

# PBSS4160V

60 V, 1 A NPN low  $V_{CEsat}$  (BISS) transistor

Rev. 02 — 31 January 2005

Product data sheet

## 1. Product profile

### 1.1 General description

Low  $V_{CEsat}$  (BISS) NPN transistor in a SOT666 plastic package.

PNP complement: PBSS5160V.

### 1.2 Features

- Low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability  $I_C$  and  $I_{CM}$
- High efficiency, reduces heat generation
- Reduces printed-circuit board area required
- Cost effective replacement for medium power transistor BCP55 and BCX55

### 1.3 Applications

- Major application segments:
  - ◆ Automotive
  - ◆ Telecom infrastructure
  - ◆ Industrial
- Power management:
  - ◆ DC-to-DC conversion
  - ◆ Supply line switching
- Peripheral driver
  - ◆ Driver in low supply voltage applications (e.g. lamps and LEDs)
  - ◆ Inductive load driver (e.g. relays, buzzers and motors)

### 1.4 Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	60	V
$I_C$	collector current (DC)		[1]	-	1	A
$I_{CM}$	peak collector current	$t = 1$ ms or limited by $T_{j(max)}$	-	-	2	A
$R_{CEsat}$	equivalent on-resistance	$I_C = 1$ A; $I_B = 100$ mA	[2]	200	250	m $\Omega$

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, 1 cm<sup>2</sup> collector mounting pad.

[2] Pulse test:  $t_p \leq 300$   $\mu$ s;  $\delta \leq 0.02$ .

# PHILIPS



## 2. Pinning information

Table 2: Discrete pinning

Pin	Description	Simplified outline	Symbol
1, 2, 5, 6	collector	<p style="text-align: center;">SOT666</p>	<p style="text-align: center;">sym014</p>
3	base		
4	emitter		

## 3. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
PBSS4160V	-	plastic surface mounted package; 6 leads	SOT666

## 4. Marking

Table 4: Marking codes

Type number	Marking code
PBSS4160V	41

## 5. Limiting values

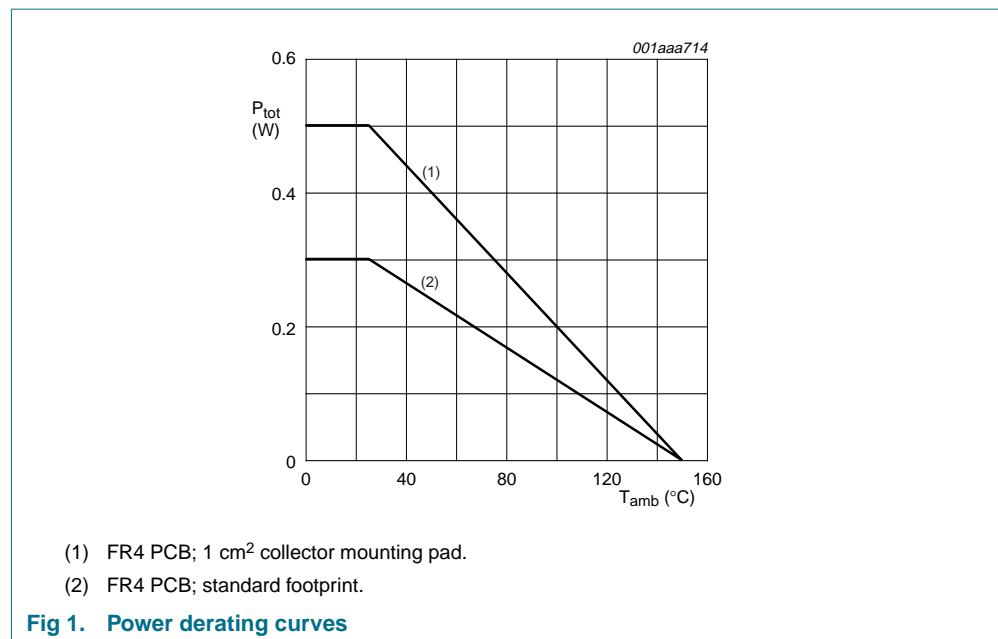
**Table 5: Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	80	V
$V_{CEO}$	collector-emitter voltage	open base	-	60	V
$V_{EBO}$	emitter-base voltage	open collector	-	5	V
$I_C$	collector current (DC)		[1] -	0.9	A
			[2]	1	
$I_{CM}$	peak collector current	$t = 1$ ms or limited by $T_{j(max)}$	-	2	A
$I_B$	base current (DC)		-	300	mA
$I_{BM}$	peak base current	$t_p \leq 300$ $\mu$ s; $\delta \leq 0.02$	-	1	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1] -	300	mW
			[2] -	500	mW
$T_j$	junction temperature		-	150	°C
$T_{amb}$	ambient temperature		-65	+150	°C
$T_{stg}$	storage temperature		-65	+150	°C

