

Radiation Hardened Low Power NPN Silicon Transistor

_2 JANS_2N3019 AND JANS_2N3019S N3019S



Product Overview

This RHA level 2N3019 and 2N3019S NPN leaded metal device is RAD hard qualified for high-reliability applications. Microchip also offers numerous other transistor products to meet higher and lower power ratings with various switching speed requirements in both through-hole and surface-mount packages.

Qualified Levels:

- JANSE
- JANSK
- JANSU
- JANSM
- JANS D
- JANSP
- JANSL
- JANSR

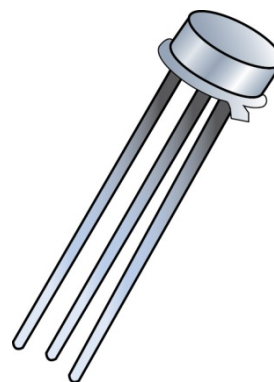
Features

- JEDEC registered 2N3019
- RHA level JAN qualifications per MIL-PRF-19500/391 (see [Part Nomenclature](#) for all options)

Applications/Benefits

- Leaded TO-39 and TO-5 package
- Lightweight
- Low power
- Military and other high-reliability applications

Figure 1. TO-39 (TO-205AD) and TO-5 Package



Also available in:

TO-46 (TO-206AB)

(leaded)

[JANS_2N3057A](#)

TO-18 (TO-206AA)

(leaded)

[JANS_2N3700](#)

UB package

(leaded)

[JANS_2N3700UB](#)

Table of Contents

Product Overview.....	1
1. Maximum Ratings.....	3
1.1. Mechanical Packaging.....	3
2. Part Nomenclature.....	4
2.1. Symbols and Definitions.....	4
3. Electrical Characteristics.....	5
4. Graphs.....	8
5. Package Dimensions.....	9
6. Revision History.....	11
Microchip Information.....	12
The Microchip Website.....	12
Product Change Notification Service.....	12
Customer Support.....	12
Microchip Devices Code Protection Feature.....	12
Legal Notice.....	12
Trademarks.....	13
Quality Management System.....	14
Worldwide Sales and Service.....	15

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 resistance junction-to-ambient	$R_{\theta JA}$	195	°C /W
Thermal resistance junction-to-case	$R_{\theta JC}$	30	°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 $T_A = +25\text{ °C}$ ¹	P_D	0.8	W
at $T_C = +25\text{ °C}$ ²		5.0	

Notes:

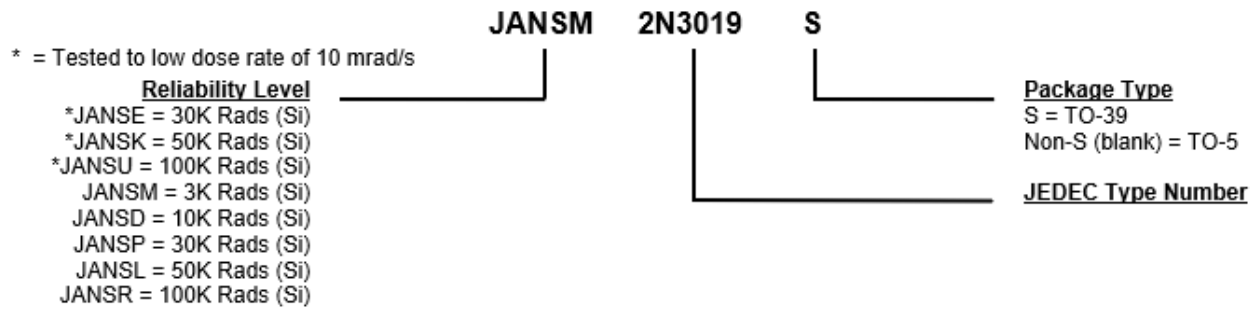
1. Derate linearly 4.6 mW/°C for $T_A \geq +25\text{ °C}$
2. Derate linearly 28.6 mW/°C for $T_C \geq +25\text{ °C}$

1.1 Mechanical Packaging

- Case: Hermetically sealed, kovar base, nickel cap
- Terminals: Gold plate, solder dip (Sn63/Pb37) available upon request
- Marking: Part number, date code, manufacturer's ID and serial number
- Polarity: NPN
- Weight: Approximately 1.064 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

