

## MMBT3904

### NPN TRANSISTOR



**VOLTAGE:** 40 Volts

**CURRENT:** 0.2 Amperes

SOT-23

Marking and Polarity

#### FEATURES

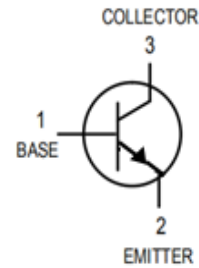
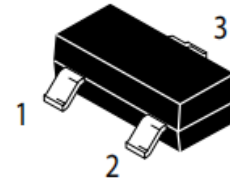
- High current capacity in compact package.  $I_C = 0.2A$ .
- Epitaxial planar type.
- Pb-Free Package is available.

#### MECHANICAL DATA

- **Package:** SOT-23
- **Epoxy UL:** 94V-0
- **Mounting position:** Any
- **Weight:** approx. 0.01g

#### DEVICE MARKING

| Device   | Marking |
|----------|---------|
| MMBT3904 | 1AM     |



#### Maximum Ratings (Ratings at 25°C ambient temperature unless otherwise specified.)

| Parameter                   | Symbol    | Value | Unit |
|-----------------------------|-----------|-------|------|
| Collector-Base Voltage)     | $V_{CBO}$ | 60    | V    |
| Collect-Emitter Voltage     | $V_{CEO}$ | 40    | V    |
| Emitter-Base Voltage        | $V_{EBO}$ | 6     | V    |
| Collector Current           | $I_C$     | 200   | mA   |
| Collector Power Dissipation | $P_C$     | 300   | mW   |

#### Thermal Characteristics (Ratings at 25°C ambient temperature unless otherwise specified.)

|                                     |                 |            |      |
|-------------------------------------|-----------------|------------|------|
| Junction Temperature                | $T_J$           | -55 to 150 | °C   |
| Storage Temperature Range           | $T_{STG}$       | -55 to 150 | °C   |
| Typical thermal resistance (Note 2) | $R_{\theta JA}$ | 417        | °C/W |



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PNP TRANSISTOR



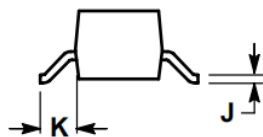
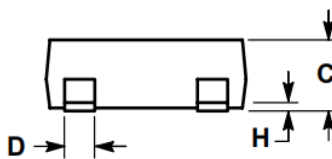
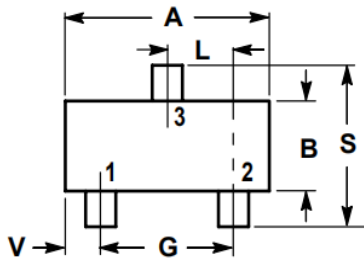
ELECTRICAL CHARACTERISTICS ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)

| Characteristic                       | Test Condition                                        | Symbol        | Min. | Typ. | Max. | Unit          |
|--------------------------------------|-------------------------------------------------------|---------------|------|------|------|---------------|
| Collector-Emitter Breakdown Voltage  | $I_C=1\text{mA}, I_B=0$                               | $V_{(BR)CEO}$ | 40   | -    | -    | V             |
| Collector-Base Breakdown Voltage     | $I_C=10\mu\text{A}, I_E=0$                            | $V_{(BR)CBO}$ | 60   | -    | -    | V             |
| Emitter-Base Breakdown Voltage       | $I_E=10\mu\text{A}, I_C=0$                            | $V_{(BR)EBO}$ | 6    | -    | -    | V             |
| Collector Cutoff Current             | $V_{CB}=30\text{V}, I_E=0$                            | $I_{CBO}$     | -    | -    | 50   | nA            |
| Emitter Cutoff Current               | $V_{EB}=30\text{V}, I_C=0$                            | $I_{EBO}$     | -    | -    | 50   | $\mu\text{A}$ |
| DC Current Gain                      | $V_{CE}=1\text{V}, I_C=1\text{mA}$                    | $H_{FE(1)}$   | 70   | -    | -    |               |
|                                      | $V_{CE}=1\text{V}, I_C=10\text{mA}$                   | $H_{FE(2)}$   | 100  | -    | 300  |               |
| Collector-Emitter Saturation Voltage | $I_C=10\text{mA}, I_B=1\text{mA}$                     | $V_{CE(Sat)}$ | -    | -    | 0.25 | V             |
| Base-Emitter Saturation Voltage      | $I_C=10\text{mA}, I_B=1\text{mA}$                     | $V_{BE(Sat)}$ | 0.65 | -    | 0.85 | V             |
| Transition Frequency                 | $V_{CE}=20\text{V}, I_C=10\text{mA}, f=100\text{MHz}$ | $F_T$         | 300  | -    | -    | MHz           |

