

# BT151X series

## Thyristors

Rev. 04 — 9 June 2004

Product data sheet

## 1. Product profile

### 1.1 General description

Passivated thyristors in a SOT186A full pack plastic package.

### 1.2 Features

- High thermal cycling performance
- High bidirectional blocking voltage capability
- Isolated mounting base.

### 1.3 Applications

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

### 1.4 Quick reference data

- $V_{DRM}, V_{RRM} \leq 800$  V (BT151X-800)
- $V_{DRM}, V_{RRM} \leq 650$  V (BT151X-650)
- $V_{DRM}, V_{RRM} \leq 500$  V (BT151X-500)
- $I_{T(RMS)} \leq 12$  A
- $I_{T(AV)} \leq 7.5$  A
- $I_{TSM} \leq 120$  A.

## 2. Pinning information

Table 1: Discrete pinning

Pin	Description	Simplified outline	Symbol
1	cathode (k)		 sym037
2	anode (a)		
3	gate (g)		
mb	mounting base; isolated		

SOT186A (TO-220)

# PHILIPS

### 3. Ordering information

Table 2: Ordering information

Type number	Package		Version
	Name	Description	
BT151X-500	-	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 lead TO-220 'full pack'	SOT186A
BT151X-650			
BT151X-800			

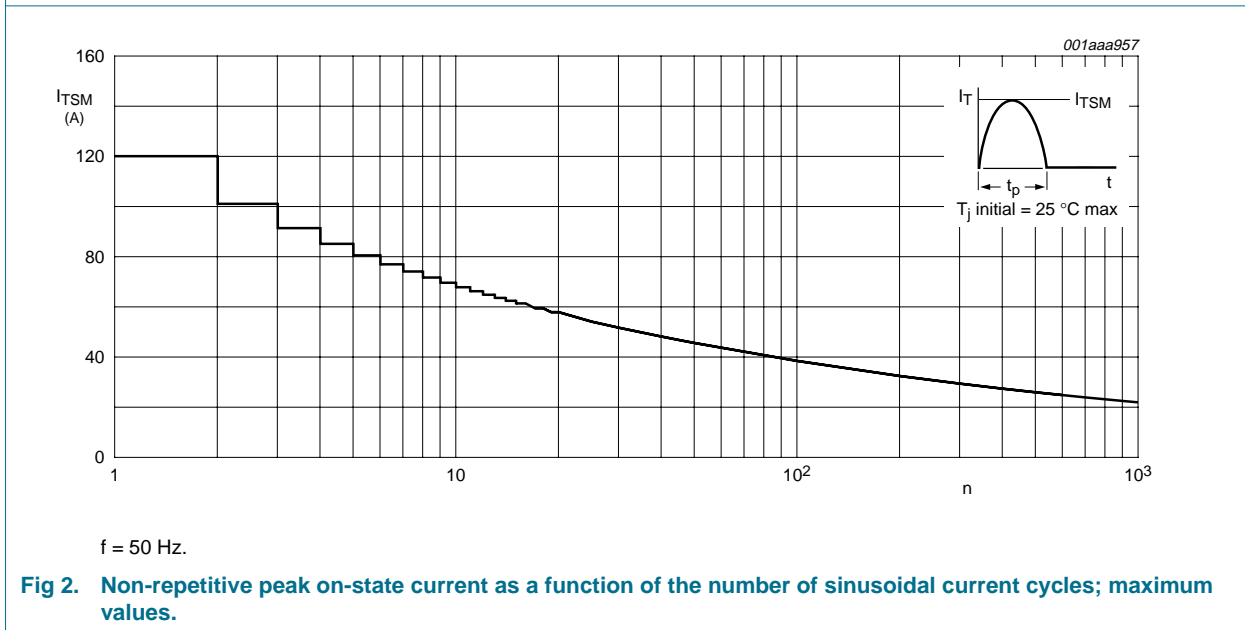
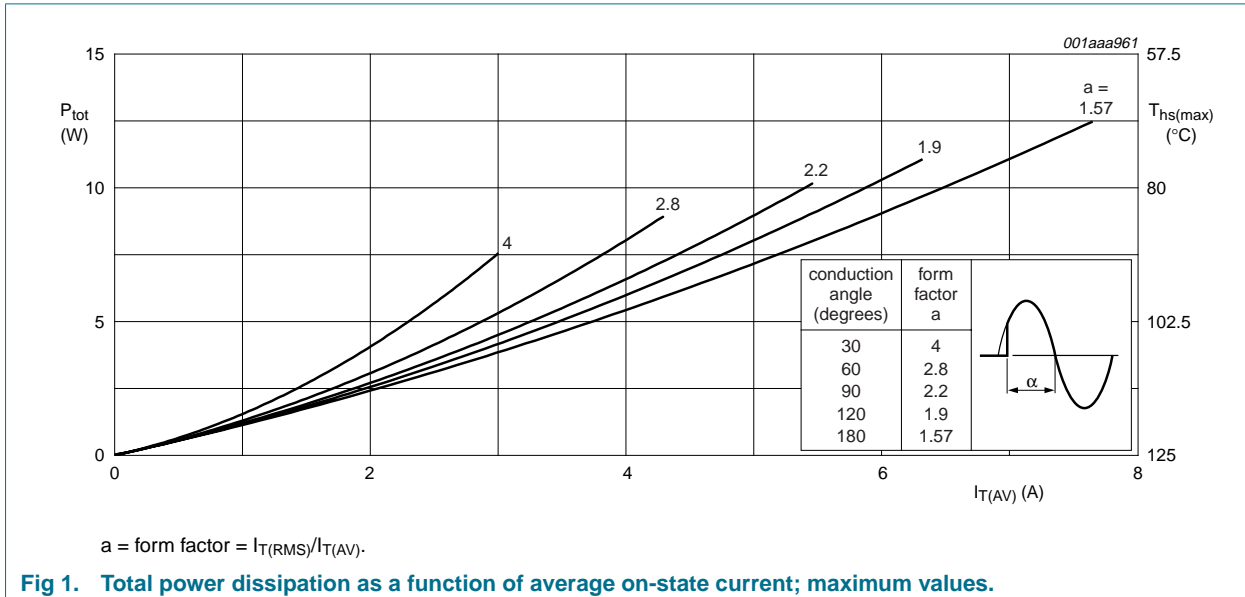
### 4. Limiting values

