

## RADIATION HARDENED PNP POWER SILICON TRANSISTOR

*Qualified per MIL-PRF-19500/545*

### DEVICES

<b>2N5151</b>	<b>2N5153</b>
<b>2N5151L</b>	<b>2N5153L</b>
<b>2N5151U3</b>	<b>2N5153U3</b>

### LEVELS

<b>JANSM – 3K Rads (Si)</b>
<b>JANSD – 10K Rads (Si)</b>
<b>JANSP – 30K Rads (Si)</b>
<b>JANSL – 50K Rads (Si)</b>
<b>JANSR – 100K Rads (Si)</b>
<b>JANSF – 300K Rads (Si)</b>

### ABSOLUTE MAXIMUM RATINGS ( $T_C = +25^\circ\text{C}$ unless otherwise noted)

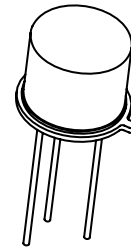
Parameters / Test Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	80	Vdc
Collector-Base Voltage	$V_{CBO}$	100	Vdc
Emitter-Base Voltage	$V_{EBO}$	5.5	Vdc
Collector Current	$I_C$	2.0	Adc
Total Power Dissipation 2N5151, 2N5153, L @ $T_A = +25^\circ\text{C}$ (1) 2N5151, 2N5153, L @ $T_C = +25^\circ\text{C}$ (2) 2N5151U3, 2N5153U3 @ $T_A = +25^\circ\text{C}$ (3) 2N5151U3, 2N5153U3 @ $T_C = +25^\circ\text{C}$ (4)	$P_T$	1.0 10 1.16 100	W
Operating & Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +200	$^\circ\text{C}$
Thermal Resistance, Junction-to Case	$R_{\theta JC}$	10 1.75 (U3)	$^\circ\text{C/W}$

**Note:**

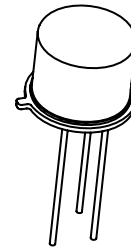
- 1) Derate linearly 5.7mW/ $^\circ\text{C}$  for  $T_A > +25^\circ$
- 2) Derate linearly 66.7mW/ $^\circ\text{C}$  for  $T_A > +25^\circ$
- 3) Derate linearly 6.63mW/ $^\circ\text{C}$  for  $T_A > +25^\circ$
- 4) Derate linearly 571mW/ $^\circ\text{C}$  for  $T_A > +25^\circ$

### ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

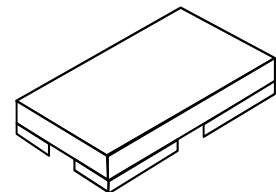
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Voltage $I_C = 100\text{mAdc}, I_B = 0$	$V_{(BR)CEO}$	80		Vdc
Emitter-Base Cutoff Current $V_{EB} = 4.0\text{Vdc}, I_C = 0$ $V_{EB} = 5.5\text{Vdc}, I_C = 0$	$I_{EBO}$		1.0 1.0	$\mu\text{Adc}$ mAdc
Collector-Emitter Cutoff Current $V_{CE} = 60\text{Vdc}, V_{BE} = 0$ $V_{CE} = 100\text{Vdc}, V_{BE} = 0$	$I_{CES}$		1.0 1.0	$\mu\text{Adc}$ mAdc
Collector-Base Cutoff Current $V_{CE} = 40\text{Vdc}, I_B = 0$	$I_{CEO}$		50	$\mu\text{Adc}$



