Radiation Hardened Low Power NPN Silicon Transistor

JANS_2N3057A

Product Overview

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 per MIL-PRF-19500/391. Microchip also offers numerous other products to meet higher and lower power voltage regulation applications.

Qualified Levels:

- JANSE
- JANSK
- JANSU
- JANSM
- JANSD
- JANSP
- JANSL
- JANSR

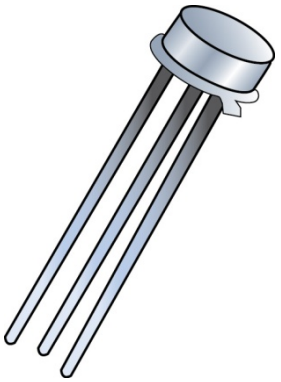
Features

- JEDEC registered 2N3057
- RHA level JAN qualifications per MIL-PRF-19500/391 (see Part Nomenclature for all options)

Applications/Benefits

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

Figure 1. 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

Table of Contents

1. Maximum Ratings

Table 1-1. Maximum Ratings at 25 °C Unless Otherwise Noted

Parameters/Test Conditions		Symbol	Value	Unit
Junction and storage temperature		T_J and T_{STG}	–65 to +200	°C
Thermal impedance junction-to-ambient		$R_{\Theta JA}$	325	°C/W
Thermal impedance junction-to-case		$R_{\Theta JC}$	80	°C/W
Collector-Emitter voltage		V_{CEO}	80	V
Collector-Base voltage		V_{CBO}	140	V
Emitter-Base voltage		V_{EBO}	7.0	V
Collector current		I_C	1.0	A
Total power dissipation:	at T_A = +25 °C[1] at T_C = +25 °C[2]	P_D	0.5 1.8	W

Notes:

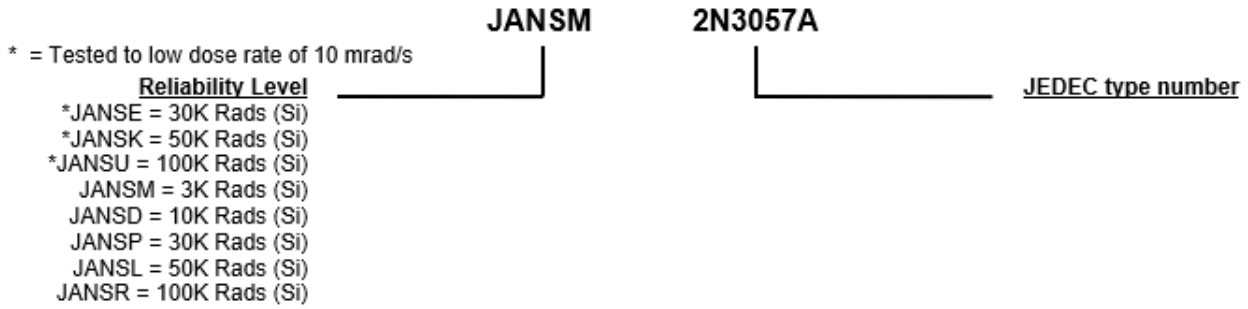
1. Derate linearly 2.3 mW/°C for $T_A \geq +25$ °C
2. Derate linearly 10.3 mW/°C for $T_C \geq +25$ °C

1.1 Mechanical 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.

2. Part Nomenclature

Figure 2-1. Part Nomenclature



2.1 Symbols and Definitions

Table 2-1. Symbols and 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)

3. Electrical Characteristics

Table 3-1. Electrical Characteristics at 25 °C Unless Otherwise Stated

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Off Characteristics				
Collector-Emitter breakdown current I_C = 30 mA	$V_{(BR)CEO}$	80	—	V
Collector-Base cutoff current V_{CB} = 140V	I_{CBO}	—	10	µA
Emitter-Base cutoff current V_{EB} = 7V	I_{EBO1}	—	10	µA
Collector-Emitter cutoff current V_{CE} = 90V	I_{CES}	—	10	ηA
Emitter-Base cutoff current V_{EB} = 5.0V	I_{EBO2}	—	10	ηA
On Characteristics				
Forward-Current transfer ratio I_C = 150 mA, V_{CE} = 10V I_C = 0.1 mA, V_{CE} = 10V I_C = 10 mA, V_{CE} = 10V I_C = 500 mA, V_{CE} = 10V I_C = 1.0A, V_{CE} = 10V	h_{FE}	100 50 90 50 15	300 300 — 300 —	—
Collector-Emitter saturation voltage I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA	$V_{CE(sat)}$	—	0.2 0.5	V
Base-Emitter saturation voltage I_C = 150 mA, I_B = 15 mA	$V_{BE(sat)}$	—	1.1	V

