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## NPN LOW POWER SILICON TRANSISTOR

**Qualified per MIL-PRF-19500/368**

*Qualified Levels:  
JAN, JANTX,  
JANTXV and JANS*

### DESCRIPTION

This family of high-frequency, epitaxial planar transistors feature low saturation voltage. These devices are also available in TO-39 and low profile U4 and UA packaging. 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 2N3439L through 2N3440L series.
- JAN, JANTX, JANTXV, and JANS qualifications are available per MIL-PRF-19500/368.
- RoHS compliant versions available (commercial grade only).
- $V_{CE(sat)} = 0.5 \text{ V @ } I_C = 50 \text{ mA}$ .
- Turn-On time  $t_{on} = 1.0 \mu\text{s max @ } I_C = 20 \text{ mA, } I_{B1} = 2.0 \text{ mA}$ .
- Turn-Off time  $t_{off} = 10 \mu\text{s max @ } I_C = 20 \text{ mA, } I_{B1} = -I_{B2} = 2.0 \text{ mA}$ .

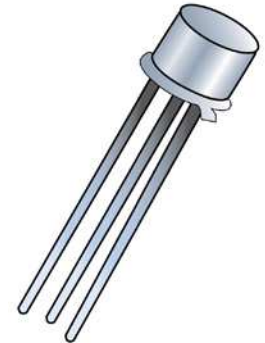
### APPLICATIONS / BENEFITS

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

### MAXIMUM RATINGS ( $T_C = +25^\circ\text{C}$ unless otherwise noted)


| Parameters / Test Conditions                   | Symbol                                     | 2N3439L     | 2N3440L | Unit             |
|--|--|-------------|---------|------------------|
| Collector-Emitter Voltage                      | $V_{CEO}$                                  | 350         | 250     | V                |
| Collector-Base Voltage                         | $V_{CBO}$                                  | 450         | 300     | V                |
| Emitter-Base Voltage                           | $V_{EBO}$                                  | 7.0         |         | V                |
| Collector Current                              | $I_C$                                      | 1.0         |         | A                |
| Total Power Dissipation                        | @ $T_A = +25^\circ\text{C}$ <sup>(1)</sup> | 0.8         |         | W                |
|  | @ $T_C = +25^\circ\text{C}$ <sup>(2)</sup> | 5.0         |         |                  |
| Operating & Storage Junction Temperature Range | $T_J, T_{stg}$                             | -65 to +200 |         | $^\circ\text{C}$ |


- Notes:**
1. Derate linearly @ 4.57 mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$ .
  2. Derate linearly @ 28.5 mW/ $^\circ\text{C}$  for  $T_C > +25^\circ\text{C}$




**TO-5 Package**

Also available in:

**TO-39 (TO-205AD)  
package  
(lead)**  
 [2N3439 - 2N3440](#)

**U4 package  
(surface mount)**  
 [2N3439U4 - 2N3440U4](#)

**UA package  
(surface mount)**  
 [2N3439UA - 2N3440UA](#)

**MSC – Lawrence**

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

**MSC – Ireland**

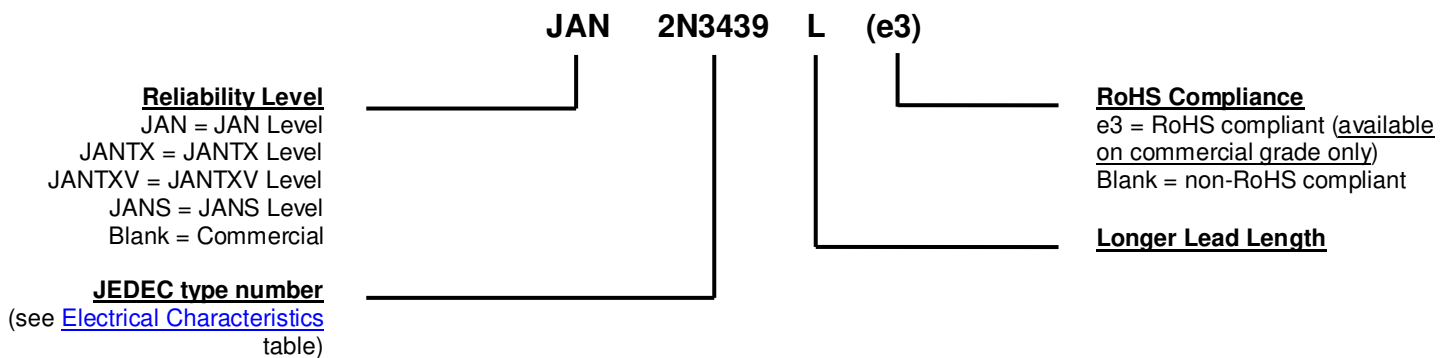
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Ennis, Co. Clare, Ireland  
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Fax: +353 (0) 65 6822298

