



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

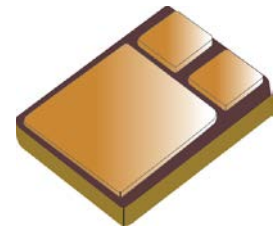
APPLICATIONS / BENEFITS

- 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 °C unless otherwise noted

| Parameters / Test Conditions | Symbol | 2N5415U4 | 2N5416U4 | Unit |
|------------------------------------------------|-----------------------------------|------------------------------------------|----------|------|
| Collector-Emitter Voltage | V _{CEO} | 200 | 300 | V |
| Collector-Base Voltage | V _{CB0} | 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 _{θJA} | 145 | | °C/W |
| Thermal Resistance Junction-to-Case | R _{θJC} | 12 | | °C/W |
| Total Power Dissipation | P _T | @ T _A = +25 °C ⁽¹⁾ | | W |
| | | @ T _C = +25 °C ⁽²⁾ | | |


- Notes:**
1. Derate linearly 6.90 mW/°C for T_A > +25 °C
 2. Derate linearly 86 mW/°C for T_C > +25 °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](#)

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MSC – Ireland

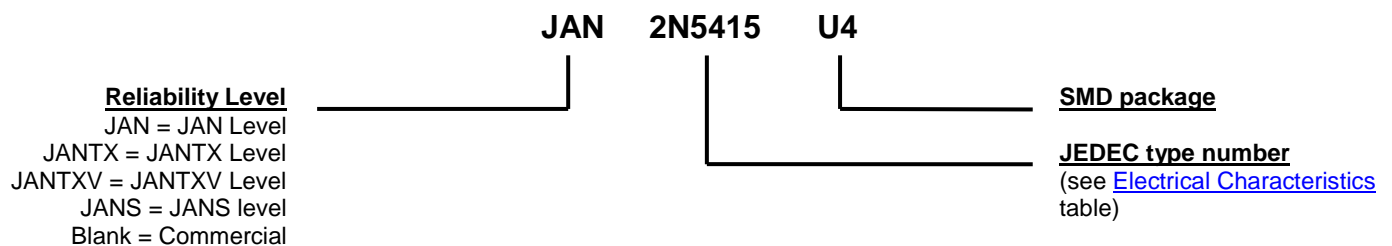
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MECHANICAL and PACKAGING

- 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 $I_C = 50\text{ mA}$, $I_B = 5\text{ mA}$, $L = 25\text{ mH}$; $f = 30 - 60\text{ Hz}$ | $V_{(BR)CEO}$ | 200 300 | | V |
| Emitter-Base Cutoff Current $V_{EB} = 6.0\text{ V}$ | I_{EBO} | | 20 | μA |
| Collector-Emitter Cutoff Current $V_{CE} = 200\text{ V}$, $V_{BE} = 1.5\text{ V}$ $V_{CE} = 300\text{ V}$, $V_{BE} = 1.5\text{ V}$ | I_{CEX} | | 50 | μA |
| Collector-Emitter Cutoff Current $V_{CE} = 150\text{ V}$ $V_{CE} = 250\text{ V}$ | I_{CEO1} | | 50 | μA |
| Collector-Emitter Cutoff Current $V_{CE} = 200\text{ V}$ $V_{CE} = 300\text{ V}$ | I_{CEO2} | | 1 | mA |
| Collector-Base Cutoff Current $V_{CB} = 175\text{ V}$ $V_{CB} = 280\text{ V}$ | I_{CBO1} | | 50 | μA |
| $V_{CB} = 200\text{ V}$ $V_{CB} = 350\text{ V}$ | I_{CBO2} | | 500 | μA |
| $V_{CB} = 175\text{ V}$, $T_A = +150\text{ }^\circ\text{C}$ $V_{CB} = 280\text{ V}$, $T_A = +150\text{ }^\circ\text{C}$ | I_{CBO3} | | 1 | mA |

