



BSP51

NPN Darlington transistor

13 July 2018

Product data sheet

1. General description

NPN Darlington transistor in an SOT223 plastic package.

PNP complement: BSP61

2. Features and benefits

- High current of 1 A
- Low voltage of 60 V
- Integrated diode and resistor
- AEC-Q101 qualified

3. Applications

- Industrial high gain amplification

4. Quick reference data

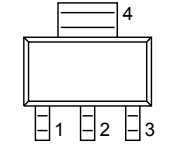
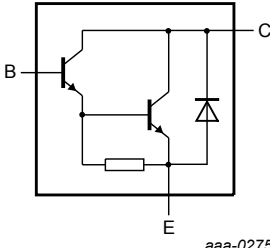
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------------------|---|-----|------|-----|------|
| V_{CBO} | collector-base voltage | open emitter | - | - | 80 | V |
| V_{CES} | collector-emitter voltage | base short-circuited to emitter | - | - | 60 | V |
| I_C | collector current | | - | - | 1 | A |
| I_{CM} | peak collector current | | - | - | 2 | A |
| h_{FE} | DC current gain | $V_{CE} = 10 \text{ V}; I_C = 150 \text{ mA}$ | [1] | 1000 | - | - |

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

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|---|---|
| 1 | B | base |  <p>SC-73 (SOT223)</p> |  <p>aaa-027580</p> |
| 2 | C | collector | | |
| 3 | E | emitter | | |
| 4 | C | collector | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|---|---------|
| | Name | Description | Version |
| BSP51 | SC-73 | plastic, surface-mounted package with increased heatsink; 4 leads; 4.6 mm pitch; 6.5 mm x 3.5 mm x 1.65 mm body | SOT223 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| BSP51 | BSP51 |

8. Limiting values

Table 5. Limiting values

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|------------|---------------------------|---------------------------------|-----|-----|------|------|
| V_{CB0} | collector-base voltage | open emitter | | - | 80 | V |
| V_{CES} | collector-emitter voltage | base short-circuited to emitter | | - | 60 | V |
| V_{EBO} | emitter-base voltage | open collector | | - | 5 | V |
| I_C | collector current | | | - | 1 | A |
| I_{CM} | peak collector current | | | - | 2 | A |
| I_{Blim} | limiting base current | | | - | 100 | mA |
| P_{tot} | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | [1] | - | 1.25 | W |
| T_j | junction temperature | | | - | 150 | °C |
| T_{amb} | ambient temperature | | | -65 | 150 | °C |
| T_{stg} | storage temperature | | | -65 | 150 | °C |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for collector 1 cm².

9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|----------------|--|------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | | [1] | - | - | 96 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | - | 17 | K/W |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for collector 1 cm².

