



# BCX56 series

80 V, 1 A NPN medium power transistors

Rev. 12 — 23 June 2023

Product data sheet

## 1. General description

NPN medium power transistors in a SOT89 (SC-62) flat lead Surface-Mounted Device (SMD) plastic package

## 2. Features and benefits

- High collector current capability  $I_C$  and  $I_{CM}$
- Three current gain selections
- High power dissipation capability

## 3. Applications

- Linear voltage regulators
- MOSFET drivers
- Low-side switches
- Battery-driven devices
- Power management
- MOSFET drivers
- Amplifiers

## 4. Quick reference data

Table 1. Quick reference data

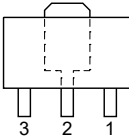
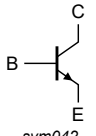
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

| Symbol    | Parameter                 | Conditions                                 | Min | Typ | Max | Unit |  |
|-----------|---------------------------|--|-----|-----|-----|------|--|
| $V_{CEO}$ | collector-emitter voltage | open base                                  | -   | -   | 80  | V    |  |
| $I_C$     | collector current         |  | -   | -   | 1   | A    |  |
| $I_{CM}$  | peak collector current    | single pulse; $t_p \leq 1\text{ ms}$       | -   | -   | 2   | A    |  |
| $h_{FE}$  | DC current gain           |  |     |     |     |      |  |
|           | BCX56                     | $V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ | [1] | 63  | -   | 250  |  |
|           | BCX56-10                  |  | [1] | 63  | -   | 160  |  |
|           | BCX56-16                  |  | [1] | 100 | -   | 250  |  |

[1] pulsed;  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$

## 5. Pinning information

Table 2. Pinning

| Pin | Symbol | Description | Simplified outline   | Graphic symbol  |
|-----|--------|-------------|--|---|
| 1   | E      | emitter     |  |  |
| 2   | C      | collector   |  |   |
| 3   | B      | base        |  |   |

## 6. Ordering information

Table 3. Ordering information

| Type number              | Package |   | Version               |
|--------------------------|---------|---|-----------------------|
|                          | Name    | Description   |                       |
| <a href="#">BCX56</a>    | SC-62   | plastic, surface-mounted package with increased heatsink; 4 leads | <a href="#">SOT89</a> |
| <a href="#">BCX56-10</a> |         |   |                       |
| <a href="#">BCX56-16</a> |         |   |                       |

## 7. Marking

Table 4. Marking

| Type number | Marking code |
|-------------|--------------|
| BCX56       | BH           |
| BCX56-10    | BK           |
| BCX56-16    | BL           |

## 8. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

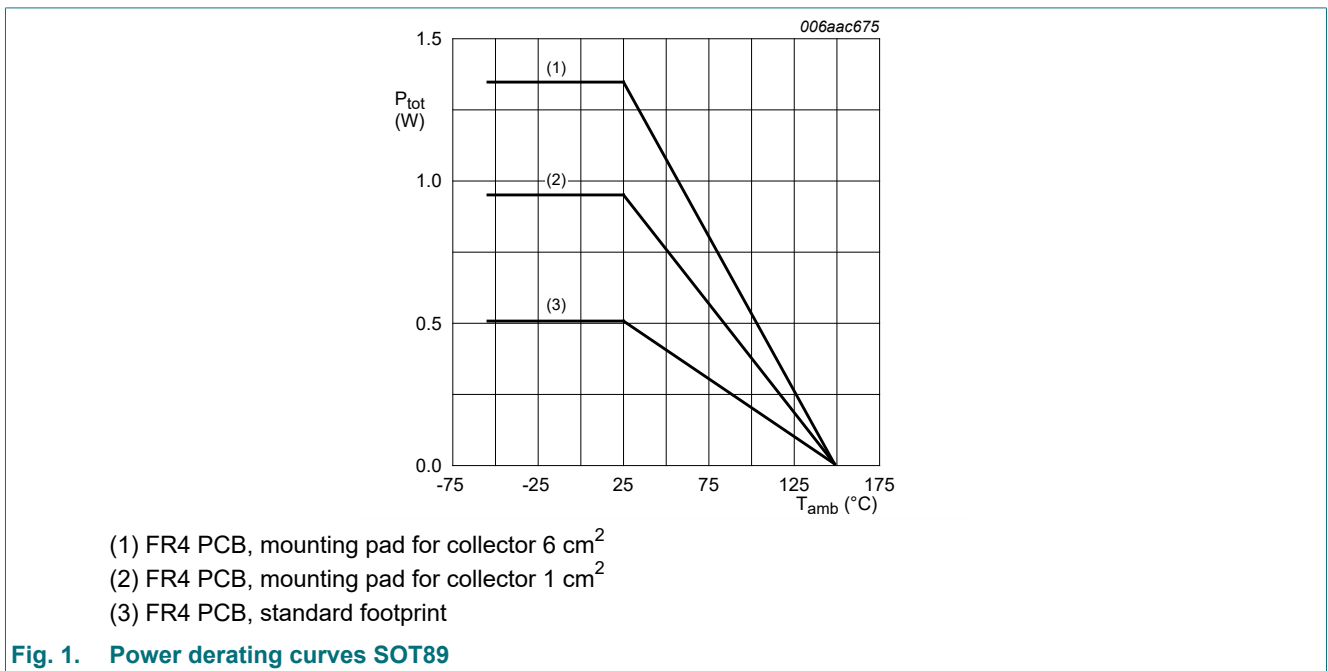
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

