



# BT139-800

## 4Q Triac

Rev. 5 — 23 March 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Planar passivated four quadrant triac in a SOT78 plastic package intended for use in applications requiring high bidirectional transient and blocking voltage capability and high thermal cycling performance. Typical applications include motor control, industrial and domestic lighting, heating and static switching.

### 1.2 Features and benefits

- High blocking voltage capability
- High noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants

### 1.3 Applications

- General purpose motor control
- General purpose switching

### 1.4 Quick reference data

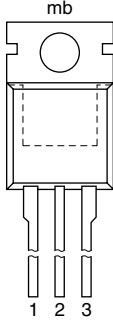

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage		-	-	800	V
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j}(\text{init})} = 25\text{ °C}$ ; $t_{\text{p}} = 20\text{ ms}$ ; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a>	-	-	155	A
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 99\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 3</a>	-	-	16	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+; $T_{\text{j}} = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	-	5	35	mA
		$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2+ G-; $T_{\text{j}} = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	-	8	35	mA
		$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2- G-; $T_{\text{j}} = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	-	10	35	mA
		$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2- G+; $T_{\text{j}} = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	-	22	70	mA



## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1		
2	T2	main terminal 2		
3	G	gate		
mb	T2	mounting base; main terminal 2		

**SOT78 (TO-220AB)**

## 3. Ordering information

Table 3. Ordering information

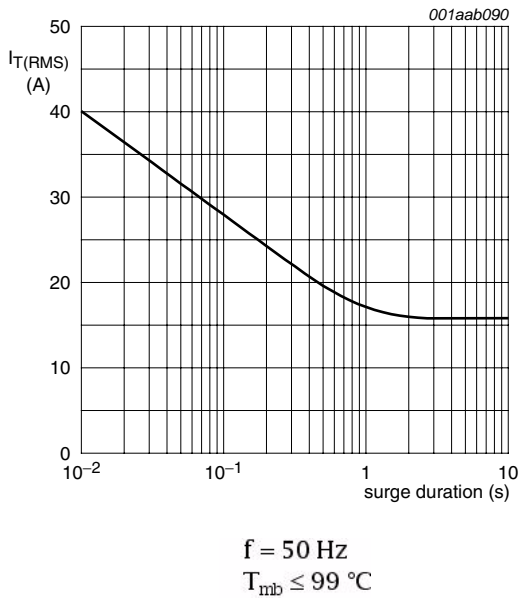
Type number	Package		
	Name	Description	Version
BT139-800	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

