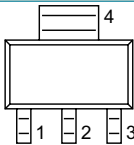
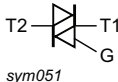


Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>	-	-	10	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>	-	-	10	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>	-	-	10	mA
$V_T$	on-state voltage	$I_T = 1.4\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 12</a>	-	1.3	1.6	V
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536\text{ V}$ ; $T_J = 110\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit; <a href="#">Fig. 14</a>	50	-	-	V/ $\mu\text{s}$
$dV_{com}/dt$	rate of change 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/ $\mu\text{s}$

## 5. 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		

## 6. Ordering information

Table 3. Ordering information

Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
Z0109NN	SOT223	Z0109NN,135	Reel	4000	SOT223	16-Mar-2006

## 7. Marking

Table 4. Marking codes

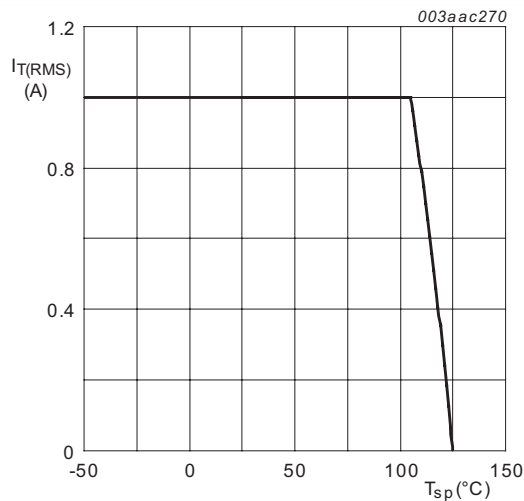
Type number	Marking codes
Z0109NN	0109NN

## 8. Limiting values

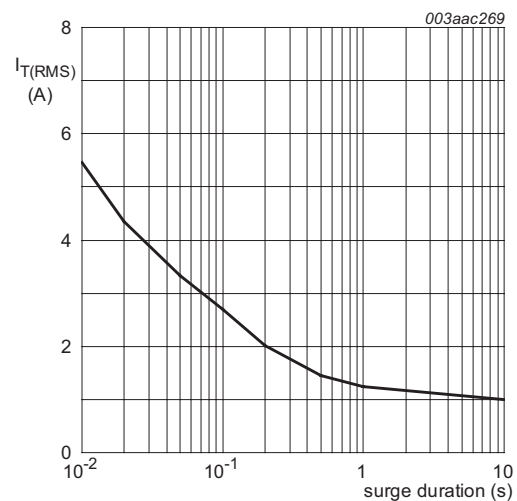
**Table 5. Limiting values**

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	full sine wave; $T_{\text{sp}} \leq 105\text{ }^{\circ}\text{C}$ ; <a href="#">Fig 1</a> ; <a href="#">Fig 2</a> ; <a href="#">Fig 3</a>	-	1	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20\text{ ms}$ ; <a href="#">Fig 4</a> ; <a href="#">Fig 5</a>	-	8	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$	-	8.5	A
$I^2t$	$I^2t$ for fusing	$t_{\text{p}} = 10\text{ ms}$ ; SIN	-	0.32	$\text{A}^2\text{s}$
$di_{\text{T}}/dt$	rate of rise of on-state current	$I_{\text{G}} = 20\text{ mA}$ ; T2+ G+	-	50	$\text{A}/\mu\text{s}$
		$I_{\text{G}} = 20\text{ mA}$ ; T2- G+	-	50	$\text{A}/\mu\text{s}$
		$I_{\text{G}} = 20\text{ mA}$ ; T2- G-	-	50	$\text{A}/\mu\text{s}$
		$I_{\text{G}} = 20\text{ mA}$ ; T2- G+	-	20	$\text{A}/\mu\text{s}$
$I_{\text{GM}}$	peak gate current		-	1	A
$P_{\text{GM}}$	peak gate power		-	2	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	-	0.1	W
$T_{\text{stg}}$	storage temperature		-40	150	$^{\circ}\text{C}$
$T_{\text{j}}$	junction temperature		-	125	$^{\circ}\text{C}$