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, 1 cm<sup>2</sup> collector mounting pad.



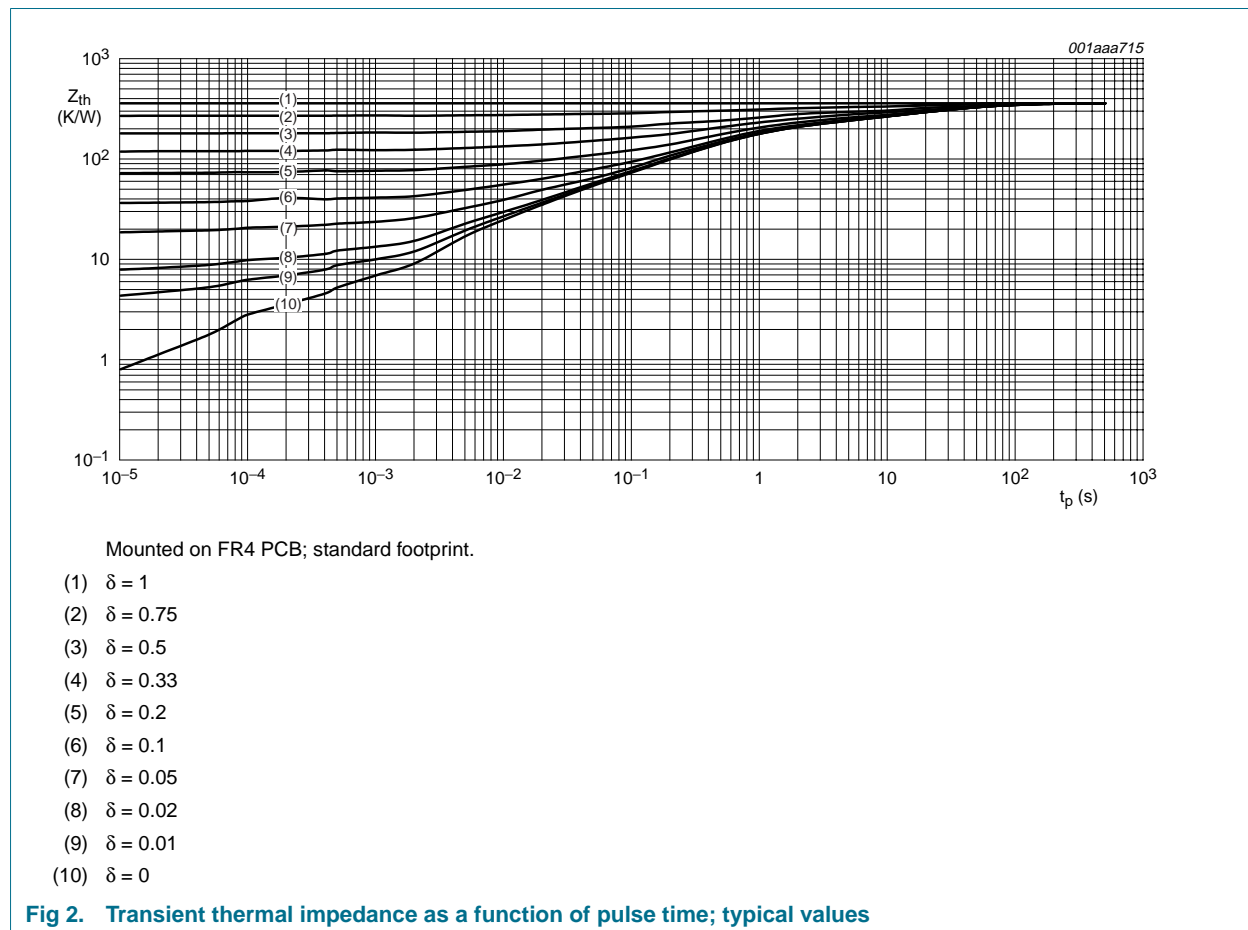
## 6. Thermal characteristics

**Table 6: Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	415 K/W
			[2]	-	-	250 K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, 1 cm<sup>2</sup> collector mounting pad.



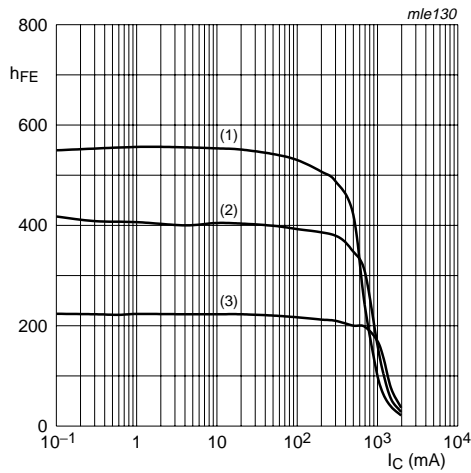
## 7. Characteristics

Table 7: Characteristics

 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

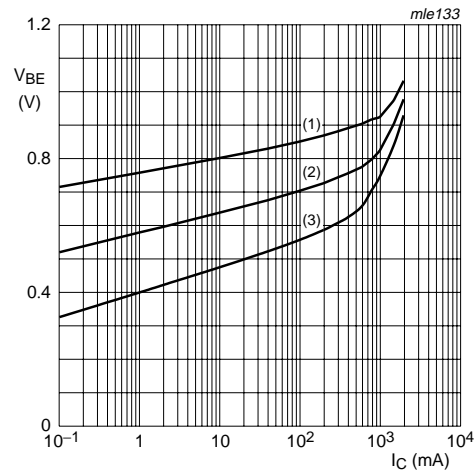
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 60\text{ V}; V_{BE} = 0\text{ V}$	-	-	100	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 1\text{ mA}$	250	400	-	
		$V_{CE} = 5\text{ V}; I_C = 500\text{ mA}$	[1] 200	350	-	
		$V_{CE} = 5\text{ V}; I_C = 1\text{ A}$	[1] 100	150	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 100\text{ mA}; I_B = 1\text{ mA}$	-	90	110	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	-	110	140	mV
		$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1] -	200	250	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 50\text{ mA}$	-	0.95	1.1	V
$R_{CEsat}$	equivalent on-resistance	$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1] -	200	250	$\text{m}\Omega$
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = 5\text{ V}; I_C = 1\text{ A}$	-	0.82	0.9	V
$t_d$	delay time	$V_{CC} = 10\text{ V}; I_C = 0.5\text{ A}; I_{Bon} = 25\text{ mA}; I_{Boff} = -25\text{ mA}$	-	11	-	ns
$t_r$	rise time		-	78	-	ns
$t_{on}$	turn-on time		-	90	-	ns
$t_s$	storage time		-	340	-	ns
$t_f$	fall time		-	160	-	ns
$t_{off}$	turn-off time		-	500	-	ns
$f_T$	transition frequency	$I_C = 50\text{ mA}; V_{CE} = 10\text{ V}; f = 100\text{ MHz}$	150	220	-	MHz
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$	-	5.5	10	pF

[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$ .



