



# PBSS4021SP

20 V, 6.3 A PNP/PNP low  $V_{CEsat}$  (BISS) transistor

Rev. 2 — 11 October 2010

Product data sheet

## 1. Product profile

### 1.1 General description

PNP/PNP low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in a SOT96-1 (SO8) medium power Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number	Package		NPN/NPN complement	NPN/PNP complement
	Nexperia	Name		
PBSS4021SP	SOT96-1	SO8	PBSS4021SN	PBSS4021SPN

### 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 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

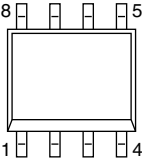
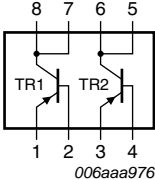
Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	-20	V
$I_C$	collector current		-	-	-6.3	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	-15	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -5$ A; $I_B = -0.5$ A <a href="#">[1]</a>	-	36	54	m $\Omega$

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

## 2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	emitter TR1		
2	base TR1		
3	emitter TR2		
4	base TR2		
5	collector TR2		
6	collector TR2		
7	collector TR1		
8	collector TR1		

## 3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4021SP	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

## 4. Marking

Table 5. Marking codes

Type number	Marking code
PBSS4021SP	4021SP

## 5. Limiting values

Table 6. Limiting values

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

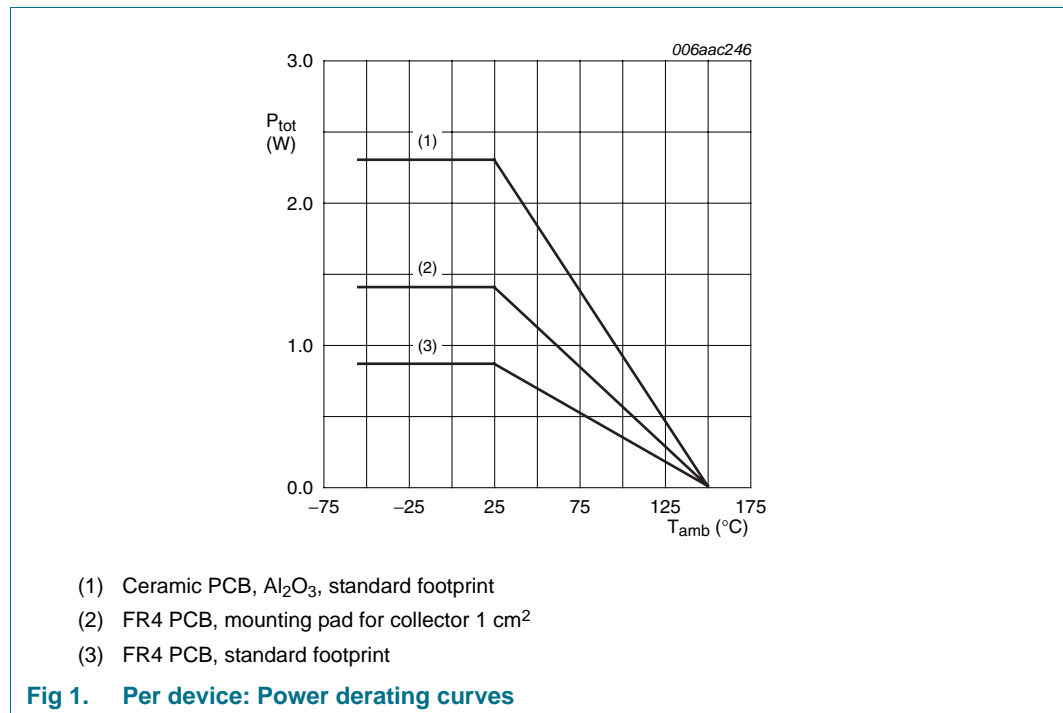
Symbol	Parameter	Conditions	Min	Max	Unit	
<b>Per transistor</b>						
$V_{CBO}$	collector-base voltage	open emitter	-	-20	V	
$V_{CEO}$	collector-emitter voltage	open base	-	-20	V	
$V_{EBO}$	emitter-base voltage	open collector	-	-5	V	
$I_C$	collector current		-	-6.3	A	
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-15	A	
$I_B$	base current		-	-1	A	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	0.73	W
			[2]	-	1	W
			[3]	-	1.7	W

**Table 6. Limiting values ...continued**

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

Symbol	Parameter	Conditions	Min	Max	Unit
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	0.86	W
			[2]	1.4	W
			[3]	2.3	W
$T_j$	junction temperature		-	150	°C
$T_{amb}$	ambient temperature		-55	+150	°C
$T_{stg}$	storage temperature		-65	+150	°C

