FAIRCHILD SEMICONDUCTOR®

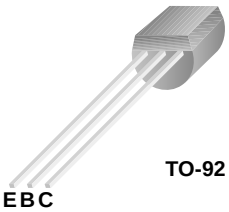
October 2011

# 2N3906 / MMBT3906 / PZT3906
# PNP General Purpose Amplifier

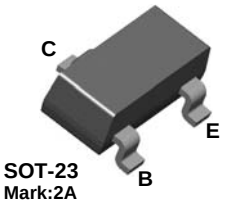
## Features

- This device is designed for general purpose amplifier and switching applications at collector currents of 10μA to 100 mA.

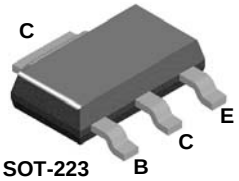
**2N3906**




**MMBT3906**




**PZT3906**




## Absolute Maximum Ratings* $T_a$ = 25°C unless otherwise noted

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{CEO}$ | Collector-Emitter Voltage | -40 | V |
| $V_{CBO}$ | Collector-Base Voltage | -40 | V |
| $V_{EBO}$ | Emitter-Base Voltage | -5.0 | V |
| $I_C$ | Collector Current - Continuous | -200 | mA |
| $T_J$, $T_{stg}$ | Operating and Storage Junction Temperature Range | -55 to +150 | °C |

* 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 $T_a$ = 25°C unless otherwise noted

| Symbol | Parameter | Max. | | | Units |
|---|---|---|---|---|---|
| | | 2N3906 | *MMBT3906 | **PZT3906 | |
| $P_D$ | Total Device Dissipation<br>Derate above 25°C | 625<br>5.0 | 350<br>2.8 | 1,000<br>8.0 | mW<br>mW/°C |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 83.3 | | | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 200 | 357 | 125 | °C/W |

* Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06".

** Device mounted on FR-4 PCB 36 mm X 18 mm X 1.5 mm; mounting pad for the collector lead min. 6 $cm^2$.

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## Electrical Characteristics $T_a$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Condition | Min. | Max. | Units |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage* | $I_C$ = -1.0mA, $I_B$ = 0 | -40 | | V |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | $I_C$ = -10μA, $I_E$ = 0 | -40 | | V |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | $I_E$ = -10μA, $I_C$ = 0 | -5.0 | | V |
| $I_{BL}$ | Base Cutoff Current | $V_{CE}$ = -30V, $V_{BE}$ = -3.0V | | -50 | nA |
| $I_{CEX}$ | Collector Cutoff Current | $V_{CE}$ = -30V, $V_{BE}$ = -3.0V | | -50 | nA |
| **ON CHARACTERISTICS** | | | | | |
| $h_{FE}$ | DC Current Gain* | $I_C$ = -0.1mA, $V_{CE}$ = -1.0V<br>$I_C$ = -1.0mA, $V_{CE}$ = -1.0V<br>$I_C$ = -10mA, $V_{CE}$ = -1.0V<br>$I_C$ = -50mA, $V_{CE}$ = -1.0V<br>$I_C$ = -100mA, $V_{CE}$ = -1.0V | 60<br>80<br>100<br>60<br>30 | 300 | |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C$ = -10mA, $I_B$ = -1.0mA<br>$I_C$ = -50mA, $I_B$ = -5.0mA | | -0.25<br>-0.4 | V<br>V |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage | $I_C$ = -10mA, $I_B$ = -1.0mA<br>$I_C$ = -50mA, $I_B$ = -5.0mA | -0.65 | -0.85<br>-0.95 | V<br>V |
| **SMALL SIGNAL CHARACTERISTICS** | | | | | |
| $f_T$ | Current Gain - Bandwidth Product | $I_C$ = -10mA, $V_{CE}$ = -20V, f = 100MHz | 250 | | MHz |
| $C_{obo}$ | Output Capacitance | $V_{CB}$ = -5.0V, $I_E$ = 0, f = 100kHz | | 4.5 | pF |
| $C_{ibo}$ | Input Capacitance | $V_{EB}$ = -0.5V, $I_C$ = 0, f = 100kHz | | 10.0 | pF |
| NF | Noise Figure | $I_C$ = -100μA, $V_{CE}$ = -5.0V, $R_S$ = 1.0kΩ, f = 10Hz to 15.7kHz | | 4.0 | dB |
| **SWITCHING CHARACTERISTICS** | | | | | |
| $t_d$ | Delay Time | $V_{CC}$ = -3.0V, $V_{BE}$ = -0.5V<br>$I_C$ = -10mA, $I_{B1}$ = -1.0mA | | 35 | ns |
| $t_r$ | Rise Time | | | 35 | ns |
| $t_s$ | Storage Time | $V_{CC}$ = -3.0V, $I_C$ = -10mA,<br>$I_{B1}$ = $I_{B2}$ = -1.0mA | | 225 | ns |
| $t_f$ | Fall Time | | | 75 | ns |

