

## 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

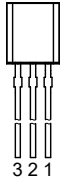
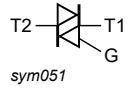
Table 1. Quick reference data

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; $T_{lead} \leq 45\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	1	A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	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
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	0.4	-	10	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	0.4	-	10	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2\text{- G-}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>	0.4	-	10	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2\text{- G+}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>	0.4	-	10	mA
$I_H$	holding current	$V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 9</a>	-	-	10	mA
$V_T$	on-state voltage	$I_T = 1\text{ A}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>	-	1.3	1.6	V
<b>Dynamic characteristics</b>						
$dV_D/dt$	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; <a href="#">Fig. 12</a>	120	-	-	V/ $\mu$ 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/ $\mu$ 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

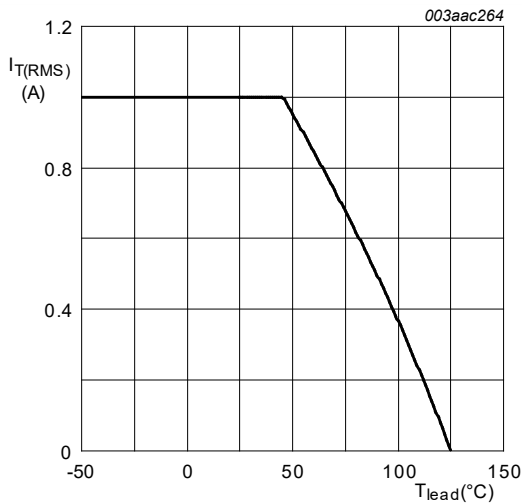
Type number	Package		
	Name	Description	Version
Z0109MA0	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

