



## NPN Darlington Power Silicon Transistor

### Qualified per MIL-PRF-19500/539

Qualified Levels:  
JAN, JANTX, and  
JANTXV

#### DESCRIPTION

This high speed NPN transistor is rated at 8 amps and is military qualified up to a JANTXV level. This TO-213AA isolated package features a 180 degree lead orientation.



**TO-213AA (TO-66)  
Package**

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

#### FEATURES

- JEDEC registered 2N6300 and 2N6301
- Hermetically sealed
- JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/539
- RoHS compliant versions available (commercial grade only)

#### APPLICATIONS / BENEFITS

- Convenient package
- Mechanically rugged
- Military, space and other high reliability applications

#### MAXIMUM RATINGS @ $T_C = 25^\circ\text{C}$ unless otherwise stated

| Parameters/Test Conditions             | Symbol              | Value                             | Unit             |
|----------------------------------------|---------------------|-----------------------------------|------------------|
| Junction and Storage Temperature       | $T_J$ and $T_{STG}$ | -55 to +200                       | $^\circ\text{C}$ |
| Thermal Resistance Junction-to-Case    | $R_{\theta JC}$     | 2.66                              | $^\circ\text{C}$ |
| Collector-Base Voltage                 | $V_{CBO}$           | 2N6300<br>60                      | V                |
|                                        |                     | 2N6301<br>80                      |                  |
| Collector-Emitter Voltage              | $V_{CEO}$           | 2N6300<br>60                      | V                |
|                                        |                     | 2N6301<br>80                      |                  |
| Emitter-Base Voltage                   | $V_{EBO}$           | 5                                 | V                |
| Continuous Operating Collector Current | $I_C$               | 8                                 | A                |
| Base Current                           | $I_B$               | 120                               | mA               |
| Total Power Dissipation <sup>(1)</sup> | $P_T$               | @ $T_C = 0^\circ\text{C}$<br>75   | W                |
|                                        |                     | @ $T_C = 100^\circ\text{C}$<br>37 |                  |

**NOTES:** 1. Derate linearly at 0.428 W/ $^\circ\text{C}$  above  $T_C > 0^\circ\text{C}$ .

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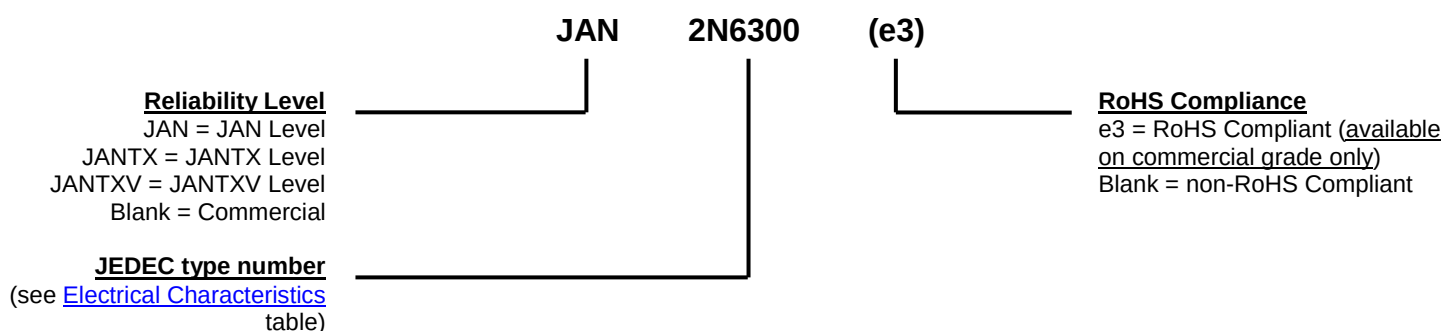
#### Website:

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

### MECHANICAL and PACKAGING

- CASE: Hermetic, TO-213AA package. Nickel plate with nickel cap.
- TERMINALS: Solder dipped (Sn63/Pb37) over nickel plated alloy 52. RoHS compliant matte-tin plating is also available on commercial grade only.
- MARKING: MSC, part number, date code, polarity symbol
- WEIGHT: Approximately 5.7 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.                                               |
| $V_{CE}$  | Collector-emitter voltage: The dc voltage between the collector and the emitter.                                                            |
| $V_{CEO}$ | Collector-emitter voltage, base open: The voltage between the collector and the emitter terminals when the base terminal is open-circuited. |
| $V_{EB}$  | 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 @ 25 °C unless otherwise stated**