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

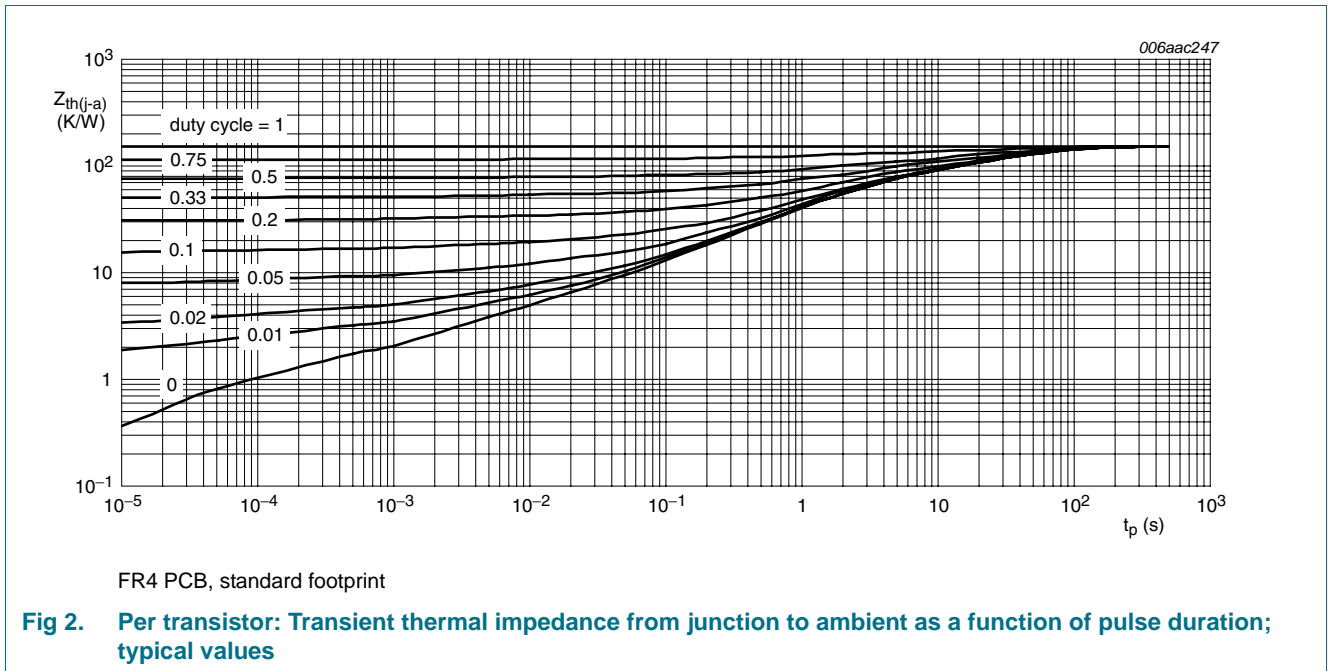
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

