

# 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;  $\delta \leq 0.02$ .

## 2. Pinning information

**Table 2. Discrete pinning**

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

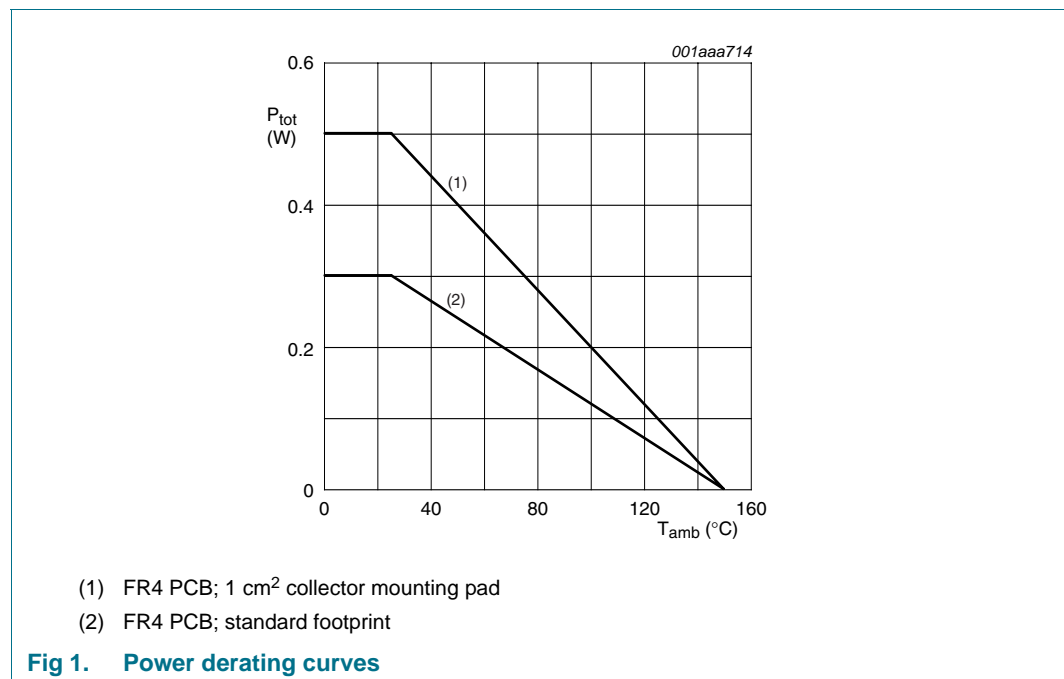
**Table 5. Limiting values**

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.



