RADIATION HARDENED LOW POWER NPN SILICON TRANSISTOR

Qualified per MIL-PRF-19500/391

Qualified Levels:
JANSM, JANSD, JANSP, JANSL, JANSR and JANSF

DESCRIPTION

This NPN leaded metal device is RAD hard qualified for high-reliability applications. 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 2N3700.
- RHA level JAN qualifications per MIL-PRF-19500/391 (see part nomenclature for all options).

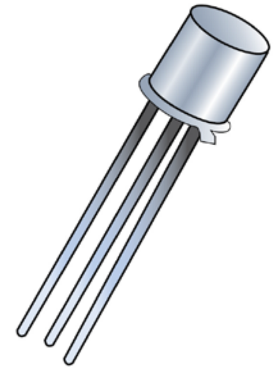
APPLICATIONS / BENEFITS

- Leaded TO-18 package.
- Lightweight.
- Low power.
- Military and other high-reliability applications.

MAXIMUM RATINGS @ T_A = +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	$R_{\Theta JC}$	150	°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: @ T_A = +25 °C (1) @ T_C = +25 °C (2)	P_D	0.5 1.0	W

Notes:
1. Derate linearly 2.85 mW/°C for $T_A \geq$ +25 °C.
2. Derate linearly 10.3 mW/°C for $T_C \geq$ +25 °C.



TO-18 (TO-206AA) Package

Also available in:

UB package
(leaded)
JANS_2N3700UB

TO-39 (TO-205AD)
(leaded)
JANS_2N3019, 2N3019S

TO-46 (TO-206AB)
(leaded)
JANS_2N3057A

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

MECHANICAL and PACKAGING

- CASE: Hermetically sealed, nickel plated kovar base, nickel cap.
- TERMINALS: Gold plate over nickel kovar.
- MARKING: Part number, date code, manufacturer's ID, and serial number.
- WEIGHT: Approximately 0.3 grams.
- See Package Dimensions on last page.

PART NOMENCLATURE

JANSM 2N3700

Reliability Level
JANSM = 3K Rads (Si)
JANSD = 10K Rads (Si)
JANSP = 30K Rads (Si)
JANSL = 50K Rads (Si)
JANSR = 100K Rads (Si)
JANSF = 300K Rads (Si)

JEDEC type number

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 °C, unless otherwise noted

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} = 140 V	I_{CBO}		10	µA
Emitter-Base Cutoff Current V_{EB} = 7 V	I_{EBO1}		10	µA
Collector-Emitter Cutoff Current V_{CE} = 90 V	I_{CES}		10	ηA
Emitter-Base Cutoff Current V_{EB} = 5.0 V	I_{EBO2}		10	ηA
ON CHARACTERISTICS (1)				
Forward-Current Transfer Ratio I_C = 150 mA, V_{CE} = 10 V I_C = 0.1 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V I_C = 500 mA, V_{CE} = 10 V I_C = 1.0 A, V_{CE} = 10 V	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

DYNAMIC CHARACTERISTICS

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

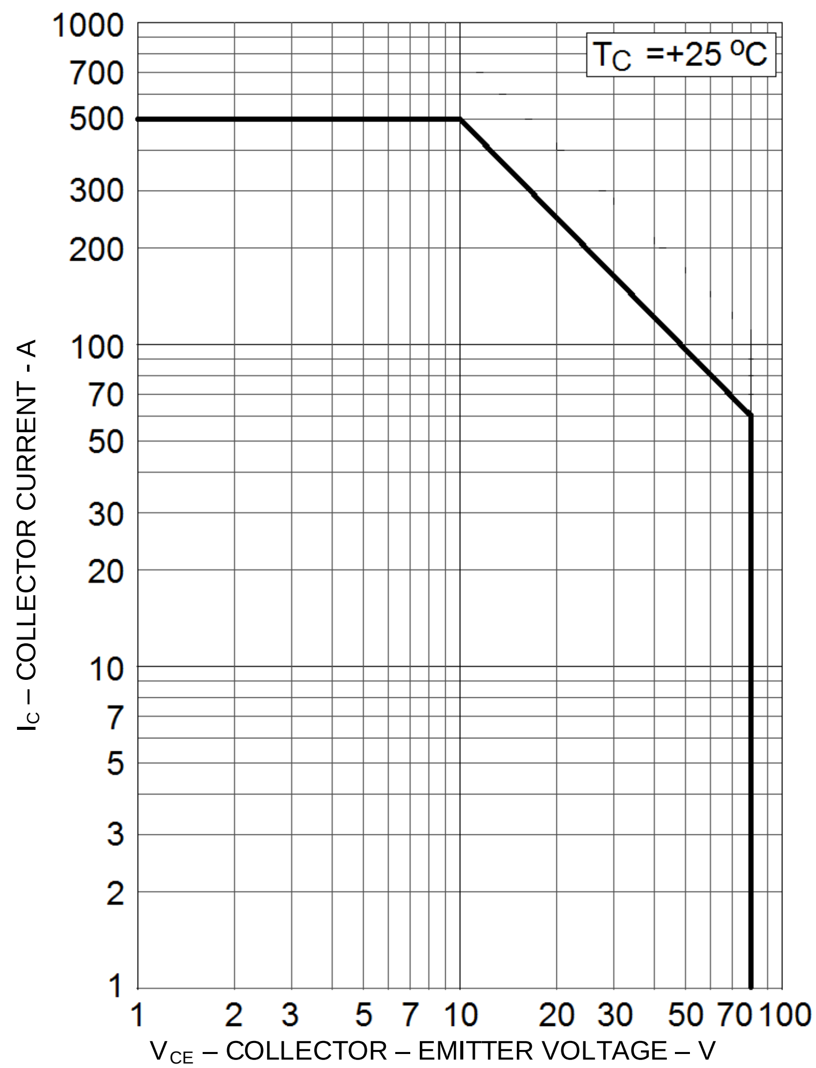
(1) Pulse Test: Pulse Width = 300 µs, duty cycle ≤ 2.0%.

