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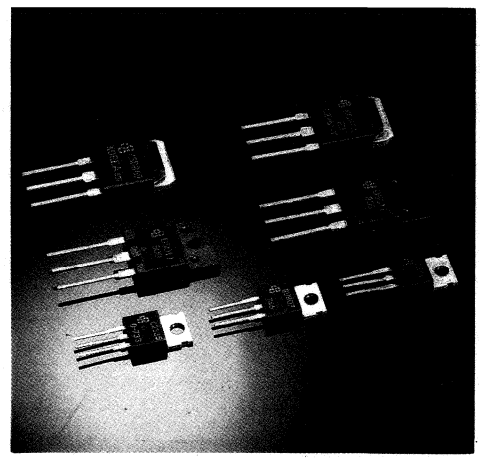
Transistor Data Book (Vol. 2)



1989

- Bipolar Power TR

PRINTED IN KOREA

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DATA BOOK LIST

I. Semiconductor Product Guide

II. Transistor Data Book

Vol. 1: Small Signal TR

Vol. 2: Bipolar Power TR

Vol. 3: TR Pellet

III. Linear IC Data Book

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Vol. 2: Telecom/Industrial

Vol. 3: Data Converter IC

IV. MOS Product Data Book

V. High Performance CMOS Logic Data Book

VI. MOS Memory Data Book

VII. SFET Data Book

VIII. MPR Data Book

IX. CPL Data Book

X. Dot Matrix Data Book

TRANSISTOR DATA BOOK

VOLUME 1

KSA Series
KSB Series
KSC Series
KSD Series
KSK Series
KSR Series
2N Series
BC Series
MM Series
MPS Series
SS Series

VOLUME 2

KSA Series
KSB Series
KSC Series
KSD Series
BD Series
BU Series
MJE Series
TIP Series

TABLE OF CONTENTS
(Volume 2)

TABLE OF CONTENTS
(Volume 1)

ALPHANUMERIC INDEX

1. KSA Series

2. KSB Series

3. KSC Series

4. KSD Series

ALPHANUMERIC INDEX (Continued)

5. KSK Series

6. KSR Series

7. 2N Series

ALPHANUMERIC INDEX (Continued)

8. BC Series

9. BD Series

10. BU Series

11. MJE Series

ALPHANUMERIC INDEX (Continued)

Device	Page
MJE803	395
MJE2955T	397
MJE3053T	399

12. MM Series

Device	Page
MMBA81C5	Vol. 1
MMBA811C6	Vol. 1
MMBA811C7	Vol. 1
MMBA811C8	Vol. 1
MMBA812M3	Vol. 1
MMBA812M4	Vol. 1
MMBA812M5	Vol. 1
MMBA812M6	Vol. 1
MMBA812M7	Vol. 1
MMBC1009F1	Vol. 1
MMBC1009F2	Vol. 1
MMBC1009F3	Vol. 1
MMBC1009F4	Vol. 1
MMBC1009F5	Vol. 1
MMBC1622D6	Vol. 1
MMBC1622D7	Vol. 1
MMBC1622D8	Vol. 1
MMBC1623L3	Vol. 1
MMBC1622L4	Vol. 1
MMBC1623L5	Vol. 1
MMBC1623L6	Vol. 1
MMBC1622L7	Vol. 1
MMBR5179	Vol. 1
MMBT2222	Vol. 1
MMBT2222A	Vol. 1
MMBT2484	Vol. 1
MMBT2907	Vol. 1
MMBT2907A	Vol. 1
MMBT3903	Vol. 1
MMBT3904	Vol. 1
MMBT3906	Vol. 1
MMBT4123	Vol. 1
MMBT4124	Vol. 1
MMBT4125	Vol. 1
MMBT4126	Vol. 1
MMBT4401	Vol. 1
MMBT4403	Vol. 1
MMBT5086	Vol. 1
MMBT5087	Vol. 1
MMBT5088	Vol. 1
MMBT5089	Vol. 1
MMBT5401	Vol. 1
MMBT5550	Vol. 1
MMBT6427	Vol. 1
MMBT6428	Vol. 1
MMBT6429	Vol. 1
MMBTA05	Vol. 1
MMBTA06	Vol. 1
MMBTA13	Vol. 1
MMBTA14	Vol. 1
MMBTA20	Vol. 1
MMBTA42	Vol. 1
MMBTA43	Vol. 1
MMBTA55	Vol. 1
MMBTA56	Vol. 1
MMBTA63	Vol. 1
MMBTA64	Vol. 1
MMBTA70	Vol. 1
MMBTA92	Vol. 1
MMBTA93	Vol. 1
MMBTH10	Vol. 1
MMBTH24	Vol. 1

13. MPS Series

Device	Page
MPS2222	Vol. 1
MPS2222A	Vol. 1
MPS2907	Vol. 1
MPS29007A	Vol. 1
MPS3702	Vol. 1
MPS3703	Vol. 1
MPS3704	Vol. 1
MPS3705	Vol. 1
MPS3706	Vol. 1
MPS4249	Vol. 1
MPS4250	Vol. 1
MPS4250A	Vol. 1
MPS5172	Vol. 1
MPS5179	Vol. 1
MPS6513	Vol. 1
MPS6517	Vol. 1
MPS6520	Vol. 1
MPS6521	Vol. 1
MPS6522	Vol. 1
MPS6523	Vol. 1
MPS6560	Vol. 1
MPS6562	Vol. 1
MPS6601	Vol. 1
MPS6602	Vol. 1
MPS6651	Vol. 1
MPS8097	Vol. 1
MPS8098	Vol. 1
MPS8099	Vol. 1
MPS8598	Vol. 1
MPS8599	Vol. 1
MPSA05	Vol. 1
MPSA06	Vol. 1
MPSA10	Vol. 1
MPSA12	Vol. 1
MPSA13	Vol. 1
MPSA14	Vol. 1
MPSA20	Vol. 1
MPSA25	Vol. 1
MPSA26	Vol. 1
MPSA27	Vol. 1
MPSA42	Vol. 1
MPSA43	Vol. 1
MPSA44	Vol. 1
MPSA45	Vol. 1
MPSA55	Vol. 1
MPSA56	Vol. 1
MPSA62	Vol. 1
MPSA63	Vol. 1
MPSA64	Vol. 1
MPSA70	Vol. 1
MPSA75	Vol. 1
MPSA76	Vol. 1
MPSA77	Vol. 1
MPSA92	Vol. 1
MPSA93	Vol. 1
MPSH10	Vol. 1
MPSH11	Vol. 1
MPSH17	Vol. 1
MPSH20	Vol. 1
MPSH24	Vol. 1
MPSL01	Vol. 1
MPSL51	Vol. 1

14. SS Series

Device	Page
SS8050	Vol. 1
SS8550	Vol. 1
SS9011	Vol. 1
SS9012	Vol. 1
SS9013	Vol. 1
SS9014	Vol. 1
SS9015	Vol. 1
SS9016	Vol. 1
SS9018	Vol. 1

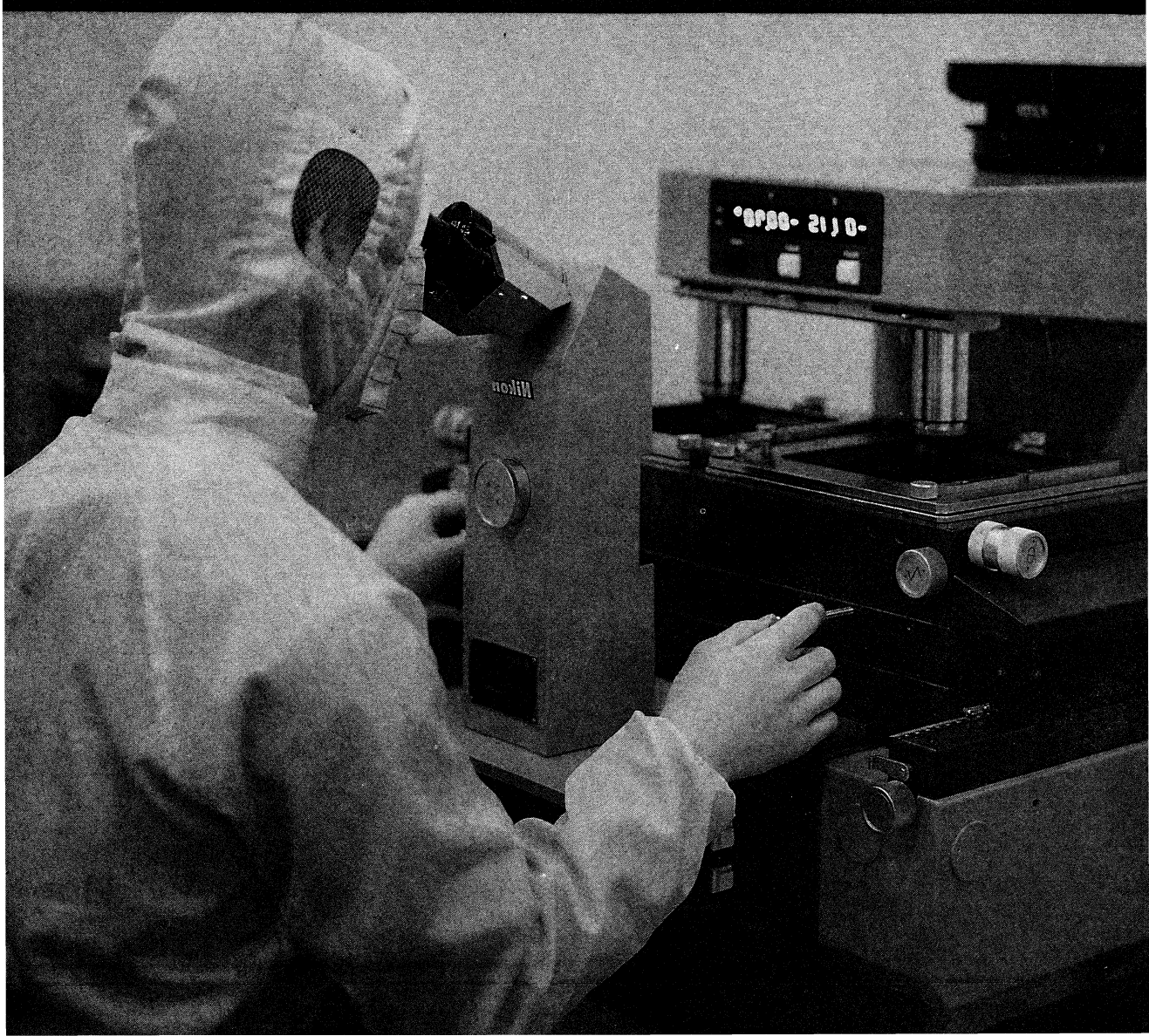
15. TIP Series

Device	Page
TIP29	401
TIP30	403
TIP31	405
TIP32	407

ALPHANUMERIC INDEX (Continued)

NOTES

QUALITY and RELIABILITY 1



1. Introduction

Samsung utilizes rigorous qualification and reliability programs to monitor the integrity of its devices. All industry standard (and various non-standard) stresses are run. Testing is done not only to collect data, but also to detect trends and product anomalies, with rectification to take place immediately (if necessary). This protects the customer from receiving discrepant material. Careful attention is given to any manufacturing changes, both through Engineering Change Notices and appropriate reliability stressing.

Items such as particular tests, frequency, sample sizes, acceptance criteria, and methods of stressing are detailed later in this chapter.

2. Policy

Samsung is committed to supplying high-quality semiconductors to its consumers. All product released for general sales has been fully tested and qualified. By meeting or exceeding normal industry standards for reliability, Samsung can confidently supply products to the world that will meet customer applications and reliability standards. Of course special programs can be run for customers who have particular requirements which are considered non-standard.

The quality organization must approve any product before it is officially qualified and sitributed. To do this most effectively, fully-functional devices must pass two critical stages prior to sales. Step 1 is product evaluation; step 2 is product qualification. Details are listed below.

3. Scope

Pass/Fail criteria are established by the quality assurance organization. All products have specifications which apply to then regarding reliability stressing, periodical monitoring, and final lot disposition.

The quality department is responsible for investigating mass-produced product for sicrepancies, and enforcing corrective actions. All outoging product goes through "QA-gating", where tests particularly critical to the product are accomplished. Only when quality assurance approves a device, either through qualification or gating acceptance, is it released. Fundamental "no-rework" policies ensure only highly reliable material leaves the factory. Testing is done to MIL-STD 883 and MIL-STD 750 standards, with sampling done in accordance with MIL-STD 19500E and MIL-STD 105D. Samsung also has internal specifications where its requirements exceed those of MIL-STDs.

4. Qualification Procedures

Procedures to qualify devices are listed below. There are both general and product-specific requirements. Procedures are detailed for new products, die-only qualifications, and package-only qualifications. The latter two are for products and/or packages already qualified, but where there is room for further product optimization.

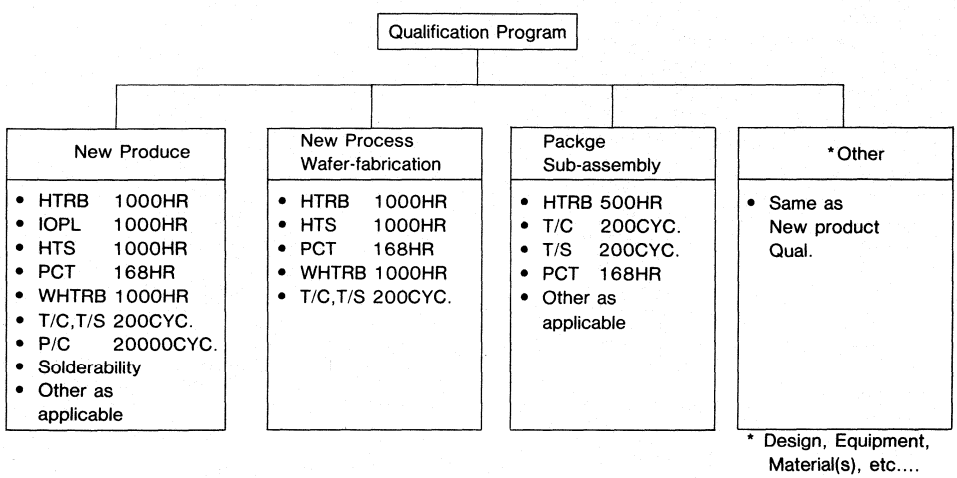


Fig. 1. Qualification Programs.

4.1 New product qualification test items

No.	Test Item	Test Condition	Sample Size	LTPD	ACC. No	Reference Method	Note
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j$(max) $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	10	1		48HR for PRT
2	High Temperature Storage (HTS)	$T_a=T_j$(max) 1000HRS	45	10	1		
3	Operating Life (OPL)	$T_a=25°C$ $P_c=P_c$(max) 1000HRS	45	10	1	MIL-STD-750 1026.3	For Small-Signal Device
4	Intermittent OPL (IOPL)	$T_a=25°C$ $P_c=P_c$(max) 2min/2min On/Off 1000HRS	45	10	1	MIL-STD-750 1036.3	
5	Power Cycle (P/C)	$\Delta T_j=125°C$ 45Sec/90Sec On/Off 20000CYC.	45	10	1		For PWR TR,
6	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ RH=100% 15PSIG 168HRS	45	10	1		48HR for PRT
7	Wet High Temperature Reverse Bias (WHTRB)	$T_a=85°C$, RH=85% $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	10	1		
8	Thermal Shock (T/S)	$-65°C\leftrightarrow150°C$ (Liquid) 5min,<10Sec, 5min 200 Cycles	45	10	1	MIL-STD-883 1011	
9	Temperature Cycle (T/C)	$-65°C\leftrightarrow25°C\leftrightarrow150°C$ 10min, 5min, 10min 200 Cycles	45	10	1	MIL-STD-883 1011	
10	Solder Heat Resistance (S/H)	$T_a=260°C\pm5°C$ $t=10\pm1$Sec (once with flux)	10	N/A	0	MIL-STD-750 2031	
11	Solderability	$T_a=260°C\pm5°C$ $t=5\pm0.5$ sec Reject is>10% uncovered surface	10	N/A	0	MIL-STD-883 2003	
12	Salt Atmosphere	$T_a=35°C$, 5% NaCl 24HRS	10	N/A	0	MIL-STD-883 1009A	
13	Mechanical Shock	1500G, 05ms 3 Times Each direction of X,Y and Z Axis	10	N/A	0	MIL-STD-750 2016	For Hermeitc
14	Vibration	20G, 3Axis f=100 to 2000 cps for 4min, 4 cycles	10	N/A	0	MIL-STD-883 2007	For Hermetic
15	Constant Acceleration	2000G X,Y,Z Axis 1 min for each Axis	10	N/A	0	MIL-STD-883 2001	For Hermetic
16	ESD (Human Body Model)	$R=1.5k\Omega$ C=100pF 5 Discharge $V\geqslant\pm1000V$	5	N/A	0	MIL-STD-883 3015	

4.2 New process, wafer fabrication qualification

No	Test Item	Test Condition	Sample Size	LTPD	ACC No
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j$(max) $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	10	1
2	High Temperature Storage (HTS)	$T_a=T_j$(max) 1000HRS	45	10	1
3	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ RH=100% 15 PSIG 168HRS	45	10	1
4	Wet High Temperature Reverse Bias (WHTRB)	$T_a=85°C$, RH=85% $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	10	1
5	Thermal Shock (T/S)	$-65°C\rightleftharpoons150°C$(Liquid) 5min,<10sec, 5min 200 cycles	45	10	1
6	Temperature Cycle (T/C)	$-65°C\rightleftharpoons25°C\rightleftharpoons150°C$ 10min, 5min, 10min 200 Cycles	45	10	1

4.3 Package Sub-Assembly Qualification

No	Test Item	Test Condition	Siample Size	LTPD	ACC No	Notes
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j$(max) $V_{CB}=V_{CBO}\times0.8$ 500HRS	45	10	1	
2	Temperature Cycle (T/C)	$-65°C\rightleftharpoons25°C\rightleftharpoons150°C$ 10min, 5min, 10min 200 CYCLES	45	10	1	
3	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ RH=100%, 15PSIG 168HRS	45	10	1	
4	Thermal Shock (T/S)	$-65°C\rightleftharpoons150°C$(Liquid) 5min,<10sec, 5min 200 CYCLES	45	10	1	
5	Solder Heat Resistance (S/H)	$260°C\pm5°C$ 10 ± 1 sec Once without Flux	10	N/A	0	
6	Vibration (Variable-Frequency)	100~2000~100Hz 20G, 5min, 5Times, X,Y,Z	10	N/A	0	
7	Mechanial Shock (M/S)	1500G, 0.5ms 3 Times, X,Y,Z	10	N/A	0	
8	Constant Acceleration	20000G X,Y,Z Axis 1 min for each Axis	10	N/A	0	

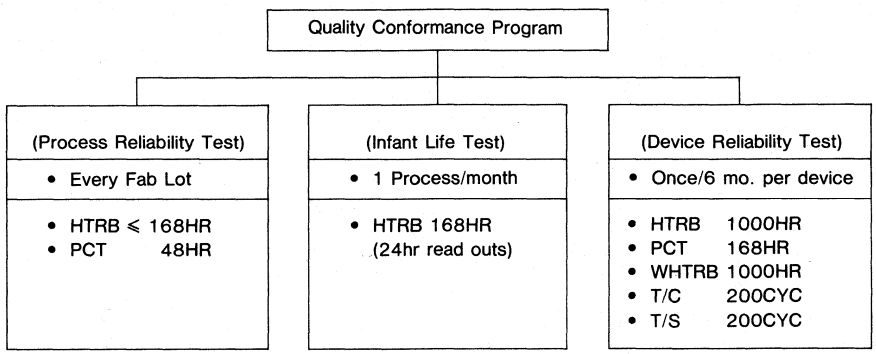
Note) • N/A: not available

5. Product Reliability (Quality Conformance) Monitors

Samsung implements periodic testing to monitor the ongoing reliability of its products. A subset of stresses used for qualification are run; they are seen as most critical for basic device reliability. Formally this is known as the Device Reliability Test System, or simply as DRT.

Lot-by-lot infant mortality reliability testing is also accomplished at Samsung. The purpose of this is to verify process integrity in a full QA step. Formally this is konwn as Process Reliability Testing, or more simply as PRT. Normally a short term accelerated lifetest and package reliability test are done, although exceptions are made in the case of special devices.

Although Samsung scrupulously utilizes statistical controls throughout it's production process, DRT and PRT serve as confirmation that indeed the customer does receive only high-grade units. The tables on the following give details of DRT and PRT processing.



Note: Test descriptions given on following pages.

Fig. 2. Quality Conformance Program

(PRT/DRT Product Stress Methodologies)

1. PRT (Process Reliability Test) Frequency: Every outgoing lot

No.	Test Item	Test Condition	Sample Size	LTPD	Accept. No.	Note
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j(max)$ $V_{CB}=V_{CBO}\times0.8$ 168HR max	45	10	1	
2	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ 100% RH, 15PSIG 48HR	45	10	1	

2. ILT (Infant Life Test) Frequency: 1 Process/month

No.	Test Item	Test Condition	Sample Size	Note
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j(max)$ $V_{CB}=V_{CBO}\times0.8$ 168HR	300	for Discrete

3. DRT (Device Reliability Test)

No.	Test Item	Test Condition	Sample Size	LTPD*	Accept. No.	Note
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j$(max) $V_{CB}=V_{CBO}\times0.8$ 1000HRS	45	5 10	0 1	
2	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ RH=100%, 15PSIG 168HRS	45	5 10	0 1	
3	Wet High Temperature Reverse Bias (WHTRB)	$T_a=85°C$, RH=85% $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	5 10	0 1	
4	Temperature Cycle (T/C)	$-65°C\leftrightarrow25°C\leftrightarrow150°C$ 10min, 5min, 10min 200 Cycles	45	5 10	0 1	
5	Thermal Shock (T/S)	$-65°C\leftrightarrow150°C$(Liquid) 5min,<10sec, 5min 200 Cycles	45	5 10	0 1	

* LTPD 5: S Grade Units LTPD 10: A,B Grade Units.

6. Reliability Tests

The test run by the quality department are accelerated tests, serving to model "real world" applications through boosted temperatures, voltages, and/or humidities. Accelerated conditions are used to derive device knowledge through means quicker than that of typical application situations. These accelerated conditions are then used to assess differing failure rate mechanisms that correlate directly with ambient conditions. Following are summaries of various stresses (and their conditions) run by Samsung on discrete and integrated devices.

High Temperature Reverse Bias (80% max. BV_{CBO}, 150°C, static)
For this test, device integrity is checked through stressing of the main blocking junction at an elevated temperature and voltage. Overall product stability is investigated through leakage current monitoring; low leakage indicates good integrity.

Intermittent Operating Life (P_{MAX}, 25°C, 2 min on/2 min off)
This test is normally applied to scrutinize die bond thermal fatigue. A stressed device undergoes an "on" cycle, where there is thermal heating due to power dissipation, and an "off" cycle, where there is thermal cooling due to lack of inputted power. Die attach (between die and package) and bond attach (between wire and die) are the critical areas of concern.

Wet High Temperature Reverse Bias (80% max. BV_{CBO}, 85°C, 85% R.H., static) or ($V_{CC}=V_{CC}$(typ), 85°C, 85% R.H, static)
Wet High Temperature Reverse Bias Test is used to accelerate failure mechanisms by applying static bias on alternate pins at high temperature and humidity ambient (85°C/85°C R.H.). This test checks for resistance to moisture penetration by using an electrolytic principle to accelerate corrosive mechanisms.

Pressure Cooker Test (Unbiased, 121°C, 15 PSIG, 100% R.H.)
The Pressure Cooker Test checks for resistance to moisture penetration. A highly pressurized vessel is used to force water (thereby promoting corrosion) into packaged devices located within the vessel.

High Temperature Storage (Unbiased, 150°C)
High Temperature Storage is utilized to test for both package and die weaknesses. For example, sensitivities to ionic contamination and bond integrity are closely scrutinized.

Temperature Cycling (Unbiased, −65°C to +150°C, air)
This stress uses a chamber with alternating temperatures of −65°C and +150°C (air ambient) to thermally cycle devices within it. No bias is applied. The cycling checks formechanical integrity of the packaged device, in particular bond wires and die attach, along with metal/polysilicon microcracks.

Thermal Shock (Unbiased, −65°C to +150°C, liquid)
This stress uses a chamber with alternating temperatures of −65°C to +150°C (liquid ambient) to thermally cycle devices within it. No bias is applied. The cycling is very rapid, and primarily checks for die/package compatibility.

Resistance to Solder Heat (Unbiased, 260°C, 10 sec)
Solder Heat Resistance is performed to establish that devices can withstand the thermal effects of solder dip, soldering iron, or solder wave operations.

Mechanical Shock (Unbiased, 1500g, Pulse=0.5msec)
This test determines the suitability of a device to be used in equipment where mechanical "shocks" may occur. Such shocks ersult from sudden or abrupt changes produced by rough (non-standard) handling, transportation, or field operations.

Variable Frequency Vibration (Unbiased, Range=100 to 2000 Hz)
Variable Frequency Vibration is done to model the effects of differential vibration in the specified range. Die attach and bonding integrity are particularly stressed, testing the mechanical soundness of device packaging.

Constant Acceleration (Unbiased, 10kg to 20kg)
This is an accelerated test designed to indicate types or modes of structural and mechanical weaknesses not necessarily detectable in Mechanical Shock and Variable Frequency Vibration stressing.

7. Failure criteria

Parameter	Symbol	Unit	SCOPE	Min.	Max.
Collector Cut-off Current	I_{CBO}	μA	COMMON	—	USL×2
Emitter Cut-off Current	I_{CEO}	μA	COMMON	—	USL×2
H_{FE} Variation Ratio	H_{FE}	—	H_{FE}(min)<500	I.V.×0.8	I.V.×1.2
		—	H_{FE}(min)≥500	I.V.×0.7	I.V.×1.3
		—	H_{FE}(min)≥1000	I.V.×0.6	I.V.×1.4
Collector-Emitter Saturation Voltage	V_{CE}(sat)	mV	COMMON	LSL	USL
Base-Emitter Saturation Voltage	V_{BE}(sat)	mV	COMMON	LSL	USL
Thermal, Resistance	ΔV_{BE}	mV	Power	LSL	USL
Noise	N_F,N_V	dB	Low Noise	—	USL×1.5

Note 1) USL: Upper Specification Limit 2) LSL: Lower Specification Limit 3) I.V.: Initial Value

8. Relative Stress Comparisons

Many stresses are run at Samsung on many different devices. Through both theoretical and actual results, it was clearly determined which stresses were most effective. Also established were the stresses which weren't fully effective.

Comparisons have been made on the basis of defects able to be determined, efficiency in detection, and cost. For the reader's benefit, Samsung provides the results of its conclusions on the following pages.

Comparison of Reliability Test Methods

Test Method	Defect	Effectivenss	Cost	Remarks
Internal Visual Inspection	Lead Structure Metallization Oxide Film Foreign Particles Die Bond Wird Bond Contamination Corroded Substrate	Good	Slightly Inexpensive to Moderate	This method of screening must be performed for high reliability devices. Cost is affected by the degree of visual inspection
Infrared ray	Design(thermal)	Very Good	Expensive	For use in design evaluation only
Radiography	Die Bond Lead Structure(Gold) Foreign Particles Manufacturing (Gross Error) Seal Package Contamination	Extremely Good Good Good Good Good Good Good Good	Moderate	Advantage to using this screening method lies in the ability to test die frame/ header bonding, and to be able to perform inspection after sealing However, some materials being transparent to X-rays (for example, Al and Si) are not able to be analyzed. The use of the complex test system results in cost six times that of visual inspection.
High Temperature Storage	Electrical stability Metallization Bulk Silicon Corrosion	Good	Very Inexpensive	This is a highly desirable screening method
Temperature Cycling	Package Seal Die Bond Wire Bond Cracked Substrate Thermal Mismatching	Good	Very Inexpensive	This screening method is one of the most effective for use
Thermal Shock	Package Seal Die Bond Wire Bond Cracked Substrate Thermal Mismatching	Good	Inexpensive	While this screening method is similar to temperature cycling, it enables high stress levels as well. It is probably equal to the temperature cycling method.
Constant Accelertion	Lead Structure Die Bond Wire Bond Cracked Substrate	Good	Moderate	Doubt exists as to the effectiveness of screening aluminum wires with stress levels in the range of 0~20,000 G
Shock (Without Monitoring)	Lead Structure	Fairly Poor	Moderate	Drop shock testing is thought to be inferior to constant acceleration methods. However, the pneupactor shock test is more effective. Shock test is a destructive test method.
Shock (With Monitoring)	Particles Intermittent Short Intermittent Open	Fairly Poor Failry Good Fairly Good	Expensive	Visual inspection or radiography is more desirable for detection of particles

Comparison of Reliability Test Methods (continued)

Test Method	Defect	Effectivenss	Cost	Remarks
Vibration Fatigue	Lead Structure Package Die Bond Wire Bond Cracked Substrage	Fairly Poor	Expensive	This test is destructive and without merit.
Variable Frequency Vibration (Without Monitoring)	Package Die Bond Wire Bond Substrate	Fairly Poor	Expensive	
Variable Frequency Vibration (Without Monitoring)	Foreign Particles Lead Structure Intermittent Open	Fairly Good Good Good	Very Expensive	The effectiveness of the method for detecting particles depends on the type of particle
Random Vibration (Without Monitoring)	Package Die Bond Wire Bond Substrate	Good	Expensive	This screening method is more effective than variable frequency vibration(without monitoring), when used with equipment intended for space vehicle operation, although it is more expensive.
Random Vibration (With Monitoring)	Foreign Particle Lead Structure Intermittent Open	Fairly Good Good Good	Very Expensive	This is one of the most expensive screening methods
Vibrational Noise	Foreign Particles	Good	Expensive	
Radioisotope Leak Test	Package Seal	Good	Moderate	This screening method is effective for detecting leakage in the range 10E6~10E12 atm. ml/sec
Helium Leak Test	Package Seal	Good	Moderate	This screening method is effective for detecting leak in the range 10E6~10E12 atm. ml/sec
Gross Leak Test	Package Seal	Good	Inexpensive	Effectiveness is dependent upon volume. Testing is possible for detecting leaks above 10E-3 atm. ml/sec.
High Voltage Test	Oxide Film	Good	Inexpensive	Effectiveness Depends on structure
Insulation Resistance	Lead Structure Metallization Contamination	Fairly Good	Inexpensive	
Intermittent Operation	Metallization Bulk Silicon Oxide Film Inversion/Channeling Design Parmeter Drift Contamination	Good	Expensive	Probably about the same as AC operating life

Test Method	Defect	Effectivenss	Cost	Remarks
AC Operation	Metallization Bulk Silicon Oxide Film Inversion/Channeling Design Parmeter Drift Contamination	Very Good	Expensive	
DC Operation	Basically the Same as Intermittent Operation	Good	Expensive	The AC operation life method is more effective for any failure mechanism
High Temperature AC Operation	Same as AC Operation Life Test	Extremely Good	Very Expensive	Failures are accelerated by temperature. This is probably the most expensive and one of the most effective screening methods.
High Temperature Reverse Bias	Inversion /Channeling	Fairly Poor	Expensive	

9. Reliability Test Results

Extensive test results have been compiled through long term reliability monitoring (DRT) of devices. Current and historical data is entered into Samsung's Reliability Newtork, SRN. Thus, past performance of a device or it's family, assembly evaluation results, manufacturing change reliability results, etcetera, can all be seen via computer through SRN.

Results included in this manual are representative of products stressed, and contain data fro mthe past year. Data is summarized from both die and package tests, on five critical stresses. Failure rates for long term life testing are in FITs, which are calculated using Arrhenius' Equation. (Arrhenius' Equation is summarized in the Appendix section). Samsung's failure rates are well below 50 FITs, which is acknowledged by customers and competitors alike as among the industry's elite.

9.1 Long Term Life Test Results

Family	Test Item	Steady State Operation Life			High Temperature Storage Life		
	Test Condition	$T_a = T_j(max.)$ $V_{CB} = V_{CBO} \times 0.8$ 1000 HRS			$T_a = 125°C$, 150°C 1000 HRS		
	Application	Number of Samples	Number of Failures	Failure Rate (FIT)	Number of Samples	Number of Failures	Failure Rate (FIT)
TR	Small Signal	1228	4	8	430	2	14
	Power	1056	16	33	708	1	6

Note 1) FIT: Failure in time or failure unit; represents the number of failures expected per 10^9 (one billion) device hours (at 55°C).
2) TR: Transistor

9.2 Environmental Test Resutls

Family	Application	Test Item	High Temp/High Humidity			Pressure Cooker			Thermal Shock		
									85°C, 85% R.H, V_{CBO} × 0.8		
			Number of Samples	Number of Failures	Failure Rate (%1 1KHRS)	Number of Samples	Number of Failures	Failure Rate (%1 168HRS)	Number of Samples	Number of Failures	Failure Rate (%1 200CYC)
TR	Small Signal		880	2	0.23	1020	12	1.2	1263	0	0
	Power		346	1	0.29	404	6	1.5	576	1	0.17

10. Product Outgoing Quality Levels

The quality of Samsung products reaching customers has improved steadily over the years. Nearly on order of magnitude reduction in outgoing product PPM levels has been achieved from 1983-7. Results can be seen below.

Average Outgoing Quality, or AOQ, is measured by the Quality Assurance Department. Prior to release, product is sampled according to MIL-STD 105D. Both electrical and visual/mechanical inspections occur. If inspection standards are met, product is approved for sales. Depending on the nature of the failure(s), rejected samples can cause an entire lot to be 100% tested and/or inspected, re-worked to screen out defective devices, or scrapped.

Electrical testing is typically done to product specification limits, guardbanded by a fixed percentage. Visual/mechanical inspection is performed to check for key package, marking, and lead parameters. (More extensive details are provided in Chapter 3, Assembly process control)

Although Samsung's AOQ levels are acceptable, efforts are constantly underway to reduce the figures (thereby increasing outgoing quality).
Enhanced focus on statistical process control in the manufacturing operation should help Samsung achieve it's goal of 50 PPM in 1988.

Samsung Product Electrical AOQ levels

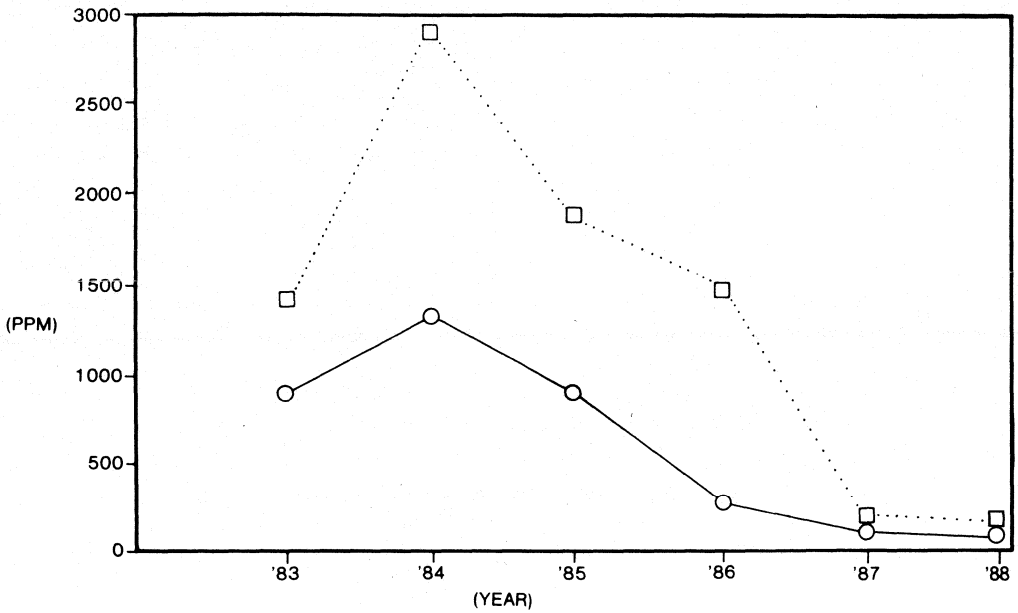
(in PPM)

Product Family	1985	1986	1987	1988	1989 (Goal)
Small-Signal Transistor	308	150	45	44	40
Power Transistor	578	664	101	98	80

Samsung Product Visual/Mechanical AOQ Levels

(in PPM)

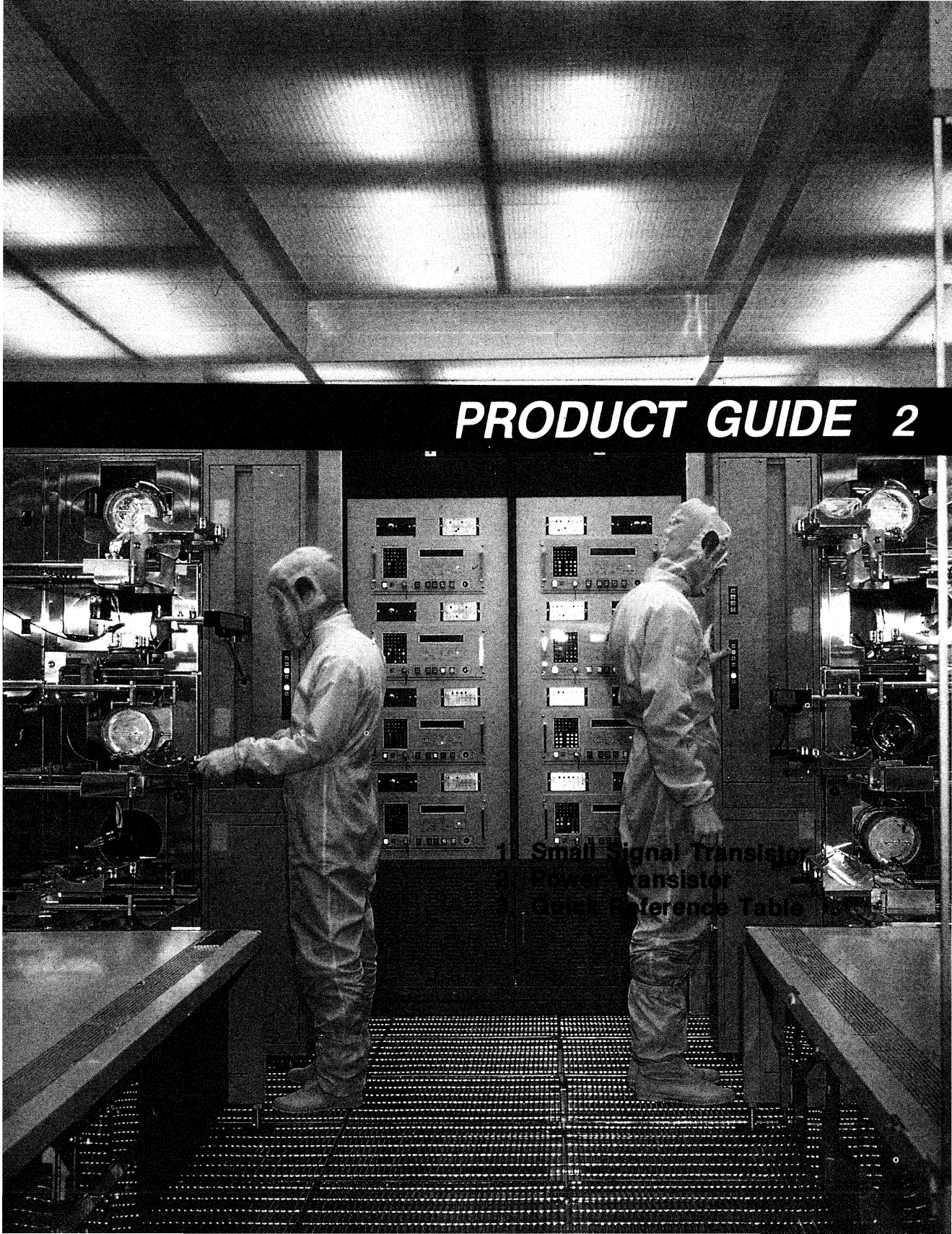
Product Family	1985	1986	1987	1988	1989 (Goal)
Small-Signal Transistor	596	129	57	51	40
Power Transistor	1297	796	140	97	70



Note: Total=Electrical + Visual/Mechanical
S/S TR=Small Signal Transistor
PWR TR=Power Transistor

Fig. 3. Total AOQ Levels

NOTES



PRODUCT GUIDE 2

1. SMALL SIGNAL TRANSISTORS

1.1 General Purpose Transistors

1.1.1 SOT-23 Type Transistors

Device and Polarity (Marking)		V_{CEO}	I_C	Condition		h_{FE}		Condition		V_{CE} (sat), V_{BE} (sat) (V)		Condition		f_T (MHz)	
NPN	PNP	(V)	(A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	V_{CE} (sat) MAX	V_{BE} (sat) MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
MMBTA06(1G)	MMBTA56(2G)	80	0.5	1	100	50		100	10	0.25		2	10	100	
MMBTA05(1H)	MMBTA55(2H)	60	0.5	1	100	50		100	10	0.25		2	10	100	
	MMBT2907A(2F)	60	0.6	10	150	100	300	500	50	1.6	2.6	20	50	200	
KSC1623(C1X)	KSA812(D1X)	50	0.1	6	1	90	600	100	10	0.3	1	6	10		250
	BCW69(H1)	45	0.1	5	2	120	260	10	0.5	0.3					
	BCW70(H2)	45	0.1	5	2	215	500	10	0.5	0.3					
BCW71(K1)		45	0.1	5	2	110	220	50	2.5			5	10		300
BCW72(K2)		45	0.1	5	2	200	450	50	2.5			5	10		300
BCX70G(AG)		45	0.1	5	2	120	220	50	1.25	0.55	1.05	5	10	125	
BCX70H(AH)		45	0.1	5	2	180	310	50	1.25	0.55	1.05	5	10	125	
BCX70J(AJ)		45	0.1	5	2	250	460	50	1.25	0.55	1.05	5	10	125	
BCX70K(AK)		45	0.1	5	2	380	630	50	1.25	0.55	1.05	5	10	125	
	BCX71G(BG)	45	0.1	5	2	120	220	50	1.25	0.55	1.05				
	BCX71H(BH)	45	0.1	5	2	180	310	50	1.25	0.55	1.05				
	BCX71J(BJ)	45	0.1	5	2	250	460	50	1.25	0.55	1.05				
	BCX71K(BK)	45	0.1	5	2	380	630	50	1.25	0.55	1.05				
	MMBA811C5(C5)	45	0.05	3	0.5	135	270	20	2	0.3		6	1	75	
	MMBA811C6(C6)	45	0.05	3	0.5	200	400	20	2	0.3		6	1	75	
	MMBA811C7(C7)	45	0.05	3	0.5	300	600	20	2	0.3		6	1	75	
	MMBA811C8(C8)	45	0.05	3	0.5	450	900	20	2	0.3		6	1	75	
MMBC1623L3(L3)	MMBA812M3(M3)	40	0.1	6	1	60	120	30	3	0.5					
MMBC1623L4(L4)	MMBA812M4(M4)	40	0.1	6	1	90	180	30	3	0.5					
MMBC1623L5(L5)	MMBA812M5(M5)	40	0.1	6	1	135	270	30	3	0.5					
MMBC1623L6(L6)	MMBA812M6(M6)	40	0.1	6	1	200	400	30	3	0.5					
MMBC1623L7(L7)	MMBA812M7(M7)	40	0.1	6	1	300	600	30	3	0.5					
MMBT2222A(1P)		40	0.6	10	150	100	300	500	50	1.6	2.6	20	20	300	
	MMBT2907(2B)	40	0.6	10	150	100	300	500	50	1.6	2.6	20	50	200	
MMBT3903(1Y)		40	0.2	1	10	50	150	50	5	0.3	0.95	20	10	250	
MMBT3904(1A)	MMBT3906(2A)	40	0.2	1	10	100	300	50	5	0.3	0.95	20	10	300	
MMBT4401(2X)	MMBT4403(2T)	40	0.6	1	150	100	300	500	50	0.75	1.2	10	10	250	
MMBTA20(1C)	MMBTA70(2C)	40	0.1	10	5	40	400	10	1	0.25		10	5	125	
MMBC1622D6(D6)		35	0.1	3	0.5	200	400	100	10	0.3		6	1	100	
MMBC1622D7(D7)		35	0.1	3	0.5	300	600	100	10	0.3		6	1	100	
MMBC1622D8(D8)		35	0.1	3	0.5	450	900	100	10	0.3		6	1	100	
BCW60A(AA)	BCW61A(BA)	32	0.1	5	2	120	220	50	1.25	0.55	1.05	5	10	125	
BCW60B(AB)	BCW61B(BB)	32	0.1	5	2	180	310	50	1.25	0.55	1.05	5	10	125	
BCW60C(AC)	BCW61C(BC)	32	0.1	5	2	250	460	50	1.25	0.55	1.05	5	10	125	
BCW60D(AD)	BCW61D(BD)	32	0.1	5	2	380	630	50	1.25	0.55	1.05	5	10	125	
MMBT2222(1B)		30	0.6	10	150	100	300	500	50	1.6	2.6	20	20	200	
KSC2859(E1X)	KSA1182(F1X)	30	0.5	1	100	70	240	100	10	0.25		6	20		200
MMBT4123(5B)	MMBT4125(ZD)	30	0.2	1	2	50	150	50	5	0.3	0.95	20	10	250	
KSC3265(K1X)	KSA1298(J1X)	25	0.8	1	100	100	320	500	20	0.4		5	10		120
MMBC1009F1(F1)		25	0.05	3	0.5	30	60	10	1	0.3		6	1	150	

SOT-23 Type Transistors (Continued)

Device and Polarity (Marking)		V_{CEO} (V)	I_C (A)	Condition V_{CE} (V)	Condition I_C (mA)	h_{FE} MIN	h_{FE} MAX	Condition I_C (mA)	Condition I_B (mA)	V_{CE} (sat), V_{BE} (sat) (V) V_{CE} (sat) MAX	V_{CE} (sat), V_{BE} (sat) (V) V_{BE} (sat) MAX	Condition V_{CE} (V)	Condition I_C (mA)	f_T (MHz) MIN	f_T (MHz) TYP
NPN	PNP														
MMBC1009F2(F2)		25	0.05	3	0.5	40	80	10	1	0.3		6	1	150	
MMBC1009F3(F3)		25	0.05	3	0.5	60	120	10	1	0.3		6	1	150	
MMBC1009F4(F4)		25	0.05	3	0.5	90	180	10	1	0.3		6	1	150	
MMBC1009F5(F5)		25	0.05	3	0.5	135	270	10	1	0.3		6	1	150	
MMBT4124(ZC)	MMBT4126(C3)	25	0.2	1	2	120	360	50	5	0.3	0.95	20	10	300	
	BCW29(C1)	20	0.1	5	2	120	260	10	0.5	0.3					
	BCW30(C2)	20	0.1	5	2	215	500	10	0.5	0.3					
BCW31(D1)		20	0.1	5	2	110	220	10	0.5	0.3					
BCW32(D2)		20	0.1	5	2	200	450	10	0.5	0.3					
BCW33(D3)		20	0.1	5	2	420	800	10	0.5	0.3					

1.1.2 TO-92S Type Transistors

Device and Polarity		V_{CEO} (V)	I_C (A)	Condition V_{CE} (V)	Condition I_C (mA)	h_{FE} MIN	h_{FE} MAX	Condition I_C (mA)	Condition I_B (mA)	V_{CE} (sat), V_{BE} (sat) (V) V_{CE} (sat) TYP	V_{CE} (sat) MAX	V_{BE} (sat) TYP	V_{BE} (sat) MAX	Condition V_{CE} (V)	Condition I_C (mA)	f_T (MHz) MIN	f_T (MHz) TYP
NPN	PNP																
	KSA1150	20	0.5	1	100	40	400	500	50	0.3	0.4	1	1.3	6	10		
	KSA1378	25	0.3	1	50	70	400	300	30	0.35	0.6						
	KSB810	25	0.7	1	100	70	400	700	70	0.25	0.4	0.95	1.2	6	10	50	160
	KSB811	25	1	0	100	70	400	1000	100		0.5		1.2	6	10		110
KSC2710		20	0.5	1	100	40	400	500	50	0.18	0.4						
KSC3488		25	0.3	1	50	70	400	300	30	0.14	0.4						
KSD1020		25	0.7	1	100	70	400	700	70	0.2	0.4	0.95	1.2	6	10	50	170
KSD1021		30	1	1	100	70	400	1000	100		0.5		1.2	6	10		130

1.1.3 TO-92 Type Transistors

Device and Polarity		V_{CEO} (V)	I_C (A)	Condition V_{CE} (V)	Condition I_C (mA)	h_{FE} MIN	h_{FE} MAX	Condition I_C (mA)	Condition I_B (mA)	V_{CE} (sat), V_{BE} (sat) (V) V_{CE} (sat) MAX	V_{BE} (sat) MAX	Condition V_{CE} (V)	Condition I_C (mA)	f_T (MHz) MIN	f_T (MHz) TYP
NPN	PNP														
MPSA06	MPSA56	80	0.5	1	100	50		100	10	0.25		2	10	100	
MPS8099	MPS8599	80	0.5	5	1	100	300	100	10	0.3		5	10	150	
KSC2003	KSA954	80	0.3	1	50	90	400	300	30	0.6	1.2	6	10	50	100
KSD1616A	KSB1116A	60	1	2	100	135	400	1000	50	0.3	1.2	2	100	70	
KSC1008	KSA708	60	0.7	2	50	40	240	500	50	0.7	1.1	10	50		50
	MPS2907A	60	0.6	10	150	100	300	500	50	1.6	2.6	20	50	200	
MPS8098	MPS8598	60	0.5	5	1	100	300	100	10	0.3		5	10	150	
MPSA05	MPSA55	60	0.5	1	100	50		100	10	0.25		2	10	100	
KSC2002	KSA953	60	0.3	1	50	90	400	300	30	0.6	1.2	6	10	50	100
KSC853	KSA545	60	0.2	1	50	40	400	150	15	0.5	1.2				
KSD1616	KSB1116	50	1	2	100	135	600	1000	50	0.3	1.2	2	100	70	100
KSC1072	KSA707	45	0.7	2	50	40	240	500	50	0.7	1.1				
KSC815	KSA539	45	0.2	1	0.05	40	240	150	15	0.5	1.2				
SS9014	SS9015	45	0.1	5	1	60	1000	100	5	0.3	1	5	10	150	270

TO-92 Type Transistors (continued)

Device and Polarity		V_{CEO} (V)	I_C (A)	Condition		h_{FE}		Condition		V_{CE} (sat), V_{BE} (sat) (V)		Condition		f_T (MHz)	
NPN	PNP			V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	V_{CE} (sat) MAX	V_{BE} (sat) MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
MPS6602		40	1	1	500	50		1000	100	0.6		10	50	100	
2N4401	2N4403	40	0.6	1	150	100	300	500	50	0.75	1.2	10	20	200	
MPS2222A	MPS2907	40	0.6	10	150	100	300	500	50	1.6	2.6	20	20	300	
2N4400	2N4402	40	0.6	1	150	50	150	500	50	0.75	1.2	10	20	200	
2N3903	2N3905	40	0.2	1	10	50	150	50	5	0.3	0.95	20	10	250	
2N3904	2N3906	40	0.2	1	10	100	300	50	5	0.3	0.95	20	10	300	
MPS6513	MPS6517	40	0.1	10	2	90	180	50	5	0.5					
MPSA10		40	0.1	10	5	40	400					10	5	125	
MPSA20	MPSA70	40	0.1	10	5	40	400					10	5	125	
KSC1330		40	0.1	6	1	70	400	30	3	0.5		6	10		300
KSD471A		30	1	1	100	70	400	1000	100	0.5	1.2	6	10		130
MPS3705	MPS3703	30	0.6	5	50	30	150	50	5	0.25		5	50	100	
MPS3704		30	0.6	2	50	100	300	100	5			2	50	100	
MPS2222		30	0.6	10	150	100	300	500	50	1.6	2.6	20	20	250	
KSC921		30	0.1	10	2	40	240	10	1	0.6		10	1	100	250
KSC839		30	0.1	12	2	40	400	10	1	0.4		10	1	80	200
SS9011		30	0.03	5	1	28	198	10	1	0.3					
SS8050	SS8550	25	1.5		100	85	300	800	80	0.5	1.2	10	50	100	190
	KSB564A	25	1		100	70	400	1000	100	0.5	1.2	10	10		110
MPS6601	MPS6651	25	1		500	50		1000	100	0.6		10	50	100	
	MPS3702	25	0.6		50	60	300	50	50	0.25			50	100	
MPS6560	MPS6562	25	0.5		500	50	200	500	50	0.5		5	10	60	
KSD227	KSA642	25	0.3		50	70	400	300	30	0.6					
MPS5172		25	0.1		10	100	500	10	1	0.25			2		120
KSC184	KSA542	25	0.05		1	40	400	20	2	0.3		6	1		100
MPS3706		20	0.6		50	30	600	100	5	1		2	50	100	
KSD261	KSA643	20	0.5		100	40	400	500	50	0.4	1.3	1			
SS9013	SS9012	20	0.5		50	64	202	500	50	0.6	1.2	1			

1.1.4 TO-92L Type Transistors

Device and Polarity		V_{CEO} (V)	I_C (A)	Condition		h_{FE}		Condition		V_{CE} (sat), V_{BE} (sat) (V)		Condition		f_T (MHz)	
NPN	PNP			V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	V_{CE} (sat) MAX	V_{BE} (sat) MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
KSC2328A	KSA928A	30	2	2	500	100	320	1500	30	2		2	500		120
KSC2331	KSA931	60	0.7	2	50	40	240	500	50	0.7	1.2	10	50		100
KSC2500		10	2	1	500	140	600	2000	50	0.5		1	500		150

1.2 Low Noise Transistors

1.2.1 SOT-23 Type Transistors

Device and Polarity (Marking)					Condition			h_{FE}		Condition		$V_{CE(sat)}$(V)
NPN	PNP	MAX	Condition Frequency	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	$V_{CE(sat)}$ MAX
MMBT6428(1K)		4	Audio	50	0.2	5	0.1	250	650	100	5	0.6
MMBT6429(1L)		4	Audio	45	0.2	5	0.1	500	1250	100	5	0.6
MMBT2484(1U)		3	Audio	60	0.05	5	1	250		1	0.1	0.35
	MMBT5086(2P)	3	Audio	50	0.05	5	0.1	150	500	10	1	0.3
MMBT5088(1Q)		3	Audio	30	0.05	5	0.1	300	900	10	1	0.5
	MMBT5087(2Q)	2	Audio	50	0.05	5	0.1	250	800	10	1	0.3
MMBT5089(1R)		2	Audio	25	0.05	5	0.1	400	1200	10	1	0.5

1.2.2 TO-92S Type Transistors

Device and Polarity(Marking)		NF(dB)		V_{CEO}	I_C	Condition		h_{FE}		Condition		V_{CE}(sat)	Condition		f_T(MHz)	
NPN	PNP	TYP	Condition Frequency	(V)	(A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
KSA1175		6	Audio	50	0.15	6	1	40	700	100	10	0.3	6	10		180
KSC2785		4	Audio	50	0.15	6	1	40	700	100	10	0.3	6	10		300

Audio = 10Hz to 15.7KHz

1.2.3 TO-92 Type Transistors

Device and Polarity		NF(dB)		V_{CEO}	I_C	Condition		h_{FE}		Condition		Saturation Voltage(V)
NPN	PNP	TYP	Condition Frequency	(V)	(A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	$V_{CE(sat)}$ MAX
2N6428		6	Audio	50	0.2	5	0.1	250	650	100	5	0.6
2N4123		6	Audio	30	0.2	1	2	50	150	50	5	0.3
	2N4125	5	Audio	30	0.2	1	2	50	150	50	5	0.4
2N4124		5	Audio	25	0.2	1	2	120	360	50	5	0.3
KSC945	KSA733	4	Audio	50	0.15	6	1	40	700	100	10	0.3
	2N4126	4	Audio	25	0.2	1	2	120	360	50	5	0.4
	MPS4249	3	Audio	60		5	0.1	100	300	10	0.5	0.25
	2N5086	3	Audio	50	0.05	5	0.1	150	500	10	1	0.3
2N5088		3	Audio	30	0.05	5	0.1	300	900	10	1	0.5
	MPS6522	3	Audio	25	0.1	10	2	200	400	50	5	0.5
MPS6520		3	Audio	25	0.1	10	2	200	400	50	5	0.5
	MPS6523	3	Audio	25	0.1	10	2	300	600	50	5	0.5
MPS6521		3	Audio	25	0.1	10	2	300	600	50	5	0.5
	MPS4250A	2	Audio	60		5	0.1	250	700	10	0.5	0.25
	2N5087	2	Audio	50	0.05	5	0.1	250	800	10	1	0.3
	MPS4250	2	Audio	40		5	0.1	250	700	10	0.5	0.25
2N5089		2	Audio	25	0.05	5	0.1	400	1200	10	1	0.5
2N6428A		*4	Audio	50	0.2	5	0.1	250	650	100	5	0.6
	2N5210	*2	Audio	50	0.05	5	0.1	200	600	10	1	0.7
2N5209		*2	Audio	50	0.05	5	0.1	100	300	10	1	0.7
MPS8097		*2	Audio	40	0.2	5	0.1	250	700			
KSC1222	KSA640	**40	Audio	45	0.05	3	0.5	120	1000	20	2	0.3
KSC900		**30	Audio	25	0.05	3	0.5	120	1000	20	2	0.2

Audio=10Hz to 15.7KHz

*=MAX, **=Noise Level

1-3. RF/VHF/UHF Amplifier Transistors

1-3-1. SOT-23 Type Transistors

Device	Condition		f_T		Cob (pF)	V_{CEO}	Gpe (dB)	Condition		h_{FE}		NF(dB)		I_{AGC}	Condition Gain Reduction
NPN	V_{CE} (V)	Ic (mA)	MIN	TYP	MAX	(V)	MIN	V_{CE} (V)	Ic (mA)	MIN	MAX	MAX	Condition f(MHz)	(mA) MAX	(dB)
KSC2734(H8Z)	10	10	1400	3500	1.5	12		10	5	20	200				
KSC3120(H9Z)	10	2	1500	2400	#0.9	15	$12	10	5	40	200	*8	800		
KSC2759(H6X)	10	5	1250	2000	1.3	14	&10	10	5	40	180				
MMBR5179	6	5	900	2000	@1	12	15	1	3	25	250	4.5	200		
KSC2757(H3X)	10	5	800	1100	1.5	15		10	5	60	240				
KSC2758(H4Z)	10	3	750	1000	0.8	25	14	10	3	60	240	4.5	900	11	30
MMBTH10(3E)	10	4	650		@0.7	25		10	4	60					
KSC2756(H2X)	10	5	500	850	#0.5	20	$15	10	5	60	240	*6.5	200		
MMBTH24(3A)	10	8	400	620	@0.36	30	$19	10	8	30					
KSC2755(H1X)	10	3	400	600	#0.5	30	20	10	3	60	240	3	200	12	30
KSC2223(H5X)	6	1	400	600	*1	20		6	1	40	180	*3	100		
KSC3125(A1Z)	10	10	250	600	1.6	25		10	10	20	200				
KSC2715(B1X)	10	1	100		3.2	30	27	12	2	40	240				

1.3.2 TO-92S Type Transistors

Device	Condition		f_T(MHz)		C_{OB} (pF)	V_{CEO}	G_{PE} (dB)	Condition		h_{FE}			N_F(dB)	Condition
(NPN)	V_{CE} (V)	Ic (mA)	MIN	TYP	MAX	(V)	MIN	V_{CE} (V)	Ic (mA)	MIN	TYP	MAX	MAX	f_T(MHz)
KSC2669	10	1	100	250	3.2	30		12	2	40		240		
KSC2786	6	1	400	600	*1.2	20	18	6	1	40		240	5	100
KSC2787	6	1	150	300	2.5	30		6	1	40		240		

1-3-2 TO-92 Type Transistors

Device	Condition		f_T		Cob (pF)	V_{CEO}	Gpe (dB)	Condition		h_{FE}		NF(dB)		I_{AGC}	Condition Gain Reduction
NPN	V_{CE} (V)	Ic (mA)	MIN	TYP	MAX	(V)	MIN	V_{CE} (V)	Ic (mA)	MIN	MAX	MAX	Condition f(MHz)	(mA) MAX	(dB)
MPS5179	6	5	900	2000	@1	12	15	1	3	25	250	4.5	200		
KSC1730	10	5	800	1100	1.5	15		10	5	40	240				
MPSH17	10	5	800		@0.9	15	*24	10	5	25	250	6	200		
KSC1070***	10	3	750	1000	0.8	25	14	10	3	40	200	4	900	11	30
SS9018	5	5	700	1100	1.7	15		5	1	28	198				
MPSH11	10	4	650		@0.7	25		10	4	60					
MPSH10	10	4	650		@0.7	25		10	4	60					
KSC1395	10	5	600	1100	1.5	15		10	5	40	240				
MPSH24	10	8	400	620	@0.36	30	$19	10	8	30					
KSC1393	10	3	400	700	#0.5	30	20	10	2	40	240	3	200	12	30
KSC1394	10	3	400	700	#0.5	30	20	10	2	40	240	3.5	200		
MPSH20	10	4	400	620	@0.65	30	$18	10	4	25					
SS9016	5	1	400	620	1.6	20		5	1	28	198	5	100		
KSC1187	10	3	400	700	#*0.6	20	20	10	2	40	240				
KSC1188	10	3	400	700	1	20	20	10	2	40	240				
KSC1674	6	1	400	600	*1.5	20	18	6	1	40	240	5	100		
KSC388	12.5	12.5	300		2	25	28	12	12.5	20	200				
KSC1675	6	1	150	300	2.5	20		6	1	40	240				
KSC838	10	1	100	250	3.2	30		12	2	40	240				

*=TYP, #=Cre, @=Ccb, $=Gce, &=Gcb, *** = DISK TYPE TRANSISTOR

1-4. High Voltage Transistors

1-4-1. SOT-23 Type Transistors

Device and polarity(Marking)		V_{CEO}	I_C	Condition		h_{FE}		Condition		Saturation Voltage(V)		Condition		$f_{T(MHz)}$	
NPN	PNP	(V)	(A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	V_{CE} MAX	V_{BE} MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
MMBTA42(1D)	MMBTA92(2D)	300	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
MMBTA43(1E)	MMBTA93(2E)	200	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
	MMBT5401(2L)	150	0.5	5	10	60	240	50	5	0.5	1	10	10	100	
MMBT5550(1F)		140	0.6	5	10	60	250	50	5	0.25	1.2	10	10	100	

1-4-2. TO-92S Type Transistors

Device and polarity(Marking)		V_{CEO}	I_C	Condition		h_{FE}		Condition		V_{CE}(sat), V_{BE}(sat)(V)				Condition		f_T(MHz)	
NPN	PNP	(V)	(A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	V_{CE}(sat) TYP	V_{CE}(sat) MAX	V_{BE}(sat) TYP	V_{BE}(sat) MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
	KSA1174	120	0.05	6	1	200	800	10	1	0.09	0.3			6	1	50	100
KSC2874		120	0.05	6	1	200	1200	10	1	0.07	0.3			6	1	50	110

1-4-3. TO-92 Type Transistors

Device and polarity(Marking)		V_{CEO}	I_C	Condition		h_{FE}		Condition		Saturation Voltage(V)		Condition		$f_{T(MHz)}$	
NPN	PNP	(V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	V_{CE} MAX	V_{BE} MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
MPSA44		400	0.3	10	10	50	200	10	1	0.5	0.75				
2N6517	2N6520	350	0.5	10	30	30	200	30	3	0.5	0.9	20	10	40	
MPSA45		350	0.3	10	10	50	200	10	1	0.5	0.75				
MPSA42	MPSA92	300	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
2N6516	2N6519	300	0.5	10	30	45	270	30	3	0.5	0.9	20	10	40	
KSC1506		300	0.1	10	10	40	240	50	5	2		30	10	40	80
2N6515	2N6518	250	0.5	10	30	50	300	30	3	0.5	0.9	20	10	40	
MPSA43	MPSA93	200	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
2N5551		160	0.6	5	10	80	250	50	6	0.2	1	10	10	100	
	KSA709	150	0.7	2	50	40	240	200	20	0.4	1	10	50		50
	2N5401	150	0.6	5	10	60	240	50	5	0.5	1	10	10	100	
KSC1009		140	0.7	2	50	40	240	200	20	0.2	0.86	10	50	30	50
2N5550		140	0.6	5	10	60	250	50	5	0.25	1.2	10	10	100	
	2N5400	120	0.6	5	10	40	180	50	5	0.5	1	10	10	100	
MPSL01		120	0.15	5	10	50	300	50	5	0.3	1.4	10	10	60	
KSC1845	KSA992	120	0.05	6	1	200	800	10	1	0.3		6	1	50	100
	MPSL51	100	0.6	5	50	40	250	50	5	0.3	1.2	10	10	60	

1-4-4. TO-92L Type Pransistors

Device and polarity(Marking)		V_{CEO}	I_C	Condition		h_{FE}		Condition		Saturation Voltage(V)		Condition		$f_{T(MHz)}$	
NPN	PNP	(V)	(A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	V_{CE}(sat) MAX	V_{BE}(sat) MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
KSC2340		350	0.1	10	20	30	150	10	1	0.5	10	20	50		
KSC2330		300	0.1	10	20	40	240	10	1	0.5		30	10		50
KSC2383	KSA1013	160	1	5	200	60	320	500	50	1.5		5	200	15	50
KSC2310	KSA910	150	0.05	5	10	40	240	10	1	0.8		30	10		100
KSC2316	KSA916	120	0.8	5	100	80	240	500	50	1		5	100		120

1-5. Darlington Transistors

1-5-1. SOT-23 Type Transistors.

Device and polarity(Marking)		V_{CES}	I_C	Condition		h_{FE}		Condition $V_{CE}(sat)V_{BE}(sat)(V)$				Condition		$f_{T(MHz)}$	
NPN	PNP	(V)	(A)	V_{CE} (V)	Ic (mA)	MIN	MAX	Ic (mA)	I_B (mA)	$V_{CE}(sat)$ MAX	$V_{BE}(sat)$ MAX	V_{CE} (V)	Ic (mA)	MIN	TYP
MMBT6427(1V)		*40	0.5	5	100	20K	200K	500	0.5	1.5	2				
MMBTA13(1M)		30	0.3	5	100	10K		100	0.1	1.5		5	10	125	
MMBTA14(1N)		30	0.3	5	100	10K		100	0.1	1.5		5	10	125	
	MMBTA63(2U)	30	0.5	5	100	10K		100	0.1	1.5	5	10	125		
	MMBTA64(2V)	30	0.5	5	100	10K		100	0.1	1.5	5	10	125		

*: V_{CEO}

1-5-2. TO-92 Type Transistors.

Device and Polarity		V_{CES}	I_C	Condition		h_{FE}		Condition $V_{CE}(sat)V_{BE}(sat)(V)$				Condition		$f_{T(MHz)}$	
NPN	PNP	(V)	(A)	V_{CE} (V)	Ic (mA)	MIN	MAX	Ic (mA)	I_B (mA)	$V_{CE}(sat)$ MAX	$V_{BE}(sat)$ MAX	V_{CE} (V)	Ic (mA)	MIN	TYP
MPSA27		60	0.5	5	100	10K		100	0.1	1.5					
	MPSA77	60	0.5	5	100	10K		100	0.1	1.5					
MPSA26		50	0.5	5	100	10K		100	0.1	1.5					
	MPSA76	50	0.5	5	100	10K		100	0.1	1.5					
2N6427		*40	0.5	5	100	20K	200K	500	0.5	1.5	2				
	MPSA75	40	0.5	5	100	10K		100	0.1	1.5					
MPSA25		40	0.5	5	100	10K		100	0.1	1.5					
MPSA14	MPSA64	30	0.5	5	100	10K		100	0.1	1.5		5	10	125	
MPSA13	MPSA63	30	0.5	5	100	20K		100	0.1	1.5		5	10	125	
MPSA12	MPSA62	20	0.5	5	10	20K		10	0.01	1					

*: V_{CEO}

1-6. Digital Transistors

1-6-1. SOT-23 Type Transistors

Device and Polarity		R1	R2	V_{CEO}	I_C	Condition		h_{FE}		Condition		V(sat)(V)		Condition		f_T(MHz)
NPN	PNP	KΩ	KΩ	(V)	(mA)	V_{CE} (V)	Ic (mA)	MIN	MAX	Ic (mA)	I_B (mA)	V_{CE}(sat) TYP	V_{CE}(sat) MAX	V_{CE} (V)	Ic (mA)	TYP
KSR1101	KSR2101	4.7	4.7	50	100	5	10	20		10	0.5	0.1	0.3	10	5	250/200
KSR1102	KSR2102	10	10	50	100	5	4	30		10	0.5	0.1	0.3	10	5	250/200
KSR1103	KSR2103	22	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1104	KSR2104	47	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1105	KSR2105	4.7	10	50	100	5	5	30		10	0.5	0.1	0.3	10	5	250/200
KSR1106	KSR2106	10	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1107	KSR2107	22	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1108	KSR2108	47	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1109	KSR2109	4.7		40	100	5	5	100	600	10	1	0.1	0.3	10	5	250/200
KSR1110	KSR2110	10		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1111	KSR2111	22		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1112	KSR2112	47		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1113	KSR2113	2.2	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1114	KSR2114	4.7	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200

1-6-2. TO-92S Type Transistors

Device and Polarity		R1	R2	V_{CEO}	I_C	Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)
						V_{CEO}	I_C			Ic	I_B	V_{CE}(sat)		V_{CE}	I_C	
NPN	PNP	KΩ	KΩ	(V)	(mA)	(V)	(mA)	MIN	MAX	(mA)	(mA)	TYP	MAX	(V)	(mA)	TYP
KSR1201	KSR2201	4.7	4.7	50	100	5	10	20		10	0.5	0.1	0.3	10	5	250/200
KSR1202	KSR2202	10	10	50	100	5	4	30		10	0.5	0.1	0.3	10	5	250/200
KSR1203	KSR2203	22	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1204	KSR2204	47	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1205	KSR2205	4.7	10	50	100	5	5	30		10	0.5	0.1	0.3	10	5	250/200
KSR1206	KSR2206	10	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1207	KSR2207	22	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1208	KSR2208	47	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1209	KSR2209	4.7		40	100	5	5	100	600	10	1	0.1	0.3	10	5	250/200
KSR1210	KSR2210	10		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1211	KSR2211	22		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1212	KSR2212	47		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1213	KSR2213	2.2	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1214	KSR2214	4.7	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200

1-6-3. TO-92 Type Transistors

Device and Polarity		R1	R2	V_{CEO}	I_C	Condition		h_{FE}		Condition		V(sat)(V)		Condition		f_T(MHz)
						V_{CE}	Ic			Ic	I_B	V_{CE}(sat)		V_{CE}	I_C	
NPN	PNP	KΩ	KΩ	(V)	(mA)	(V)	(mA)	MIN	MAX	(mA)	(mA)	TYP	MAX	(V)	(mA)	TYP
KSR1001	KSR2001	4.7	4.7	50	100	5	10	20		10	0.5	0.1	0.3	10	5	250/200
KSR1002	KSR2002	10	10	50	100	5	5	30		10	0.5	0.1	0.3	10	5	250/200
KSR1003	KSR2003	22	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1004	KSR2004	47	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1005	KSR2005	4.7	10	50	100	5	5	30		10	0.5	0.1	0.3	10	5	250/200
KSR1006	KSR2006	10	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1007	KSR2007	22	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1008	KSR2008	47	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1009	KSR2009	4.7		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1010	KSR2010	10		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1011	KSR2011	22		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1012	KSR2012	47		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1013	KSR2013	2.2	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1014	KSR2014	4.7	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200

1.7 JUNCTION FETS

1.7.1 SOT-23 Type J-FET.

DEVICE	V_{GDO} (V)	I_G (mA)	P_D (mW)	I_{DSS} (mA) MIN	MAX	V_{DS} (V)	g_m(mS) MIN	TYP	V_{DS} (V)	$V_{GS(OFF)}$ (V) V_{DS} (V)	I_D (μA)	MIN	MAX
KSK123	20	2	200	0.13	0.47	4.5	0.9	1.6	4.5				
KSK211	18	10	200	1	10	10		9	10	10	1	0.4	4

1.7.2 TO-92S Type J-FET

DEVICE	V_{GDO} (V)	I_G (mA)	P_D (mW)	I_{DSS}(mA) MIN	MAX	V_{DS} (V)	g_m(mS) MIN	TYP	MAX	$V_{GS(OFF)}$ V_{DS} (V)	V_{DS}	I_D(μA)	MIN	(V) MAX
KSK65	12	2	20	0.04	0.8	4.5	0.3	0.5		4.5				
KSK161	18	10	200	1	10	10		9		10	10	1	0.4	4

1.7.3 TO-92 Type J-FET

DEVICE	V_{GDO} (V)	I_G (mA)	P_D (mW)	I_{DSS} (mA) MIN	MAX	V_{DS} (V)	g_m(mS) MIN	TYP	V_{DS} (V)	$V_{GS(OFF)}$ (V) V_{DS} (V)	I_D (μA)	MIN	(V) MAX
KSK30	50	10	100	0.3	6.5	10	1.2		10	10	0.1	0.4	5
KSK117	50	10	300	0.6	14	10	4	15	10	10	0.1	0.2	1.5

2. POWER TRANSISTORS

2-1. General Purpose Transistors

2.1.1 TO-126 Type Transistors

I_C (A)	V_{CEO} (V)	Device Type		h_{FE}				$V_{CE(SAT)}$ (V)				f_T (MHz)				P_C (W)
		NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	
0.1	180	KSC2682	KSA1142	5	0.01	100	320	0.05	0.005	0.16	0.5	10	0.02		180	8
0.2	300	KSC2688		10	0.01	40	250	0.05	0.005		1.5	30	0.01	50	80	10
0.5	250	BD157		10	0.05	30	240	0.25	0.025		2.5					20
	300	BD158		10	0.05	30	240	0.25	0.025		2.5					20
	300	MJE340	MJE350	10	0.05	30	240									20
	350	BD159		10	0.05	30	240	0.25	0.025		2.5					20
1.2	120	KSC2690	KSA1220	5	0.3	60	320	1	0.2	0.4	0.7	5	0.2		175	20
	160	KSC2690A	KSA1220A	5	0.3	60	320	1	0.2	0.4	0.7	5	0.2		11	20
1.5	45	BD135	BD136	2	0.15	40	250	0.5	0.05		0.5					13
	60	BD137	BD138	2	0.15	40	160	0.5	0.05		0.5					13
	80	BD139	BD140	2	0.15	40	160	0.5	0.05		0.5					13
2	45	BD375	BD376	2	0.15	40	375	1	0.1		1.0					25
	45	BD233	BD234	2	1	25		1	0.1		0.6	10	0.25	3		25
	60	BD377	BD378	2	0.15	40	375	1	0.1		1.0					25
	60	BD235	BD236	2	1	25		1	0.1		0.6	10	0.25	3		25
	80	BD379	BD380	2	0.15	40	375	1	0.1		1.0					25
	80	BD237	BD238	2	1	25		1	0.1		0.6	10	0.25	3		25
3	30	KSD882	KSB772	2	1	60	400	2	0.2	0.3	0.5	5	0.1		80	10
	40	MJE180	MJE170	1	0.1	50	250	3	0.6		1.7	10	0.1	50		12.5
	45	KSD794	KSB744	5	0.5	60	320	1.5	0.15	0.5	2	5	0.1		45	10
	45	BD175	BD176	2	0.15	40		1	0.1		0.8	10	0.25	3		30
	60	KSD794A	KSB744A	5	0.5	60		1.5		0.5	2	5	0.1		45	10
		MJE181	MJE171	1	0.1	50	250	3	0.6		1.7	10	0.1	50		12.5
	60	BD177	BD178	2	0.15	40		1	0.1		0.8	10	0.25	3		30
	80	MJE182	MJE172	1	0.1	50	250	3	0.6		1.7	10	0.1	50		12.5
	80	BD179	BD180	2	0.15	40		1	0.1		0.8	10	0.25	3		30
4	22	BD433	BD434	1	0.5	85		2	0.2		0.5	1	0.25	3		36
	32	BD435	BD436	1	0.5	85		2	0.2		0.5	1	0.2	3		36
	45	BD437	BD438	1	0.5	85		2	0.2		0.6	1	0.25	3		36
	60	BD439	BD440	1	0.5	40		2	0.2		0.8	1	0.25	3		36
	80	BD441	BD442	1	0.5	40		2	0.2		0.8	1	0.25	3		36
5	25	MJE200	MJE210	1	2	45	180	2	0.2		0.75	10	0.1	65		15
	60	KSD1691	KSB1151	1	2	100	400	2	0.2	0.1	0.3					20

2.1.2 TO-202 Type Transistors

I_C (A)	V_{CEO} (V)	Device Type		h_{FE}				$V_{CE(SAT)}$ (V)				f_T (MHz)				P_C (W)
		NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	
0.2	250	KSC1520		10	0.01	40	240	0.05	0.005		2	30	0.01	40	80	10
	300	KSC1520A		10	0.01	40	240	0.05	0.005		2	30	0.01	40	80	10
2	30	KSC1096	KSA634	5	1	40	240	1.5	0.15	0.3	0.7					10
	45	KSC1098	KSA636	5	0.5	40	240	1	0.1	0.15	0.7					10

2.1.3 TO-220 Type Transistors

I_C (A)	V_{CEO} (V)	Device Type		h_{FE}				$V_{CE(SAT)}$ (V)				f_T (MHz)				P_C (W)
		NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	
0.2	300	KSC1507		10	0.01	40	240	0.05	0.005		2	30	0.01	40	80	15
1	40	TIP29	TIP30	4	1	15	75	1	0.125		0.7	10	0.2	3		30
	60	TIP29A	TIP30A	4	1	15	75	1	0.125		0.7	10	0.2	3		30
	80	TIP29B	TIP30B	4	1	15	75	1	0.125		0.7	10	0.2	3		30
	100	TIP29C	TIP30C	4	1	15	75	1	0.125		0.7	10	0.2	3		30
	250	TIP47		10	0.3	30	150	1	0.2		0.1	10	0.2	10		40
	300	TIP48		10	0.3	30	150	1	0.2		0.1	10	0.2	10		40
	350	TIP49		10	0.3	30	150	1	0.2		0.1	10	0.2	10		40
	400	TIP50		10	0.3	30	150	1	0.2		0.1	10	0.2	10		40
1.5	150	KSC2073	KSA940	10	0.5	40	140	0.5	0.05		1.5	10	0.5	4		25
2	45	BD239	BD240	4	1	15		1	0.1		0.7	10	0.2	3		30
	60	BD239A	BD240A	4	1	15		1	0.1		0.7	10	0.2	3		30
	80	BD239B	BD240B	4	1	15		1	0.1		0.7	10	0.2	3		30
	100	BD239C	BD240C	4	1	15		1	0.1		0.7	10	0.2	3		30
	150	KSD401	KSB546	10	0.4	40	240					10	0.4		5	25
3	30	KSC1173	KSA473	2	0.5	70	240	2	0.2	0.3	0.8	2	0.5		100	10
	40	TIP31	TIP32	4	3	10	50	3	0.375		1.2	10	0.5	3		40
	45	BD241	BD242	4	3	10		3	0.6		1.2	10	0.5	3		40
	55	KSD288	KSA614	5	0.5	40	240	1	0.1	0.15	0.5					25
	60	TIP31A	TIP32A	4	3	10	50	3	0.375		1.2	10	0.5	3		40
		KSD880	KSB834	5	0.5	60	200	3	0.3	0.5		5	0.5		9	30
		KSC1983		4	0.5	500		2	0.05		1	12	0.2		15	30
	60	BD241A	BD242A	4	3	10		3	0.6		1.2	10	0.5	3		40

2.1.3 TO-220 Type Transistors (Continued)

I_C (A)	V_{CEO} (V)	Device Type		h_{FE}				$V_{CE(SAT)}$ (V)				f_T (MHz)				P_C (W)
		NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	
3	80	TIP31B	TIP32B	4	3	10	50	3	0.375		1.2	10	0.5	3		40
	80	BD241B	BD242B	4	3	10		3	0.6		1.2	10	0.5	3		40
	100	TIP31C	TIP32C	4	3	10	50	3	0.375		1.2	10	0.5	3		40
	100	BD241C	BD242C	4	3	10		3	0.6		1.2	10	0.5	3		40
4	60	KSC2233		5	1	30	150	4	0.4		1	5	0.5		10	40
	80	KSD526	KSB596	5	0.5	40	240	3	0.3	1.0	1.7	5	0.5	3		30
5	60	KSD73		10	1	70	240	5	0.5		2	10	0.3		20	30
	70	KSD362		5	5	20	140	5	0.5		1	5	0.5		10	40
	100	KSC2517		5	2	40	200	3	0.3		0.6					30
6	40	TIP41	TIP42	4	3	15	75	6	0.6		1.5	10	0.5	3		65
	45	BD243	BD244	4	3	15		6	1		1.5	10	0.5	3		65
	60	BD243A	BD244A	4	3	15		6	1		1.5	10	0.5	3		65
	60	TIP41A	TIP42A	4	3	15	75	6	0.6		1.5	10	0.5	3		65
	80	BD243B	BD244B	4	3	15		6	1		1.5	10	0.5	3		65
	80	TIP41B	TIP42B	4	3	15	75	6	0.6		1.5	10	0.5	3		65
	100	BD243C	BD244C	4	3	15		6	1		1.5	10	0.5	3		65
	100	TIP41C	TIP42C	4	3	15	75	6	0.6		1.5	10	0.5	3		65
	120	KSD363		5	1	40	240	1	0.1		1	5	0.5		10	40
7	60	KSD568	KSB707	1	3	40	200	5	0.5		0.5					40
	80	KSD569	KSB708	1	3	40	200	5	0.5		0.5					40
	100	KSC2334	KSA1010	5	3	40	200	5	0.5		0.6					40
	150	BU407						5	0.5		1	10	0.5	10		60
		BU407H						5	0.8		1	10	0.5	10		60
	200	BU406						5	0.5		1	10	5	10		60
		BU406H						5	0.8		1	10	5	10		60
		BU408						6	1.2		1	10	5	10		60
8	45	BD533	BD534	2	2	30	100	2	0.2		0.8	5	0.5	3		50
	60	BD535	BD536	2	2	30	100	2	0.2		0.8	5	0.5	3		50
	80	BD537	BD538	2	2	30	100	2	0.2		0.8	5	0.5	3		50
10	60	MJE3055T	MJE2955T	4	4	20	100	4	0.4		1.1	10	0.5	2		75

2.2.2 TO-220 Type Transistors (Continued)

I_C (A)	V_{CEO} (V)	Device Type		h_{FE}				$V_{CE(SAT)}$ (V)				f_T (MHz)				P_C (W)
		NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	
8	45	BDX53	BDX54	3	3	0.75K		3	0.012		2.5					60
	60	BDX53A	BDX54A	3	3	0.75K		3	0.012		2.5					60
	60	TIP100	TIP105	4	3	1K	20K	3	0.006		2					80
	80	BDX53B	BDX54B	3	3	0.75K		3	0.012		2.5					60
	80	TIP101	TIP106	4	3	1K	20K	3	0.006		2					80
	100	BDX53C	BDX54C	3	3	0.75K		3	0.012		2.5					60
	100	TIP102	TIP107	4	3	1K	20K	3	0.006		2					80
	150	BU807						5	0.05		1.5					60
	200	BU806						5	0.05		1.5					60
10	45	BDX33	BDX34	3	4	0.75K		4	0.008		2.5					70
	60	BDX33A	BDX34A	3	4	0.75K		4	0.008		2.5					70
	60	TIP140T	TIP145T	4	5	1K		5	0.01		2					80
	80	BDX33B	BDX34B	3	3	0.75K		3	0.006		2.5					70
	80	TIP141T	TIP146T	4	5	1K		5	0.01		2					80
	100	BDX33C	BDX34C	3	3	0.75K		3	0.006		2.5					70
	100	TIP142T	TIP147T	4	5	1K		5	0.01		2					80
12	45	BDW93	BDW94	3	5	0.754	20K	5	0.02		2					80
	60	BDW93A	BDW94A	3	5	0.75K	20K	5	0.02		2					80
	80	BDW93B	BDW94B	3	5	0.75K	20K	5	0.02		2					80
	100	BDW93C	BDW94C	3	5	0.75K	20K	5	0.02		2					80

2.2.3 TO-3P & TO-3P(F) Type Transistors

I_C (A)	V_{CEO} (V)	Device Type		h_{FE}				$V_{CE(SAT)}$ (V)				f_T (MHz)				P_C (W)	PKG
		NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP		
10	60	TIP140F	TIP145F	4	5	1K		5	0.01		2					60	TO-3P(F)
		TIP140	TIP145	4	5	1K		5	0.01		2					125	TO-3P
	80	TIP141F	TIP142F	4	5	1K		5	0.01		2					60	TO-3P(F)
		TIP141	TIP142	4	5	1K		5	0.01		2					125	TO-3P
	100	TIP142F	TIP142F	4	5	1K		5	0.01		2					60	TO-3P(F)
		TIP142	TIP147	4	5	1K		5	0.01		2					125	TO-3P
12	60	BDV65	BDV64	4	5	1K		5	0.02		2					125	TO-3P
	80	BDV65A	BDV64A	4	5	1K		5	0.02		2					125	TO-3P
	100	BDV65B	BDV64B	4	5	1K		5	0.02		2					125	TO-3P

2-3. Switching Transistors

V_{CEO} (V)	I_C (A)	Device (NPN)	h_{FE} V_{CE} (V)	h_{FE} I_C (A)	h_{FE} MIN	h_{FE} MAX	$V_{CE(SAT)}$(V) I_C (A)	$V_{CE(SAT)}$(V) I_B (A)	$V_{CE(SAT)}$(V) TYP	$V_{CE(SAT)}$(V) MAX	Switching Time t_{on} MAX (μS)	Switching Time t_{stg} MAX (μS)	Switching Time t_f MAX (μS)	P_C (W)	Package
375	6	*BU426	5	0.6		60	2.5	0.5		1.5	0.5	3.5	0.5	113	TO-3P
400	0.5	KSC2752	5	0.05	20	80	0.3	0.06		1	1	2.5	1	10	TO-126
	2	KSC2333	5	0.1	20	80	0.5	0.1		1	1	2.5	1	15	TO-220
	2	*BUX84	5	1			1	0.2		3	0.5	3.5	1.4	40	TO-220
	5	KSC2518	5	0.5	20	80	2	0.4		1	1	2.5	0.7	40	TO-220
	5	*BUT11	5	2	5		3	0.6		1.5	1	4	0.8	100	TO-220
	5	*BUV46	5	2	5		3.5	0.7		5	1	3	0.8	85	TO-220
	5	*BUW11	5	2	5		3	0.6		1.5	1	4	0.8	113	TO-3P
	6	*BU426A	5	0.6		60	2.5	0.5		1.5	0.5	3.5	0.5	113	TO-3P
	7	KSC2335	5	1	20	80	3	0.6		1	1	2.5	1	40	TO-220
	8	*BUW12	5	3	5		6	1.2		1.5	1	4	0.8	125	TO-3P
	9	*BUV47	5	5	5		9	3		3	0.8	2.5	0.8	120	TO-3P
	10	KSC2749	5	1	15	80	6	1.2		1	1	2.5	0.7	100	TO-3P
	15	KSC2751	5	2	15	80	10	2	0.3	1	1	2.5	0.7	120	TO-3P
	15	*BUV48	5	10	5		12	2.4		5	1	3	0.8	150	TO-3P
450	5	**BUT11A	5	2	5		2.5	0.5		1.5	1	4	0.8	100	TO-220
	5	**BUW11A	5	2	5		2.5	0.5		1.5	1	4	0.8	113	TO-3P
	8	**BUW12A	5	3	5		6	1.2		1.5	1	4	0.8	125	TO-3P
	9	**BUV47A	5	5	5		8	2.5		3	0.7	3	0.8	120	TO-3P
	15	**BUV48A	5	10	5		15	3		5	1	3	0.8	150	TO-3P
500	3	KSC5020	5	0.3	15	50	1.5	0.3		1	0.5	3	0.3	40	TO-220
	4	KSC5022	5	0.3	15	50	1.5	0.3		1	0.5	3	0.3	60	TO-3P
	5	KSC5021	5	0.6	15	50	3	0.6		1	0.5	3	0.3	50	TO-220
	7	KSC5023	5	0.6	15	50	3	0.6		1	0.5	3	0.3	80	TO-3P
	10	KSC5024	5	0.8	15	50	4	0.8		1	0.5	3	0.3	90	TO-3P
	15	KSC5025	5	1.2	15	50	6	1.2		1	0.5	3	0.3	100	TO-3P
600	15	***BUV48B	5	10	5		10	4		3	1	3	0.7	150	TO-3P
700	15	***BUV48C	5	10	5		10	4		3	1	3	0.7	150	TO-3P
800	1.5	KSC5026	5	0.1	10	40	0.75	0.15		2	0.5	3	0.3	40	TO-220
	3	KSC5027	5	0.2	10	40	1.5	0.3		2	0.5	3	0.3	50	TO-220
		KSC5028	5	0.2	10	40	1.5	0.3		2	0.5	3	0.3	80	TO-3P
	4.5	KSC5029	5	0.3	10	40	2	0.4		2	0.5	3	0.3	90	TO-3P
	6	KSC5030	5	0.4	10	40	3	0.6		2	0.5	3	0.3	100	TO-3P
	8	KSC5031	5	0.6	10	40	4	0.8		2	0.5	3	0.3	140	TO-3P

*: BV_{CES} 850V
**: BU_{CES} 1000V
***: BU_{CES} 1200V

2-4. Horizental Defelection Output Transistors

2.4.1 TO-3P Type Transistors

V_{CEO} (V)	V_{CEO} (V)	I_C (A)	Device (NPN)	h_{FE}				$V_{CE(SAT)}$(V)				Switching Time			P_C (W)	Comment
				V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	t_{on} MAX (μS)	t_{stg} MAX (μS)	t_f MAX (μS)		
1500	800	2.5	KSD5000	5	0.5	8		2	0.6		8			0.4	80	Built in Damper Diode
		3.5	KSD5001	5	0.5	8		2.5	0.8		8			0.4	80	Built in Damper Diode
		5	KSD5002	5	1	8		4	0.8		5			0.4	120	Built in Damper Diode
		5	BU508D	5	4.5	2.25		4.5	2		5				120	Built in Damper Diode
		6	KSD5003	5	1	8		5	1		5			0.4	120	Built in Damper Diode
		2.5	KSD5004	5	0.5	8		2	0.6		8			0.4	80	
		3.5	KSD5005	5	0.5	8		2.5	0.8		8			0.4	80	
		5	KSD5006	5	1	8		4	0.8		5			0.4	120	
		5	BU508	5	4.5	2.25		4.5	2		5				120	
		6	KSD5007	5	1	8		5	1		5			0.4	120	

2.4.2 TO-3P(F) Type Transistors

V_{CEO} (V)	V_{CEO} (V)	I_C (A)	Device (NPN)	h_{FE}				$V_{CE(SAT)}$(V)				Switching Time			P_C (W)	Comment
				V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	t_{on} MAX (μS)	t_{stg} MAX (μS)	t_f MAX (μS)		
1500	800	2.5	KSD5010	5	0.5	8		2	0.6		8			0.4	50	Built in Damper Diode
		3.5	KSD5011	5	0.5	8		2.5	0.8		8			0.4	50	Built in Damper Diode
		5	KSD5012	5	1	8		4	0.8		5			0.4	60	Built in Damper Diode
		5	BU508DF	5	4.5	2.25		4.5	2		5				60	Built in Damper Diode
		6	KSD5013	5	1	8		5	1		5			0.4	60	Built in Damper Diode
		2.5	KSD5014	5	0.5	8		2	0.6		8			0.4	50	
		3.5	KSD5015	5	0.5	8		2.5	0.8		8			0.4	50	
		5	KSD5016	5	1	8		4	0.8		5			0.4	60	
		5	BU508F	5	4.5	2.25		4.5	2		5				60	
		6	KSD5017	5	1	8		5	1		5			0.4	60	

3. QUICK REFERENCE TABLE (APPLICATION)

3.1 Audio Equipment

Application \ Package		SOT-23	TO-92	TO-92L	TO-126	TO-220
FM	RM AMP	KSC2223	KSC1674			
	Mix, Conv	KSC2223	KSC1674			
	Local Osc	KSC2223	KSC1674,KSC1675			
	IF	KSC2715	KSC838,KSC1675			
AM	RF	KSC1623	KSC945,KSC815			
	Conv Osc	KSC2715	KSC1675,KSC945 KSC838			
	IF	KSC2715	KSC1675,KSC945 KSC838			
Diff Amp	10W	KSA812,KSC1623	KSA733,KSC945			
	20W	KSA812,KSC1623	KSA733,KSC945			
	25W	KSA812,KSC1623	KSA733,KSC945			
	30W	KSA812,KSC1623	KSA733,KSC945			
	35W	KSA812,KSC1623	KSA733,KSC945			
	40W		KSA992,KSC1845			
	50W		KSA992,KSC1845			
	60W		KSA991,KSC1845			
	80W		KSA992,KSC1845			
	100W		KSA992,KSC1845			
	150W		KSA992,KSC1845			
Pre Driver	20W		KSA954,KSC2003			
	25W		KSA954,KSC2003			
	30W			KSA910,KSC2310		
	35W			KSA910,KSC2310		
	40W			KSA910,KSC2310		
	50W			KSA910,KSC2310		
	60W			KSA910,KSC2310		
	80W			KSA910,KSC2310		
	100W			KSA910,KSC2310	KSA1142,KSC2682	
	150W				KSA1142,KSC2682	
	20W				KSA1142,KSC2682	
Driver	3W		KSA642,KSD227			
	5W		KSA642,KSD227			
	10W		KSA954,KSC2003			
	20W		KSA954,KSC2003			
	25W		KSA954,KSC2003			
	30W		KSA954,KSC2003			
	40W			KSA916,KSC2316		
	50W			KSA916,KSC2316	KSA1220,KSC2690	
	60W				KSA1220,KSC2690	
	80W				KSA1220A,KSC2690A	
Output	3W			KSA928A,KSC2328A		
	5W				KSB772,KSD882	
	10W				KSB744,KSD794	
	20W					KSB834,KSD880 KSA614,KSD288
	25W					KSB596,KSD526
	30W					TIP41C,TIP42C
	35W					TIP41C,TIP42C

3.2 Video Equipment

Application			Package	Color TV	B/W TV
Tuner	VHF	RF	SOT-23	KSC2755	KSC2755
			TO-92		KSC1393
		MIX	SOT-23	KSC2756	KSC2756
			TO-92	KSC1393,MPSH24	KSC1394,MPSH24
		UHF	SOT-23	KSC2757,KSC2759 ,MMBR5179	KSC2757,KSC2759 ,MMBR5179
			TO-92	KSC1730,MPS5179,MPSH10	KSC1730,MPS5179,MPSH10
	UHF	RF	DISK	KSC1070	KSC1070
			SOT-23	KSC2758	KSC2758
		MIX	DISK	KSC1070	KSC1070
			SOT-23	KSC2758	KSC2758
		UHF	SOT-23	KSC2757,KSC2759,MMBR5179	KSC2757,KSC2759 ,MMBR5179
			TO-92	KSC1730,MPS5179,MPSH10	KSC1730,MPS5179,MPSH10
Video Chroma	Output		TO-92	KSA643,KSA733	KSA733,KSC945
			TO-92L	KSC2330,KSC2340	KSC2330,KSC2340
			TO-202	KSC1520A	KSC1520A
			TO-126	KSC2688	
			TO-220	KSC1257	KSC1507
Vertical Deflection	OSC		TO-92		KSC945,KSA733
	Driver		TO-92		KSA642,KSA643,KSD227,KSD261
			TO-92L	KSC2310,KSA910	
	Output		TO-220	KSB546,KSD401,KSA940,KSC2073	KSD880,KSD288,KSA614,KSB834
			TO-126	KSA1220A,KSC2690A	KSA1220A,KSC2690A,KSB772,KSD882
			TO-202		KSC1096,KSA634
			TO-92L		KSC2328,KSA928A
Sound	Output		TO-126	KSA1220A,KSC2690A	
			TO-220	KSB546,KSD401,KSA940,KSC2073	
			TO-202		
			TO-92L	KSC2383,KSA1013	KSC2328A,KSA928A
			TO-92		KSD261,KSB564,KSB1116,KSA643,KSD471,KSD1616
AGC			TO-92	KSC945,KSA733	KSC945,KSA733
Sync Separator			TO-92	KSC945,KSA733	KSC945,KSA733
Horizontal Deflection	OSC		TO-92	KSC945,KSA733	KSC945,KSA733
	Driver		TO-92		
			TO-92L	KSC2330,KSC2316,KSA916	
	Output		TO-3P	KSD5000,KSD5001,KSD5002,KSD5003	KSD5004,KSD5005,KSD5006,KSD5007
			TO-220		KSD362,KSD73
Series Regurator	Error Amp		TO-92		KSA733,KSC945
			TO-92L	KSC2310,KSA910	
	Driver		TO-92		KSA733,KSC945
			TO-92L	KSC2310,KSA910	
	Output		TO-220	KSD560	KSD288,KSD880,KSB834,KSA614
			TO-126		KSB772,KSD882
			TO-202		KSC1096,KSA634
Switching	Driver		TO-92	KSD471A,KSB564A,KSD261,KSA643	KSD471A,KSB564A,KSD261,KSA643
Regurator	Output		TO-3P	KSD5007	KSD5007

SOT-23 TYPE

I_C / V_{CEO}	20mA	30mA	50mA	0.1A	0.2A	0.3A	0.5A	0.6A	0.8A	10mA
12V			MMBR5179							
14V			KSC2734 KSC2759							
15V			KSC3120 KSC2757							
20V	KSC2223	KSC2756		BCW29-33						(2mA) KSK123
25V	KSC2758		KSC3125 MMBT5089 MMBC1009F1-5	MMBTH10	MMBTA4124 MMBTA4126				KSA1298 KSC3265	
30V	KSC2755		KSC2715 MMBT5088	MMBTH24	MMBTA4123 MMBTA4125	MMBTA13 MMBTA14	KSA1182 KSC2859 MMBTA63 MMBTA64	MMBT2222		
32V				BCW60A-D BCW61A-D						
35V				MMBC1622D6-8						
40V				MMBA812M3-7 MMBC1623L3-7 MMBTA20 MMBTA70 KSR1109-12 KSR2109-12	MMBT3903 MMBT3904 MMBT3906		MMBT6427	MMBT2222A MMBT2907 MMBT4401 MMBT4403		
45V			MMBA811C5-8	BCW69-72 BCW70G-K BCW71G-K	MMBT6429					
50V			MMBT5086 MMBT5087	KSA812 KSC1623 KSR1101-8 KSR2101-8 KSR1113/4 KSR2113/4	MMBT6428					
60V			MMBT2484				MMBTA05 MMBTA55	MMBT2907A		
80V							MMBTA06 MMBTA56			
140V								MMBT5550		
150V							MMBT5401			
200V							MMBTA43 MMBTA93			
300V							MMBTA42 MMBTA92			

TO-92S, TO-92 & TO-92L TYPE (V_{CEO}: 12V~60V)

V_{CEO} / I_C	12V	15V	20V	25V	30V	35V	40V	45V	50V	60V
20mA	KSK65 (2mA)	KSC1395	KSK161(10mA) KSK211(10mA) KSC1674 KSC2786	KSC1070	KSC1393 KSC1394				KSK117 (10mA) KSK30 (10mA)	
25mA			SS9016							
30mA			KSC1187 KSC1188		SS9011 KSC838 KSC2669					
50mA	MPS5179	KSC1730 SS9018		KSA542 KSC184 KSC2787 KSC388 KSC900 2N5089	2N5088 KSC1675			KSA640 KSC1222	2N5086 2N5087 2N5209 2N5210	
0.1A		MPSH17		MPS5172 MPS6520 MPS6521 MPS6522 MPS6523 MPSH10 MPSH11	KSC839 KSC921 MPSH20 MPSH24		KSC1330 MPS6513 MPS6517 MPSA10 MPSA20 MPSA70 KSR1009-12 KSR2009-12 KSR1209-12 KSR2209-12	SS9014 SS9015	KSR1201-8 KSR1213/4 KSR2201-8 KSR2213/4 KSR1001-8 KSR2001-8 KSR1013/4 KSR2013/4	
0.15A							MPS4250		KSA1175 KSC2785 KSA733 KSC945	MPS4250A MPS4249
0.2A				2N4124 2N4126	2N4123 2N4125		2N3903 2N3904 2N3905 2N3906 MPS8097	KSA539 KSC815	2N6428 2N6428A	KSA545 KSC853
0.3A				KSC3488 KSA1378 KSA642 KSD227						KSA953 KSC2002
0.5A			MPSA12 MPSA62 KSA643 KSD261 SS9012 SS9013 KSA1150 KSC2710	MPS6560 MPS6562	MPSA13 MPSA14 MPSA63 MPSA64		2N6427 MPSA25 MPSA75		MPSA26 MPSA76	MPS8098 MPS8598 MPSA05 MPSA55 MPSA27 MPSA77
0.6A			MPS3706	MPS3702	MPS2222 MPS3703 MPS3704 MPS3705		2N4400 2N4401 2N4402 2N4403 MPS2222A MPS2907			MPS2907A
0.7A				KSB810 KSB811				KSA707 KSC1072		KSA708 KSC1008 KSA931 KSC2331

2

TO-92S, TO-92 & TO-92L TYPE (Continued)

V_{CEO} / I_C	12V	15V	20V	25V	30V	35V	40V	45V	50V	60V
0.8A										
1A				KSB564A KSB811 MPS6601 MPS6651	KSD1021 KSD471A		MPS6602		KSB1116 KSD1616	KSB116A KSD1616A
1.5A				SS8050 SS8550						
2A	(10V) KSC2500				KSA928A KSC2328A					

TO-92S, TO-92 & TO-92L Type (V_{CEO}: 80V~400V)

V_{CEO} / I_C	80V	100V	120V	140V	150V	160V	200V	250V	300V	350V	400V
20mA											
25mA											
30mA											
50mA			KSA992 KSC1845 KSA1174 KSC2874		KSA910 KSC2310						
0.1mA									KSC1506 KSC2330	KSC2340	
0.15A			MPSL01								
0.2A											
0.3A	KSA954 KSC2003									MPSA45	MPSA44
0.5A	MPS8099 MPS8599 MPSA06 MPSA56						MPSA43 MPSA93	2N6515 2N6518	2N6519 MPSA92 2N6516 MPSA42	2N6517 2N6520	
0.6A		MPSL51	2N5400	2N5550	2N5401	2N5551					

TO-92S, TO-92 & TO-92L Type (Continued)

I_C \ V_{CEO}	80V	100V	120V	140V	150V	160V	200V	250V	300V	350V	400V
0.7A				KSC1009	KSA709						
0.8A			KSA916 KSC2316								
1A						KSA1013 KSC2383					
1.5A											
2A											

TO-126 & TO-202 TYPE (V_{CEO}: 25V 400V)

I_C \ V_{CEO}	25V	30V	40V	45V	60V	80V	100V	120V	160V	180V	250V	300V	400V
0.1A										KSC2682 KSA1142			
0.2A											KSC1520	KSC2688 KSC1520A	
0.5A											BD157	MJE340 MJE350 BD158 BD159	KSC2752
1.2A								KSC2690 KSA1220	KSC2690A KSA1220A				
1.5A				BD135 BD136	BD138 KSB794 BD137 KSD985	KSD986 KSB795 BD139 BD140							
2A		KSC1096 KSA634		BD233 BD378 KSC1098 KSA636 BD375 BD376	BD377 BD237 BD235 BD236	BD379 BD237 BD238 BD380							
3A		KSD882 KSB772	MJE170 MJE180	KSD794 KSB744 BD175 BD176	KSD794A KSB744A MJE171 MJE181 BD177 BD178 KSD1693 KSB1150	MJE172 MJE182 BD179 BD180	KSD1692 KSB1149						
4A	BD433 BD434	BD435 BD436		BD437 BD438 BD675 BD675A BD676 BD676A	MJE700 MJE701 BD677 BD677A BD678 BD678A MJE800 MJE801 BD439 BD440	MJE702 MJE703 BD679 BD679A BD680 BD680A MJE802 MJE803 BD441 BD442	BD681 BD682	BD683 BD684					
5A	MJE200 MJE210				KSD1691 KSB1151								

TO-220 TYPE

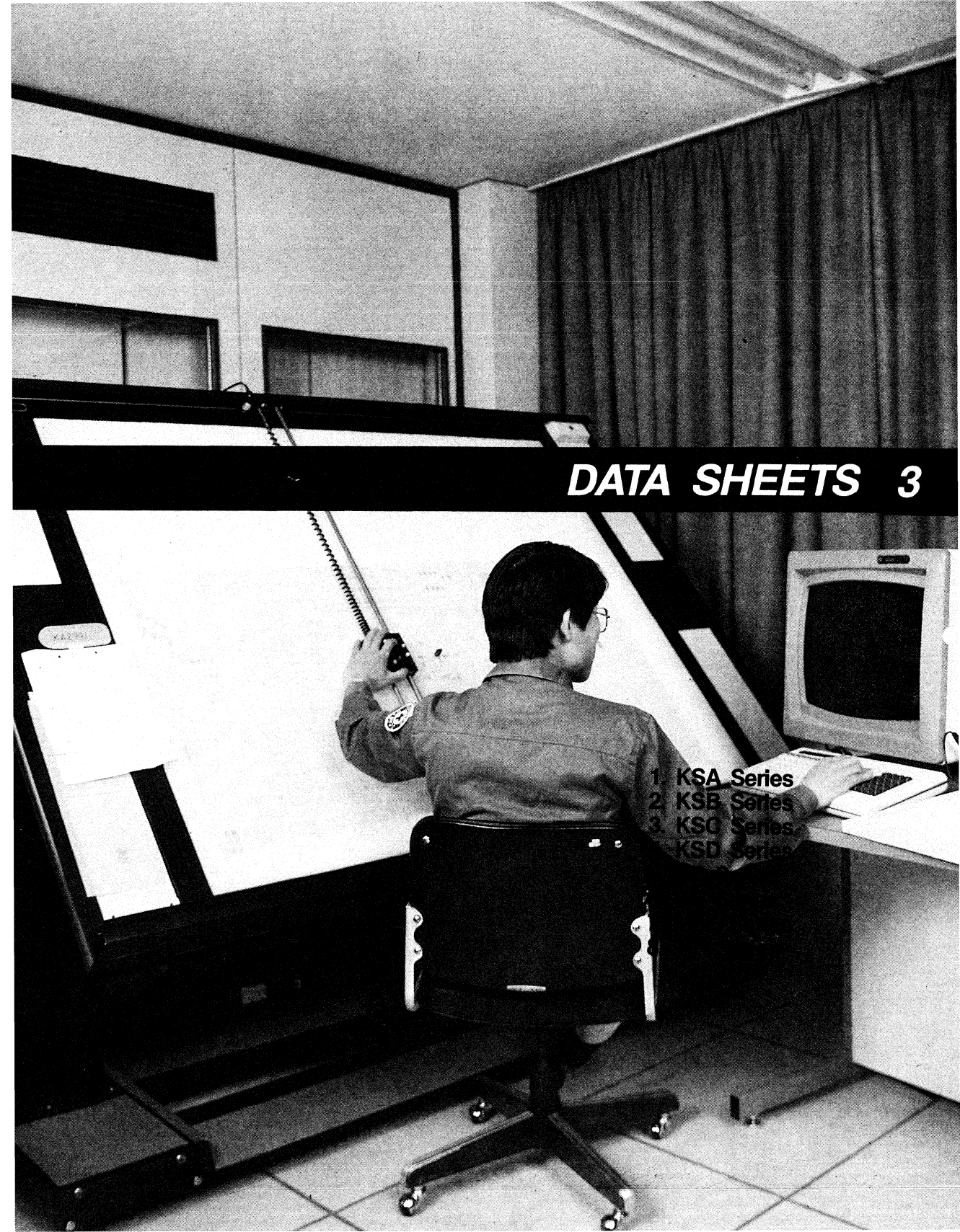
V_{CEO} / I_C	30V	40V	45V	55V	60V	70V	80V	100V	120V	150V	200V	250V	300V	350V	400V	450V	500V	800V
0.2													KSC1507					
1		TIP29 TIP30			TIP29A TIP30A		TIP29B TIP30B	TIP29C TIP30C				TIP47	TIP48	TIP49	TIP50			
1.5										KSC2073 KSA940								*KSC5026
2A			BD239 BD240		TIP110 TIP115 BD239A BD240A		TIP111 TIP116 BD239B BD240B	TIP112 TIP117 BD239C BD240C		KSD401 KSB546					KSC2333 BUX84			
3A	KSC1173 KSA473	TIP31 TIP32	BD241 BD242	KSD288 KSA614	TIP31A TIP32A KSD880 KSB834 KSC1983 BD241A BD242A		TIP31B TIP32B BD241B BD242B	TIP31C TIP32C BD241C BD242C									KSC5020	*KSC5027
4A					KSC2233		KSD526 KSB596											
5A					KSD73 TIP120 TIP125	KSD362	TIP121 TIP126	KSC2517 TIP122 TIP127 KSB601 KSD560							KSC2518 BUT11 BUV46	BUT11A	*KSC5021	
6		TIP41 TIP42	BDW23 BDW24 BD243 BD244		TIP41A TIP42A BDW23A BDW24A BD243A BD244A		TIP41B TIP42B BUW23B BUW24B BD243B BD244B	TIP41C TIP42C BD243C BD244C BDW23C BDW24C	KSD363						KSC2335			
7					KSD568 KSB707		KSD569 KSB708	KSC2334 KSA1010		BU407 BU407H	BU406 BU406H BU408							
8			BDX53 BDX54 BD533 BD534		TIP100 TIP105 BDX53A BDX54A BD535 BD536		TIP101 TIP106 BDX53B BDX54B BD537 BD538	TIP102 TIP107 BDX53C BDX54C		BU807	BU806							
10			BDX33A BDX34A		MJE3055T MJE2955T TIP140T TIP145T BDX33A BDX34A		TIP141T TIP146T BDX33B BDX34B	TIP142T TIP147T BDX33C BDX34C										
12			BDW93 BDW94		BDW93A BDW94A		BDW93B BDW94B	BDW93C BDW94C										

TO-3P & TO-3P(F) TYPE

V_{CEO} \ I_C	2.5V	3V	3.5V	4V	4.5V	5V	6V	7V	8V	9V	10V	15V
375							BU426					
400						BUW11	BU426A		BUW12	BUV47	KSC2749	KSC2751 BUV48
450						BUT11A BUW11A			BUW12A	BUV47A		BUV48A
500				KSC5022				KSC5023			KSC5024	KSC5025
600												BUV48B
700						BU508 BU508D BU508F BU508DF						BUV48C
800	KSD5000 KSD5004 KSD5010 KSD5014	KSC5028	KSD5000 KSD5005 KSD5011 KSD5012		KSC5029	KSD5002 KSD5006 KSD5012 KSD5016	KSC5030 KSD5003 KSD5007 KSD5013 KSD5017		KSC5031			

2

NOTES



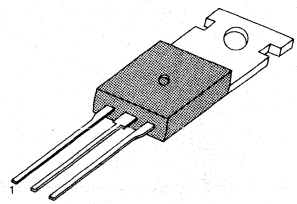
DATA SHEETS 3

1. KSA Series
2. KSB Series
3. KSC Series
4. KSD Series

LOW FREQUENCY POWER AMPLIFIER
POWER REGULATOR

- **Complement to KSC1173**
- **Collector Current: $I_C = -3A$**
- **Collector Dissipation: $P_C = 10W$ ($T_C = 25°C$)**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−30	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−3	A
Collector Dissipation ($T_C = 25°C$)	P_C	10	W
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

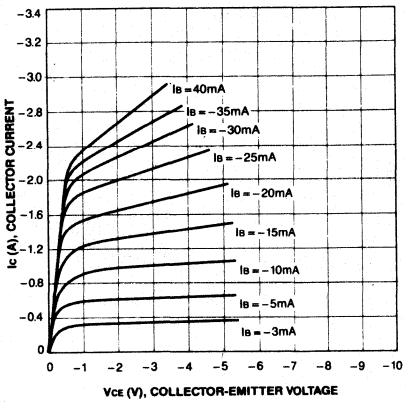
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -500\mu A$, $I_E = 0$	−30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 1mA$, $I_C = 0$	−5			
Collector Cut-off Current	I_{CBO}	$V_{CB} = -20V$, $I_E = 0$			−1.0	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−1.0	μA
DC Current Gain	$h_{FE}1$	$V_{CE} = -2V$, $I_C = -0.5A$	70		240	
	$h_{FE}2$	$V_{CE} = -2V$, $I_C = -2.5A$	25			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = -2A$, $I_B = -0.2A$		−0.3	−0.8	V
Base-Emitter On Voltage	V_{BE} (on)	$V_{CE} = -2V$, $I_C = -0.5A$		−0.75	−1.0	V
Current Gain Bandwidth Product	f_T	$V_{CE} = -2V$, $I_C = -0.5A$		100		MHz
Output Capacitance	Cob	$V_{CB} = -10V$, $I_E = 0$, f=1MHz		40		PF

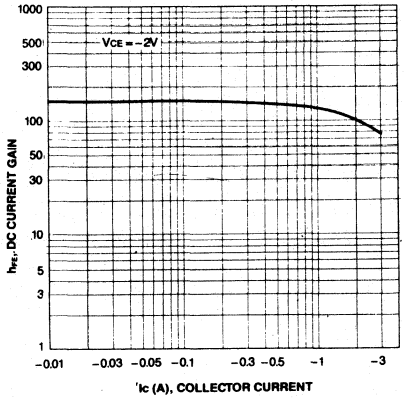
h_{FE} CLASSIFICATION

Classification	O	Y
h_{FE} (1)	70-140	120-240

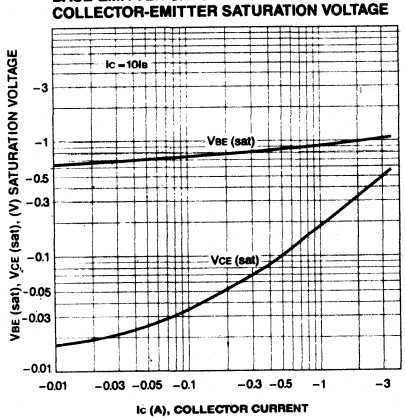
STATIC CHARACTERISTIC



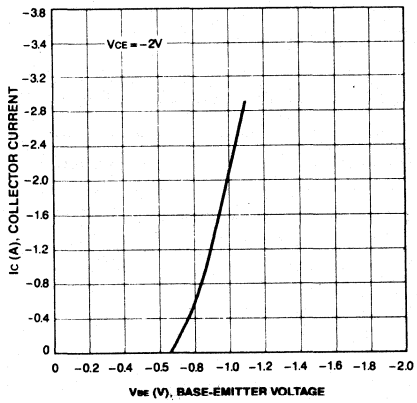
DC CURRENT GAIN



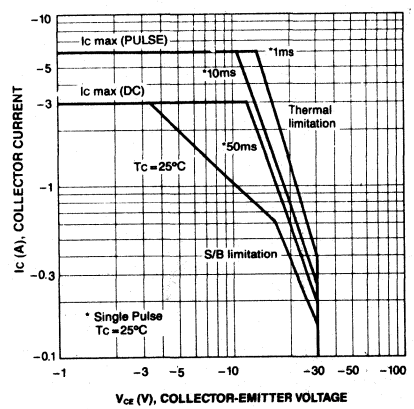
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



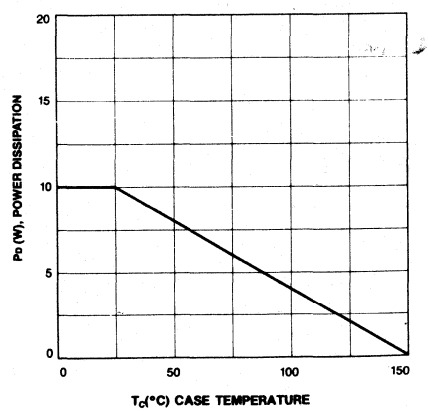
BASE-EMITTER ON VOLTAGE



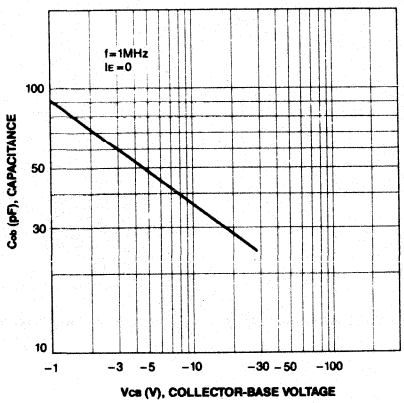
SAFE OPERATING AREA



POWER DERTING



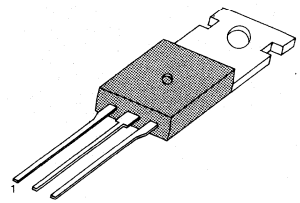
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY POWER AMPLIFIER POWER REGULATOR

- **Complement to KSD288**
- **Collector-Base Voltage $V_{CBO} = -80V$**
- **Collector Dissipation $P_C = 25W$ ($T_C = 25°C$)**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−80	V
Collector-Emitter Voltage	V_{CEO}	−55	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−3.0	A
Collector Dissipation ($T_C = 25°C$)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

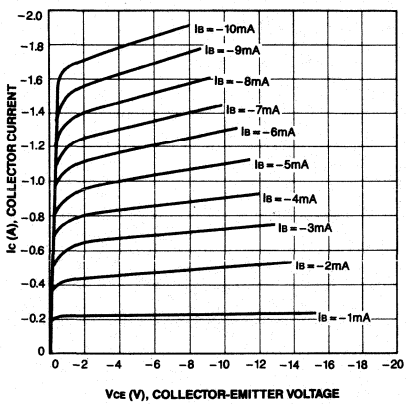
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -500\mu A$, $I_E = 0$	−80			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−55			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -500\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -50V$, $I_E = 0$			50	μA
DC Current Gain	h_{FE}	$V_{CE} = -5V$, $I_C = -0.5A$	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = -1A$, $I_B = -0.1A$		−0.15	−0.5	V

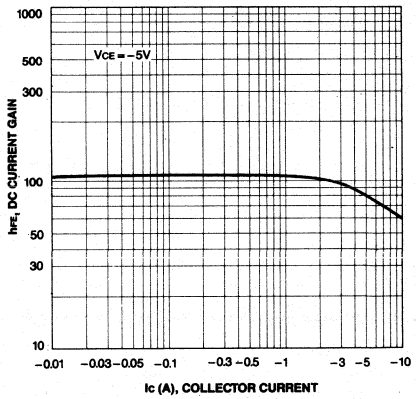
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

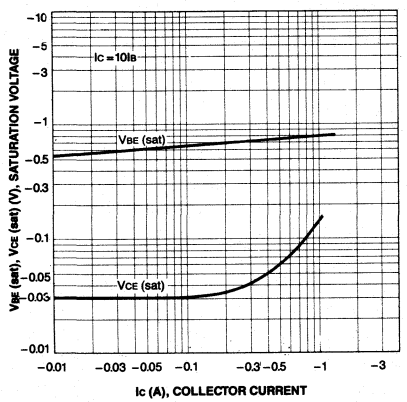
STATIC CHARACTERISTIC



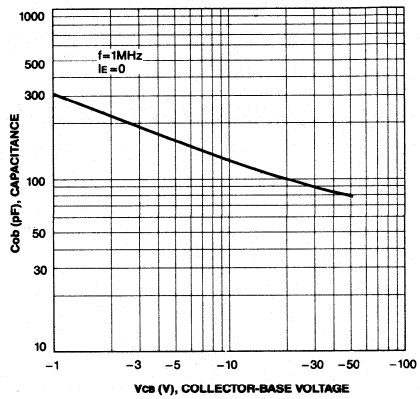
DC CURRENT GAIN



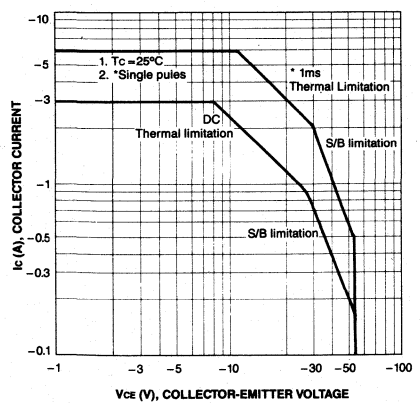
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



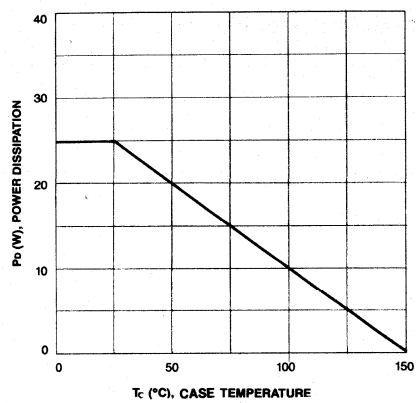
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



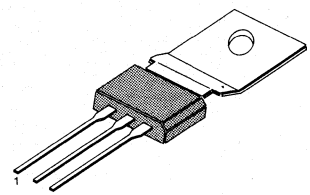
POWER DERATING



LOW FREQUENCY POWER AMPLIFIER
POWER REGULATOR

- **Complement to KSC1096**
- **Collector Current $I_C = -2A$**
- **Collector Dissipation $P_C = 10W$ ($T_C = 25°C$)**

TO-202



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−30	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−2.0	A
Collector Dissipation ($T_C = 25°C$)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

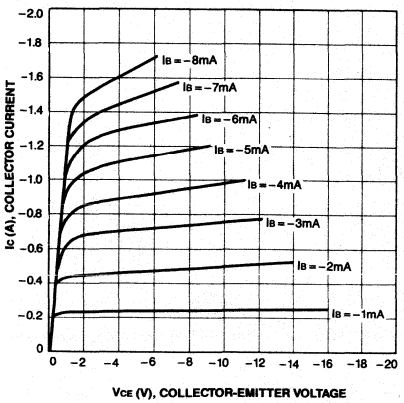
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -500\mu A$, $I_E = 0$	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -500\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -30V$, $I_E = 0$			−1	μA
DC Current Gain	h_{FE}	$V_{CE} = -5V$, $I_C = -1.0A$	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = -1.5A$, $I_B = -0.15A$		−0.3	−0.7	V

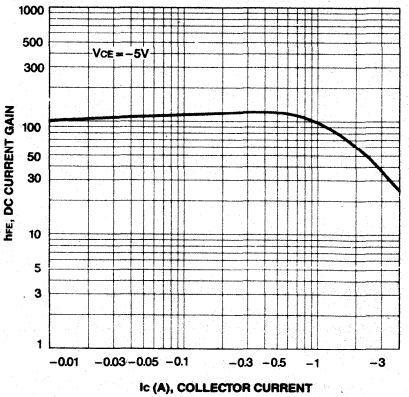
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

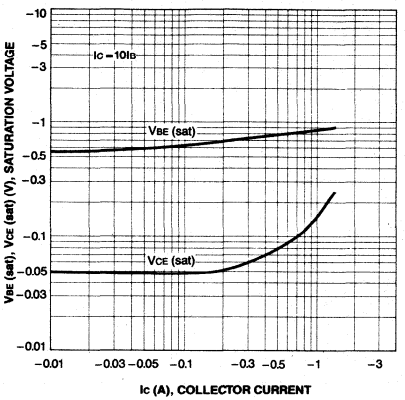
STATIC CHARACTERISTIC



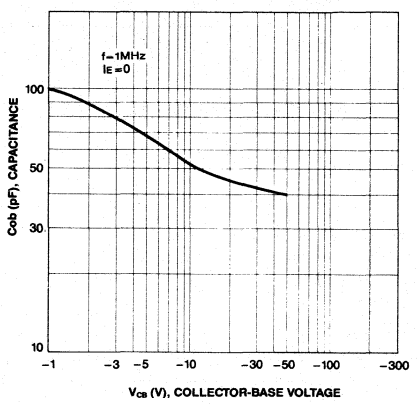
DC CURRENT GAIN



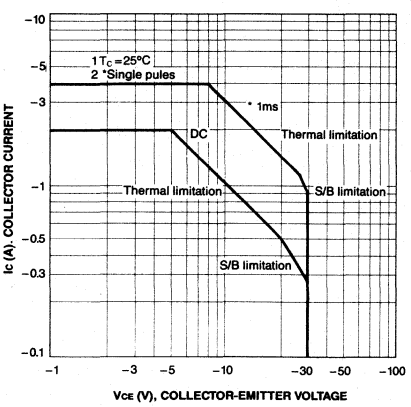
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



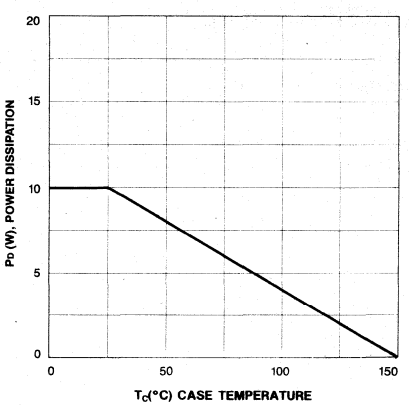
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



POWER DERATING

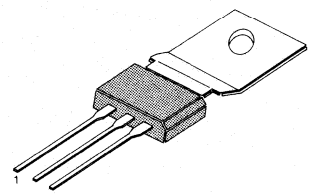


3

LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSC1098**
- **High Collector-Base Voltage $V_{CBO} = -70V$**
- **Collector Current $I_C = -2A$**
- **Collector Dissipation $P_C = 10W$ ($T_C = 25°C$)**

TO-202



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−70	V
Collector-Emitter Voltage	V_{CEO}	−45	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−2.0	A
Collector Dissipation ($T_C = 25°C$)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

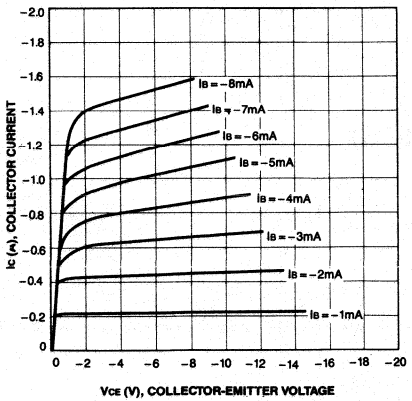
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -500\mu A$, $I_E = 0$	−70			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−45			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -500\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -40V$, $I_E = 0$			−1	μA
DC Current Gain	h_{FE}	$V_{CE} = -5V$, $I_C = -0.5A$	40		240	
Collector-Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -1A$, $I_B = -0.1A$		−0.15	−0.7	V

