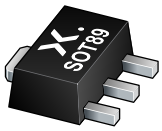

PBSS5320X

20 V, 3 A PNP low VCEsat (BISS) transistor

27 May 2019 — Product data sheet

1. General description

PNP low V_{CEsat} transistor in a medium power flat lead SOT89 plastic package.

NPN complement: PBSS4320X

2. Features and benefits

- SOT89 (SC-62) package
- Low collector-emitter saturation voltage V_{CEsat}
- High collector current capability: I_C and I_{CM}
- Higher efficiency leading to less heat generation
- Reduced printed-circuit board requirements.
- AEC-Q101 qualified

3. Applications

- Power management
  - DC/DC converters
  - Supply line switching
  - Battery charger
  - LCD backlighting.
- Peripheral drivers
  - Driver in low supply voltage applications (e.g. lamps and LEDs)
  - Inductive load driver (e.g. relays, buzzers and motors).

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base		-	-	-20	V
I_C	collector current		[1]	-	-	-3	A
I_{CM}	peak collector current	limited by $T_{j(max)}$		-	-	-5	A
h_{FE}	DC current gain	V_{CE} = -2 V; I_C = -0.1 A		220	-	-	
R_{CEsat}	collector-emitter saturation resistance	I_C = -3 A; I_B = -300 mA	[2]	-	90	105	mΩ

[1] Device mounted on a ceramic printed-circuit board 7 cm^2, single-sided copper, tin-plated.
[2] Pulsed test: $t_p \leq 300$ µs; $\delta \leq 0.02$

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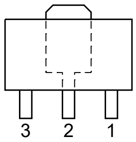
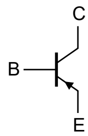
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E	emitter	 **SOT89**	 *sym132*
2	C	collector		
3	B	base		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS5320X	SOT89	plastic surface-mounted package; die pad for good heat transfer; 3 leads	SOT89

7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS5320X	S45

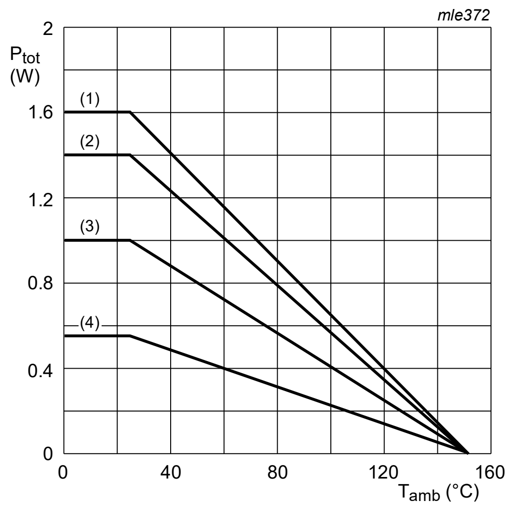
8. Limiting values

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		-	-20	V
V_{CEO}	collector-emitter voltage	open base		-	-20	V
V_{EBO}	emitter-base voltage	open collector		-	-5	V
I_C	collector current		[1]	-	-3	A
I_{CM}	peak collector current	limited by $T_{j(max)}$		-	-5	A
I_B	base current			-	-0.5	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[2]	-	550	mW
			[3]	-	1	W
			[4]	-	1.4	W
			[1]	-	1.6	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 a ceramic printed-circuit board 7 cm^2, single-sided copper, tin-plated.
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm^2.
[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.



(1) Ceramic PCB; 7 cm^2 mounting pad for collector
(2) FR4 PCB; 6 cm^2 copper mounting pad for collector
(3) FR4 PCB; 1 cm^2 copper mounting pad for collector
(4) Standard footprint

