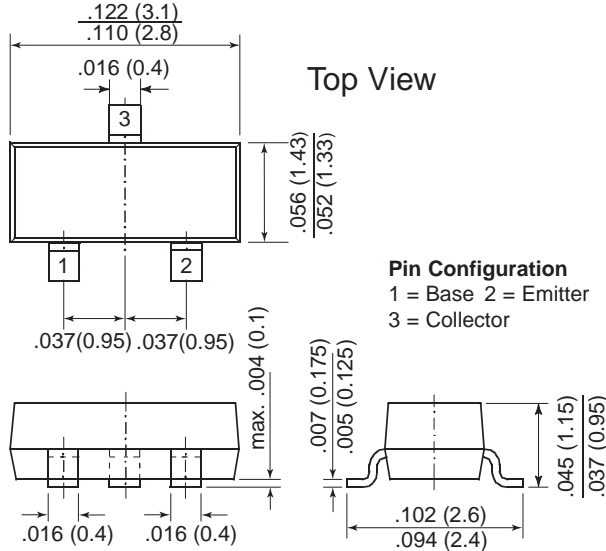


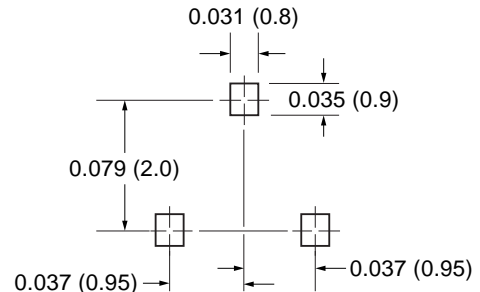


## Small Signal Transistor (PNP)

**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	$-V_{CB0}$	40	V
Collector-Emitter Voltage	$-V_{CEO}$	40	V
Emitter-Base Voltage	$-V_{EB0}$	5.0	V
Collector Current	$-I_C$	600	mA
Power Dissipation <sup>(1)</sup>	$P_{tot}$	225 1.8	mW mW/°C
Power Dissipation <sup>(2)</sup>	$P_{tot}$	300 2.4	mW mW/°C
Thermal Resistance Junction to Ambient Air	$R_{\theta JA}$	556 <sup>(1)</sup> 417 <sup>(2)</sup>	°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.

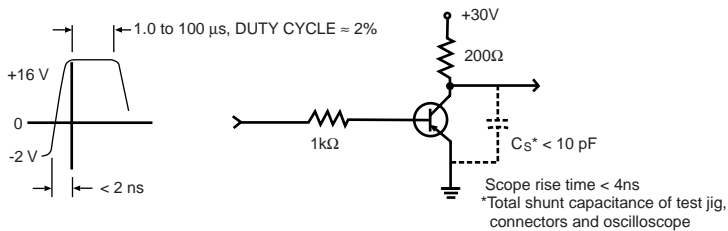
**Electrical Characteristics** (T<sub>J</sub> = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DC Current Gain	h <sub>FE</sub>	-V <sub>CE</sub> = 1V, -I <sub>C</sub> = 0.1mA	30	—	—	—
		-V <sub>CE</sub> = 1V, -I <sub>C</sub> = 1mA	60	—	—	
		-V <sub>CE</sub> = 1V, -I <sub>C</sub> = 10mA	100	—	—	
		-V <sub>CE</sub> = 2V, -I <sub>C</sub> = 150mA <sup>(1)</sup>	100	—	300	
		-V <sub>CE</sub> = 2V, -I <sub>C</sub> = 500mA <sup>(1)</sup>	20	—	—	
Collector-Base Breakdown Voltage	-V <sub>(BR)CBO</sub>	-I <sub>C</sub> = 0.1mA, I <sub>E</sub> = 0	40	—	—	V
Collector-Emitter Breakdown Voltage <sup>(1)</sup>	-V <sub>(BR)CEO</sub>	-I <sub>C</sub> = 1mA, I <sub>B</sub> = 0	40	—	—	V
Emitter-Base Breakdown Voltage	-V <sub>(BR)EBO</sub>	-I <sub>E</sub> = 0.1mA, I <sub>C</sub> = 0	5.0	—	—	V
Collector-Emitter Saturation Voltage <sup>(1)</sup>	-V <sub>CEsat</sub>	-I <sub>C</sub> = 150mA, -I <sub>B</sub> = 15mA	—	—	0.40	V
		-I <sub>C</sub> = 500mA, -I <sub>B</sub> = 50mA	—	—	0.75	
Base-Emitter Saturation Voltage <sup>(1)</sup>	-V <sub>BEsat</sub>	-I <sub>C</sub> = 150mA, -I <sub>B</sub> = 15mA	0.75	—	0.95	V
		-I <sub>C</sub> = 500mA, -I <sub>B</sub> = 50mA	—	—	1.30	
Collector-Emitter Cut-off Current	-I <sub>CEV</sub>	-V <sub>EB</sub> = 0.4V, -V <sub>CE</sub> = 35V	—	—	100	nA
Emitter-Base Cut-off Current	-I <sub>BEV</sub>	-V <sub>EB</sub> = 0.4V, -V <sub>CE</sub> = 35V	—	—	100	nA
Current Gain-Bandwidth Product	f <sub>T</sub>	-V <sub>CE</sub> = 10V, -I <sub>C</sub> = 20mA f = 100MHz	200	—	—	MHz
Collector-Base Capacitance	C <sub>CBO</sub>	-V <sub>CB</sub> = 10V, I <sub>E</sub> = 0, f = 1MHz	—	—	8.5	pF
Emitter-Base Capacitance	C <sub>EBO</sub>	-V <sub>EB</sub> = 0.5V, I <sub>C</sub> = 0, f = 1MHz	—	—	30	pF
Input Impedance	h <sub>ie</sub>	-V <sub>CE</sub> = 10V, -I <sub>C</sub> = 1mA, f = 1kHz	1.5	—	15	kΩ
Small Signal Current Gain	h <sub>fe</sub>	-V <sub>CE</sub> = 10V, -I <sub>C</sub> = 1mA, f = 1kHz	60	—	500	—
Voltage Feedback Ratio	h <sub>re</sub>	-V <sub>CE</sub> = 10V, -I <sub>C</sub> = 1mA, f = 1kHz	0.1 • 10 <sup>-4</sup>	—	8 • 10 <sup>-4</sup>	—
Output Admittance	h <sub>oe</sub>	-V <sub>CE</sub> = 10V, -I <sub>C</sub> = 1mA, f = 1kHz	1.0	—	100	μS

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