Table 3: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$ , $V_{RRM}$	repetitive peak off-state voltage				
	BT151X-500		[1]	500	V
	BT151X-650		[1]	650	V
	BT151X-800		-	800	V
$I_{T(AV)}$	average on-state current	half sinewave; $T_{hs} \leq 69\text{ °C}$ ; <a href="#">Figure 1</a>	-	7.5	A
$I_{T(RMS)}$	RMS on-state current	all conduction angles; <a href="#">Figure 4</a> and <a href="#">Figure 5</a>	-	12	A
$I_{TSM}$	non-repetitive peak on-state current	half sinewave; $T_j = 25\text{ °C}$ prior to surge; <a href="#">Figure 2</a> and <a href="#">Figure 3</a>			
		$t = 10\text{ ms}$	-	120	A
		$t = 8.3\text{ ms}$	-	132	A
$I^2t$	$I^2t$ for fusing	$t = 10\text{ ms}$	-	72	A <sup>2</sup> s
$di_T/dt$	repetitive rate of rise of on-state current after triggering	$I_{TM} = 20\text{ A}$ ; $I_G = 50\text{ mA}$ ; $di_G/dt 50\text{ mA}/\mu\text{s}$	-	50	A/ $\mu\text{s}$
$I_{GM}$	peak gate current		-	2	A
$V_{RGM}$	peak reverse 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 thyristor may switch to the on-state. The rate of rise of current should not exceed 15 A/ $\mu\text{s}$ .