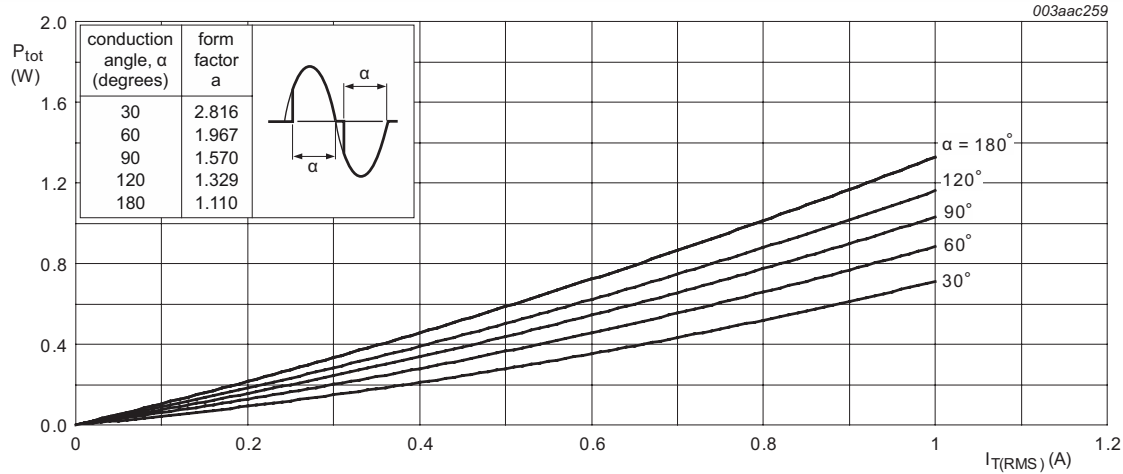


**Fig. 1. RMS on-state current as a function of Solder point temperature; maximum values**



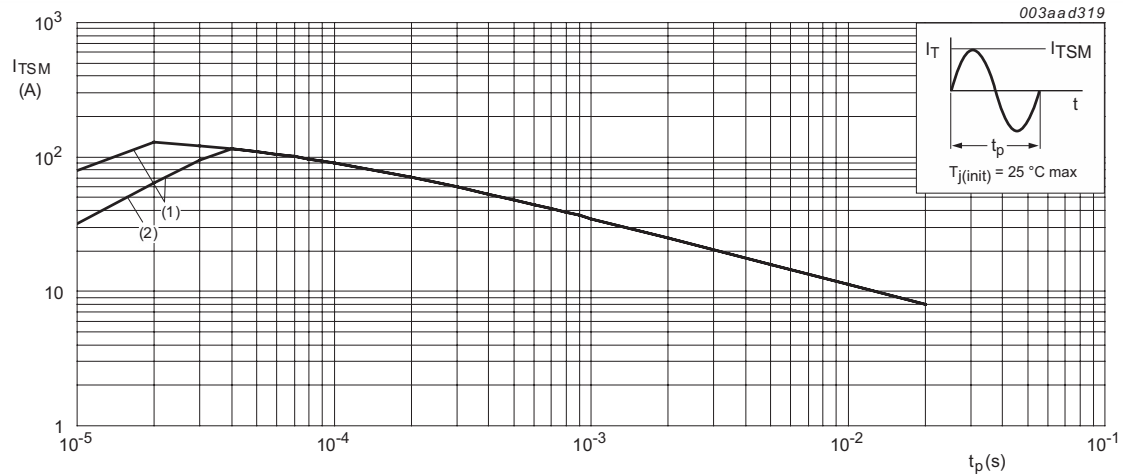
$f = 50\text{ Hz}$ ;  $T_{\text{sp}} = 105\text{ }^{\circ}\text{C}$

