



# BT169 series

Thyristors logic level

Rev. 04 — 23 August 2004

Product data sheet

## 1. Product profile

### 1.1 General description

Passivated, sensitive gate thyristors in a SOT54 plastic package.

### 1.2 Features

- Designed to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

### 1.3 Applications

- General purpose switching and phase control applications.

### 1.4 Quick reference data

- $V_{DRM}, V_{RRM} \leq 200$  V (BT169B)
- $V_{DRM}, V_{RRM} \leq 400$  V (BT169D)
- $V_{DRM}, V_{RRM} \leq 600$  V (BT169G)
- $I_{T(RMS)} \leq 0.8$  A
- $I_{T(AV)} \leq 0.5$  A
- $I_{TSM} \leq 8$  A.

## 2. Pinning information

Table 1: Discrete pinning

Pin	Description	Simplified outline	Symbol
1	anode (a)	<p>SOT54 (TO-92)</p>	<p>sym037</p>
2	gate (g)		
3	cathode (k)		

### 3. Ordering information

**Table 2: Ordering information**

Type number	Package		Version
	Name	Description	
BT169B	-	plastic single-ended leaded (through hole) package; 3 leads	SOT54
BT169D			
BT169G			

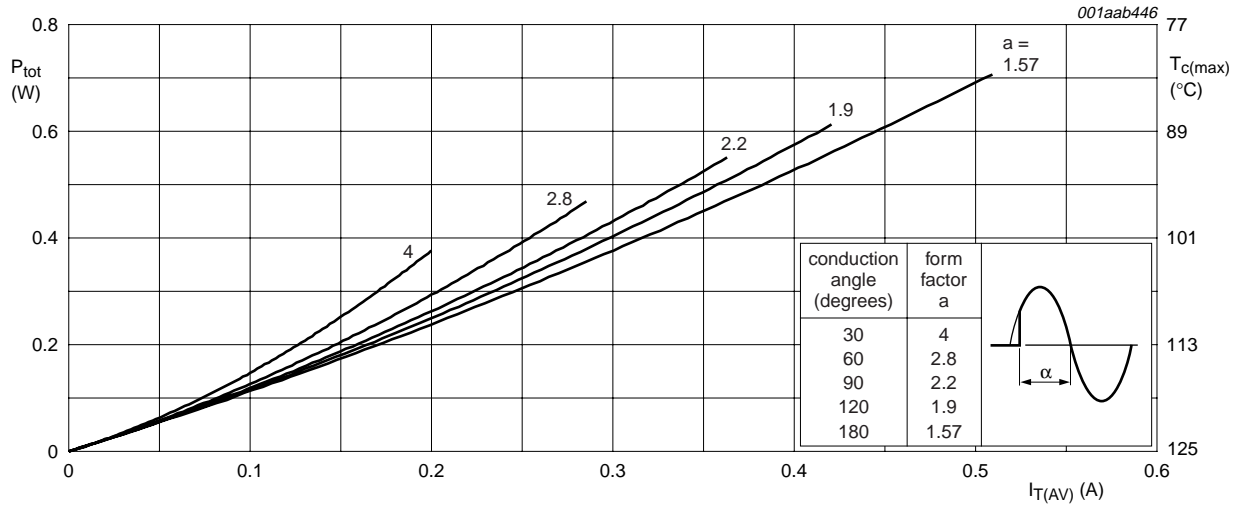
### 4. Limiting values

**Table 3: Limiting values**

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

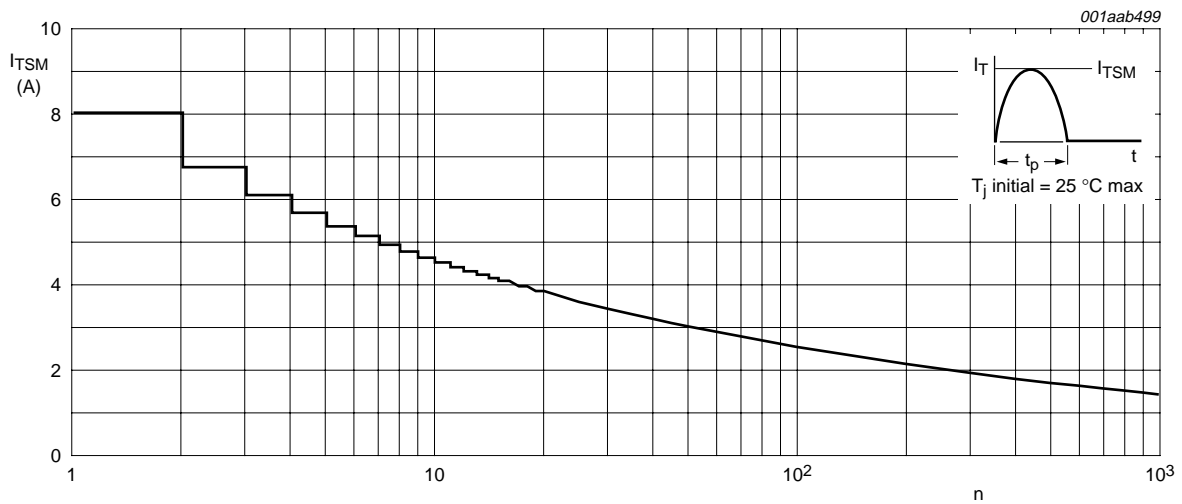
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}, V_{RRM}$	repetitive peak off-state voltages				
	BT169B		[1] -	200	V