| Symbol    | Parameter                 | Conditions                           | Min | Max  | Unit |
|-----------|---------------------------|--------------------------------------|-----|------|------|
| $V_{CBO}$ | collector-base voltage    | open emitter                         | -   | 100  | V    |
| $V_{CEO}$ | collector-emitter voltage | open base                            | -   | 80   | V    |
| $V_{EBO}$ | emitter-base voltage      | open collector                       | -   | 5    | V    |
| $I_C$     | collector current         |                                      | -   | 1    | A    |
| $I_{CM}$  | peak collector current    | single pulse; $t_p \leq 1\text{ ms}$ | -   | 2    | A    |
| $I_B$     | base current              |                                      | -   | 0.3  | A    |
| $I_{BM}$  | peak base current         | single pulse; $t_p \leq 1\text{ ms}$ | -   | 0.3  | A    |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25\text{ °C}$          | [1] | 0.50 | W    |
|           |                           |                                      | [2] | 0.95 | W    |
|           |                           |                                      | [3] | 1.35 | W    |
| $T_j$     | junction temperature      |                                      | -   | 150  | °C   |
| $T_{amb}$ | ambient temperature       |                                      | -55 | 150  | °C   |
| $T_{stg}$ | storage temperature       |                                      | -65 | 150  | °C   |

[1] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated and standard footprint.

[2] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated; mounting pad for collector 6 cm<sup>2</sup>.



