



PBHV8540Z

500 V, 0.5 A NPN high-voltage low V_{CEsat} (BISS) transistor

Rev. 01 — 7 February 2008

Product data sheet

1. Product profile

1.1 General description

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

PNP complement: PBHV9040Z.

1.2 Features

- 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

1.3 Applications

- Electronic ballast for fluorescent lighting
- LED driver for LED chain module
- LCD backlighting
- High Intensity Discharge (HID) front lighting
- Automotive motor management
- Hook switch for wired telecom
- Switch mode power supply

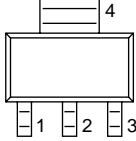
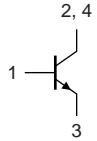
1.4 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------|--------------------------------|--|-----|-----|-----|------|
| V_{CESM} | collector-emitter peak voltage | $V_{BE} = 0\text{ V}$ | - | - | 500 | V |
| V_{CEO} | collector-emitter voltage | open base | - | - | 400 | V |
| I_C | collector current | | - | - | 0.5 | A |
| h_{FE} | DC current gain | $V_{CE} = 10\text{ V}; I_C = 50\text{ mA}$ | 100 | - | - | |

2. Pinning information

Table 2. Pinning

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

sym016

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|--|---------|
| | Name | Description | Version |
| PBHV8540Z | SC-73 | plastic surface-mounted package with increased heatsink; 4 leads | SOT223 |

4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBHV8540Z | V8540Z |

5. Limiting values

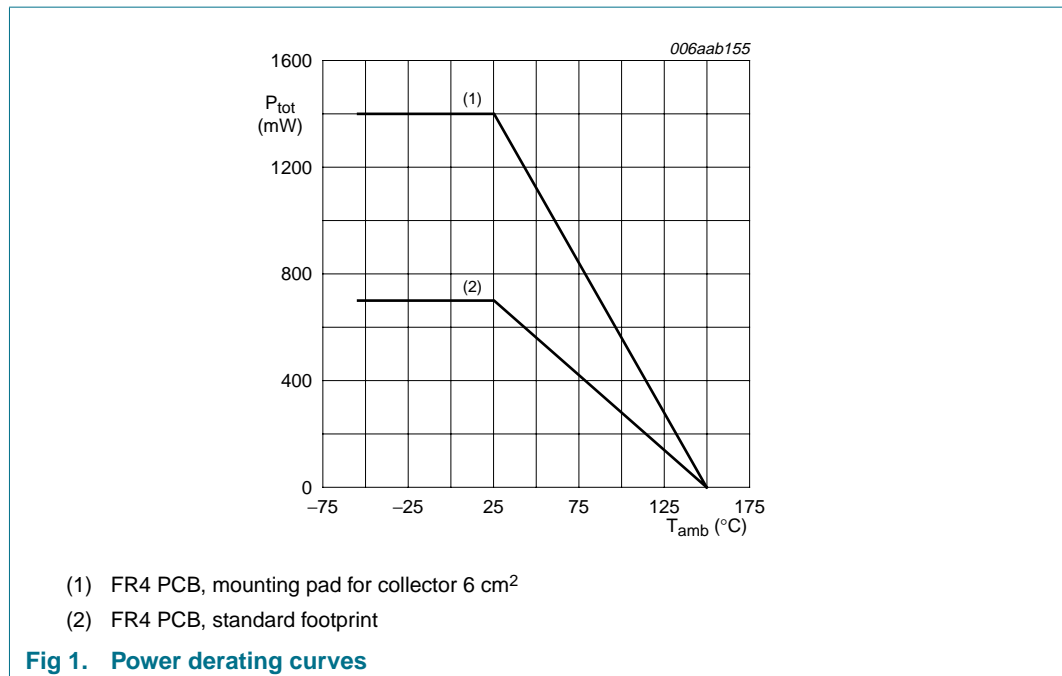
Table 5. Limiting values

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 | - | 400 | V |
| V_{CESM} | collector-emitter peak voltage | $V_{BE} = 0$ V | - | 500 | V |
| V_{EBO} | emitter-base voltage | open collector | - | 6 | V |
| I_C | collector current | | - | 0.5 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | 1 | A |
| I_{BM} | peak base current | single pulse; $t_p \leq 1$ ms | - | 200 | mA |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | [1] | 0.7 | W |
| | | | [2] | 1.4 | 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 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] | - | - | 89 | 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.

