



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>.

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

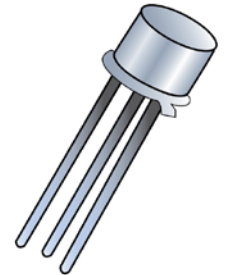
APPLICATIONS / BENEFITS

- 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 °C unless otherwise noted

Parameters / Test Conditions	Symbol	2N5415S	2N5416S	Unit
Collector-Emitter Voltage	V _{CEO}	200	300	V
Collector-Base Voltage	V _{CB0}	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 _{θJA}	234		°C/W
Thermal Resistance Junction-to-Case	R _{θJC}	17.5		°C/W
Total Power Dissipation	P _T	0.75	10	W
		@ T _A = +25 °C ⁽¹⁾		
		@ T _C = +25 °C ⁽²⁾		


- 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.




TO-205AD (TO-39) Package

Also available in:

TO-5 package
(long-leaded)

 [2N5415 – 2N5416](#)

U4 package
(surface mount)

 [2N5415U4 – 2N5416U4](#)

UA package
(surface mount)

 [2N5415UA – 2N5416UA](#)

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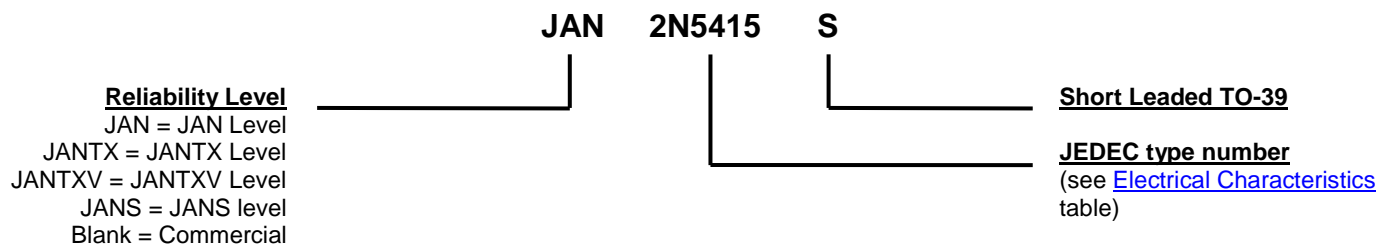
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MECHANICAL and PACKAGING

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

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

ON CHARACTERISTICS

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

DYNAMIC CHARACTERISTICS

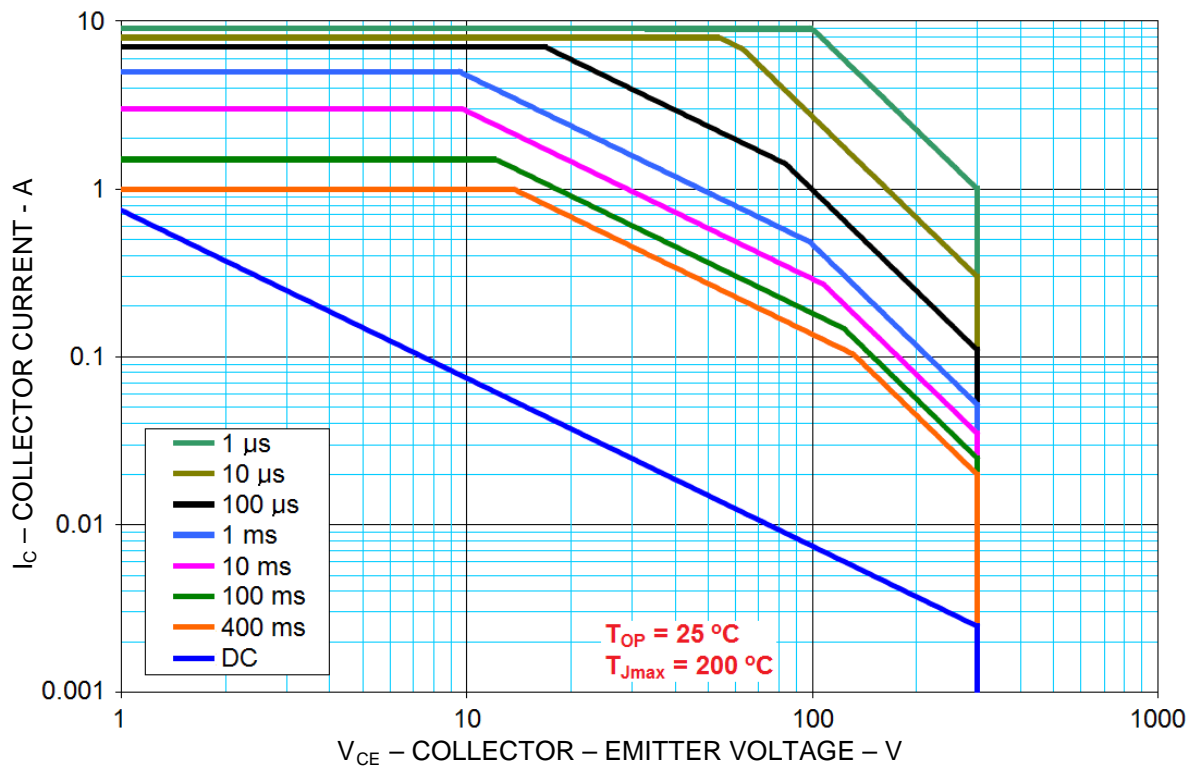
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 10\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 5\text{ MHz}$	$ h_{fe} $	3	15	
Small-signal short Circuit Forward-Current Transfer Ratio $I_C = 5\text{ mA}$, $V_{CE}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

