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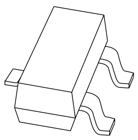


# PBHV8540T

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

Rev. 02 — 14 January 2009 | Product data sheet

## 1. Product profile

### 1.1 General description

NPN high-voltage low $V_{CEsat}$ Breakthrough In Small Signal (BISS) transistor in a SOT23 (TO-236AB) small Surface-Mounted Device (SMD) plastic package.

PNP complement: PBHV9040T.

### 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

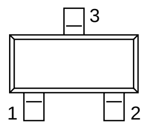
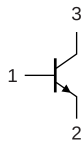
### 1.4 Quick reference data

**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CESM}$ | collector-emitter peak voltage | $V_{BE}$ = 0 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 V; $I_C$ = 50 mA | 100 | 200 | - | |

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| 1 | base |   |   sym021 |
| 2 | emitter | | |
| 3 | collector | | |

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PBHV8540T | - | plastic surface-mounted package; 3 leads | SOT23 |

## 4. Marking

**Table 4. Marking codes**

| Type number | Marking code[1] |
|---|---|
| PBHV8540T | W4* |

[1] * = -: made in Hong Kong
* = p: made in Hong Kong
* = t: made in Malaysia
* = W: made in China

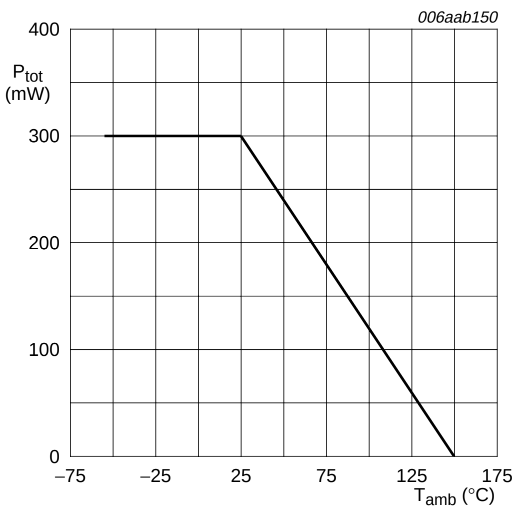
# 5. Limiting values

**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] | - | 300 | 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.




FR4 PCB, standard footprint

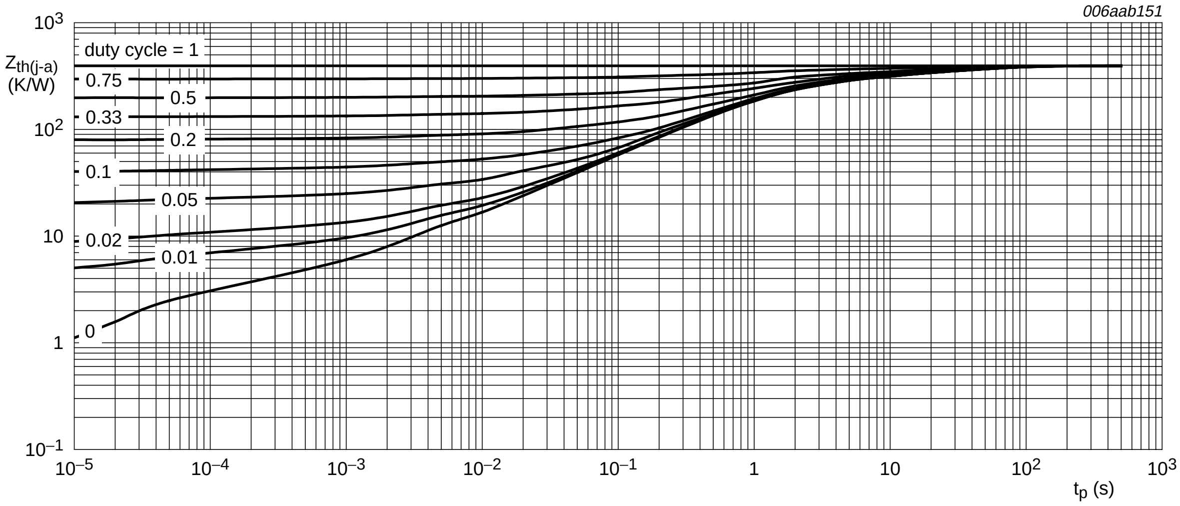
**Fig 1. Power derating curve**

## 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] | - | - | 417 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | - | 70 | K/W |

