



# PBSS306PZ

100 V, 4.1 A PNP low  $V_{CEsat}$  (BISS) transistor

Rev. 3 — 26 July 2011

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: PBSS306NZ.

### 1.2 Features and benefits

- 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 Printed-Circuit Board (PCB) area than for conventional transistors
- AEC-Q101 qualified

### 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

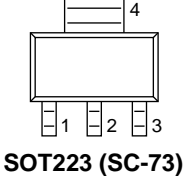
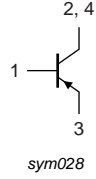
### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	-100	V
$I_C$	collector current		-	-	-4.1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	-8.2	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -4$ A; $I_B = -400$ mA; pulsed; $t_p \leq 300$ $\mu$ s; $\delta \leq 0.02$ ; $T_{amb} = 25$ °C	-	56	80	m $\Omega$

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>SOT223 (SC-73)</p>	 <p>sym028</p>
2	C	collector		
3	E	emitter		
4	C	collector		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS306PZ	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS306PZ	S306PZ

## 5. Limiting values

Table 5. Limiting values

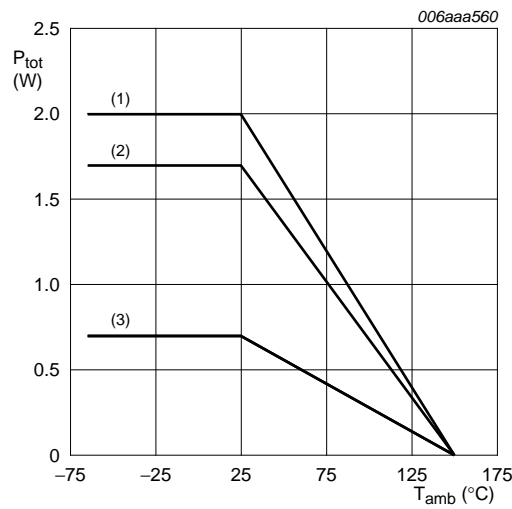
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{CBO}$	collector-base voltage	open emitter	-	-100	V	
$V_{CEO}$	collector-emitter voltage	open base	-	-100	V	
$V_{EBO}$	emitter-base voltage	open collector	-	-5	V	
$I_C$	collector current		-	-4.1	A	
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-8.2	A	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	0.7	W
			[2]	-	1.7	W
			[3]	-	2	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.



- (1) Ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint
- (2) FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>
- (3) FR4 PCB, standard footprint

