

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

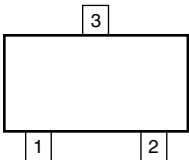
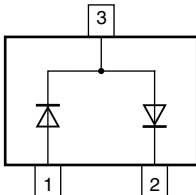
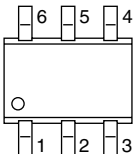
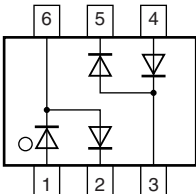
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|-----------------------|--------------|-----|-----|-----|---------|
| Per diode | | | | | | |
| I_R | reverse current | $V_R = 80$ V | - | - | 0.5 | μ A |
| V_R | reverse voltage | | - | - | 100 | V |
| t_{rr} | reverse recovery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

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

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] | | |
| | | $t_p = 1 \mu s$ | - | 4 | A |
| | | $t_p = 1 ms$ | - | 1 | A |
| | | $t_p = 1 s$ | - | 0.5 | A |
| P_{tot} | total power dissipation | | [1][4] | | |
| | BAV99 | $T_{amb} \leq 25 \text{ }^\circ\text{C}$ | - | 250 | mW |
| | BAV99S | $T_{sp} \leq 85 \text{ }^\circ\text{C}$ | [5] - | 250 | mW |
| | BAV99W | $T_{amb} \leq 25 \text{ }^\circ\text{C}$ | - | 200 | mW |
| Per device | | | | | |
| T_j | junction temperature | | - | 150 | $^\circ\text{C}$ |
| T_{amb} | ambient temperature | | -65 | +150 | $^\circ\text{C}$ |
| T_{stg} | storage temperature | | -65 | +150 | $^\circ\text{C}$ |

[1] Single diode loaded.

[2] Double diode loaded.

[3] $T_j = 25 \text{ }^\circ\text{C}$ 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.

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

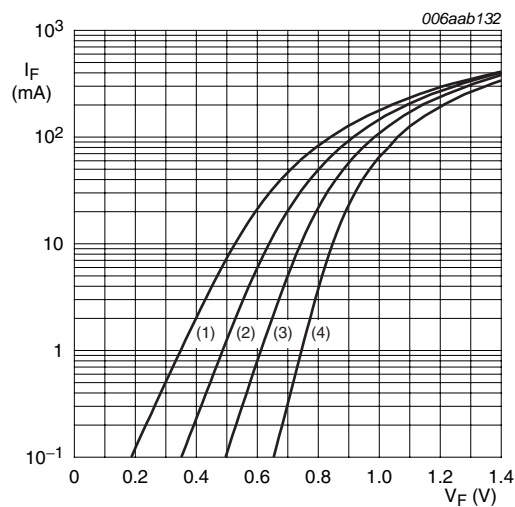
Table 8. Characteristics

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

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

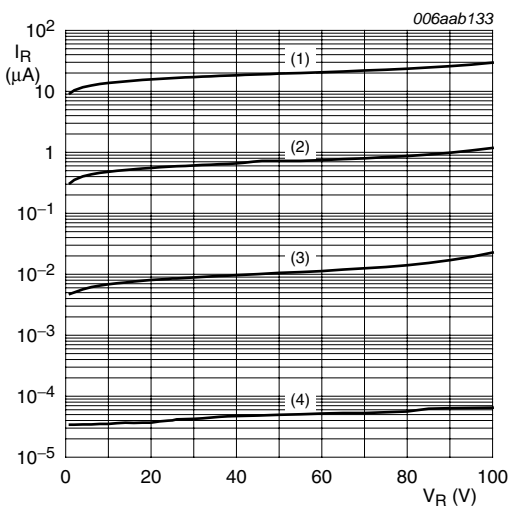
[1] When switched from $I_F = 10\text{ mA}$ to $I_R = 10\text{ mA}$; $R_L = 100\text{ }\Omega$; measured at $I_R = 1\text{ mA}$.

