

# BCP55; BCX55; BC55PA

60 V, 1 A NPN medium power transistors

Rev. 8 — 24 October 2011

Product data sheet

## 1. Product profile

### 1.1 General description

NPN medium power transistor series in Surface-Mounted Device (SMD) plastic packages.

Table 1. Product overview

| Type number <sup>[1]</sup> | Package |       |        | PNP complement |
|----------------------------|---------|-------|--------|----------------|
|                            | NXP     | JEITA | JEDEC  |                |
| BCP55                      | SOT223  | SC-73 | -      | BCP52          |
| BCX55                      | SOT89   | SC-62 | TO-243 | BCX52          |
| BC55PA                     | SOT1061 | -     | -      | BC52PA         |

[1] Valid for all available selection groups.

### 1.2 Features and benefits

- High current
- Three current gain selections
- High power dissipation capability
- Exposed heatsink for excellent thermal and electrical conductivity (SOT89, SOT1061)
- Leadless very small SMD plastic package with medium power capability (SOT1061)
- AEC-Q101 qualified

### 1.3 Applications

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

### 1.4 Quick reference data

Table 2. Quick reference data

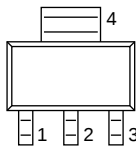
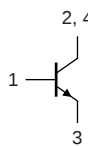
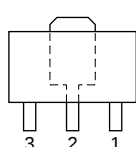
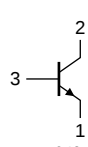
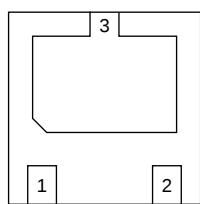
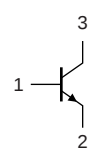
| Symbol    | Parameter                 | Conditions                                    | Min | Typ | Max | Unit |
|-----------|---------------------------|-----------------------------------------------|-----|-----|-----|------|
| $V_{CE0}$ | collector-emitter voltage | open base                                     | -   | -   | 60  | V    |
| $I_C$     | collector current         |                                               | -   | -   | 1   | A    |
| $I_{CM}$  | peak collector current    | single pulse; $t_p \leq 1$ ms                 | -   | -   | 2   | A    |
| $h_{FE}$  | DC current gain           | $V_{CE} = 2$ V; $I_C = 150$ mA <sup>[1]</sup> | 63  | -   | 250 |      |
|           | $h_{FE}$ selection -10    | $V_{CE} = 2$ V; $I_C = 150$ mA <sup>[1]</sup> | 63  | -   | 160 |      |
|           | $h_{FE}$ selection -16    | $V_{CE} = 2$ V; $I_C = 150$ mA <sup>[1]</sup> | 100 | -   | 250 |      |

[1] Pulse test:  $t_p \leq 300$   $\mu$ s;  $\delta = 0.02$ .



## 2. Pinning information

**Table 3. Pinning**

| Pin                            | Description | Simplified outline                                                                   | Graphic symbol                                                                        |
|--------------------------------|-------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>SOT223</b>                  |             |                                                                                      |                                                                                       |
| 1                              | base        |   |    |
| 2                              | collector   |                                                                                      |                                                                                       |
| 3                              | emitter     |                                                                                      |                                                                                       |
| 4                              | collector   |                                                                                      |                                                                                       |
| sym016                         |             |                                                                                      |                                                                                       |
| <b>SOT89</b>                   |             |                                                                                      |                                                                                       |
| 1                              | emitter     |   |    |
| 2                              | collector   |                                                                                      |                                                                                       |
| 3                              | base        |                                                                                      |                                                                                       |
| sym042                         |             |                                                                                      |                                                                                       |
| <b>SOT1061</b>                 |             |                                                                                      |                                                                                       |
| 1                              | base        |  |  |
| 2                              | emitter     |                                                                                      |                                                                                       |
| 3                              | collector   |                                                                                      |                                                                                       |
| Transparent top view<br>sym021 |             |                                                                                      |                                                                                       |

## 3. Ordering information

**Table 4. Ordering information**

| Type number <sup>[1]</sup> | Package |                                                                                                        |         |
|----------------------------|---------|--------------------------------------------------------------------------------------------------------|---------|
|                            | Name    | Description                                                                                            | Version |
| BCP55                      | SC-73   | plastic surface-mounted package with increased heatsink; 4 leads                                       | SOT223  |
| BCX55                      | SC-62   | plastic surface-mounted package; exposed die pad for good heat transfer; 3 leads                       | SOT89   |
| BC55PA                     | HUSON3  | plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 × 2 × 0.65 mm | SOT1061 |

[1] Valid for all available selection groups.

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code |
|-------------|--------------|
| BCP55       | BCP55        |
| BCP55-10    | BCP55/10     |
| BCP55-16    | BCP55/16     |
| BCX55       | BE           |
| BCX55-10    | BG           |
| BCX55-16    | BM           |
| BC55PA      | AW           |
| BC55-10PA   | BH           |
| BC55-16PA   | BJ           |

## 5. Limiting values

**Table 6. Limiting values**

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

| Symbol           | Parameter                 | Conditions                             | Min                  | Max   | Unit |      |    |
|------------------|---------------------------|----------------------------------------|----------------------|-------|------|------|----|
| V <sub>CBO</sub> | collector-base voltage    | open emitter                           | -                    | 60    | V    |      |    |
| V <sub>CEO</sub> | collector-emitter voltage | open base                              | -                    | 60    | V    |      |    |
| V <sub>EBO</sub> | emitter-base voltage      | open collector                         | -                    | 5     | V    |      |    |
| I <sub>C</sub>   | collector current         |                                        | -                    | 1     | A    |      |    |
| I <sub>CM</sub>  | peak collector current    | single pulse;<br>t <sub>p</sub> ≤ 1 ms | -                    | 2     | A    |      |    |
| I <sub>B</sub>   | base current              |                                        | -                    | 0.3   | A    |      |    |
| I <sub>BM</sub>  | peak base current         | single pulse;<br>t <sub>p</sub> ≤ 1 ms | -                    | 0.3   | A    |      |    |
| P <sub>tot</sub> | total power dissipation   | T <sub>amb</sub> ≤ 25 °C               |                      |       |      |      |    |
|                  |                           |                                        | BCP55                | [1] - | 0.65 | W    |    |
|                  |                           |                                        |                      | [2] - | 1.00 | W    |    |
|                  | [3] -                     |                                        |                      | 1.35  | W    |      |    |
|                  | BCX55                     |                                        | [1] -                | 0.50  | W    |      |    |
|                  |                           |                                        | [2] -                | 0.95  | W    |      |    |
|                  |                           |                                        | [3] -                | 1.35  | W    |      |    |
|                  | BC55PA                    |                                        | [1] -                | 0.42  | W    |      |    |
|                  |                           |                                        | [2] -                | 0.83  | W    |      |    |
|                  |                           |                                        | [3] -                | 1.10  | W    |      |    |
|                  |                           |                                        | [4] -                | 0.81  | W    |      |    |
|                  |                           |                                        | [5] -                | 1.65  | W    |      |    |
|                  | T <sub>j</sub>            |                                        | junction temperature |       | -    | 150  | °C |
|                  | T <sub>amb</sub>          |                                        | ambient temperature  |       | -55  | +150 | °C |
| T <sub>stg</sub> | storage temperature       |                                        | -65                  | +150  | °C   |      |    |

