RoHS Compliant commercial version

PNP Silicon Low-Power Transistor

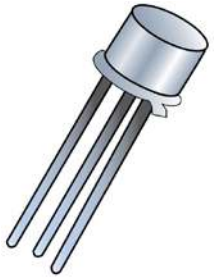
Qualified per MIL-PRF-19500/485

Qualified Levels:
JAN, JANTX, JANTXV and JANS

DESCRIPTION

This family of 2N5415S and 2N5416S epitaxial planar transistors are military qualified up to a JANS level for high-reliability applications. These devices are also available in the longer leaded TO-5 and low profile U4 and UA packaging.

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



TO-205AD
(TO-39) Package

FEATURES

- JEDEC registered 2N5415 through 2N5416 series
- JAN, JANTX, JANTXV, and JANS qualifications are available per MIL-PRF-19500/485. (See part nomenclature for all available options.)
- RoHS compliant commercial version

Also available in:

TO-5 package
(long-leaded)
2N5415 – 2N5416

U4 package
(surface mount)
2N5415U4 – 2N5416U4

UA package
(surface mount)
2N5415UA – 2N5416UA

APPLICATIONS / BENEFITS

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

MAXIMUM RATINGS @ T_A = +25 ºC unless otherwise noted

Parameters / Test Conditions	Symbol	2N5415S	2N5416S	Unit
Collector-Emitter Voltage	V_{CEO}	200	300	V
Collector-Base Voltage	V_{CBO}	200	350	V
Emitter-Base Voltage	V_{EBO}	6.0	6.0	V
Collector Current	I_C	1.0	1.0	A
Operating & Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200		°C
Thermal Resistance Junction-to-Ambient	$R_{\Theta JA}$	234		°C/W
Thermal Resistance Junction-to-Case	$R_{\Theta JC}$	17.5		°C/W
Total Power Dissipation @ T_A = +25 °C (1) @ T_C = +25 °C (2)	P_T	0.75 10		W

Notes: 1. Derate linearly 4.29 mW/°C for T_A > +25 °C.
2. Derate linearly 57.2 mW/°C for T_C > +25 °C.

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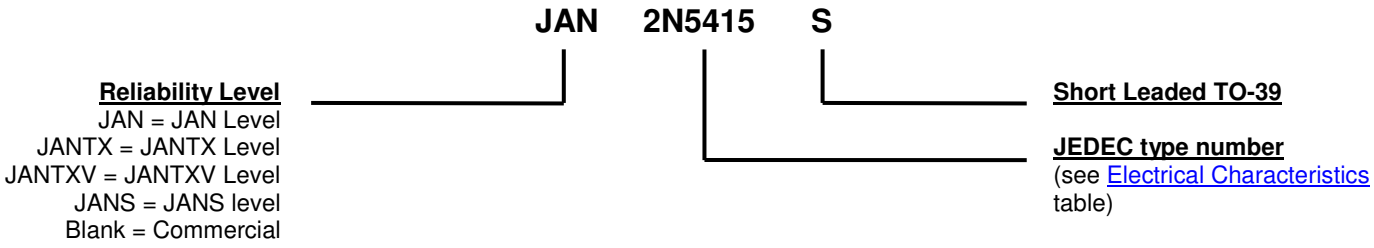
MECHANICAL and PACKAGING

- CASE: Hermetically sealed, kovar base, nickel cap
- TERMINALS: Gold plated kovar and solder dip (Sn63/Pb37) on JAN, JANTX, and JANTXV versions. NOTE: Solder dipped versions are not RoHS compliant.
- MARKING: Part number, date code, manufacturer's ID and serial number
- POLARITY: PNP
- WEIGHT: Approximately 1.064 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

