

## 1. Product profile

### 1.1 General description

Passivated sensitive gate 4-Q triac in a SOT223 surface-mountable plastic package

### 1.2 Features and benefits

- Direct interfacing to logic level ICs
- Direct interfacing to low power gate drive circuits
- High blocking voltage of 800V
- Sensitive gate in four quadrants
- Surface-mountable package

### 1.3 Applications

- General purpose low power motor control
- Home appliances
- Industrial process control
- Low power AC Fan controllers

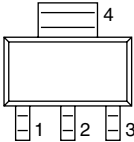
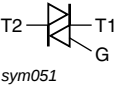
### 1.4 Quick reference data

Table 1. Quick reference

| Symbol                        | Parameter                         | Conditions                                                                                                           | Min | Typ | Max | Unit |
|-------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $V_{\text{DRM}}$              | repetitive peak off-state voltage |                                                                                                                      | -   | -   | 800 | V    |
| $I_{\text{T(RMS)}}$           | RMS on-state current              | half sine wave; $T_{\text{sp}} \leq 89\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 4</a> and <a href="#">1</a> | -   | -   | 1   | A    |
| <b>Static characteristics</b> |                                   |                                                                                                                      |     |     |     |      |
| $I_{\text{GT}}$               | gate trigger current              | $V_{\text{D}} = 12\text{ V}$ ; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; T2+ G-; see <a href="#">Figure 6</a>    | -   | -   | 10  | mA   |
|                               |                                   | $V_{\text{D}} = 12\text{ V}$ ; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; T2- G-                                  | -   | -   | 10  | mA   |
|                               |                                   | $V_{\text{D}} = 12\text{ V}$ ; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; T2+ G+                                  | -   | -   | 10  | mA   |
|                               |                                   | $V_{\text{D}} = 12\text{ V}$ ; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; T2- G+                                  | -   | -   | 10  | mA   |

2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description     | Simplified outline                                                                                      | Graphic symbol                                                                                |
|-----|--------|-----------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1   | T1     | main terminal 1 | <br>SOT223<br>(SC-73) | <br>sym051 |
| 2   | T2     | main terminal 2 |                                                                                                         |                                                                                               |
| 3   | G      | gate            |                                                                                                         |                                                                                               |
| 4   | T2     | main terminal 2 |                                                                                                         |                                                                                               |

3. Ordering information

Table 3. Ordering information

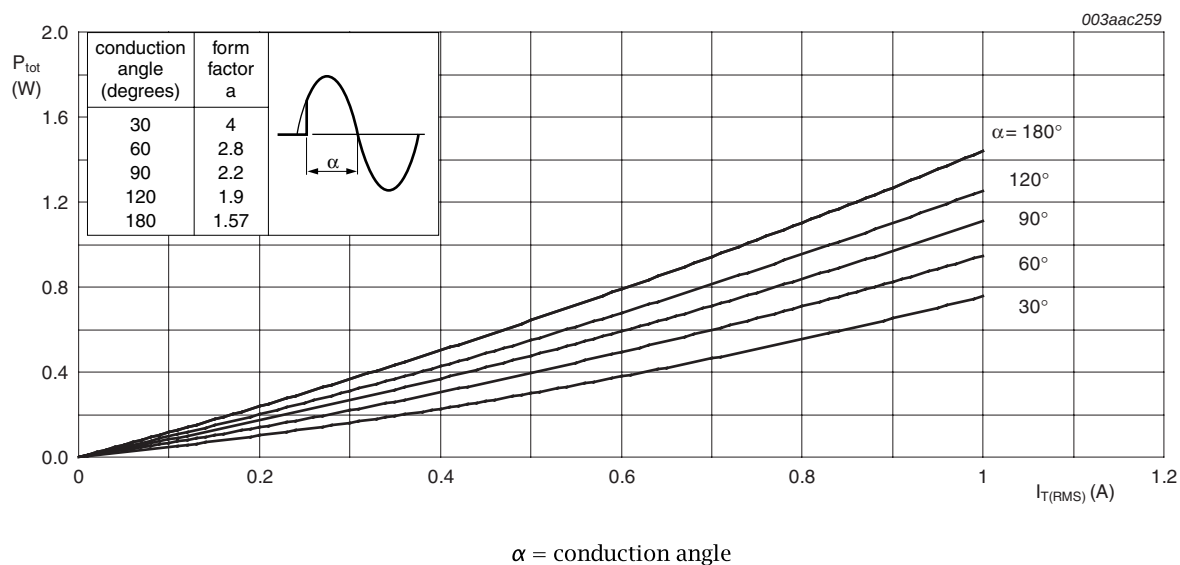
| Type number | Package |                                                                  | Version |
|-------------|---------|------------------------------------------------------------------|---------|
|             | Name    | Description                                                      |         |
| Z0109NN     | SC-73   | plastic surface-mounted package with increased heatsink; 4 leads | SOT223  |

