



## 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. The U4 package is hermetically sealed and provides a low profile for minimizing board height. These devices are also available in TO-5 and TO-39 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 2N3418U4 through 2N3421U4 series.
- 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  $t_f = 0.20\ \mu\text{s max @ } I_C = 1.0\text{ A, } I_{B2} = -100\text{ mA}$ .

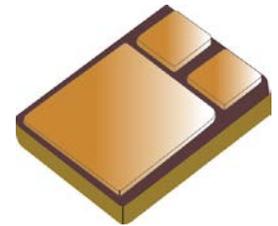
### APPLICATIONS / BENEFITS

- 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	2N3418U4 2N3420U4	2N3419U4 2N3421U4	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	$I_C$	3 5		A
Total Power Dissipation	$P_D$	1 15		W
		@ $T_A = +25^\circ\text{C}$ <sup>(1)</sup>		
		@ $T_C = +100^\circ\text{C}$ <sup>(2)</sup>		
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  $T_A > +25\ ^\circ\text{C}$ .
  2. Derate linearly 150 mW/ $^\circ\text{C}$  for  $T_C > +100\ ^\circ\text{C}$ .



**U4 Package**

Also available in:

**TO-5 package**  
(lead)

 [2N3418 – 2N3421](#)

**TO-39 package**  
(short lead)

 [2N3418S – 2N3421S](#)

**MSC – Lawrence**

6 Lake Street,  
Lawrence, MA 01841  
Tel: 1-800-446-1158 or  
(978) 620-2600  
Fax: (978) 689-0803

**MSC – Ireland**

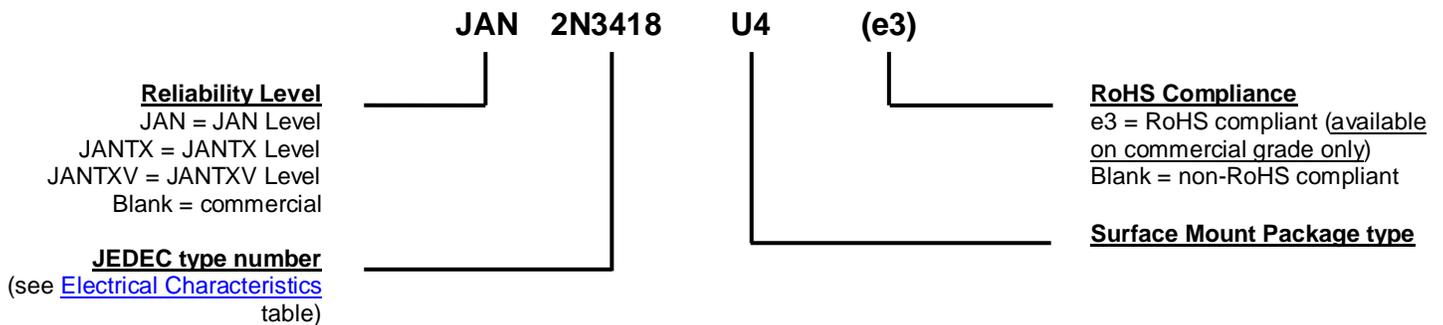
Gort Road Business Park,  
Ennis, Co. Clare, Ireland  
Tel: +353 (0) 65 6840044  
Fax: +353 (0) 65 6822298

**Website:**

[www.microsemi.com](http://www.microsemi.com)

