RoHS

Available on commercial versions

PNP SWITCHING SILICON TRANSISTOR

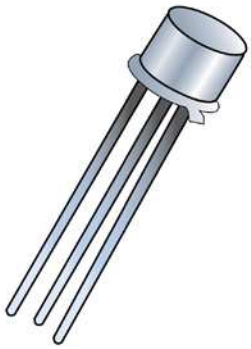
Qualified per MIL-PRF-19500/290

Qualified Levels:
JAN, JANTX, JANTXV and JANS

DESCRIPTION

This family of 2N2904AL and 2N2905AL switching transistors are military qualified up to the JANS level for high-reliability applications. These devices are also available in a TO-39 package. 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.



TO-5 Package

Also available in:

TO-39 (TO-205AD) package
(long-leaded)
2N2904 & 2N2905A

FEATURES

- JEDEC registered 2N2904 through 2N2905 series.
- JAN, JANTX, JANTXV, and JANS qualifications are available per MIL-PRF-19500/290. (See part nomenclature for all available options.)
- RoHS compliant versions available (commercial grade only).

APPLICATIONS / BENEFITS

- General purpose transistors for high speed switching applications.
- Military and other high-reliability applications.

MAXIMUM RATINGS

Parameters / Test Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	60	V
Collector-Base Voltage	V_{CBO}	60	V
Emitter-Base Voltage	V_{EBO}	5.0	V
Thermal Resistance Junction-to-Ambient	$R_{\Theta JA}$	195	°C/W
Thermal Resistance Junction-to-Case	$R_{\Theta JC}$	50	°C/W
Collector Current	I_C	600	mA
Total Power Dissipation @ T_A = +25 °C (1) @ T_C = +25 °C (2)	P_T	0.8 3.0	W
Operating & Storage Junction Temperature Range	T_J and T_{stg}	-65 to +200	°C

Notes: 1. For derating, see figures 1 and 2.
2. For thermal impedance, see figures 3 and 4.

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

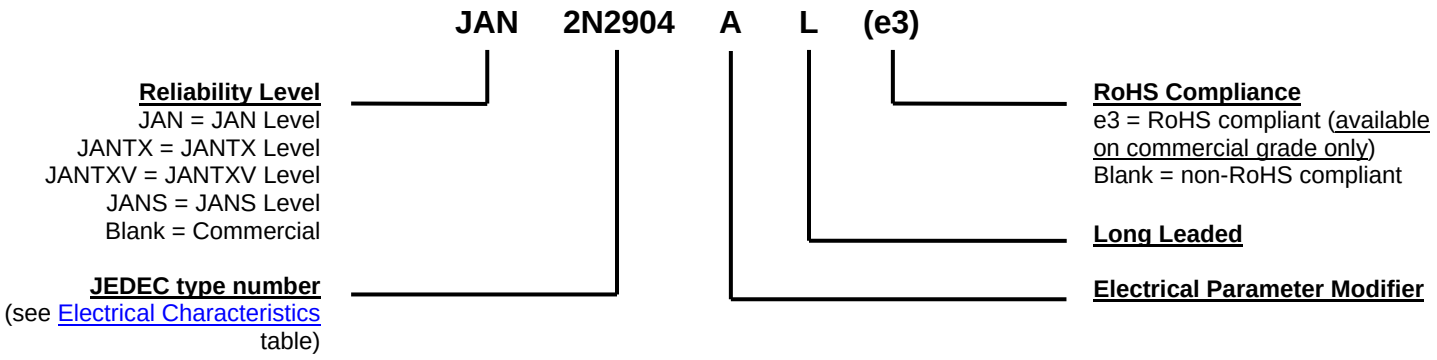
MSC – Ireland
Gort Road Business Park,
Ennis, Co. Clare, Ireland
Tel: +353 (0) 65 6840044
Fax: +353 (0) 65 6822298

Website:
www.microsemi.com

MECHANICAL and PACKAGING

- CASE: Hermetically sealed, kovar base, nickel cap.
- TERMINALS: Tin/lead plate or RoHS compliant matte/tin (commercial grade only) over nickel.
- MARKING: Part number, date code, manufacturer's ID.
- POLARITY: PNP (see package outline).
- WEIGHT: Approximately 1.14 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 Current I_C = 10 mA		$V_{(BR)CEO}$	60		V
Collector-Emitter Cutoff Voltage V_{CE} = 60 V		I_{CES}		1.0	µA
Collector-Base Cutoff Current					
V_{CB} = 60 V	All Types	I_{CBO1}		10	µA
V_{CB} = 50 V	2N2904AL, 2N2905AL	I_{CBO2}		10	nA
V_{CB} = 50 V @ T_A = +150 ºC	2N2904AL, 2N2905AL	I_{CBO3}		10	µA
Collector-Base Cutoff Current V_{CB} = 50 V V_{CB} = 60 V		I_{CBO}		10 10	nA µA
Emitter-Base Cutoff Current V_{EB} = 3.5 V V_{EB} = 5.0 V		I_{EBO}		50 10	nA µA

