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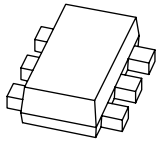
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Kind regards,

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# PBSS4220V

20 V, 2 A NPN low  $V_{CEsat}$  (BISS) transistor

Rev. 02 — 11 December 2009

Product data sheet

## 1. Product profile

### 1.1 General description

NPN low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in a SOT666 Surface Mounted Device (SMD) plastic package.

PNP complement: PBSS5220V.

### 1.2 Features

- Low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability:  $I_C$  and  $I_{CM}$
- High collector current gain ( $h_{FE}$ ) at high  $I_C$
- High efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors

### 1.3 Applications

- DC-to-DC conversion
- MOSFET gate driving
- Motor control
- Charging circuits
- Low power switches (e.g. motors, fans)
- Portable applications

### 1.4 Quick reference data

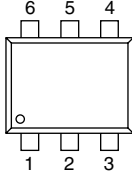
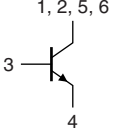
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	20	V
$I_C$	collector current		-	-	2	A
$I_{CM}$	peak collector current	$t_p \leq 300 \mu s$	-	-	4	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = 1 A;$ $I_B = 100 mA$	[1] -	140	175	m $\Omega$

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

## 2. Pinning information

**Table 2. Pinning**

Pin	Description	Simplified outline	Symbol
1	collector		 sym014
2	collector		
3	base		
4	emitter		
5	collector		
6	collector		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
PBSS4220V	-	plastic surface mounted package; 6 leads	SOT666

## 4. Marking

**Table 4. Marking codes**

Type number	Marking code
PBSS4220V	N6

## 5. Limiting values

**Table 5. Limiting values**

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

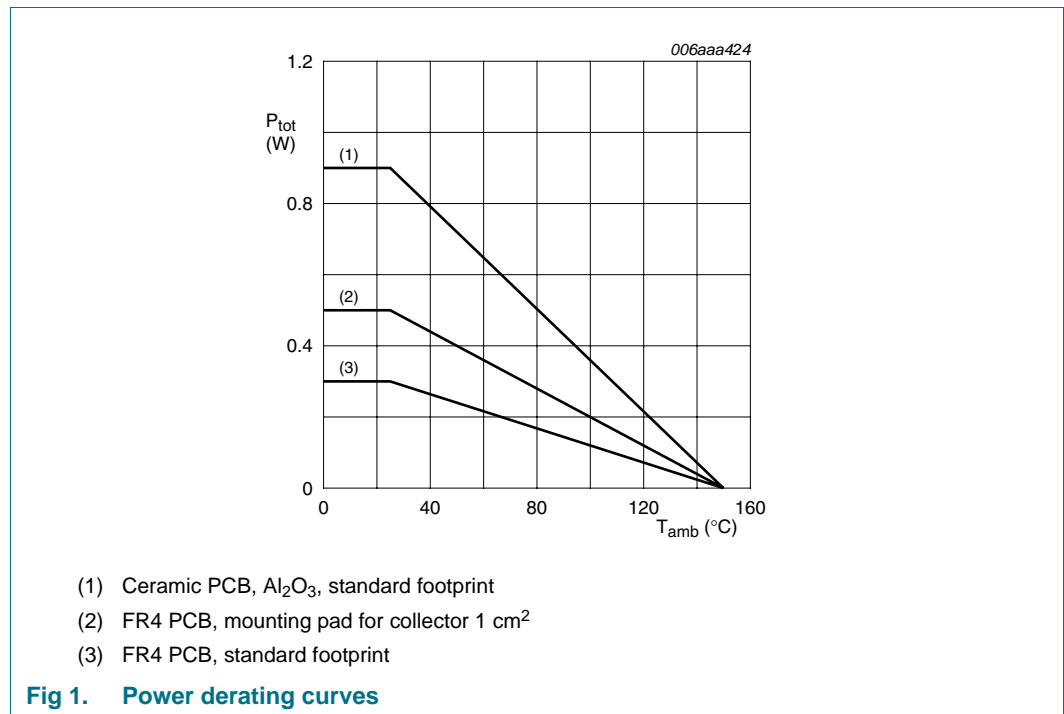
Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{CBO}$	collector-base voltage	open emitter	-	20	V	
$V_{CEO}$	collector-emitter voltage	open base	-	20	V	
$V_{EBO}$	emitter-base voltage	open collector	-	5	V	
$I_C$	collector current		-	2	A	
$I_{CM}$	peak collector current	$t_p \leq 300 \mu s$	-	4	A	
$I_B$	base current		-	0.3	A	
$I_{BM}$	peak base current	$t_p \leq 300 \mu s$	-	0.6	A	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25 \text{ }^\circ\text{C}$	[1][4]	-	0.3	W
			[2][4]	-	0.5	W
			[3][4]	-	0.9	W
$T_j$	junction temperature		-	150	$^\circ\text{C}$	

