Micro Commercial Components
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# MMDT3946

## NPN/PNP Small Signal Surface Mount Transistors

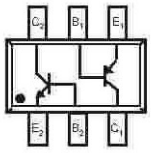
## Features

- Halogen free available upon request by adding suffix "-HF"
- Lead Free Finish/RoHS Compliant ("P" Suffix designates RoHS Compliant. See ordering information)
- Complementary Pari: NPN(3904), PNP(3906)
- Ideal for Low Power Amplification and Switching
- Ultra-small Surface Mount Package
- Epitaxial Planar Die Construction
- Marking:K46
- Epoxy meets UL 94 V-0 flammability rating
- Moisure Sensitivity Level 1

## Maximum Ratings @ 25°C Unless Otherwise Specified

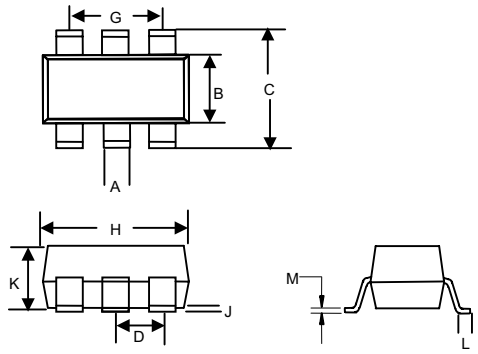
| Symbol | Rating | Rating(NPN) | Unit |
|---|---|---|---|
| $V_{CEO}$ | Collector-Emitter Voltage | 40 | V |
| $V_{CBO}$ | Collector-Base Voltage | 60 | V |
| $V_{EBO}$ | Emitter-Base Voltage | 6 | V |
| $I_C$ | Collector Current-Continuous | 0.2 | A |
| $P_C$ | Collector Dissipation | 0.2 | W |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient | 625 | ℃/W |
| $T_J$ | Operating Junction Temperature | -55 to +150 | ℃ |
| $T_{STG}$ | Storage Temperature | -55 to +150 | ℃ |

| Symbol | Rating | Rating(PNP) | Unit |
|---|---|---|---|
| $V_{CEO}$ | Collector-Emitter Voltage | -40 | V |
| $V_{CBO}$ | Collector-Base Voltage | -40 | V |
| $V_{EBO}$ | Emitter-Base Voltage | -5 | V |
| $I_C$ | Collector Current-Continuous | -0.2 | A |
| $P_C$ | Collector Dissipation | 0.2 | W |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient | 625 | ℃/W |
| $T_J$ | Operating Junction Temperature | -55 to +150 | ℃ |
| $T_{STG}$ | Storage Temperature | -55 to +150 | ℃ |




$E_1$, $B_1$, $C_1$ = PNP3906 Section
$E_2$, $B_2$, $C_2$ = NPN3904 Section

## SOT-363




| DIMENSIONS | | | | | |
|---|---|---|---|---|---|
| | INCHES | | MM | | |
| DIM | MIN | MAX | MIN | MAX | NOTE |
| A | .006 | .014 | 0.15 | 0.35 | |
| B | .045 | .053 | 1.15 | 1.35 | |
| C | .085 | .096 | 2.15 | 2.45 | |
| D | .026 | | 0.65Nominal | | |
| G | .047 | .055 | 1.20 | 1.40 | |
| H | .071 | .087 | 1.80 | 2.20 | |
| J | --- | .004 | --- | 0.10 | |
| K | .035 | .043 | 0.90 | 1.10 | |
| L | .010 | .018 | 0.26 | 0.46 | |
| M | .003 | .006 | 0.08 | 0.15 | |