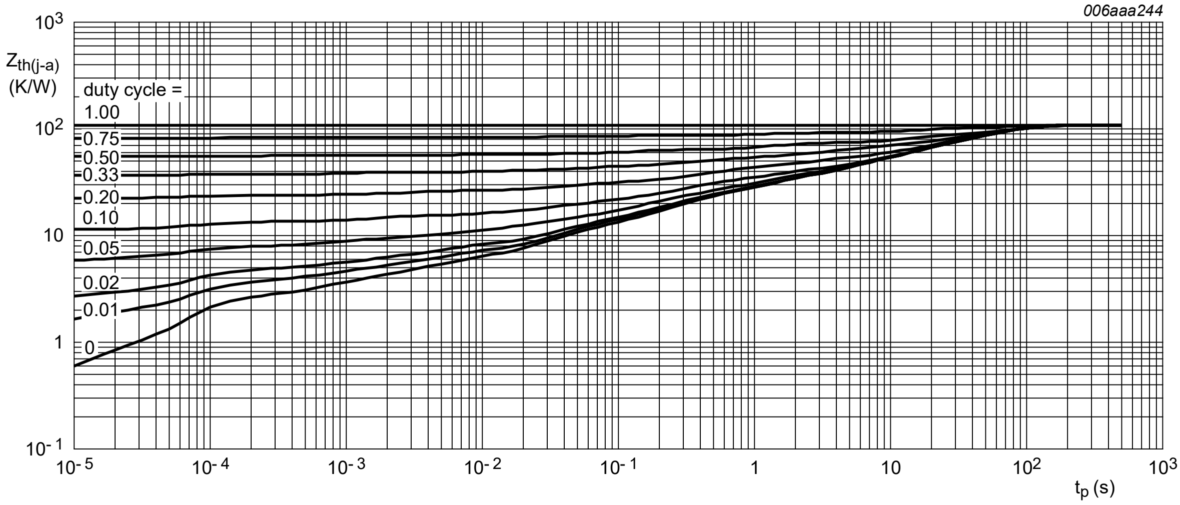
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

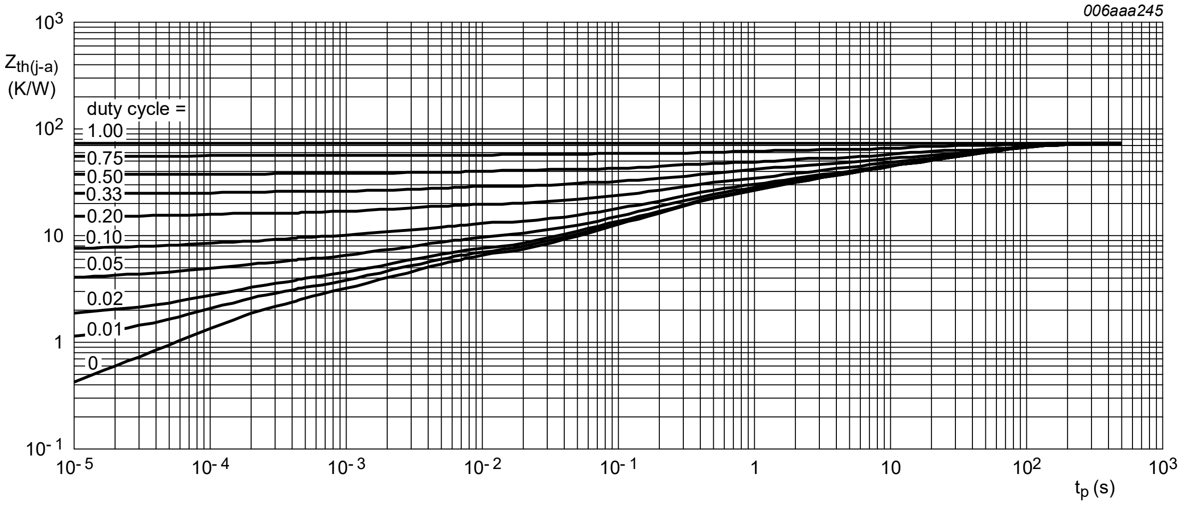
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	225	K/W
			[2]	-	-	125	K/W
			[3]	-	-	90	K/W
			[4]	-	-	80	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	16	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm^2.
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.
[4] Device mounted on a ceramic printed-circuit board 7 cm^2, single-sided copper, tin-plated.



Mounted on FR4 PCB; mounting pad for collector 1 cm^2

Fig. 2. Transient thermal impedance as a function of pulse duration; typical values



Mounted on FR4 PCB; mounting pad for collector 6 cm^2

Fig. 3. Transient thermal impedance as a function of pulse duration; typical values

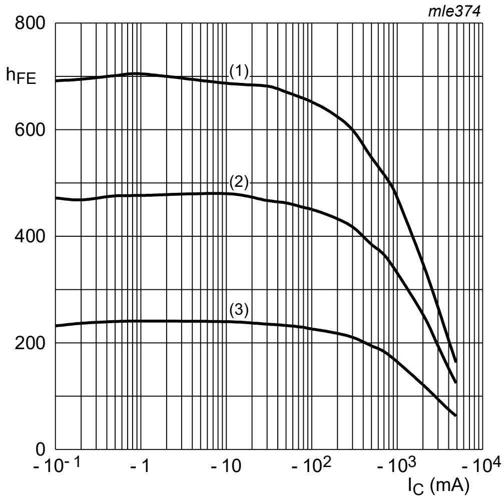
10. Characteristics

Table 7. Characteristics

T_{amb} = 25 °C unless otherwise specified.

