



# BCX54T series

45 V, 1 A NPN power bipolar transistors

Rev. 1 — 22 August 2019

Product data sheet

## 1. Product profile

### 1.1. General description

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

Table 1. Product overview

| Type number | Package  |       | PNP complement |
|-------------|----------|-------|----------------|
|             | Nexperia | JEDEC |                |
| BCX54T      | SOT89    | SC-62 | BCX51T         |
| BCX54-10T   |          |       | BCX51-10T      |
| BCX54-16T   |          |       | BCX51-16T      |

### 1.2. Features and benefits

- High collector current capability  $I_C$  and  $I_{CM}$
- Three current gain selections
- High power dissipation capability
- AEC-Q101 qualified

### 1.3. Applications

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

### 1.4. Quick reference data

Table 2. Quick reference data

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

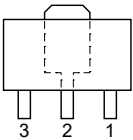
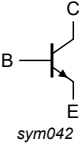
| Symbol    | Parameter                 | Conditions                           | Min | Typ | Max | Unit |
|-----------|---------------------------|--------------------------------------|-----|-----|-----|------|
| $V_{CEO}$ | collector-emitter voltage | open base                            | -   | -   | 45  | V    |
| $I_C$     | collector current         |                                      | -   | -   | 1   | A    |
| $I_{CM}$  | peak collector current    | single pulse; $t_p \leq 1\text{ ms}$ | -   | -   | 2   | A    |

| Symbol    | Parameter       | Conditions                                   |     | Min | Typ | Max | Unit |
|-----------|-----------------|--|-----|-----|-----|-----|------|
| $h_{FE}$  | DC current gain |  |     |     |     |     |      |
|           | BCX54T          | $V_{CE} = 2 \text{ V}; I_C = 150 \text{ mA}$ | [1] | 63  | -   | 250 |      |
|           | BCX54-10T       |  | [1] | 63  | -   | 160 |      |
| BCX54-16T | [1]             |  | 100 | -   | 250 |     |      |

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

## 2. Pinning information

Table 3. Pinning

| Pin | Symbol | Description | Simplified outline   | Graphic symbol  |
|-----|--------|-------------|--|---|
| 1   | E      | emitter     |  | <br>sym042 |
| 2   | C      | collector   |  |   |
| 3   | B      | base        |  |   |

## 3. Ordering information

Table 4. Ordering information

| Type number | Package |   | Version |
|-------------|---------|---|---------|
|             | Name    | Description   |         |
| BCX54T      | SC-62   | plastic, surface-mounted package; 3 leads; 1.5 mm pitch;<br>4.5 mm x 2.5 mm x 1.5 mm body | SOT89   |
| BCX54-10T   |         |   |         |
| BCX54-16T   |         |   |         |

## 4. Marking

Table 5. Marking

| Type number | Marking code |
|-------------|--------------|
| BCX54T      | B5           |
| BCX54-10T   | B6           |
| BCX54-16T   | B7           |