## 7. Limiting values

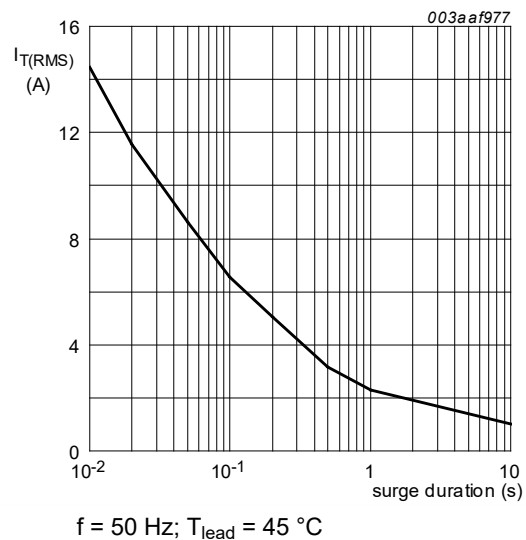
**Table 4. Limiting values**

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

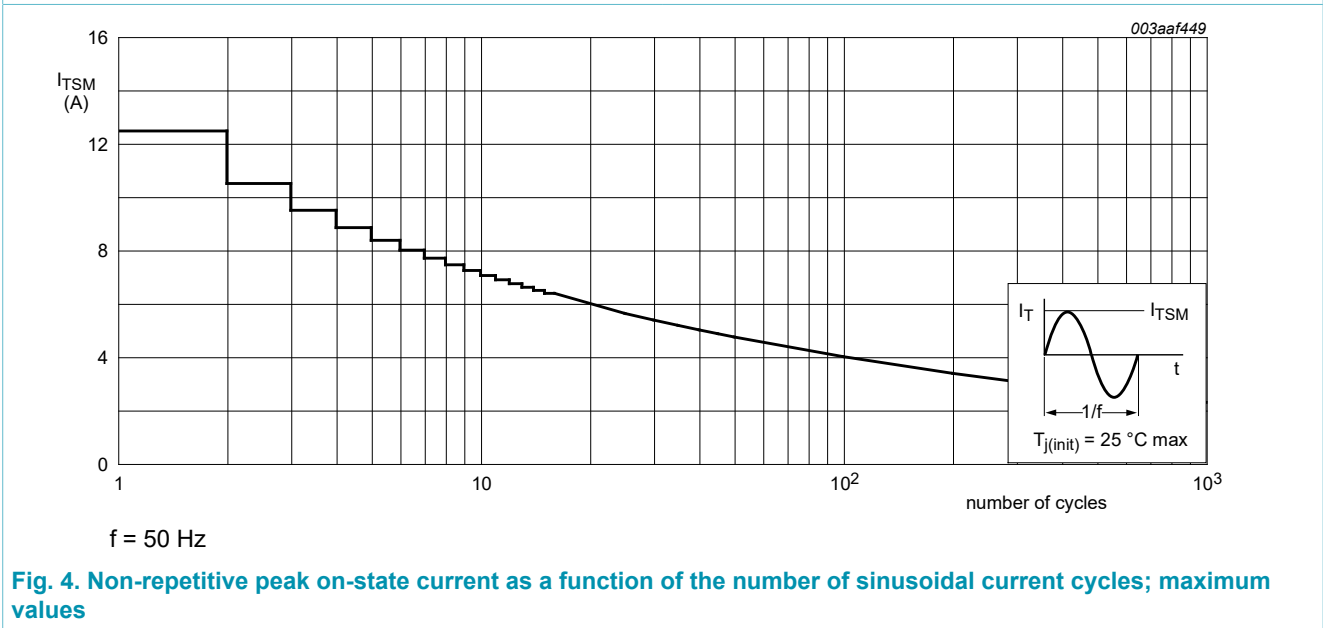
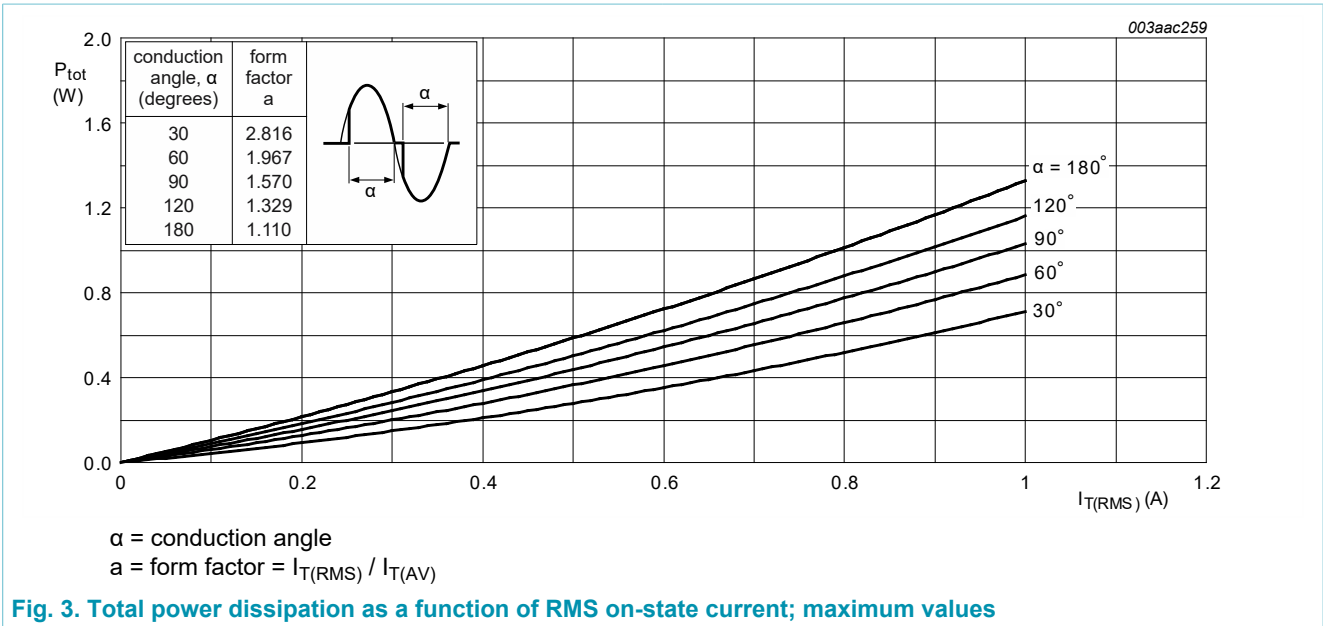
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	600	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{lead} \leq 45\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	1	A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	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 <sup>2</sup> s
$di_T/dt$	rate of rise of on-state current	$I_G = 20\text{ mA}$ ; T2+ G+	-	50	A/ $\mu$ s
		$I_G = 20\text{ mA}$ ; T2+ G-	-	50	A/ $\mu$ s
		$I_G = 20\text{ mA}$ ; T2- G-	-	50	A/ $\mu$ s
		$I_G = 20\text{ mA}$ ; T2- G+	-	20	A/ $\mu$ 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