ON CHARACTERISTICS

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

DYNAMIC CHARACTERISTICS

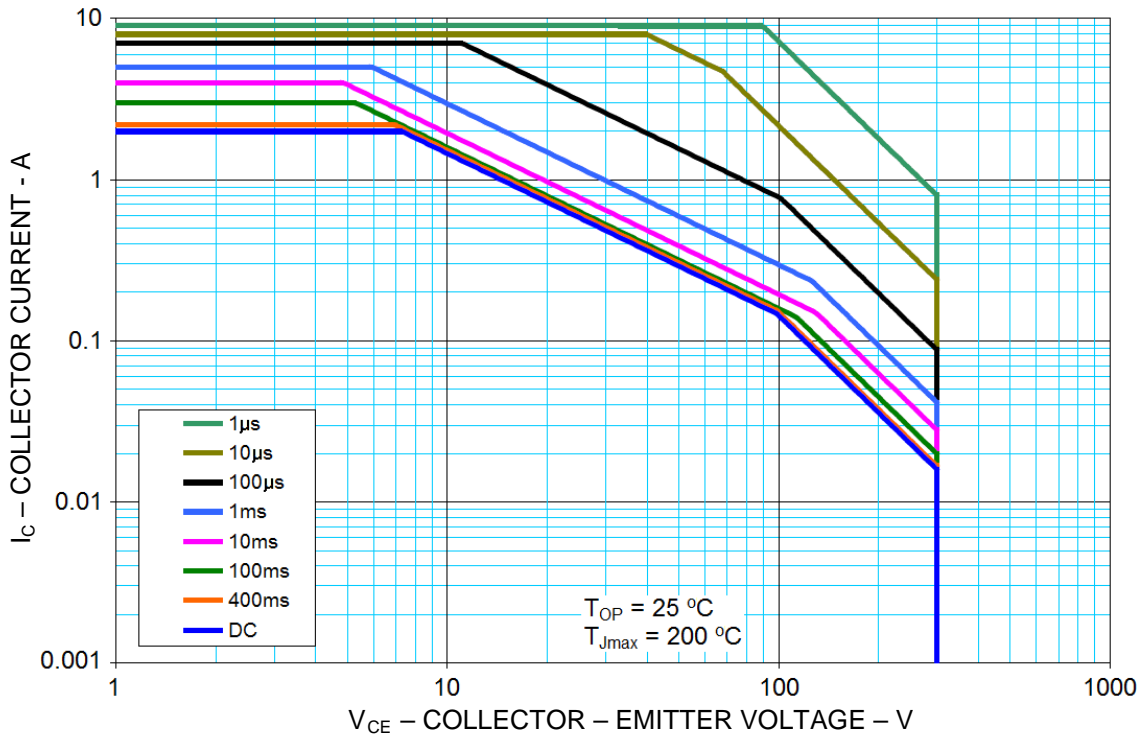
| Parameters / Test Conditions | Symbol | Min. | Max. | Unit |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|------|------|
| Magnitude of Common Emitter Small-Signal Short-Circuit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

