



# BCX54-Q series

45 V, 1 A NPN medium power transistors

Rev. 2 — 30 March 2022

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
- Qualified according to AEC-Q101 and recommended for use in automotive applications

## 3. Applications

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

## 4. Quick reference data

Table 1. Quick reference data

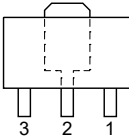
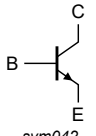
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

| Symbol    | Parameter                 | Conditions                                 | Min | Typ | Max | Unit |  |
|-----------|---------------------------|--|-----|-----|-----|------|--|
| $V_{CEO}$ | collector-emitter voltage | open base                                  | -   | -   | 45  | 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           |  |     |     |     |      |  |
|           | BCX54-Q                   | $V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ | [1] | 63  | -   | 250  |  |
|           | BCX54-10-Q                |  | [1] | 63  | -   | 160  |  |
|           | BCX54-16-Q                |  | [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  |         |
| BCX54-Q     | SC-62   | plastic surface-mounted package; exposed die pad for good heat transfer; 3 leads | SOT89   |
| BCX54-10-Q  |         |  |         |
| BCX54-16-Q  |         |  |         |

## 7. Marking

Table 4. Marking

| Type number | Marking code |
|-------------|--------------|
| BCX54-Q     | BA           |
| BCX54-10-Q  | BC           |
| BCX54-16-Q  | BD           |

## 8. Limiting values

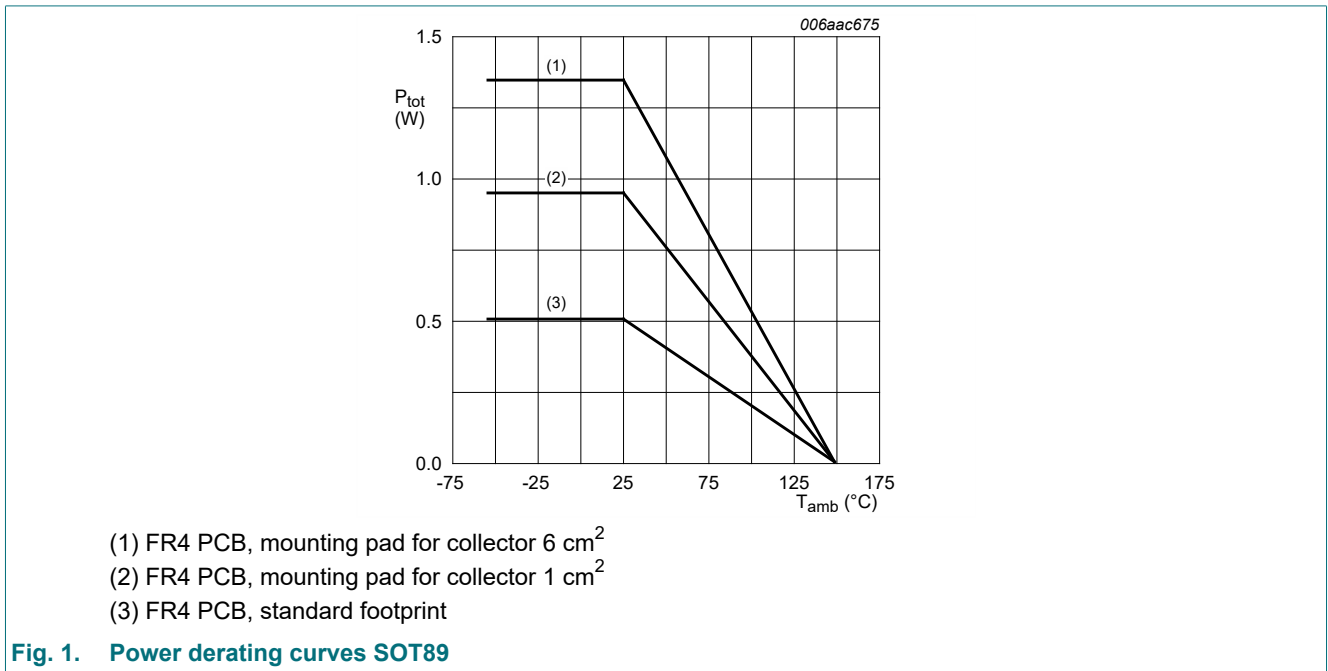
**Table 5. Limiting values**

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                         | -   | 45   | V    |
| $V_{CEO}$ | collector-emitter voltage | open base                            | -   | 45   | 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>.