**Fig. 2. RMS on-state current as a function of surge duration; maximum values**



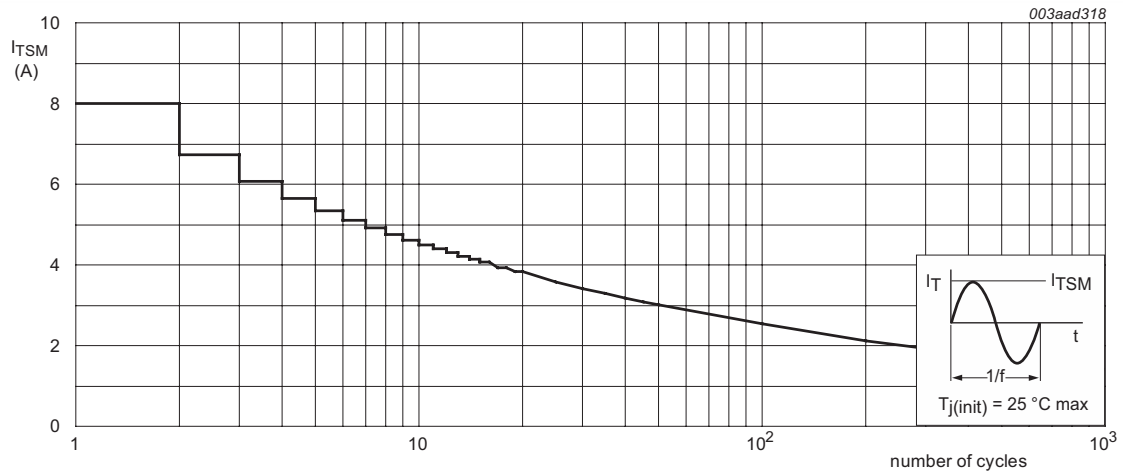
$\alpha$  = conduction angle  
 $a$  = form factor =  $I_{T(RMS)} / I_{T(AV)}$

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



$t_p \leq 20$  ms  
 (1)  $di_T/dt$  limit  
 (2) T2- G+ quadrant limit

Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values



$f = 50$  Hz

Fig. 5. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

9. 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; <a href="#">Fig 6</a>		-	-	15	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	full cycle; printed circuit board mounted; minimum footprint; <a href="#">Fig 7</a>		-	156	-	K/W
		full cycle; printed circuit board mounted; pad area; <a href="#">Fig 8</a>		-	70	-	K/W

