

# BT139 series

## Triacs

Rev. 04.00 — 6 July 2004

Product data sheet

## 1. Product profile

### 1.1 General description

Passivated triacs in a SOT78 plastic package, intended for use in applications requiring high bidirectional transient and blocking voltage capability.

### 1.2 Features

- High thermal cycling performance.

### 1.3 Applications

- Motor control
- Industrial and domestic lighting, heating and static switching.

### 1.4 Quick reference data

- $V_{\text{DRM}} \leq 600 \text{ V}$  (BT139-600)
- $V_{\text{DRM}} \leq 600 \text{ V}$  (BT139-600F)
- $V_{\text{DRM}} \leq 800 \text{ V}$  (BT139-800)
- $V_{\text{DRM}} \leq 800 \text{ V}$  (BT139-800F)
- $V_{\text{DRM}} \leq 800 \text{ V}$  (BT139-800G)
- $I_{\text{T(RMS)}} \leq 16 \text{ A}$
- $I_{\text{TSM}} \leq 155 \text{ A}$ .

## 2. Pinning information

Table 1: Discrete pinning

Pin	Description	Simplified outline	Symbol
1	main terminal 1	<p>SOT78 (TO-220AB)</p>	<p>sym051</p>
2	main terminal 2		
3	gate		
mb	main terminal 2		

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### 3. Ordering information

**Table 2: Ordering information**

Type number	Package		
	Name	Description	Version
BT139-600	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78
BT139-600F			
BT139-800			
BT139-800F			
BT139-800G			

