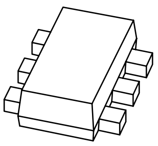


PBSS4220V

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	$t_p \leq 300$ µs		-	-	4	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 1$ A; $I_B = 100$ mA	[1]	-	140	175	mΩ

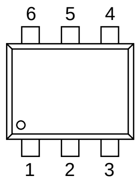
[1] Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

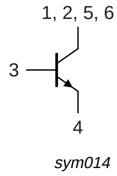
PHILIPS

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

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.

Table 5: Limiting values *…continued*

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

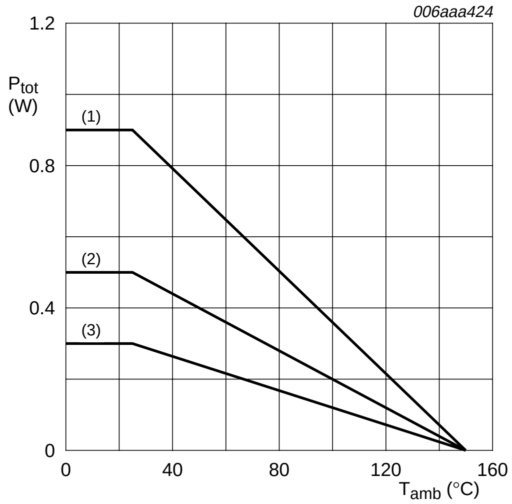
Symbol	Parameter	Conditions	Min	Max	Unit
T_{amb}	ambient temperature		–65	+150	°C
T_{stg}	storage temperature		–65	+150	°C

[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^2.

[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.

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



(1) Ceramic PCB, Al_2O_3, standard footprint

(2) FR4 PCB, mounting pad for collector 1 cm^2

(3) FR4 PCB, standard footprint

Fig 1. Power derating curves

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.

6. Thermal characteristics

Table 6: Thermal characteristics

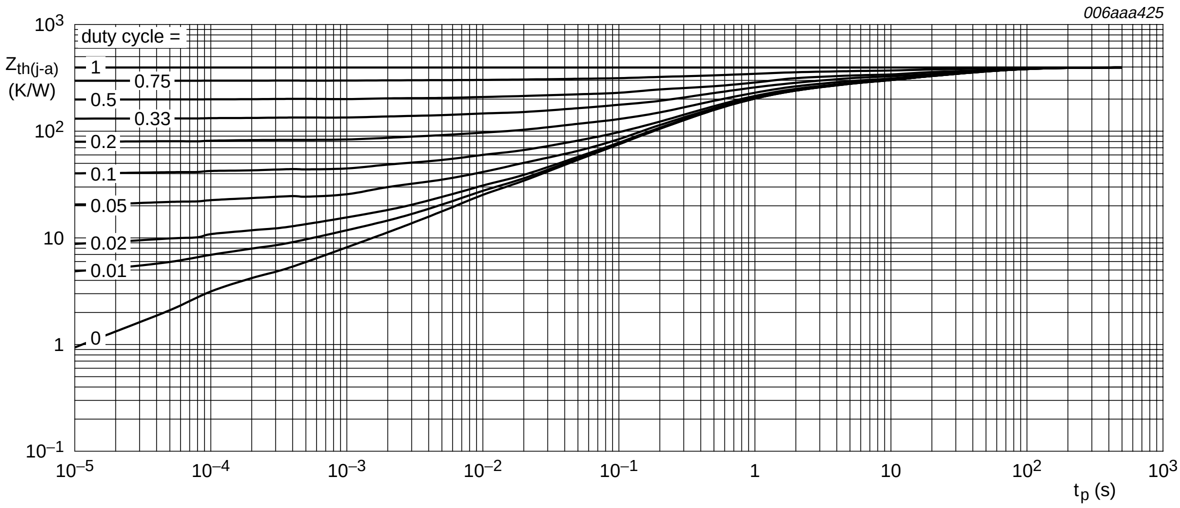
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] [4]	-	-	410	K/W
			[2] [4]	-	-	250	K/W
			[3] [4]	-	-	140	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	80	K/W

[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^2.

[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.

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



FR4 PCB, standard footprint

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

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.

