

BSP60

PNP Darlington transistor

2 May 2018 **Product data sheet**

1. General description

PNP Darlington transistor in an SOT223 plastic package.

NPN complement: BSP50

2. Features and benefits

- High current of -1 A
- Low voltage of -45 V
- Integrated diode and resistor
- AEC-Q101 qualified

3. Applications

- Industrial switching applications such as:
  - Print hammer
  - Solenoid
  - Relay and lamp drivers

4. Quick reference data

Table 1. Quick reference data

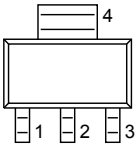
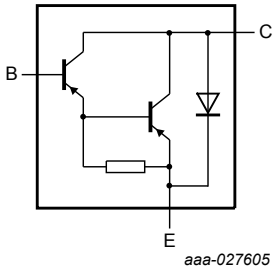
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CBO}	collector-base voltage	open emitter		-	-	-60	V
V_{CES}	collector-emitter voltage	base short-circuited to emitter		-	-	-45	V
I_C	collector current			-	-	-1	A
I_{CM}	peak collector current			-	-	-2	A
h_{FE}	DC current gain	V_{CE} = -10 V; I_C = -150 mA	[1]	1000	-	-	

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

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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 SC-73 (SOT223)	
2	C	collector		
3	E	emitter		
4	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BSP60	SC-73	plastic, surface-mounted package with increased heatsink; 4 leads; 4.6 mm pitch; 6.5 mm x 3.5 mm x 1.65 mm body	SOT223

7. Marking

Table 4. Marking codes

Type number	Marking code
BSP60	BSP60

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8. Limiting values

Table 5. 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		-	-60	V
V_{CES}	collector-emitter voltage	base short-circuited to emitter		-	-45	V
V_{EBO}	emitter-base voltage	open collector		-	-5	V
I_C	collector current			-	-1	A
I_{CM}	peak collector current			-	-2	A
I_{Blim}	limiting base current			-	-100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	1.25	W
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			-65	150	°C
T_{stg}	storage temperature			-65	150	°C

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for collector 1 cm^2.

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient		[1]	-	-	98	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	17	K/W

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for collector 1 cm^2.

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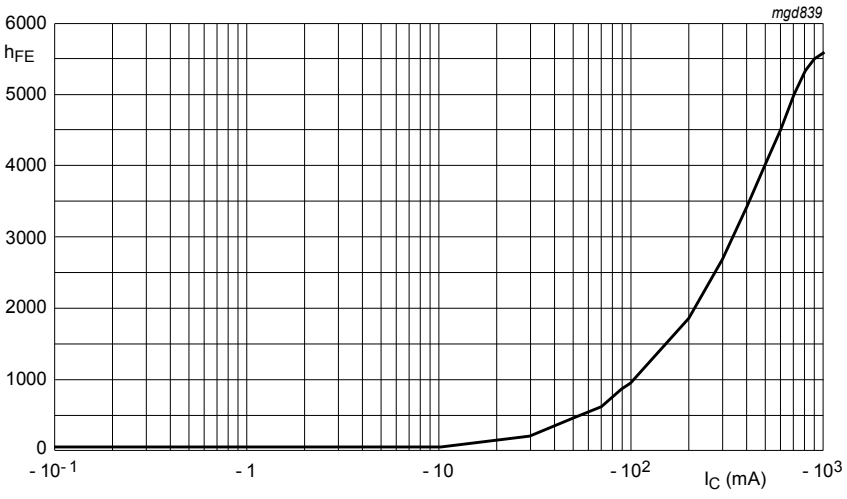
10. Characteristics

Table 7. Characteristics

T_j = 25 °C unless otherwise specified

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = -100 µA; I_E = 0 A		-60	-	-	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = -2 mA; V_{BE} = 0 V		-45	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_C = 0 A; I_E = -100 µA		-5	-	-	V
I_{CES}	collector-emitter cut-off current	V_{BE} = 0 V; V_{CE} = -45 V		-	-	-50	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = -4 V; I_C = 0 A		-	-	-50	nA
h_{FE}	DC current gain	V_{CE} = -10 V; I_C = -150 mA	[1]	1000	-	-	
		V_{CE} = -10 V; I_C = -500 mA	[1]	2000	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = -500 mA; I_B = -0.5 mA		-	-	-1.3	V
		I_C = -500 mA; I_B = -0.5 mA; T_j = 150 °C		-	-	-1.3	V
V_{BEsat}	base-emitter saturation voltage	I_C = -500 mA; I_B = -0.5 mA		-	-	-1.9	V
t_{on}	turn-on time	I_C = -500 mA; I_{Bon} = -0.5 mA; I_{Boff} = 0.5 mA		-	400	-	ns
t_{off}	turn-off time			-	1500	-	ns
f_T	transition frequency	V_{CE} = -5 V; I_C = -500 mA; f = 100 MHz		-	200	-	MHz

