

1. General description

AC Thyristor power switch in a SOT223 surface-mountable plastic package with self-protective capabilities against low and high energy transients.

2. Features and benefits

- Common terminal on mounting base allows multiple ACTs on shared cooling pad
- Exclusive negative gate triggering
- Full cycle AC conduction
- High voltage capability
- Remote gate separates the gate driver from the effects of the load current
- Safe clamping of low energy over-voltage transients
- Self-protective turn-on during high energy voltage transients
- Surface-mountable package
- Very high noise immunity

3. Applications

- Fan motor circuits
- Pump motor circuits
- Lower-power highly inductive, resistive and safety loads
- Contactors, circuit breakers, valves, dispensers and door locks

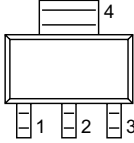
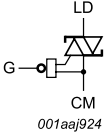
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
Absolute maximum rating							
V _{DRM}	repetitive peak off-state voltage			600			V
I _{T(RMS)}	RMS on-state current	full sine wave; T _{sp} ≤ 90 °C; Fig. 1 ; Fig. 2 ; Fig. 3		1.5			A
I _{TSM}	non-repetitive peak on-state current	full sine wave; T _{j(init)} = 25 °C; t _p = 20 ms; Fig. 4 ; Fig. 5		16			A
		full sine wave; T _{j(init)} = 25 °C; t _p = 16.7 ms		17.6			A
T _j	operating junction temperature			-40 to 125			°C
V _{PP}	peak pulse voltage	T _j = 25 °C; non-repetitive, off-state; Fig. 6		2.5			kV
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
I _{GT}	gate trigger current	V _D = 12 V; I _T = 0.1 A; LD+ G-; T _j = 25 °C; Fig. 10		-	-	10	mA
		V _D = 12 V; I _T = 0.1 A; LD- G-; T _j = 25 °C; Fig. 10		-	-	10	mA
I _H	holding current	V _D = 12 V; T _j = 25 °C; Fig. 12		-	-	10	mA
V _T	on-state voltage	I _T = 1.1 A; T _j = 25 °C; Fig. 13		-	-	1.35	V
V _{CL}	clamping voltage	I _{CL} = 0.1 mA; t _b = 1 ms		650	-	-	V

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	LD	load		
2	CM	common		
3	G	gate		
4	CM	common		

6. Ordering information

Table 3. Ordering information

Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
ACT110W-600E	SOT223	ACT110W-600EF	Reel	4000	SOT223	16-Mar-2006

7. Marking

Table 4. Marking codes

Type number	Marking codes	
	Assembly factory: d	Assembly factory: L
ACT110W-600E	Jdxxx 110W6E	JLxxx 110W6E

8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Notes	Max	Unit
V_{DRM}	repetitive peak off-state voltage			600	V
V_{RRM}	repetitive peak reverse voltage			600	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{sp}} \leq 90\text{ }^{\circ}\text{C}$; Fig 1 ; Fig 2 ; Fig 3		1.5	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 20\text{ ms}$; Fig 4 ; Fig 5		16	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 16.7\text{ ms}$		17.6	A
I^2t	I^2t for fusing	$t_{\text{p}} = 10\text{ ms}$; SIN		1.28	A^2s
di_{T}/dt	rate of rise of on-state current	$I_{\text{G}} = 20\text{ mA}$		100	$\text{A}/\mu\text{s}$
I_{GM}	peak gate current	$t = 20\text{ }\mu\text{s}$		1	A
V_{GM}	peak gate voltage	$t = 20\text{ }\mu\text{s}$		15	V
P_{GM}	peak gate power			0.1	W
T_{stg}	storage temperature			-40 to 150	$^{\circ}\text{C}$
T_{j}	operating junction temperature			-40 to 125	$^{\circ}\text{C}$
V_{PP}	peak pulse voltage	$T_{\text{j}} = 25\text{ }^{\circ}\text{C}$; non-repetitive, off-state; Fig. 6		2.5	kV

