



## PNP Silicon Low-Power Transistor

*Qualified per MIL-PRF-19500/485*

Qualified Levels:  
JAN, JANTX, JANTXV  
and JANS

### DESCRIPTION

This family of 2N5415U4 and 2N5416U4 epitaxial planar transistors are military qualified up to a JANS level for high-reliability applications. These devices are also available in the long-leaded TO-5, short-leaded TO-39 and low profile 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

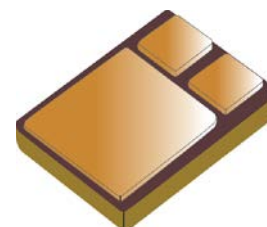
### APPLICATIONS / BENEFITS

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

### MAXIMUM RATINGS @ $T_A = +25^\circ\text{C}$ unless otherwise noted

| Parameters / Test Conditions                                                                                        | Symbol          | 2N5415U4    | 2N5416U4 | 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 |          | $^\circ\text{C}$   |
| Thermal Resistance Junction-to-Ambient                                                                              | $R_{\theta JA}$ | 145         |          | $^\circ\text{C/W}$ |
| Thermal Resistance Junction-to-Case                                                                                 | $R_{\theta JC}$ | 12          |          | $^\circ\text{C/W}$ |
| Total Power Dissipation<br>@ $T_A = +25^\circ\text{C}$ <sup>(1)</sup><br>@ $T_C = +25^\circ\text{C}$ <sup>(2)</sup> | $P_T$           | 1<br>15     |          | W                  |

**Notes:** 1. Derate linearly 6.90 mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$   
2. Derate linearly 86 mW/ $^\circ\text{C}$  for  $T_C > +25^\circ\text{C}$



### U4 Package

Also available in:

**TO-5 package**  
(long-leaded)

 [2N5415 – 2N5416](#)

**TO-39 (TO-205AD)**  
package  
(short-leaded)

 [2N5415S – 2N5416S](#)

**UA package**  
(surface mount)

 [2N5415UA – 2N5416UA](#)

#### MSC – Lawrence

6 Lake Street,  
Lawrence, MA 01841  
Tel: 1-800-446-1158 or  
(978) 620-2600  
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#### MSC – Ireland

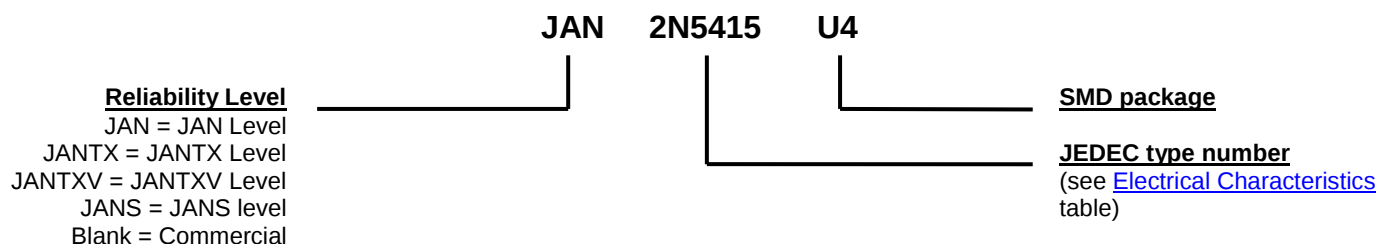
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[www.microsemi.com](http://www.microsemi.com)