**Table 5. Limiting values ...continued**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$T_{amb}$	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, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.
- [4] Reflow soldering is the only recommended soldering method.

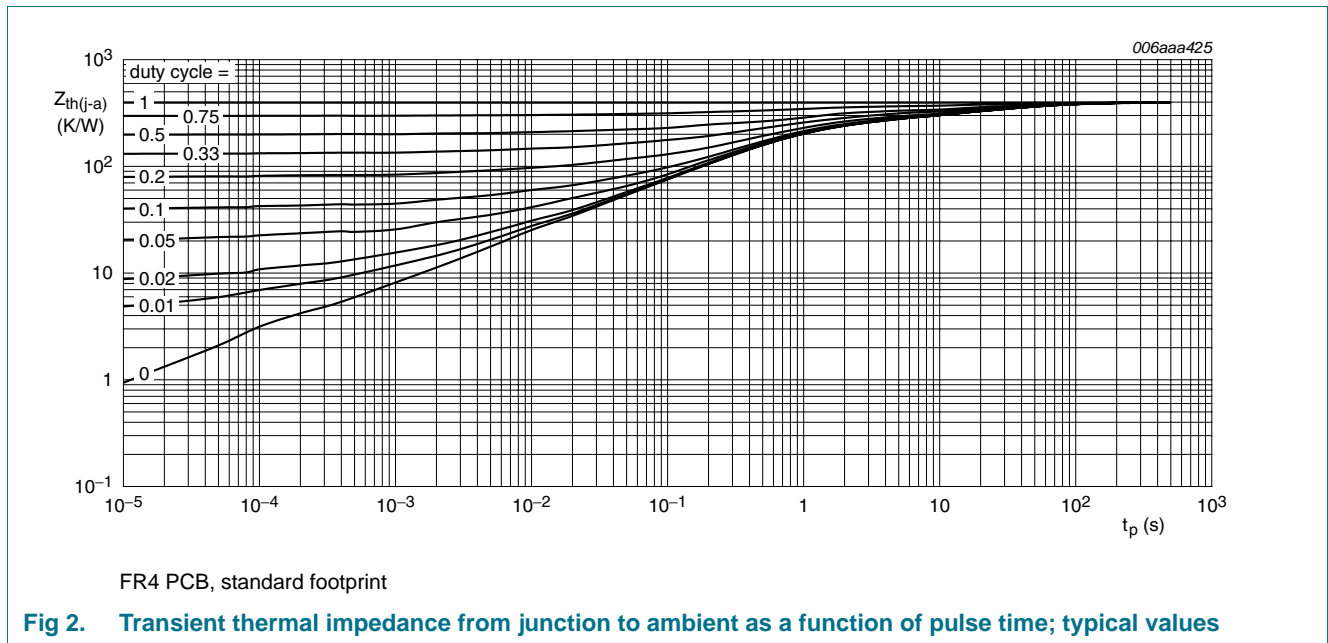


## 6. Thermal characteristics

**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][4]	-	-	410	K/W
			[2][4]	-	-	250	K/W
			[3][4]	-	-	140	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	80	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, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.
- [4] Reflow soldering is the only recommended soldering method.