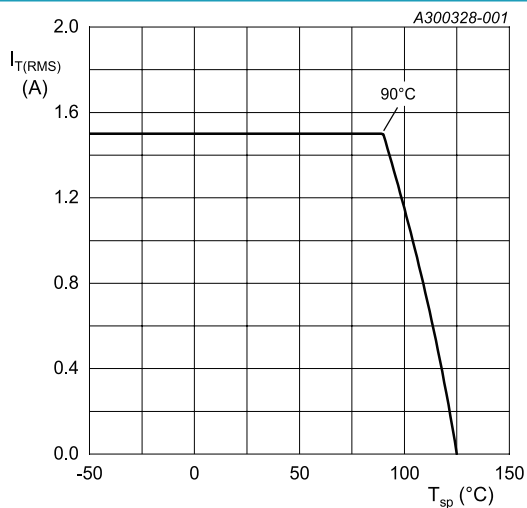
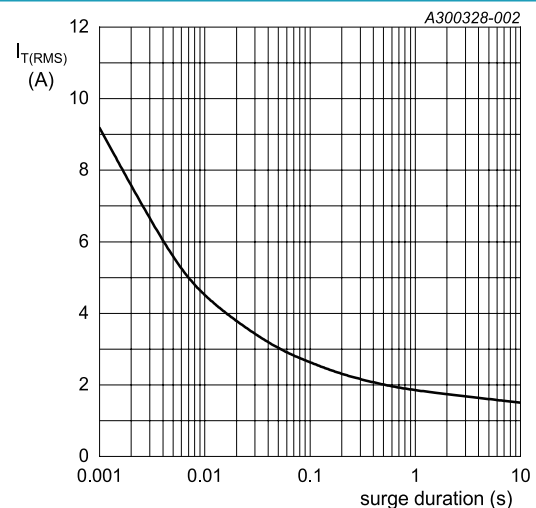


Fig. 1. RMS on-state current as a function of solder point temperature; maximum values



