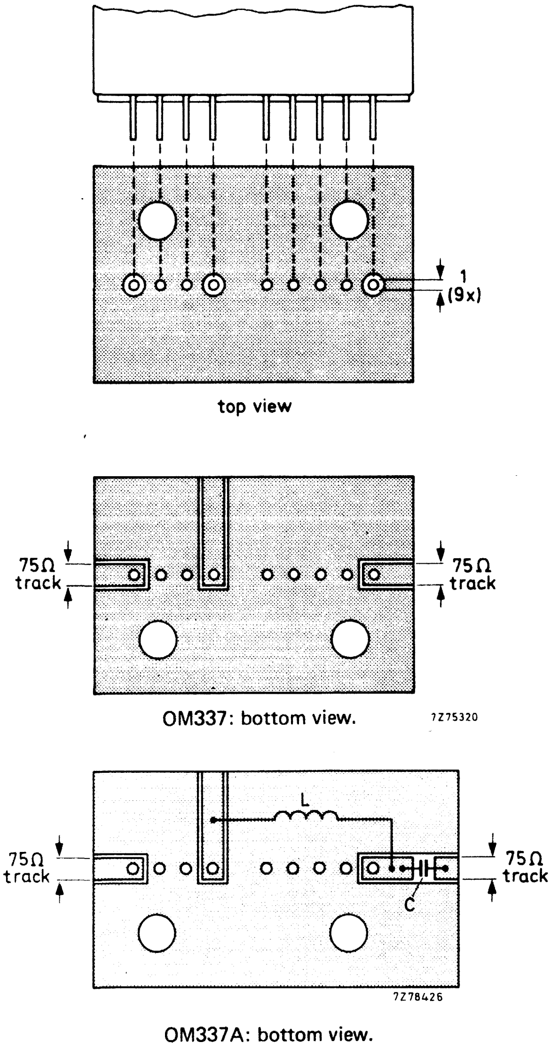


Fig. 3 Printed-circuit board holes and tracks for the OM337 and OM337A.

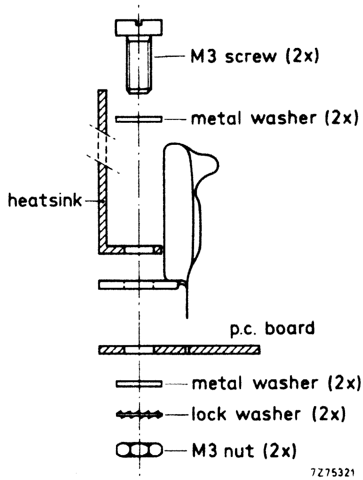


Fig. 4 Example of heatsink mounting.

L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

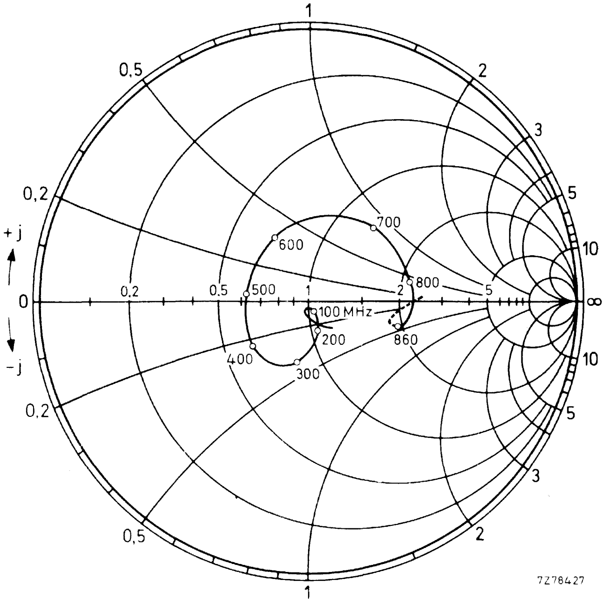


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

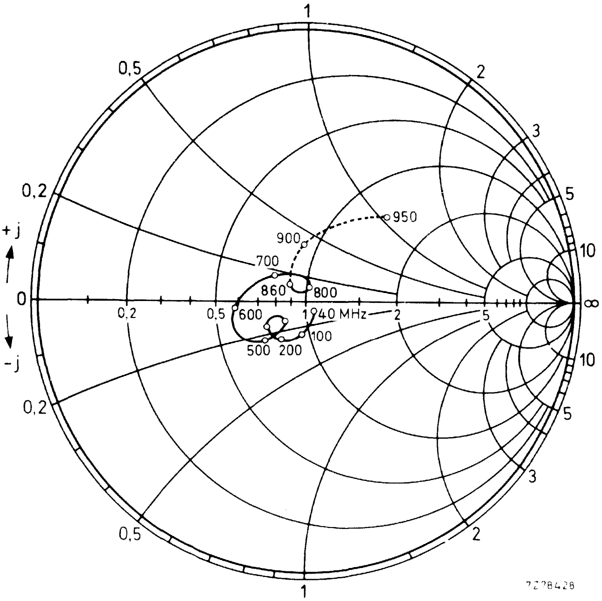


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

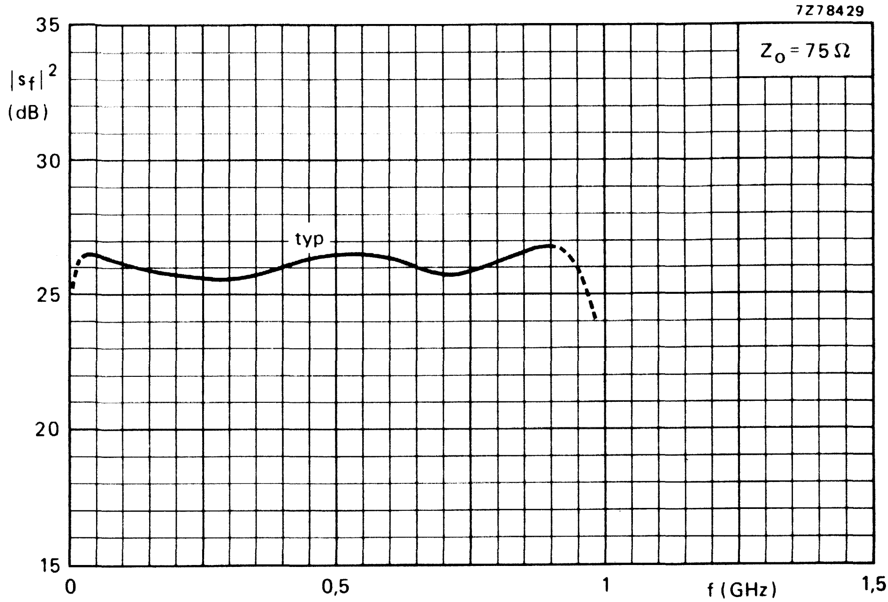


Fig. 7 Transducer gain as a function of frequency.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in the hybrid integrated circuit technique, designed for use in mast-head booster-amplifiers, as amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	28	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,5	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	6	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

