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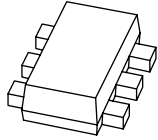
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Kind regards,

Team Nexperia



# PBSS5220V

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

Rev. 03 — 14 December 2009

Product data sheet

## 1. Product profile

### 1.1 General description

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

NPN complement: PBSS4220V.

### 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

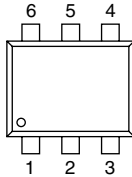
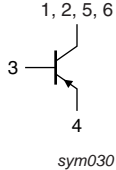
Table 1. Quick reference data

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	210	$m\Omega$

[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		
2	collector		
3	base		
4	emitter		
5	collector		
6	collector		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PBSS5220V	-	plastic surface mounted package; 6 leads	SOT666

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS5220V	N7

## 5. Limiting values

Table 5. Limiting values

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

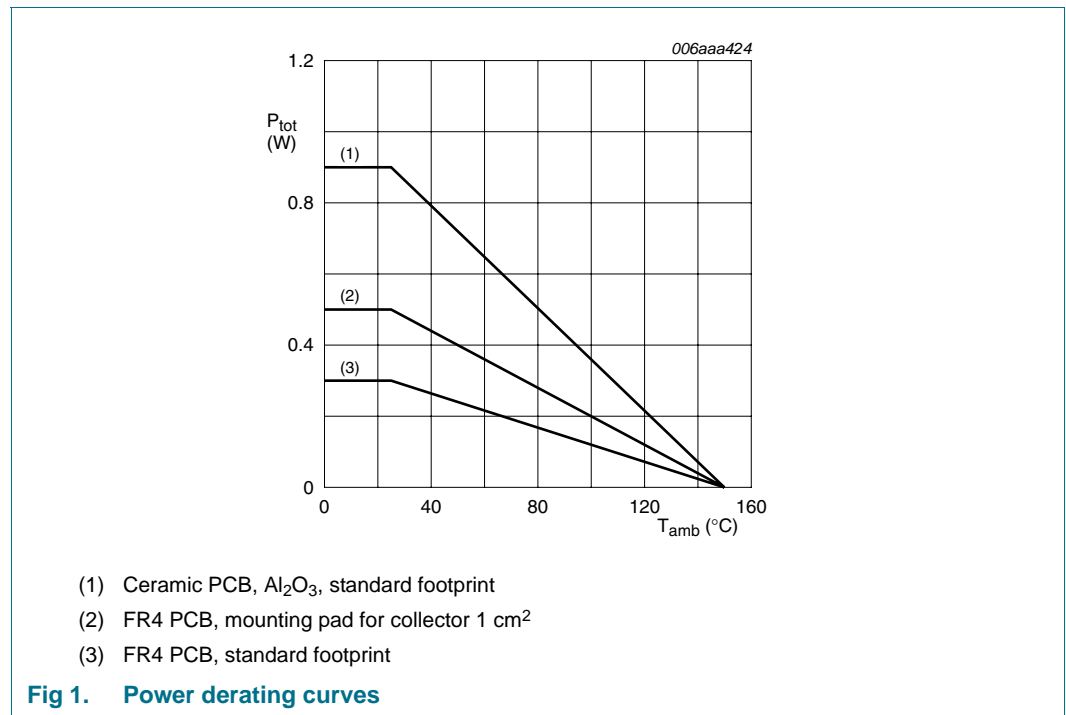
Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{CBO}$	collector-base voltage	open emitter	-	-20	V	
$V_{CEO}$	collector-emitter voltage	open base	-	-20	V	
$V_{EBO}$	emitter-base voltage	open collector	-	-5	V	
$I_C$	collector current		-	-2	A	
$I_{CM}$	peak collector current	$t_p \leq 300 \mu s$	-	-4	A	
$I_B$	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.

