2N3902 & 2N5157

NPN High Power Silicon Transistors

Rev. V1

Features

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

Electrical Characteristics

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Off Characteristics					
Collector - Emitter Cutoff Current	V_{CE} = 400 Vdc, 2N3902 V_{CE} = 500 Vdc, 2N5157	I_{CEO}	µAdc	—	100 100
Collector - Emitter Cutoff Current	V_{BE} = 1.5 Vdc, V_{CE} = 700 Vdc	I_{CEX}	µAdc	—	20
Collector - Emitter Cutoff Current	V_{BE} = 5 Vdc, 2N3902 V_{BE} = 6 Vdc, 2N5157	I_{EBO}	µAdc	—	200 200
On Characteristics[1]					
Forward Current Transfer Ratio	I_C = 0.5 Adc, V_{CE} = 5 Vdc I_C = 1.0 Adc, V_{CE} = 5 Vdc I_C = 2.5 Adc, V_{CE} = 5 Vdc I_C = 3.5 Adc, V_{CE} = 5 Vdc	H_{FE}	-	25 30 10 5	90
Collector - Emitter Saturation Voltage	I_C = 1.0 Adc, I_B = 0.1 Adc I_C = 3.5 Adc, I_B = 0.7 Adc	$V_{CE(SAT)}$	Vdc	—	0.8 2.5
Base - Emitter Saturation Voltage	I_C = 1.0 Adc, I_B = 0.1 Adc I_C = 3.5 Adc, I_B = 0.7 Adc	$V_{CE(SAT)}$	Vdc	—	1.5 2.0
Dynamic Characteristics					
Small-Signal Short-Circuit Forward Current Transfer Ratio	I_C = 0.2 Adc, V_{CE} = 10 Vdc, f = 1 MHz	$\lvert H_{FE} \rvert$	-	2.5	25
Output Capacitance	V_{CB} = 10 Vdc, I_E = 0, 100 kHz ≤ f ≤ 1 MHz	C_{OBO}	pF	—	250

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤2.0%.

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Electrical Characteristics

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Switching Characteristics					
Turn-On Time	V_{CC} = 125 Vdc; I_C = 1.0 Adc; I_B1 = 0.1 Adc	T_{ON}	µs	—	0.8
Turn-Off Time	V_{CC} = 125 Vdc; I_C = 1.0 Adc; I_B1 = 0.1 Adc, $-I_B2$ = 0.50 Adc	T_{OFF}	µs	—	1.7
Safe Operating Area					

DC Tests: T_C = +25°C, I Cycle, t = 1.0 s (see Fig. 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 Fig. 4 of MIL-PRF-19500/371)
Test 1: tP = 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 <14 Ω
Test 2: tP = 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 <83 Ω

Load Condition (clamped inductive load): T_C = +25°C, duty cycle <10% (See Fig. 5 of MIL-PRF-19500/371)
Test 1: tP = 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 <0 Ω
(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)

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Absolute Maximum Ratings

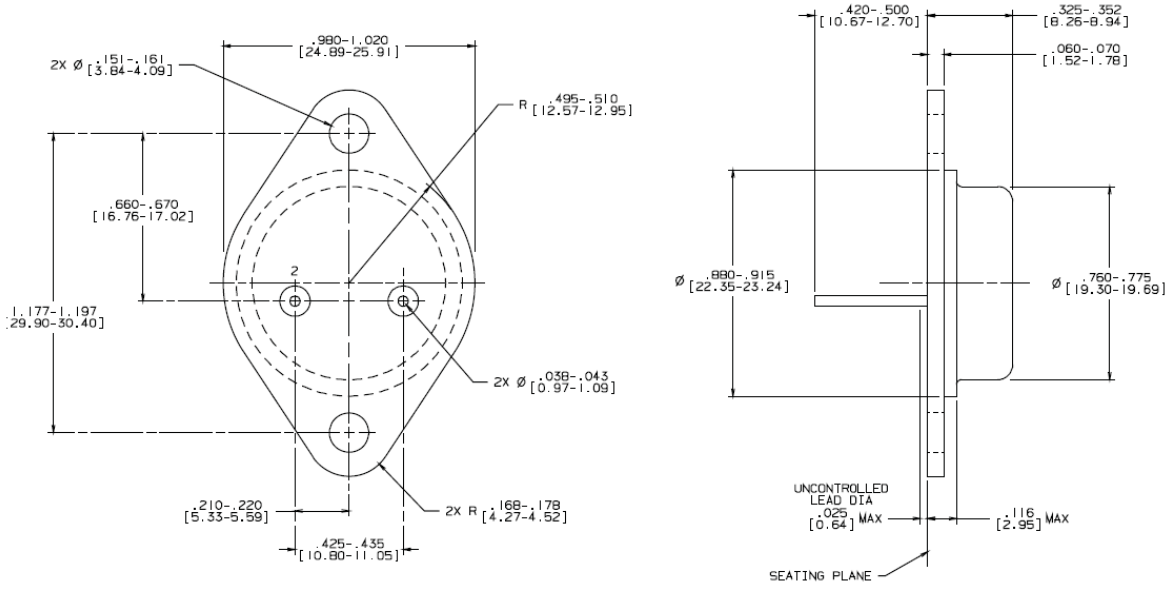
Ratings	Symbol	Value
Collector - Emitter Voltage 2N3902 2N5157	V_{CEO}	400 Vdc 500 Vdc
Emitter - Base Voltage 2N3902 2N5157	V_{EBO}	5 Vdc 6 Vdc
Collector - Base Voltage	V_{CBO}	700 Vdc
Base Current	I_B	2.0 Adc
Collector Current	I_C	3.5 Adc
Total Power Dissipation @ T_A = +25°C[2] @ T_A = +25°C[3]	P_T	5 W 100 W
Operating & Storage Temperature Range	T_{OP}, T_{STG}	-65°C to +200°C

2. Derate linearly @ 28.57 mW / °C for T_A >+25°C.
3. Derate linearly @ 0.8 mW / °C for T_A >+75°C.

Thermal Characteristics

Characteristics	Symbol	Max. Value
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.25°C/W

Outline Drawing



Notes:
Dimensions in inches [mm]
Standard header type solid base.
Standard lead finish: per MIL-M-38510 type x or equivalent.
Lead not bent >15°
Dimensions based on JEDEC standard TO-3 publication 95, PA