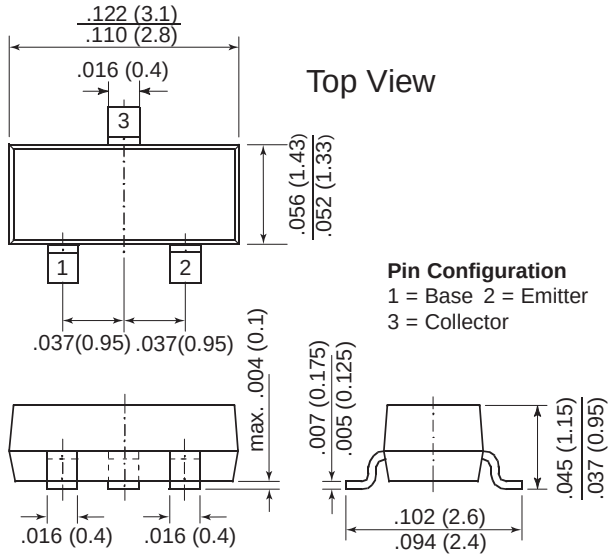
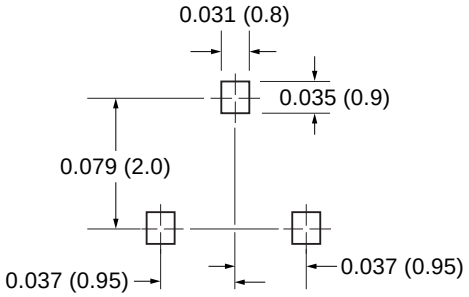
Small Signal Transistor (PNP)

TO-236AB (SOT-23)



Dimensions in inches and (millimeters)

Mounting Pad Layout



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

Packaging Codes/Options:

E8/10K per 13" reel (8mm tape), 30K/box
E9/3K per 7" reel (8mm tape), 30K/box

Maximum Ratings & Thermal Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Parameters		Symbols	Value	Units
Collector-Base Voltage		$-V_{CBO}$	40	V
Collector-Emitter Voltage		$-V_{CEO}$	40	V
Emitter-Base Voltage		$-V_{EBO}$	5.0	V
Collector Current		$-I_C$	600	mA
Power Dissipation[1]	T_A = 25°C Derate above 25°C	P_{tot}	225 1.8	mW mW/°C
Power Dissipation[2]	T_A = 25°C Derate above 25°C	P_{tot}	300 2.4	mW mW/°C
Thermal Resistance Junction to Ambient Air		$R_{\theta JA}$	556[1] 417[2]	°C/W
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_S	–55 to +150	°C

Notes: (1) FR-5 Board = 1.0 x 0.75 x 0.062 in.
(2) Alumina Substrate = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

