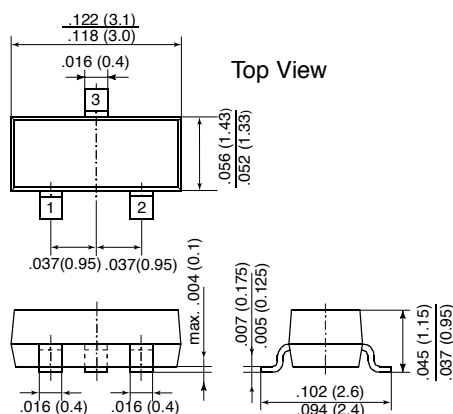


# MMBT4403

## SMALL SIGNAL TRANSISTORS (PNP)

### SOT-23



Dimensions in inches and (millimeters)

Pin configuration

1 = Base, 2 = Emitter, 3 = Collector.

### FEATURES

- ◆ PNP Silicon Epitaxial Planar Transistor for switching and amplifier applications.
- ◆ As complementary type, the NPN transistor MMBT4401 is recommended.
- ◆ This transistor is also available in the TO-92 case with the type designation 2N4403.



### MECHANICAL DATA

**Case:** SOT-23 Plastic Package

**Weight:** approx. 0.008g

**Marking code:** 2T

### MAXIMUM RATINGS AND THERMAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

|  | SYMBOL          | VALUE       | UNIT        |
|--|-----------------|-------------|-------------|
| Collector-Base Voltage   | $-V_{CBO}$      | 40          | Volts       |
| Collector-Emitter Voltage  | $-V_{CEO}$      | 40          | Volts       |
| Emitter-Base Voltage   | $-V_{EBO}$      | 5.0         | Volts       |
| Collector Current  | $-I_C$          | 600         | mA          |
| Power Dissipation FR-5 Board,* $T_A=25^\circ\text{C}$<br>Derate above 25°C         | $P_{tot}$       | 225<br>1.8  | mW<br>mW/°C |
| Power Dissipation Alumina Substrate,** $T_A=25^\circ\text{C}$<br>Derate above 25°C | $P_{tot}$       | 300<br>2.4  | mW<br>mW/°C |
| Thermal Resistance, Junction to Ambient<br>FR-5 Board<br>Alumina Substrate         | $R_{\theta JA}$ | 556<br>417  | °C/W        |
| Junction Temperature   | $T_j$           | 150         | °C          |
| Storage Temperature Range  | $T_s$           | -55 to +150 | °C          |

\*FR-5 = 1.0 x 0.75 x 0.062 in.

\*\*Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

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## ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

|  | SYMBOL         | MIN. | MAX. | UNIT       |
|--|----------------|------|------|------------|
| Collector-Base Breakdown Voltage<br>at $-I_C = 0.1 \text{ mA}$ , $I_E = 0$                                     | $-V_{(BR)CBO}$ | 40   | —    | Volts      |
| Collector-Emitter Breakdown Voltage <sup>(1)</sup><br>at $-I_C = 1 \text{ mA}$ , $I_B = 0$                     | $-V_{(BR)CEO}$ | 40   | —    | Volts      |
| Emitter-Base Breakdown Voltage<br>at $-I_E = 0.1 \text{ mA}$ , $I_C = 0$                                       | $-V_{(BR)EBO}$ | 5.0  | —    | Volts      |
| Collector-Emitter Saturation Voltage <sup>(1)</sup><br>at $-I_C = 150 \text{ mA}$ , $-I_B = 15 \text{ mA}$     | $-V_{CEsat}$   | —    | 0.40 | Volts      |
| at $-I_C = 500 \text{ mA}$ , $-I_B = 50 \text{ mA}$  | $-V_{CEsat}$   | —    | 0.75 | Volts      |
| Base-Emitter Saturation Voltage <sup>(1)</sup><br>at $-I_C = 150 \text{ mA}$ , $-I_B = 15 \text{ mA}$          | $-V_{BEsat}$   | 0.75 | 0.95 | Volts      |
| at $-I_C = 500 \text{ mA}$ , $-I_B = 50 \text{ mA}$  | $-V_{BEsat}$   | —    | 1.30 | Volts      |
| Collector-Emitter Cutoff Current<br>at $-V_{EB} = 0.4 \text{ V}$ , $-V_{CE} = 35 \text{ V}$                    | $-I_{CEX}$     | —    | 100  | nA         |
| Emitter-Base Cutoff Current<br>at $-V_{EB} = 0.4 \text{ V}$ , $-V_{CE} = 35 \text{ V}$                         | $-I_{BEV}$     | —    | 100  | nA         |
| DC Current Gain<br>at $-V_{CE} = 1 \text{ V}$ , $-I_C = 0.1 \text{ mA}$  | $h_{FE}$       | 30   | —    | —          |
| at $-V_{CE} = 1 \text{ V}$ , $-I_C = 1 \text{ mA}$   | $h_{FE}$       | 60   | —    | —          |
| at $-V_{CE} = 1 \text{ V}$ , $-I_C = 10 \text{ mA}$  | $h_{FE}$       | 100  | —    | —          |
| at $-V_{CE} = 2 \text{ V}$ , $-I_C = 150 \text{ mA}$   | $h_{FE}$       | 100  | 300  | —          |
| at $-V_{CE} = 2 \text{ V}$ , $-I_C = 500 \text{ mA}$   | $h_{FE}$       | 20   | —    | —          |
| Input Impedance<br>at $-V_{CE} = 10 \text{ V}$ , $-I_C = 1 \text{ mA}$ , $f = 1 \text{ kHz}$                   | $h_{ie}$       | 1.5  | 15   | k $\Omega$ |
| Current Gain-Bandwidth Product<br>at $-V_{CE} = 10 \text{ V}$ , $-I_C = 20 \text{ mA}$ , $f = 100 \text{ MHz}$ | $f_T$          | 200  | —    | MHz        |
| Collector-Base Capacitance<br>at $-V_{CB} = 10 \text{ V}$ , $I_E = 0$ , $f = 1 \text{ MHz}$                    | $C_{CBO}$      | —    | 8.5  | pF         |
| Emitter-Base Capacitance<br>at $-V_{EB} = 0.5 \text{ V}$ , $I_C = 0$ , $f = 1 \text{ MHz}$                     | $C_{EBO}$      | —    | 30   | pF         |