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

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

SAFE OPERATING AREA (See SOA graph below and [MIL-STD-750, method 3053](#))
DC Tests
 $T_C = +25\text{ }^\circ\text{C}$, $t_p = 0.4\text{ s}$, 1 Cycle

Test 1
 $V_{CE} = 10\text{ V}$, $I_C = 1\text{ A}$
Test 2
 $V_{CE} = 100\text{ V}$, $I_C = 100\text{ mA}$
Test 3
 $V_{CE} = 200\text{ V}$, $I_C = 24\text{ mA}$ (2N5415S only)

Test 4
 $V_{CE} = 300\text{ V}$, $I_C = 10\text{ mA}$ (2N5416S only)

Maximum Safe Operating Area ($T_J = 200\text{ }^\circ\text{C}$)

GRAPHS

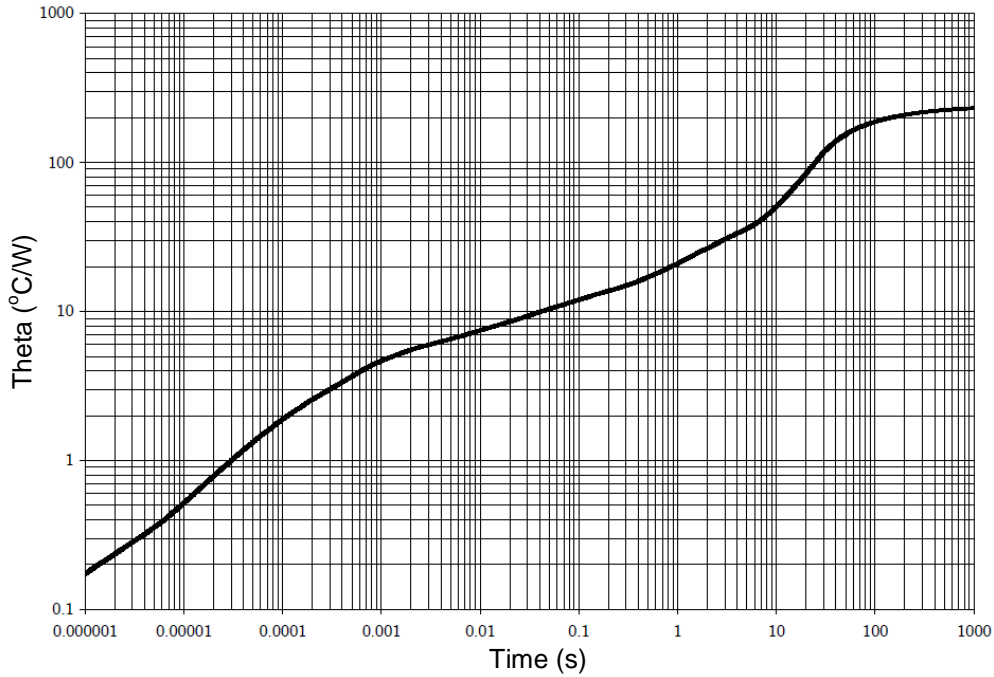


FIGURE 1
Thermal impedance graph ($R_{\theta JA}$)

