



# MAC97A6

4Q Triac

1 May 2015

Product data sheet

## 1. General description

Planar passivated very sensitive gate four quadrant triac in a SOT54 plastic package intended to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

## 2. Features and benefits

- Direct interfacing to logic level ICs
- Direct interfacing to low power gate drivers and microcontrollers
- High blocking voltage capability
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants
- Very sensitive gate

## 3. Applications

- General purpose low power phase control
- General purpose low power switching
- Solid-state relay

## 4. Quick reference data

Table 1. Quick reference data

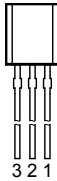
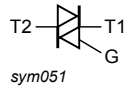
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage		-	-	400	V
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{J}(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	8	A
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{lead}} \leq 50\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	0.6	A
<b>Static characteristics</b>						
$I_{\text{GT}}$	gate trigger current	$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2+ G+; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	-	1	5	mA
		$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2+ G-; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	-	2	5	mA
		$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2- G-; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	-	2	5	mA



Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>	-	4	7	mA

## 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

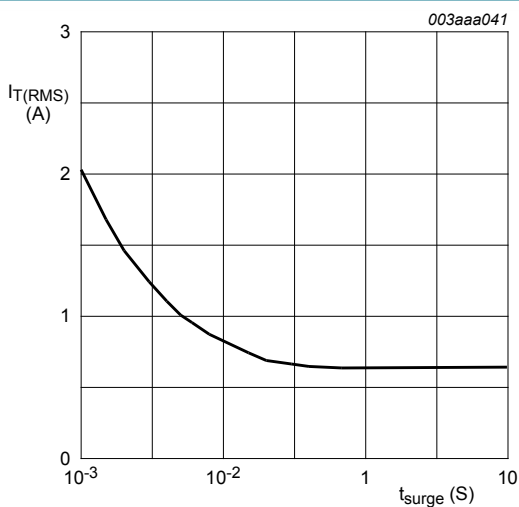
Type number	Package		
	Name	Description	Version
MAC97A6	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

## 7. Limiting values

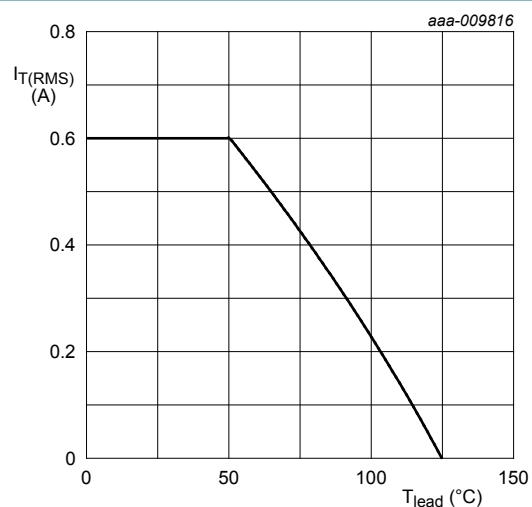
**Table 4. Limiting values**

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

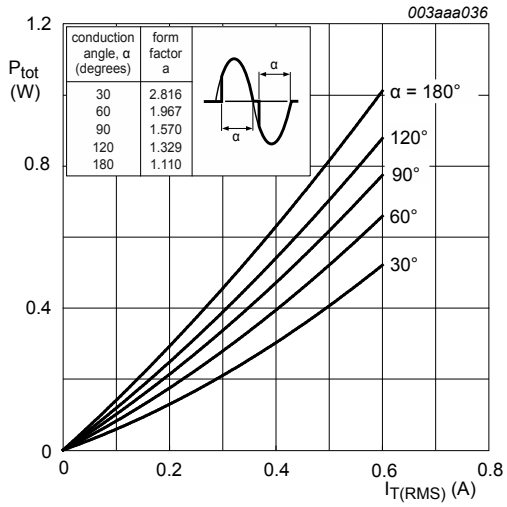
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	400	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{lead} \leq 50\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	0.6	A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	8	A
		full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 16.7\text{ ms}$	-	8.8	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; SIN	-	0.32	$\text{A}^2\text{s}$
$dl_T/dt$	rate of rise of on-state current	$I_G = 10\text{ mA}$ ; T2+ G+	-	50	$\text{A}/\mu\text{s}$
		$I_G = 10\text{ mA}$ ; T2+ G-	-	50	$\text{A}/\mu\text{s}$
		$I_G = 14\text{ mA}$ ; T2- G+	-	10	$\text{A}/\mu\text{s}$
		$I_G = 10\text{ mA}$ ; T2- G-	-	50	$\text{A}/\mu\text{s}$
$I_{GM}$	peak gate current	$t = 20\text{ microseconds (max)}$	-	1	A
$P_{GM}$	peak gate power		-	5	W
$P_{G(AV)}$	average gate power	over any 20 ms period; $T(lead) \leq 80\text{ }^{\circ}\text{C}$ ; $t = 2\text{ microseconds (max)}$	-	0.1	W
$T_{stg}$	storage temperature		-40	150	$^{\circ}\text{C}$
$T_j$	junction temperature		-	125	$^{\circ}\text{C}$