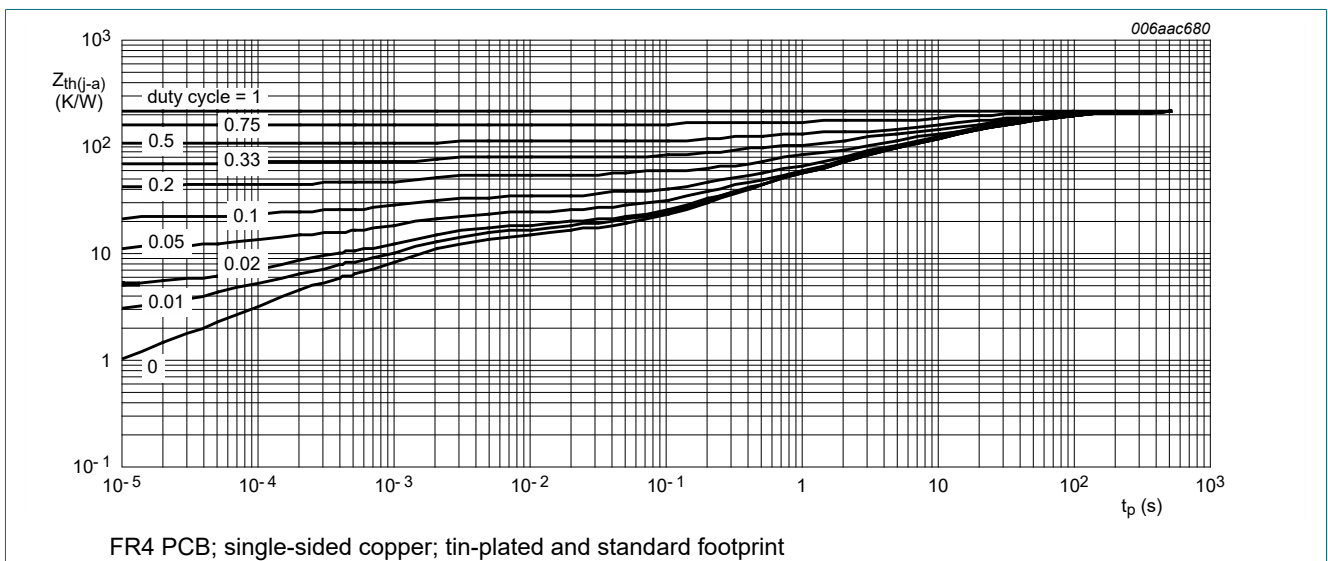
## 9. Thermal characteristics

**Table 6. Thermal characteristics**

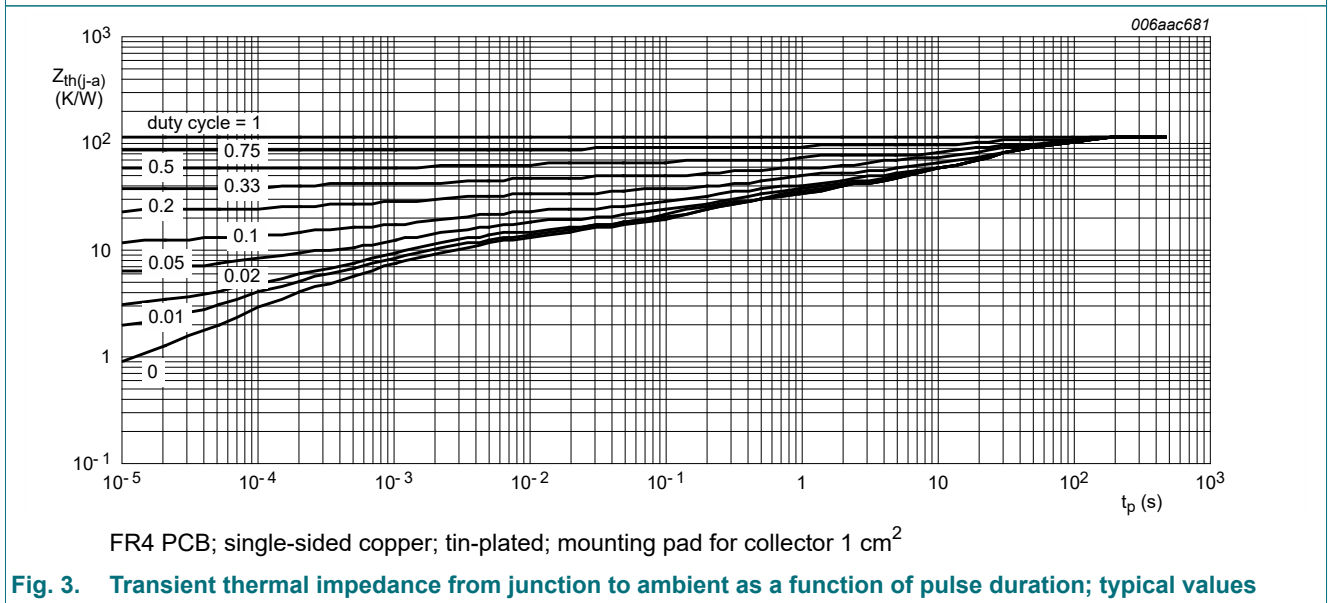
$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| Symbol        | Parameter  | Conditions  |     | Min | Typ | Max | Unit |
|---------------|--|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient      | in free air | [1] | -   | -   | 250 | K/W  |
|               |  |             | [2] |     |     | 132 | K/W  |
|               |  |             | [3] |     |     | 93  | K/W  |
| $R_{(j-sp)}$  | thermal resistance from junction to solder point |             |     | -   | -   | 16  | K/W  |