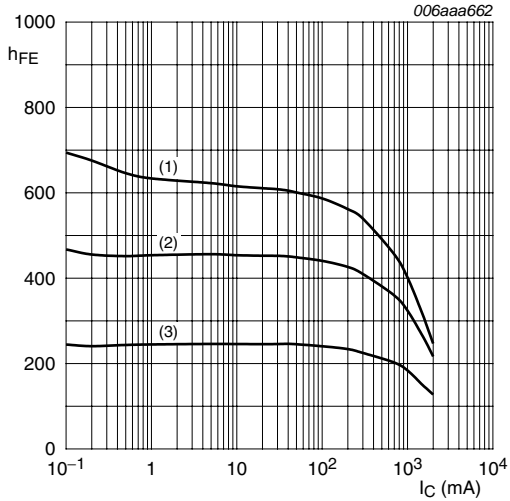
**Fig 2. Transient thermal impedance from junction to ambient as a function of pulse time; typical values**

## 7. Characteristics

**Table 7. Characteristics**
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

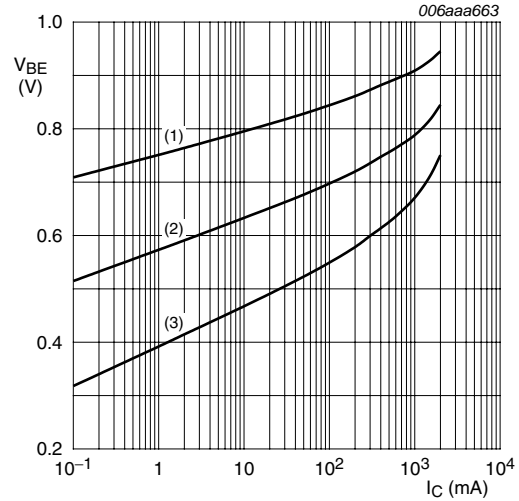
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 20\text{ V}; I_E = 0\text{ A}$	-	-	0.1	$\mu\text{A}$	
		$V_{CB} = 20\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	$\mu\text{A}$	
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 20\text{ V}; V_{BE} = 0\text{ V}$	-	-	0.1	$\mu\text{A}$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	0.1	$\mu\text{A}$	
$h_{FE}$	DC current gain	$V_{CE} = 2\text{ V}; I_C = 1\text{ mA}$	220	480	-		
		$V_{CE} = 2\text{ V}; I_C = 100\text{ mA}$	220	440	-		
		$V_{CE} = 2\text{ V}; I_C = 500\text{ mA}$	[1]	220	410	-	
		$V_{CE} = 2\text{ V}; I_C = 1\text{ A}$	[1]	200	360	-	
		$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	[1]	120	220	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 100\text{ mA}; I_B = 1\text{ mA}$	-	35	55	mV	
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	[1]	-	70	95	mV
		$I_C = 1\text{ A}; I_B = 50\text{ mA}$	[1]	-	145	180	mV
		$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1]	-	140	175	mV
		$I_C = 2\text{ A}; I_B = 100\text{ mA}$	[1]	-	275	355	mV
		$I_C = 2\text{ A}; I_B = 200\text{ mA}$	[1]	-	270	350	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1]	-	140	$\text{m}\Omega$	
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 50\text{ mA}$	[1]	-	0.95	1.1	V
		$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1]	-	1	1.2	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = 5\text{ V}; I_C = 1\text{ A}$	-	0.8	1.1	V	
$t_d$	delay time	$I_C = 1\text{ A}; I_{Bon} = 50\text{ mA}; I_{Boff} = -50\text{ mA}$	-	9	-	ns	
$t_r$	rise time		-	29	-	ns	
$t_{on}$	turn-on time		-	38	-	ns	
$t_s$	storage time		-	200	-	ns	
$t_f$	fall time		-	40	-	ns	
$t_{off}$	turn-off time		-	240	-	ns	
$f_T$	transition frequency	$V_{CE} = 10\text{ V}; I_C = 50\text{ mA}; f = 100\text{ MHz}$	-	210	-	MHz	
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$	-	11	-	pF	

