



## NPN Darlington Power Silicon Transistor

Qualified per MIL-PRF-19500/472

Qualified Levels:  
JAN, JANTX, and  
JANTXV

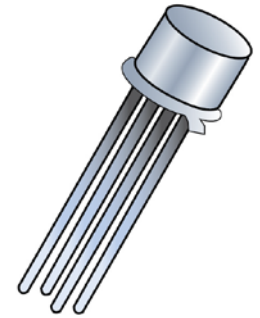
### DESCRIPTION

This high speed NPN transistor is military qualified up to the JANTXV level. This TO-33 leaded top-hat has three isolated terminals with terminal four, the collector terminal, tied to the case.

**Important:** For the latest information, visit our website <http://www.microsemi.com>.

### FEATURES

- JEDEC registered 2N6350 and 2N6351
- JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/472 (See [part nomenclature](#) for all available options)
- RoHS compliant versions available (commercial grade only)



**TO-33 Package**

### APPLICATIONS / BENEFITS

- Military and other high reliability applications
- High frequency response
- TO-33 leaded top-hat

### MAXIMUM RATINGS @ T<sub>C</sub> = +25 °C unless otherwise noted

| Parameters/Test Conditions          | Symbol                              | Value       | Unit |
|-------------------------------------|-------------------------------------|-------------|------|
| Junction and Storage Temperature    | T <sub>J</sub> and T <sub>STG</sub> | -65 to +200 | °C   |
| Thermal Resistance Junction-to-Case | R <sub>EJC</sub>                    | 20          | °C/W |
| Collector-Emitter Voltage           | V <sub>CEO</sub>                    | 80          | V    |
|                                     |                                     | 150         |      |
| Collector-Base Voltage              | V <sub>CBO</sub>                    | 80          | V    |
|                                     |                                     | 150         |      |
| Emitter-Base Voltage                | V <sub>EBO</sub>                    | 12          | V    |
|                                     |                                     | 6.0         |      |
| Total Power Dissipation             | P <sub>T</sub>                      | 1.0         | W    |
|                                     |                                     | 5.0         |      |
| Base Current                        | I <sub>B</sub>                      | 0.5         | A    |
| Collector Current                   | I <sub>C</sub>                      | 5           | A    |

- Notes:**
1. Derate linearly 5.72 mW/°C for T<sub>A</sub> > +25 °C
  2. Derate linearly 50 mW/°C for T<sub>C</sub> > +100 °C

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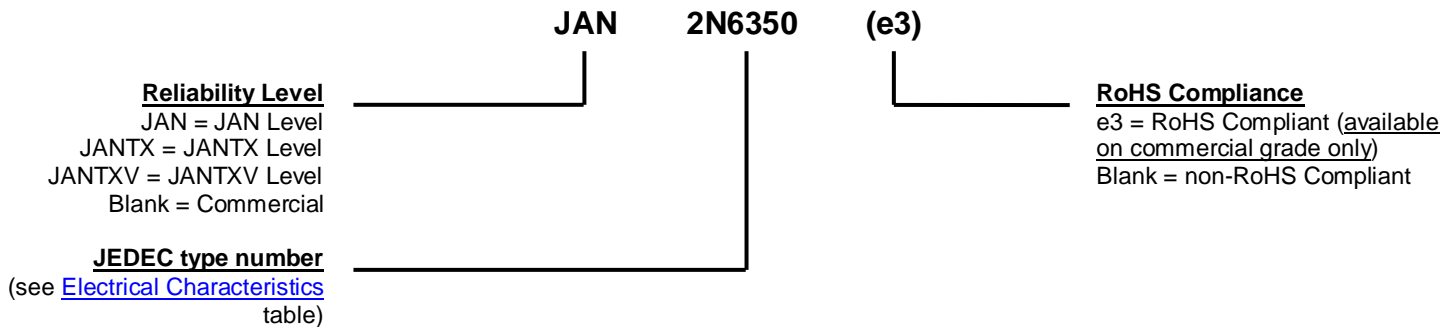
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**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed, kovar base, nickel cap.
- TERMINALS: Solder dip (Sn63/Pb37), RoHS compliant matte-tin plating available on commercial grade only.
- MARKING: Part number, date code, manufacturer's ID and serial number
- WEIGHT: Approximately 1.2 grams
- See [package dimensions](#) on last page.

