

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

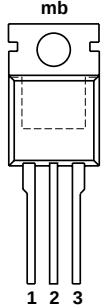
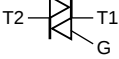
- Motor control
- Industrial and domestic lighting, heating and static switching.

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		 <i>sym051</i>
2	main terminal 2		
3	gate		
mb	main terminal 2		
		SOT78 (TO-220AB)	

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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_{DRM}	repetitive peak off-state voltage				
	BT139-600		-	600 ^[1]	V
	BT139-800		-	800	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 99\text{ °C}$; Figure 4 and Figure 5	-	16	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{\text{j}} = 25\text{ °C}$ prior to surge; Figure 2 and Figure 3			
		$t = 20\text{ ms}$	-	155	A
		$t = 16.7\text{ ms}$	-	170	A
I^2t	I^2t for fusing	$t = 10\text{ ms}$	-	120	A ² 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/ μs
		T2+ G-	-	50	A/ μs
		T2- G-	-	50	A/ μs
		T2- G+	-	10	A/ μs
I_{GM}	peak gate current		-	2	A
V_{GM}	peak gate voltage		-	5	V
P_{GM}	peak gate power		-	5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	-	0.5	W
T_{stg}	storage temperature		-40	+150	°C
T_{j}	junction temperature		-	125	°C

[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/ μs .

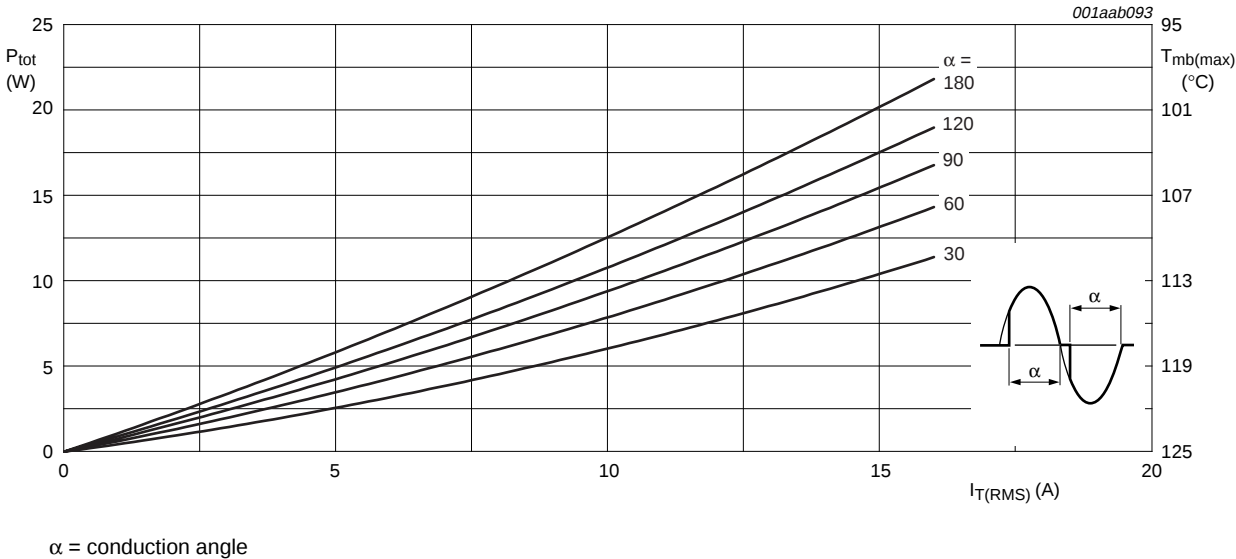


Fig 1. Total power dissipation as a function of RMS on-state current; maximum values.