## 5. Limiting values

**Table 6. Limiting values**

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

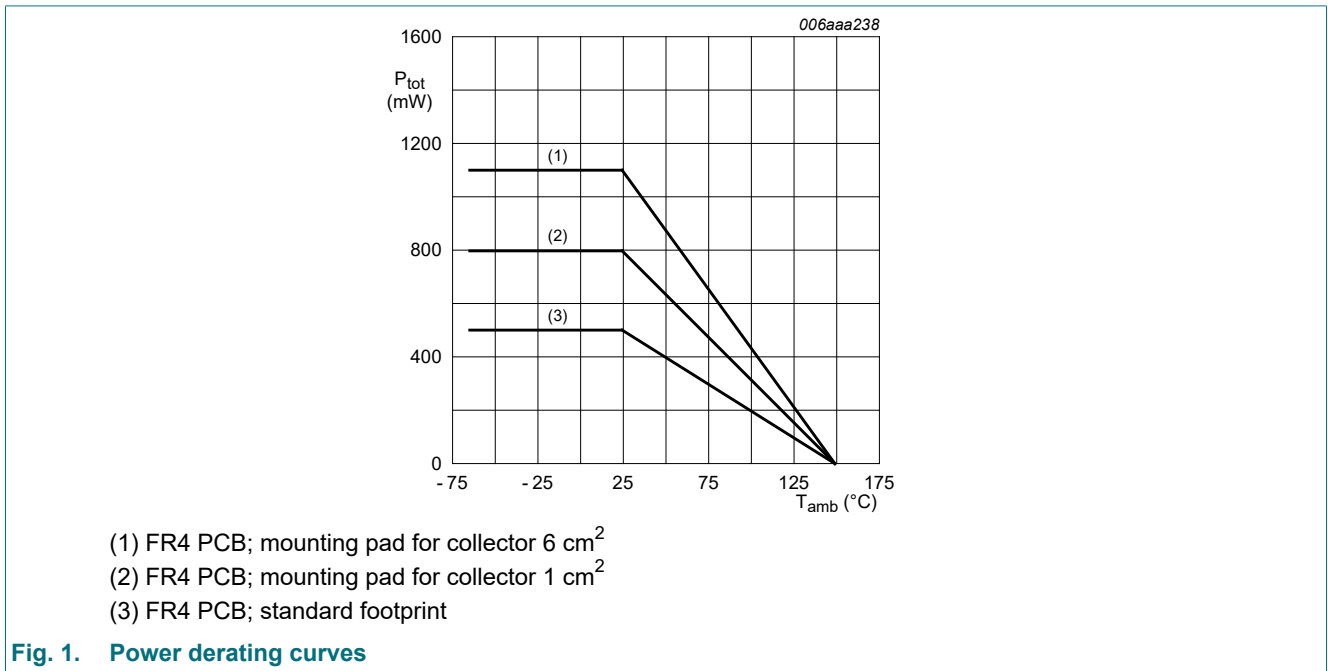
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

| 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              |                                      | -   | 200  | mA   |
| $I_{BM}$  | peak base current         | single pulse; $t_p \leq 1\text{ ms}$ | -   | 300  | mA   |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25\text{ °C}$          | [1] | 500  | mW   |
|           |                           |                                      | [2] | 800  | mW   |
|           |                           |                                      | [3] | 1100 | mW   |
| $T_j$     | junction temperature      |                                      | -   | 150  | °C   |
| $T_{amb}$ | ambient temperature       |                                      | -55 | 150  | °C   |
| $T_{stg}$ | storage temperature       |                                      | -65 | 150  | °C   |

[1] Device mounted on an FR4 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. 1. Power derating curves**

