# BAV99 series

## High-speed switching diodes

Rev. 8 — 18 November 2010 Product data sheet

## 1. Product profile

### 1.1 General description

High-speed switching diodes, encapsulated in small Surface-Mounted Device (SMD) plastic packages.

**Table 1. Product overview**

| Type number | Package | | | Configuration | Package configuration |
|---|---|---|---|---|---|
| | NXP | JEITA | JEDEC | | |
| BAV99 | SOT23 | - | TO-236AB | dual series | small |
| BAV99S | SOT363 | SC-88 | - | quadruple; 2 series | very small |
| BAV99W | SOT323 | SC-70 | - | dual series | very small |

### 1.2 Features and benefits

- High switching speed: $t_{rr} \leq 4$ ns
- Low leakage current
- Small SMD plastic packages
- Low capacitance: $C_d \leq 1.5$ pF
- Reverse voltage: $V_R \leq 100$ V
- AEC-Q101 qualified

### 1.3 Applications

- High-speed switching
- General-purpose switching
- Reverse polarity protection

### 1.4 Quick reference data

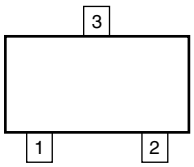
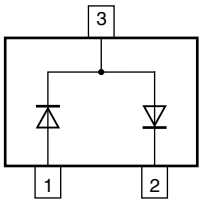
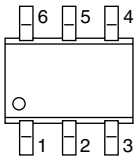
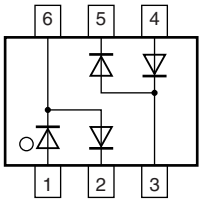
**Table 2. Quick reference data**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Per diode** | | | | | | |
| $I_R$ | reverse current | $V_R = 80$ V | - | - | 0.5 | μA |
| $V_R$ | reverse voltage | | - | - | 100 | V |
| $t_{rr}$ | reverse recovery time | [1] | - | - | 4 | ns |

[1] When switched from $I_F = 10$ mA to $I_R = 10$ mA; $R_L = 100\ \Omega$; measured at $I_R = 1$ mA.

## 2. Pinning information

**Table 3. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| **BAV99; BAV99W** | | | |
| 1 | anode (diode 1) |  006aaa144 |  006aaa763 |
| 2 | cathode (diode 2) | | |
| 3 | cathode (diode 1), anode (diode 2) | | |
| **BAV99S** | | | |
| 1 | anode (diode 1) |  |  006aab101 |
| 2 | cathode (diode 2) | | |
| 3 | cathode (diode 3), anode (diode 4) | | |
| 4 | anode (diode 3) | | |
| 5 | cathode (diode 4) | | |
| 6 | cathode (diode 1), anode (diode 2) | | |

## 3. Ordering information

**Table 4. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BAV99 | - | plastic surface-mounted package; 3 leads | SOT23 |
| BAV99S | SC-88 | plastic surface-mounted package; 6 leads | SOT363 |
| BAV99W | SC-70 | plastic surface-mounted package; 3 leads | SOT323 |

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code[1] |
|---|---|
| BAV99 | A7* |
| BAV99S | K1* |
| BAV99W | A7* |

[1] * = placeholder for manufacturing site code


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## 5. Limiting values

**Table 6. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| **Per diode** | | | | | | |
| $V_{RRM}$ | repetitive peak reverse voltage | | | - | 100 | V |
| $V_R$ | reverse voltage | | | - | 100 | V |
| $I_F$ | forward current | | | | | |
| | BAV99 | | [1] | - | 215 | mA |
| | | | [2] | - | 125 | mA |
| | BAV99S | | [1] | - | 200 | mA |
| | BAV99W | | [1] | - | 150 | mA |
| | | | [2] | - | 130 | mA |
| $I_{FRM}$ | repetitive peak forward current | | | - | 500 | mA |
| $I_{FSM}$ | non-repetitive peak forward current | square wave | [3] | | | |
| | | $t_p$ = 1 μs | | - | 4 | A |
| | | $t_p$ = 1 ms | | - | 1 | A |
| | | $t_p$ = 1 s | | - | 0.5 | A |
| $P_{tot}$ | total power dissipation | | [1][4] | | | |
| | BAV99 | $T_{amb} \leq 25$ °C | | - | 250 | mW |
| | BAV99S | $T_{sp} \leq 85$ °C | [5] | - | 250 | mW |
| | BAV99W | $T_{amb} \leq 25$ °C | | - | 200 | mW |
| **Per device** | | | | | | |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | | −65 | +150 | °C |
| $T_{stg}$ | storage temperature | | | −65 | +150 | °C |

[1] Single diode loaded.