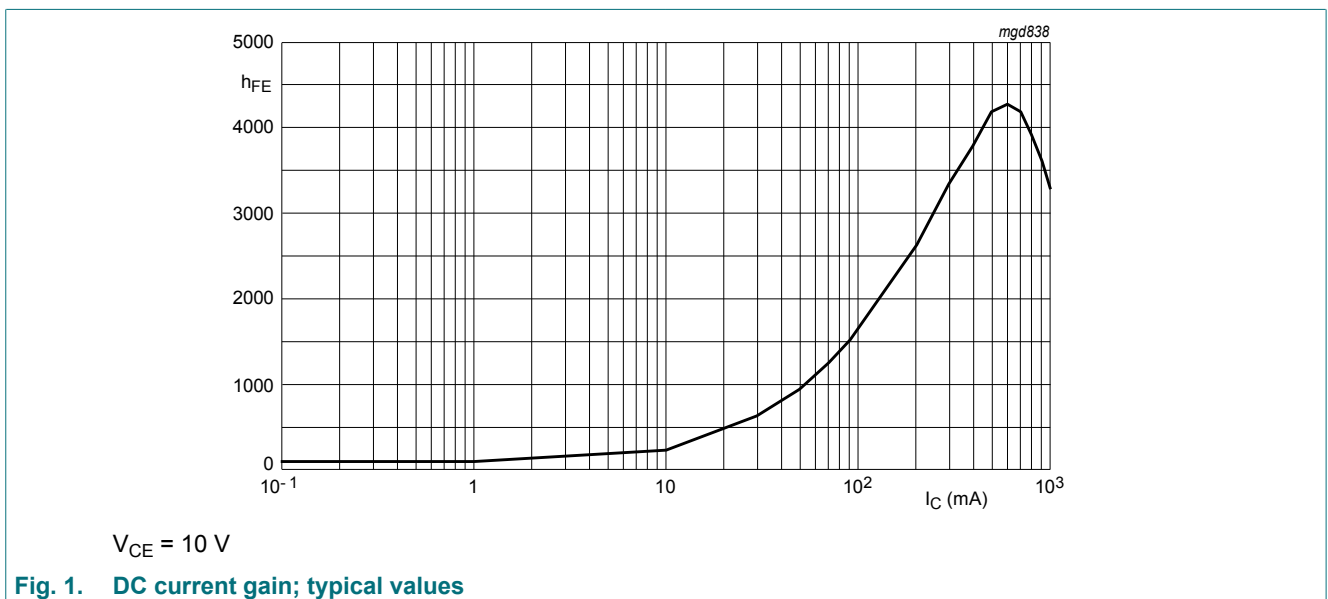
10. Characteristics

Table 7. Characteristics

$T_j = 25\text{ °C}$ unless otherwise specified

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|--------------------------------------|---|-----|------|-----|------|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C = 100\ \mu\text{A}; I_E = 0\ \text{A}$ | 80 | - | - | V |
| $V_{(BR)CES}$ | collector-emitter breakdown voltage | $I_C = 2\ \text{mA}; V_{BE} = 0\ \text{V}$ | 60 | - | - | V |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | $I_C = 0\ \text{A}; I_E = 100\ \mu\text{A}$ | 5 | - | - | V |
| I_{CES} | collector-emitter cut-off current | $V_{BE} = 0\ \text{V}; V_{CE} = 60\ \text{V}$ | - | - | 50 | nA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 4\ \text{V}; I_C = 0\ \text{A}$ | - | - | 50 | nA |
| h_{FE} | DC current gain | $V_{CE} = 10\ \text{V}; I_C = 150\ \text{mA}$ | [1] | 1000 | - | - |
| | | $V_{CE} = 10\ \text{V}; I_C = 500\ \text{mA}$ | [1] | 2000 | - | - |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 500\ \text{mA}; I_B = 0.5\ \text{mA}$ | - | - | 1.3 | V |
| | | $I_C = 500\ \text{mA}; I_B = 0.5\ \text{mA}; T_j = 150\text{ °C}$ | - | - | 1.3 | V |
| V_{BEsat} | base-emitter saturation voltage | $I_C = 500\ \text{mA}; I_B = 0.5\ \text{mA}$ | - | - | 1.9 | V |
| t_{on} | turn-on time | $I_C = 500\ \text{mA}; I_{B(on)} = 0.5\ \text{mA};$ $I_{B(off)} = -0.5\ \text{mA}$ | - | 500 | - | ns |
| t_{off} | turn-off time | | - | 1300 | - | ns |
| f_T | transition frequency | $V_{CE} = 5\ \text{V}; I_C = 500\ \text{mA}; f = 100\ \text{MHz}$ | - | 200 | - | MHz |