## 4. Limiting values

**Table 4. Limiting values**

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

| Symbol              | Parameter                            | Conditions                                                                                                                                   | Min | Max  | Unit                 |
|---------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------------------|
| $V_{\text{DRM}}$    | repetitive peak off-state voltage    |                                                                                                                                              | -   | 800  | V                    |
| $I_{\text{T(RMS)}}$ | RMS on-state current                 | half sine wave; $T_{\text{sp}} \leq 89^\circ\text{C}$ ; see <a href="#">Figure 4</a> and <a href="#">1</a>                                   | -   | 1    | A                    |
| $di_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{T}} = 1\text{ A}$ ; $I_{\text{G}} = 20\text{ mA}$ ; $di_{\text{G}}/dt = 100\text{ mA}/\mu\text{s}$ ; T2+ G+                        | -   | 50   | A/ $\mu\text{s}$     |
|                     |                                      | $I_{\text{T}} = 1\text{ A}$ ; $I_{\text{G}} = 20\text{ mA}$ ; $di_{\text{G}}/dt = 100\text{ mA}/\mu\text{s}$ ; T2+ G-                        | -   | 50   | A/ $\mu\text{s}$     |
|                     |                                      | $I_{\text{T}} = 1\text{ A}$ ; $I_{\text{G}} = 20\text{ mA}$ ; $di_{\text{G}}/dt = 100\text{ mA}/\mu\text{s}$ ; T2- G+                        | -   | 20   | A/ $\mu\text{s}$     |
|                     |                                      | $I_{\text{T}} = 1\text{ A}$ ; $I_{\text{G}} = 20\text{ mA}$ ; $di_{\text{G}}/dt = 100\text{ mA}/\mu\text{s}$ ; T2- G-                        | -   | 50   | A/ $\mu\text{s}$     |
| $I_{\text{GM}}$     | peak gate current                    |                                                                                                                                              | -   | 1    | A                    |
| $P_{\text{GM}}$     | peak gate power                      |                                                                                                                                              | -   | 2    | W                    |
| $T_{\text{stg}}$    | storage temperature                  |                                                                                                                                              | -40 | 150  | $^\circ\text{C}$     |
| $T_{\text{j}}$      | junction temperature                 |                                                                                                                                              | -   | 125  | $^\circ\text{C}$     |
| $I_{\text{TSM}}$    | non-repetitive peak on-state current | full sine wave; $t_{\text{p}} = 20\text{ ms}$ ; $T_{\text{j(init)}} = 25^\circ\text{C}$ ; see <a href="#">Figure 2</a> and <a href="#">3</a> | -   | 8    | A                    |
|                     |                                      | full sine wave; $t_{\text{p}} = 16.7\text{ ms}$ ; $T_{\text{j(init)}} = 25^\circ\text{C}$                                                    | -   | 8.5  | A                    |
| $I^2t$              | $I^2t$ for fusing                    | $t_{\text{p}} = 10\text{ ms}$ ; sine-wave pulse                                                                                              | -   | 0.32 | $\text{A}^2\text{s}$ |
| $P_{\text{G(AV)}}$  | average gate power                   |                                                                                                                                              | -   | 0.1  | W                    |