[2] Double diode loaded.

[3] $T_j$ = 25 °C prior to surge.

[4] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[5] Soldering points at pins 2, 3, 5 and 6.


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## 6. Thermal characteristics

**Table 7. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1][2] | | | | |
| | BAV99 | | | - | - | 500 | K/W |
| | BAV99W | | | - | - | 625 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | | | | |
| | BAV99 | | | - | - | 360 | K/W |
| | BAV99S | | [3] | - | - | 260 | K/W |
| | BAV99W | | | - | - | 300 | K/W |

[1] Single diode loaded.

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

[3] Soldering points at pins 2, 3, 5 and 6.

## 7. Characteristics

**Table 8. Characteristics**

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

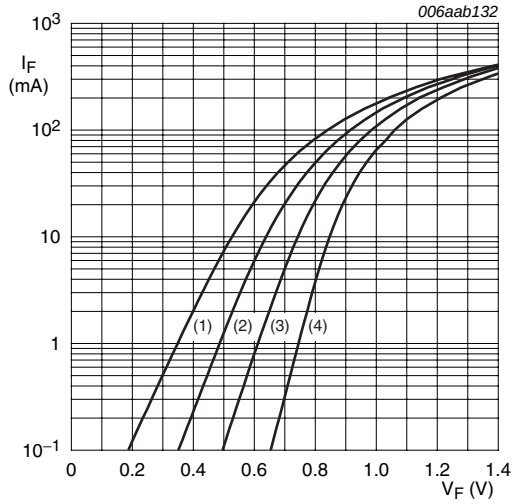
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Per diode** | | | | | | | |
| $V_F$ | forward voltage | $I_F$ = 1 mA | | - | - | 715 | mV |
| | | $I_F$ = 10 mA | | - | - | 855 | mV |
| | | $I_F$ = 50 mA | | - | - | 1 | V |
| | | $I_F$ = 150 mA | | - | - | 1.25 | V |
| $I_R$ | reverse current | $V_R$ = 25 V | | - | - | 30 | nA |
| | | $V_R$ = 80 V | | - | - | 0.5 | µA |
| | | $V_R$ = 25 V; $T_j$ = 150 °C | | - | - | 30 | µA |
| | | $V_R$ = 80 V; $T_j$ = 150 °C | | - | - | 50 | µA |
| $C_d$ | diode capacitance | f = 1 MHz; $V_R$ = 0 V | | - | - | 1.5 | pF |
| $t_{rr}$ | reverse recovery time | | [1] | - | - | 4 | ns |
| $V_{FR}$ | forward recovery voltage | | [2] | - | - | 1.75 | V |

[1] When switched from $I_F$ = 10 mA to $I_R$ = 10 mA; $R_L$ = 100 Ω; measured at $I_R$ = 1 mA.

[2] When switched from $I_F$ = 10 mA; $t_r$ = 20 ns.

