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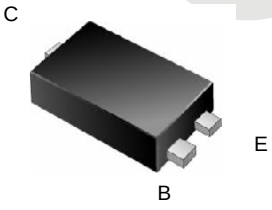
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FAIRCHILD SEMICONDUCTOR®

February 2008

# MMBT3904SL

## NPN Epitaxial Silicon Transistor




**SOT-923F** **Marking : AA**

## Features

- General purpose amplifier transistor.
- Ultra small surface mount package for all types(max 0.43mm tall)
- Suitable for general switching & amplification
- Well suited for portable application
- As complementary type, PNP MMBT3906SL is recommended
- Pb free

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

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CBO}$ | Collector-Base Voltage | 60 | V |
| $V_{CEO}$ | Collector-Emitter Voltage | 40 | V |
| $V_{EBO}$ | Emitter-Base Voltage | 6 | V |
| $I_C$ | Collector Current | 200 | mA |
| $T_J$ | Junction Temperature | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | -55 ~ 150 | °C |

* 1. These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.
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 | Unit |
|---|---|---|---|
| $P_C$ | Collector Power Dissipation, by $R_{\theta JA}$ | 227 | mW |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 550 | °C/W |

* Minimum land pad.

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

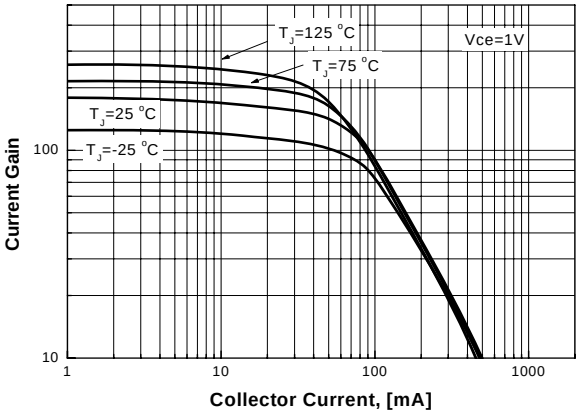
| Symbol | Parameter | Test Condition | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $BV_{CBO}$ | Collector-Base Breakdown Voltage | $I_C$ = 10μA, $I_E$ = 0 | 60 | | V |
| $BV_{CEO}$ | Collector-Emitter Breakdown Voltage | $I_C$ = 1mA, $I_B$ = 0 | 40 | | V |
| $BV_{EBO}$ | Emitter-Base Breakdown Voltage | $I_E$ = 10μA, $I_C$ = 0 | 6 | | V |
| $I_{CEX}$ | Collector Cut-off Current | $V_{CE}$ = 60V, $V_{EB(OFF)}$ = 3V | | 50 | nA |
| $h_{FE}$ | DC Current Gain | $V_{CE}$ = 1V, $I_C$ = 0.1mA<br>$V_{CE}$ = 1V, $I_C$ = 1mA<br>$V_{CE}$ = 1V, $I_C$ = 10mA<br>$V_{CE}$ = 1V, $I_C$ = 50mA<br>$V_{CE}$ = 1V, $I_C$ = 100mA | 40<br>70<br>100<br>60<br>30 | <br><br><br>300<br> | |
| $V_{CE}$ (sat) | Collector-Emitter Saturation Voltage | $I_C$ = 10mA, $I_B$ = 1mA<br>$I_C$ = 50mA, $I_B$ = 5mA | | 0.2<br>0.3 | V<br>V |
| $V_{BE}$ (sat) | Base-Emitter Saturation Voltage | $I_C$ = 10mA, $I_B$ = 1mA<br>$I_C$ = 50mA, $I_B$ = 5mA | 0.65 | 0.85<br>0.95 | V<br>V |
| $f_T$ | Current Gain Bandwidth Product | $V_{CE}$ = 20V, $I_C$ = 10mA, f = 100MHz | 300 | | MHz |
| $C_{ob}$ | Output Capacitance | $V_{CB}$ = 5V, $I_E$ = 0, f = 1MHz | | 6 | pF |
| $C_{ib}$ | Input Capacitance | $V_{EB}$ = 0.5V, $I_C$ = 0, f = 1MHz | | 15 | pF |
| $t_d$ | Delay Time | $V_{CC}$ = 3V, $I_C$ = 10mA<br>$I_{B1}$ =- $I_{B2}$ = 1mA | | 35 | ns |
| $t_r$ | Rise Time | | | 35 | ns |
| $t_s$ | Storage Time | | | 200 | ns |
| $t_f$ | Fall Time | | | 50 | ns |

* DC Item are tested by Pulse Test : Pulse Width≤300us, Duty Cycle≤2%

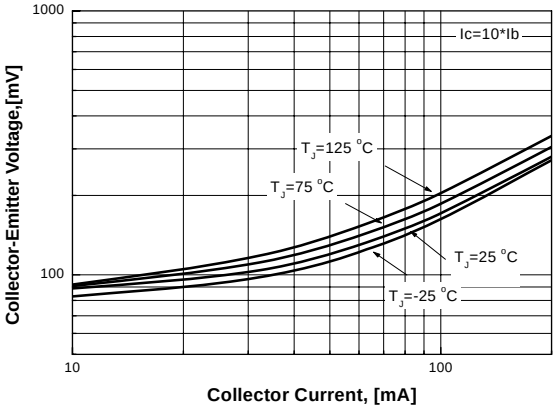
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## Typical Performance Characteristics

