

### 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.
<b>Off Characteristics</b>					
Collector - Emitter Cutoff Current	$V_{CE} = 400 \text{ Vdc}$ , 2N3902 $V_{CE} = 500 \text{ Vdc}$ , 2N5157	$I_{CEO}$	$\mu\text{Adc}$	—	100 100
Collector - Emitter Cutoff Current	$V_{BE} = 1.5 \text{ Vdc}$ , $V_{CE} = 700 \text{ Vdc}$	$I_{CEX}$	$\mu\text{Adc}$	—	20
Collector - Emitter Cutoff Current	$V_{BE} = 5 \text{ Vdc}$ , 2N3902 $V_{BE} = 6 \text{ Vdc}$ , 2N5157	$I_{EBO}$	$\mu\text{Adc}$	—	200 200
<b>On Characteristics<sup>1</sup></b>					
Forward Current Transfer Ratio	$I_C = 0.5 \text{ Adc}$ , $V_{CE} = 5 \text{ Vdc}$ $I_C = 1.0 \text{ Adc}$ , $V_{CE} = 5 \text{ Vdc}$ $I_C = 2.5 \text{ Adc}$ , $V_{CE} = 5 \text{ Vdc}$ $I_C = 3.5 \text{ Adc}$ , $V_{CE} = 5 \text{ Vdc}$	$H_{FE}$	-	25 30 10 5	90
Collector - Emitter Saturation Voltage	$I_C = 1.0 \text{ Adc}$ , $I_B = 0.1 \text{ Adc}$ $I_C = 3.5 \text{ Adc}$ , $I_B = 0.7 \text{ Adc}$	$V_{CE(SAT)}$	Vdc	—	0.8 2.5
Base - Emitter Saturation Voltage	$I_C = 1.0 \text{ Adc}$ , $I_B = 0.1 \text{ Adc}$ $I_C = 3.5 \text{ Adc}$ , $I_B = 0.7 \text{ Adc}$	$V_{CE(SAT)}$	Vdc	—	1.5 2.0
<b>Dynamic Characteristics</b>					
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	$V_{CB} = 10 \text{ Vdc}$ , $I_E = 0$ , $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	$C_{OBO}$	pF	—	250

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

(Continued next page)

### Electrical Characteristics

Parameter	Test Conditions	Symbol	Units	Min.	Max.
<b>Switching Characteristics</b>					
Turn-On Time	$V_{CC} = 125 \text{ Vdc}; I_C = 1.0 \text{ Adc}; I_{B1} = 0.1 \text{ Adc}$	$T_{ON}$	$\mu\text{s}$	—	0.8
Turn-Off Time	$V_{CC} = 125 \text{ Vdc}; I_C = 1.0 \text{ Adc}; I_{B1} = 0.1 \text{ Adc}, -I_{B2} = 0.50 \text{ Adc}$	$T_{OFF}$	$\mu\text{s}$	—	1.7
<b>Safe Operating Area</b>					
<p>DC Tests: <math>T_C = +25^\circ\text{C}</math>, 1 Cycle, <math>t = 1.0 \text{ s}</math> (see Fig. 3 of MIL-PRF-19500/371)</p> <p>Test 1: <math>V_{CE} = 28.6 \text{ Vdc}, I_C = 3.5 \text{ Adc}</math></p> <p>Test 2: <math>V_{CE} = 70 \text{ Vdc}, I_C = 1.43 \text{ Adc}</math></p> <p>Test 3: <math>V_{CE} = 325 \text{ Vdc}, I_C = 55 \text{ mAdc}</math>, 2N3902  <math>V_{CE} = 400 \text{ Vdc}, I_C = 35 \text{ mAdc}</math>, 2N5157</p> <p>Switching Tests:</p> <p>Load Condition C (unclamped inductive load): <math>T_C = +25^\circ\text{C}</math>, duty cycle <math>&lt;10\%</math>; <math>R_S = 0.1 \Omega</math> (See Fig. 4 of MIL-PRF-19500/371)</p> <p>Test 1: <math>t_P =</math> approximately 3 ms (vary to obtain <math>I_C</math>), <math>R_{BB1} = 20 \Omega</math>, <math>V_{BB1} = 10 \text{ Vdc}</math>; <math>R_{BB2} = 3 \text{ k}\Omega</math>, <math>V_{BB2} = 1.5 \text{ Vdc}</math>, <math>V_{CC} = 50 \text{ Vdc}</math>, <math>I_C = 3.5 \text{ Adc}</math>, <math>L = 60 \text{ mH}</math>, <math>R = 3 \Omega</math>; <math>R_L &lt; 14 \Omega</math></p> <p>Test 2: <math>t_P =</math> approximately 3 ms (vary to obtain <math>I_C</math>), <math>R_{BB1} = 100 \Omega</math>, <math>V_{BB1} = 10 \text{ Vdc}</math>; <math>R_{BB2} = 3 \text{ k}\Omega</math>, <math>V_{BB2} = 1.5 \text{ Vdc}</math>, <math>I_C = 0.6 \text{ Adc}</math>, <math>V_{CC} = 50 \text{ Vdc}</math>, <math>L = 200 \text{ mH}</math>, <math>R = 8 \Omega</math>; <math>R_L &lt; 83 \Omega</math></p> <p>Load Condition (clamped inductive load): <math>T_C = +25^\circ\text{C}</math>, duty cycle <math>&lt;10\%</math> (See Fig. 5 of MIL-PRF-19500/371)</p> <p>Test 1: <math>t_P =</math> approximately 30 ms (vary to obtain <math>I_C</math>), <math>R_S = 0.1 \Omega</math>, <math>R_{BB1} = 20 \Omega</math>, <math>V_{BB1} = 10 \text{ Vdc}</math>; <math>R_{BB2} = 100 \Omega</math>, <math>V_{BB2} = 1.5 \text{ Vdc}</math>, <math>V_{CC} = 50 \text{ Vdc}</math>, <math>I_C = 3.5 \text{ Adc}</math>, <math>L = 60 \text{ mH}</math>, <math>R = 3 \Omega</math>; <math>R_L &lt; 0 \Omega</math> (A suitable clamping circuit or diode can be used.)</p> <p>Clamp Voltage = 400 +0, -5 Vdc 2N3902  Clamp Voltage = 500 +0, -5 Vdc 2N5157  (Clamped voltage must be reached)</p>					

