

PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR
Features

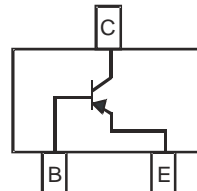
- Epitaxial Planar Die Construction
- Complementary NPN Type Available (MMBT3904)
- Ideal for Low Power Amplification and Switching
- **Lead, Halogen and Antimony Free, RoHS Compliant (Note 2)**
- **“Green” Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

Mechanical Data

- Case: SOT-23
- Case Material: Molded Plastic, “Green” Molding Compound, (Note 3). UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminal Connections: See Diagram
- Terminals: Lead Free Plating (Matte Tin Finish annealed over Alloy 42 leadframe). Solderable per MIL-STD-202, Method 208
- Marking Information: See Page 3
- Ordering Information: See Page 3
- Weight: 0.008 grams (approximate)



Top View



Device Schematic

Maximum Ratings @ $T_A = 25^\circ\text{C}$ unless otherwise specified

| Characteristic | Symbol | Value | Unit |
|---|-----------|-------|------|
| Collector-Base Voltage | V_{CBO} | -40 | V |
| Collector-Emitter Voltage | V_{CEO} | -40 | V |
| Emitter-Base Voltage | V_{EBO} | -5.0 | V |
| Collector Current - Continuous (Note 1) | I_C | -200 | mA |

Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|--|-----------------|-------------|--------------------|
| Power Dissipation (Note 1) | P_D | 300 | mW |
| Thermal Resistance, Junction to Ambient (Note 1) | $R_{\theta JA}$ | 417 | $^\circ\text{C/W}$ |
| Operating and Storage and Temperature Range | T_J, T_{STG} | -55 to +150 | $^\circ\text{C}$ |

- Notes:
1. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch; pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.
 2. No purposefully added lead.
 3. Product manufactured with Data Code V9 (week 33, 2008) and newer are built with Green Molding Compound. Product manufactured prior to Date Code V9 are built with Non-Green Molding Compound and may contain Halogens or Sb_2O_3 Fire Retardants.

