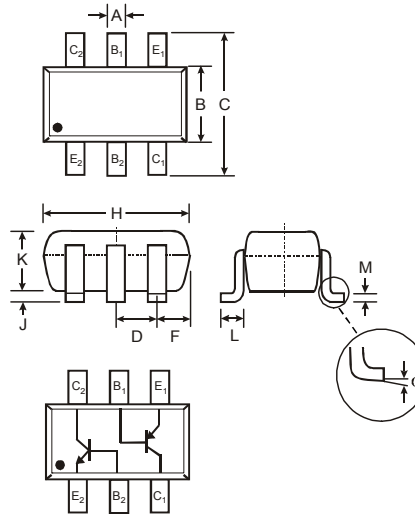


COMPLEMENTARY NPN / PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR
Features

- Complementary Pair One 3904-Type NPN
One 3906-Type PNP
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching
- Ultra-Small Surface Mount Package
- Lead Free/RoHS Compliant (Note 3)**
- "Green" Device (Note 4 and 5)**

Mechanical Data

- Case: SOT-363
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminals: Solderable per MIL-STD-202, Method 208
- Lead Free Plating (Matte Tin Finish annealed over Alloy 42 leadframe).
- Terminal Connections: See Diagram
- Marking Information: K46 - See Page 5
- Ordering & Date Code Information: See Page 5
- Weight: 0.006 grams (approximate)



E1, B1, C1 = PNP3906 Section
E2, B2, C2 = NPN3904 Section

| SOT-363 | | |
|----------------------|--------------|------|
| Dim | Min | Max |
| A | 0.10 | 0.30 |
| B | 1.15 | 1.35 |
| C | 2.00 | 2.20 |
| D | 0.65 Nominal | |
| F | 0.30 | 0.40 |
| H | 1.80 | 2.20 |
| J | — | 0.10 |
| K | 0.90 | 1.00 |
| L | 0.25 | 0.40 |
| M | 0.10 | 0.25 |
| α | 0° | 8° |
| All Dimensions in mm | | |

Maximum Ratings, NPN 3904 Section @T_A = 25°C unless otherwise specified

| Characteristic | Symbol | NPN 3904 Section | Unit |
|--|-----------------------------------|------------------|------|
| Collector-Base Voltage | V _{CBO} | 60 | V |
| Collector-Emitter Voltage | V _{CEO} | 40 | V |
| Emitter-Base Voltage | V _{EBO} | 6.0 | V |
| Collector Current - Continuous (Note 1) | I _C | 200 | mA |
| Power Dissipation (Note 1, 2) | P _d | 200 | mW |
| Thermal Resistance, Junction to Ambient (Note 1) | R _{θJA} | 625 | °C/W |
| Operating and Storage Temperature Range | T _J , T _{STG} | -55 to +150 | °C |

Maximum Ratings, PNP 3906 Section @T_A = 25°C unless otherwise specified

| Characteristic | Symbol | PNP 3906 Section | 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 |
| Power Dissipation (Note 1, 2) | P _d | 200 | mW |
| Thermal Resistance, Junction to Ambient (Note 1) | R _{θJA} | 625 | °C/W |
| Operating and Storage Temperature Range | T _J , T _{STG} | -55 to +150 | °C |

- Notes:
- 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>.
 - Maximum combined dissipation.
 - No purposefully added lead.
 - Diodes Inc.'s "Green" policy can be found on our website at http://www.diodes.com/products/lead_free/index.php.
 - Product manufactured with Date Code UO (week 40, 2007) and newer are built with Green Molding Compound. Product manufactured prior to Date Code UO are built with Non-Green Molding Compound and may contain Halogens or Sb2O3 Fire Retardants.

Electrical Characteristics, NPN 3904 Section @T_A = 25°C unless otherwise specified