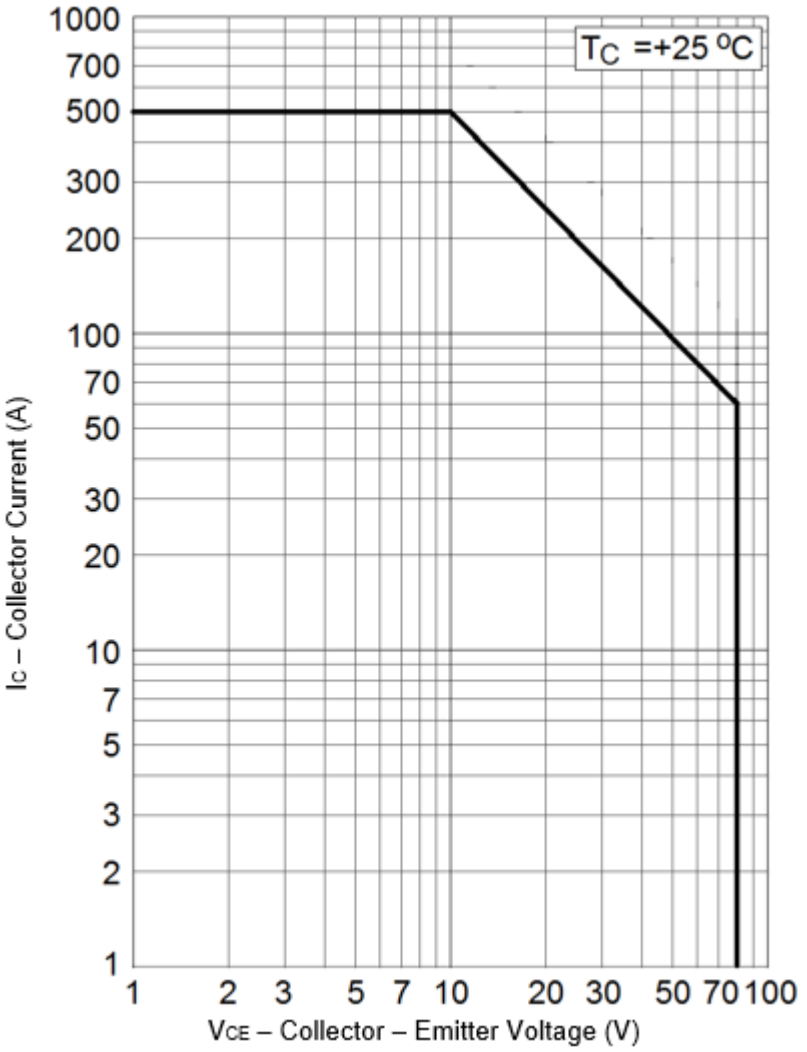
Table 3-2. Dynamic Characteristics

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Small-Signal short-circuit forward current transfer ratio I_C = 1.0 mA, V_{CE} = 5.0V, f = 1.0 kHz	h_{fe}	80	400	—
Magnitude of small-signal short-circuit forward current transfer ratio I_C = 50 mA, V_{CE} = 10V, f = 20 MHz	$\lvert h_{fe} \rvert$	5.0	20	—
Output capacitance V_{CB} = 10V, I_E = 0, 100 kHz ≤ f ≤ 1.0 MHz	C_{obo}	—	12	pF
Input capacitance V_{EB} = 0.5V, I_C = 0, 100 kHz ≤ f ≤ 1.0 MHz	C_{ibo}	—	60	pF

Table 3-3. Safe Operation Area (See the Following SOA Graph and MIL-STD-750, Method 3053)

DC Tests T_C = 25 °C, 1 cycle, t = 10 ms	
Test 1 2N3057A	V_{CE} = 10V I_C = 180 mA
Test 2 2N3057A	V_{CE} = 40V I_C = 45 mA
Test 3 2N3057A	V_{CE} = 80V I_C = 22.5 mA

Figure 3-1. Maximum Safe Operating Area[1]



Note:

