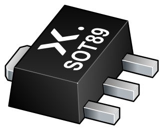


# PBSS5320X

## 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: $t_p$ ≤ 300 μs; δ ≤ 0.02

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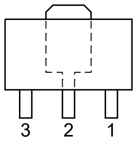
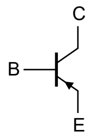
# 5. Pinning information

**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 |

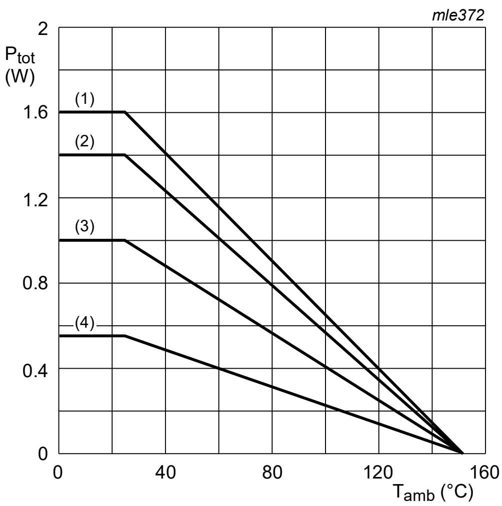
## 8. Limiting values

**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

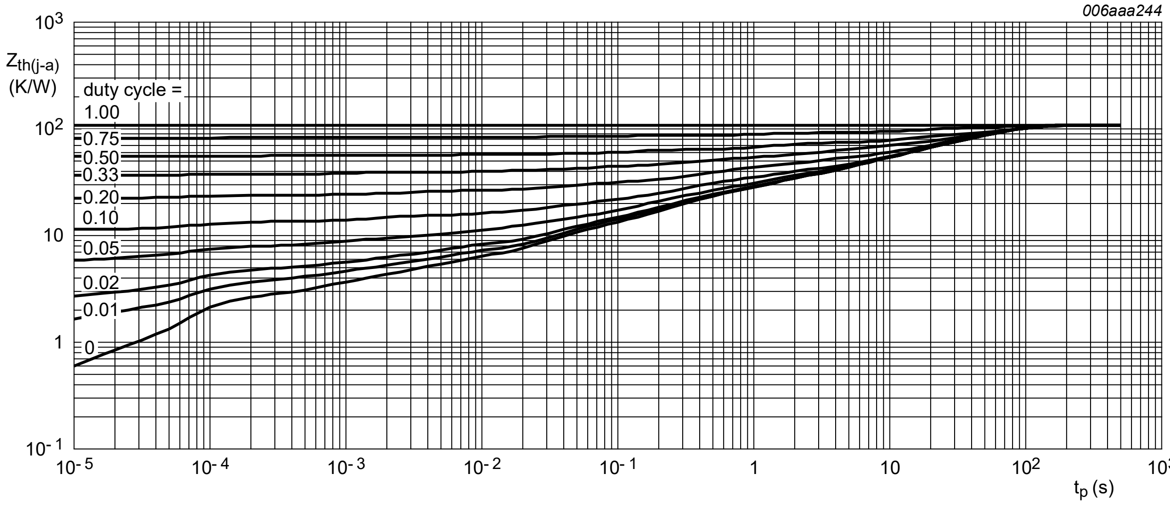
**Fig. 1. Power derating curves**

## 9. Thermal characteristics

**Table 6. Thermal characteristics**

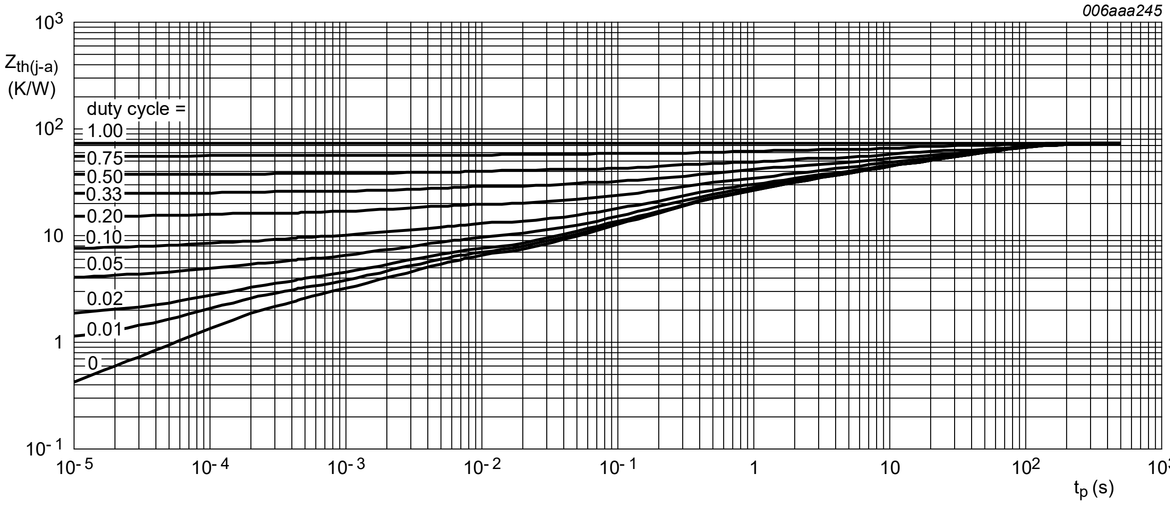
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 225 | K/W |
