



PBSS305NZ-Q

80 V, 5.1 A NPN low V_{CEsat} transistor

29 August 2024

Product data sheet

1. General description

NPN low V_{CEsat} transistor in a SOT223 (SC-73) small Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS305PZ-Q

2. Features and benefits

- Low collector-emitter saturation voltage V_{CEsat}
- High collector current capability I_C and I_{CM}
- High collector current gain (h_{FE}) at high I_C
- High efficiency due to less heat generation
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- High-voltage DC-to-DC conversion
- High-voltage MOSFET gate driving
- High-voltage motor control
- High-voltage power switches (e.g. motors, fans)
- Automotive applications

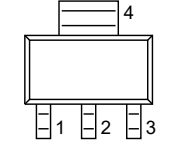
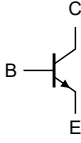
4. Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|---|---|-----|-----|------|------------|
| V_{CEO} | collector-emitter voltage | open base | - | - | 80 | V |
| I_C | collector current | | - | - | 5.1 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | - | 10.2 | A |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = 4$ A; $I_B = 200$ mA; pulsed; $t_p \leq 300$ μ s; $\delta \leq 0.02$; $T_{amb} = 25$ °C | - | 40 | 56 | m Ω |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|---|---|
| 1 | B | base |  SC-73 (SOT223) |  sym123 |
| 2 | C | collector | | |
| 3 | E | emitter | | |
| 4 | C | collector | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-----------------------------|---------|---|------------------------|
| | Name | Description | Version |
| PBSS305NZ-Q | SC-73 | plastic, surface-mounted package with increased heatsink; 4 leads; 2.3 mm pitch; 6.5 mm x 3.5 mm x 1.65 mm body | SOT223 |

7. Marking

Table 4. Marking codes

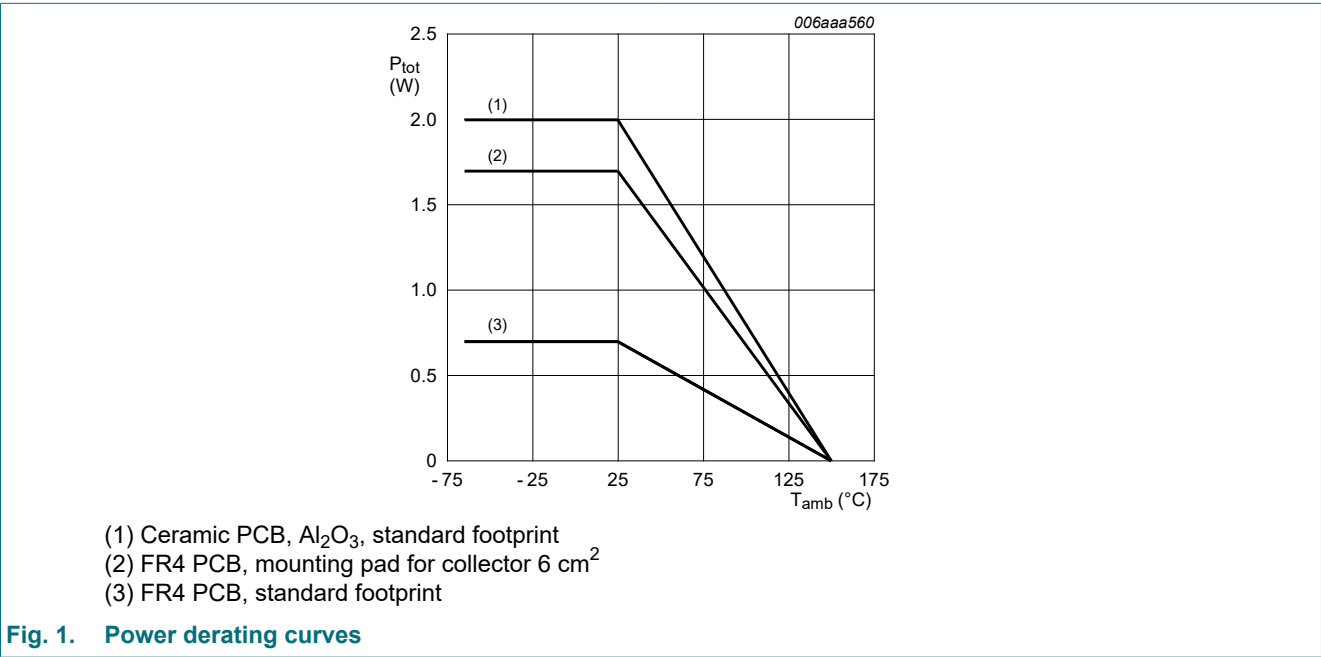
| Type number | Marking code |
|-------------|--------------|
| PBSS305NZ-Q | S305NZ |

