



**THE DATASHEET OF  
BT168E,112**



## 1. General description

Planar passivated Silicon Controlled Rectifier with sensitive gate in a SOT54 (TO-92) plastic package. This SCR is designed to be interfaced directly to microcontrollers, logic ICs and other low power gate trigger circuits.

## 2. Features and benefits

- Guaranteed minimum gate trigger current limit
- Planar passivated for voltage ruggedness and reliability
- Sensitive gate
- Direct triggering from low power gate circuits and logic ICs

## 3. Applications

- Ground Fault Interrupters (GFI)
- Leakage Current Circuit Breakers (LCCB)
- Residual Current Devices (RCD)

## 4. Quick reference data

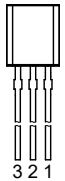
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{RRM}$	repetitive peak reverse voltage		-	-	500	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{lead} \leq 83\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a>	-	-	0.5	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_{lead} \leq 83\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	0.8	A
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 10\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	8	A
		half sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 8.3\text{ ms}$	-	-	9	A
$T_j$	junction temperature		-	-	125	$^{\circ}\text{C}$
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 10\text{ mA}$ ; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	20	50	200	$\mu\text{A}$
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $R_{GK} = 1\text{ k}\Omega$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; <a href="#">Fig. 12</a>	500	800	-	$\text{V}/\mu\text{s}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_{DM} = 335 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit; <a href="#">Fig. 12</a>	-	25	-	V/ $\mu\text{s}$

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	A	anode	 <p>TO-92 (SOT54)</p>	
2	G	gate		
3	K	cathode		

## 6. Ordering information

Table 3. Ordering information

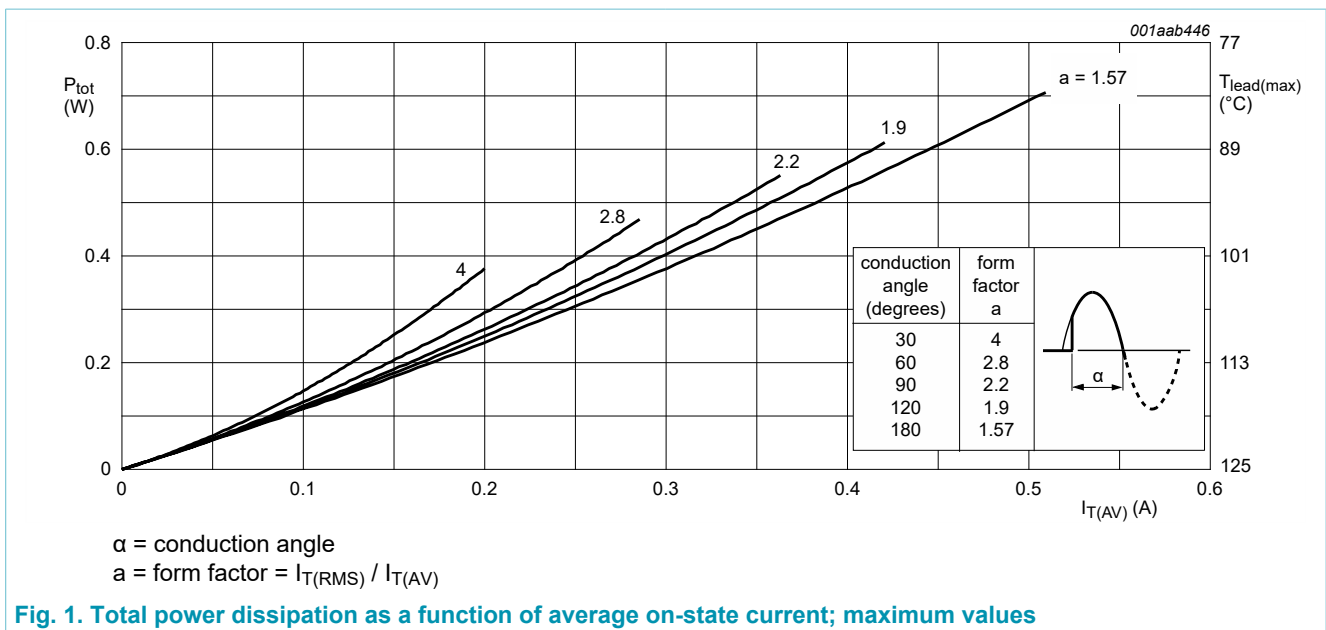
Type number	Package		
	Name	Description	Version
BT168E	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