$f = 50\text{ Hz}$; $T_{\text{sp}} = 90\text{ }^{\circ}\text{C}$

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

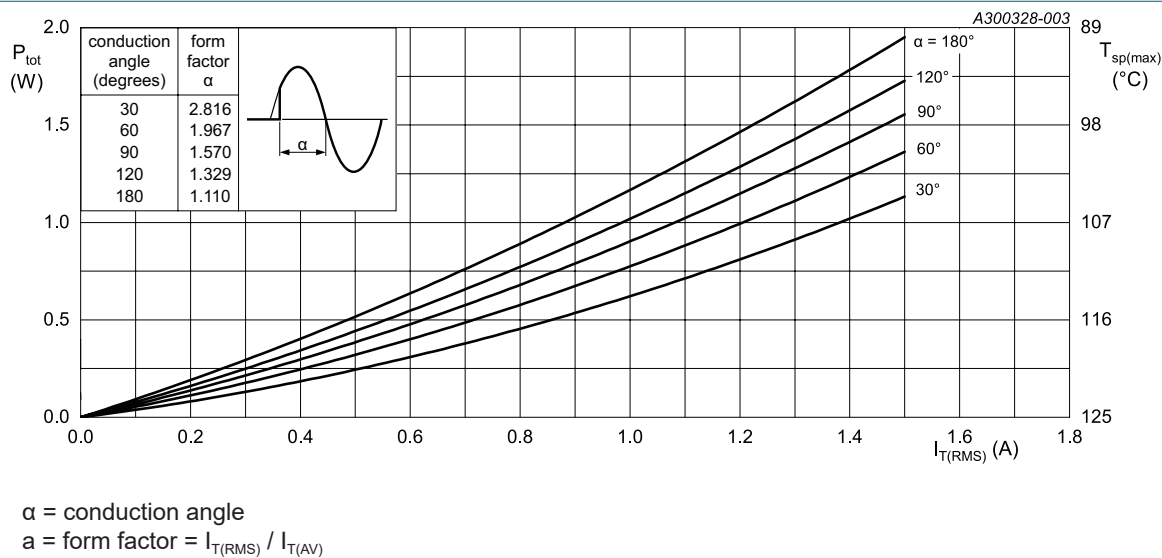
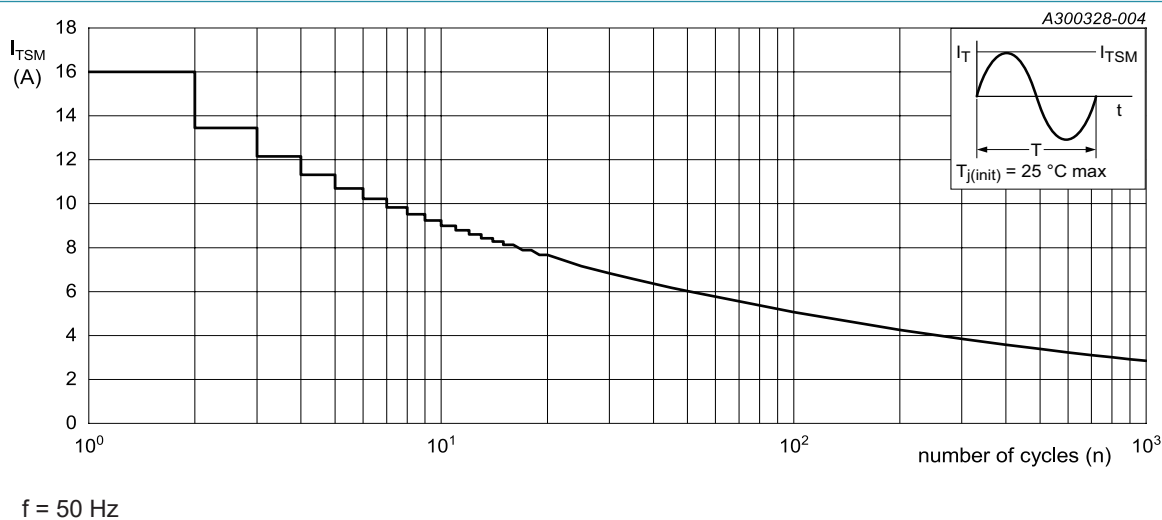
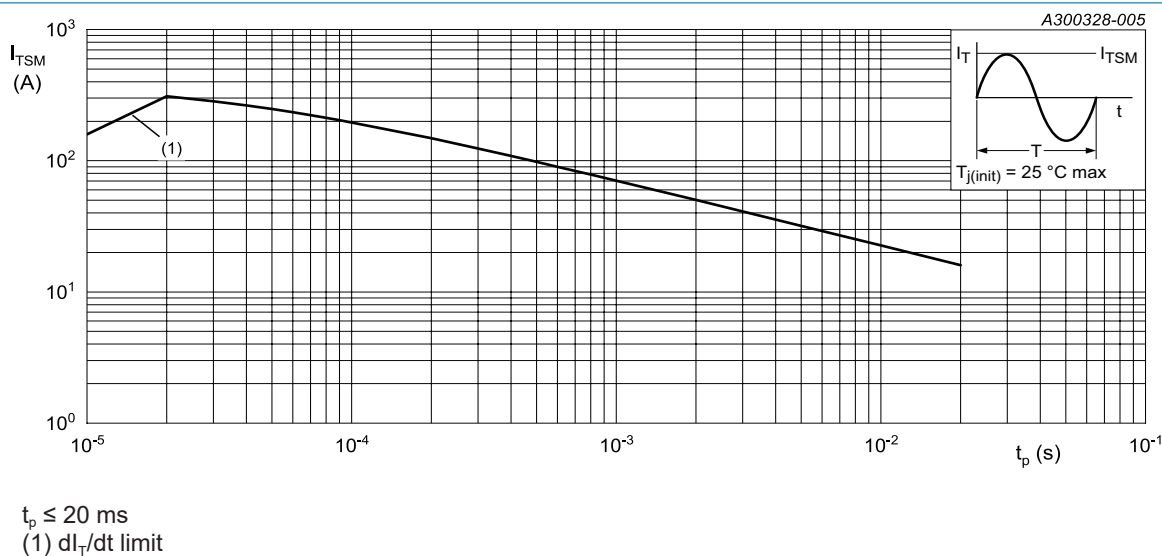