## 4. Limiting values

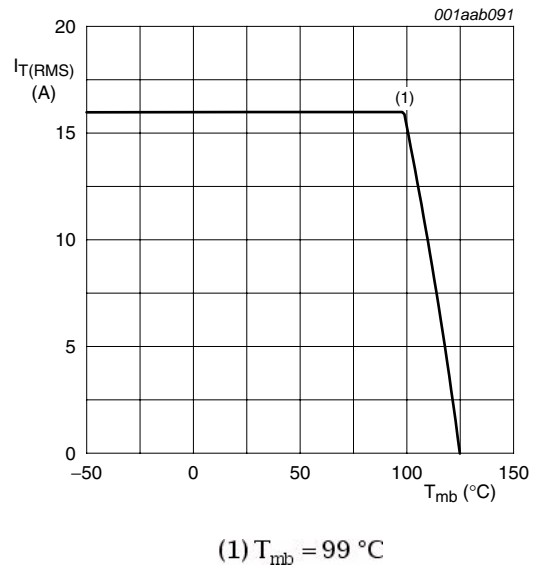
**Table 4. Limiting values**

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

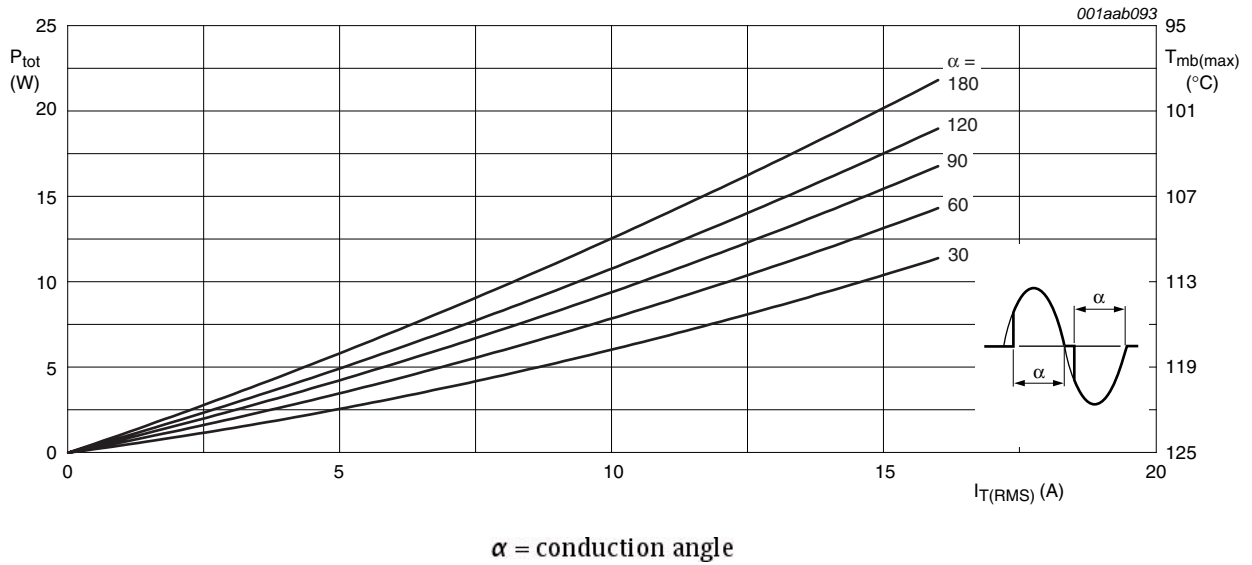
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 99\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 3</a>	-	16	A
$I_{TSM}$	non-repetitive peak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



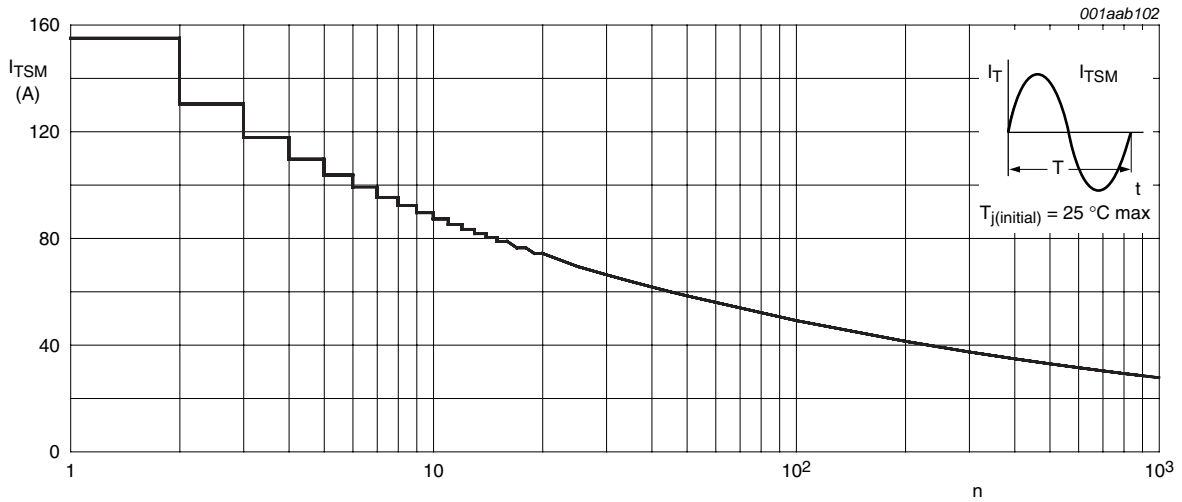
**Fig 1. RMS on-state current as a function of surge duration; maximum values**