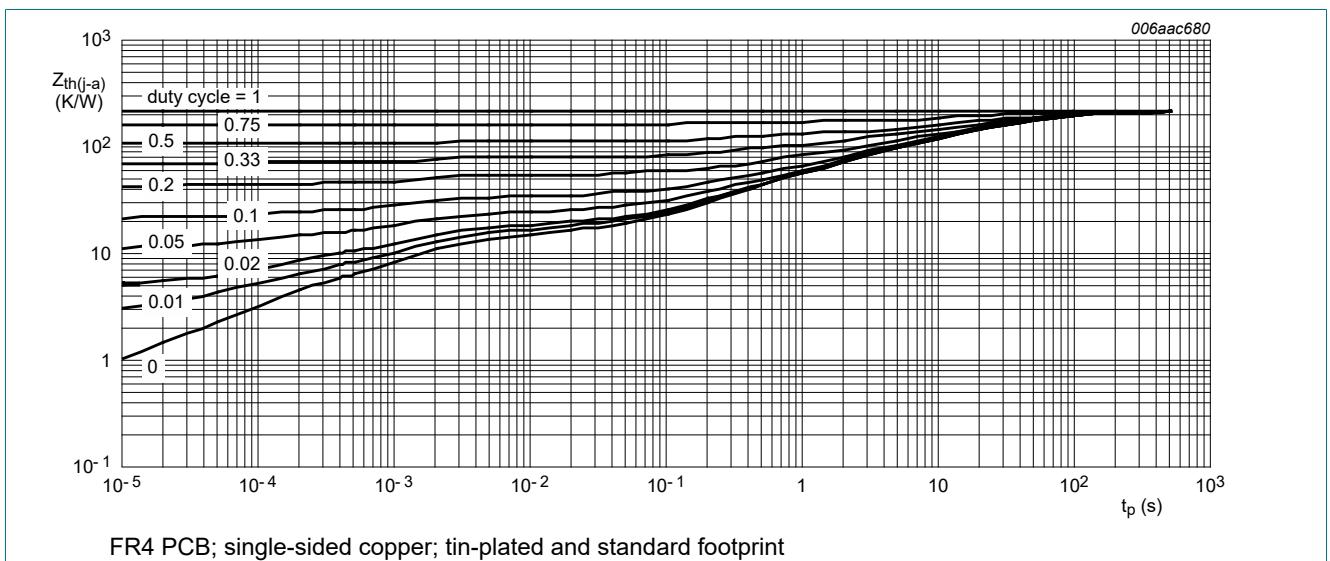
## 9. Thermal characteristics

**Table 6. Thermal characteristics**

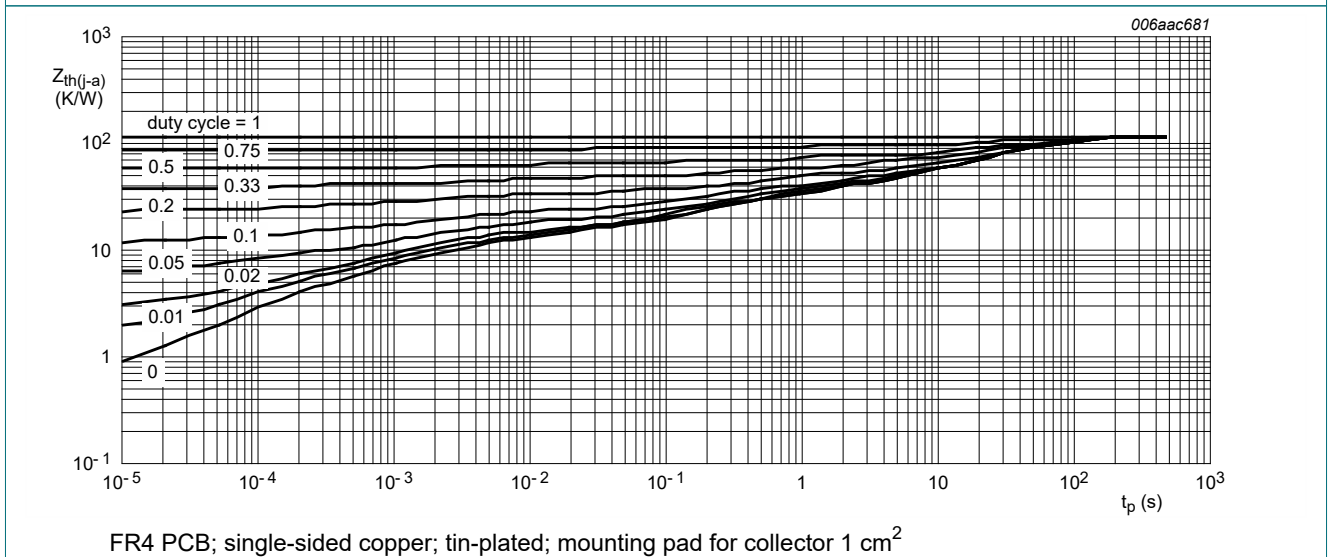
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