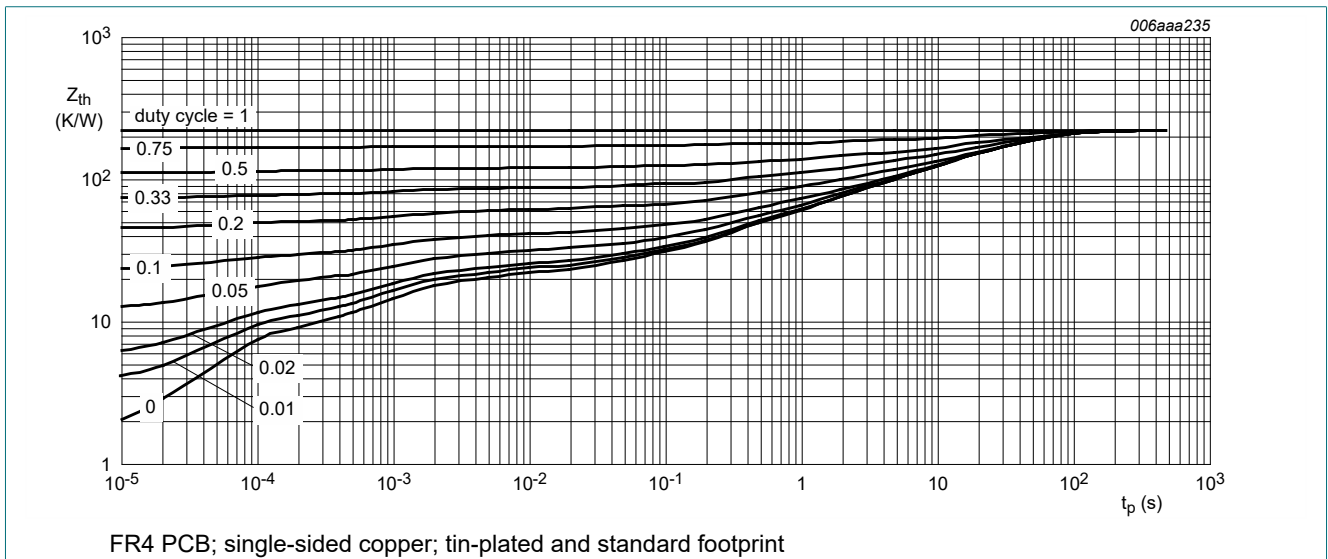
## 6. Thermal characteristics

**Table 7. Thermal characteristics**

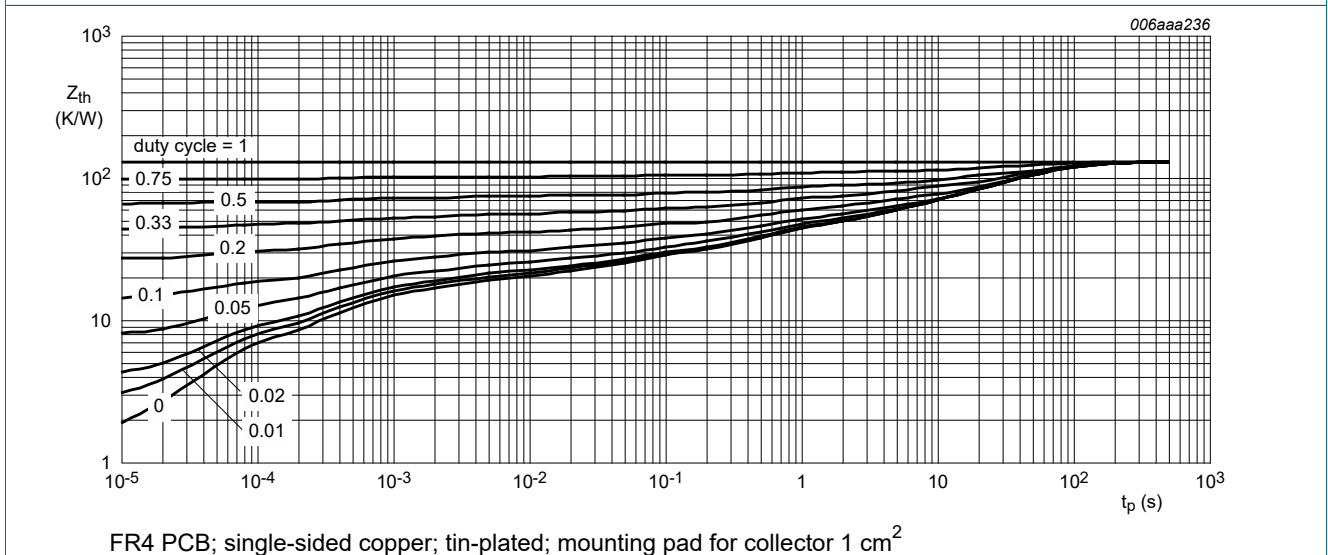
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

| 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] | -   | -   | 157 | K/W  |
|               |   |             | [3] | -   | -   | 114 | K/W  |