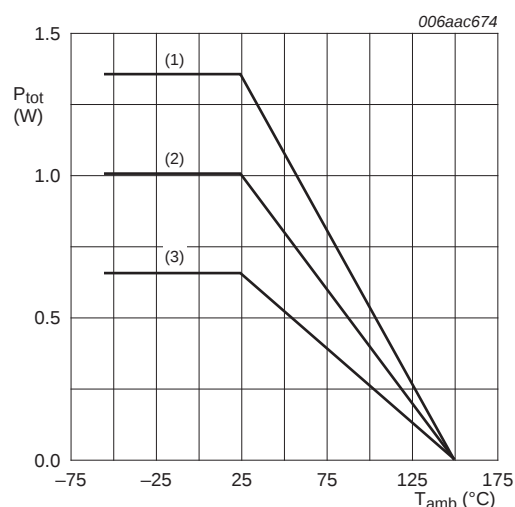
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.

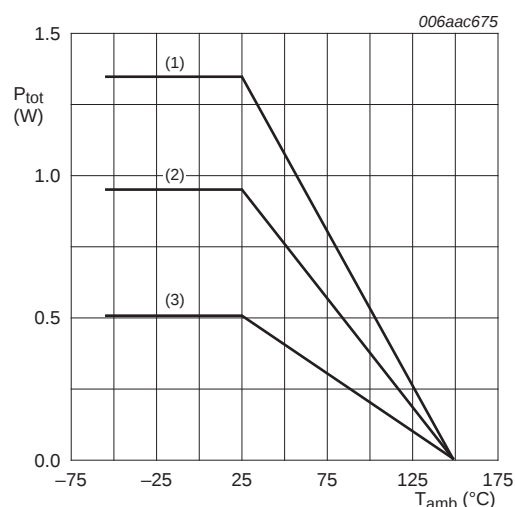
[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



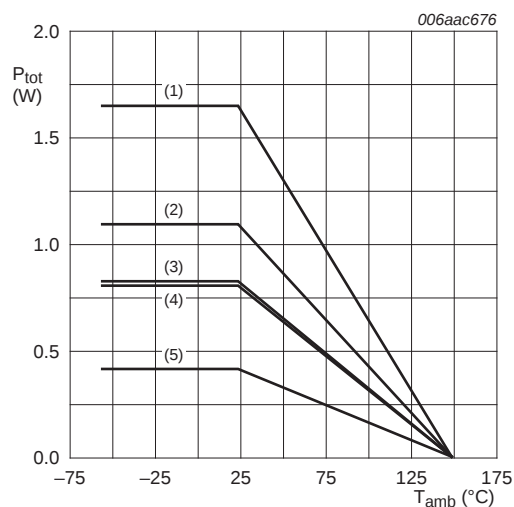
- (1) FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>
- (2) FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>
- (3) FR4 PCB, standard footprint

**Fig 1. Power derating curves SOT223**



- (1) FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>
- (2) FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>
- (3) FR4 PCB, standard footprint

**Fig 2. Power derating curves SOT89**



- (1) FR4 PCB, 4-layer copper, mounting pad for collector 1 cm<sup>2</sup>
- (2) FR4 PCB, single-sided copper, mounting pad for collector 6 cm<sup>2</sup>
- (3) FR4 PCB, single-sided copper, mounting pad for collector 1 cm<sup>2</sup>
- (4) FR4 PCB, 4-layer copper, standard footprint
- (5) FR4 PCB, single-sided copper, standard footprint

**Fig 3. Power derating curves SOT1061**

## 6. Thermal characteristics

**Table 7. Thermal characteristics**

| Symbol         | Parameter                                        | Conditions  | Min | Typ | Max | Unit    |
|----------------|--------------------------------------------------|-------------|-----|-----|-----|---------|
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air |     |     |     |         |
|                |                                                  |             | [1] | -   | -   | 192 K/W |
|                |                                                  |             | [2] | -   | -   | 125 K/W |
|                |                                                  |             | [3] | -   | -   | 93 K/W  |
|                |                                                  |             | [1] | -   | -   | 250 K/W |
|                |                                                  |             | [2] | -   | -   | 132 K/W |
|                |                                                  |             | [3] | -   | -   | 93 K/W  |
|                |                                                  |             | [1] | -   | -   | 298 K/W |
|                |                                                  |             | [2] | -   | -   | 151 K/W |
|                |                                                  |             | [3] | -   | -   | 114 K/W |
|                |                                                  |             | [4] | -   | -   | 154 K/W |
|                |                                                  |             | [5] | -   | -   | 76 K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             |     |     |     |         |
|                |                                                  | BCP55       | -   | -   | 16  | K/W     |
|                |                                                  | BCX55       | -   | -   | 16  | K/W     |
|                |                                                  | BC55PA      | -   | -   | 20  | K/W     |

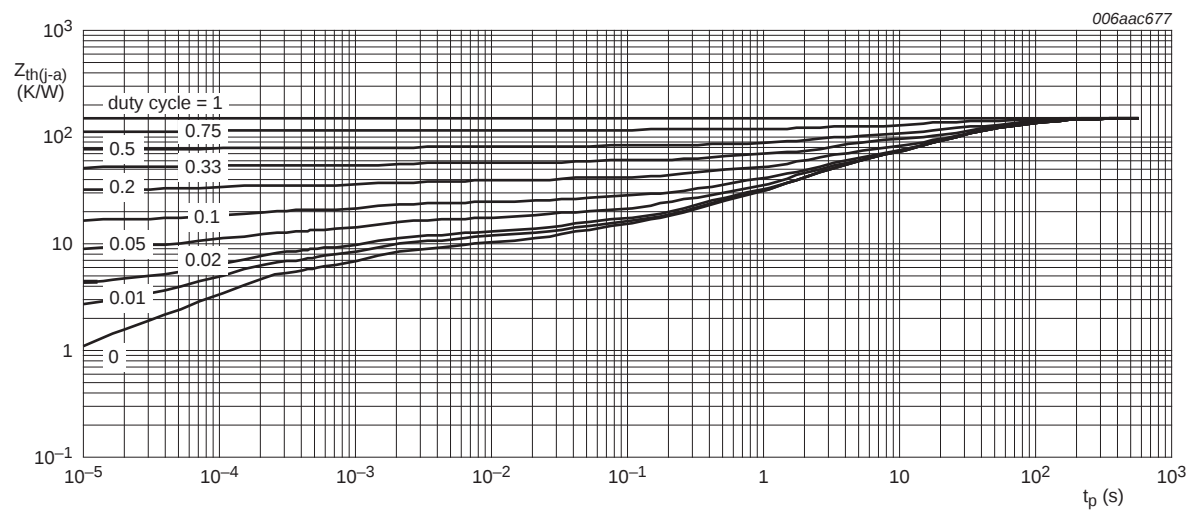
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.