| 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  |     |

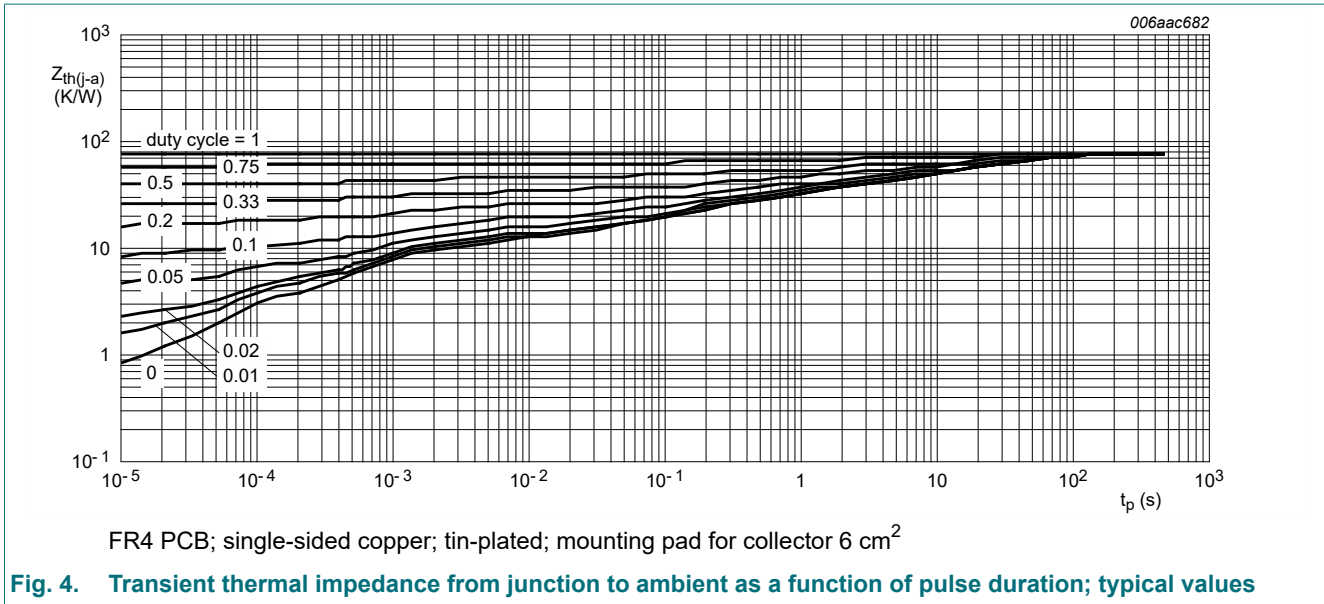
- [1] Device mounted on an FR4 PCB; single-sided copper; tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB; single-sided copper; tin-plated; mounting pad for collector  $1\text{ cm}^2$ .
- [3] Device mounted on an FR4 PCB; single-sided copper; tin-plated; mounting pad for collector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



