

PBHV9050Z

500 V, 250 mA PNP high-voltage low V_{CEsat} (BISS) transistor

Rev. 1 — 19 August 2010

Product data sheet

1. Product profile

1.1 General description

PNP high-voltage low V_{CEsat} Breakthrough In Small Signal (BISS) transistor in a medium power SOT223 (SC-73) Surface-Mounted Device (SMD) plastic package.

1.2 Features and benefits

- High voltage
- 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
- AEC-Q101 qualified
- Medium power SMD plastic package

1.3 Applications

- Electronic ballasts
- LED driver for LED chain module
- LCD backlighting
- Automotive motor management
- Flyback converters
- Hook switch for wired telecom
- Switch Mode Power Supply (SMPS)

1.4 Quick reference data

Table 1. Quick reference data

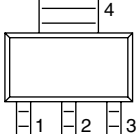
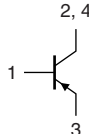
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------|--------------------------------|-------------------------------------|--------|-----|-------|------|
| V_{CESM} | collector-emitter peak voltage | $V_{BE} = 0$ | - | - | -500 | V |
| V_{CEO} | collector-emitter voltage | open base | - | - | -500 | V |
| I_C | collector current | | - | - | -0.25 | A |
| h_{FE} | DC current gain | $V_{CE} = -10$ V; $I_C = -50$ mA | [1] 80 | 160 | 300 | |

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



2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline | Graphic symbol |
|-----|-------------|---|---|
| 1 | base |  |  |
| 2 | collector | | |
| 3 | emitter | | |
| 4 | collector | | |

sym028

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|---|---------|
| | Name | Description | Version |
| PBHV9050Z | SC-73 | plastic surface-mounted package with increased heat sink; 4 leads | SOT223 |

4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBHV9050Z | V9050Z |

5. 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 | - | -500 | V |
| V_{CEO} | collector-emitter voltage | open base | - | -500 | V |
| V_{CESM} | collector-emitter peak voltage | $V_{BE} = 0$ | - | -500 | V |
| V_{EBO} | emitter-base voltage | open collector | - | -6 | V |
| I_C | collector current | | - | -0.25 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | -0.5 | A |
| I_{BM} | peak base current | single pulse; $t_p \leq 1$ ms | - | -200 | mA |

