

# 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 $\Omega$

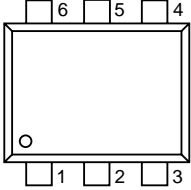
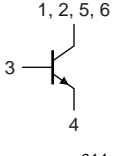
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, 1 cm<sup>2</sup> collector mounting pad.

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

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## 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

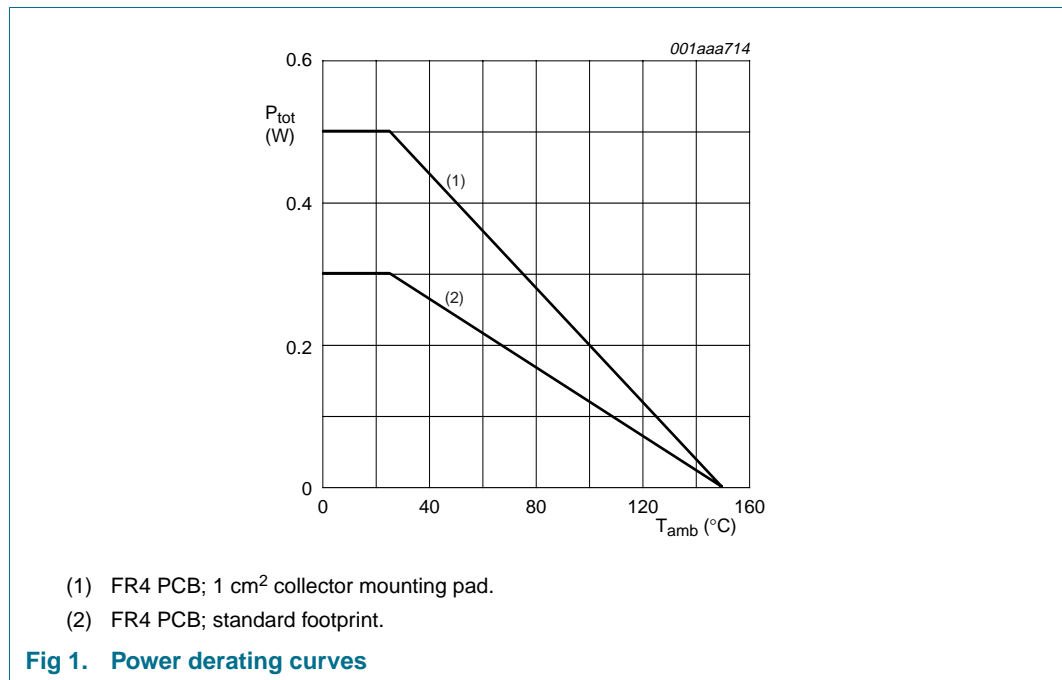
**Table 5: Limiting values**

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] - [2]	0.9 1	A
$I_{CM}$	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] - [2] -	300 500	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.



