



MMBT3904

NPN GENERAL PURPOSE SWITCHING TRANSISTOR

VOLTAGE 40 Volt **POWER** 225 mWatt

SOT-23 Unit : inch (mm)

FEATURES

- NPN epitaxial silicon, planar design
- Collector-emitter voltage $V_{CE} = 40V$
- Collector current $I_C = 200mA$
- Transition frequency $f_T > 300MHz$ @ $I_C = 10mA_{dc}$, $V_{CE} = 20V_{dc}$, $f = 100MHz$
- Lead free in compliance with EU RoHS 2.0
- Green molding compound as per IEC 61249 standard

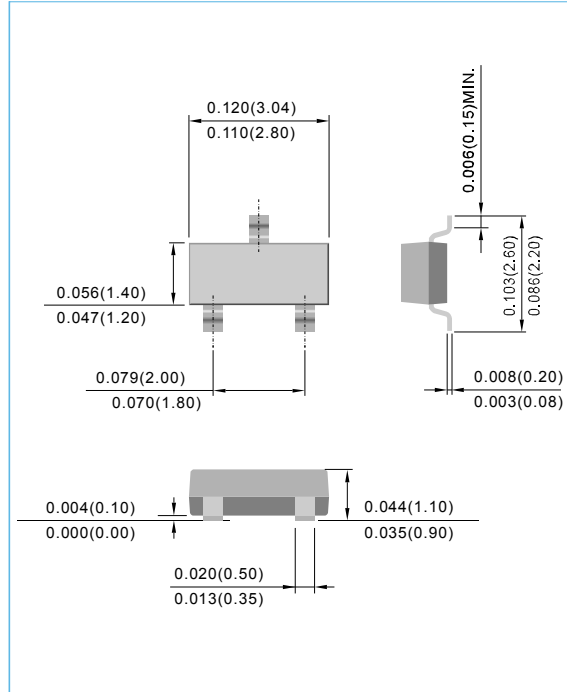
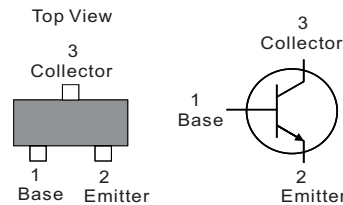
MECHANICAL DATA

Case: SOT-23, Plastic

Terminals: Solderable per MIL-STD-750, Method 2026

Approx. Weight: 0.0003 ounces, 0.0084 grams

Marking: S1A



ABSOLUTE RATINGS

| PARAMETER | Symbol | Value | Units |
|--------------------------------|-----------|-------|-------|
| Collector - Emitter Voltage | V_{CEO} | 40 | V |
| Collector - Base Voltage | V_{CBO} | 60 | V |
| Emitter - Base Voltage | V_{EBO} | 6.0 | V |
| Collector Current - Continuous | I_C | 200 | mA |

THERMAL CHARACTERISTICS

| PARAMETER | Symbol | Value | Units |
|--|-----------------|------------|---------------|
| Max Power Dissipation (Note 1) | P_{TOT} | 225 | mW |
| Thermal Resistance , Junction to Ambient | $R_{\theta JA}$ | 556 | $^{\circ}C/W$ |
| Junction Temperature | T_J | -55 to 150 | $^{\circ}C$ |
| Storage Temperature | T_{STG} | -55 to 150 | $^{\circ}C$ |

Note 1: Transistor mounted on FR-5 board 1.0 x 0.75 x 0.062 in.



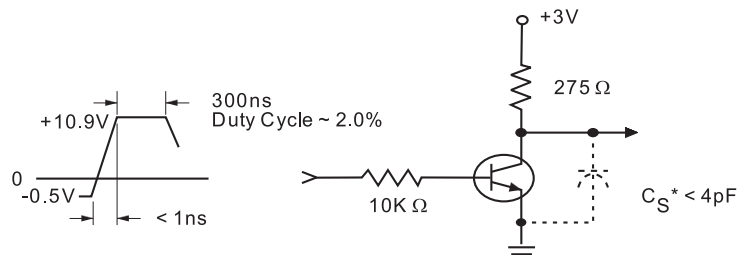
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ELECTRICAL CHARACTERISTICS