**Fig 1. Total power dissipation as a function of RMS on-state current; maximum values**

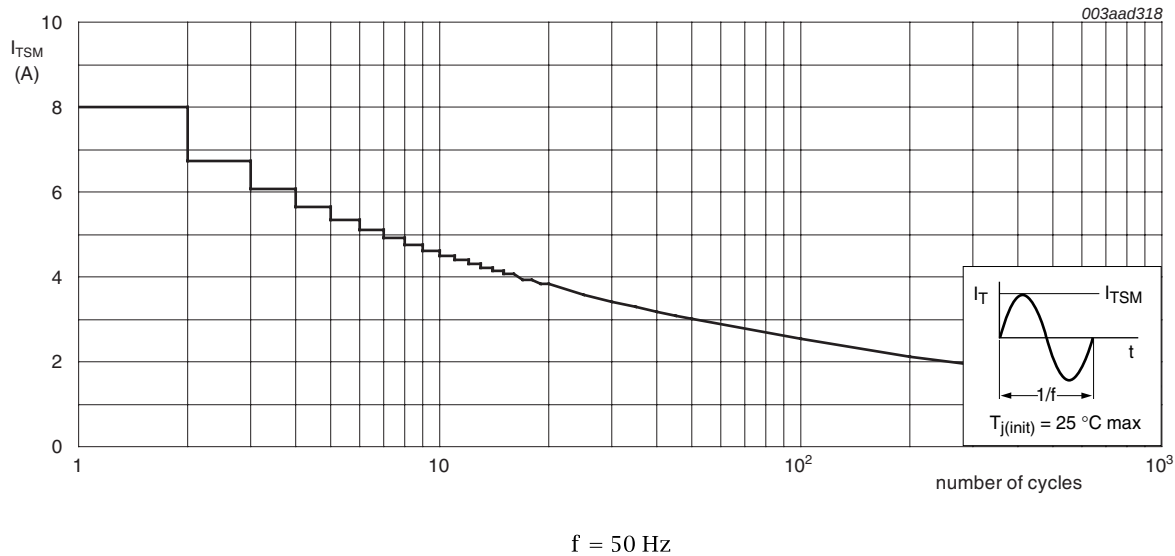


Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

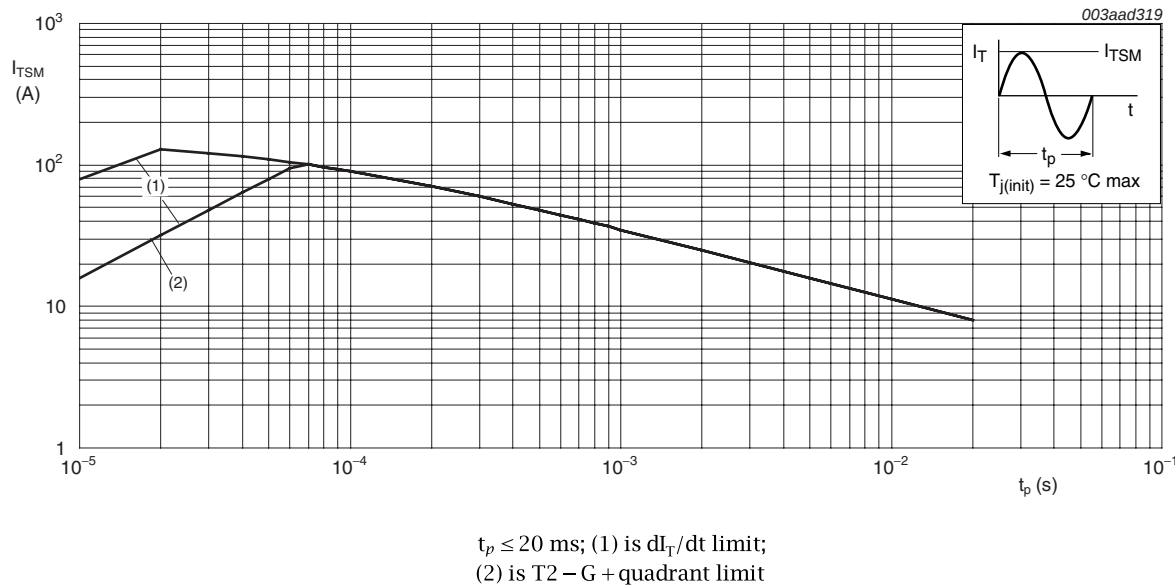


Fig 3. Non-repetitive peak on-state current as a function of pulse width; maximum values