8. Limiting values

Table 5. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|------------------|---------------------------|-------------------------------------|-----|-----|------|------|
| V _{CBO} | collector-base voltage | open emitter | | - | 80 | V |
| V _{CEO} | collector-emitter voltage | open base | | - | 80 | V |
| V _{EBO} | emitter-base voltage | open collector | | - | 5 | V |
| I _C | collector current | | | - | 5.1 | A |
| I _{CM} | peak collector current | single pulse; t _p ≤ 1 ms | | - | 10.2 | A |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | [1] | - | 0.7 | W |
| | | | [2] | - | 1.7 | W |
| | | | [3] | - | 2 | 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 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 6 cm².
[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.



9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|----------------|--|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 179 | K/W |
| | | | [2] | - | - | 74 | K/W |
| | | | [3] | - | - | 63 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | - | 15 | 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 6 cm².
[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

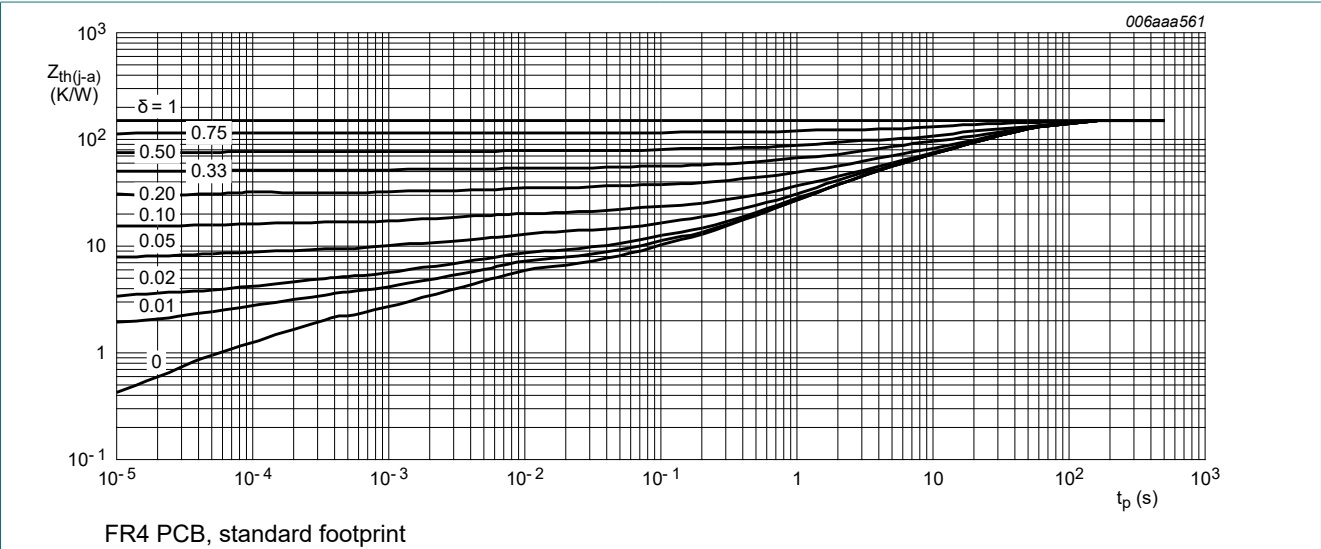


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

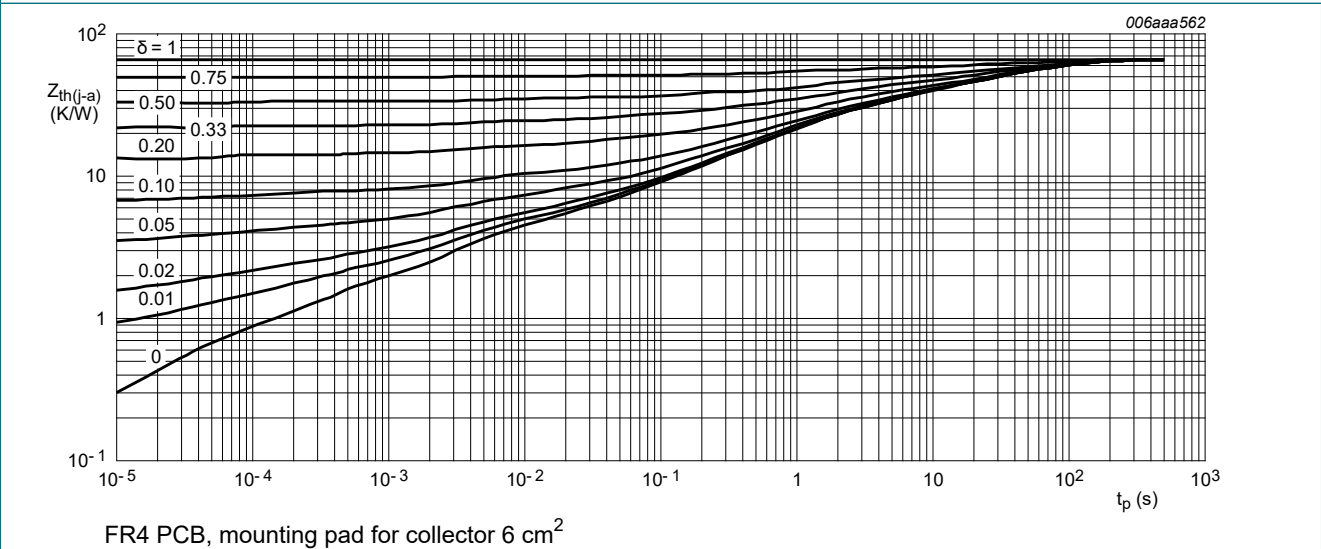
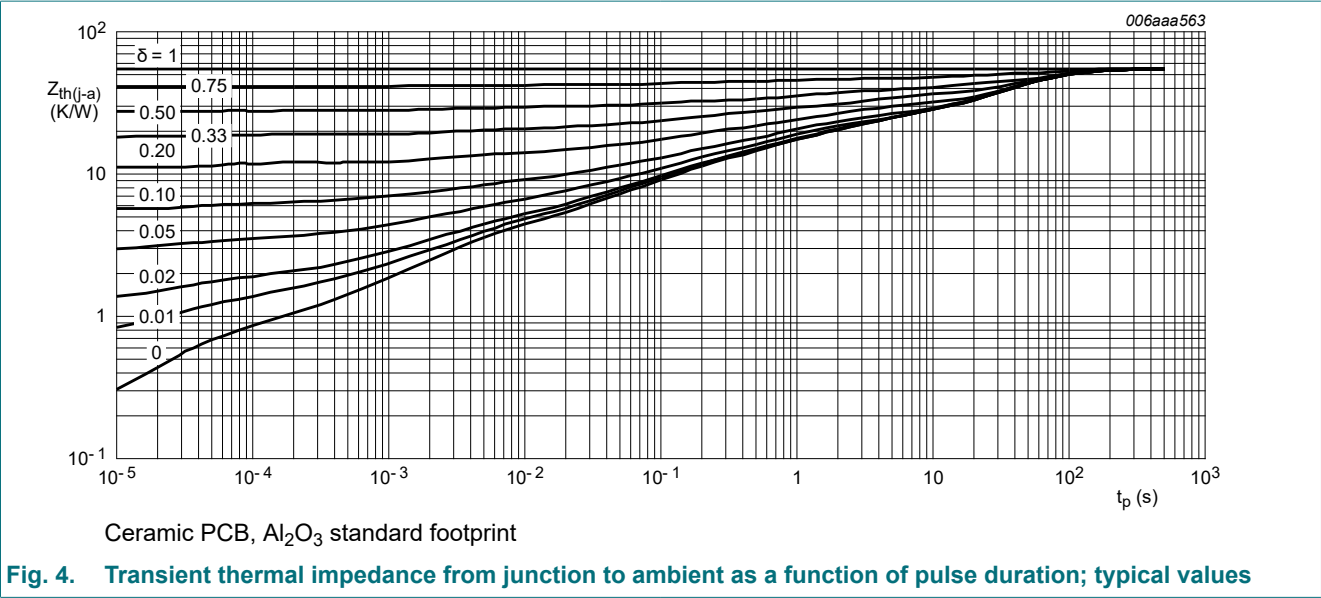