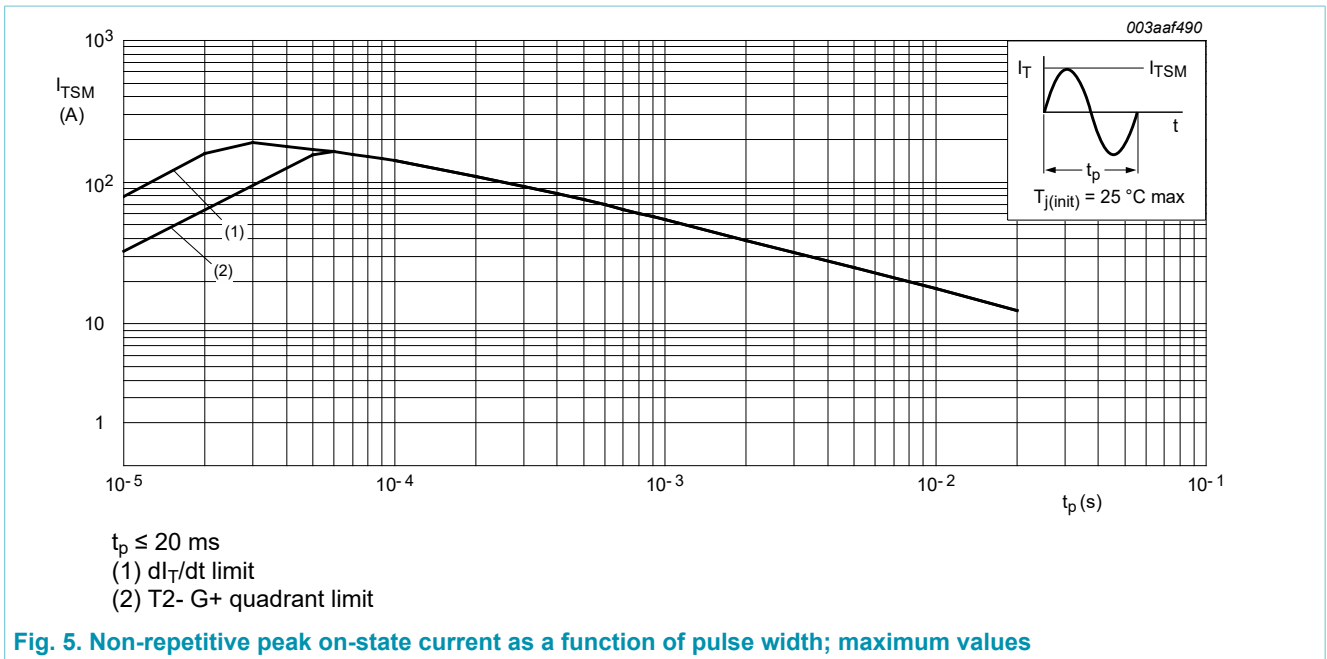


**Fig. 1. RMS on-state current as a function of lead temperature; maximum values**



**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; <a href="#">Fig. 6</a>	-	-	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