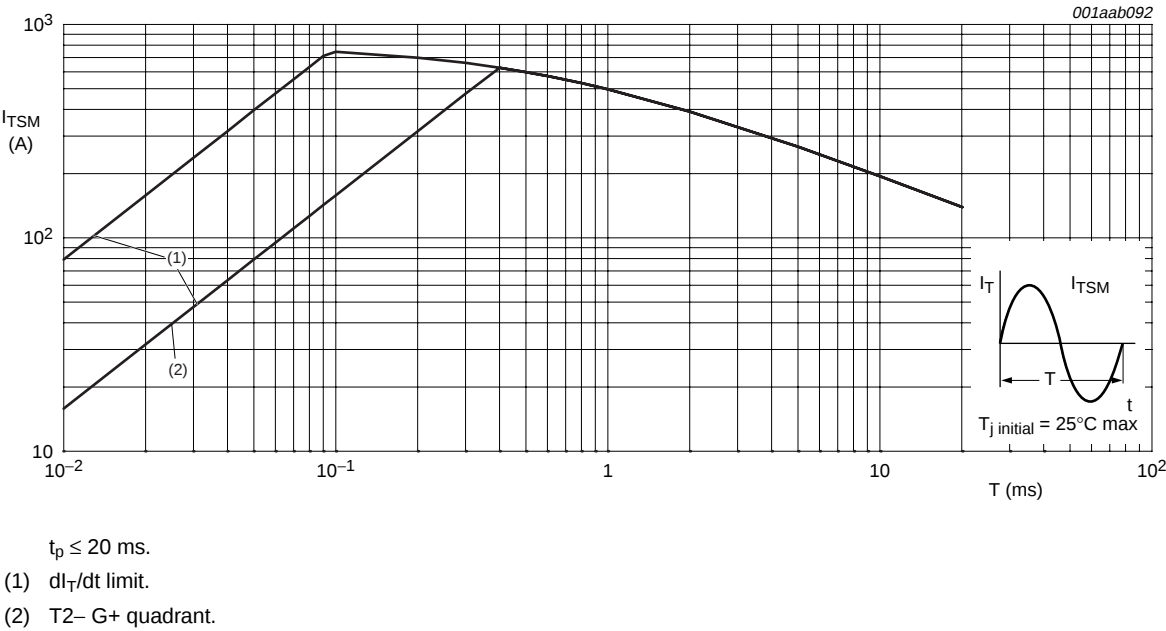


Fig 2. Non-repetitive peak on-state current as a function of pulse width; maximum values.