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|---|--|-----|------|------|---------------|
| I_{CBO} | collector-base cut-off current | $V_{CB} = 80 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | - | 100 | nA |
| | | $V_{CB} = 80 \text{ V}; I_E = 0 \text{ A}; T_J = 150 \text{ }^{\circ}\text{C}$ | - | - | 50 | μA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | - | 100 | nA |
| h_{FE} | DC current gain | $V_{CE} = 2 \text{ V}; I_C = 0.5 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | 300 | 470 | - | |
| | | $V_{CE} = 2 \text{ V}; I_C = 1 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | 250 | 420 | - | |
| | | $V_{CE} = 2 \text{ V}; I_C = 2 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | 180 | 280 | - | |
| | | $V_{CE} = 2 \text{ V}; I_C = 4 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | 90 | 140 | - | |
| | | $V_{CE} = 2 \text{ V}; I_C = 6 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | 50 | 80 | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 0.5 \text{ A}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 25 | 40 | mV |
| | | $I_C = 1 \text{ A}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 50 | 70 | mV |
| | | $I_C = 1 \text{ A}; I_B = 10 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 85 | 120 | mV |
| | | $I_C = 2 \text{ A}; I_B = 40 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 105 | 150 | mV |
| | | $I_C = 4 \text{ A}; I_B = 200 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 160 | 225 | mV |
| | | $I_C = 4 \text{ A}; I_B = 400 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 150 | 210 | mV |
| | | $I_C = 4 \text{ A}; I_B = 80 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 225 | 340 | mV |
| | | $I_C = 5.1 \text{ A}; I_B = 255 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 190 | 270 | mV |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = 4 \text{ A}; I_B = 200 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 40 | 56 | m Ω |
| | | $I_C = 4 \text{ A}; I_B = 80 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 56 | 85 | m Ω |
| V_{BEsat} | base-emitter saturation voltage | $I_C = 1 \text{ A}; I_B = 100 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 0.82 | 0.9 | V |
| | | $I_C = 4 \text{ A}; I_B = 400 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 0.94 | 1.05 | V |
| V_{BEon} | base-emitter turn-on voltage | $V_{CE} = 2 \text{ V}; I_C = 2 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 0.77 | 0.85 | V |
| t_d | delay time | $V_{CC} = 12.5 \text{ V}; I_C = 3 \text{ A}; I_{B(on)} = 0.15 \text{ A}; I_{B(off)} = -0.15 \text{ A}; T_{amb} = 25 \text{ }^{\circ}\text{C}$ | - | 15 | - | ns |
| t_r | rise time | | - | 200 | - | ns |
| t_{on} | turn-on time | | - | 215 | - | ns |
| t_s | storage time | | - | 310 | - | ns |
| t_f | fall time | | - | 245 | - | ns |
| t_{off} | turn-off time | | - | 555 | - | ns |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------|-----------------------|--|-----|-----|-----|------|
| f_T | transition frequency | $V_{CE} = 10\text{ V}$; $I_C = 100\text{ mA}$; $f = 100\text{ MHz}$ | - | 110 | - | MHz |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}$; $I_E = 0\text{ A}$; $i_e = 0\text{ A}$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$ | - | 30 | 50 | pF |

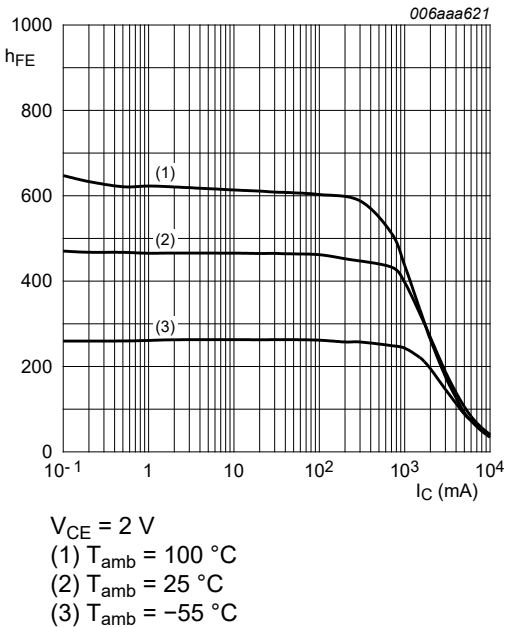


Fig. 5. DC current gain as a function of collector current; typical values

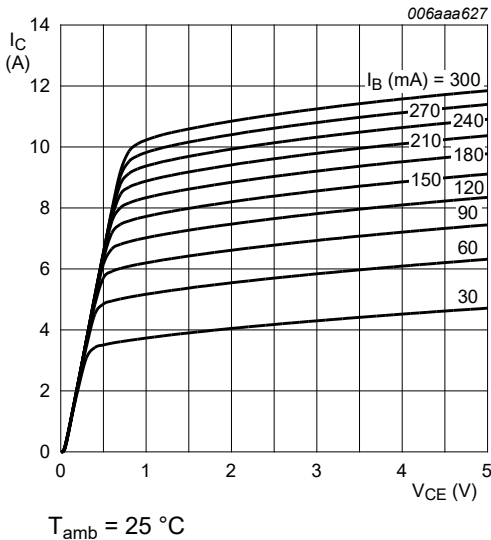


Fig. 6. Collector current as a function of collector-emitter voltage; typical values