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




FR4 PCB, standard footprint

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

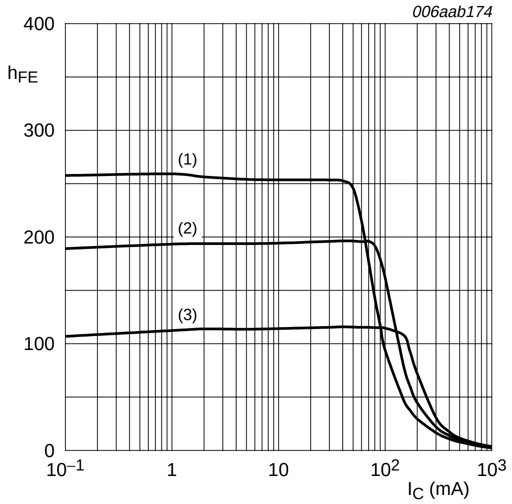
## 7. Characteristics

**Table 7. Characteristics**

*$T_{amb}$ = 25 °C unless otherwise specified.*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = 320 V; $I_E$ = 0 A | | - | - | 100 | nA |
| | | $V_{CB}$ = 320 V; $I_E$ = 0 A; $T_j$ = 150 °C | | - | - | 10 | µA |
| $I_{CES}$ | collector-emitter cut-off current | $V_{CE}$ = 320 V; $I_C$ = 0 A | | - | - | 100 | nA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = 4 V; $I_C$ = 0 A | | - | - | 100 | nA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 10 V | | | | | |
| | | $I_C$ = 50 mA | | 100 | 200 | - | |
| | | $I_C$ = 100 mA | | 80 | 150 | - | |
| | | $I_C$ = 300 mA | [1] | 10 | 20 | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 100 mA; $I_B$ = 10 mA | | - | 100 | 200 | mV |
| | | $I_C$ = 100 mA; $I_B$ = 20 mA | | - | 60 | 90 | mV |
| | | $I_C$ = 300 mA; $I_B$ = 60 mA | | - | 135 | 250 | mV |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = 300 mA; $I_B$ = 60 mA | [1] | - | 0.91 | 1.1 | V |
| $f_T$ | transition frequency | $V_{CE}$ = 10 V; $I_C$ = 100 mA; f = 100 MHz | | - | 30 | - | MHz |
| $C_c$ | collector capacitance | $V_{CB}$ = 20 V; $I_E$ = $i_e$ = 0 A; f = 1 MHz | | - | 4 | - | pF |
| $C_e$ | emitter capacitance | $V_{EB}$ = 0.5 V; $I_C$ = $i_c$ = 0 A; f = 1 MHz | | - | 165 | - | pF |
| $t_d$ | delay time | $V_{CC}$ = 6 V; $I_C$ = 0.5 A; $I_{Bon}$ = 0.1 A; $I_{Boff}$ = –0.1 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: $t_p \leq 300$ µs; $\delta \leq 0.02$.



