BT168 series

Thyristors logic level for RCD/GFI/LCCB applications

Rev. 5 — 1 November 2011 Product data sheet

1. Product profile

1.1 General description

Passivated, sensitive gate thyristors in a SOT54 plastic package.

1.2 Features and benefits

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

1.3 Applications

- For use in Residual Current Devices (RCD), Ground Fault Interrupters (GFI) and Leakage Current Circuit Breakers (LCCB) applications, where a minimum I_{GT} limit is needed.

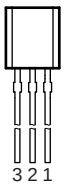
1.4 Quick reference data

- V_{DRM}, $V_{RRM} \leq 500$ V (BT168E)
- V_{DRM}, $V_{RRM} \leq 600$ V (BT168G)
- $I_{T(RMS)} \leq 0.8$ 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)		
2	gate (G)		
3	cathode (K)		



SOT54 (TO-92)

3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
BT168E	-	plastic single-ended leaded (through hole) package; 3 leads	SOT54
BT168G			

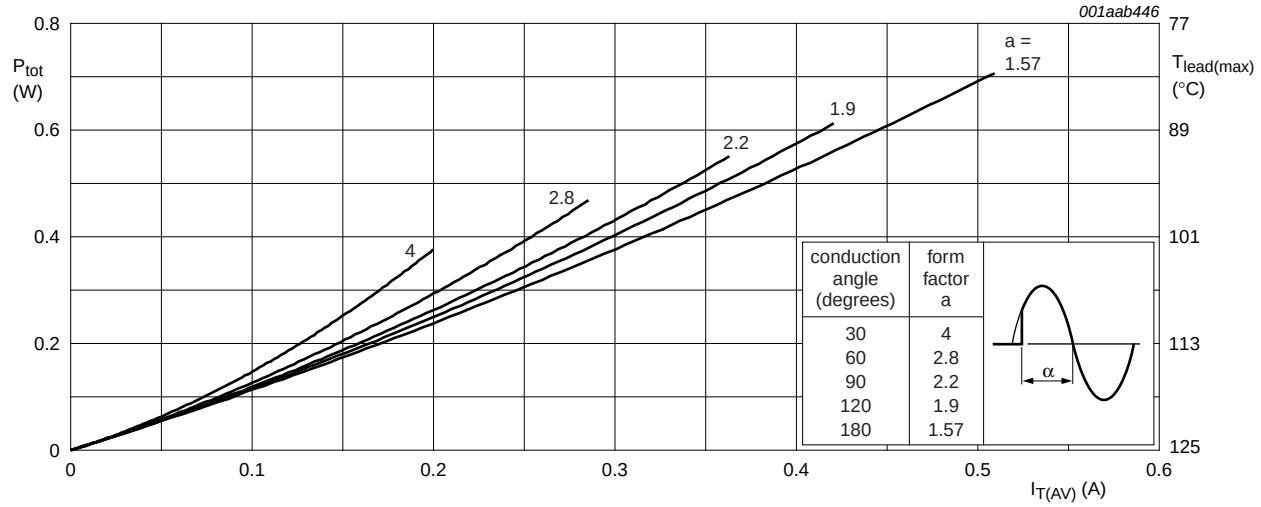
4. Limiting values