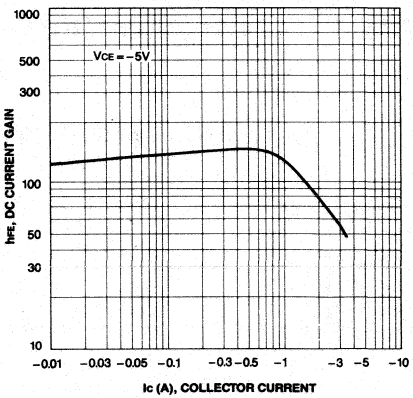
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

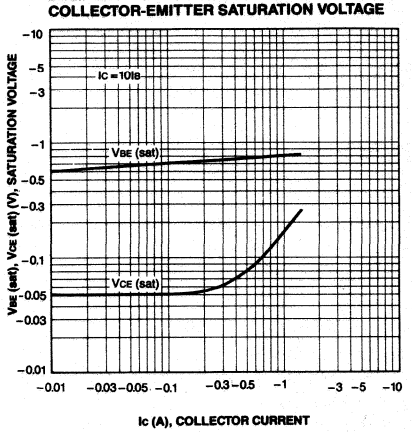
STATIC CHARACTERISTIC



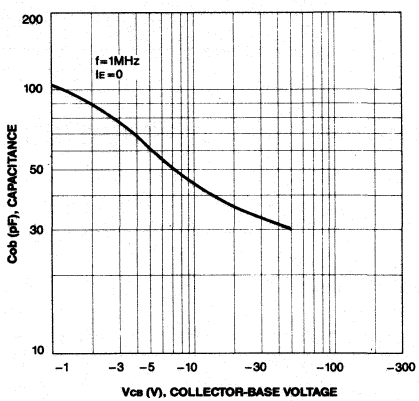
DC CURRENT GAIN



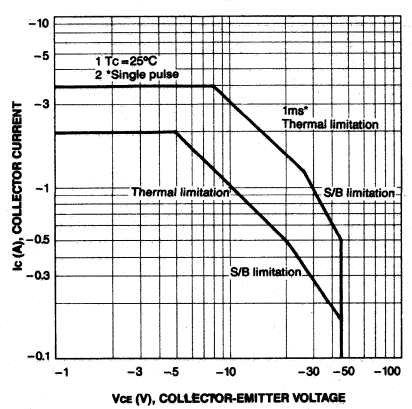
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



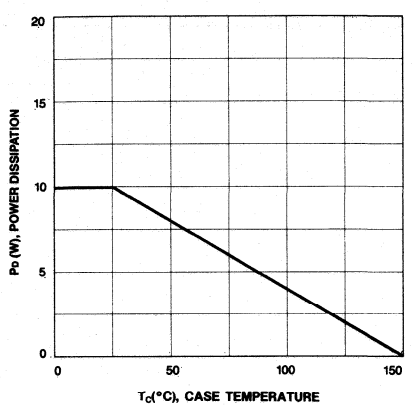
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



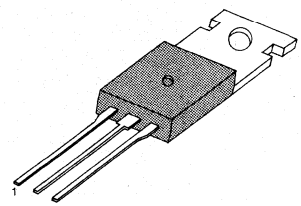
POWER DERATING



POWER AMPLIFIER
VERTICAL DEFLECTION OUTPUT

- **Complement to KSC2073**

TO-220



1. Base 2. Collector 3. Emitter

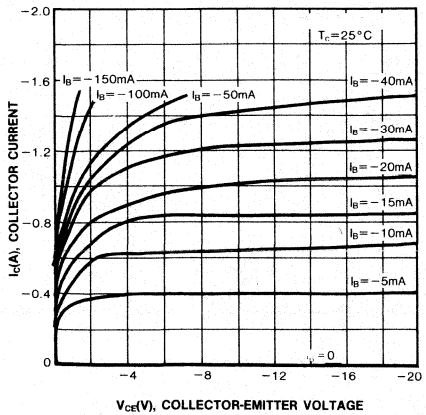
ABSOLUTE MAXIMUM RATINGS (T_c=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−150	V
Collector-Emitter Voltage	V_{CEO}	−150	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−1.5	A
Base Current	I_B	−0.5	A
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Collector Dissipation (T_c=25°C)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

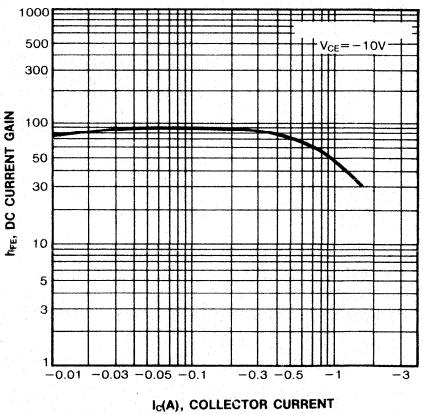
ELECTRICAL CHARACTERISTICS (T_c=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−120V, I_E=0			−10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−10	μA
DC Current Gain	h_{FE}	V_{CE}=−10V, I_C=−500mA	40	75	140	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−500mA, I_B=−50mA			−1.5	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−10V, I_C=−500mA	−0.65	−0.75	−0.85	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−500mA		4		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		55		pF

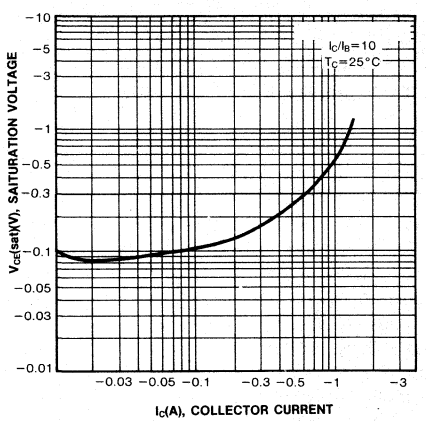
STATIC CHARACTERISTIC



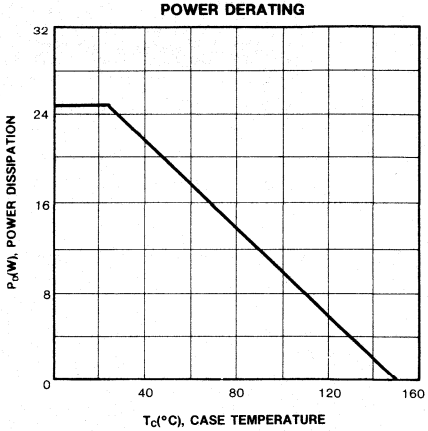
DC CURRENT GAIN



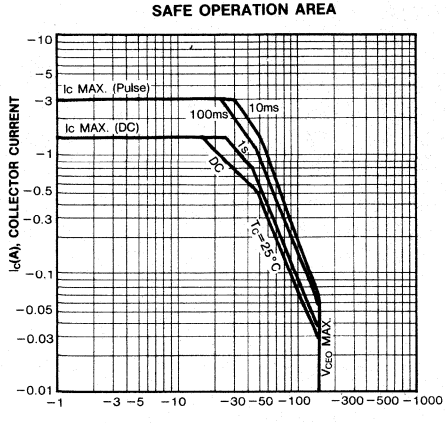
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



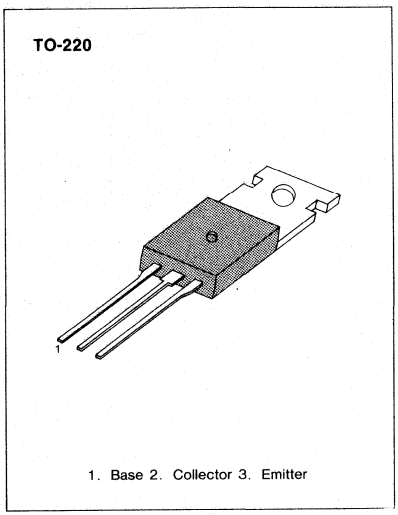
SAFE OPERATION AREA



3

HIGH SPEED HIGH VOLTAGE SWITCHING INDUSTRIAL USE

- **Complement to KSC2334**



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−100	V
Collector-Emitter Voltage	V_{CEO}	−100	V
Emitter-Base Voltage	V_{EBO}	−7	V
Collector Current (DC)	I_C	−7	A
Collector Current (Pulse)	I_C	−15	A
Base Current (DC)	I_B	−3.5	A
Collector Dissipation (T_c=25°C)	P_C	40	W
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

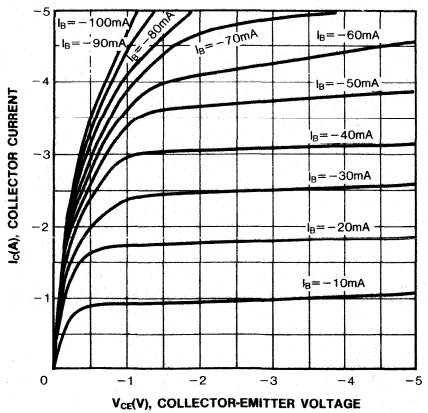
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO} (sus)	I_C=−5A, I_B1=−0.5A, L=1mH	−100		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)1	I_C=−5A, I_B1=−I_B2=−0.5A V_{BE} (off)=5V, L=180μH Clamped	−100		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)2	I_C=−10A, I_B1=−1A I_B2=0.5A, V_{BE} (off)=5V L=180μH, Clamped	−100		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−100V, I_E=0		−10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=−100V, R_{BE}=51Ω T_a=125°C		−1	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}=−100V, V_{BE} (off)=1.5V		−10	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=−100V, V_{BE}(off)=1.5V T_a=125°C		−1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0		−10	μA
*DC Current Gain	h_{FE1}	V_{CE}=−5V, I_C=−0.5A	40	200	
	h_{FE2}	V_{CE}=−5V, I_C=−3A	40	200	
	h_{FE3}	V_{CE}=−5V, I_C=−5A	20		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−5A, I_B=−0.5A		−0.6	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−5A, I_B=−0.5A		−1.5	V
Turn On Time	ton	I_C=−5A, RL=10Ω		0.5	μs
Storage Time	ts	I_B1=−I_B2=−0.5A		1.5	μs
Fall Time	tf	V_{CC}=−50V		0.5	μs

*Pulse Test: PW≤350μs, Duty Cycle≤2%

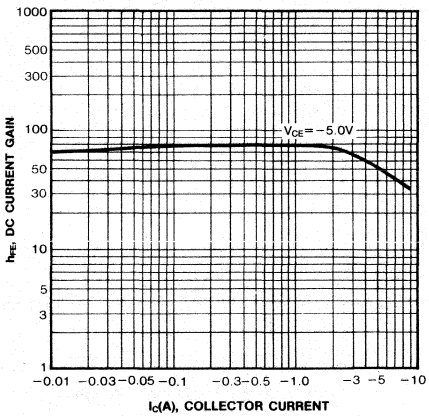
h_{FE} (2) CLASSIFICATION

Classification	R	O	Y
h_{FE} (2)	40-80	60-120	100-200

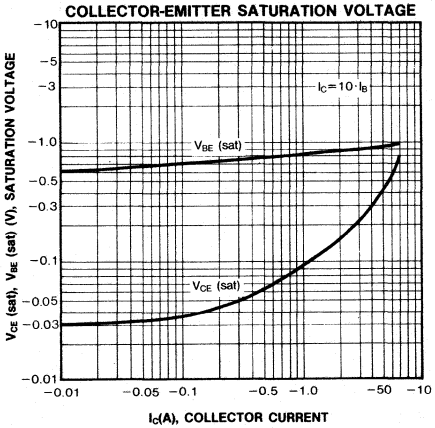
STATIC CHARACTERISTIC



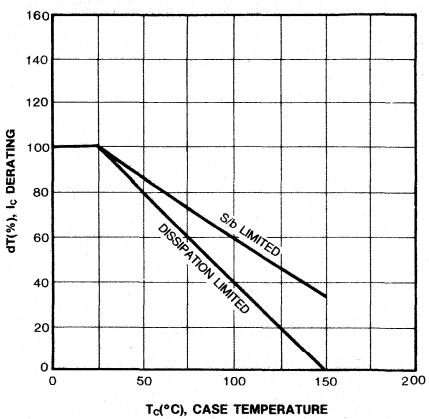
DC CURRENT GAIN



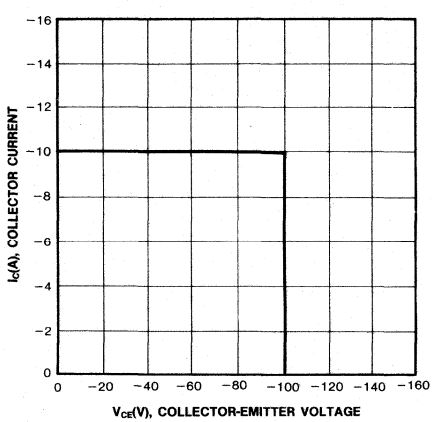
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



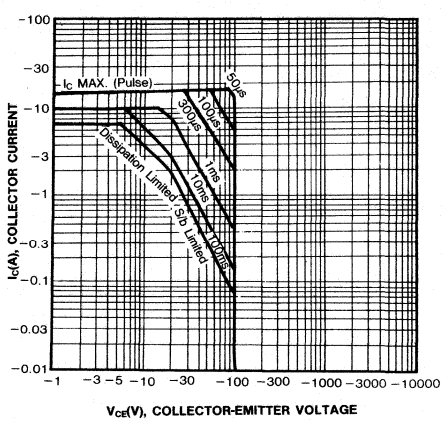
DERATING CURVE OF SAFE OPERATING AREAS



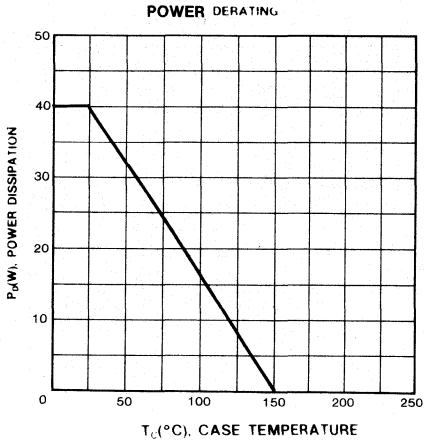
REVERSE BIAS SAFE OPERATING AREAS



SAFE OPERATING AREA



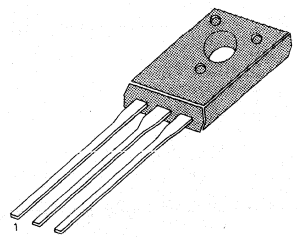
3


POWER DERATING
50
40
30
20
10
0
50
100
150
200
250
P_C(W), POWER DISSIPATION
T_C(°C), CASE TEMPERATURE

AUDIO FREQUENCY POWER AMPLIFIER
HIGH FREQUENCY POWER AMPLIFIER

- **Complement to KSC2682**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−180	V
Collector-Emitter Voltage	V_{CEO}	−180	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation (T_a=25°C)	P_C	1.2	W
Collector Dissipation (T_c=25°C)	P_C	8	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

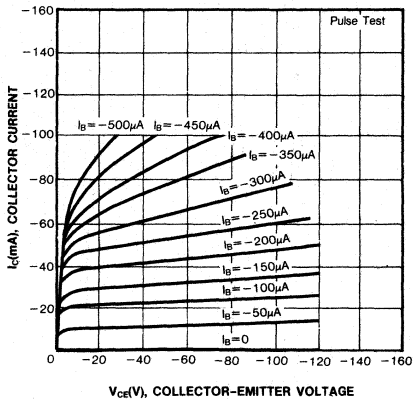
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−180V, I_E=0			−1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−3V, I_C=0			−1	μA
*DC Current Gain	h_{FE1}	V_{CE}=−5V, I_C=−1mA	90	200		
	h_{FE2}	V_{CE}=−5V, I_C=−10mA	100	200	320	
*Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=−50mA, I_B=−5mA		−0.16	−0.5	V
*Base Emitter Saturation Voltage	V_{BE} (sat)	I_C=−50mV, I_B=−5mA		−0.8	−1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=−10V, I_C= −20mA		180		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		4.5	7	pF
Noise Figure	NF	V_{CE}=−10V, I_C=−1mA Rs=10kΩ, f=1kHz		4		dB

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

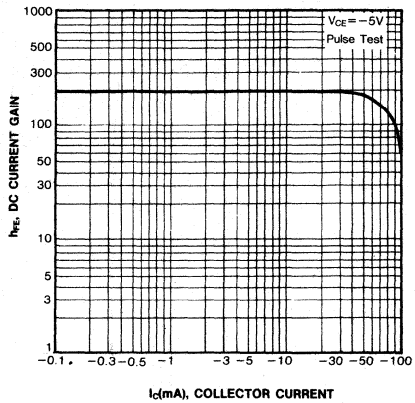
h_{FE}(2) CLASSIFICATION

Classification	O	Y
h_{FE}(2)	100-200	160-320

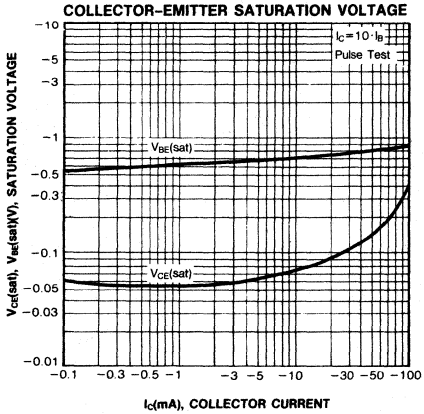
STATIC CHARACTERISTIC



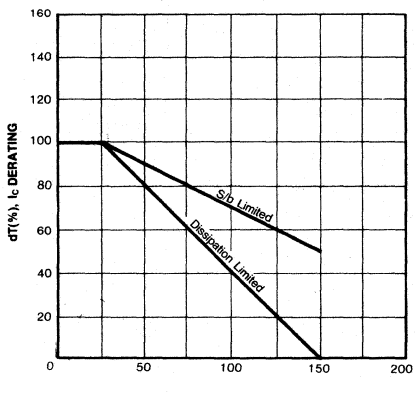
DC CURRENT GAIN



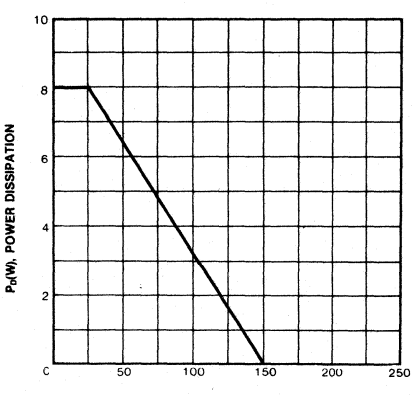
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



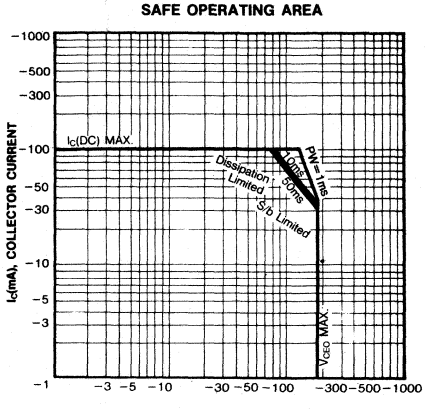
DERATING CURVE OF SAFE OPERATING AREAS



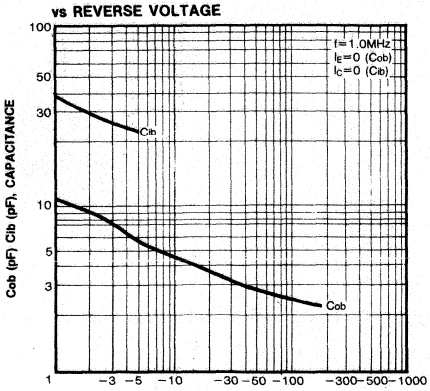
POWER DERATING



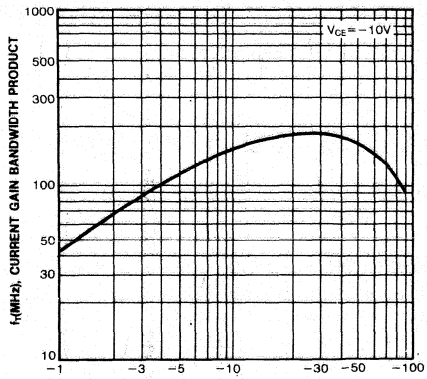
SAFE OPERATING AREA



OUTPUT AND INPUT CAPACITANCE
vs REVERSE VOLTAGE



CURRENT GAIN BANDWIDTH PRODUCT

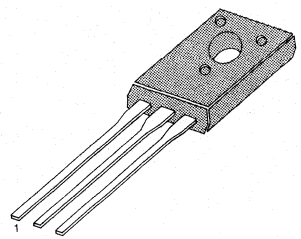


3

AUDIO FREQUENCY POWER AMPLIFIER
HIGH FREQUENCY POWER AMPLIFIER

- **Complement to KSC2690/KSC2690A**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : KSA1220	V_{CBO}	−120	V
: KSA1220A		−160	V
Collector-Emitter Voltage : KSA1220	V_{CEO}	−120	V
: KSA1220A		−160	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−1.2	A
*Collector Current (Pulse)	I_C	−2.5	A
Base Current	I_B	−0.3	A
Collector Dissipation (T_a=25°C)	P_C	1.2	W
Collector Dissipation (T_c=25°C)	P_C	20	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

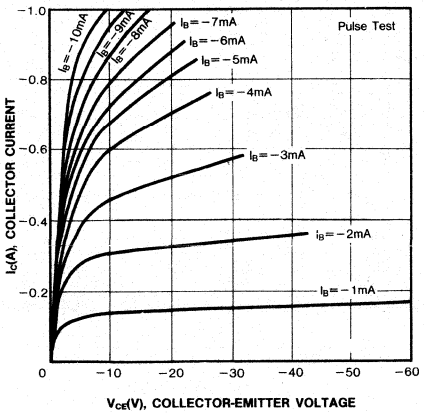
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−120V, I_E=0			−1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−3V, I_C=0			−1	μA
*DC Current Gain	h_{FE1}	V_{CE}=−5V, I_C=−5mA	35	150		
	h_{FE2}	V_{CE}=−5V, I_C=−0.3A	60	140	320	
*Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=−1A, I_B=−0.2A		−0.4	−0.7	V
*Base Emitter Saturation Voltage	V_{BE} (sat)	I_C=−1A, I_B=−0.2A		−1	−1.3	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−0.2A		175		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		26		pF

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

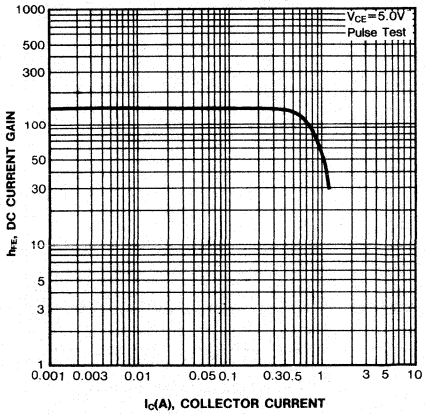
h_{FE} (2) CLASSIFICATION

Classification	R	O	Y
h_{FE}(2)	60-120	100-200	160-320

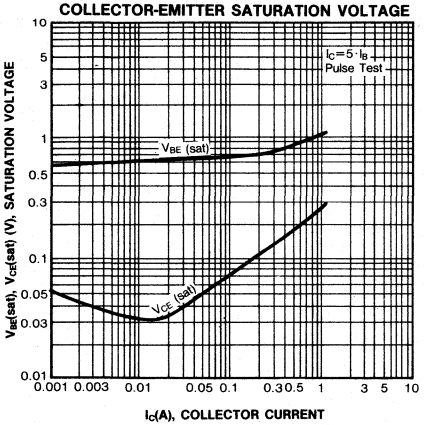
STATIC CHARACTERISTIC



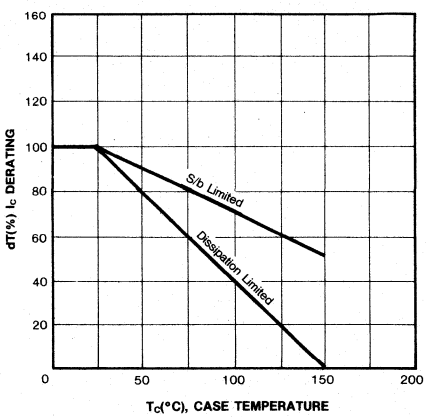
DC CURRENT GAIN



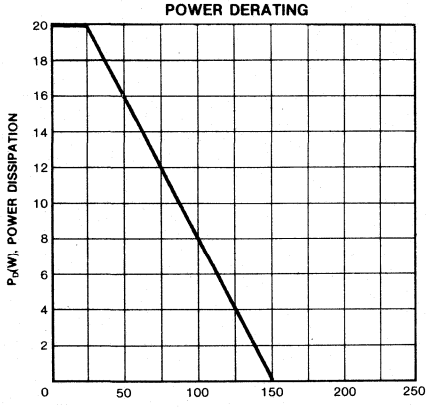
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



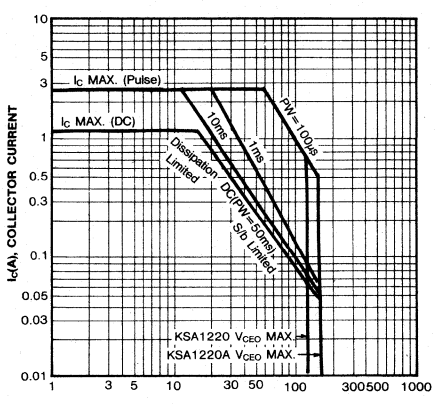
DERATING CURVE OF SAFE OPERATING AREAS



POWER DERATING

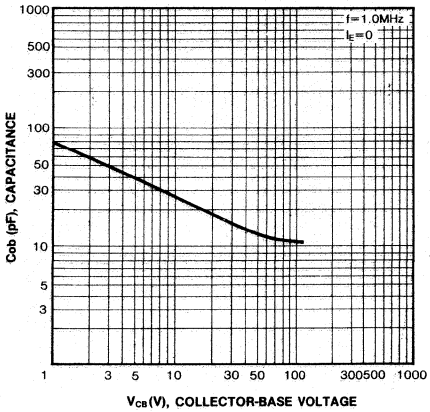


SAFE OPERATING AREA

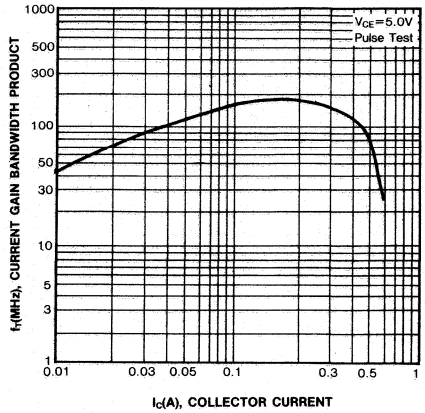


3

COLLECTOR OUTPUT CAPACITANCE



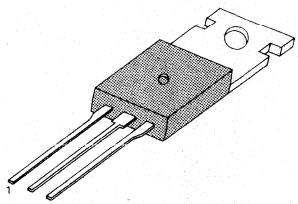
CURRENT GAIN-BANDWIDTH PRODUCT



TV VERTICAL DEFLECTION OUTPUT

- Complement to KSD401
- Collector-Base Voltage $V_{CBO} = -200V$
- Collector Current $I_C = -2A$
- Collector Dissipation $P_C = 25W$ ($T_C = 25°C$)

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−200	V
Collector-Emitter Voltage	V_{CEO}	−150	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−2	A
Collector Dissipation ($T_C = 25°C$)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

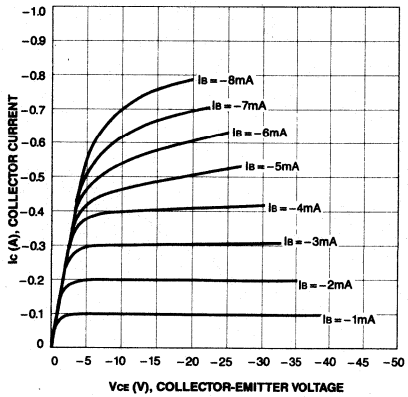
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -500\mu A$, $I_E = 0$	−200			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−150			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -500\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -150V$, $I_E = 0$			−50	μA
DC Current Gain	h_{FE}	$V_{CE} = -10V$, $I_C = -0.4A$	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = -500mA$, $I_B = -50mA$			−1	V
Current Gain-Bandwidth Product	f_T	$V_{CE} = -10V$, $I_C = -0.4A$		5		MHz

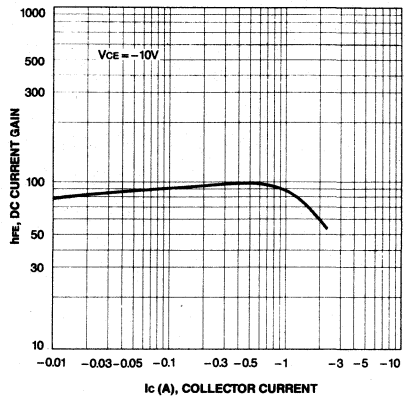
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

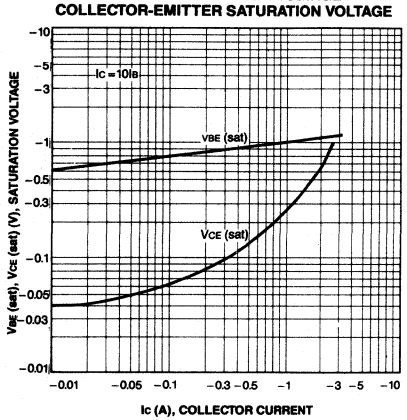
STATIC CHARACTERISTIC



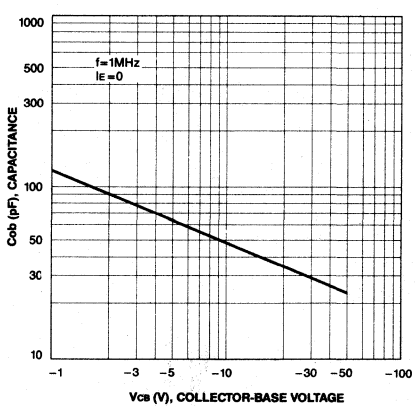
DC CURRENT GAIN



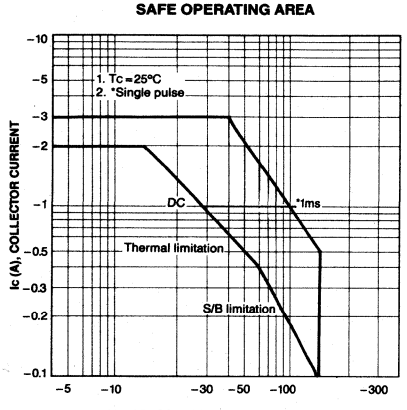
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



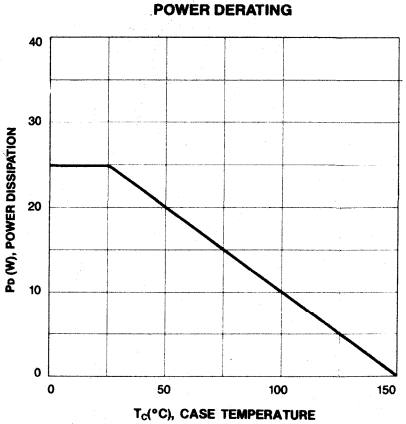
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



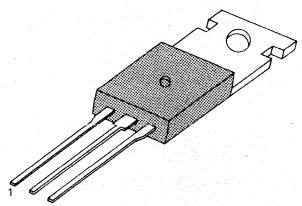
POWER DERATING



POWER AMPLIFIER APPLICATIONS

- **Complement to KSD526**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−80	V
Collector-Emitter Voltage	V_{CEO}	−80	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−4	A
Base Current	I_B	−0.4	A
Collector Dissipation (T_c=25°C)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

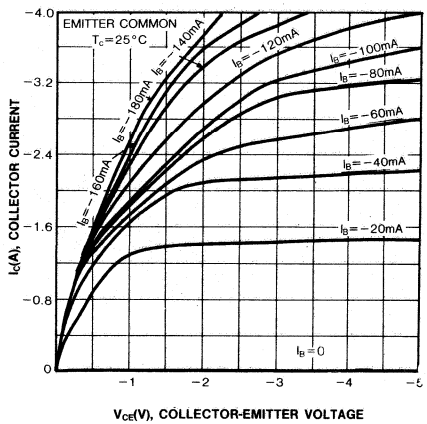
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−80V, I_E=0			−70	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−100	μA
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−50mA, I_B=0	−80			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10mA, I_C=0	−5			V
DC Current Gain	h_{FE1}	V_{CE}=−5V, I_C=−0.5A	40		240	
	h_{FE2}	V_{CE}=−5V, I_C=−3A	15			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−3A, I_B=−0.3A		−1	−1.7	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−5V, I_C=−3A		−1	−1.5	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5V, I_C=−0.5A	3			MHz
Collector Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		130		pF

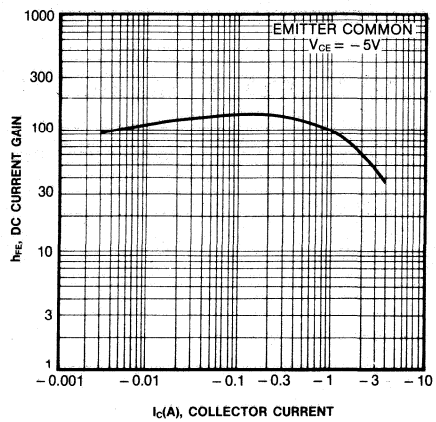
h_{FE}(1) CLASSIFICATION

Classification	R	O	Y
h_{FE}(1)	40-80	70-140	120-240

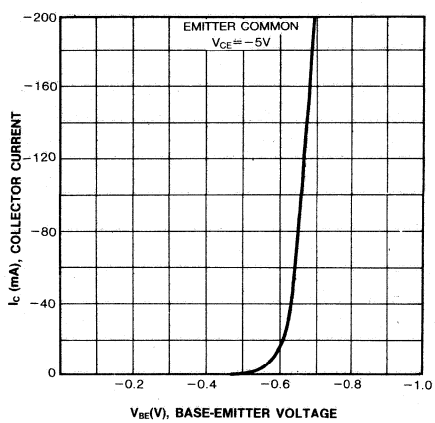
STATIC CHARACTERISTIC



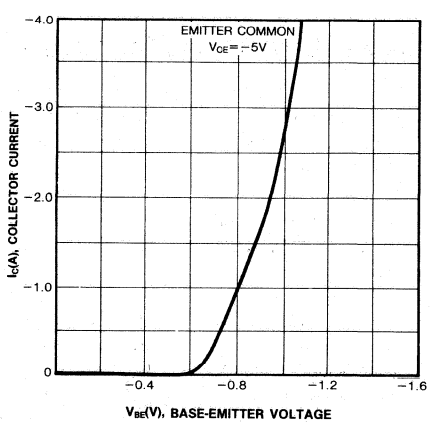
DC CURRENT GAIN



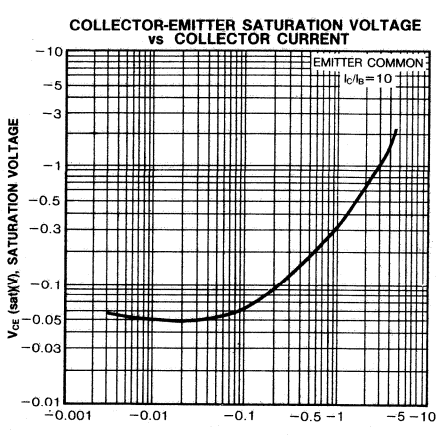
BASE-EMITTER ON VOLTAGE



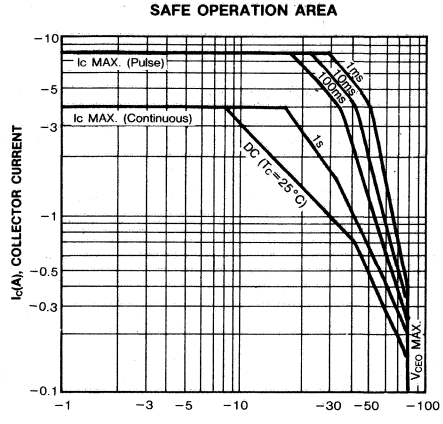
BASE-EMITTER VOLTAGE vs COLLECTOR CURRENT



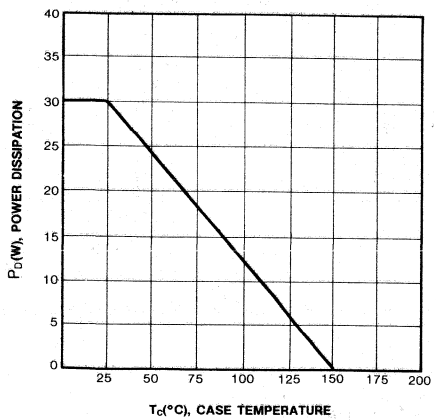
COLLECTOR-EMITTER SATURATION VOLTAGE vs COLLECTOR CURRENT



SAFE OPERATION AREA



POWER DERATING

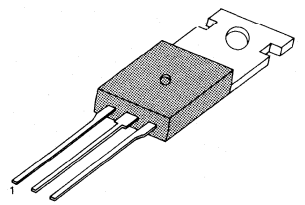


PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

LOW FREQUENCY POWER AMPLIFIER
MEDIUM SPEED SWITCHING
INDUSTRIAL USE

- **Complement to KSD560**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−100	V
Collector-Emitter Voltage	V_{CEO}	−100	V
Emitter-Base Voltage	V_{EBO}	−7	V
Collector Current (DC)	I_C	−5	A
*Collector Current (Pulse)	I_C	−8	A
Base Current (DC)	I_B	−0.5	A
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Collector Dissipation (T_c=25°C)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

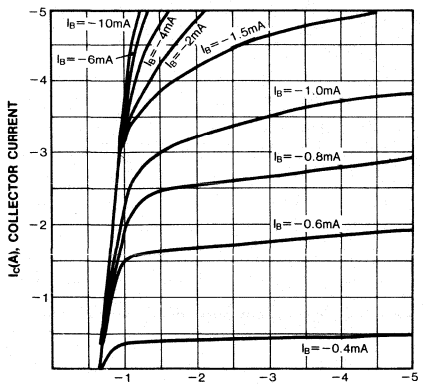
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO} (sus)	I_C=−3A, I_{B1}=−3mA, L=1mH	−100			V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)1	I_C=−3A, I_{B1}=−I_{B2}=−3mA V_{BE} (off)=5V, L=180μH Clamped	−100			V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)2	I_C=−6A, I_{B1}=−12mA I_{B2}=3mA, V_{BE} (off)=5V L=180μH, Clamped	−100			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−100V, I_E=0			−10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=−100V, R_{BE}=51Ω T_a=125°C			−1	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}=−100V, V_{BE} (off)=1.5V			−10	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=−100V, V_{BE}(off)=1.5V T_a=125°C			−1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−3	mA
*DC Current Gain	h_{FE1}	V_{CE}=−2V, I_C=−3A	2000		15000	
	h_{FE2}	V_{CE}=−2V, I_C=−5A	500			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−3A, I_B=−3mA			−1.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−3A, I_B=−3mA			−2	V
Turn On Time	ton	I_C=−3A, RL=17Ω		0.5		μs
Storage Time	ts	I_{B1}=−I_{B2}=−3mA		1		μs
Fall time	tf	V_{CC}≅−50V		1		μs

*Pulse Test: PW≤350μs, Duty Cycle≤2%

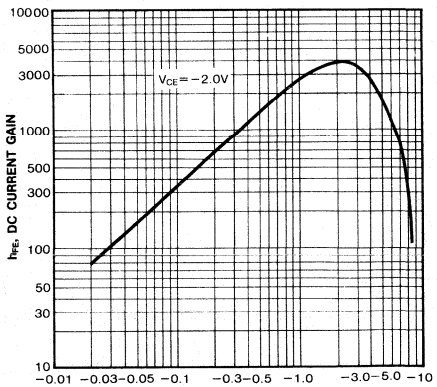
h_{FE}(1) CLASSIFICATION

Classification	R	O	Y
h_{FE}(1)	2000-5000	3000-7000	5000-15000

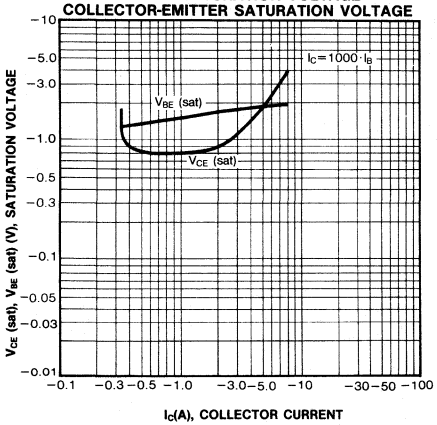
STATIC CHARACTERISTIC



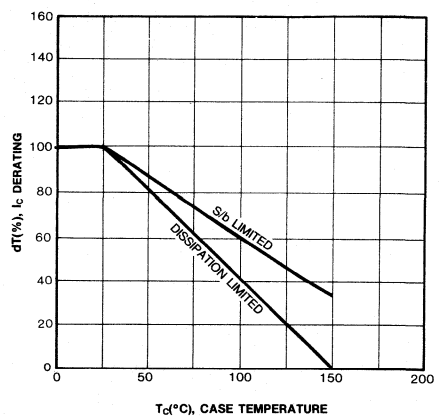
DC CURRENT GAIN



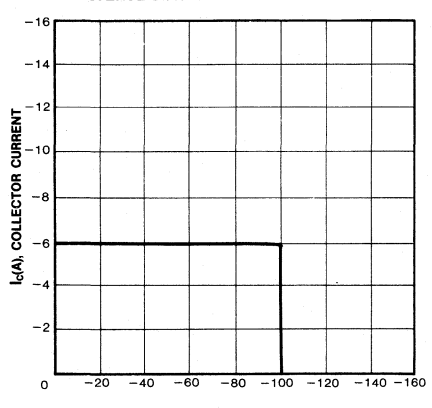
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



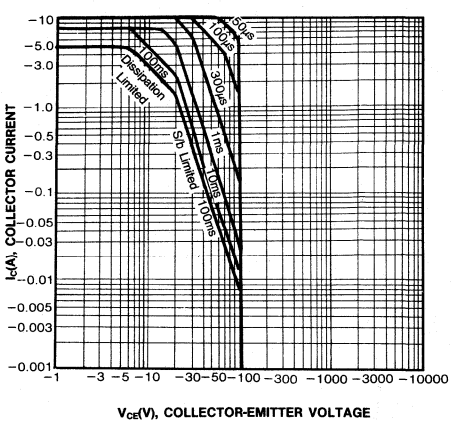
DERATING CURVE OF SAFE OPERATING AREAS



REVERSE BIAS SAFE OPERATING AREAS



SAFE OPERATING AREA



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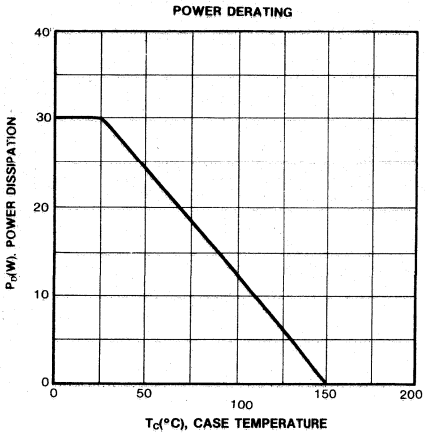
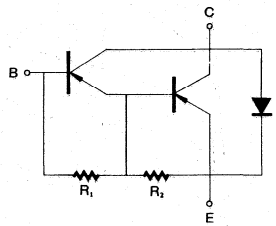


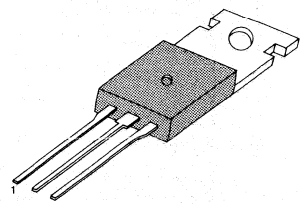


$R_1 \fallingdotseq 3k\Omega$
$R_2 \fallingdotseq 300\Omega$

LOW FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING
INDUSTRIAL USE

- **Complement to KSD568**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−80	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Emitter-Base Voltage	V_{EBO}	−7.0	V
Collector Current (DC)	I_C	−7.0	A
*Collector Current (Pulse)	I_C	−15	A
Base Current (DC)	I_B	−3.5	A
Collector Dissipation (T_c=25°C)	P_C	40	W
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

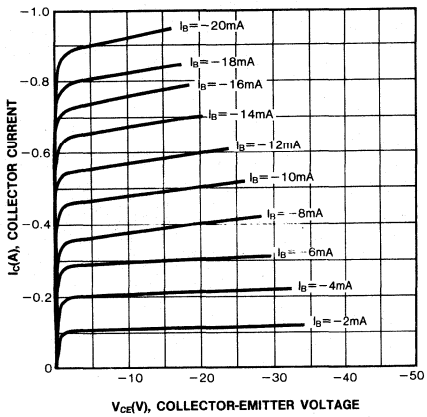
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−60V, I_E=0		−10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0		−10	μA
*DC Current Gain	h_{FE1}	V_{CE}=−1V, I_C=−3A	40	200	
	h_{FE2}	V_{CE}=−1V, I_C=−5A	20		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−5A, I_B=−0.5A		-0.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−5A, I_B=−0.5A		−1.5	V

*Pulse Test: PW≤350μs, Duty Cycle≤2%

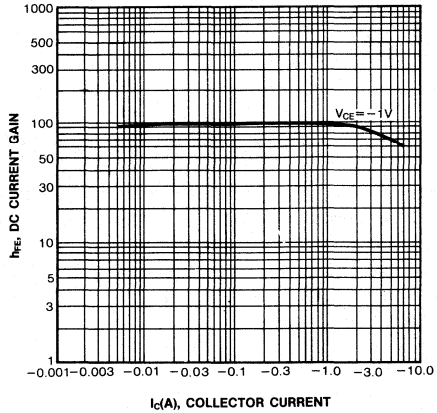
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE} (1)	40-80	60-120	100-200

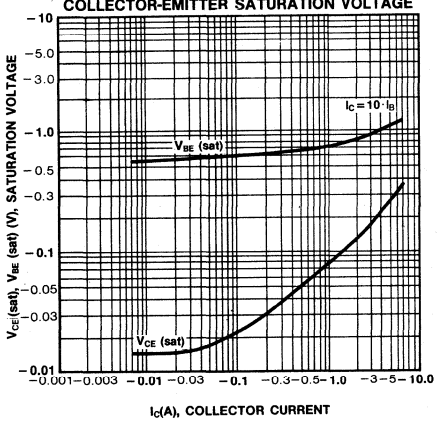
STATIC CHARACTERISTIC



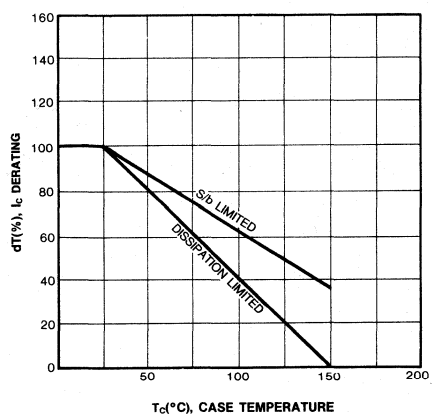
DC CURRENT GAIN



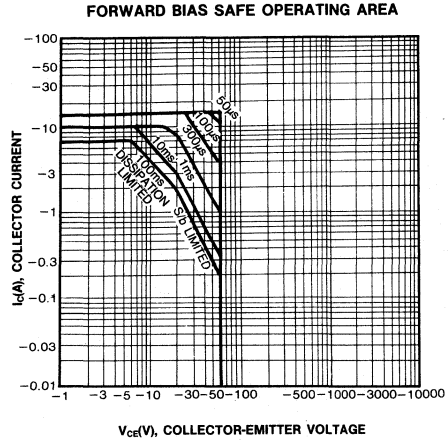
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



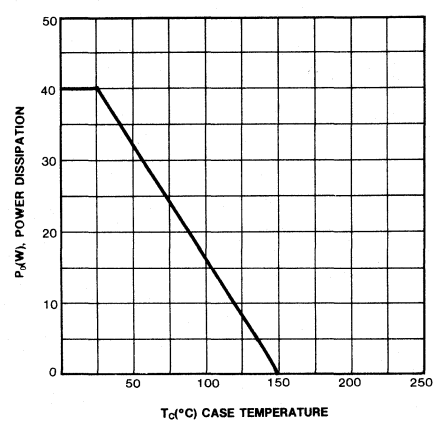
DERATING CURVE OF SAFE OPERATING AREAS



FORWARD BIAS SAFE OPERATING AREA



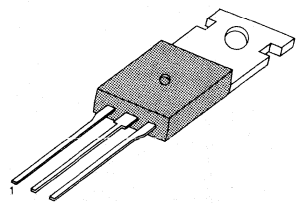
POWER DERATING



LOW FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING
INDUSTRIAL USE

- Complement to KSD569

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−80	V
Collector-Emitter Voltage	V_{CEO}	−80	V
Emitter-Base Voltage	V_{EBO}	−7.0	V
Collector Current (DC)	I_C	−7.0	A
*Collector Current (Pulse)	I_C	−15	A
Base Current (DC)	I_B	−3.5	A
Collector Dissipation (T_c=25°C)	P_C	40	W
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

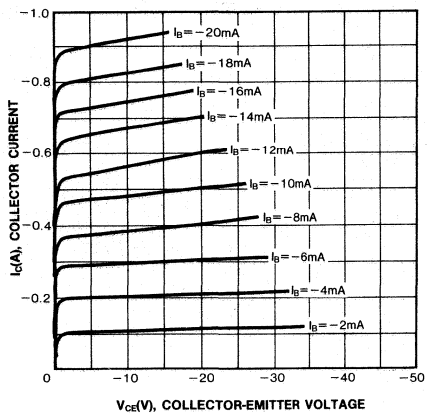
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−60V, I_E=0		−10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0		−10	μA
*DC Current Gain	h_{FE1}	V_{CE}=−1V, I_C=−3A	40	200	
	h_{FE2}	V_{CE}=−1V, I_C=−5A	20		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−5A, I_B=−0.5A		−0.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−5A, I_B=−0.5A		−1.5	V

*Pulse Test: PW≤350μs, Duty Cycle≤2%

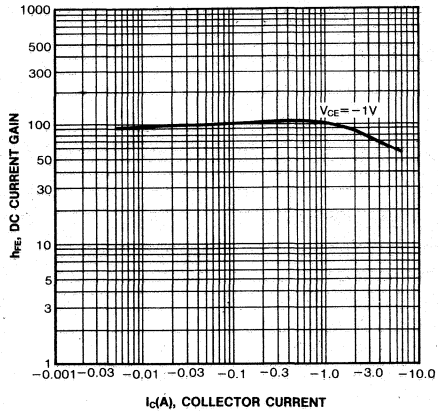
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE} (1)	40-80	60-120	100-200

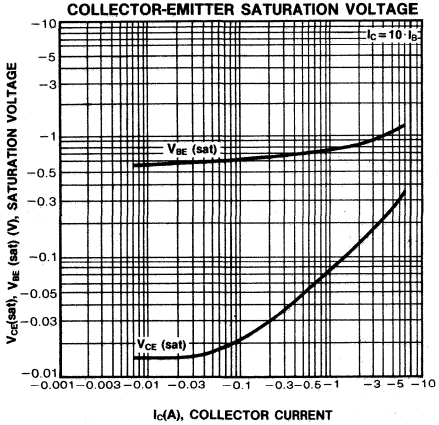
STATIC CHARACTERISTIC



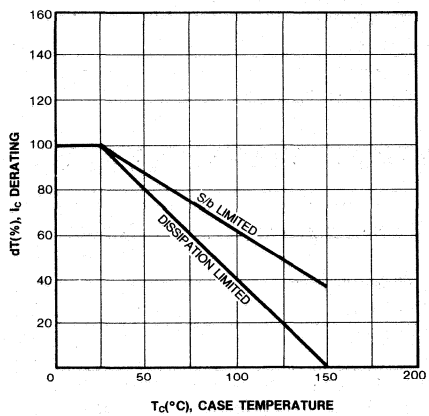
DC CURRENT GAIN



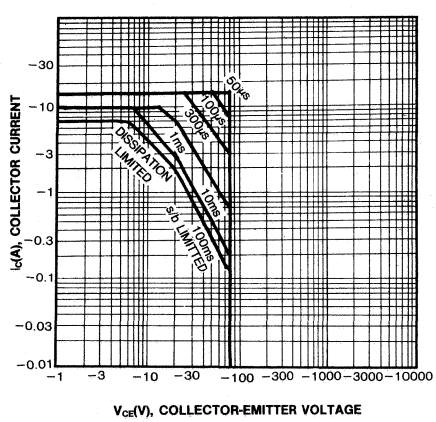
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



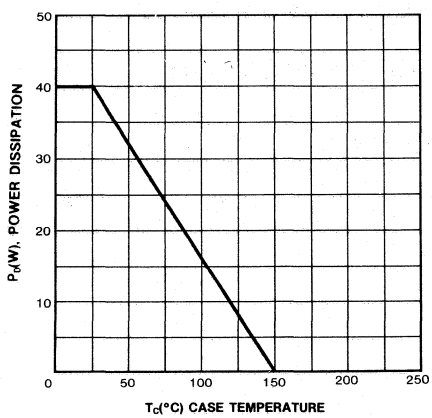
DERATING CURVE OF SAFE OPERATING AREAS



FORWARD BIAS SAFE OPERATING AREA



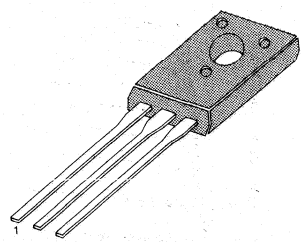
POWER DERATING



AUDIO FREQUENCY POWER AMPLIFIER

- **Complement to KSD794/KSD794A**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−70	V
Collector-Emitter Voltage : KSB744	V_{CEO}	−45	V
: KSB744A		−60	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−3	A
*Collector Current (Pulse)	I_C	−5	A
Base Current	I_B	−0.6	A
Collector Dissipation (T_a=25°C)	P_C	1	W
Collector Dissipation (T_c=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

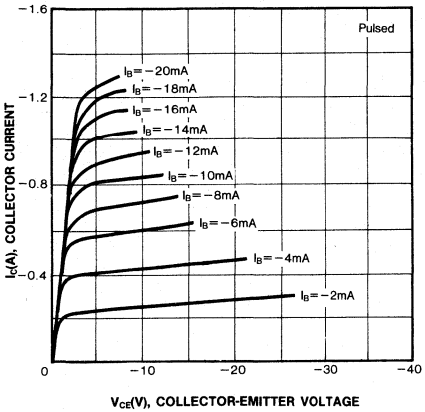
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−45V, I_E=0			−1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−3V, I_C=0			−1	μA
*DC Current Gain	h_{FE1}	V_{CE}=−5V, I_C=−20mA	30	120		
	h_{FE2}	V_{CE}=−5V, I_C=−0.5A	60	100	320	
*Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=−1.5A, I_B=−0.15A		−0.5	−2	V
*Base Emitter Saturation Voltage	V_{BE} (sat)	I_C=−1.5A, I_B=−0.15A		−0.8	−2	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−0.1A		45		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		60		pF

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

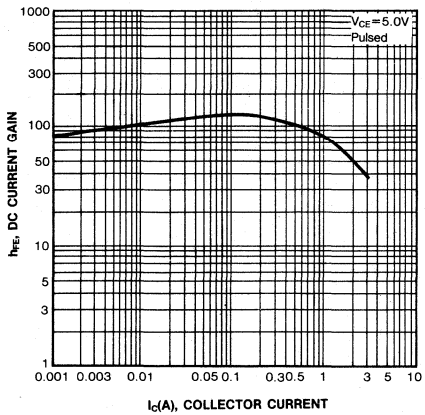
h_{FE}(2) CLASSIFICATION

Classification	R	O	Y
h_{FE}(2)	60-120	100-200	160-320

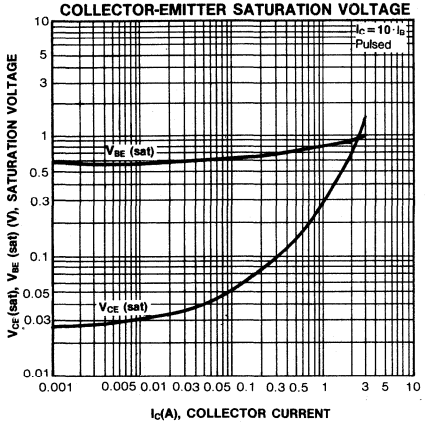
STATIC CHARACTERISTIC



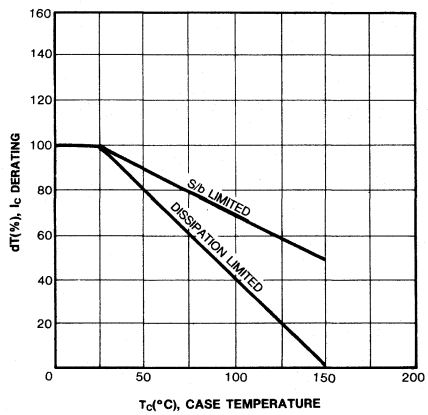
DC CURRENT GAIN



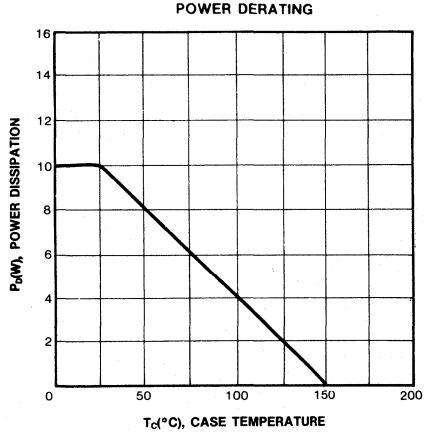
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



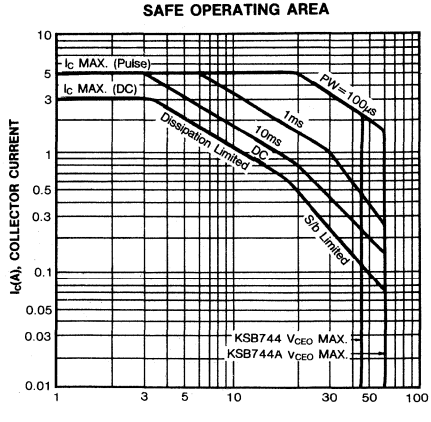
DERATING CURVE OF SAFE OPERATING AREAS



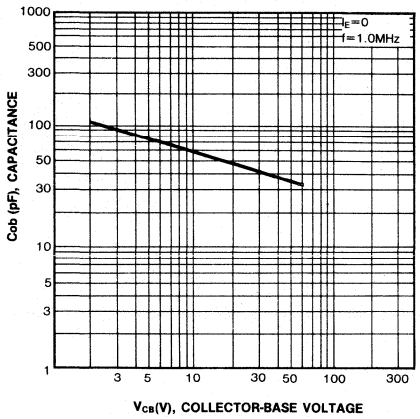
POWER DERATING



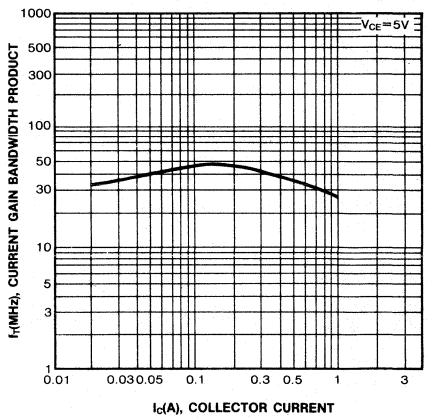
SAFE OPERATING AREA



COLLECTOR OUTPUT CAPACITANCE



CURRENT GAIN-BANDWIDTH PRODUCT

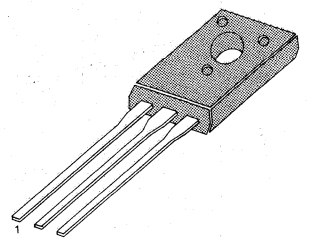


3

AUDIO FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING

- **Complement to KSD882**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−30	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−3	A
*Collector Current (Pulse)	I_C	−7	A
Base Current (DC)	I_B	−0.6	A
Collector Dissipation (T_c=25°C)	P_C	10	W
Collector Dissipation (T_a=25°C)	P_C	1	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

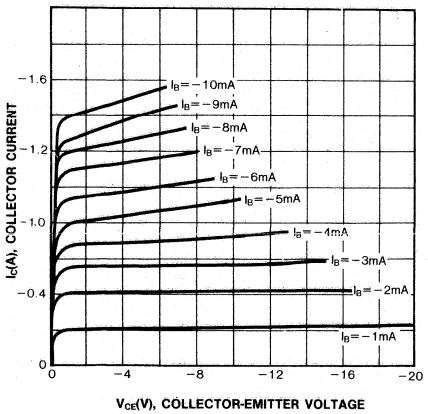
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−3V, I_C=0			−1	μA
*DC Current Gain	h_{FE1}	V_{CE}=−2V, I_C=−20mA	30	220		
	h_{FE2}	V_{CE}=−2V, I_C=−1A	60	160	400	
*Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=−2A, I_B=−0.2A		−0.3	−0.5	V
*Base Emitter Saturation Voltage	V_{BE} (sat)	I_C=−2A, I_B=−0.2A		−1.0	−2.0	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_E=0.1A		80		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		55		pF

* Pulse Test: PW≤350μs, Duty Cycle≤2%

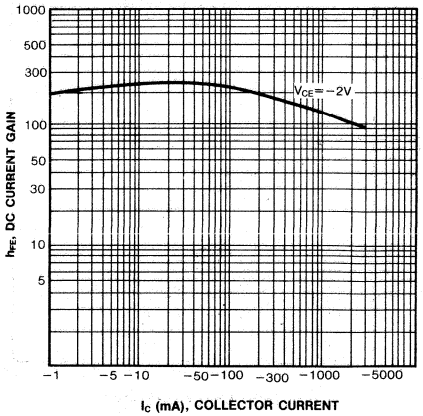
h_{FE}(2) CLASSIFICATION

Classification	R	O	Y	G
h_{FE}(2)	60-120	100-200	160-320	200-400

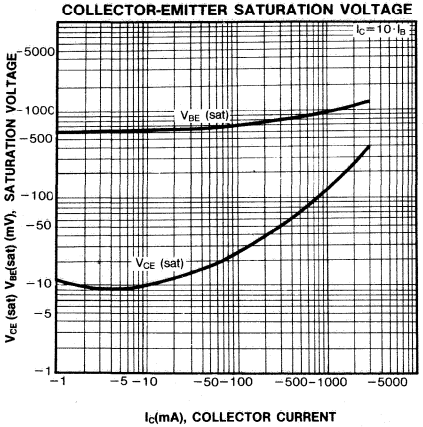
STATIC CHARACTERISTIC



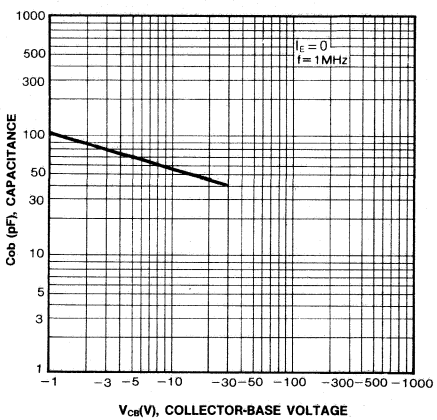
DC CURRENT GAIN



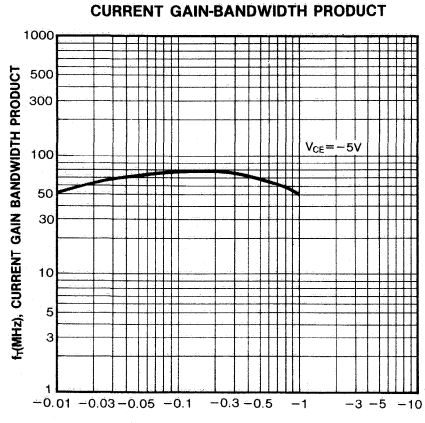
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



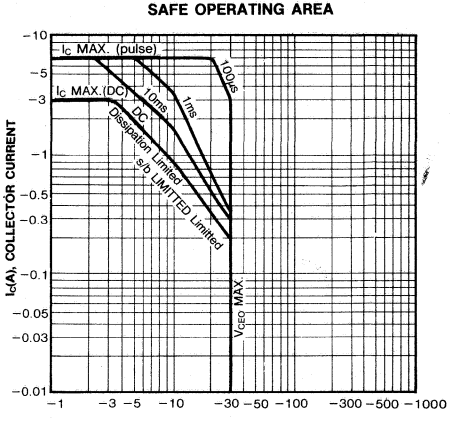
COLLECTOR OUTPUT CAPACITANCE



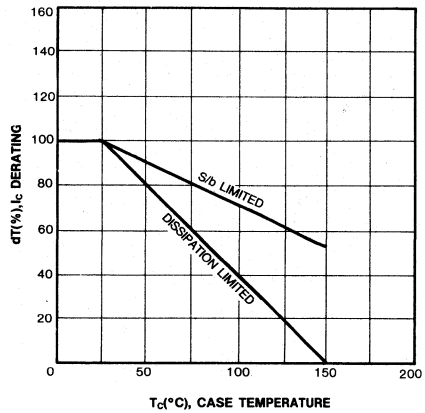
CURRENT GAIN-BANDWIDTH PRODUCT



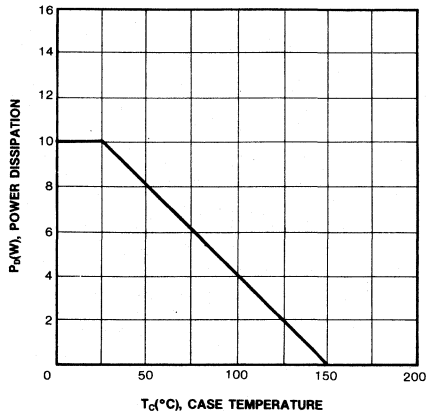
SAFE OPERATING AREA



DERATING CURVE OF SAFE OPERATING AREAS



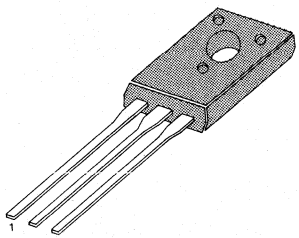
POWER DERATING



PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

AUDIO FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING
INDUSTRIAL USE

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Emitter-Base Voltage	V_{EBO}	−8	V
Collector Current (DC)	I_C	±1.5	A
*Collector Current (Pulse)	I_C	±3	A
Base Current (DC)	I_B	−0.15	A
Collector Dissipation (T_a=25°C)	P_C	1	W
Collector Dissipation (T_c=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

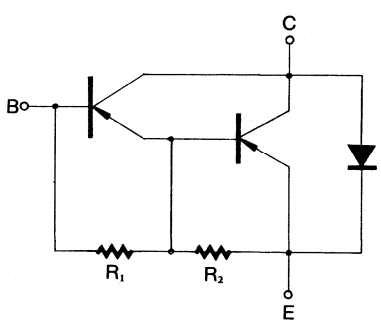
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−60V, I_E=0		−10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=−60V, R_{BE}=51Ω, T_a=125°C		−1	mA
Collector Cutoff Current	$I_{CEX}1$	V_{CE}=−60V, V_{BE} (off)=1.5V		−10	μA
Collector Cutoff Current	$I_{CEX}2$	V_{CE}=−60V, V_{BE} (off)=1.5V T_a=125°C		−1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0		−1	mA
*DC Current Gain	h_{FE1}	V_{CE}=−2V, I_C=−0.5A	1000		
	h_{FE2}	V_{CE}=−2V, I_C=−1A	2000	30000	
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−1A, I_B=−1mA		−1.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−1A, I_B=−1mA		− 2	V

*Pulse Test: PW≤350μs, Duty Cycle≤2% pulsed.

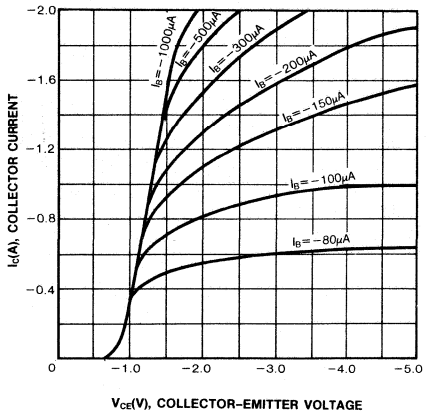
h_{FE}(2) CLASSIFICATION

Classification	R	O	Y
h_{FE}(2)	2000-5000	4000-10000	8000-30000

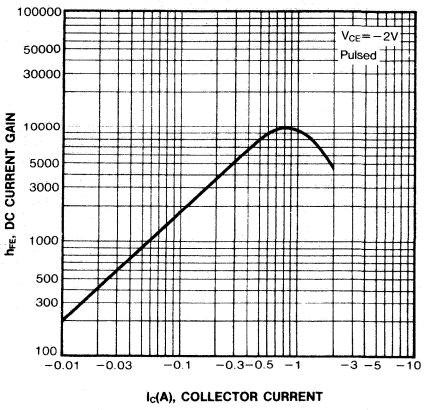


R_1≒10kΩ
R_2≒500Ω

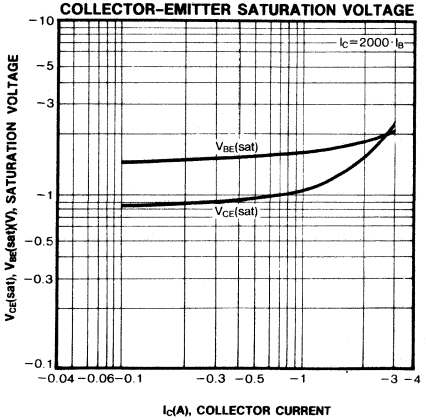
STATIC CHARACTERISTIC



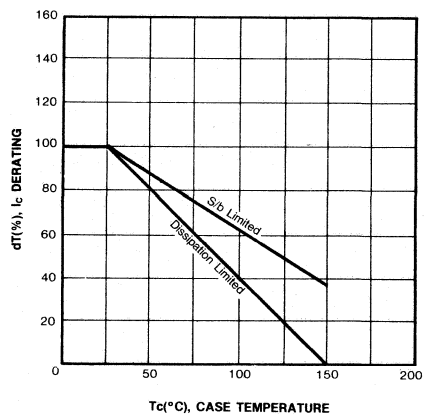
DC CURRENT GAIN



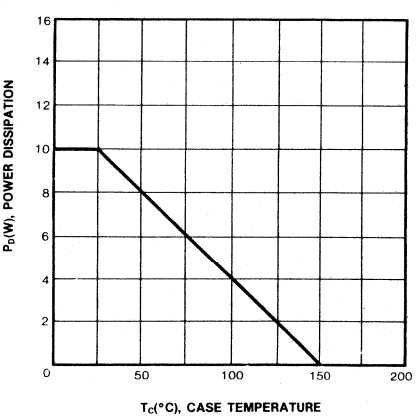
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



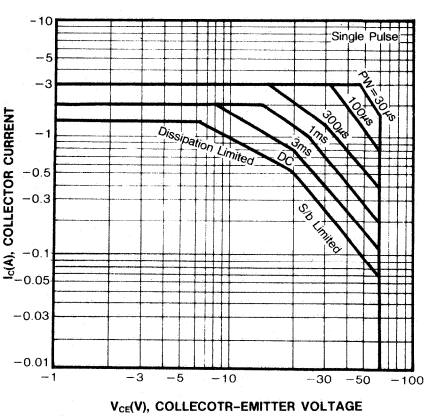
DERATING CURVE OF SAFE OPERATING AREAS



POWER DERATING



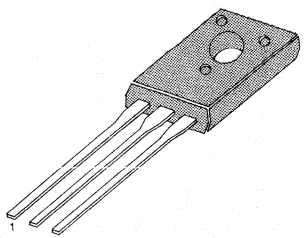
SAFE OPERATING AREA



PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

AUDIO FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING
INDUSTRIAL USE

TO-126



1. Emitter 2. Collector 3 Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−80	V
Collector-Emitter Voltage	V_{CEO}	−80	V
Emitter-Base Voltage	V_{EBO}	−8	V
Collector Current (DC)	I_C	±1.5	A
*Collector Current (Pulse)	I_C	±3	A
Base Current (DC)	I_B	−0.15	A
Collector Dissipation (T_a=25°C)	P_C	1	W
Collector Dissipation (T_c=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

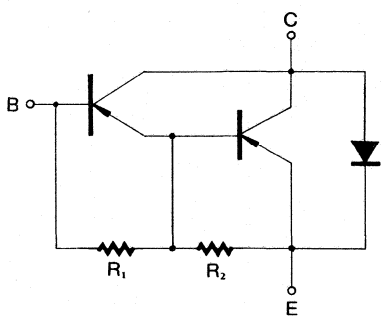
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−80V, I_E=0		−10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=−80V, R_{BE}=51Ω, T_a=125°C		−1	mA
Collector Cutoff Current	$I_{CEX}1$	V_{CE}=−80V, V_{BE} (off)=1.5V		−10	μA
Collector Cutoff Current	$I_{CEX}2$	V_{CE}=−80V, V_{BE} (off)=1.5V T_a=125°C		−1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0		−1	mA
*DC Current Gain	h_{FE1}	V_{CE}=−2V, I_C=−0.5A	1000		
	h_{FE2}	V_{CE}=−2V, I_C=−1A	2000	30000	
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−1A, I_B=−1mA		−1.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−1A, I_B=−1mA		−2	V

*Pulse Test: PW≤350μs, Duty Cycle≤2% pulsed.

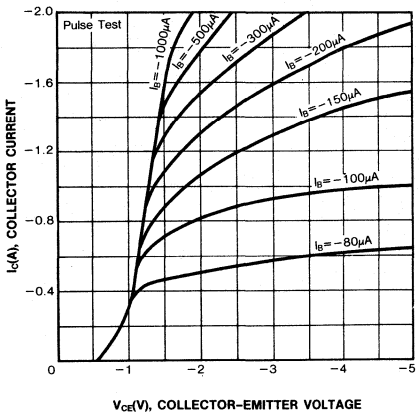
h_{FE}(2) CLASSIFICATION

Classification	R	O	Y
h_{FE}(2)	2000-5000	4000-10000	8000-30000

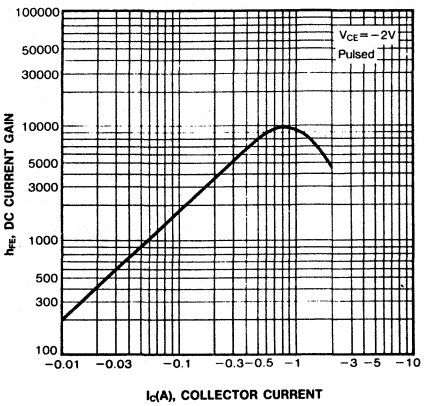


R_1≒10kΩ
R_2≒500Ω

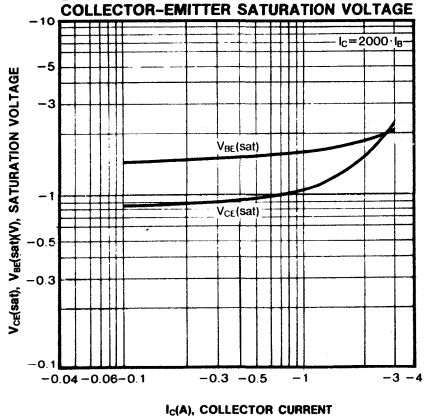
STATIC CHARACTERISTIC



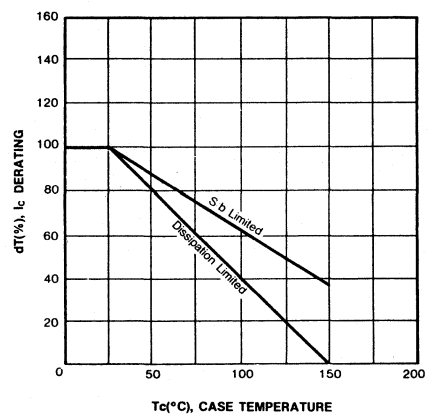
DC CURRENT GAIN



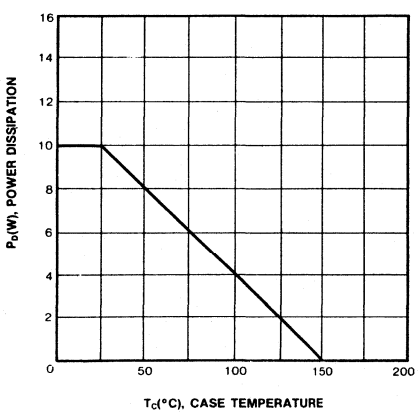
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



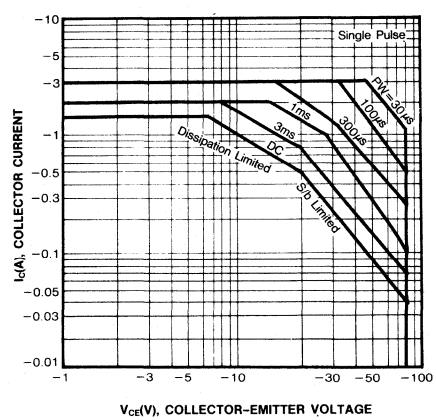
DERATING CURVE OF SAFE OPERATING AREAS



POWER DERATING



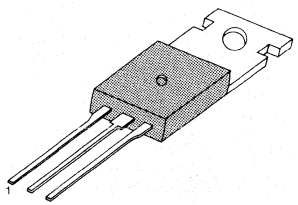
SAFE OPERATING AREA



LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSD880**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Emitter-Base Voltage	V_{EBO}	−7	V
Collector Current	I_C	−3	A
Base Current	I_B	−0.5	A
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Collector Dissipation (T_c=25°C)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

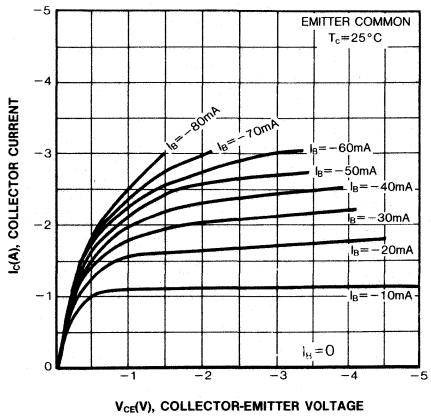
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−60V, I_E=0			−100	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−7V, I_C=0			−100	μA
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−50mA, I_B=0	−60			V
DC Current Gain	h_{FE1}	V_{CE}=−5V, I_C=−0.5A	60		200	
	h_{FE2}	V_{CE}=−5V, I_C=−3A	20			
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=−3A, I_B=−0.3A		−0.5	−1	V
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=−5V, I_C=−0.5A		−0.7	−1	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−0.5A		9		MHz
Collector Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		150		pF
Turn on Time	ton			0.4		μs
Storage Time	ts	$-I_B1=I_B2$=0.2A		1.7		μs
Fall Time	tf	V_{CC}=−30V		0.5		μs

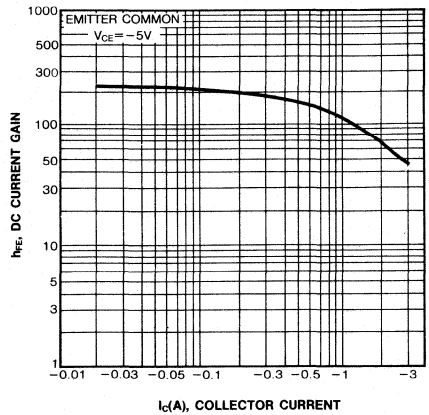
h_{FE}(1) CLASSIFICATION

Classification	O	Y
h_{FE}(1)	60-120	100-200

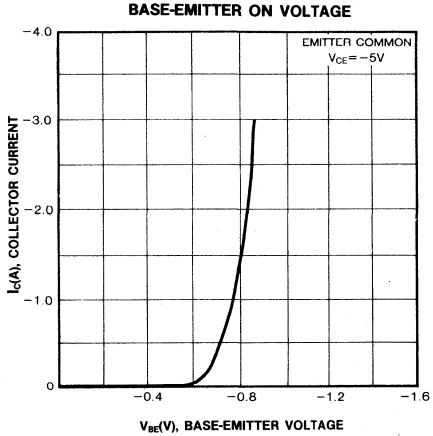
STATIC CHARACTERISTIC



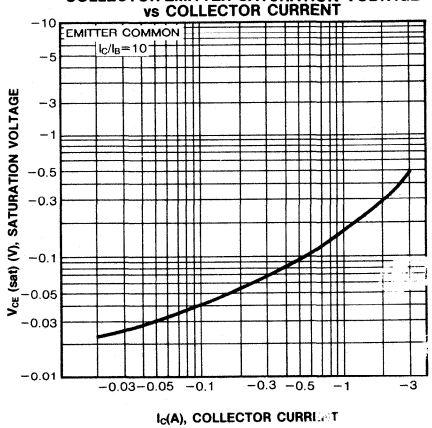
DC CURRENT GAIN



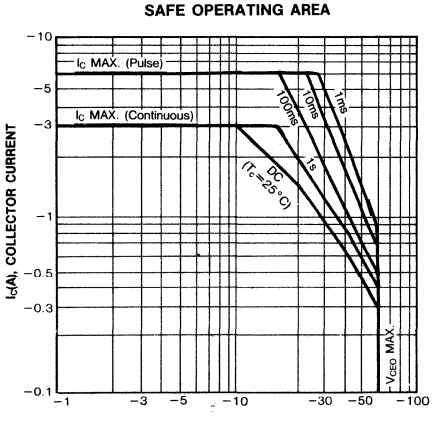
BASE-EMITTER ON VOLTAGE



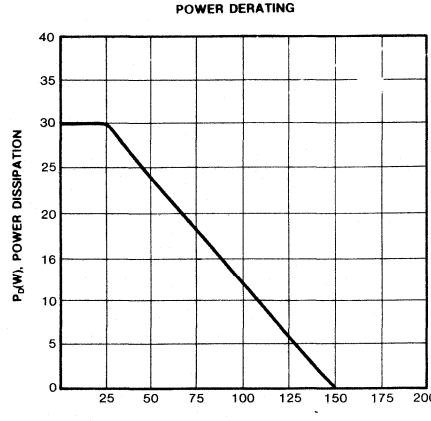
COLLECTOR-EMITTER SATURATION VOLTAGE vs COLLECTOR CURRENT



SAFE OPERATING AREA



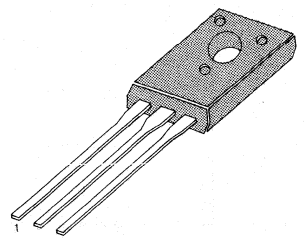
POWER DERATING



HIGH DC CURRENT GAIN
LOW COLLECTOR SATURATION VOLTAGE
BUILT-IN A DAMPER DIODE AT E-C

HIGH POWER DISSIPATION: PT=1.3W (T_a=25°C)

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−100	V
Collector-Emitter Voltage	V_{CEO}	−100	V
Emitter-Base Voltage	V_{EBO}	−8	V
Collector Current (DC)	I_C	−3	A
*Collector Current (Pulse)	I_C	−5	A
Collector Dissipation (T_a=25°C)	P_C	1.3	W
Collector Dissipation (T_C=25°C)	P_C	15	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle≤50%

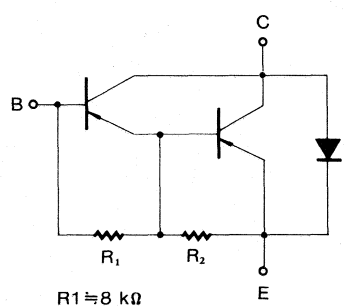
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−100V, I_E=0			−10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−2	mA
*DC Current Gain	h_{FE1}	V_{CE}=−2V, I_C=−1.5A	2000		15000	
	h_{FE2}	V_{CE}=−2V, I_C=−3A	1000			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−1.5A, I_B=−1.5mA		−0.9	−1.2	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−1.5A, I_B=−1.5mA		−1.5	−2	V
Turn On Time	ton	I_C=−1.5A		0.5		μS
Storage Time	tstg	I_{B1}=−I_{B2}=−1.5mA		2		μS
Fall Time	tf	RL=27Ω, V_{CC}=−40V		1		μS

* Pulse test: PW ≤ 350μs, duty cycle ≤ 2% Pulsed

h_{FE}(1) CLASSIFICATION

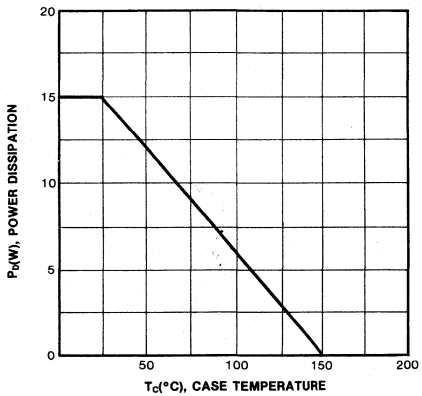
Classification	O	Y	G
h_{FE}1	2000-5000	4000-12000	6000-20000



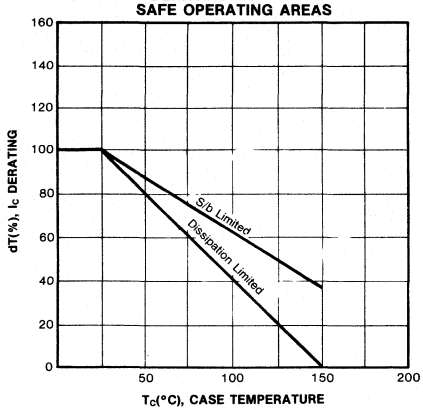
R1≒8 kΩ
R2≒0.6 kΩ

3

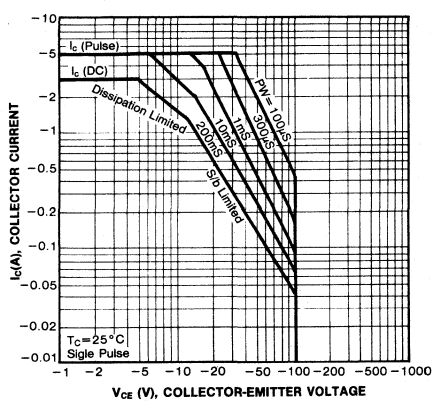
POWER DERATING



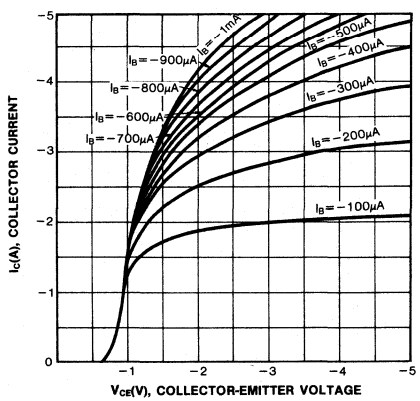
DERATING CURVE OF SAFE OPERATING AREAS



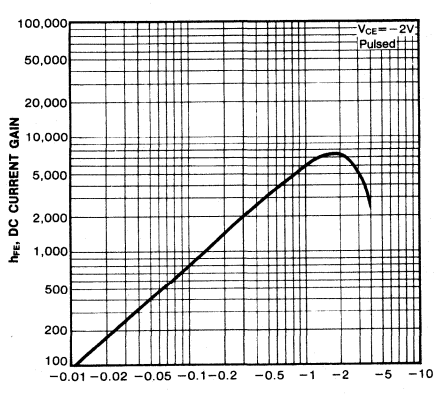
FORWARD BIAS SAFE OPERATING AREA



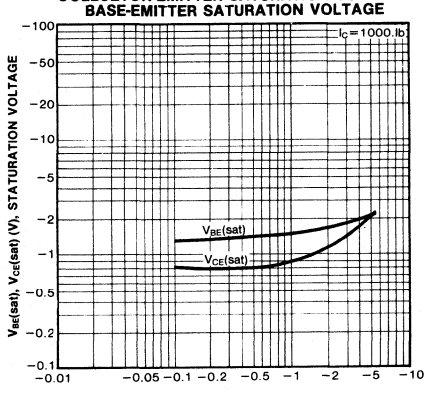
STATIC CHARACTERISTIC



DC CURRENT GAIN

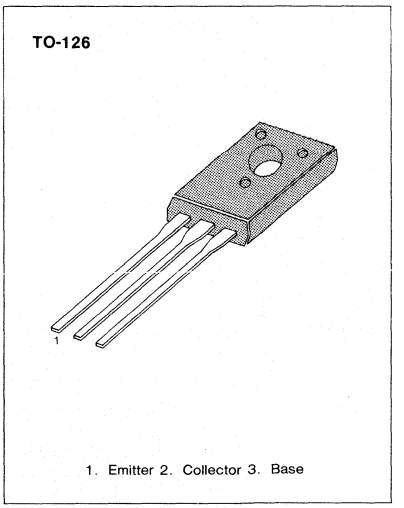


COLLCETOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



HIGH DC CURRENT GAIN
LOW COLLECTOR SATURATION VOLTAGE
BUILT-IN A ZENER DIODE AT B-C AND A DAMPER DIODE AT E-C

HIGH POWER DISSIPATION: PT = 1.3W (T_a = 25°C)



ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60±10	V
Collector-Emitter Voltage	V_{CEO}	−60±10	V
Emitter-Base Voltage	V_{EBO}	−8	V
Collector Current (DC)	I_C	−3	A
*Collector Current (Pulse)	I_C	−5	A
Collector Dissipation (T_a=25°C)	P_C	1.3	W
Collector Dissipation (T_C=25°C)	P_C	15	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle≤50%

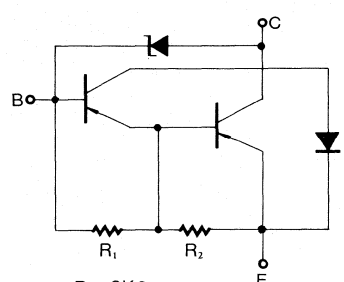
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Voltage	V_{CBO}	I_C=−1mA, I_E=0	−50	−60	−70	V
Collector-Emitter Voltage	V_{CEO}	I_C=−10mA, R_{BE}=∞	−50	−60	−70	V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−2	mA
*DC Current Gain	$h_{FE}1$	V_{CE}=−2V, I_C=−1.5A	2000		15000	
	$h_{FE}2$	V_{CE}=−2V, I_C=−3A	1000			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−1.5A, I_B=−1.5mA		−0.9	−1.2	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−1.5A, I_B=−1.5mA		−1.5	−2	V
Turn On Time	ton	I_C=1.5A		0.5		μS
Storage Time	tstg	I_{B1}=−I_{B2}=1.5mA		2		μS
Fall Time	tf	RL=27Ω, V_{CC}=40V		1		μS

* Pulse test: PW≤350μs, Duty Cycle≤2% Pulsed

h_{FE}(1) CLASSIFICATION

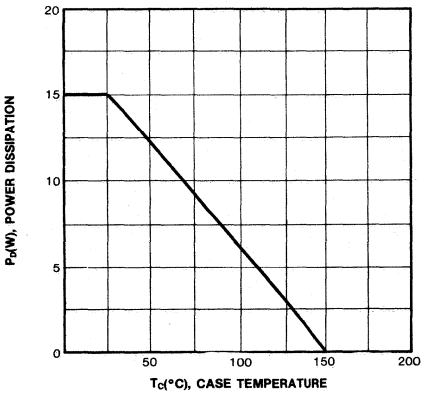
Classification	O	Y	G
$h_{FE}1$	2000-5000	4000-12000	6000-20000



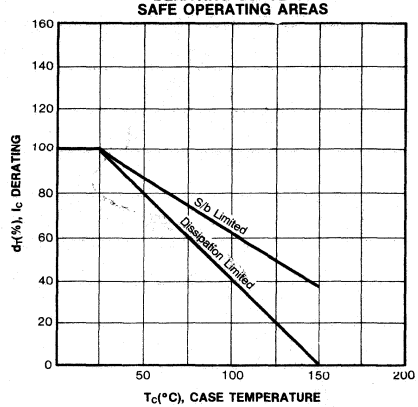
R_1=8KΩ
R_2=0.6kΩ

3

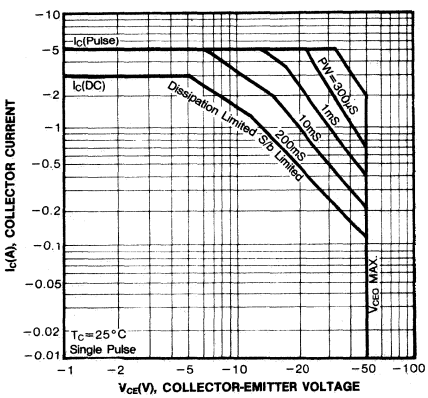
POWER DERATING



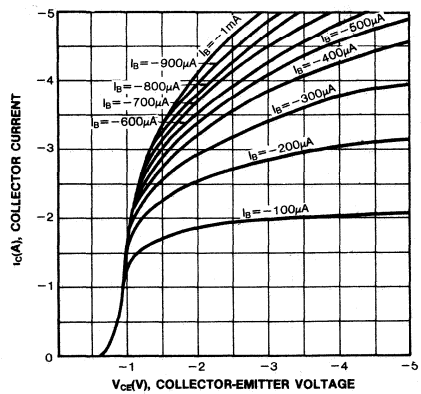
DERATING CURVE OF SAFE OPERATING AREAS



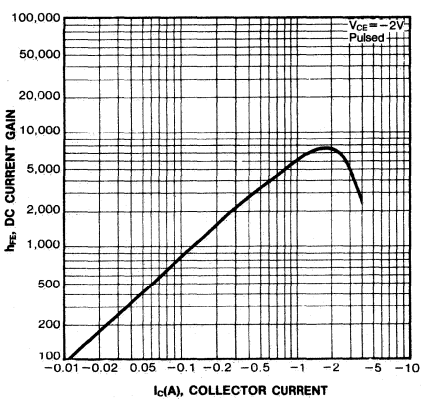
FORWARD BIAS SAFE OPERATING AREA



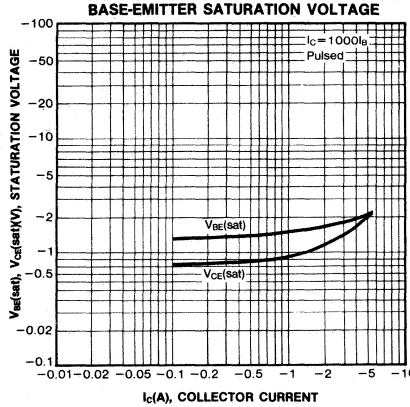
STATIC CHARACTERISTIC



DC CURRENT GAIN



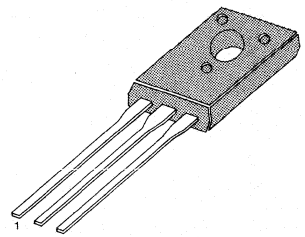
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



LOW COLLECTOR SATURATION VOLTAGE LARGE CURRENT

HIGH POWER DISSIPATION: PT=1.3W (T_a=25°C)
Complementary to KSD1691

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Emitter-Base Voltage	V_{EBO}	−7	V
Collector Current (DC)	I_C	−5	A
*Collector Current (Pulse)	I_C	−8	A
Base Current (DC)	I_B	−1	A
Collector Dissipation (T_a=25°C)	P_C	1.3	W
Collector Dissipation (T_C=25°C)	P_C	20	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

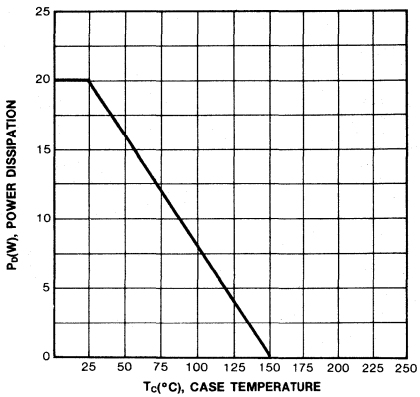
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−50V, I_E=0			−10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−7V, I_C=0			−10	μA
*DC Current Gain	$h_{FE}1$	V_{CE}=−1V, I_C=−0.1A	60			
	$h_{FE}2$	V_{CE}=−1V, I_C=−2A	100	200	400	
	$h_{FE}3$	V_{CE}=−2V, I_C=−5A	50			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−2A, I_B=−0.2A		−0.14	−0.3	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−2A, I_B=−0.2A		−0.9	−1.2	V
Turn On Time	ton	I_C=−2A, I_B1=−I_B2=0.2A		0.15	1	μS
Storage Time	tstg	RL=5Ω, V_{CC}=−10V		0.78	2.5	μS
Fall Time	tf			0.18	1	μS

* Pulse test: PW≤350μs, Duty Cycle≤2% Pulsed

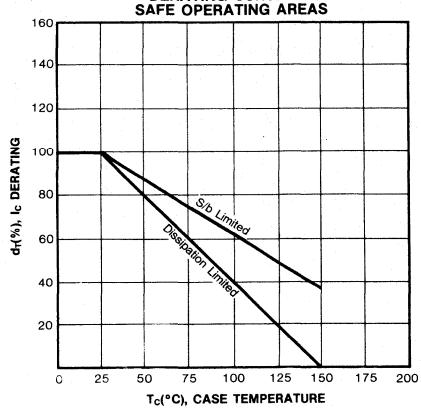
h_{EE}(2) CLASSIFICATION

Classification	O	Y	G
$h_{FE}2$	100-200	160-320	200-400

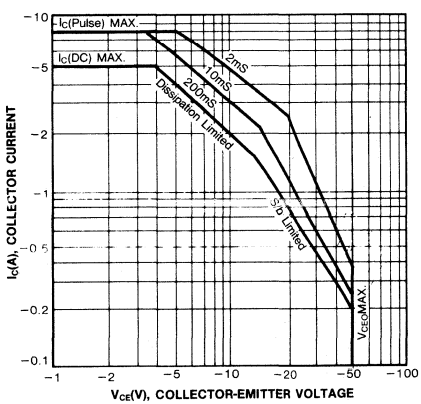
POWER DERATING



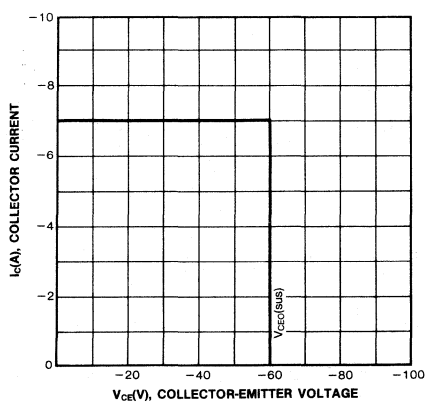
DERATING CURVE OF SAFE OPERATING AREAS



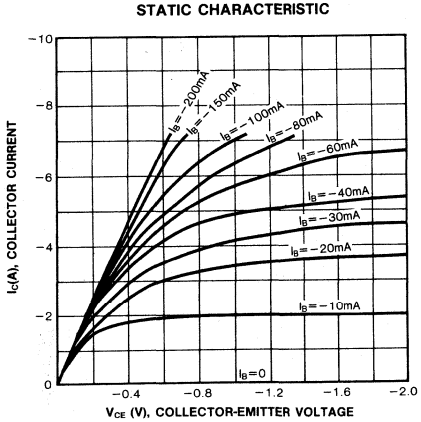
FORWARD BIAS OPERATING AREA



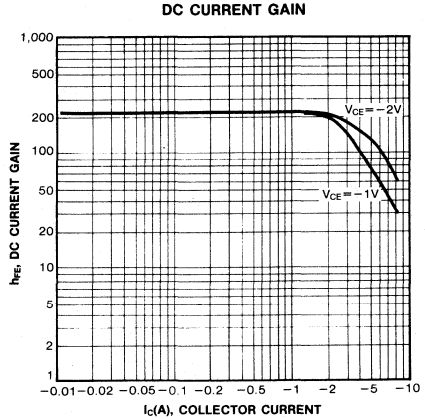
REVERSE BIAS SAFE OPERATING AREA

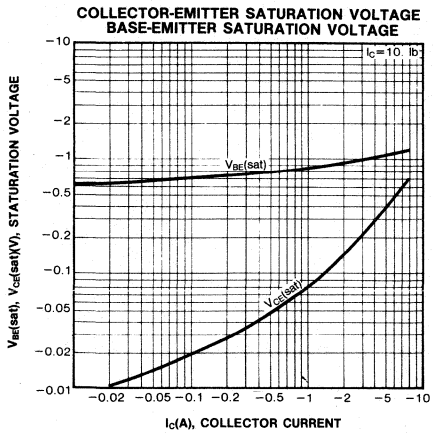


STATIC CHARACTERISTIC



DC CURRENT GAIN

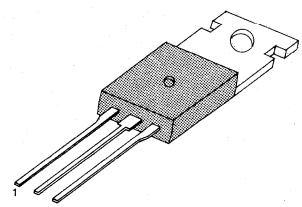



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE
I_C=10 I_B
$V_{BE(sat)}$
$V_{CE(sat)}$
$V_{BE(sat)}$, $V_{CE(sat)}$(V), STATURATION VOLTAGE
−10
−5
−2
−1
−0.5
−0.2
−0.1
−0.05
−0.02
−0.01
−0.02 −0.05 −0.1 −0.2 −0.5 −1 −2 −5 −10
I_C(A), COLLECTOR CURRENT

LOW FREQUENCY POWER AMPLIFIER

- **Low Saturation Voltage**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	70	V
Collector Emitter Voltage	V_{CEO}	50	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	4	A
Collector Current (Pulse)	I_C	8	A
Collector Dissipation ($T_c = 25°C$)	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-55 \sim 150$	°C

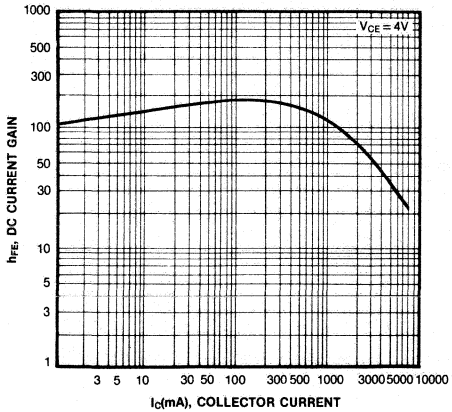
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	$I_C = 10\mu A$, $I_E = 0$	70			V
Collector Emitter Breakdown Voltage	BV_{CEO}	$I_C = 10mA$, $R_{BE} = \infty$	50			V
Emitter Base Breakdown Voltage	BV_{EBO}	$I_E = 10\mu A$, $I_C = 0$	5			V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 50V$, $I_E = 0$			1	μA
DC Current Gain	$h_{FE}1$	$V_{CE} = 4V$, $I_C = 1A$	80		320	
	$h_{FE}2$	$V_{CE} = 4V$, $I_C = 0.1A$	35			
Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 2A$, $I_B = 0.2A$			1	V
Base Emitter Voltage	V_{BE}	$V_{CE} = 4V$, $I_C = 1A$			1	V
Current Gain Bandwidth Product	f_T	$V_{CE} = 4V$, $I_C = 0.5A$		7		MHz

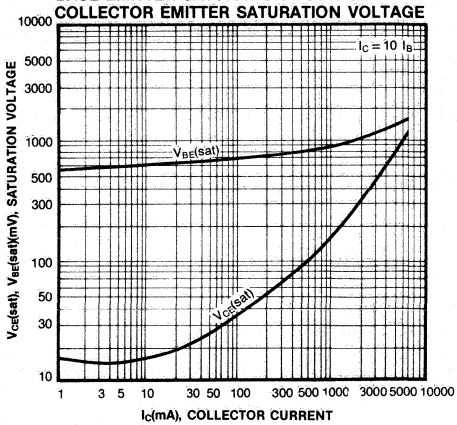
h_{FE} (1) CLASSIFICATION

Classification	B	C	D
$h_{FE}1$	80-120	100-200	160-320

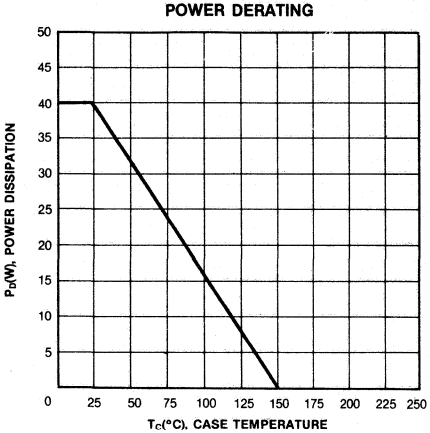
DC CURRENT GAIN



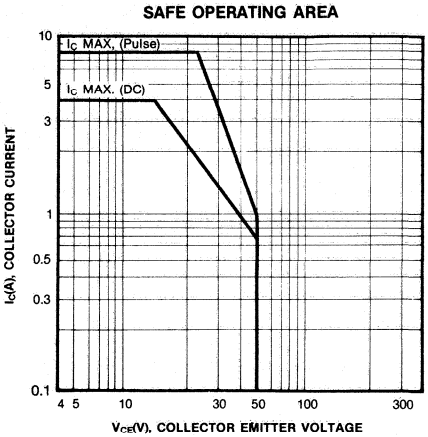
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



POWER DERATING



SAFE OPERATING AREA

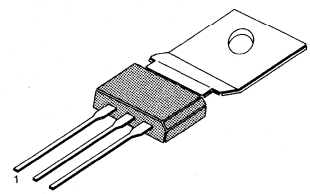


3

LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSA634**
- **Collector Current I_C=2.0A**
- **Collector Dissipation P_C=10W (Ta=25°C)**

TO-202



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	2.0	A
Collector Dissipation (T_C=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

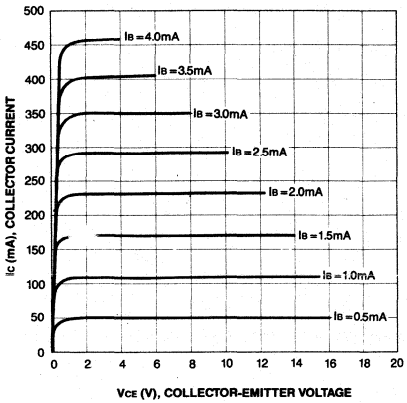
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=500μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−500μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1.0A	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=2A, I_B=0.2A			1.0	V

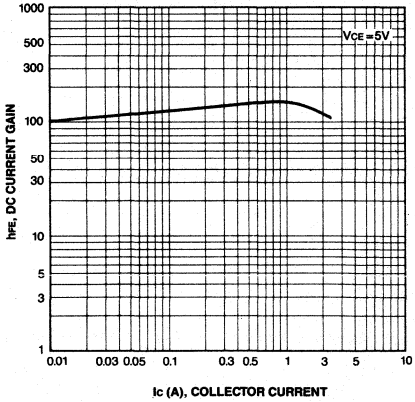
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

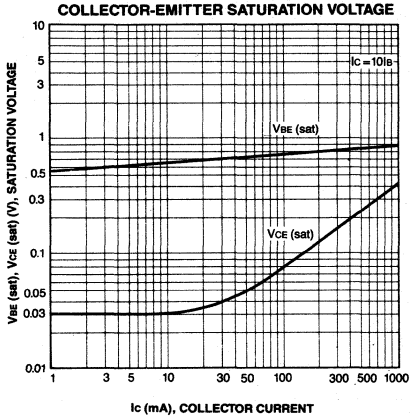
STATIC CHARACTERISTIC



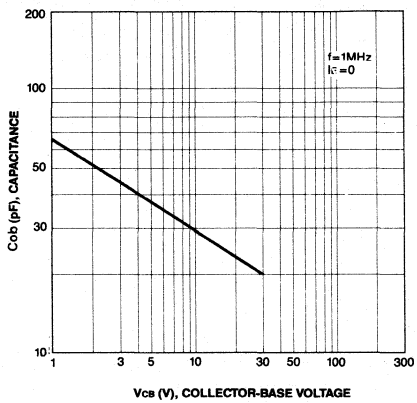
DC CURRENT GAIN



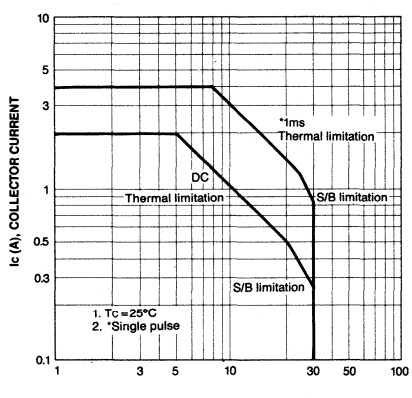
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



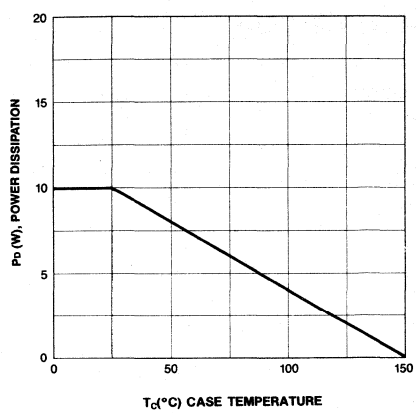
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



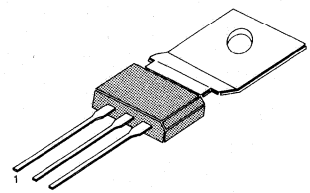
POWER DERATING



LOW FREQUENCY AMPLIFIER

- **Complement to KSA636**
- **Collector-Base Voltage V_{CBO}=70V**
- **Collector Current I_C=2A**
- **Collector Dissipation P_C=10W (T_C=25°C)**

TO-202



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	70	V
Collector-Emitter Voltage	V_{CEO}	45	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	2.0	A
Collector Dissipation (T_C=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼+150	°C

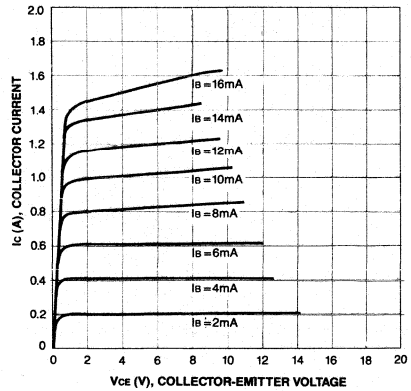
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=500μA, I_E=0	70			V
Collector-Emitter Breakdown Voltage	BV_{CBO}	I_C=10mA, R_{BE}=∞	45			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=500μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=40V, I_E=0			100	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1A, I_B=0.1A			1.0	V

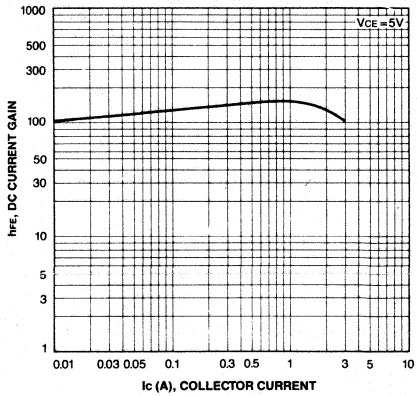
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

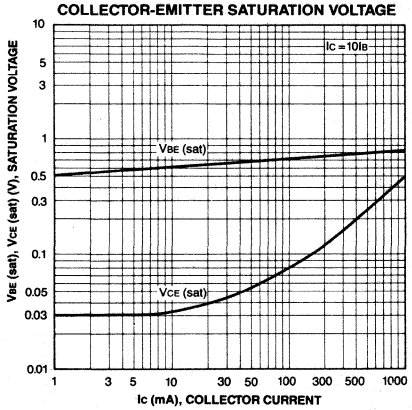
STATIC CHARACTERISTIC



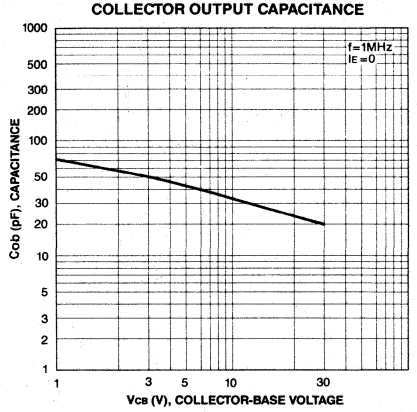
DC CURRENT GAIN



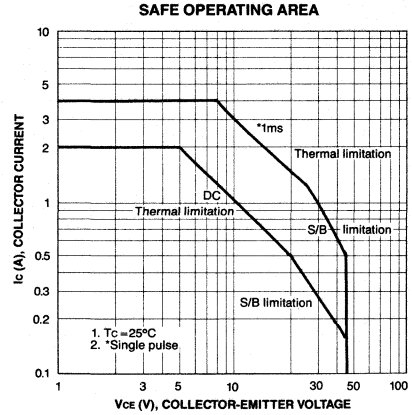
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



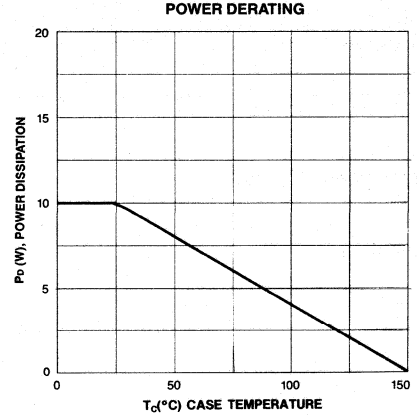
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



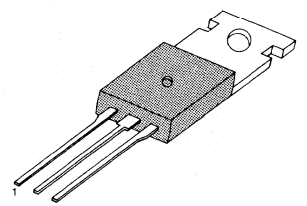
POWER DERATING



LOW FREQUENCY POWER AMPLIFIER POWER REGULATOR

* Complement to KSA473
* Collector Current: $I_C = 3A$
* Collector Dissipation: $P_C = 10W$ ($T_C = 25°C$)

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	BV_{CBO}	30	V
Collector-Emitter Voltage	BV_{CEO}	30	V
Emitter-Base Voltage	BV_{EBO}	5	V
Collector Current	I_C	3	A
Collector Dissipation ($T_C = 25°C$)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

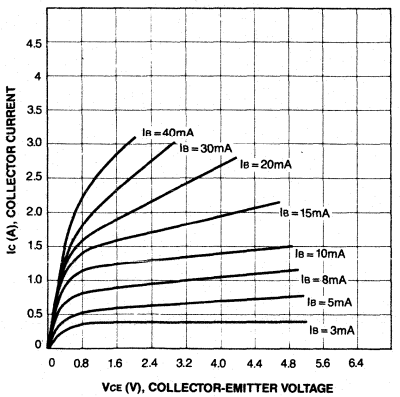
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 500\mu A$, $I_E = 0$	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = 10mA$, $I_B = 0$	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -1mA$, $I_C = 0$	5			
Collector Cut-off Current	I_{CBO}	$V_{CB} = 20V$, $I_E = 0$			1.0	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			1.0	μA
DC Current Gain	$h_{FE}1$	$V_{CE} = 2V$, $I_C = 0.5A$	70		240	
	$h_{FE}2$	$V_{CE} = 2V$, $I_C = 2.5A$	25			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = 2A$, $I_B = 0.2A$		0.3	0.8	V
Base-Emitter On Voltage	V_{BE}(on)	$V_{CE} = 2V$, $I_C = 0.5A$		0.75	1.0	V
Current Gain Base Width Product	f_T	$V_{CE} = 2V$, $I_C = 0.5A$		100		MHz
Output Capacitance	Cob	$V_{CB} = 10V$, $I_E = 0$, f=1MHz		35		PF

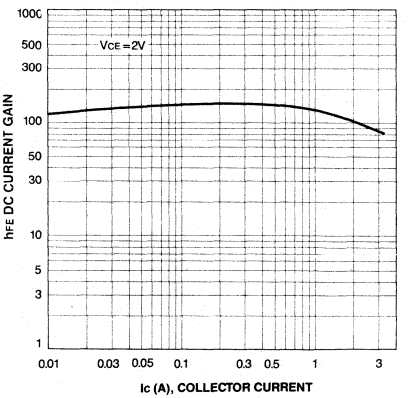
h_{FE} CLASSIFICATION

Classification	O	Y
h_{FE} (1)	70-140	120-240

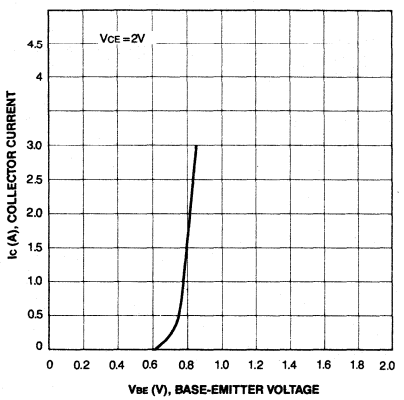
STATIC CHARACTERISTIC



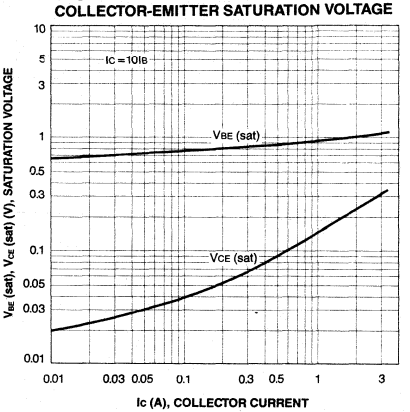
DC CURRENT GAIN



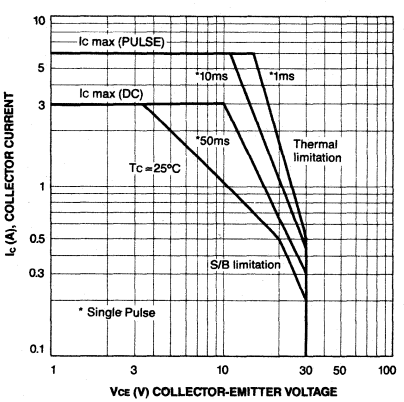
BASE-EMITTER ON VOLTAGE



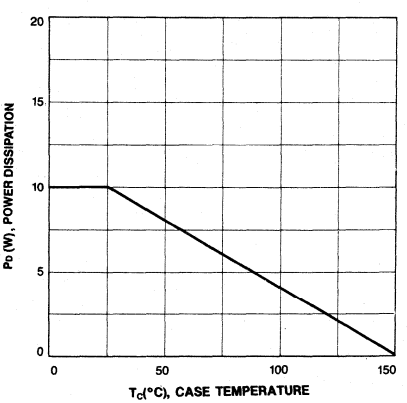
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



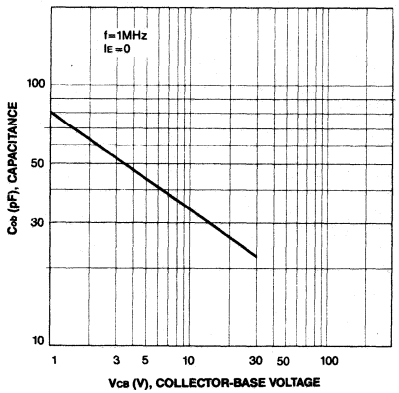
SAFE OPERATING AREA



POWER DERATING



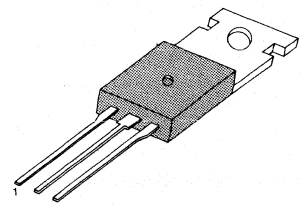
COLLECTOR OUTPUT CAPACITANCE



COLOR TV CHROMA OUTPUT

- **High Collector-Emitter Voltage V_{CEO} = 300V**
- **Current-Gain-Bandwidth Product f_T = 40MHz (Min)**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	300	V
Collector-Emitter Voltage	V_{CEO}	300	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	200	mA
Collector Dissipation (T_C = 25°C)	P_C	15	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

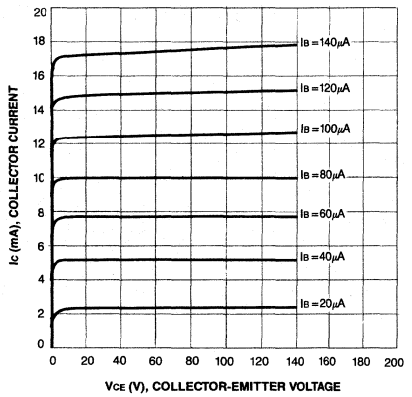
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 100μA, I_E = 0	300			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 10mA, I_B = 0	300			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = −10μA, I_C = 0	7			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 200V, I_E = 0			100	μA
DC Current Gain	h_{FE}	V_{CE} = 10V, I_C = 10mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 50mA, I_B = 5mA			2.0	V
Current Gain-Bandwidth Product	f_T	V_{CE} = 30V, I_C = 10mA	40	80		MHz
Output Capacitance	Cob	V_{CB} = 50V, I_E = 0 f=1MHz		4		pF

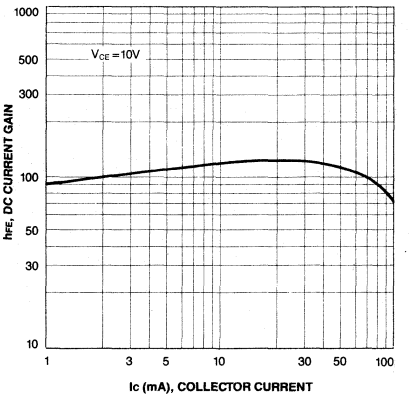
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

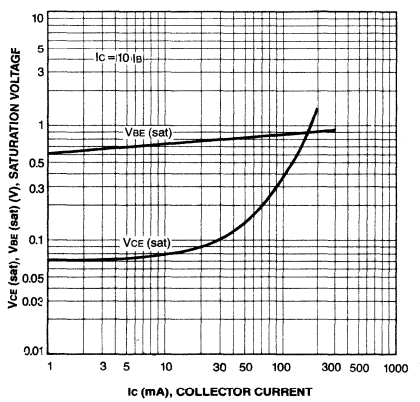
STATIC CHARACTERISTIC



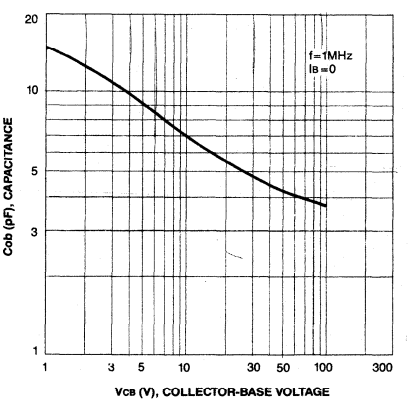
DC CURRENT GAIN



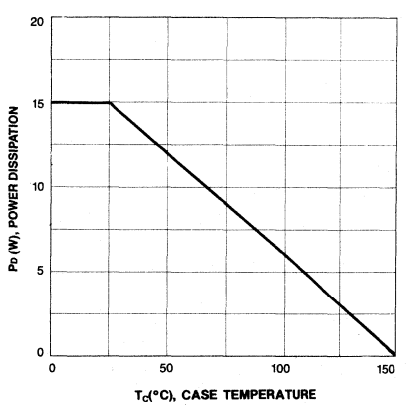
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



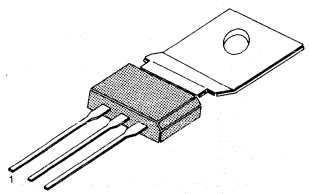
POWER DERATING



COLOR TV CHROMA OUTPUT

- **High Collector-Emitter Voltage V_{CEO}=250V**
- **Current Gain-Bandwidth Product f_T=80MHz (Typ)**

TO-202



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	250	V
Collector-Emitter Voltage	V_{CEO}	250	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	200	mA
Collector Dissipation (T_C=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

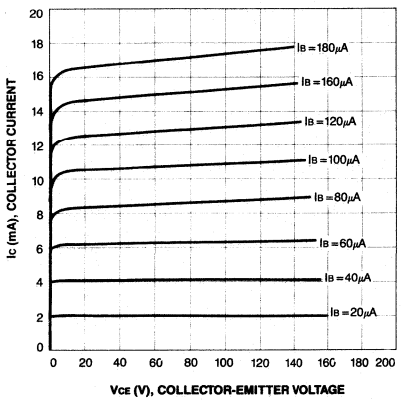
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	250			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	250			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	7			V
Collector Cut-off Current	I_{CBO}	V_{CB}=150V, I_E=0			1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=10mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=5mA			2.0	V
Current Gain-Bandwidth Product	f_T	V_{CE}=30V, I_C=10mA	40	80		MHz
Output Capacitance	Cob	V_{CB}=50V, I_E=0 f=1MHz		4		pF

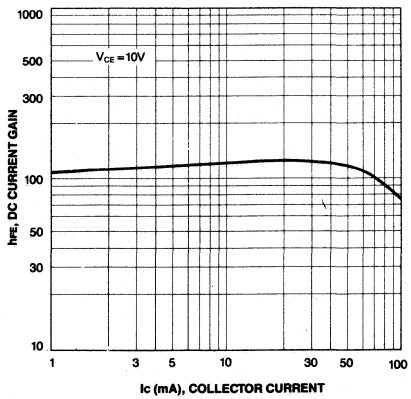
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

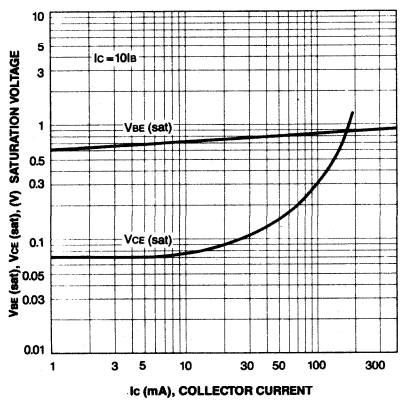
STATIC CHARACTERISTIC



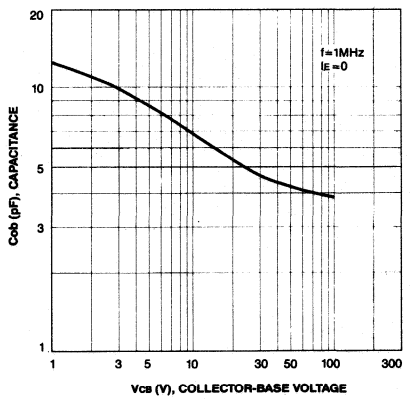
DC CURRENT GAIN



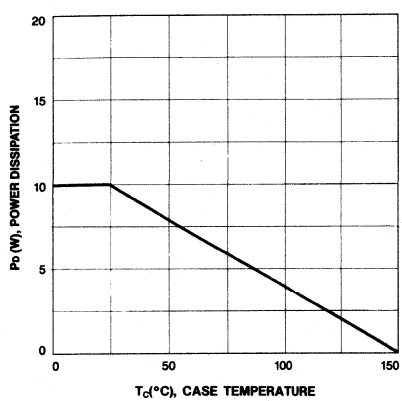
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



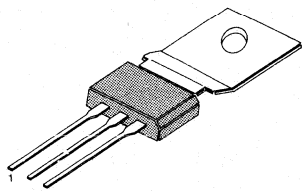
POWER DERATING



COLOR TV CHROMA OUTPUT

- **High Collector-Emitter Voltage V_{CEO}=300V**
- **Current Gain-Bandwidth Product f_T=80MHz (Typ)**

TO-202



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	300	V
Collector-Emitter Voltage	V_{CEO}	300	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	200	mA
Collector Dissipation (T_c=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