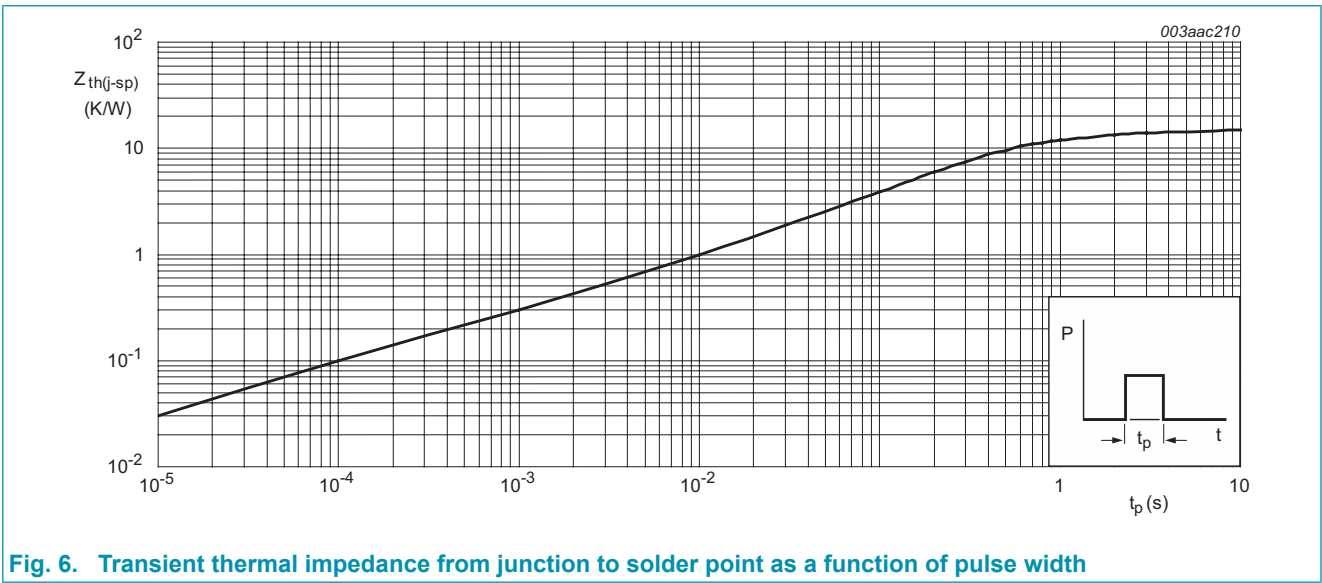
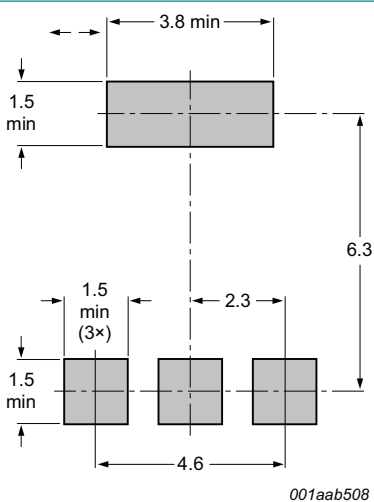
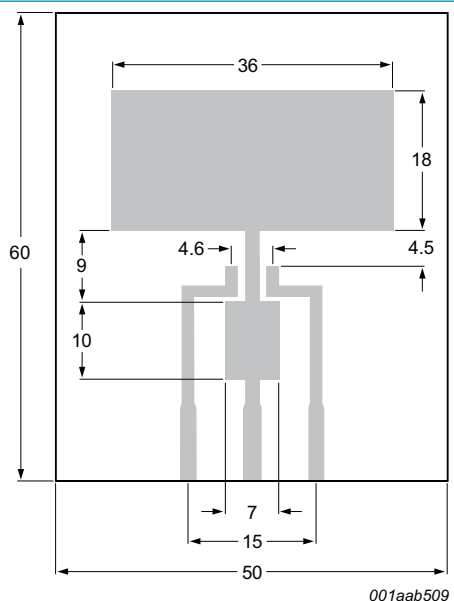


Fig. 6. Transient thermal impedance from junction to solder point as a function of pulse width



All dimensions are in mm

Fig. 7. Minimum footprint SOT223



All dimensions are in mm

Printed circuit board:

