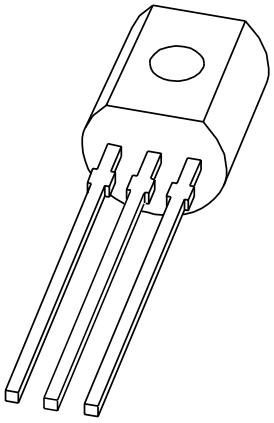
DATA SHEET



BSR50; BSR51; BSR52
NPN Darlington transistors

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

1997 May 12

Philips
Semiconductors

PHILIPS

NPN Darlington transistors BSR50; BSR51; BSR52

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Industrial high gain amplification.

DESCRIPTION

NPN Darlington transistor in a TO-92; SOT54 plastic package. PNP complements: BSR60, BSR61 and BSR62.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

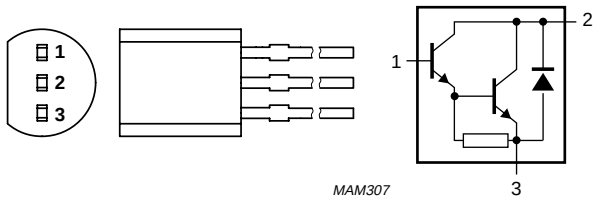


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter				
	BSR50		–	–	60	V
	BSR51		–	–	80	V
	BSR52		–	–	90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0				
	BSR50		–	–	45	V
	BSR51		–	–	60	V
	BSR52		–	–	80	V
I_C	collector current (DC)		–	–	1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	0.83	W
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 10 V	1000	–	–	
		I_C = 500 mA; V_{CE} = 10 V	2000	–	–	
f_T	transition frequency	I_C = 500 mA; V_{CE} = 5 V; f = 100 MHz	–	200	–	MHz

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			
	BSR50		–	60	V
	BSR51		–	80	V
	BSR52		–	90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BSR50		–	45	V
	BSR51		–	60	V
	BSR52		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	0.83	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