| Characteristic | Symbol | Min | Max | Unit | Test Condition |
|--------------------------------------|----------------------|-----------------------------|-------------------------|--------------------|--|
| OFF CHARACTERISTICS (Note 6) | | | | | |
| Collector-Base Breakdown Voltage | V _{(BR)CBO} | 60 | — | V | I _C = 10μA, I _E = 0 |
| Collector-Emitter Breakdown Voltage | V _{(BR)CEO} | 40 | — | V | I _C = 1.0mA, I _B = 0 |
| Emitter-Base Breakdown Voltage | V _{(BR)EBO} | 5.0 | 6.0 | V | I _E = 10μA, I _C = 0 |
| Collector Cutoff Current | I _{CEX} | — | 50 | nA | V _{CE} = 30V, V _{EB(OFF)} = 3.0V |
| Base Cutoff Current | I _{BL} | — | 50 | nA | V _{CE} = 30V, V _{EB(OFF)} = 3.0V |
| ON CHARACTERISTICS (Note 6) | | | | | |
| DC Current Gain | h _{FE} | 40 70 100 60 30 | — — 300 — — | — | I _C = 100μA, V _{CE} = 1.0V I _C = 1.0mA, V _{CE} = 1.0V I _C = 10mA, V _{CE} = 1.0V I _C = 50mA, V _{CE} = 1.0V I _C = 100mA, V _{CE} = 1.0V |
| Collector-Emitter Saturation Voltage | V _{CE(SAT)} | — | 0.20 0.30 | V | I _C = 10mA, I _B = 1.0mA I _C = 50mA, I _B = 5.0mA |
| Base-Emitter Saturation Voltage | V _{BE(SAT)} | 0.65 — | 0.85 0.95 | V | I _C = 10mA, I _B = 1.0mA I _C = 50mA, I _B = 5.0mA |
| SMALL SIGNAL CHARACTERISTICS | | | | | |
| Output Capacitance | C _{obo} | — | 4.0 | pF | V _{CB} = 5.0V, f = 1.0MHz, I _E = 0 |
| Input Capacitance | C _{ibo} | — | 8.0 | pF | V _{EB} = 0.5V, f = 1.0MHz, I _C = 0 |
| Input Impedance | h _{ie} | 1.0 | 10 | kΩ | V _{CE} = 10V, I _C = 1.0mA, f = 1.0kHz |
| Voltage Feedback Ratio | h _{re} | 0.5 | 8.0 | x 10 ⁻⁴ | |
| Small Signal Current Gain | h _{fe} | 100 | 400 | — | |
| Output Admittance | h _{oe} | 1.0 | 40 | μS | |
| Current Gain-Bandwidth Product | f _T | 300 | — | MHz | V _{CE} = 20V, I _C = 20mA, f = 100MHz |
| Noise Figure | NF | — | 5.0 | dB | V _{CE} = 5.0V, I _C = 100μA, R _S = 1.0kΩ, f = 1.0kHz |
| SWITCHING CHARACTERISTICS | | | | | |
| Delay Time | t _d | — | 35 | ns | V _{CC} = 3.0V, I _C = 10mA, |
| Rise Time | t _r | — | 35 | ns | V _{BE(off)} = -0.5V, I _{B1} = 1.0mA |
| Storage Time | t _s | — | 200 | ns | V _{CC} = 3.0V, I _C = 10mA, I _{B1} = I _{B2} = 1.0mA |
| Fall Time | t _f | — | 50 | ns | |

Notes: 6. Short duration pulse test used to minimize self-heating effect.

Electrical Characteristics, PNP 3906 Section @T_A = 25°C unless otherwise specified

