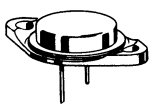
2N3902 NPN (SILICON)
2N5157

HIGH VOLTAGE NPN SILICON TRANSISTORS

. . . designed for use in high-voltage inverters, converters, switching regulators and line operated amplifiers.

- High Collector-Emitter Voltage – V_{CEX} = 700 Vdc
- Excellent DC Current Gain – h_{FE} = 10 (Min) @ I_C = 2.5 Adc
- Low Collector-Emitter Saturation Voltage – $V_{CE(sat)}$ = 0.8 Vdc (Max) @ I_C = 1.0 Adc

3.5 AMPERE
POWER TRANSISTORS NPN SILICON
400 and 500 VOLTS
100 WATTS



*MAXIMUM RATINGS

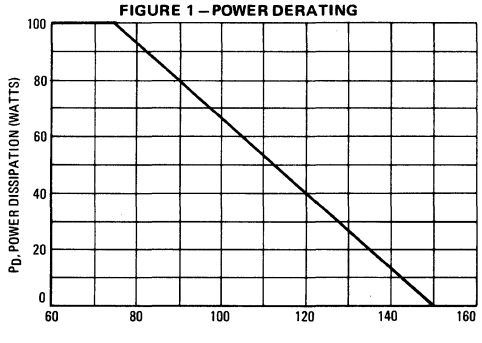
Rating	Symbol	2N3902	2N5157	Unit
Collector-Emitter Voltage	V_{CEO}	400	500	Vdc
Collector-Emitter Voltage	V_{CEX}	700		Vdc
Emitter-Base Voltage	V_{EB}	5.0	6.0	Vdc
Collector Current – Continuous	I_C	3.5		Adc
Base Current	I_B	2.0		Adc
Total Device Dissipation @ T_C = 75°C Derate above 75°C	P_D	100 1.33		Watts W/°C
Operating Junction Temperature Range	T_J	-65 to +150		°C
Storage Temperature Range	T_{stg}	-65 to +200		°C

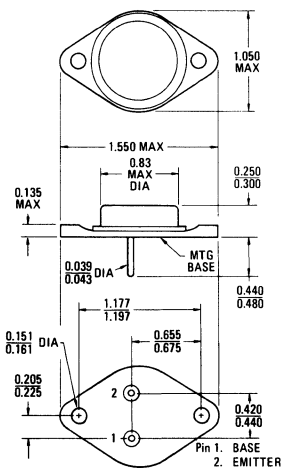
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	0.75	°C/W

*Indicates JEDEC Registered Data

FIGURE 1 – POWER DERATING





To convert inches to millimeters multiply by 25.4
All JEDEC dimensions and notes apply
Collector connected to case

CASE 11
TO-3

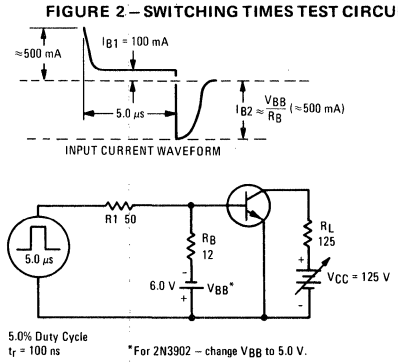
***ELECTRICAL CHARACTERISTICS** (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage (I_C = 100 mAdc, I_B = 0) (See Figure 12)	2N3902	$V_{CEO(sus)}$	325	–	Vdc
	2N5157		400	–	
Collector-Emitter Breakdown Voltage (I_C = 3.5 Adc, R_{BE} = 10 Ohms) (See Figure 12)	2N5157	BV_{CER}	500	–	Vdc
Collector Cutoff Current		I_{CEO}			mAdc
(V_{CE} = 400 Vdc, I_B = 0)	2N3902		0.25	–	
(V_{CE} = 500 Vdc, I_B = 0)	2N5157		0.25	–	
Collector Cutoff Current		I_{CEX}			mAdc
(V_{CE} = 700 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N3902		–	2.5	
	2N5157		–	0.5	
(V_{CE} = 400 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 125°C)	Both Types		–	0.5	
Emitter Cutoff Current		I_{EBO}			mAdc
(V_{BE} = 5.0 Vdc, I_C = 0)	2N3902		–	5.0	
(V_{BE} = 6.0 Vdc, I_C = 0)	2N5157		–	5.0	
ON CHARACTERISTICS(1)					
DC Current Gain		h_{FE}			–
(I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)	2N3902,2N5157		30	90	
(I_C = 2.5 Adc, V_{CE} = 5.0 Vdc)	2N3902,2N5157		10	–	
(I_C = 1.0 Adc, V_{CE} = 5.0 Vdc, T_C = -55°C)	2N5157		10	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 1.0 Adc, I_B = 0.1 Adc)	2N3902,2N5157		–	0.8	
(I_C = 2.5 Adc, I_B = 0.5 Adc)	2N3902		–	2.5	
(I_C = 3.5 Adc, I_B = 0.7 Adc)	2N5157		–	2.5	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
(I_C = 1.0 Adc, I_B = 0.1 Adc)	2N3902,2N5157		–	1.5	
(I_C = 2.5 Adc, I_B = 0.5 Adc)	2N3902		–	2.0	
(I_C = 3.5 Adc, I_B = 0.7 Adc)	2N5157		–	2.0	
DYNAMIC CHARACTERISTICS					
Current-Gain–Bandwidth Product		f_T			MHz
(I_C = 0.2 Adc, V_{CE} = 10 Vdc)	2N3902		2.8	–	
(I_C = 0.2 Adc, V_{CE} = 12 Vdc)	2N5157		2.8	–	
Output Capacitance (V_{CB} = 20 Vdc, I_E = 0, f = 1.0 MHz)	2N5157	C_{ob}	–	150	pF
SWITCHING CHARACTERISTICS					
Turn-On Time (V_{CC} = 125 Vdc, I_C = 1.0 Adc, I_{B1} = 0.1 Adc)	2N5157	t_{on}	–	0.8	μs
Turn-Off Time (V_{CC} = 125 Vdc, I_C = 1.0 Adc, I_{B1} = 0.1 Adc, I_{B2} = 0.5 Adc)	2N5157	t_{off}	–	1.7	μs

