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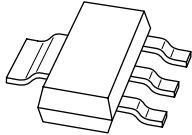
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Kind regards,

Team Nexperia



# PBSS305PZ

80 V, 4.5 A PNP low  $V_{CEsat}$  (BISS) transistor

Rev. 02 — 8 December 2009

Product data sheet

## 1. Product profile

### 1.1 General description

PNP low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in a SOT223 (SC-73) small Surface-Mounted Device (SMD) plastic package.

NPN complement: PBSS305NZ.

### 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

- High-voltage DC-to-DC conversion
- High-voltage MOSFET gate driving
- High-voltage motor control
- High-voltage power switches (e.g. motors, fans)
- Automotive applications

### 1.4 Quick reference data

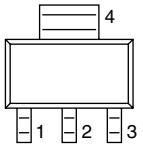
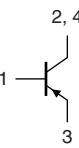
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{CEO}$	collector-emitter voltage	open base	-	-	-80	V	
$I_C$	collector current		-	-	-4.5	A	
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	-9	A	
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -4$ A; $I_B = -200$ mA	[1]	-	61	87	$m\Omega$

[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	base		
2	collector		
3	emitter		
4	collector		 sym028

## 3. Ordering information

Table 3. Ordering information

Type number	Package			Version
	Name	Description		
PBSS305PZ	SC-73	plastic surface-mounted package with increased heatsink; 4 leads		SOT223

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS305PZ	S305PZ

## 5. Limiting values

**Table 5. Limiting values**

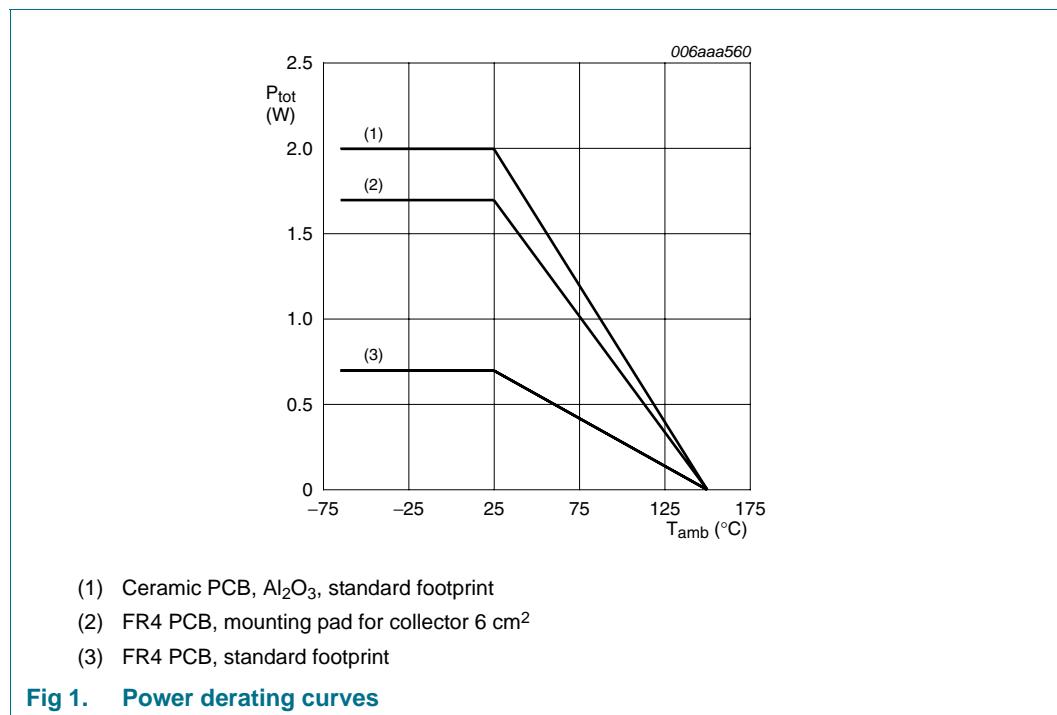
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	-80	V
$V_{CEO}$	collector-emitter voltage	open base	-	-80	V
$V_{EBO}$	emitter-base voltage	open collector	-	-5	V
$I_C$	collector current		-	-4.5	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-9	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	<a href="#">[1]</a>	-	0.7 W
			<a href="#">[2]</a>	-	1.7 W
			<a href="#">[3]</a>	-	2.0 W
$T_j$	junction temperature		-	150	°C
$T_{amb}$	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 6 cm<sup>2</sup>.

