

TECHNICAL DATA

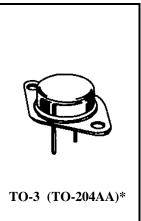
NPN HIGH POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/371

DevicesQualified Level2N39022N5157JAN
JANTX

MAXIMUM RATINGS

	r	1		
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}	70	00	Vdc
Base Current	IB	2	.0	Adc
Collector Current	I _C	3	.5	Adc
Total Power Dissipation $@ T_A = +25^{0}C^{(1)}$ $@ T_C = +75^{0}C^{(2)}$	D	5.0		W
@ $T_{\rm C} = +75^{0} {\rm C}^{(2)}$	P _T	10	00	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 _{θJC}	1.	25	⁰ C/W
1) Derate linearly 29 mW/ 0 C for T _A > +25 0 C	•	•		•



*See Appendix A for Package Outline

2) Derate linearly 2.5 mW/ C for $T_{\rm C} > +75^{\circ}{\rm C}$

ELECTRICAL CHARACTERISTICS

Characteristics	5	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		т		500	uAda
$V_{BE} = 1.5 \text{ Vdc}; V_{CE} = 700 \text{ Vdc}$		I _{CEX}		300	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
$I_{\rm C} = 3.5 \text{ Adc}; I_{\rm B} = 0.7 \text{ Adc}$				2.0	
Collector-Emitter Saturation Voltage					
$I_{C} = 1.0 \text{ Adc}; I_{B} = 0.1 \text{ Adc}$		V _{CE(sat)}		0.8	Vdc
$I_{\rm C} = 3.5 \text{ Adc}; I_{\rm B} = 0.7 \text{ Adc}$				2.5	
6 Lake Street, Lawrence, MA 01841					12010
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2N3902, 2N5157 JAN SERIES

