



Z0109MN0

4Q Triac

Rev. 3 — 12 May 2011

Product data sheet

1. Product profile

1.1 General description

Planar passivated sensitive gate four quadrant triac in a SOT223 (SC-73) surface-mountable plastic package intended for applications requiring enhanced immunity to noise and direct interfacing to logic level ICs and low power gate drivers.

1.2 Features and benefits

- Direct interfacing to logic level ICs
- Enhanced current surge capability
- Enhanced noise immunity
- High blocking voltage capability
- Planar passivated for voltage ruggedness and reliability
- Sensitive gate in four quadrants
- Surface-mountable package
- Triggering in all four quadrants

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 data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------|--------------------------------------|---|-----|-----|------|------|
| V_{DRM} | repetitive peak off-state voltage | | - | - | 600 | V |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{\text{j(init)}} = 25\text{ °C}$; $t_{\text{p}} = 20\text{ ms}$; see Figure 4 ; see Figure 5 | - | - | 12.5 | A |
| $I_{\text{T(RMS)}}$ | RMS on-state current | full sine wave; $T_{\text{sp}} \leq 105\text{ °C}$; see Figure 1 ; see Figure 3 ; see Figure 2 | - | - | 1 | A |

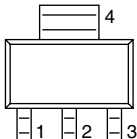
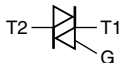


Table 1. Quick reference data ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|----------------------|--|-----|-----|-----|------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ G+;$ $T_j = 25\text{ }^\circ\text{C};$ see Figure 9 | 0.4 | - | 10 | mA |
| | | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ G-;$ $T_j = 25\text{ }^\circ\text{C};$ see Figure 9 | 0.4 | - | 10 | mA |
| | | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2- G-;$ $T_j = 25\text{ }^\circ\text{C};$ see Figure 9 | 0.4 | - | 10 | mA |
| | | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2- G+;$ $T_j = 25\text{ }^\circ\text{C};$ see Figure 9 | 0.4 | - | 10 | mA |

2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------|--|---|
| 1 | T1 | main terminal 1 |  |  sym051 |
| 2 | T2 | main terminal 2 | | |
| 3 | G | gate | | |
| 4 | T2 | main terminal 2 | | |

SOT223 (SOT223)

3. Ordering information

Table 3. Ordering information

| Type number | Package | | Version |
|-------------|---------|--|---------|
| | Name | Description | |
| Z0109MN0 | SOT223 | plastic surface-mounted package with increased heatsink; 4 leads | SOT223 |

4. Marking

Table 4. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| Z0109MN0 | 109MN0 |

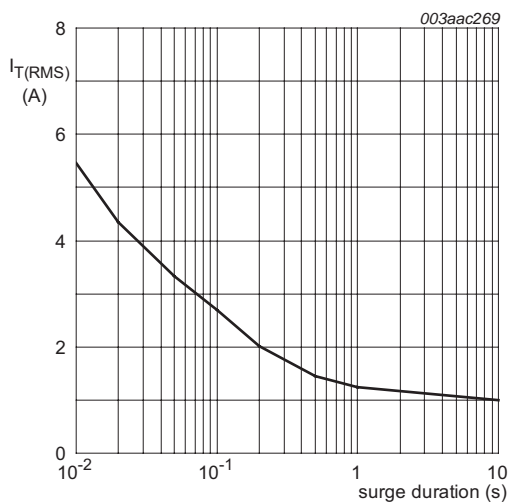
[1] % = placeholder for manufacturing site code

5. Limiting values

Table 5. Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|--------------|--------------------------------------|--|-----|------|------------------|
| V_{DRM} | repetitive peak off-state voltage | | - | 600 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{sp} \leq 105\text{ °C}$; see Figure 1 ; see Figure 3 ; see Figure 2 | - | 1 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 20\text{ ms}$; see Figure 4 ; see Figure 5 | - | 12.5 | A |
| | | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | 13.8 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; sine-wave pulse | - | 0.78 | A ² s |
| dl_T/dt | rate of rise of on-state current | $I_T = 1\text{ A}$; $I_G = 20\text{ mA}$; $dl_G/dt = 100\text{ mA}/\mu\text{s}$; T2+ G+ | - | 50 | A/ μs |
| | | $I_T = 1\text{ A}$; $I_G = 20\text{ mA}$; $dl_G/dt = 100\text{ mA}/\mu\text{s}$; T2+ G- | - | 50 | A/ μs |
| | | $I_T = 1\text{ A}$; $I_G = 20\text{ mA}$; $dl_G/dt = 100\text{ mA}/\mu\text{s}$; T2- G- | - | 50 | A/ μs |
| | | $I_T = 1\text{ A}$; $I_G = 20\text{ mA}$; $dl_G/dt = 100\text{ mA}/\mu\text{s}$; T2- G+ | - | 20 | A/ μs |
| I_{GM} | peak gate current | | - | 1 | A |
| P_{GM} | peak gate power | | - | 2 | W |
| $P_{G(AV)}$ | average gate power | over any 20 ms period | - | 0.1 | W |
| T_{stg} | storage temperature | | -40 | 150 | °C |
| T_j | junction temperature | | - | 125 | °C |