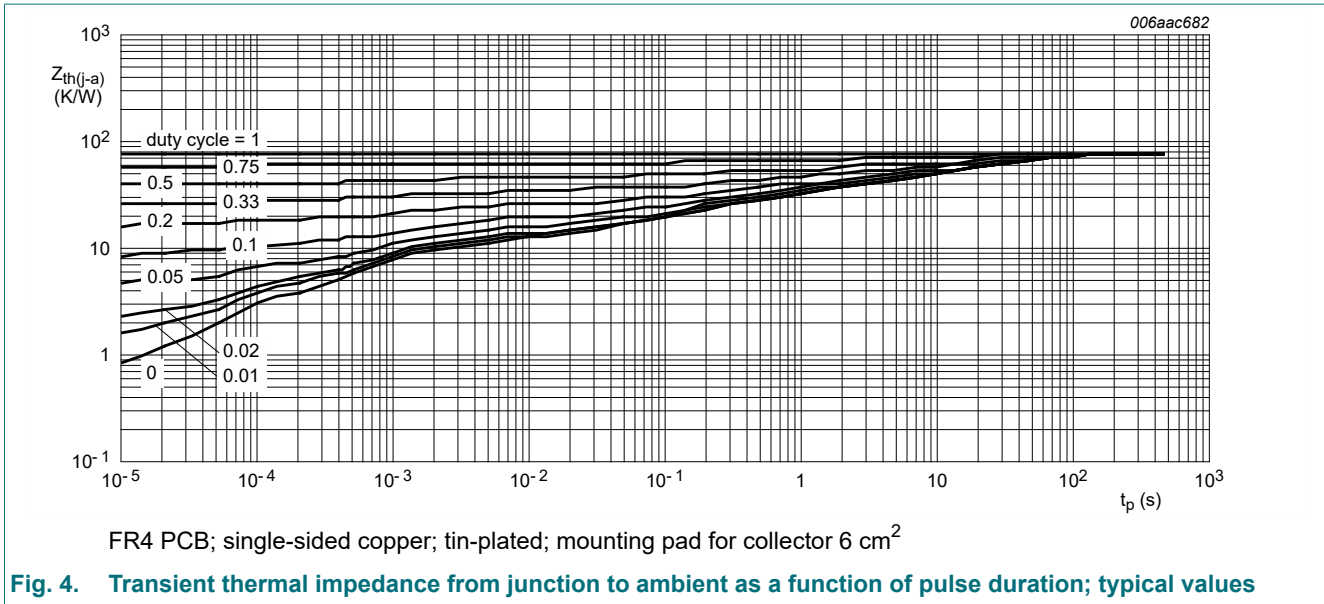
- [1] Device mounted on an FR4 PCB; single-sided copper; tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB; single-sided copper; tin-plated; mounting pad for collector  $1\text{ cm}^2$ .
- [3] Device mounted on an FR4 PCB; single-sided copper; tin-plated; mounting pad for collector  $6\text{ cm}^2$ .



**Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**



**Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**



## 10. Characteristics

**Table 7. Characteristics**
 $T_{amb} = 25\text{ °C}$  unless otherwise specified.

| Symbol                                       | Parameter                            | Conditions  | Min | Typ | Max | Unit          |  |
|--|--------------------------------------|---|-----|-----|-----|---------------|--|
| $V_{(BR)CBO}$                                | collector-base breakdown voltage     | $I_C = 100\ \mu\text{A}; I_E = 0\ \text{A}$                         | 100 | -   | -   | V             |  |
| $V_{(BR)CEO}$                                | collector-emitter breakdown voltage  | $I_C = 2\ \text{mA}; I_B = 0\ \text{A}$                             | 80  | -   | -   | V             |  |
| $V_{(BR)EBO}$                                | emitter-base breakdown voltage       | $I_E = 100\ \mu\text{A}; I_C = 0\ \text{A}$                         | 5   | -   | -   | V             |  |
| $I_{CBO}$                                    | collector-base cut-off current       | $V_{CB} = 30\ \text{V}; I_E = 0\ \text{A}$                          | -   | -   | 100 | nA            |  |
|  |                                      | $V_{CB} = 30\ \text{V}; I_E = 0\ \text{A}; T_j = 150\text{ °C}$     | -   | -   | 10  | $\mu\text{A}$ |  |
| $I_{EBO}$                                    | emitter-base cut-off current         | $V_{EB} = 5\ \text{V}; I_C = 0\ \text{A}$                           | -   | -   | 100 | nA            |  |
| $h_{FE}$                                     | DC current gain                      |   |     |     |     |               |  |
|  | BCX56                                | $V_{CE} = 2\ \text{V}; I_C = 5\ \text{mA}$                          | [1] | 63  | -   | -             |  |
|  |                                      | $V_{CE} = 2\ \text{V}; I_C = 150\ \text{mA}$                        |     | 63  | -   | 250           |  |
|  |                                      | $V_{CE} = 2\ \text{V}; I_C = 500\ \text{mA}$                        |     | 40  | -   | -             |  |
|  | BCX56-10                             | $V_{CE} = 2\ \text{V}; I_C = 5\ \text{mA}$                          | [1] | 63  | -   | -             |  |
|  |                                      | $V_{CE} = 2\ \text{V}; I_C = 150\ \text{mA}$                        |     | 63  | -   | 160           |  |
|  |                                      | $V_{CE} = 2\ \text{V}; I_C = 500\ \text{mA}$                        |     | 40  | -   | -             |  |
|  | BCX56-16                             | $V_{CE} = 2\ \text{V}; I_C = 5\ \text{mA}$                          | [1] | 63  | -   | -             |  |
|  |                                      | $V_{CE} = 2\ \text{V}; I_C = 150\ \text{mA}$                        |     | 100 | -   | 250           |  |
| $V_{CE} = 2\ \text{V}; I_C = 500\ \text{mA}$ |                                      |   | 40  | -   | -   |               |  |
| $V_{CEsat}$                                  | collector-emitter saturation voltage | $I_C = 500\ \text{mA}; I_B = 50\ \text{mA}$                         | [1] | -   | 0.5 | V             |  |
| $V_{BE}$                                     | base-emitter voltage                 | $V_{CE} = 2\ \text{V}; I_C = 500\ \text{mA}$                        | [1] | -   | 1   | V             |  |
| $C_C$  | collector capacitance                | $V_{CB} = 10\ \text{V}; I_E = i_e = 0\ \text{A}; f = 1\ \text{MHz}$ | -   | 6   | -   | pF            |  |
| $f_T$  | transition frequency                 | $V_{CE} = 5\ \text{V}; I_C = 50\ \text{mA}; f = 100\ \text{MHz}$    | 100 | 180 | -   | MHz           |  |

[1] pulsed;  $t_p \leq 300\ \mu\text{s}$ ;  $\delta \leq 0.02$

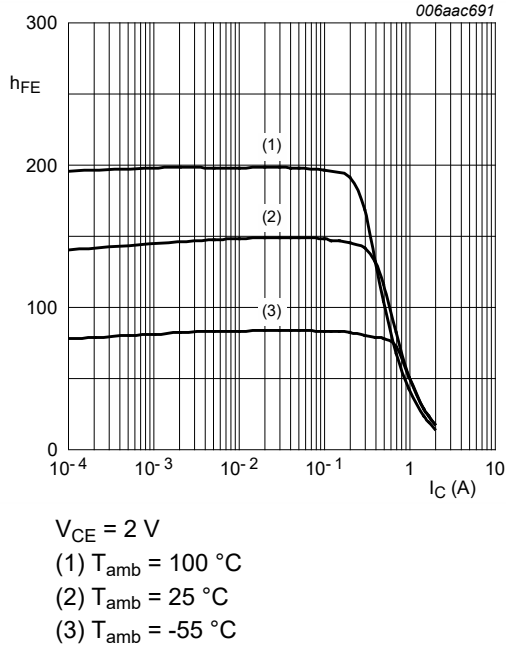


Fig. 5. DC current gain as a function of collector current; typical values

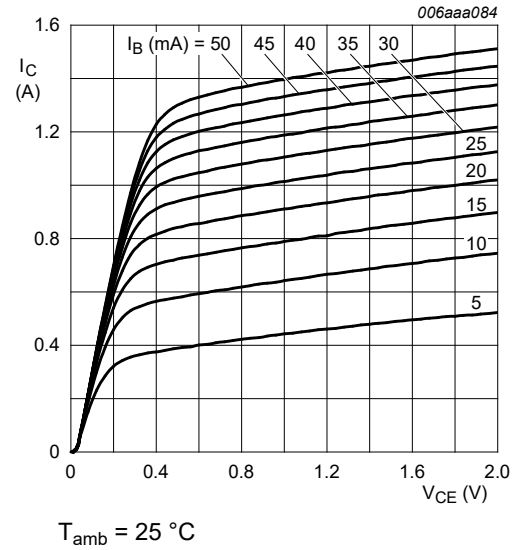


Fig. 6. Collector current as a function of collector-emitter voltage; typical values

