

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

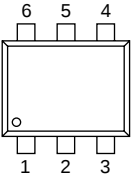
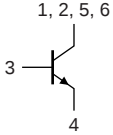
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	20	V
I_C	collector current		-	-	2	A
I_{CM}	peak collector current	$t_p \leq 300 \mu s$	-	-	4	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 1 A$; $I_B = 100 mA$	[1] -	140	175	m Ω

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

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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		
	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

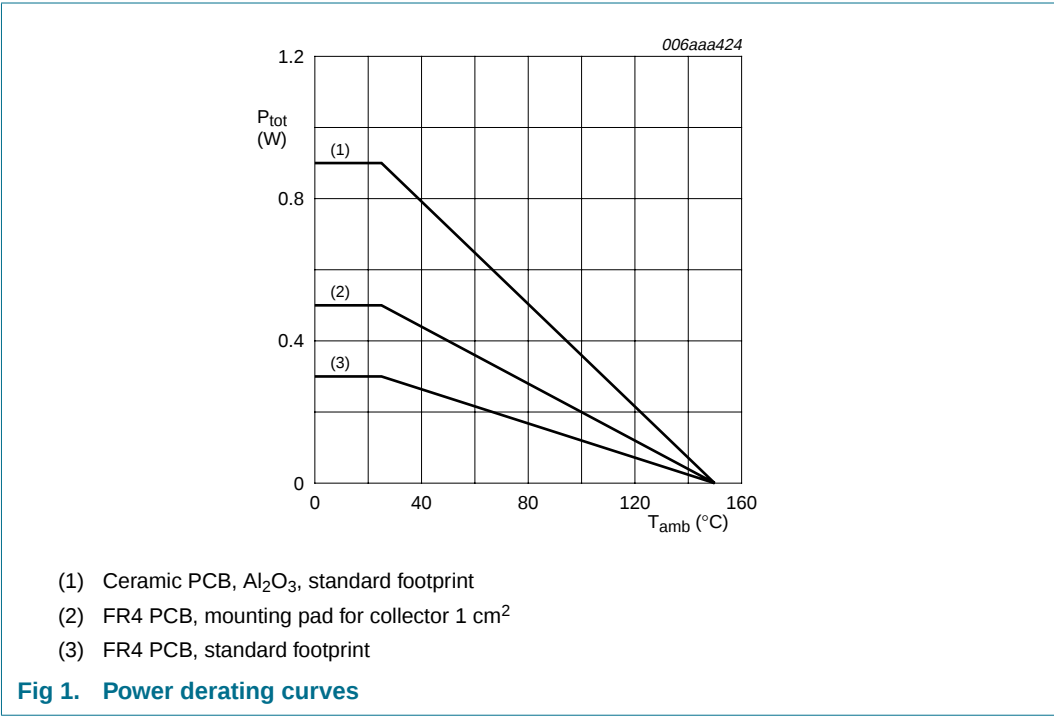
In accordance with the Absolute Maximum Rating System (IEC 60134).

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	$T_{amb} \leq 25 \text{ }^\circ C$	[1] [4]	0.3	W
			[2] [4]	0.5	W
			[3] [4]	0.9	W
T_j	junction temperature		-	150	$^\circ C$

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.

