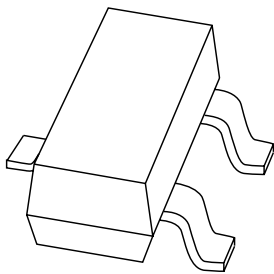


DATA SHEET



BSR13; BSR14 NPN switching transistors

Product data sheet
Supersedes data of 1999 Apr 15

2004 Jan 13

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

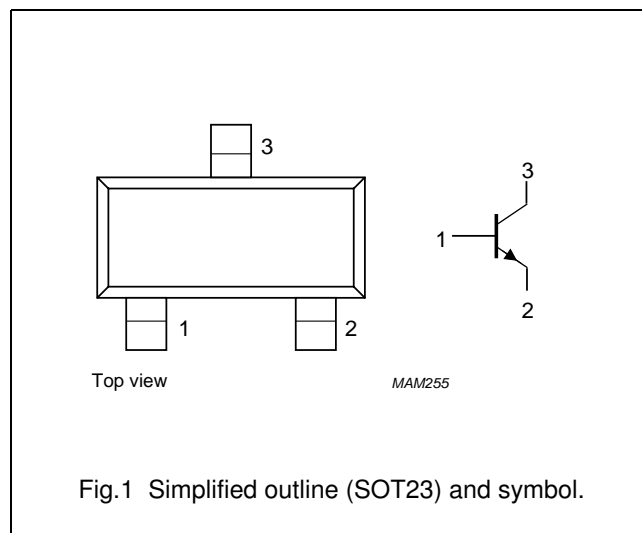
TYPE NUMBER	MARKING CODE ⁽¹⁾
BSR13	U7*
BSR14	U8*

Note

1. * = p : Made in Hong Kong.
 * = t : Made in Malaysia.
 * = W : Made in China.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
BSR13	—	plastic surface mounted package; 3 leads	SOT23
BSR14			

NPN switching transistors

BSR13; BSR14

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

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	$T_{amb} \leq 25\text{ °C}$	–	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
$R_{th(j-a)}$	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	μA
	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	μA
I_{EBO}	emitter cut-off current	$I_C = 0; V_{EB} = 5\text{ V}$			
	BSR13		–	30	nA
	BSR14		–	10	nA

NPN switching transistors

BSR13; BSR14

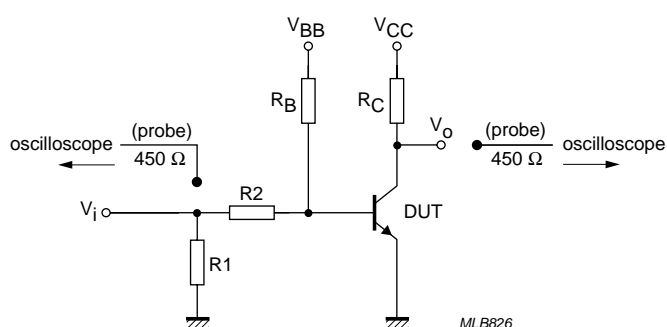
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
h_{FE}	DC current gain	$I_C = 0.1 \text{ mA}$; $V_{CE} = 10 \text{ V}$; note 1	35	—	
		$I_C = 1 \text{ mA}$; $V_{CE} = 10 \text{ V}$; note 1	50	—	
		$I_C = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$; note 1	75	—	
		$I_C = 150 \text{ mA}$; $V_{CE} = 10 \text{ V}$; note 1	100	300	
		$I_C = 150 \text{ mA}$; $V_{CE} = 1 \text{ V}$; note 1	50	—	
	DC current gain BSR13 BSR14	$I_C = 500 \text{ mA}$; $V_{CE} = 10 \text{ V}$; note 1	30 40	— —	
V_{CEsat}	collector-emitter saturation voltage BSR13	$I_C = 150 \text{ mA}$; $I_B = 15 \text{ mA}$	—	400	mV
	BSR14		—	300	mV
	collector-emitter saturation voltage BSR13	$I_C = 500 \text{ mA}$; $I_B = 50 \text{ mA}$	—	1.6	V
	BSR14		—	1	V
V_{BEsat}	base-emitter saturation voltage BSR13	$I_C = 150 \text{ mA}$; $I_B = 15 \text{ mA}$	—	1.3	V
	BSR14		0.6	1.2	V
	base-emitter saturation voltage BSR13	$I_C = 500 \text{ mA}$; $I_B = 50 \text{ mA}$	—	2.6	V
	BSR14		—	2	V
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = 10 \text{ V}$; $f = 1 \text{ MHz}$	—	8	pF
f_T	transition frequency BSR13	$I_C = 20 \text{ mA}$; $V_{CE} = 20 \text{ V}$; $f = 100 \text{ MHz}$	250	—	MHz
	BSR14		300	—	MHz
Switching times (between 10% and 90% levels); see Fig.2					
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



