

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

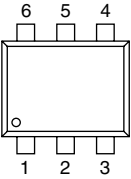
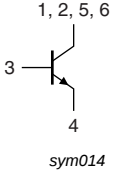
Table 1. Quick reference data

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 Ω

[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		
	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

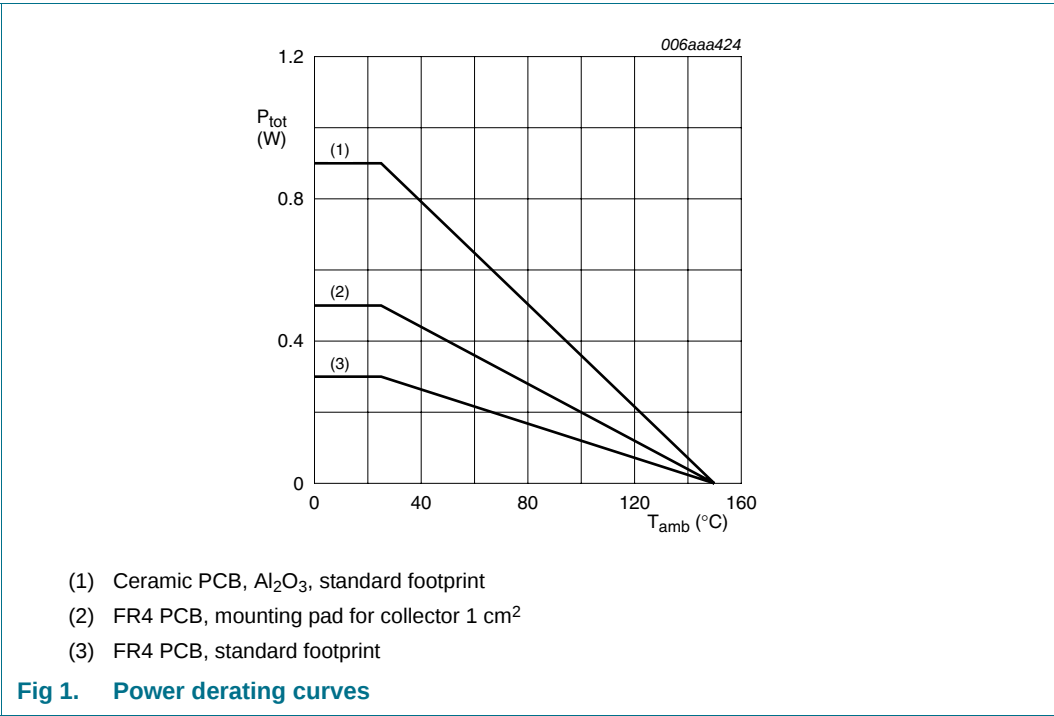
In accordance with the Absolute Maximum Rating System (IEC 60134).

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	$T_{amb} \leq 25^\circ C$	[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.

