# MMBT3904

## SMALL SIGNAL NPN TRANSISTOR

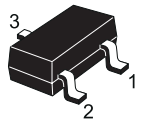
**PRELIMINARY DATA**

| Type | Marking |
|---|---|
| MMBT3904 | 34 |

- SILICON EPITAXIAL PLANAR NPN TRANSISTOR
- MINIATURE SOT-23 PLASTIC PACKAGE FOR SURFACE MOUNTING CIRCUITS
- TAPE AND REEL PACKING
- THE PNP COMPLEMENTARY TYPE IS MMBT3906

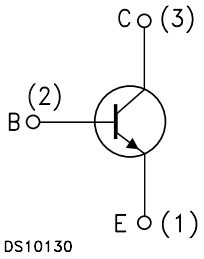
**APPLICATIONS**

- WELL SUITABLE FOR PORTABLE EQUIPMENT
- SMALL LOAD SWITCH TRANSISTOR WITH HIGH GAIN AND LOW SATURATION VOLTAGE




**SOT-23**

**INTERNAL SCHEMATIC DIAGRAM**




**ABSOLUTE MAXIMUM RATINGS**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CBO}$ | Collector-Base Voltage ($I_E$ = 0) | 60 | V |
| $V_{CEO}$ | Collector-Emitter Voltage ($I_B$ = 0) | 40 | V |
| $V_{EBO}$ | Emitter-Base Voltage ($I_C$ = 0) | 6 | V |
| $I_C$ | Collector Current | 200 | mA |
| $P_{tot}$ | Total Dissipation at $T_C$ = 25 $^oC$ | 350 | mW |
| $T_{stg}$ | Storage Temperature | -65 to 150 | $^oC$ |
| $T_j$ | Max. Operating Junction Temperature | 150 | $^oC$ |

## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| $R_{thj\text{-}amb}$ • | Thermal Resistance Junction-Ambient | Max | 357.1 | $^oC/W$ |

• Device mounted on a PCB area of 1 $cm^2$

## ELECTRICAL CHARACTERISTICS ($T_{case}$ = 25 $^oC$ unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CEX}$ | Collector Cut-off Current ($V_{BE}$ = -3 V) | $V_{CE}$ = 30 V | | | 50 | nA |
| $I_{BEX}$ | Base Cut-off Current ($V_{BE}$ = -3 V) | $V_{CE}$ = 30 V | | | 50 | nA |
| $V_{(BR)CEO}$* | Collector-Emitter Breakdown Voltage ($I_B$ = 0) | $I_C$ = 1 mA | 40 | | | V |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage ($I_E$ = 0) | $I_C$ = 10 µA | 60 | | | V |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage ($I_C$ = 0) | $I_E$ = 10 µA | 6 | | | V |
| $V_{CE(sat)}$* | Collector-Emitter Saturation Voltage | $I_C$ = 10 mA $I_B$ = 1 mA<br>$I_C$ = 50 mA $I_B$ = 5 mA | | | 0.2<br>0.2 | V<br>V |
| $V_{BE(sat)}$* | Base-Emitter Saturation Voltage | $I_C$ = 10 mA $I_B$ = 1 mA<br>$I_C$ = 50 mA $I_B$ = 5 mA | <br>0.65 | | 0.85<br>0.95 | V<br>V |
| $h_{FE}$* | DC Current Gain | $I_C$ = 0.1 mA $V_{CE}$ = 1 V<br>$I_C$ = 1 mA $V_{CE}$ = 1 V<br>$I_C$ = 10 mA $V_{CE}$ = 1 V<br>$I_C$ = 50 mA $V_{CE}$ = 1 V<br>$I_C$ = 100 mA $V_{CE}$ = 1 V | 60<br>80<br>100<br>60<br>30 | | 300 | |
| $f_T$ | Transition Frequency | $I_C$ = 10 mA $V_{CE}$ = 20 V f = 100 MHz | 250 | 270 | | MHz |
| $C_{CBO}$ | Collector-Base Capacitance | $I_E$ = 0 $V_{CB}$ = 10 V f = 1 MHz | | 4 | | pF |
| $C_{EBO}$ | Emitter-Base Capacitance | $I_C$ = 0 $V_{EB}$ = 0.5 V f = 1MHz | | 18 | | pF |
| NF | Noise Figure | $V_{CE}$ = 5 V $I_C$ = 0.1 mA f = 10 Hz to 15.7 KHz $R_G$ = 1 KΩ | | 5 | | dB |
| $t_d$<br>$t_r$ | Delay Time<br>Rise Time | $I_C$ = 10 mA $I_B$ = 1 mA<br>$V_{CC}$ = 30 V | | | 35<br>35 | ns<br>ns |
| $t_s$<br>$t_f$ | Storage Time<br>Fall Time | $I_C$ = 10 mA $I_{B1}$ = -$I_{B2}$ = 1 mA<br>$V_{CC}$ = 30 V | | | 200<br>50 | ns<br>ns |

∗ Pulsed: Pulse duration = 300 µs, duty cycle ≤ 2 %

## SOT-23 MECHANICAL DATA

| DIM. | mm | | | mils | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 0.85 | | 1.1 | 33.4 | | 43.3 |
| B | 0.65 | | 0.95 | 25.6 | | 37.4 |
| C | 1.20 | | 1.4 | 47.2 | | 55.1 |
| D | 2.80 | | 3 | 110.2 | | 118 |
| E | 0.95 | | 1.05 | 37.4 | | 41.3 |
| F | 1.9 | | 2.05 | 74.8 | | 80.7 |
| G | 2.1 | | 2.5 | 82.6 | | 98.4 |
| H | 0.38 | | 0.48 | 14.9 | | 18.8 |
| L | 0.3 | | 0.6 | 11.8 | | 23.6 |
| M | 0 | | 0.1 | 0 | | 3.9 |
| N | 0.3 | | 0.65 | 11.8 | | 25.6 |
| O | 0.09 | | 0.17 | 3.5 | | 6.7 |