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



11. Test information

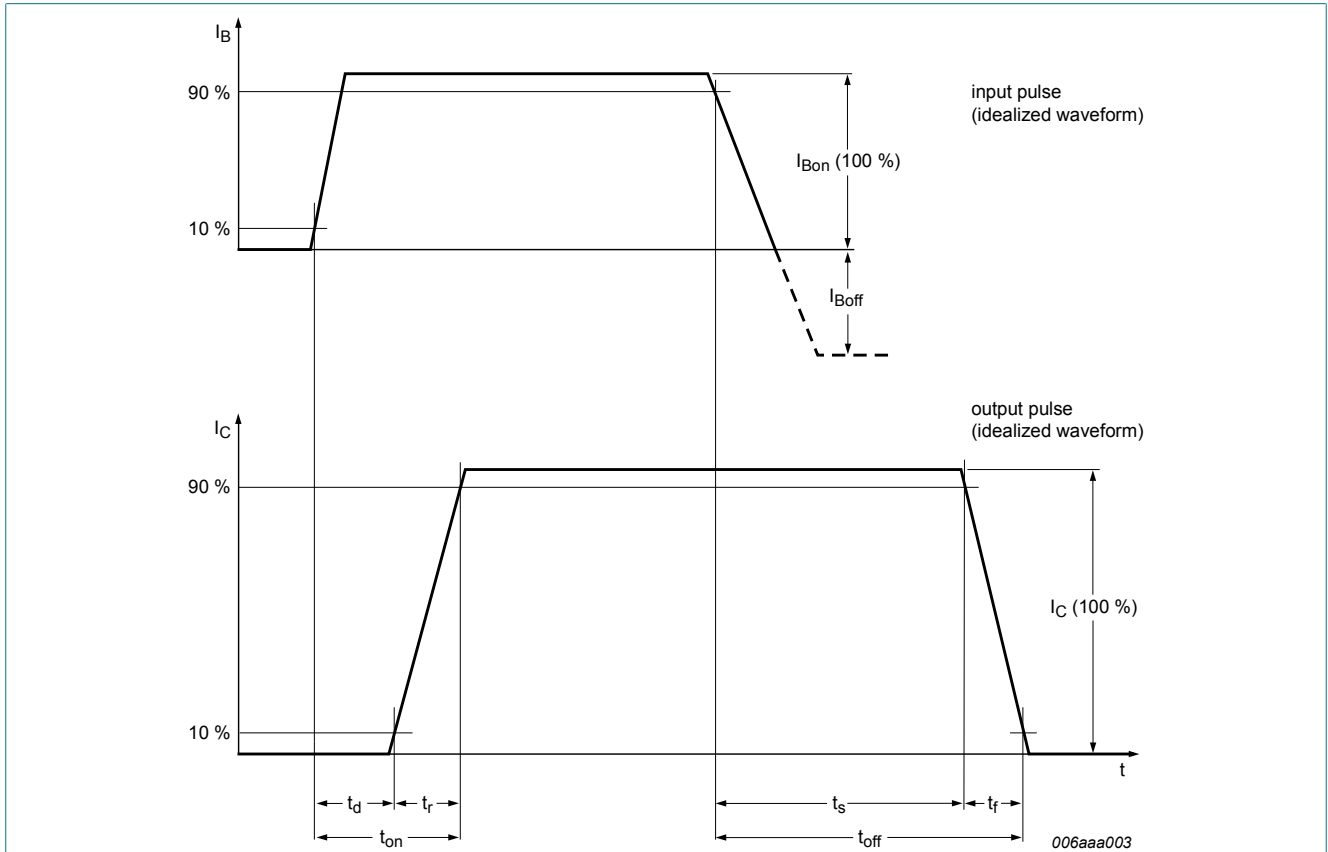


Fig. 2. Transistor switching time definition

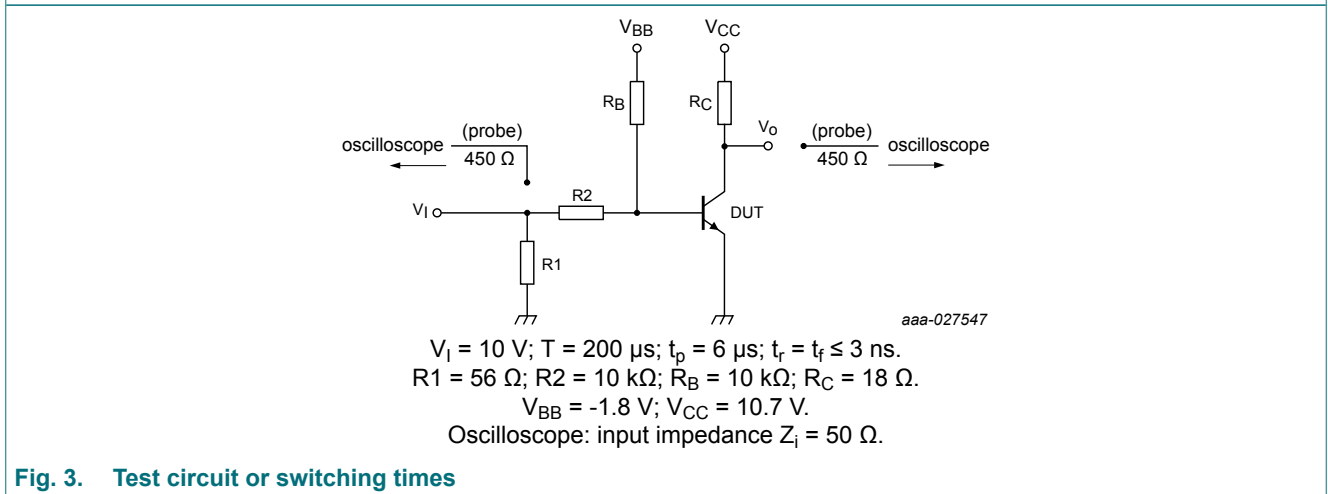