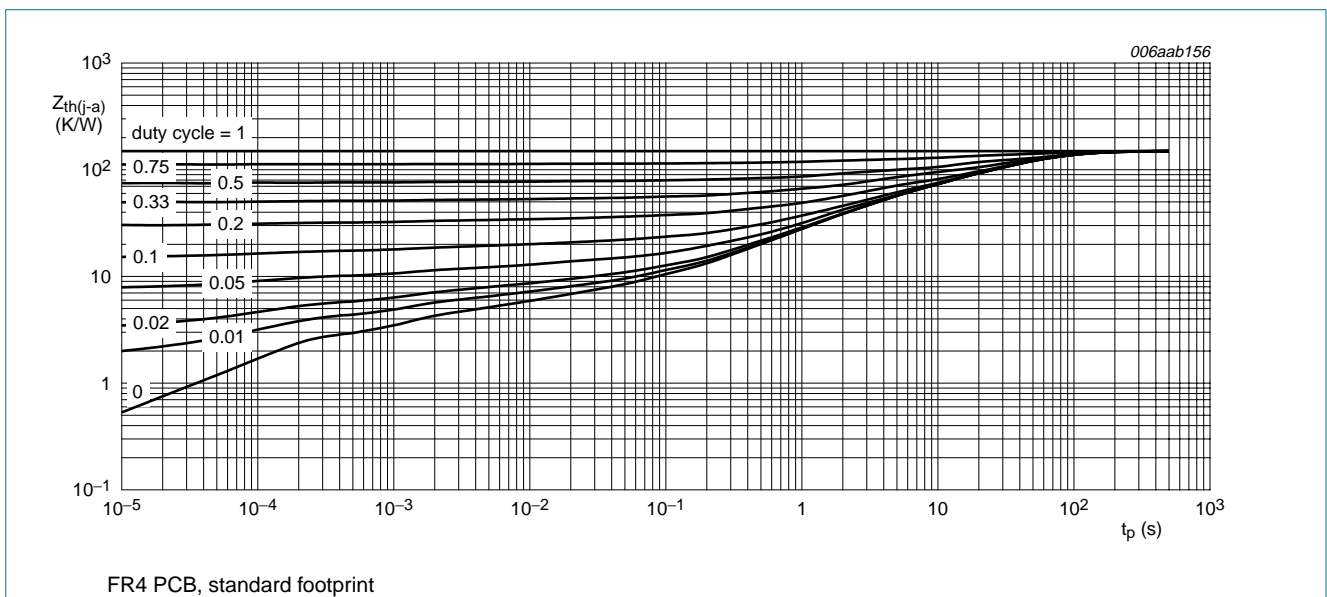


Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

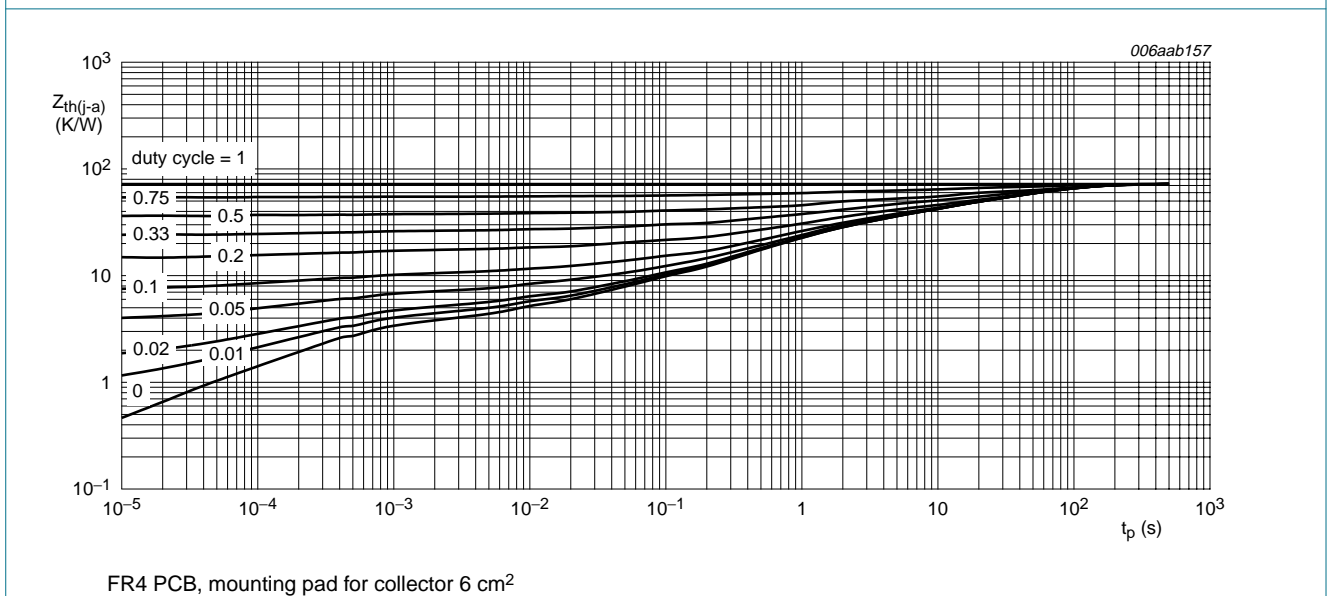


Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

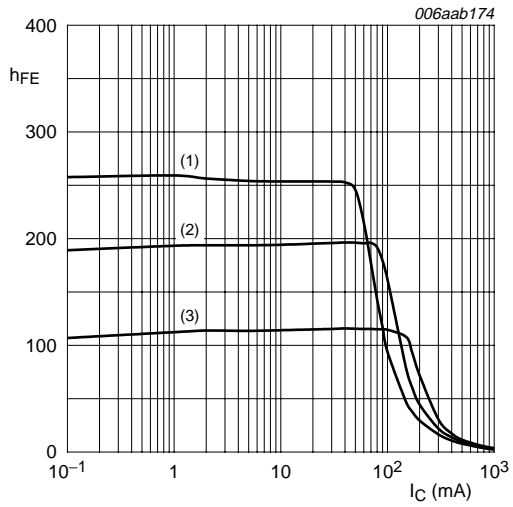
7. Characteristics

Table 7. Characteristics

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

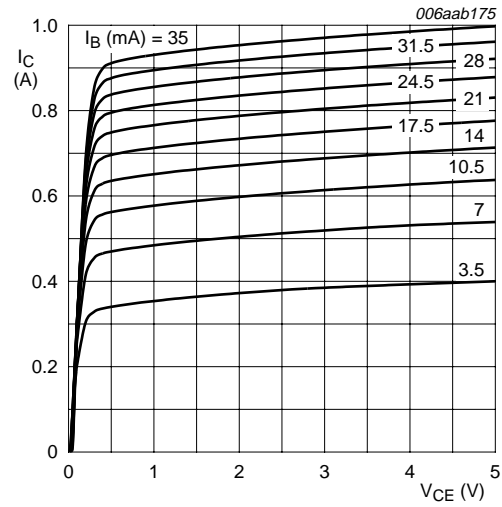
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|--------------------------------------|---|--------|------|-----|---------------|
| I_{CBO} | collector-base cut-off current | $V_{CB} = 320\text{ V}; I_E = 0\text{ A}$ | - | - | 100 | nA |
| | | $V_{CB} = 320\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | - | - | 10 | μA |
| I_{CES} | collector-emitter cut-off current | $V_{CE} = 320\text{ V}; I_C = 0\text{ A}$ | - | - | 100 | nA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 4\text{ V}; I_C = 0\text{ A}$ | - | - | 100 | nA |
| h_{FE} | DC current gain | $V_{CE} = 10\text{ V}$ | | | | |
| | | $I_C = 50\text{ mA}$ | 100 | 200 | - | |
| | | $I_C = 100\text{ mA}$ | 80 | 150 | - | |
