1991 HIGHWAY 22 WEST
BOUND BROOK, NEW JERSEY 08805

2N5683, 2N5684 PNP
2N5685, 2N5686 NPN

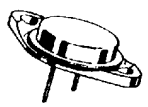
HIGH-CURRENT COMPLEMENTARY SILICON POWER TRANSISTORS

. designed for use in high-power amplifier and switching circuit applications.

- High Current Capability – I_C Continuous = 50 Amperes
- DC Current Gain –
  h_{FE} = 15 - 60 @ I_C = 25 Adc
- Low Collector Emitter Saturation Voltage -
  $V_{CE(sat)}$ = 1 0 Vdc (Max) @ I_C = 25 Adc

50 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS

60–80 VOLTS
300 WATTS



*MAXIMUM RATINGS

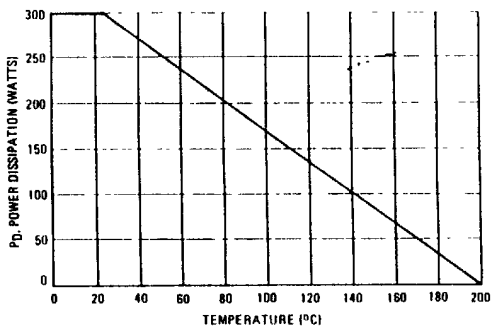
Rating	Symbol	2N5683 2N5685	2N5684 2N5686	Unit
Collector Emitter Voltage	V_{CEO}	60	80	Vdc
Collector Base Voltage	V_{CB}	60	80	Vdc
Emitter Base Voltage	V_{EB}	5 0		Vdc
Collector Current – Continuous	I_C	50		Adc
Base Current	I_B	15		Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	300 1 715		Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200		°C

*THERMAL CHARACTERISTICS

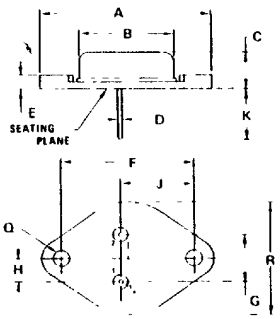
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	0 584	°C/W

*Indicates JEDEC Registered Data

FIGURE 1 – POWER DERATING



Safe Area Curves are indicated by Figure 5 All limits are applicable and must be observed



STYLE 1
PIN 1 BASE
2 EMITTER
CASE COLLECTOR

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	38 35	39 37	1 510	1 550
B	19 30	21 08	0 760	0 830
C	6 35	7 62	0 250	0 300
D	1 45	1 60	0 057	0 063
E	–	3 43	–	0 135
F	29 90	30 40	1.177	1 197
G	10 67	11 18	0 420	0 440
H	5 21	5 72	0.205	0 225
J	16 64	17 15	0 655	0 675
K	11 18	12 19	0 440	0 480
Q	3 84	4 09	0 151	0.161
R	24 89	26 67	0 980	1 050

CASE 197 01
TO 3 Except Pin Diameter

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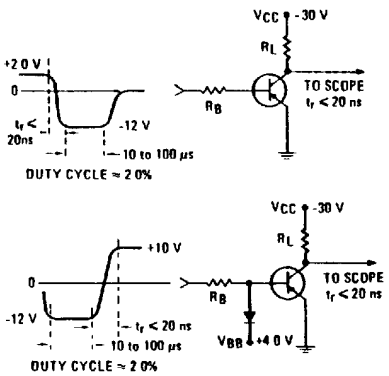
***ELECTRICAL CHARACTERISTICS** (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector Emitter Sustaining Voltage (Note 1) (I_C = 0.2 Adc, I_B = 0)	2N5683, 2N5685 2N5684, 2N5686	$V_{CEO(sus)}$	60 80	– –	Vdc
Collector Cutoff Current (V_{CE} = 30 Vdc, I_B = 0) (V_{CE} = 40 Vdc, I_B = 0)	2N5683, 2N5685 2N5684, 2N5686	I_{CEO}	– –	1.0 1.0	mAdc
Collector Cutoff Current (V_{CE} = 60 Vdc, $V_{EB(off)}$ = 1.5 Vdc) (V_{CE} = 80 Vdc, $V_{EB(off)}$ = 1.5 Vdc) (V_{CE} = 60 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 150°C) (V_{CE} = 80 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 150°C)	2N5683, 2N5685 2N5684, 2N5686 2N5683, 2N5685 2N5684, 2N5686	I_{CEX}	– –	2.0 2.0 10 10	mAdc
Collector Cutoff Current (V_{CB} = 60 Vdc, I_E = 0) (V_{CB} = 80 Vdc, I_E = 0)	2N5683, 2N5685 2N5684, 2N5686	I_{CBO}	– –	2.0 2.0	mAdc
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)		I_{EBO}	–	5.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (Note 1) (I_C = 25 Adc, V_{CE} = 2.0 Vdc) (I_C = 50 Adc, V_{CE} = 5.0 Vdc)		h_{FE}	15 5.0	60 –	–
Collector Emitter Saturation Voltage (Note 1) (I_C = 25 Adc, I_B = 2.5 Adc) (I_C = 50 Adc, I_B = 10 Adc)		$V_{CE(sat)}$	– –	1.0 5.0	Vdc
Base-Emitter Saturation Voltage (Note 1) (I_C = 25 Adc, I_B = 2.5 Adc)		$V_{BE(sat)}$	–	2.0	Vdc
Base Emitter On Voltage (Note 1) (I_C = 25 Adc, V_{CE} = 2.0 Vdc)		$V_{BE(on)}$	–	2.0	Vdc
DYNAMIC CHARACTERISTICS					
Current Gain–Bandwidth Product (I_C = 5.0 Adc, V_{CE} = 10 Vdc, f = 1.0 MHz)		f_T	2.0	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)	2N5683, 2N5684 2N5685, 2N5686	C_{ob}	– –	2000 1200	pF
Small Signal Current Gain (I_C = 10 Adc, V_{CE} = 5.0 Vdc, f = 1.0 kHz)		h_{fe}	15	–	

