



# BAT46WJ

Single Schottky barrier diode

Rev. 2 — 8 November 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Single planar Schottky barrier diode with an integrated guard ring for stress protection, encapsulated in a very small and flat lead SOD323F (SC-90) Surface-Mounted Device (SMD) plastic package.

### 1.2 Features and benefits

- Low forward voltage
- Reverse voltage  $V_R \leq 100$  V
- Very small and flat lead SMD plastic package
- Low capacitance
- AEC-Q101 qualified

### 1.3 Applications

- High-speed switching
- Line termination
- Voltage clamping
- Reverse polarity protection

### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter       | Conditions     | Min   | Typ | Max | Unit    |
|--------|-----------------|----------------|-------|-----|-----|---------|
| $V_R$  | reverse voltage |                | -     | -   | 100 | V       |
| $V_F$  | forward voltage | $I_F = 250$ mA | [1] - | -   | 850 | mV      |
| $I_R$  | reverse current | $V_R = 75$ V   | [1] - | -   | 4   | $\mu$ A |

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

## 2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline | Graphic symbol |
|-----|-------------|--------------------|----------------|
| 1   | cathode [1] |                    | <br>sym001     |
| 2   | anode       |                    |                |

[1] The marking bar indicates the cathode.



### 3. Ordering information

Table 3. Ordering information

| Type number | Package |                                          |         |
|-------------|---------|------------------------------------------|---------|
|             | Name    | Description                              | Version |
| BAT46WJ     | SC-90   | plastic surface-mounted package; 2 leads | SOD323F |

### 4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| BAT46WJ     | JK           |

### 5. Limiting values

Table 5. Limiting values

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

| Symbol    | Parameter                           | Conditions                    | Min      | Max  | Unit |
|-----------|-------------------------------------|-------------------------------|----------|------|------|
| $V_R$     | reverse voltage                     |                               | -        | 100  | V    |
| $I_F$     | forward current                     |                               | -        | 250  | mA   |
| $I_{FSM}$ | non-repetitive peak forward current | square wave;<br>$t_p < 10$ ms | [1] -    | 2.5  | A    |
| $P_{tot}$ | total power dissipation             | $T_{amb} \leq 25$ °C          | [2][4] - | 400  | mW   |
|           |                                     |                               | [3][4] - | 715  | mW   |
| $T_j$     | junction temperature                |                               | -        | 150  | °C   |
| $T_{amb}$ | ambient temperature                 |                               | -55      | +150 | °C   |
| $T_{stg}$ | storage temperature                 |                               | -65      | +150 | °C   |

[1]  $T_j = 25$  °C before surge.

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

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

[4] Reflow soldering is the only recommended soldering method.

### 6. Thermal characteristics

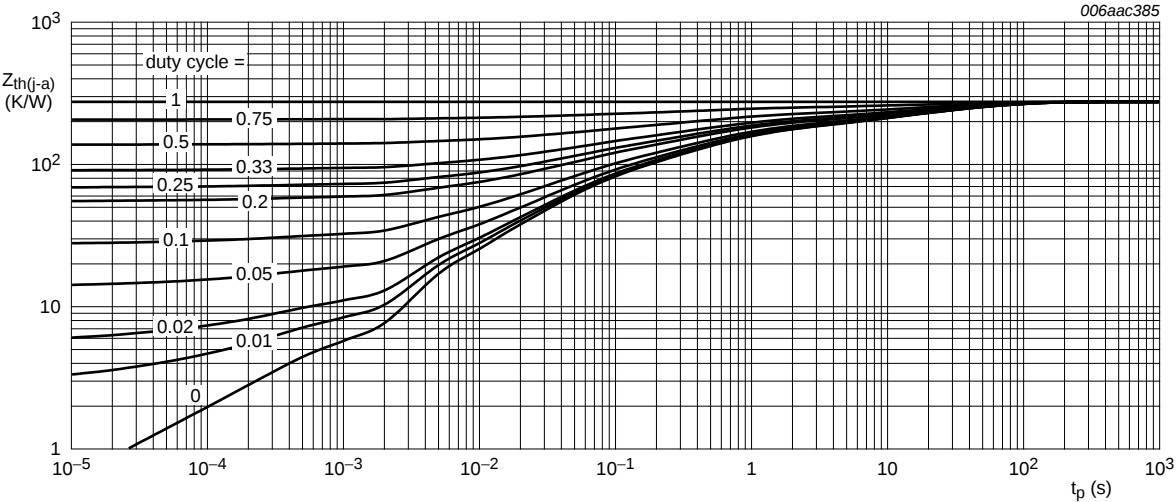
Table 6. Thermal characteristics

| Symbol        | Parameter                                   | Conditions  | Min      | Typ | Max | Unit |
|---------------|---------------------------------------------|-------------|----------|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1][3] - | -   | 310 | K/W  |
|               |                                             |             | [2][3] - | -   | 175 | K/W  |