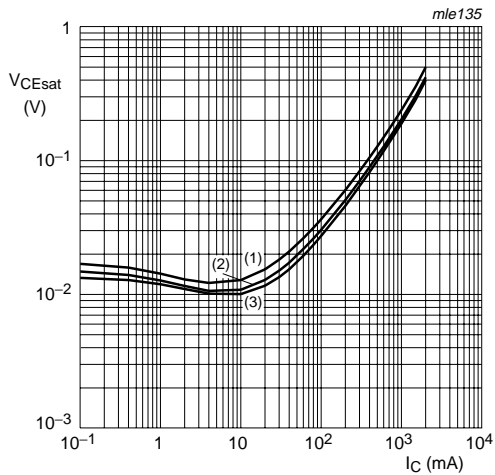
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 3. DC current gain as a function of collector current; typical values**



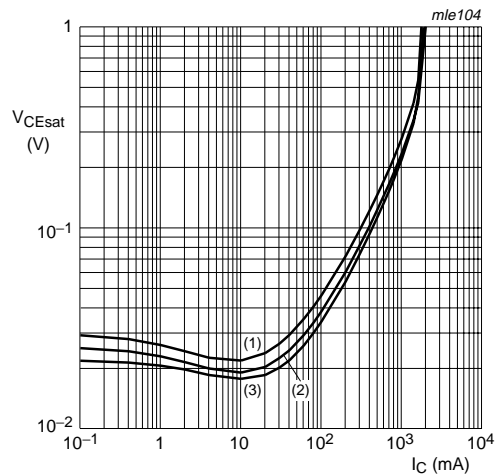
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 4. Base-emitter voltage as a function of collector current; typical values**



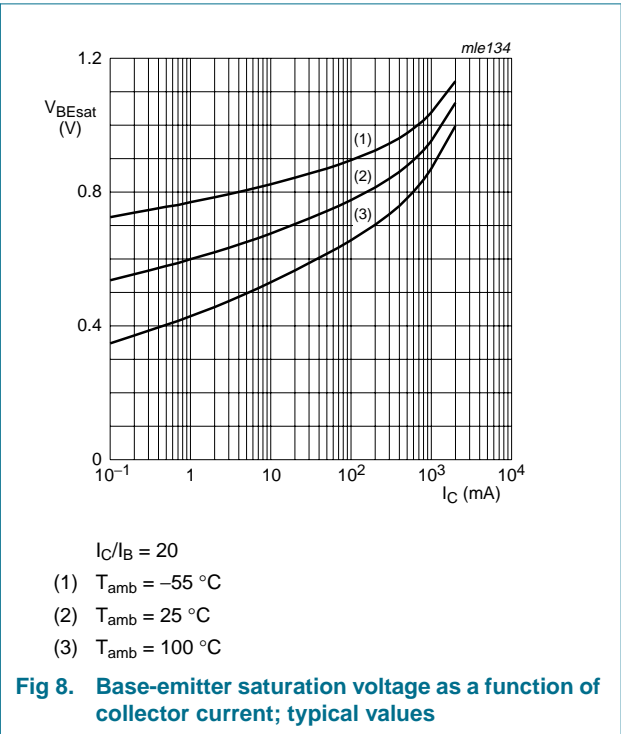
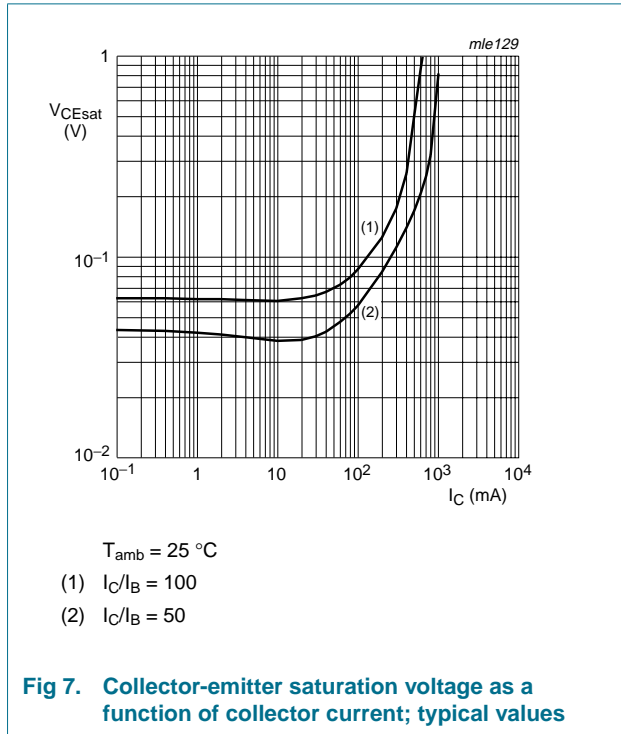
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

