



# BCP56T-Q series

80 V, 1 A NPN medium power transistors

Rev. 2 — 29 June 2022

Product data sheet

## 1. General description

NPN medium power transistors in a medium power SOT223 (SC-73) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

| Type number | Package  |       | NPN complement |
|-------------|----------|-------|----------------|
|             | Nexperia | JEDEC |                |
| BCP56T-Q    | SOT223   | SC-73 | BCP53T-Q       |
| BCP56-10T-Q |          |       | BCP53-10T-Q    |
| BCP56-16T-Q |          |       | BCP53-16T-Q    |

## 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
- High-side switches
- Power management
- Amplifiers

## 4. Quick reference data

Table 2. Quick reference data

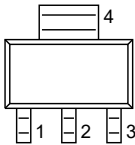
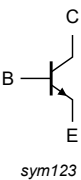
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

| Symbol    | Parameter                 | Conditions                                 |     | Min | Typ | Max | Unit |
|-----------|---------------------------|--------------------------------------------|-----|-----|-----|-----|------|
| $V_{CEO}$ | collector-emitter voltage | open base                                  |     | -   | -   | 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           |                                            |     |     |     |     |      |
|           | BCP56T-Q                  | $V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ | [1] | 63  | -   | 250 |      |
|           | BCP56-10T-Q               |                                            | [1] | 63  | -   | 160 |      |
|           | BCP56-16T-Q               |                                            | [1] | 100 | -   | 250 |      |

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

## 5. Pinning information

Table 3. Pinning

| Pin | Symbol | Description | Simplified outline                                                                 | Graphic symbol                                                                      |
|-----|--------|-------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | B      | base        |  |  |
| 2   | C      | collector   |                                                                                    |                                                                                     |
| 3   | E      | emitter     |                                                                                    |                                                                                     |
| 4   | C      | collector   |                                                                                    |                                                                                     |

## 6. Ordering information

Table 4. Ordering information

| Type number | Package |                                                                      |         |
|-------------|---------|----------------------------------------------------------------------|---------|
|             | Name    | Description                                                          | Version |
| BCP56T-Q    | SC-73   | plastic, surface-mounted package with increased heatsink;<br>4 leads | SOT223  |
| BCP56-10T-Q |         |                                                                      |         |
| BCP56-16T-Q |         |                                                                      |         |

## 7. Marking

Table 5. Marking

| Type number | Marking code |
|-------------|--------------|
| BCP56T-Q    | BCP56T       |
| BCP56-10T-Q | P5610T       |
| BCP56-16T-Q | P5616T       |