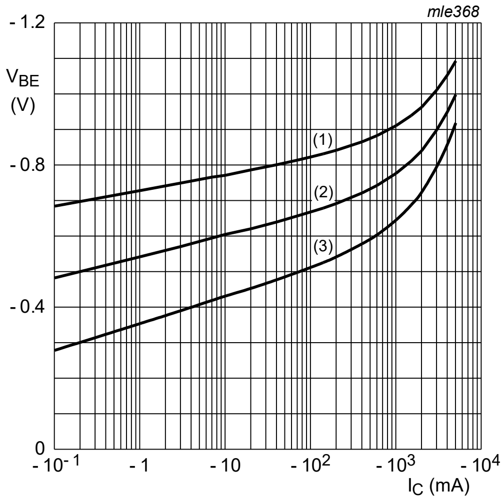
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = -20 V; I_E = 0 A		-	-	-100	nA
		V_{CB} = -20 V; I_E = 0 A; T_j = 150 °C		-	-	-50	µA
I_{CES}	collector-emitter cut-off current	V_{CE} = -20 V; V_{BE} = 0 V		-	-	-100	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = -5 V; I_C = 0 A		-	-	-100	nA
h_{FE}	DC current gain	V_{CE} = -2 V; I_C = -0.1 A		220	-	-	
		V_{CE} = -2 V; I_C = -0.5 A		220	-	-	
		V_{CE} = -2 V; I_C = -1 A	[1]	200	-	-	
		V_{CE} = -2 V; I_C = -2 A	[1]	150	-	-	
		V_{CE} = -2 V; I_C = -3 A	[1]	100	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = -0.5 A; I_B = -50 mA		-	-	-70	mV
		I_C = -1 A; I_B = -50 mA		-	-	-130	mV
		I_C = -2 A; I_B = -100 mA		-	-	-230	mV
		I_C = -3 A; I_B = -300 mA	[1]	-	-	-300	mV
R_{CEsat}	collector-emitter saturation resistance		[1]	-	90	105	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = -2 A; I_B = -100 mA		-	-	-1.1	V
		I_C = -3 A; I_B = -300 mA	[1]	-	-	-1.2	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = -2 V; I_C = -1 A		-1.1	-	-	V
f_T	transition frequency	V_{CE} = -5 V; I_C = -100 mA; f = 100 MHz		100	-	-	MHz
C_c	collector capacitance	V_{CB} = -10 V; I_E = 0 A; i_e = 0 A; f = 1 MHz		-	-	50	pF

[1] Pulsed test: t_p ≤ 300 µs; δ ≤ 0.02



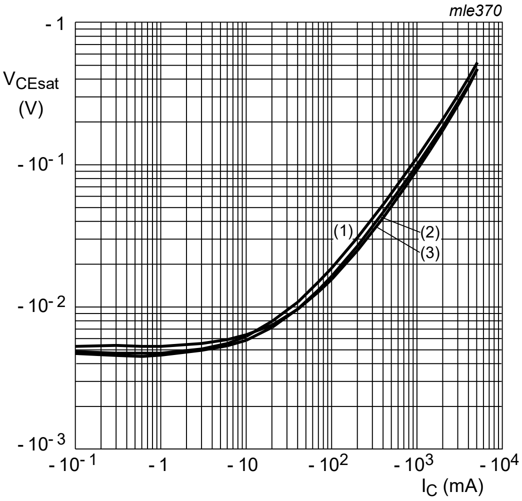
$V_{CE} = -2$ V
(1) $T_{amb} = 100$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = -55$ °C

Fig. 4. DC current gain as a function of collector current; typical values



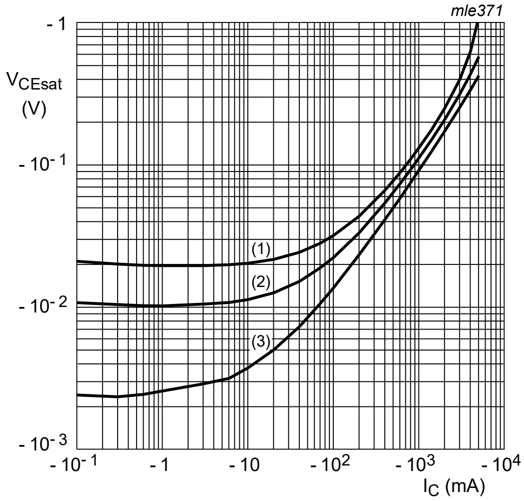
$V_{CE} = -2$ V
(1) $T_{amb} = -55$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = 100$ °C