**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**

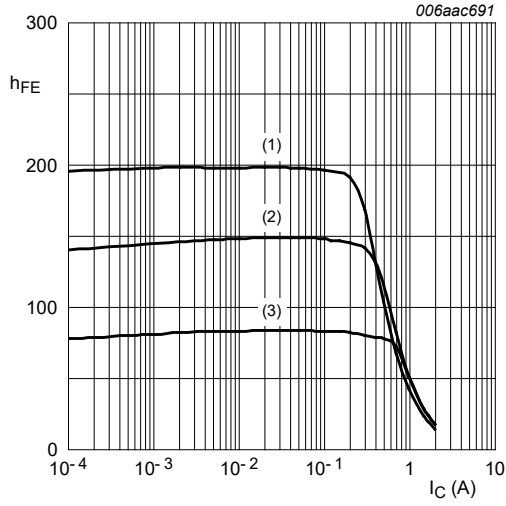


## 10. Characteristics

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

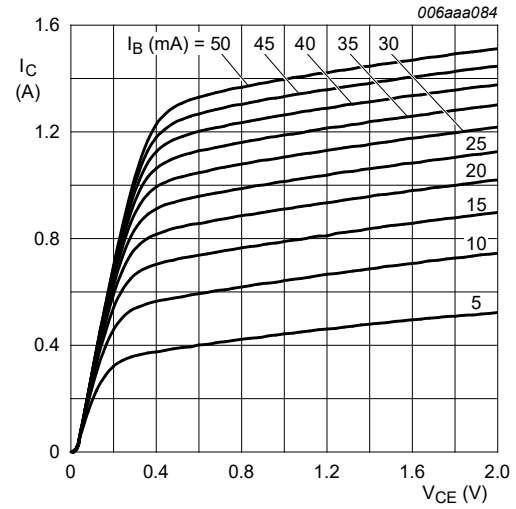
| Symbol                                       | Parameter                            | Conditions  | Min | Typ | Max | Unit          |  |
|--|--------------------------------------|---|-----|-----|-----|---------------|--|
| $V_{(BR)CBO}$                                | collector-base breakdown voltage     | $I_C = 100\ \mu\text{A}; I_E = 0\ \text{A}$                         | 45  | -   | -   | V             |  |
| $V_{(BR)CEO}$                                | collector-emitter breakdown voltage  | $I_C = 2\ \text{mA}; I_B = 0\ \text{A}$                             | 45  | -   | -   | 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                      |   |     |     |     |               |  |
|  | BCX54-Q                              | $V_{CE} = 2\ \text{V}; I_C = 5\ \text{mA}$                          | [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  | -   | -             |  |
|  | BCX54-10-Q                           | $V_{CE} = 2\ \text{V}; I_C = 5\ \text{mA}$                          | [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  | -   | -             |  |
|  | BCX54-16-Q                           | $V_{CE} = 2\ \text{V}; I_C = 5\ \text{mA}$                          | [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;  $t_p \leq 300\ \mu\text{s}$ ;  $\delta \leq 0.02$



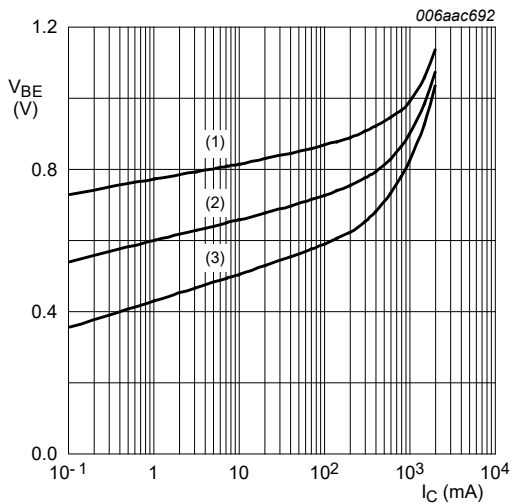
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



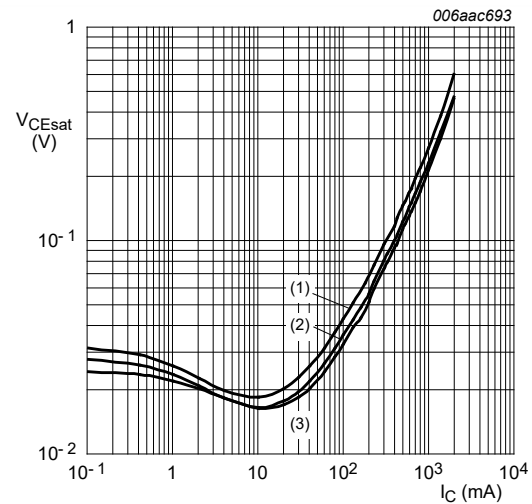
$T_{amb} = 25\text{ }^\circ\text{C}$

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



$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



$I_C/I_B = 10$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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

