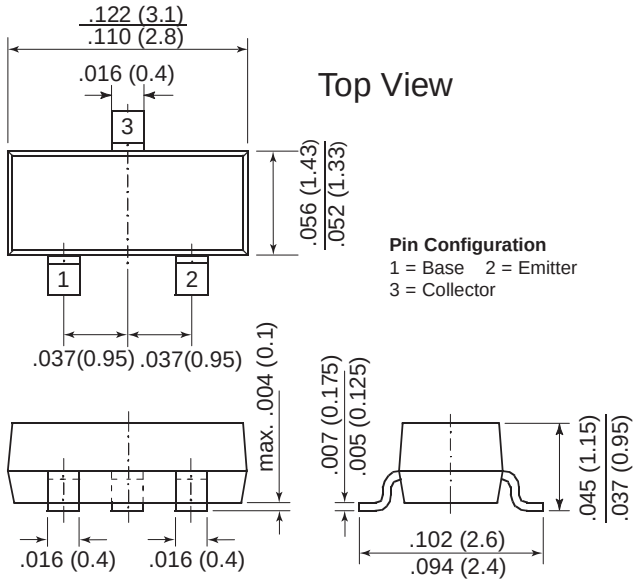
New Product

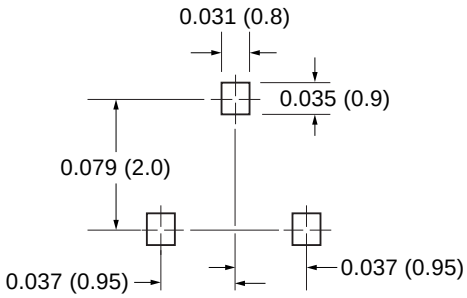
Vishay Semiconductors
formerly General Semiconductor

Small Signal Transistor (PNP)

TO-236AB (SOT-23)



Mounting Pad Layout



Dimensions in inches and (millimeters)

Features

- PNP Silicon Epitaxial Planar Transistor for switching and amplifier applications.
- As complementary type, the NPN transistor MMBT3904 is recommended.
- This transistor is also available in the TO-92 case with the type designation 2N3906.

Mechanical Data

Case: SOT-23 Plastic Package

Weight: approx. 0.008g

Marking Code: 2A

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	$-V_{CBO}$	40	V
Collector-Emitter Voltage	$-V_{CEO}$	40	V
Emitter-Base Voltage	$-V_{EBO}$	5.0	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 Ambient Air	$R_{\theta JA}$	450(1)	°C/W
Thermal Resistance Junction to Substrate Backside	$R_{\theta SB}$	320(1)	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_S	–55 to +150	°C