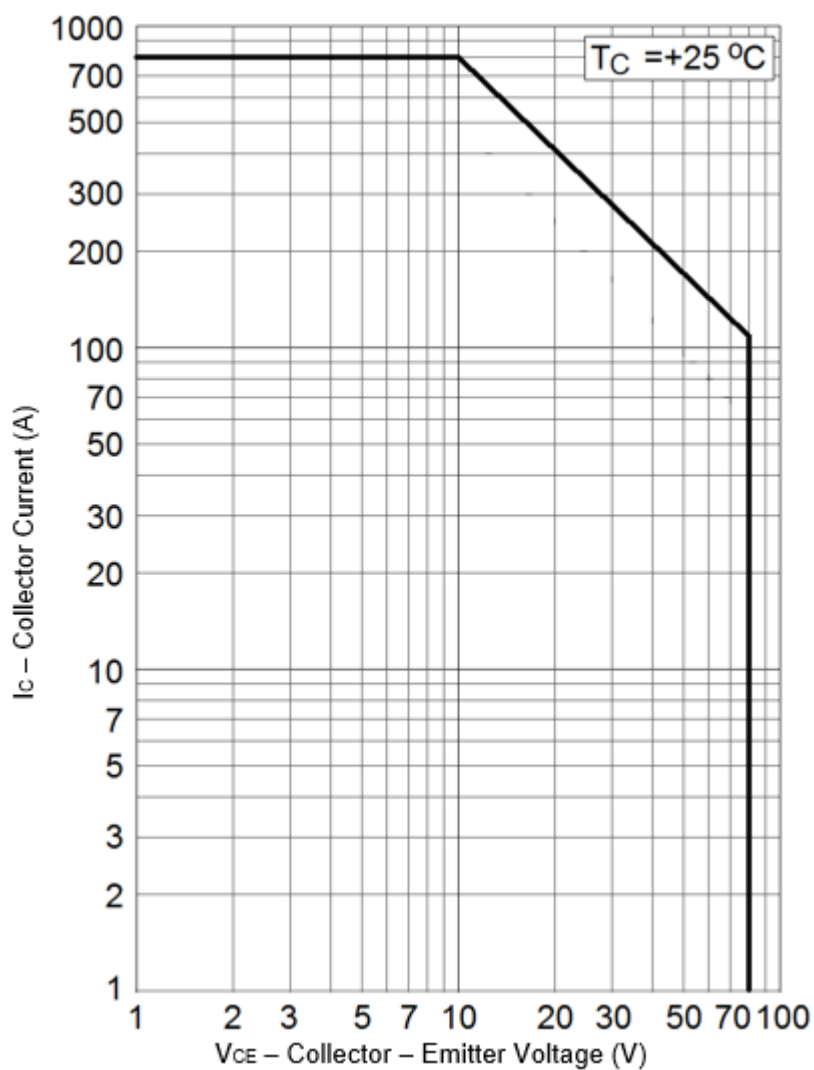
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Off Characteristics				
Collector-Emitter breakdown current $I_C = 30 \text{ mA}$	$V_{(BR)CEO}$	80	—	V
Collector-Base cutoff current $V_{CB} = 140\text{V}$	I_{CBO}	—	10	μA
Emitter-Base cutoff current $V_{EB} = 7\text{V}$	I_{EBO1}	—	10	μA
Collector-Emitter cutoff current $V_{CE} = 90\text{V}$	I_{CES}	—	10	ηA
Emitter-Base cutoff current $V_{EB} = 5.0\text{V}$	I_{EBO2}	—	10	ηA
On Characteristics				
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

Table 3-2. 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

Table 3-3. Safe Operation Area (See the following SOA graph and [MIL-STD-750, Method 3053](#))

DC Tests	
$T_C = 25\text{ }^{\circ}\text{C}$, 1 cycle, $t = 10\text{ ms}$	
Test 1 2N3019, 2N3019S	$V_{CE} = 10\text{V}$ $I_C = 500\text{ mA}$
Test 2 2N3019, 2N3019S	$V_{CE} = 40\text{V}$ $I_C = 125\text{ mA}$
Test 3 2N3019, 2N3019S	$V_{CE} = 80\text{V}$ $I_C = 60\text{ mA}$