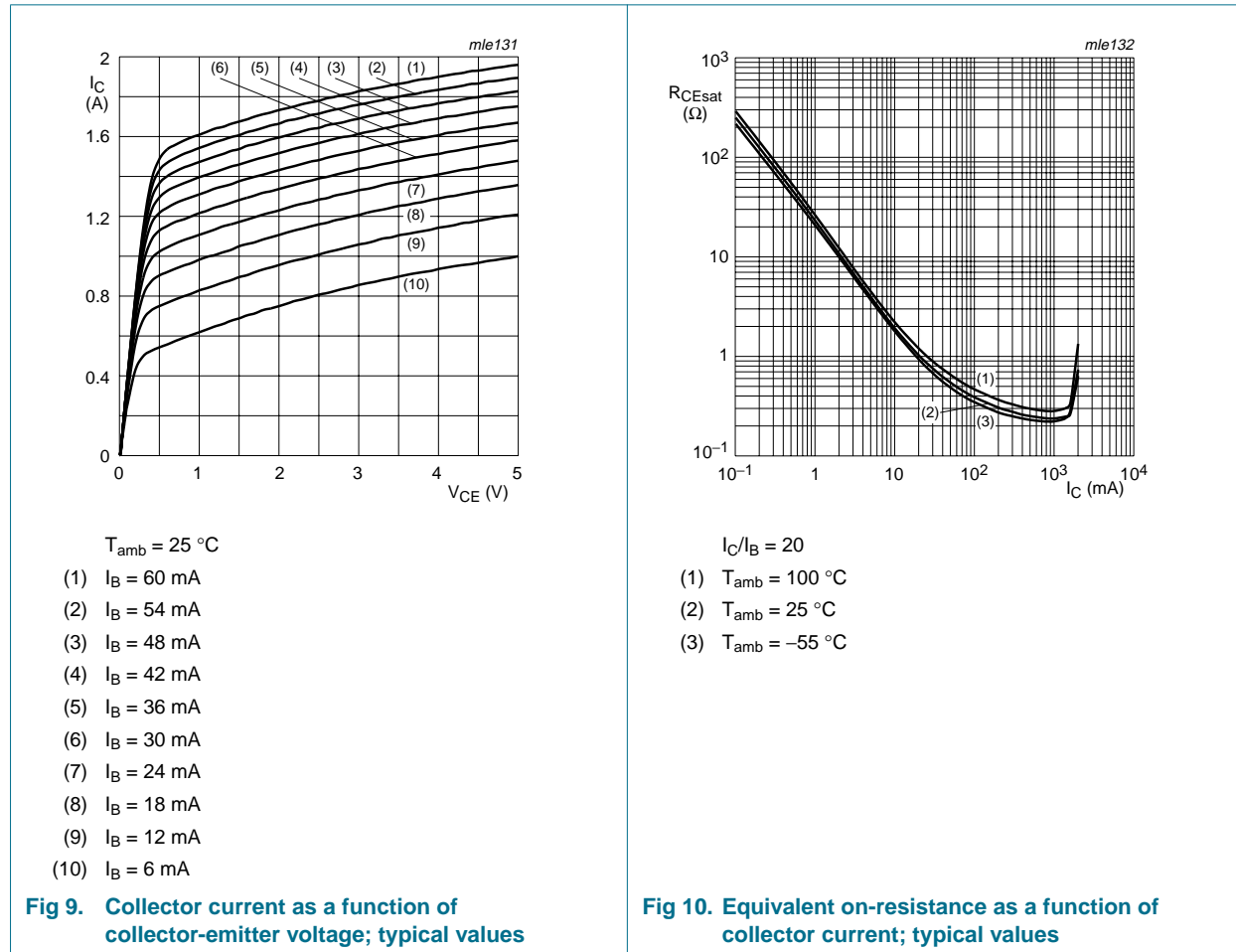
**Fig 5. Collector-emitter saturation voltage as a function of collector current; typical values**



