The Power Semiconductor Data Book

Design Engineers

First Edition

TEXAS INSTRUMENTS
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THE POWER SEMICONDUCTOR DATA BOOK

From the earliest days of transistors, semiconductor circuit designers have needed devices capable of handling the *power* functions of their equipment.

The past twenty years in the semiconductor industry have brought extensive development of power products—germanium power transistors, silicon power transistors, thyristors, and more recently, power function modules. The future will certainly bring even further developments in power devices and functions.

Along with advancements in integrated circuit technology, improvements in power devices will aid equipment design engineers in their efforts toward continual enhancement of functional utility, cost effectiveness, and reliability of designs.

In this 800-page data book, Texas Instruments is pleased to catalog important power semiconductor products available in the industry, and to present technical information on TI's broad line of power transistors, thyristors, and power function products.

You will find essential design information on Germanium and Silicon Power Transistors, SCR's, Triacs, and Power Function modules. In Silicon Power, TI's extensive product line encompasses high-voltage as well as low-voltage, high-safe-operating-area (SOA) designs, power Darlingtons, fast switching types, radiation-tolerant designs, JAN and JANTX types, and both metal can and plastic package types.

Most of the silicon power devices, as well as a broad range of SCR's and Triacs, are offered in TI's specially designed plastic packages. These designs incorporate glass-passivated junctions with thermally-matched epoxy and piece-parts, for high reliability—plus the adaptability for high-volume, cost-effective production.

Section 8 features the Technical Response Lab (TRL). The TRL facility provides a broad capability for custom designs to meet special needs. This capability includes custom silicon chip design for specific electrical performance, together with custom packaging techniques for reliable performance of devices under unique environmental conditions. These high-volume, low-cost, highly-reliable devices, on one hand, and high-performance, custom designs for special applications, on the other, represent TI's two-fold approach to the power market. Thus product coverage is broad, with the capability of serving a very wide range of customer needs.

The data book indices are designed with margin tabs for ease in location of data sheets for specific products, as well as general information categories. Included are an alpha-numeric index to product data sheets and product cross-reference and selection guides.

We sincerely hope you will find this Power Semiconductor Data Book for Design Engineers a valuable addition to your technical library. It represents TI experience since the early 1950's in the design and manufacture of power semiconductor products.

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POWER TRANSISTORS

POWER TRANSISTOR SAFETY CONSIDERATIONS

The designer, maker, and user of electrical equipment containing power transistors should give attention to the following points relative to the safety of personnel that may operate the equipment.

The electrical potentials of the collector, emitter, and base terminals on the transistor present an electrical shock hazard when the equipment is energized.

The normal operating case temperature of energized transistors is often high enough to present burn hazards to both operating personnel and flammable material touching the transistor.

If the transistor is falsely turned "on" or fails, power will be applied to the equipment load. Operator safety may be affected by an unexpected energizing of the load.

In the event that an equipment output short or internal fault condition develops, very high surge current can be passed through the transistor. If this condition exceeds transistor ratings for magnitude and duration, the transistor may be damaged; *and if the surge is severe enough, internal heating can cause the transistor to rupture and perhaps sustain an* arc.

POWER TRANSISTOR STANDARDS

Following are sources of standard material relating to Power Transistors:

EIA and JEDEC Standards:
Electronic Industries Association
2001 Eye St. N.W., Washington, D.C. 20006
Telephone: 202-659-2200

JC-25 Power Transistor Registration Formats RDF-1 to RDF-6

Test Procedures for Verification of Maximum Ratings of Power Transistors—JEDEC Publication No.65

Thermal Resistance Measurements of Conduction Cooled Power Transistors—EIA Standard RS-313-A

JEDEC Recommendations for Letter Symbols, Abbreviations, Terms, and Definitions for Semiconductor Device Data Sheets and Specifications—JEDEC Publication No. 77

Standard List of Values to be used in Power Transistor Device Registration and Minimum Differences for Discretness of Registration—JEDEC Publication NO. 74

IEC Standards

American National Standards Institute, Inc.
1430 Broadway
New York, N. Y. 10018
Telephone: 212-868-1220

IEC Publication 147: Essential Ratings and Characteristics of Semiconductor Devices and General Principles of Measuring Methods.