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values



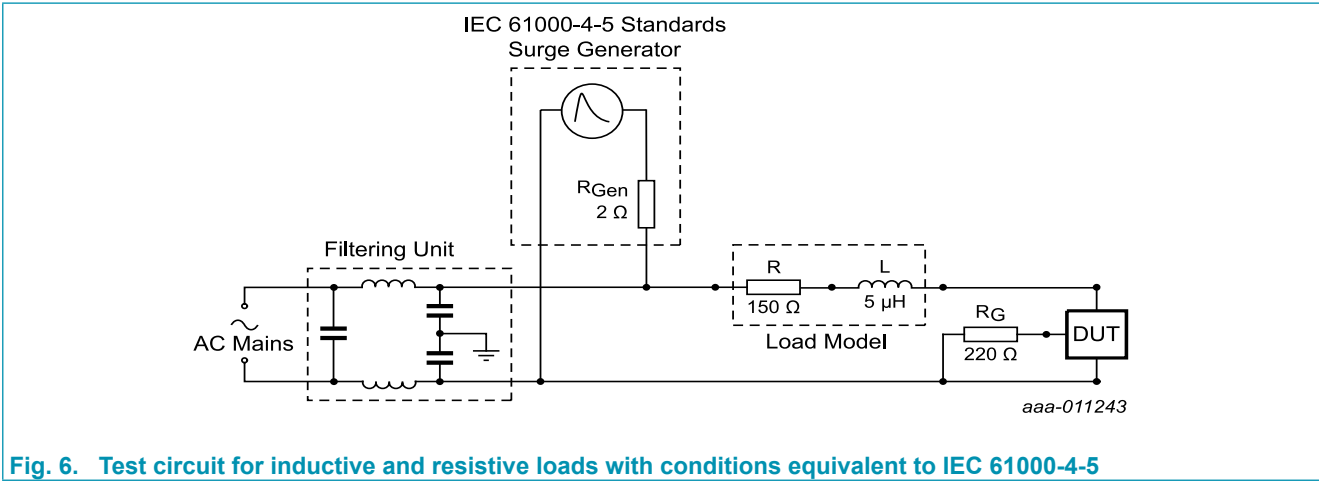
$f = 50\text{ Hz}$

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



$t_p \leq 20\text{ ms}$
(1) di_T/dt limit

Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values



9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	full