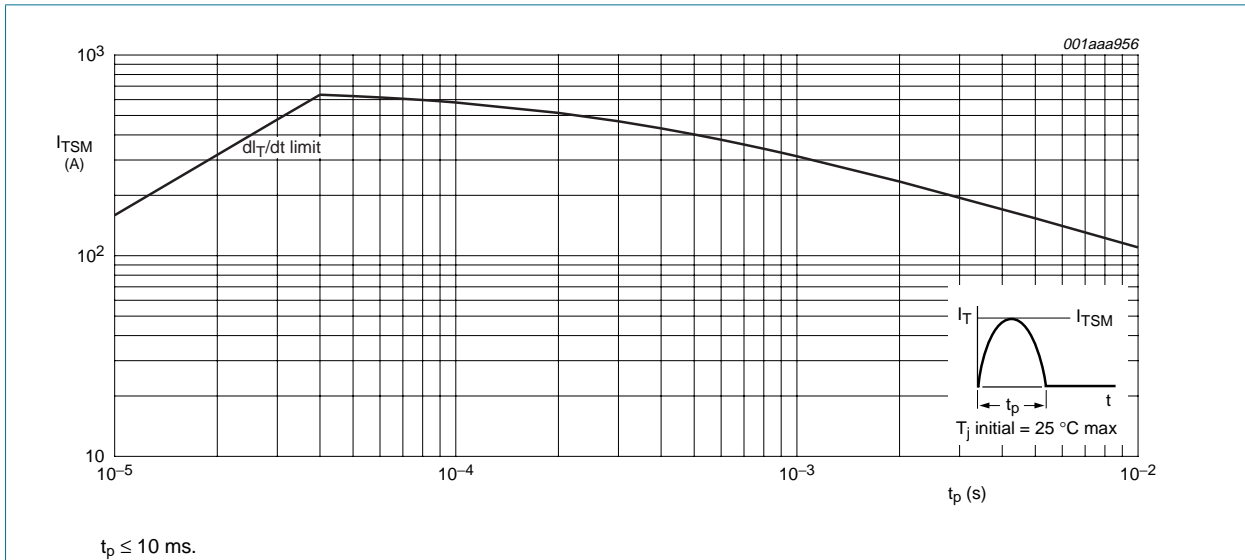


Fig 3. Non-repetitive peak on-state current as a function of pulse width; maximum values.

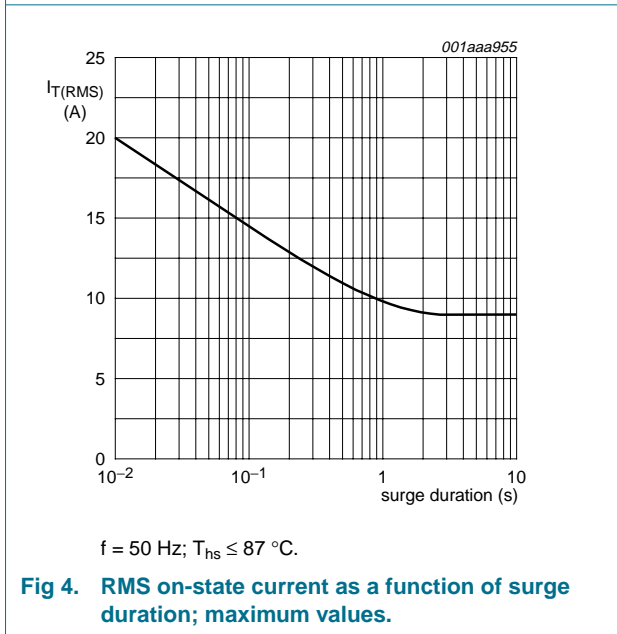


Fig 4. RMS on-state current as a function of surge duration; maximum values.

