

# PBSS4160V

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

Rev. 03 — 11 December 2009

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 Printed-Circuit Board (PCB), single-sided copper, tin-plated, 1 cm<sup>2</sup> collector mounting pad.

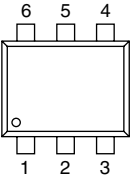
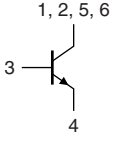
[2] Pulse test:  $t_p \leq 300$   $\mu$ s;  $\delta \leq 0.02$ .



founded by Philips

## 2. Pinning information

Table 2. Discrete pinning

Pin	Description	Simplified outline	Symbol
1, 2, 5, 6	collector		 sym014
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

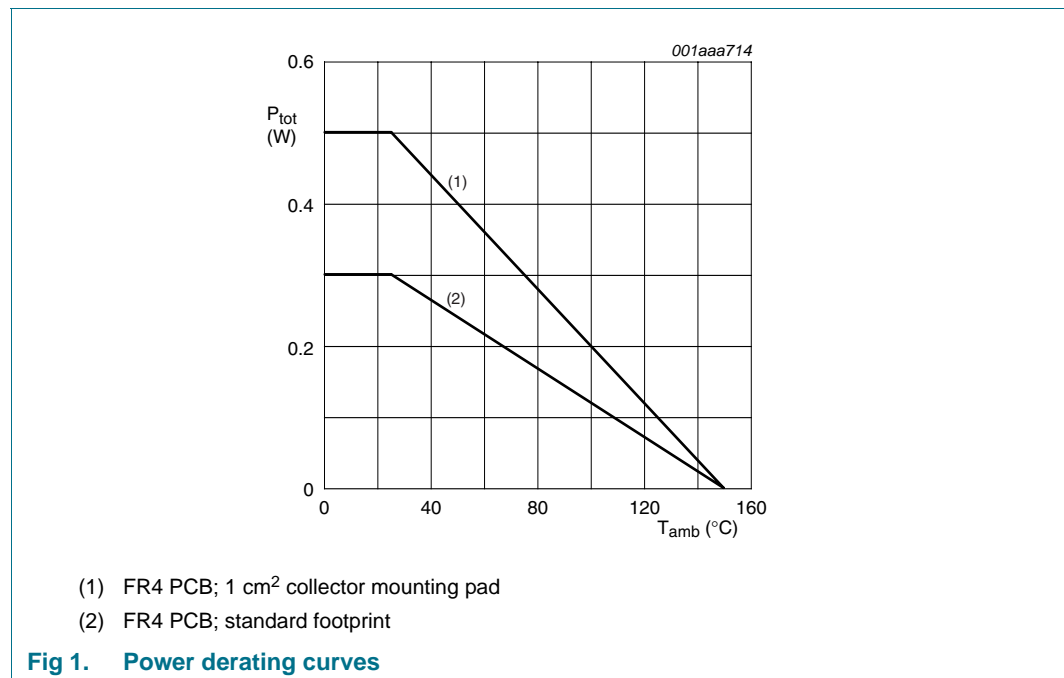
**Table 5. Limiting values**

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	$t = 1 \text{ ms}$ or limited by $T_{j(max)}$	-	2	A
$I_B$	base current (DC)		-	300	mA
$I_{BM}$	peak base current	$t_p \leq 300 \mu\text{s}$ ; $\delta \leq 0.02$	-	1	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25 \text{ }^\circ\text{C}$	[1] -	300	mW
			[2] -	500	mW
$T_j$	junction temperature		-	150	$^\circ\text{C}$
$T_{amb}$	ambient temperature		-65	+150	$^\circ\text{C}$
$T_{stg}$	storage temperature		-65	+150	$^\circ\text{C}$

[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.



