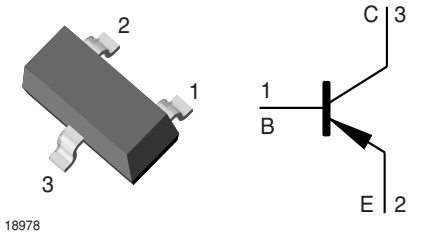
Small Signal Transistor (PNP)

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 case
Weight: approx. 8.8 mg

Packaging Codes/Options:
GS18 / 10 k per 13" reel (8 mm tape), 10 k/box
GS08 / 3 k per 7" reel (8 mm tape), 15 k/box

Parts Table

Part	Type differentiation	Ordering code	Marking	Remarks
MMBT3906	h_{FE}, 100 to 300 @ 10 mA	MMBT3906-GS18 or MMBT3906-GS08	2A	Tape and Reel

Absolute Maximum Ratings

T_{amb} = 25 °C, unless otherwise specified

Parameter	Test condition	Symbol	Value	Unit
Collector - base voltage		$-V_{CBO}$	40	V
Collector - emitter voltage		$-V_{CEO}$	40	V
Emitter - base voltage		$-V_{EBO}$	5	V
Collector current		$-I_C$	200	mA
Power dissipation	T_A = 25 °C	P_{tot}	225[1)]	mW
		P_{tot}	300[2)]	mW

1) Device on fiberglass substrate, see layout.

2) Device on alumina substrate.

Maximum Thermal Resistance

Parameter	Test condition	Symbol	Value	Unit
Thermal resistance junction to ambient air		R_{thJA}	450[1)]	°C/W
Thermal resistance junction to substrate backside		R_{thSB}	320[1)]	°/W
Junction temperature		T_j	150	°C
Storage temperature range		T_S	- 55 to + 150	°C

1) Device on fiberglass substrate, see layout.

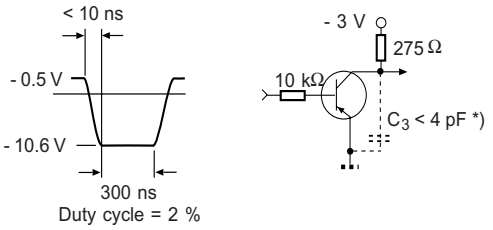
Electrical DC Characteristics

Parameter	Test condition	Symbol	Min	Typ	Max	Unit
DC current gain	$-V_{CE}$ = 1 V, $-I_C$ = 0.1 mA	h_{FE}	60			
	$-V_{CE}$ = 1 V, $-I_C$ = 1 mA	h_{FE}	80			
	$-V_{CE}$ = 1 V, $-I_C$ = 10 mA	h_{FE}	100		300	
	$-V_{CE}$ = 1 V, $-I_C$ = 50 mA	h_{FE}	60			
	$-V_{CE}$ = 1 V, $-I_C$ = 100 mA	h_{FE}	30			
Collector - emitter breakdown voltage	$-I_C$ = 1 mA, I_B = 0	$-V_{(BR)CEO}$	40			V
Emitter - base breakdown voltage	$-I_E$ = 10 µA, I_C = 0	$-V_{(BR)EBO}$	5			V
Collector saturation voltage	$-I_C$ = 10 mA, $-I_B$ = 1 mA	$-V_{CEsat}$			0.25	V
	$-I_C$ = 50 mA, $-I_B$ = 5 mA	$-V_{CEsat}$			0.4	V
Base saturation voltage	$-I_C$ = 10 mA, $-I_B$ = 1 mA	$-V_{BEsat}$			0.85	V
	$-I_C$ = 50 mA, $-I_B$ = 5 mA	$-V_{BEsat}$			0.95	V
Collector - emitter cut - off current	$-V_{EB}$ = 3 V, $-V_{CE}$ = 30 V	$-I_{CEV}$			50	nA
Emitter-base cut-off current	$-V_{EB}$ = 3 V, V_{CE} = 30 V	I_{EBV}			50	nA