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

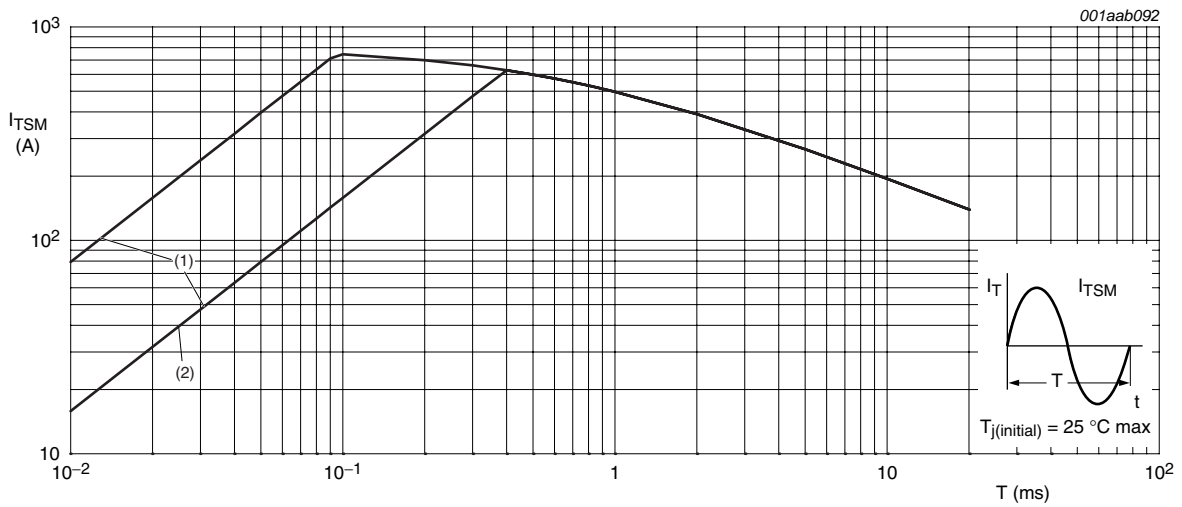


**Fig 3. Total power dissipation as a function of RMS on-state current; maximum values.**



$f = 50 \text{ Hz}; n = \text{number of cycles}$

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



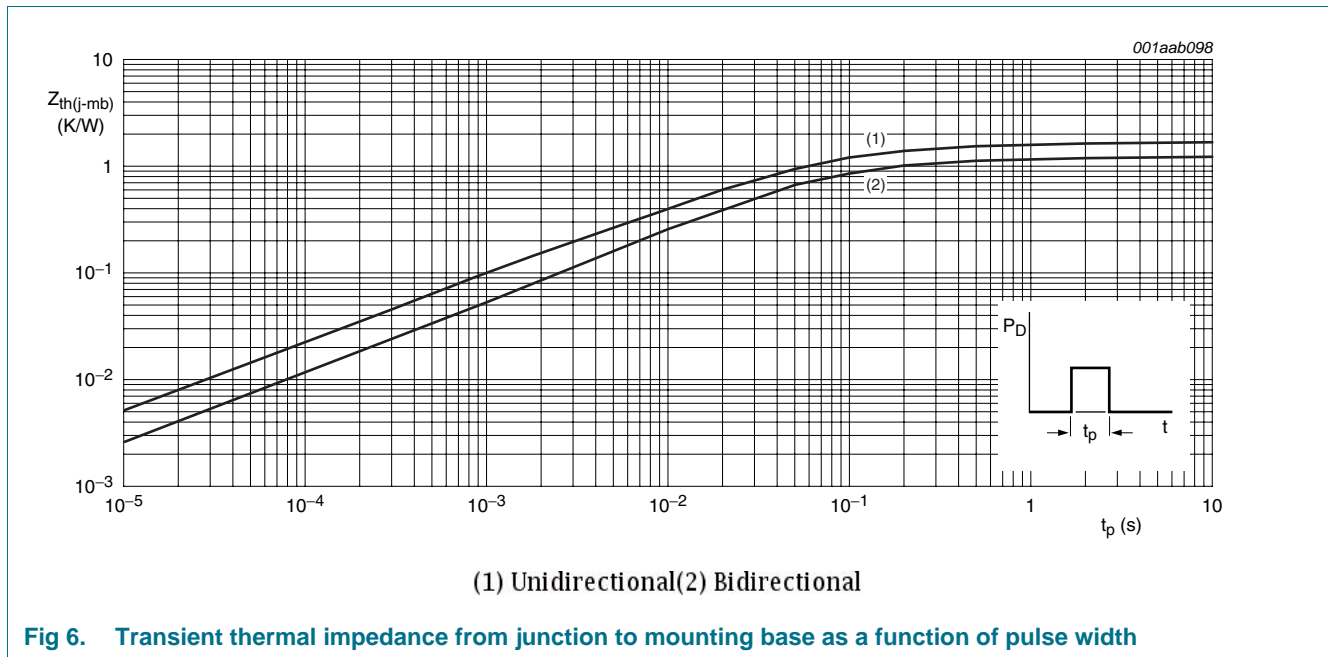
$t_p \leq 20\text{ms}$   
 (1)  $dI_T/dt$  limit  
 (2) T2 - G + quadrant limit