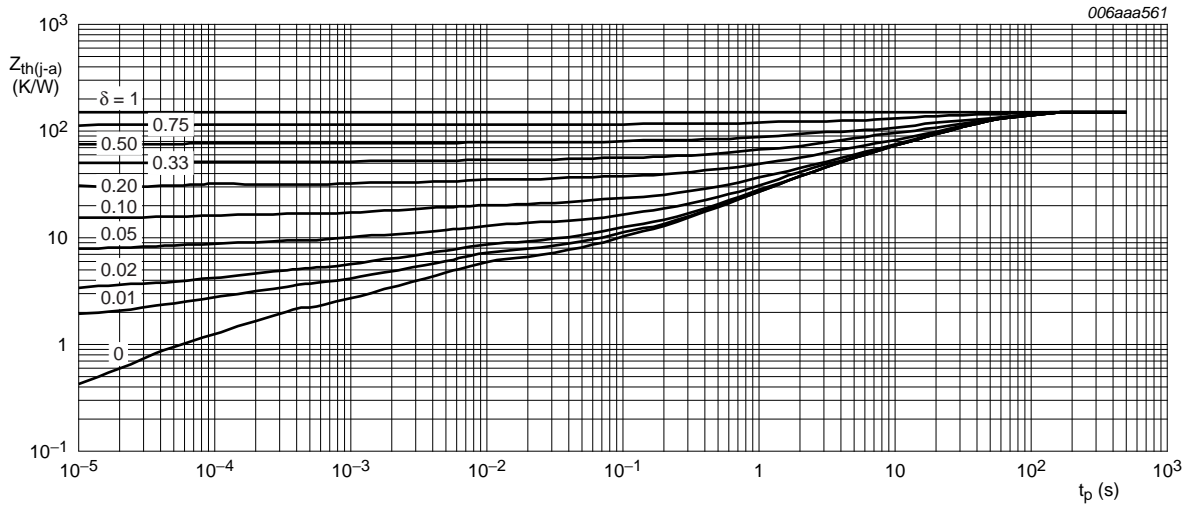
Fig 1. Power derating curves

## 6. Thermal characteristics

Table 6. Thermal characteristics

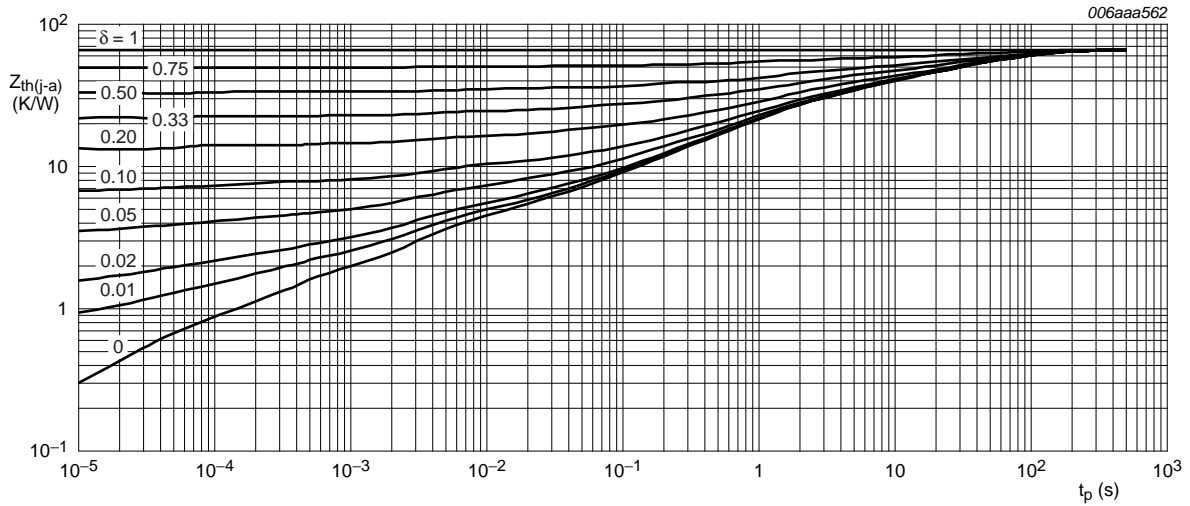
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	179	K/W
			[2]	-	-	74	K/W
			[3]	-	-	63	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point		-	-	15	K/W	

- [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.



