

# BAS16 series

## High-speed switching diodes

Rev. 6 — 24 September 2014

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    |                 |                           |
| BAS16       | SOT23   | -     | TO-236AB | single          | small                     |
| BAS16H      | SOD123F | -     | -        | single          | small and flat lead       |
| BAS16J      | SOD323F | SC-90 | -        | single          | very small and flat lead  |
| BAS16L      | SOD882  | -     | -        | single          | leadless ultra small      |
| BAS16T      | SOT416  | SC-75 | -        | single          | ultra small               |
| BAS16VV     | SOT666  | -     | -        | triple isolated | ultra small and flat lead |
| BAS16VY     | SOT363  | SC-88 | -        | triple isolated | very small                |
| BAS16W      | SOT323  | SC-70 | -        | single          | very small                |
| BAS316      | SOD323  | SC-76 | -        | single          | very small                |
| BAS516      | SOD523  | SC-79 | -        | single          | ultra small and flat lead |

### 1.2 Features and benefits

- High switching speed:  $t_{rr} \leq 4$  ns
- Low leakage current
- Repetitive peak reverse voltage:  $V_{RRM} \leq 100$  V
- AEC-Q101 qualified
- Low capacitance
- Reverse voltage:  $V_R \leq 100$  V
- Small SMD plastic packages

### 1.3 Applications

- High-speed switching
- General-purpose switching



## 1.4 Quick reference data

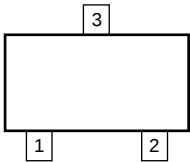
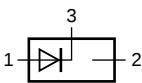
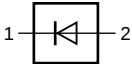
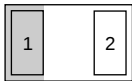
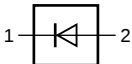
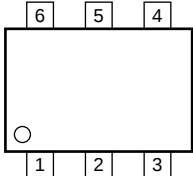
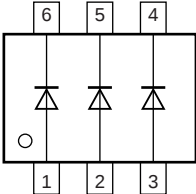
**Table 2. Quick reference data**

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

| Symbol           | Parameter             | Conditions                                                                                               | Min | Typ | Max | Unit          |
|------------------|-----------------------|----------------------------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| <b>Per diode</b> |                       |                                                                                                          |     |     |     |               |
| $V_R$            | reverse voltage       |                                                                                                          | -   | -   | 100 | V             |
| $I_R$            | reverse current       | $V_R = 80\text{ V}$                                                                                      | -   | -   | 0.5 | $\mu\text{A}$ |
| $t_{rr}$         | reverse recovery time | $I_F = 10\text{ mA}$ ; $I_R = 10\text{ mA}$ ;<br>$R_L = 100\text{ }\Omega$ ; $I_{R(meas)} = 1\text{ mA}$ | -   | -   | 4   | ns            |

## 2. Pinning information

**Table 3. Pinning**

| Pin                            | Description       |                     | Simplified outline                                                                                            | Graphic symbol                                                                                     |
|--------------------------------|-------------------|---------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| BAS16; BAS16T; BAS16W          |                   |                     |                                                                                                               |                                                                                                    |
| 1                              | anode             |                     | <br>006aaa144             | <br>006aaa764  |
| 2                              | not connected     |                     |                                                                                                               |                                                                                                    |
| 3                              | cathode           |                     |                                                                                                               |                                                                                                    |
| BAS16H; BAS16J; BAS316; BAS516 |                   |                     |                                                                                                               |                                                                                                    |
| 1                              | cathode           | <a href="#">[1]</a> | <br>001aab540            | <br>006aab040 |
| 2                              | anode             |                     |                                                                                                               |                                                                                                    |
| BAS16L                         |                   |                     |                                                                                                               |                                                                                                    |
| 1                              | cathode           | <a href="#">[1]</a> | <br>Transparent top view | <br>006aab040 |
| 2                              | anode             |                     |                                                                                                               |                                                                                                    |
| BAS16VV; BAS16VY               |                   |                     |                                                                                                               |                                                                                                    |
| 1                              | anode (diode 1)   |                     | <br>001aab555            | <br>006aab106 |
| 2                              | anode (diode 2)   |                     |                                                                                                               |                                                                                                    |
| 3                              | anode (diode 3)   |                     |                                                                                                               |                                                                                                    |
| 4                              | cathode (diode 3) |                     |                                                                                                               |                                                                                                    |
| 5                              | cathode (diode 2) |                     |                                                                                                               |                                                                                                    |
| 6                              | cathode (diode 1) |                     |                                                                                                               |                                                                                                    |

[1] The marking bar indicates the cathode.