## NPN High Power Silicon Transistors

Rev. V1

### Absolute Maximum Ratings

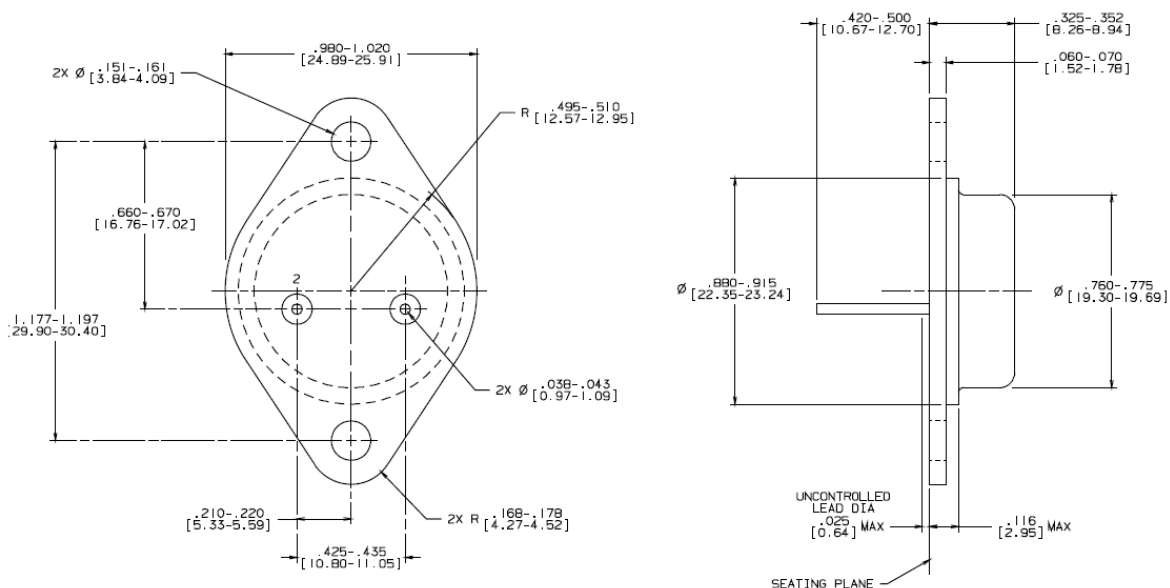
Ratings	Symbol	Value
Collector - Emitter Voltage 2N3902 2N5157	$V_{CEO}$	400 Vdc 500 Vdc
Emitter - Base Voltage 2N3902 2N5157	$V_{EBO}$	5 Vdc 6 Vdc
Collector - Base Voltage	$V_{CBO}$	700 Vdc
Base Current	$I_B$	2.0 Adc
Collector Current	$I_C$	3.5 Adc
Total Power Dissipation @ $T_A = +25^\circ\text{C}^2$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

- Derate linearly @ 28.57 mW / °C for  $T_A > +25^\circ\text{C}$ .
- Derate linearly @ 0.8 mW / °C for  $T_A > +75^\circ\text{C}$ .

### 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  $>15^\circ$
  - Dimensions based on JEDEC standard TO-3 publication 95, PA

3

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

For further information and support please visit:  
<https://www.macom.com/support>

MACOM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with MACOM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.