



# Low Power NPN Silicon Transistor

Qualified per MIL-PRF-19500/391

Qualified Levels:  
JAN, JANTX,  
JANTXV, and JANS

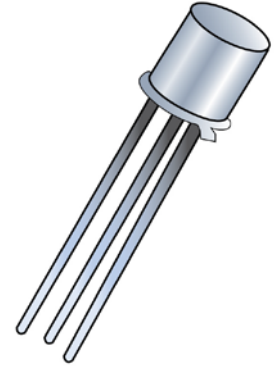
## DESCRIPTION

This 2N3700 NPN transistor comes in a hermetically sealed metal TO-18 package and is military qualified for high-reliability applications.

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


## FEATURES

- JEDEC registered 2N3700 number.
- JAN, JANTX, JANTXV and JANS qualifications are available per MIL-PRF-19500/391.
- Rad hard levels are also available per MIL-PRF-19500/391. (See RHA datasheet for [JANS 2N3700](#).)
- RoHS compliant versions available (commercial grade only).





**TO-18 (TO-206AA)  
Package**

Also available in:

**UB package**  
(surface mount)  
 [2N3700UB](#)

**TO-39 (TO-205AD)**  
(lead)  
 [2N3019](#)

**TO-5 package**  
(lead)  
 [2N3019S](#)

**TO-46 (TO-206AB)**  
(lead)  
 [2N3057A](#)

## APPLICATIONS / BENEFITS

- Leaded, hermetically sealed TO-18 package.
- Lightweight.
- Low power.
- Military and other high-reliability applications.

## MAXIMUM RATINGS @ T<sub>A</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 Impedance Junction-to-Ambient    | R <sub>θJA</sub>                    | 325         | °C/W |
| Thermal Impedance Junction-to-Case       | R <sub>θJC</sub>                    | 150         | °C/W |
| Collector-Emitter Voltage                | V <sub>CEO</sub>                    | 80          | V    |
| Collector-Base Voltage                   | V <sub>CBO</sub>                    | 140         | V    |
| Emitter-Base Voltage                     | V <sub>EBO</sub>                    | 7.0         | V    |
| Collector Current                        | I <sub>C</sub>                      | 1.0         | A    |
| Total Power Dissipation:                 |                                     |             |      |
| @ T <sub>A</sub> = +25 °C <sup>(1)</sup> | P <sub>D</sub>                      | 0.5         | W    |
| @ T <sub>C</sub> = +25 °C <sup>(2)</sup> |                                     | 1.0         |      |

- Notes:**
1. Derate linearly 2.85 mW/°C for T<sub>A</sub> ≥ +25 °C.
  2. Derate linearly 10.3 mW/°C for T<sub>C</sub> ≥ +25 °C.

**MSC – Lawrence**

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

**MSC – Ireland**

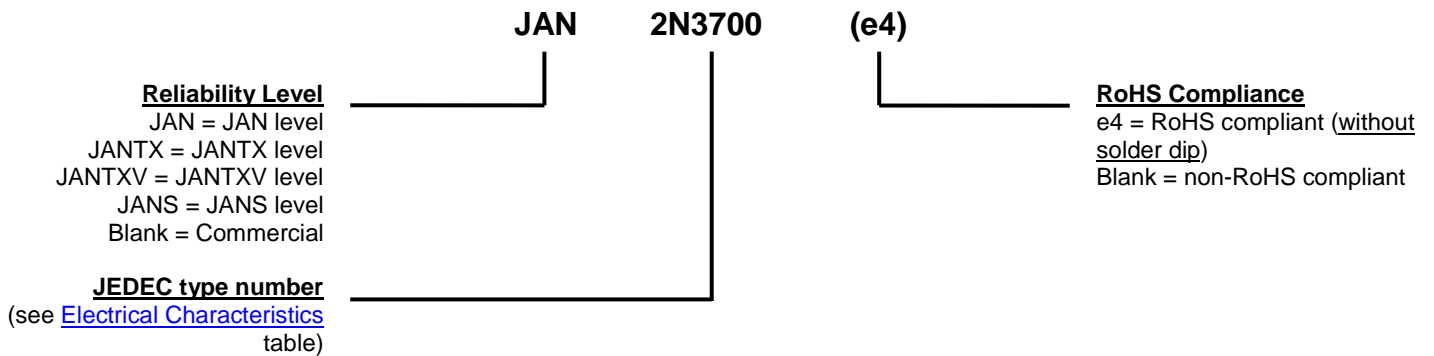
Gort Road Business Park,  
Ennis, Co. Clare, Ireland  
Tel: +353 (0) 65 6840044  
Fax: +353 (0) 65 6822298

