

# RADIATION HARDENED LOW POWER NPN SILICON TRANSISTOR

Qualified per MIL-PRF-19500/391

Qualified Levels:  
JANSM, JANSJ,  
JANSP, JANSL, and  
JANSR

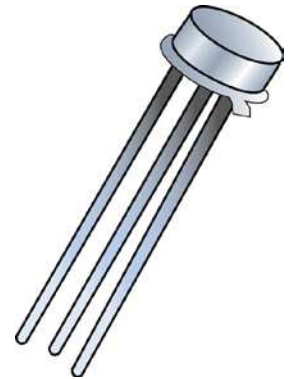
## DESCRIPTION

This RHA level 2N3057A NPN Silicon Transistor device is military qualified up to a JANSR level for high-reliability applications requiring a radiation hardened device. Microsemi also offers numerous other products to meet higher and lower power voltage regulation applications.

**Important:** For the latest information, visit our website <http://www.microsemi.com>.

## FEATURES


- JEDEC registered 2N3057.
- RHA level JAN qualifications per MIL-PRF-19500/391 (see [part nomenclature](#) for all options).




## TO-46 (TO-206AB) Package

Also available in:


## TO-39 (TO-205AD)

(leaded)  
 [JANS 2N3019, 2N3019S](#)

## TO-18 (TO-206AA)

(leaded)  
 [JANS 2N3700](#)

## UB package

(surface mount)  
 [JANS 2N3700UB](#)

## APPLICATIONS / BENEFITS

- Low profile metal TO-46 leaded package.
- Light weight.
- General-purpose switching and amplifier applications.
- Military and high-reliability applications.

## MAXIMUM RATINGS @ T<sub>A</sub> = +25 °C unless otherwise noted.

Parameters/Test Conditions	Symbol	Value	Unit
Junction and Storage Temperature	T <sub>J</sub> and T <sub>STG</sub>	-65 to +200	°C
Thermal Impedance Junction-to-Ambient	R <sub>θJA</sub>	325	°C/W
Thermal Impedance Junction-to-Case	R <sub>θJC</sub>	80	°C/W
Collector-Emitter Voltage	V <sub>CEO</sub>	80	V
Collector-Base Voltage	V <sub>CBO</sub>	140	V
Emitter-Base Voltage	V <sub>EBO</sub>	7.0	V
Collector Current	I <sub>C</sub>	1.0	A
Total Power Dissipation:			
@ T <sub>A</sub> = +25 °C <sup>(1)</sup>	P <sub>D</sub>	0.5	W
@ T <sub>C</sub> = +25 °C <sup>(2)</sup>		1.8	

- Notes:**
1. Derate linearly 2.3 mW/°C for T<sub>A</sub> ≥ +25 °C.
  2. Derate linearly 10.3 mW/°C for T<sub>C</sub> ≥ +25 °C.

### MSC – Lawrence

6 Lake Street,  
Lawrence, MA 01841  
Tel: 1-800-446-1158 or  
(978) 620-2600  
Fax: (978) 689-0803

### MSC – Ireland

Gort Road Business Park,  
Ennis, Co. Clare, Ireland  
Tel: +353 (0) 65 6840044  
Fax: +353 (0) 65 6822298

### Website:

[www.microsemi.com](http://www.microsemi.com)

**MECHANICAL and PACKAGING**

- CASE: Nickel plated kovar, glass seals.
- TERMINALS: Gold over nickel plated kovar leads. Solder dip (Sn63/Pb37) available upon request.
- MARKING: Part number, date code, manufacturer's ID and serial number.
- WEIGHT: Approximately 0.234 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**SYMBOLS & DEFINITIONS**

Symbol	Definition
f	frequency
$I_B$	Base current (dc)
$I_E$	Emitter current (dc)
$T_A$	Ambient temperature
$T_C$	Case temperature
$V_{CB}$	Collector to base voltage (dc)
$V_{CE}$	Collector to emitter voltage (dc)
$V_{EB}$	Emitter to base voltage (dc)

**ELECTRICAL CHARACTERISTICS @  $T_A = +25\text{ }^\circ\text{C}$ , unless otherwise noted**

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Current $I_C = 30\text{ mA}$	$V_{(BR)CEO}$	80		V
Collector-Base Cutoff Current $V_{CB} = 140\text{ V}$	$I_{CBO}$		10	$\mu\text{A}$
Emitter-Base Cutoff Current $V_{EB} = 7\text{ V}$	$I_{EBO1}$		10	$\mu\text{A}$
Collector-Emitter Cutoff Current $V_{CE} = 90\text{ V}$	$I_{CES}$		10	$\eta\text{A}$
Emitter-Base Cutoff Current $V_{EB} = 5.0\text{ V}$	$I_{EBO2}$		10	$\eta\text{A}$
<b>ON CHARACTERISTICS</b>				
Forward-Current Transfer Ratio $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 0.1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 1.0\text{ A}, V_{CE} = 10\text{ V}$	$h_{FE}$	100 50 90 50 15	300 300 300	
Collector-Emitter Saturation Voltage $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	$V_{CE(sat)}$		0.2 0.5	V
Base-Emitter Saturation Voltage $I_C = 150\text{ mA}, I_B = 15\text{ mA}$	$V_{BE(sat)}$		1.1	V