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

## Ordering Information

| Part Number | Marking | Package | Packing Method | Pack Qty |
|---|---|---|---|---|
| 2N3906BU | 2N3906 | TO-92 | BULK | 10000 |
| 2N3906TA | 2N3906 | TO-92 | AMMO | 2000 |
| 2N3906TAR | 2N3906 | TO-92 | AMMO | 2000 |
| 2N3906TF | 2N3906 | TO-92 | TAPE REEL | 2000 |
| 2N3906TFR | 2N3906 | TO-92 | TAPE REEL | 2000 |
| MMBT3906 | 2A | SOT-23 | TAPE REEL | 3000 |
| PZT3906 | 3906 | SOT-223 | TAPE REEL | 2500 |

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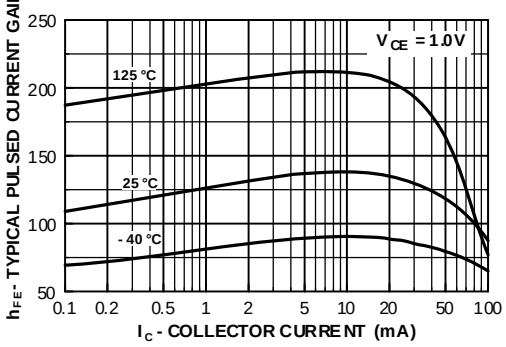
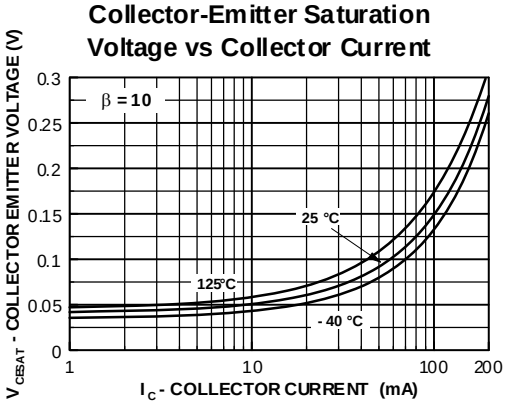
## Typical Performance Characteristics

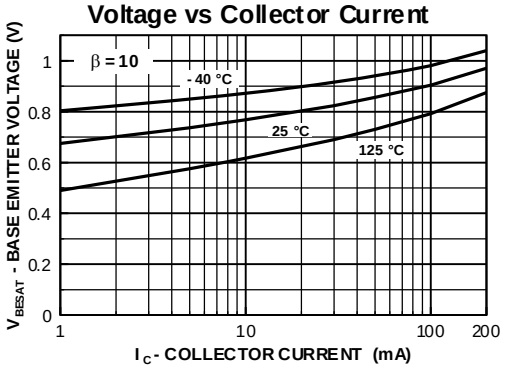
**Typical Pulsed Current Gain vs Collector Current**