## 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		-	500	V
$V_{RRM}$	repetitive peak reverse voltage		-	500	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{lead} \leq 83\text{ }^{\circ}\text{C}$ ; Fig. 1	-	0.5	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_{lead} \leq 83\text{ }^{\circ}\text{C}$ ; Fig. 2; Fig. 3	-	0.8	A
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 10\text{ ms}$ ; Fig. 4; Fig. 5	-	8	A
		half sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 8.3\text{ ms}$	-	9	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	$I_T = 2\text{ A}$ ; $I_G = 10\text{ mA}$ ; $dl_G/dt = 100\text{ mA}/\mu\text{s}$	-	50	$\text{A}/\mu\text{s}$
$I_{GM}$	peak gate current		-	1	A
$V_{RGM}$	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	$^{\circ}\text{C}$



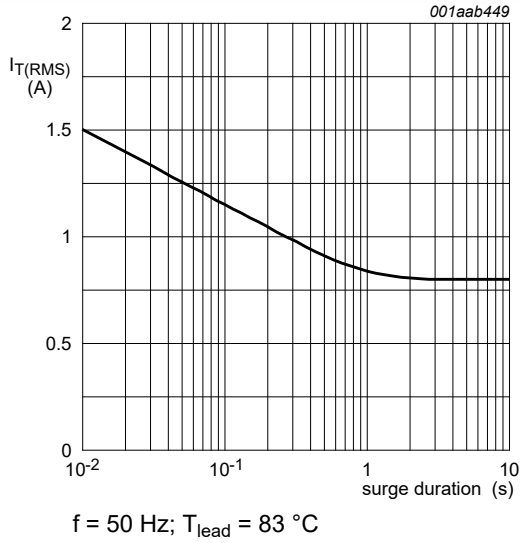


Fig. 2. RMS on-state current as a function of surge duration for sinusoidal currents