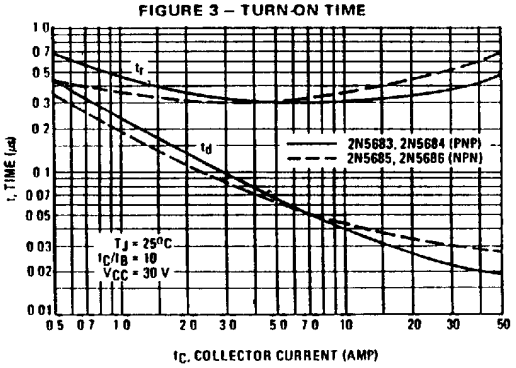
*Indicates JEDEC Registered Data
Note 1 Pulse Test Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%

FIGURE 2 – SWITCHING TIME TEST CIRCUIT



FOR CURVES OF FIGURES 3 & 6, R_B & R_L ARE VARIED
INPUT LEVELS ARE APPROXIMATELY AS SHOWN
FOR NPN CIRCUITS, REVERSE ALL POLARITIES

FIGURE 3 – TURN-ON TIME



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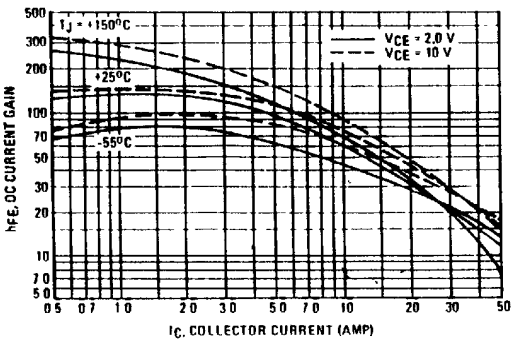
PNP
2N5683, 2N5684

NPN
2N5685, 2N5686

FIGURE 8 – DC CURRENT GAIN



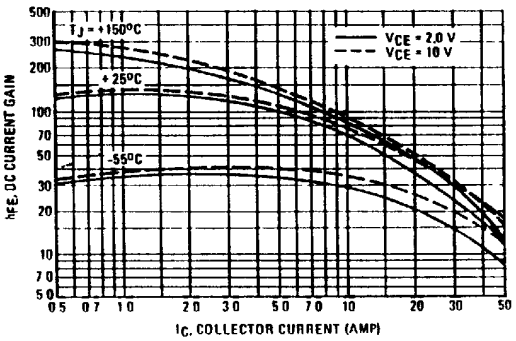
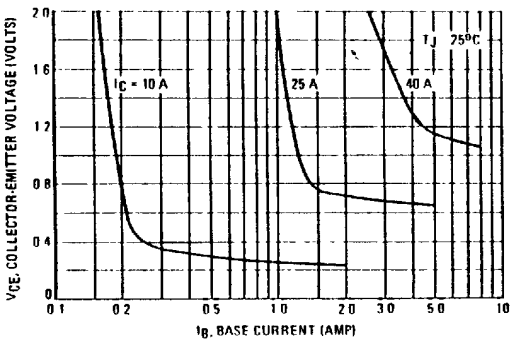