**Website:**

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

**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed, nickel plated kovar base, nickel cap.
- TERMINALS: Gold plate over nickel, kovar for JANS. Gold plate over nickel, kovar, solder dipped for JAN, JANTX, and JANTXV.
- MARKING: Part number, date code, manufacturer's ID.
- WEIGHT: Approximately 0.3 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**SYMBOLS & DEFINITIONS**

| Symbol   | Definition                        |
|----------|-----------------------------------|
| f        | Frequency                         |
| $I_B$    | Base current (dc)                 |
| $I_E$    | Emitter current (dc)              |
| $T_A$    | Ambient temperature               |
| $T_C$    | Case temperature                  |
| $V_{CB}$ | Collector to base voltage (dc)    |
| $V_{CE}$ | Collector to emitter voltage (dc) |
| $V_{EB}$ | Emitter to base voltage (dc)      |

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

| Parameters / Test Conditions  | Symbol        | Min.                        | Max.              | Unit          |
|---|---------------|-----------------------------|-------------------|---------------|
| <b>OFF CHARACTERISTICS</b>  |               |                             |                   |               |
| Collector-Emitter Breakdown Voltage<br>$I_C = 30\text{ mA}$   | $V_{(BR)CEO}$ | 80                          |                   | V             |
| Collector-Base Cutoff Current<br>$V_{CB} = 140\text{ V}$  | $I_{CBO}$     |                             | 10                | $\mu\text{A}$ |
| Emitter-Base Cutoff Current<br>$V_{EB} = 7\text{ V}$  | $I_{EBO1}$    |                             | 10                | $\mu\text{A}$ |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 90\text{ V}$  | $I_{CES}$     |                             | 10                | nA            |
| Emitter-Base Cutoff Current<br>$V_{EB} = 5.0\text{ V}$  | $I_{EBO2}$    |                             | 10                | nA            |
| <b>ON CHARACTERISTICS</b>   |               |                             |                   |               |
| Forward-Current Transfer Ratio<br>$I_C = 150\text{ mA}, V_{CE} = 10\text{ V}$<br>$I_C = 0.1\text{ mA}, V_{CE} = 10\text{ V}$<br>$I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$<br>$I_C = 500\text{ mA}, V_{CE} = 10\text{ V}$<br>$I_C = 1.0\text{ A}, V_{CE} = 10\text{ V}$ | $h_{FE}$      | 100<br>50<br>90<br>50<br>15 | 300<br>300<br>300 |               |
| Collector-Emitter Saturation Voltage<br>$I_C = 150\text{ mA}, I_B = 15\text{ mA}$<br>$I_C = 500\text{ mA}, I_B = 50\text{ mA}$  | $V_{CE(sat)}$ |                             | 0.2<br>0.5        | V             |
| Base-Emitter Saturation Voltage<br>$I_C = 150\text{ mA}, I_B = 15\text{ mA}$  | $V_{BE(sat)}$ |                             | 1.1               | V             |

