

# 2N4150, 2N4150S

## NPN Power Silicon Transistor

Rev. V4

### Features

- Available in commercial, JAN, JANTX, JANTXV, JANS and JANSR 100K rads (Si) per MIL-PRF-19500/394
- Radiation Tolerant Levels M, D, P, L and R
- TO-5 Package
- Designed for Use in High Current Switching Applications
- Ideal for Converters, Inverters and Wide Band Amplifiers



### Electrical Characteristics ( $T_A = +25^\circ\text{C}$ unless otherwise noted)

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Collector - Emitter Breakdown Voltage	$I_C = 100 \text{ mA dc}$	$V_{(BR)CEO}$	V dc	70	—
Emitter - Base Cutoff Current	$V_{EB} = 7.0 \text{ Vdc}$ $V_{EB} = 5.0 \text{ Vdc}$	$I_{EBO1}$ $I_{EBO2}$	$\mu\text{A dc}$	—	10 0.1
Collector - Emitter Cutoff Current	$V_{BE} = -0.5 \text{ Vdc}$ , $V_{CE} = 60 \text{ V dc}$	$I_{CEX1}$	$\mu\text{A dc}$	—	10
Collector - Emitter Cutoff Current	$V_{CE} = 60 \text{ V dc}$	$I_{CEO}$	$\mu\text{A dc}$	—	10
Collector - Base Cutoff Current	$V_{CB} = 100 \text{ V dc}$ $V_{CB} = 80 \text{ V dc}$	$I_{CBO1}$ $I_{CBO2}$	$\mu\text{A dc}$	—	10 0.1
Collector - Base Cutoff Current	$I_C = 1.0 \text{ A dc}$ , $V_{CE} = 5.0 \text{ V dc}$ $I_C = 5.0 \text{ A dc}$ , $V_{CE} = 5.0 \text{ V dc}$ $I_C = 10.0 \text{ A dc}$ , $V_{CE} = 5.0 \text{ V dc}$	$h_{FE}$	V dc	50 40 10	200 120 —
Collector-Emitter Saturation Voltage	$I_C = 5.0 \text{ A dc}$ , $I_B = 0.5 \text{ A dc}$ $I_C = 10.0 \text{ A dc}$ , $I_B = 1.0 \text{ A dc}$	$V_{CE(sat)1}$ $V_{CE(sat)2}$	V dc	—	0.6 2.5
Base-Emitter Saturation Voltage	$I_C = 5.0 \text{ A dc}$ , $I_B = 0.5 \text{ A dc}$ $I_C = 10.0 \text{ A dc}$ , $I_B = 1.0 \text{ A dc}$	$V_{BE(sat)1}$ $V_{BE(sat)2}$	V dc	—	1.5 2.5
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio	$I_C = 0.2 \text{ A dc}$ , $V_{CE} = 10.0 \text{ Vdc}$ , $f = 10 \text{ MHz}$	$ h_{fe} $	-	1.5	7.5
Output Capacitance	$V_{CB} = 10 \text{ Vdc}$ , $I_E = 0$ , $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	$C_{obo}$	pF	—	350
<b>Switching Characteristics</b>					
Delay Time	$V_{CC} = 20 \text{ V dc}$ , $V_{BB} = 5.0 \text{ V dc}$ , $I_C = 5.0 \text{ A dc}$ , $I_{B1} = 0.5 \text{ A dc}$	$t_d$	ns	—	50
Rise Time		$t_r$	ns	—	500
Storage Time		$t_s$	$\mu\text{s}$	—	1.5
Fall Time		$t_f$	ns	—	500

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Parameter	Test Conditions	Symbol	Units	Min.	Max.
Collector - Emitter Cutoff Current	$T_A = +150^{\circ}\text{C}$ $V_{BE} = -0.5 \text{ Vdc}$ , $V_{CE} = 60 \text{ V dc}$	$I_{CEX2}$	$\mu\text{A dc}$	—	100
Forward - Current Transfer Ratio	$T_A = -55^{\circ}\text{C}$ $V_{CE} = 5 \text{ V dc}$ , $I_C = 5 \text{ A dc}$	$h_{FE4}$		20	