| | | | [2] | - | - | 125 | K/W |
| | | | [3] | - | - | 90 | K/W |
| | | | [4] | - | - | 80 | K/W |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

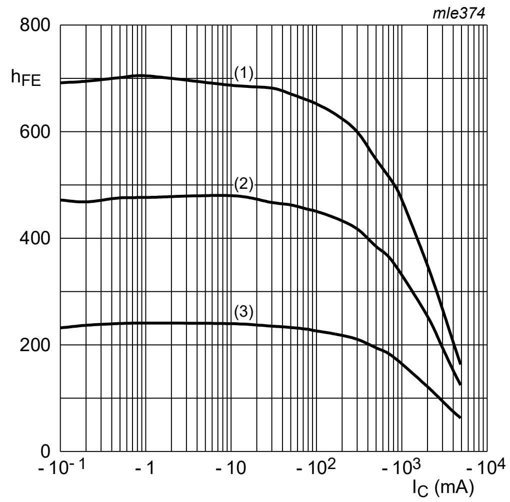
## 10. Characteristics

**Table 7. Characteristics**

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

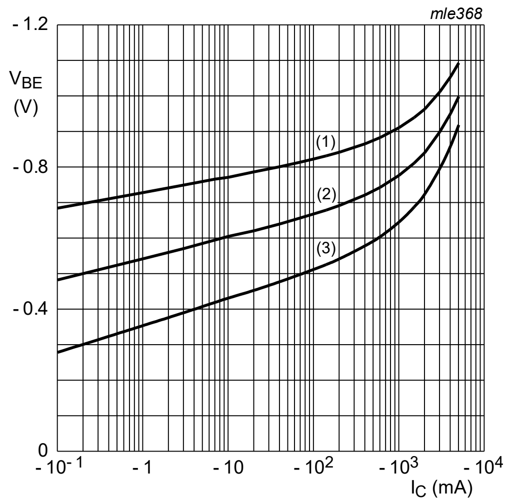
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = -20 V; $I_E$ = 0 A | | - | - | -100 | nA |
| | | $V_{CB}$ = -20 V; $I_E$ = 0 A; $T_j$ = 150 °C | | - | - | -50 | µA |
| $I_{CES}$ | collector-emitter 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



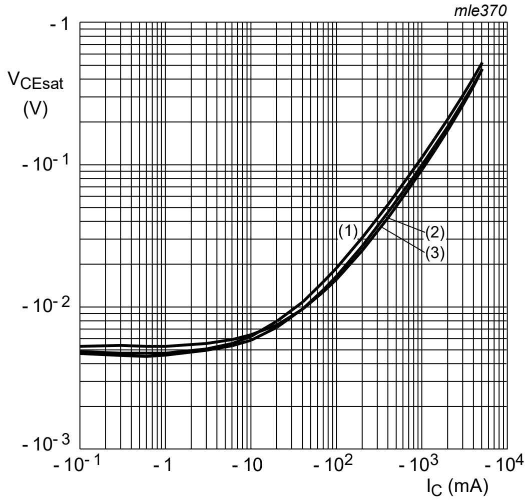

$V_{CE} = -2$ V
(1) $T_{amb} = 100$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = -55$ °C

