



## NPN MEDIUM POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/393

Qualified Levels:  
JAN, JANTX and  
JANTXV

### DESCRIPTION

This family of high-frequency, epitaxial planar transistors feature low saturation voltage. These devices are also available in TO-5 and low profile U4 packages. 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>.

### FEATURES

- JEDEC registered 2N3418 through 2N3421 series.
- JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/393.
- RoHS compliant versions available (commercial grade only).
- $V_{CE(sat)} = 0.25\text{ V @ } I_C = 1\text{ A}$ .
- Rise time  $t_r = 0.22\ \mu\text{s max @ } I_C = 1.0\text{ A, } I_{B1} = 100\text{ mA}$ .
- Fall time  $t_f = 0.20\ \mu\text{s max @ } I_C = 1.0\text{ A, } I_{B2} = -10\text{ mA}$ .

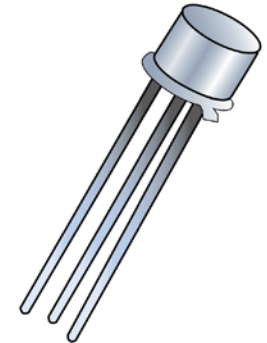
### APPLICATIONS / BENEFITS

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

### MAXIMUM RATINGS

Parameters / Test Conditions	Symbol	2N3418S 2N3420S	2N3419S 2N3421S	Unit
Collector-Emitter Voltage	$V_{CEO}$	60	80	V
Collector-Base Voltage	$V_{CBO}$	85	125	V
Emitter-Base Voltage	$V_{EBO}$	8		V
Collector Current $t_p \leq 1\text{ ms, duty cycle } \leq 50\%$	$I_C$	3 5		A
Total Power Dissipation @ $T_A = +25\text{ }^\circ\text{C}^{(1)}$ @ $T_C = +100\text{ }^\circ\text{C}^{(2)}$	$P_D$	1 5		W
Operating & Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +200		$^\circ\text{C}$

- Notes:**
1. Derate linearly 5.72 mW/ $^\circ\text{C}$  for  $T_A > +25\text{ }^\circ\text{C}$ .
  2. Derate linearly 150 mW/ $^\circ\text{C}$  for  $T_C > +100\text{ }^\circ\text{C}$ .




**TO-39 (TO-205AD)  
Package**

Also available in:

**TO-5 package**  
(lead)

 [2N3418 – 2N3421](#)

**U4 package**  
(surface mount)

 [2N3418U4 – 2N3421U4](#)

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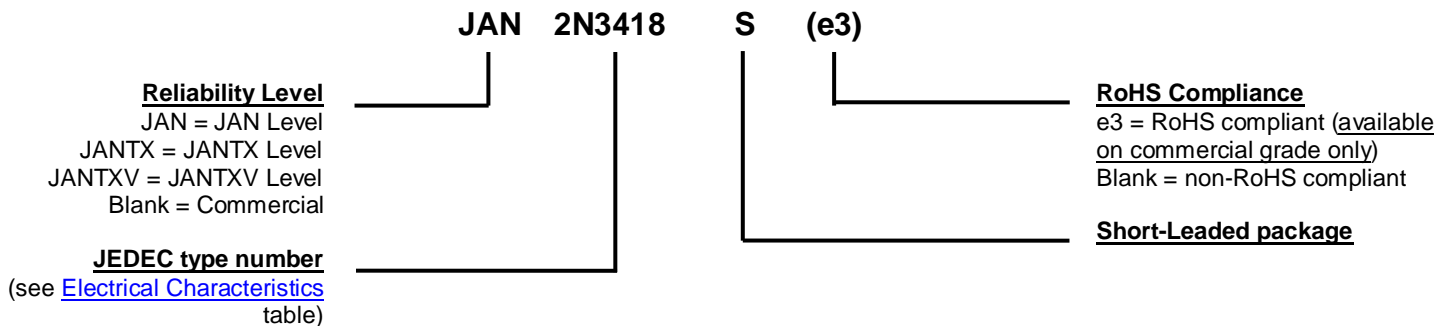
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**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed, kovar base, nickel cap.
- MARKING: Part number, date code, manufacturer's ID.
- POLARITY: 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.
$T_A$	Ambient temperature, free-air temperature.
$V_{CEO}$	Collector-emitter voltage, base open.
$V_{CBO}$	Collector-emitter voltage, emitter open.
$V_{EBO}$	Emitter-base voltage, collector open.

**ELECTRICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

**OFF CHARACTERISTICS**

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Collector-Emitter Breakdown Current $I_C = 50\text{ mA}$ , $I_B = 0$ 2N3418S, 2N3420S 2N3419S, 2N3421S	$V_{(BR)CEO}$	60 80		V
Collector-Emitter Cutoff Current $V_{BE} = -0.5\text{ V}$ , $V_{CE} = 80\text{ V}$ $V_{BE} = -0.5\text{ V}$ , $V_{CE} = 120\text{ V}$ 2N3418S, 2N3420S 2N3419S, 2N3421S	$I_{CEX}$		0.3 0.3	$\mu\text{A}$
Collector-Base Cutoff Current $V_{CE} = 45\text{ V}$ , $I_B = 0$ $V_{CE} = 60\text{ V}$ , $I_B = 0$ 2N3418S, 2N3420S 2N3419S, 2N3421S	$I_{CEO}$		5.0 5.0	$\mu\text{A}$
Emitter-Base Cutoff Current $V_{EB} = 6.0\text{ V}$ , $I_C = 0$ $V_{EB} = 8.0\text{ V}$ , $I_C = 0$	$I_{EBO}$		0.5 10	$\mu\text{A}$

**ON CHARACTERISTICS** <sup>(1)</sup>

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Forward-Current Transfer Ratio $I_C = 100\text{ mA}$ , $V_{CE} = 2.0\text{ V}$ 2N3418S, 2N3419S 2N3420S, 2N3421S	$h_{FE}$	20 40		
$I_C = 1.0\text{ A}$ , $V_{CE} = 2.0\text{ V}$ 2N3418S, 2N3419S 2N3420S, 2N3421S		20 40	60 120	
$I_C = 2.0\text{ A}$ , $V_{CE} = 2.0\text{ V}$ 2N3418S, 2N3419S 2N3420S, 2N3421S		15 30		
$I_C = 5.0\text{ A}$ , $V_{CE} = 5.0\text{ V}$ 2N3418S, 2N3419S 2N3420S, 2N3421S		10 15		
Collector-Emitter Saturation Voltage $I_C = 1.0\text{ A}$ , $I_B = 0.1\text{ A}$ $I_C = 2.0\text{ A}$ , $I_B = 0.2\text{ A}$	$V_{CE(sat)}$		0.25 0.5	V
Base-Emitter Saturation Voltage $I_C = 1.0\text{ A}$ , $I_B = 0.1\text{ A}$ $I_C = 2.0\text{ A}$ , $I_B = 0.2\text{ A}$	$V_{BE(sat)}$	0.6 0.7	1.2 1.4	V

**DYNAMIC CHARACTERISTICS**

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short Circuit Forward Current Transfer Ratio $I_C = 0.1\text{ A}$ , $V_{CE} = 10\text{ V}$ , $f = 20\text{ MHz}$	$ h_{fe} $	1.3	0.8	
Output Capacitance $V_{CB} = 10\text{ V}$ , $I_E = 0$ , $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$	$C_{obo}$		150	pF

**NOTES:** (1) Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

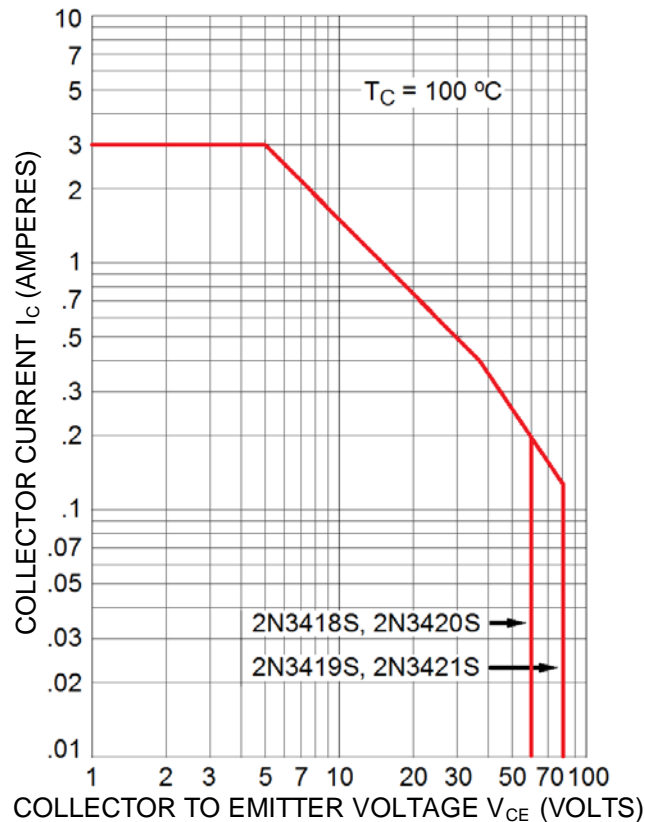
**ELECTRICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted) continued