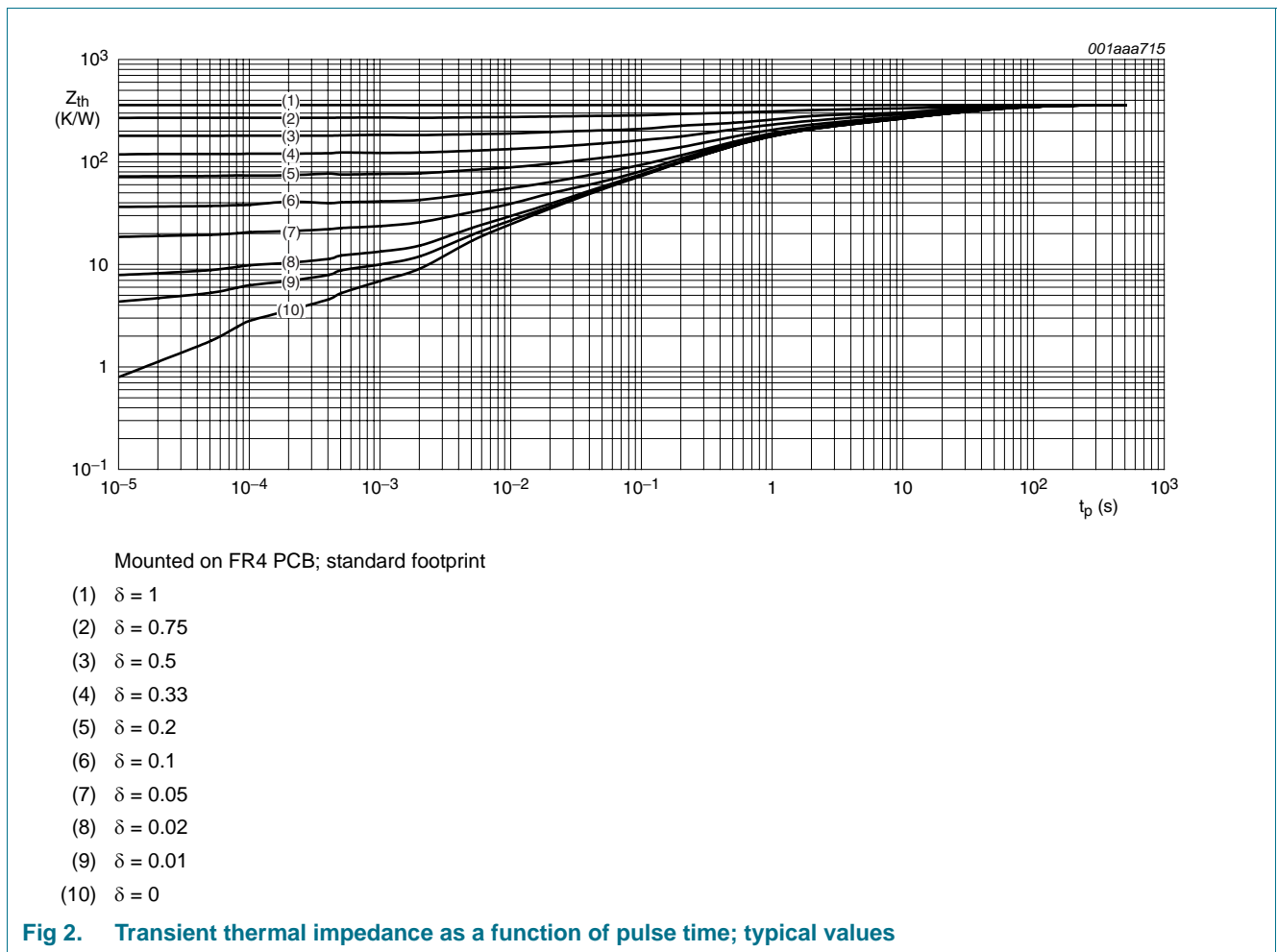
## 6. Thermal characteristics

**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.



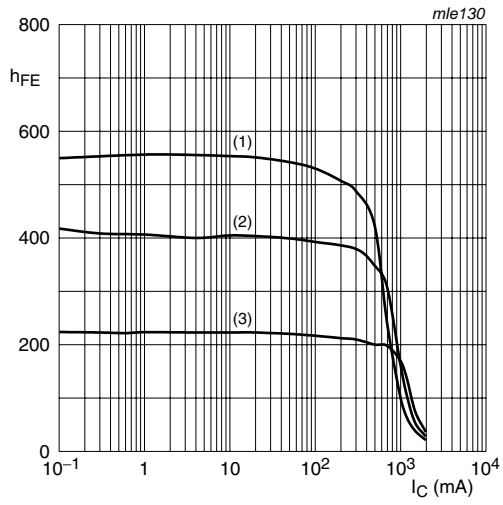
## 7. Characteristics

**Table 7. Characteristics**

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

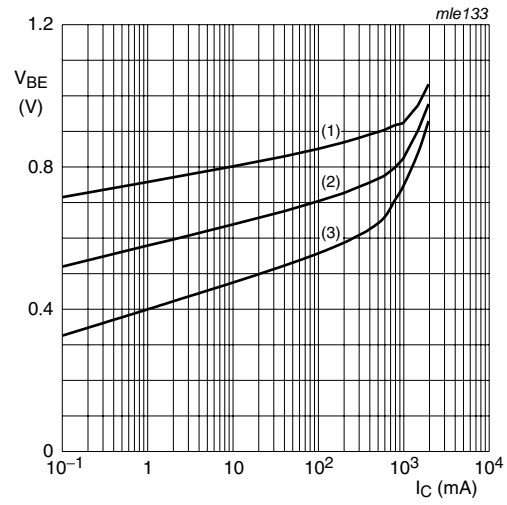
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60\text{ V}; I_E = 0\text{ A}$	-	-	100	nA	
		$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	$\mu\text{A}$	
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 60\text{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