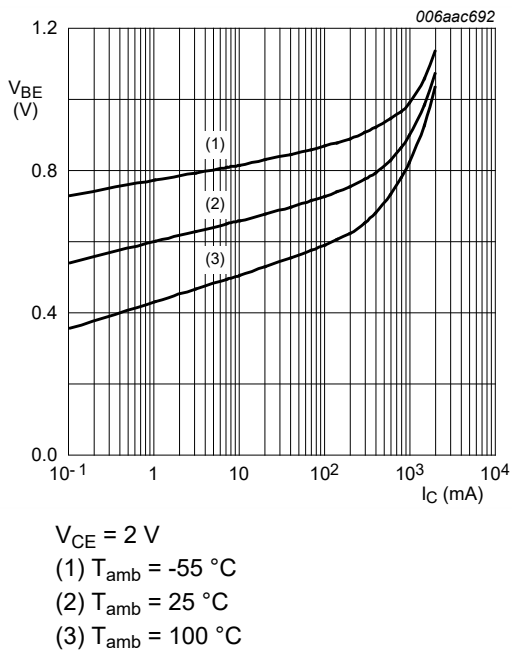


Fig. 7. Base-emitter voltage as a function of collector current; typical values

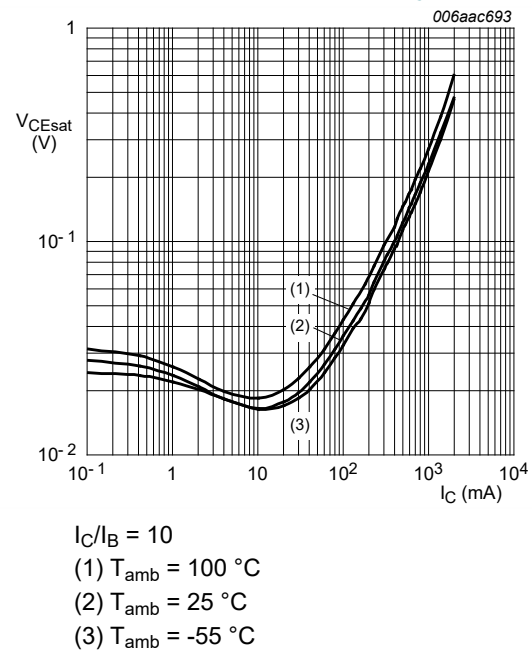


Fig. 9.

11. Package outline

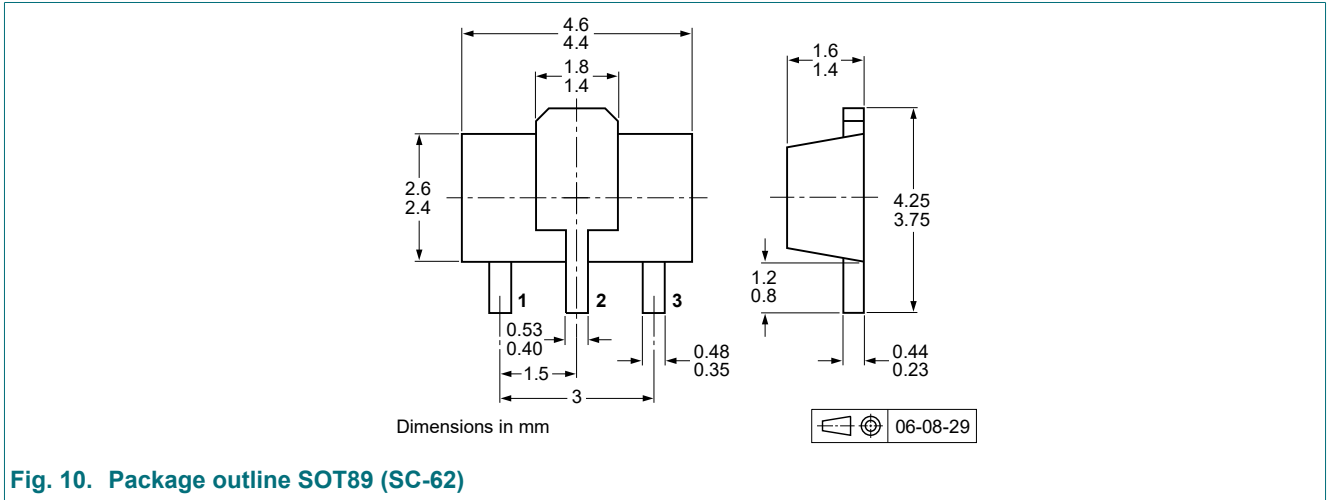


Fig. 10. Package outline SOT89 (SC-62)