	BT169D		[1] -	400	V
	BT169G		[1] -	600	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{lead} \leq 83 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 1</a>	-	0.5	A
$I_{T(RMS)}$	RMS on-state current	all conduction angles; see <a href="#">Figure 4</a> and <a href="#">5</a>	-	0.8	A
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $T_j = 25 \text{ }^\circ\text{C}$ prior to surge; see <a href="#">Figure 2</a> and <a href="#">3</a>			
		$t = 10 \text{ ms}$	-	8	A
		$t = 8.3 \text{ ms}$	-	9	A
$I^2t$	$I^2t$ for fusing	$t = 10 \text{ ms}$	-	0.32	$\text{A}^2\text{s}$
$di_T/dt$	repetitive rate of rise of on-state current after triggering	$I_{TM} = 2 \text{ A}$ ; $I_G = 10 \text{ mA}$ ; $di_G/dt = 100 \text{ mA}/\mu\text{s}$	-	50	$\text{A}/\mu\text{s}$
$I_{GM}$	peak gate current		-	1	A
$V_{GM}$	peak gate voltage		-	5	V
$V_{RGM}$	peak reverse gate voltage		-	5	V
$P_{GM}$	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	$^\circ\text{C}$
$T_j$	junction temperature		-	125	$^\circ\text{C}$

- [1] Although not recommended, off-state voltages up to 800 V may be applied without damage, but the thyristor may switch to the on-state. The rate of rise of current should not exceed 15 A/ $\mu\text{s}$ .



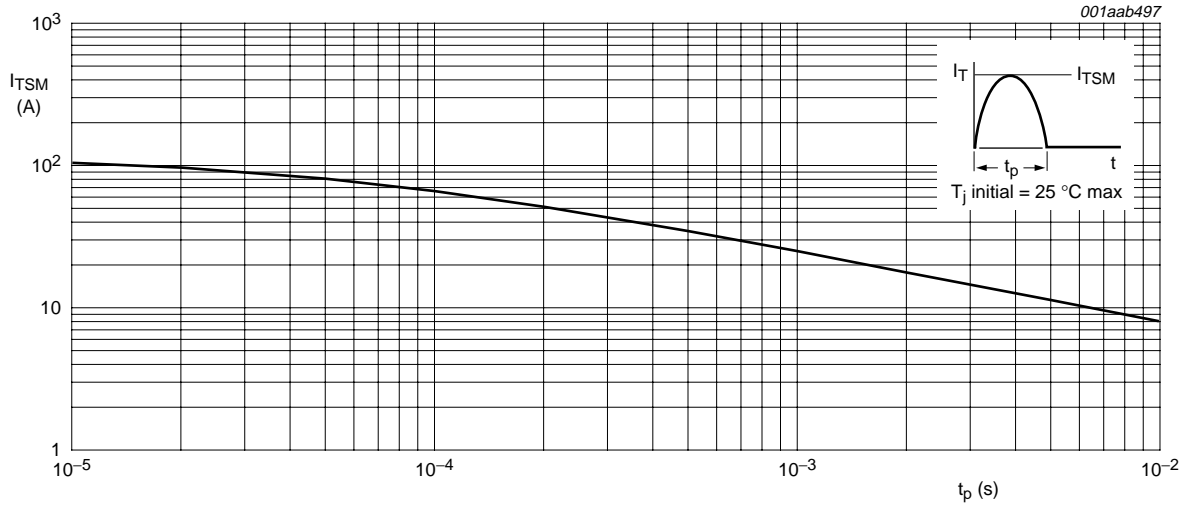
$a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$ .