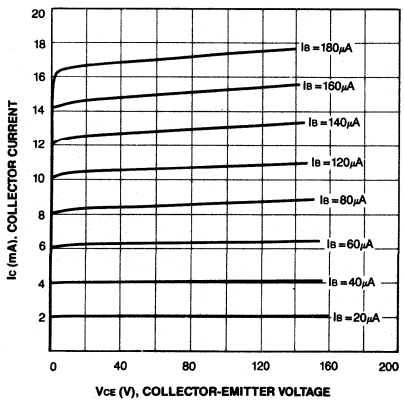
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	300			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	300			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	7			V
Collector Cutoff Current	I_{CBO}	V_{CB}=150V, I_E=0			1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=10mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=5mA			2.0	V
Current Gain-Bandwidth Product	f_T	V_{CE}=30V, I_C=10mA	40	80		MHz
Output Capacitance	Cob	V_{CB}=50V, I_E=0 f=1MHz		5		pF

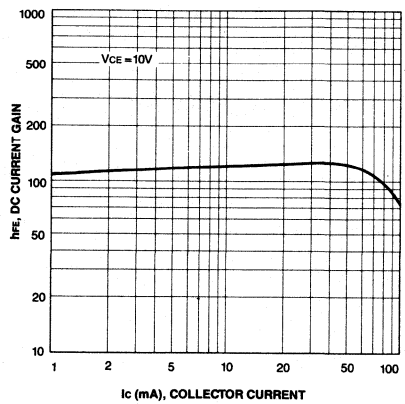
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

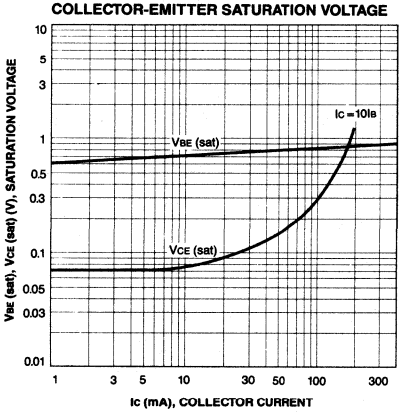
STATIC CHARACTERISTIC



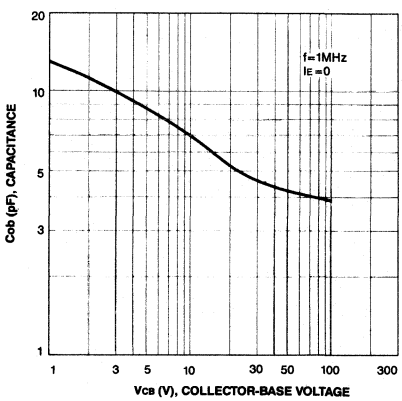
DC CURRENT GAIN



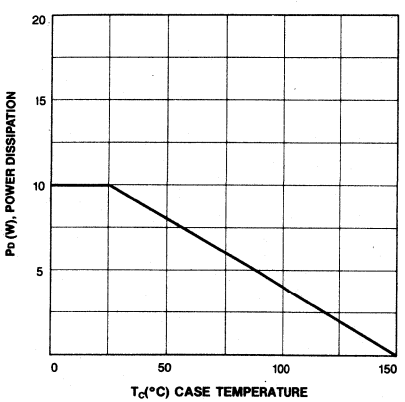
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE

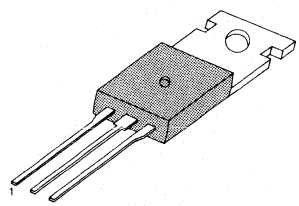


POWER DERATING



HIGH β POWER TRANSISTOR

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	80	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	3	A
Base Current	I_B	1	A
Collector Dissipation (T_c=25°C)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

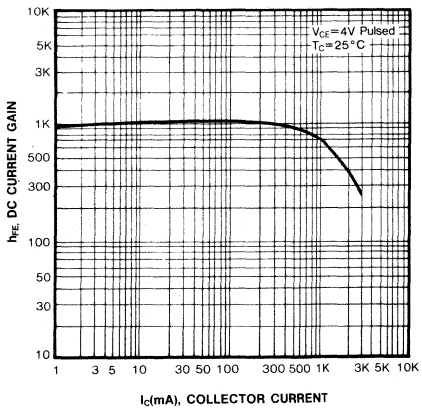
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=80V, I_E=0			100	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=6V, I_C=0			100	μA
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=25mA, I_B=0	60			V
*DC Current Gain	h_{FE}	V_{CE}=4V, I_C=0.5A	500			
*Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=2A, I_B=0.05A			1	V
Current Gain Bandwidth Product	f_T	V_{CE}=12V, I_E=−0.2A		15		MHz

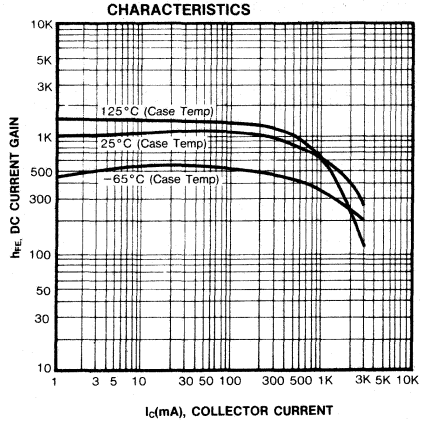
*Pulse Test: PW≤350μS, Duty Cycle≤2% pulsed

3

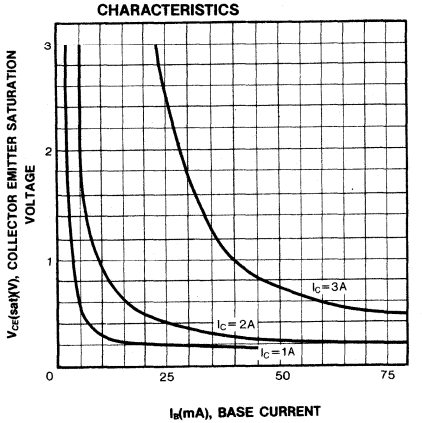
DC CURRENT GAIN



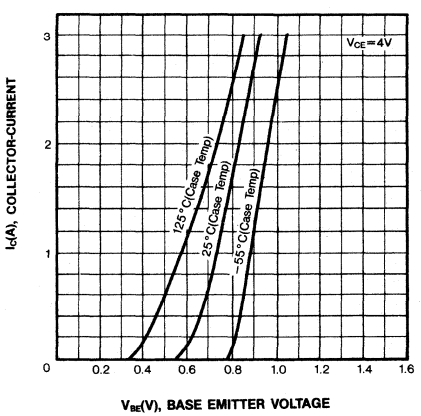
DC CURRENT GAIN TEMPERATURE CHARACTERISTICS



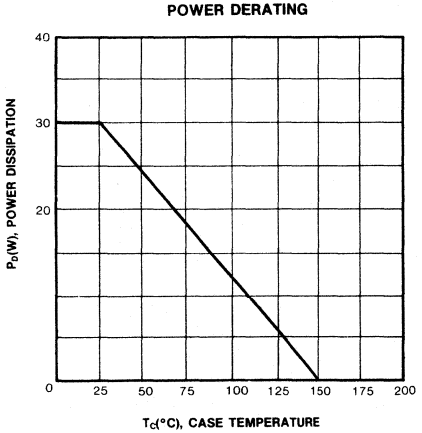
COLLECTOR EMITTER SATURATION CHARACTERISTICS



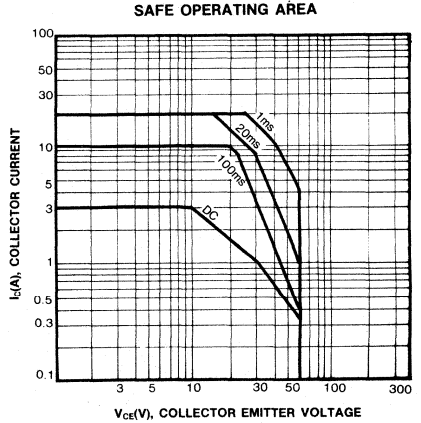
BASE-EMITTER ON VOLTAGE



POWER DERATING



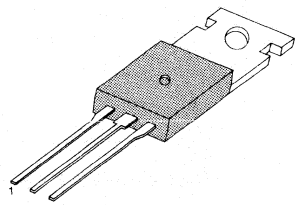
SAFE OPERATING AREA



TV VERTICAL DEFLECTION OUTPUT

- **Complement to KSA940**
- **Collector-Base Voltage V_{CBO} = 150V**

TO-220



1. Base 2. Collector 3. Emitter

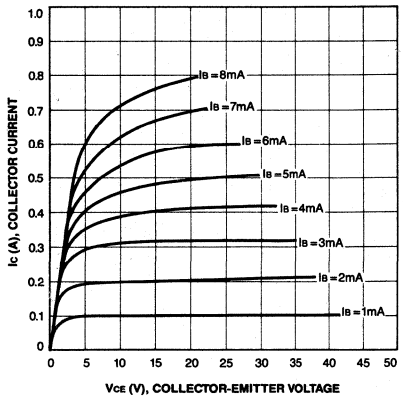
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	150	V
Collector-Emitter Voltage	V_{CEO}	150	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	1.5	A
Collector Dissipation (T_C=25°C)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

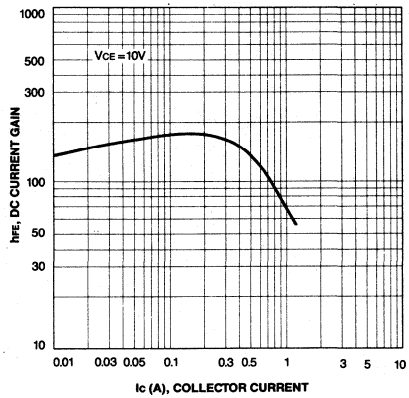
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 500μA, I_E = 0	150			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 10mA, I_B = 0	150			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 500μA, I_C = 0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB} = 120V, I_E = 0			10	μA
DC Current Gain	h_{FE}	V_{CE} = 10V, I_C = 0.5A	40	75	140	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 500mA, I_B = 50mA			1	V
Current Gain Bandwidth Product	f_T	V_{CE} = 10V, I_C = 0.5A		4		MHz
Output Capacitance	Cob	V_{CB} = 10V, I_E = 0, f = 1MHz		50		pF

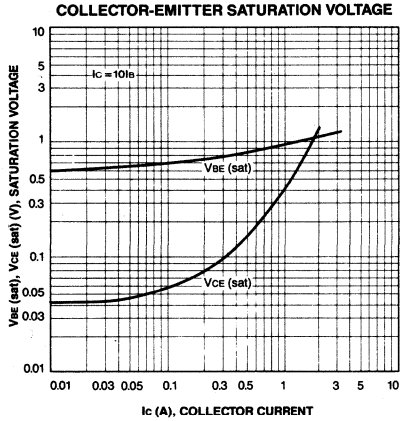
STATIC CHARACTERISTIC



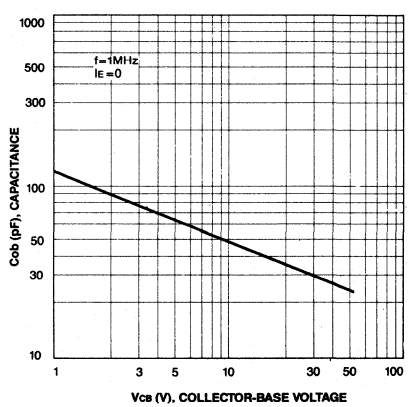
DC CURRENT GAIN



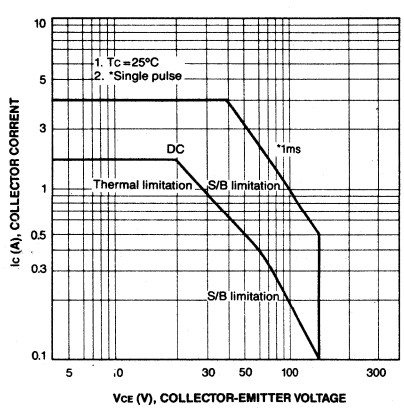
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



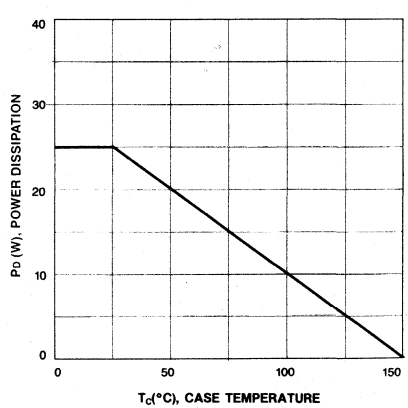
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



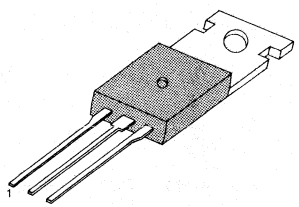
POWER DERATING



B/W TV HORIZONTAL DEFLECTION OUTPUT

- **Collector-Base Voltage: V_{CBO}=200V**
- **Collector Current (D.C): I_C=4A**
- **Collector Dissipation: P_C=40W**

TO-220



1. Base 2. Collector 3. Emitter

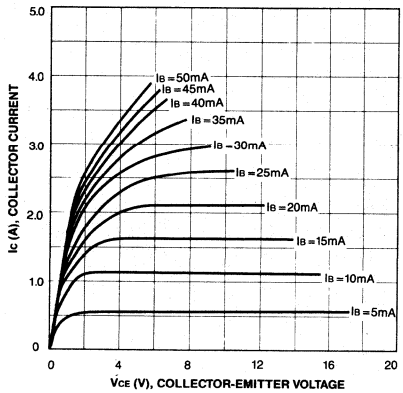
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	200	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	4	A
Collector Dissipation (T_C=25°C)	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

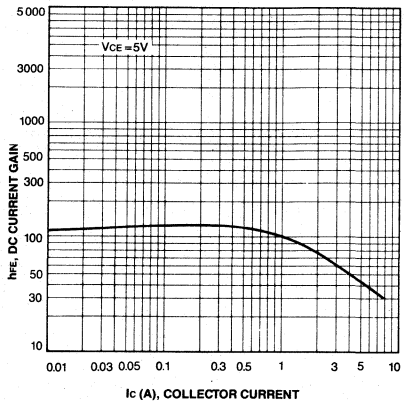
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	200			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=20mA, I_B=0	60			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−1mA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=170V, I_E=0			10	μA
DC Current Gain	$h_{FE}1$	V_{CE}=5V, I_C=1A	30		150	
	$h_{FE}2$	V_{CE}=5V, I_C=4A	20	40		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=4A, I_B=0.4A			1	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=4A, I_B=0.4A			1.5	V
Current Gain-Band Width Product	f_T	V_{CE}=5V, I_C=0.5A		10		MHz

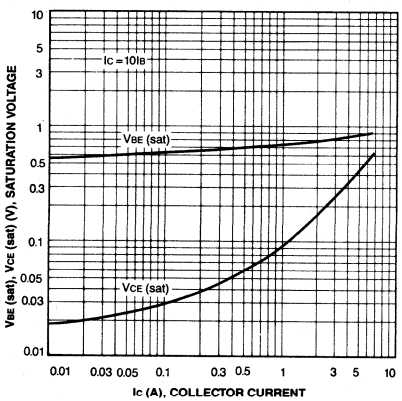
STATIC CHARACTERISTIC



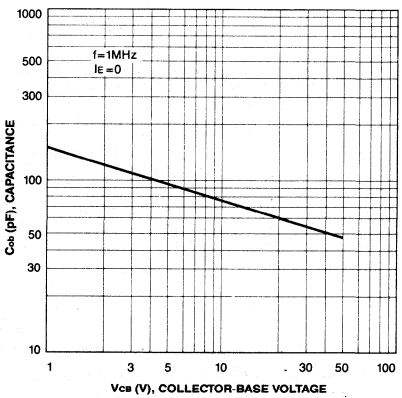
DC CURRENT GAIN



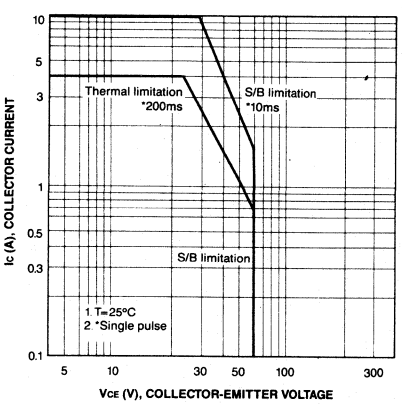
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



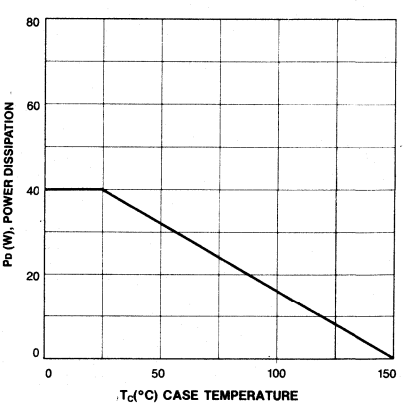
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA

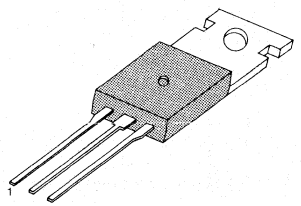


POWER DERATING



HIGH SPEED SWITCHING
LOW COLLECTOR SATURATION VOLTAGE
SPECIFIED OF REVERSE BIASED SOA
WITH INDUCTIVE LOADS

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	500	V
Collector-Emitter Voltage	V_{CEO}	400	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	2	A
*Collector Current (Pulse)	I_C	4	A
Base Current (DC)	I_B	1	A
Collector Dissipation	P_C	15	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤350μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

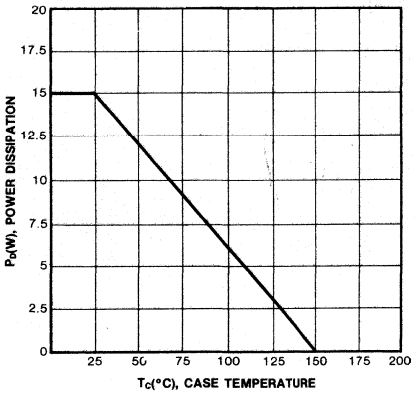
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=0.5A, I_B=0.1A, L=1mH	400		V
Collector-Emitter Sustaining Voltage	V_{CEX}(sus)1	I_C=0.5A, I_B1=−I_B2=0.1A T_a=125°C, L=180μH, Clamped	450		V
Collector-Emitter Sustaining Voltage	V_{CEX}(sus)2	I_C=1A, I_B1=0.2A, −I_B2=0.2A T_a=125°C, L=180μH, Clamped	400		V
Collector Cutoff Current	I_{CBO}	V_{CB}=400V, I_E=0		10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=400V, R_{BE}=51Ω, T_a=125°C		1	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}=400V, V_{BE}(off)=−5V		10	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=400V, V_{BE}(off)=−5V T_a=125°C		1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		10	μA
*DC Current Gain	h_{FE}1	V_{CE}=5V, I_C=0.1A	20	80	
	h_{FE}2	V_{CE}=5V, I_C=0.5A	10		
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=0.5A, I_B=0.1A		1	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=0.5A, I_B=0.1A		1.2	V
Turn On Time	ton	I_C=0.5A, I_B1=−I_B2=0.1A		1	μS
Storage Time	tstg	RL=300Ω, V_{CC}=150V		2.5	μS
Fall Time	tf			1	μS

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

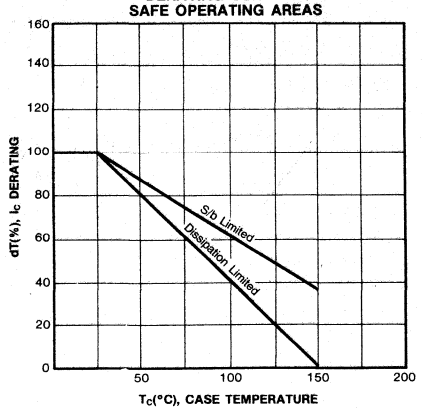
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE}1	20-40	30-60	40-80

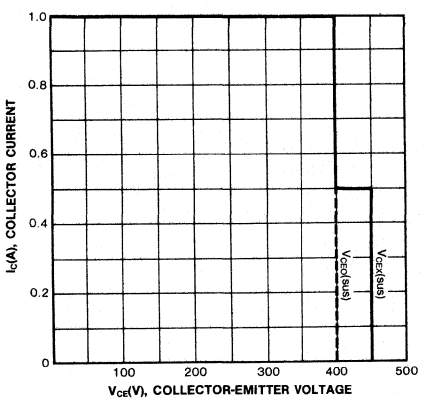
POWER DERATING



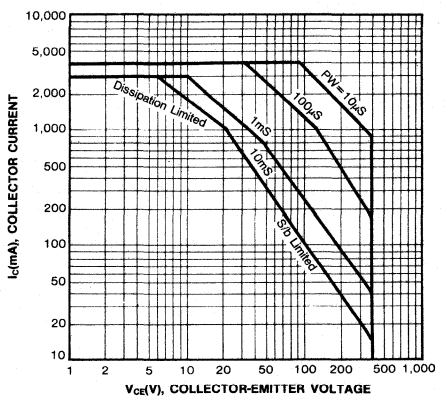
DERATING CURVE OF SAFE OPERATING AREAS



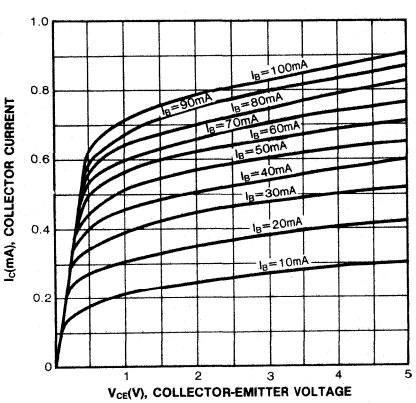
REVERSE BIAS SAFE OPERATING AREA



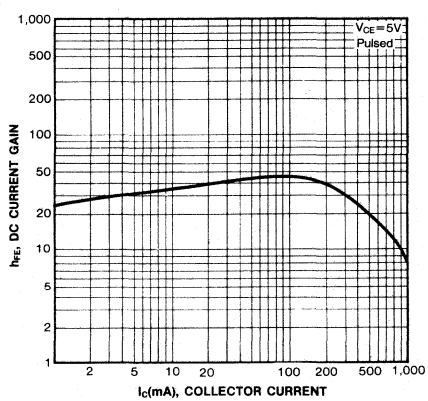
FORWARD BIAS SAFE OPERATING AREA



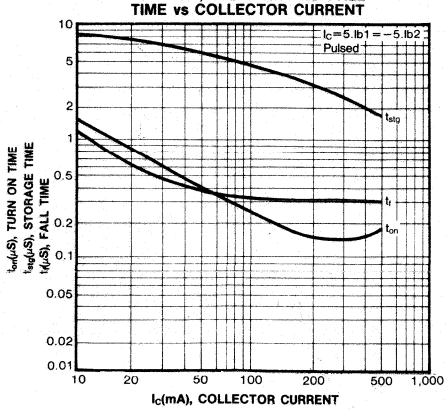
STATIC CHARACTERISTIC



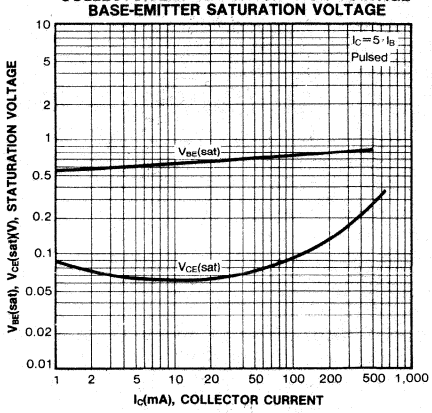
DC CURRENT GAIN



TURN ON, STORAGE AND FALL TIME vs COLLECTOR CURRENT



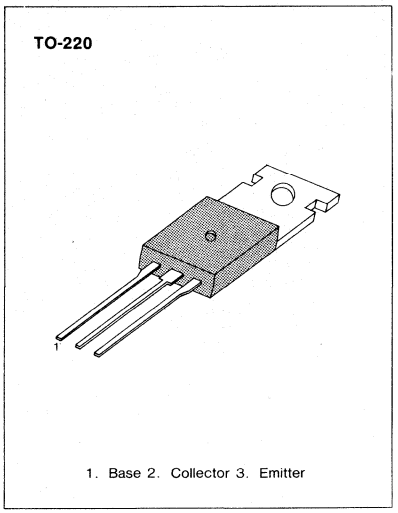
COLLECTOR-EMITTER SATURATION VOLTAGE BASE-EMITTER SATURATION VOLTAGE



3

HIGH SPEED SWITCHING
INDUSTRIAL USE

- Complement to KSA1010



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	150	V
Collector-Emitter Voltage	V_{CEO}	100	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	7	A
*Collector Current (Pulse)	I_C	15	A
Base Current (DC)	I_B	3.5	A
Collector Dissipation (T_c=25°C)	P_C	40	W
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

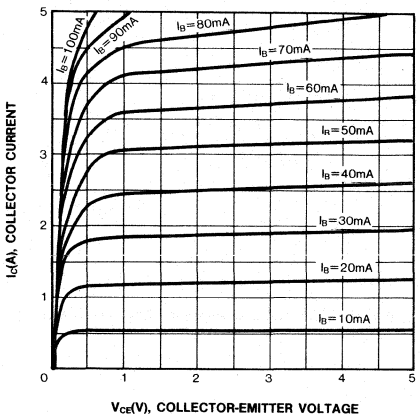
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO} (sus)	I_C=5A, I_B1=0.5A, L=1mH	100		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)1	I_C=5A, I_B1=−I_B2=0.5A, V_{BE} (off)=−5V, L=180μH Clamped	100		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)2	I_B=1A, I_B2=−0.5A, I_C=10A, V_{BE} (off)= −5V, L=180μH, Clamped	100		V
Collector Cutoff Current	I_{CBO}	V_{CB}=100V, I_E=0		10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=100V, R_{BE}=51Ω T_a=125°C		1	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}=100V, V_{BE} (off)= −1.5V		10	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=100V, V_{BE}(off)=−1.5V T_a=125°C		1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		10	μA
*DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=0.5A	40		
	h_{FE2}	V_{CE}=5V, I_C=3A	40	240	
	h_{FE3}	V_{CE}=5V, I_C=5A	20		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=5A, I_B=0.5A		0.6	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=5A, I_B=0.5A		1.5	V
Turn On Time	ton	I_C=5A, RL=10Ω		0.5	μs
Storage Time	ts	I_B1=−I_B2=0.5A		1.5	μs
Fall Time	tf	V_{CC}≃50V		0.5	μs

*Pulse Test: PW≤350μs, Duty Cycle≤2%

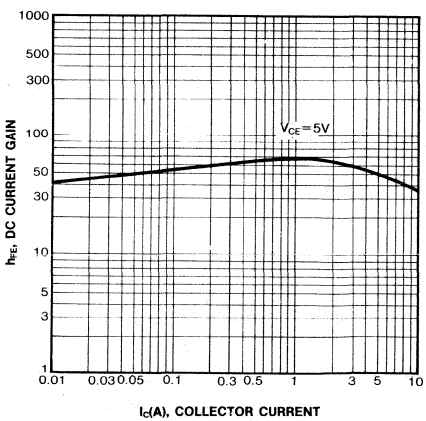
h_{FE}(2) CLASSIFICATION

Classification	R	O	Y
h_{FE}(2)	40-80	70-140	120-240

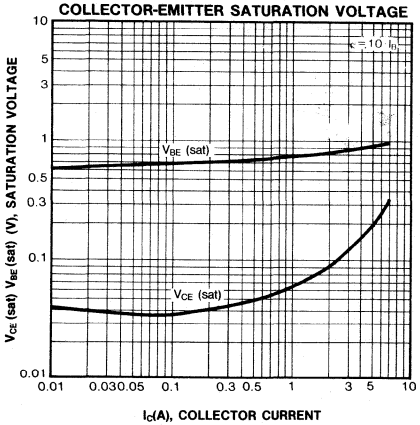
STATIC CHARACTERISTIC



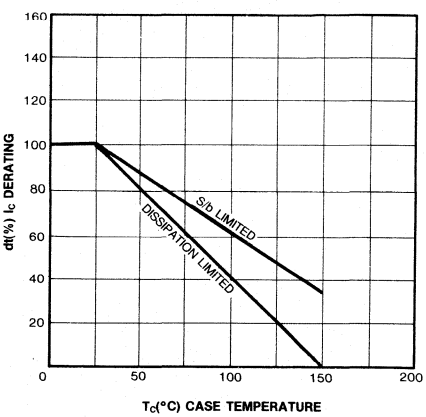
DC CURRENT GAIN



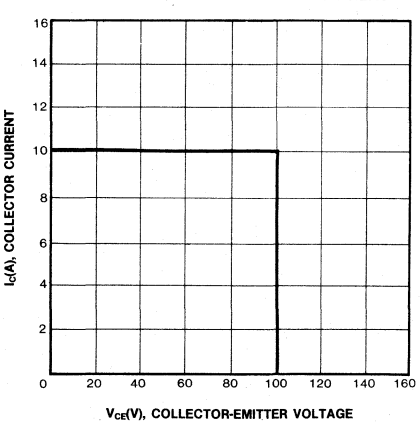
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



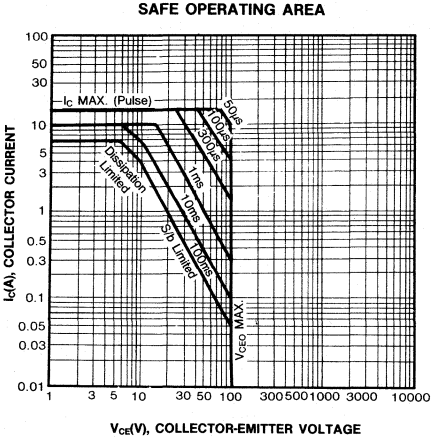
DERATING CURVE OF SAFE OPERATING AREAS

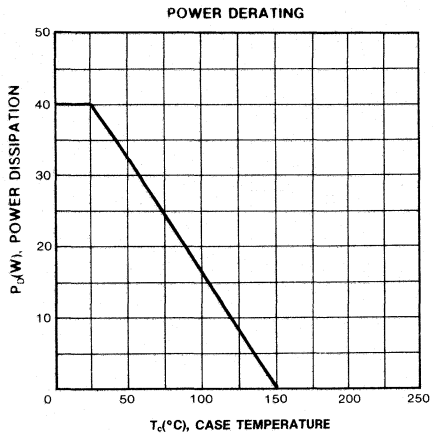


REVERSE BIAS SAFE OPERATING AREAS



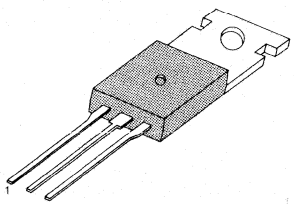
SAFE OPERATING AREA




POWER DERATING
50
40
30
20
10
0
50
100
150
200
250
P_C(W), POWER DISSIPATION
T_C(°C), CASE TEMPERATURE

HIGH SPEED, HIGH VOLTAGE SWITCHING INDUSTRIAL USE

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	500	V
Collector-Emitter Voltage	V_{CEO}	400	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	7	A
*Collector Current (Pulse)	I_C	15	A
Base Current (DC)	I_B	3.5	A
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Collector Dissipation (T_c=25°C)	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

3

ELECTRICAL CHARACTERISTICS (T_a=25°C)

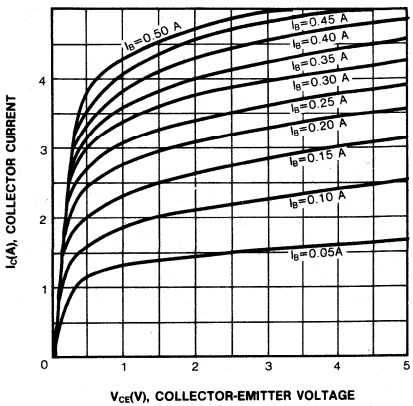
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO} (sus)	I_C=3A, I_B1=0.6A, L=1mH	400		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)1	I_C=3A, I_B1=−I_B2=0.6A V_{BE} (off)=−5V, L=180μH, Clamped	450		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)2	I_C=6A, I_B1=2A, I_B2=−0.6A V_{BE} (off)=−5V, L=180μH, Clamped	400		V
Collector Cutoff Current	I_{CBO}	V_{CB}=400V, I_E=0		10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=400V, R_{BE}=51Ω, T_a=125°C		1	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}=400V, V_{BE} (off)=−1.5V		10	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=400V, V_{BE} (off)=−1.5V T_a=125°C		1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		10	μA
*DC Current Gain	h_{FE1}	V_{CE}=5V, I_C= 0.1A	20	80	
	h_{FE2}	V_{CE}=5V, I_C=1A	20	80	
	h_{FE3}	V_{CE}=5V, I_C=3A	10		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=3A, I_B=0.6A		1	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=3A, I_B=0.6A		1.2	V
Turn On Time	ton	I_C=3A, RL=50Ω		1	μs
Storage Time	ts	I_B1=−I_B2=0.6A, V_{CC}=150V		2.5	μs
Fall Time	tf			1	μs

*Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

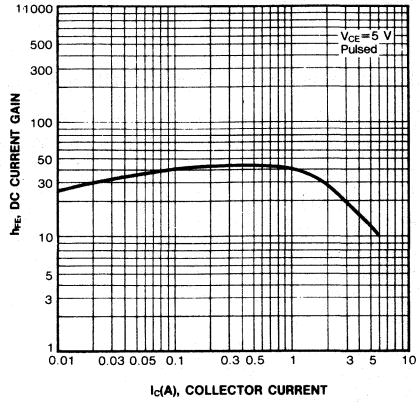
h_{FE} (2) CLASSIFICATION

Classification	R	O	Y
h_{FE} (2)	20-40	30-60	40-80

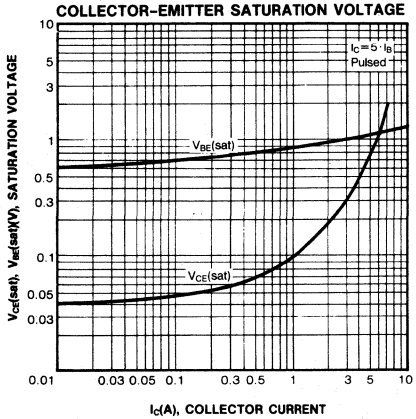
STATIC CHARACTERISTIC



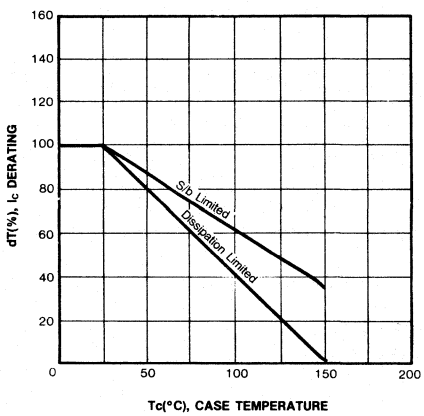
DC CURRENT GAIN



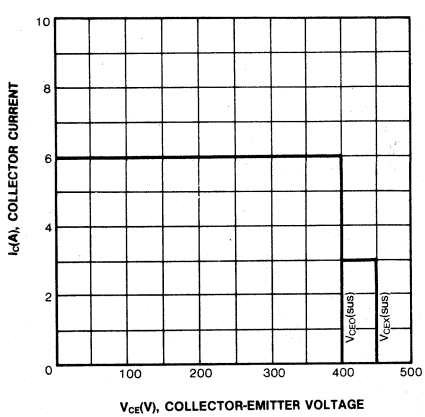
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



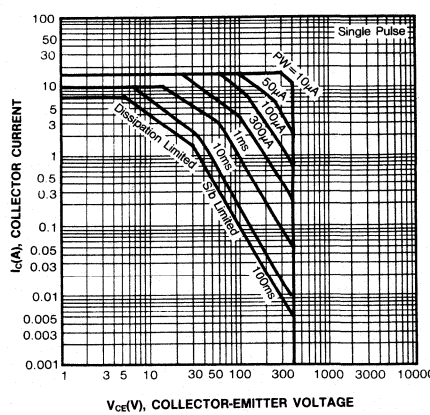
DERATING CURVE OF SAFE OPERATING AREAS



REVERSE BIAS SAFE OPERATING AREA

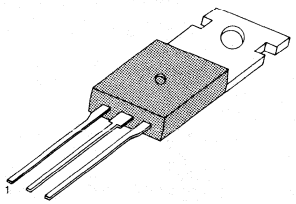


SAFE OPERATING AREA



HIGH SPEED SWITCHING
INDUSTRIAL USE

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	150	V
Collector-Emitter Voltage	V_{CEO}	100	V
Emitter-Base Voltage	V_{EBO}	12	V
Collector Current (DC)	I_C	5	A
Collector Current (Pulse)	I_C	10	A
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Collector Dissipation (T_c=25°C)	P_C	30	W
Base Current	I_B	2.5	A
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle <10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

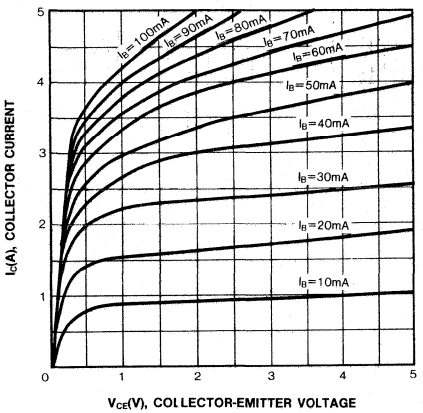
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO} (sus)	I_C=3A, I_B1=0.3A, L=1mH	100		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)1	I_C=3A, I_B1=−I_B2=0.3A, V_{BE} (off)=−5V, L=180μH Clamped	150		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)2	I_C=6A, I_B1=1.2A, I_B2=−0.3A, V_{BE} (off)=−5V L=180μA, Clamped	100		V
Collector Cutoff Current	I_{CBO}	V_{CB}=100V, I_E=0		10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=100V, R_{BE}=51Ω T_a=125°C		1	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}=100V, V_{BE} (off)=−1.5V		10	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=100V, T_a=125°C V_{BE}(off)=−1.5V		1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=10V, I_C=0		10	μA
*DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=0.2A	40		
	h_{FE2}	V_{CE}=5V, I_C=2A	40	200	
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=3A, I_B=0.3A		0.6	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=3A, I_B=0.3A		1.5	V
Turn On Time	ton	I_C=3A, RL=17Ω, V_{CC}=50V		0.5	μs
Storage Time	ts	I_B1=−I_B2=0.3A		2.5	μs
Fall Time	tf			0.5	μs

*Pulse Test: PW≤350μs, Duty Cycle≤2%

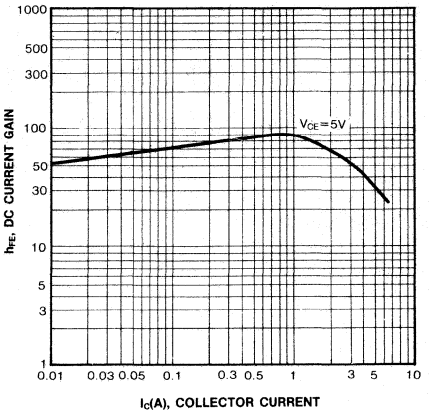
h_{FE}(2) CLASSIFICATION

Classification	R	O	Y
h_{FE}(2)	40-80	60-120	100-200

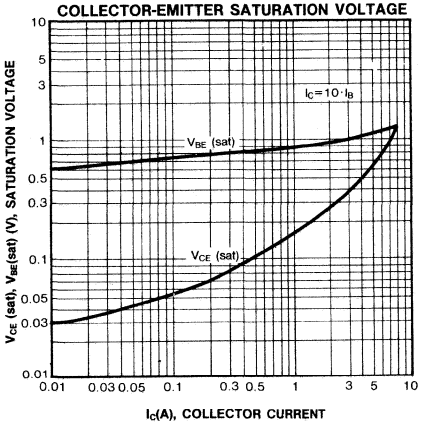
STATIC CHARACTERISTIC



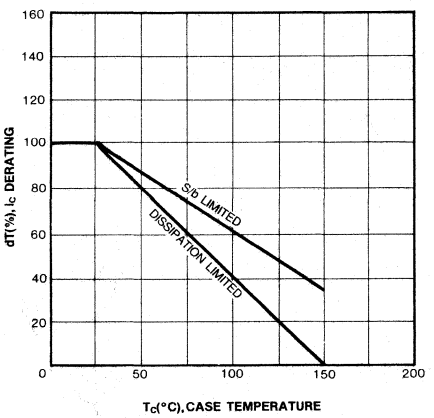
DC CURRENT GAIN



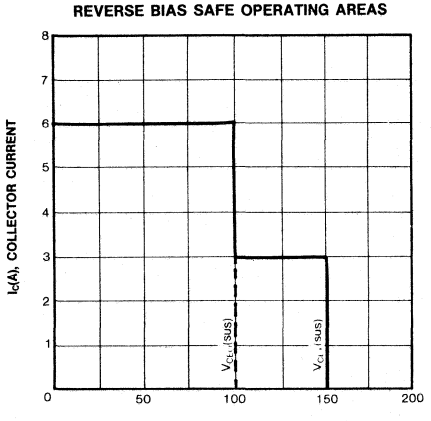
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



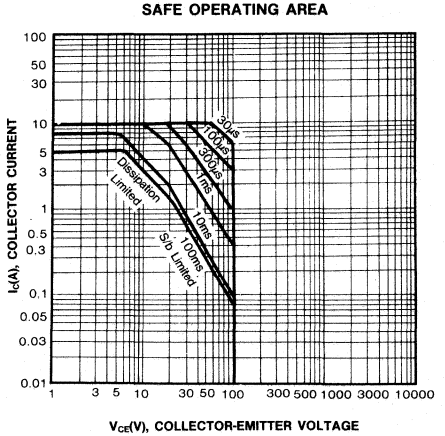
DERATING CURVE OF SAFE OPERATING AREAS

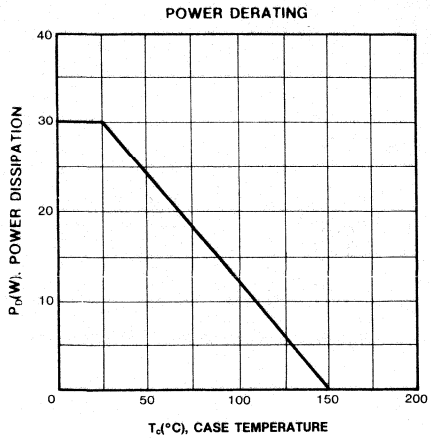


REVERSE BIAS SAFE OPERATING AREAS



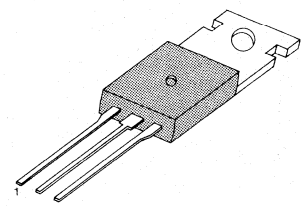
SAFE OPERATING AREA




POWER DERATING
40
30
20
10
0
50
100
150
200
P_D(W), POWER DISSIPATION
T_c(°C), CASE TEMPERATURE

HIGH SPEED, HIGH VOLTAGE SWITCHING
LOW COLLECTOR SATURATION VOLTAGE
SPECIFIED OF REVERSE BIASED SOA
WITH INDUCTIVE LOADS

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	500	V
Collector-Emitter Voltage	V_{CEO}	400	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	4	A
*Collector Current (Pulse)	I_C	8	A
Base Current (DC)	I_B	1	A
Collector Dissipation	P_C	15	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

* PW≤350μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

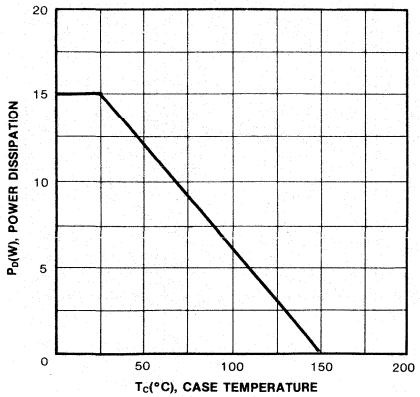
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=2A, I_B=0.4A, L=1mH	400		V
Collector-Emitter Sustaining Voltage	V_{CEX}(sus)1	I_C=2A, I_B1=−I_B2=0.4A T_a=125°C, L=180μH, Clamped	450		V
Collector-Emitter Sustaining Voltage	V_{CEX}(sus)2	I_C=4A, I_B1=0.8A, −I_B2=0.4A T_a=125°C, L=180μH, Clamped	400		V
Collector Cutoff Current	I_{CBO}	V_{CB}=400V, I_E=0		10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=400V, R_{BE}=51Ω, T_a=125°C		1	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}= 400V, V_{BE}(off)=−1.5V		10	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=400V, V_{BE}(off)=−1.5V T_a=125°C		1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		10	μA
*DC Current Gain	h_{FE}1	V_{CE}=5V, I_C=0.3A	20	80	
	h_{FE}2	V_{CE}=5V, I_C=1.5A	10		
*Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=1.5A, I_B=0.3A		1	V
*Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=1.5A, I_B=0.3A		1.5	V
Turn On Time	ton	I_C=2A, I_B1=−I_B2=0.4A		1	μS
Storage Time	tstg	RL=75Ω, V_{CC}=150V		2.5	μS
Fall Time	tf			0.7	μS

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

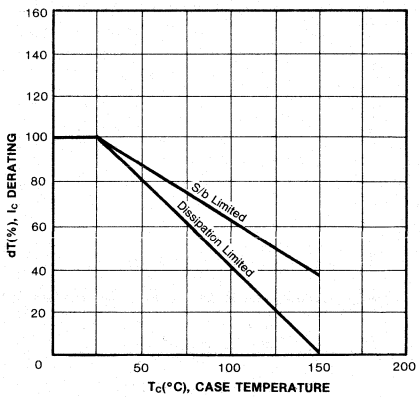
h_{EE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE}1	20-40	30-60	40-80

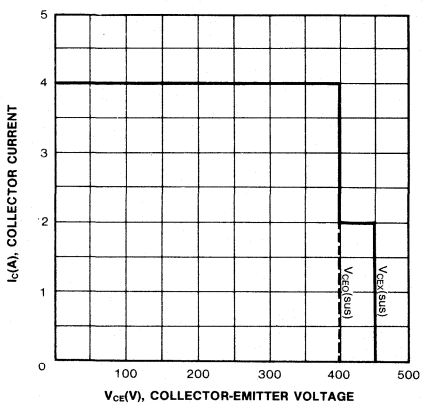
POWER DERATING



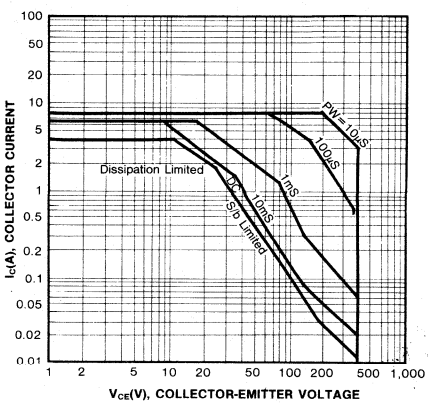
DERATING CURVE OF SAFE OPERATING AREAS



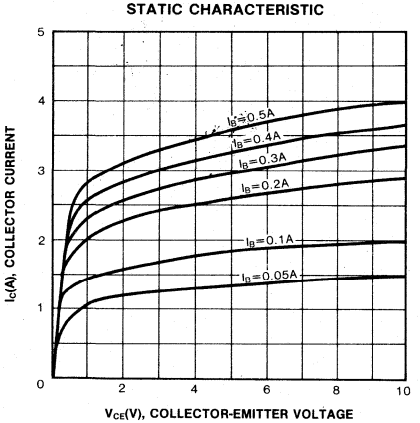
REVERSE BIAS SAFE OPERATING AREA



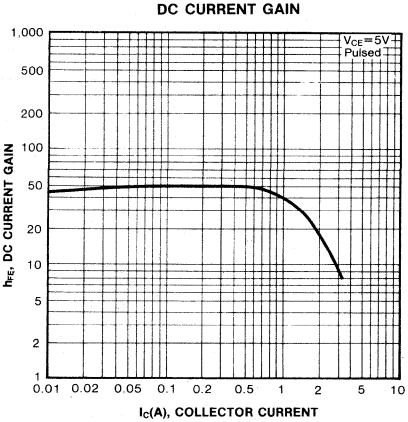
FORWARD BIAS SAFE OPERATING AREA



STATIC CHARACTERISTIC

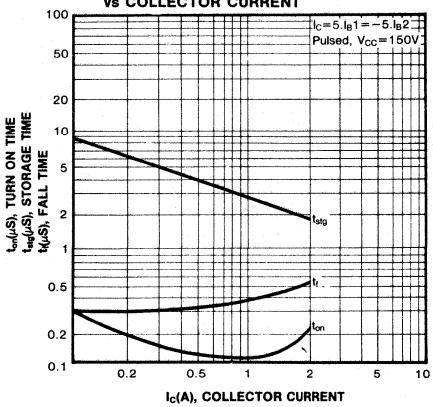


DC CURRENT GAIN

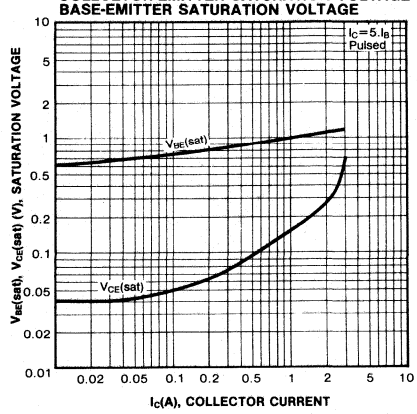


3

TURN ON, STORAGE AND FALL TIME
vs COLLECTOR CURRENT



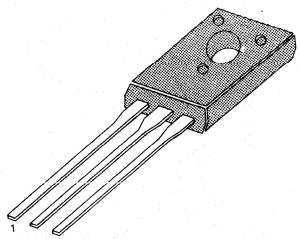
COLLCETOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



AUDIO FREQUENCY POWER AMPLIFIER

- **Complement to KSA1142**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	180	V
Collector-Emitter Voltage	V_{CEO}	180	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation (T_a=25°C)	P_C	1.2	W
Collector Dissipation (T_c=25°C)	P_C	8	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

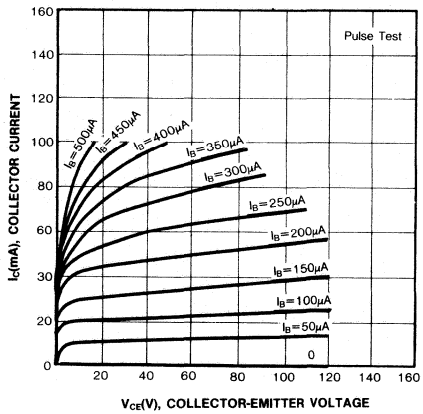
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=180V, I_E=0			1.0	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0			1.0	μA
*DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=1mA	90	190		
	h_{FE2}	V_{CE}=5V, I_C=10mA	100	200	320	
*Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=5mA		0.12	0.5	V
*Base Emitter Saturation Voltage	V_{BE} (sat)	I_C=50mA I_B=5mA		0.8	1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=20mA		200		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.2	5.0	pF
Noise Figure	NF	V_{CE}=10V, I_C=1mA Rs=10kΩ, f=1kHz		4		dB

* Pulse Test: PW≤350μs, Duty Cycle≤2%

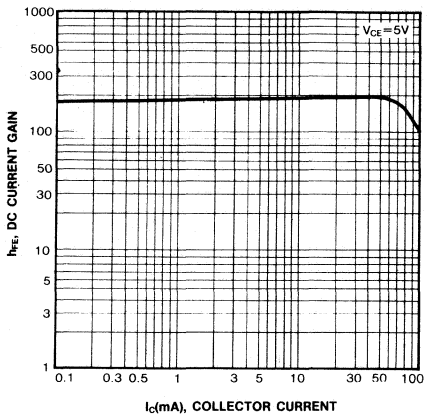
h_{FE}(2) CLASSIFICATION

Classification	O	Y
h_{FE}(2)	100-200	160-320

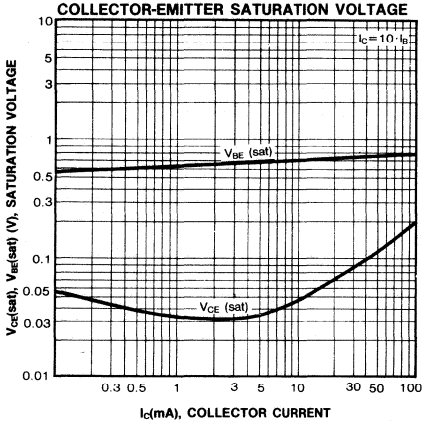
STATIC CHARACTERISTIC



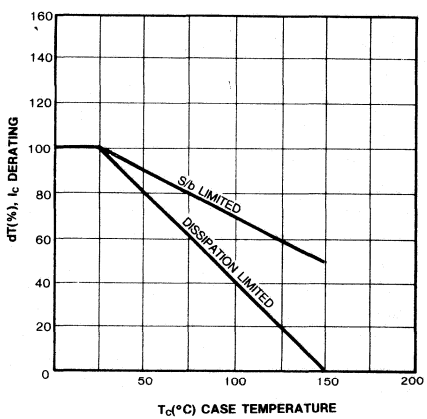
DC CURRENT GAIN



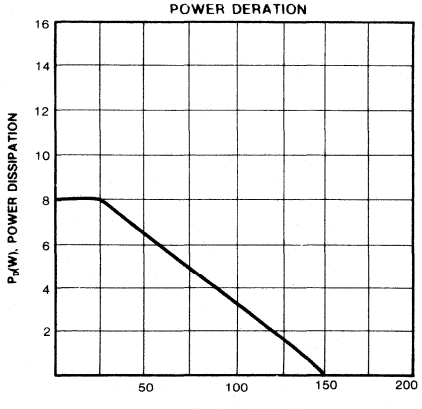
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



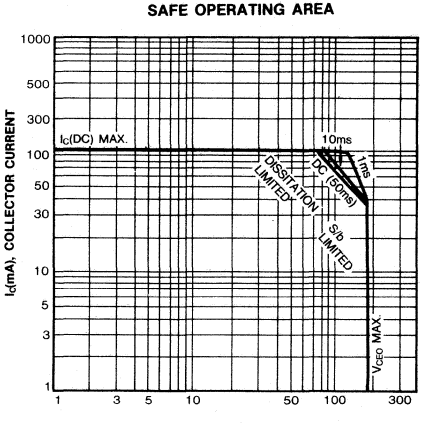
DERATING CURVE OF SAFE OPERATING AREAS



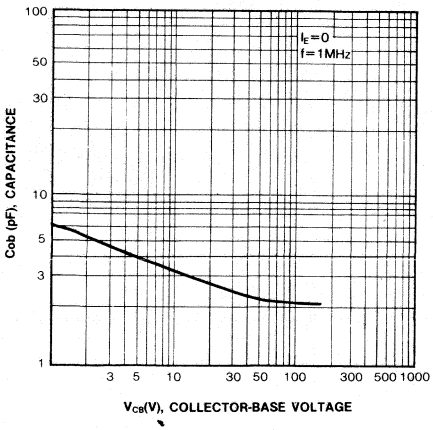
POWER DERATION



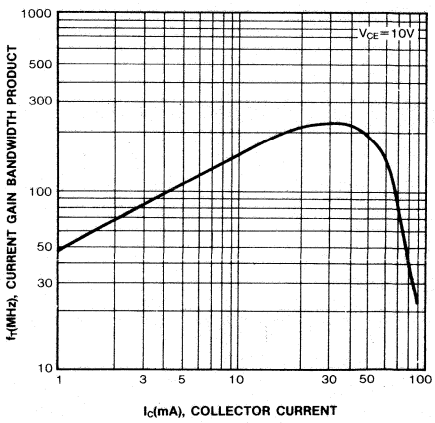
SAFE OPERATING AREA



COLLECTOR OUTPUT CAPACITANCE



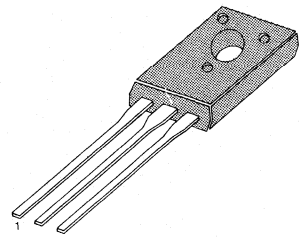
CURRENT GAIN-BANDWIDTH PRODUCT



3

COLOR TV CHROMA OUTPUT
VIDEO OUTPUT

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	300	V
Collector-Emitter Voltage	V_{CEO}	300	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Collector Dissipation (T_a=25°C)	P_C	1.25	W
Collector Dissipation (T_c=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

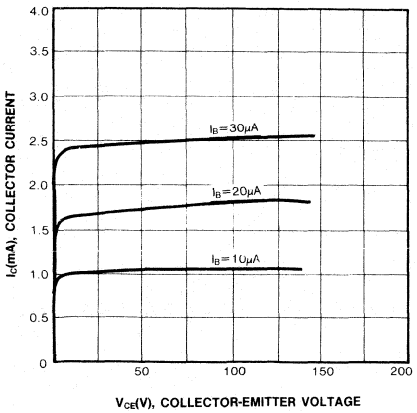
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	V_{CBO}	I_C=0.1mA, I_E=0	300			V
Collector-Emitter Breakdown Voltage	V_{CEO}	I_C=5mA, I_B=0, R_{BE}=∞	300			V
Emitter-Base Breakdown Voltage	V_{EBO}	I_E=0.1mA, I_C=0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=200V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0			100	nA
* DC Current Gain	h_{FE}	V_{CE}=10V, I_C=10mA	40		250	
* Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=5mA			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=30V, I_E=−10mA	50	80		MHz
Feed Back Capacitance	Cre	V_{CB}=30V, I_E=0 f=1MHz			3	pF

* Pulse Test: PW≤350μS, Duty Cycle≤2%

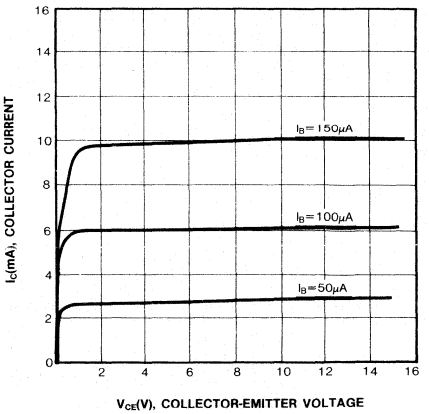
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	60-120	100-200	160-250

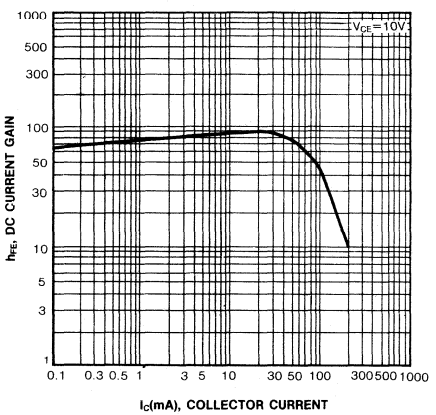
STATIC CHARACTERISTIC



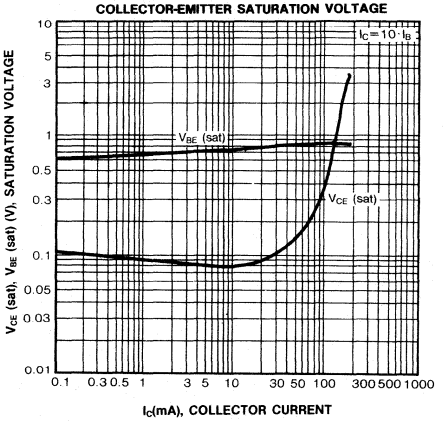
STATIC CHARACTERISTIC



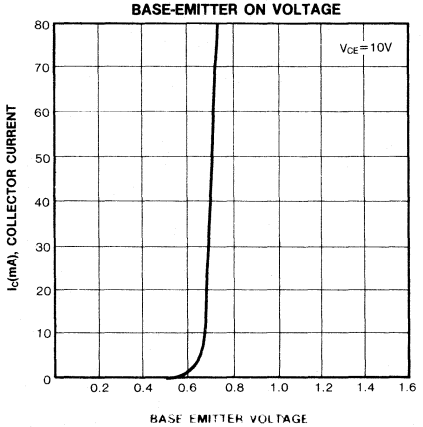
DC CURRENT GAIN



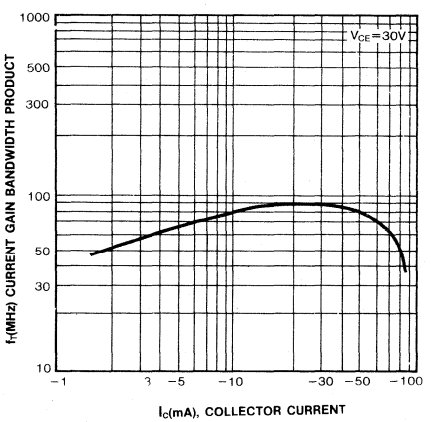
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



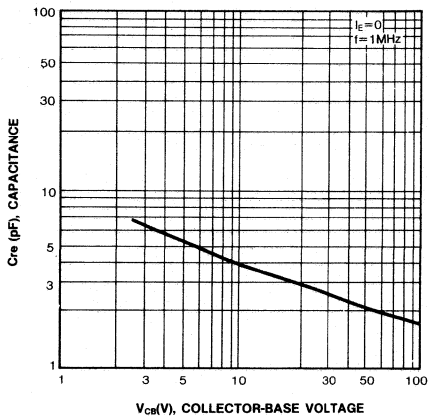
BASE-EMITTER ON VOLTAGE



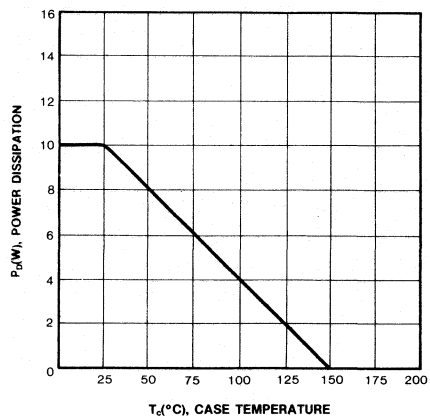
CURRENT GAIN BANDWIDTH PRODUCT



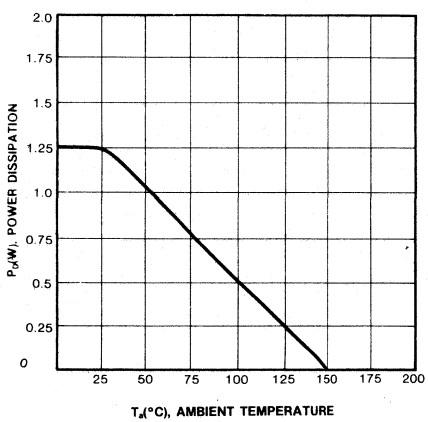
FEEDBACK CAPACITANCE



POWER DERATING



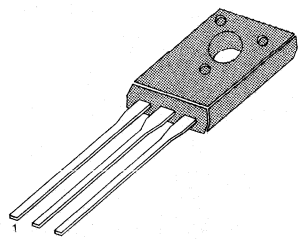
POWER DERATING



AUDIO FREQUENCY, HIGH FREQUENCY POWER AMPLIFIER

- **Complement to KSA1220/KSA1220A**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : KSC2690	V_{CBO}	120	V
: KSC2690A		160	V
Collector-Emitter Voltage : KSC2690	V_{CEO}	120	V
: KSC2690A		160	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	1.2	A
* Collector Current (Pulse)	I_C	2.5	A
Base Current (DC)	I_B	0.3	A
Collector Dissipation (T_a=25°C)	P_C	1.2	W
Collector Dissipation (T_c=25°C)	P_C	20	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

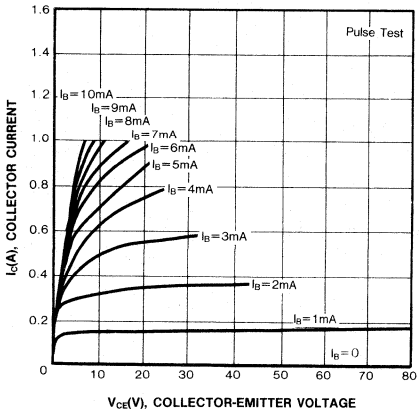
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=120V, I_E=0			1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0			1	μA
* DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=5mA	35	105		
	h_{FE2}	V_{CE}=5V, I_C=0.3A	60	140	320	
* Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=1A, I_B=0.2A		0.4	0.7	V
* Base Emitter Saturation Voltage	V_{BE} (sat)	I_C=1A, I_B=0.2A		1	1.3	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=0.2A		155		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz		19		pF

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

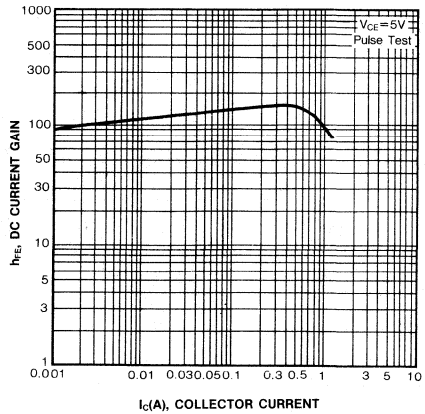
h_{FE} (2) CLASSIFICATION

Classification	R	O	Y
h_{FE}(2)	60-120	100-200	160-320

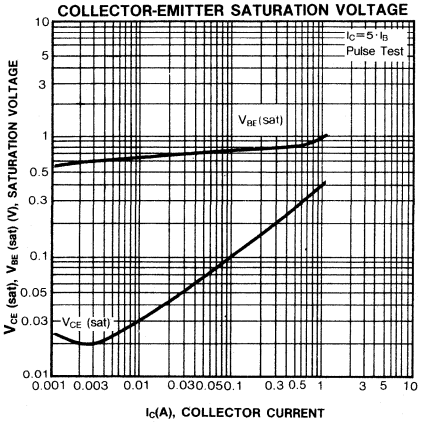
STATIC CHARACTERISTIC



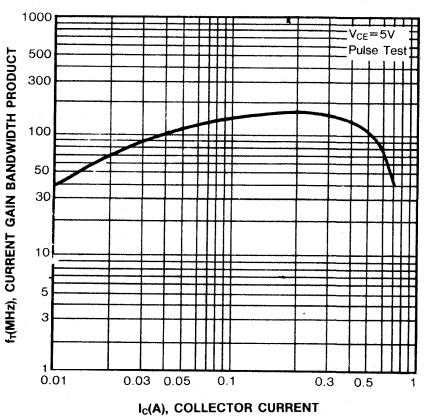
DC CURRENT GAIN



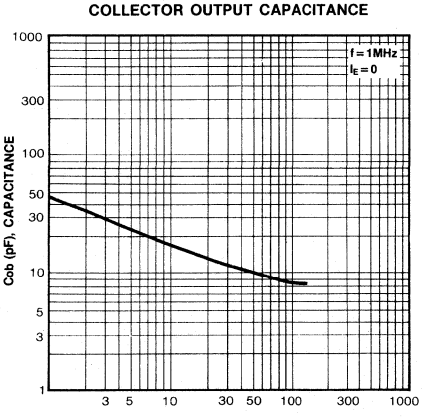
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



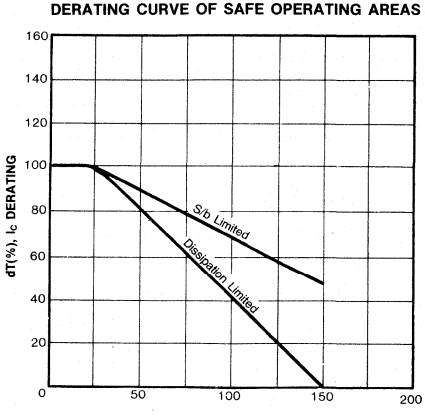
CURRENT GAIN-BANDWIDTH PRODUCT



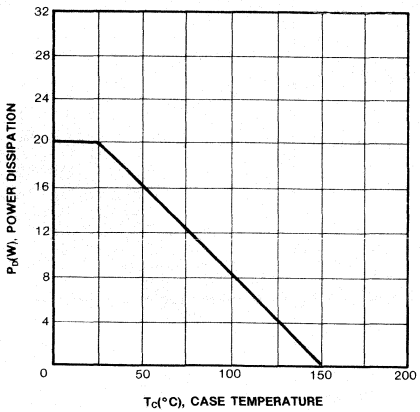
COLLECTOR OUTPUT CAPACITANCE



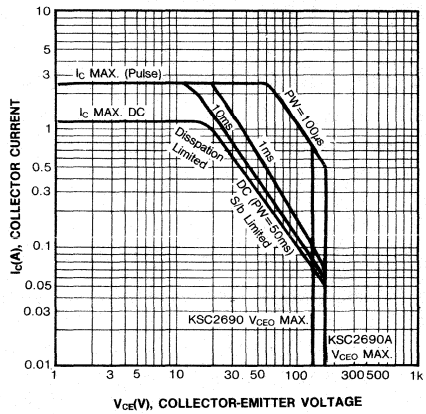
DERATING CURVE OF SAFE OPERATING AREAS



POWER DERATING



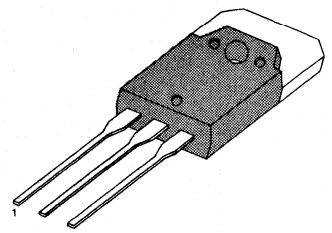
SAFE OPERATING AREA



3

HIGH SPEED, HIGH CURRENT SWITCHING INDUSTRIAL USE

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	500	V
Collector-Emitter Voltage	V_{CEO}	400	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	10	A
*Collector Current (Pulse)	I_C	20	A
Base Current (DC)	I_B	5	A
Collector Dissipation (T_c=25°C)	P_C	100	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

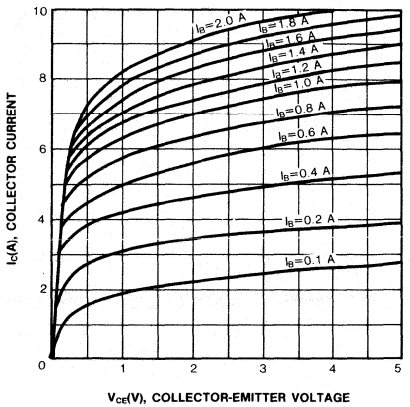
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO} (sus)	I_C=6A, I_B1=1.2A, L=100μH	400			V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)1	I_C=6A, I_B1=−I_B2=1.2A T_a=125°C, L=180μH, Clamped	450			V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)2	I_C=12A, I_B1=2.4A, −I_B2=1.2A T_a=125°C, L=180μH, Clamped	400			V
Collector Cutoff Current	I_{CBO}	V_{CB}=400V, I_E=0			100	μA
Collector Cutoff Current	I_{CER}	V_{CE}=400V, R_{BE}=50Ω, T_a=125°C			2	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}=400V, V_{BE} (off)=−1.5V			100	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=400V, V_{BE} (off)=−1.5V T_a=125°C			1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
*DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=1A	15	35	80	
	h_{FE2}	V_{CE}=5V, I_C=3A	10			
	h_{FE3}	V_{CE}=5V, I_C=6A	7			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=6A, I_B=1.2A			1	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=6A, I_B=1.2A			1.5	V
Turn On Time	ton	I_C=6A, RL=25Ω			1	μs
Storage Time	ts	I_B1=−I_B2=1.2A, V_{CC}≒150V			2.5	μs
Fall Time	tf				0.7	μs

*Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

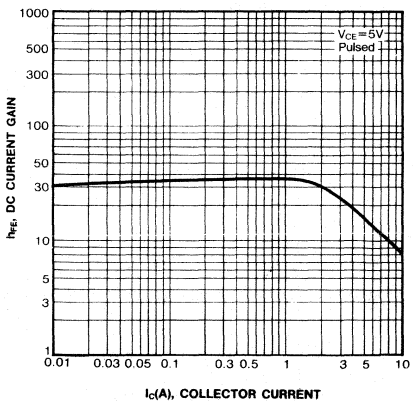
h_{FE} (1) CLASSIFICATION

Classification	N	R	O	Y
h_{FE} (1)	15-30	20-40	30-60	40-80

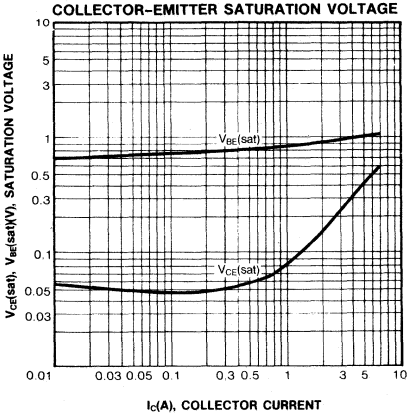
STATIC CHARACTERISTIC



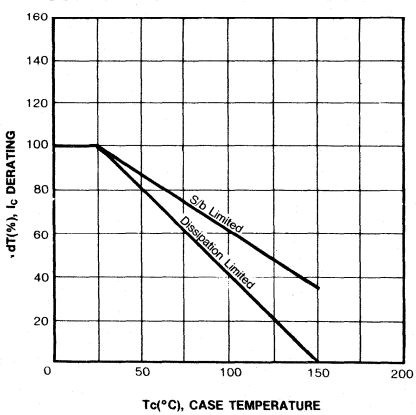
DC CURRENT GAIN



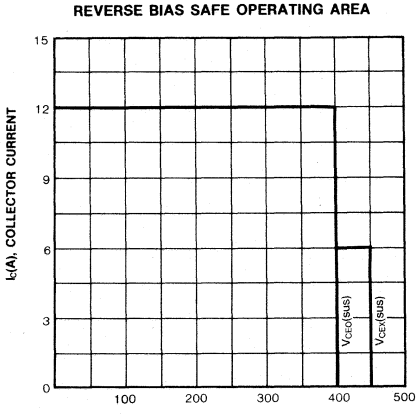
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



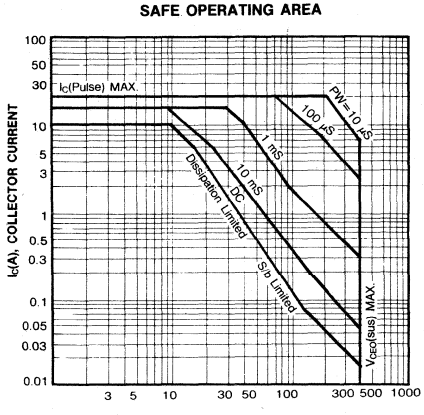
DERATING CURVE OF SAFE OPERATING AREAS



REVERSE BIAS SAFE OPERATING AREA

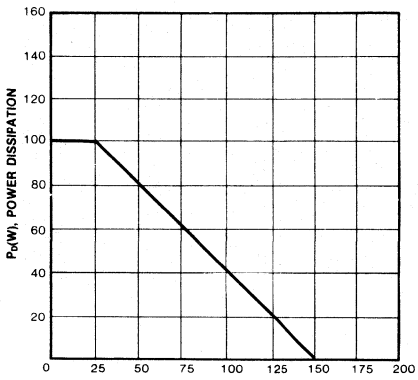


SAFE OPERATING AREA

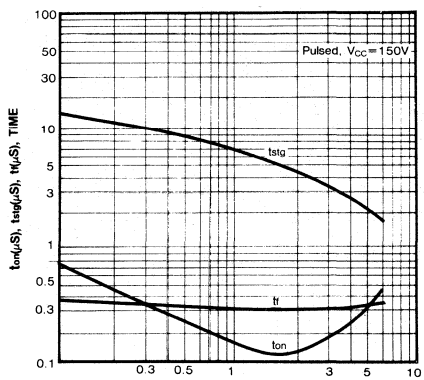


3

POWER DERATING

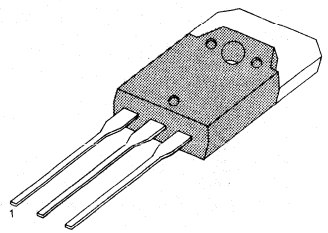


SWITCHING TIME



HIGH SPEED, HIGH CURRENT SWITCHING INDUSTRIAL USE

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	500	V
Collector-Emitter Voltage	V_{CEO}	400	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	15	A
*Collector Current (Pulse)	I_C	30	A
Base Current (DC)	I_B	7.5	A
Collector Dissipation (T_c=25°C)	P_C	120	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

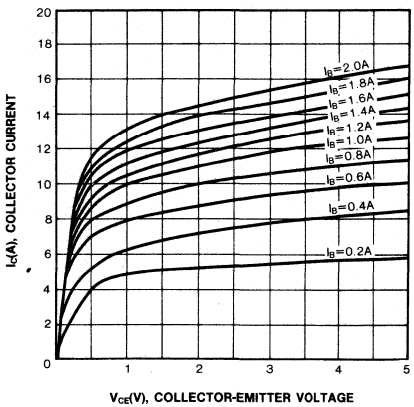
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO} (sus)	I_C=10A, I_B=2A, L=50μH	400			V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)1	I_C=10A, I_B1=−I_B2=2A T_a=125°C, L=180μH, Clamped	450			V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)2	I_C=20A, I_B1=4A, −I_B2=2A T_a=125°C, L=180μH, Clamped	400			V
Collector Cutoff Current	I_{CBO}	V_{CB}=400V, I_E=0			100	μA
Collector Cutoff Current	I_{CER}	V_{CE}=400V, R_{BE}=50Ω, T_a=125°C			2	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}=400V, V_{BE} (off)=−1.5V			100	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=400V, V_{BE} (off)=−1.5V T_a=125°C			1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
*DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=2A	15	35	80	
	h_{FE2}	V_{CE}=5V, I_C=5A	10			
	h_{FE3}	V_{CE}=5V, I_C=10A	7			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10A, I_B=2A		0.3	1	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10A, I_B=2A		1	1.5	V
Turn On Time	ton	I_C=10A, RL=15Ω			1	μs
Storage Time	ts	I_B1=−I_B2=2A, V_{CC}≒150V			2.5	μs
Fall Time	tf				0.7	μs

*Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

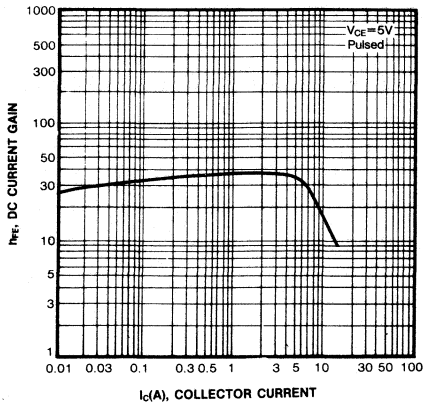
h_{FE} (1) CLASSIFICATION

Classification	N	R	O	Y
h_{FE} (1)	15-30	20-40	30-60	40-80

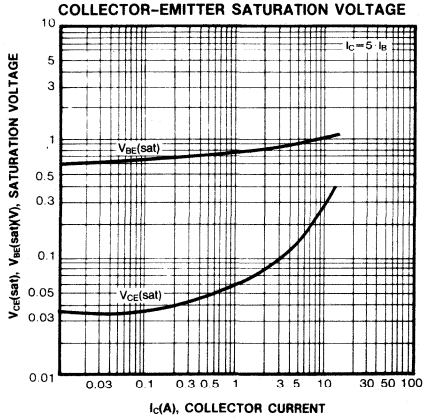
STATIC CHARACTERISTIC



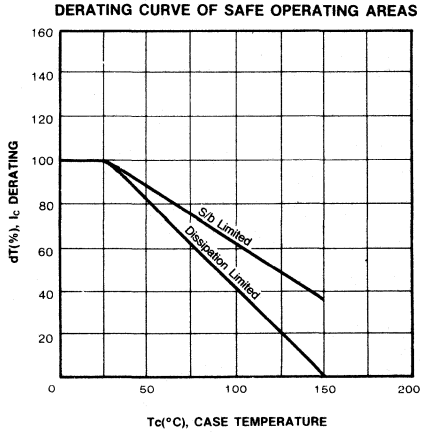
DC CURRENT GAIN



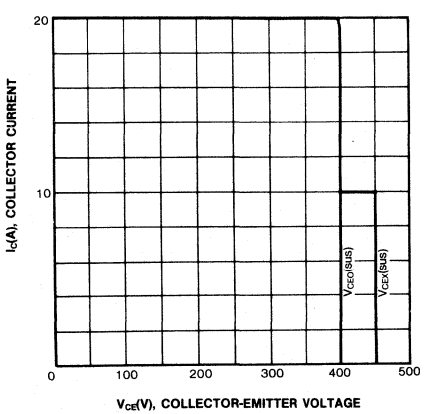
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



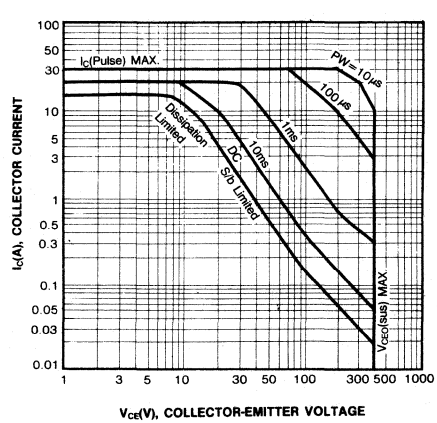
DERATING CURVE OF SAFE OPERATING AREAS



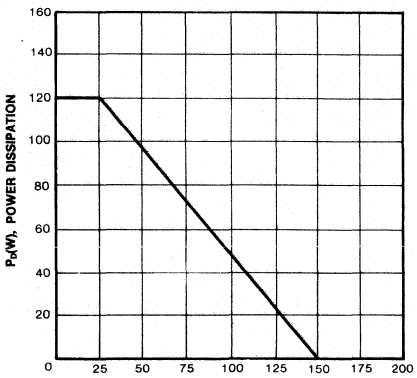
REVERSE BIAS SAFE OPERATING AREA



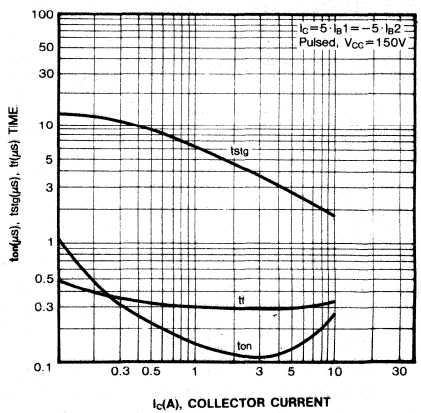
SAFE OPERATING AREA



POWER DERATING



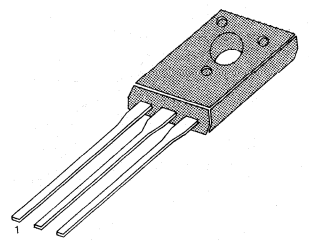
SWITCHING TIME



3

HIGH SPEED, HIGH VOLTAGE SWITCHING INDUSTRIAL USE

TO-126



1. Emitter 2. Collector 3 Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	500	V
Collector-Emitter Voltage	V_{CEO}	400	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	0.5	A
*Collector Current (Pulse)	I_C	1	A
Base Current (DC)	I_B	0.25	A
Collector Dissipation (T_a=25°C)	P_C	1	W
Collector Dissipation (T_c=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle <10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

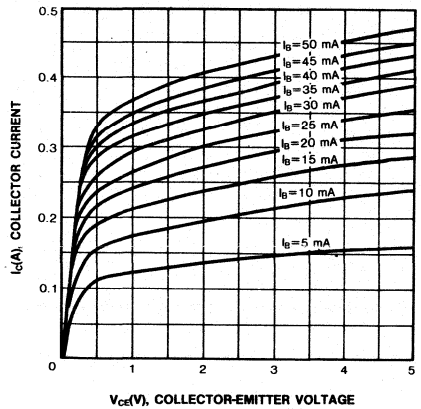
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO} (sus)	I_C=0.3A, I_B1=0.06A, L=10mH	400		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)1	I_C=0.3A, I_B1=−I_B2=0.06A V_{BE} (off)=−5V, L=10mH, Clamped	450		V
Collector Emitter Sustaining Voltage	V_{CEX} (sus)2	I_C=0.6A, I_B1=0.2A, I_B2=−0.06A V_{BE} (off)=−5V, L=10mH, Clamped	400		V
Collector Cutoff Current	I_{CBO}	V_{CB}=400V, I_E=0		10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=400V, R_{BE}=51Ω, T_a=125°C		1	mA
Collector Cutoff Current	I_{CEX}1	V_{CE}=400V, V_{BE} (off)=−1.5V		10	μA
Collector Cutoff Current	I_{CEX}2	V_{CE}=400V, V_{BE} (off)=−1.5V T_a=125°C		1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		10	μA
*DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=0.05A	20	80	
	h_{FE2}	V_{CE}=5V, I_C=0.3A	10		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=0.3A, I_B=0.06A		1	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=0.3A, I_B=0.06A		1.2	V
Turn On Time	ton	I_C=0.3A RL=500Ω		1	μs
Storage Time	ts	I_B1=−I_B2=0.06A, V_{CC}=150V		2.5	μs
Fall Time	tf	PW=50μs, Duty Cycle≤2%		1	μs

*Pulse Test: PW≤350μs, Duty Cycle≤2% pulsed

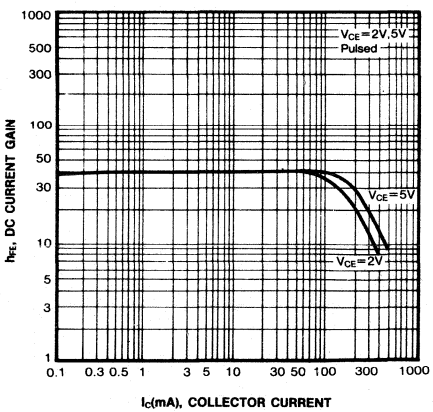
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE} (1)	20-40	30-60	40-80

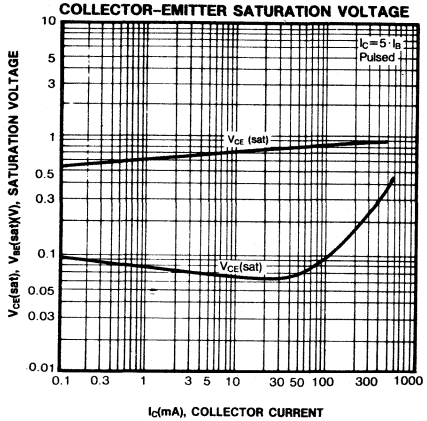
STATIC CHARACTERISTIC



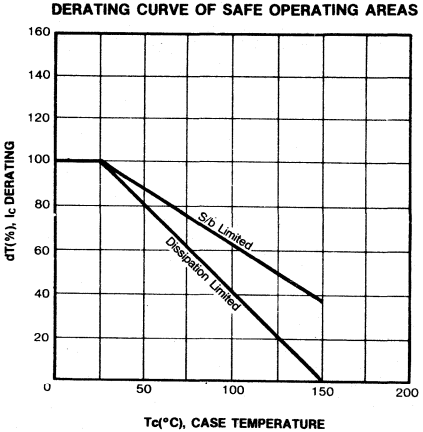
DC CURRENT GAIN



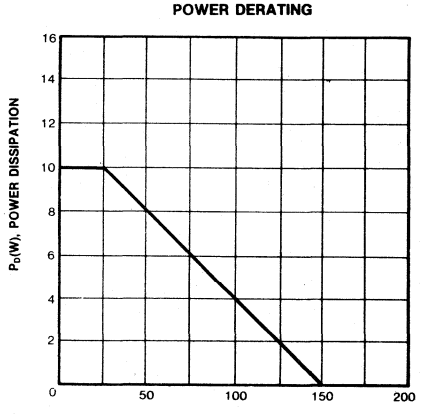
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



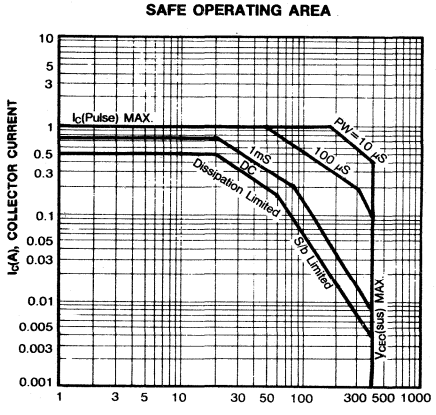
DERATING CURVE OF SAFE OPERATING AREAS



POWER DERATING



SAFE OPERATING AREA



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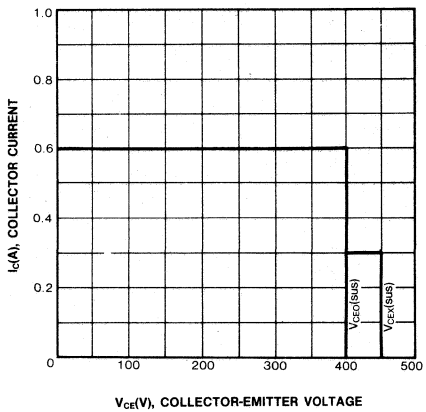
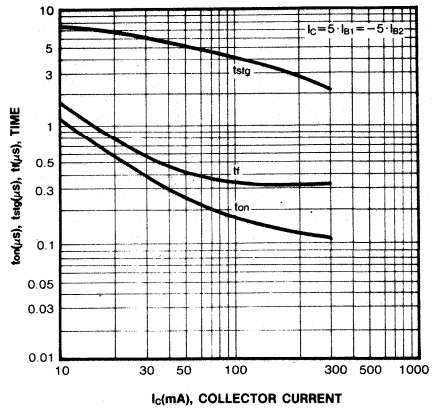
REVERSE BIAS SAFE OPERATING AREA



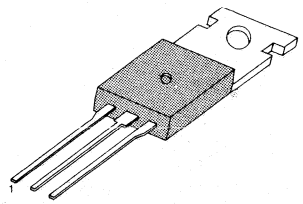
SWITCHING TIME



HIGH VOLTAGE, HIGH QUALITY

HIGH SPPED SWITCHING: t_f=0.1μS
- WIDE SOA

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	800	V
Collector-Emitter Voltage	V_{CEO}	500	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	3	A
Collector Current (Pulse)	I_C	6	A
Base Current (DC)	I_B	1	A
Collector Dissipation	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

3

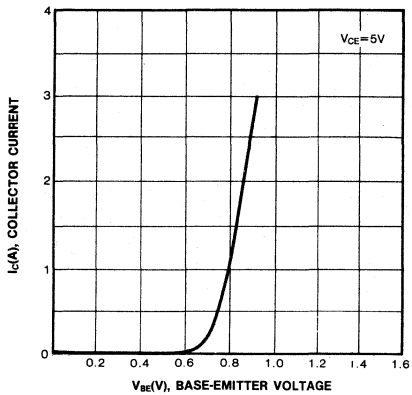
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	800			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	500			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaning Voltage	V_{CEX}(sus)	I_C=1.5A I_{B1}=−I_{B2}=0.6A L=2mH, Clamped	500			V
Collector Cutoff Current	I_{CBO}	V_{CB}=500V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	h_{EE}1	V_{CE}=5V, I_C=0.3A	15		50	
	h_{FE}2	V_{CE}=5V, I_C=1.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=1.5A, I_B=0.3A			1	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=1.5A, I_B=0.3A			1.5	V
Output Capacitance	C_{OB}	V_{CB}=10V, f=1MHz		50		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.3A		18		MHz
Turn On Time	t_{on}	V_{CC}=200V			0.5	μS
Storage Time	t_S	5I_{B1}=−2.5I_{B2}=I_C=2A			3	μS
Fall Time	t_f	RL=100ohm			0.3	μS

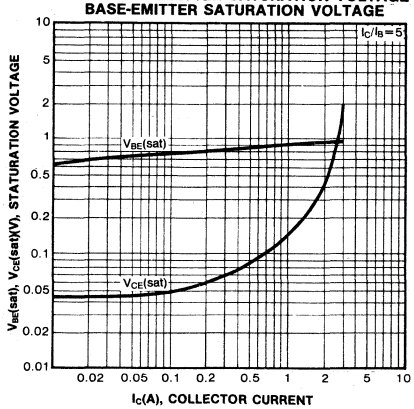
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}1	15-30	20-40	30-50

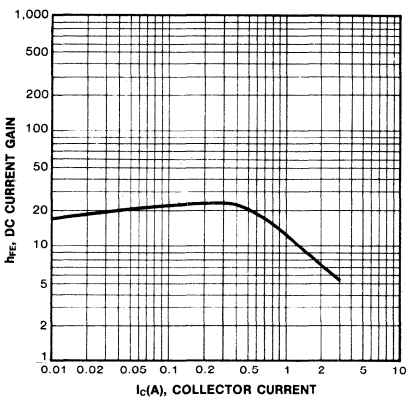
BASE-EMITTER ON VOLTAGE



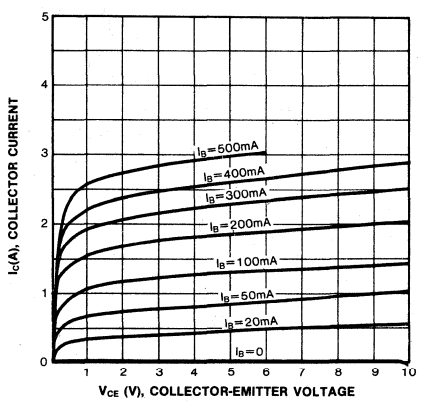
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



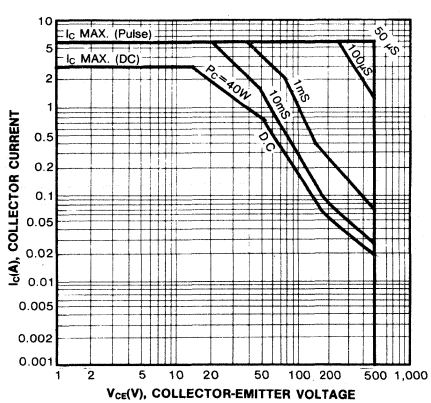
DC CURRENT GAIN



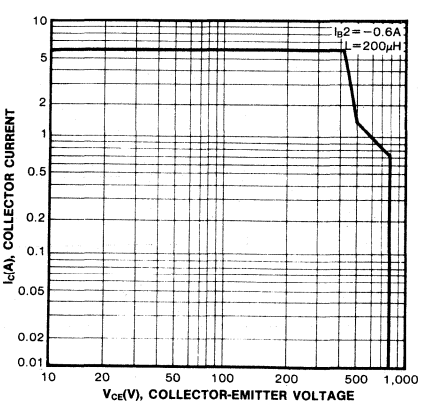
STATIC CHARACTERISTIC



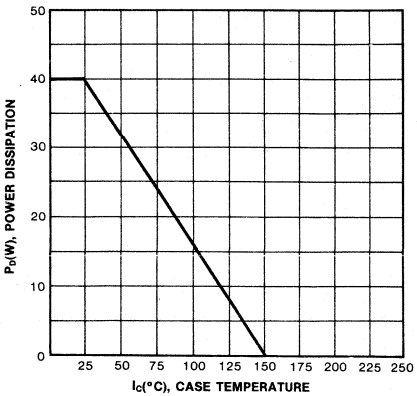
FORWARD BIAS SAFE OPERATING AREA



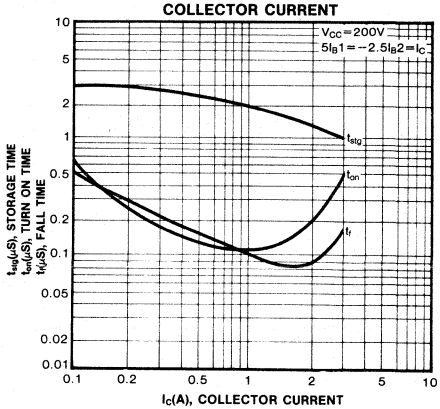
REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



TURN ON, STORAGE AND FALL TIME vs. COLLECTOR CURRENT

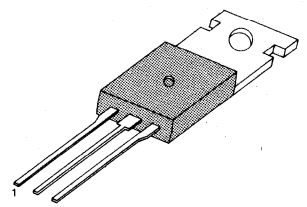


3

HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING: t_f = 0.1 μS (Typ)
WIDE SOA

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	800	V
Collector-Emitter Voltage	V_{CEO}	500	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	5	A
Collector Current (Pulse)	I_C	10	A
Base Current	I_B	2	A
Collector Dissipation	P_C	50	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

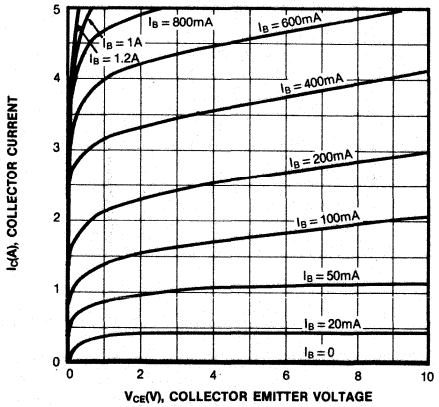
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	800			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	500			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=2.5A, I_B1=−I_B2=1A L=1mH, Clamped	500			V
Collector Cutoff Current	I_{CBO}	V_{CB}=500V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	$h_{FE}1$	V_{CE}=5V, I_C=0.6A	15		50	
	$h_{FE}2$	V_{CE}=5V, I_C=3A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=3A, I_B=0.6A			1	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=3A, I_B=0.6A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		80		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.6A		18		MHz
Trun On Time	t_{on}	V_{CC}=200V			0.5	μS
Storage Time	t_S	5I_B1=−2.5I_B2=I_C=4A			3	μS
Fall Time	t_f	RL=50Ω			0.3	μS

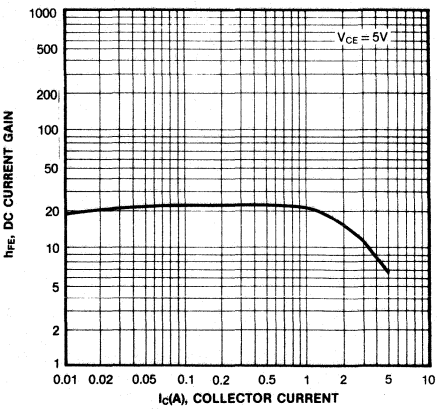
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE} 1	15-30	20-40	30-50

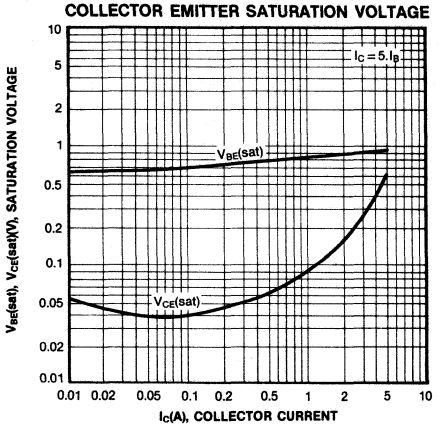
STATIC CHARACTERISTIC



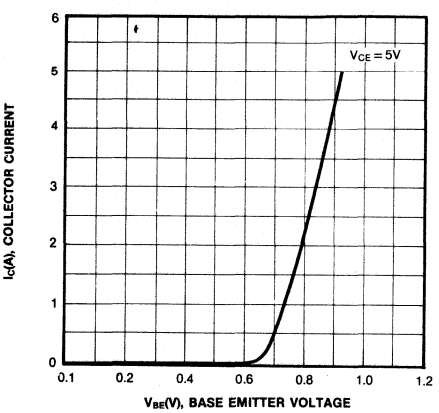
DC CURRENT GAIN



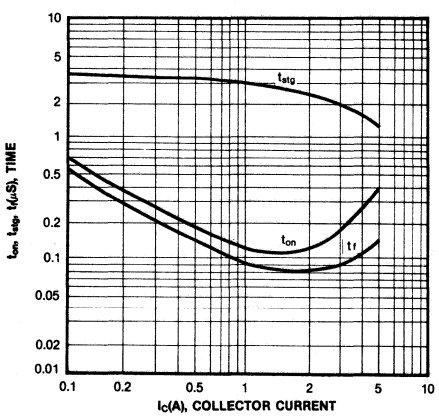
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



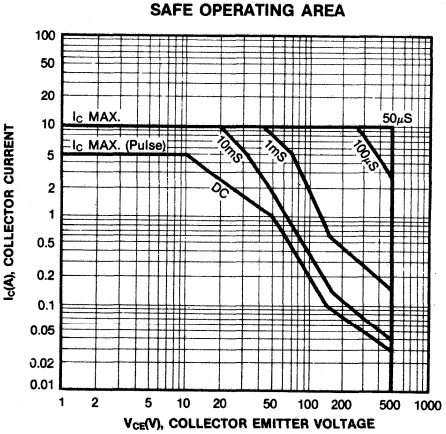
BASE EMITTER ON VOLTAGE



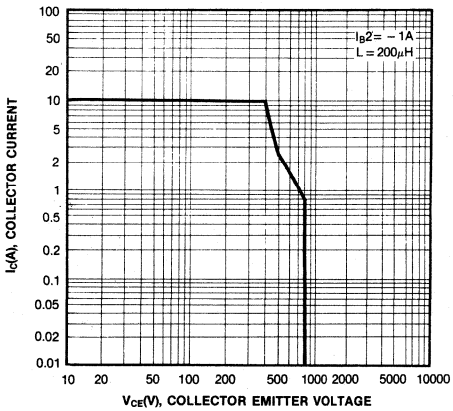
SWITCHING TIME



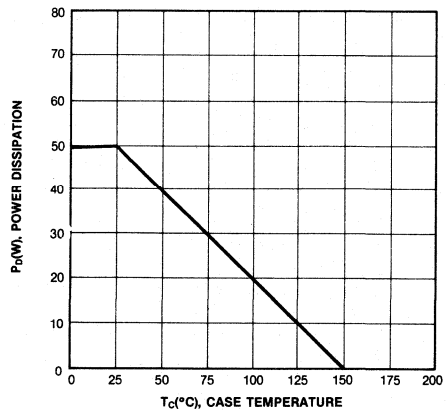
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



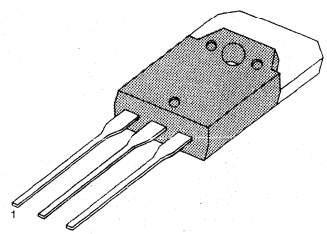
POWER DERATING



HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING: t_f = 0.1 μS (Typ)
WIDE SOA

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	800	V
Collector-Emitter Voltage	V_{CEO}	500	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	4	A
Collector Current (Pulse)	I_C	8	A
Base Current	I_B	1.5	A
Collector Dissipation	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

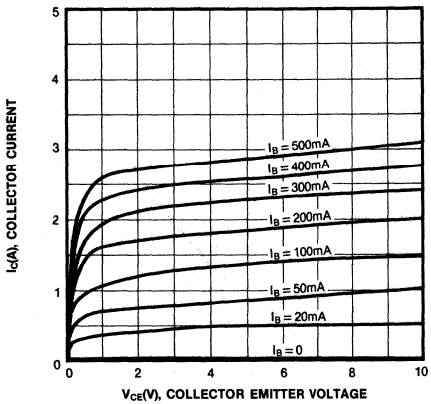
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	800			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	500			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=1.5A, I_{B1}=−I_{B2}=0.6A L=1mH, Clamped	500			V
Collector Cutoff Current	I_{CBO}	V_{CB}=500V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	h_{FE}1	V_{CE}=5V, I_C=0.3A	15		50	
	h_{FE}2	V_{CE}=5V, I_C=1.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=1.5A, I_B=0.3A			1	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=1.5A, I_B=0.3A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		50		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.3A		18		MHz
Trun On Time	t_{on}	V_{CC}=200V			0.5	μS
Storage Time	t_S	5I_{B1}=−2.5I_{B2}=I_C=2A			3	μS
Fall Time	t_f	RL=100Ω			0.3	μS

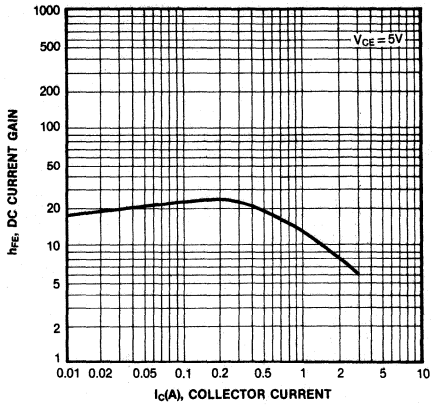
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE} 1	15-30	20-40	30-50

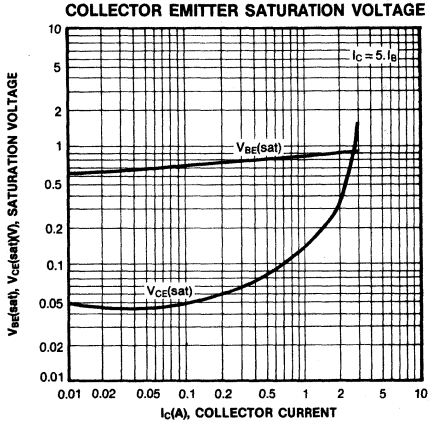
STATIC CHARACTERISTIC



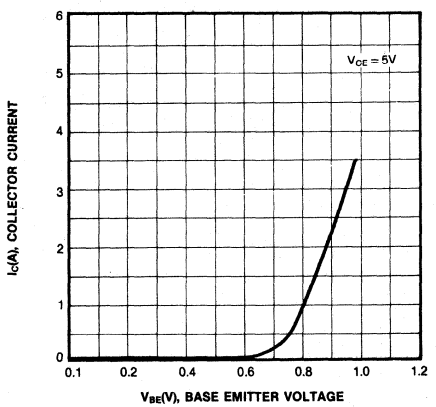
DC CURRENT GAIN



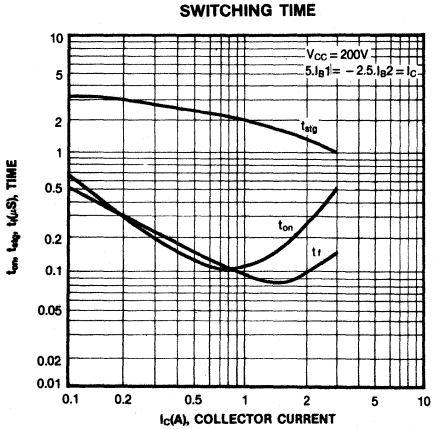
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



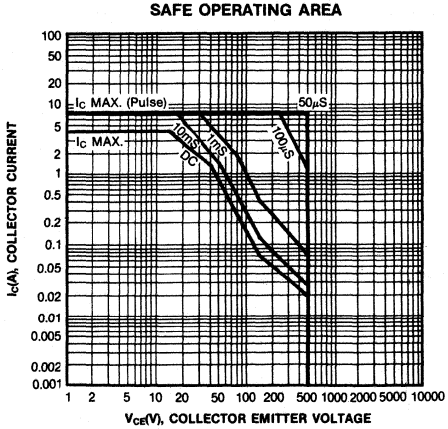
BASE EMITTER ON VOLTAGE



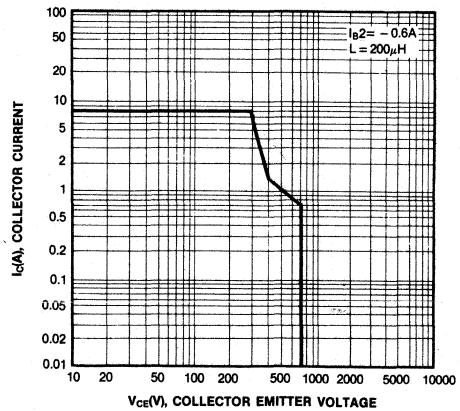
SWITCHING TIME



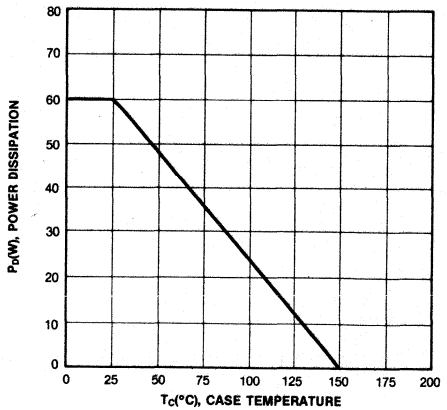
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING

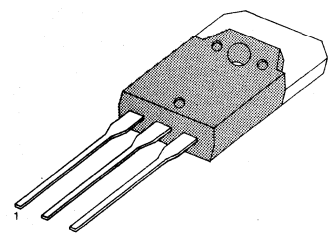


3

HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING: t_f = 0.1 μS (Typ)
WIDE SOA

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	800	V
Collector-Emitter Voltage	V_{CEO}	500	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	7	A
Collector Current (Pulse)	I_C	14	A
Base Current	I_B	3	A
Collector Dissipation	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

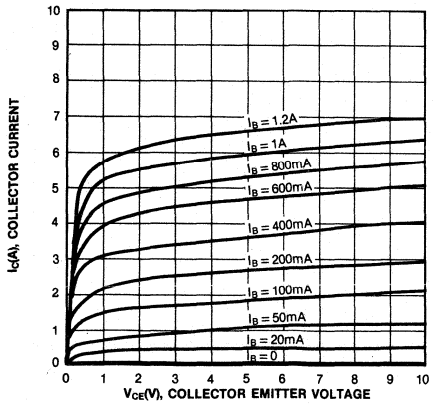
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	800			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	500			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=2.5A, I_{B1}=−I_{B2}=1A L=1mH, Clamped	500			V
Collector Cutoff Current	I_{CBO}	V_{CB}=500V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	h_{FE}1	V_{CE}=5V, I_C=0.6A	15		50	
	h_{FE}2	V_{CE}=5V, I_C=3A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=3A, I_B=0.6A			1	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=3A, I_B=0.6A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		80		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.6A		18		MHz
Trun On Time	t_{on}	V_{CC}=200V			0.5	μS
Storage Time	t_S	5I_{B1}=−2.5I_{B2}=I_C=4A			3	μS
Fall Time	t_f	RL=50Ω			0.3	μS

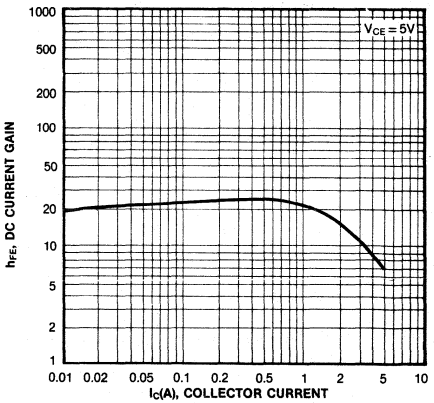
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE} 1	15-30	20-40	30-50

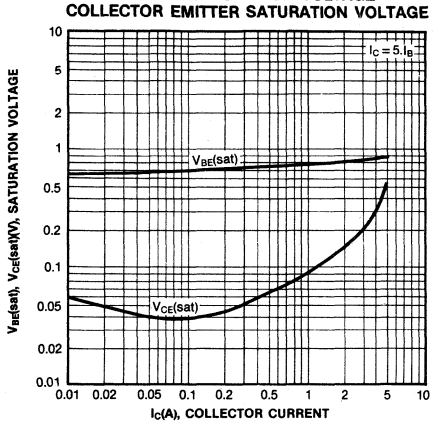
STATIC CHARACTERISTIC



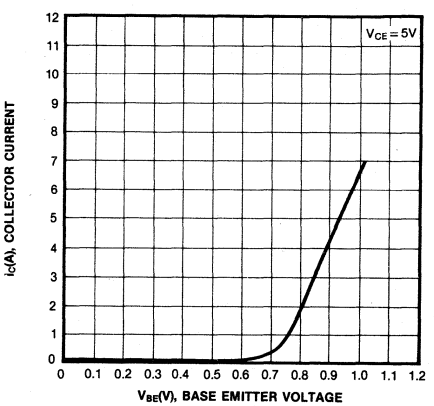
DC CURRENT GAIN



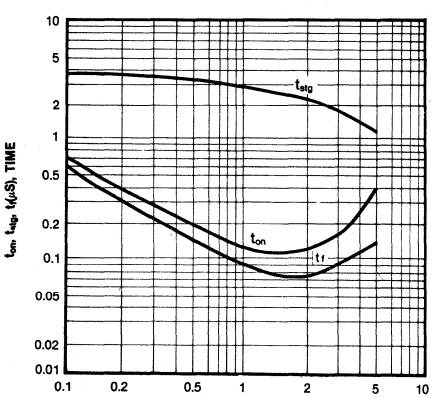
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



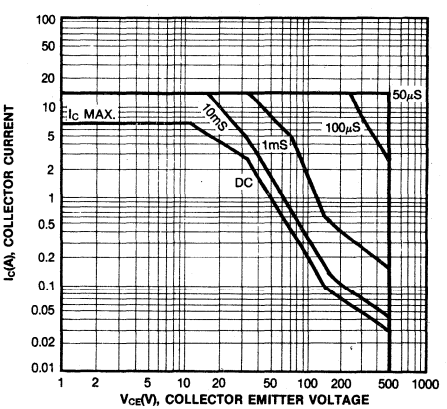
BASE EMITTER ON VOLTAGE



SWITCHING TIME



SAFE OPERATING AREA



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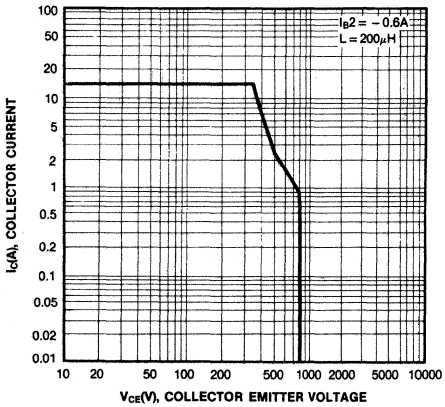
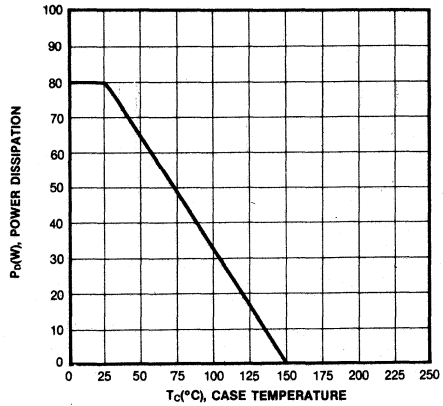
REVERSE BIAS SAFE OPERATING AREA



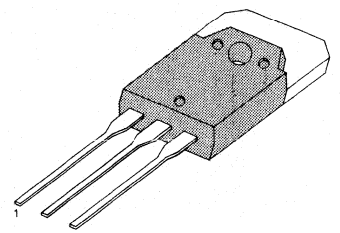
POWER DERATING



HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING
WIDE SOA

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	800	V
Collector-Emitter Voltage	V_{CEO}	500	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	10	A
Collector Current (Pulse)	I_C	20	A
Base Current	I_B	3	A
Collector Dissipation	P_C	90	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

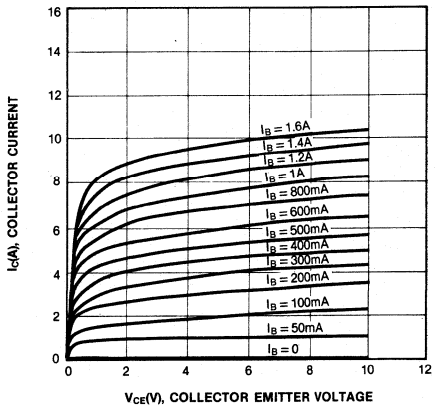
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	800			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	500			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=3.5A, I_B1=−I_B2=1.4A L=500μH, Clamped	500			V
Collector Cutoff Current	I_{CBO}	V_{CB}=500V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	$h_{FE}1$	V_{CE}=5V, I_C=0.8A	15		50	
	$h_{FE}2$	V_{CE}=5V, I_C=4A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=4A, I_B=0.8A			1	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=4A, I_B=0.8A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		120		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.8A		18		MHz
Trun On Time	t_{on}	V_{CC}=200V			0.5	μS
Storage Time	t_S	5I_B1=−2.5I_B2=I_C=5A			3	μS
Fall Time	t_f	RL=40Ω			0.3	μS

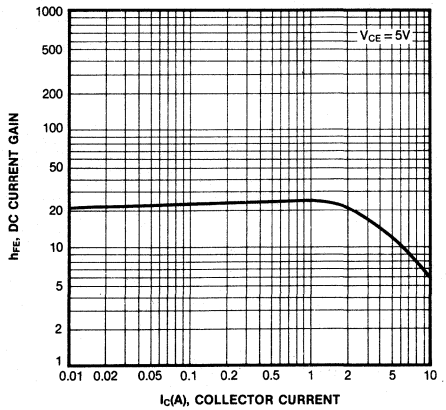
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE} 1	15-30	20-40	30-50

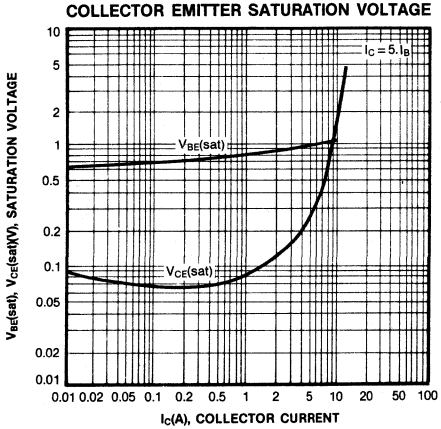
STATIC CHARACTERISTIC



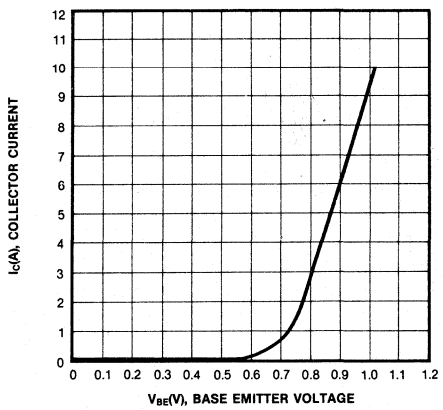
DC CURRENT GAIN



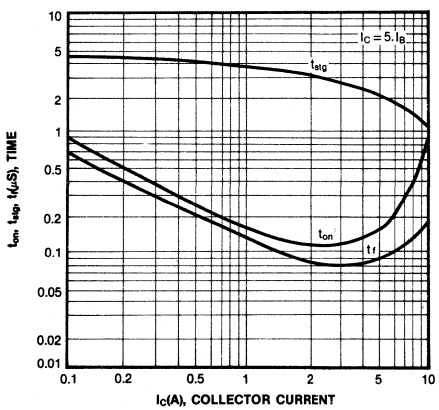
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



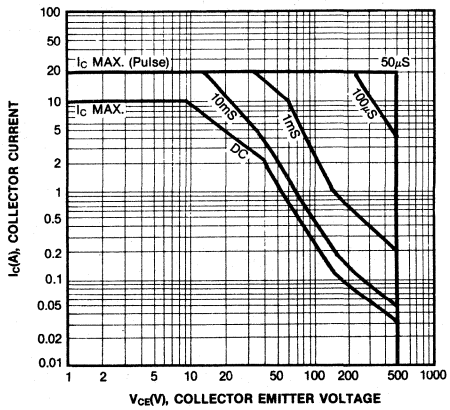
BASE EMITTER ON VOLTAGE



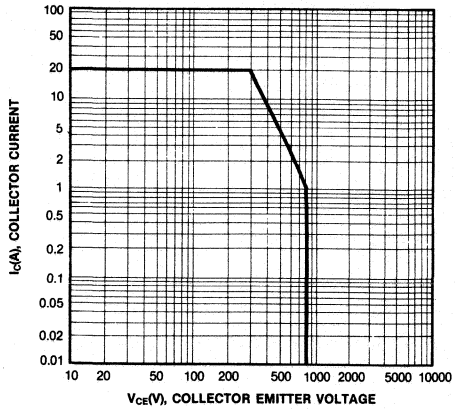
SWITCHING TIME



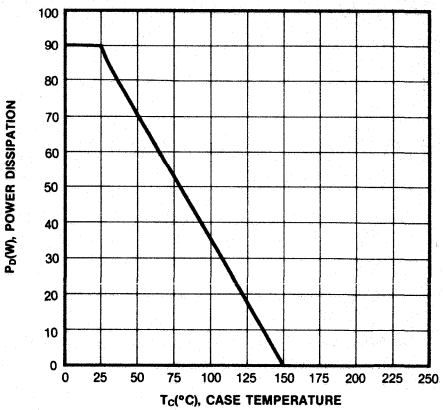
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING

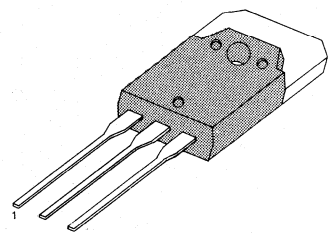


3

HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING
WIDE SOA

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	800	V
Collector-Emitter Voltage	V_{CEO}	500	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	15	A
Collector Current (Pulse)	I_C	25	A
Base Current	I_B	4	A
Collector Dissipation	P_C	100	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

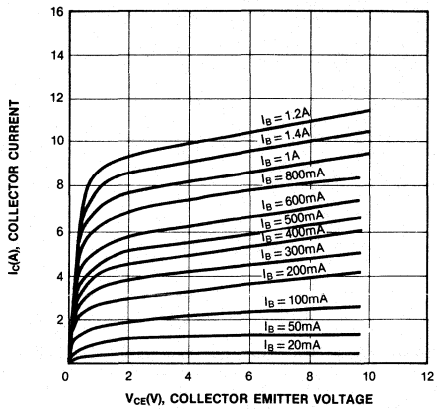
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	800			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	500			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=5A, I_B1=−I_B2=2A L=500μH, Clamped	500			V
Collector Cutoff Current	I_{CBO}	V_{CB}=500V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	$h_{FE}1$	V_{CE}=5V, I_C=1.2A	15		50	
	$h_{FE}2$	V_{CE}=5V, I_C=6A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=6A, I_B=1.2A			1	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=6A, I_B=1.2A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		160		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1.2A		18		MHz
Trun On Time	t_{on}	V_{CC}=200V			0.5	μS
Storage Time	t_S	5I_B1=−2.5I_B2=I_C=7A			3	μS
Fall Time	t_f	RL=28.6Ω			0.3	μS

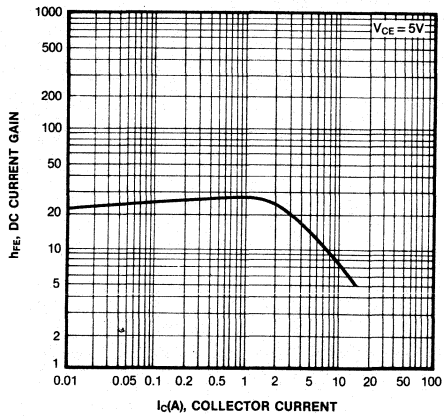
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE} 1	15-30	20-40	30-50

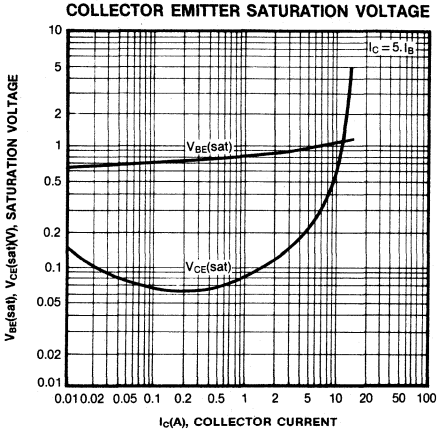
STATIC CHARACTERISTIC



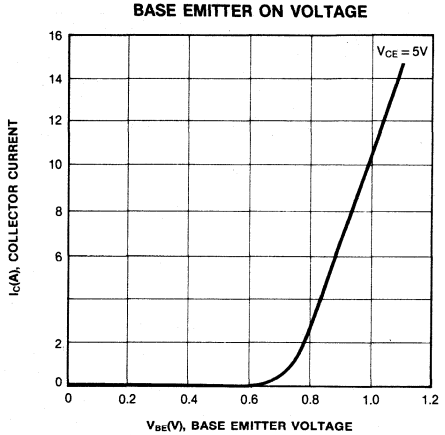
DC CURRENT GAIN



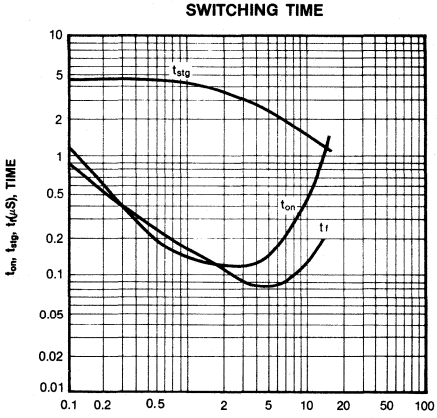
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



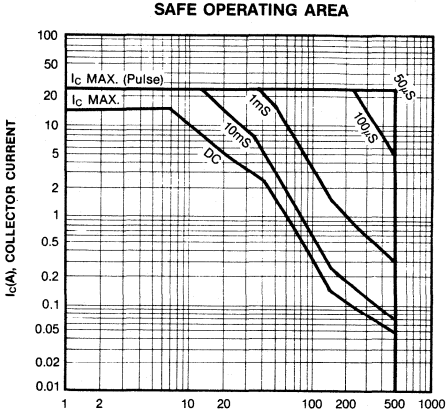
BASE EMITTER ON VOLTAGE



SWITCHING TIME



SAFE OPERATING AREA



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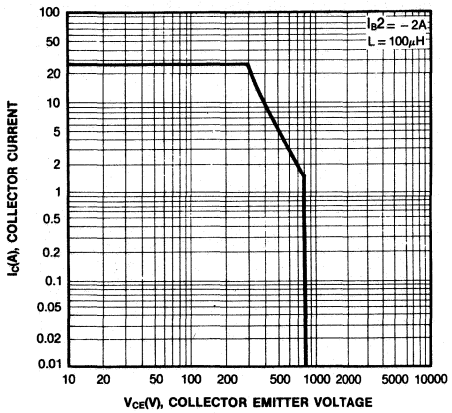
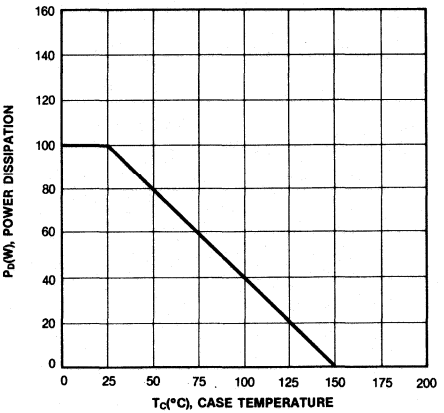
REVERSE BIAS SAFE OPERATING AREA



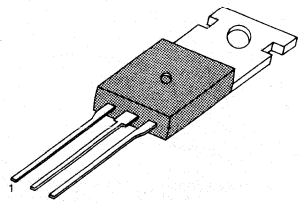
POWER DERATING



HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING
WIDE SOA

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1100	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	1.5	A
Collector Current (Pulse)	I_C	5	A
Base Current	I_B	0.8	A
Collector Dissipation	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

