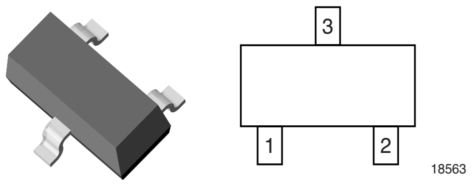
Small Signal Transistor (NPN)

Features
- NPN Silicon Epitaxial Planar Transistor for switching and amplifier applications.
- This transistor is also available in the TO-92 case with the type designation MPS2222A.



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
Pinning:
1 = Base, 2 = Emitter, 3 = Collector

Parts Table

Part	Ordering code	Marking	Remarks
MMBT2222A	MMBT2222A-GS18 or MMBT2222A-GS08	1P	Tape and Reel

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

Parameter	Test condition	Symbol	Value	Unit
Collector - base voltage		V_{CBO}	75	V
Collector - emitter voltage		V_{CEO}	40	V
Emitter - base voltage		V_{EBO}	6.0	V
Collector current		I_C	600	mA
Power dissipation	on FR-5 board[1], T_A = 25 °C	P_{tot}	225	mW
	Derate above 25 °C	P_{tot}	1.8	mW/K
	on alumina substrate[2], T_A = 25 °C	P_{tot}	300	mW
	Derate above 25 °C	P_{tot}	2.4	mW/K

[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.

Maximum Thermal Resistance

Parameter	Test condition	Symbol	Value	Unit
Thermal resistance junction to ambient air	FR-5 board	R_{thJA}	556	K/W
	Alumina substrate	R_{thJA}	417	K/W
Junction temperature		T_j	150	°C
Storage temperature range		T_S	- 55 to + 150	°C

Electrical DC Characteristics

Parameter	Test condition	Symbol	Min	Typ	Max	Unit
DC current gain	V_{CE} = 10 V, I_C = 0.1 mA	h_{FE}	35			
	V_{CE} = 10 V, I_C = 1 mA	h_{FE}	50			
	V_{CE} = 10 V, I_C = 10 mA	h_{FE}	75			
	V_{CE} = 10 V, I_C = 10 mA, T_A = - 55 °C	h_{FE}	35			
	V_{CE} = 10 V, I_C = 150 mA[1)]	h_{FE}	100		300	
	V_{CE} = 10 V, I_C = 500 mA[1)]	h_{FE}	40			
	V_{CE} = 1.0 V, I_C = 150 mA[1)]	h_{FE}	50			
Collector - base breakdown voltage	I_C = 10 μA, I_E = 0	$V_{(BR)CBO}$	75			V
Collector - emitter breakdown voltage[1)]	I_C = 10 μA, I_B = 0	$V_{(BR)CEO}$	40			V
Emitter - base breakdown voltage	I_E = 10 μA, I_C = 0	$V_{(BR)EBO}$	6.0			V
Collector - emiter saturation voltage[1)]	I_C = 150 mA, I_B = 15 mA	V_{CEsat}			0.3	V
	I_C = 500 mA, I_B = 50 mA	V_{CEsat}			1.0	V
Base - emitter saturation voltage	I_C = 150 mA, I_B = 15 mA	V_{BEsat}	0.6		1.2	V
	I_C = 500 mA, I_B = 50 mA	V_{BEsat}			2.0	V
Collector-emitter cut-off current	V_{EB} = 3 V, V_{CE} = 60 V	I_{CEX}			10	nA
Collector-base cut-off current	V_{CB} = 60 V, I_E = 0	I_{CBO}			10	nA
	V_{CB} = 50 V, I_E = 0, T_A = 125 °C	I_{CBO}			10	μA
Base cut - off current	V_{EB} = 3 V, V_{CE} = 60 V	I_{BL}			20	nA
Emitter-base cut-off current	V_{EB} = 3 V_{DC}, I_C = 0	I_{EBO}			100	nA

[1)] Pulse Test: Pulse width ≤ 300 μs - Duty cycle ≤ 2 %

Electrical AC Characteristics

Parameter	Test condition	Symbol	Min	Typ	Max	Unit
Current gain - bandwidth product	V_{CE} = 20 V, I_C = 20 mA, f = 100 MHz	f_T	300			MHz
Output capacitance	V_{CB} = 10 V, f = 1 MHz, I_E = 0	C_{ob}			8	pF
Input capacitance	V_{EB} = 0.5 V, f = 1 MHz, I_C = 0	C_{ibo}			25	pF
Noise figure	V_{CE} = 10 V, I_C = 100 μA, R_S = 1 kΩ, f = 1 kHz	NF			4.0	dB