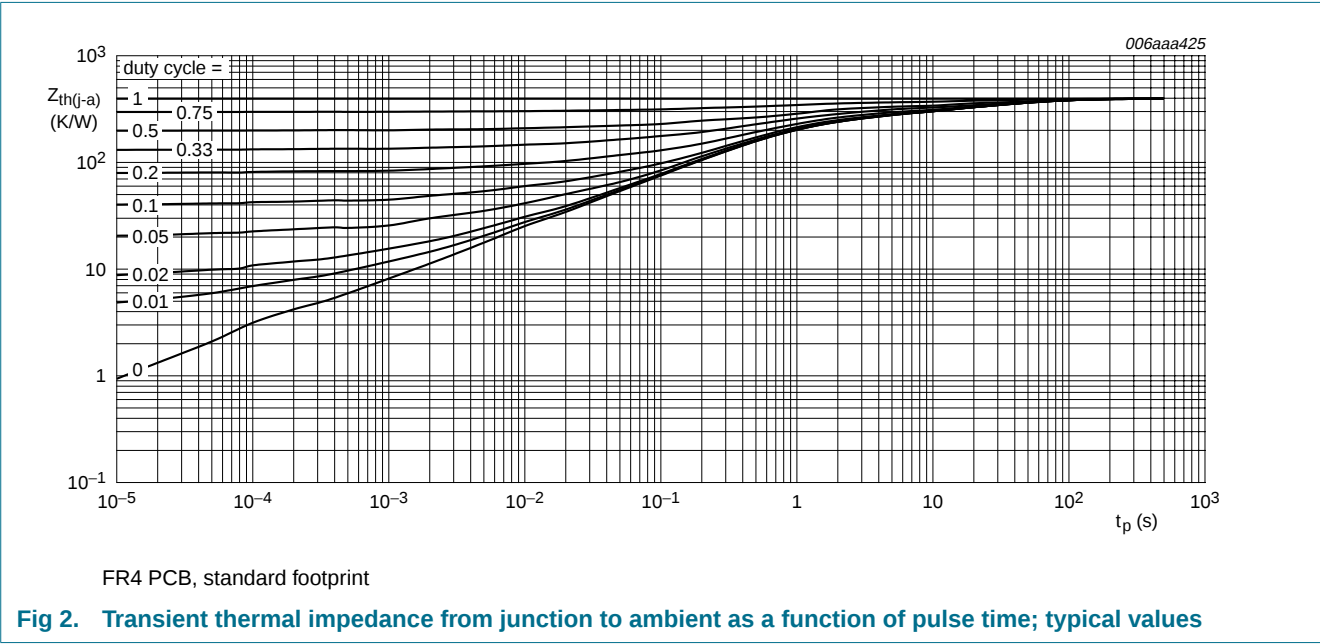


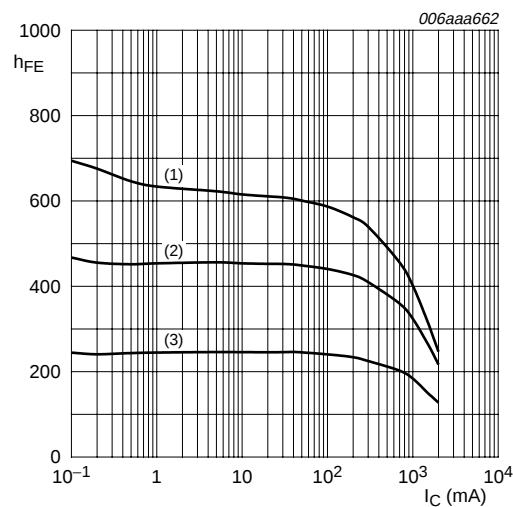
Fig 2. Transient thermal impedance from junction to ambient as a function of pulse time; typical values

7. Characteristics

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

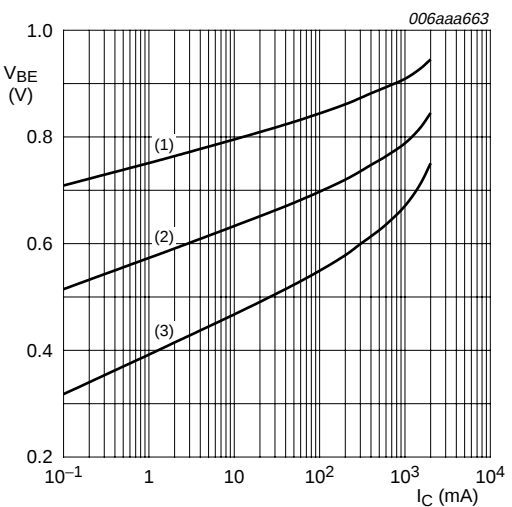
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 20\text{ V}; I_E = 0\text{ A}$	-	-	0.1	μA
		$V_{CB} = 20\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	μA
I_{CES}	collector-emitter cut-off current	$V_{CE} = 20\text{ V}; V_{BE} = 0\text{ V}$	-	-	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	175	$\text{m}\Omega$
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	$V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$	-	11	-	pF