Table 6. Thermal characteristics ...continued

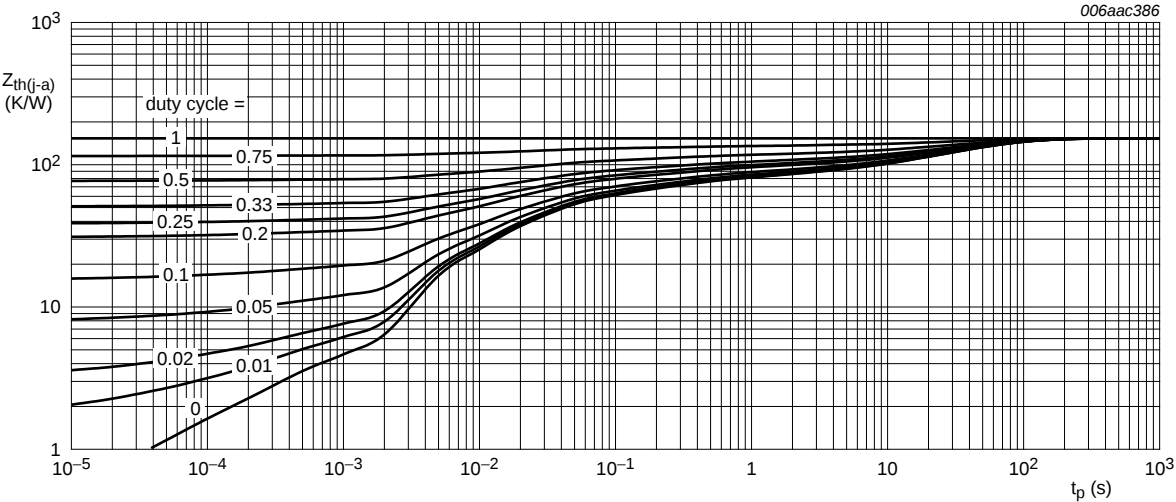
| Symbol         | Parameter                                        | Conditions | Min | Typ | Max | Unit |
|----------------|--------------------------------------------------|------------|-----|-----|-----|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | [4]        | -   | -   | 35  | K/W  |

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm<sup>2</sup>.
- [3] Reflow soldering is the only recommended soldering method.
- [4] Soldering point of cathode tab.



FR4 PCB, standard footprint

Fig 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, mounting pad for cathode 1 cm<sup>2</sup>

