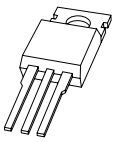


BT139 series E

Triacs; sensitive gate

Rev. 03 — 23 September 2004 Product data sheet

1. Product profile

1.1 General description

Passivated, sensitive gate triacs in a SOT78 (TO-220AB) plastic package.

1.2 Features

- High sensitivity in all four quadrants.

1.3 Applications

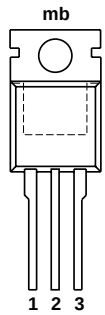
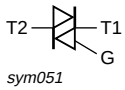
- General purpose bidirectional switching
- Phase control.

1.4 Quick reference data

- $V_{DRM} \leq 600$ V (BT139-600E)
- $V_{DRM} \leq 800$ V (BT139-800E)
- $I_{T(RMS)} \leq 16$ A
- $I_{TSM} \leq 155$ A
- $I_{GT} \leq 10$ mA (T2+ G+; T2+ G–; T2– G–)
- $I_{GT} \leq 25$ mA (T2– G+).

2. Pinning information

Table 1: Pinning

Pin	Description	Simplified outline	Symbol
1	main terminal 1 (T1)	 SOT78 (TO-220AB)	 sym051
2	main terminal 2 (T2)		
3	gate (G)		
mb	mounting base, connected to main terminal 2 (T2)		

PHILIPS

3. Ordering information

Table 2: Ordering information

Type number	Package		
	Name	Description	Version
BT139-600E	SC-46	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78
BT139-800E			