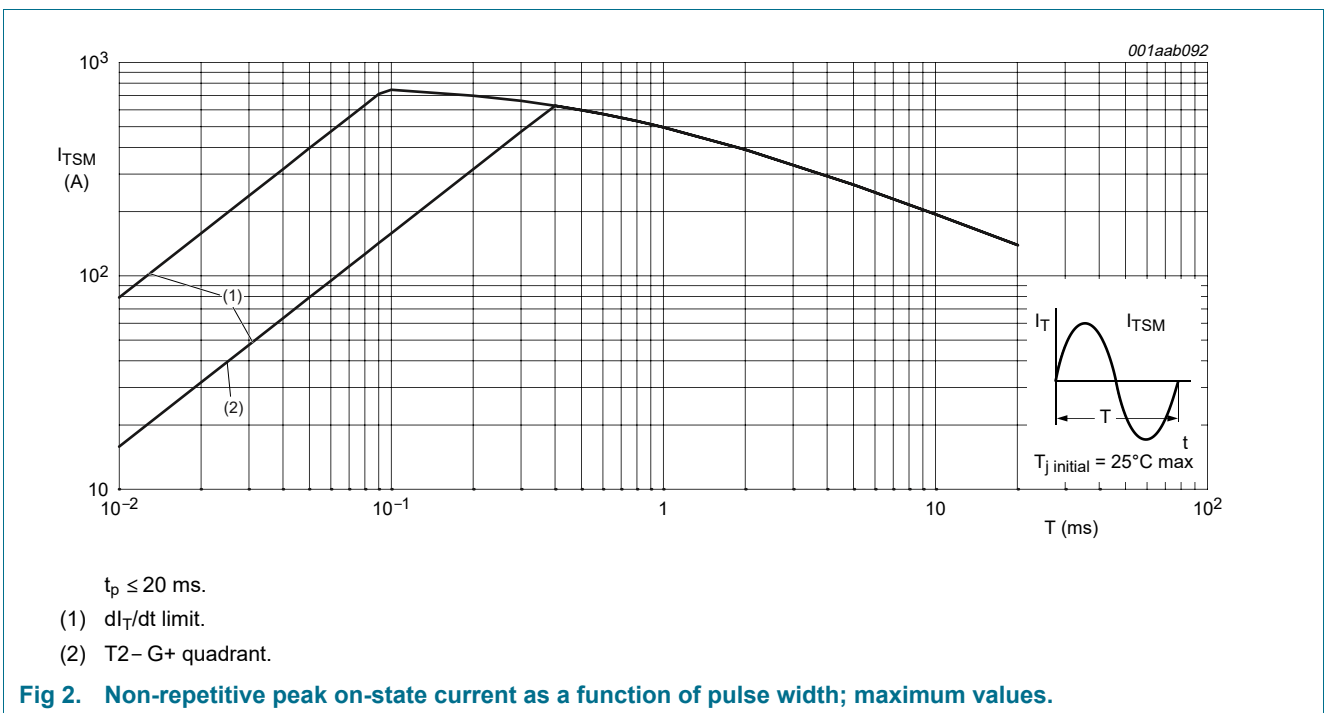
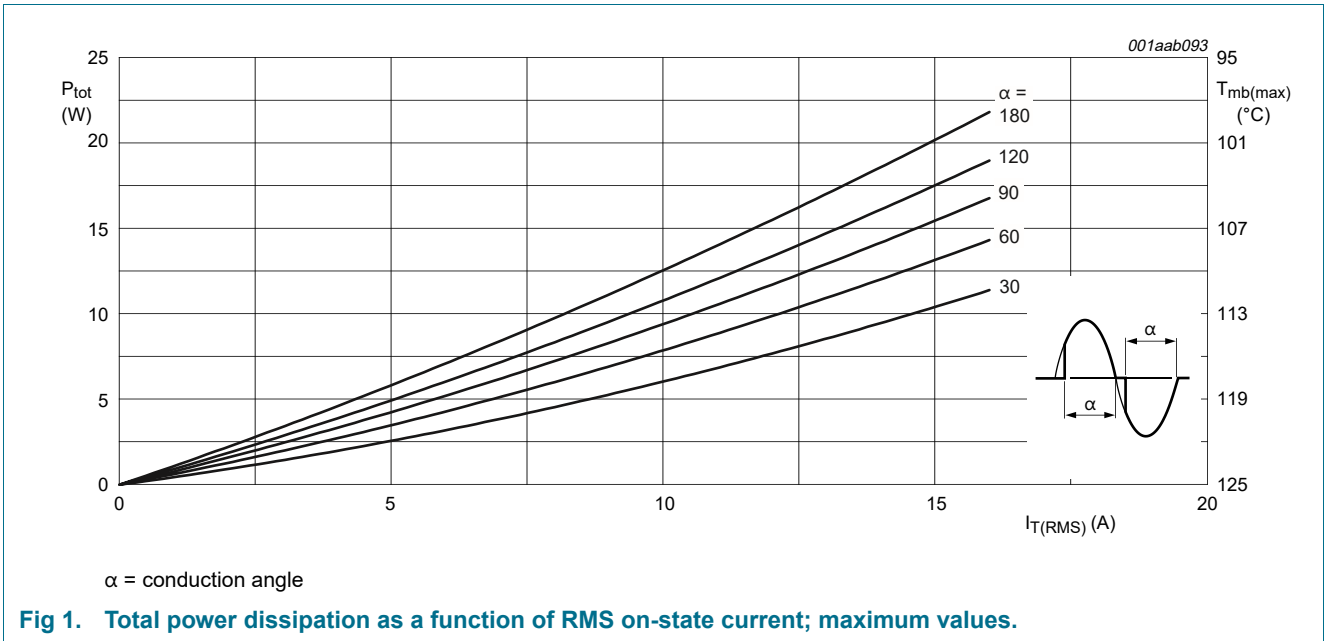
### 4. Limiting values