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

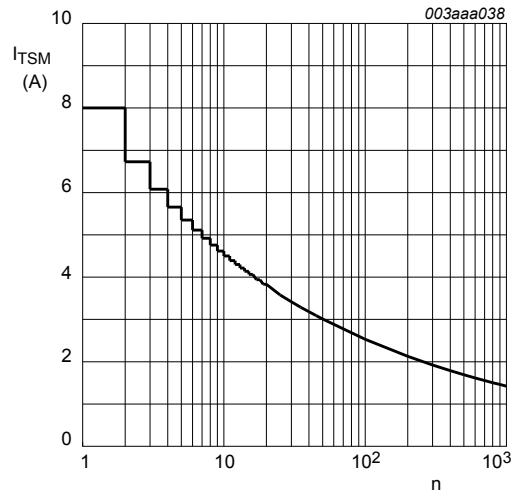


**Fig. 2. RMS on-state current as a function of lead temperature; maximum values**



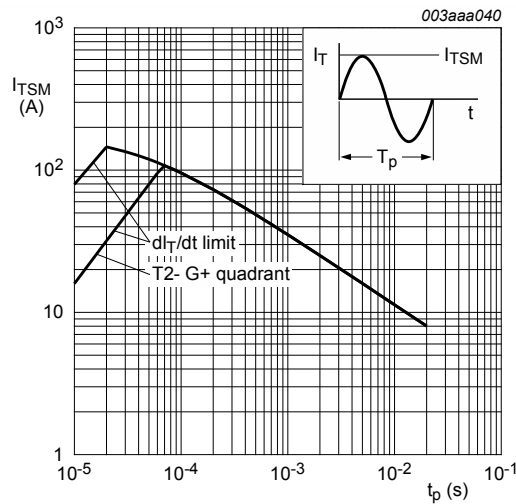
$\alpha$  = conduction angle  
 $a$  = form factor =  $I_{T(RMS)} / I_{T(AV)}$

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



$f = 50$  Hz

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



$t_p \leq 20$  ms

Fig. 5. Non-repetitive peak on-state current as a function of pulse width; 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
		half cycle	-	-	80	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	printed circuit board mounted: lead length = 4 mm	-	150	-	K/W