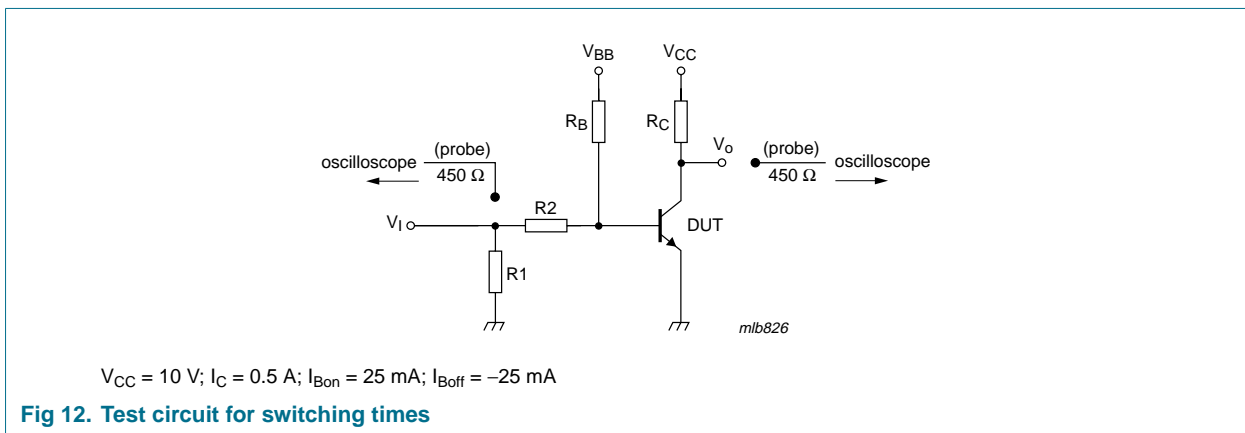
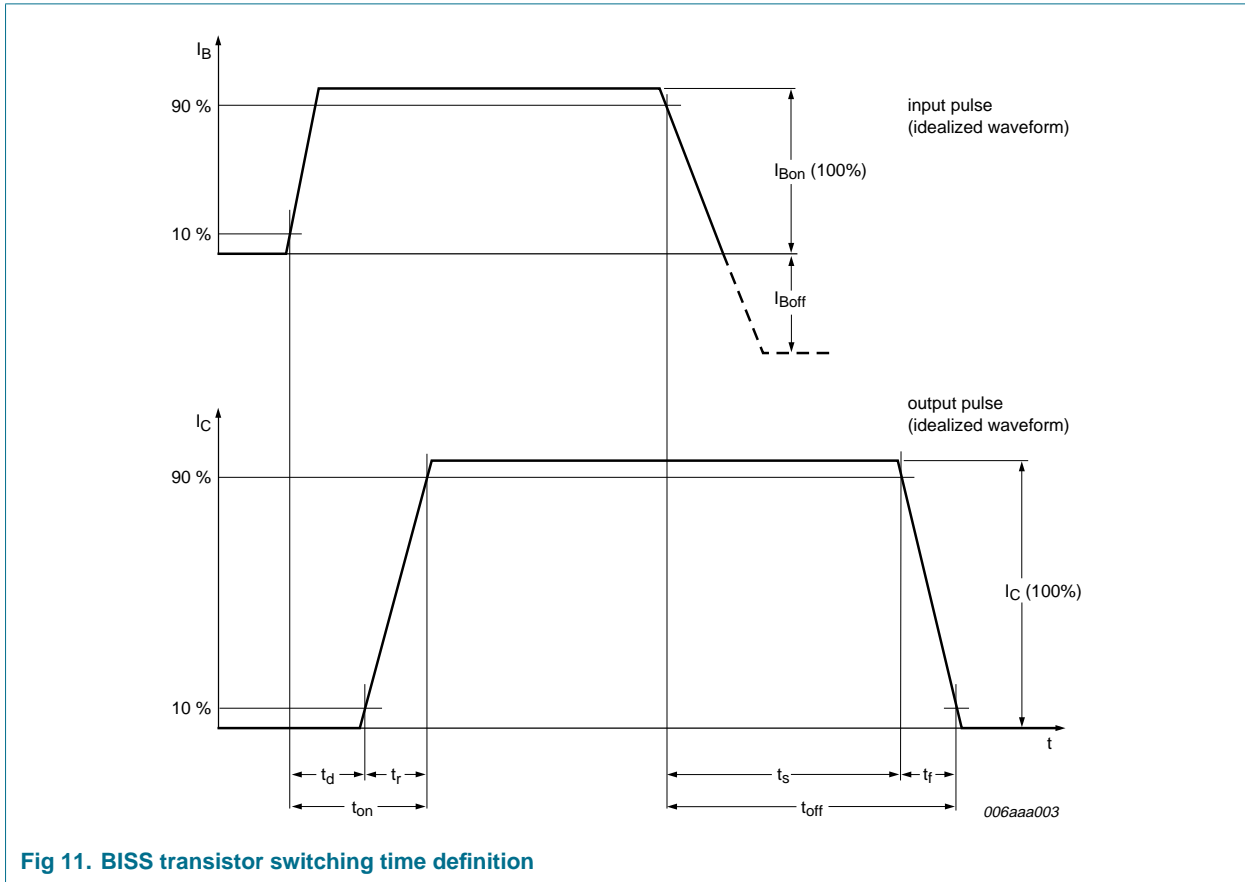
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 6. Collector-emitter saturation voltage as a function of collector current; typical values**









