

# 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

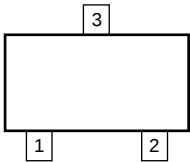
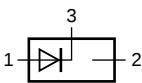
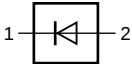
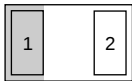
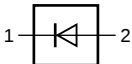
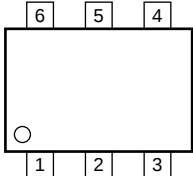
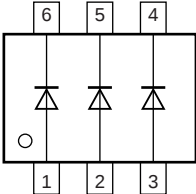
**Table 2. Quick reference data**

$T_{amb} = 25\text{ }^{\circ}\text{C}$  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           | [1] | <br>001aab540            | <br>006aab040 |
| 2                              | anode             |     |                                                                                                               |                                                                                                    |
| BAS16L                         |                   |     |                                                                                                               |                                                                                                    |
| 1                              | cathode           | [1] | <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 |           |     |      |      |
|                   |                                     | $t_p = 1$ µs                                 |           | -   | 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 µm 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.

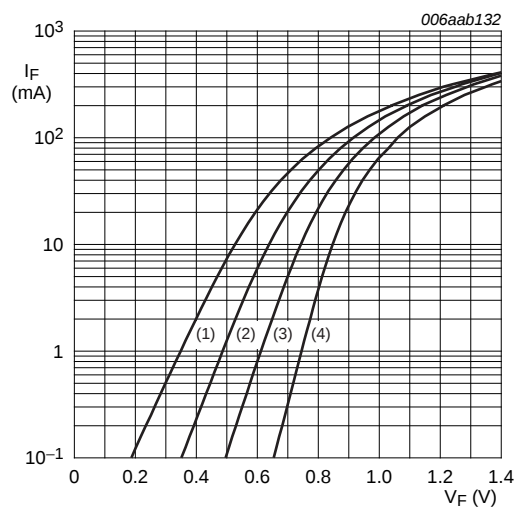
## 7. Characteristics

**Table 8. Characteristics**

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

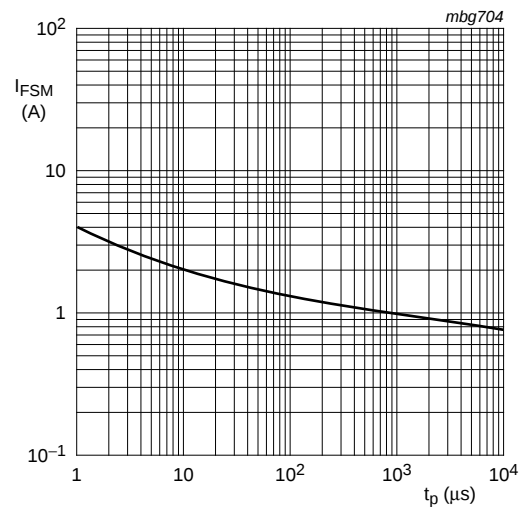
| Symbol           | Parameter                                                                           | Conditions                                                                                                    | Min | Typ | Max  | Unit          |
|------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----|-----|------|---------------|
| <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:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$ .



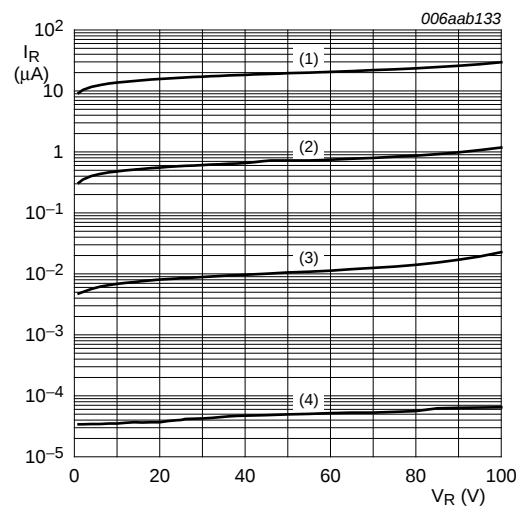
- (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = 85\text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (4)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



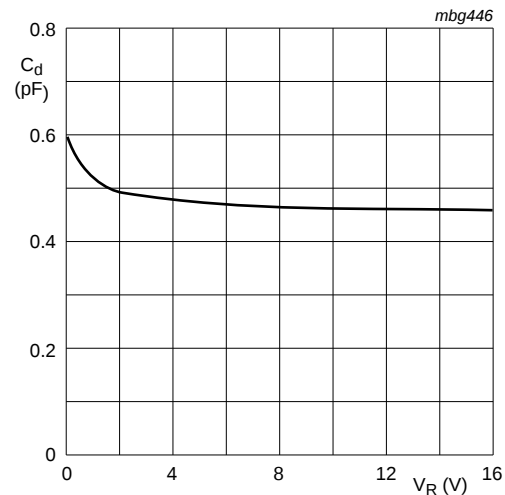
Based on square wave currents.  
 $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$

