RoHS
*Available on commercial versions*

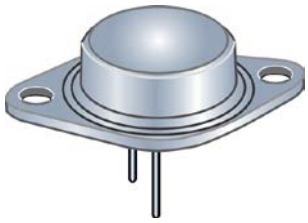
# NPN Darlington Power Silicon Transistor

*Qualified per MIL-PRF-19500/504*

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

## DESCRIPTION

This high speed NPN transistor is rated at 20 amps and is military qualified up to a JANTXV level. This TO-204AA isolated package features a 180 degree lead orientation.



**TO-204AA (TO-3) Package**

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

## FEATURES

- JEDEC registered 2N6283 and 2N6284.
- JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/504.
- RoHS compliant versions available (commercial grade only).

## APPLICATIONS / BENEFITS

- Military, space and other high reliability applications.
- High frequency response.
- TO-204AA case with isolated terminals.

## MAXIMUM RATINGS @ $T_C$ = +25 °C unless otherwise noted

| Parameters/Test Conditions | | Symbol | Value | Unit |
|---|---|---|---|---|
| Junction and Storage Temperature | | $T_J$ and $T_{STG}$ | -65 to +200 | °C |
| Thermal Resistance Junction-to-Case | | $R_{\Theta JC}$ | 0.857 | °C/W |
| Collector Current | | $I_C$ | 20 | A |
| Collector-Emitter Voltage | 2N6283 | $V_{CEO}$ | 80 | V |
| | 2N6284 | | 100 | |
| Collector-Base Voltage | 2N6283 | $V_{CBO}$ | 80 | V |
| | 2N6284 | | 100 | |
| Emitter-Base Voltage | | $V_{EBO}$ | 7 | V |
| Total Power Dissipation | @ $T_C$ = +25 °C (1) | $P_T$ | 175 | W |
| | @ $T_C$ = +100 °C (2) | | 87.5 | |

**Notes:** 1. Derate linearly 1.17 W/°C above $T_C$ > +25 °C. (See Figure 1)
2. Derate linearly 0.875 W/°C above $T_C$ > +100 °C. (See Figure 1)

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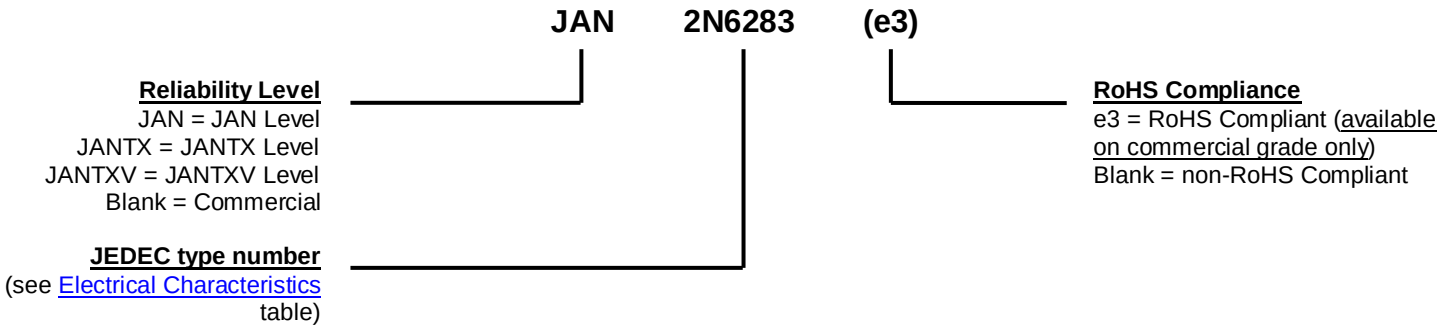
## MECHANICAL and PACKAGING