IEC Publication 148: Letter Symbols for Semiconductor Devices and Integrated Microcircuits

IEC Publication 191: Mechanical Standardization of Semiconductor Devices.

Military Standards
Commanding Officer, U.S. Naval Publications and Forms Center,
5801 Tabor Avenue, Philadelphia, Pa., 19120.

MIL-S-19500: Semiconductor Devices, General Specification for

MIL-STD-105: Sampling Procedures and Tables for Inspection by Attributes

MIL-STD-202: Test Methods for Electronic and Electrical Component Parts

MIL-STD-750: Test Methods for Semiconductor Devices

MIL-STD-883: Test Methods and Procedures for Microelectronics

POWER TRANSISTOR TERMS, DEFINITIONS, AND LETTER SYMBOLS

Introduction

This part contains letter symbols, abbreviations, terms, and definitions commonly used with Power Transistors. Most of the information was obtained from JEDEC Publication No. 77. This document and the JC-25 JEDEC registration formats have over-riding authority where any conflict may occur.

Power Transistor Terms and Definitions

Term	Definition
base (B, b)*	A region which lies between an emitter and collector of a transistor and into which minority carriers are injected. (Ref. 60 IRE 28.S1)
breakdown	A phenomenon occurring in a reverse-biased semiconductor junction, the initiation of which is observed as a transition from a region of high small-signal resistance to a region of substantially lower small-signal resistance for an increasing magnitude of reverse current. (Ref RS-282 par. 1.38)
breakdown region	A region of the volt-ampere characteristic beyond the initiation of breakdown for an increasing magnitude of reverse current. (Ref RS-282 par. 1.37)
breakdown voltage	The voltage measured at a specified current in a breakdown region. (Ref MIL-S-19500D par. 20.3)
collector (C, c)*	A region through which a primary flow of charge carriers leaves the base. (Ref. 60 IRE 28.S1)
emitter (E, e)*	A region from which charge carriers that are minority carriers in the base are injected into the base. (Ref. 60 IRE 28.S1)
junction, collector	A semiconductor junction normally biased in the high-resistance direction, the current through which can be controlled by the introduction of minority carriers into the base. (Ref. 60 IRE 28.S1)
junction, emitter	A semiconductor junction normally biased in the low-resistance direction to inject minority carriers into the base. (Ref. 60 IRE 28.S1)
open-circuit	A circuit shall be considered as open-circuited if halving the magnitude of the terminating impedance does not produce a change in the parameter being measured greater than the required accuracy of the measurement. (Ref MIL-S-19500D par. 20.8)
reverse current	The current that flows through a semiconductor junction in the reverse direction.

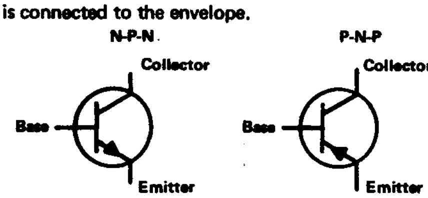
*NOTE: References to base, collector, and emitter symbolism (B, b, C, c, E, and e) refer to the device terminals connected to those regions.