## 12. Soldering

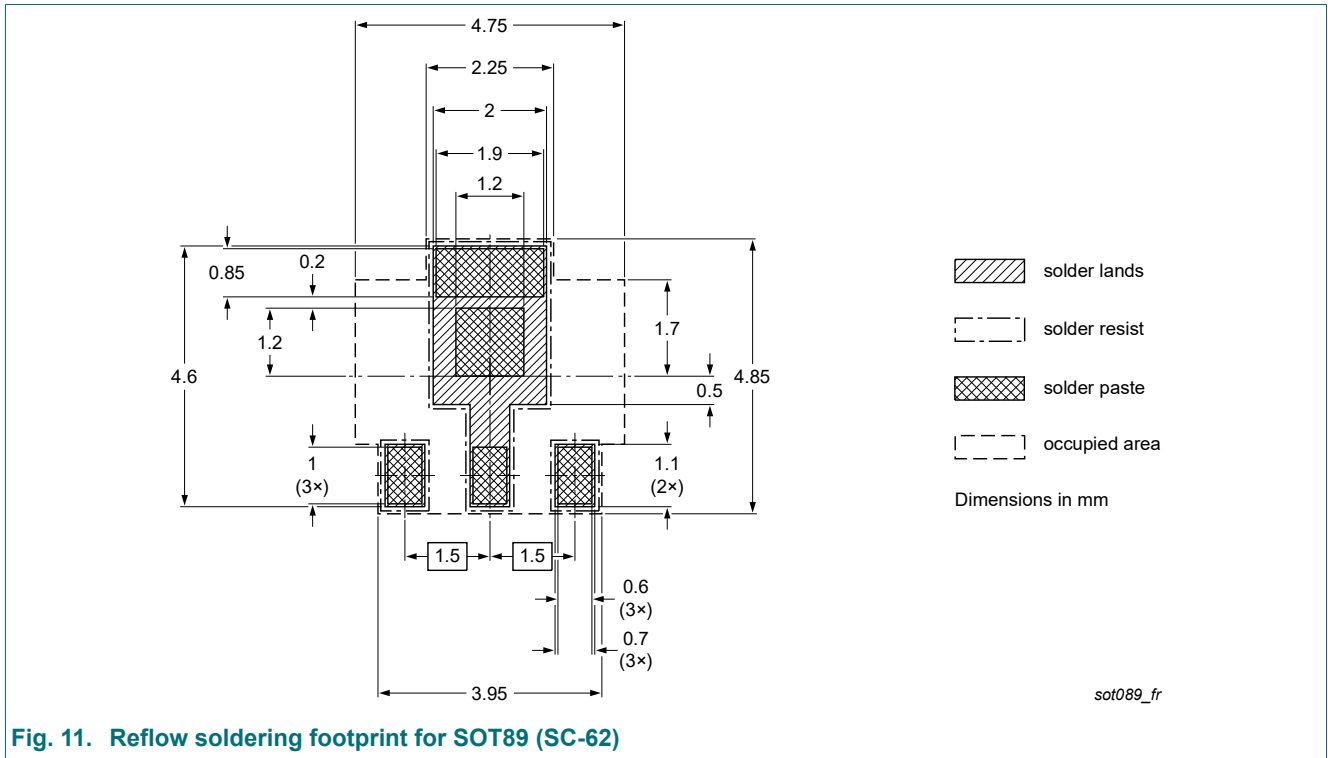


Fig. 11. Reflow soldering footprint for SOT89 (SC-62)