- CASE: Industry standard TO-204AA (TO-3), hermetically sealed, 0.040 inch diameter pins
- FINISH: Solder dipped tin-lead over nickel plated alloy 52 or RoHS compliant matte-tin plating. Solderable per MIL-STD-750 method 2026.
- POLARITY: NPN (see schematic)
- MOUNTING HARDWARE: Consult factory for optional insulator and sheet metal screws
- WEIGHT: Approximately 15 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 @ $T_A$ = +25 °C unless otherwise noted

| Characteristics | | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Emitter Breakdown Voltage<br>$I_C$ = 100 mA | 2N6283<br>2N6284 | $V_{(BR)CEO}$ | 80<br>100 | | V |
| Collector-Emitter Cutoff Current<br>$V_{CE}$ = 40 V<br>$V_{CE}$ = 50 V | <br>2N6283<br>2N6284 | $I_{CEO}$ | | 1.0<br>1.0 | mA |
| Collector-Emitter Cutoff Current<br>$V_{CE}$ = 80 V, $V_{BE}$ = 1.5 V<br>$V_{CE}$ = 100 V, $V_{BE}$ = 1.5 V | <br>2N6283<br>2N6284 | $I_{CEX}$ | | 0.01<br>0.01 | mA |
| Emitter-Base Cutoff Current<br>$V_{EB}$ = 7.0 V | | $I_{EBO}$ | | 2.5 | mA |
| **ON CHARACTERISTICS** | | | | | |
| Forward-Current Transfer Ratio<br>$I_C$ = 1.0 A, $V_{CE}$ = 3.0 V<br>$I_C$ = 10 A, $V_{CE}$ = 3.0 V<br>$I_C$ = 20 A, $V_{CE}$ = 3.0 V | | $h_{FE}$ | 1,500<br>1,250<br>500 | 18,000 | |
| Collector-Emitter Saturation Voltage<br>$I_C$ = 20 A, $I_B$ = 200 mA<br>$I_C$ = 10 A, $I_B$ = 40 mA | | $V_{CE(sat)}$ | | 3.0<br>2.0 | V |
| Base-Emitter Saturation Voltage<br>$I_C$ = 20 A, $I_B$ = 200 mA | | $V_{BE(sat)}$ | | 4.0 | V |
| Base-Emitter Voltage Non-saturated<br>$V_{CE}$ = 3.0 V, $I_C$ = 10 A | | $V_{BE}$ | | 2.8 | V |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C$ = 10 A, $V_{CE}$ = 3.0 V, f = 1 kHz | | $h_{fe}$ | 700 | | |
| Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C$ = 10 A, $V_{CE}$ = 3.0 V, f = 1 MHz | | $\|h_{fe}\|$ | 8 | 80 | |
| Output Capacitance<br>$V_{CB}$ = 10 V, $I_E$ = 0, f = 100 kHz ≤ f ≤ 1 MHz | | $C_{obo}$ | | 350 | pF |

**ELECTRICAL CHARACTERISTICS** @ $T_C$ = 25 °C unless otherwise noted. (continued)

**SWITCHING CHARACTERISTICS**

| | | | | |
|---|---|---|---|---|
| Turn-On Time<br>$V_{CC}$ = 30 V, $I_C$ = 10 A; $I_B$= 40 mA | $t_{on}$ | | 2.0 | µs |
| Turn-Off Time<br>$V_{CC}$ = 30 V, $I_C$ = 10 A; $I_{B1}$= $I_{B2}$ = 40 mA | $t_{off}$ | | 10 | µs |

**SAFE OPERATING AREA (See Figures 1 and 2 below and MIL-STD-750,Test Method 3053)**

**DC Tests**

$T_C$ = +25 °C, +10 ºC, -0 ºC, t ≥ 1 second, 1 Cycle

**Test 1**

$V_{CE}$ = 8.75 V, $I_C$ = 20 A

**Test 2**

$V_{CE}$ = 30 V, $I_C$ = 5.8 A

**Test 3**

$V_{CE}$ = 80 V, $I_C$ = 100 mA (2N6283)

$V_{CE}$ = 100 V, $I_C$ = 100 mA (2N6284)