Electrical Characteristics (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DC Current Gain	h_{FE}	$-V_{CE}$ = 1V, $-I_C$ = 0.1mA $-V_{CE}$ = 1V, $-I_C$ = 1mA $-V_{CE}$ = 1V, $-I_C$ = 10mA $-V_{CE}$ = 2V, $-I_C$ = 150mA(1) $-V_{CE}$ = 2V, $-I_C$ = 500mA(1)	30 60 100 100 20	— — — — —	— — — 300 —	—
Collector-Base Breakdown Voltage	$-V_{(BR)CBO}$	$-I_C$ = 0.1mA, I_E = 0	40	—	—	V
Collector-Emitter Breakdown Voltage(1)	$-V_{(BR)CEO}$	$-I_C$ = 1mA, I_B = 0	40	—	—	V
Emitter-Base Breakdown Voltage	$-V_{(BR)EBO}$	$-I_E$ = 0.1mA, I_C = 0	5.0	—	—	V
Collector-Emitter Saturation Voltage(1)	$-V_{CEsat}$	$-I_C$ = 150mA, $-I_B$ = 15mA $-I_C$ = 500mA, $-I_B$ = 50mA	— —	— —	0.40 0.75	V
Base-Emitter Saturation Voltage(1)	$-V_{BEsat}$	$-I_C$ = 150mA, $-I_B$ = 15mA $-I_C$ = 500mA, $-I_B$ = 50mA	0.75 —	— —	0.95 1.30	V
Collector-Emitter Cut-off Current	$-I_{CEV}$	$-V_{EB}$ = 0.4V, $-V_{CE}$ = 35V	—	—	100	nA
Emitter-Base Cut-off Current	$-I_{BEV}$	$-V_{EB}$ = 0.4V, $-V_{CE}$ = 35V	—	—	100	nA
Current Gain-Bandwidth Product	f_T	$-V_{CE}$ = 10V, $-I_C$ = 20mA f = 100MHz	200	—	—	MHz
Collector-Base Capacitance	C_{CBO}	$-V_{CB}$ = 10V, I_E = 0, f = 1MHz	—	—	8.5	pF
Emitter-Base Capacitance	C_{EBO}	$-V_{EB}$ = 0.5V, I_C = 0, f = 1MHz	—	—	30	pF
Input Impedance	h_{ie}	$-V_{CE}$ = 10V, $-I_C$ = 1mA, f = 1kHz	1.5	—	15	kΩ
Small Signal Current Gain	h_{fe}	$-V_{CE}$ = 10V, $-I_C$ = 1mA, f = 1kHz	60	—	500	—
Voltage Feedback Ratio	h_{re}	$-V_{CE}$ = 10V, $-I_C$ = 1mA, f = 1kHz	$0.1 \cdot 10^{-4}$	—	$8 \cdot 10^{-4}$	—
Output Admittance	h_{oe}	$-V_{CE}$ = 10V, $-I_C$ = 1mA, f = 1kHz	1.0	—	100	µS

Notes: (1) Pulse test: pulse width ≤ 300 µs duty cycle ≤ 2%

Electrical Characteristics (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Delay Time (see Fig. 1)	t_d	$-I_{B1}$ = 15mA, $-I_C$ = 150mA $-V_{CC}$ = 30V, $-V_{EB}$ = 2V	—	—	15	ns
Rise Time (see Fig. 1)	t_r	$-I_{B1}$ = 15mA, $-I_C$ = 150mA $-V_{CC}$ = 30V, $-V_{EB}$ = 2V	—	—	20	ns
Storage Time (see Fig. 2)	t_s	$-I_{B1} = -I_{B2}$ = 15mA, $-I_C$ = 150mA, $-V_{CC}$ = 30V	—	—	225	ns
Fall Time (see Fig. 2)	t_f	$-I_{B1} = -I_{B2}$ = 15mA, $-I_C$ = 150mA, $-V_{CC}$ = 30V	—	—	30	ns

Switching Time Equivalent Test Circuit

Figure 1: Turn-ON Time

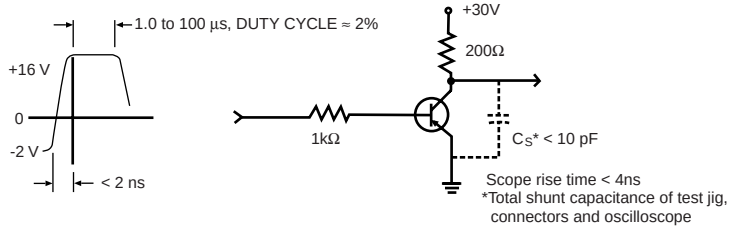
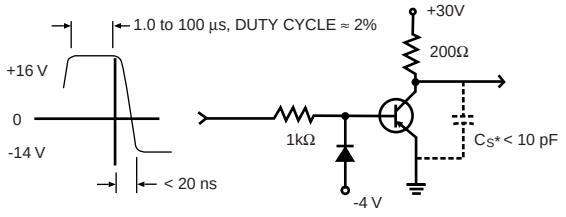


Figure 2: Turn-OFF Time



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