[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.



## 6. Thermal characteristics

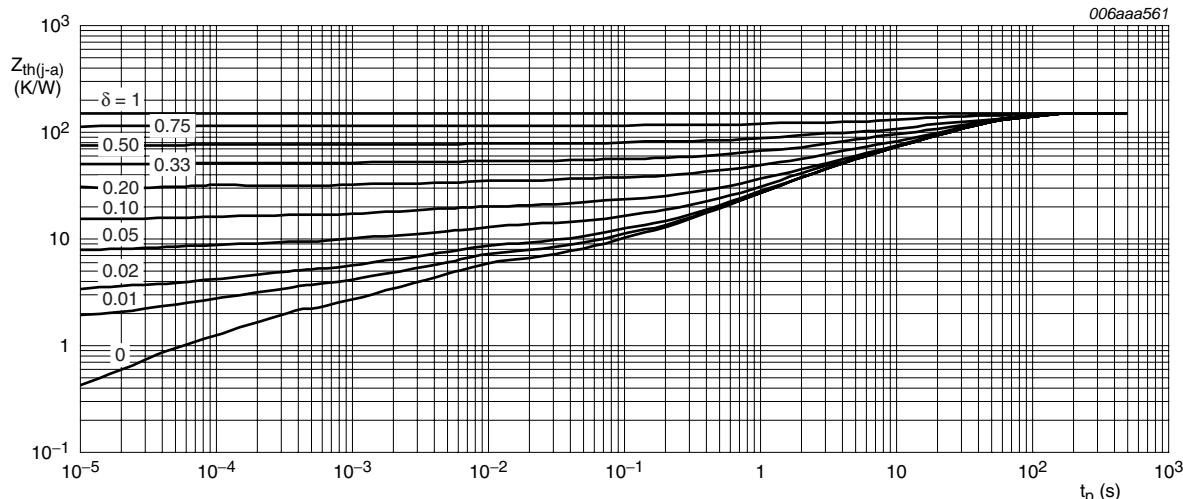
**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	179 K/W
			[2]	-	-	74 K/W
			[3]	-	-	63 K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	15	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

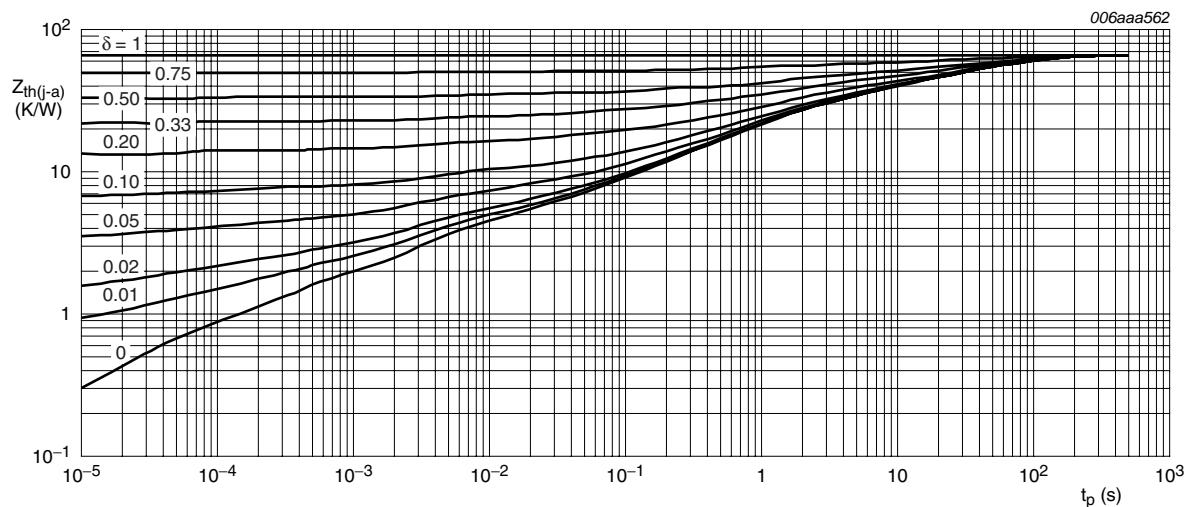
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.