Figure 3-1. Maximum Safe Operating Area¹**Note:**

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

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 $I_C = 30\text{ mA}$	$V_{(BR)CEO}$	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 $I_C = 150\text{ mA}, V_{CE} = 10V$ $I_C = 0.1\text{ mA}, V_{CE} = 10V$ $I_C = 10\text{ mA}, V_{CE} = 10V$ $I_C = 500\text{ mA}, V_{CE} = 10V$ $I_C = 1A, V_{CE} = 10V$	$[h_{FE}]$	[50] [25] [45] [25] [7.5]	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

Note:

- 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 ($R_{\theta JA}$)

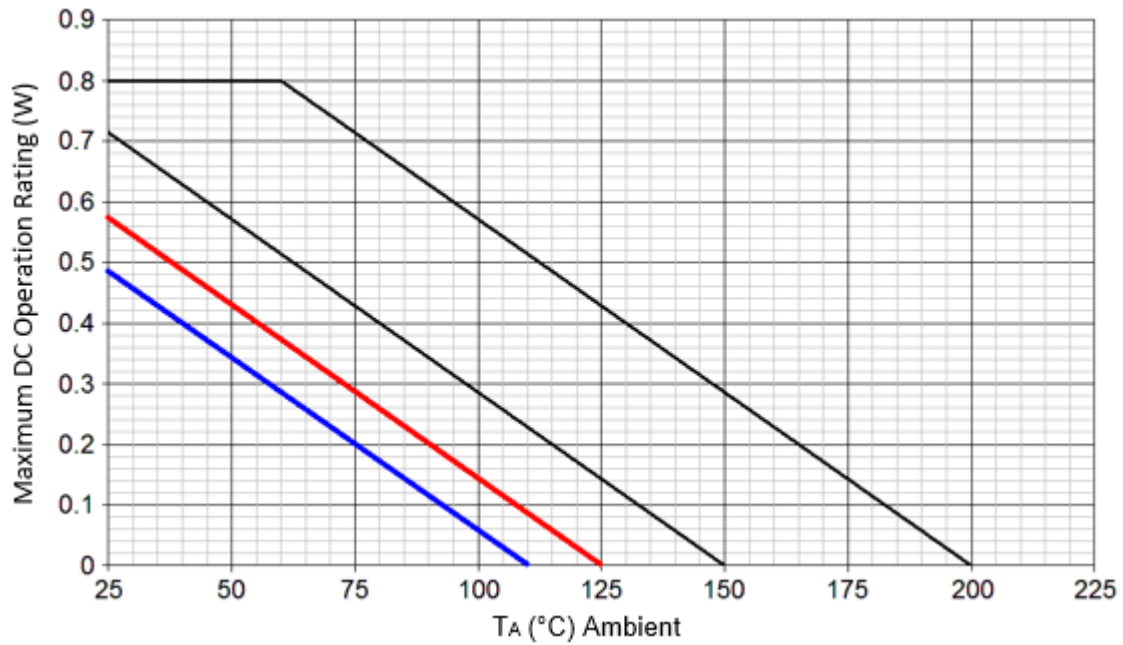
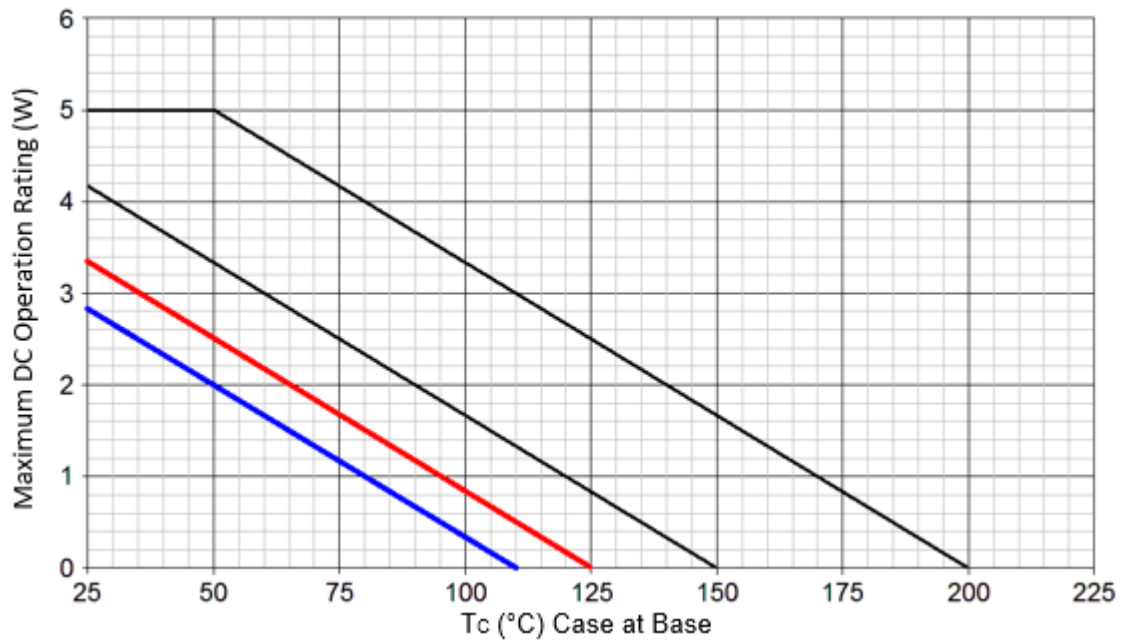
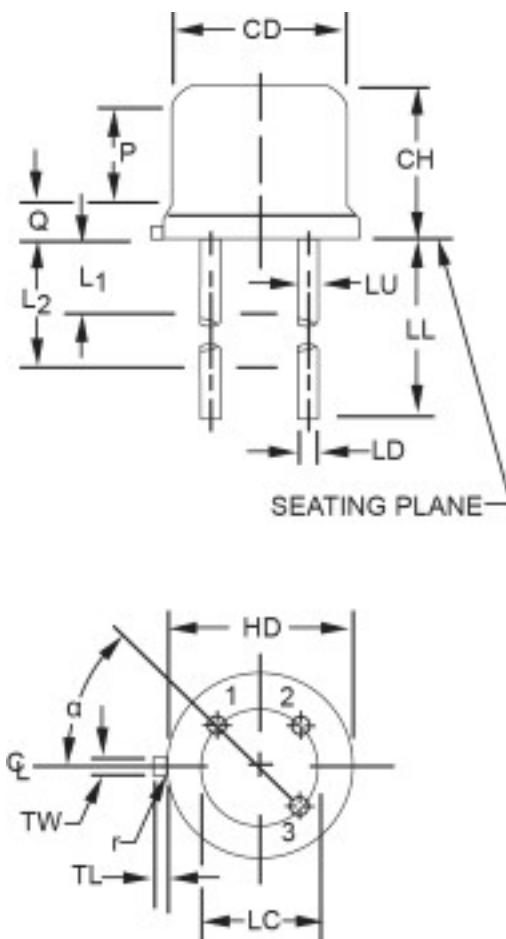