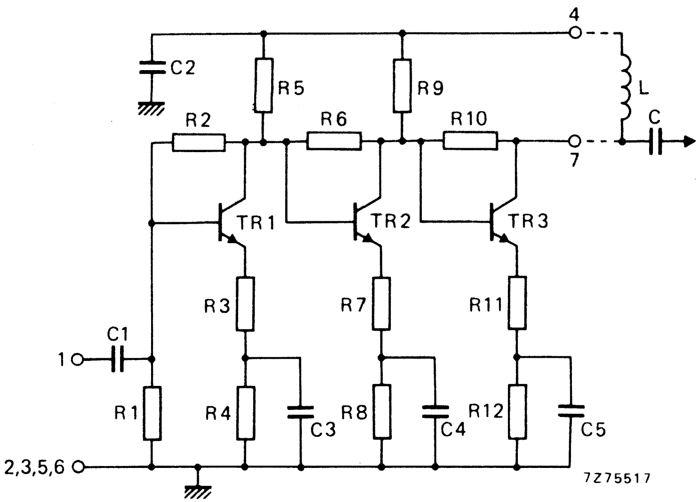


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}	−20 to +70	°C
Storage temperature	T_{stg}	−40 to +125	°C
D.C. supply voltage	V_B	max. 28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max. 28	V
	$-V_{1M}, -V_{7M}$	max. 10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max. 100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *		
Ambient temperature	T_{amb}	= 25	°C
D.C. supply voltage	V_B	= 24	V
Source impedance and load impedance	R_s, R_ℓ	= 75	Ω
Characteristic impedance of h.f. connections	Z_o	= 75	Ω
Frequency range	f	= 40 to 860	MHz

Performance

Supply current	I_B	typ. 67	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	25 to 30	dB
		typ. 28	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ. 1,5	dB
Individual maximum v.s.w.r.			
input	$VSWR_{(i)}$	typ. 1,5	**
output	$VSWR_{(o)}$	typ. 1,5	**
Back attenuation			
f = 100 MHz	$\|s_r\|^2$	typ. 46	dB
f = 860 MHz	$\|s_r\|^2$	typ. 31	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	> 105	dBμV
		typ. 107	dBμV
Noise figure	F	typ. 6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.

** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}	−20 to +70 °C
D.C. supply voltage	V_B	= 24 V ±10%
Frequency range	f	40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	= 75 Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

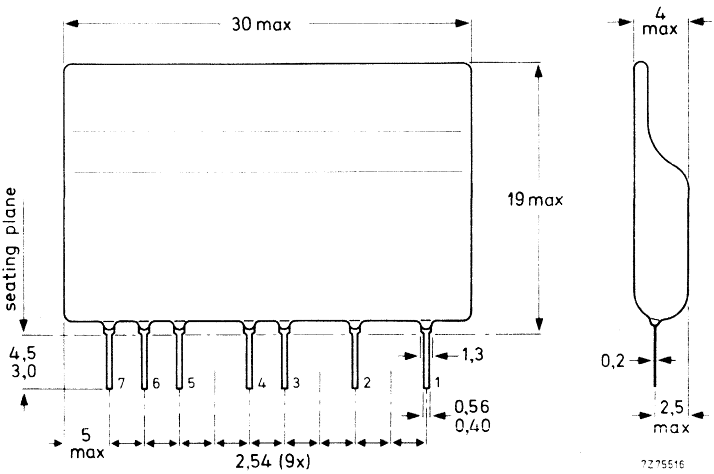


Fig. 2 Encapsulation.

Terminal connections

1 = input
2, 3, 5, 6 = common
4 = supply (+)
7 = output

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

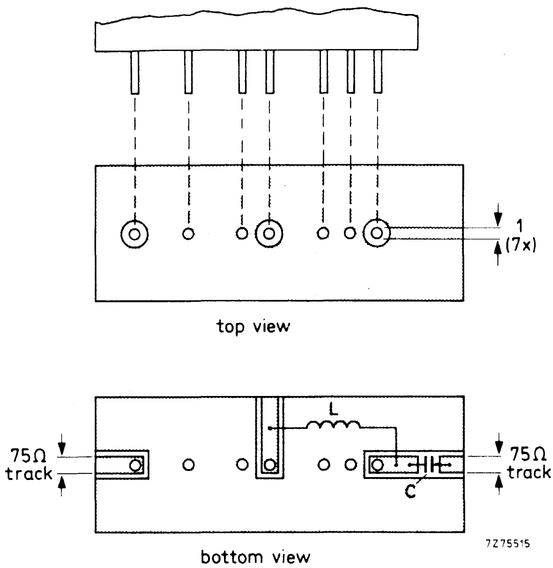
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

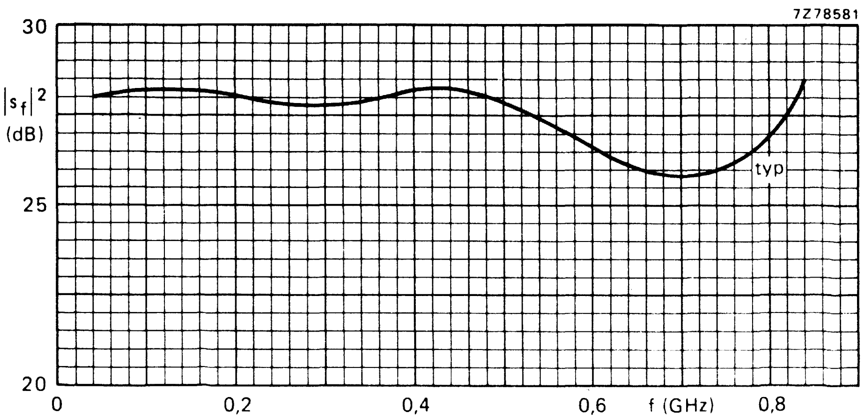


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

One-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for aerial amplifiers in car radios, caravans or RATV and MATV applications.

QUICK REFERENCE DATA

D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	12	dB
Flatness of frequency response	$\pm \Delta \|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	typ.	99	dBμV
Noise figure	F	typ.	5,5	dB
Operating ambient temperature	T_{amb}		−20 to + 70	°C

ENCAPSULATION 5-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

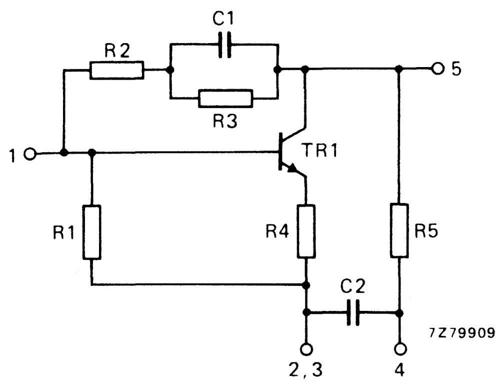


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 5	P_{I1M}, P_{I5M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	11,5	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	12	dB
Flatness of frequency response	$\pm \Delta \|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,0	*
output	$VSWR_{(o)}$	typ.	1,4	*
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	22	dB
f = 860 MHz	$\|s_r\|^2$	typ.	19	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	typ.	99	dBμV
Noise figure	F	typ.	5,5	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* Highest value, for a sample, occuring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to + 70	°C
D.C. supply voltage	V_B	=	12	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

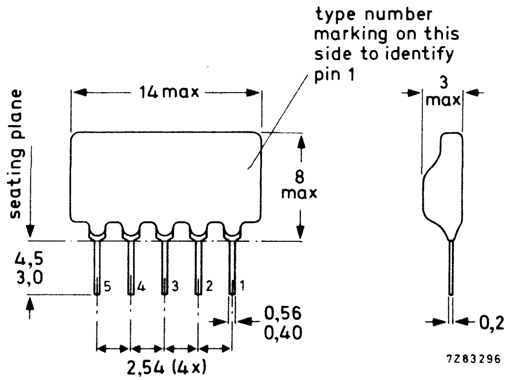


Fig. 2 Encapsulation.

Terminal connections

1 = input
2,3 = common
4 = supply (+)
5 = output

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.