Fig. 5. Base-emitter voltage as a function of collector current; typical values



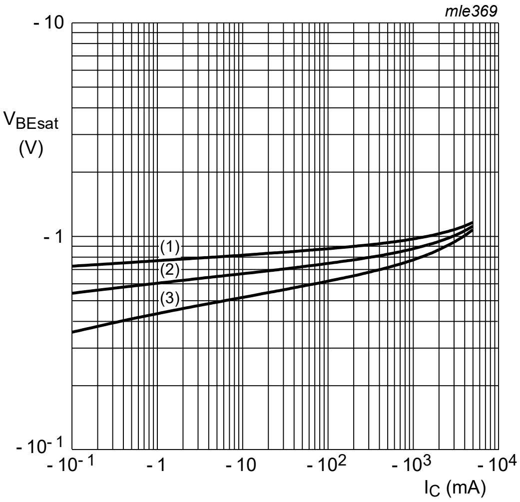
$I_C/I_B = 20$
(1) $T_{amb} = 100$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = -55$ °C

Fig. 6. Collector-emitter saturation voltage as a function of collector current; typical values



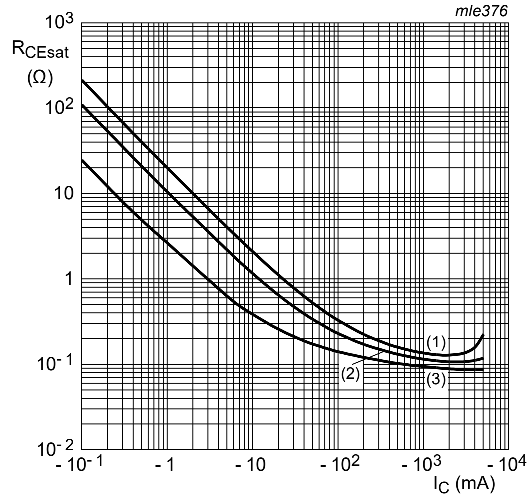
$T_{amb} = 25$ °C
(1) $I_C/I_B = 100$
(2) $I_C/I_B = 50$
(3) $I_C/I_B = 10$

Fig. 7. Collector-emitter saturation voltage as a function of collector current; typical values



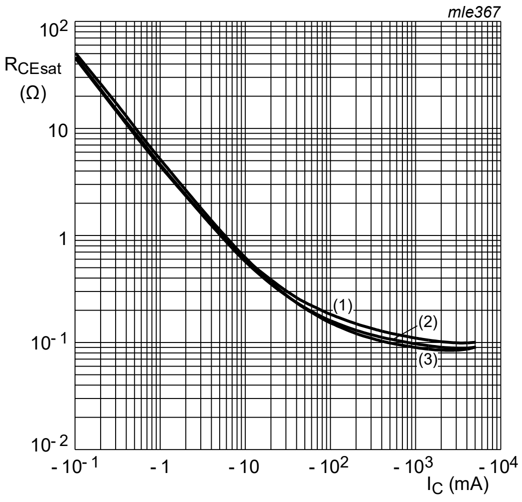
$I_C/I_B = 20$
(1) $T_{amb} = -55$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = 100$ °C

Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values



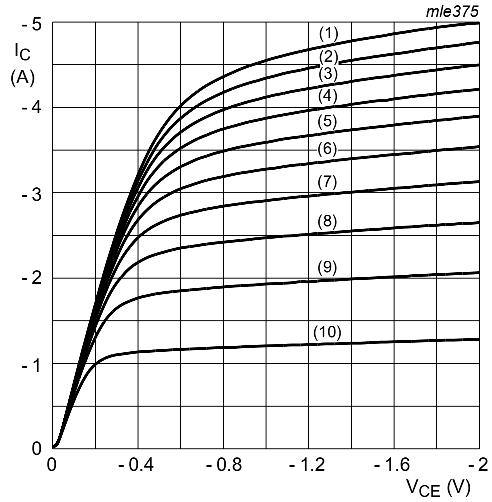
$T_{amb} = 25$ °C
(1) $I_C/I_B = 100$
(2) $I_C/I_B = 50$
(3) $I_C/I_B = 10$