Characteristics	5	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		
$I_{C} = 1.0 \text{ Adc}; V_{CE} = 5.0 \text{ Vdc}$		h _{FE}	30	90	
$I_{C} = 2.5 \text{ Adc}; V_{CE} = 5.0 \text{ Vdc}$			10		
$I_C = 3.5 \text{ Adc}; V_{CE} = 5.0 \text{ Vdc}$			5		
Collector-Emitter Sustaining Voltage					
$I_{\rm C} = 100 \text{ mAdc}$	2N3902	V _{CEO(sus)}	325		Vdc
	2N5157		400		
DYNAMIC CHARACTERISTICS					
Small-Signal Short-Circuit Forward Curren	nt Transfer Ratio	1.	2.5	25	
$I_{C} = 0.2 \text{ Adc}; V_{CE} = 10 \text{ Vdc}, f = 1 \text{ MHz}$		h _{fe}	2.5	25	
Output Capacitance		C		250	"Е
$V_{CB} = 10$ Vdc; $I_E = 0$, 100 kHz $\le f \le 1.0$	MHz	C _{obo}		250	pF
WITCHING CHARACTERISTICS					
Turn-On Time		ton		0.0	
$V_{CC} = 125 \text{ Vdc}; I_C = 1.0 \text{ Adc}; I_{B1} = 0.1 \text{ A}$	dc	on		0.8	μs
Turn-Off Time		t cc		17	
$V_{CC} = 125 \text{ Vdc}; I_C = 1.0 \text{ Adc}; I_{B1} = 0.1 \text{ Adc}$	Adc; $-I_{B2} = 0.50$ Adc	toff		1.7	μs
AFE OPERATING AREA					
$T_{C} = +25^{0}C$; $t \ge 1.0$ s (See Figure 3 of M Test 1 $V_{CE} = 28.6$ Vdc, $I_{C} = 3.5$ Adc Test 2	IL-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 $V_{CE} = 325 \text{ Vdc}, I_C = 55 \text{ mAdc}$ $V_{CE} = 400 \text{ Vdc}, I_C = 35 \text{ mAdc}$ Switching Tests Load condition C (unclamped inductive) $T_C = 25^0$ C; duty cycle $\leq 10\%$; $R_S = 0.1 \Omega$ Test 1 $t_P = approximately 3 \text{ ms}$ (vary to obtain Interpret of the second sec	2N3902 2N5157 ve load) 2 (See Figure 4 of MIL-Pl c); R _{BB1} = 20 Ω; V _{BB1} = 10	0 Vdc; $R_{BB2} = 3 k\Omega$;			
$\label{eq:centre} \begin{array}{l} \textbf{Test 1} \\ V_{CE} = 28.6 \ Vdc, \ I_C = 3.5 \ Adc \\ \textbf{Test 2} \\ V_{CE} = 70 \ Vdc, \ I_C = 1.43 \ Adc \\ \textbf{Test 3} \\ V_{CE} = 325 \ Vdc, \ I_C = 55 \ mAdc \\ V_{CE} = 400 \ Vdc, \ I_C = 35 \ mAdc \\ \textbf{Switching Tests} \\ \textbf{Load condition C (unclamped inductive)} \\ T_C = 25^0 C; \ duty \ cycle \leq 10\%; \ R_S = 0.1 \ \Omega \\ \textbf{Test 1} \\ t_P = approximately \ 3 \ ms \ (vary \ to \ obtain \ I_C \\ V_{BB2} = 1.5 \ Vdc; \ V_{CC} = 50 \ Vdc; \ I_C = 3.5 \ \textbf{Test 2} \\ t_P = approximately \ 3 \ ms \ (vary \ to \ obtain \ I_C \\ V_{BB2} = 1.5 \ Vdc; \ I_C = 0.6 \ Adc \ V_{CC} = 50 \ Vdc \\ \end{array}$	2N3902 2N5157 ve load) 2 (See Figure 4 of MIL-Pl c); $R_{BB1} = 20 \Omega$; $V_{BB1} = 10$ Adc; $L = 60 \text{ mH}$; $R = 3 \Omega$; c); $R_{BB1} = 100 \Omega$; $V_{BB1} = 1$	0 Vdc; $R_{BB2} = 3 k\Omega$; ; $R_L \le 14\Omega$. 0 Vdc; $R_{BB2} = 3 k\Omega$;			
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 $V_{CE} = 325 \text{ Vdc}, I_C = 55 \text{ mAdc}$ $V_{CE} = 400 \text{ Vdc}, I_C = 35 \text{ mAdc}$ Switching Tests Load condition C (unclamped inductive $T_C = 25^{\circ}C$; duty cycle $\leq 10\%$; $R_S = 0.1 \Omega$ Test 1 $t_P = approximately 3 \text{ ms}$ (vary to obtain Ia $V_{BB2} = 1.5 \text{ Vdc}$; $V_{CC} = 50 \text{ Vdc}$; $I_C = 3.5 \text{ Test 2}$ $t_P = approximately 3 \text{ ms}$ (vary to obtain Ia $V_{BB2} = 1.5 \text{ Vdc}$; $I_C = 0.6 \text{ Adc} V_{CC} = 50 \text{ V}$ Switching Tests Load condition (clamped inductive load	2N3902 2N5157 Te load) 2 (See Figure 4 of MIL-Pl c); $R_{BB1} = 20 \Omega$; $V_{BB1} = 10$ Adc; $L = 60 \text{ mH}$; $R = 3 \Omega$; c); $R_{BB1} = 100 \Omega$; $V_{BB1} = 1$ /dc; $L = 200 \text{ mH}$; $R = 8 \Omega$;	0 Vdc; $R_{BB2} = 3 k\Omega$; ; $R_L \le 14\Omega$. 0 Vdc; $R_{BB2} = 3 k\Omega$; ; $R_L \le 83\Omega$.			
