RoHS compliant

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.

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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.

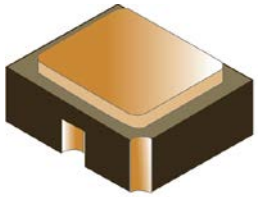
APPLICATIONS / BENEFITS

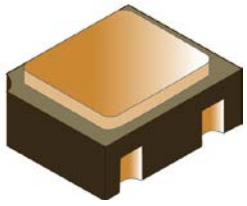
- General purpose transistors for medium power applications requiring high frequency switching.
- Low profile ceramic package.
- Lightweight.
- Military and other high-reliability applications.

MAXIMUM RATINGS @ T_C = +25 ºC 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	$R_{\Theta JA}$	325	°C/W
Thermal Resistance Junction-to-Solder Pad	$R_{\Theta JSP}$	90	°C/W
Collector-Emitter Voltage	V_{CEO}	150	V
Collector-Base Voltage	V_{CBO}	150	V
Emitter-Base Voltage	V_{EBO}	6.0	V
Collector Current	I_C	300	mA
Total Power Dissipation @ T_A = +25 °C (1) @ T_{SP} = +25 °C (2)	P_T	0.5 1.5	W

Notes: 1. See figure 1.
2. See figure 2.





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

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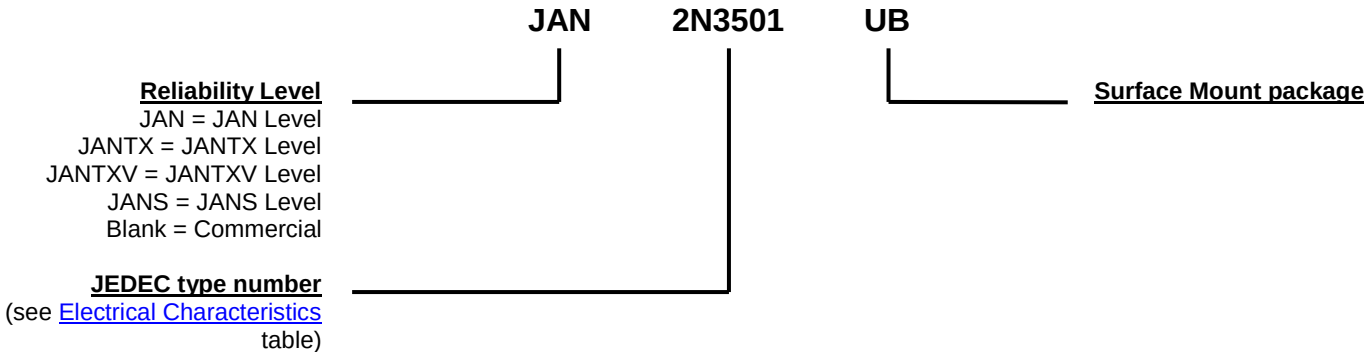
MECHANICAL and PACKAGING

- 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 °C, unless otherwise noted

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage I_C = 10 mA, pulsed	$V_{(BR)CEO}$	150		V
Collector-Base Cutoff Current V_{CB} = 75 V V_{CB} = 150 V	I_{CBO}		50 10	nA µA
Emitter-Base Cutoff Current V_{EB} = 4.0 V V_{EB} = 6.0 V	I_{EBO}		25 10	nA µA
ON CHARACTERISTICS (1)				
Forward-Current Transfer Ratio I_C = 0.1 mA, V_{CE} = 10 V I_C = 1.0 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V I_C = 150 mA, V_{CE} = 10 V I_C = 300 mA, V_{CE} = 10 V	h_{FE}	35 50 75 100 20	300	
Collector-Emitter Saturation Voltage I_C = 10 mA, I_B = 1.0 mA I_C = 150 mA, I_B = 15 mA	$V_{CE(sat)}$		0.2 0.4	V
Base-Emitter Saturation Voltage I_C = 10 mA, I_B = 1.0 mA I_C = 150 mA, I_B = 15 mA	$V_{BE(sat)}$		0.8 1.2	V
DYNAMIC CHARACTERISTICS				
Forward Current Transfer Ratio, Magnitude I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz	$\|h_{fe}\|$	1.5	8.0	
Output Capacitance V_{CB} = 10 V, I_E = 0, 100 kHz ≤ f ≤ 1.0 MHz	C_{obo}		8.0	pF
Input Capacitance V_{EB} = 0.5 V, I_C = 0, 100 kHz ≤ f ≤ 1.0 MHz	C_{ibo}		80	pF