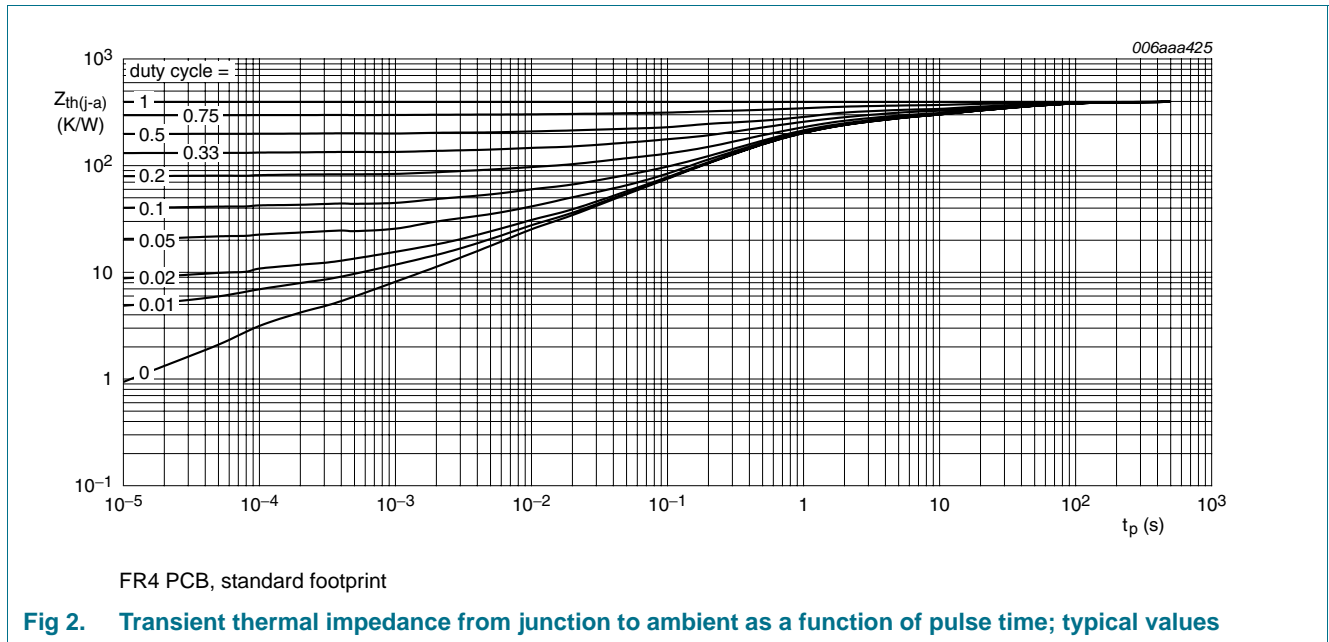


## 6. Thermal characteristics

**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.

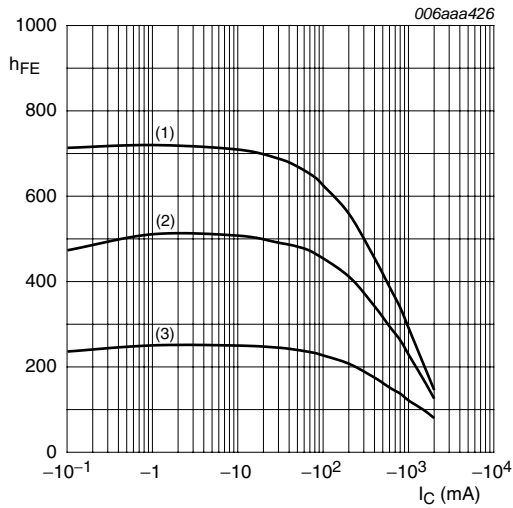


## 7. Characteristics

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

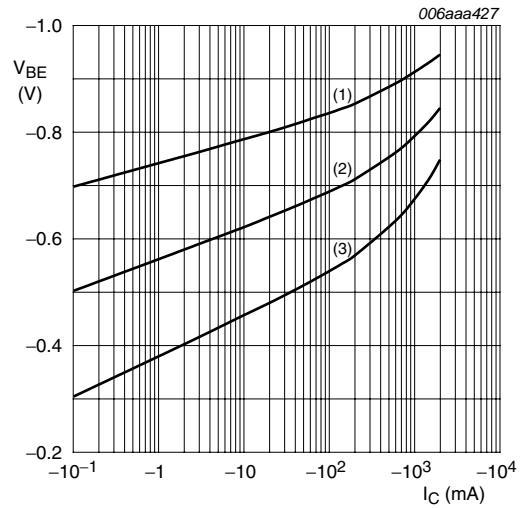
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -20\text{ V}; I_E = 0\text{ A}$	-	-	-0.1	$\mu\text{A}$	
		$V_{CB} = -20\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	-50	$\mu\text{A}$	
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = -20\text{ V}; V_{BE} = 0\text{ V}$	-	-	-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	495	-		
		$V_{CE} = -2\text{ V}; I_C = -100\text{ mA}$	220	440	-		
		$V_{CE} = -2\text{ V}; I_C = -500\text{ mA}$	[1]	220	310	-	
		$V_{CE} = -2\text{ V}; I_C = -1\text{ A}$	[1]	155	220	-	
		$V_{CE} = -2\text{ V}; I_C = -2\text{ A}$	[1]	60	120	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -100\text{ mA}; I_B = -1\text{ mA}$	-	-50	-80	mV	
		$I_C = -500\text{ mA}; I_B = -50\text{ mA}$	[1]	-	-75	-115	mV
		$I_C = -1\text{ A}; I_B = -50\text{ mA}$	[1]	-	-155	-220	mV
		$I_C = -1\text{ A}; I_B = -100\text{ mA}$	[1]	-	-140	-210	mV
