NPN RF Transistor

This device is designed for use as RF amplifiers, oscillators and multipliers with collector currents in the 1.0 mA to 30 mA range. Sourced from Process 43.

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>15</td>
<td>V</td>
</tr>
<tr>
<td>( V_{CEO} )</td>
<td>Collector-Base Voltage</td>
<td>30</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.

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>( P_D )</td>
<td>Total Device Dissipation</td>
<td>350</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Derate above 25°C</td>
<td>2.8</td>
<td>mW/°C</td>
</tr>
<tr>
<td>( R_{Jac} )</td>
<td>Thermal Resistance, Junction to Case</td>
<td>125</td>
<td>°C/W</td>
</tr>
<tr>
<td>( R_{JJA} )</td>
<td>Thermal Resistance, Junction to Ambient</td>
<td>357</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PN918</th>
<th>MMBT918</th>
</tr>
</thead>
<tbody>
<tr>
<td>225</td>
<td>556</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

<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_{CEO(sus)})</td>
<td>Collector-Emitter Sustaining Voltage*</td>
<td>(I_C = 3.0\ mA, I_B = 0)</td>
<td>15</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>(V_{BRCBO})</td>
<td>Collector-Base Breakdown Voltage</td>
<td>(I_C = 1.0\ \mu A, I_E = 0)</td>
<td>30</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>(V_{BREBO})</td>
<td>Emitter-Base Breakdown Voltage</td>
<td>(I_E = 10\ \mu A, I_C = 0)</td>
<td>3.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>(I_{CAO})</td>
<td>Collector Cutoff Current</td>
<td>(\begin{aligned} V_{CB} &amp;= 15\ V, I_C = 0 \ V_{CB} &amp;= 15\ V, T_A = 150^\circ\ C \end{aligned})</td>
<td>0.01</td>
<td>(\mu A)</td>
<td></td>
</tr>
</tbody>
</table>

### OFF CHARACTERISTICS

### 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 = 3.0\ mA, V_{CE} = 1.0\ V)</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_{CE(sat)})</td>
<td>Collector-Emitter Saturation Voltage</td>
<td>(I_C = 10\ mA, I_B = 1.0\ mA)</td>
<td>0.4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>(V_{BE(sat)})</td>
<td>Base-Emitter Saturation Voltage</td>
<td>(I_C = 10\ mA, I_B = 1.0\ mA)</td>
<td>1.0</td>
<td>V</td>
<td></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>(\begin{aligned} I_C &amp;= 4.0\ mA, V_{CE} = 10\ V, \ f &amp;= 100\ MHz \end{aligned})</td>
<td>600</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>(C_{obo})</td>
<td>Output Capacitance</td>
<td>(\begin{aligned} V_{CB} &amp;= 10\ V, I_C = 0, f = 1.0\ MHz \ V_{CB} &amp;= 0, I_B = 0, f = 1.0\ MHz \end{aligned})</td>
<td>1.7</td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>(C_{ibo})</td>
<td>Input Capacitance</td>
<td>(\begin{aligned} V_{BE} &amp;= 0.5\ V, I_C = 0, f = 1.0\ MHz \end{aligned})</td>
<td>3.0</td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>NF</td>
<td>Noise Figure</td>
<td>(\begin{aligned} I_C &amp;= 1.0\ mA, V_{CE} = 6.0\ V, \ R_G &amp;= 400\Omega, f = 60\ MHz \end{aligned})</td>
<td>6.0</td>
<td>dB</td>
<td></td>
</tr>
</tbody>
</table>

### FUNCTIONAL TEST

<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>(G_{pe})</td>
<td>Amplifier Power Gain</td>
<td>(V_{CB} = 12\ V, I_C = 6.0\ mA, f = 200\ MHz)</td>
<td>15</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>PO</td>
<td>Power Output</td>
<td>(V_{CB} = 15\ V, I_C = 8.0\ mA, f = 500\ MHz)</td>
<td>30</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>(\eta)</td>
<td>Collector Efficiency</td>
<td>(V_{CB} = 15\ V, I_C = 8.0\ mA, f = 500\ MHz)</td>
<td>25</td>
<td>%</td>
<td></td>
</tr>
</tbody>
</table>

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

- **Typical Pulsed Current Gain vs Collector Current**
- **Collector-Emitter Saturation Voltage vs Collector Current**
- **Base-Emitter Saturation Voltage vs Collector Current**
- **Base-Emitter ON Voltage vs Collector Current**
- **Collector-Cutoff Current vs Ambient Temperature**
- **Input and Output Capacitance vs Reverse Voltage**
Typical Characteristics  (continued)

Gain Bandwidth Product vs Collector Current

Contours of Constant Gain Bandwidth Product ($f_T$)

Contours of Constant Noise Figure

Small Signal Current Gain vs Collector Current

Power Dissipation vs Ambient Temperature
**Common Emitter Y Parameters vs. Frequency**