[1] Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



V_{CE} = -10 V

Fig. 1. DC current gain; typical values

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11. Test information

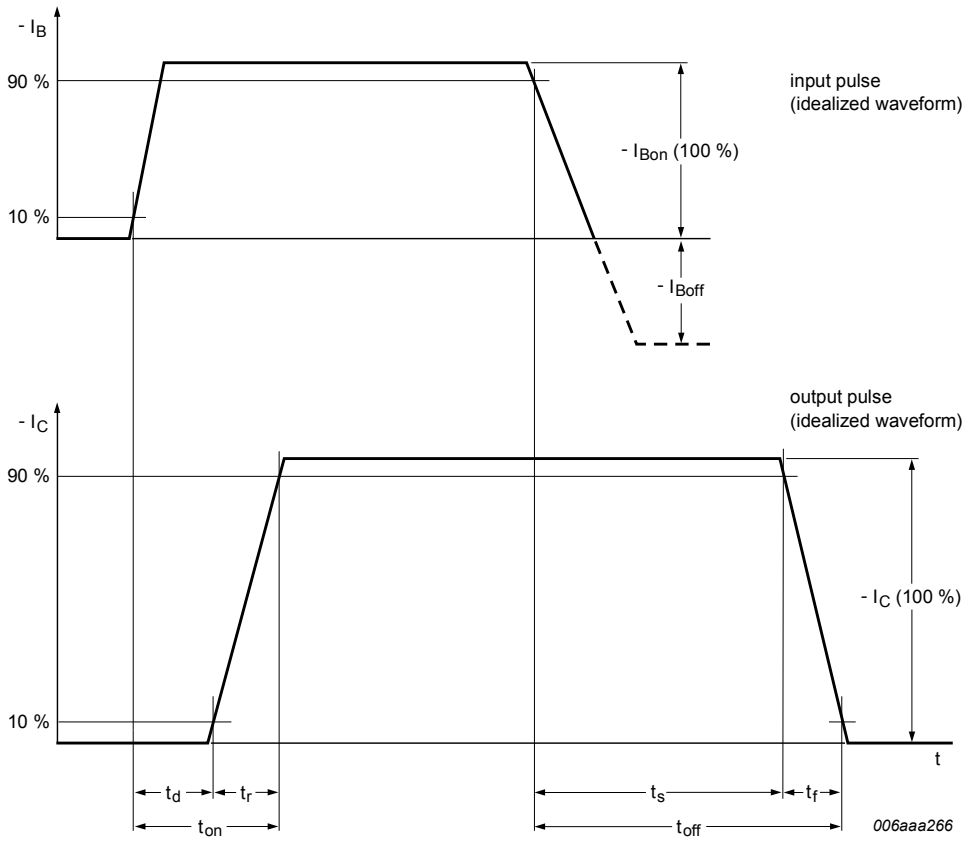
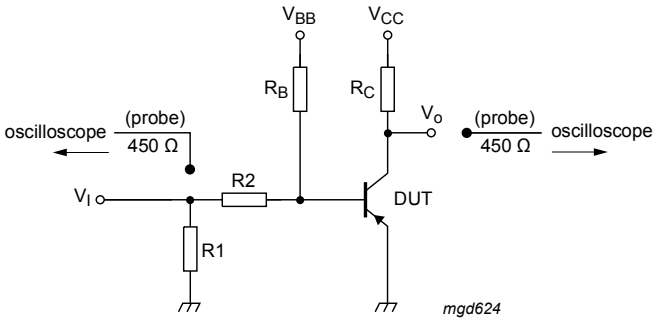


Fig. 2. Transistor switching time definition



V_I = -10 V; T = 200 µs; t_p = 6 µs; t_r = t_f ≤ 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 or switching times