Term	Definition
reverse direction	The direction of current flow which results when the n-type semiconductor region is at a positive potential relative to the p-type region.
saturation	A base-current and a collector-current condition resulting in a forward-biased collector junction.
second breakdown	A condition of the transistor, resulting from a lateral current instability, in which the electrical characteristics are determined principally by the spreading resistance of a thermally maintained current constriction. The initiation of second breakdown is observed as a decrease in the voltage sustained by the collector. NOTE: Second breakdown differs from thermal failure in that its initiation can not be predicted from low-voltage thermal resistance measurements. Unless the current and duration in second breakdown are limited, the high junction temperature at the current constriction will result in failure, usually as a collector-to-emitter short-circuit. Second breakdown can occur at postitive, negative, or zero base current. (To protect a transistor against second breakdown, see section: "Safe Operating Areas for Power Transistors.")
semiconductor device	A device whose essential characteristics are due to the flow of charge carriers within a semiconductor. (Ref. RS-282 par. 1.09)
semiconductor junction	A region of transition between semiconductor regions of different electrical properties (e.g., n-n+, p-n, p-p+ semiconductors), or between a metal and a semiconductor. (Ref. RS-282 par. 1.0)
short-circuit	A circuit in which doubling the magnitude of the terminating impedance does not produce a change in the parameter being measured that is greater than the required accuracy of the measurement. (Ref. MIL-S-19500D par. 20.16)
small-signal	A signal which when doubled in magnitude does not produce a change in the parameter being measured that is greater than the required accuracy of the measurement. (Ref. MIL-S-19500D par. 20.17)
static value	A non-varying value or quantity of measurement at a specified fixed point, or the slope of the line from the origin to the operating point on the appropriate characteristic curve. (Ref. IEEE #255 par. 2.2.1)
terminal	An externally available point of connection to one or more electrodes. (Ref. RS-282 par. 1.14)
thermal resistance (steady-state)	The temperature difference between two specified points or regions divided by the power dissipation under conditions of thermal equilibrium. (Ref. IEEE #223)

Term	Definition
transient thermal impedance	The change of temperature difference between two specified points or regions at the end of a time interval divided by the step function change in power dissipation at the beginning of the same time interval causing the change of temperature difference. (Ref. IEEE #223)
transistor	An active semiconductor device capable of providing power amplification and having three or more terminals. (Ref. IEC #147-0 par. 0-2.8)
transistor, junction, multijunction type . . .	A transistor having a base and two or more junctions.

Graphic symbols for emitter, base, collector transistors: (Ref. ANS Y32.2)

NOTE: In the graphic symbols, the envelope is optional if no element is connected to the envelope.



Power Transistor Letter Symbols, Terms, and Definitions

Symbol	Term	Definition
C_{ibo}	open-circuit input capacitance	The capacitance measured across the input terminals (emitter and base) with the collector open-circuited for ac. (Ref. IEEE #255)
C_{obo}	open-circuit output capacitance	The capacitance measured across the output terminals (collector and base) with the input open-circuited to ac. (Ref. IEEE #255)
f_{hfe}	small-signal short-circuit forward current transfer ratio cutoff frequency (common-emitter)	The lowest frequency at which the magnitude of the small-signal short-circuit forward current transfer ratio is 0.707 of its value at a specified low frequency (usually 1 kHz or less). (Ref. IEEE #255)
f_T	transition frequency or frequency at which small-signal forward current transfer ratio (common-emitter) extrapolates to unity	The product of the modulus (magnitude) of the common-emitter small-signal short-circuit forward current transfer ratio, h_{fe}, and the frequency of measurement when this frequency is sufficiently high so that the modulus (magnitude) of h_{fe} is decreasing with a slope of approximately 6 dB per octave. (Ref. IEEE #255)
G_{PE}	large-signal insertion power gain (common-emitter)	The ratio, usually expressed in dB, of the signal power delivered to the load to the large-signal power delivered to the input.
h_{FE}	static forward current transfer ratio (common-emitter)	The ratio of the dc collector current to the dc base current. (Ref. MIL-S-19500D par. 30.28)
h_{fe}	small-signal short-circuit forward current transfer ratio (common-emitter)	The ratio of the ac collector current to the small-signal ac base current with the collector short-circuited to the emitter for ac. (Ref. MIL-S-19500D par. 30.20)
h_{IE}	static input resistance (common-emitter)	The ratio of the dc base-emitter voltage to the dc base current. (Ref. MIL-S-19500D par. 30.29)
h_{ie}	small-signal short-circuit input impedance (common-emitter)	The ratio of the small-signal ac base-emitter voltage to the ac base current with the collector short-circuited to the emitter for ac. (Ref. MIL-S-19500D par. 30.24)
$h_{ie(imag)}$	imaginary part of the small-signal short-circuit input impedance, (common-emitter)	The ratio of the out-of-phase (imaginary) component of the small-signal ac base-emitter voltage to the ac base current with the collector terminal short-circuited to the emitter terminal for ac.
$h_{ie(real)}$	real part of the small-signal short-circuit input impedance, (common-emitter)	The ratio of the in-phase (real) component of the small-signal ac base-emitter voltage to the ac base current with the collector terminal short-circuited to the emitter terminal for ac.
h_{oe}	small-signal open-circuit output admittance, (common-emitter)	The ratio of the ac collector current to the small-signal ac collector-emitter voltage with the base terminal open-circuited to ac. (Ref. MIL-S-19500D par. 30.15)