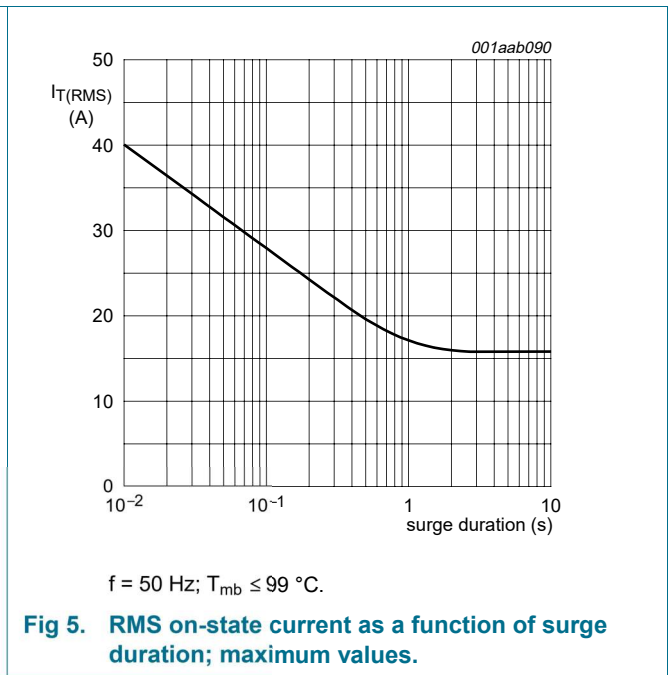
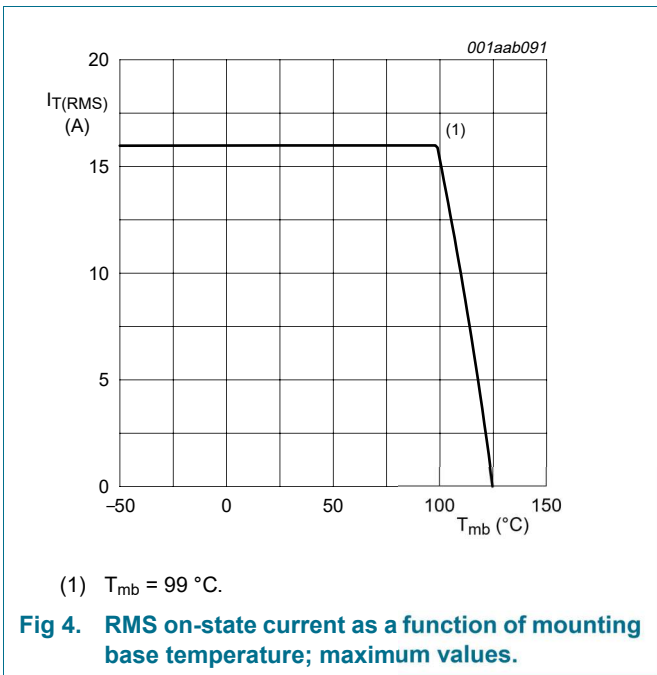
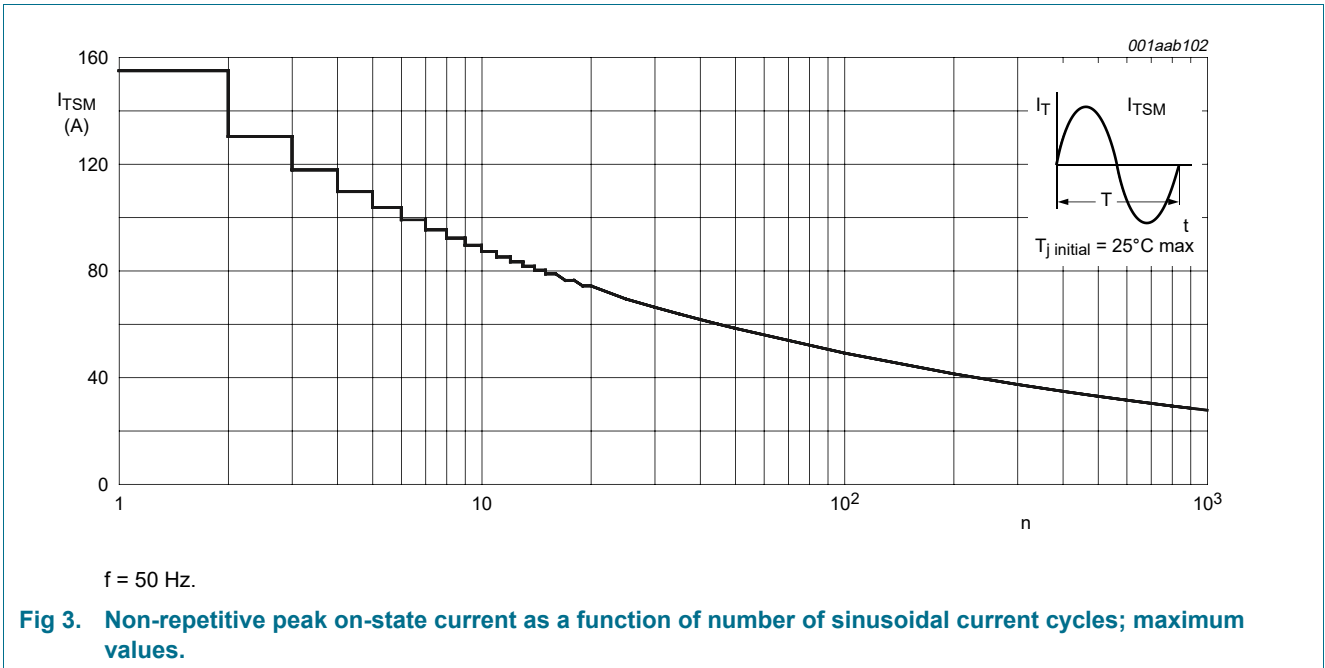
**Table 3: Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage				
			-	600 <sup>[1]</sup>	V
			-	800	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 99\text{ °C}$ ; <a href="#">Figure 4</a> and <a href="#">Figure 5</a>	-	16	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j}} = 25\text{ °C}$ prior to surge; <a href="#">Figure 2</a> and <a href="#">Figure 3</a>			
		$t = 20\text{ ms}$	-	155	A
		$t = 16.7\text{ ms}$	-	170	A
$I^2t$	$I^2t$ for fusing	$t = 10\text{ ms}$	-	120	A <sup>2</sup> s
$di_{\text{T}}/dt_{\text{T}}$	repetitive rate of rise of on-state current after triggering	$I_{\text{TM}} = 20\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$			
		T2+ G+	-	50	A/ $\mu\text{s}$
		T2+ G-	-	50	A/ $\mu\text{s}$
		T2- G-	-	50	A/ $\mu\text{s}$
		T2- G+	-	10	A/ $\mu\text{s}$
$I_{\text{GM}}$	peak gate current		-	2	A
$V_{\text{GM}}$	peak gate voltage		-	5	V
$P_{\text{GM}}$	peak gate power		-	5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	-	0.5	W
$T_{\text{stg}}$	storage temperature		-40	+150	°C
$T_{\text{j}}$	junction temperature		-	125	°C