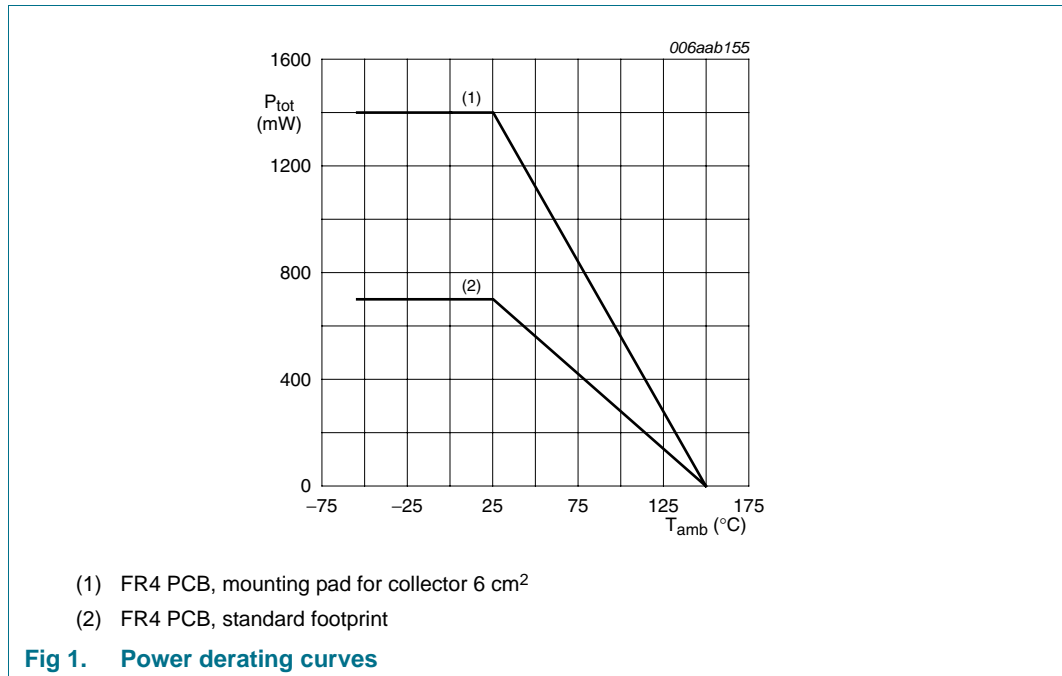
Table 5. Limiting values ...continued

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------|-----------------------------|-----|------|------|
| P_{tot} | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | [1] | 700 | mW |
| | | | [2] | 1400 | 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 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm².



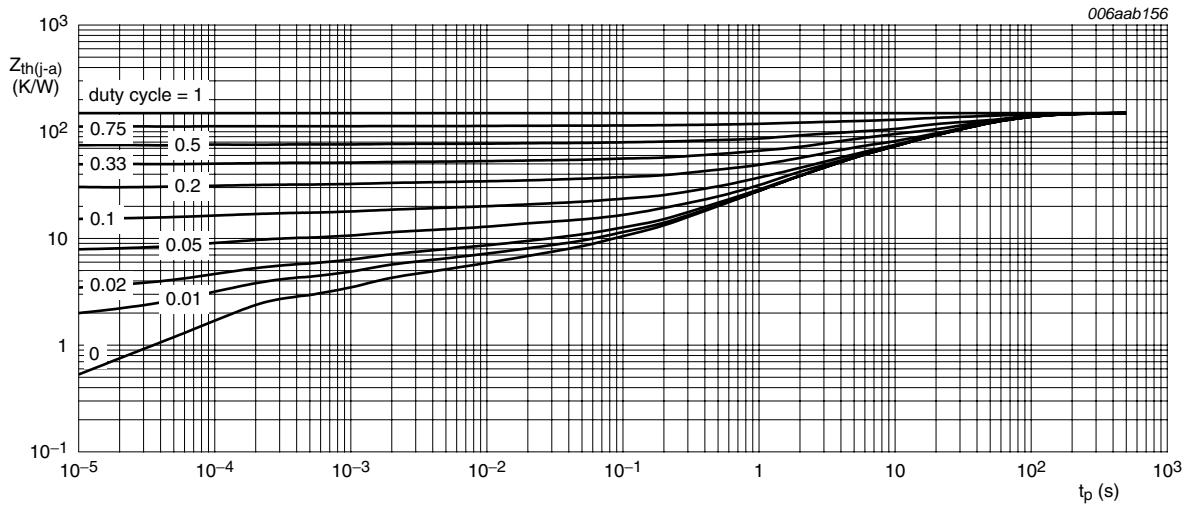
6. Thermal characteristics

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] | - | 175 | K/W |
| | | | [2] | - | 90 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | - | - | 20 | K/W |

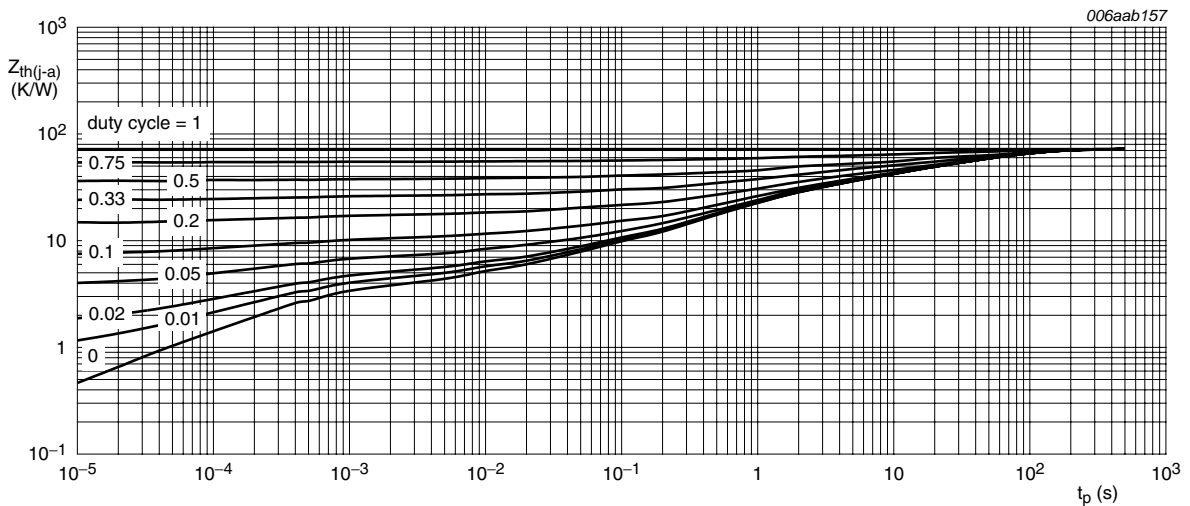
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm².



FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 6 cm²

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

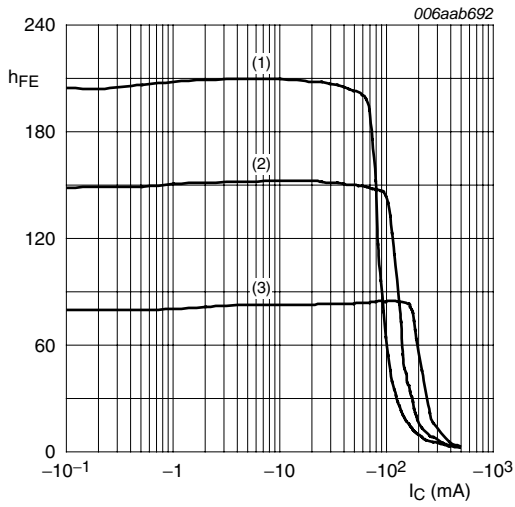
7. Characteristics

Table 7. Characteristics

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

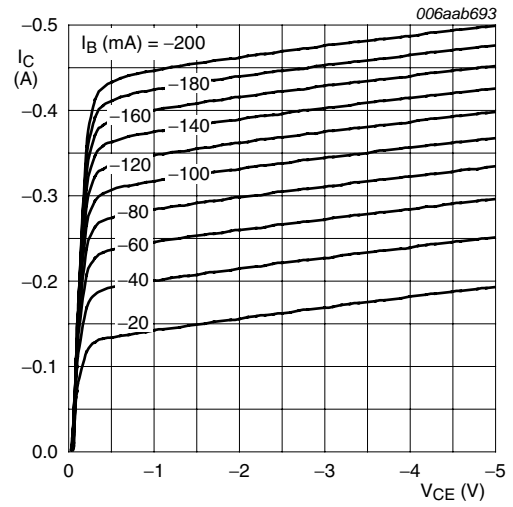
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|--------------------------------------|--|---------|-------|------|---------------|
| I_{CBO} | collector-base cut-off current | $V_{CB} = -360\text{ V}; I_E = 0\text{ A}$ | - | - | -100 | nA |
| | | $V_{CB} = -360\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | - | - | -10 | μA |
| I_{CES} | collector-emitter cut-off current | $V_{CE} = -360\text{ V}; V_{BE} = 0\text{ V}$ | - | - | -100 | nA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = -5\text{ V}; I_C = 0\text{ A}$ | - | - | -100 | nA |
| h_{FE} | DC current gain | $V_{CE} = -10\text{ V}$ | | | | |
| | | $I_C = -10\text{ mA}$ | [1] 100 | 160 | 300 | |
| | | $I_C = -50\text{ mA}$ | [1] 80 | 160 | 300 | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = -20\text{ mA}; I_B = -2\text{ mA}$ | [1] - | -115 | -200 | mV |
| | | $I_C = -50\text{ mA}; I_B = -10\text{ mA}$ | [1] - | -95 | -200 | mV |
| | | $I_C = -100\text{ mA}; I_B = -20\text{ mA}$ | [1] - | -140 | -350 | mV |
| V_{BEsat} | base-emitter saturation voltage | $I_C = -50\text{ mA}; I_B = -10\text{ mA}$ | [1] - | -0.75 | -0.9 | V |
| t_d | delay time | $V_{CC} = -20\text{ V}; I_C = -0.05\text{ A}; I_{Bon} = -5\text{ mA}; I_{Boff} = 10\text{ mA}$ | - | 75 | - | ns |
| t_r | rise time | | - | 1600 | - | ns |
| t_{on} | turn-on time | | - | 1675 | - | ns |
| t_s | storage time | | - | 1200 | - | ns |
| t_f | fall time | | - | 550 | - | ns |
| t_{off} | turn-off time | | - | 1750 | - | ns |
| f_T | transition frequency | $V_{CE} = -10\text{ V}; I_E = -10\text{ mA}; f = 100\text{ MHz}$ | - | 50 | - | MHz |
| C_c | collector capacitance | $V_{CB} = -20\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$ | - | 6 | - | pF |
| C_e | emitter capacitance | $V_{EB} = -0.5\text{ V}; I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$ | - | 170 | - | pF |