8. Limiting values

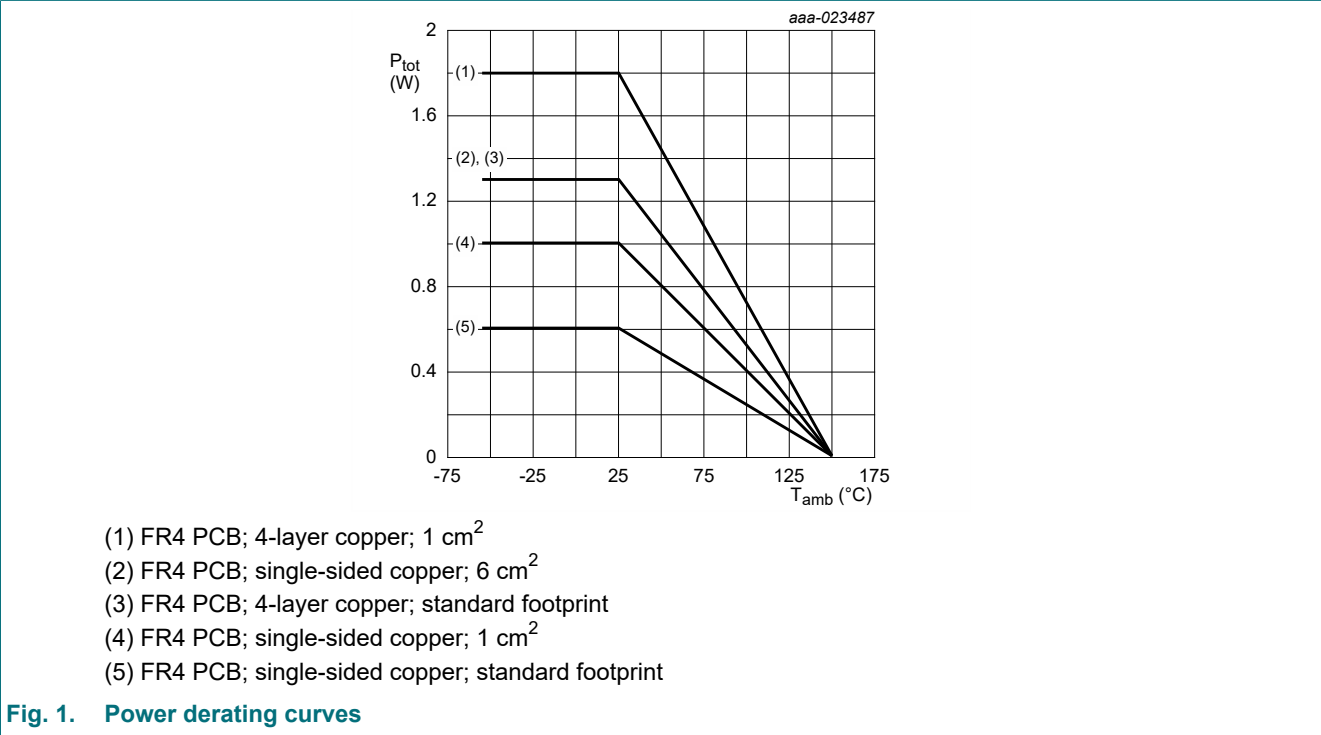
Table 6. Limiting values

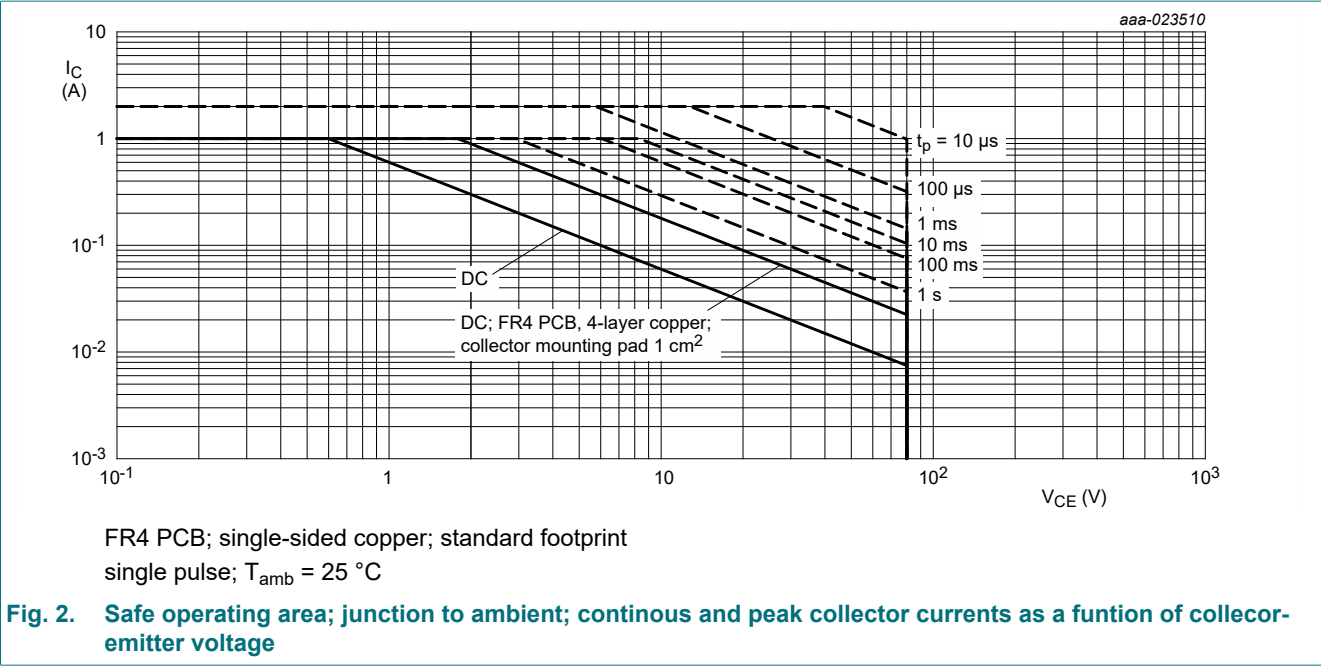
In accordance with the Absolute Maximum Rating System (IEC 60134).

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

| Symbol    | Parameter                 | Conditions                           | Min | Max | Unit |
|-----------|---------------------------|--------------------------------------|-----|-----|------|
| $V_{CBO}$ | collector-base voltage    | open emitter                         | -   | 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              |                                      | -   | 0.2 | 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]      | -   | 0.6 | W    |
|           |                           | [2]                                  | -   | 1   | W    |
|           |                           | [3]                                  | -   | 1.3 | W    |
|           |                           | [4]                                  | -   | 1.3 | W    |
|           |                           | [5]                                  | -   | 1.8 | 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>.
- [4] Device mounted on an FR4 Printed-Circuit-Board (PCB); 4-layer copper; tin-plated and standard footprint.
- [5] Device mounted on an FR4 Printed-Circuit-Board (PCB); 4-layer copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>.





9. Thermal characteristics

Table 7. 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] | -   | -   | 209 | K/W  |
|               |                                                  |             | [2] |     |     | 125 | K/W  |
|               |                                                  |             | [3] |     |     | 97  | K/W  |
|               |                                                  |             | [4] | -   | -   | 97  | K/W  |
|               |                                                  |             | [5] | -   | -   | 70  | K/W  |
| $R_{(j-sp)}$  | thermal resistance from junction to solder point |             |     | -   | -   | 18  | K/W  |

- [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>.  
[4] Device mounted on an FR4 Printed-Circuit-Board (PCB); 4-layer copper; tin-plated and standard footprint.  
[5] Device mounted on an FR4 Printed-Circuit-Board (PCB); 4-layer copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>.