Fig. 9. Equivalent on-resistance as a function of collector current; typical values



$I_C/I_B = 20$
(1) $T_{amb} = 100$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = -55$ °C

Fig. 10. Equivalent on-resistance as a function of collector current; typical values



$T_{amb} = 25$ °C
(1) $I_B = -25$ mA
(2) $I_B = -22.5$ mA
(3) $I_B = -20$ mA
(4) $I_B = -17.5$ mA
(5) $I_B = -15$ mA
(6) $I_B = -12.5$ mA
(7) $I_B = -10$ mA
(8) $I_B = -7.5$ mA
(9) $I_B = -5$ mA
(10) $I_B = -2.5$ mA

Fig. 11. Collector current as a function of collector-emitter voltage; typical values

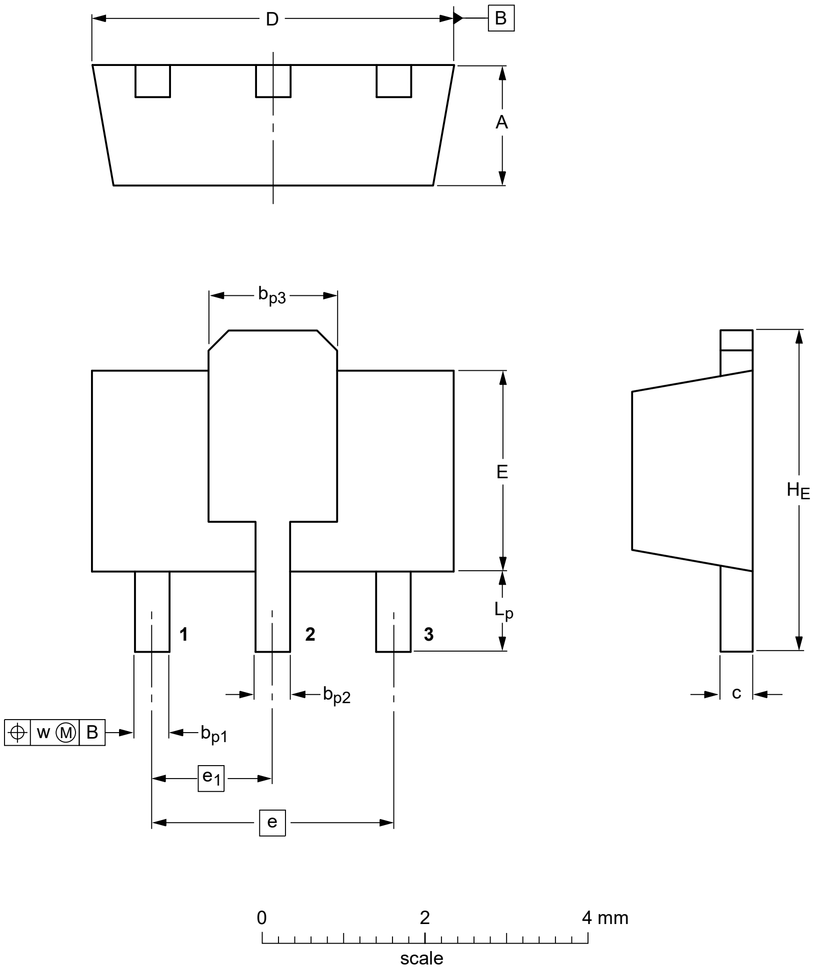
11. Test information

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.

12. Package outline

Plastic surface-mounted package; exposed die pad for good heat transfer; 3 leads **SOT89**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b_{p1}	b_{p2}	b_{p3}	c	D	E	e	e_1	H_E	L_p	w
mm	1.6 1.4	0.48 0.35	0.53 0.40	1.8 1.4	0.44 0.23	4.6 4.4	2.6 2.4	3.0	1.5	4.25 3.75	1.2 0.8	0.13

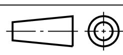
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT89		TO-243	SC-62			~~06-03-16~~ 06-08-29