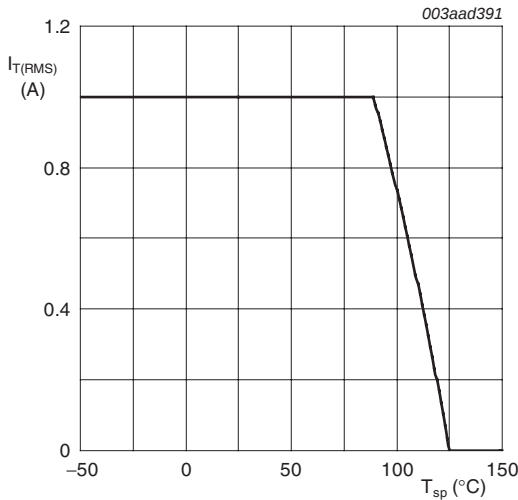


Fig 4. Maximum permissible RMS on-state current as a function of solder point temperature; typical values.

5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol         | Parameter                                        | Conditions                   | Min | Typ | Max | Unit |
|----------------|--------------------------------------------------|------------------------------|-----|-----|-----|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | see <a href="#">Figure 5</a> | -   | -   | 25  | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      |                              | -   | 150 | -   | K/W  |
|                |                                                  |                              | -   | 60  | -   | K/W  |

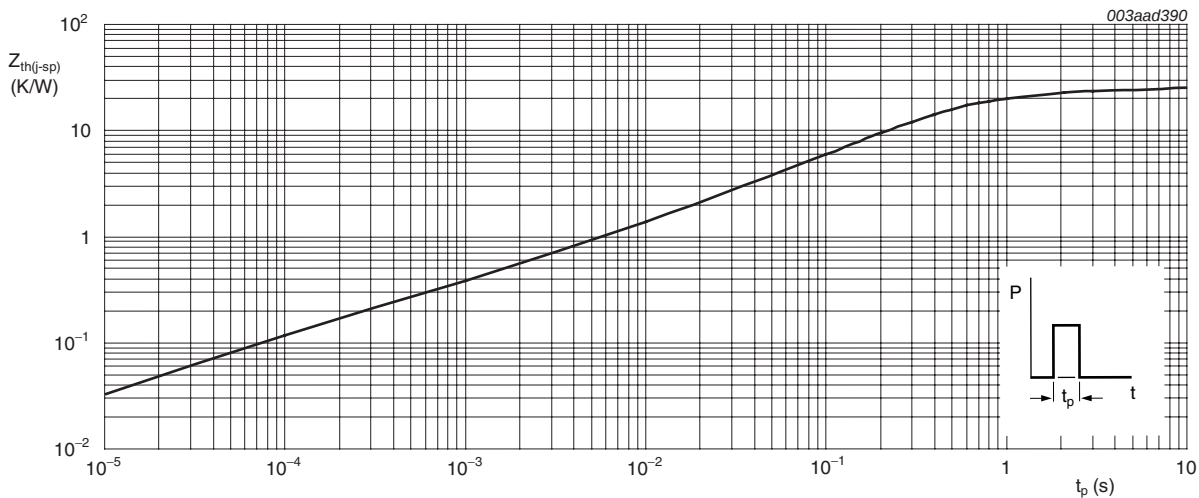
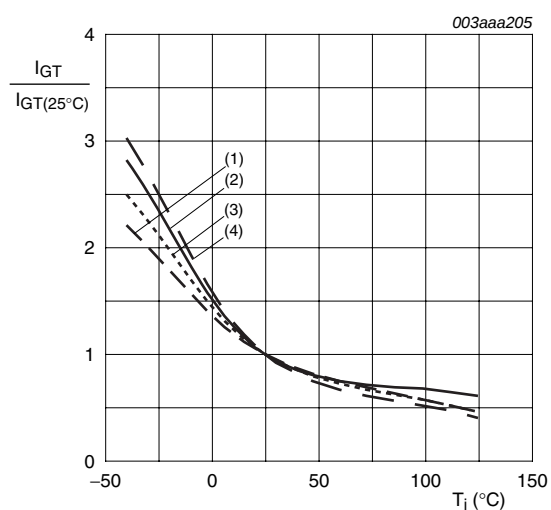


Fig 5. Transient thermal impedance from junction to solder point as a function of pulse duration

