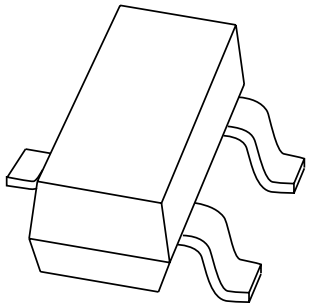
DATA SHEET



BSR13; BSR14
NPN switching transistors

Product specification
Supersedes data of 1997 Apr 22

1999 Apr 15

Philips
Semiconductors

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NPN switching transistors BSR13; BSR14

FEATURES

- High current (max. 800 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching and linear applications.

DESCRIPTION

NPN switching transistor in a SOT23 plastic package.
PNP complements: BSR15 and BSR16.

MARKING

TYPE NUMBER	MARKING CODE(1)
BSR13	U7∗
BSR14	U8∗

Note

1. ∗ = p : Made in Hong Kong.
   ∗ = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

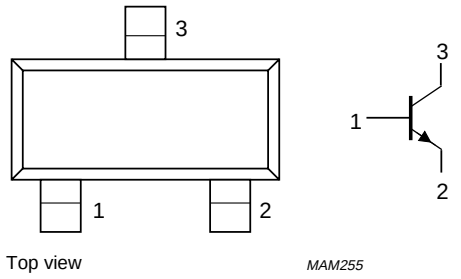


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSR13		–	60	V
	BSR14		–	75	V
V_{CEO}	collector-emitter voltage	open base			
	BSR13		–	30	V
	BSR14		–	40	V
V_{EBO}	emitter-base voltage	open collector			
	BSR13		–	5	V
	BSR14		–	6	V
I_C	collector current (DC)		–	800	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

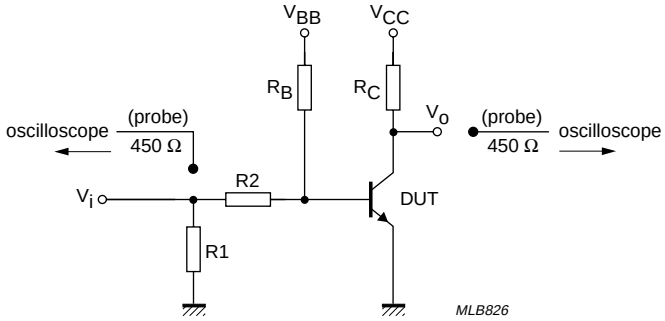
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	BSR13	I_E = 0; V_{CB} = 50 V	–	30	nA
		I_E = 0; V_{CB} = 50 V; T_j = 150 °C	–	10	µA
	collector cut-off current				
	BSR14	I_E = 0; V_{CB} = 60 V	–	10	nA
		I_E = 0; V_{CB} = 60 V; T_j = 150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V			
	BSR13		–	30	nA
	BSR14		–	10	nA
h_{FE}	DC current gain	I_C = 0.1 mA; V_{CE} = 10 V; note 1	35	–	
		I_C = 1 mA; V_{CE} = 10 V; note 1	50	–	
		I_C = 10 mA; V_{CE} = 10 V; note 1	75	–	
		I_C = 150 mA; V_{CE} = 10 V; note 1	100	300	
		I_C = 150 mA; V_{CE} = 1 V; note 1	50	–	
	DC current gain	I_C = 500 mA; V_{CE} = 10 V; note 1			
	BSR13		30	–	
	BSR14		40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA			
	BSR13		–	400	mV
	BSR14		–	300	mV
	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA			
	BSR13		–	1.6	V
	BSR14		–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA			
	BSR13		–	1.3	V
	BSR14		0.6	1.2	V
	base-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA			
	BSR13		–	2.6	V
	BSR14		–	2	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	8	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 20 V; f = 100 MHz			
	BSR13		250	–	MHz
	BSR14		300	–	MHz
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

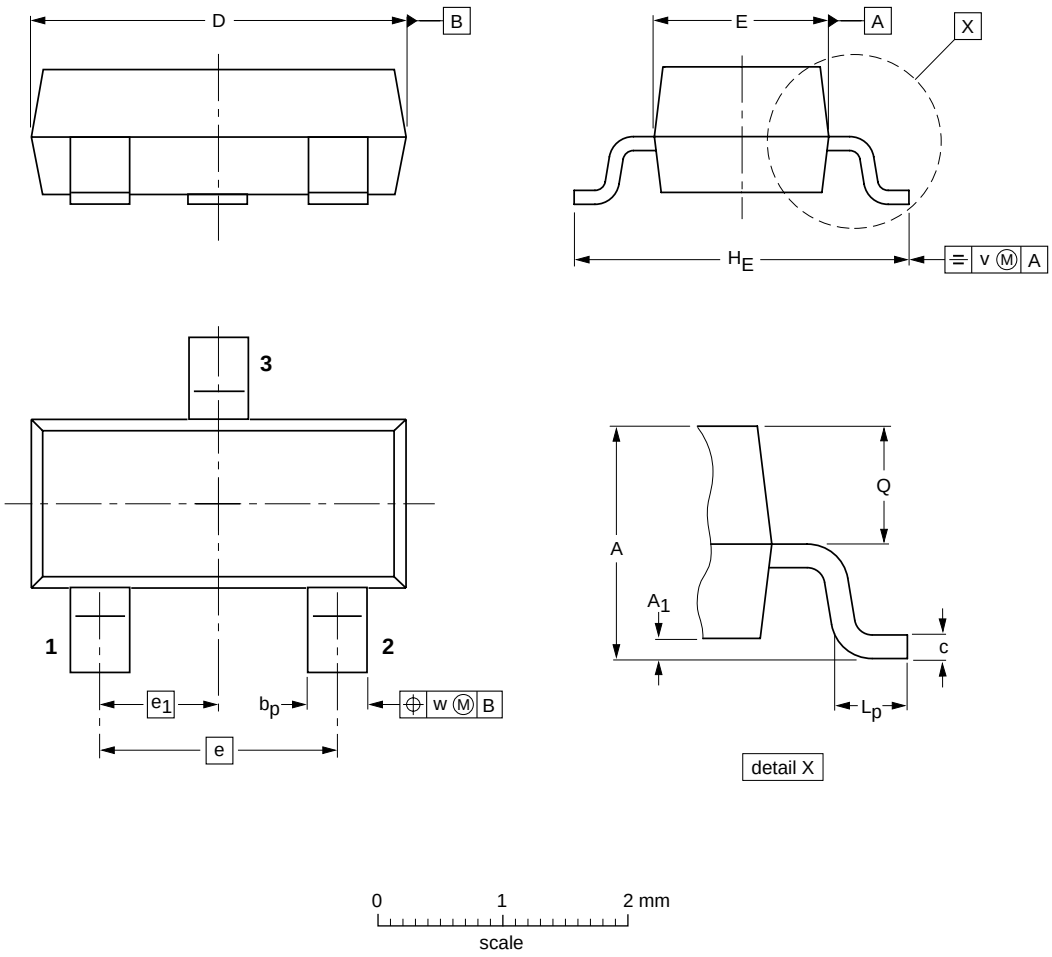


V_i = 9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope: input impedance Z_i = ≥ 100 Ω.

Fig.2 Test circuit for switching times.

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads **SOT23**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max.	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT23						97-02-28

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.	

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