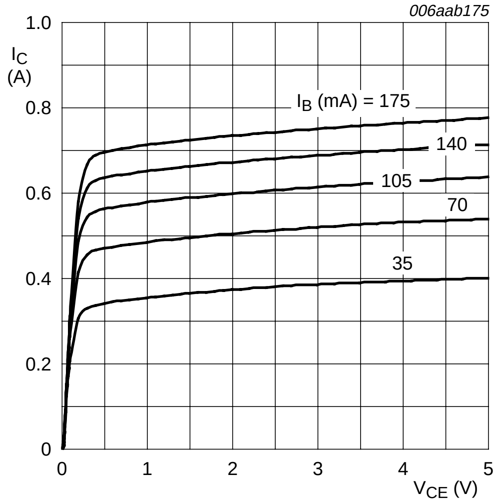

$V_{CE}$ = 10 V

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

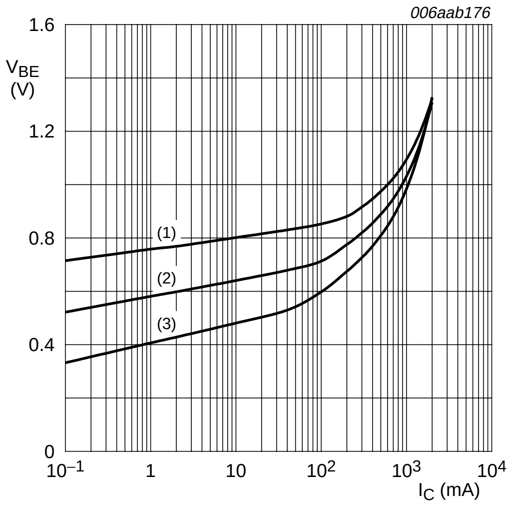
(3) $T_{amb}$ = −55 °C

**Fig 3. DC current gain as a function of collector current; typical values**




$T_{amb}$ = 25 °C

**Fig 4. Collector current as a function of collector-emitter voltage; typical values**



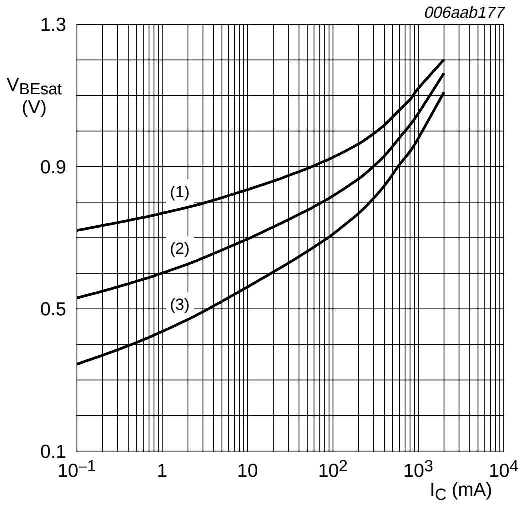

$V_{CE}$ = 10 V

(1) $T_{amb}$ = −55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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



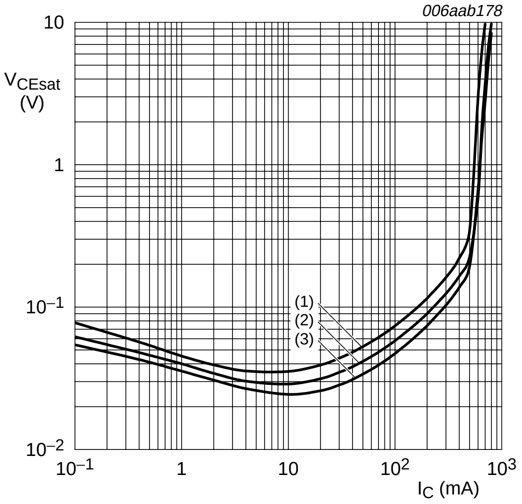

$I_C/I_B$ = 5

(1) $T_{amb}$ = −55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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