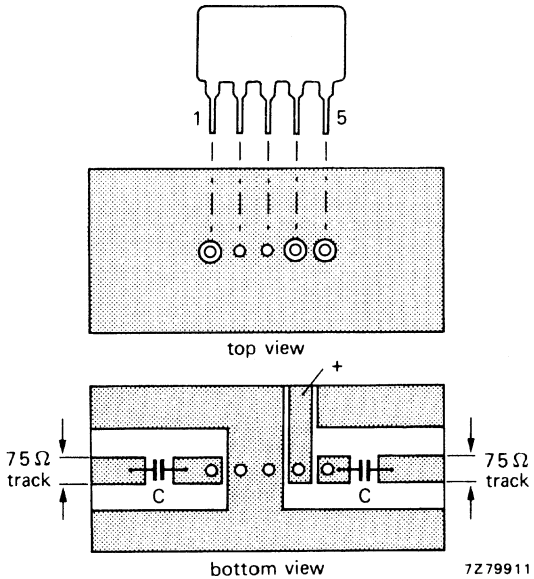


Fig. 3 Printed-circuit board holes and tracks.
C > 220 pF ceramic capacitor.

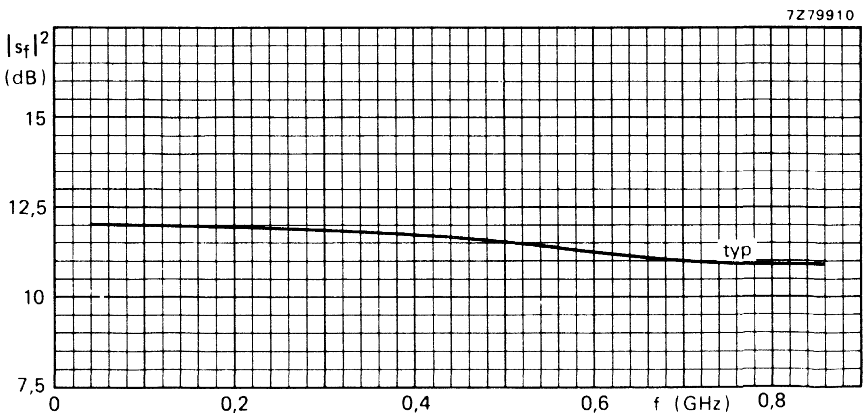


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

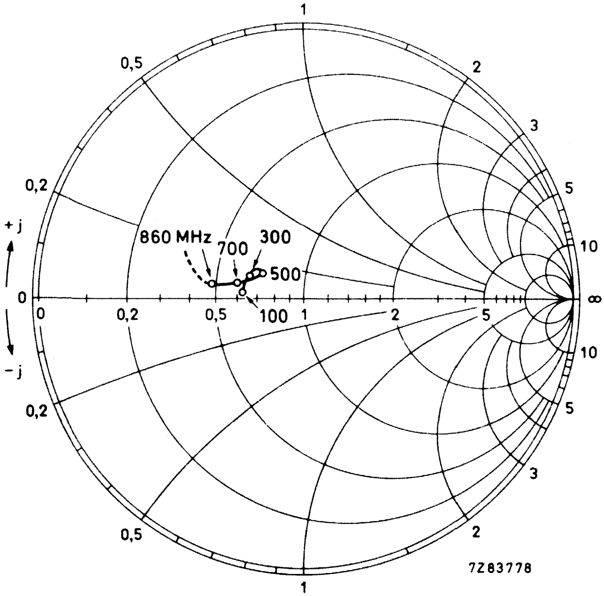


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

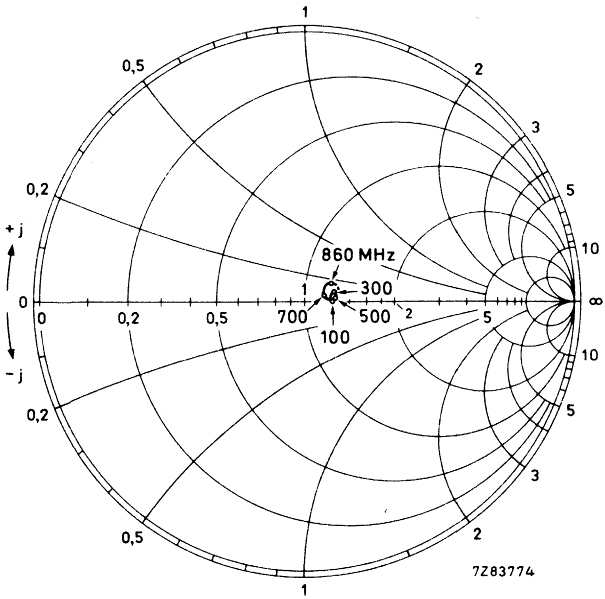


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

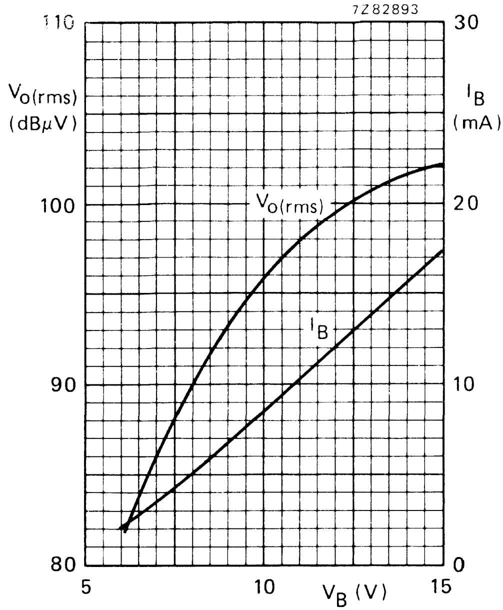


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

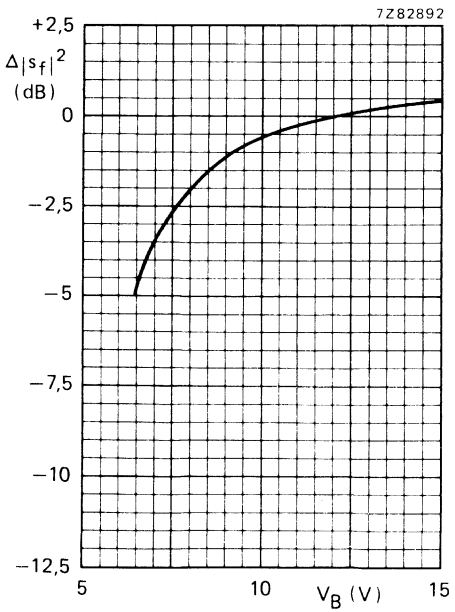


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V; f = 100 to 860 MHz; typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for RATV and MATV applications.

QUICK REFERENCE DATA

D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	18	dB
Flatness of frequency response	$\pm \Delta \lvert s_f \rvert^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	typ.	100	dBμV
Noise figure	F	typ.	6	dB
Operating ambient temperature	T_{amb}		−20 to + 70	°C

ENCAPSULATION 5-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

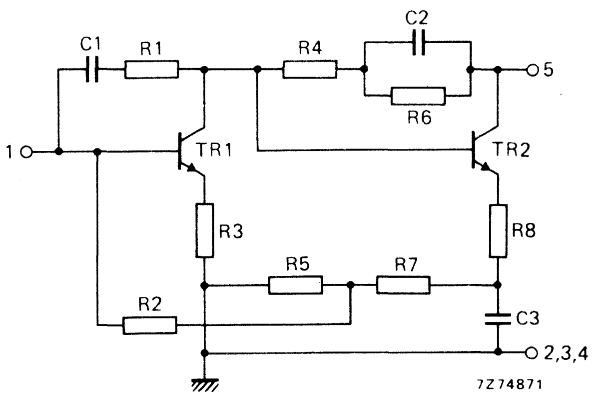


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}	−20 to	+70	°C
Storage temperature	T_{stg}	−40 to	+125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 5	P_{I1M}, P_{I5M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	18	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	18	dB
Flatness of frequency response	$\pm \Delta \|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,5	*
output	$VSWR_{(o)}$	typ.	1,9	*
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	29	dB
f = 860 MHz	$\|s_r\|^2$	typ.	25	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	typ.	100	dBμV
Noise figure	F	typ.	6	dB

s-parameters: $s_f = s_{21}$ $s_i = s_{11}$
$s_r = s_{12}$ $s_o = s_{22}$

* Highest value, for a sample, occuring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to + 70 °C
D.C. supply voltage	V_B	=	12 V ± 10%
Frequency range	f		40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	=	75 Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

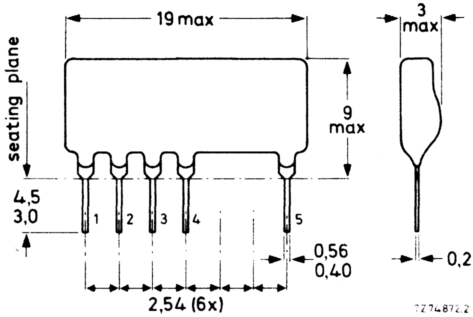


Fig. 2 Encapsulation.