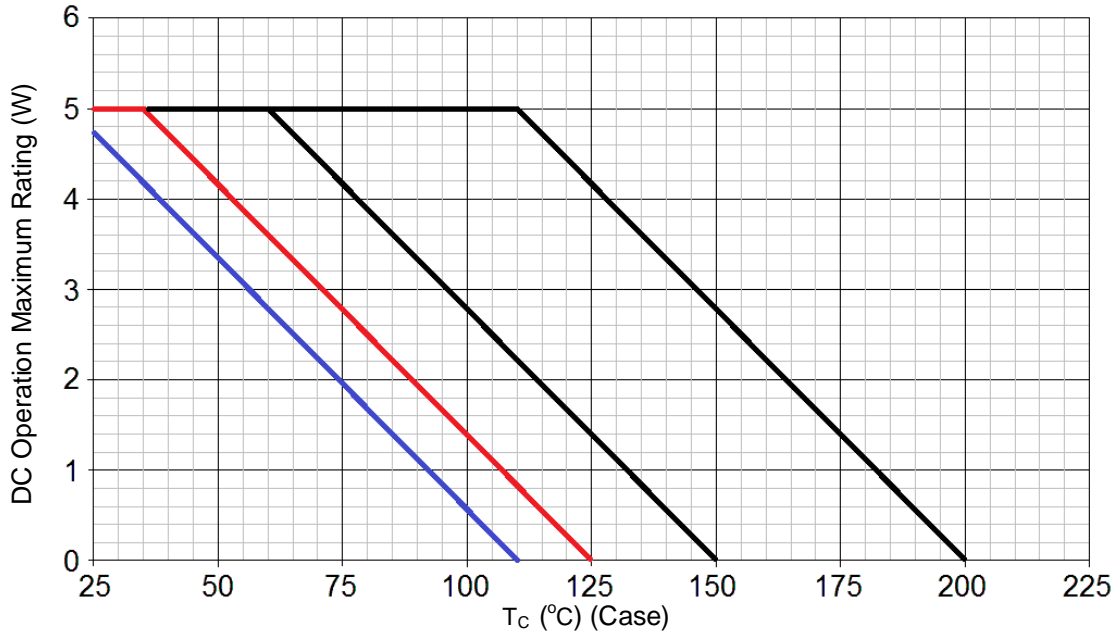
**SWITCHING CHARACTERISTICS**

Parameters / Test Conditions (for all symbols)	Symbol	Min.	Max.	Unit
Delay Time Rise Time	$V_{BE(off)} = -3.7\text{ V}$ , $I_C = 1.0\text{ A}$ , $I_{B1} = 100\text{ mA}$	$t_d$ $t_r$	0.08 0.22	$\mu\text{s}$
Storage Time Fall Time	$V_{BE(off)} = -3.7\text{ V}$ , $I_C = 1.0\text{ A}$ , $I_{B2} = -100\text{ mA}$	$t_s$ $t_f$	1.10 0.20	$\mu\text{s}$
Turn-Off Time	$V_{BE(off)} = -3.7\text{ V}$ , $I_C = 1.0\text{ A}$ , $I_{B2} = -100\text{ mA}$ , $R_L = 20\ \Omega$	$t_{off}$	1.20	$\mu\text{s}$