FIGURE 9 – COLLECTOR SATURATION REGION



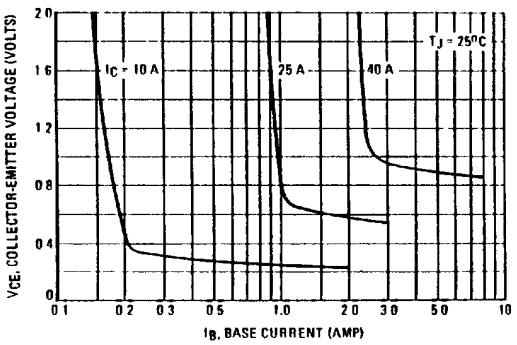
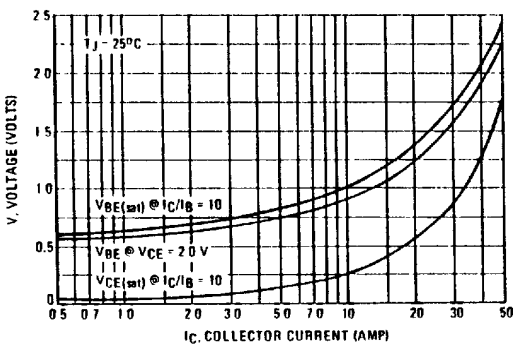


FIGURE 10 – "ON" VOLTAGES



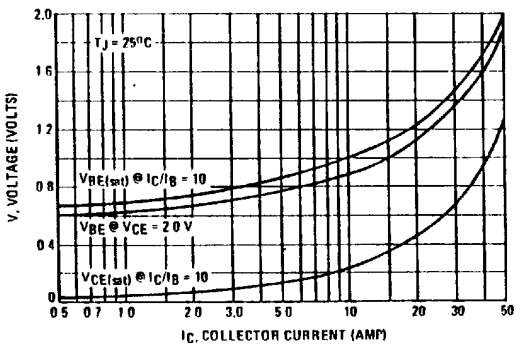


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FIGURE 4 – THERMAL RESPONSE

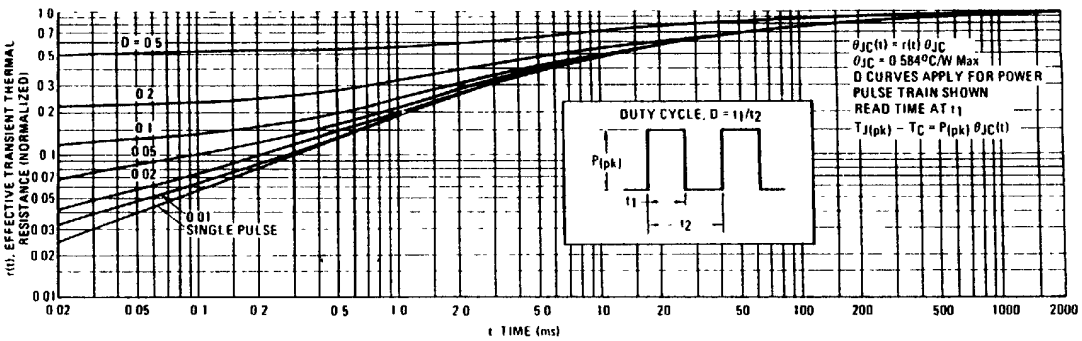
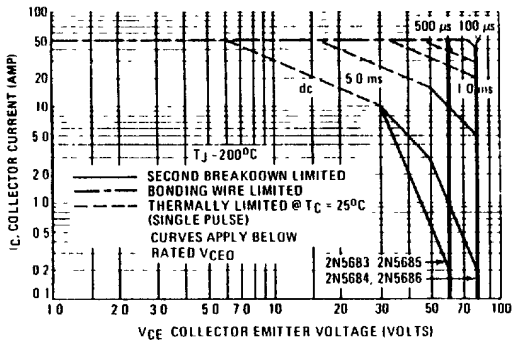


FIGURE 5 – ACTIVE REGION SAFE OPERATING AREA



There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on $T_{J(pk)} = 200°C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 200°C$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

FIGURE 6 – TURN-OFF TIME

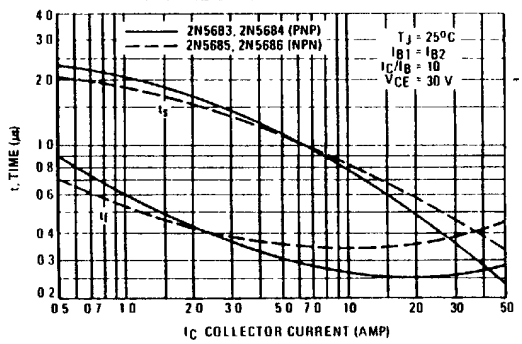
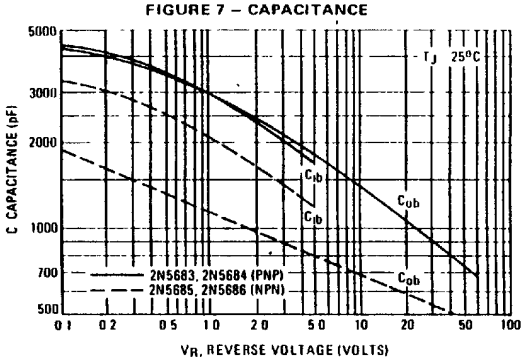


FIGURE 7 – CAPACITANCE



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