[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.



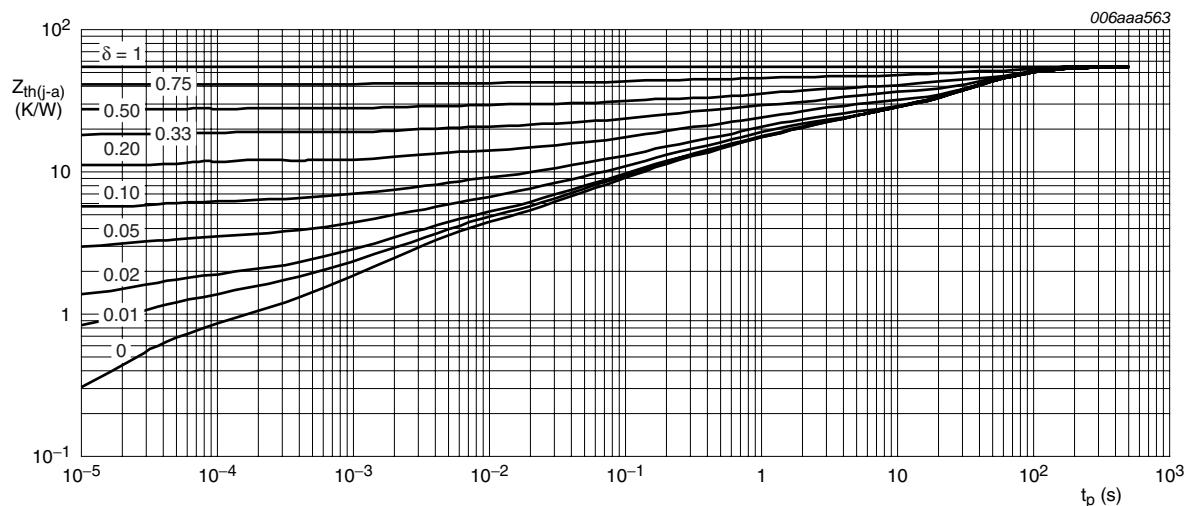
FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

**Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**



Ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint

**Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

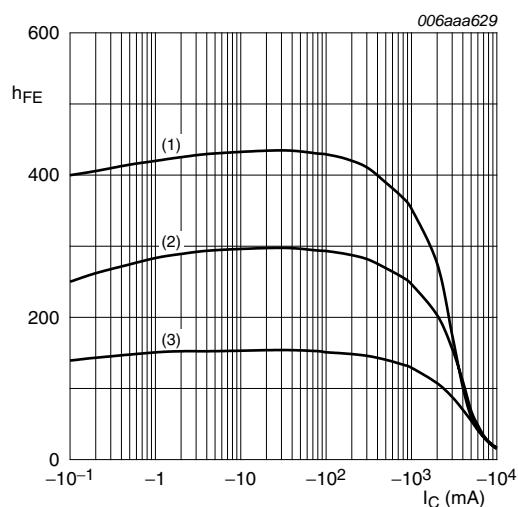
## 7. Characteristics

**Table 7. Characteristics**

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

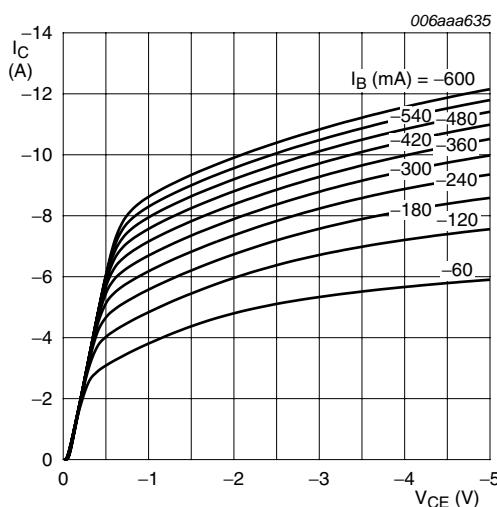
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -80\text{ V}; I_E = 0\text{ A}$	-	-	-100	nA	
		$V_{CB} = -80\text{ V}; I_E = 0\text{ A}; T_J = 150^\circ\text{C}$	-	-	-50	$\mu\text{A}$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}$	-	-	-100	nA	
$h_{FE}$	DC current gain	$V_{CE} = -2\text{ V}; I_C = -0.5\text{ A}$	[1]	200	280	-	
		$V_{CE} = -2\text{ V}; I_C = -1\text{ A}$	[1]	150	240	-	
		$V_{CE} = -2\text{ V}; I_C = -2\text{ A}$	[1]	120	190	-	
		$V_{CE} = -2\text{ V}; I_C = -4\text{ A}$	[1]	60	100	-	
		$V_{CE} = -2\text{ V}; I_C = -6\text{ A}$	[1]	30	45	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -0.5\text{ A}; I_B = -50\text{ mA}$	[1]	-	-36	-50	mV
		$I_C = -1\text{ A}; I_B = -50\text{ mA}$	[1]	-	-70	-100	mV
		$I_C = -1\text{ A}; I_B = -10\text{ mA}$	[1]	-	-180	-260	mV
		$I_C = -2\text{ A}; I_B = -40\text{ mA}$	[1]	-	-200	-280	mV
		$I_C = -4\text{ A}; I_B = -200\text{ mA}$	[1]	-	-245	-345	mV
		$I_C = -4\text{ A}; I_B = -400\text{ mA}$	[1]	-	-180	-245	mV
		$I_C = -4.5\text{ A}; I_B = -225\text{ mA}$	[1]	-	-310	-450	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -2\text{ A}; I_B = -40\text{ mA}$	[1]	-	100	140	$\text{m}\Omega$
		$I_C = -4\text{ A}; I_B = -200\text{ mA}$	[1]	-	61	87	$\text{m}\Omega$
		$I_C = -4\text{ A}; I_B = -400\text{ mA}$	[1]	-	44	63	$\text{m}\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -1\text{ A}; I_B = -100\text{ mA}$	[1]	-	-0.81	-0.9	V
		$I_C = -4\text{ A}; I_B = -400\text{ mA}$	[1]	-	-0.93	-1.05	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = -2\text{ V}; I_C = -2\text{ A}$	[1]	-	-0.78	-0.85	V
$t_d$	delay time	$V_{CC} = -12.5\text{ V}; I_C = -3\text{ A}; I_{Bon} = -0.15\text{ A}; I_{Boff} = 0.15\text{ A}$	-	15	-	ns	
$t_r$	rise time		-	85	-	ns	
$t_{on}$	turn-on time		-	100	-	ns	
$t_s$	storage time		-	185	-	ns	
$t_f$	fall time		-	100	-	ns	
$t_{off}$	turn-off time		-	285	-	ns	
$f_T$	transition frequency	$V_{CE} = -10\text{ V}; I_C = -100\text{ mA}; f = 100\text{ MHz}$	-	100	-	MHz	
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	65	90	pF	

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



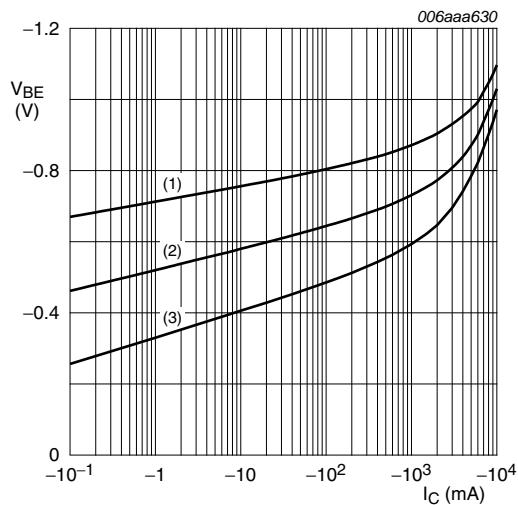
$V_{CE} = -2 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55 \text{ }^{\circ}\text{C}$