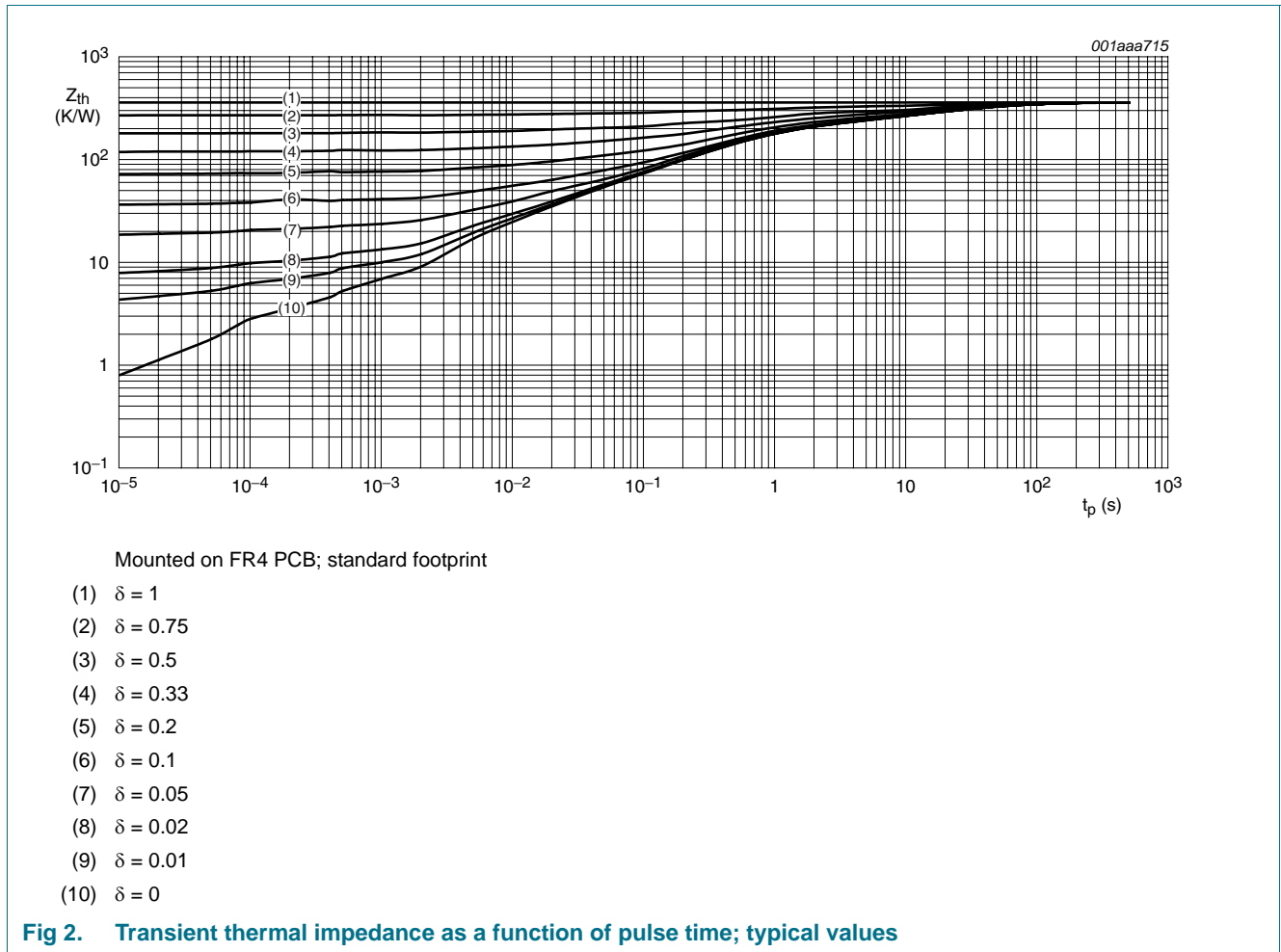
## 6. Thermal characteristics

**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.



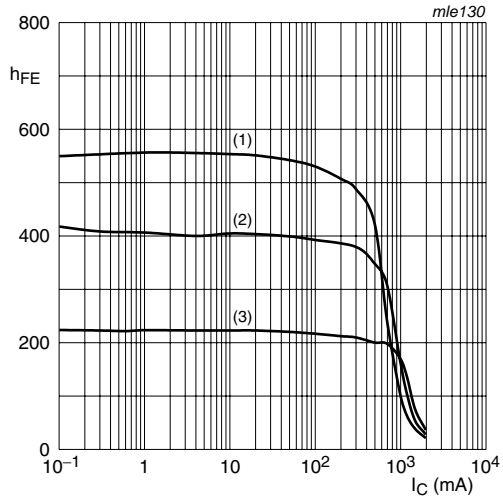
## 7. Characteristics

**Table 7. Characteristics**

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

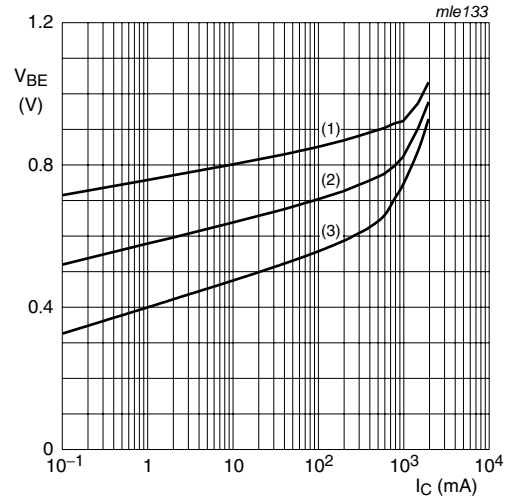
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60\text{ V}; I_E = 0\text{ A}$	-	-	100	nA	