| | | $I_C = 300\text{ mA}$ | [1] 10 | 20 | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 100\text{ mA}; I_B = 10\text{ mA}$ | - | 100 | 200 | mV |
| | | $I_C = 100\text{ mA}; I_B = 20\text{ mA}$ | - | 60 | 90 | mV |
| | | $I_C = 300\text{ mA}; I_B = 60\text{ mA}$ | - | 135 | 250 | mV |
| V_{BEsat} | base-emitter saturation voltage | $I_C = 300\text{ mA}; I_B = 60\text{ mA}$ | [1] - | 0.91 | 1.1 | V |
| f_T | transition frequency | $V_{CE} = 10\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}$ | - | 30 | - | MHz |
| C_c | collector capacitance | $V_{CB} = 20\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$ | - | 4 | - | pF |
| C_e | emitter capacitance | $V_{EB} = 0.5\text{ V}; I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$ | - | 165 | - | pF |
| t_d | delay time | $V_{CC} = 6\text{ V}; I_C = 0.5\text{ A}; I_{Bon} = 0.1\text{ A}; I_{Boff} = -0.1\text{ A}$ | - | 50 | - | ns |
| t_r | rise time | | - | 6200 | - | ns |
| t_{on} | turn-on time | | - | 6250 | - | ns |
| t_s | storage time | | - | 800 | - | ns |
| t_f | fall time | | - | 2200 | - | ns |
| t_{off} | turn-off time | | - | 3000 | - | ns |