**Fig 5. DC current gain as a function of collector current; typical values**



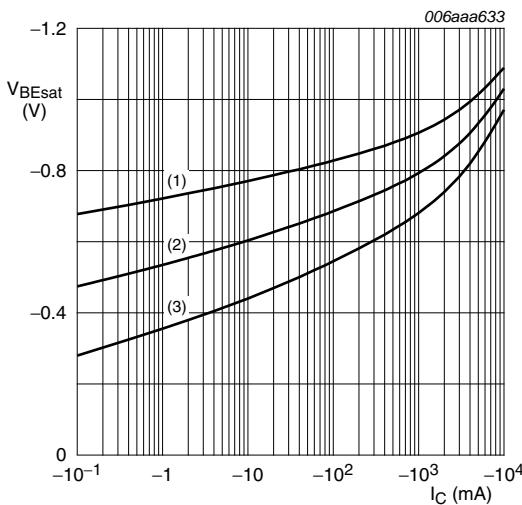
$T_{amb} = 25 \text{ }^{\circ}\text{C}$

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



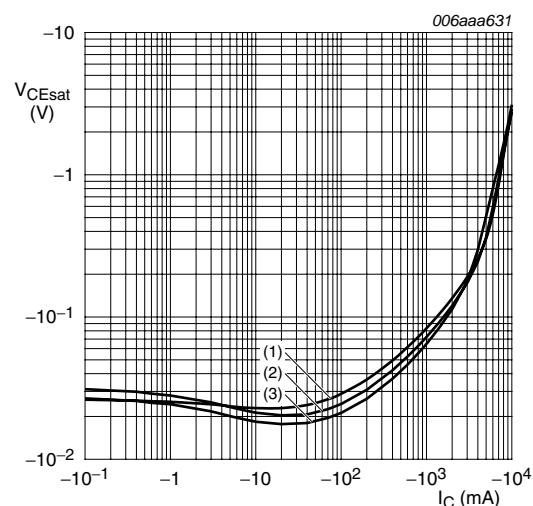
$V_{CE} = -2 \text{ V}$   
 (1)  $T_{amb} = -55 \text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$

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



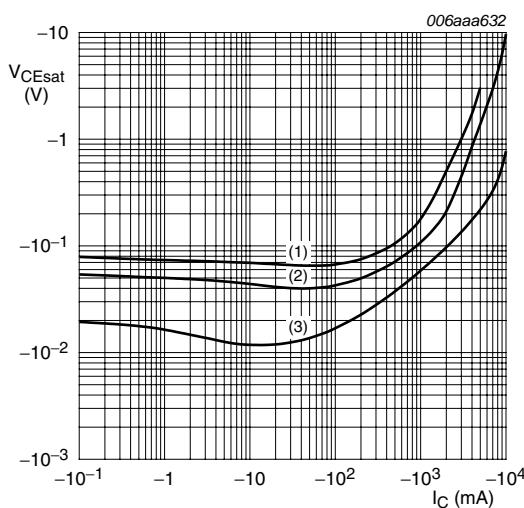
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55 \text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$

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



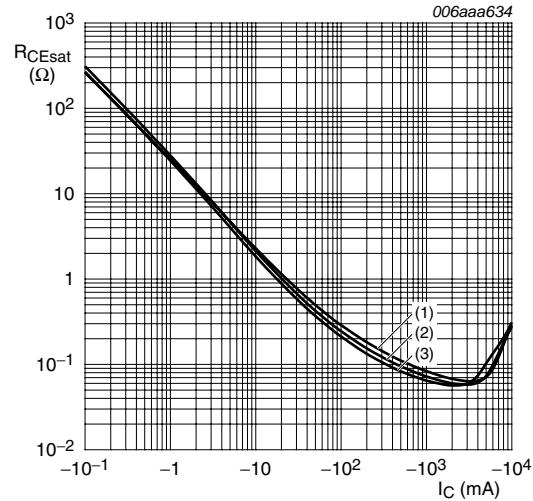
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55 \text{ }^{\circ}\text{C}$