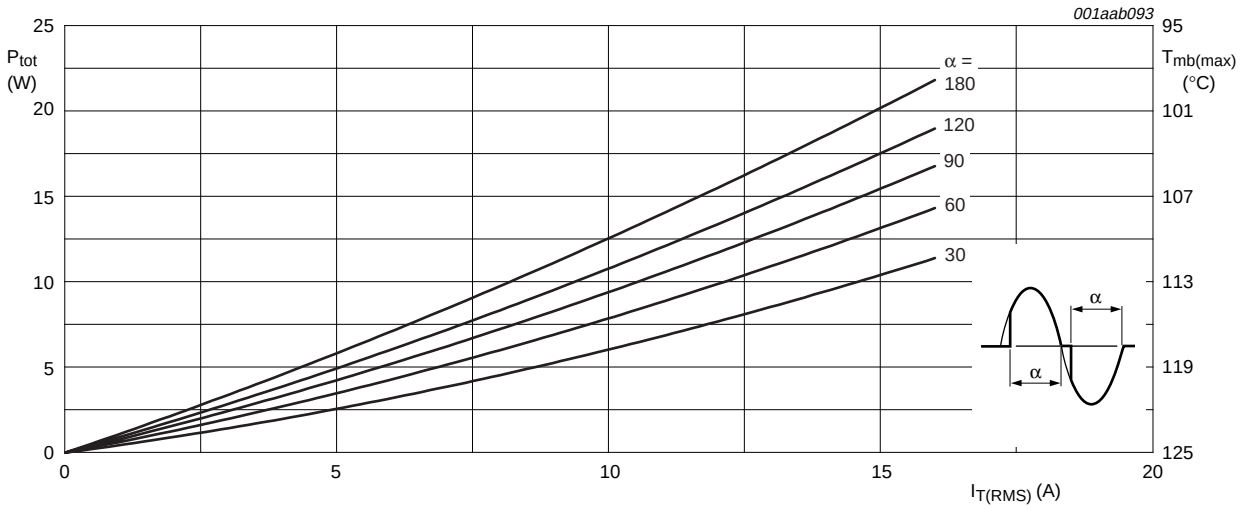
4. Limiting values

Table 3: Limiting values

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

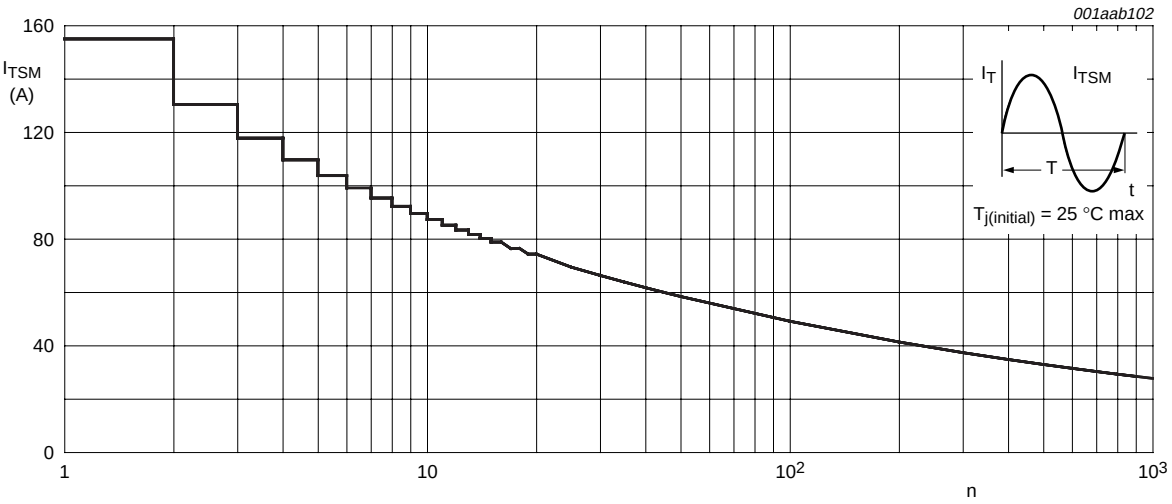
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage					
	BT139-600E		[1]	-	600	V
	BT139-800E			-	800	V
$I_{T(RMS)}$	RMS on-state current	full sinewave; $T_{mb} \leq 99$ °C; Figure 4 and Figure 5		-	16	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; T_j = 25 °C prior to surge; Figure 2 and Figure 3				
		t = 20 ms		-	155	A
		t = 16.7 ms		-	170	A
I^2t	I^2t for fusing	t = 10 ms		-	120	A^2s
dI_T/dt	repetitive rate of rise of on-state current after triggering	I_{TM} = 20 A; I_G = 0.2 A; dI_G/dt = 0.2 A/µs				
		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
$P_{G(AV)}$	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.



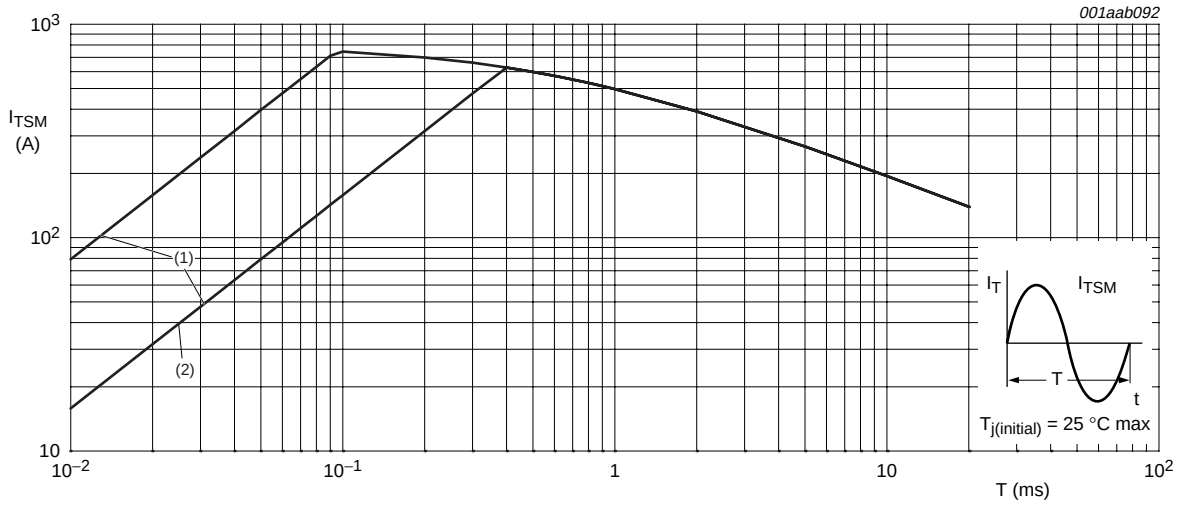
α = conduction angle.