$f = 50\text{ Hz}$;
 $T_{sp} = 105\text{ °C}$

Fig 1. RMS on-state current as a function of surge duration; maximum values

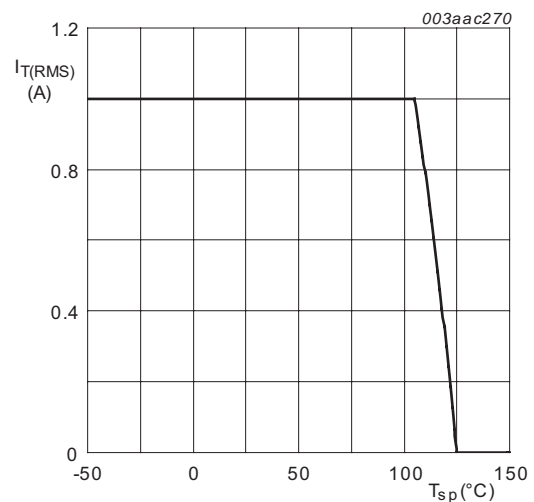


Fig 2. RMS on-state current as a function of solder point temperature; maximum values

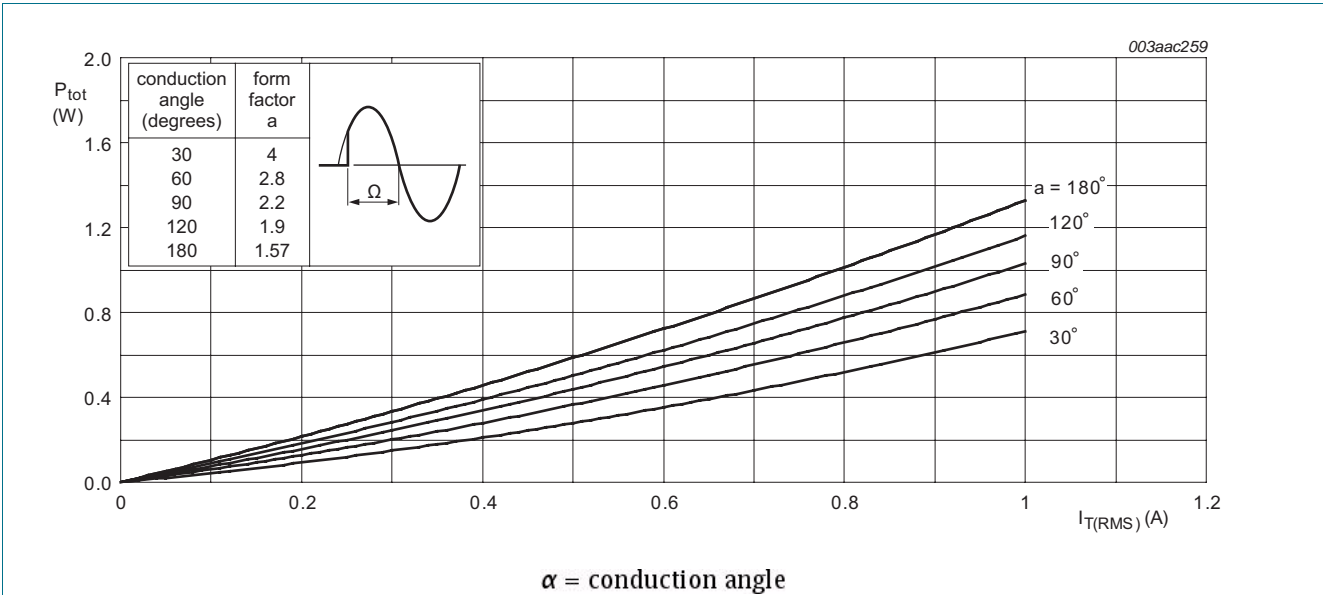


Fig 3. Total power dissipation as a function of RMS on-state current; maximum values