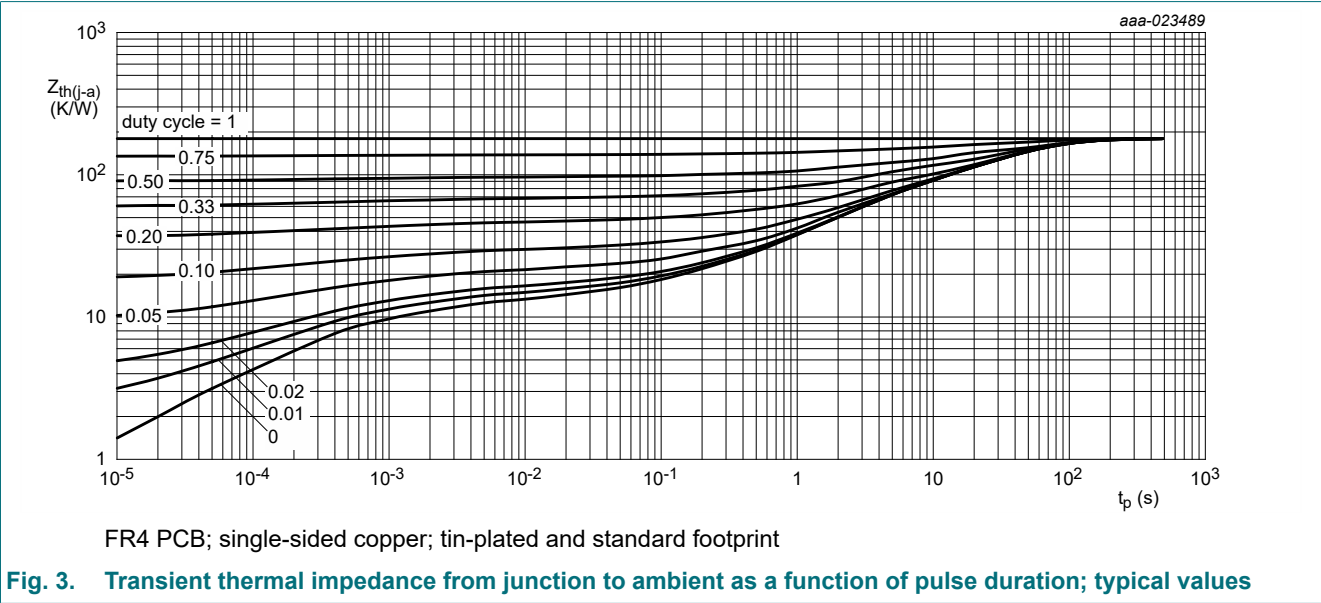
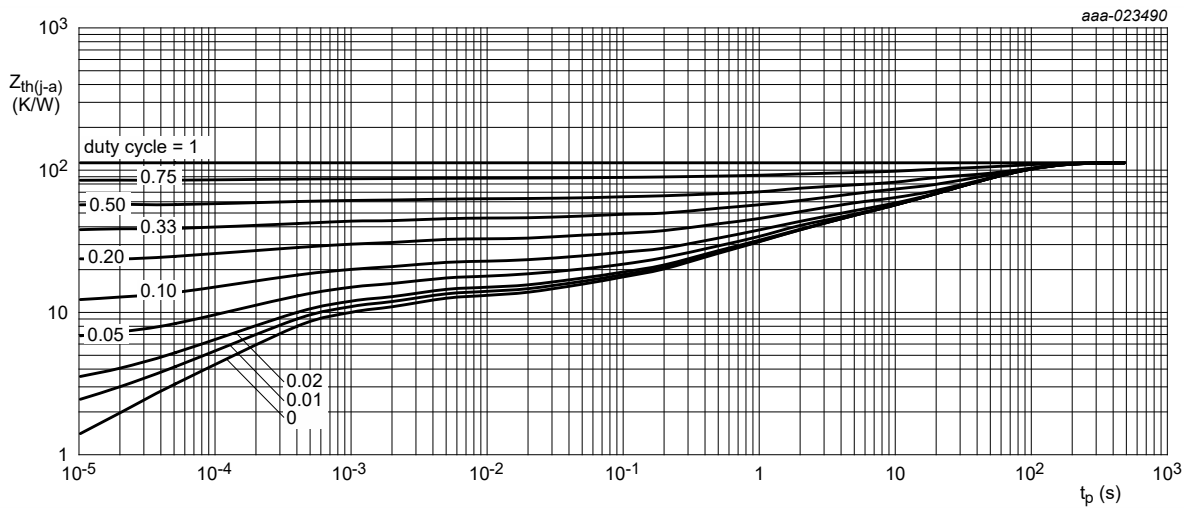
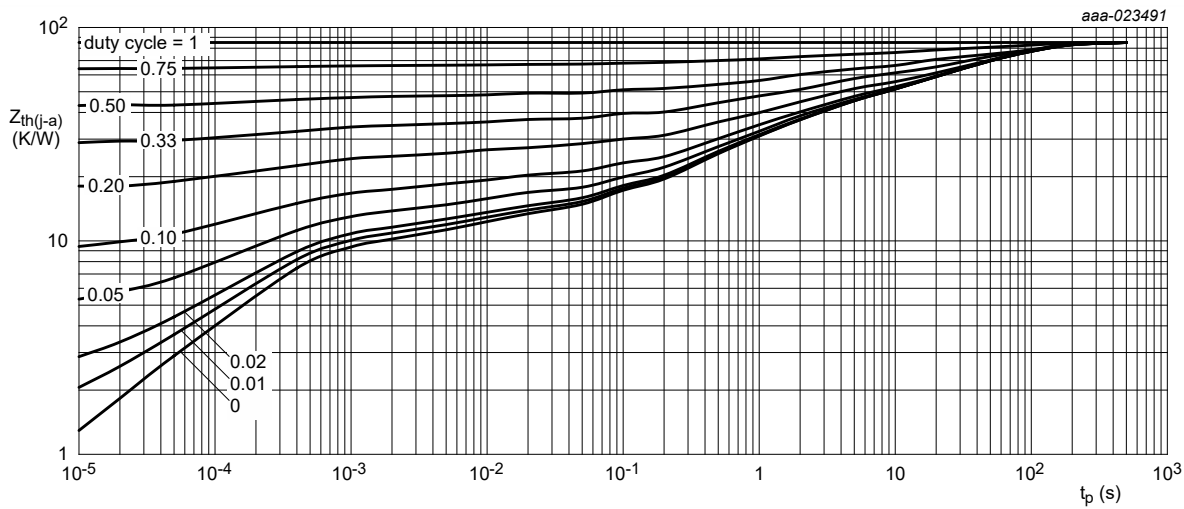