Table 3. Limiting values

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

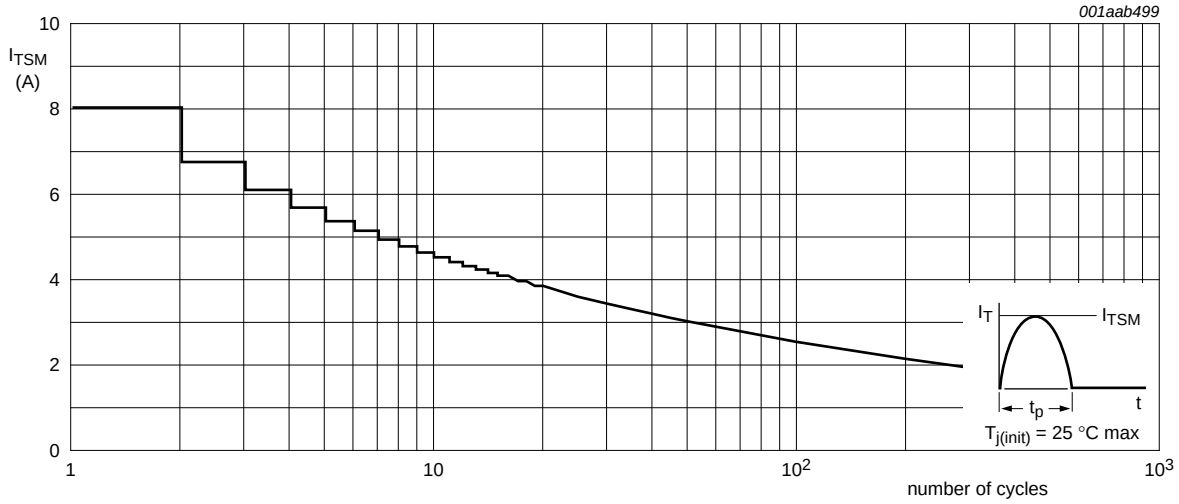
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DRM}, V_{RRM}	repetitive peak off-state voltage					
	BT168E		[1]	-	500	V
	BT168G		[1]	-	600	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{lead} \leq 83$ °C; see Figure 1		-	0.5	A
$I_{T(RMS)}$	RMS on-state current	all conduction angles; see Figure 4 and 5		-	0.8	A
I_{TSM}	non-repetitive peak on-state current	half sine wave; T_j = 25 °C prior to surge; see Figure 2 and 3				
		t = 10 ms		-	8	A
		t = 8.3 ms		-	9	A
I^2t	I^2t for fusing	t = 10 ms		-	0.32	A^2s
dI_T/dt	repetitive rate of rise of on-state current after triggering	I_{TM} = 2 A; I_G = 10 mA; dI_G/dt = 100 mA/µs		-	50	A/µs
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	°C
T_j	junction temperature			-	125	°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/µs.



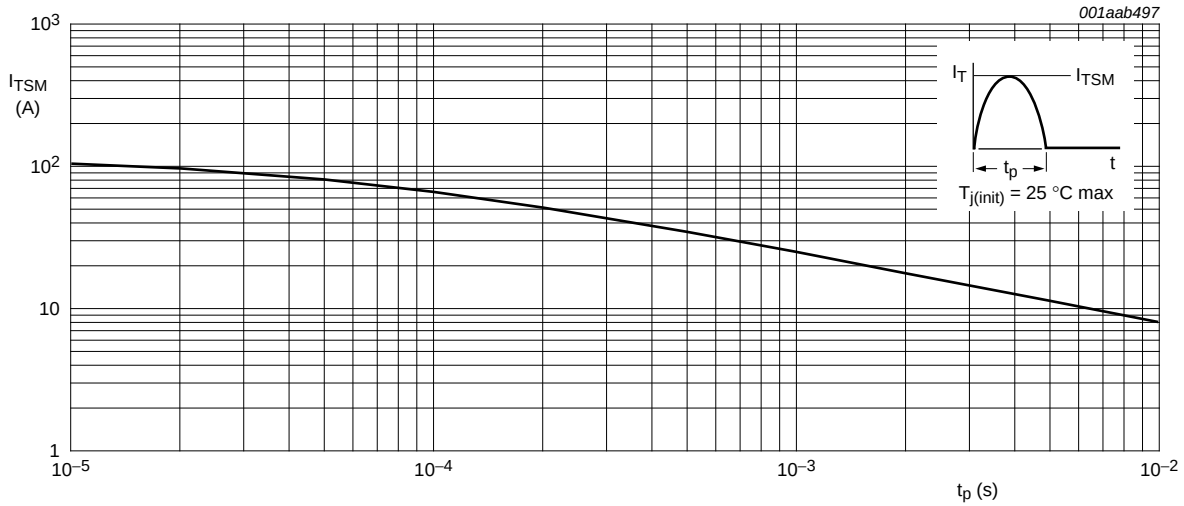
a = form factor = $I_{T(RMS)}/I_{T(AV)}$.