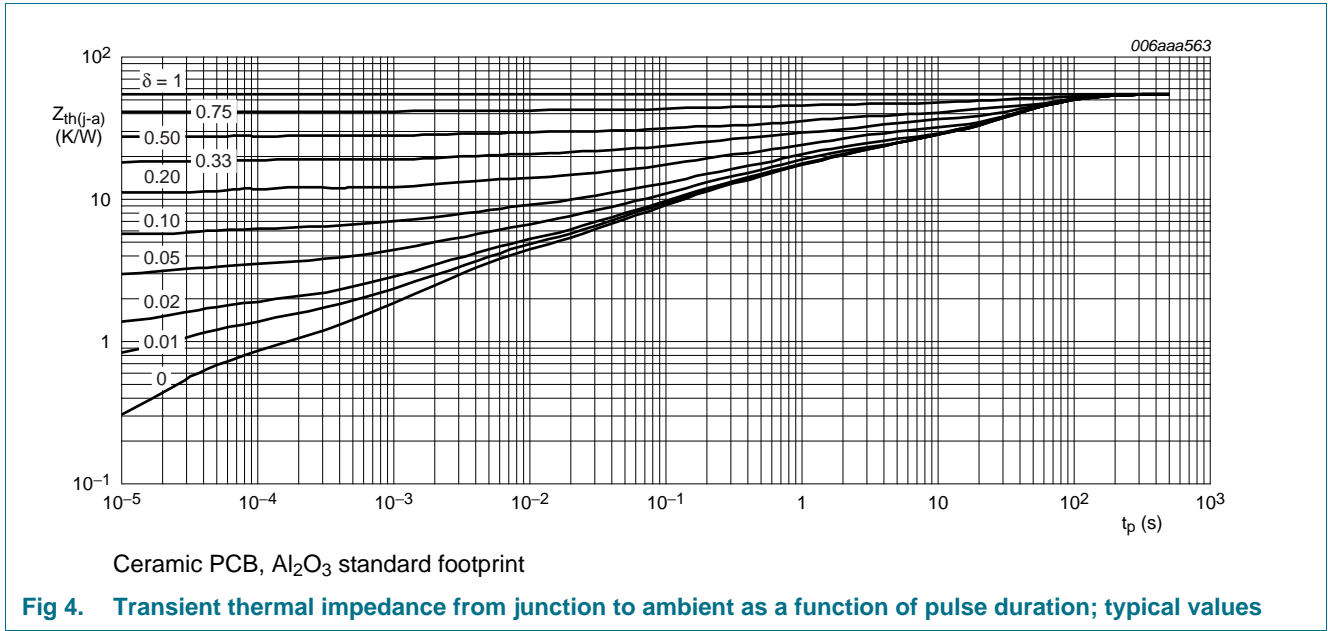
FR4 PCB, standard footprint

**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**



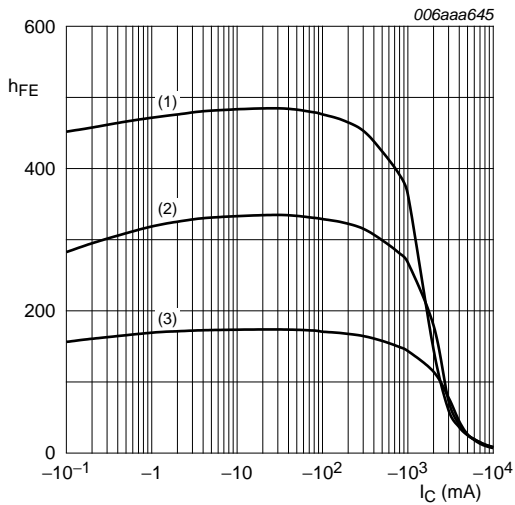
## 7. Characteristics

**Table 7. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = -80 V; I <sub>E</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	-100	nA
		V <sub>CB</sub> = -80 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C; T <sub>amb</sub> = 25 °C	-	-	-50	µA
I <sub>CES</sub>	collector-emitter cut-off current	V <sub>CE</sub> = -48 V; V <sub>BE</sub> = 0 V; T <sub>amb</sub> = 25 °C	-	-	-100	nA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = -5 V; I <sub>C</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	-100	nA
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = -2 V; I <sub>C</sub> = -0.5 A; pulsed; t <sub>p</sub> ≤ 300 µs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	200	300	-	
		V <sub>CE</sub> = -2 V; I <sub>C</sub> = -1 A; pulsed; t <sub>p</sub> ≤ 300 µs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	150	260	-	
		V <sub>CE</sub> = -2 V; I <sub>C</sub> = -2 A; pulsed; t <sub>p</sub> ≤ 300 µs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	100	175	-	
		V <sub>CE</sub> = -2 V; I <sub>C</sub> = -4 A; pulsed; t <sub>p</sub> ≤ 300 µs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	25	40	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = -0.5 A; I <sub>B</sub> = -50 mA; pulsed; t <sub>p</sub> ≤ 300 µs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	-45	-65	mV
		I <sub>C</sub> = -1 A; I <sub>B</sub> = -50 mA; pulsed; t <sub>p</sub> ≤ 300 µs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	-90	-130	mV