Fig. 3. Test circuit or switching times

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

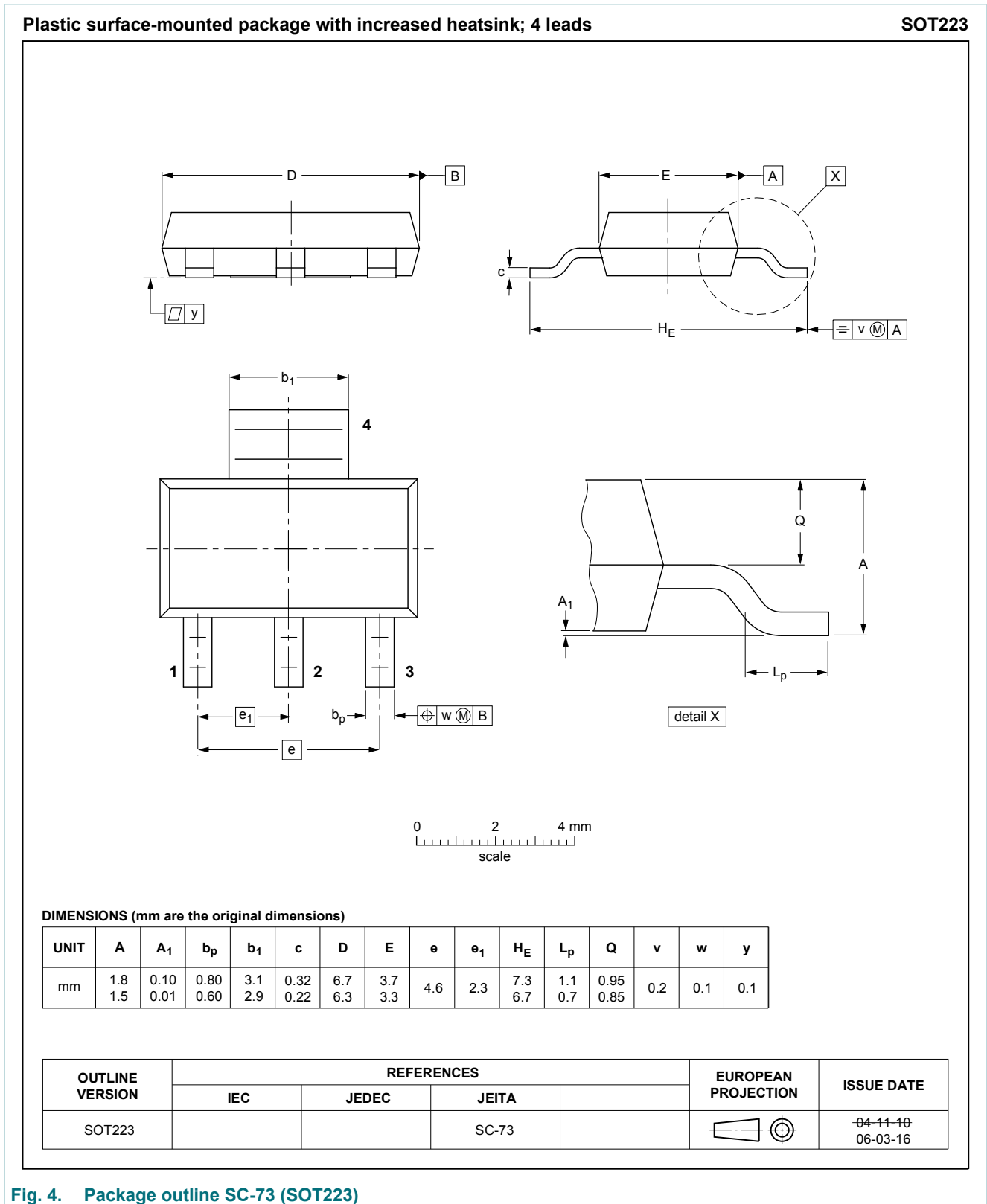


Fig. 4. Package outline SC-73 (SOT223)

