



**THE DATASHEET OF
Z0109MA0,412**



1. General description

Planar passivated sensitive gate four quadrant triac in a SOT54 (TO-92) plastic package intended for use in applications requiring enhanced noise immunity and direct interfacing to logic ICs and low power gate drivers.

2. Features and benefits

- Direct interfacing to logic level ICs
- Enhanced current surge capability
- Enhanced noise immunity
- High blocking voltage of 600V
- Planar passivated for voltage ruggedness and reliability
- Sensitive gate in four quadrants
- Triggering in all four quadrants

3. Applications

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

4. Quick reference data

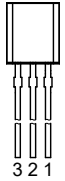
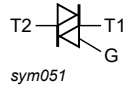
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	-	600	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{lead} \leq 45\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3	-	-	1	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5	-	-	12.5	A
		full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$	-	-	13.8	A
T_j	junction temperature		-	-	125	°C
Static characteristics						
I_{GT}	gate trigger current	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 7	0.4	-	10	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7	0.4	-	10	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2\text{- G-}; T_j = 25\text{ }^\circ\text{C};$ Fig. 7	0.4	-	10	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2\text{- G+}; T_j = 25\text{ }^\circ\text{C};$ Fig. 7	0.4	-	10	mA
I_H	holding current	$V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C};$ Fig. 9	-	-	10	mA
V_T	on-state voltage	$I_T = 1\text{ A}; T_j = 25\text{ }^\circ\text{C};$ Fig. 10	-	1.3	1.6	V
Dynamic characteristics						
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}; T_j = 110\text{ }^\circ\text{C}; (V_{DM} = 67\% \text{ of } V_{DRM});$ exponential waveform; gate open circuit; Fig. 12	120	-	-	V/ μ 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/ μ s

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T2	main terminal 2	 <p>TO-92 (SOT54)</p>	 <p>sym051</p>
2	G	gate		
3	T1	main terminal 1		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
Z0109MA0	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

7. Limiting values

Table 4. 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; $T_{lead} \leq 45\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3	-	1	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5	-	12.5	A
		full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$	-	13.8	A
I^2t	I^2t for fusing	$t_p = 10\text{ ms}$; SIN	-	0.78	A ² s
di_T/dt	rate of rise of on-state current	$I_G = 20\text{ mA}$; T2+ G+	-	50	A/ μ s
		$I_G = 20\text{ mA}$; T2+ G-	-	50	A/ μ s
		$I_G = 20\text{ mA}$; T2- G-	-	50	A/ μ s
		$I_G = 20\text{ mA}$; T2- G+	-	20	A/ μ s
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