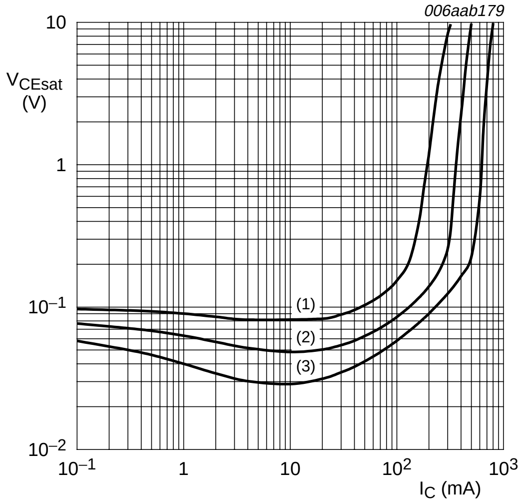

$I_C/I_B = 5$

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −55 °C

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



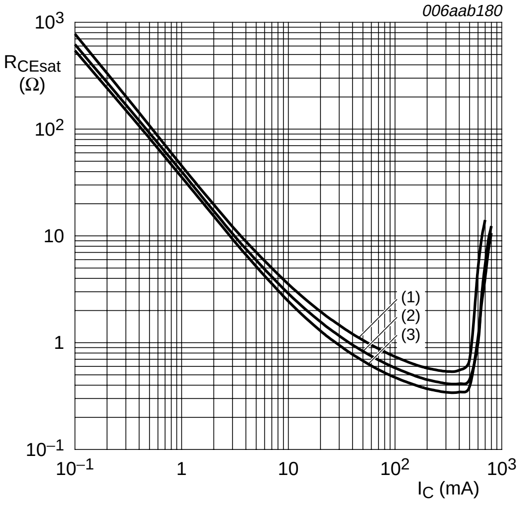

$T_{amb}$ = 25 °C

(1) $I_C/I_B = 20$

(2) $I_C/I_B = 10$

(3) $I_C/I_B = 5$

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



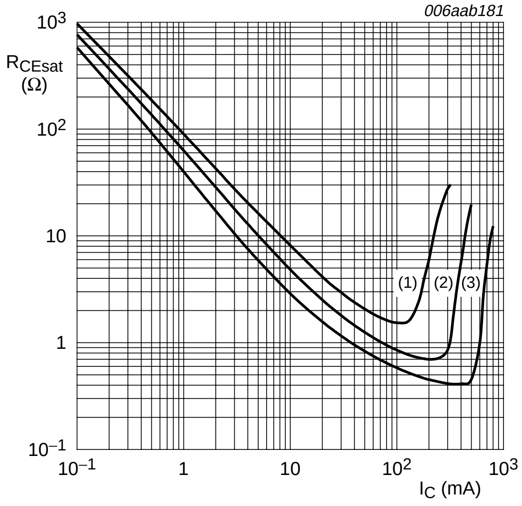

$I_C/I_B = 5$

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −55 °C

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




$T_{amb}$ = 25 °C

(1) $I_C/I_B = 20$

(2) $I_C/I_B = 10$

(3) $I_C/I_B = 5$

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

# 8. Test information

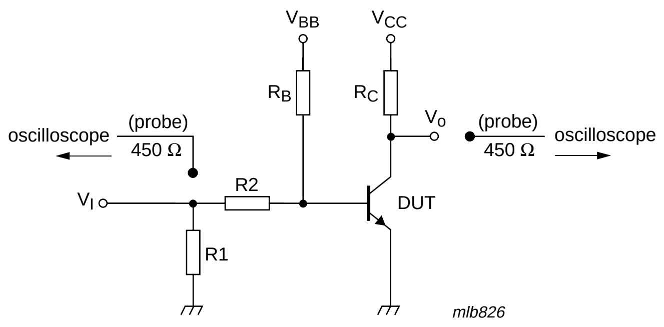



**Fig 11. Test circuit for switching times**

## 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

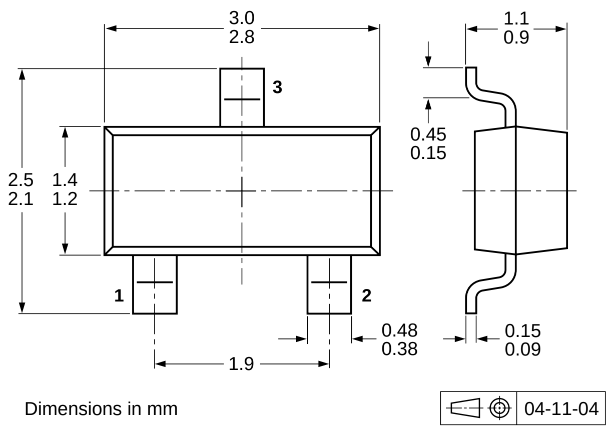



**Fig 12. Package outline SOT23 (TO-236AB)**

# 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 | |
|---|---|---|---|---|
| | | | 3000 | 10000 |
| PBHV8540T | SOT23 | 4 mm pitch, 8 mm tape and reel | -215 | -235 |