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

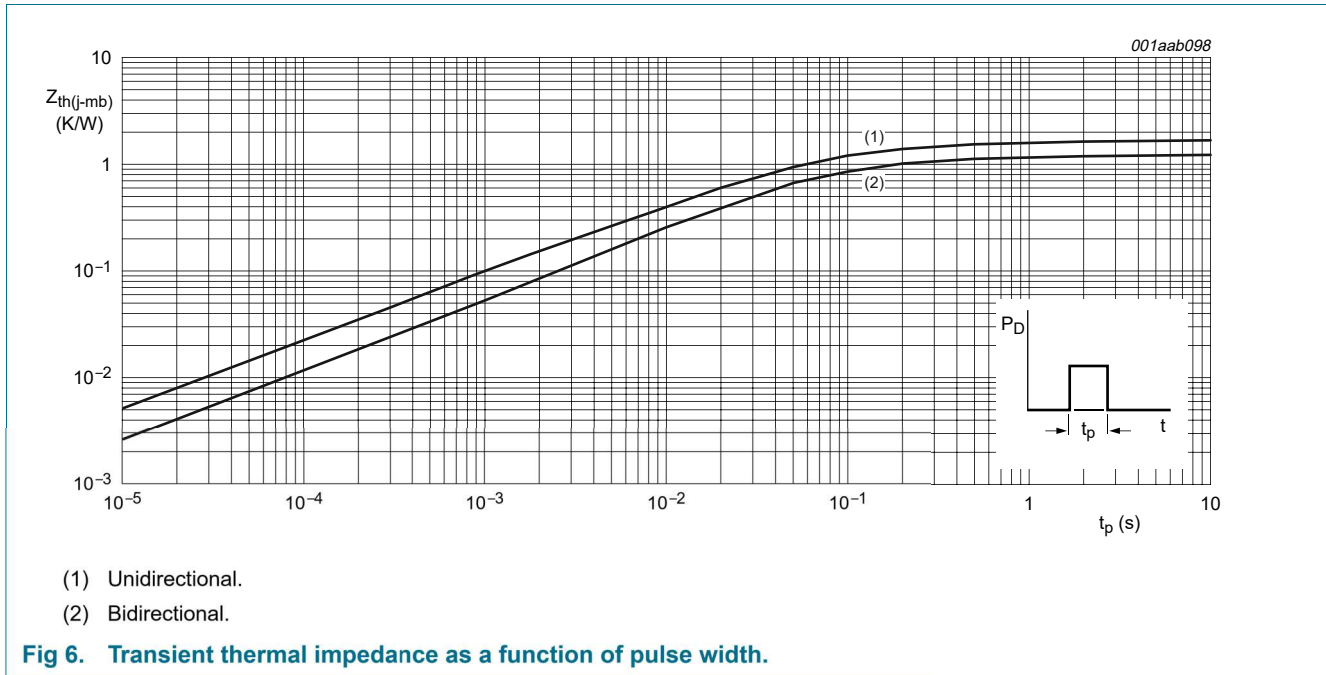




## 5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance junction to mounting base	full cycle <a href="#">Figure 6</a>	-	1.2	K/W
		half cycle <a href="#">Figure 6</a>	-	1.7	K/W
$R_{th(j-a)}$	thermal resistance junction to ambient	in free air	60	-	K/W



## 6. Static characteristics

**Table 5: Static characteristics**

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

Symbol	Parameter	Conditions	BT139			BT139-F			BT139-G			Unit	
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
$I_{GT}$	gate trigger current	$V_D = 12\text{ V};$ $I_T = 0.1\text{ A};$ <a href="#">Figure 8</a>	T2+ G+	-	5	35	-	5	25	-	5	50	mA
			T2+ G-	-	8	35	-	8	25	-	8	50	mA
			T2- G-	-	10	35	-	10	25	-	10	50	mA
			T2- G+	-	22	70	-	22	70	-	22	100	mA
			$I_L$	latching current	$V_D = 12\text{ V};$ $I_{GT} = 0.1\text{ A};$ <a href="#">Figure 9</a>	T2+ G+	-	7	40	-	7	40	-
			T2+ G-	-	20	60	-	20	60	-	20	90	mA
			T2- G-	-	8	40	-	8	40	-	8	60	mA
			T2- G+	-	10	60	-	10	60	-	10	90	mA
$I_H$	holding current	$V_D = 12\text{ V};$ $I_{GT} = 0.1\text{ A};$ <a href="#">Figure 10</a>	-	6	45	-	6	45	-	6	60	mA	
$V_T$	on-state voltage	$I_T = 20\text{ A};$ <a href="#">Figure 11</a>	-	1.2	1.6	-	1.2	1.6	-	1.2	1.6	V	