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



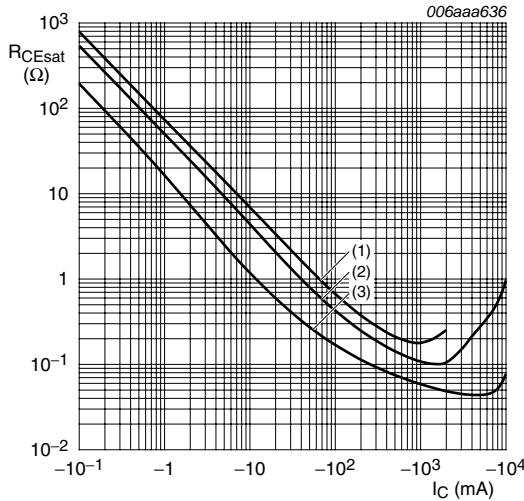
$T_{amb} = 25 \text{ }^{\circ}\text{C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig 10. Collector-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 11. Collector-emitter saturation resistance 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 12. Collector-emitter saturation resistance as a function of collector current; typical values**

## 8. Test information

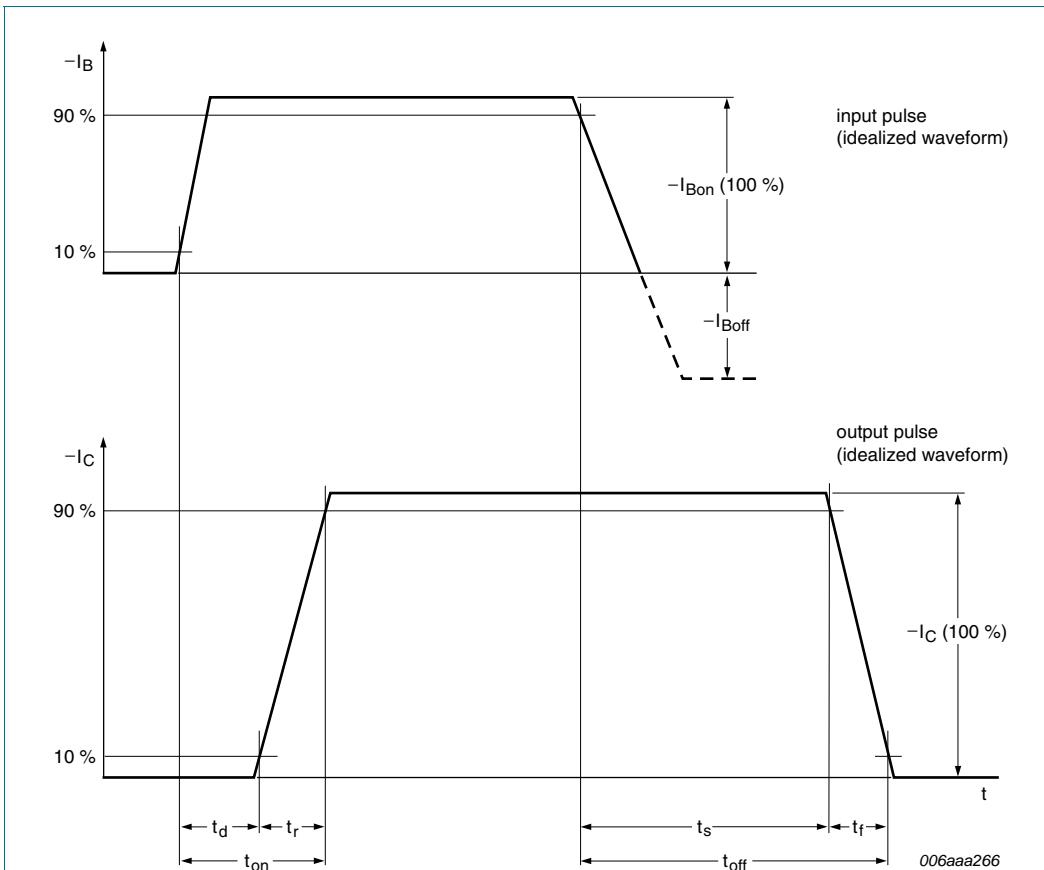
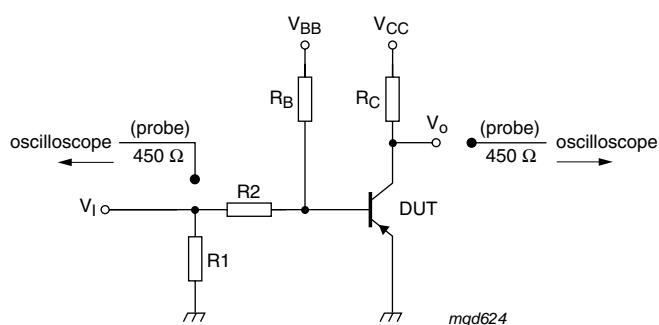