		$I_C = -2\text{ A}; I_B = -100\text{ mA}$	[1]	-	-305	-455	mV
		$I_C = -2\text{ A}; I_B = -200\text{ mA}$	[1]	-	-265	-390	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -1\text{ A}; I_B = -100\text{ mA}$	[1]	-	140	210	$\text{m}\Omega$
$V_{BEsat}$	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	-1.1	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = -5\text{ V}; I_C = -1\text{ A}$	-	-0.8	-1	V	
$t_d$	delay time	$I_C = -1\text{ A}; I_{Bon} = -50\text{ mA}; I_{Boff} = 50\text{ mA}$	-	8	-	ns	
$t_r$	rise time		-	34	-	ns	
$t_{on}$	turn-on time		-	42	-	ns	
$t_s$	storage time		-	140	-	ns	
$t_f$	fall time		-	45	-	ns	
$t_{off}$	turn-off time		-	185	-	ns	
$f_T$	transition frequency	$V_{CE} = -10\text{ V}; I_C = -50\text{ mA}; f = 100\text{ MHz}$	150	185	-	MHz	
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$	-	15	20	pF	

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



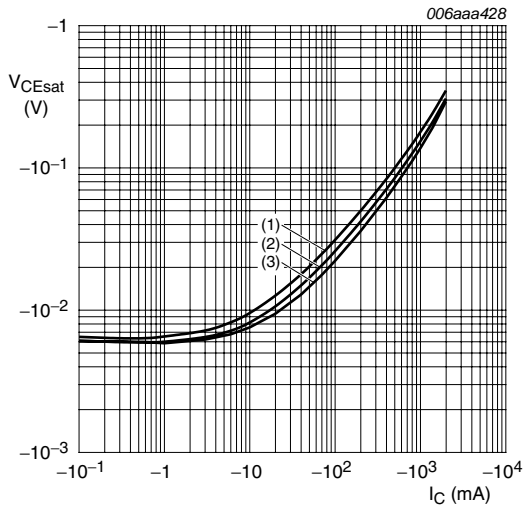
$V_{CE} = -2 V$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -55^\circ C$

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



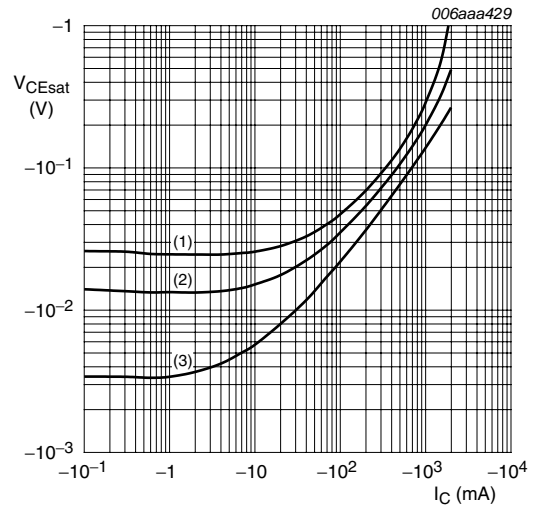
$V_{CE} = -5 V$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 100^\circ C$