Table 5: Static characteristics ...continued

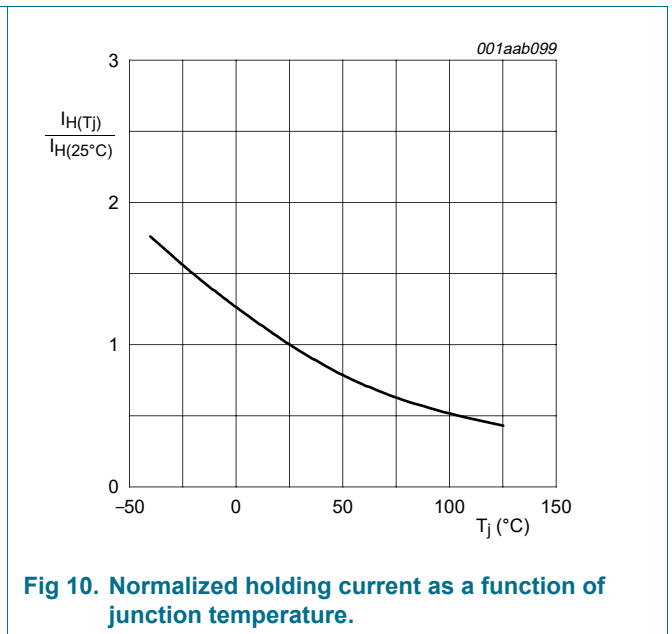
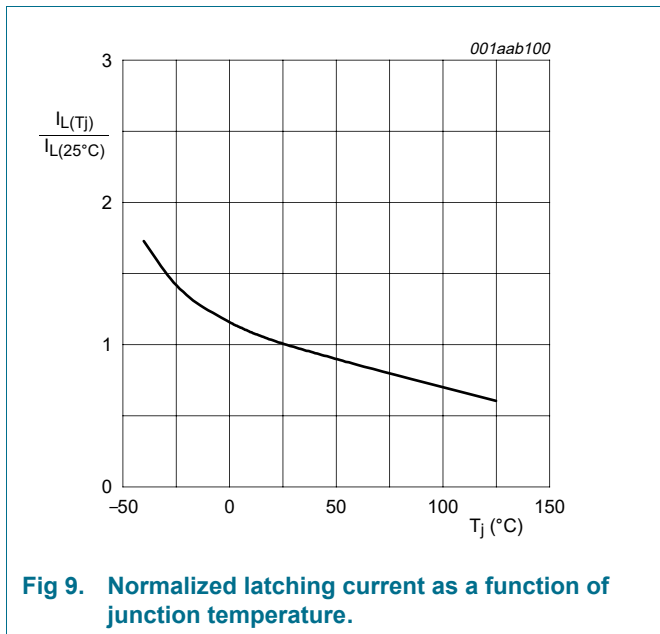
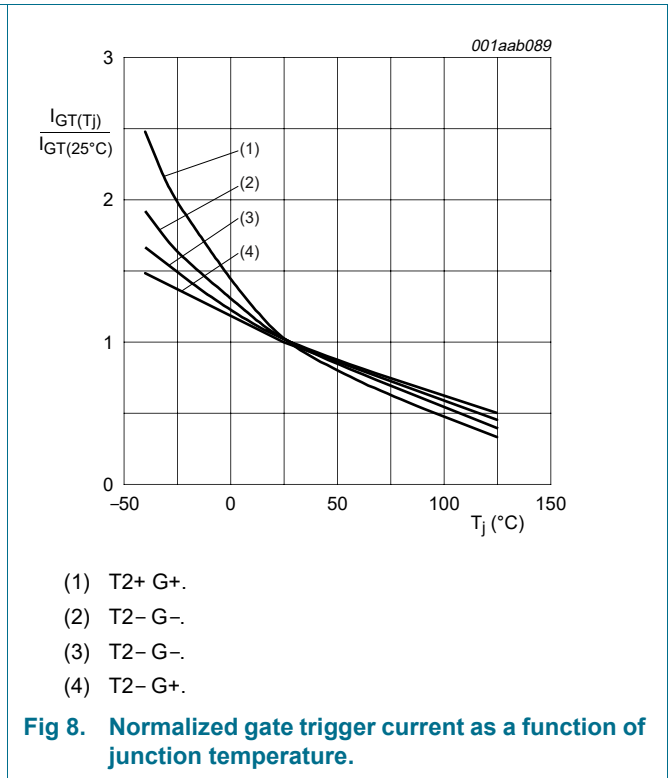
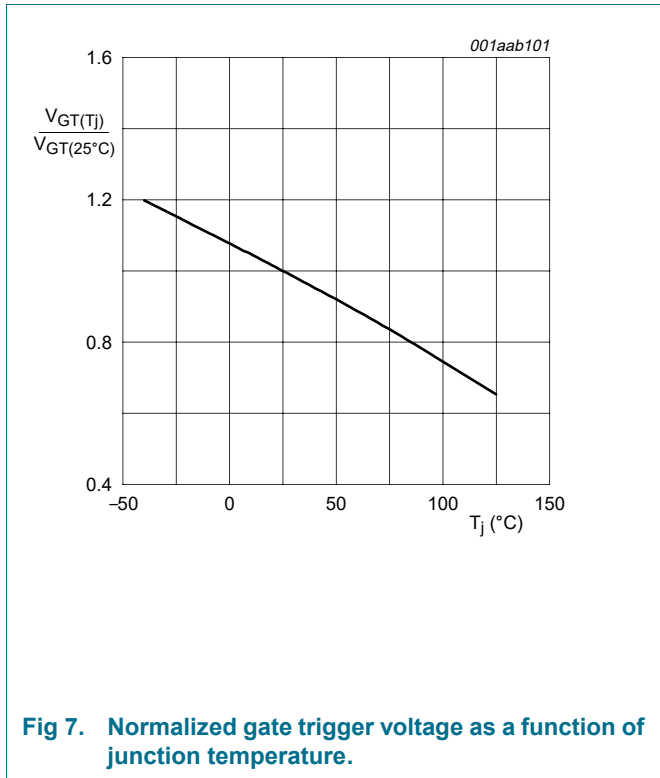
 $T_j = 25\text{ }^\circ\text{C}$  unless otherwise stated.