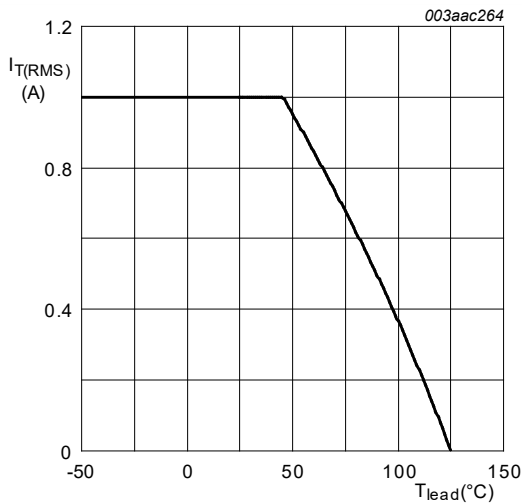


Fig. 1. RMS on-state current as a function of lead temperature; maximum values

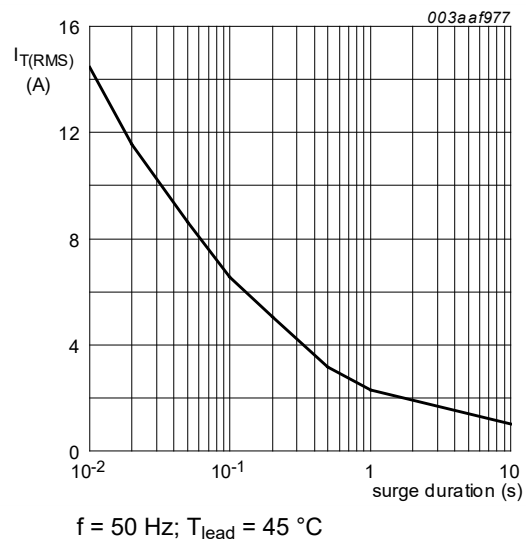
