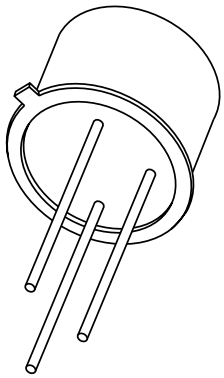
DATA SHEET



BSX20
NPN switching transistor

Product specification
Supersedes data of September 1994
File under Discrete Semiconductors, SC04

1997 May 14

Philips
Semiconductors

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NPN switching transistor BSX20

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 15 V).

APPLICATIONS

- High-speed saturated switching (and HF amplifier applications).

DESCRIPTION

NPN switching transistor in a TO-18 metal package.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector, connected to case

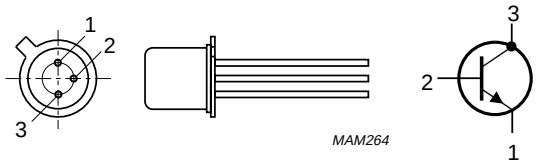


Fig.1 Simplified outline (TO-18) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	collector current (DC)		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	360	mW
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 1 V	40	120	
		I_C = 100 mA; V_{CE} = 2 V	20	–	
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	500	–	MHz
t_{off}	turn-off time	I_{Con} = 10 mA; I_{Bon} = 3 mA; I_{Boff} = –1.5 mA	–	30	ns

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	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	4.5	V
I_C	collector current (DC)		–	200	mA
I_{CM}	peak collector current	$t \leq 10$ µs	–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation		–	360	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

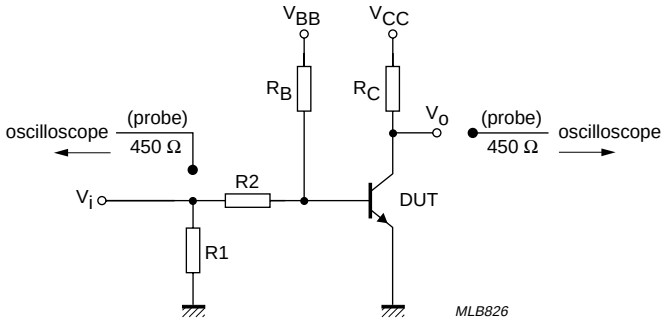
SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	480	K/W
$R_{th\ j\text{-}c}$	thermal resistance from junction to case		150	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 20$ V	–	–	400	nA
		$I_E = 0$; $V_{CB} = 20$ V; $T_j = 150$ °C	–	–	30	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 4$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 1$ V	40	–	120	
		$I_C = 10$ mA; $V_{CE} = 1$ V; $T_j = –55$ °C	20	–	–	
		$I_C = 100$ mA; $V_{CE} = 2$ V	20	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.3$ mA	–	–	300	mV
		$I_C = 10$ mA; $I_B = 1$ mA	–	–	250	mV
		$I_C = 100$ mA; $I_B = 10$ mA	–	–	600	mV
V_{BEsat}	base-emitter saturation voltage	$I_C = 10$ mA; $I_B = 1$ mA	700	–	850	mV
		$I_C = 100$ mA; $I_B = 10$ mA	–	–	1.5	V
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 5$ V; f = 1 MHz	–	–	4	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 1$ V; f = 1 MHz	–	–	4.5	pF
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 10$ V; f = 100 MHz	500	600	–	MHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Switching times (between 10% and 90% levels)						
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 3 mA; I_{Boff} = −1.5 mA; see Fig.2, test conditions A	–	–	10	ns
t_d	delay time		–	–	4	ns
t_r	rise time		–	–	6	ns
t_{off}	turn-off time		–	–	30	ns
t_s	storage time		–	–	15	ns
t_f	fall time		–	–	15	ns
t_{on}	turn-on time	I_{Con} = 100 mA; I_{Bon} = 40 mA; I_{Boff} = −20 mA; see Fig.2, test conditions B	–	–	13	ns
t_d	delay time		–	–	3	ns
t_r	rise time		–	–	10	ns
t_{off}	turn-off time		–	–	35	ns
t_s	storage time		–	–	25	ns
t_f	fall time		–	–	10	ns



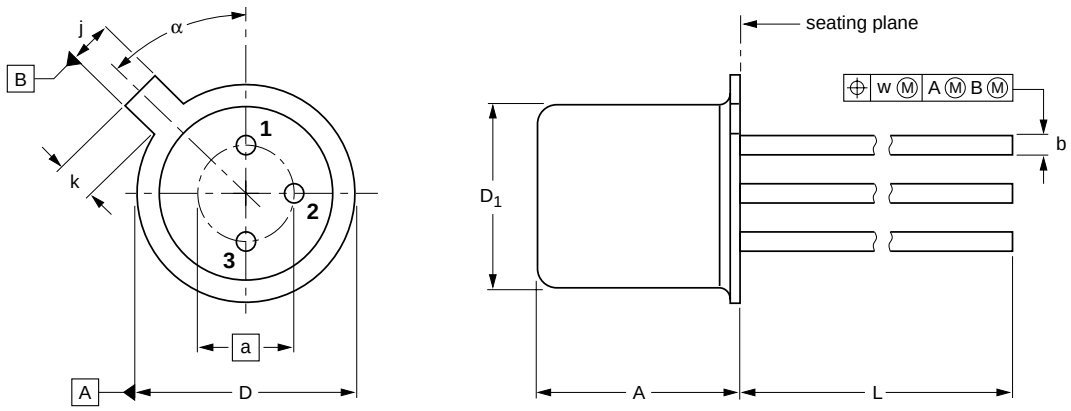
Test conditions A.
V_i = 0.5 to 4.2 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 1$ ns.
R1 = 56 Ω; R2 = 1 kΩ; R_B = 1 kΩ; R_C = 270 Ω.
V_{BB} = 0.2 V; V_{CC} = 2.7 V.

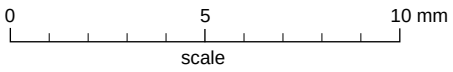
Test conditions B.
V_i = 0.5 to 4.52 V; T = 200 µs; t_p = 10 µs; $t_r = t_f \leq 1$ ns.
R1 = 100 Ω; R2 = 68 Ω; R_B = 390 Ω; R_C = 47 Ω.
V_{BB} = −3 V; V_{CC} = 4.6 V.

Fig.2 Test circuit for switching times.

PACKAGE OUTLINE

Metal-can cylindrical single-ended package; 3 leads **SOT18/13**





DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	a	b	D	D_1	j	k	L	w	α
mm	5.31 4.74	2.54	0.47 0.41	5.45 5.30	4.70 4.55	1.03 0.94	1.1 0.9	15.0 12.7	0.40	45°

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT18/13	B11/C7 type 3	TO-18				97-04-18

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.	

LIFE SUPPORT APPLICATIONS

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