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)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

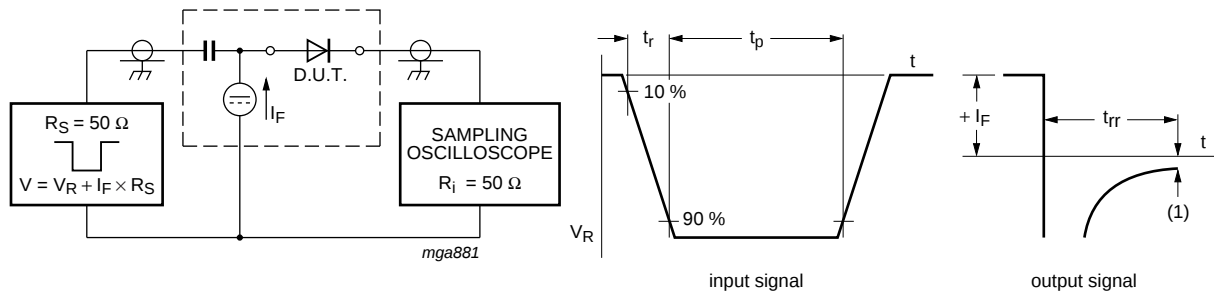
Fig 3. Reverse current as a function of reverse voltage; typical values



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

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

## 8. Test information

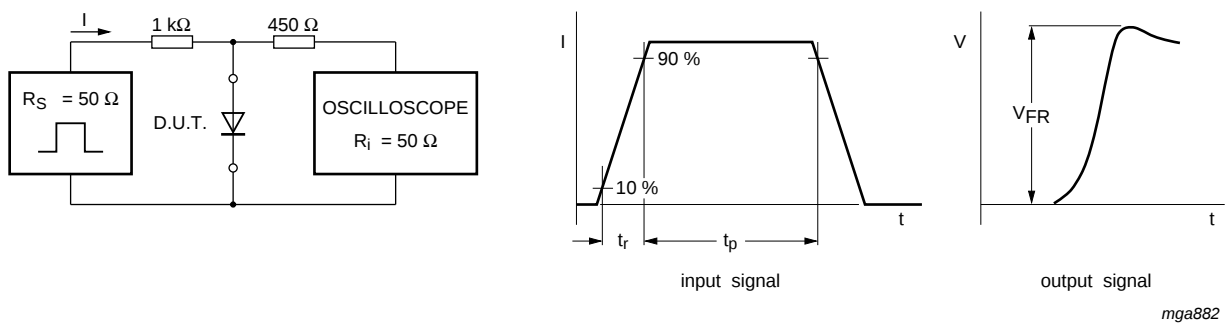


(1)  $I_R = 1 \text{ mA}$

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**



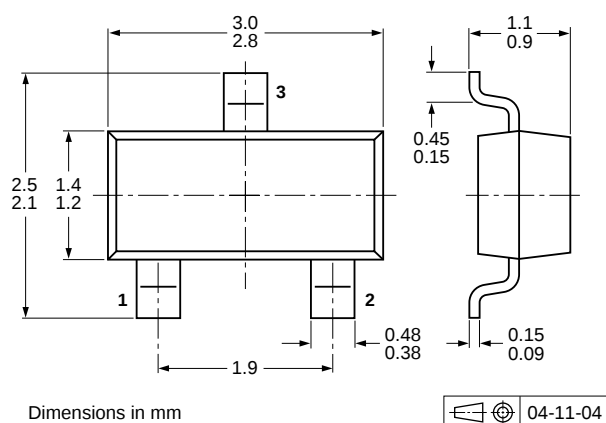
Input signal: forward pulse rise time  $t_r = 20 \text{ ns}$ ; forward current pulse duration  $t_p \geq 100 \text{ ns}$ ; duty cycle  $\delta \leq 0.005$

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

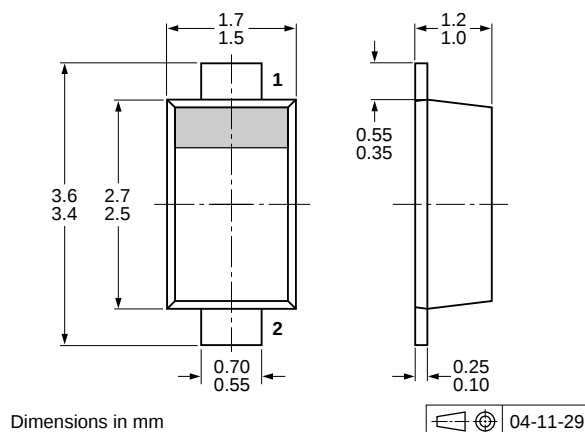
### 8.1 Quality information

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.