		I <sub>C</sub> = -4 A; I <sub>B</sub> = -400 mA; pulsed; t <sub>p</sub> ≤ 300 µs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	-225	-320	mV
		I <sub>C</sub> = -4.1 A; I <sub>B</sub> = -410 mA; pulsed; t <sub>p</sub> ≤ 300 µs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	-230	-325	mV
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = -4 A; I <sub>B</sub> = -400 mA; pulsed; t <sub>p</sub> ≤ 300 µs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	56	80	mΩ

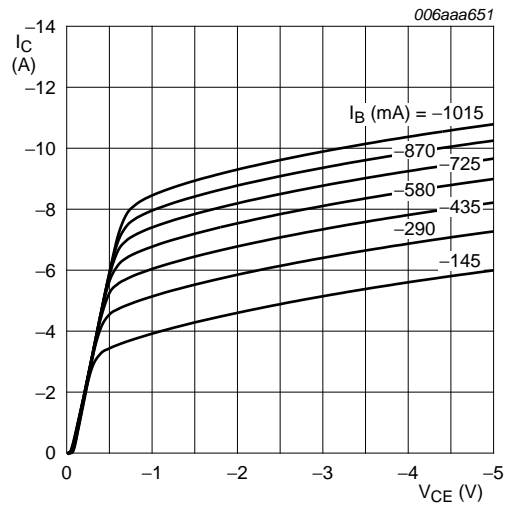
**Table 7. Characteristics ...continued**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -1\text{ A}; I_B = -100\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.81	-0.9	V
		$I_C = -4\text{ A}; I_B = -400\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.93	-1.05	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = -2\text{ V}; I_C = -2\text{ A};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.78	-0.85	V
$t_d$	delay time	$V_{CC} = -12.5\text{ V}; I_C = -3\text{ A}; I_{Bon} = -0.15\text{ A};$ $I_{Boff} = 0.15\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	15	-	ns
$t_r$	rise time		-	185	-	ns
$t_{on}$	turn-on time		-	200	-	ns
$t_s$	storage time		-	150	-	ns
$t_f$	fall time		-	175	-	ns
$t_{off}$	turn-off time		-	325	-	ns
$f_T$	transition frequency	$V_{CE} = -10\text{ V}; I_C = -100\text{ mA};$ $f = 100\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	100	-	MHz
$C_C$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A};$ $f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	50	80	pF