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



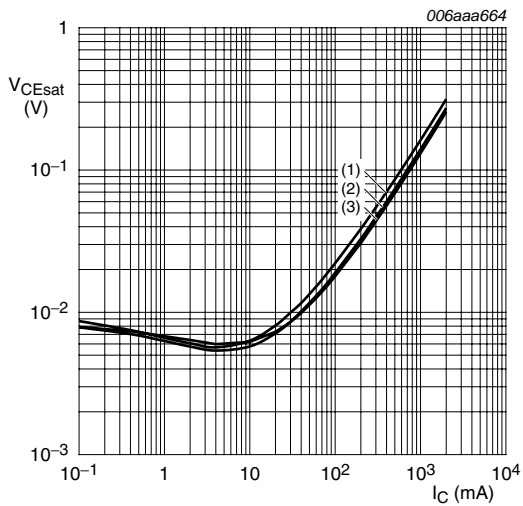
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



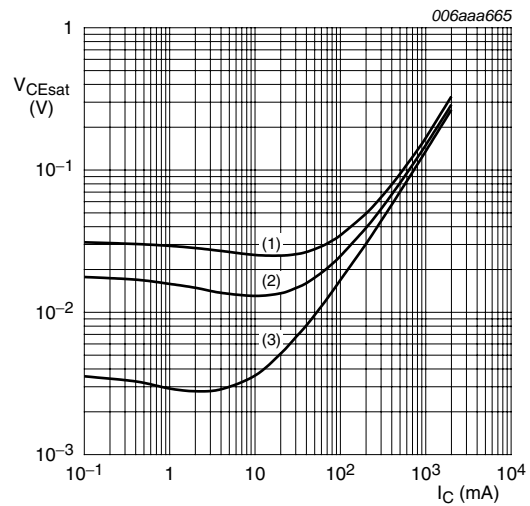
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



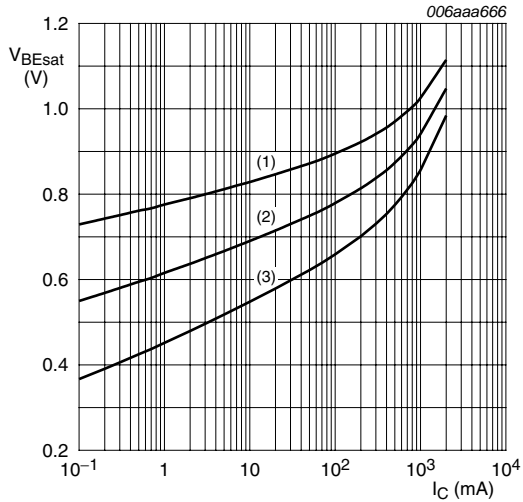
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



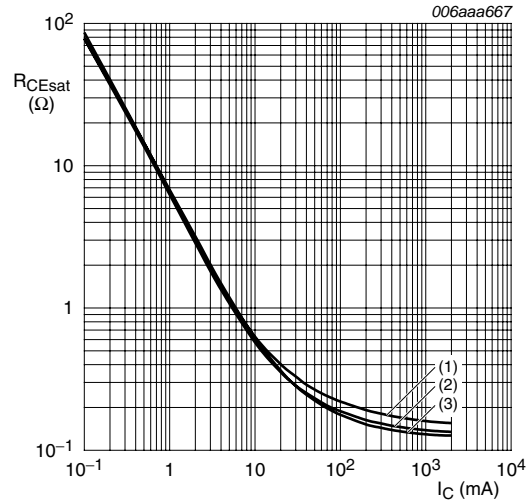
$T_{amb} = 25\text{ }^\circ\text{C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