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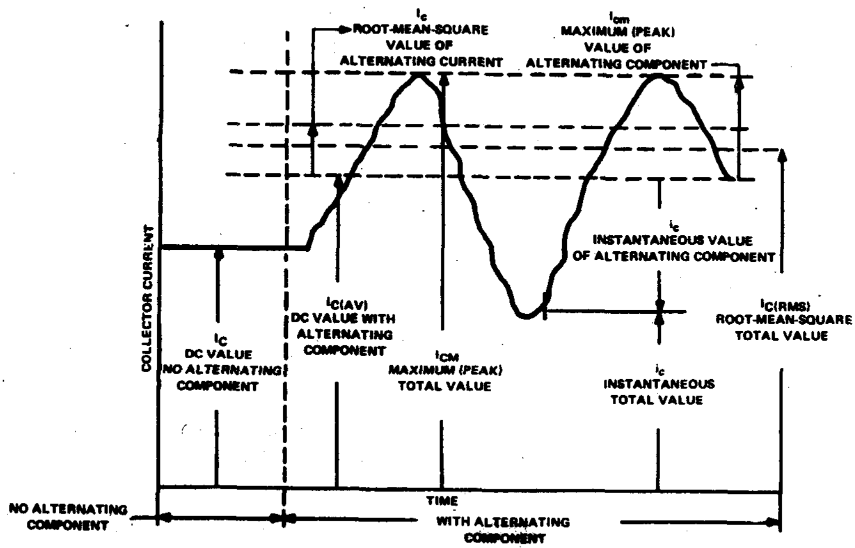
Symbol	Term	Definition
$h_{oe(imag)}$	imaginary part of the small-signal open-circuit output admittance, (common-emitter)	The ratio of the ac collector current to the out-of-phase (imaginary) component of the small-signal collector-emitter voltage with the base terminal open-circuited to ac.
$h_{oe(real)}$	real part of the small-signal open-circuit output admittance, (common-emitter)	The ratio of the ac collector current to the in-phase (real) component of the small-signal collector-emitter voltage with the base terminal open-circuited to ac.
I_B, I_C, I_E	current, dc (base-terminal, collector-terminal, emitter-terminal)	The value of the dc current into the terminal indicated by the subscript.
I_b, I_c, I_e	current, rms value of alternating component (base-terminal, collector-terminal, emitter-terminal)	The root-mean-square value of alternating current into the terminal indicated by the subscript.
i_B, i_C, i_E	current, instantaneous total value (base-terminal, collector-terminal, emitter-terminal)	The instantaneous total value of alternating current into the terminal indicated by the subscript.

DIAGRAM ILLUSTRATING FOREGOING CURRENTS (Ref IEEE # 255)



Symbol	Term	Definition
I_{CBO}	collector cutoff current, dc, emitter open	The dc current into the collector terminal when it is biased in the reverse direction with respect to the base terminal and the emitter terminal is open-circuited. (Ref. IEEE #255)

