PNP General Purpose Amplifier

This device is designed for low level, high gain, low noise general purpose amplifier applications at collector currents to 50 mA.

**Absolute Maximum Ratings**

<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>50</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CBO}$</td>
<td>Collector-Base Voltage</td>
<td>50</td>
<td>V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>Emitter-Base Voltage</td>
<td>5.0</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>Collector Current - Continuous</td>
<td>100</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**

<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>625</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>Derate above 25°C</td>
<td>5.0</td>
<td>2.8</td>
</tr>
<tr>
<td>$R_{JJC}$</td>
<td>Thermal Resistance, Junction to Case</td>
<td>83.3</td>
<td></td>
</tr>
<tr>
<td>$R_{JJA}$</td>
<td>Thermal Resistance, Junction to Ambient</td>
<td>200</td>
<td>357</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>$V_{BRCEO}$</td>
<td>Collector-Emitter Breakdown Voltage</td>
<td>$I_C = 1.0 , mA$, $I_E = 0$</td>
<td>50</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{BRCEO}$</td>
<td>Collector-Base Breakdown Voltage</td>
<td>$I_C = 100 , \mu A$, $I_E = 0$</td>
<td>50</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$I_{CEO}$</td>
<td>Collector Cutoff Current</td>
<td>$V_{CE} = 10 , V$, $I_E = 0$</td>
<td>10</td>
<td>nA</td>
<td></td>
</tr>
<tr>
<td>$I_{EBO}$</td>
<td>Emitter Cutoff Current</td>
<td>$V_{BE} = 3.0 , V$, $I_C = 0$</td>
<td>50</td>
<td>nA</td>
<td></td>
</tr>
</tbody>
</table>

**ON CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>$I_C = 100 , \mu A$, $V_{CE} = 5.0 , V$, $f = 20 , \text{MHz}$</th>
<th>$I_C = 1.0 , mA$, $V_{CE} = 5.0 , V$, $f = 1.0 , \text{kHz}$</th>
<th>$I_C = 10 , mA$, $V_{CE} = 5.0 , V$, $f = 10 , \text{kHz}$ to $15.7 , \text{kHz}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h_{FE}$</td>
<td>DC Current Gain</td>
<td>150</td>
<td>500</td>
<td>3.0</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>Small-Signal Current Gain</td>
<td>250</td>
<td>600</td>
<td>3.0</td>
</tr>
<tr>
<td>$NF$</td>
<td>Noise Figure</td>
<td>4.0</td>
<td>1.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

*Pulse Test: Pulse Width $\leq 300 \, \mu s$, Duty Cycle $\leq 2.0\%$

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

### Spice Model

PNP (Is=6.734f  Xl=1.11  Eg=45.7  Bi=254.1  Ne=1.741  Ise=6.734f  lkf=.1962  Xtb=1.5  Br=2.683  Isc=0  Rb=10)
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 Bias Voltage

2N5086 / MMBT5086 / 2N5087 / MMBT5087

PNP General Purpose Amplifier (continued)
Typical Characteristics (continued)

Gain Bandwidth Product vs Collector Current

Noise Figure vs Frequency

Wideband Noise Frequency vs Source Resistance

Power Dissipation vs Ambient Temperature

Equivalent Input Noise Current vs Collector Current

Equivalent Input Noise Voltage vs Collector Current
Typical Characteristics (continued)

Contours of Constant Narrow Band Noise Figure

- Collector Current (mA)
- Source Resistance (Ω)
- Bandwidth

Vces = -5V
Ic = 10 mA

Contours of Constant Narrow Band Noise Figure

- Collector Current (mA)
- Source Resistance (Ω)
- Bandwidth

Vces = -5V
Ic = 10 kHz

Contours of Constant Narrow Band Noise Figure

- Collector Current (mA)
- Source Resistance (Ω)
- Bandwidth

Vces = -5V
Ic = 10 MHz

2N5086 / MMBT5086 / 2N5087 / MMBT5087
PNP General Purpose Amplifier (continued)
Typical Common Emitter Characteristics \( (f = 1.0 \text{ kHz}) \)