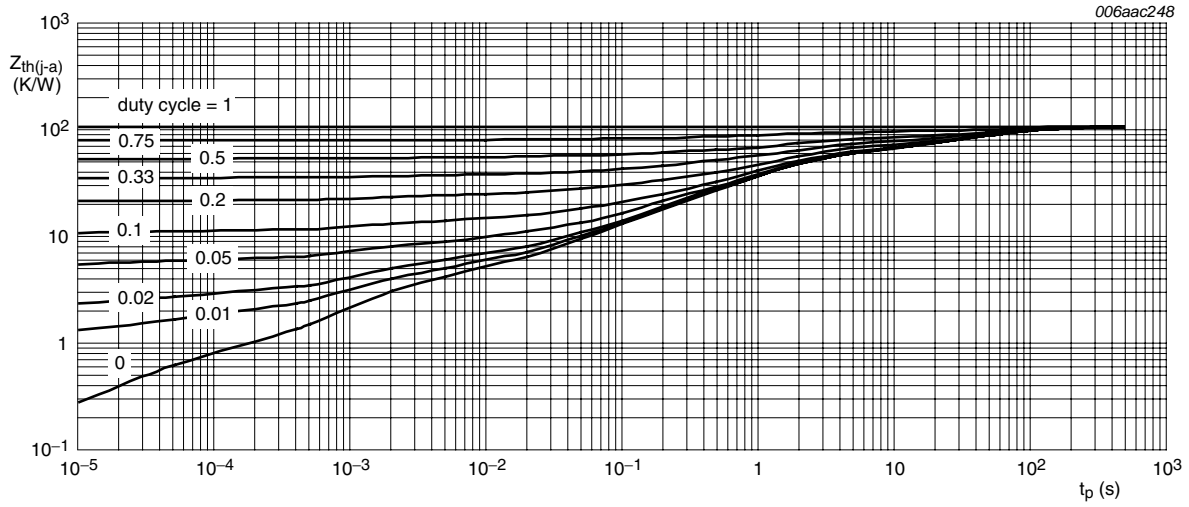
**6. Thermal characteristics**

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Per transistor</b>							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	170	K/W
			[2]	-	-	125	K/W
			[3]	-	-	75	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	40	K/W	
<b>Per device</b>							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	145	K/W
			[2]	-	-	90	K/W
			[3]	-	-	55	K/W

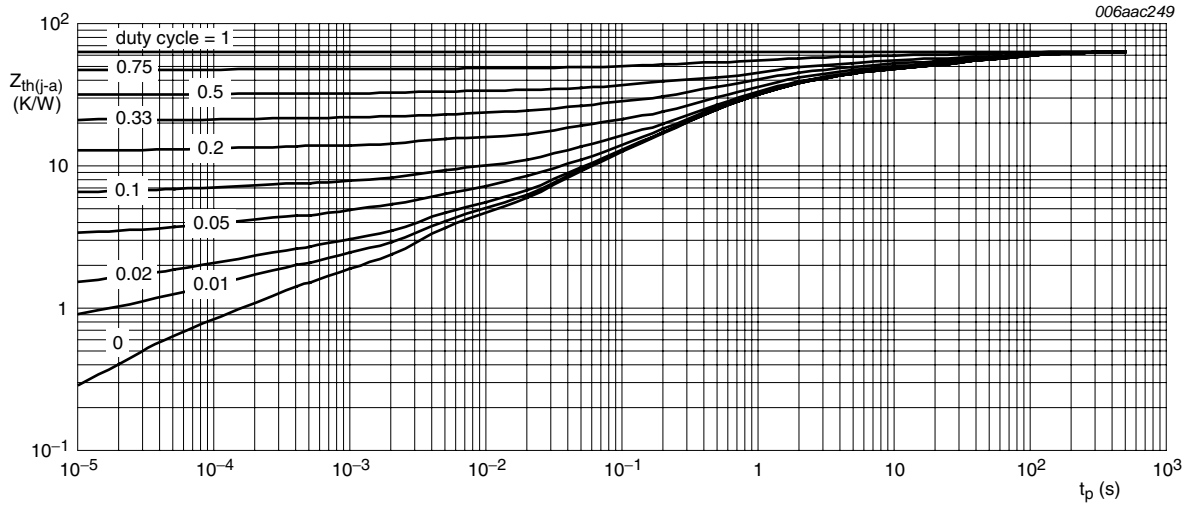
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.





FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

**Fig 3.** Per transistor: 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

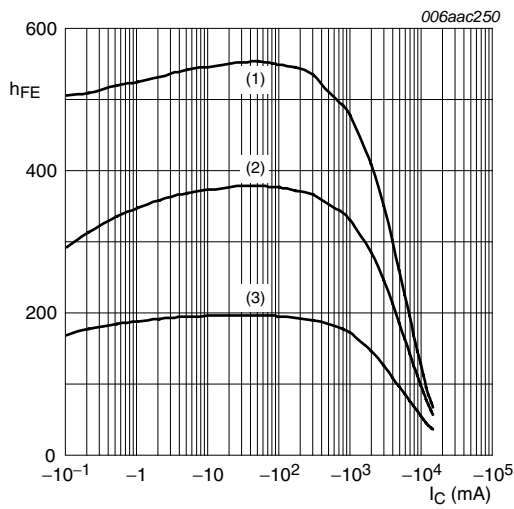
**Fig 4.** Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. Characteristics

