Schottky Diode & PNP Transistor Combination

PZT1102

Transistor 60V / 200mA
Schottky Diode 40V / 1A

DATASHEET

OEM – Philips

Source: Philips Databook 1999

Datasheet Rev. 1.3 – 04/19 – data without warranty / liability

PNP transistor/Schottky-diode module PZTM1102

FEATURES

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

APPLICATIONS

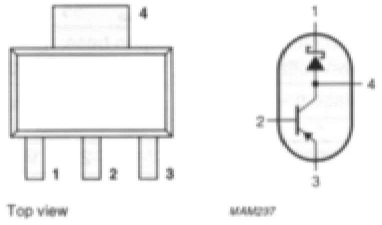
- High-speed switching for industrial applications.

PINNING

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

DESCRIPTION

Combination of a PNP transistor and a Schottky barrier diode in a plastic SOT223 package. NPN complement: PZTM1101.



Marking code: TM1102.

Fig.1 Simplified outline (SOT223) and symbol.

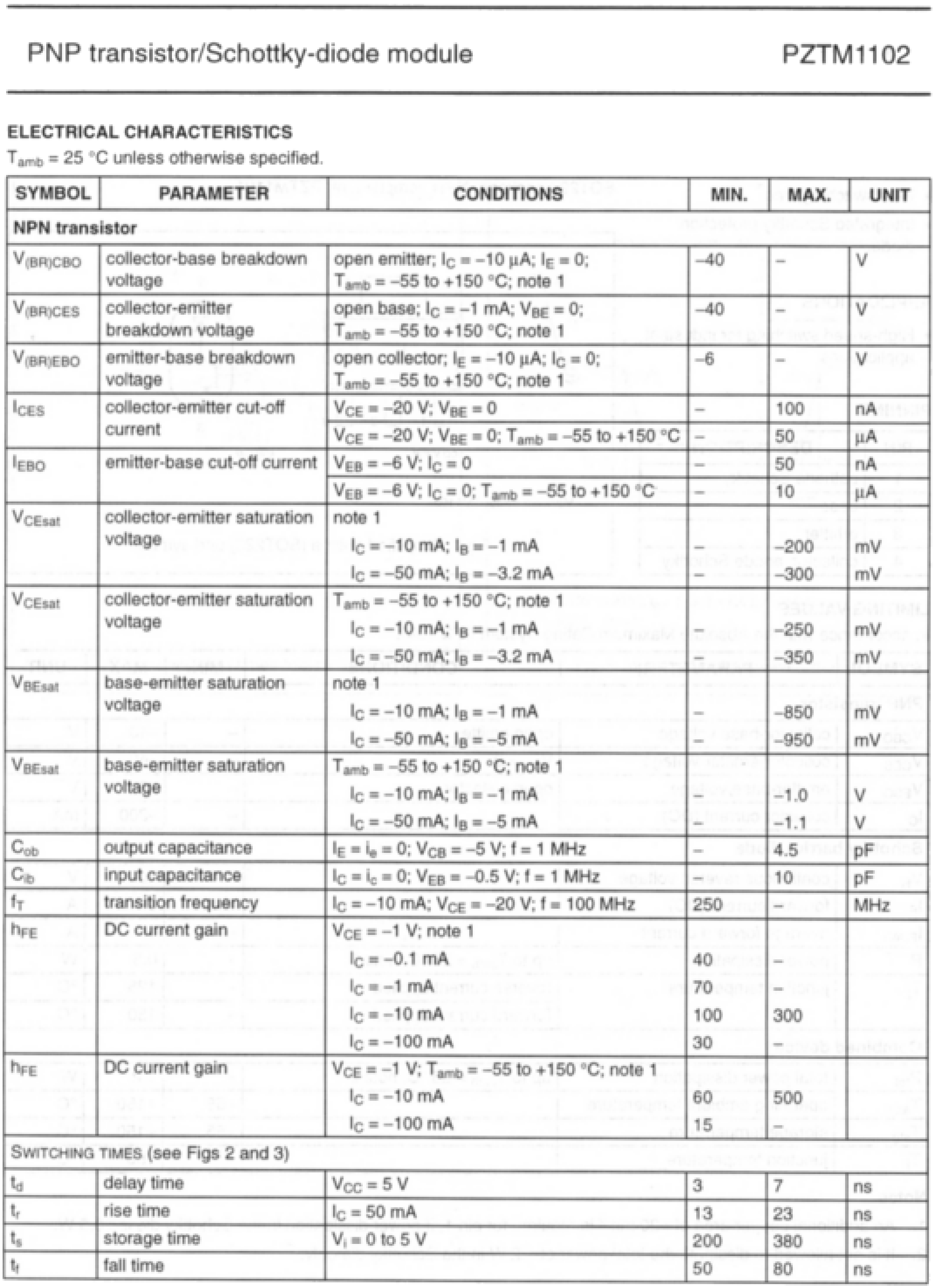
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
PNP transistor					
V_{CBO}	collector-base voltage	open emitter	–	−40	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
P	power dissipation	up to $T_{amb} = 25$ °C; note 1	–	0.5	W
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; note 2	–	1.2	W
T_{amb}	operating ambient temperature		−55	+150	°C
T_{stg}	storage temperature		−55	+150	°C
T_j	junction temperature		–	150	°C

Notes

1. An additional copper area of >20 mm^2 is required for pin 1, if power dissipation in the Schottky die is >0.5 W.
2. It is not allowed to dissipate the total power of 1.2 W in the Schottky die only.