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



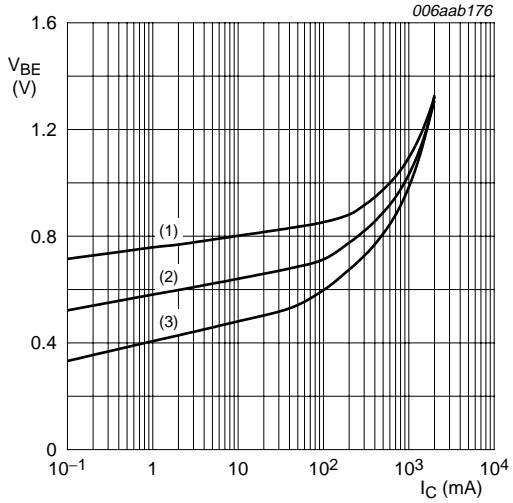
$V_{CE} = 10\text{ V}$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

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



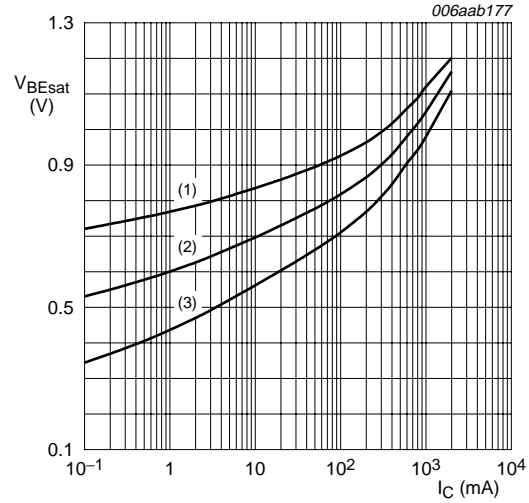
$T_{amb} = 25\text{ }^\circ\text{C}$

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



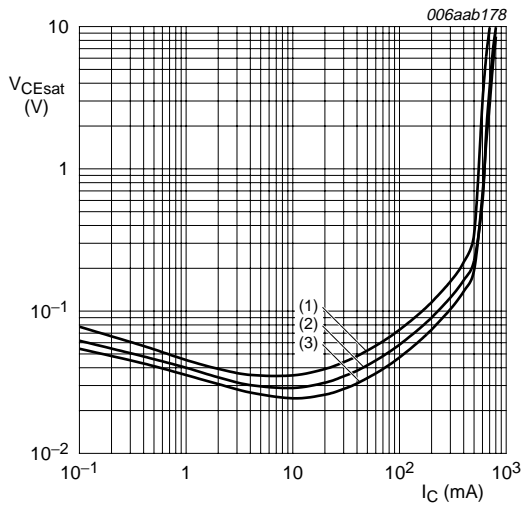
$V_{CE} = 10\text{ V}$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



