

# PBSS4021PZ

20 V, 6.6 A PNP low  $V_{CEsat}$  (BISS) transistor

Rev. 01 — 31 March 2010

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) medium power Surface-Mounted Device (SMD) plastic package.

NPN complement: PBSS4021NZ.

### 1.2 Features and benefits

- Very 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 energy efficiency due to less heat generation
- AEC-Q101 qualified
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors

### 1.3 Applications

- Loadswitch
- Battery-driven devices
- Power management
- Charging circuits
- Power switches (e.g. motors, fans)

### 1.4 Quick reference data

Table 1. Quick reference data

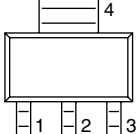
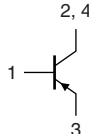
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	-20	V
$I_C$	collector current		-	-	-6.6	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	-20	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -6$ A; $I_B = -600$ mA	<a href="#">[1]</a> -	22	33	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	Graphic symbol
1	base		
2	collector		
3	emitter		
4	collector		

sym028

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4021PZ	SC-73	plastic surface-mounted package with increased heat sink; 4 leads	SOT223

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4021PZ	PB4021PZ

## 5. Limiting values

Table 5. Limiting values

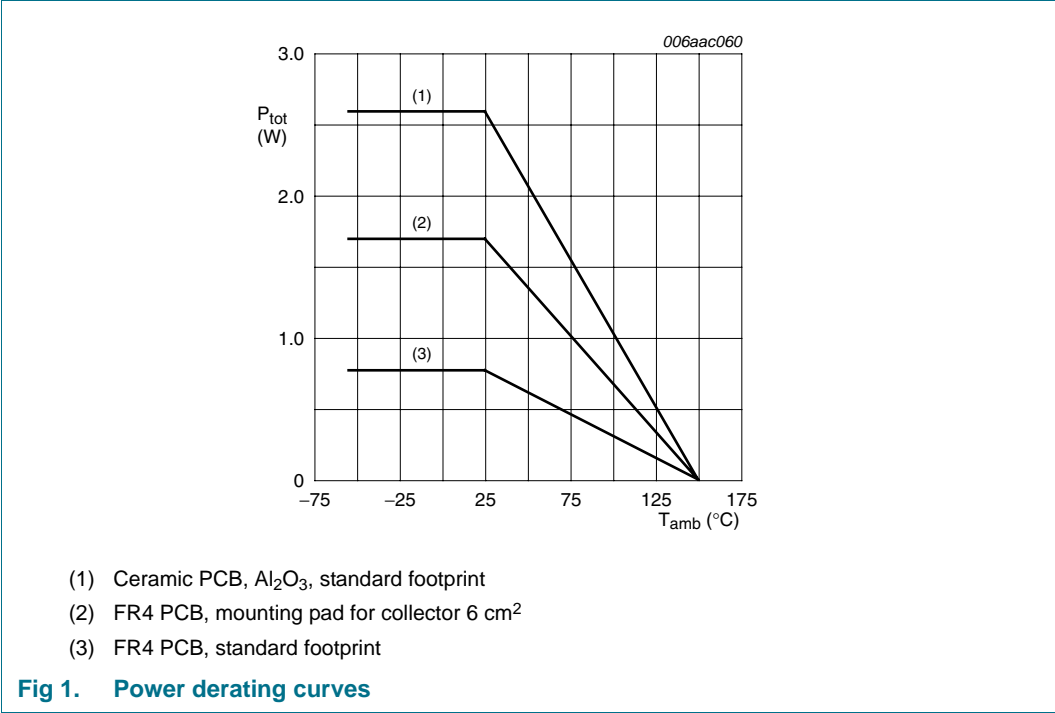
In accordance with the Absolute Maximum Rating System (IEC 60134).

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		-	-6.6	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-20	A
$I_B$	base current		-	-1	A

**Table 5. Limiting values ...continued**  
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1] -	770	mW
			[2] -	1700	mW
			[3] -	2600	mW
T <sub>j</sub>	junction temperature		-	150	°C
T <sub>amb</sub>	ambient temperature		-55	+150	°C
T <sub>stg</sub>	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.