**Table 8. Characteristics**
 $T_{amb} = 25\text{ °C}$  unless otherwise specified.

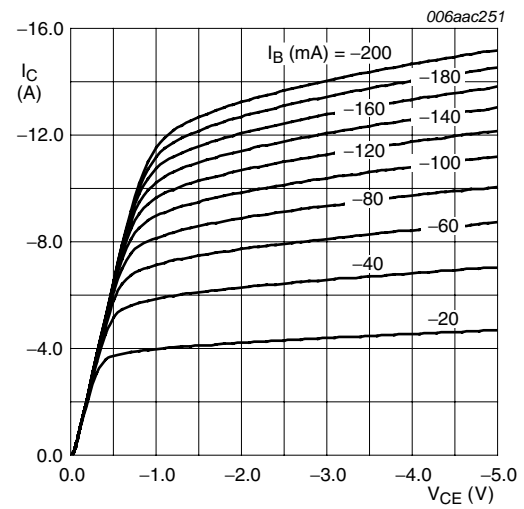
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Per transistor</b>							
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -20\text{ V}; I_E = 0\text{ A}$	-	-	-100	nA	
		$V_{CB} = -20\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$	-	-	-50	$\mu\text{A}$	
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = -16\text{ V}; V_{BE} = 0\text{ V}$	-	-	-100	nA	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}$	-	-	-100	nA	
$h_{FE}$	DC current gain	$V_{CE} = -2\text{ V}$	[1]				
		$I_C = -500\text{ mA}$	250	400	-		
		$I_C = -1\text{ A}$	250	400	-		
		$I_C = -2\text{ A}$	200	350	-		
		$I_C = -4\text{ A}$	150	300	-		
$V_{CEsat}$	collector-emitter saturation voltage	[1]					
		$I_C = -1\text{ A}; I_B = -50\text{ mA}$	-	-45	-68	mV	
		$I_C = -1\text{ A}; I_B = -10\text{ mA}$	-	-70	-115	mV	
		$I_C = -2\text{ A}; I_B = -40\text{ mA}$	-	-100	-150	mV	
		$I_C = -4\text{ A}; I_B = -200\text{ mA}$	-	-150	-225	mV	
		$I_C = -4\text{ A}; I_B = -40\text{ mA}$	-	-250	-375	mV	
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -5\text{ A}; I_B = -500\text{ mA}$	[1]	-	36	54	$\text{m}\Omega$
$V_{BEsat}$	base-emitter saturation voltage	[1]					
		$I_C = -1\text{ A}; I_B = -100\text{ mA}$	-	-0.85	-1	V	
		$I_C = -4\text{ A}; I_B = -400\text{ mA}$	-	-1	-1.2	V	
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = -2\text{ V}; I_C = -2\text{ A}$	[1]	-	-0.76	-0.85	V
$t_d$	delay time	$V_{CC} = -12.5\text{ V}; I_C = -1\text{ A}; I_{Bon} = -0.05\text{ A}; I_{Boff} = 0.05\text{ A}$	-	40	-	ns	
$t_r$	rise time		-	55	-	ns	
$t_{on}$	turn-on time		-	95	-	ns	
$t_s$	storage time		-	340	-	ns	
$t_f$	fall time		-	85	-	ns	
$t_{off}$	turn-off time		-	425	-	ns	
$f_T$	transition frequency	$V_{CE} = -10\text{ V}; I_C = -100\text{ mA}; f = 100\text{ MHz}$	-	105	-	MHz	
$C_C$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$	-	95	-	pF	

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



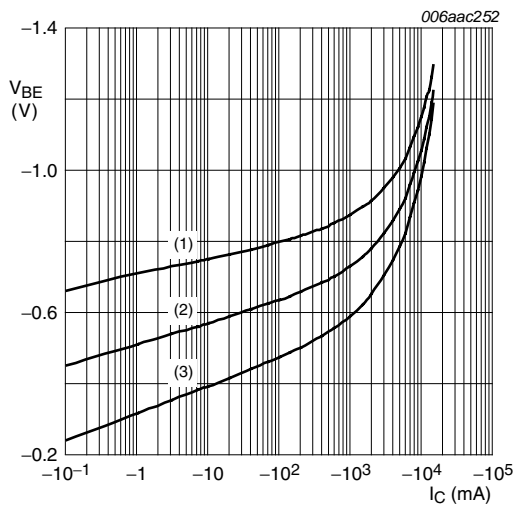
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