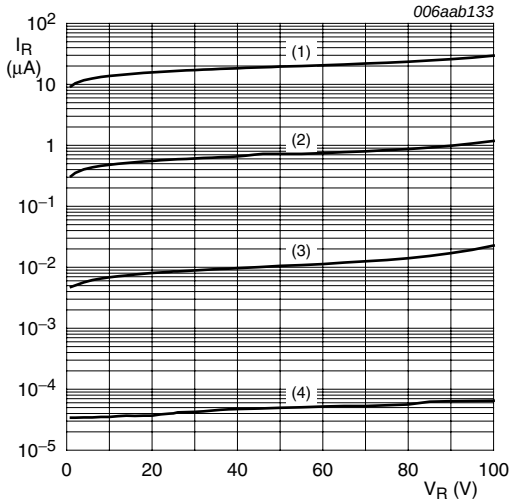

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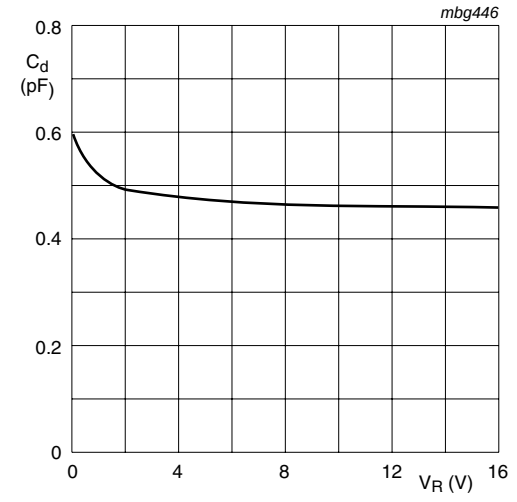

(1) $T_{amb}$ = 150 °C
(2) $T_{amb}$ = 85 °C
(3) $T_{amb}$ = 25 °C
(4) $T_{amb}$ = −40 °C

**Fig 1. Forward current as a function of forward voltage; typical values**



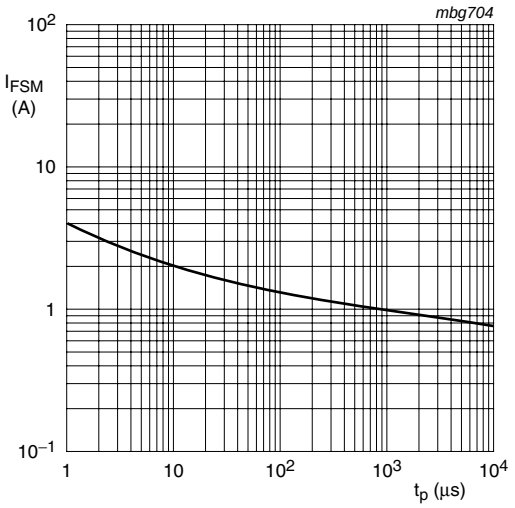

(1) $T_{amb}$ = 150 °C
(2) $T_{amb}$ = 85 °C
(3) $T_{amb}$ = 25 °C
(4) $T_{amb}$ = −40 °C

**Fig 2. Reverse current as a function of reverse voltage; typical values**




f = 1 MHz; $T_{amb}$ = 25 °C

**Fig 3. Diode capacitance as a function of reverse voltage; typical values**




Based on square wave currents.