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

## 7. Characteristics

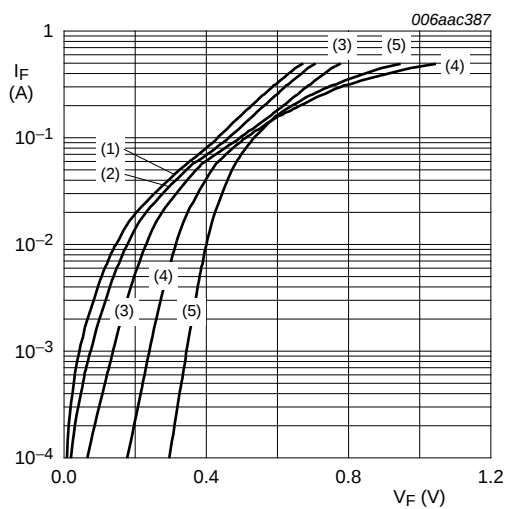
**Table 7. Characteristics**

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

| Symbol   | Parameter             | Conditions                                              | Min | Typ | Max | Unit          |
|----------|-----------------------|---------------------------------------------------------|-----|-----|-----|---------------|
| $V_F$    | forward voltage       |                                                         | [1] |     |     |               |
|          |                       | $I_F = 0.1\text{ mA}$                                   | -   | 175 | 200 | mV            |
|          |                       | $I_F = 10\text{ mA}$                                    | -   | 315 | 350 | mV            |
|          |                       | $I_F = 10\text{ mA}; T_j = -40\text{ }^{\circ}\text{C}$ | -   | -   | 470 | mV            |
|          |                       | $I_F = 50\text{ mA}$                                    | -   | 415 | 475 | mV            |
|          |                       | $I_F = 50\text{ mA}; T_j = -40\text{ }^{\circ}\text{C}$ | -   | -   | 560 | mV            |
|          |                       | $I_F = 250\text{ mA}$                                   | -   | 710 | 850 | mV            |
| $I_R$    | reverse current       |                                                         | [1] |     |     |               |
|          |                       | $V_R = 1.5\text{ V}$                                    | -   | 0.2 | 0.5 | $\mu\text{A}$ |
|          |                       | $V_R = 1.5\text{ V}; T_j = 60\text{ }^{\circ}\text{C}$  | -   | -   | 12  | $\mu\text{A}$ |
|          |                       | $V_R = 10\text{ V}$                                     | -   | 0.3 | 0.8 | $\mu\text{A}$ |
|          |                       | $V_R = 10\text{ V}; T_j = 60\text{ }^{\circ}\text{C}$   | -   | -   | 20  | $\mu\text{A}$ |
|          |                       | $V_R = 50\text{ V}$                                     | -   | 0.7 | 2   | $\mu\text{A}$ |
|          |                       | $V_R = 50\text{ V}; T_j = 60\text{ }^{\circ}\text{C}$   | -   | -   | 44  | $\mu\text{A}$ |
|          |                       | $V_R = 75\text{ V}$                                     | -   | 1   | 4   | $\mu\text{A}$ |
|          |                       | $V_R = 75\text{ V}; T_j = 60\text{ }^{\circ}\text{C}$   | -   | -   | 80  | $\mu\text{A}$ |
|          |                       | $V_R = 100\text{ V}$                                    | -   | 2   | 9   | $\mu\text{A}$ |
|          |                       | $V_R = 100\text{ V}; T_j = 60\text{ }^{\circ}\text{C}$  | -   | -   | 120 | $\mu\text{A}$ |
|          |                       | $V_R = 100\text{ V}; T_j = 85\text{ }^{\circ}\text{C}$  | -   | -   | 600 | $\mu\text{A}$ |
| $C_d$    | diode capacitance     | $f = 1\text{ MHz}$                                      |     |     |     |               |
|          |                       | $V_R = 0\text{ V}$                                      | -   | -   | 39  | pF            |
|          |                       | $V_R = 1\text{ V}$                                      | -   | -   | 21  | pF            |
| $t_{rr}$ | reverse recovery time |                                                         | [2] | 5.9 | -   | ns            |

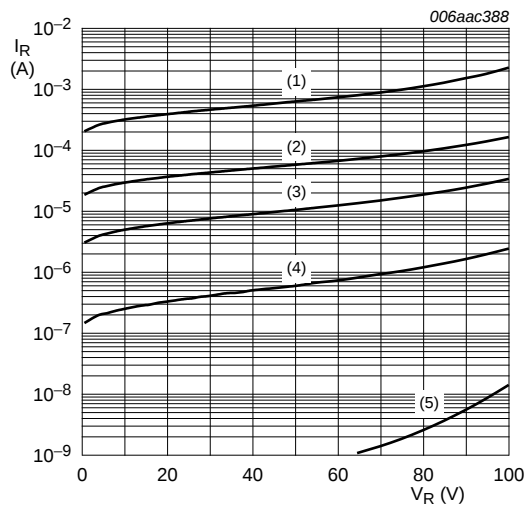
[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$ .

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



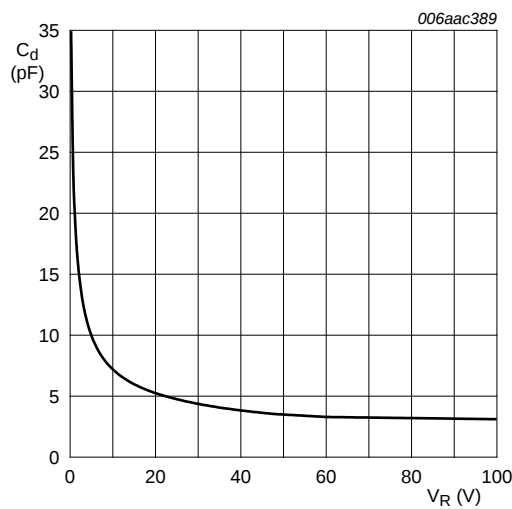
- (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = 125\text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = 85\text{ }^{\circ}\text{C}$
- (4)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (5)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

