PNP RF Transistor

This device is designed for general RF amplifier and mixer applications to 250 MHz with collector currents in the 1.0 mA to 30 mA range. Sourced from Process 75.

Absolute Maximum Ratings*  
TA = 25°C unless otherwise noted

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CEO}</td>
<td>Collector-Emitter Voltage</td>
<td>20</td>
<td>V</td>
</tr>
<tr>
<td>V_{CBO}</td>
<td>Collector-Base Voltage</td>
<td>20</td>
<td>V</td>
</tr>
<tr>
<td>V_{EBO}</td>
<td>Emitter-Base Voltage</td>
<td>3.0</td>
<td>V</td>
</tr>
<tr>
<td>I_C</td>
<td>Collector Current - Continuous</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>T_{J, T_{stg}}</td>
<td>Operating and Storage Junction Temperature Range</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
</tbody>
</table>

*These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

NOTES:
1) These ratings are based on a maximum junction temperature of 150 degrees C.
2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3) All voltages (V) and currents (A) are negative polarity for PNP transistors.

Thermal Characteristics  
TA = 25°C unless otherwise noted

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Characteristic</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P_D</td>
<td>Total Device Dissipation Derate above 25°C</td>
<td>350</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.8</td>
<td>mW/°C</td>
</tr>
<tr>
<td>R_{JUC}</td>
<td>Thermal Resistance, Junction to Case</td>
<td>125</td>
<td>°C/W</td>
</tr>
<tr>
<td>R_{JUA}</td>
<td>Thermal Resistance, Junction to Ambient</td>
<td>357</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>556</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

* Device mounted on FR-4 PCB 1.6” X 1.6” X 0.06.”
Electrical Characteristics

TA = 25°C unless otherwise noted

OFF CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{BRCEO} )</td>
<td>Collector-Emitter Breakdown Voltage*</td>
<td>( I_C = 1.0 , \text{mA}, , I_E = 0 )</td>
<td>20</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{BRBCO} )</td>
<td>Collector-Base Breakdown Voltage</td>
<td>( I_C = 10 , \mu\text{A}, , I_E = 0 )</td>
<td>20</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{BRUEBO} )</td>
<td>Emitter-Base Breakdown Voltage</td>
<td>( I_E = 10 , \mu\text{A}, , I_C = 0 )</td>
<td>3.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( I_{CEO} )</td>
<td>Collector Cutoff Current</td>
<td>( V_{CB} = 10 , \text{V}, , I_E = 0 )</td>
<td>100</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>( I_{EBO} )</td>
<td>Emitter Cutoff Current</td>
<td>( V_{EB} = 2.0 , \text{V}, , I_C = 0 )</td>
<td>100</td>
<td></td>
<td>nA</td>
</tr>
</tbody>
</table>

ON CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( h_{FE} )</td>
<td>DC Current Gain</td>
<td>( I_C = 5.0 , \text{mA}, , V_{CE} = 10 , \text{V} )</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{CEsat} )</td>
<td>Collector-Emitter Saturation Voltage</td>
<td>( I_C = 5.0 , \text{mA}, , I_E = 0.5 , \text{mA} )</td>
<td>0.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{BEon} )</td>
<td>Base-Emitter On Voltage</td>
<td>( I_C = 5.0 , \text{mA}, , V_{CE} = 10 , \text{V} )</td>
<td>0.9</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

SMALL SIGNAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f_T )</td>
<td>Current Gain - Bandwidth Product</td>
<td>( I_C = 5.0 , \text{mA}, , V_{CE} = 10 , \text{V}, , f = 100 , \text{MHz} )</td>
<td>600</td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>( C_{cb} )</td>
<td>Collector-Base Capacitance</td>
<td>( V_{CB} = 10 , \text{V}, , I_E = 0, , f = 1.0 , \text{MHz} )</td>
<td>0.85</td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>( C_{ce} )</td>
<td>Collector Emitter Capacitance</td>
<td>( V_{CB} = 10 , \text{V}, , I_B = 0, , f = 1.0 , \text{MHz} )</td>
<td>0.65</td>
<td></td>
<td>pF</td>
</tr>
</tbody>
</table>

*Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%

NOTE: All voltages (V) and currents (A) are negative polarity for PNP transistors.