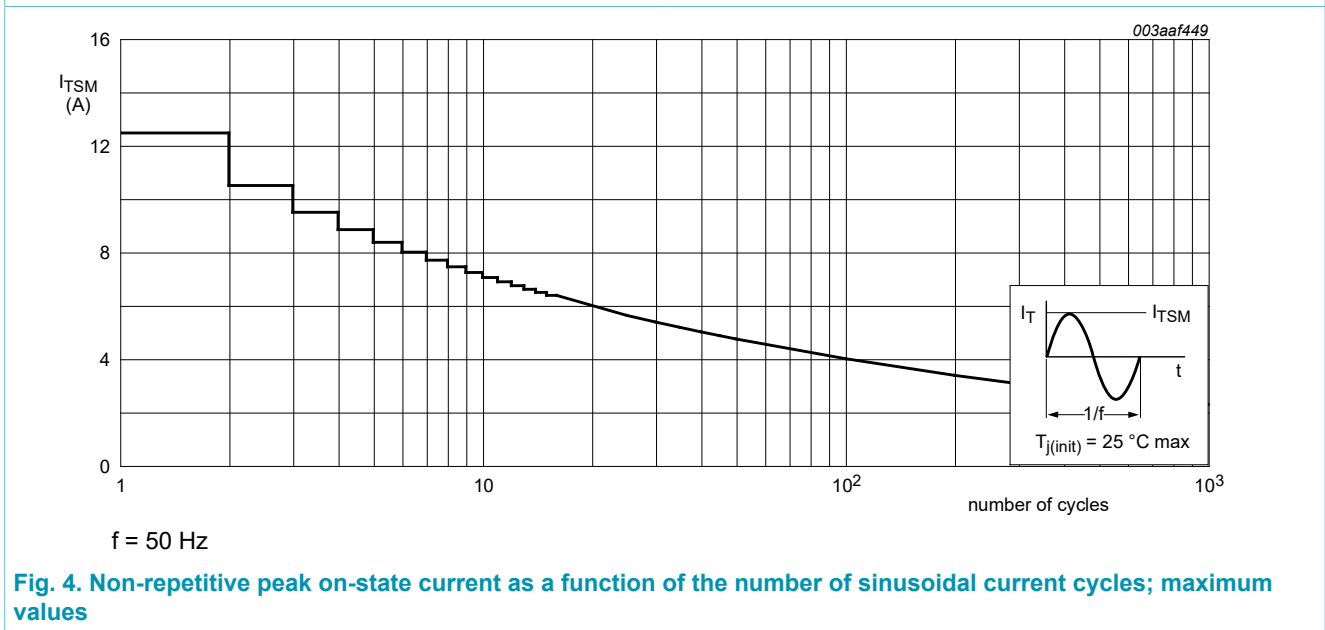
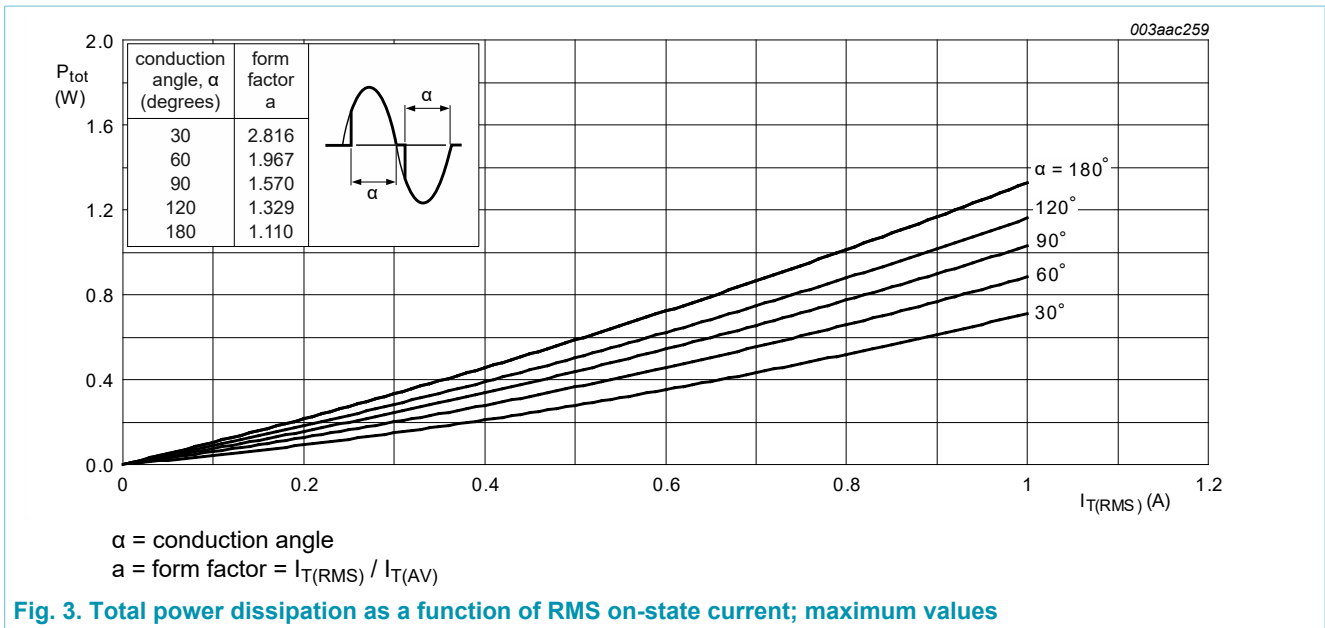
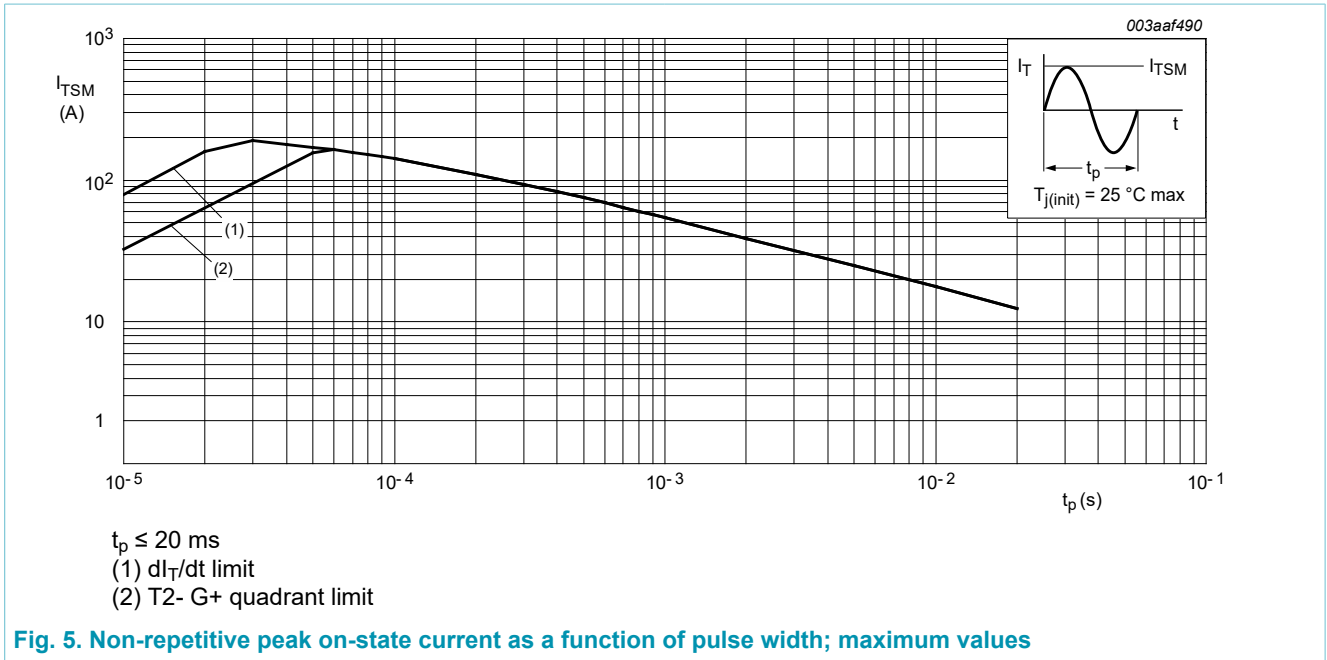