**PART NOMENCLATURE**

**SYMBOLS & DEFINITIONS**

| Symbol    | Definition  |
|-----------|---|
| $I_B$     | Base current: The value of the dc current into the base terminal.   |
| $I_C$     | Collector current: The value of the dc current into the collector terminal.   |
| $I_E$     | Emitter current: The value of the dc current into the emitter terminal.   |
| $T_C$     | Case temperature: The temperature measured at a specified location on the case of a device.   |
| $V_{CB}$  | Collector-base voltage: The dc voltage between the collector and the base.  |
| $V_{CBO}$ | Collector-base voltage, base open: The voltage between the collector and base terminals when the emitter terminal is open-circuited.        |
| $V_{CC}$  | Collector-supply voltage: The supply voltage applied to a circuit connected to the collector.   |
| $V_{CEO}$ | Collector-emitter voltage, base open: The voltage between the collector and the emitter terminals when the base terminal is open-circuited. |
| $V_{CE}$  | Collector-emitter voltage: The dc voltage between the collector and the emitter.  |
| $V_{EB}$  | Emitter-base voltage: The dc voltage between the emitter and the base.  |
| $V_{EBO}$ | Emitter-base voltage, collector open: The voltage between the emitter and base terminals with the collector terminal open-circuited.        |

**ELECTRICAL CHARACTERISTICS @  $T_A = +25^\circ\text{C}$  unless otherwise noted**

| Characteristics | Symbol | Min. | Max. | Unit |
|-----------------|--------|------|------|------|
|-----------------|--------|------|------|------|

**OFF CHARACTERISTICS**

|   |                  |               |           |               |
|---|------------------|---------------|-----------|---------------|
| Collector-Emitter Breakdown Voltage<br>$I_C = 25\text{ mA}$ , $R_{B1E} = 2.2\text{ k}\Omega$ , $R_{B2E} = 100\ \Omega$  | 2N6350<br>2N6351 | $V_{(BR)CEO}$ | 80<br>150 | V             |
| Collector-Emitter Breakdown Voltage<br>$I_E = 12\text{ mA}$ , base 1 open<br>$I_E = 12\text{ mA}$ , base 2 open   |                  | $V_{(BR)EBO}$ | 6.0<br>12 | V             |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 80\text{ V}$ , $V_{EB1} = 2\text{ V}$ , $R_{B2E} = 100\ \Omega$<br>$V_{CE} = 150\text{ V}$ , $V_{EB1} = 2\text{ V}$ , $R_{B2E} = 100\ \Omega$ | 2N6350<br>2N6351 | $I_{CEX}$     | 1.0       | $\mu\text{A}$ |

**ON CHARACTERISTICS**

|   |                  |               |                |                  |
|---|------------------|---------------|----------------|------------------|
| Forward-Current Transfer Ratio<br>$I_C = 1.0\text{ A}$ , $V_{CE} = 5.0\text{ V}$ , $R_{B2E} = 1\text{ k}\Omega$   | 2N6350<br>2N6351 | hFE           | 2,000<br>1,000 |                  |
| $I_C = 5.0\text{ A}$ , $V_{CE} = 5.0\text{ V}$ , $R_{B2E} = 100\ \Omega$  | 2N6350<br>2N6351 |               | 2,000<br>1,000 | 10,000<br>10,000 |
| $I_C = 10.0\text{ A}$ , $V_{CE} = 5.0\text{ V}$ , $R_{B2E} = 100\ \Omega$   | 2N6350<br>2N6351 |               | 400<br>200     |                  |
| Collector-Emitter Saturation Voltage<br>$I_C = 5.0\text{ A}$ , $I_B = 5\text{ mA}$ , $R_{B2E} = 100\ \Omega$<br>$I_C = 5.0\text{ A}$ , $I_B = 10\text{ mA}$ , $R_{B2E} = 100\ \Omega$ |                  | $V_{CE(sat)}$ | 1.5<br>2.5     | V                |
| Base-Emitter Voltage Non-saturated<br>$V_{CE} = 5.0\text{ V}$ , $I_C = 5.0\text{ A}$ , $R_{B2E} = 100\ \Omega$  |                  | $V_{BE}$      | 2.5            | V                |