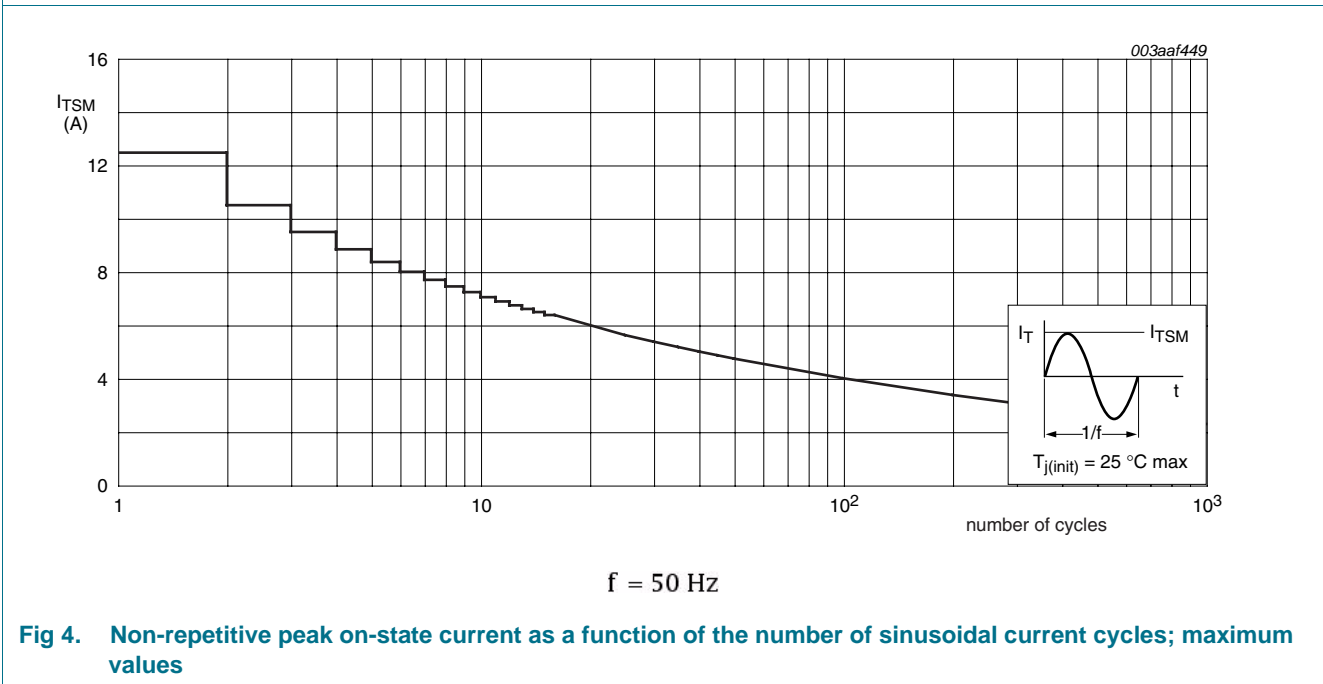
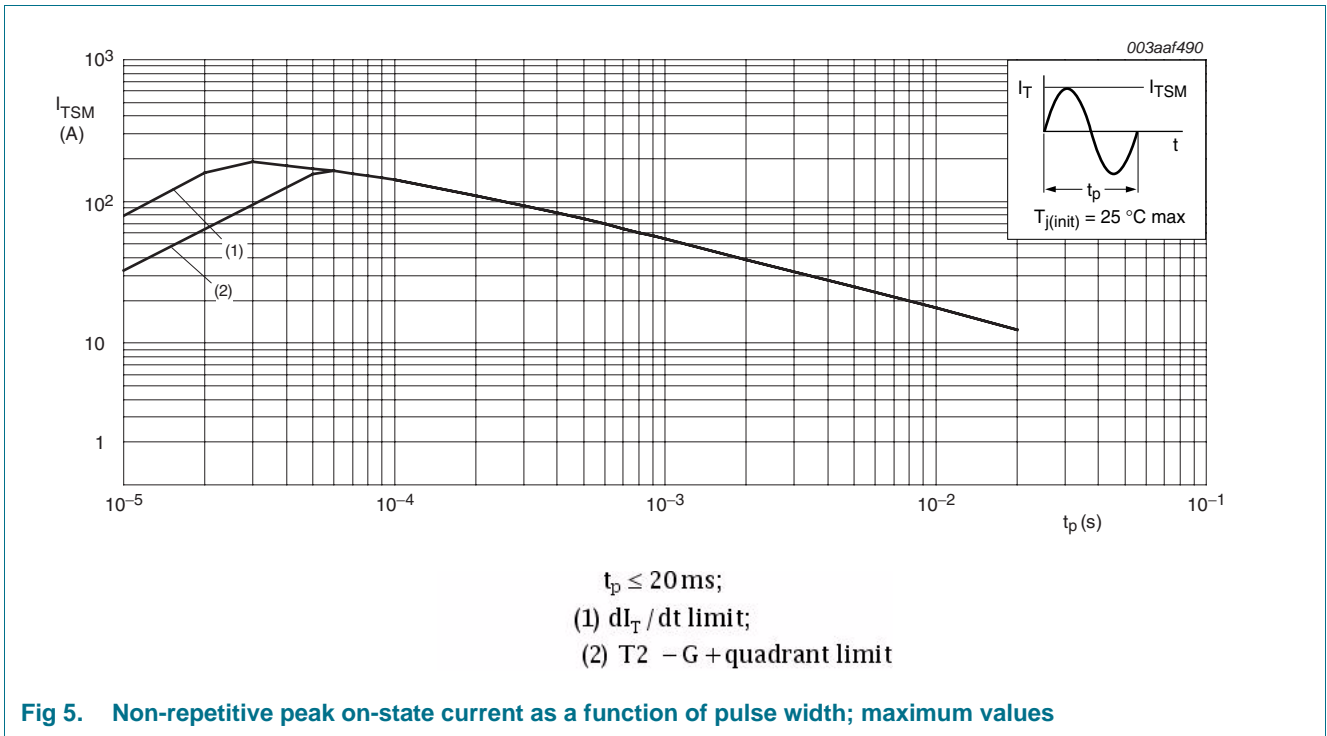


Fig 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



6. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|--|---|-----|-----|-----|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | full cycle; see Figure 8 | - | - | 15 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air; printed-circuit board mounted: minimum footprint; full cycle; see Figure 6 | - | 156 | - | K/W |
| | | in free air; printed-circuit board mounted: pad area; full cycle; see Figure 7 | - | 70 | - | K/W |