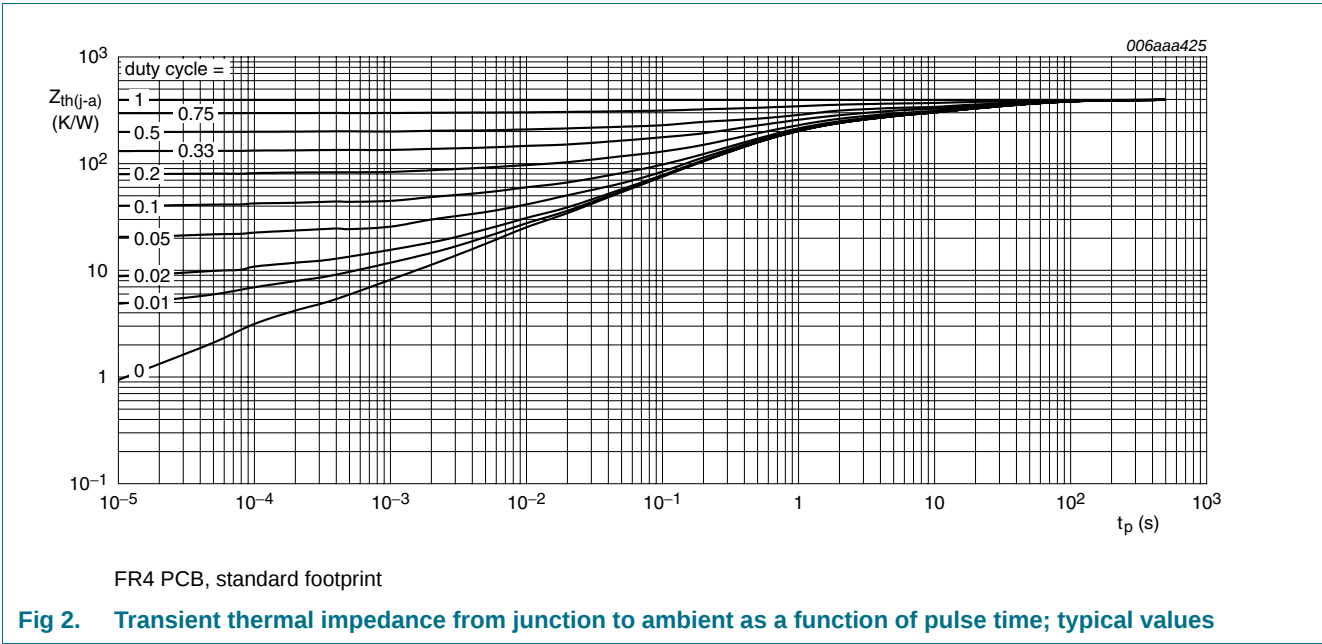


6. Thermal characteristics

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.



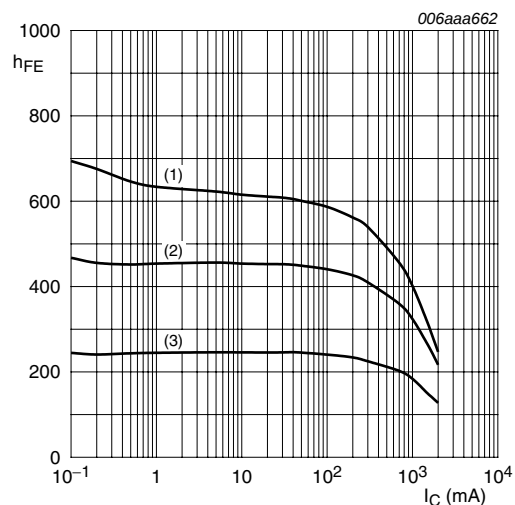
7. Characteristics

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

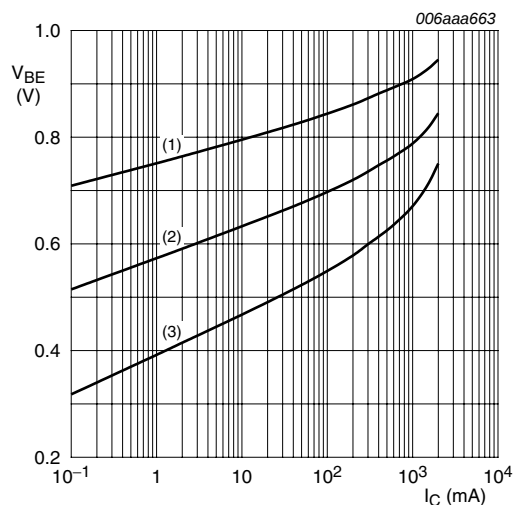
[1] Pulse test: $t_p \leq 300\text{ }\mu\text{s}$; $\delta \leq 0.02$.