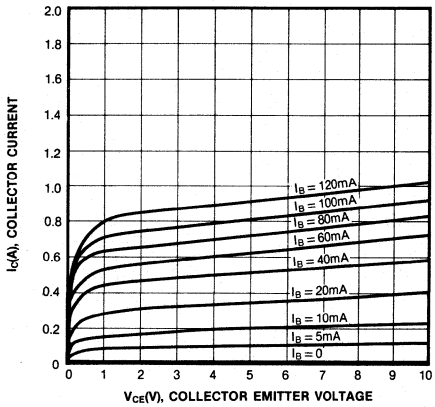
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	1100			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	800			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=0.75A				
		I_B1=−I_B2=0.15A	800			V
		L=5mH, Clamped				
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	$h_{FE}1$	V_{CE}=5V, I_C=0.1A	10		40	
	$h_{FE}2$	V_{CE}=5V, I_C=0.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=0.75A, I_B=0.15A			2	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=0.75A, I_B=0.15A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		35		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.1A		15		MHz
Trun On Time	t_{on}	V_{CC}=400V			0.5	μS
Storage Time	t_S	5I_B1=−2.5I_B2=I_C=1A			3	μS
Fall Time	t_f	RL=400Ω			0.3	μS

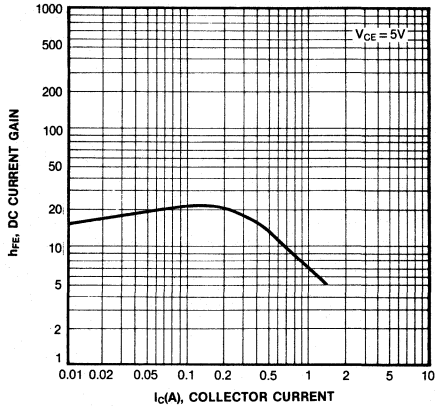
h_{FE} (1) CLASSIFICATION

Classification	N	R	O
h_{FE} 1	10-20	15-30	20-40

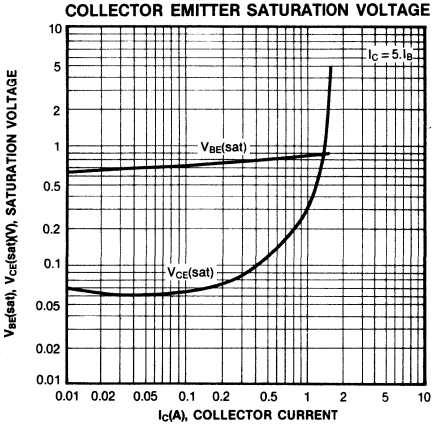
STATIC CHARACTERISTIC



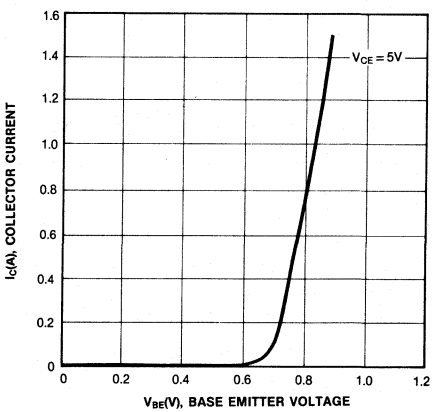
DC CURRENT GAIN



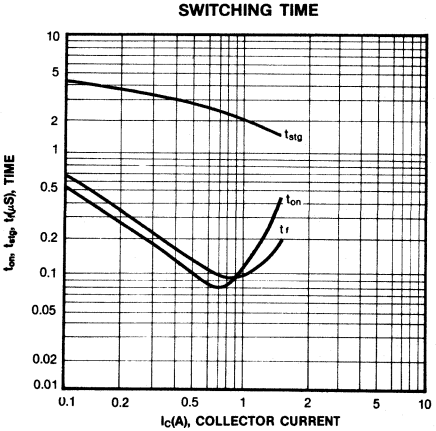
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



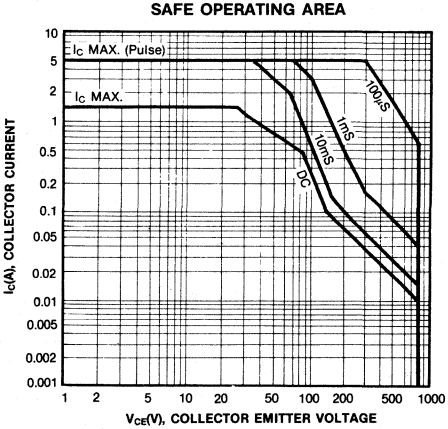
BASE EMITTER ON VOLTAGE



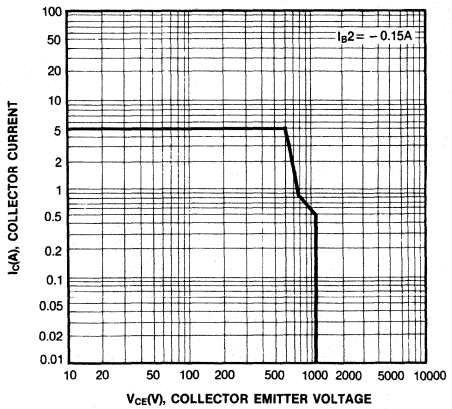
SWITCHING TIME



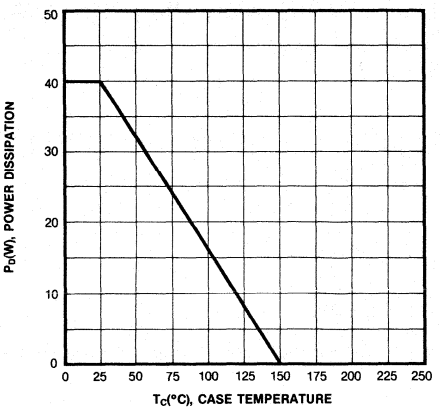
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



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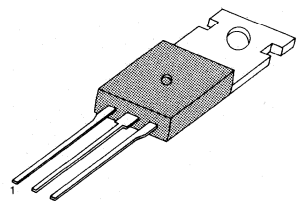
HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING
WIDE SOA

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1100	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	3	A
Collector Current (Pulse)	I_C	10	A
Base Current	I_B	1.5	A
Collector Dissipation	P_C	50	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

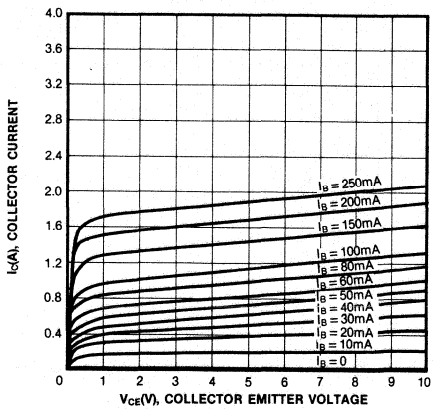
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	1100			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	800			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=1.5A, I_B1=−I_B2=0.3A L=2mH, Clamped	800			V
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	$h_{FE}1$	V_{CE}=5V, I_C=0.2A	10		40	
	$h_{FE}2$	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=1.5A, I_B=0.3A			2	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=1.5A, I_B=0.3A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		60		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.2A		15		MHz
Trun On Time	t_{on}	V_{CC}=400V			0.5	μS
Storage Time	t_S	5I_B1=−2.5I_B2=I_C=2A			3	μS
Fall Time	t_f	RL=200Ω			0.3	μS

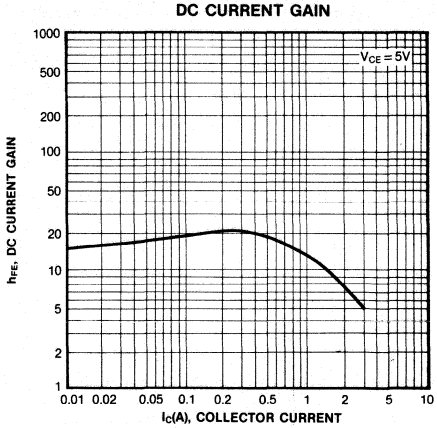
h_{FE} (1) CLASSIFICATION

Classification	N	R	O
h_{FE} 1	10-20	15-30	20-40

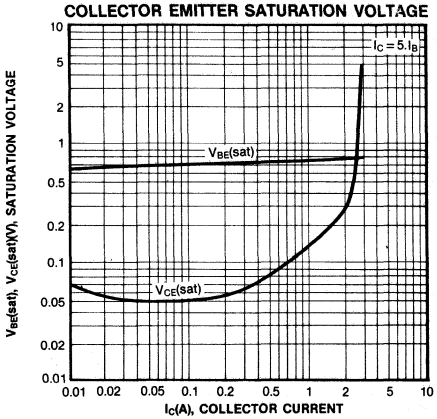
STATIC CHARACTERISTIC



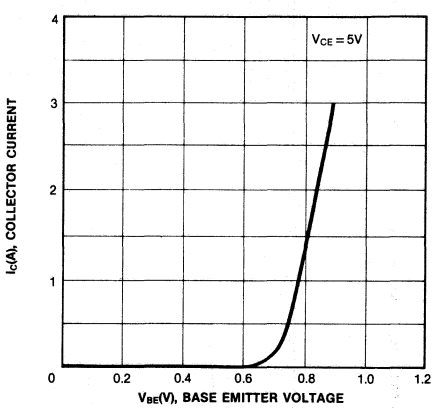
DC CURRENT GAIN



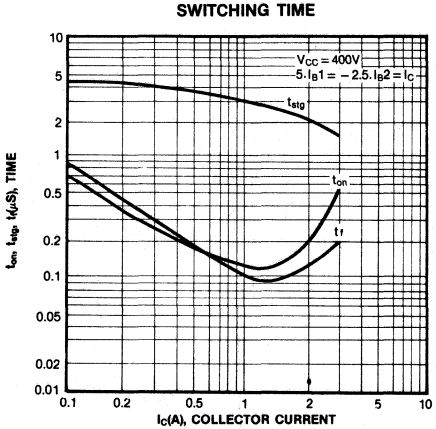
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



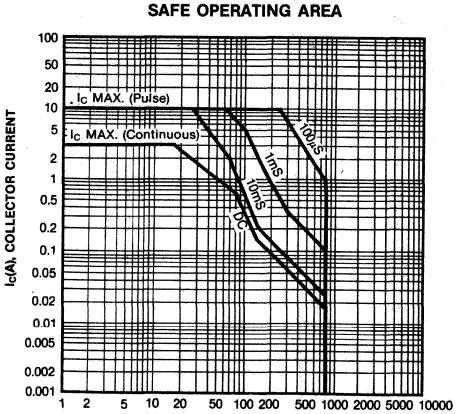
BASE EMITTER ON VOLTAGE



SWITCHING TIME



SAFE OPERATING AREA



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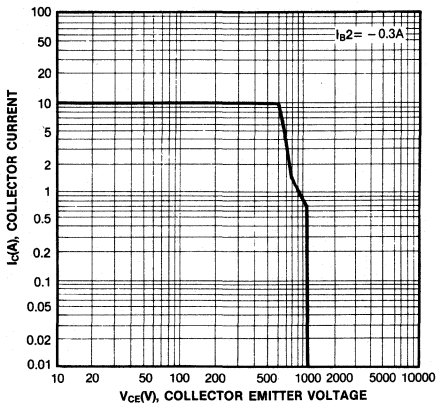
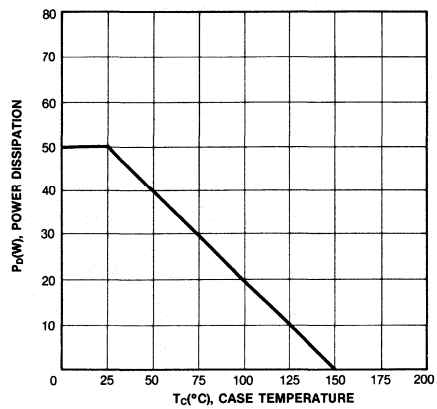
REVERSE BIAS SAFE OPERATING AREA



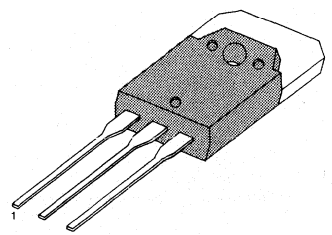
POWER DERATING



HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING
WIDE SOA

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1100	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	3	A
Collector Current (Pulse)	I_C	10	A
Base Current	I_B	1.5	A
Collector Dissipation	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

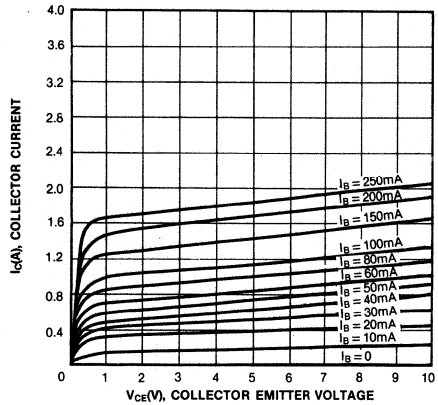
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	1100			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	800			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=1.5A, I_{B1}=−I_{B2}=0.3A L=2mH, Clamped	800			V
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	h_{FE}1	V_{CE}=5V, I_C=0.2A	10		40	
	h_{FE}2	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=1.5A, I_B=0.3A			2	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=1.5A, I_B=0.3A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		60		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.2A		15		MHz
Trun On Time	t_{on}	V_{CC}=400V			0.5	μS
Storage Time	t_S	5I_{B1}=−2.5I_{B2}=I_C=2A			3	μS
Fall Time	t_f	RL=200Ω			0.3	μS

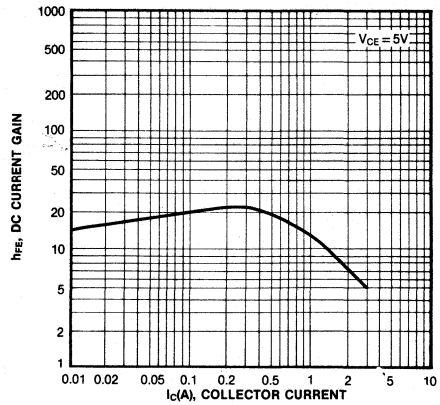
h_{FE} (1) CLASSIFICATION

Classification	N	R	O
h_{FE} 1	10-20	15-30	20-40

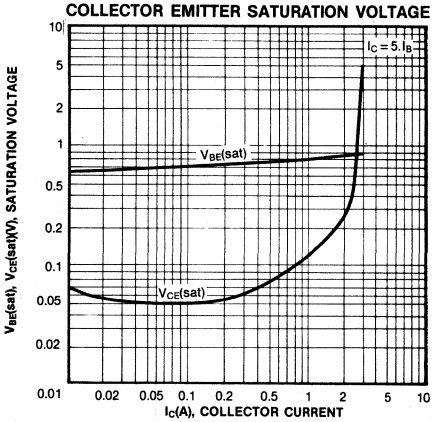
STATIC CHARACTERISTIC



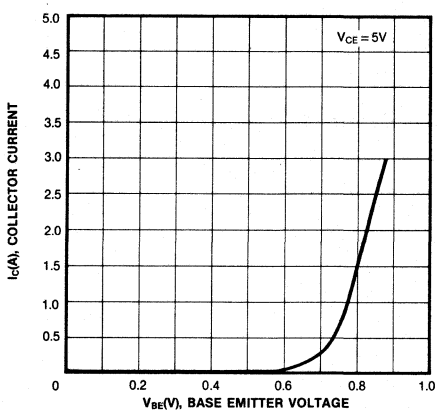
DC CURRENT GAIN



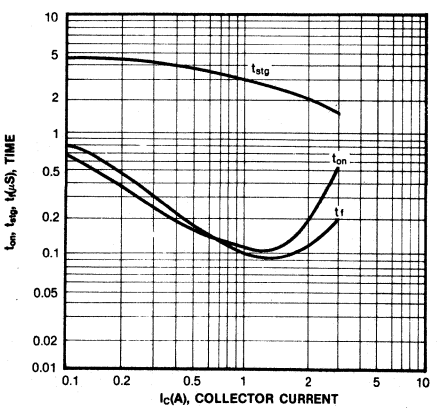
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



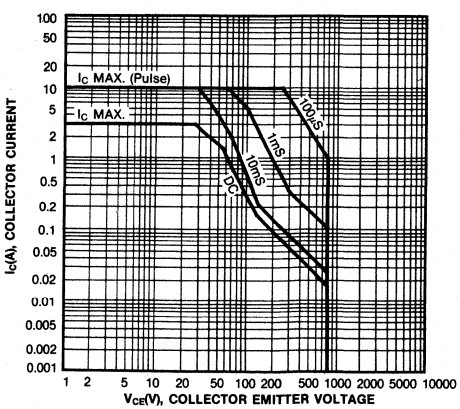
BASE EMITTER ON VOLTAGE



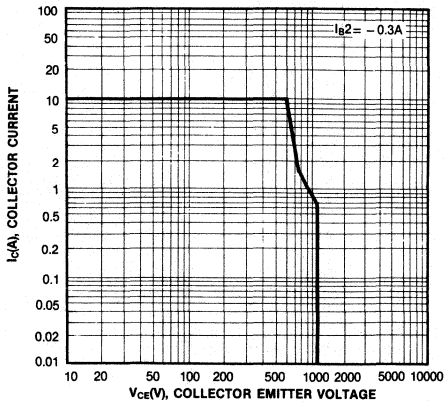
SWITCHING TIME



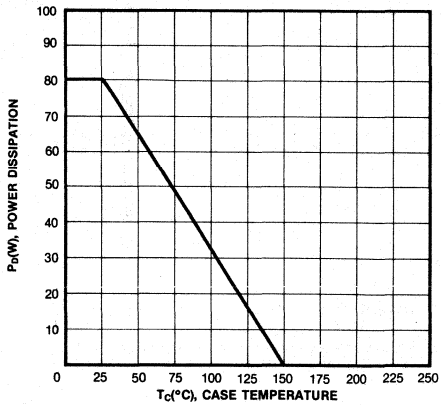
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING

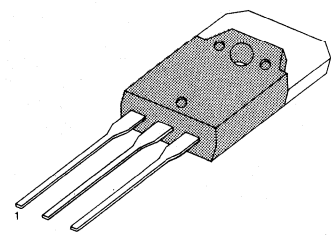


3

HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING
WIDE SOA

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1100	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	4.5	A
Collector Current (Pulse)	I_C	15	A
Base Current	I_B	2	A
Collector Dissipation	P_C	90	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

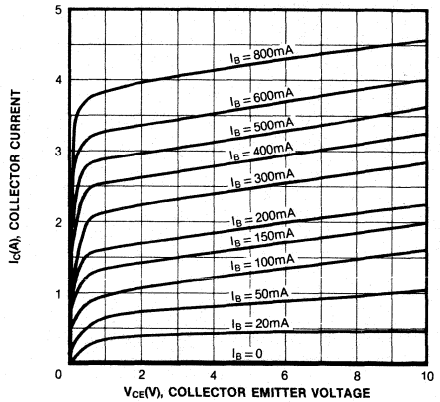
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	1100			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	800			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=2A, I_B1=−I_B2=0.4A L=2mH, Clamped	800			V
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	$h_{FE}1$	V_{CE}=5V, I_C=0.3A	10		40	
	$h_{FE}2$	V_{CE}=5V, I_C=1.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2A, I_B=0.4A			2	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=2A, I_B=0.4A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		90		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.3A		15		MHz
Trun On Time	t_{on}	V_{CC}=400V			0.5	μS
Storage Time	t_S	5I_B1=−2.5I_B2=I_C=3A			3	μS
Fall Time	t_f	RL=133Ω			0.3	μS

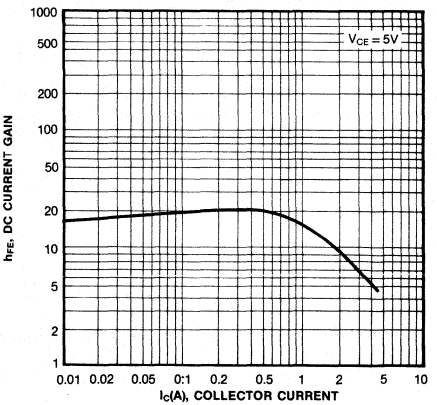
h_{FE} (1) CLASSIFICATION

Classification	N	R	O
h_{FE} 1	10-20	15-30	20-40

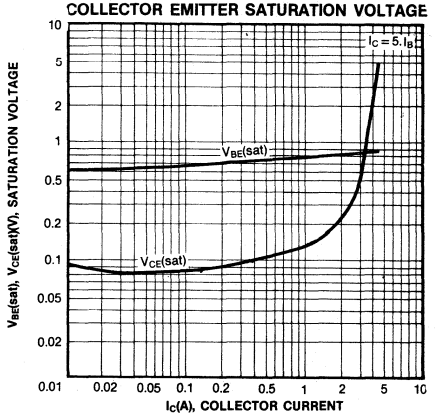
STATIC CHARACTERISTIC



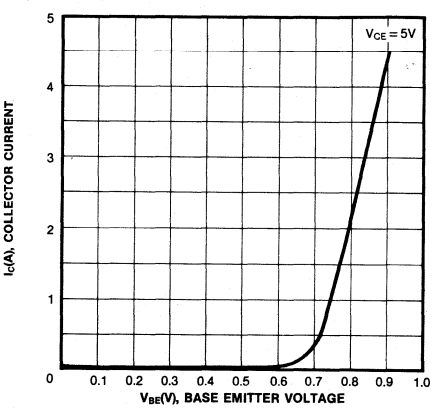
DC CURRENT GAIN



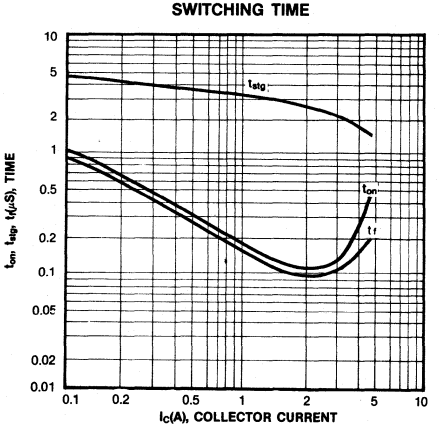
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



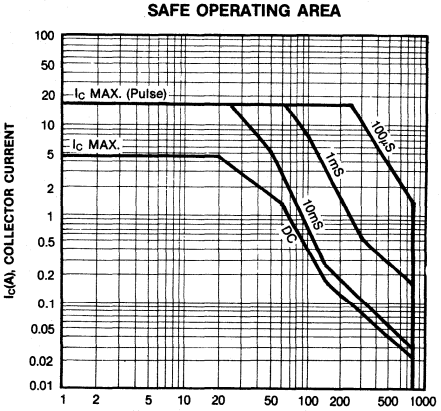
BASE EMITTER ON VOLTAGE



SWITCHING TIME



SAFE OPERATING AREA



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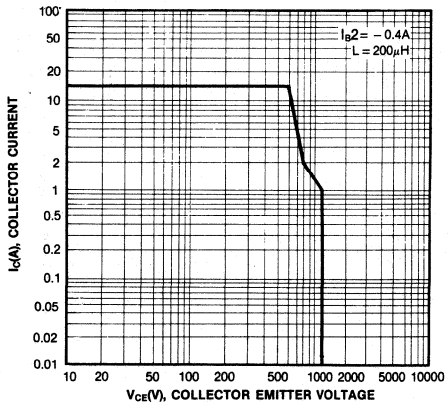
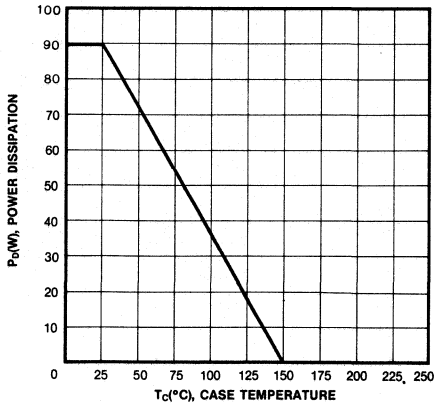
REVERSE BIAS SAFE OPERATING AREA



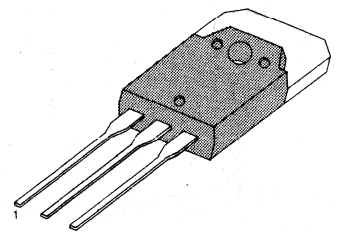
POWER DERATING



HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING
WIDE SOA

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1100	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	6	A
Collector Current (Pulse)	I_C	20	A
Base Current	I_B	3	A
Collector Dissipation	P_C	100	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

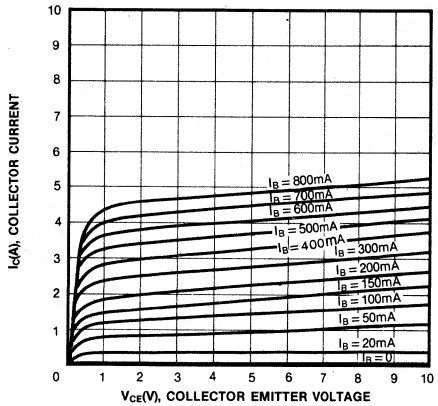
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	1100			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	800			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=3A, I_{B1}=−I_{B2}=0.6A L=1mH, Clamped	800			V
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	h_{FE}1	V_{CE}=5V, I_C=0.4A	10		40	
	h_{FE}2	V_{CE}=5V, I_C=2A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=3A, I_B=0.6A			2	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=3A, I_B=0.6A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		120		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.4A		15		MHz
Trun On Time	t_{on}	V_{CC}=400V			0.5	μS
Storage Time	t_S	5I_{B1}=−2.5I_{B2}=I_C=4A			3	μS
Fall Time	t_f	RL=100Ω			0.3	μS

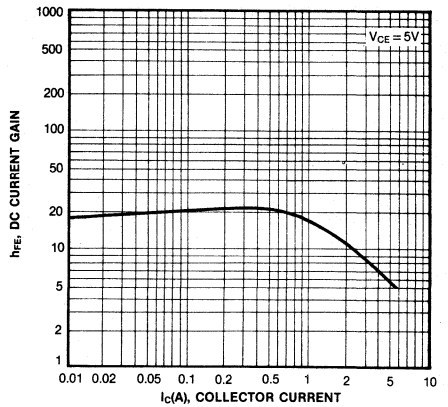
h_{FE} (1) CLASSIFICATION

Classification	N	R	O
h_{FE} 1	10-20	15-30	20-40

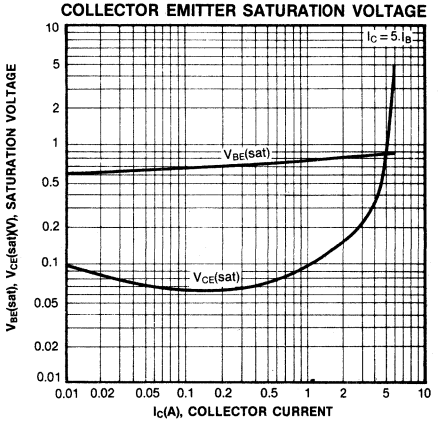
STATIC CHARACTERISTIC



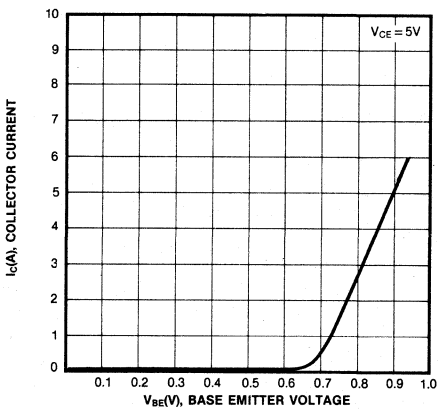
DC CURRENT GAIN



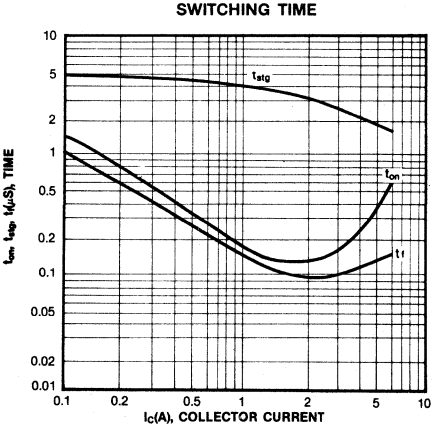
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



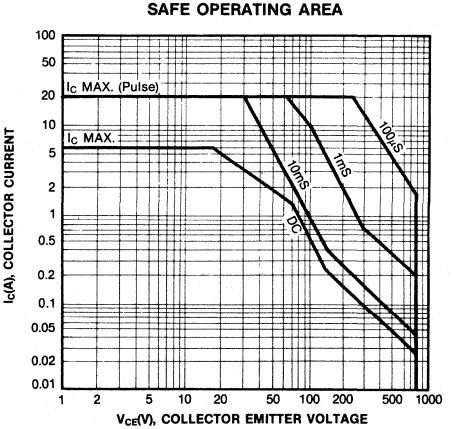
BASE EMITTER ON VOLTAGE



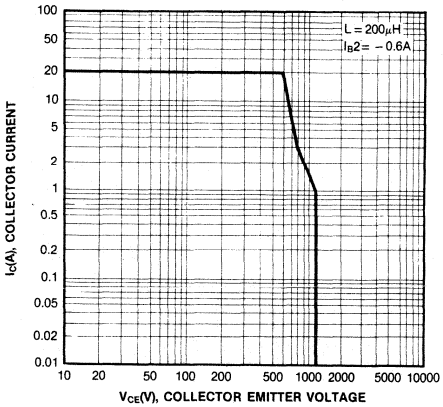
SWITCHING TIME



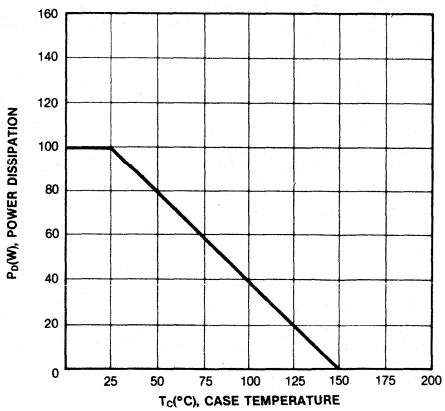
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING

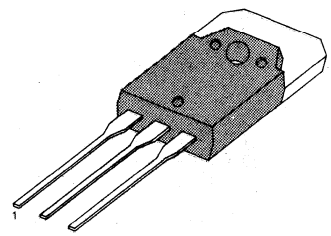


3

HIGH VOLTAGE AND HIGH RELIABILITY

HIGH SPEED SWITCHING
WIDE SOA

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1100	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	8	A
Collector Current (Pulse)	I_C	25	A
Base Current	I_B	4	A
Collector Dissipation	P_C	140	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

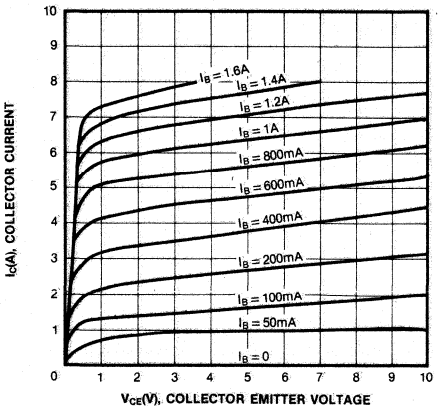
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	1100			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, R_{BE}=∞	800			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	7			V
Collector Emitter Sustaining Voltage	V_{CEX}(sus)	I_C=4A, $2I_{B1}=-I_{B2}$=0.8A L=1mH, Clamped	800			V
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			10	μA
DC Current Gain	$h_{FE}1$	V_{CE}=5V, I_C=0.6A	10		40	
	$h_{FE}2$	V_{CE}=5V, I_C=3A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=4A, I_B=0.8A			2	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=4A, I_B=0.8A			1.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		155		pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.6A		15		MHz
Trun On Time	t_{on}	V_{CC}=400V			0.5	μS
Storage Time	t_S	$5I_{B1}=-2.5I_{B2}=I_C$=6A			3	μS
Fall Time	t_f	RL=66.7Ω			0.3	μS

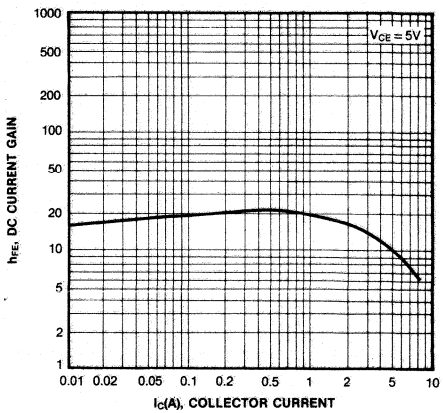
h_{FE} (1) CLASSIFICATION

Classification	N	R	O
h_{FE} 1	10-20	15-30	20-40

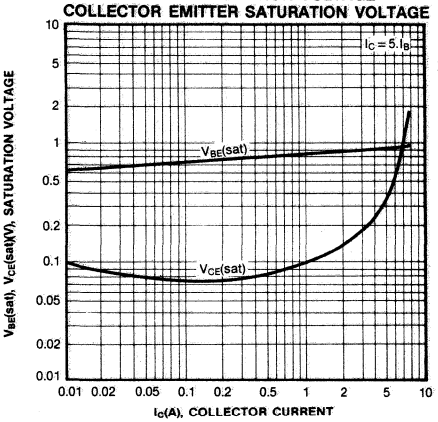
STATIC CHARACTERISTIC



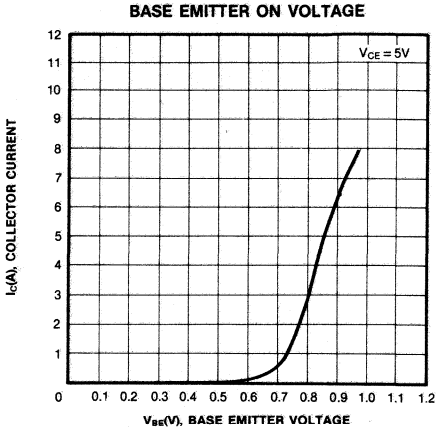
DC CURRENT GAIN



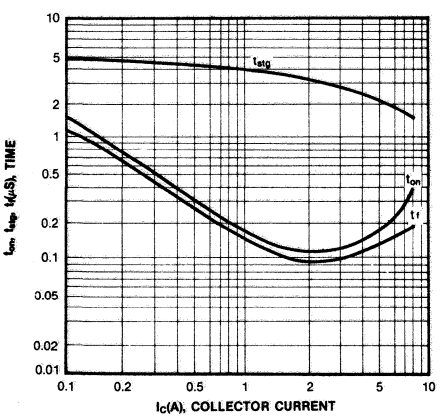
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



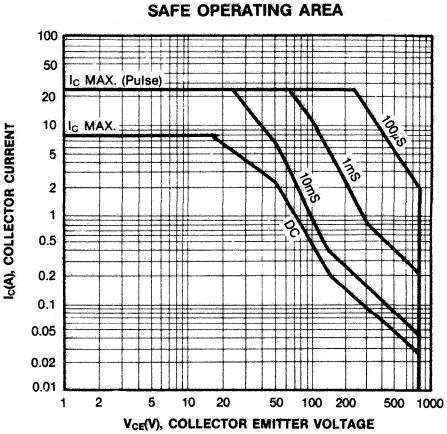
BASE EMITTER ON VOLTAGE



SWITCHING TIME



SAFE OPERATING AREA



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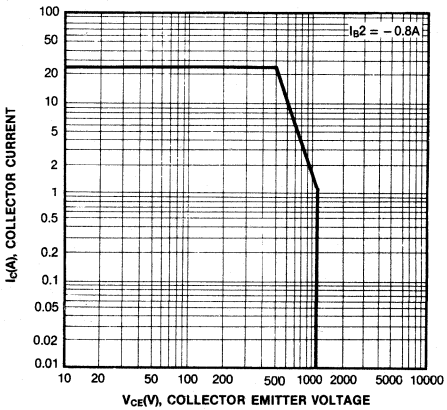
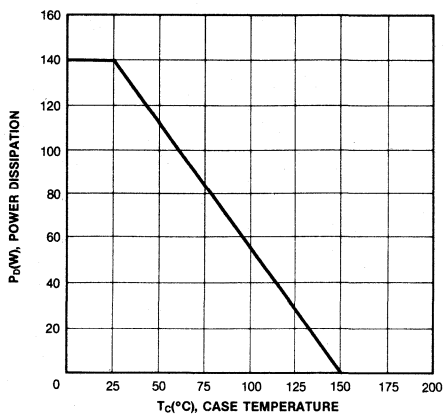
REVERSE BIAS SAFE OPERATING AREA



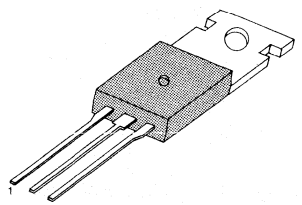
POWER DERATING



LOW FREQUENCY HIGH POWER AMPLIFIER

- **Collector-Base Voltage V_{CBO} = 100V**
- **Collector Current I_C = 5A**
- **Collector Dissipation P_C = 30W (T_C = 25°C)**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	100	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	5	A
Collector Dissipation (T_C = 25°C)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

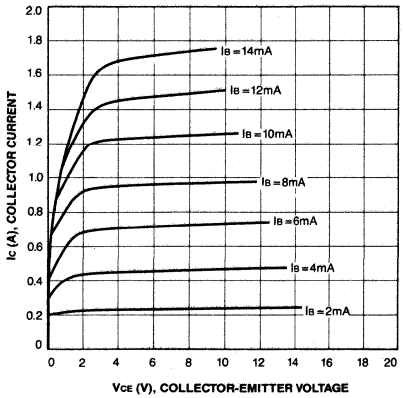
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 1mA, I_E = 0	100			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 20mA, I_B = 0	60			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = −1mA, I_C = 0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB} = 100V, I_E = 0			5	mA
DC Current Gain	h_{FE}	V_{CE} = 10V, I_C = 1.0A	70		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 5A, I_B = 0.5A			2.0	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C = 5A, I_B = 0.5A			1.5	V
Current-Gain Bandwidth Product	f_T	V_{CE} = 10V, I_C = 0.3A		20		MHz
Base-Emitter On Voltage	V_{BE} (on)	V_{CE} = 10V, I_C = 1.0A		0.75		V

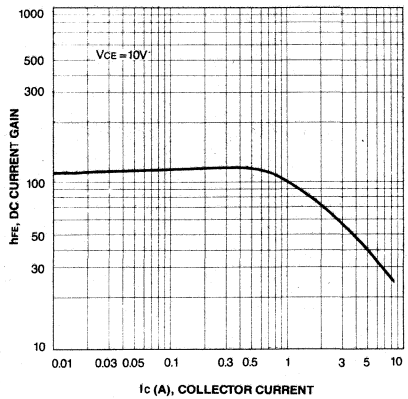
h_{FE} CLASSIFICATION

Classification	O	Y
h_{FE}	70-140	120-240

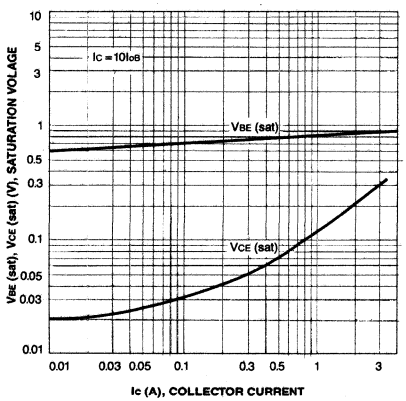
STATIC CHARACTERISTIC



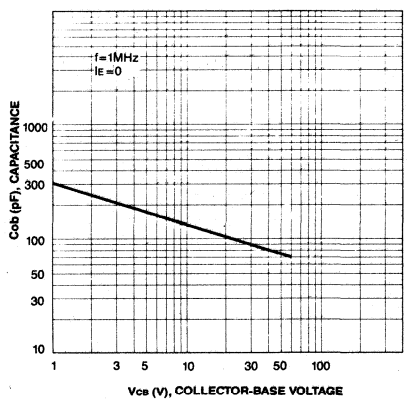
DC CURRENT GAIN



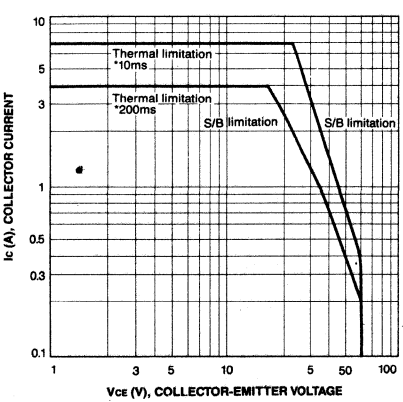
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



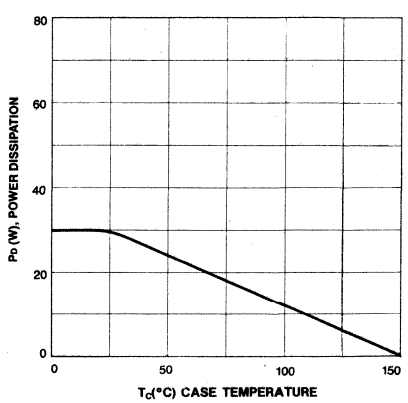
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



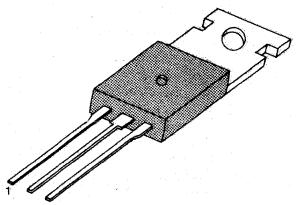
POWER DERATING



POWER REGULATOR
LOW FREQUENCY POWER AMPLIFIER

- Complement to KSA614
- Collector-Base Voltage V_{CBO}=80V
- Collector Dissipation P_C=25W (T_C=25°C)

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	80	V
Collector-Emitter Voltage	V_{CEO}	55	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	3	A
Collector Dissipation (T_C=25°C)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

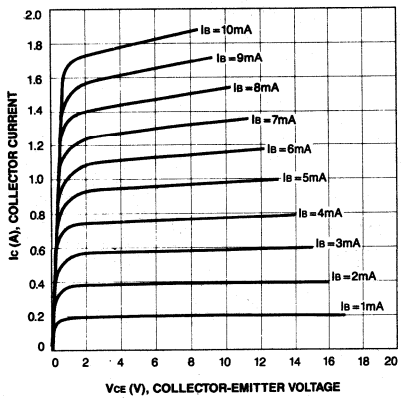
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=500μA, I_E=0	80			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	55			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−500μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=50V, I_E=0			50	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1A, I_B=0.1A			1	V

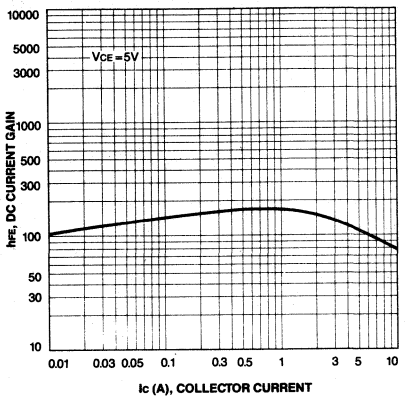
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

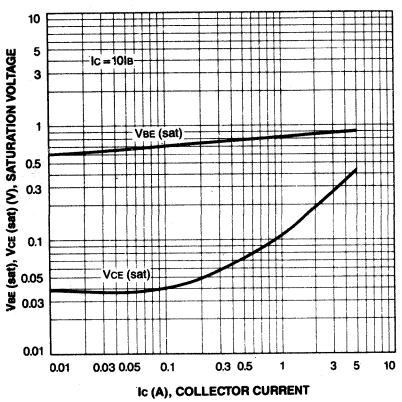
STATIC CHARACTERISTIC



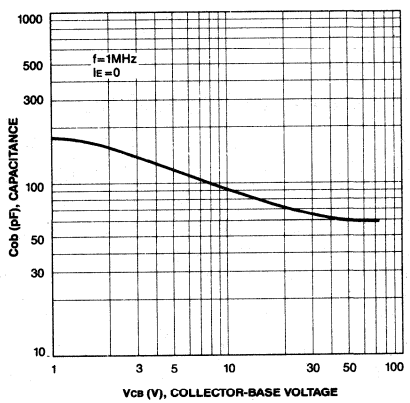
DC CURRENT GAIN



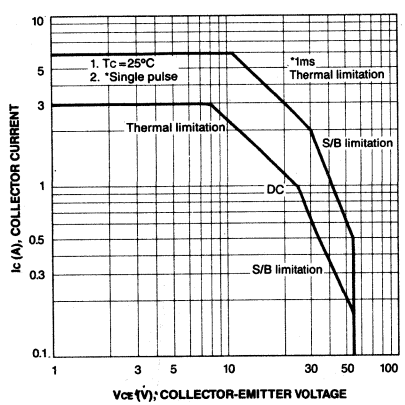
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



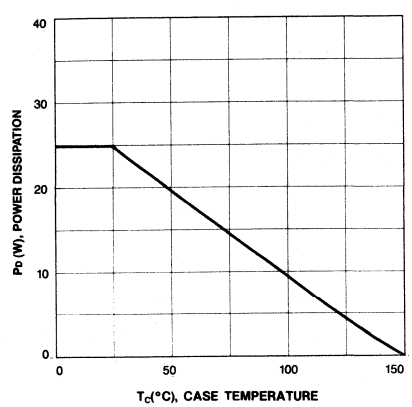
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



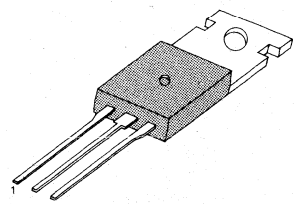
POWER DERATING



B/W TV HORIZONTAL DEFLECTION OUTPUT

- **Collector-Base Voltage V_{CBO} = 150V**
- **Collector Current I_C = 5A**
- **Collector Dissipation P_C = 40W (T_C = 25°C)**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	150	V
Collector-Emitter Voltage	V_{CEO}	70	V
Emitter-Base Voltage	V_{EBO}	8	V
Collector Current	I_C	5	A
Collector Dissipation (T_C = 25°C)	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

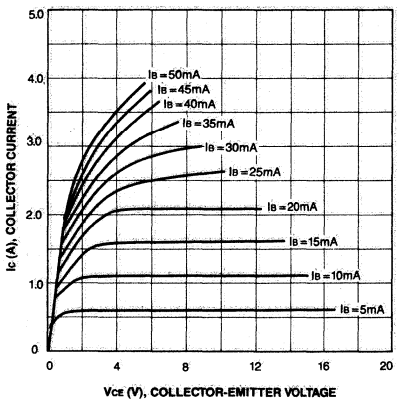
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 1mA, I_E = 0	150			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 20mA, R_{BE} = ∞	70			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 1mA, I_C = 0	8			V
Collector Cutoff Current	I_{CBO}	V_{CB} = 100V, I_E = 0			20	μA
DC Current Gain	h_{FE}	V_{CE} = 5V, I_C = 5A	20		140	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 5A, I_B = 0.5A			1	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C = 5A, I_B = 0.5A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE} = 5V, I_C = 0.5A		10		MHz

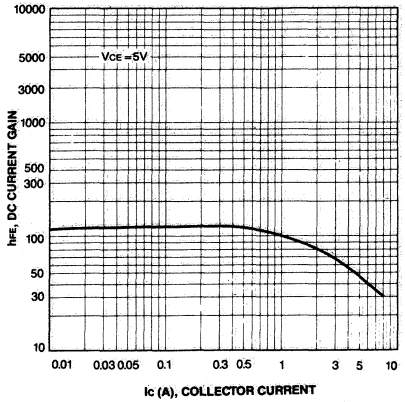
h_{FE} CLASSIFICATION

Classification	N	R	O
h_{FE}	20-50	40-80	70-140

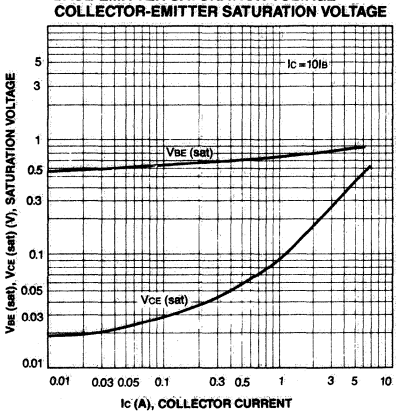
STATIC CHARACTERISTIC



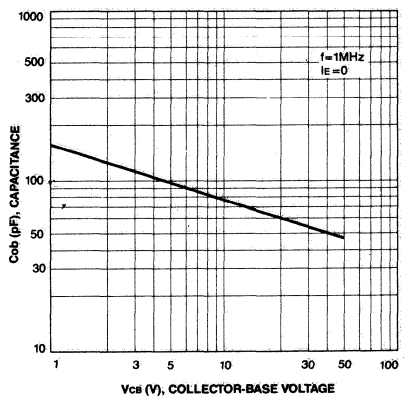
DC CURRENT GAIN



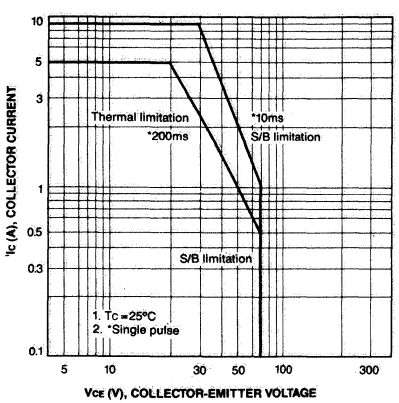
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



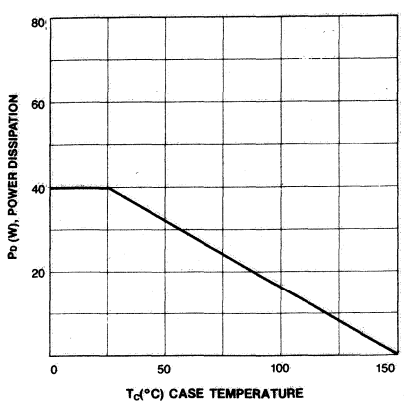
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



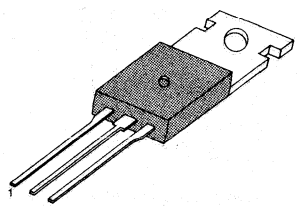
POWER DERATING



B/W TV HORIZONTAL DEFLECTION OUTPUT

- **Collector-Base Voltage V_{CBO}=300V**
- **Collector Current I_C=6A**
- **Collector Dissipation P_C=40W (T_C=25°C)**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	300	V
Collector-Emitter Voltage	V_{CEO}	120	V
Emitter-Base Voltage	V_{EBO}	8	V
Collector Current	I_C	6	A
Collector Dissipation (T_C=25°C)	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

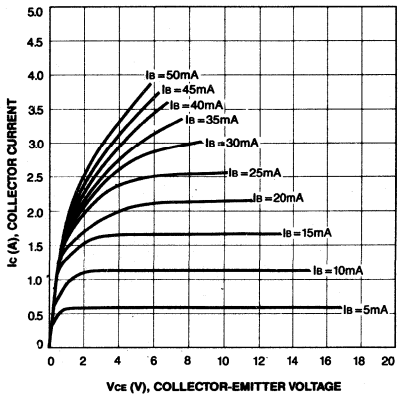
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	300			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=20mA, I_B=0	120			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−1mA, I_C=0	8			V
Collector Cut-off Current	I_{CBO}	V_{CB}=250V, I_E=0			1	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1A	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1A, I_B=0.1A			1	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=1A, I_B=0.1A			1.5	V
Current Gain-Band width Product	f_T	V_{CE}=5V, I_C=0.5A		10		MHz

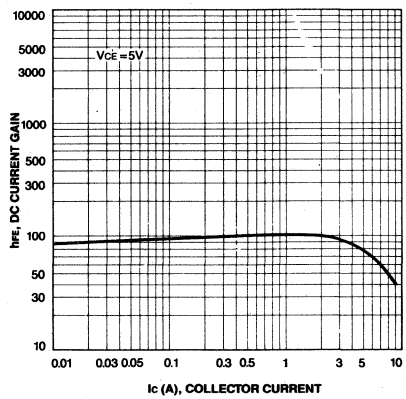
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

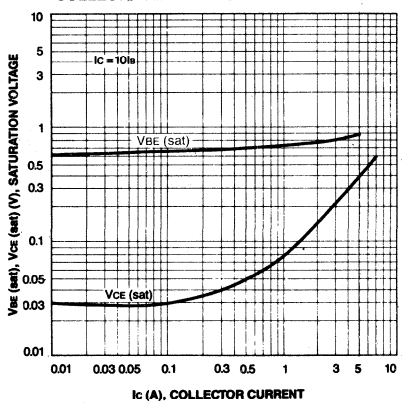
STATIC CHARACTERISTIC



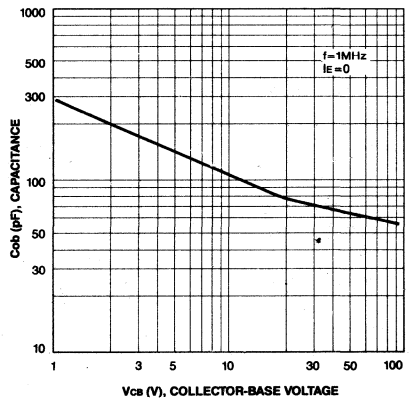
DC CURRENT GAIN



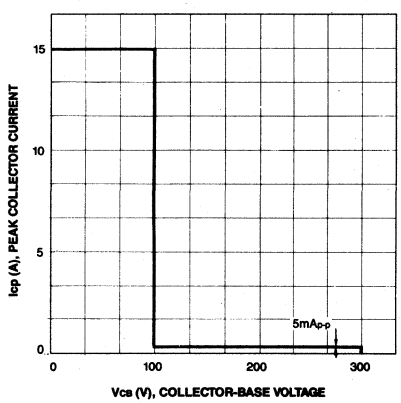
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



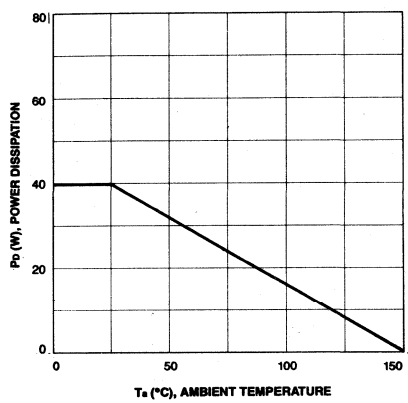
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA
(On HORIZONTAL DEFLECTION OUTPUT CIRCUIT)



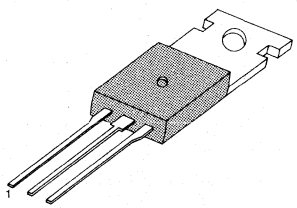
POWER DERATING



TV VERTICAL DEFLECTION OUTPUT

- **Complement to KSB546**
- **Collector-Base Voltage V_{CBO}=200V**
- **Collector Current I_C=2A**
- **Collector Dissipation P_C=25W (T_C=25°C)**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	200	V
Collector-Emitter Voltage	V_{CEO}	150	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	2	A
Collector Dissipation (T_C=25°C)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

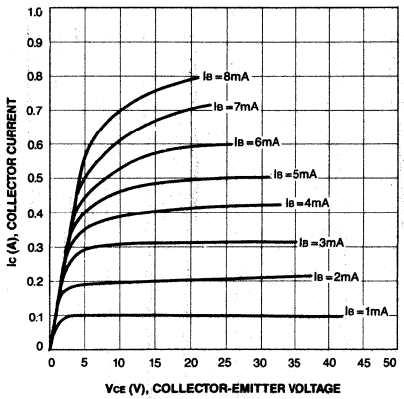
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=500μA, I_E=0	200			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	150			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−500μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=150V, I_E=0			50	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=0.4A	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=500mA, I_B=50mA			1	V
Current Gain-Band width Product	f_T	V_{CE}=10V, I_C=0.4A		5		MHz

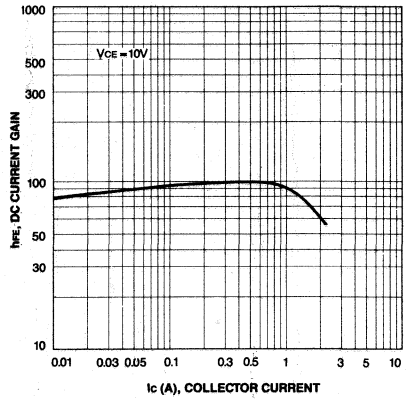
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

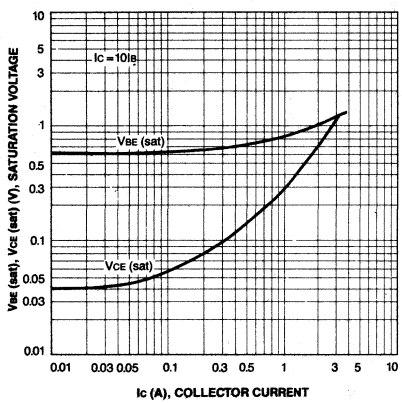
STATIC CHARACTERISTIC



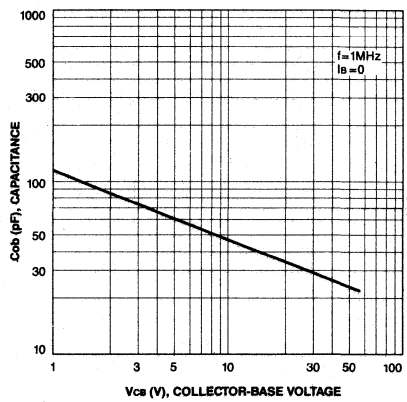
DC CURRENT GAIN



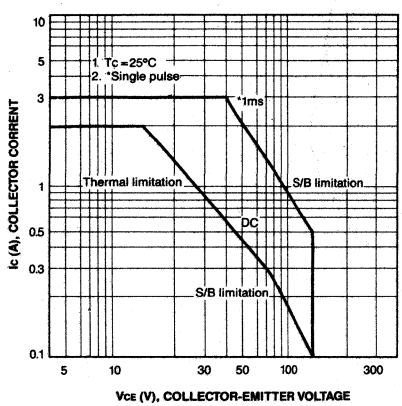
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



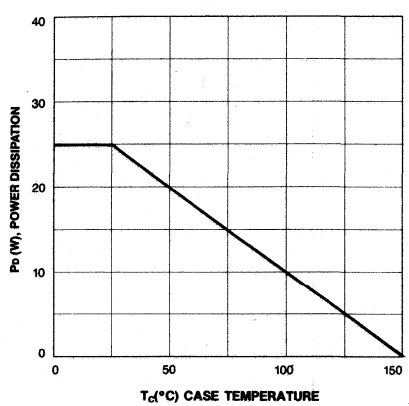
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



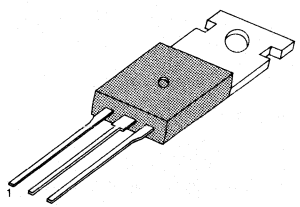
POWER DERATING



POWER AMPLIFIER APPLICATIONS

- **Complement to KSB596**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	80	V
Collector-Emitter Voltage	V_{CEO}	80	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	4	A
Base Current	I_B	0.4	A
Collector Dissipation (T_c=25°C)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

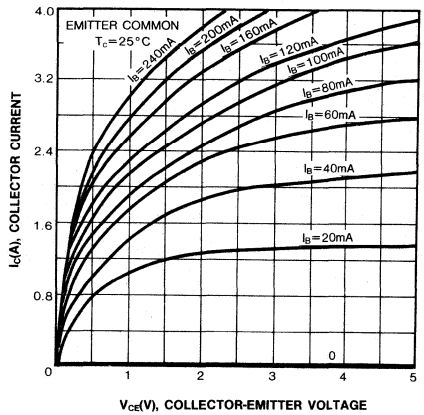
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=80V, I_E=0			30	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			100	μA
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=50mA, I_B=0	80			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=10mA, I_C=0	5			V
DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=0.5A	40		240	
	h_{FE2}	V_{CE}=5V, I_C=3A	15	50		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=3A, I_B=0.3A		0.45	1.5	V
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=3A		1	1.5	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=0.5A	3	8		MHz
Collector Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz		90		pF

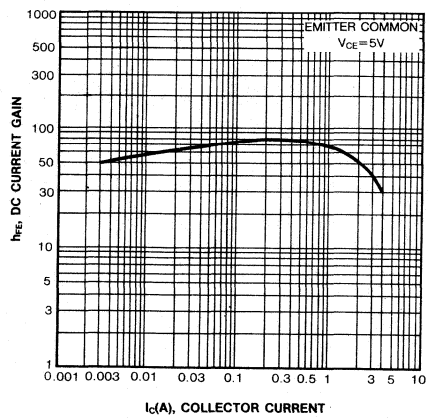
h_{FE}(1) CLASSIFICATION

Classification	R	O	Y
h_{FE}(1)	40-80	70-140	120-240

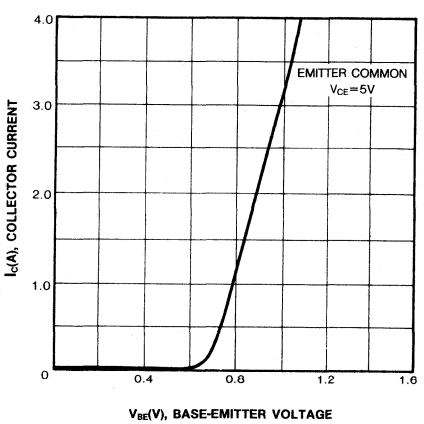
STATIC CHARACTERISTIC



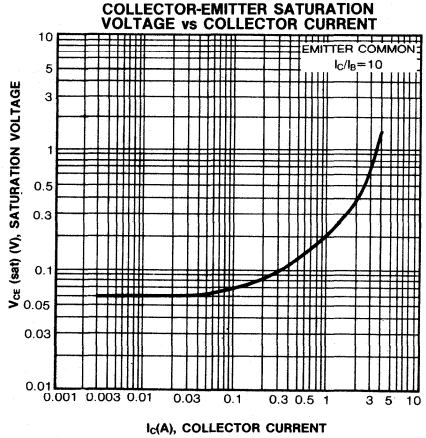
DC CURRENT GAIN



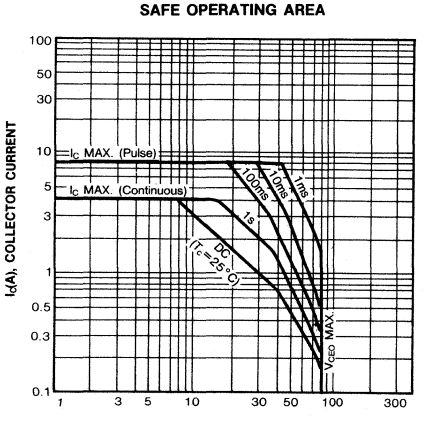
BASE-EMITTER ON VOLTAGE



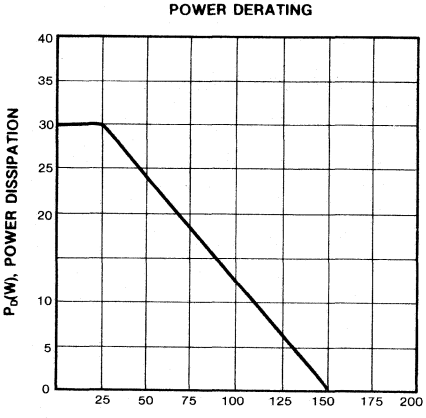
COLLECTOR-EMITTER SATURATION VOLTAGE vs COLLECTOR CURRENT



SAFE OPERATING AREA



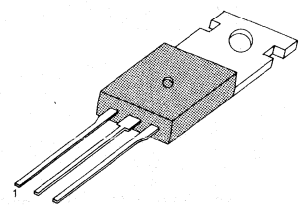
POWER DERATING



LOW FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING
INDUSTRIAL USE

- **Complement to KSB601**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	150	V
Collector-Emitter Voltage	V_{CEO}	100	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	±5	A
*Collector Current (Pulse)	I_C	±8	A
Base Current	I_B	0.5	A
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Collector Dissipation (T_c=25°C)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle ≤50%

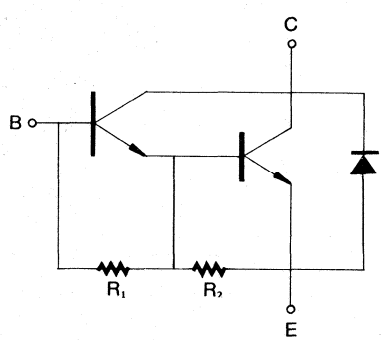
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=100V, I_E=0			1	μA
*DC Current Gain	h_{FE1}	V_{CE}=2V, I_C=3A	2000	6000	15000	
	h_{FE2}	V_{CE}=2V, I_C=5A	500			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=3A, I_B=3mA		0.9	1.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=3A, I_B=3mA		1.6	2	V
Turn On Time	ton	I_C=3A, RL=16.7Ω		1		μs
Storage Time	ts	I_B1=−I_B2=3mA		3.5		μs
Fall time	tf	V_{CC}≒50V		1.2		μs

*Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

h_{FE}(1) CLASSIFICATION

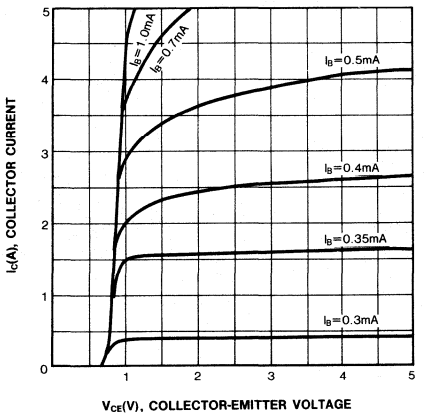
Classification	R	O	Y
$h_{FE\ (1)}$	2000-5000	3000-7000	5000-15000



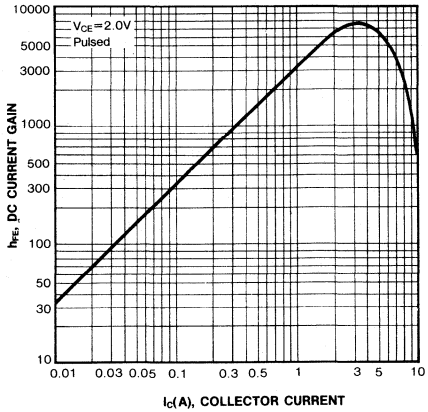
R_1≒3kΩ
R_2≒300Ω

NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

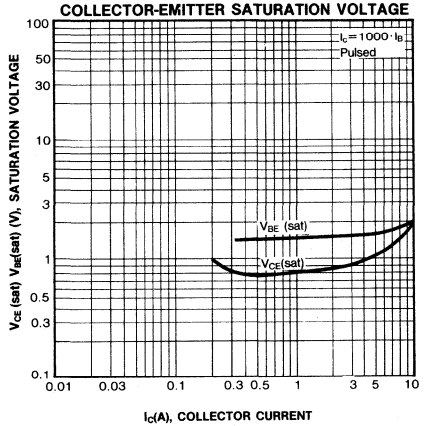
STATIC CHARACTERISTIC



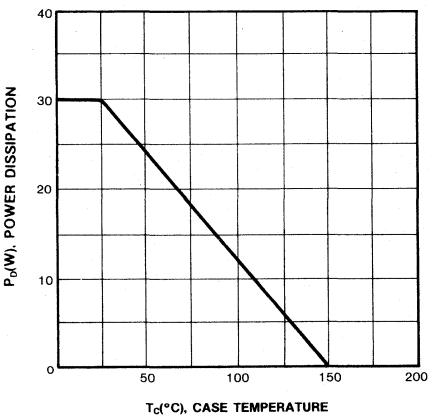
DC CURRENT GAIN



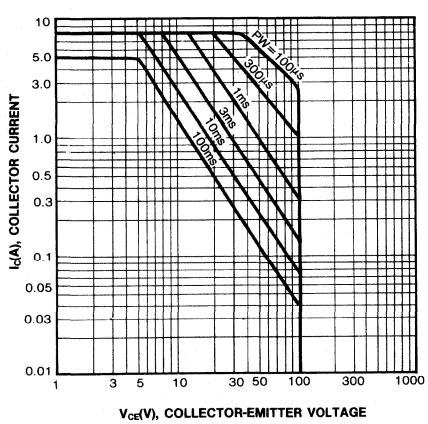
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



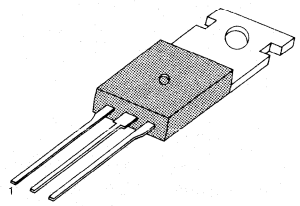
SAFE OPERATING AREA



LOW FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING
INDUSTRIAL USE

- **Complement to KSB707**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	100	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	7	A
*Collector Current (Pulse)	I_C	15	A
Base Current (DC)	I_B	3.5	A
Collector Dissipation (T_c=25°C)	P_C	40	W
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

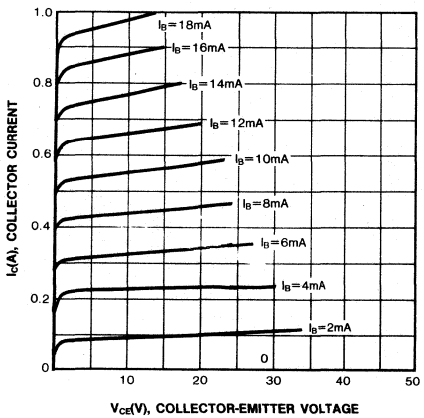
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=80V, I_E=0		10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		10	μA
*DC Current Gain	h_{FE1}	V_{CE}=1V, I_C=3A	40	200	
	h_{FE2}	V_{CE}=1V, I_C=5A	20		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=5A, I_B=0.5A		0.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=5A, I_B=0.5A		1.5	V

* Pulse Test: PW≤350μs, Duty Cycle≤2%

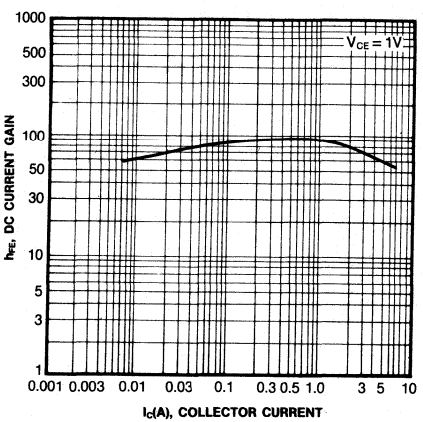
h_{FE} CLASSIFICATION

Classification	R	O	Y
$h_{FE}1$	40-80	60-120	100-200

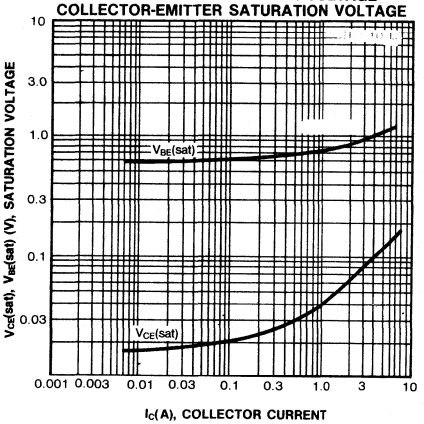
STATIC CHARACTERISTIC



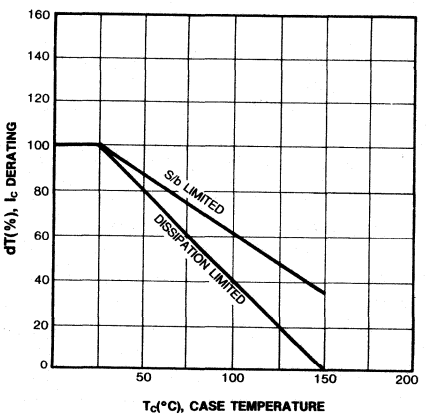
DC CURRENT GAIN



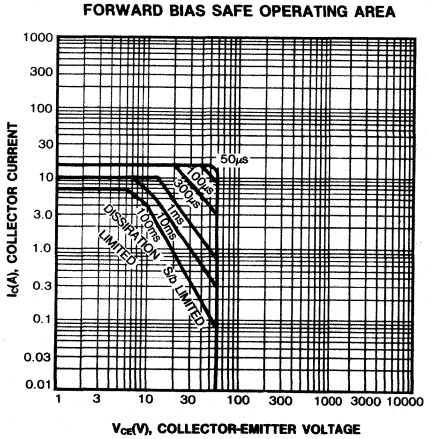
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



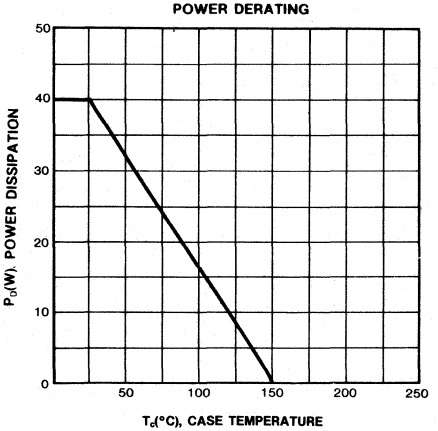
DERATING CURVE OF SAFE OPERATING AREAS



FORWARD BIAS SAFE OPERATING AREA



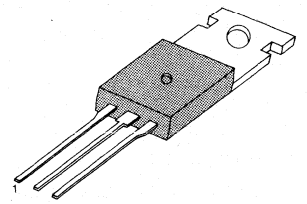
POWER DERATING



LOW FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING
INDUSTRIAL USE

- **Complement to KSB708**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	100	V
Collector-Emitter Voltage	V_{CEO}	80	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	7	A
*Collector Current (Pulse)	I_C	15	A
Base Current (DC)	I_B	3.5	A
Collector Dissipation (T_c=25°C)	P_C	40	W
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

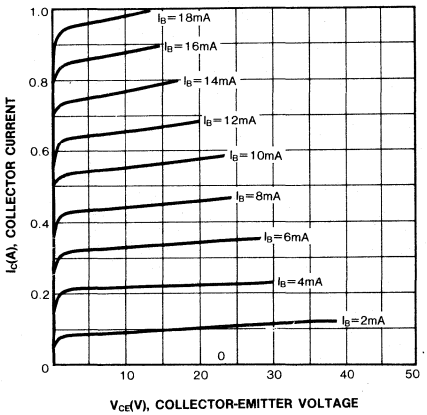
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=80V, I_E=0		10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		10	μA
*DC Current Gain	h_{FE1}	V_{CE}=1V, I_C=3A	40	200	
	h_{FE2}	V_{CE}=1V, I_C=5A	20		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=5A, I_B=0.5A		0.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=5A, I_B=0.5A		1.5	V

* Pulse Test: PW≤350μs, Duty Cycle≤2%

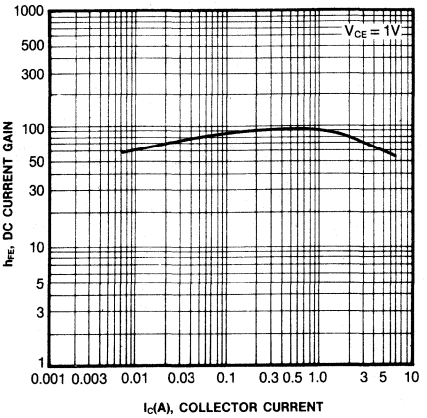
h_{FE} (1) CLASSIFICATION

Classification	R	O	Y
h_{FE} (1)	40-80	60-120	100-200

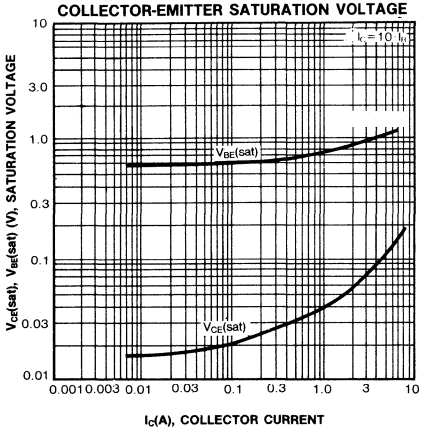
STATIC CHARACTERISTIC



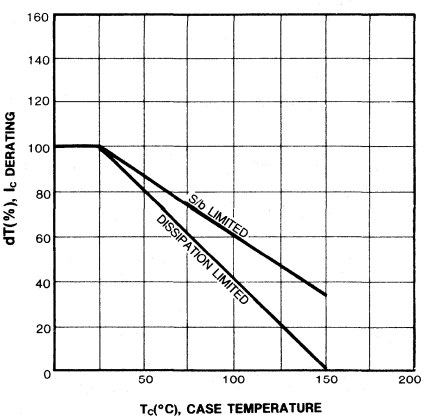
DC CURRENT GAIN



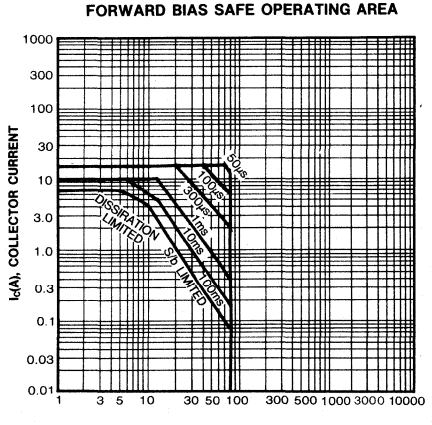
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



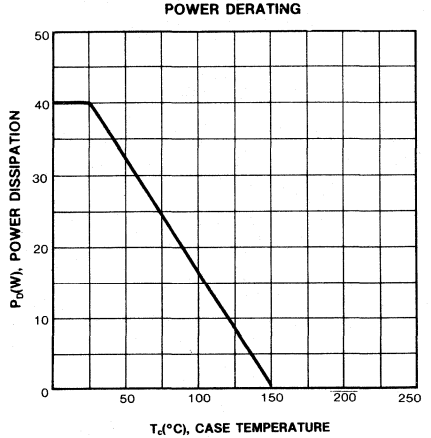
DERATING CURVE OF SAFE OPERATING AREAS



FORWARD BIAS SAFE OPERATING AREA



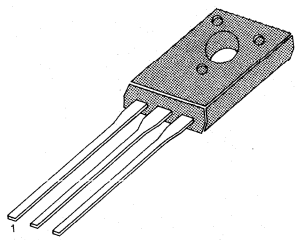
POWER DERATING



AUDIO FREQUENCY POWER AMPLIFIER

- **Complement to KSB744/KSB744A**

TO-126



1. Emitter 2. Collector 3 Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	70	V
Collector-Emitter Voltage : KSD794	V_{CEO}	45	V
: KSD794A		60	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	3	A
* Collector Current (Pulse)	I_C	5	A
Base Current (DC)	I_B	0.6	A
Collector Dissipation (T_a=25°C)	P_C	1	W
Collector Dissipation (T_c=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

* PW≤10ms, Duty Cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

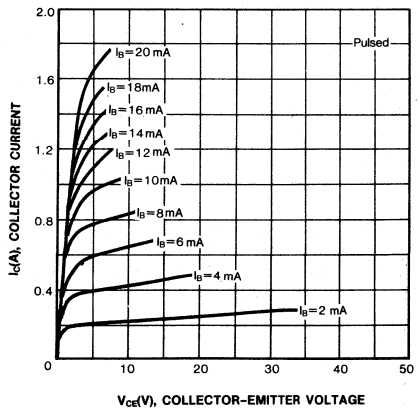
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=45V, I_E=0			1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0			1	μA
* DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=20mA	30	70		
	h_{FE2}	V_{CE}=5V, I_C=0.5A	60	100	320	
* Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=1.5A, I_B=0.15A		0.3	2	V
* Base Emitter Saturation Voltage	V_{BE} (sat)	I_C=1.5A, I_B=0.15A		0.8	2	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=0.1A		60		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz		40		pF

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

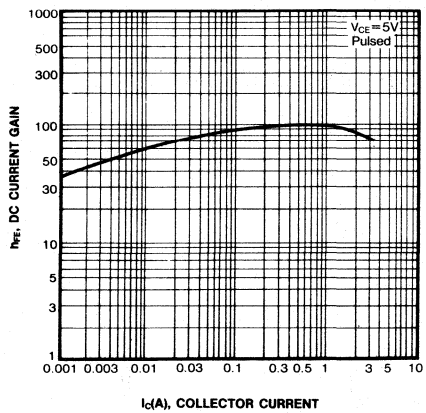
h_{FE} (2) CLASSIFICATION

Classification	R	O	Y
h_{FE} (2)	60-120	100-200	160-320

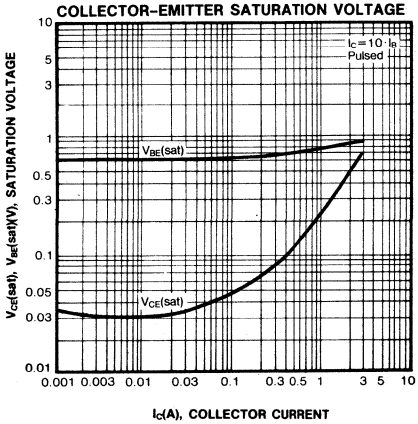
STATIC CHARACTERISTIC



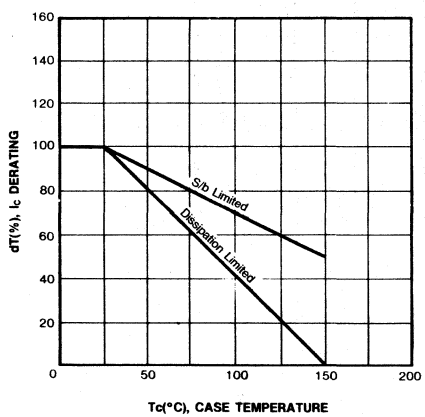
DC CURRENT GAIN



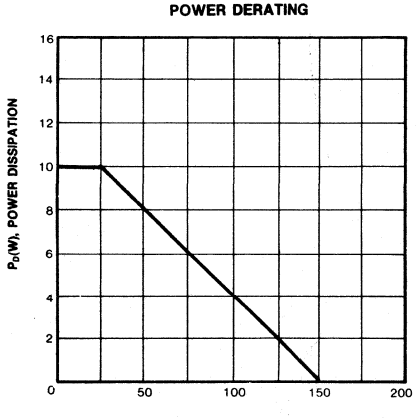
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



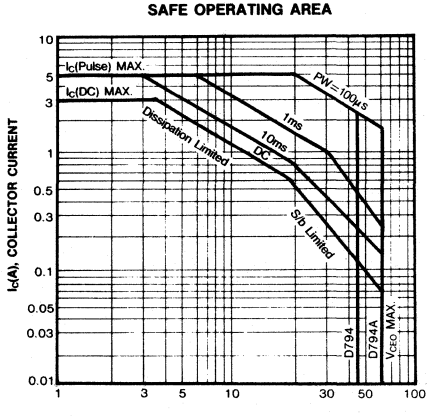
DERATING CURVE OF SAFE OPERATING AREAS



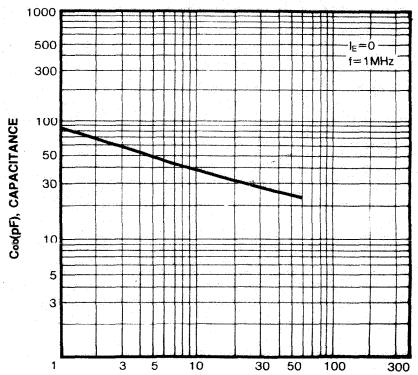
POWER DERATING



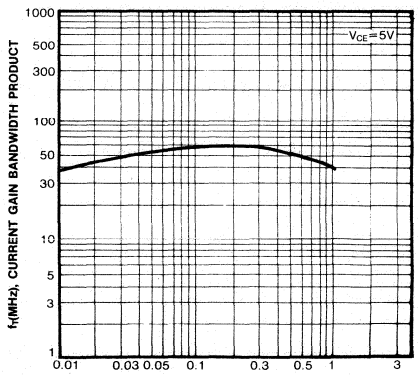
SAFE OPERATING AREA



COLLECTOR OUTPUT CAPACITANCE



CURRENT GAIN BANDWIDTH PRODUCT

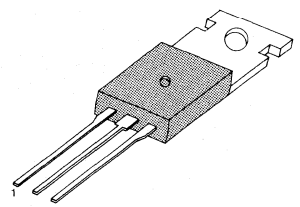


3

LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSB834**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	3	A
Base Current	I_B	0.3	A
Collector Dissipation (T_c=25°C)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

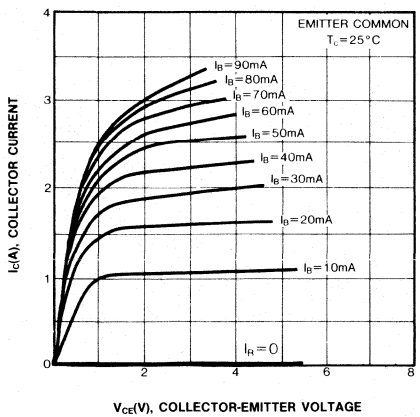
ELECTRICAL CHARACTERISTICS (T_c=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=60V, I_E=0			100	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=7V, I_C=0			100	μA
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=50mA, I_B=0	60			V
DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=0.5A	60		300	
	h_{FE2}	V_{CE}=5V, I_C=3A	20			
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=3A, I_B=0.3A		0.4	1	V
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=0.5A		0.7	1	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=0.5A		3		MHz
Collector Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz		70		pF
Turn on Time	ton	I_{B1}=−I_{B2}=0.2A		0.8		μs
Storage Time	ts	V_{CC}=30V		1.5		μs
Fall Time	tf			0.8		μs

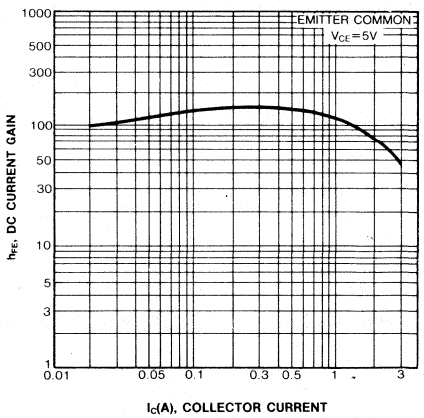
h_{FE}(1) CLASSIFICATION

Classification	O	Y	G
h_{FE}(1)	60-120	100-200	150-300

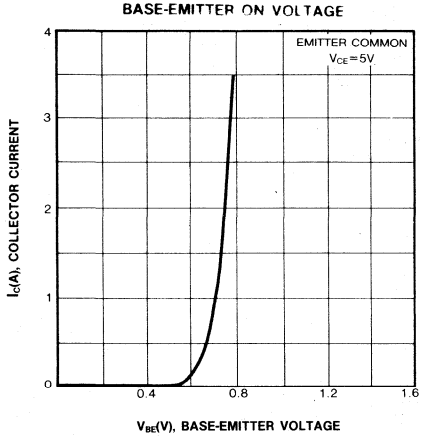
STATIC CHARACTERISTIC



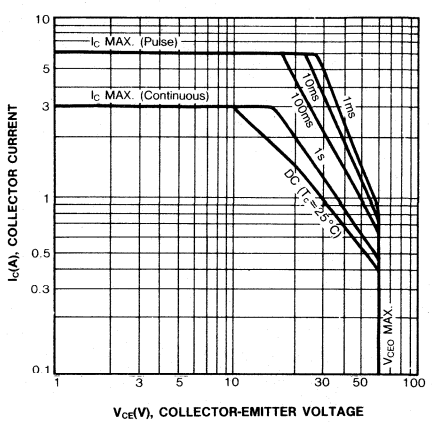
DC CURRENT GAIN



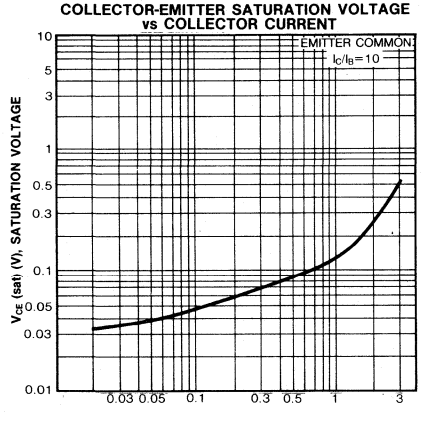
BASE-EMITTER ON VOLTAGE



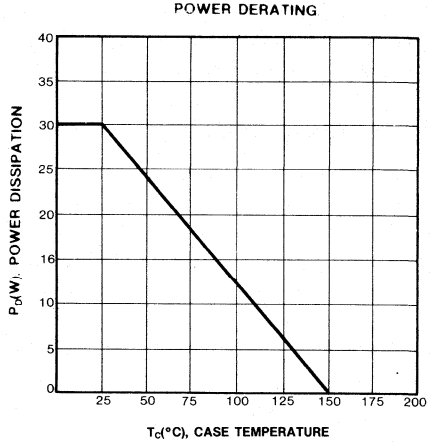
SAFE OPERATING AREA



COLLECTOR-EMITTER SATURATION VOLTAGE vs COLLECTOR CURRENT



POWER DERATING



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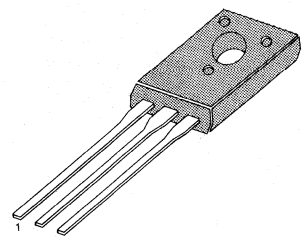
AUDIO FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING

- **Complement to KSB772**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	3	A
Collector Current (Pulse)	I_C	7	A
Base Current (DC)	I_B	0.6	A
Collector Dissipation (T_c=25°C)	P_C	10	W
Collector Dissipation (T_a=25°C)	P_C	1	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, Duty Cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

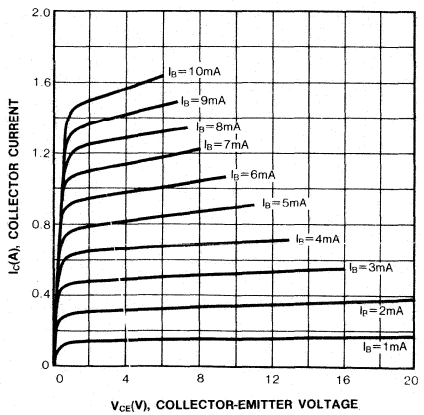
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0			1	μA
*DC Current Gain	h_{FE1}	V_{CE}=2V, I_C=20mA	30	150		
	h_{FE2}	V_{CE}=2V, I_C=1A	60	160	400	
*Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=2A, I_B=0.2A		0.3	0.5	V
*Base Emitter Saturation Voltage	V_{BE} (sat)	I_C=2A, I_B=0.2A		1.0	2.0	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_E=−0.1A		90		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		45		pF

* Pulse Test: PW≤350μs, Duty Cycle≤2%

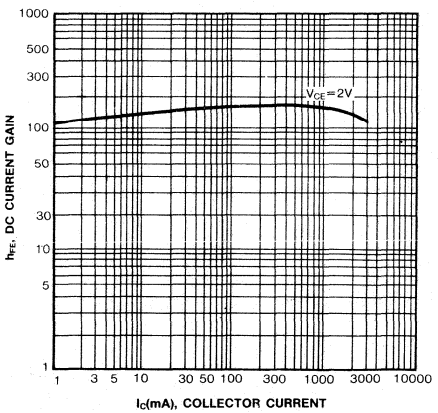
h_{FE}(2) CLASSIFICATION

Classification	R	O	Y	G
h_{FE}(2)	60-120	100-200	160-320	200-400

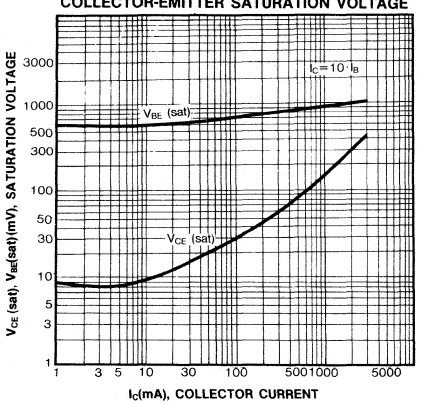
STATIC CHARACTERISTIC



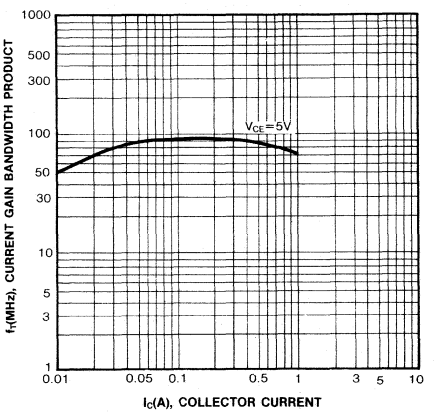
DC CURRENT GAIN



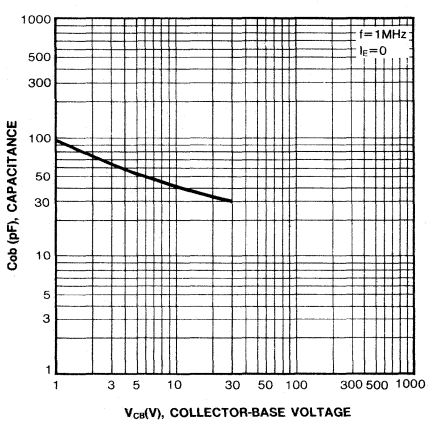
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



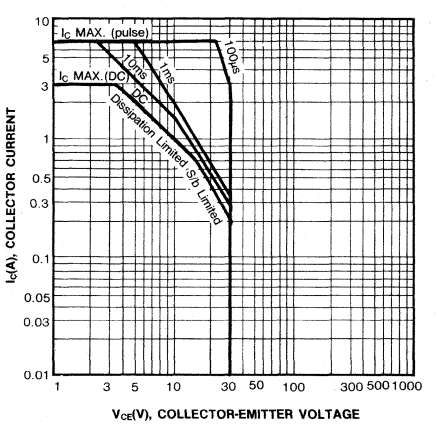
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



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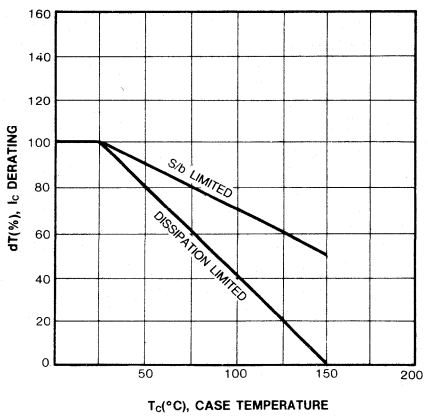
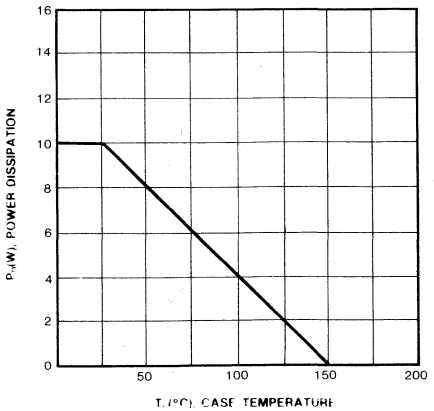
DERATING CURVE OF SAFE OPERATING AREAS



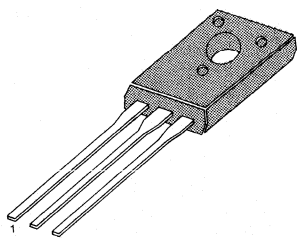
POWER DERATING



NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

LOW FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING
INDUSTRIAL USE

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	150	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	8.0	V
Collector Current (DC)	I_C	±1.5	A
*Collector Current (Pulse)	I_C	±3.0	A
Base Current (DC)	I_B	0.15	A
Collector Dissipation (T_a=25°C)	P_C	1.0	W
Collector Dissipation (T_c=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

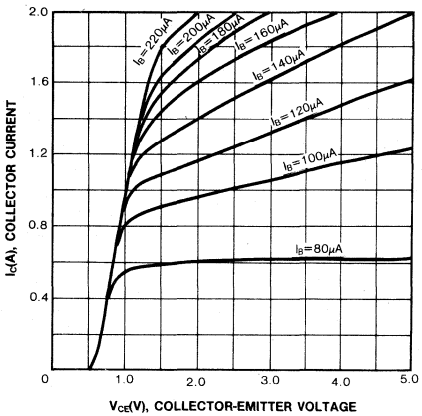
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=60V, I_E=0			10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=60V, R_{BE}=51Ω T_a=125°C			1.0	mA
Collector Cutoff Current	$I_{CEX}1$	V_{CE}=60V, V_{BE} (off)=−1.5V			10	μA
Collector Cutoff Current	$I_{CEX}2$	V_{CE}=60V, V_{BE} (off)=−1.5V T_a=125°C			1.0	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1.0	mA
*DC Current Gain	h_{FE1}	V_{CE}=2V, I_C=0.5A	1000			
	h_{FE2}	V_{CE}=2V, I_C=1A	2000		30000	
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1A, I_B=1mA			1.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=1A, I_B=1mA			2.0	V
Turn On Time	ton	I_C=1A, RL=50Ω		0.5		μs
Storage Time	ts	I_B1=−I_B2=1mA		1.0		μs
Fall time	tf	V_{CC}≅50V		1.0		μs

*Pulse Test: PW≤350μs, Duty Cycle≤2%

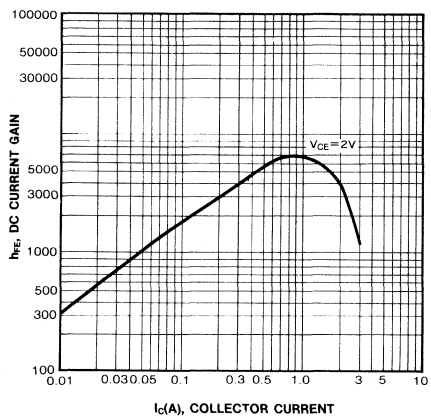
h_{FE}(2) CLASSIFICATION

Classification	R	O	Y
h_{FE}(2)	2000-5000	4000-10000	8000-30000

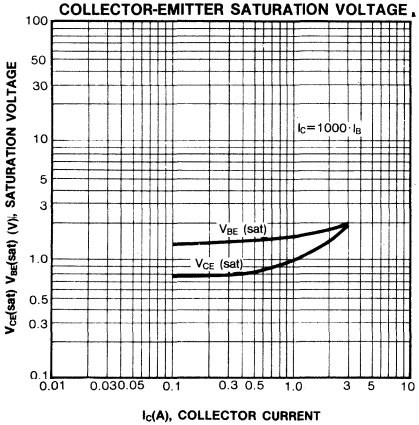
STATIC CHARACTERISTIC



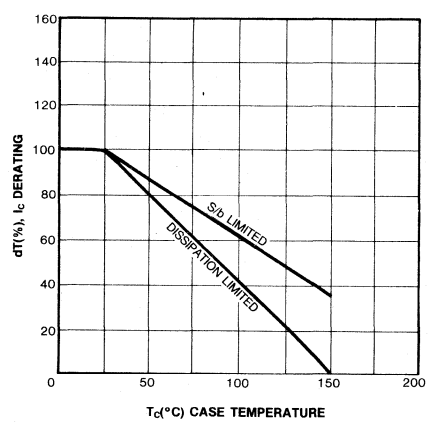
DC CURRENT GAIN



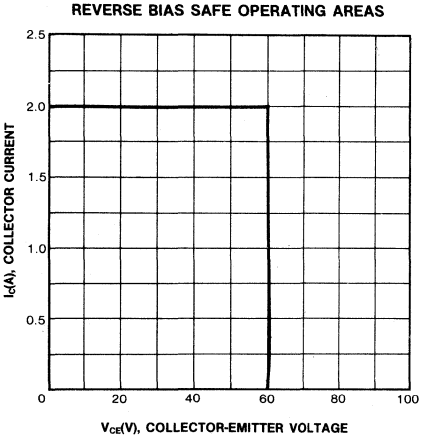
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



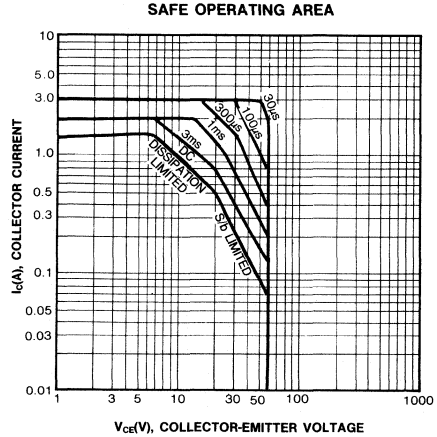
DERATING CURVE OF SAFE OPERATING AREAS

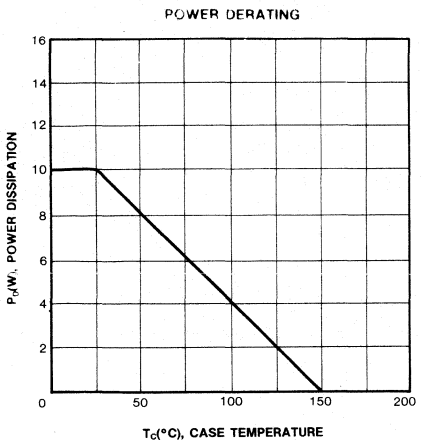


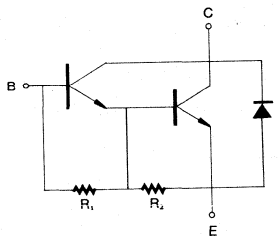
REVERSE BIAS SAFE OPERATING AREAS



SAFE OPERATING AREA







$R_1 \fallingdotseq 10k\Omega$
$R_2 \fallingdotseq 500\Omega$

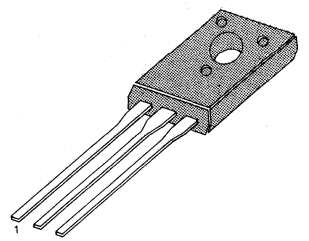
3

KSD986

NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

LOW FREQUENCY POWER AMPLIFIER
LOW SPEED SWITCHING
INDUSTRIAL USE

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	150	V
Collector-Emitter Voltage	V_{CEO}	80	V
Emitter-Base Voltage	V_{EBO}	8.0	V
Collector Current (DC)	I_C	±1.5	A
*Collector Current (Pulse)	I_C	±3.0	A
Base Current (DC)	I_B	0.15	A
Collector Dissipation (T_a=25°C)	P_C	1.0	W
Collector Dissipation (T_c=25°C)	P_C	10	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤300μs, Duty Cycle ≤10%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

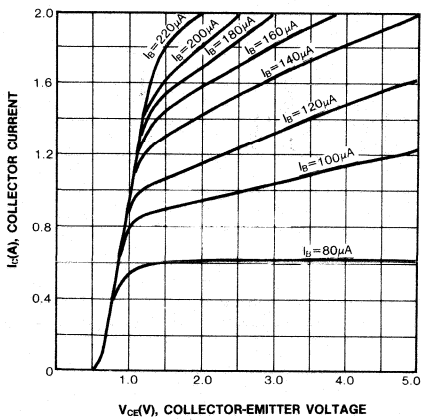
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=80V, I_E=0			10	μA
Collector Cutoff Current	I_{CER}	V_{CE}=80V, R_{BE}=51Ω T_a=125°C			1.0	mA
Collector Cutoff Current	$I_{CEX}1$	V_{CE}=80V, V_{BE} (off)=−1.5V			10	μA
Collector Cutoff Current	$I_{CEX}2$	V_{CE}=80V, V_{BE} (off)=−1.5V T_a=125°C			1.0	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1.0	mA
*DC Current Gain	h_{FE1}	V_{CE}=2V, I_C=0.5A	1000			
	h_{FE2}	V_{CE}=2V, I_C=1A	2000		30000	
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1A, I_B=1mA			1.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=1A, I_B=1mA			2.0	V
Turn On Time	ton	I_C=1A, RL=50Ω		0.5		μs
Storage Time	ts	I_{B1}=−I_{B2}=1mA		1.0		μs
Fall time	tf	V_{CC}≅50V		1.0		μs

*Pulse Test: PW≤350μs, Duty Cycle≤2%

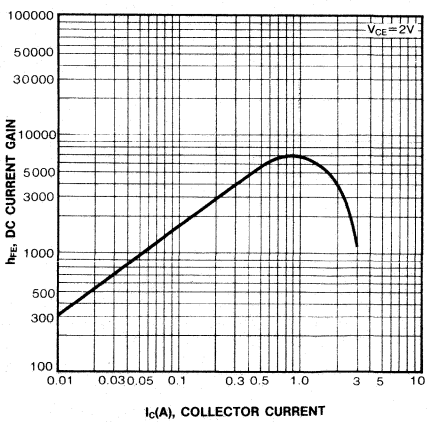
h_{FE}(2) CLASSIFICATION

Classification	R	O	Y
h_{FE}(2)	2000-5000	4000-10000	8000-30000

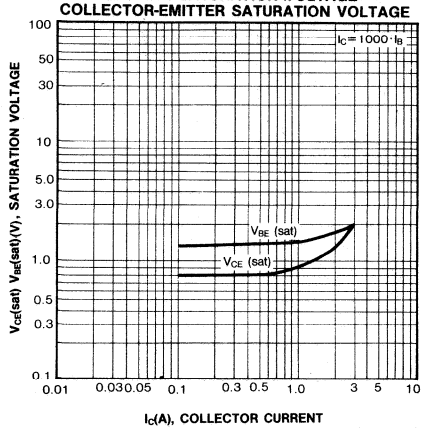
STATIC CHARACTERISTIC



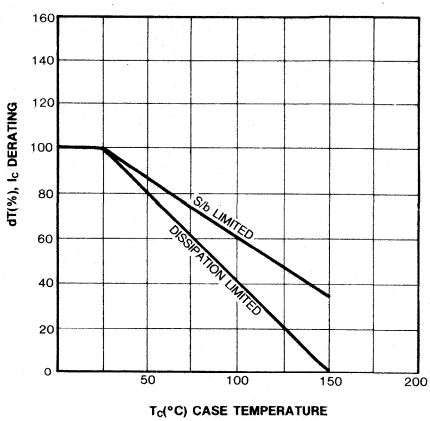
DC CURRENT GAIN



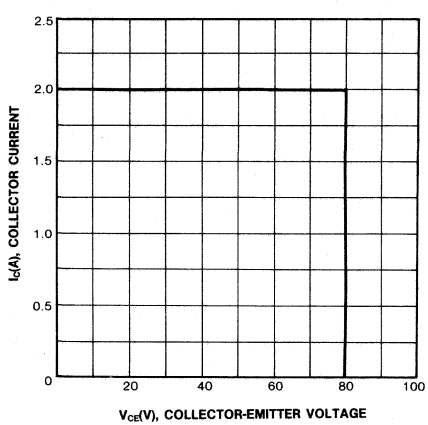
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



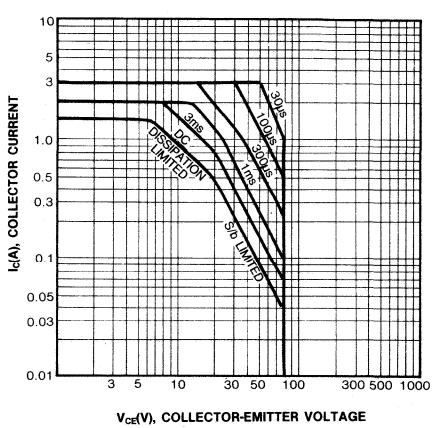
DERATING CURVE OF SAFE OPERATING AREAS

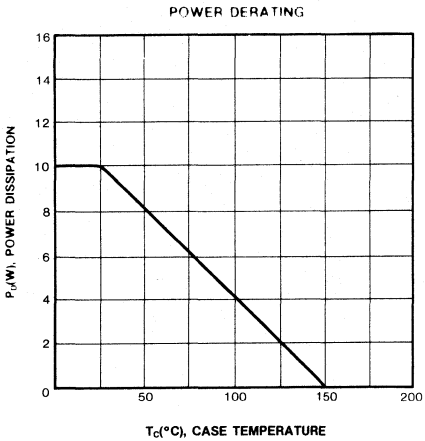


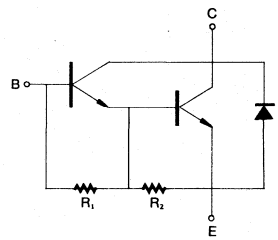
REVERSE BIAS SAFE OPERATING AREAS



SAFE OPERATING AREA





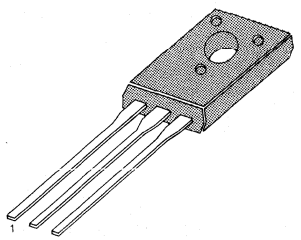


$R_1 \fallingdotseq 10k\Omega$
$R_2 \fallingdotseq 500\Omega$

LOW COLLECTOR SATURATION VOLTAGE LARGE CURRENT

HIGH POWER DISSIPATION : PT = 1.3W (T_a=25°C)
Complementary to KSB1151

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	5	A
*Collector Current (Pulse)	I_C	8	A
Base Current (DC)	I_B	1	A
Collector Dissipation (T_a=25°C)	P_C	1.3	W
Collector Dissipation (T_c=25°C)	P_C	20	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤ 10mS, duty cycle ≤ 50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

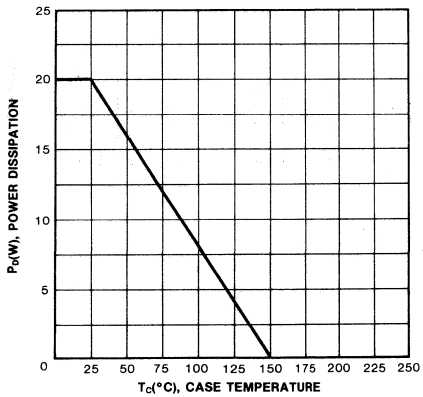
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=50V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=7V, I_C=0			10	μA
*DC Current Gain	h_{FE1}	V_{CE}=1V, I_C=0.1A	60			
	h_{FE2}	V_{CE}=1V, I_C=2A	100		400	
	h_{FE3}	V_{CE}=1V, I_C=5A	50			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=2A, I_B=0.2A		0.1	0.3	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=2A, I_B=0.2A		0.9	1.2	V
Turn On Time	t_{on}	I_C=2A, I_{B1}=−I_{B2}=0.2A		0.2	1	μS
Storage Time	t_{stg}	R_L=5Ω, V_{CC}=10V		1.1	2.5	μS
Fall Time	t_f			0.2	1	μS

* Pulse test: PW ≤ 350μs, duty cycle ≤ 2% Pulsed

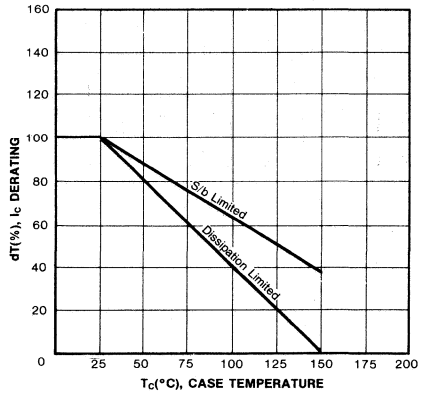
h_{FE} (2) CLASSIFICATION

Classification	O	Y	G
h_{FE} 2	100-200	160-320	200-400

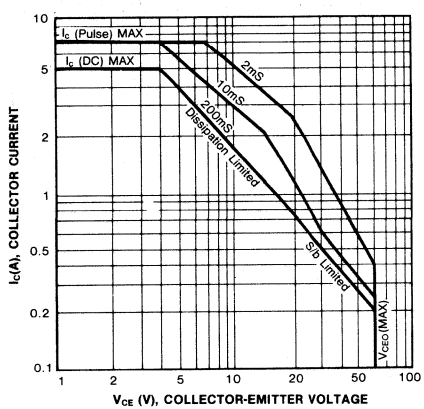
POWER DERATING



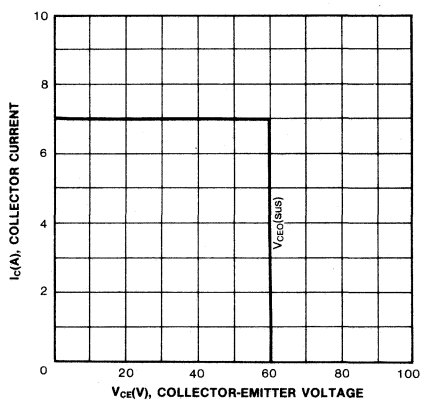
DERATING CURVE OF SAFE OPERATING AREAS



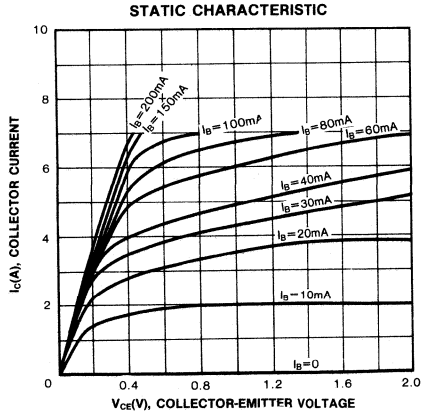
FORWARD BIAS SAFE OPERATING AREA



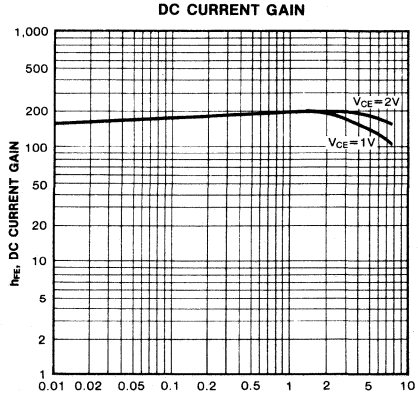
REVERSE BIAS SAFE OPERATING AREA



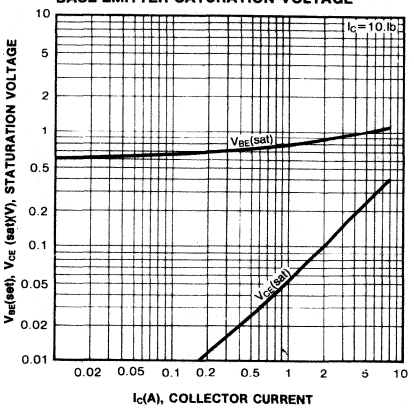
STATIC CHARACTERISTIC



DC CURRENT GAIN



COLLCETOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE

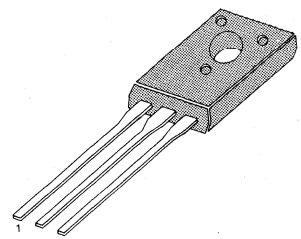


3

HIGH DC CURRENT GAIN
LOW COLLECTOR SATURATION VOLTAGE
BUILT-IN A DAMPER DIODE AT E-C

HIGH POWER DISSIPATION : PT = 1.3W (T_a=25°C)

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	150	V
Collector-Emitter Voltage	V_{CEO}	100	V
Emitter-Base Voltage	V_{EBO}	8	V
Collector Current (DC)	I_C	3	A
*Collector Current (Pulse)	I_C	5	A
Collector Dissipation (T_a=25°C)	P_C	1.3	W
Collector Dissipation (T_c=25°C)	P_C	15	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10 mS duty cycle ≤ 50%

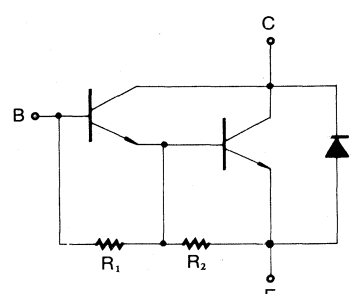
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=100V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			2	mA
*DC Current Gain	h_{FE1}	V_{CE}=2V, I_C=1.5A	2000		20000	
	h_{FE2}	V_{CE}=2V, I_C=3A	1000			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=1.5A, I_B=1.5mA		0.9	1.2	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=1.5A, I_B=1.5mA		1.5	2	V
Turn On Time	t_{on}	I_C=1.5A, I_{B1}=−I_{B2}=1.5mA		0.5		μS
Storage Time	t_{stg}	R_L=27Ω, V_{CC}=40V		2		μS
Fall Time	t_f			1		μS

* Pulse test: PW ≤ 350μs, duty cycle ≤ 2% Pulsed

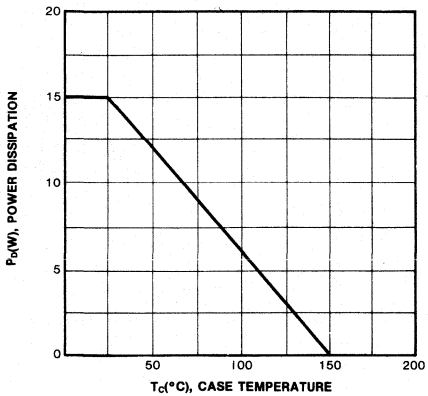
h_{FE} (1) CLASSIFICATION

Classification	O	Y	G
h_{FE} 1	2000-5000	4000-12000	6000-20000

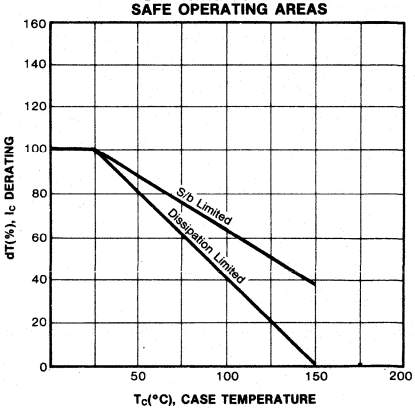


R1=8 kΩ
R2=0.6 kΩ

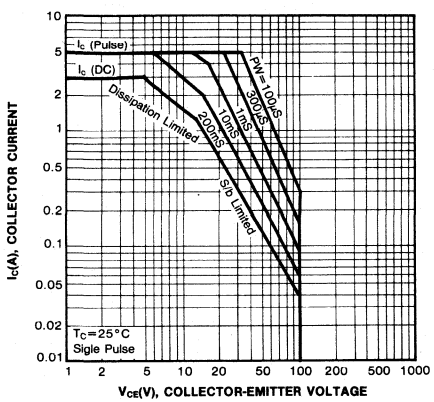
POWER DERATING



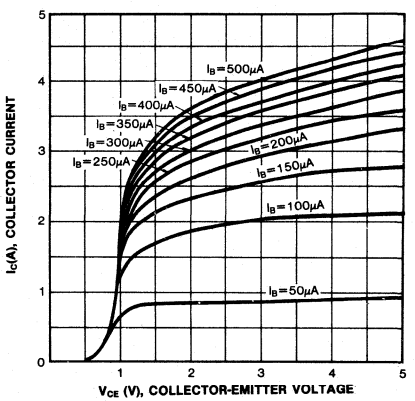
DERATING CURVE OF SAFE OPERATING AREAS



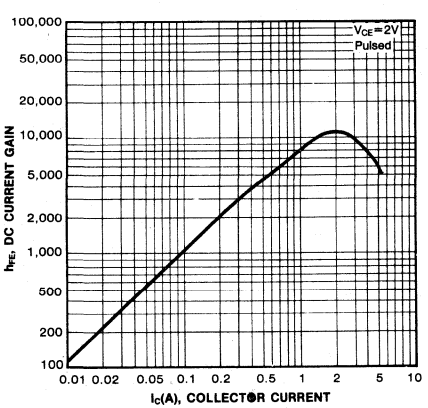
FORWARD BIAS SAFE OPERATING AREA



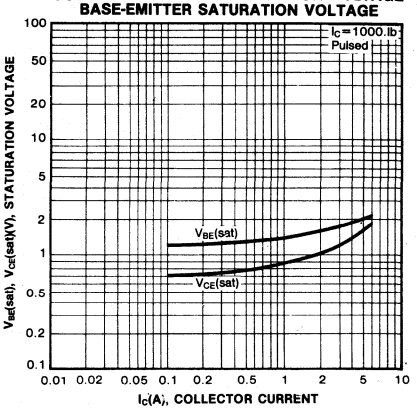
STATIC CHARACTERISTIC



DC CURRENT GAIN



COLLCETOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE

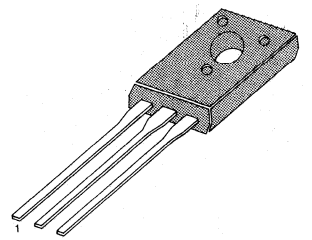


3

HIGH DC CURRENT GAIN
LOW COLLECTOR SATURATION VOLTAGE
BUILT-IN A ZENER DIODE AT B-C AND A DAMPER DIODE AT E-C

HIGH POWER DISSIPATION : PT = 1.3W (T_a = 25°C)

TO-126



1. Emitter 2. Collector 3 Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60±10	V
Collector-Emitter Voltage	V_{CEO}	60±10	V
Emitter-Base Voltage	V_{EBO}	8	V
Collector Current (DC)	I_C	3	A
*Collector Current (Pulse)	I_C	5	A
Collector Dissipation (T_a=25°C)	P_C	1.3	W
Collector Dissipation (T_c=25°C)	P_C	15	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

* PW≤10mS, duty cycle≤50%

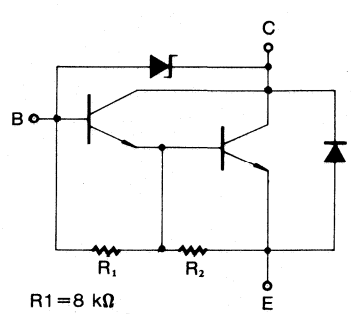
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Voltage	V_{CBO}	I_C=1mA, I_E=0	50	60	70	V
Collector-Emitter Voltage	V_{CEO}	I_C=10mA, R_{BE}=∞	50	60	70	V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			2	mA
*DC Current Gain	h_{FE1}	V_{CE}=2V, I_C=1.5A	2000		20000	
	h_{FE2}	V_{CE}=2V, I_C=3A	1000			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=1.5A, I_B=1.5mA		0.9	1.2	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=1.5A, I_B=1.5mA		1.5	2	V
Turn On Time	t_{on}	I_C=1.5A, I_{B1}=−I_{B2}=1.5mA		0.5		μS
Storage Time	t_{stg}	R_L=27Ω, V_{CC}=40V		2		μS
Fall Time	t_f			1		μS

* Pulse test: PW ≤ 350μs, duty cycle ≤ 2% Pulsed

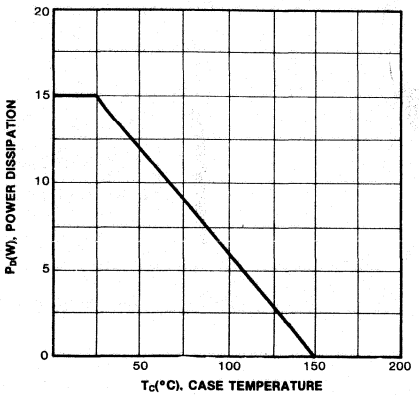
h_{FE} (1) CLASSIFICATION

Classification	O	Y	G
h_{FE} 1	2000-5000	4000-12000	6000-20000

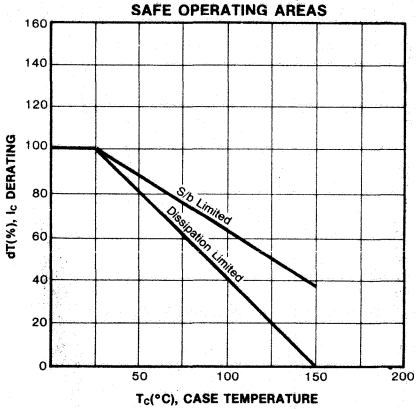


R1=8 kΩ
R2=0.6 kΩ

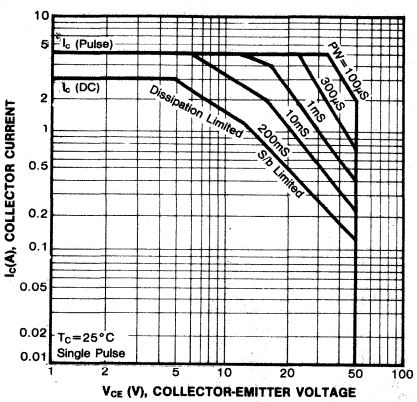
POWER DERATING



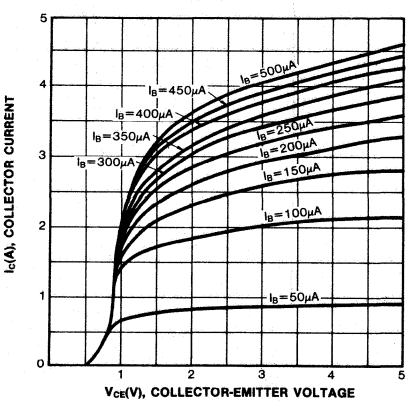
DERATING CURVE OF SAFE OPERATING AREAS



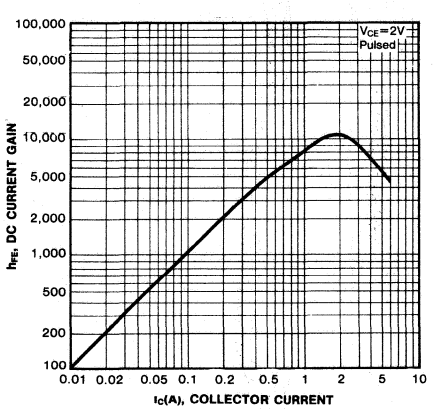
FORWARD BIAS SAFE OPERATING AREA



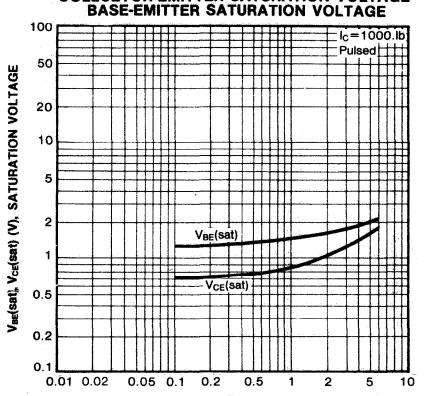
STATIC CHARACTERISTIC



DC CURRENT GAIN



COLLCETOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



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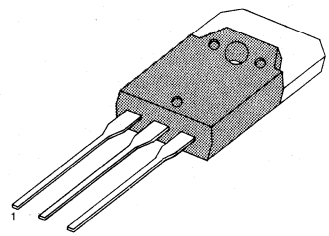
COLOR TV HORIZONTAL OUTPUT APPLICATIONS (DAMPER DIODE BUILT IN)

HIGH Collector-Base Voltage V_{CBO}=1500V

TO-3P



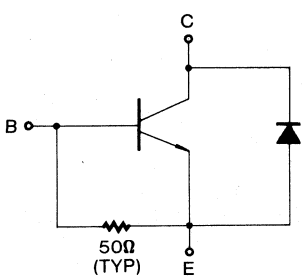
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

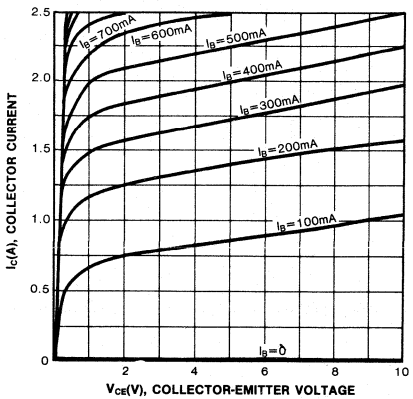
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	2.5	A
Collector Current (Peak)	I_C	10	A
Collector Dissipation (T_C=25°C)	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