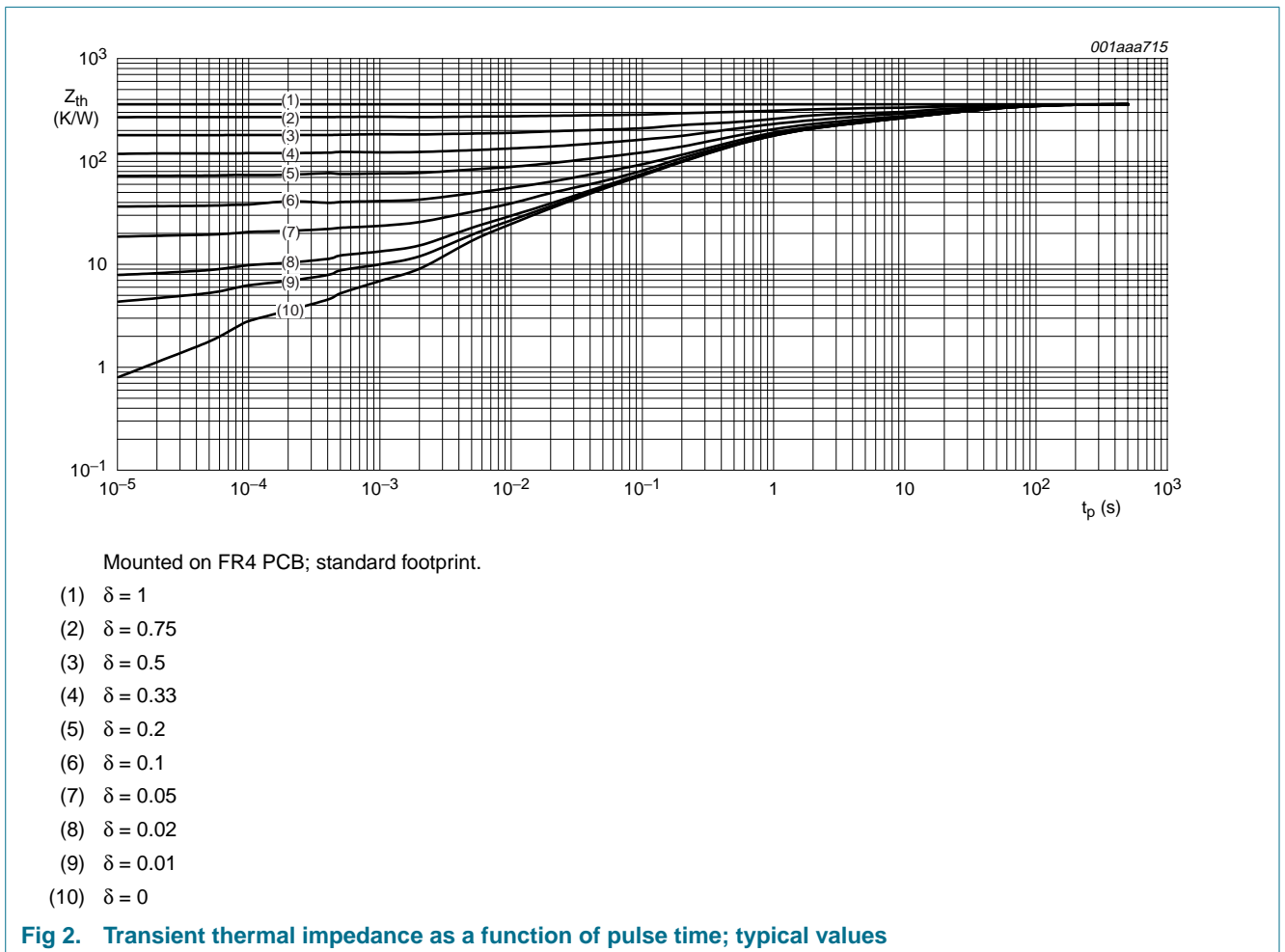
## 6. Thermal characteristics

**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.

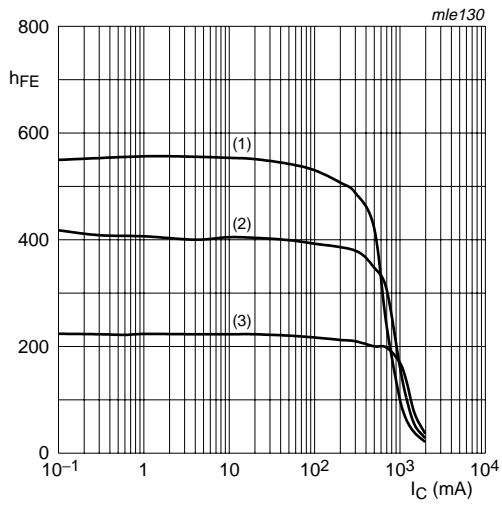


## 7. Characteristics

**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	

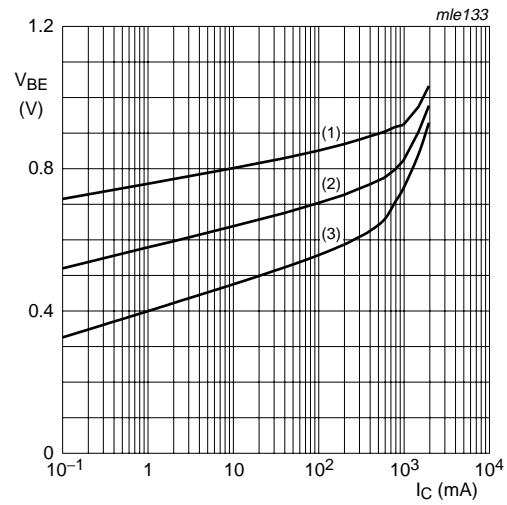
[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$ .



$V_{CE} = 5\text{ V}$

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

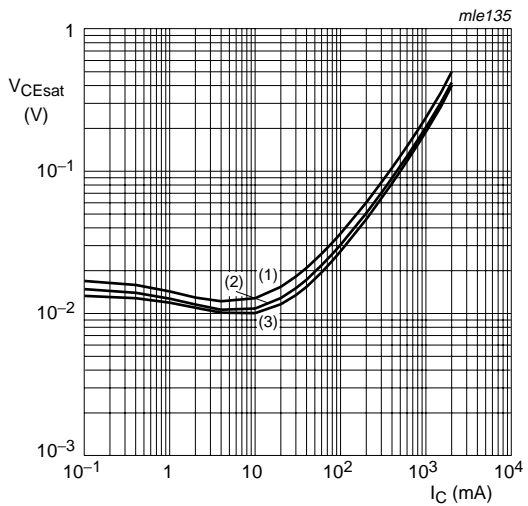