## SAFE OPERATING AREA

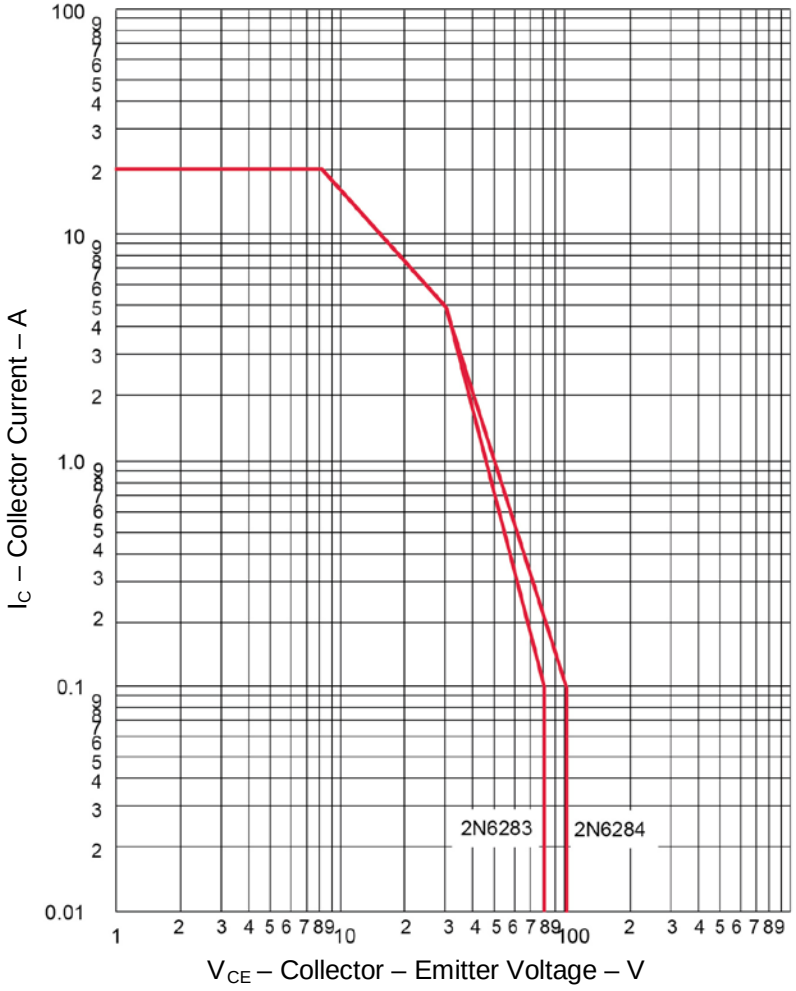



**FIGURE 1**
Maximum Safe Operating Area
(continuous dc)

## SAFE OPERATING AREA (continued)

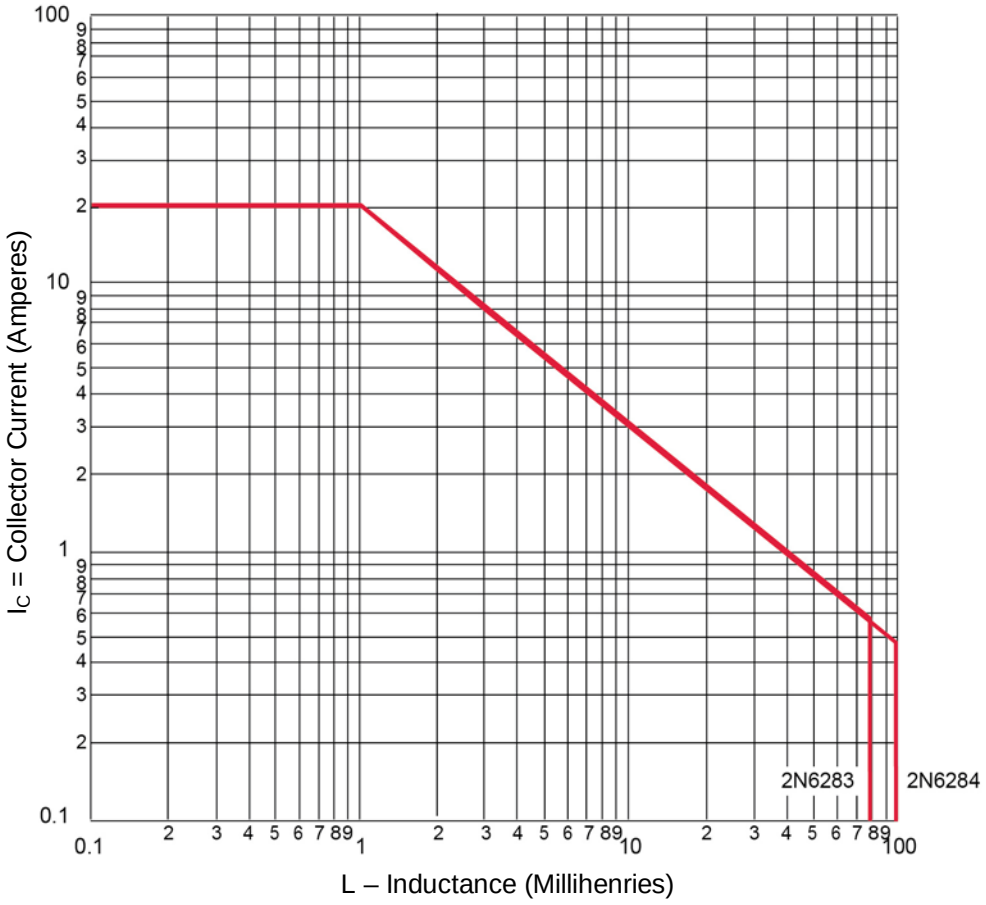