Fig 3. Forward current as a function of forward voltage; typical values



- (1)  $T_{amb} = 125\text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = 85\text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = 60\text{ }^{\circ}\text{C}$
- (4)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (5)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

Fig 4. Reverse current as a function of reverse voltage; typical values



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

Fig 5. Diode capacitance as a function of reverse voltage; typical values

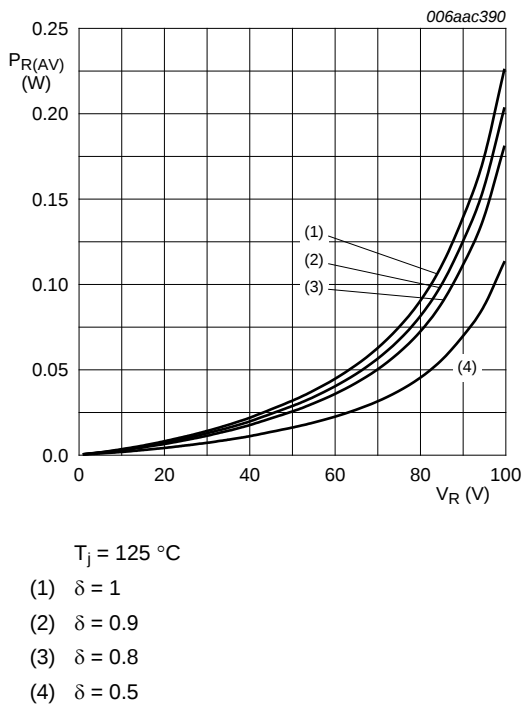


Fig 6. Average reverse power dissipation as a function of reverse voltage; typical values

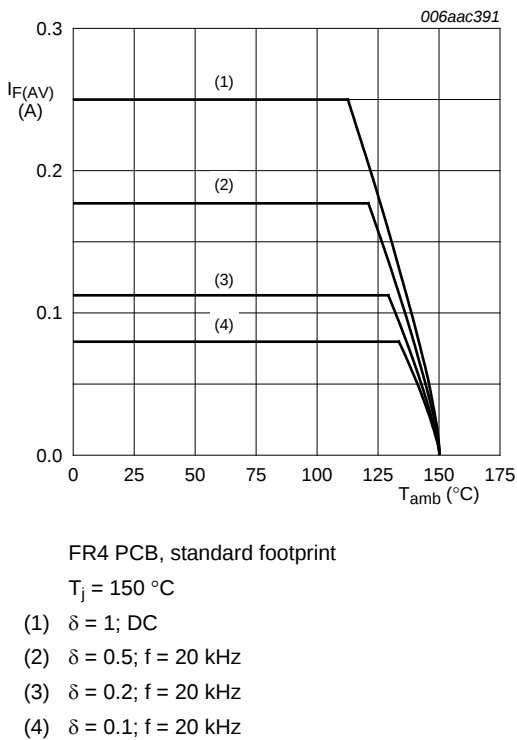


Fig 7. Average forward current as a function of ambient temperature; typical values

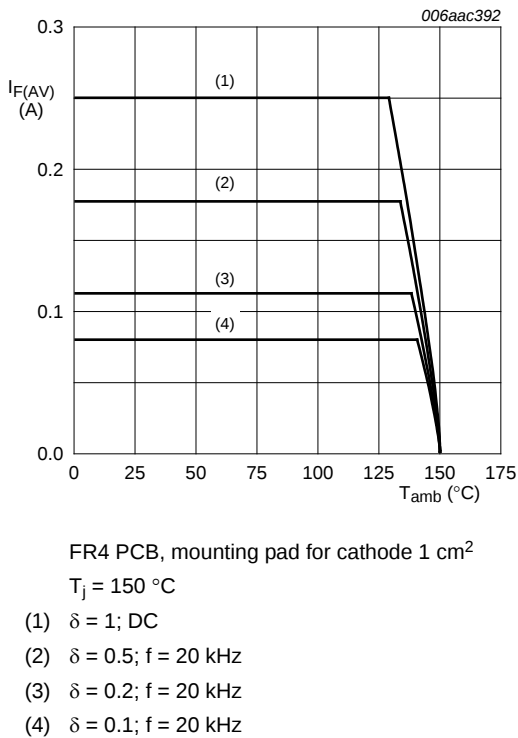


Fig 8. Average forward current as a function of ambient temperature; typical values

