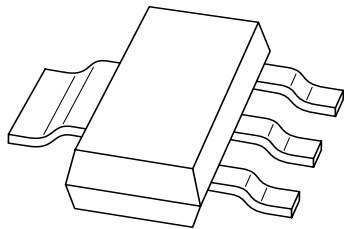


# DATA SHEET



## **PZTM1101** NPN transistor/Schottky-diode module

Product specification

1996 May 09

## NPN transistor/Schottky-diode module

## PZTM1101

## FEATURES

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

## APPLICATIONS

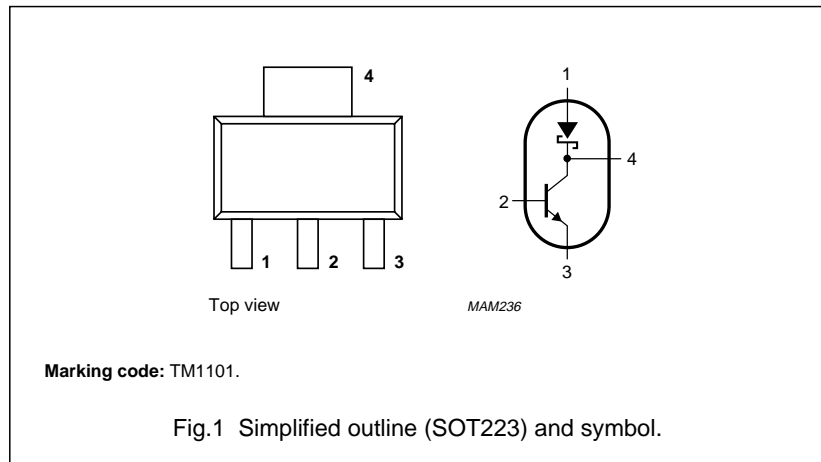
- High-speed switching for industrial applications.

## 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.



## LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
<b>NPN transistor</b>					
$V_{CBO}$	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
<b>Schottky barrier diode</b>					
$V_R$	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
<b>Combined device</b>					
$P_{tot}$	total power dissipation	up to $T_{amb} = 25\text{ °C}$	–	1.2	W
$T_{amb}$	operating ambient temperature		–55	+150	°C
$T_{stg}$	storage temperature		–55	+150	°C
$T_j$	junction temperature		–	150	°C

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**ELECTRICAL CHARACTERISTICS** $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

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

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SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
<b>Schottky barrier diode</b>					
V <sub>F</sub>	forward voltage	I <sub>F</sub> = 100 mA; note 1	–	330	mV
		I <sub>F</sub> = 100 mA; T <sub>amb</sub> = –55 to +150 °C; note 1	–	400	mV
		I <sub>F</sub> = 1 A; note 1	–	500	mV
		I <sub>F</sub> = 1 A; T <sub>amb</sub> = –55 to +150 °C; note 1	–	560	mV
I <sub>R</sub>	reverse current	V <sub>R</sub> = 40 V; note 1	–	300	μA
		V <sub>R</sub> = 40 V; T <sub>j</sub> = 125 °C; T <sub>amb</sub> = –55 to +150 °C; note 1	–	35 <sup>(2)</sup>	mA
I <sub>R</sub>	reverse current	V <sub>R</sub> = 10 V; note 1	–	40	μA
		V <sub>R</sub> = 10 V; T <sub>j</sub> = 125 °C; T <sub>amb</sub> = –55 to +150 °C; note 1	–	15 <sup>(2)</sup>	mA
C <sub>j</sub>	junction capacitance	V <sub>R</sub> = 0 V; f = 1 MHz	–	250	pF

**Notes**

1. Measured under pulsed conditions: t<sub>p</sub> ≤ 300 μs; δ ≤ 0.01.
2. Limiting value for T<sub>j</sub> = 125 °C; T<sub>j</sub> = 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<sub>j</sub> = 150 °C is only allowed with forward voltage applied.

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
R <sub>th j-a</sub>	thermal resistance from junction to ambient (combined device)	note 1	100	K/W

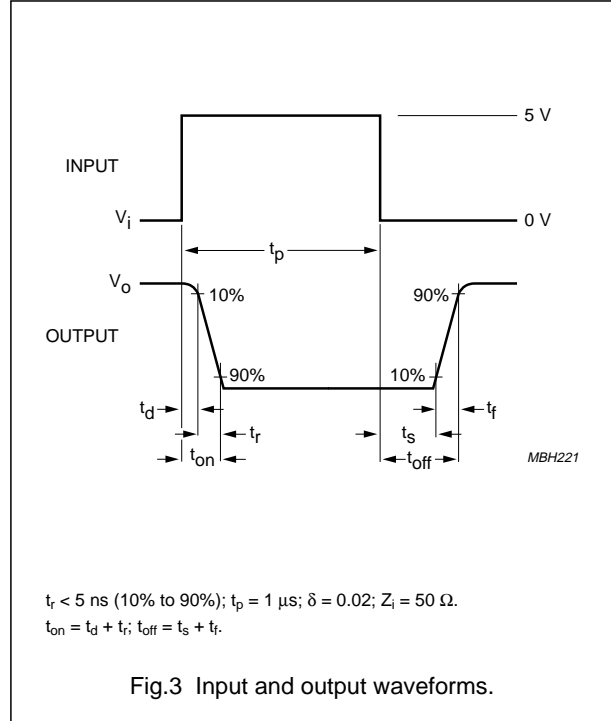
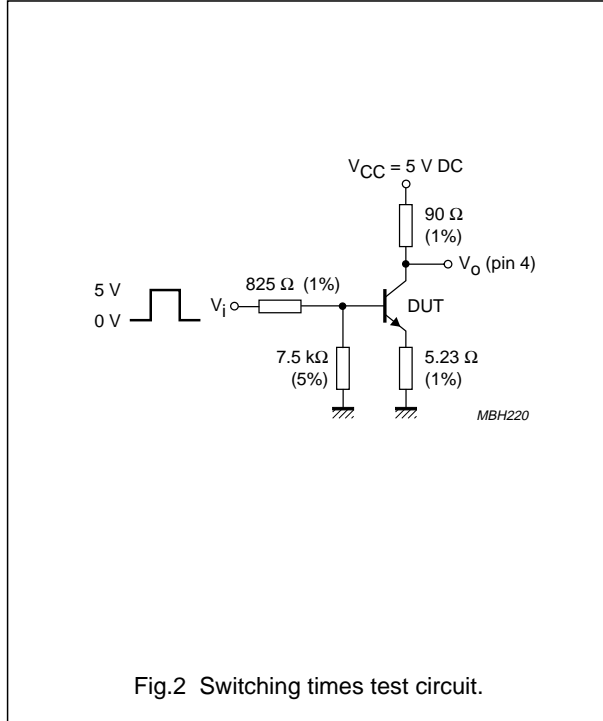
**Note**