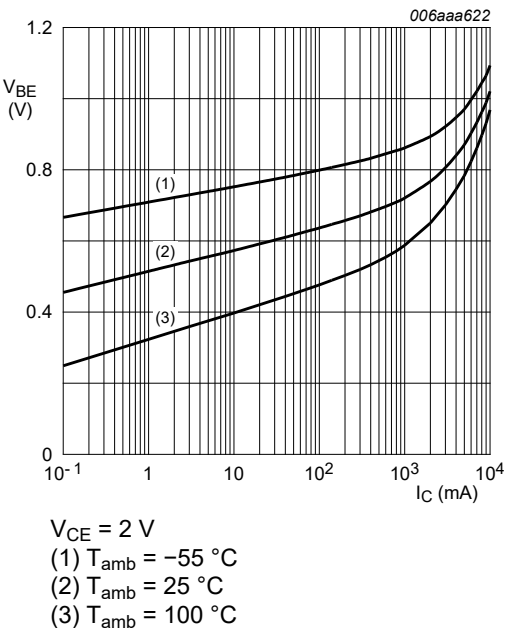


Fig. 7. Base-emitter voltage as a function of collector current; typical values

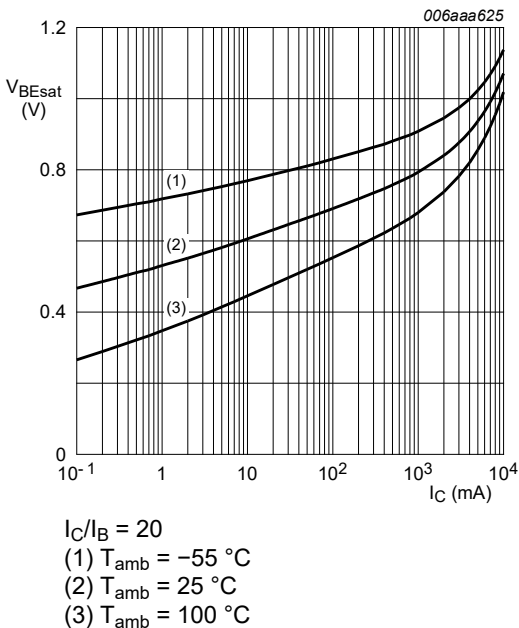


Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values

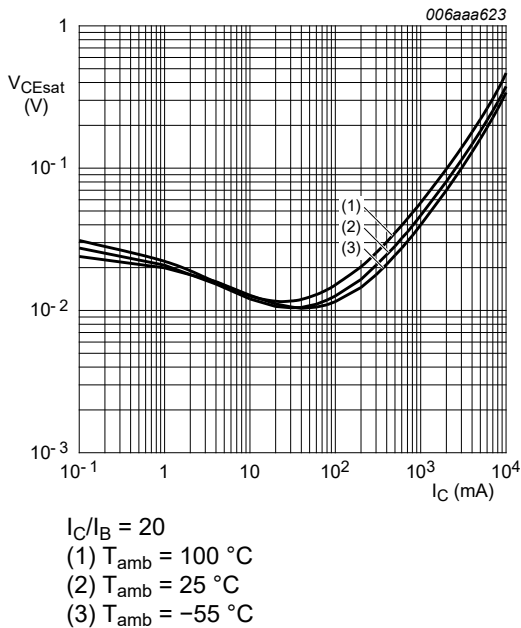


Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values

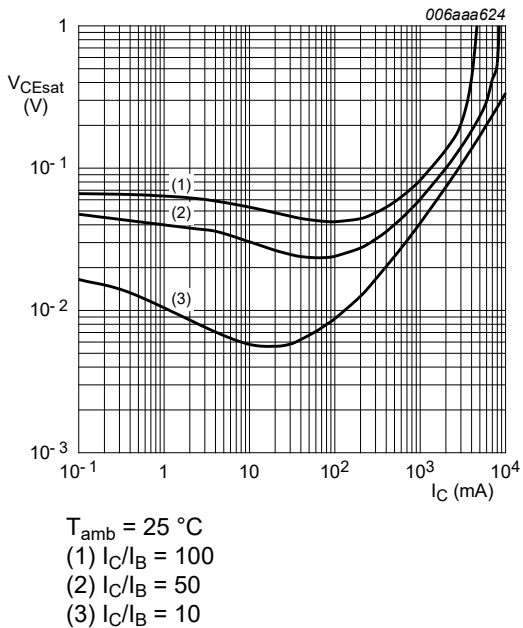


Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values

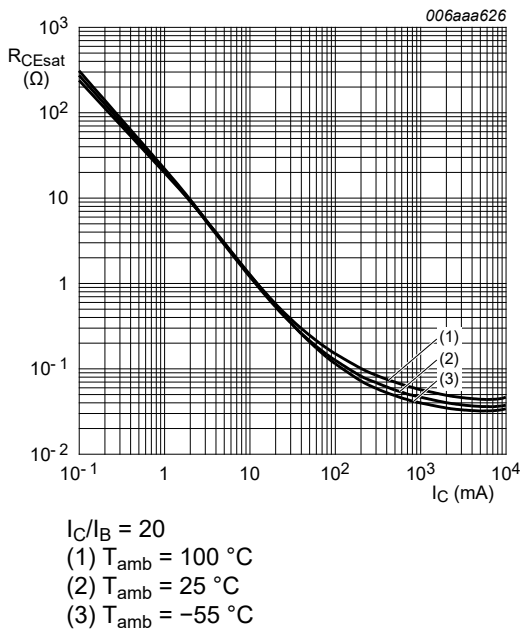


Fig. 11. Collector-emitter saturation resistance as a function of collector current; typical values