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

## 11. Soldering

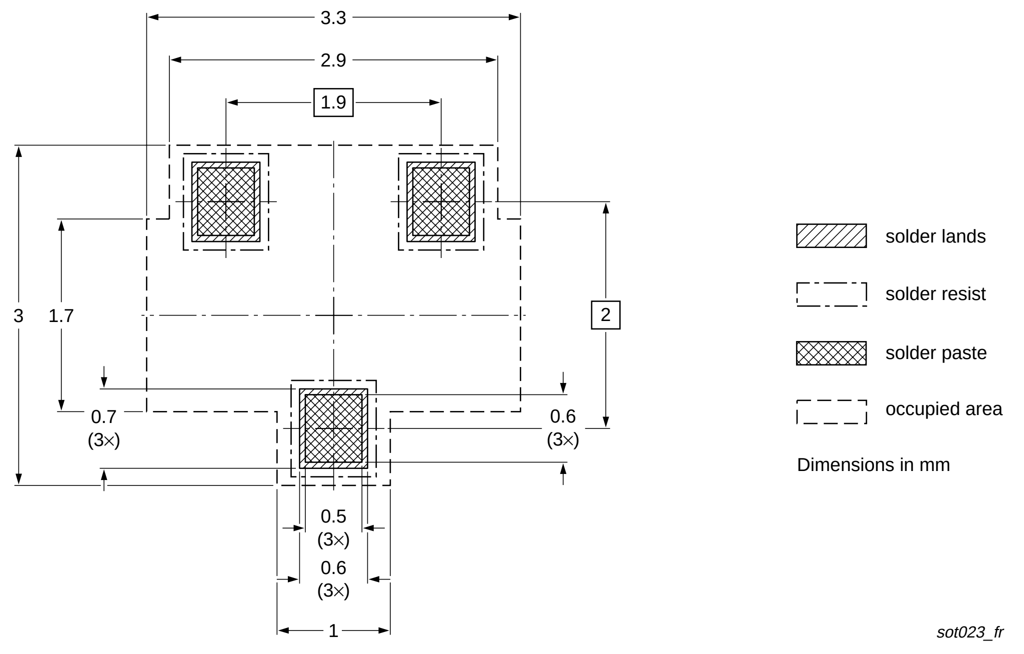



**Fig 13. Reflow soldering footprint SOT23 (TO-236AB)**

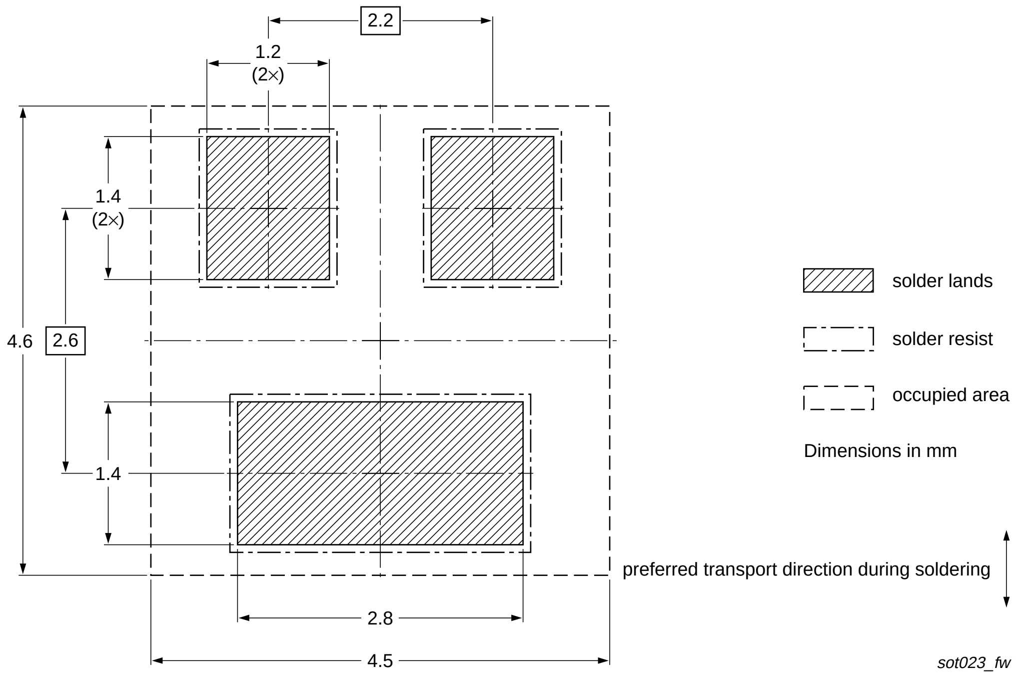



**Fig 14. Wave soldering footprint SOT23 (TO-236AB)**

## 12. Revision history

**Table 9. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PBHV8540T_2 | 20090114 | Product data sheet | - | PBHV8540T_1 |
| Modifications: | • Figure 4: amended<br>• Section 13 “Legal information”: updated | | | |
| PBHV8540T_1 | 20080205 | 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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## 15. Contents





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Document identifier: PBHV8540T_2