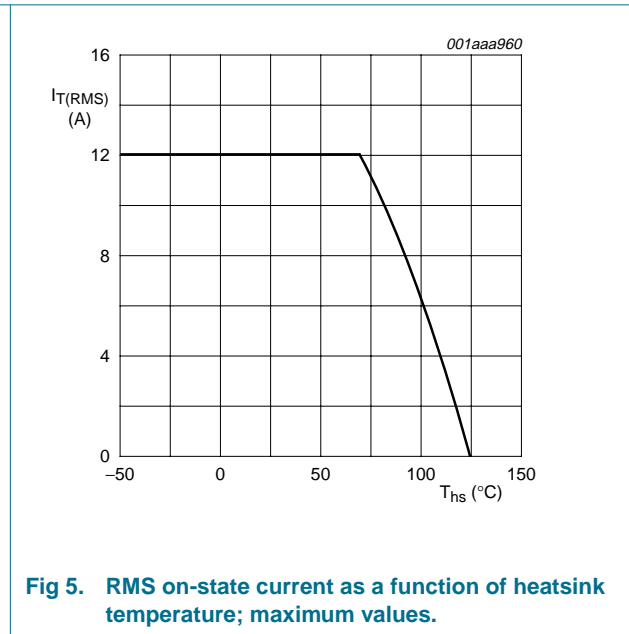
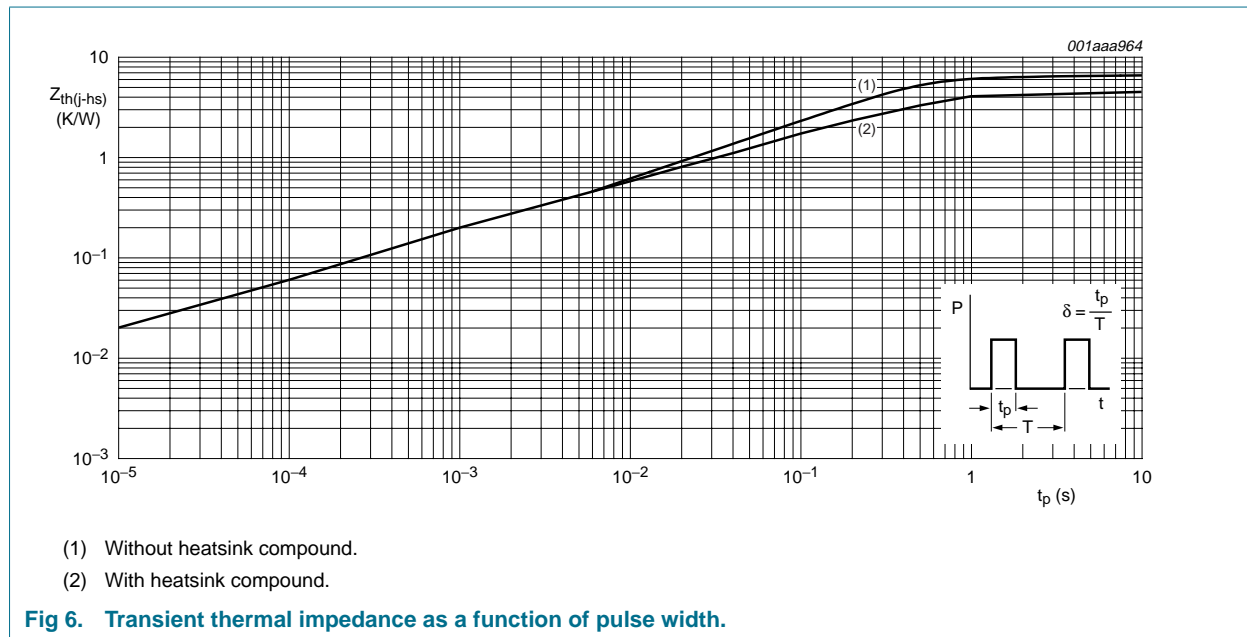


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values.