## NPN 3904 Electrical Characteristics @ 25°C Unless Otherwise Specified

| Symbol | Parameter | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage<br>($I_C$=1mAdc, $I_B$=0) | | 40 | --- | --- | Vdc |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage<br>($I_C$=10uAdc, $I_E$=0) | | 60 | --- | --- | Vdc |
| $V_{(BR)EBO}$ | Collector-Emitter Breakdown Voltage<br>($I_E$=10uAdc, $I_C$=0) | | 5 | --- | --- | Vdc |
| $I_{CBO}$ | Collector Cutoff Current<br>($V_{CB}$=30Vdc,$I_E$=0) | | --- | --- | 50 | nAdc |
| $I_{CEO}$ | Collector Cutoff Current<br>($V_{CE}$=30Vdc,$I_B$=0) | | --- | --- | 500 | nAdc |
| $I_{EBO}$ | Emitter Cutoff Current<br>($V_{EB}$=5Vdc,$I_C$=0) | | --- | --- | 50 | nAdc |
| $h_{FE}$ | DC Current Gain<br>($I_C$=0.1mAdc, $V_{CE}$=1Vdc)<br>($I_C$=1mAdc, $V_{CE}$=1Vdc)<br>($I_C$=10mAdc, $V_{CE}$=1Vdc)<br>($I_C$=50mAdc, $V_{CE}$=1Vdc)<br>($I_C$=100mAdc, $V_{CE}$=1Vdc) | | <br>40<br>70<br>100<br>60<br>30 | <br>---<br>---<br>---<br>---<br>--- | <br>---<br>---<br>300<br>---<br>--- | --- |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage<br>($I_C$=10mAdc, $I_B$=1mAdc)<br>($I_C$=50mAdc, $I_B$=5mAdc) | | <br>---<br>--- | <br>---<br>--- | <br>0.2<br>0.3 | Vdc |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage<br>($I_C$=10mAdc, $I_B$=1mAdc)<br>($I_C$=50mAdc, $I_B$=5mAdc) | | <br>0.65<br>--- | <br>---<br>--- | <br>0.85<br>0.95 | Vdc |
| $f_T$ | Current Gain-Bandwidth Product<br>($V_{CE}$=20Vdc, $I_C$=20mAdc, f=100MHz) | | 300 | --- | --- | MHz |
| $C_{ob}$ | Output Capacitance<br>($V_{CB}$=5Vdc, f=1.0MHz, $I_E$=0) | | --- | --- | 4 | pF |
| NF | Noise Figure<br>($V_{CE}$=5V,$I_C$=0.1mA, f=1KHz, $R_S$=1kΩ) | | --- | --- | 5 | dB |
| $t_d$ | Delay Time | $V_{CC}$=3V, $I_C$=10mA, $V_{BE}$=0.5V, $I_{B1}$=1mA | --- | --- | 35 | ns |
| $t_r$ | Rise Time | | --- | --- | 35 | ns |
| $t_S$ | Storage Time | $V_{CC}$=3V, $I_C$=10mA, $I_{B1}$=$I_{B2}$=1mA | --- | --- | 200 | ns |
| $t_f$ | Fall Time | | --- | --- | 50 | ns |

## PNP 3906 Electrical Characteristics @ 25°C Unless Otherwise Specified

| Symbol | Parameter | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage ($I_C$=-1mAdc, $I_B$=0) | | -40 | --- | --- | Vdc |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage ($I_C$=-10uAdc, $I_E$=0) | | -40 | --- | --- | Vdc |
| $V_{(BR)EBO}$ | Collector-Emitter Breakdown Voltage ($I_E$=-10uAdc, $I_C$=0) | | -5 | --- | --- | Vdc |
| $I_{CBO}$ | Collector Cutoff Current ($V_{CB}$=-30Vdc,$I_E$=0) | | --- | --- | -50 | nAdc |
| $I_{EBO}$ | Emitter Cutoff Current ($V_{EB}$=-5Vdc,$I_C$=0) | | --- | --- | -50 | nAdc |
| $h_{FE}$ | DC Current Gain<br>($I_C$=-0.1mAdc, $V_{CE}$=-1Vdc)<br>($I_C$=-1mAdc, $V_{CE}$=-1Vdc)<br>($I_C$=-10mAdc, $V_{CE}$=-1Vdc)<br>($I_C$=-50mAdc, $V_{CE}$=-1Vdc)<br>($I_C$=-100mAdc, $V_{CE}$=-1Vdc) | | <br>40<br>70<br>100<br>60<br>30 | <br>---<br>---<br>---<br>---<br>--- | <br>---<br>---<br>300<br>---<br>--- | --- |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage<br>($I_C$=-10mAdc, $I_B$=-1mAdc)<br>($I_C$=-50mAdc, $I_B$=-5mAdc) | | <br>---<br>--- | <br>---<br>--- | <br>-0.25<br>-0.4 | Vdc |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage<br>($I_C$=-10mAdc, $I_B$=-1mAdc)<br>($I_C$=-50mAdc, $I_B$=-5mAdc) | | <br>-0.65<br>--- | <br>---<br>--- | <br>-0.85<br>-0.95 | Vdc |
| $f_T$ | Current Gain-Bandwidth Product ($V_{CE}$=-20Vdc, $I_C$=-10mAdc, f=100MHz) | | 250 | --- | --- | MHz |
| $C_{ob}$ | Output Capacitance ($V_{CB}$=-5Vdc, f=1.0MHz, $I_E$=0) | | --- | --- | 4.5 | pF |
| NF | Noise Figure ($V_{CE}$=-5V,$I_C$=-0.1mA, f=1KHz, $R_S$=1kΩ) | | --- | --- | 4 | dB |
| $t_d$ | Delay Time | $V_{CC}$=-3V, $I_C$=-10mA, $V_{BE}$=-0.5V, | --- | --- | 35 | ns |
| $t_r$ | Rise Time | $I_{B1}$=-$I_{B2}$=-1mA | --- | --- | 35 | ns |
| $t_S$ | Storage Time | $V_{CC}$=-3V, $I_C$=-10mA, $I_{B1}$=-$I_{B2}$=-1mA | --- | --- | 225 | ns |
| $t_f$ | Fall Time | | --- | --- | 75 | ns |