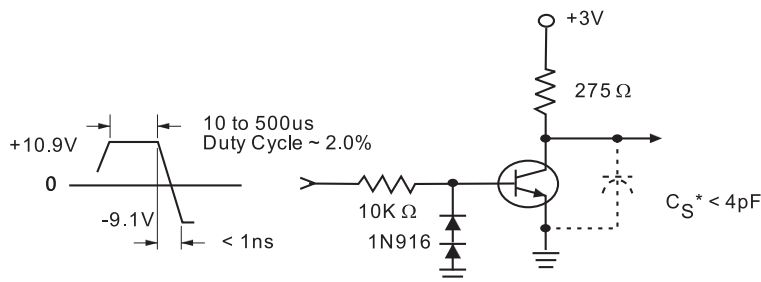
| PARAMETER | Symbol | Test Condition | MIN. | TYP. | MAX. | Units |
|---|---------------|--|-----------|------|--------------|-------|
| Collector - Emitter Breakdown Voltage | $V_{(BR)CEO}$ | $I_C=1.0mA, I_B=0$ | 40 | - | - | V |
| Collector - Base Breakdown Voltage | $V_{(BR)CBO}$ | $I_C=10\mu A, I_E=0$ | 60 | - | - | V |
| Emitter - Base Breakdown Voltage | $V_{(BR)EBO}$ | $I_E=10\mu A, I_C=0$ | 6.0 | - | - | V |
| Base Cutoff Current | I_{BL} | $V_{CE}=30V, V_{EB}=3.0V$ | - | - | 50 | nA |
| Collector Cutoff Current | I_{CEX} | $V_{CE}=30V, V_{EB}=3.0V$ | - | - | 50 | nA |
| DC Current Gain (Note 2) | h_{FE} | $I_C=0.1mA, V_{CE}=1.0V$ | 40 | - | - | - |
| | | $I_C=1.0mA, V_{CE}=1.0V$ | 70 | - | - | |
| | | $I_C=10mA, V_{CE}=1.0V$ | 100 | - | 300 | |
| | | $I_C=50mA, V_{CE}=1.0V$ | 60 | - | - | |
| | | $I_C=100mA, V_{CE}=1.0V$ | 30 | - | - | |
| Collector - Emitter Saturation Voltage (Note 2) | $V_{CE(SAT)}$ | $I_C=10mA, I_B=1.0mA$ $I_C=50mA, I_B=5.0mA$ | - | - | 0.2 0.3 | V |
| Base - Emitter Saturation Voltage (Note 2) | $V_{BE(SAT)}$ | $I_C=10mA, I_B=1.0mA$ $I_C=50mA, I_B=5.0mA$ | 0.65 - | - | 0.85 0.95 | V |
| Collector - Base Capacitance | C_{CBO} | $V_{CB}=5V, I_E=0, f=1MHz$ | - | - | 4.0 | pF |
| Emitter - Base Capacitance | C_{EBO} | $V_{EB}=0.5V, I_C=0, f=1MHz$ | - | - | 8.0 | pF |
| Delay Time | t_d | $V_{CC}=3V, V_{BE}=0.5V, I_C=10mA, I_B=1.0mA$ | - | - | 35 | ns |
| Rise Time | t_r | $V_{CC}=3V, V_{BE}=0.5V, I_C=10mA, I_B=1.0mA$ | - | - | 35 | ns |
| Storage Time | t_s | $V_{CC}=3V, I_C=10mA, I_{B1}=I_{B2}=1.0mA$ | - | - | 200 | ns |
| Fall Time | t_f | $V_{CC}=3V, I_C=10mA, I_{B1}=I_{B2}=1.0mA$ | - | - | 50 | ns |

Note 2: Pulse Test: Pulse Width < 300 us, Duty Cycle < 2.0%.