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



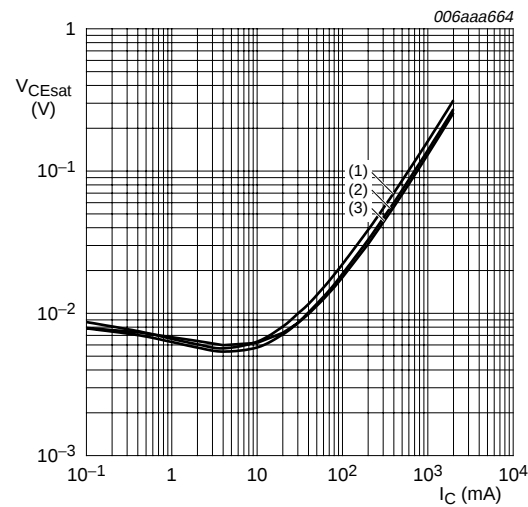
$V_{CE} = 2\text{ V}$
(1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



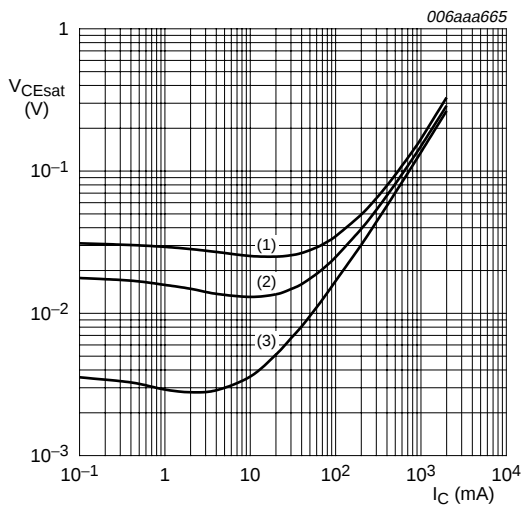
$V_{CE} = 5\text{ V}$
(1) $T_{amb} = -55\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



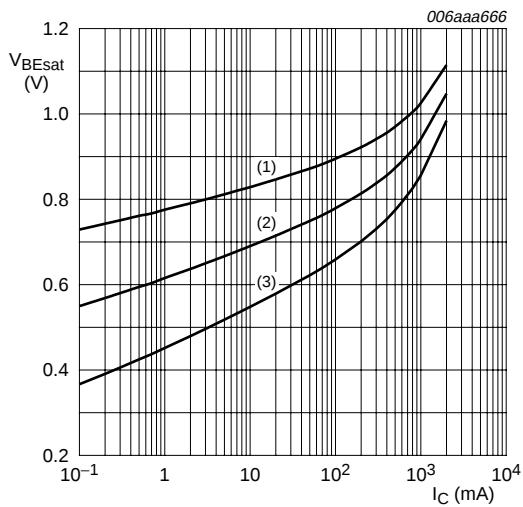
$I_C/I_B = 20$
(1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