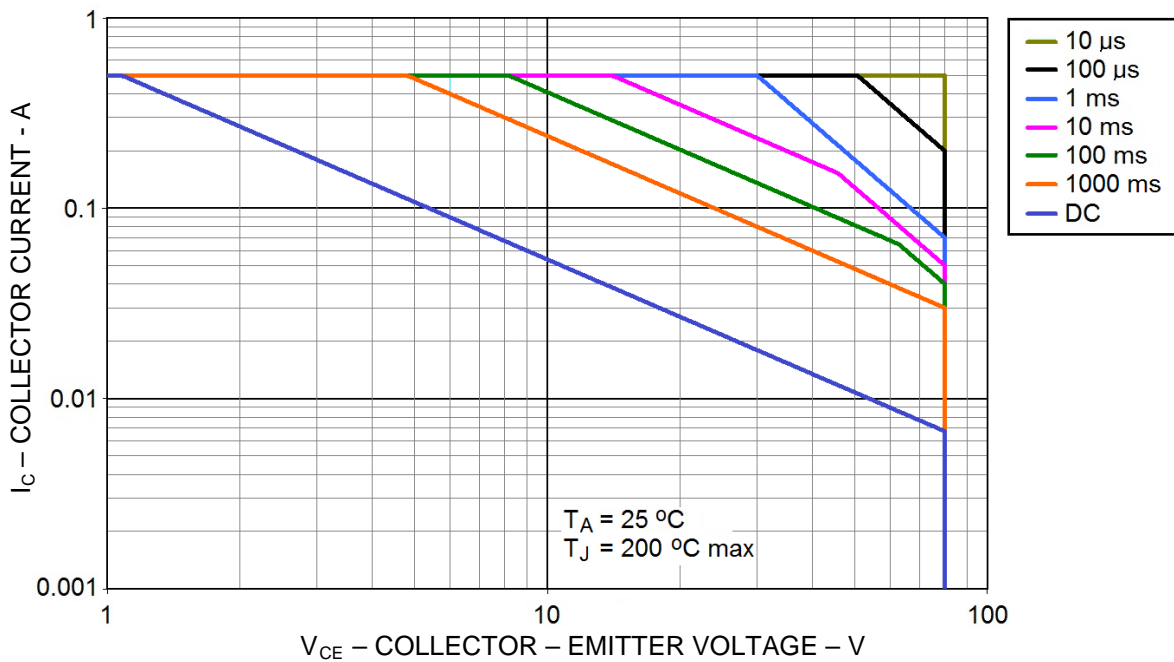
**DYNAMIC CHARACTERISTICS**

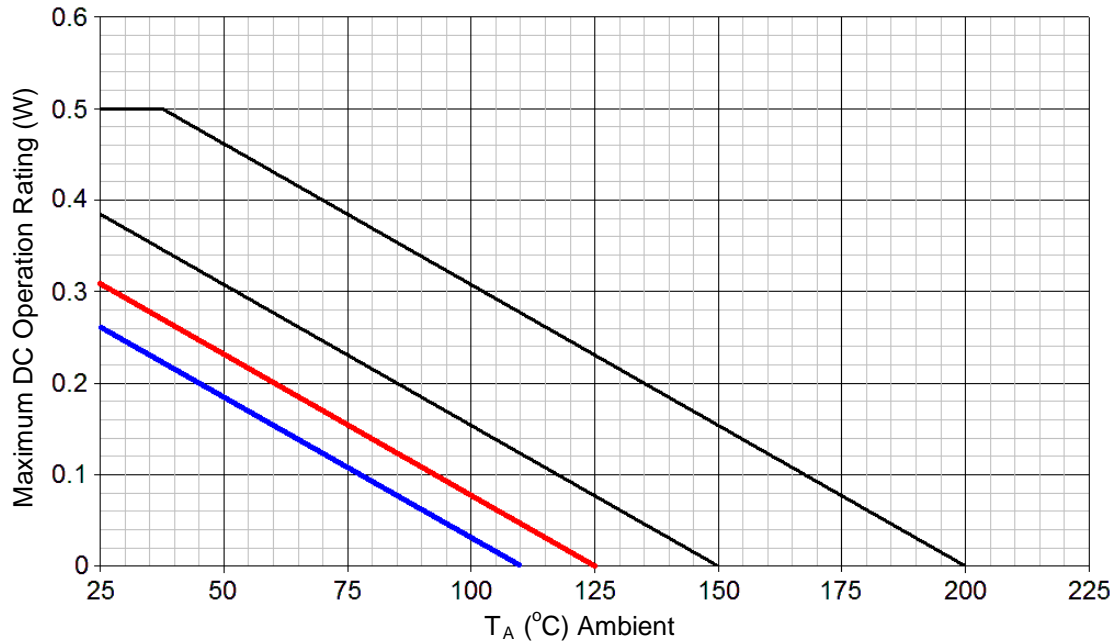
| Parameters / Test Conditions  | Symbol     | Min. | Max. | Unit |
|---|------------|------|------|------|
| Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 1.0\text{ mA}, V_{CE} = 5.0\text{ V}, f = 1.0\text{ kHz}$           | $h_{fe}$   | 80   | 400  |      |
| Magnitude of Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 50\text{ mA}, V_{CE} = 10\text{ V}, f = 20\text{ MHz}$ | $ h_{fe} $ | 5.0  | 20   |      |
| Output Capacitance<br>$V_{CB} = 10\text{ V}, I_E = 0, 100\text{ kHz} \leq f \leq 1.0\text{ MHz}$  | $C_{obo}$  |      | 12   | pF   |
| Input Capacitance<br>$V_{EB} = 0.5\text{ V}, I_C = 0, 100\text{ kHz} \leq f \leq 1.0\text{ MHz}$  | $C_{ibo}$  |      | 60   | pF   |

