

PBSS4220V

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

Rev. 01 — 6 February 2006

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

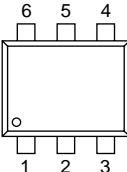
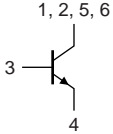
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	20	V
I_C	collector current		-	-	2	A
I_{CM}	peak collector current	$t_p \leq 300 \mu\text{s}$	-	-	4	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 1 \text{ A};$ $I_B = 100 \text{ mA}$	[1]	140	175	m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

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

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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).

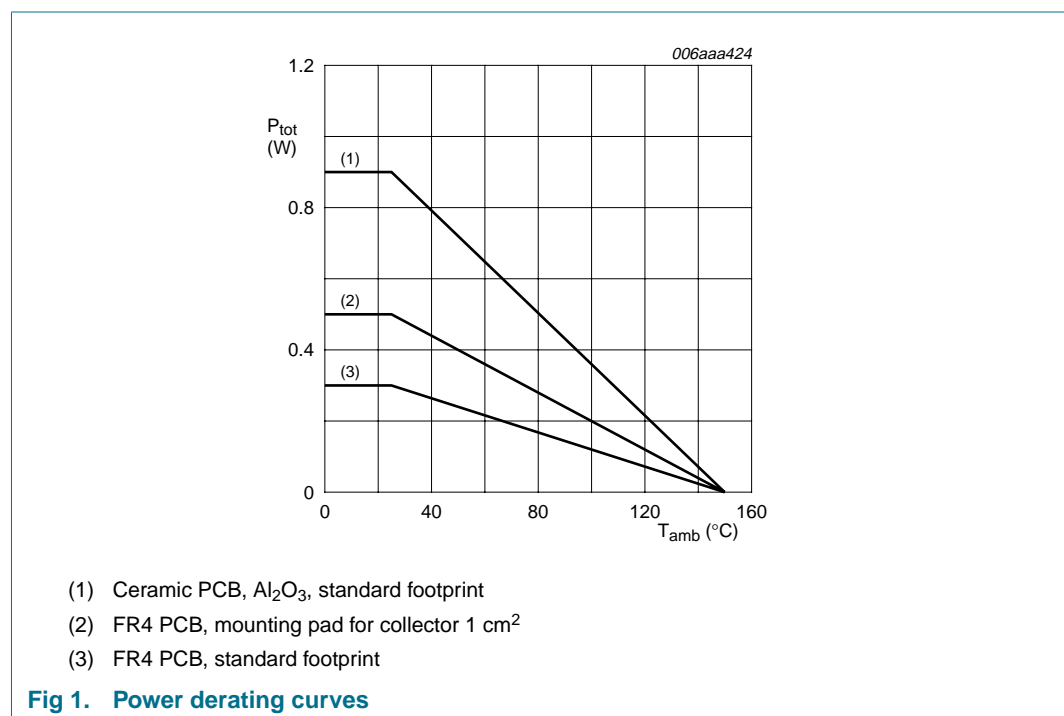
Symbol	Parameter	Conditions	Min	Max	Unit	
V_{CBO}	collector-base voltage	open emitter	-	20	V	
V_{CEO}	collector-emitter voltage	open base	-	20	V	
V_{EBO}	emitter-base voltage	open collector	-	5	V	
I_C	collector current		-	2	A	
I_{CM}	peak collector current	$t_p \leq 300 \mu s$	-	4	A	
I_B	base current		-	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 cm².
- [3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.
- [4] Reflow soldering is the only recommended soldering method.