Quality information

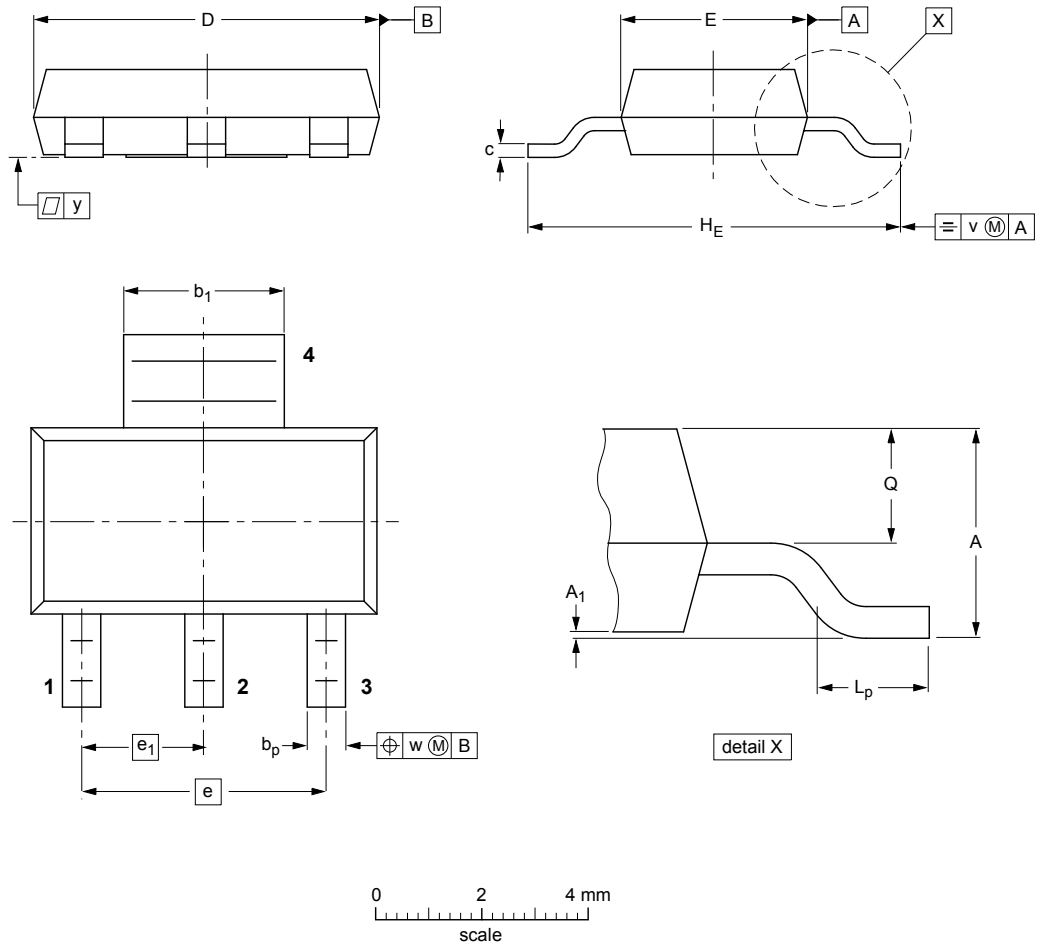
This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

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12. Package outline

Plastic surface-mounted package with increased heatsink; 4 leads **SOT223**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.8 1.5	0.10 0.01	0.80 0.60	3.1 2.9	0.32 0.22	6.7 6.3	3.7 3.3	4.6	2.3	7.3 6.7	1.1 0.7	0.95 0.85	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT223			SC-73			~~04-11-10~~ 06-03-16

Fig. 4. Package outline SC-73 (SOT223)