**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: PNP
- TAPE & REEL option: Standard per EIA-481D. Consult factory for quantities
- WEIGHT: Approximately 0.125 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       |
| $V_{CEO}$ | 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<br>$I_C = 50\text{ mA}$ , $I_B = 5\text{ mA}$ ,<br>$L = 25\text{ mH}$ ; $f = 30 - 60\text{ Hz}$        | $V_{(BR)CEO}$ | 200<br>300 |      | V             |
| Emitter-Base Cutoff Current<br>$V_{EB} = 6.0\text{ V}$                                                                                     | $I_{EBO}$     |            | 20   | $\mu\text{A}$ |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 200\text{ V}$ , $V_{BE} = 1.5\text{ V}$<br>$V_{CE} = 300\text{ V}$ , $V_{BE} = 1.5\text{ V}$ | $I_{CEX}$     |            | 50   | $\mu\text{A}$ |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 150\text{ V}$<br>$V_{CE} = 250\text{ V}$                                                     | $I_{CEO1}$    |            | 50   | $\mu\text{A}$ |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 200\text{ V}$<br>$V_{CE} = 300\text{ V}$                                                     | $I_{CEO2}$    |            | 1    | mA            |
| Collector-Base Cutoff Current<br>$V_{CB} = 175\text{ V}$<br>$V_{CB} = 280\text{ V}$                                                        | $I_{CBO1}$    |            | 50   | $\mu\text{A}$ |
| $V_{CB} = 200\text{ V}$<br>$V_{CB} = 350\text{ V}$                                                                                         | $I_{CBO2}$    |            | 500  | $\mu\text{A}$ |
| $V_{CB} = 175\text{ V}$ , $T_A = +150\text{ }^{\circ}\text{C}$<br>$V_{CB} = 280\text{ V}$ , $T_A = +150\text{ }^{\circ}\text{C}$           | $I_{CBO3}$    |            | 1    | mA            |