ON CHARACTERISTICS (1)					
Forward-Current Transfer Ratio					
I_C = 0.1 mA, V_{CE} = 10 V	2N2904AL 2N2905AL	h_{FE}	40 75		
I_C = 1.0 mA, V_{CE} = 10 V	2N2904AL 2N2905AL		40 100	175 450	
I_C = 10 mA, V_{CE} = 10 V	2N2904AL 2N2905AL		40 100		
I_C = 150 mA, V_{CE} = 10 V	2N2904AL 2N2905AL		40 100	120 300	
I_C = 500 mA, V_{CE} = 10 V	2N2904AL 2N2905AL		40 50		
Collector-Emitter Saturation Voltage I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		$V_{CE(sat)}$		0.4 1.6	V
Base-Emitter Saturation Voltage I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		$V_{BE(sat)}$		1.3 2.6	V

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

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

DYNAMIC CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Small-Signal Short-Circuit Forward-Current Transfer Ratio I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz	h_{fe}		100	
Small-Signal Short-Circuit Forward-Current Transfer Ratio I_C = 50 mA, V_{CE} = 20 V, f = 100 MHz	$\|h_{fe}\|$		2.0	
Output Capacitance V_{CB} = 10 V, I_E = 0, 100 kHz ≤ f ≤ 1.0MHz	C_{obo}		8.0	pF
Iutput Capacitance V_{EB} = 2.0 V, I_C = 0, 100 kHz ≤ f ≤ 1.0MHz	C_{ibo}		30	pF

SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time	t_{on}		45	ns
Turn-Off Time	t_{off}		300	ns