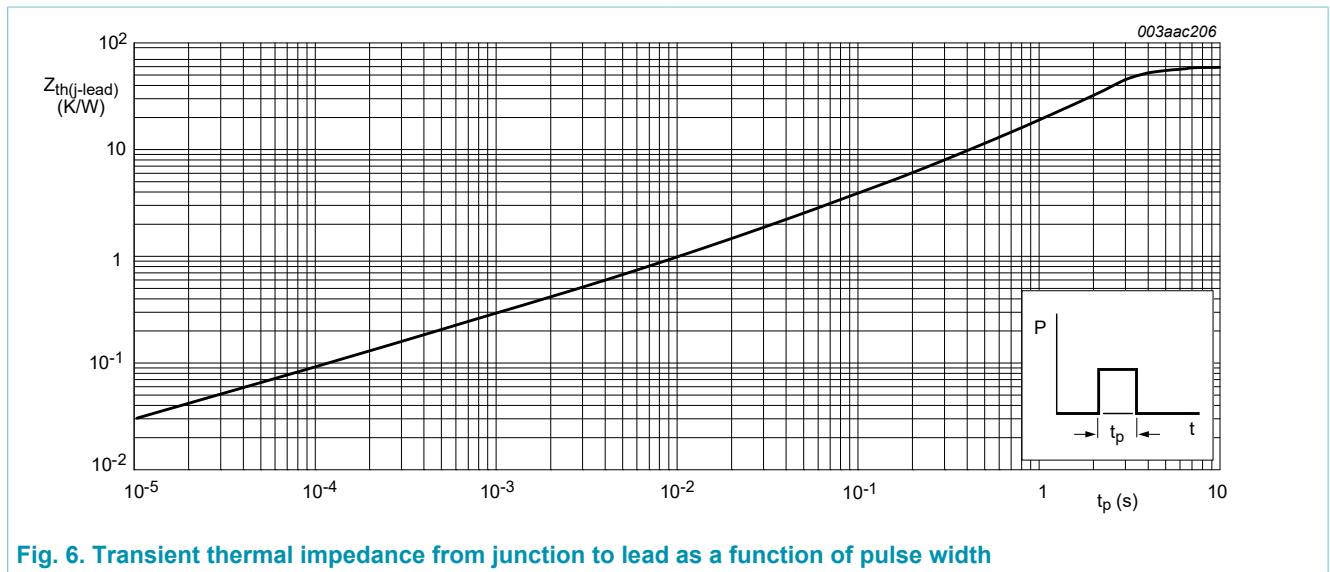


Fig. 6. Transient thermal impedance from junction to lead as a function of pulse width

## 9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<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. 7</a>	0.4	-	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. 7</a>	0.4	-	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. 7</a>	0.4	-	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. 7</a>	0.4	-	10	mA
$I_L$	latching current	$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T2+ G+;$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 8</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. 8</a>	-	-	30	mA
		$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T2- G-;$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 8</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. 8</a>	-	-	15	mA
$I_H$	holding current	$V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 9</a>	-	-	10	mA
$V_T$	on-state voltage	$I_T = 1\text{ A}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 10</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. 11</a>	-	-	1	V
		$V_D = 600\text{ V}; I_T = 0.1\text{ A}; T_j = 125\text{ }^\circ\text{C};$ <a href="#">Fig. 11</a>	0.2	-	-	V
$I_D$	off-state current	$V_D = 600\text{ V}; T_j = 125\text{ }^\circ\text{C}$	-	-	0.5	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}; T_j = 110\text{ }^\circ\text{C}; (V_{DM} = 67\%$ of $V_{DRM});$ exponential waveform; gate open circuit; <a href="#">Fig. 12</a>	120	-	-	V/ $\mu$ 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/ $\mu$ s