Figure 4-2. Temperature-Power Derating ($R_{\theta JP}$)



5. Package Dimensions

Figure 5-1. Package Dimensions



Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min.	Max.	Min.	Max.	
CD	0.305	0.335	7.75	8.51	—
CH	0.240	0.260	6.10	6.60	—
HD	0.335	0.370	8.51	9.40	—
LC	0.200 TP		5.08 TP		6
LD	0.016	0.021	0.41	0.53	7, 8
LL	0.500	0.750	12.70	19.05	7, 8, 12
LU	0.016	0.019	0.41	0.48	7, 8
L ₁	—	0.050	—	1.27	7, 8
L ₂	0.250	—	6.35	—	7, 8
Q	—	0.050	—	1.27	5
TL	0.029	0.045	0.74	1.14	4

.....continued

.....continued

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min.	Max.	Min.	Max.	
TW	0.028	0.034	0.71	0.86	3
r	—	0.010	—	0.25	10
α	45° TP		45° TP		6
P	0.100	—	2.54	—	—

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 (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 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.
7. Dimension LU applies between L1 and L2. Dimension LD applies between L2 and minimum. Diameter is uncontrolled in L1 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. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.
12. For "S" suffix devices, dimension LL is 0.500 (12.70 mm) minimum, 0.750 (19.05 mm) maximum.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector
14. TO-39, Dim LL is 0.50" - 0.75"; TO-5, Dim LL is 1.500" - 1.750"

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-0098 was replaced with DS00005463A.

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