| Characteristic | Symbol | Min | Max | Unit | Test Condition |
|--------------------------------------|----------------------|-----------------------------|-------------------------|--------------------|--|
| OFF CHARACTERISTICS (Note 6) | | | | | |
| Collector-Base Breakdown Voltage | V _{(BR)CBO} | -40 | — | V | I _C = -10μA, I _E = 0 |
| Collector-Emitter Breakdown Voltage | V _{(BR)CEO} | -40 | — | V | I _C = -1.0mA, I _B = 0 |
| Emitter-Base Breakdown Voltage | V _{(BR)EBO} | -5.0 | — | V | I _E = -10μA, I _C = 0 |
| Collector Cutoff Current | I _{CEX} | — | -50 | nA | V _{CE} = -30V, V _{EB(OFF)} = -3.0V |
| Base Cutoff Current | I _{BL} | — | -50 | nA | V _{CE} = -30V, V _{EB(OFF)} = -3.0V |
| ON CHARACTERISTICS (Note 6) | | | | | |
| DC Current Gain | h _{FE} | 60 80 100 60 30 | — — 300 — — | — | I _C = -100μA, V _{CE} = -1.0V I _C = -1.0mA, V _{CE} = -1.0V I _C = -10mA, V _{CE} = -1.0V I _C = -50mA, V _{CE} = -1.0V I _C = -100mA, V _{CE} = -1.0V |
| Collector-Emitter Saturation Voltage | V _{CE(SAT)} | — | -0.25 -0.40 | V | I _C = -10mA, I _B = -1.0mA I _C = -50mA, I _B = -5.0mA |
| Base-Emitter Saturation Voltage | V _{BE(SAT)} | -0.65 | -0.85 -0.95 | V | I _C = -10mA, I _B = -1.0mA I _C = -50mA, I _B = -5.0mA |
| SMALL SIGNAL CHARACTERISTICS | | | | | |
| Output Capacitance | C _{obo} | — | 4.5 | pF | V _{CB} = -5.0V, f = 1.0MHz, I _E = 0 |
| Input Capacitance | C _{ibo} | — | 10 | pF | V _{EB} = -0.5V, f = 1.0MHz, I _C = 0 |
| Input Impedance | h _{ie} | 2.0 | 12 | kΩ | V _{CE} = 10V, I _C = 1.0mA, f = 1.0kHz |
| Voltage Feedback Ratio | h _{re} | 0.1 | 10 | x 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 | V _{CE} = -20V, I _C = -10mA, f = 100MHz |
| Noise Figure | NF | — | 4.0 | dB | V _{CE} = -5.0V, I _C = -100μA, R _S = 1.0kΩ, f = 1.0kHz |
| SWITCHING CHARACTERISTICS | | | | | |
| Delay Time | t _d | — | 35 | ns | V _{CC} = -3.0V, I _C = -10mA, V _{BE(off)} = 0.5V, I _{B1} = -1.0mA |
| Rise Time | t _r | — | 35 | ns | V _{CC} = -3.0V, I _C = -10mA, I _{B1} = I _{B2} = -1.0mA |
| Storage Time | t _s | — | 225 | ns | |
| Fall Time | t _f | — | 75 | ns | |

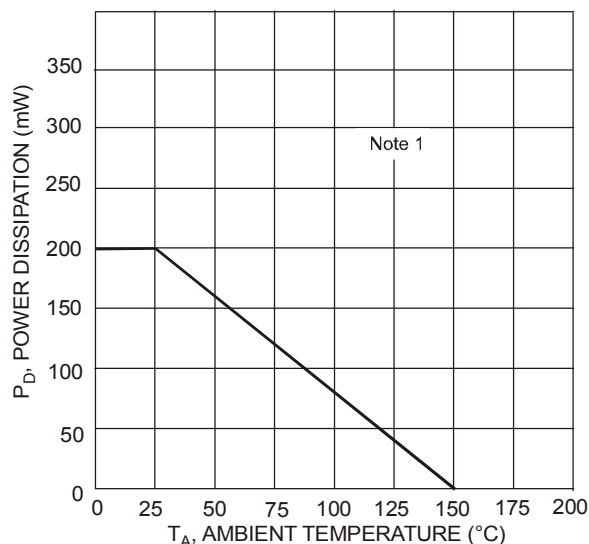


Fig. 1, Max Power Dissipation vs. Ambient Temperature (Total Device)

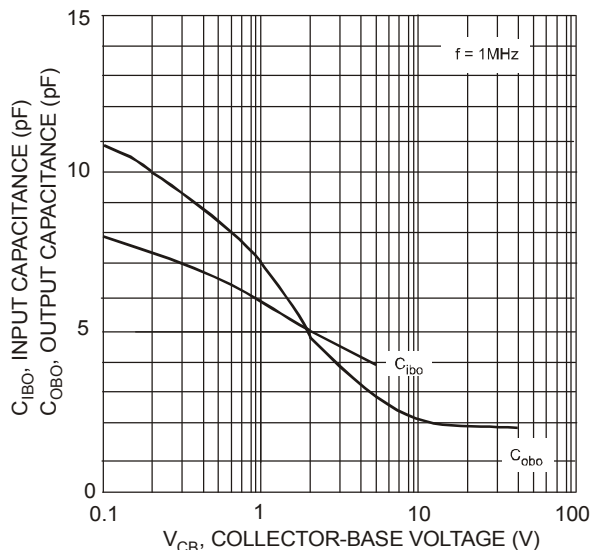


Fig. 2, Input and Output Capacitance vs. Collector-Base Voltage (NPN-3904)