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



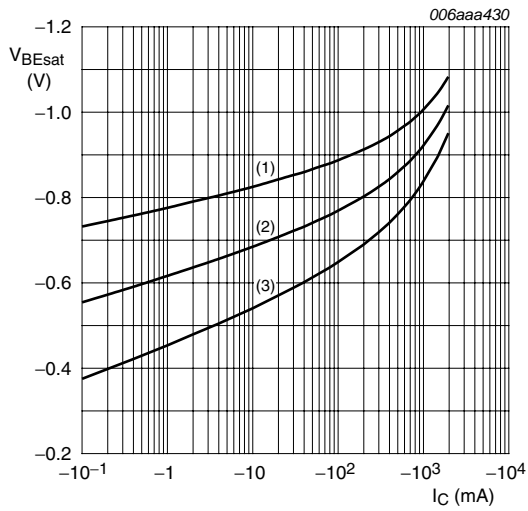
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -55^\circ C$

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



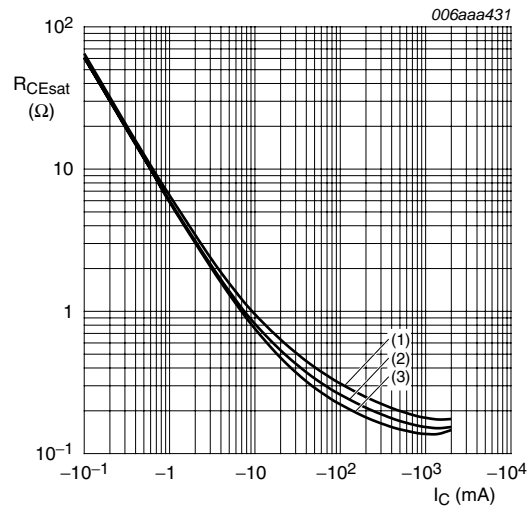
$T_{amb} = 25^\circ C$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

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



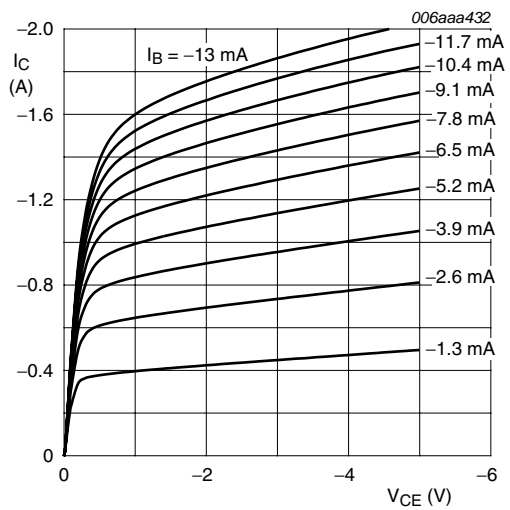
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 100^\circ C$

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



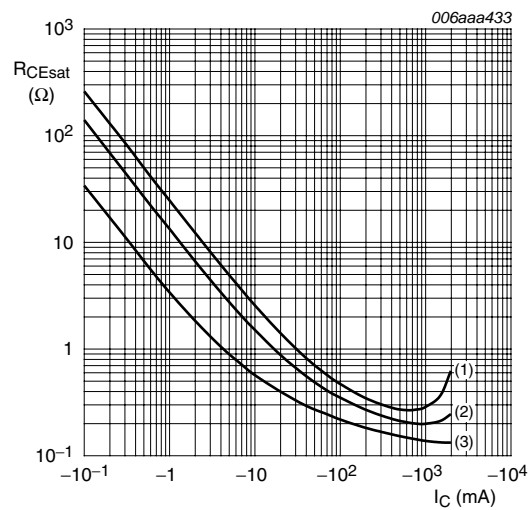
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -55^\circ C$

