



NPN High Power Silicon Transistors

2N3902 & 2N5157

Features

- Available in JAN, JANTX, and JANTXV per MIL-PRF-19500/371
- TO-3 (TO-204AA) Package



Maximum Ratings

Ratings	Symbol	2N3902	2N5157	Units
Collector - Emitter Voltage	V_{CEO}	400	500	Vdc
Emitter - Base Voltage	V_{EBO}	5.0	6.0	Vdc
Collector - Base Voltage	V_{CBO}	7.0		Vdc
Base Current	I_B	2.0		Adc
Collector Current	I_C	3.5		Adc
Total Power Dissipation @ $T_A = +25\text{ }^\circ\text{C}$ (1) @ $T_A = +25\text{ }^\circ\text{C}$ (2)	P_T	5.0		W
		100		W
Operating & Storage Temperature Range	T_j, T_{stg}	-65 to +200		$^\circ\text{C}$

Thermal Characteristics

Characteristics	Symbol	Maximum	Units
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.25	$^\circ\text{C}/\text{W}$

- 1) Derate linearly @ 28.57 mW/ $^\circ\text{C}$ for $T_A > +25\text{ }^\circ\text{C}$
- 2) Derate linearly @ 0.8 mW/ $^\circ\text{C}$ for $T_C > +75\text{ }^\circ\text{C}$

Electrical Characteristics

OFF Characteristics	Symbol	Minimum	Maximum	Units
Collector - Emitter Cutoff Current $V_{CE} = 325\text{ Vdc}$ 2N3902 $V_{CE} = 400\text{ Vdc}$ 2N5157	I_{CEO}	---	250 250	μAdc
Collector - Emitter Cutoff Current $V_{BE} = 1.5\text{ Vdc}, V_{CE} = 700\text{ Vdc}$	I_{CEX}	---	500	μAdc
Collector - Emitter Cutoff Current $V_{EB} = 5.0\text{ Vdc}$ 2N3902 $V_{EB} = 6.0\text{ Vdc}$ 2N5157	I_{EBO}	---	200 200	μAdc
OFF Characteristics				
Base - Emitter Saturation Voltage $I_C = 1.0\text{ Adc}, I_B = 0.1\text{ Vdc}$ $I_C = 3.5\text{ Adc}, I_B = 0.7\text{ Vdc}$	$V_{BE(sat)}$	---	1.5 2.0	Vdc
Collector - Emitter Saturation Voltage $I_C = 1.0\text{ Adc}, I_B = 0.1\text{ Adc}$ $I_C = 3.5\text{ Adc}, I_B = 0.7\text{ Adc}$	$V_{CE(sat)}$	---	0.8 2.5	Vdc