GRAPHS

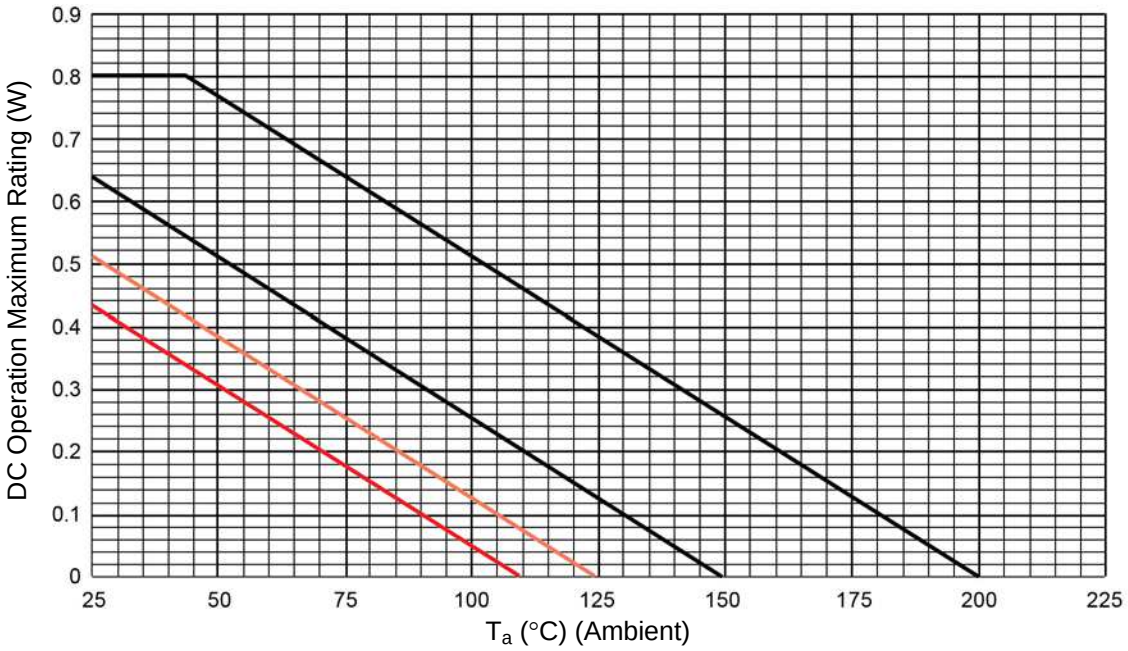


FIGURE 1
Derating ($R_{\theta JA}$) PCB

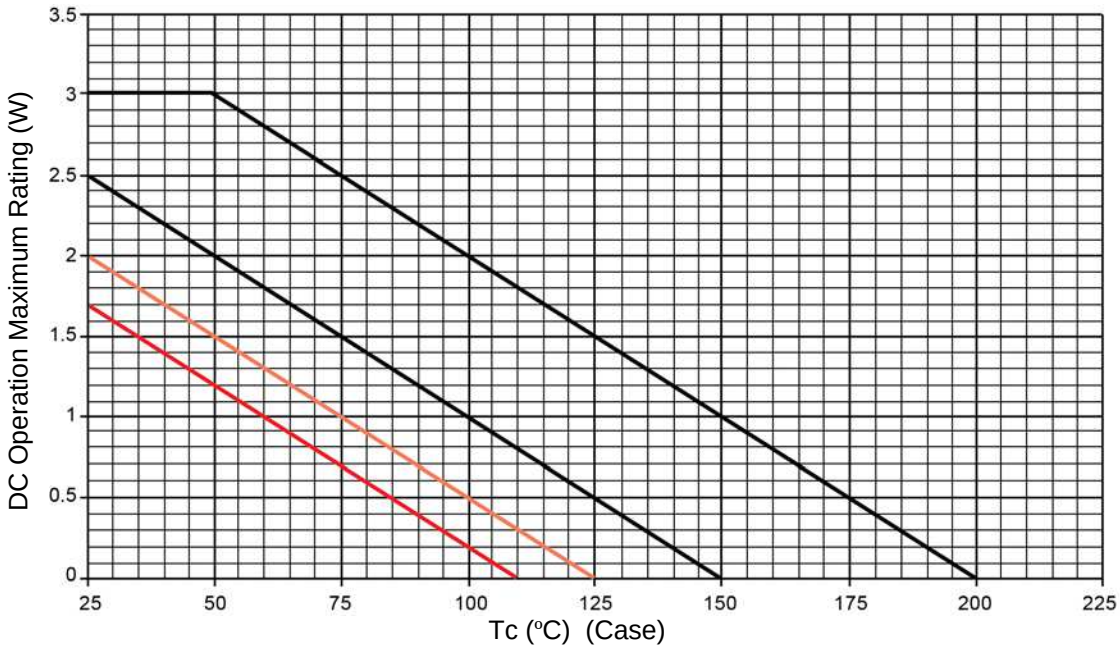


FIGURE 2
Derating ($R_{\theta JA}$) PCB

GRAPHS (continued)

