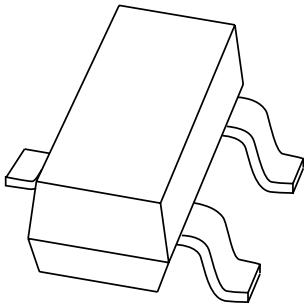


# DATA SHEET



## **BSR13; BSR14** NPN switching transistors

Product specification  
Supersedes data of 1997 Apr 22

1999 Apr 15

# 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 <sup>(1)</sup>
BSR13	U7*
BSR14	U8*

### Note

- \* = p : Made in Hong Kong.  
\* = t : Made in Malaysia.

### PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

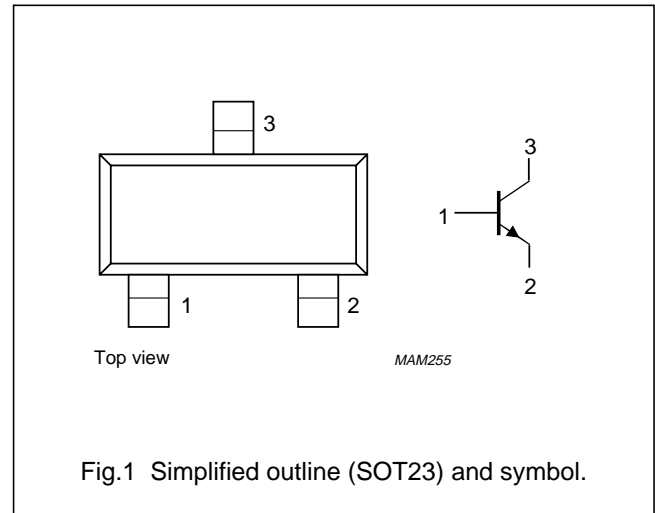


Fig.1 Simplified outline (SOT23) and symbol.

### LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>CBO</sub>	collector-base voltage	open emitter			
	BSR13		–	60	V
	BSR14		–	75	V
V <sub>CEO</sub>	collector-emitter voltage	open base			
	BSR13		–	30	V
	BSR14		–	40	V
V <sub>EBO</sub>	emitter-base voltage	open collector			
	BSR13		–	5	V
	BSR14		–	6	V
I <sub>C</sub>	collector current (DC)		–	800	mA
I <sub>CM</sub>	peak collector current		–	800	mA
I <sub>BM</sub>	peak base current		–	200	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	–	250	mW
T <sub>stg</sub>	storage temperature		–65	+150	°C
T <sub>j</sub>	junction temperature		–	150	°C
T <sub>amb</sub>	operating ambient temperature		–65	+150	°C

## NPN switching transistors

## BSR13; BSR14

## THERMAL CHARACTERISTICS

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

## Note

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

## CHARACTERISTICS

$T_j = 25\text{ °C}$  unless otherwise specified.

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

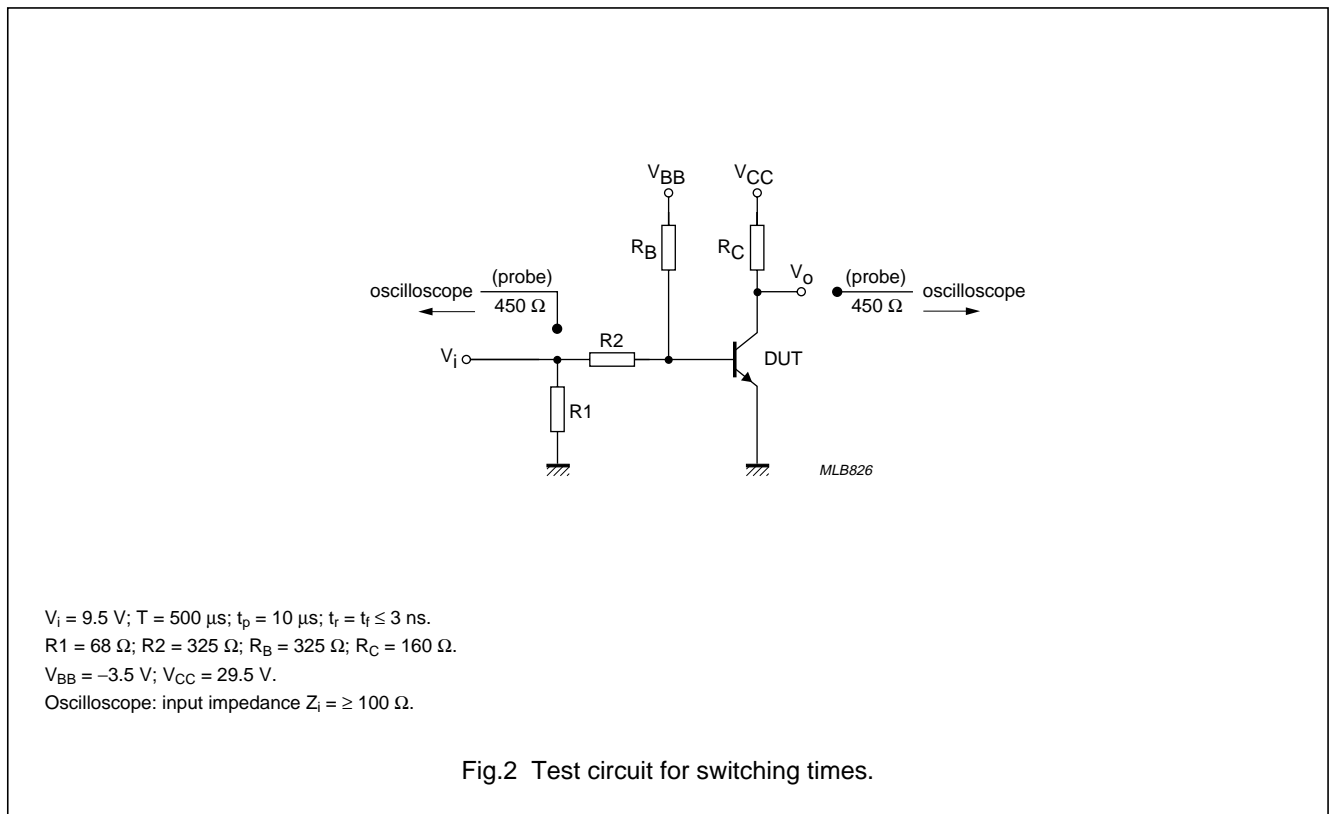
NPN switching transistors

BSR13; BSR14

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$C_c$	collector capacitance	$I_E = i_e = 0; V_{CB} = 10 \text{ V}; f = 1 \text{ MHz}$	–	8	pF
$f_T$	transition frequency	$I_C = 20 \text{ mA}; V_{CE} = 20 \text{ V}; f = 100 \text{ MHz}$	250	–	MHz
	BSR13		300	–	MHz
	BSR14				
<b>Switching times (between 10% and 90% levels); see Fig.2</b>					
$t_{on}$	turn-on time	$I_{Con} = 150 \text{ mA}; I_{Bon} = 15 \text{ mA}; I_{Boff} = -15 \text{ mA}$	–	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:  $t_p \leq 300 \mu\text{s}; \delta \leq 0.02$ .



NPN switching transistors

BSR13; BSR14

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> max.	b <sub>p</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	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

## NPN switching transistors

## BSR13; BSR14

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<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.	
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NPN switching transistors

BSR13; BSR14

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