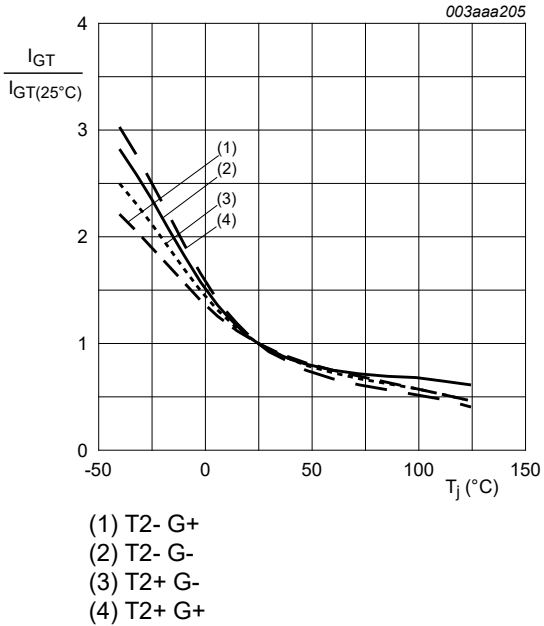


Fig. 7. Normalized gate trigger current as a function of junction temperature

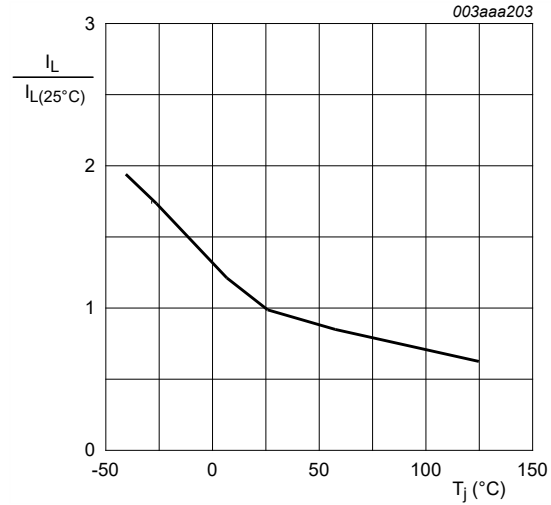


Fig. 8. Normalized latching current as a function of junction temperature

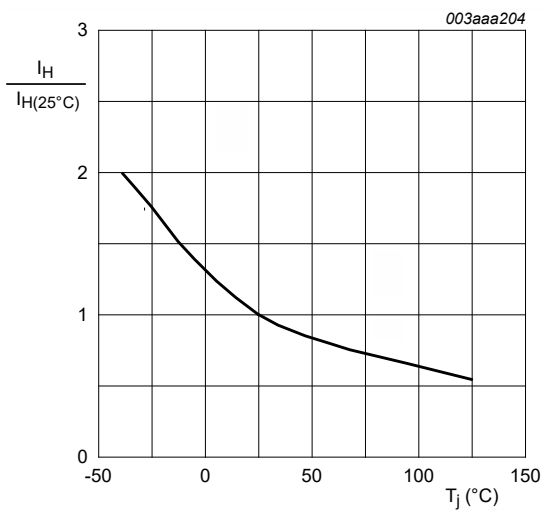
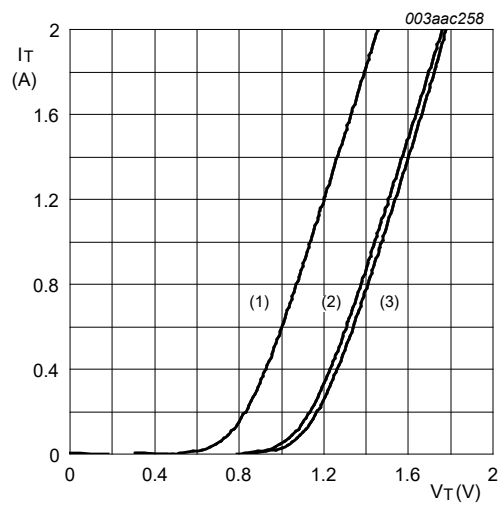


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.13 \text{ V}$   
 $R_s = 0.31 \Omega$   
 (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



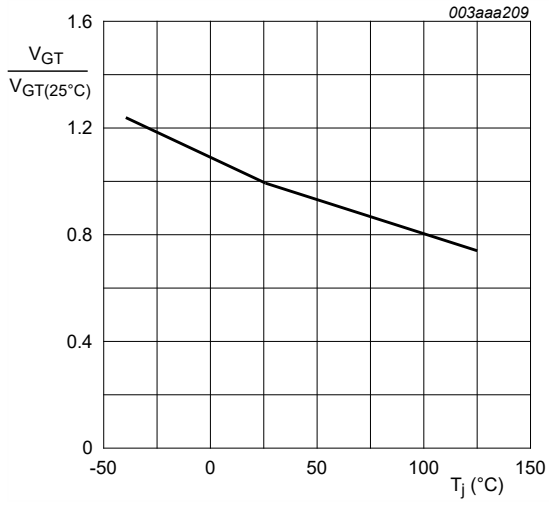
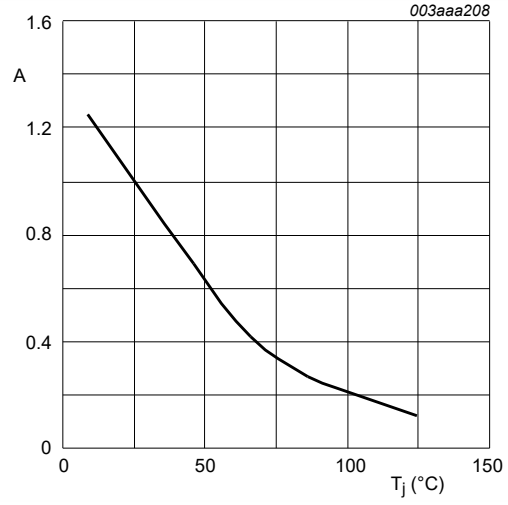