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

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

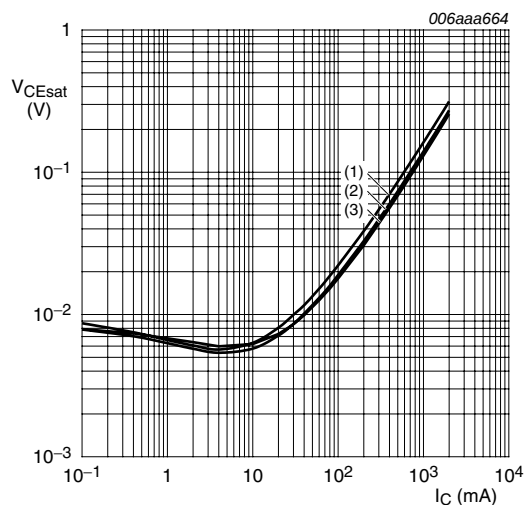
Fig 3. DC current gain as a function of collector current; typical values



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

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

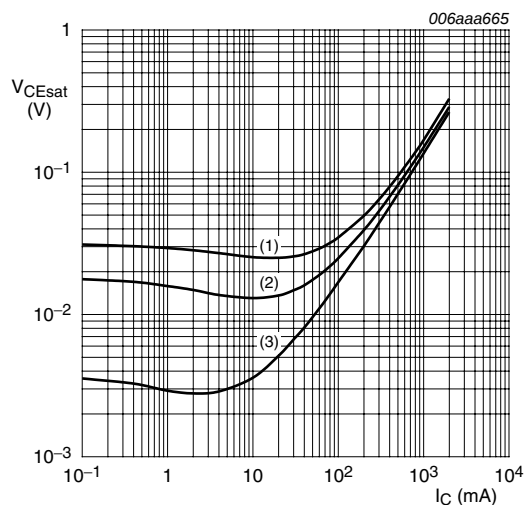
Fig 4. Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 20$

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

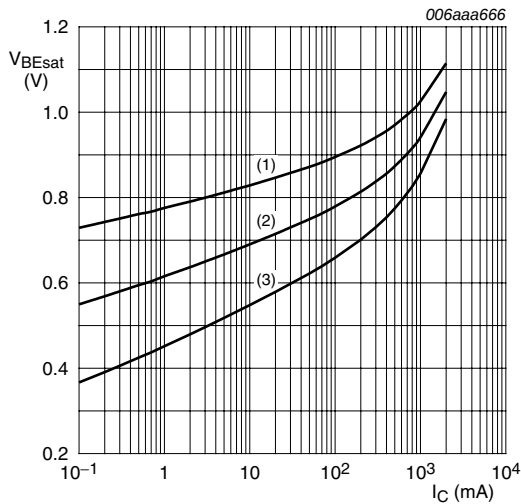
Fig 5. Collector-emitter saturation voltage as a function of collector current; typical values



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

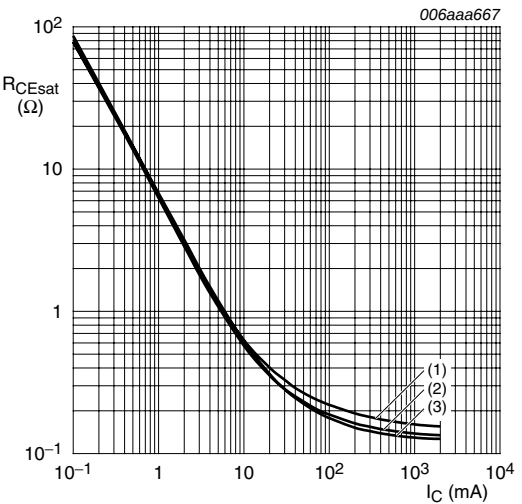
- (1) $I_C/I_B = 100$
- (2) $I_C/I_B = 50$
- (3) $I_C/I_B = 10$

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



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

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



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

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

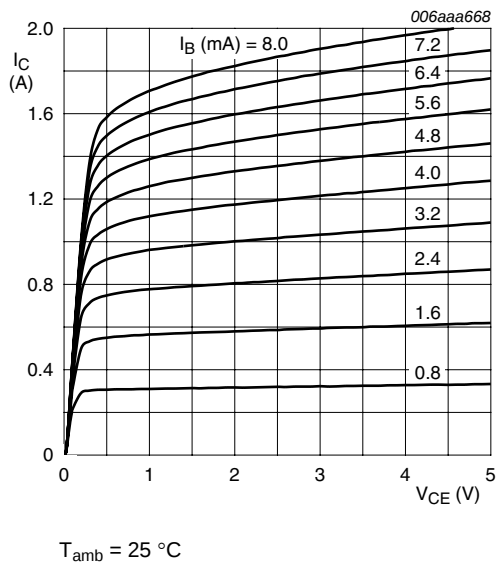


Fig 9. Collector current as a function of collector-emitter voltage; typical values