13. Soldering

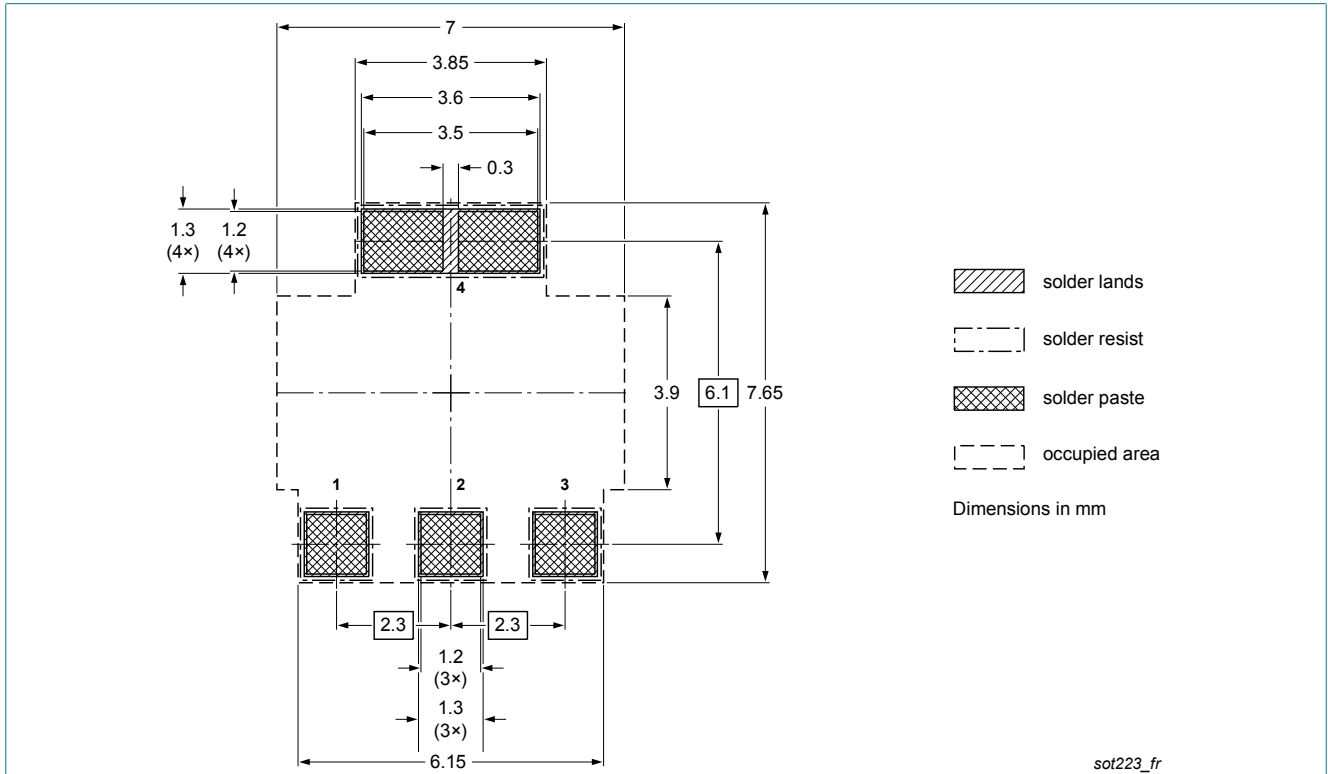


Fig. 5. Reflow soldering footprint for SC-73 (SOT223)