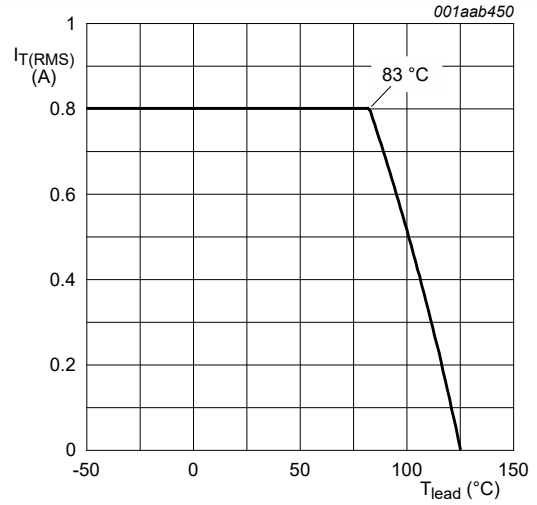


Fig. 3. RMS on-state current as a function of lead temperature; maximum values

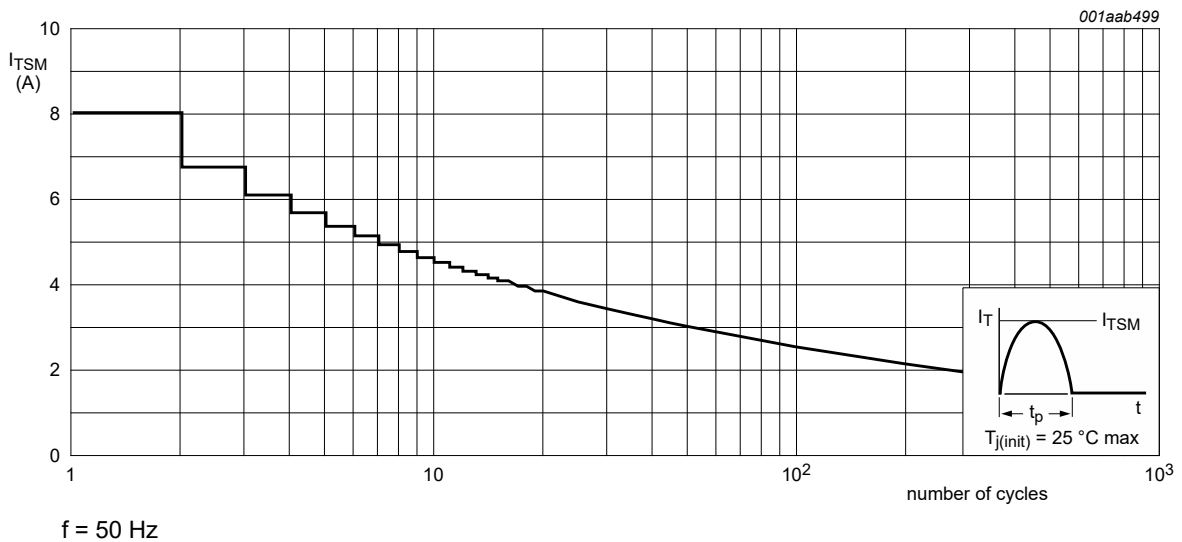
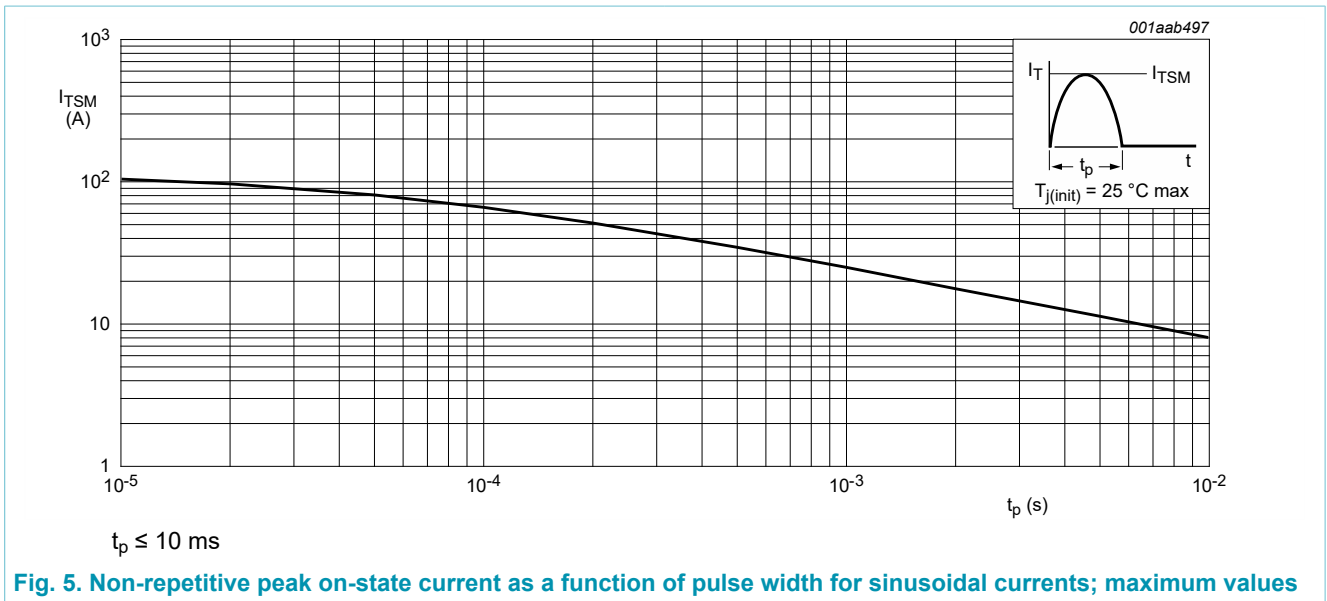


