

300mW, NPN Small Signal Transistor

FEATURES

- Low power loss, high efficiency
- Ideal for automated placement
- High surge current capability
- Moisture sensitivity level: level 1, per J-STD-020
- RoHS Compliant
- Halogen-free according to IEC 61249-2-21

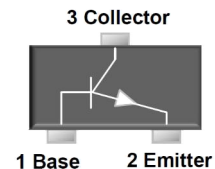
APPLICATIONS

- Switching mode power supply (SMPS)
- Adapters
- Lighting application
- On-board DC/DC converter

MECHANICAL DATA

- Case: SOT-23
- Molding compound meets UL 94 V-0 flammability rating
- Terminal: Matte tin plated leads, solderable per J-STD-002
- Meet JESD 201 class 1A whisker test
- Weight: 8 mg (approximately)

| KEY PARAMETERS | | |
|----------------|------------|------|
| PARAMETER | VALUE | UNIT |
| V_{CBO} | 60 | V |
| V_{CEO} | 40 | V |
| V_{EBO} | 6 | V |
| I_C | 200 | mA |
| h_{FE} | 400 | |
| Package | SOT-23 | |
| Configuration | Single die | |



| ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted) | | | |
|---|-----------|-------------|------------------|
| PARAMETER | SYMBOL | MMBT3904 | UNIT |
| Marking code on the device | | 1AM | |
| Collector-base voltage | V_{CBO} | 60 | V |
| Collector-emitter voltage | V_{CEO} | 40 | V |
| Emitter-base voltage | V_{EBO} | 6 | V |
| Collector current | I_C | 200 | mA |
| Power dissipation | P_D | 300 | mW |
| Junction temperature | T_J | -55 to +150 | $^\circ\text{C}$ |
| Storage temperature | T_{STG} | -55 to +150 | $^\circ\text{C}$ |

| ELECTRICAL SPECIFICATIONS ($T_A = 25^\circ\text{C}$ unless otherwise noted) | | | | | | |
|---|--|---------------|-----|-----|------|---------------|
| PARAMETER | CONDITIONS | SYMBOL | MIN | TYP | MAX | UNIT |
| Collector-base breakdown voltage | $I_C = 10\ \mu\text{A}, I_E = 0$ | $V_{(BR)CBO}$ | 60 | - | - | V |
| Collector-emitter breakdown voltage | $I_C = 1\ \text{mA}, I_B = 0$ | $V_{(BR)CEO}$ | 40 | - | - | V |
| Emitter-base breakdown voltage | $I_E = 10\ \mu\text{A}, I_C = 0$ | $V_{(BR)EBO}$ | 6 | - | - | V |
| Collector cutoff current | $V_{CB} = 60\ \text{V}, I_E = 0$ | I_{CBO} | - | - | 0.1 | μA |
| Collector cutoff current | $V_{CE} = 30\ \text{V}, V_{BE(OFF)} = 3\ \text{V}$ | I_{CEO} | - | - | 50 | nA |
| Emitter cutoff current | $V_{EB} = 5\ \text{V}, I_C = 0$ | I_{EBO} | - | - | 0.1 | μA |
| DC current gain | $V_{CE} = 1\ \text{V}, I_C = 10\ \text{mA}$ | h_{FE} | 100 | - | 400 | |
| | $V_{CE} = 1\ \text{V}, I_C = 50\ \text{mA}$ | | 60 | - | - | |
| | $V_{CE} = 1\ \text{V}, I_C = 100\ \text{mA}$ | | 30 | - | - | |
| Collector-emitter saturation voltage | $I_C = 50\ \text{mA}, I_B = 5\ \text{mA}$ | $V_{CE(sat)}$ | - | - | 0.30 | V |
| Base-emitter saturation voltage | $I_C = 50\ \text{mA}, I_B = 5\ \text{mA}$ | $V_{BE(sat)}$ | - | - | 0.95 | V |
| Transition frequency | $V_{CE} = 20\ \text{V}, I_C = 10\ \text{mA}, f = 100\ \text{MHz}$ | f_T | 250 | - | - | MHz |
| Delay time | $V_{CC} = 3\ \text{V}, V_{BE} = 0.5\ \text{V}, I_C = 10\ \text{mA}, I_{B1} = 1\ \text{mA}$ | t_d | - | - | 35 | ns |
| Rise time | | t_r | - | - | 35 | ns |
| Storage time | $V_{CC} = 3\ \text{V}, I_{B1} = I_{B2} = 1\ \text{mA}, I_C = 10\ \text{mA}$ | t_s | - | - | 200 | ns |
| Fall time | | t_f | - | - | 50 | ns |