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



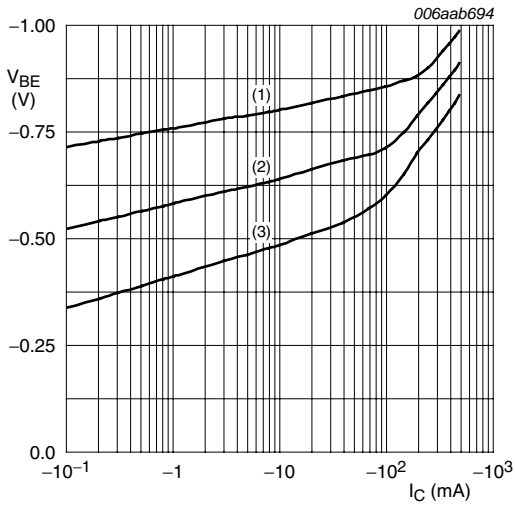
$V_{CE} = -10\text{ V}$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

Fig 4. DC current gain as a function of collector current; typical values



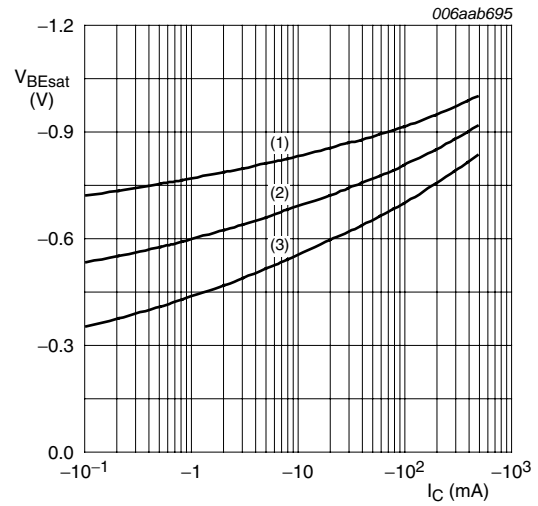
$T_{amb} = 25\text{ }^\circ\text{C}$

Fig 5. Collector current as a function of collector-emitter voltage; typical values



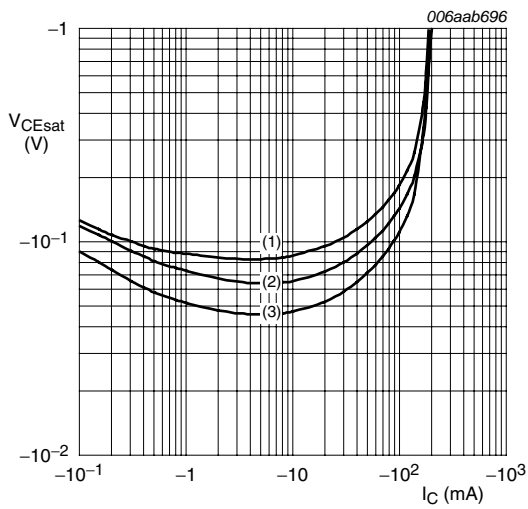
$V_{CE} = -10\text{ V}$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