## 6. Characteristics

Table 6. Characteristics

| Symbol                         | Parameter                           | Conditions                                                                                                           | Min | Typ | Max | Unit             |
|--------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------------------|
| <b>Static characteristics</b>  |                                     |                                                                                                                      |     |     |     |                  |
| $I_{GT}$                       | gate trigger current                | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; T2+ G-; see <a href="#">Figure 6</a>                        | -   | -   | 10  | mA               |
|                                |                                     | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; T2- G-                                                      | -   | -   | 10  | mA               |
|                                |                                     | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; T2+ G+                                                      | -   | -   | 10  | mA               |
|                                |                                     | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; T2- G+                                                      | -   | -   | 10  | mA               |
| $I_L$                          | latching current                    | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-; see <a href="#">Figure 7</a> | -   | -   | 25  | mA               |
|                                |                                     | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+                               | -   | -   | 15  | mA               |
|                                |                                     | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; $I_G = 0.1\text{ A}$ ; T2- G+                               | -   | -   | 15  | mA               |
|                                |                                     | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; $I_G = 0.1\text{ A}$ ; T2- G-                               | -   | -   | 15  | mA               |
| $I_H$                          | holding current                     | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 10</a>                               | -   | -   | 10  | mA               |
| $V_T$                          | on-state voltage                    | $I_T = 1\text{ A}$ ; see <a href="#">Figure 8</a>                                                                    | -   | 1.3 | 1.6 | V                |
| $V_{GT}$                       | gate trigger voltage                | $I_T = 0.1\text{ A}$ ; $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 9</a>         | -   | -   | 1.3 | V                |
|                                |                                     | $I_T = 0.1\text{ A}$ ; $V_D = 800\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$                                      | 0.2 | -   | -   | V                |
| $I_D$                          | off-state current                   | $V_D = 800\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$                                                             | -   | -   | 0.5 | mA               |
| <b>Dynamic characteristics</b> |                                     |                                                                                                                      |     |     |     |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage   | $V_{DM} = 536\text{ V}$ ; $T_j = 110\text{ }^\circ\text{C}$ ; gate open circuit; see <a href="#">Figure 11</a>       | 50  | -   | -   | V/ $\mu\text{s}$ |
| $dV_{com}/dt$                  | rate of rise of commutating voltage | $V_D = 400\text{ V}$ ; $T_j = 110\text{ }^\circ\text{C}$ ; $di_{com}/dt = 0.44\text{ A/ms}$ ; gate open circuit      | 2   | -   | -   | V/ $\mu\text{s}$ |



(1) is T2+G+ quadrant; (2) is T2+G- quadrant;  
(3) is T2- G- quadrant; (4) is T2- G+ quadrant

Fig 6. Normalized gate trigger current as a function of junction temperature

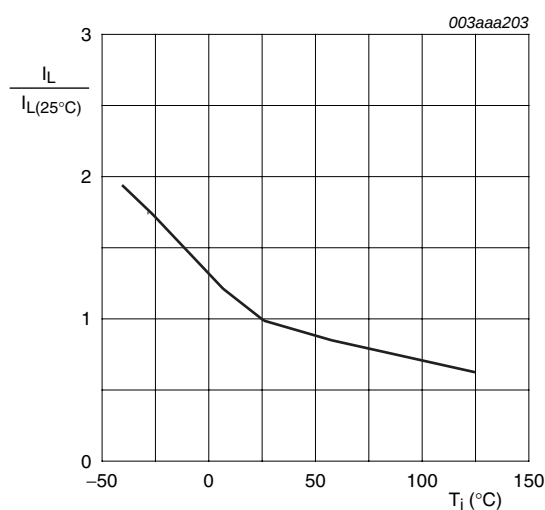
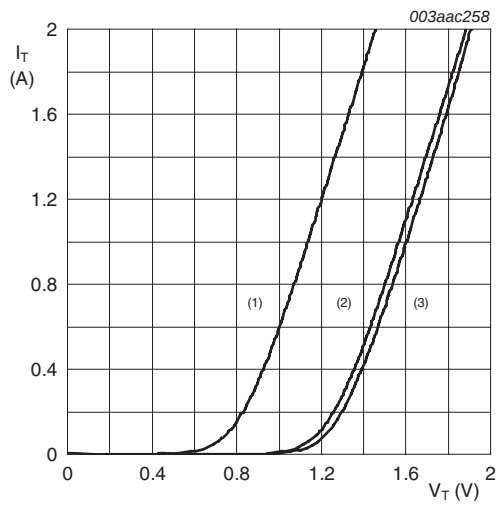