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



f = 50 Hz.

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

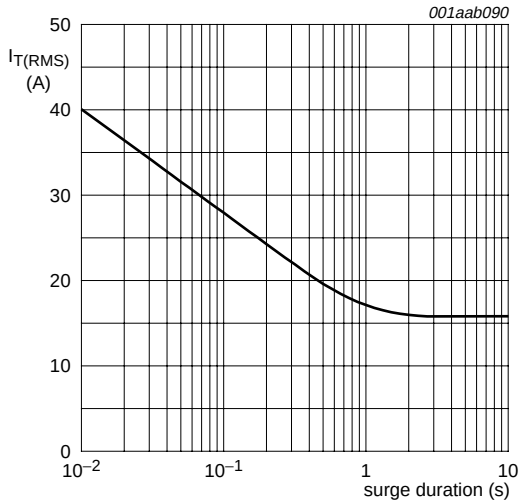


$t_p \leq 20$ ms.

(1) dI_T/dt limit.

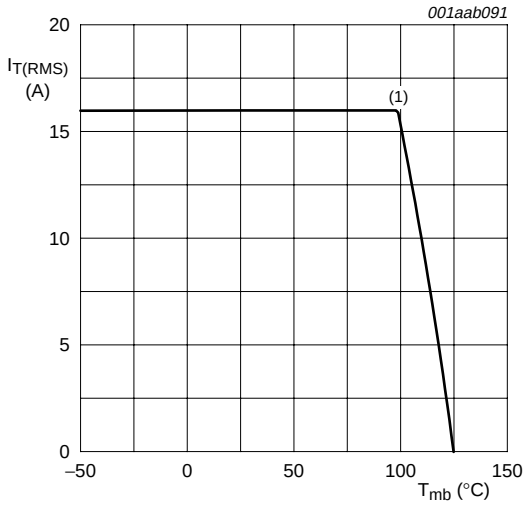
(2) T2– G+ quadrant.

Fig 3. Non-repetitive peak on-state current as a function of pulse width; maximum values.



f = 50 Hz; $T_{mb} \leq 99$ °C.

Fig 4. RMS on-state current as a function of surge duration; maximum values.



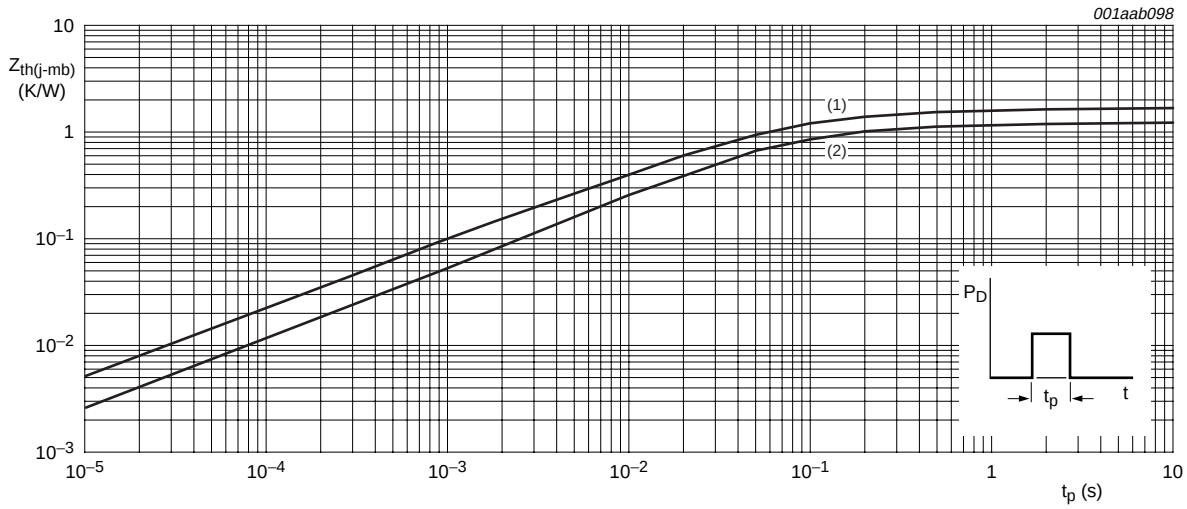
(1) T_{mb} = 99 °C.