1. Pulse Test: Pulse Width = 300 µs, duty cycle ≤ 2.0%.

Table 3-4. Post Radiation Electrical Characteristics

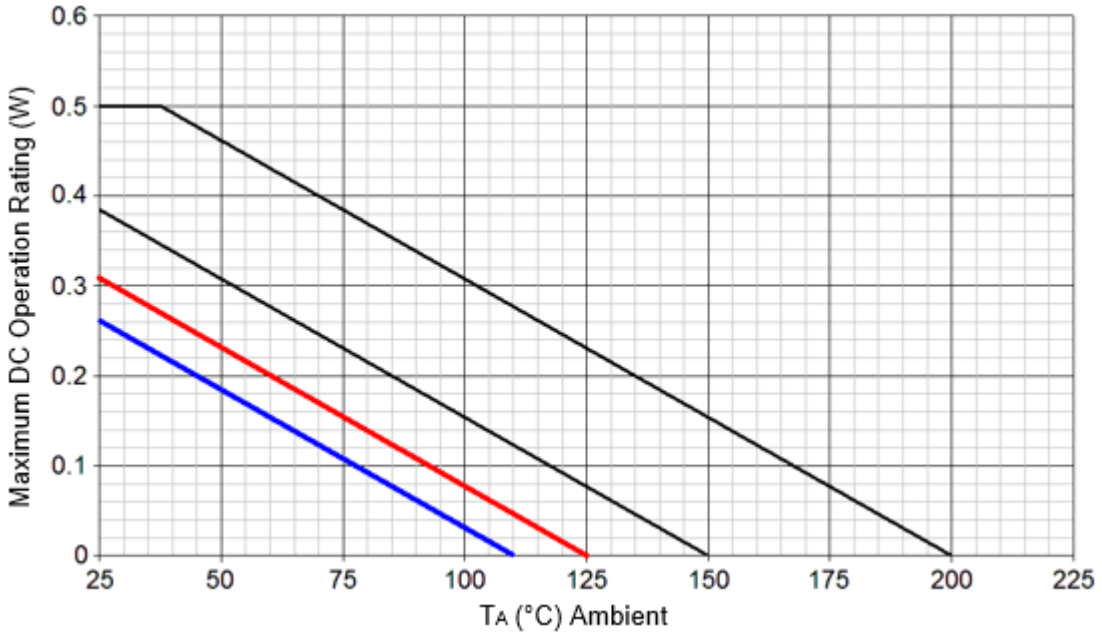
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Collector to base cutoff current V_{CB} = 140V	I_{CBO}	—	20	µA
Emitter to base cutoff current V_{EB} = 7V	I_{EBO}	—	20	µA
Collector to emitter breakdown voltage I_C = 30 mA	$V_{(BR)CEO}$	80	—	V
Collector-Emitter cutoff current V_{CE} = 90V	I_{CES}	—	20	ηA
Emitter-Base cutoff current V_{EB} = 5.0V	I_{EBO}	—	20	ηA
Forward-Current transfer ratio[1] I_C = 150 mA, V_{CE} = 10V I_C = 0.1 mA, V_{CE} = 10V I_C = 10 mA, V_{CE} = 10V I_C = 500 mA, V_{CE} = 10V I_C = 1 A, V_{CE} = 10V	$[h_{FE}]$	[50] [25] [45] [25] [7.5]	300 300 — 300 —	—
Collector-Emitter saturation voltage I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA	$V_{CE(sat)}$	—	0.23 0.58	V
Base-Emitter saturation voltage I_C = 150 mA, I_B = 15 mA	$V_{BE(sat)}$	—	1.27	V

Note:

1. 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.

4. Graphs

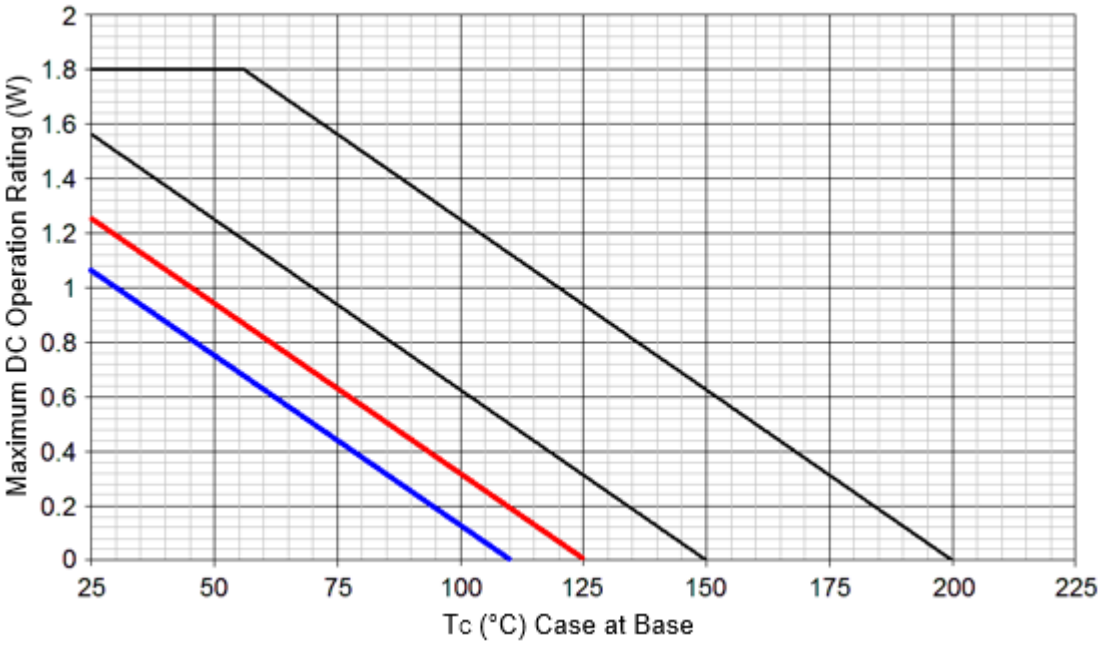
Figure 4-1. Temperature-Power Derating ($R_{\Theta JA}$)[1]