## 11. Test information

### 11.1. 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

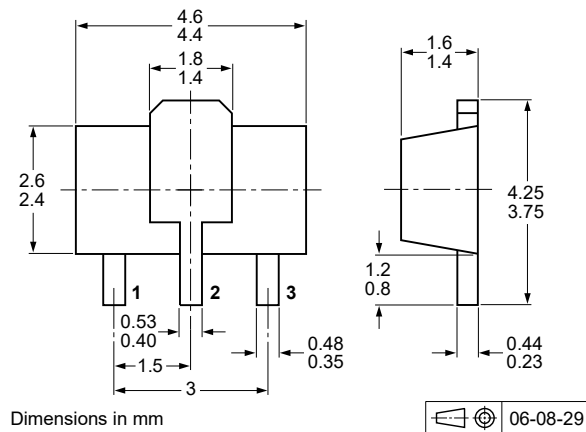


Fig. 9. Package outline SOT89 (SC-62)



### 13. Soldering

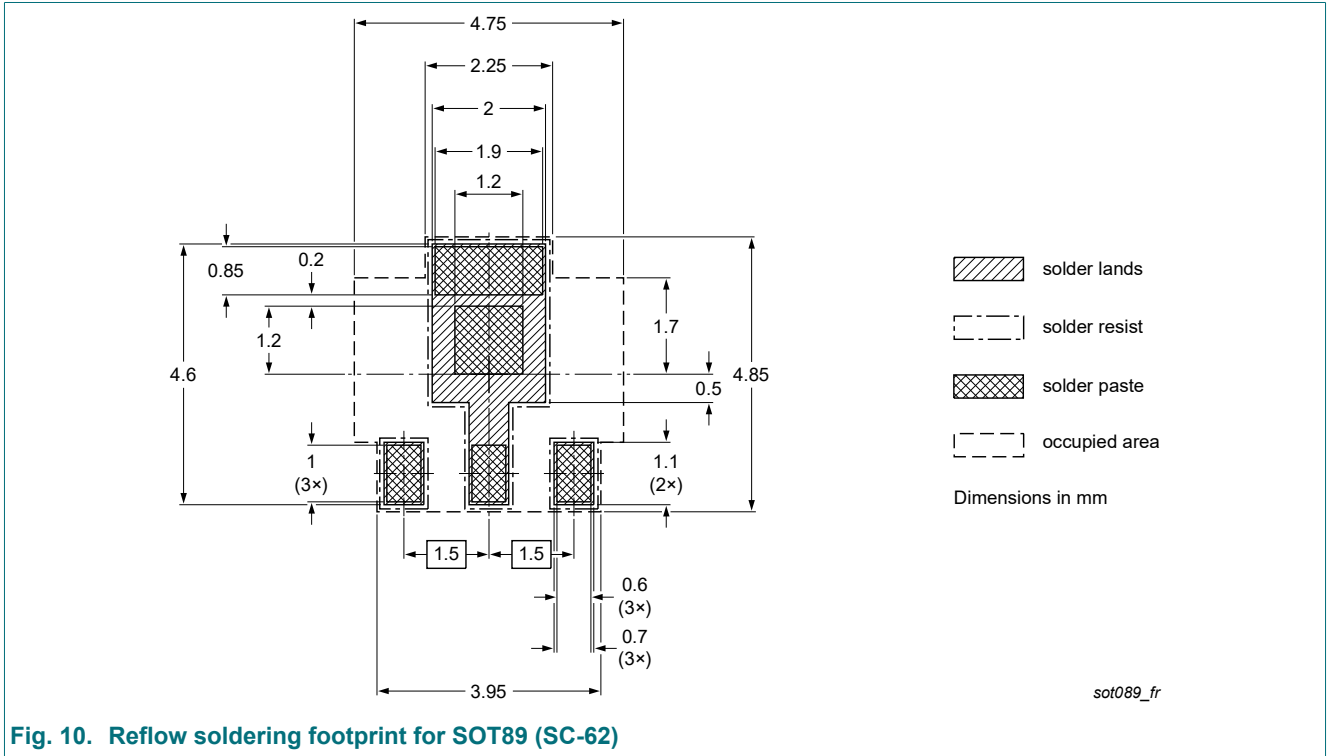


Fig. 10. Reflow soldering footprint for SOT89 (SC-62)