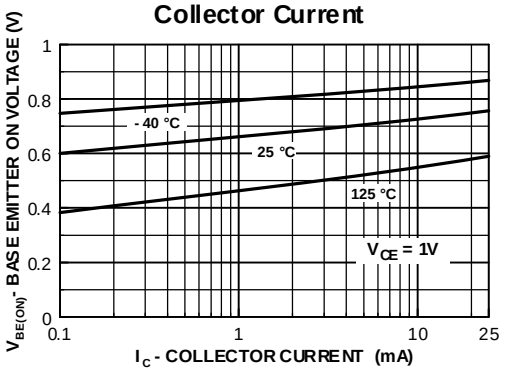

**Collector-Emitter Saturation Voltage vs Collector Current**



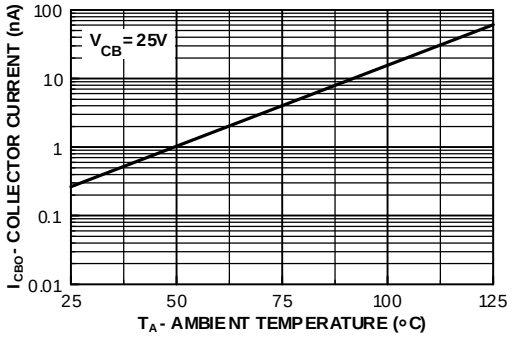

**Base-Emitter Saturation Voltage vs Collector Current**



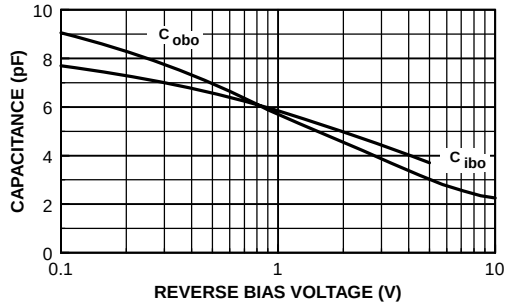

**Base Emitter ON Voltage vs Collector Current**




**Collector-Cutoff Current vs Ambient Temperature**




**Common-Base Open Circuit Input and Output Capacitance vs Reverse Bias Voltage**

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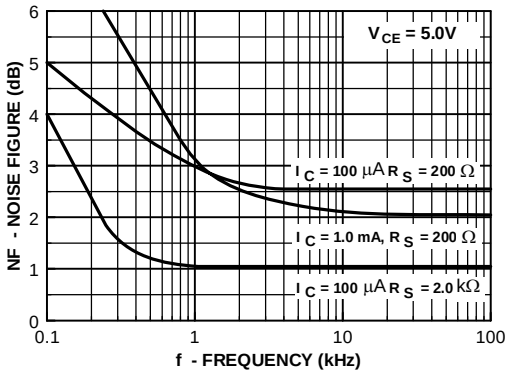
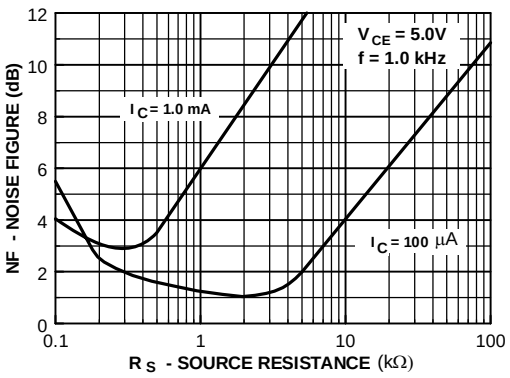
## Typical Performance Characteristics (continued)