cycle; Fig 7		-	-	18	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air; printed-circuit board mounted; minimum footprint; Fig 8		-	156	-	K/W
		in free air; printed-circuit board mounted; pad area; Fig 9		-	70	-	K/W

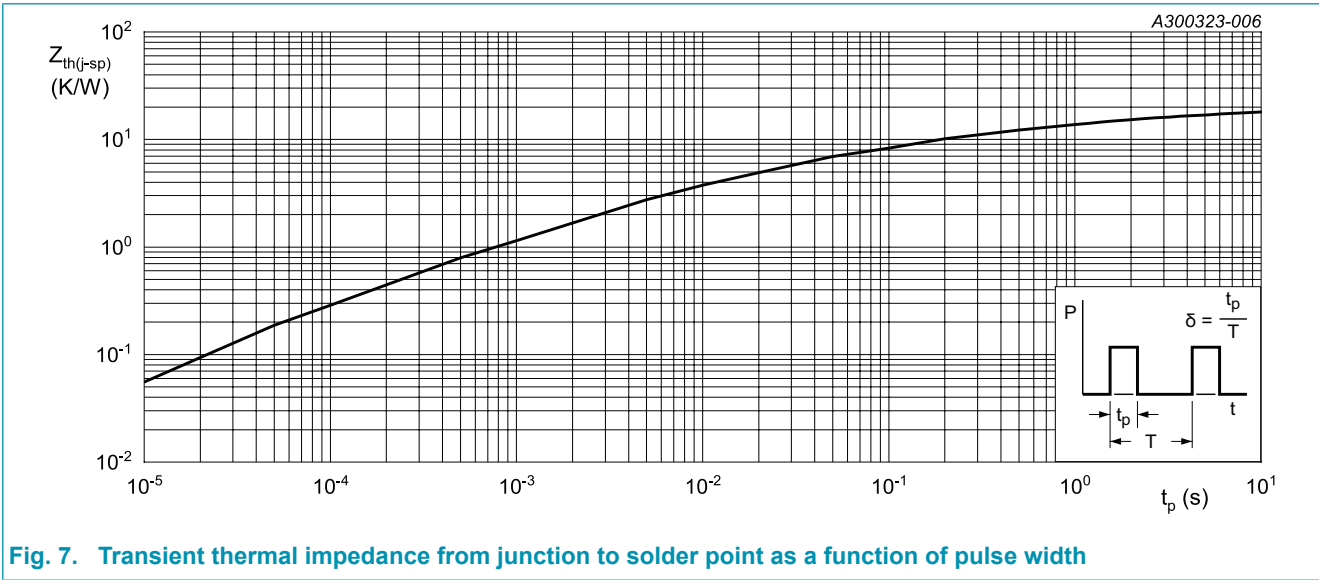
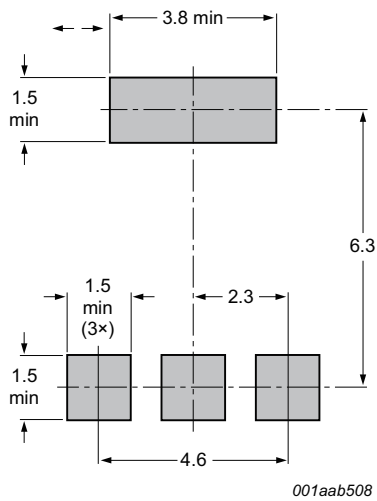
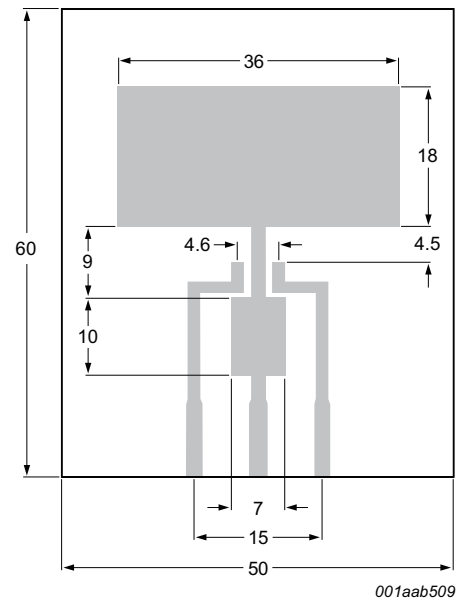


