



## 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  $t_f = 0.20\ \mu\text{s max @ } I_C = 1.0\text{ A, } I_{B2} = -10\text{ mA}$ .

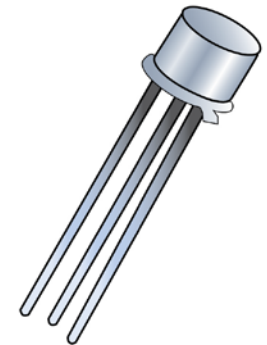
### APPLICATIONS / BENEFITS

- 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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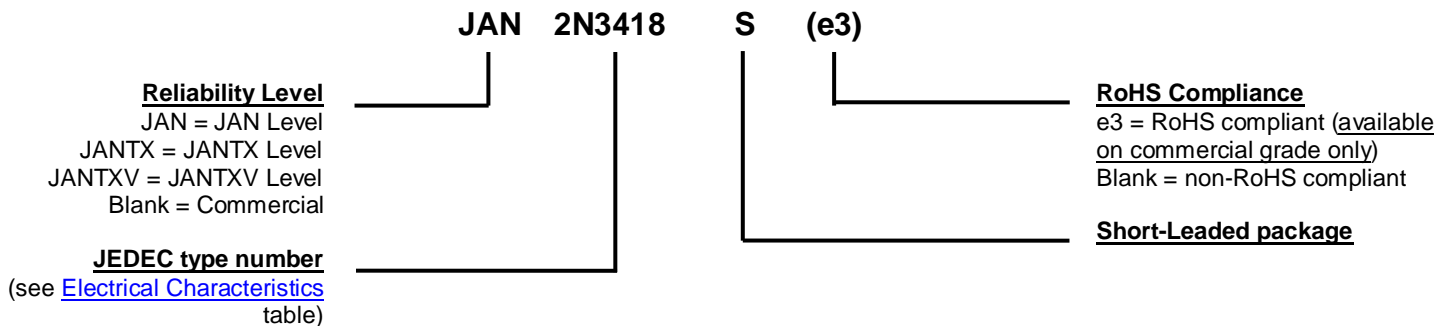
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**MECHANICAL and PACKAGING**

- 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  $\leq 2.0\%$ .

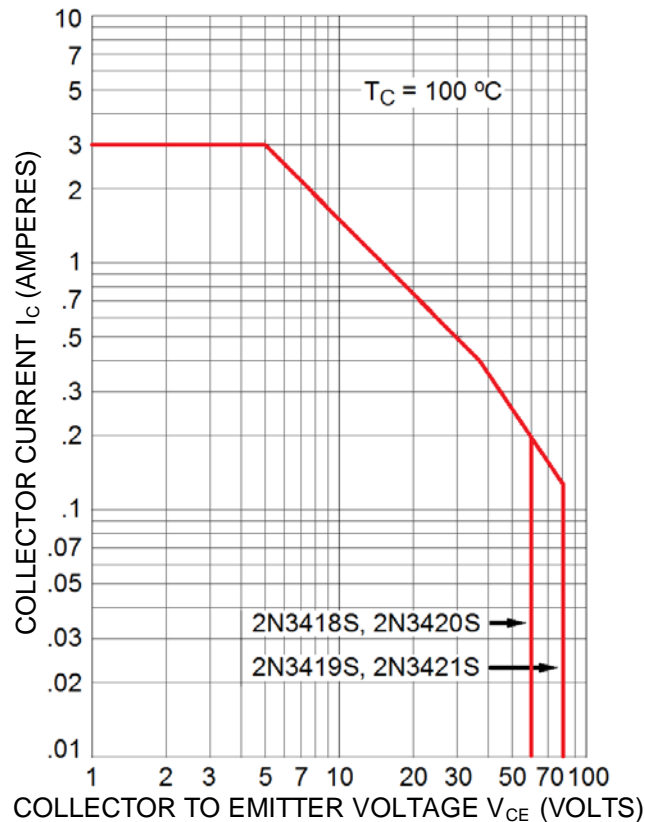
**ELECTRICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted) continued