Electrical Characteristics @ $T_A = 25^\circ\text{C}$ unless otherwise specified

| Characteristic | Symbol | Min | Max | Unit | Test Condition |
|--|---------------|------------|----------------|------------------|---|
| OFF CHARACTERISTICS | | | | | |
| Collector-Base Breakdown Voltage | $V_{(BR)CBO}$ | -40 | — | V | $I_C = -10\mu\text{A}, I_E = 0$ |
| Collector-Emitter Breakdown Voltage (Note 4) | $V_{(BR)CEO}$ | -40 | — | V | $I_C = -1.0\text{mA}, I_B = 0$ |
| Emitter-Base Breakdown Voltage | $V_{(BR)EBO}$ | -5.0 | — | V | $I_E = -10\mu\text{A}, I_C = 0$ |
| Collector Cutoff Current | I_{CEX} | — | -50 | nA | $V_{CE} = -30\text{V}, V_{EB(OFF)} = -3.0\text{V}$ |
| | I_{CBO} | — | -50 | nA | $V_{CB} = -30\text{V}, I_E = 0$ |
| Base Cutoff Current | I_{BL} | — | -50 | nA | $V_{CE} = -30\text{V}, V_{EB(OFF)} = -3.0\text{V}$ |
| ON CHARACTERISTICS (Note 4) | | | | | |
| DC Current Gain | h_{FE} | 60 | — | — | $I_C = -100\mu\text{A}, V_{CE} = -1.0\text{V}$ |
| | | 80 | — | | $I_C = -1.0\text{mA}, V_{CE} = -1.0\text{V}$ |
| | | 100 | 300 | | $I_C = -10\text{mA}, V_{CE} = -1.0\text{V}$ |
| | | 60 | — | | $I_C = -50\text{mA}, V_{CE} = -1.0\text{V}$ |
| | | 30 | — | | $I_C = -100\text{mA}, V_{CE} = -1.0\text{V}$ |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | — | -0.25 -0.40 | V | $I_C = -10\text{mA}, I_B = -1.0\text{mA}$ $I_C = -50\text{mA}, I_B = -5.0\text{mA}$ |
| Base-Emitter Saturation Voltage | $V_{BE(SAT)}$ | -0.65 — | -0.85 -0.95 | V | $I_C = -10\text{mA}, I_B = -1.0\text{mA}$ $I_C = -50\text{mA}, I_B = -5.0\text{mA}$ |
| SMALL SIGNAL CHARACTERISTICS | | | | | |
| Output Capacitance | C_{obo} | — | 4.5 | pF | $V_{CB} = -5.0\text{V}, f = 1.0\text{MHz}, I_E = 0$ |
| Input Capacitance | C_{ibo} | — | 10 | pF | $V_{EB} = -0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$ |
| Input Impedance | h_{ie} | 2.0 | 12 | k Ω | $V_{CE} = 10\text{V}, I_C = 1.0\text{mA},$ $f = 1.0\text{kHz}$ |
| Voltage Feedback Ratio | h_{re} | 0.1 | 10 | $\times 10^{-4}$ | |
| Small Signal Current Gain | h_{fe} | 100 | 400 | — | |
| Output Admittance | h_{oe} | 3.0 | 60 | μS | |
| Current Gain-Bandwidth Product | f_T | 250 | — | MHz | |
| Noise Figure | NF | — | 4.0 | dB | $V_{CE} = -5.0\text{V}, I_C = -100\mu\text{A},$ $R_S = 1.0\text{k}\Omega, f = 1.0\text{kHz}$ |
| SWITCHING CHARACTERISTICS | | | | | |
| Delay Time | t_d | — | 35 | ns | $V_{CC} = -3.0\text{V}, I_C = -10\text{mA},$ |
| Rise Time | t_r | — | 35 | ns | $V_{BE(off)} = 0.5\text{V}, I_{B1} = -1.0\text{mA}$ |
| Storage Time | t_s | — | 225 | ns | $V_{CC} = -3.0\text{V}, I_C = -10\text{mA},$ |
| Fall Time | t_f | — | 75 | ns | $I_{B1} = I_{B2} = -1.0\text{mA}$ |

Notes: 4. Short duration pulse test used to minimize self-heating effect.

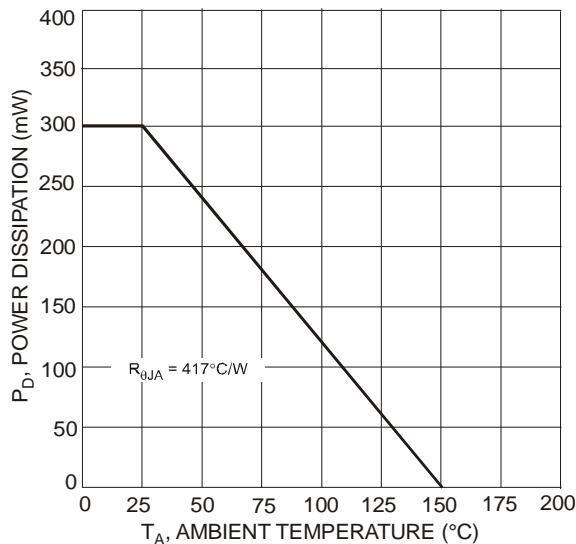


Fig. 1 Power Dissipation vs. Ambient Temperature (Note 1)