ELECTRICAL CHARACTERISTICS @ T_A = +25 °C, unless otherwise noted (continued)

SAFE OPERATION AREA (See SOA graph below and MIL-STD-750, method 3053)

DC Tests
T_C = 25 °C, 1 cycle, t = 10 ms

Test 1 2N3700	V_{CE} = 10 V I_C = 180 mA
Test 2 2N3700	V_{CE} = 40 V I_C = 45 mA
Test 3 2N3700	V_{CE} = 80 V I_C = 22.5 mA



Maximum Safe Operating Area

ELECTRICAL CHARACTERISTICS @ T_A = +25 °C, unless otherwise noted (continued)

POST RADIATION ELECTRICAL CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Collector to Base Cutoff Current V_{CB} = 140 V	I_{CBO}		20	µA
Emitter to Base Cutoff Current V_{EB} = 7 V	I_{EBO}		20	µA
Collector to Emitter Breakdown Voltage I_C = 30 mA	$V_{(BR)CEO}$	80		V
Collector-Emitter Cutoff Current V_{CE} = 90 V	I_{CES}		20	ηA
Emitter-Base Cutoff Current V_{EB} = 5.0 V	I_{EBO}		20	ηA
Forward-Current Transfer Ratio (2) I_C = 150 mA, V_{CE} = 10 V I_C = 0.1 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V I_C = 500 mA, V_{CE} = 10 V I_C = 1 A, V_{CE} = 10 V	[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

(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

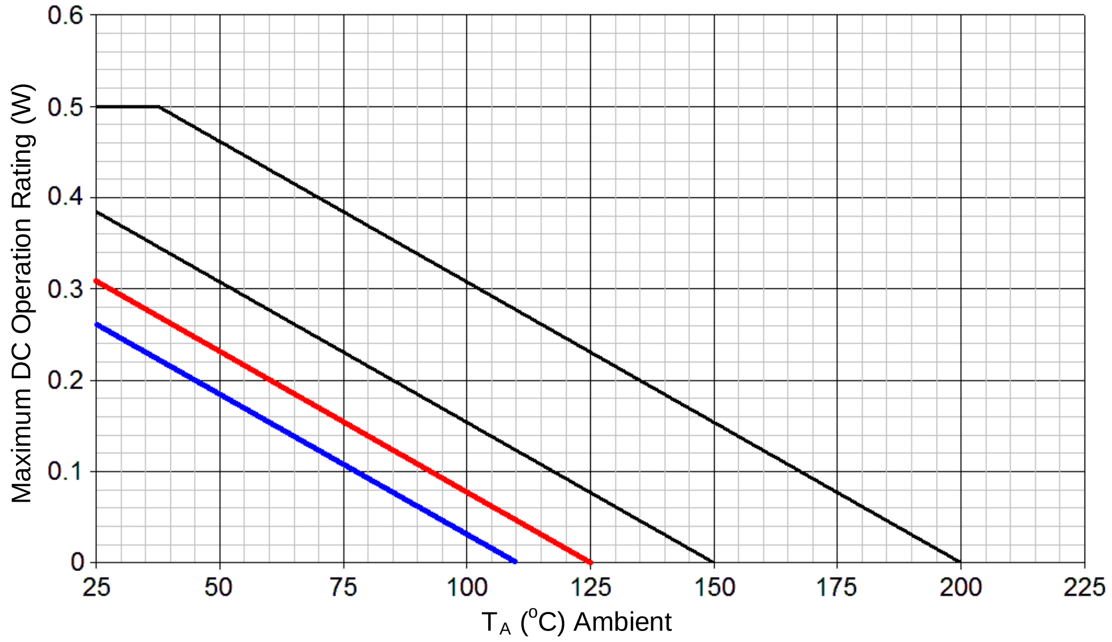


FIGURE 1

Temperature-Power Derating ($R_{\Theta JA}$)

Leads = .125 inch (3.175mm)