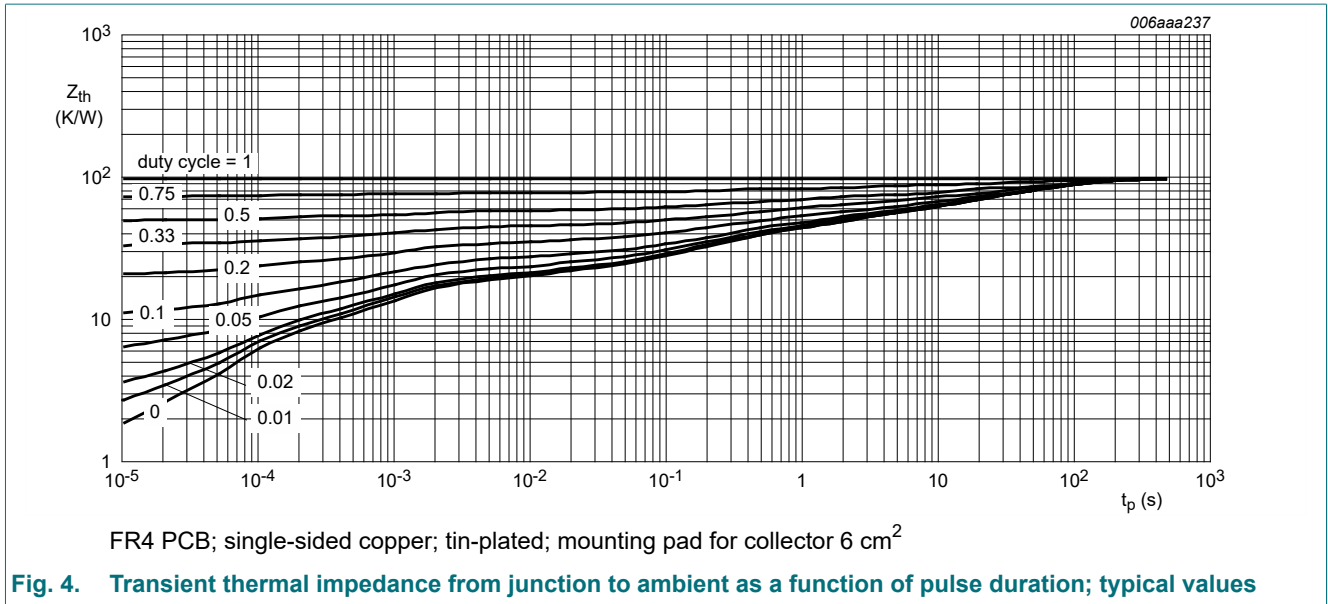
- [1] Device mounted on an FR4 PCB; single-sided copper; tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB; single-sided copper; tin-plated; mounting pad for collector  $1\text{ cm}^2$ .
- [3] Device mounted on an FR4 PCB; single-sided copper; tin-plated; mounting pad for collector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



**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**



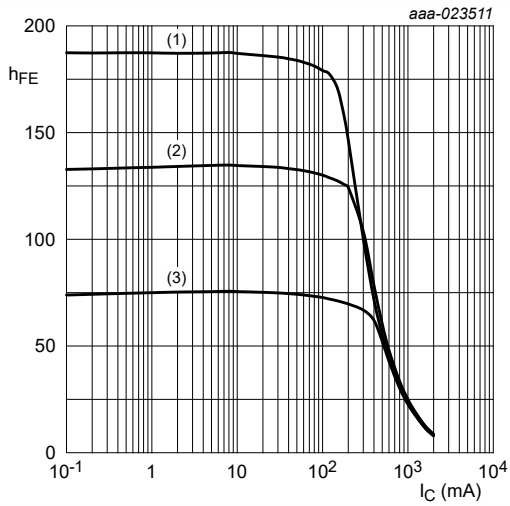
## 7. Characteristics

**Table 8. Characteristics**

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

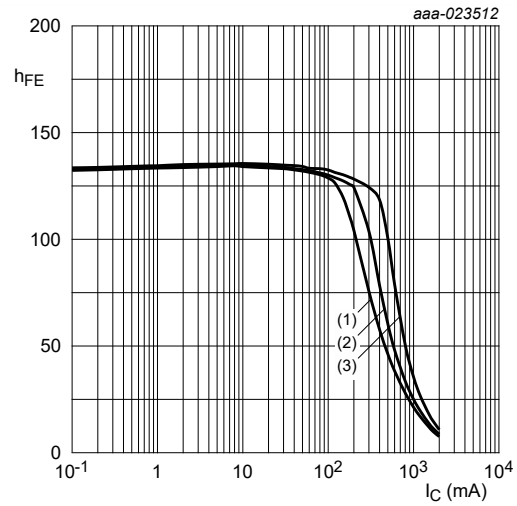
| Symbol        | Parameter                                  | Conditions  | Min | Typ | Max | Unit          |  |
|---------------|--|---|-----|-----|-----|---------------|--|
| $V_{(BR)CBO}$ | collector-base breakdown voltage           | $I_C = 100\text{ }\mu\text{A}; I_E = 0\text{ A}$                            | 45  | -   | -   | V             |  |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage        | $I_C = 2\text{ mA}; I_E = 0\text{ A}$                                       | 45  | -   | -   | V             |  |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage             | $I_E = 100\text{ }\mu\text{A}; I_C = 0\text{ A}$                            | 5   | -   | -   | V             |  |
| $I_{CBO}$     | collector-base cut-off current             | $V_{CB} = 30\text{ V}; I_E = 0\text{ A}$                                    | -   | -   | 100 | nA            |  |
|               |  | $V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_J = 150\text{ }^{\circ}\text{C}$ | -   | -   | 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                            |   |     |     |     |               |  |
|               | BCX54T, -10T, -16T                         | $V_{CE} = 2\text{ V}; I_C = 5\text{ mA}$                                    |     | 63  | -   | -             |  |
|               |  | $V_{CE} = 2\text{ V}; I_C = 500\text{ mA}$                                  | [1] | 40  | -   | -             |  |
|               | BCX54T                                     | $V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$                                  | [1] | 63  | -   | 250           |  |
|               | BCX54-10T                                  | $V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$                                  | [1] | 63  | -   | 160           |  |
| BCX54-16T     | $V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ | [1]   | 100 | -   | 250 |               |  |
| $V_{CEsat}$   | collector-emitter saturation voltage       | $I_C = 500\text{ mA}; I_B = 50\text{ mA}$                                   | [1] | -   | -   | 500 mV        |  |
| $V_{BE}$      | base-emitter voltage                       | $V_{CE} = 2\text{ V}; I_C = 500\text{ mA}$                                  | [1] | -   | -   | 1 V           |  |
| $f_T$         | transition frequency                       | $V_{CE} = 5\text{ V}; I_C = 50\text{ mA}; f = 100\text{ MHz}$               | -   | 155 | -   | MHz           |  |
| $C_c$         | collector capacitance                      | $V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$            | -   | 4.5 | -   | pF            |  |