1. Refer to SOT223 standard mounting conditions.

NPN transistor/Schottky-diode module

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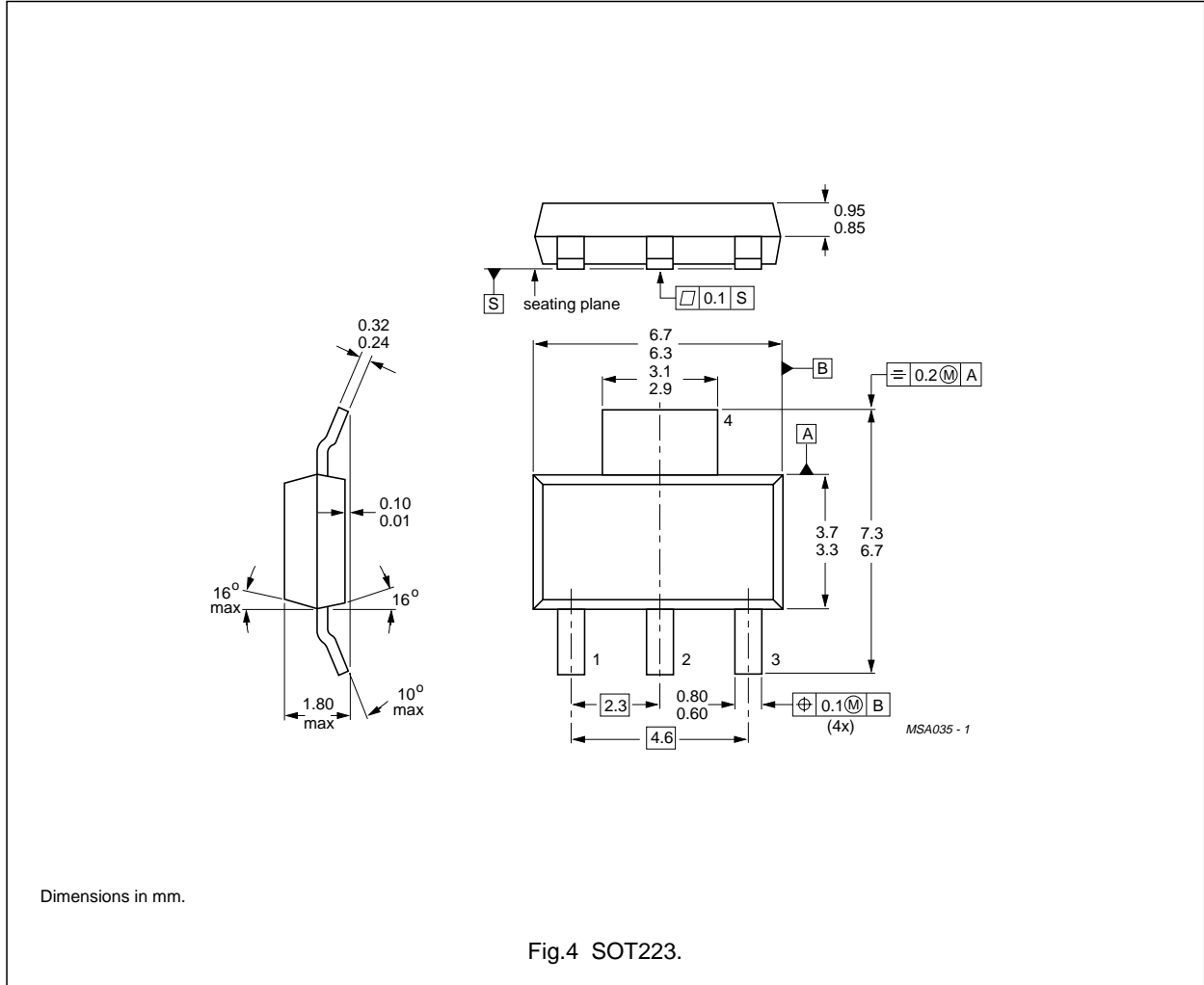
GRAPHICAL DATA



NPN transistor/Schottky-diode module

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PACKAGE OUTLINE



## NPN transistor/Schottky-diode module

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**DEFINITIONS**

<b>Data sheet status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

**LIFE SUPPORT APPLICATIONS**

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