7. Characteristics

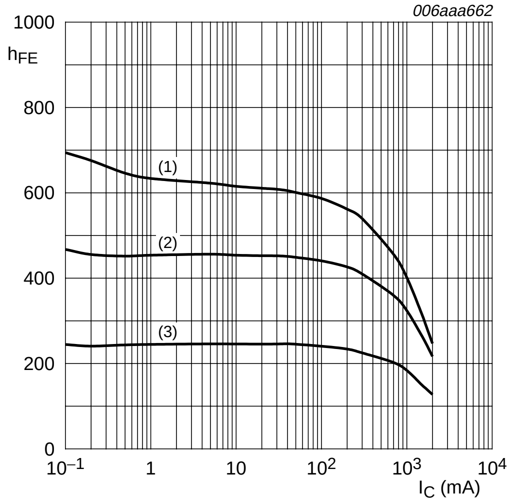
Table 7: Characteristics

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = 20 V; I_E = 0 A		-	-	0.1	µA
		V_{CB} = 20 V; I_E = 0 A; T_j = 150 °C		-	-	50	µA
I_{CES}	collector-emitter cut-off current	V_{CE} = 20 V; V_{BE} = 0 V		-	-	0.1	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A		-	-	0.1	µA
h_{FE}	DC current gain	V_{CE} = 2 V; I_C = 1 mA		220	480	-	
		V_{CE} = 2 V; I_C = 100 mA		220	440	-	
		V_{CE} = 2 V; I_C = 500 mA	[1]	220	410	-	
		V_{CE} = 2 V; I_C = 1 A	[1]	200	360	-	
		V_{CE} = 2 V; I_C = 2 A	[1]	120	220	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 1 mA		-	35	55	mV
		I_C = 500 mA; I_B = 50 mA	[1]	-	70	95	mV
		I_C = 1 A; I_B = 50 mA	[1]	-	145	180	mV
		I_C = 1 A; I_B = 100 mA	[1]	-	140	175	mV
		I_C = 2 A; I_B = 100 mA	[1]	-	275	355	mV
		I_C = 2 A; I_B = 200 mA	[1]	-	270	350	mV
R_{CEsat}	collector-emitter saturation resistance	I_C = 1 A; I_B = 100 mA	[1]	-	140	175	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = 1 A; I_B = 50 mA	[1]	-	0.95	1.1	V
		I_C = 1 A; I_B = 100 mA	[1]	-	1	1.2	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = 5 V; I_C = 1 A		-	0.8	1.1	V
t_d	delay time	I_C = 1 A; I_{Bon} = 50 mA; I_{Boff} = –50 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 V; I_C = 50 mA; f = 100 MHz		-	210	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	11	-	pF

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

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.



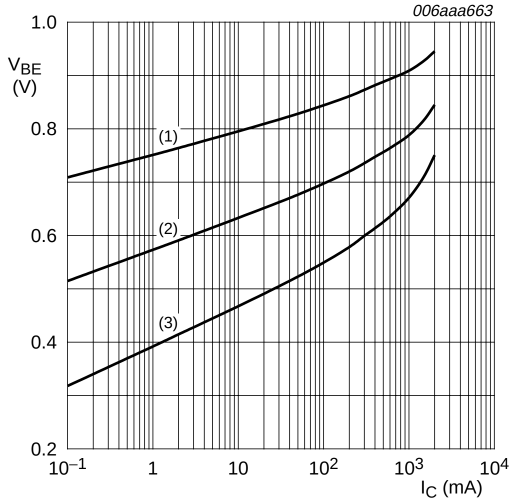
V_{CE} = 2 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = –55 °C