		$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	$\mu\text{A}$	
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 60\text{ V}; V_{BE} = 0\text{ V}$	-	-	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:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$ .



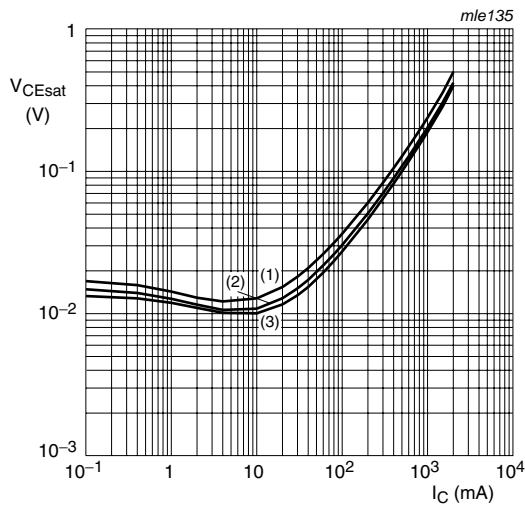
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



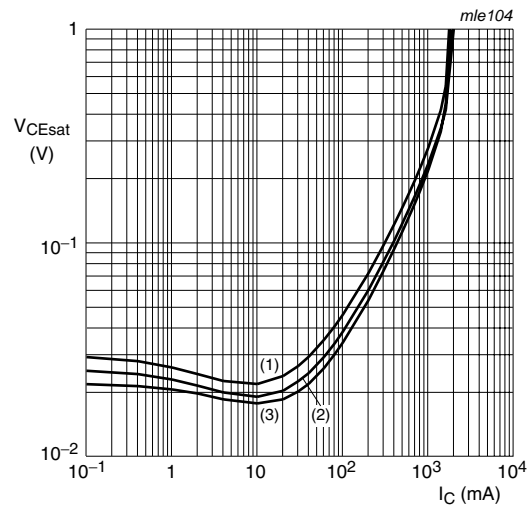
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