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

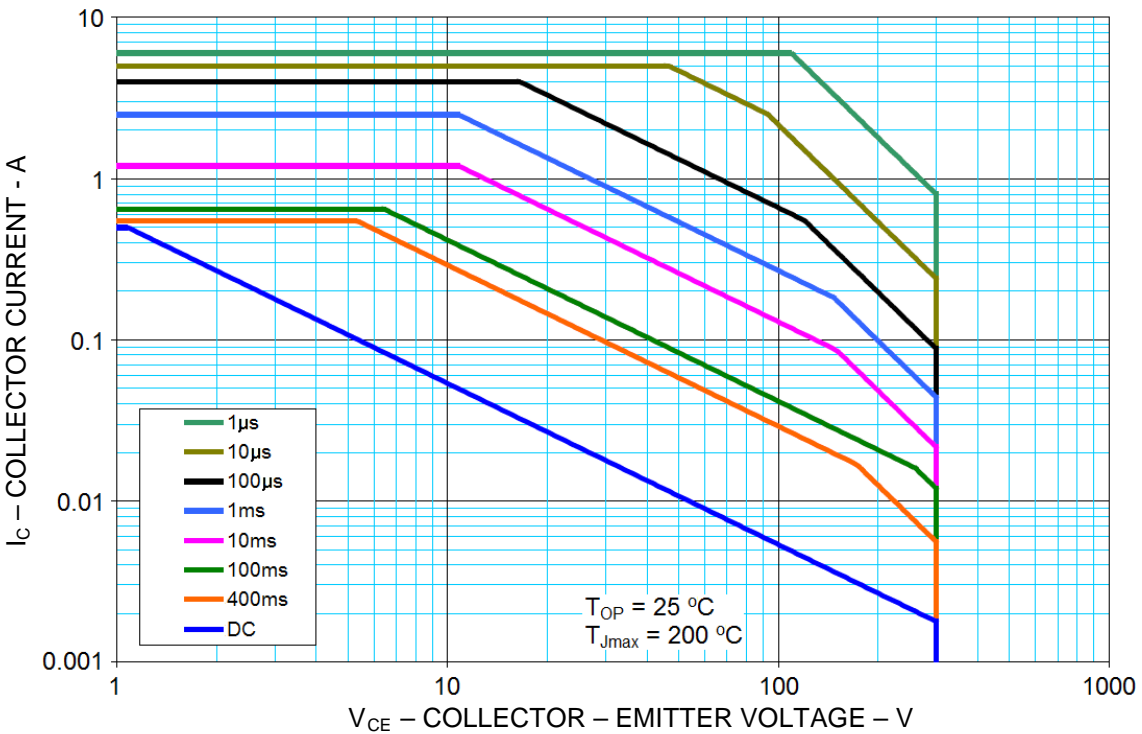
| Parameters / Test Conditions | Symbol | Min. | Max. | Unit |
|---------------------------------------------------------------------------------------------------|-----------|------|------|---------------|
| Turn-On Time $V_{CC} = 200\text{ V}$, $I_C = 50\text{ mA}$, $I_{B1} = 5\text{ mA}$ | t_{on}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

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 ($T_J = 200\text{ °C}$, U4 on copper sink $T_C = 25\text{ °C}$)



Maximum Safe Operating Area ($T_J = 200\text{ °C}$)