**TO-5**  
**2N5151L, 2N5153L**  
 (See Figure 1)



**TO-39 (TO-205AD)**  
**2N5151, 2N5153**



**U-3**  
**2N5151U3, 2N5153U3**

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### ELECTRICAL CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>ON CHARACTERISTICS</b>				
Forward-Current Transfer Ratio $I_C = 50\text{mA}$ , $V_{CE} = 5\text{Vdc}$		20		
2N5151		50		
2N5153				
$I_C = 2.5\text{A}$ , $V_{CE} = 5\text{Vdc}$	$h_{FE}$	30	90	
2N5151		70	200	
2N5153				
$I_C = 5\text{A}$ , $V_{CE} = 5\text{Vdc}$		20		
2N5151		40		
2N5153				
Collector-Emitter Saturation Voltage $I_C = 2.5\text{A}$ , $I_B = 250\text{mA}$ $I_C = 5.0\text{A}$ , $I_B = 500\text{mA}$	$V_{CE(sat)}$		0.75 1.5	Vdc
Base-Emitter Voltage Non-Saturation $I_C = 2.5\text{A}$ , $V_{CE} = 5\text{Vdc}$	$V_{BE}$		1.45	Vdc
Base-Emitter Saturation Voltage $I_C = 2.5\text{A}$ , $I_B = 250\text{mA}$ $I_C = 5.0\text{A}$ , $I_B = 500\text{mA}$	$V_{BE(sat)}$		1.45 2.2	Vdc

### DYNAMIC CHARACTERISTICS

Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 500\text{mA}$ , $V_{CE} = 5\text{Vdc}$ , $f = 10\text{MHz}$				
2N5151	$ h_{fe} $	6		
2N5153		7		
Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio $I_C = 100\text{mA}$ , $V_{CE} = 5\text{Vdc}$ , $f = 1\text{kHz}$				
2N5151	$h_{fe}$	20		
2N5153		50		
Output Capacitance $V_{CB} = 10\text{Vdc}$ , $I_E = 0$ , $f = 1.0\text{MHz}$	$C_{obo}$		250	pF

### SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time $I_C = 5\text{A}$ , $I_{B1} = 500\text{mA}$ $I_{B2} = -500\text{mA}$ $R_L = 6\Omega$ $V_{BE(OFF)} = 3.7\text{Vdc}$	$t_{on}$		0.5	$\mu\text{s}$
Turn-Off Time $I_C = 5\text{A}$ , $I_{B1} = 500\text{mA}$ $I_{B2} = -500\text{mA}$ $R_L = 6\Omega$ $V_{BE(OFF)} = 3.7\text{Vdc}$	$t_{off}$		1.5	$\mu\text{s}$

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### SWITCHING CHARACTERISTICS (cont.)

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Storage Time $I_C = 5\text{Adc}$ , $I_{B1} = 500\text{mAdc}$ $I_{B2} = -500\text{mAdc}$	$t_s$		1.4	$\mu\text{s}$
Fall Time $R_L = 6\Omega$ $V_{BE(OFF)} = 3.7\text{Vdc}$	$t_f$		0.5	$\mu\text{s}$

### SAFE OPERATING AREA

#### DC Tests

$T_C = +25^\circ\text{C}$ , 1 Cycle,  $t_p = 1.0\text{s}$

#### Test 1

$V_{CE} = 5.0\text{Vdc}$ ,  $I_C = 2.0\text{Adc}$

#### Test 2

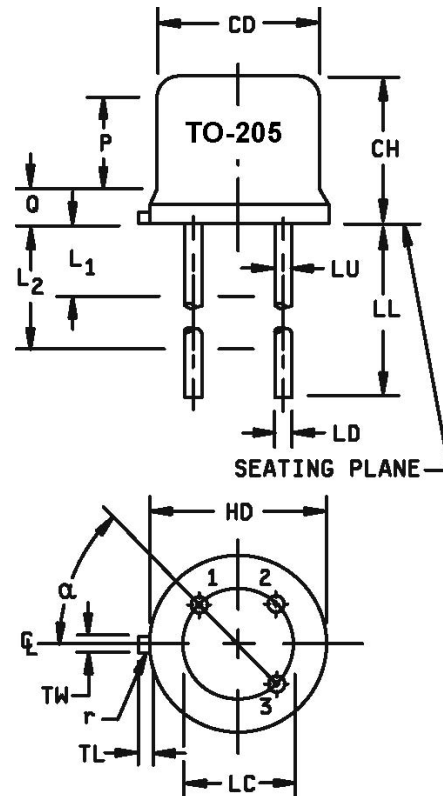
$V_{CE} = 32\text{Vdc}$ ,  $I_C = 310\text{mAdc}$