### Absolute Maximum Ratings ( $T_A = +25^{\circ}\text{C}$ unless otherwise noted)

Ratings	Symbol	Value
Collector - Emitter Voltage	$V_{CEO}$	70 Vdc
Collector - Base Voltage	$V_{CBO}$	100 Vdc
Emitter - Base Voltage	$V_{EBO}$	10 Vdc
Collector Current	$I_C$	10 Adc
Total Power Dissipation @ $T_C = +25^{\circ}\text{C}$ <sup>(1)</sup> @ $T_A = +25^{\circ}\text{C}$ <sup>(2)</sup>	$P_T$	15 W 1.0 W
Operating & Storage Temperature Range	$T_J$ , $T_{STG}$	$-65^{\circ}\text{C}$ to $+200^{\circ}\text{C}$

### Thermal Characteristics

Characteristics	Symbol	Max. Value
Thermal Resistance Junction to Ambient <sup>(3)</sup> Junction to Case <sup>(4)</sup>	$R_{\theta JA}$ $R_{\theta JC}$	175°C/W 10°C/W

- (1) For derating see figure 6 of MIL-PRF-19500/394  
(2) For derating see figure 7 of MIL-PRF-19500/394  
(3) For thermal impedance curve see figure 8 of MIL-PRF-19500/394  
(4) For thermal impedance curve see figure 9 of MIL-PRF-19500/394

### Safe Operating Area

DC Tests:  $T_C = +25^{\circ}\text{C}$ , 1 Cycle,  $t = 1.0 \text{ s}$   
Test 1:  $V_{CE} = 40.0 \text{ Vdc}$ ,  $I_C = 0.22 \text{ A dc}$   
Test 2:  $V_{CE} = 70 \text{ Vdc}$ ,  $I_C = 90 \text{ mA dc}$

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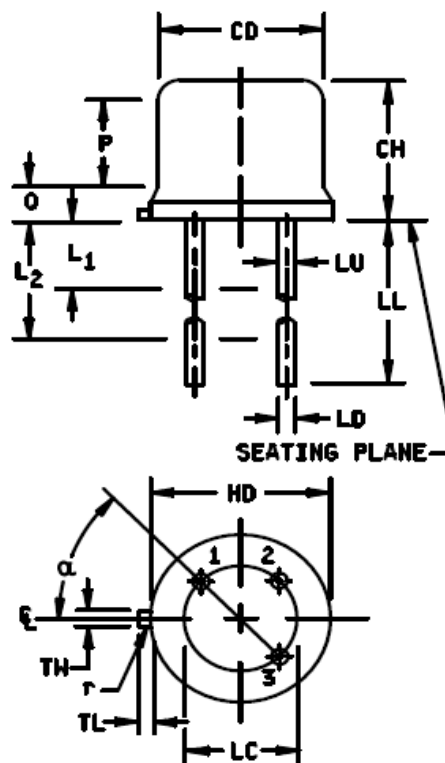
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### Outline Drawings: (TO-5)

MIL-PRF-19500/394P

Symbol	Inches		Millimeters		Notes
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7, 8
LL	See notes				7, 8, 11,12
LU	.016	.019	0.41	0.48	7, 8
L <sub>1</sub>		.050		1.27	7, 8
L <sub>2</sub>	.250		6.35		7, 8
P	.100		2.54		5
Q		.050		1.27	4
r		.010		0.25	10
TL	.029	.045	0.74	1.14	3
TW	.028	.034	0.71	0.86	2
α	45°TP		45°TP		6



#### NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TH shall be held for a minimum length of .011 (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
7. Dimension LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> and beyond LL minimum.
8. All three leads.
9. The collector shall be internally connected to the case.
10. Dimension r (radius) applies to both inside corners of tab.
11. For 2N4150, 2N5237, and 2N5238 dimension LL shall be 1.5 inches (38.1 mm) minimum and 1.75 inches (44.4 mm) maximum.
12. For 2N4150S, 2N5237S, and 2N5238S, dimension LL shall be .5 inch (12.7 mm) minimum and .75 inch (19.0 mm) maximum.
13. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi$ x symbology.
14. Lead 1 = emitter, lead 2 = base, lead 3 = collector.

FIGURE 1. Physical dimensions (TO-5).

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