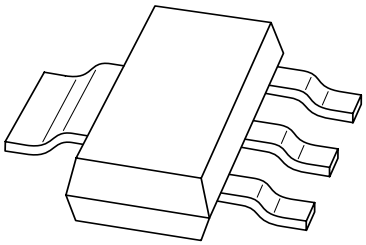
DATA SHEET



PZTM1101
NPN transistor/Schottky-diode module

Product specification

1996 May 09

Philips
Semiconductors

PHILIPS

NPN transistor/Schottky-diode module PZTM1101

FEATURES

- Low output capacitance
- Fast switching time
- Integrated Schottky protection diode.

APPLICATIONS

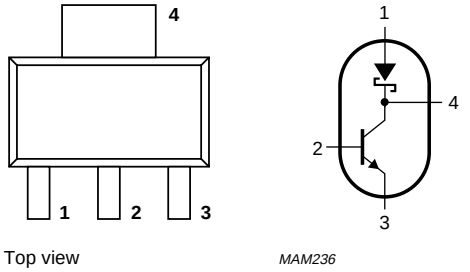
- High-speed switching for industrial applications.

PINNING

PIN	DESCRIPTION
1	anode Schottky
2	base
3	emitter
4	collector, cathode Schottky

DESCRIPTION

Combination of an NPN transistor and a Schottky barrier diode in a plastic SOT223 package. PNP complement: PZTM1102.



Marking code: TM1101.

Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
NPN transistor					
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	200	mA
Schottky barrier diode					
V_R	continuous reverse voltage		–	40	V
I_F	forward current (DC)		–	1	A
$I_{F(AV)}$	average forward current		–	1	A
T_j	junction temperature	reverse current applied	–	125	°C
		forward current applied	–	150	°C
Combined device					
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	1.2	W
T_{amb}	operating ambient temperature		–55	+150	°C
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–	150	°C

ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
NPN transistor					
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 10 μA; I_E = 0; T_{amb} = –55 to +150 °C; note 1	60	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	open base; I_C = 1 mA; V_{BE} = 0; T_{amb} = –55 to +150 °C; note 1	40	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 μA; I_C = 0; T_{amb} = –55 to +150 °C; note 1	6	–	V
I_{CES}	collector-emitter cut-off current	V_{CE} = 20 V; V_{BE} = 0	–	100	nA
		V_{CE} = 20 V; V_{BE} = 0; T_{amb} = –55 to +150 °C	–	50	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = 6 V; I_C = 0	–	50	nA
		V_{EB} = 6 V; I_C = 0; T_{amb} = –55 to +150 °C	–	10	μA
V_{CEsat}	collector-emitter saturation voltage	note 1			
		I_C = 10 mA; I_B = 1 mA	–	200	mV
		I_C = 50 mA; I_B = 3.2 mA	–	300	mV
V_{CEsat}	collector-emitter saturation voltage	T_{amb} = –55 to +150 °C; note 1			
		I_C = 10 mA; I_B = 1 mA	–	250	mV
		I_C = 50 mA; I_B = 3.2 mA	–	350	mV
V_{BEsat}	base-emitter saturation voltage	note 1			
		I_C = 10 mA; I_B = 1 mA	–	850	mV
		I_C = 50 mA; I_B = 5 mA	–	950	mV
V_{BEsat}	base-emitter saturation voltage	T_{amb} = –55 to +150 °C; note 1			
		I_C = 10 mA; I_B = 1 mA	–	1000	mV
		I_C = 50 mA; I_B = 5 mA	–	1100	mV
C_{ob}	output capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_{ib}	input capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	8	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
h_{FE}	DC current gain	V_{CE} = 1 V; note 1			
		I_C = 0.1 mA	40	–	
		I_C = 1 mA	70	–	
		I_C = 10 mA	100	300	
		I_C = 100 mA	30	–	
h_{FE}	DC current gain	V_{CE} = 1 V; T_{amb} = –55 to +150 °C; note 1			
		I_C = 10 mA	60	500	
		I_C = 100 mA	15	–	
SWITCHING TIMES (see Figs 2 and 3)					
t_d	delay time	V_{CC} = 5 V	1	5	ns
t_r	rise time	I_C = 50 mA	16	31	ns
t_s	storage time	V_i = 0 to 5 V	110	310	ns
t_f	fall time		70	100	ns

