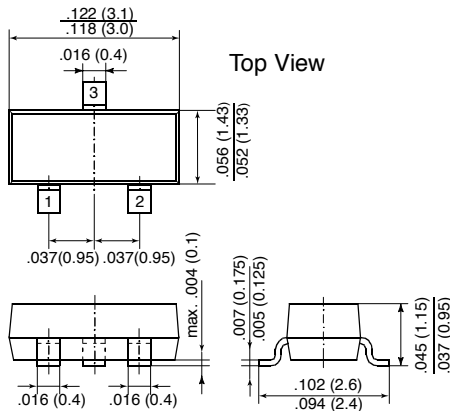


MMBT4401

SMALL SIGNAL TRANSISTORS (NPN)

SOT-23



Dimensions in inches and (millimeters)

Pin configuration

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

FEATURES

- ◆ NPN Silicon Epitaxial Planar Transistor for switching and amplifier applications.
- ◆ As complementary type, the PNP transistor MMBT4403 is recommended.
- ◆ This transistor is also available in the TO-92 case with the type designation 2N4401.



MECHANICAL DATA

Case: SOT-23 Plastic Package

Weight: approx. 0.008g

Marking code: 2X

MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

	SYMBOL	VALUE	UNIT
Collector-Base Voltage	V _{CBO}	60	Volts
Collector-Emitter Voltage	V _{CEO}	40	Volts
Emitter-Base Voltage	V _{EBO}	6.0	Volts
Collector Current-Continuous	I _C	600	mA
Power Dissipation FR-5 Board,* T _A =25°C Derate above 25°C	P _{tot}	225 1.8	mW mW/°C
Power Dissipation Alumina Substrate,** T _A =25°C Derate above 25°C	P _{tot}	300 2.4	mW mW/°C
Thermal Resistance, Junction to Ambient	R _{θJA}	FR-5 Board	556
		Alumina Substrate	417
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 at $I_C = 0.1 \text{ mA}$, $I_E = 0$	$V_{(BR)CBO}$	60	–	Volts
Collector-Emitter Breakdown Voltage ⁽¹⁾ at $I_C = 1 \text{ mA}$, $I_B = 0$	$V_{(BR)CEO}$	40	–	Volts
Emitter-Base Breakdown Voltage at $I_E = 0.1 \text{ mA}$, $I_C = 0$	$V_{(BR)EBO}$	6.0	–	Volts
Collector-Emitter Saturation Voltage at $I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$ at $I_C = 500 \text{ mA}$, $I_B = 50 \text{ mA}$	V_{CEsat} V_{CEsat}	– –	0.40 0.75	Volts Volts
Base-Emitter Saturation Voltage at $I_C = 150 \text{ mA}$, $I_B = 15 \text{ mA}$ at $I_C = 500 \text{ mA}$, $I_B = 50 \text{ mA}$	V_{BEsat} V_{BEsat}	0.75 –	0.95 1.20	Volts Volts
Collector Cutoff Current at $V_{EB} = 0.4 \text{ V}$, $V_{CE} = 35 \text{ V}$	I_{CEX}	–	100	nA
Base Cutoff Current at $V_{EB} = 0.4 \text{ V}$, $V_{CE} = 35 \text{ V}$	I_{BEV}	–	100	nA
DC Current Gain at $V_{CE} = 1 \text{ V}$, $I_C = 0.1 \text{ mA}$ at $V_{CE} = 1 \text{ V}$, $I_C = 1 \text{ mA}$ at $V_{CE} = 1 \text{ V}$, $I_C = 10 \text{ mA}$ at $V_{CE} = 1 \text{ V}$, $I_C = 150 \text{ mA}^{(1)}$ at $V_{CE} = 2 \text{ V}$, $I_C = 500 \text{ mA}^{(1)}$	h_{FE} h_{FE} h_{FE} h_{FE} h_{FE}	20 40 80 100 40	– – – 300 –	– – – – –
Input Impedance at $V_{CE} = 10 \text{ V}$, $I_C = 1 \text{ mA}$, $f = 1 \text{ kHz}$	h_{ie}	1	15	k Ω
Voltage Feedback Ratio at $V_{CE} = 10 \text{ V}$, $I_C = 1 \text{ mA}$, $f = 1 \text{ kHz}$	h_{re}	$0.1 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	–
Current Gain-Bandwidth Product at $V_{CE} = 10 \text{ V}$, $I_C = 20 \text{ mA}$, $f = 100 \text{ MHz}$	f_T	250	–	MHz
Collector-Base Capacitance at $V_{CB} = 5 \text{ V}$, $f = 1 \text{ MHz}$, $I_E = 0$	C_{CBO}	–	6.5	pF
Emitter-Base Capacitance at $V_{EB} = 0.5 \text{ V}$, $f = 1 \text{ MHz}$, $I_C = 0$	C_{EBO}	–	30	pF

NOTES:

(1) Pulse test: pulse width $\leq 300 \mu\text{s}$, cycle $\leq 2.0\%$

MMBT4401

ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

	SYMBOL	MIN.	MAX.	UNIT
Small Signal Current Gain at $V_{CE} = 10\text{ V}$, $I_C = 1\text{ mA}$, $f = 1\text{ kHz}$	h_{fe}	40	500	–
Output Admittance at $V_{CE} = 10\text{ V}$, $I_C = 1\text{ mA}$, $f = 1\text{ kHz}$	h_{oe}	1.0	30	μS
Delay Time (see Fig. 1) at $I_{B1} = 15\text{ mA}$, $I_C = 150\text{ mA}$ $V_{CC} = 30\text{ V}$, $V_{BE} = 40\text{ V}$	t_d	–	15	ns
Rise Time (see Fig. 1) at $I_{B1} = 15\text{ mA}$, $I_C = 150\text{ mA}$ $V_{CC} = 30\text{ V}$, $V_{BE} = 40\text{ V}$	t_r	–	20	ns
Storage Time (see Fig. 2) at $I_{B1} = I_{B2} = 15\text{ mA}$, $I_C = 150\text{ mA}$ $V_{CC} = 30\text{ V}$, $I_C = 150\text{ mA}$	t_s	–	225	ns
Fall Time (see Fig. 2) at $I_{B1} = I_{B2} = 15\text{ mA}$, $I_C = 150\text{ mA}$ $V_{CC} = 30\text{ V}$, $I_C = 150\text{ mA}$	t_f	–	30	ns

SWITCHING TIME EQUIVALENT TEST CIRCUIT

FIGURE 1 - TURN-ON TIME

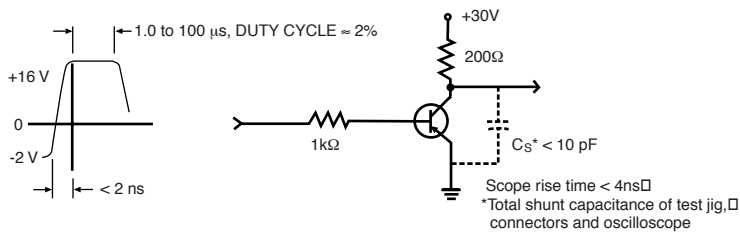


FIGURE 2 - TURN-OFF TIME