### 3. Ordering information

Table 4. Ordering information

| Type number | Package   |                                                                            |         |
|-------------|-----------|----------------------------------------------------------------------------|---------|
|             | Name      | Description                                                                | Version |
| BAS16       | TO-236AB  | plastic surface-mounted package; 3 leads                                   | SOT23   |
| BAS16H      | -         | plastic surface-mounted package; 2 leads                                   | SOD123F |
| BAS16J      | SC-90     | plastic surface-mounted package; 2 leads                                   | SOD323F |
| BAS16L      | DFN1006-2 | leadless ultra small plastic package; 2 terminals; body 1.0 × 0.6 × 0.5 mm | SOD882  |
| BAS16T      | SC-75     | plastic surface-mounted package; 3 leads                                   | SOT416  |
| BAS16VV     | -         | plastic surface-mounted package; 6 leads                                   | SOT666  |
| BAS16VY     | SC-88     | plastic surface-mounted package; 6 leads                                   | SOT363  |
| BAS16W      | SC-70     | plastic surface-mounted package; 3 leads                                   | SOT323  |
| BAS316      | SC-76     | plastic surface-mounted package; 2 leads                                   | SOD323  |
| BAS516      | SC-79     | plastic surface-mounted package; 2 leads                                   | SOD523  |

### 4. Marking

Table 5. Marking codes

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| BAS16       | A6*                         |
| BAS16H      | A1                          |
| BAS16J      | AR                          |
| BAS16L      | S2                          |
| BAS16T      | A6                          |
| BAS16VV     | 53                          |
| BAS16VY     | 16*                         |
| BAS16W      | A6*                         |
| BAS316      | A6                          |
| BAS516      | 6                           |

[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 |
|------------------|---------------------------------|------------|-----|-----|------|
| <b>Per diode</b> |                                 |            |     |     |      |
| $V_{RRM}$        | repetitive peak reverse voltage |            | -   | 100 | V    |
| $V_R$            | reverse voltage                 |            | -   | 100 | V    |

**Table 6. Limiting values ...continued**

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

| Symbol            | Parameter                           | Conditions                                   |           | Min | Max  | Unit |
|-------------------|-------------------------------------|----------------------------------------------|-----------|-----|------|------|
| $I_F$             | forward current                     |                                              |           |     |      |      |
|                   | BAS16                               |                                              | [1]       | -   | 215  | mA   |
|                   | BAS16H<br>BAS16L                    |                                              | [2]       | -   | 215  | mA   |
|                   | BAS16T                              |                                              | [1]       | -   | 155  | mA   |
|                   | BAS16VV<br>BAS16VY                  |                                              | [1][3]    | -   | 200  | mA   |
|                   | BAS16W                              |                                              | [1]       | -   | 175  | mA   |
|                   | BAS16J<br>BAS316<br>BAS516          |                                              | [1]       | -   | 250  | mA   |
| $I_{FRM}$         | repetitive peak forward current     | $t_p \leq 0.5$ ms;<br>$\delta \leq 0.25$     |           | -   | 500  | mA   |
| $I_{FSM}$         | non-repetitive peak forward current | square wave;<br>$T_{j(\text{init})} = 25$ °C |           |     |      |      |
|                   |                                     | $t_p = 1$ $\mu$ s                            |           | -   | 4    | A    |
|                   |                                     | $t_p = 1$ ms                                 |           | -   | 1    | A    |
|                   |                                     | $t_p = 1$ s                                  |           | -   | 0.5  | A    |
| $P_{\text{tot}}$  | total power dissipation             |                                              |           |     |      |      |
|                   | BAS16                               | $T_{\text{amb}} \leq 25$ °C                  | [1]       | -   | 250  | mW   |
|                   | BAS16H                              | $T_{\text{amb}} \leq 25$ °C                  | [2]       | -   | 380  | mW   |
|                   |                                     |                                              | [5]       | -   | 830  | mW   |
|                   | BAS16J                              | $T_{\text{amb}} \leq 25$ °C                  | [5]       | -   | 550  | mW   |
|                   | BAS16L                              | $T_{\text{amb}} \leq 25$ °C                  | [2]       | -   | 250  | mW   |
|                   | BAS16T                              | $T_{\text{sp}} \leq 90$ °C                   | [1][4]    | -   | 170  | mW   |
|                   | BAS16VV                             | $T_{\text{amb}} \leq 25$ °C                  | [1][3]    | -   | 180  | mW   |
|                   | BAS16VY                             | $T_{\text{sp}} \leq 85$ °C                   | [1][3][6] | -   | 250  | mW   |
|                   | BAS16W                              | $T_{\text{amb}} \leq 25$ °C                  | [1]       | -   | 200  | mW   |
|                   | BAS316                              | $T_{\text{sp}} \leq 90$ °C                   | [1][4]    | -   | 400  | mW   |
|                   | BAS516                              | $T_{\text{sp}} \leq 90$ °C                   | [1][4]    | -   | 500  | mW   |
| <b>Per device</b> |                                     |                                              |           |     |      |      |
| $T_j$             | junction temperature                |                                              |           | -   | 150  | °C   |
| $T_{\text{amb}}$  | ambient temperature                 |                                              |           | -65 | +150 | °C   |
| $T_{\text{stg}}$  | 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 with 60  $\mu$ m copper strip line.

[3] Single diode loaded.

[4] Soldering point of cathode tab.

[5] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm<sup>2</sup>.

