



RADIATION HARDENED NPN SILICON SWITCHING TRANSISTOR

Qualified per MIL-PRF-19500/366

*Qualified Levels:
JAN, JANTX, JANTXV
AND JANS*

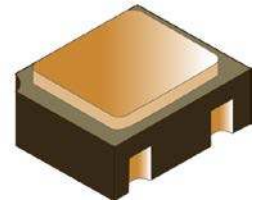
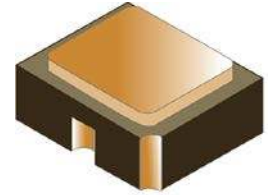
DESCRIPTION

This 2N3501 epitaxial planar transistor is military qualified up to a JANS level for high-reliability applications. This device is also available in thru hole TO-5 and TO-39 packaging as well as a low profile U4 surface mount. Microsemi 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.

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

FEATURES


- Surface mount equivalent of JEDEC registered 2N3501 number.
- JAN, JANTX, JANTXV and JANS qualifications are available per MIL-PRF-19500/366. (See [part nomenclature](#) for all available options.)
- RoHS compliant by design.



UB Package

Also available in:


TO-5 package
(long-leaded)

 [2N3498L – 2N3501L](#)

TO-39 (TO-205AD)
package
(leaded)

 [2N3498 – 2N3501](#)

U4 package
(surface mount)

 [2N3498U4 – 2N3501U4](#)

APPLICATIONS / BENEFITS

- General purpose transistors for medium power applications requiring high frequency switching.
- Low profile ceramic package.
- Lightweight.
- Military and other high-reliability applications.

MAXIMUM RATINGS @ T_C = +25 °C unless otherwise noted

Parameters / Test Conditions	Symbol	Value	Unit
Junction & Storage Temperature Range	T _J , T _{stg}	-65 to +200	°C
Thermal Resistance Junction-to-Ambient	R _{θJA}	325	°C/W
Thermal Resistance Junction-to-Solder Pad	R _{θJSP}	90	°C/W
Collector-Emitter Voltage	V _{CEO}	150	V
Collector-Base Voltage	V _{CB0}	150	V
Emitter-Base Voltage	V _{EBO}	6.0	V
Collector Current	I _C	300	mA
Total Power Dissipation	P _T	0.5 1.5	W
		@ T _A = +25 °C ⁽¹⁾	
		@ T _{SP} = +25 °C ⁽²⁾	

Notes: 1. See [figure 1](#).
2. See [figure 2](#).

MSC – Lawrence

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

MSC – Ireland

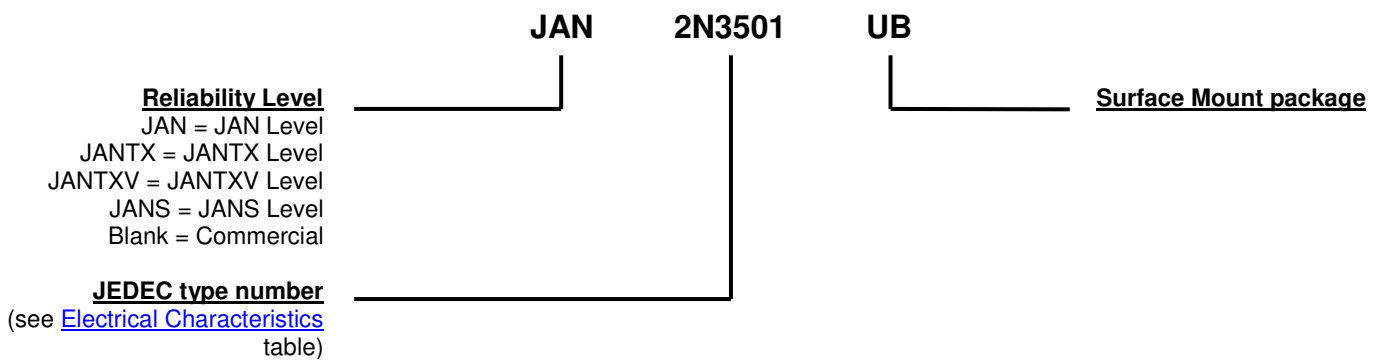
Gort Road Business Park,
Ennis, Co. Clare, Ireland
Tel: +353 (0) 65 6840044
Fax: +353 (0) 65 6822298