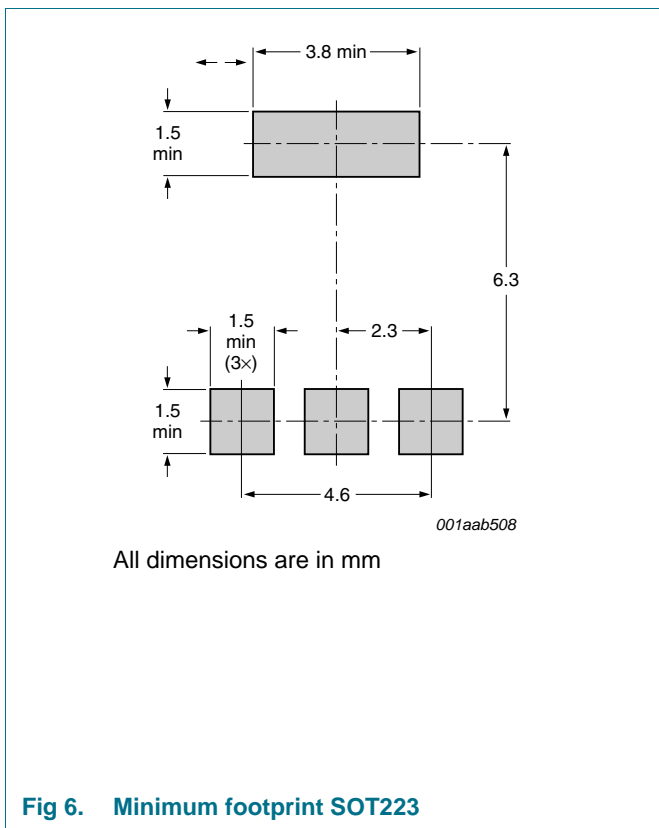


Fig 6. Minimum footprint SOT223

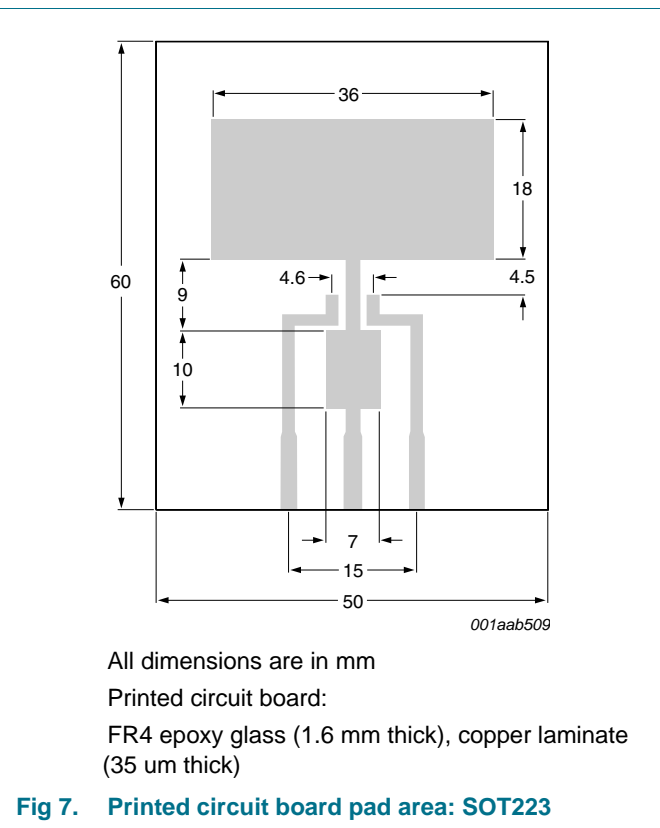
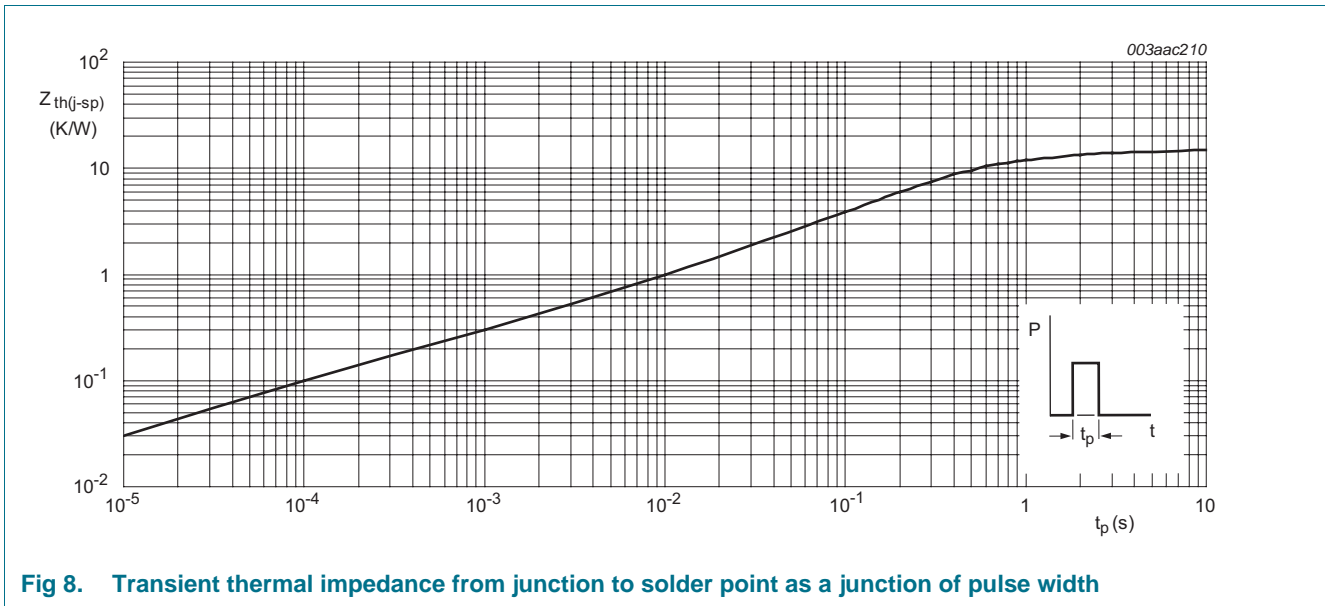