OFF CHARACTERISTICS

Parameters / Test Conditions		Symbol	Min.	Max.	Unit
Collector-Emitter Breakdown Voltage I_C = 50 mA, I_B = 5 mA, L = 25 mH; f = 30 – 60 Hz	2N5415S 2N5416S	$V_{(BR)CEO}$	200 300		V
Emitter-Base Cutoff Current V_{EB} = 6.0 V		I_{EBO}		20	µA
Collector-Emitter Cutoff Current V_{CE} = 200 V, V_{BE} = 1.5 V V_{CE} = 300 V, V_{BE} = 1.5 V	2N5415S 2N5416S	I_{CEX}		50	µA
Collector-Emitter Cutoff Current V_{CE} = 150 V V_{CE} = 250 V	2N5415S 2N5416S	I_{CEO1}		50	µA
Collector-Emitter Cutoff Current V_{CE} = 200 V V_{CE} = 300 V	2N5415S 2N5416S	I_{CEO2}		1	mA
Collector-Base Cutoff Current V_{CB} = 175 V V_{CB} = 280 V	2N5415S 2N5416S	I_{CBO1}		50	µA
V_{CB} = 200 V V_{CB} = 350 V	2N5415S 2N5416S	I_{CBO2}		500	µA
V_{CB} = 175 V, T_A = +150 ºC V_{CB} = 280 V, T_A = +150 ºC	2N5415S 2N5416S	I_{CBO3}		1	mA

ON CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Forward-Current Transfer Ratio I_C = 50 mA, V_{CE} = 10 V I_C = 1 mA, V_{CE} = 10 V I_C = 50 mA, V_{CE} = 10 V, T_A = +150 ºC	h_{FE}	30 15 15	120	
Collector-Emitter Saturation Voltage I_C = 50 mA, I_B = 5 mA	$V_{CE(sat)}$		2.0	V
Base-Emitter Voltage Non-Saturation I_C = 50 mA, V_{CE} = 10 V	V_{BE}		1.5	V

DYNAMIC CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio I_C = 10 mA, V_{CE} = 10 V, f = 5 MHz	$\|h_{fe}\|$	3	15	
Small-signal short Circuit Forward-Current Transfer Ratio I_C = 5 mA, V_{CE} = 10 V, f ≤ 1 kHz	h_{fe}	25		
Output Capacitance V_{CB} = 10 V, I_E = 0, 100 kHz ≤ f ≤ 1 MHz	C_{obo}		15	pF

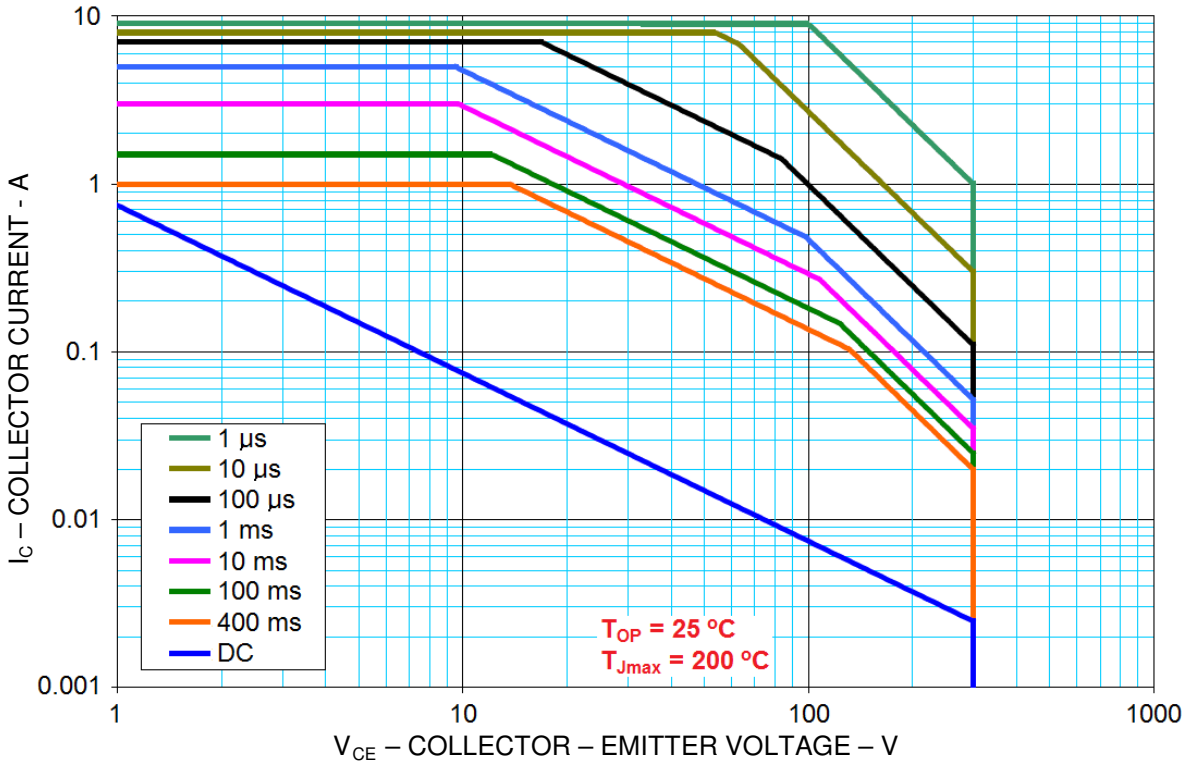
ELECTRICAL CHARACTERISTICS @ T_A = +25 °C unless otherwise noted. (continued)

SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time V_{CC} = 200 V, I_C = 50 mA, I_{B1} = 5 mA	t_{on}		1	µs
Turn-Off Time V_{CC} = 200 V, I_C = 50 mA, I_{B1} = I_{B2} = 5 mA	t_{off}		10	µs

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

DC Tests
T_C = +25 °C, t_P = 0.4 s, 1 Cycle
Test 1
V_{CE} = 10 V, I_C = 1 A
Test 2
V_{CE} = 100 V, I_C = 100 mA
Test 3
V_{CE} = 200 V, I_C = 24 mA (2N5415S only)
Test 4
V_{CE} = 300 V, I_C = 10 mA (2N5416S only)



Maximum Safe Operating Area (T_J = 200 ºC)

GRAPHS

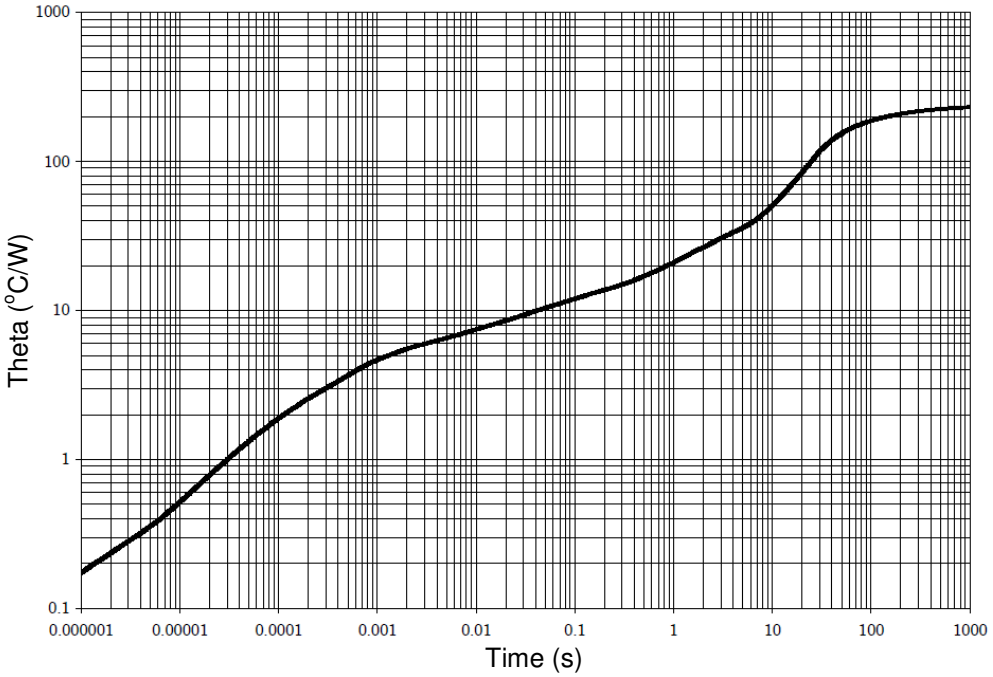


FIGURE 1
Thermal impedance graph ($R_{\Theta JA}$)