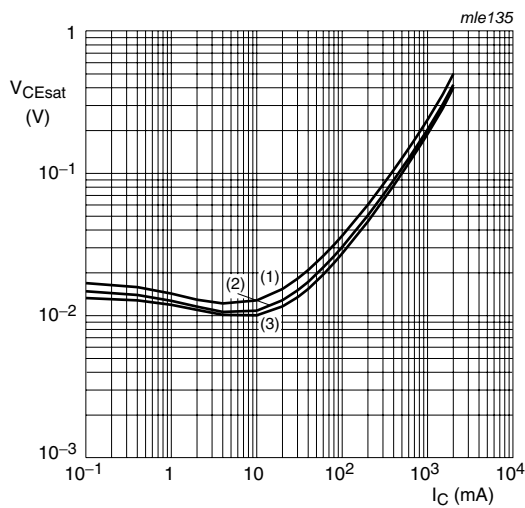
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



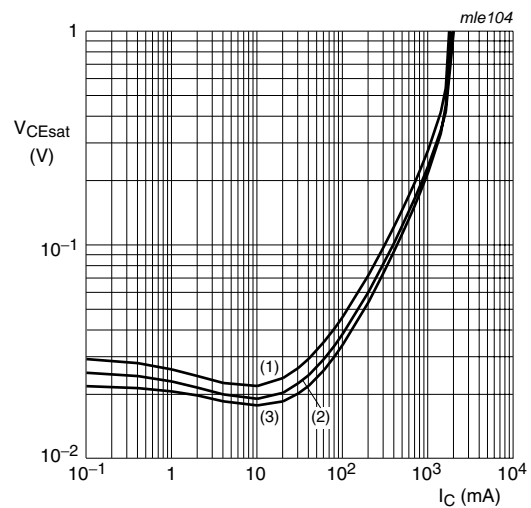
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



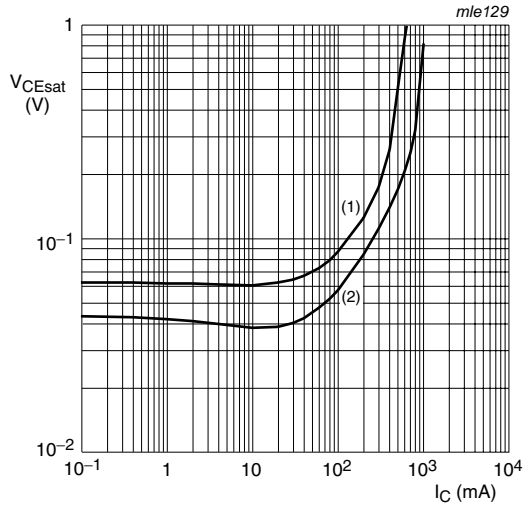
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



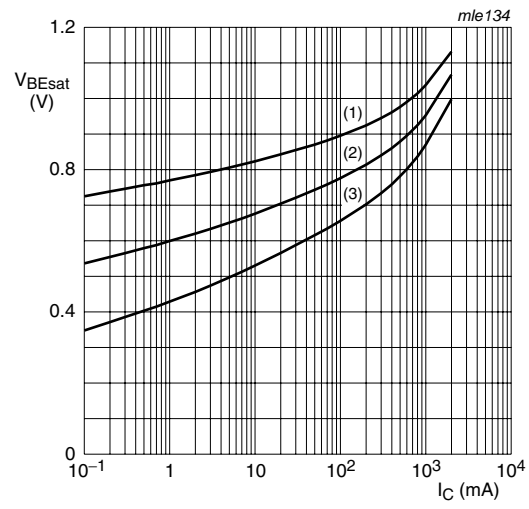
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



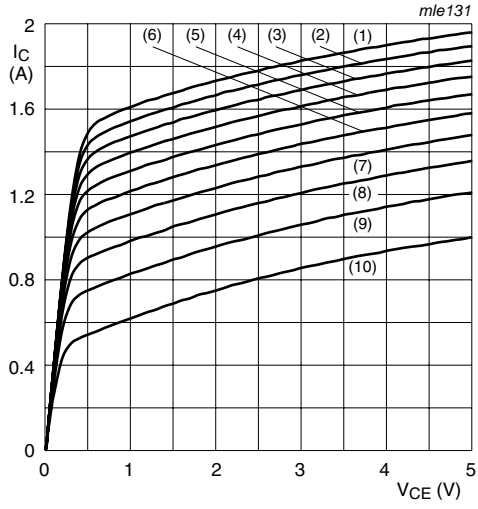
$T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$