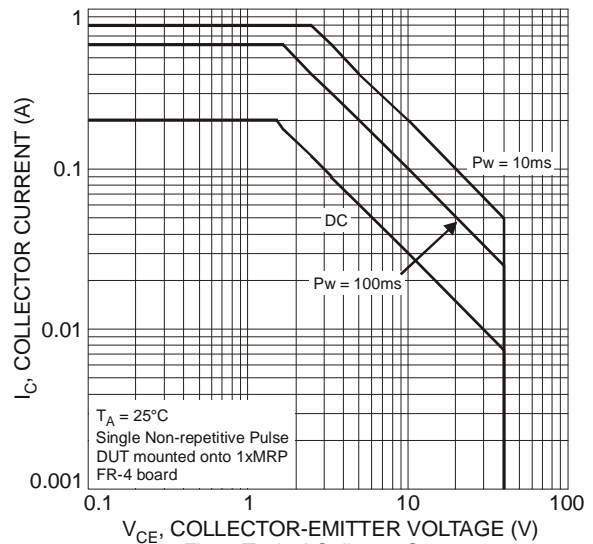


Fig. 2 Typical Collector Current vs. Collector-Emitter Voltage

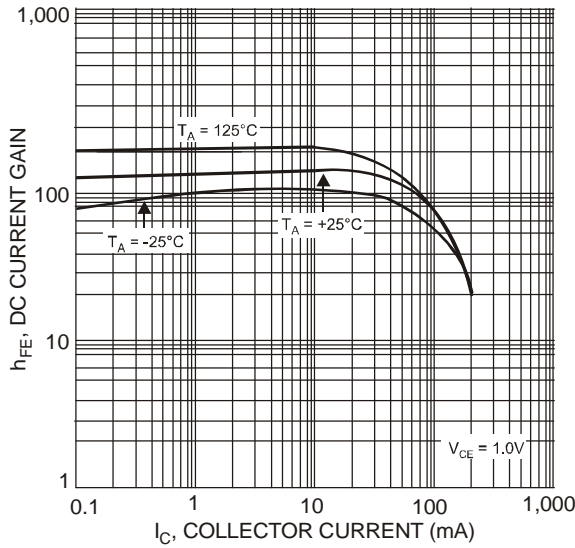


Fig. 3 Typical DC Current Gain vs. Collector Current (DRDP02W)