[6] Soldering points at pins 4, 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 |        |     |     |     |      |
|                | BAS16                                            |             | [1]    | -   | -   | 500 | K/W  |
|                | BAS16H                                           |             | [2]    | -   | -   | 330 | K/W  |
|                |                                                  |             | [3]    | -   | -   | 150 | K/W  |
|                | BAS16J                                           |             | [3]    | -   | -   | 230 | K/W  |
|                | BAS16L                                           |             | [2]    | -   | -   | 500 | K/W  |
|                | BAS16VV                                          |             | [2][4] | -   | -   | 700 | K/W  |
|                |                                                  |             | [3][4] | -   | -   | 410 | K/W  |
|                | BAS16W                                           |             | [1]    | -   | -   | 625 | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             |        |     |     |     |      |
|                | BAS16                                            |             |        | -   | -   | 330 | K/W  |
|                | BAS16H                                           |             | [5]    | -   | -   | 70  | K/W  |
|                | BAS16J                                           |             | [5]    | -   | -   | 55  | K/W  |
|                | BAS16T                                           |             |        | -   | -   | 350 | K/W  |
|                | BAS16VY                                          |             | [4][6] | -   | -   | 260 | K/W  |
|                | BAS16W                                           |             |        | -   | -   | 300 | K/W  |
|                | BAS316                                           |             | [5]    | -   | -   | 150 | K/W  |
|                | BAS516                                           |             | [5]    | -   | -   | 120 | K/W  |

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

[2] Device mounted on an FR4 PCB with 60  $\mu\text{m}$  copper strip line.

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1  $\text{cm}^2$ .

[4] Single diode loaded.

[5] Soldering point of cathode tab.

[6] Soldering points at pins 4, 5 and 6.

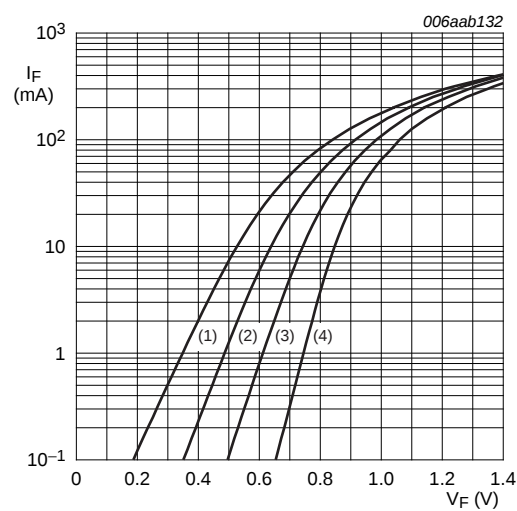
## 7. Characteristics

**Table 8. Characteristics**

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

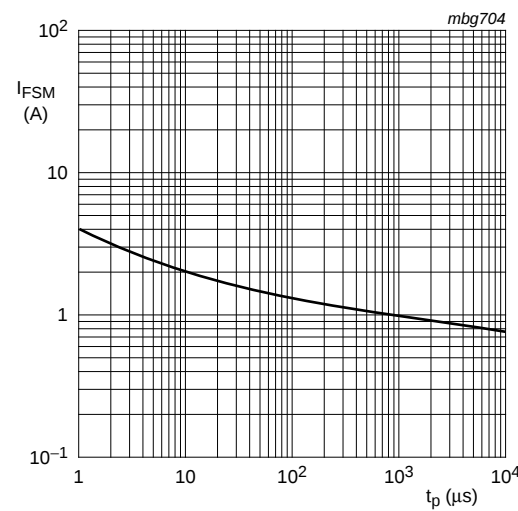
| Symbol           | Parameter                                                                           | Conditions                                                                                                    | Min | Typ | Max  | Unit          |
|------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----|-----|------|---------------|
| <b>Per diode</b> |                                                                                     |                                                                                                               |     |     |      |               |
| $V_F$            | forward voltage                                                                     |                                                                                                               | [1] |     |      |               |
|                  |                                                                                     | $I_F = 1\text{ mA}$                                                                                           | -   | -   | 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  | $\mu\text{A}$ |
|                  |                                                                                     | $V_R = 25\text{ V}; T_j = 150\text{ }^{\circ}\text{C}$                                                        | -   | -   | 30   | $\mu\text{A}$ |
|                  |                                                                                     | $V_R = 80\text{ V}; T_j = 150\text{ }^{\circ}\text{C}$                                                        | -   | -   | 50   | $\mu\text{A}$ |
| $C_d$            | diode capacitance                                                                   | $f = 1\text{ MHz}; V_R = 0\text{ V}$                                                                          |     |     |      |               |
|                  | BAS16; BAS16H;<br>BAS16J; BAS16L;<br>BAS16T; BAS16VV;<br>BAS16VY; BAS16W;<br>BAS316 |                                                                                                               | -   | -   | 1.5  | pF            |
|                  | BAS516                                                                              |                                                                                                               | -   | -   | 1    | pF            |
| $t_{rr}$         | reverse recovery time                                                               | $I_F = 10\text{ mA}; I_R = 10\text{ mA};$<br>$R_L = 100\text{ }\Omega;$<br>$I_{R(\text{meas})} = 1\text{ mA}$ | -   | -   | 4    | ns            |
| $V_{FR}$         | forward recovery voltage                                                            | $I_F = 10\text{ mA}; t_r = 20\text{ ns}$                                                                      | -   | -   | 1.75 | V             |