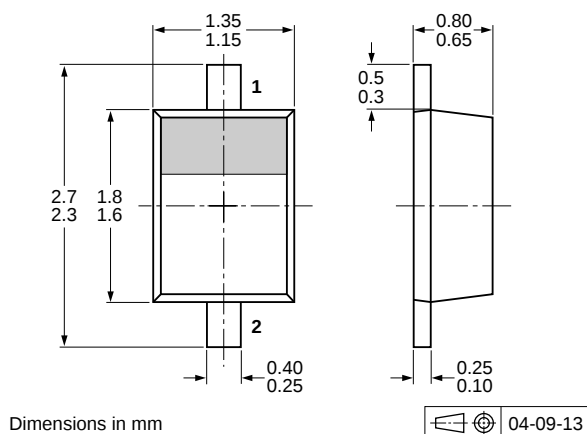
## 9. Package outline



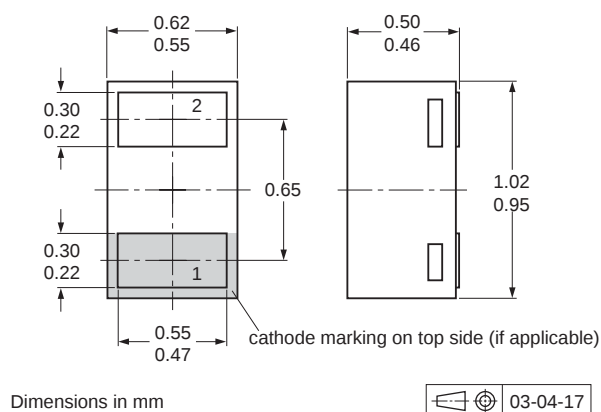
**Fig 7. Package outline BAS16 (SOT23/TO-236AB)**



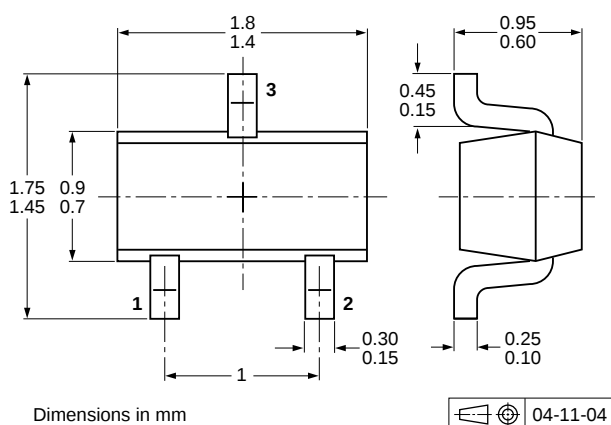
**Fig 8. Package outline BAS16H (SOD123F)**



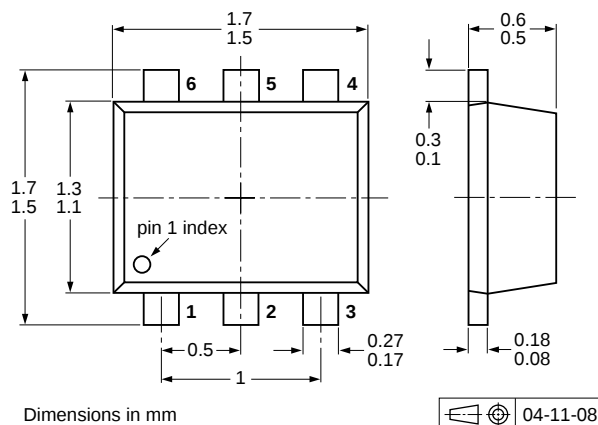
**Fig 9. Package outline BAS16J (SOD323F/SC-90)**