**Website:**

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

**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed, kovar base, nickel cap.
- TERMINALS: Tin/lead plate or RoHS compliant matte/tin (commercial grade only) over nickel.
- MARKING: Part number, date code, manufacturer's ID.
- POLARITY: NPN (see package outline).
- WEIGHT: Approximately 1.14 grams.
- 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** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

**OFF CHARACTERISTICS**

| Parameters / Test Conditions  | Symbol  | Min.       | Max.                     | Unit          |
|---|---|------------|--------------------------|---------------|
| Collector-Emitter Breakdown Voltage<br>$I_C = 10\text{ mA}$<br>$R_{BB1} = 470\ \Omega$ ; $V_{BB1} = 6\text{ V}$<br>$L = 25\text{ mH (min)}$ ; $f = 30 - 60\text{ Hz}$ | 2N3439L<br>2N3440L<br>$V_{(BR)CEO}$                   | 350<br>250 |                          | V             |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 300\text{ V}$<br>$V_{CE} = 200\text{ V}$  | 2N3439L<br>2N3440L<br>$I_{CEO}$                       |            | 2.0<br>2.0               | $\mu\text{A}$ |
| Emitter-Base Cutoff Current<br>$V_{EB} = 7.0\text{ V}$  | $I_{EBO}$   |            | 10                       | $\mu\text{A}$ |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 450\text{ V}$ , $V_{BE} = -1.5\text{ V}$<br>$V_{CE} = 300\text{ V}$ , $V_{BE} = -1.5\text{ V}$                          | 2N3439L<br>2N3440L<br>$I_{CEX}$                       |            | 5.0<br>5.0               | $\mu\text{A}$ |
| Collector-Base Cutoff Current<br>$V_{CB} = 360\text{ V}$<br>$V_{CB} = 250\text{ V}$<br>$V_{CB} = 450\text{ V}$<br>$V_{CB} = 300\text{ V}$                             | 2N3439L<br>2N3440L<br>2N3439L<br>2N3440L<br>$I_{CBO}$ |            | 2.0<br>2.0<br>5.0<br>5.0 | $\mu\text{A}$ |

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

| Parameters / Test Conditions  | Symbol        | Min.           | Max. | Unit |
|---|---------------|----------------|------|------|
| Forward-Current Transfer Ratio<br>$I_C = 20\text{ mA}$ , $V_{CE} = 10\text{ V}$<br>$I_C = 2.0\text{ mA}$ , $V_{CE} = 10\text{ V}$<br>$I_C = 0.2\text{ mA}$ , $V_{CE} = 10\text{ V}$ | $h_{FE}$      | 40<br>30<br>10 | 160  |      |
| Collector-Emitter Saturation Voltage<br>$I_C = 50\text{ mA}$ , $I_B = 4.0\text{ mA}$  | $V_{CE(sat)}$ |                | 0.5  | V    |
| Base-Emitter Saturation Voltage<br>$I_C = 50\text{ mA}$ , $I_B = 4.0\text{ mA}$   | $V_{BE(sat)}$ |                | 1.3  | V    |