Fig 5. RMS on-state current as a function of mounting base temperature; maximum values.

5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from 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 from junction to ambient	in free air	-	60	-	K/W



(1) Unidirectional.

(2) Bidirectional.

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

6. Characteristics

Table 5: Characteristics

T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{GT}	gate trigger current	V_D = 12 V; I_T = 0.1 A; Figure 8				
		T2+ G+	-	2.5	10	mA
		T2+ G–	-	4	10	mA
		T2– G–	-	5	10	mA
		T2– G+	-	11	25	mA
I_L	latching current	V_D = 12 V; I_{GT} = 0.1 A; Figure 10				
		T2+ G+	-	3.2	30	mA
		T2+ G–	-	16	40	mA
		T2– G–	-	4	30	mA
		T2– G+	-	5.5	40	mA
I_H	holding current	V_D = 12 V; I_{GT} = 0.1 A; Figure 11	-	4	45	mA
V_T	on-state voltage	I_T = 20 A; Figure 9	-	1.2	1.6	V
V_{GT}	gate trigger voltage	V_D = 12 V; I_T = 0.1 A; Figure 7	-	0.7	1.5	V
		V_D = 400 V; I_T = 0.1 A; T_j = 125 °C	0.25	0.4	-	V
I_D	off-state leakage current	$V_D = V_{DRM(max)}$; T_j = 125 °C	-	0.1	0.5	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; gate open circuit	-	50	-	V/µs
t_{gt}	gate controlled turn-on time	I_{TM} = 20 A; $V_D = V_{DRM(max)}$; I_G = 0.1 A; dI_G/dt = 5 A/µs	-	2	-	µs