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



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



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

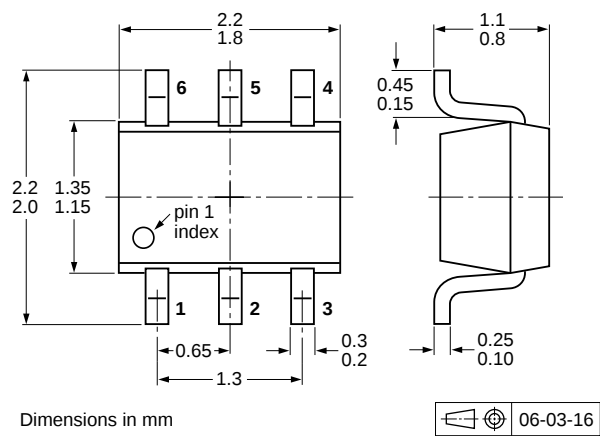


Fig 13. Package outline BAS16VY (SOT363)

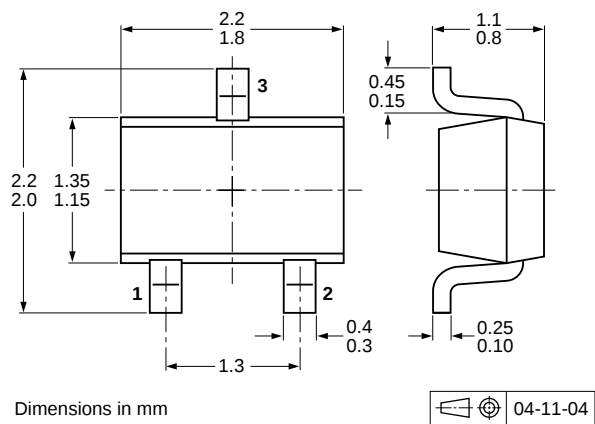


Fig 14. Package outline BAS16W (SOT323/SC-70)

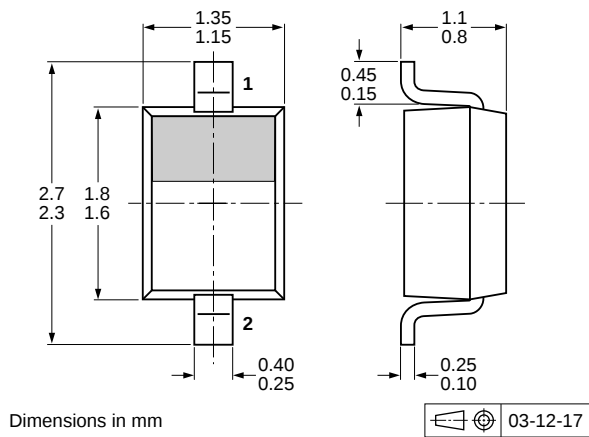


Fig 15. Package outline BAS316 (SOD323/SC-76)

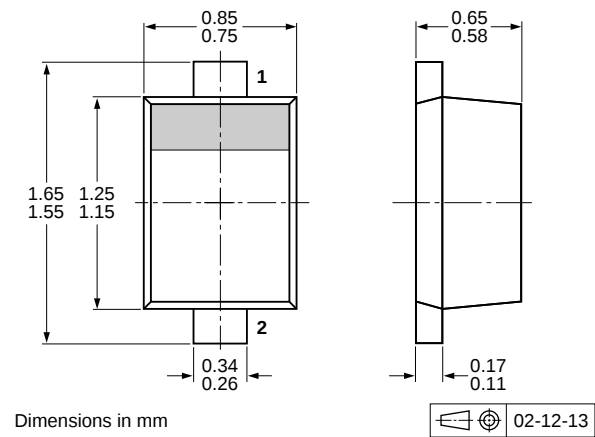


Fig 16. Package outline BAS516 (SOD523/SC-79)

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)