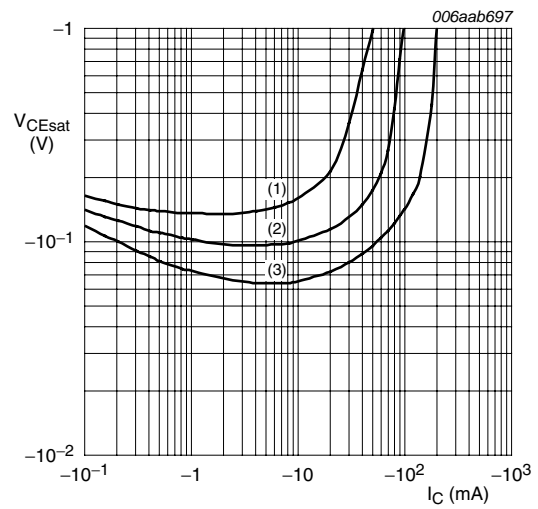
$I_C/I_B = 5$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



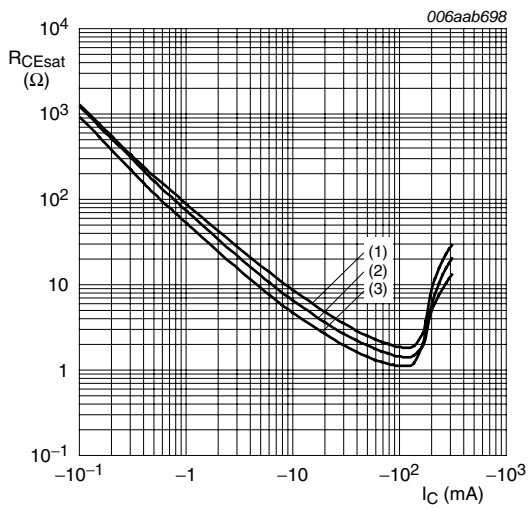
- $I_C/I_B = 5$
- (1) $T_{amb} = 100\text{ °C}$
 - (2) $T_{amb} = 25\text{ °C}$
 - (3) $T_{amb} = -55\text{ °C}$

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



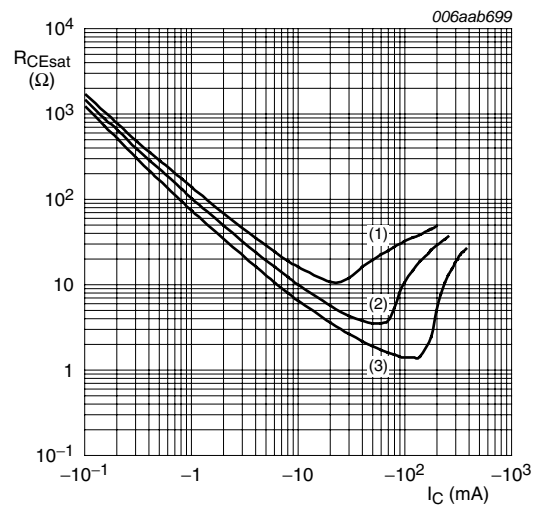
- $T_{amb} = 25\text{ °C}$
- (1) $I_C/I_B = 20$
 - (2) $I_C/I_B = 10$
 - (3) $I_C/I_B = 5$

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



- $I_C/I_B = 5$
- (1) $T_{amb} = 100\text{ °C}$
 - (2) $T_{amb} = 25\text{ °C}$
 - (3) $T_{amb} = -55\text{ °C}$

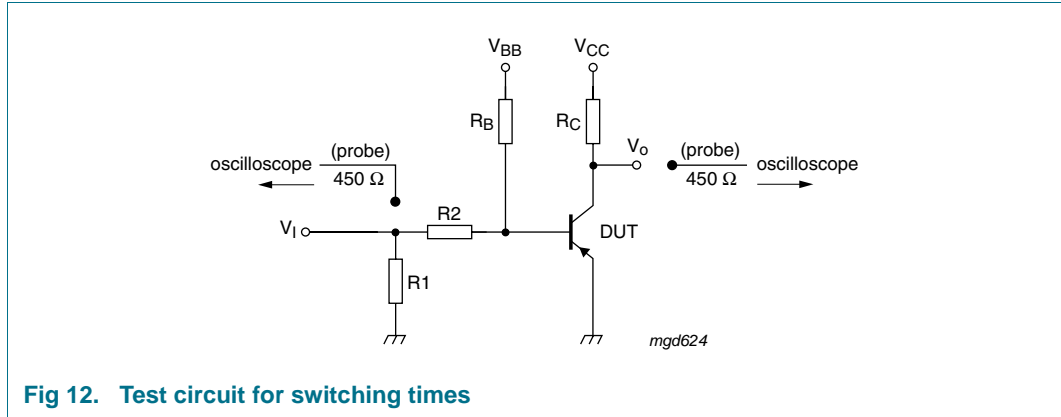
Fig 10. Collector-emitter saturation resistance as a function of collector current; typical values