Fig 1. Total power dissipation as a function of average on-state current; maximum values.



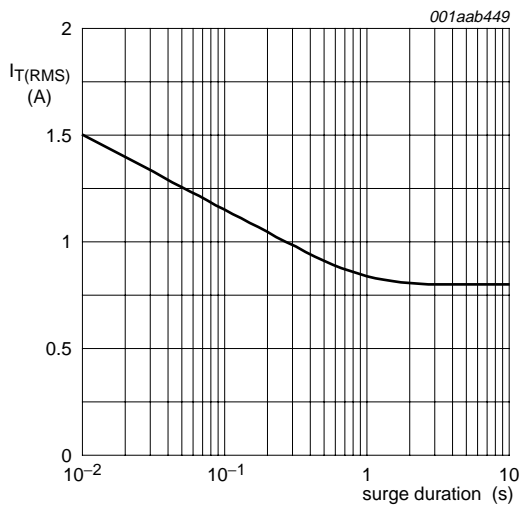
$f = 50 \text{ Hz}$ .

Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values.



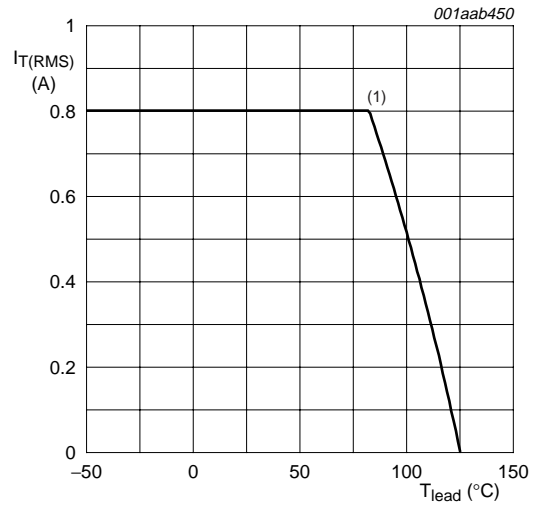
$t_p \leq 10$  ms.

**Fig 3. Non-repetitive peak on-state current as a function of pulse width for sinusoidal currents; maximum values.**



$f = 50$  Hz;  $T_{lead} \leq 83$  °C.

**Fig 4. RMS on-state current as a function of surge duration for sinusoidal currents.**



(1)  $T_{lead} = 83$  °C.