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



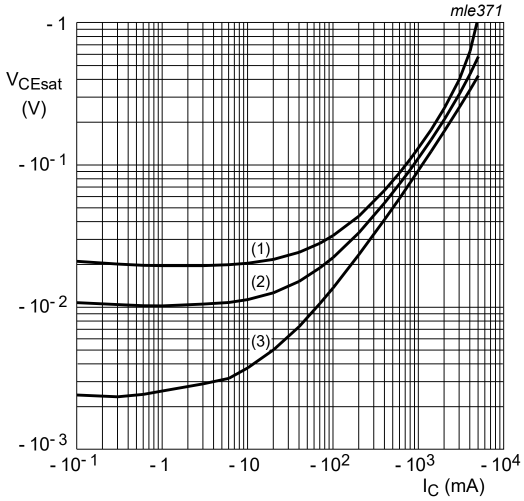

$V_{CE} = -2$ V
(1) $T_{amb} = -55$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = 100$ °C

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



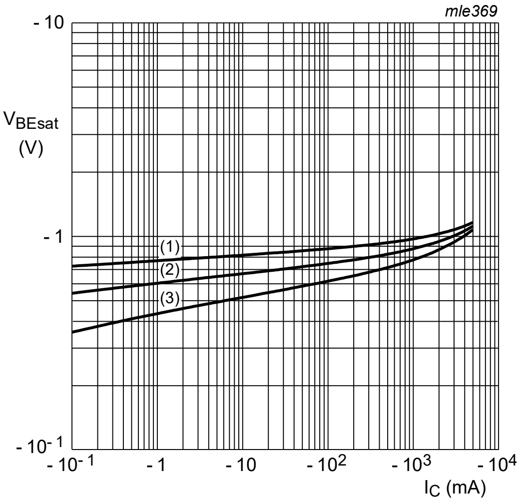

$I_C/I_B = 20$
(1) $T_{amb} = 100$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = -55$ °C

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



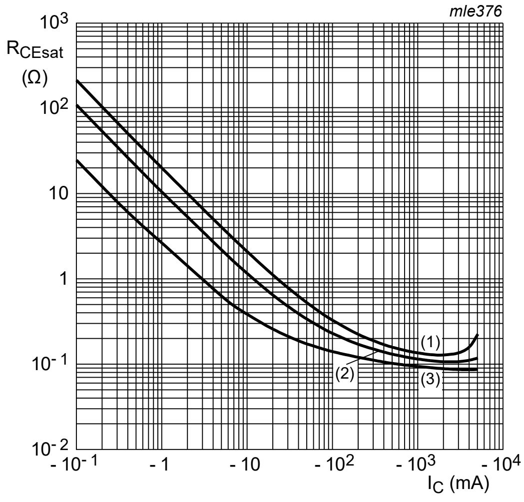

$T_{amb} = 25$ °C
(1) $I_C/I_B = 100$
(2) $I_C/I_B = 50$
(3) $I_C/I_B = 10$

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



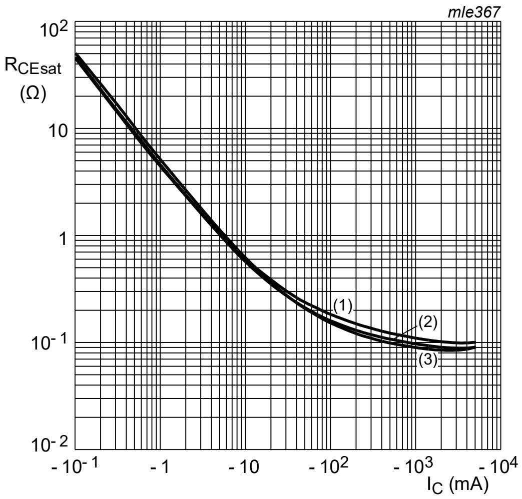

$I_C/I_B = 20$
(1) $T_{amb} = -55$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = 100$ °C