Website:

www.microsemi.com

MECHANICAL and PACKAGING

- CASE: Ceramic.
- TERMINALS: Gold plating over nickel under plate.
- MARKING: Part number, date code, manufacturer's ID.
- TAPE & REEL option: Standard per EIA-418D. Consult factory for quantities.
- WEIGHT: < 0.04 Grams.
- See [Package Dimensions](#) on last page.

PART NOMENCLATURE

SYMBOLS & DEFINITIONS

Symbol	Definition
C_{obo}	Common-base open-circuit output capacitance
I_{CEO}	Collector cutoff current, base open
I_{CEX}	Collector cutoff current, circuit between base and emitter
I_{EBO}	Emitter cutoff current, collector open
h_{FE}	Common-emitter static forward current transfer ratio
V_{CEO}	Collector-emitter voltage, base open
V_{CBO}	Collector-emitter voltage, emitter open
V_{EBO}	Emitter-base voltage, collector open

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

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage $I_C = 10\text{ mA}$, pulsed	$V_{(BR)CEO}$	150		V
Collector-Base Cutoff Current $V_{CB} = 75\text{ V}$ $V_{CB} = 150\text{ V}$	I_{CBO}		50 10	nA μA
Emitter-Base Cutoff Current $V_{EB} = 4.0\text{ V}$ $V_{EB} = 6.0\text{ V}$	I_{EBO}		25 10	nA μA

ON CHARACTERISTICS ⁽¹⁾

Forward-Current Transfer Ratio $I_C = 0.1\text{ mA}$, $V_{CE} = 10\text{ V}$ $I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}$, $V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}$, $V_{CE} = 10\text{ V}$ $I_C = 300\text{ mA}$, $V_{CE} = 10\text{ V}$	h_{FE}	35 50 75 100 20	300	
Collector-Emitter Saturation Voltage $I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$ $I_C = 150\text{ mA}$, $I_B = 15\text{ mA}$	$V_{CE(sat)}$		0.2 0.4	V
Base-Emitter Saturation Voltage $I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$ $I_C = 150\text{ mA}$, $I_B = 15\text{ mA}$	$V_{BE(sat)}$		0.8 1.2	V