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



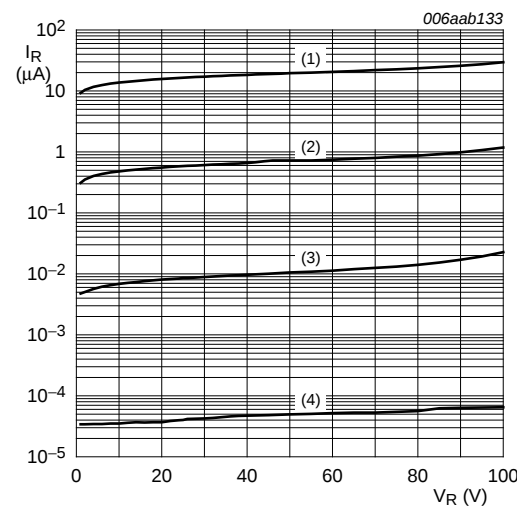
- (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = 85\text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (4)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



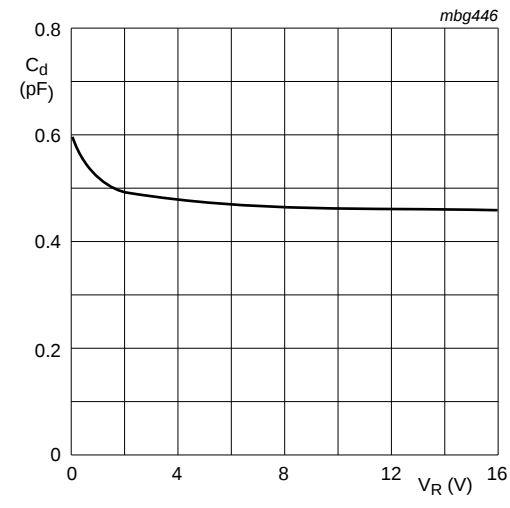
Based on square wave currents.  
 $T_{j(init)} = 25\text{ }^{\circ}\text{C}$

Fig 2. Non-repetitive peak forward current as a function of pulse duration; maximum 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)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

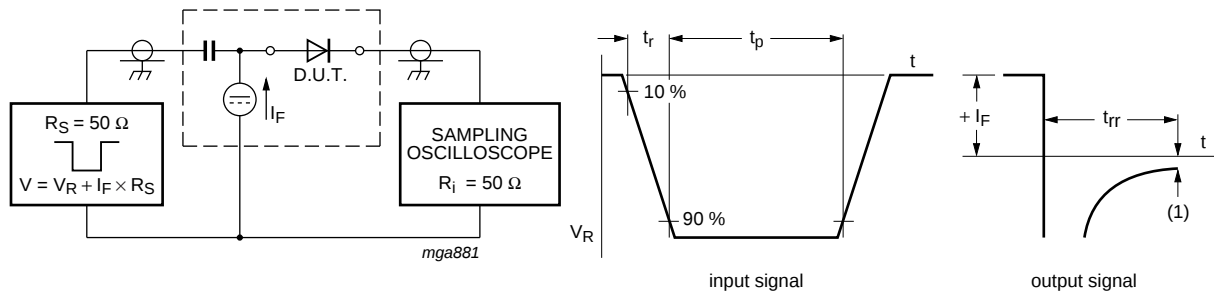
Fig 3. Reverse current as a function of reverse voltage; typical values



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

Fig 4. Diode capacitance as a function of reverse voltage; typical 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**



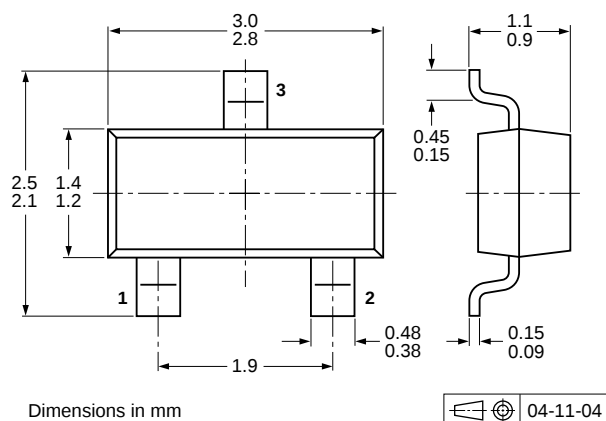
Input signal: forward pulse rise time  $t_r = 20 \text{ ns}$ ; forward current pulse duration  $t_p \geq 100 \text{ ns}$ ; duty cycle  $\delta \leq 0.005$

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

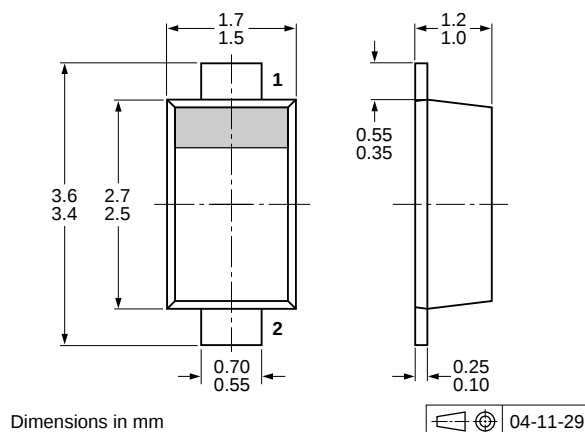
### 8.1 Quality information

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.