Note:

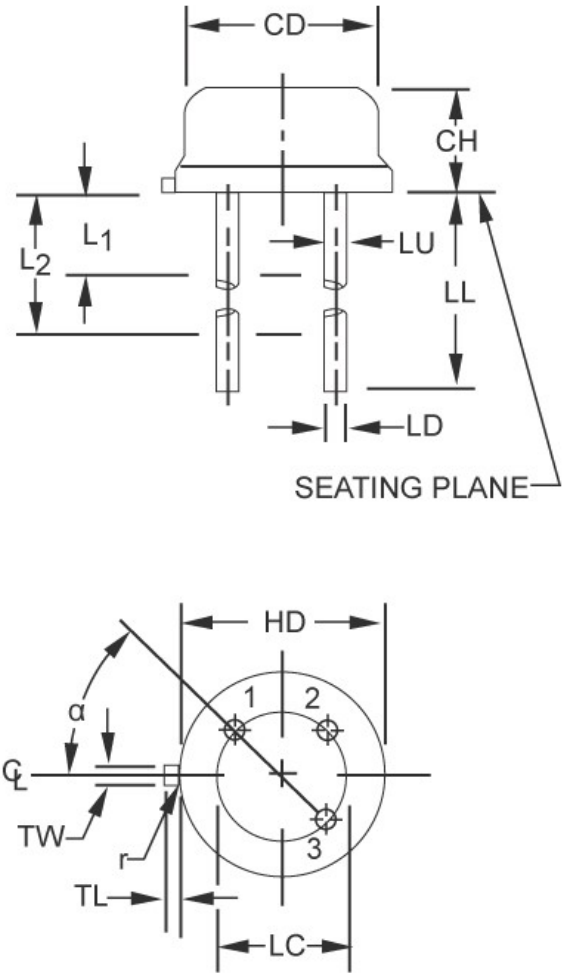
1. Leads = 0.125 inch (3.175 mm)

Figure 4-2. Temperature-Power Derating ($R_{\Theta JSP}$)



5. Package Dimensions

Figure 5-1. Package Dimensions



Symbol	Dimensions				Note
	Inches		Millimeters		
	Min.	Max.	Min.	Max.	
CD	0.178	0.195	4.52	4.95	—
CH	0.065	0.085	1.65	2.16	—
HD	0.209	0.230	5.31	5.84	—
LC	0.100 TP		2.54 TP		6
LD	0.016	0.021	0.41	0.53	7
LL	0.500	1.750	12.70	44.45	7
LU	0.016	0.019	0.41	0.48	7
L1	—	0.050	—	1.27	7
L2	0.250	—	6.35	—	7
TL	0.028	0.048	0.71	1.22	3

.....continued

Symbol	Dimensions				Note
	Inches		Millimeters		
	Min.	Max.	Min.	Max.	
TW	0.036	0.046	0.91	1.17	2
r	—	0.007	—	0.18	10, 11
α	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 0.011 inch (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Leads at gauge plane 0.054 +0.001 –0.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within 0.007 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_1 and L_2. Dimension LD applies between L_2 and LL minimum. The diameter is uncontrolled in L_1 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 Φx symbology.
11. Lead 1 = emitter, lead 2 = base, lead 3 = collector

6. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Description
A	06/2024	Document was converted to Microchip template. Previous Microsemi literature number T4-LDS-0262 was replaced with DS00005462A.

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