#### Test 3

$V_{CE} = 80\text{Vdc}$ ,  $I_C = 14.5\text{mAdc}$

**FIGURE 1 (TO-5, TO-39)  
 PACKAGE DIMENSIONS**

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	6
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		7
LD	.016	.021	0.41	0.53	8, 9
LL	See notes 8, 9, 12, 13				
LU	.016	.019	0.41	0.48	8, 9
L1		.050		1.27	8, 9
L2	.250		6.35		8, 9
Q		.050		1.27	6
TL	.029	.045	0.74	1.14	4, 5
TW	.028	.034	0.71	0.86	3
r		.010		0.25	11
$\alpha$	45° TP		45° TP		7
P	.100		2.54		



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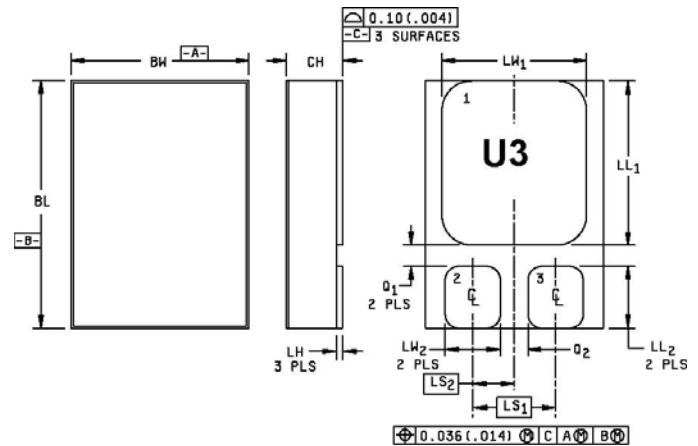
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### NOTES:

- 1 Dimensions are in inches.
- 2 Millimeters are given for general information only.
- 3 Beyond r (radius) maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
- 4 TL measured from maximum HD.
- 5 Outline in this zone is not controlled.
- 6 CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
- 7 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.
- 8 LU applied between L1 and L2. LD applies between L2 and LL minimum. Diameter is uncontrolled in L1 and beyond LL minimum.
- 9 All three leads.
- 10 The collector shall be electrically and mechanically connected to the case.
- 11 r (radius) applies to both inside corners of tab.
- 12 In accordance with ASME Y14.5M, diameters are equivalent to  $\phi x$  symbology.
- 13 For transistor types 2N5151 and 2N5153, LL is .5 inch (13 mm) minimum, and .75 inch (19 mm) maximum.
- 14 For transistor types 2N5151L and 2N5153L, LL is 1.5 inch (38 mm) minimum and 1.75 inch (44.4 mm) maximum.
- 15 Lead designation, depending on device type, shall be as follows: lead numbering; lead 1 = emitter, lead 2 = base, and lead 3 = collector.

**FIGURE 2 (U3)**  
 PACKAGE DIMENSIONS

Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.395	.405	10.04	10.28
BW	.291	.301	7.40	7.64
CH	.1085	.1205	2.76	3.06
LH	.010	.020	0.25	0.51
LL1	.220	.230	5.59	5.84
LL2	.115	.125	2.93	3.17
LS1	.150 BSC		3.81 BSC	
LS2	.075 BSC		1.91 BSC	
LW1	.281	.291	7.14	7.39
LW2	.090	.100	2.29	2.54
Q1	.030		0.762	
Q2	.030		0.762	



### NOTES:

- 1 Dimensions are in inches.
- 2 Millimeters are given for general information only.
- 3 Terminal 1 - collector, terminal 2 - base, terminal 3 - emitter