**DYNAMIC CHARACTERISTICS**

| Parameters / Test Conditions  | Symbol     | Min. | Max. | Unit |
|---|------------|------|------|------|
| Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 10\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $f = 5.0\text{ MHz}$ | $ h_{fe} $ | 3.0  | 15   |      |
| Forward Current Transfer Ratio<br>$I_C = 5.0\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ kHz}$   | $h_{fe}$   | 25   |      |      |
| Output Capacitance<br>$V_{CB} = 10\text{ V}$ , $I_E = 0$ , $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$  | $C_{obo}$  |      | 10   | pF   |
| Input Capacitance<br>$V_{CB} = 5.0\text{ V}$ , $I_E = 0$ , $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$  | $C_{ibo}$  |      | 75   | pF   |

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

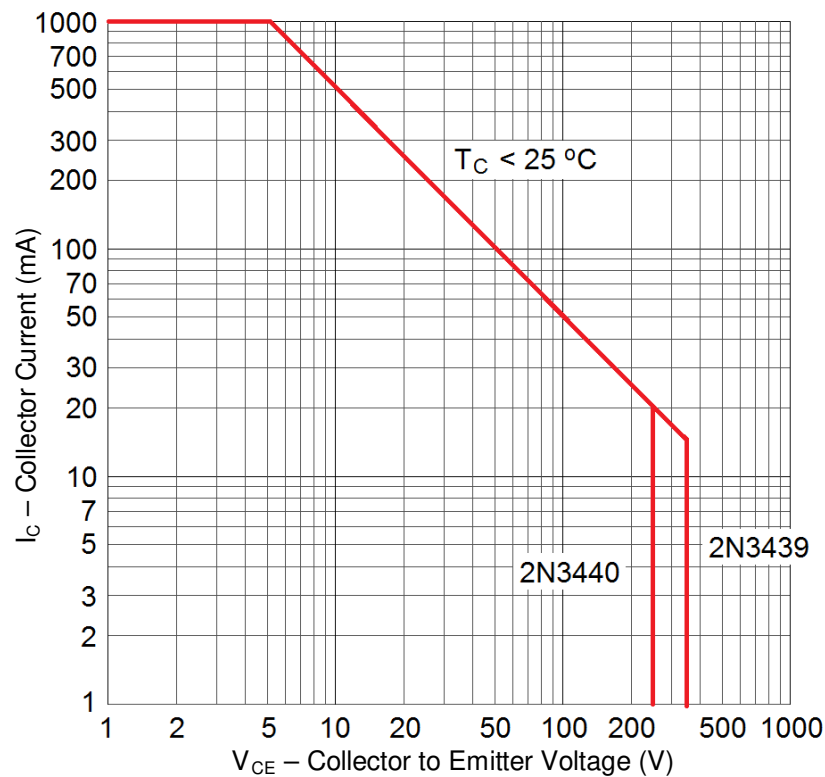
**ELECTRICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted) continued

**SWITCHING CHARACTERISTICS**

| Parameters / Test Conditions   | Symbol    | Min. | Max. | Unit          |
|--|-----------|------|------|---------------|
| Turn-On Time<br>$V_{CC} = 200\text{ V}; I_C = 20\text{ mA}, I_{B1} = 2.0\text{ mA}$            | $t_{on}$  |      | 1.0  | $\mu\text{s}$ |
| Turn-Off Time<br>$V_{CC} = 200\text{ V}; I_C = 20\text{ mA}, I_{B1} = -I_{B2} = 2.0\text{ mA}$ | $t_{off}$ |      | 10   | $\mu\text{s}$ |