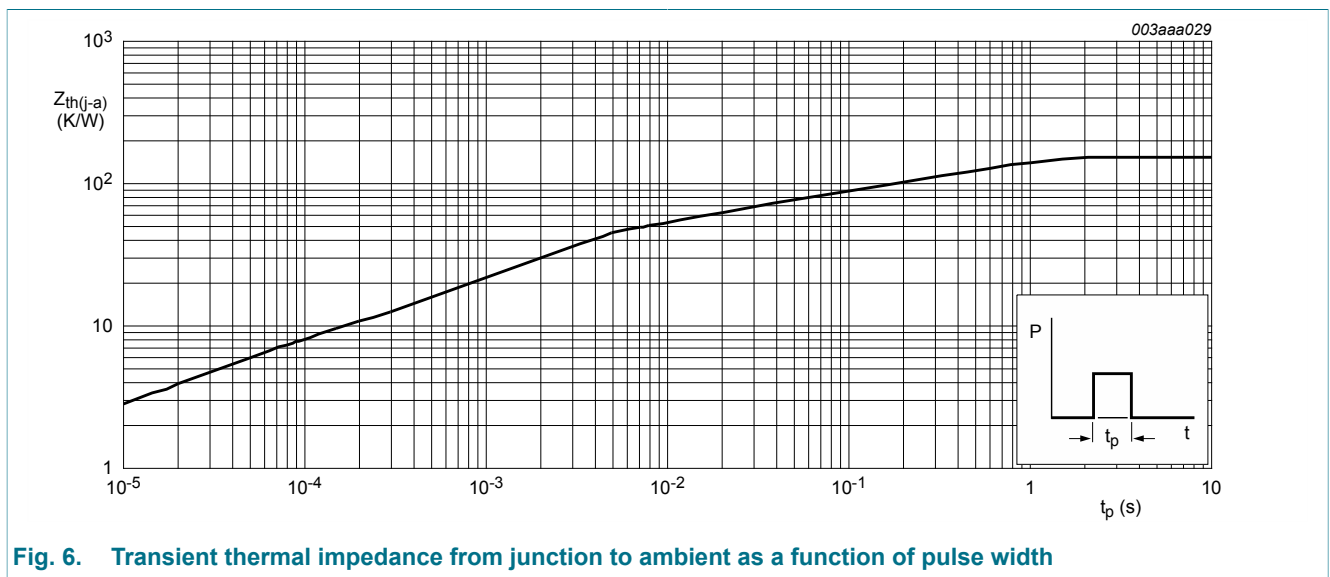


Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse width

## 9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
I <sub>GT</sub>	gate trigger current	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>	-	1	5	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>	-	2	5	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>	-	2	5	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>	-	4	7	mA
I <sub>L</sub>	latching current	V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G+; T <sub>j</sub> = 25 °C	-	1	10	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	5	10	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2- G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	1	10	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2- G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	2	10	mA
I <sub>H</sub>	holding current	V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 9</a>	-	1	10	mA
V <sub>T</sub>	on-state voltage	I <sub>T</sub> = 0.85 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 10</a>	-	1.4	1.9	V
V <sub>GT</sub>	gate trigger voltage	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 11</a>	-	0.9	1.5	V
		V <sub>D</sub> = 400 V; I <sub>T</sub> = 0.1 A; T <sub>j</sub> = 110 °C; <a href="#">Fig. 11</a>	0.1	0.7	-	V
I <sub>D</sub>	off-state current	V <sub>D</sub> = 400 V; T <sub>j</sub> = 110 °C	-	3	100	μA
<b>Dynamic characteristics</b>						
dV <sub>D</sub> /dt	rate of rise of off-state voltage	V <sub>DM</sub> = 268 V; T <sub>j</sub> = 110 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit; <a href="#">Fig. 12</a>	30	45	-	V/μs
dV <sub>com</sub> /dt	rate of change of commutating voltage	V <sub>D</sub> = 400 V; T <sub>j</sub> = 50 °C; dI <sub>com</sub> /dt = 0.3 A/ms; I <sub>T</sub> = 0.84 A; gate open circuit	-	5	-	V/μs
t <sub>gt</sub>	gate-controlled turn-on time	I <sub>TM</sub> = 1 A; V <sub>D</sub> = 400 V; I <sub>G</sub> = 25 mA; dI <sub>G</sub> /dt = 5 A/μs	-	2	-	μs