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



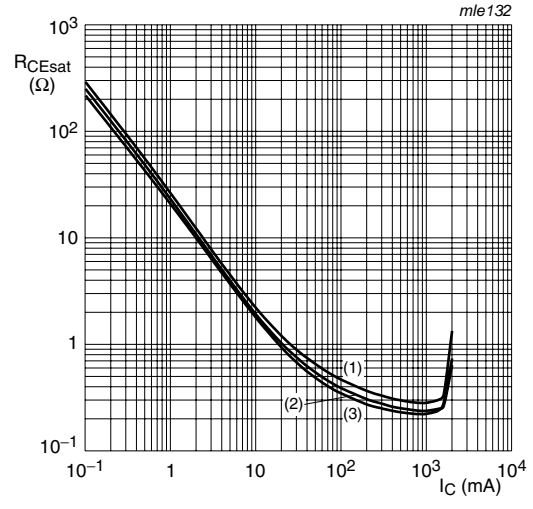
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

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

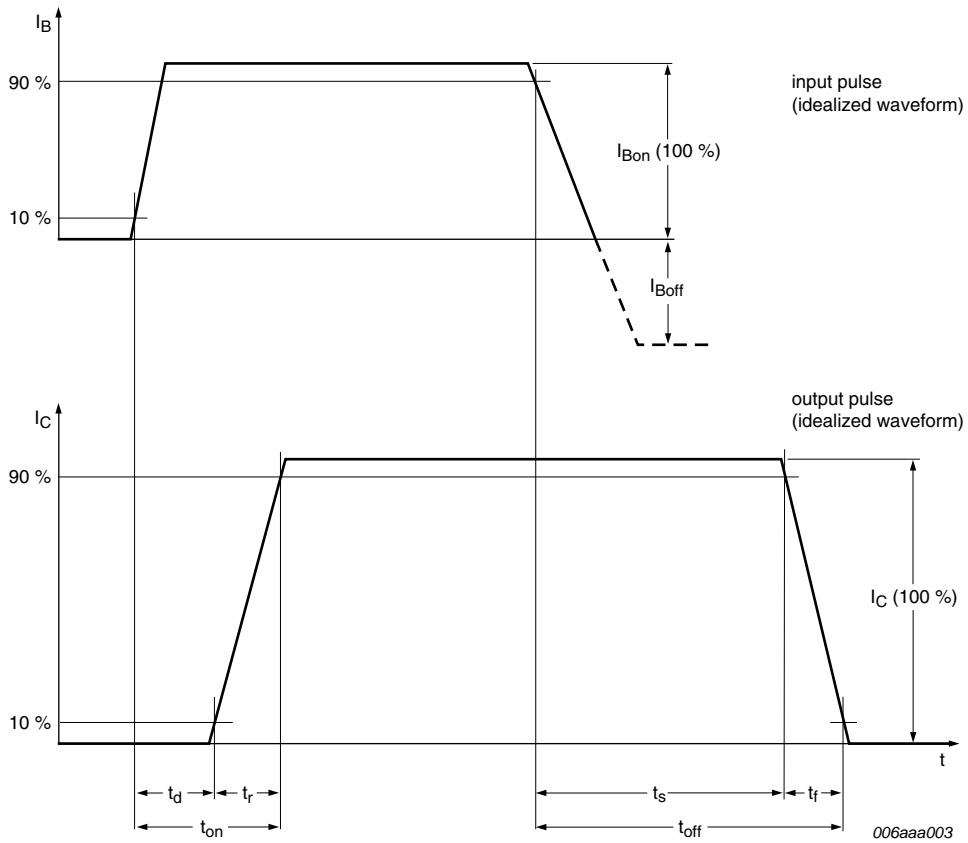
**Fig 9. Collector current as a function of collector-emitter voltage; typical values**



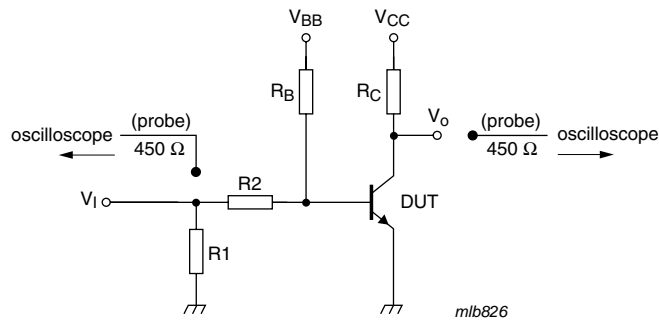
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ }^\circ\text{C}$
  - (2)  $T_{amb} = 25\text{ }^\circ\text{C}$
  - (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

