RoHS

Available on commercial versions

PNP SWITCHING SILICON TRANSISTOR

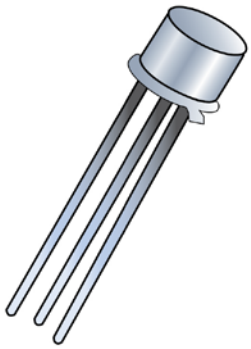
Qualified per MIL-PRF-19500/290

Qualified Levels:
JAN, JANTX, JANTXV and JANS

DESCRIPTION

This family of 2N2904 and 2N2905A switching transistors are military qualified up to the JANS level for high-reliability applications. These devices are also available in a TO-5 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-39 (TO-205AD) Package

Also available in:

TO-5 package
(long-leaded)
2N2904AL & 2N2905AL

FEATURES

- JEDEC registered 2N2904 through 2N2905A 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
		2N2904 2N2905	2N2904A 2N2905A	
Collector-Emitter Voltage	V_{CEO}	40	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 & T_{stg}	-65 to +200		°C

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

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MECHANICAL and PACKAGING

- CASE: Hermetically sealed, kovar base, nickel cap.
- TERMINALS: Leads are kovar, nickel plated, and finish is solder dip (Sn63/Pb37). Can be RoHS compliant with pure matte-tin (commercial grade only).
- MARKING: Part number, date code, manufacturer's ID.
- POLARITY: PNP (see package outline).
- WEIGHT: Approximately 1.064 grams.
- See Package Dimensions on last page.

PART NOMENCLATURE

JAN 2N2904 A (e3)

Reliability Level
JAN = JAN Level
JANTX = JANTX Level
JANTXV = JANTXV Level
JANS = JANS Level
Blank = Commercial

JEDEC type number
(see Electrical Characteristics table)

RoHS Compliance
e3 = RoHS compliant (available on commercial grade only)
Blank = non-RoHS compliant

Electrical Parameter Modifier

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.

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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	2N2904, 2N2905	$V_{(BR)CEO}$	40		V
	2N2904A, 2N2905A		60		
Collector-Emitter Cutoff Voltage					
V_{CE} = 40 V	2N2904, 2N2905	I_{CES}		1.0	µA
V_{CE} = 60 V	2N2904A, 2N2905A				
Collector-Base Cutoff Current					
V_{CB} = 60 V	All Types	I_{CBO1}		10	µA
V_{CB} = 50 V	2N2904, 2N2905	I_{CBO2}		20	nA
	2N2904A, 2N2905A			10	nA
V_{CB} = 50 V @ T_A = +150 ºC	2N2904, 2N2905	I_{CBO3}		20	µA
	2N2904A, 2N2905A			10	µA
Emitter-Base Cutoff Current					
V_{EB} = 3.5 V		I_{EBO}		50	nA
V_{EB} = 5.0 V				10	µA

ON CHARACTERISTICS (1)					
Forward-Current Transfer Ratio					
I_C = 0.1 mA, V_{CE} = 10 V	2N2904	h_{FE}	20		
	2N2905		35		
	2N2904A		40		
	2N2905A		75		
I_C = 1.0 mA, V_{CE} = 10 V	2N2904		25	175	
	2N2905		50	450	
	2N2904A		40	175	
	2N2905A		100	450	
I_C = 10 mA, V_{CE} = 10 V	2N2904		35		
	2N2905		75		
	2N2904A		40		
	2N2905A		100		
I_C = 150 mA, V_{CE} = 10 V	2N2904, 2N2904A		40	120	
	2N2905, 2N2905A		100	300	
I_C = 500 mA, V_{CE} = 10 V	2N2904		20		
	2N2905		30		
	2N2904A		40		
	2N2905A		50		

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

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
ON CHARACTERISTICS (1) (continued)				
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%.