*Indicates JEDEC Registered Data

(1)Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

FIGURE 2 – SWITCHING TIMES TEST CIRCUIT



5.0% Duty Cycle
t_r = 100 ns

*For 2N3902 – change V_{BB} to 5.0 V.

FIGURE 3 – TURN-ON TIME

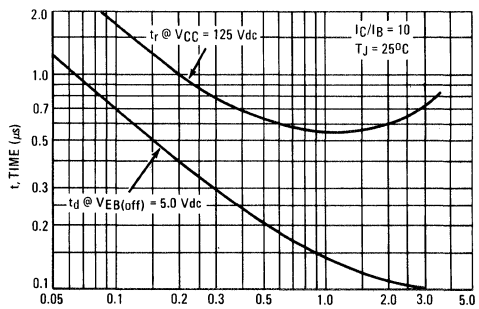


FIGURE 4 – THERMAL RESPONSE

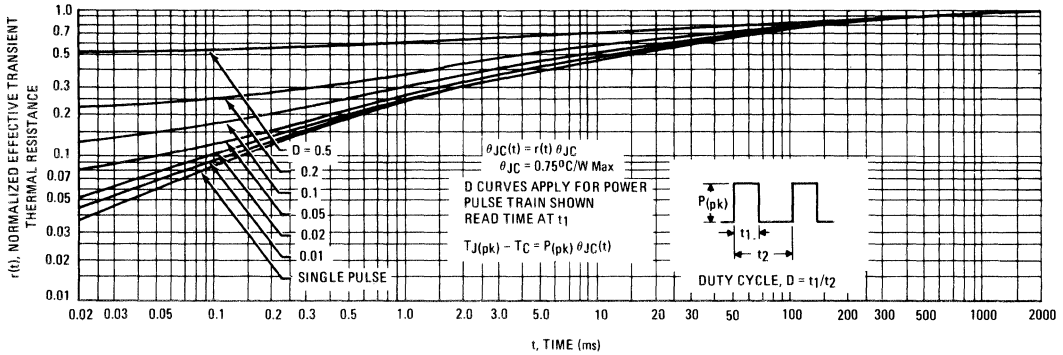
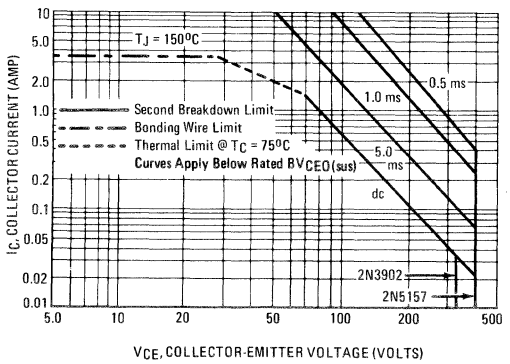