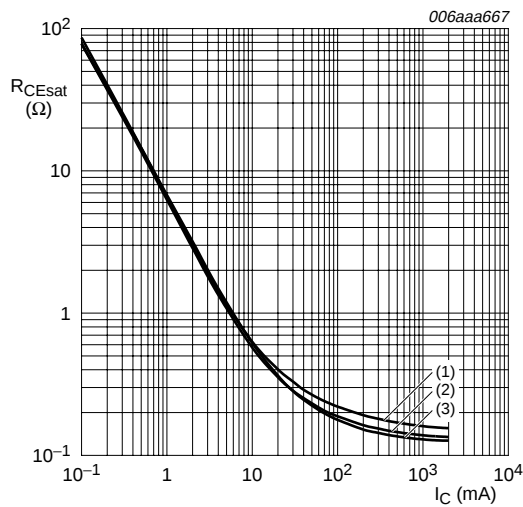
$T_{amb} = 25\text{ }^{\circ}\text{C}$
(1) $I_C/I_B = 100$
(2) $I_C/I_B = 50$
(3) $I_C/I_B = 10$

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



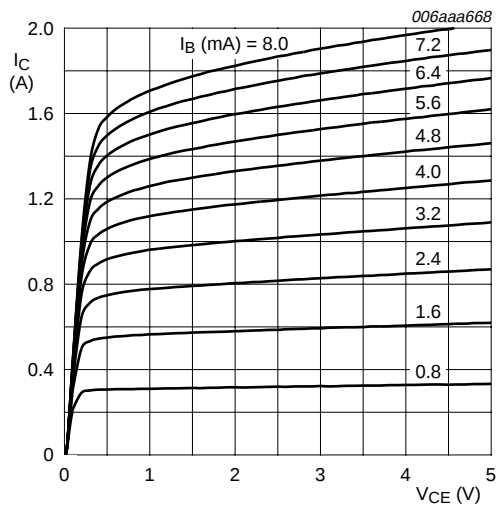
$I_C/I_B = 20$
(1) $T_{amb} = -55\text{ °C}$
(2) $T_{amb} = 25\text{ °C}$
(3) $T_{amb} = 100\text{ °C}$

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



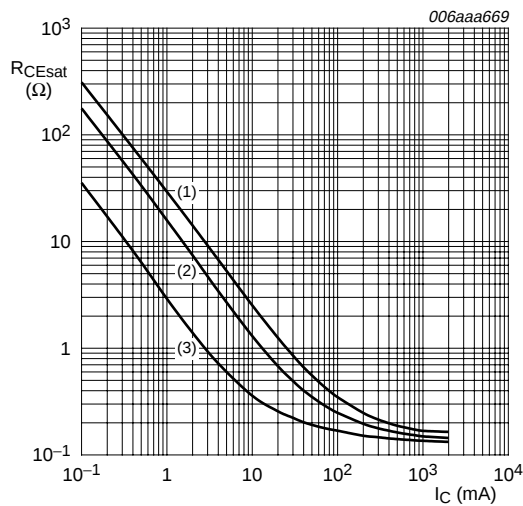
$I_C/I_B = 20$
(1) $T_{amb} = 100\text{ °C}$
(2) $T_{amb} = 25\text{ °C}$
(3) $T_{amb} = -55\text{ °C}$