$V_i = 9.5 \text{ V}$; $T = 500 \text{ } \mu\text{s}$; $t_p = 10 \text{ } \mu\text{s}$; $t_r = t_f \leq 3 \text{ ns}$.
 $R1 = 68 \text{ } \Omega$; $R2 = 325 \text{ } \Omega$; $R_B = 325 \text{ } \Omega$; $R_C = 160 \text{ } \Omega$.
 $V_{BB} = -3.5 \text{ V}$; $V_{CC} = 29.5 \text{ V}$.
 Oscilloscope: input impedance $Z_i = \geq 100 \text{ } \Omega$.

Fig.2 Test circuit for switching times.

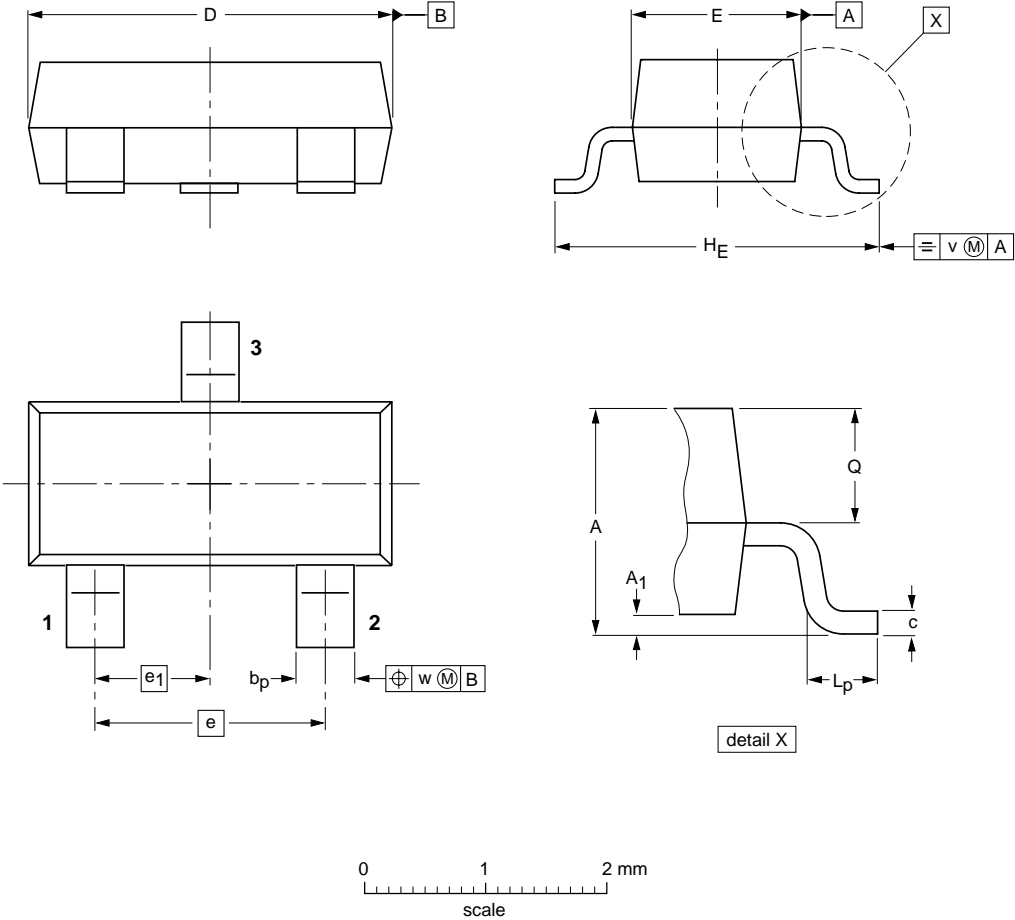
NPN switching transistors

BSR13; BSR14

PACKAGE OUTLINE

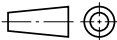
Plastic surface-mounted package; 3 leads

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	JEITA			
SOT23		TO-236AB				04-11-04 06-03-16

NPN switching transistors

BSR13; BSR14

DATA SHEET STATUS

DOCUMENT STATUS ⁽¹⁾	PRODUCT STATUS ⁽²⁾	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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Contact information

For additional information please visit: **<http://www.nxp.com>**

For sales offices addresses send e-mail to: **salesaddresses@nxp.com**

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Printed in The Netherlands

R75/04/pp8

Date of release: 2004 Jan 13

Document order number: 9397 750 12419

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