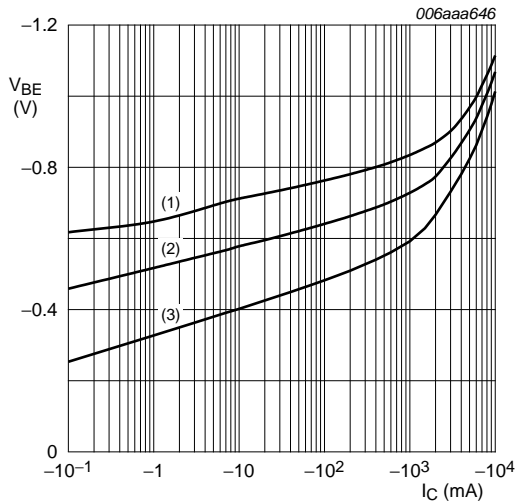
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



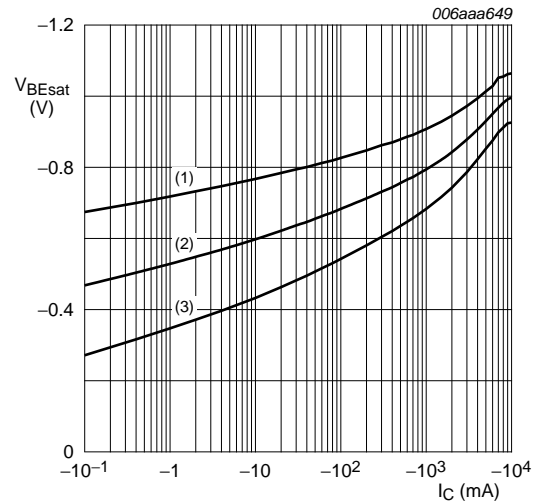
$T_{amb} = 25\text{ }^\circ\text{C}$

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



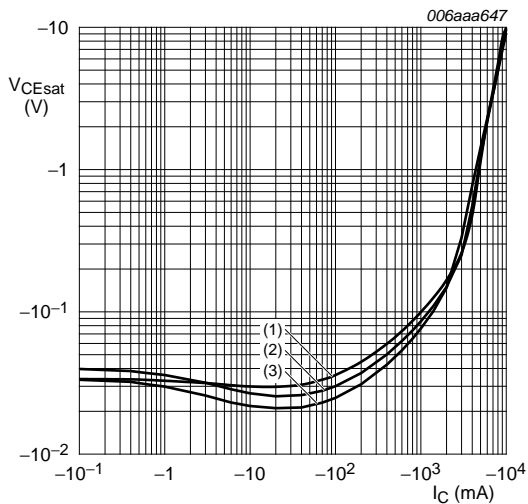
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



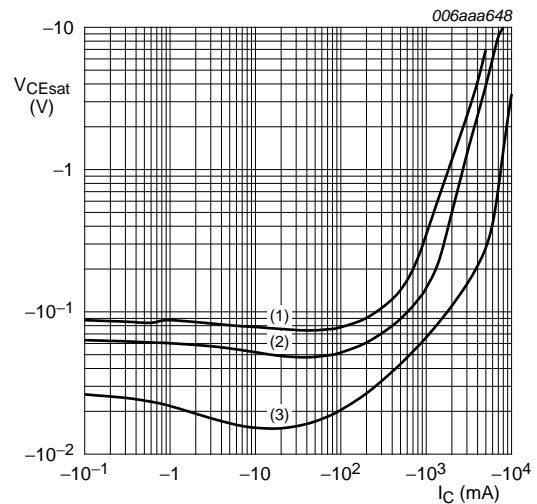
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



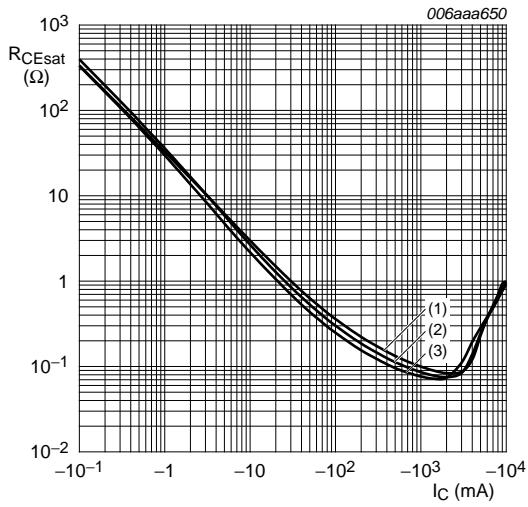
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