6. Thermal characteristics

Table 6: Thermal characteristics

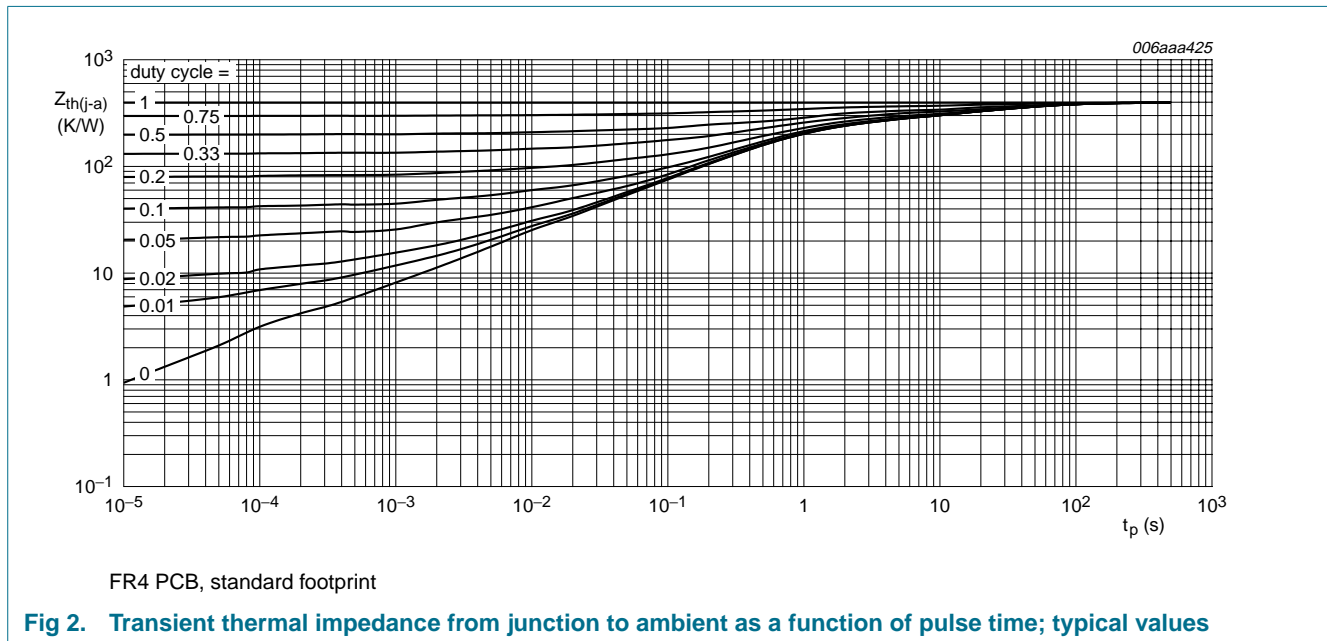
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] [4]	-	-	410	K/W
			[2] [4]	-	-	250	K/W
			[3] [4]	-	-	140	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	80	K/W	

[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 cm².

[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

[4] Reflow soldering is the only recommended soldering method.



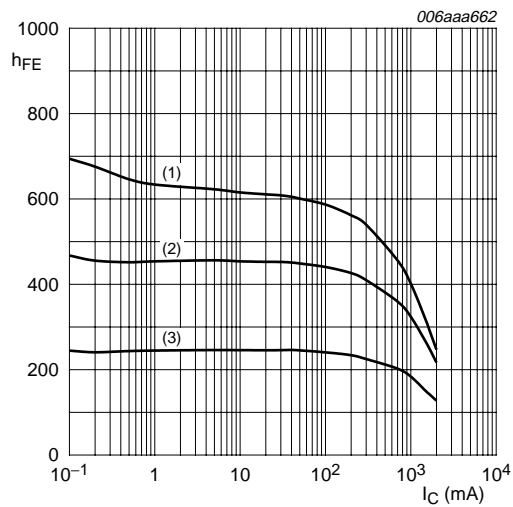
7. Characteristics

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	μA	
		$V_{CB} = 20\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	μA	
I_{CES}	collector-emitter cut-off current	$V_{CE} = 20\text{ V}; V_{BE} = 0\text{ V}$	-	-	0.1	μA	
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	0.1	μA	
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	$I_C = 1\text{ A}; I_{B(on)} = 50\text{ mA}; I_{B(off)} = -50\text{ mA}$	-	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	