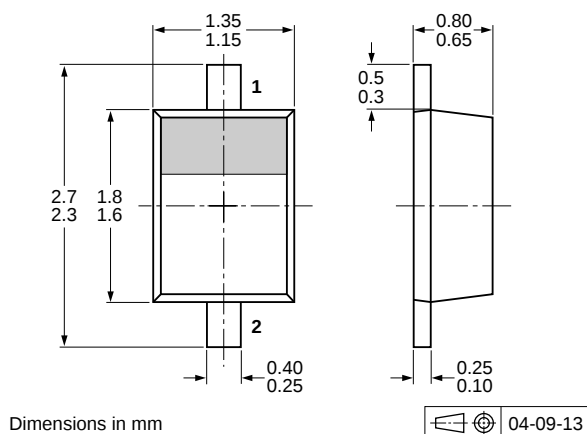
## 9. Package outline



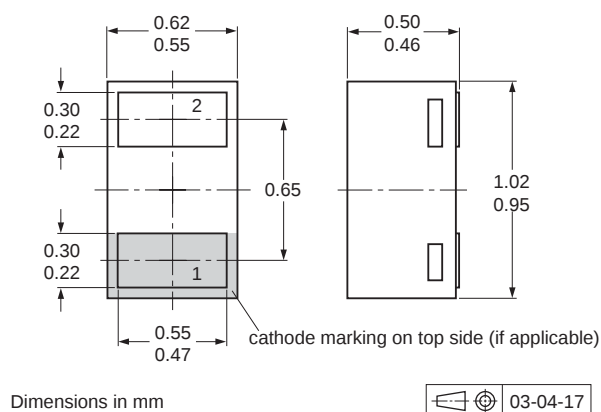
**Fig 7. Package outline BAS16 (SOT23/TO-236AB)**



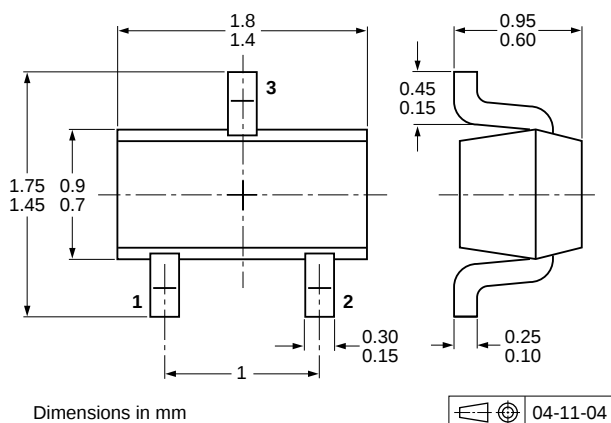
**Fig 8. Package outline BAS16H (SOD123F)**



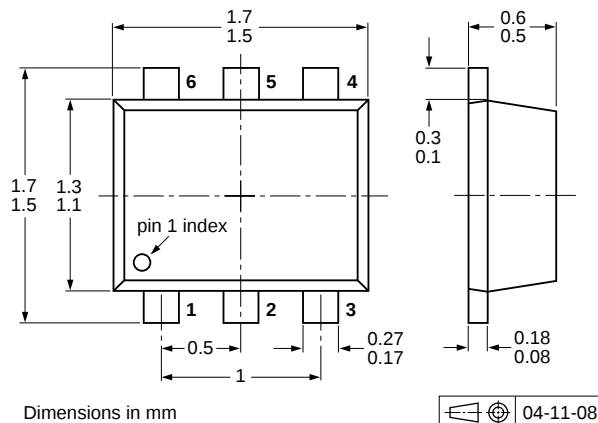
**Fig 9. Package outline BAS16J (SOD323F/SC-90)**



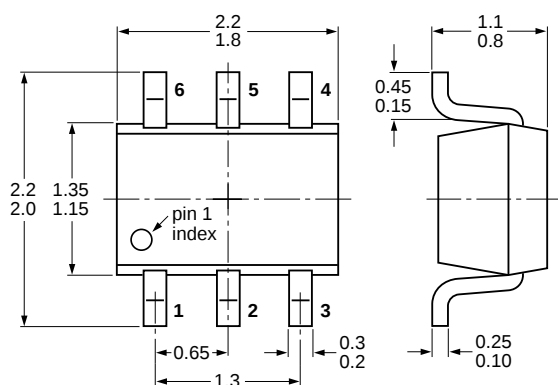
**Fig 10. Package outline BAS16L (SOD882/DFN1006-2)**



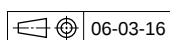
**Fig 11. Package outline BAS16T (SOT416/SC-75)**



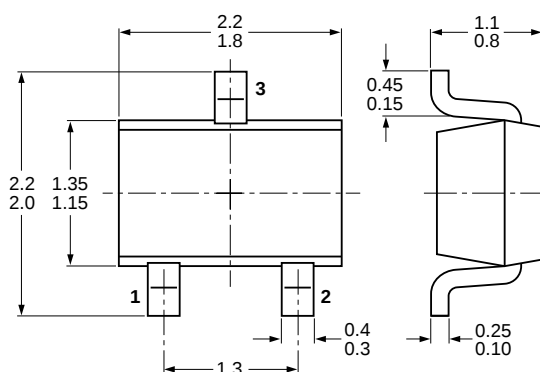
**Fig 12. Package outline BAS16VV (SOT666)**