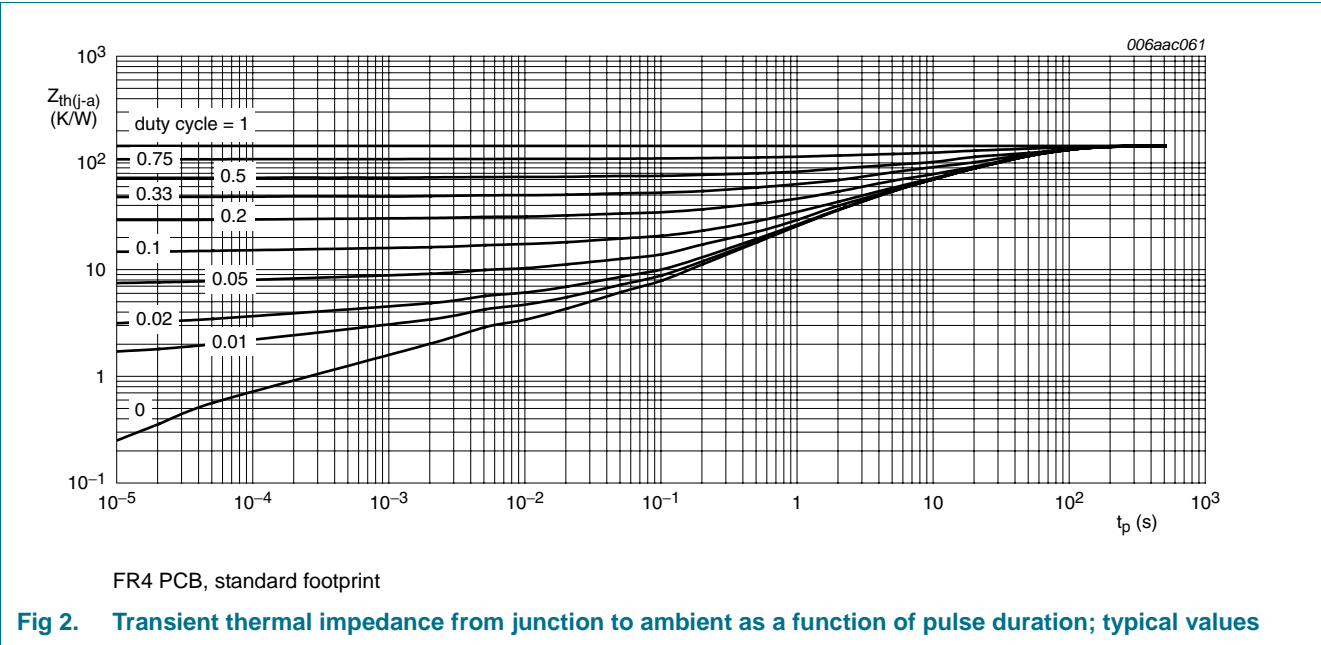


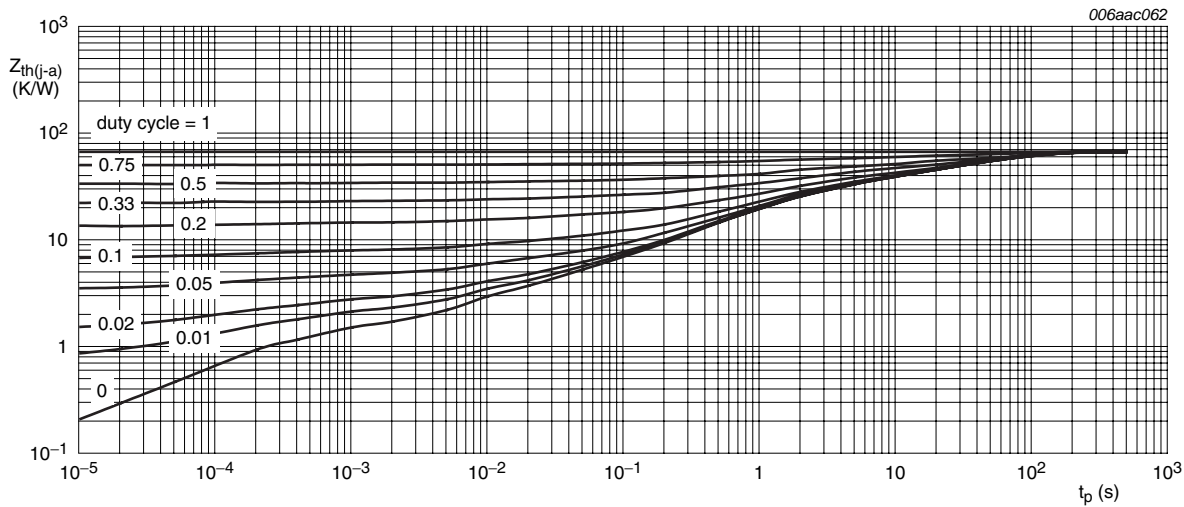
6. Thermal characteristics

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] -	-	160	K/W
			[2] -	-	75	K/W
			[3] -	-	50	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	11	K/W