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



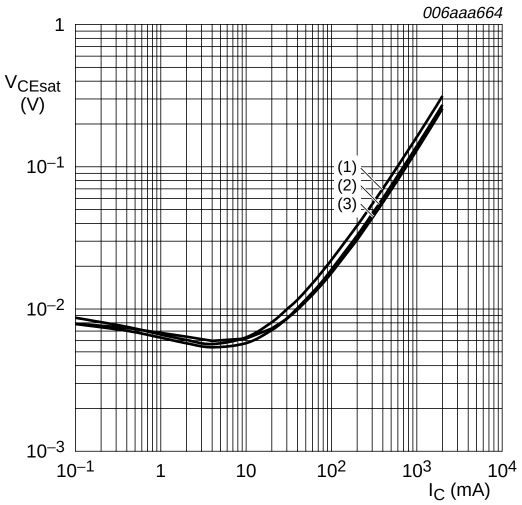
V_{CE} = 5 V

(1) T_{amb} = –55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



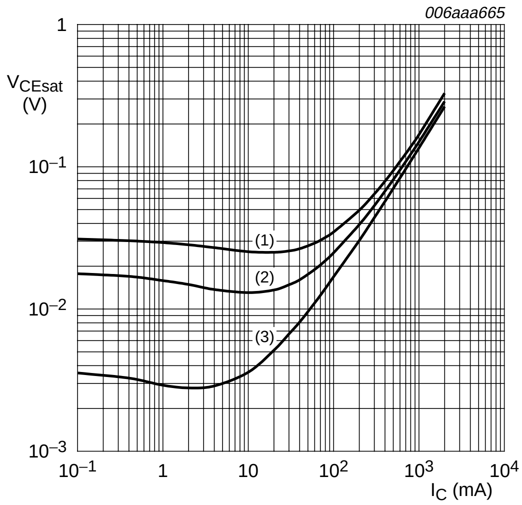
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = –55 °C

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



T_{amb} = 25 °C

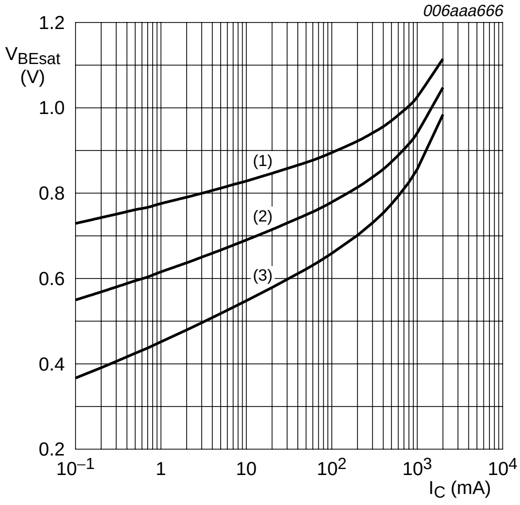
(1) I_C/I_B = 100

(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

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.



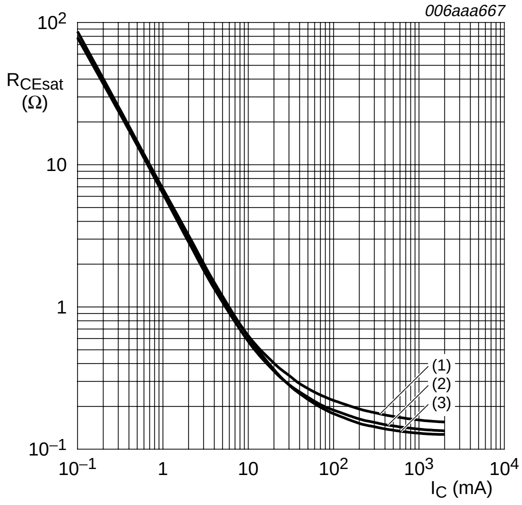
$I_C/I_B = 20$

(1) $T_{amb} = -55$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = 100$ °C