**Fig 5. RMS on-state current as a function of lead temperature; maximum values.**

## 5. Thermal characteristics

Table 4: Thermal characteristics

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

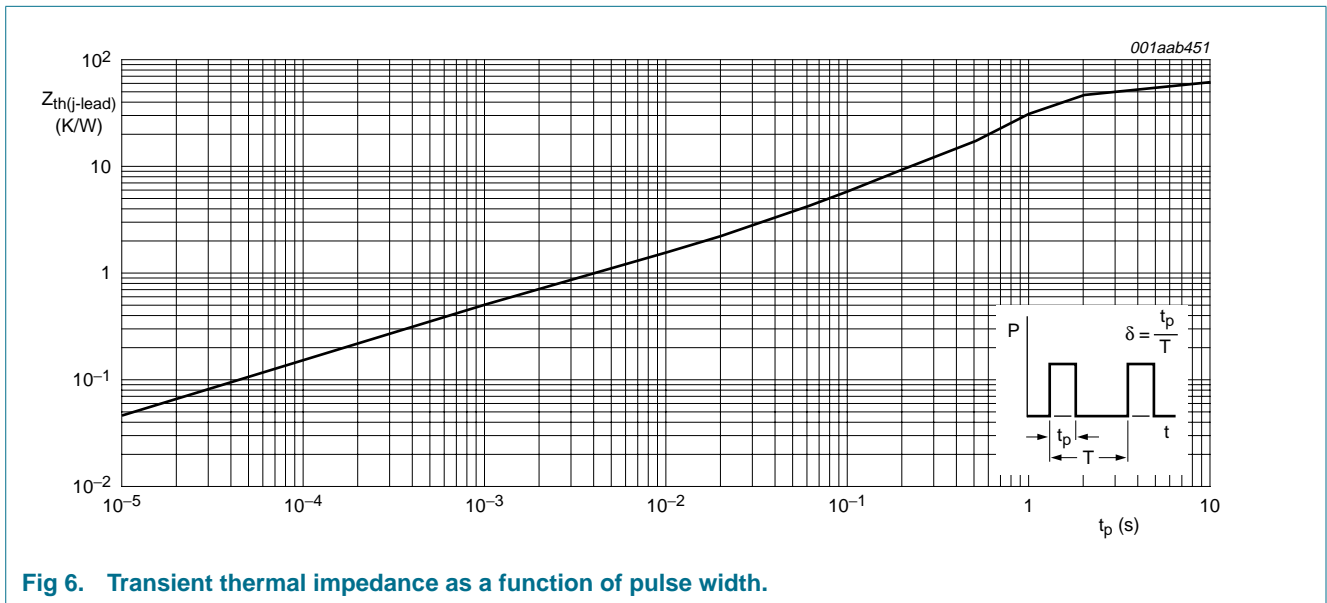


Fig 6. Transient thermal impedance as a function of pulse width.

## 6. Characteristics

**Table 5: Characteristics**

$T_j = 25\text{ °C}$  unless otherwise stated.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 10\text{ mA}$ ; gate open circuit; see <a href="#">Figure 8</a>	-	50	200	$\mu\text{A}$
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_{GT} = 0.5\text{ mA}$ ; $R_{GK} = 1\text{ k}\Omega$ ; see <a href="#">Figure 10</a>	-	2	6	$\text{mA}$
$I_H$	holding current	$V_D = 12\text{ V}$ ; $I_{GT} = 0.5\text{ mA}$ ; $R_{GK} = 1\text{ k}\Omega$ ; see <a href="#">Figure 11</a>	-	2	5	$\text{mA}$
$V_T$	on-state voltage	$I_T = 1.2\text{ A}$	-	1.25	1.7	$\text{V}$
$V_{GT}$	gate trigger voltage	$I_T = 10\text{ mA}$ ; gate open circuit; see <a href="#">Figure 7</a>				
		$V_D = 12\text{ V}$	-	0.5	0.8	$\text{V}$
		$V_D = V_{DRM(max)}$ ; $T_j = 125\text{ °C}$	0.2	0.3	-	$\text{V}$
$I_D, I_R$	off-state leakage current	$V_D = V_{DRM(max)}$ ; $V_R = V_{RRM(max)}$ ; $T_j = 125\text{ °C}$ ; $R_{GK} = 1\text{ k}\Omega$	-	0.05	0.1	$\text{mA}$
<b>Dynamic characteristics</b>						
$dV_D/dt$	critical rate of rise of off-state voltage	$V_{DM} = 67\% V_{DRM(max)}$ ; $T_j = 125\text{ °C}$ ; exponential waveform; see <a href="#">Figure 12</a>				
		$R_{GK} = 1\text{ k}\Omega$	500	800	-	$\text{V}/\mu\text{s}$
		gate open circuit	-	25	-	$\text{V}/\mu\text{s}$
$t_{gt}$	gate controlled turn-on time	$I_{TM} = 2\text{ A}$ ; $V_D = V_{DRM(max)}$ ; $I_G = 10\text{ mA}$ ; $dI_G/dt = 0.1\text{ A}/\mu\text{s}$	-	2	-	$\mu\text{s}$
$t_q$	circuit commuted turn-off time	$V_D = 67\% V_{DRM(max)}$ ; $T_j = 125\text{ °C}$ ; $I_{TM} = 1.6\text{ A}$ ; $V_R = 35\text{ V}$ ; $dI_{TM}/dt = 30\text{ A}/\mu\text{s}$ ; $dV_D/dt = 2\text{ V}/\mu\text{s}$ ; $R_{GK} = 1\text{ k}\Omega$	-	100	-	$\mu\text{s}$