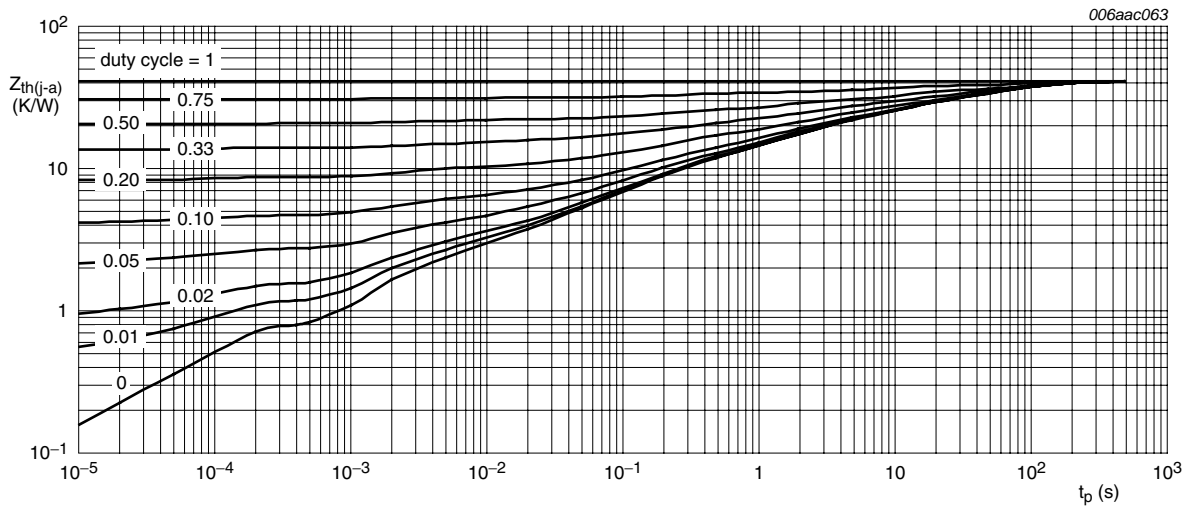
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.





FR4 PCB, 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

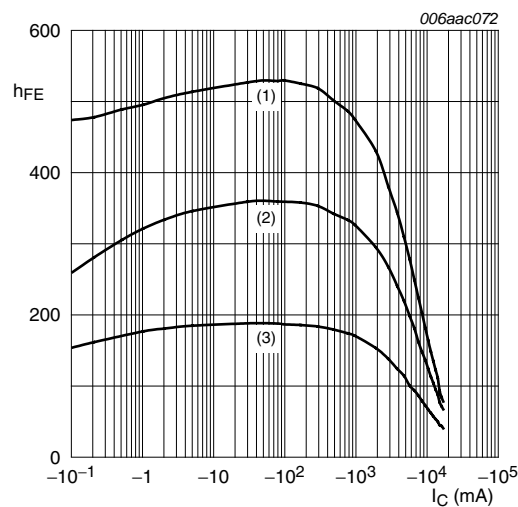
Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. Characteristics