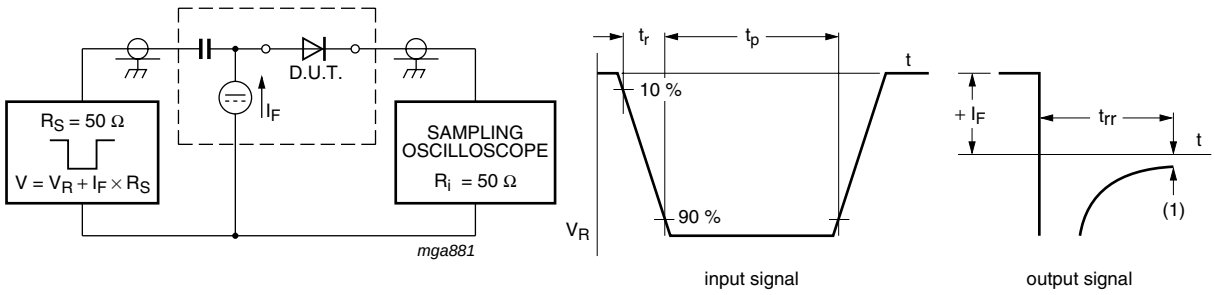
$T_j$ = 25 °C; prior to surge

**Fig 4. Non-repetitive peak forward current as a function of pulse duration; maximum values**


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# 8. Test information

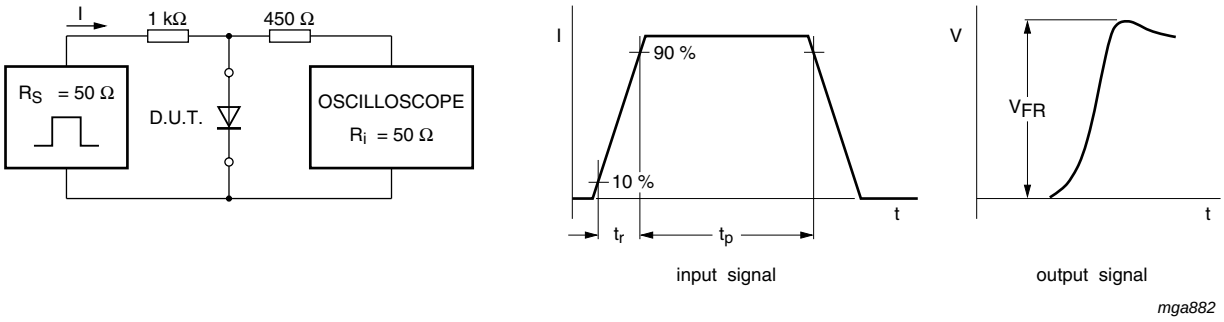



(1) $I_R$ = 1 mA

Input signal: reverse pulse rise time $t_r$ = 0.6 ns; reverse voltage pulse duration $t_p$ = 100 ns; duty cycle $\delta$ = 0.05

Oscilloscope: rise time $t_r$ = 0.35 ns

**Fig 5. Reverse recovery time test circuit and waveforms**




Input signal: forward pulse rise time $t_r$ = 20 ns; forward current pulse duration $t_p \geq$ 100 ns; duty cycle $\delta \leq$ 0.005

**Fig 6. Forward recovery voltage test circuit and waveforms**

## 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.


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## 9. Package outline

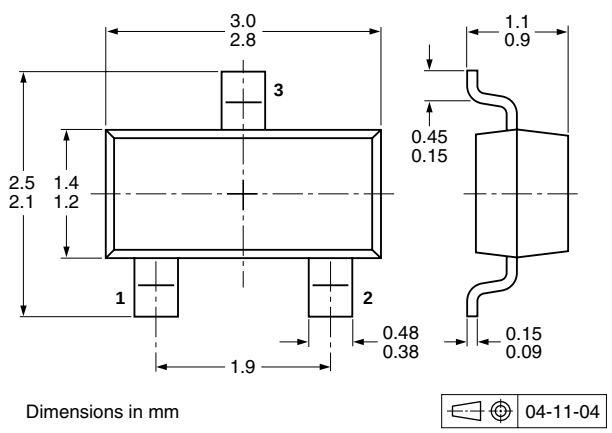



Fig 7. Package outline BAV99 (SOT23/TO-236AB)

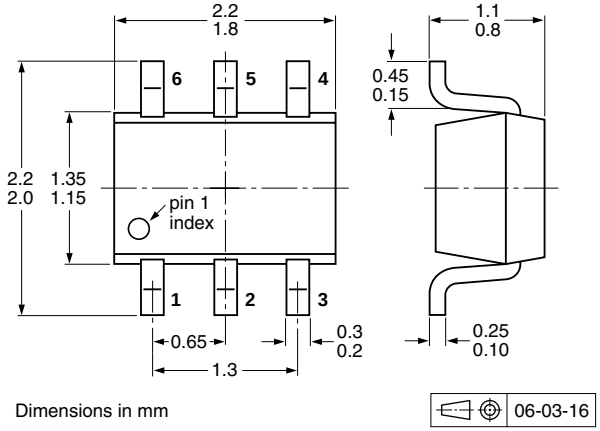



Fig 8. Package outline BAV99S (SOT363/SC-88)

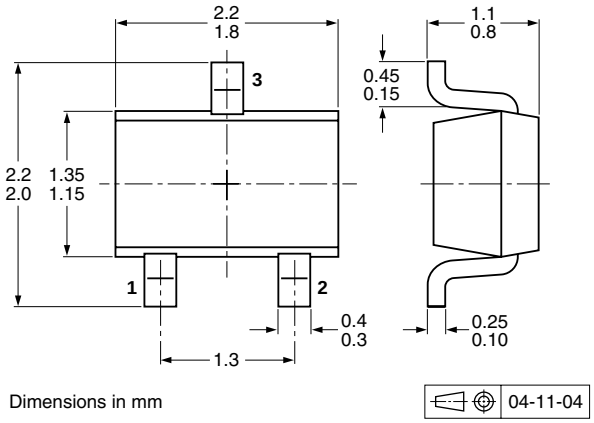



Fig 9. Package outline BAV99W (SOT323/SC-70)