Terminal connections

1 = input
2,3,4 = common
5 = output/supply(+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

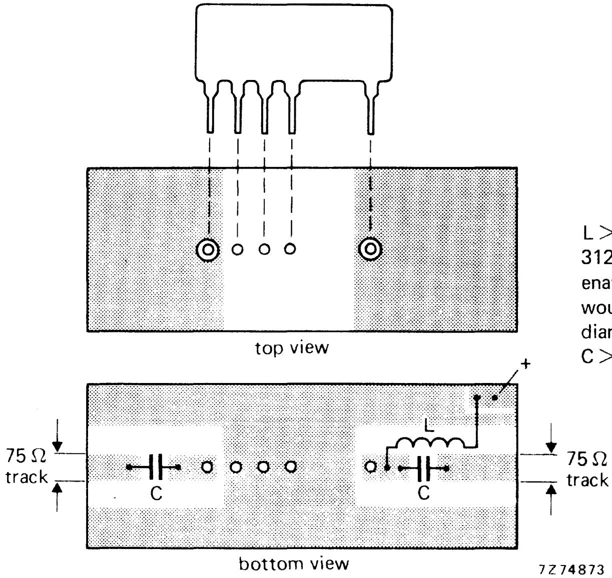
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

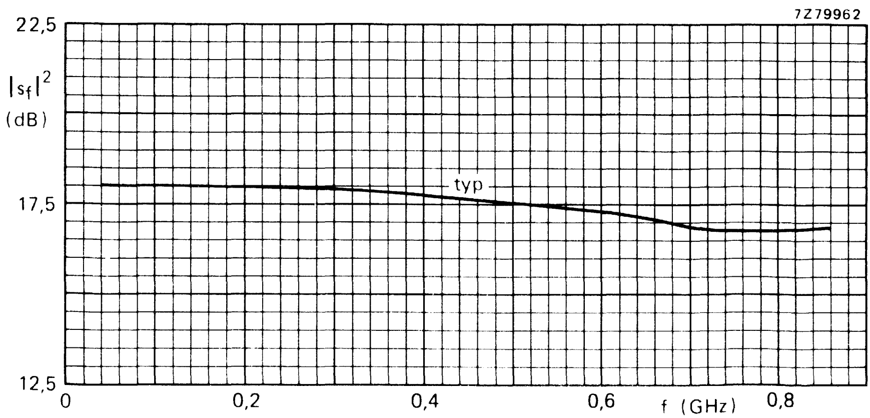


Fig. 4 Transducer gain as a function of frequency; $Z_o = 75\ \Omega$.

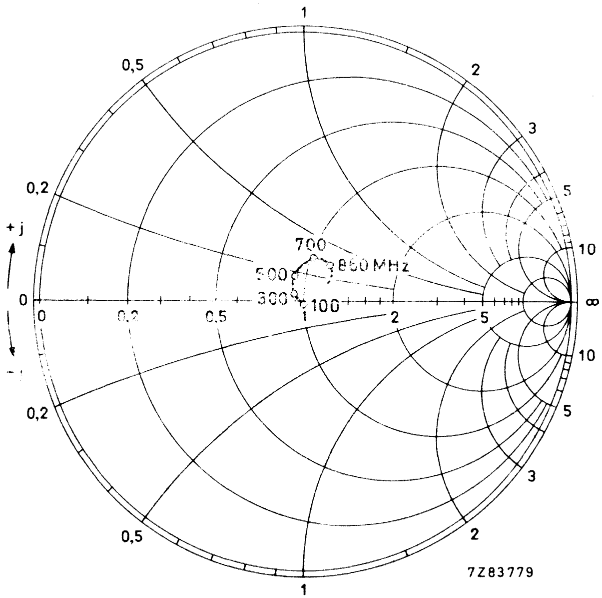


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

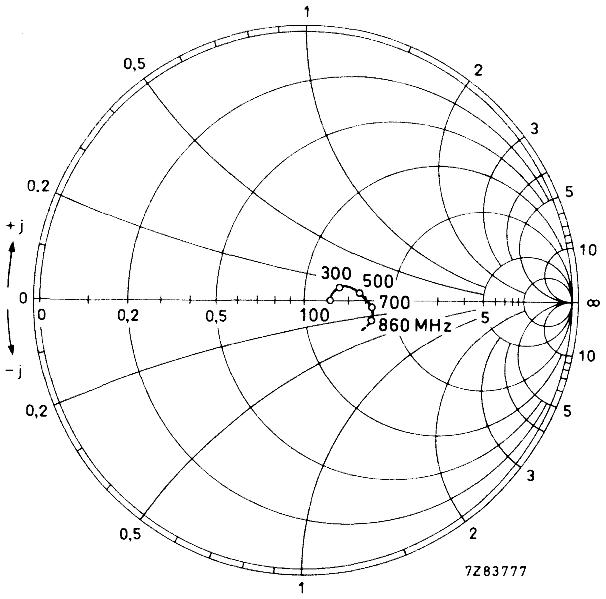


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

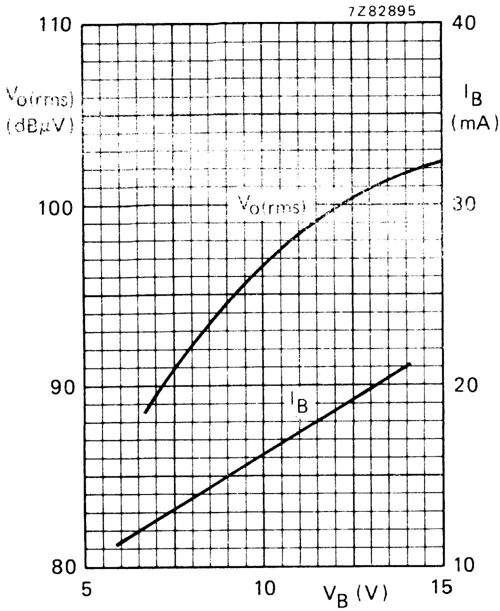


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

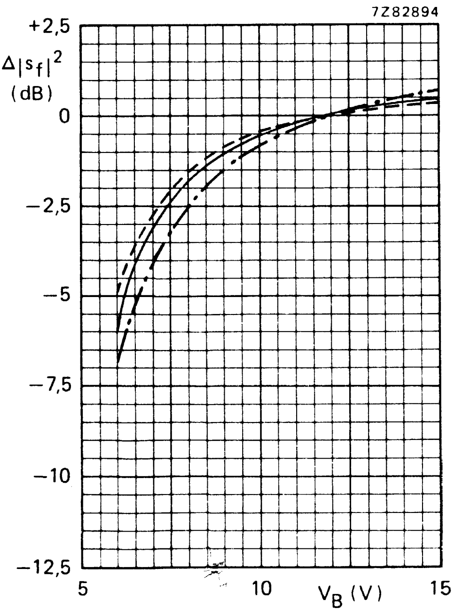


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V:
——— f = 500 MHz;
– – – – f = 100 MHz;
—·—·—· f = 860 MHz;
typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for use in mast-head booster-amplifiers, as preamplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	23	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0,5	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	12	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 8-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