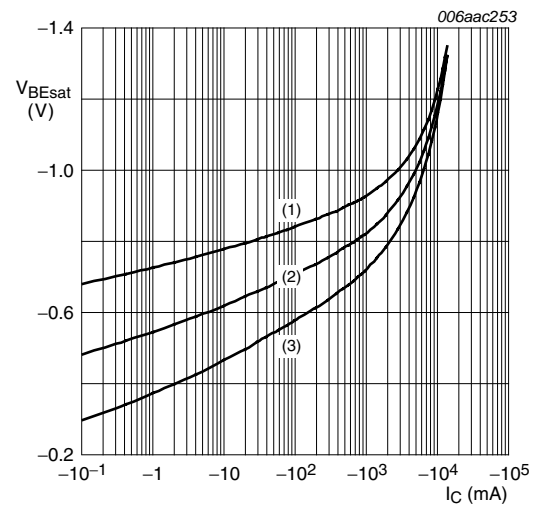
$T_{amb} = 25\text{ °C}$

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



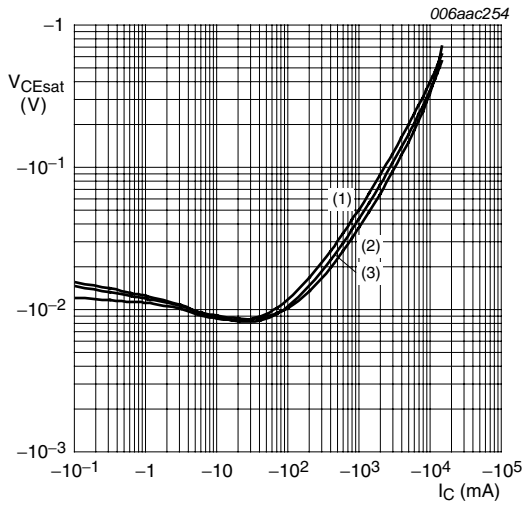
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



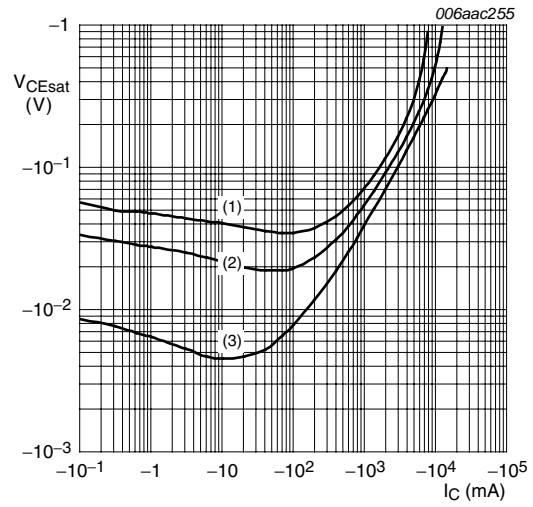
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



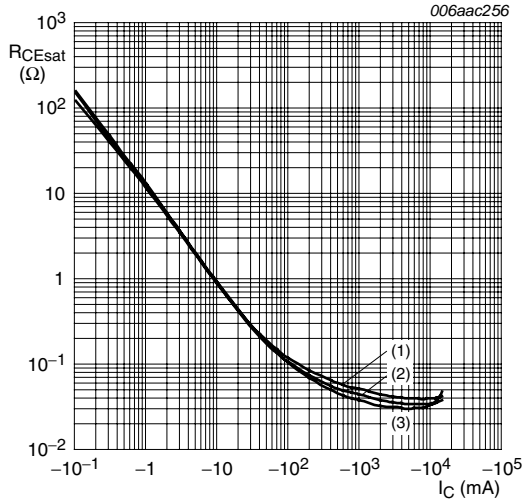
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ °C}$
  - (2)  $T_{amb} = 25\text{ °C}$
  - (3)  $T_{amb} = -55\text{ °C}$

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



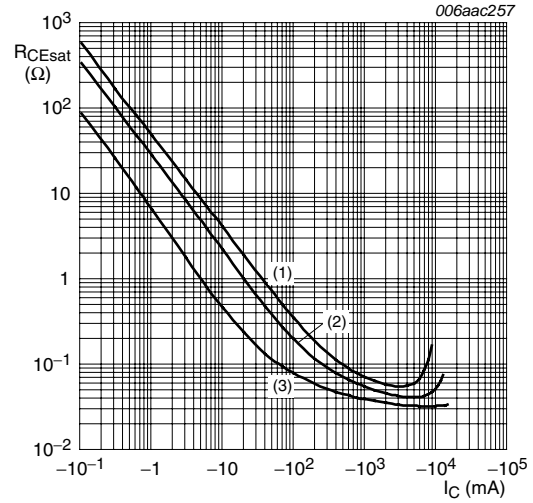
- $T_{amb} = 25\text{ °C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