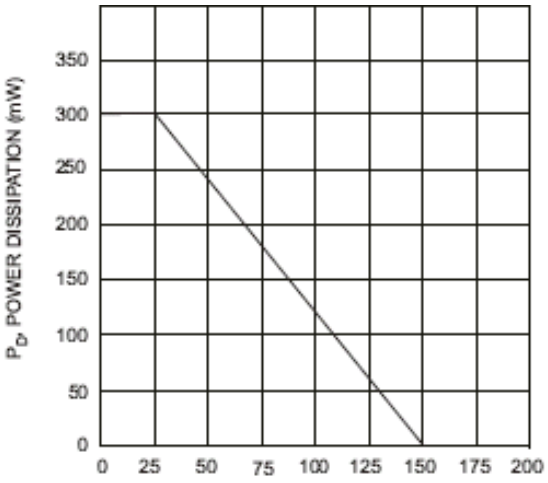



Fig. 1, Max Power Dissipation vs Ambient Temperature (Total Device)

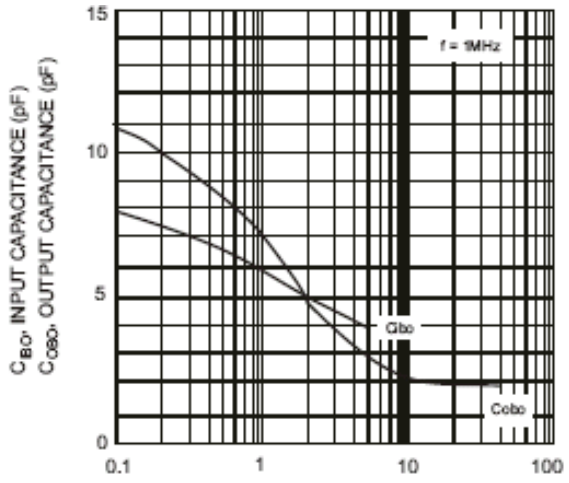



Fig. 2, Input and Output Capacitance vs. Collector-Base Voltage (NPN-3904)

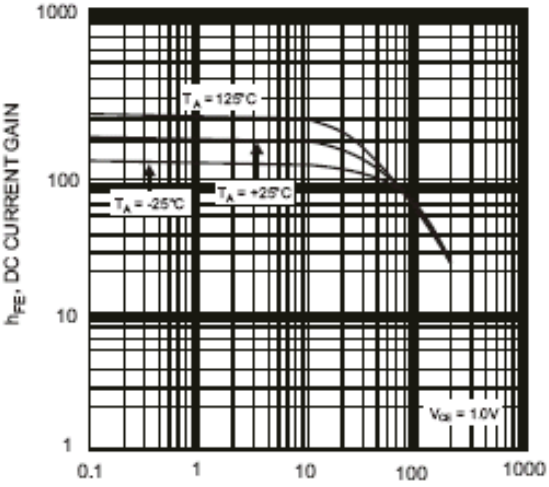



Fig. 3, Typical DC Current Gain vs Collector Current (NPN-3904)

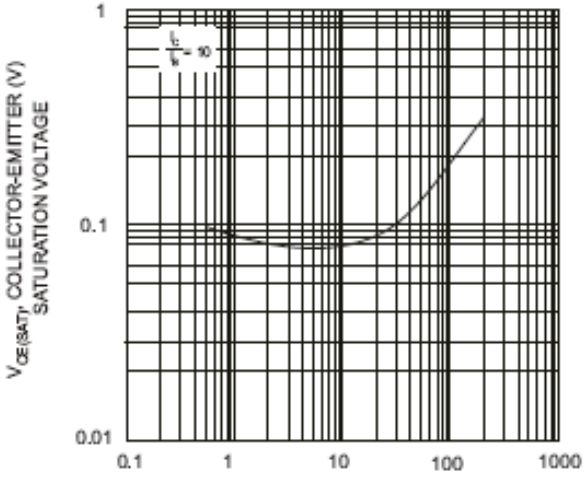



Fig. 4, Typical Collector-Emitter Saturation Voltage vs. Collector Current (NPN-3904)