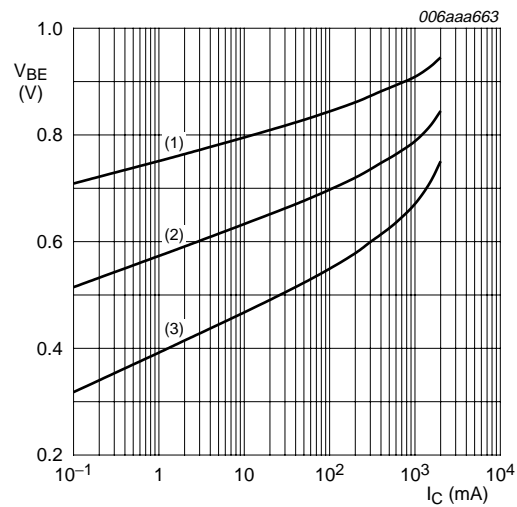
[1] Pulse test: $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$.



$V_{CE} = 2 \text{ V}$

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

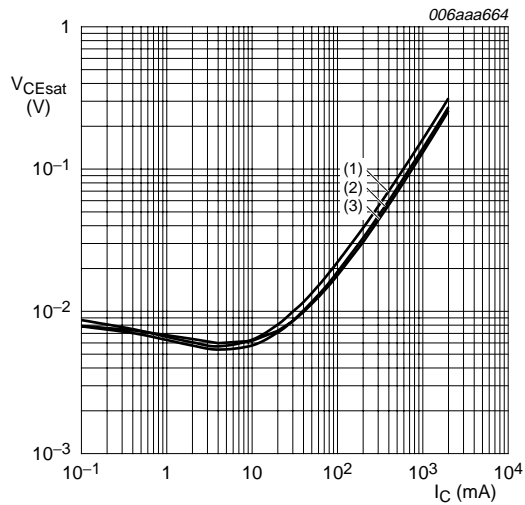
Fig 3. DC current gain as a function of collector current; typical values



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

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

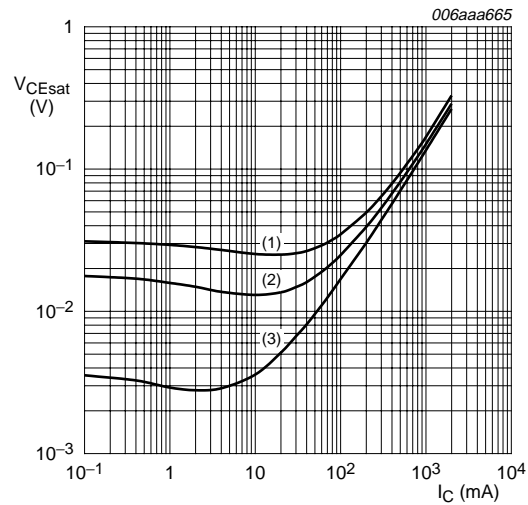
Fig 4. Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 20$

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

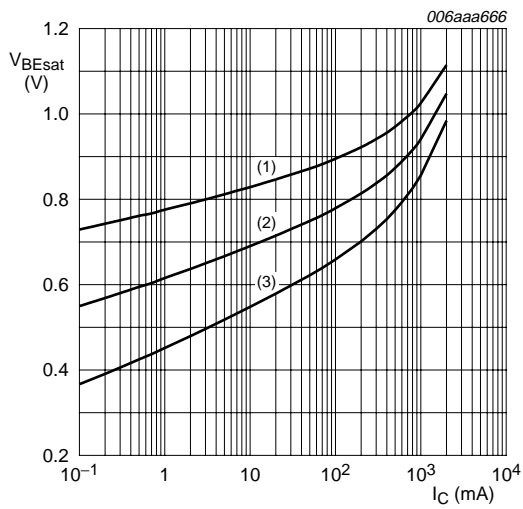
Fig 5. Collector-emitter saturation voltage as a function of collector current; typical values