## 5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Typ	Max	Unit
$R_{th(j-hs)}$	thermal resistance from junction to heatsink	Figure 6 with heatsink compound	-	4.5	K/W
		without heatsink compound	-	6.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	55	-	K/W



## 6. Isolation characteristics

Table 5: Isolation limiting values and characteristics

$T_{hs} = 25^{\circ}C$  unless otherwise specified

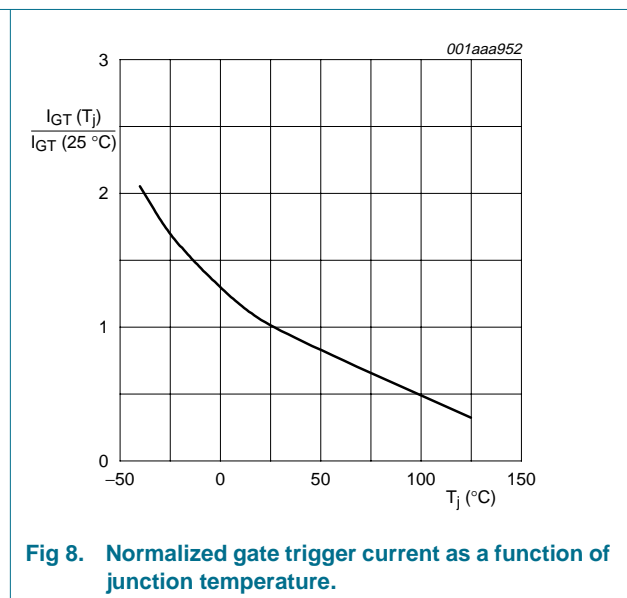
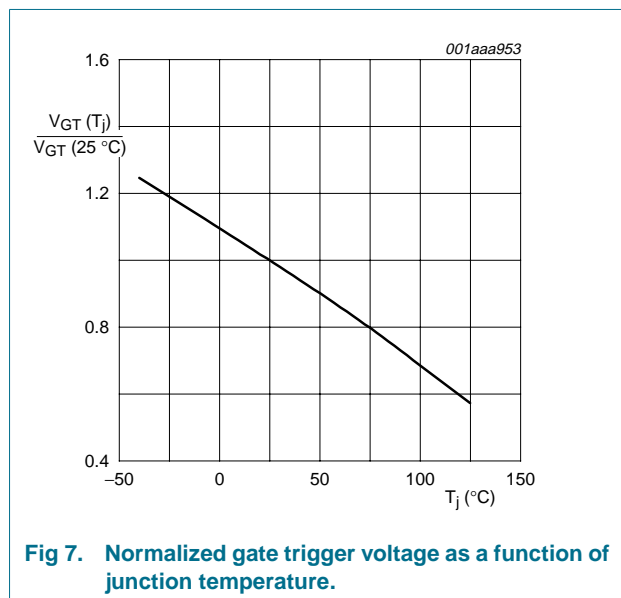
Symbol	Parameter	Conditions	Typ	Max	Unit
$V_{isol}$	RMS isolation voltage from all three terminals to external heatsink	$f = 50$ to $60$ Hz; sinusoidal waveform; R.H. $\leq 65\%$ ; clean and dust free	-	2500	V
$C_{isol}$	capacitance from pin 2 to external heatsink	$f = 1$ MHz	10	-	pF