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 $V_{CE} = 325 \text{ Vdc}, I_C = 55 \text{ mAdc}$ $V_{CE} = 400 \text{ Vdc}, I_C = 35 \text{ mAdc}$ Switching Tests Load condition C (unclamped inductive $T_C = 25^0\text{C}$; duty cycle $\leq 10\%$; $R_S = 0.1 \Omega$ Test 1 $t_P = approximately 3 \text{ ms}$ (vary to obtain IL $V_{BB2} = 1.5 \text{ Vdc}$; $V_{CC} = 50 \text{ Vdc}$; $I_C = 3.5 \text{ Test 2}$ $t_P = approximately 3 \text{ ms}$ (vary to obtain IL $V_{BB2} = 1.5 \text{ Vdc}$; $I_C = 0.6 \text{ Adc} V_{CC} = 50 \text{ V}$ Switching Tests Load condition (clamped inductive load	2N3902 2N5157 7e load) 2 (See Figure 4 of MIL-PI c); $R_{BB1} = 20 \Omega$; $V_{BB1} = 10$ Adc; $L = 60 \text{ mH}$; $R = 3 \Omega$; c); $R_{BB1} = 100 \Omega$; $V_{BB1} = 1$ 7dc; $L = 200 \text{ mH}$; $R = 8 \Omega$; d)	0 Vdc; $R_{BB2} = 3 k\Omega$; ; $R_L \le 14\Omega$. 0 Vdc; $R_{BB2} = 3 k\Omega$; ; $R_L \le 83\Omega$.			
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 $V_{CE} = 325 \text{ Vdc}, I_C = 55 \text{ mAdc}$ $V_{CE} = 400 \text{ Vdc}, I_C = 35 \text{ mAdc}$ Switching Tests Load condition C (unclamped inductive $T_C = 25^0\text{C}$; duty cycle $\leq 10\%$; $R_S = 0.1 \Omega$ Test 1 $t_P = approximately 3 \text{ ms}$ (vary to obtain IL $V_{BB2} = 1.5 \text{ Vdc}$; $V_{CC} = 50 \text{ Vdc}$; $I_C = 3.5 \text{ Test 2}$ $t_P = approximately 3 \text{ ms}$ (vary to obtain IL $V_{BB2} = 1.5 \text{ Vdc}$; $I_C = 0.6 \text{ Adc} V_{CC} = 50 \text{ V}$ Switching Tests Load condition (clamped inductive load $T_C = +25^0\text{C}$; duty cycle $\leq 10\%$. (See Fi	2N3902 2N5157 ve load) 2 (See Figure 4 of MIL-Pl c); $R_{BB1} = 20 \Omega$; $V_{BB1} = 10$ Adc; $L = 60 \text{ mH}$; $R = 3 \Omega$; c); $R_{BB1} = 100 \Omega$; $V_{BB1} = 1$ /dc; $L = 200 \text{ mH}$; $R = 8 \Omega$; d) igure 5 of MIL-PRF-19500	0 Vdc; $R_{BB2} = 3 \text{ k}\Omega$; ; $R_L \le 14\Omega$. 0 Vdc; $R_{BB2} = 3 \text{ k}\Omega$; ; $R_L \le 83\Omega$.	R _{BB2} = 100 9	Ω;	
$\begin{array}{l} \textbf{Test 1} \\ \textbf{V}_{CE} = 28.6 \ \text{Vdc}, \ \textbf{I}_{C} = 3.5 \ \text{Adc} \\ \textbf{Test 2} \\ \textbf{V}_{CE} = 70 \ \text{Vdc}, \ \textbf{I}_{C} = 1.43 \ \text{Adc} \\ \textbf{Test 3} \\ \textbf{V}_{CE} = 325 \ \text{Vdc}, \ \textbf{I}_{C} = 55 \ \text{mAdc} \\ \textbf{V}_{CE} = 400 \ \text{Vdc}, \ \textbf{I}_{C} = 35 \ \text{mAdc} \\ \textbf{Switching Tests} \\ \textbf{Load condition C (unclamped inductive)} \\ \textbf{T}_{C} = 25^{0}\text{C}; \ \text{duty cycle} \leq 10\%; \ \textbf{R}_{S} = 0.1 \ \Omega \\ \textbf{Test 1} \\ \textbf{t}_{P} = \text{approximately 3 ms (vary to obtain Iac)} \\ \textbf{V}_{BB2} = 1.5 \ \text{Vdc}; \ \textbf{V}_{CC} = 50 \ \text{Vdc}; \ \textbf{I}_{C} = 3.5 \\ \textbf{Test 2} \\ \textbf{t}_{P} = \text{approximately 3 ms (vary to obtain Iac)} \\ \textbf{V}_{BB2} = 1.5 \ \text{Vdc}; \ \textbf{I}_{C} = 0.6 \ \text{Adc} \ \textbf{V}_{CC} = 50 \ \text{V} \\ \textbf{Switching Tests} \\ \textbf{Load condition (clamped inductive load)} \\ \textbf{T}_{C} = +25^{0}\text{C}; \ \text{duty cycle} \leq 10\%. (\text{See Fit} 1) \\ \textbf{Test 1} \end{array}$	2N3902 2N5157 fe load) 2 (See Figure 4 of MIL-PI c); $R_{BB1} = 20 \Omega$; $V_{BB1} = 10$ Adc; $L = 60 \text{ mH}$; $R = 3 \Omega$; c); $R_{BB1} = 100 \Omega$; $V_{BB1} = 1$ dc; $L = 200 \text{ mH}$; $R = 8 \Omega$; d) igure 5 of MIL-PRF-19500 I _C); $R_S = 0.1 \Omega$; $R_{BB1} = 20$	0 Vdc; $R_{BB2} = 3 \text{ k}\Omega$; ; $R_L \le 14\Omega$. 0 Vdc; $R_{BB2} = 3 \text{ k}\Omega$; ; $R_L \le 83\Omega$. 0/371) 0 Ω ; $V_{BB1} = 10 \text{ Vdc}$; F	$R_{BB2} = 100 \ s$	Ω;	
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