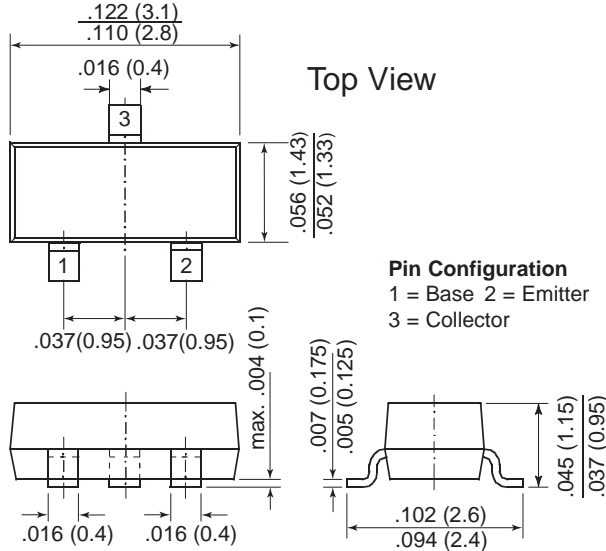




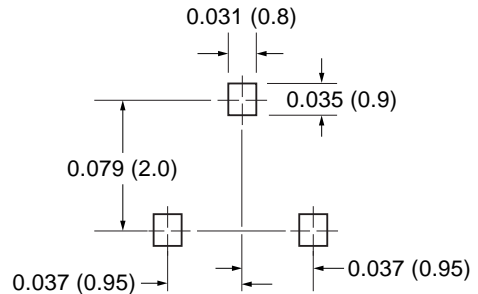
Small Signal Transistor (PNP)

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⁾	P_{tot}	225 1.8	mW mW/°C
Power Dissipation ⁽²⁾	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.

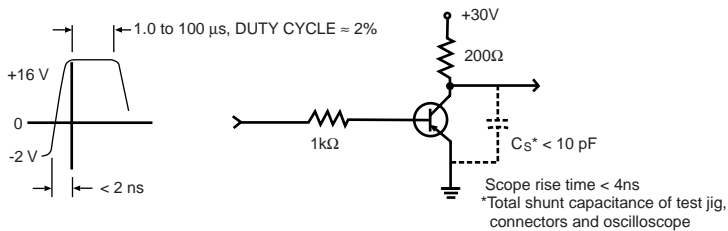
Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

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

Notes: (1) Pulse test: pulse width $\leq 300 \mu\text{s}$ duty cycle $\leq 2\%$

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

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

Switching Time Equivalent Test Circuit
Figure 1: Turn-ON Time

Figure 2: Turn-OFF Time