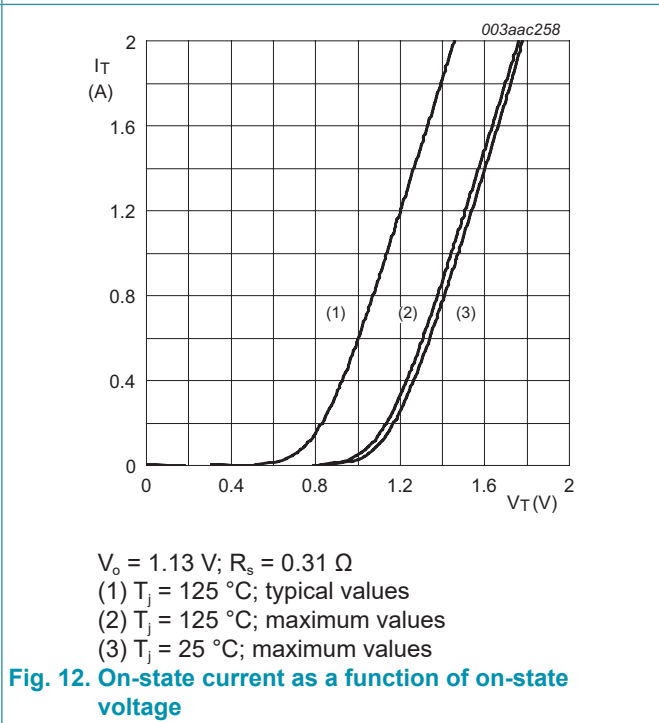
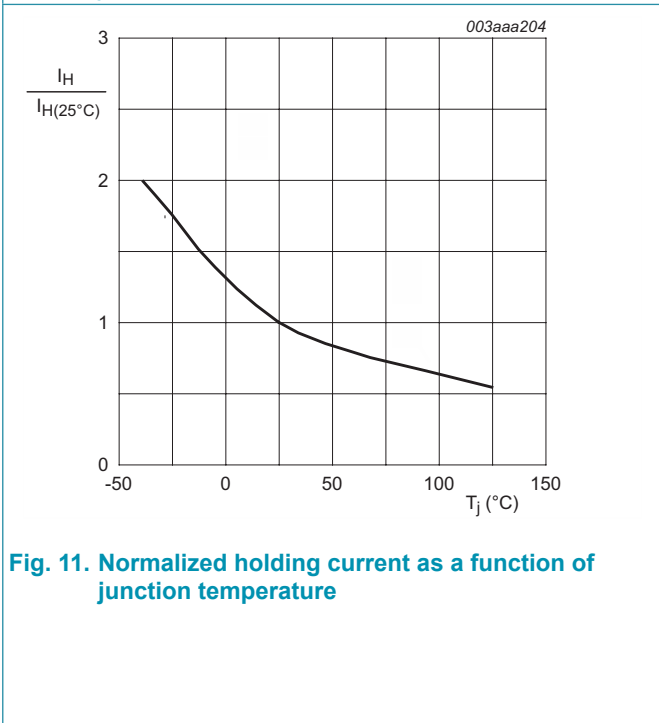
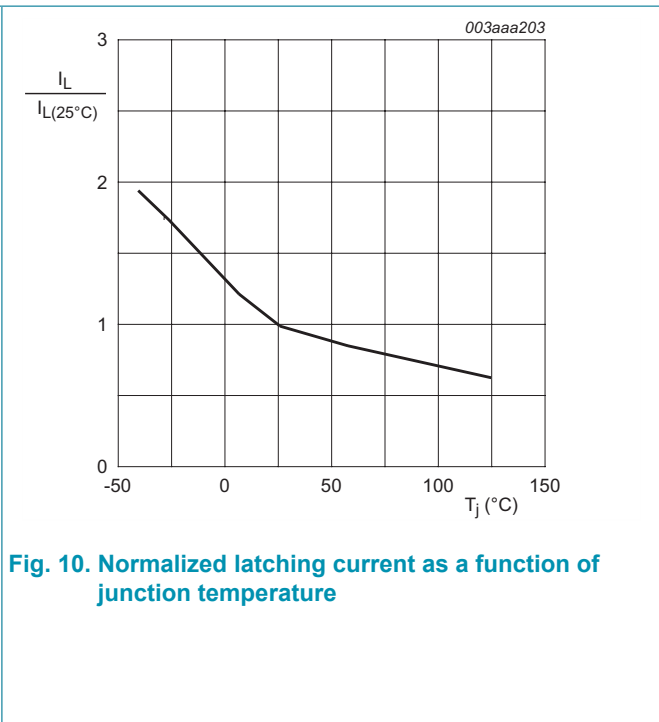
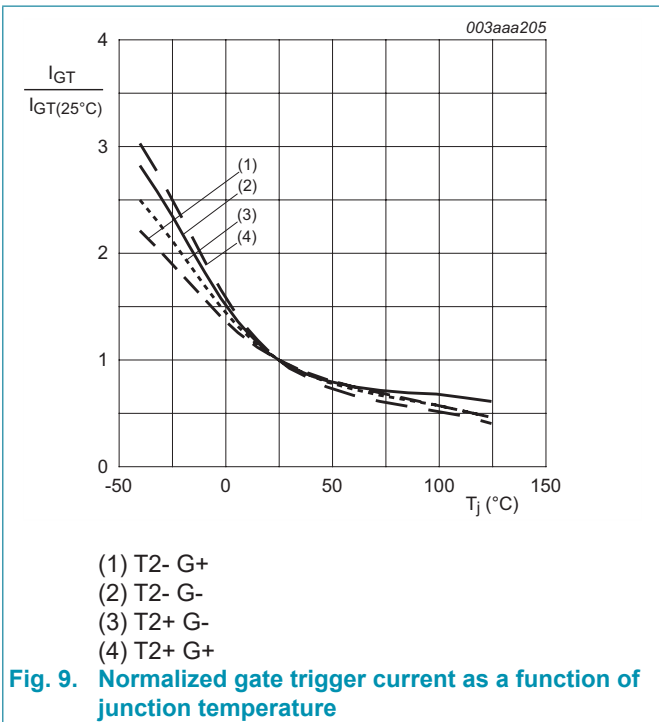
FR4 epoxy glass (1.6 mm thick), copper laminate (35 um thick)