**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

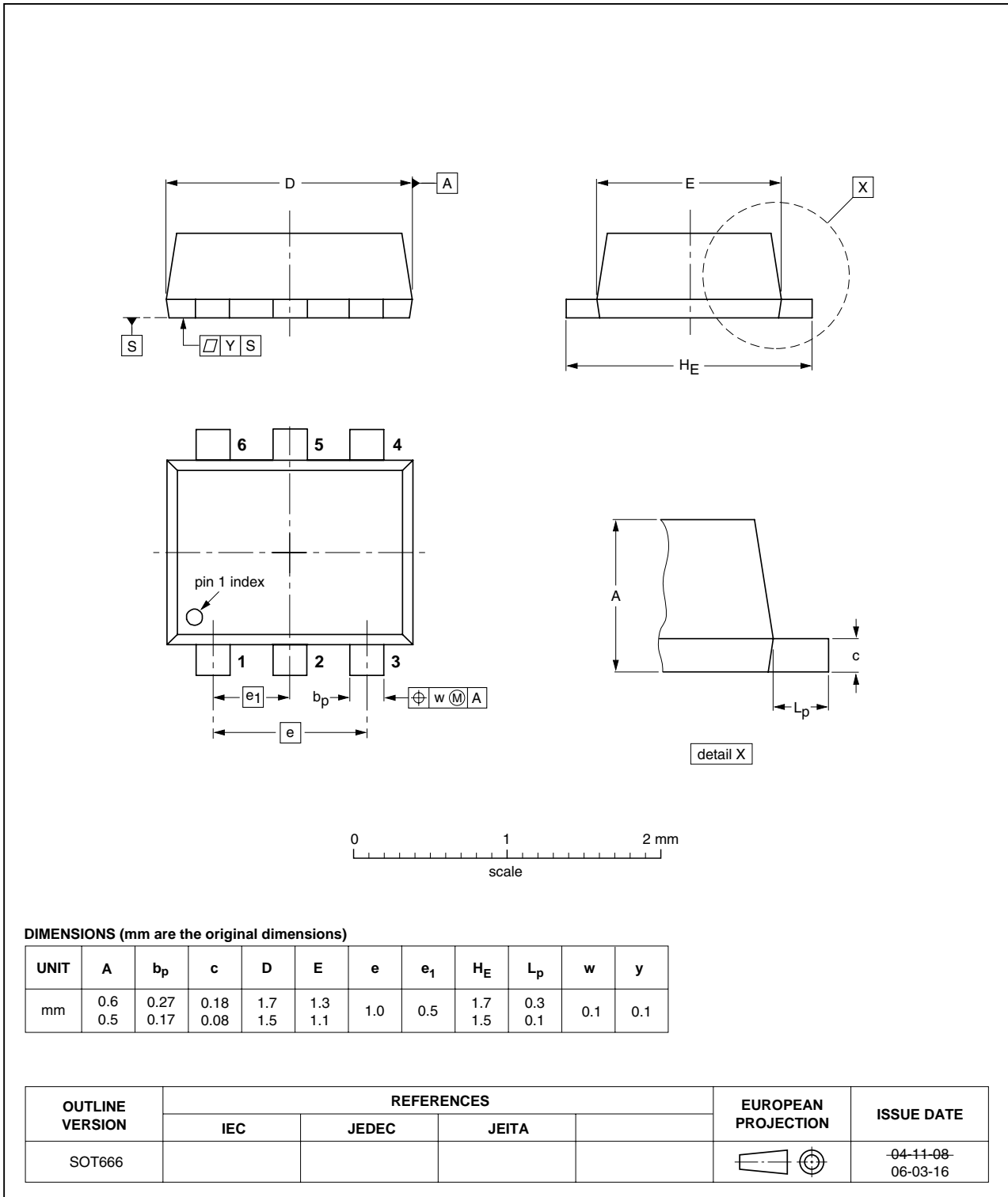


Fig 13. Package outline SOT666

## 9. Packing information

**Table 8. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<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".

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## 13. 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>Legal information</b> . . . . .	<b>13</b>
11.1	Data sheet status . . . . .	13
11.2	Definitions . . . . .	13
11.3	Disclaimers . . . . .	13
11.4	Trademarks . . . . .	13
<b>12</b>	<b>Contact information</b> . . . . .	<b>13</b>
<b>13</b>	<b>Contents</b> . . . . .	<b>14</b>

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