| Parameters / Test Conditions                                                                                                                                          | Symbol        | Min.              | Max.       | Unit          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------|------------|---------------|
| <b>ON CHARACTERISTICS</b>                                                                                                                                             |               |                   |            |               |
| Collector-Emitter Breakdown Voltage<br>$I_C = 100 \text{ mA}$                                                                                                         | $V_{(BR)CEO}$ | 60<br>80          |            | V             |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 60 \text{ V}, V_{BE} = 1.5 \text{ V}$<br>$V_{CE} = 80 \text{ V}, V_{BE} = 1.5 \text{ V}$                                | $I_{CEX}$     |                   | 10         | $\mu\text{A}$ |
| Collector-Emitter Cutoff Current, Base Open<br>$V_{CE} = 30 \text{ V}$<br>$V_{CE} = 40 \text{ V}$                                                                     | $I_{CEO}$     |                   | 0.5        | mA            |
| Emitter-Base Cutoff Current<br>$V_{EB} = 5 \text{ V}$                                                                                                                 | $I_{EBO}$     |                   | 2.0        | mA            |
| Forward Current Transfer Ratio<br>$I_C = 1 \text{ A}, V_{CE} = 3 \text{ V}$<br>$I_C = 4 \text{ A}, V_{CE} = 3 \text{ V}$<br>$I_C = 8 \text{ A}, V_{CE} = 3 \text{ V}$ | $h_{FE}$      | 500<br>750<br>100 | 18000      |               |
| Collector-Emitter Saturation Voltage<br>$I_C = 4.0 \text{ A}, I_B = 16 \text{ mA}$<br>$I_C = 8.0 \text{ A}, I_B = 80 \text{ mA}$                                      | $V_{CE(sat)}$ |                   | 2.0<br>3.0 | V             |
| Base-Emitter Saturation Voltage<br>$V_{CE} = 3.0 \text{ V}, I_C = 4 \text{ A}$<br>$I_C = 8.0 \text{ A}, I_B = 80 \text{ mA}$                                          | $V_{BE(sat)}$ |                   | 2.8<br>4.0 | V             |

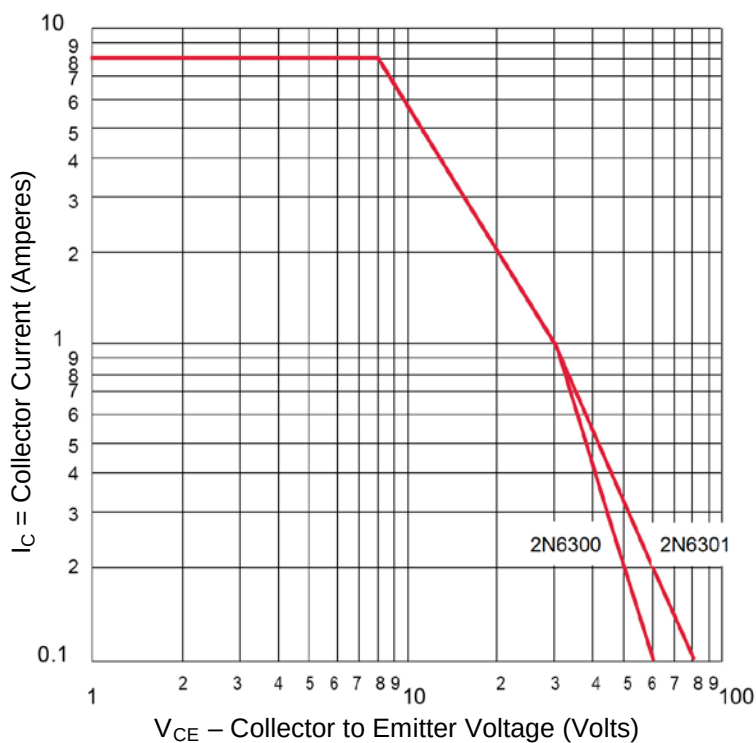
**DYNAMIC CHARACTERISTICS**

| Parameters / Test Conditions                                                                                                                              | Symbol     | Min. | Max. | Unit |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|------|------|
| Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$V_{CE} = 3.0 \text{ V}, I_C = 3.0 \text{ A}, f = 1 \text{ MHz}$ | $ h_{fe} $ | 25   | 350  |      |
| Common Emitter Small-Signal Short-Circuit Forward Current Trans-Ratio<br>$V_{CE} = 3 \text{ V}, I_C = 3 \text{ A}, f = 1 \text{ kHz}$                     | $h_{fe}$   | 300  |      |      |
| Common Base Output<br>$V_{CB} = 10 \text{ V}, I_E = 0 \text{ A}, 100 \text{ kHz} \leq f \leq 1 \text{ MHz}$                                               | $C_{obo}$  |      | 200  | pF   |