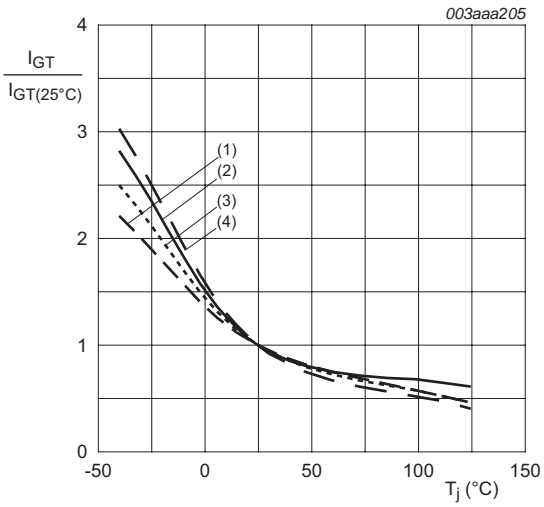
Fig 7. Printed circuit board pad area: SOT223



7. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|-----|-----|-----|------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; see Figure 9 | 0.4 | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; see Figure 9 | 0.4 | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; see Figure 9 | 0.4 | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; see Figure 9 | 0.4 | - | 10 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; see Figure 10 | - | - | 15 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; see Figure 10 | - | - | 30 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; see Figure 10 | - | - | 15 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; see Figure 10 | - | - | 15 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; see Figure 11 | - | - | 10 | mA |
| V_T | on-state voltage | $I_T = 1.4\text{ A}$; $T_j = 25\text{ °C}$; see Figure 12 | - | 1.3 | 1.6 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ °C}$; see Figure 13 | - | - | 1.3 | V |
| | | $V_D = 600\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 125\text{ °C}$; see Figure 13 | 0.2 | - | - | V |
| I_D | off-state current | $V_D = 600\text{ V}$; $T_j = 125\text{ °C}$ | - | - | 0.5 | mA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$; $T_j = 110\text{ °C}$; gate open circuit; exponential waveform; see Figure 14 | 120 | - | - | V/ μ s |
| dV_{com}/dt | rate of change of commutating voltage | $V_D = 400\text{ V}$; $T_j = 110\text{ °C}$; $dI_{com}/dt = 0.44\text{ A/ms}$; gate open circuit | 2 | - | - | V/ μ s |



- (1) T2- G+
- (2) T2- G-
- (3) T2+ G-
- (4) T2+ G+

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

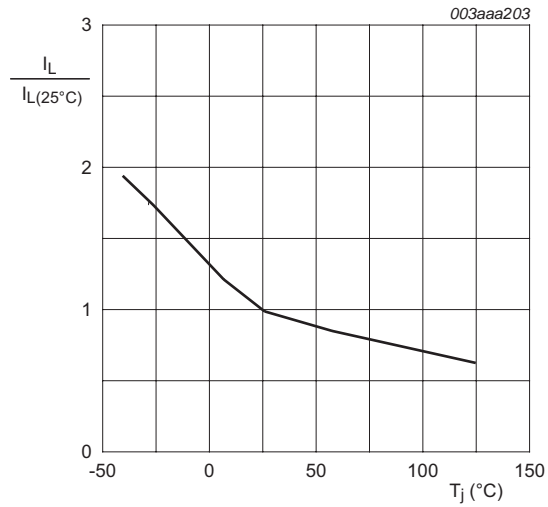


Fig 10. Normalized latching current as a function of junction temperature

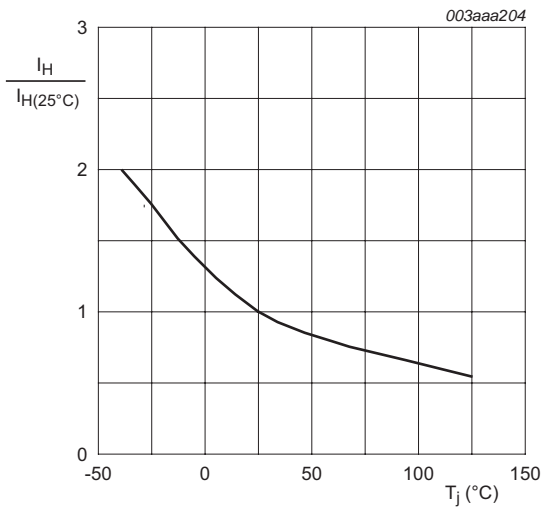
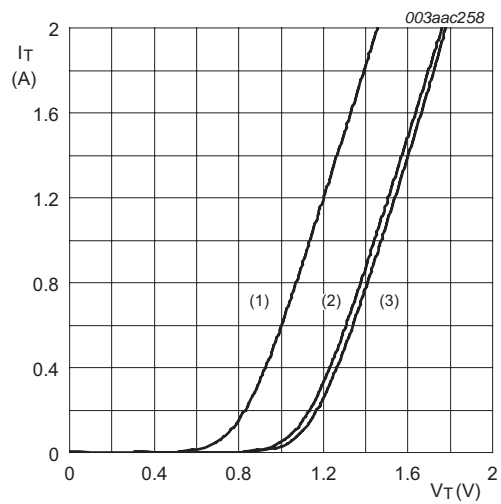