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



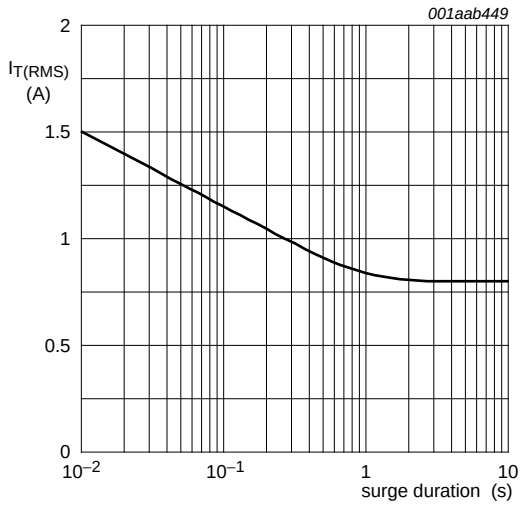
f = 50 Hz.

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



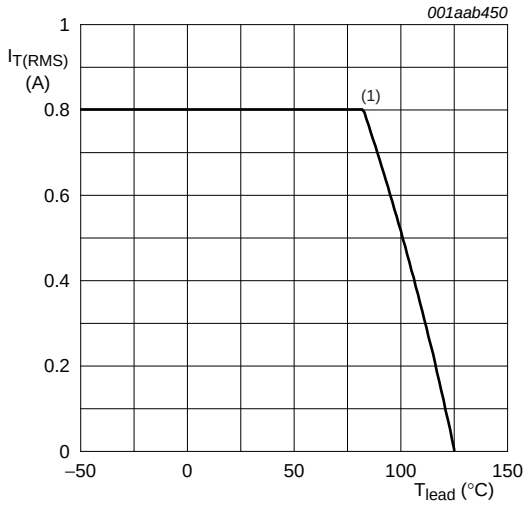
$t_p \leq 10$ ms.

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; maximum values



(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
$R_{th(j\text{-}lead)}$	thermal resistance from junction to lead		-	-	60	K/W
$R_{th(j\text{-}a)}$	thermal resistance from junction to ambient	printed-circuit board mounted; lead length = 4 mm	-	150	-	K/W