Fig. 2. RMS on-state current as a function of surge duration; maximum values





8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-lead)}$	thermal resistance from junction to lead	full cycle; Fig. 6	-	-	60	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	full cycle; printed circuit board mounted; lead length 4 mm	-	150	-	K/W

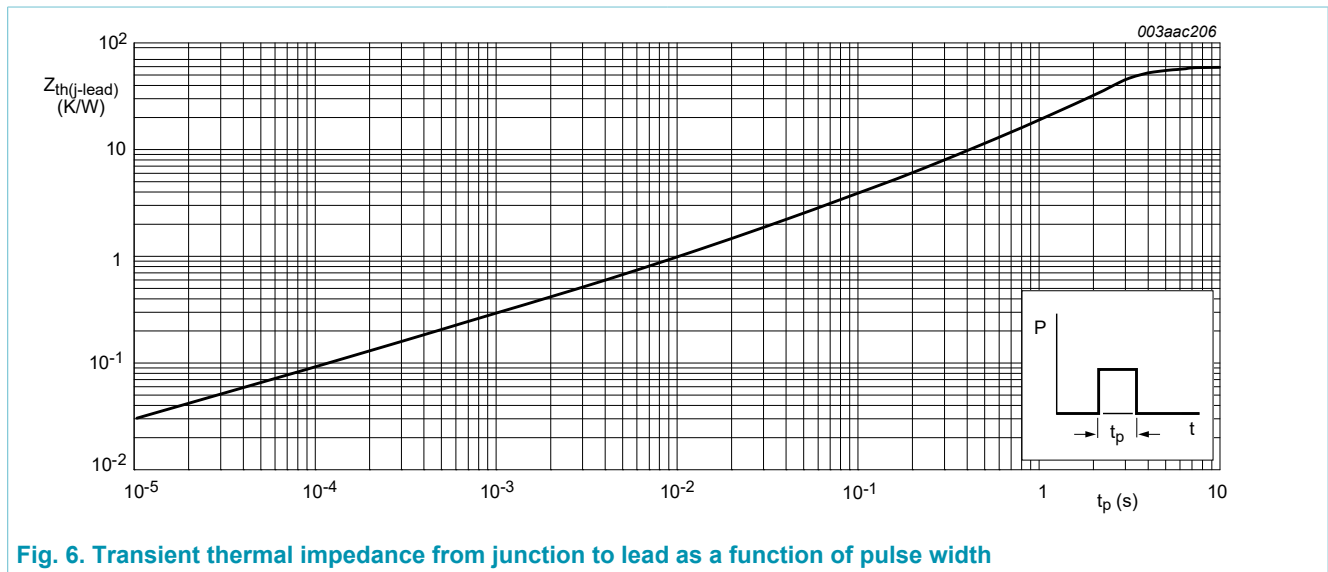


Fig. 6. Transient thermal impedance from junction to lead as a function of pulse width