**Fig 3. DC current gain as a function of collector current; typical values**



$V_{CE} = 5\text{ V}$

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

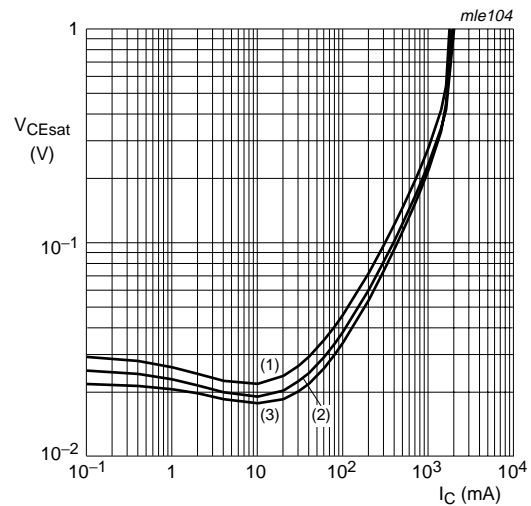
**Fig 4. Base-emitter voltage as a function of collector current; typical values**



$I_C/I_B = 10$

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

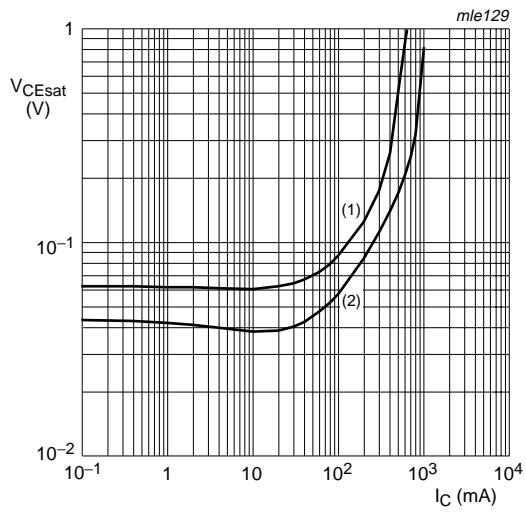
**Fig 5. Collector-emitter saturation voltage as a function of collector current; typical values**