Spice Model

PNP(Is=10f Xti=3 Eg=1.11 Vaf=100 Bf=133.8 Ise=1.678p Ne=2.159 Ikf=.1658 Nk=.901 Xtb=1.5 Var=100 Br=1 Ise=9.519n Ne=3.88 Ikf=.581p Mje=.1615 Vje=.8282 Fc=.5 Cje=.3214 Vje=.7026 Tr=11.32n Tt=97.83p Tif=69.29 Xf=599u Vtf=10)

Typical Characteristics

DC Current Gain vs Collector Current

Collector Saturation Voltage vs Collector Current

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Typical Characteristics (continued)

- **Base-Emitter Saturation Voltage vs Collector Current**
- **Base-Emitter ON Voltage vs Collector Current**
- **Collector Reverse Current vs Ambient Temperature**
- **Input / Output Capacitance vs Reverse Bias Voltage**
- **Contours of Constant Gain Bandwidth Product (f<sub>T</sub>)**
- **Power Dissipation vs Ambient Temperature**
TO-92 Tape and Reel Data

TO-92 Packaging
Configuration: Figure 1.0

TO-92 Tape and Reel Data

TO-92 Tape and Reel Data

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TO-92 Tape and Reel Data

TO-92 Tape and Reel Data

TO-92 Tape and Reel Data

TO-92 Tape and Reel Data

TO-92 Tape and Reel Data

TO-92 Tape and Reel Data
TO-92 Tape and Reel Data, continued

TO-92 Reeling Style
Configuration: Figure 2.0

Machine Option “A” (H)
- Style “A”, D26Z, D70Z (s/h)
- FIRST WIRE OFF IS Emitter
- ADHESIVE TAPE IS ON THE TOP SIDE
- FLAT OF TRANSISTOR IS ON BOTTOM

Machine Option “E” (J)
- Style “E”, D27Z, D71Z (s/h)
- FIRST WIRE OFF IS COLLECTOR
- ADHESIVE TAPE IS ON THE TOP SIDE
- FLAT OF TRANSISTOR IS ON TOP

TO-92 Radial Ammo Packaging
Configuration: Figure 3.0

ORDER STYLE
D74Z (M)
- FIRST WIRE OFF IS Emitter (ON PKG. 92)
- ADHESIVE TAPE IS ON BOTTOM SIDE
- FLAT OF TRANSISTOR IS ON BOTTOM

ORDER STYLE
D75Z (P)
- FIRST WIRE OFF IS COLLECTOR (ON PKG. 92)
- ADHESIVE TAPE IS ON BOTTOM SIDE
- FLAT OF TRANSISTOR IS ON TOP
**TO-92 Tape and Reel Data, continued**

**TO-92 Tape and Reel Taping**

**Dimension Configuration:** Figure 4.0

**TO-92 Reel Configuration:** Figure 5.0

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**ITEM DESCRIPTION** | SYMBOL | DIMENSION
---|---|---
Base of Package to Lead Bend | b | 0.038 (max)
Component Height | H6 | 0.928 (+/- 0.025)
Lead Clinch Height | H0 | 0.630 (+/- 0.020)
Component Base Height | H1 | 0.748 (+/- 0.020)
Component Alignment ( side/ side ) | Pd | 0.040 (max)
Component Alignment ( front/ back ) | H0 | 0.031 (max)
Component Pitch | P | 0.040 (+/- 0.020)
Feed Hole Pitch | PO | 0.031 (max)
Hole Center to First Lead | P1 | 0.130 (+/-0.006, -0.010)
Hole Center to Component Center | P2 | 0.247 (+/- 0.007)
Lead Spread | P1/P2 | 0.124 (+/- 0.010)
Lead Thickness | d | 0.016 (+/-0.002, -0.003)
Cut Lead Length | L | 0.420 (max)
Taped Lead Length | H1 | 0.210 (+/-0.051, -0.052)
Taped Lead Thickness | I | 0.005 (+/- 0.003)
Carrier Tape Thickness | k | 0.021 (+/- 0.006)
Carrier Tape Width | W | 0.706 (+/-0.020, -0.013)
Hold - down Tape Width | W0 | 0.236 (+/- 0.012)
Hold - down Tape Position | W1 | 0.035 (max)
Feed Hole Position | W2 | 0.320 (+/- 0.025)
Speckled Hole Diameter | D0 | 0.157 (+/-0.006, -0.007)
Lead Spring Out | S | 0.024 (max)

Note: All dimensions are in inches.
TO-92 Package Dimensions

TO-92 (FS PKG Code 92, 94, 96)

Scale 1:1 on letter size paper
Dimensions shown below are in:
-inches [millimeters]

Part Weight per unit (gram): 0.1977

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SOT-23 Tape and Reel Data

SOT-23 Packaging Configuration: Figure 10

Package Description:
SOT-23 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 3,000 units per 7" or 177cm diameter reel. The reels are dark blue in color and are made of polystyrene plastic (anti-static coated). Other options come in 10,000 units per 13" or 330cm diameter reel. This and some other options are described in the Packaging Information table.