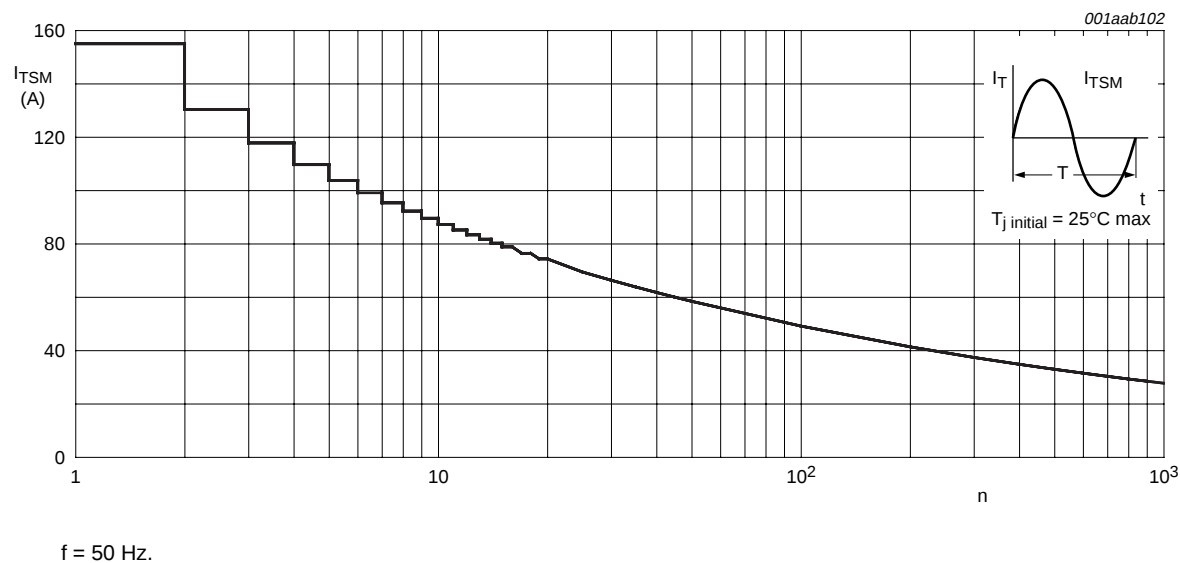


Fig 3. Non-repetitive peak on-state current as a function of number of sinusoidal current cycles; maximum values.

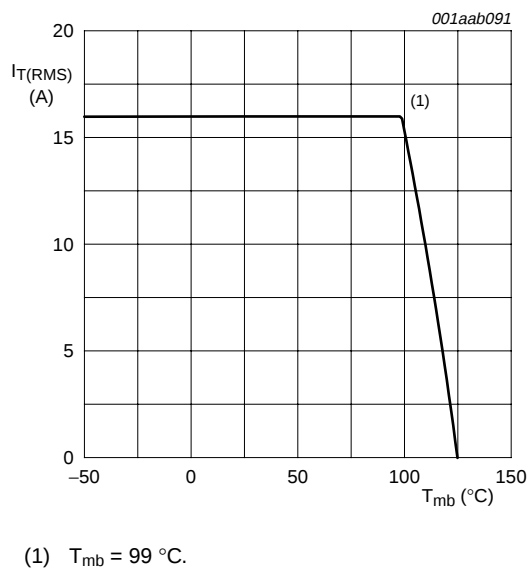