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



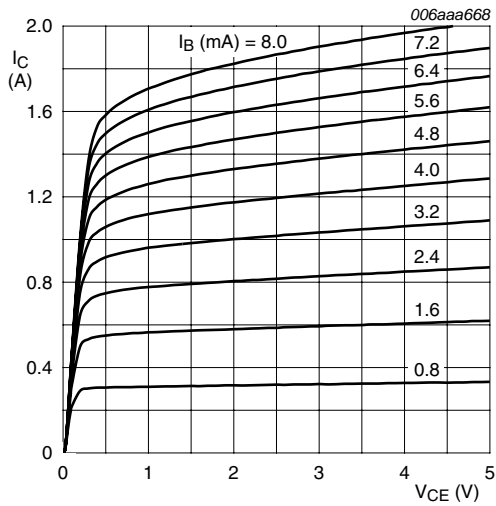
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



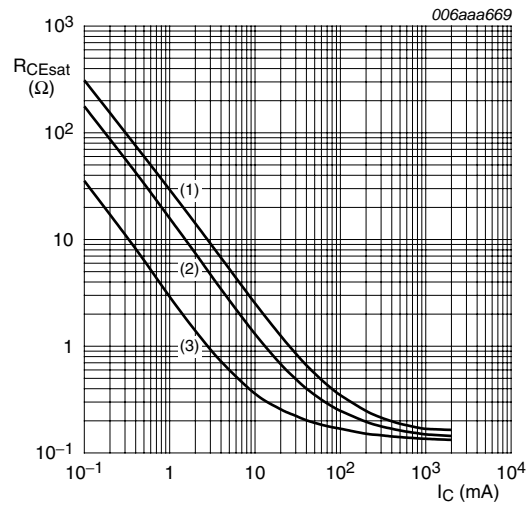
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