These full reels are individually labeled and placed inside a standard intermediate made of recyclable corrugated brown paper with an ON Semiconductor logo printing. One pizza box contains eight reels maximum. And these intermediate boxes are placed inside a labeled shipping box which comes in different sizes depending on the number of parts shipped.

Table: SOT-23 Packaging/Information

<table>
<thead>
<tr>
<th>Packaging Option</th>
<th>Standard (flow code)</th>
<th>O1/Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging Type</td>
<td>THR, TNR</td>
<td></td>
</tr>
<tr>
<td>Qty per Reel/Tub/Bag</td>
<td>3000</td>
<td>10,000</td>
</tr>
<tr>
<td>Reel Tape</td>
<td>7&quot; Dia.</td>
<td>13&quot;</td>
</tr>
<tr>
<td>Box Dimension (mm)</td>
<td>187x107x183</td>
<td>343x343x64</td>
</tr>
<tr>
<td>Max qty per Box</td>
<td>24,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Weight per unit (gm)</td>
<td>0.0082</td>
<td>0.0082</td>
</tr>
<tr>
<td>Weight per Reel (kg)</td>
<td>0.1175</td>
<td>0.4006</td>
</tr>
<tr>
<td>Note/Comments</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SOT-23 Tape and Reel Data, continued

SOT-23 Embossed Carrier Tape
Configuration: Figure 3.0

User Direction of Feed

Dimensions are in millimeter

<table>
<thead>
<tr>
<th>Pkg type</th>
<th>A0</th>
<th>B0</th>
<th>W</th>
<th>D0</th>
<th>D1</th>
<th>E1</th>
<th>E2</th>
<th>F</th>
<th>P1</th>
<th>P0</th>
<th>K0</th>
<th>T</th>
<th>Wc</th>
<th>Tc</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOT-23</td>
<td>3.15</td>
<td>2.77</td>
<td>8.0</td>
<td>1.55</td>
<td>1.125</td>
<td>1.75</td>
<td>6.25</td>
<td>3.50</td>
<td>4.0</td>
<td>4.0</td>
<td>1.35</td>
<td>0.238</td>
<td>5.2</td>
<td>0.06</td>
</tr>
<tr>
<td>(8mm)</td>
<td>+/-0.10</td>
<td>+/-0.10</td>
<td>+/-0.3</td>
<td>+/-0.05</td>
<td>+/-0.125</td>
<td>+/-0.10</td>
<td>6.25</td>
<td>+/-0.05</td>
<td>+/-0.1</td>
<td>+/-0.1</td>
<td>+/-0.3</td>
<td>0.238</td>
<td>+/-0.013</td>
<td>+/-0.3</td>
</tr>
</tbody>
</table>

Notes: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).

20 deg maximum component rotation

Sketch A (Side or Front Sectional View)
Component Rotation

Sketch B (Top View)
Component Rotation

Sketch C (Top View)
Component lateral movement

W1 Measured at Hub

W2 max Measured at Hub

7” Diameter Option

13” Diameter Option

Dimensions are in inches and millimeters

<table>
<thead>
<tr>
<th>Tape Size</th>
<th>Reel Option</th>
<th>Dim A</th>
<th>Dim B</th>
<th>Dim C</th>
<th>Dim D</th>
<th>Dim N</th>
<th>Dim W1</th>
<th>Dim W2</th>
<th>Dim W3 (LSL-USL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8mm</td>
<td>7” Dia</td>
<td>7.00</td>
<td>0.059</td>
<td>0.020</td>
<td>512</td>
<td>0.255</td>
<td>0.331</td>
<td>0.035</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.776</td>
<td>1.5</td>
<td>13</td>
<td>0.5</td>
<td>0.2</td>
<td>15</td>
<td>0.4</td>
<td>7.3 – 10.9</td>
</tr>
<tr>
<td>8mm</td>
<td>13” Dia</td>
<td>13.00</td>
<td>0.059</td>
<td>0.020</td>
<td>512</td>
<td>0.255</td>
<td>0.331</td>
<td>0.035</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.33</td>
<td>1.5</td>
<td>13</td>
<td>0.5</td>
<td>0.2</td>
<td>15</td>
<td>0.4</td>
<td>7.3 – 10.9</td>
</tr>
</tbody>
</table>

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SOT-23 Package Dimensions

SOT-23 (FS PKG Code 49)

Scale 1:1 on letter size paper
Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.0082

NOTE: UNLESS OTHERWISE SPECIFIED
1. STANDARD LEAD FINISH: 150 MICROINCHES / 3.81 MICROMETERS
   MINIMUM TIN / LEAD (SOLDER) ON ALLOY 42
2. REFERENCE: JEDEC REGISTRATION TO-236, VARIATION AB, ISSUE G, DATED JUL 1993