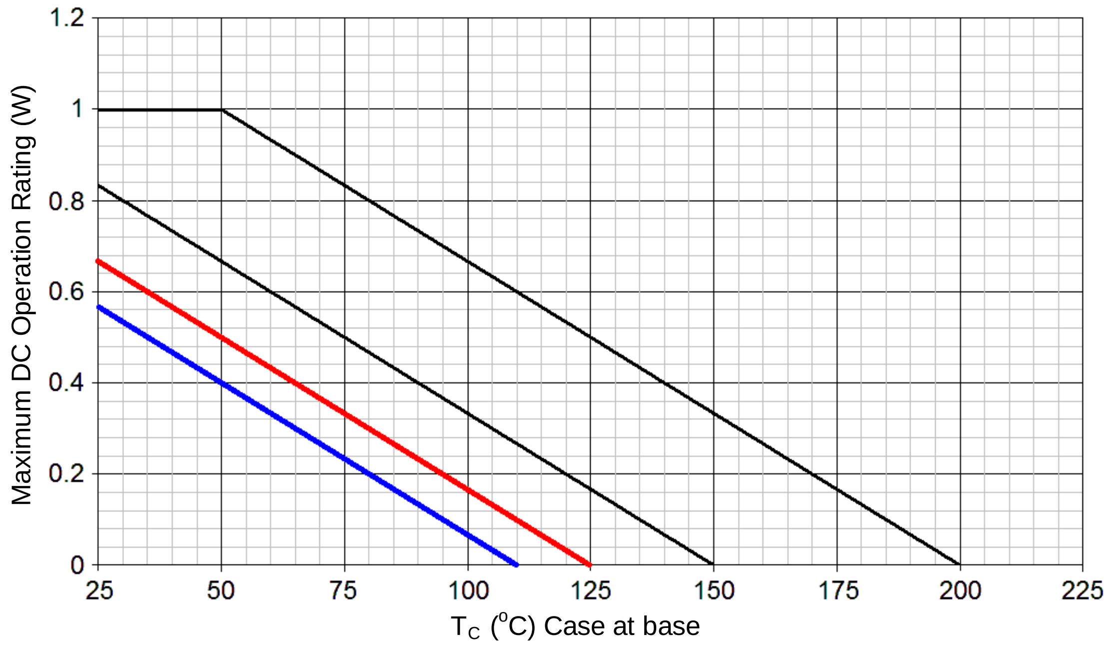
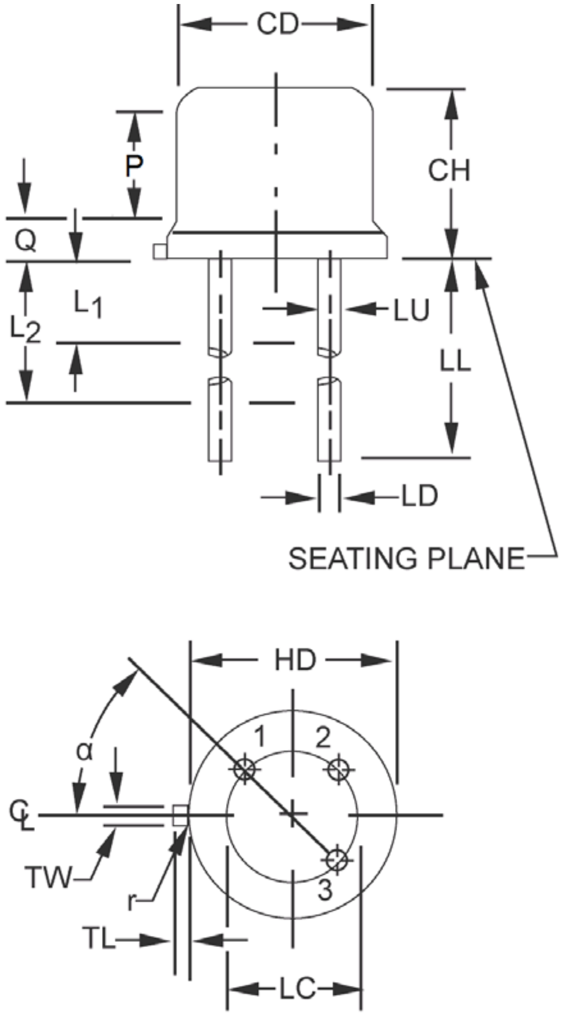


FIGURE 2

Temperature-Power Derating ($R_{\Theta JC}$)

PACKAGE DIMENSIONS



Symbol	Dimensions				Note
	Inch		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7,8
LL	.500	.750	12.70	19.05	7,8
LU	.016	.019	0.41	0.48	7,8
L1		.050		1.27	7,8
L2	.250		6.35		7,8
P	.100		2.54		
Q		.030		0.76	5
TL	.028	.048	0.71	1.22	3,4
TW	.036	.046	0.91	1.17	3
r		.010		0.25	10
α	45° TP		45° TP		6
1, 2, 9, 11, 12					

NOTES:

1. Dimension 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 inch (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. The device may be measured by direct methods or by the gauge and gauging procedure shown in figure 2.
7. Dimension LU applies between L_1 and L_2. Dimension LD applies between L_2 and LL minimum. Diameter is uncontrolled in L_1 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 Φx symbology.
12. Lead 1 = emitter, lead 2 = base, lead 3 = collector.