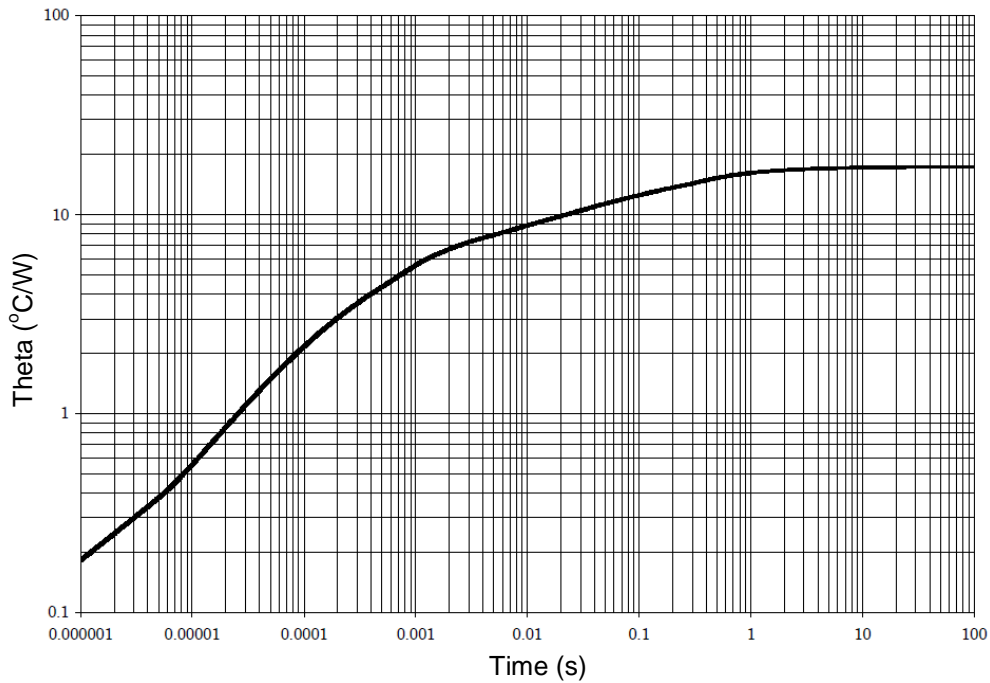
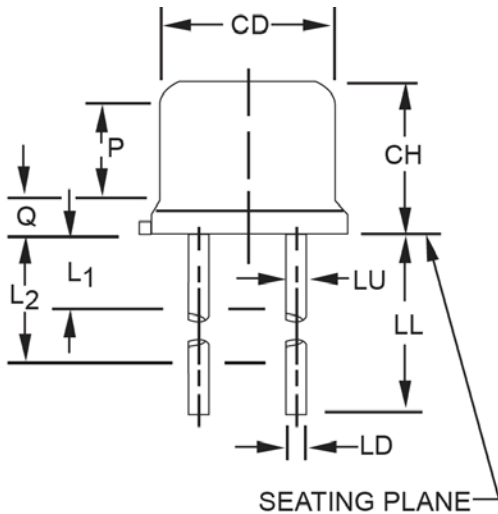
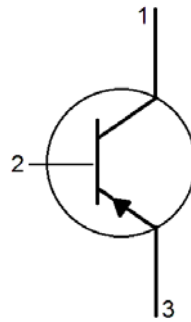
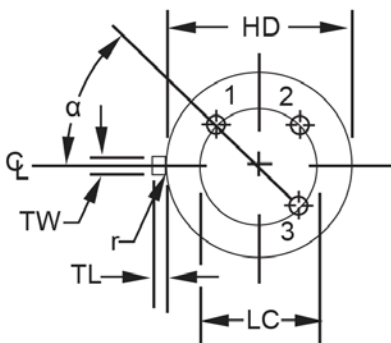


FIGURE 2
Thermal impedance graph ($R_{\theta JA}$)

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
L₁	-	0.050	-	1.27	7, 8
L₂	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:

- Dimensions are in inches.
- Millimeters are given for information only.
- Beyond r (radius) maximum, TW shall be held for a minimum length of 0.011 (0.28 mm).
- Dimension TL measured from maximum HD.
- Body contour optional within zone defined by HD, CD, and Q.
- 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.
- Dimension LU applies between L₁ and L₂. Dimension LD applies between L₂ and minimum. Diameter is uncontrolled in L₁ and beyond LL minimum.
- All three leads.
- The collector shall be internally connected to the case.
- Dimension r (radius) applies to both inside corners of tab.
- In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.
- Lead 1 = emitter, lead 2 = base, lead 3 = collector.