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13. Soldering

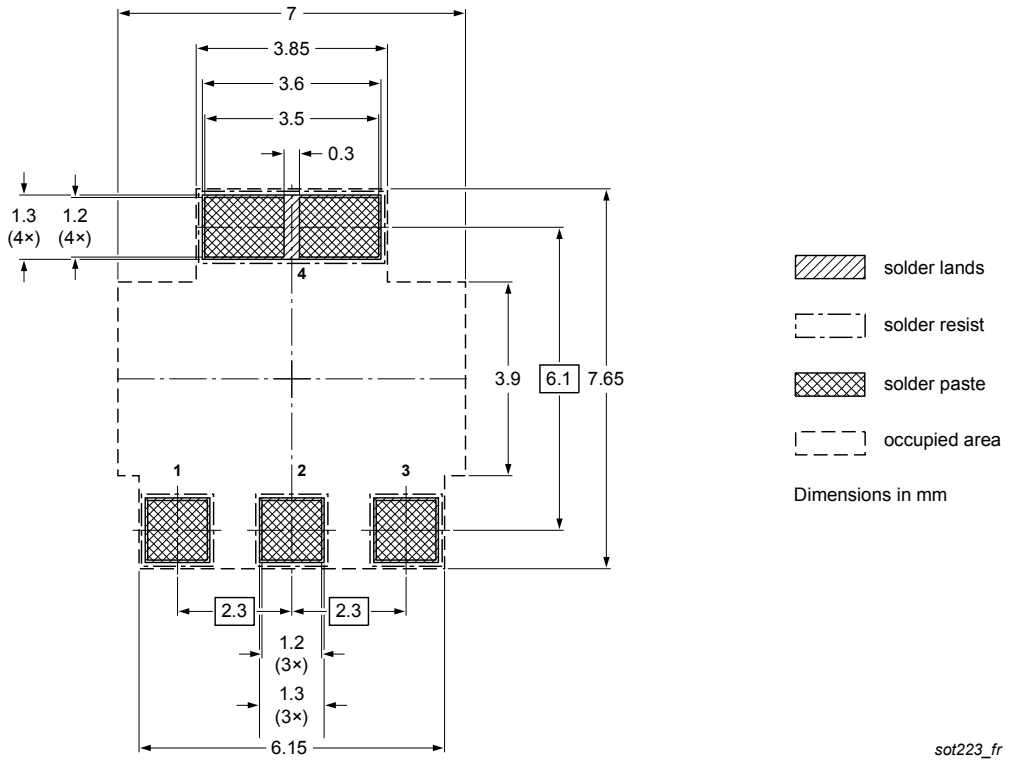


Fig. 5. Reflow soldering footprint for SC-73 (SOT223)

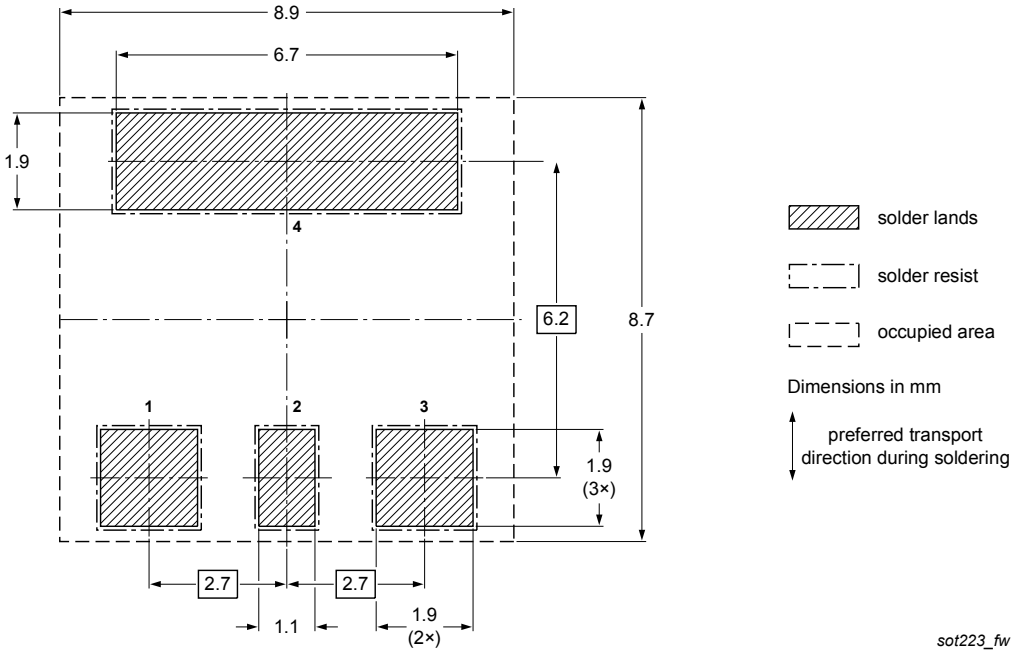


Fig. 6. Wave soldering footprint for SC-73 (SOT223)

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14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BSP60 v.4	20180502	Product data sheet	-	BSP60 v.3
Modifications:	• I_{CES} values corrected.			
BSP60 v.3	20180216	Product data sheet	-	BSP60_61_62 v.2

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15. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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