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

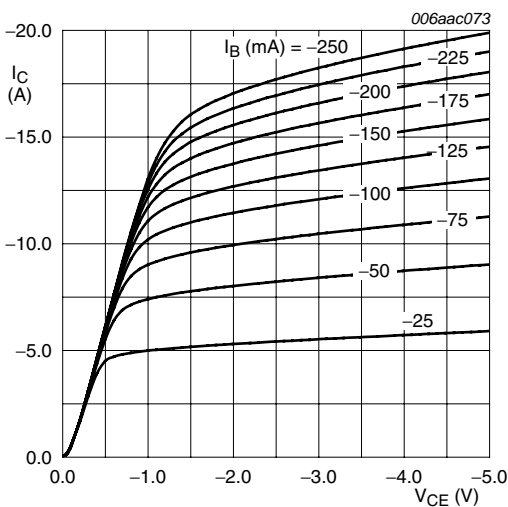
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = −20 V; I <sub>E</sub> = 0 A	-	-	−100	nA	
		V <sub>CB</sub> = −20 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	−55	μA	
I <sub>CES</sub>	collector-emitter cut-off current	V <sub>CE</sub> = −16 V; V <sub>BE</sub> = 0 V	-	-	−100	nA	
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = −5 V; I <sub>C</sub> = 0 A	-	-	−100	nA	
h <sub>FE</sub>	DC current gain		[1]				
		V <sub>CE</sub> = −2 V; I <sub>C</sub> = −500 mA	250	400	-		
		V <sub>CE</sub> = −2 V; I <sub>C</sub> = −1 A	250	400	-		
		V <sub>CE</sub> = −2 V; I <sub>C</sub> = −2 A	200	350	-		
		V <sub>CE</sub> = −2 V; I <sub>C</sub> = −4 A	150	250	-		
		V <sub>CE</sub> = −2 V; I <sub>C</sub> = −7 A	100	180	-		
V <sub>CEsat</sub>	collector-emitter saturation voltage		[1]				
		I <sub>C</sub> = −1 A; I <sub>B</sub> = −50 mA	-	−31	−50	mV	
		I <sub>C</sub> = −1 A; I <sub>B</sub> = −10 mA	-	−53	−80	mV	
		I <sub>C</sub> = −2 A; I <sub>B</sub> = −40 mA	-	−66	−100	mV	
		I <sub>C</sub> = −4 A; I <sub>B</sub> = −200 mA	-	−95	−140	mV	
		I <sub>C</sub> = −4 A; I <sub>B</sub> = −40 mA	-	−150	−225	mV	
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = −6 A; I <sub>B</sub> = −600 mA	[1]	-	22	33	mΩ
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = −1 A; I <sub>B</sub> = −50 mA	[1]	-	−0.79	−0.9	V
		I <sub>C</sub> = −4 A; I <sub>B</sub> = −400 mA	[1]	-	−0.94	−1.05	V
V <sub>BEon</sub>	base-emitter turn-on voltage	V <sub>CE</sub> = −2 V; I <sub>C</sub> = −2 A	[1]	-	−0.73	−0.85	V
t <sub>d</sub>	delay time	V <sub>CC</sub> = −12.5 V;	-	55	-	ns	
t <sub>r</sub>	rise time	I <sub>C</sub> = −1 A; I <sub>BEon</sub> = −0.05 A;	-	60	-	ns	
t <sub>on</sub>	turn-on time	I <sub>Boff</sub> = 0.05 A	-	115	-	ns	
t <sub>s</sub>	storage time		-	400	-	ns	
t <sub>f</sub>	fall time		-	110	-	ns	
t <sub>off</sub>	turn-off time		-	510	-	ns	
f <sub>T</sub>	transition frequency	V <sub>CE</sub> = −10 V; I <sub>C</sub> = −100 mA; f = 100 MHz	-	85	-	MHz	
C <sub>c</sub>	collector capacitance	V <sub>CB</sub> = −10 V; I <sub>E</sub> = i <sub>e</sub> = 0 A; f = 1 MHz	-	125	-	pF	

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



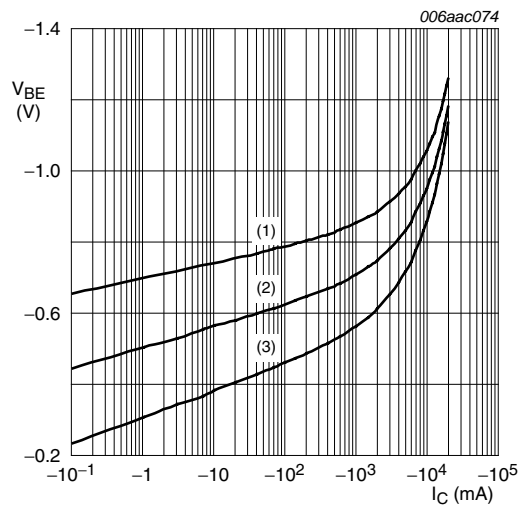
$V_{CE} = -2\text{ V}$   
(1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