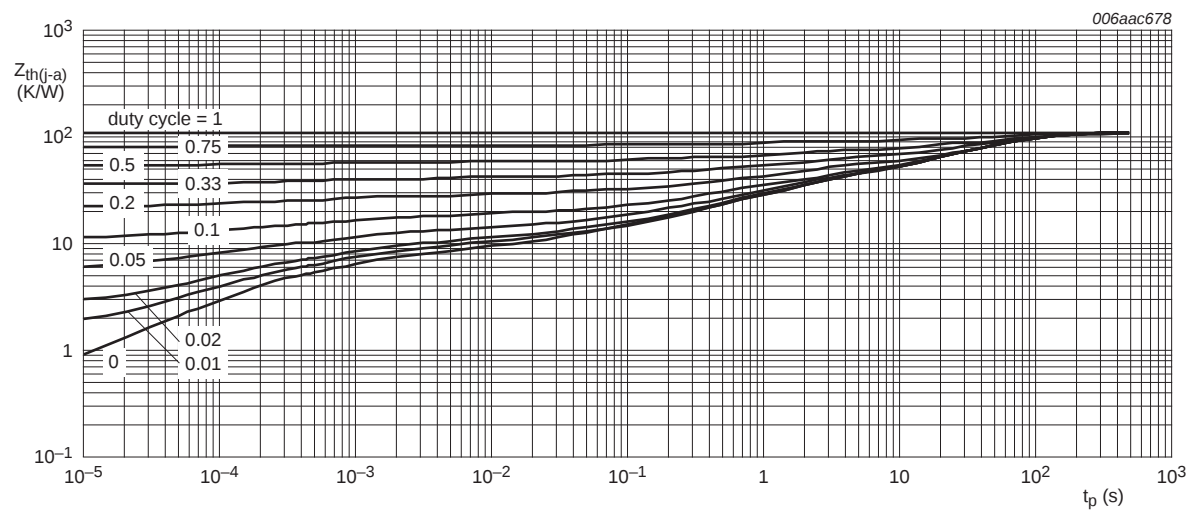
[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



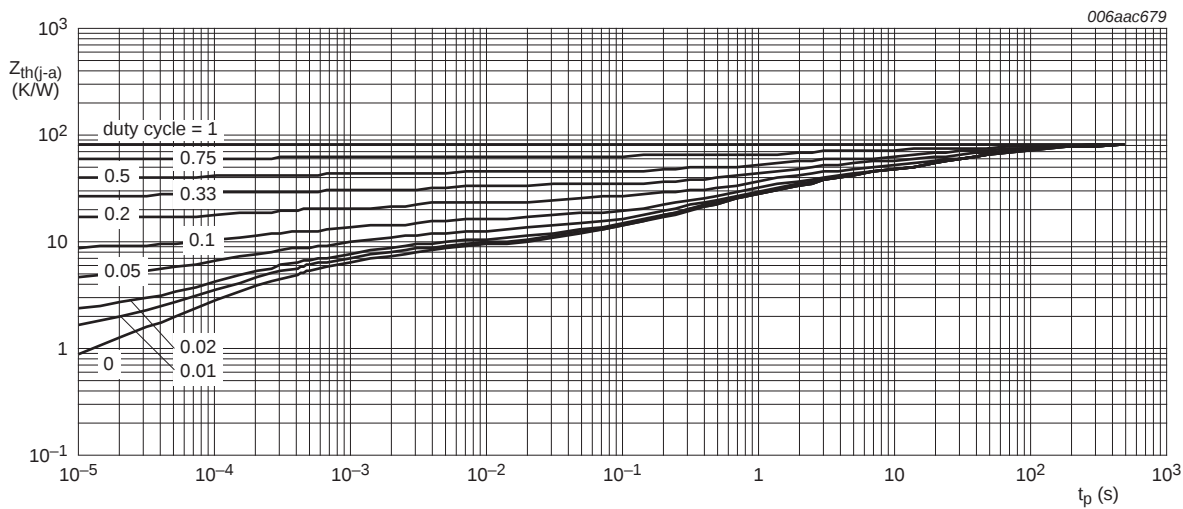
FR4 PCB, standard footprint

Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT223; typical values



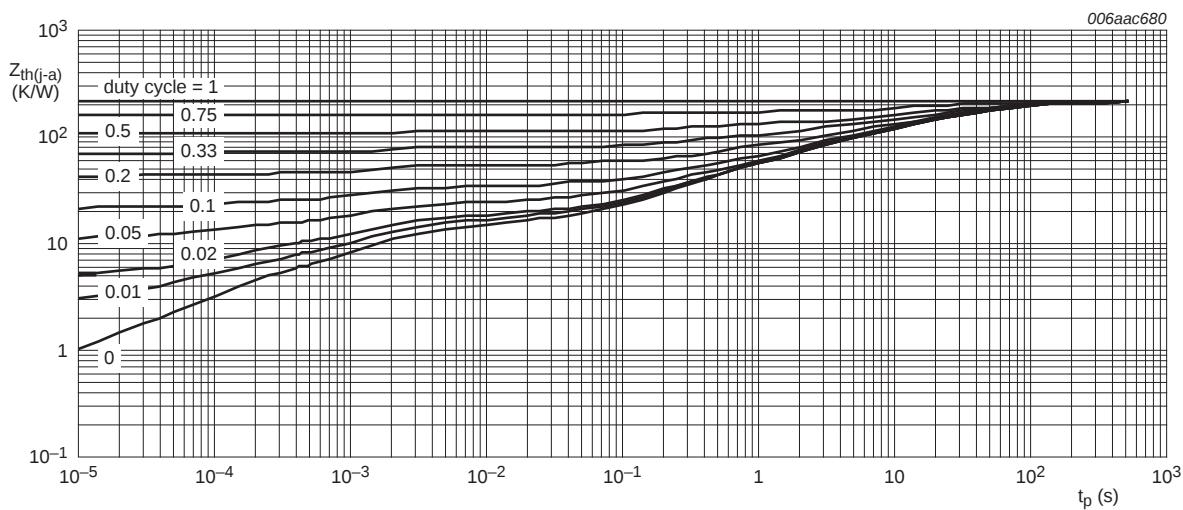
FR4 PCB, mounting pad for collector 1 cm²

Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT223; typical values



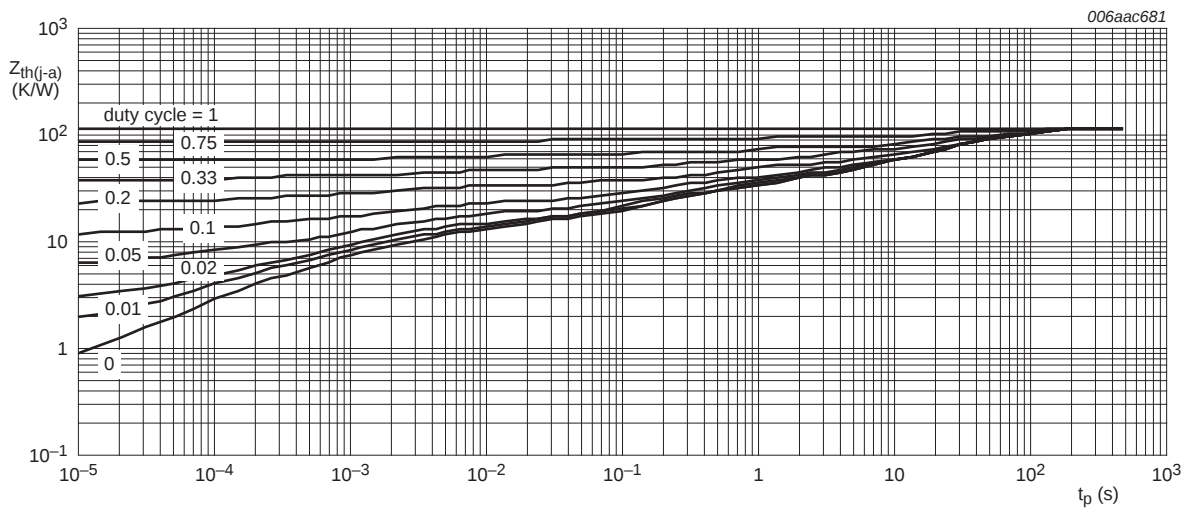
FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

**Fig 6. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT223; typical values**



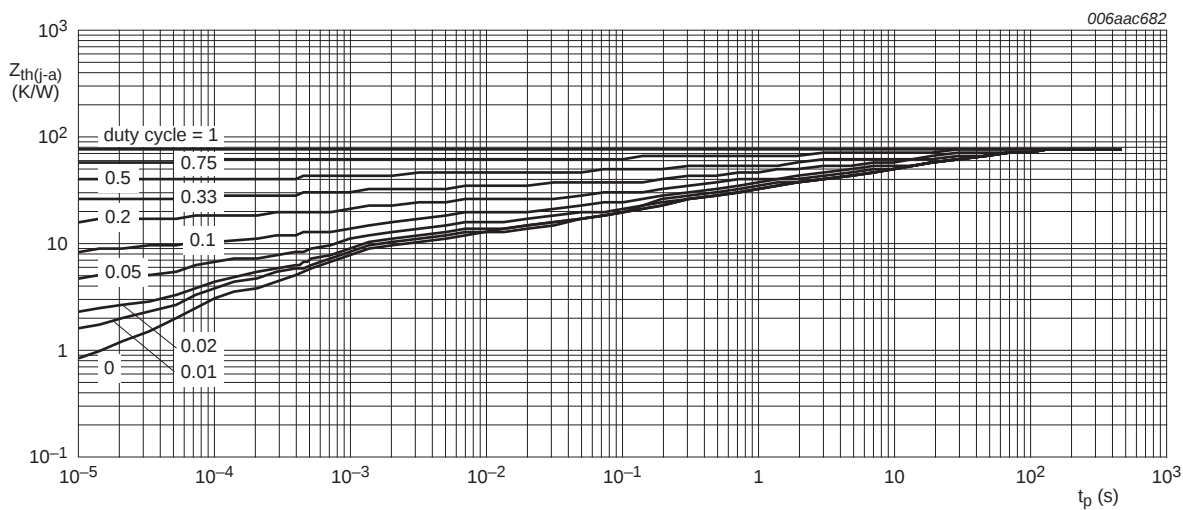
FR4 PCB, standard footprint

**Fig 7. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values**



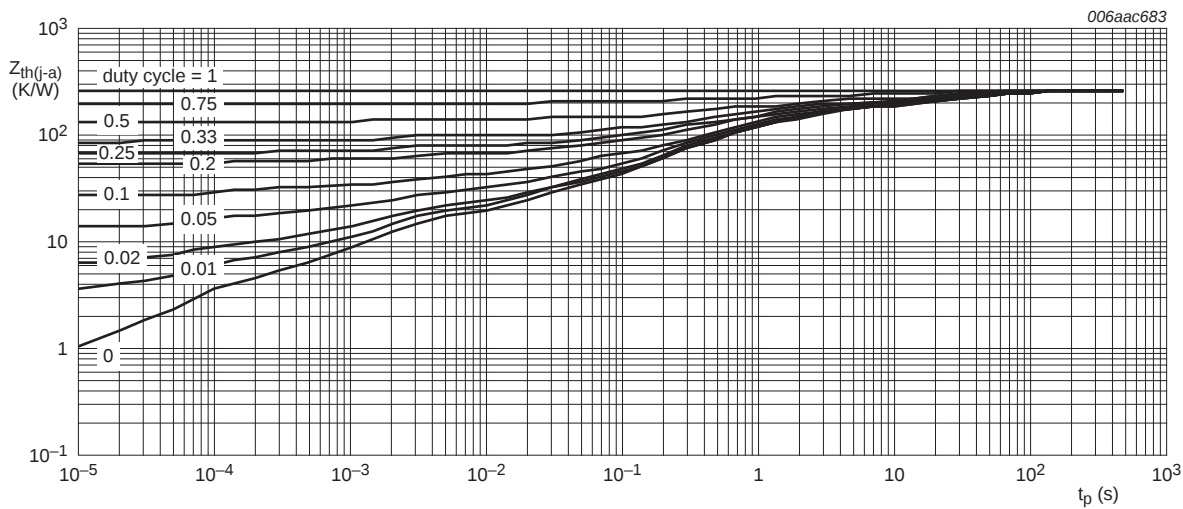
FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