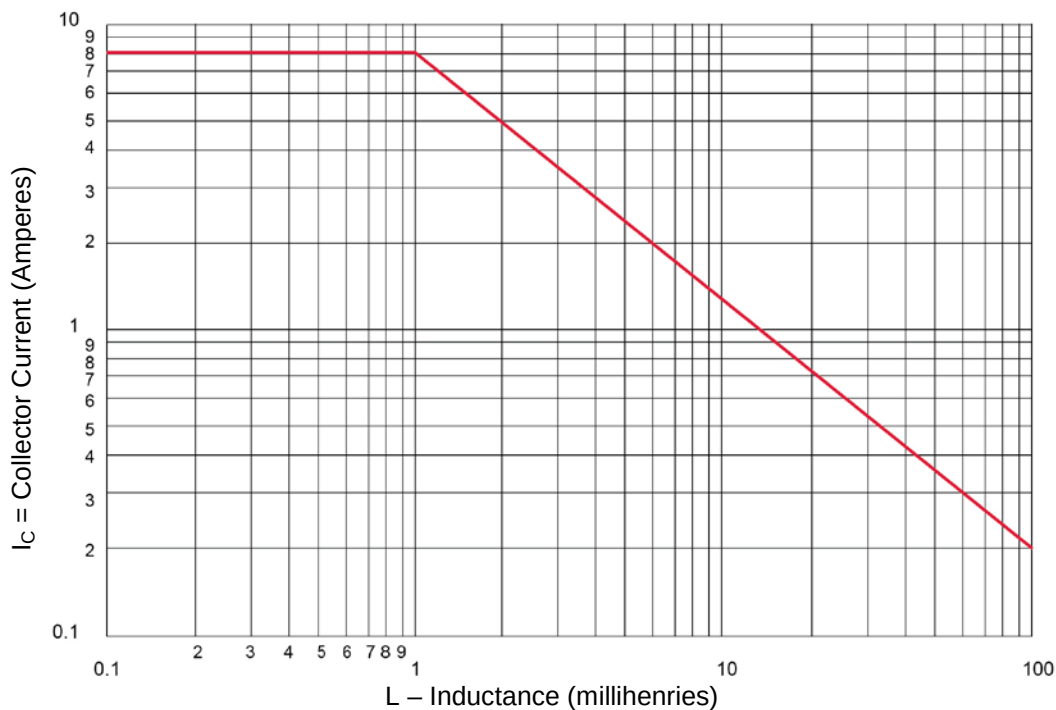
**ELECTRICAL CHARACTERISTICS @  $T_C = 25^\circ\text{C}$  unless otherwise noted. (continued)****SWITCHING CHARACTERISTICS**

| Parameters / Test Conditions                                                                     | Symbol    | Min. | Max. | Unit          |
|--------------------------------------------------------------------------------------------------|-----------|------|------|---------------|
| Turn-On time<br>$V_{CC} = 30\text{ V}$ , $I_C = 4\text{ A}$ , $I_{B1} = 16\text{ mA}$            | $t_{on}$  |      | 2.0  | $\mu\text{s}$ |
| Turn-Off time<br>$V_{CC} = 30\text{ V}$ , $I_C = 4\text{ A}$ , $I_{B1} = -I_{B2} = 16\text{ mA}$ | $t_{off}$ |      | 8.0  | $\mu\text{s}$ |