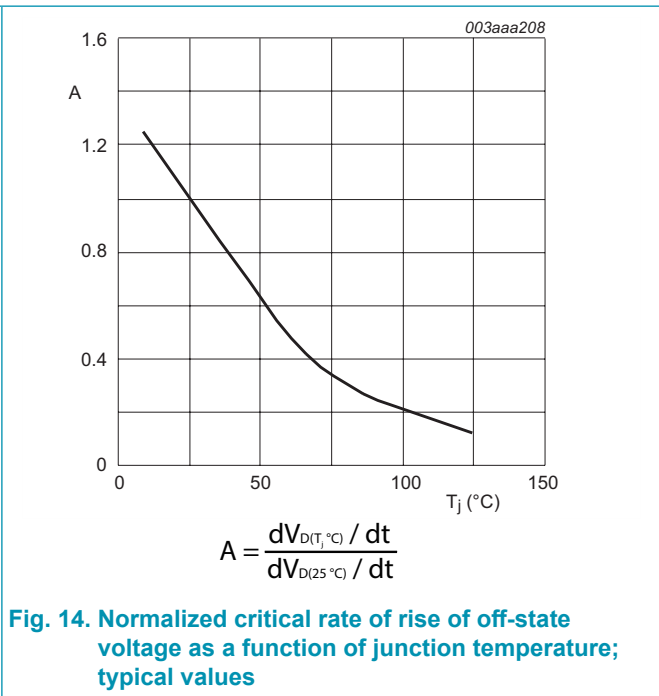
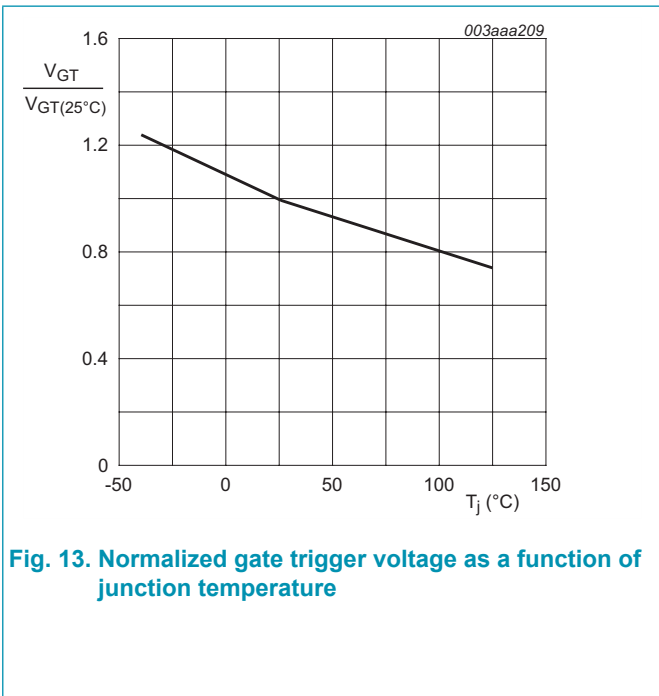
Fig. 8. Printed circuit board pad area: SOT223