Fig 7. Normalized latching current as a function of junction temperature



$V_0 = 1.254 \text{ V}$ ;  $R_s = 0.31 \Omega$   
(1)  $T_j = 125 \text{ }^\circ\text{C}$ ; typical values  
(2)  $T_j = 125 \text{ }^\circ\text{C}$ ; maximum values  
(3)  $T_j = 25 \text{ }^\circ\text{C}$ ; maximum values

Fig 8. On-state current as a function of on-state voltage

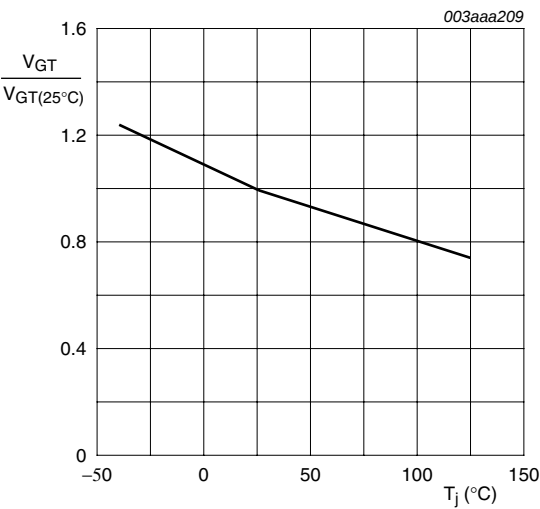


Fig 9. Normalized gate trigger voltage as a function of junction temperature

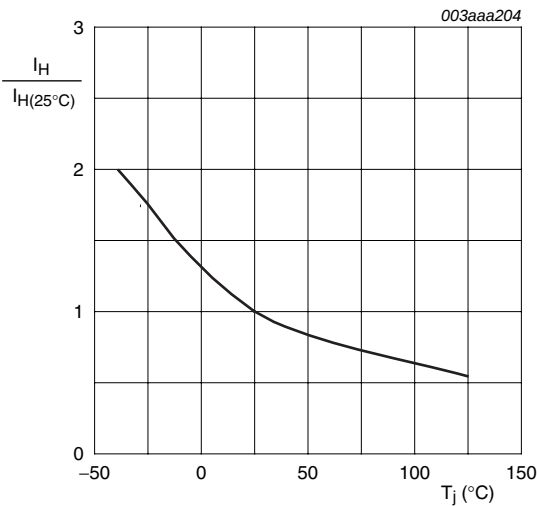
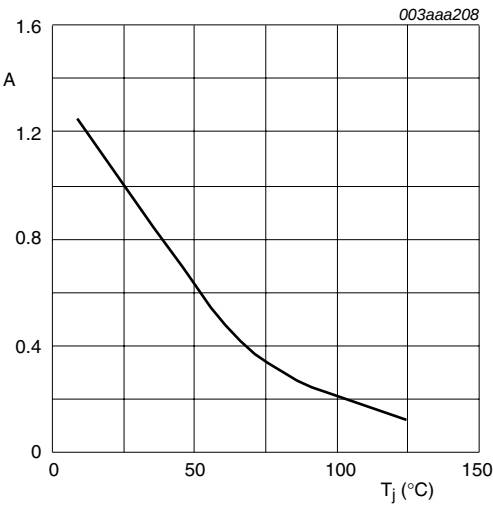


Fig 10. Normalized holding current as a function of junction temperature



$$A = \frac{dV_D/dt}{dV_{D(25^{\circ}\text{C})}/dt}$$

Fig 11. Normalized critical rate of rise of off-state voltage as a function of junction temperature;typical values