- Collector-Emitter Voltage \( V_{CE} \), Collector-Emitter Voltage \( V_{CE} \) Relative to Value, \( V_{CE} = -5.0 \text{ V} \)
- Collector Current \( I_C \), Collector Current \( I_C \) Relative to Value, \( I_C = 1.0 \text{ mA} \)
- Ambient Temperature \( T_A \), Ambient Temperature \( T_A \) Relative to Value, \( T_A = 25^\circ \text{C} \)
TO-92 Tape and Reel Data

TO-92 Packaging
Configuration: Figure 1.0

TO-92 Tape and Reel Data

TAPE and REEL OPTION
See Fig 2.0 for various Reeling Styles

AMMO PACK OPTION
See Fig 3.0 for 2 Ammo Pack Options

BULK OPTION
See Bulk Packing Information table

<table>
<thead>
<tr>
<th>Packing Style</th>
<th>Quantity</th>
<th>EOL code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reel A</td>
<td>2,000</td>
<td>D26Z</td>
</tr>
<tr>
<td>E</td>
<td>2,000</td>
<td>D27Z</td>
</tr>
<tr>
<td>Ammo M</td>
<td>2,000</td>
<td>D74Z</td>
</tr>
<tr>
<td>P</td>
<td>2,000</td>
<td>D75Z</td>
</tr>
</tbody>
</table>

Unit weight = 0.22 gm
Reel weight with components = 1.04 kg
Ammo weight with components = 1.02 kg
Max quantity per intermediate box = 10,000 units

<table>
<thead>
<tr>
<th>EOL CODE</th>
<th>DESCRIPTION</th>
<th>LEADCLIP DIMENSION</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>375Z</td>
<td>TO-18 OPTION STD</td>
<td>NO LEAD CLIP</td>
<td>2.0 K / BOX</td>
</tr>
<tr>
<td>376Z</td>
<td>TO-5 OPTION STD</td>
<td>NO LEAD CLIP</td>
<td>1.5 K / BOX</td>
</tr>
<tr>
<td>378Z</td>
<td>TO-92 STANDARD STRAIGHT FOR: PKG 94, 94 (NON PROELECTRON SERIES), 94</td>
<td>NO LEAD CLIP</td>
<td>2.0 K / BOX</td>
</tr>
<tr>
<td>379Z</td>
<td>TO-92 STANDARD STRAIGHT FOR: PKG 94 PROELECTRON SERIES BCXXX, BFXXX, BS100XX, 97, 99</td>
<td>NO LEADCLIP</td>
<td>2.0 K / BOX</td>
</tr>
</tbody>
</table>

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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 BOTTOM 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

User Direction of Feed

TO-92 Reel
Configuration: Figure 5.0

ITEM DESCRIPTION          SYMBOL   DIMENSION
Base of Package to Lead Bend  b       0.038 (max)
Component Height            H6      0.928 (+/- 0.025)
Lead Clinch Height          HO      0.630 (+/- 0.020)
Component Base Height       H1      0.746 (+/- 0.020)
Component Alignment ( side/side )  PD  0.040 (max)
Component Alignment ( front/back )  HD  0.031 (max)
Component Pitch            P       0.040 (+/- 0.020)
Feed Hole Pitch            P0      0.031 (max)
Hole Center to First Lead  P1      0.150 (+/-0.009, -0.010)
Hole Center to Component Center  P2  0.247 (+/- 0.007)
Lead Spread                P1-P2    0.124 (+/- 0.010)
Lead Thickness             d       0.018 (+/- 0.002, -0.003)
Cut Lead Length            L       0.429 (max)
Tapped Lead Length         L1      0.209 (+/-0.051, -0.052)
Tapped Lead Thickness       t1     0.032 (+/- 0.006)
Carrier Tape Thickness      t2     0.032 (+/- 0.006)
Carrier Tape Width         W       0.726 (+/-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      0.030 (+/- 0.025)
Spikeed Hole Diameter      D0      0.157 (+/-0.008, -0.007)
Lead Spring Out            S       0.024 (max)

Note: All dimensions are in inches.