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

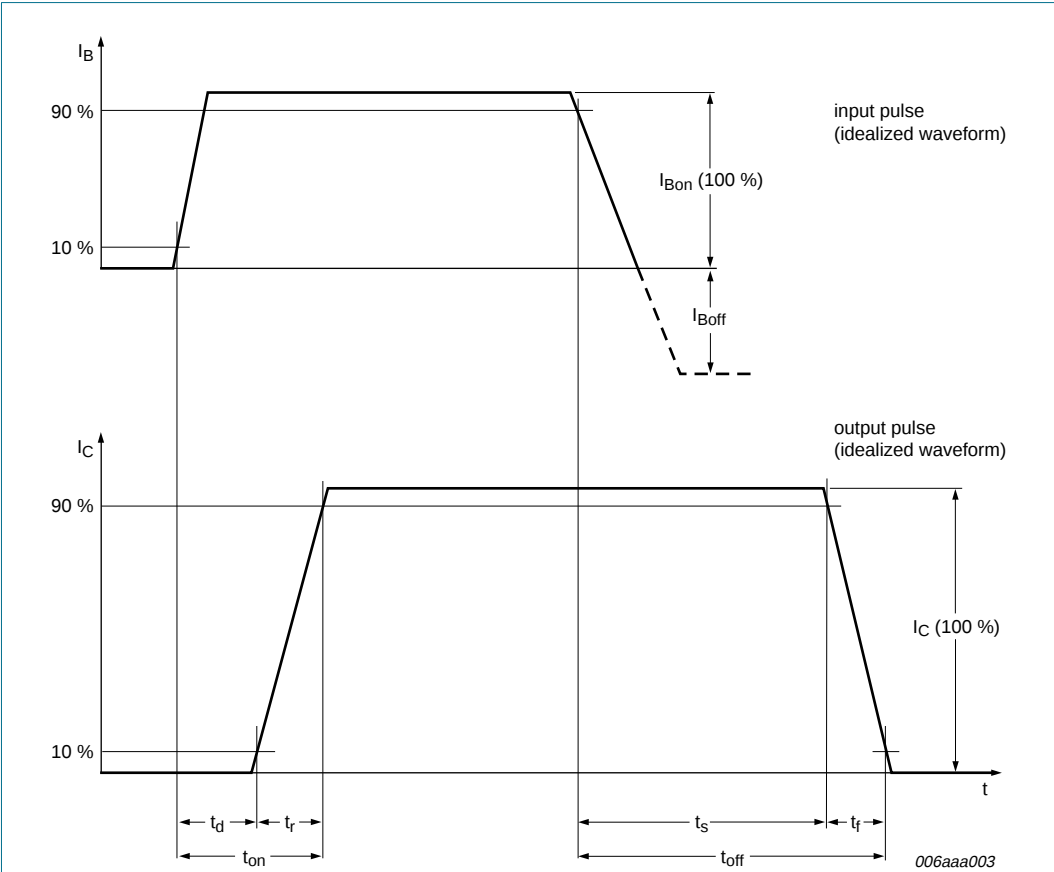
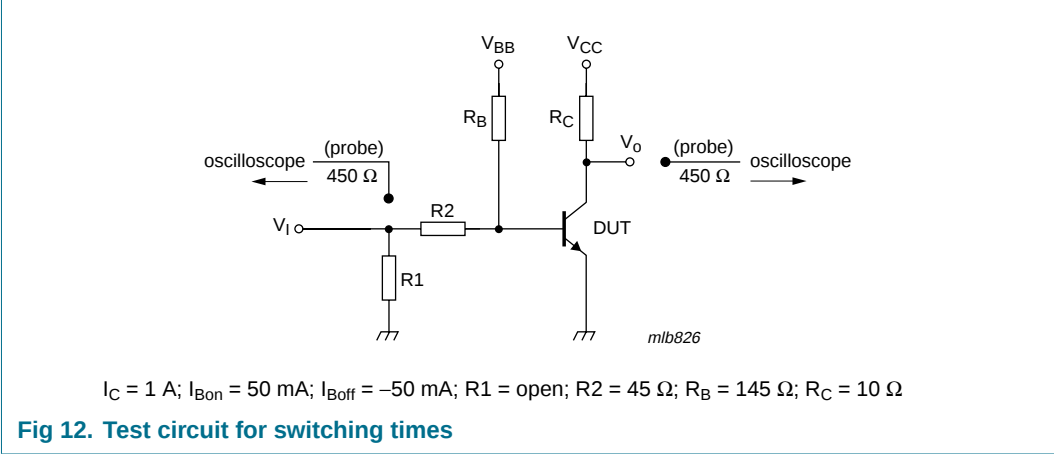
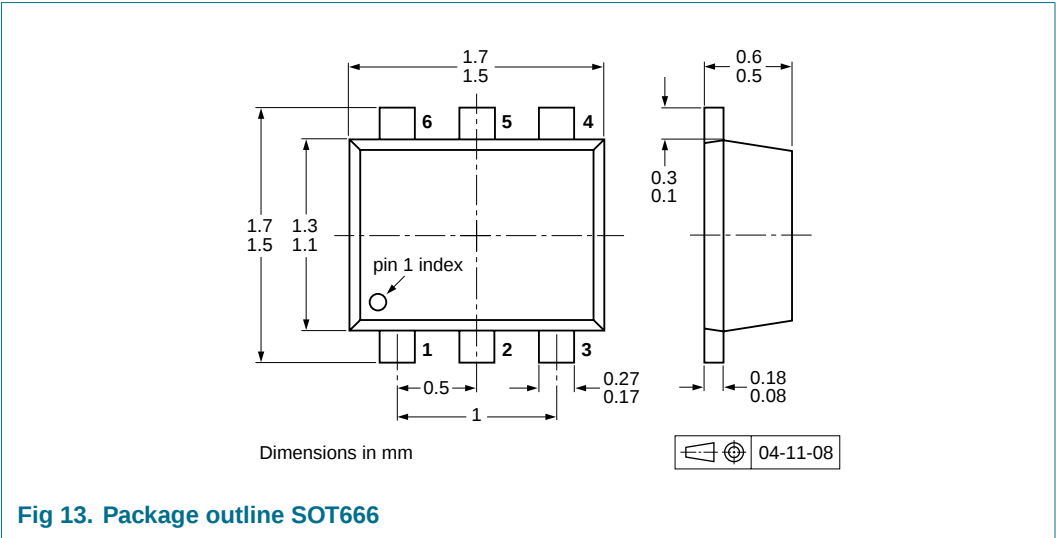


