



## NPN MEDIUM POWER SILICON TRANSISTOR

**Qualified per MIL-PRF-19500/349**

Qualified Levels:  
JAN, JANTX and JANTXV

### DESCRIPTION

This family of 2N3506L through 2N3507AL high-frequency, epitaxial planar transistors feature low saturation voltage. These devices are also available in TO-5 and low profile U4 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 2N3506 through 2N3507 series.
- RoHS compliant versions available (commercial grade only).
- $V_{CE(sat)} = 0.5\text{ V @ } I_C = 500\text{ mA}$ .
- Rise time  $t_r = 30\text{ ns max @ } I_C = 1.5\text{ A, } I_{B1} = 150\text{ mA}$ .
- Fall time  $t_f = 35\text{ ns max @ } I_C = 1.5\text{ A, } I_{B1} = I_{B2} = 150\text{ mA}$ .

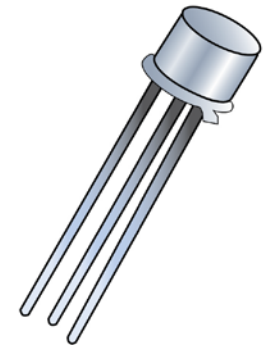
### APPLICATIONS / BENEFITS

- 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          | 2N3506L   | 2N3507L | Unit                 |
|--|-----------------|---|---------|----------------------|
| Collector-Emitter Voltage                      | $V_{CEO}$       | 40  | 50      | V                    |
| Collector-Base Voltage                         | $V_{CBO}$       | 60  | 80      | V                    |
| Emitter-Base Voltage                           | $V_{EBO}$       | 5.0   |         | V                    |
| Thermal Resistance Junction-to-Ambient         | $R_{\theta JA}$ | 175   |         | $^{\circ}\text{C/W}$ |
| Thermal Resistance Junction-to-Case            | $R_{\theta JC}$ | 18  |         | $^{\circ}\text{C/W}$ |
| Collector Current                              | $I_C$           | 3.0   |         | A                    |
| Total Power Dissipation                        | $P_D$           | @ $T_A = +25\text{ }^{\circ}\text{C}$ <sup>(1)</sup>  |         | W                    |
|  |                 | @ $T_C = +110\text{ }^{\circ}\text{C}$ <sup>(2)</sup> |         |                      |
| Operating & Storage Junction Temperature Range | $T_J, T_{stg}$  | -65 to +200   |         | $^{\circ}\text{C}$   |

- Notes:**
1. Derate linearly 5.71 mW/ $^{\circ}\text{C}$  for  $T_A > +25\text{ }^{\circ}\text{C}$ .
  2. Derate linearly 55.5 mW/ $^{\circ}\text{C}$  for  $T_C > +110\text{ }^{\circ}\text{C}$ .




**TO-5 Package**

Also available in:

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

 [2N3506 – 2N3507A](#)

**U4 package**  
(surface mount)

 [2N3506U4 – 2N3507AU4](#)

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**MSC – Ireland**

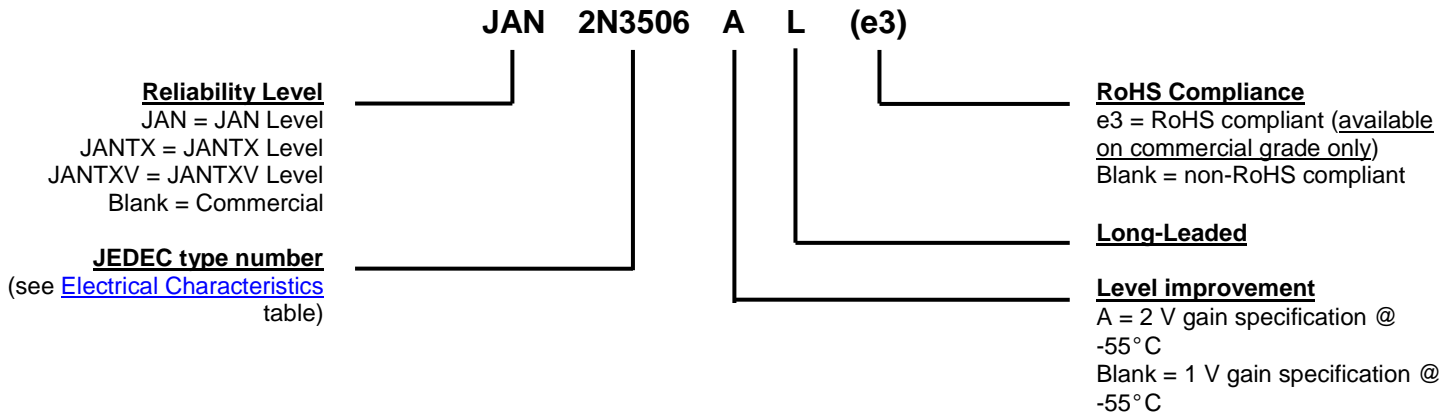
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**Website:**