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



## 8. Thermal characteristics

Table 5. Thermal characteristics

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

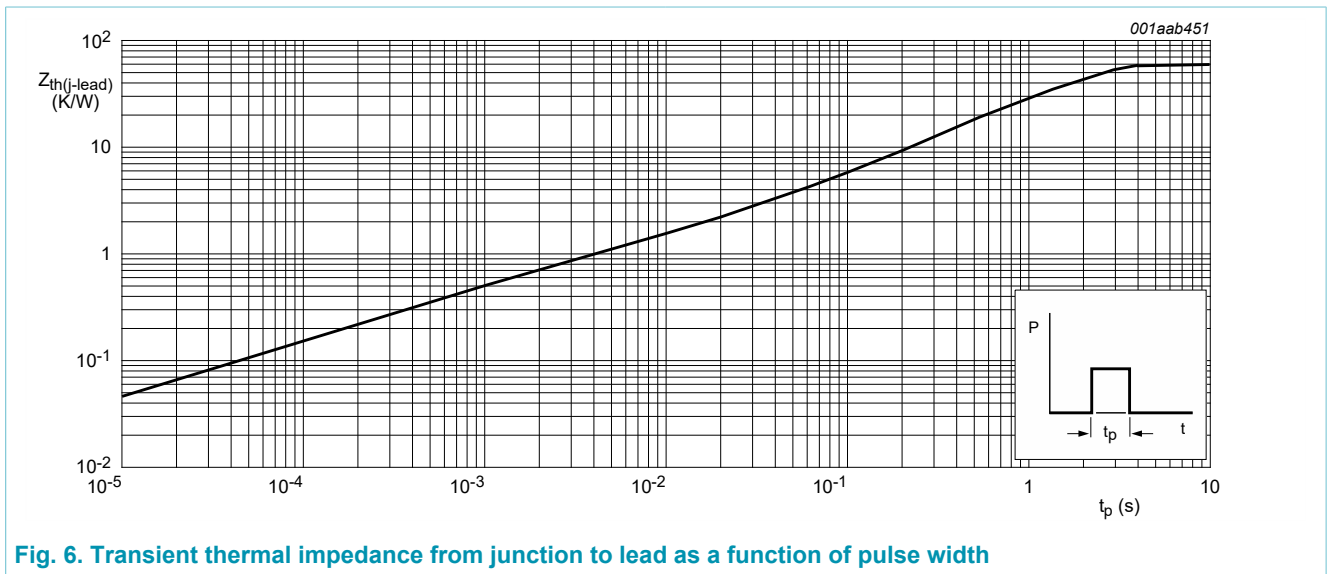


Fig. 6. Transient thermal impedance from junction to lead as a function of pulse width

## 9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 10\text{ mA}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	20	50	200	$\mu\text{A}$
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 10\text{ mA}$ ; $T_j = 25\text{ °C}$ ; $R_{GK(\text{ext})} = 1\text{ k}\Omega$ ; <a href="#">Fig. 8</a>	-	2	6	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; $R_{GK(\text{ext})} = 1\text{ k}\Omega$ ; <a href="#">Fig. 9</a>	-	2	5	mA
$V_T$	on-state voltage	$I_T = 1.2\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>	-	1.25	1.7	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 10\text{ mA}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 11</a>	-	0.5	0.8	V
		$V_D = 500\text{ V}$ ; $I_T = 10\text{ mA}$ ; $T_j = 125\text{ °C}$ ; <a href="#">Fig. 11</a>	0.2	0.3	-	V
$I_D$	off-state current	$V_D = 500\text{ V}$ ; $R_{GK(\text{ext})} = 1\text{ k}\Omega$ ; $T_j = 125\text{ °C}$	-	0.05	0.1	mA
$I_R$	reverse current	$V_R = 500\text{ V}$ ; $T_j = 125\text{ °C}$ ; $R_{GK(\text{ext})} = 1\text{ k}\Omega$	-	0.05	0.1	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ °C}$ ; $R_{GK} = 1\text{ k}\Omega$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; <a href="#">Fig. 12</a>	500	800	-	V/ $\mu\text{s}$
		$V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit; <a href="#">Fig. 12</a>	-	25	-	V/ $\mu\text{s}$
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 2\text{ A}$ ; $V_D = 500\text{ V}$ ; $I_G = 10\text{ mA}$ ; $dI_G/dt = 0.1\text{ A}/\mu\text{s}$ ; $T_j = 25\text{ °C}$	-	2	-	$\mu\text{s}$
$t_q$	commutated turn-off time	$V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{TM} = 1.6\text{ A}$ ; $V_R = 35\text{ V}$ ; $(dI_T/dt)_M = 30\text{ A}/\mu\text{s}$ ; $dV_D/dt = 2\text{ V}/\mu\text{s}$ ; $R_{GK(\text{ext})} = 1\text{ k}\Omega$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ )	-	100	-	$\mu\text{s}$