**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**

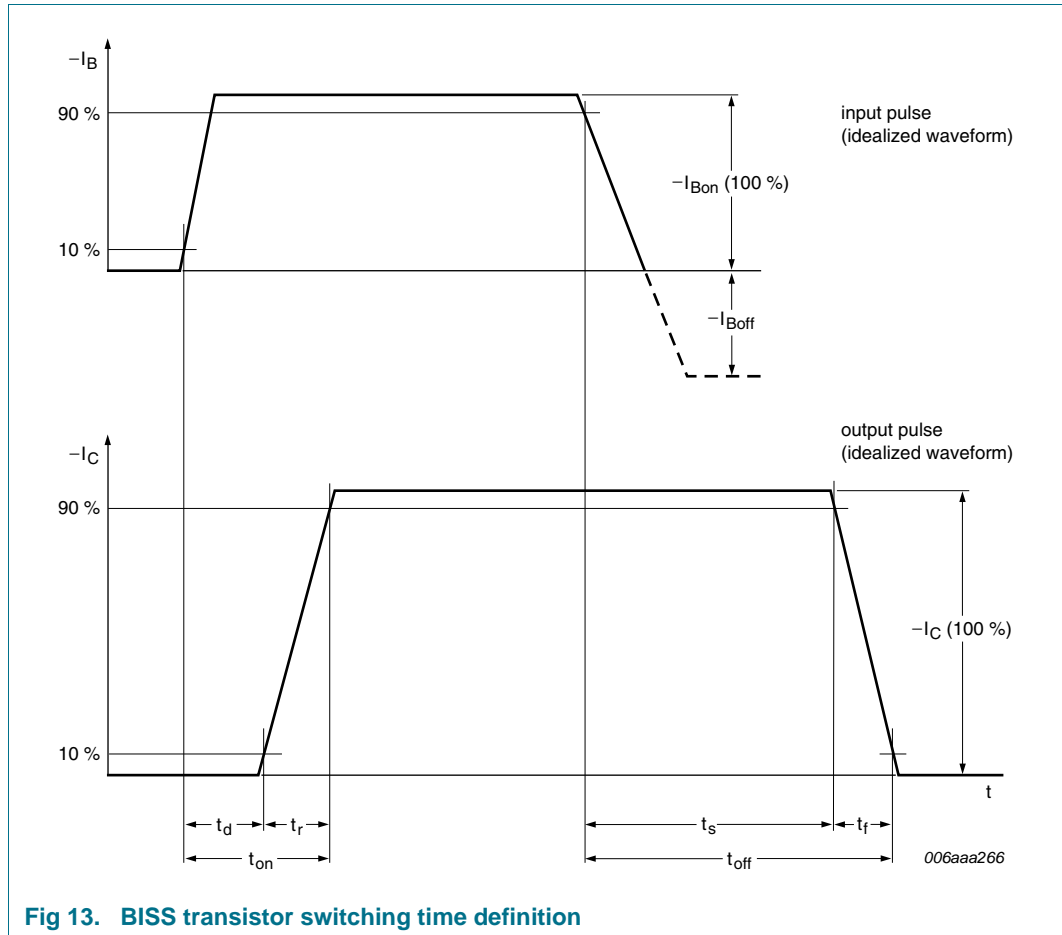


- $T_{amb} = 25\text{ °C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

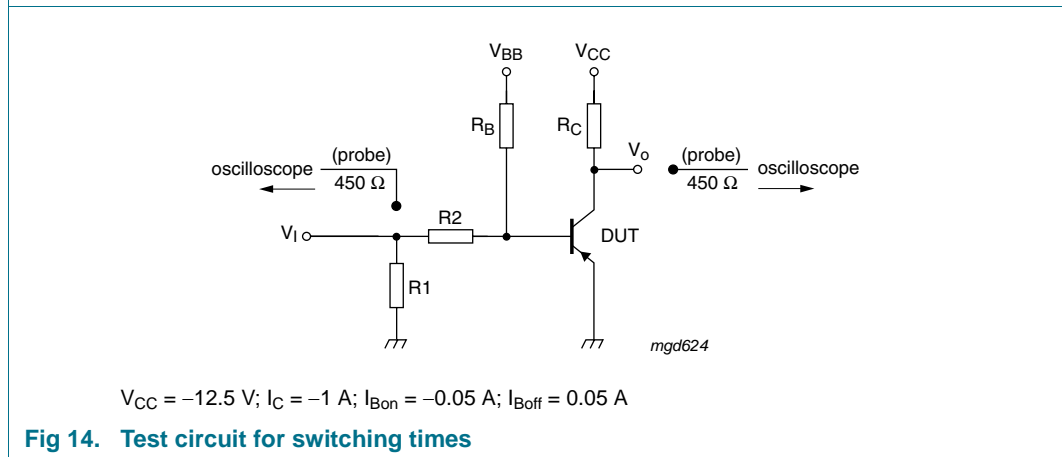
**Fig 12. Collector-emitter saturation resistance as a function of collector current; typical values**