**Input Admittance vs Collector Current-Output Short Circuit**
- Frequency: 10.7 MHz
- Collector Current: 0 to 10 mA
- Collector Voltage: 10 V
- Input Admittance: Y vs IC

**Input Admittance vs Collector Current-Output Short Circuit**
- Frequency: 100 MHz
- Collector Current: 0 to 10 mA
- Collector Voltage: 5 V, 10 V
- Input Admittance: Y vs IC

**Input Admittance vs Frequency-Output Short Circuit**
- Collector Current: 5 mA
- Collector Voltage: 10 V
- Frequency: 10 MHz to 1000 MHz
- Input Admittance: Y vs f

**Forward Transfer Admittance vs Collector Current-Output Short Circuit**
- Frequency: 10.7 MHz
- Collector Current: 0 to 10 mA
- Collector Voltage: 10 V
- Forward Admittance: fe vs IC

**Forward Transfer Admittance vs Collector Current-Output Short Circuit**
- Frequency: 100 MHz
- Collector Current: 0 to 10 mA
- Collector Voltage: 5 V, 10 V
- Forward Admittance: fe vs IC

**Forward Transfer Admittance vs Frequency-Output Open Circuit**
- Collector Current: 5 mA
- Collector Voltage: 10 V
- Frequency: 10 MHz to 1000 MHz
- Forward Admittance: fe vs f

**PN918 / MMBT918**
NPN RF Transistor
(continued)
Common Emitter Y Parameters vs. Frequency (continued)

Reverse Transfer Admittance vs Collector Current-Input Short Circuit

Output Admittance vs Collector Current-Input Short Circuit

Output Admittance vs Frequency-Input Short Circuit

NPN RF Transistor (continued)

PN918 / MMBT918
FIGURE 1: 500 MHz Oscillator Circuit

NOTE 1: 2 turns No. 16 AWG wire, 3/8 inch OD, 1 1/4 inch long
NOTE 2: 9 turns No. 22 AWG wire, 3/16 inch OD, 1/2 inch long
TO-92 Tape and Reel Data

TO-92 Packaging
Configuration: Figure 1.0

TO-92 TAPE and REEL OPTION
See Fig 2.0 for various Reeling Styles

TAPE and REEL OPTION
See Fig 2.0 for various Reeling Styles

FSCINT Label
Customized Label

375mm x 267mm x 375mm
Intermediate Box

333mm x 231mm x 183mm
Intermediate Box

F63TNR Label
Customized Label

TO-92 AMMO PACK OPTION
See Fig 3.0 for 2 Ammo Pack Options

TO-92 TNR/AMMO PACKING INFORMATION
Packing Style Quantity EOL code
Reel A 2,000 D26Z
E 2,000 D27Z
Ammo M 2,000 D74Z
P 2,000 D75Z

Unit weight
Reel weight with components = 0.22 gm
Ammo weight with components = 1.04 kg
Max quantity per intermediate box = 10,000 units

BULK OPTION
See Bulk Packing Information table

BULK OPTION
See Bulk Packing Information table

FSCINT Label
Customized Label

327mm x 158mm x 135mm
Immediate Box

333mm x 231mm x 183mm
Intermediate Box

F63TNR Label
Customized Label

5 Ammo boxes per Intermediate Box

5 Reels per Intermediate Box

LOT: CBVK741B019
NSID: PN2222N
D/C1: D9842
SPEC REV: B2
SPEC:
QTY: 10000
QA REV: FAIRCHILD SEMICONDUCTOR CORPORATION
HTB:B

©2001 Fairchild Semiconductor Corporation
March 2001, Rev. B1
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 bottom.

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

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

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

Part Weight per unit (gram): 0.1977

Dimensions shown below are in: inches [millimeters]

Scale 1:1 on letter size paper
**SOT-23 Tape and Reel Data**

### SOT-23 Packaging

**Configuration:** Figure 10

#### Packaging 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 polyolefin film, adhesive layer, sealant, and anti-static sprayed agent). These reel parts in standard option are shipped with 3,000 units per 7” or 177cm diameter reel. The reels are dark blue in color and made of polystyrene plastic (anti-static coated). Other option comes in 10,000 units per 13” or 330cm diameter reel. Two 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 a Fairchild logo printing. One pizza box contains eight reels maximum. These intermediate boxes are placed inside a labeled shipping box which comes in different sizes depending on the number of parts shipped.