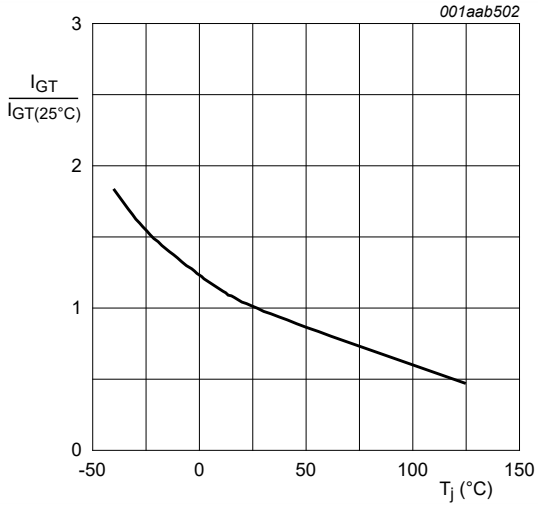


Fig. 7. Normalized gate trigger current as a function of junction temperature

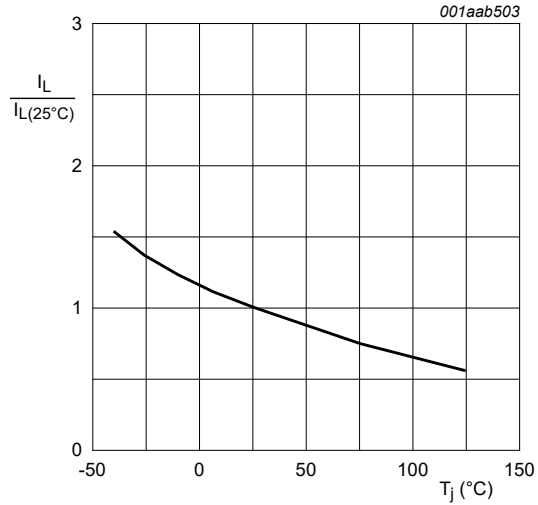


Fig. 8. Normalized latching current as a function of junction temperature  
 $R_{GK} = 1 \text{ k}\Omega$

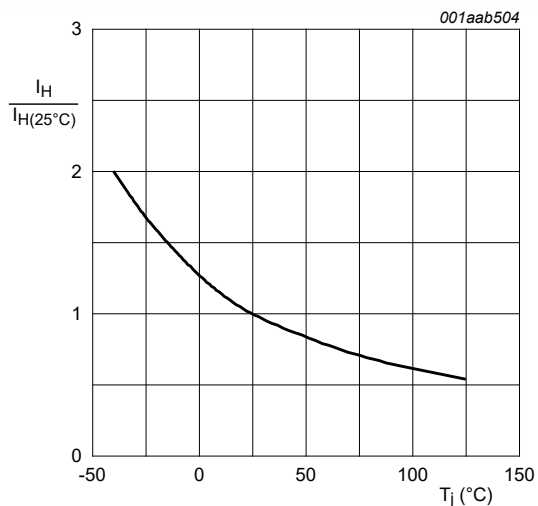


Fig. 9. Normalized holding current as a function of junction temperature  
 $R_{GK} = 1 \text{ k}\Omega$