Fig 11. Normalized holding current as a function of junction temperature



$V_o = 1.13 \text{ V}$

$R_s = 0.31 \text{ } \Omega$

(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 12. On-state current as a function of on-state voltage

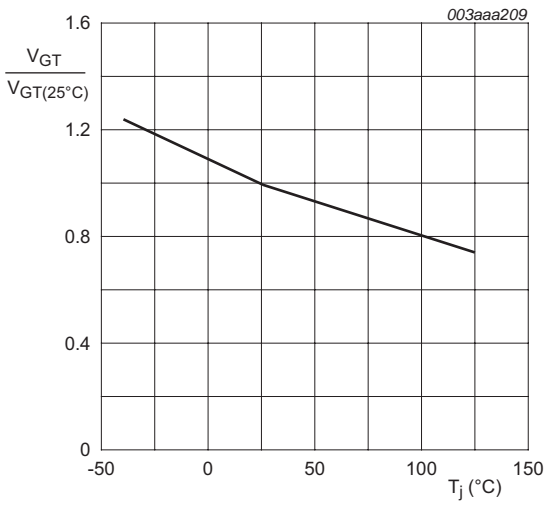
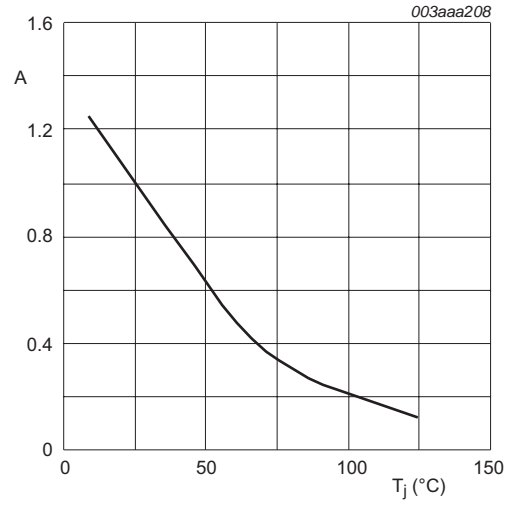


Fig 13. Normalized gate trigger voltage as a function of junction temperature



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

Fig 14. Normalized critical rate of rise of off-state voltage as a function of junction temperature; typical values