## 10. Packing information

**Table 9. Packing methods**

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

| Type number | Package | Description | Packing quantity | |
|---|---|---|---|---|
| | | | 3000 | 10000 |
| BAV99 | SOT23 | 4 mm pitch, 8 mm tape and reel | -215 | -235 |
| BAV99S | SOT363 | 4 mm pitch, 8 mm tape and reel; T1 [2] | -115 | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 [3] | -125 | -165 |
| BAV99W | SOT323 | 4 mm pitch, 8 mm tape and reel | -115 | -135 |

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

[2] T1: normal taping

[3] T2: reverse taping


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## 11. Soldering

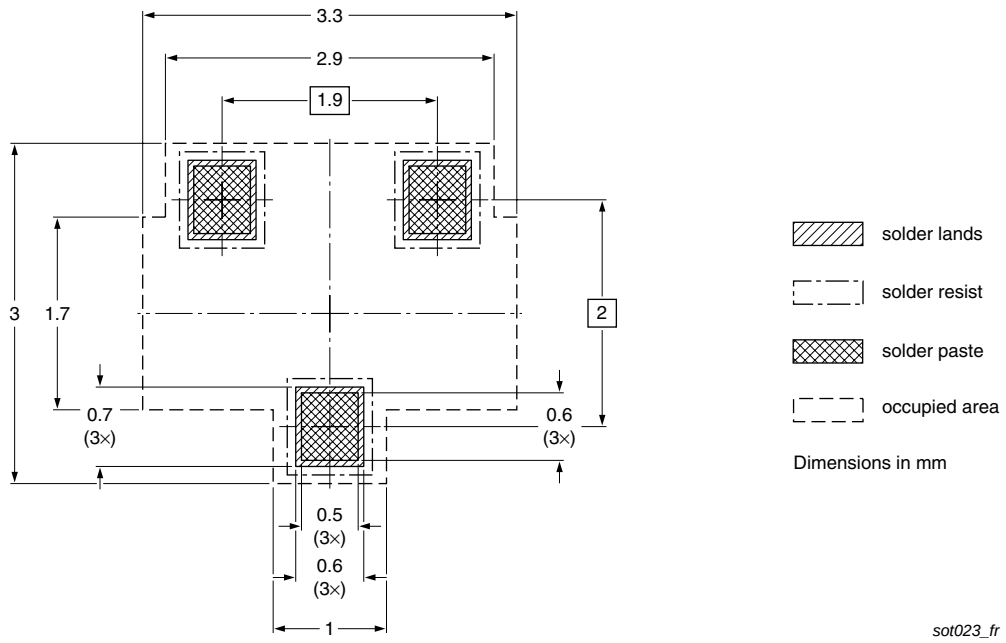



**Fig 10. Reflow soldering footprint BAV99 (SOT23/TO-236AB)**

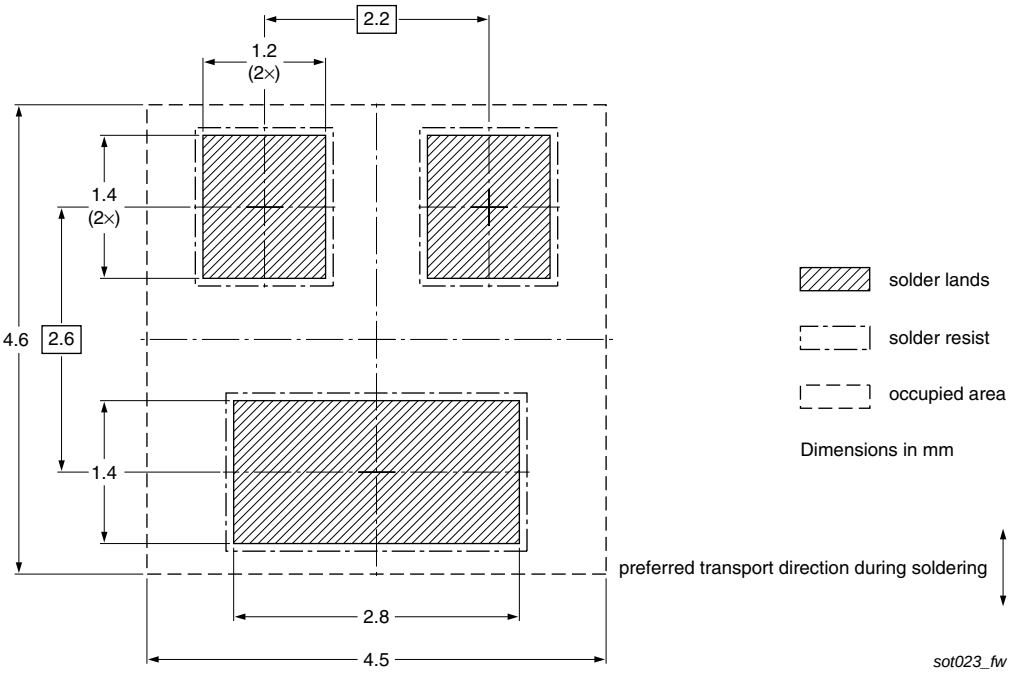



**Fig 11. Wave soldering footprint BAV99 (SOT23/TO-236AB)**


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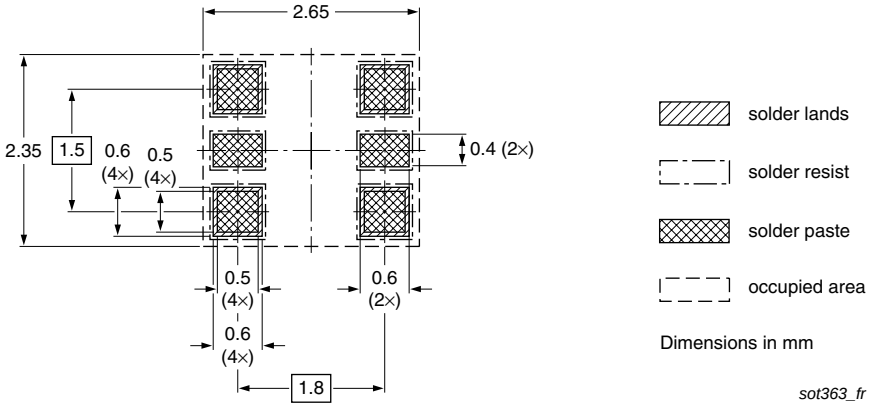