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



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

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

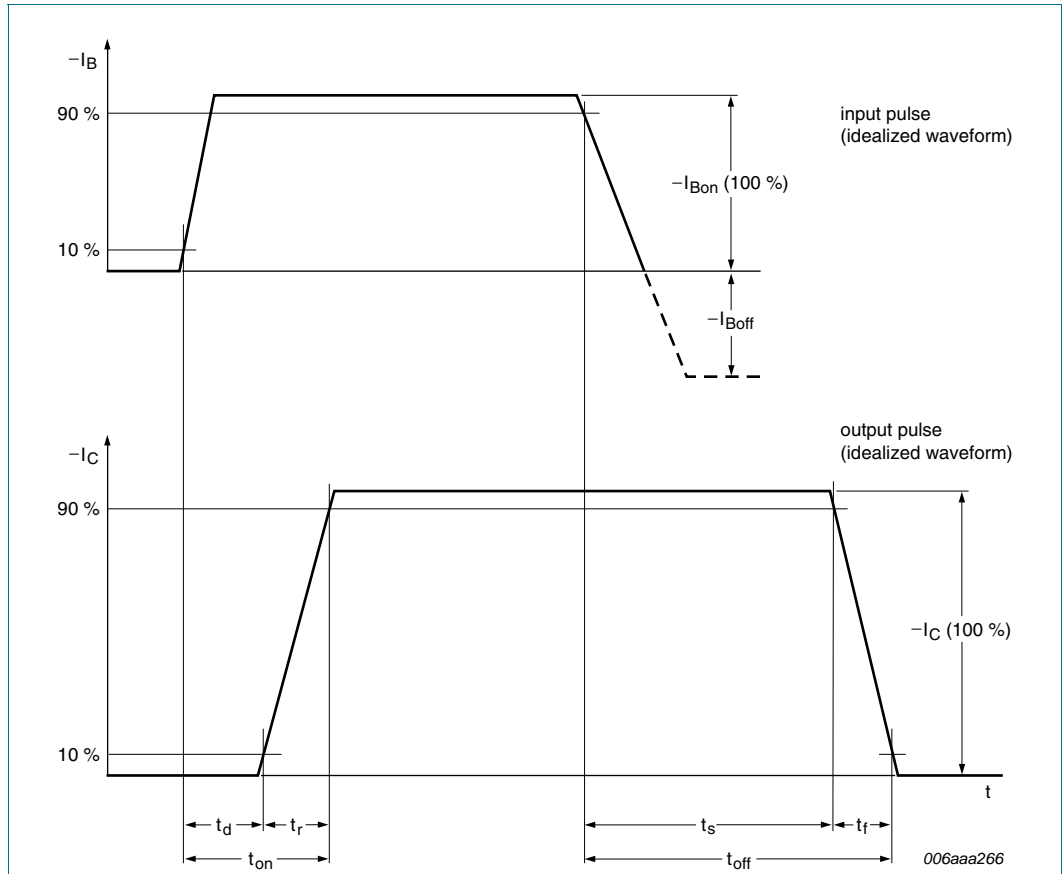


$T_{amb} = 25^\circ C$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

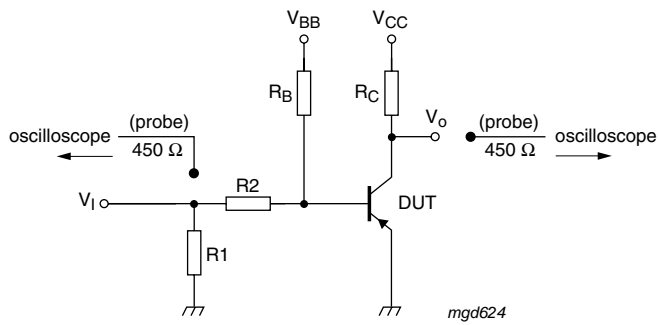
**Fig 10. Collector-emitter saturation resistance as a function of collector current; typical values**