$I_C/I_B = 20$

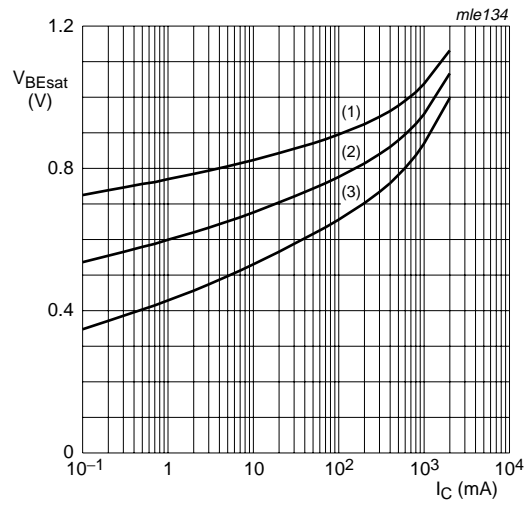
- (1)  $T_{amb} = 100\text{ °C}$
- (2)  $T_{amb} = 25\text{ °C}$
- (3)  $T_{amb} = -55\text{ °C}$

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



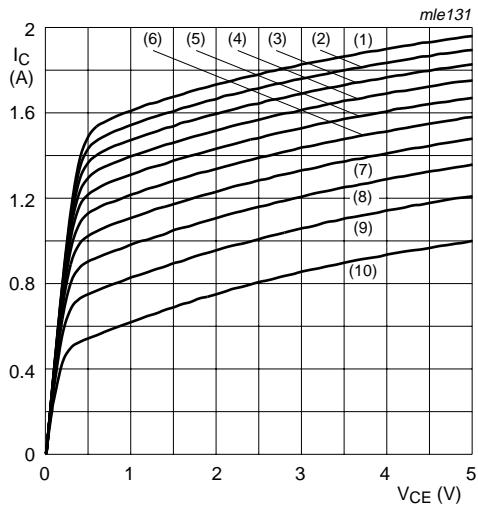
$T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$

**Fig 7. Collector-emitter saturation voltage as a function of collector current; typical values**



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

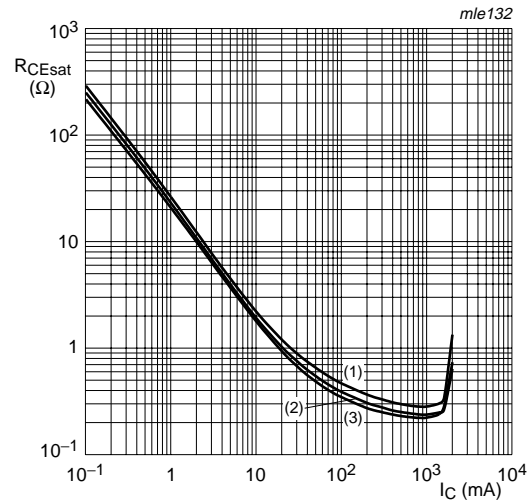
**Fig 8. Base-emitter saturation voltage as a function of collector current; typical values**



$T_{amb} = 25\text{ }^\circ\text{C}$

- (1)  $I_B = 60\text{ mA}$
- (2)  $I_B = 54\text{ mA}$
- (3)  $I_B = 48\text{ mA}$
- (4)  $I_B = 42\text{ mA}$
- (5)  $I_B = 36\text{ mA}$
- (6)  $I_B = 30\text{ mA}$
- (7)  $I_B = 24\text{ mA}$
- (8)  $I_B = 18\text{ mA}$
- (9)  $I_B = 12\text{ mA}$
- (10)  $I_B = 6\text{ mA}$