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

**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed, kovar base, nickel cap.
- TERMINALS: Leads are kovar, nickel plated, and finish is solder dip (Sn63/Pb37). Can be RoHS compliant (commercial grade only) with pure matte tin (commercial grade only).
- 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>$I_C = 10\text{ mA}$  | $V_{(BR)CEO}$ | 40<br>50 |            | V             |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 40\text{ V}; V_{EB} = 4\text{ V}$<br>$V_{CE} = 60\text{ V}; V_{EB} = 4\text{ V}$ | $I_{CEX}$     |          | 1.0<br>1.0 | $\mu\text{A}$ |
| Collector-Base Breakdown Voltage<br>$I_C = 100\text{ }\mu\text{A}$   | $V_{(BR)CBO}$ | 60<br>80 |            | V             |
| Emitter-Base Breakdown Voltage<br>$I_E = 10\text{ }\mu\text{A}$  | $V_{(BR)EBO}$ | 5        |            | V             |

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

| Parameters / Test Conditions  | Symbol        | Min.     | Max.       | Unit |
|---|---------------|----------|------------|------|
| Forward-Current Transfer Ratio<br>$I_C = 500\text{ mA}, V_{CE} = 1\text{ V}$                        | $h_{FE}$      | 50<br>35 | 250<br>175 |      |
| Forward-Current Transfer Ratio<br>$I_C = 1.5\text{ A}, V_{CE} = 2\text{ V}$                         | $h_{FE}$      | 40<br>30 | 200<br>150 |      |
| Forward-Current Transfer Ratio<br>$I_C = 2.5\text{ A}, V_{CE} = 3\text{ V}$                         | $h_{FE}$      | 30<br>25 |            |      |
| Forward-Current Transfer Ratio<br>$I_C = 3.0\text{ A}, V_{CE} = 5\text{ V}$                         | $h_{FE}$      | 25<br>20 |            |      |
| Forward-Current Transfer Ratio<br>$I_C = 500\text{ mA}, V_{CE} = 1.0\text{ V @ } -55^\circ\text{C}$ | $h_{FE}$      | 25<br>17 |            |      |
| Forward-Current Transfer Ratio<br>$I_C = 500\text{ mA}, V_{CE} = 2.0\text{ V @ } -55^\circ\text{C}$ | $h_{FE}$      | 25<br>17 |            |      |
| Collector-Emitter Saturation Voltage<br>$I_C = 500\text{ mA}, I_B = 50\text{ mA}$                   | $V_{CE(sat)}$ |          | 0.5        | V    |
| Collector-Emitter Saturation Voltage<br>$I_C = 1.5\text{ A}, I_B = 150\text{ mA}$                   | $V_{CE(sat)}$ |          | 1.0        | V    |
| Collector-Emitter Saturation Voltage<br>$I_C = 2.5\text{ A}, I_B = 250\text{ mA}$                   | $V_{CE(sat)}$ |          | 1.5        | V    |
| Base-Emitter Saturation Voltage<br>$I_C = 500\text{ mA}, I_B = 50\text{ mA}$                        | $V_{BE(sat)}$ |          | 1.0        | V    |
| Base-Emitter Saturation Voltage<br>$I_C = 1.5\text{ A}, I_B = 150\text{ mA}$                        | $V_{BE(sat)}$ | 0.8      | 1.3        | V    |
| Base-Emitter Saturation Voltage<br>$I_C = 2.5\text{ A}, I_B = 250\text{ mA}$                        | $V_{BE(sat)}$ |          | 2.0        | V    |

(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)**
**DYNAMIC CHARACTERISTICS**