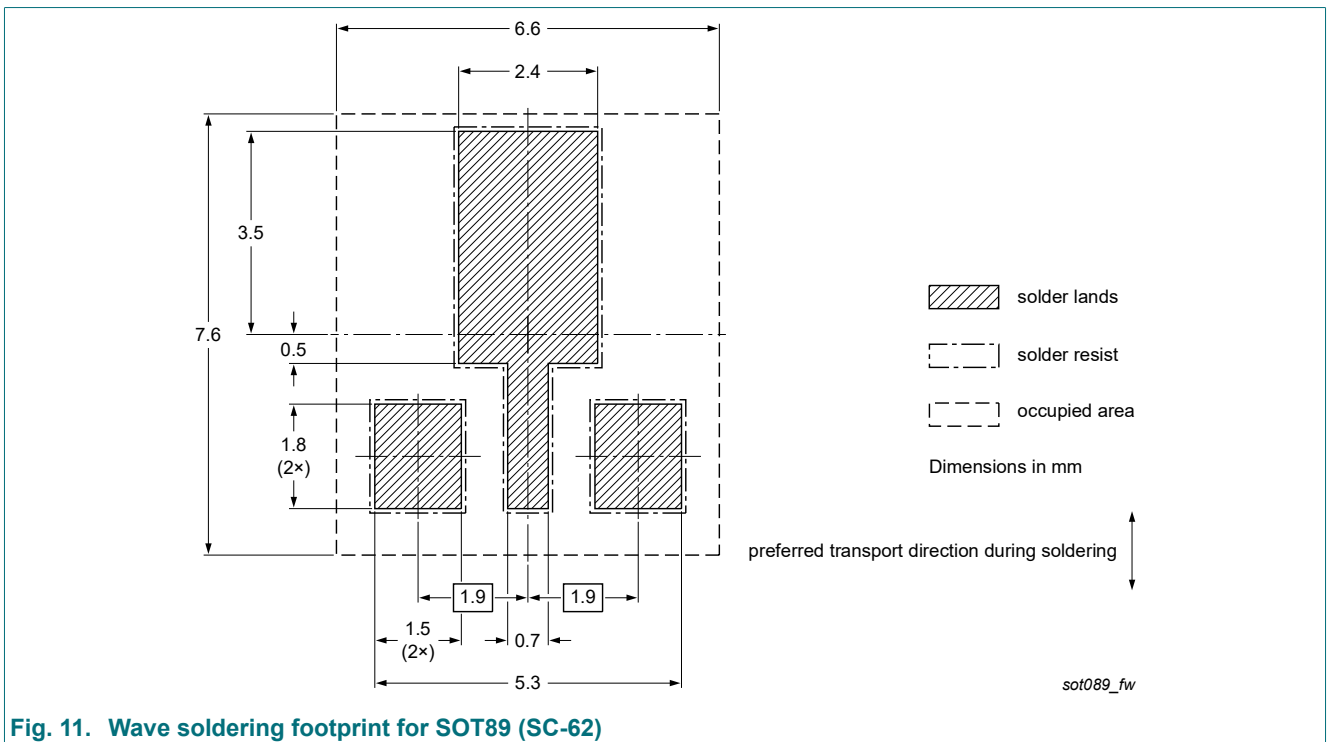


Fig. 11. Wave soldering footprint for SOT89 (SC-62)

## 14. Revision history

Table 8. Revision history

| Document ID     | Release date                               | Data sheet status  | Change notice | Supersedes      |
|-----------------|--|--------------------|---------------|-----------------|
| BCX54-Q_SER v.2 | 20220330                                   | Product data sheet | -             | BCX54-Q_SER v.1 |
| Modifications:  | • Characteristics, Fig 8: Legend corrected |                    |               |                 |
| BCX54-Q_SER v.1 | 20220324                                   | 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.
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