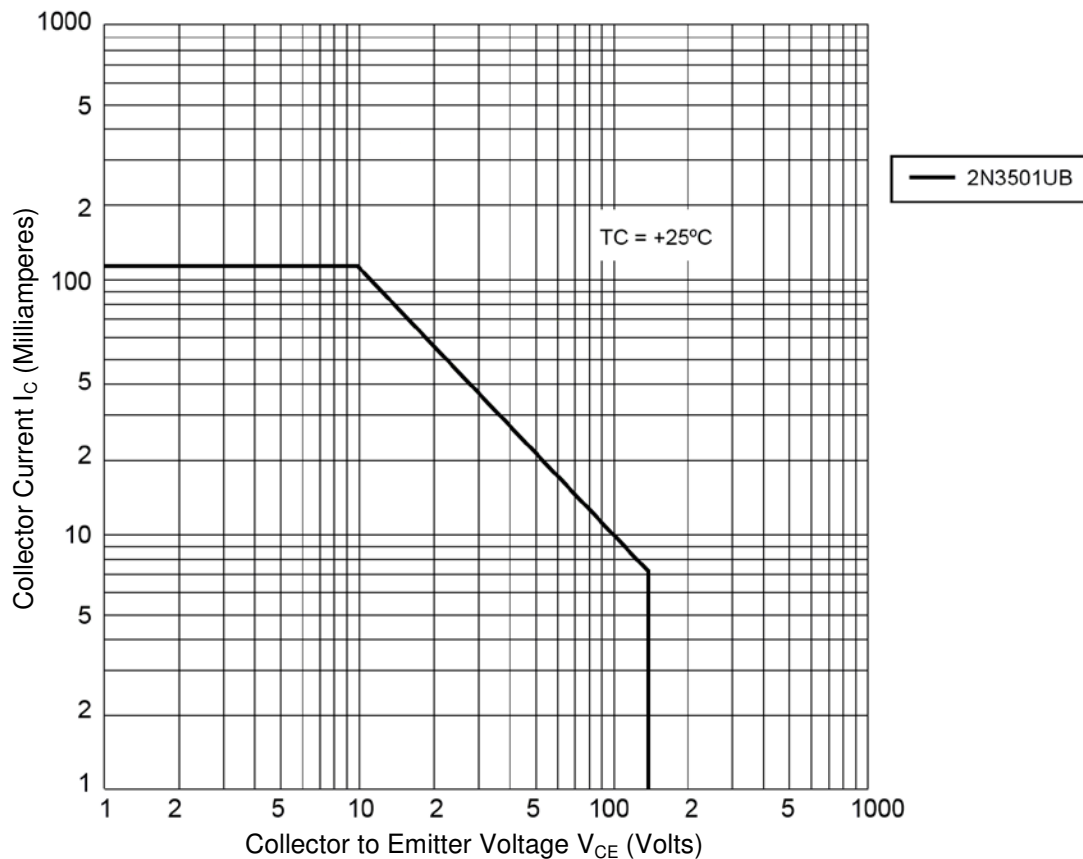
DYNAMIC CHARACTERISTICS

Forward Current Transfer Ratio, Magnitude $I_C = 20\text{ mA}$, $V_{CE} = 20\text{ V}$, $f = 100\text{ MHz}$	$ h_{fe} $	1.5	8.0	
Output Capacitance $V_{CB} = 10\text{ V}$, $I_E = 0$, $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$	C_{obo}		8.0	pF
Input Capacitance $V_{EB} = 0.5\text{ V}$, $I_C = 0$, $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$	C_{ibo}		80	pF

(1) Pulse Test: pulse width = 300 μs , duty cycle $\leq 2.0\%$.

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

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time $V_{EB} = 5\text{ V}; I_C = 150\text{ mA}; I_{B1} = 15\text{ mA}$	t_{on}		115	ns
Turn-Off Time $I_C = 150\text{ mA}; I_{B1} = I_{B2} = 15\text{ mA}$	t_{off}		1150	ns

SAFE OPERATING AREA (See SOA figure and reference [MIL-STD-750 method 3053](#))
DC Tests
 $T_C = +25^\circ\text{C}$, $t_r \geq 10\text{ ns}$; 1 Cycle, $t = 1.0\text{ s}$
Test 1
 $V_{CE} = 10\text{ V}, I_C = 113\text{ mA}$
Test 2
 $V_{CE} = 50\text{ V}, I_C = 23\text{ mA}$
Test 3
 $V_{CE} = 80\text{ V}, I_C = 14\text{ mA}$
Clamped Switching
 $T_A = +25^\circ\text{C}$
Test 1
 $I_B = 50\text{ mA}, I_C = 300\text{ mA}$