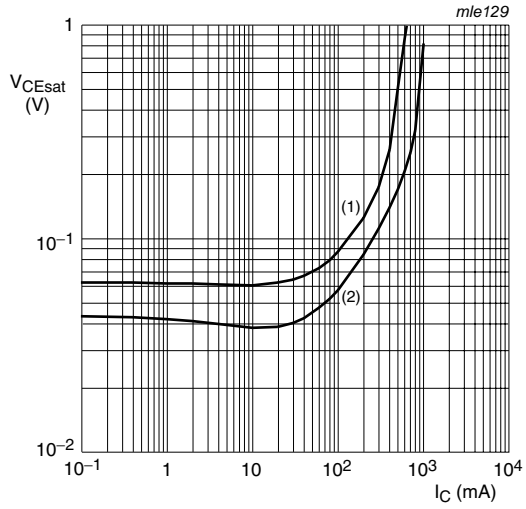
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



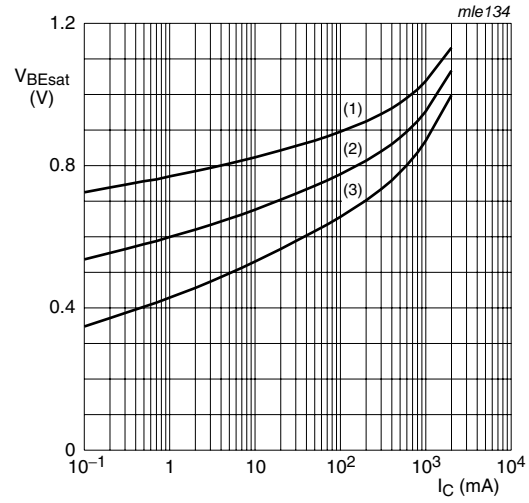
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



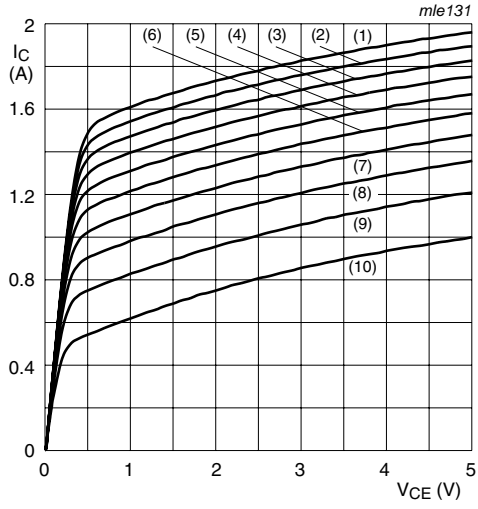
$T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$

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



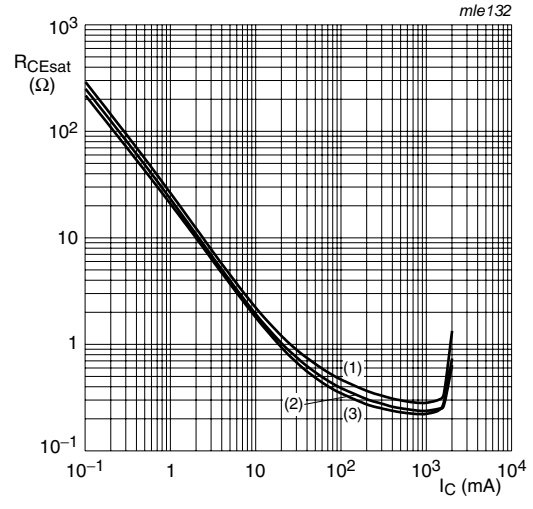
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**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)  $I_B = 6\text{ mA}$