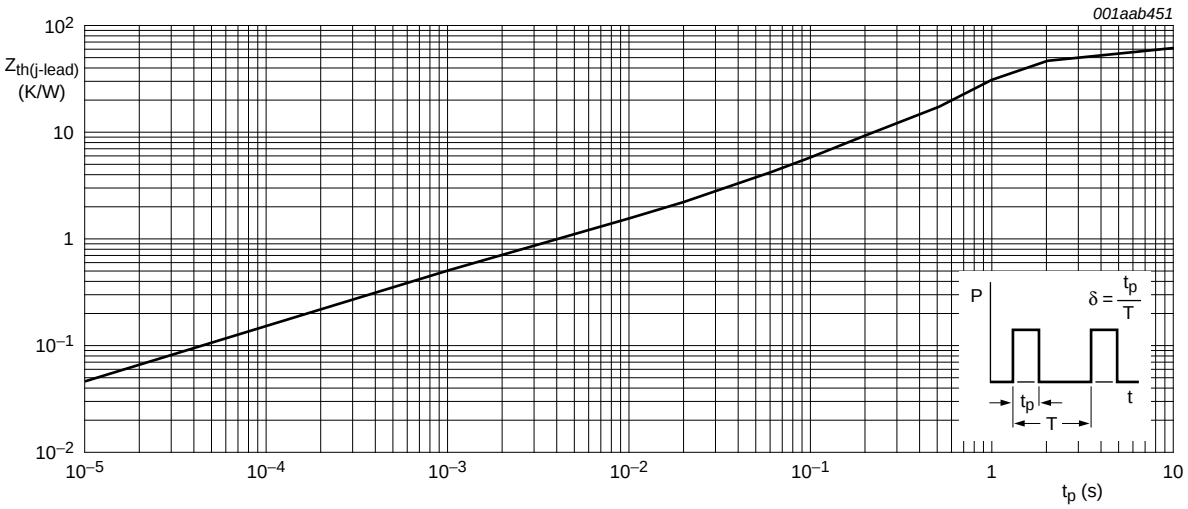


Fig 6. Transient thermal impedance as a function of pulse width

6. Characteristics

Table 5. Characteristics

T_j = 25 °C unless otherwise stated.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{GT}	gate trigger current	V_D = 12 V; I_T = 10 mA; gate open circuit; see Figure 8	20	50	200	µA
I_L	latching current	V_D = 12 V; I_{GT} = 0.5 mA; R_{GK} = 1 kΩ; see Figure 10	-	2	6	mA
I_H	holding current	V_D = 12 V; I_{GT} = 0.5 mA; R_{GK} = 1 kΩ; see Figure 11	-	2	5	mA
V_T	on-state voltage	I_T = 1.2 A	-	1.25	1.7	V
V_{GT}	gate trigger voltage	I_T = 10 mA; gate open circuit; see Figure 7				
		V_D = 12 V	-	0.5	0.8	V
		$V_D = V_{DRM(max)}$; T_j = 125 °C	0.2	0.3	-	V
I_D, I_R	off-state leakage current	$V_D = V_{DRM(max)}$; $V_R = V_{RRM(max)}$; T_j = 125 °C; R_{GK} = 1 kΩ	-	0.05	0.1	mA
Dynamic characteristics						
dV_D/dt	critical rate of rise of off-state voltage	V_{DM} = 67 % $V_{DRM(max)}$; T_j = 125 °C; exponential waveform; see Figure 12				
		R_{GK} = 1 kΩ	500	800	-	V/µs
		gate open circuit	-	25	-	V/µs
t_{gt}	gate controlled turn-on time	I_{TM} = 2 A; $V_D = V_{DRM(max)}$; I_G = 10 mA; dI_G/dt = 0.1 A/µs	-	2	-	µs
t_q	circuit commuted turn-off time	V_D = 67 % $V_{DRM(max)}$; T_j = 125 °C; I_{TM} = 1.6 A; V_R = 35 V; dI_{TM}/dt = 30 A/µs; dV_D/dt = 2 V/µs; R_{GK} = 1 kΩ	-	100	-	µs

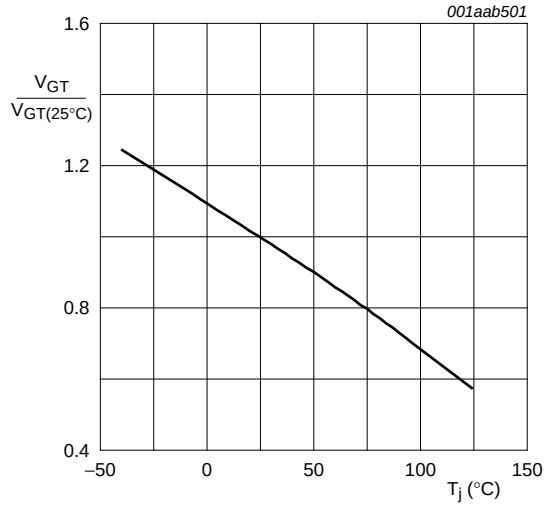


Fig 7. Normalized gate trigger voltage as a function of junction temperature

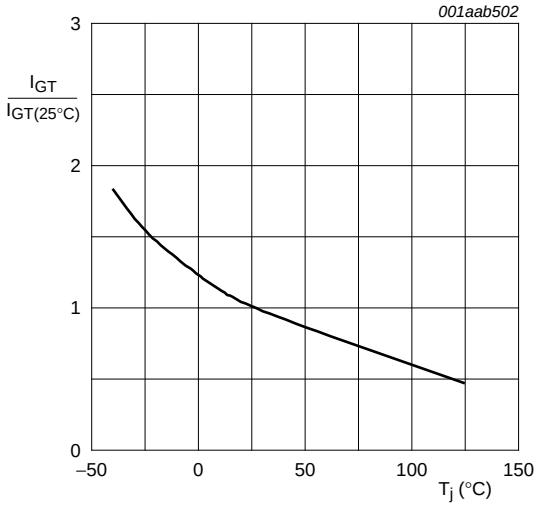
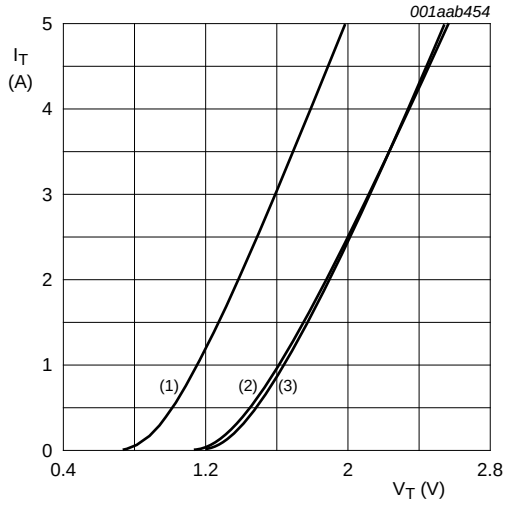


Fig 8. Normalized gate trigger current as a function of junction temperature



V_O = 1.067 V.