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



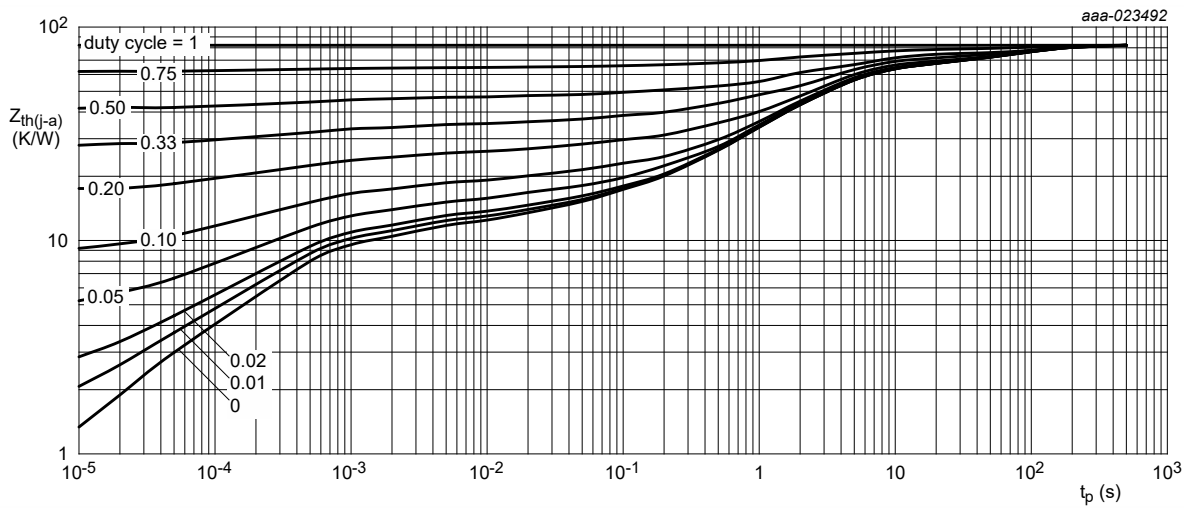
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>

Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



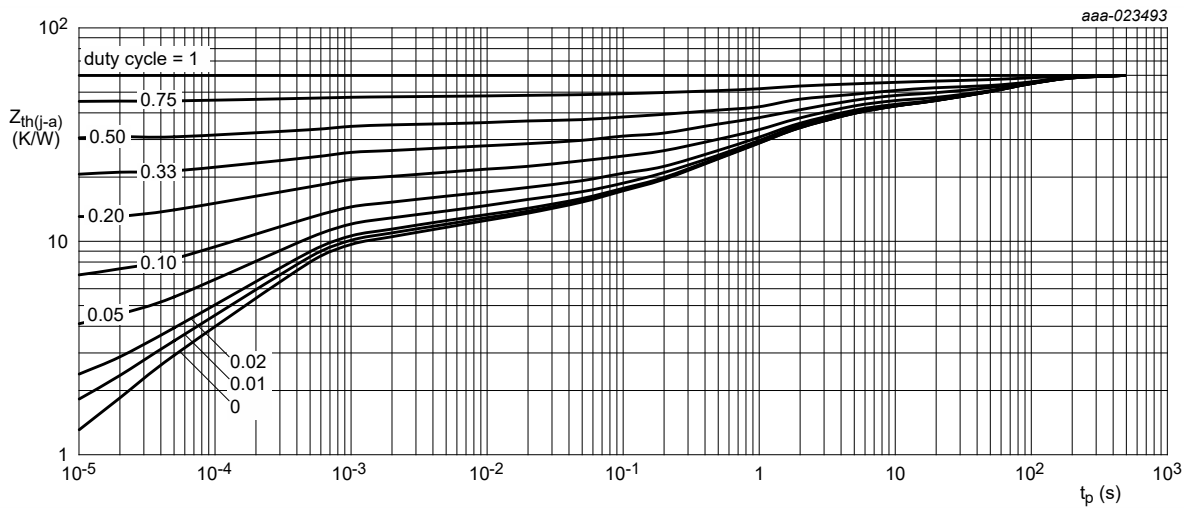
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 6 cm<sup>2</sup>

Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB; 4-layer copper; tin-plated and standard footprint

Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB; 4-layer copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>