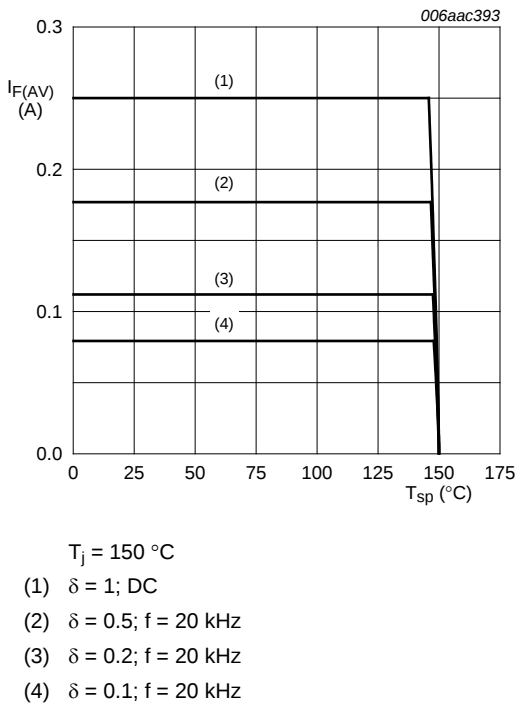
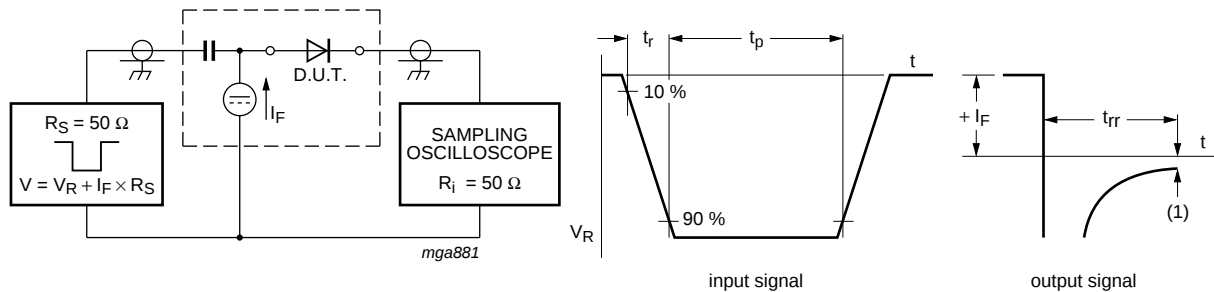


Fig 9. Average forward current as a function of solder point temperature; typical values

## 8. Test information

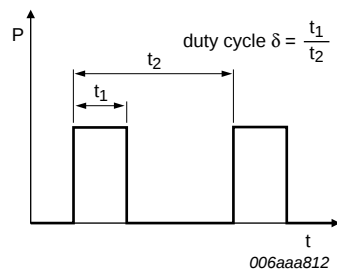


(1)  $I_R = 1 \text{ mA}$

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 10. Reverse recovery time test circuit and waveforms**



**Fig 11. Duty cycle definition**

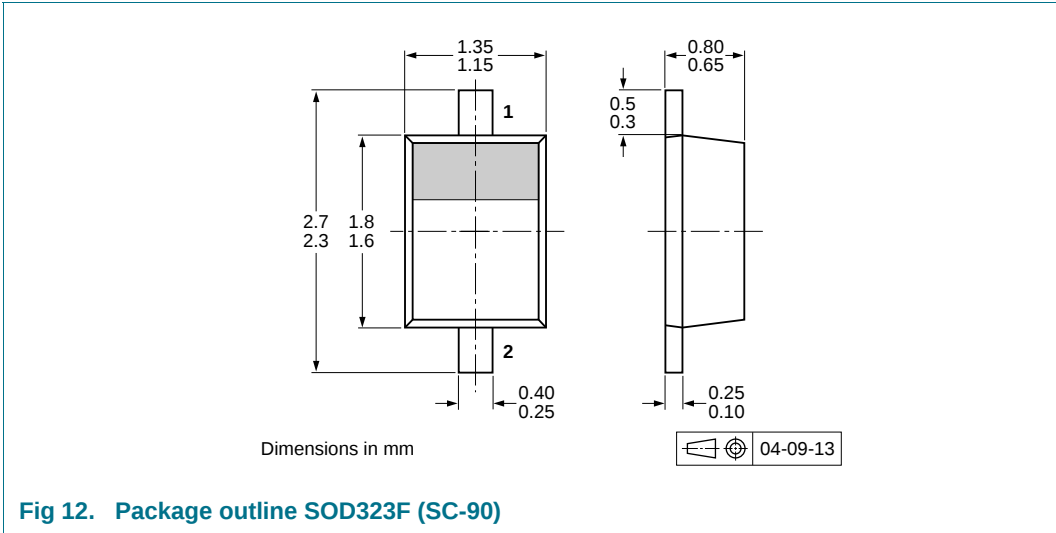
The current ratings for the typical waveforms as shown in [Figure 7](#), [8](#) and [9](#) are calculated according to the equations:  $I_{F(AV)} = I_M \times \delta$  with  $I_M$  defined as peak current,