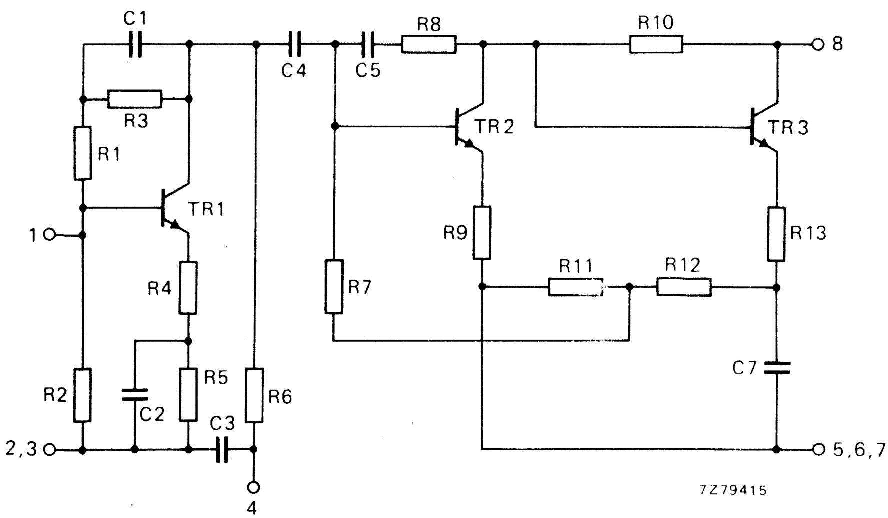


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	55	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	23	dB
			21 to 25	dB
Flatness of frequency response	$\pm\Delta\lvert s_f \rvert^2$	typ.	0,5	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,3	*
output	$VSWR_{(o)}$	typ.	1,5	*
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	42	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	33	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	105	dBμV
		typ.	107	dBμV
Noise figure	F	typ.	7	dB

s-parameters:		
	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}	−20 to +70 °C
D.C. supply voltage	V_B	= 12 V ± 10%
Frequency range	f	40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	= 75 Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

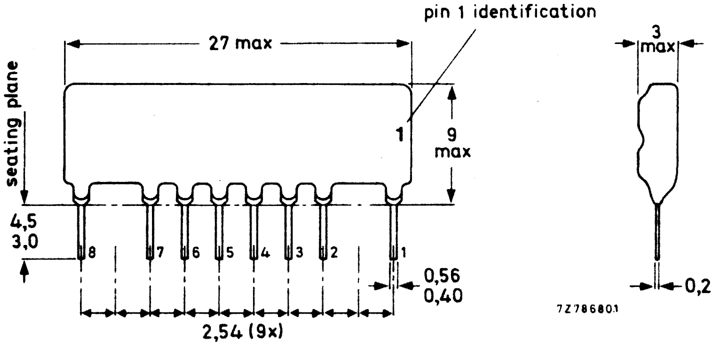


Fig. 2 Encapsulation.

Terminal connections

1 = input
2, 3, 5, 6, 7 = common
4 = supply (+)
8 = output/supply (+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

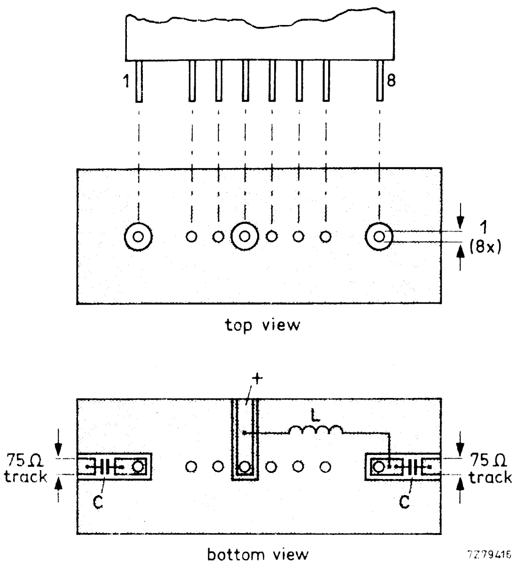
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