- $T_{amb} = 25\text{ °C}$
- (1) $I_C/I_B = 20$
 - (2) $I_C/I_B = 10$
 - (3) $I_C/I_B = 5$

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

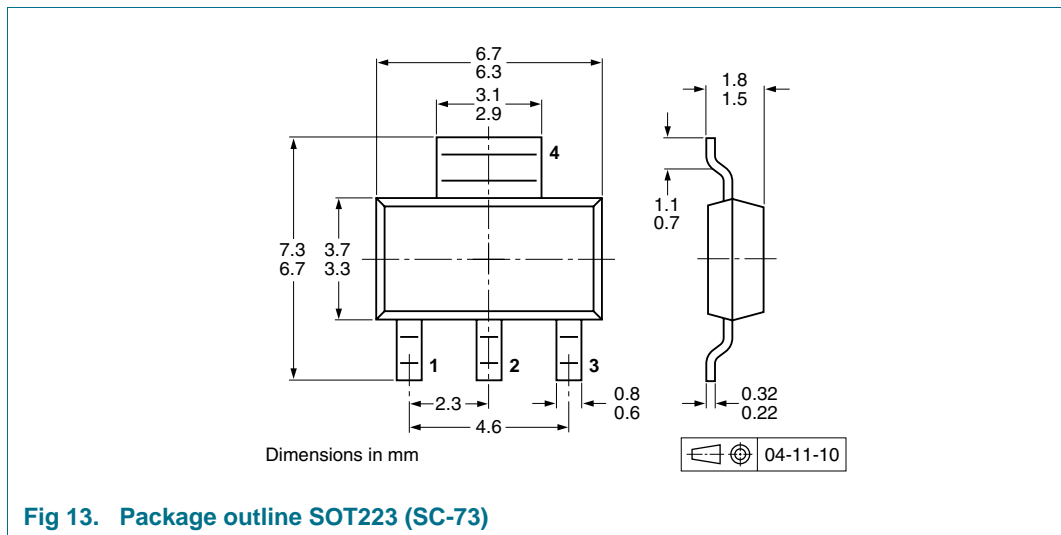
8. Test information



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



10. Packing information

Table 8. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.^[1]

| Type number | Package | Description | Packing quantity | |
|-------------|---------|---------------------------------|------------------|------|
| | | | 1000 | 4000 |
| PBHV9050Z | SOT223 | 8 mm pitch, 12 mm tape and reel | -115 | -135 |