**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

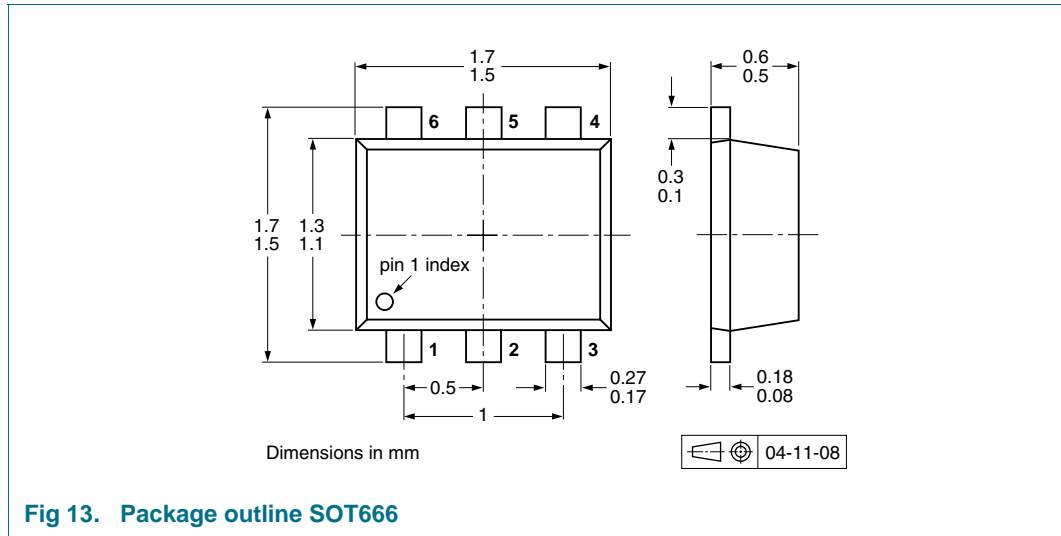


Fig 13. Package outline SOT666

## 10. Packing information

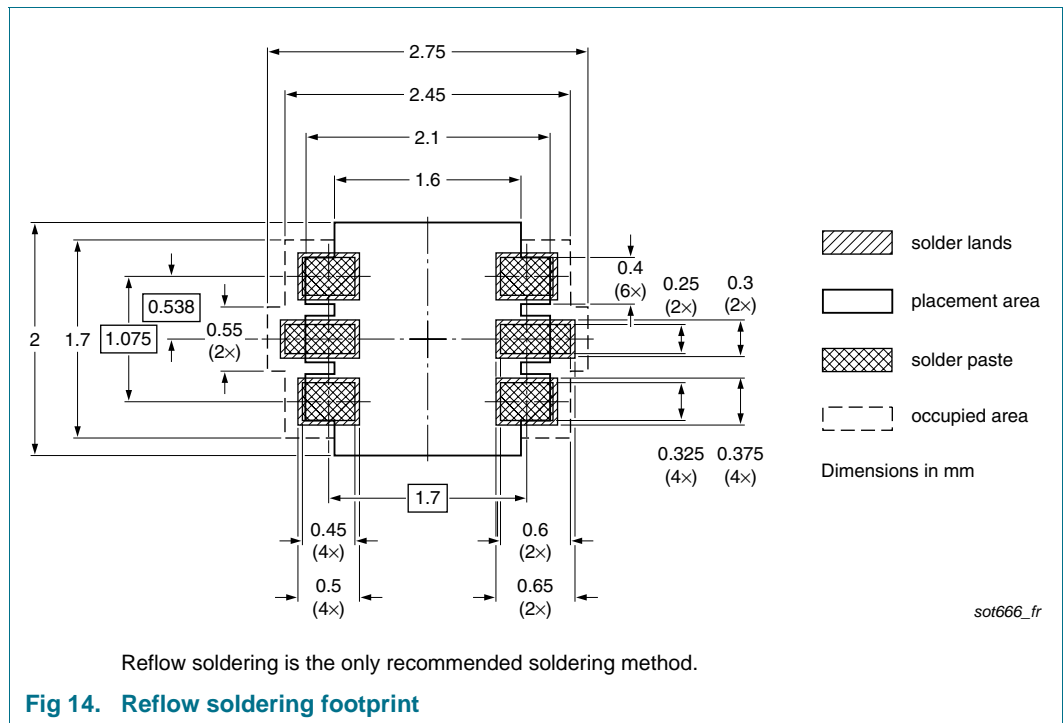
**Table 8. Packing methods**

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

Type number	Package	Description	Packing quantity	
			4000	8000
PBSS5220V	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
PBSS5220V_3	20091214	Product data sheet	-	PBSS5220V_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="#">Figure 14 "Reflow soldering footprint"</a>: updated</li></ul>			
PBSS5220V_2	20060208	Product data sheet	-	PBSS5220V_1
PBSS5220V_1	20050613	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.
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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