**DYNAMIC CHARACTERISTICS**

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 1.0\text{ mA}, V_{CE} = 5.0\text{ V}, f = 1.0\text{ kHz}$	$h_{fe}$	80	400	
Magnitude of Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 50\text{ mA}, V_{CE} = 10\text{ V}, f = 20\text{ MHz}$	$ h_{fe} $	5.0	20	
Output Capacitance $V_{CB} = 10\text{ V}, I_E = 0, 100\text{ kHz} \leq f \leq 1.0\text{ MHz}$	$C_{obo}$		12	pF
Input Capacitance $V_{EB} = 0.5\text{ V}, I_C = 0, 100\text{ kHz} \leq f \leq 1.0\text{ MHz}$	$C_{ibo}$		60	pF

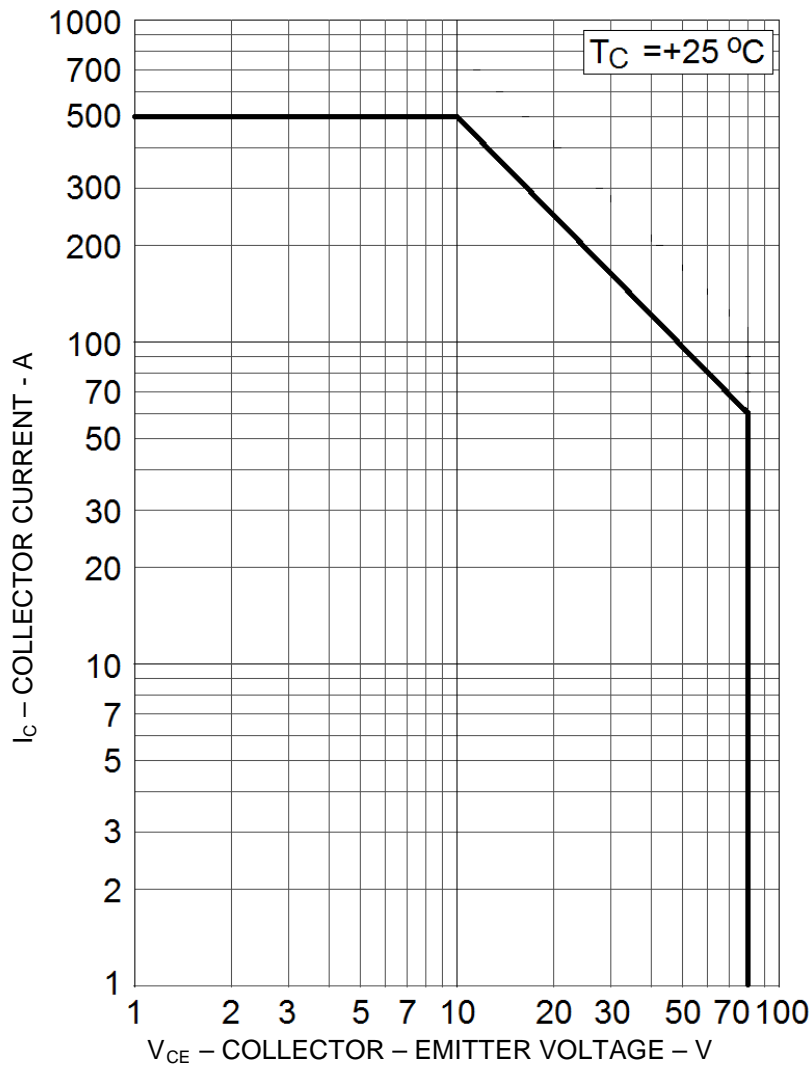
**ELECTRICAL CHARACTERISTICS @  $T_A = +25\text{ }^\circ\text{C}$ , unless otherwise noted (continued)**
**SAFE OPERATION AREA** (See SOA graph below and [MIL-STD-750, method 3053](#))