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

11. Soldering

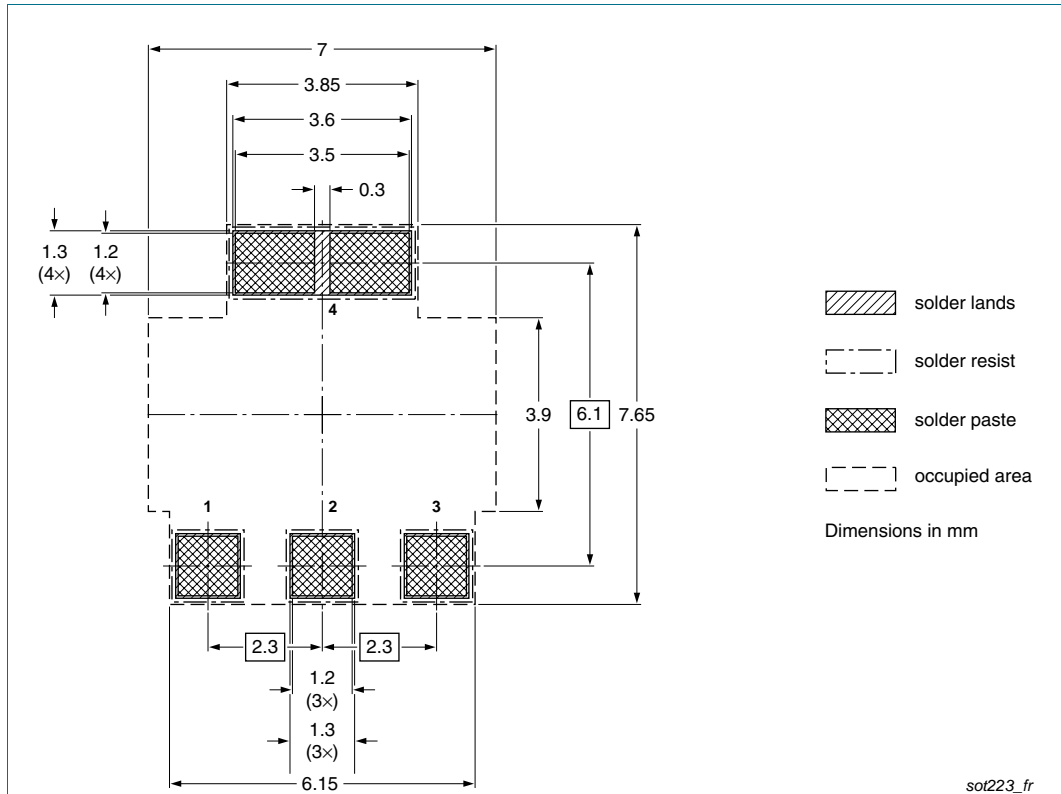


Fig 14. Reflow soldering footprint SOT223 (SC-73)

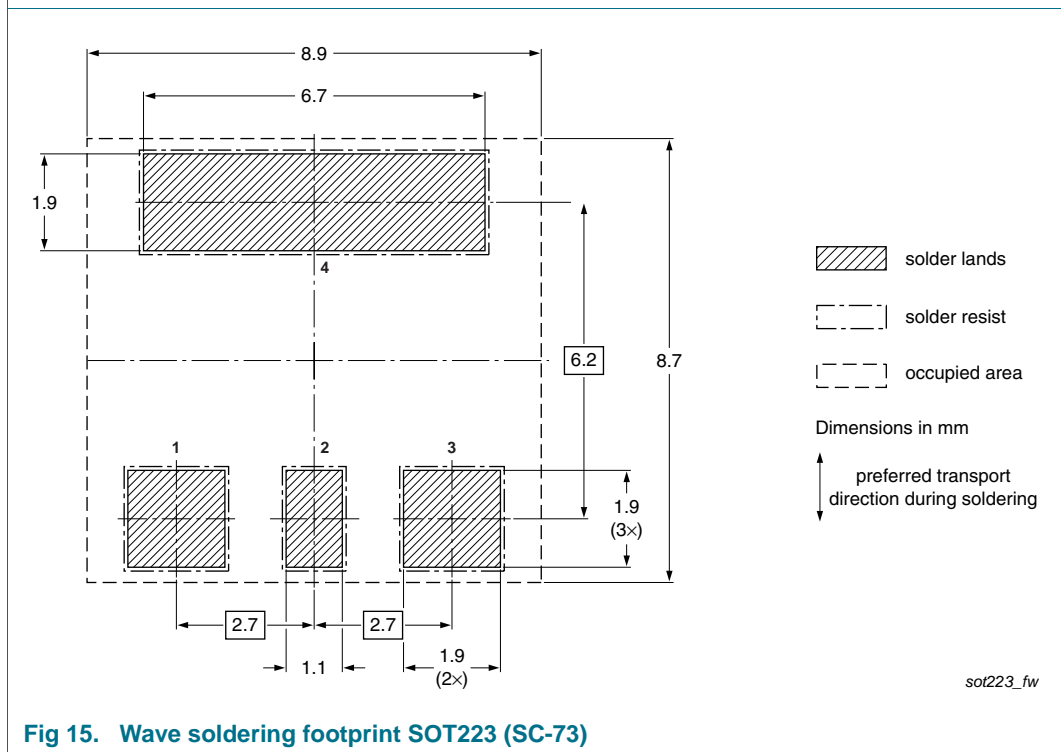


Fig 15. Wave soldering footprint SOT223 (SC-73)

12. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PBHV9050Z v.1 | 20100819 | Product data sheet | - | - |

13. Legal information

13.1 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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