Fig 4. RMS on-state current as a function of mounting base temperature; maximum values.

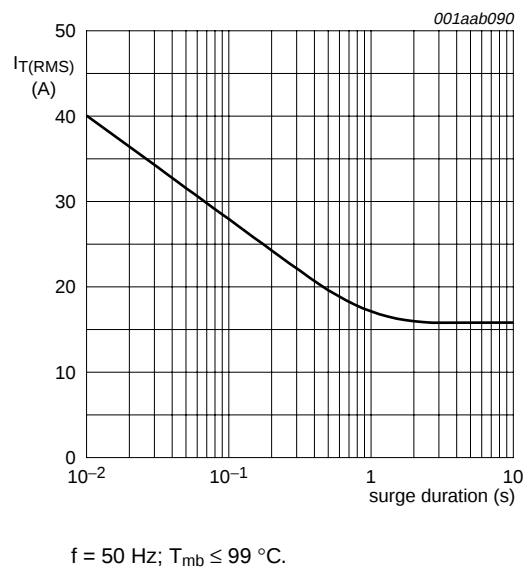
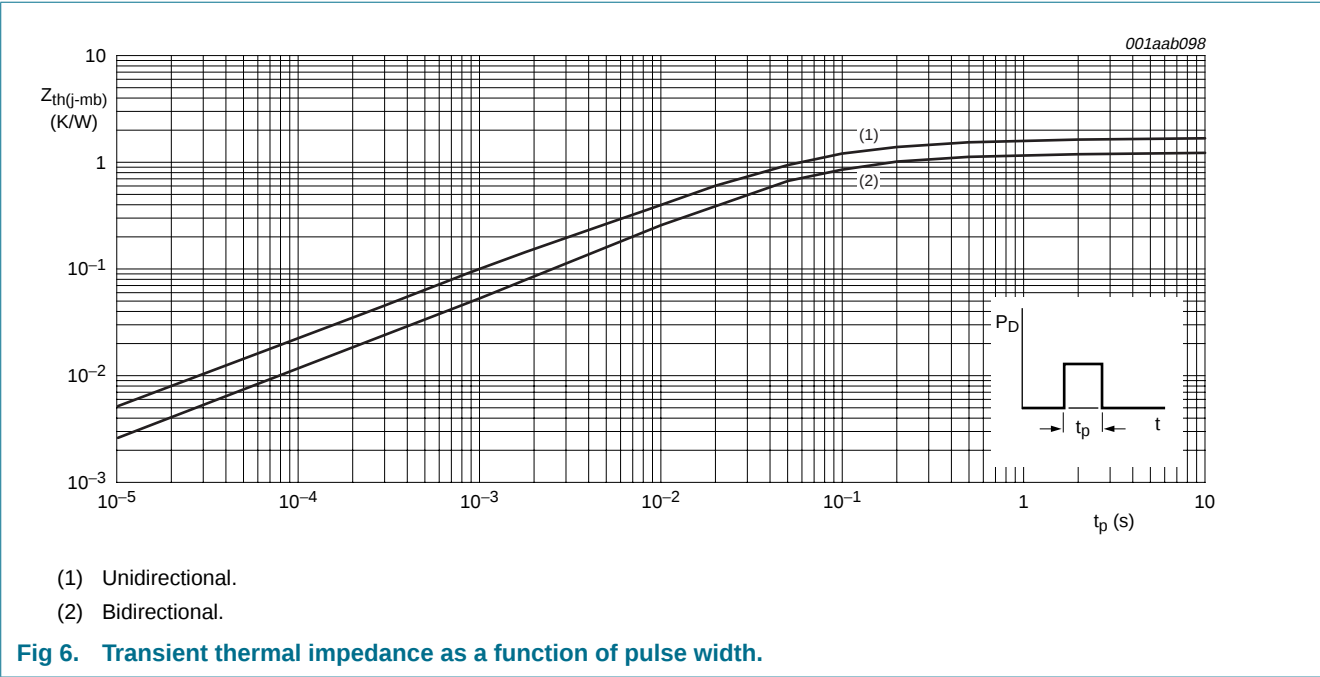


