

NPN HIGH POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/371

Devices Qualified Level

2N3902 2N5157

JAN JANTX

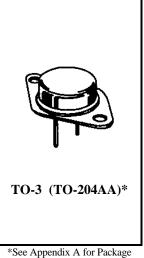
MAXIMUM RATINGS

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 @ $T_A = +25^0 C^{(1)}$	5.0		W	
	P_{T}	100		W
Operating & Storage Temperature Range	T _j , T _{stg}	-65 to +200		⁰ C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Max.	Unit
Thermal Resistance, Junction-to-Case	$R_{ heta JC}$	1.25	⁰ C/W

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



*See Appendix A for Package Outline

ELECTRICAL CHARACTERISTICS

Characteristics		Symbol	Min.	Max.	Unit
OFF CHARACTERISTICS					
Collector-Emitter Cutoff Current					
$V_{CE} = 325 \text{ Vdc}$	2N3902	I_{CEO}		250	μAdc
$V_{CE} = 400 \text{ Vdc}$	2N5157			250	,
Collector-Emitter Cutoff Current		T		500	4.1.
$V_{BE} = 1.5 \text{ Vdc}; V_{CE} = 700 \text{ Vdc}$		I_{CEX}		500	μAdc
Emitter-Base Cutoff Current					
$V_{EB} = 5.0 \text{ Vdc}$	2N3902	I_{EBO}		200	μAdc
$V_{EB} = 6.0 \text{ Vdc}$	2N5157			200	
ON CHARACTERISTICS ⁽³⁾			•		•
Base-Emitter Saturation Voltage					
$I_C = 1.0 \text{ Adc}; I_B = 0.1 \text{ Adc}$		V _{BE(sat)}		1.5	Vdc
$I_C = 3.5 \text{ Adc}; I_B = 0.7 \text{ Adc}$				2.0	
Collector-Emitter Saturation Voltage					
$I_C = 1.0 \text{ Adc}; I_B = 0.1 \text{ Adc}$		V _{CE(sat)}		0.8	Vdc
$I_C = 3.5 \text{ Adc}; I_B = 0.7 \text{ Adc}$				2.5	
6 Lake Street Lawrence MA 01841				1 2.3	12

6 Lake Street, Lawrence, MA 01841

1-800-446-1158 / (978) 794-1666 / Fax: (978) 689-0803 Page 1 of 2

120101

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

2N3902, 2N5157 JAN SERIES

ELECTRICAL CHARACTERISTICS (con't)

Characteristics		Symbol	Min.	Max.	Unit
ON CHARACTERISTICS(3) (con't					
Forward-Current Transfer Ratio					
$I_C = 0.5 \text{ Adc}; V_{CE} = 5.0 \text{ Vdc}$			25		
$I_{C} = 1.0 \text{ Adc}; V_{CE} = 5.0 \text{ Vdc}$ $I_{C} = 2.5 \text{ Adc}; V_{CE} = 5.0 \text{ Vdc}$		$h_{ m FE}$	30	90	
			10		
$I_C = 3.5 \text{ Adc}; V_{CE} = 5.0 \text{ Vdc}$			5		<u>. </u>
Collector-Emitter Sustaining Voltage					
$I_C = 100 \text{ mAdc}$	2N3902	V _{CEO(sus)}	325		Vdc
	2N5157		400		
DYNAMIC CHARACTERISTICS					
Small-Signal Short-Circuit Forward Cu	rrent Transfer Ratio	$ h_{\mathrm{fe}} $	2.5	25	
$I_C = 0.2 \text{ Adc}; V_{CE} = 10 \text{ Vdc}, f = 1 \text{ M}$	Hz	II _{fe}			
Output Capacitance		C_{obo}		250	pF
$V_{CB} = 10 \text{ Vdc}$; $I_E = 0$, $100 \text{ kHz} \le f \le$	1.0 MHz	Cobo			
SWITCHING CHARACTERISTI	CS				
Turn-On Time		ton		0.8	Ша
$V_{CC} = 125 \text{ Vdc}$; $I_C = 1.0 \text{ Adc}$; $I_{B1} = 0$.	$_{C} = 125 \text{ Vdc}; I_{C} = 1.0 \text{ Adc}; I_{B1} = 0.1 \text{ Adc}$			0.0	μs
Turn-Off Time		^t off		1.7	μs
$V_{CC} = 125 \text{ Vdc}; I_C = 1.0 \text{ Adc}; I_{B1} = 0$.1 Adc; $-I_{B2} = 0.50$ Adc	OII		1./	

SAFE OPERATING AREA

DC Tests (continuous)

 $T_C = +25^{\circ}C$; $t \ge 1.0$ 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)

 $T_C = 25^{\circ}C$; 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 Vdc; V_{CC} = 50 Vdc; I_{C} = 3.5 Adc; L = 60 mH; R = 3 Ω ; R_{L} \leq 14 Ω .

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 mH; $R = 8 \Omega$; $R_L \le 83 \Omega$.

Switching Tests

Load condition (clamped inductive load)

 $T_C = +25^{\circ}C$; 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 Ω ; R_{BB1} = 20 Ω ; V_{BB1} = 10 Vdc; R_{BB2} = 100 Ω ;

 $V_{BB2}=1.5~Vdc;~V_{CC}=50~Vdc;~I_{C}=3.5~Adc;~L=60~mH;~R=3~\Omega;~R_{L}\geq0\Omega.$

(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 = 300μ s, Duty Cycle $\leq 2.0\%$.

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