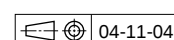
Dimensions in mm



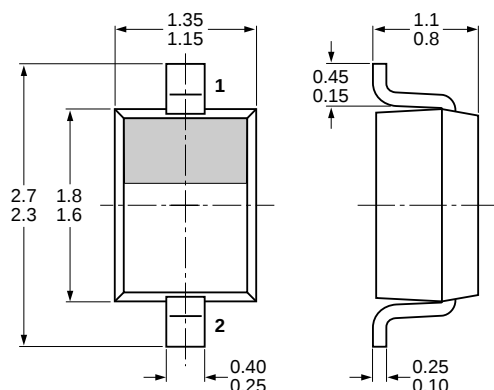
**Fig 13. Package outline BAS16VY (SOT363)**



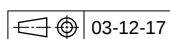
Dimensions in mm



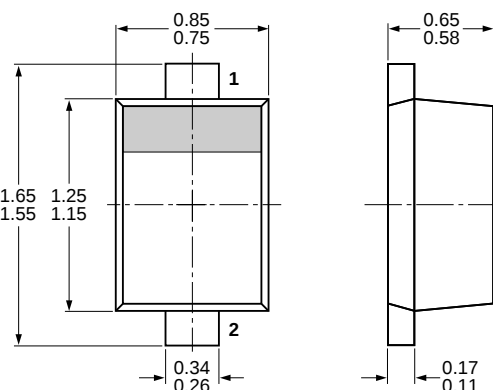
**Fig 14. Package outline BAS16W (SOT323/SC-70)**



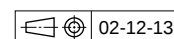
Dimensions in mm



**Fig 15. Package outline BAS316 (SOD323/SC-76)**



Dimensions in mm



**Fig 16. Package outline BAS516 (SOD523/SC-79)**

10. Soldering

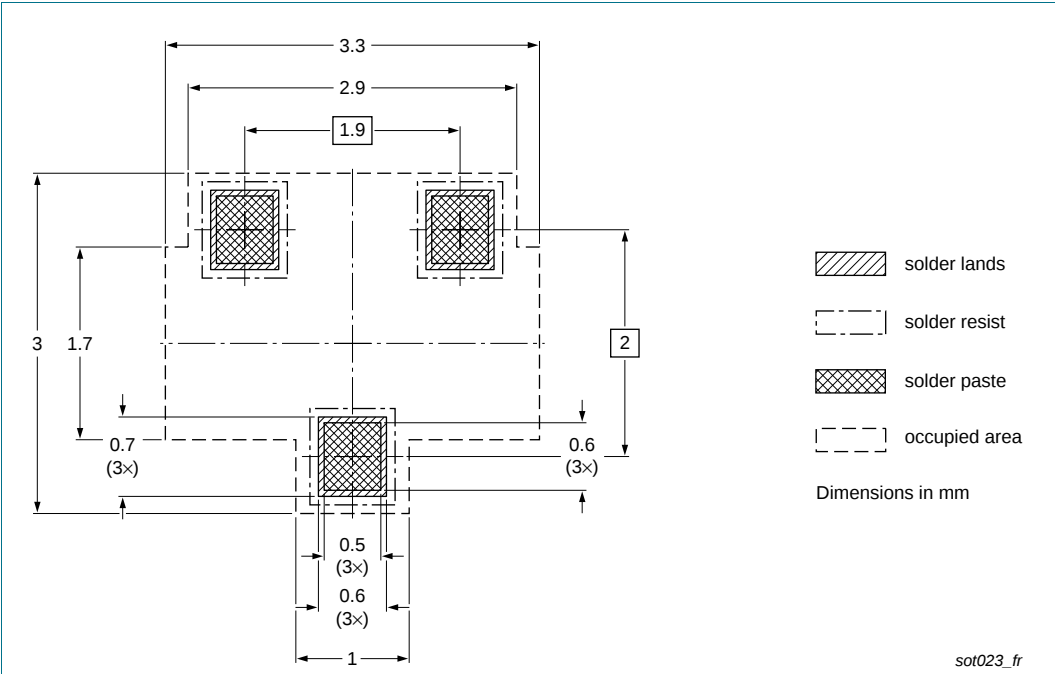


Fig 17. Reflow soldering footprint BAS16 (SOT23/TO-236AB)