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**OUTLINE DRAWINGS**

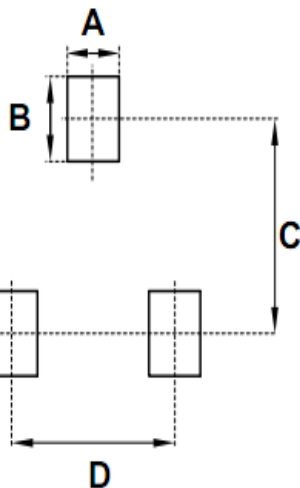


**SOT-23**

**OUTLINE DIMENSIONS**

| Dim. | Millimeters |      |       | Inches |      |        |
|------|-------------|------|-------|--------|------|--------|
|      | Min.        | Typ. | Max.  | Min.   | Typ. | Max.   |
| A    | 2.800       | -    | 3.040 | 0.1102 | -    | 0.1197 |
| B    | 1.200       | -    | 1.400 | 0.0472 | -    | 0.0551 |
| C    | 0.890       | -    | 1.110 | 0.0350 | -    | 0.0437 |
| D    | 0.370       | -    | 0.500 | 0.0146 | -    | 0.0197 |
| G    | 1.780       | -    | 2.040 | 0.0701 | -    | 0.0803 |
| H    | 0.013       | -    | 0.100 | 0.0005 | -    | 0.0039 |
| J    | 0.085       | -    | 0.177 | 0.0033 | -    | 0.0070 |
| K    | 0.350       | -    | 0.690 | 0.0138 | -    | 0.0272 |
| L    | 0.890       | -    | 1.020 | 0.0350 | -    | 0.0402 |
| S    | 2.100       | -    | 2.640 | 0.0827 | -    | 0.1039 |
| V    | 0.450       | -    | 0.600 | 0.0177 | -    | 0.0236 |

**MOUNTING PAD LAYOUT**



**SOT-23**

**RECOMMENDED MOUNTING PAD DIMENSIONS**

| Dim. | Millimeters |       |      | Inches |        |      |
|------|-------------|-------|------|--------|--------|------|
|      | Min.        | Typ.  | Max. | Min.   | Typ.   | Max. |
| A    | -           | 0.600 | -    | -      | 0.0236 | -    |
| B    | -           | 0.800 | -    | -      | 0.0315 | -    |
| C    | -           | 2.020 | -    | -      | 0.0795 | -    |
| D    | -           | 1.900 | -    | -      | 0.0748 | -    |

**PACKING INFORMATION**

**SOT-23**

| Package Method | Reel Size (mm) | Quantity (pcs/reel) | Inner Box Size L×W×H(mm) | Quantity (pcs/Inner Box) | Carton Size L×W×H(mm) | Quantity (pcs/carton) |
|----------------|----------------|---------------------|--------------------------|--------------------------|-----------------------|-----------------------|
| Tape Reel      | Φ180           | 3000                | 340×340×40               | 6000                     | 364×364×360           | 160000                |

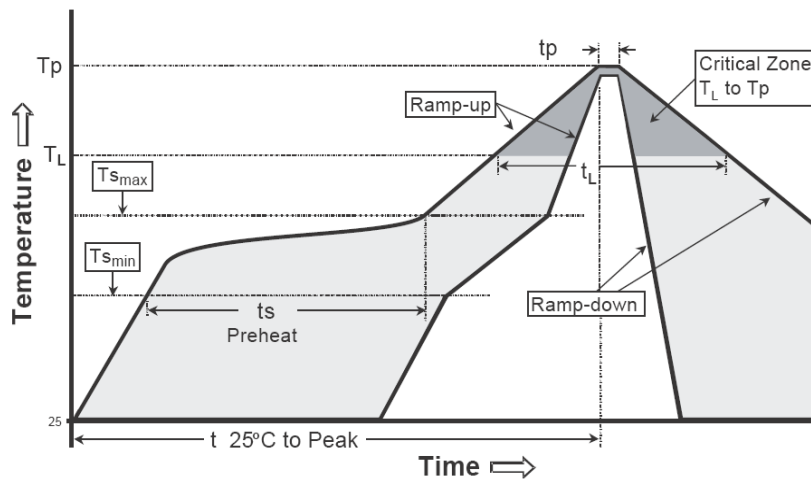
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**Recommended wave soldering condition**

| Product         | Peak Temperature | Soldering Time  |
|-----------------|------------------|-----------------|
| Pb-free devices | 260 +0/-5 °C     | 5 +1/-1 seconds |

**Recommended temperature profile for IR reflow**



| Profile feature                                                                            | Sn-Pb eutectic Assembly          | Pb-free Assembly                 |
|--------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|
| Average ramp-up rate (Tsmmax to Tp)                                                        | 3°C/second max.                  | 3°C/second max.                  |
| Preheat<br>-Temperature Min(TS min)<br>-Temperature Max(TS max)<br>-Time(ts min to ts max) | 100°C<br>150°C<br>60-120 seconds | 150°C<br>200°C<br>60-180 seconds |
| Time maintained above:<br>-Temperature (TL)<br>- Time (tL)                                 | 183°C<br>60-150 seconds          | 217°C<br>60-150 seconds          |
| Peak Temperature(TP)                                                                       | 240 +0/-5 °C                     | 260 +0/-5 °C                     |
| Time within 5°C of actual peak temperature(tp)                                             | 10-30 seconds                    | 20-40 seconds                    |
| Ramp down rate                                                                             | 6°C/second max.                  | 6°C/second max.                  |
| Time 25 °C to peak temperature                                                             | 6 minutes max.                   | 8 minutes max.                   |

Note : All temperatures refer to topside of the package, measured on the package body surface.

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