**Fig 5. Non-repetitive peak on-state current as a function of pulse width; maximum values**

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

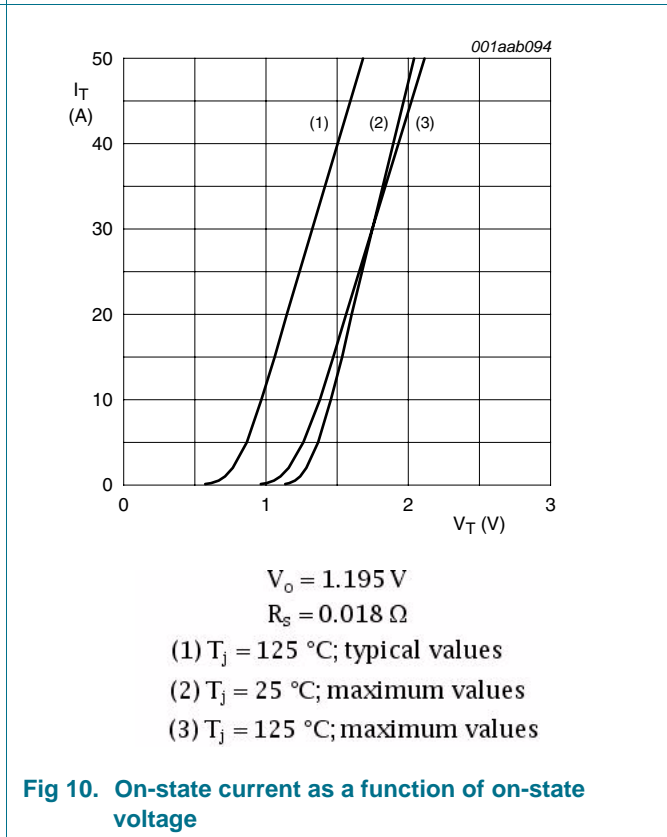
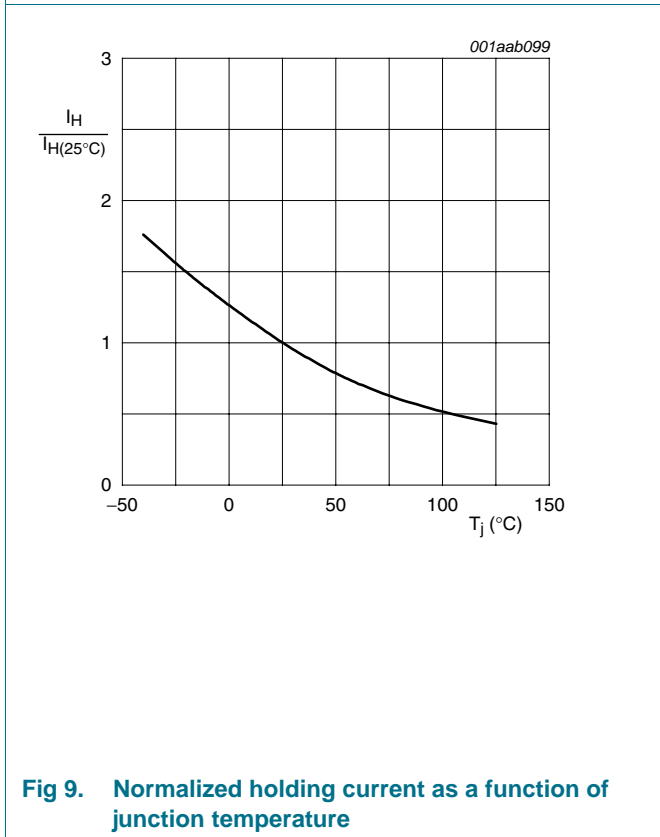
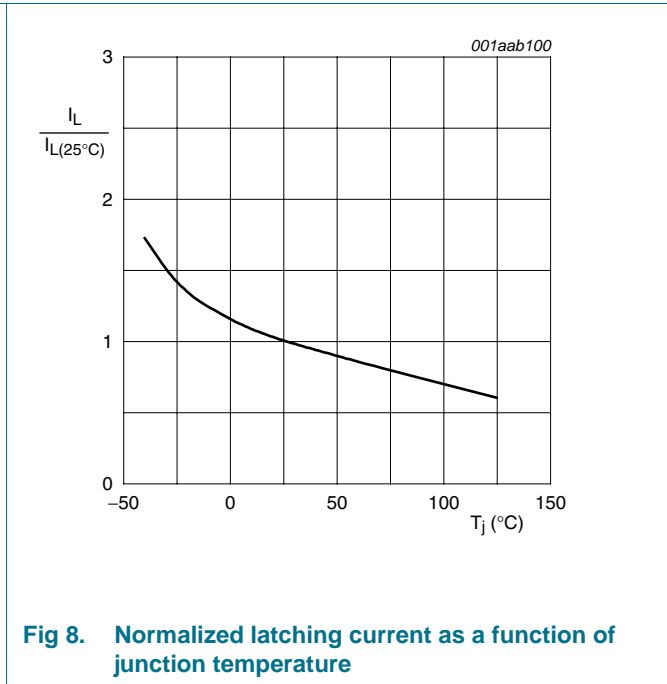
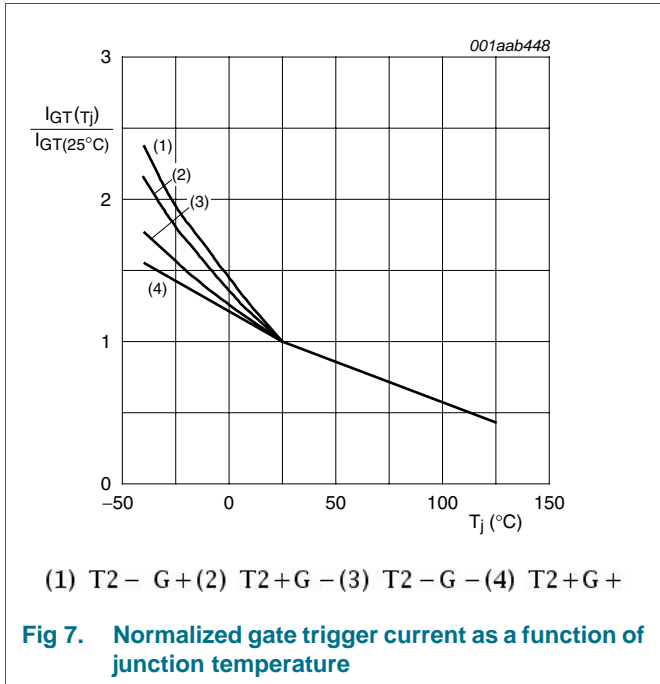
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	half cycle; see <a href="#">Figure 6</a>	-	-	1.7	K/W
		full cycle; see <a href="#">Figure 6</a>	-	-	1.2	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W