**ELECTRICAL CHARACTERISTICS @  $T_A = +25\text{ }^\circ\text{C}$  unless otherwise noted (continued)**
**SAFE OPERATION AREA** (See SOA graph below and [MIL-STD-750, method 3053](#))

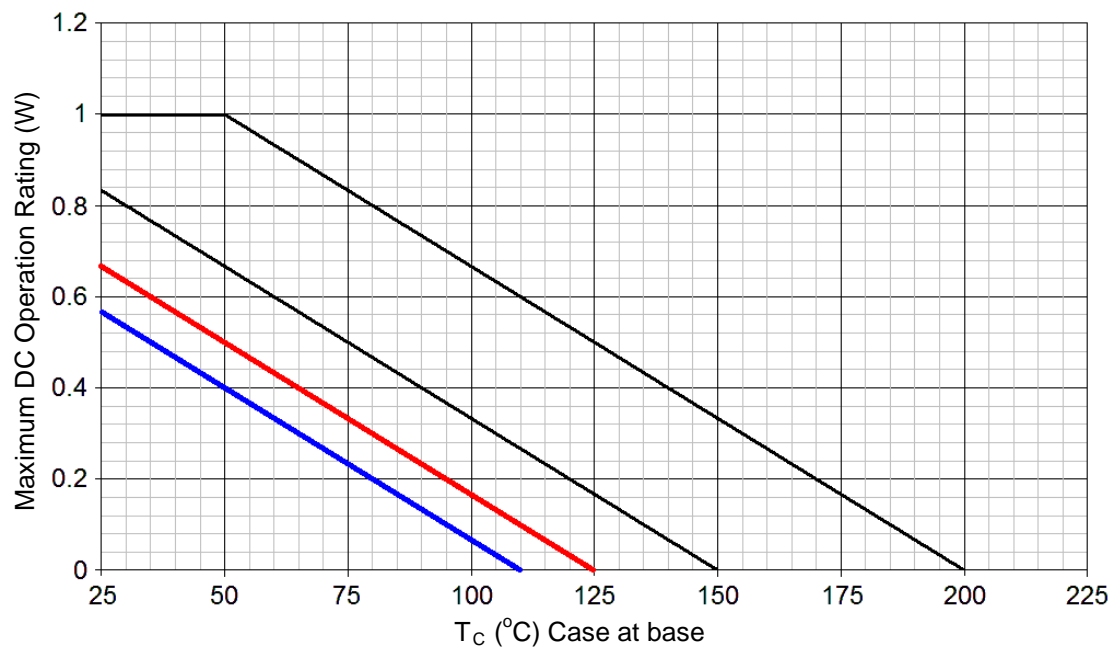
**DC Tests**
 $T_C = 25\text{ }^\circ\text{C}$ , 1 cycle,  $t = 10\text{ ms}$ 

|                         |  |
|-------------------------|--|
| <b>Test 1</b><br>2N3700 | $V_{CE} = 10\text{ V}$<br>$I_C = 180\text{ mA}$  |
| <b>Test 2</b><br>2N3700 | $V_{CE} = 40\text{ V}$<br>$I_C = 45\text{ mA}$   |
| <b>Test 3</b><br>2N3700 | $V_{CE} = 80\text{ V}$<br>$I_C = 22.5\text{ mA}$ |