8. Package outline

Plastic surface-mounted package with increased heatsink; 4 leads

SOT223

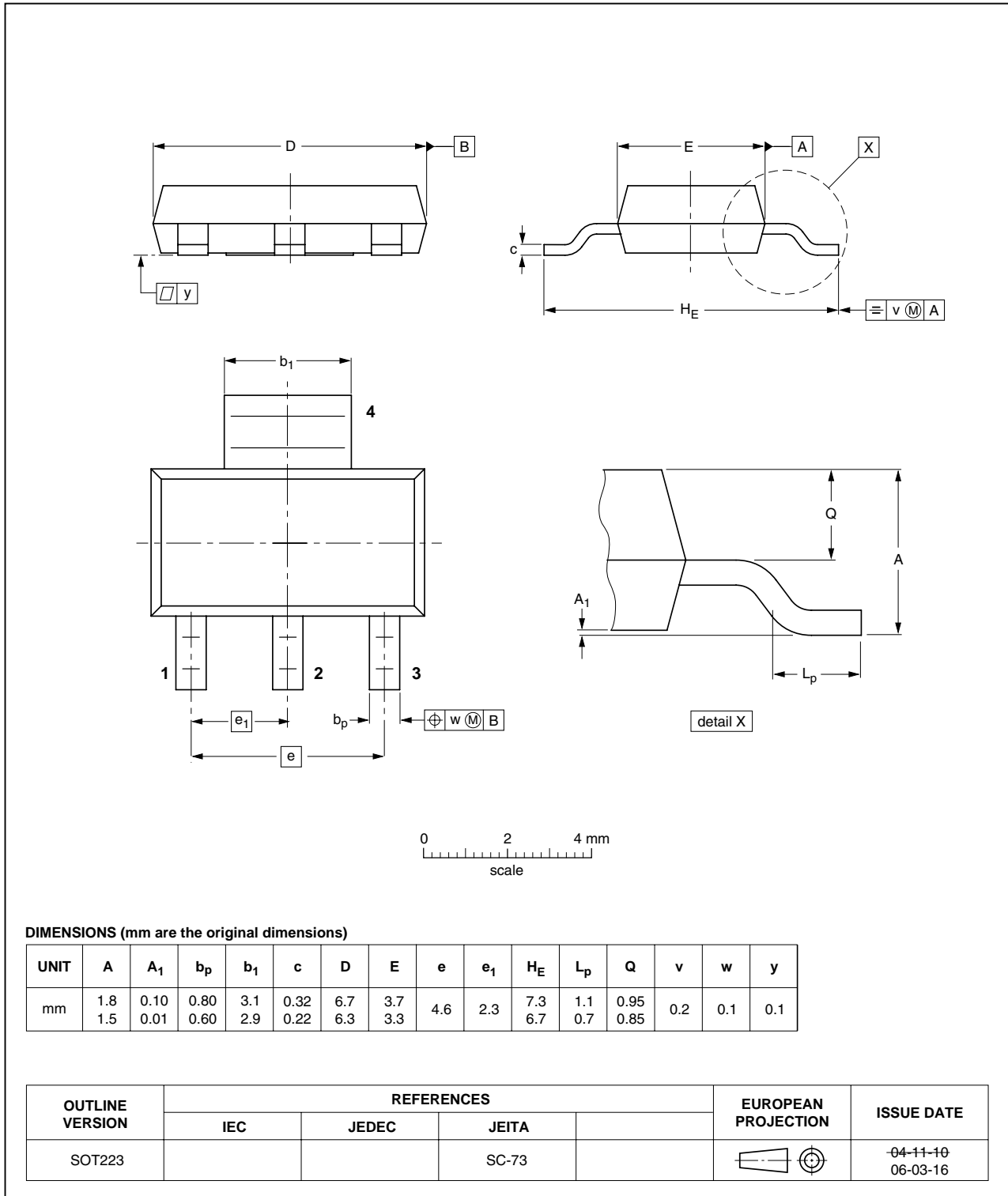


Fig 15. Package outline SOT223 (SOT223)

9. Package outline

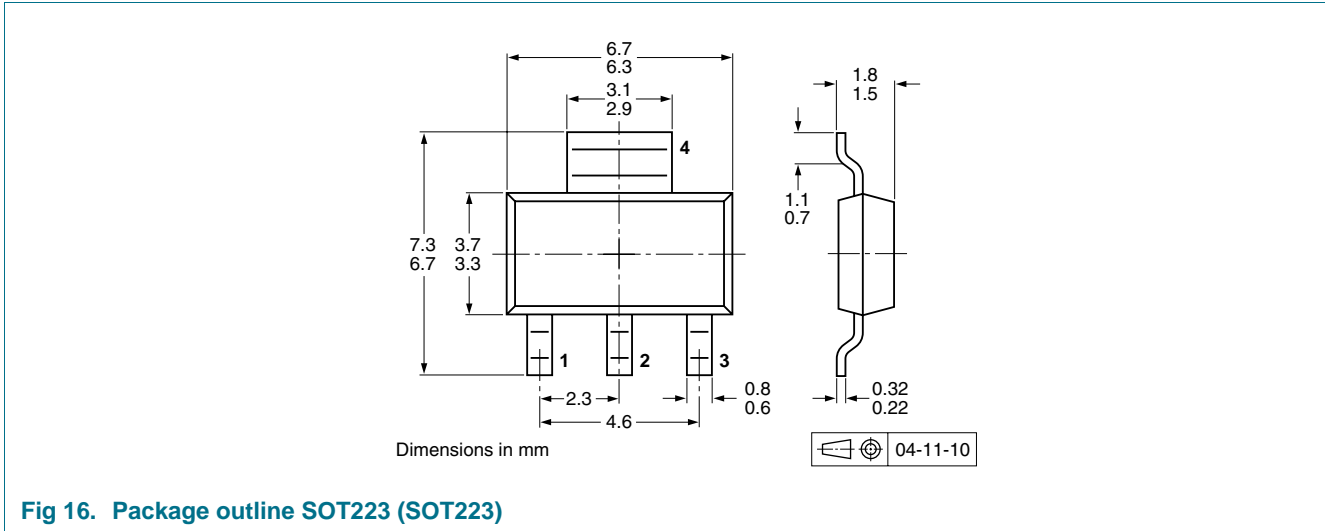


Fig 16. Package outline SOT223 (SOT223)