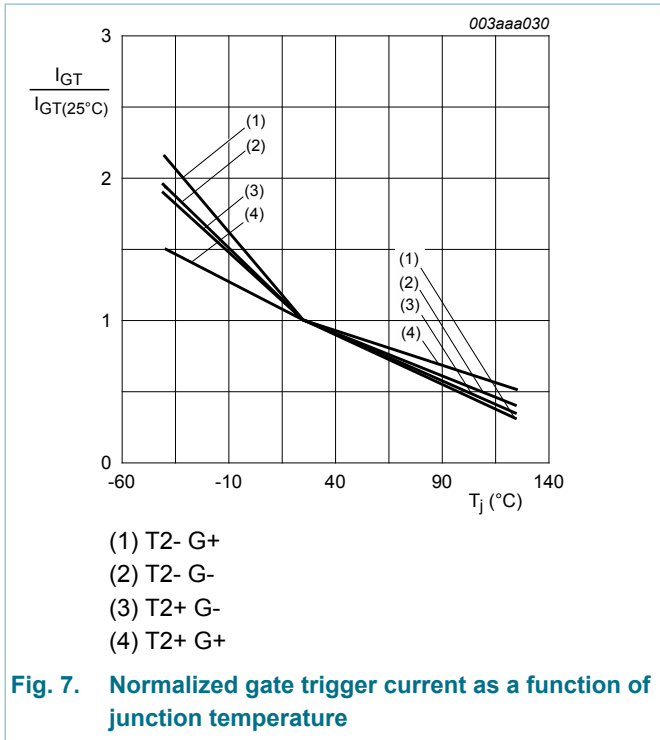


Fig. 7. Normalized gate trigger current as a function of junction temperature

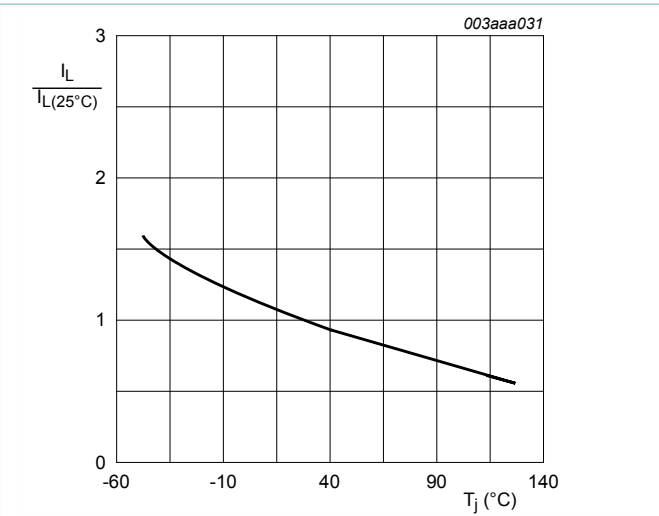


Fig. 8. Normalized latching current as a function of junction temperature

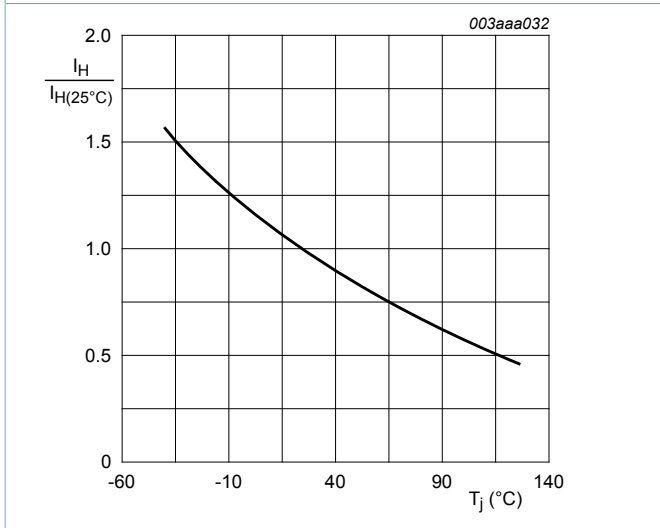


Fig. 9. Normalized holding current as a function of junction temperature