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

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

SWITCHING CHARACTERISTICS

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

SAFE OPERATING AREA (See SOA figure and reference MIL-STD-750 method 3053)

DC Tests

T_C = +25 °C, tr ≥ 10 ns; 1 Cycle, t = 1.0 s

Test 1

V_{CE} = 10 V, I_C = 113 mA

Test 2

V_{CE} = 50 V, I_C = 23 mA

Test 3

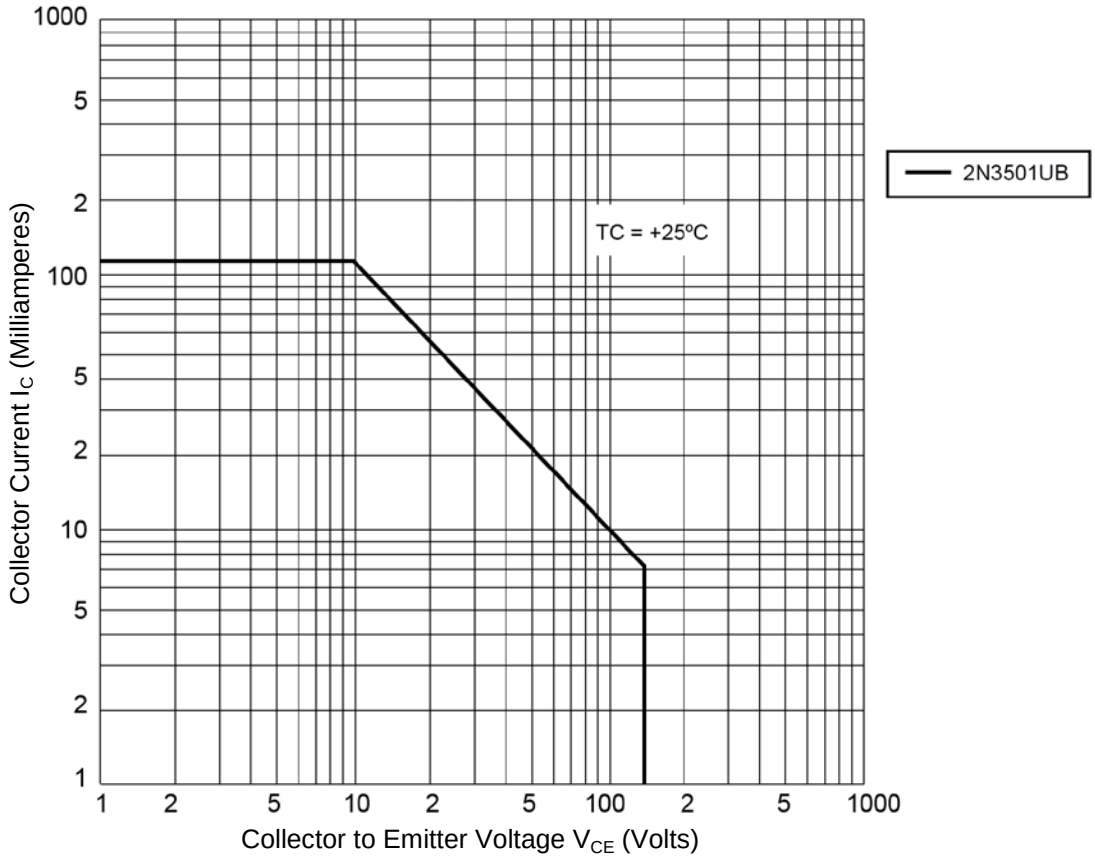
V_{CE} = 80 V, I_C = 14 mA

Clamped Switching

T_A = +25 °C

Test 1

I_B = 50 mA, I_C = 300 mA



Maximum Safe Operating Area

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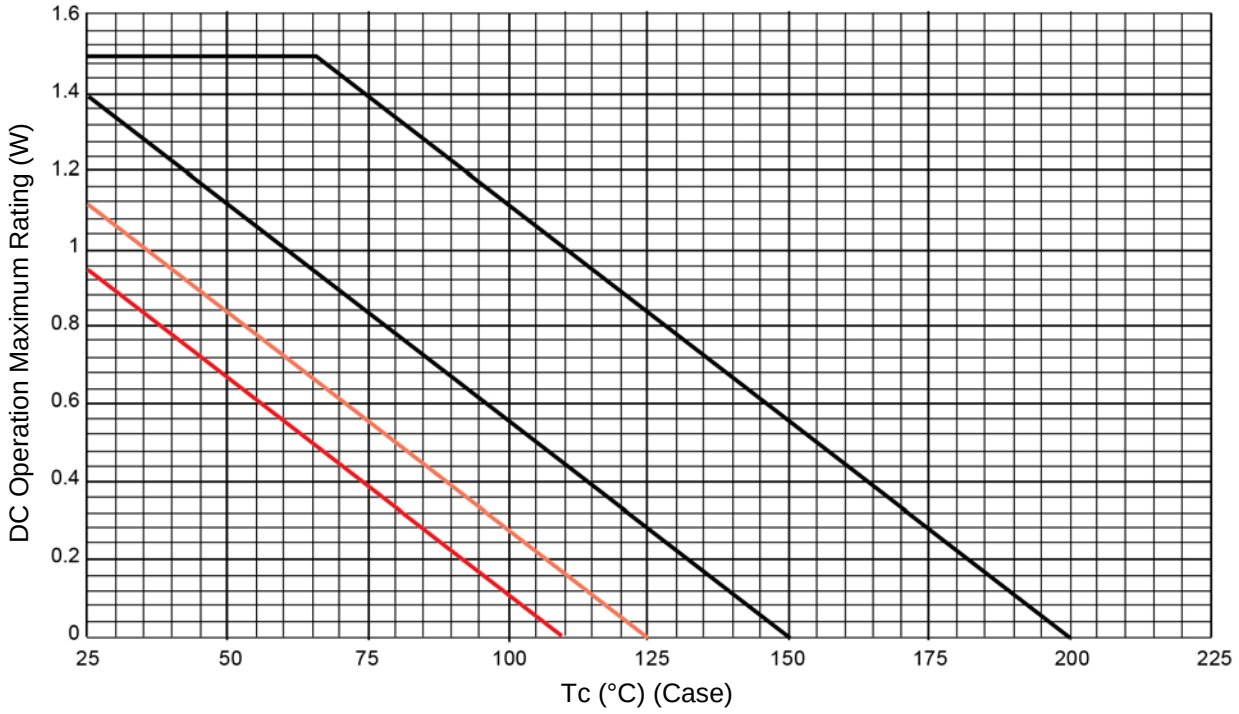