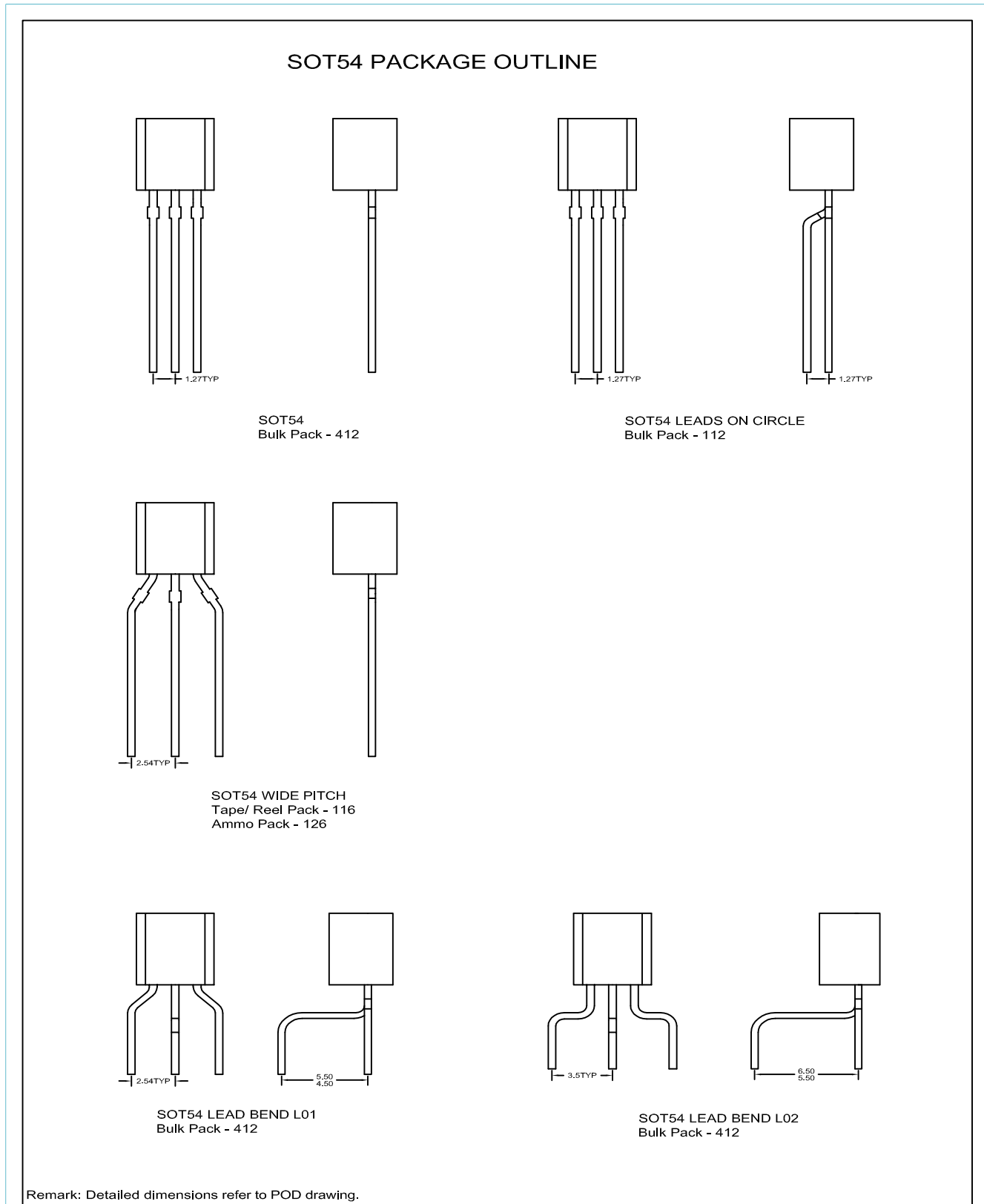
Fig. 11. Normalized gate trigger voltage as a function of junction temperature



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

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

## 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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