**8. Test information**



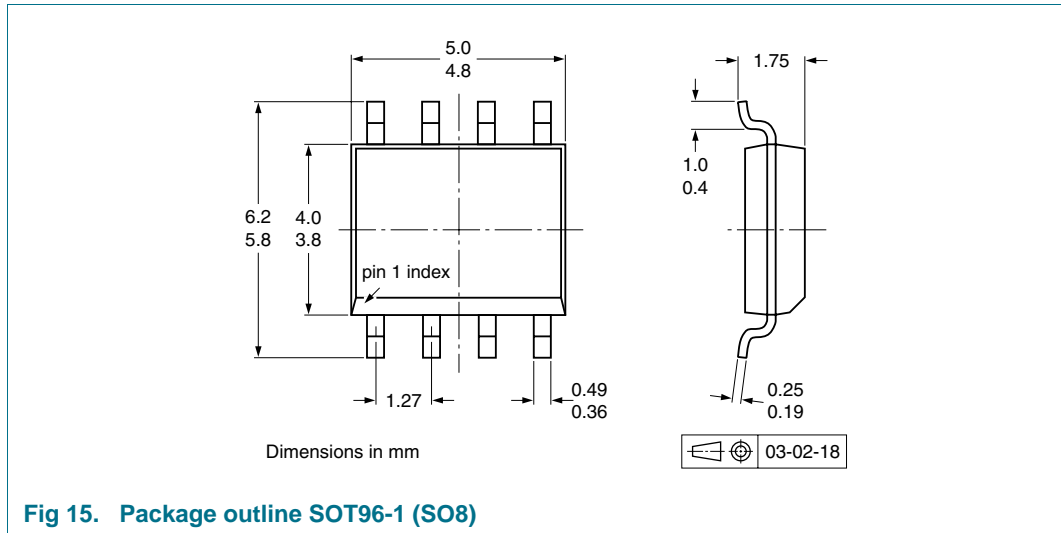
**Fig 13. BISS transistor switching time definition**



$V_{CC} = -12.5\text{ V}$ ;  $I_C = -1\text{ A}$ ;  $I_{B(on)} = -0.05\text{ A}$ ;  $I_{B(off)} = 0.05\text{ A}$