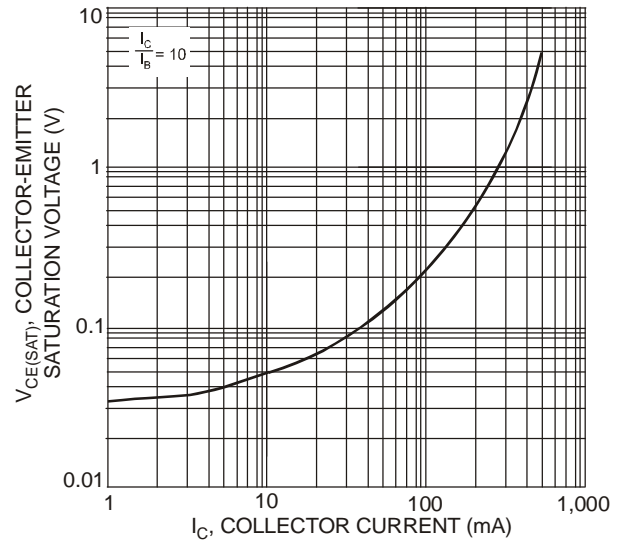


Fig. 4 Typical Collector-Emitter Saturation Voltage vs. Collector Current

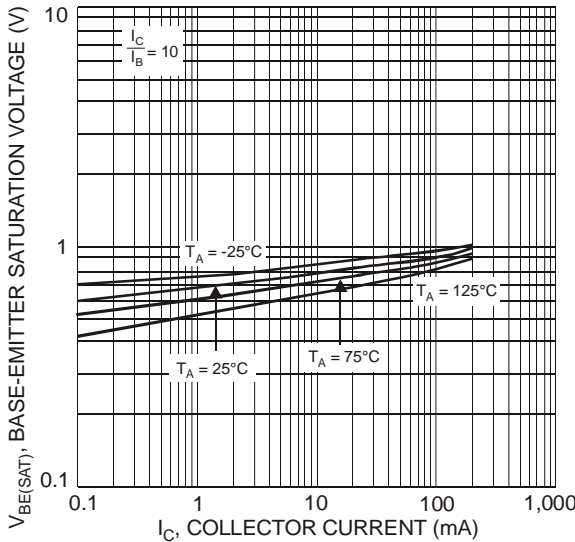


Fig. 5 Typical Base-Emitter Saturation Voltage vs. Collector Current

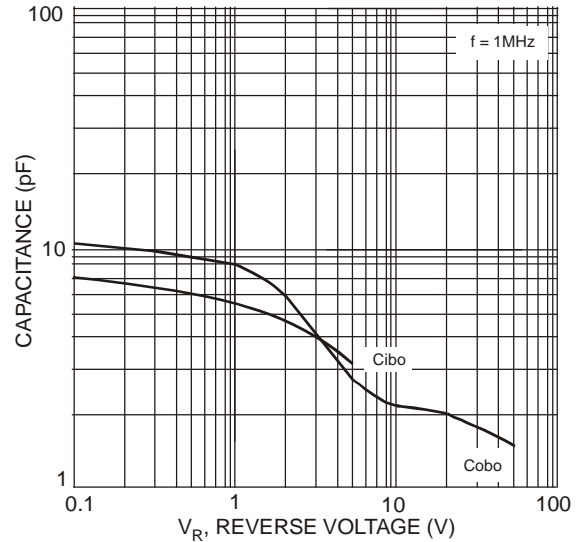


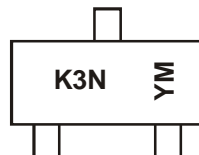
Fig. 6 Typical Capacitance Characteristics

Ordering Information (Note 5)

| Part Number | Case | Packaging |
|---------------|--------|------------------|
| MMBT3906 -7-F | SOT-23 | 3000/Tape & Reel |

Notes: 5. For packaging details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

Marking Information

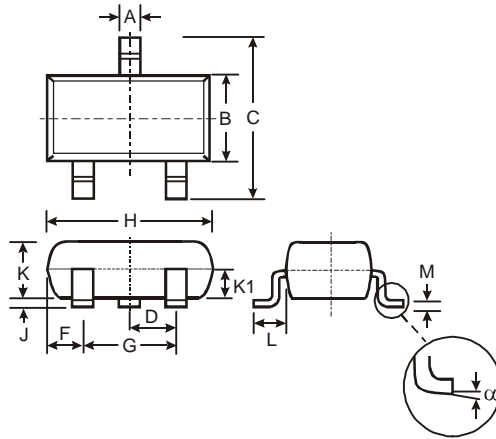


K3N = Product Type Marking Code
 YM = Date Code Marking
 Y = Year (ex: N = 2002)
 M = Month (ex: 9 = September)

Date Code Key

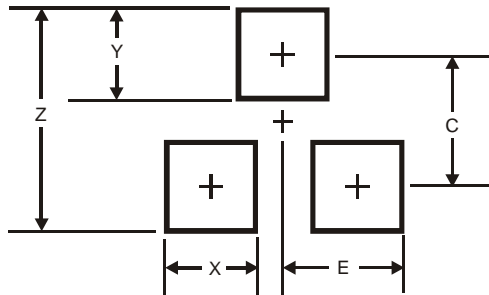
| Year | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Code | J | K | L | M | N | P | R | S | T | U | V | W | X | Y | Z | A | B | C |
| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | | | | | |
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D | | | | | | |

Package Outline Dimensions



| SOT-23 | | | |
|----------------------|-------|------|-------|
| Dim | Min | Max | Typ |
| A | 0.37 | 0.51 | 0.40 |
| B | 1.20 | 1.40 | 1.30 |
| C | 2.30 | 2.50 | 2.40 |
| D | 0.89 | 1.03 | 0.915 |
| F | 0.45 | 0.60 | 0.535 |
| G | 1.78 | 2.05 | 1.83 |
| H | 2.80 | 3.00 | 2.90 |
| J | 0.013 | 0.10 | 0.05 |
| K | 0.903 | 1.10 | 1.00 |
| K1 | - | - | 0.400 |
| L | 0.45 | 0.61 | 0.55 |
| M | 0.085 | 0.18 | 0.11 |
| α | 0° | 8° | - |
| All Dimensions in mm | | | |

Suggested Pad Layout



| Dimensions | Value (in mm) |
|------------|---------------|
| Z | 2.9 |
| X | 0.8 |
| Y | 0.9 |
| C | 2.0 |
| E | 1.35 |

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