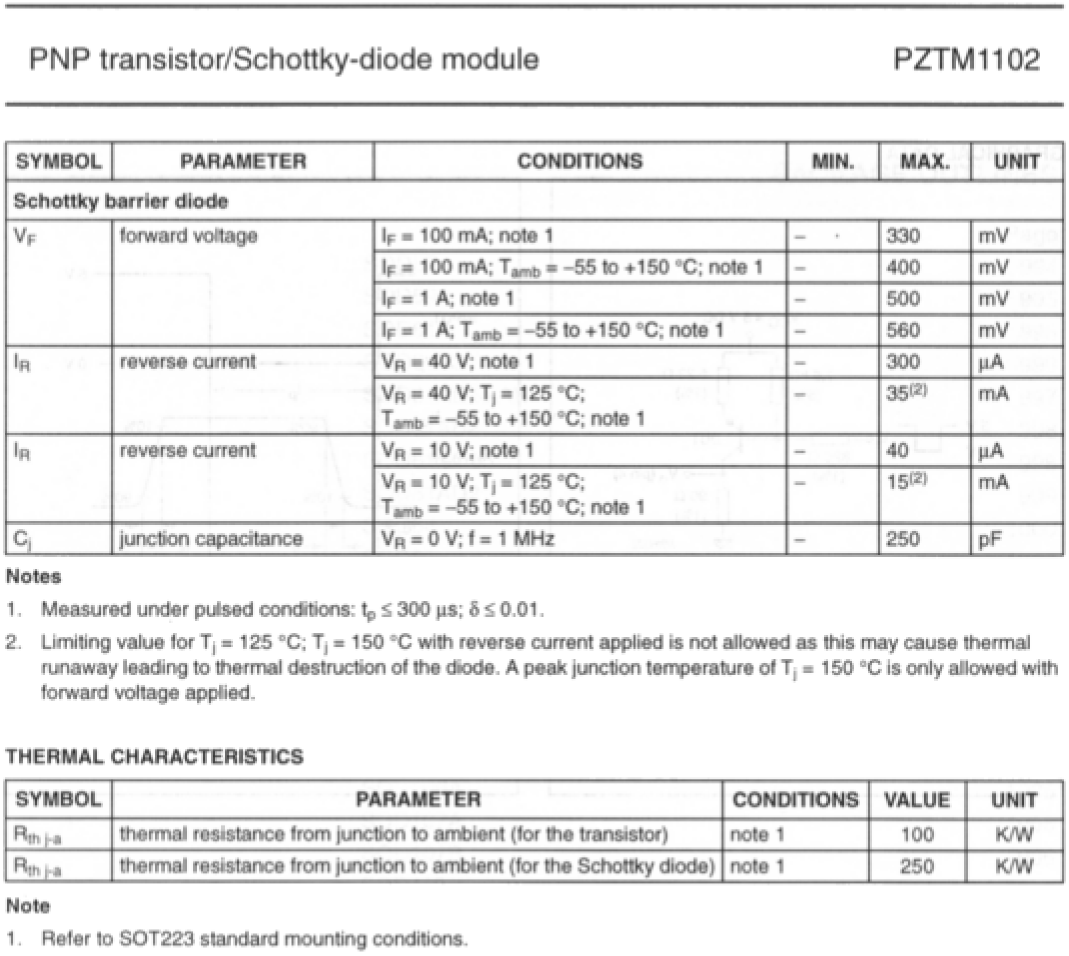


PNP transistor/Schottky-diode module PZTM1102

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	–40	–	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	–	–1.0	V
		I_C = –50 mA; I_B = –5 mA	–	–1.1	V
C_{ob}	output capacitance	$I_E = i_e = 0$; V_{CB} = –5 V; f = 1 MHz	–	4.5	pF
C_{ib}	input capacitance	$I_C = i_c = 0$; V_{EB} = –0.5 V; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –20 V; f = 100 MHz	250	–	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	3	7	ns
t_r	rise time	I_C = 50 mA	13	23	ns
t_s	storage time	V_i = 0 to 5 V	200	380	ns
t_f	fall time		50	80	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 (for the transistor)	note 1	100	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient (for the Schottky diode)	note 1	250	K/W

Note

1. Refer to SOT223 standard mounting conditions.

GRAPHICAL DATA

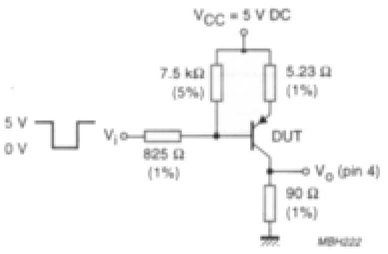
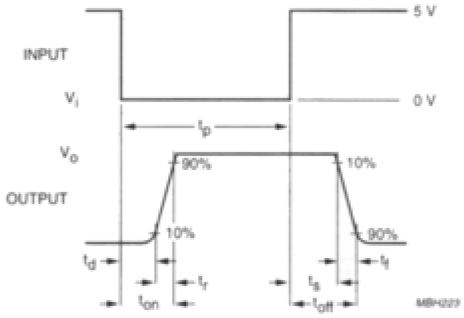


Fig.2 Switching times test circuit.



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

Fig.3 Input and output waveforms.