7. Package outline

Plastic surface-mounted package with increased heatsink; 4 leads

SOT223

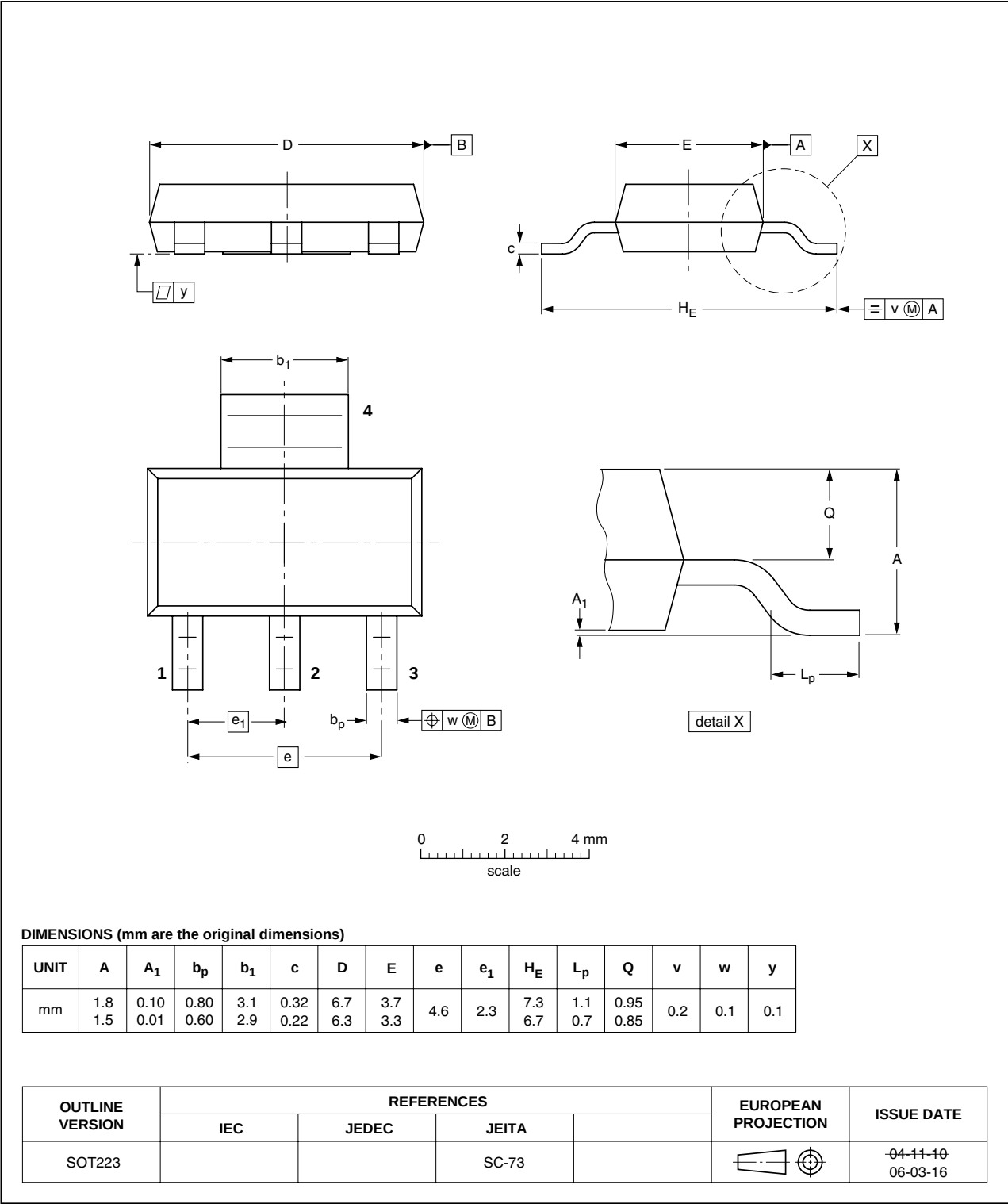


Fig 12. Package outline SOT223 (SC-73)

## 8. Revision history

Table 7. Revision history

| Document ID                               | Release date                                                                                                                                                                                                                                                                                                                            | Data sheet status  | Change notice | Supersedes            |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-----------------------|
| Z0109NN_3                                 | 20090805                                                                                                                                                                                                                                                                                                                                | Product data sheet | -             | Z0103_07_09_SERIES-02 |
| Modifications:                            | <ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• Type number Z0109NN separated from data sheet Z0103_07_09_SERIES-02.</li></ul> |                    |               |                       |
| Z0103_07_09_SERIES-02<br>(9397 750 10102) | 20020912                                                                                                                                                                                                                                                                                                                                | Product data       | -             | Z0103_07_09_SERIES-01 |
| Z0103_07_09_SERIES-01<br>(9397 750 09419) | 20020411                                                                                                                                                                                                                                                                                                                                | Product data       | -             | -                     |

## 9. Legal information

### 9.1 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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