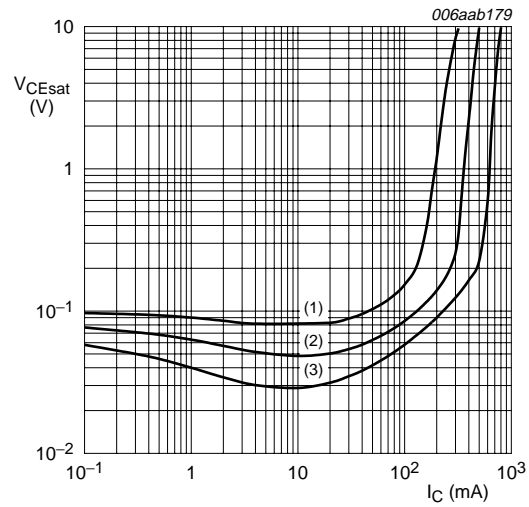
$I_C/I_B = 5$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



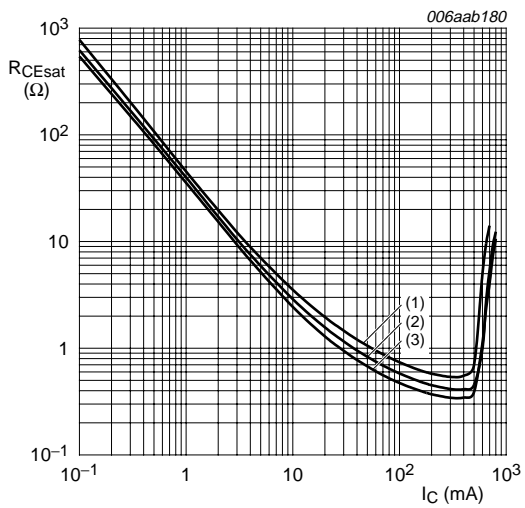
- $I_C/I_B = 5$
- (1) $T_{amb} = 100\text{ °C}$
 - (2) $T_{amb} = 25\text{ °C}$
 - (3) $T_{amb} = -55\text{ °C}$

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



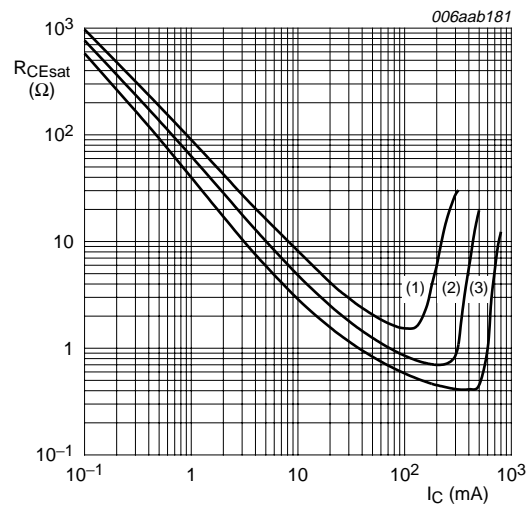
- $T_{amb} = 25\text{ °C}$
- (1) $I_C/I_B = 20$
 - (2) $I_C/I_B = 10$
 - (3) $I_C/I_B = 5$

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) $T_{amb} = -55\text{ °C}$

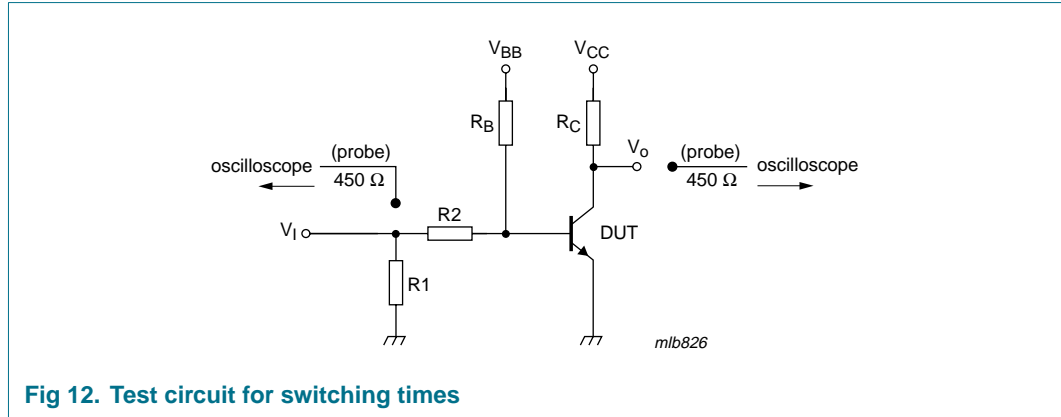
Fig 10. Collector-emitter saturation resistance as a function of collector current; typical values