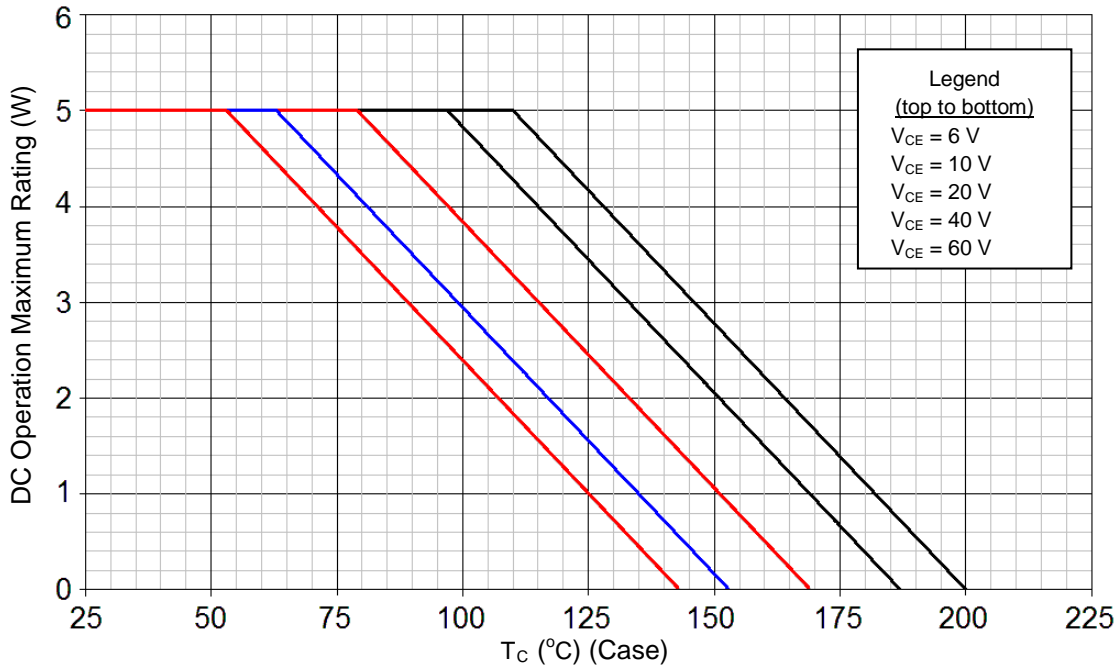
| Parameters / Test Conditions  | Symbol     | Min. | Max. | Unit |
|---|------------|------|------|------|
| Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 100 \text{ mA}$ , $V_{CE} = 5\text{Vdc}$ , $f = 20 \text{ MHz}$ | $ h_{fe} $ | 3.0  | 15   |      |
| Output Capacitance<br>$V_{CB} = 10 \text{ V}$ , $I_E = 0$ , $100 \text{ kHz} \leq f \leq 1.0 \text{ MHz}$   | $C_{obo}$  |      | 40   | pF   |
| Input Capacitance<br>$V_{EB} = 3.0 \text{ V}$ , $I_C = 0$ , $100 \text{ kHz} \leq f \leq 1.0 \text{ MHz}$   | $C_{ibo}$  |      | 300  | pF   |

**SWITCHING CHARACTERISTICS <sup>(2)</sup>**

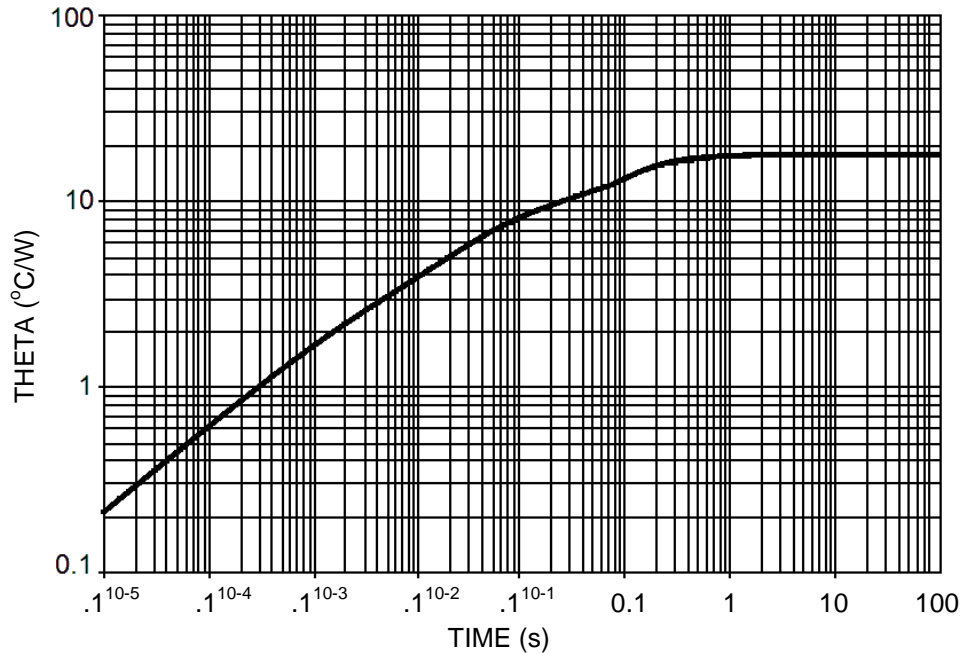
| Parameters / Test Conditions   | Symbol | Min. | Max. | Unit |
|--|--------|------|------|------|
| Delay Time<br>$I_C = 1.5 \text{ A}$ , $I_{B1} = 150 \text{ mA}$            | $t_d$  |      | 15   | ns   |
| Rinse Time<br>$I_C = 1.5 \text{ A}$ , $I_{B1} = 150 \text{ mA}$            | $t_r$  |      | 30   | ns   |
| Storage Time<br>$I_C = 1.5 \text{ A}$ , $I_{B1} = I_{B2} = 150 \text{ mA}$ | $t_s$  |      | 55   | ns   |
| Fall Time<br>$I_C = 1.5 \text{ A}$ , $I_{B1} = I_{B2} = 150 \text{ mA}$    | $t_f$  |      | 35   | ns   |