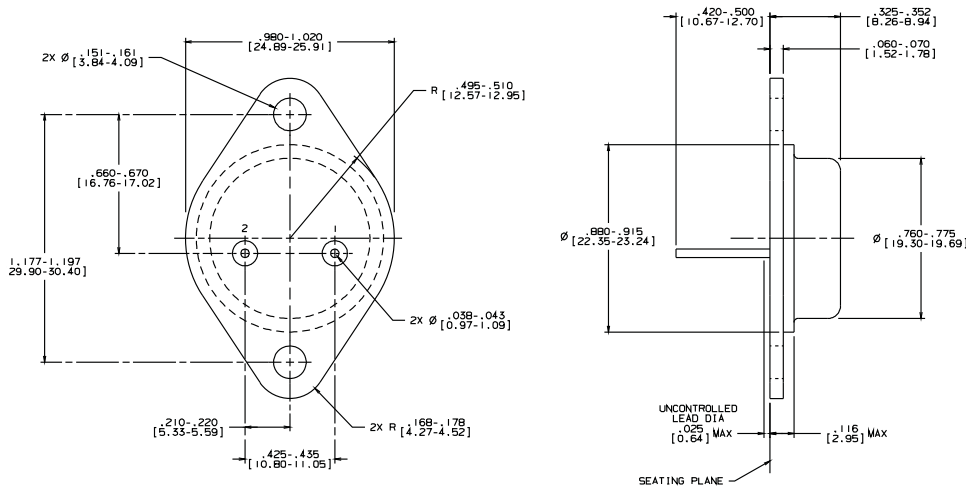


Electrical Characteristics -con't

ON Characteristics (2) (con't)	Symbol	Minimum	Maximum	Unit
Forward Current Transfer Ratio $I_C = 0.5 \text{ Adc}, V_{CE} = 5.0 \text{ Vdc}$ $I_C = 1.0 \text{ Adc}, V_{CE} = 5.0 \text{ Vdc}$ $I_C = 2.5 \text{ Adc}, V_{CE} = 5.0 \text{ Vdc}$ $I_C = 3.5 \text{ Adc}, V_{CE} = 5.0 \text{ Vdc}$	H_{FE}	25 30 10 5	90	
Collector - Emitter Sustaining Voltage $I_C = 100 \text{ mAdc}$	$V_{CE(sat)}$	2N3902 ---	1.0 2.5	Vdc
DYNAMIC Characteristic				
Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 0.2 \text{ Adc}, V_{CE} = 10 \text{ Vdc}, f = 1 \text{ MHz}$	$ h_{fe} $	2.5	25	
Output Capacitance $V_{CB} = 10 \text{ Vdc}, I_E = 0, 100 \text{ kHz} \leq f \leq 1.0 \text{ MHz}$	C_{obo}	---	500	pF
Switching Characteristic				
Turn-On Time $V_{CC} = 125 \text{ Vdc}, I_C = 1.0 \text{ Adc}, I_{B1} = 0.1 \text{ Adc}$	t_{on}	---	0.8	μs
Turn-Off Time $V_{CC} = 125 \text{ Vdc}, I_C = 1.0 \text{ Adc}, I_{B1} = 0.1 \text{ Adc}, -I_{B2} = 0.50 \text{ Adc}$	t_{off}	---	1.7	μs
SAFE OPERATING AREA				
DC Tests: $T_C = +25^\circ\text{C}, 1 \text{ Cycle}, t = 1.0 \text{ s}$ (See Figure 3 of MIL-PRF-19500/371)				
Test 1: $V_{CE} = 28.6 \text{ Vdc}, I_C = 3.5 \text{ Adc}$				
Test 2: $V_{CE} = 70 \text{ Vdc}, I_C = 1.43 \text{ Adc}$				
TEST 3: $V_{CE} = 325 \text{ Vdc}, I_C = 55 \text{ mAdc}$ 2N3902 $V_{CE} = 400 \text{ Vdc}, I_C = 35 \text{ mAdc}$ 2N5157				
Switching Test: Load condition C (unclamped inductive load) $T_C = 25^\circ\text{C}, \text{duty cycle} \leq 10\%; R_S = 0.1 \Omega$ (See Figure 4 of MIL-PRF-19500/371)				
Test 1: $t_p = \text{approximately } 3 \text{ ms (vary to obtain } I_C), R_{BB1} = 20 \Omega, V_{BB1} = 10 \text{ Vdc}; R_{BB2} = 3 \text{ k}\Omega,$ $V_{BB2} = 1.5 \text{ Vdc}, V_{CC} = 50 \text{ Vdc}, I_C = 3.5 \text{ Adc}, L = 60 \text{ mH}, R = 3 \Omega; R_L \leq 14 \Omega$				
Test 2: $t_p = \text{approximately } 3 \text{ ms (vary to obtain } I_C), R_{BB1} = 100 \Omega, V_{BB1} = 10 \text{ Vdc}; R_{BB2} = 3 \text{ k}\Omega,$ $V_{BB2} = 1.5 \text{ Vdc}, I_C = 0.6 \text{ Adc}, V_{CC} = 50 \text{ Vdc}, L = 200 \text{ mH}, R = 8 \Omega; R_L \leq 83 \Omega$				
Switching Tests: Load condition (clamped inductive load) $T_C = 25^\circ\text{C}, \text{duty cycle} \leq 10\%$ (See Figure 5 of MIL-PRF-19500/371)				
Test 1: $t_p = \text{approximately } 30 \text{ ms (vary to obtain } I_C), R_S = 0.1 \Omega, R_{BB1} = 20 \Omega, V_{BB1} = 10 \text{ Vdc};$ $R_{BB2} = 100 \Omega, V_{BB2} = 1.5 \text{ Vdc}, V_{CC} = 50 \text{ Vdc}, I_C = 3.5 \text{ Adc}, L = 60 \text{ mH}, R = 3 \Omega; R_L \leq 0 \Omega$ (A suitable clamping circuit or diode can be used.) Clamp Voltage = 400 +0, -5 Vdc 2N3902 Clamp Voltage = 500 +0, -5 Vdc 2N5157 (Clamped voltage must be reached)				

 (2) Pulse Test: Pulse Width = 300 μs , Duty Cycle $\leq 2.0\%$.

Outline Drawing



- NOTES:
 1. STANDARD HEADER TYPE SOLID BASE.
 2. STANDARD LEAD FINISH PER MIL-M-88510 TYPE X OR EQUIVALENT.
 3. LEAD NOT BENT GREATER THAN 15°.
 4. DIMENSIONS BASED ON JEDEC STANDARD TO-3 PUBLICATION 95, PA

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