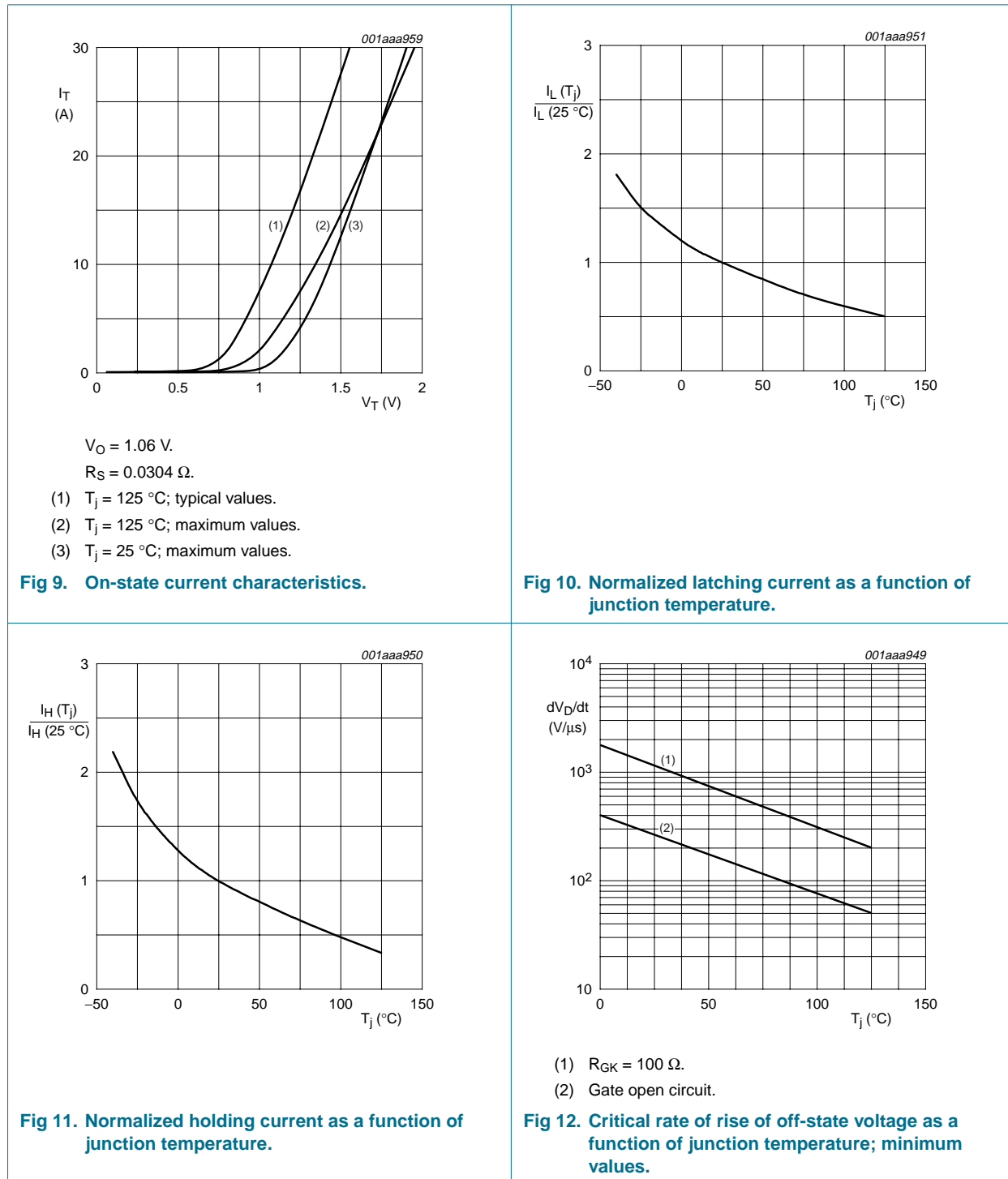
## 7. Characteristics

**Table 6: Characteristics**

$T_j = 25\text{ °C}$  unless otherwise stated

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; <a href="#">Figure 8</a>	-	2	15	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$ ; <a href="#">Figure 10</a>	-	10	40	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$ ; <a href="#">Figure 11</a>	-	7	20	mA
$V_T$	on-state voltage	$I_T = 23\text{ A}$ ; <a href="#">Figure 9</a>	-	1.4	1.75	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; <a href="#">Figure 7</a>	-	0.6	1.5	V
		$V_D = V_{DRM(max)}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ °C}$	0.25	0.4	-	V
$I_D, I_R$	off-state leakage current	$V_D = V_{DRM(max)}$ ; $V_R = V_{RRM(max)}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	critical rate of rise of off-state voltage	$V_{DM} = 67\% V_{DRM(max)}$ ; $T_j = 125\text{ °C}$ ; exponential waveform; <a href="#">Figure 12</a>				
		gate open circuit	50	130	-	V/ $\mu$ s
		$R_{GK} = 100\ \Omega$	200	1000	-	V/ $\mu$ s
$t_{gt}$	gate controlled turn-on time	$I_{TM} = 40\text{ A}$ ; $V_D = V_{DRM(max)}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$	-	2	-	$\mu$ s
$t_q$	circuit commuted turn-on time	$V_D = 67\% V_{DRM(max)}$ ; $T_j = 125\text{ °C}$ ; $I_{TM} = 20\text{ A}$ ; $V_R = 25\text{ V}$ ; $dI_{TM}/dt = 30\text{ A}/\mu\text{s}$ ; $dV_D/dt = 50\text{ V}/\mu\text{s}$ ; $R_{GK} = 100\ \Omega$	-	70	-	$\mu$ s





## 8. Package information

Epoxy meets requirements of UL94 V-0 at  $\frac{1}{8}$  inch.

9. Package outline

Plastic single-ended package; isolated heatsink mounted;  
1 mounting hole; 3 lead TO-220 'full pack'