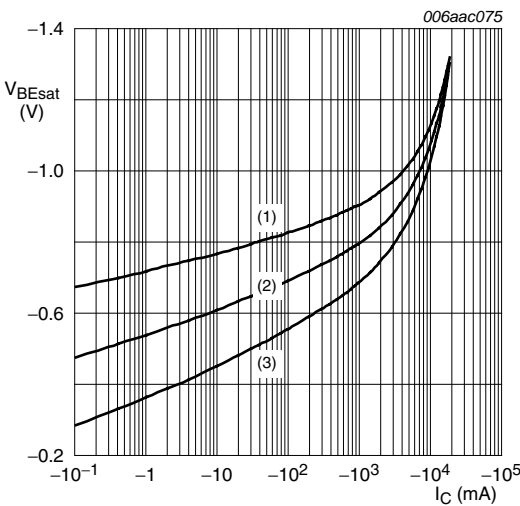
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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



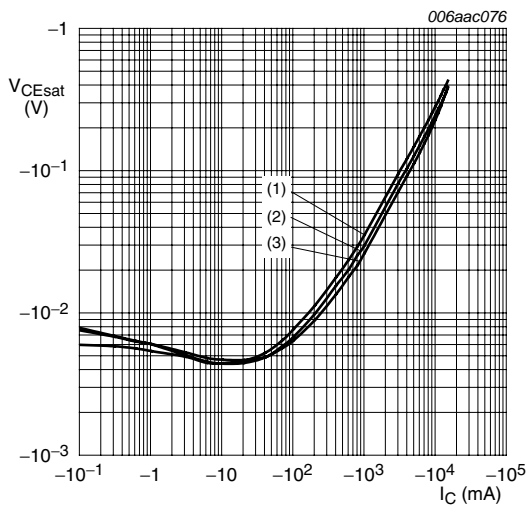
$V_{CE} = -2\text{ V}$   
(1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



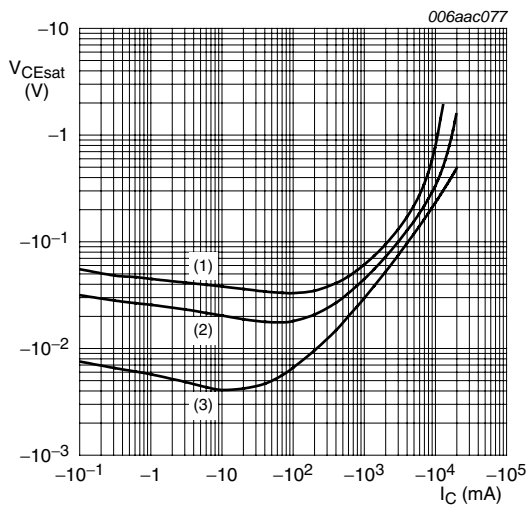
$I_C/I_B = 20$   
(1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



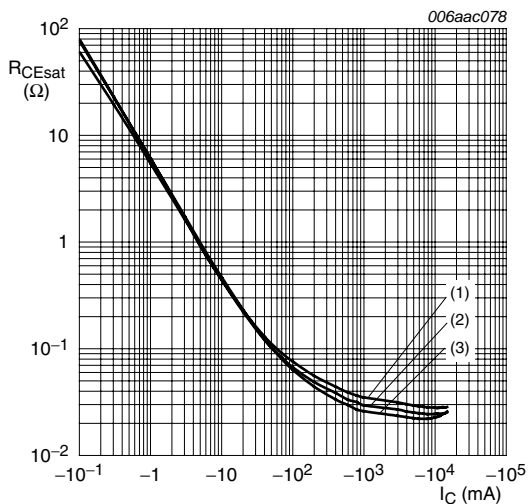
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



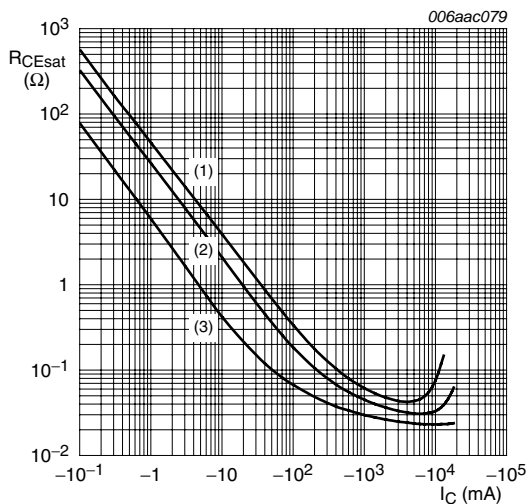
- $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