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



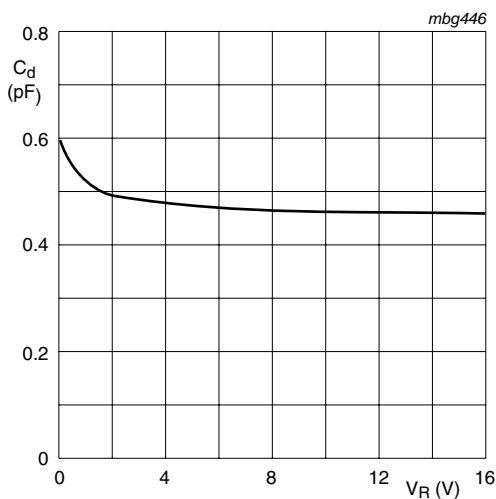
- (1) $T_{amb} = 150\text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



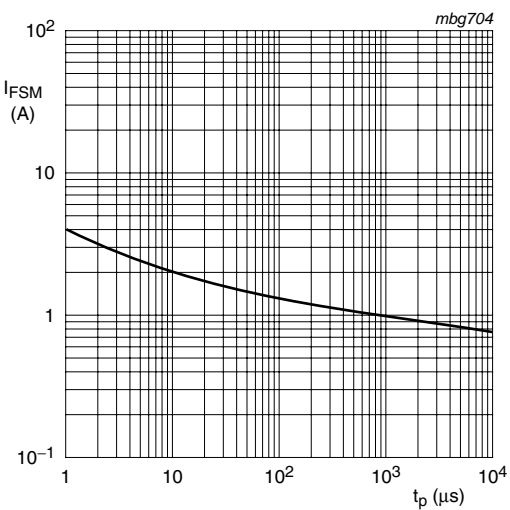
- (1) $T_{amb} = 150\text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



$f = 1\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$

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

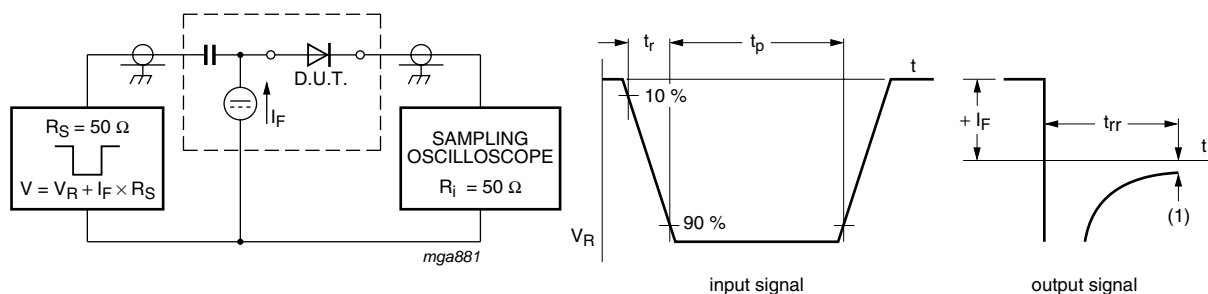


Based on square wave currents.

$T_j = 25\text{ }^{\circ}\text{C}$; prior to surge

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

8. Test information

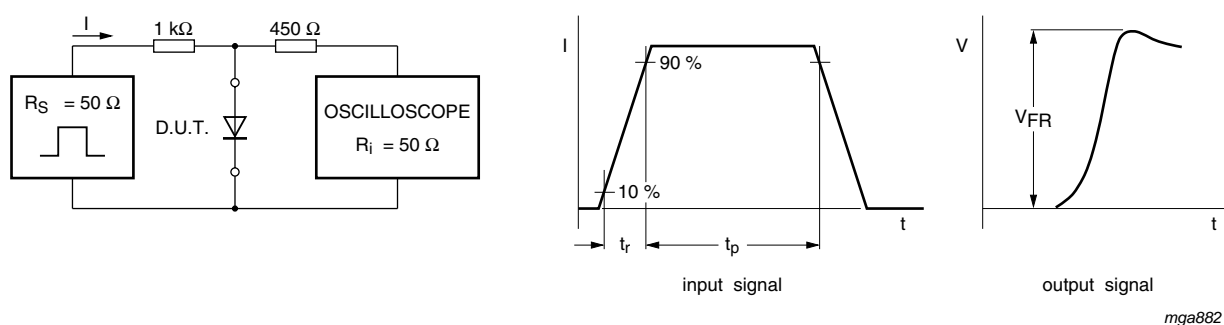


(1) $I_R = 1 \text{ mA}$

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

Oscilloscope: rise time $t_r = 0.35 \text{ ns}$

Fig 5. Reverse recovery time test circuit and waveforms



Input signal: forward pulse rise time $t_r = 20 \text{ ns}$; forward current pulse duration $t_p \geq 100 \text{ ns}$; 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.