Notes: (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}	$-V_{CE}$ = 1V, $-I_C$ = 0.1mA $-V_{CE}$ = 1V, $-I_C$ = 1mA $-V_{CE}$ = 1V, $-I_C$ = 10mA $-V_{CE}$ = 1V, $-I_C$ = 50mA $-V_{CE}$ = 1V, $-I_C$ = 100mA	60 80 100 60 30	— — — — —	— — 300 — —	—
Collector-Base Breakdown Voltage	$-V_{(BR)CBO}$	$-I_C$ = 10μA, I_E = 0	40	—	—	V
Collector-Emitter Breakdown Voltage	$-V_{(BR)CEO}$	$-I_C$ = 1mA, I_B = 0	40	—	—	V
Emitter-Base Breakdown Voltage	$-V_{(BR)EBO}$	$-I_E$ = 10μA, I_C = 0	5	—	—	V
Collector Saturation Voltage	$-V_{CEsat}$	$-I_C$ = 10mA, $-I_B$ = 1mA $-I_C$ = 50mA, $-I_B$ = 5mA	— —	— —	0.25 0.4	V
Base Saturation Voltage	$-V_{BEsat}$	$-I_C$ = 10mA, $-I_B$ = 1mA $-I_C$ = 50mA, $-I_B$ = 5mA	— —	— —	0.85 0.95	V
Collector-Emitter Cut-off Current	$-I_{CEV}$	$-V_{EB}$ = 3V, $-V_{CE}$ = 30V	—	—	50	nA
Emitter-Base Cut-off Current	$-I_{EBV}$	$-V_{EB}$ = 3V, V_{CE} = 30V	—	—	50	nA
Gain-Bandwidth Product	f_T	$-V_{CE}$ = 20V, $-I_C$ = 10mA f = 100MHz	250	—	—	MHz
Collector-Base Capacitance	C_{CBO}	$-V_{CB}$ = 5V, f = 100kHz	—	—	4.5	pF
Emitter-Base Capacitance	C_{EBO}	$-V_{CB}$ = 0.5V, f = 100kHz	—	—	10	pF
Noise Figure	NF	$-V_{CE}$ = 5V, $-I_C$ = 100μA, R_G = 1kΩ, f = 10...15000Hz	—	—	4	dB
Input Impedance	h_{ie}	$-V_{CE}$ = 10V, $-I_C$ = 1mA f = 1kHz	1	—	10	kΩ
Small Signal Current Gain	h_{fe}	$-V_{CE}$ = 10V, $-I_C$ = 1mA, f = 1kHz	100	—	400	—
Voltage Feedback Ratio	h_{re}	$-V_{CE}$ = 10V, $-I_C$ = 1mA, f = 1kHz	$0.5 \cdot 10^{-4}$	—	$8 \cdot 10^{-4}$	—
Output Admittance	h_{oe}	$-V_{CE}$ = 1V, $-I_C$ = 1mA, f = 1kHz	1	—	40	μS

Electrical Characteristics (T$_J$ = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Delay Time (see fig. 1)	t_d	$-I_{B1}$ = 1mA, $-I_C$ = 10mA	—	—	35	ns
Rise Time (see fig. 1)	t_r	$-I_{B1}$ = 1mA, $-I_C$ = 10mA,	—	—	35	ns
Storage Time (see fig. 2)	t_s	$I_{B1} = -I_{B2}$ = 1mA, $-I_C$ = 10mA	—	—	225	ns
Fall Time (see fig. 2)	t_f	$I_{B1} = -I_{B2}$ = 1mA, $-I_C$ = 10mA	—	—	75	ns

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

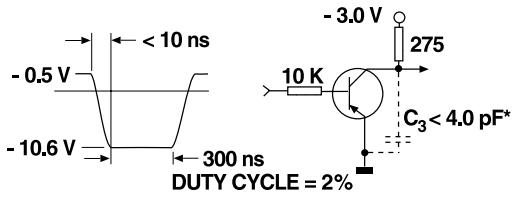
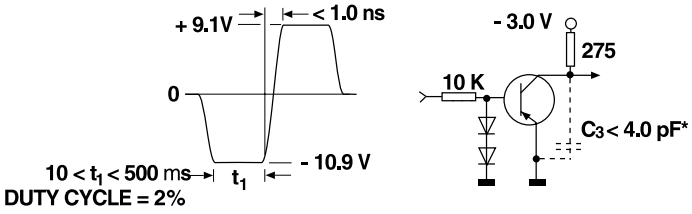
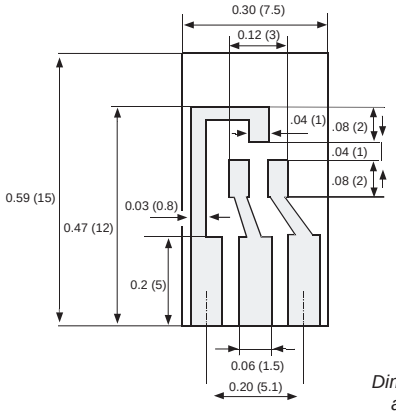


Fig. 2: Test circuit for storage and fall time
* total shunt capacitance of test jig and connectors





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)