**Fig 12. Reflow soldering footprint BAV99S (SOT363/SC-88)**

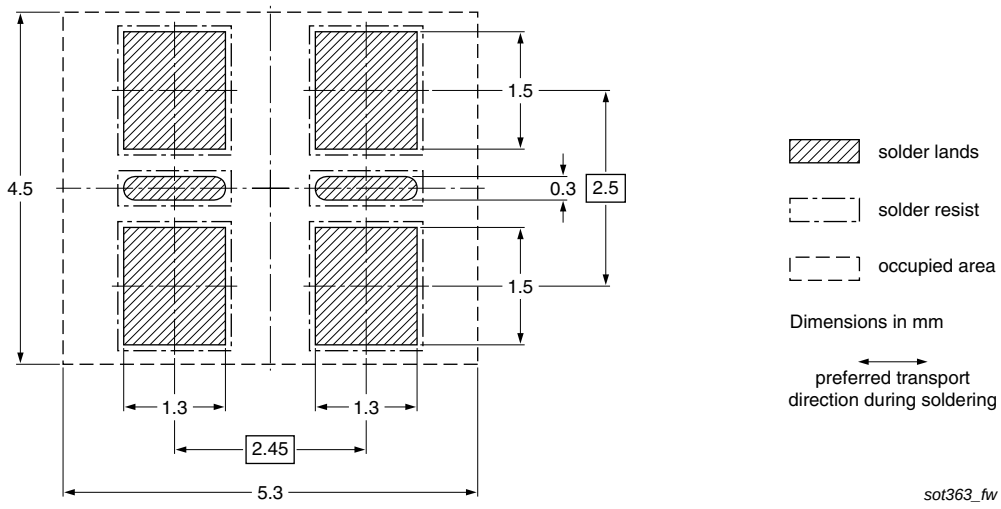



**Fig 13. Wave soldering footprint BAV99S (SOT363/SC-88)**


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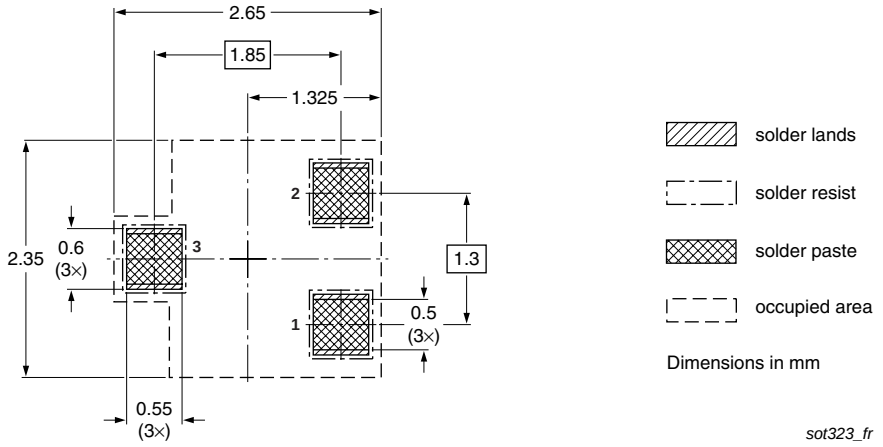



**Fig 14. Reflow soldering footprint BAV99W (SOT323/SC-70)**

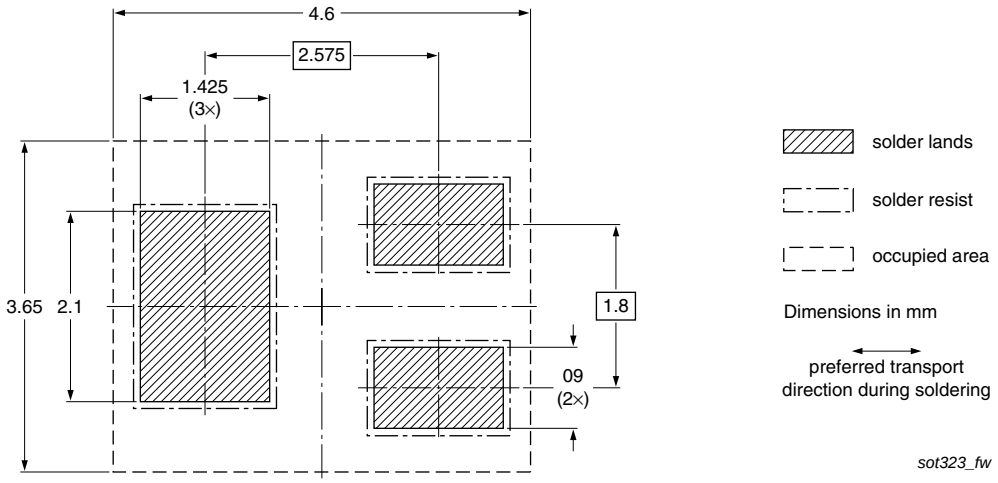



**Fig 15. Wave soldering footprint BAV99W (SOT323/SC-70)**


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## 12. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BAV99_SER_8 | 20101118 | Product data sheet | - | BAV99_SER_7 |
| Modifications: | • Section 4 “Marking”: marking placeholder explanation in table footer updated<br>• Section 5 “Limiting values”: $P_{tot}$ condition for BAV99S corrected<br>• Section 13 “Legal information”: updated | | | |
| BAV99_SER_7 | 20100414 | Product data sheet | - | BAV99_SER_6 |
| BAV99_SER_6 | 20100310 | Product data sheet | - | BAV99_SER_5 |
| BAV99_SER_5 | 20080820 | Product data sheet | - | BAV99_4<br>BAV99S_3<br>BAV99W_4 |
| BAV99_4 | 20011015 | Product specification | - | BAV99_3 |
| BAV99S_3 | 20010514 | Product specification | - | BAV99S_N_2 |
| BAV99W_4 | 19990511 | Product specification | - | BAV99W_3 |


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# 13. Legal information

## 13.1 Data sheet status

| Document status[1][2] | Product status[3] | Definition |
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| 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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