| ORDERING INFORMATION | | |
|-----------------------------|---------|----------------|
| ORDERING CODE | PACKAGE | PACKING |
| MMBT3904 RF | SOT-23 | 3K / 7" Reel |
| MMBT3904 RFG | SOT-23 | 3K / 7" Reel |
| MMBT3904 R5 | SOT-23 | 10K / 13" Reel |
| MMBT3904 R5G | SOT-23 | 10K / 13" Reel |
| MMBT3904-D0 RF | SOT-23 | 3K / 7" Reel |
| MMBT3904-D0 RFG | SOT-23 | 3K / 7" Reel |
| MMBT3904-D0 R5 | SOT-23 | 10K / 13" Reel |
| MMBT3904-D0 R5G | SOT-23 | 10K / 13" Reel |
| MMBT3904-B0 RF | SOT-23 | 3K / 7" Reel |
| MMBT3904-B0 RFG | SOT-23 | 3K / 7" Reel |
| MMBT3904-B0 R5 | SOT-23 | 10K / 13" Reel |
| MMBT3904-B0 R5G | SOT-23 | 10K / 13" Reel |

CHARACTERISTICS CURVES

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

Fig. 1 Typical Pulsed Current Gain VS. Collector Current

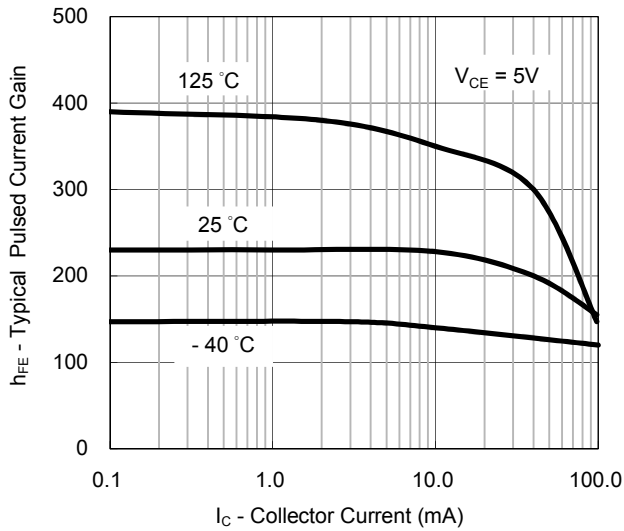


Fig.2 Collector-Emitter Saturation Voltage VS. Collector Current

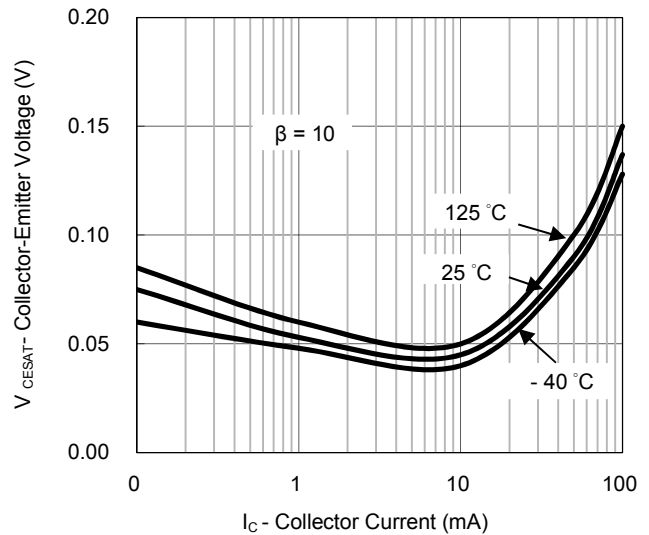


Fig.3 Base-Emitter Saturation Voltage VS. Collector Current

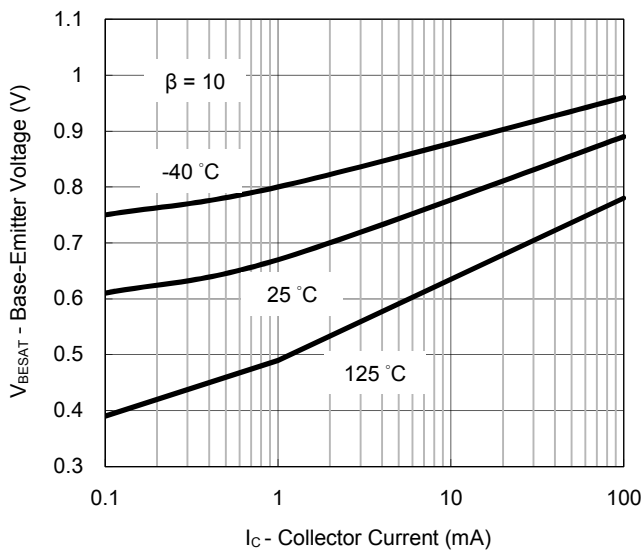
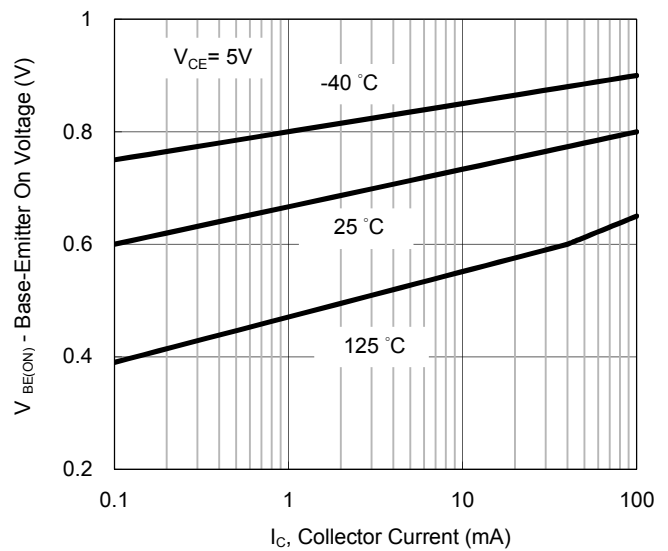