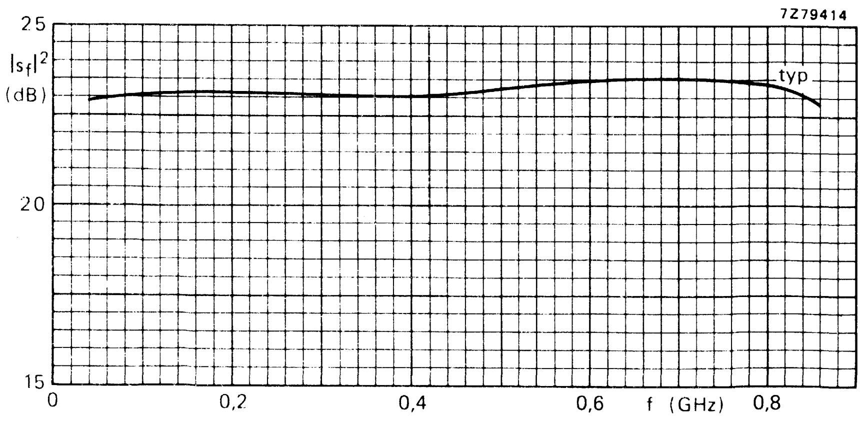


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

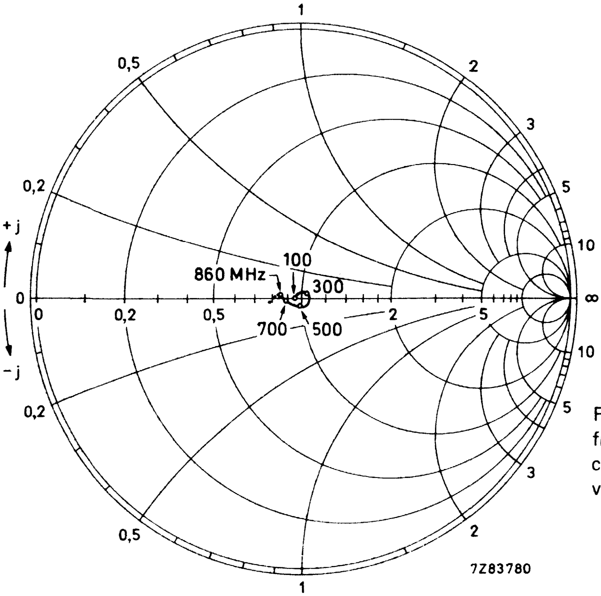


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

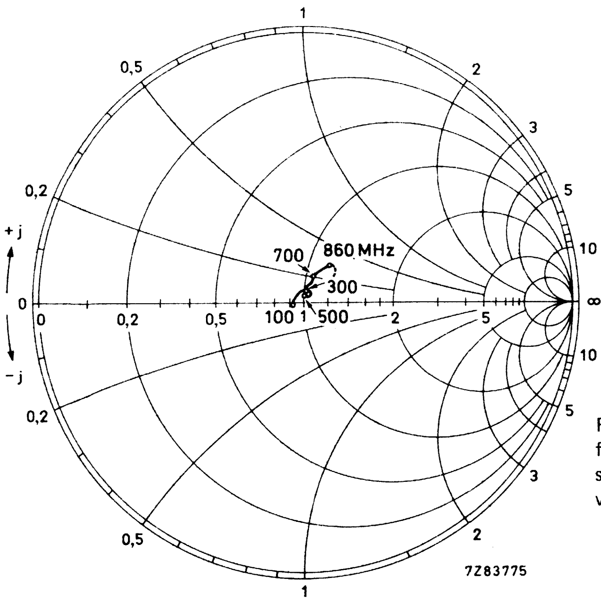


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

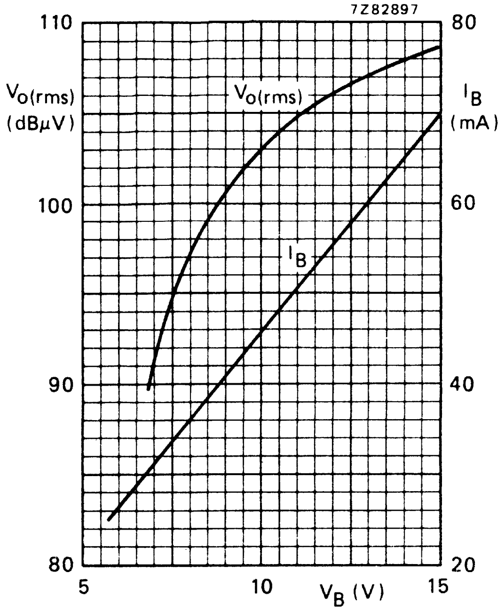


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

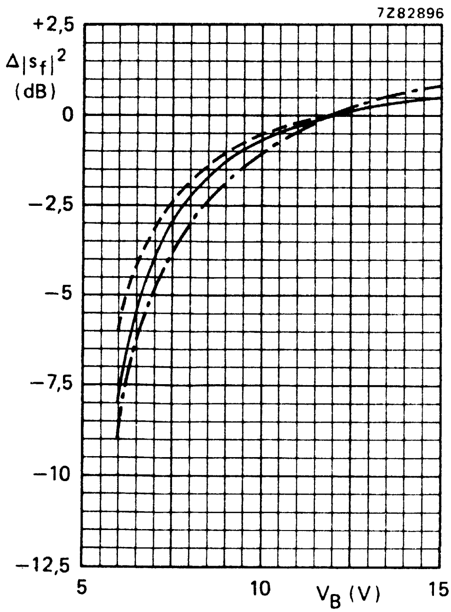


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V;
——— f = 500 MHz;
– – – – f = 100 MHz;
—.—.— f = 860 MHz;
typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for use in mast-head booster-amplifiers, as an amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	28	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	6	dB
D.C. supply voltage	V_B	=	12	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 8-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

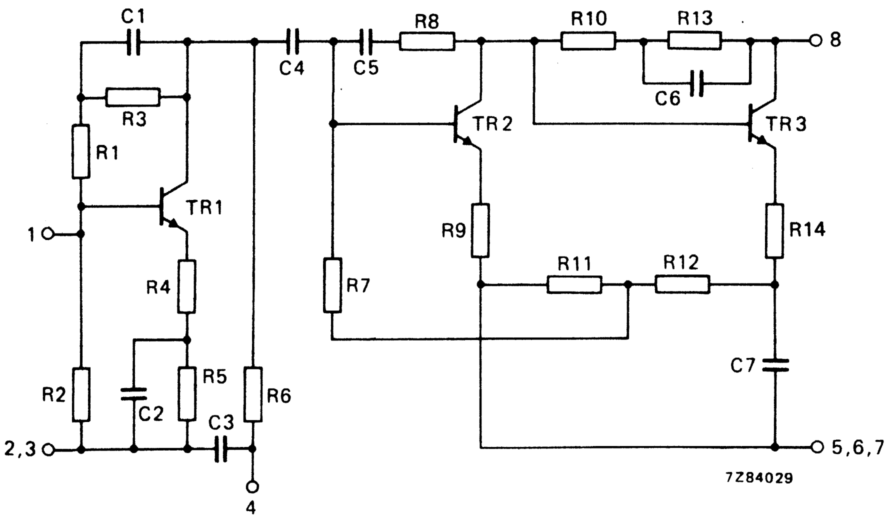


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 8	P_{I1M}, P_{I8M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	50	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	28	dB
			26 to 31	dB
Flatness of frequency response	$\pm\Delta\lvert s_f \rvert^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,5	*
output	$VSWR_{(o)}$	typ.	1,7	*
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	45	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	35	dB
Output voltage				
at −60 dB intermodulation distortion	$V_{o(rms)}$	>	105	dBμV
(DIN 45004, par. 6,3; 3-tone)		typ.	107	dBμV
Noise figure	F	typ.	6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

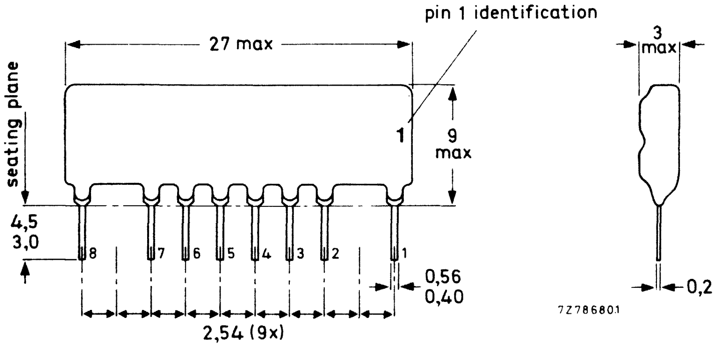


Fig. 2 Encapsulation.

Terminal connections

1	= input
2, 3, 5, 6, 7	= common
4	= supply (+)
8	= output/supply (+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

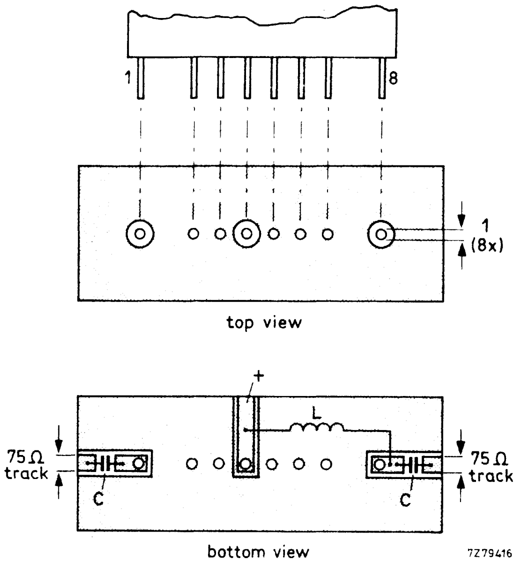
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core (material 4B1; catalogue number 3122 104 91110) with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