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

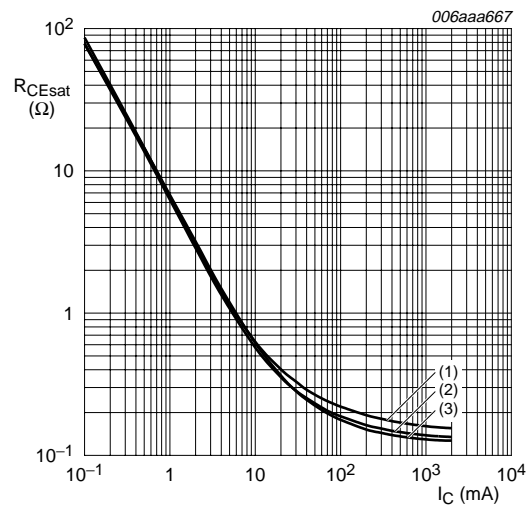
- (1) $I_C/I_B = 100$
- (2) $I_C/I_B = 50$
- (3) $I_C/I_B = 10$

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



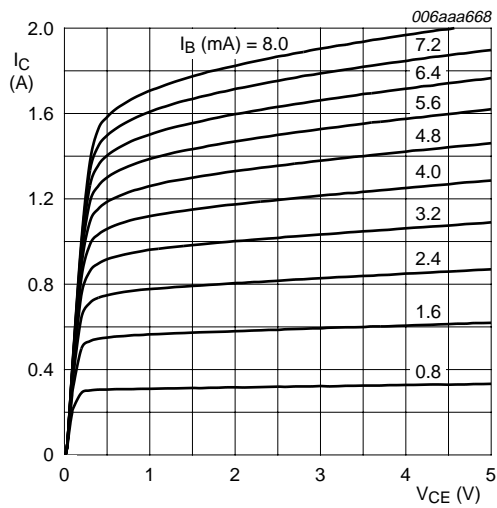
$I_C/I_B = 20$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



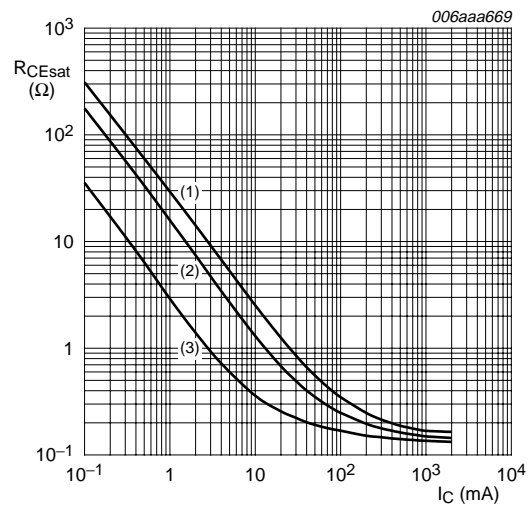
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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