FIGURE 1

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

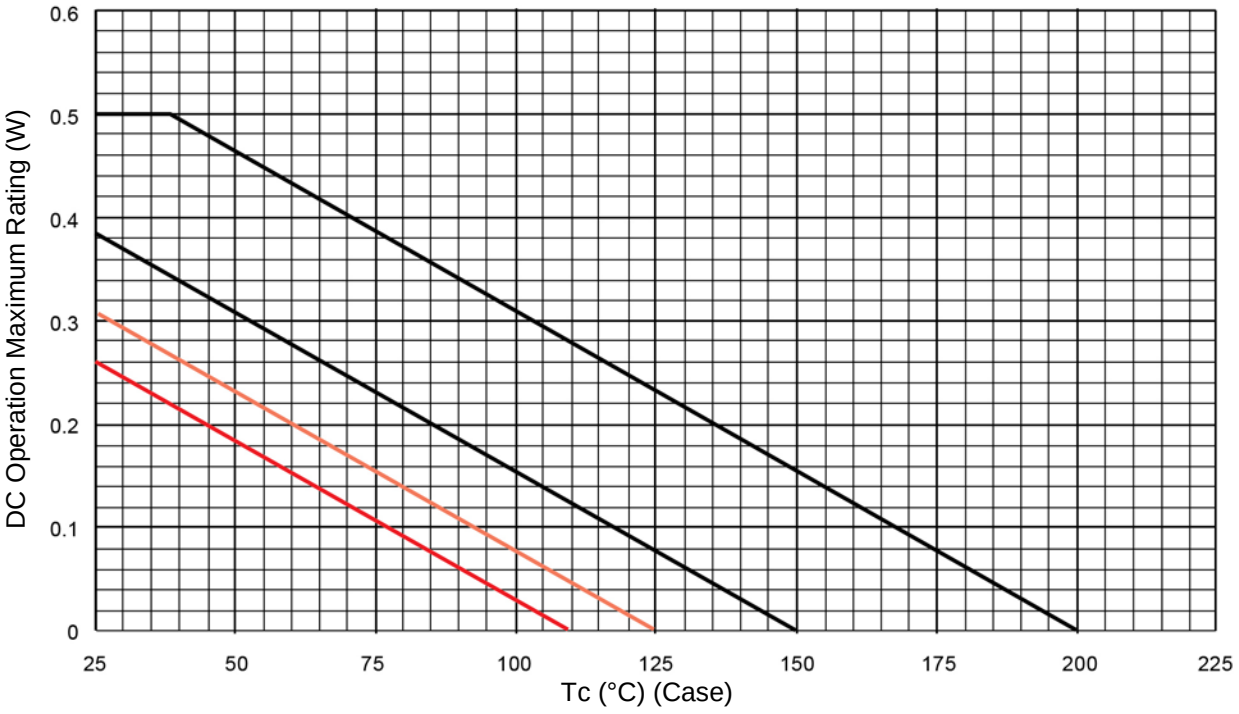

FIGURE 2

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

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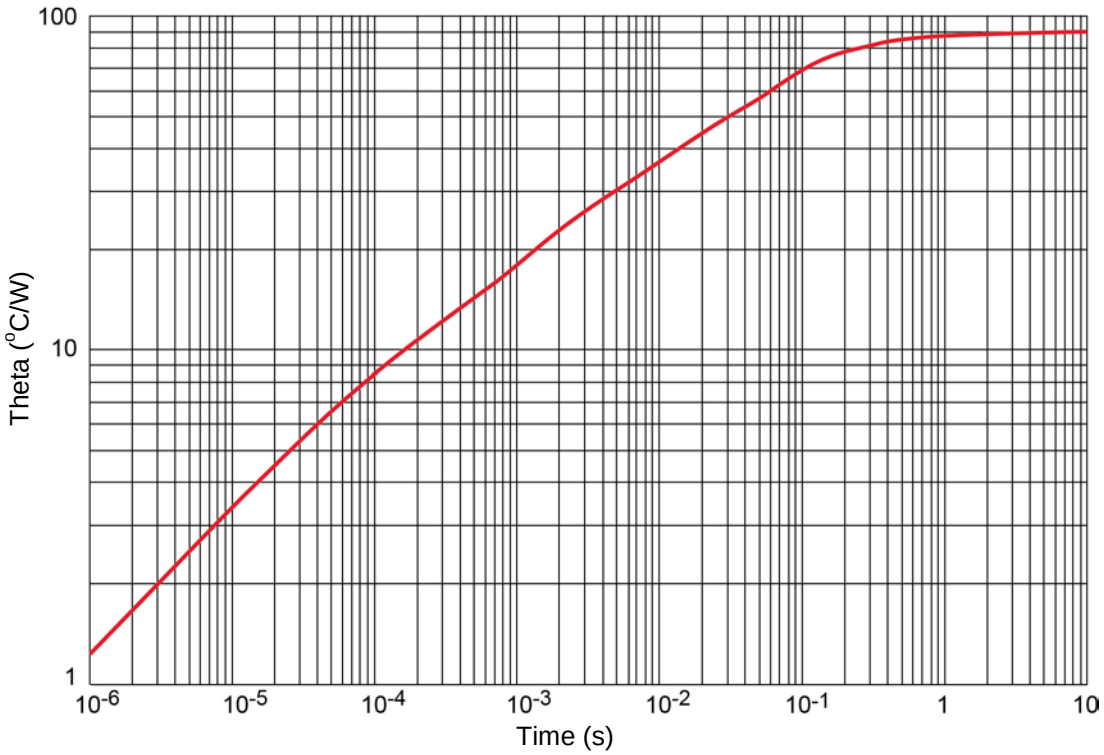
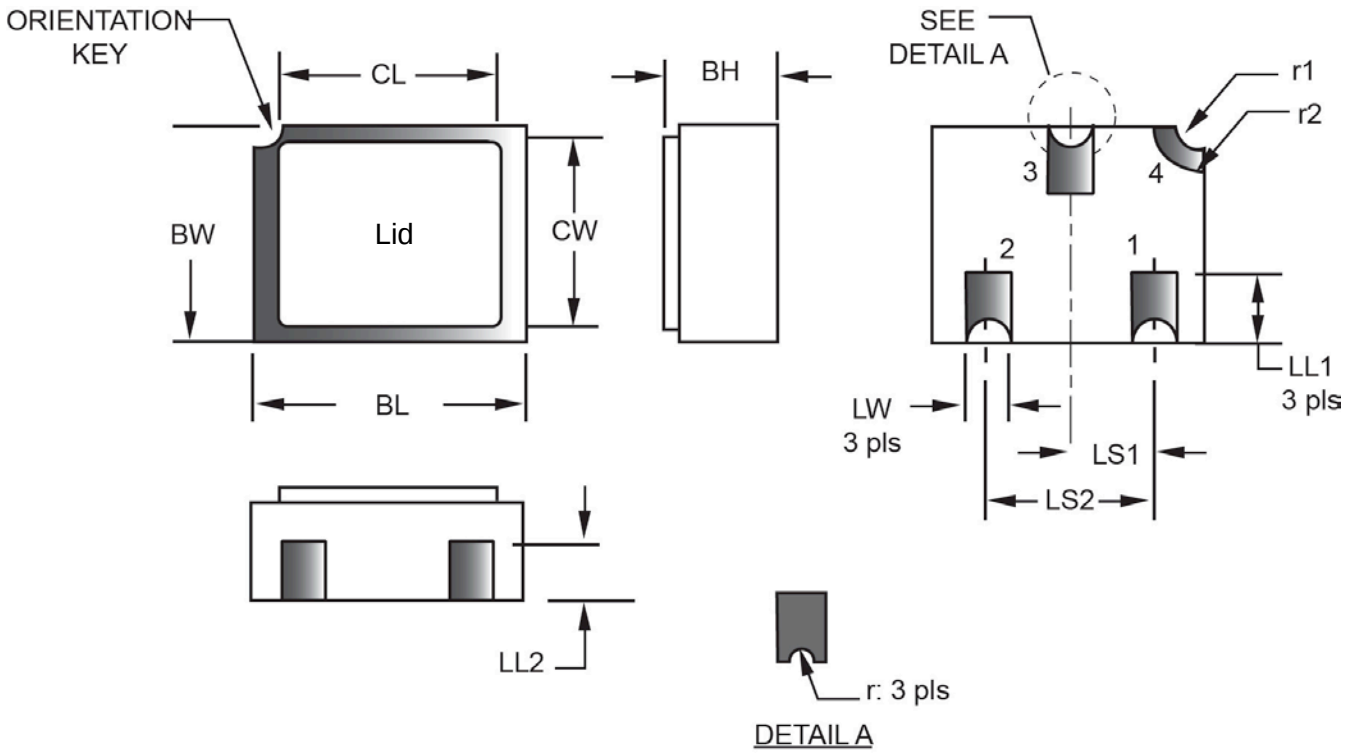


FIGURE 3

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

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		**LS_1**	.036	.040	0.91	1.02	
BL	.115	.128	2.92	3.25		**LS_2**	.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		**r_1**	-	.012	-	0.305	
LL_1	.022	.038	0.56	0.97		**r_2**	-	.022	-	0.559	
LL_2	.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 Φx symbology.

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