FIGURE 5 – ACTIVE-REGION SAFE-OPERATING AREA



There are two limitations on the power handling ability of a transistor: junction temperature and secondary 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 $T_{J(pk)} = 150^oC$; T_C is variable depending on conditions. Pulse curves are valid for duty cycles of 10% provided $T_{J(pk)} \leq 150^oC$. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by secondary breakdown. (See AN-415)

FIGURE 6 – TURN-OFF TIME

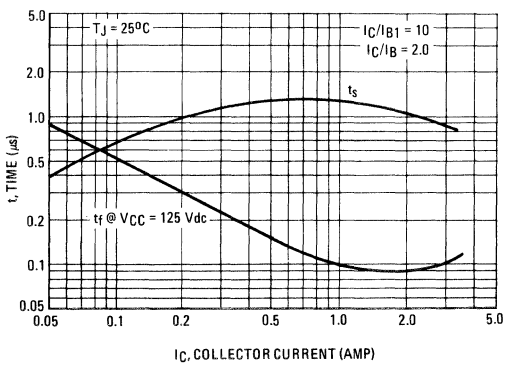


FIGURE 7 – CAPACITANCE

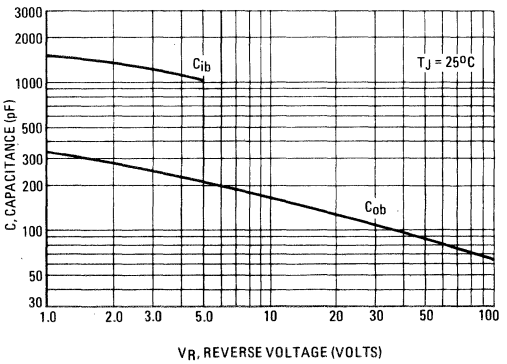


FIGURE 8 – DC CURRENT GAIN

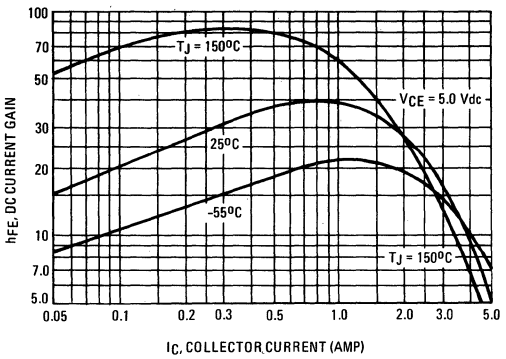


FIGURE 9 – "ON" VOLTAGES

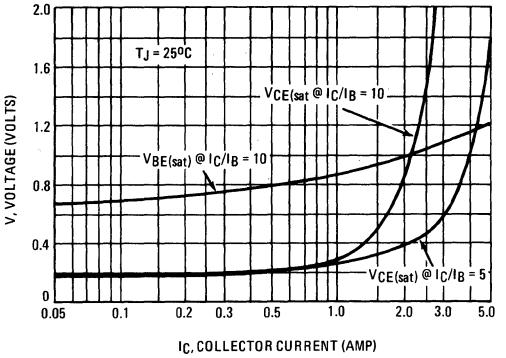


FIGURE 10 – COLLECTOR CUT-OFF REGION

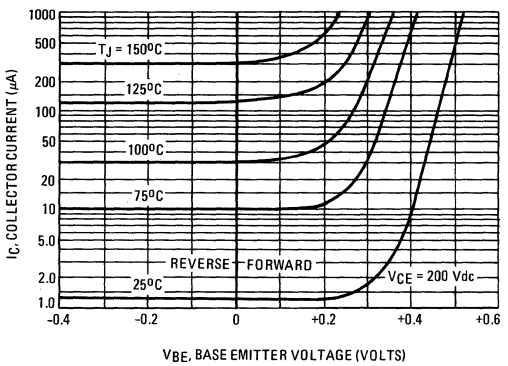


FIGURE 11 – TEMPERATURE COEFFICIENTS

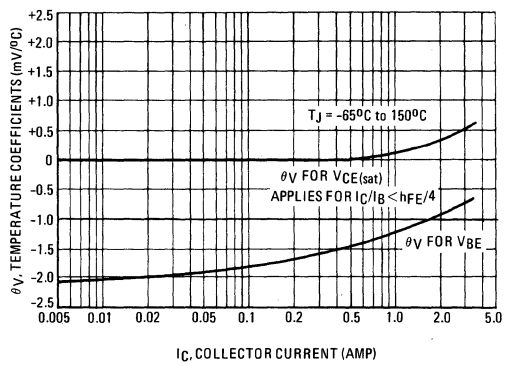


FIGURE 12 – COLLECTOR-EMITTER SUSTAINING VOLTAGE TEST CIRCUITS AND LOAD LINES