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



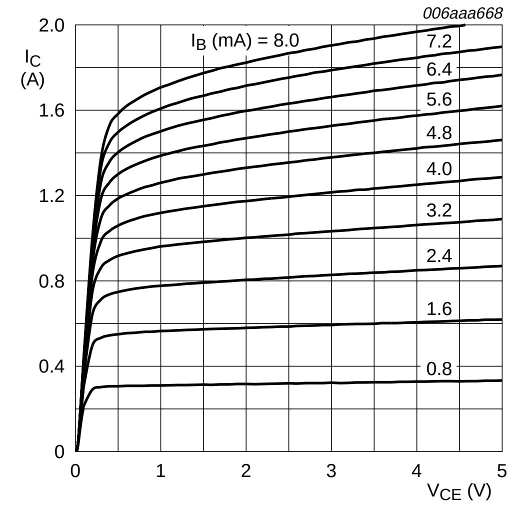
$I_C/I_B = 20$

(1) $T_{amb} = 100$ °C

(2) $T_{amb} = 25$ °C

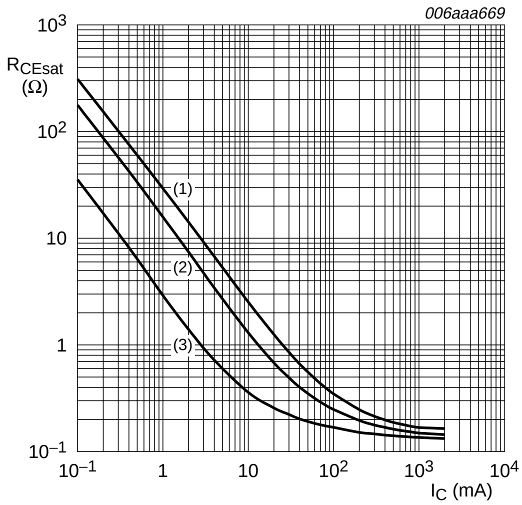
(3) $T_{amb} = -55$ °C

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



$T_{amb} = 25$ °C

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



$T_{amb} = 25$ °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

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.

8. Test information

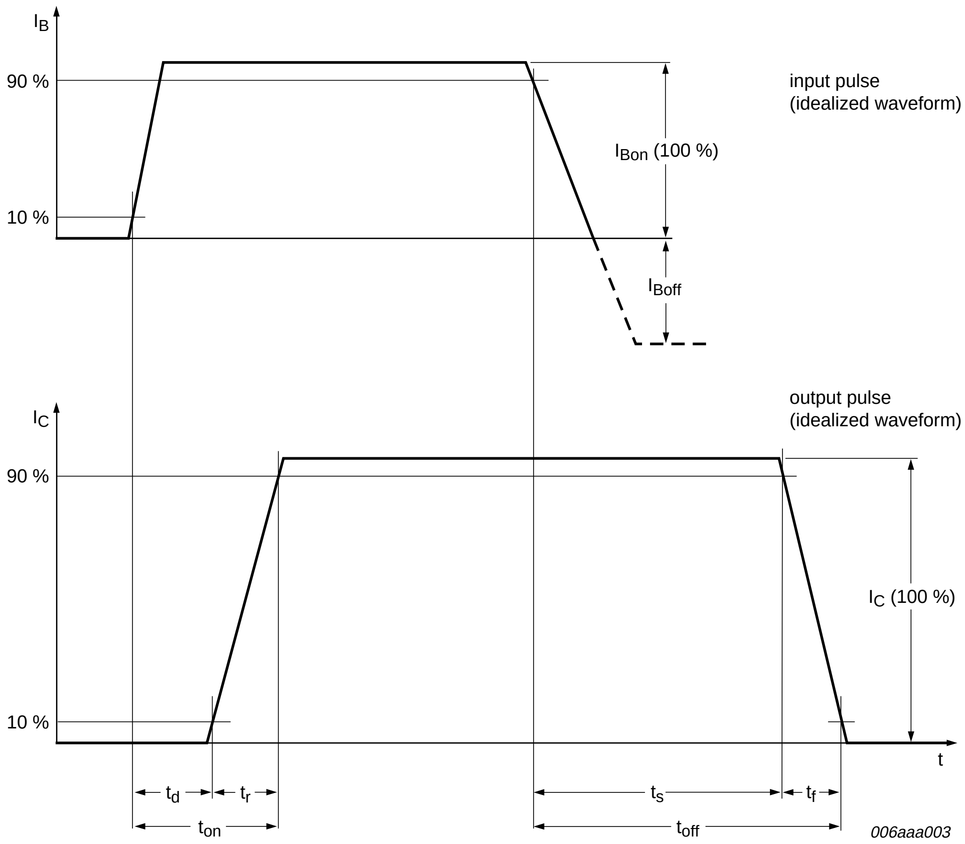
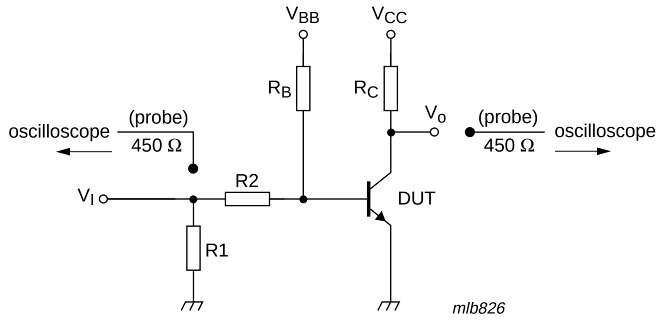