9. Package outline

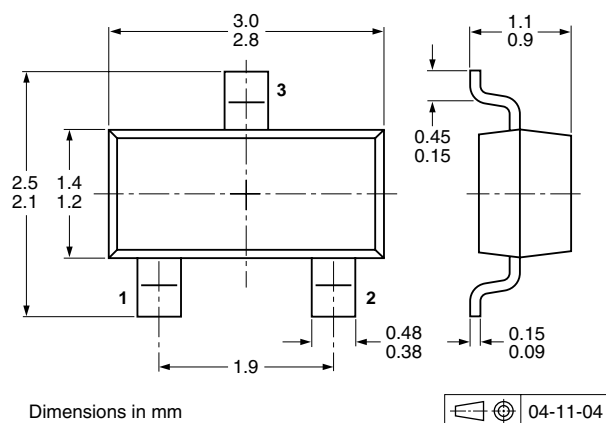


Fig 7. Package outline BAV99 (SOT23/TO-236AB)

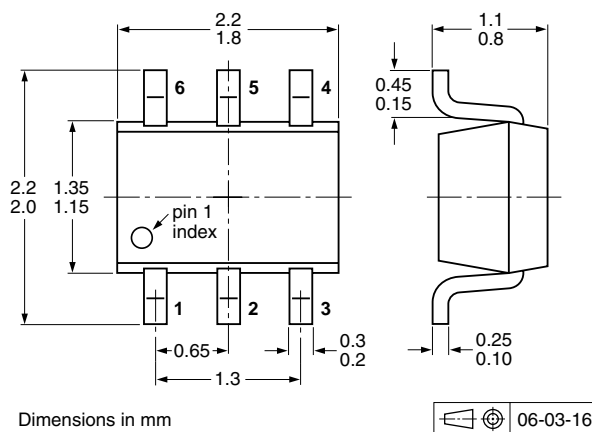


Fig 8. Package outline BAV99S (SOT363/SC-88)

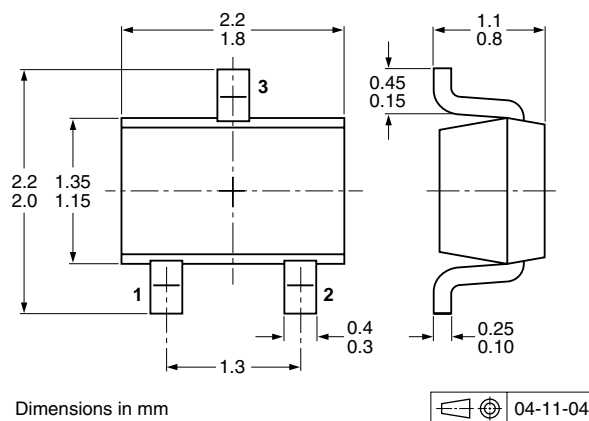


Fig 9. Package outline BAV99W (SOT323/SC-70)