Fig 8. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values



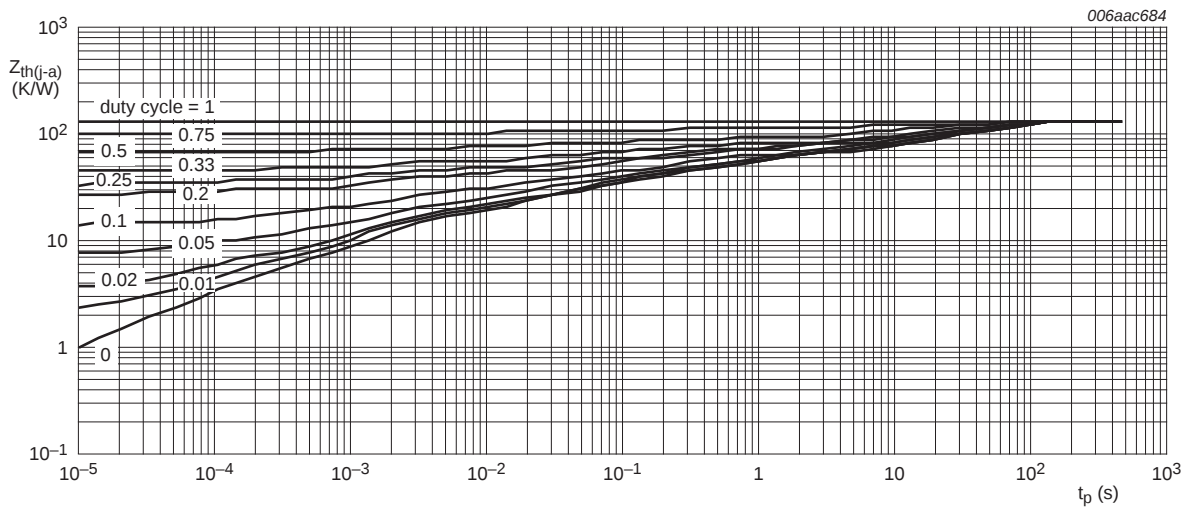
FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

Fig 9. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values



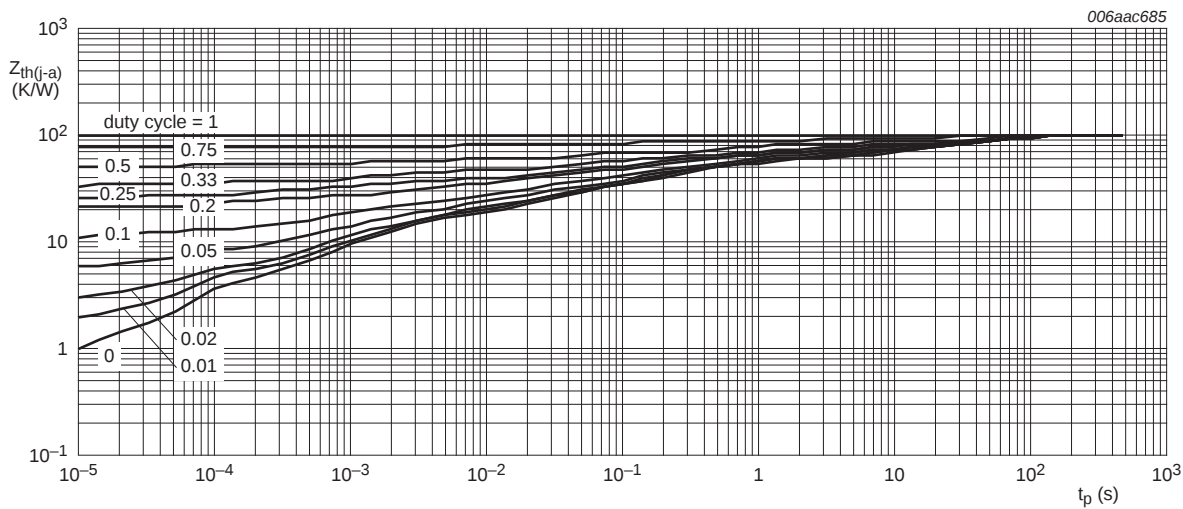
FR4 PCB, single-sided copper, standard footprint

Fig 10. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values



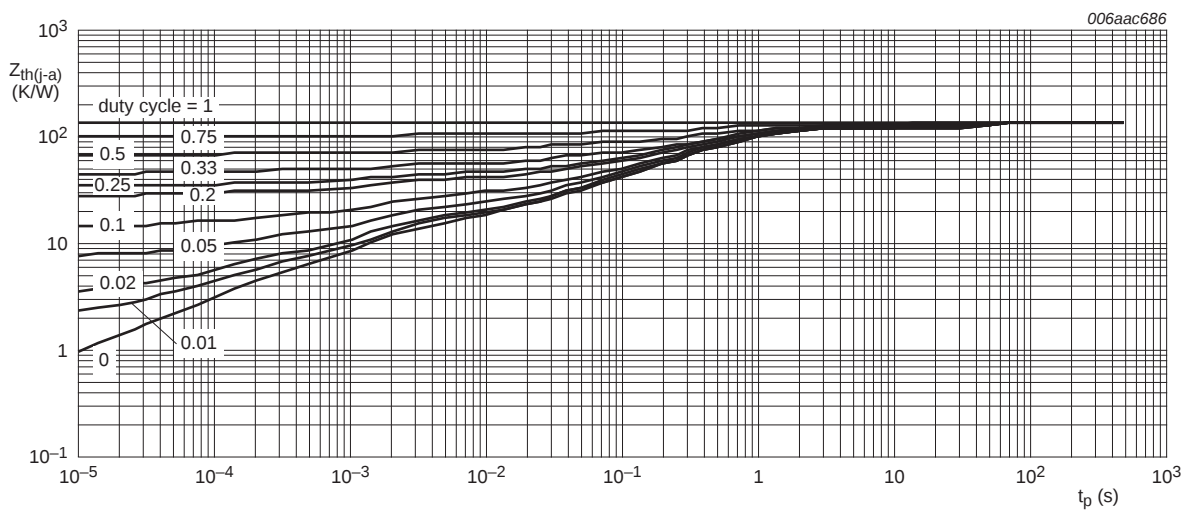
FR4 PCB, single-sided copper, mounting pad for collector 1 cm<sup>2</sup>

Fig 11. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values



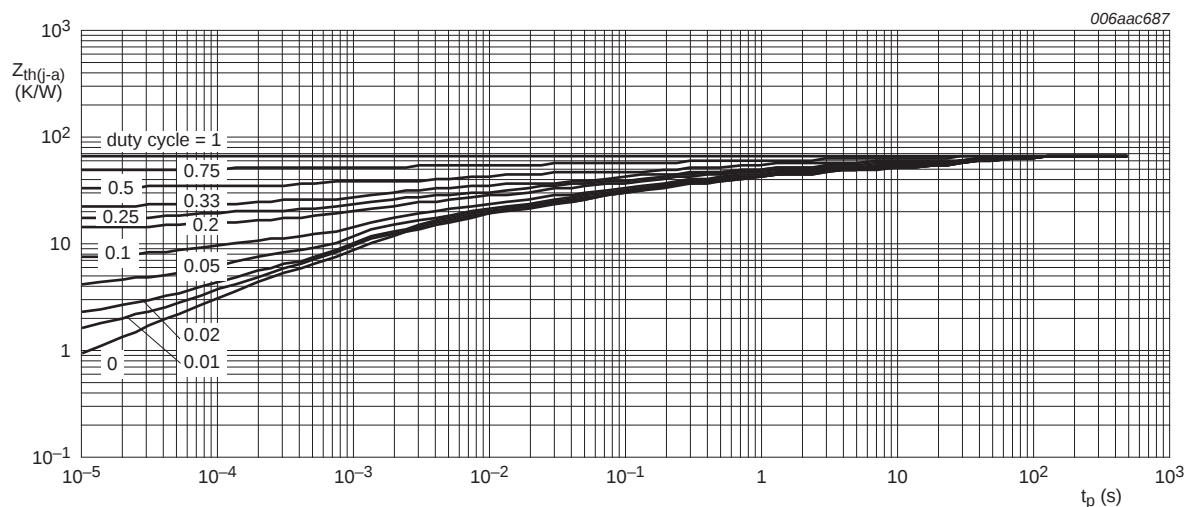
FR4 PCB, single-sided copper, mounting pad for collector 6 cm<sup>2</sup>