Fig 11. BISS transistor switching time definition



I_C = 1 A; I_{Bon} = 50 mA; I_{Boff} = –50 mA; R1 = open; R2 = 45 Ω; R_B = 145 Ω; R_C = 10 Ω

Fig 12. Test circuit for switching times

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.

9. Package outline

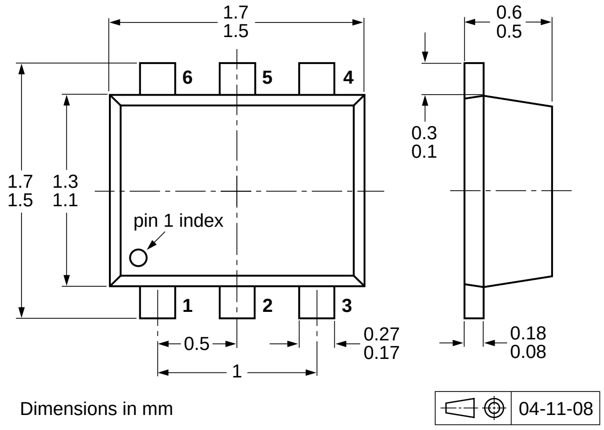


Fig 13. Package outline SOT666

10. Packing information

Table 8: Packing methods

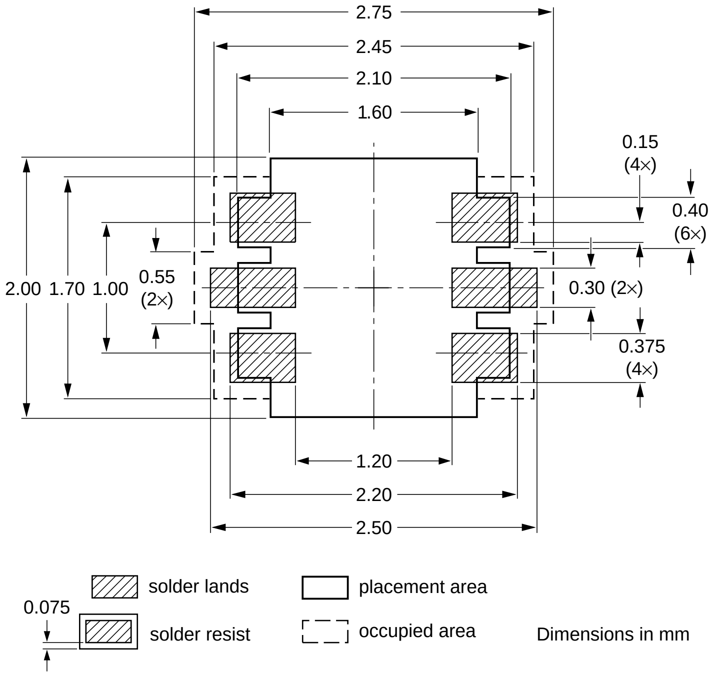
The indicated -xxx are the last three digits of the 12NC ordering code. [1]

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.

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.

11. Soldering



Reflow soldering is the only recommended soldering method.

Fig 14. Reflow soldering footprint

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.

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	-	-	-

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.

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.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

14. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

15. Disclaimers

Life support — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status ‘Production’), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

16. Trademarks

Notice — All referenced brands, product names, service names and trademarks are the property of their respective owners.

17. Contact information

For additional information, please visit: **http://www.semiconductors.philips.com**

For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**

© Koninklijke Philips Electronics N.V. 2006. All rights reserved.

18. Contents

© Koninklijke Philips Electronics N.V. 2006

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Date of release: 6 February 2006
Document number: PBSS4220V_1

Published in The Netherlands