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



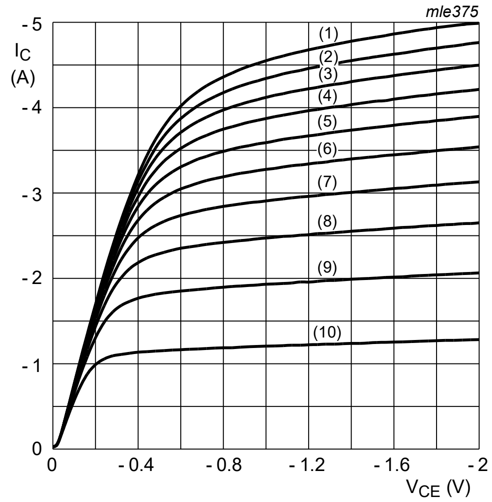

$T_{amb} = 25$ °C
(1) $I_C/I_B = 100$
(2) $I_C/I_B = 50$
(3) $I_C/I_B = 10$

**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**

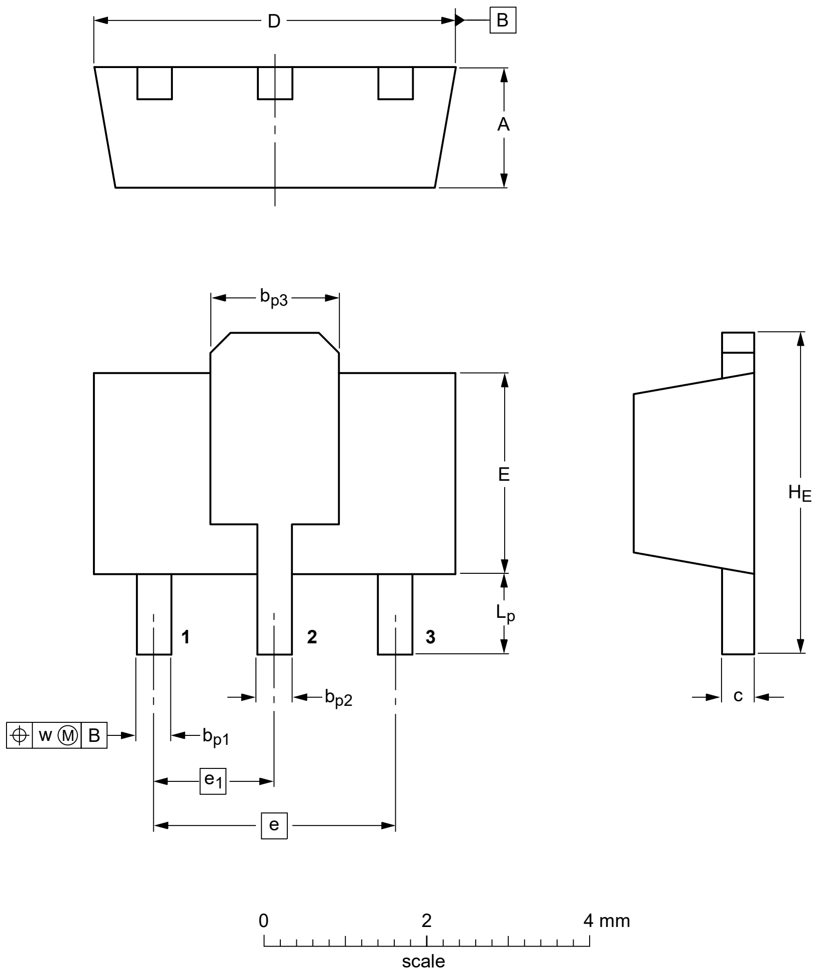
## 11. Test information

### 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<br>1.4 | 0.48<br>0.35 | 0.53<br>0.40 | 1.8<br>1.4 | 0.44<br>0.23 | 4.6<br>4.4 | 2.6<br>2.4 | 3.0 | 1.5 | 4.25<br>3.75 | 1.2<br>0.8 | 0.13 |