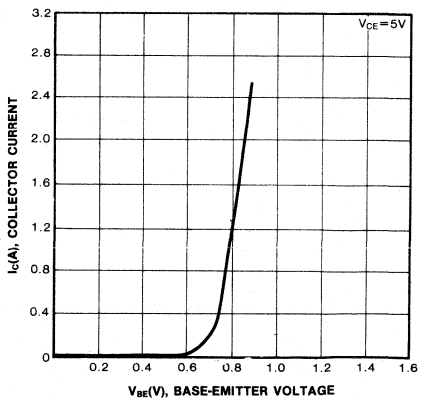
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0	40		130	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2A, I_B=0.6A			8	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=2A, I_B=0.6A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A		3		MHz
Damper Diode Turn On Voltage	V_f	I_f=2.5A			2	V
Fall Time	t_f	I_C=2A, I_{B1}=0.6A I_{B2}=−1.2A, V_{CC}=200V RL=100Ω			0.4	μS



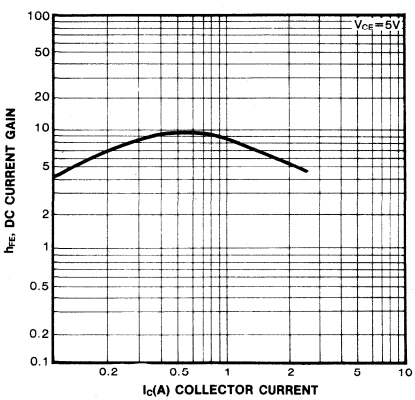
STATIC CHARACTERISTIC



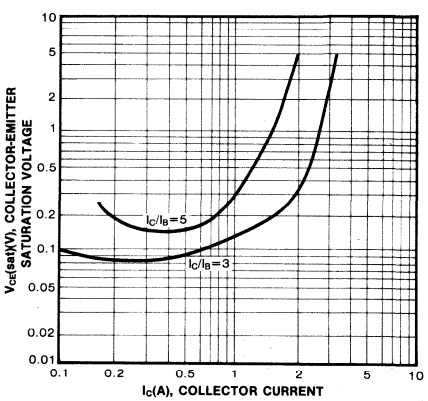
BASE-EMITTER ON VOLTAGE



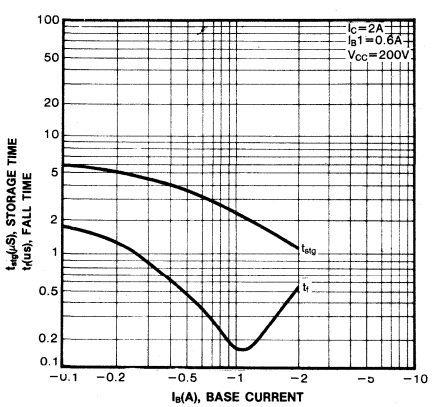
DC CURRENT GAIN



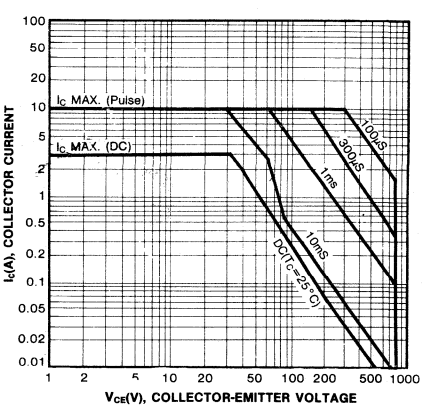
COLLECTOR-EMITTER SATURATION VOLTAGE



TURN ON TIME

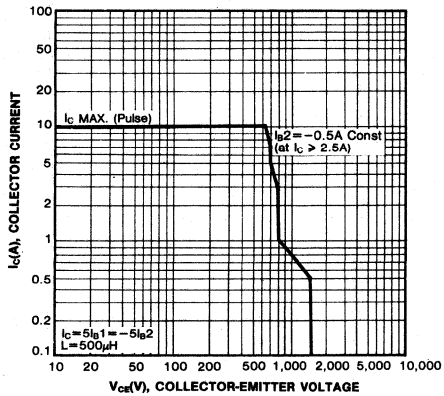


SAFE OPERATING AREA

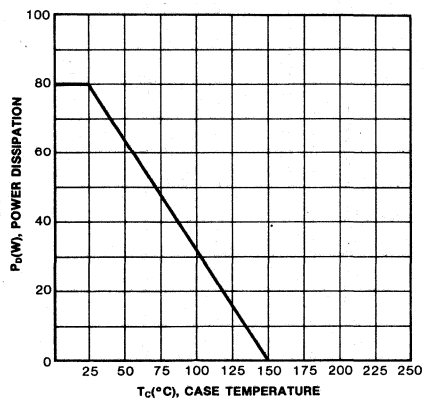


3

REVERSE BIAS SAFE OPERATING AREA



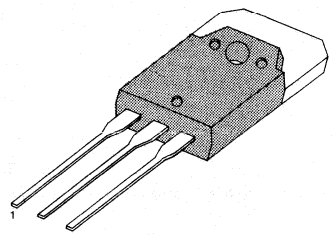
POWER DERATING



COLOR TV HORIZONTAL OUTPUT APPLICATIONS (DAMPER DIODE BUILT IN)

HIGH Collector-Base Voltage V_{CBO}=1500V

TO-3P



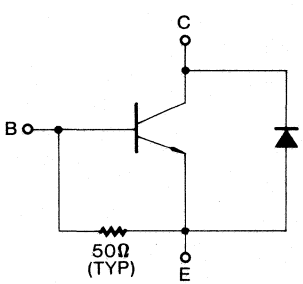
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

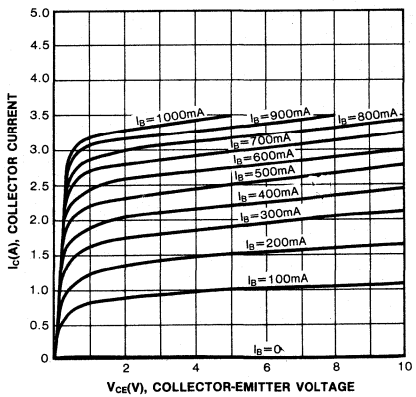
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	3.5	A
Collector Current (Peak)	I_C	10	A
Collector Dissipation (T_C=25°C)	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

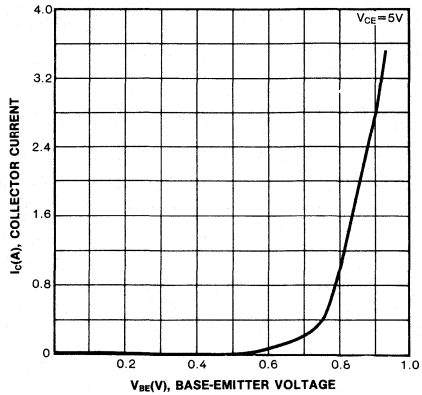
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0	40		130	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2.5A, I_B=0.8A			8	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=2.5A, I_B=0.8A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A		3		MHz
Damper Diode Turn On Voltage	V_f	I_f=3.5A			2	V
Fall Time	t_f	I_C=3A, I_{B1}=0.8A I_{B2}=−1.6A, V_{CC}=200V RL=66.7Ω			0.4	μS



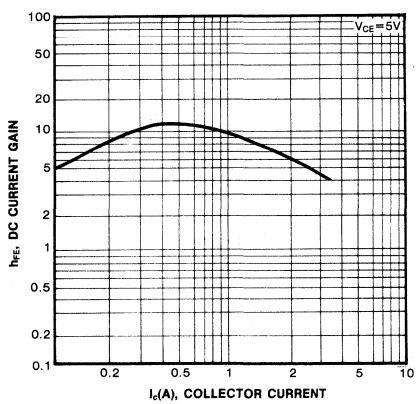
STATIC CHARACTERISTIC



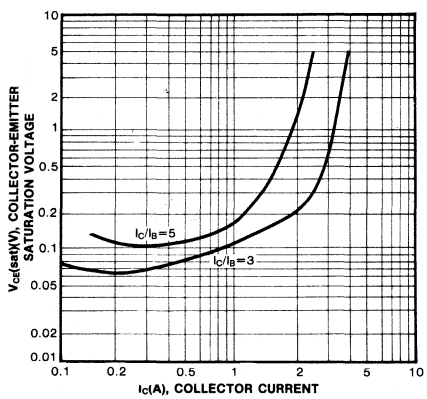
BASE-EMITTER ON VOLTAGE



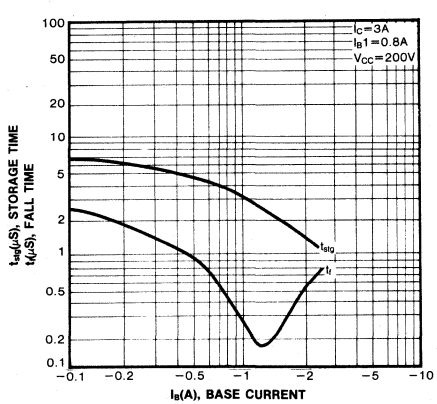
DC CURRENT GAIN



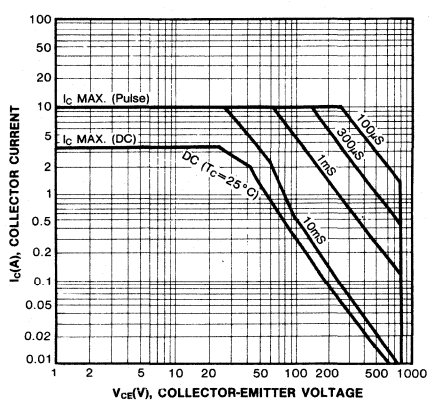
COLLECTOR-EMITTER SATURATION VOLTAGE



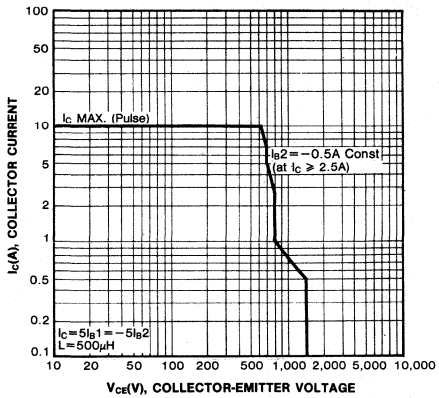
TURN ON TIME



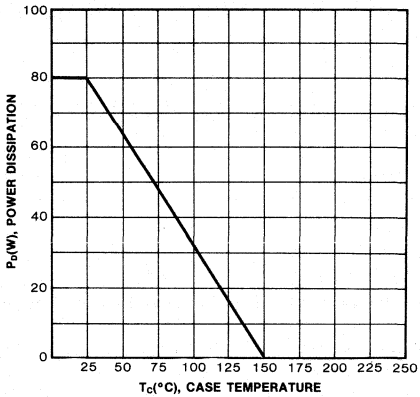
SAFE OPERATING AREAS



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



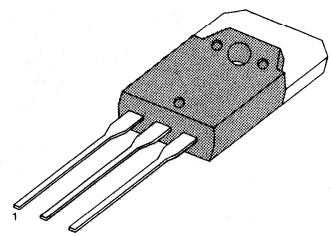
3

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS (DAMPER DIODE BUILT IN)

HIGH Collector-Base Voltage V_{CBO}=1500V

TO-3P



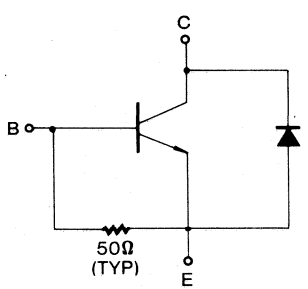
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

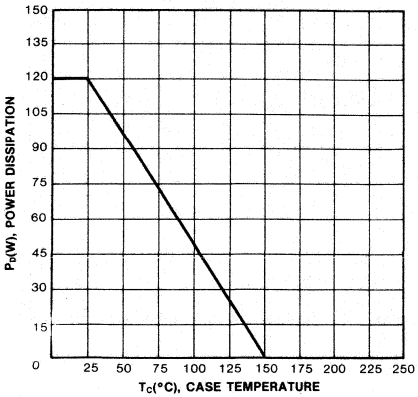
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	5	A
Collector Current (Peak)	I_C	16	A
Collector Dissipation (T_C=25°C)	P_C	120	W
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

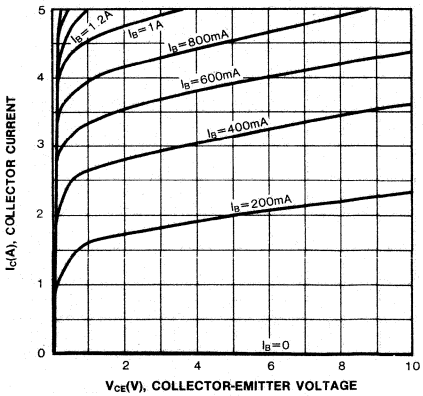
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0	40		130	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=4A, I_B=0.8A			5	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=4A, I_B=0.8A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1A		3		MHz
Damper Diode Turn On Voltage	V_f	I_f=5A			2	V
Fall Time	t_f	I_C=4A, I_{B1}=0.8A I_{B2}=−1.6A, V_{CC}=200V RL=50Ω			0.4	μS



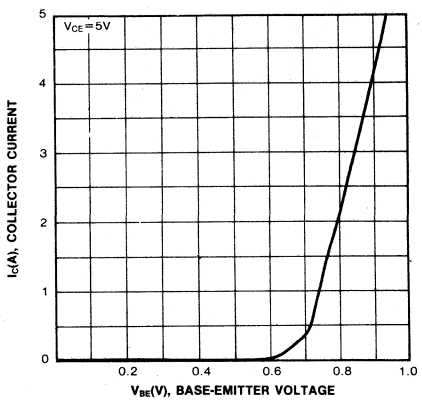
POWER DERATING



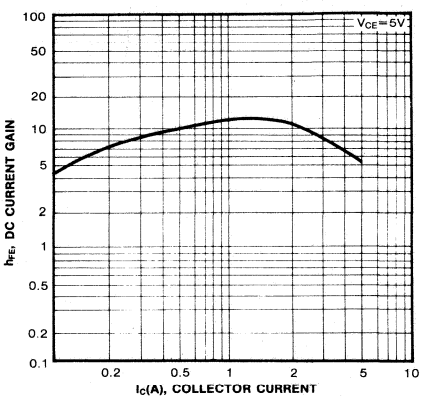
STATIC CHARACTERISTIC



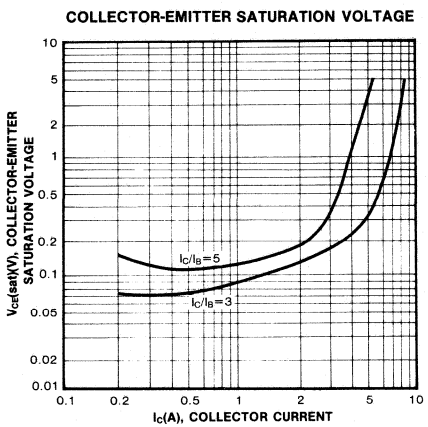
BASE-EMITTER ON VOLTAGE



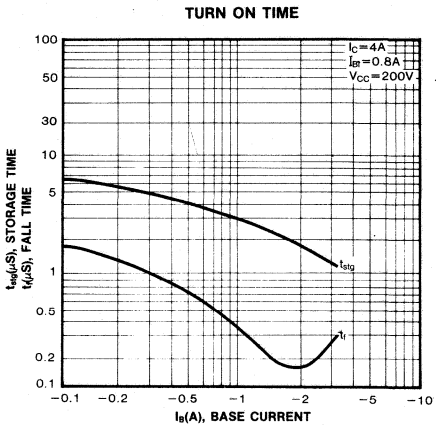
DC CURRENT GAIN



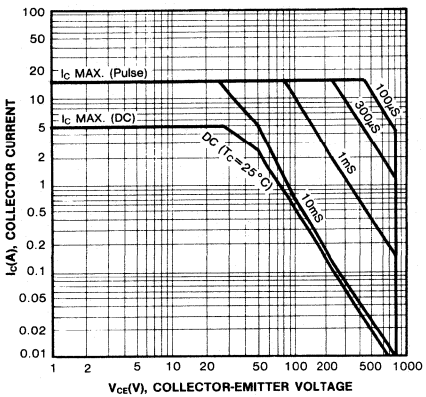
COLLECTOR-EMITTER SATURATION VOLTAGE



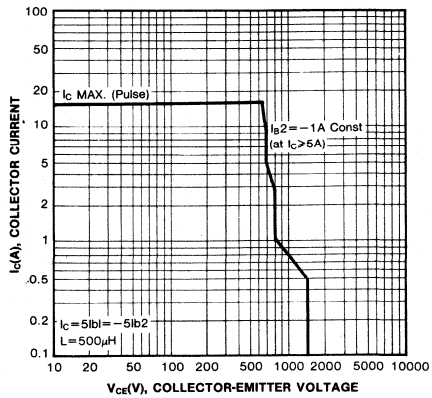
TURN ON TIME



SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA

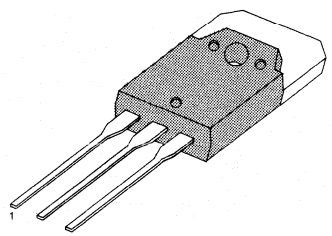


NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS (DAMPER DIODE BUILT IN)

HIGH Collector-Base Voltage V_{CBO} = 1500 V

TO-3P



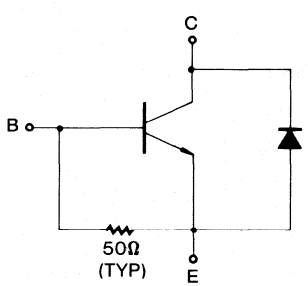
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	6	A
Collector Current (Peak)	I_C	16	A
Collector Dissipation (T_C=25°C)	P_C	120	W
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

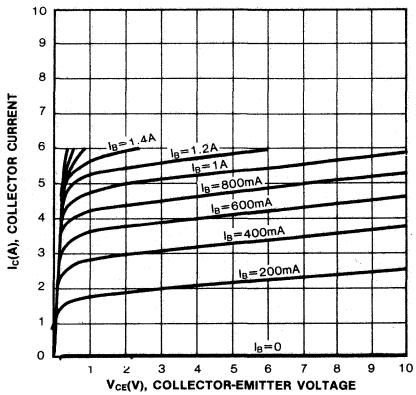
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0	40		130	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=5A, I_B=1A			5	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=5A, I_B=1A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1A		3		MHz
Damper Diode Turn On Voltage	V_f	I_f=6A			2	V
Fall Time	t_f	I_C=5A, I_{B1}=1A I_{B2}=−2A, V_{CC}=200V RL=40Ω			0.4	μS

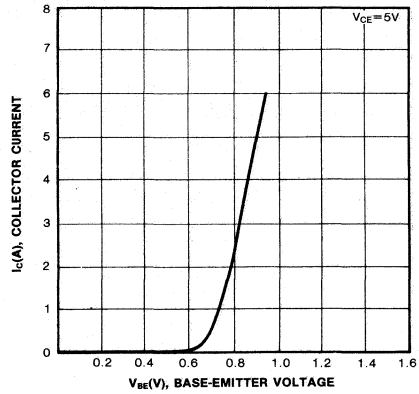


NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

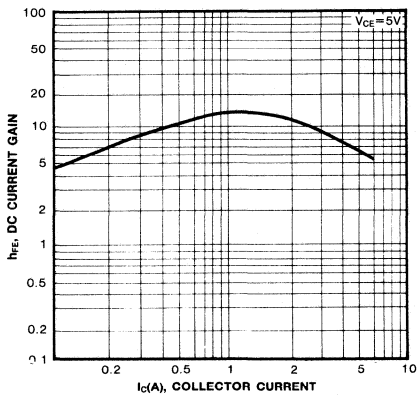
STATIC CHARACTERISTIC



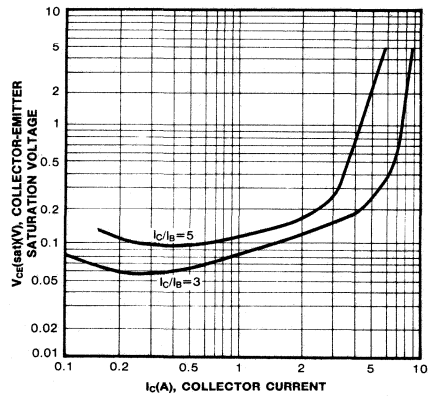
BASE-EMITTER ON VOLTAGE



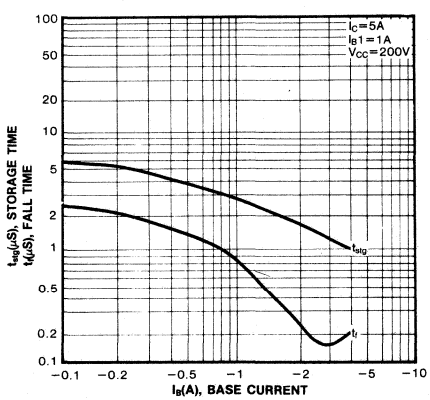
DC CURRENT GAIN



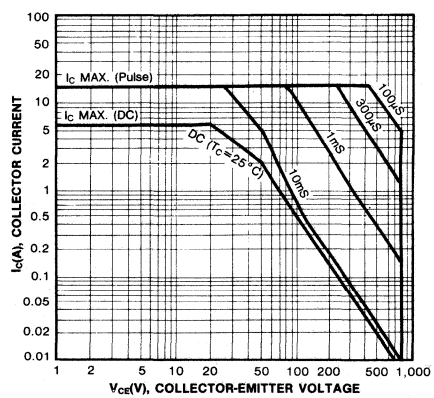
COLLECTOR-EMITTER SATURATION VOLTAGE



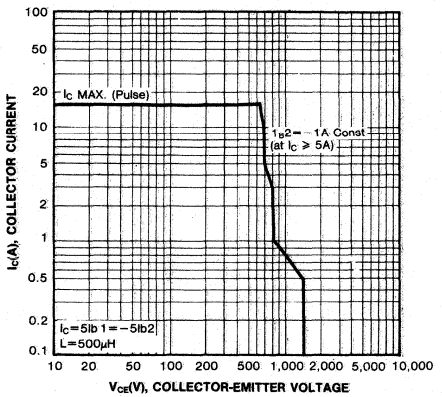
TURN ON TIME



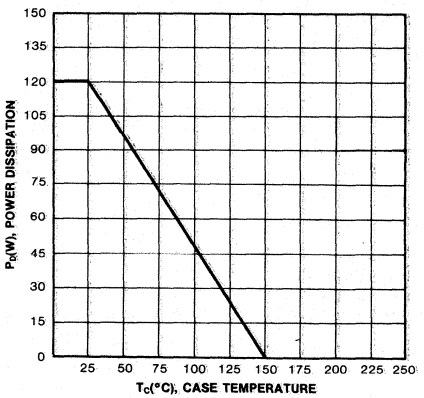
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



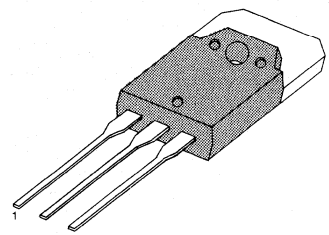
3

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS

HIGH Collector-Base Voltage V_{CBO} =1500V

TO-3P



1. Base 2. Collector 3. Emitter

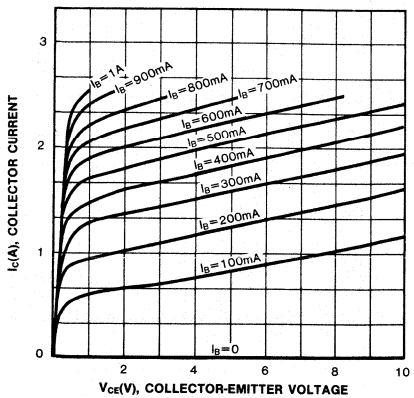
ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	2.5	A
Collector Current (Peak)	I_C	10	A
Collector Dissipation (T_C=25°C)	P_C	80	W
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

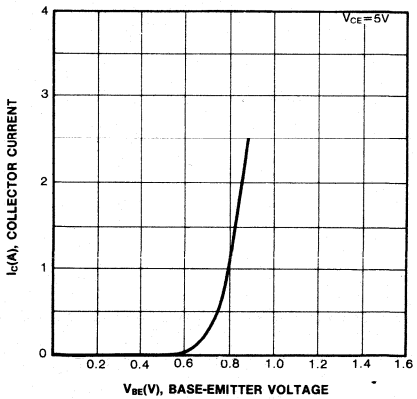
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2A, I_B=0.6A			8	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=2A, I_B=0.6A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A		3		MHz
Fall Time	t_f	I_C=2A, I_B1=0.6A I_B2=−1.2A, V_{CC}=200V RL=100Ω			0.4	μS

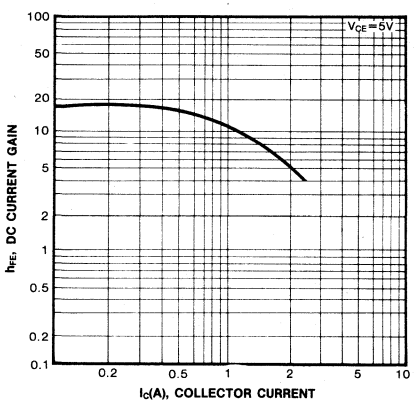
STATIC CHARACTERISTIC



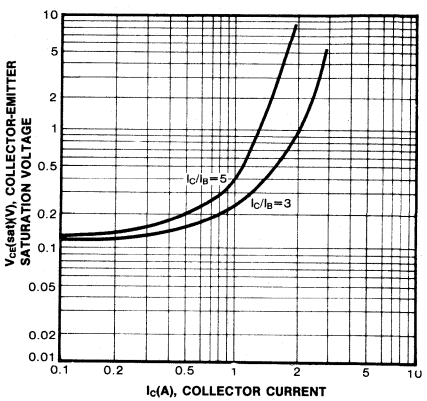
BASE-EMITTER ON VOLTAGE



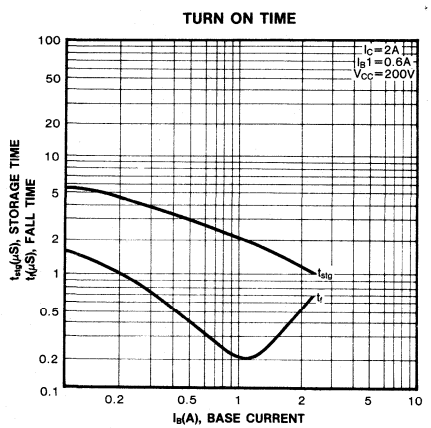
DC CURRENT GAIN



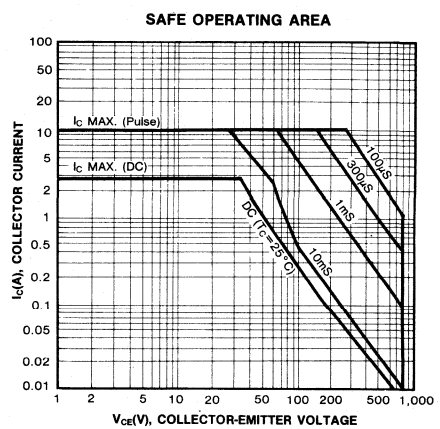
COLLECTOR-EMITTER SATURATION VOLTAGE



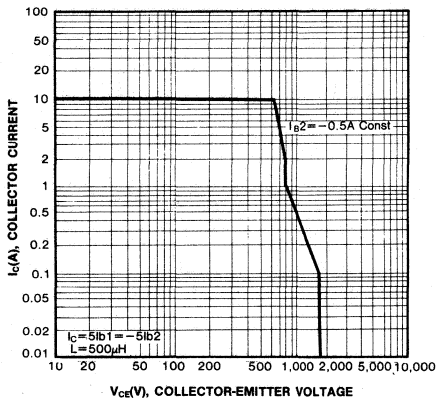
TURN ON TIME



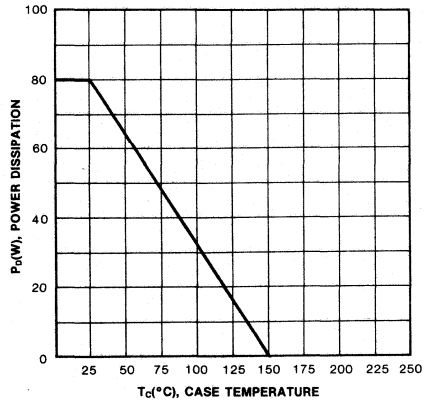
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING

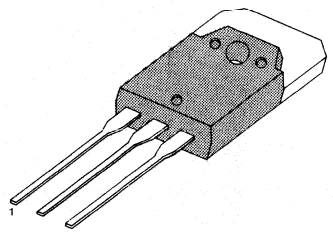


NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS

HIGH Collector-Base Voltage V_{CBO}=1500V

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

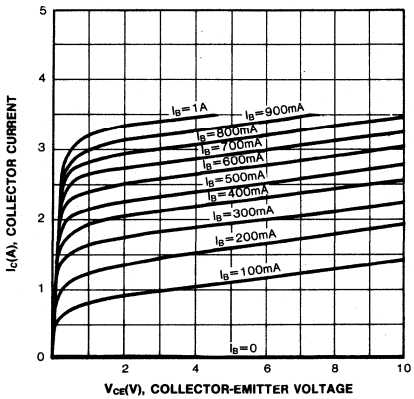
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	3.5	A
Collector Current (Peak)	I_C	10	A
Collector Dissipation (T_C=25°C)	P_C	80	W
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

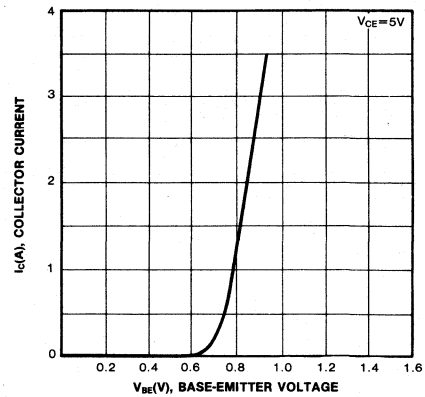
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2.5A, I_B=0.8A			8	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=2.5A, I_B=0.8A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A		3		MHz
Fall Time	t_f	I_C=3A, I_B1=0.8A I_B2=−1.6A, V_{CC}=200V RL=66.7Ω			0.4	μS

3

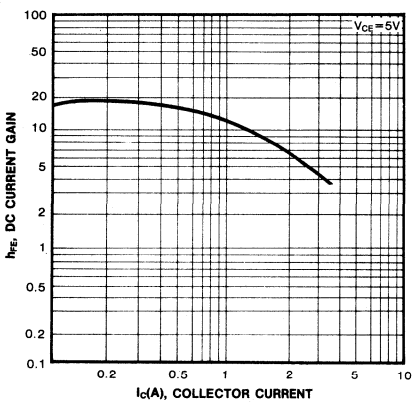
STATIC CHARACTERISTIC



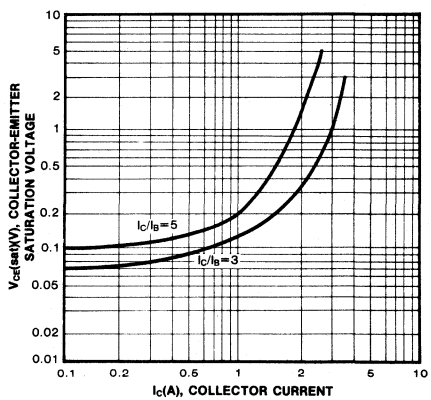
BASE-EMITTER ON VOLTAGE



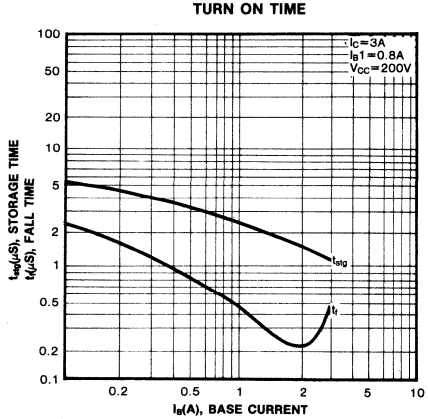
DC CURRENT GAIN



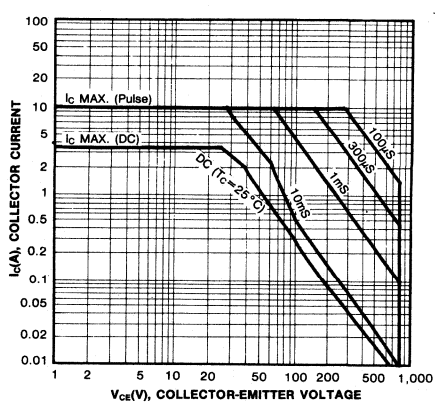
COLLECTOR-EMITTER SATURATION VOLTAGE



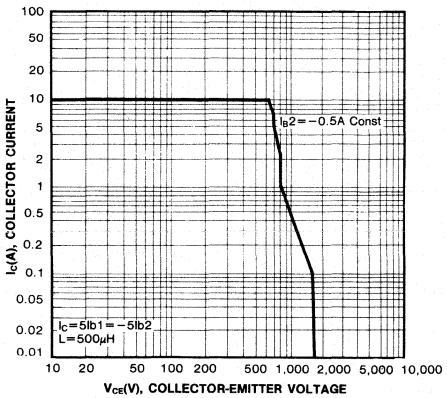
TURN ON TIME



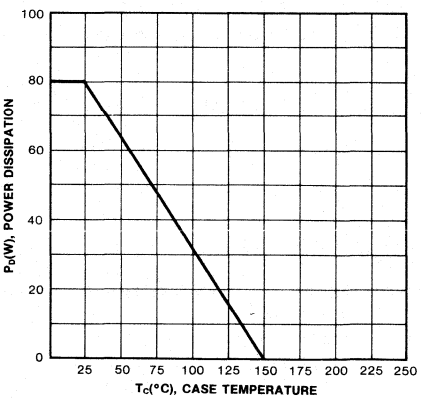
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



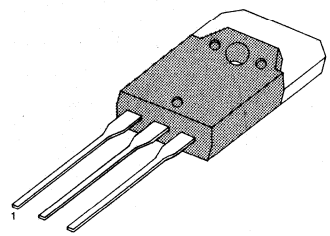
3

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS

HIGH Collector-Base Voltage V_{CBO}=1500V

TO-3P



1. Base 2. Collector 3. Emitter

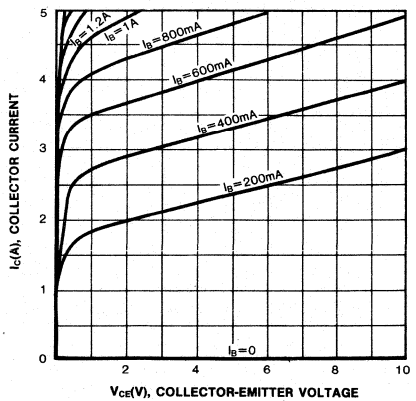
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	5	A
Collector Current (Peak)	I_C	16	A
Collector Dissipation (T_C=25°C)	P_C	120	W
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

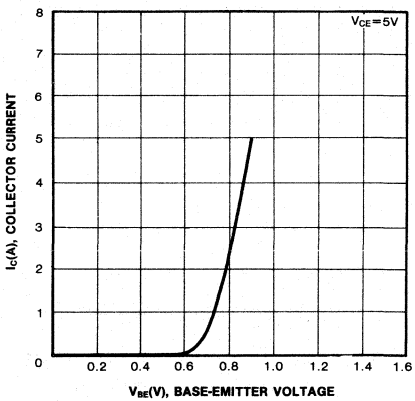
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=4A, I_B=0.8A			5	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=4A, I_B=0.8A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1A		3		MHz
Fall Time	t_f	I_C=4A, I_{B1}=0.8A I_{B2}=−1.6A, V_{CC}=200V RL=50Ω			0.4	μS

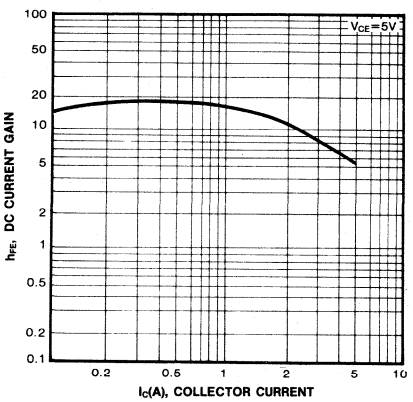
STATIC CHARACTERISTIC



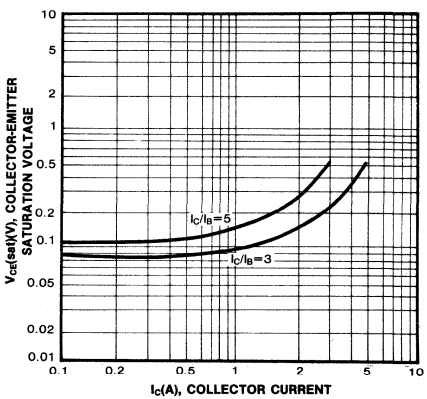
BASE-EMITTER ON VOLTAGE



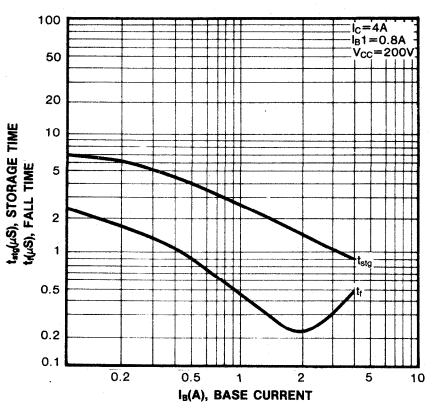
DC CURRENT GAIN



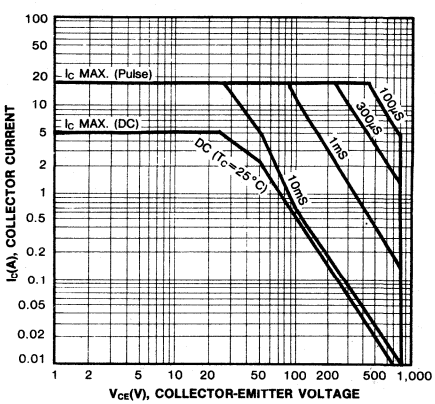
COLLECTOR-EMITTER SATURATION VOLTAGE



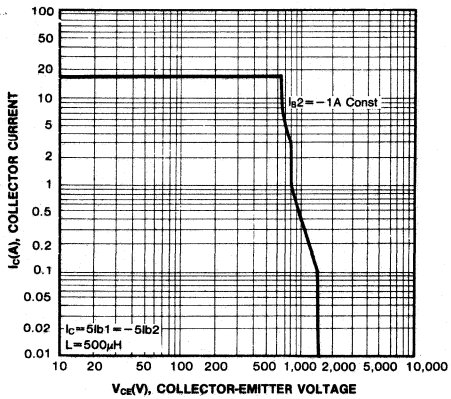
TURN ON TIME



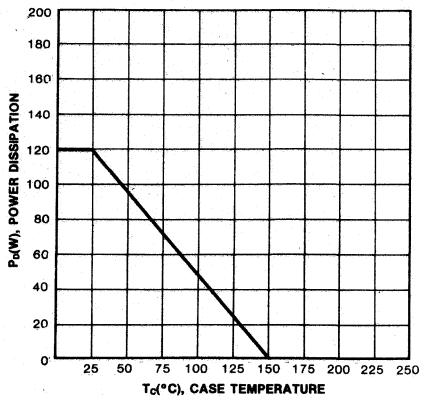
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING

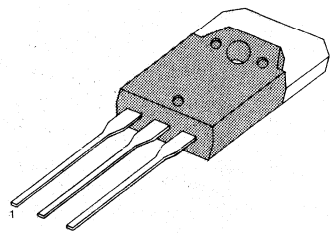


NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS

High Collector-Base Voltage V_{CBO} = 1500V

TO-3P



1. Base 2. Collector 3. Emitter

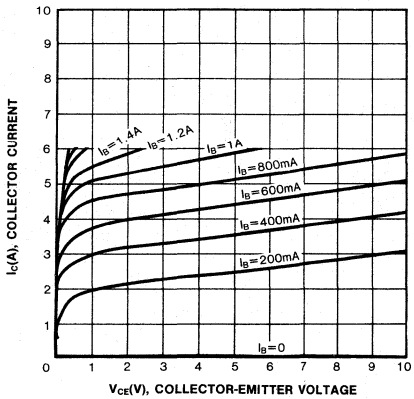
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	6	A
Collector Current (Peak)	I_C	16	A
Collector Dissipation (T_C=25°C)	P_C	120	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

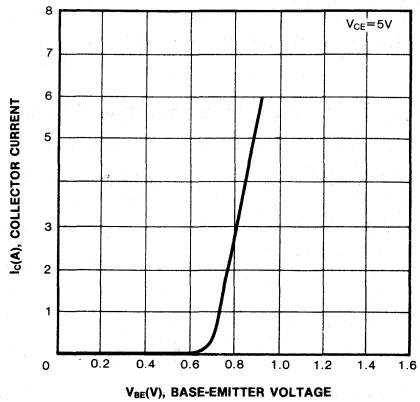
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=5A, I_B=1A			5	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=5A, I_B=1A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1A		3		MHz
Fall Time	t_f	I_C=5A, I_{B1}=1A I_{B2}=−2A, RL=40Ω			0.4	μS

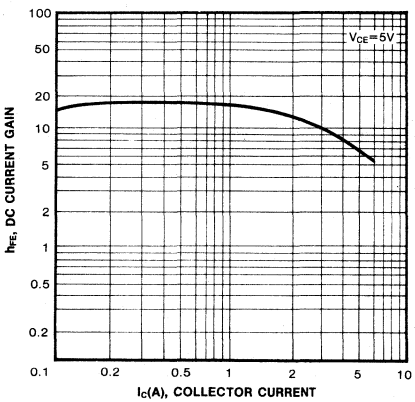
STATIC CHARACTERISTIC



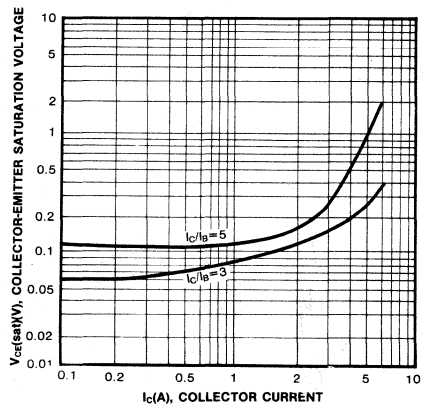
BASE-EMITTER ON VOLTAGE



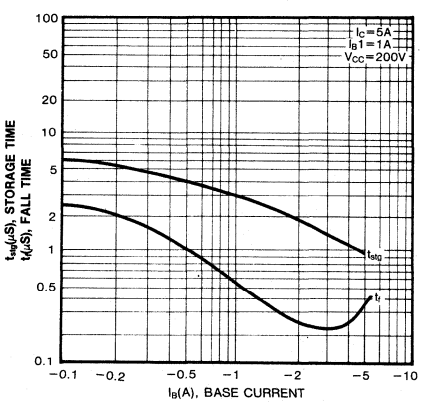
DC CURRENT GAIN



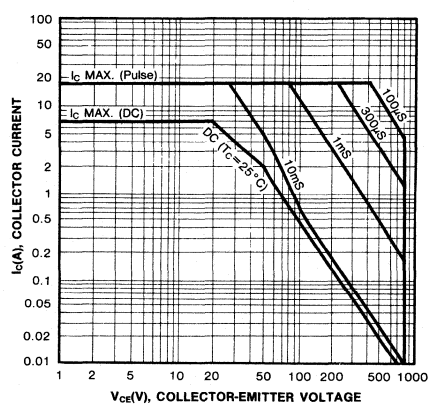
COLLECTOR-EMITTER SATURATION VOLTAGE



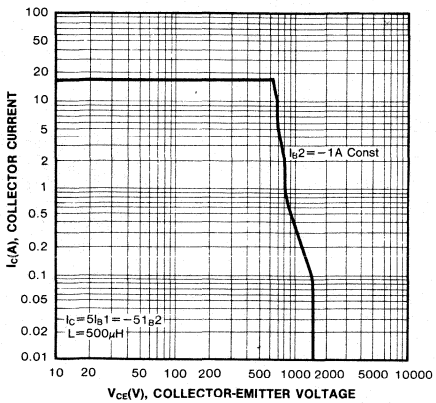
TURN ON TIME



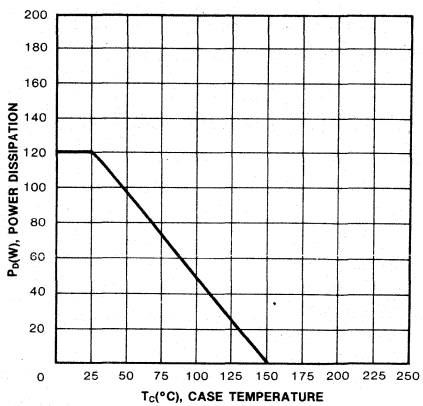
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



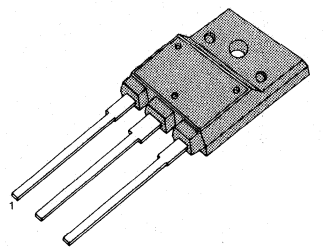
3

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS (DAMPER DIODE BUILT IN)

High Collector-Base Voltage V_{CBO}=1500V

TO-3P(F)



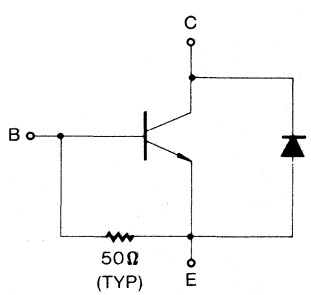
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

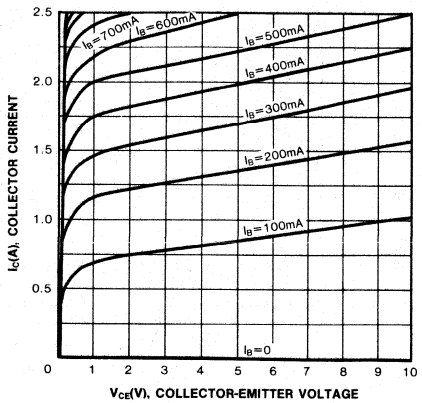
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	2.5	A
Collector Current (Peak)	I_C	10	A
Collector Dissipation (T_C=25°C)	P_C	50	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

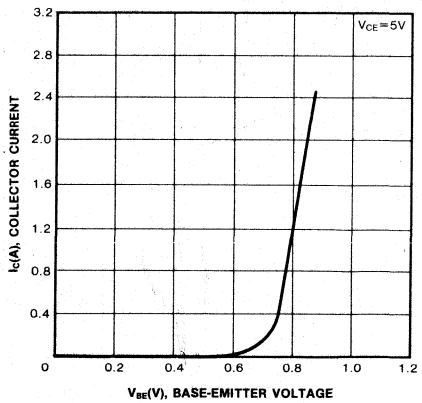
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0	40		130	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2A, I_B=0.6A			8	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=2A, I_B=0.6A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A		3		MHz
Damper Diode Turn On Voltage	V_f	I_f=2.5A			2	V
Fall Time	t_f	I_C=2A, I_{B1}=0.6A I_{B2}=−1.2A, V_{CC}=200V RL=100Ω			0.4	μS



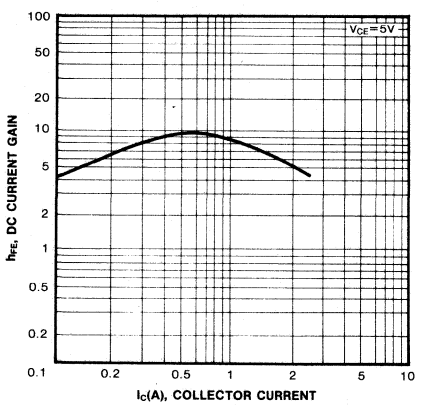
STATIC CHARACTERISTIC



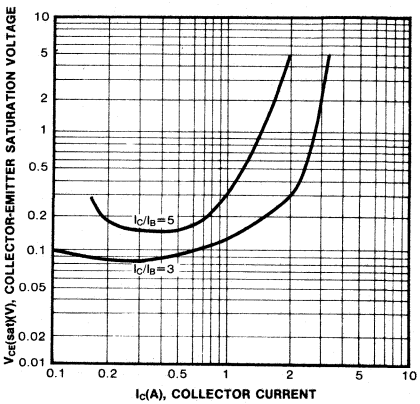
BASE-EMITTER ON VOLTAGE



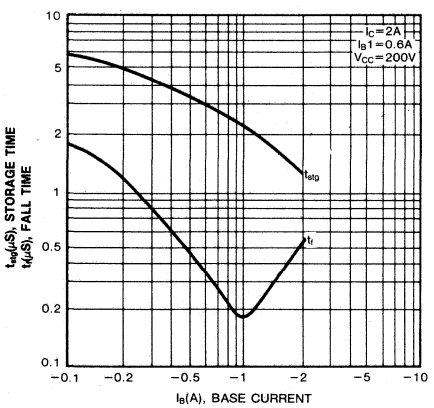
DC CURRENT GAIN



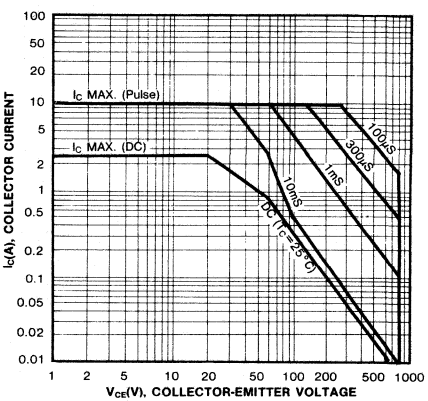
COLLECTOR-EMITTER SATURATION VOLTAGE



TURN ON TIME



SAFE OPERATING AREA



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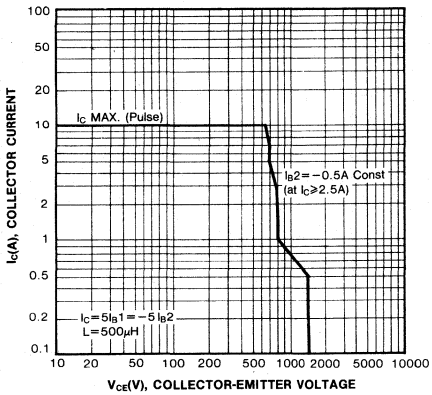
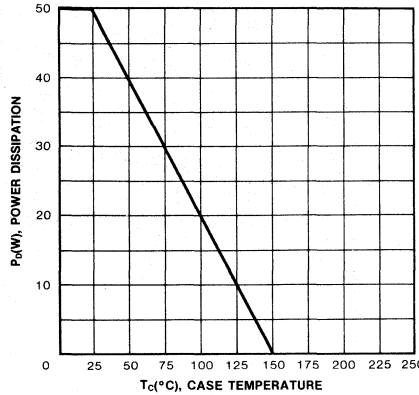
REVERSE BIAS SAFE OPERATING AREA



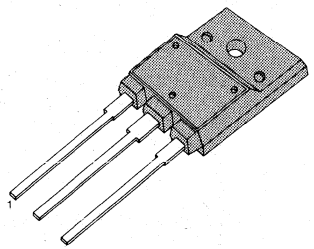
POWER DERATING



COLOR TV HORIZONTAL OUTPUT APPLICATIONS (DAMPER DIODE BUILT IN)

High Collector-Base Voltage V_{CBO}=1500V

TO-3P(F)



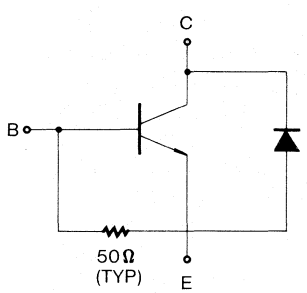
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

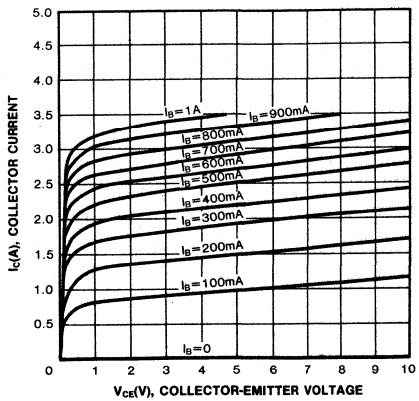
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	3.5	A
Collector Current (Peak)	I_C	10	A
Collector Dissipation T_C=25°C	P_C	50	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

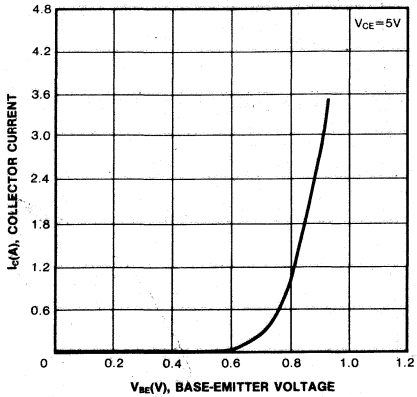
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0	40		130	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2.5A, I_B=0.8A			8	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=2.5A, I_B=0.8A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A		3		MHz
Damper Diode Turn On Voltage	V_f	I_f=3.5A			2	V
Fall Time	t_f	I_C=3A, I_B1=0.8A I_B2=−1.6A, V_{CC}=200V RL=66.7Ω			0.4	μS



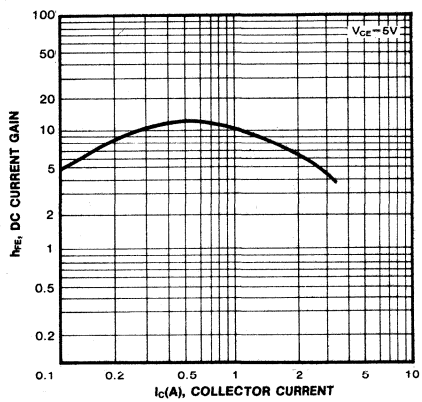
STATIC CHARACTERISTIC



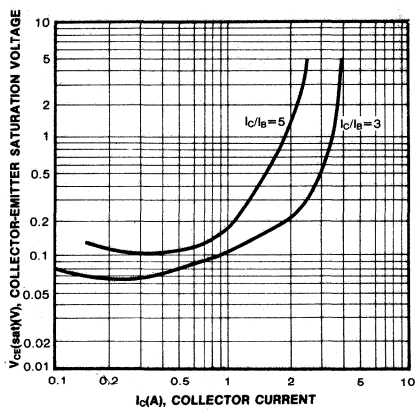
BASE-EMITTER ON VOLTAGE



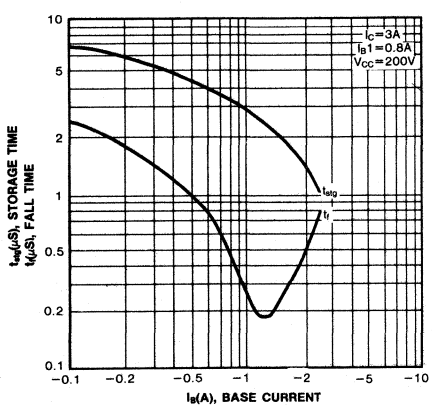
DC CURRENT GAIN



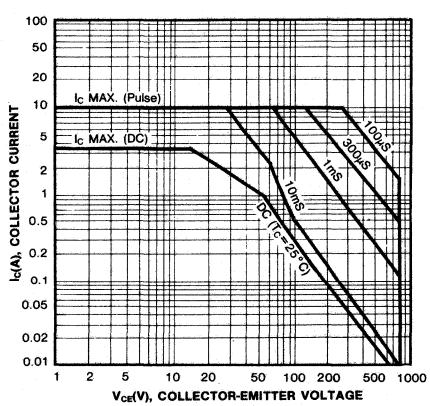
COLLECTOR-EMITTER SATURATION VOLTAGE



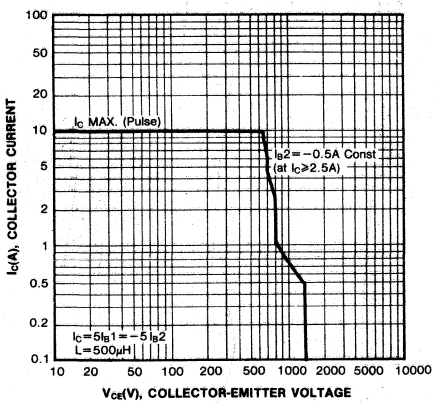
TURN ON TIME



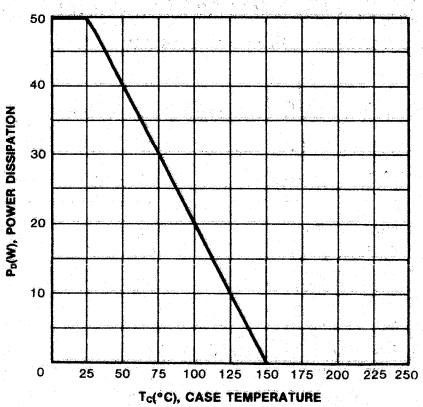
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



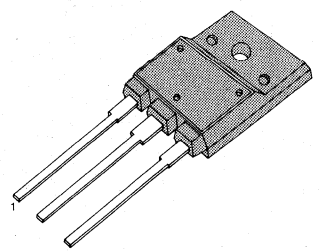
3

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS (DAMPER DIODE BUILT IN)

High Collector-Base Voltage V_{CBO}=1500V

TO-3P(F)



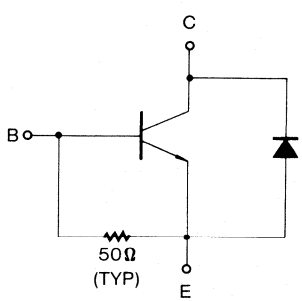
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

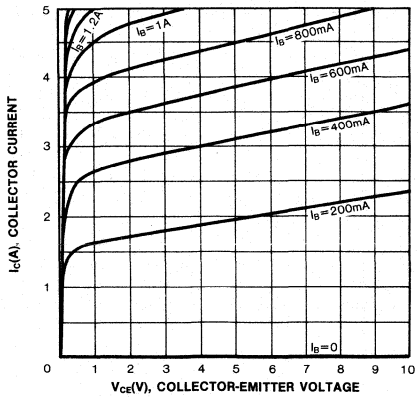
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	5	A
Collector Current (Peak)	I_C	16	A
Collector Dissipation (T_C=25°C)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

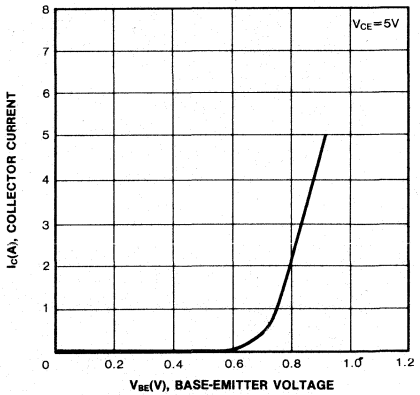
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0	40		130	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=4A, I_B=0.8A			5	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=4A, I_B=0.8A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1A		3		MHz
Damper Diode Turn On Voltage	V_f	I_f=5A			2	V
Fall Time	t_f	I_C=4A, I_{B1}=0.8A I_{B2}=−1.6A, V_{CC}=200V RL=50Ω			0.4	μS



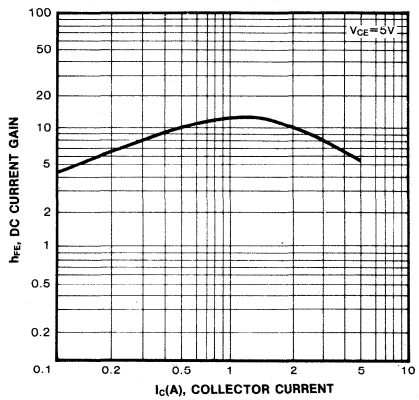
STATIC CHARACTERISTIC



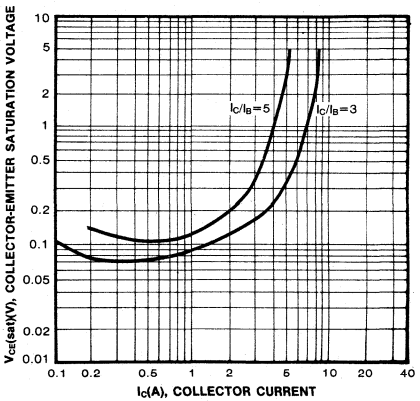
BASE-EMITTER ON VOLTAGE



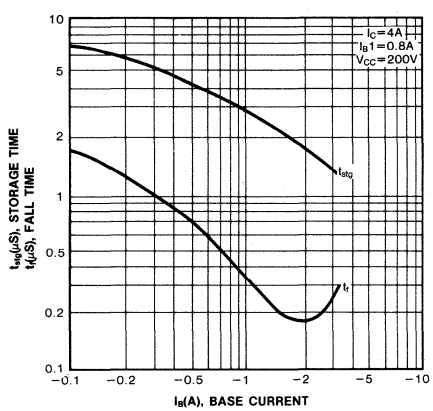
DC CURRENT GAIN



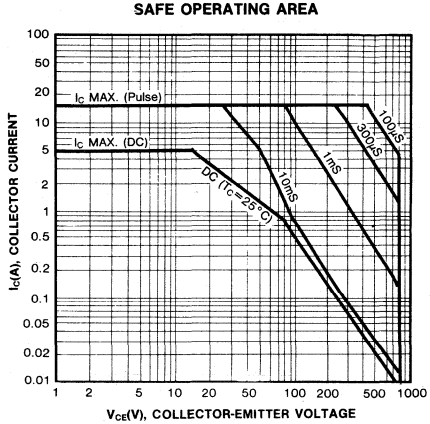
COLLECTOR-EMITTER SATURATION VOLTAGE



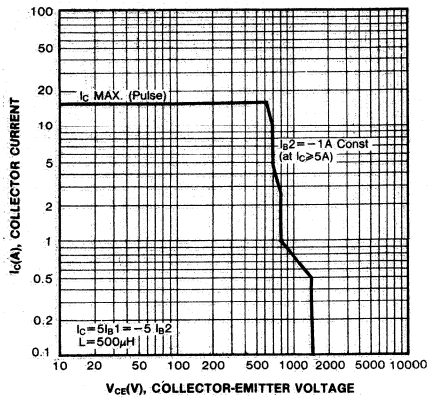
TURN ON TIME



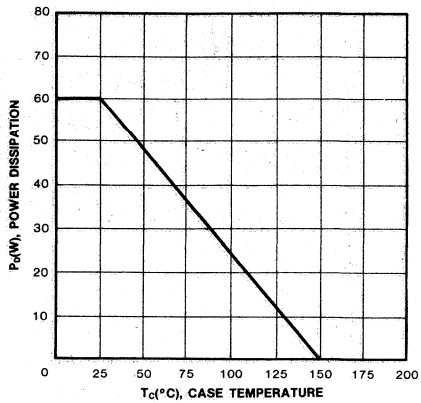
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



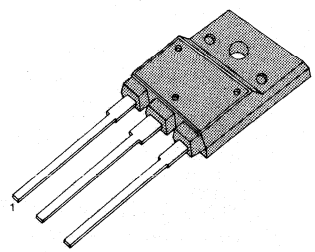
POWER DERATING



COLOR TV HORIZONTAL OUTPUT APPLICATIONS (DAMPER DIODE BUILT IN)

High Collector-Base Voltage V_{CBO}=1500V

TO-3P(F)



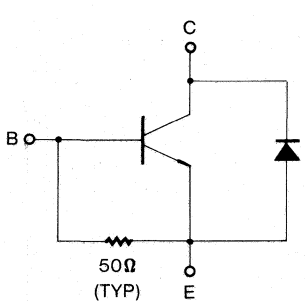
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	6	A
Collector Current (Peak)	I_C	16	A
Collector Dissipation (T_C=25°C)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

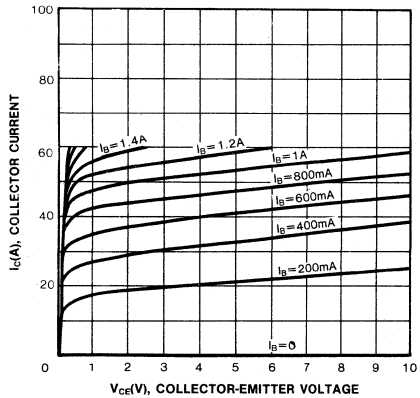
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0	40		130	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=5A, I_B=1A			5	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=5A, I_B=1A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1A		3		MHz
Damper Diode Turn On Voltage	V_f	I_f=6A			2	V
Fall Time	t_f	I_C=5A, I_{B1}=1A I_{B2}=−2A, V_{CC}=200V RL=40Ω			0.4	μS

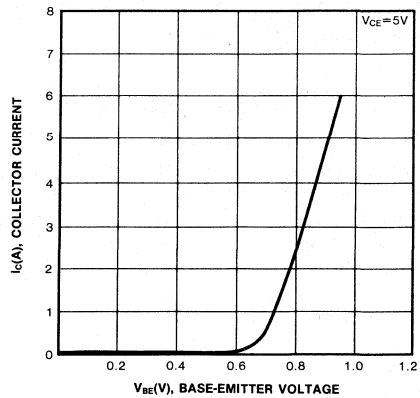


NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

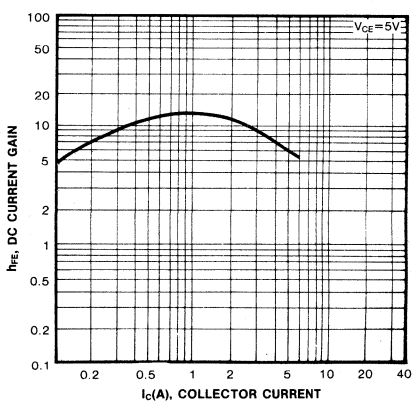
STATIC CHARACTERISTIC



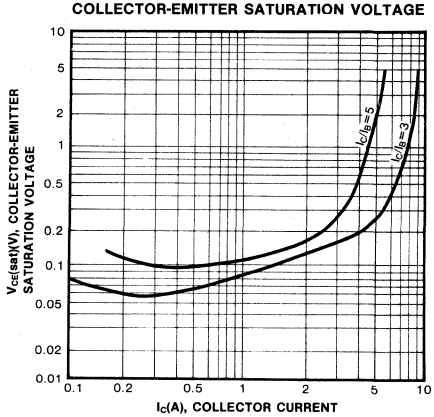
BASE-EMITTER ON VOLTAGE



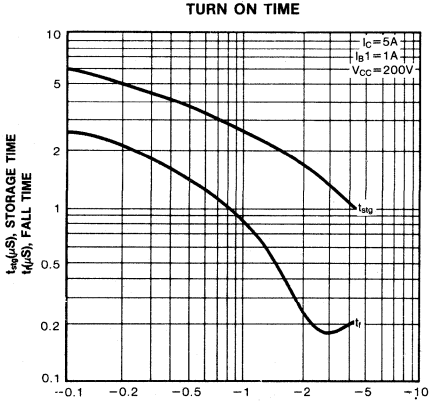
DC CURRENT GAIN



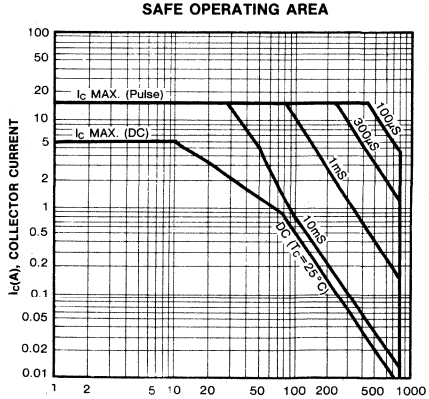
COLLECTOR-EMITTER SATURATION VOLTAGE



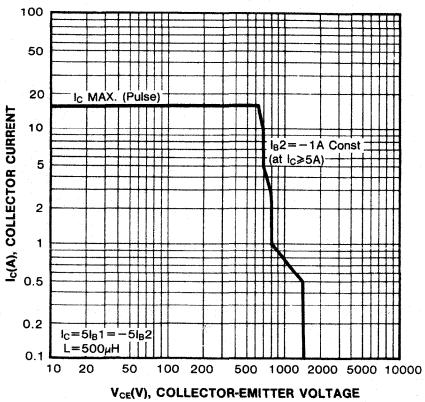
TURN ON TIME



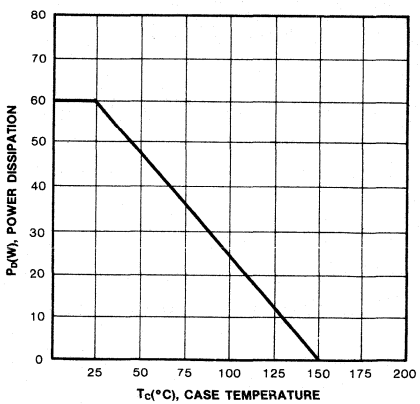
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



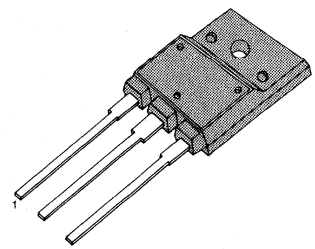
3

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS

High Collector-Base Voltage V_{CBO}=1500V

TO-3P(F)



1. Base 2. Collector 3. Emitter

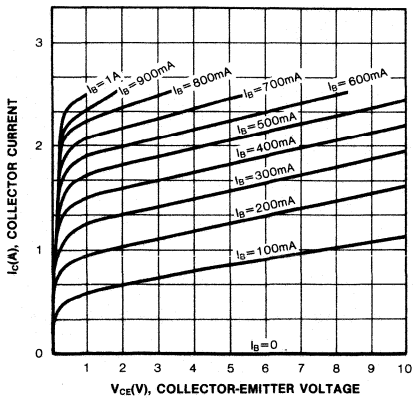
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	2.5	A
Collector Current (Peak)	I_C	10	A
Collector Dissipation (T_C=25°C)	P_C	50	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

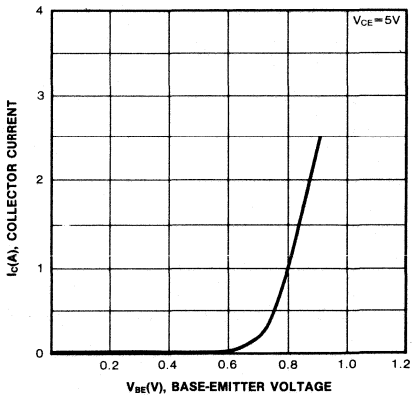
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2A, I_B=0.6A			8	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=2A, I_B=0.6A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A		3		MHz
Fall Time	t_f	I_C=2A, I_B1=0.6A I_B2=−1.2A, RL=100Ω			0.4	μS

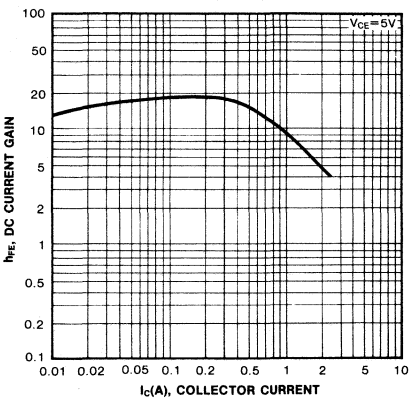
STATIC CHARACTERISTIC



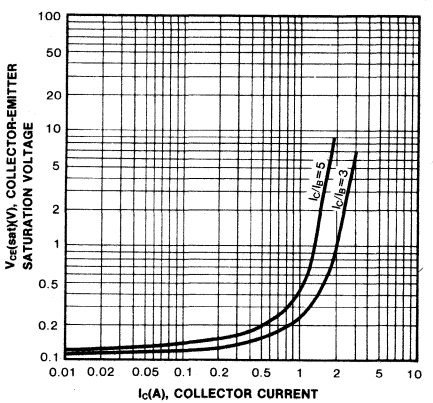
BASE-EMITTER ON VOLTAGE



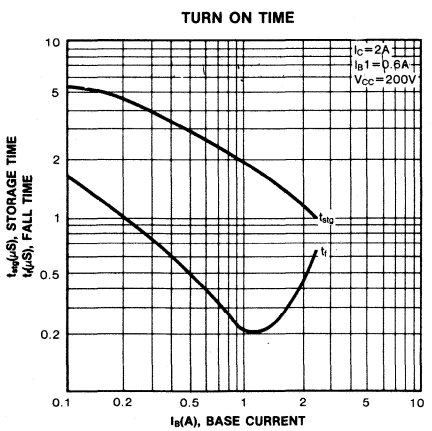
DC CURRENT GAIN



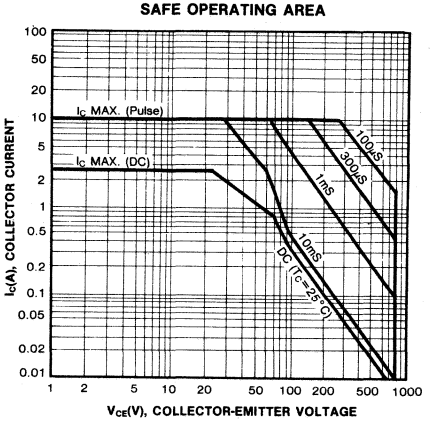
COLLECTOR-EMITTER SATURATION VOLTAGE



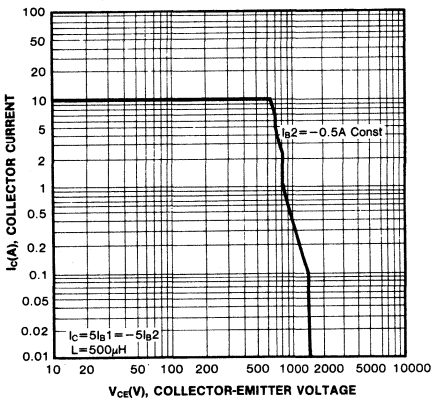
TURN ON TIME



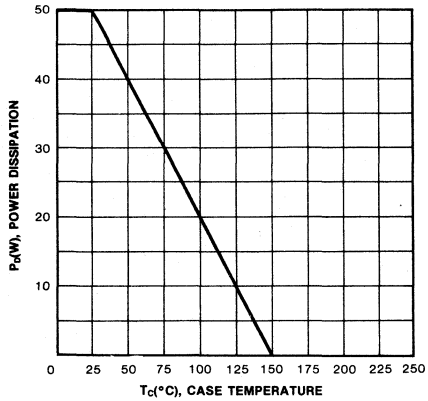
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



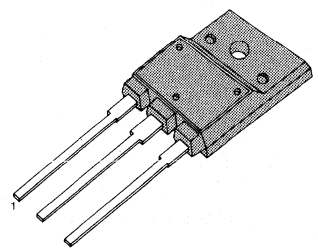
POWER DERATING



COLOR TV HORIZONTAL OUTPUT APPLICATIONS

High Collector-Base Voltage V_{CBO}=1500V

TO-3P(F)



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	3.5	A
Collector Current (Peak)	I_C	10	A
Collector Dissipation (T_C=25°C)	P_C	50	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=0.5A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2.5A, I_B=0.8A			8	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=2.5A, I_B=0.8A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A		3		MHz
Fall Time	t_f	I_C=3A, I_B1=0.8A I_B2=−1.6A, RL=66.7Ω			0.4	μS

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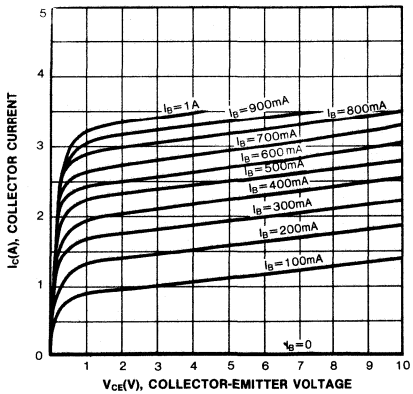
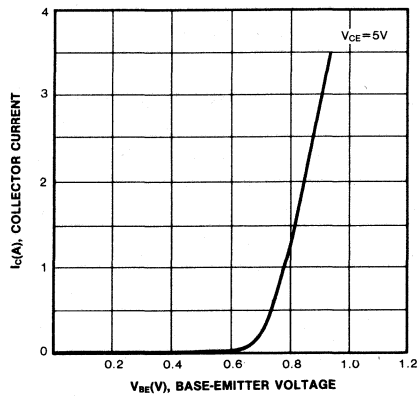
NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

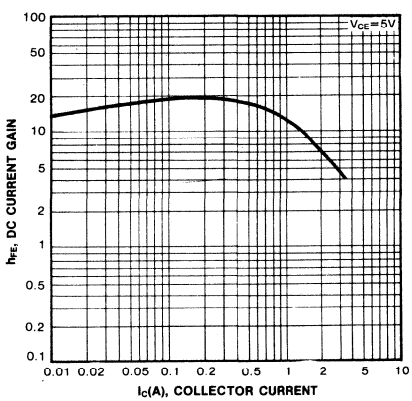
STATIC CHARACTERISTIC



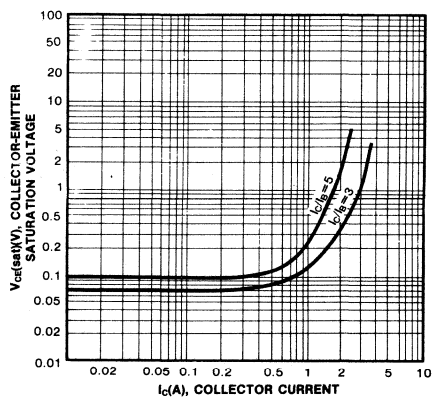
BASE-EMITTER ON VOLTAGE



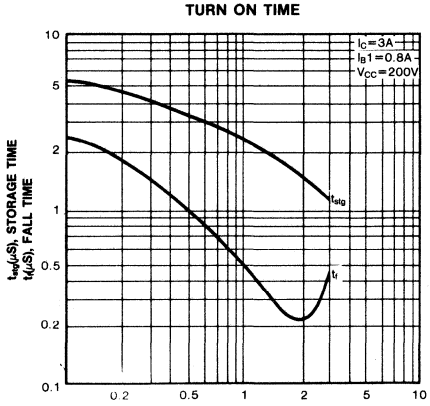
DC CURRENT GAIN



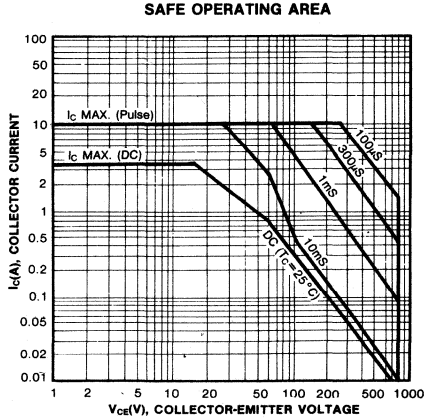
COLLECTOR-EMITTER SATURATION VOLTAGE



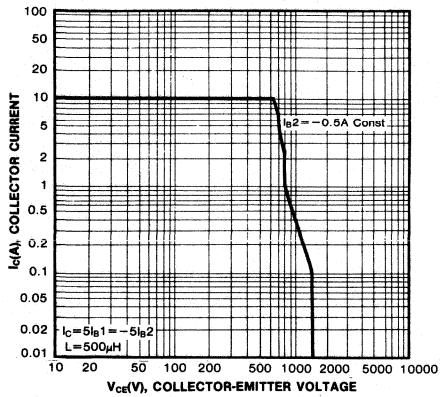
TURN ON TIME



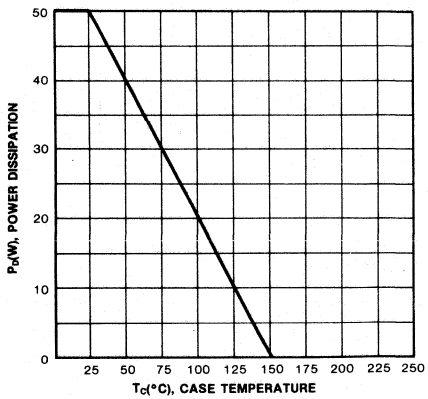
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



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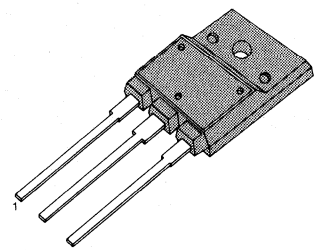
NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS

High Collector-Base Voltage V_{CBO}=1500V

TO-3P(F)



1. Base 2. Collector 3. Emitter

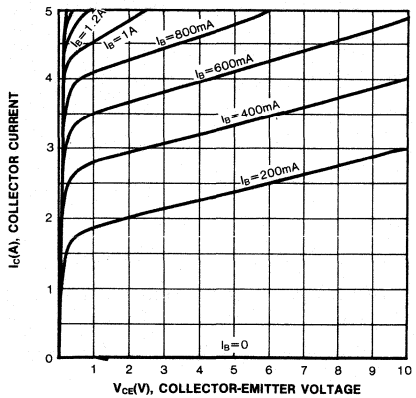
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	5	A
Collector Current (Peak)	I_C	16	A
Collector Dissipation (T_C=25°C)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

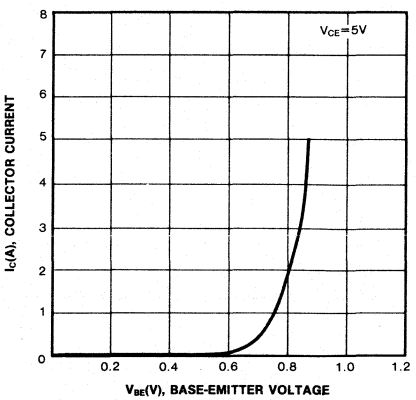
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=4A, I_B=0.8A			5	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=4A, I_B=0.8A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1A		3		MHz
Fall Time	t_f	I_C=4A, I_B1=0.8A I_B2=−1.6A, RL=50Ω			0.4	μS

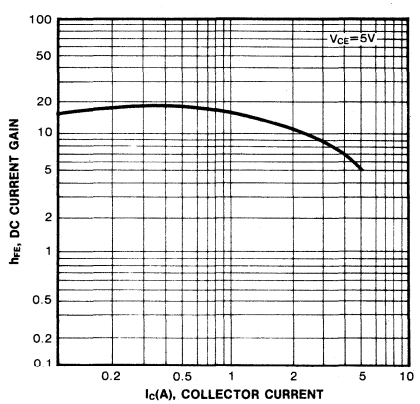
STATIC CHARACTERISTIC



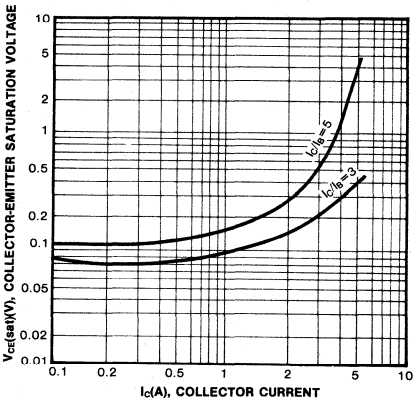
BASE-EMITTER ON VOLTAGE



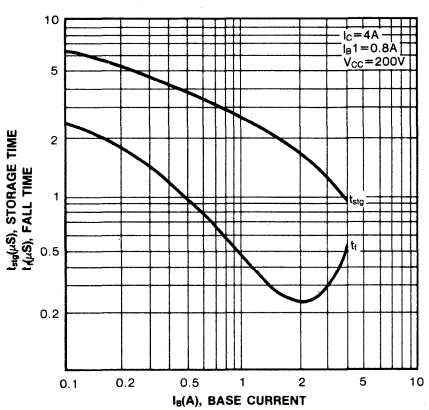
DC CURRENT GAIN



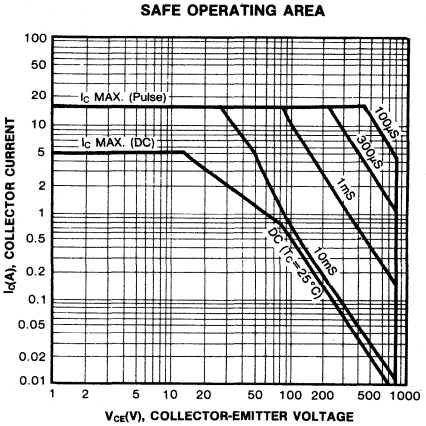
COLLECTOR-EMITTER SATURATION VOLTAGE



TURN ON TIME



SAFE OPERATING AREA



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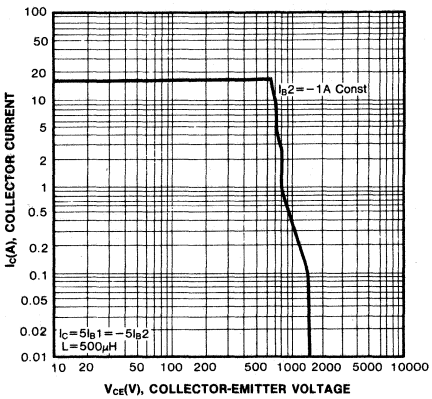
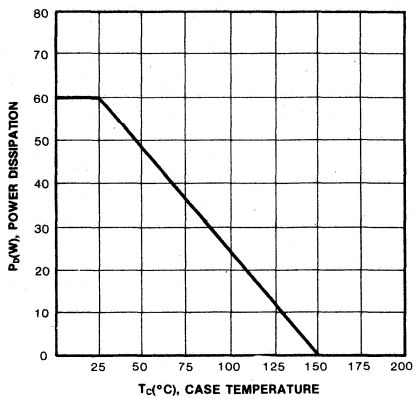
REVERSE BIAS SAFE OPERATING AREA



POWER DERATING

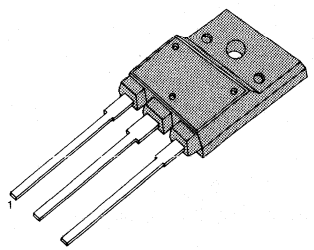


NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR TV HORIZONTAL OUTPUT APPLICATIONS

High Collector-Base Voltage V_{CBO}=1500V

TO-3P(F)



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

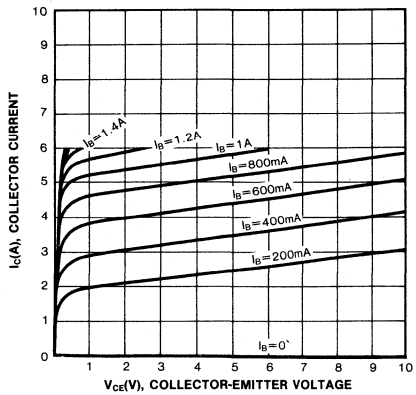
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	1500	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	6	A
Collector Current (Peak)	I_C	16	A
Collector Dissipation (T_C=25°C)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

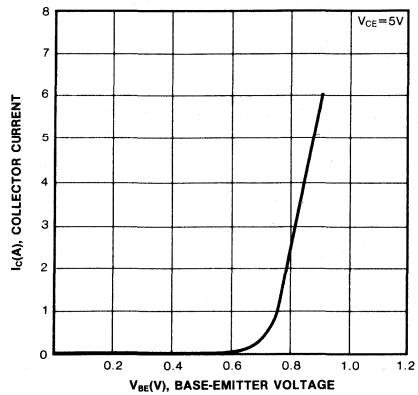
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=800V, I_E=0			10	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1A	8			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=5A, I_B=1A			5	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=5A, I_B=1A			1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1A		3		MHz
Fall Time	t_f	I_C=5A, I_B1=1A I_B2=−2A, RL=40Ω			0.4	μS

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

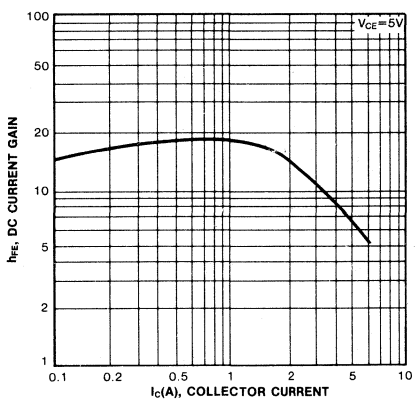
STATIC CHARACTERISTIC



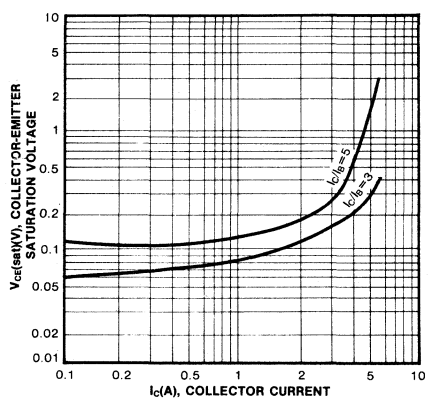
BASE-EMITTER ON VOLTAGE



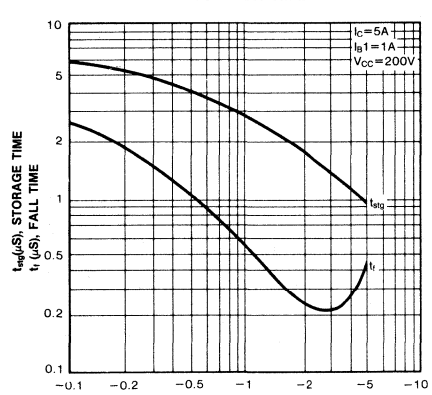
DC CURRENT GAIN



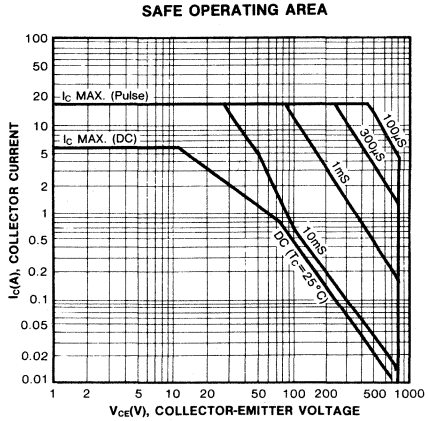
COLLECTOR-EMITTER SATURATION VOLTAGE



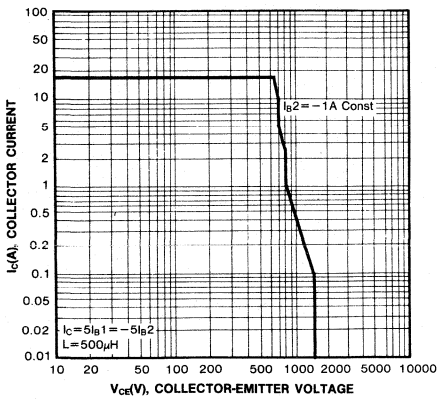
TURN ON TIME



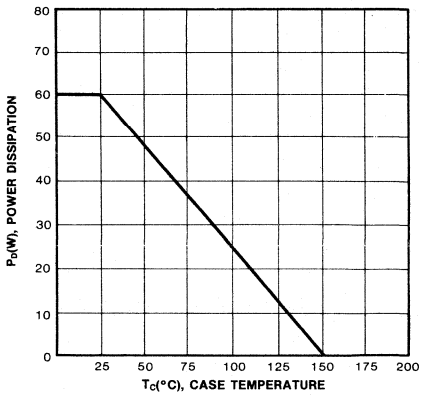
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



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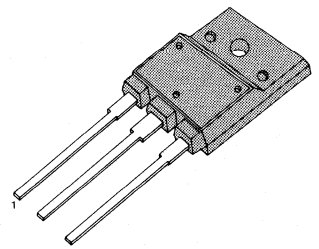
KSD5056

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR MONITOR HORIZONTAL OUTPUT APPLICATIONS

- **High Collector Base Voltage: $V_{CBO} = 1500V$**
- **Built In Damper Diode**

TO-3P(F)



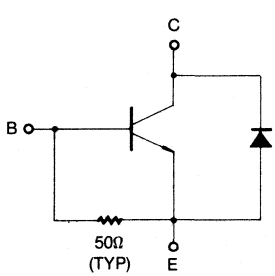
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

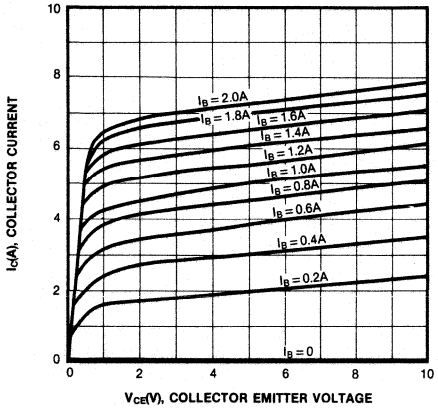
Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	1500	V
Collector Emitter Voltage	V_{CEO}	800	V
Emitter Base Voltage	V_{EBO}	6	V
Collector Current (DC)	I_C	5	A
Collector Current (Pulse)	I_C	20	A
Collector Dissipation ($T_C = 25°C$)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-55 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

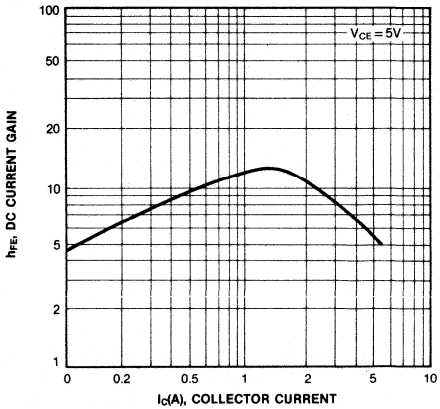
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	800			V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 800V$, $I_E = 0$			10	μA
Collector Cutoff Current	I_{CES}	$V_{CE} = 1500V$, $V_{BE} = 0$			1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 4V$, $I_C = 0$	40		130	mA
DC Current Gain	$h_{FE}1$	$V_{CE} = 5V$, $I_C = 1A$	8			
	$h_{FE}2$	$V_{CE} = 5V$, $I_C = 4A$	3			
Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 4A$, $I_B = 0.8A$			5	V
Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = 4A$, $I_B = 0.8A$			1.5	V
Damper Diode Turn On Voltage	V_f	$I_f = 5A$			2	V
Fall Time	t_f	$I_C = 4A$, $I_B1 = 0.8A$ $I_B2 = -1.6A$		0.1	0.3	μS



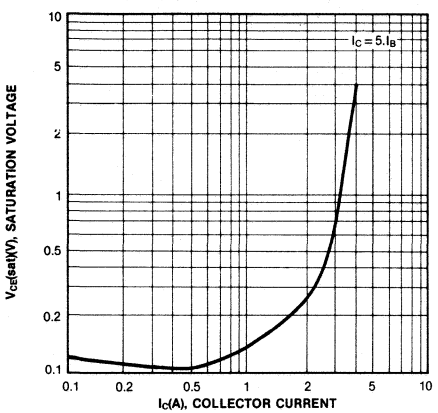
STATIC CHARACTERISTIC



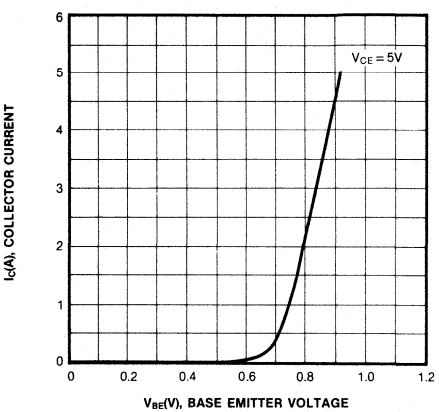
DC CURRENT GAIN



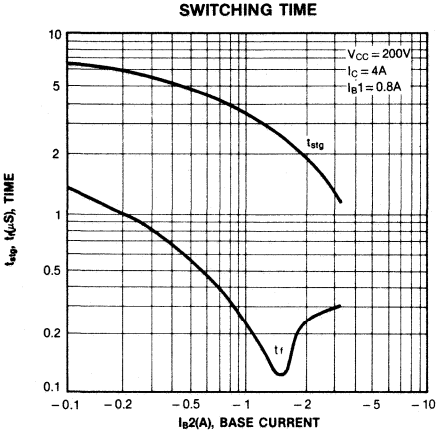
COLLECTOR EMITTER SATURATION VOLTAGE



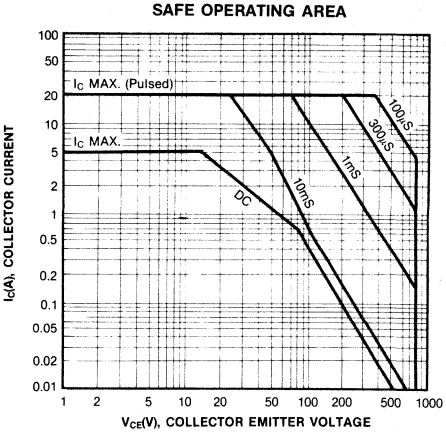
BASE EMITTER ON VOLTAGE



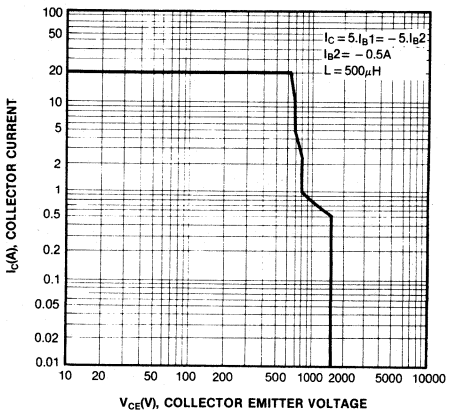
SWITCHING TIME



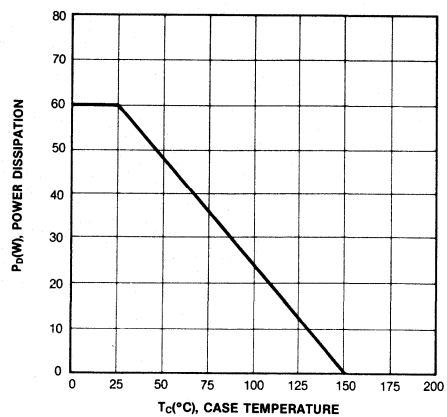
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING

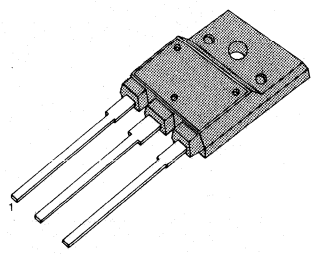


NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR MONITOR HORIZONTAL OUTPUT APPLICATIONS

- **High Collector Base Voltage: $V_{CBO} = 1500V$**
- **Built In Damper Diode**

TO-3P(F)



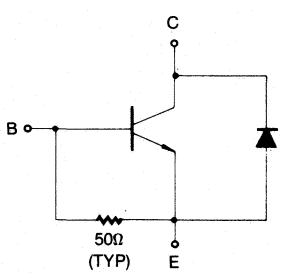
1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

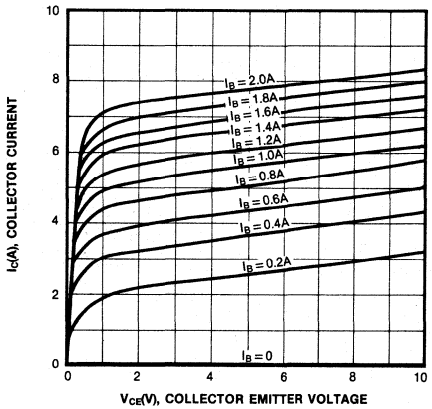
Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	1500	V
Collector Emitter Voltage	V_{CEO}	800	V
Emitter Base Voltage	V_{EBO}	6	V
Collector Current (DC)	I_C	6	A
Collector Current (Pulse)	I_C	20	A
Collector Dissipation ($T_C = 25°C$)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-55 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

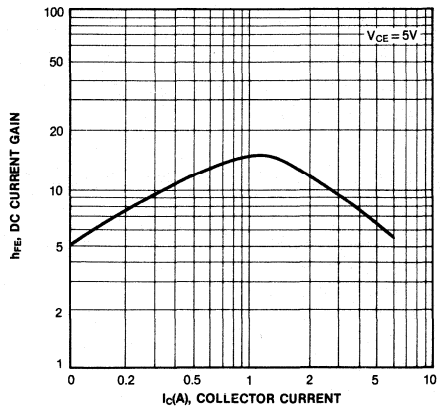
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	800			V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 800V$, $I_E = 0$			10	μA
Collector Cutoff Current	I_{CES}	$V_{CE} = 1500V$, $V_{BE} = 0$			1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 4V$, $I_C = 0$	40		130	mA
DC Current Gain	$h_{FE}1$	$V_{CE} = 5V$, $I_C = 1A$	8			
	$h_{FE}2$	$V_{CE} = 5V$, $I_C = 5A$	3			
Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 5A$, $I_B = 1A$			5	V
Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = 5A$, $I_B = 1A$			1.5	V
Damper Diode Turn On Voltage	V_f	$I_f = 6A$			2	V
Fall Time	t_f	$I_C = 4A$, $I_B1 = 0.8A$ $I_B2 = -1.6A$		0.1	0.3	μS



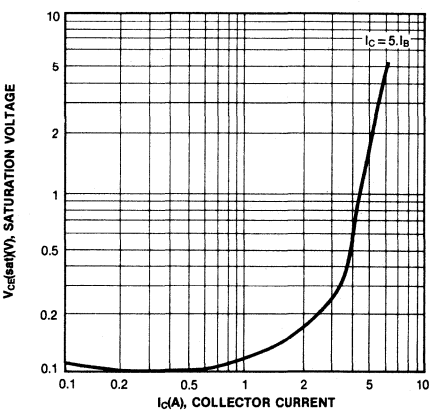
STATIC CHARACTERISTIC



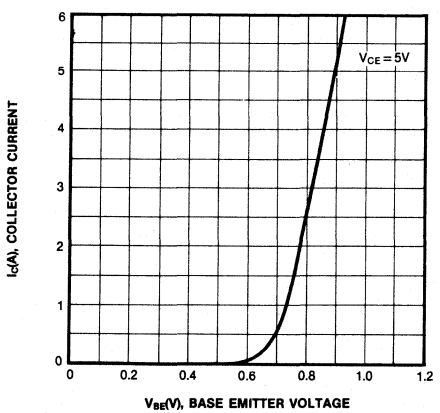
DC CURRENT GAIN



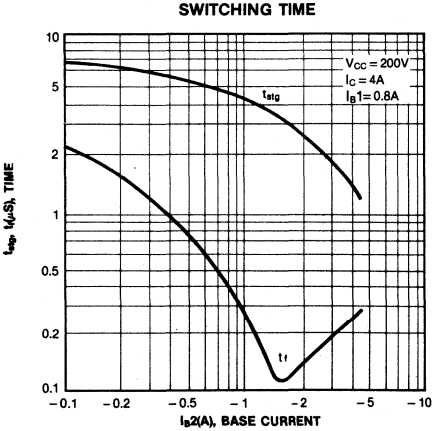
COLLECTOR EMITTER SATURATION VOLTAGE



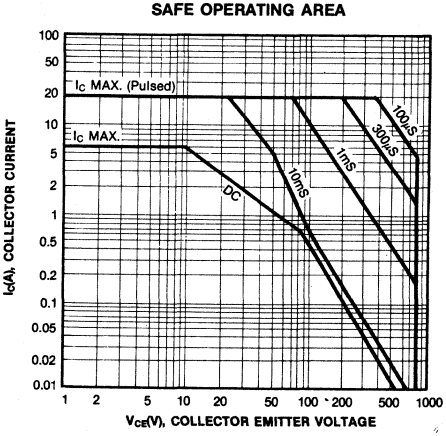
BASE EMITTER ON VOLTAGE



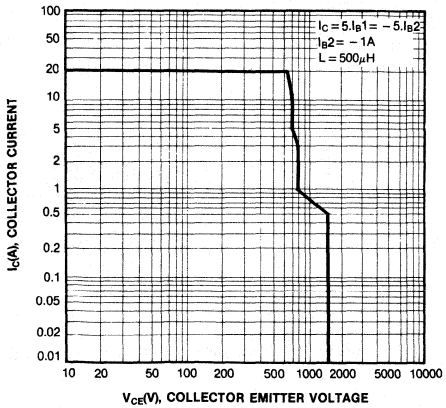
SWITCHING TIME



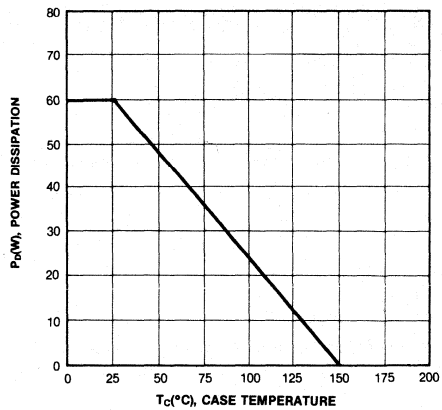
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING



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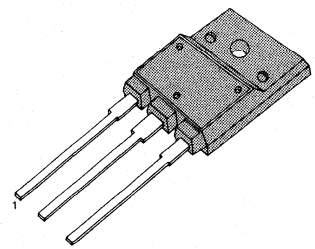
NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

COLOR MONITOR HORIZONTAL OUTPUT APPLICATIONS

- **High Collector Base Voltage: $V_{CBO} = 1500V$**

TO-3P(F)



1. Base 2. Collector 3. Emitter

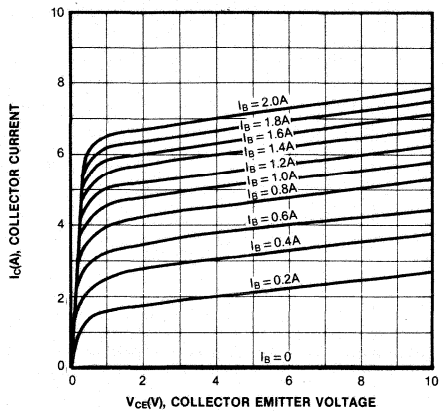
ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	1500	V
Collector Emitter Voltage	V_{CEO}	800	V
Emitter Base Voltage	V_{EBO}	6	V
Collector Current (DC)	I_C	5	A
Collector Current (Pulse)	I_C	20	A
Collector Dissipation ($T_C = 25°C$)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-55 \sim 150$	°C

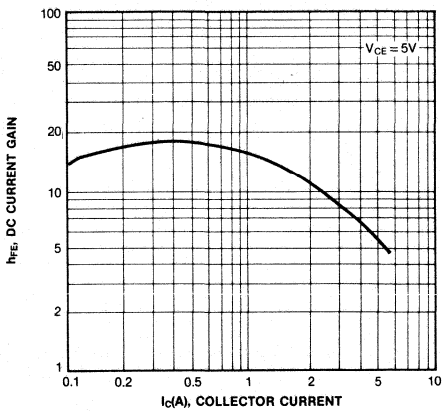
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	800			V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 800V$, $I_E = 0$			10	μA
Collector Cutoff Current	I_{CES}	$V_{CE} = 1500V$, $V_{BE} = 0$			1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 4V$, $I_C = 0$			1	mA
DC Current Gain	$h_{FE}1$	$V_{CE} = 5V$, $I_C = 1A$	8			
	$h_{FE}2$	$V_{CE} = 5V$, $I_C = 4A$	3			
Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 4A$, $I_B = 0.8A$			5	V
Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = 4A$, $I_B = 0.8A$			1.5	V
Fall Time	t_f	$I_C = 4A$, $I_B1 = 0.8A$ $I_B2 = -1.6A$		0.1	0.3	μS

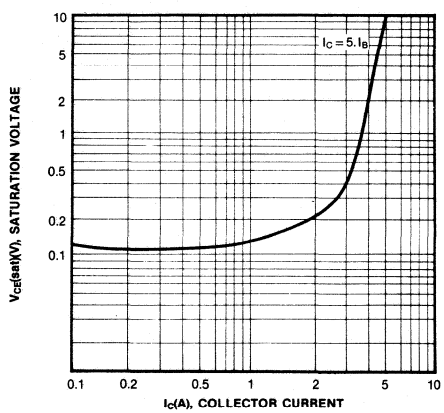
STATIC CHARACTERISTIC



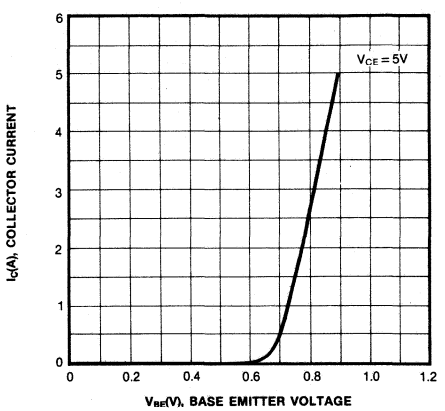
DC CURRENT GAIN



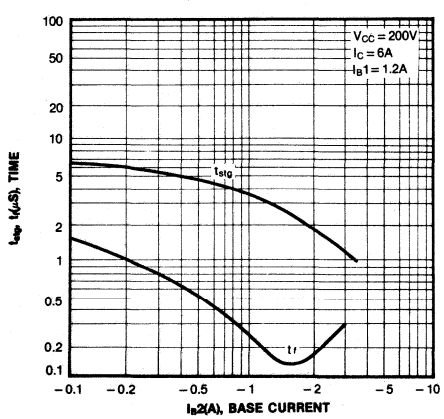
COLLECTOR EMITTER SATURATION VOLTAGE



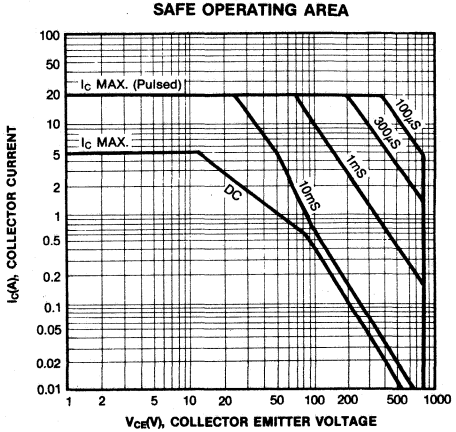
BASE EMITTER ON VOLTAGE



SWITCHING TIME



SAFE OPERATING AREA



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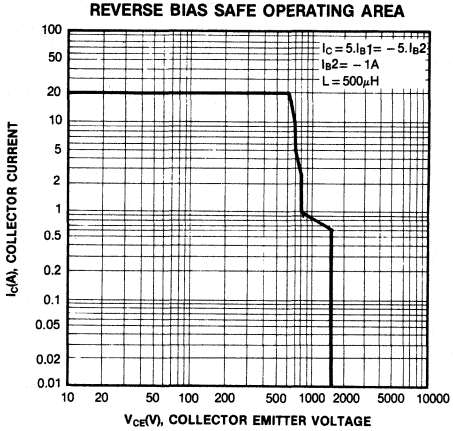
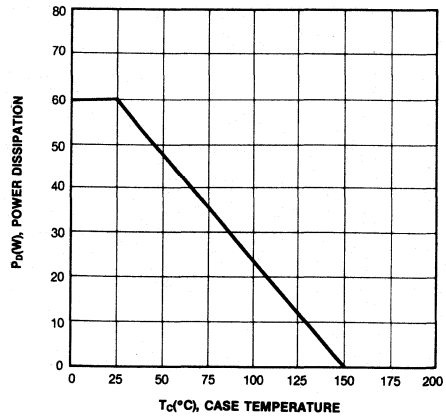
REVERSE BIAS SAFE OPERATING AREA



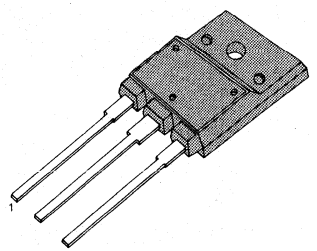
POWER DERATING



COLOR MONITOR HORIZONTAL OUTPUT APPLICATIONS

- **High Collector Base Voltage: $V_{CBO} = 1500V$**

TO-3P(F)



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

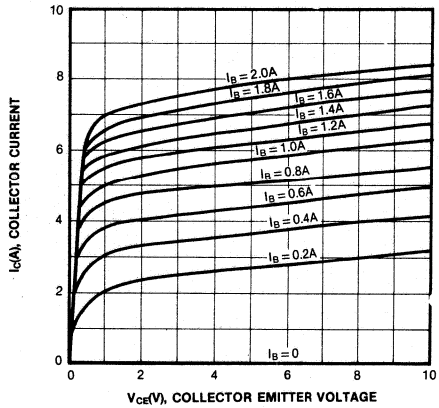
Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	1500	V
Collector Emitter Voltage	V_{CEO}	800	V
Emitter Base Voltage	V_{EBO}	6	V
Collector Current (DC)	I_C	6	A
Collector Current (Pulse)	I_C	20	A
Collector Dissipation ($T_C = 25°C$)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-55 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

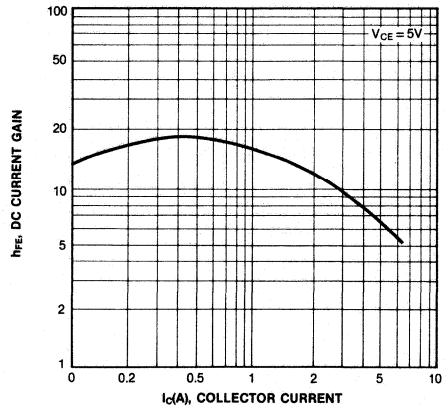
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	800			V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 800V$, $I_E = 0$			10	μA
Collector Cutoff Current	I_{CES}	$V_{CE} = 1500V$, $V_{BE} = 0$			1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 4V$, $I_C = 0$			1	mA
DC Current Gain	$h_{FE}1$	$V_{CE} = 5V$, $I_C = 1A$	8			
	$h_{FE}2$	$V_{CE} = 5V$, $I_C = 5A$	3			
Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 5A$, $I_B = 1A$			5	V
Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = 5A$, $I_B = 1A$			1.5	V
Fall Time	t_f	$I_C = 4A$, $I_{B1} = 0.8A$ $I_{B2} = -1.6A$		0.1	0.3	μS

3

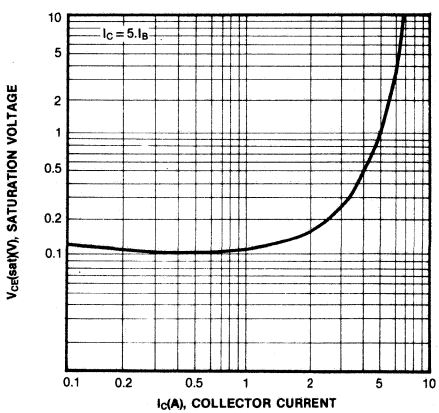
STATIC CHARACTERISTIC



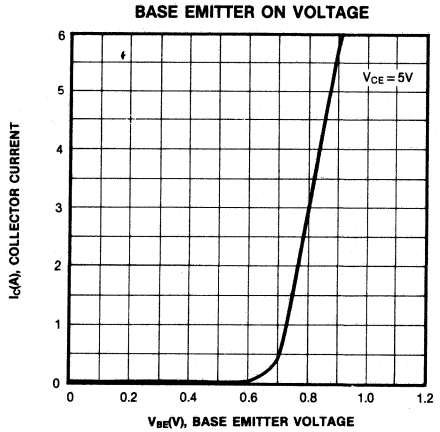
DC CURRENT GAIN



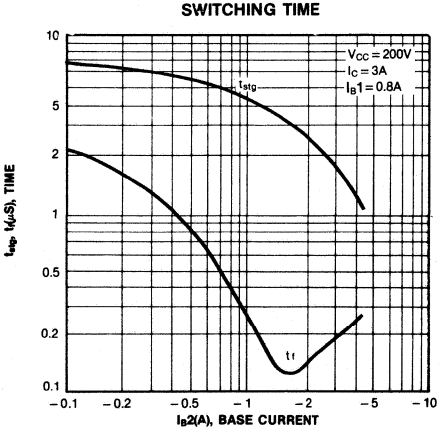
COLLECTOR EMITTER SATURATION VOLTAGE



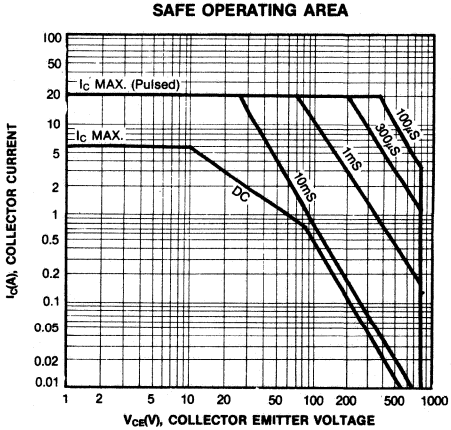
BASE EMITTER ON VOLTAGE



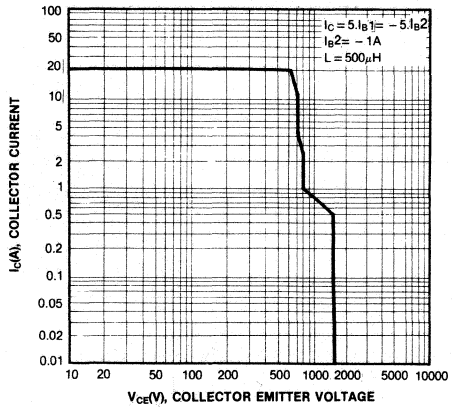
SWITCHING TIME



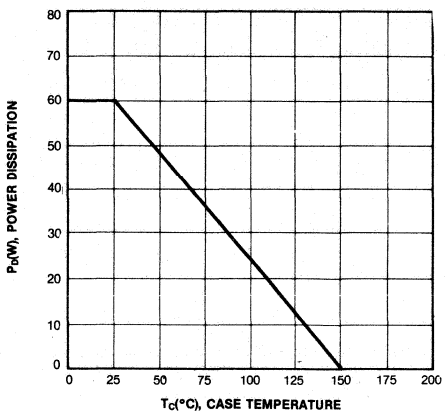
SAFE OPERATING AREA



REVERSE BIAS SAFE OPERATING AREA



POWER DERATING

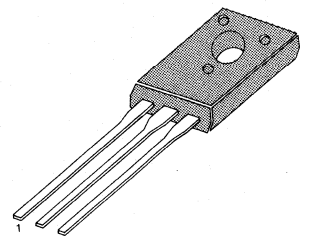


3

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD136, BD138 and BD140 respectively**

TO-126



1. Emitter 2. Collector 3 Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD135	V_{CBO}	45	V
	: BD137		60	V
	: BD139		80	V
Collector Emitter Voltage	: BD135	V_{CEO}	45	V
	: BD137		60	V
	: BD139		80	V
Emitter Base Voltage		V_{EBO}	5	V
Collector Current (DC)		I_C	1.5	A
Collector Current (Pulse)		I_C	3.0	A
Base Current		I_B	0.5	A
Collector Dissipation ($T_c = 25°C$)		P_C	12.5	W
Collector Dissipation ($T_a = 25°C$)		P_C	1.25	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	$-55 \sim 150$	°C

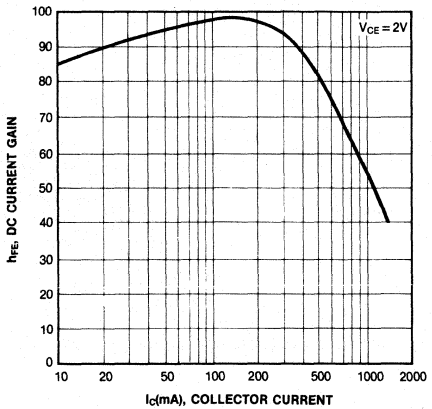
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	: BD135	$V_{CEO}(sus)$	$I_C = 30mA$, $I_B = 0$	45			V
	: BD137			60			V
	: BD139			80			V
Collector Cutoff Current		I_{CBO}	$V_{CB} = 30V$, $I_E = 0$			0.1	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			10	μA
DC Current Gain	: ALL DEVICE	$h_{FE}1$	$V_{CE} = 2V$, $I_C = 5mA$	25			
	: ALL DEVICE	$h_{FE}2$	$V_{CE} = 2V$, $I_C = 0.5A$	25			
	: BD135	$h_{FE}3$	$V_{CE} = 2V$, $I_C = 150mA$	40		250	
	: BD137, BD139			40		160	
Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = 500mA$, $I_B = 50mA$			0.5	V
Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = 2V$, $I_C = 0.5A$			1	V

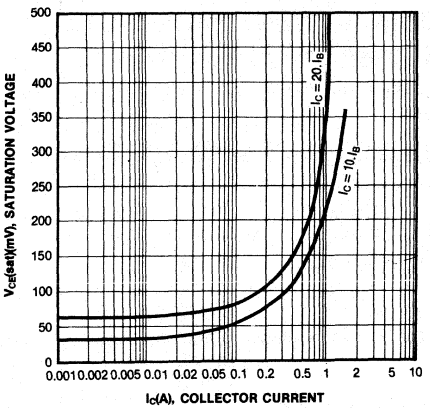
h_{FE} (3) CLASSIFICATION

Classification	6	10	16
$h_{FE}3$	40-100	63-160	100-250

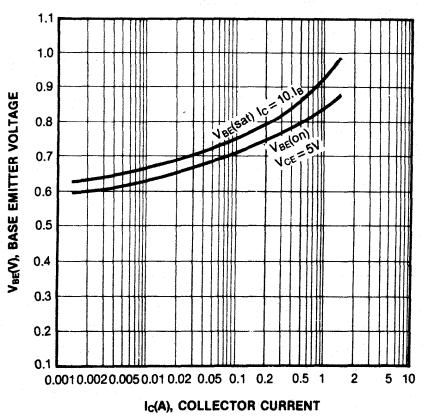
DC CURRENT GAIN



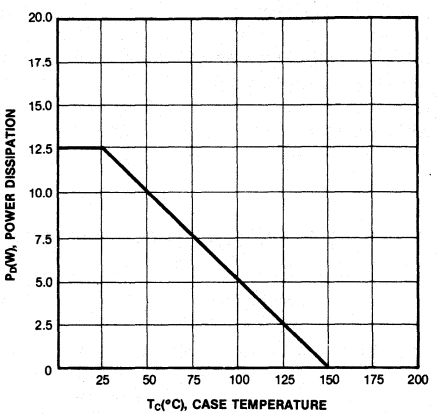
COLLECTOR EMITTER SATURATION VOLTAGE



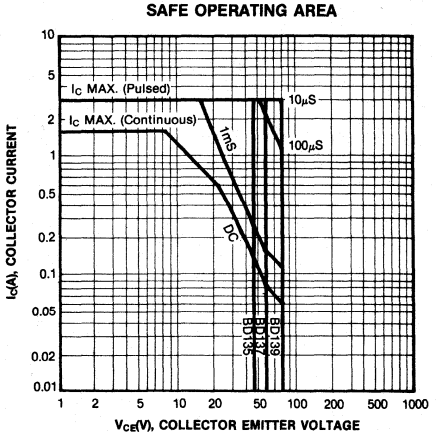
BASE EMITTER VOLTAGE



POWER DERATING



SAFE OPERATING AREA



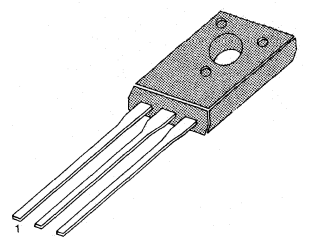
3

BD136/138/140 PNP EPITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD135, BD137 and BD139 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD136	V_{CBO}	−45	V
	: BD138		−60	V
	: BD140		−80	V
Collector Emitter Voltage	: BD136	V_{CEO}	−45	V
	: BD138		−60	V
	: BD140		−80	V
Emitter Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−1.5	A
Collector Current (Pulse)		I_C	−3.0	A
Base Current		I_B	−0.5	A
Collector Dissipation ($T_c = 25°C$)		P_C	12.5	W
Collector Dissipation ($T_a = 25°C$)		P_C	1.25	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

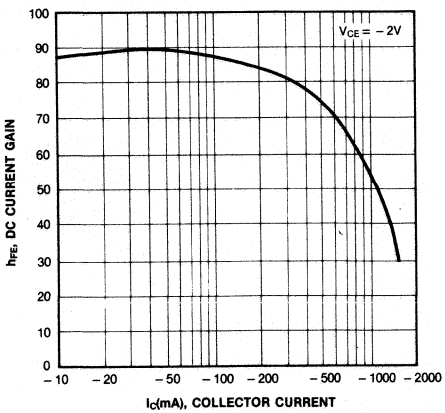
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage	: BD136	$V_{CEO}(sus)$	$I_C = -30mA$, $I_B = 0$	−45			V
	: BD138			−60			V
	: BD140			−80			V
Collector Cutoff Current		I_{CBO}	$V_{CB} = -30V$, $I_E = 0$			−0.1	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−10	μA
*DC Current Gain	: ALL DEVICE	$h_{FE}1$	$V_{CE} = -2V$, $I_C = -5mA$	25			
	: ALL DEVICE	$h_{FE}2$	$V_{CE} = -2V$, $I_C = -0.5A$	25			
	: BD136	$h_{FE}3$	$V_{CE} = -2V$, $I_C = -150mA$	40		250	
	: BD138, BD140			40		160	
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = -500mA$, $I_B = -50mA$			−0.5	V
*Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = -2V$, $I_C = -0.5A$			−1	V

