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NPN HIGH POWER SILICON TRANSISTOR

Devices

2N3902 **2N5157**

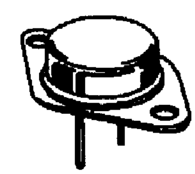
MAXIMUM RATINGS

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 @ $T_A = +25^0C$ (1)	P_T	5.0		W
@ $T_C = +75^0C$ (2)		100		W
Operating & Storage Temperature Range	T_j, T_{stg}	-65 to +200		^0C

THERMAL CHARACTERISTICS

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

1) Derate linearly 29 mW/^0C for $T_A > +25^0C$
2) Derate linearly 0.8 W/^0C for $T_C > +75^0C$



TO-3 (TO-204AA)*

*See Appendix A for Package Outline

ELECTRICAL CHARACTERISTICS

Characteristics		Symbol	Min.	Max.	Unit
OFF CHARACTERISTICS					
Collector-Emitter Cutoff Current		I_{CEO}			μAdc
$V_{CE} = 325$ Vdc	2N3902			250	
$V_{CE} = 400$ Vdc	2N5157			250	
Collector-Emitter Cutoff Current $V_{BE} = 1.5$ Vdc; $V_{CE} = 700$ Vdc		I_{CEX}		500	μAdc
Emitter-Base Cutoff Current		I_{EBO}			μAdc
$V_{EB} = 5.0$ Vdc	2N3902			200	
$V_{EB} = 6.0$ Vdc	2N5157			200	
ON CHARACTERISTICS(3)					
Base-Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
$I_C = 1.0$ Adc; $I_B = 0.1$ Adc				1.5	
$I_C = 3.5$ Adc; $I_B = 0.7$ Adc				2.0	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
$I_C = 1.0$ Adc; $I_B = 0.1$ Adc				0.8	
$I_C = 3.5$ Adc; $I_B = 0.7$ Adc				2.5	

ELECTRICAL CHARACTERISTICS (con't)

Characteristics		Symbol	Min.	Max.	Unit
ON CHARACTERISTICS[3] (con't)					
Forward-Current Transfer Ratio					
I_C = 0.5 Adc; V_{CE} = 5.0 Vdc		h_{FE}	25		
I_C = 1.0 Adc; V_{CE} = 5.0 Vdc			30	90	
I_C = 2.5 Adc; V_{CE} = 5.0 Vdc			10		
I_C = 3.5 Adc; V_{CE} = 5.0 Vdc			5		
Collector-Emitter Sustaining Voltage					
I_C = 100 mAdc	2N3902	$V_{CEO(sus)}$	325		Vdc
	2N5157		400		
DYNAMIC CHARACTERISTICS					
Small-Signal Short-Circuit Forward Current Transfer Ratio I_C = 0.2 Adc; V_{CE} = 10 Vdc, f = 1 MHz		$\|h_{fe}\|$	2.5	25	
Output Capacitance V_{CB} = 10 Vdc; I_E = 0, 100 kHz ≤ f ≤ 1.0 MHz		C_{obo}		250	pF
SWITCHING CHARACTERISTICS					
Turn-On Time V_{CC} = 125 Vdc; I_C = 1.0 Adc; I_{B1}= 0.1 Adc		t_{on}		0.8	µs
Turn-Off Time V_{CC} = 125 Vdc; I_C = 1.0 Adc; I_{B1} = 0.1 Adc; $-I_{B2}$ = 0.50 Adc		t_{off}		1.7	µs

SAFE OPERATING AREA

DC Tests (continuous)

T_C = +25°C; t ≥ 1.0 s (See Figure 3 of MIL-PRF-19500/371)

Test 1

V_{CE} = 28.6 Vdc, I_C = 3.5 Adc

Test 2

V_{CE} = 70 Vdc, I_C = 1.43 Adc

Test 3

V_{CE} = 325 Vdc, I_C = 55 mAdc 2N3902

V_{CE} = 400 Vdc, I_C = 35 mAdc 2N5157

Switching Tests

Load condition C (unclamped inductive load)

T_C = 25°C; duty cycle ≤ 10%; R_S = 0.1 Ω (See Figure 4 of MIL-PRF-19500/371)

Test 1

t_P = approximately 3 ms (vary to obtain I_C); R_{BB1} = 20 Ω; V_{BB1} = 10 Vdc; R_{BB2} = 3 kΩ; V_{BB2} = 1.5 Vdc; V_{CC} = 50 Vdc; I_C = 3.5 Adc; L = 60 mH; R = 3 Ω; R_L ≤ 14Ω.

Test 2

t_P = approximately 3 ms (vary to obtain I_C); R_{BB1} = 100 Ω; V_{BB1} = 10 Vdc; R_{BB2} = 3 kΩ; V_{BB2} = 1.5 Vdc; I_C = 0.6 Adc V_{CC} = 50 Vdc; L = 200 mH; R = 8 Ω; R_L ≤ 83Ω.

Switching Tests

Load condition (clamped inductive load)

T_C = +25°C; duty cycle ≤ 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 Ω; R_L ≥ 0Ω.

(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 = 300µs, Duty Cycle ≤ 2.0%.