## 10. Characteristics

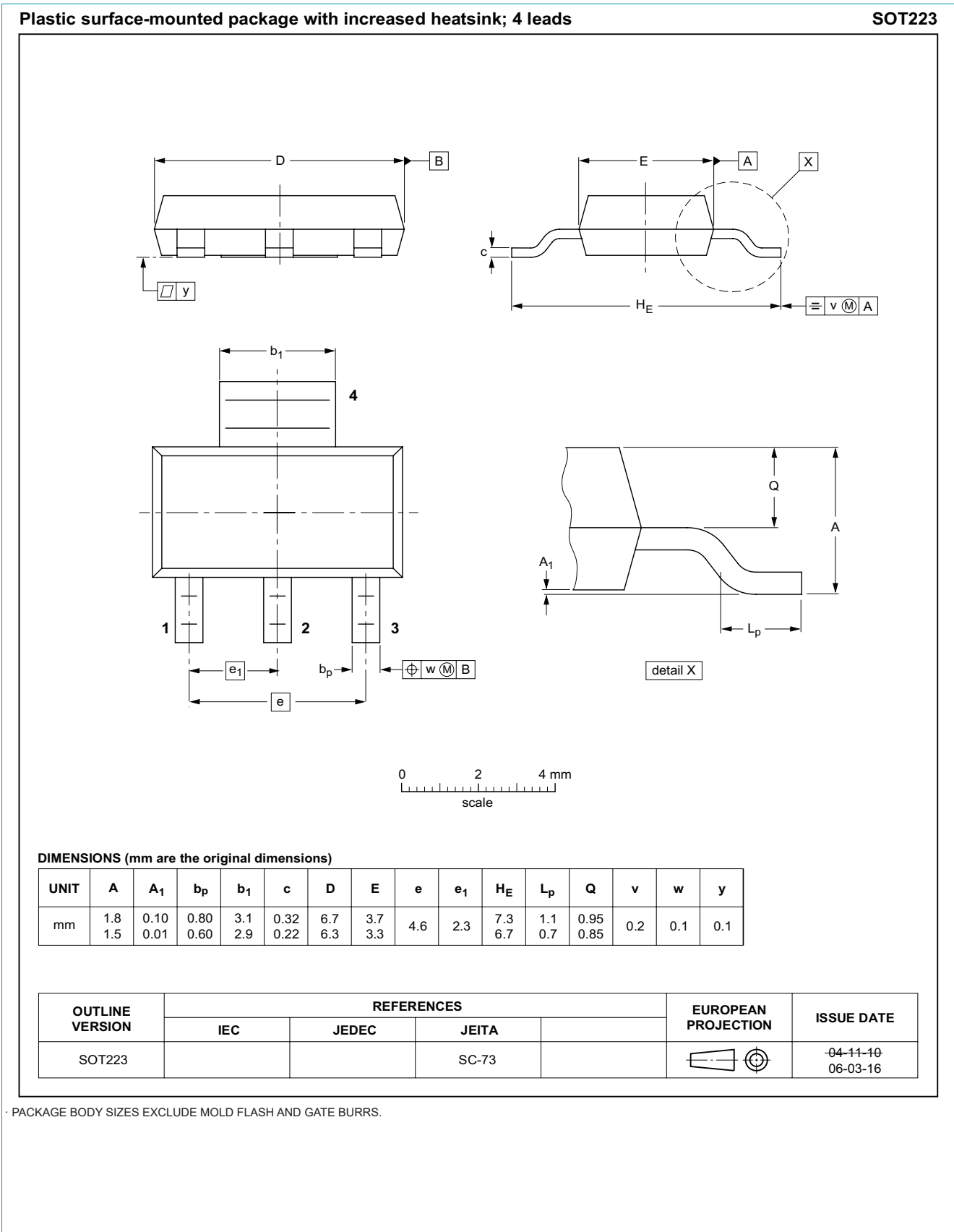
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Static characteristics</b>							
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>		-	-	10	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>		-	-	10	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>		-	-	10	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>		-	-	10	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>		-	-	15	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>		-	-	25	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>		-	-	15	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G+; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>		-	-	15	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>		-	-	10	mA
$V_T$	on-state voltage	$I_T = 1.4\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 12</a>		-	1.3	1.6	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 13</a>		-	-	1	V
		$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 125\text{ }^\circ\text{C}$		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	$V_{DM} = 536\text{ V}$ ; $T_J = 110\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit; <a href="#">Fig. 14</a>		50	-	-	V/ $\mu\text{s}$
$dV_{com}/dt$	rate of change 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/ $\mu\text{s}$





11. Package outline



## 12. Legal information

### 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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 06 April 2021