$T_{amb} = 25\text{ °C}$

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

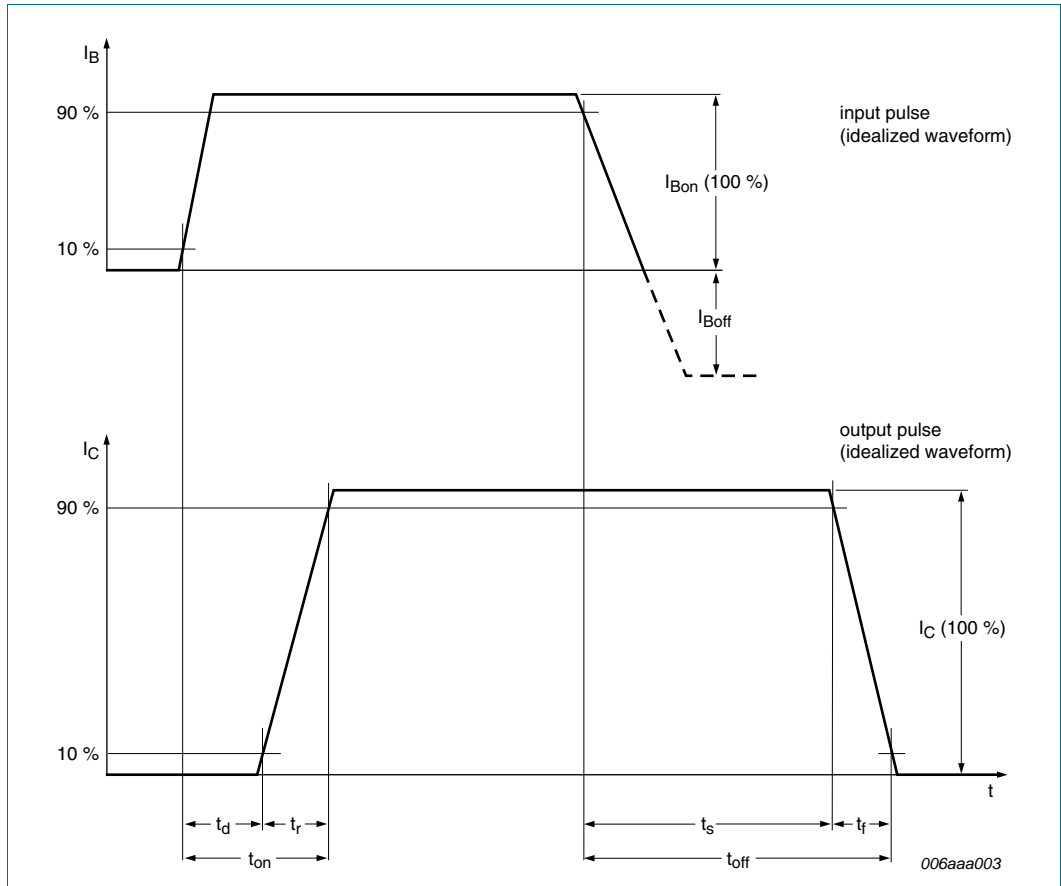


$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

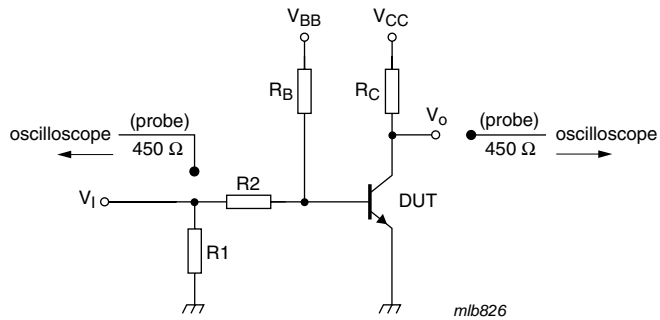
**Fig 10. Collector-emitter saturation resistance as a function of collector current; typical values**



**8. Test information**



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



$I_C = 1\text{ A}$ ;  $I_{Bon} = 50\text{ mA}$ ;  $I_{Boff} = -50\text{ mA}$ ;  $R_1 = \text{open}$ ;  $R_2 = 45\ \Omega$ ;  $R_B = 145\ \Omega$ ;  $R_C = 10\ \Omega$