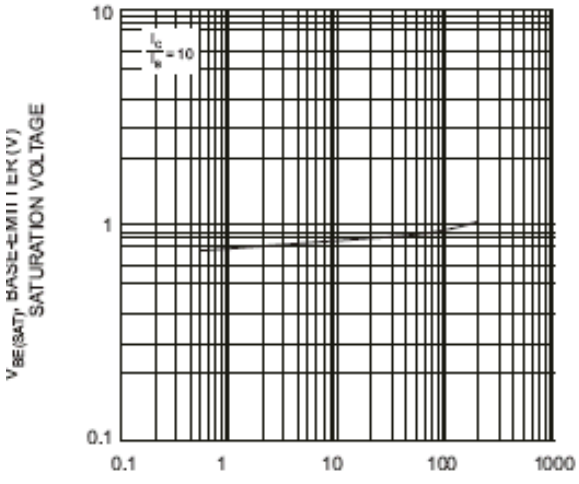



Fig. 5, Typical Base-Emitter Saturation Voltage vs. Collector Current (NPN-3904)

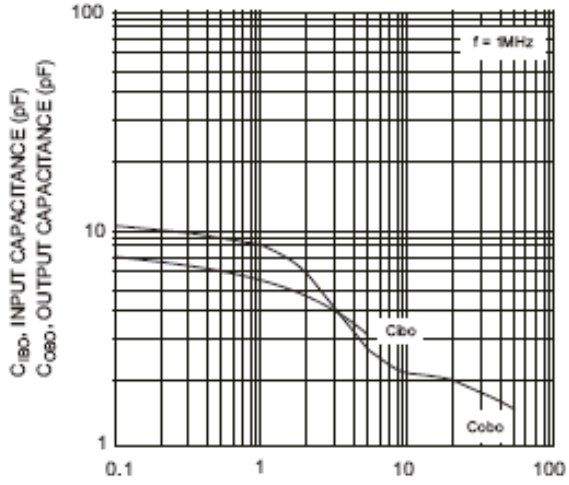



Fig. 6, Input and Output Capacitance vs. Collector-Base Voltage (PNP-3906)

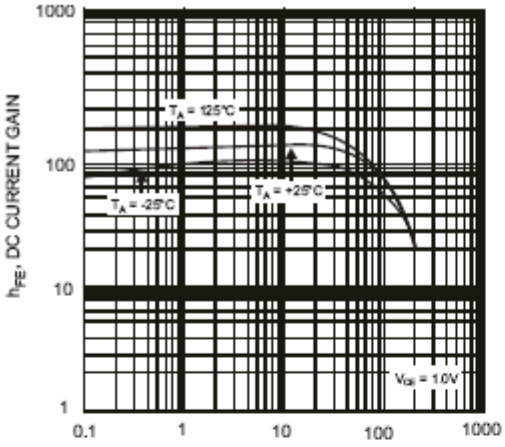



Fig. 7, Typical DC Current Gain vs Collector Current (PNP-3906)

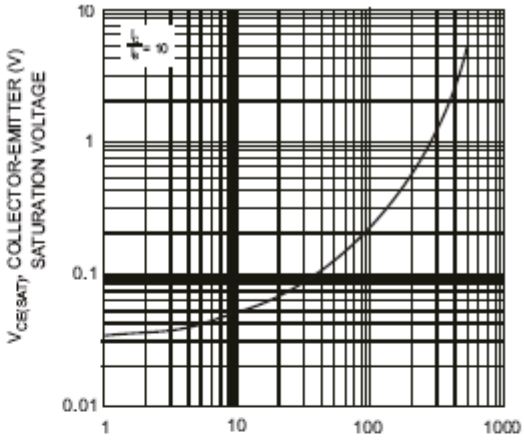



Fig. 8, Typical Collector-Emitter Saturation Voltage vs. Collector Current (PNP-3906)

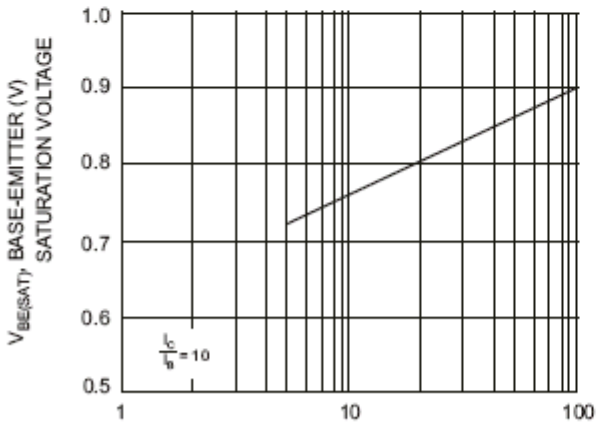



Fig. 9, Typical Base-Emitter Saturation Voltage vs. Collector Current (PNP-3906)

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## Ordering Information :

| Device | Packing |
|---|---|
| Part Number-TP | Tape&Reel;3Kpcs/Reel |

Note : Adding "-HF" suffix for halogen free, eg. Part Number-TP-HF

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