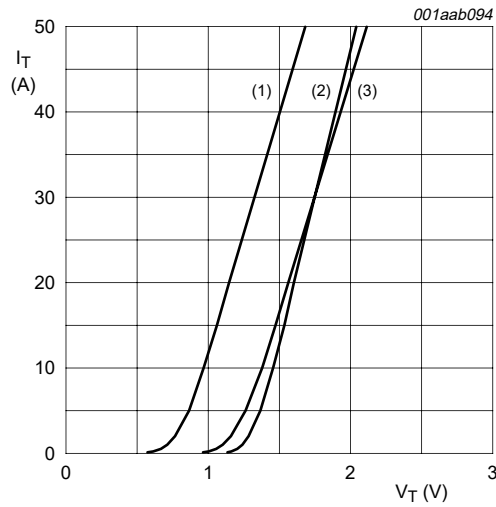
Symbol	Parameter	Conditions	BT139			BT139-F			BT139-G			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V};$ $I_T = 0.1\text{ A};$ <a href="#">Figure 7</a>	-	0.7	1.5	-	0.7	1.5	-	0.7	1.5	V
		$V_D = 400\text{ V};$ $I_T = 0.1\text{ A};$ $T_j = 125\text{ }^\circ\text{C}$	0.25	0.4	-	0.25	0.4	-	0.25	0.4	-	V
$I_D$	off-state leakage current	$V_D = V_{DRM(max)};$ $T_j = 125\text{ }^\circ\text{C}$	-	0.1	0.5	-	0.1	0.5	-	0.1	0.5	mA

## 7. Dynamic characteristics

Table 6: Dynamic characteristics

Symbol	Parameter	Conditions	BT139			BT139-F			BT139-G			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$dV_D/dt$	critical rate of rise of off-state voltage	$V_{DM} = 67\text{ }%$ $V_{DRM(max)};$ $T_j = 125\text{ }^\circ\text{C};$ exponential waveform; gate open circuit	200	250	-	50	250	-	200	250	-	V/ $\mu\text{s}$
$dV_{com}/dt$	critical rate of change of commutating voltage	$V_{DM} = 400\text{ V};$ $T_j = 95\text{ }^\circ\text{C};$ $I_{T(RMS)} = 16\text{ A};$ $dI_{com}/dt = 7.2\text{ A/ms};$ gate open circuit	10	20	-	-	20	-	10	20	-	V/ $\mu\text{s}$
$t_{gt}$	gate controlled turn-on time	$I_{TM} = 20\text{ A};$ $V_D = V_{DRM(max)};$ $I_G = 0.1\text{ A};$ $dI_G/dt = 5\text{ A}/\mu\text{s}$		2	-	-	2	-		2	-	$\mu\text{s}$

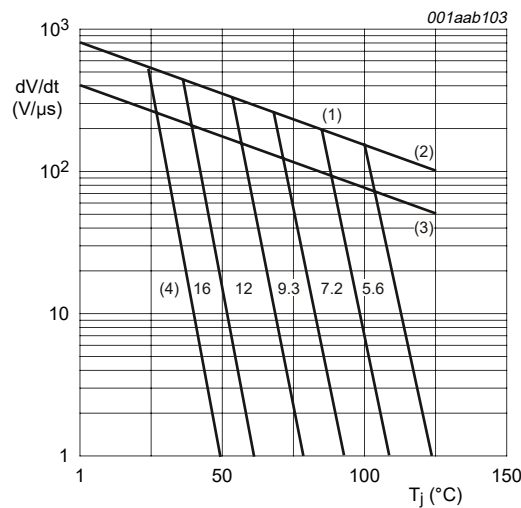




$V_O = 1.06 \text{ V.}$   
 $R_S = 0.0304 \Omega.$

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

**Fig 11. On-state current characteristics.**



The triac should commute when the  $dI_T/dt$  is below the value on the appropriate curve for pre-commutation  $dI_T/dt$ .