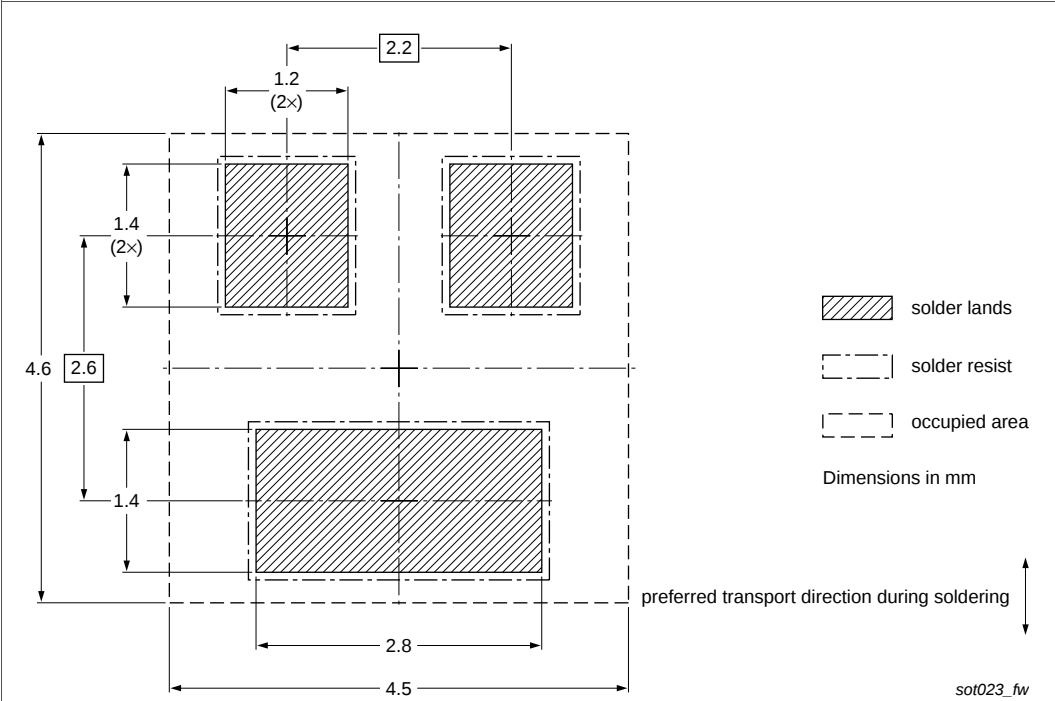


Fig 18. Wave soldering footprint BAS16 (SOT23/TO-236AB)





Fig 21. Reflow soldering footprint BAS16L (SOD882/DFN1006-2)



Fig 22. Reflow soldering footprint BAS16T (SOT416/SC-75)



Fig 23. Reflow soldering footprint BAS16VV (SOT666)



Fig 24. Reflow soldering footprint BAS16VY (SOT363/SC-88)



Fig 25. Wave soldering footprint BAS16VY (SOT363/SC-88)



Fig 26. Reflow soldering footprint BAS16W (SOT323/SC-70)

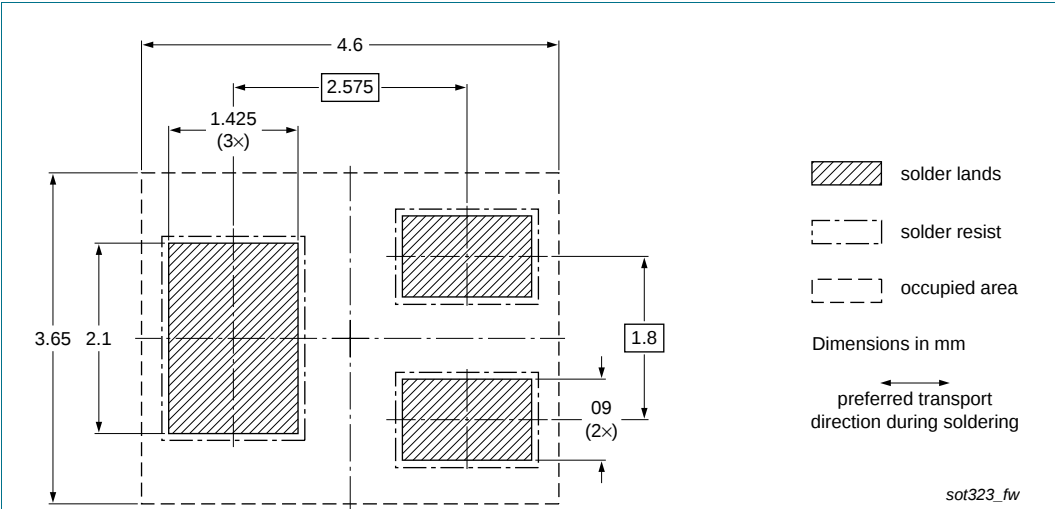


Fig 27. Wave soldering footprint BAS16W (SOT323/SC-70)