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I _{GT}	gate trigger current	V _D = 12 V; I _T = 0.1 A; T2+ G+; T _j = 25 °C; Fig. 7	0.4	-	10	mA
		V _D = 12 V; I _T = 0.1 A; T2+ G-; T _j = 25 °C; Fig. 7	0.4	-	10	mA
		V _D = 12 V; I _T = 0.1 A; T2- G-; T _j = 25 °C; Fig. 7	0.4	-	10	mA
		V _D = 12 V; I _T = 0.1 A; T2- G+; T _j = 25 °C; Fig. 7	0.4	-	10	mA
I _L	latching current	V _D = 12 V; I _G = 0.1 A; T2+ G+; T _j = 25 °C; Fig. 8	-	-	15	mA
		V _D = 12 V; I _G = 0.1 A; T2+ G-; T _j = 25 °C; Fig. 8	-	-	30	mA
		V _D = 12 V; I _G = 0.1 A; T2- G-; T _j = 25 °C; Fig. 8	-	-	15	mA
		V _D = 12 V; I _G = 0.1 A; T2- G+; T _j = 25 °C; Fig. 8	-	-	15	mA
I _H	holding current	V _D = 12 V; T _j = 25 °C; Fig. 9	-	-	10	mA
V _T	on-state voltage	I _T = 1 A; T _j = 25 °C; Fig. 10	-	1.3	1.6	V
V _{GT}	gate trigger voltage	V _D = 12 V; I _T = 0.1 A; T _j = 25 °C; Fig. 11	-	-	1	V
		V _D = 600 V; I _T = 0.1 A; T _j = 125 °C; Fig. 11	0.2	-	-	V
I _D	off-state current	V _D = 600 V; T _j = 125 °C	-	-	0.5	mA
Dynamic characteristics						
dV _D /dt	rate of rise of off-state voltage	V _{DM} = 402 V; T _j = 110 °C; (V _{DM} = 67% of V _{DRM}); exponential waveform; gate open circuit; Fig. 12	120	-	-	V/μs
dV _{com} /dt	rate of change of commutating voltage	V _D = 400 V; T _j = 110 °C; dI _{com} /dt = 0.44 A/ms; gate open circuit	2	-	-	V/μs