SOT186A

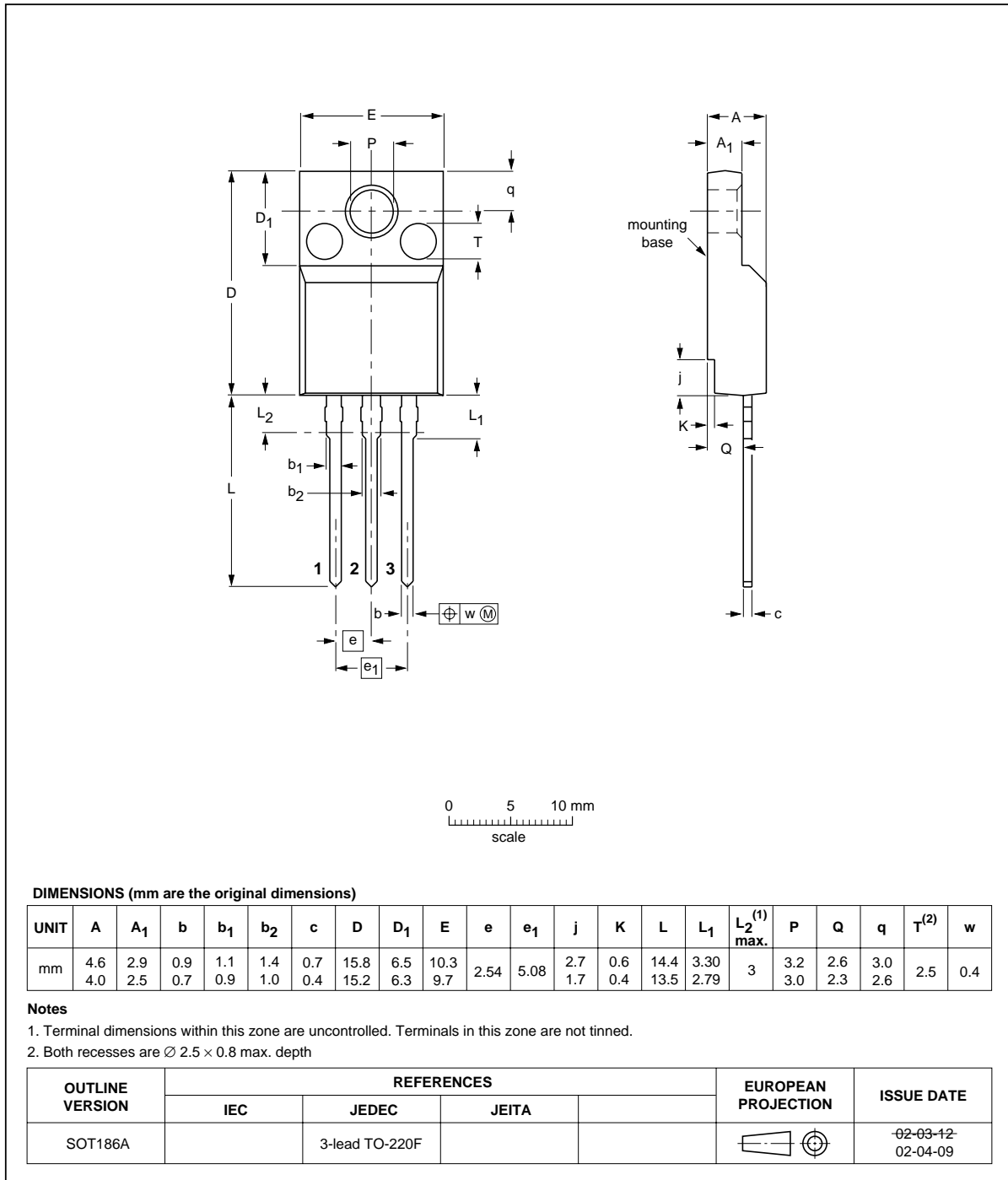


Fig 13. Package outline.



## 10. Revision history

Table 7: Revision history

Document ID	Release date	Data sheet status	Change notice	Order number	Supersedes
BT151X_SERIES_4	20040609	Product specification	-	9397 750 13162	BT151X_SERIES_3
Modifications:	<ul style="list-style-type: none"><li>The format of this specification has be redesigned to comply with Philips Semiconductors' new presentation and information standard</li></ul>				
BT151X_SERIES_3	20030901	Product specification	-	-	BT151X_SERIES_2
BT151X_SERIES_2	19990601	Product specification	-	-	BT151X_SERIES_1
BT151X_SERIES_1	19970901	Product specification	-	-	-

## 11. 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.

## 12. 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.

**Application information** — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

## 13. Disclaimers

**Life support** — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

**Right to make changes** — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

## 14. Contact information

For additional information, please visit: <http://www.semiconductors.philips.com>

For sales office addresses, send an email to: [sales.addresses@www.semiconductors.philips.com](mailto:sales.addresses@www.semiconductors.philips.com)

## 15. Contents

---

<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description. . . . .	1
1.2	Features . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data. . . . .	1
<b>2</b>	<b>Pinning information</b> . . . . .	<b>1</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Limiting values</b> . . . . .	<b>2</b>
<b>5</b>	<b>Thermal characteristics</b> . . . . .	<b>5</b>
<b>6</b>	<b>Isolation characteristics</b> . . . . .	<b>5</b>
<b>7</b>	<b>Characteristics</b> . . . . .	<b>6</b>
<b>8</b>	<b>Package information</b> . . . . .	<b>7</b>
<b>9</b>	<b>Package outline</b> . . . . .	<b>8</b>
<b>10</b>	<b>Revision history</b> . . . . .	<b>9</b>
<b>11</b>	<b>Data sheet status</b> . . . . .	<b>10</b>
<b>12</b>	<b>Definitions</b> . . . . .	<b>10</b>
<b>13</b>	<b>Disclaimers</b> . . . . .	<b>10</b>
<b>14</b>	<b>Contact information</b> . . . . .	<b>10</b>



© Koninklijke Philips Electronics N.V. 2004

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Date of release: 9 June 2004  
Document order number: 9397 750 13162

Published in The Netherlands