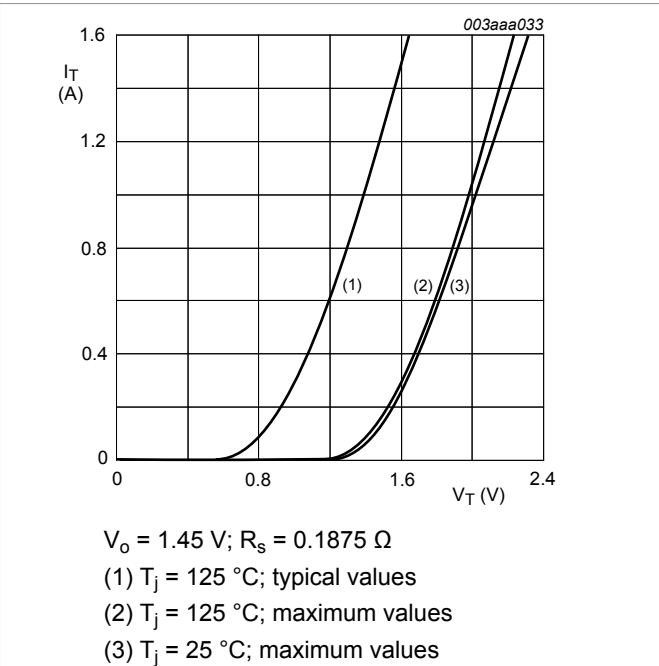


Fig. 10. On-state current as a function of on-state voltage

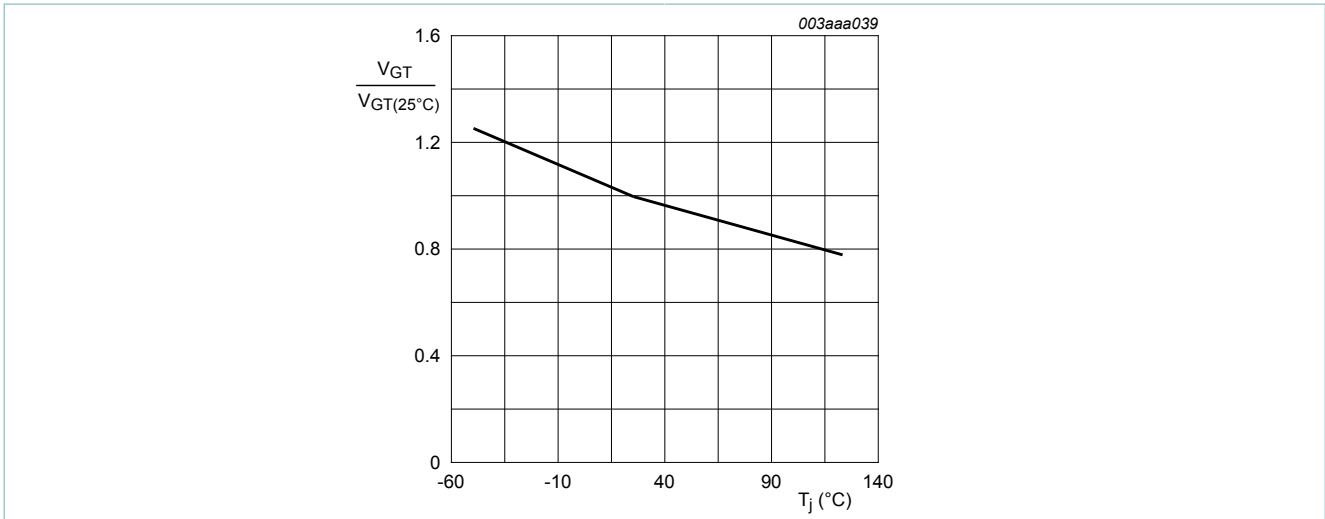


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

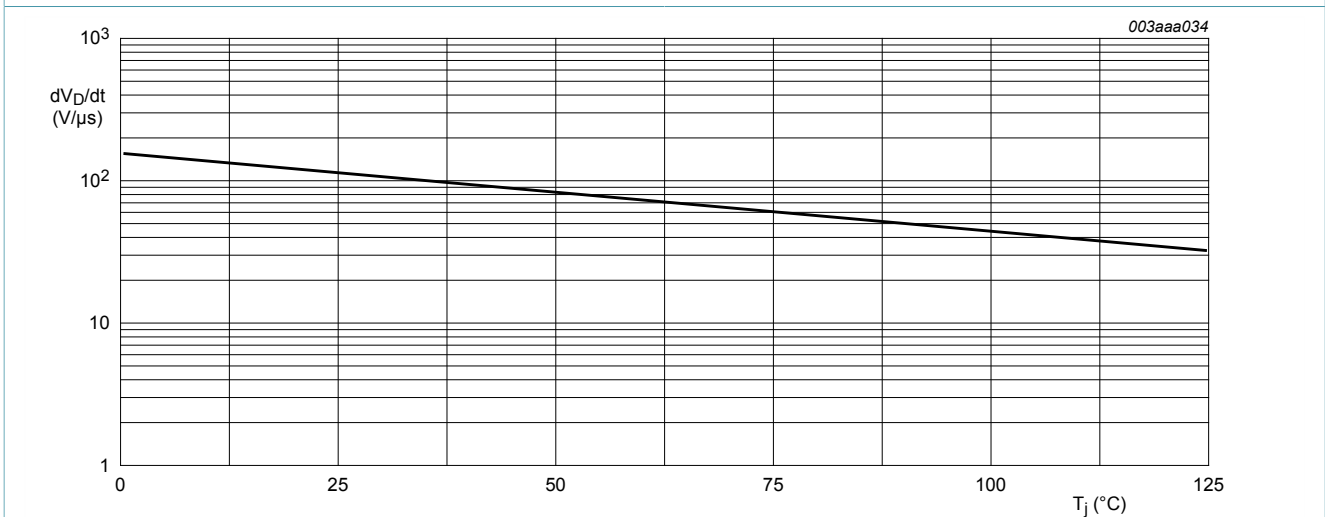


Fig. 12. Critical rate of rise of off-state voltage as a function of junction temperature; typical values