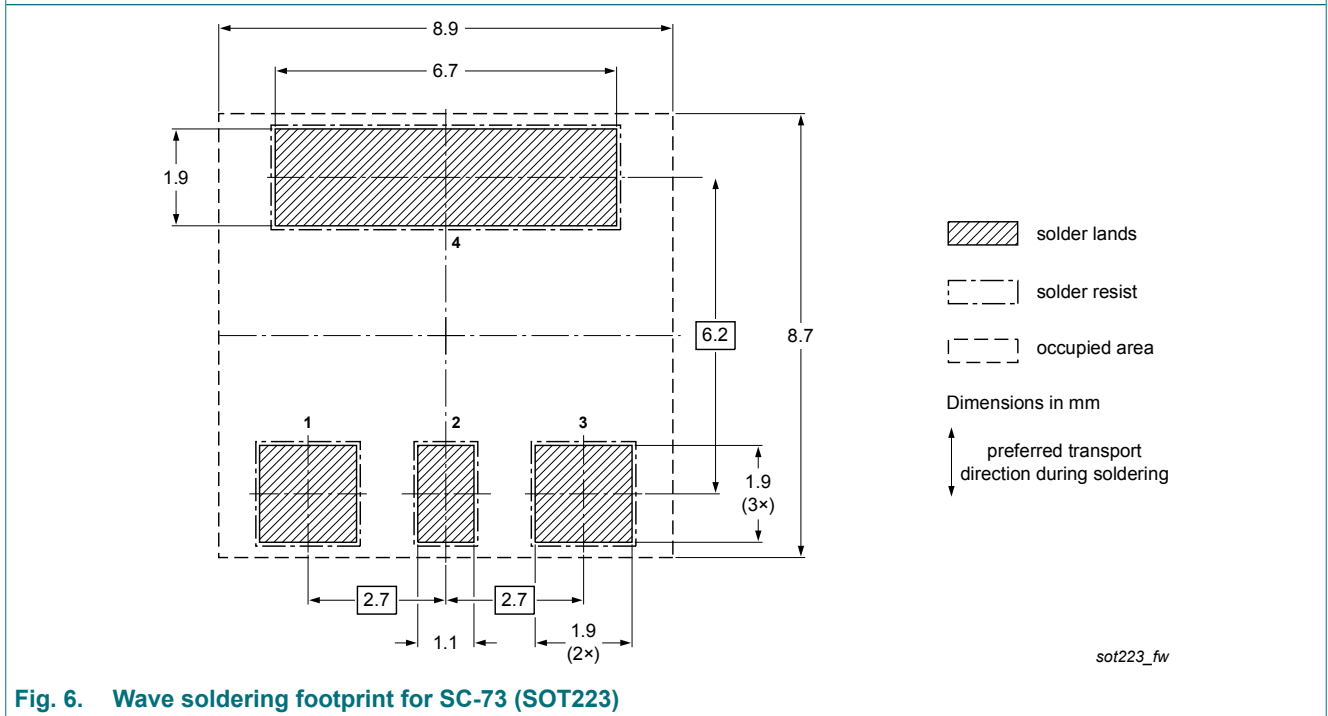


Fig. 6. Wave soldering footprint for SC-73 (SOT223)

14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|---|--------------------|---------------|-----------------|
| BSP51 v.3 | 20180713 | Product data sheet | - | BSP50_51_52 v.2 |
| Modifications: | <ul style="list-style-type: none"> The product is AEC-Q101 qualified. Family data sheet is transformed to single data sheet. The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. | | | |
| BSP50_51_52 v.2 | 19990423 | Product data sheet | - | BSP50_51_52 v.1 |
| BSP50_51_52 v.1 | 19970422 | 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.
- [2] The term 'short data sheet' is explained in section "Definitions".
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Contents

| | |
|---------------------------------|---|
| 1. General description..... | 1 |
| 2. Features and benefits..... | 1 |
| 3. Applications..... | 1 |
| 4. Quick reference data..... | 1 |
| 5. Pinning information..... | 2 |
| 6. Ordering information..... | 2 |
| 7. Marking..... | 2 |
| 8. Limiting values..... | 3 |
| 9. Thermal characteristics..... | 3 |
| 10. Characteristics..... | 4 |
| 11. Test information..... | 5 |
| 12. Package outline..... | 6 |
| 13. Soldering..... | 7 |
| 14. Revision history..... | 8 |
| 15. Legal information..... | 9 |

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