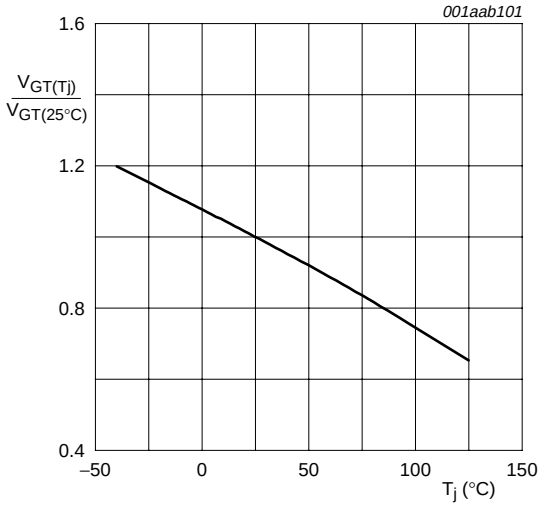
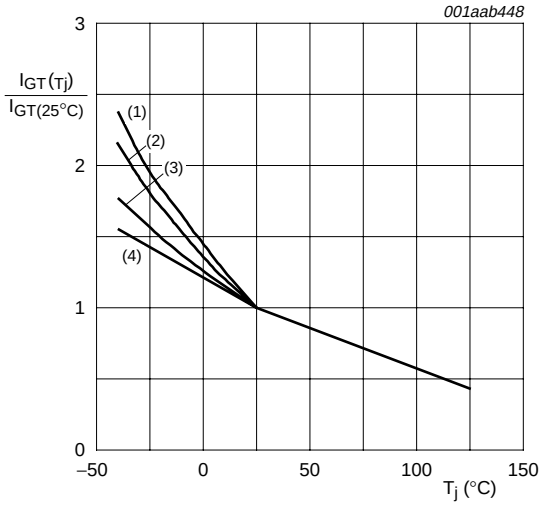
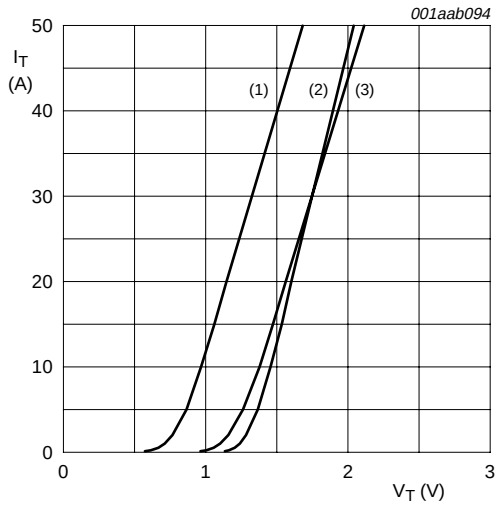


Fig 7. Normalized gate trigger voltage as a function of junction temperature.



(1) T2– G+.
(2) T2+ G–.
(3) T2– G–.
(4) T2+ G+.

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



V_O = 1.195 V.

R_s = 0.018 Ω.

(1) T_j = 125 °C; typical values.
(2) T_j = 25 °C; maximum values.
(3) T_j = 125 °C; maximum values.

Fig 9. On-state current characteristics.

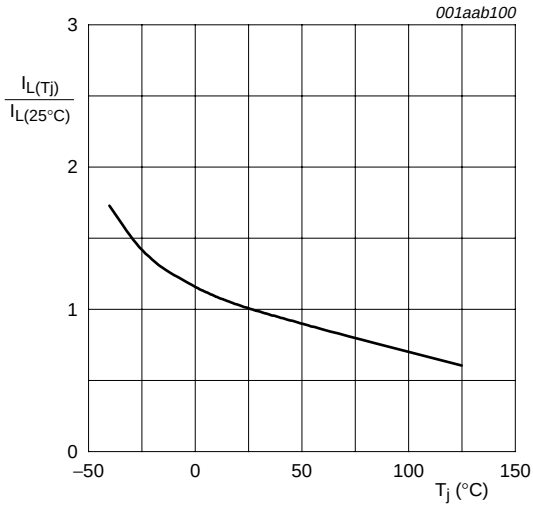


Fig 10. Normalized latching current as a function of junction temperature.

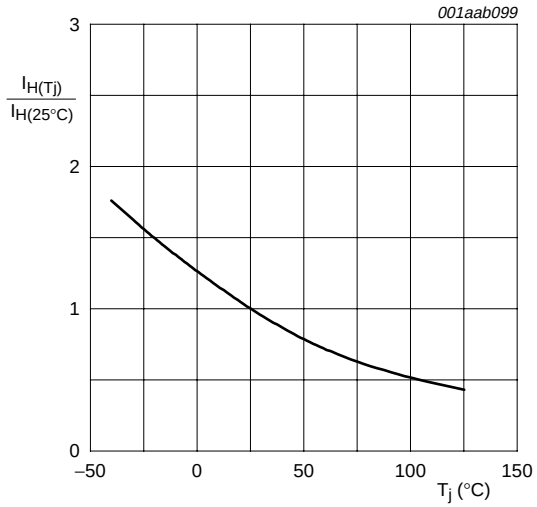


Fig 11. Normalized holding current as a function of junction temperature.