Fig 11. BISS transistor switching time definition



9. Package outline



10. Packing information

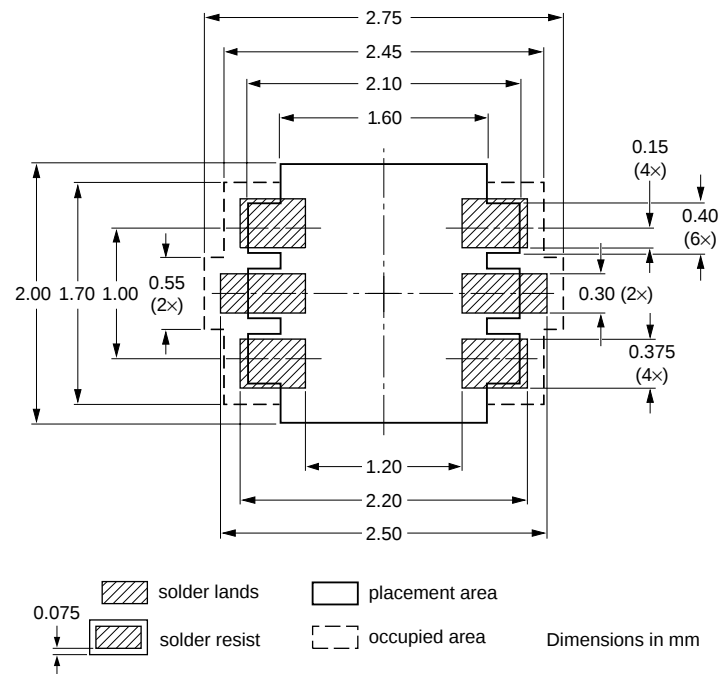
Table 8: Packing methods

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



Reflow soldering is the only recommended soldering method.

Fig 14. Reflow soldering footprint



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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18. Contents

1	Product profile	1
1.1	General description.	1
1.2	Features	1
1.3	Applications	1
1.4	Quick reference data.	1
2	Pinning information	2
3	Ordering information	2
4	Marking	2
5	Limiting values	2
6	Thermal characteristics	4
7	Characteristics	5
8	Test information	8
9	Package outline	9
10	Packing information	9
11	Soldering	10
12	Revision history	11
13	Data sheet status	12
14	Definitions	12
15	Disclaimers	12
16	Trademarks	12
17	Contact information	12



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