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

11. Soldering

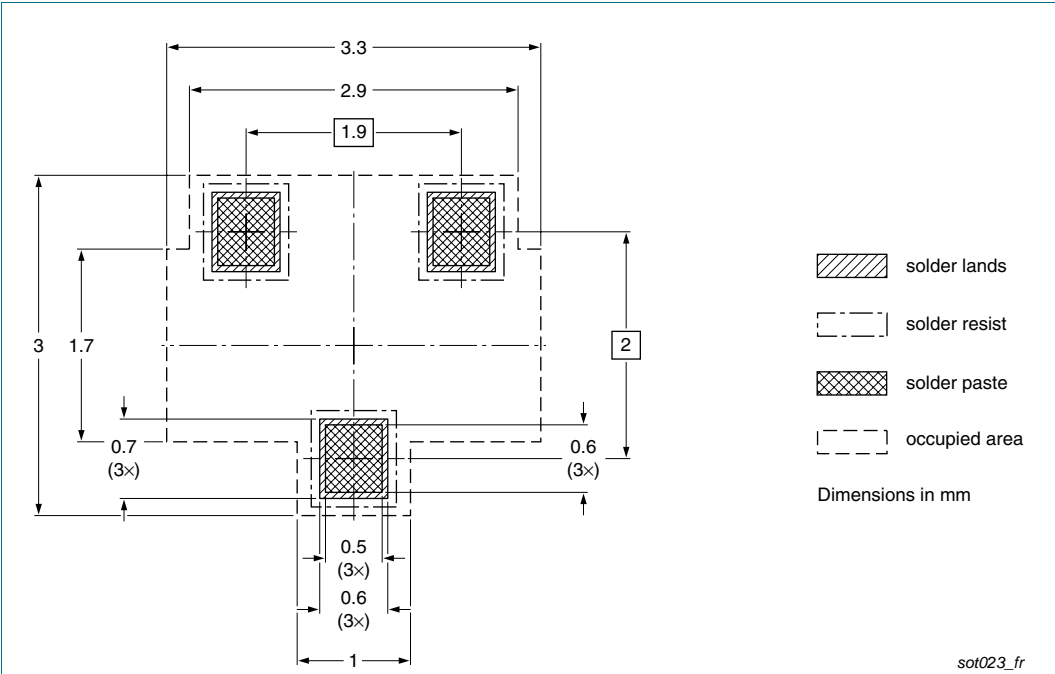


Fig 10. Reflow soldering footprint BAV99 (SOT23/TO-236AB)

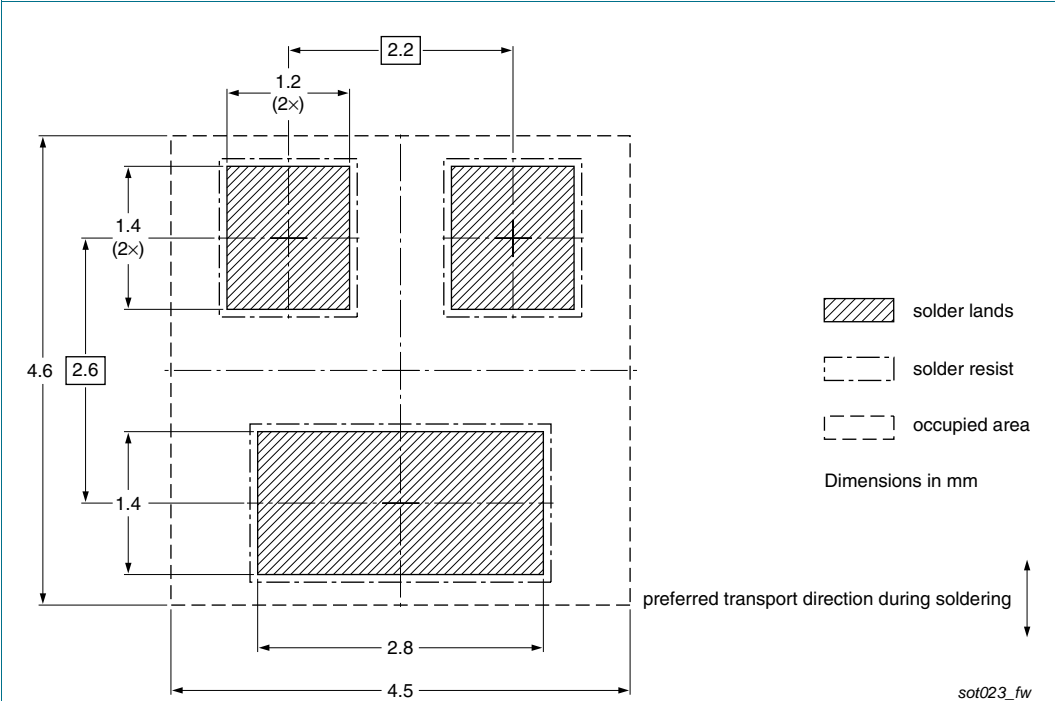


Fig 11. Wave soldering footprint BAV99 (SOT23/TO-236AB)