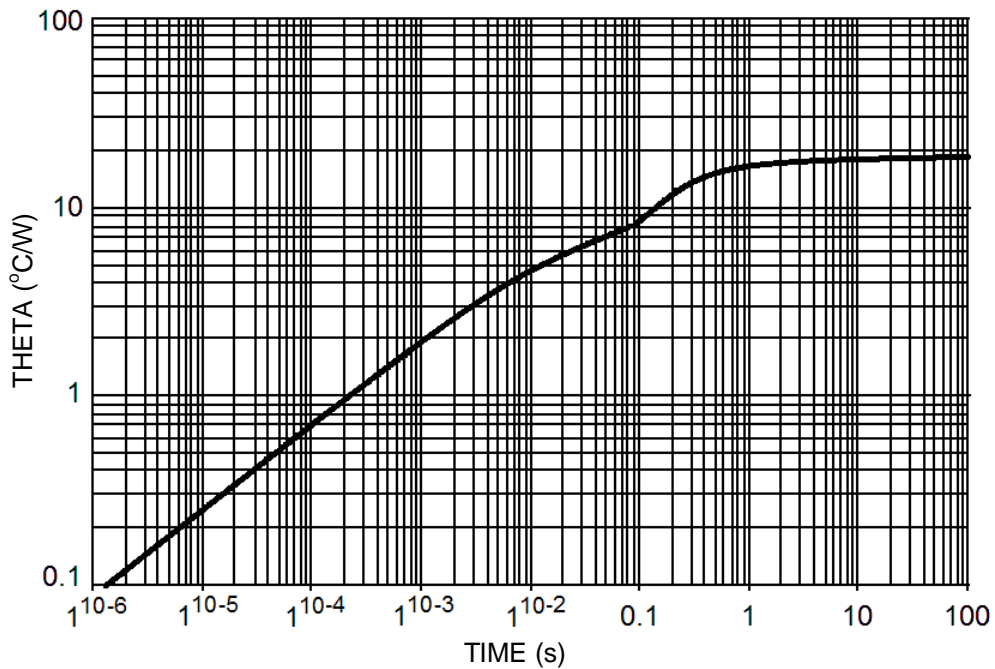
**SAFE OPERATING AREA** (See graph below and reference [MIL-STD-750, method 3053](#))

<b>DC Test</b>	
$T_C = +100^\circ\text{C}$ , 1 cycle, $t \geq 1.0\text{ s}$	
<b>Test 1</b>	
$V_{CE} = 5.0\text{ V}$ , $I_C = 3.0\text{ A}$	
<b>Test 2</b>	
$V_{CE} = 37\text{ V}$ , $I_C = 0.4\text{ A}$	
<b>Test 3</b>	
$V_{CE} = 60\text{ V}$ , $I_C = 0.185\text{ A}$	2N3418S, 2N3420S
$V_{CE} = 80\text{ V}$ , $I_C = 0.12\text{ A}$	2N3419S, 2N3421S
<b>Clamped Switching</b>	$T_A = +25^\circ\text{C}$ , $I_B = 0.5\text{ A}$ , $I_C = 3.0\text{ A}$


**Maximum Safe Operating Area (continuous dc)**

**GRAPHS**

**FIGURE 1**
Temperature-Power Derating Curve

**NOTES:** Thermal Resistance Junction to Case = 4.5 °C/W  
Max Finish-Alloy Temp = 175.0 °C


**FIGURE 2**
Maximum Thermal Impedance

**NOTE:**  $T_C = +25\text{ }^\circ\text{C}$ , Thermal Resistance  $R_{\theta JC} = 4.5\text{ }^\circ\text{C/W}$

**PACKAGE DIMENSIONS**


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	
LL	.500	.750	12.7	19.05	7
LU	See notes 7, 13, 14				
L <sub>1</sub>		.050		1.27	7
L <sub>2</sub>	.250		6.35		7
P	.100		2.54		5
Q		.040		1.02	4
TL	.029	.045	0.74	1.14	3, 10
TW	.028	.034	0.71	.86	9, 10
r		.010		0.25	11
α	45° TP		45° TP		6



1. Dimensions are in inches.
2. Millimeters are given for general 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 .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane .054 inch (1.37 mm) +.001 inch (0.03 mm) -.000 inch (0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of TP relative to tab. Device may be measured by direct methods or by gauge.
7. Symbol LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> and beyond LL minimum.
8. Lead number 3 is electrically connected to case.
9. Beyond r maximum, TW shall be held for a minimum length of .021 inch (0.53 mm).
10. Lead number 4 omitted on this variation.
11. Symbol r applied to both inside corners of tab.
12. For transistor types 2N3418S, 2N3419S, 2N3420S, 2N3421S, LL is .500 (12.70 mm) minimum and .750 (19.05 mm) maximum.
13. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.
14. Lead 1 is emitter, lead 2 is base, and lead 3 is collector.