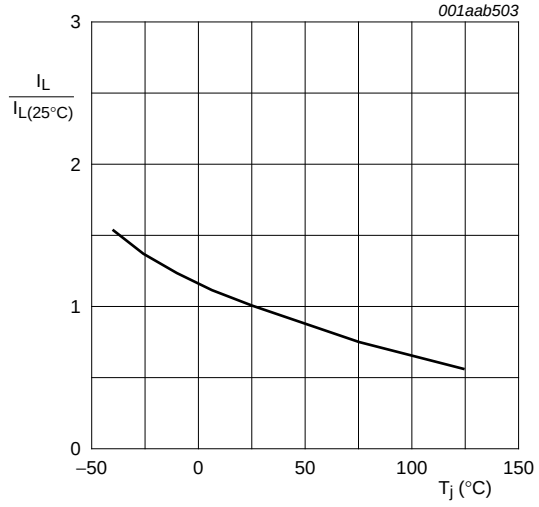
R_S = 0.187 Ω.

(1) T_j = 125 °C; typical values.

(2) T_j = 125 °C; maximum values.

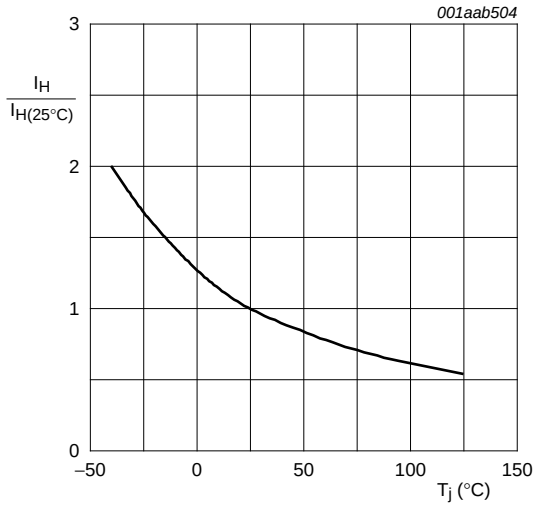
(3) T_j = 25 °C; maximum values.

Fig 9. On-state current characteristics



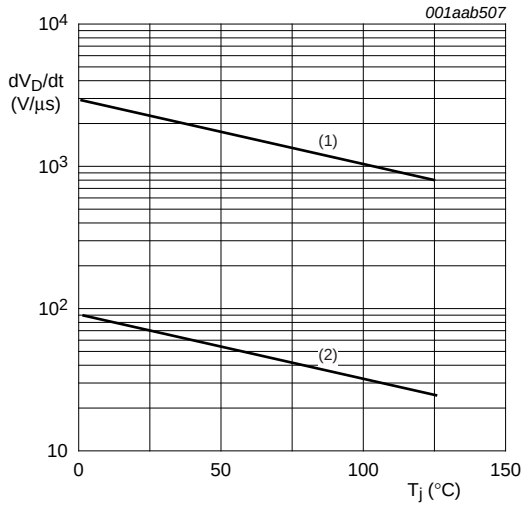
R_{GK} = 1 kΩ.

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



R_{GK} = 1 kΩ.

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



(1) R_{GK} = 1 kΩ.

(2) Gate open circuit.