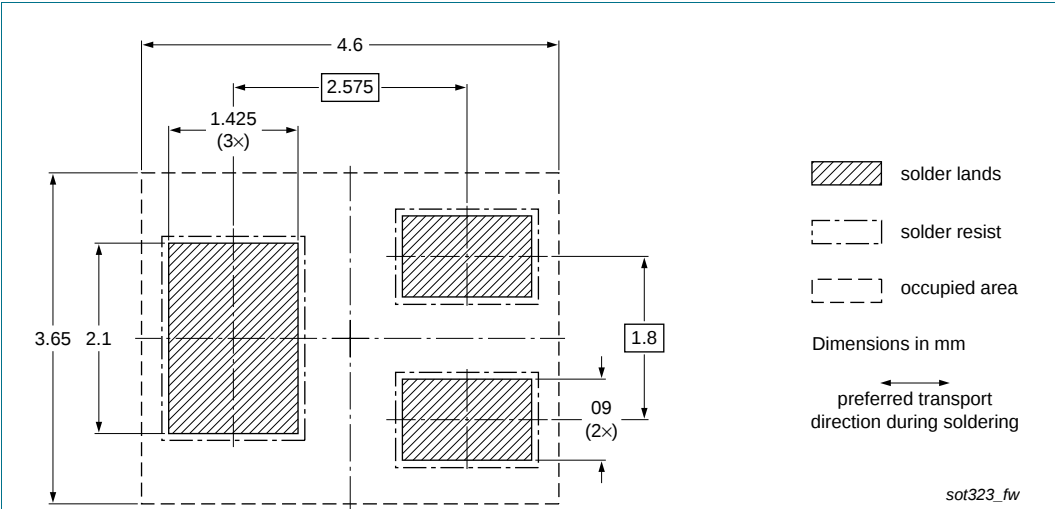


Fig 27. Wave soldering footprint BAS16W (SOT323/SC-70)

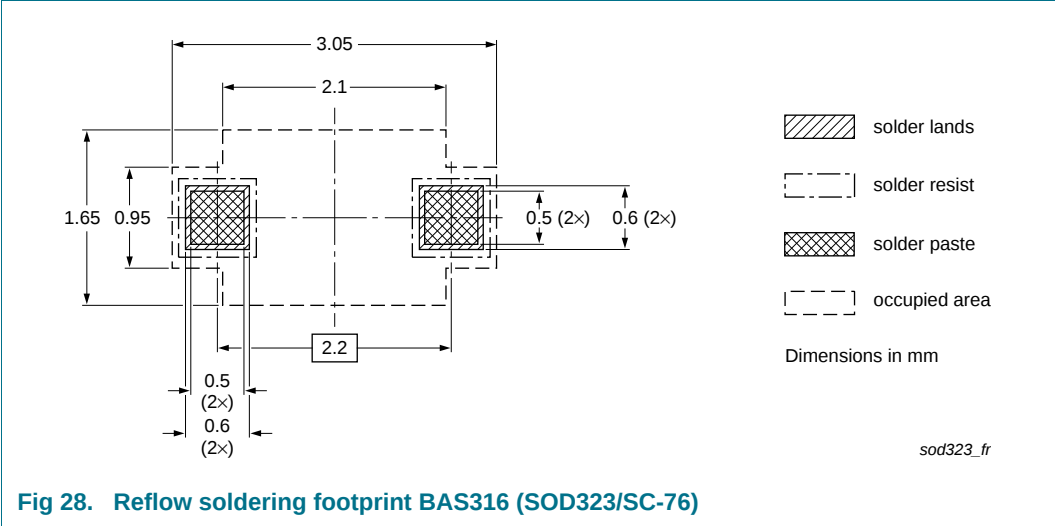


Fig 28. Reflow soldering footprint BAS316 (SOD323/SC-76)

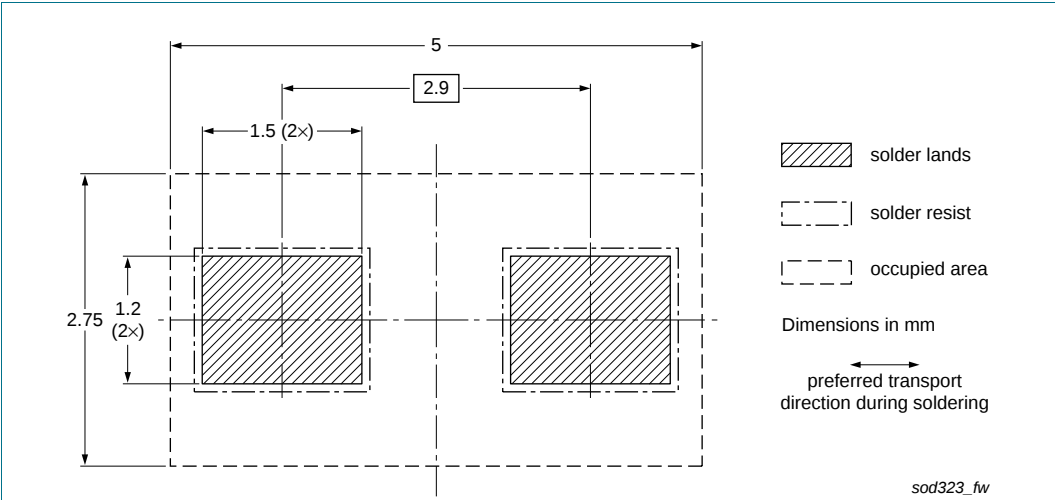


Fig 29. Wave soldering footprint BAS316 (SOD323/SC-76)



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".

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