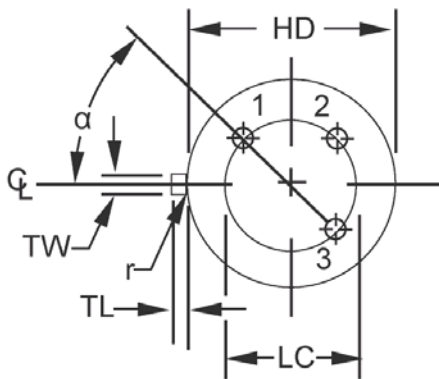
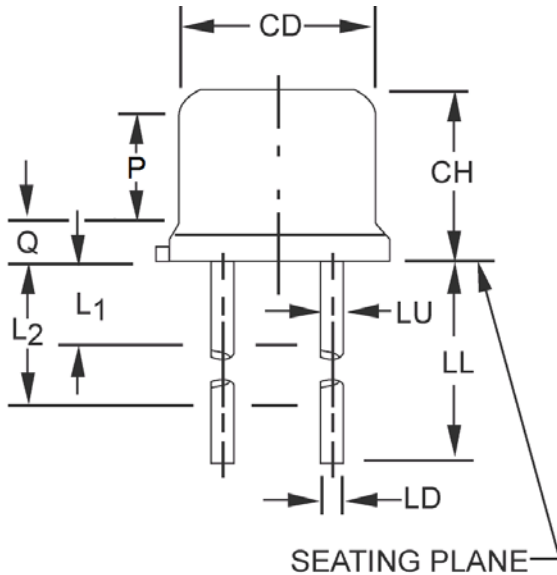
 (1) Pulse Test: Pulse Width =  $300\text{ }\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .

Maximum Safe Operating Area @  $T_A = 25\text{ }^\circ\text{C}$

**GRAPHS**


**FIGURE 1**  
Temperature-Power Derating (R<sub>θJA</sub>)  
 Leads = 0.125 inch (3.175mm)



**FIGURE 2**  
Temperature-Power Derating (R<sub>θJC</sub>)

**PACKAGE DIMENSIONS**


| Symbol          | Dimensions |       |             |       | Note |
|-----------------|------------|-------|-------------|-------|------|
|                 | Inch       |       | Millimeters |       |      |
|                 | Min        | Max   | Min         | Max   |      |
| <b>CD</b>       | 0.178      | 0.195 | 4.52        | 4.95  |      |
| <b>CH</b>       | 0.170      | 0.210 | 4.32        | 5.33  |      |
| <b>HD</b>       | 0.209      | 0.230 | 5.31        | 5.84  |      |
| <b>LC</b>       | 0.100 TP   |       | 2.54 TP     |       | 6    |
| <b>LD</b>       | 0.016      | 0.021 | 0.41        | 0.53  | 7,8  |
| <b>LL</b>       | 0.500      | 0.750 | 12.70       | 19.05 | 7,8  |
| <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        | -     |      |
| <b>Q</b>        | -          | 0.030 | -           | 0.76  | 5    |
| <b>TL</b>       | 0.028      | 0.048 | 0.71        | 1.22  | 3,4  |
| <b>TW</b>       | 0.036      | 0.046 | 0.91        | 1.17  | 3    |
| <b>r</b>        | -          | 0.010 | -           | 0.25  | 10   |
| <b>α</b>        | 45° TP     |       | 45° TP      |       | 6    |
| 1, 2, 9, 11, 12 |            |       |             |       |      |

**NOTES:**

1. Dimensions 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 inch (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. This device may be measured by direct methods.
7. Dimension LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> 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. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.
12. Lead 1 = emitter, lead 2 = base, lead 3 = collector.