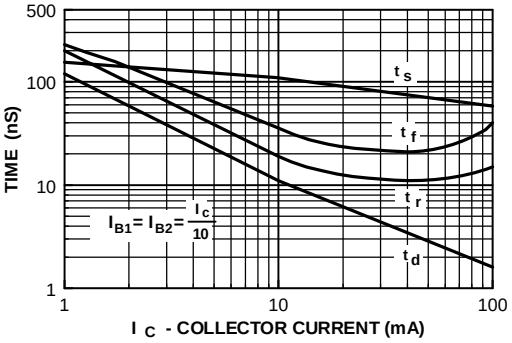
**Noise Figure vs Frequency**



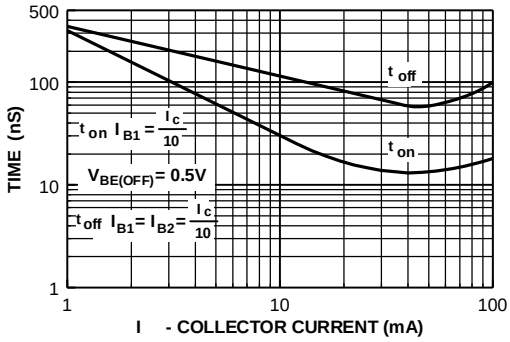

**Noise Figure vs Source Resistance**



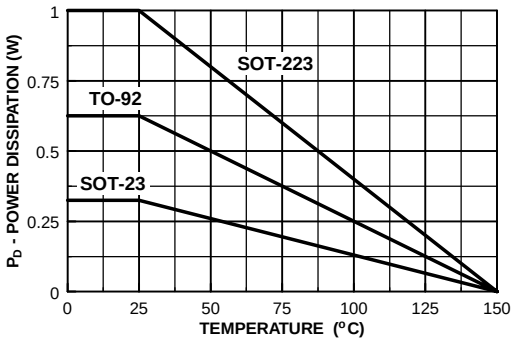

**Switching Times vs Collector Current**




**Turn On and Turn Off Times vs Collector Current**




**Power Dissipation vs Ambient Temperature**

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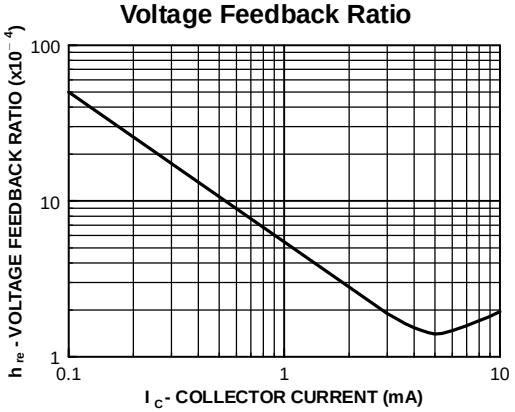
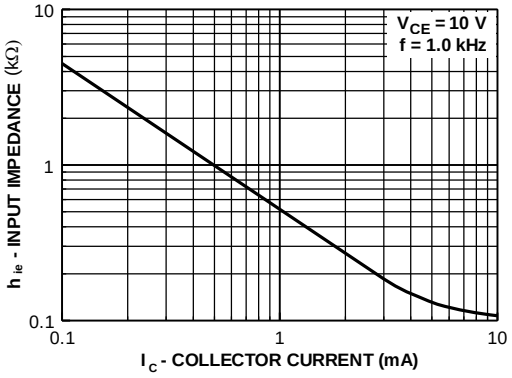
## Typical Performance Characteristics (continued)

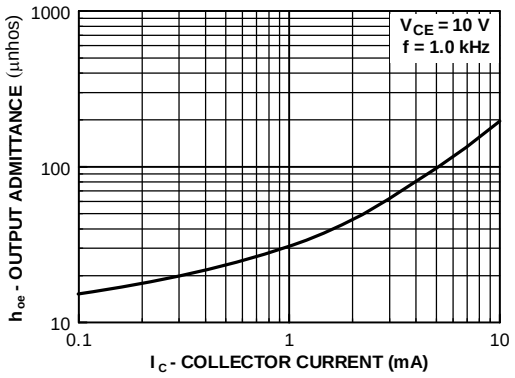
**Voltage Feedback Ratio**



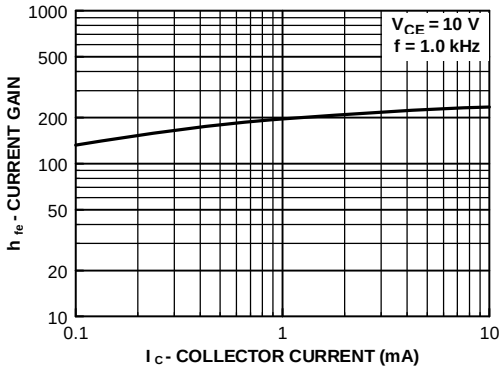

**Input Impedance**




**Output Admittance**




**Current Gain**

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