Maximum Safe Operating Area

GRAPHS

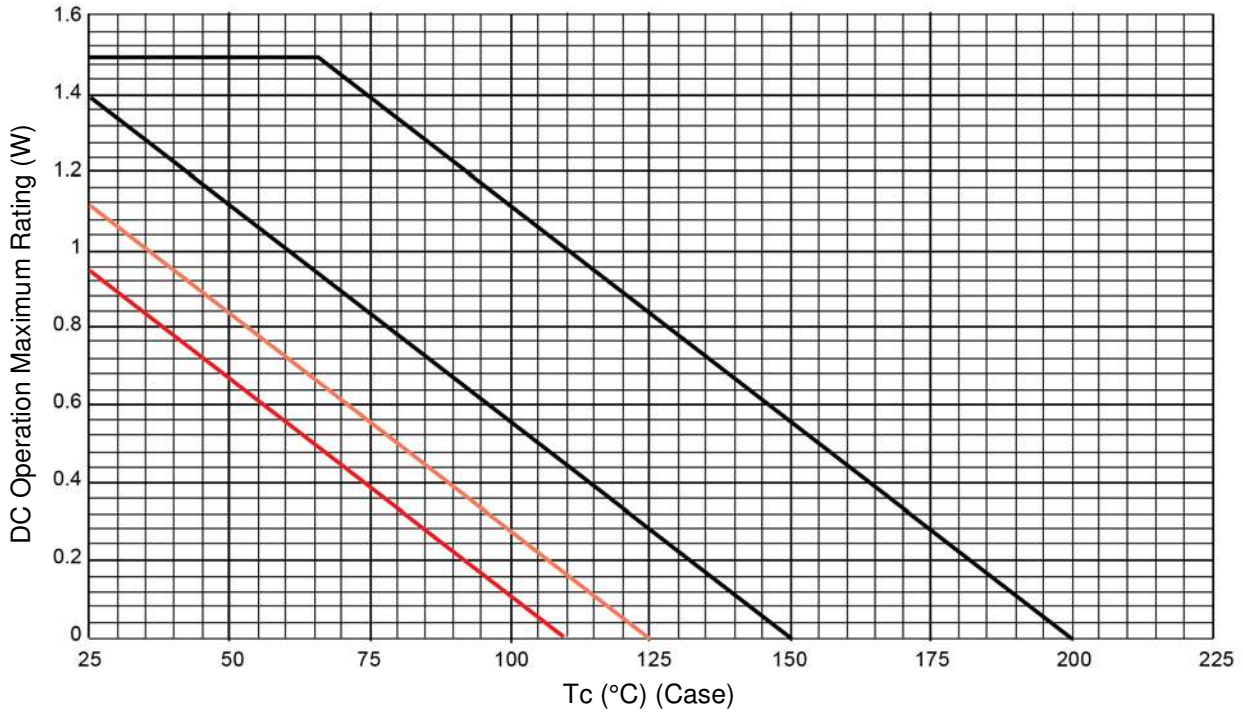


FIGURE 1
Derating for all devices ($R_{\theta JSP}$)