TERMS AND DEFINITIONS
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Symbol	Term	Definition
I_{CEO}	collector cutoff current, dc (base open	The dc current into the collector terminal when it is biased in the reverse direction* with respect to the emitter terminal and the base terminal is (as indicated by the first subscript letter as follows): O = open-circuited R = returned to the emitter terminal through a specified resistance. S = short-circuited to the emitter terminal. V = returned to the emitter terminal through a specified voltage. X = returned to the emitter terminal through a specified circuit. (Ref. IEEE #255)
I_{CER}	resistance between base and emitter,	
I_{CES}	base short-circuited to emitter,	
I_{CEV}	voltage between base and emitter,	
I_{CEX}	circuit between base and emitter)	
I_{EBO}	emitter cutoff current, dc, collector open	The dc current into the emitter terminal when it is baised in the reverse direction with respect to the base terminal and the collector terminal open-circuited. (Ref. IEEE #255)
P_{BE}	power input, dc (to the base, common-emitter)	The product of the dc input current and voltage with the common-emitter circuit configuration.
p_{BE}	power input; instantaneous total (to the base, common-emitter)	The product of the instantaneous input current and voltage with the common-emitter circuit configuration.
P_{OE}	large-signal output power (common-emitter)	The product of the large-signal ac output current and voltage with the common-emitter circuit configuration.
P_T	total nonreactive power input to all terminals	The sum of the products of the dc input currents and voltages, i.e.. $V_{BE} \cdot I_B + V_{CE} \cdot I_C$ or $V_{BE} \cdot I_E + V_{CB} \cdot I_C$
p_T	nonreactive power input, instantaneous total, to all terminals	The sum of the products of the instantaneous input currents and voltages.
$r_b'C_c$	collector-base time constant	The product of the intrinsic base resistance and collector capacitance under specified small-signal conditions.

*For these parameters, the collector terminal is considered to be biased in the reverse direction when it is made positive for N-P-N transistors or negative for P-N-P transistors with respect to the emitter terminal.

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Symbol	Term	Definition
R_θ (formerly θ)	thermal resistance	Refer to thermal resistance (steady state), page 1-4.
$R_{\theta CA}$	thermal resistance case-to-ambient	The thermal resistance (steady-state) from the device case to the ambient.
$R_{\theta JA}$ (formerly θ_{J-A})	thermal resistance junction-to-ambient	The thermal resistance (steady-state) from the semiconductor junction (s) to the ambient.
$R_{\theta JC}$ (formerly θ_{J-C})	thermal resistance junction-to-case	The thermal resistance (steady-state) from the semiconductor junction (s) to a stated location on the case.
$R_{\theta JM}$	thermal resistance junction-to-mounting surface	The thermal resistance (steady-state) from the semiconductor junction (s) to a stated location on the mounting surface.
T_A	ambient temperature or free-air temperature	The air temperature measured below a device, in an environment of substantially uniform temperature, cooled only by natural air convection and not materially affected by reflective and radiant surfaces. (Ref. MIL-S-19500D par. 20.20.1)
T_C	case temperature	The temperature measured at a specified location on the case of a device. (Ref. MIL-S-19500D par. 20.20.2)
T_J	virtual junction temperature	A theoretical temperature based on a simplified representation of the thermal and electrical behavior of the semiconductor device. NOTE: This term (and its definition) is taken from IEC standards. It is particularly applicable to multi-junction semiconductors and is used in this publication to denote the temperature of the active semiconductor element when required in specifications and test methods. The term "junction temperature" is used interchangeably with the term "virtual junction temperature" in this publication.
T_{stg}	storage temperature	The temperature at which the device, without any power applied, is stored. (Ref. MIL-S-19500D par. 20.20.3)
t_d	delay time	The time interval from the point at which the leading edge of the input pulse has reached 10 percent of its maximum amplitude to the point at which the leading edge of the output pulse has reached 10 percent of its maximum amplitude. (Ref. MIL-S-19500D par. 20.13)
t_f	fall time	The time duration during which the trailing edge of a pulse is decreasing from 90 to 10 percent of its maximum amplitude. (Ref. MIL-S-19500D par. 20.12)