**Fig 9. Collector current as a function of collector-emitter voltage; typical values**

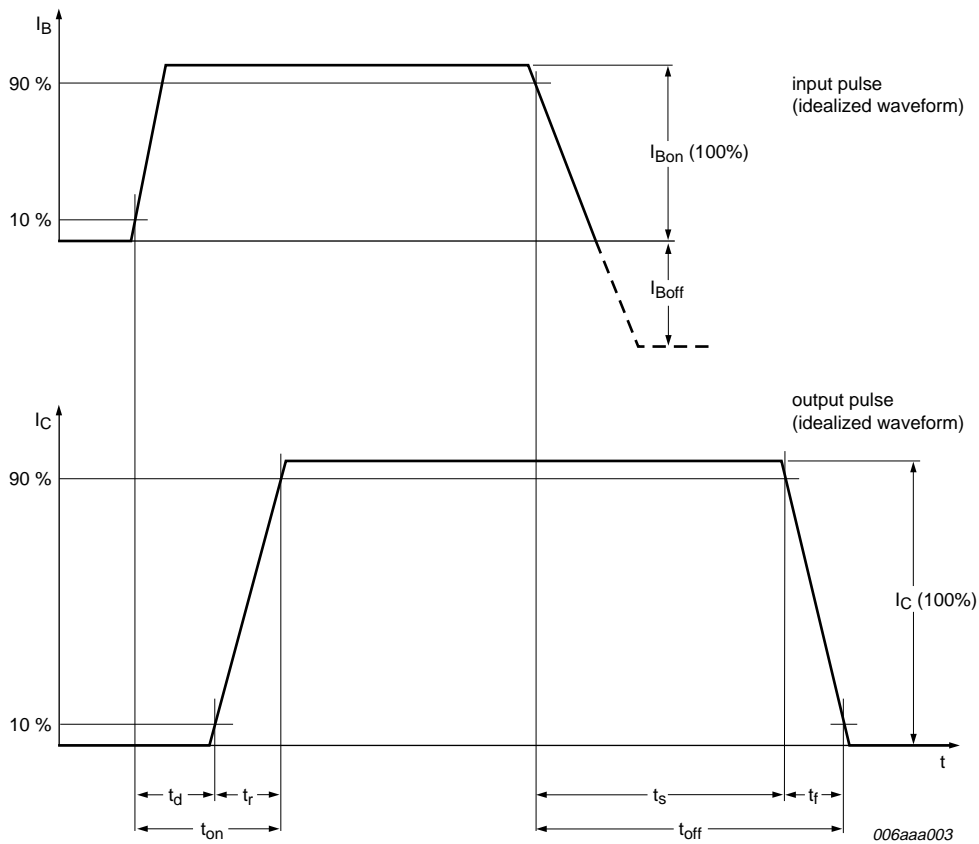


$I_C/I_B = 20$

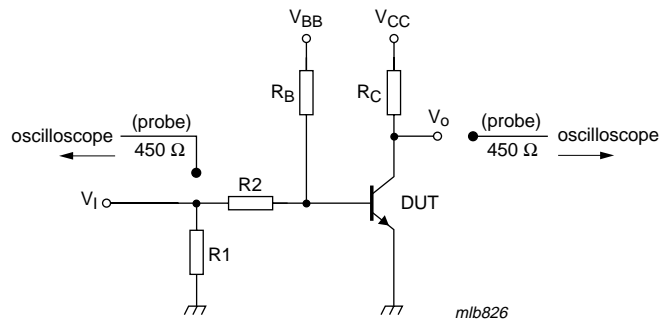
- (1)  $T_{amb} = 100\text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25\text{ }^\circ\text{C}$
- (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

**Fig 10. Equivalent on-resistance as a function of collector current; typical values**





**Fig 11. BISS transistor switching time definition**



$V_{CC} = 10\text{ V}$ ;  $I_C = 0.5\text{ A}$ ;  $I_{Bon} = 25\text{ mA}$ ;  $I_{Boff} = -25\text{ mA}$