*Pulse Test: PW = 350μS, duty cycle = 2% pulsed

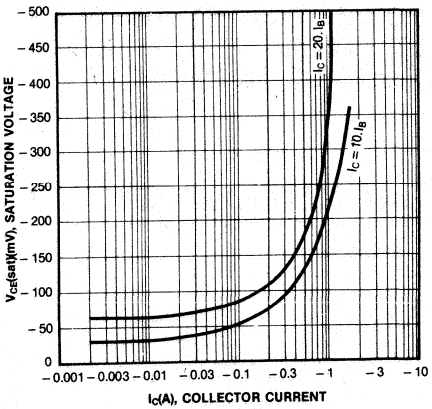
h_{FE} (3) CLASSIFICATION

Classification	6	10	16
$h_{FE}3$	40-100	63-160	100-250

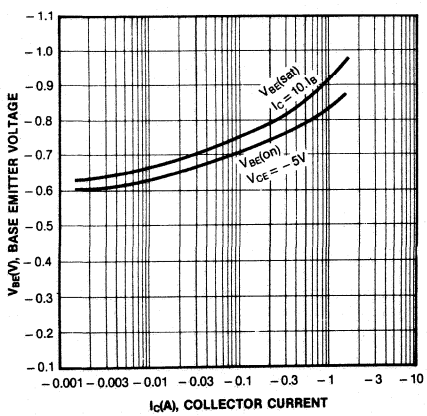
DC CURRENT GAIN



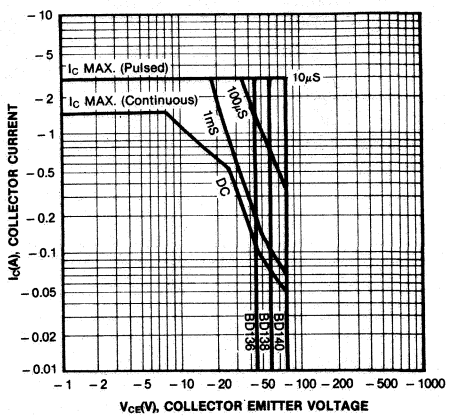
COLLECTOR EMITTER SATURATION VOLTAGE



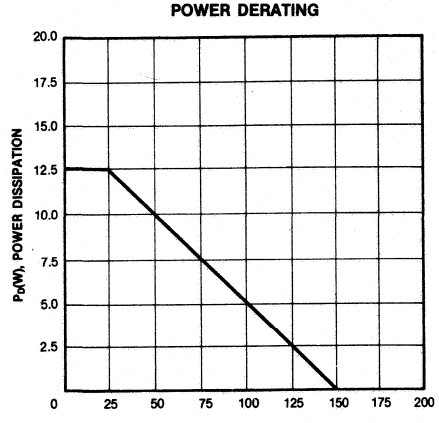
BASE EMITTER VOLTAGE



SAFE OPERATING AREA



POWER DERATING

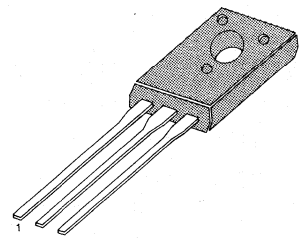


3

BD157/158/159 NPN EPITAXIAL SILICON TRANSISTOR

LOW POWER FAST SWITCHING OUTPUT STAGES FOR T.V. RADIO AUDIO OUTPUT AMPLIFIERS

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

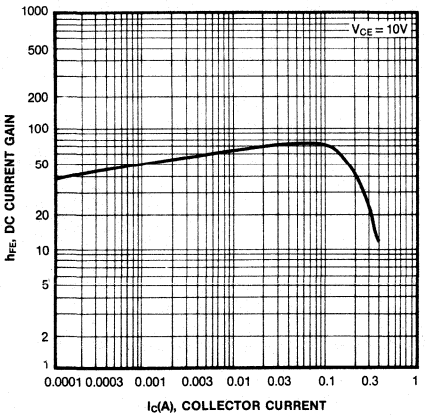
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BD157	V_{CBO}	275	V
: BD158		325	V
: BD159		375	V
Collector Emitter Voltage: BD157	V_{CEO}	250	V
: BD158		300	V
: BD159		350	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	0.5	A
Collector Current (Pulse)	I_C	1.0	A
Base Current	I_B	0.25	A
Collector Dissipation ($T_c = 25°C$)	P_C	20	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

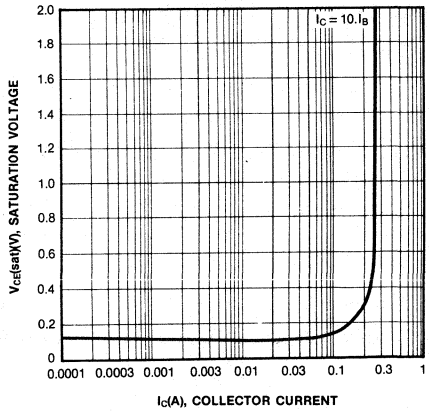
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Voltage: BD157	V_{CEO}	$I_C = 1mA$, $I_B = 0$	250			V
: BD158			300			V
: BD159			350			V
Collector Cutoff Current : BD157	I_{CBO}	$V_{CB} = 275V$, $I_E = 0$			100	μA
: BD158		$V_{CB} = 325V$, $I_E = 0$			100	μA
: BD159		$V_{CB} = 375V$, $I_E = 0$			100	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			100	μA
*DC Current Gain	h_{FE}	$V_{CE} = 10V$, $I_C = 50mA$	30		240	

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

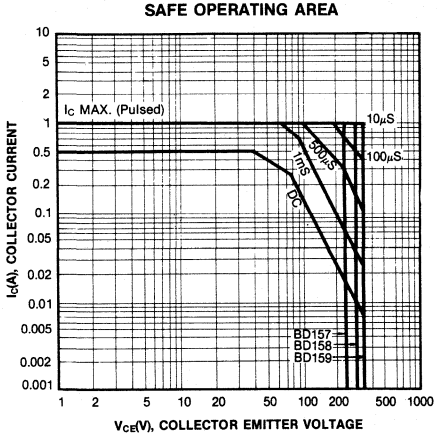
DC CURRENT GAIN



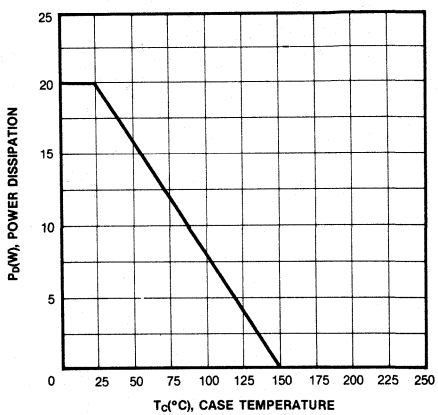
COLLECTOR EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING



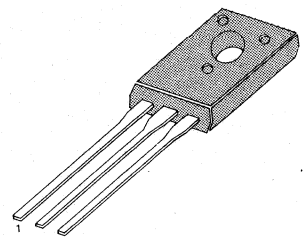
3

BD175/177/179 NPN EPITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD176/178/180 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

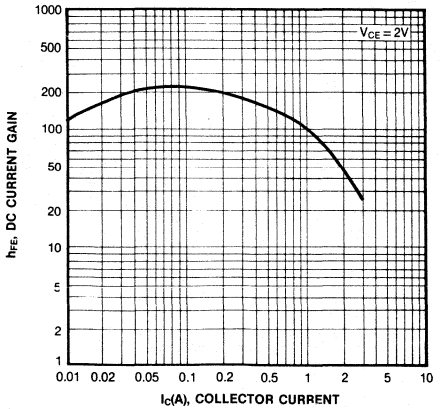
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD175	V_{CBO}	45	V
	: BD177		60	V
	: BD179		80	V
Collector Emitter Voltage:	BD175	V_{CEO}	45	V
	: BD177		60	V
	: BD179		80	V
Emitter Base Voltage		V_{EBO}	5	V
Collector Current (DC)		I_C	3	A
Collector Current (Pulse)		I_C	7	A
Collector Dissipation ($T_C = 25°C$)		P_C	30	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_c = 25°C$)

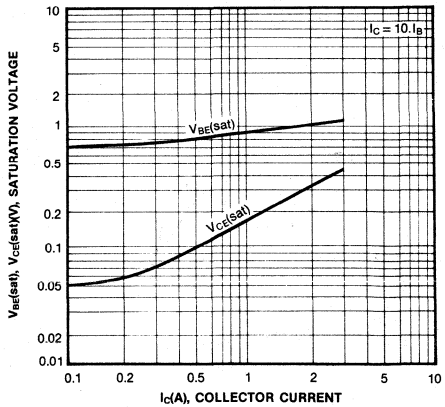
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage:	BD175	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	45			V
	: BD177			60			V
	: BD179			80			V
Collector Cutoff Current	: BD175	I_{CBO}	$V_{CB} = 45V$, $I_E = 0$			100	μA
	: BD177		$V_{CB} = 60V$, $I_E = 0$			100	μA
	: BD179		$V_{CB} = 80V$, $I_E = 0$			100	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			1	mA
*DC Current Gain		h_{FE}	$V_{CE} = 2V$, $I_C = 150mA$	40			
			$V_{CE} = 2V$, $I_C = 1A$	15			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = 1A$, $I_B = 0.1A$			0.8	V
*Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = 2V$, $I_C = 1A$			1.3	V
Current Gain Bandwidth Product		f_T	$V_{CE} = 10V$, $I_C = 250mA$	3			MHz

*Pulse Test: PW = 300μS, duty cycle ≤ 1.5% pulsed

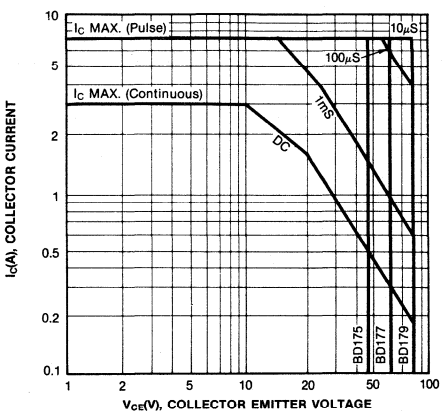
DC CURRENT GAIN



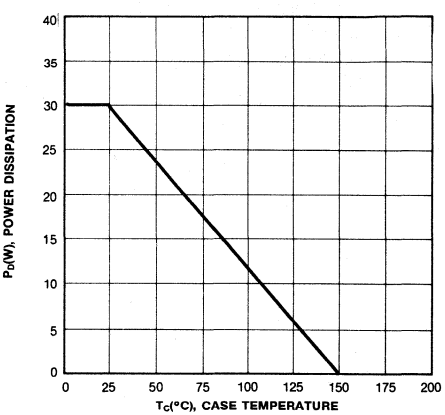
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING

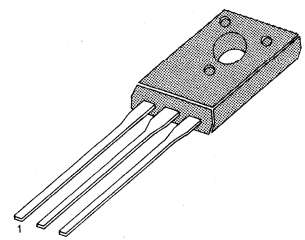


3

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD175/177/179 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

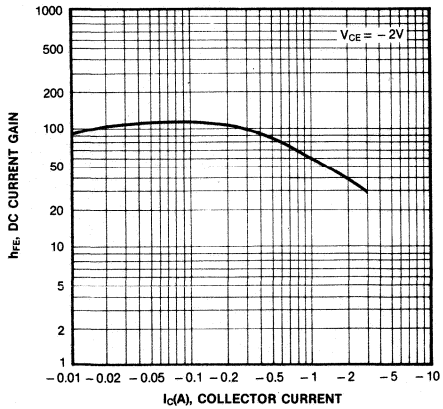
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BD176	V_{CBO}	−45	V
: BD178		−60	V
: BD180		−80	V
Collector Emitter Voltage: BD176	V_{CEO}	−45	V
: BD178		−60	V
: BD180		−80	V
Emitter Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−3	A
Collector Current (Pulse)	I_C	−7	A
Collector Dissipation ($T_C = 25°C$)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_c = 25°C$)

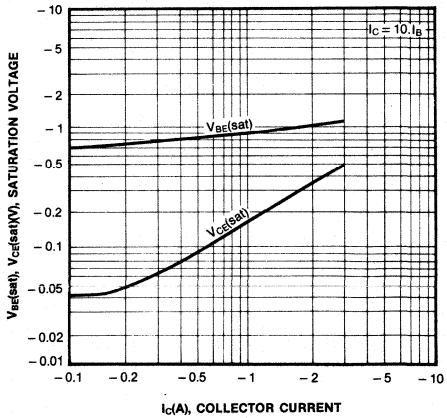
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD176	$V_{CEO}(sus)$	$I_C = -100mA$, $I_B = 0$	−45			V
: BD178			−60			V
: BD180			−80			V
Collector Cutoff Current: : BD176	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−100	μA
: BD178		$V_{CB} = -60V$, $I_E = 0$			−100	μA
: BD180		$V_{CB} = -80V$, $I_E = 0$			−100	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−1	mA
*DC Current Gain	h_{FE}	$V_{CE} = -2V$, $I_C = -150mA$	40			
		$V_{CE} = -2V$, $I_C = -1A$	15			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -1A$, $I_B = -0.1A$			−0.8	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = -2V$, $I_C = -1A$			−1.3	V
Current Gain Bandwidth Product	f_T	$V_{CE} = -10V$, $I_C = -250mA$	3			MHz

*Pulse Test: PW = 300μS, duty cycle ≤ 1.5% pulsed

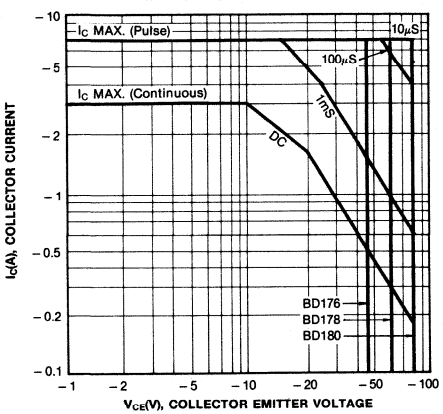
DC CURRENT GAIN



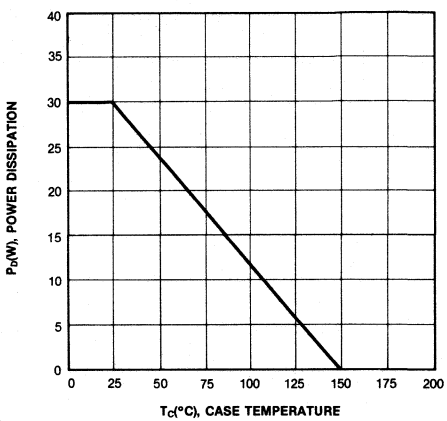
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING



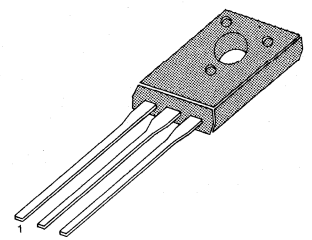
3

BD233/235/237 PNP EPITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD234/236/238 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

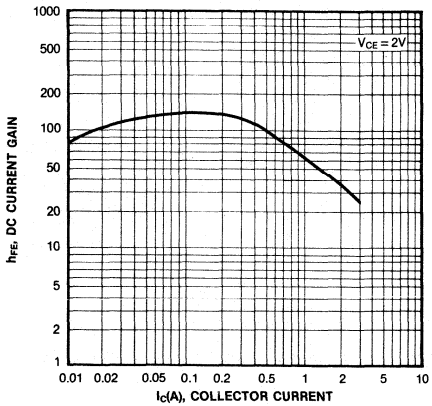
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BD233	V_{CBO}	45	V
: BD235		60	V
: BD237		100	V
Collector Emitter Voltage: BD233	V_{CEO}	45	V
: BD235		60	V
: BD237		80	V
Collector Emitter Voltage: BD233	V_{CER}	45	V
: BD235		60	V
: BD237		100	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	2	A
Collector Current (Pulse)	I_C	6	A
Collector Dissipation ($T_C = 25°C$)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_c = 25°C$)

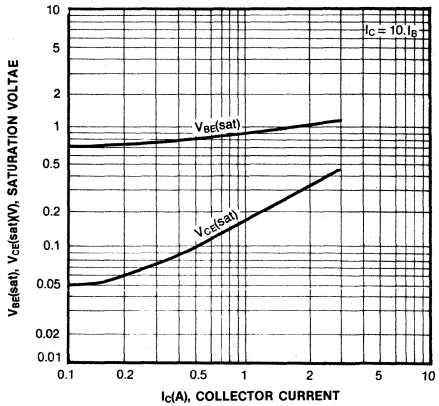
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD233	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	45			V
: BD235			60			V
: BD237			80			V
Collector Cutoff Current: : BD233	I_{CBO}	$V_{CB} = 45V$, $I_E = 0$			100	μA
: BD235		$V_{CB} = 60V$, $I_E = 0$			100	μA
: BD237		$V_{CB} = 100V$, $I_E = 0$			100	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			1	mA
*DC Current Gain	h_{FE}	$V_{CE} = 2V$, $I_C = 150mA$	40			
		$V_{CE} = 2V$, $I_C = 1A$	25			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 1A$, $I_B = 0.1A$			0.6	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = 2V$, $I_C = 1A$			1.3	V
Current Gain Bandwidth Product	f_T	$V_{CE} = 10V$, $I_C = 250mA$	3			MHz

*Pulse Test: PW = 300μS, duty cycle ≤ 1.5% pulsed

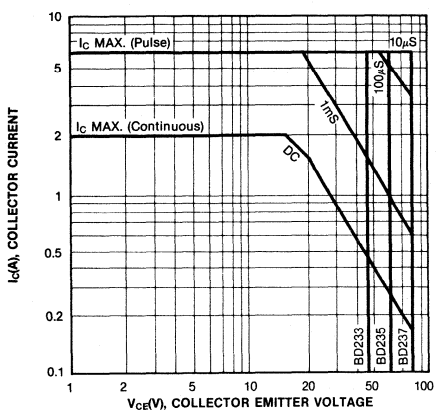
DC CURRENT GAIN



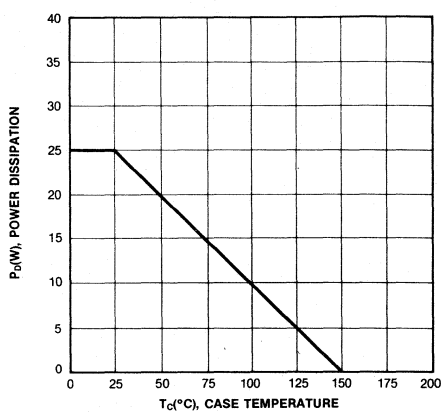
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING



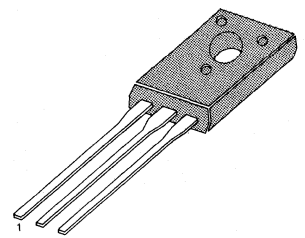
3

BD234/236/238 PNP EPITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD233/235/237 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

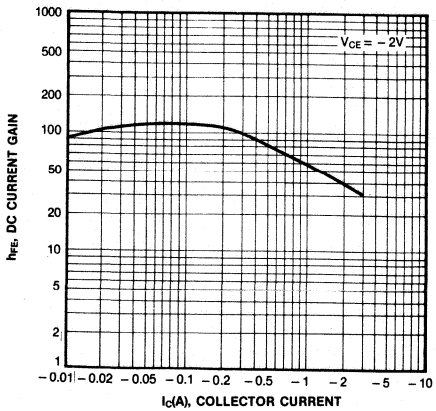
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BD234	V_{CBO}	−45	V
: BD236		−60	V
: BD238		−100	V
Collector Emitter Voltage: BD234	V_{CEO}	−45	V
: BD236		−60	V
: BD238		−80	V
Collector Emitter Voltage: BD234	V_{CER}	−45	V
: BD236		−60	V
: BD238		−100	V
Emitter Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−2	A
Collector Current (Pulse)	I_C	−6	A
Collector Dissipation ($T_C = 25°C$)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_c = 25°C$)

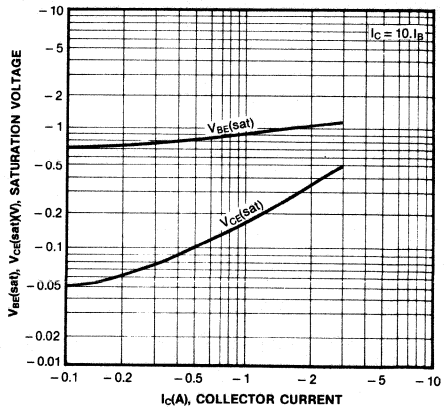
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD234	$V_{CEO}(sus)$	$I_C = -100mA$, $I_B = 0$	−45			V
: BD236			−60			V
: BD238			−80			V
Collector Cutoff Current : BD234	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−100	μA
: BD236		$V_{CB} = -60V$, $I_E = 0$			−100	μA
: BD238		$V_{CB} = -100V$, $I_E = 0$			−100	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−1	mA
*DC Current Gain	h_{FE}	$V_{CE} = -2V$, $I_C = -150mA$	40			
		$V_{CE} = -2V$, $I_C = -1A$	25			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -1A$, $I_B = -0.1A$			−0.6	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = -2V$, $I_C = -1A$			−1.3	V
Current Gain Bandwidth Product	f_T	$V_{CE} = -10V$, $I_C = -250mA$	3			MHz

*Pulse Test: PW = 300μS, duty cycle ≤ 1.5% pulsed

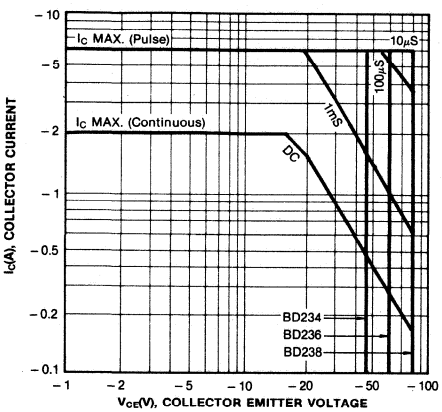
DC CURRENT GAIN



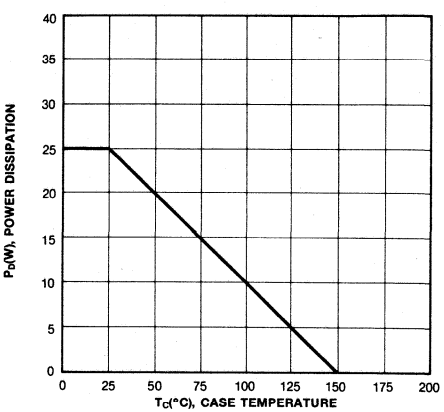
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING

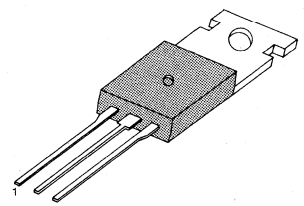


3

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD240/A/B/C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage: BD239	V_{CEO}	45	V
: BD239A		60	V
: BD239B		80	V
: BD239C		100	V
Collector Emitter Voltage: BD239	V_{CER}	55	V
: BD239A		70	V
: BD239B		90	V
: BD239C		115	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	2	A
Collector Current (Pulse)	I_C	4	A
Base Current	I_B	0.6	A
Collector Dissipation ($T_C = 25°C$)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_c = 25°C$)

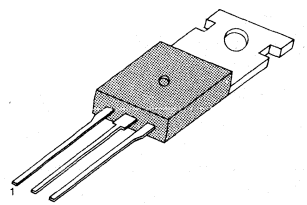
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD239		$V_{CEO}(sus)$	$I_C = 30mA$, $I_B = 0$	45			V
: BD239A				60			V
: BD239B				80			V
: BD239C				100			V
Collector Cutoff Current	: BD239/A	I_{CEO}	$V_{CE} = 30V$, $I_B = 0$			0.3	mA
	: BD239B/C		$V_{CE} = 60V$, $I_B = 0$			0.3	mA
Collector Cutoff Current	: BD239	I_{CES}	$V_{CE} = 45V$, $V_{BE} = 0$			0.2	mA
	: BD239A		$V_{CE} = 60V$, $V_{BE} = 0$			0.2	mA
	: BD239B		$V_{CE} = 80V$, $V_{BE} = 0$			0.2	mA
	: BD239C		$V_{CE} = 100V$, $V_{BE} = 0$			0.2	mA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			1	mA
*DC Current Gain		h_{FE}	$V_{CE} = 4V$, $I_C = 0.2A$	40			
			$V_{CE} = 4V$, $I_C = 1A$	15			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = 1A$, $I_B = 0.2A$			0.7	V
*Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = 4V$, $I_C = 1A$			1.3	V

*Pulse Test: PW = 300μS, duty cycle ≤ 2.0% pulsed

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD239/A/B/C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage: BD240	V_{CEO}	−45	V
: BD240A		−60	V
: BD240B		−80	V
: BD240C		−100	V
Collector Emitter Voltage: BD240	V_{CER}	−55	V
: BD240A		−70	V
: BD240B		−90	V
: BD240C		−115	V
Emitter Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−2	A
Collector Current (Pulse)	I_C	−4	A
Base Current	I_B	−0.6	A
Collector Dissipation ($T_C = 25°C$)	P_C	30	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

ELECTRICAL CHARACTERISTICS ($T_c = 25°C$)

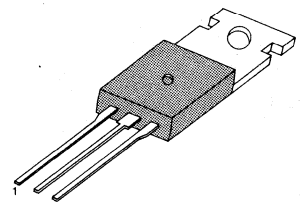
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD240	$V_{CEO}(sus)$	$I_C = -30mA$, $I_B = 0$	−45			V
: BD240A			−60			V
: BD240B			−80			V
: BD240C			−100			V
Collector Cutoff Current : BD240/A	I_{CEO}	$V_{CE} = -30V$, $I_B = 0$			−0.3	mA
: BD240B/C		$V_{CE} = -60V$, $I_B = 0$			−0.3	mA
Collector Cutoff Current : BD240	I_{CES}	$V_{CE} = -45V$, $V_{BE} = 0$			−0.2	mA
: BD240A		$V_{CE} = -60V$, $V_{BE} = 0$			−0.2	mA
: BD240B		$V_{CE} = -80V$, $V_{BE} = 0$			−0.2	mA
: BD240C		$V_{CE} = -100V$, $V_{BE} = 0$			−0.2	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−1	mA
*DC Current Gain	h_{FE}	$V_{CE} = -4V$, $I_C = -0.2A$	40			
		$V_{CE} = -4V$, $I_C = -1A$	15			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -1A$, $I_B = -0.2A$			−0.7	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = -4V$, $I_C = -1A$			−1.3	V

*Pulse Test: PW = 300μS, duty cycle ≤ 2.0% pulsed

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD242/A/B/C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage: BD241	V_{CEO}	45	V
: BD241A		60	V
: BD241B		80	V
: BD241C		100	V
Collector Emitter Voltage: BD241	V_{CER}	55	V
: BD241A		70	V
: BD241B		90	V
: BD241C		115	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	3	A
Collector Current (Pulse)	I_C	5	A
Base Current	I_B	1	A
Collector Dissipation ($T_C = 25°C$)	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_c = 25°C$)

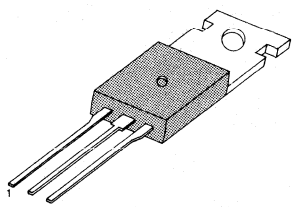
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD241	$V_{CEO}(sus)$	$I_C = 30mA$, $I_B = 0$	45			V
: BD241A			60			V
: BD241B			80			V
: BD241C			100			V
Collector Cutoff Current : BD241/A	I_{CEO}	$V_{CE} = 30V$, $I_B = 0$			0.3	mA
: BD241B/C		$V_{CE} = 60V$, $I_B = 0$			0.3	mA
Collector Cutoff Current : BD241	I_{CES}	$V_{CE} = 45V$, $V_{BE} = 0$			0.2	mA
: BD241A		$V_{CE} = 60V$, $V_{BE} = 0$			0.2	mA
: BD241B		$V_{CE} = 80V$, $V_{BE} = 0$			0.2	mA
: BD241C		$V_{CE} = 100V$, $V_{BE} = 0$			0.2	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			1	mA
*DC Current Gain	h_{FE}	$V_{CE} = 4V$, $I_C = 1A$	25			
		$V_{CE} = 4V$, $I_C = 3A$	10			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 3A$, $I_B = 0.6A$			1.2	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = 4V$, $I_C = 3A$			1.8	V

*Pulse Test: PW = 300μS, duty cycle ≤ 2.0% pulsed

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD241/A/B/C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage: BD242	V_{CEO}	−45	V
: BD242A		−60	V
: BD242B		−80	V
: BD242C		−100	V
Collector Emitter Voltage: BD242	V_{CER}	−55	V
: BD242A		−70	V
: BD242B		−90	V
: BD242C		−115	V
Emitter Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−3	A
Collector Current (Pulse)	I_C	−5	A
Base Current	I_B	−1	A
Collector Dissipation ($T_C = 25°C$)	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

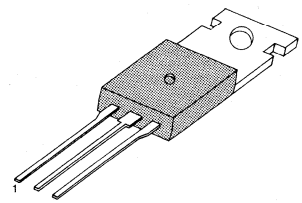
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD242	$V_{CEO}(sus)$	$I_C = -30mA$, $I_B = 0$	−45			V
: BD242A			−60			V
: BD242B			−80			V
: BD242C			−100			V
Collector Cutoff Current : BD242/A	I_{CEO}	$V_{CE} = -30V$, $I_B = 0$			−0.3	mA
: BD242B/C		$V_{CE} = -60V$, $I_B = 0$			−0.3	mA
Collector Cutoff Current : BD242	I_{CES}	$V_{CE} = -45V$, $V_{BE} = 0$			−0.2	mA
: BD242A		$V_{CE} = -60V$, $V_{BE} = 0$			−0.2	mA
: BD242B		$V_{CE} = -80V$, $V_{BE} = 0$			−0.2	mA
: BD242C		$V_{CE} = -100V$, $V_{BE} = 0$			−0.2	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−1	mA
*DC Current Gain	h_{FE}	$V_{CE} = -4V$, $I_C = -1A$	25			
		$V_{CE} = -4V$, $I_C = -3A$	10			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -3A$, $I_B = -0.6A$			−1.2	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = -4V$, $I_C = -3A$			−1.8	V

*Pulse Test: PW = 300μS, duty cycle ≤ 2.0% pulsed

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD244, BD244A, BD244B and BD244C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

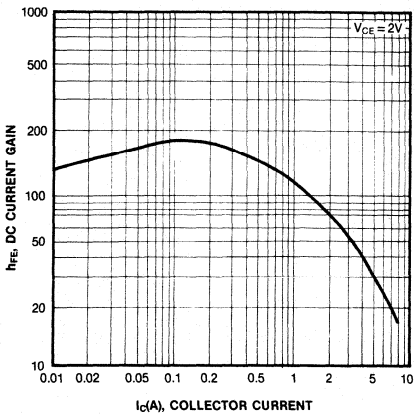
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BD243	V_{CBO}	45	V
: BD243A		60	V
: BD243B		80	V
: BD243C		100	V
Collector Emitter Voltage BD243	V_{CEO}	45	V
: BD243A		60	V
: BD243B		80	V
: BD243C		100	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	6	A
Collector Current (Pulse)	I_C	10	A
Base Current	I_B	2	A
Collector Dissipation ($T_c = 25°C$)	P_C	65	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

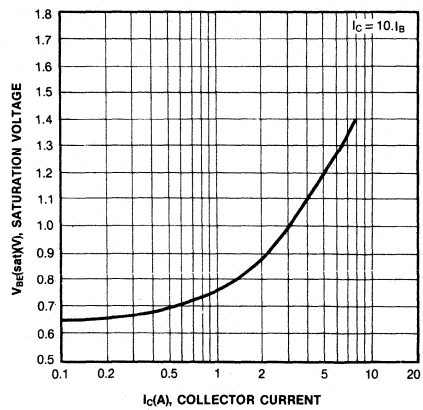
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD243	$V_{CEO}(sus)$	$I_C = 30mA$, $I_B = 0$	45			V
: BD243A			60			V
: BD243B			80			V
: BD243C			100			V
Collector Cutoff Current : BD243/243A	I_{CEO}	$V_{CE} = 30V$, $I_B = 0$			0.7	mA
: BD243B/243C		$V_{CE} = 60V$, $I_B = 0$			0.7	mA
Collector Cutoff Current : BD243	I_{CES}	$V_{CE} = 45V$, $V_{BE} = 0$			0.4	mA
: BD243A		$V_{CE} = 60V$, $V_{BE} = 0$			0.4	mA
: BD243B		$V_{CE} = 80V$, $V_{BE} = 0$			0.4	mA
: BD243C		$V_{CE} = 100V$, $V_{BE} = 0$			0.4	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			1	mA
*DC Current Gain	h_{FE}	$V_{CE} = 4V$, $I_C = 0.3A$	30			
		$V_{CE} = 4V$, $I_C = 3A$	15			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 6A$, $I_B = 1A$			1.5	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = 4V$, $I_C = 6A$			2	V

*Pulse Test: PW = 300μS, duty cycle<2% pulsed

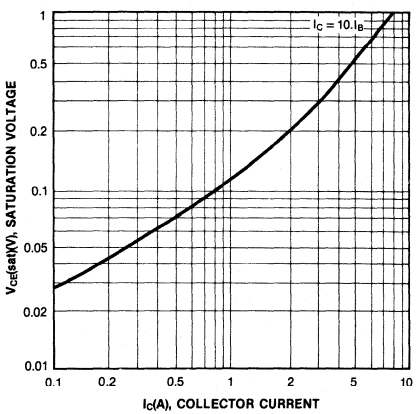
DC CURRENT GAIN



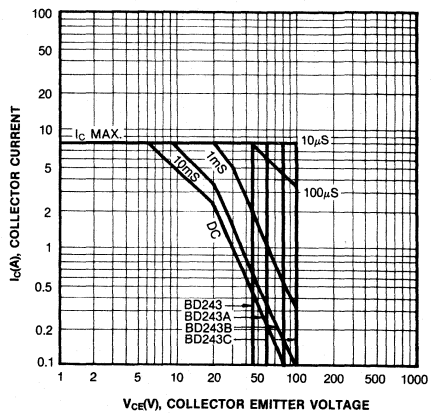
BASE EMITTER SATURATION VOLTAGE



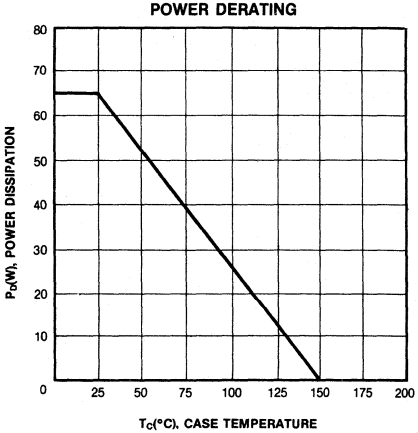
COLLECTOR EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING

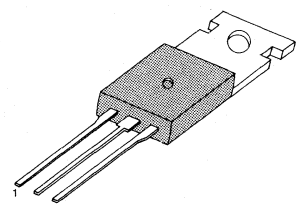


3

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD243, BD243A, BD243B and BD243C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

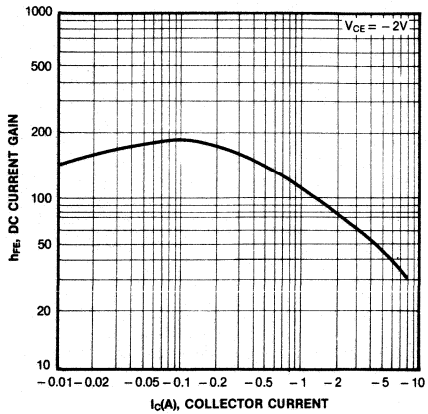
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD244	V_{CBO}	−45	V
	: BD244A		−60	V
	: BD244B		−80	V
	: BD244C		−100	V
Collector Emitter Voltage:	BD244	V_{CEO}	−45	V
	: BD244A		−60	V
	: BD244B		−80	V
	: BD244C		−100	V
Emitter Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−6	A
Collector Current (Pulse)		I_C	−10	A
Base Current		I_B	−2	A
Collector Dissipation ($T_c = 25°C$)		P_C	65	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65∼150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

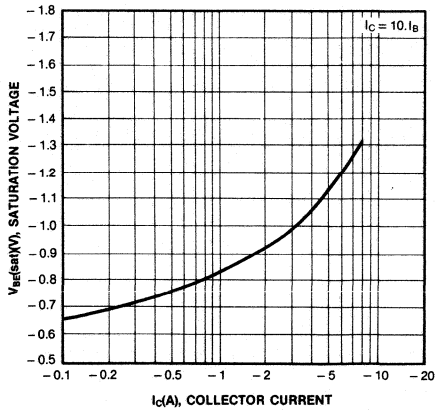
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage:	BD244	$V_{CEO}(sus)$	$I_C = -30mA$, $I_B = 0$	−45			V
	: BD244A			−60			V
	: BD244B			−80			V
	: BD244C			−100			V
Collector Cutoff Current	: BD244/244A	I_{CEO}	$V_{CE} = -30V$, $I_B = 0$			−0.7	mA
	: BD244B/244C		$V_{CE} = -60V$, $I_B = 0$			−0.7	mA
Collector Cutoff Current	: BD244	I_{CES}	$V_{CE} = -45V$, $V_{BE} = 0$			−0.4	mA
	: BD244A		$V_{CE} = -60V$, $V_{BE} = 0$			−0.4	mA
	: BD244B		$V_{CE} = -80V$, $V_{BE} = 0$			−0.4	mA
	: BD244C		$V_{CE} = -100V$, $V_{BE} = 0$			−0.4	mA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−1	mA
*DC Current Gain		h_{FE}	$V_{CE} = -4V$, $I_C = -0.3A$	30			
			$V_{CE} = -4V$, $I_C = -3A$	15			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = -6A$, $I_B = -1A$			−1.5	V
*Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = -4V$, $I_C = -6A$			−2	V

*Pulse Test: PW = 300μS, duty cycle < 2% pulsed

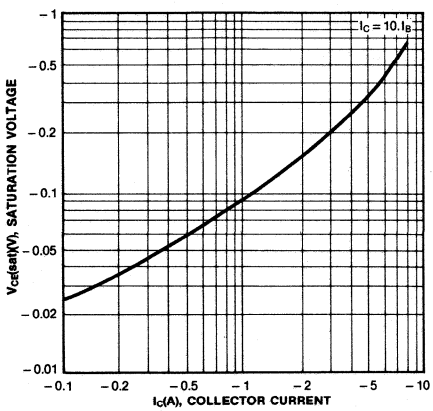
DC CURRENT GAIN



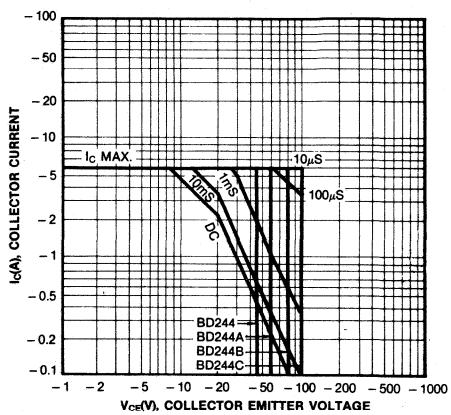
BASE EMITTER SATURATION VOLTAGE



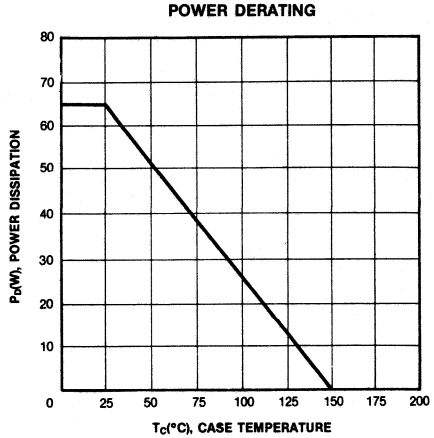
COLLECTOR EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING

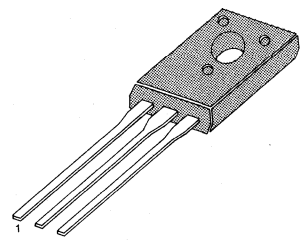


3

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD376, BD378 and BD380 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BD375	V_{CBO}	50	V
: BD377		75	V
: BD379		100	V
Collector Emitter Voltage: BD375	V_{CEO}	45	V
: BD377		60	V
: BD379		80	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	2	A
Collector Current (Pulse)	I_C	3	A
Base Current	I_B	1	A
Collector Dissipation ($T_c = 25°C$)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-55 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

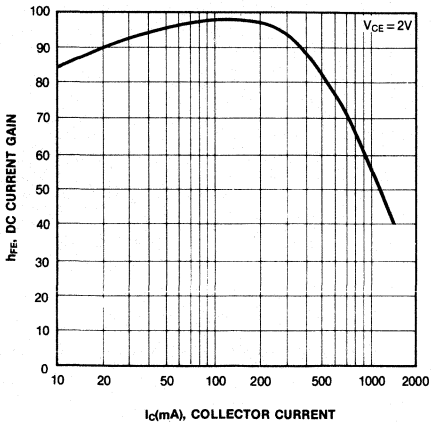
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD375	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	45			V
: BD377			60			V
: BD379			80			V
Collector Base Voltage : BD375	V_{CBO}	$I_C = 100\mu A$, $I_E = 0$	50			V
: BD377			75			V
: BD379			100			V
Collector Cutoff Current : BD375	I_{CBO}	$V_{CB} = 45V$, $I_E = 0$			2	μA
: BD377		$V_{CB} = 60V$, $I_E = 0$			2	μA
: BD379		$V_{CB} = 80V$, $I_E = 0$			2	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			100	μA
*DC Current Gain	$h_{FE}1$	$V_{CE} = 2V$, $I_C = 0.15A$	40		375	
	$h_{FE}2$	$V_{CE} = 2V$, $I_C = 1A$	20			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 1A$, $I_B = 0.1A$			1	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = 2V$, $I_C = 1A$			1.5	V
Turn On Time	t_{on}	$V_{CC} = 30V$, $I_C = 0.5A$ $I_B1 = 0.05A$		50		nS
Turn Off Time	t_{off}	$V_{CC} = 30V$, $I_C = 0.5A$ $I_B1 = -I_B2 = 0.05A$		500		nS

*Pulse Test: PW = 300μS, duty cycle = 2% pulsed

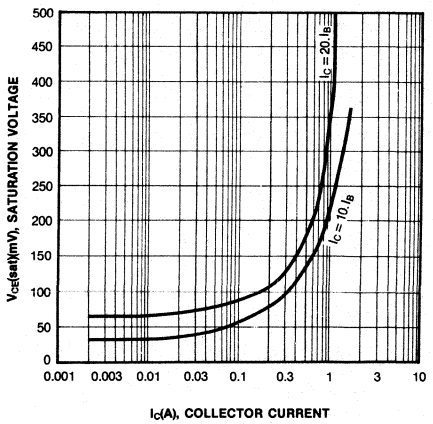
h_{FE} (1) CLASSIFICATION

Classification	6	10	16	25
$h_{FE}1$	40-100	63-160	100-250	150-375

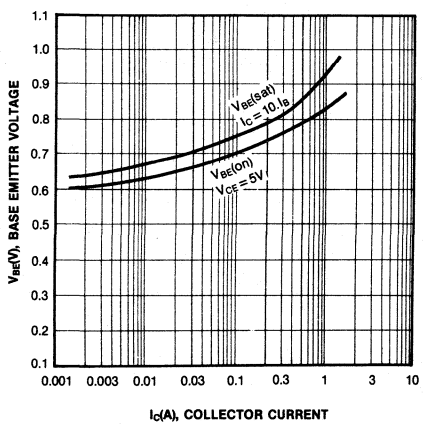
DC CURRENT GAIN



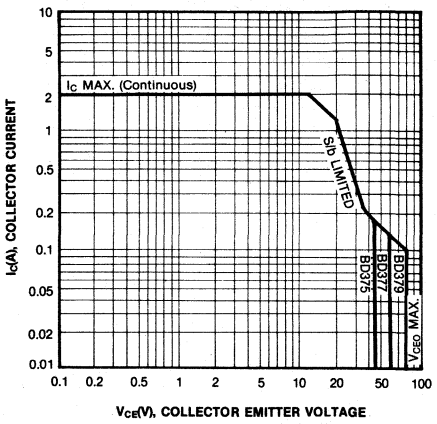
COLLECTOR EMITTER SATURATION VOLTAGE



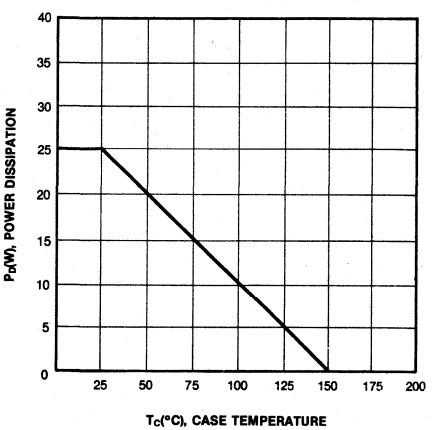
BASE EMITTER VOLTAGE



SAFE OPERATING AREA



POWER DERATING

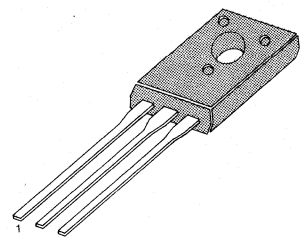


3

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD375, BD377 and BD379 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BD376	V_{CBO}	−50	V
: BD378		−75	V
: BD380		−100	V
Collector Emitter Voltage: BD376	V_{CEO}	−45	V
: BD378		−60	V
: BD380		−80	V
Emitter Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−2	A
Collector Current (Pulse)	I_C	−3	A
Base Current	I_B	−1	A
Collector Dissipation ($T_c = 25°C$)	P_C	25	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

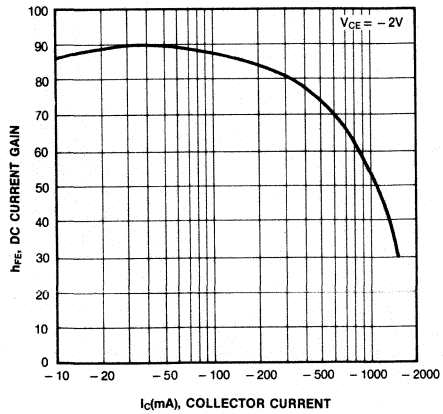
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD376	$V_{CEO}(sus)$	$I_C = -100mA$, $I_B = 0$	−45			V
: BD378			−60			V
: BD380			−80			V
Collector Base Voltage : BD376	V_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−50			V
: BD378			−75			V
: BD380			−100			V
Collector Cutoff Current : BD376	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−2	μA
: BD378		$V_{CB} = -60V$, $I_E = 0$			−2	μA
: BD380		$V_{CB} = -80V$, $I_E = 0$			−2	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−100	μA
*DC Current Gain	$h_{FE}1$	$V_{CE} = -2V$, $I_C = -0.15A$	40		375	
	$h_{FE}2$	$V_{CE} = -2V$, $I_C = -1A$	20			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -1A$, $I_B = -0.1A$			−1	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = -2V$, $I_C = -1A$			−1.5	V
Turn On Time	t_{on}	$V_{CC} = -30V$, $I_C = -0.5A$, $I_{B1} = -0.05A$		50		nS
Turn Off Time	t_{off}	$V_{CC} = -30V$, $I_C = -0.5A$, $I_{B1} = -I_{B2} = -0.05A$		500		nS

*Pulse Test: PW = 300μS, duty cycle = 2% pulsed

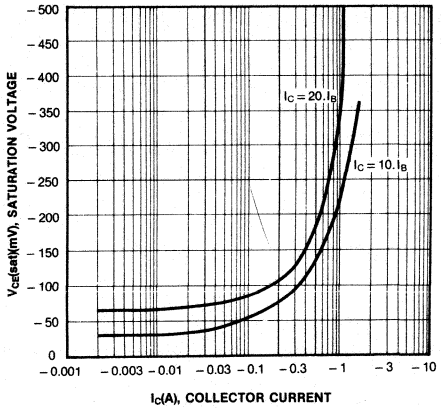
h_{FE} (1) CLASSIFICATION

Classification	6	10	16	25
$h_{FE}1$	40-100	63-160	100-250	150-375

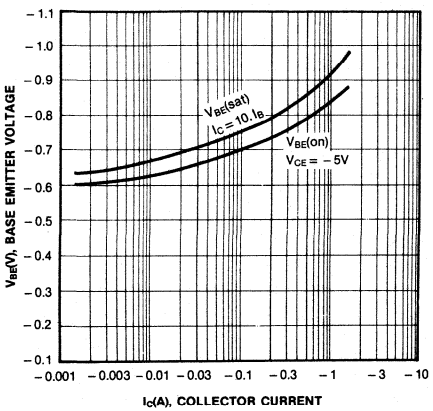
DC CURRENT GAIN



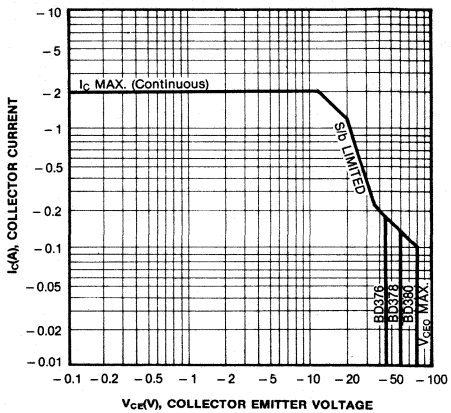
COLLECTOR EMITTER SATURATION VOLTAGE



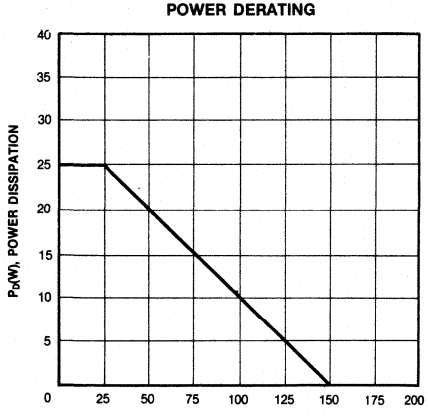
BASE EMITTER VOLTAGE



SAFE OPERATING AREA



POWER DERATING

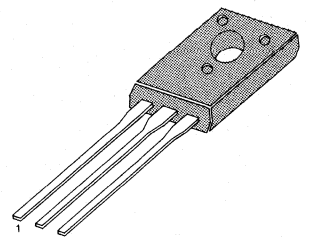


3

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD434, BD436 and BD438 respectively**

TO-126



1. Emitter 2. Collector 3 Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

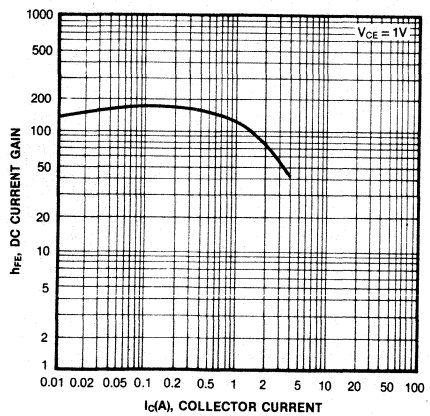
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD433	V_{CBO}	22	V
	: BD435		32	V
	: BD437		45	V
Collector Emitter Voltage	: BD433	V_{CES}	22	V
	: BD435		32	V
	: BD437		45	V
Collector Emitter Voltage	: BD433	V_{CEO}	22	V
	: BD435		32	V
	: BD437		45	V
Emitter Base Voltage		V_{EBO}	5	V
Collector Current (DC)		I_C	4	A
Collector Current (Pulse)		I_C	7	A
Base Current		I_B	1	A
Collector Dissipation ($T_c = 25°C$)		P_C	36	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

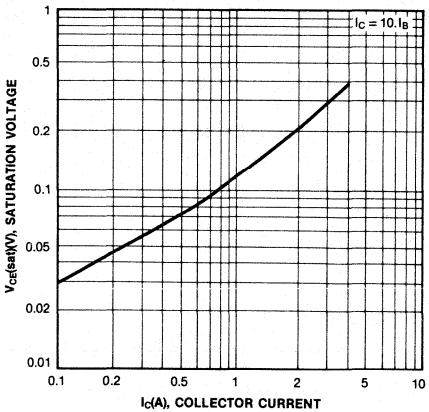
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage:	BD433	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	22			V
	: BD435			32			V
	: BD437			45			V
Collector Cutoff Current	: BD433	I_{CBO}	$V_{CB} = 22V$, $I_E = 0$			100	μA
	: BD435		$V_{CB} = 32V$, $I_E = 0$			100	μA
	: BD437		$V_{CB} = 45V$, $I_E = 0$			100	μA
Collector Cutoff Current	: BD433	I_{CES}	$V_{CE} = 22V$, $V_{BE} = 0$			100	μA
	: BD435		$V_{CE} = 32V$, $V_{BE} = 0$			100	μA
	: BD437		$V_{CE} = 45V$, $V_{BE} = 0$			100	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			1	mA
*DC Current Gain	: BD433/435	h_{FE}	$V_{CE} = 5V$, $I_C = 10mA$	40	130		
	: BD437			30	130		
	: ALL DEVICE		$V_{CE} = 1V$, $I_C = 500mA$	85	140		
	: BD433/435		$V_{CE} = 1V$, $I_C = 2A$	50			
	: BD437			40			
*Collector Emitter Saturation Voltage:	BD433	$V_{CE}(sat)$	$I_C = 2A$, $I_B = 0.2A$		0.2	0.5	V
	: BD435				0.2	0.5	V
	: BD437				0.2	0.6	V
*Base Emitter On Voltage	: BD433	$V_{BE}(on)$	$V_{CE} = 1V$, $I_C = 2A$			1.1	V
	: BD435					1.1	V
	: BD437					1.2	V
Transition Frequency		f_T	$V_{CE} = 1V$, $I_C = 250mA$	3			MHz

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

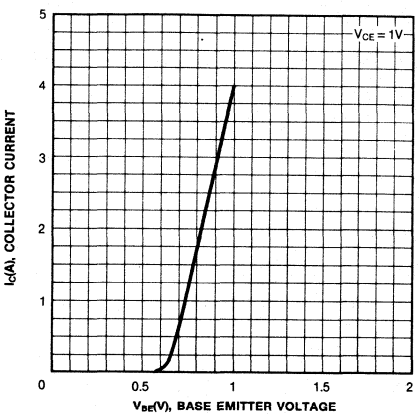
DC CURRENT GAIN



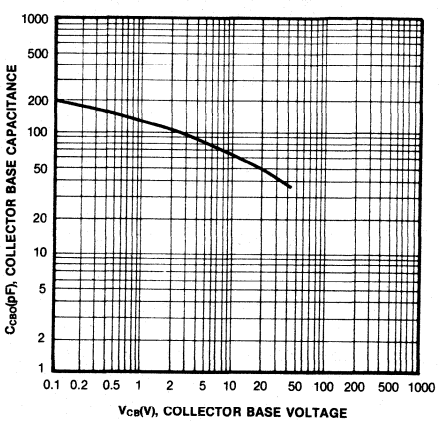
COLLECTOR EMITTER SATURATION VOLTAGE



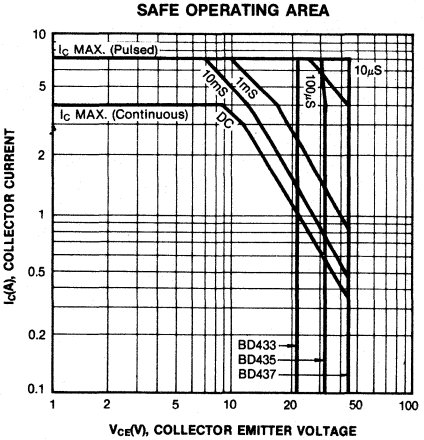
BASE EMITTER VOLTAGE



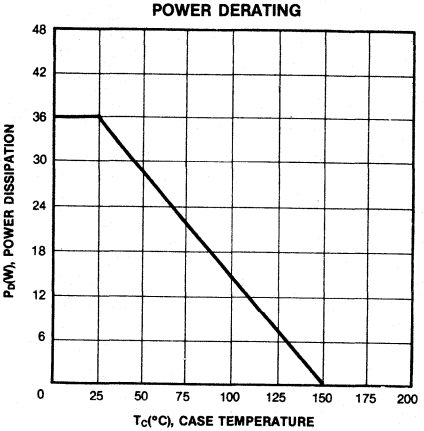
COLLECTOR BASE CAPACITANCE



SAFE OPERATING AREA



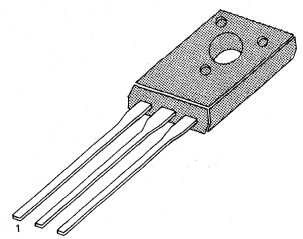
POWER DERATING



MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD433, BD435 and BD437 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

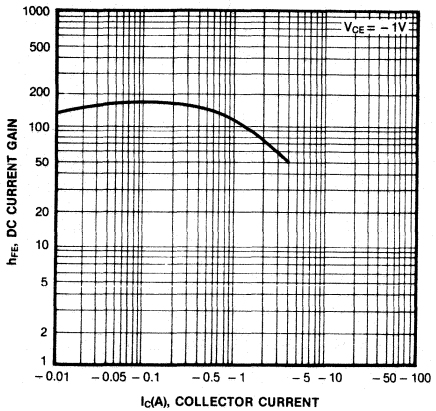
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD434	V_{CBO}	−22	V
	: BD436		−32	V
	: BD438		−45	V
Collector Emitter Voltage	: BD434	V_{CES}	−22	V
	: BD436		−32	V
	: BD438		−45	V
Collector Emitter Voltage	: BD434	V_{CEO}	−22	V
	: BD436		−32	V
	: BD438		−45	V
Emitter Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−4	A
Collector Current (Pulse)		I_C	−7	A
Base Current		I_B	−1	A
Collector Dissipation ($T_c = 25°C$)		P_C	36	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65 ∼ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

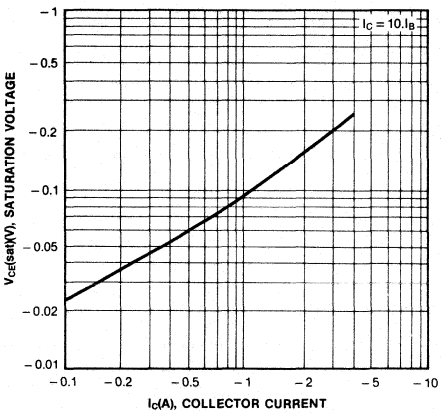
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage	: BD434	$V_{CEO}(sus)$	$I_C = -100mA$, $I_B = 0$	−22			V
	: BD436			−32			V
	: BD438			−45			V
Collector Cutoff Current	: BD434	I_{CBO}	$V_{CB} = -22V$, $I_E = 0$			−100	μA
	: BD436		$V_{CB} = -32V$, $I_E = 0$			−100	μA
	: BD438		$V_{CB} = -45V$, $I_E = 0$			−100	μA
Collector Cutoff Current	: BD434	I_{CEO}	$V_{CE} = -22V$, $V_{BE} = 0$			−100	μA
	: BD436		$V_{CE} = -32V$, $V_{BE} = 0$			−100	μA
	: BD438		$V_{CE} = -45V$, $V_{BE} = 0$			−100	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−1	mA
*DC Current Gain	: BD434/436	h_{FE}	$V_{CE} = -5V$, $I_C = -10mA$	40	140		
	: BD438			30	140		
	: ALL DEVICE		$V_{CE} = -1V$, $I_C = -500mA$	85	140		
	: BD434/436		$V_{CE} = -1V$, $I_C = -2A$	50			
	: BD438			40			
*Collector Emitter Saturation Voltage	: BD434	$V_{CE}(sat)$	$I_C = -2A$, $I_B = -0.2A$		−0.2	−0.5	V
	: BD436				−0.2	−0.5	V
	: BD438				−0.2	−0.6	V
*Base Emitter On Voltage	: BD434	$V_{BE}(on)$	$V_{CE} = -1V$, $I_C = -2A$			−1.1	V
	: BD436					−1.1	V
	: BD438					−1.2	V
Transition Frequency		f_T	$V_{CE} = -1V$, $I_C = -250mA$	3			MHz

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

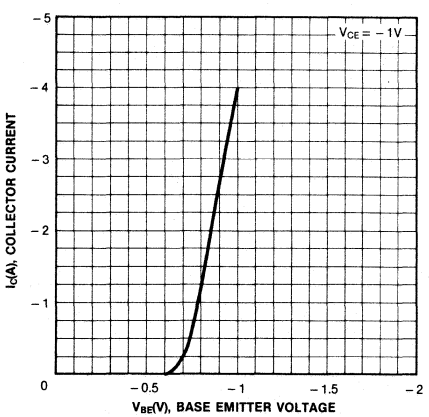
DC CURRENT GAIN



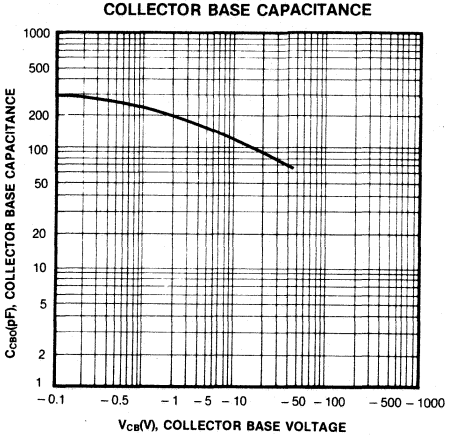
COLLECTOR EMITTER SATURATION VOLTAGE



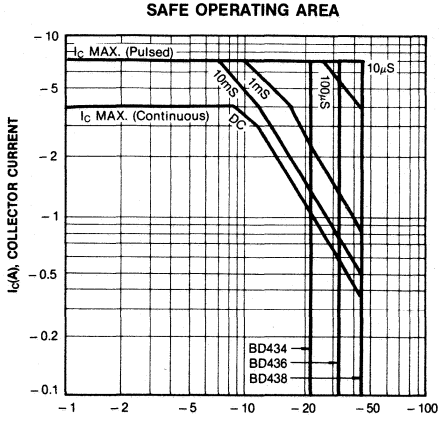
BASE EMITTER VOLTAGE



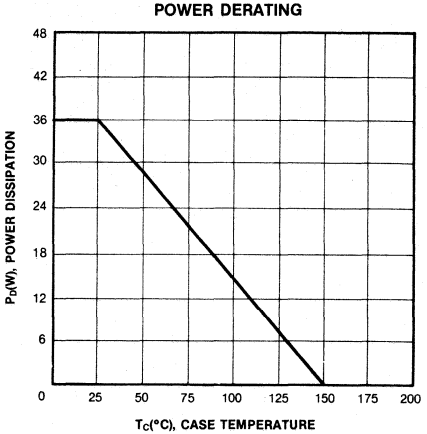
COLLECTOR BASE CAPACITANCE



SAFE OPERATING AREA



POWER DERATING

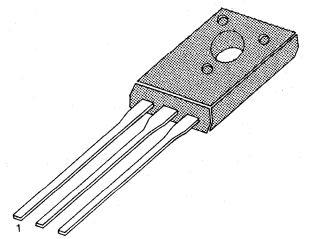


3

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD440, BD442 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

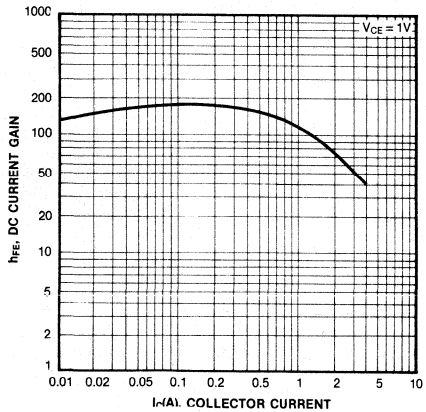
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD439	V_{CBO}	60	V
	: BD441		80	V
Collector Emitter Voltage	: BD439	V_{CES}	60	V
	: BD441		80	V
Collector Emitter Voltage	: BD439	V_{CEO}	60	V
	: BD441		80	V
Emitter Base Voltage		V_{EBO}	5	V
Collector Current (DC)		I_C	4	A
Collector Current (Pulse)		I_C	7	A
Base Current		I_B	1	A
Collector Dissipation ($T_c = 25°C$)		P_C	36	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

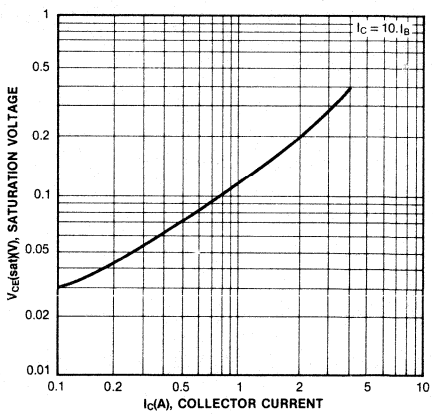
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage:	BD439	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	60			V
	: BD441			80			V
Collector Cutoff Current	: BD439	I_{CBO}	$V_{CB} = 60V$, $I_E = 0$			100	μA
	: BD441		$V_{CB} = 80V$, $I_E = 0$			100	μA
Collector Cutoff Current	: BD439	I_{CES}	$V_{CE} = 60V$, $V_{BE} = 0$			100	μA
	: BD441		$V_{CE} = 80V$, $V_{BE} = 0$			100	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			1	mA
*DC Current Gain	: BD439	h_{FE}	$V_{CE} = 5V$, $I_C = 10mA$	20	130		
	: BD441			15	130		
	: BD439		$V_{CE} = 1V$, $I_C = 500mA$	40	140		
	: BD441			40	140		
	: BD439		$V_{CE} = 1V$, $I_C = 2A$	25			
	: BD441			15			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = 2A$, $I_B = 0.2A$			0.8	V
*Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = 5V$, $I_C = 10mA$		0.58		V
			$V_{CE} = 1V$, $I_C = 2A$			1.5	V
Transition Frequency		f_T	$V_{CE} = 1V$, $I_C = 250mA$	3			MHz

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

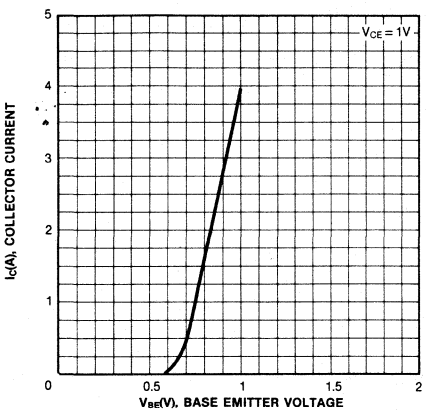
DC CURRENT GAIN



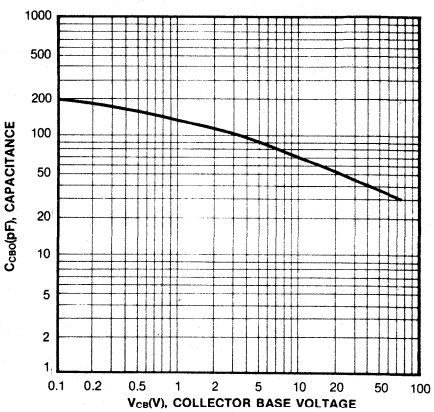
COLLECTOR EMITTER SATURATION VOLTAGE



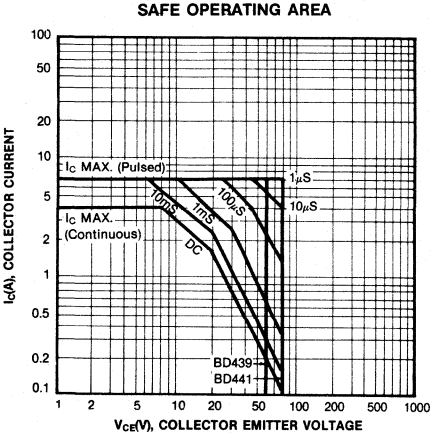
BASE EMITTER VOLTAGE



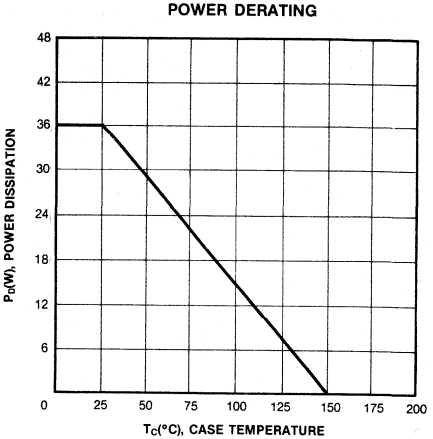
COLLECTOR BASE CAPACITANCE



SAFE OPERATING AREA



POWER DERATING

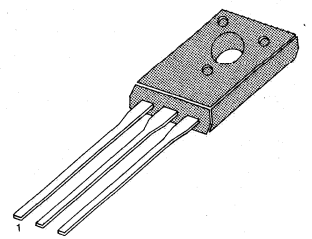


3

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD439, BD441 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

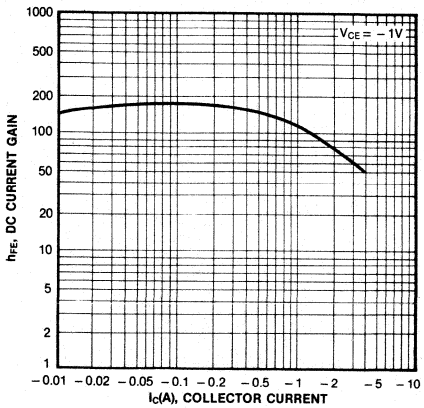
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD440	V_{CBO}	−60	V
	: BD442		−80	V
Collector Emitter Voltage	: BD440	V_{CES}	−60	V
	: BD442		−80	V
Collector Emitter Voltage	: BD440	V_{CEO}	−60	V
	: BD442		−80	V
Emitter Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−4	A
Collector Current (Pulse)		I_C	−7	A
Base Current		I_B	−1	A
Collector Dissipation ($T_C = 25°C$)		P_C	36	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

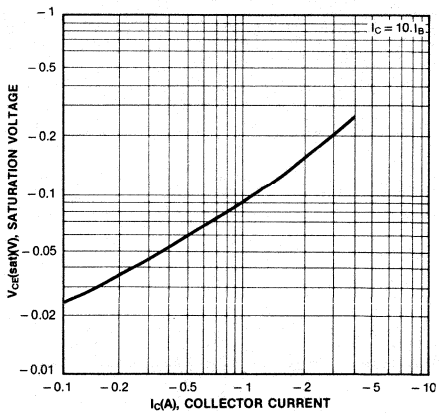
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage:	BD440	$V_{CEO}(sus)$	$I_C = -100mA$, $I_B = 0$	−60			V
	: BD442			−80			V
Collector Cutoff Current	: BD440	I_{CBO}	$V_{CB} = -60V$, $I_E = 0$			−100	μA
	: BD442		$V_{CB} = -80V$, $I_E = 0$			−100	μA
Collector Cutoff Current	: BD440	I_{CES}	$V_{CE} = -60V$, $V_{BE} = 0$			−100	μA
	: BD442		$V_{CE} = -80V$, $V_{BE} = 0$			−100	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−1	mA
*DC Current Gain	: BD440	h_{FE}	$V_{CE} = -5V$, $I_C = -10mA$	20	140		
	: BD442			15	140		
	: BD440		$V_{CE} = -1V$, $I_C = -500mA$	40	140		
	: BD442			40	140		
	: BD440		$V_{CE} = -1V$, $I_C = -2A$	25			
	: BD442			15			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = -2A$, $I_B = -0.2A$			−0.8	V
*Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = -5V$, $I_C = -10mA$		−0.58		V
			$V_{CE} = -1V$, $I_C = -2A$			−1.5	V
Transition Frequency		f_T	$V_{CE} = -1V$, $I_C = -250mA$	3			MHz

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

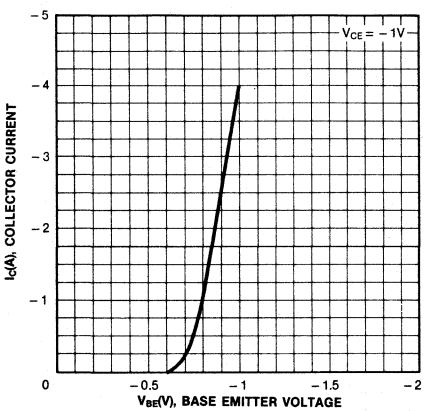
DC CURRENT GAIN



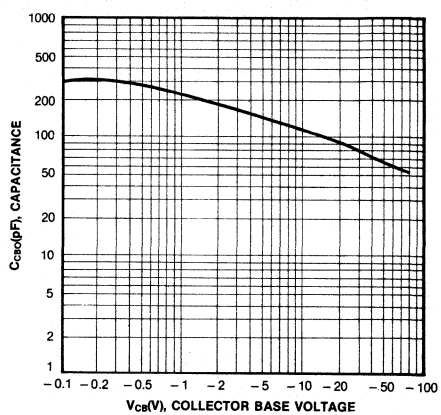
COLLECTOR EMITTER SATURATION VOLTAGE



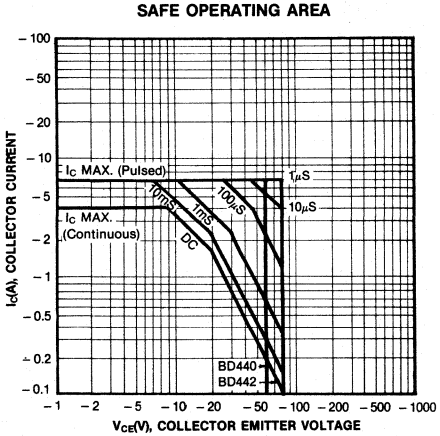
BASE EMITTER VOLTAGE



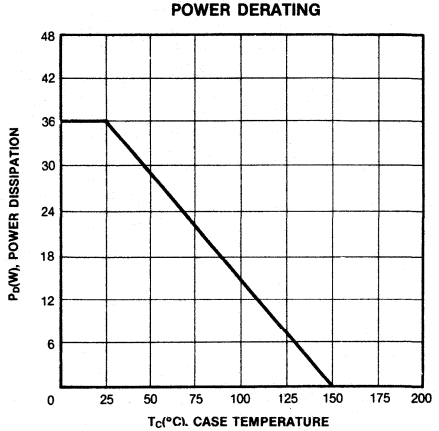
COLLECTOR BASE CAPACITANCE



SAFE OPERATING AREA



POWER DERATING



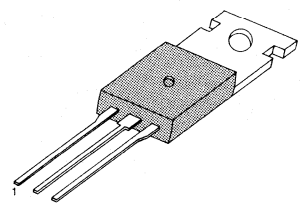
3

BD533/535/537 NPN EPITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS
LOW SATURATION VOLTAGE

- **Complement to BD534, BD536 and BD538 respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

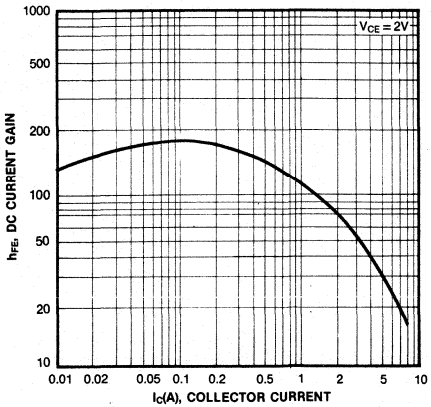
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD533	V_{CBO}	45	V
	: BD535		60	V
	: BD537		80	V
Collector Emitter Voltage	: BD533	V_{CES}	45	V
	: BD535		60	V
	: BD537		80	V
Collector Emitter Voltage	: BD533	V_{CEO}	45	V
	: BD535		60	V
	: BD537		80	V
Emitter Base Voltage		V_{EBO}	5	V
Collector Current (DC)		I_C	8	A
Emitter Current		I_E	8	A
Base Current		I_B	1	A
Collector Dissipation ($T_C = 25°C$)		P_C	50	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

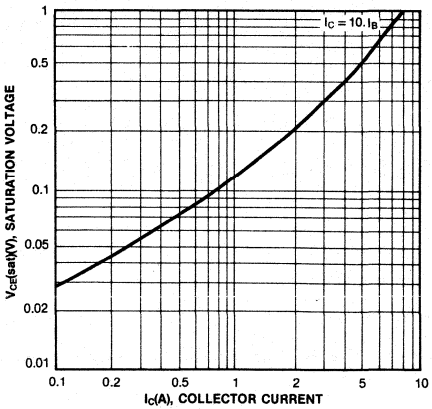
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	: BD533	I_{CBO}	$V_{CB} = 45V$, $I_E = 0$			100	μA
	: BD535		$V_{CB} = 60V$, $I_E = 0$			100	μA
	: BD537		$V_{CB} = 80V$, $I_E = 0$			100	μA
Collector Cutoff Current	: BD533	I_{CES}	$V_{CE} = 45V$, $V_{BE} = 0$			100	μA
	: BD535		$V_{CE} = 60V$, $V_{BE} = 0$			100	μA
	: BD537		$V_{CE} = 80V$, $V_{BE} = 0$			100	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			1	mA
*DC Current Gain	: BD533/535	h_{FE}	$V_{CE} = 5V$, $I_C = 10mA$	20			
	: BD537			15			
	: ALL DEVICE		$V_{CE} = 2V$, $I_C = 500mA$	40			
	: BD533/535		$V_{CE} = 2V$, $I_C = 2A$	25			
	: BD537			15			
h_{FE} Groups J	: ALL DEVICE	h_{FE}	$V_{CE} = 2V$, $I_C = 2A$	30		75	
			$V_{CE} = 2V$, $I_C = 3A$	15			
K	: ALL DEVICE		$V_{CE} = 2V$, $I_C = 2A$	40		100	
			$V_{CE} = 2V$, $I_C = 3A$	20			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = 2A$, $I_B = 0.2A$			0.8	V
			$I_C = 6A$, $I_B = 0.6A$		0.8		V
*Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = 2V$, $I_C = 2A$			1.5	V
Transition Frequency		f_T	$V_{CE} = 1V$, $I_C = 500mA$	3	12		MHz

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

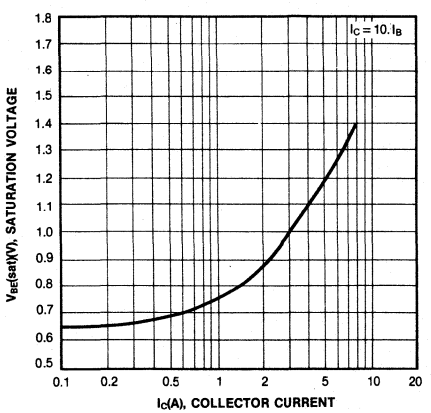
DC CURRENT GAIN



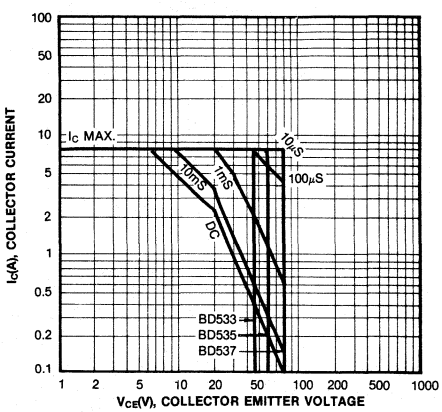
COLLECTOR EMITTER SATURATION VOLTAGE



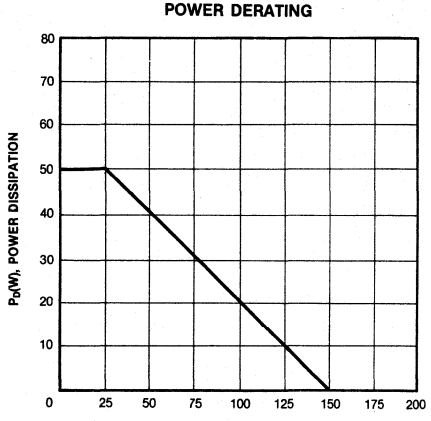
BASE EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



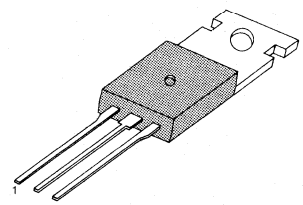
POWER DERATING



MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS
LOW SATURATION VOLTAGE

- **Complement to BD533, BD535 and BD537 respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

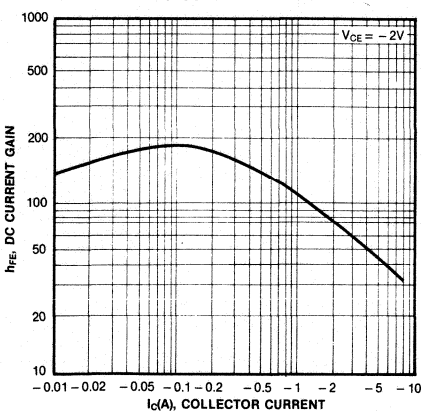
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BD534	V_{CBO}	−45	V
	: BD536		−60	V
	: BD538		−80	V
Collector Emitter Voltage	: BD534	V_{CES}	−45	V
	: BD536		−60	V
	: BD538		−80	V
Collector Emitter Voltage	: BD534	V_{CEO}	−45	V
	: BD536		−60	V
	: BD538		−80	V
Emitter Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−8	A
Emitter Current		I_E	−8	V
Base Current		I_B	−1	A
Collector Dissipation ($T_C = 25°C$)		P_C	50	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65∼150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

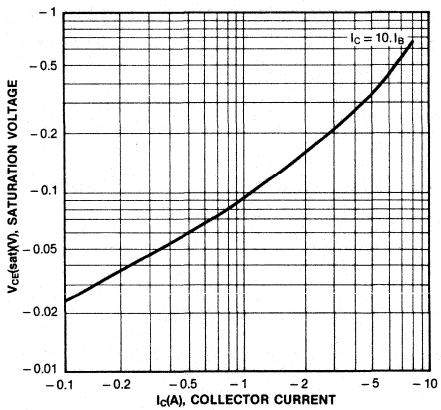
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	: BD534	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−100	μA
	: BD536		$V_{CB} = -60V$, $I_E = 0$			−100	μA
	: BD538		$V_{CB} = -80V$, $I_E = 0$			−100	μA
Collector Cutoff Current	: BD534	I_{CES}	$V_{CE} = -45V$, $V_{BE} = 0$			−100	μA
	: BD536		$V_{CE} = -60V$, $V_{BE} = 0$			−100	μA
	: BD538		$V_{CE} = -80V$, $V_{BE} = 0$			−100	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−1	mA
*DC Current Gain	: BD534/536	h_{FE}	$V_{CE} = -5V$, $I_C = -10mA$	20			
	: BD538			15			
	: ALL DEVICE		$V_{CE} = -2V$, $I_C = -500mA$	40			
	: BD534/536		$V_{CE} = -2V$, $I_C = -2A$	25			
	: BD538			15			
h_{FE} Groups J	: ALL DEVICE	h_{FE}	$V_{CE} = -2V$, $I_C = -2A$	30		75	
			$V_{CE} = -2V$, $I_C = -3A$	15			
K	: ALL DEVICE		$V_{CE} = -2V$, $I_C = -2A$	40		100	
			$V_{CE} = -2V$, $I_C = -3A$	20			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = -2A$, $I_B = -0.2A$			−0.8	V
			$I_C = -6A$, $I_B = -0.6A$		−0.8		V
*Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = -2V$, $I_C = -2A$			−1.5	V
Transition Frequency		f_T	$V_{CE} = -1V$, $I_C = -500mA$	3	12		MHz

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

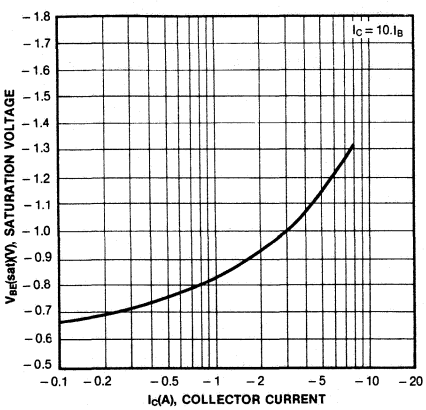
DC CURRENT GAIN



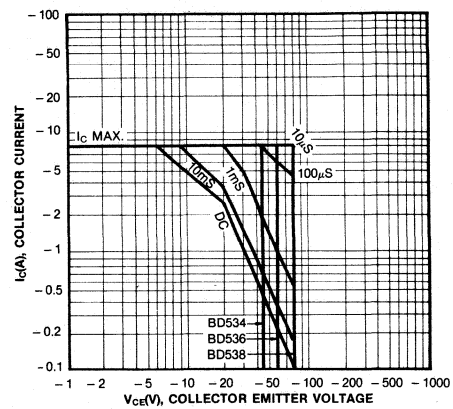
COLLECTOR EMITTER SATURATION VOLTAGE



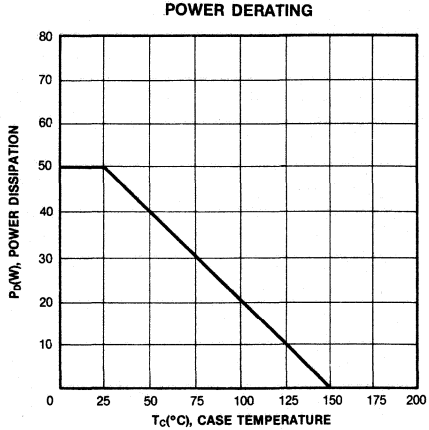
BASE EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING

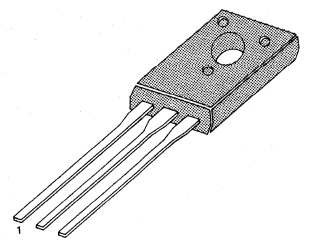


BD675A/677A/679A/681 NPN EPITAXIAL SILICON TRANSISTOR

MEDIUM POWER DARLINGTON TR
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD676A, BD678A, BD680A and BD682 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

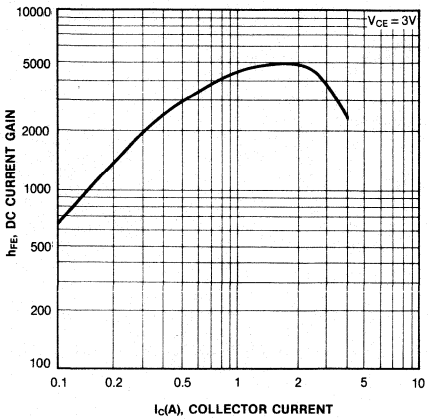
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BD675A	V_{CBO}	45	V
: BD677A		60	V
: BD679A		80	V
: BD681		100	V
Collector Emitter Voltage: BD675A	V_{CEO}	45	V
: BD677A		60	V
: BD679A		80	V
: BD681		100	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	4	A
Collector Current (Pulse)	I_C	6	A
Base Current	I_B	100	mA
Collector Dissipation ($T_C = 25°C$)	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

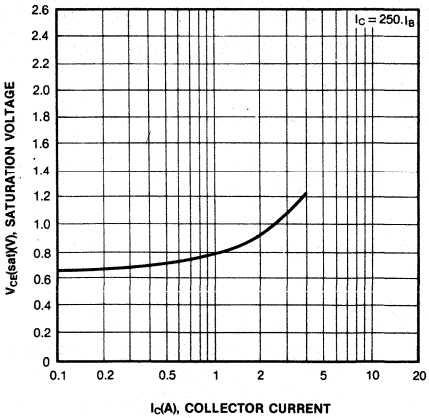
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD675A	$V_{CEO}(sus)$	$I_C = 50mA$, $I_B = 0$	45			V
: BD677A			60			V
: BD679A			80			V
: BD681			100			V
Collector Cutoff Current : BD675A	I_{CBO}	$V_{CB} = 45V$, $I_E = 0$			200	μA
: BD677A		$V_{CB} = 60V$, $I_E = 0$			200	μA
: BD679A		$V_{CB} = 80V$, $I_E = 0$			200	μA
: BD681		$V_{CB} = 100V$, $I_E = 0$			200	μA
Collector Cutoff Current : BD675A	I_{CEO}	$V_{CE} = 45V$, $I_B = 0$			500	μA
: BD677A		$V_{CE} = 60V$, $I_B = 0$			500	μA
: BD679A		$V_{CE} = 80V$, $I_B = 0$			500	μA
: BD681		$V_{CE} = 100V$, $I_B = 0$			500	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			2	mA
*DC Current Gain : BD675A/677A/679A	h_{FE}	$V_{CE} = 3V$, $I_C = 2A$	750			
: BD681		$V_{CE} = 3V$, $I_C = 1.5A$	750			
*Collector Emitter Saturation Voltage:	$V_{CE}(sat)$					
: BD675A/677A/679A		$I_C = 2A$, $I_B = 40mA$			2.8	V
: BD681		$I_C = 1.5A$, $I_B = 30mA$			2.5	V
*Base Emitter On Voltage : BD675A/677A/679A	$V_{BE}(on)$	$V_{CE} = 3V$, $I_C = 2A$			2.5	V
: BD681		$V_{CE} = 3V$, $I_C = 1.5A$			2.5	V

*Pulse Test: PW = 300 μS, duty cycle = 1.5% pulsed

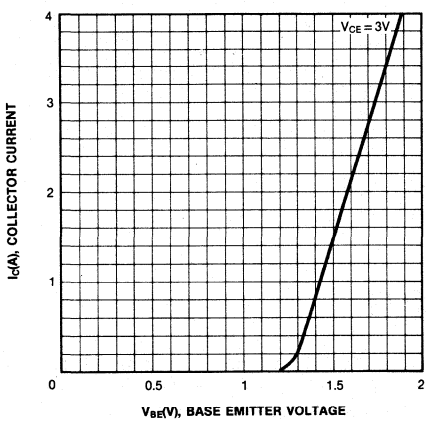
DC CURRENT GAIN



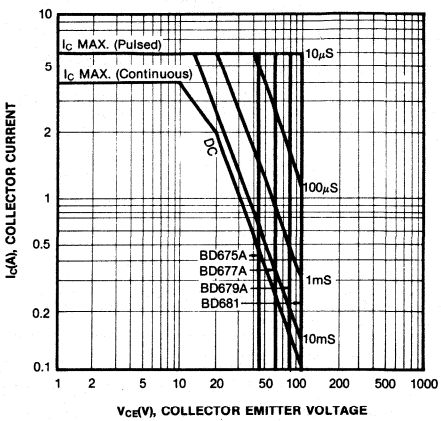
COLLECTOR EMITTER SATURATION VOLTAGE



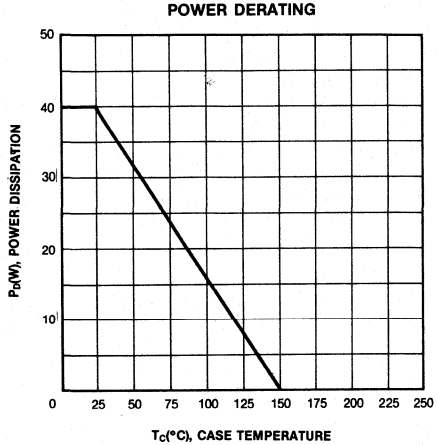
BASE EMITTER VOLTAGE



SAFE OPERATING AREA



POWER DERATING

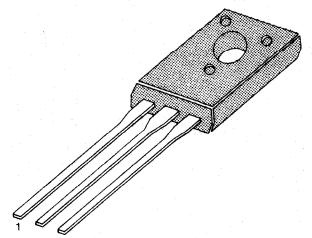


BD676A/678A/680A/682 PNP EPITAXIAL SILICON TRANSISTOR

MEDIUM POWER DARLINGTON TR
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BD675A, BD677A, BD679A and BD681 respectively**

TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

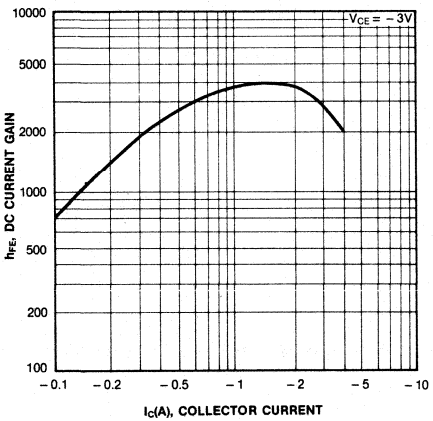
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BD676A	V_{CBO}	−45	V
: BD678A		−60	V
: BD680A		−80	V
: BD682		−100	V
Collector Emitter Voltage: BD676A	V_{CEO}	−45	V
: BD678A		−60	V
: BD680A		−80	V
: BD682		−100	V
Emitter Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−4	A
Collector Current (Pulse)	I_C	−6	A
Base Current	I_B	−100	mA
Collector Dissipation ($T_C = 25°C$)	P_C	40	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

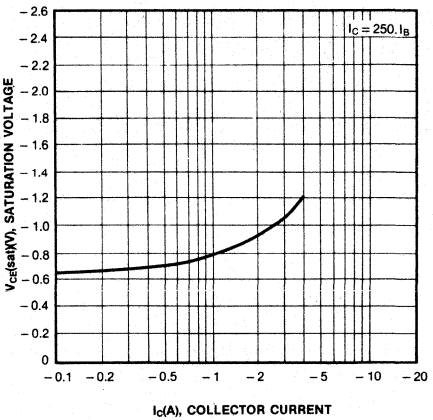
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BD676A	$V_{CEO}(sus)$	$I_C = -50mA$, $I_B = 0$	−45			V
: BD678A			−60			V
: BD680A			−80			V
: BD682			−100			V
Collector Cutoff Current : BD676A	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−200	μA
: BD678A		$V_{CB} = -60V$, $I_E = 0$			−200	μA
: BD680A		$V_{CB} = -80V$, $I_E = 0$			−200	μA
: BD682		$V_{CB} = -100V$, $I_E = 0$			−200	μA
Collector Cutoff Current : BD676A	I_{CEO}	$V_{CE} = -45V$, $I_B = 0$			−500	μA
: BD678A		$V_{CE} = -60V$, $I_B = 0$			−500	μA
: BD680A		$V_{CE} = -80V$, $I_B = 0$			−500	μA
: BD682		$V_{CE} = -100V$, $I_B = 0$			−500	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−2	mA
*DC Current Gain : BD676A/678A/680A	h_{FE}	$V_{CE} = -3V$, $I_C = -2A$	750			
: BD682		$V_{CE} = -3V$, $I_C = -1.5A$	750			
*Collector Emitter Saturation Voltage:	$V_{CE}(sat)$					
: BD676A/678A/680A		$I_C = -2A$, $I_B = -40mA$			−2.8	V
: BD682		$I_C = -1.5A$, $I_B = -30mA$			−2.5	V
*Base Emitter On Voltage : BD676A/678A/680A	$V_{BE}(on)$	$V_{CE} = -3V$, $I_C = -2A$			−2.5	V
: BD682		$V_{CE} = -3V$, $I_C = -1.5A$			−2.5	V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

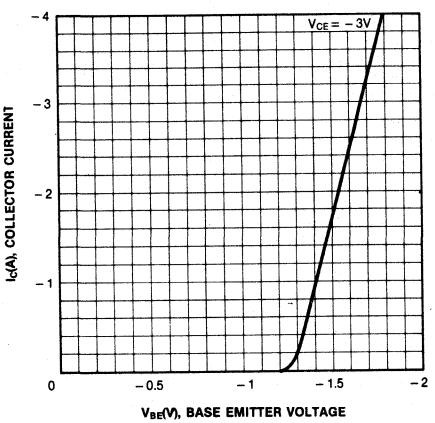
DC CURRENT GAIN



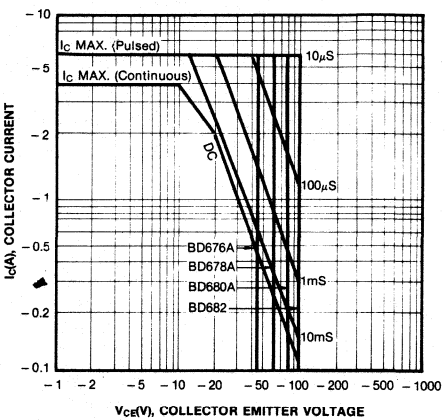
COLLECTOR EMITTER SATURATION VOLTAGE



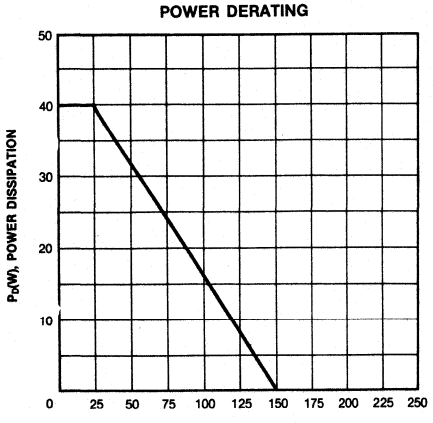
BASE EMITTER VOLTAGE



SAFE OPERATING AREA



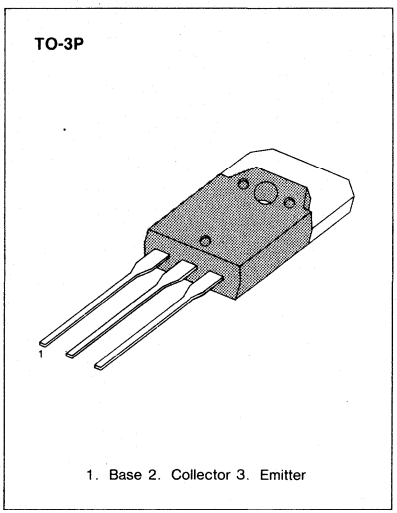
POWER DERATING



3

POWER DARLINGTON TR SWITCHING APPLICATIONS

- **Complement to BDV65/65A/65B respectively**



1. Base 2. Collector 3. Emitter

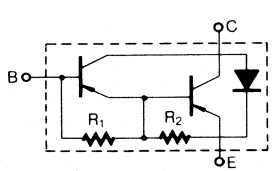
ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BDV64	V_{CBO}	−60	V
: BDV64A		−80	V
: BDV64B		−100	V
Collector Emitter Voltage: BDV64	V_{CEO}	−60	V
: BDV64A		−80	V
: BDV64B		−100	V
Emitter Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−12	A
Collector Current (Pulse)	I_C	−20	A
Base Current	I_B	−0.5	A
Collector Dissipation ($T_C = 25°C$)	P_C	125	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65 ~ 150	°C

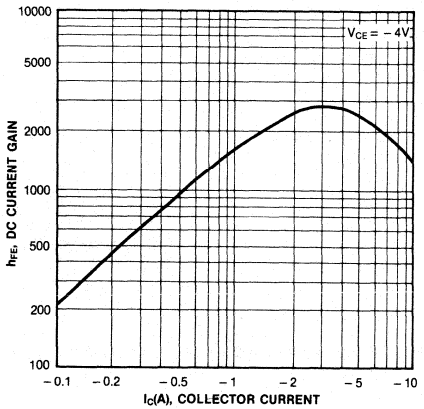
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BDV64	$V_{CEO}(sus)$	$I_C = -30mA$, $I_B = 0$	−60			V
: BDV64A			−80			V
: BDV64B			−100			V
Collector Cutoff Current : BDV64	I_{CBO}	$V_{CB} = -60V$, $I_E = 0$			−400	μA
: BDV64A		$V_{CB} = -80V$, $I_E = 0$			−400	μA
: BDV64B		$V_{CB} = -100V$, $I_E = 0$			−400	μA
Collector Cutoff Current : BDV64	I_{CEO}	$V_{CE} = -30V$, $I_B = 0$			−1	mA
: BDV64A		$V_{CE} = -40V$, $I_B = 0$			−1	mA
: BDV64B		$V_{CE} = -50V$, $I_B = 0$			−1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−5	mA
Collector Base Capacitance	C_{CBO}	$V_{CB} = -10V$, $I_E = 0$, $f = 1MHz$		−100		pF
*DC Current Gain	h_{FE}	$V_{CE} = -4V$, $I_C = -1A$		2500		
		$V_{CE} = -4V$, $I_C = -5A$	1000			
		$V_{CE} = -4V$, $I_C = -10A$		500		
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -5A$, $I_B = -20mA$			−2	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = -4V$, $I_C = -5A$			−2.5	V
Turn On Time	t_{on}	$I_C = -5A$, $I_B1 = -20mA$		0.5		μS
Storage Time	t_{stg}	$I_B2 = -20A$, $V_{CC} = -16V$		1.1		μS
Fall Time	t_f			2.5		μS

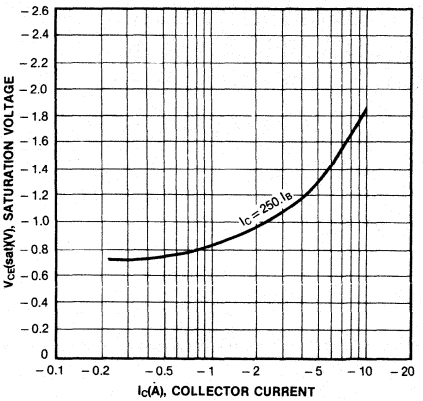
*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed



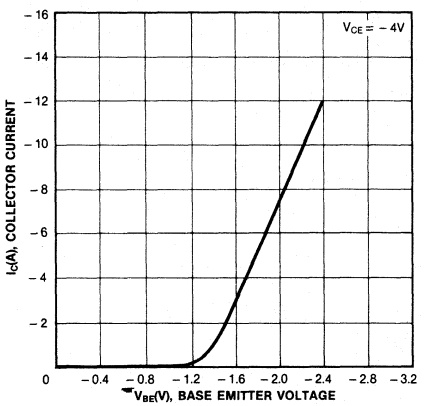
DC CURRENT GAIN



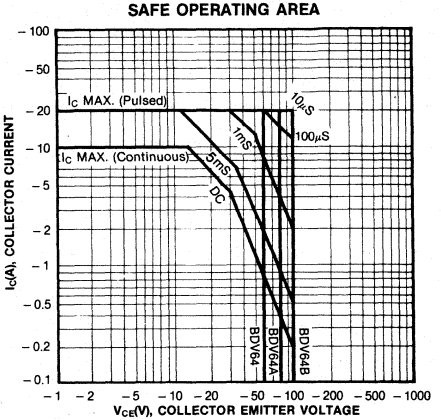
COLLECTOR EMITTER SATURATION VOLTAGE



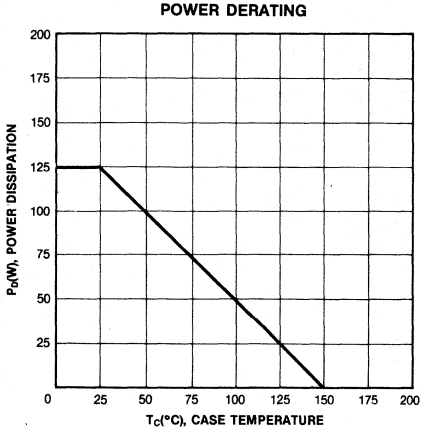
BASE EMITTER VOLTAGE



SAFE OPERATING AREA



POWER DERATING

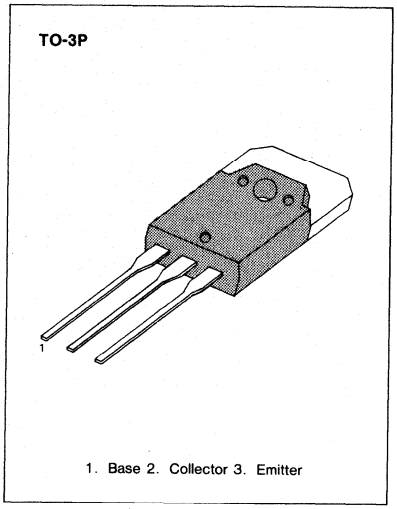


3

BDV65/65A/65B NPN EPITAXIAL SILICON TRANSISTOR

POWER DARLINGTON TR SWITCHING APPLICATIONS

- **Complement to BDV64/64A/64B respectively**



1. Base 2. Collector 3. Emitter

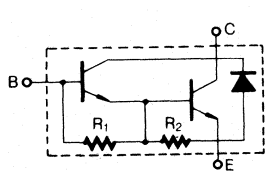
ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BDV65	V_{CBO}	60	V
: BDV65A		80	V
: BDV65B		100	V
Collector Emitter Voltage: BDV65	V_{CEO}	60	V
: BDV65A		80	V
: BDV65B		100	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	12	A
Collector Current (Pulse)	I_C	20	A
Base Current	I_B	0.5	A
Collector Dissipation ($T_C = 25°C$)	P_C	125	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

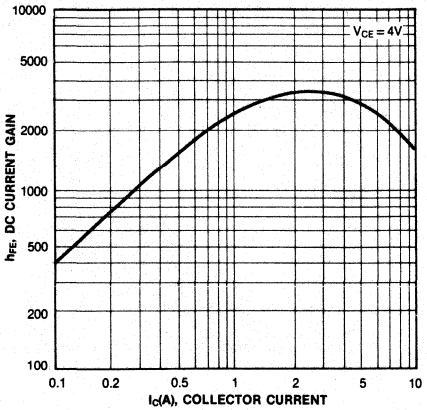
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BDV65	$V_{CEO}(sus)$	$I_C = 30mA$, $I_B = 0$	60			V
: BDV65A			80			V
: BDV65B			100			V
Collector Cutoff Current : BDV65	I_{CBO}	$V_{CB} = 60V$, $I_E = 0$			400	μA
: BDV65A		$V_{CB} = 80V$, $I_E = 0$			400	μA
: BDV65B		$V_{CB} = 100V$, $I_E = 0$			400	μA
Collector Cutoff Current : BDV65	I_{CEO}	$V_{CE} = 30V$, $I_B = 0$			1	mA
: BDV65A		$V_{CE} = 40V$, $I_B = 0$			1	mA
: BDV65B		$V_{CE} = 50V$, $I_B = 0$			1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			5	mA
Collector Base Capacitance	C_{CBO}	$V_{CB} = 10V$, $I_E = 0$, f = 1MHz		100		pF
*DC Current Gain	h_{FE}	$V_{CE} = 4V$, $I_C = 1A$		2500		
		$V_{CE} = 4V$, $I_C = 5A$	1000			
		$V_{CE} = 4V$, $I_C = 10A$		500		
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 5A$, $I_B = 20mA$			2	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = 4V$, $I_C = 5A$			2.5	V
Turn On Time	t_{on}	$I_C = 5A$, $I_{B1} = 20mA$		0.5		μS
Storage Time	t_{stg}	$I_{B2} = 20A$, $V_{CC} = 16V$		1.3		μS
Fall Time	t_f			1.0		μS

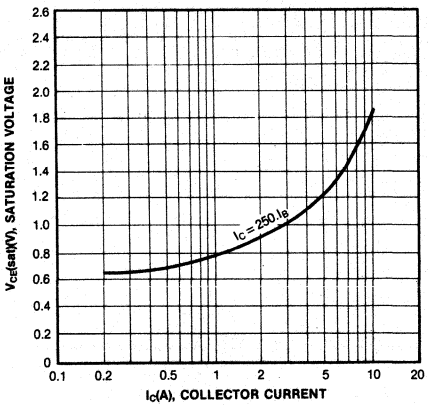
*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed



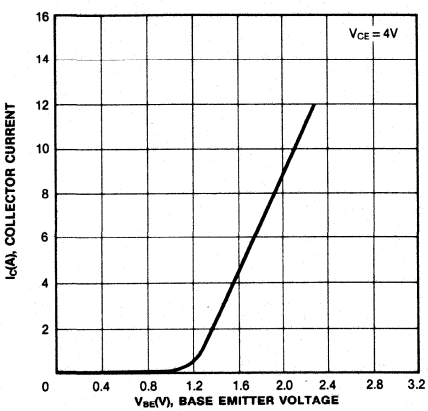
DC CURRENT GAIN



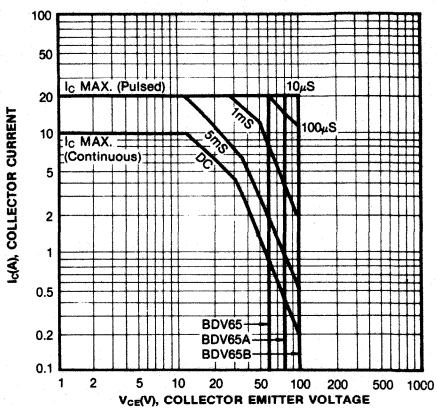
COLLECTOR EMITTER SATURATION VOLTAGE



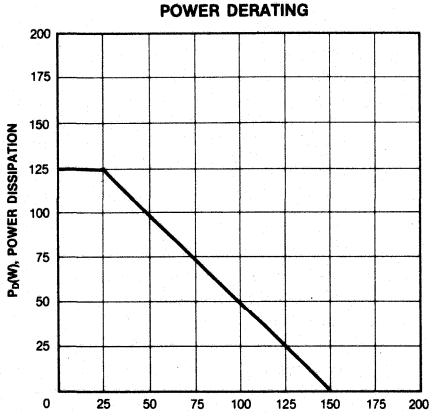
BASE EMITTER VOLTAGE



SAFE OPERATING AREA



POWER DERATING

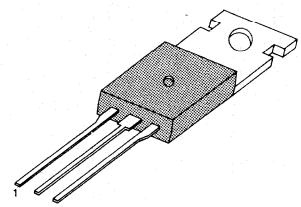


3

POWER DARLINGTON TR HAMMER DRIVERS, AUDIO AMPLIFIERS APPLICATIONS

- **Complement to BDW24, BDW24A, BDW24B and BDW24C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

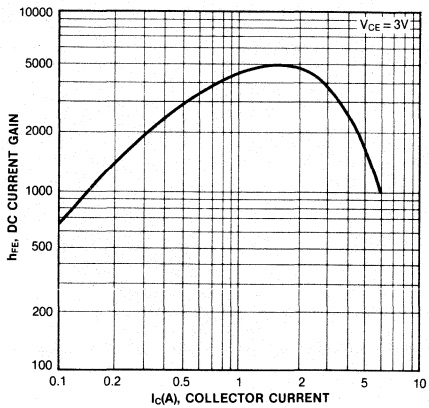
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BDW23	V_{CBO}	45	V
: BDW23A		60	V
: BDW23B		80	V
: BDW23C		100	V
Collector Emitter Voltage: BDW23	V_{CEO}	45	V
: BDW23A		60	V
: BDW23B		80	V
: BDW23C		100	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	6	A
Collector Current (Pulse)	I_C	8	A
Base Current	I_B	0.2	A
Collector Dissipation ($T_C = 25°C$)	P_C	50	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

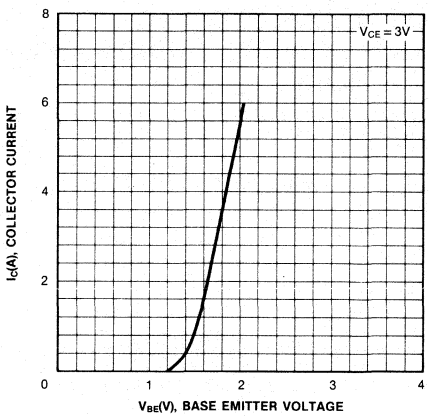
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage : BDW23	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	45			V
: BDW23A			60			V
: BDW23B			80			V
: BDW23C			100			V
Collector Cutoff Current : BDW23	I_{CBO}	$V_{CB} = 45V$, $I_E = 0$			200	μA
: BDW23A		$V_{CB} = 60V$, $I_E = 0$			200	μA
: BDW23B		$V_{CB} = 80V$, $I_E = 0$			200	μA
: BDW23C		$V_{CB} = 100V$, $I_E = 0$			200	μA
Collector Cutoff Current : BDW23	I_{CEO}	$V_{CE} = 22V$, $I_B = 0$			500	μA
: BDW23A		$V_{CE} = 30V$, $I_B = 0$			500	μA
: BDW23B		$V_{CE} = 40V$, $I_B = 0$			500	μA
: BDW23C		$V_{CE} = 50V$, $I_B = 0$			500	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			2	mA
*DC Current Gain	h_{FE}	$V_{CE} = 3V$, $I_C = 1A$	1000			
		$V_{CE} = 3V$, $I_C = 2A$	750		20000	
		$V_{CE} = 3V$, $I_C = 6A$	100			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 2A$, $I_B = 8mA$			2	V
		$I_C = 6A$, $I_B = 60mA$			3	V
*Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = 2A$, $I_B = 8mA$			2.5	V
*Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE} = 3V$, $I_C = 1A$			2.5	V
		$V_{CE} = 3V$, $I_C = 6A$			3	V
*Parallel Diode Forward Voltage	V_f	$I_f = 2A$			1.8	V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

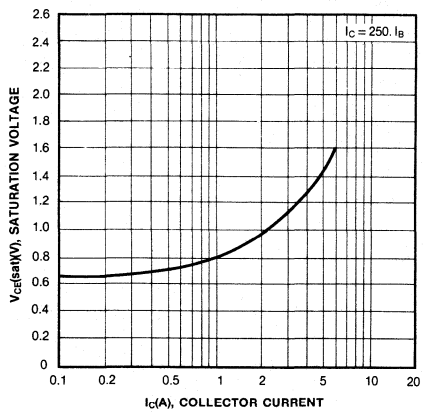
DC CURRENT GAIN



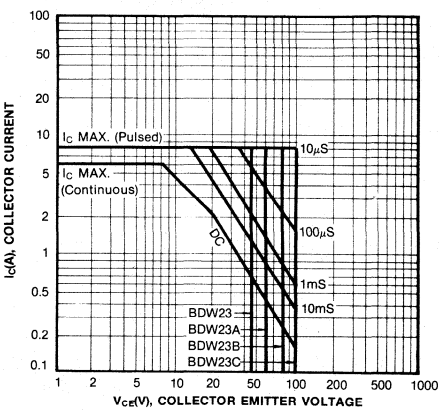
COLLECTOR EMITTER SATURATION VOLTAGE



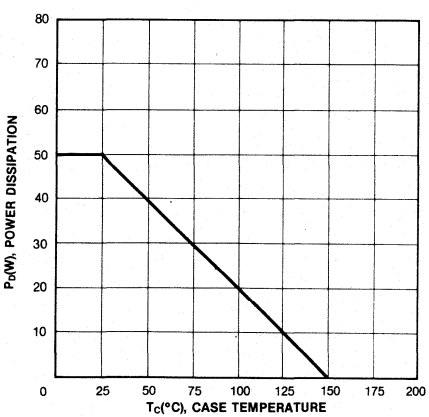
BASE EMITTER VOLTAGE



SAFE OPERATING AREA



POWER DERATING



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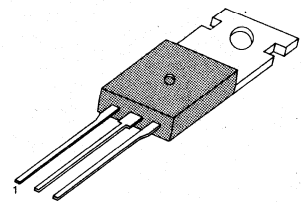
POWER DARLINGTON TR HAMMER DRIVERS, AUDIO AMPLIFIERS APPLICATIONS

- **Complement to BDW23, BDW23A, BDW23B and BDW23C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

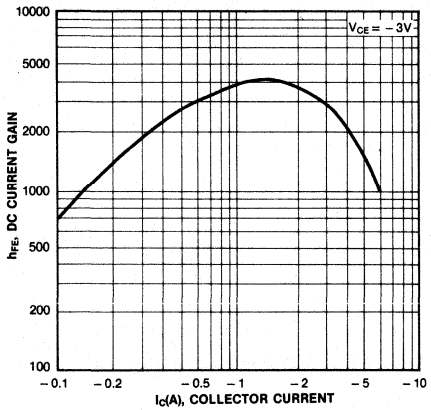
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BDW24	V_{CBO}	−45	V
	: BDW24A		−60	V
	: BDW24B		−80	V
	: BDW24C		−100	V
Collector Emitter Voltage:	BDW24	V_{CEO}	−45	V
	: BDW24A		−60	V
	: BDW24B		−80	V
	: BDW24C		−100	V
Emitter Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−6	A
Collector Current (Pulse)		I_C	−8	A
Base Current		I_B	−0.2	A
Collector Dissipation ($T_C = 25°C$)		P_C	50	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

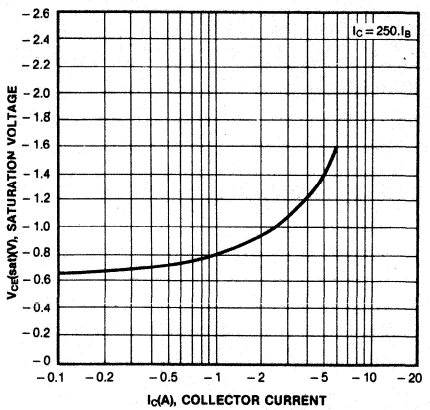
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage :	BDW24	$V_{CEO}(sus)$	$I_C = -100mA$, $I_B = 0$	−45			V
	: BDW24A			−60			V
	: BDW24B			−80			V
	: BDW24C			−100			V
Collector Cutoff Current	: BDW24	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−200	μA
	: BDW24A		$V_{CB} = -60V$, $I_E = 0$			−200	μA
	: BDW24B		$V_{CB} = -80V$, $I_E = 0$			−200	μA
	: BDW24C		$V_{CB} = -100V$, $I_E = 0$			−200	μA
Collector Cutoff Current	: BDW24	I_{CEO}	$V_{CE} = -22V$, $I_B = 0$			−500	μA
	: BDW24A		$V_{CE} = -30V$, $I_B = 0$			−500	μA
	: BDW24B		$V_{CE} = -40V$, $I_B = 0$			−500	μA
	: BDW24C		$V_{CE} = -50V$, $I_B = 0$			−500	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−2	mA
*DC Current Gain		h_{FE}	$V_{CE} = -3V$, $I_C = -1A$	1000			
			$V_{CE} = -3V$, $I_C = -2A$	750		20000	
			$V_{CE} = -3V$, $I_C = -6A$	100			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = -2A$, $I_B = -8mA$			−2	V
			$I_C = -6A$, $I_B = -60mA$			−3	V
*Base Emitter Saturation Voltage		$V_{BE}(sat)$	$I_C = -2A$, $I_B = -8mA$			−2.5	V
*Base Emitter On Voltage		$V_{BE}(on)$	$V_{CE} = -3V$, $I_C = -1A$			−2.5	V
			$V_{CE} = -3V$, $I_C = -6A$			−3	V
*Parallel Diode Forward Voltage		V_f	$I_f = 2A$			1.8	V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

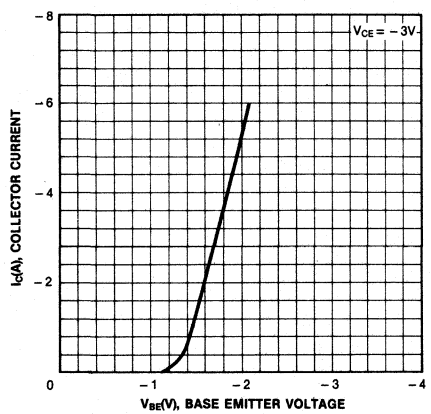
DC CURRENT GAIN



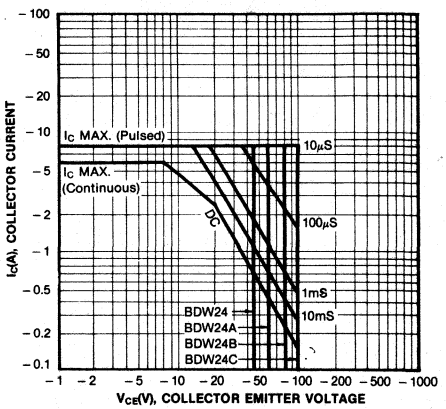
COLLECTOR EMITTER SATURATION VOLTAGE



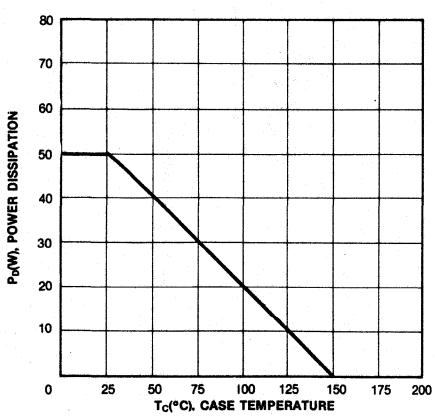
BASE EMITTER VOLTAGE



SAFE OPERATING AREA



POWER DERATING

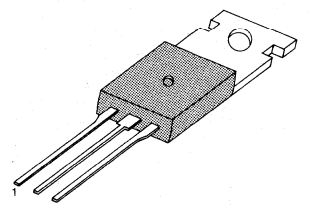


3

POWER DARLINGTON TR
HAMMER DRIVERS, AUDIO AMPLIFIERS
APPLICATIONS

- **Complement to BDW94, BDW94A, BDW94B and BDW94C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

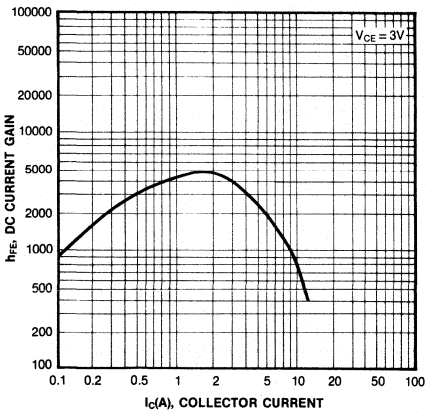
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BDW93	V_{CBO}	45	V
: BDW93A		60	V
: BDW93B		80	V
: BDW93C		100	V
Collector Emitter Voltage: BDW93	V_{CEO}	45	V
: BDW93A		60	V
: BDW93B		80	V
: BDW93C		100	V
Collector Current (DC)	I_C	12	A
Collector Current (Pulse)	I_C	15	A
Base Current	I_B	0.2	A
Collector Dissipation ($T_C = 25°C$)	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

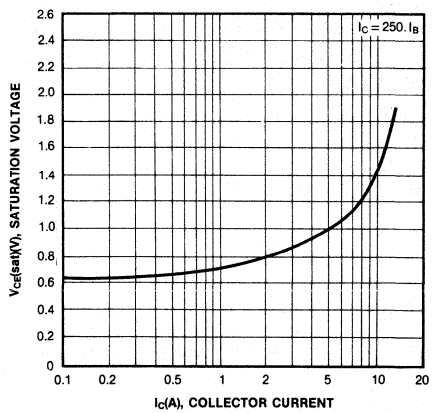
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage:	BDW93	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	45			V
	: BDW93A			60			V
	: BDW93B			80			V
	: BDW93C			100			V
Collector Cutoff Current	: BDW93	I_{CBO}	$V_{CB} = 45V$, $I_E = 0$			100	μA
	: BDW93A		$V_{CB} = 60V$, $I_E = 0$			100	μA
	: BDW93B		$V_{CB} = 80V$, $I_E = 0$			100	μA
	: BDW93C		$V_{CB} = 100V$, $I_E = 0$			100	μA
Collector Cutoff Current	: BDW93	I_{CEO}	$V_{CE} = 45V$, $I_B = 0$			1	mA
	: BDW93A		$V_{CE} = 60V$, $I_B = 0$			1	mA
	: BDW93B		$V_{CE} = 80V$, $I_B = 0$			1	mA
	: BDW93C		$V_{CE} = 100V$, $I_B = 0$			1	mA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			2	mA
*DC Current Gain		h_{FE}	$V_{CE} = 3V$, $I_C = 3A$	1000			
			$V_{CE} = 3V$, $I_C = 5A$	750		20000	
			$V_{CE} = 3V$, $I_C = 10A$	100			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = 5A$, $I_B = 20mA$			2	V
			$I_C = 10A$, $I_B = 100mA$			3	V
*Base Emitter Saturation Voltage		$V_{BE}(sat)$	$I_C = 5A$, $I_B = 20mA$			2.5	V
			$I_C = 10A$, $I_B = 100mA$			4	V
*Parallel Diode Forward Voltage		V_f	$I_f = 5A$		1.3	2	V
			$I_f = 10A$		1.8	4	V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

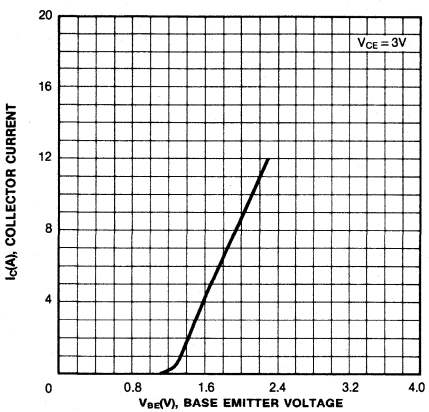
DC CURRENT GAIN



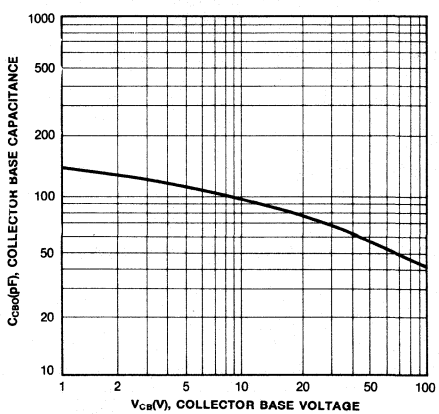
COLLECTOR EMITTER SATURATION VOLTAGE



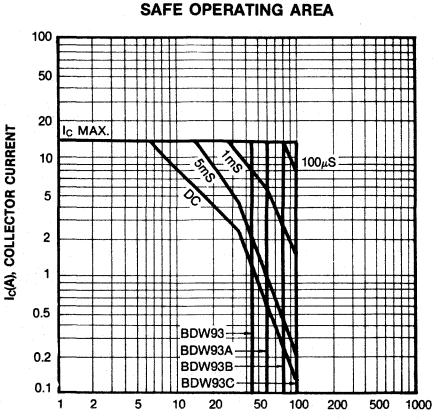
BASE EMITTER VOLTAGE



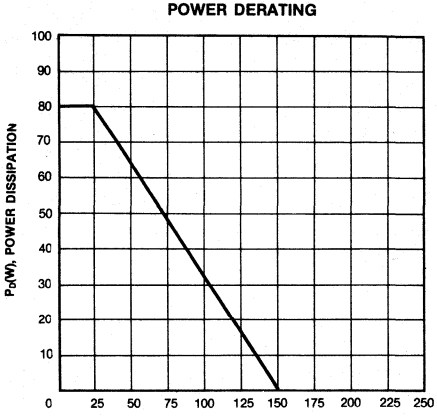
COLLECTOR BASE CAPACITANCE



SAFE OPERATING AREA



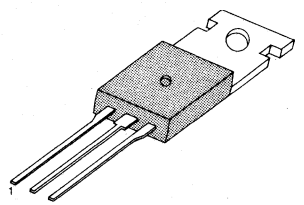
POWER DERATING



POWER DARLINGTON TR
POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BDW93, BDW93A, BDW93B and BDW93C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

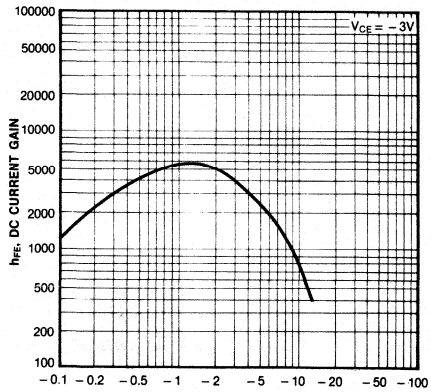
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BDW94	V_{CBO}	−45	V
: BDW94A		−60	V
: BDW94B		−80	V
: BDW94C		−100	V
Collector Emitter Voltage: BDW94	V_{CEO}	−45	V
: BDW94A		−60	V
: BDW94B		−80	V
: BDW94C		−100	V
Collector Current (DC)	I_C	−12	A
Collector Current (Pulse)	I_C	−15	A
Base Current	I_B	−0.2	A
Collector Dissipation ($T_C = 25°C$)	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

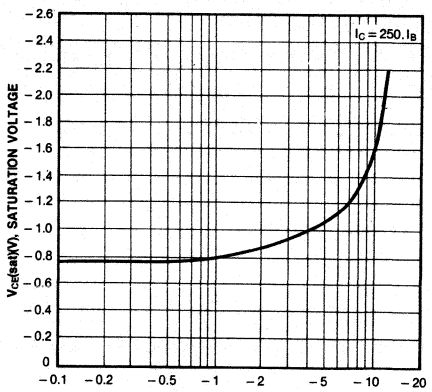
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BDW94	$V_{CEO}(sus)$	$I_C = -100mA$, $I_B = 0$	−45			V
: BDW94A			−60			V
: BDW94B			−80			V
: BDW94C			−100			V
Collector Cutoff Current : BDW94	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−100	μA
: BDW94A		$V_{CB} = -60V$, $I_E = 0$			−100	μA
: BDW94B		$V_{CB} = -80V$, $I_E = 0$			−100	μA
: BDW94C		$V_{CB} = -100V$, $I_E = 0$			−100	μA
Collector Cutoff Current : BDW94	I_{CEO}	$V_{CE} = -45V$, $I_B = 0$			−1	mA
: BDW94A		$V_{CE} = -60V$, $I_B = 0$			−1	mA
: BDW94B		$V_{CE} = -80V$, $I_B = 0$			−1	mA
: BDW94C		$V_{CE} = -100V$, $I_B = 0$			−1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−2	mA
*DC Current Gain	h_{FE}	$V_{CE} = -3V$, $I_C = -3A$	1000			
		$V_{CE} = -3V$, $I_C = -5A$	750		20000	
		$V_{CE} = -3V$, $I_C = -10A$	100			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -5A$, $I_B = -20mA$			−2	V
		$I_C = -10A$, $I_B = -100mA$			−3	V
*Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = -5A$, $I_B = -20mA$			−2.5	V
		$I_C = -10V$, $I_B = -100mA$			−4	V
*Parallel Diode Forward Voltage	V_f	$I_f = -5A$		−1.3	−2	V
		$I_f = -10A$		−1.8	−4	V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