GRAPHS

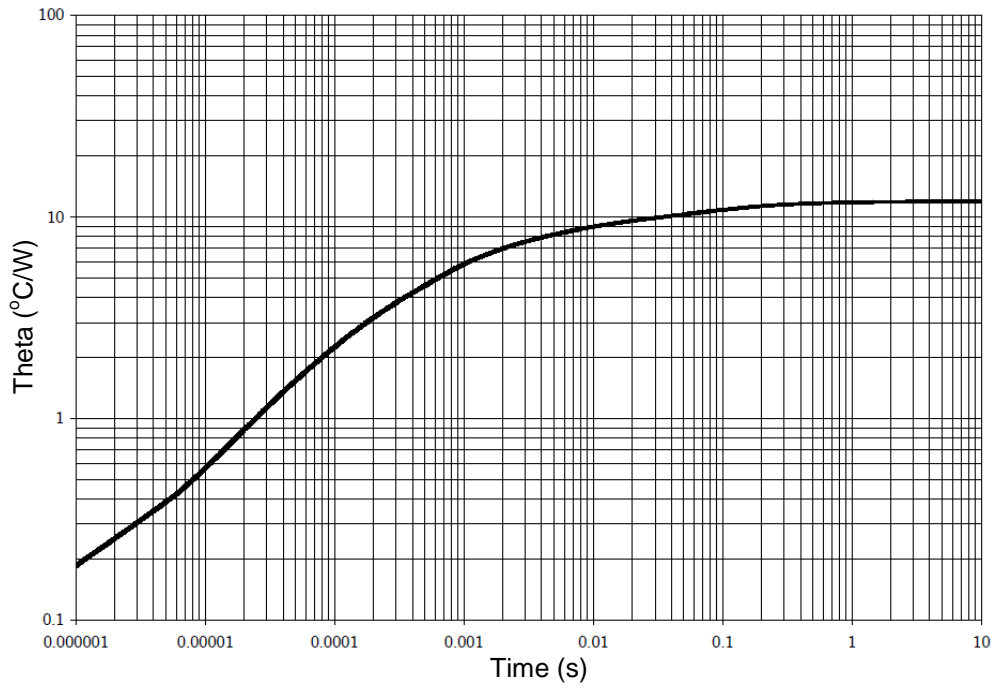
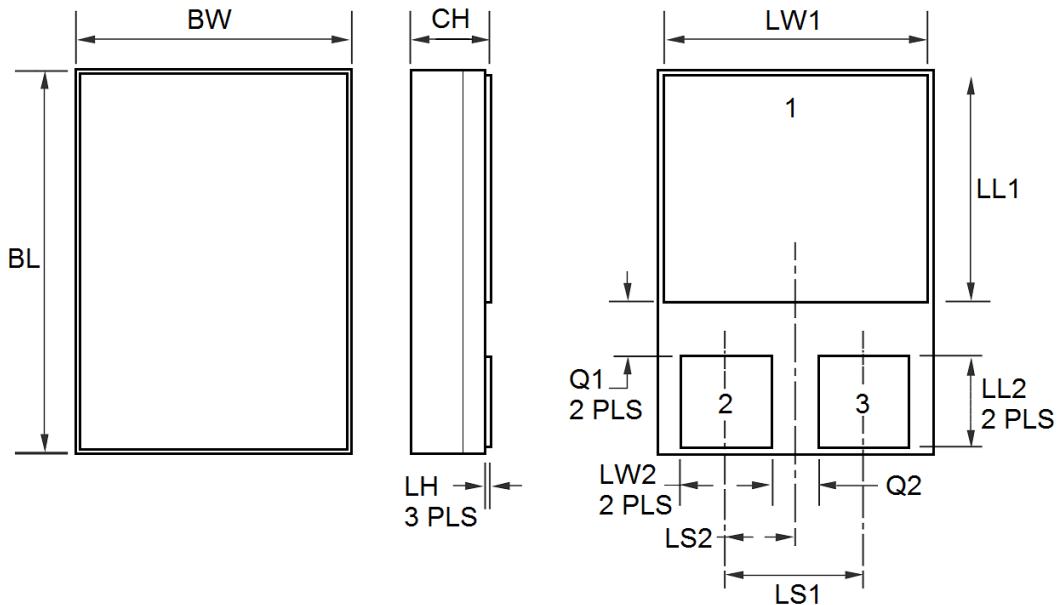
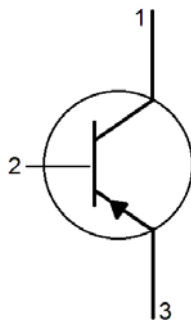


FIGURE 1
Thermal impedance graph ($R_{\Theta JA}$)

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 Φ x symbology.



| Ltr | Dimensions | | | |
|-----------------|------------|-------|-------------|------|
| | Inch | | Millimeters | |
| | Min | Max | Min | Max |
| BL | 0.215 | 0.225 | 5.46 | 5.72 |
| BW | 0.145 | 0.155 | 3.68 | 3.94 |
| CH | 0.049 | 0.075 | 1.24 | 1.91 |
| LH | - | 0.02 | - | 0.51 |
| LW1 | 0.135 | 0.145 | 3.43 | 3.68 |
| LW2 | 0.047 | 0.057 | 1.19 | 1.45 |
| LL1 | 0.085 | 0.125 | 2.16 | 3.18 |
| LL2 | 0.045 | 0.075 | 1.14 | 1.91 |
| LS1 | 0.070 | 0.095 | 1.78 | 2.41 |
| LS2 | 0.035 | 0.048 | 0.89 | 1.22 |
| Q1 | 0.030 | 0.070 | 0.76 | 1.78 |
| Q2 | 0.020 | 0.035 | 0.51 | 0.89 |
| TERMINAL | | | | |
| 1 | COLLECTOR | | | |
| 2 | BASE | | | |
| 3 | EMITTER | | | |

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