**ON CHARACTERISTICS**

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

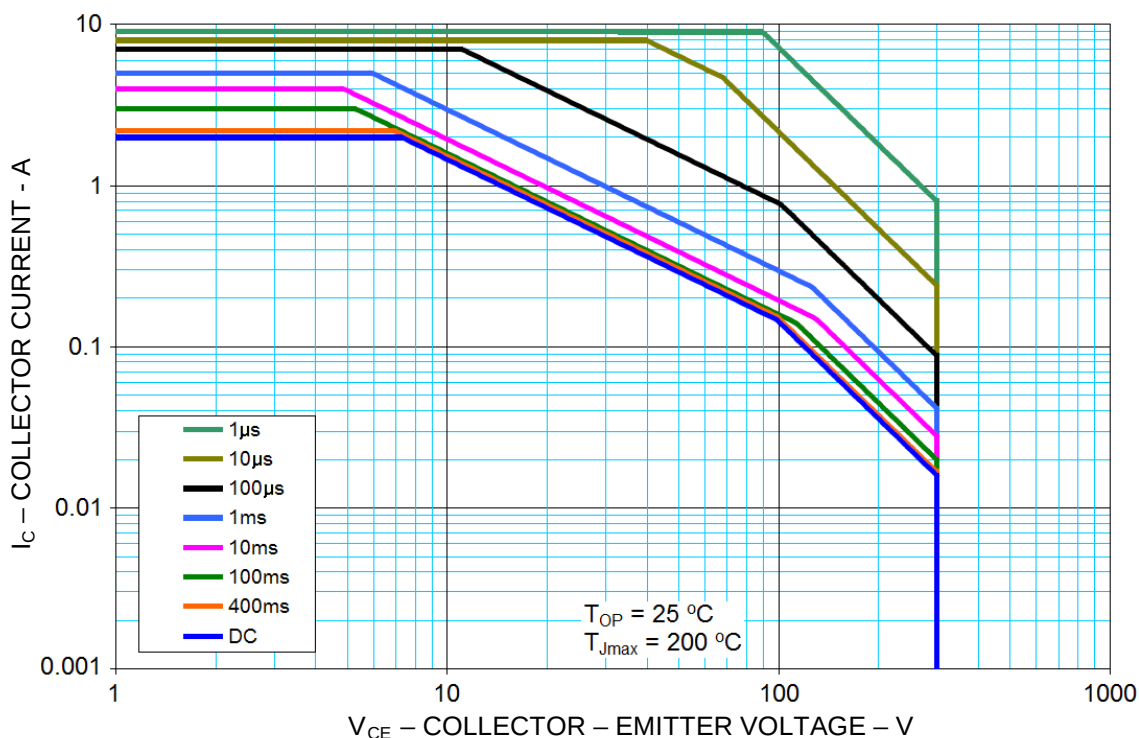
**DYNAMIC CHARACTERISTICS**

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

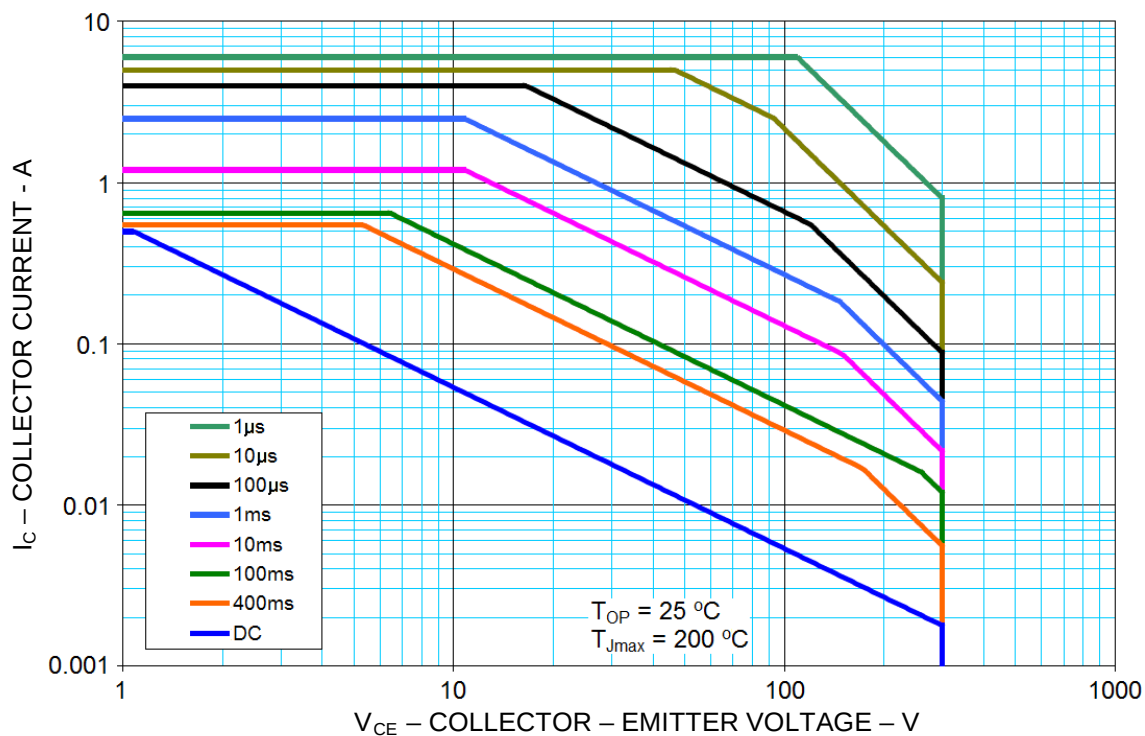
**ELECTRICAL CHARACTERISTICS @  $T_A = +25\text{ }^{\circ}\text{C}$  unless otherwise noted. (continued)****SWITCHING CHARACTERISTICS**

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

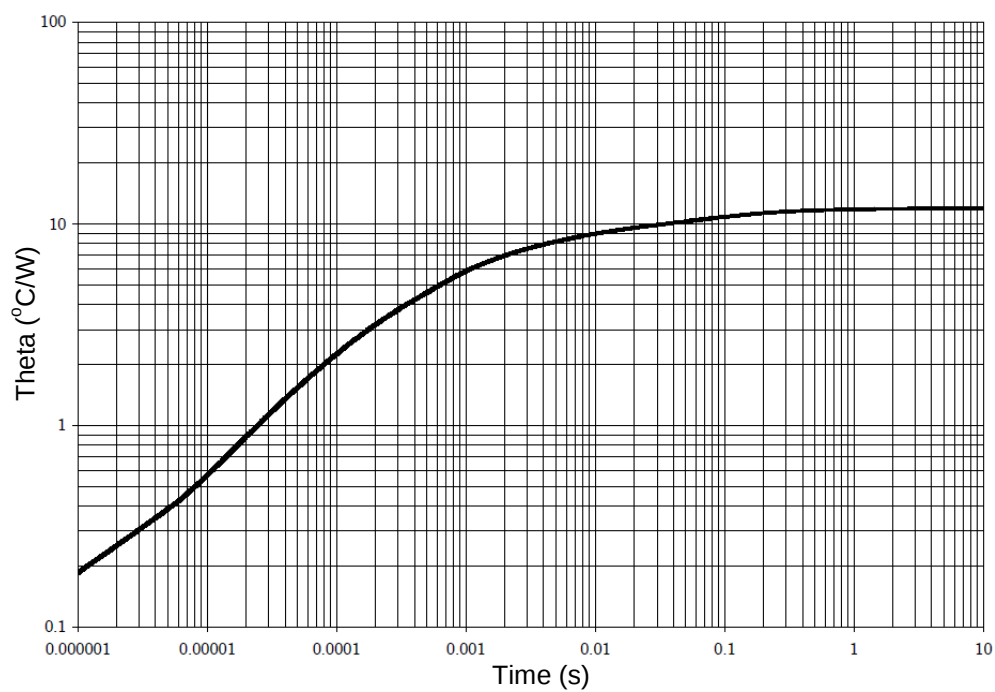
**SAFE OPERATING AREA** (See SOA graph below and [MIL-STD-750, method 3053](#))**DC Tests** $T_C = +25\text{ }^{\circ}\text{C}$ ,  $t_P = 0.4\text{ s}$ , 1 Cycle**Test 1** $V_{CE} = 10\text{ V}$ ,  $I_C = 1\text{ A}$ **Test 2** $V_{CE} = 100\text{ V}$ ,  $I_C = 100\text{ mA}$ **Test 3** $V_{CE} = 200\text{ V}$ ,  $I_C = 24\text{ mA}$ **Test 4** $V_{CE} = 300\text{ V}$ ,  $I_C = 10\text{ mA}$ *See SOA graphs on next page*