Fig. 7. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

**Table 8. Characteristics**

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

| Symbol        | Parameter                            | Conditions                                                             |     | Min | Typ | Max | Unit          |
|---------------|--------------------------------------|------------------------------------------------------------------------|-----|-----|-----|-----|---------------|
| $V_{(BR)CBO}$ | collector-base breakdown voltage     | $I_C = 100\text{ }\mu\text{A}$ ; $I_E = 0\text{ A}$                    |     | 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       | $I_E = 100\text{ }\mu\text{A}$ ; $I_C = 0\text{ A}$                    |     | 5   | -   | -   | V             |
| $I_{CBO}$     | collector-base cut-off current       | $V_{CB} = 30\text{ V}$ ; $I_E = 0\text{ A}$                            |     | -   | -   | 100 | nA            |
|               |                                      | $V_{CB} = 30\text{ V}$ ; $I_E = 0\text{ A}$ ; $T_J = 150\text{ °C}$    |     | -   | -   | 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                      |                                                                        |     |     |     |     |               |
|               | BCP56T-Q                             | $V_{CE} = 2\text{ V}$ ; $I_C = 5\text{ mA}$                            | [1] | 63  | -   | -   |               |
|               |                                      | $V_{CE} = 2\text{ V}$ ; $I_C = 150\text{ mA}$                          | [1] | 63  | -   | 250 |               |
|               |                                      | $V_{CE} = 2\text{ V}$ ; $I_C = 500\text{ mA}$                          | [1] | 40  | -   | -   |               |
|               | BCP56-10T-Q                          | $V_{CE} = 2\text{ V}$ ; $I_C = 5\text{ mA}$                            | [1] | 63  | -   | -   |               |
|               |                                      | $V_{CE} = 2\text{ V}$ ; $I_C = 150\text{ mA}$                          | [1] | 63  | -   | 160 |               |
|               |                                      | $V_{CE} = 2\text{ V}$ ; $I_C = 500\text{ mA}$                          | [1] | 40  | -   | -   |               |
|               | BCP56-16T-Q                          | $V_{CE} = 2\text{ V}$ ; $I_C = 5\text{ mA}$                            | [1] | 63  | -   | -   |               |
|               |                                      | $V_{CE} = 2\text{ V}$ ; $I_C = 150\text{ mA}$                          | [1] | 100 | -   | 250 |               |
|               |                                      | $V_{CE} = 2\text{ V}$ ; $I_C = 500\text{ mA}$                          | [1] | 40  | -   | -   |               |
| $V_{CEsat}$   | 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             |
| $C_c$         | collector capacitance                | $V_{CB} = 10\text{ V}$ ; $I_E = i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$ |     | -   | 4.5 | -   | pF            |
| $f_T$         | transition frequency                 | $V_{CE} = 5\text{ V}$ ; $I_C = 50\text{ mA}$ ; $f = 100\text{ MHz}$    |     | 100 | 155 | -   | MHz           |

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

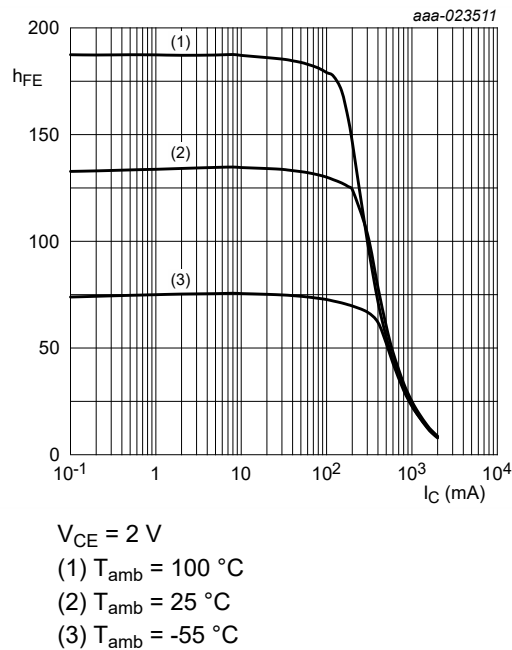


Fig. 8. DC current gain as a function of collector current; typical values

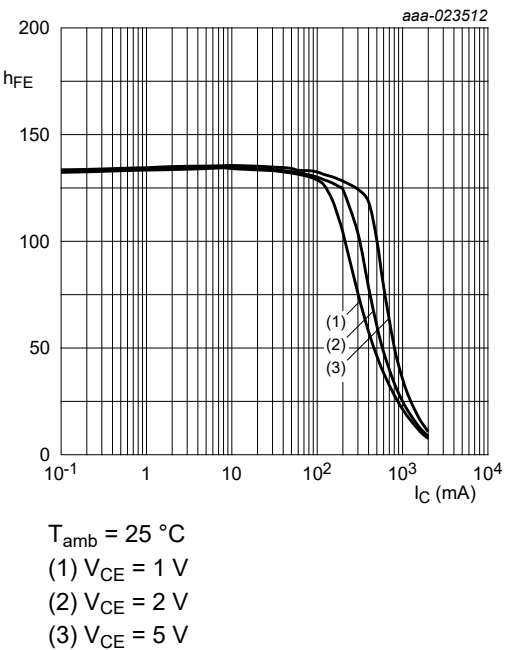


Fig. 9. DC current gain as a function of collector current; typical values

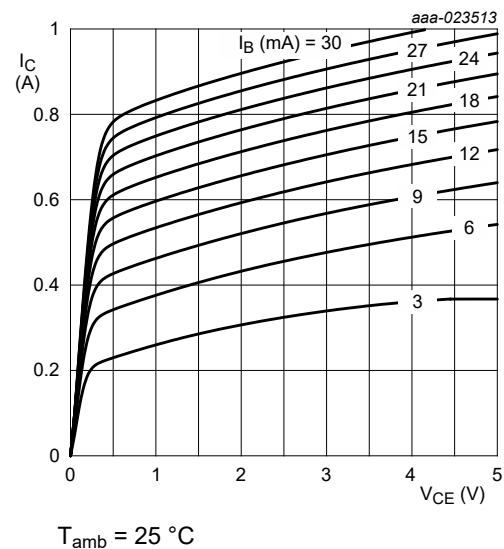


Fig. 10. Collector current as a function of collector-emitter voltage; typical values