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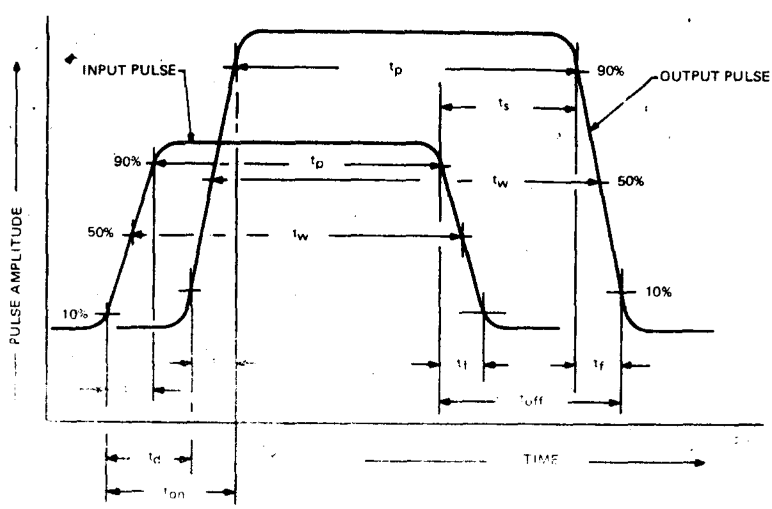
Symbol	Term	Definition
t_{off}	turn-off time	The sum of $t_s + t_f$.
t_{on}	turn-on time	The sum of $t_d + t_r$.
t_p	pulse time	The time duration from the point on the leading edge which is 90 percent of the maximum amplitude to the point on the trailing edge which is 90 percent of the maximum amplitude. (Ref. MIL-S-19500D par. 20.15)
t_r	rise time	The time duration during which the amplitude of the leading edge of a pulse is increasing from 10 to 90 percent of its maximum amplitude. (Ref. MIL-S-19500D par. 20.13)
t_s	storage time	The time interval from a point 90 percent of the maximum amplitude on the trailing edge of the input pulse to a point 90 percent of the maximum amplitude on the trailing edge of the output pulse. (Ref. MIL-S-19500D par. 20.14)
t_w	pulse average time	The time duration from the point on the leading edge which is 50 percent of the maximum amplitude to a point on the trailing edge which is 50 percent of the maximum amplitude. (Ref. MIL-S-19500D par. 20.10)

DIAGRAM ILLUSTRATING PULSE TIME SYMBOLOGY



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Symbol	Term	Definition
$V_{(BR)CBO}$ (formerly BV_{CBO})	breakdown voltage collector-to-base, emitter open	The breakdown voltage between the collector terminal and the base terminal when the collector terminal is biased in the reverse direction with respect to the base terminal and the emitter terminal is open-circuited. (Ref. IEEE #255)
$V_{(BR)CEO}$, (formerly BV_{CEO})	breakdown voltage, collector-to-emitter with (base open,	The breakdown voltage between the collector terminal and the emitter terminal when the collector terminal is biased in the reverse direction* with respect to the emitter terminal and the base terminal is (as indicated by the last subscript letter as follows): O = open-circuited. R = returned to the emitter terminal through a specified resistance. S = short-circuited to the emitter terminal. V = returned to the emitter terminal through a specified voltage. X = returned to the emitter terminal through a specified circuit. (Ref. IEEE #255)
$V_{(BR)CER}$, (formerly BV_{CER})	resistance between base and emitter,	
$V_{(BR)CES}$, (formerly BV_{CES})	base short-circuited to emitter,	
$V_{(BR)CEV}$, (formerly BV_{CEV})	voltage between base and emitter,	
$V_{(BR)CEX}$ (formerly BV_{CEX})	circuit between base and emitter)	
$V_{(BR)EBO}$, (formerly BV_{EBO})	breakdown voltage, emitter-to-base, collector open	The breakdown voltage between the emitter and base terminals when the emitter terminal is biased in the reverse direction with respect to the base terminal and the collector terminal is open-circuited. (Ref. IEEE #255)
V_{BB}, V_{CC}, V_{EE}	supply voltage, dc (base, collector, emitter)	The dc supply voltage applied to a circuit connected to the reference terminal.
V_{BC},	voltage, dc or average (base-to-collector,	The dc voltage between the terminal indicated by the first subscript and the reference terminal (stated in terms of the polarity at the terminal indicated by the first subscript).
V_{BE},	base-to-emitter,	
V_{CB},	collector-to-base,	
V_{CE}	collector-to-emitter,	
V_{EB},	emitter-to-base,	
V_{EC}	emitter-to-collector)	
$V_{BE(sat)}$	saturation voltage, dc, base-to-emitter	The dc voltage between the base and emitter terminals for specified base-current and collector-current conditions which are intended to ensure that the collector junction is forward-biased.

*For these parameters, the collector terminal is considered to be biased in the reverse direction when it is made positive for N-P-N transistors or negative for P-N-P transistors with respect to the emitter terminal.