Fig 12. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values



FR4 PCB, 4-layer copper, standard footprint

Fig 13. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values



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

**Fig 14. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values**

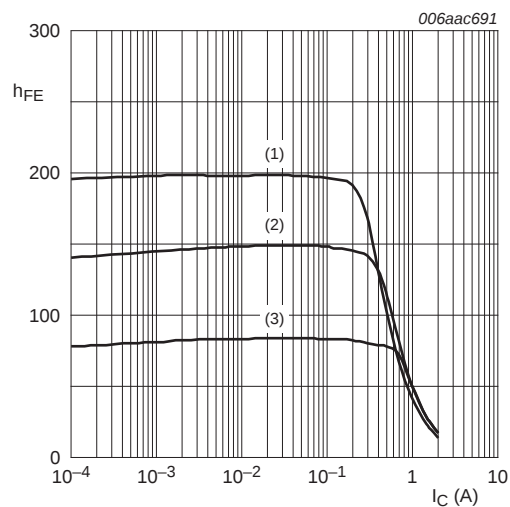
## 7. Characteristics

**Table 8. Characteristics**

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

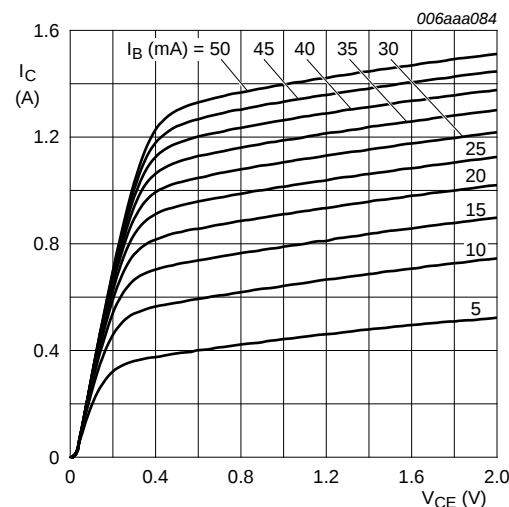
| Symbol      | Parameter                            | Conditions                                                                  | Min     | Typ | Max | Unit          |
|-------------|--------------------------------------|-----------------------------------------------------------------------------|---------|-----|-----|---------------|
| $I_{CBO}$   | 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                      | $V_{CE} = 2\text{ V}$                                                       |         |     |     |               |
|             |                                      | $I_C = 5\text{ mA}$                                                         | [1] 63  | -   | -   |               |
|             |                                      | $I_C = 150\text{ mA}$                                                       | [1] 63  | -   | 250 |               |
|             |                                      | $I_C = 500\text{ mA}$                                                       | [1] 40  | -   | -   |               |
|             | DC current gain                      | $V_{CE} = 2\text{ V}$                                                       |         |     |     |               |
|             |                                      |                                                                             |         |     |     |               |
|             | $h_{FE}$ selection -10               | $I_C = 150\text{ mA}$                                                       | [1] 63  | -   | 160 |               |
|             | $h_{FE}$ selection -16               | $I_C = 150\text{ mA}$                                                       | [1] 100 | -   | 250 |               |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C = 500\text{ mA}; I_B = 50\text{ mA}$                                   | [1] -   | -   | 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                | $V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$            | -       | 6   | -   | pF            |
| $f_T$       | transition frequency                 | $V_{CE} = 5\text{ V}; I_C = 50\text{ mA}; f = 100\text{ MHz}$               | 100     | 180 | -   | MHz           |

[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta = 0.02$ .



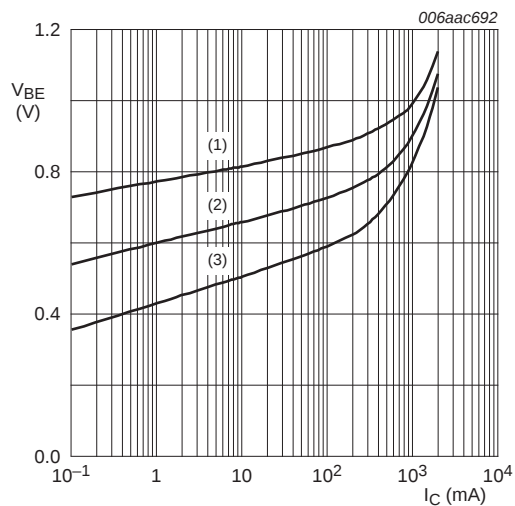
- $V_{CE} = 2 \text{ V}$
- (1)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -55 \text{ }^{\circ}\text{C}$

Fig 15. DC current gain as a function of collector current; typical values



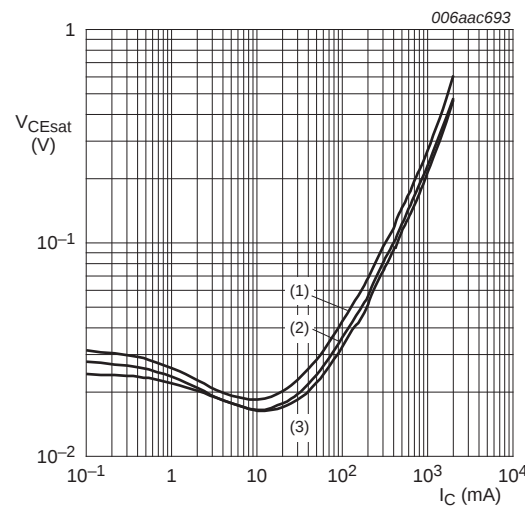
$T_{amb} = 25 \text{ }^{\circ}\text{C}$

Fig 16. 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 17. 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)  $T_{amb} = -55 \text{ }^{\circ}\text{C}$