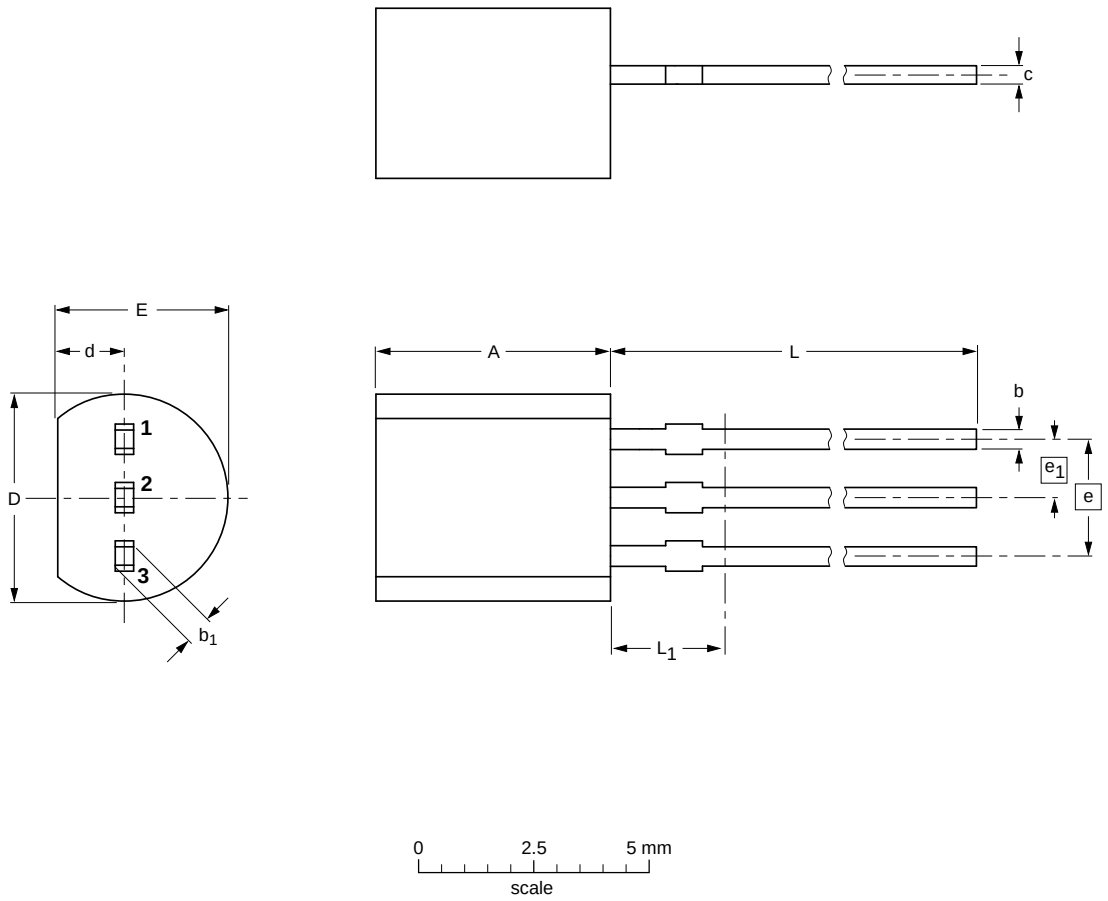
Fig 12. Critical rate of rise of off-state voltage as a function of junction temperature; typical values

7. Package information

Epoxy meets requirements of UL94 V-0 at $\frac{1}{8}$ inch.

8. Package outline

Plastic single-ended leaded (through hole) package; 3 leads **SOT54**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b	b_1	c	D	d	E	e	e_1	L	L_1 (1) max.
mm	5.2 5.0	0.48 0.40	0.66 0.55	0.45 0.38	4.8 4.4	1.7 1.4	4.2 3.6	2.54	1.27	14.5 12.7	2.5

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			~~04-06-28~~ 04-11-16

Fig 13. Package outline SOT54 (TO-92)

9. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BT168_SER v.5	20111101	Product data sheet		BT168_SERIES v.4
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate.			
BT168_SERIES v.4	20040820	Product data sheet		BT168_SERIES v.3
BT168_SERIES v.3	20010902	Product specification		BT168_SERIES v.2
BT168_SERIES v.2	20010901	Product specification		BT168_SERIES v.1
BT168_SERIES v.1	19970901	Product specification		-

10. Legal information

10.1 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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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For sales office addresses, please send an email to: **salesaddresses@nxp.com**

12. Contents

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Date of release: 1 November 2011
Document identifier: BT168_SER