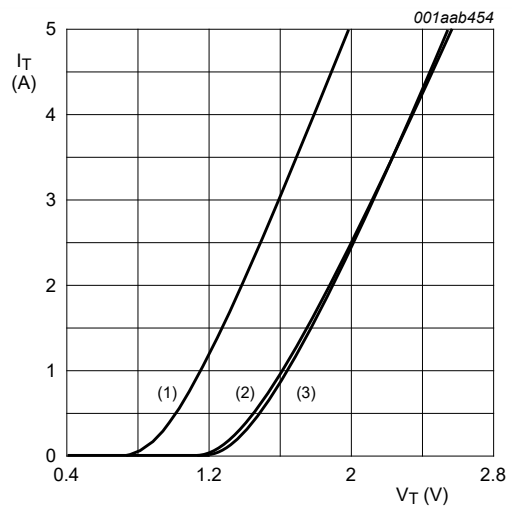
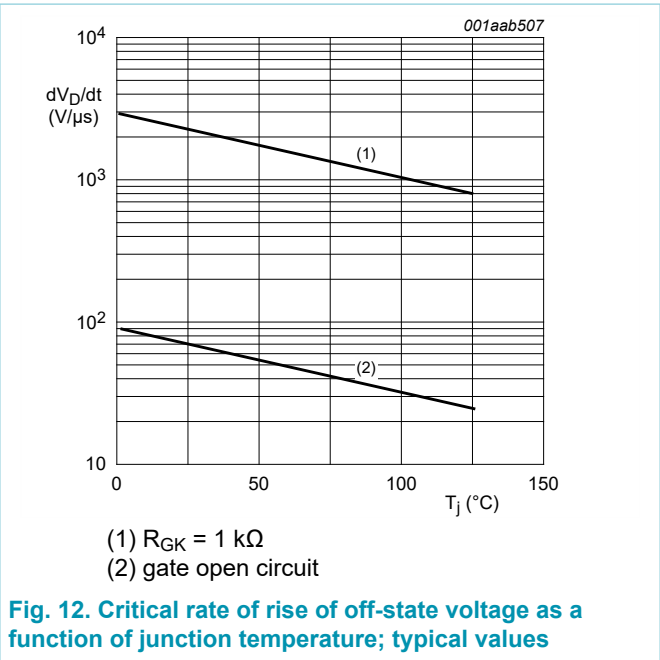
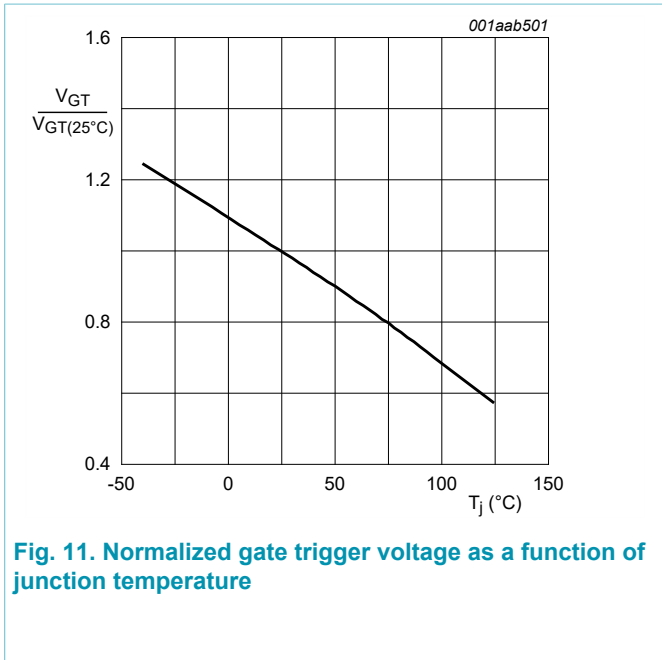


Fig. 10. On-state current as a function of on-state voltage  
 $V_o = 1.067 \text{ V}; R_s = 0.187 \Omega$   
 (1)  $T_j = 125 \text{ }^\circ\text{C}$ ; typical values  
 (2)  $T_j = 125 \text{ }^\circ\text{C}$ ; maximum values  
 (3)  $T_j = 25 \text{ }^\circ\text{C}$ ; maximum values