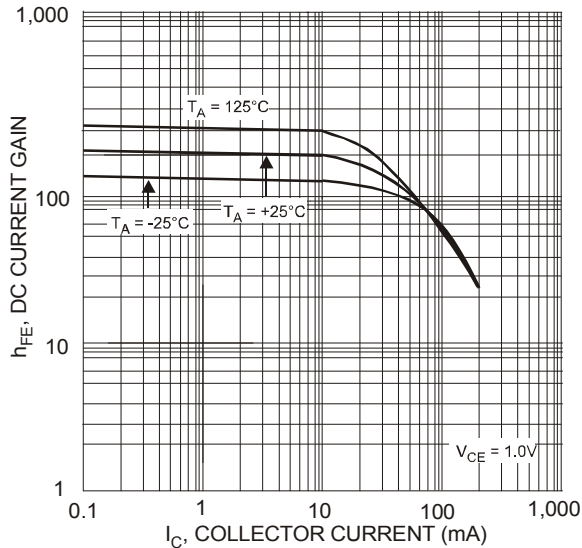


Fig. 3, Typical DC Current Gain vs. Collector Current (NPN-3904)

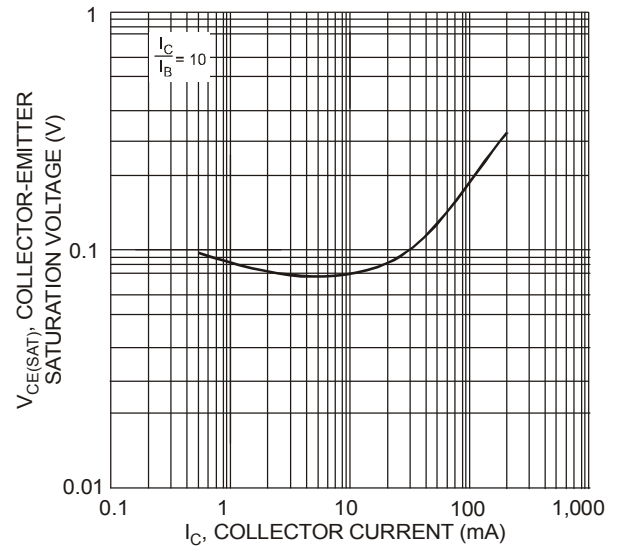


Fig. 4, Typical Collector-Emitter Saturation Voltage vs. Collector Current (NPN-3904)

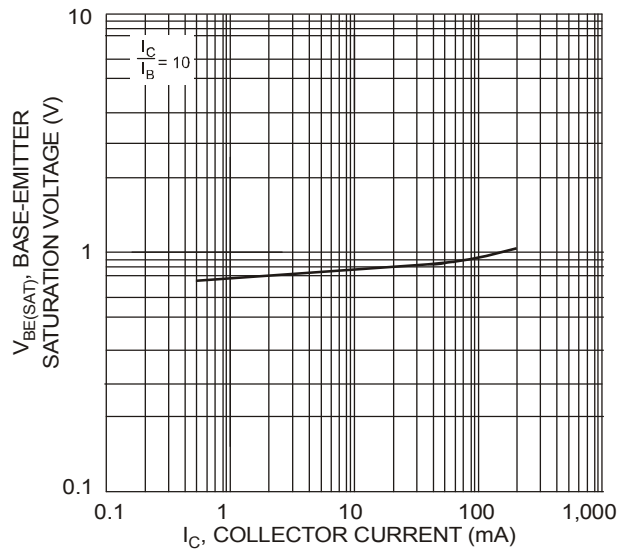


Fig. 5, Typical Base-Emitter Saturation Voltage vs. Collector Current (NPN-3904)

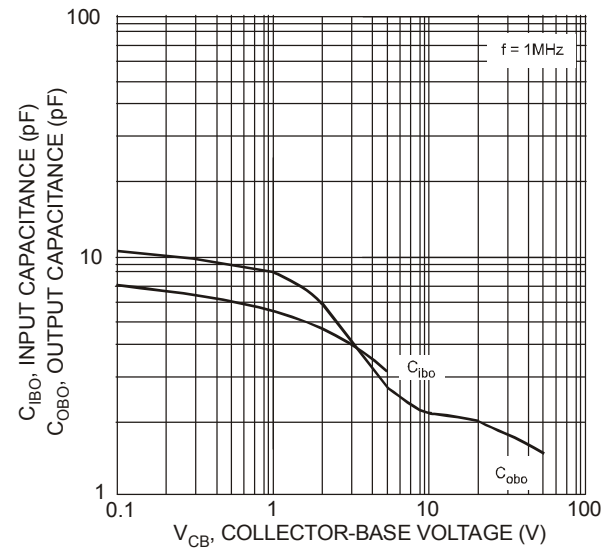


Fig. 6, Input and Output Capacitance vs. Collector-Base Voltage (PNP-3906)