**FIGURE 2**
Safe Operating Area for Switching Between Saturation and Cutoff
(unclamped inductive load)

## GRAPHS

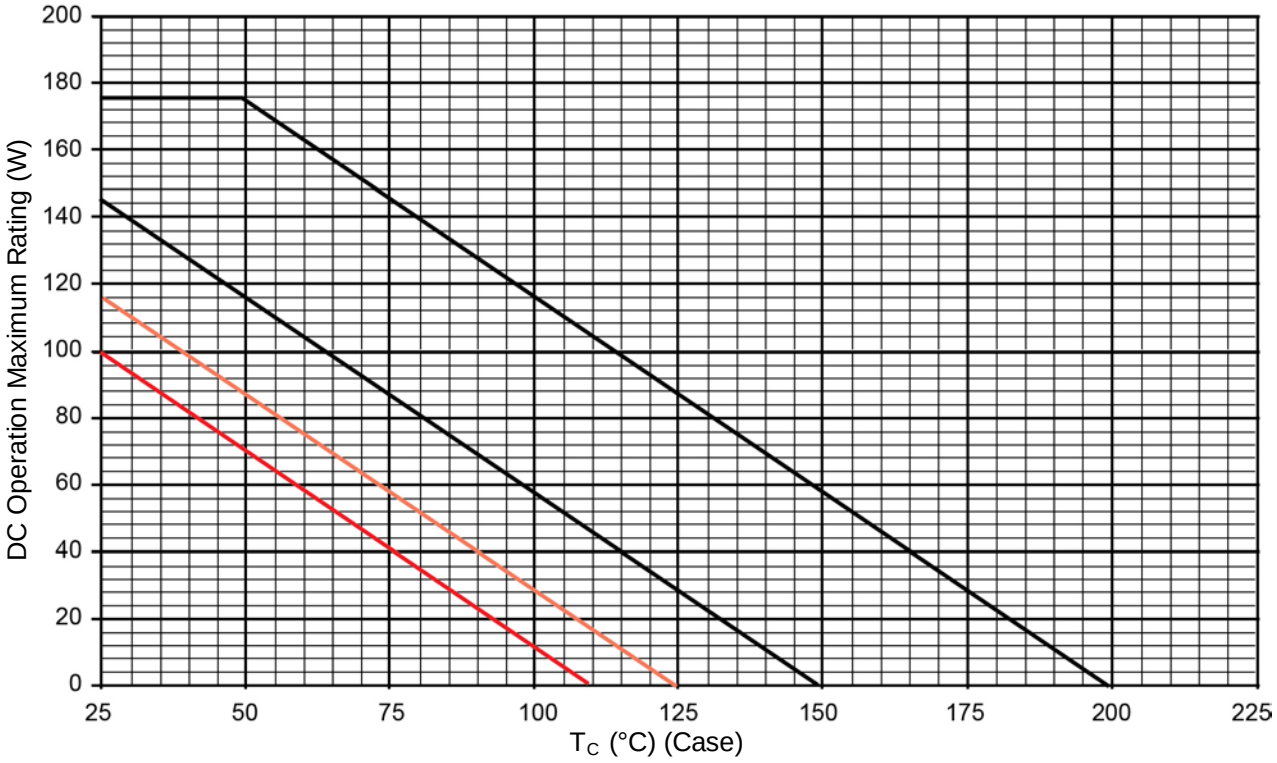
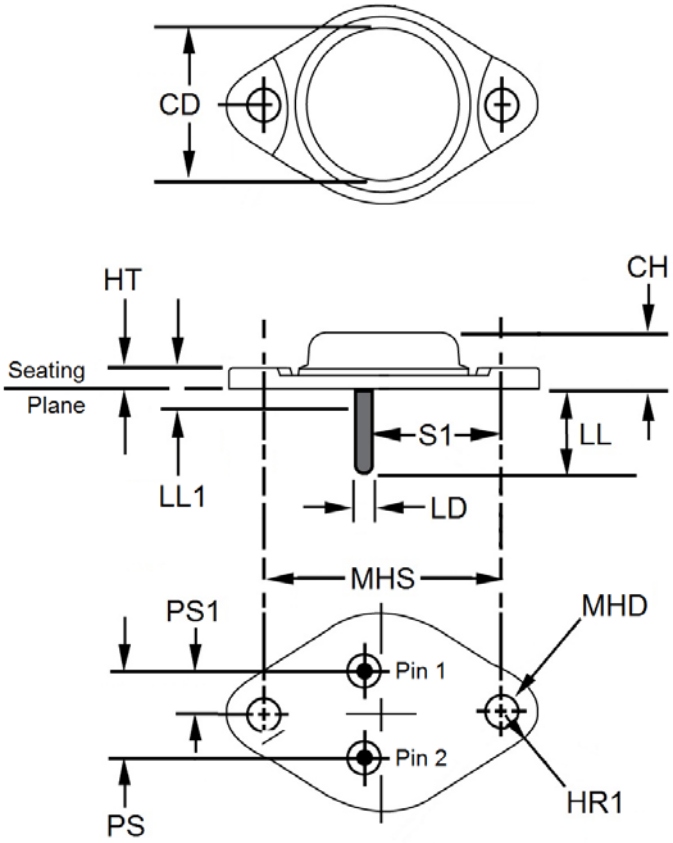