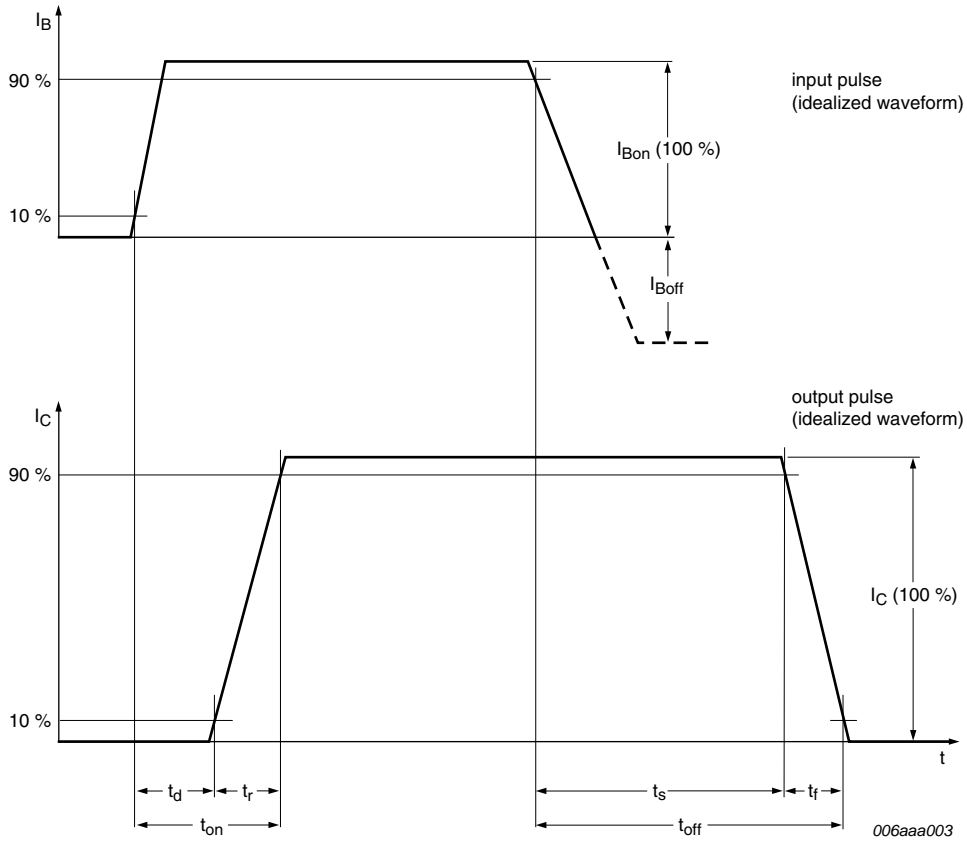
**Fig 9. Collector current as a function of collector-emitter voltage; typical values**



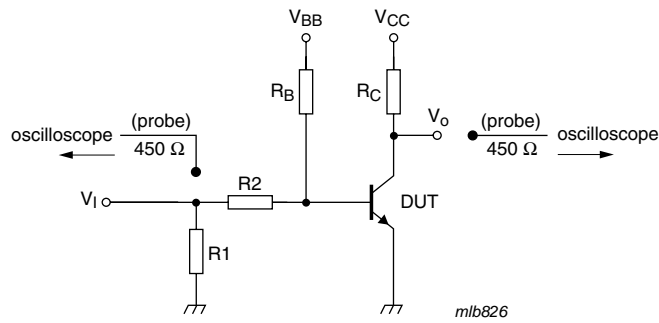
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ }^\circ\text{C}$
  - (2)  $T_{amb} = 25\text{ }^\circ\text{C}$
  - (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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





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



$V_{CC} = 10\text{ V}$ ;  $I_C = 0.5\text{ A}$ ;  $I_{B\text{on}} = 25\text{ mA}$ ;  $I_{B\text{off}} = -25\text{ mA}$