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Schottky barrier diode					
V_F	forward voltage	I_F = 100 mA; note 1	–	330	mV
		I_F = 100 mA; T_{amb} = –55 to +150 °C; note 1	–	400	mV
		I_F = 1 A; note 1	–	500	mV
		I_F = 1 A; T_{amb} = –55 to +150 °C; note 1	–	560	mV
I_R	reverse current	V_R = 40 V; note 1	–	300	μA
		V_R = 40 V; T_j = 125 °C; T_{amb} = –55 to +150 °C; note 1	–	35(2)	mA
I_R	reverse current	V_R = 10 V; note 1	–	40	μA
		V_R = 10 V; T_j = 125 °C; T_{amb} = –55 to +150 °C; note 1	–	15(2)	mA
C_j	junction capacitance	V_R = 0 V; f = 1 MHz	–	250	pF

Notes

1. Measured under pulsed conditions: $t_p \leq 300$ μs; $\delta \leq 0.01$.
2. Limiting value for T_j = 125 °C; T_j = 150 °C with reverse current applied is not allowed as this may cause thermal runaway leading to thermal destruction of the diode. A peak junction temperature of T_j = 150 °C is only allowed with forward voltage applied.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient (combined device)	note 1	100	K/W

Note

1. Refer to SOT223 standard mounting conditions.

GRAPHICAL DATA

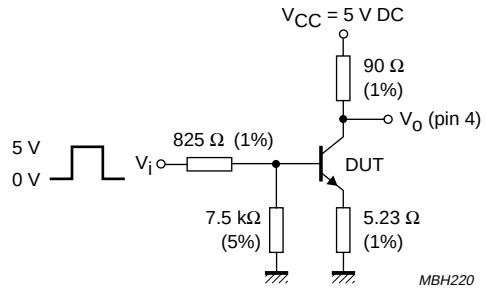
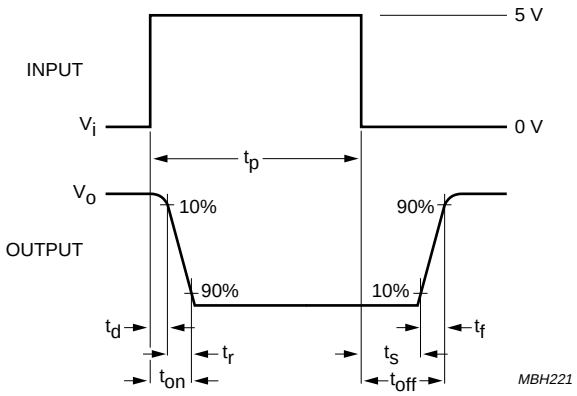


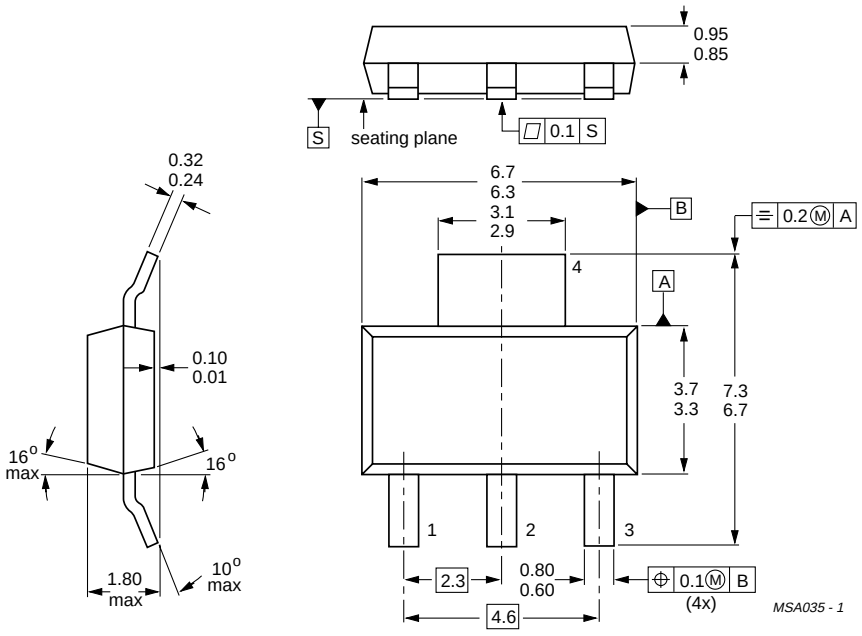
Fig.2 Switching times test circuit.



t_r < 5 ns (10% to 90%); t_p = 1 µs; δ = 0.02; Z_i = 50 Ω.
$t_{on} = t_d + t_r$; $t_{off} = t_s + t_f$.

Fig.3 Input and output waveforms.

PACKAGE OUTLINE



Dimensions in mm.

Fig.4 SOT223.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.