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

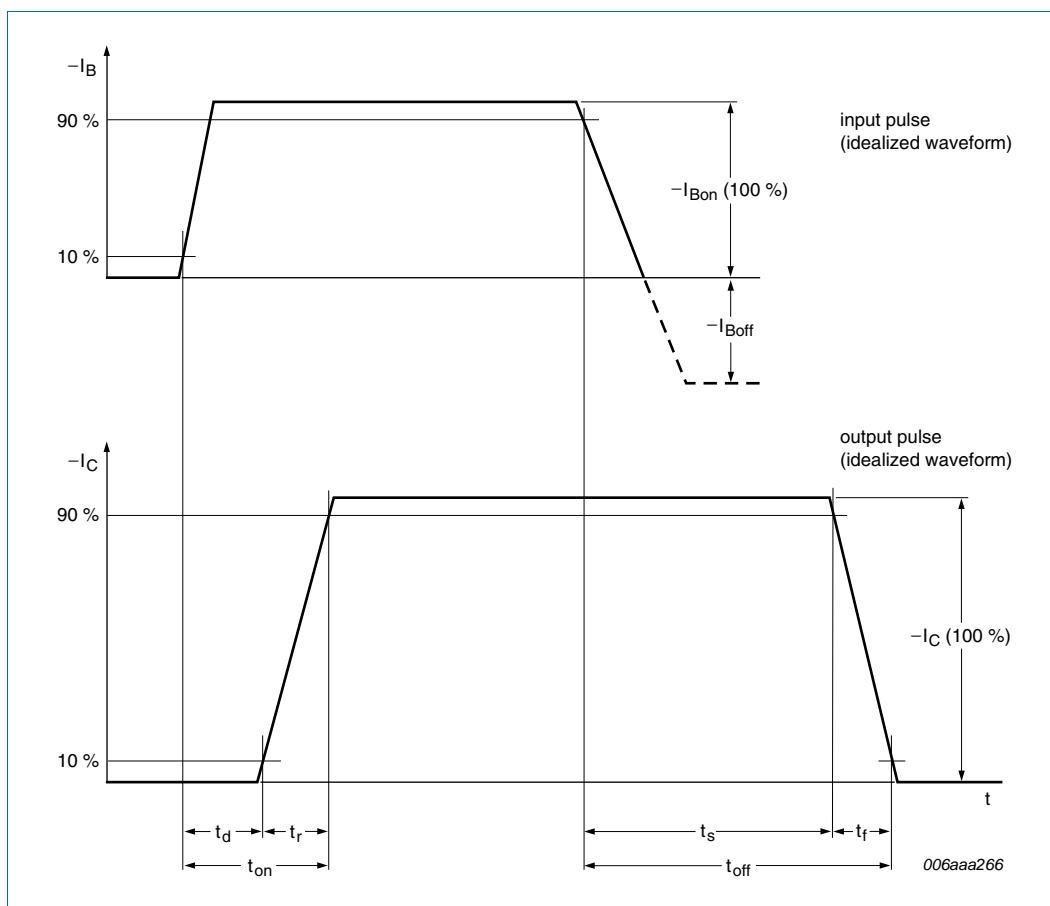


Fig 13. BISS transistor switching time definition

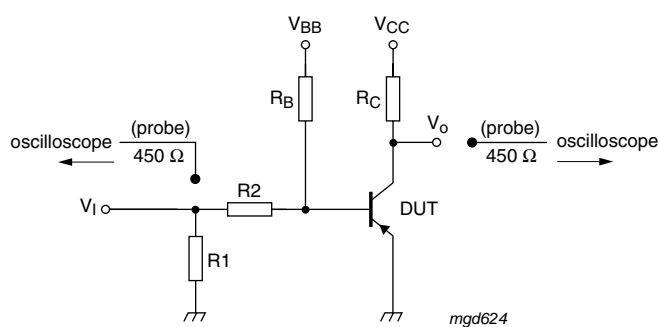
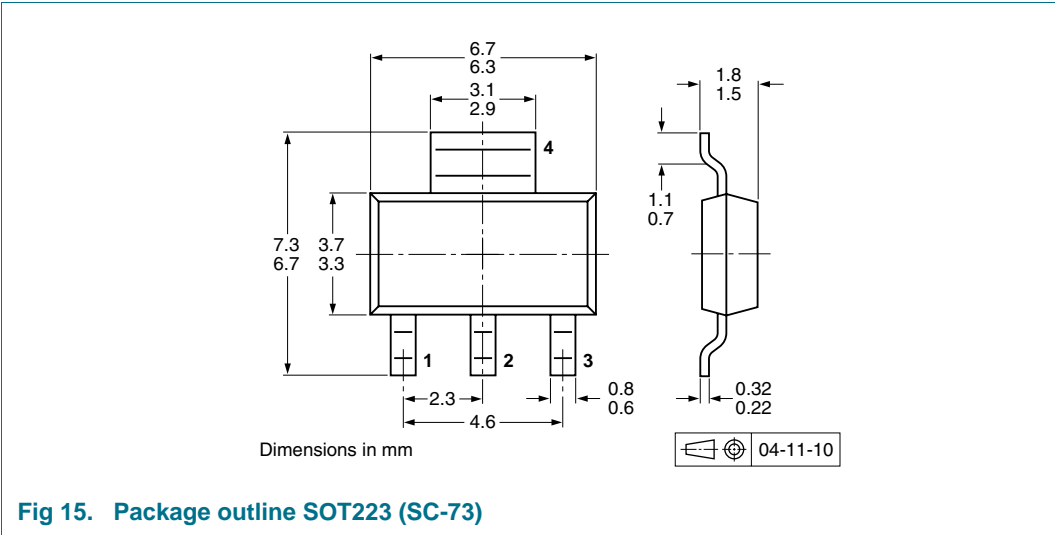