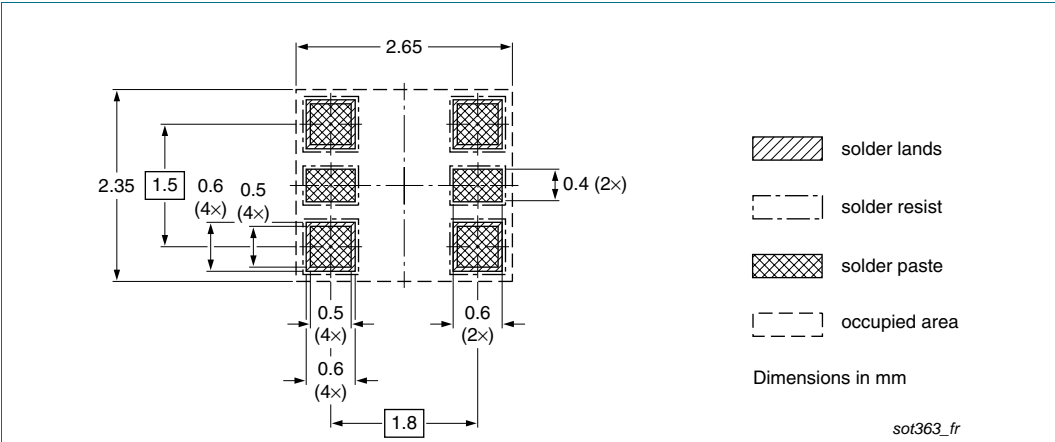


Fig 12. Reflow soldering footprint BAV99S (SOT363/SC-88)

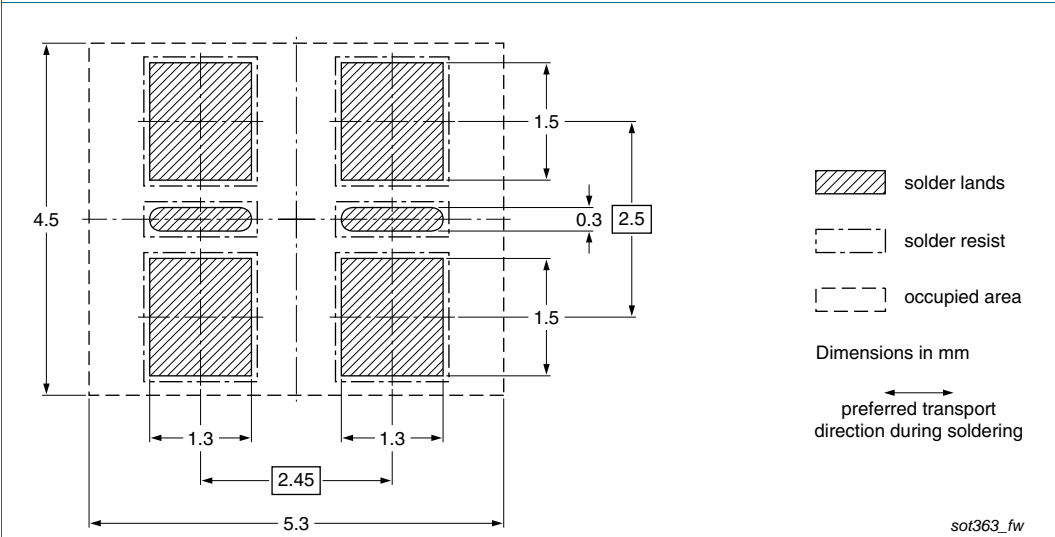


Fig 13. Wave soldering footprint BAV99S (SOT363/SC-88)