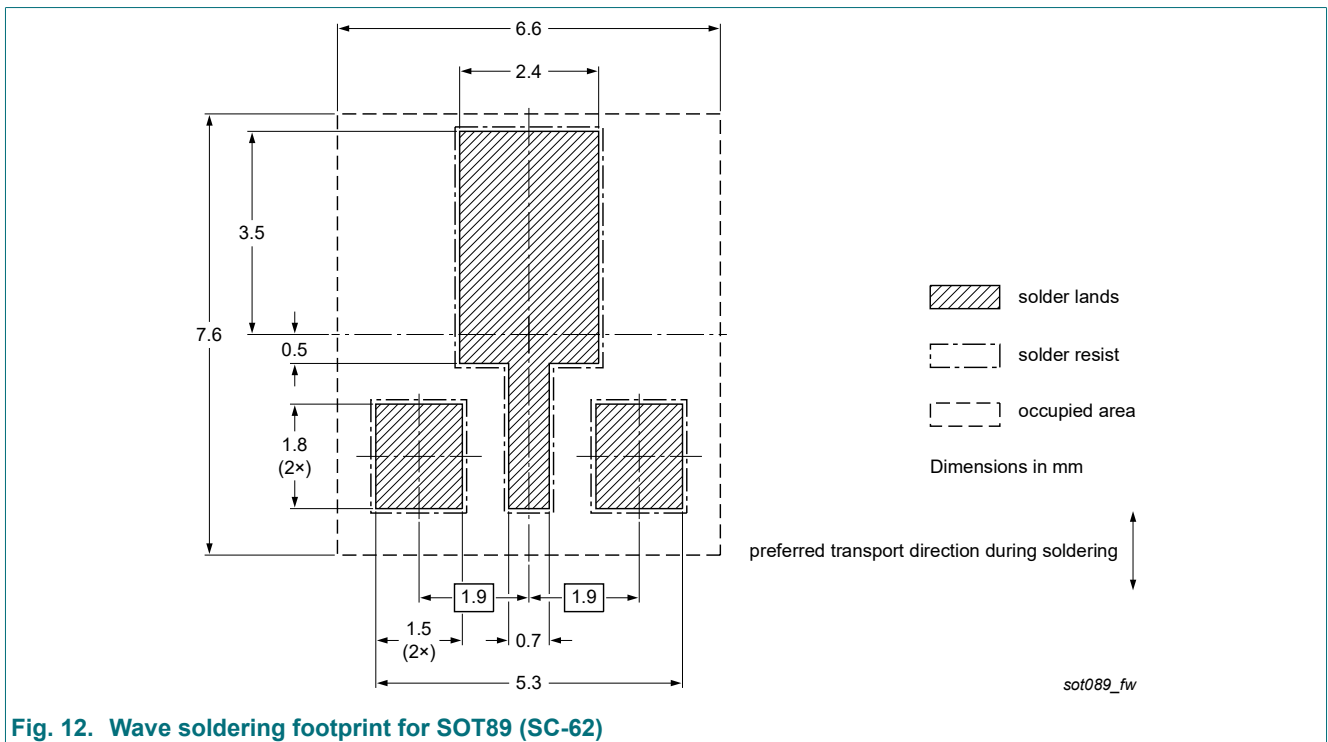


Fig. 12. Wave soldering footprint for SOT89 (SC-62)

## 13. Revision history

Table 8. Revision history

| Document ID            | Release date  | Data sheet status     | Change notice     | Supersedes  |
|------------------------|---|-----------------------|-------------------|---|
| BCX56_SER v.12         | 20230623  | Product data sheet    | -                 | BCX56_SER v.11  |
| Modifications:         | <ul style="list-style-type: none"> <li>Characteristics, Figure 6: Legend corrected</li> </ul> |                       |                   |   |
| BCX56_SER v.11         | 20230401  | Product data sheet    | -                 | BCX56_SER v.10  |
| BCX56_SER v.10         | 20220624  | Product data sheet    | -                 | BCP56_BCX56_BC56PA v.9                                  |
| BCP56_BCX56_BC56PA v.9 | 20111025  | Product data sheet    | -                 | BC639_BCP56_BCX56 v.8                                   |
| BC639_BCP56_BCX56 v.8  | 20070622  | Product data sheet    | -                 | BC639_BCP56_BCX56 v.7                                   |
| BC639_BCP56_BCX56 v.7  | 20050308  | Product data sheet    |                   | BC639_BCP56_BCX56 v.6                                   |
| BC639_BCP56_BCX56 v.6  | 20050303  | Product data sheet    | CPCN2004050<br>29 | BC635_637_639 v.4<br>BCP54_55_56 v.5<br>BCX54_55_56 v.4 |
| BC635_637_639 v.4      | 20011010  | Product specification | -                 | BC635_637_639 v.3                                       |
| BCX54_55_56 v.5        | 20030206  | Product specification | -                 | BCX54_55_56 v.4   |
| BCX54_55_56 v.4        | 20011010  | Product specification | -                 | BCX54_55_56 v.3   |

## 14. Legal information

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| 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.                                     |

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