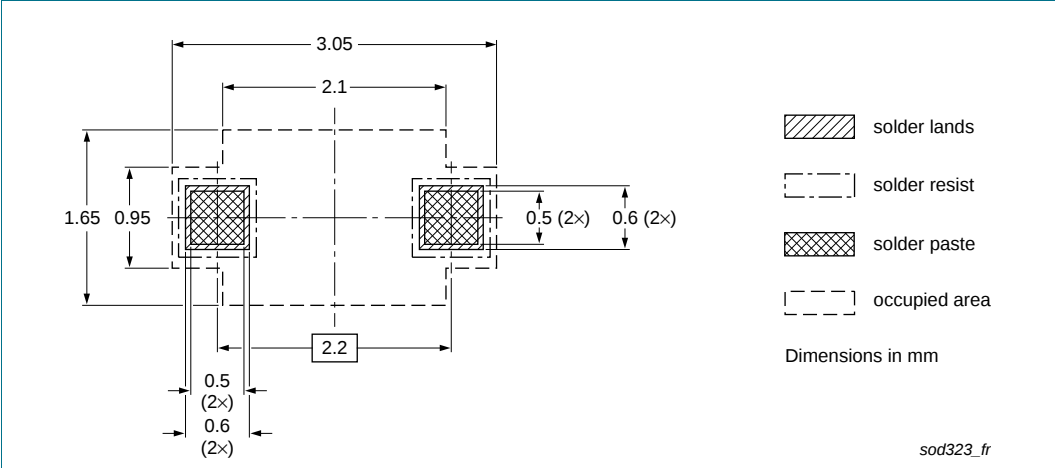


Fig 28. Reflow soldering footprint BAS316 (SOD323/SC-76)

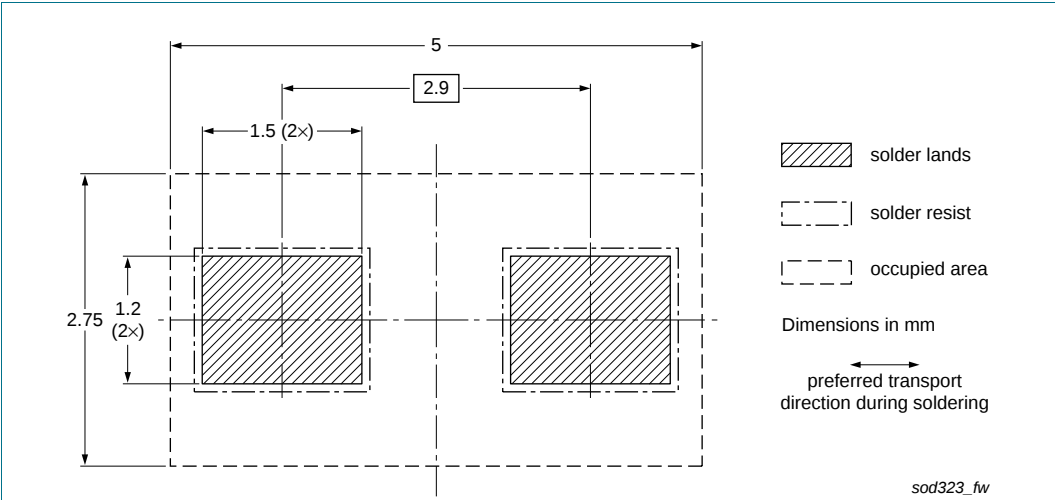


Fig 29. Wave soldering footprint BAS316 (SOD323/SC-76)



Fig 30. Reflow soldering footprint BAS516 (SOD523/SC-79)

## 11. Revision history

Table 9. Revision history

| Document ID       | Release date                                                                                                                                                                                                                                                                                                                                                               | Data sheet status     | Change notice | Supersedes                                                                                                       |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------------------------------------------------------------------------------------------------------------------|
| BAS16_SER_6       | 20140924                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | BAS16_SER_5                                                                                                      |
| Modifications:    | <ul style="list-style-type: none"> <li>• <a href="#">Section 1.2 "Features and benefits"</a>: updated</li> <li>• <a href="#">Section 4 "Marking"</a>: updated</li> <li>• <a href="#">Table 6 "Limiting values"</a>: updated</li> <li>• <a href="#">Section 8 "Test information"</a>: updated</li> <li>• <a href="#">Section 12 "Legal information"</a>: updated</li> </ul> |                       |               |                                                                                                                  |
| BAS16_SER_5       | 20080825                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | BAS16_4<br>BAS16H_1<br>BAS16J_1<br>BAS16L_1<br>BAS16T_1<br>BAS16VV_BAS16VY_3<br>BAS16W_4<br>BAS316_4<br>BAS516_1 |
| BAS16_4           | 20011010                                                                                                                                                                                                                                                                                                                                                                   | Product specification | -             | BAS16_3                                                                                                          |
| BAS16H_1          | 20050415                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | -                                                                                                                |
| BAS16J_1          | 20070308                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | -                                                                                                                |
| BAS16L_1          | 20030623                                                                                                                                                                                                                                                                                                                                                                   | Product specification | -             | -                                                                                                                |
| BAS16T_1          | 19980120                                                                                                                                                                                                                                                                                                                                                                   | Product specification | -             | -                                                                                                                |
| BAS16VV_BAS16VY_3 | 20070420                                                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | BAS16VV_BAS16VY_2                                                                                                |
| BAS16W_4          | 19990506                                                                                                                                                                                                                                                                                                                                                                   | Product specification | -             | BAS16W_3                                                                                                         |
| BAS316_4          | 20040204                                                                                                                                                                                                                                                                                                                                                                   | Product specification | -             | BAS316_3                                                                                                         |
| BAS516_1          | 19980831                                                                                                                                                                                                                                                                                                                                                                   | Product specification | -             | -                                                                                                                |

## 12. Legal information

### 12.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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".

[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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