8. Package outline

Plastic surface mounted package; 6 leads

SOT666

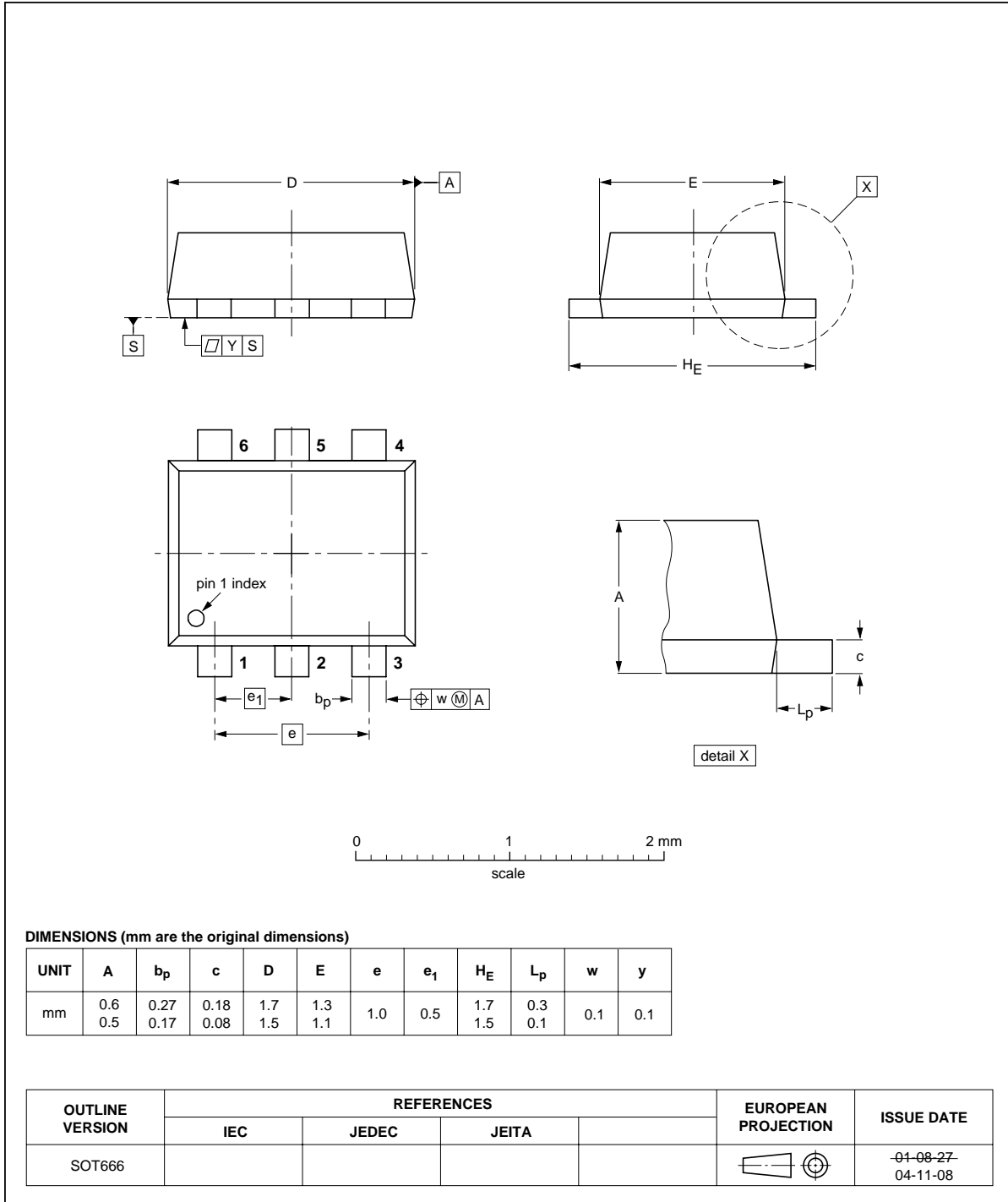


Fig 13. Package outline SOT666



## 9. Packing information

**Table 8: Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code. [\[1\]](#)

Type number	Package	Description	Packing quantity
			4000
PBSS4160V	SOT666	4 mm pitch, 8 mm tape and reel	-115

[1] For further information and the availability of packing methods, see [Section 14](#).



## 10. Revision history

Table 9: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PBSS4160V_2	20050131	Product data sheet	-	9397 750 14359	PBSS4160V_1
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Table 7</a> Switching time parameters <math>t_d</math>, <math>t_r</math>, <math>t_{on}</math>, <math>t_s</math>, <math>t_f</math> and <math>t_{off}</math> added</li> <li>• <a href="#">Figure 11</a> BISS transistor switching time definition added</li> <li>• <a href="#">Figure 12</a> Test circuit for switching times added</li> <li>• <a href="#">Section 9</a> Packing information added</li> </ul>				
PBSS4160V_1	20040423	Objective data sheet	-	9397 750 12884	-

## 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>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Marking</b> . . . . .	<b>2</b>
<b>5</b>	<b>Limiting values</b> . . . . .	<b>3</b>
<b>6</b>	<b>Thermal characteristics</b> . . . . .	<b>4</b>
<b>7</b>	<b>Characteristics</b> . . . . .	<b>5</b>
<b>8</b>	<b>Package outline</b> . . . . .	<b>10</b>
<b>9</b>	<b>Packing information</b> . . . . .	<b>11</b>
<b>10</b>	<b>Revision history</b> . . . . .	<b>12</b>
<b>11</b>	<b>Data sheet status</b> . . . . .	<b>13</b>
<b>12</b>	<b>Definitions</b> . . . . .	<b>13</b>
<b>13</b>	<b>Disclaimers</b> . . . . .	<b>13</b>
<b>14</b>	<b>Contact information</b> . . . . .	<b>13</b>



© Koninklijke Philips Electronics N.V. 2005

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: 31 January 2005  
Document number: 9397 750 14359

Published in The Netherlands