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



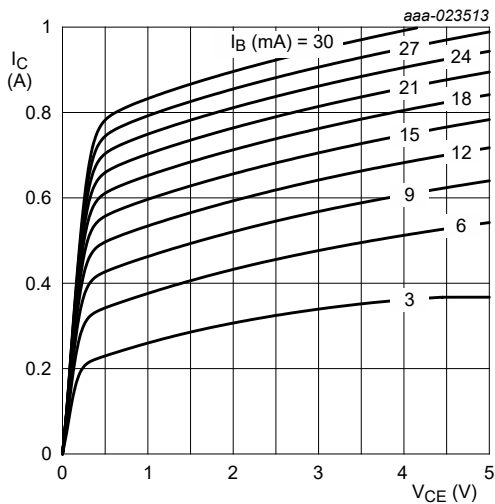
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



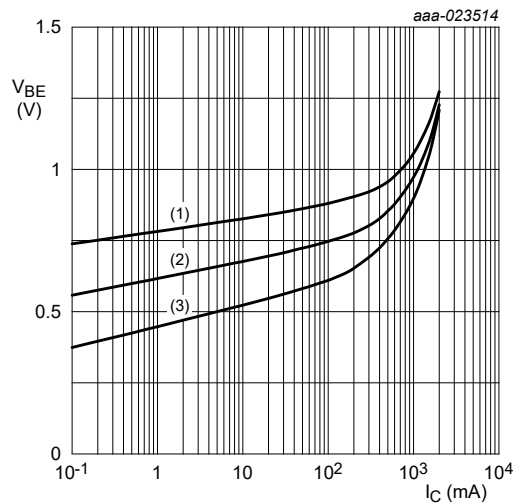
$T_{amb} = 25\text{ °C}$   
 (1)  $V_{CE} = 1\text{ V}$   
 (2)  $V_{CE} = 2\text{ V}$   
 (3)  $V_{CE} = 5\text{ V}$