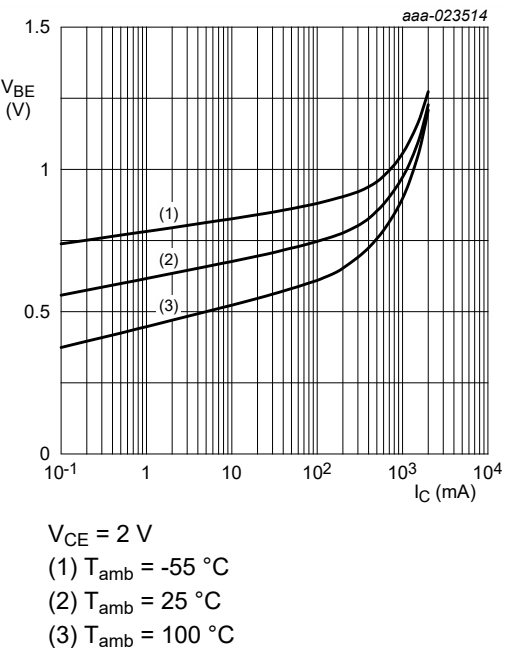


Fig. 11. Base-emitter voltage as a function of collector current; typical values

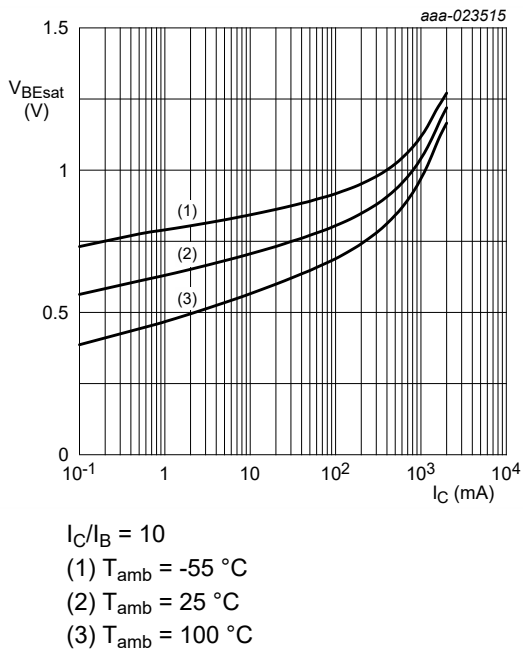


Fig. 12. Base-emitter saturation voltage as a function of collector current; typical values

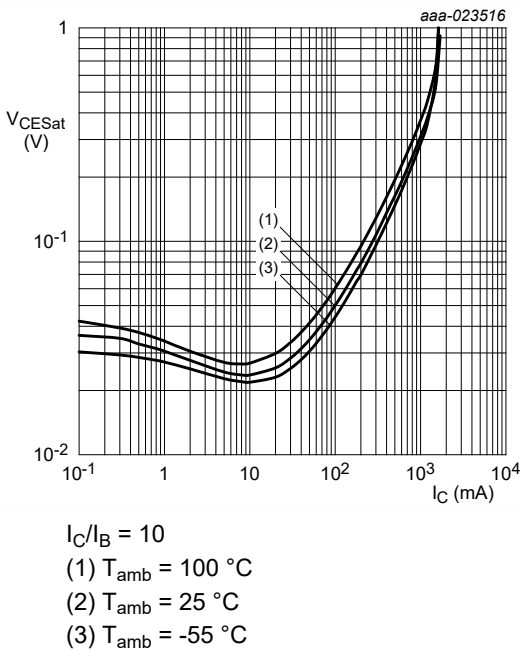


Fig. 13. Collector-emitter saturation voltage as a function of collector current; typical values

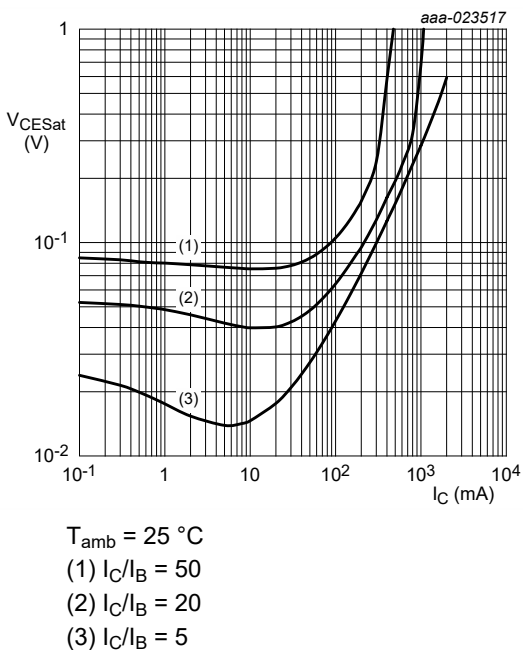


Fig. 14. Collector-emitter saturation voltage as a function of collector current; typical values

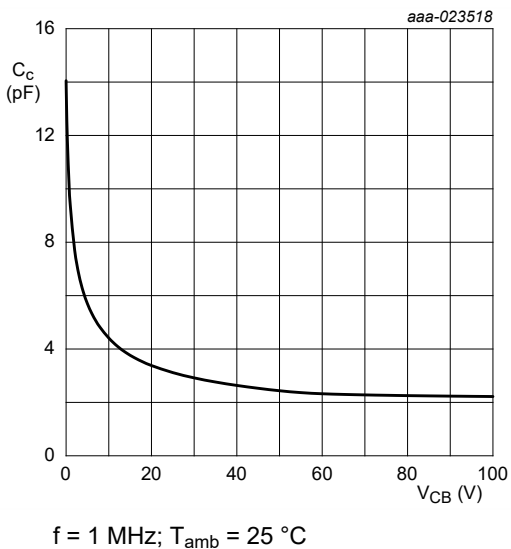


Fig. 15. Collector capacitance as a function of collector-base voltage; typical values