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

## 8. Package outline

Plastic surface-mounted package; 6 leads

SOT666

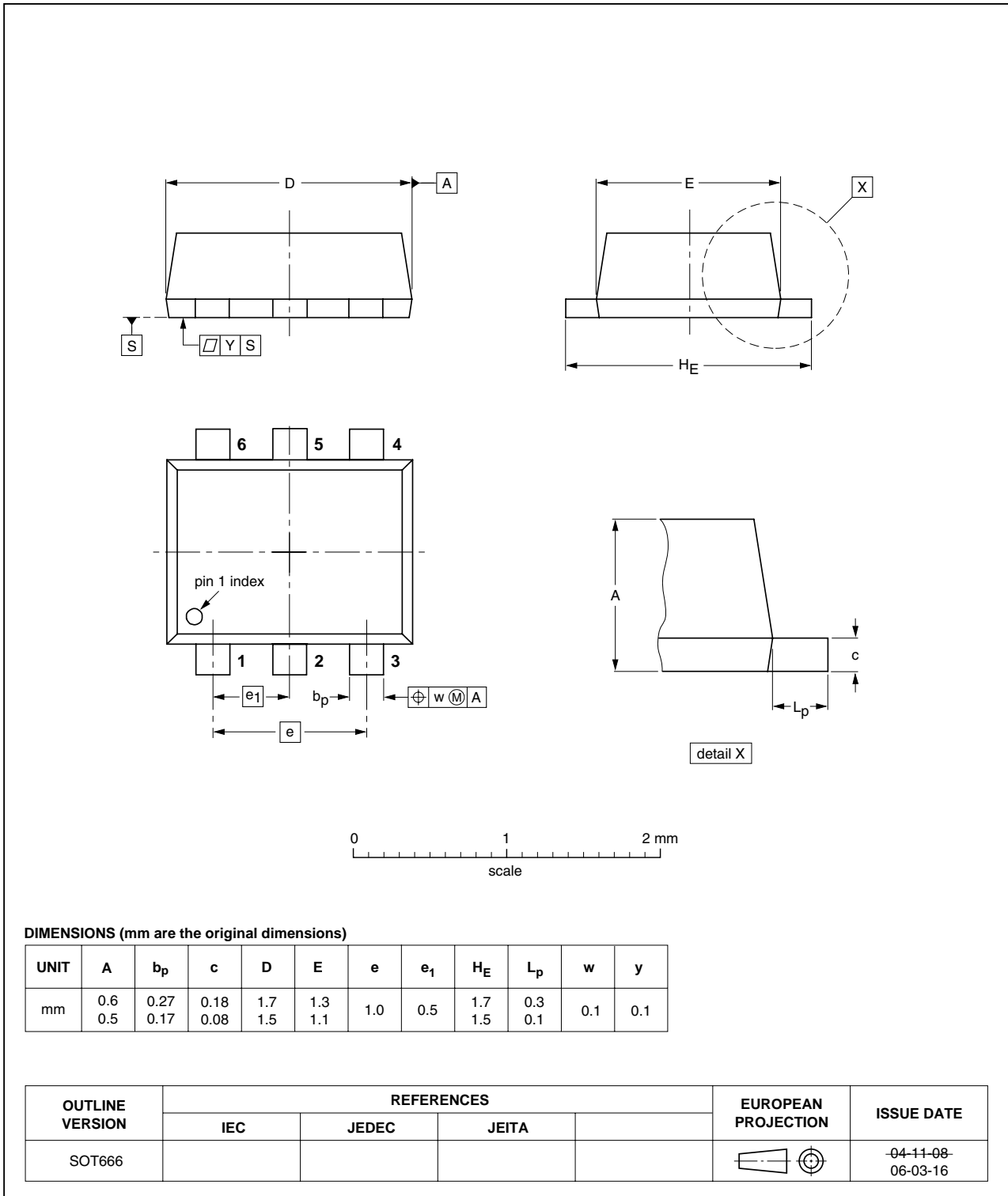


Fig 13. Package outline SOT666

## 9. Packing information

**Table 8. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

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 12](#).

## 10. Revision history

**Table 9. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4160V_3	20091211	Product data sheet	-	PBSS4160V_2
Modifications:	<ul style="list-style-type: none"> <li>• This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content.</li> <li>• <a href="#">Table 2 “Discrete pinning”</a>: updated</li> <li>• <a href="#">Figure 13 “Package outline SOT666”</a>: updated</li> </ul>			
PBSS4160V_2	20050131	Product data sheet	-	PBSS4160V_1
PBSS4160V_1	20040423	Objective data sheet	-	-

## 11. Legal information

### 11.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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