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

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

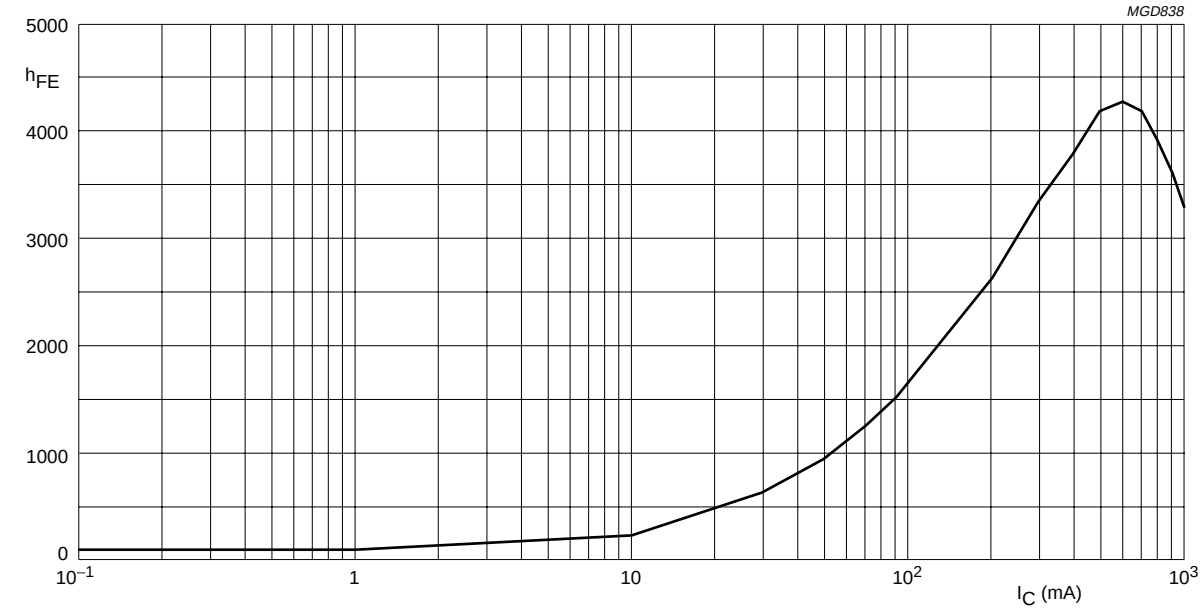
Note

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

CHARACTERISTICS

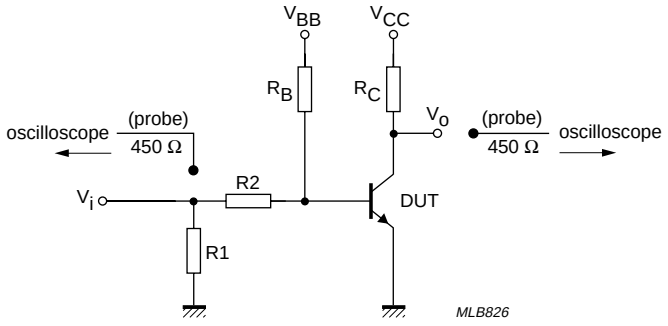
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current					
	BSR50	V_{BE} = 0; V_{CE} = 45 V	–	–	50	nA
	BSR51	V_{BE} = 0; V_{CE} = 60 V	–	–	50	nA
	BSR52	V_{BE} = 0; V_{CE} = 80 V	–	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 10 V; see Fig.2				
		I_C = 150 mA	1000	–	–	
		I_C = 500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 0.5 A; I_B = 0.5 mA	–	–	1.3	V
V_{CEsat}	collector-emitter saturation voltage					
	BSR51	I_C = 1 A; I_B = 1 mA	–	–	1.6	V
	BSR50; BSR52	I_C = 1 A; I_B = 4 mA	–	–	1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = 0.5 A; I_B = 0.5 mA	–	–	1.9	V
V_{BEsat}	base-emitter saturation voltage					
	BSR51	I_C = 1 A; I_B = 1 mA	–	–	2.2	V
	BSR50; BSR52	I_C = 1 A; I_B = 4 mA	–	–	2.2	V
f_T	transition frequency	I_C = 500 mA; V_{CE} = 5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3						
t_{on}	turn-on time	I_{Con} = 500 mA; I_{Bon} = 0.5 mA; I_{Boff} = –0.5 mA	–	–	500	ns
t_{off}	turn-off time		–	–	1300	ns



V_{CE} = 10 V.

Fig.2 DC current gain; typical values.

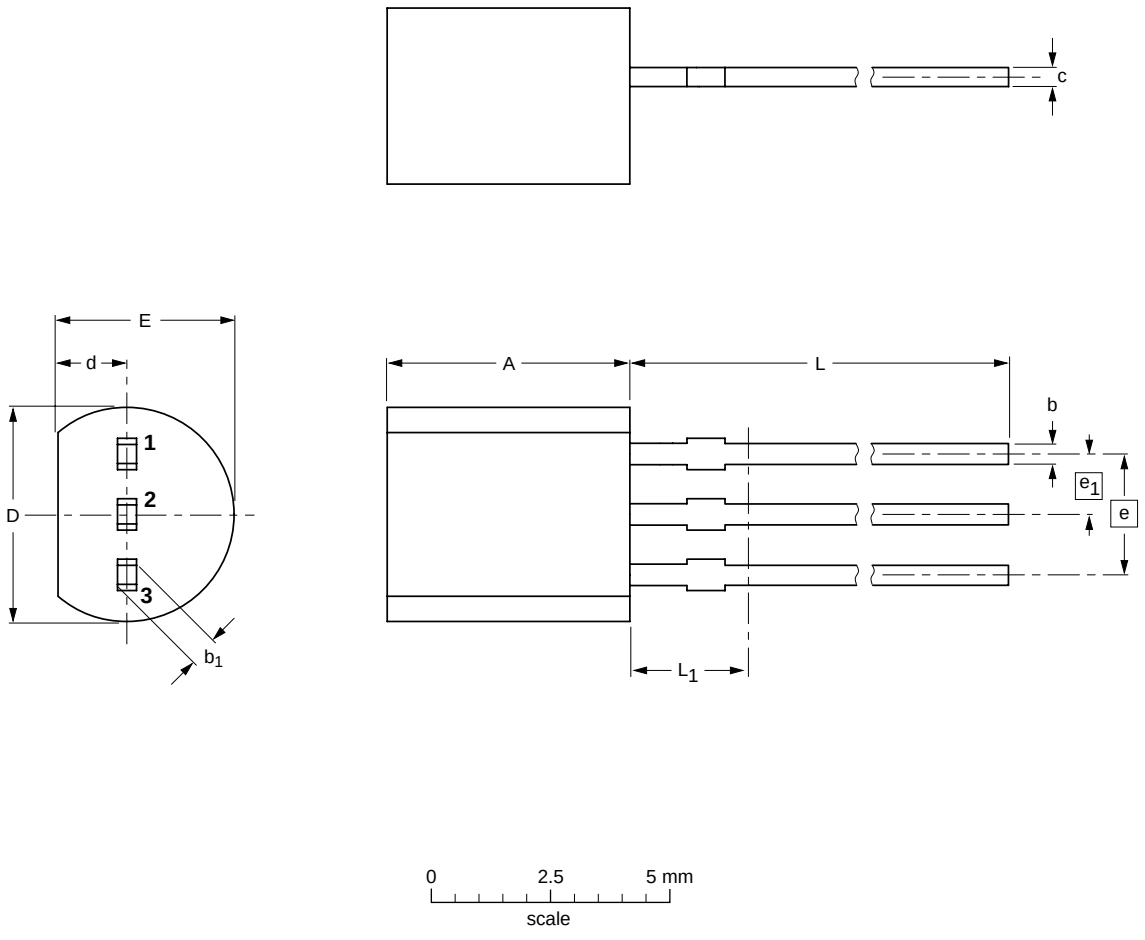


V_i = 10 V; T = 200 µs; t_p = 6 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 10 kΩ; R_B = 10 kΩ; R_C = 18 Ω.
V_{BB} = –1.8 V; V_{CC} = 10.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PACKAGE OUTLINE

Plastic single-ended leaded (through hole) package; 3 leads **SOT54**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b	b_1	c	D	d	E	e	e_1	L	L_1(1)
mm	5.2 5.0	0.48 0.40	0.66 0.56	0.45 0.40	4.8 4.4	1.7 1.4	4.2 3.6	2.54	1.27	14.5 12.7	2.5

Note

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT54		TO-92	SC-43			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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