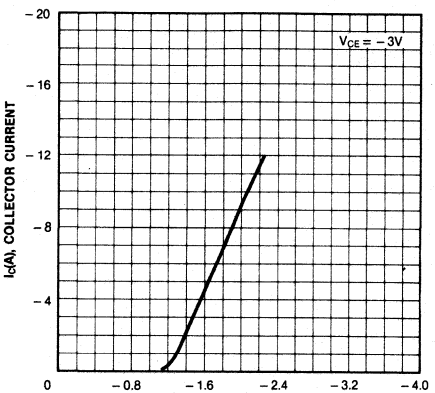
DC CURRENT GAIN



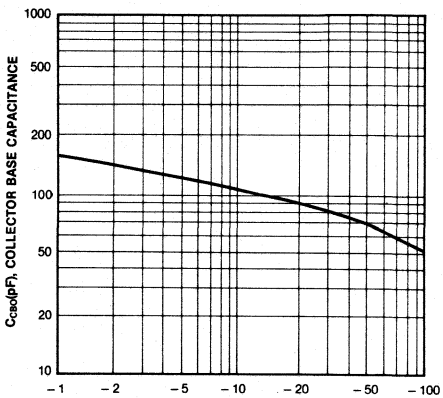
COLLECTOR EMITTER SATURATION VOLTAGE



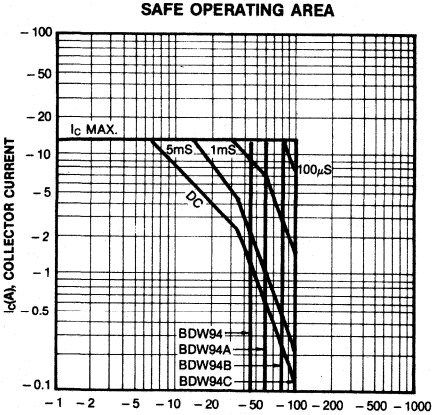
BASE EMITTER VOLTAGE



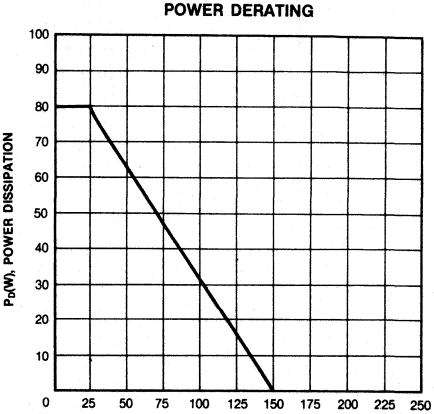
COLLECTOR BASE CAPACITANCE



SAFE OPERATING AREA



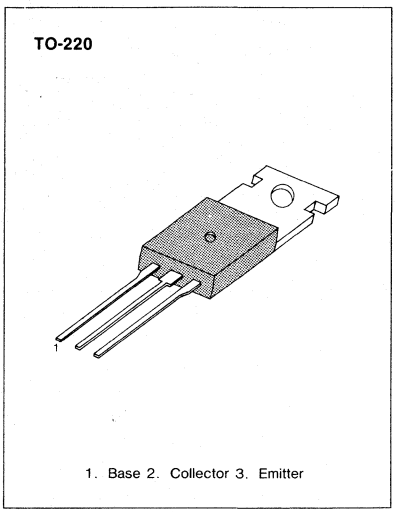
POWER DERATING



3

HIGH GAIN GENERAL PURPOSE POWER DARLINGTON TR
POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BDX34/34A/34B/34C respectively**



ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

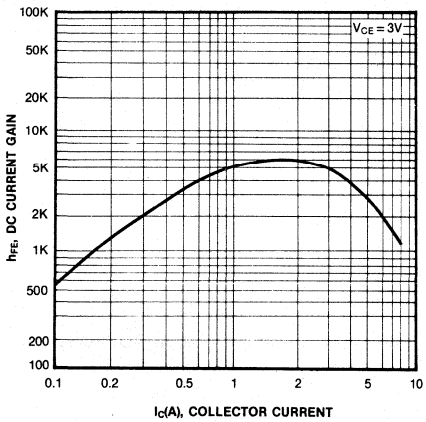
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BDX33	V_{CBO}	45	V
	: BDX33A		60	V
	: BDX33B		80	V
	: BDX33C		100	V
Collector Emitter Voltage	: BDX33	V_{CEO}	45	V
	: BDX33A		60	V
	: BDX33B		80	V
	: BDX33C		100	V
Collector Current (DC)		I_C	10	A
Collector Current (Pulse)		I_C	15	A
Base Current		I_B	0.25	A
Collector Dissipation ($T_C = 25°C$)		P_C	70	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

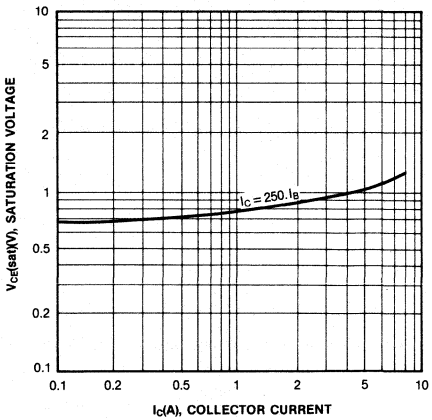
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage	: BDX33	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	45			V
	: BDX33A			60			V
	: BDX33B			80			V
	: BDX33C			100			V
*Collector Emitter Sustaining Voltage	: BDX33	$V_{CER}(sus)$	$I_C = 100mA$, $I_B = 0$	45			V
	: BDX33A		$R_{BE} = 100\,\Omega$	60			V
	: BDX33B			80			V
	: BDX33C			100			V
*Collector Emitter Sustaining Voltage	: BDX33	$V_{CEV}(sus)$	$I_C = 100mA$, $I_B = 0$	45			V
	: BDX33A		$V_{BE} = 1.5V$	60			V
	: BDX33B			80			V
	: BDX33C			100			V
Collector Cutoff Current	: BDX33	I_{CBO}	$V_{CB} = 45V$, $I_E = 0$			0.2	mA
	: BDX33A		$V_{CB} = 60V$, $I_E = 0$			0.2	mA
	: BDX33B		$V_{CB} = 80V$, $I_E = 0$			0.2	mA
	: BDX33C		$V_{CB} = 100V$, $I_E = 0$			0.2	mA
Collector Cutoff Current	: BDX33	I_{CEO}	$V_{CE} = 22V$, $I_B = 0$			0.5	mA
	: BDX33A		$V_{CE} = 30V$, $I_B = 0$			0.5	mA
	: BDX33B		$V_{CE} = 40V$, $I_B = 0$			0.5	mA
	: BDX33C		$V_{CE} = 50V$, $I_B = 0$			0.5	mA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			5	mA
*DC Current Gain	: BDX33/33A	h_{FE}	$V_{CE} = 3V$, $I_C = 4A$	750			
	: BDX33B/33C		$V_{CE} = 3V$, $I_C = 3A$	750			
*Collector Emitter Saturation Voltage	: BDX33/33A	$V_{CE}(sat)$	$I_C = 4A$, $I_B = 8mA$			2.5	V
	: BDX33B/33C		$I_C = 3A$, $I_B = 6mA$			2.5	V
*Base Emitter On Voltage	: BDX33/33A	$V_{BE}(on)$	$V_{CE} = 3V$, $I_C = 4A$			2.5	V
	: BDX33B/33C		$V_{CE} = 3V$, $I_C = 3A$			2.5	V
Parallel Diode Forward Voltage		V_f	$I_f = 8A$			4	V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

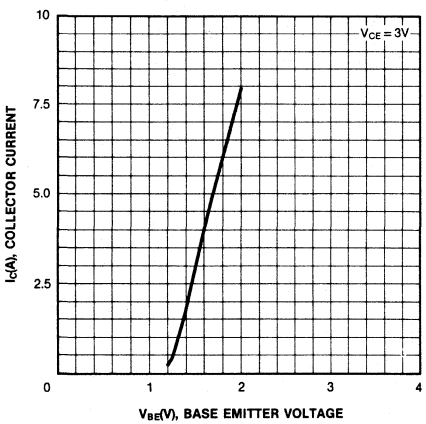
DC CURRENT GAIN



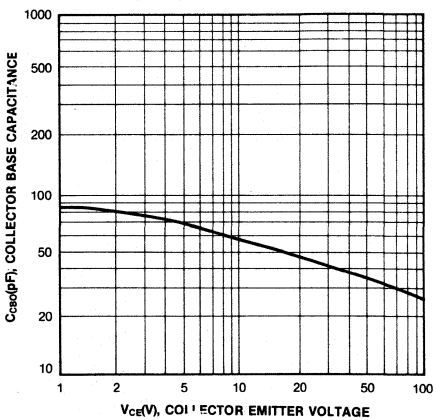
COLLECTOR EMITTER SATURATION VOLTAGE



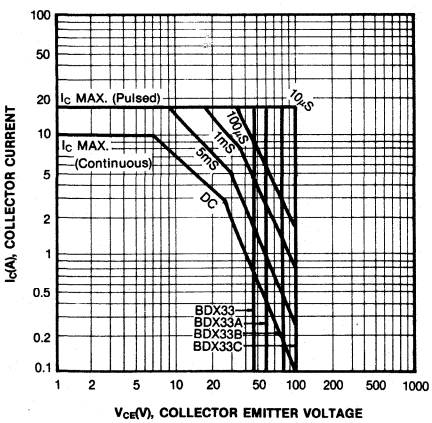
BASE EMITTER VOLTAGE



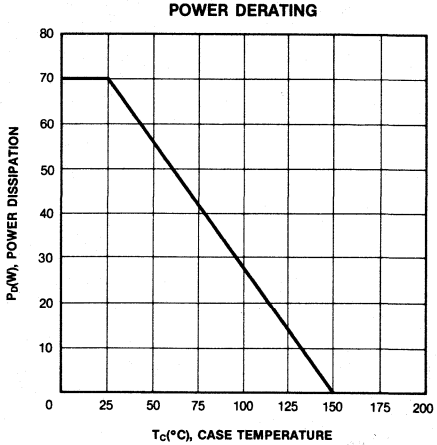
COLLECTOR BASE CAPACITANCE



SAFE OPERATING AREA



POWER DERATING



3

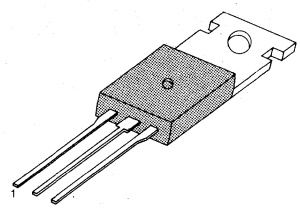
HIGH GAIN GENERAL PURPOSE POWER DARLINGTON TR
POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BDX33/33A/33B/33C respectively**

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BDX34	V_{CBO}	−45	V
	: BDX34A		−60	V
	: BDX34B		−80	V
	: BDX34C		−100	V
Collector Emitter Voltage	: BDX34	V_{CEO}	−45	V
	: BDX34A		−60	V
	: BDX34B		−80	V
	: BDX34C		−100	V
Collector Current (DC)		I_C	−10	A
Collector Current (Pulse)		I_C	−15	A
Base Current		I_B	−0.25	A
Collector Dissipation ($T_C = 25°C$)		P_C	70	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65 ∼ 150	°C

TO-220



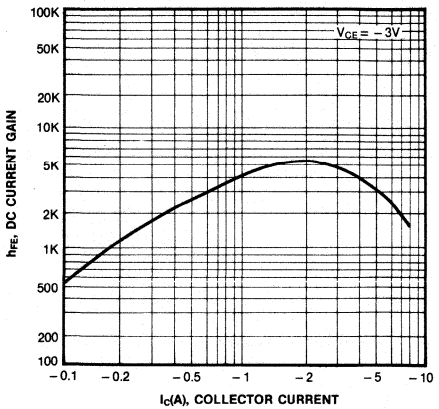
1. Base 2. Collector 3. Emitter

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

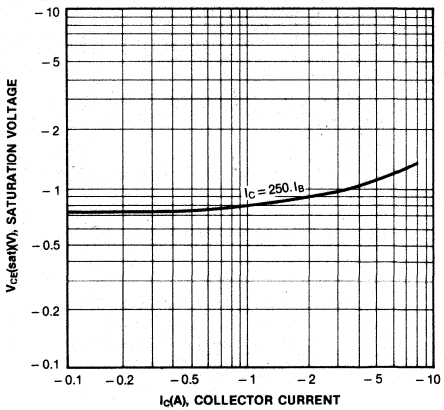
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage	: BDX34	$V_{CEO}(sus)$	$I_C = -100mA$, $I_B = 0$	−45			V
	: BDX34A			−60			V
	: BDX34B			−80			V
	: BDX34C			−100			V
*Collector Emitter Sustaining Voltage	: BDX34	$V_{CER}(sus)$	$I_C = -100mA$, $I_B = 0$	−45			V
	: BDX34A		$R_{BE} = 100\Omega$	−60			V
	: BDX34B			−80			V
	: BDX34C			−100			V
*Collector Emitter Sustaining Voltage	: BDX34	$V_{CEV}(sus)$	$I_C = -100mA$, $I_B = 0$	−45			V
	: BDX34A		$V_{BE} = -1.5V$	−60			V
	: BDX34B			−80			V
	: BDX34C			−100			V
Collector Cutoff Current	: BDX34	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−0.2	mA
	: BDX34A		$V_{CB} = -60V$, $I_E = 0$			−0.2	mA
	: BDX34B		$V_{CB} = -80V$, $I_E = 0$			−0.2	mA
	: BDX34C		$V_{CB} = -100V$, $I_E = 0$			−0.2	mA
Collector Cutoff Current	: BDX34	I_{CEO}	$V_{CE} = -22V$, $I_B = 0$			−0.5	mA
	: BDX34A		$V_{CE} = -30V$, $I_B = 0$			−0.5	mA
	: BDX34B		$V_{CE} = -40V$, $I_B = 0$			−0.5	mA
	: BDX34C		$V_{CE} = -50V$, $I_B = 0$			−0.5	mA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−5	mA
*DC Current Gain	: BDX34/3 x A	h_{FE}	$V_{CE} = -3V$, $I_C = -4A$	750			
	: BDX34B/34C		$V_{CE} = -3V$, $I_C = -3A$	750			
*Collector Emitter Saturation Voltage	: BDX34/34A	$V_{CE}(sat)$	$I_C = -4A$, $I_B = -8mA$			−2.5	V
	: BDX34B/34C		$I_C = -3A$, $I_B = -6mA$			−2.5	V
*Base Emitter On Voltage	: BDX34/34A	$V_{BE}(on)$	$V_{CE} = -3V$, $I_C = -4A$			−2.5	V
	: BDX34B/34C		$V_{CE} = -3V$, $I_C = -3A$			−2.5	V
Parallel Diode Forward Voltage		V_f	$I_f = -8A$			−4	V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

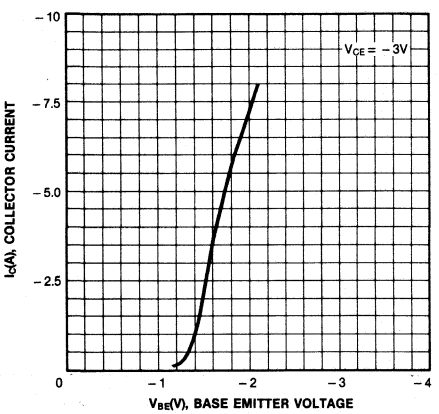
DC CURRENT GAIN



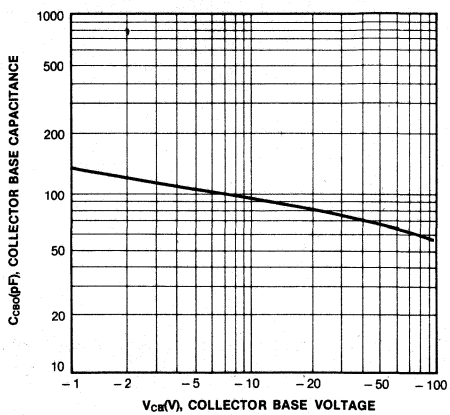
COLLECTOR EMITTER SATURATION VOLTAGE



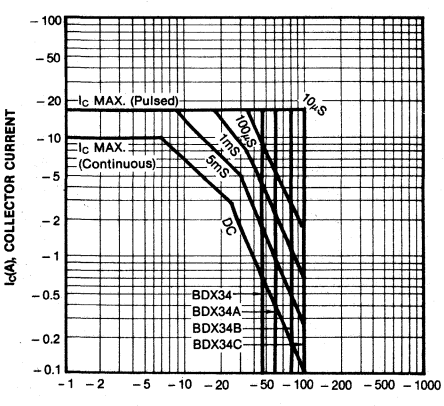
BASE EMITTER VOLTAGE



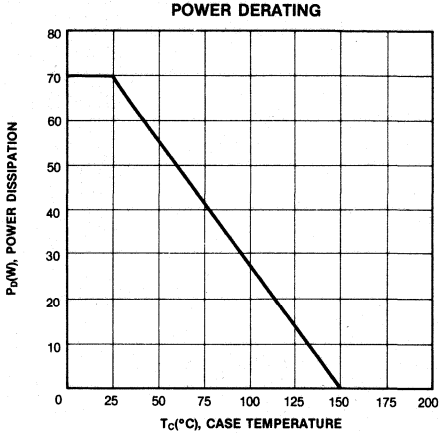
COLLECTOR BASE CAPACITANCE



SAFE OPERATING AREA



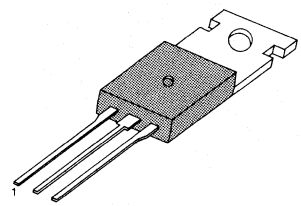
POWER DERATING



POWER DARLINGTON TR
HAMMER DRIVERS, AUDIO AMPLIFIERS APPLICATION
POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BDX54, BDX54A, BDX54B and BDX54C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

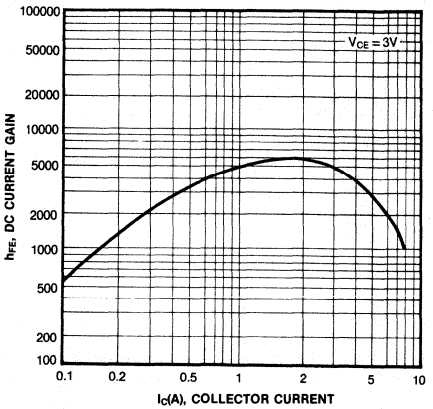
Characteristic	Symbol	Rating	Unit
Collector Base Voltage : BDX53	V_{CBO}	45	V
: BDX53A		60	V
: BDX53B		80	V
: BDX53C		100	V
Collector Emitter Voltage : BDX53	V_{CEO}	45	V
: BDX53A		60	V
: BDX53B		80	V
: BDX53C		100	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	8	A
Collector Current (Pulse)	I_C	12	A
Base Current	I_B	0.2	A
Collector Dissipation ($T_C = 25°C$)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

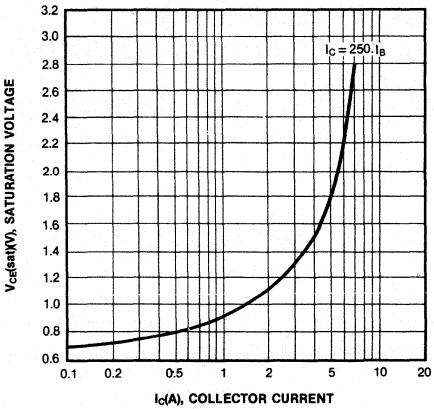
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BDX53	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	45			V
: BDX53A			60			V
: BDX53B			80			V
: BDX53C			100			V
Collector Cutoff Current : BDX53	I_{CBO}	$V_{CB} = 45V$, $I_E = 0$			200	μA
: BDX53A		$V_{CB} = 60V$, $I_E = 0$			200	μA
: BDX53B		$V_{CB} = 80V$, $I_E = 0$			200	μA
: BDX53C		$V_{CB} = 100V$, $I_E = 0$			200	μA
Collector Cutoff Current : BDX53	I_{CEO}	$V_{CE} = 22V$, $I_B = 0$			500	μA
: BDX53A		$V_{CE} = 30V$, $I_B = 0$			500	μA
: BDX53B		$V_{CE} = 40V$, $I_B = 0$			500	μA
: BDX53C		$V_{CE} = 50V$, $I_B = 0$			500	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			2	mA
*DC Current Gain	h_{FE}	$V_{CE} = 3V$, $I_C = 3A$	750			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 3A$, $I_B = 12mA$			2	V
*Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = 3A$, $I_B = 12mA$			2.5	V
Parallel Diode Forward Voltage	V_f	$I_f = 3A$		1.8	2.5	V
		$I_f = 8A$		2.5		V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

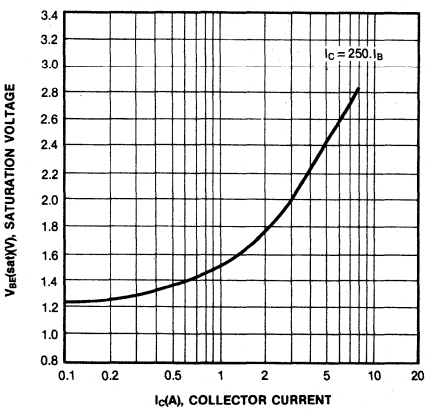
DC CURRENT GAIN



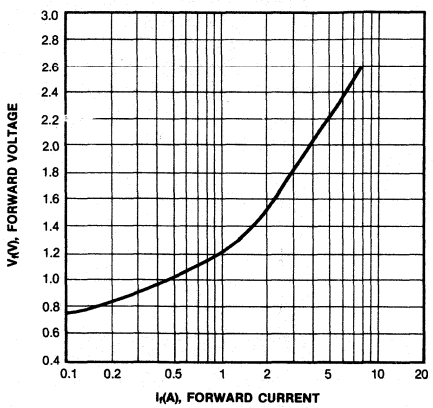
COLLECTOR EMITTER SATURATION VOLTAGE



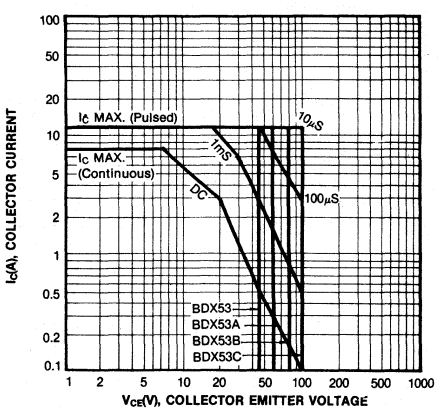
BASE EMITTER SATURATION VOLTAGE



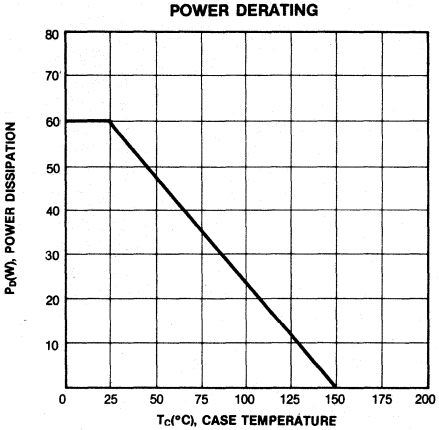
DAMPER DIODE FORWARD VOLTAGE



SAFE OPERATING AREA



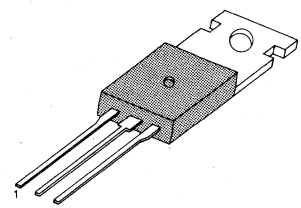
POWER DERATING



POWER DARLINGTON TR
HAMMER DRIVERS, AUDIO AMPLIFIERS
APPLICATION
POWER LINEAR AND SWITCHING APPLICATIONS

- **Complement to BDX53, BDX53A, BDX53B and BDX53C respectively**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

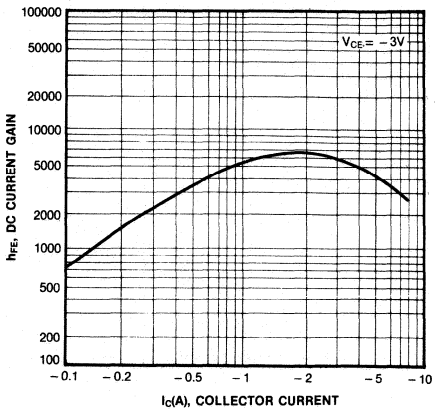
Characteristic		Symbol	Rating	Unit
Collector Base Voltage	: BDX54	V_{CBO}	−45	V
	: BDX54A		−60	V
	: BDX54B		−80	V
	: BDX54C		−100	V
Collector Emitter Voltage	: BDX54	V_{CEO}	−45	V
	: BDX54A		−60	V
	: BDX54B		−80	V
	: BDX54C		−100	V
Emitter Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−8	A
Collector Current (Pulse)		I_C	−12	A
Base Current		I_B	−0.2	A
Collector Dissipation ($T_C = 25°C$)		P_C	60	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65 ∼ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

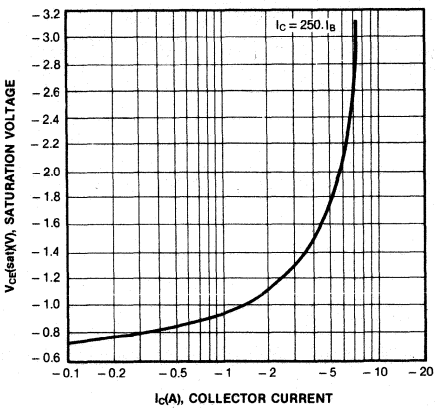
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage	: BDX54	$V_{CEO}(sus)$	$I_C = -100mA$, $I_B = 0$	−45			V
	: BDX54A			−60			V
	: BDX54B			−80			V
	: BDX54C			−100			V
Collector Cutoff Current	: BDX54	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−200	μA
	: BDX54A		$V_{CB} = -60V$, $I_E = 0$			−200	μA
	: BDX54B		$V_{CB} = -80V$, $I_E = 0$			−200	μA
	: BDX54C		$V_{CB} = -100V$, $I_E = 0$			−200	μA
Collector Cutoff Current	: BDX54	I_{CEO}	$V_{CE} = -22V$, $I_B = 0$			−500	μA
	: BDX54A		$V_{CE} = -30V$, $I_B = 0$			−500	μA
	: BDX54B		$V_{CE} = -40V$, $I_B = 0$			−500	μA
	: BDX54C		$V_{CE} = -50V$, $I_B = 0$			−500	μA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−2	mA
*DC Current Gain		h_{FE}	$V_{CE} = -3V$, $I_C = -3A$	750			
*Collector Emitter Saturation Voltage		$V_{CE}(sat)$	$I_C = -3A$, $I_B = -12mA$			−2	V
*Base Emitter Saturation Voltage		$V_{BE}(sat)$	$I_C = -3A$, $I_B = -12mA$			−2.5	V
Parallel Diode Forward Voltage		V_f	$I_f = -3A$		−1.8	−2.5	V
			$I_f = -8A$		−2.5		V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

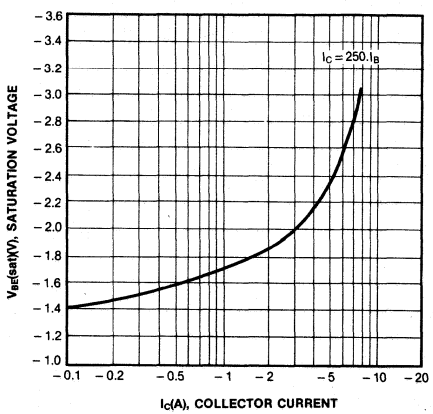
DC CURRENT GAIN



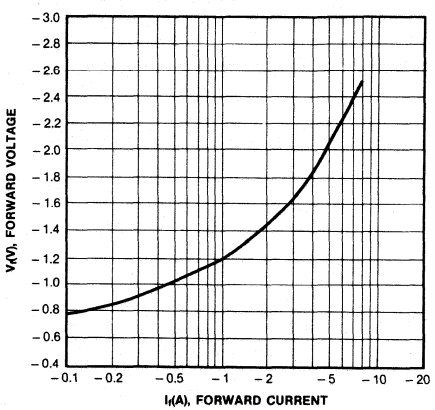
COLLECTOR EMITTER SATURATION VOLTAGE



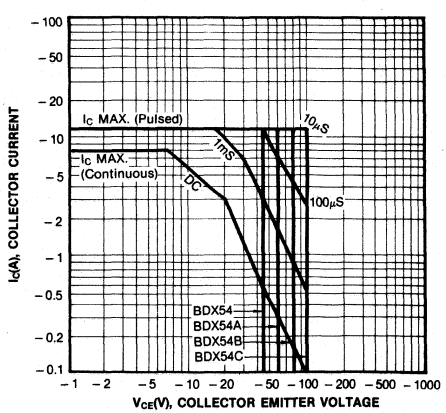
BASE EMITTER SATURATION VOLTAGE



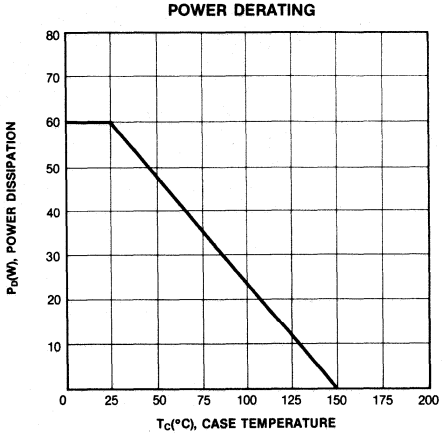
DAMPER DIODE FORWARD VOLTAGE



SAFE OPERATING AREA

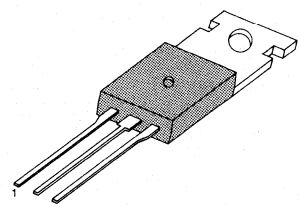


POWER DERATING



HIGH VOLTAGE SWITCHING
USE IN HORIZONTAL DEFLECTION OUTPUT STAGE

TO-220



1. Base 2. Collector 3. Emitter

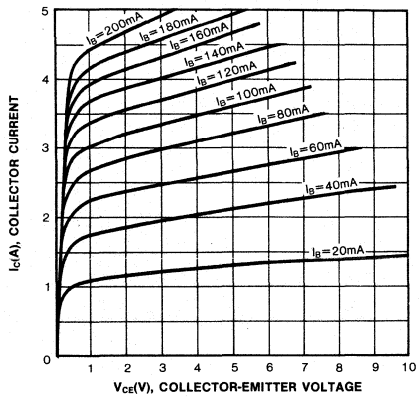
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	400	V
Collector-Emitter Voltage	V_{CEO}	200	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	7	A
Collector Peck Current	I_{CM}	10	A
Base Current	I_B	4	A
Collector Dissipation	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

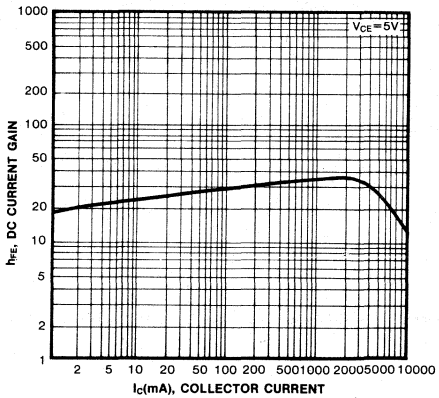
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Cutoff Current (V_{BE}=0)	I_{CES}	V_{CE}=400V, V_{BE}=0		5	mA
		V_{CE}=250V, V_{BE}=0		100	μA
		V_{CE}=250V, V_{BE}=0, T_C=150°C		1	mA
Emitter Cutoff Current (I_C=0)	I_{EBO}	V_{BE}=6V, I_C=0		1	mA
Collector Emitter Saturation Voltage					
: BU406	V_{CE}(sat)	I_C=5A, I_B=0.5A		1	V
: BU406H		I_C=5A, I_B=0.8A		1	V
: BU408		I_C=6A, I_B=1.2A		1	V
Base Emitter Saturation Voltage					
: BU406	V_{BE}(sat)	I_C=5A, I_B=0.5A		1.2	V
: BU406H		I_C=5A, I_B=0.8A		1.2	V
: BU408		I_C=6A, I_B=1.2A		1.5	V
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A	10		MHz
Turn-Off Time : BU406	toff	I_C=5A, I_B=0.5A		0.75	μS
: BU406H		I_C=5A, I_B=0.8A		0.4	μS
: BU408		I_C=6A, I_B=1.2A		0.4	μS

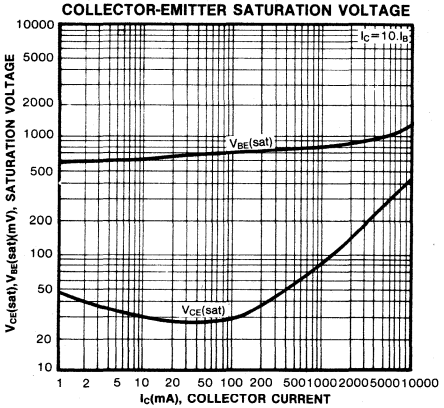
STATIC CHARACTERISTIC



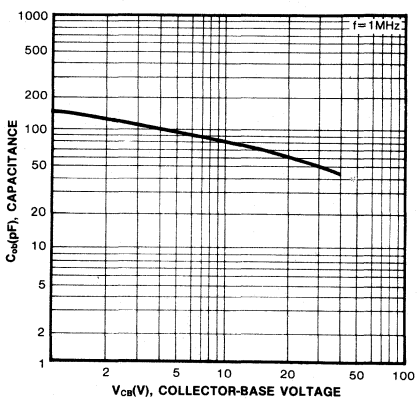
DC CURRENT GAIN



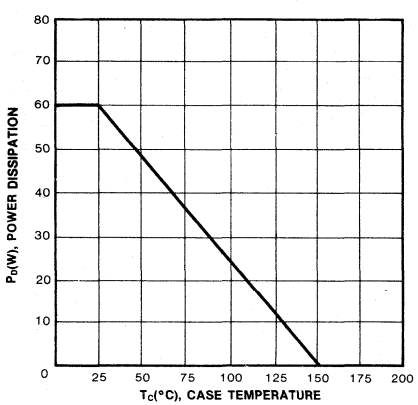
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



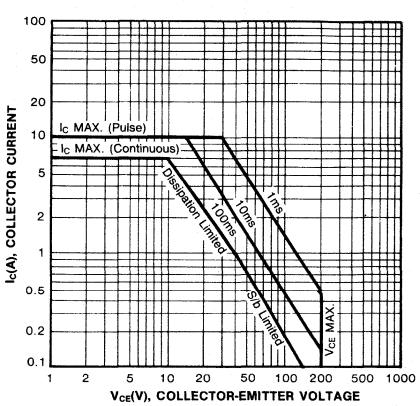
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



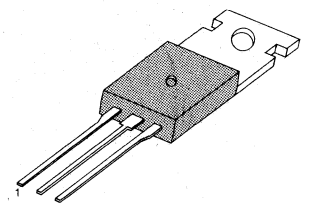
SAFE OPERATING AREA



3

HIGH VOLTAGE SWITCHING
USE IN HORIZONTAL DEFLECTION OUTPUT STAGE

TO-220



1. Base 2. Collector 3. Emitter

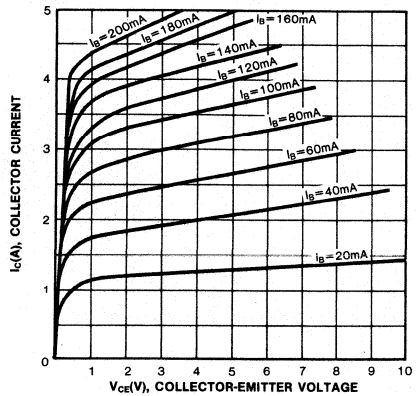
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	330	V
Collector-Emitter Voltage	V_{CEO}	150	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	7	A
Collector Peck Current	I_{CM}	10	A
Base Current	I_B	4	A
Collector Dissipation	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

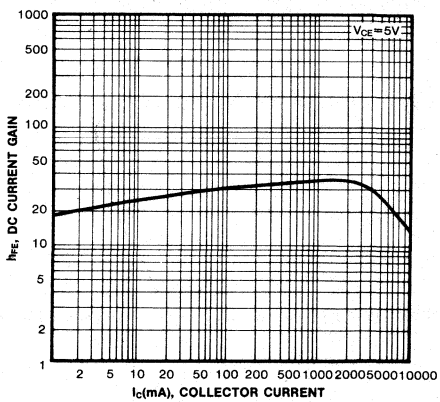
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Cutoff Current (V_{BE}=0)	I_{CES}	V_{CE}=330V, V_{BE}=0		5	mA
		V_{CE}=200V, V_{BE}=0		100	μA
		V_{CE}=200V, V_{BE}=0, T_C=150°C		1	mA
Emitter Cutoff Current (I_C=0)	I_{EBO}	V_{BE}=6V, I_C=0		1	mA
Collector Emitter Saturation Voltage					
: BU407	V_{CE}(sat)	I_C=5A, I_B=0.5A		1	V
: BU407H		I_C=5A, I_B=0.8A		1	V
Base Emitter Saturation Voltage					
: BU407	V_{BE}(sat)	I_C=5A, I_B=0.5A		1.2	V
: BU407H		I_C=5A, I_B=0.8A		1.2	V
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=0.5A	10		MHz
Turn-Off Time : BU407	toff	I_C=5A, I_B=0.5A		0.75	μS
: BU407H		I_C=5A, I_B=0.8A		0.4	μS

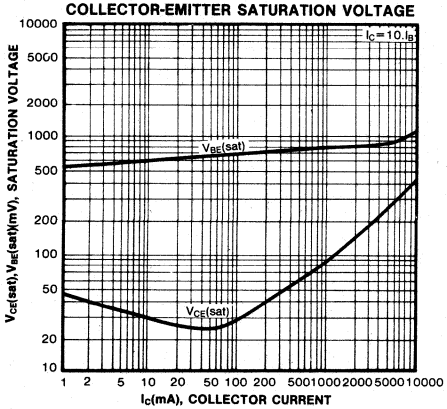
STATIC CHARACTERISTIC



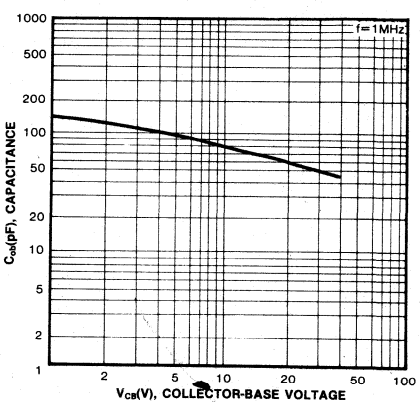
DC CURRENT GAIN



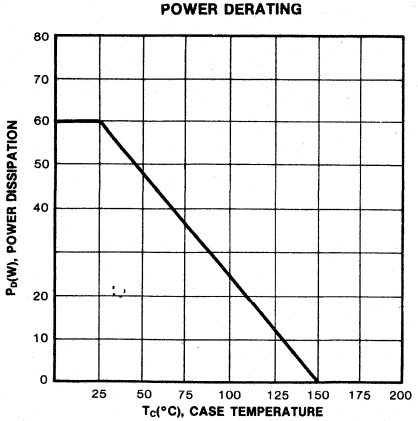
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



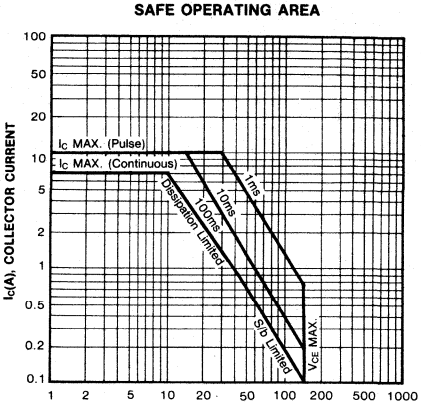
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



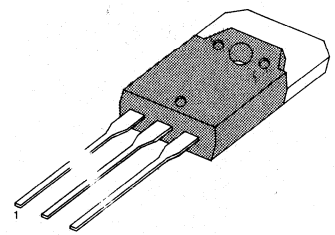
SAFE OPERATING AREA



3

HIGH VOLTAGE POWER SWITCH SWITCHING APPLICATIONS

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

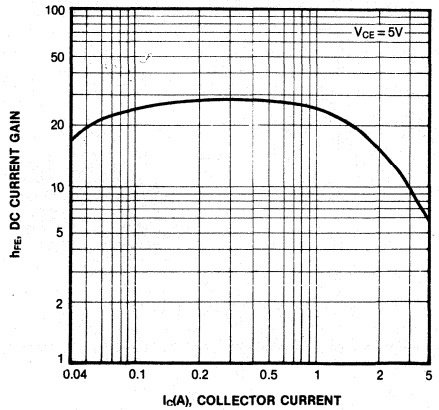
Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage : BU426	V_{CES}	800	V
: BU426A		900	V
Collector Emitter Voltage : BU426	V_{CEO}	375	V
: BU426A		400	V
Emitter Base Voltage	V_{EBO}	10	V
Collector Current (DC)	I_C	6	A
Collector Current (Pulse)	I_C	8	A
Base Current	I_B	3	A
Collector Dissipation ($T_C = 25°C$)	P_C	113	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

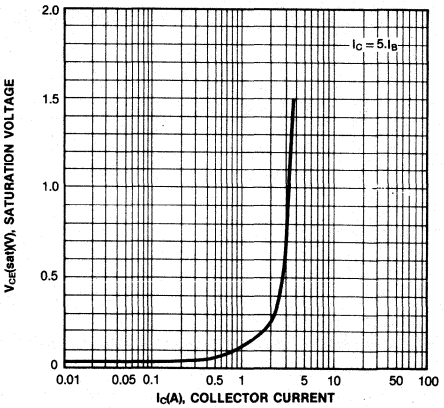
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage: BU426	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	375			V
: BU426A			400			V
Collector Cutoff Current : BU426	I_{CES}	$V_{CE} = 800V$, $V_{BE} = 0$			1	mA
: BU426A		$V_{CE} = 900V$, $V_{BE} = 0$			1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 10V$, $I_C = 0$			10	mA
*DC Current Gain	h_{FE}	$V_{CE} = 5V$, $I_C = 0.6A$		30	60	
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 2.5A$, $I_B = 0.5A$			1.5	V
		$I_C = 4A$, $I_B = 1.25A$			3	V
*Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = 2.5A$, $I_B = 0.5A$			1.4	V
		$I_C = 4A$, $I_B = 1.25A$			1.6	V
Turn On Time	t_{on}	$V_{CC} = 250V$, $I_C = 2.5A$		0.25	0.5	μS
Storage Time	t_{stg}	$I_{B1} = 0.5A$, $I_{B2} = -1A$		2.5	3.5	μS
Fall Time	t_f			0.2	0.5	μS

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

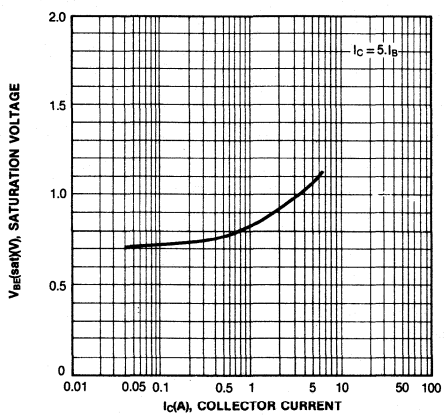
DC CURRENT GAIN



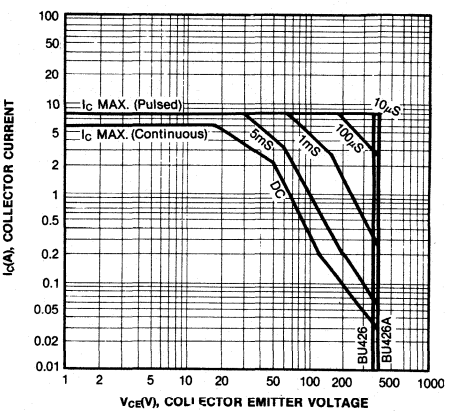
COLLECTOR EMITTER SATURATION VOLTAGE



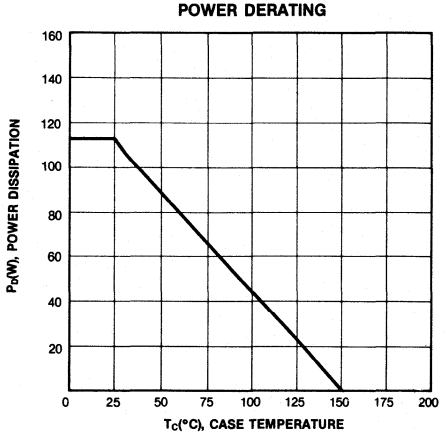
BASE EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING

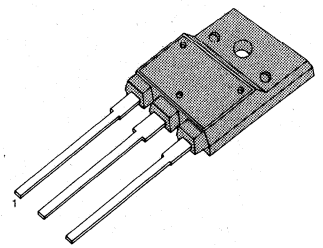


BU508F/BU508AF

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

TV HORIZONTAL OUTPUT APPLICATIONS

TO-3P(F)



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

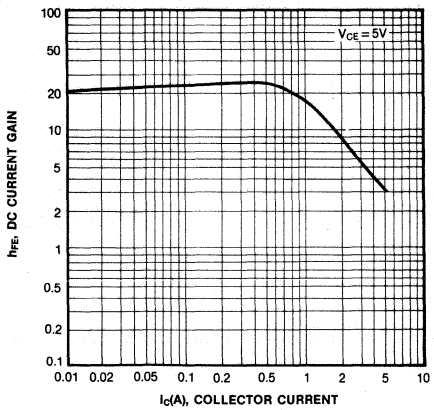
Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage	V_{CES}	1500	V
Collector Emitter Voltage	V_{CEO}	700	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	5	A
Collector Current (Pulse)	I_C	15	A
Collector Dissipation ($T_C = 25°C$)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

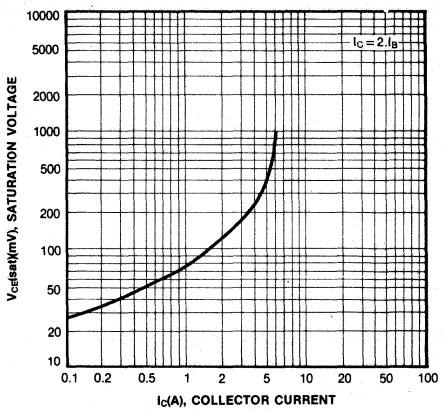
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	700			V
Emitter Base Voltage	V_{EBO}	$I_E = 10mA$, $I_C = 0$	5			V
Collector Cutoff Current	I_{CES}	$V_{CE} = 1500V$, $V_{BE} = 0$			1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5V$, $I_C = 0$			10	mA
*DC Current Gain	h_{FE}	$V_{CE} = 5V$, $I_C = 4.5A$	2.25			
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 4.5A$, $I_B = 2A$				
: BU508F					5	V
: BU508AF					1	V
*Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = 4.5A$, $I_B = 2A$			1.5	V

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

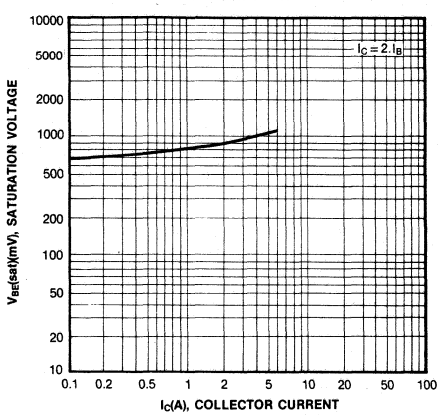
DC CURRENT GAIN



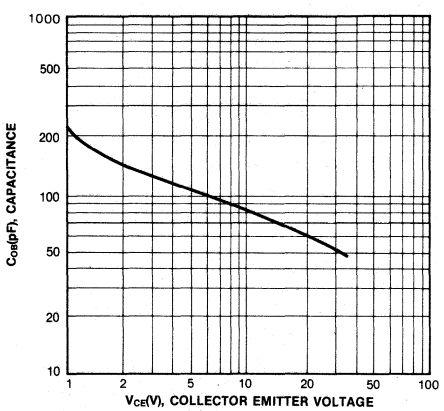
COLLECTOR EMITTER SATURATION VOLTAGE



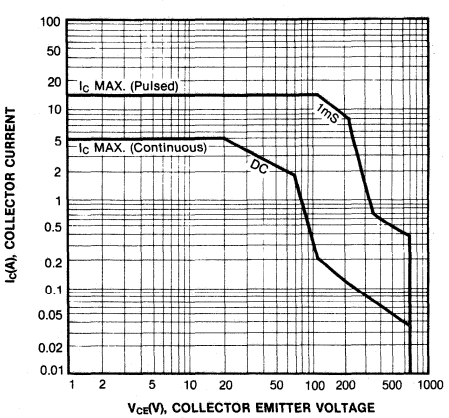
BASE EMITTER SATURATION VOLTAGE



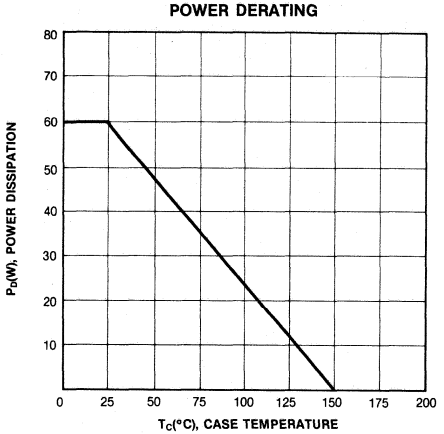
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



POWER DERATING



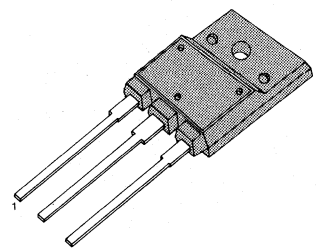
3

NPN TRIPLE DIFFUSED PLANAR SILICON TRANSISTOR

TV HORIZONTAL OUTPUT APPLICATIONS

- **With Damper Diode**
- **High Collector Base Voltage V_{CBO} = 1500V**

TO-3P(F)



1. Base 2. Collector 3. Emitter

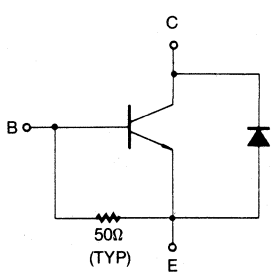
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage	V_{CES}	1500	V
Collector Emitter Voltage	V_{CEO}	700	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	5	A
Collector Current (Pulse)	I_C	15	A
Collector Dissipation (T_C = 25°C)	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65 ~ 150	°C

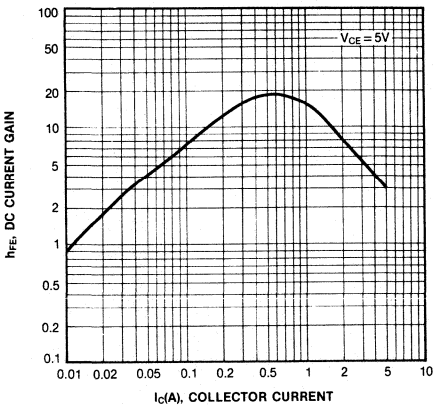
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage	V_{CEO}(sus)	I_C = 100mA, I_B = 0	700			V
Emitter Base Voltage	V_{EBO}	I_E = 200mA, I_C = 0	5			V
Collector Cutoff Current	I_{CES}	V_{CE} = 1500V, V_{BE} = 0			1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB} = 5V, I_C = 0			300	mA
*DC Current Gain	h_{FE}	V_{CE} = 5V, I_C = 4.5A	2.25			
*Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C = 4.5A, I_B = 2A				
: BU508DF					5	V
: BU508ADF					1	V
*Base Emitter Saturation Voltage	V_{BE}(sat)	I_C = 4.5A, I_B = 2A			1.5	V

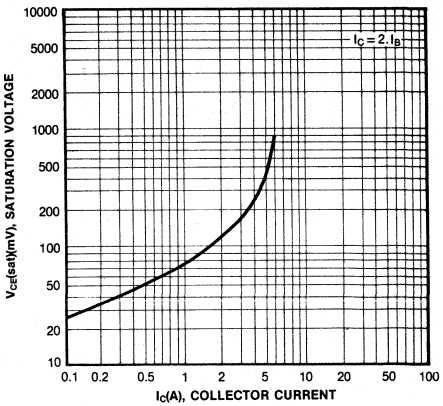
*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed



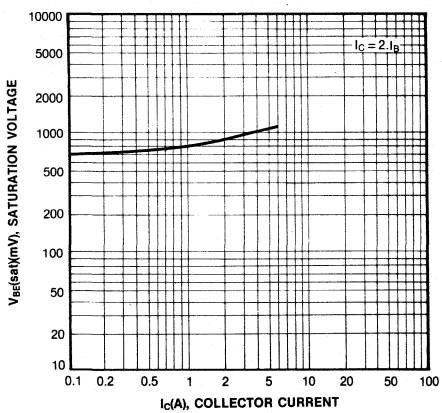
DC CURRENT GAIN



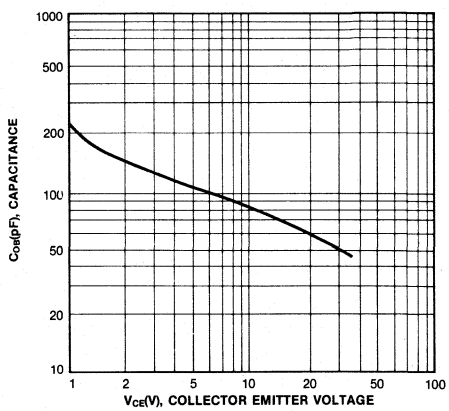
COLLECTOR EMITTER SATURATION VOLTAGE



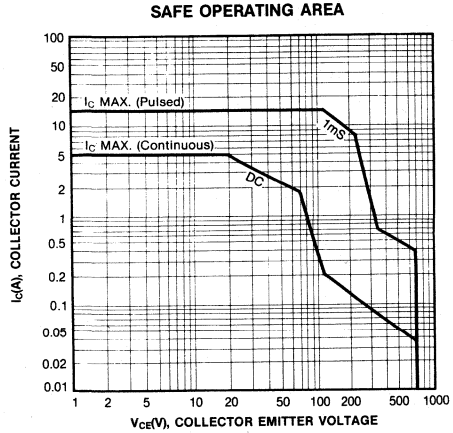
BASE EMITTER SATURATION VOLTAGE



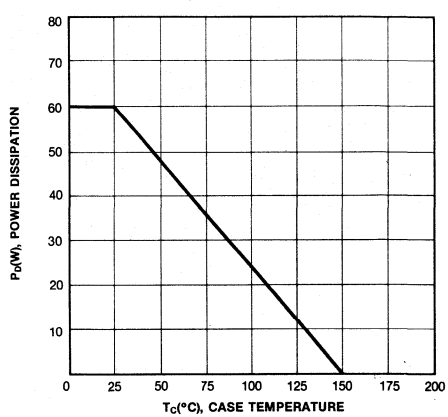
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



POWER DERATING



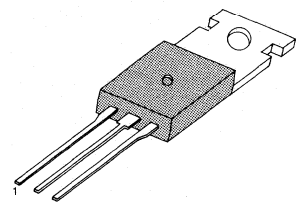
3

NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

FAST SWITCHING DARLINGTON TRANSISTOR
HIGH VOLTAGE DARLINGTON TRANSISTOR USING IN HORIZONTAL OUTPUT STAGES OF 110° CRT VIDEO DISPLAYS

BUILT-IN SPEED-UP Diode Between Base and Emitter

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : BU806	V_{CBO}	400	V
: BU807		330	V
Collector Emitter Voltage	V_{CEO}		
: BU806		200	V
: BU807		150	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current (DC)	I_C	8	A
Collector Current (Pulse)	I_C	15	A
Base Current	I_B	2	A
Collector Dissipation	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

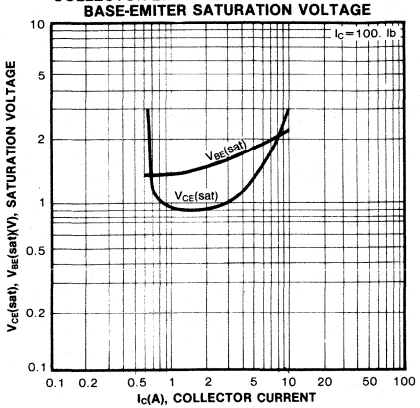
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector-Emitter Sustaining Voltage	V_{CEO}(sus)					
: BU806		I_C=100mA, I_B=0	200			V
: BU807			150			V
Collector Cutoff Current : BU806	I_{CES}	V_{CE}=400V, V_{BE}=0			100	μA
: BU807		V_{CE}=330V, V_{BE}=0			100	μA
Collector Cutoff Current : BU806	I_{CEV}	V_{CE}=400V, V_{BE}=−6V			100	μA
: BU807		V_{CE}=330V, V_{BE}=−6V			100	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=6V, I_C=0			3	mA
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=5A, I_B=50mA			1.5	V
*Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=5A, I_B=50mA			2.4	V
*Damper Diode Forward Voltage	V_f	I_f=4A			2	V

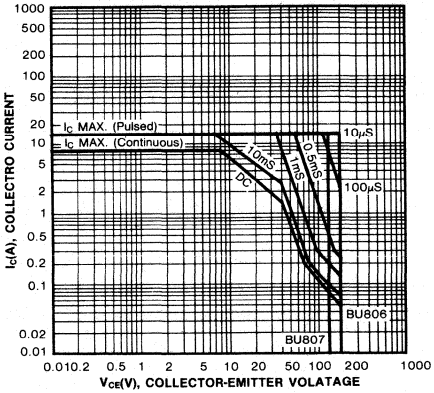
* Pulsed: pulsed duration = 300μS, duty cycle=1.5%

NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

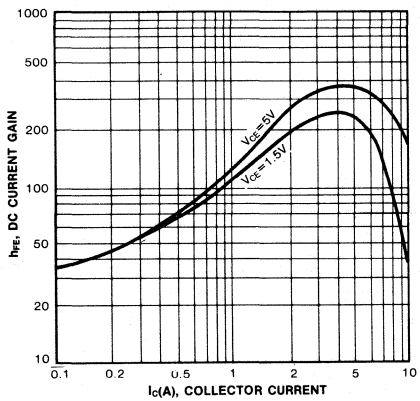
COLLECTOR-EMITTER SATURATION VOLTAGE BASE-EMITER SATURATION VOLTAGE



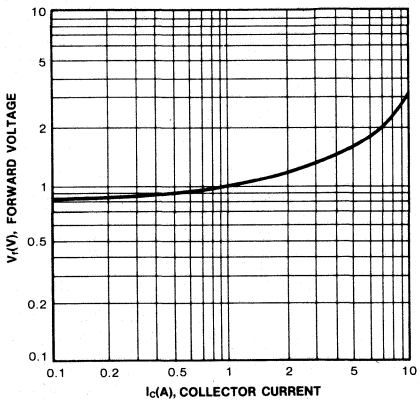
SAFE OPERATING AREA



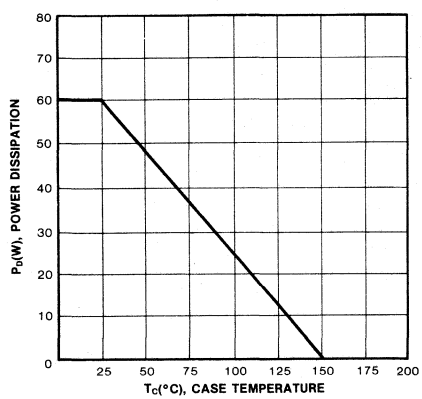
DC CURRENT GAIN



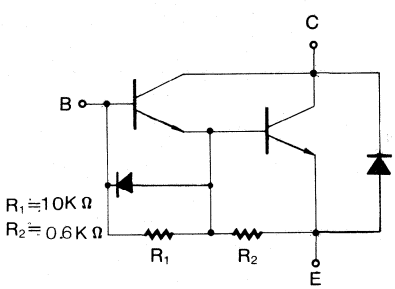
DAMPER DIODE



POWER DERATING

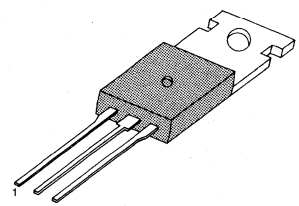


EQUIVALENT CIRCUIT



HIGH VOLTAGE POWER SWITCH SWITCHING APPLICATIONS

TO-220



1. Base 2. Collector 3. Emitter

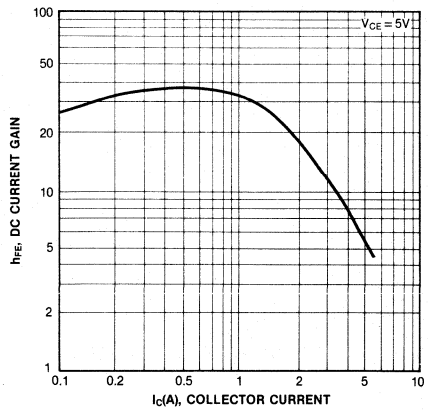
ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage : BUT11	V_{CES}	850	V
: BUT11A		1000	V
Collector Emitter Voltage : BUT11	V_{CEO}	400	V
: BUT11A		450	V
Emitter Base Voltage	V_{EBO}	9	V
Collector Current (DC)	I_C	5	A
Collector Current (Pulse)	I_C	10	A
Base Current (DC)	I_B	2	A
Base Current (Pulse)	I_B	4	A
Collector Dissipation ($T_C = 25°C$)	P_C	100	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

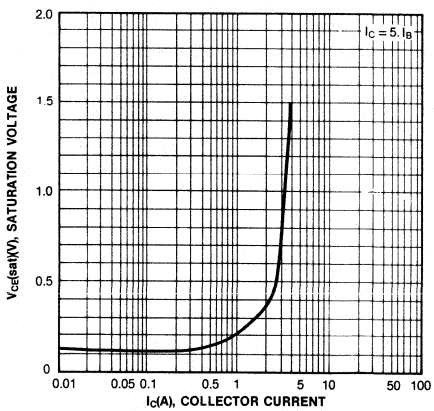
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage : BUT11	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	400			V
: BUT11A			450			V
Collector Cutoff Current: : BUT11	I_{CES}	$V_{CE} = 850V$, $V_{BE} = 0$			1	mA
: BUT11A		$V_{CE} = 1000V$, $V_{BE} = 0$			1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 9V$, $I_C = 0$			10	mA
Collector Emitter Saturation Voltage : BUT11	$V_{CE}(sat)$	$I_C = 3A$, $I_B = 0.6A$			1.5	V
: BUT11A		$I_C = 2.5A$, $I_B = 0.5A$			1.5	V
Base Emitter Saturation Voltage : BUT11	$V_{BE}(sat)$	$I_C = 3A$, $I_B = 0.6A$			1.3	V
: BUT11A		$I_C = 2.5A$, $I_B = 0.5A$			1.3	V
Turn On Time	t_{on}	$V_{CC} = 250V$, $I_C = 2.5A$			1	μS
Storage Time	t_{stg}	$I_B1 = I_B2 = 0.5A$			4	μS
Fall Time	t_f				0.8	μS

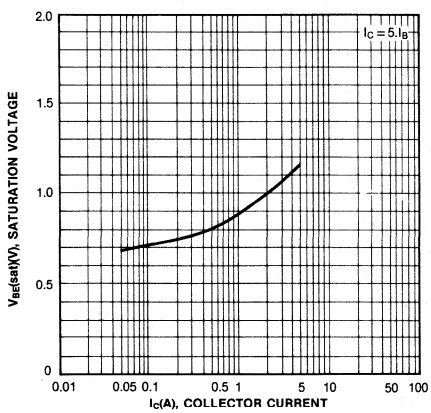
DC CURRENT GAIN



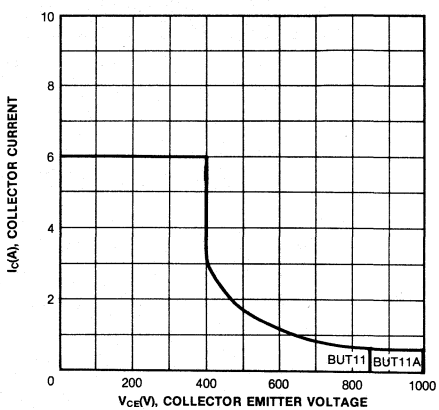
COLLECTOR EMITTER SATURATION VOLTAGE



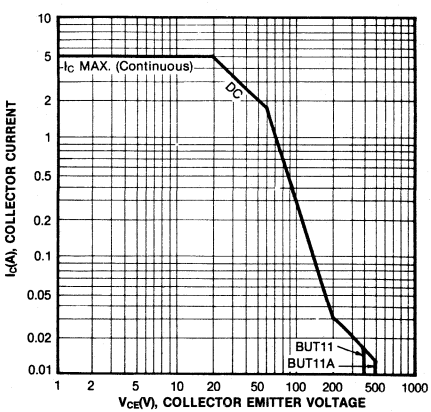
BASE EMITTER SATURATION VOLTAGE



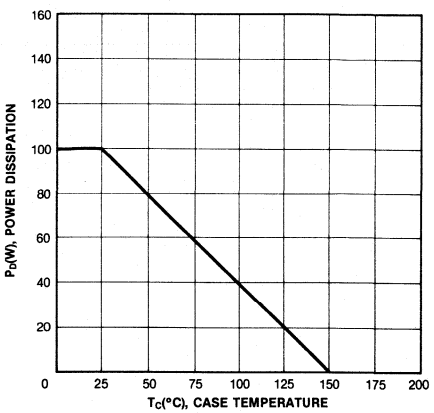
REVERSE BIASED SAFE OPERATING AREA



SAFE OPERATING AREA



POWER DERATING



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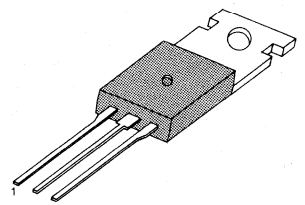
HIGH VOLTAGE SWITCH
SWITCHING APPLICATIONS

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : BUT12	V_{CES}	850	V
: BUT12A		1000	V
Collector Emitter Voltage			
: BUT12	V_{CEO}	400	V
: BUT12A		450	V
Collector Current (DC)	I_C	8	A
Collector Current (Pulse)	I_C	20	A
Base Current	I_B	4	A
Collector Dissipation	P_C	100	W
Junction Temperature	Tj	175	°C
Storage Temperature	Tstg	−65~175	°C

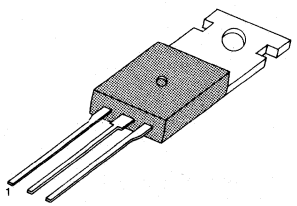
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector-Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=100mA, L=25mH	400			V
Collector Cutoff Current	I_{CES}	V_{CE}=V_{CES}, V_{BE}=0			1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=9V, I_C=0			10	mA
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=6A, I_B=1.2A			1.5	V
*Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=6A, I_B=1.2A			1.5	V
Turn On Time	ton	I_C=6A, I_B1=I_B2=1.2A			1	μS
Storage Time	ts				4	μS
Fall Time	tf				0.8	μS

* Pulsed Test: PW=300 μs, duty cycle=1.5%

HIGH VOLTAGE POWER SWITCH SWITCHING APPLICATIONS

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage	V_{CES}	850	V
Collector Emitter Voltage	V_{CEX}	850	V
Collector Emitter Voltage	V_{CEO}	400	V
Emitter Base Voltage	V_{EBO}	7	V
Collector Current	I_C	5	A
Base Current	I_B	3	A
Collector Dissipation ($T_C = 25°C$)	P_C	85	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

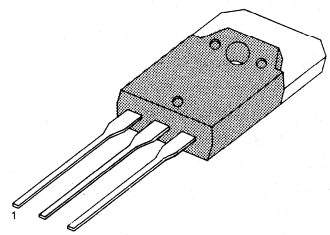
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	400			V
Collector Cutoff Current	I_{CES}	$V_{CE} = 850V$, $V_{BE} = 0$			100	μA
Collector Cutoff Current	I_{CER}	$V_{CE} = 850V$, $R_{BE} = 10\Omega$			300	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 7V$, $I_C = 0$			1	mA
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = 2.5A$, $I_B = 0.5A$			1.5	V
		$I_C = 3.5A$, $I_B = 0.7A$			5	V
*Base Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = 2.5A$, $I_B = 0.5A$			1.3	V
Turn On Time	t_{on}	$V_{CC} = 150V$, $I_C = 2.5A$			1	μS
Storage Time	t_{stg}	$I_B1 = -I_B2 = 0.5A$			3	μS
Fall Time	t_f				0.8	μS

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

HIGH VOLTAGE SWITCH

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : BUV47	V_{CBO}	850	V
: BUV47A		1000	V
Collector Emitter Voltage			
: BUV47	V_{CEO}	400	V
: BUV47A		450	V
Emitter Base Voltage	V_{CBO}	7	V
Collector Current (DC)	I_C	9	A
Collector Current (Pulse)	I_C	15	A
Base Current	I_B	8	A
Collector Dissipation	P_C	120	W
Junction Temperature	Tj	175	°C
Storage Temperature	Tstg	−65~175	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector-Emitter Sustaining Voltage						
: BUV47	V_{CEO}(sus)	I_C=0.2A, L=25mH	400			V
: BUV47A			450			V
Collector Cutoff Current	I_{CER}	V_{CE}=850V, R_{BE}=10ohm			0.4	mA
Collector Cutoff Current	I_{CEV}	V_{CE}=850V, V_{BE}=−2.5V			0.15	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
*Collector-Emitter Saturation Voltage						
:BUV47	V_{CE}(sat)	I_C=6A, I_B=1.2A			1.5	V
		I_C=9A, I_B=3A			3	V
:BUV47A		I_C=5A, I_B=1A			1.5	V
		I_C=8A, I_B=2.5A			3	V
*Base Emitter Saturation Voltage						
:BUV47	V_{BE}(sat)	I_C=6A, I_B=1.2A			1.6	V
:BUV47A		I_C=5A, I_B=1A			1.6	V
Turn On Time	ton	V_{CC}=150V, I_C=6A			0.8	μS
Storage Time	ts	I_B=−I_B2=1.2A			2.5	μS
Fall Time	tf				0.8	μS

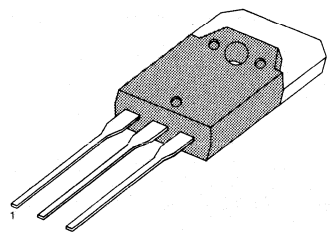
* Pulse Test: PW≤300 μs, duty cycle<1.5%

HIGH VOLTAGE POWER SWITCH

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage : BUV48	V_{CES}	850	V
: BUV48A		1000	V
Collector Emitter Voltage : BUV48	V_{CEO}	400	V
: BUV48A		450	V
Emitter Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	15	A
Collector Current (Pulse)	I_C	30	A
Base Current	I_B	4	A
Collector Dissipation	P_C	150	W
Junction Temperature	Tj	175	°C
Storage Temperature	Tstg	−65~175	°C

TO-3P



1. Base 2. Collector 3. Emitter

3

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector-Emitter Sustaining Voltage : BUV48	V_{CEO}(sus)	I_C=200mA L=25mH	400			V
: BUV48A			450			V
Collector Cutoff Current	I_{CES}	V_{CE}=V_{CES}, V_{BE}=0			200	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			1	mA
*Collector-Emitter Saturation Voltage :BUV48	V_{CE}(sat)	I_C=10A, I_B=2A			1.5	V
		I_C=15A, I_B=4A			3.5	V
		I_C=15A, I_B=3A			5	V
:BUV48A		I_C=8A, I_B=1.6A			1.5	V
		I_C=12A, I_B=2.4A			5	V
*Base Emitter Saturation Voltage :BUV48	V_{BE}(sat)	I_C=10A, I_B=2A			1.6	V
:BUV48A		I_C=8A, I_B=1.6A			1.6	V
Turn On Time	ton	V_{CC}=150V, I_C=10A			1	μS
Storage Time	ts	I_B=−I_B2=2A			3	μS
Fall Time	tf				0.8	μS

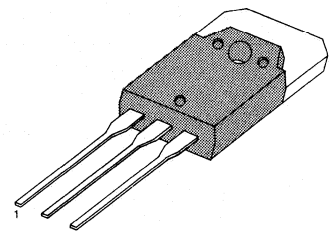
* Pulse Test: PW=300 μs, duty cycle≤2%

HIGH VOLTAGE POWER SWITCH

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : BUV48B	V_{CBO}	1200	V
: BUV48C		1200	V
Collector Emitter Voltage			
: BUV48B	V_{CEO}	600	V
: BUV48C		700	V
Emitter Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	15	A
Collector Current (Pulse)	I_C	30	A
Base Current	I_B	4	A
Collector Dissipation	P_C	150	W
Junction Temperature	Tj	175	°C
Storage Temperature	Tstg	−65∼175	°C

TO-3P



1. Base 2. Collector 3. Emitter

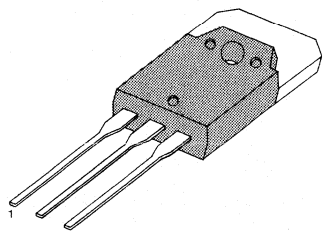
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector-Emitter Sustaining Voltage						
: BUV48B	V_{CEO}(sus)	I_C=100mA, I_B=0	600			V
: BUV48C			700			V
*Collector Emitter Sustaining Voltage	V_{CER}(sus)	V_{CE}=1200V, I_C=0.5A	1200			V
Collector Cutoff Current	I_{CER}	V_{CE}=1200V, R_{BE}=10Ω			500	μA
Collector Cutoff Current	I_{CES}	V_{CE}=1200V, V_{BE}=0			500	μA
Collector Cutoff Current	I_{CEO}	V_{CE}=V_{CEO}, I_B=0			1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=6V, I_C=0			1	mA
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=6A, I_B=1.5A			1.5	V
		I_C=10A, I_B=4A			3	V
*Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=6A, I_B=1.5A			1.5	V
		I_C=10A, I_B=4A			2	V
Turn On Time	ton	V_{CC}=250V, I_C=6A		0.5	1	μS
Storage Time	ts	I_B=−I_B2=1.5A		1.5	3	μS
Fall Time	tf			0.2	0.7	μS

* Pulse Test: PW=300 μs, duty cycle=1.5%

HIGH VOLTAGE POWER SWITCH SWITCHING APPLICATIONS

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

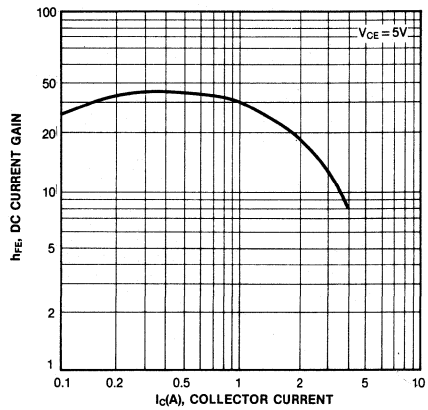
Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage: BUW11	V_{CES}	850	V
: BUW11A		1000	V
Collector Emitter Voltage: BUW11	V_{CEO}	400	V
: BUW11A		450	V
Emitter Base Voltage	V_{EBO}	9	V
Collector Current (DC)	I_C	5	A
Collector Current (Pulse)	I_C	10	A
Base Current (DC)	I_B	2	A
Base Current (Pulse)	I_B	4	A
Collector Dissipation ($T_C = 25°C$)	P_C	113	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	$-65 \sim 150$	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

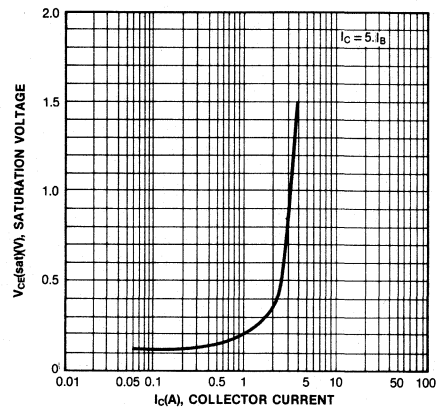
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
*Collector Emitter Sustaining Voltage	: BUW11	$V_{CEO}(sus)$	$I_C = 100mA$, $I_B = 0$	400			V
	: BUW11A			450			V
Collector Cutoff Current:	: BUW11	I_{CES}	$V_{CE} = 850V$, $V_{BE} = 0$			1	mA
	: BUW11A		$V_{CE} = 1000V$, $V_{BE} = 0$			2	mA
Emitter Cutoff Current		I_{EBO}	$V_{EB} = 9V$, $I_C = 0$			10	mA
Collector Emitter Saturation Voltage	: BUW11	$V_{CE}(sat)$	$I_C = 3A$, $I_B = 0.6A$			1.5	V
	: BUW11A		$I_C = 2.5A$, $I_B = 0.5A$			1.5	V
Base Emitter Saturation Voltage	: BUW11	$V_{BE}(sat)$	$I_C = 3A$, $I_B = 0.6A$			1.3	V
	: BUW11A		$I_C = 2.5A$, $I_B = 0.5A$			1.3	V
Turn On Time		t_{on}	$V_{CC} = 250V$, $I_C = 2.5A$			1	μS
Storage Time		t_{stg}	$I_B1 = -I_B2 = 0.5A$			4	μS
Fall Time		t_f				0.8	μS

*Pulse Test: PW = 300μS, duty cycle = 1.5% pulsed

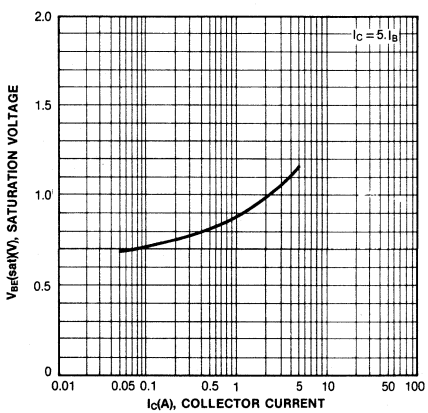
DC CURRENT GAIN



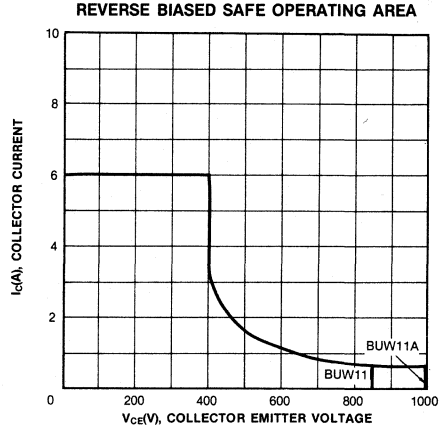
COLLECTOR EMITTER SATURATION VOLTAGE



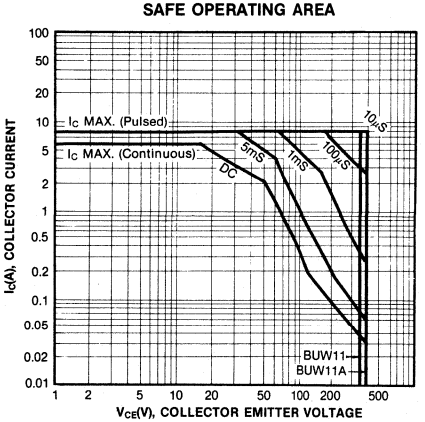
BASE EMITTER SATURATION VOLTAGE



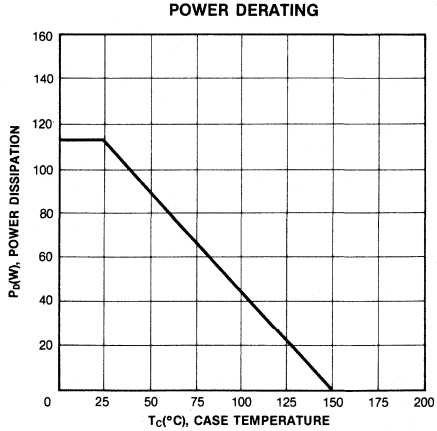
REVERSE BIASED SAFE OPERATING AREA



SAFE OPERATING AREA

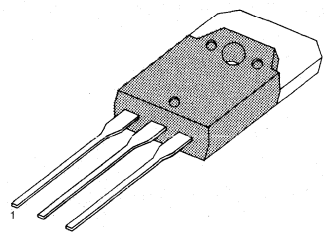


POWER DERATING



HIGH VOLTAGE SWITCH SWITCHING APPLICATIONS

TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage: BUW12	V_{CES}	850	V
: BUW12A		1000	V
Collector Emitter Voltage			
: BUW12	V_{CEO}	400	V
: BUW12A		450	V
Collector Current (DC)	I_C	8	A
Collector Current (Pulse)	I_C	20	A
Base Current	I_B	4	A
Collector Dissipation	P_C	125	W
Junction Temperature	Tj	175	°C
Storage Temperature	Tstg	−65~175	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

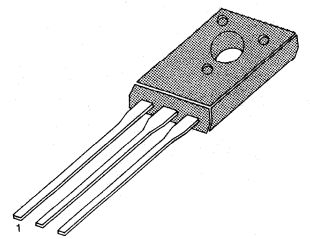
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Collector-Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=100mA, L=25mH	400			V
Collector Cutoff Current	I_{CES}	V_{CE}=V_{CES}, V_{BE}=0			1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=9V, I_C=0			10	mA
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=6A, I_B=1.2A			1.5	V
*Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=6A, I_B=1.2A			1.5	V
Turn On Time	ton	I_C=6A, I_B1=I_B2=1.2A			1	μS
Storage Time	ts				4	μS
Fall Time	tf				0.8	μS

* Pule Test: PW=300 μs, Duty cycle=1.5 %

PNP EPITAXIAL SILICON TRANSISTOR

LOW POWER AUDIO AMPLIFIER
LOW CURRENT, HIGH SPEED SWITCHING APPLICATIONS

TO-126



1. Emitter 2. Collector 3 Base

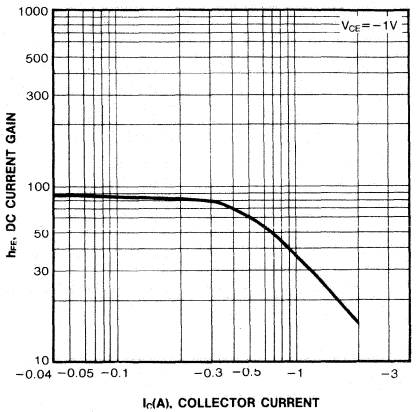
ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage: MJE170	V_{CBO}	−60	V
: MJE171		−80	V
: MJE172		−100	V
Collector-Emitter Voltage			
: MJE170	V_{CEO}	−40	V
: MJE171		−60	V
: MJE172		−80	V
Emitter-Base Voltage	V_{EBO}	−7	V
Collector Current (DC)	I_C	−3	A
Collector Current (Pulse)	I_C	−6	A
Base Current (DC)	I_B	−1	A
Collector Dissipation (T_a = 25°C)	P_C	1.5	W
Collector Dissipation (T_c = 25°C)	P_C	12.5	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65 ∼ 150	°C

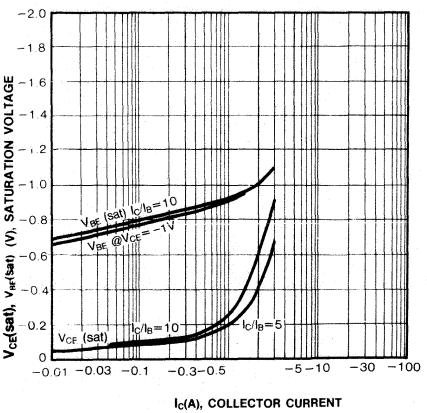
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)				
: MJE170		I_C = 10mA, I_B = 0	−40		V
: MJE171			−60		V
: MJE172			−80		V
Collector Cutoff Current : MJE170	I_{CBO}	V_{CB} = −60V, I_B = 0		−0.1	μA
: MJE171		V_{CB} = −80V, I_E = 0		−0.1	μA
: MJE172		V_{CB} = −100V, I_E = 0		−0.1	μA
: MJE170		V_{CB} = −60V, I_E = 0, T_C = 150°C		−0.1	mA
: MJE171		V_{CB} = −80V, I_E = 0, T_C = 150°C		−0.1	mA
: MJE172		V_{CB} = −100V, I_E = 0, T_C = 150°C		−0.1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE} = −7V, I_C = 0		−0.1	μA
DC Current Gain	h_{FE}	V_{CE} = −1V, I_C = −100mA	50	250	
		V_{CE} = −1V, I_C = −500mA	30		
		V_{CE} = −1V, I_C = −1.5A	12		
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C = −500mA, I_B = −50mA		−0.3	V
		I_C = −1.5A, I_B = −150mA		−0.9	V
		I_C = −3A, I_B = −600mA		−1.7	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C = −1.5A, I_B = −150mA		−1.5	V
		I_C = −3A, I_B = −600mA			
Base Emitter On Voltage	V_{BE}(on)	V_{CE} = −1V, I_C = −500mA		−1.2	V
Current Gain-Bandwidth Product	f_T	V_{CE} = −10V, I_C = −100mA, f = 10MHz	50		MHz
Output Capacitance	Cob	V_{CB} = −10V, I_E = 0, f = 0.1MHz		50	pF

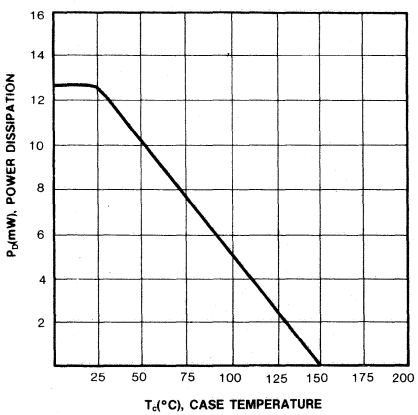
DC CURRENT GAIN



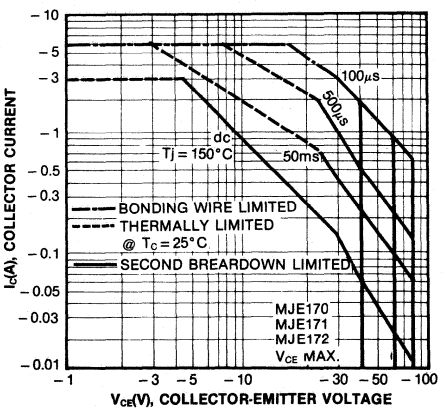
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



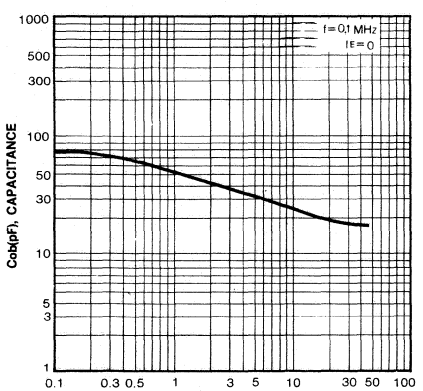
POWER DERATING



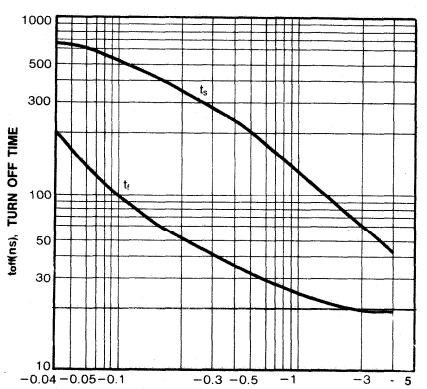
SAFE OPERATING AREA



COLLECTOR OUTPUT CAPACITANCE

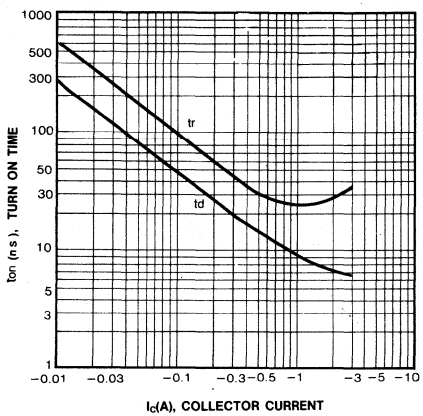


TURN OFF TIME



3

TURN ON TIME


1000
500
300
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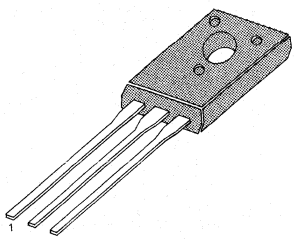
−0.03
−0.1
−0.3
−0.5
−1
−3
−5
−10
ton (n.s.), TURN ON TIME
IC(A), COLLECTOR CURRENT

DESIGNED FOR LOW POWER AUDIO AMPLIFIER AND LOW CURRENT HIGH SPEED SWITCHING APPLICATIONS

TO-126



1. Emitter 2. Collector 3. Base

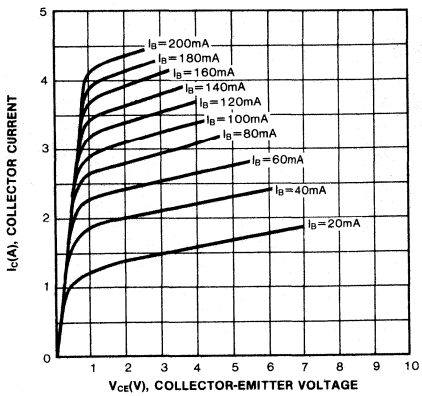
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage: MJE180	V_{CBO}	60	V
: MJE181		80	V
: MJE182		100	V
Collector-Emitter Voltage			
: MJE180	V_{CEO}	40	V
: MJE181		60	V
: MJE182		80	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current (DC)	I_C	3	A
Collector Current (Pulse)	I_C	6	A
Base Current (DC)	I_B	1	A
Collector Dissipation (T_a=25°C)	P_C	1.5	W
Collector Dissipation (T_C=25°C)	P_C	12.5	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

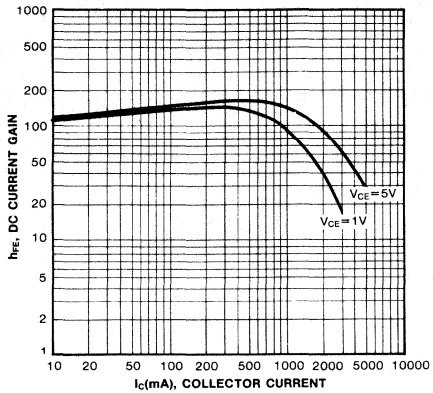
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)				
: MJE180		I_C=10mA, I_B=0	40		V
: MJE181			60		V
: MJE182			80		V
Collector Cutoff Current : MJE180	I_{CBO}	V_{CB}=60V, I_B=0		0.1	μA
: MJE181		V_{CB}=80V, I_E=0		0.1	μA
: MJE182		V_{CB}=100V, I_E=0		0.1	μA
: MJE180		V_{CB}=60V, I_E=0, T_C=150°C		0.1	mA
: MJE181		V_{CB}=80V, I_E=0, T_C=150°C		0.1	mA
: MJE182		V_{CB}=100V, I_E=0, T_C=150°C		0.1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE}=7V, I_C=0		0.1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=100mA	50	250	
		V_{CE}=1V, I_C=500mA	30		
		V_{CE}=1V, I_C=1.5A	12		
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=500mA, I_B=50mA		0.3	V
		I_C=1.5A, I_B=150mA		0.9	V
		I_C=3A, I_B=600mA		1.7	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=1.5A, I_B=150mA		1 5	V
		I_C=3A, I_B=600mA		2.0	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=1V, I_C=500mA		1.2	V
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=100mA, f=10MHz	50		MHz
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=0.1MHz		30	pF

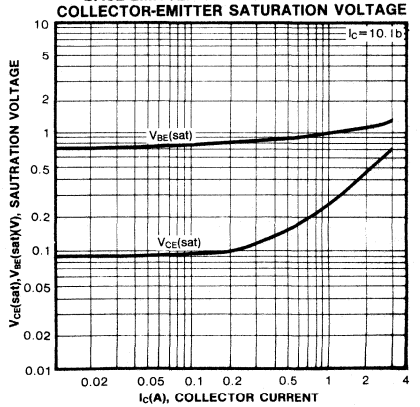
STATIC CHARACTERISTIC



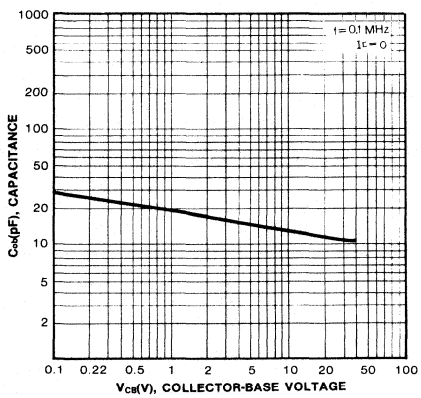
DC CURRENT GAIN



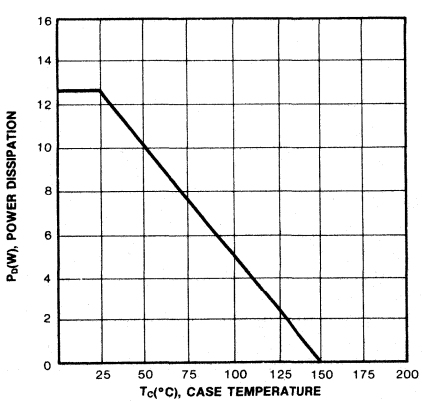
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



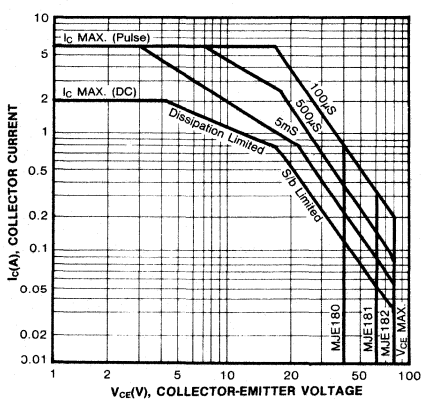
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



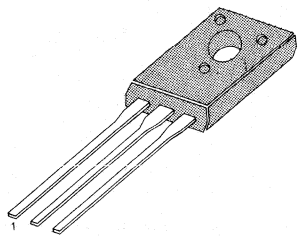
SAFE OPERATING AREA



COLLECTOR-EMITTER SUSTAINING VOLTAGE
LOW COLLECTOR-EMITTER SATURATION VOLTAGE
HIGH CURRENT GAIN-BANDWIDTH PRODUCT-MIN fT=65MHz @ Ic=100mA

Complementary to MJE210

TO-126



1. Emitter 2. Collector 3 Base

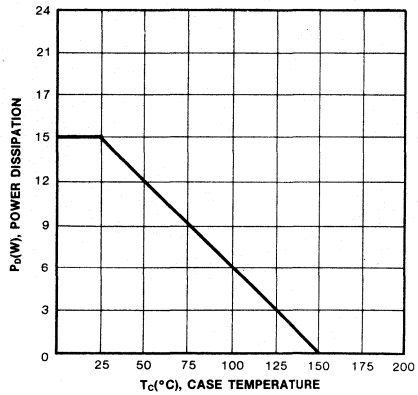
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	8	V
Collector Current	I_C	5	A
Collector Dissipation	P_C	15	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∿150	°C

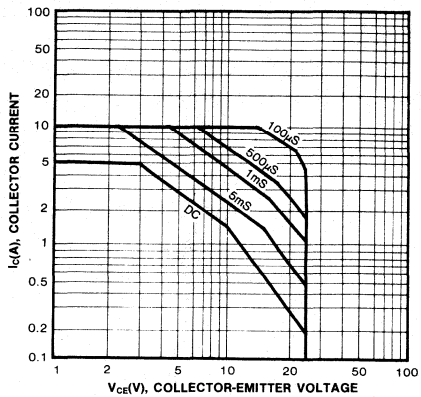
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=10mA, I_B=0	25		V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0		100	nA
		V_{CB}=40V, I_E=0, T_j=125°C		100	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=8V, I_C=0		100	nA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=500mA	70		
		V_{CE}=1V, I_C=2A	45	180	
		V_{CE}=2V, I_C=5A	10		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=500mA, I_B=50mA		0.3	V
		I_C=2A, I_B=200mA		0 75	V
		I_C=5A, I_B=1A		1.8	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=5A, I_B=1A		2.5	V
Base-Emitter On Voltage	V_{BE}(on)	V_{CE}=1V, I_C=2A		1.6	V
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=100mA, f=10MHz	65		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=0.1MHz		80	pF

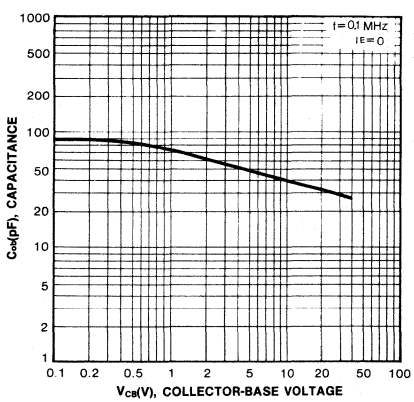
POWER DERATING



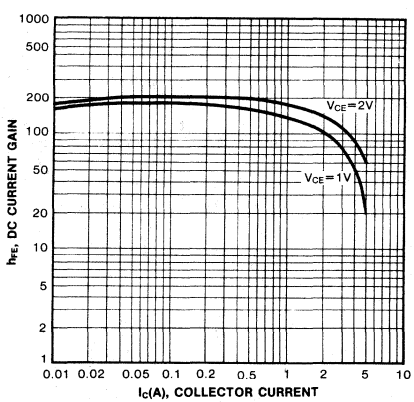
FORWARD BIAS SAFE OPERATING AREA



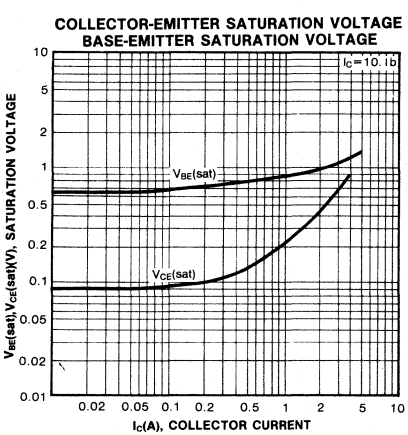
COLLECTOR OUTPUT CAPACITANCE



DC CURRENT GAIN



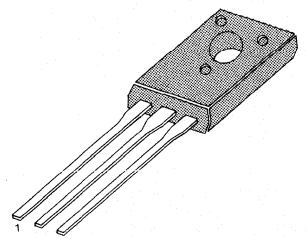
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



COLLECTOR-EMITTER SUSTAINING VOLTAGE
LOW COLLECTOR-EMITTER SATURATION VOLTAGE
HIGH CURRENT GAIN-BANDWIDTH PRODUCT-MIN fT=65MHz @ Ic=−100mA

Complementary to MJE200

TO-126



1. Emitter 2. Collector 3. Base

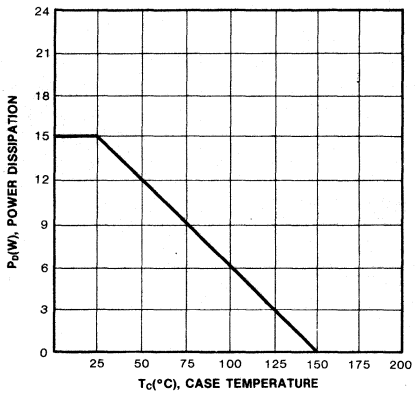
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−8	V
Collector Current	I_C	−5	A
Collector Dissipation	P_C	15	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

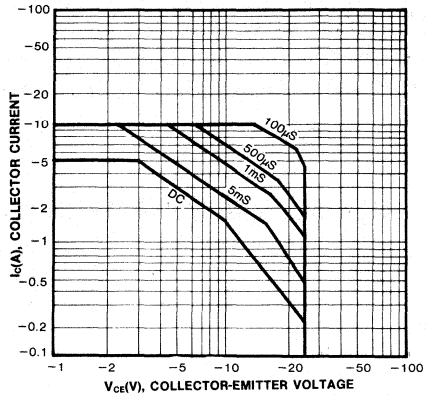
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=−10mA, I_B=0	−25		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0		−100	nA
		V_{CB}=−40V, I_E=0, T_j=125°C		−100	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=−8V, I_C=0		−100	nA
DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−500mA	70		
		V_{CE}=−1V, I_C=−2A	45	180	
		V_{CE}=−2V, I_C=−5A	10		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−500mA, I_B=−50mA		−0.3	V
		I_C=−2A, I_B=−200mA		−0.75	V
		I_C=−5A, I_B=−1A		−1.8	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−5A, I_B=−1A		−2.5	V
Base-Emitter On Voltage	V_{BE}(on)	V_{CE}=−1V, I_C=−2A		−1.6	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−100mA			
		f=10MHz	65		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0, f=0.1MHz		120	pF

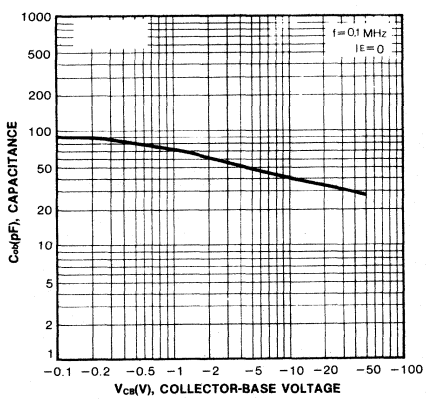
POWER DERATING



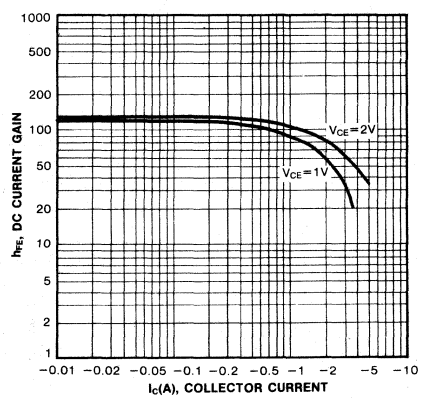
FORWARD BIAS SAFE OPERATING AREA



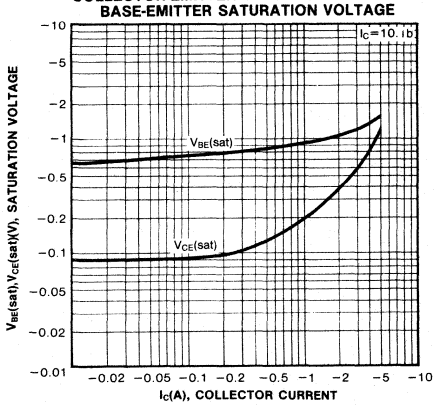
COLLECTOR OUTPUT CAPACITANCE



DC CURRENT GAIN



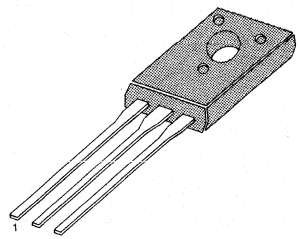
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



HIGH COLLECTOR-EMITTER SUSTAINING VOLTAGE
HIGH VOLTAGE GENERAL PURPOSE APPLICATIONS
SUITABLE FOR TRANSFORMER

Complementary to MJE350

TO-126



1. Emitter 2. Collector 3 Base

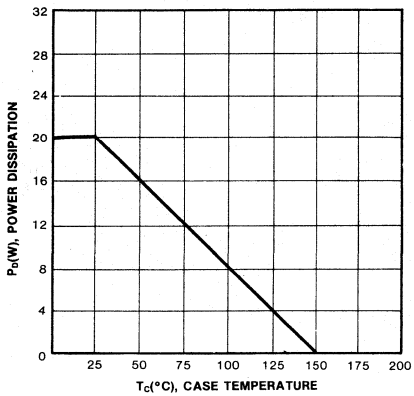
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	300	V
Collector-Emitter Voltage	V_{CEO}	300	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	20	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

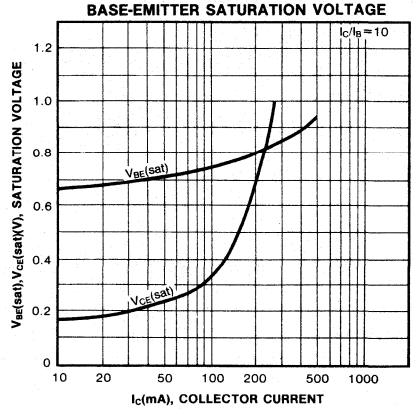
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=1mA, I_B=0	300		V
Collector Cutoff Current	I_{CBO}	V_{CB}=300V, I_E=0		100	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=3V, I_C=0		100	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=50mA	30	240	

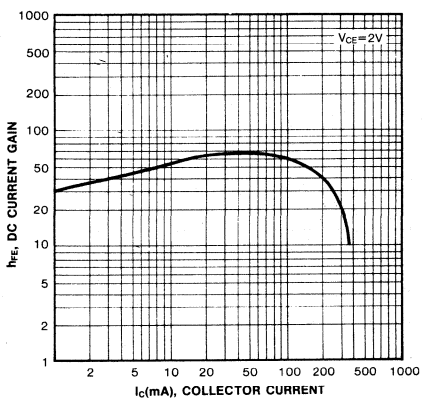
POWER DERATING



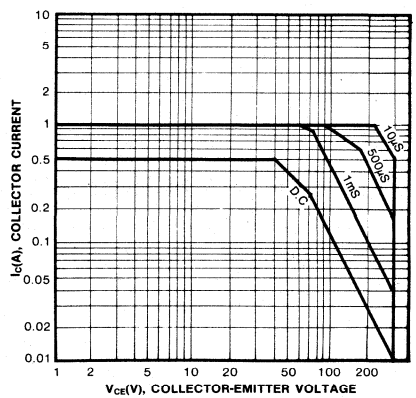
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



DC CURRENT GAIN



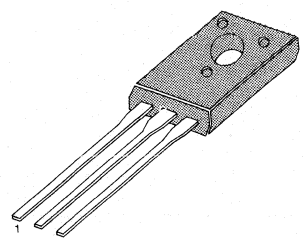
FORWARD BIAS SAFE OPERATING AREA



HIGH COLLECTOR-EMITTER SUSTAINING VOLTAGE
HIGH VOLTAGE GENERAL PURPOSE APPLICATIONS
SUITABLE FOR TRANSFORMER

Complementary to MJE340

TO-126



1. Emitter 2. Collector 3. Base

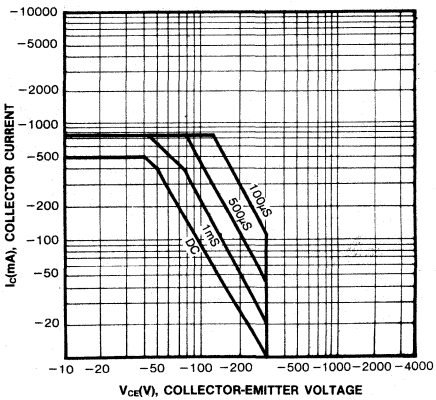
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−300	V
Collector-Emitter Voltage	V_{CEO}	−300	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	20	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

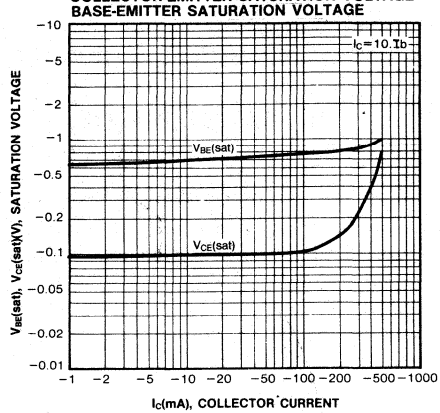
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=−1mA, I_B=0	−300		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−300V, I_E=0		−100	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=−3V, I_C=0		−100	μA
DC Current Gain	h_{FE}	V_{CE}=−10V, I_C=−50mA	30	240	

SAFE OPERATING AREA



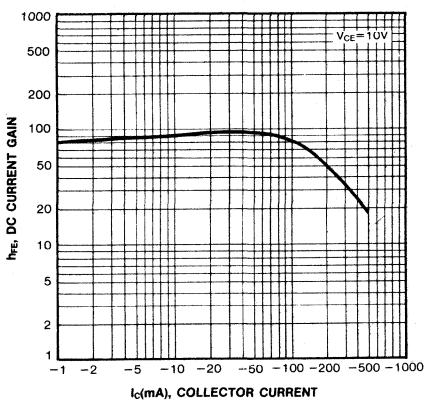
VCE(V), COLLECTOR-EMITTER VOLTAGE

COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



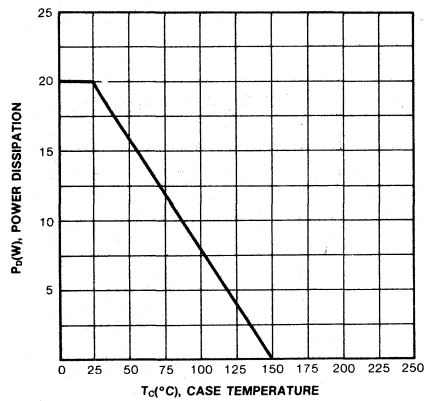
IC(mA), COLLECTOR CURRENT

DC CURRENT GAIN



IC(mA), COLLECTOR CURRENT

POWER DERATING

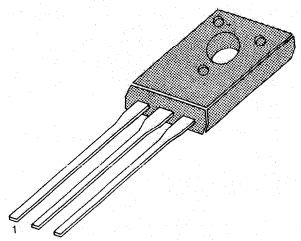


TC(°C), CASE TEMPERATURE

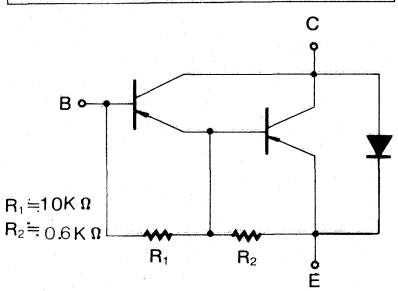
HIGH DC CURRENT GAIN
MIN h_{FE}=750 @ Ic=−1.5 and −2.0A DC
MONOLITHIC CONSTRUCTION WITH BUILT-IN BASE-EMITTER RESISTORS

- Complementary to MJE800/801/802/803

TO-126



1. Emitter 2. Collector 3. Base



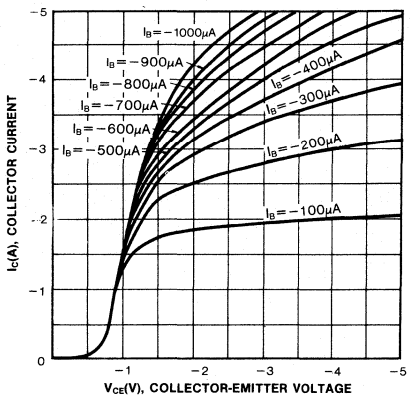
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MJE700/701		−60	V
:MJE702/703		−80	V
Collector-Emitter Voltage	V_{CEO}		
:MJE700/701		−60	V
:MJE702/703		−80	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−4	A
Base Current	I_B	−0.1	A
Collector Dissipation	P_C	40	W
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

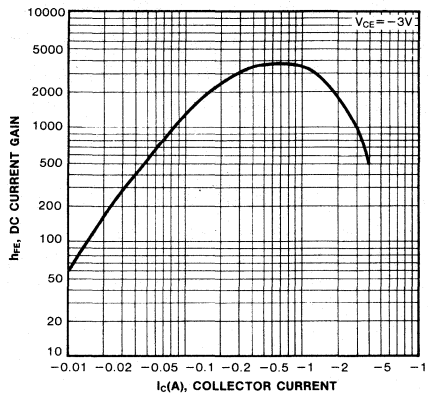
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}				
:MJE700/701		I_C=−50mA, I_B=0	−60		V
:MJE702/703			−80		V
Collector Cutoff Current	I_{CEO}				
:MJE700/701		V_{CE}=−60V, I_B=0		−100	μA
:MJE702/703		V_{CE}=−80V, I_B=0		−100	μA
Collector Cutoff Current	I_{CBO}	V_{CB}=Rated BV_{CEO}, I_E=0		−100	μA
		V_{CB}=Rated BV_{CEO}, I_E=0 T_C=100°C		−500	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=−5V, I_C=0		−2	mA
DC Current Gain :MJE700/702	h_{FE}	V_{CE}=−3V, I_C=−1.5A	750		
:MJE701/703		V_{CE}=−3V, I_C=−2A	750		
:ALL DEVICES		V_{CE}=−3V, I_C=−4A	100		
Collector-Emitter Saturation Voltage:	V_{CE}(sat)				
:MJE700/702		I_C=−1.5A, I_B=−30mA		−2.5	V
:MJE701/703		I_C=−2A, I_B=−40mA		−2.8	V
:ALL DEVICES		I_C=−4A, I_B=−40mA		−3	V
Base-Emitter On Voltage	V_{BE}(on)				
:MJE700/702		V_{CE}=−3V, I_C=−1.5A		−2.5	V
:MJE701/703		V_{CE}=−3V, I_C=−2A		−2.5	V
:ALL DEVICES		V_{CE}=−3V, I_C=−4A		−3	V

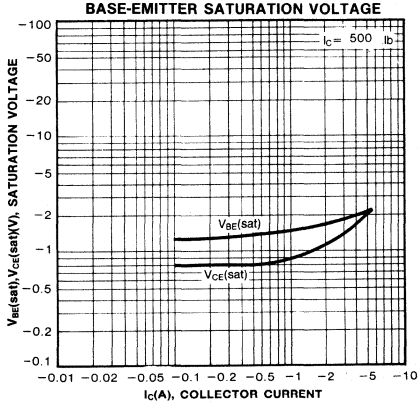
STATIC CHARACTERISTIC



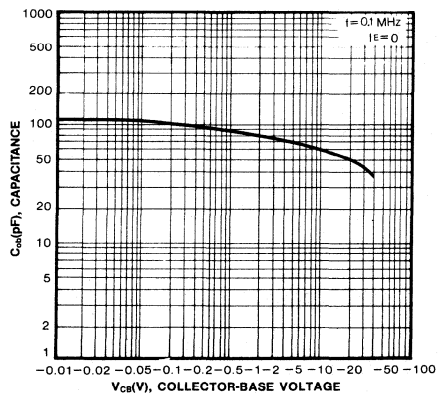
DC CURRENT GAIN



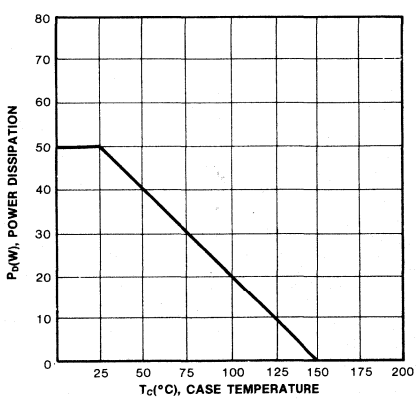
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



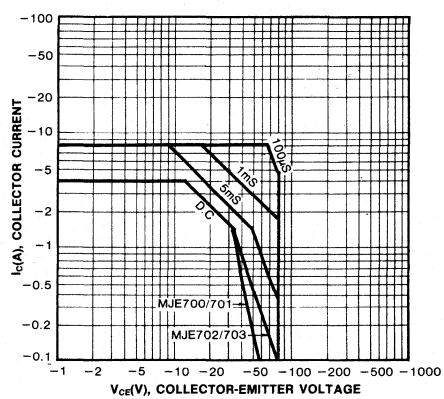
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



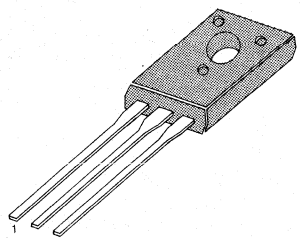
SAFE OPERATING AREA



HIGH DC CURRENT GAIN
MIN h_{FE}=750 @ Ic=−1.5 and −2.0A DC
MONOLITHIC CONSTRUCTION WITH BUILT-IN BASE-EMITTER RESISTORS

- **Complementary to MJE700/701/702/703**

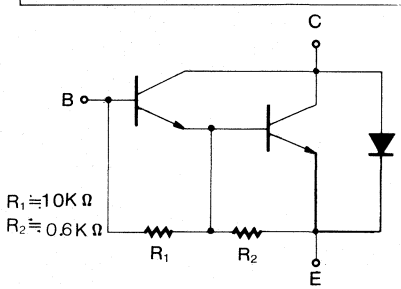
TO-126



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

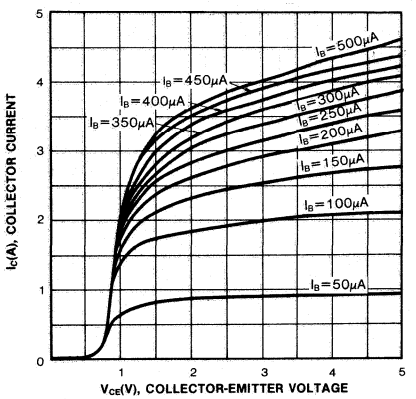
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MJE800/801		60	V
:MJE802/803		80	V
Collector-Emitter Voltage	V_{CEO}		
:MJE800/801		60	V
:MJE802/803		80	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	4	A
Base Current	I_B	0.1	A
Collector Dissipation	P_C	40	W
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C



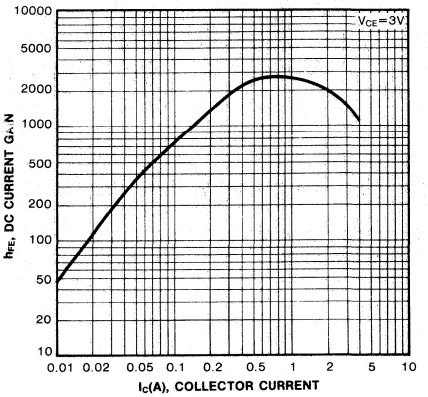
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}				
:MJE800/801		I_C=50mA, I_B=0	60		V
:MJE802/803			80		V
Collector Cutoff Current	I_{CEO}				
:MJE800/801		V_{CE}=60V, I_B=0		100	μA
:MJE802/803		V_{CE}=80V, I_B=0		100	μA
Collector Cutoff Current	I_{CBO}	V_{CB}=Rated BV_{CEO}, I_E=0		100	μA
		V_{CB}=Rated BV_{CEO}, I_E=0 T_C=100°C		500	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=5V, I_C=0		2	mA
DC Current Gain :MJE800/802	h_{FE}	V_{CE}=3V, I_C=1.5A	750		
:MJE801/803		V_{CE}=3V, I_C=2A	750		
:ALL DEVICES		V_{CE}=3V, I_C=4A	100		
Collector-Emitter Saturation Voltage:	V_{CE}(sat)				
:MJE800/802		I_C=1.5A, I_B=30mA		2.5	V
:MJE801/803		I_C=2A, I_B=40mA		2.8	V
:ALL DEVICES		I_C=4A, I_B=40mA		3	V
Base-Emitter On Voltage	V_{BE}(on)				
:MJE800/802		V_{CE}=3V, I_C=1.5A		2.5	V
:MJE801/803		V_{CE}=3V, I_C=2A		2.5	V
:ALL DEVICES		V_{CE}=3V, I_C=4A		3	V

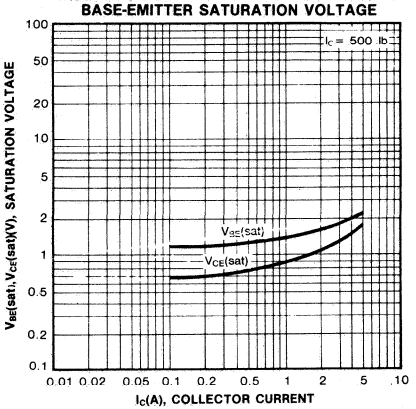
STATIC CHARACTERISTIC



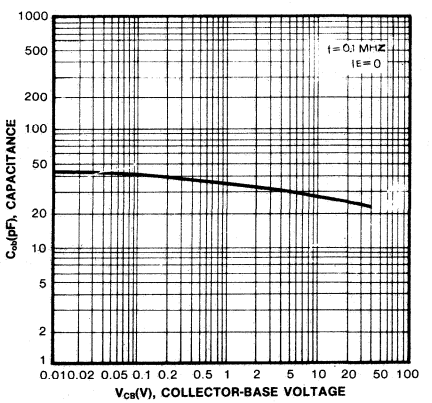
DC CURRENT GAIN



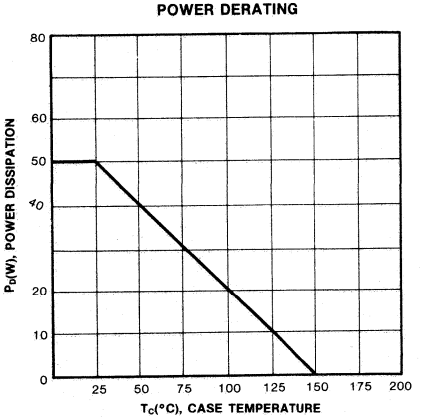
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



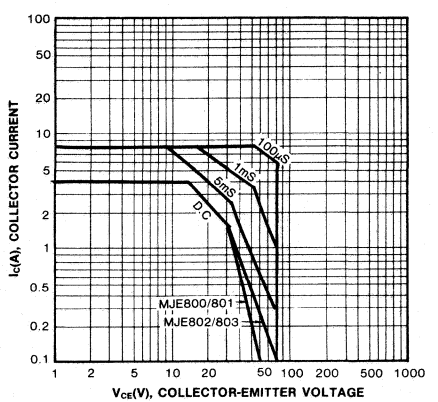
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



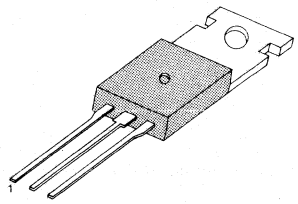
SAFE OPERATING AREA



GENERAL PURPOSE AND SWITCHING APPLICATIONS
DC CURRENT GAIN SPECIFIED TO 10 AMPERES

- High Current Gain-Bandwidth Product (f_T = 2MHz (MIN))

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

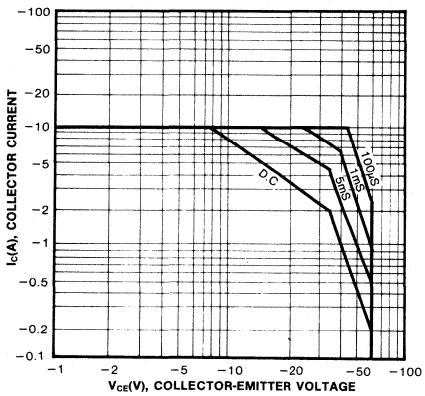
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−70	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−10	A
Base Current	I_B	−6	A
Collector Dissipation (T_C=25°C)	P_C	75	W
Collector Dissipation (T_a=25°C)	P_C	0.6	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

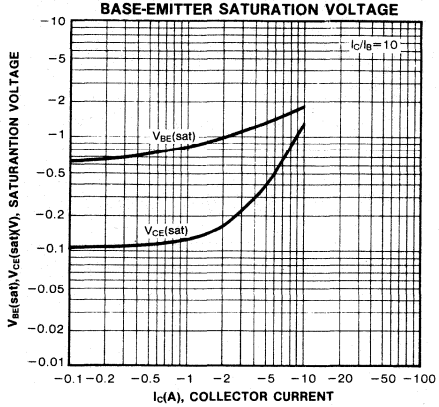
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=−200mA, I_B=0	−60		V
Collector Cutoff Current	I_{CEO}	V_{CE}=−30V, I_B=0		−700	μA
Collector Cutoff Current	I_{CEX}	V_{CE}=−70V, V_{BE}(off)=1.5V		−1	mA
		V_{CE}=−70V, V_{BE}(off)=1.5V T_C=150°C		−5	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0		−5	mA
*DC Current Gain	h_{FE}	V_{CE}=−4V, I_C=−4A	20	100	
		V_{CE}=−4V, I_C=−10A	5		
*Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−4A, I_B=−0.4A		−1.1	V
		I_C=−10A, I_B=−3.3A		−8	V
*Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−4V, I_C=−4A		−1.8	V
Current Gain Bandwidth Product	f_T	V_{CE}=−10V, I_C=−500mA, f=500KHz	2		MHz

* Pulse test: PW≤300μs, duty cycle≤2% Pulse

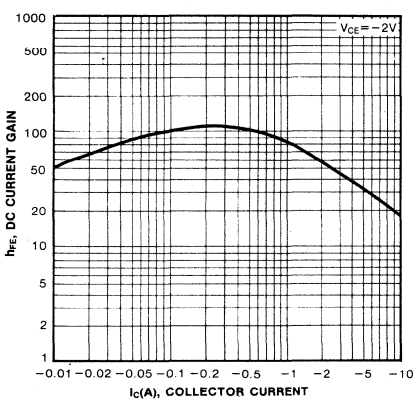
SAFE OPERATING AREA



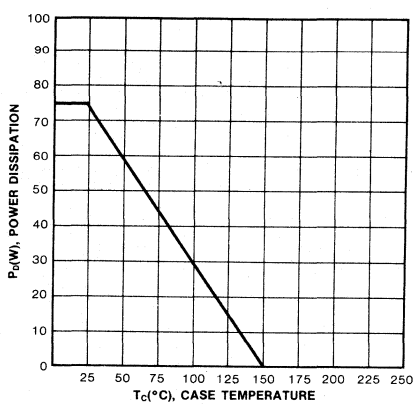
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



DC CURRENT GAIN

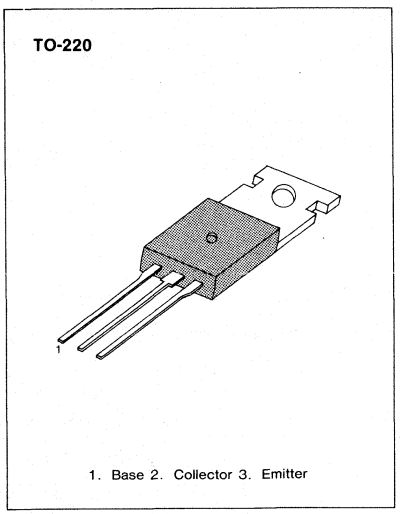


POWER DERATING



GENERAL PURPOSE AND SWITCHING APPLICATIONS
DC CURRENT GAIN SPECIFIED TO 10 AMPERES

High Current Gain-Bandwidth Product (f_T = 2MHz (MIN))