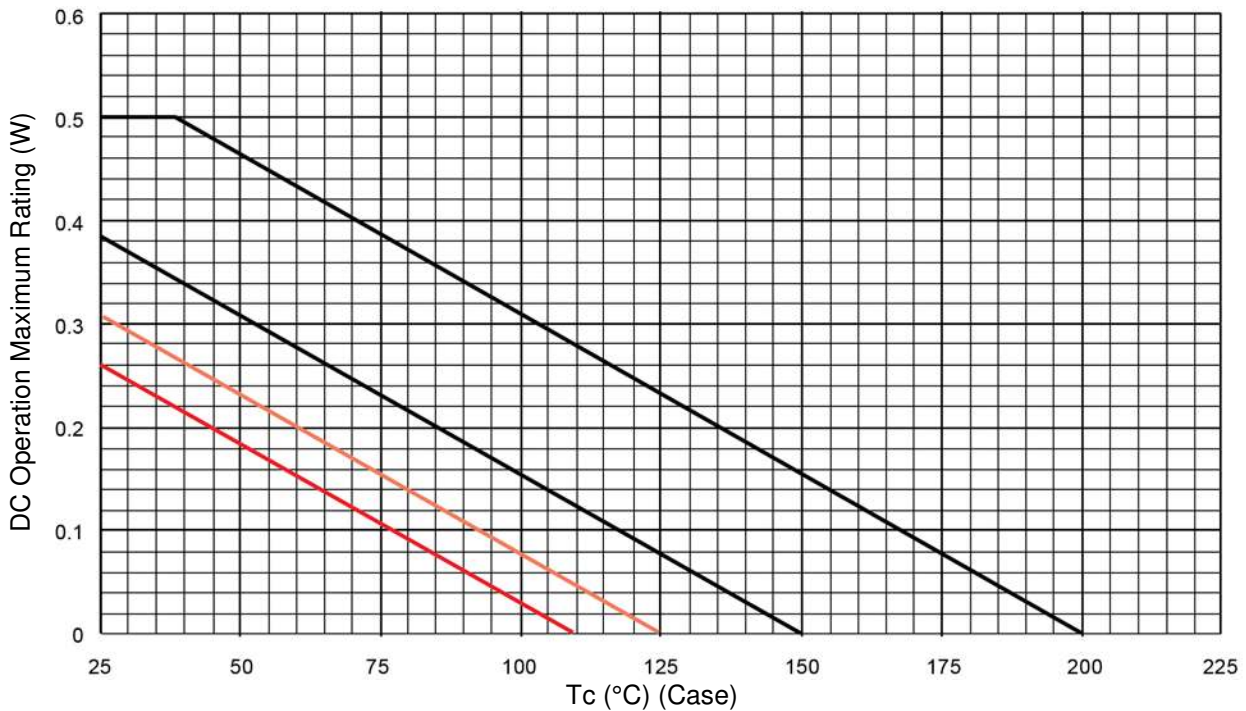


FIGURE 2
Derating for all devices ($R_{\theta JA}$)