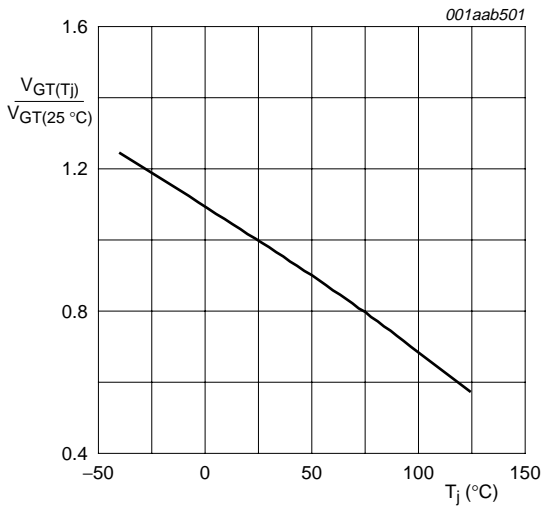


Fig 7. Normalized gate trigger voltage as a function of junction temperature.

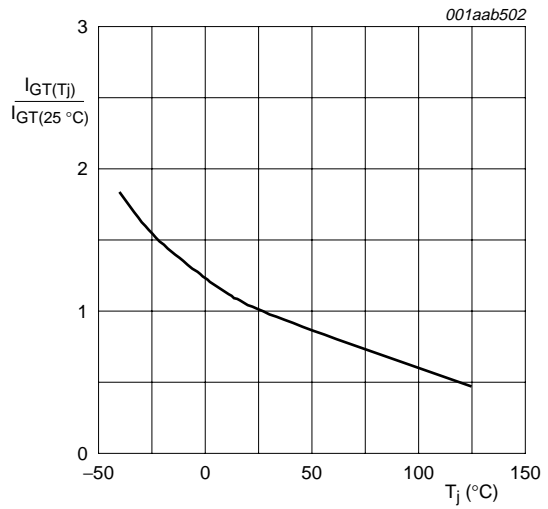
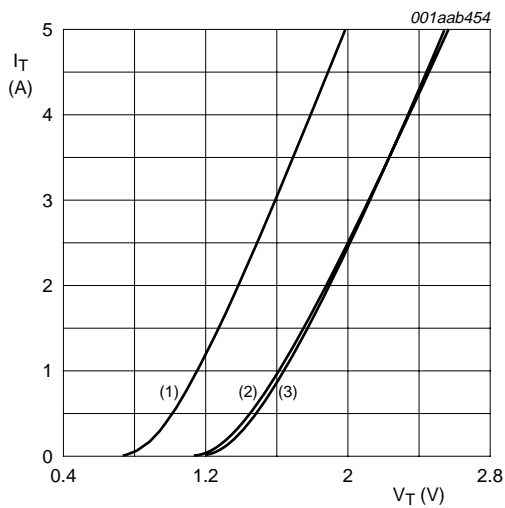


Fig 8. Normalized gate trigger current as a function of junction temperature.