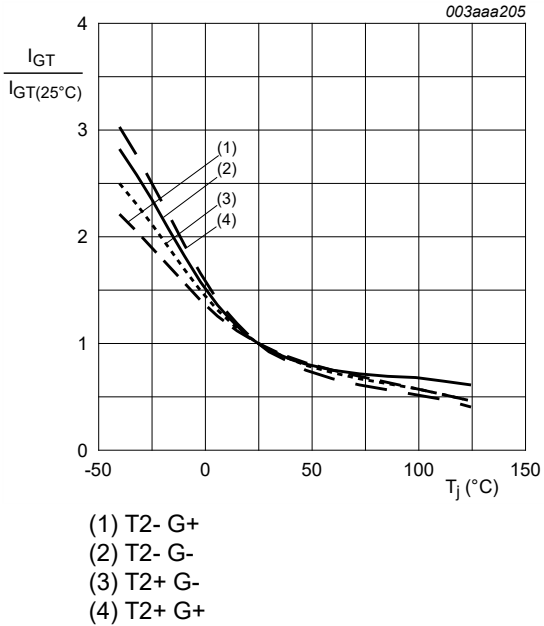


Fig. 7. Normalized gate trigger current as a function of junction temperature

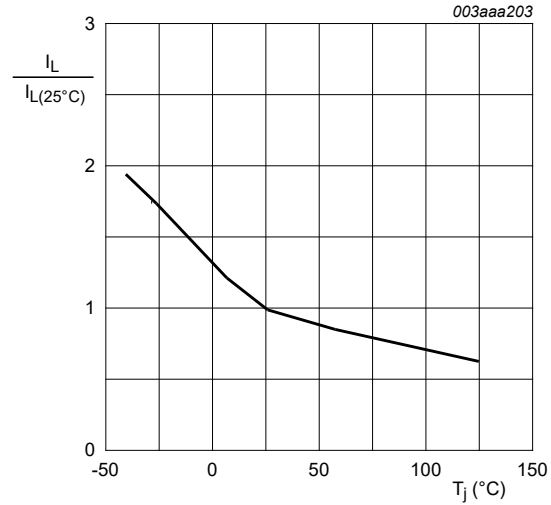


Fig. 8. Normalized latching current as a function of junction temperature

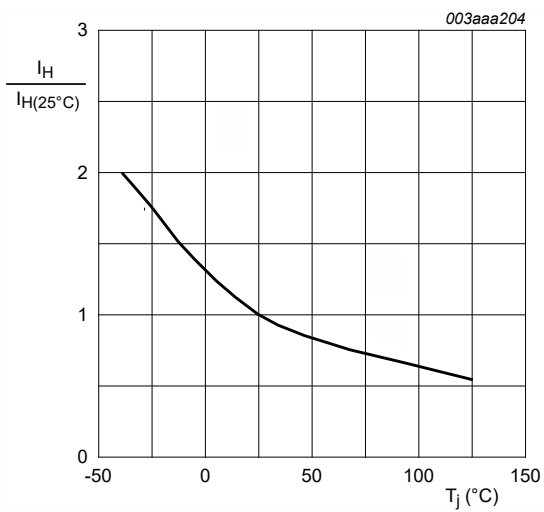
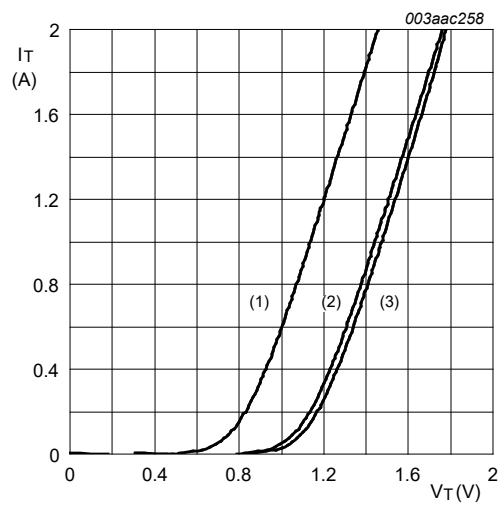


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.13 \text{ V}$
 $R_s = 0.31 \Omega$
 (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. 10. On-state current as a function of on-state voltage

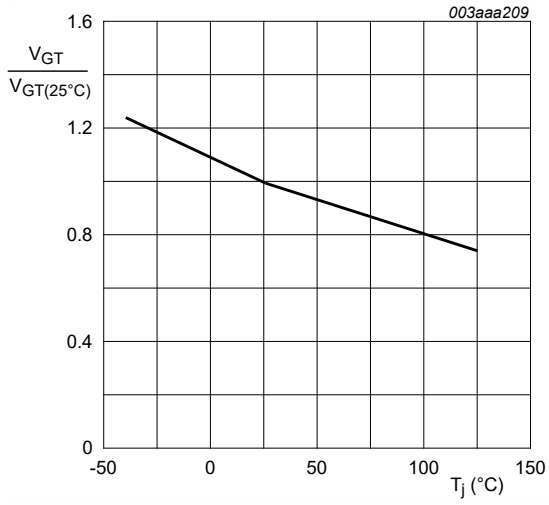
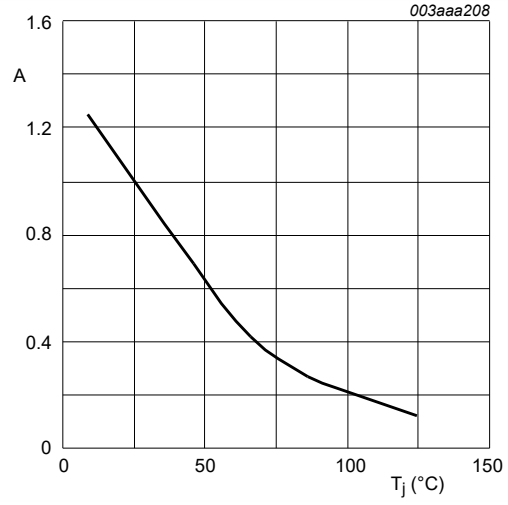


Fig. 11. Normalized gate trigger voltage as a function of junction temperature



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

Fig. 12. Normalized critical rate of rise of off-state voltage as a function of junction temperature; typical values