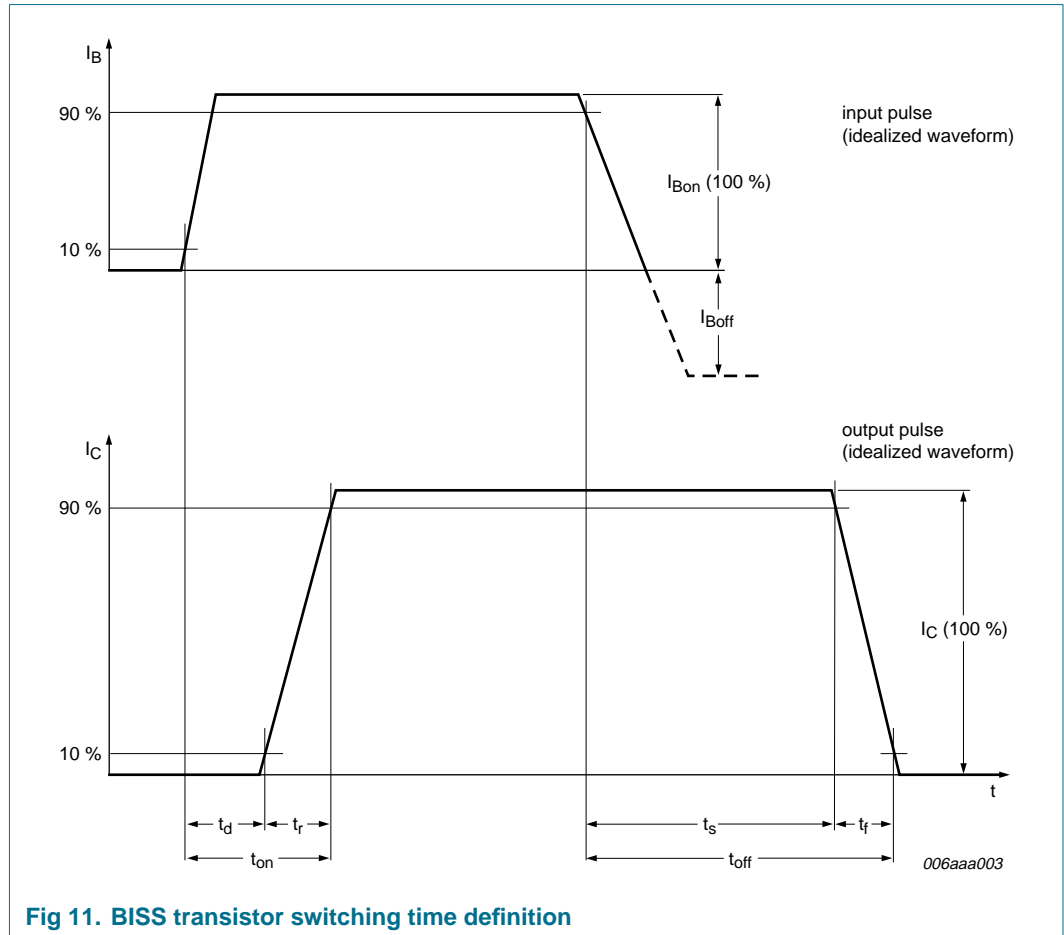
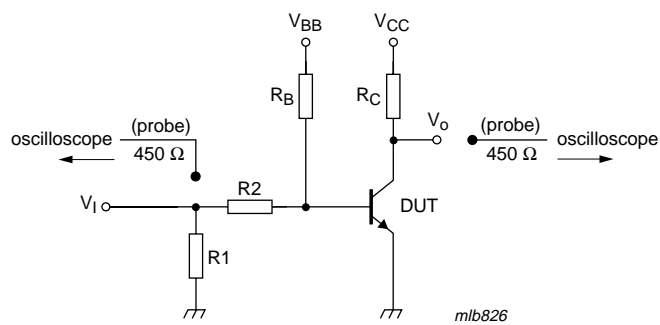


