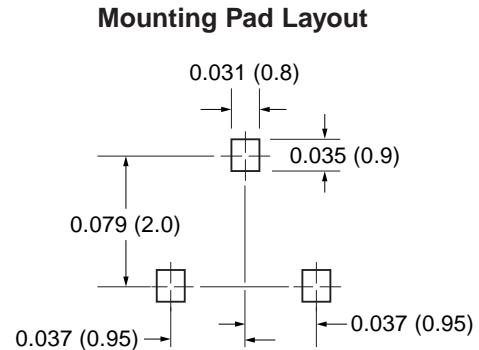
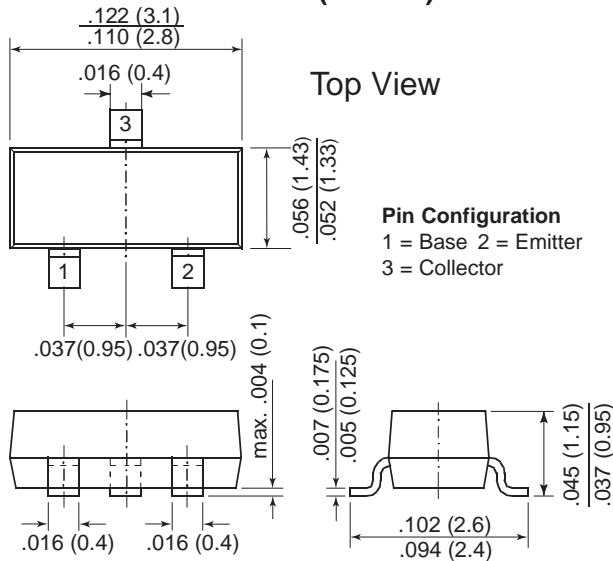




Small Signal Transistor (NPN)



TO-236AB (SOT-23)



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

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.

Parameter	Symbol	Value	Unit
Collector-Base Voltage	V _{CB0}	60	V
Collector-Emitter Voltage	V _{CE0}	40	V
Emitter-Base Voltage	V _{EB0}	6.0	V
Collector Current (continuous)	I _c	200	mA
Power Dissipation	P _{tot}	FR-5 Board ⁽¹⁾ , T _A = 25°C	225
		Derate above 25°C	1.8
Power Dissipation	P _{tot}	Alumina Substrate ⁽²⁾ , T _A = 25°C	300
		Derate above 25°C	2.4
Thermal Resistance Junction to Ambient Air	R _{θJA}	FR-5 Board	556
		Alumina Substrate	417
Junction Temperature	T _j	150	°C
Storage Temperature Range	T _s	-55 to +150	°C

Notes: (1) FR-5 = 1.0 x 0.75 x 0.062 in.
(2) Alumina = 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} = 1 V, I _C = 0.1 mA	20	—	—	—
		V _{CE} = 1 V, I _C = 1 mA	40	—	—	
		V _{CE} = 1 V, I _C = 10 mA	80	—	—	
		V _{CE} = 1 V, I _C = 150 mA	100	—	300	
		V _{CE} = 2 V, I _C = 500 mA	40	—	—	
Collector-Base Breakdown Voltage	V _{(BR)CBO}	I _C = 0.1 mA, I _E = 0	60	—	—	V
Collector-Emitter Breakdown Voltage ⁽¹⁾	V _{(BR)CEO}	I _C = 1 mA, I _B = 0	40	—	—	V
Emitter-Base Breakdown Voltage	V _{(BR)EBO}	I _E = 0.1 mA, I _C = 0	6.0	—	—	V
Collector-Emitter Saturation Voltage	V _{CEsat}	I _C = 150 mA, I _B = 15 mA	—	—	0.40	V
		I _C = 500 mA, I _B = 50 mA	—	—	0.75	
Base-Emitter Saturation Voltage	V _{BEsat}	I _C = 150 mA, I _B = 15 mA	0.75	—	0.95	V
		I _C = 500 mA, I _B = 50 mA	—	—	1.20	
Collector Cut-off Current	I _{CEV}	V _{EB} = 0.4 V, V _{CE} = 35 V	—	—	100	nA
Base Cut-off Current	I _{BEV}	V _{EB} = 0.4 V, V _{CE} = 35 V	—	—	100	nA
Input Impedance	h _{ie}	V _{CE} = 10 V, I _C = 1 mA, f = 1 kHz	1	—	15	kΩ
Voltage Feedback Ratio	h _{re}	V _{CE} = 10 V, I _C = 1 mA, f = 1 kHz	0.1 • 10 ⁻⁴	—	8 • 10 ⁻⁴	—
Output Admittance	h _{oe}	V _{CE} = 10 V, I _C = 1 mA, f = 1 kHz	1.0	—	30	μS
Small Signal Current Gain	h _{fe}	V _{CE} = 10 V, I _C = 1 mA, f = 1 kHz	40	—	500	—
Current Gain-Bandwidth Product	f _T	V _{CE} = 10 V, I _C = 20 mA, f = 100 MHz	250	—	—	MHz
Collector-Base Capacitance	C _{CBO}	V _{CB} = 5 V, f = 1 MHz, I _E = 0	—	—	6.5	pF
Emitter-Base Capacitance	C _{EBO}	V _{CB} = 0.5 V, f = 1 MHz, I _C = 0	—	—	30	pF
Delay Time (see Fig. 1)	t _d	I _{B1} = 15 mA, I _C = 150 mA V _{CC} = 30 V V _{BE} = 40 V	—	—	15	ns
Rise Time (see Fig. 1)	t _r	I _{B1} = 15 mA, I _C = 150 mA V _{CC} = 30 V V _{BE} = 40 V	—	—	20	ns
Storage Time (see Fig. 2)	t _s	I _{B1} = I _{B2} = 15 mA, I _C = 150 mA V _{CC} = 30 V	—	—	225	ns
Fall Time (see Fig. 2)	t _f	I _{B1} = I _{B2} = 1 mA, I _C = 150 mA V _{CC} = 30 V	—	—	30	ns

Note: (1) Pulse test: pulse width ≤ 300 μs, cycle ≤ 2.0%

Switching Time Equivalent Test Circuit

Figure 1 - Turn-On Time

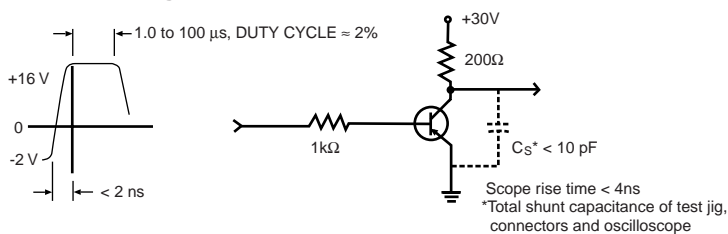


Figure 2 - Turn-Off Time

