RoHS
Compliant

PNP Silicon Low-Power Transistor

Qualified per MIL-PRF-19500/485

Qualified Levels:
JAN, JANTX, JANTXV
and JANS

DESCRIPTION

This family of 2N5415 and 2N5416 epitaxial planar transistors are military qualified up to a JANS level for high-reliability applications. These devices are also available in TO-39 and low profile U4 and UA packaging.

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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

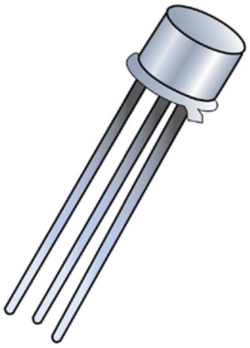
APPLICATIONS / BENEFITS

- 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	2N5415	2N5416	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		^{o}C/W
Thermal Resistance Junction-to-Case	$R_{\Theta JC}$	17.5		^{o}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



TO-5 Package

Also available in:

TO-205AD (TO-39)
package
(short-leaded)
2N5415S – 2N5416S

U4 package
(surface mount)
2N5415U4 – 2N5416U4

UA package
(surface mount)
2N5415UA – 2N5416UA

MSC – Lawrence
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Lawrence, MA 01841
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Ennis, Co. Clare, Ireland
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Fax: +353 (0) 65 6822298

Website:
www.microsemi.com

MECHANICAL and PACKAGING

- CASE: Hermetically sealed, kovar base, nickel cap
- TERMINALS: Leads are gold plated kovar (Solder dip (Sn63/Pb37) is available upon special request. NOTE: Solder dipping will eliminate RoHS compliance.)
- MARKING: Part number, date code, manufacturer's ID
- POLARITY: NPN
- WEIGHT: Approximately 1.14 grams
- See Package Dimensions on last page.

PART NOMENCLATURE

JAN 2N5415

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

JEDEC type number
(see Electrical Characteristics
table)

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, 2N5415 L = 25 mH; f = 30 – 60 Hz 2N5416	$V_{(BR)CEO}$	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 2N5415 V_{CE} = 300 V, V_{BE} = 1.5 V 2N5416	I_{CEX}		50	µA
Collector-Emitter Cutoff Current V_{CE} = 150 V 2N5415 V_{CE} = 250 V 2N5416	I_{CEO1}		50	µA
Collector-Emitter Cutoff Current V_{CE} = 200 V 2N5415 V_{CE} = 300 V 2N5416	I_{CEO2}		1	mA
Collector-Base Cutoff Current V_{CB} = 175 V 2N5415 V_{CB} = 280 V 2N5416	I_{CBO1}		50	µA
V_{CB} = 200 V 2N5415 V_{CB} = 350 V 2N5416	I_{CBO2}		500	µA
V_{CB} = 175 V, T_A = +150 ºC 2N5415 V_{CB} = 280 V, T_A = +150 ºC 2N5416	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

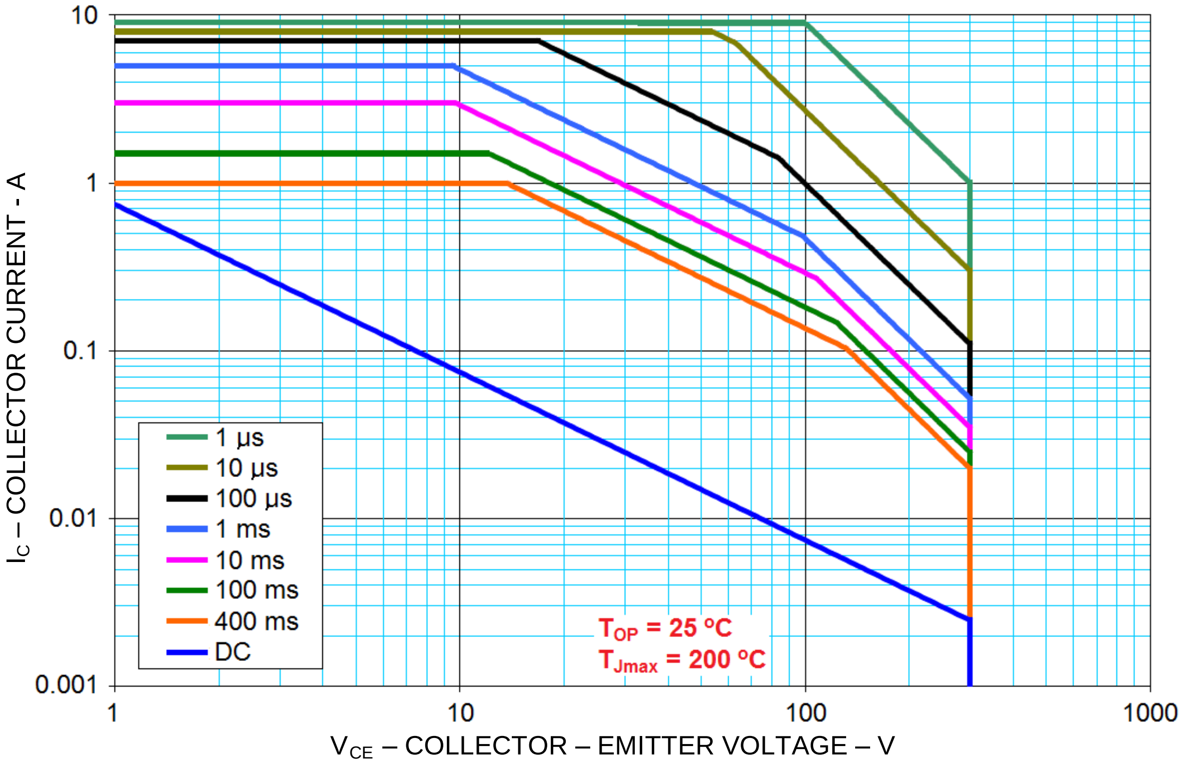
ELECTRICAL CHARACTERISTICS @ T_A = +25 °C unless otherwise noted. (continued)