Fig 11. BISS transistor switching time definition



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

Fig 12. Test circuit for switching times

9. Package outline

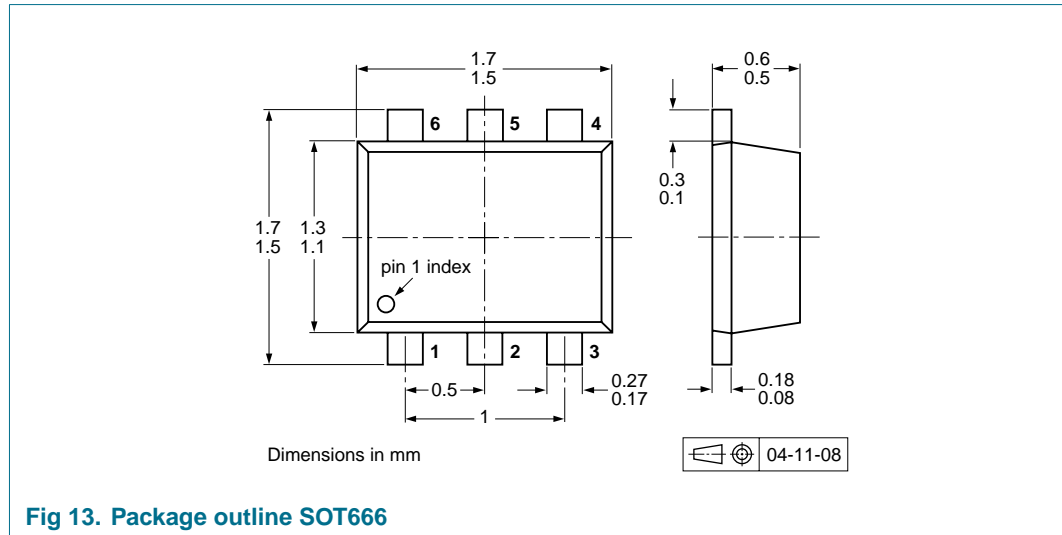


Fig 13. Package outline SOT666

10. Packing information

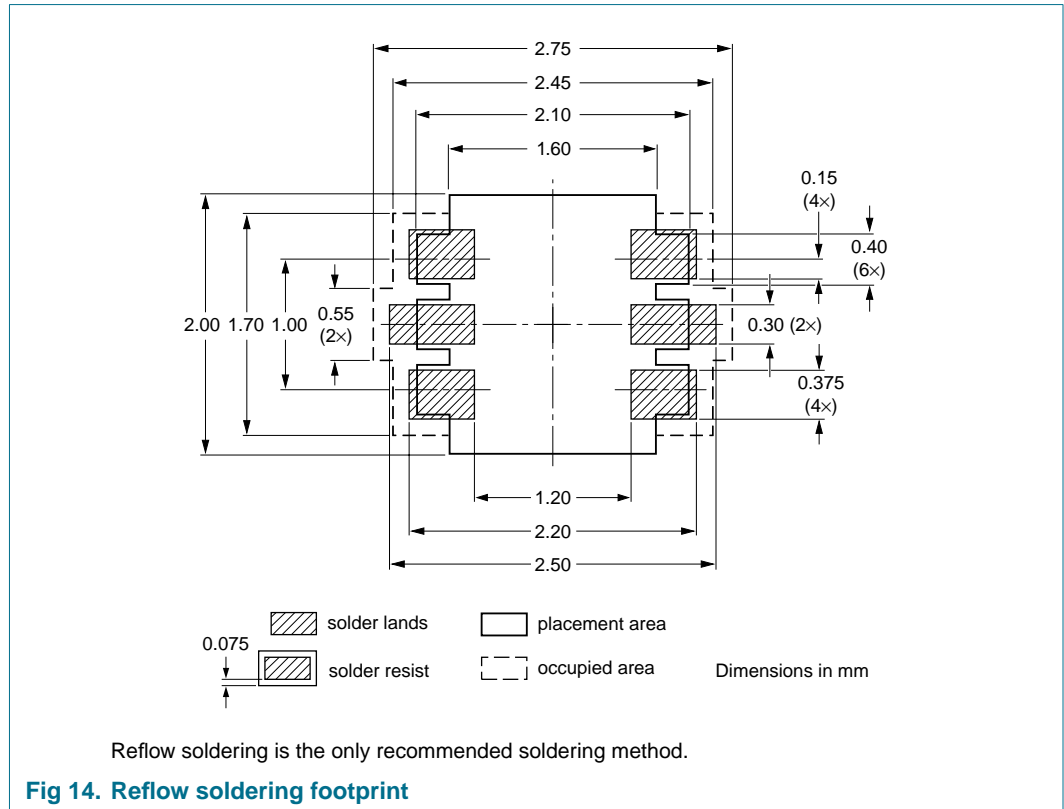
Table 8: Packing methods

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

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 17](#).

11. Soldering



12. Revision history

Table 9: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PBSS4220V_1	20060206	Product data sheet	-	-	-

13. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	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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