

## NPN HIGH POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/371

### Devices

**2N3902**

**2N5157**

### Qualified Level

**JAN  
JANTX**

### MAXIMUM RATINGS

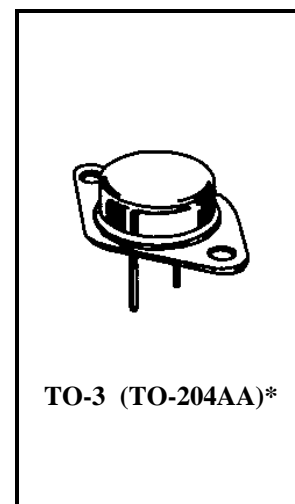
Ratings	Symbol	2N3902	2N5157	Unit
Collector-Emitter Voltage	$V_{CEO}$	400	500	Vdc
Emitter-Base Voltage	$V_{EBO}$	5.0	6.0	Vdc
Collector-Base Voltage	$V_{CBO}$	700		Vdc
Base Current	$I_B$	2.0		Adc
Collector Current	$I_C$	3.5		Adc
Total Power Dissipation	$P_T$	@ $T_A = +25^{\circ}C$ <sup>(1)</sup>	5.0	W
		@ $T_C = +75^{\circ}C$ <sup>(2)</sup>	100	W
Operating & Storage Temperature Range	$T_j, T_{stg}$	-65 to +200		$^{\circ}C$

### THERMAL CHARACTERISTICS

Characteristics	Symbol	Max.	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.25	$^{\circ}C/W$

1) Derate linearly 29 mW/ $^{\circ}C$  for  $T_A > +25^{\circ}C$

2) Derate linearly 0.8 mW/ $^{\circ}C$  for  $T_C > +75^{\circ}C$



\*See Appendix A for Package Outline

### ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Min.	Max.	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Cutoff Current $V_{CE} = 325$ Vdc $V_{CE} = 400$ Vdc	2N3902 2N5157	$I_{CEO}$	250 250	$\mu$ Adc
Collector-Emitter Cutoff Current $V_{BE} = 1.5$ Vdc; $V_{CE} = 700$ Vdc		$I_{CEX}$	500	$\mu$ Adc
Emitter-Base Cutoff Current $V_{EB} = 5.0$ Vdc $V_{EB} = 6.0$ Vdc	2N3902 2N5157	$I_{EBO}$	200 200	$\mu$ Adc

### ON CHARACTERISTICS<sup>(3)</sup>

Base-Emitter Saturation Voltage $I_C = 1.0$ Adc; $I_B = 0.1$ Adc $I_C = 3.5$ Adc; $I_B = 0.7$ Adc		$V_{BE(sat)}$	1.5 2.0	Vdc
Collector-Emitter Saturation Voltage $I_C = 1.0$ Adc; $I_B = 0.1$ Adc $I_C = 3.5$ Adc; $I_B = 0.7$ Adc		$V_{CE(sat)}$	0.8 2.5	Vdc

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**ELECTRICAL CHARACTERISTICS (con't)**

Characteristics	Symbol	Min.	Max.	Unit
<b>ON CHARACTERISTICS<sup>(3)</sup> (con't)</b>				
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 $I_C = 100 \text{ mAdc}$	$V_{CEO(sus)}$	2N3902 2N5157	325 400	Vdc

**DYNAMIC CHARACTERISTICS**

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 $V_{CB} = 10 \text{ Vdc}; I_E = 0, 100 \text{ kHz} \leq f \leq 1.0 \text{ MHz}$	$C_{obo}$		250	pF

**SWITCHING CHARACTERISTICS**

Turn-On Time $V_{CC} = 125 \text{ Vdc}; I_C = 1.0 \text{ Adc}; I_{B1} = 0.1 \text{ Adc}$	$t_{on}$		0.8	$\mu\text{s}$
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	$\mu\text{s}$

**SAFE OPERATING AREA****DC Tests (continuous)**

$T_C = +25^\circ\text{C}; t \geq 1.0 \text{ s}$  (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 Tests****Load condition C (unclamped inductive load)**

$T_C = 25^\circ\text{C};$  duty cycle  $\leq 10\%; R_S = 0.1 \Omega$  (See Figure 4 of MIL-PRF-19500/371)

**Test 1**

$t_P =$  approximately 3 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**

$t_P =$  approximately 3 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)**

$T_C = +25^\circ\text{C};$  duty cycle  $\leq 10\%.$  (See Figure 5 of MIL-PRF-19500/371)

**Test 1**

$t_P =$  approximately 30 ms (vary to obtain  $I_C$ );  $R_S = 0.1 \Omega; R_{BB1} = 20 \Omega; V_{BB1} = 10 \text{ Vdc}; R_{BB2} = 100 \Omega;$   
 $V_{BB2} = 1.5 \text{ Vdc}; V_{CC} = 50 \text{ Vdc}; I_C = 3.5 \text{ Adc}; L = 60 \text{ mH}; R = 3 \Omega; R_L \geq 0\Omega.$

(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)

3.) Pulse Test: Pulse Width = 300 $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%.$