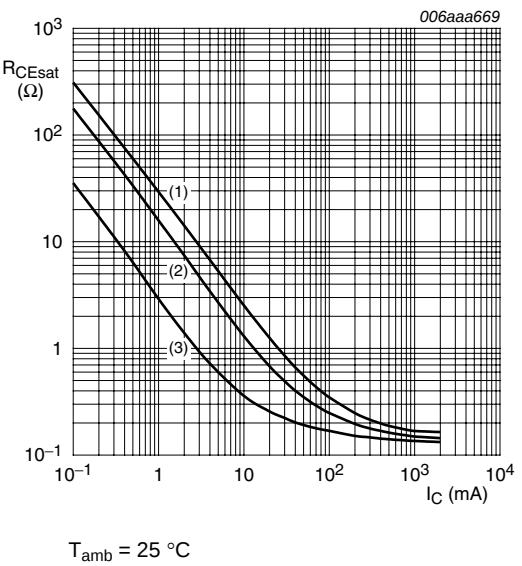


Fig 10. Collector-emitter saturation resistance as a function of collector current; typical values

8. Test information

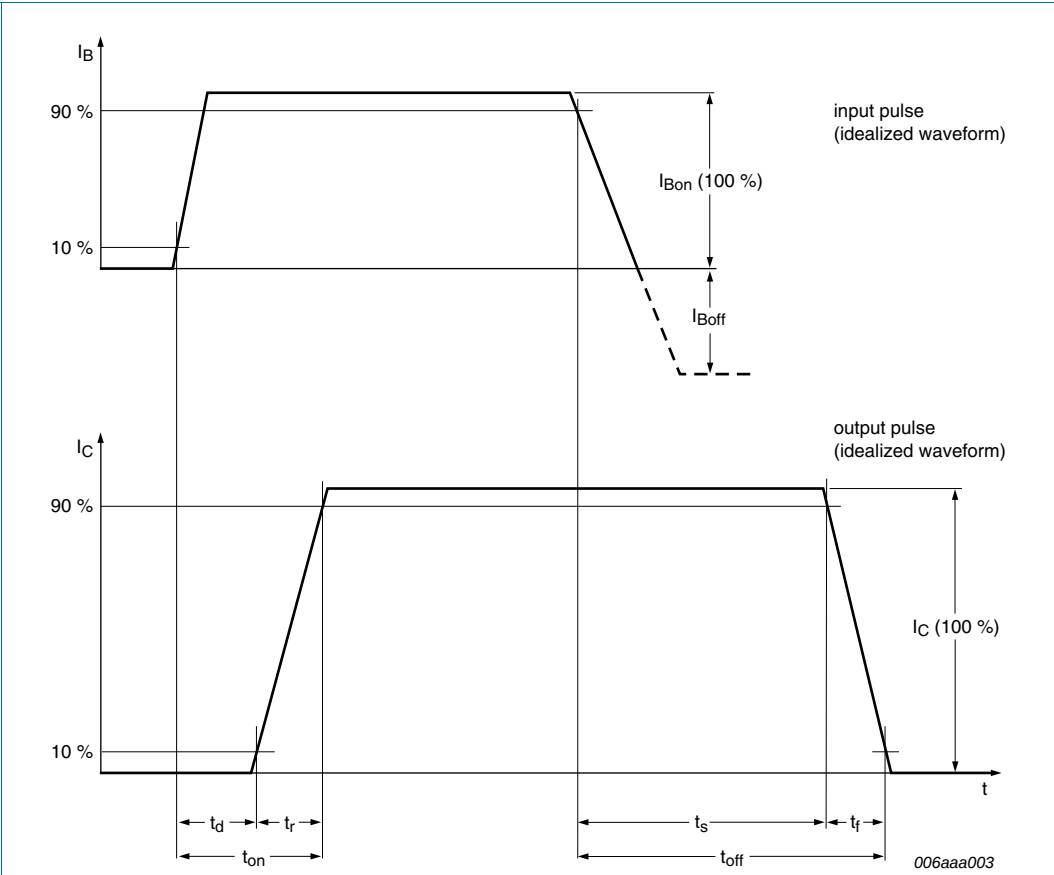
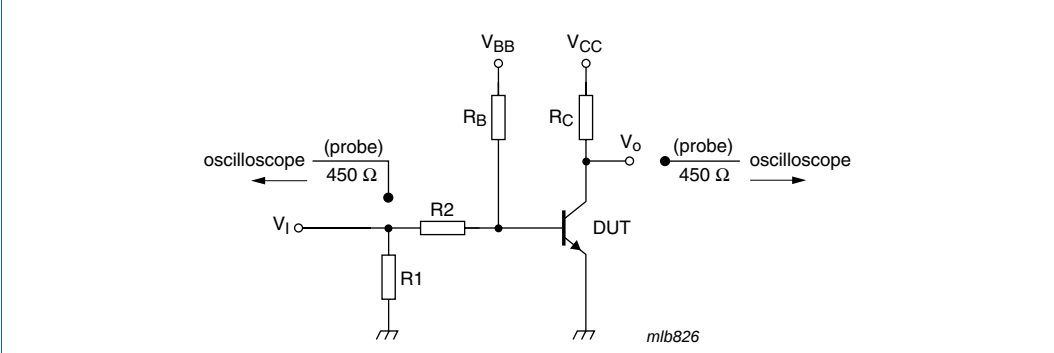