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 (2N5415 only)
Test 4
V_{CE} = 300 V, I_C = 10 mA (2N5416 only)



Maximum Safe Operating Area (T_J = 200 °C)

GRAPHS

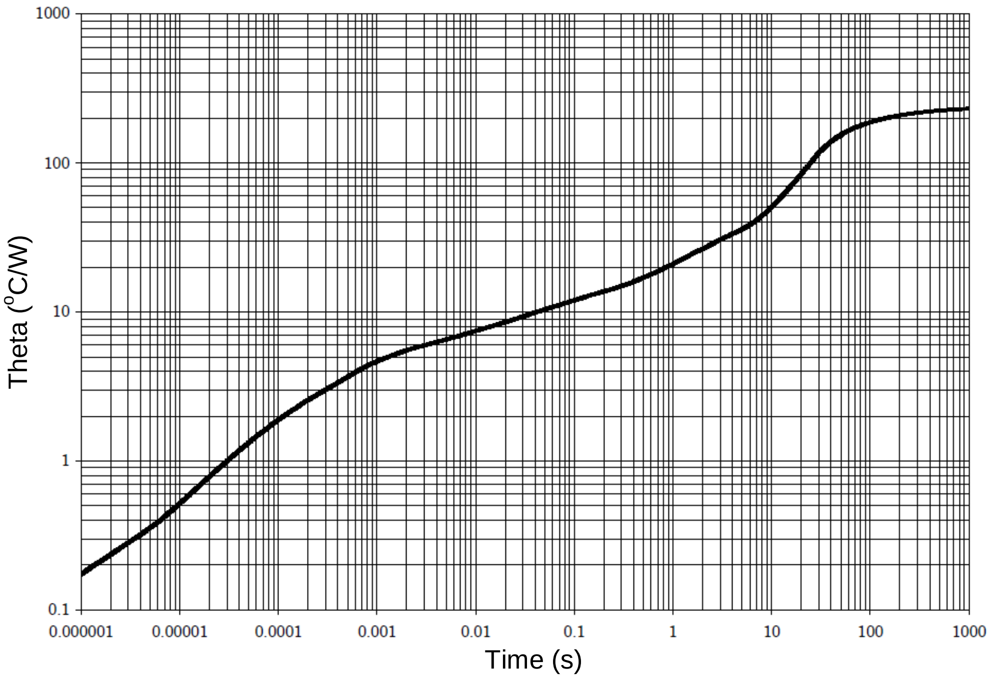


FIGURE 1

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

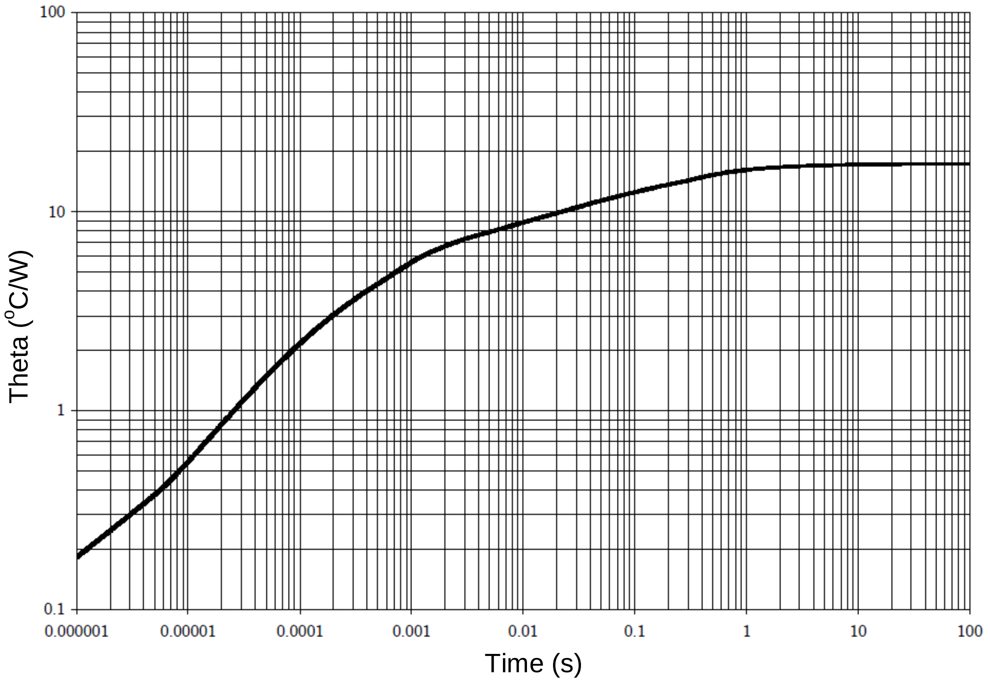
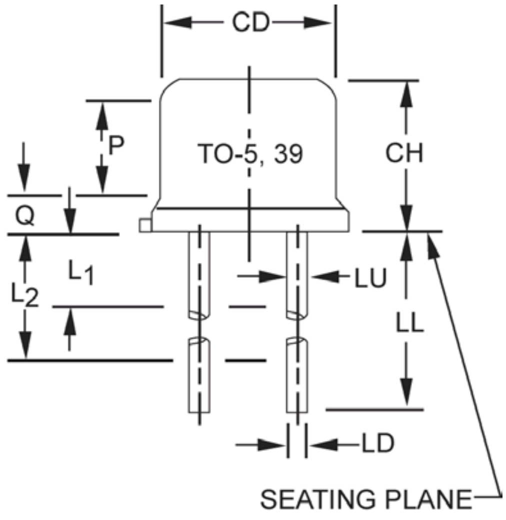


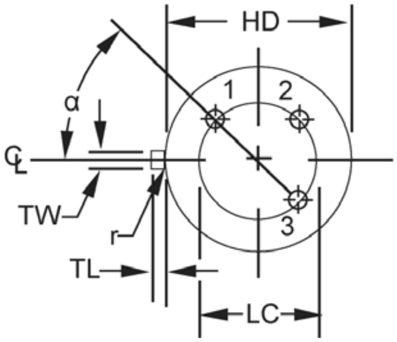
FIGURE 2

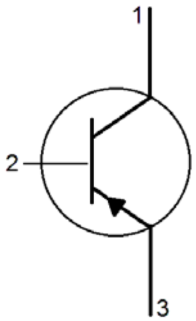
Thermal impedance graph ($R_{\Theta JA}$)

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
LL	See notes 7, 12 and 13				
LU	0.016	0.019	0.41	0.48	7, 13
L1	-	0.050	-	1.27	13
L2	0.250	-	6.35	-	13
P	0.100	-	2.54	-	5
Q	-	0.050	-	1.27	4
TL	0.029	0.045	0.74	1.14	3
TW	0.028	0.034	0.71	0.86	10, 11
r	-	0.010	-	0.25	11
α	45° TP		45° TP		6





NOTES:

1. Dimensions are in inches.
2. Millimeters are given for information only.
3. Symbol TL is measured from HD maximum.
4. Details of outline in this zone are optional.
5. Symbol CD shall not vary more than 0.010 (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane 0.054 inch (1.37 mm) +0.001 inch (0.03 mm) -0.000 inch (0.00 mm) below seating plane shall be within 0.007 inch (0.18 mm) radius of true position (TP) relative to tab. Device may be measured by direct methods or by gauge.
7. Symbol LD applies between L1 and L2. Dimension LD applies between L2 and LL minimum. Lead diameter shall not exceed 0.042 inch (1.07 mm) within L1 and beyond LL minimum.
8. Lead designation, shall be as follows: 1 - emitter, 2 - base, 3 - collector.
9. Lead number three is electrically connected to case.
10. Beyond r maximum, TW shall be held for a minimum length of 0.011 inch (0.28 mm).
11. Symbol r applied to both inside corners of tab.
12. For transistor types 2N5415 and 2N5416, dimension LL shall be 1.5 inches (38.1 mm) minimum and 1.75 inch (44.4 mm) maximum.
13. All three leads.
14. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.