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

## 9. Package outline



## 10. Packing information

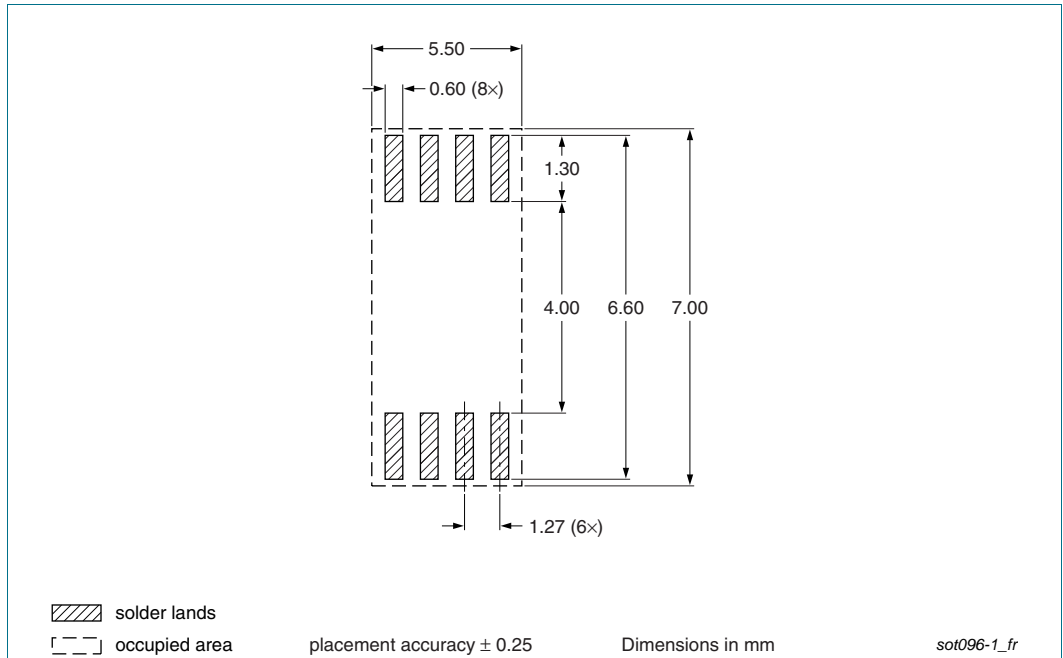
**Table 9. Packing methods**

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

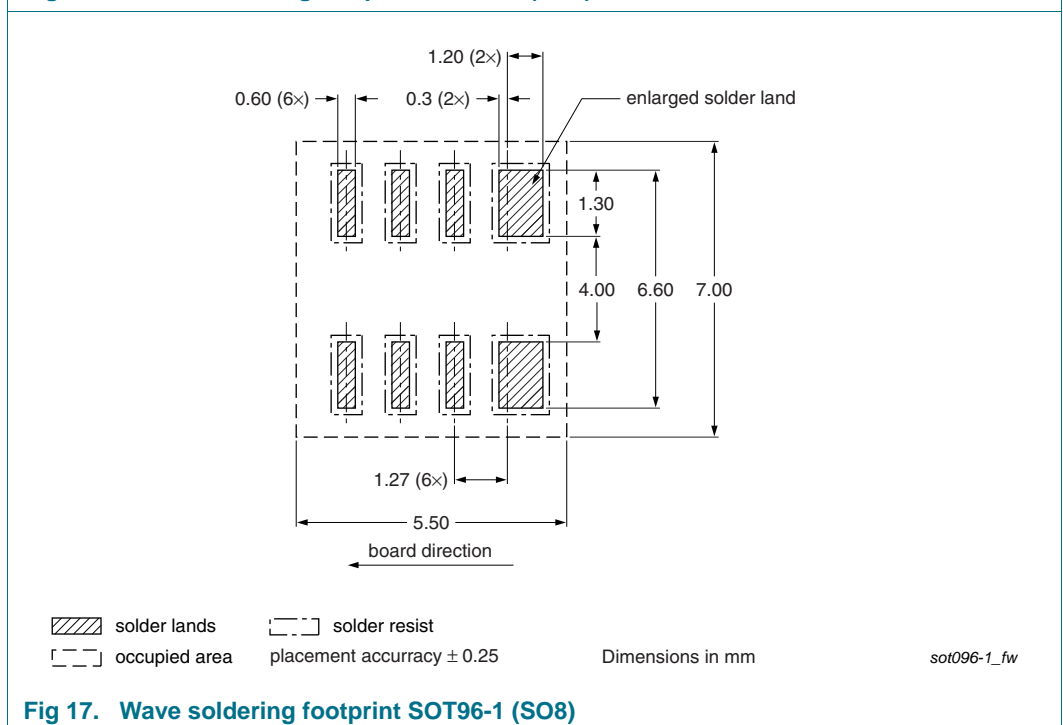
Type number	Package	Description	Packing quantity	
			1000	2500
PBSS4021SP	SOT96-1	8 mm pitch, 12 mm tape and reel	-115	-118

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

**11. Soldering**



**Fig 16. Reflow soldering footprint SOT96-1 (SO8)**



**Fig 17. Wave soldering footprint SOT96-1 (SO8)**

## 12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4021SP v.2	20101011	Product data sheet	-	PBSS4021SP v.1
Modifications:	• <a href="#">Figure 1 "Per device: Power derating curves"</a> : updated.			
PBSS4021SP v.1	20100714	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.

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[2N2369ADCSM](#) [2N5769](#) [2SC2412KT146S](#) [2SC5490A-TL-H](#) [2SD1816S-TL-E](#) [2SD1816T-TL-E](#) [CMXT2207 TR](#) [CPH6501-TL-E](#)  
[MCH4021-TL-E](#) [US6T6TR](#) [NJL0281DG](#) [732314D](#) [CMXT3906 TR](#) [CPH3121-TL-E](#) [CPH6021-TL-H](#) [873787E](#) [IMZ2AT108](#) [UMX21NTR](#)  
[MCH6102-TL-E](#) [NJL0302DG](#) [2N3583](#) [2SA1434-TB-E](#) [2SC3143-4-TB-E](#) [2SD1621S-TD-E](#) [NTE103](#) [30A02MH-TL-E](#) [NSV40301MZ4T1G](#)  
[NTE101](#) [NTE13](#) [NTE15](#)