**Fig. 6. DC current gain as a function of collector current; typical values**



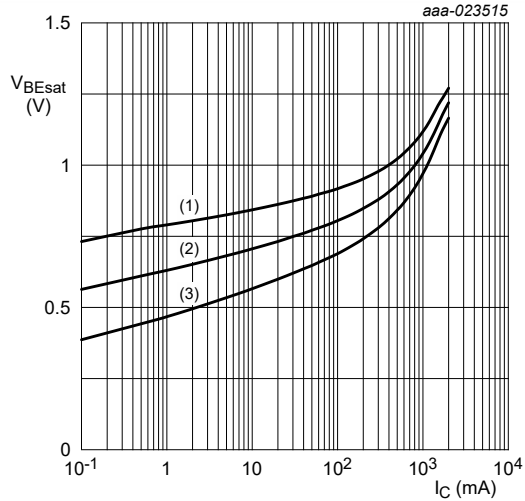
$T_{amb} = 25\text{ °C}$

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



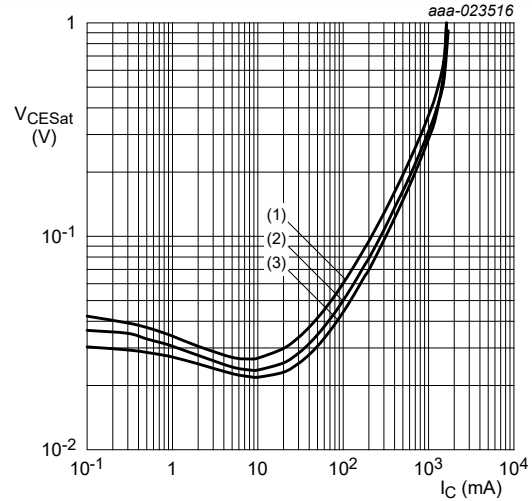
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



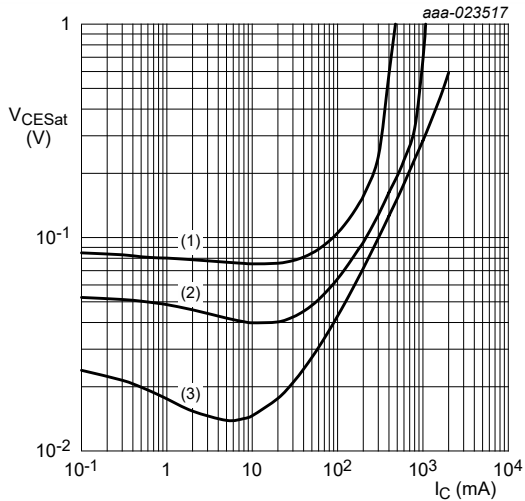
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

Fig. 9. Base-emitter saturation voltage as a function of collector current; typical values



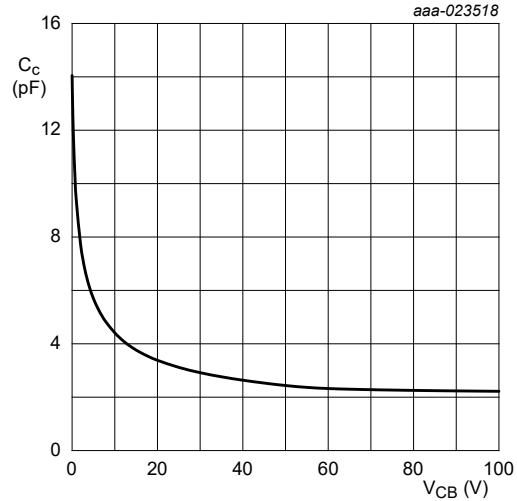
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values



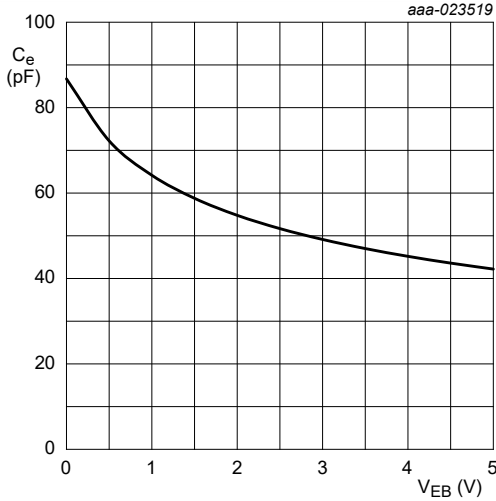
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 50$   
 (2)  $I_C/I_B = 20$   
 (3)  $I_C/I_B = 5$

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



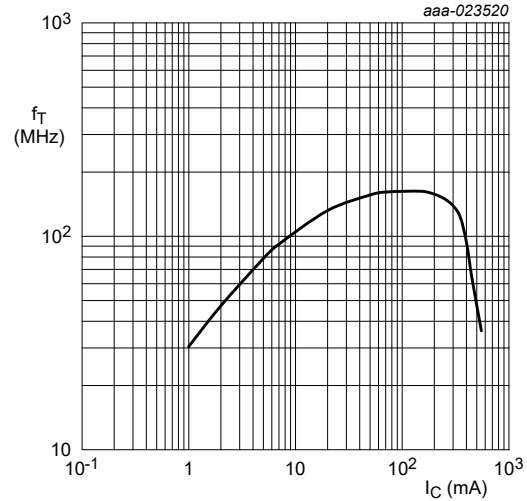
$f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$