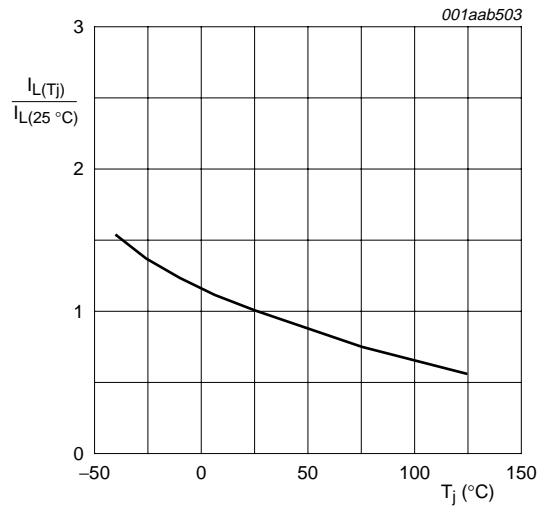


$V_O = 1.067 \text{ V.}$

$R_S = 0.187 \text{ }\Omega.$

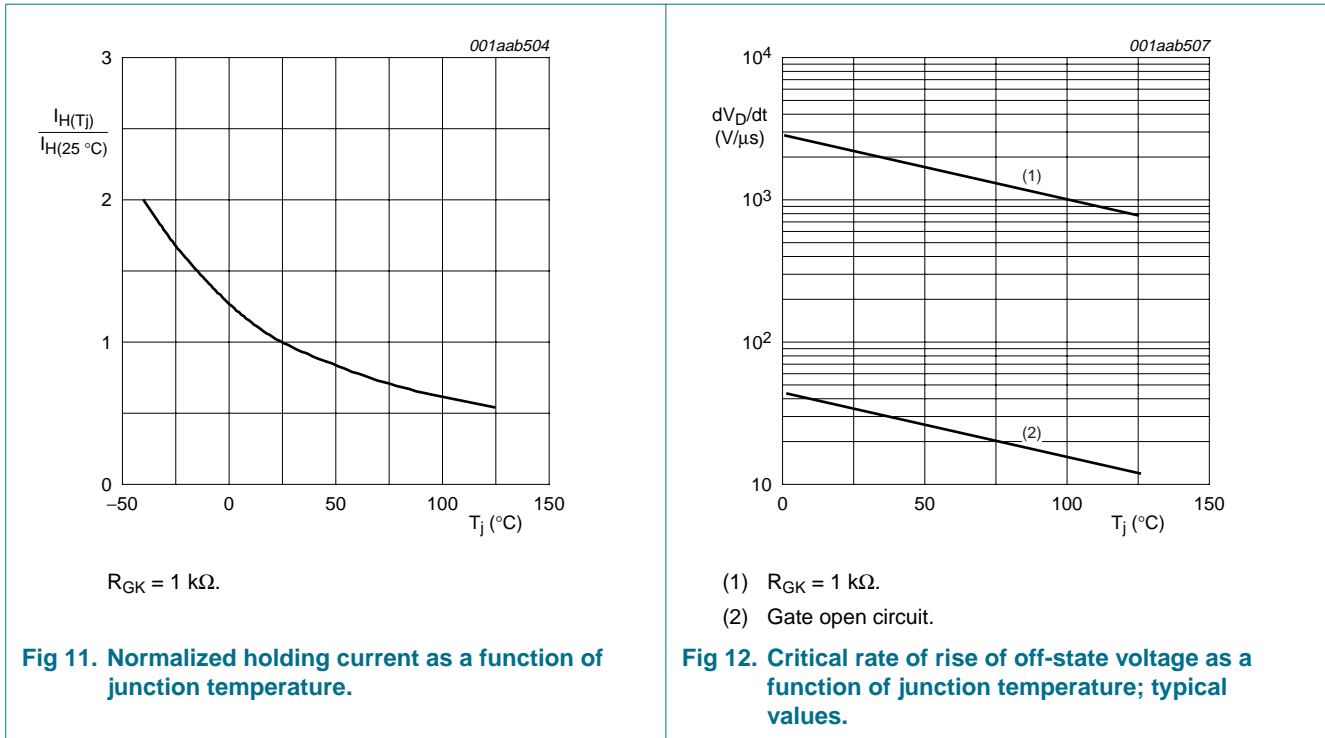
- (1)  $T_j = 125 \text{ }^\circ\text{C};$  typical values.
- (2)  $T_j = 125 \text{ }^\circ\text{C};$  maximum values.
- (3)  $T_j = 25 \text{ }^\circ\text{C};$  maximum values.

Fig 9. On-state current characteristics.



$R_{GK} = 1 \text{ k}\Omega.$

Fig 10. Normalized latching current as a function of junction temperature.