### 10. Package outline

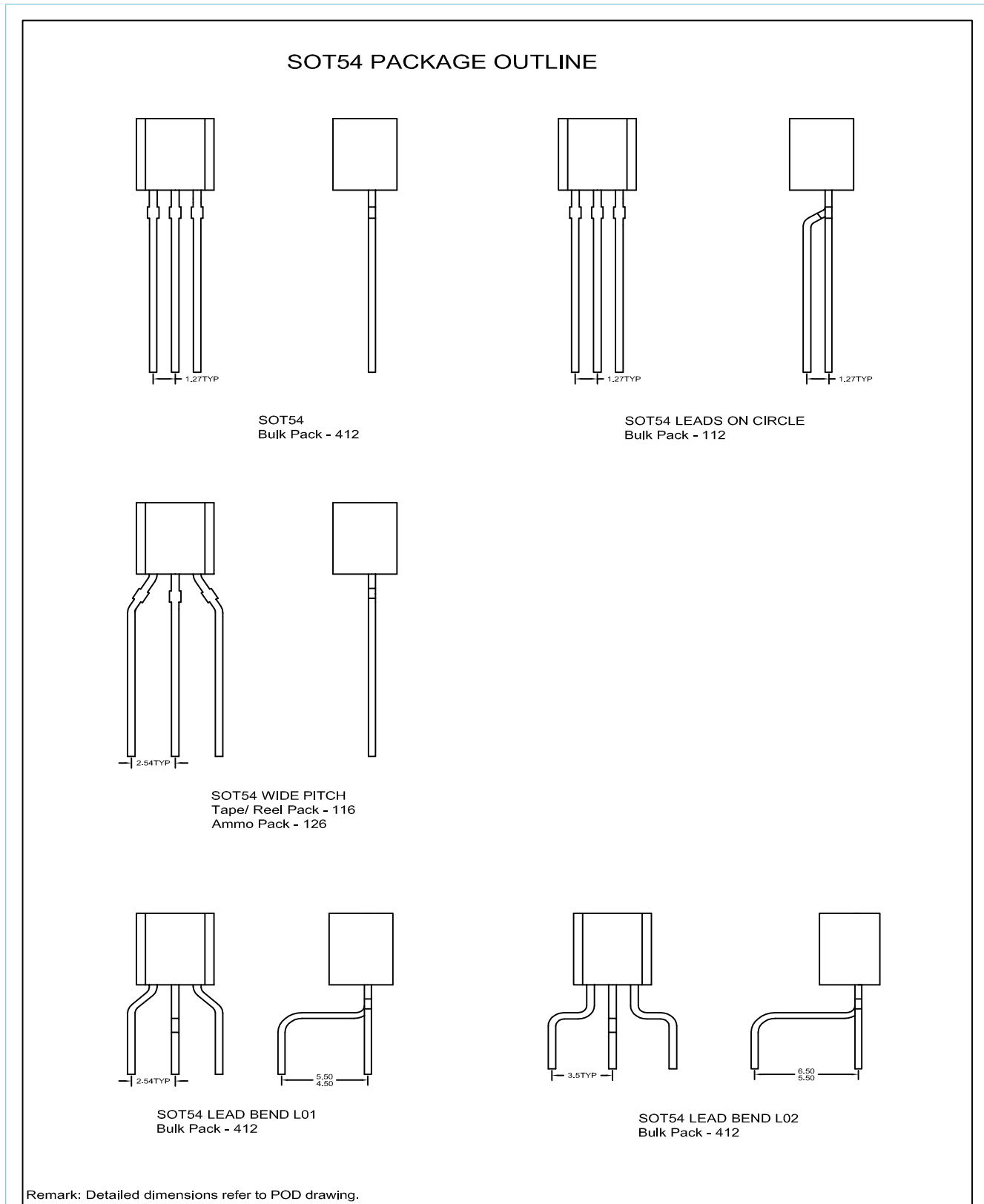


Fig. 13. Package outline TO-92 (SOT54)

## 11. Legal information

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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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