Fig 5. RMS on-state current as a function of surge duration; maximum values.

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 Figure 6	-	1.2	K/W
		half cycle Figure 6	-	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 °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 V; I _T = 0.1 A; Figure 8										
		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 V; I _{GT} = 0.1 A; Figure 9										
		T2+ G+	-	7	40	-	7	40	-	7	60	mA
		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 V; I _{GT} = 0.1 A; Figure 10	-	6	45	-	6	45	-	6	60	mA
V _T	on-state voltage	I _T = 20 A; Figure 11	-	1.2	1.6	-	1.2	1.6	-	1.2	1.6	V

Table 5: Static characteristics ...continued

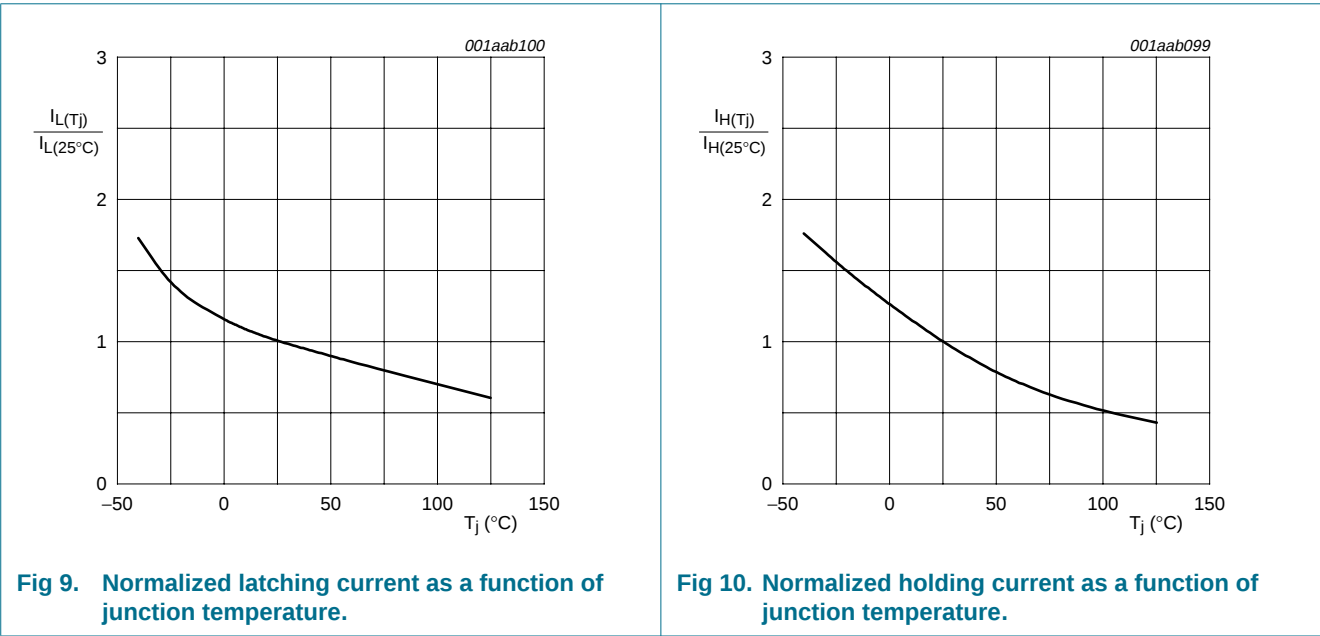
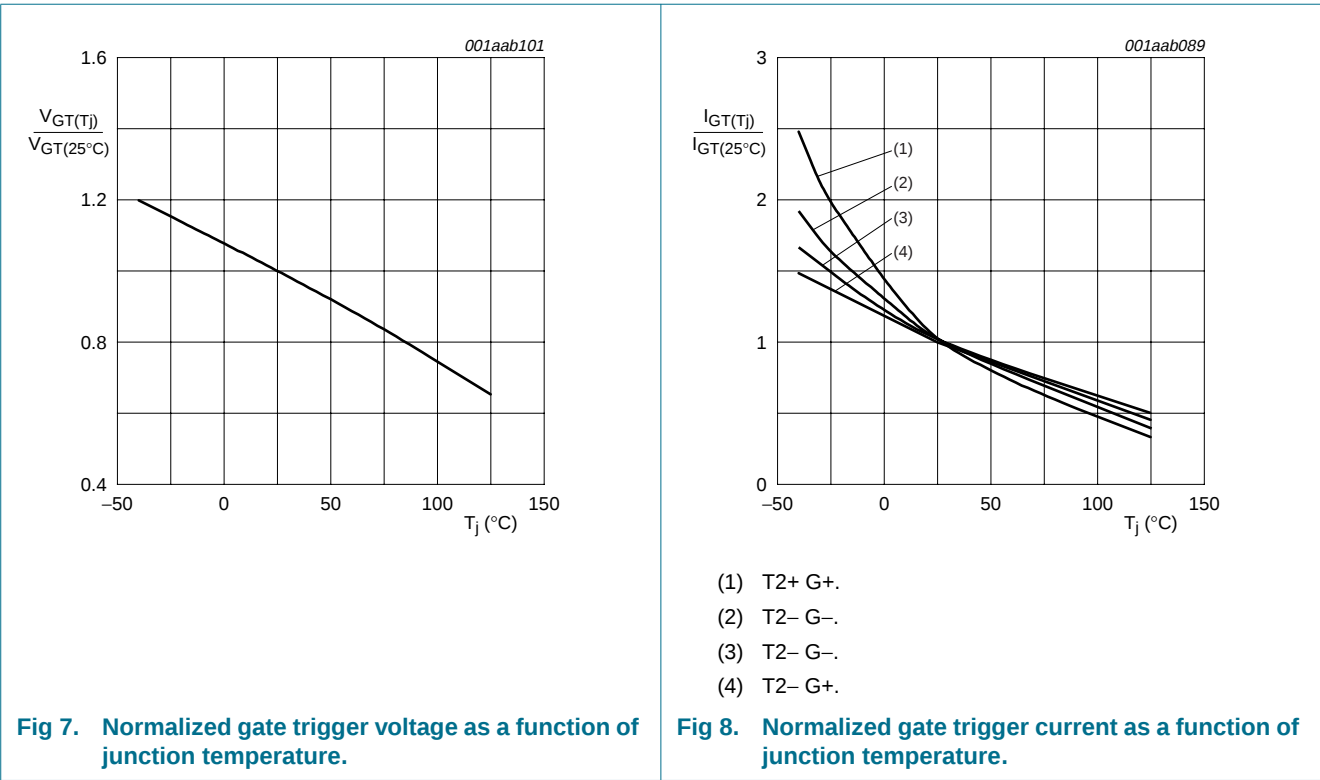
 $T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise stated.