Fig. 12. Collector capacitance as a function of collector-base voltage; typical values



$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

Fig. 13. Emitter capacitance as a function of emitter-base voltage; typical values



$V_{CE} = 5 \text{ V}$

$f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

Fig. 14. Transition frequency as a function of collector current; typical values

## 8. Test information

### 8.1. 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.

## 9. Package outline

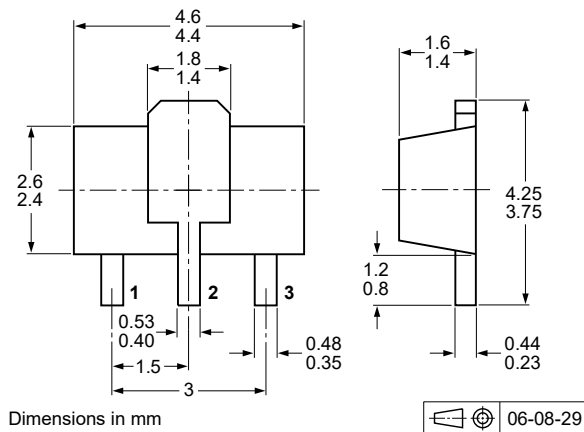


Fig. 15. Package outline SOT89 (SC-62)



10. Soldering

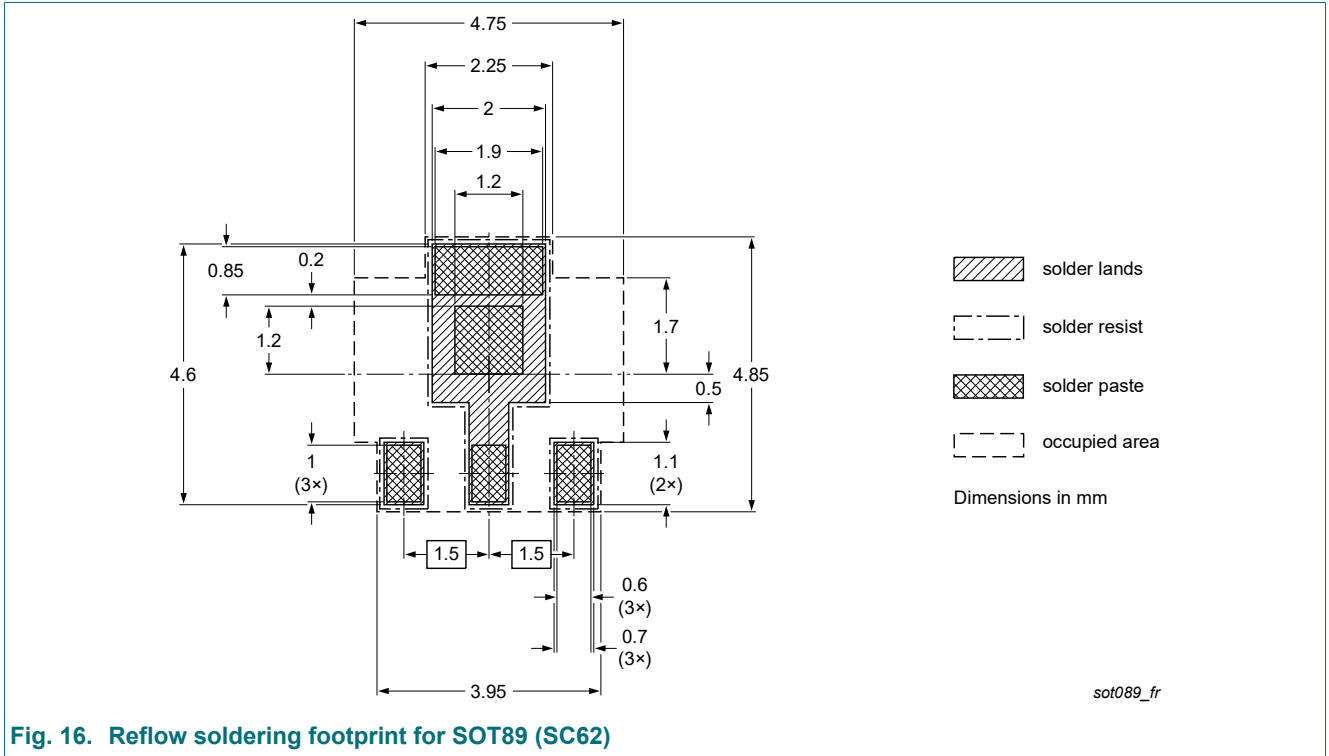


Fig. 16. Reflow soldering footprint for SOT89 (SC62)

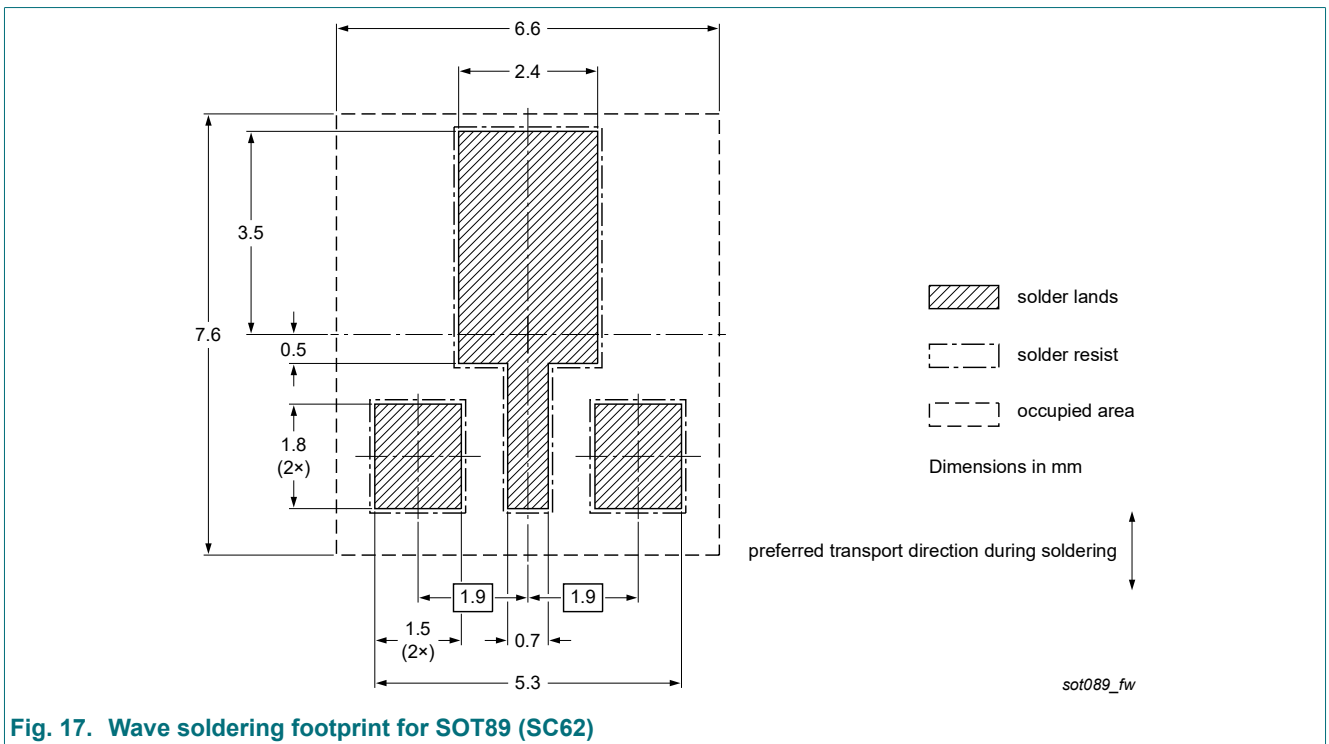


Fig. 17. Wave soldering footprint for SOT89 (SC62)

## 11. Revision history

**Table 9. Revision history**

| Document ID    | Release date | Data sheet status  | Change notice | Supersedes |
|----------------|--------------|--------------------|---------------|------------|
| BCX54T_SER v.1 | 20190822     | Product data sheet | -             | -          |

## 12. 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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Date of release: 22 August 2019