(2) Consult MIL-PRF-19500/349 for additional information.

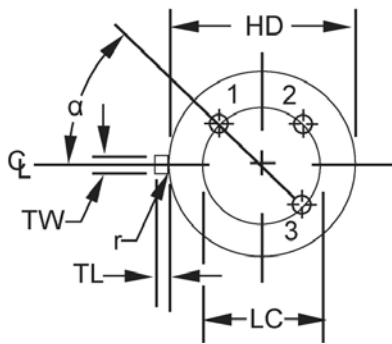
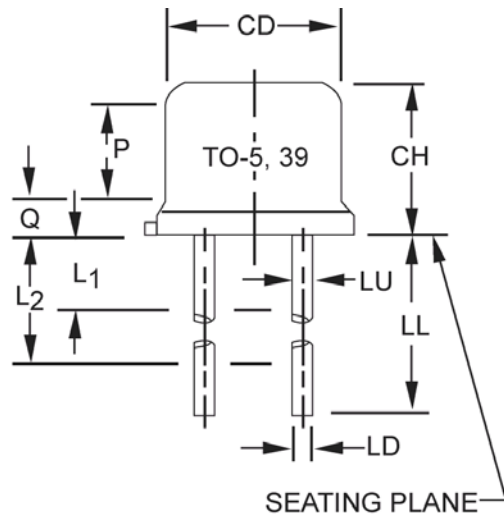
GRAPHS



**FIGURE 1**  
Temperature-Power Derating Curve  
**NOTE:** Thermal Resistance Junction to Case = 18.0 °C/W



**FIGURE 2**  
Maximum Thermal Impedance ( $R_{\theta JC}$ )

**PACKAGE DIMENSIONS**


| Symbol    | Dimensions         |       |             |      | Note |
|-----------|--------------------|-------|-------------|------|------|
|           | Inches             |       | Millimeters |      |      |
|           | Min                | Max   | Min         | Max  |      |
| <b>CD</b> | 0.305              | 0.335 | 7.75        | 8.51 |      |
| <b>CH</b> | 0.240              | 0.260 | 6.10        | 6.60 |      |
| <b>HD</b> | 0.335              | 0.370 | 8.51        | 9.40 |      |
| <b>LC</b> | 0.200 TP           |       | 5.08 TP     |      | 6    |
| <b>LD</b> | 0.016              | 0.021 | 0.41        | 0.53 | 7, 8 |
| <b>LL</b> | See notes 7, 8, 11 |       |             |      |      |
| <b>LU</b> | 0.016              | 0.019 | 0.41        | 0.48 | 7, 8 |
| <b>L1</b> |                    | 0.050 |             | 1.27 | 7, 8 |
| <b>L2</b> | 0.250              |       | 6.35        |      | 7, 8 |
| <b>P</b>  | 0.100              |       | 2.54        |      | 5    |
| <b>Q</b>  |                    | 0.050 |             | 1.27 | 4    |
| <b>TL</b> | 0.029              | 0.045 | 0.74        | 1.14 | 3    |
| <b>TW</b> | 0.028              | 0.034 | 0.71        | 0.86 | 2    |
| <b>r</b>  |                    | 0.010 |             | 0.25 | 10   |
| <b>α</b>  | 45° TP             |       | 45° TP      |      | 6    |

**NOTES:**

1. Dimension are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TH shall be held for a minimum length of .011 (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. 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.
7. Dimension LU applies between L1 and L2. Dimension LD applies between L2 and LL minimum. Diameter is uncontrolled in L1 and beyond LL minimum.
8. All three leads.
9. The collector shall be internally connected to the case.
10. Dimension r (radius) applies to both inside corners of tab.
11. Dimension LL shall be 1.5 inches (38.1mm) minimum and 1.75 inches (44.4 mm) maximum.
12. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.



**Стандарт  
Электрон  
Связь**

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