ITEM DESCRIPTION          SYMBOL   MINIMUM   MAXIMUM
Reel Diameter              D4      13.975     14.025
Core Diameter (Standard)   D2      1.160      1.300
Core Diameter (Small Hole) D2      0.600      0.700
Hub Recess Inner Diameter  D4      3.100      3.300
Hub Recess Depth           W1      0.700      0.570
Flange to Flange Inner Width W2     1.620      1.850
Hub to Hub Center Width    W3      2.090

Note: All dimensions are inches

July 1999, Rev. A
SOT-23 Packaging Configuration: Figure 10

**SOT-23 Tape and Reel Data**

**SOT-23 Packaging Information**

<table>
<thead>
<tr>
<th>Packaging/Option</th>
<th>Standard</th>
<th>D87Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging Type</td>
<td>TNR</td>
<td>TNR</td>
</tr>
<tr>
<td>Qty per Reel/Tube/Bag</td>
<td>3,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Reel Diameter (mm)</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>0.4006</td>
</tr>
</tbody>
</table>

**Note/Comments**

**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 multi-layer film (Heat Activated Adhesive in nature primarily composed of polyolefin film, adhesive layer, sealant, and anti-static agent). These taped 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 polyolefin plastic (anti-static coated). Other option comes in 10,000 units per 13" or 330cm diameter reel. This and some other options are described in the Reel Configuration table.

These full reels are individually labeled and placed inside a standard intermediate case 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 and Reel Data, continued

**SOT-23 Embossed Carrier Tape**

Configuration: Figure 3.0

#### Dimensions are in millimeter

<table>
<thead>
<tr>
<th>Pkg type</th>
<th>A0 (±0.10)</th>
<th>B0 (±0.10)</th>
<th>W (±0.3)</th>
<th>D0 (±0.05)</th>
<th>D1 (±0.125)</th>
<th>E1 (±0.10)</th>
<th>E2 (±0.05)</th>
<th>F (±0.1)</th>
<th>P1 (±0.10)</th>
<th>P0 (±0.05)</th>
<th>K0 (±0.05)</th>
<th>T (±0.10)</th>
<th>Wc (±0.05)</th>
<th>Tc (±0.10)</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>1.75</td>
<td>6.25 min</td>
<td>1.50</td>
<td>4.0</td>
<td>4.0</td>
<td>1.35</td>
<td>0.238</td>
<td>5.2</td>
<td>6.25</td>
<td>3.50</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).

### SOT-23 Reel Configuration: Figure 4.0

#### Dimensions are in inches and millimeters

<table>
<thead>
<tr>
<th>Tape Size</th>
<th>7” Diameter</th>
<th>13” Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dim A</td>
<td>Dim B</td>
<td>Dim C</td>
</tr>
<tr>
<td>8mm</td>
<td>7.00</td>
<td>0.059</td>
</tr>
<tr>
<td></td>
<td>1.77</td>
<td>1.5</td>
</tr>
</tbody>
</table>

#### Notes
- Tc: 0.06 ± 0.02
- Wc: 0.65 ± 0.05
- W2: max Measured at Hub

September 1999, Rev. C
SOT-23 (FS PKG Code 49)

Part Weight per unit (gram): 0.0082

Dimensions shown below are in:

- inches [millimeters]

Scale 1:1 on letter size paper

NOTE: UNLESS OTHERWISE SPECIFIED
1. STANDARD LEAD FINISH: 150 MICRONCHES / 3.81 MICROMETERS
   MINIMUM TIN / LEAD (SOLDER) ON ALLOY 42
2. REFERENCE: JEDEC REGISTRATION TO-236, VARIATION AB, ISSUE C, DATED JUL 1993
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SuperSOT™-6
SuperSOT™-8

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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>
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</tr>
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