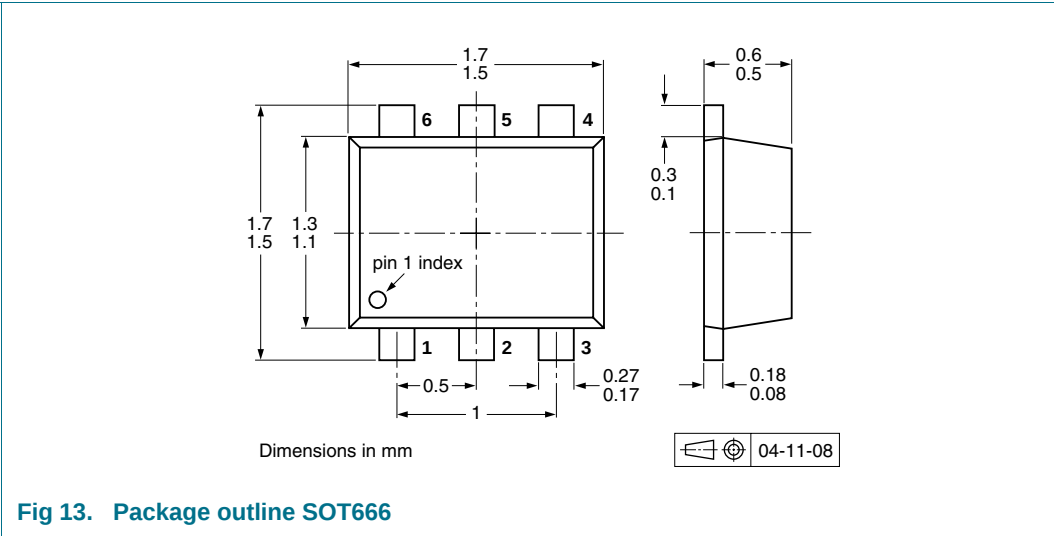
Fig 11. BISS transistor switching time definition



$I_C = 1 \text{ A}$; $I_{B(on)} = 50 \text{ mA}$; $I_{B(off)} = -50 \text{ mA}$; $R_1 = \text{open}$; $R_2 = 45 \Omega$; $R_B = 145 \Omega$; $R_C = 10 \Omega$

Fig 12. Test circuit for switching times

9. Package outline



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 14](#).

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:	- 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. Figure 14 "Reflow soldering footprint": updated			
PBSS4220V_1	20060206	Product data sheet	-	-

13. Legal information

13.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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