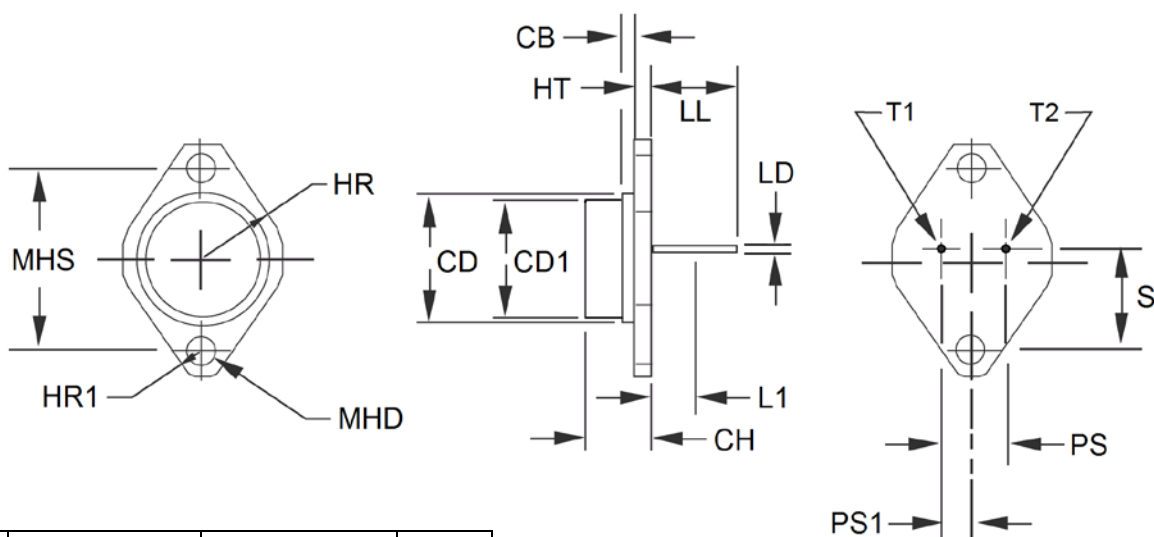
**SAFE OPERATING AREA (See [Figures 1 and 2](#) and [MIL-STD-750, Test Method 3053](#))****DC Tests** $T_C = +25^\circ\text{C}$ ,  $t = 1\text{ second}$ , duty cycle  $\leq 10\%$ **Test 1** $V_{CE} = 8\text{ V}$ ,  $I_C = 8\text{ A}$ **Test 2** $V_{CE} = 20\text{ V}$ ,  $I_C = 2.0\text{ A}$ **Test 3** $V_{CE} = 60\text{ V}$ ,  $I_C = 100\text{ mA}$  (2N6300) $V_{CE} = 80\text{ V}$ ,  $I_C = 100\text{ mA}$  (2N6301)

**SAFE OPERATING AREA**


**FIGURE 1 – Maximum Safe Operating Area (dc)**



**FIGURE 2 – Safe Operating Area for switching between saturation and cutoff (unclamped inductive load)**

**PACKAGE DIMENSIONS**


| DIM  | INCH      |       | MILLIMETERS |       | Notes |
|------|-----------|-------|-------------|-------|-------|
|      | MIN       | MAX   | MIN         | MAX   |       |
| CB   | 0.470     | 0.500 | 11.94       | 12.70 |       |
| CD   | -         | 0.620 | -           | 15.76 |       |
| CH   | 0.250     | 0.340 | 6.35        | 8.64  |       |
| HR   | -         | 0.350 | -           | 8.89  |       |
| HT   | 0.050     | 0.075 | 1.27        | 1.91  |       |
| HR1  | 0.115     | 0.145 | 2.92        | 3.68  | 4     |
| LD   | 0.028     | 0.034 | 0.71        | 0.86  | 4, 6  |
| LL   | 0.360     | 0.500 | 9.14        | 12.70 |       |
| L1   | -         | 0.050 | -           | 1.27  | 6     |
| MHD  | 0.142     | 0.152 | 3.61        | 3.86  | 4     |
| MHS  | 0.958     | 0.962 | 24.33       | 24.43 |       |
| PS   | 0.190     | 0.210 | 4.83        | 5.33  | 3     |
| PS1  | 0.093     | 0.107 | 2.36        | 2.73  | 3     |
| S    | 0.570     | 0.590 | 14.48       | 14.99 |       |
| T1   | Base      |       |             |       |       |
| T2   | Emitter   |       |             |       |       |
| Case | Collector |       |             |       |       |

**NOTES:**

1. Dimensions are in inches.
2. Millimeters are given for information only.
3. These dimensions should be measured at points 0.050 inch (1.27 mm) +0.005 inch (0.13 mm) -0.000 inch (0.00 mm) below seating plane. When gauge is not used, measurement will be made at the seating plane.
4. Two places.
5. The seating plane of the header shall be flat within 0.001 inch (0.03 mm) concave to 0.004 inch (0.10 mm) convex inside a 0.930 inch (23.62 mm) diameter circle on the center of the header and flat within 0.001 inch (0.03 mm) concave to 0.006 inch (0.15 mm) convex overall.
6. Lead diameter shall not exceed twice LD within L1.
7. Lead number 1 is the emitter, lead 2 is the base, case is the collector.
8. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$  x symbology.

**SCHEMATIC**