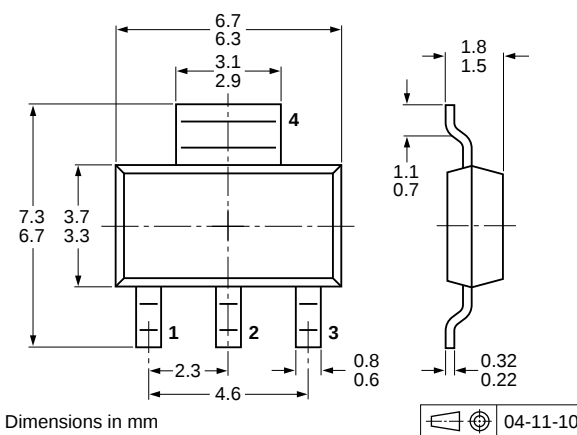
Fig 18. Collector-emitter saturation voltage as a function of collector current; typical values

## 8. Test information

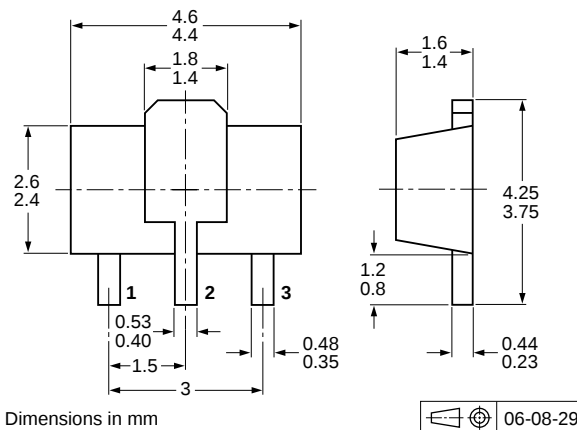
### 8.1 Quality information

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.

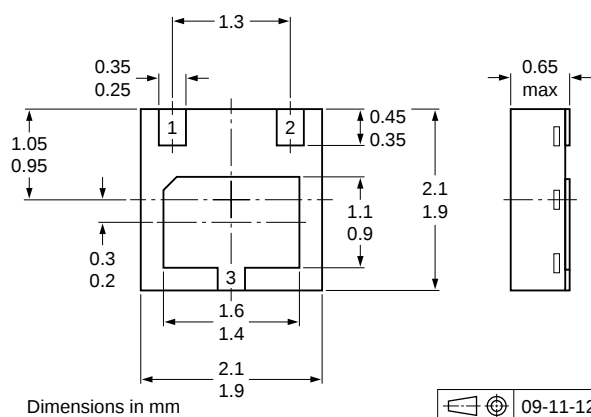
## 9. Package outline



**Fig 19. Package outline SOT223 (SC-73)**



**Fig 20. Package outline SOT89 (SC-62/TO-243)**

**Fig 21. Package outline SOT1061 (HUSON3)**

## 10. Packing information

**Table 9. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

| Type number <sup>[2]</sup> | Package | Description                                        | Packing quantity |      |      |
|----------------------------|---------|----------------------------------------------------|------------------|------|------|
|                            |         |                                                    | 1000             | 3000 | 4000 |
| BCP55                      | SOT223  | 8 mm pitch, 12 mm tape and reel                    | -115             | -    | -135 |
| BCX55                      | SOT89   | 8 mm pitch, 12 mm tape and reel; T1 <sup>[3]</sup> | -115             | -    | -135 |
|                            |         | 8 mm pitch, 12 mm tape and reel; T3 <sup>[4]</sup> | -146             | -    | -    |
| BC55PA                     | SOT1061 | 4 mm pitch, 8 mm tape and reel                     | -                | -115 | -    |

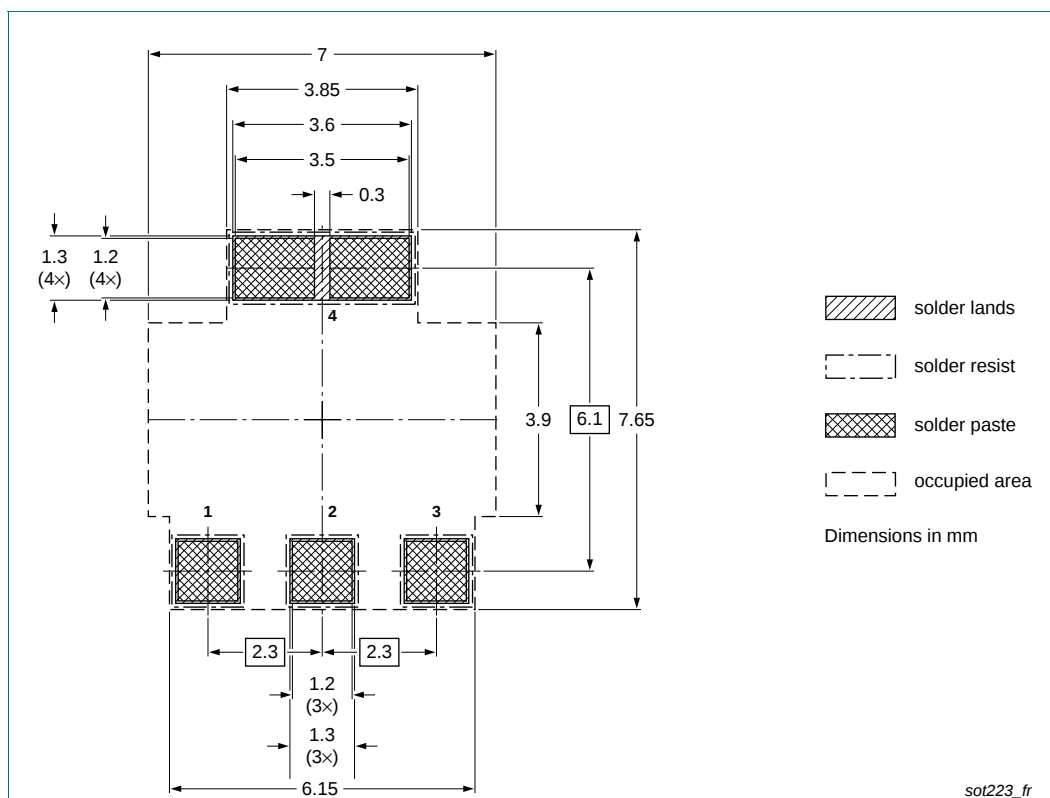
[1] For further information and the availability of packing methods, see [Section 14](#).

[2] Valid for all available selection groups.