**FIGURE 1**
Temperature – Power Derating Curve

## PACKAGE DIMENSIONS

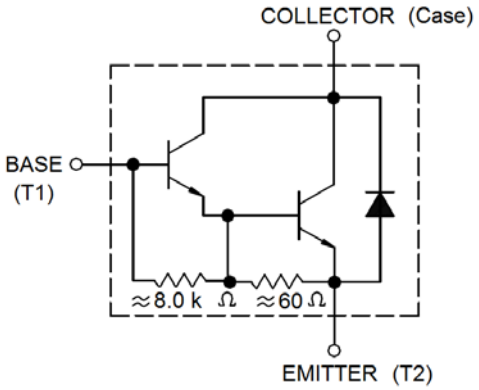



| Ltr | Dimensions | | | | Notes |
|---|---|---|---|---|---|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| **CD** | - | 0.875 | - | 22.23 | 3 |
| **CH** | 0.250 | 0.328 | 6.35 | 8.33 | |
| **HR** | 0.495 | 0.525 | 12.57 | 13.34 | |
| **HR1** | 0.131 | 0.188 | 3.33 | 4.78 | 6 |
| **HT** | 0.060 | 0.135 | 1.52 | 3.43 | |
| **LD** | 0.038 | 0.043 | 0.97 | 1.09 | 4, 5, 9 |
| **LL** | 0.312 | 0.500 | 7.92 | 12.70 | 4, 5, 9 |
| **LL1** | - | 0.050 | - | 1.27 | 5, 9 |
| **MHD** | 0.151 | 0.161 | 3.84 | 4.09 | 7 |
| **MHS** | 1.177 | 1.197 | 29.90 | 30.40 | |
| **PS** | 0.420 | 0.440 | 10.67 | 11.18 | |
| **PS1** | 0.205 | 0.225 | 5.21 | 5.72 | 5 |
| **S1** | 0.655 | 0.675 | 16.64 | 17.15 | |

**NOTES:**

1. Dimensions are in inches. Millimeters are given for information only.
2. Millimeters are given for information only.
3. Body contour is optional within zone defined by CD.
4. These dimensions shall be measured at points .050 inch (1.27 mm) to .055 inch (1.40 mm) below seating plane. When gauge is not used, measurement shall be made at seating plane.
5. Both terminals.
6. At both ends.
7. Two holes.
8. The collector shall be electrically connected to the case.
9. LD applies between L1 and LL. Lead diameter shall not exceed twice LD within L1.
10. The seating plane of the header shall be flat within .001 inch (0.03 mm), concave to .004 inch (0.10 mm), convex inside a .930 inch (23.62 mm) diameter circle on the center of the header, and flat within .001 inch (0.03 mm) concave to .006 inch (0.15 mm), convex overall.
11. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.

## SCHEMATIC



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