Fig. 7. Transient thermal impedance from junction to solder point as a function of pulse width



All dimensions are in mm

Fig. 8. Minimum footprint SOT223



All dimensions are in mm

Printed circuit board:

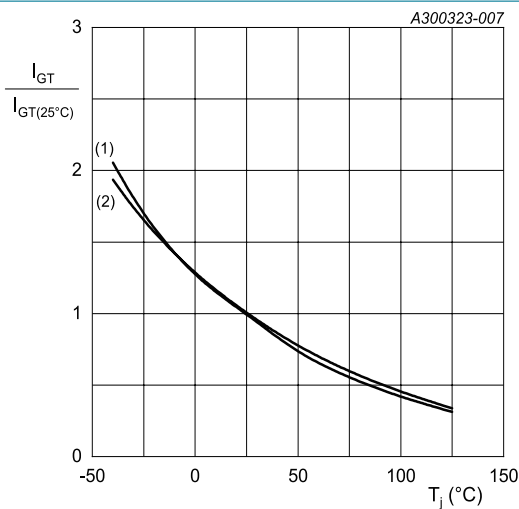
FR4 epoxy glass (1.6 mm thick), copper laminate
(35 um thick)

Fig. 9. Printed circuit board pad area: SOT223

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
I_{GT}	gate trigger current	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; LD+ G-; $T_J = 25\text{ }^\circ\text{C}$; Fig. 10		-	-	10	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; LD- G-; $T_J = 25\text{ }^\circ\text{C}$; Fig. 10		-	-	10	mA
I_L	latching current	$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; LD+ G-; $T_J = 25\text{ }^\circ\text{C}$; Fig. 11		-	-	25	mA
		$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; LD- G-; $T_J = 25\text{ }^\circ\text{C}$; Fig. 11		-	-	20	mA
I_H	holding current	$V_D = 12\text{ V}$; $T_J = 25\text{ }^\circ\text{C}$; Fig. 12		-	-	10	mA
V_T	on-state voltage	$I_T = 1.1\text{ A}$; $T_J = 25\text{ }^\circ\text{C}$; Fig. 13		-	-	1.35	V
V_{GT}	gate trigger voltage	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_J = 25\text{ }^\circ\text{C}$; Fig. 14		-	-	1	V
		$V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_J = 125\text{ }^\circ\text{C}$		0.15	-	-	V
I_D	off-state current	$V_D = 600\text{ V}$; $T_J = 25\text{ }^\circ\text{C}$		-	-	2	μA
		$V_D = 600\text{ V}$; $T_J = 125\text{ }^\circ\text{C}$		-	-	0.2	mA
I_R	reverse current	$V_R = 600\text{ V}$; $T_J = 25\text{ }^\circ\text{C}$		-	-	2	μA
		$V_R = 600\text{ V}$; $T_J = 125\text{ }^\circ\text{C}$		-	-	0.2	mA
V_{CL}	clamping voltage	$I_{CL} = 0.1\text{ mA}$; $t_p = 1\text{ ms}$		650	-	-	V
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}$; $T_J = 125\text{ }^\circ\text{C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit		2000	-	-	V/ μs
dI_{com}/dt	rate of change of commutating current	$V_D = 400\text{ V}$; $I_{T(RMS)} = 1.5\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); gate open circuit		2	-	-	A/ms



(1) LD+ G-
(2) LD- G-

Fig. 10. Normalized gate trigger current as a function of junction temperature

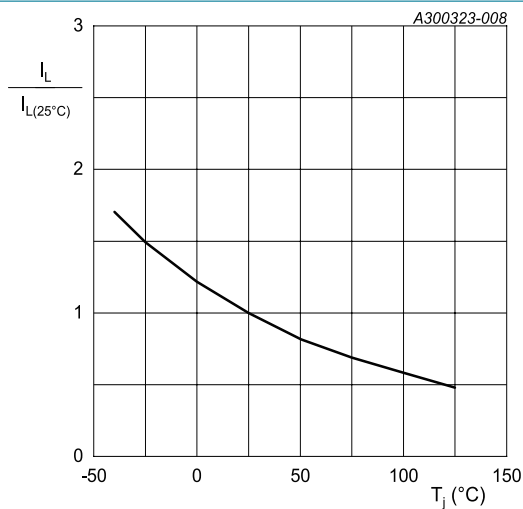


Fig. 11. Normalized latching current as a function of junction temperature

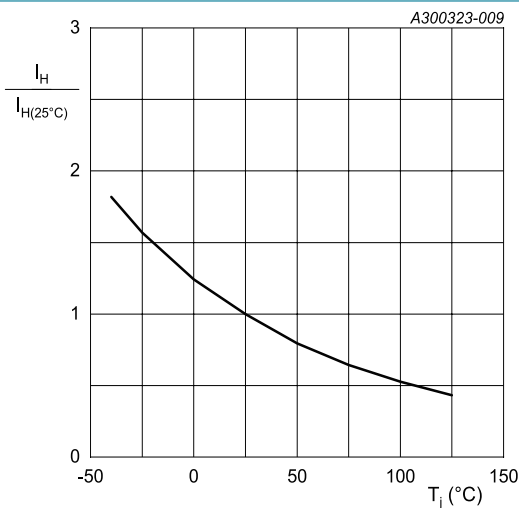
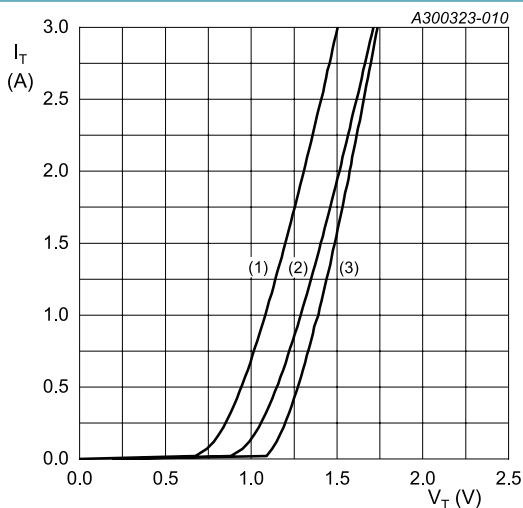


Fig. 12. Normalized holding current as a function of junction temperature



$V_o = 0.999\text{ V}$; $R_s = 0.2667\ \Omega$
(1) $T_j = 125^\circ\text{C}$; typical values
(2) $T_j = 125^\circ\text{C}$; maximum values
(3) $T_j = 25^\circ\text{C}$; maximum values

