Schottky Diode & NPN Transistor Combination

PZT1101

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

DATASHEET

OEM – Philips

Source: Philips Databook 1999

NPN transistor/Schottky-diode module PZTM1101

FEATURES

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

APPLICATIONS

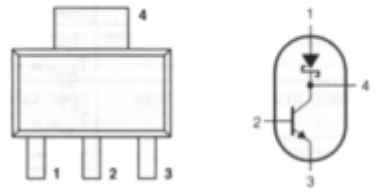
- High-speed switching for industrial applications.

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

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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

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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.

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GRAPHICAL DATA

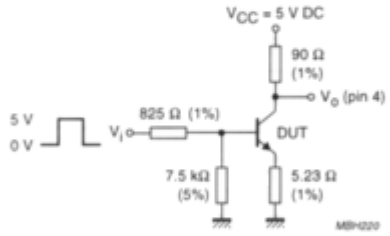
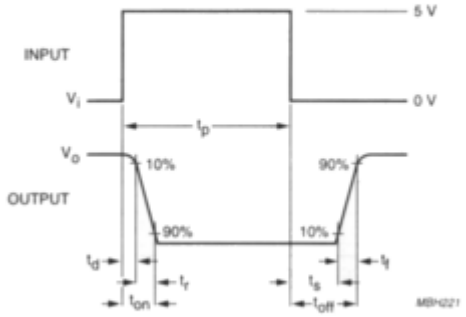


Fig.2 Switching times test circuit.



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.