### NOTES:

(1) Pulse test: pulse width  $\leq 300\mu$  duty cycle  $\leq 2\%$

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## ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

|   | SYMBOL   | MIN.                | MAX.              | UNIT          |
|---|----------|---------------------|-------------------|---------------|
| Voltage Feedback Ratio<br>at $-V_{CE} = 10\text{ V}$ , $-I_C = 1\text{ mA}$ , $f = 1\text{ kHz}$                      | $h_{re}$ | $0.1 \cdot 10^{-4}$ | $8 \cdot 10^{-4}$ | —             |
| Small Signal Current Gain<br>at $-V_{CE} = 10\text{ V}$ , $-I_C = 1\text{ mA}$ , $f = 1\text{ kHz}$                   | $h_{fe}$ | 60                  | 500               | —             |
| Output Admittance<br>at $-V_{CE} = 1\text{ V}$ , $-I_C = 1\text{ mA}$ , $f = 1\text{ kHz}$                            | $h_{oe}$ | 1.0                 | 100               | $\mu\text{S}$ |
| Delay Time<br>at $-I_{B1} = 15\text{ mA}$ , $-I_C = 150\text{ mA}$ , $-V_{CC} = 30\text{ V}$ , $-V_{EB} = 2\text{ V}$ | $t_d$    | —                   | 15                | ns            |
| Rise Time<br>at $-I_{B1} = 15\text{ mA}$ , $-I_C = 150\text{ mA}$ , $-V_{CC} = 30\text{ V}$ , $-V_{EB} = 2\text{ V}$  | $t_r$    | —                   | 20                | ns            |
| Storage Time<br>at $I_{B1} = -I_{B2} = 15\text{ mA}$ , $-I_C = 150\text{ mA}$ , $-V_{CC} = 30\text{ V}$               | $t_s$    | —                   | 225               | ns            |
| Fall Time<br>at $I_{B1} = -I_{B2} = 15\text{ mA}$ , $-I_C = 150\text{ mA}$ , $-V_{CC} = 30\text{ V}$                  | $t_f$    | —                   | 30                | ns            |

## SWITCHING TIME EQUIVALENT TEST CIRCUIT

FIGURE 1 - TURN-ON TIME

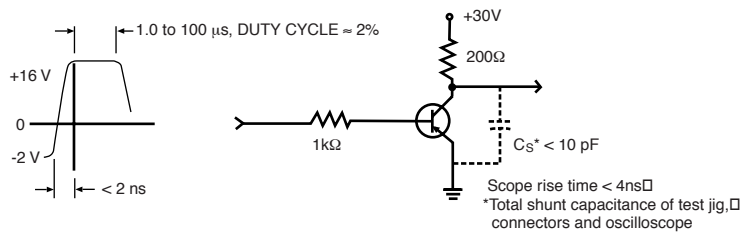


FIGURE 2 - TURN-OFF TIME