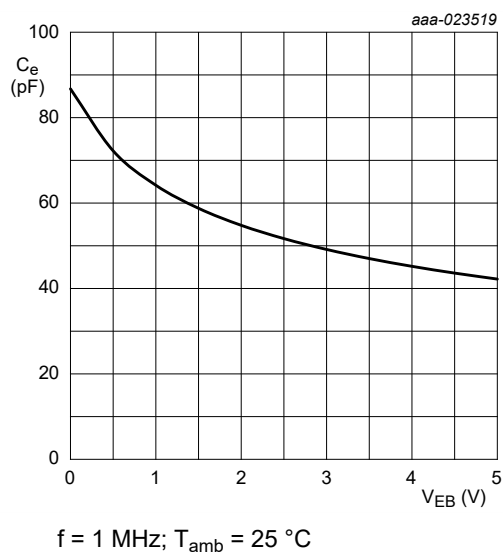


Fig. 16. Emitter capacitance as a function of emitter-base voltage; typical values

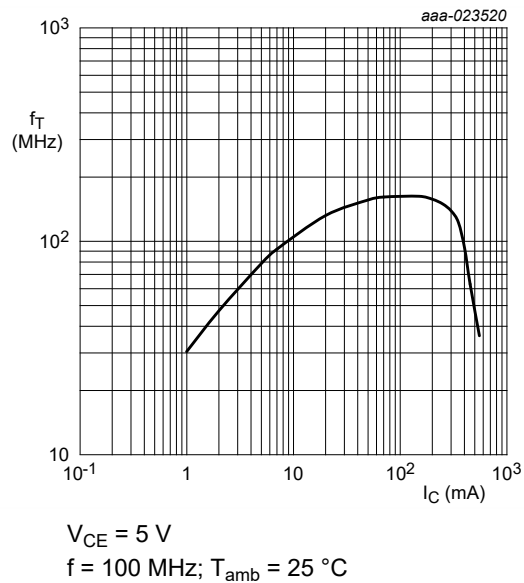


Fig. 17. Transition frequency as a function of collector current; typical values

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

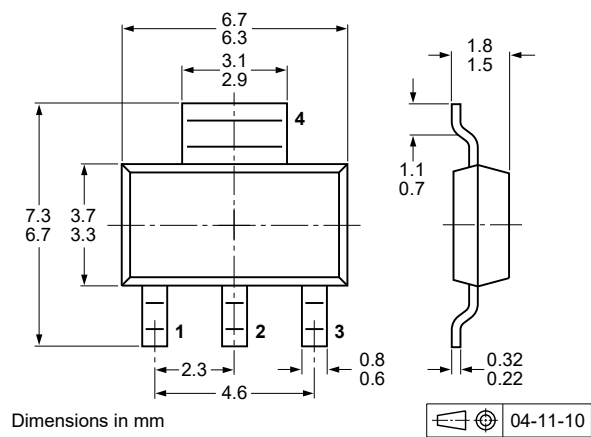


Fig. 18. Package outline SOT223 (SC-73)