Fig. 12. Package outline SOT89

13. Soldering

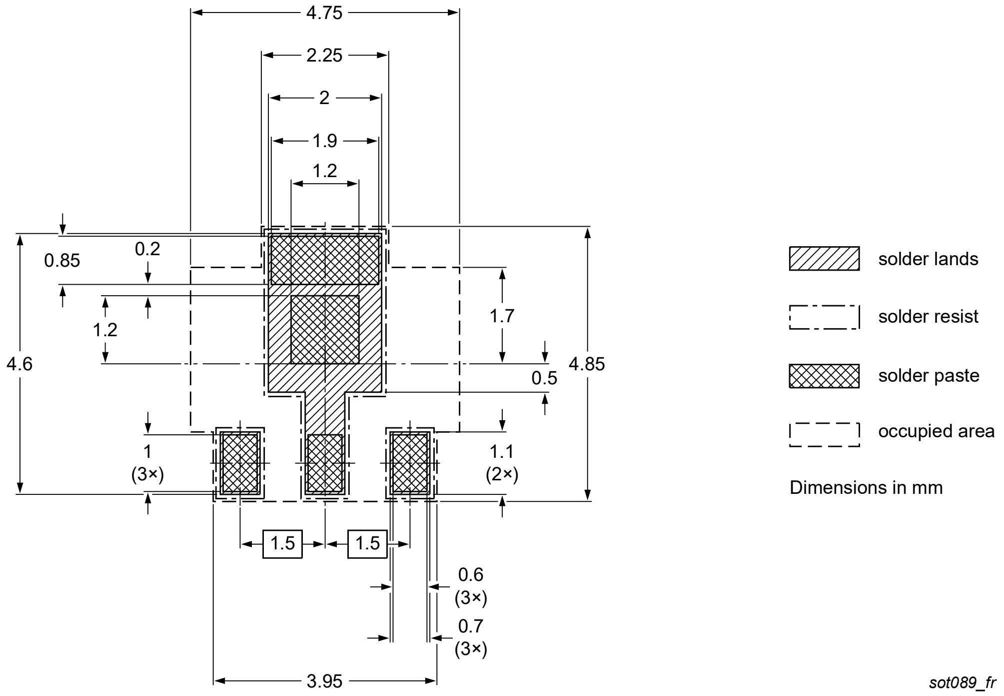


Fig. 13. Reflow soldering footprint for SOT89

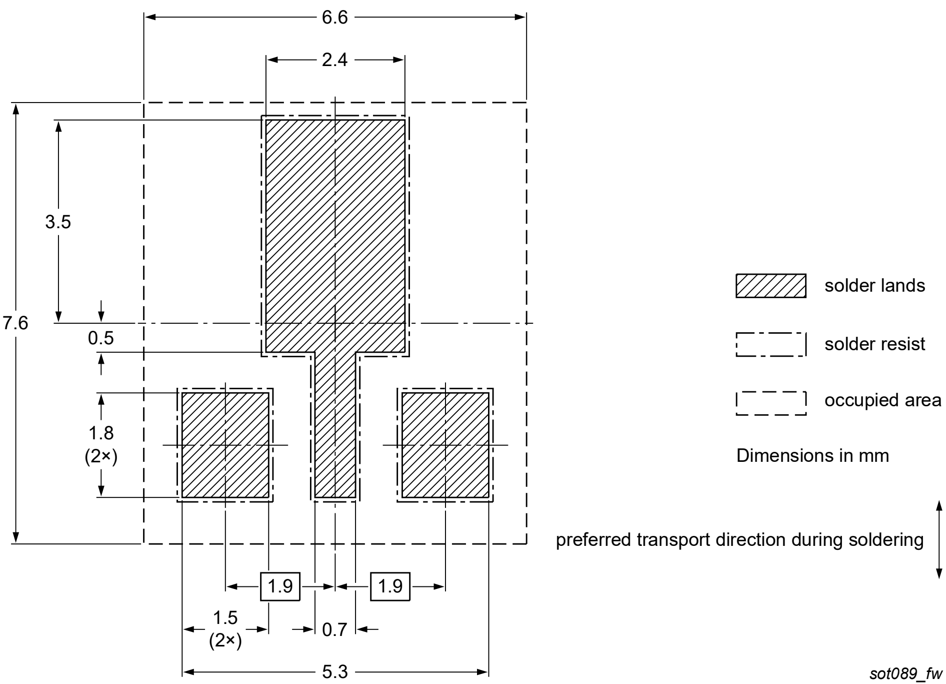


Fig. 14. Wave soldering footprint for SOT89

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS5320X v.3	20190527	Product data sheet	-	PBSS5320X v.2
Modifications:	• Characteristics: V_{BEsat} corrected from typical to maximum. • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate.			
PBSS5320X v.2	20041104	Product data sheet	-	PBSS5320X v.1
PBSS5320X v.1	20031127	Product data sheet	-	-

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".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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