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

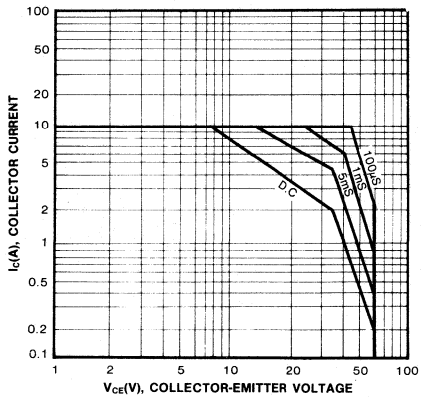
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	70	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	10	A
Base Current	I_B	6	A
Collector Dissipation (T_C=25°C)	P_C	75	W
Collector Dissipation (T_a=25°C)	P_C	0.6	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

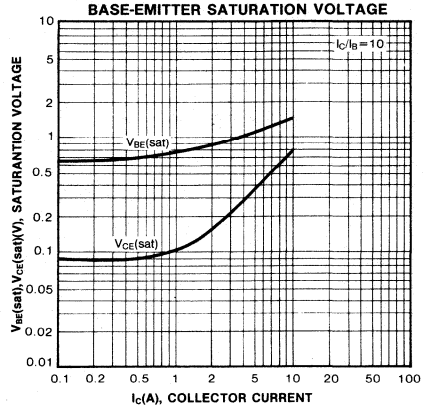
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)	I_C=200mA, I_B=0	60		V
Collector Cutoff Current	I_{CEO}	V_{CE}=30V, I_B=0		700	μA
Collector Cutoff Current	I_{CEX}	V_{CE}=70V, V_{BE}(off)=−1.5V		1	mA
		V_{CE}=70V, V_{BE}(off)=−1.5V T_C=150°C		5	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		5	mA
*DC Current Gain	h_{FE}	V_{CE}=4V, I_C=4A	20	100	
		V_{CE}=4V, I_C=10A	5		
*Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=4A, I_B=0.4A		1.1	V
		I_C=10A, I_B=3.3A		8	V
*Base Emitter On Voltage	V_{BE}(on)	V_{CE}=4V, I_C=4A		1.8	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=500mA, f=500KHz	2		MHz

* Pulse test: PW≤300μs, duty cycle≤2% Pulse

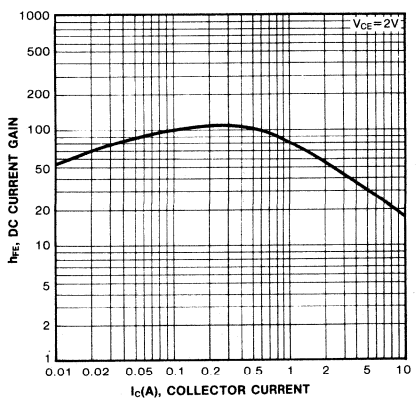
SAFE OPERATING AREA



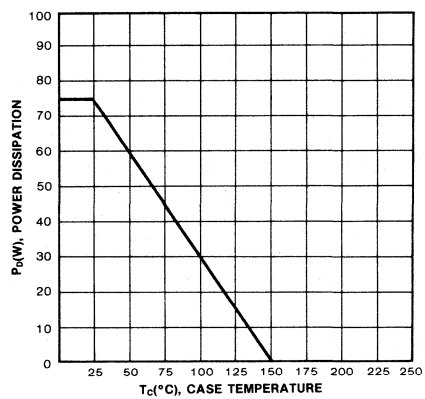
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



DC CURRENT GAIN



POWER DERATING

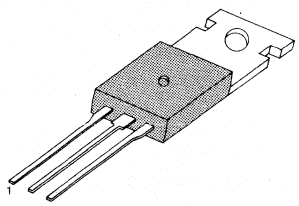


TIP29 SERIES
(TIP29/29A/29B/29C) NPN EXITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR SWITCHING APPLICATIONS

- Complementary to TIP30/30A/30B/30C

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

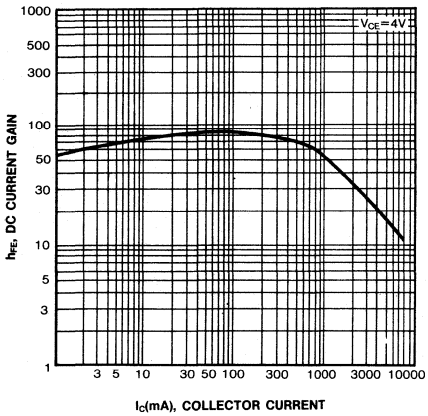
Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: TIP29	V_{CBO}	40	V
	: TIP29A		60	V
	: TIP29B		80	V
	: TIP29C		100	V
Collector-Emitter Voltage	: TIP29	V_{CEO}	40	V
	: TIP29A		60	V
	: TIP29B		80	V
	: TIP29C		100	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current (DC)		I_C	1	A
Collector Current (Pulse)		I_C	3	A
Base Current		I_B	0.4	A
Collector Dissipation (T_c=25°C)		P_C	30	W
Collector Dissipation (T_a=25°C)		P_C	2	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65~150	°C

ELECTRICAL CHARACTERISTICS (T_c=25°C)

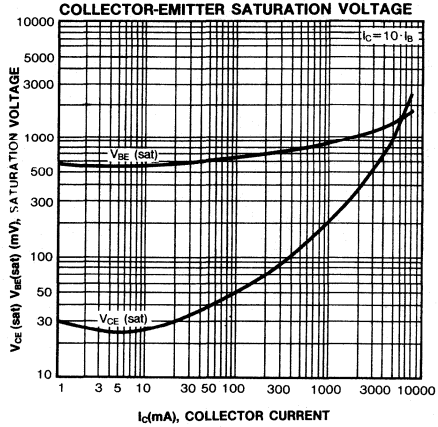
Characteristic		Symbol	Test Condition	Min	Max	Unit
*Collector Emitter Sustaining Voltage	: TIP29	BV_{CEO} (sus)	I_C=30mA, I_B=0	40		V
	: TIP29A			60		V
	: TIP29B			80		V
	: TIP29C			100		V
Collector Cutoff Current	: TIP29/29A	I_{CEO}	V_{CE}=30V, I_B=0		0.3	mA
	: TIP29B/29C		V_{CE}=60V, I_B=0		0.3	mA
Collector Cutoff Current	: TIP29	I_{CES}	V_{CE}=40V, V_{EB}=0		200	μA
	: TIP29A		V_{CE}=60V, V_{EB}=0		200	μA
	: TIP29B		V_{CE}=80V, V_{EB}=0		200	μA
	: TIP29C		V_{CE}=100V, V_{EB}=0		200	μA
Emitter Cutoff Current		I_{EBO}	V_{BE}=5V, I_C=0		1.0	mA
*DC Current Gain		h_{FE}	V_{CE}=4V, I_C=0.2A	40		
			V_{CE}=4V, I_C=1A	15	75	
*Collector-Emitter Saturation Voltage		V_{CE} (sat)	I_C=1A, I_B=125mA		0.7	V
*Base-Emitter On Voltage		V_{BE} (on)	V_{CE}=4V, I_C=1A		1.3	V
Current Gain Bandwidth Product		f_T	V_{CE}=10V, I_C=200mA f=1MHz	3.0		MHz

* Pulse Test: PW≤300μs, Duty Cycle≤2%

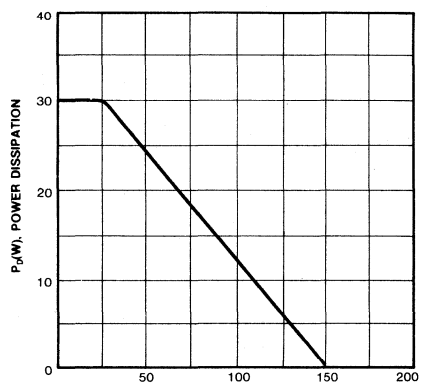
DC CURRENT GAIN



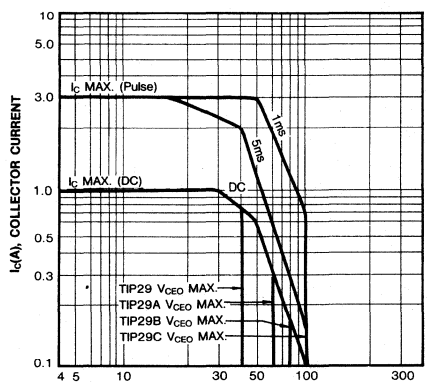
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



SAFE OPERATING AREA

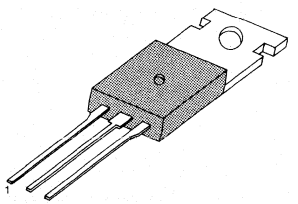


TIP30 SERIES
(TIP30/30A/30B/30C) PNP EXITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR SWITCHING APPLICATIONS

- **Complement to TIP29/29A/29B/29C**

TO-220



1. Base 2. Collector 3. Emitter

3

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

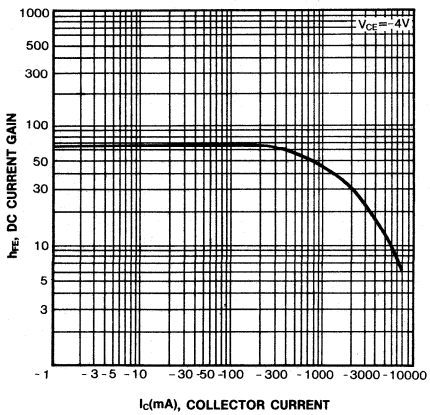
Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: TIP30	V_{CBO}	−40	V
	: TIP30A		−60	V
	: TIP30B		−80	V
	: TIP30C		−100	V
Collector-Emitter Voltage	: TIP30	V_{CEO}	−40	V
	: TIP30A		−60	V
	: TIP30B		−80	V
	: TIP30C		−100	V
Emitter-Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−1	A
Collector Current (Pulse)		I_C	−3	A
Base Current		I_B	−0.4	A
Collector Dissipation (T_c=25°C)		P_C	30	W
Collector Dissipation (T_a=25°C)		P_C	2	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65~150	°C

ELECTRICAL CHARACTERISTICS (T_c=25°C)

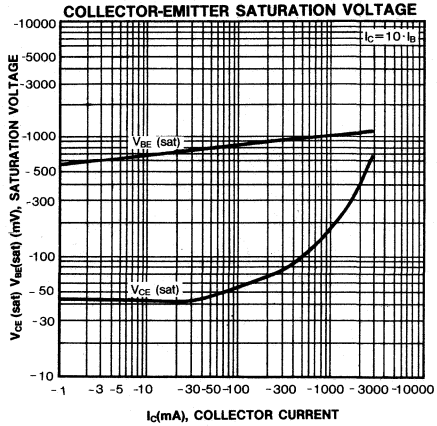
Characteristic		Symbol	Test Condition	Min	Max	Unit
* Collector Emitter Sustaining Voltage	: TIP30	BV_{CEO} (sus)	I_C=−30mA, I_B=0	−40		V
	: TIP30A			−60		V
	: TIP30B			−80		V
	: TIP30C			−100		V
Collector Cutoff Current	: TIP30/30A	I_{CEO}	V_{CE}=−30V, I_B=0		−0.3	mA
	: TIP30B/30C		V_{CE}=−60V, I_B=0		−0.3	mA
Collector Cutoff Current	: TIP30	I_{CES}	V_{CE}=−40V, V_{EB}=0		−200	μA
	: TIP30A		V_{CE}=−60V, V_{EB}=0		−200	μA
	: TIP30B		V_{CE}=−80V, V_{EB}=0		−200	μA
	: TIP30C		V_{CE}=−100V, V_{EB}=0		−200	μA
Emitter Cutoff Current		I_{EBO}	V_{BE}=−5V, I_C=0		−1.0	mA
*DC Current Gain		h_{FE}	V_{CE}=−4V, I_C=−0.2A	40		
			V_{CE}=−4V, I_C=−1A	15	75	
* Collector-Emitter Saturation Voltage		V_{CE} (sat)	I_C=−1A, I_B=−125mA		−0.7	V
* Base-Emitter On Voltage		V_{BE} (on)	V_{CE}=−4V, I_C=−1A		−1.3	V
Current Gain Bandwidth Product		f_T	V_{CE}=−10V, I_C=−200mA f=1MHz	3.0		MHz

* Pulse Test: PW≤300μs, Duty Cycle≤2%

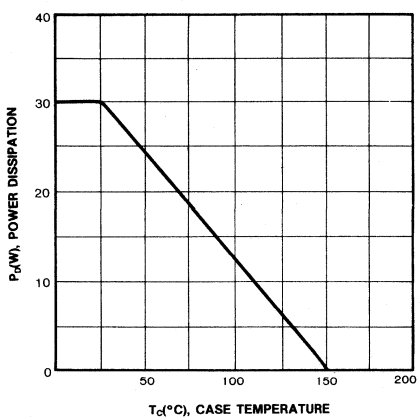
DC CURRENT GAIN



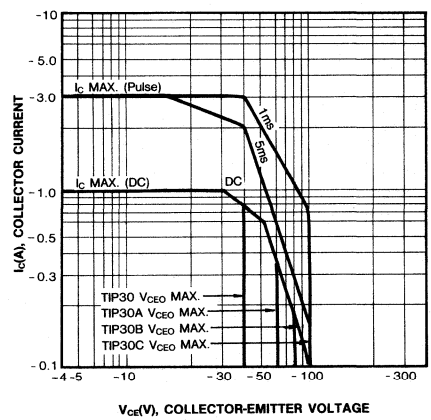
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



SAFE OPERATING AREA

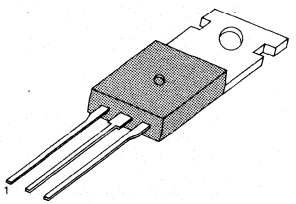


TIP31 SERIRES
(TIP31/31A/31B/31C) NPN EXITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR SWITCHING APPLICATIONS

- **Complement to TIP32/32A/32B/32C**

TO-220



1. Base 2. Collector 3. Emitter

3

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

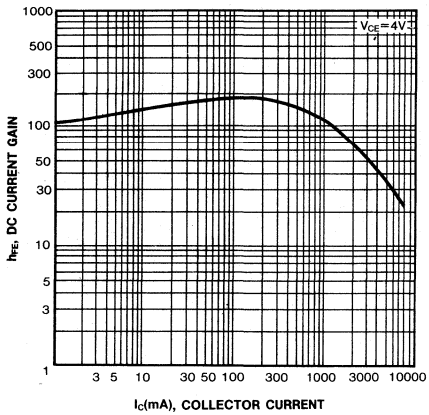
Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: TIP31	V_{CBO}	40	V
	: TIP31A		60	V
	: TIP31B		80	V
	: TIP31C		100	V
Collector-Emitter Voltage	: TIP31	V_{CEO}	40	V
	: TIP31A		60	V
	: TIP31B		80	V
	: TIP31C		100	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current (DC)		I_C	3	A
Collector Current (Pulse)		I_C	5	A
Base Current		I_B	1	A
Collector Dissipation (T_c=25°C)		P_C	40	W
Collector Dissipation (T_a=25°C)		P_C	2	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65~150	°C

ELECTRICAL CHARACTERISTICS (T_c=25°C)

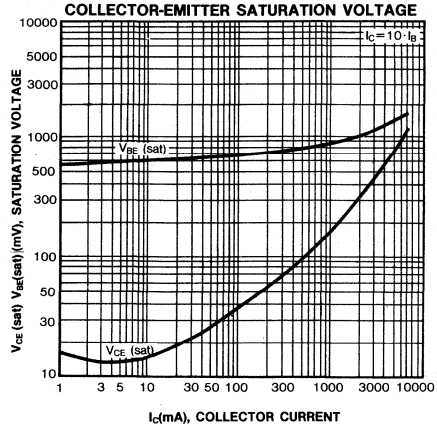
Characteristic		Symbol	Test Condition	Min	Max	Unit
* Collector Emitter Sustaining Voltage	: TIP31	BV_{CEO} (sus)	I_C=30mA, I_B=0	40		V
	: TIP31A			60		V
	: TIP31B			80		V
	: TIP31C			100		V
Collector Cutoff Current	: TIP31/31A	I_{CEO}	V_{CE}=30V, I_B=0		0.3	mA
	: TIP31B/31C		V_{CE}=60V, I_B=0		0.3	mA
Collector Cutoff Current	: TIP31	I_{CES}	V_{CE}=40V, V_{EB}=0		200	μA
	: TIP31A		V_{CE}=60V, V_{EB}=0		200	μA
	: TIP31B		V_{CE}=80V, V_{EB}=0		200	μA
	: TIP31C		V_{CE}=100V, V_{EB}=0		200	μA
Emitter Cutoff Current		I_{EBO}	V_{BE}=5V, I_C=0		1	mA
* DC Current Gain		h_{FE}	V_{CE}=4V, I_C=1A	25		
			V_{CE}=4V, I_C=3A	10	50	
* Collector-Emitter Saturation Voltage		V_{CE} (sat)	I_C=3A, I_B=375mA		1.2	V
* Base-Emitter On Voltage		V_{BE} (on)	V_{CE}=4V, I_C=3A		1.8	V
Current Gain Bandwidth Product		f_T	V_{CE}=10V, I_C=500mA f=1MHz	3.0		MHz

* Pulse Test: PW≤300μs, Duty Cycle≤2%

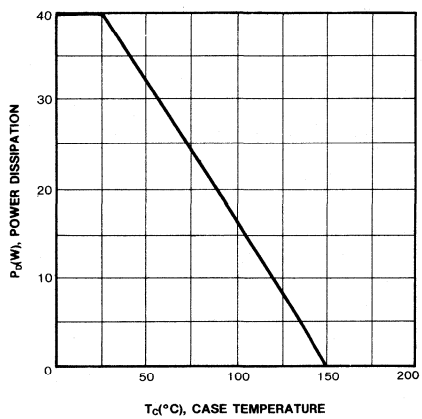
DC CURRENT GAIN



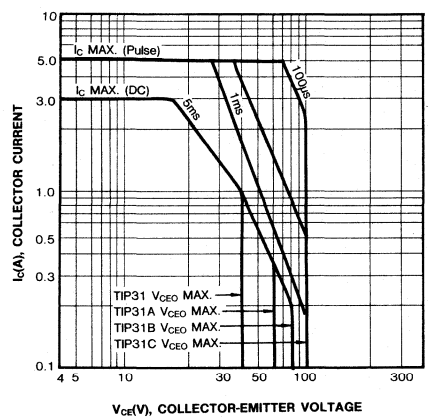
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



SAFE OPERATING AREA

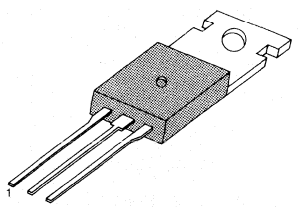


TIP32 SERIRES
(TIP32/32A/32B/32C) PNP EXITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR SWITCHING APPLICATIONS

- **Complement to TIP31/31A/31B/31C**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

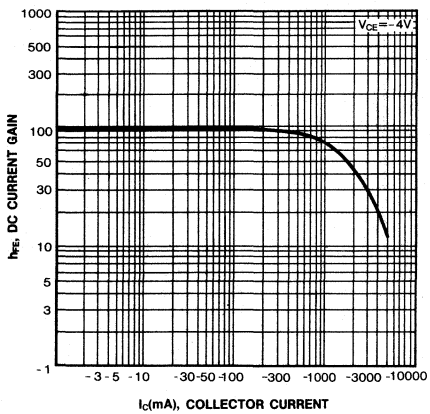
Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: TIP32	V_{CBO}	−40	V
	: TIP32A		−60	V
	: TIP32B		−80	V
	: TIP32C		−100	V
Collector-Emitter Voltage	: TIP32	V_{CEO}	−40	V
	: TIP32A		−60	V
	: TIP32B		−80	V
	: TIP32C		−100	V
Emitter-Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−3	A
Collector Current (Pulse)		I_C	−5	A
Base Current		I_B	−1	A
Collector Dissipation (T_c=25°C)		P_C	40	W
Collector Dissipation (T_a=25°C)		P_C	2	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65~150	°C

ELECTRICAL CHARACTERISTICS (T_c=25°C)

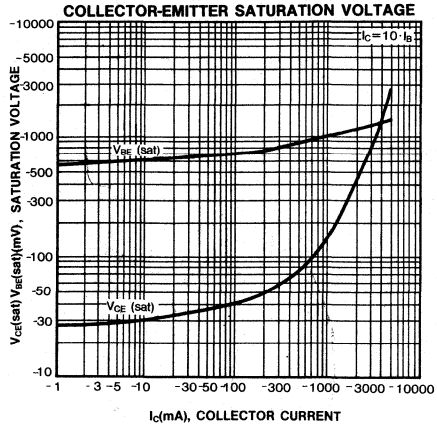
Characteristic		Symbol	Test Condition	Min	Max	Unit
*Collector Emitter Sustaining Voltage	: TIP32	BV_{CEO} (sus)	I_C=−30mA, I_B=0	−40		V
	: TIP32A			−60		V
	: TIP32B			−80		V
	: TIP32C			−100		V
Collector Cutoff Current	: TIP32/32A	I_{CEO}	V_{CE}=−30V, I_B=0		−0.3	mA
	: TIP32B/32C		V_{CE}=−60V, I_B=0		−0.3	mA
Collector Cutoff Current	: TIP32	I_{CES}	V_{CE}=−40V, V_{EB}=0		−200	μA
	: TIP32A		V_{CE}=−60V, V_{EB}=0		−200	μA
	: TIP32B		V_{CE}=−80V, V_{EB}=0		−200	μA
	: TIP32C		V_{CE}=−100V, V_{CE}=0		−200	μA
Emitter Cutoff Current		I_{EBO}	V_{BE}=−5V, I_C=0		−1	mA
*DC Current Gain		h_{FE}	V_{CE}=−4V, I_C=−1A	25		
			V_{CE}=−4V, I_C=−3A	10	50	
*Collector-Emitter Saturation Voltage		V_{CE} (sat)	I_C=−3A, I_B=−375mA		−1.2	V
*Base-Emitter On Voltage		V_{BE} (on)	V_{CE}=−4V, I_C=−3A		−1.8	V
Current Gain Bandwidth Product		f_T	V_{CE}=−10V, I_C=−500mA f=1MHz	3.0		MHz

* Pulse Test: PW≤300μs, Duty Cycle≤2%

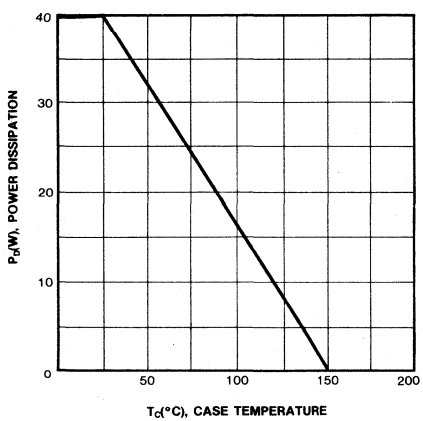
DC CURRENT GAIN



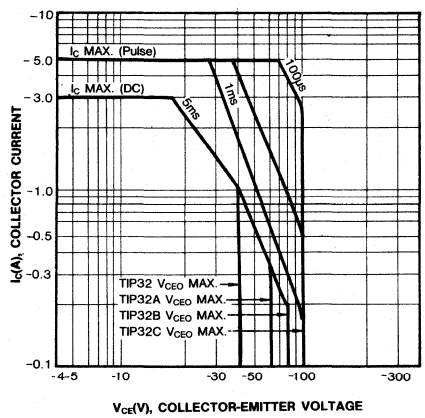
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



SAFE OPERATING AREA

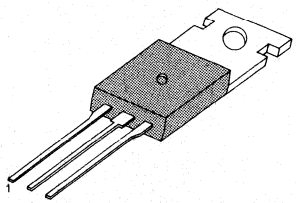


TIP41 SERIRES
(TIP41/41A/41B/41C) NPN EXITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR SWITCHING APPLICATIONS

- **Complement to TIP42/42A/42 B/42C**

TO-220



1. Base 2. Collector 3. Emitter

3

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

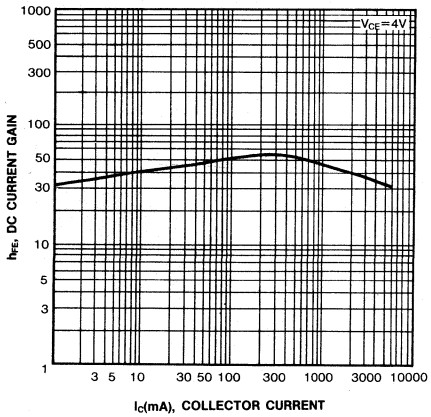
Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: TIP41	V_{CBO}	40	V
	: TIP41A		60	V
	: TIP41B		80	V
	: TIP41C		100	V
Collector-Emitter Voltage	: TIP41	V_{CEO}	40	V
	: TIP41A		60	V
	: TIP41B		80	V
	: TIP41C		100	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current (DC)		I_C	6	A
Collector Current (Pulse)		I_C	10	A
Base Current		I_B	2	A
Collector Dissipation (T_c=25°C)		P_C	65	W
Collector Dissipation (T_a=25°C)		P_C	2	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65~150	°C

ELECTRICAL CHARACTERISTICS (T_c=25°C)

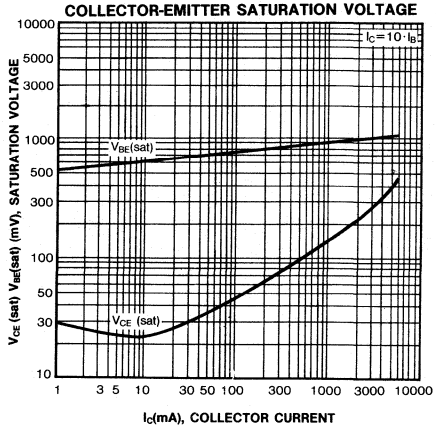
Characteristic		Symbol	Test Condition	Min	Max	Unit
* Collector Emitter Sustaining Voltage	: TIP41	BV_{CEO} (sus)	I_C=30mA, I_B=0	40		V
	: TIP41A			60		V
	: TIP41B			80		V
	: TIP41C			100		V
Collector Cutoff Current	: TIP41/41A	I_{CEO}	V_{CE}=30V, I_B=0		0.7	mA
	: TIP41B/41C		V_{CE}=60V, I_B=0		0.7	mA
Collector Cutoff Current	: TIP41	I_{CES}	V_{CE}=40V, V_{EB}=0		400	μA
	: TIP41A		V_{CE}=60V, V_{EB}=0		400	μA
	: TIP41B		V_{CE}=80V, V_{EB}=0		400	μA
	: TIP41C		V_{CE}=100V, V_{EB}=0		400	μA
Emitter Cutoff Current		I_{EBO}	V_{BE}=5V, I_C=0		1	mA
* DC Current Gain		h_{FE}	V_{CE}=4V, I_C=0.3A	30		
			V_{CE}=4V, I_C=3A	15	75	
* Collector-Emitter Saturation Voltage		V_{CE} (sat)	I_C=6A, I_B=600mA		1.5	V
* Base-Emitter On Voltage		V_{BE} (on)	V_{CE}=4V, I_C=6A		2.0	V
Current Gain Bandwidth Product		f_T	V_{CE}=10V, I_C=500mA f=1MHz	3.0		MHz

* Pulse Test: PW≤300μs, Duty Cycle≤2%

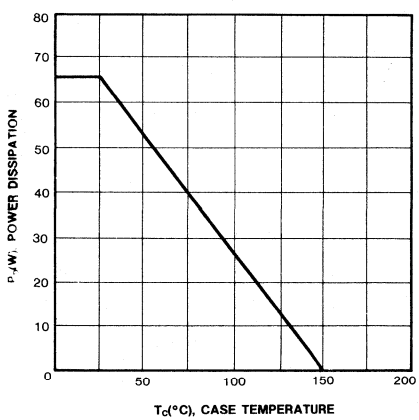
DC CURRENT GAIN



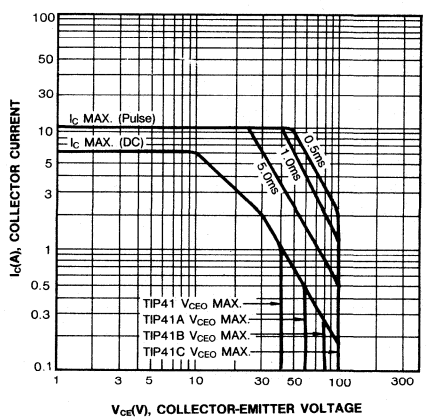
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



SAFE OPERATING AREA

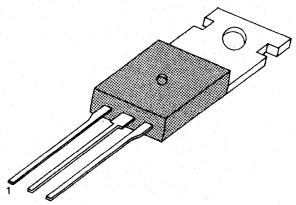


TIP42 SERIES
(TIP42/42A/42B/42C) PNP EXITAXIAL SILICON TRANSISTOR

MEDIUM POWER LINEAR SWITCHING APPLICATIONS

- **Complement to TIP41/41A/41B/41C**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

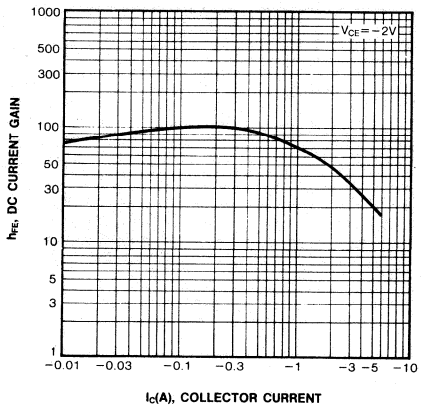
Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: TIP42	V_{CBO}	−40	V
	: TIP42A		−60	V
	: TIP42B		−80	V
	: TIP42C		−100	V
Collector-Emitter Voltage	: TIP42	V_{CEO}	−40	V
	: TIP42A		−60	V
	: TIP42B		−80	V
	: TIP42C		−100	V
Emitter-Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−6	A
Collector Current (Pulse)		I_C	−10	A
Base Current		I_B	−2	A
Collector Dissipation (T_c=25°C)		P_C	65	W
Collector Dissipation (T_a=25°C)		P_C	2	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−65~150	°C

ELECTRICAL CHARACTERISTICS (T_c=25°C)

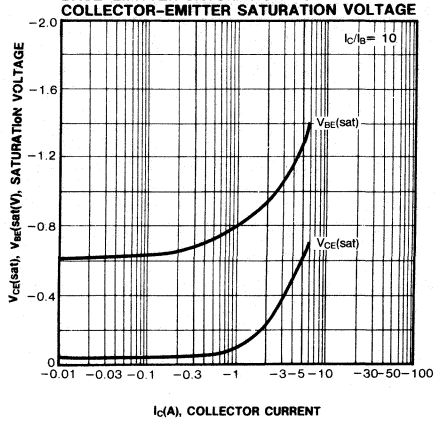
Characteristic		Symbol	Test Condition	Min	Max	Unit
* Collector Emitter Sustaining Voltage	: TIP42	BV_{CEO} (sus)	I_C= −30mA, I_B=0	−40		V
	: TIP42A			−60		V
	: TIP42B			−80		V
	: TIP42C			−100		V
Collector Cutoff Current	: TIP42/42A	I_{CEO}	V_{CE}=−30V, I_B=0		−0.7	mA
	: TIP42B/42C		V_{CE}=−60V, I_B=0		−0.7	mA
Collector Cutoff Current	: TIP42	I_{CES}	V_{CE}=−40V, V_{EB}=0		−400	μA
	: TIP42A		V_{CE}=−60V, V_{EB}=0		−400	μA
	: TIP42B		V_{CE}=−80V, V_{EB}=0		−400	μA
	: TIP42C		V_{CE}=−100V, V_{EB}=0		−400	μA
Emitter Cutoff Current		I_{EBO}	V_{BE}=−5V, I_C=0		−1	mA
*DC Current Gain		h_{FE}	V_{CE}=−4V, I_C=−0.3A	30		
			V_{CE}=−4V, I_C=−3A	15	75	
*Collector-Emitter Saturation Voltage		V_{CE} (sat)	I_C=−6A, I_B=−600mA		−1.5	V
*Base-Emitter On Voltage		V_{BE} (on)	V_{CE}=−4V, I_C=−6A		−2.0	V
Current Gain Bandwidth Product		f_T	V_{CE}=−10V, I_C=−500mA f=1MHz	3.0		MHz

* Pulse Test: PW≤300μs, Duty Cycle≤2%

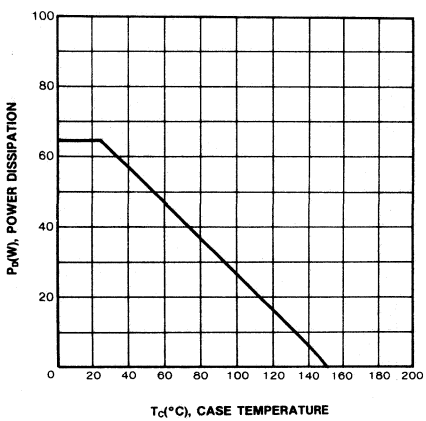
DC CURRENT GAIN



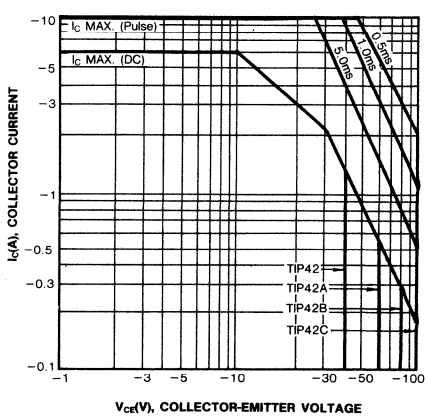
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

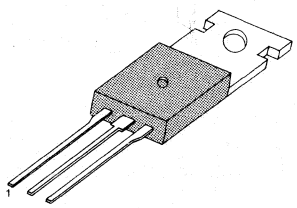


SAFE OPERATING AREA



HIGH VOLTAGE AND SWITCHING APPLICATIONS
HIGH SUSTAINING VOLTAGE
(Vceo(sus): 250 to 400V)
1A RETED COLLECTOR CURRENT

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

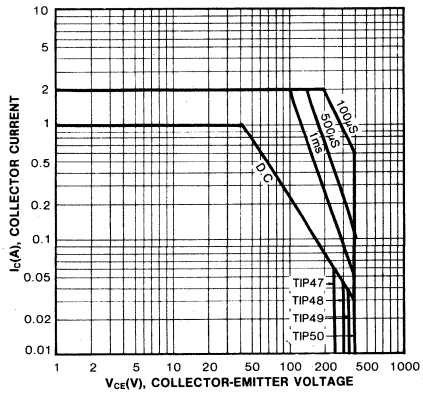
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : TIP47	V_{CBO}	350	V
: TIP48		400	V
: TIP49		450	V
: TIP50		500	V
Collector-Emitter Voltage : TIP47	V_{CEO}	250	V
: TIP48		300	V
: TIP49		350	V
: TIP50		400	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	1	A
Collector Current (Pulse)	I_C	2	A
Base Current	I_B	0.6	A
Collector Dissipation (T_C=25°C)	P_C	40	W
Collector Dissipation (T_a=25°C)	P_C	2	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

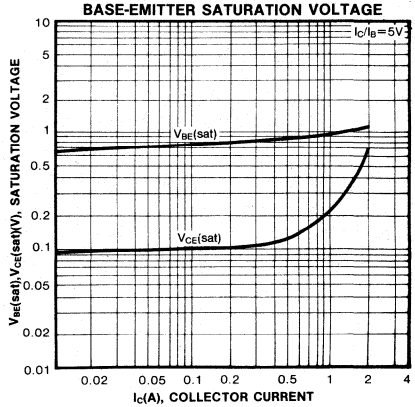
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEX}(sus)				
: TIP47		I_C=30mA, I_B=0	250		V
: TIP48			300		V
: TIP49			350		V
: TIP50			400		V
Collector Cutoff Current : TIP47	I_{CEO}	V_{CE}=150V, I_B=0		1	mA
: TIP48		V_{CE}=200V, I_B=0		1	mA
: TIP49		V_{CE}=250V, I_B=0		1	mA
: TIP50		V_{CE}=300V, I_B=0		1	mA
Collector Cutoff Current : TIP47	I_{CEX}	V_{CE}=350V, V_{BE}=0		1	mA
: TIP48		V_{CE}=400, V_{BE}=0		1	mA
: TIP49		V_{CE}=450V, V_{BE}=0		1	mA
: TIP50		V_{CE}=500V, V_{BE}=0		1	mA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		1	mA
*DC Current Gain	h_{FE}	V_{CE}=10V, I_C=0.3A	30	150	
		V_{CE}=10V, I_C=1A	10		
*Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=1A, I_B=0.2A		1	V
*Base Emitter On Voltage	V_{BE}(on)	V_{CE}=10V, I_C=1A		1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=0.2A, f=1KHz	10		MHz
Turn On Time	ton	V_{CC}=400V		0.5	μS
Storage Time	ts	$5I_B1=-2.5I_B2=I_C$=6A		3	μS
Fall Time	tf	RL=66.7Ω		0.3	μS

* Pulse test: PW≤300μs, duty cycle ≤ 2% Pulse

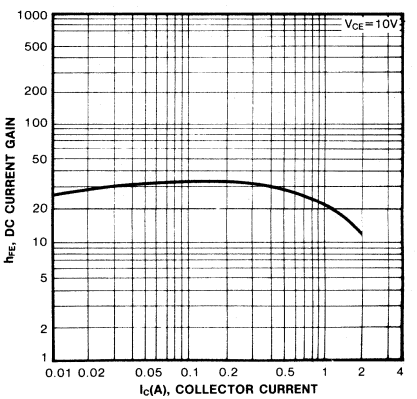
SAFE OPERATING AREA



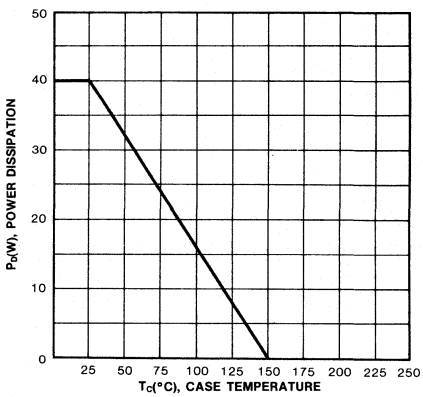
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



DC CURRENT GAIN



POWER DERATING

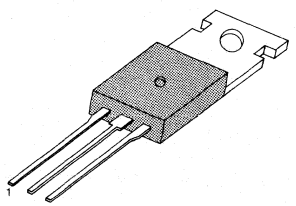


NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

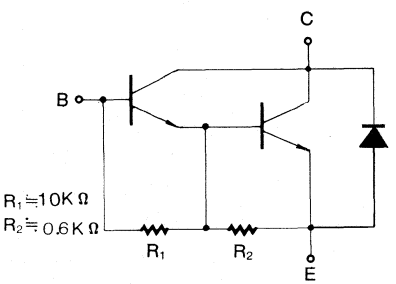
HIGH DC CURRENT GAIN
MIN h_{FE}=1000 @ V_{CE}=4V, I_C=3A
COLLECTOR-EMITTER SUSTAINING VOLTAGE
LOW COLLECTOR-EMITTER SATURATION VOLTAGE
MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS
INDUSTRIAL USE

Complementary to TIP105/106/107

TO-220



1. Base 2. Collector 3. Emitter



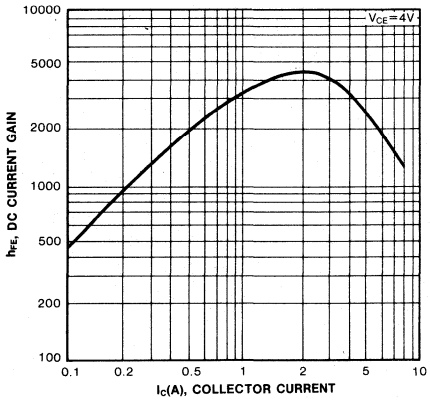
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : TIP100	V_{CBO}	60	V
: TIP101		80	V
: TIP102		100	V
Collector-Emitter Voltage	V_{CEO}		
: TIP100		60	V
: TIP101		80	V
: TIP102		100	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	8	A
Collector Current (Pulse)	I_C	15	A
Base Current (DC)	I_B	1	A
Collector Dissipation (T_a=25°C)	P_C	2	W
Collector Dissipation (T_C=25°C)	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

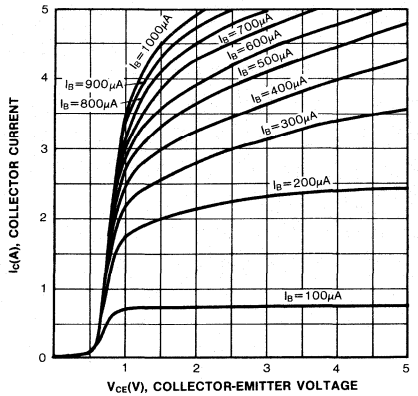
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)				
: TIP100		I_C=30mA, I_B=0	60		V
: TIP101			80		V
: TIP102			100		V
Collector Cutoff Current : TIP100	I_{CEO}	V_{CE}=30V, I_B=0		50	μA
: TIP101		V_{CE}=40V, I_B=0		50	μA
: TIP102		V_{CE}=50V, I_B=0		50	μA
Collector Cutoff Current : TIP100	I_{CBO}	V_{CB}=60V, I_E=0		50	μA
: TIP101		V_{CB}=80V, I_E=0		50	μA
: TIP102		V_{CB}=100V, I_E=0		50	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=5V, I_C=0		2	mA
DC Current Gain	h_{FE}	V_{CE}=4V, I_C=3A	1000	20000	
		V_{CE}=4V, I_C=8A	200		
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=3A, I_B=6mA		2	V
		I_C=8A, I_B=80mA		2.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=4V, I_C=8A		2.8	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=0.1MHz		200	pF

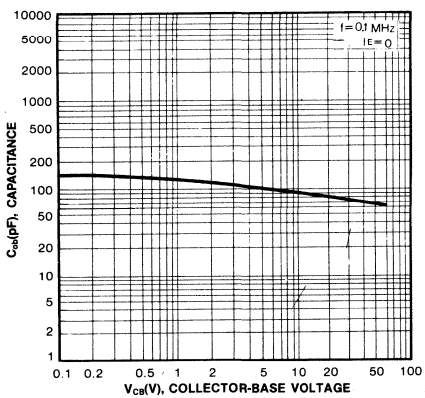
DC CURRENT GAIN



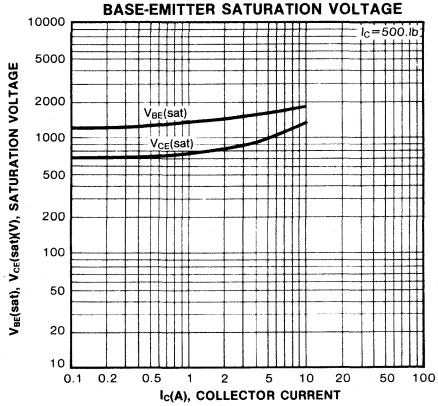
STATIC CHARACTERISTIC



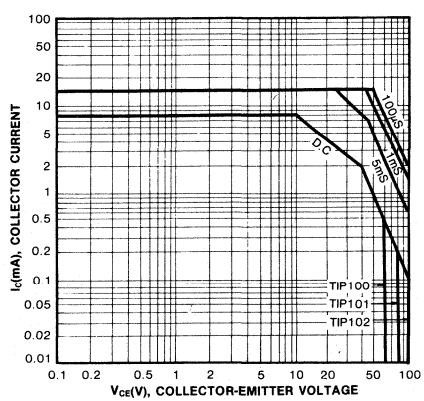
COLLECTOR OUTPUT CAPACITANCE



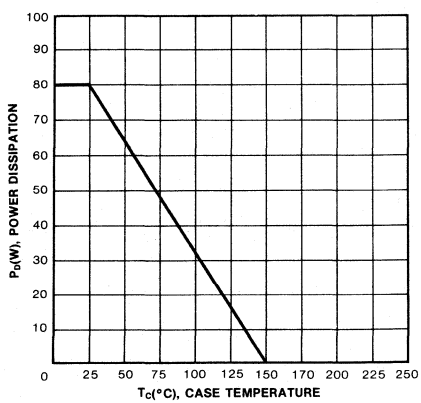
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING

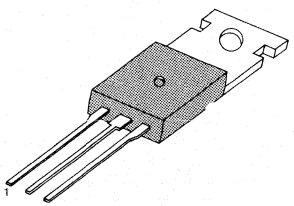


PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

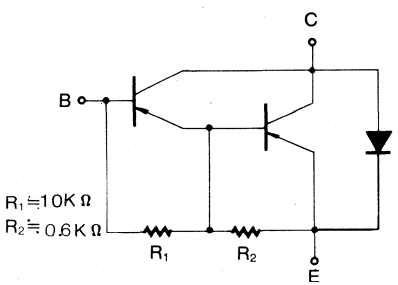
HIGH DC CURRENT GAIN
MIN h_{FE} = 1000 @ V_{CE} = −4V, I_C = −3A
COLLECTOR-EMITTER SUSTAINING VOLTAGE
LOW COLLECTOR-EMITTER SATURATION VOLTAGE
MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS
INDUSTRIAL USE

Complementary to TIP100/101/102

TO-220



1. Base 2. Collector 3. Emitter



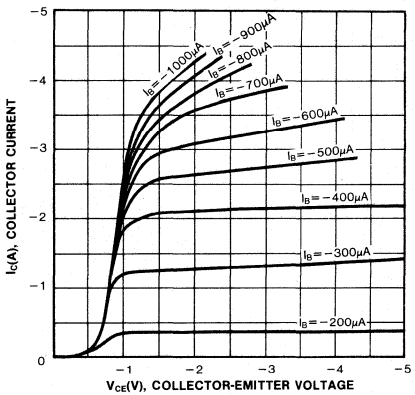
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : TIP105	V_{CBO}	−60	V
: TIP106		−80	V
: TIP107		−100	V
Collector-Emitter Voltage	V_{CEO}		
: TIP105		−60	V
: TIP106		−80	V
: TIP107		−100	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−8	A
Collector Current (Pulse)	I_C	−15	A
Base Current (DC)	I_B	−1	A
Collector Dissipation (T_a=25°C)	P_C	2	W
Collector Dissipation (T_C=25°C)	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

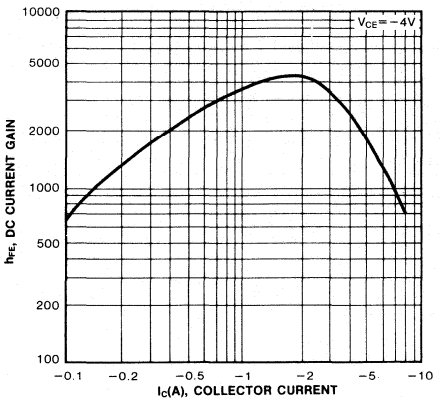
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)				
: TIP105		I_C=−30mA, I_B=0	−60		V
: TIP106			−80		V
: TIP107			−100		V
Collector Cutoff Current : TIP105	I_{CEO}	V_{CE}=−30V, I_B=0		−50	μA
: TIP106		V_{CE}=−40V, I_B=0		−50	μA
: TIP107		V_{CE}=−50V, I_B=0		−50	μA
Collector Cutoff Current : TIP105	I_{CBO}	V_{CB}=−60V, I_E=0		−50	μA
: TIP106		V_{CB}=−80V, I_E=0		−50	μA
: TIP107		V_{CB}=−100V, I_E=0		−50	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=−5V, I_C=0		−2	mA
DC Current Gain	h_{FE}	V_{CE}=−4V, I_C=−3A	1000	20000	
		V_{CE}=−4V, I_C=−8A	200		
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−3A, I_B=−6mA		−2	V
		I_C=−8A, I_B=−80mA		−2.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−4V, I_C=−8A		−2.8	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0, f=0.1MHz		300	pF

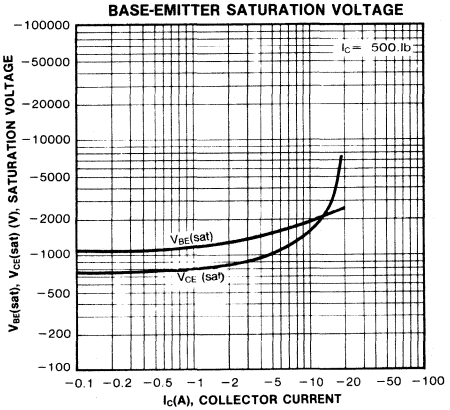
STATIC CHARACTERISTIC



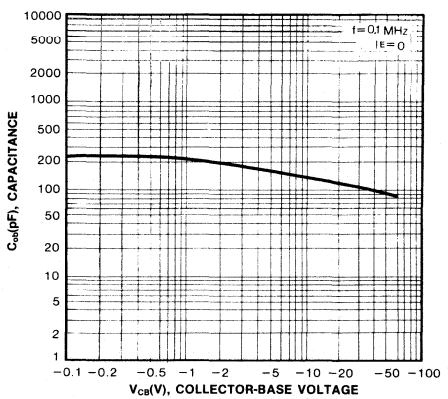
DC CURRENT GAIN



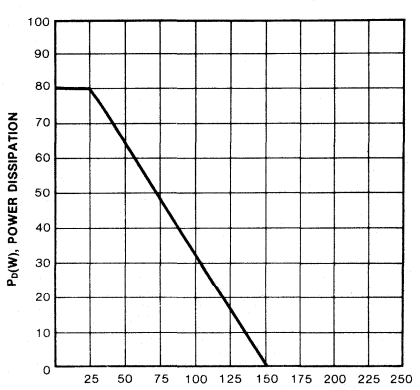
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



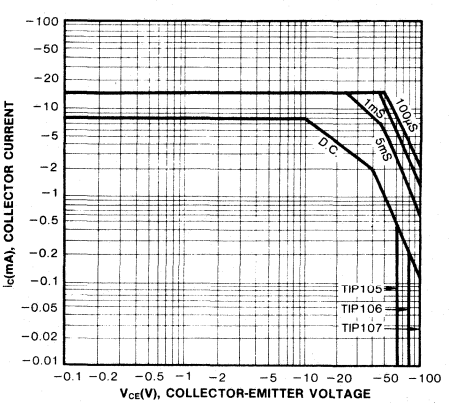
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



SAFE OPERATING AREA

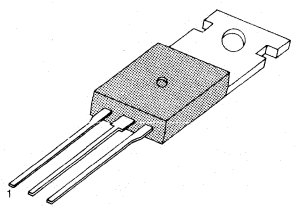


NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

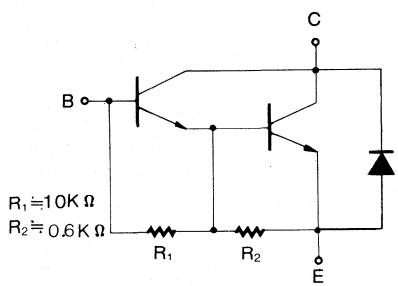
HIGH DC CURRENT GAIN
MIN h_{FE}=1000 @ V_{CE}=4V, I_C=1A
LOW COLLECTOR-EMITTER SATURATION VOLTAGE
MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS
INDUSTRIAL USE

Complementary to TIP115/116/117

TO-220



1. Base 2. Collector 3. Emitter



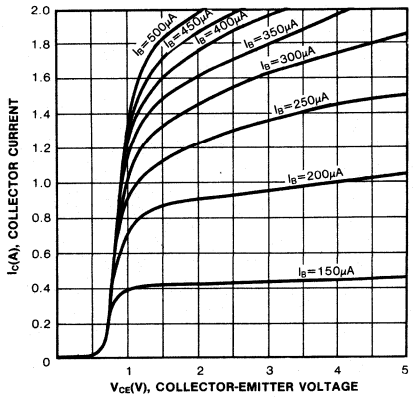
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : TIP110	V_{CBO}	60	V
: TIP111		80	V
: TIP112		100	V
Collector-Emitter Voltage	V_{CEO}		
: TIP110		60	V
: TIP111		80	V
: TIP112		100	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	2	A
Collector Current (Pulse)	I_C	4	A
Base Current (DC)	I_B	50	mA
Collector Dissipation (T_a=25°C)	P_C	2	W
Collector Dissipation (T_C=25°C)	P_C	50	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

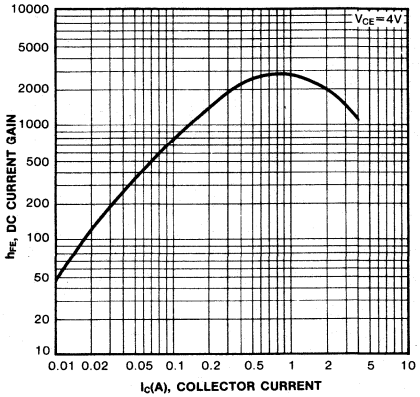
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)				
: TIP110		I_C=30mA, I_B=0	60		V
: TIP111			80		V
: TIP112			100		V
Collector Cutoff Current : TIP110	I_{CEO}	V_{CE}=30V, I_B=0		2	mA
: TIP111		V_{CE}=40V, I_B=0		2	mA
: TIP112		V_{CE}=50V, I_B=0		2	mA
Collector Cutoff Current : TIP110	I_{CBO}	V_{CB}=60V, I_E=0		1	mA
: TIP111		V_{CB}=80V, I_E=0		1	mA
: TIP112		V_{CB}=100V, I_E=0		1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE}=5V, I_C=0		2	mA
DC Current Gain	h_{FE}	V_{CE}=4V, I_C=1A	1000		
		V_{CE}=4V, I_C=2A	500		
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=2A, I_B=8mA		2.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=4V, I_C=2A		2.8	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=0.1MHz		100	pF

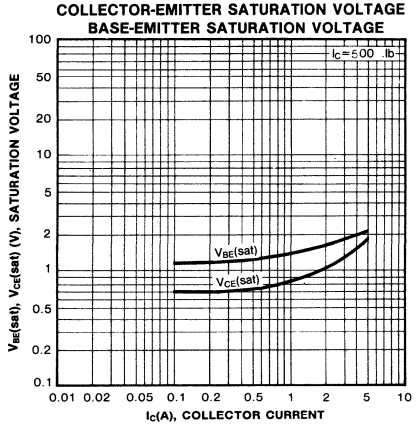
STATIC CHARACTERISTIC



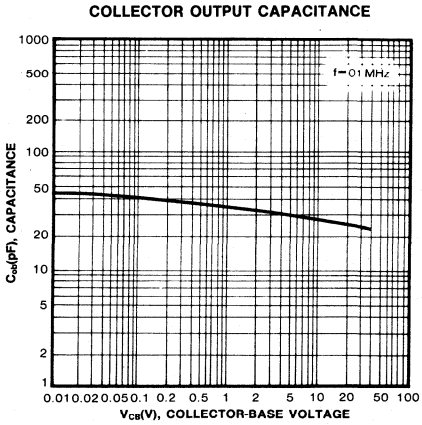
DC CURRENT GAIN



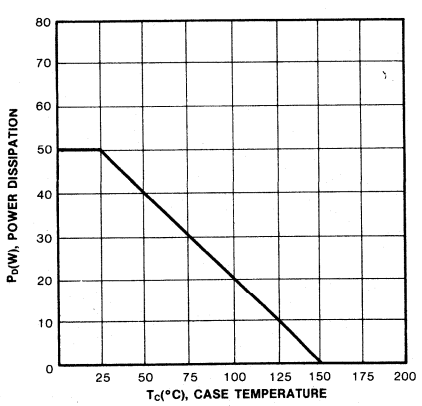
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



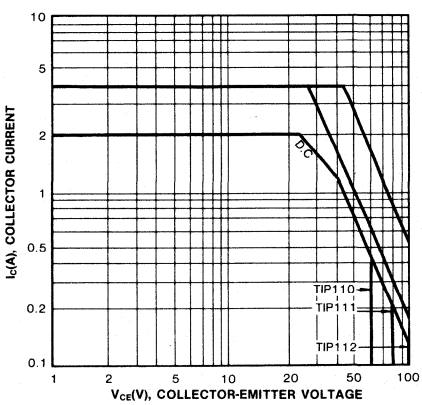
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



SAFE OPERATING AREA

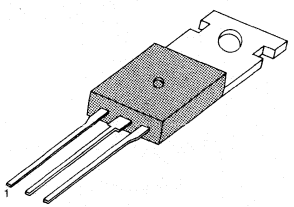


PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

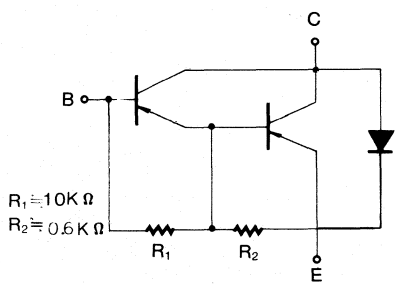
HIGH DC CURRENT GAIN
MIN h_{FE} = 1000 @ V_{CE} = −4V, I_C = −1A
LOW COLLECTOR-EMITTER SATURATION VOLTAGE
MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS
INDUSTRIAL USE

Complementary to TIP110/111/112

TO-220



1. B se 2. Collector 3. Emitter



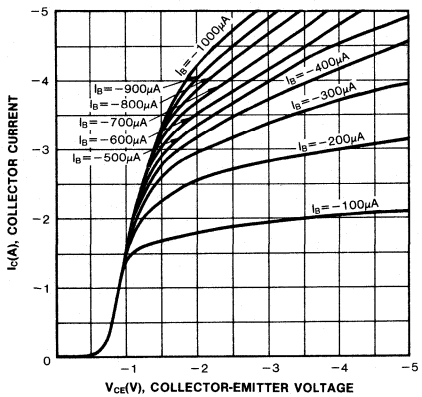
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage : TIP115	V_{CBO}	−60	V
: TIP116		−80	V
: TIP117		−100	V
Collector Emitter Voltage	V_{CEO}		
: TIP 115		−60	V
: TIP116		−80	V
: TIP117		-100	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−2	A
Collector Current (Pulse)	I_C	−4	A
Base Current (DC)	I_B	−50	mA
Collector Dissipation (T_a=25°C)	P_C	2	W
Collector Dissipation (T_C=25°C)	P_C	50	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

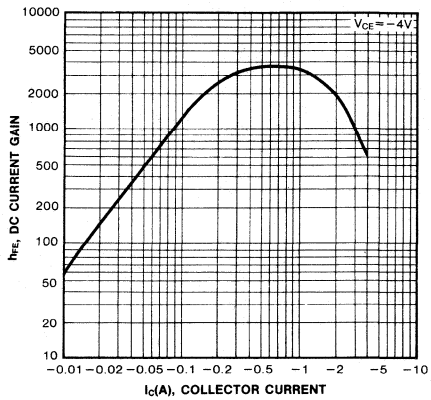
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)				
: TIP115		I_C=−30mA, I_B=0	−60		V
: TIP116			−80		V
: TIP117			−100		V
Collector Cutoff Current : TIP115	I_{CEO}	V_{CE}=−30V, I_B=0		−2	mA
: TIP116		V_{CE}=−40V, I_B=0		−2	mA
: TIP117		V_{CE}=−50V, I_B=0		−2	mA
Collector Cutoff Current : TIP115	I_{CBO}	V_{CB}=−60V, I_E=0		−1	mA
: TIP116		V_{CB}=−80V, I_E=0		−1	mA
: TIP117		V_{CB}=−100V, I_E=0		−1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE}=−5V, I_C=0		−2	mA
DC Current Gain	h_{FE}	V_{CE}=−4V, I_C=−1A	1000		
		V_{CE}=−4V, I_C=−2A	500		
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−2A, I_B=−8mA		−2.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−4V, I_C=−2A		−2.8	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0, f=0.1MHz		200	pF

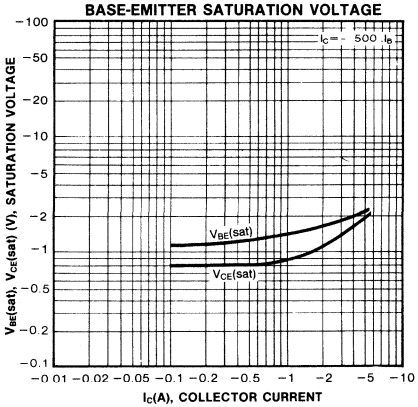
STATIC CHARACTERISTIC



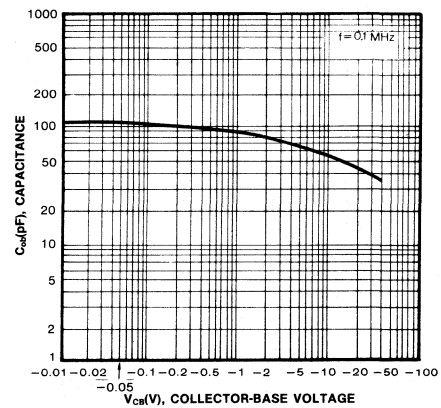
DC CURRENT GAIN



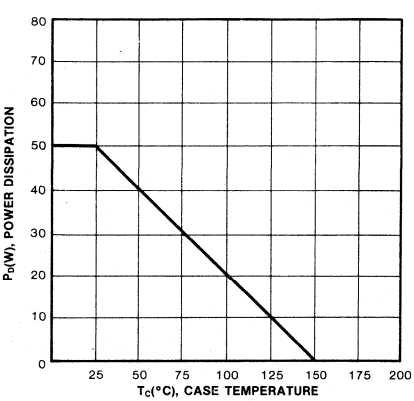
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



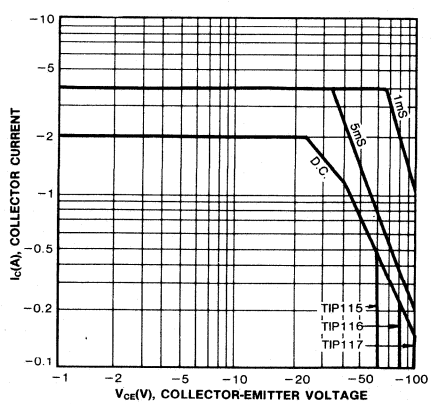
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



SAFE OPERATING AREA

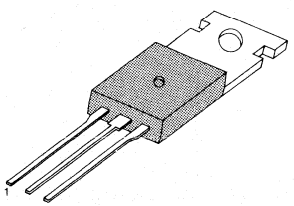


NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

MEDIUM POWER LINEAR SWITCHING APPLICATIONS

- **Complement to TIP125/126/127**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

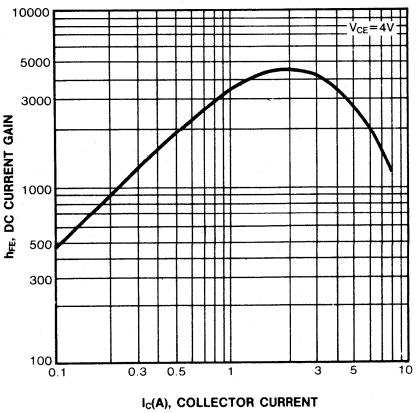
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage: TIP120	V_{CBO}	60	V
: TIP121		80	V
: TIP122		100	V
Collector-Emitter Voltage			
: TIP120	V_{CEO}	60	V
: TIP121		80	V
: TIP122		100	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	5	A
Collector Current (Pulse)	I_C	8	A
Base Current (DC)	I_B	120	mA
Collector Dissipation (T_a = 25°C)	P_C	2	W
Collector Dissipation (T_c = 25°C)	P_C	65	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65 ~ 150	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

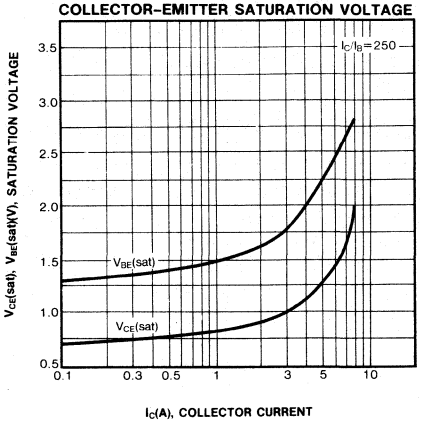
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)				
: TIP120		I_C = 100mA, I_B = 0	60		V
: TIP121			80		V
: TIP122			100		V
Collector Cutoff Current : TIP120	I_{CEO}	V_{CE} = 30V, I_B = 0		2	mA
: TIP121		V_{CE} = 40V, I_B = 0		2	mA
: TIP122		V_{CE} = 50V, I_B = 0		2	mA
Collector Cutoff Current : TIP120	I_{CBO}	V_{CB} = 60V, I_E = 0		1	mA
: TIP121		V_{CB} = 80V, I_E = 0		1	mA
: TIP122		V_{CB} = 100V, I_E = 0		1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE} = 5V, I_C = 0		2	mA
*DC Current Gain	h_{FE}	V_{CE} = 3V, I_C = 0.5A	1000		
		V_{CE} = 3V, I_C = 3A	1000		
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C = 3A, I_B = 12mA		2.0	V
		I_C = 5A, I_B = 20mA		4.0	V
*Base-Emitter On Voltage	V_{BE}(on)	V_{CE} = 3V, I_C = 3A		2.5	V
Output Capacitance	Cob	V_{CB} = 10V, I_E = 0, f = 0.1MHz		200	pF

*Pulse Test: PW ≤ 300μs, Duty Cycle ≤ 2%

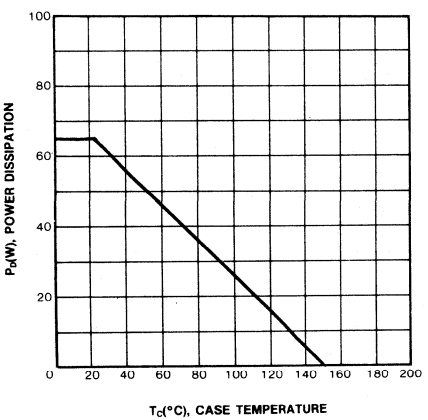
DC CURRENT GAIN



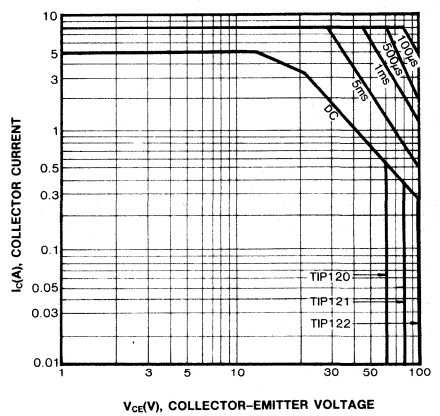
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



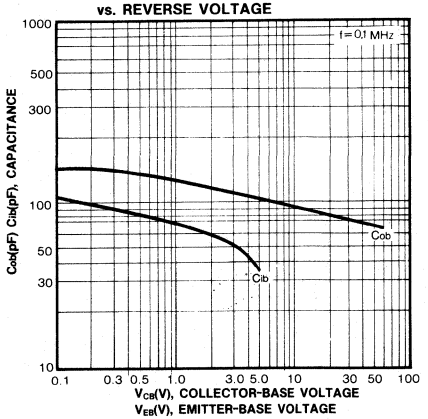
POWER DERATING

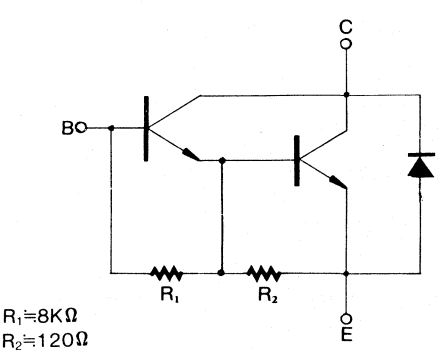


SAFE OPERATING AREA



OUTPUT AND INPUT CAPACITANCE
vs. REVERSE VOLTAGE





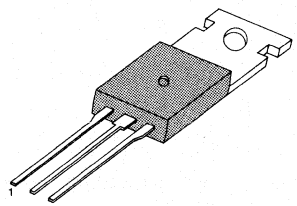
$R_1 \fallingdotseq 8K\Omega$
$R_2 \fallingdotseq 120\Omega$

PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

MEDIUM POWER LINEAR SWITCHING APPLICATIONS

- **Complement to TIP120/121/122**

TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage: TIP125	V_{CBO}	−60	V
: TIP126		−80	V
: TIP127		−100	V
Collector-Emitter Voltage			
: TIP125	V_{CEO}	−60	V
: TIP126		−80	V
: TIP127		−100	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−5	A
Collector Current (Pulse)	I_C	−8	A
Base Current (DC)	I_B	−120	mA
Collector Dissipation (T_a = 25°C)	P_C	2	W
Collector Dissipation (T_c = 25°C)	P_C	65	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

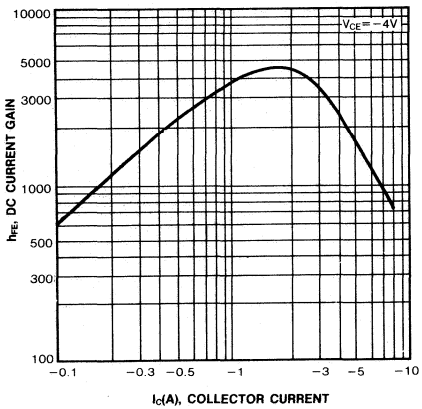
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)				
: TIP125		I_C = −100mA, I_B = 0	−60		V
: TIP126			−80		V
: TIP127			−100		V
Collector Cutoff Current : TIP125	I_{CEO}	V_{CE} = −30V, I_B = 0		−2	mA
: TIP126		V_{CE} = −40V, I_B = 0		−2	mA
: TIP127		V_{CE} = −50V, I_B = 0		−2	mA
Collector Cutoff Current : TIP125	I_{CBO}	V_{CB} = −60V, I_E = 0		−1	mA
: TIP126		V_{CB} = −80V, I_E = 0		−1	mA
: TIP127		V_{CB} = −100V, I_E = 0		−1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE} = −5V, I_C = 0		−2	mA
*DC Current Gain	h_{FE}	V_{CE} = −3V, I_C = −0.5A	1000		
		V_{CE} = −3V, I_C = −3A	1000		
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C = −3A, I_B = −12mA		−2	V
		I_C = −5A, I_B = −20mA		−4	V
*Base-Emitter On Voltage	V_{BE}(on)	V_{CE} = −3V, I_C = −3A		−2.5	V
Output Capacitance	Cob	V_{CB} = −10V, I_E = 0, f = 0.1MHz		300	pF

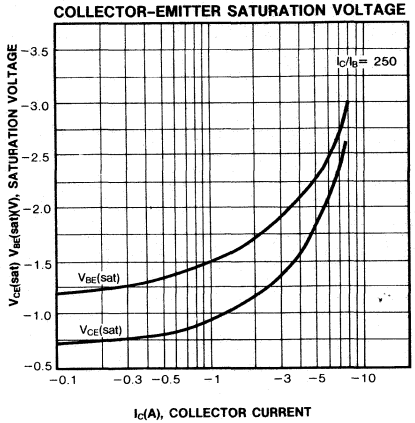
*Pulse Test: PW≤300μs, Duty Cycle≤2%

PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

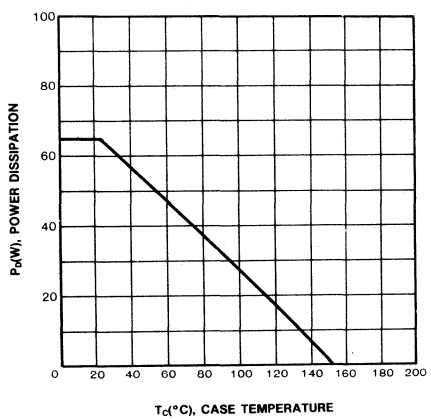
DC CURRENT GAIN



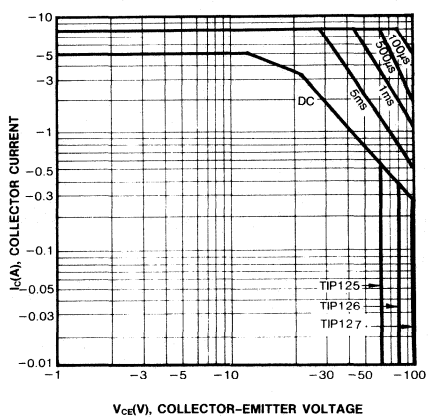
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



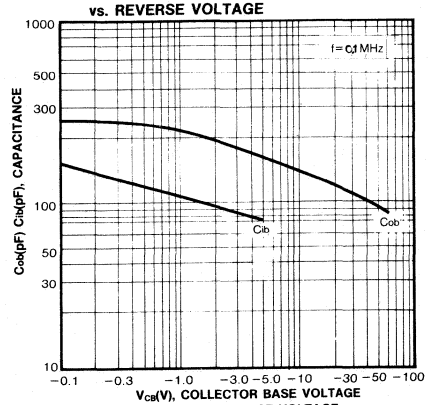
POWER DERATING

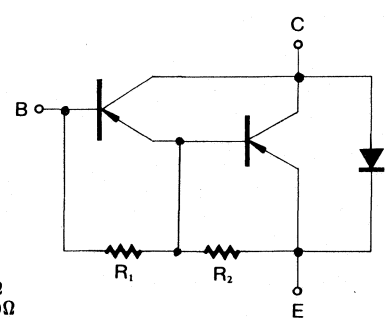


SAFE OPERATING AREA



OUTPUT AND INPUT CAPACITANCE
vs. REVERSE VOLTAGE





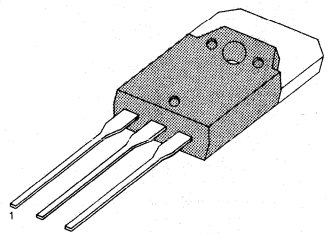
$R_1 \fallingdotseq 8K\Omega$
$R_2 \fallingdotseq 120\Omega$

NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

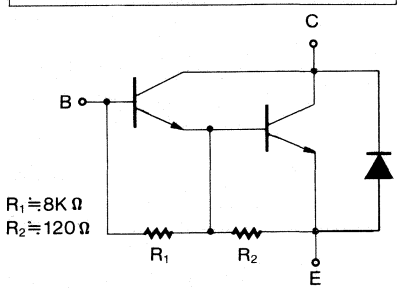
HIGH DC CURRENT GAIN
MIN h_{FE}=1000 @ V_{CE}=−4V, I_C=−5A
MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS
INDUSTRIAL USE

Complementary to TIP145/146/147

TO-3P



1. Base 2. Collector 3. Emitter



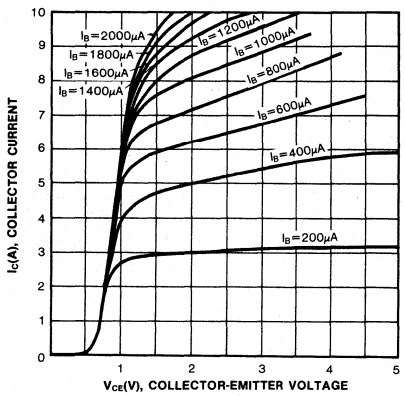
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : TIP140	V_{CBO}	60	V
: TIP141		80	V
: TIP142		100	V
Collector Emitter Voltage	V_{CEO}		
: TIP140		60	V
: TIP141		80	V
: TIP142		100	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	10	A
Collector Current (Pulse)	I_C	15	A
Base Current (DC)	I_B	0.5	A
Collector Dissipation	P_C	125	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

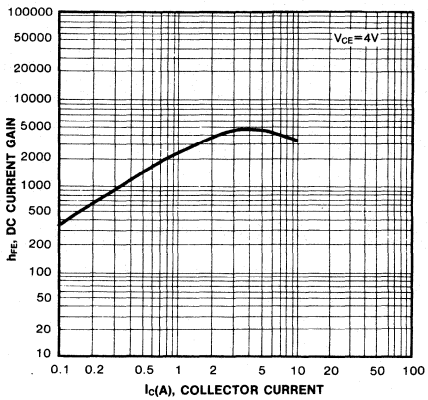
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)					
: TIP140		I_C=30mA, I_B=0	60			V
: TIP141			80			V
: TIP142			100			V
Collector Cutoff Current : TIP140	I_{CEO}	V_{CE}=30V, I_B=0			2	mA
: TIP141		V_{CE}=40V, I_B=0			2	mA
: TIP142		V_{CE}=50V, I_B=0			2	mA
Collector Cutoff Current : TIP140	I_{CBO}	V_{CB}=60V, I_E=0			1	mA
: TIP141		V_{CB}=80V, I_E=0			1	mA
: TIP142		V_{CB}=100V, I_E=0			1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE}=5V, I_C=0			2	mA
DC Current Gain	h_{FE}	V_{CE}=4V, I_C=5A	1000			
		V_{CE}=4V, I_C=10A	500			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=5A, I_B=10mA			2	V
		I_C=10A, I_B=40mA			3	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=10A, I_B=40mA			3.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=4V, I_C=10A			3	V
Delay Time	t_d	V_{CC}=30V, I_C=5A		0.15		μS
Rise Time	t_r	I_B=20mA, I_B1=I_B2		0.55		μS
Storage Time	t_S			2.5		μS
Fall Time	t_f			2.5		μS

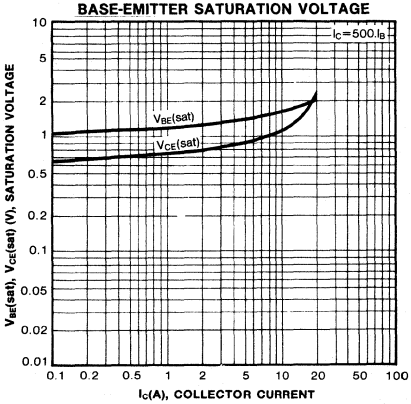
STATIC CHARACTERISTIC



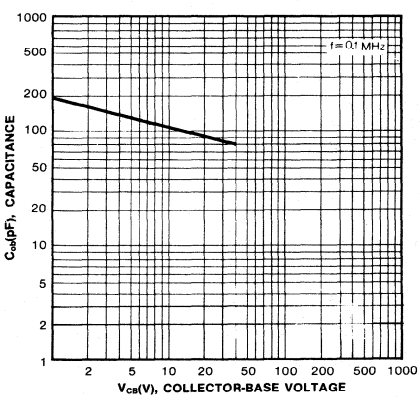
DC CURRENT GAIN



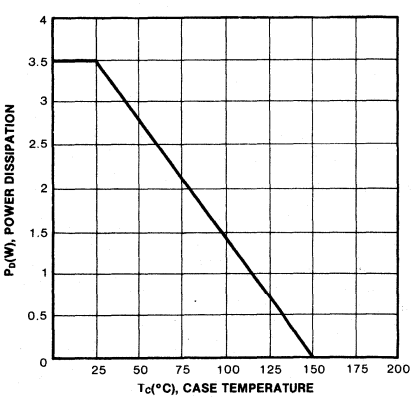
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



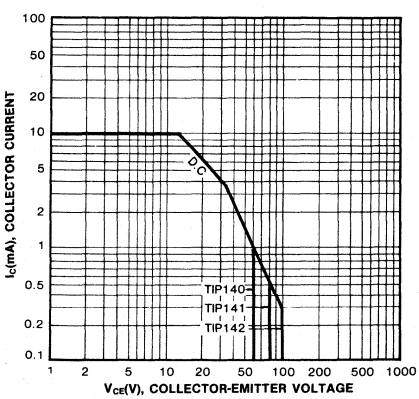
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



SAFE OPERATING AREA

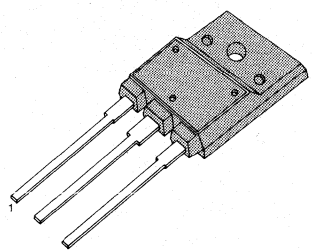


NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

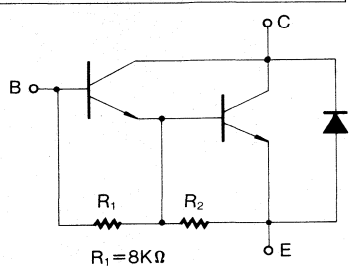
HIGH DC CURRENT GAIN
MIN h_{FE}=1000 @ V_{CE}=−4V, I_C=−5A
MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS
INDUSTRIAL USE

Complementary to TIP145F/146F/147F

TO-3P(F)



1. Base 2. Collector 3. Emitter



R_1=8KΩ
R_2=120Ω

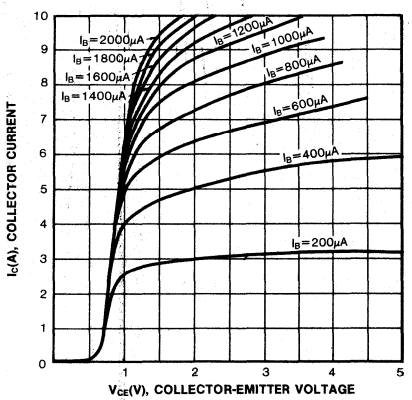
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
: TIP140F		60	V
: TIP141F		80	V
: TIP142F		100	V
Collector Emitter Voltage	V_{CEO}		
: TIP140F		60	V
: TIP141F		80	V
: TIP142F		100	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	10	A
Collector Current (Pulse)	I_C	15*	A
Base Current (DC)	I_B	0.5	A
Collector Dissipation	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

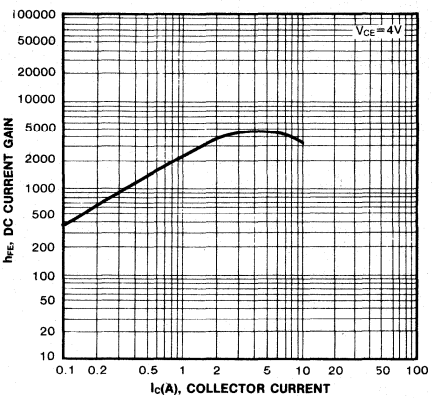
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)					
: TIP140F		I_C=30mA, I_B=0	60			V
: TIP141F			80			V
: TIP142F			100			V
Collector Cutoff Current : TIP140F	I_{CEO}	V_{CE}=30V, I_B=0			2	mA
: TIP141F		V_{CE}=40V, I_B=0			2	mA
: TIP142F		V_{CE}=50V, I_B=0			2	mA
Collector Cutoff Current : TIP140F	I_{CBO}	V_{CB}=60V, I_E=0			1	mA
: TIP141F		V_{CB}=80V, I_E=0			1	mA
: TIP142F		V_{CB}=100V, I_E=0			1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE}=5V, I_C=0			2	mA
DC Current Gain	h_{FE}	V_{CE}=4V, I_C=5A	1000			
		V_{CE}=4V, I_C=10A	500			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=5A, I_B=10mA			2	V
		I_C=10A, I_B=40mA			3	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=10A, I_B=40mA			3.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=4V, I_C=10A			3	V
Delay Time	t_d	V_{CC}=30V, I_C=5A		0.15		μS
Rise Time	t_r	I_B=20mA, I_{B1}=I_{B2}		0.55		μS
Storage Time	t_S			2.5		μS
Fall Time	t_f			2.5		μS

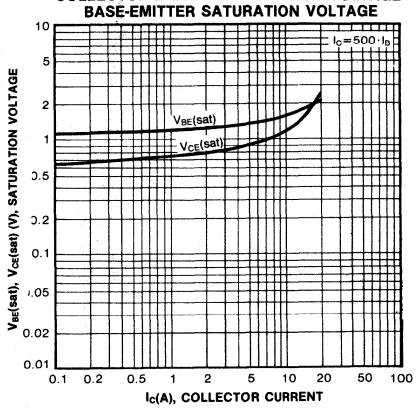
STATIC CHARACTERISTIC



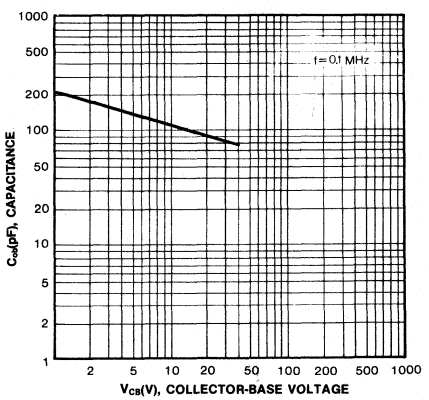
DC CURRENT GAIN



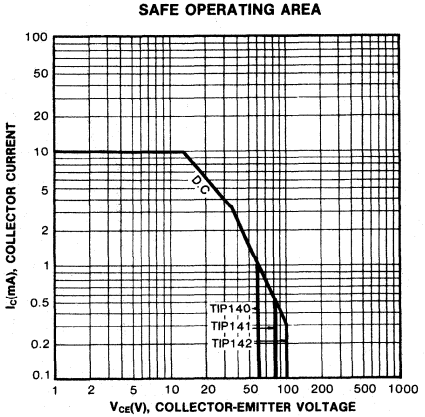
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



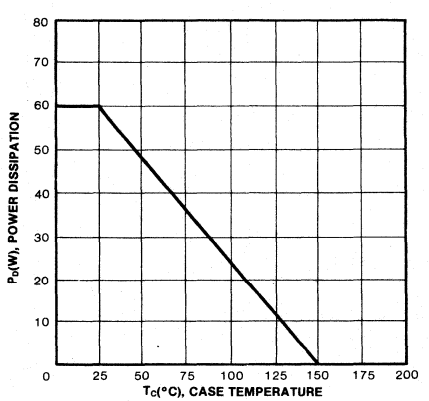
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



POWER DERATING



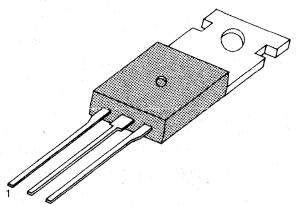
NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

HIGH DC CURRENT GAIN-MIN hFE=1000 @ Vce=4V, Ic=5A

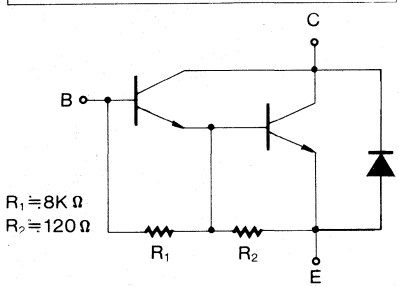
MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS DINDUSTRIAL USE

Complementary to TIP145T/146T/147T

TO-220



1. Base 2. Collector 3. Emitter



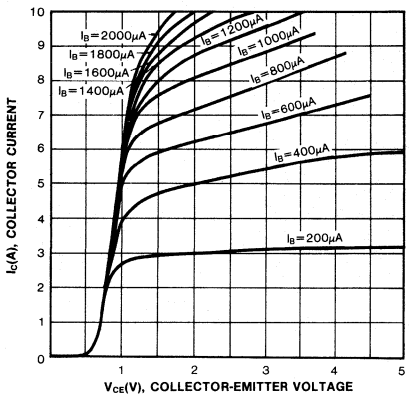
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : TIP140T	V_{CBO}	60	V
: TIP141T		80	V
: TIP142T		100	V
Collector-Emitter Voltage	V_{CEO}		
: TIP140T		60	V
: TIP141T		80	V
: TIP142T		100	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	10	A
Collector Current (Pulse)	I_C	15	A
Base Current (DC)	I_B	0.5	A
Collector Dissipation	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

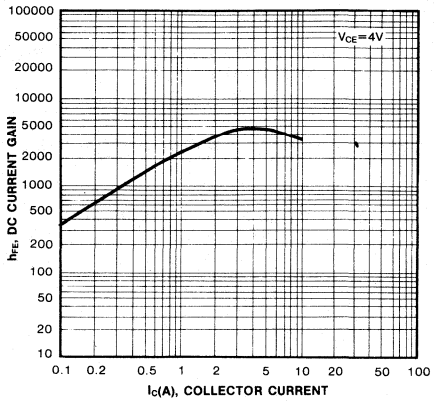
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)					
: TIP140T		I_C=30mA, I_B=0	60			V
: TIP141T			80			V
: TIP142T			100			V
Collector Cutoff Current : TIP140T	I_{CEO}	V_{CE}=30V, I_B=0			2	mA
: TIP141T		V_{CE}=40V, I_B=0			2	mA
: TIP142T		V_{CE}=50V, I_B=0			2	mA
Collector Cutoff Current : TIP140T	I_{CBO}	V_{CB}=60V, I_E=0			1	mA
: TIP141T		V_{CB}=80V, I_E=0			1	mA
: TIP142T		V_{CB}=100V, I_E=0			1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE}=5V, I_C=0			2	mA
DC Current Gain	h_{FE}	V_{CE}=4V, I_C=5A	1000			
		V_{CE}=4V, I_C=10A	500			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=5A, I_B=10mA			2	V
		I_C=10A, I_B=40mA			3	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=10A, I_B=40mA			3.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=4V, I_C=10A			3	V
Delay Time	td	V_{CC}=30V, I_C=5A		0.15		μS
Rise Time	t_r	I_B=20mA, I_B1=I_B2		0.55		μS
Storage Time	t_s			2.5		μS
Fall Time	t_f			2.5		μS

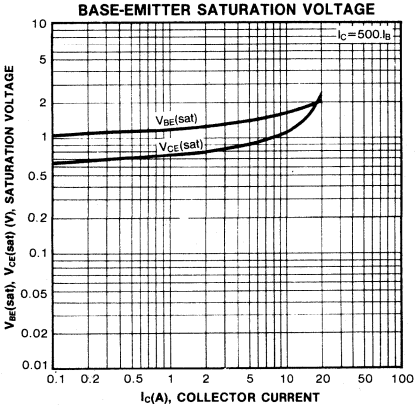
STATIC CHARACTERISTIC



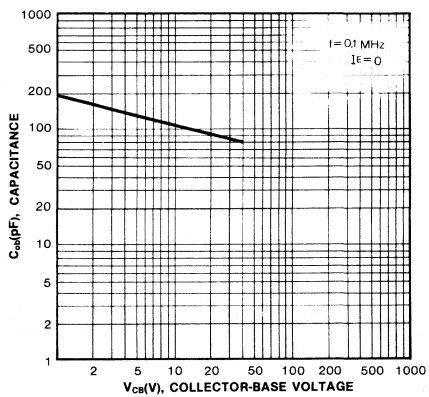
DC CURRENT GAIN



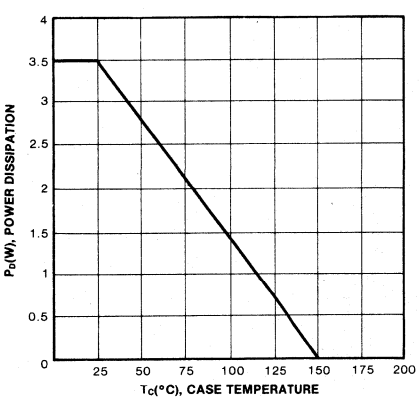
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



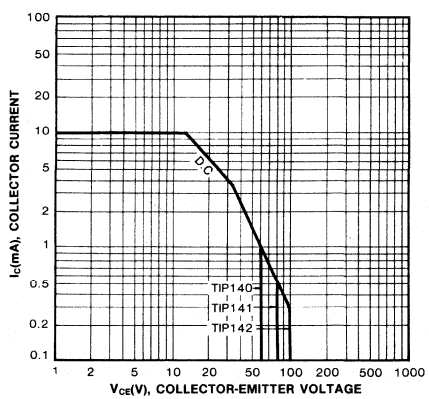
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



SAFE OPERATING AREA

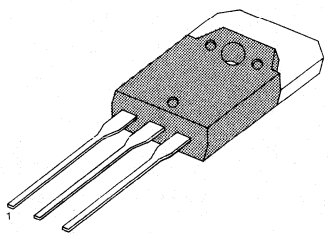


PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

HIGH DC CURRENT GAIN
MIN h_{FE}=1000 @ V_{CE}=−4V, I_C=−5A
MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS
INDUSTRIAL USE

Complementary to TIP140/141/142

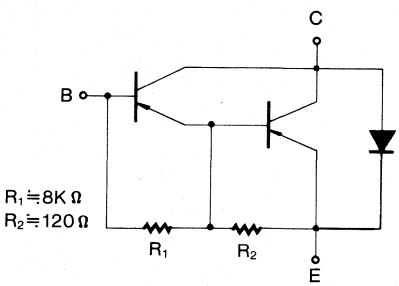
TO-3P



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

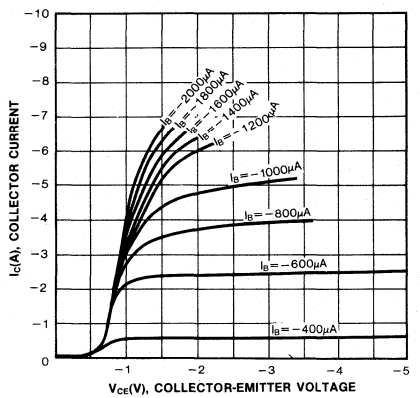
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : TIP145	V_{CBO}	−60	V
: TIP146		−80	V
: TIP147		−100	V
Collector Emitter Voltage	V_{CEO}		
: TIP145		−60	V
: TIP146		−80	V
: TIP147		−100	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−10	A
Collector Current (Pulse)	I_C	−15	A
Base Current (DC)	I_B	−0.5	A
Collector Dissipation	P_C	125	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C



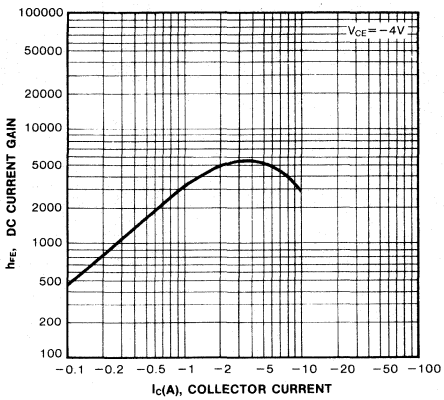
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)					
: TIP145		I_C=−30mA, I_B=0	−60			V
: TIP146			−80			V
: TIP147			−100			V
Collector Cutoff Current : TIP145	I_{CEO}	V_{CE}=−30V, I_B=0			−2	mA
: TIP146		V_{CE}=−40V, I_B=0			−2	mA
: TIP147		V_{CE}=−50V, I_B=0			−2	mA
Collector Cutoff Current : TIP145	I_{CBO}	V_{CB}=−60V, I_E=0			−1	mA
: TIP146		V_{CB}=−80V, I_E=0			−1	mA
: TIP147		V_{CB}=−100V, I_E=0			−1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE}=−5V, I_C=0			−2	mA
DC Current Gain	h_{FE}	V_{CE}=−4V, I_C=−5A	1000			
		V_{CE}=−4V, I_C=−10A	500			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−5A, I_B=−10mA			−2	V
		I_C=−10A, I_B=−40mA			−3	V
Base Emitter saturation Voltage	V_{BE}(sat)	I_C=−10A, I_B=−40mA			−3.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−4V, I_C=−10A			−3	V
Delay Time	t_d	V_{CC}=−30V, I_C=−5A		0.15		μS
Rise Time	t_r	I_B=−20mA, I_B1=I_B2		0.55		μS
Storage Time	t_S			2.5		μS
Fall Time	t_f			2.5		μS

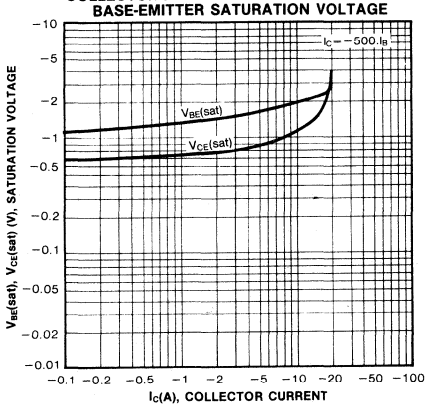
STATIC CHARACTERISTIC



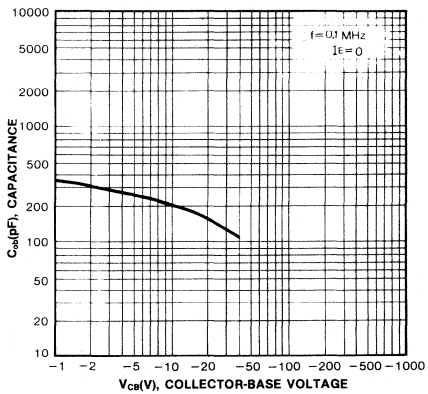
DC CURRENT GAIN



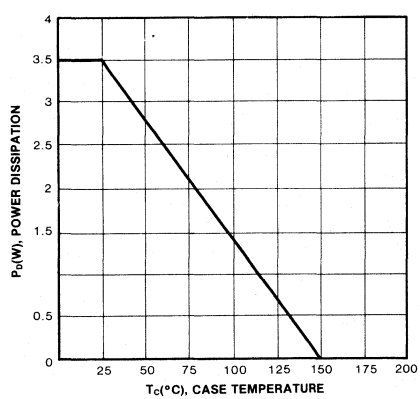
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



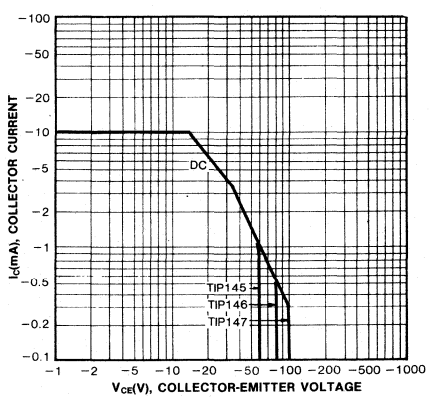
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



SAFE OPERATING AREA

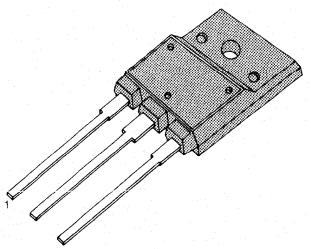


PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

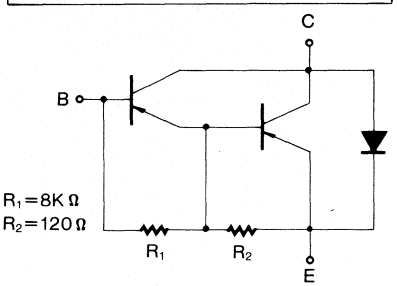
HIGH DC CURRENT GAIN
MIN h_{FE} = 1000 @ V_{CE} = −4V, I_C = −5A
MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS
INDUSTRIAL USE

Complementary to TIP140F/141F/142F

TO-3P(F)



1. Base 2. Collector 3. Emitter



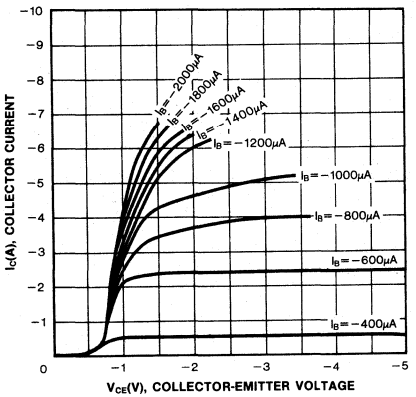
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
: TIP145F		−60	V
: TIP146F		−80	V
: TIP147F		−100	V
Collector Emitter Voltage	V_{CEO}		
: TIP145F		−60	V
: TIP146F		−80	V
: TIP147F		−100	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−10	A
Collector Current (Pulse)	I_C	−15	A
Base Current (DC)	I_B	−0.5	A
Collector Dissipation	P_C	60	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

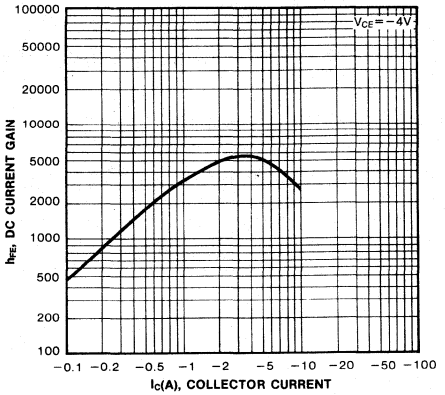
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)					
: TIP145F		I_C = −30mA, I_B = 0	−60			V
: TIP146F			−80			V
: TIP147F			−100			V
Collector Cutoff Current : TIP145F	I_{CEO}	V_{CE} = −30V, I_B = 0			−2	mA
: TIP146F		V_{CE} = −40V, I_B = 0			−2	mA
: TIP147F		V_{CE} = −50V, I_B = 0			−2	mA
Collector Cutoff Current : TIP145F	I_{CBO}	V_{CB} = −60V, I_E = 0			−1	mA
: TIP146F		V_{CB} = −80V, I_E = 0			−1	mA
: TIP147F		V_{CB} = −100V, I_E = 0			−1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE} = −5V, I_C = 0			−2	mA
DC Current Gain	h_{FE}	V_{CE} = −4V, I_C = −5A	1000			
		V_{CE} = −4V, I_C = −10A	500			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C = −5A, I_B = −10mA			−2	V
		I_C = −10A, I_B = −40mA			−3	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C = −10A, I_B = −40mA			−3.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE} = −4V, I_C = −10A			−3	V
Delay Time	t_d	V_{CC} = −30V, I_C = −5A		0.15		μS
Rise Time	t_r	I_B = −20mA, I_{B1} = I_{B2}		0.55		μS
Storage Time	t_S			2.5		μS
Fall Time	t_f			2.5		μS

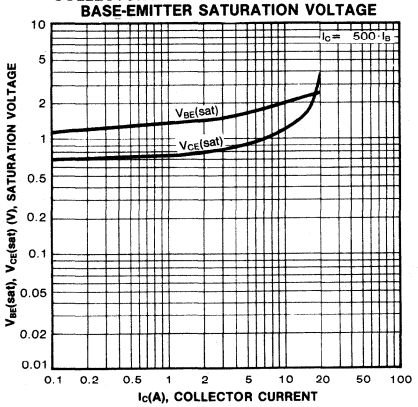
STATIC CHARACTERISTIC



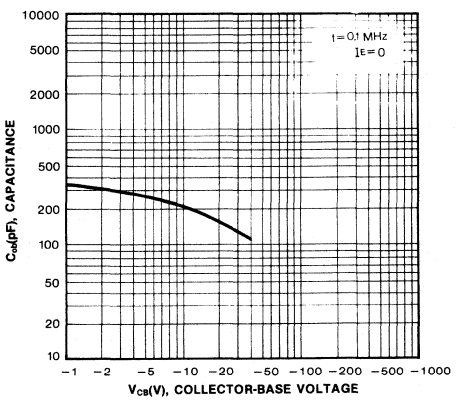
DC CURRENT GAIN



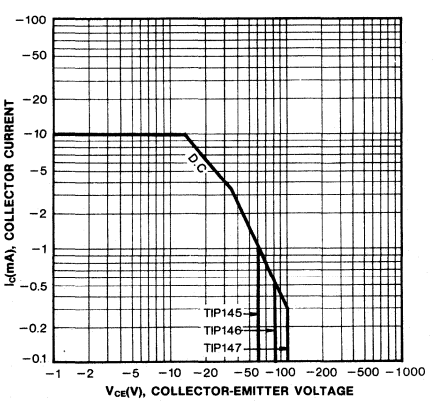
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



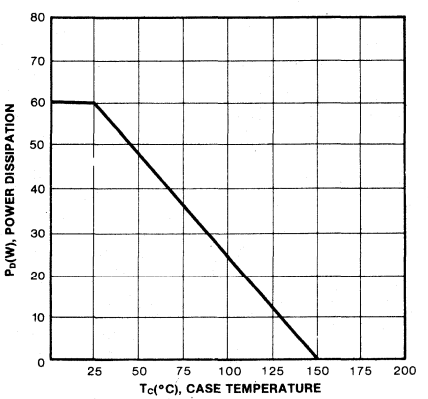
COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA



POWER DERATING

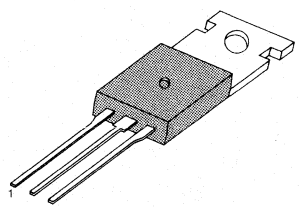


HIGH DC CURRENT GAIN-MIN hFE=1000 @ Vce=−4V, Ic=−5A

MONOLITHIC CONSTRUCTION WITH BUILT IN BASE-EMITTER SHUNT RESISTORS DINDUSTRIAL USE

Complementary to TIP140T/141T/142T

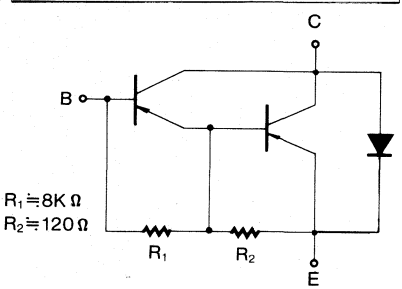
TO-220



1. Base 2. Collector 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

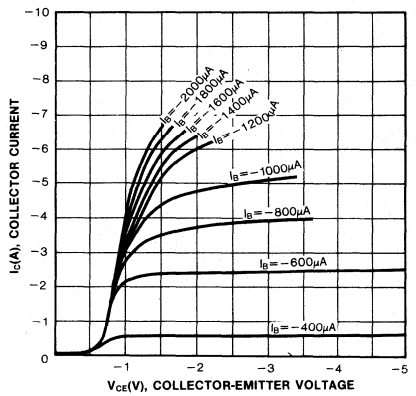
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : TIP145T	V_{CBO}	−60	V
: TIP146T		−80	V
: TIP147T		−100	V
Collector-Emitter Voltage	V_{CEO}		
: TIP145T		−60	V
: TIP146T		−80	V
: TIP147T		−100	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−10	A
Collector Current (Pulse)	I_C	−15	A
Base Current (DC)	I_B	−0.5	A
Collector Dissipation	P_C	80	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C



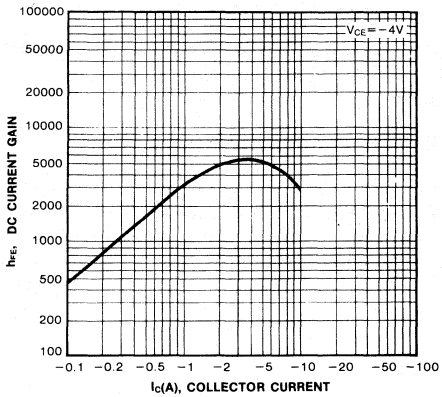
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO}(sus)					
: TIP145T		I_C=−30mA, I_B=0	−60			V
: TIP146T			−80			V
: TIP147T			−100			V
Collector Cutoff Current : TIP145T	I_{CEO}	V_{CE}=−30V, I_B=0			−2	mA
: TIP146T		V_{CE}=−40V, I_B=0			−2	mA
: TIP147T		V_{CE}=−50V, I_B=0			−2	mA
Collector Cutoff Current : TIP145T	I_{CBO}	V_{CB}=−60V, I_E=0			−1	mA
: TIP146T		V_{CB}=−80V, I_E=0			−1	mA
: TIP147T		V_{CB}=−100V, I_E=0			−1	mA
Emitter Cutoff Current	I_{EBO}	V_{BE}=−5V, I_C=0			−2	mA
DC Current Gain	h_{FE}	V_{CE}=−4V, I_C=−5A	1000			
		V_{CE}=−4V, I_C=−10A	500			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−5A, I_B=−10mA			−2	V
		I_C=−10A, I_B=−40mA			−3	V
Base Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10A, I_B=−40mA			−3.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−4V, I_C=−10A			−3	V
Delay Time	td	V_{CC}=−30V, I_C=−5A		0.15		μS
Rise Time	tr	I_B=−20mA, I_B1=1b2		0.55		μS
Storage Time	ts			2.5		μS
Fall Time	tf			2.5		μS

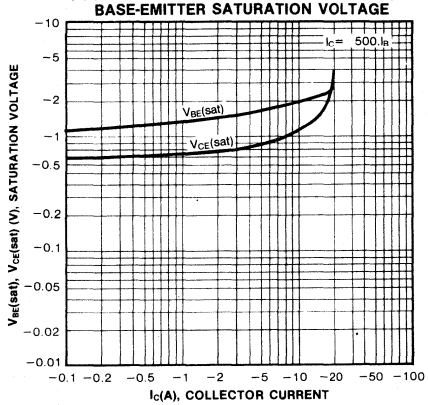
STATIC CHARACTERISTIC



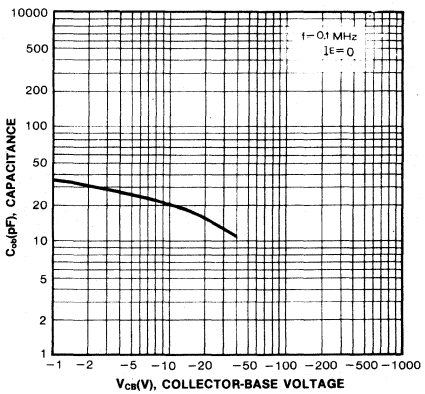
DC CURRENT GAIN



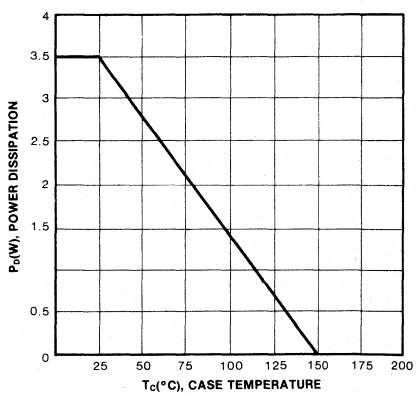
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



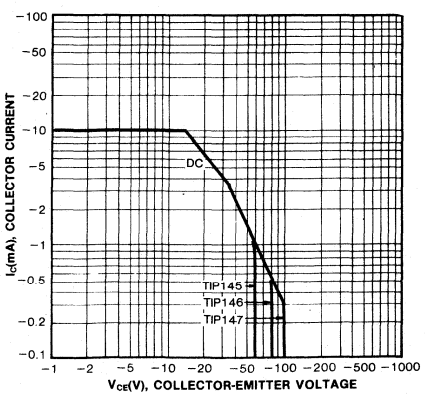
COLLECTOR OUTPUT CAPACITANCE



POWER DERATING



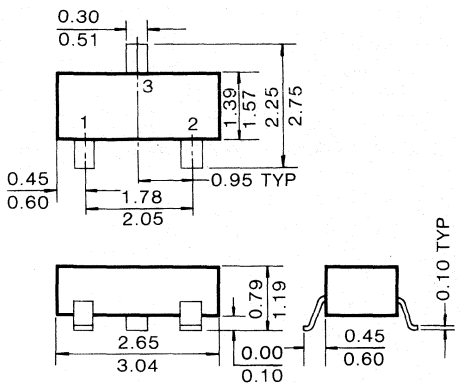
SAFE OPERATING AREA



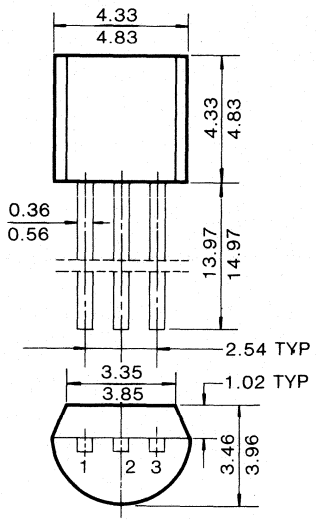
PACKAGE DIMENSIONS 4

PACKAGE DIMENSIONS

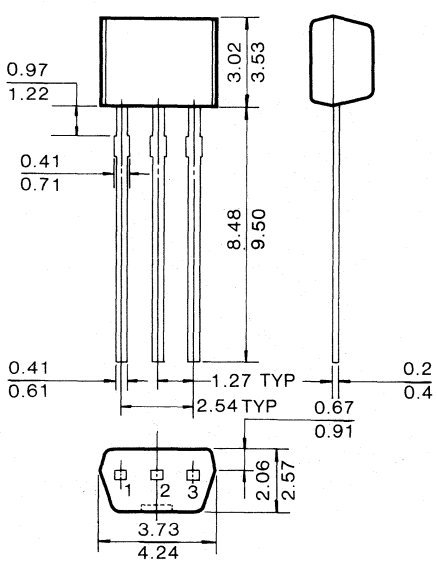
SOT-23 Unit: mm



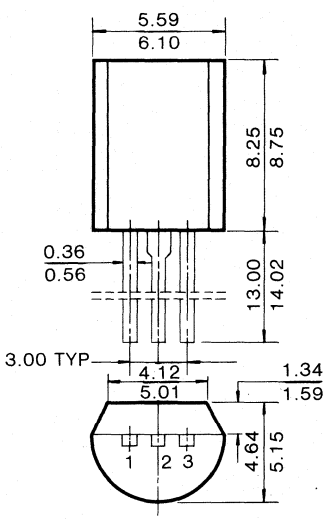
TO-92 Unit: mm



TO-92S Unit: mm



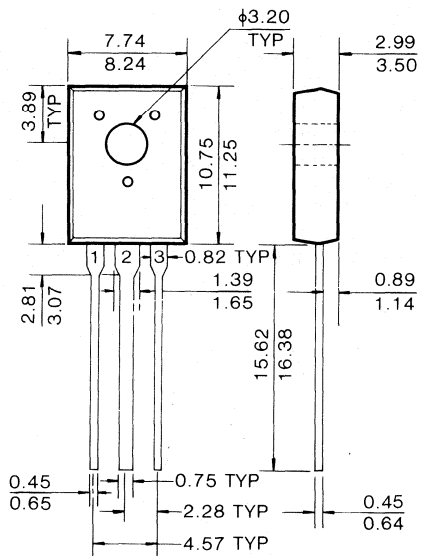
TO-92L Unit: mm



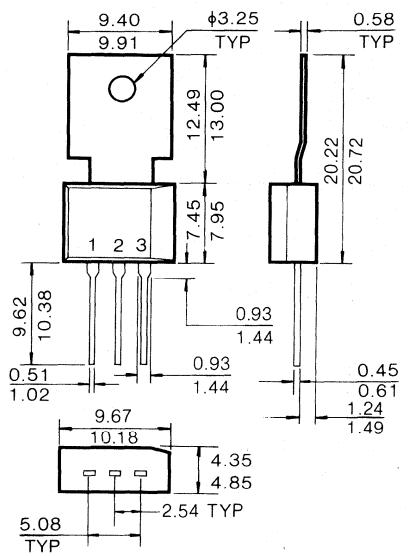
4

PACKAGE DIMENSIONS

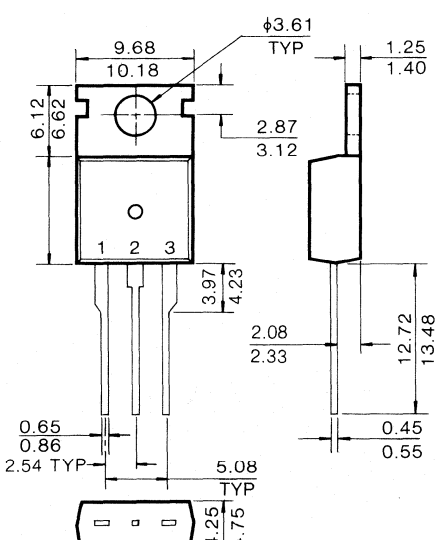
TO-126 Unit: mm



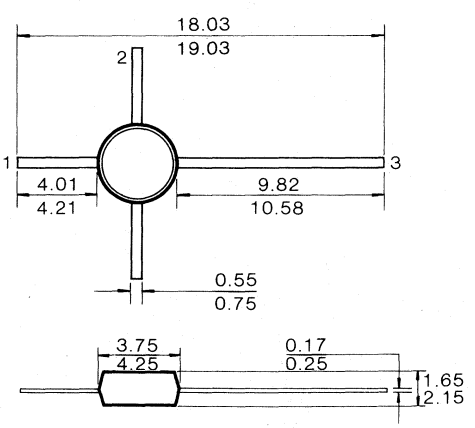
TO-202 Unit: mm



TO-220 Unit: mm



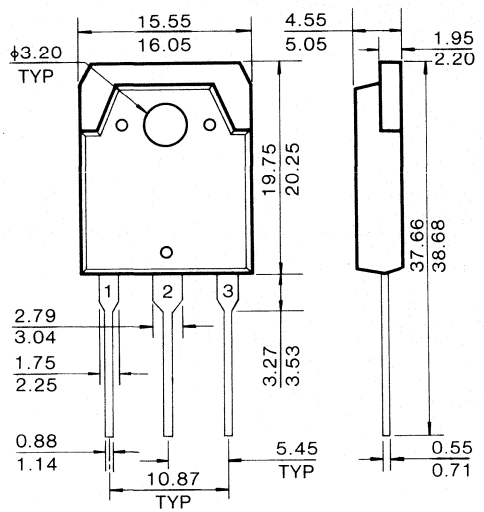
DISK TR Unit: mm



PACKAGE DIMENSIONS

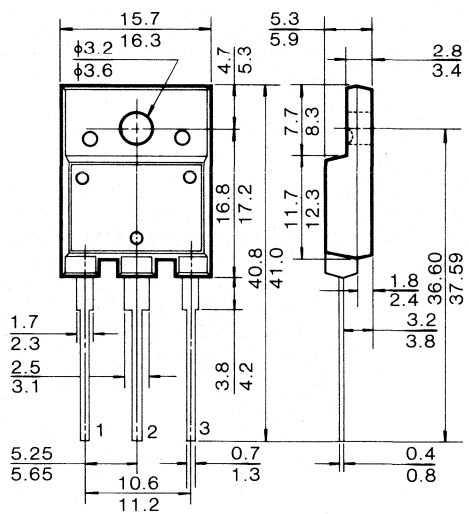
TO-3P

Unit: mm



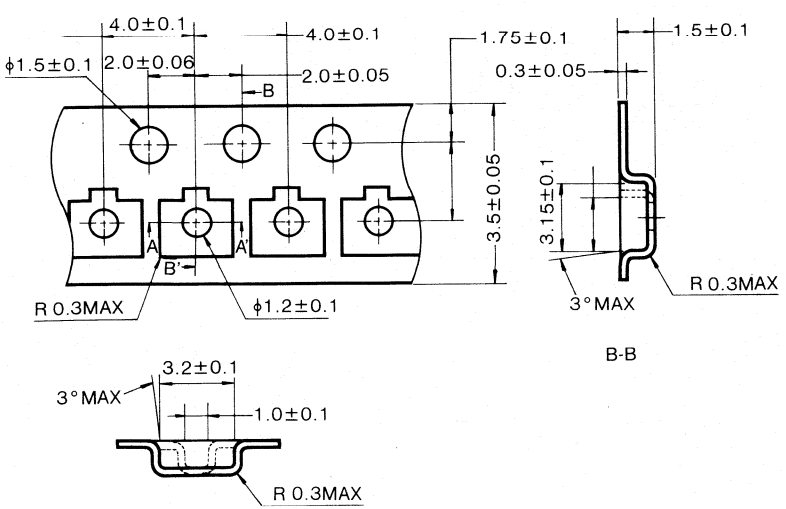
TO-3P(F)

Unit: mm



EMBOSSED CARRIER Specification for SOT-23

Unit: mm

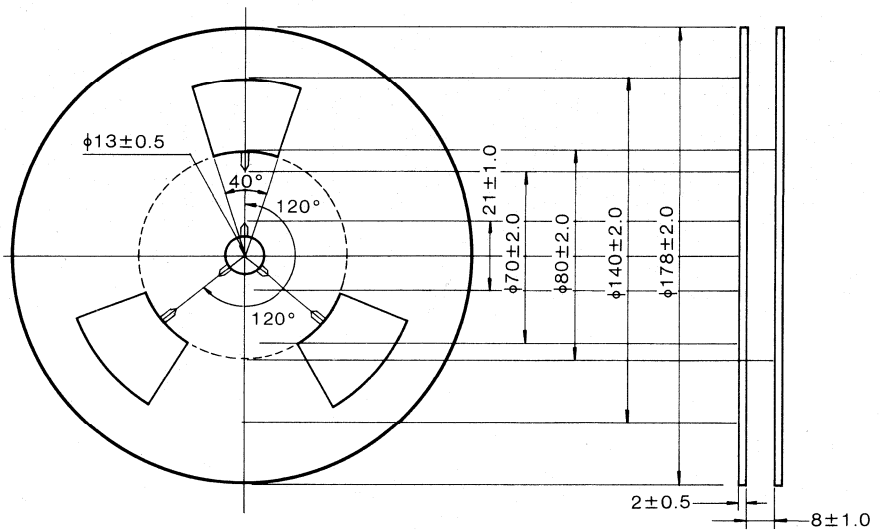


4

PACKAGE DIMENSIONS

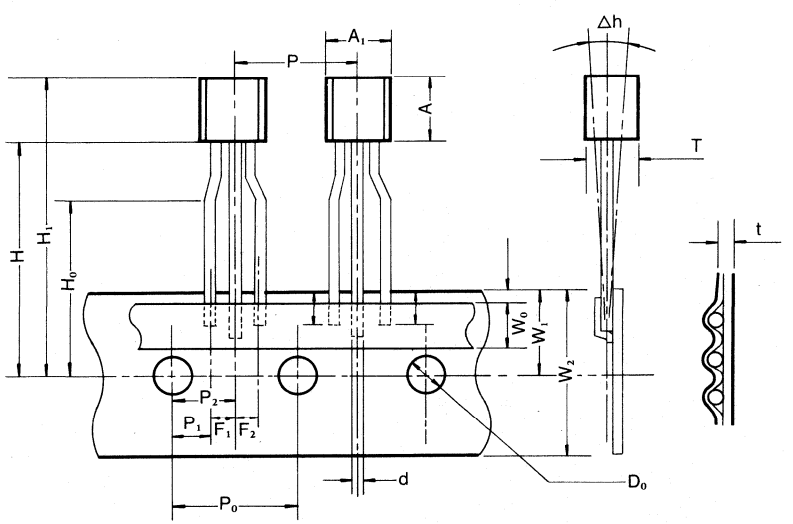
CARRIER TAPE REELS

Unit: mm



TO-92 TAPING SPECIFICATION

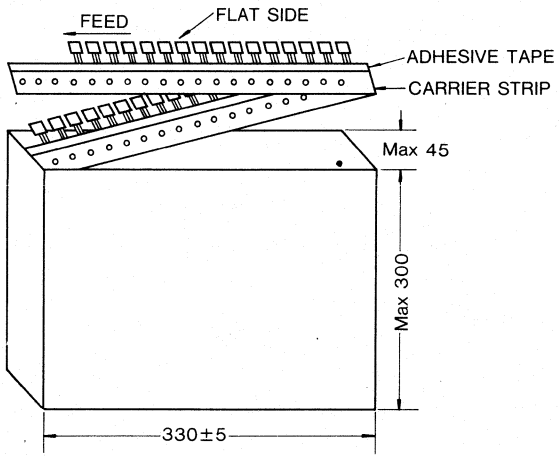
Unit: mm



P	12.7±0.5
P_0	12.7±0.2
P_1	3.85±0.5
P_2	6.35±0.5
W	$18^{+1.0}_{-0.5}$
W_0	6±0.5
W_1	9±0.5
W_2	Max. 0.5
H	Max. 21
H_1	Max. 27
H_0	16±0.5
F	$5^{+0.8}_{-0.2}$
F_1-F_2	±0.3
D_0	4±0.2
t	0.65±0.2
Δh	C±1
d	0.46
T	3.56
L_1	Min. 2.5

TO-92 AMMO PACK

Unit: mm

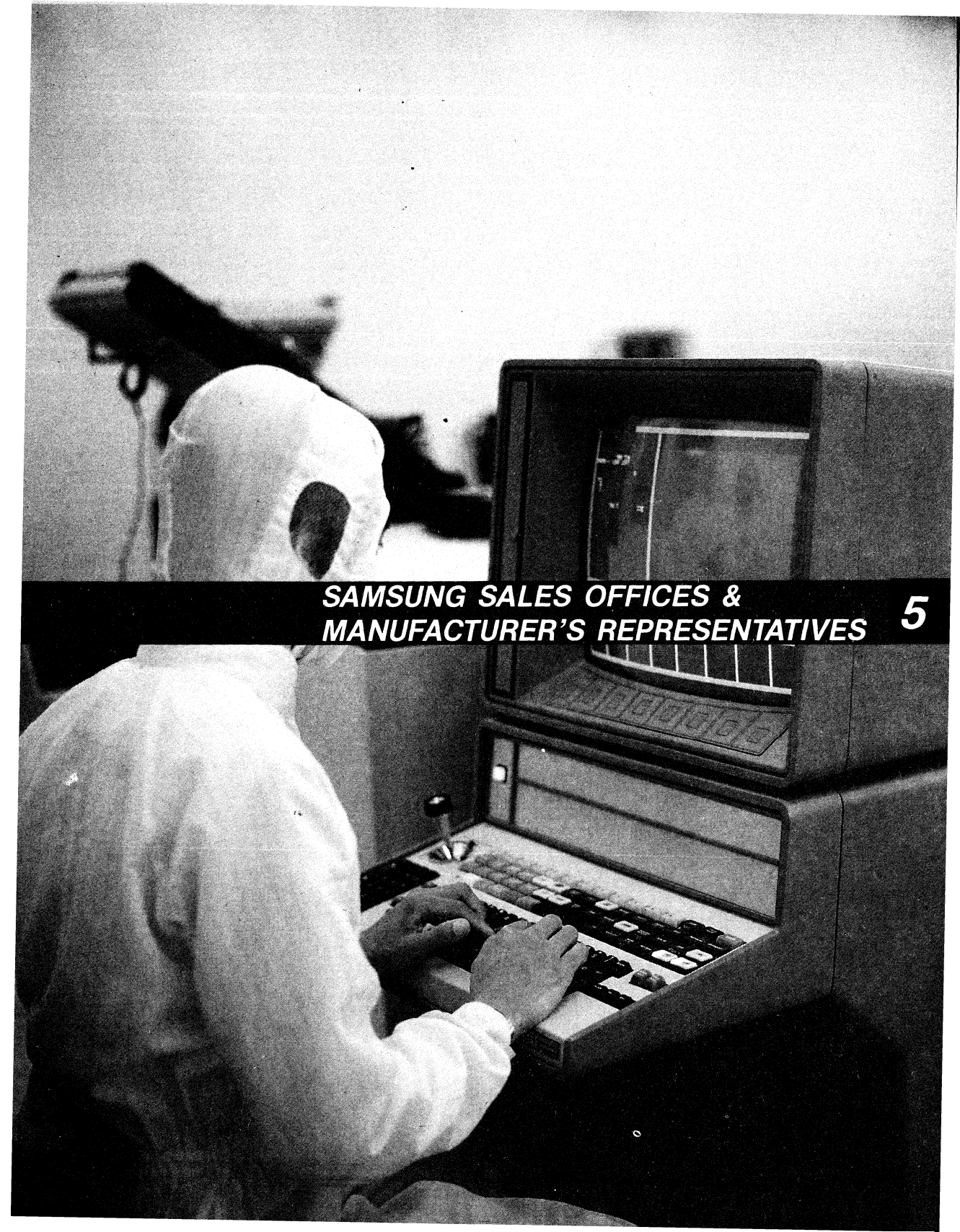


FLAT SIDE OF TRANSISTOR and ADHESIVE TAPE VISIBLE

SAMSUNG's AMMO PACK is equivalent to styles A,B,C,D of reel pack depending on which box-flat is opened and which end of the box the devices are fed from.

1 AMMO PACK contains 2000 pcs Transistors.

NOTES



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