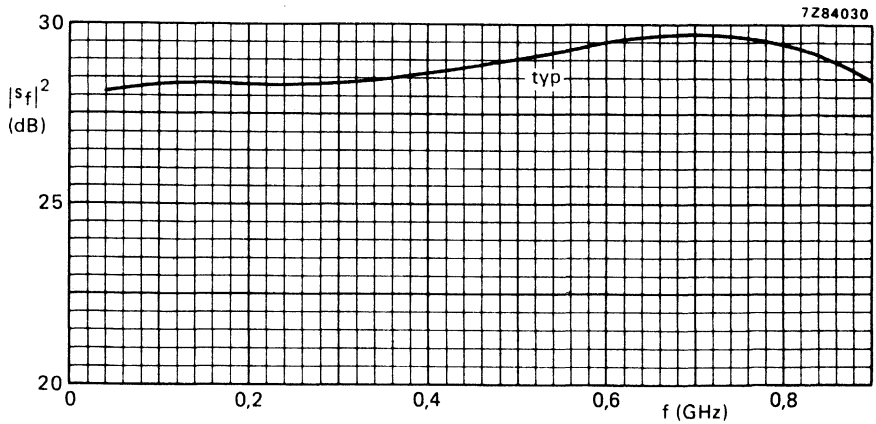


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

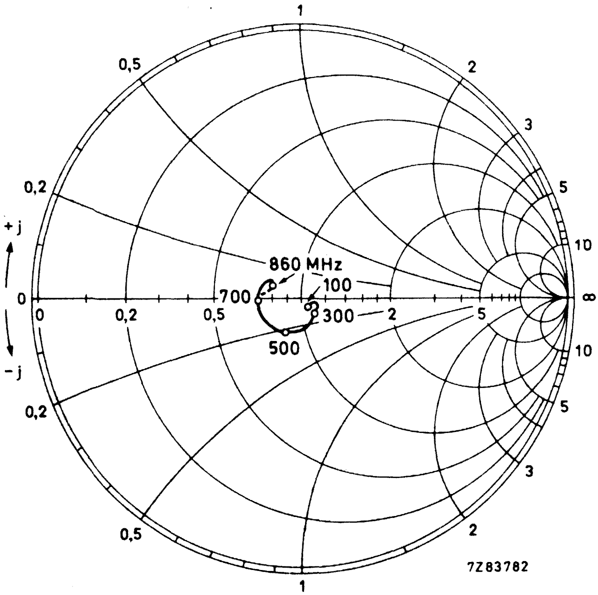


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

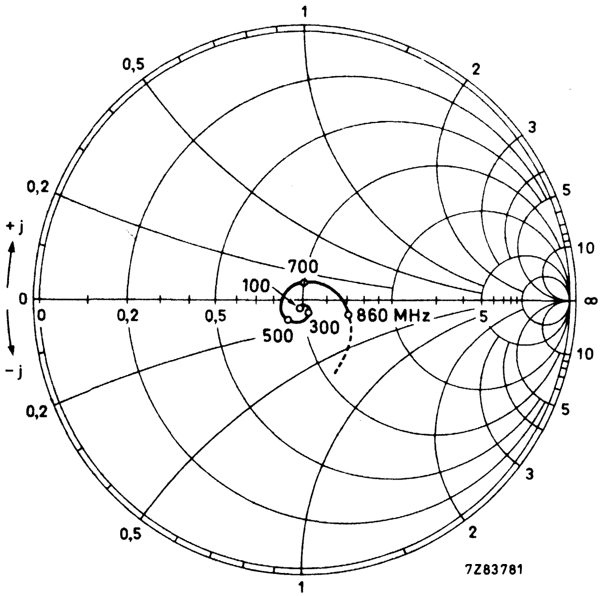


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

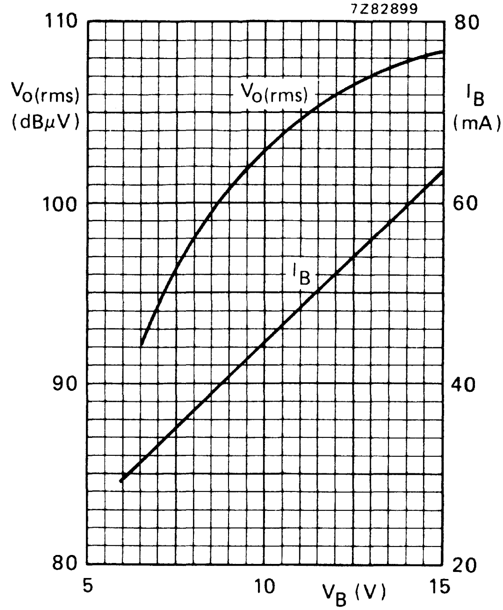


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

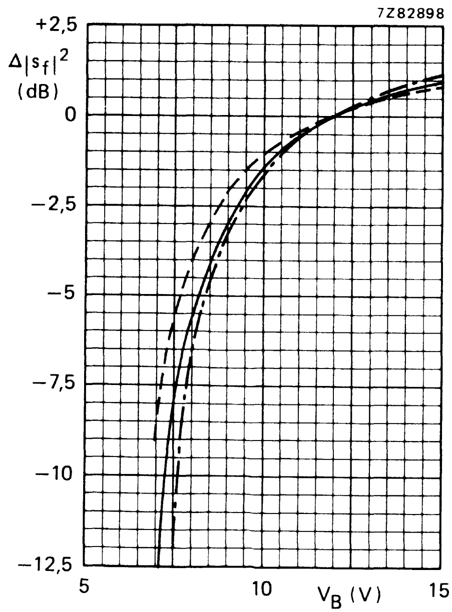


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V;
——— f = 500 MHz;
– – – – f = 100 MHz;
—.—.—. f = 860 MHz;
typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for use in mast-head booster-amplifiers, as an amplifier in MATV and CATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	28	dB
Flatness of frequency response	$\pm\Delta\lvert s_f \rvert^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)				
VHF	$V_{o(rms)}$	typ.	113	dBμV
UHF	$V_{o(rms)}$	typ.	112	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	12	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 9-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig.2)

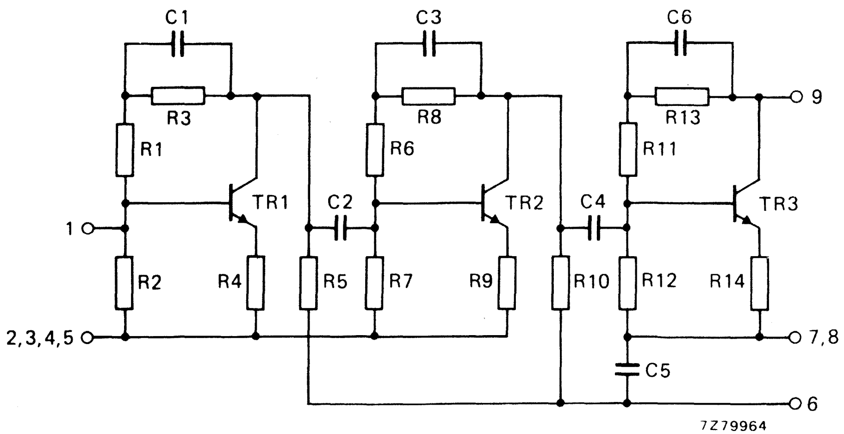


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to +70	^oC
Storage temperature	T_{stg}		−40 to +125	^oC
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 8	P_{I1M}, P_{I8M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	^oC
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	105	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	28	dB
			26 to 31	dB
Flatness of frequency response	$\pm\Delta\lvert s_f \rvert^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,3	*
output	$VSWR_{(o)}$	typ.	1,9	*
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	45	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	35	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6,3; 3-tone)				
VHF	$V_{o(rms)}$	>	111	dBμV
		typ.	113	dBμV
UHF	$V_{o(rms)}$	>	110	dBμV
		typ.	112	dBμV
Noise figure	F	typ.	7	dB

s-parameters:		
	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to +70 °C
D.C. supply voltage	V_B	=	12 V ± 10%
Frequency range	f		40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	=	75 Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

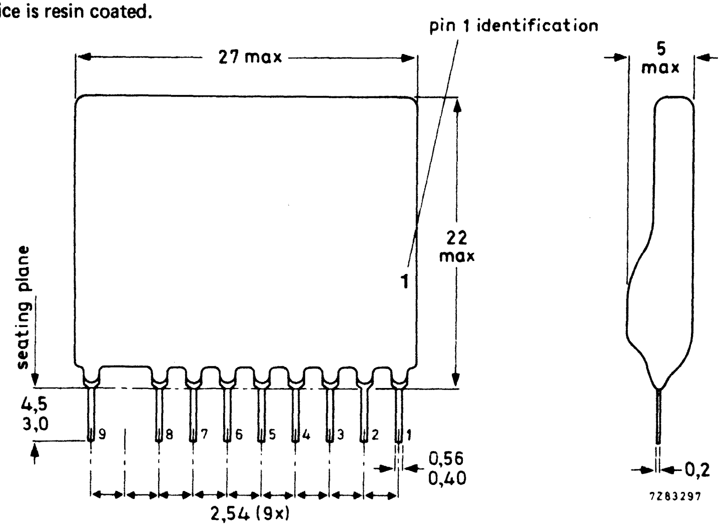


Fig. 2 Encapsulation.