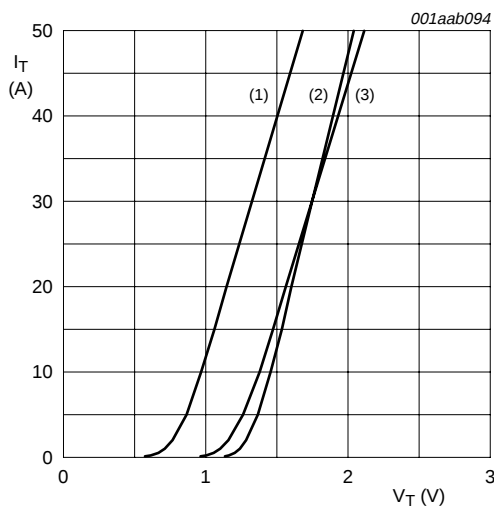
Symbol	Parameter	Conditions	BT139			BT139-F			BT139-G			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{GT}	gate trigger voltage	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; Figure 7	-	0.7	1.5	-	0.7	1.5	-	0.7	1.5	V
		$V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 125\text{ }^{\circ}\text{C}$	0.25	0.4	-	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/ μs
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/ μs
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	-	μs



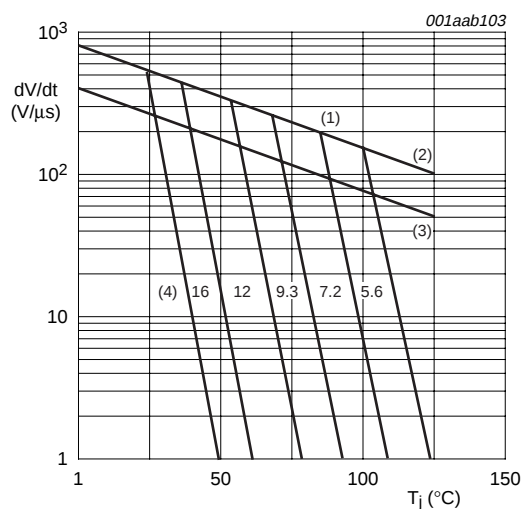


$V_O = 1.06 \text{ V}$.

$R_S = 0.0304 \text{ } \Omega$.

- (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.

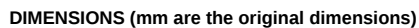


The triac should commute when the dI_T/dt is below the value on the appropriate curve for pre-commutation dI_T/dt .

- (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.

SOT78



Note

1. Terminals in this zone are not tinned.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			01-02-16 03-01-22

9397 750 13358



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 ^[1]	Product status ^{[2] [3]}	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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14. Contents

1 Product profile 1

1.1 General description..... 1

1.2 Features 1

1.3 Applications 1

1.4 Quick reference data..... 1

2 Pinning information..... 1

3 Ordering information..... 2

4 Limiting values..... 2

5 Thermal characteristics 3

6 Static characteristics 3

7 Dynamic characteristics 4

8 Package outline 9

9 Revision history..... 10

10 Data sheet status..... 11

11 Definitions 11

12 Disclaimers..... 11

13 Contact information11



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