Fig. 13. On-state current as a function of on-state voltage

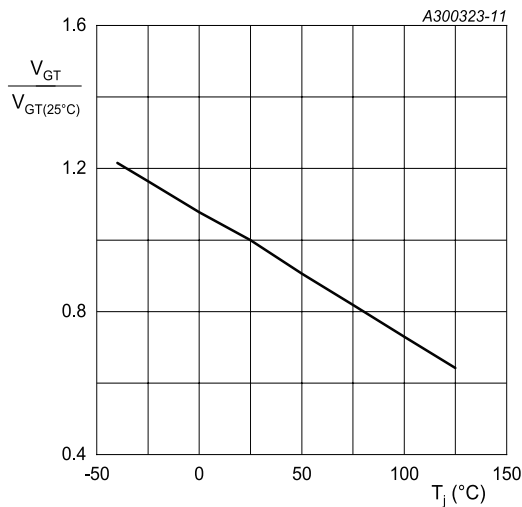
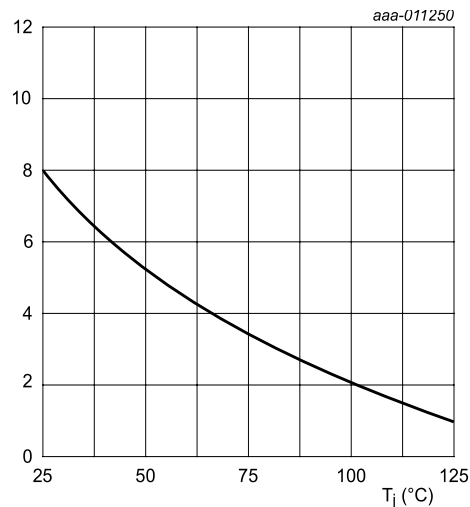
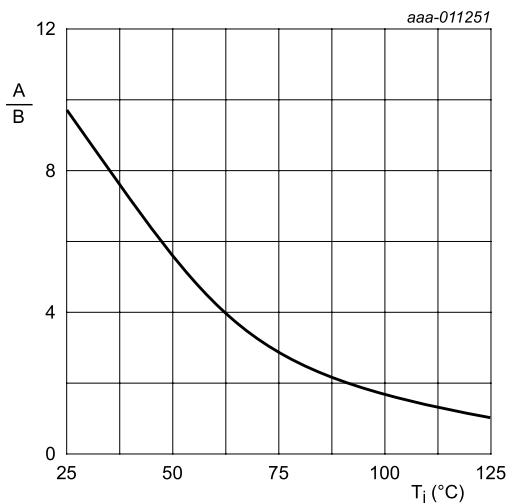


Fig. 14. Normalized gate trigger voltage as a function of junction temperature



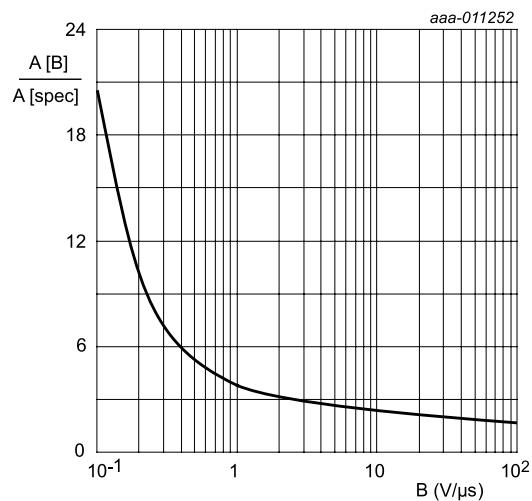
A = dV_D/dt at condition T_j $^\circ\text{C}$
B = dV_D/dt at condition T_j [125] $^\circ\text{C}$

Fig. 15. Normalized rate of rise of off-state voltage as a function of junction temperature



A = dI_{com}/dt at condition T_j $^\circ\text{C}$
B = dI_{com}/dt at condition T_j [125] $^\circ\text{C}$
 $V_D = 400$ V