Terminal connections

1	= input
2, 3, 4, 5 and 7, 8	= common
6	= supply (+)
9	= output/supply (+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

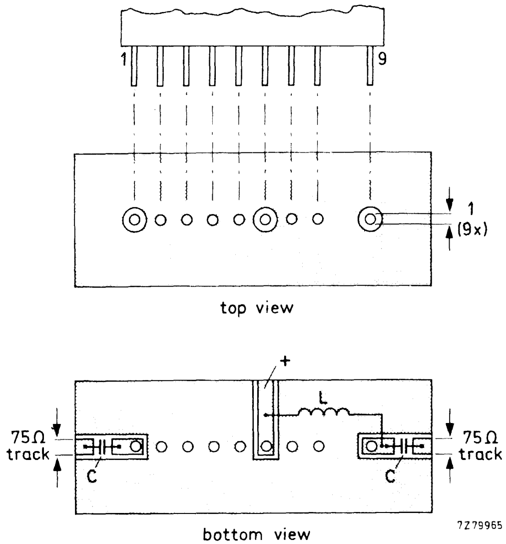
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core (material 4B1; catalogue no. 3122 104 91110) with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

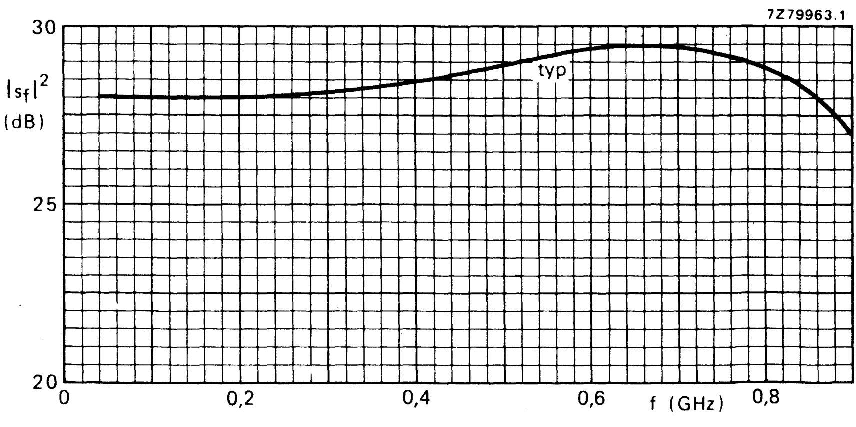


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

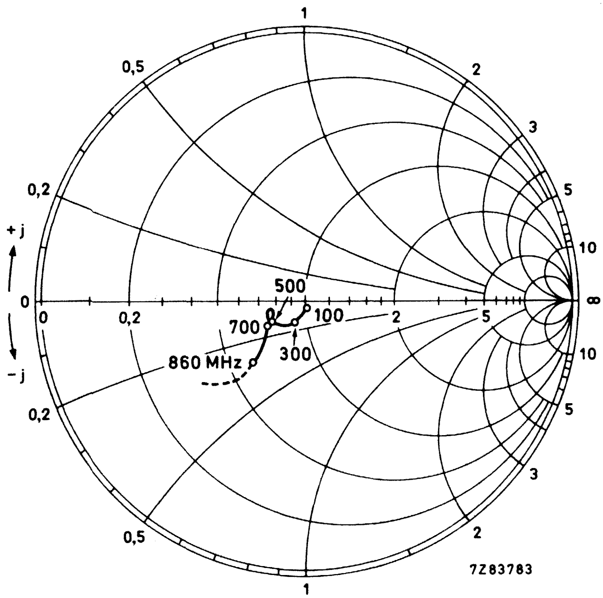


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

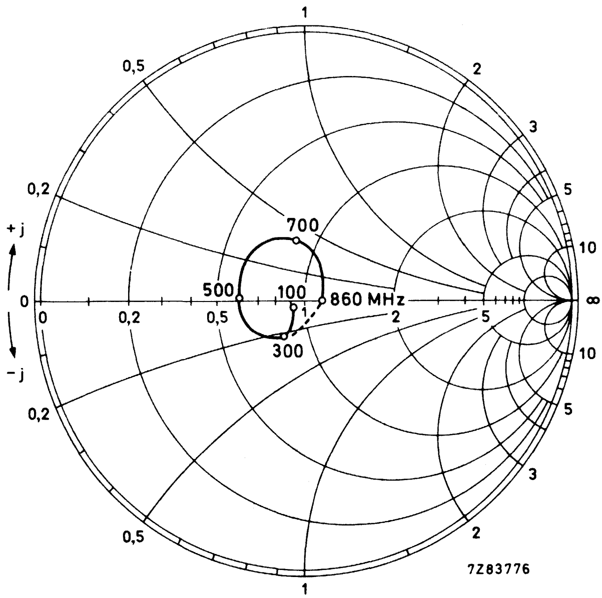


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

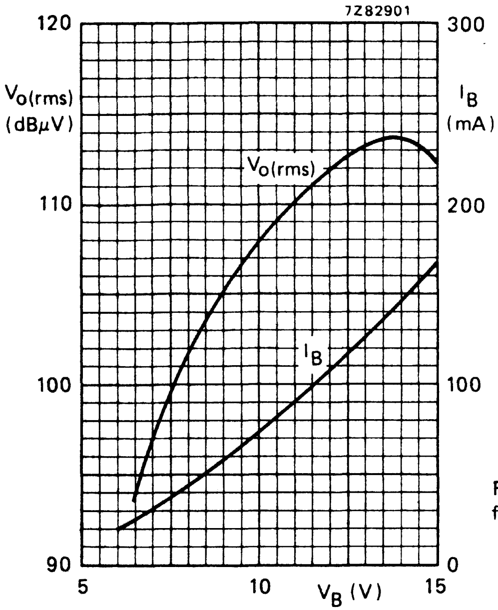


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

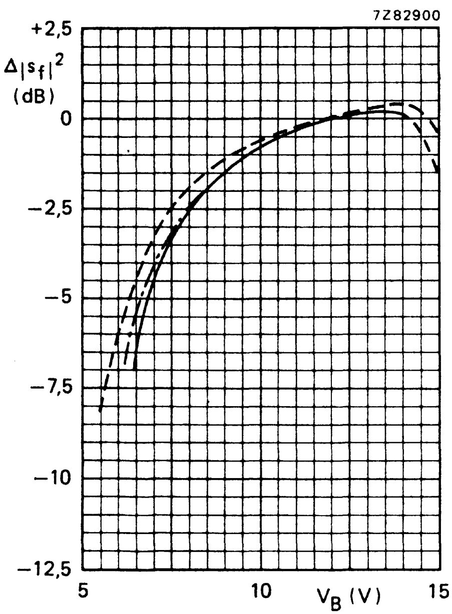


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V;
——— f = 500 MHz;
– – – – f = 100 MHz;
—.—.—. f = 860 MHz;
typical values.

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

WIDEBAND TRANSISTORS AND WIDEBAND HYBRID IC MODULES

GENERAL

WIDEBAND TRANSISTORS

HYBRID IC MODULES:

CATV AMPLIFIER MODULES (V.H.F.)

WIDEBAND AMPLIFIERS (V.H.F. & U.H.F.)