Fig 13. BISS transistor switching time definition



$V_{CC} = -12.5$  V;  $I_C = -3$  A;  $I_{Bon} = -0.15$  A;  $I_{Boff} = 0.15$  A

Fig 14. Test circuit for switching times

## 9. Package outline

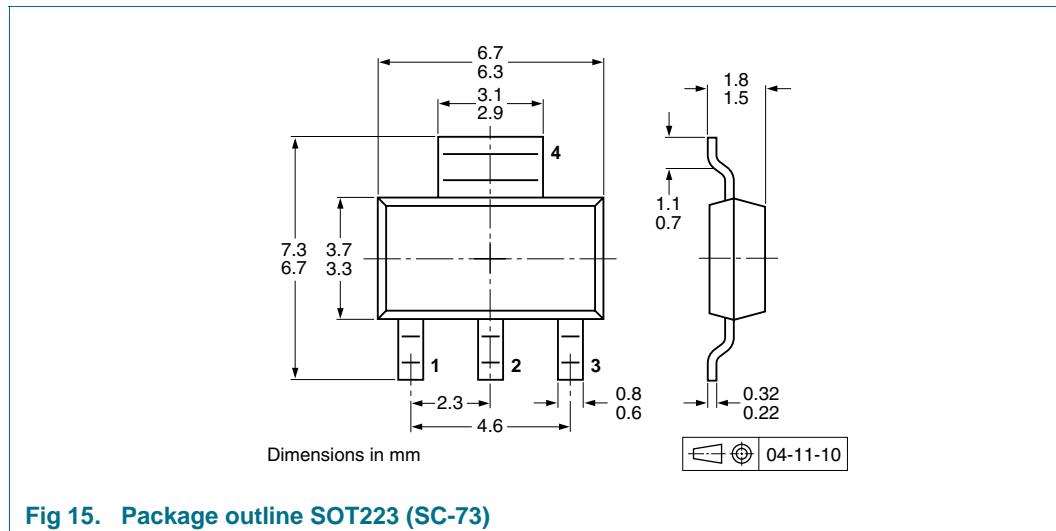


Fig 15. Package outline SOT223 (SC-73)

## 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	
			1000	4000
PBSS305PZ	SOT223	8 mm pitch, 12 mm tape and reel	-115	-135

[1] For further information and the availability of packing methods, see [Section 14](#).