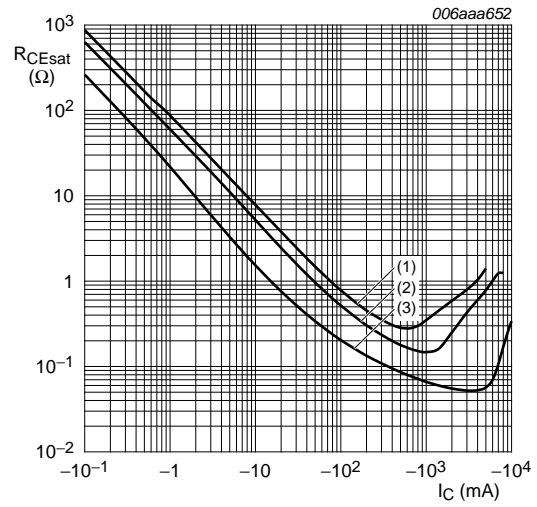
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

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

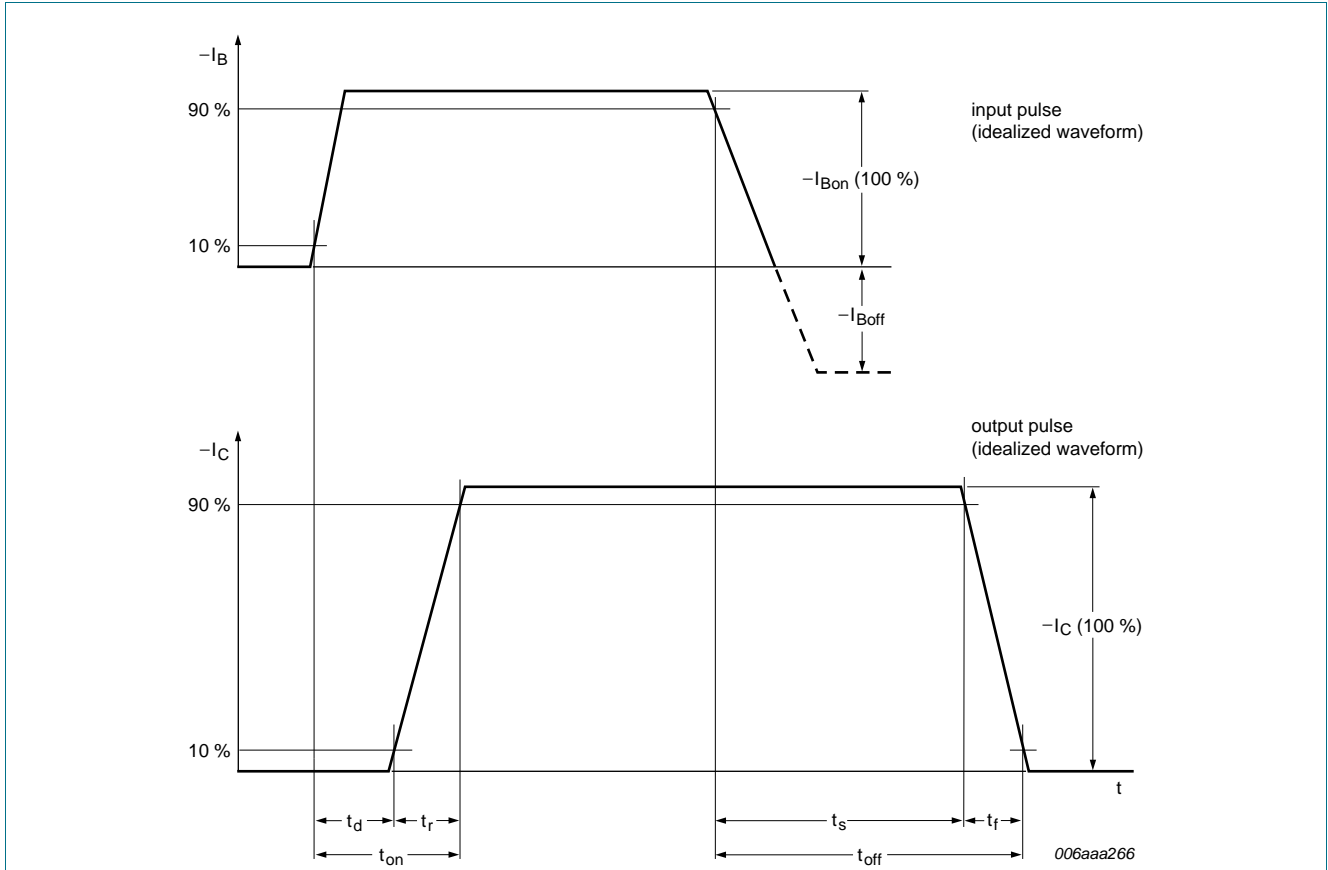


$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

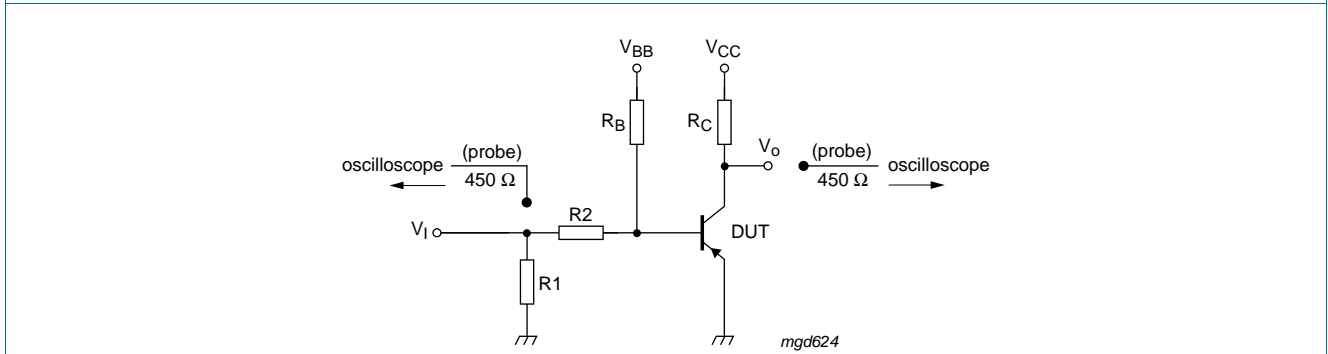
**Fig 12. Collector-emitter saturation resistance as a function of collector current; typical values**



**8. Test information**



**Fig 13. BISS transistor switching time definition**



$V_{CC} = -12.5\text{ V}$ ;  $I_C = -3\text{ A}$ ;  $I_{B\text{on}} = -0.15\text{ A}$ ;  $I_{B\text{off}} = 0.15\text{ A}$

**Fig 14. Test circuit for switching times**

**8.1 Quality information**

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors and is suitable for use in automotive applications.