- (1) BT139 SERIES.
- (2) BT139...G SERIES.
- (3) BT139...F SERIES.
- (4)  $dI_{com}/dt = 20 \text{ A/ms.}$

**Fig 12. Critical rate of change of commutating voltage as a function of junction temperature; minimum values.**



8. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78

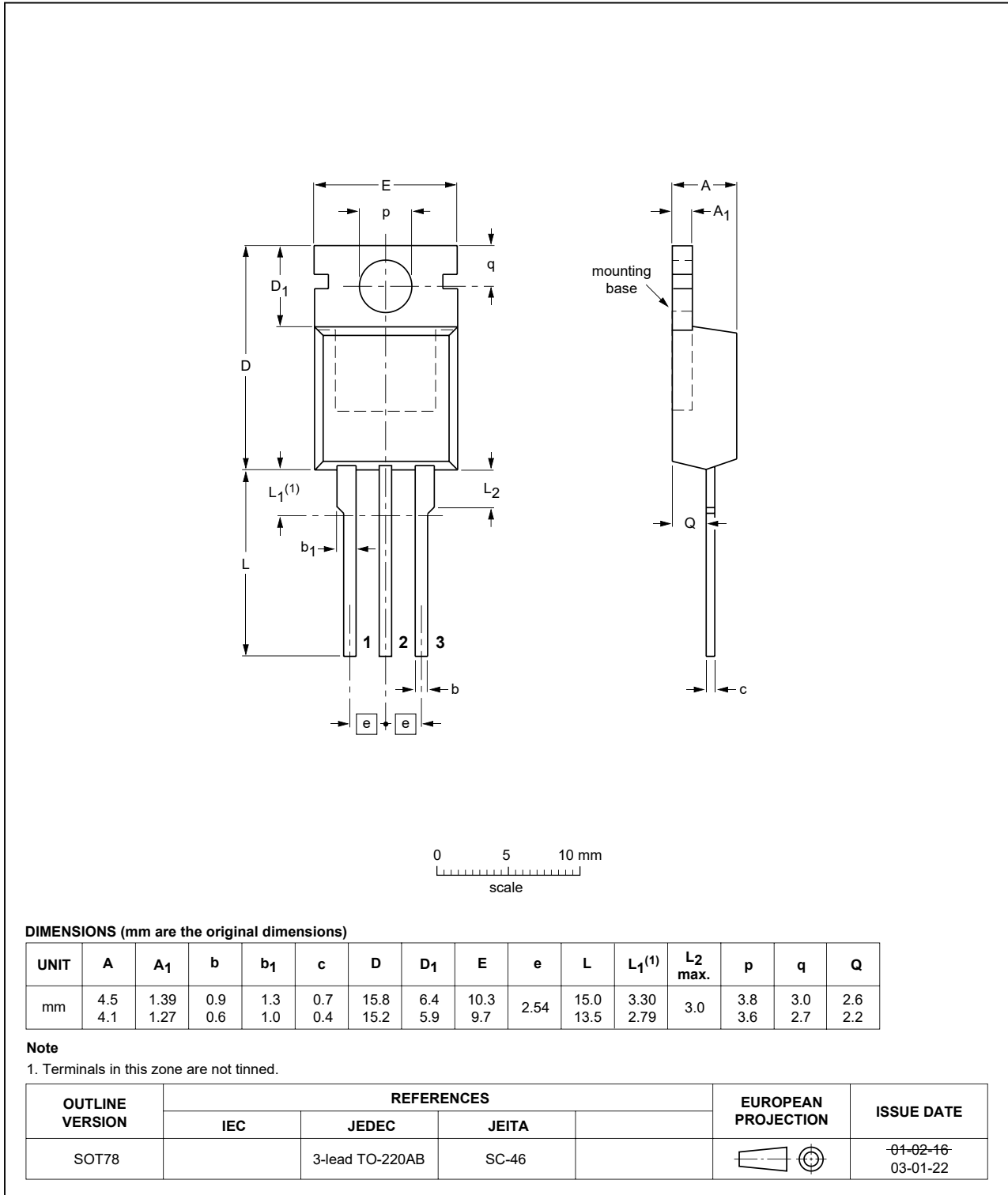


Fig 13. Package outline.

## 9. Revision history

**Table 7: Revision history**

Document ID	Release date	Data sheet status	Change notice	Order number	Supersedes
BT139_SERIES_4	20040706	Product data sheet	-	9397 750 13358	BT139_SERIES_3
Modifications:	Data sheet updated to latest standards.				
BT139_SERIES_3	20030401	Product specification	-	-	BT139_SERIES_2
BT139_SERIES_2	20010701	Product specification	-	-	BT139_SERIES_1
BT139_SERIES_1	19970901	Product specification	-	-	-

## 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.

## 11. Definitions

**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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