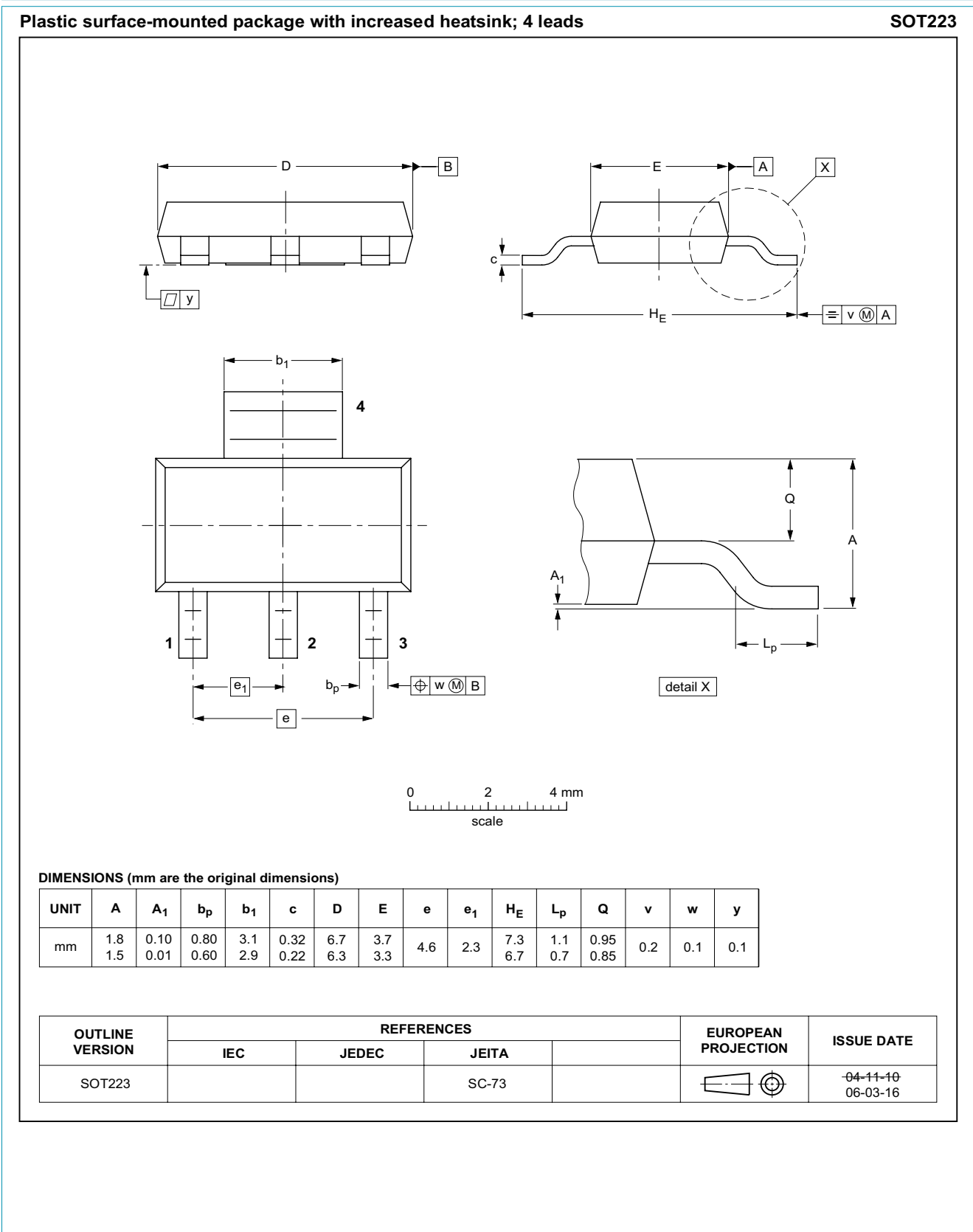
Fig. 16. Normalized critical rate of rise of commutating current as a function of junction temperature



A [B] = dI_{com}/dt at condition B, dV_{com}/dt
A [spec] is the data sheet value for dI_{com}/dt
turn-off time is less than 20 ms

Fig. 17. Normalized critical rate of change of commutating current as a function of critical rate of change of commutating voltage; minimum values

11. Package outline



12. Legal information

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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.
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- [2] The term 'short data sheet' is explained in section "Definitions".
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For sales office addresses, please send an email to: salesaddresses@ween-semi.com

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