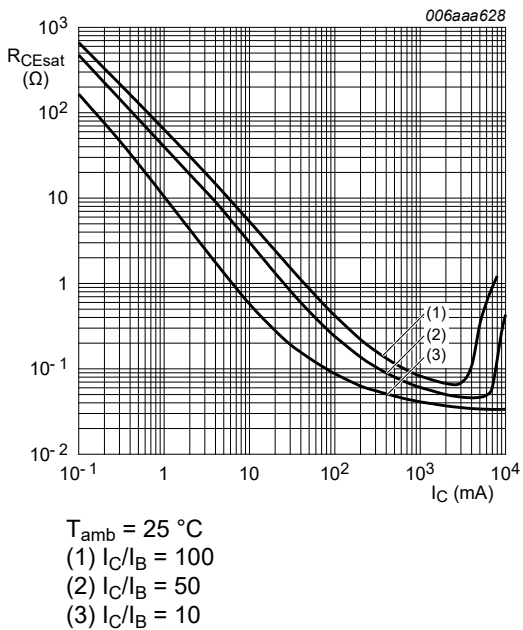


Fig. 12. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information



Fig. 13. Transistor switching time definition

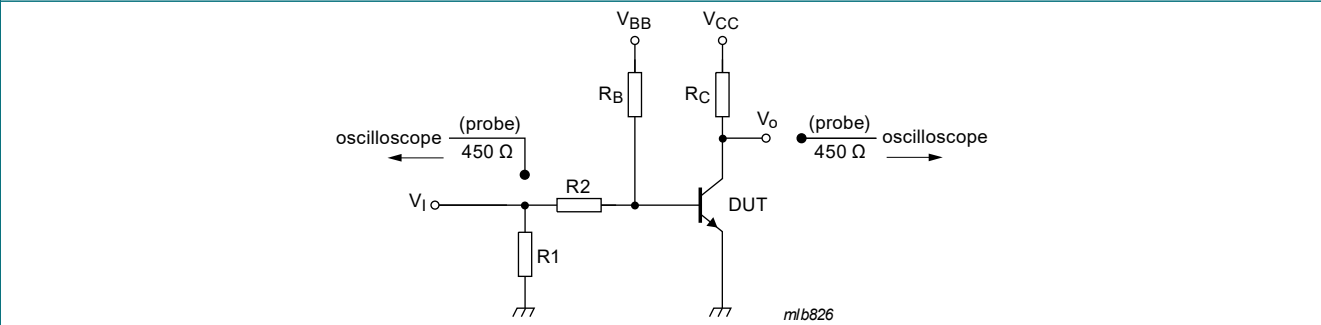
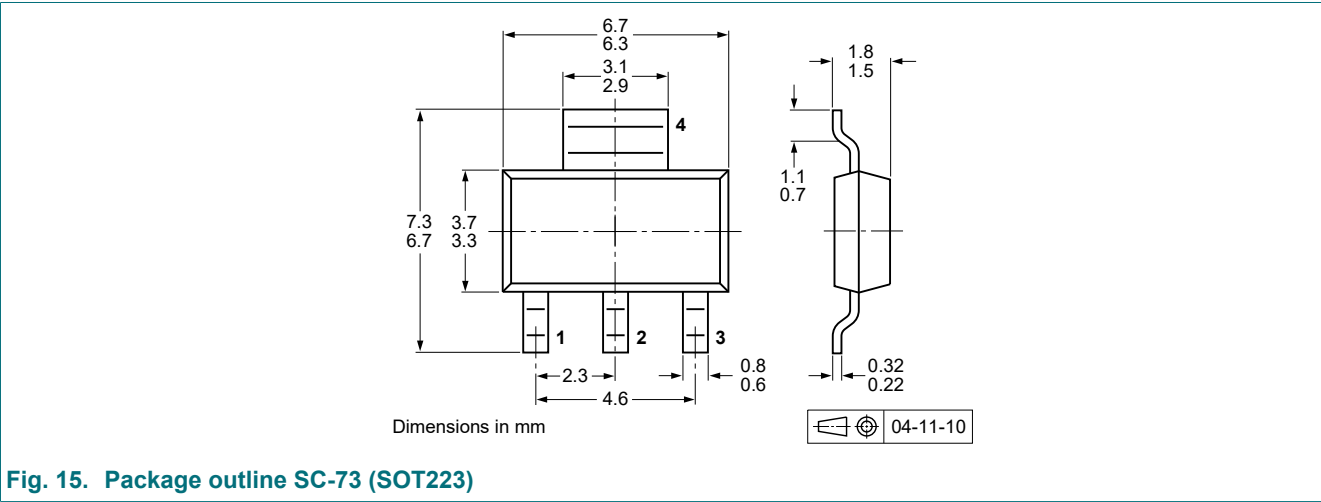