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	2N2904 2N2905 2N2904A, 2N2905A	h_{fe}		25 50 40	
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

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GRAPHS

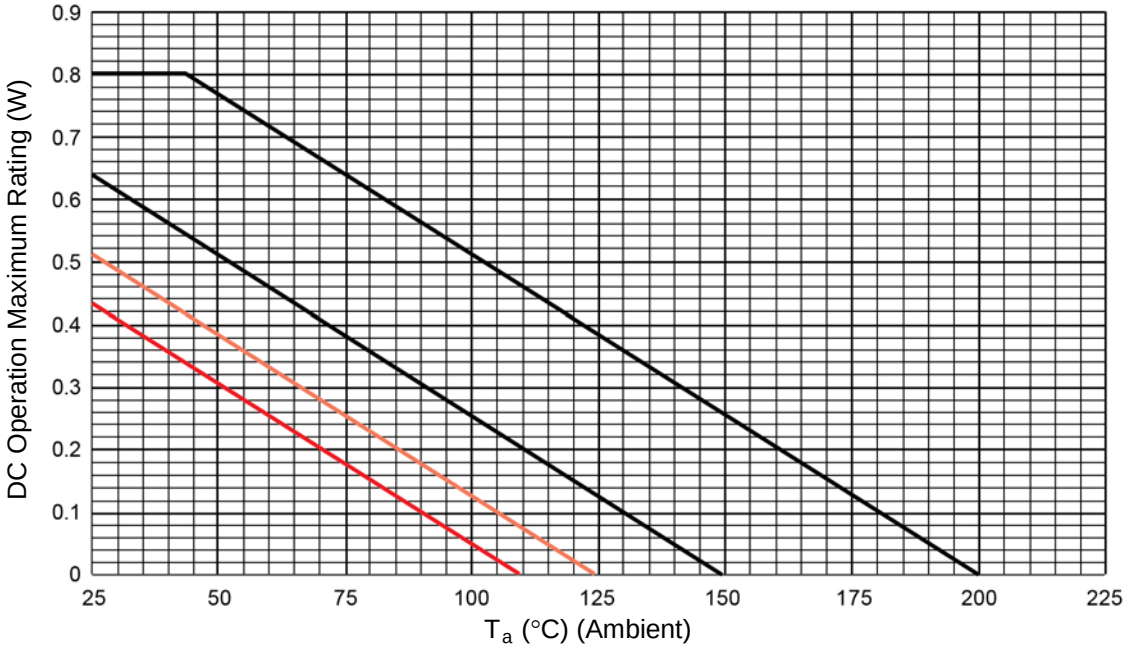

FIGURE 1
Derating ($R_{\theta JA}$) PCB

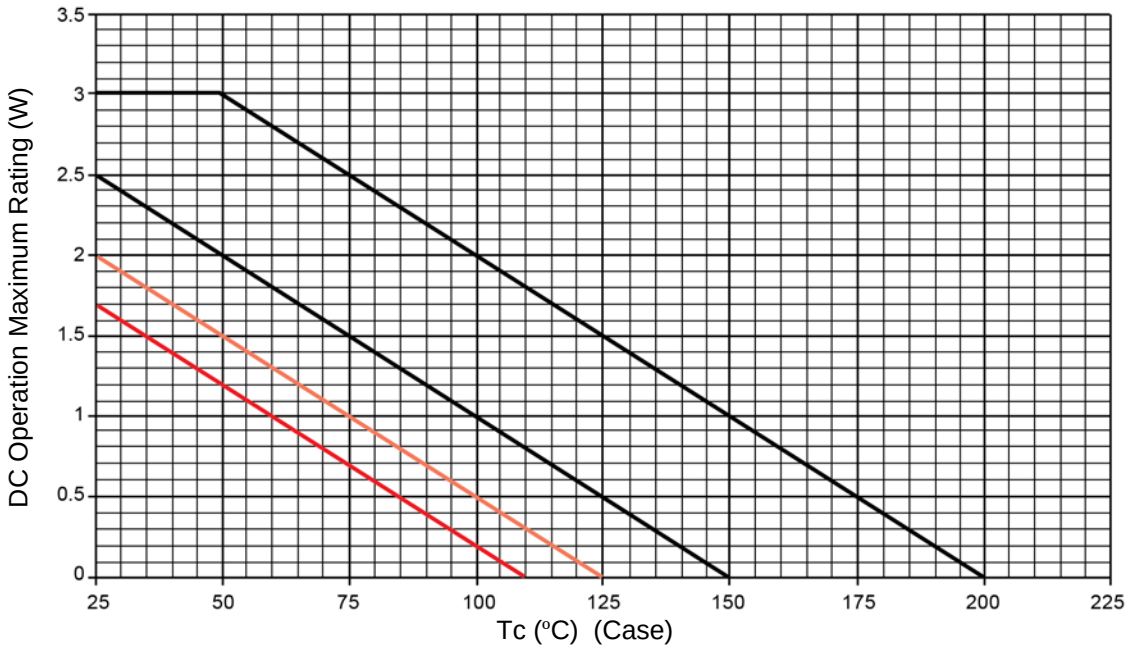

FIGURE 2
Derating ($R_{\theta JA}$) PCB

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GRAPHS (continued)