SWITCHING TIME EQUIVALENT TEST CIRCUITS



Delay and Rise Time Equivalent Test Circuit



Storage and Fall Time Equivalent Test Circuit



ELECTRICAL CHARACTERISTICS CURVE

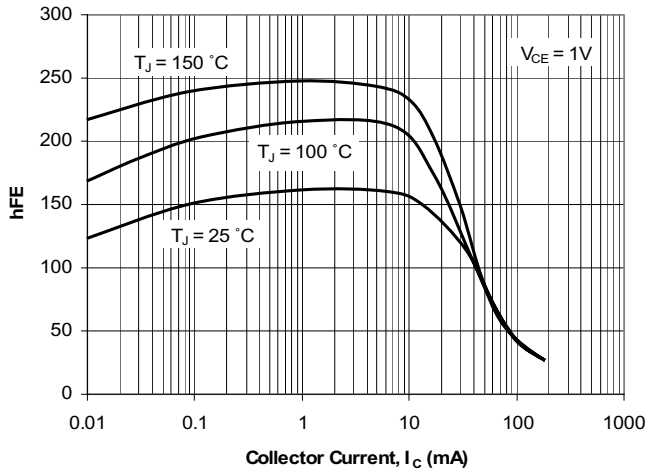


Fig. 1. Typical h_{FE} vs Collector Current

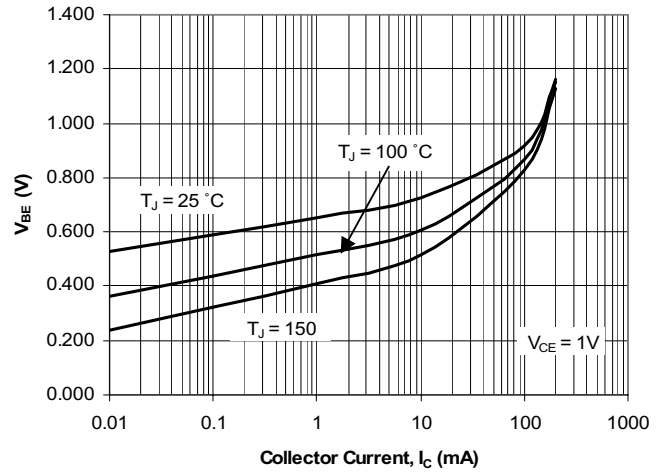


Fig. 2. Typical V_{BE} vs Collector Current

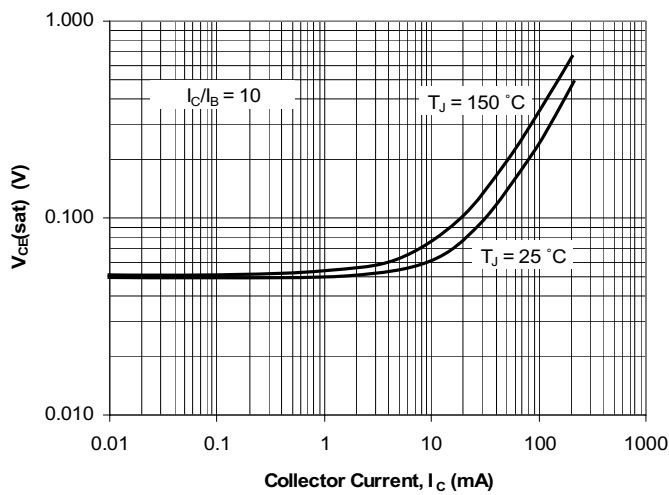


Fig. 3. Typical V_{CE} (sat) vs Collector Current

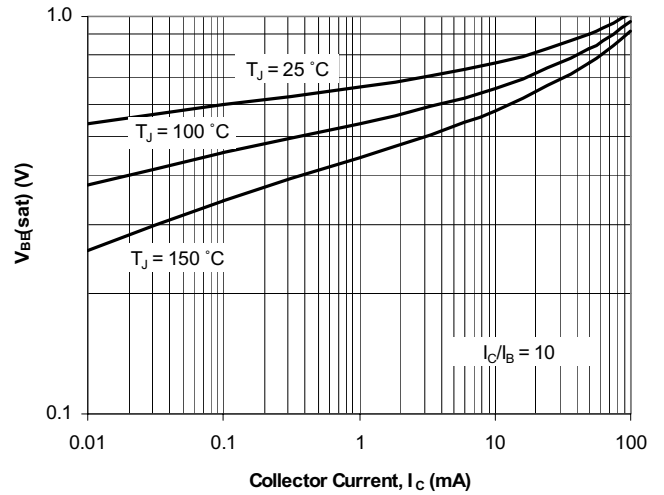


Fig. 4. Typical V_{BE} (sat) vs Collector Current

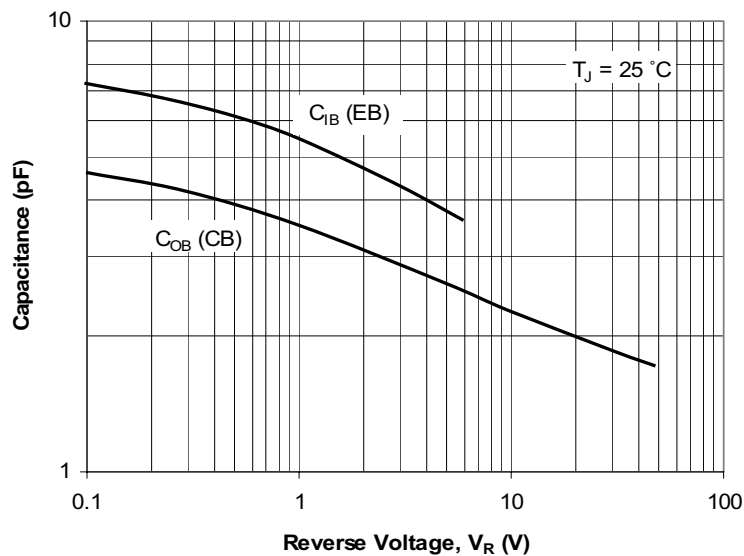
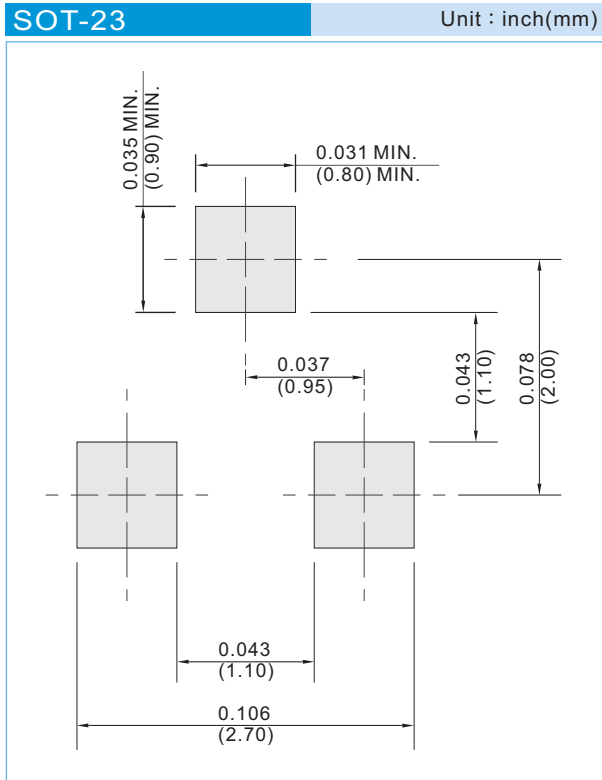


Fig. 5. Typical Capacitances vs Reverse Voltage



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MOUNTING PAD LAYOUT



ORDER INFORMATION

- Packing information
 - T/R - 12K per 13" plastic Reel
 - T/R - 3K per 7" plastic Reel



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Part No_packing code_Version

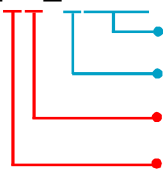
MMBT3904_R1_00001

MMBT3904_R2_00001

For example :

RB500V-40_R2_00001

Part No.



Serial number

Version code means HF

Packing size code means 13"

Packing type means T/R

| Packing Code XX | | | | Version Code XXXXX | | |
|--------------------------------------|----------------------|----------------------------------|----------------------|---------------------------|----------------------|---------------------------------------|
| Packing type | 1 st Code | Packing size code | 2 nd Code | HF or RoHS | 1 st Code | 2 nd ~5 th Code |
| Tape and Ammunition Box (T/B) | A | N/A | 0 | HF | 0 | serial number |
| Tape and Reel (T/R) | R | 7" | 1 | RoHS | 1 | serial number |
| Bulk Packing (B/P) | B | 13" | 2 | | | |
| Tube Packing (T/P) | T | 26mm | X | | | |
| Tape and Reel (Right Oriented) (TRR) | S | 52mm | Y | | | |
| Tape and Reel (Left Oriented) (TRL) | L | PANASERT T/B CATHODE UP (PBCU) | U | | | |
| FORMING | F | PANASERT T/B CATHODE DOWN (PBCD) | D | | | |



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