**9. Package outline**

Plastic surface-mounted package with increased heatsink; 4 leads

SOT223

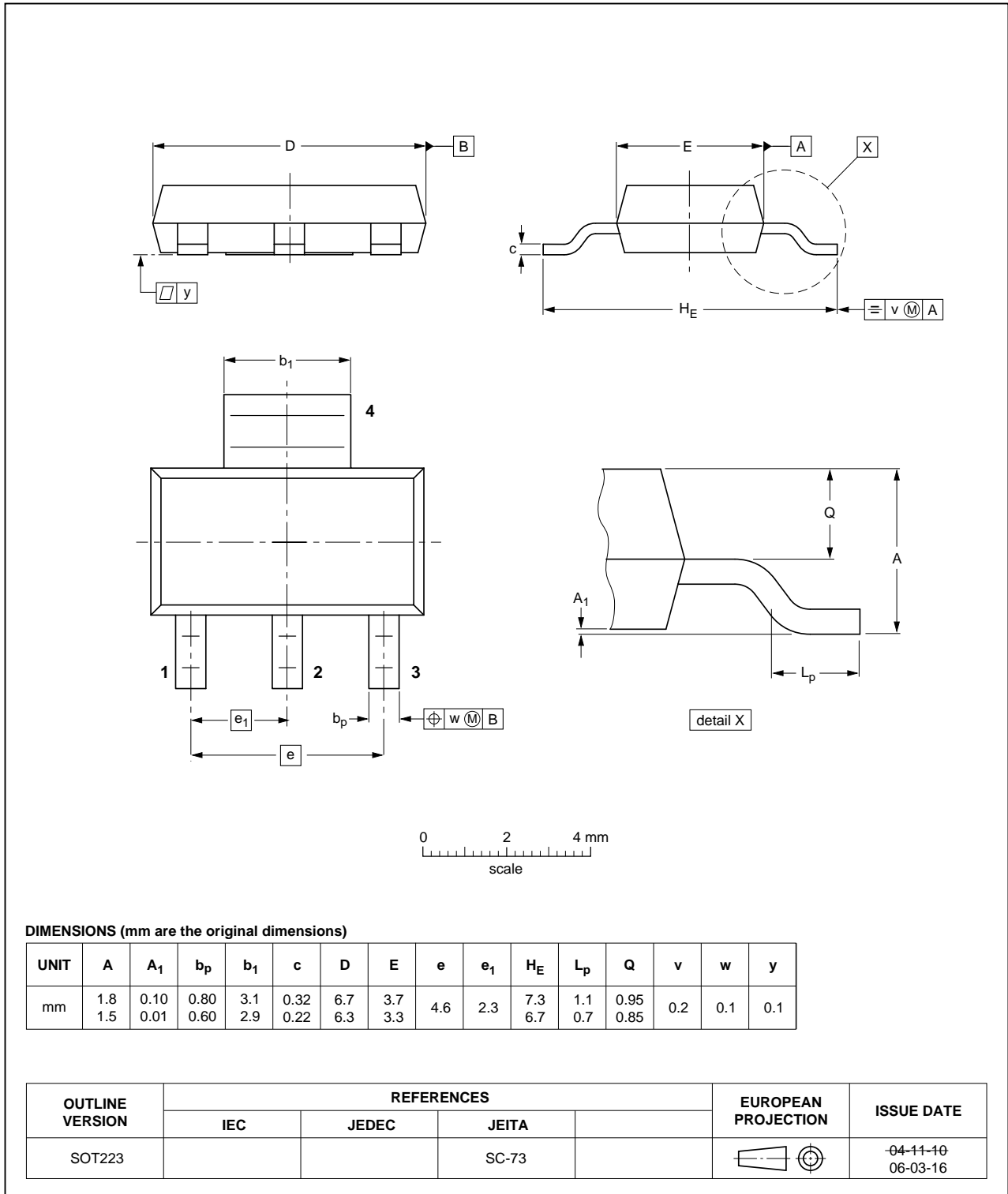
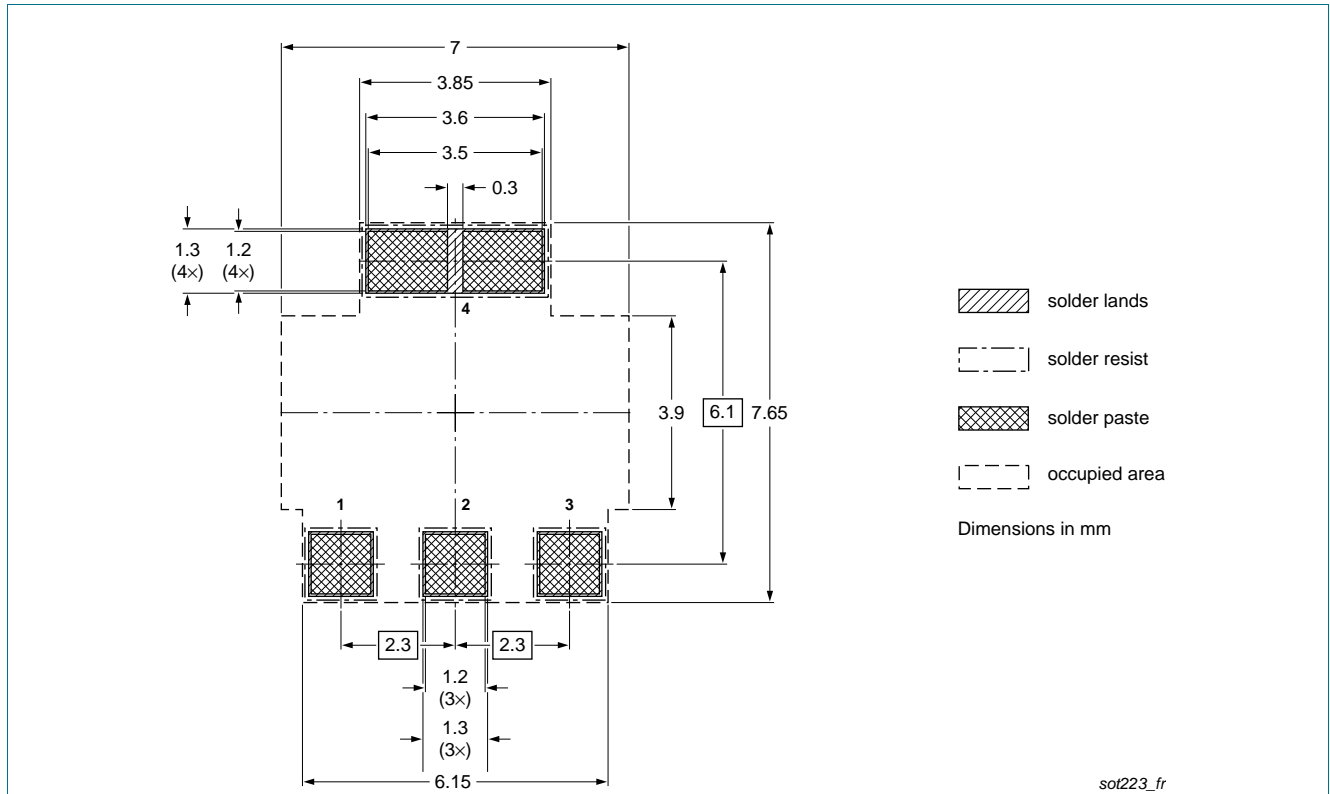
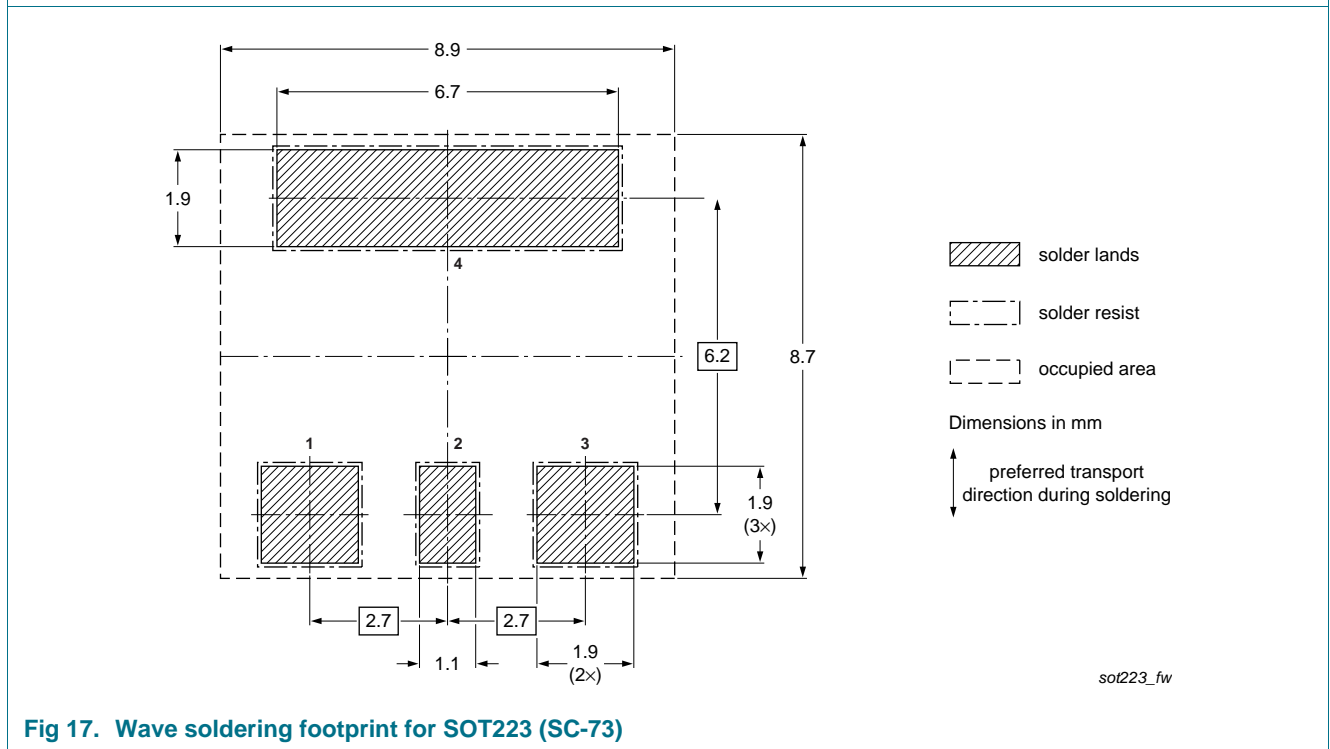


Fig 15. Package outline SOT223 (SC-73)

## 10. Soldering



**Fig 16. Reflow soldering footprint for SOT223 (SC-73)**



**Fig 17. Wave soldering footprint for SOT223 (SC-73)**

## 11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS306PZ v.3	20110726	Product data sheet	-	PBSS306PZ v.2
Modifications:	<ul style="list-style-type: none"><li>• <a href="#">1.2 "Features and benefits"</a> updated</li><li>• In <a href="#">7 "Characteristics"</a> new parameter added, <math>I_{CES}</math></li><li>• <a href="#">Fig 15.</a> updated</li><li>• <a href="#">12 "Legal information"</a> updated</li></ul>			
PBSS306PZ v.2	20091211	Product data sheet	-	PBSS306PZ v.1
PBSS306PZ v.1	20060920	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <a href="#">[1]</a> <a href="#">[2]</a>	Product status <a href="#">[3]</a>	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.nexperia.com>.

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