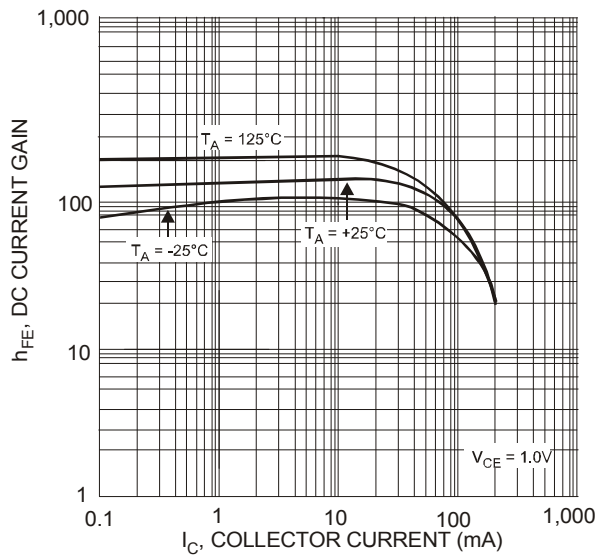


Fig. 7, Typical DC Current Gain vs. Collector Current (PNP-3906)

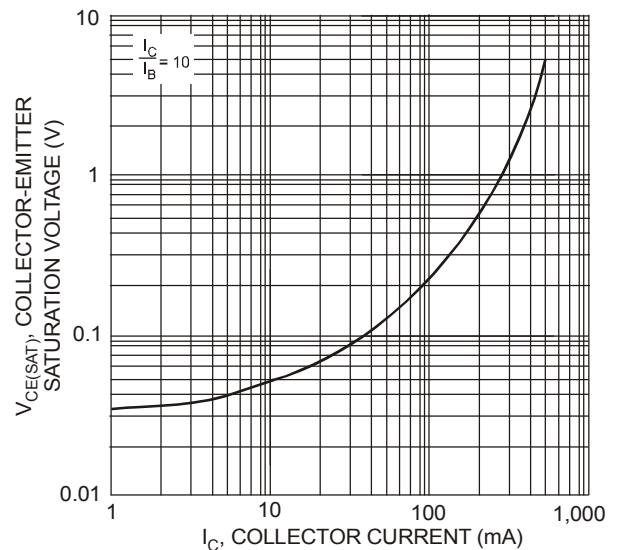


Fig. 8, Typical Collector-Emitter Saturation Voltage vs. Collector Current (PNP-3906)

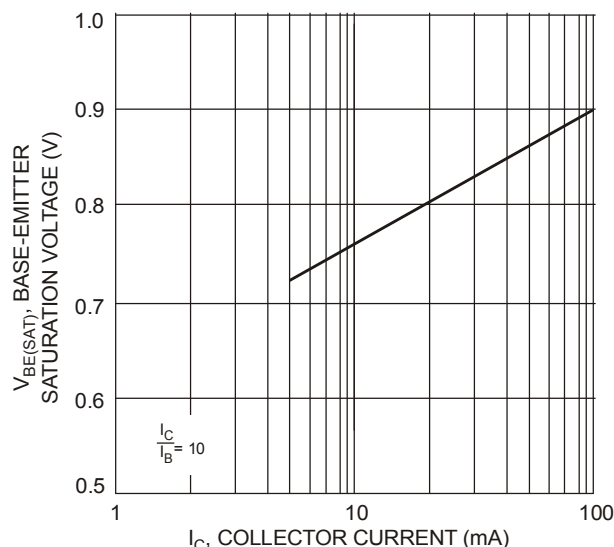


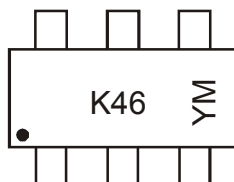
Fig. 9, Typical Base-Emitter Saturation Voltage vs. Collector Current (PNP-3906)

Ordering Information (Note 7)

| Device | Packaging | Shipping |
|--------------|-----------|------------------|
| MMDT3946-7-F | SOT-363 | 3000/Tape & Reel |

Notes: 7. For packaging details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

Marking Information



K46 = 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 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Code | J | K | L | M | N | P | R | S | T | U | V | W | X | Y | Z |

| 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 |

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