Document Number 85123
Rev. 1.2, 31-Aug-04

Parameter	Test condition	Symbol	Min	Typ	Max	Unit
Input impedance	V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	h_{ie}	2		8.0	kΩ
	V_{CE} = 10 V, I_C = 10 mA, f = 1 kHz	h_{ie}	0.25		1.25	kΩ
Small signal current gain	V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	h_{fe}	50		300	
	V_{CE} = 10 V, I_C = 10 mA, f = 1 kHz	h_{fe}	75		375	
Voltage feedback ratio	V_{CE} = 10 V, I_C = 1 mA	h_{re}	50		300	
	f = 1 kHz	h_{re}	75		375	
Output admittance	V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	h_{oe}	5.0		35	µS
	V_{CE} = 10 V, I_C = 10 mA, f = 1 kHz	h_{oe}	25		200	µS
Collector base time constant	I_E = 20 mA, V_{CB} = 20 V, f = 31.8 MHz	$r_b'C_{CC}$			150	ps
Delay time (see fig.1)	I_{B1} = 15 mA, I_C = 150 mA, V_{CC} = 30 V, V_{BE} = - 0.5 V	t_d			10	ns
Rise time (see fig.1)	I_{B1} = 15 mA, I_C = 150 mA, V_{CC} = 30 V, V_{BE} = - 0.5 V	t_r			25	ns
Storage time (see fig.2)	I_{B1} = I_{B2} = 15 mA, I_C = 150 mA, V_{CC} = 30 V	t_s			225	ns
Fall time (see fig.2)	I_{B1} = I_{B2} = 15 mA, I_C = 150 mA, V_{CC} = 30 V	t_s			60	ns

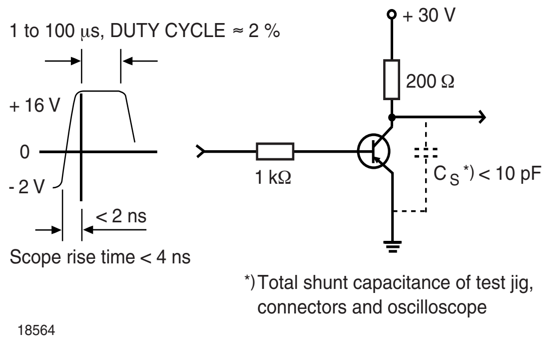


Figure 1. Turn-On Time

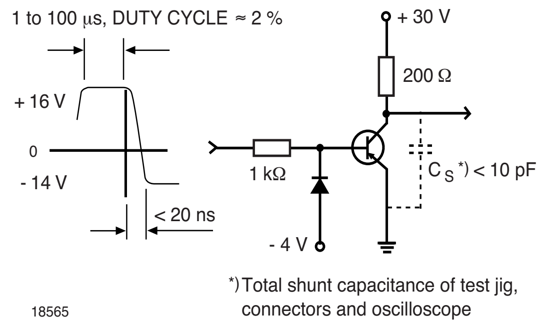
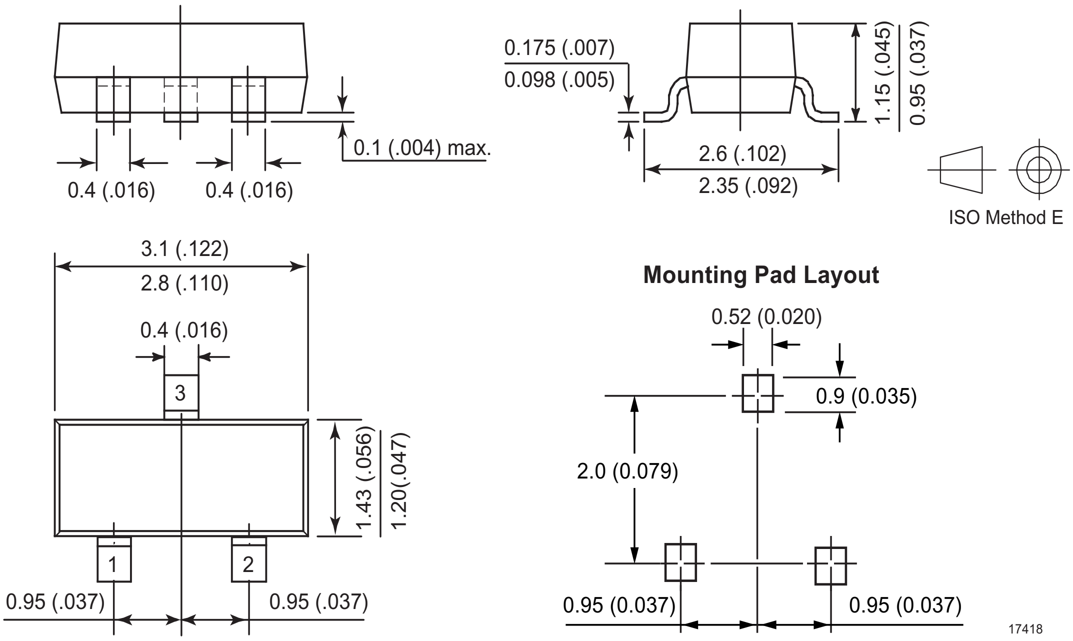


Figure 2. Turn-Off Time

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.

We reserve the right to make changes to improve technical design and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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