10. Package outline

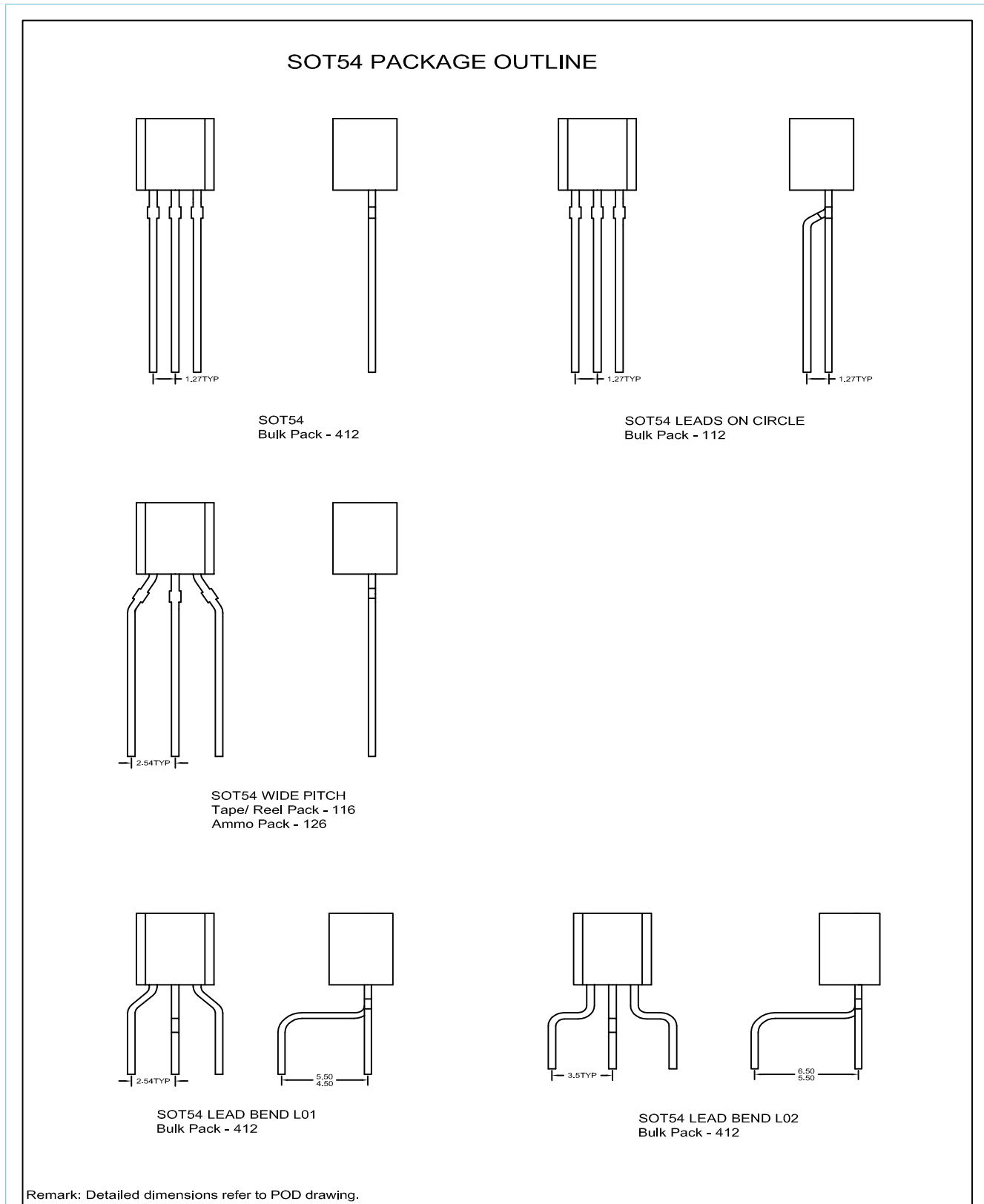


Fig. 13. Package outline TO-92 (SOT54)

11. Legal information

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Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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