## 11. Soldering

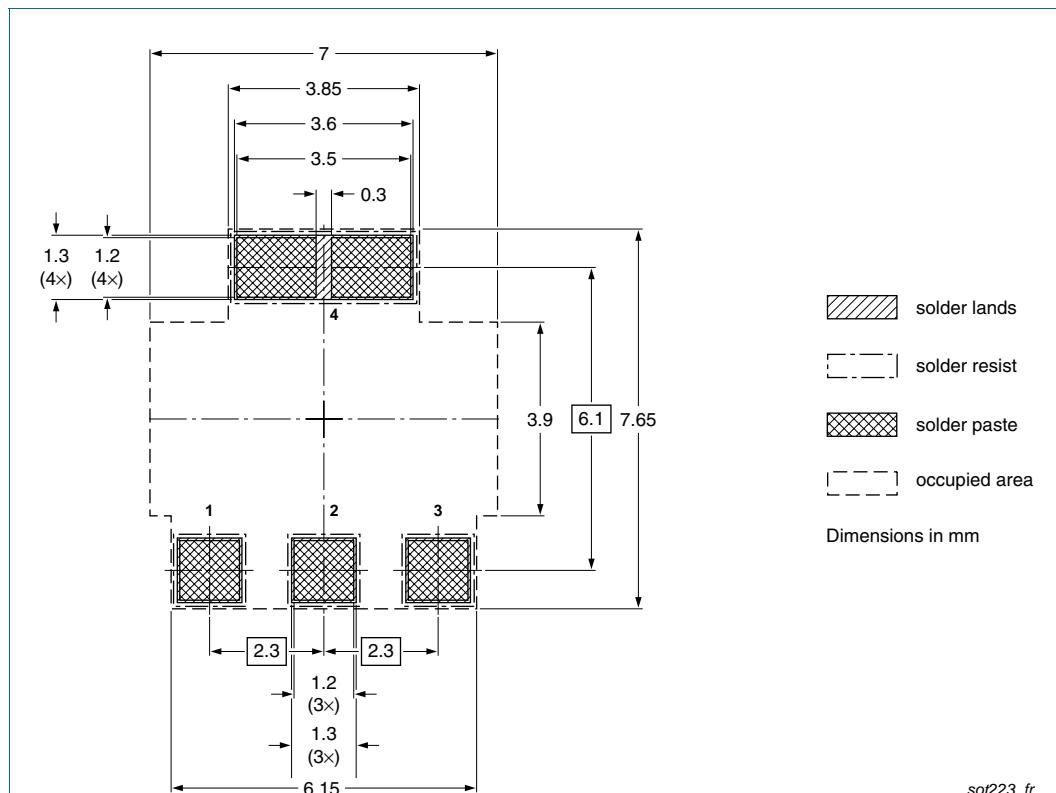


Fig 16. Reflow soldering footprint

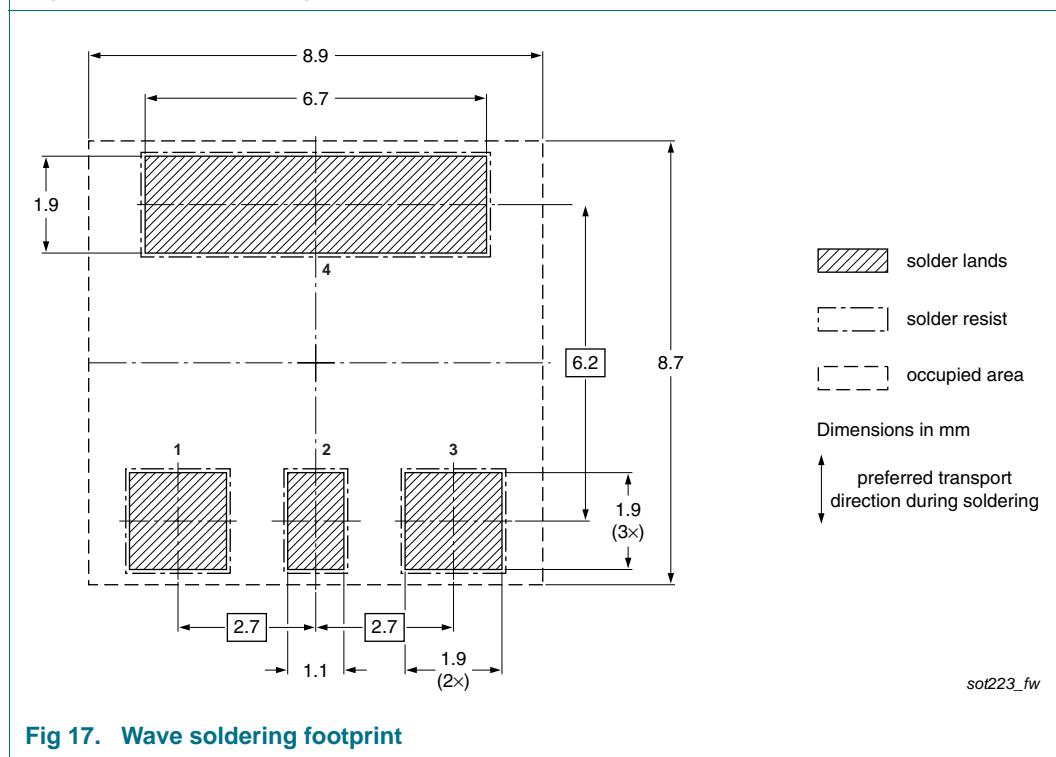


Fig 17. Wave soldering footprint

## 12. Revision history

**Table 9. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS305PZ_2	20091208	Product data sheet	-	PBSS305PZ_1
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 16 “Reflow soldering footprint”</a>: updated</li><li>• <a href="#">Figure 17 “Wave soldering footprint”</a>: updated</li></ul>			
PBSS305PZ_1	20060920	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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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