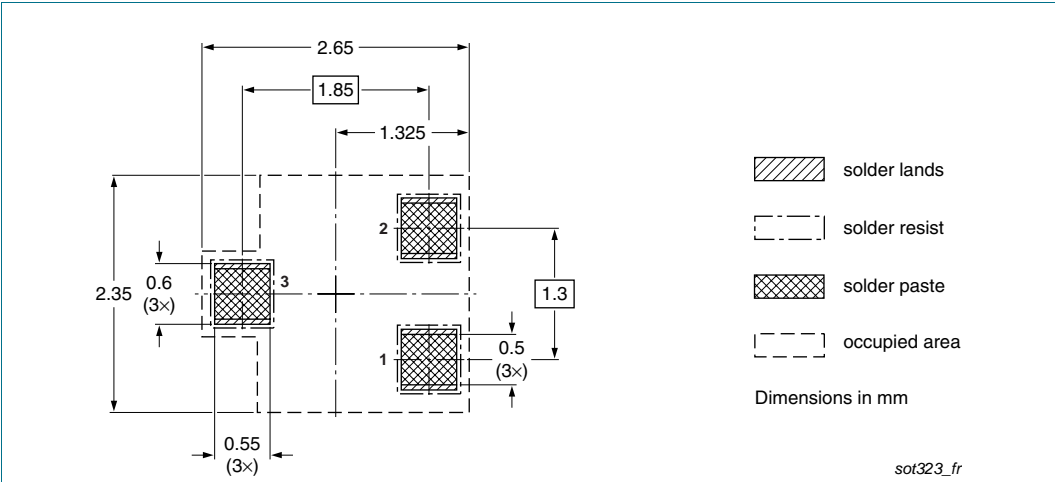


Fig 14. Reflow soldering footprint BAV99W (SOT323/SC-70)

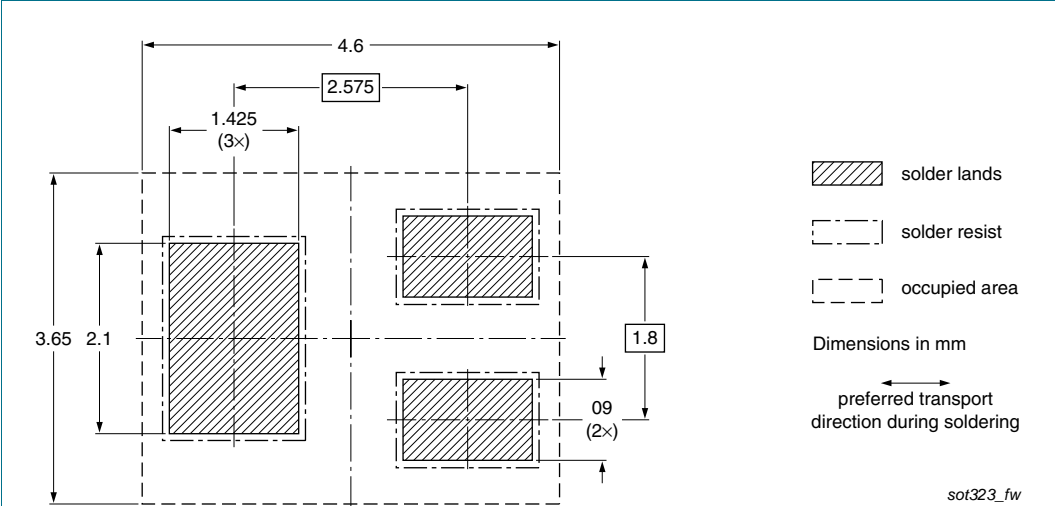


Fig 15. Wave soldering footprint BAV99W (SOT323/SC-70)

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: | <ul style="list-style-type: none">• Section 4 "Marking": marking placeholder explanation in table footer updated• Section 5 "Limiting values": P_{tot} condition for BAV99S corrected• 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 BAV99S_3 BAV99W_4 |
| BAV99_4 | 20011015 | Product specification | - | BAV99_3 |
| BAV99S_3 | 20010514 | Product specification | - | BAV99S_N_2 |
| BAV99W_4 | 19990511 | Product specification | - | BAV99W_3 |

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".

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Date of release: 18 November 2010

Document identifier: BAV99_SER

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