**SWITCHING CHARACTERISTICS**

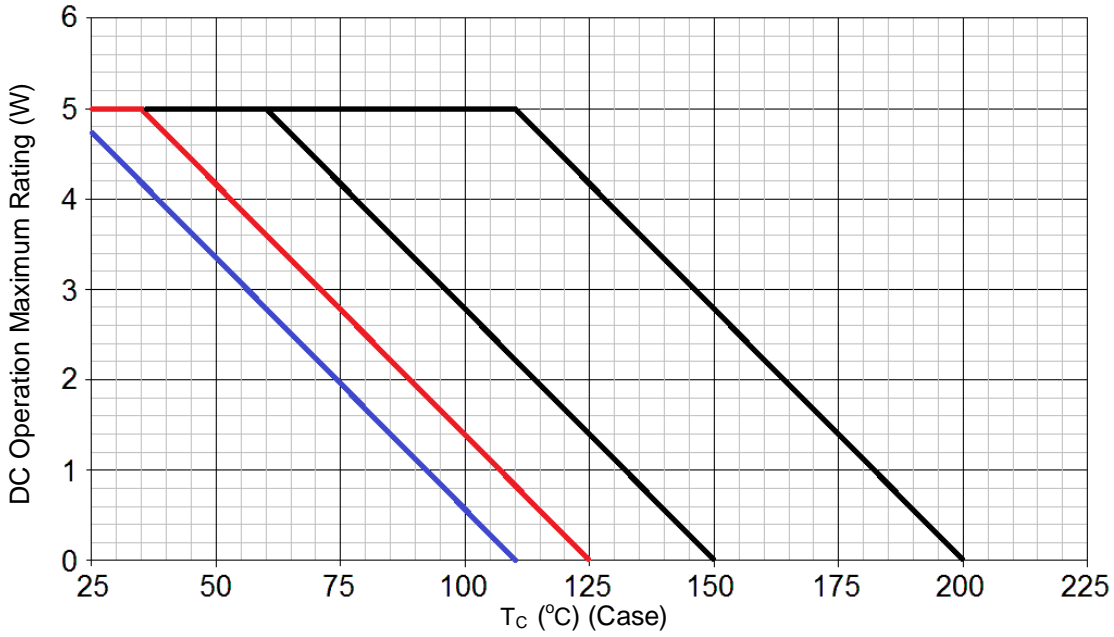
Parameters / Test Conditions (for all symbols)	Symbol	Min.	Max.	Unit
Delay Time Rise Time	$V_{BE(off)} = -3.7\text{ V}$ , $I_C = 1.0\text{ A}$ , $I_{B1} = 100\text{ mA}$	$t_d$ $t_r$	0.08 0.22	$\mu\text{s}$
Storage Time Fall Time	$V_{BE(off)} = -3.7\text{ V}$ , $I_C = 1.0\text{ A}$ , $I_{B2} = -100\text{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

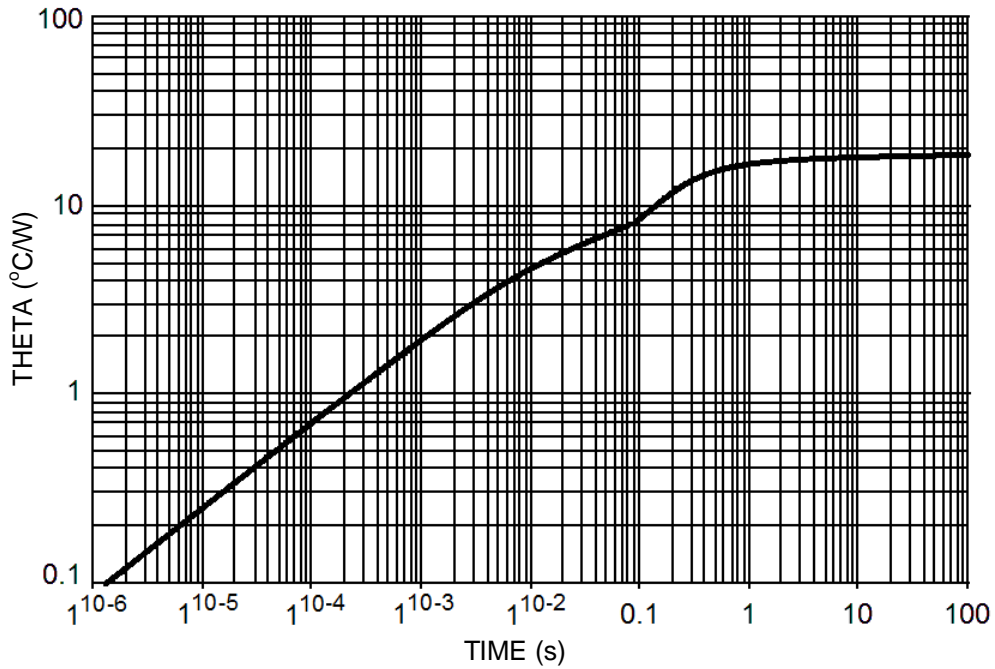
<b>DC Test</b>	
$T_C = +100^\circ\text{C}$ , 1 cycle, $t \geq 1.0\text{ s}$	
<b>Test 1</b>	
$V_{CE} = 5.0\text{ V}$ , $I_C = 3.0\text{ A}$	
<b>Test 2</b>	
$V_{CE} = 37\text{ V}$ , $I_C = 0.4\text{ A}$	
<b>Test 3</b>	
$V_{CE} = 60\text{ V}$ , $I_C = 0.185\text{ A}$	2N3418S, 2N3420S
$V_{CE} = 80\text{ V}$ , $I_C = 0.12\text{ A}$	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<sub>C</sub> = +25 °C, Thermal Resistance R<sub>θJC</sub> = 4.5 °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



- Dimensions are in inches.
- Millimeters are given for general information only.
- Symbol TL is measured from HD maximum.
- Details of outline in this zone are optional.
- Symbol CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
- 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.
- 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.
- Lead number 3 is electrically connected to case.
- Beyond r maximum, TW shall be held for a minimum length of .021 inch (0.53 mm).
- Lead number 4 omitted on this variation.
- Symbol r applied to both inside corners of tab.
- For transistor types 2N3418S, 2N3419S, 2N3420S, 2N3421S, LL is .500 (12.70 mm) minimum and .750 (19.05 mm) maximum.
- In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.
- Lead 1 is emitter, lead 2 is base, and lead 3 is collector.



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