## 6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	-	5	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	-	8	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	-	10	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	-	22	70	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	7	40	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	22	60	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	8	40	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G+; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	10	60	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 9</a>	-	6	45	mA
$V_T$	on-state voltage	$I_T = 20\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 10</a>	-	1.2	1.6	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	-	0.7	1.5	V
		$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ °C}$ ; see <a href="#">Figure 11</a>	0.25	0.4	-	V
$I_D$	off-state current	$V_D = 800\text{ V}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536\text{ V}$ ; $T_j = 125\text{ °C}$ ; exponential waveform; gate open circuit	200	250	-	V/ $\mu$ s
$dV_{com}/dt$	rate of change of commutating voltage	$V_D = 400\text{ V}$ ; $T_j = 95\text{ °C}$ ; $dI_{com}/dt = 7.2\text{ A/ms}$ ; $I_T = 16\text{ A}$ ; gate open circuit	10	20	-	V/ $\mu$ s
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 20\text{ A}$ ; $V_D = 800\text{ V}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu$ s	-	2	-	$\mu$ s





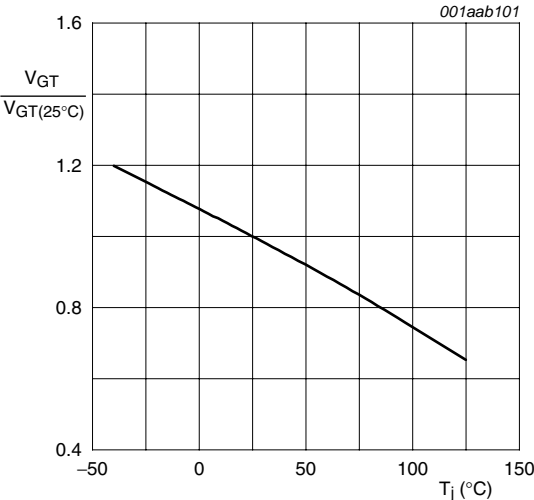


Fig 11. Normalized gate trigger voltage as a function of junction temperature

7. Package outline

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

SOT78



Fig 12. Package outline SOT78 (TO-220AB)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BT139-800 v.5	20110323	Product data sheet	-	BT139_SERIES_4
Modifications:	<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• Type number BT139-800 separated from data sheet BT139_SERIES_4.</li></ul>			
BT139_SERIES_4 (9397 750 13358)	20040706	Product data sheet	-	BT139_SERIES_3

## 9. Legal information

### 9.1 Data sheet status

Document status <sup>[1]</sup> <sup>[2]</sup>	Product status <sup>[3]</sup>	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.

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

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