Fig. 14. Test circuit for switching times

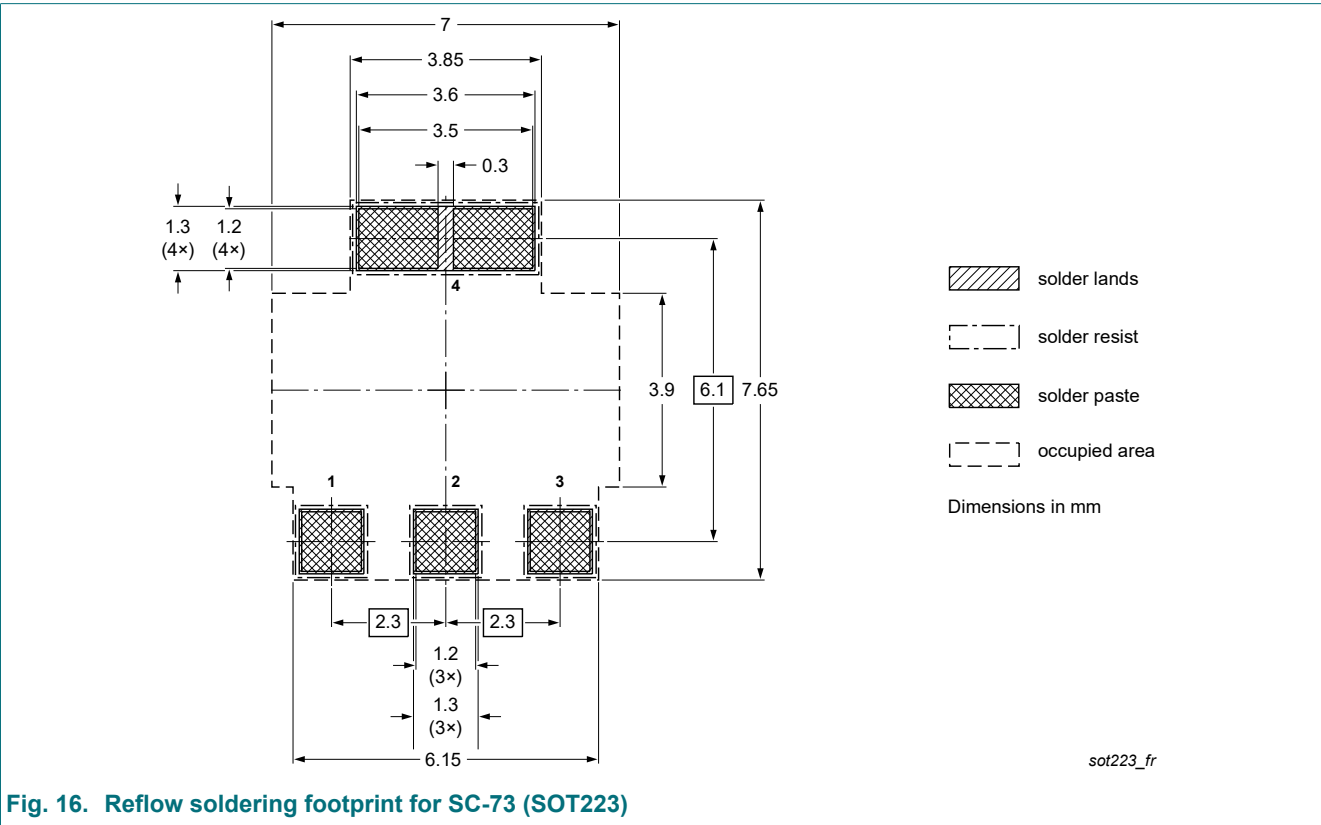
Quality information

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



13. Soldering



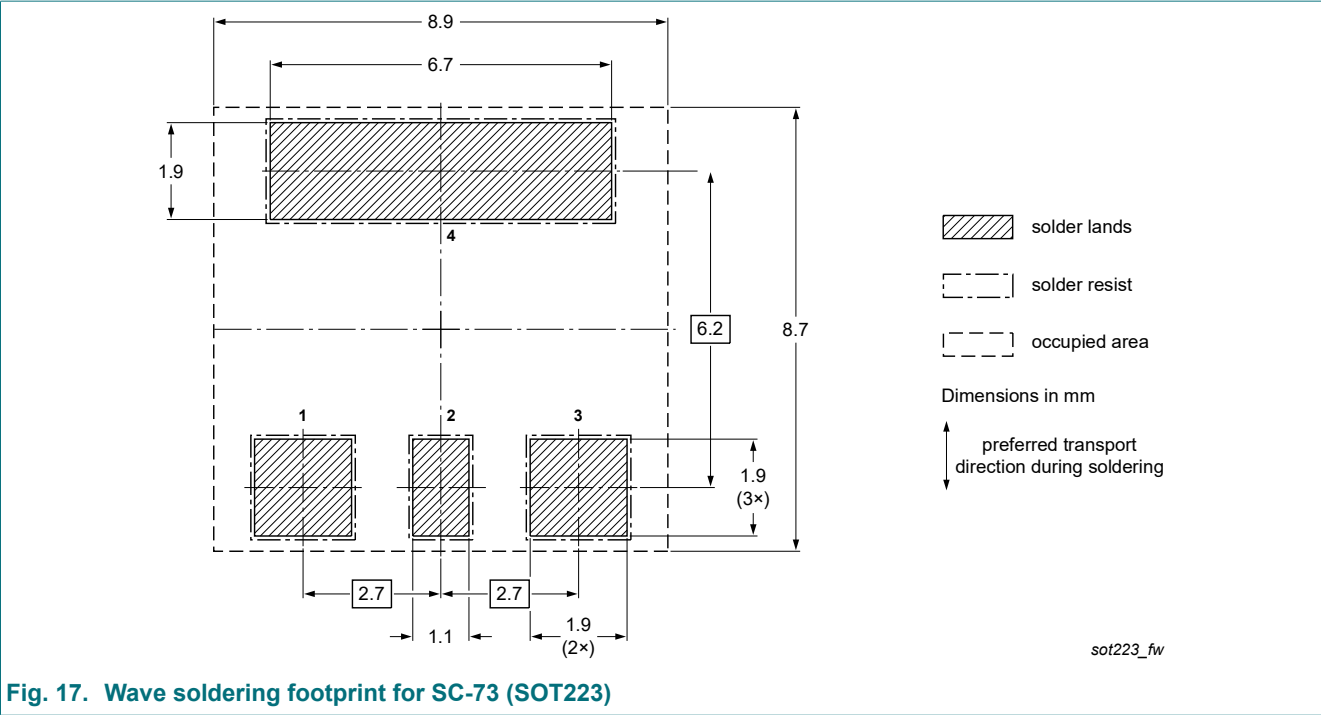


Fig. 17. Wave soldering footprint for SC-73 (SOT223)

14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|--------------|--------------------|---------------|------------|
| PBSS305NZ-Q v.1 | 20240829 | 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. |

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