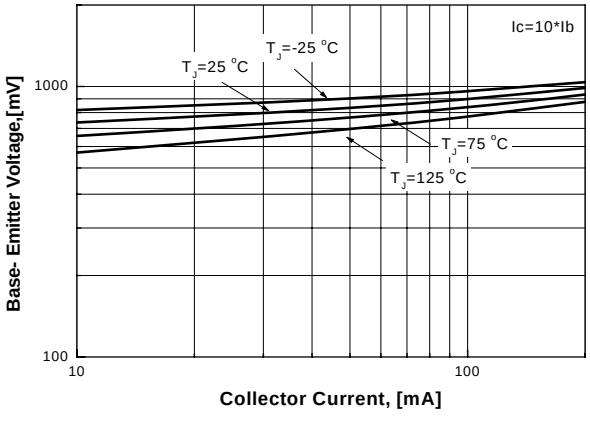
### Figure 1. DC Current Gain



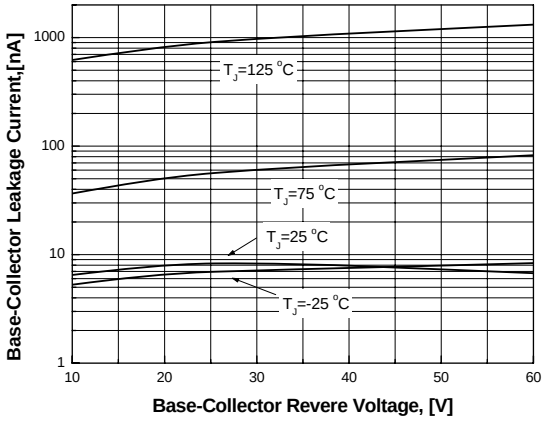

### Figure 2. Collector-Emitter Saturation Voltage



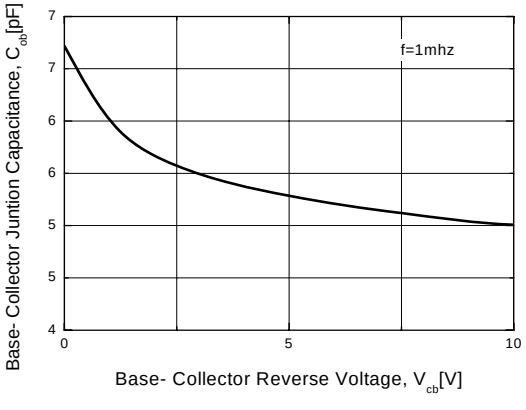

### Figure 3. Base- Emitter Saturation Voltage



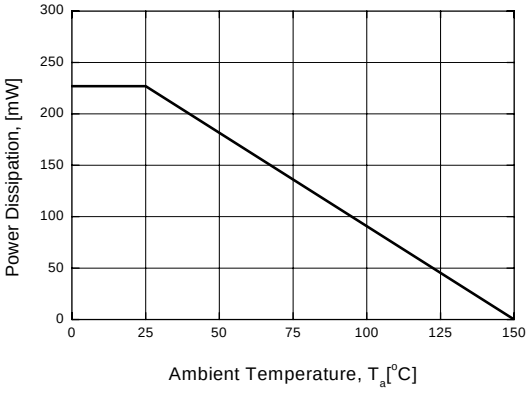

### Figure 4. Collector- Base Leakage Current




### Figure 5. Collector- Base Capacitance




### Figure 6. Power Derating

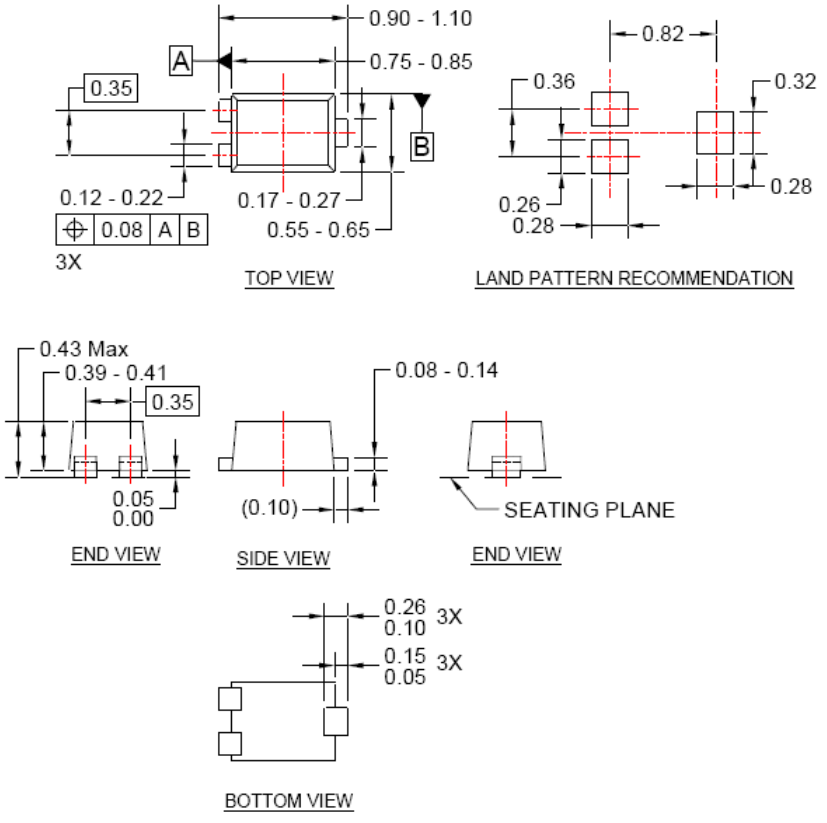



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# Package Dimensions

## SOT-923F

- Case : SOT-923F
- Case Material(Molded Plastic): KTMC1060SC
- UL Flammability classification rating : “V0”
- Moisture Sensitivity level per JESD22-A1113B : MSL 1
- Lead terminals solderable per MIL-STD7502026 /JESD22A121
- Lead Free Plating : Pure Tin(Matte)




Dimensions in Millimeters

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