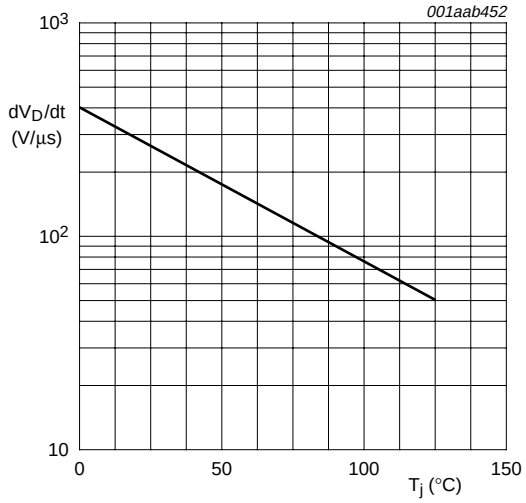
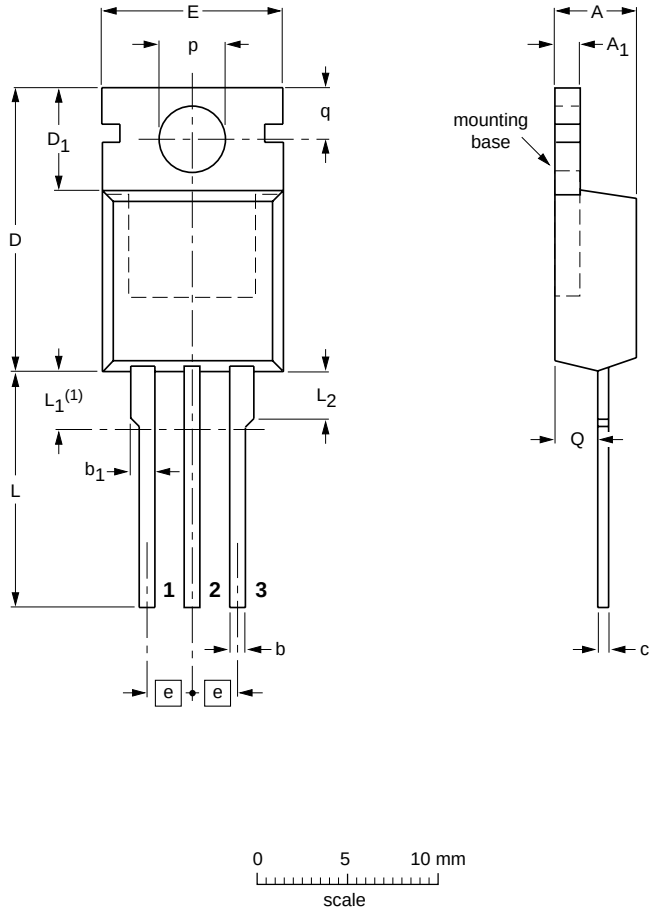


Fig 12. Critical rate of rise of off-state voltage as a function of junction temperature; minimum values.

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB **SOT78**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	c	D	D_1	E	e	L	L_1(1)	L_2 max.	p	q	Q
mm	4.5 4.1	1.39 1.27	0.9 0.6	1.3 1.0	0.7 0.4	15.8 15.2	6.4 5.9	10.3 9.7	2.54	15.0 13.5	3.30 2.79	3.0	3.8 3.6	3.0 2.7	2.6 2.2

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

Fig 13. Package outline; SOT78 (TO-220AB).

8. Revision history

Table 6: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BT139_SERIES_E_3	20040923	Product data sheet	-	9397 750 13437	BT139_SERIES_E_2
Modifications:	• The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.				
BT139_SERIES_E_2	20010701	Product specification	-	-	BT139_SERIES_E_1
BT139_SERIES_E_1	19971001	Product specification	-	-	-

9. 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.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

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

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

10. 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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13. Contents

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