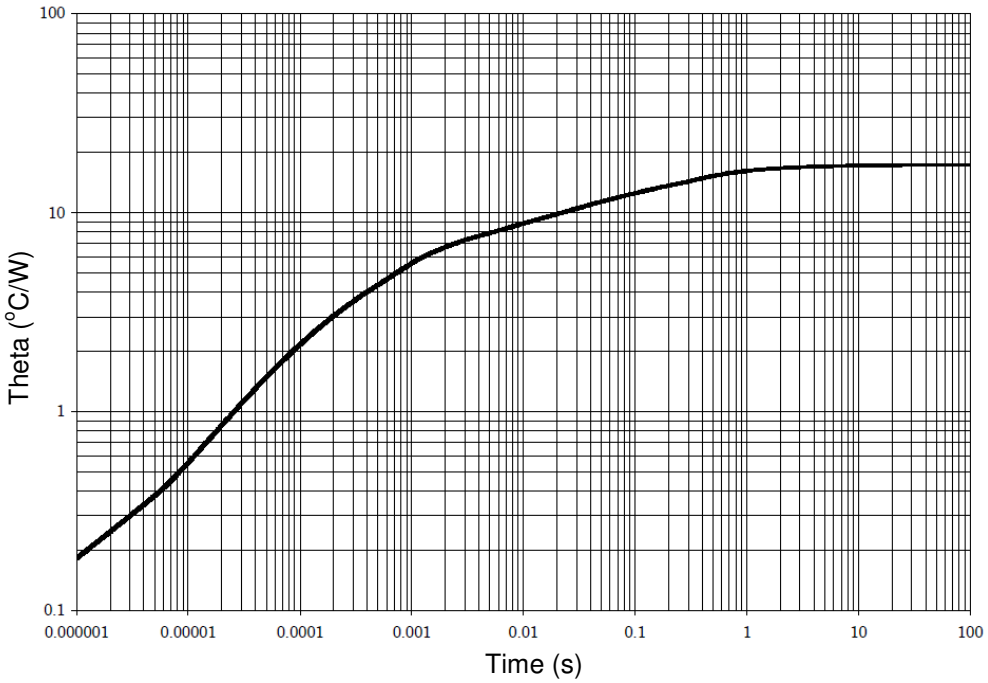
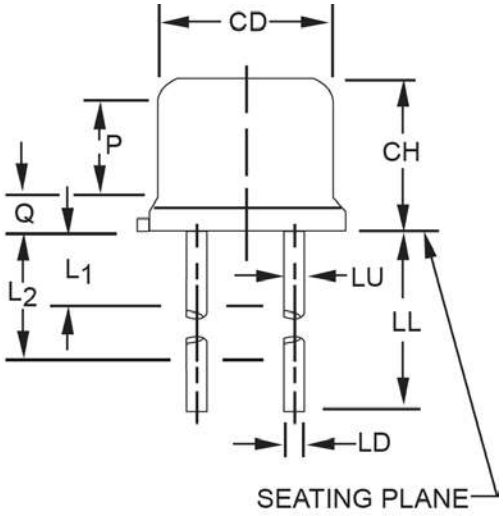
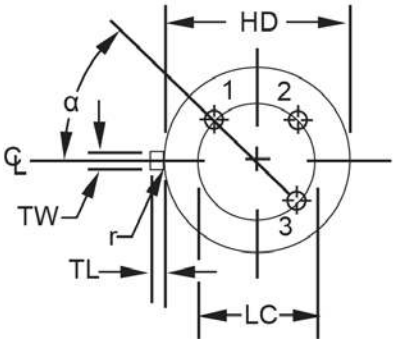


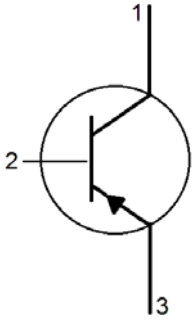
FIGURE 2
Thermal impedance graph ($R_{\Theta JA}$)

PACKAGE DIMENSIONS



Symbol	Dimensions				Notes
	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
LU	0.016	0.019	0.41	0.48	7, 8
L_1	-	0.050	-	1.27	7, 8
L_2	0.250	-	6.35	-	7, 8
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
P	0.100	-	2.54	-	





NOTES:

1. Dimensions are in inches.
2. Millimeters are given for information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of 0.011 (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 0.054 +0.001 -0.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within 0.007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. This device may be measured by direct methods.
7. Dimension LU applies between L_1 and L_2. Dimension LD applies between L_2 and 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.