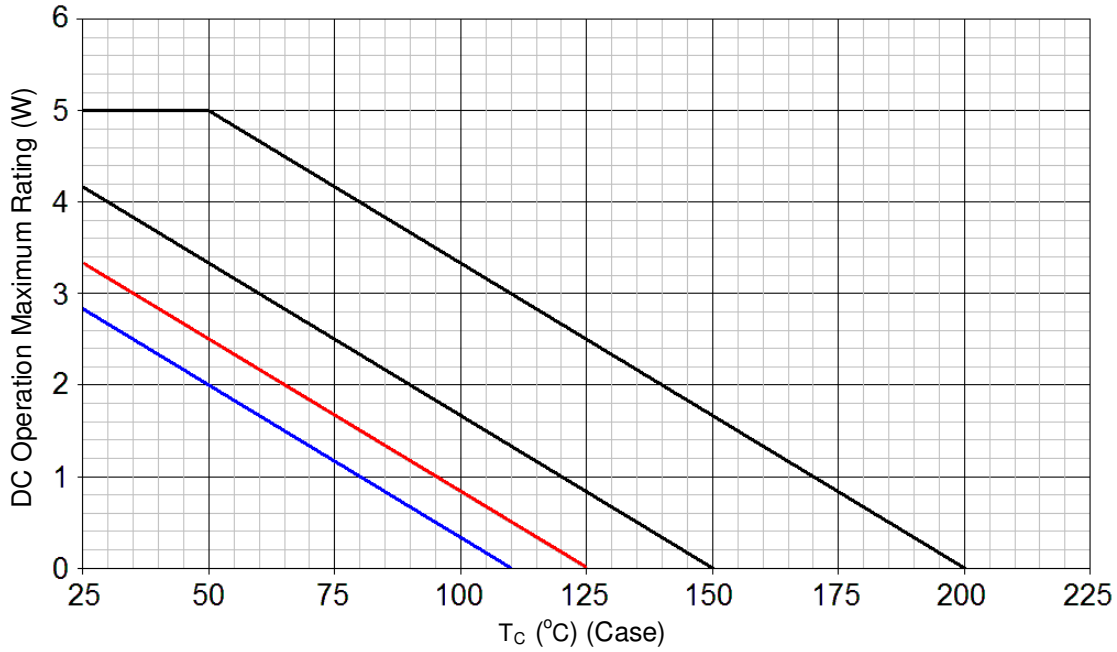
**SAFE OPERATING AREA** (See graph below and also reference test method 3053 of [MIL-STD-750](#).)

| DC Tests   |            |
|--|------------|
| $T_C = +25^\circ\text{C}$ , 1 Cycle, $t = 1.0\text{ s}$      |            |
| <b>Test 1</b><br>$V_{CE} = 5.0\text{ V}, I_C = 1.0\text{ A}$ | Both Types |
| <b>Test 2</b><br>$V_{CE} = 350\text{ V}, I_C = 14\text{ mA}$ | 2N3439L    |
| <b>Test 3</b><br>$V_{CE} = 250\text{ V}, I_C = 20\text{ mA}$ | 2N3440L    |



Maximum Safe Operating graph (continuous dc)