13. Soldering

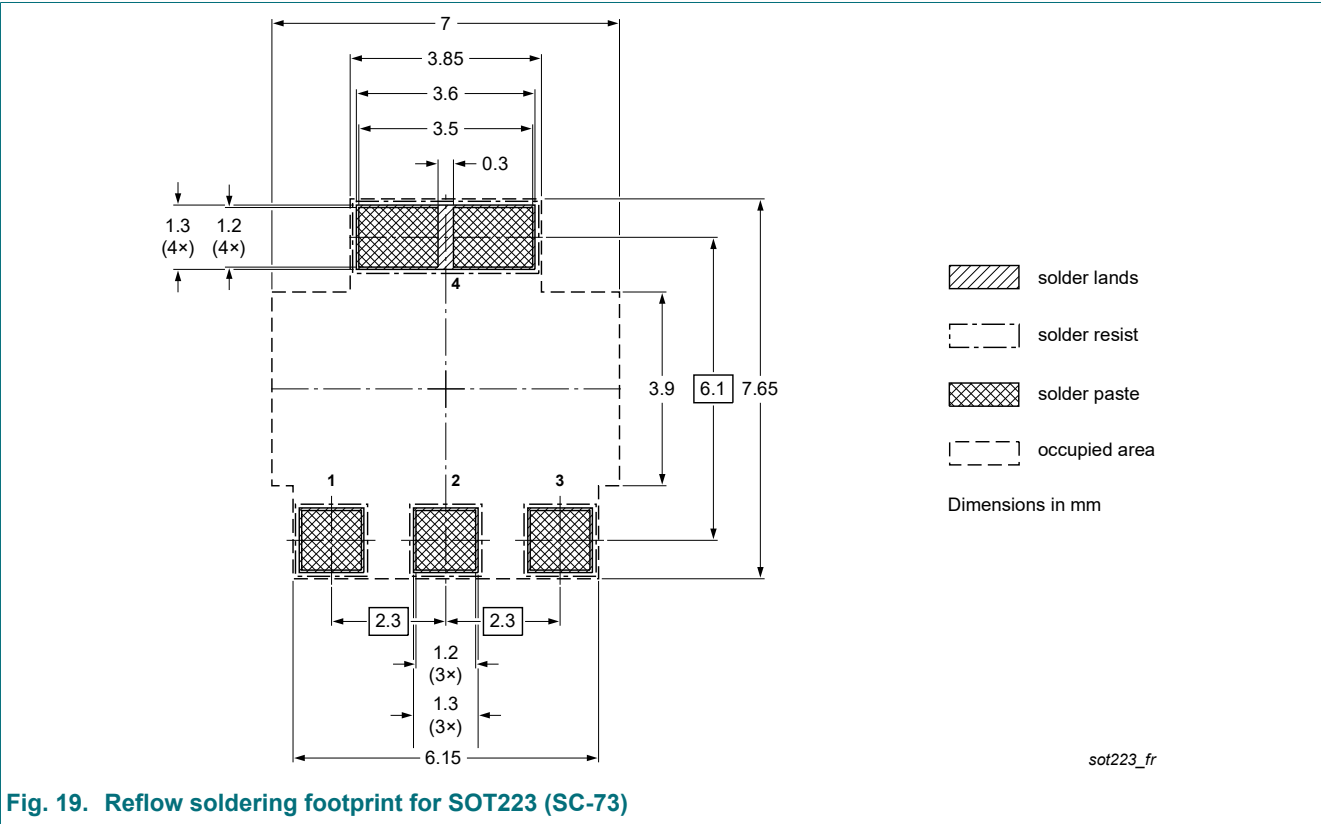


Fig. 19. Reflow soldering footprint for SOT223 (SC-73)

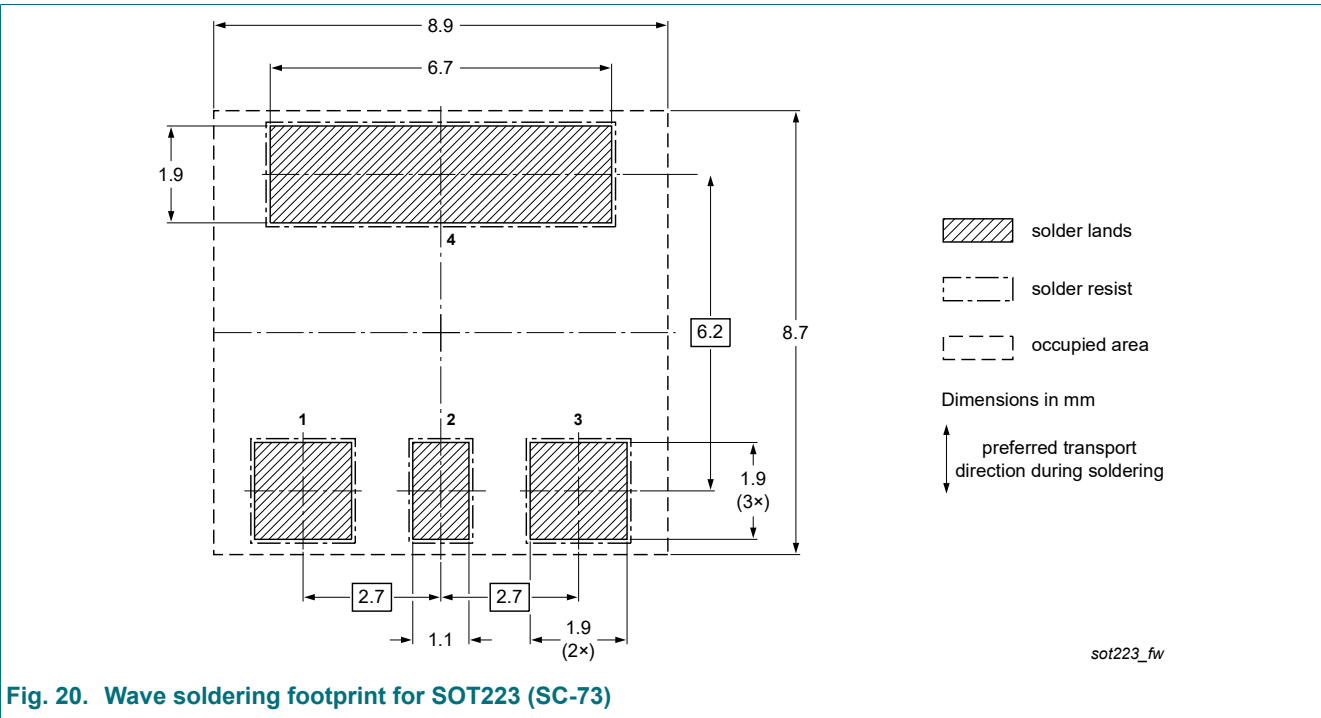


Fig. 20. Wave soldering footprint for SOT223 (SC-73)

## 14. Revision history

**Table 9. Revision history**

| Document ID      | Release date                                              | Data sheet status  | Change notice | Supersedes       |
|------------------|-----------------------------------------------------------|--------------------|---------------|------------------|
| BCP56T-Q_SER v.1 | 20220629                                                  | Product data sheet | -             | BCP56T-Q_SER v.1 |
| Modifications:   | • Characteristics at $V_{(BR)CEO}$ : Conditions corrected |                    |               |                  |
| BCP56T-Q_SER v.1 | 20210623                                                  | Product data sheet | -             | -                |

## 15. Legal information

### Data sheet status

| Document status<br>[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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