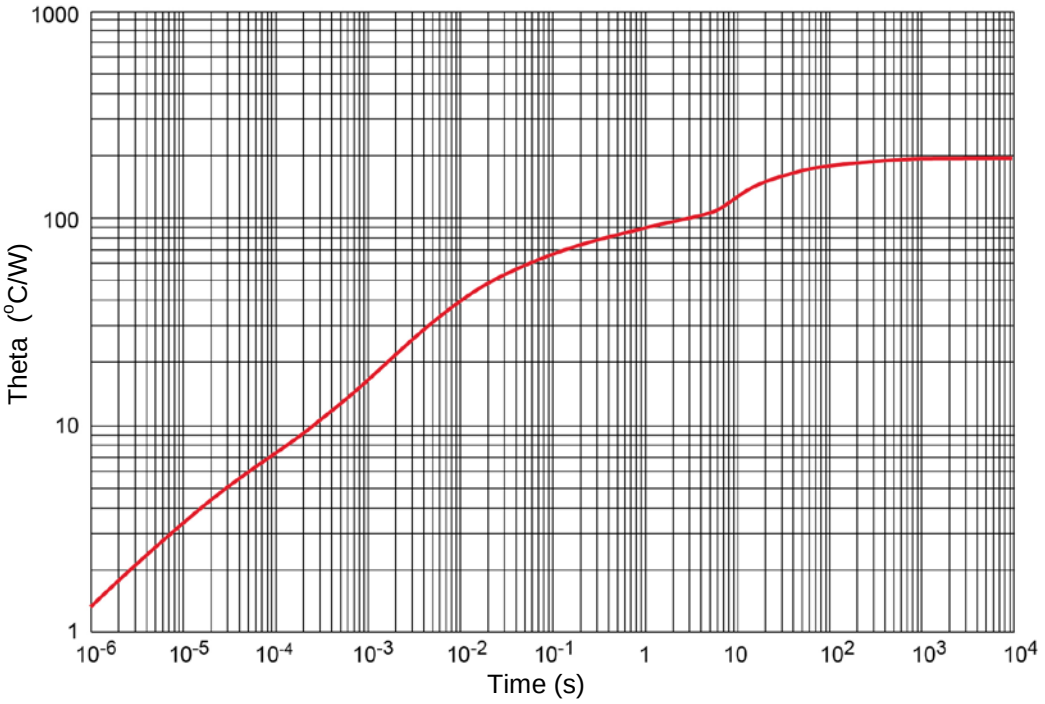

FIGURE 3

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

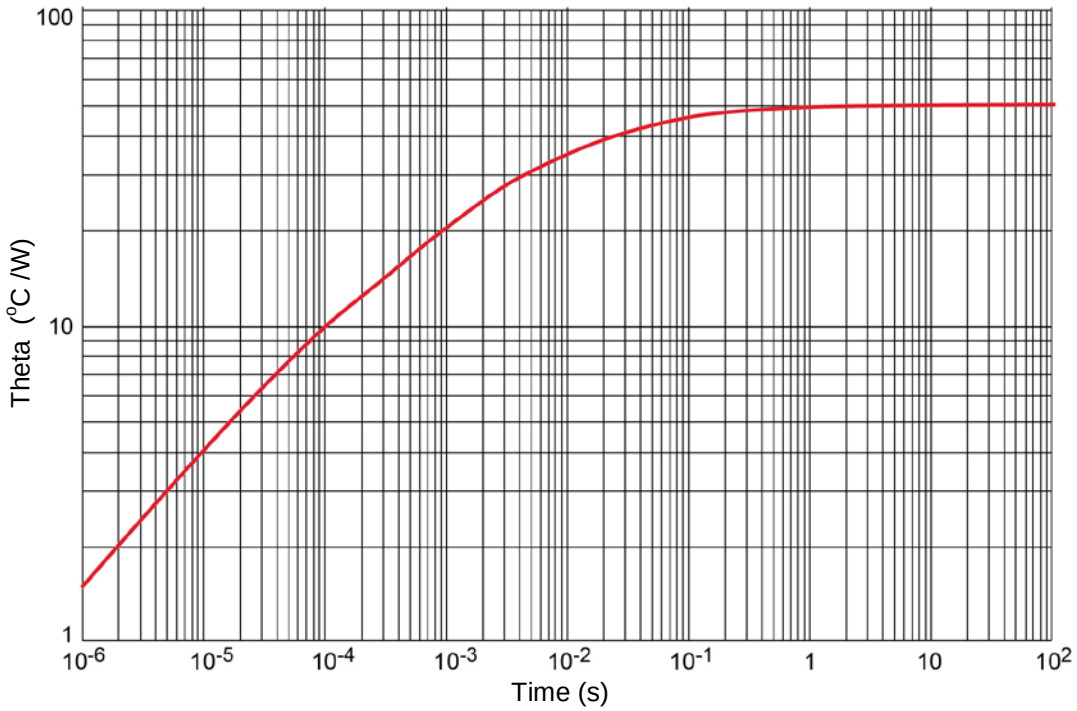

FIGURE 4

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