**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed, aluminum nitride (AlN) ceramic body with gold over nickel plated kovar lid.
- TERMINALS: Gold over nickel plated surface mount terminations.
- MARKING: Part number, date code, manufacturer's ID.
- POLARITY: See package dimensions.
- TAPE & REEL option: Standard per EIA-481D. Consult factory for quantities.
- WEIGHT: .125 grams (125 milligrams).
- 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 $I_C = 50 \text{ mA}$ , $I_B = 0$ 2N3418U4, 2N3420U4 2N3419U4, 2N3421U4	$V_{(BR)CEO}$	60 80		V
Collector-Emitter Cutoff Current $V_{BE} = -0.5 \text{ V}$ , $V_{CE} = 80 \text{ V}$ $V_{BE} = -0.5 \text{ V}$ , $V_{CE} = 120 \text{ V}$ 2N3418U4, 2N3420U4 2N3419U4, 2N3421U4	$I_{CEX}$		0.3 0.3	$\mu\text{A}$
Collector-Base Cutoff Current $V_{CE} = 45 \text{ V}$ , $I_B = 0$ $V_{CE} = 60 \text{ V}$ , $I_B = 0$ 2N3418U4, 2N3420U4 2N3419U4, 2N3421U4	$I_{CEO}$		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 $I_C = 100 \text{ mA}$ , $V_{CE} = 2.0 \text{ V}$ 2N3418U4, 2N3419U4 2N3420U4, 2N3421U4	$h_{FE}$	20 40		
$I_C = 1.0 \text{ A}$ , $V_{CE} = 2.0 \text{ V}$ 2N3418U4, 2N3419U4 2N3420U4, 2N3421U4		20 40	60 120	
$I_C = 2.0 \text{ A}$ , $V_{CE} = 2.0 \text{ V}$ 2N3418U4, 2N3419U4 2N3420U4, 2N3421U4		15 30		
$I_C = 5.0 \text{ A}$ , $V_{CE} = 5.0 \text{ V}$ 2N3418U4, 2N3419U4 2N3420U4, 2N3421U4		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

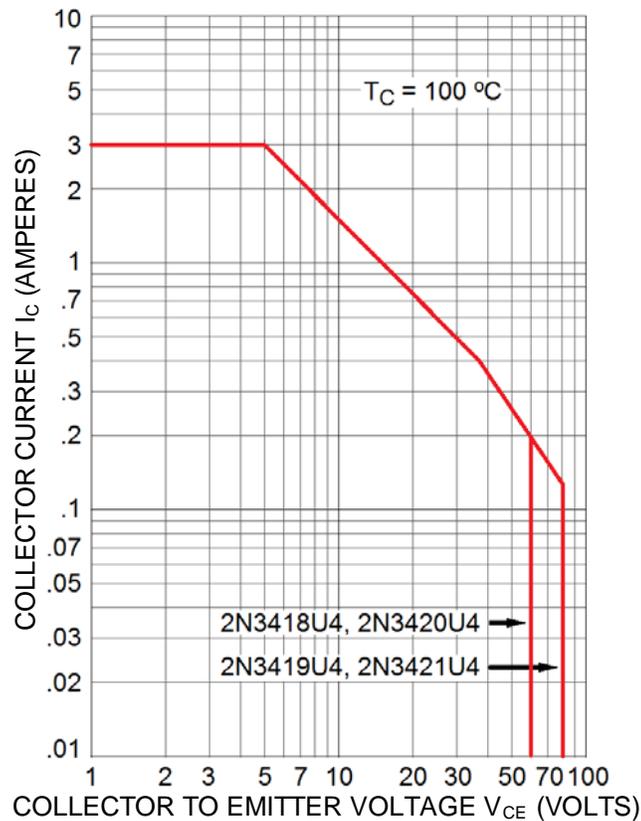
(1) Pulse Test: Pulse Width = 300  $\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .

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

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

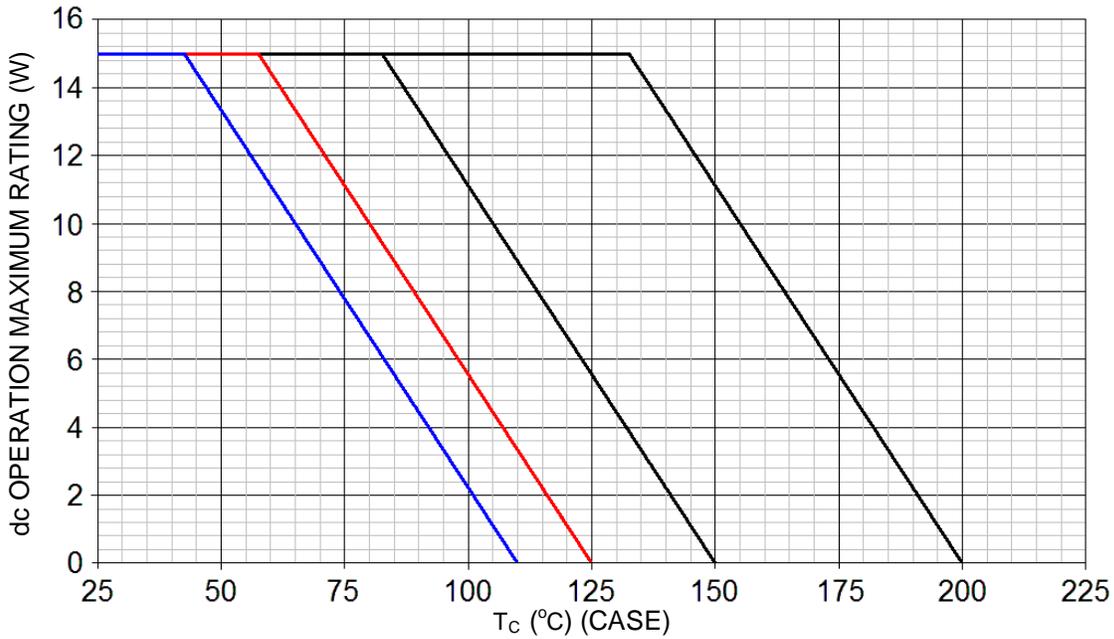
**SAFE OPERATING AREA** (See graph below and reference [MIL-STD-750, method 3053](#))

<b>DC Test</b>	
$T_C = +100^\circ\text{C}$ , 1 cycle, $t \geq 1 \text{ s}$	
<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>	
$V_{CE} = 60 \text{ V}$ , $I_C = 0.185 \text{ A}$	2N3418U4, 2N3420U4
$V_{CE} = 80 \text{ V}$ , $I_C = 0.12 \text{ A}$	2N3419U4, 2N3421U4
<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)