**SAFE OPERATING AREA**


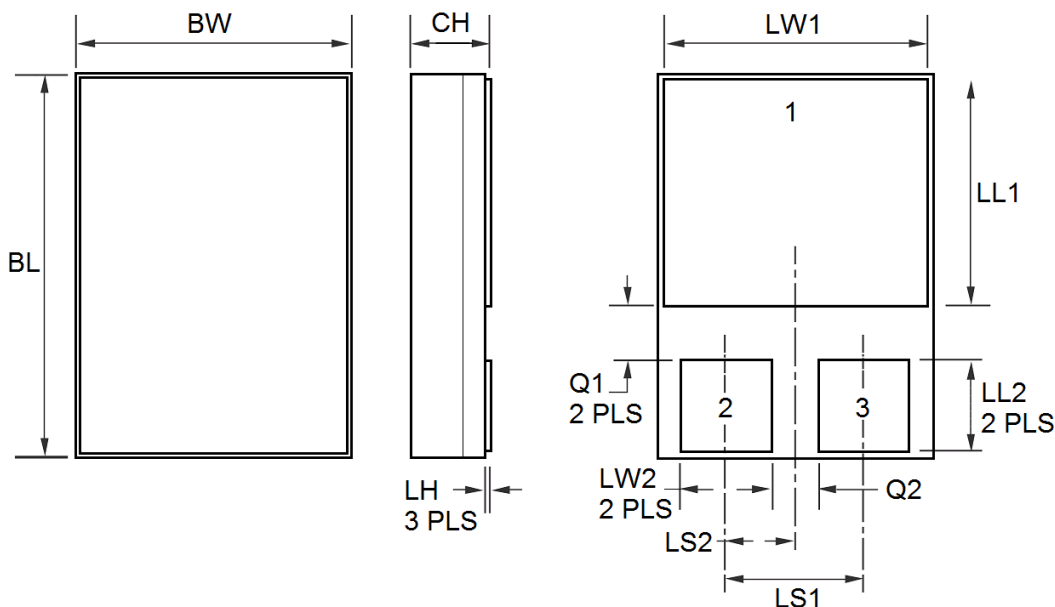
**Maximum Safe Operating Area ( $T_J = 200\text{ }^{\circ}\text{C}$ , U4 on copper sink  $T_C = 25\text{ }^{\circ}\text{C}$ )**



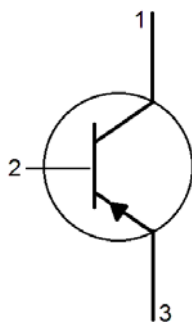
**Maximum Safe Operating Area ( $T_J = 200\text{ }^{\circ}\text{C}$ )**

**GRAPHS**


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

**PACKAGE DIMENSIONS**

**NOTES:**

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



| Ltr             | Dimensions |       |             |      |
|-----------------|------------|-------|-------------|------|
|                 | Inch       |       | 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>       | -          | 0.02  | -           | 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        | 3.18 |
| <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        | 1.22 |
| <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    |       |             |      |

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