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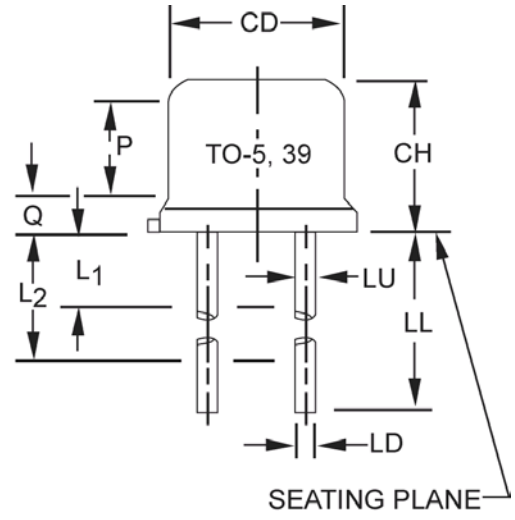
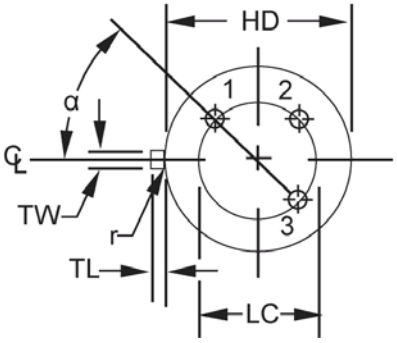
PACKAGE DIMENSIONS





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.

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