**DYNAMIC CHARACTERISTICS**

|  |            |   |     |    |
|--|------------|---|-----|----|
| Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 1.0\text{ A}$ , $V_{CE} = 10.0\text{ V}$ , $f = 10\text{ MHz}$ , $R_{B2E} = 100\ \Omega$ | $ h_{fe} $ | 5 | 25  |    |
| Output Capacitance<br>$V_{CB} = 10\text{ V}$ , $100\text{ kHz} \leq f \leq 1\text{ MHz}$ , base 2 open   | Cobo       |   | 120 | pF |

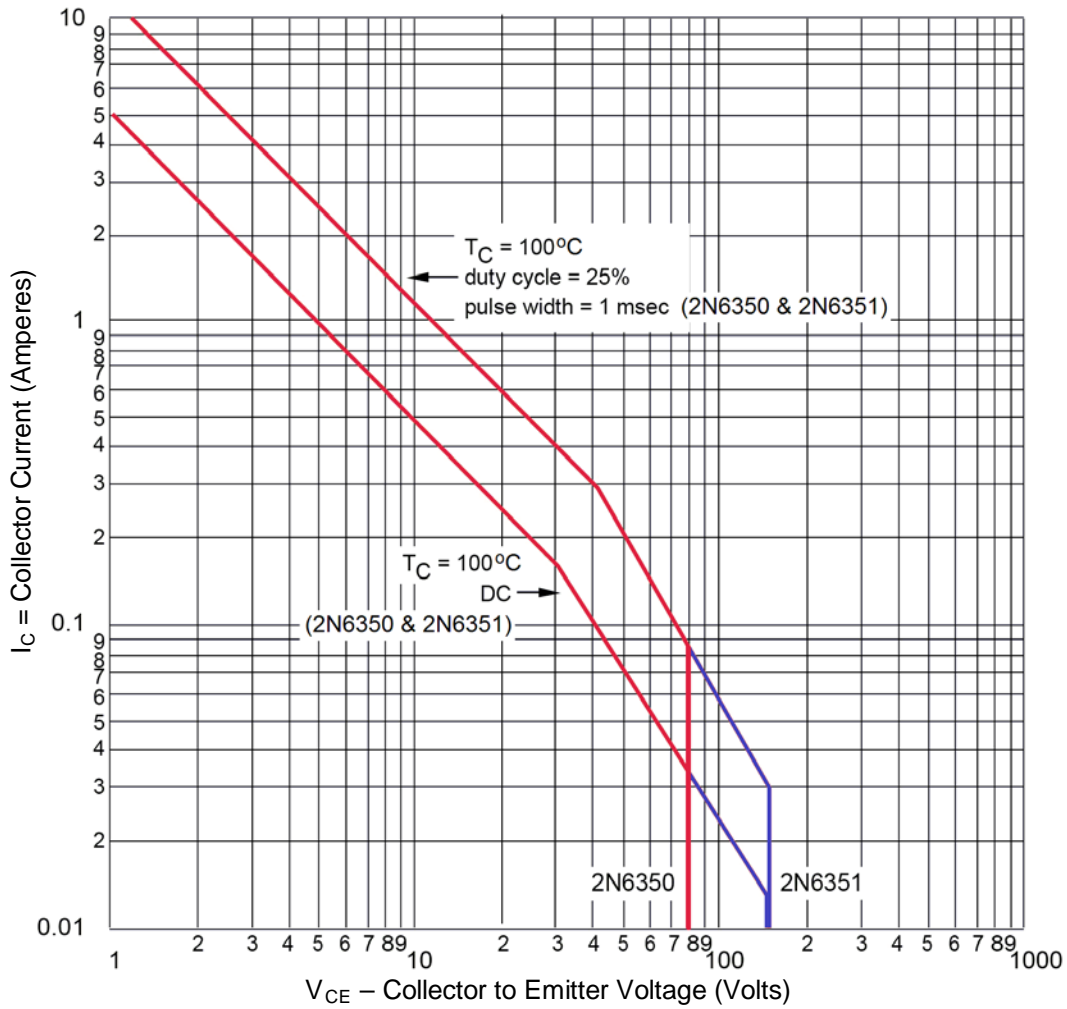
**ELECTRICAL CHARACTERISTICS @  $T_C = 25^\circ\text{C}$  unless otherwise noted. (continued)**
**SWITCHING CHARACTERISTICS**

|   |           |  |     |               |
|---|-----------|--|-----|---------------|
| Turn-On Time<br>$V_{CC} = 30\text{ V}, I_C = 5.0\text{ A}$  | $t_{on}$  |  | 0.5 | $\mu\text{s}$ |
| Turn-Off Time<br>$V_{CC} = 30\text{ V}, I_C = 5.0\text{ A}$ | $t_{off}$ |  | 1.2 | $\mu\text{s}$ |