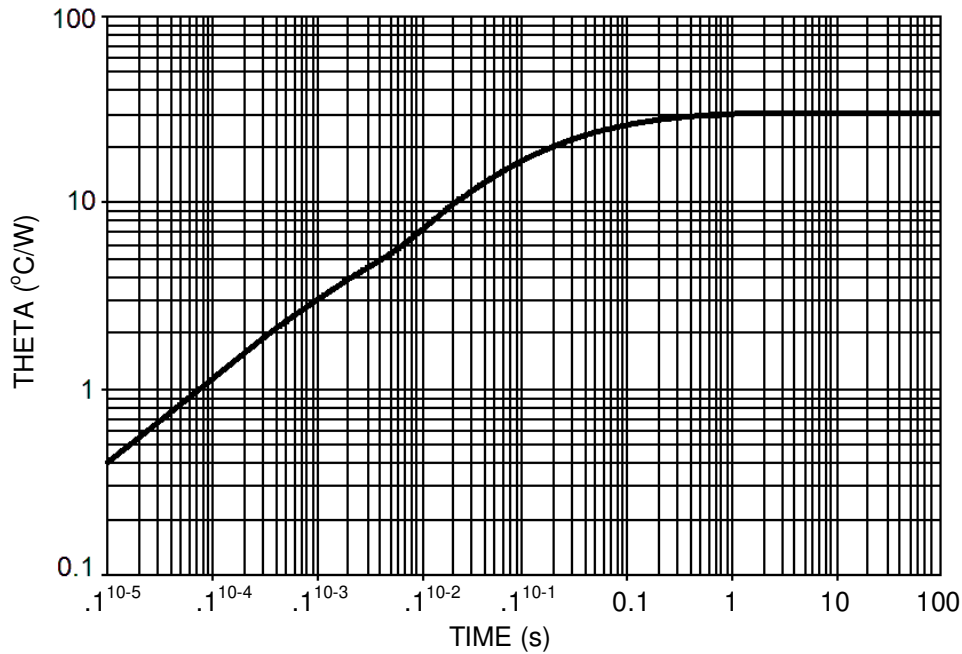
GRAPHS



**FIGURE 1**

Temperature-Power Derating Curve

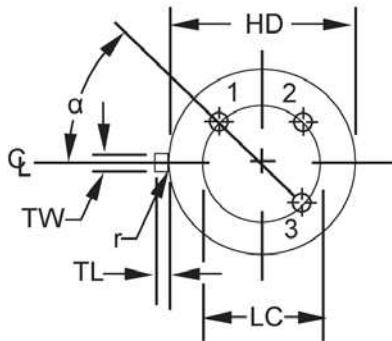
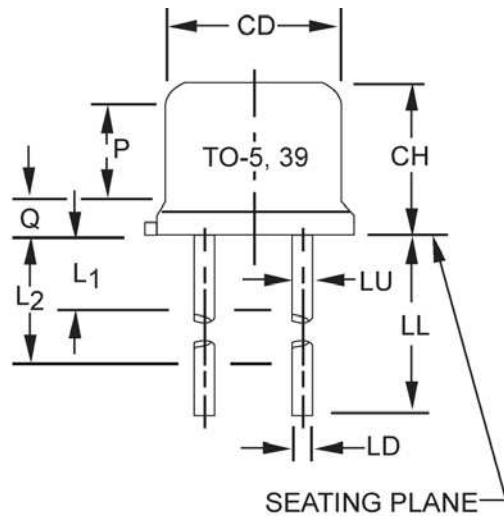
**NOTES:** Thermal Resistance Junction to Case = 30.0 °C/W  
Max Finish-Alloy Temp = 175.0 °C



**FIGURE 2**

Maximum Thermal Impedance

**NOTE:**  $T_c = +25$  °C,  $P_T = 5.0$  W, thermal resistance  $R_{\theta JC} = 30$  °C/W, steel.

**PACKAGE DIMENSIONS**


| Symbol   | Dimensions  |      |             |      | Note |
|----------|-------------|------|-------------|------|------|
|          | Inches      |      | Millimeters |      |      |
|          | Min         | Max  | Min         | Max  |      |
| CD       | .305        | .335 | 7.75        | 8.51 | 6    |
| CH       | .240        | .260 | 6.10        | 6.60 |      |
| HD       | .335        | .370 | 8.51        | 9.40 |      |
| LC       | .200 TP     |      | 5.08 TP     |      | 7    |
| LD       | .016        | .019 | 0.41        | 0.48 | 8,9  |
| LL       | See note 14 |      |             |      |      |
| LU       | .016        | .019 | 0.41        | 0.48 | 8,9  |
| L1       |             | .050 |             | 1.27 | 8,9  |
| L2       | .250        |      | 6.35        |      | 8,9  |
| P        | .100        |      | 2.54        |      | 7    |
| Q        |             | .030 |             | 0.76 | 5    |
| TL       | .029        | .045 | 0.74        | 1.14 | 3,4  |
| TW       | .028        | .034 | 0.71        | 0.86 | 3    |
| r        |             | .010 |             | 0.25 | 10   |
| $\alpha$ | 45° TP      |      | 45° TP      |      | 7    |

**NOTES:**

- Dimensions are in inches.
- Millimeters are given for general information only.
- Beyond  $r$  (radius) maximum, TW shall be held for a minimum length of .011 (0.28 mm).
- Dimension TL measured from maximum HD.
- Body contour optional within zone defined by HD, CD, and Q.
- 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 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods or by gauging procedure.
- Dimension LU applies between L1 and L2. Dimension LD applies between L2 and LL minimum. Diameter is uncontrolled in and beyond LL minimum.
- All three leads.
- The collector shall be internally connected to the case.
- Dimension  $r$  (radius) applies to both inside corners of tab.
- In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi x$  symbology.
- Lead 1 = emitter, lead 2 = base, lead 3 = collector.
- For transistor types 2N3439L and 2N3440L (TO-5), dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max.