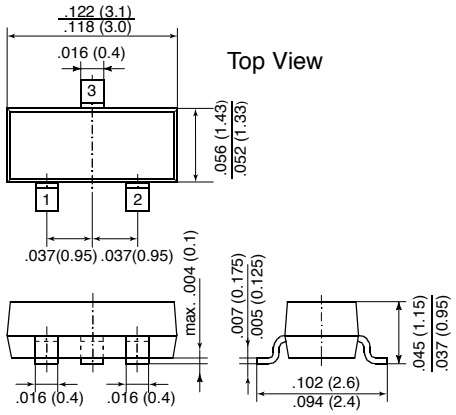
MMBT4401

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 FR-5 Board Alumina Substrate	$R_{\Theta JA}$	556 417	°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.

GENERAL SEMICONDUCTOR®

MMBT4401

ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

	SYMBOL	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage at I_C = 0.1 mA, I_E = 0	$V_{(BR)CBO}$	60	–	Volts
Collector-Emitter Breakdown Voltage[1] at I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	40	–	Volts
Emitter-Base Breakdown Voltage at I_E = 0.1 mA, I_C = 0	$V_{(BR)EBO}$	6.0	–	Volts
Collector-Emitter Saturation Voltage at I_C = 150 mA, I_B = 15 mA at I_C = 500 mA, I_B = 50 mA	 V_{CEsat} V_{CEsat}	 – –	 0.40 0.75	 Volts Volts
Base-Emitter Saturation Voltage at I_C = 150 mA, I_B = 15 mA at I_C = 500 mA, I_B = 50 mA	 V_{BEsat} V_{BEsat}	 0.75 –	 0.95 1.20	 Volts Volts
Collector Cutoff Current at V_{EB} = 0.4 V, V_{CE} = 35 V	I_{CEX}	–	100	nA
Base Cutoff Current at V_{EB} = 0.4 V, V_{CE} = 35 V	I_{BEV}	–	100	nA
DC Current Gain at V_{CE} = 1 V, I_C = 0.1 mA at V_{CE} = 1 V, I_C = 1 mA at V_{CE} = 1 V, I_C = 10 mA at V_{CE} = 1 V, I_C = 150 mA[1] at V_{CE} = 2 V, I_C = 500 mA[1]	 h_{FE} h_{FE} h_{FE} h_{FE} h_{FE}	 20 40 80 100 40	 – – – 300 –	 – – – – –
Input Impedance at V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	h_{ie}	1	15	kΩ
Voltage Feedback Ratio at V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	h_{re}	$0.1 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	–
Current Gain-Bandwidth Product at V_{CE} = 10 V, I_C = 20 mA, f = 100 MHz	f_T	250	–	MHz
Collector-Base Capacitance at V_{CB} = 5 V,f = 1 MHz, I_E=0	C_{CBO}	–	6.5	pF
Emitter-Base Capacitance at V_{EB} = 0.5 V,f = 1 MHz, I_C=0	C_{EBO}	–	30	pF

NOTES:
(1) Pulse test: pulse width ≤300μs, cycle ≤ 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 V, I_C = 1 mA, f = 1 kHz	h_{fe}	40	500	–
Output Admittance at V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	h_{oe}	1.0	30	μS
Delay Time (see Fig. 1) at I_{B1} = 15 mA, I_C = 150 mA V_{CC} = 30 V, V_{BE} = 40 V	t_d	–	15	ns
Rise Time (see Fig. 1) at I_{B1} = 15 mA, I_C = 150 mA V_{CC} = 30 V, V_{BE} = 40 V	t_r	–	20	ns
Storage Time (see Fig. 2) at I_{B1} = I_{B2} = 15 mA, I_C = 150 mA V_{CC} = 30 V, I_C = 150 mA	t_s	–	225	ns
Fall Time (see Fig. 2) at I_{B1} = I_{B2} = 15 mA, I_C = 150 mA V_{CC} = 30 V, I_C = 150 mA	t_f	–	30	ns

SWITCHING TIME EQUIVALENT TEST CIRCUIT

FIGURE 1 - TURN-ON TIME

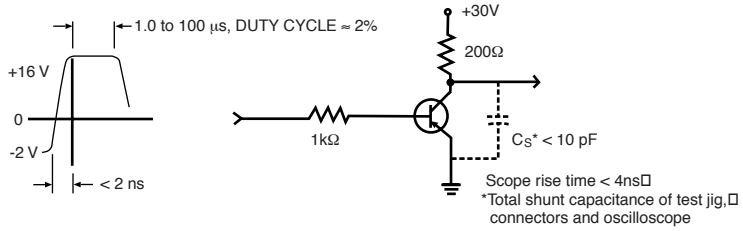
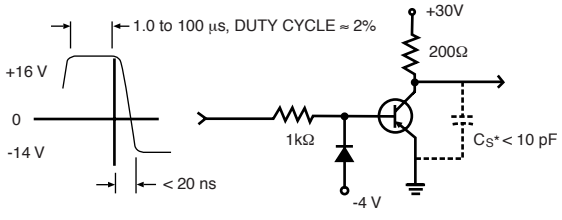


FIGURE 2 - TURN-OFF TIME



GENERAL SEMICONDUCTOR®