**Fig 12. Test circuit for switching times**

8. Package outline

Plastic surface mounted package; 6 leads

SOT666

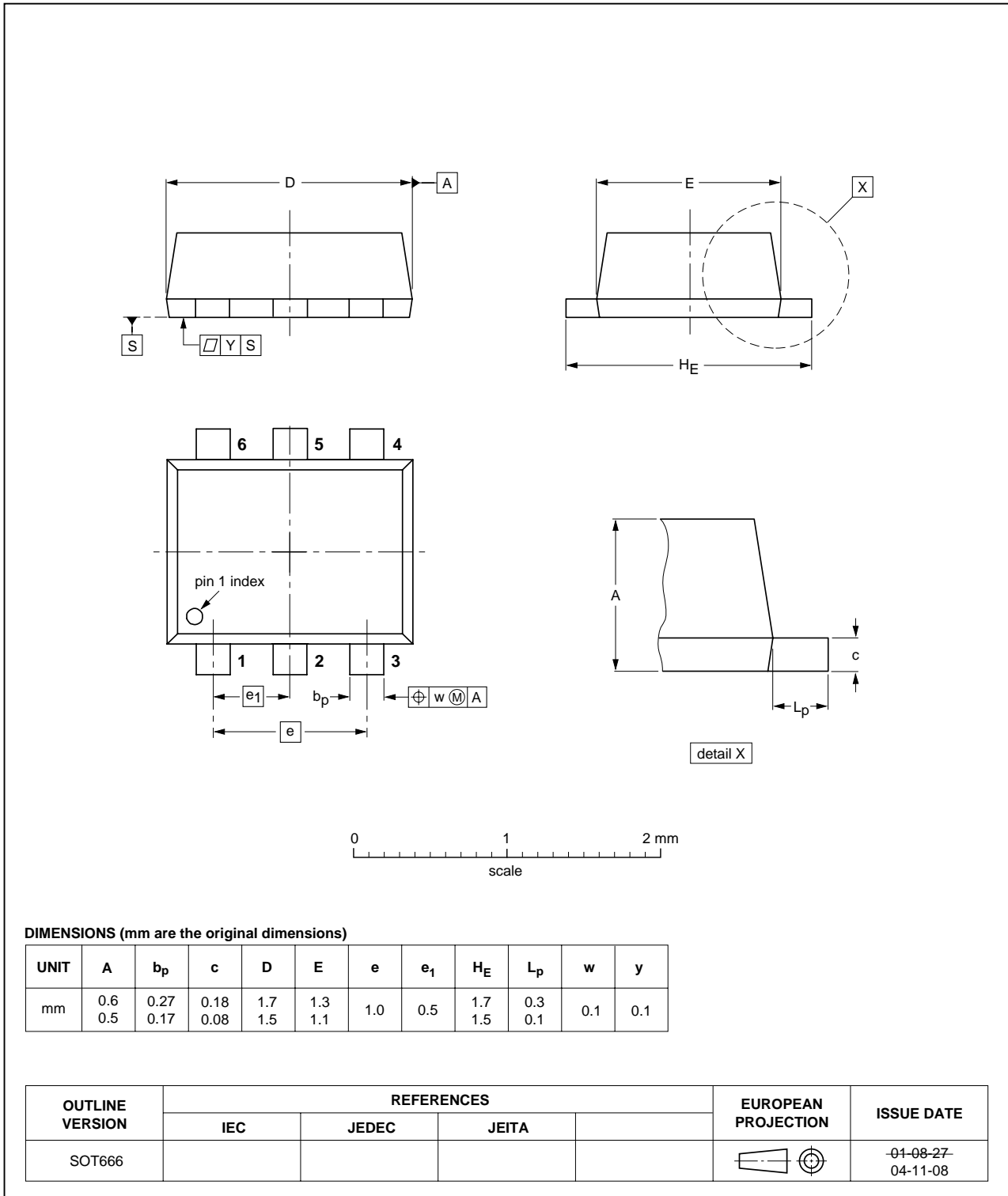


Fig 13. Package outline SOT666

## 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
			<b>4000</b>
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 <sup>[1]</sup>	Product status <sup>[2]</sup> <sup>[3]</sup>	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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**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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