**DC Tests**
 $T_C = 25\text{ }^\circ\text{C}$ , 1 cycle,  $t = 10\text{ ms}$ 

<b>Test 1</b>	$V_{CE} = 10\text{ V}$
2N3057A	$I_C = 180\text{ mA}$

<b>Test 2</b>	$V_{CE} = 40\text{ V}$
2N3057A	$I_C = 45\text{ mA}$

<b>Test 3</b>	$V_{CE} = 80\text{ V}$
2N3057A	$I_C = 22.5\text{ mA}$

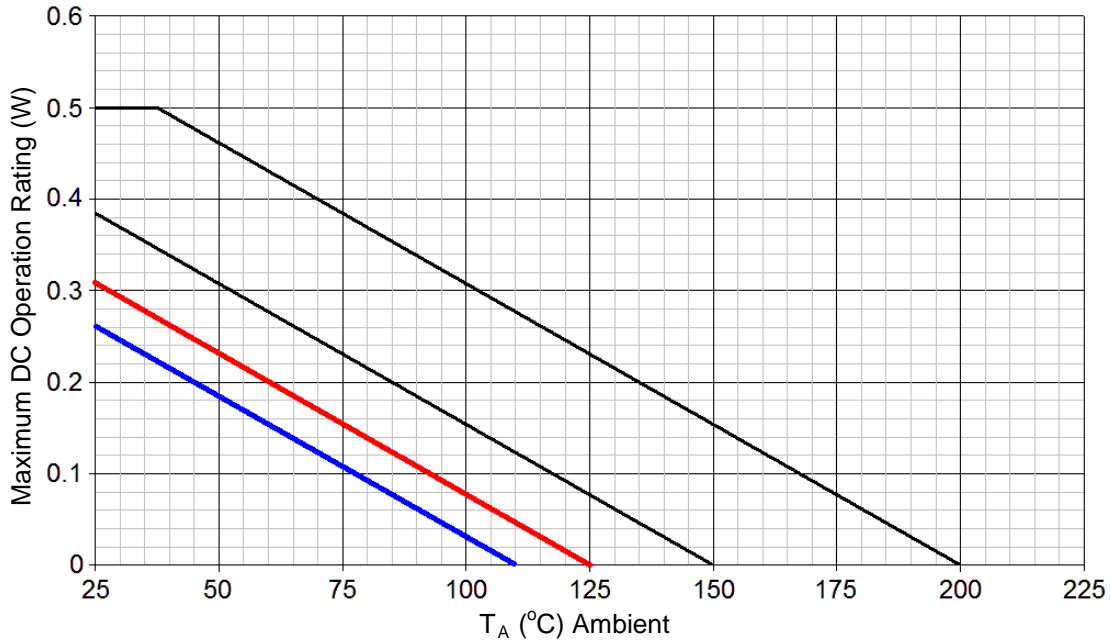
(1) Pulse Test: Pulse Width =  $300\text{ }\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .

Maximum Safe Operating Area

**ELECTRICAL CHARACTERISTICS @  $T_A = +25\text{ }^\circ\text{C}$ , unless otherwise noted (continued)**
**POST RADIATION ELECTRICAL CHARACTERISTICS**

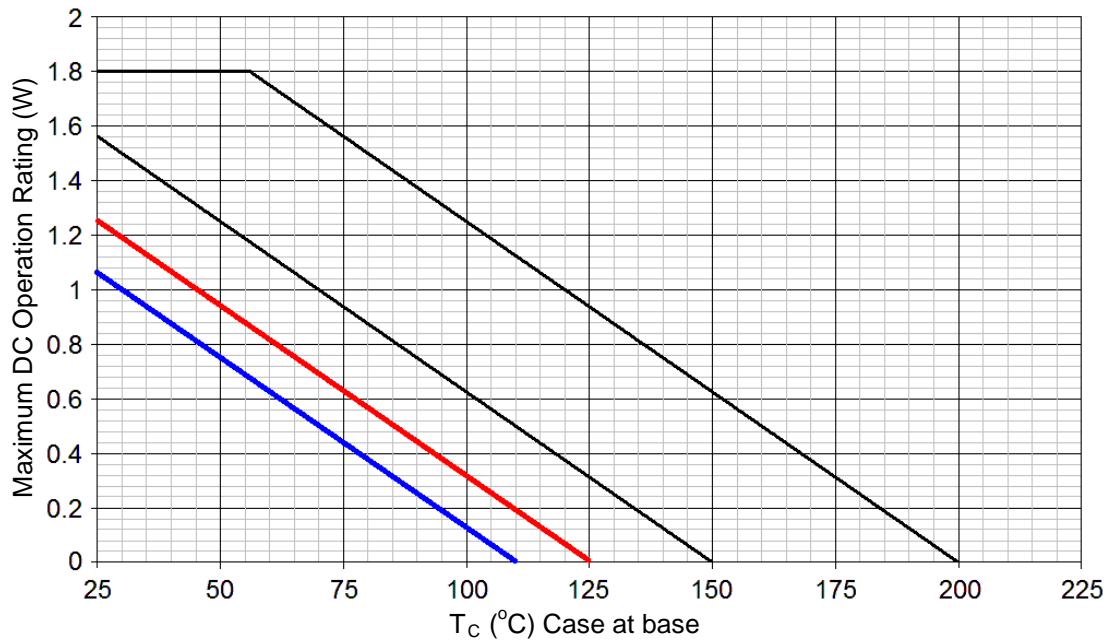
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Collector to Base Cutoff Current $V_{CB} = 140\text{ V}$	$I_{CBO}$		20	$\mu\text{A}$
Emitter to Base Cutoff Current $V_{EB} = 7\text{ V}$	$I_{EBO}$		20	$\mu\text{A}$
Collector to Emitter Breakdown Voltage $I_C = 30\text{ mA}$	$V_{(BR)CEO}$	80		V
Collector-Emitter Cutoff Current $V_{CE} = 90\text{ V}$	$I_{CES}$		20	$\eta\text{A}$
Emitter-Base Cutoff Current $V_{EB} = 5.0\text{ V}$	$I_{EBO}$		20	$\eta\text{A}$
Forward-Current Transfer Ratio <sup>(2)</sup> $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 0.1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 1\text{ A}, V_{CE} = 10\text{ V}$	$[h_{FE}]$	[50] [25] [45] [25] [7.5]	300 300 300 300	
Collector-Emitter Saturation Voltage $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$	$V_{CE(sat)}$		0.23 0.58	V
Base-Emitter Saturation Voltage $I_C = 150\text{ mA}, I_B = 15\text{ mA}$	$V_{BE(sat)}$		1.27	V