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

Fig. 12. Package outline SOT89

## 13. Soldering

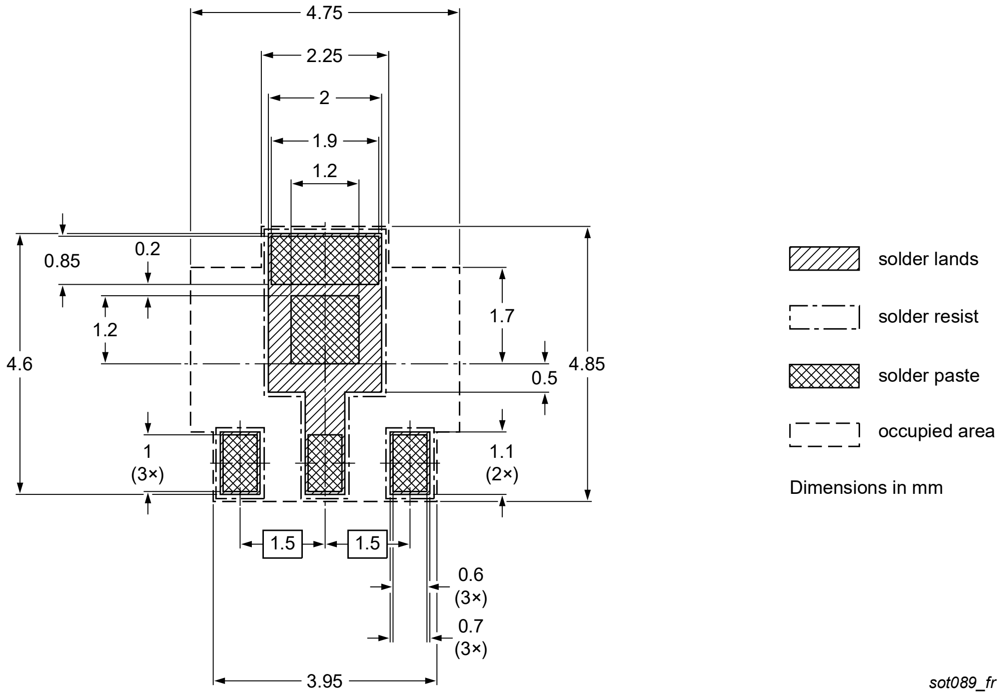



**Fig. 13. Reflow soldering footprint for SOT89**

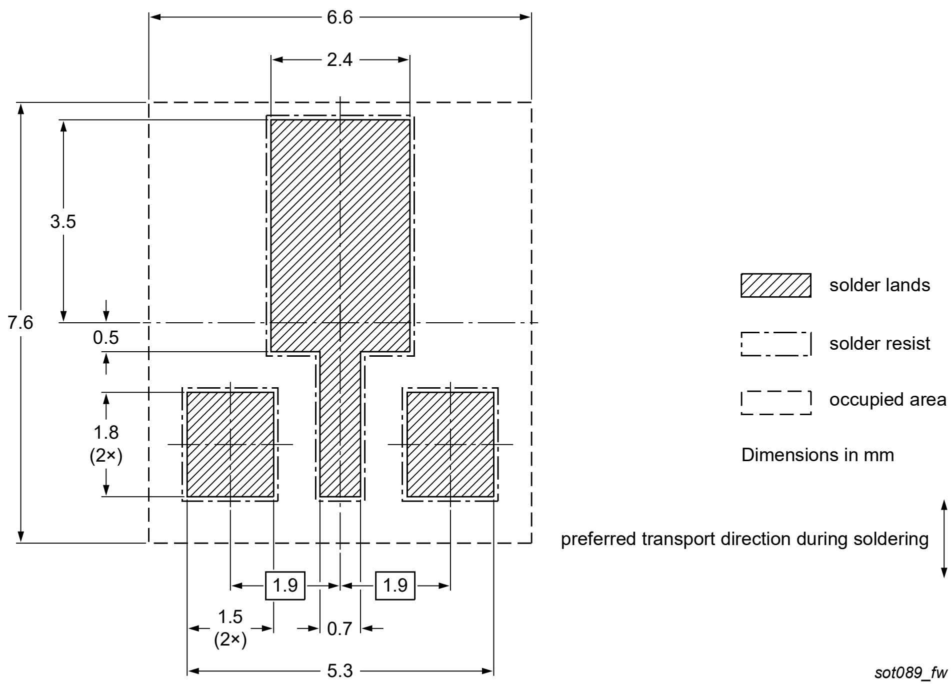



**Fig. 14. Wave soldering footprint for SOT89**

## 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.<br>• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• 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".
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## Contents





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**Date of release: 27 May 2019**