## 7. Package information

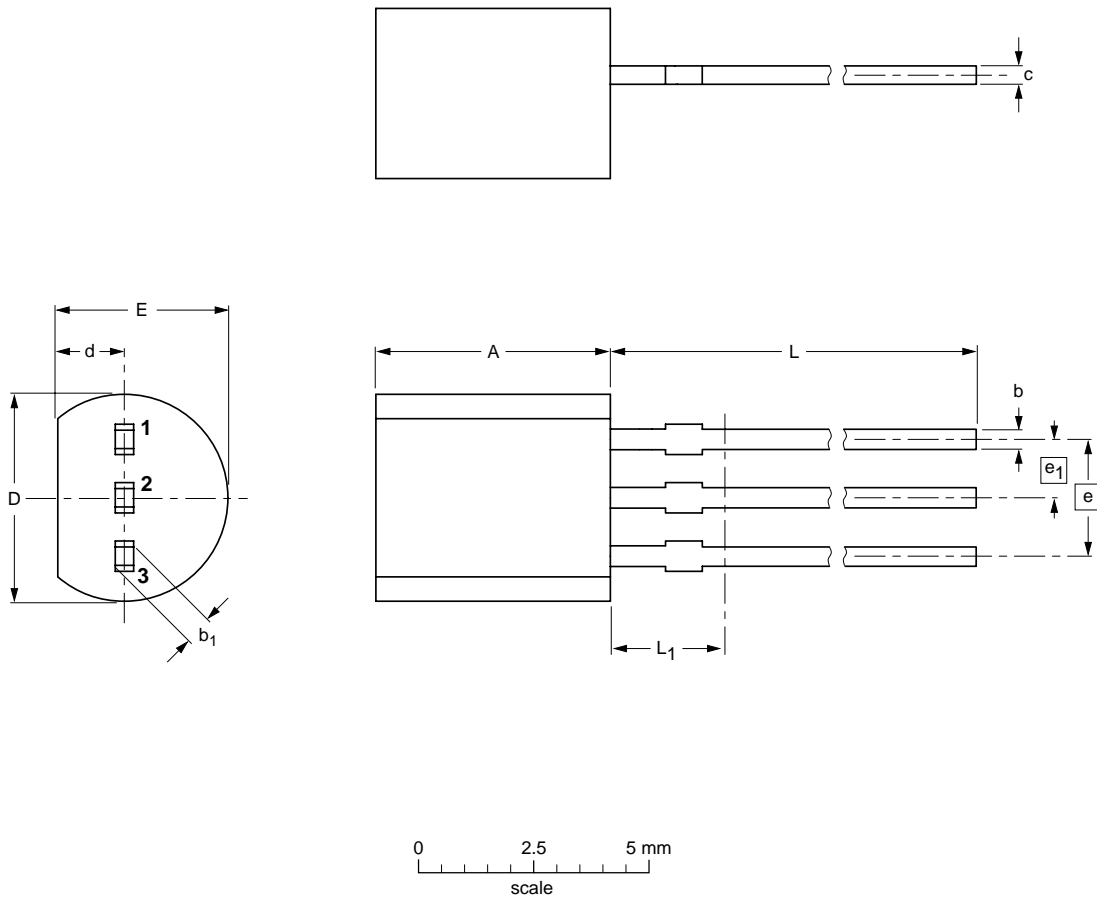
Epoxy meets requirements of UL94 V-0 at 1/8 inch.



8. Package outline

Plastic single-ended leaded (through hole) package; 3 leads

SOT54



DIMENSIONS (mm are the original dimensions)

UNIT	A	b	b <sub>1</sub>	c	D	d	E	e	e <sub>1</sub>	L	L <sub>1</sub> <sup>(1)</sup> max.
mm	5.2	0.48	0.66	0.45	4.8	1.7	4.2	2.54	1.27	14.5	2.5
	5.0	0.40	0.55	0.38	4.4	1.4	3.6				

Note

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT54		TO-92	SC-43A		97-02-28 04-06-28

Fig 13. Package outline.

## 9. Revision history

**Table 6: Revision history**

Document ID	Release date	Data sheet status	Change notice	Order number	Supersedes
BT169_SERIES_4	20040823	Product data sheet	-	9397 750 13512	BT169_SERIES_3
Modifications:					
					<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li><li>• <a href="#">Section 1.4 "Quick reference data"</a>: BT169E obsolete, removed from list.</li><li>• <a href="#">Table 2 "Ordering information"</a>: BT169E obsolete, removed from table.</li><li>• <a href="#">Table 3 "Limiting values"</a>: BT169E obsolete, removed from table.</li></ul>
BT169_SERIES_3	20010902	Product specification	-	not applicable	BT169_SERIES_2
BT169_SERIES_2	20010901	Product specification	-	not applicable	BT169_SERIES_1
BT169_SERIES_1	19970901	Product specification	-	not applicable	-

## 10. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2]</sup> <sup>[3]</sup>	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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