- (2) See method 1019 of MIL-STD-750 for how to determine  $[h_{FE}]$  by first calculating the delta ( $1/h_{FE}$ ) from the pre- and post-radiation  $h_{FE}$ . Notice the  $[h_{FE}]$  is not the same as  $h_{FE}$  and cannot be measured directly. The  $[h_{FE}]$  value can never exceed the pre-radiation minimum  $h_{FE}$  that it is based upon.

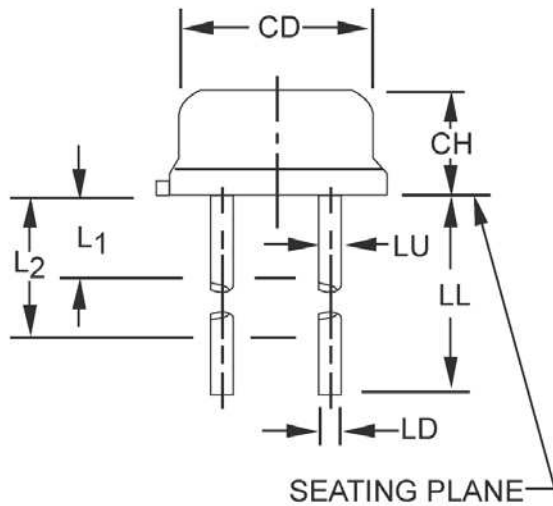
GRAPHS



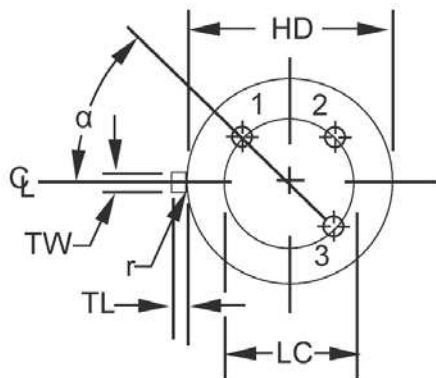
**FIGURE 1**  
Temperature-Power Derating ( $R_{\theta JA}$ )  
 Leads = .125 inch (3.175mm)



**FIGURE 2**  
Temperature-Power Derating ( $R_{\theta JC}$ )

**PACKAGE DIMENSIONS**


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.065	.085	1.65	2.16	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7
LL	.500	1.750	12.70	44.45	7
LU	.016	.019	0.41	0.48	7
L1		.050		1.27	7
L2	.250		6.35		7
TL	.028	.048	0.71	1.22	3
TW	.036	.046	0.91	1.17	2
r		.007		0.18	10, 11
$\alpha$	45° TP		45° TP		6


**NOTES:**

1. Dimension 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. Dimension TL measured from maximum HD.
5. 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. The device may be measured by direct methods.
6. 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.
7. All three leads.
8. The collector shall be internally connected to the case.
9. Dimension r (radius) applies to both inside corners of tab.
10. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.
11. Lead 1 = emitter, lead 2 = base, lead 3 = collector.