### SOT-23 Tape Leader and Trailer

**Configuration:** Figure 20

#### Human Readable Label sample

#### Customized Label

#### Embossed Carrier Tape

#### Antistatic Cover Tape

#### Human Readable Label

### SOT-23 Tape and Reel Data Table

<table>
<thead>
<tr>
<th>Packaging/Information</th>
<th>Standard (no flow code)</th>
<th>D87Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging/Opt</td>
<td>TNRI</td>
<td>TNRI</td>
</tr>
<tr>
<td>Qty per Reel/Tube/Bag</td>
<td>3,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Core Diameter (in)</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>0.1775</td>
<td>0.406</td>
</tr>
</tbody>
</table>

### SOT-23 Unit Orientation

343mm x 342mm x 64mm Intermediate box for L87Z Option

187mm x 107mm x 183mm Intermediate Box for Standard Option
SOT-23 Tape and Reel Data, continued

SOT-23 Embossed Carrier Tape
Configuration: Figure 3.0

User Direction of Feed

SOT-23 Reel Configuration: Figure 4.0

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>2.77</td>
<td>1.85</td>
<td>1.75</td>
<td>6.25</td>
<td>2.50</td>
<td>4.0</td>
<td>1.35</td>
<td>0.238</td>
<td>6.2</td>
<td>0.06</td>
<td>8mm</td>
<td>0.10</td>
<td>0.10</td>
<td></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).

Sketch A (Side or Front Sectional View)
Component Rotation

Sketch B (Top View)
Component Rotation

Sketch C (Top View)
Component lateral movement

SOT-23 Tape and Reel Data, continued

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&quot; Dia</td>
<td>0.059</td>
<td>0.059</td>
<td>0.059</td>
<td>0.795</td>
<td>0.331</td>
<td>0.311 – 0.429</td>
<td>0.311 – 0.429</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>30.2</td>
<td>16.4</td>
<td>7.9 – 10.9</td>
<td>7.9 – 10.9</td>
<td></td>
</tr>
</tbody>
</table>

9mm       | 13" Dia     | 0.059 | 0.059 | 0.059 | 0.795 | 0.331 | 0.311 – 0.429 | 0.311 – 0.429 |
|           |             | 0.15  | 0.15  | 0.15  | 30.2  | 16.4  | 7.9 – 10.9    | 7.9 – 10.9    |

9mm       | 13" Dia     | 0.059 | 0.059 | 0.059 | 0.795 | 0.331 | 0.311 – 0.429 | 0.311 – 0.429 |
|           |             | 0.15  | 0.15  | 0.15  | 30.2  | 16.4  | 7.9 – 10.9    | 7.9 – 10.9    |

See detail AA
SOT-23 Package Dimensions

SOT-23 (FS PKG Code 49)

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 A3, ISSUE D, DATED JUL 1993
TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

<table>
<thead>
<tr>
<th>Trademark</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACEx™</td>
<td>PowerTrench®</td>
</tr>
<tr>
<td>Bottomless™</td>
<td>QFET™</td>
</tr>
<tr>
<td>CoolFET™</td>
<td>QS™</td>
</tr>
<tr>
<td>CROSSVOLT™</td>
<td>QT Optoelectronics™</td>
</tr>
<tr>
<td>DOME™</td>
<td>Quiet Series™</td>
</tr>
<tr>
<td>E²CMOS™</td>
<td>Silent Switcher®</td>
</tr>
<tr>
<td>EnSigna™</td>
<td>SMART START™</td>
</tr>
<tr>
<td>FACT™</td>
<td>SuperSOT™-3</td>
</tr>
<tr>
<td>FACT Quiet Series™</td>
<td>SuperSOT™-6</td>
</tr>
<tr>
<td>FAST®</td>
<td>SuperSOT™-8</td>
</tr>
<tr>
<td>FAST™</td>
<td>SyncFET™</td>
</tr>
<tr>
<td>GlobalOptoisolator™</td>
<td>TinyLogic™</td>
</tr>
<tr>
<td>GTO™</td>
<td>UHC™</td>
</tr>
<tr>
<td>HiSeC™</td>
<td>VCX™</td>
</tr>
<tr>
<td>ISOPLANAR™</td>
<td></td>
</tr>
<tr>
<td>MICROWIRE™</td>
<td></td>
</tr>
<tr>
<td>OPTOLOGIC™</td>
<td></td>
</tr>
<tr>
<td>OPTOPLANAR™</td>
<td></td>
</tr>
<tr>
<td>PACMAN™</td>
<td></td>
</tr>
<tr>
<td>POP™</td>
<td></td>
</tr>
</tbody>
</table>

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DEScribed HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD’S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:
1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

<table>
<thead>
<tr>
<th>Datasheet Identification</th>
<th>Product Status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advance Information</td>
<td>Formative or In Design</td>
<td>This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.</td>
</tr>
<tr>
<td>Preliminary</td>
<td>First Production</td>
<td>This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.</td>
</tr>
<tr>
<td>No Identification Needed</td>
<td>Full Production</td>
<td>This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.</td>
</tr>
<tr>
<td>Obsolete</td>
<td>Not In Production</td>
<td>This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.</td>
</tr>
</tbody>
</table>