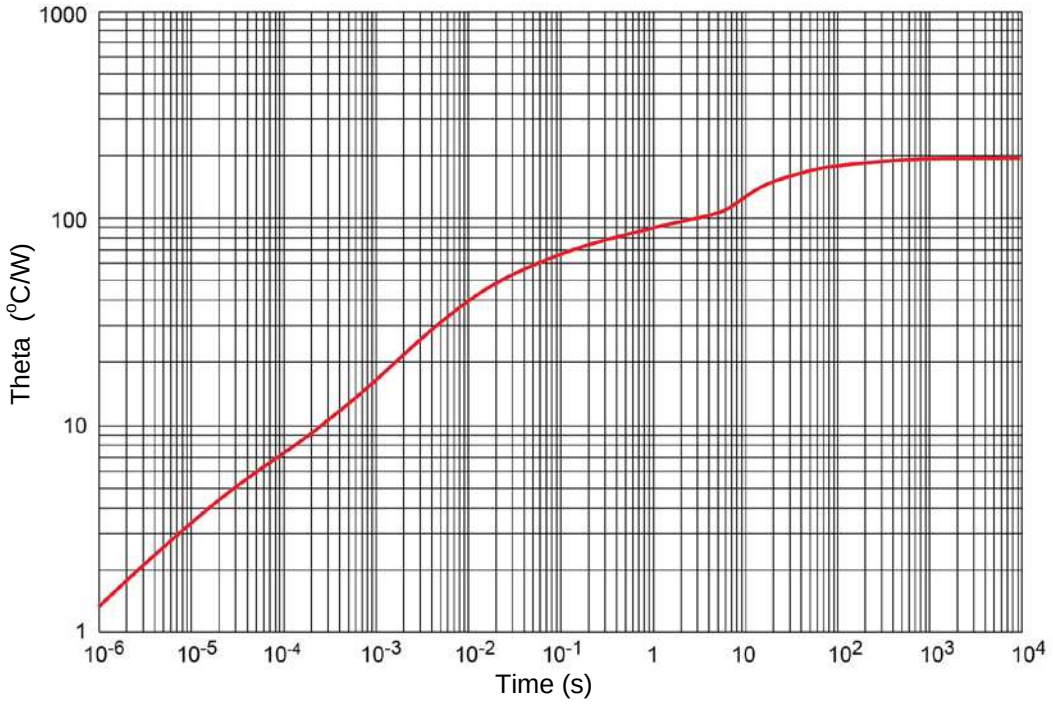


FIGURE 3

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

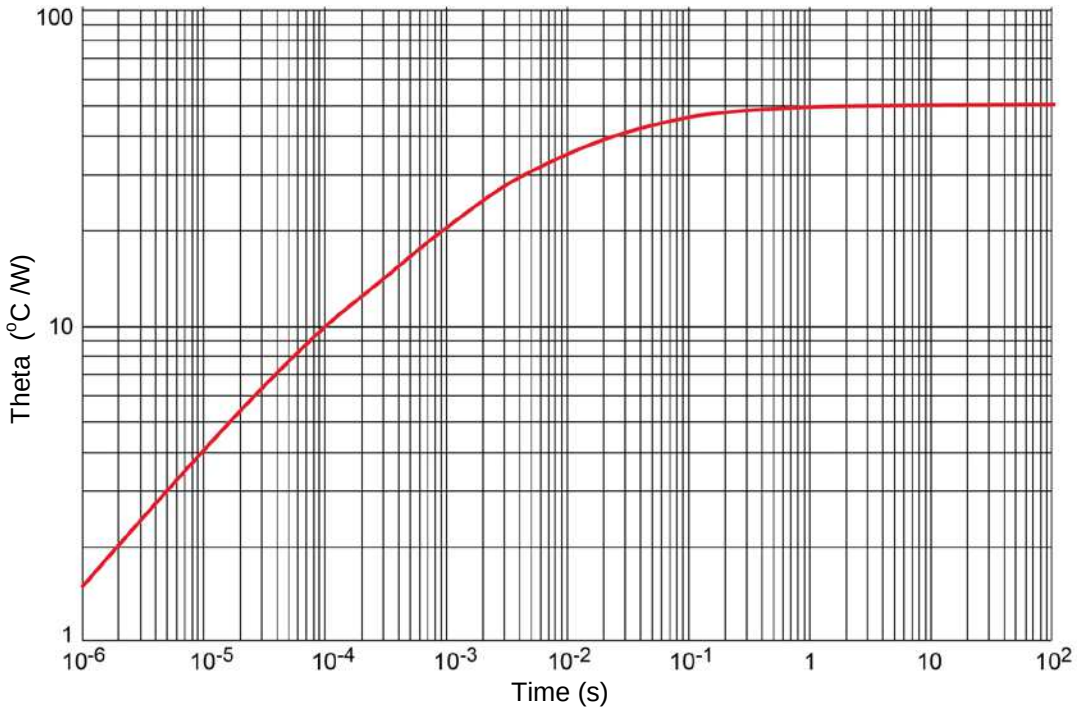
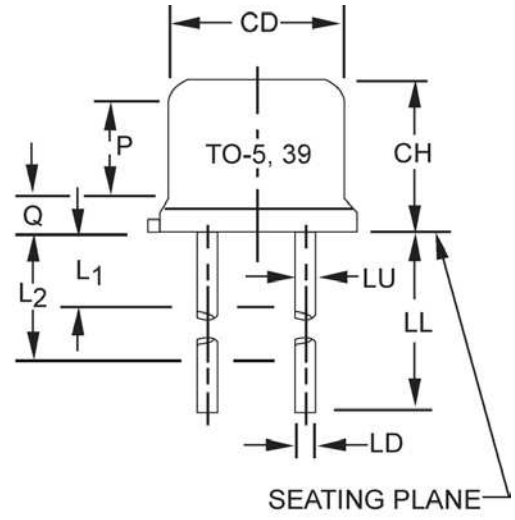
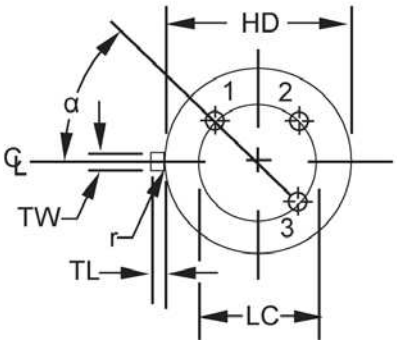


FIGURE 4

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

PACKAGE DIMENSIONS





Symbol	Dimensions				Note
	Inch		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
L1		0.050		1.27	7, 8
L2	0.250		6.35		7, 8
P	0.100		2.54		
Q		0.050		1.27	5
TL	0.029	0.045	0.74	1.14	4
TW	0.028	0.034	0.71	0.86	3
r		0.010		0.25	10
α	45° TP		45° TP		6

NOTES:

1. Dimensions 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 .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 .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.
7. Dimension LU applies between L1 and L2. Dimension LD applies between L2 and LL 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 Φx symbology.
12. For “L” suffix devices, dimension LL is 1.50 (38.10 mm) minimum, 1.75 (44.45 mm) maximum.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.