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

## 9. Package outline

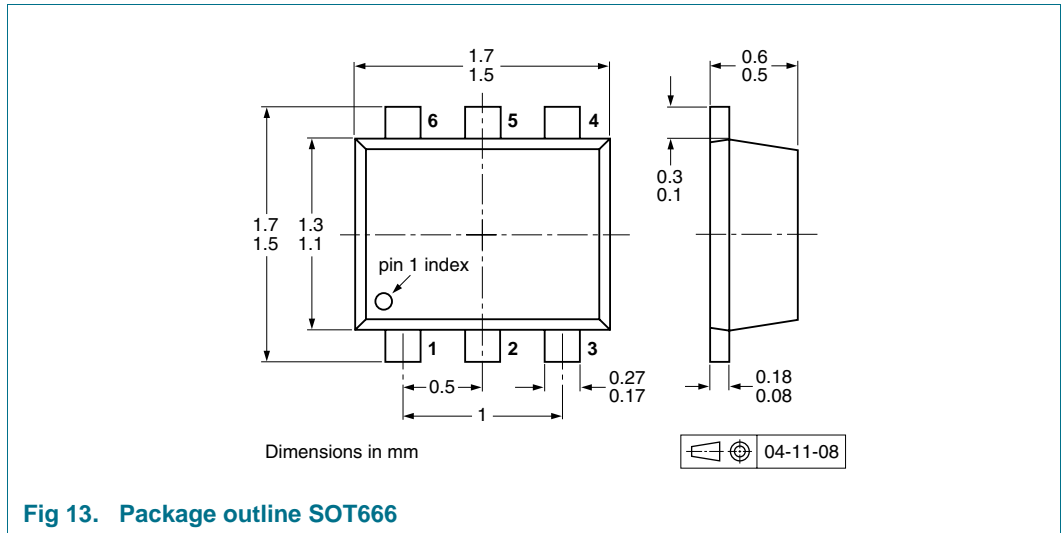


Fig 13. Package outline SOT666

## 10. Packing information

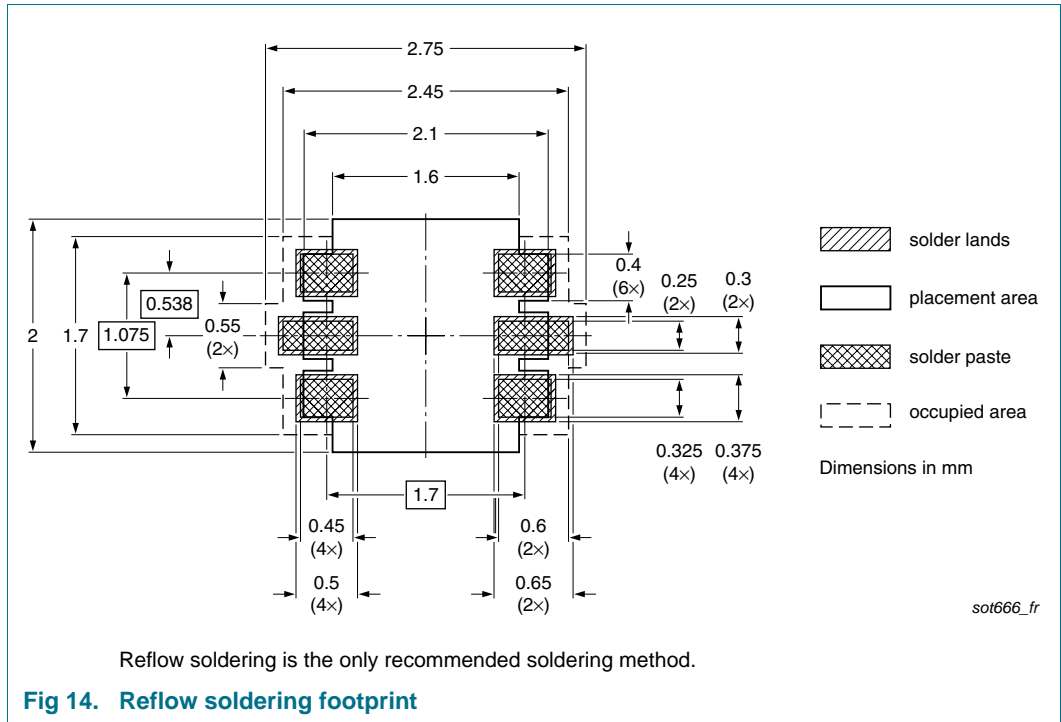
**Table 8. Packing methods**

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

Type number	Package	Description	Packing quantity	
			4000	8000
PBSS4220V	SOT666	2 mm pitch, 8 mm tape and reel	-	-315
		4 mm pitch, 8 mm tape and reel	-115	-

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

**11. Soldering**



## 12. Revision history

**Table 9.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4220V_2	20091211	Product data sheet	-	PBSS4220V_1
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="#">Figure 14 "Reflow soldering footprint"</a>: updated</li></ul>			
PBSS4220V_1	20060206	Product data sheet	-	-

## 13. Legal information

### 13.1 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.
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[2] The term 'short data sheet' is explained in section "Definitions".

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Date of release: 11 December 2009

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