Fig 14. Test circuit for switching times

### 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



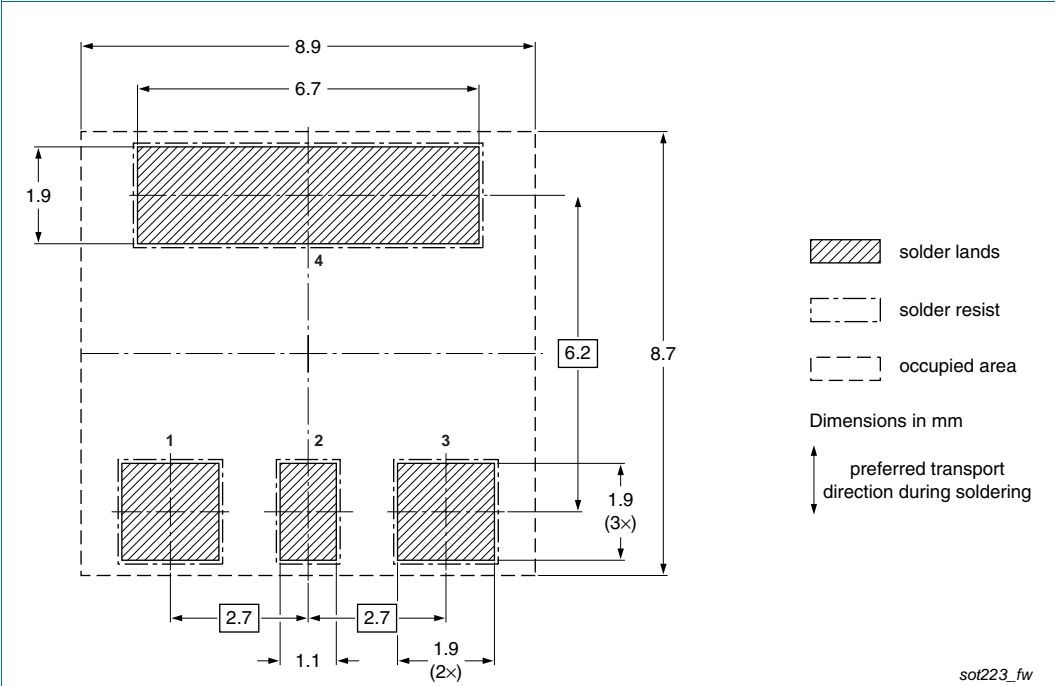
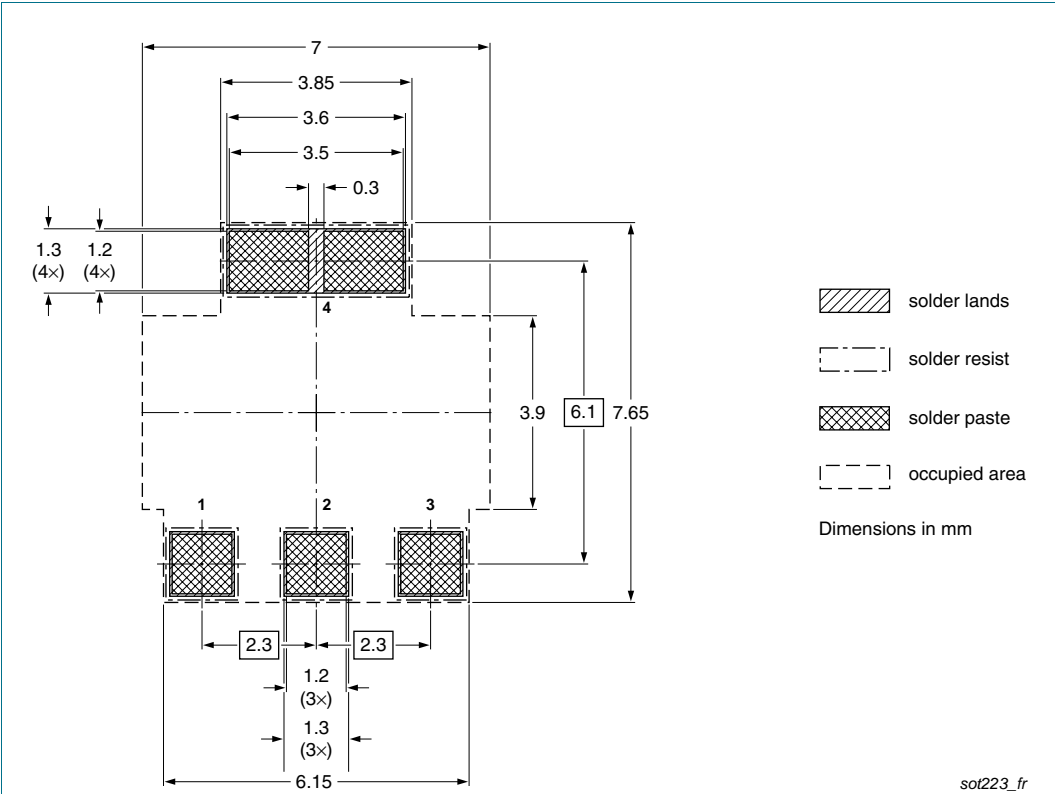
10. Packing information

**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
PBSS4021PZ	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



## 12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4021PZ_1	20100331	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.

[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".

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## 15. Contents

<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description . . . . .	1
1.2	Features and benefits . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data . . . . .	1
<b>2</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Marking</b> . . . . .	<b>2</b>
<b>5</b>	<b>Limiting values</b> . . . . .	<b>2</b>
<b>6</b>	<b>Thermal characteristics</b> . . . . .	<b>4</b>
<b>7</b>	<b>Characteristics</b> . . . . .	<b>6</b>
<b>8</b>	<b>Test information</b> . . . . .	<b>9</b>
8.1	Quality information . . . . .	9
<b>9</b>	<b>Package outline</b> . . . . .	<b>10</b>
<b>10</b>	<b>Packing information</b> . . . . .	<b>10</b>
<b>11</b>	<b>Soldering</b> . . . . .	<b>11</b>
<b>12</b>	<b>Revision history</b> . . . . .	<b>12</b>
<b>13</b>	<b>Legal information</b> . . . . .	<b>13</b>
13.1	Data sheet status . . . . .	13
13.2	Definitions . . . . .	13
13.3	Disclaimers . . . . .	13
13.4	Trademarks . . . . .	13
<b>14</b>	<b>Contact information</b> . . . . .	<b>14</b>
<b>15</b>	<b>Contents</b> . . . . .	<b>15</b>

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Date of release: 31 March 2010

Document identifier: PBSS4021PZ\_1