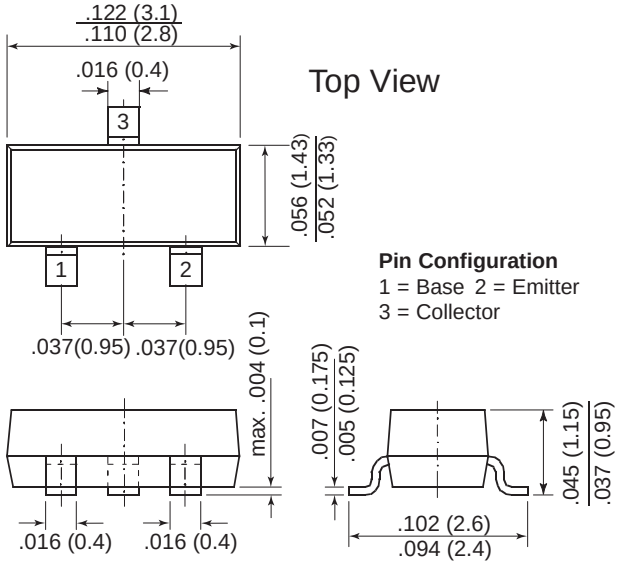
New Product

Vishay Semiconductors
formerly General Semiconductor

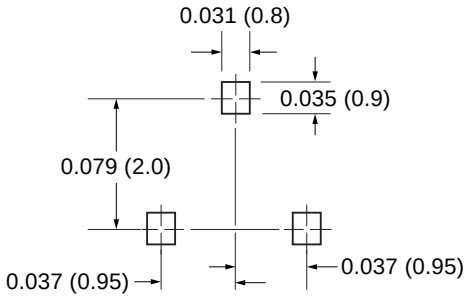
Small Signal Transistor (NPN)

TO-236AB (SOT-23)



Dimensions in inches and (millimeters)

Mounting Pad Layout



Features

- NPN Silicon Epitaxial Planar Transistor for switching and amplifier applications.
- As complementary type, the PNP transistor MMBT3906 is recommended.
- This transistor is also available in the TO-92 case with the type designation 2N3904.

Mechanical Data

Case: SOT-23 Plastic Package
Weight: approx. 0.008g
Marking Code: 1AM
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

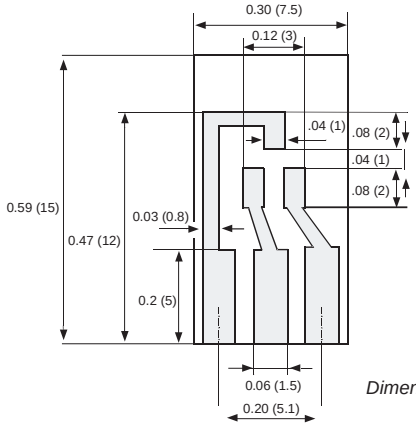
Ratings at 25°C ambient temperature unless otherwise specified.

Parameter	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6.0	V
Collector Current	I_C	200	mA
Power Dissipation at T_A = 25°C	P_{tot}	225(1) 300(2)	mW
Thermal Resistance Junction to Substrate Backside	$R_{\Theta SB}$	320(1)	°C/W
Thermal Resistance Junction to Ambient Air	$R_{\Theta JA}$	450(1)	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_S	–65 to +150	°C

Note: (1) Device on fiberglass substrate, see layout.
(2) Device on alumina substrate.

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 V_{CE} = 1 V, I_C = 1 mA V_{CE} = 1 V, I_C = 10 mA V_{CE} = 1 V, I_C = 50 mA V_{CE} = 1 V, I_C = 100 mA	40 70 100 60 30	— — — — —	— — 300 — —	—
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 10 µA, I_E = 0	60	—	—	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C = 1 mA, I_B = 0	40	—	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E = 10 µA, I_C = 0	6.0	—	—	V
Collector Saturation Voltage	V_{CEsat}	I_C = 10 mA, I_B = 1 mA I_C = 50 mA, I_B = 5 mA	— —	— —	0.2 0.3	V
Base Saturation Voltage	V_{BEsat}	I_C = 10 mA, I_B = 1 mA I_C = 50 mA, I_B = 5 mA	— —	— —	0.85 0.95	V
Collector-Emitter Cut-off Current	I_{CEV}	V_{EB} = 3 V, V_{CE} = 30 V	—	—	50	nA
Emitter-Base Cut-off Current	I_{EBV}	V_{EB} = 3 V, V_{CE} = 30 V	—	—	50	nA
Gain-Bandwidth Product	f_T	V_{CE} = 20 V, I_C = 10 mA f = 100 MHz	300	—	—	MHz
Collector-Base Capacitance	C_{CBO}	V_{CB} = 5 V, f = 100 kHz	—	—	4	pF
Emitter-Base Capacitance	C_{EBO}	V_{EB} = 0.5 V, f = 100 kHz	—	—	8	pF



Dimensions in inches and (millimeters)

Layout for R_{thJA} test
Thickness: Fiberglass 0.059 in (1.5 mm)
Copper leads 0.012 in (0.3 mm)

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Noise Figure	NF	V_{CE} = 5 V, I_C = 100 μA, R_G = 1 kΩ, f = 10...15000 Hz	—	—	5	dB
Input Impedance	h_{ie}	V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	1	—	10	kΩ
Small Signal Current Gain	h_{fe}	V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	100	—	400	—
Voltage Feedback Ratio	h_{re}	V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	$0.5 \cdot 10^{-4}$	—	$8 \cdot 10^{-4}$	—
Output Admittance	h_{oe}	V_{CE} = 1 V, I_C = 1 mA, f = 1 kHz	1	—	40	μS
Delay Time (see Fig. 1)	t_d	I_{B1} = 1 mA, I_C = 10 mA	—	—	35	ns
Rise Time (see Fig. 1)	t_r	I_{B1} = 1 mA, I_C = 10 mA	—	—	35	ns
Storage Time (see Fig. 2)	t_s	$-I_{B1} = I_{B2}$ = 1 mA, I_C = 10 mA	—	—	200	ns
Fall Time (see Fig. 2)	t_f	$-I_{B1} = I_{B2}$ = 1 mA, I_C = 10 mA	—	—	50	ns

Fig. 1: Test circuit for delay and rise time
* total shunt capacitance of test jig and connectors

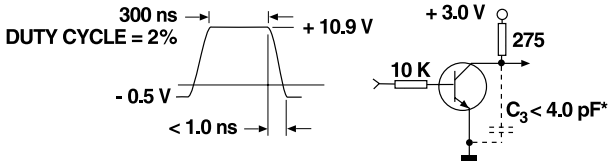


Fig. 2: Test circuit for storage and fall time
* total shunt capacitance of test jig and connectors