TERMS AND DEFINITIONS
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Symbol	Term	Definition
V_{CBO}	collector-to-base voltage, dc, emitter open	The dc voltage between the collector terminal and the base terminal when the emitter terminal is open-circuited.
$V_{CE(sat)}$	saturation voltage, dc, collector-to-emitter	The dc voltage between the collector and the emitter terminals for specified saturation conditions. (Ref. IEEE #255)
V_{CEO}	collector-to-emitter voltage, dc, with (base open,	The dc voltage between the collector terminal and the emitter terminal when the base terminal is (as indicated by the last subscript letter):
V_{CER}	resistance between base and emitter,	O = open-circuited.
V_{CES}	base short-circuited to emitter,	R = returned to the emitter terminal through a specified resistance.
V_{CEV}	voltage between base and emitter,	S = short-circuited to the emitter terminal. V = returned to the emitter terminal through a specified voltage.
V_{CEX}	circuit between base and emitter)	X = returned to the emitter terminal through a specified circuit.
$V_{CEO(sus)}$	sustaining voltage, collector-to-emitter with (base open,	The collector-to-emitter breakdown voltage at relatively high values of collector current where the breakdown voltage is relatively insensitive to changes in collector current. The base terminal is (as indicated by the third subscript letter as follows):
$V_{CER(sus)}$	resistance between base and emitter,	O = open-circuited
$V_{CES(sus)}$	base short-circuited to emitter,	R = returned to the emitter terminal through a specified resistance
$V_{CEV(sus)}$	voltage between base and emitter,	S = short-circuited to the emitter terminal
$V_{CEX(sus)}$	circuit between base and emitter)	V = returned to the emitter terminal through a specified voltage. X = returned to the emitter terminal through a specified circuit. NOTE: This would be the transient voltage between the collector and emitter terminals during switching with an inductive load from a forward-biased base-emitter to an external condition described by the third subscript letter.
$V_{EB(fl)}$	dc open-circuit voltage (floating potential) (emitter-to-base)	The dc open-circuit voltage (floating potential) between the emitter terminal and the base terminal when the collector terminal is biased in the reverse direction with respect to the base terminal. (Ref. IEEE #255)

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Symbol	Term	Definition
V_{EBO}	emitter-to-base voltage, dc, collector open	The dc voltage between the emitter terminal and the base terminal with the collector terminal open-circuited.
$Z_{\theta}(t)$ (formerly $\theta_{(t)}$)	transient thermal impedance	Refer to transient thermal impedance, page 1-5.
$Z_{\theta JA}(t)$ (formerly $\theta_{J\text{-}A(t)}$)	transient thermal impedance, junction-to-ambient	The transient thermal impedance from the semiconductor junction (s) to the ambient.
$Z_{\theta JC}(t)$ (formerly $\theta_{JC(t)}$)	transient thermal impedance, junction-to-case	The transient thermal impedance from the semiconductor junction (s) to a stated location on the case.

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THYRISTORS

Thyristor Standards

The documents listed below have overriding authority where any conflict may occur with this data book.

EIA and JEDEC Standards

The thyristor terms and definitions presented in this data book were obtained from EIA Standards Proposal No. 1101. This standard is in the process of publication and will be available from:

Electronic Industries Association
2001 Eye St. N.W.,
Washington, D.C. 20006
Telephone: 202-659-2200

IEEE Standards

Institute of Electrical and Electronic Engineers, Inc.
345 East 47th. Street
New York, N.Y. 10017

IEEE No. 233: Standard Definitions of Terms for Thyristors

International Electrotechnical Commission Standards

American National Standards Institute, Inc.
1430 Broadway
New York, N.Y. 10018

IEC Publication 147-IC: Essential Ratings and Characteristics of Semiconductor Devices and General Principles of Measuring Methods

IEC Publication 148: Letter Symbols for Semiconductor Devices and Integrated Circuits

IEC Publication 191: Mechanical Standardization of Semiconductor Devices.

Military Standards

Commanding Officer, U.S. Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, Pa., 19120

MIL-S-19500: Semiconductor Devices, General Specification for

MIL-STD-105: Sampling Procedures and Tables for Inspection by Attributes

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MIL-STD-750: Test Methods for Semiconductor Devices

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