Electrical AC Characteristics

Parameter	Test condition	Symbol	Min	Typ	Max	Unit
Gain - bandwidth product	$-V_{CE}$ = 20 V, $-I_C$ = 10 mA, f = 100 MHz	f_T	250			MHz
Collector - base capacitance	$-V_{CB}$ = 5 V, f = 100 KHz,	C_{CBO}			4.5	pF
Emitter - base capacitance	$-V_{CB}$ = 0.5 V, f = 100 kHz	C_{EBO}			10	pF
Noise figure	$-V_{CE}$ = 5 V, $-I_C$ = 100 µA, R_G = 1 kΩ, f = 10 to 15000 Hz	NF			4	dB
Input impedance	$-V_{CE}$ = 10 V, $-I_C$ = 1 mA, f = 1 kHz	h_{ie}	1		10	kΩ
Small signal current gain	$-V_{CE}$ = 10 V, $-I_C$ = 1 mA, f = 1 kHz	h_{fe}	100		400	
Voltage feedback ratio	$-V_{CE}$ = 10 V, $-I_C$ = 1 mA, f = 1 kHz	h_{re}	0.5×10^{-4}		8×10^{-4}	
Output admittance	$-V_{CE}$ = 10 V, $-I_C$ = 1 mA, f = 1 kHz	h_{oe}	1		40	µS
Delay time (see fig. 1)	$-I_{B1}$ = 1 mA, $-I_C$ = 10 mA	t_d			35	ns
Rise time (see fig. 1)	$-I_{B1}$ = 1 mA, $-I_C$ = 10 mA	t_r			35	ns
Storage time (see fig. 2)	$I_{B1} = -I_{B2}$ = 1 mA, $-I_C$ = 10 mA	t_s			225	ns
Fall time (see fig. 2)	$I_{B1} = -I_{B2}$ = 1 mA, $-I_C$ = 10 mA	t_f			75	ns

Test Circuit



*) total shunt capacitance of test jig and connectors

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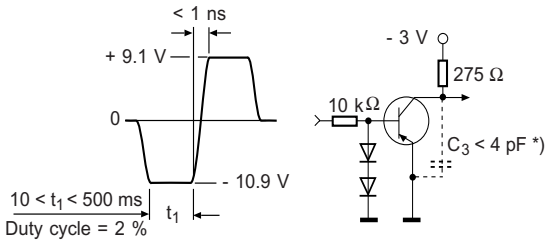
Figure 1. Test Circuit for Delay and Rise Time



*) total shunt capacitance of test jig and connectors

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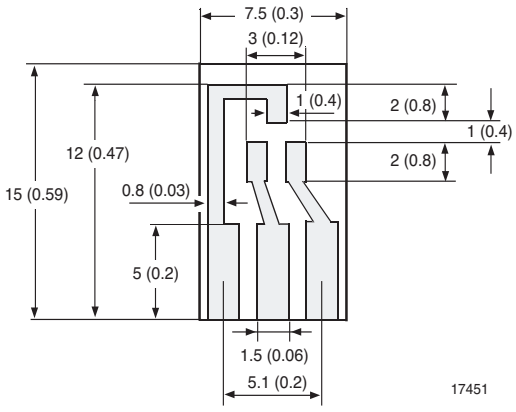
Figure 2. Test Circuit for Storage and Fall Time

Layout for R_{thJA} test

Thickness: Fiberglass 1.5 mm (0.059 in.)
Copper leads 0.3 mm (0.012 in.)



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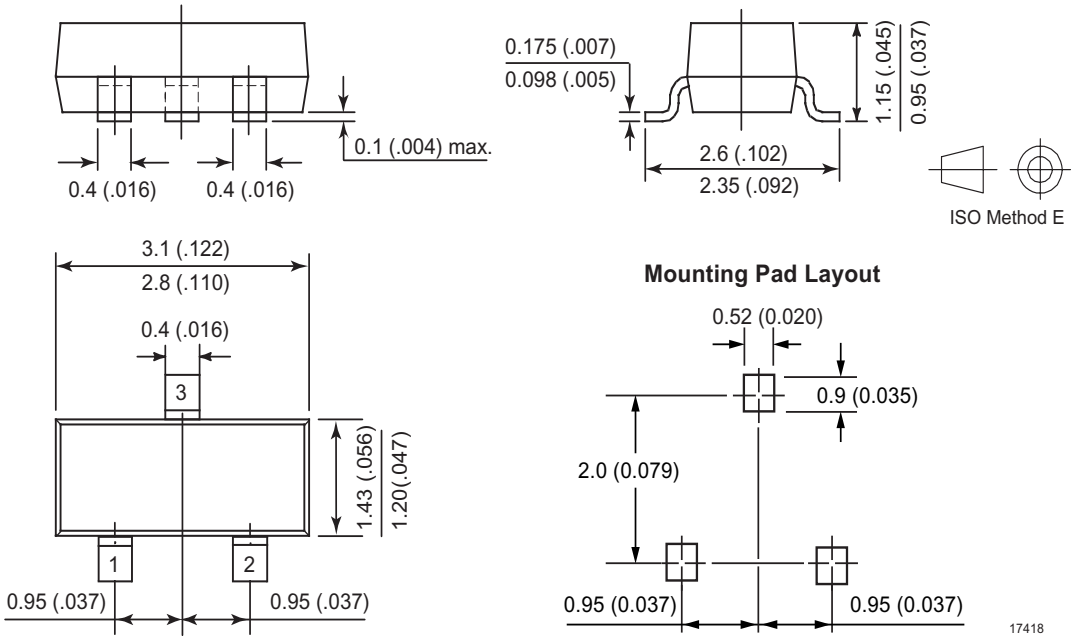
Package Dimensions in mm (Inches)



Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operatingsystems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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