Fig.4 Base-Emitter On Voltage VS. Collector Current



CHARACTERISTICS CURVES

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

Fig. 5 Collector-Cutoff Current VS. Ambient Temperature

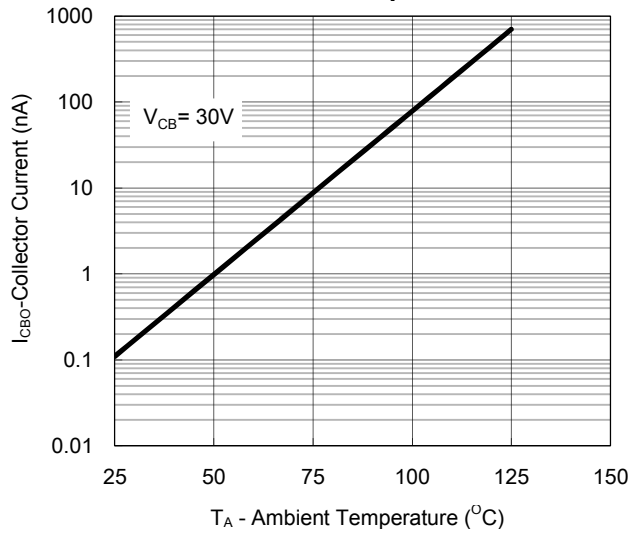
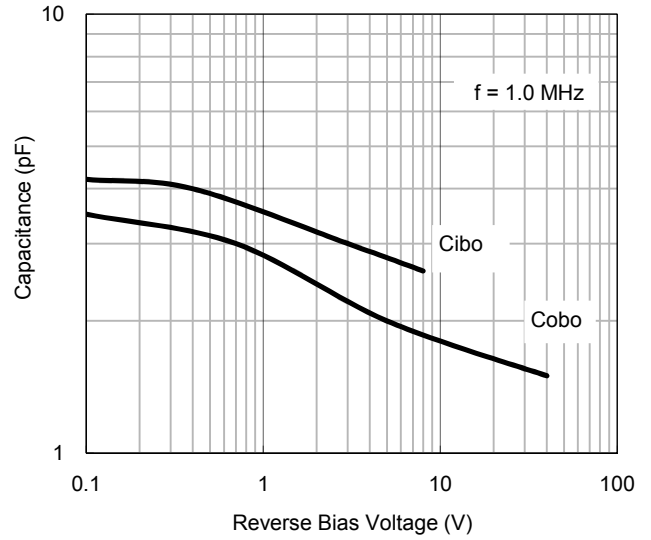
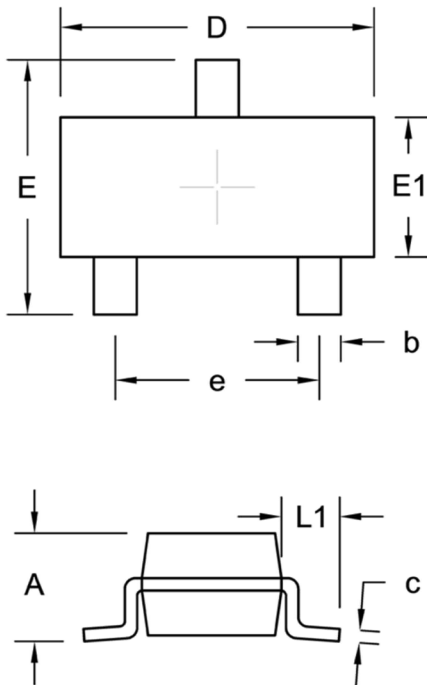


Fig. 6 Capacitance VS. Reverse Bias Voltage



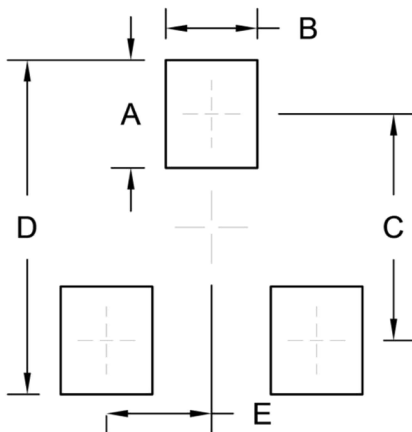
PACKAGE OUTLINE DIMENSION

SOT-23



| DIM. | Unit (mm) | | Unit (inch) | |
|------|-----------|------|-------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 0.89 | 1.12 | 0.035 | 0.044 |
| b | 0.30 | 0.50 | 0.012 | 0.020 |
| c | 0.08 | 0.20 | 0.003 | 0.008 |
| D | 2.80 | 3.04 | 0.110 | 0.120 |
| E | 2.10 | 2.64 | 0.083 | 0.104 |
| E1 | 1.20 | 1.40 | 0.047 | 0.055 |
| e | 1.90 BSC | | 0.075 BSC | |
| L1 | 0.54 REF. | | 0.021 REF. | |

SUGGESTED PAD LAYOUT



| Symbol | Unit (mm) | Unit (inch) |
|--------|-----------|-------------|
| A | 1.00 | 0.039 |
| B | 0.85 | 0.033 |
| C | 2.10 | 0.083 |
| D | 3.10 | 0.122 |
| E | 0.98 | 0.039 |

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