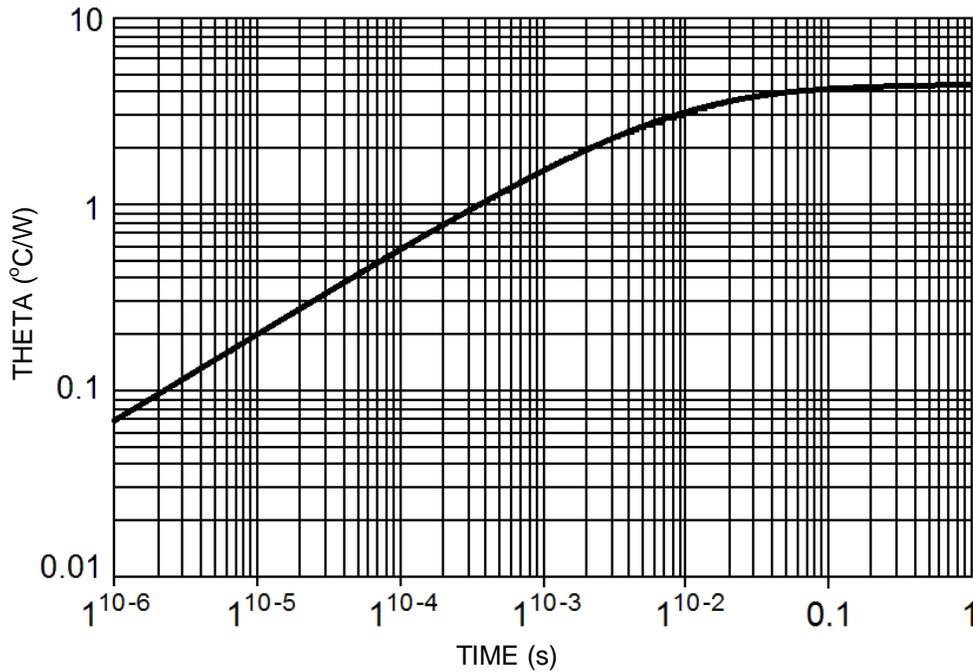
GRAPHS



**FIGURE 1**

Temperature-Power Derating Curve

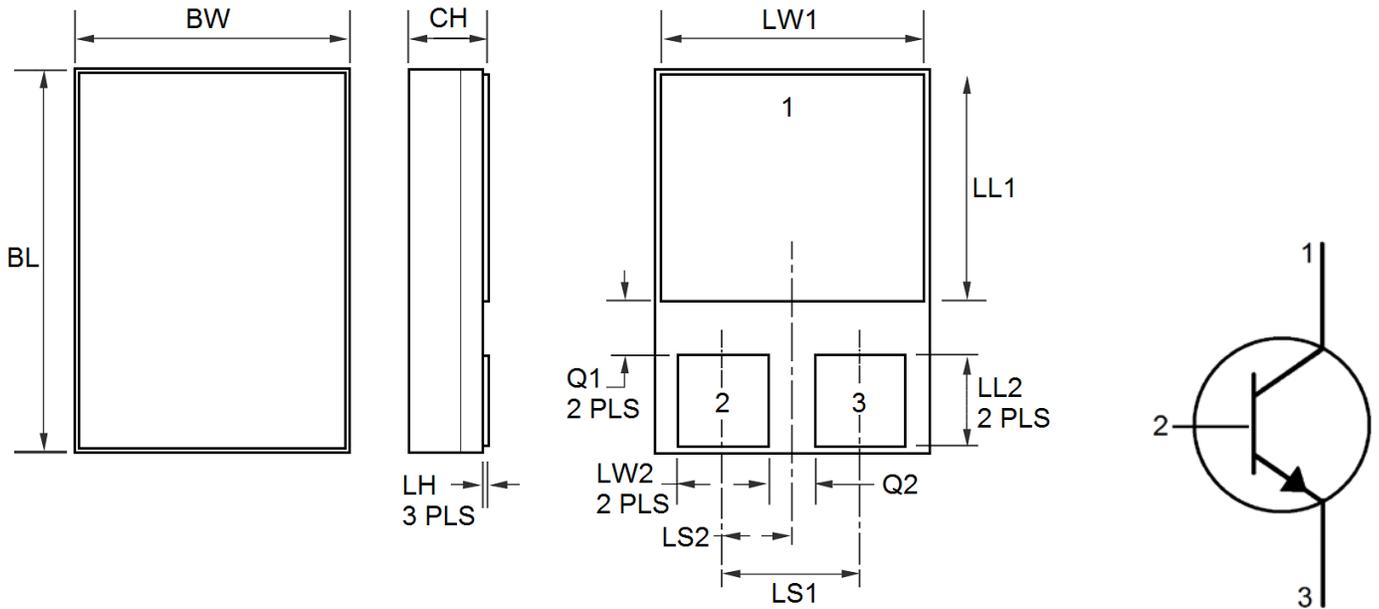
**NOTES:** Thermal Resistance Junction to Case = 4.5 °C/W  
Max Finish-Alloy Temp = 175 °C



**FIGURE 2**

Maximum Thermal Impedance

**NOTE:** T<sub>C</sub> = +25 °C, Thermal Resistance R<sub>θJC</sub> = 4.5 °C/W

**PACKAGE DIMENSIONS**

**NOTES:**

1. Dimensions are in inches.
2. Millimeter equivalents are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
<b>BL</b>	0.215	0.225	5.46	5.72
<b>BW</b>	0.145	0.155	3.68	3.94
<b>CH</b>	0.049	0.075	1.24	1.91
<b>LH</b>		0.020		0.51
<b>LW1</b>	0.135	0.145	3.43	3.68
<b>LW2</b>	0.047	0.057	1.19	1.45
<b>LL1</b>	0.085	0.125	2.16	3.17
<b>LL2</b>	0.045	0.075	1.14	1.91
<b>LS1</b>	0.070	0.095	1.78	2.41
<b>LS2</b>	0.035	0.048	0.89	1.21
<b>Q1</b>	0.030	0.070	0.76	1.78
<b>Q2</b>	0.020	0.035	0.51	0.89
<b>TERMINAL</b>				
<b>1</b>	COLLECTOR			
<b>2</b>	BASE			
<b>3</b>	EMITTER			