GRAPHS

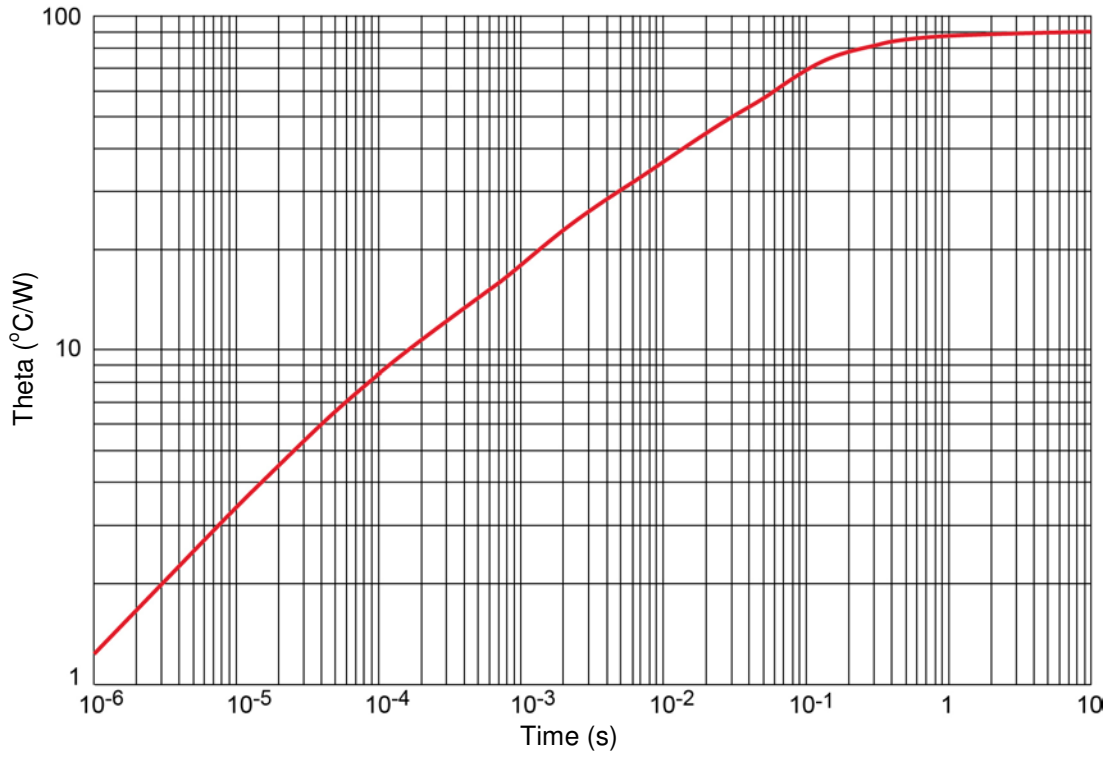
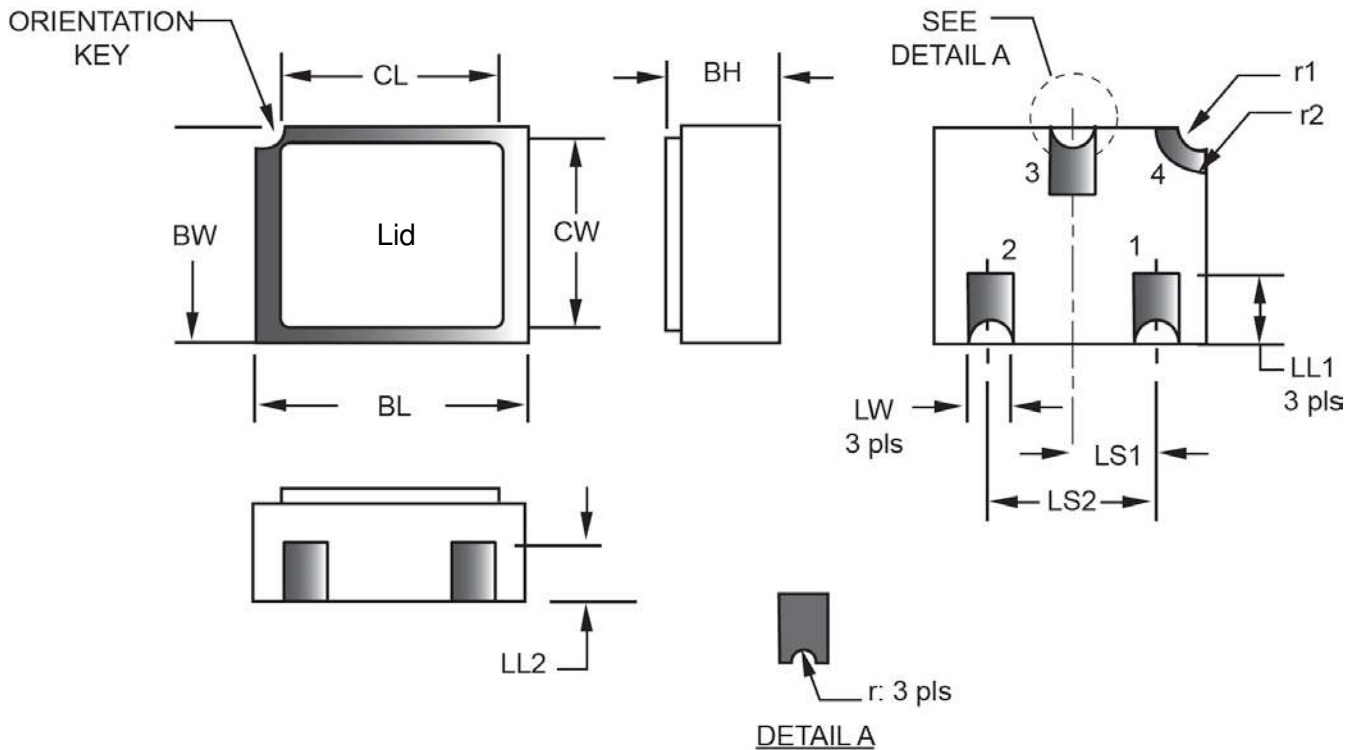


FIGURE 3
Thermal impedance graph ($R_{\theta\text{JSP}}$)

PACKAGE DIMENSIONS


Symbol	Dimensions				Note	Symbol	Dimensions				Note
	Inch		Millimeters				Inch		Millimeters		
	Min	Max	Min	Max			Min	Max	Min	Max	
BH	.046	.056	1.17	1.42		LS₁	.036	.040	0.91	1.02	
BL	.115	.128	2.92	3.25		LS₂	.071	.079	1.80	2.01	
BW	.085	.108	2.16	2.74		LW	.016	.024	0.41	0.61	
CL	-	.128	-	3.25		r	-	.008	-	0.203	
CW	-	.108	-	2.74		r₁	-	.012	-	0.305	
LL₁	.022	.038	0.56	0.97		r₂	-	.022	-	0.559	
LL₂	.017	.035	0.43	0.89							

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metallized areas.
4. Lid material: Kovar.
5. Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
6. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.