$I_{RMS} = I_{F(AV)}$  at DC, and  $I_{RMS} = I_M \times \sqrt{\delta}$  with  $I_{RMS}$  defined as RMS current.

### 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



10. Packing information

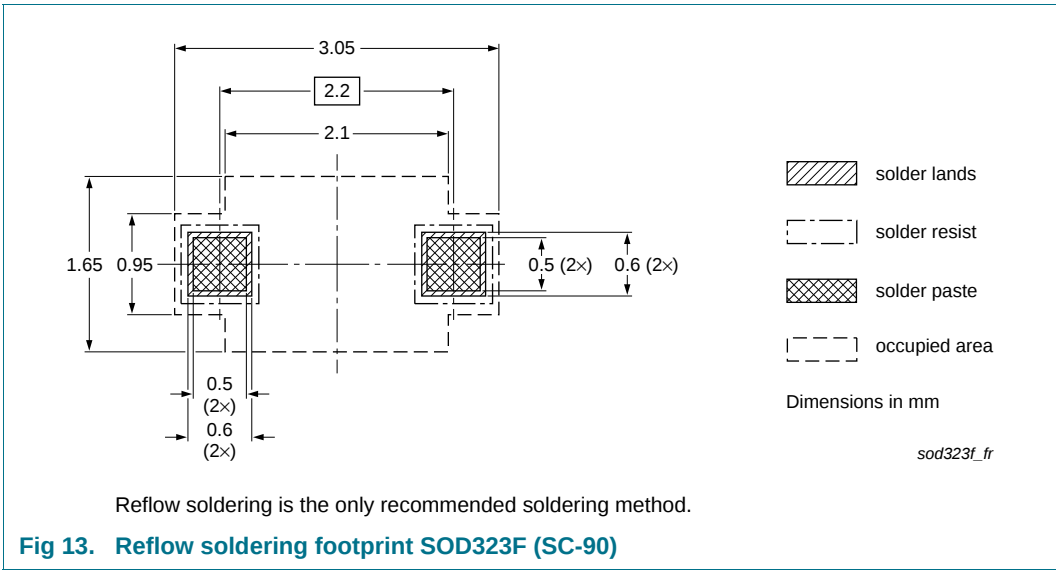
Table 8. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.[\[1\]](#)

| Type number | Package | Description                    | Packing quantity |       |
|-------------|---------|--------------------------------|------------------|-------|
|             |         |                                | 3000             | 10000 |
| BAT46WJ     | SOD323F | 4 mm pitch, 8 mm tape and reel | -115             | -135  |

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

11. Soldering



## 12. Revision history

Table 9. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                                                                                                                               | Data sheet status  | Change notice | Supersedes  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-------------|
| BAT46WJ v.2    | 20111108                                                                                                                                                                                                                                                                                                                                                   | Product data sheet | -             | BAT46WJ v.1 |
| Modifications: | <ul style="list-style-type: none"><li>• <a href="#">Table 7</a>: unit for reverse current <math>I_R</math> at <math>V_R = 50\text{ V}</math> corrected to <math>\mu\text{A}</math></li><li>• <a href="#">Table 7</a>: conditions of reverse voltage <math>V_R</math> corrected</li><li>• <a href="#">Section 13 "Legal information"</a>: updated</li></ul> |                    |               |             |
| BAT46WJ v.1    | 20100728                                                                                                                                                                                                                                                                                                                                                   | Product data sheet | -             | -           |

## 13. Legal information

### 13.1 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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Date of release: 8 November 2011

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