**SAFE OPERATING AREA (See [Figures 1 and 2](#) and [MIL-STD-750, Test Method 3053](#))**
**DC Tests**
 $T_C = +100^\circ\text{C}, t \geq 1\text{ second}, 1\text{ Cycle}; t_r + t_f = 10\ \mu\text{s}, R_{B2E} = 100\ \Omega$ 
**Test 1**
 $V_{CE} = 1.5\text{ V}, I_C = 3.3\text{ A}$ 
**Test 2**
 $V_{CE} = 30\text{ V}, I_C = 167\text{ mA}$ 
**Test 3**
 $V_{CE} = 80\text{ V}, I_C = 35\text{ mA}$  (2N6350)

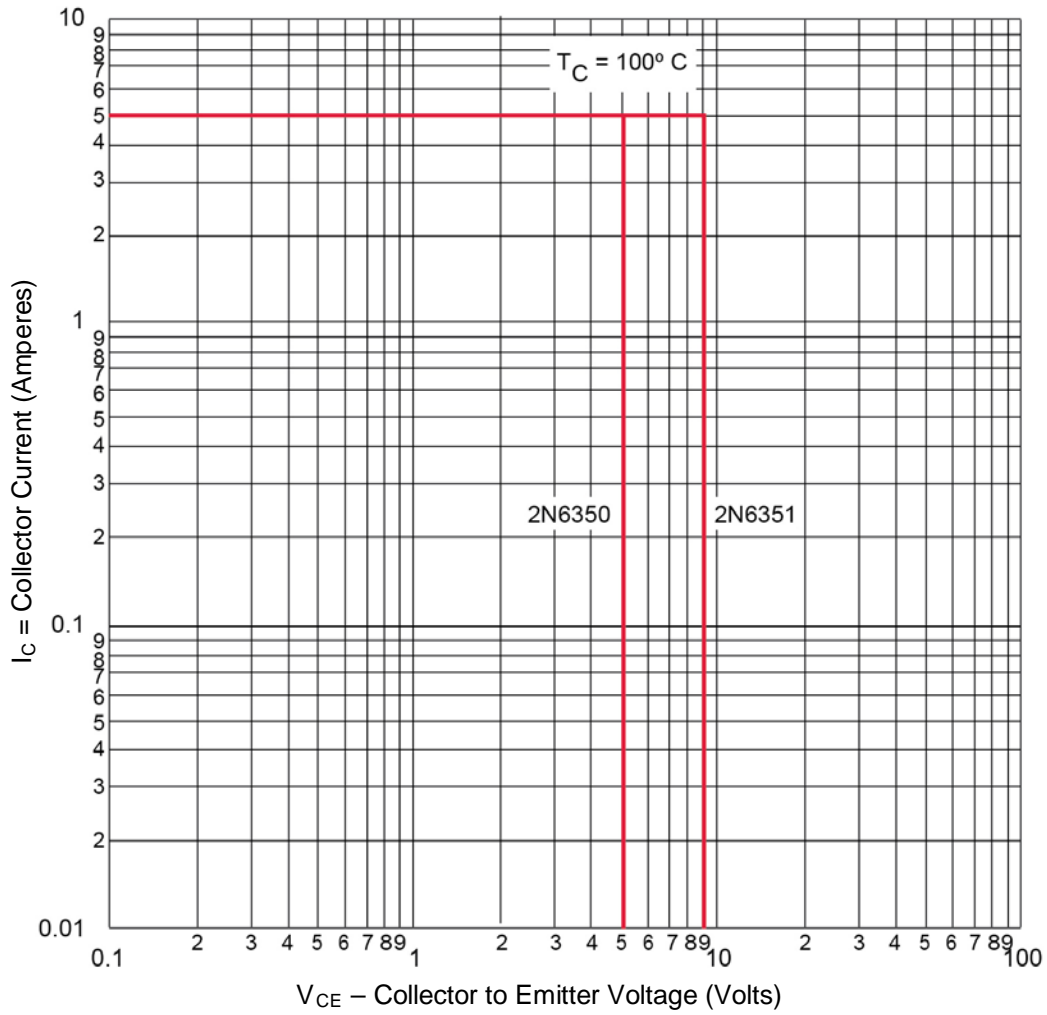
**Test 4**
 $V_{CE} = 150\text{ V}, I_C = 13\text{ mA}$  (2N6351)