### 10. Package outline

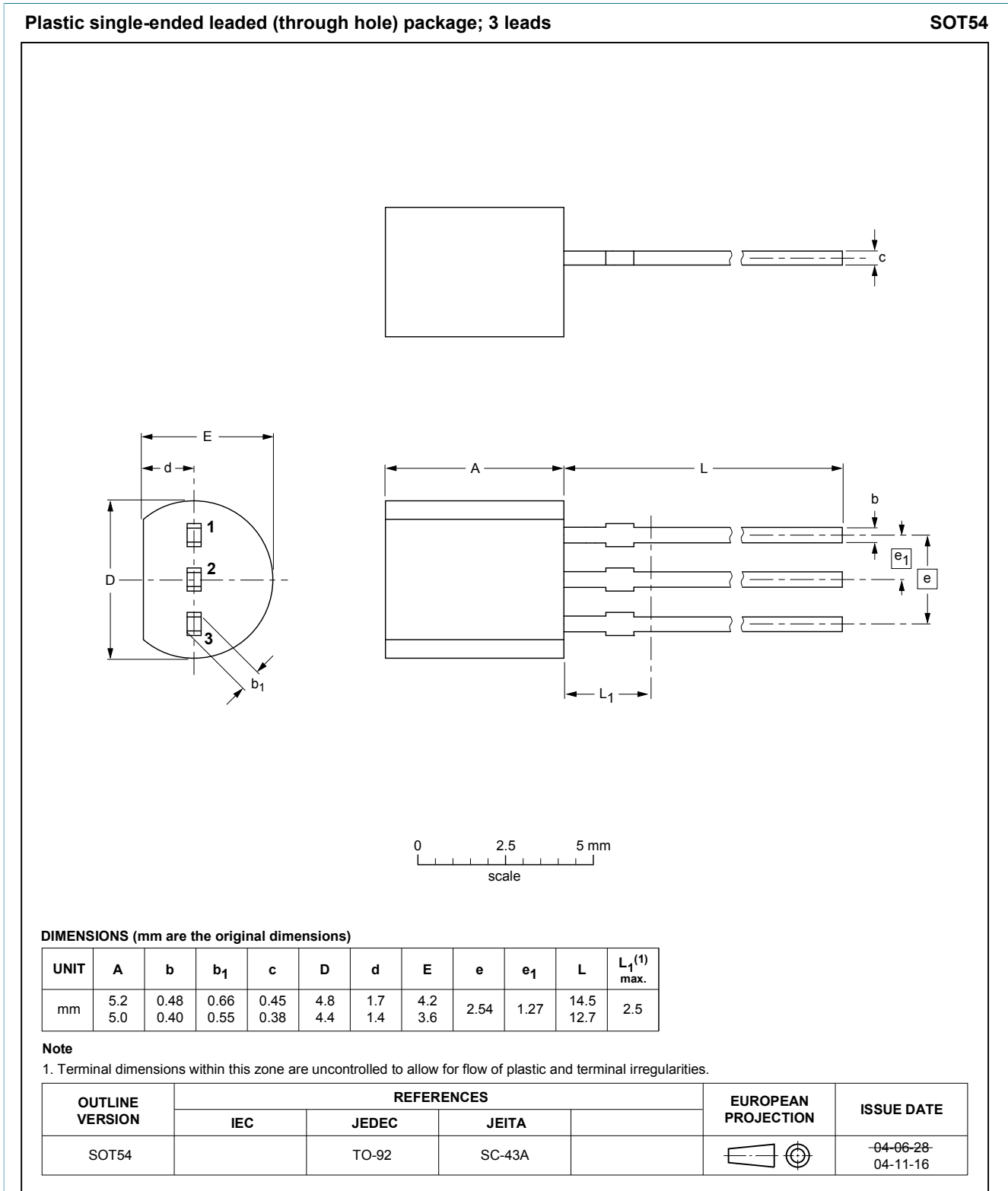


Fig. 13. Package outline TO-92 (SOT54)

## 11. Legal information

### 11.1 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.
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Product [short] data sheet	Production	This document contains the product specification.

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