- $T_{amb} = 25\text{ °C}$
- (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

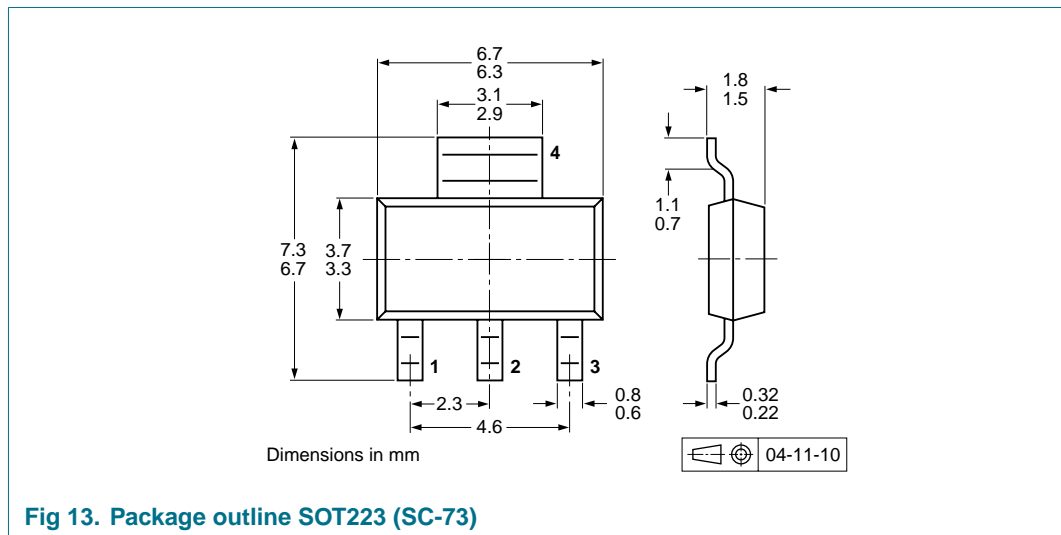
8. Test information



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 |
| PBHV8540Z | 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