**SAFE OPERATING AREA**

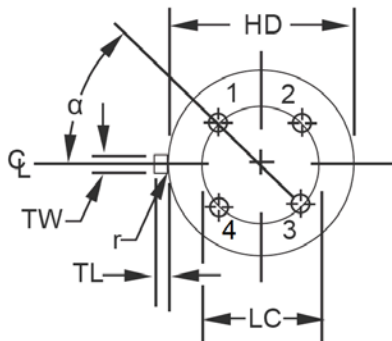
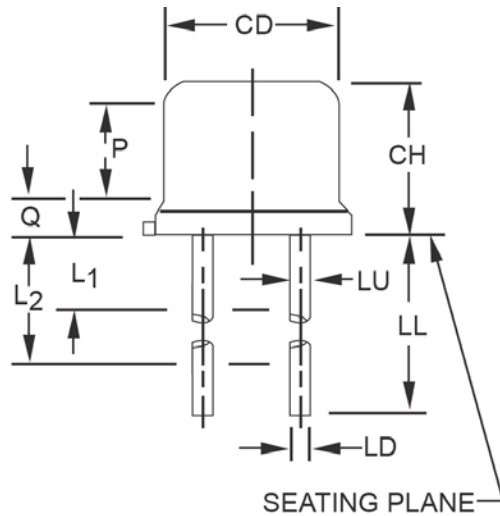


**FIGURE 1**  
Maximum Safe Operating Area

**SAFE OPERATING AREA (continued)**



**FIGURE 2**  
Safe Operating Area For Switching Between Saturation And Cutoff  
 (unclamped inductive load)

**PACKAGE DIMENSIONS**


| Symbol               | Dimensions |       |             |       | Notes |
|----------------------|------------|-------|-------------|-------|-------|
|                      | Inches     |       | Millimeters |       |       |
|                      | Min        | Max   | Min         | Max   |       |
| <b>CD</b>            | 0.305      | 0.335 | 7.75        | 8.51  | 3     |
| <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     |       | 4     |
| <b>LD</b>            | 0.016      | 0.021 | 0.41        | 0.53  | 5, 6  |
| <b>LL</b>            | 1.500      | 1.750 | 38.10       | 44.45 | 5, 6  |
| <b>LU</b>            | 0.016      | 0.019 | 0.41        | 0.48  | 5, 6  |
| <b>L<sub>1</sub></b> | -          | 0.050 | -           | 1.27  | 5, 6  |
| <b>L<sub>2</sub></b> | 0.250      | -     | 6.35        | -     | 5, 6  |
| <b>Q</b>             | -          | 0.050 | -           | 1.27  | 9     |
| <b>TL</b>            | 0.029      | 0.045 | 0.74        | 1.14  | 7     |
| <b>TW</b>            | 0.028      | 0.034 | 0.71        | 0.86  | 8     |
| <b>r</b>             | -          | 0.010 | -           | 0.25  | 10    |
| <b>α</b>             | 45° TP     |       | 45° TP      |       | 4     |
| <b>P</b>             | 0.100      | -     | 2.54        | -     | 3     |

**NOTES:**

- Dimensions are in inches. Millimeters are given for information only.
- Internal resistance (typically 750 ohms). This resistor is optional.
- Dimension CD shall not vary more than 0.010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
- Leads at gauge plane 0.054 +0.001 -0.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within 0.007 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.
- Dimension LU applies between dimension L1 and dimension L2. Dimension LD applies between L2 and LL minimum. Diameter is uncontrolled in dimension L1 and beyond dimension LL minimum.
- All terminals.
- Dimension TL measured from maximum HD.
- Beyond r (radius) maximum, dimension TW shall be held for a minimum length of 0.011 inch (0.28 mm).
- Outline in this zone is not controlled.
- The radius (dimension r) applies to both inside corners of the tab.
- Terminal designation is as follows: 1 – emitter, 2 – base (B2), 3 – base (B1), 4 – collector. The collector shall be connected to the case.
- In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.

See schematic on next page

**SCHEMATIC**