10. Soldering

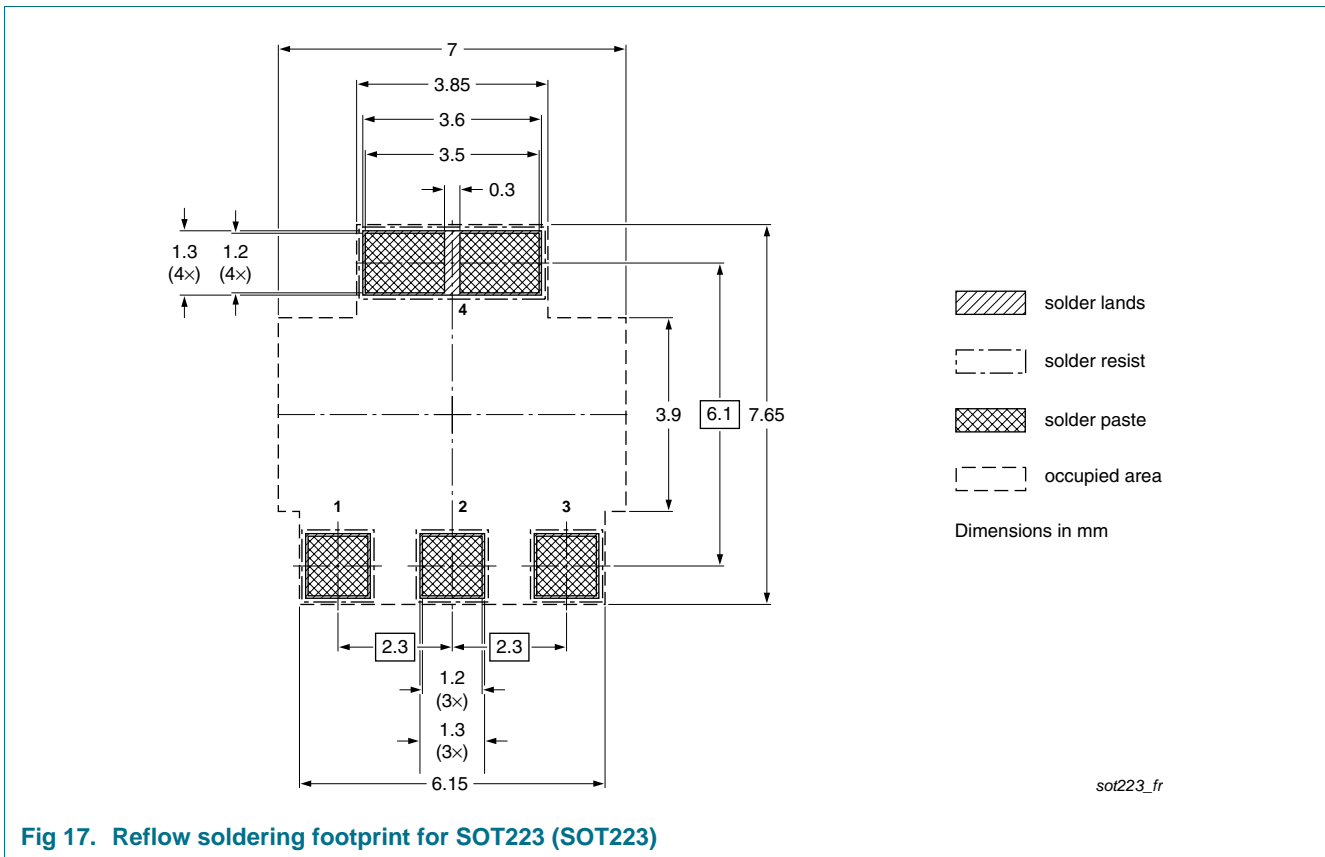


Fig 17. Reflow soldering footprint for SOT223 (SOT223)

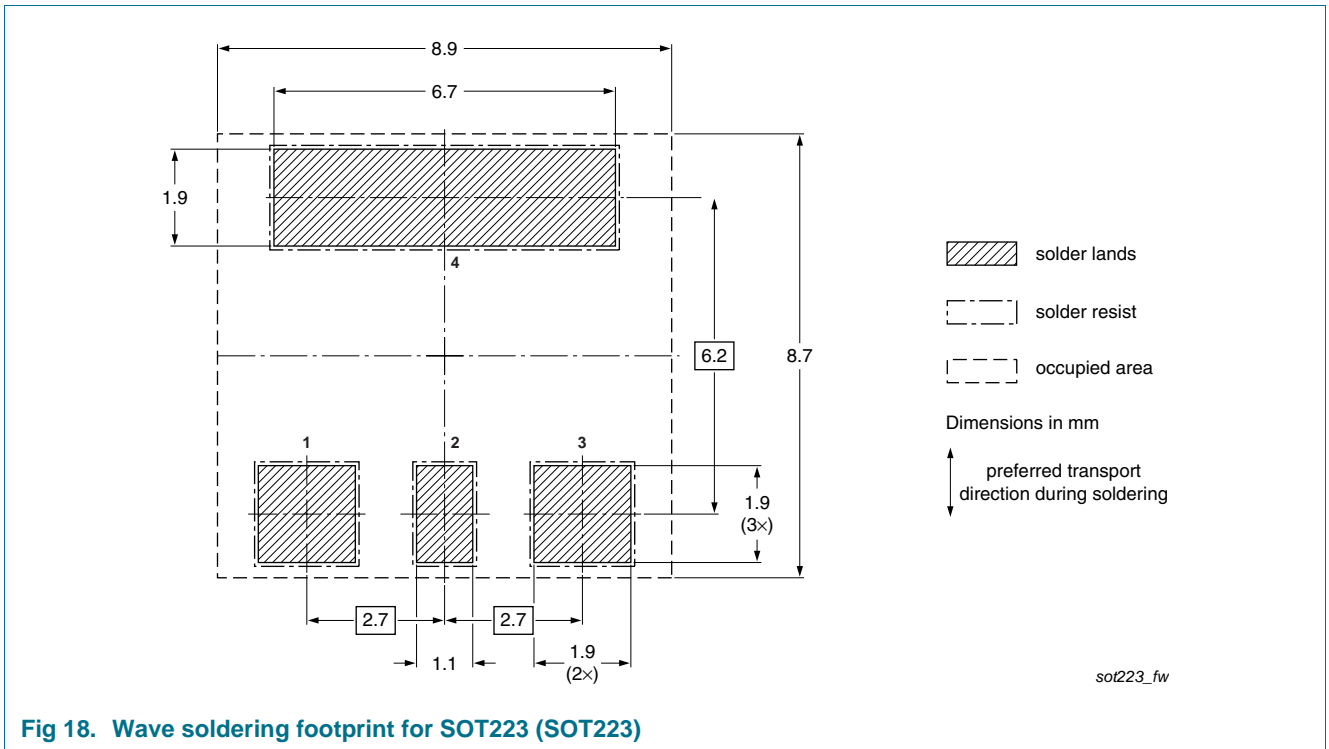


Fig 18. Wave soldering footprint for SOT223 (SOT223)

11. Revision history

Table 8. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|-------------------------------|--------------------|---------------|--------------|
| Z0109MN0 v.3 | 20110512 | Product data sheet | - | Z0109MN0 v.2 |
| Modifications: | • Various changes to content. | | | |
| Z0109MN0 v.2 | 20110321 | Product data sheet | - | Z0109MN0 v.1 |

12. Legal information

12.1 Data sheet status

| Document status ^[1] ^[2] | Product status ^[3] | 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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