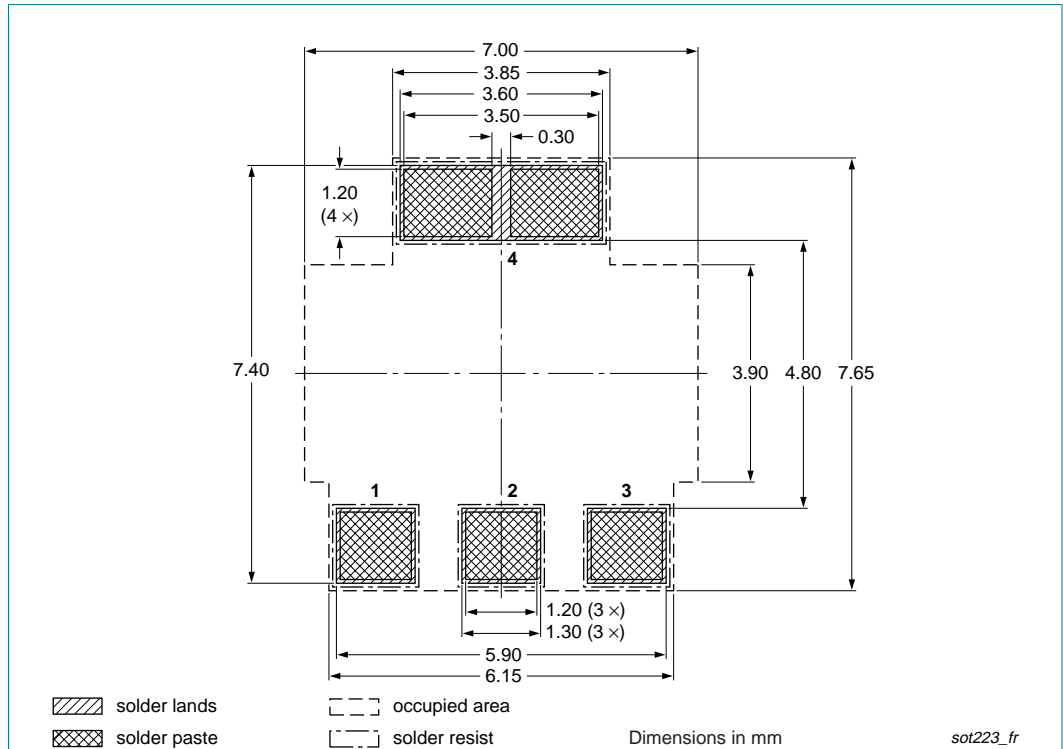


Fig 14. Reflow soldering footprint SOT223 (SC-73)

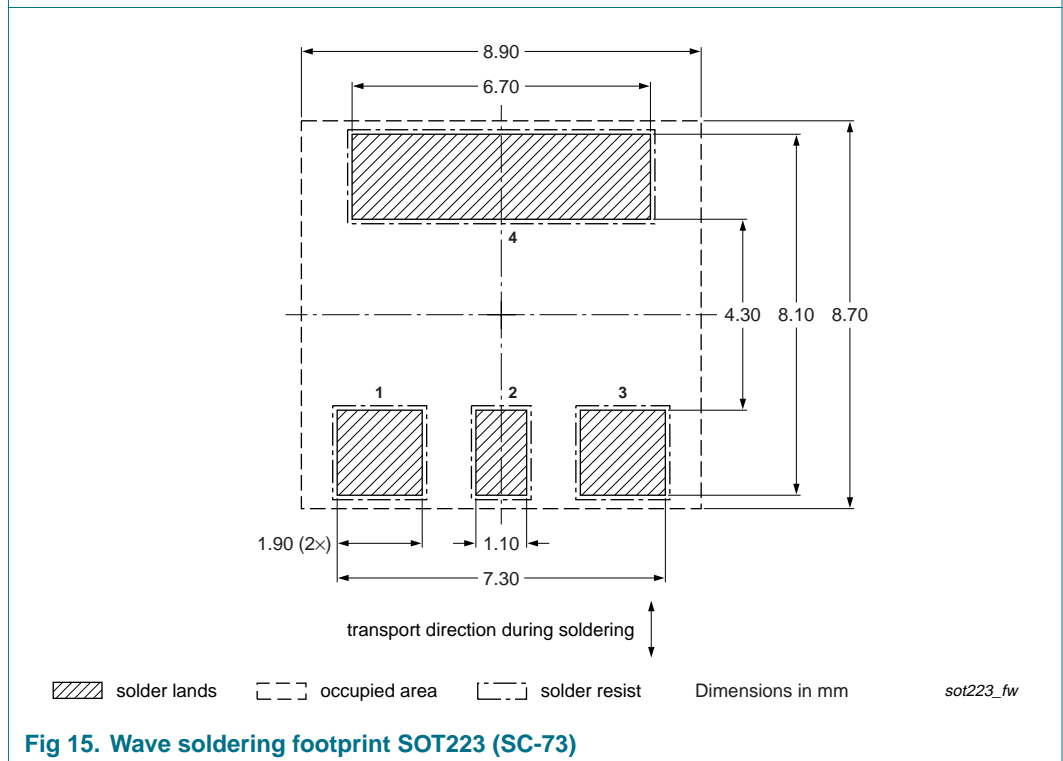


Fig 15. Wave soldering footprint SOT223 (SC-73)

12. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| PBHV8540Z_1 | 20080207 | 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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