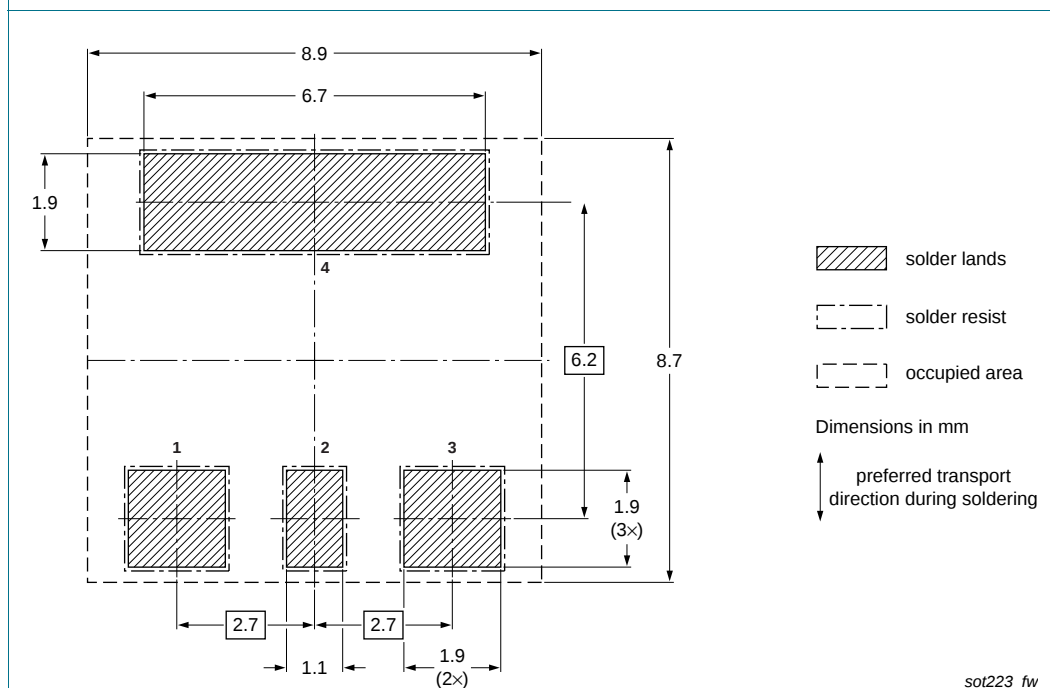
[3] T1: normal taping

[4] T3: 90° rotated taping

## 11. Soldering



**Fig 22. Reflow soldering footprint SOT223 (SC-73)**



**Fig 23. Wave soldering footprint SOT223 (SC-73)**

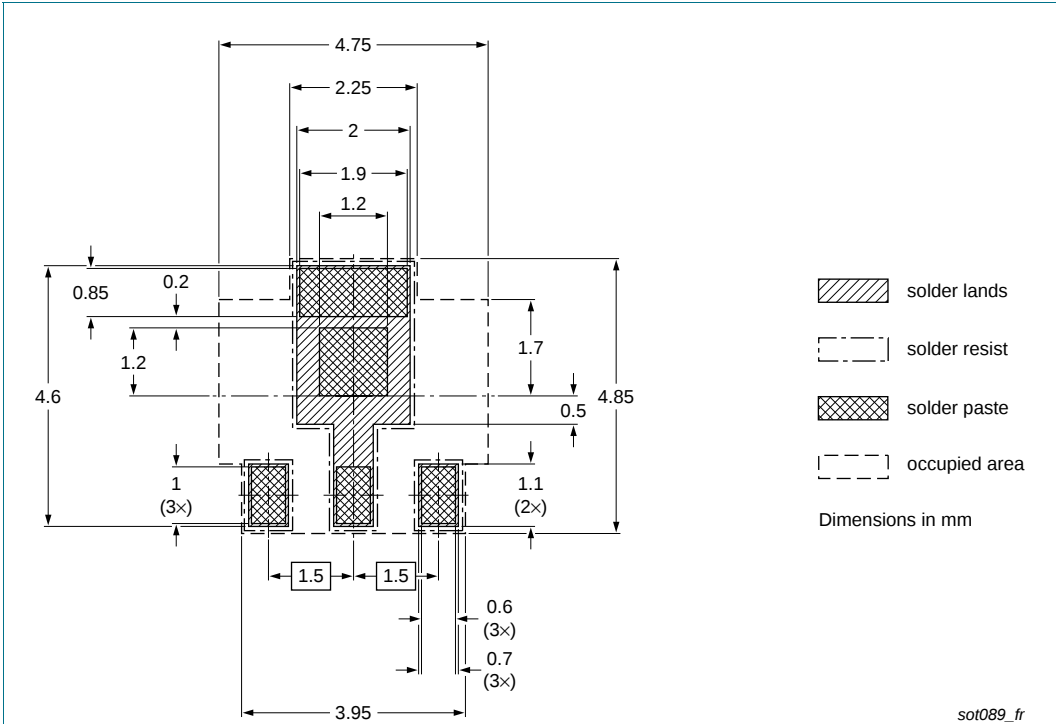


Fig 24. Reflow soldering footprint SOT89 (SC-62/TO-243)

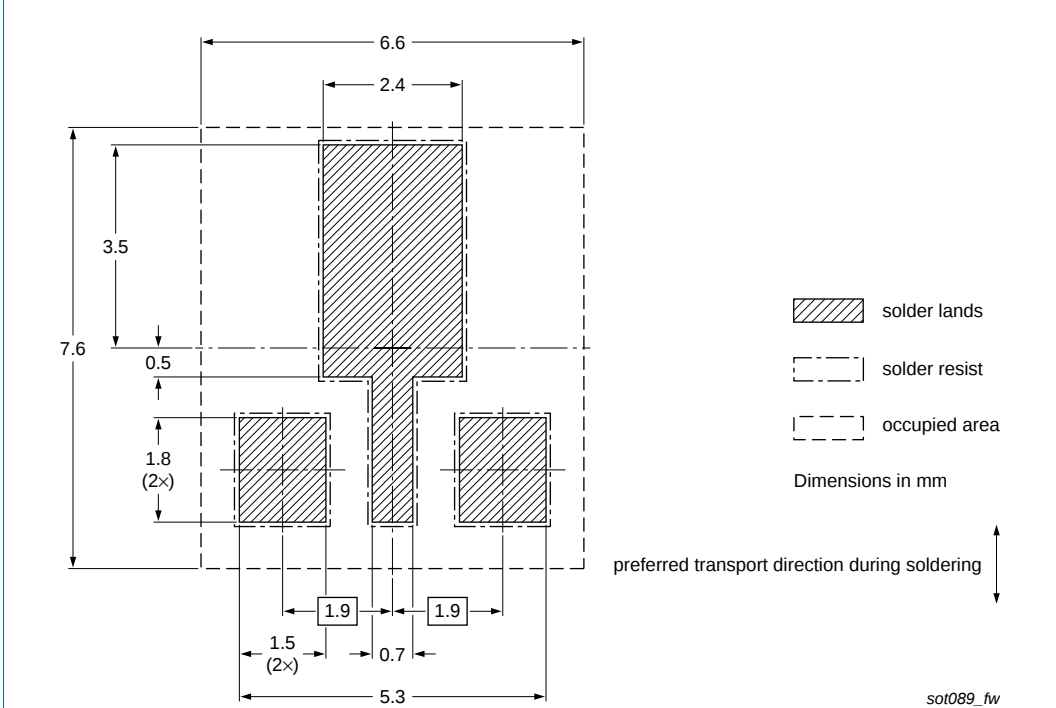


Fig 25. Wave soldering footprint SOT89 (SC-62/TO-243)

