

# PBSS4612PA

12 V, 6 A NPN low  $V_{CEsat}$  (BISS) transistor

Rev. 01 — 7 May 2010

Product data sheet

## 1. Product profile

### 1.1 General description

NPN low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor, encapsulated in an ultra thin SOT1061 leadless small Surface-Mounted Device (SMD) plastic package with medium power capability.

PNP complement: PBSS5612PA.

### 1.2 Features and benefits

- Low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability  $I_C$  and  $I_{CM}$
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- Exposed heat sink for excellent thermal and electrical conductivity
- Leadless small SMD plastic package with medium power capability

### 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

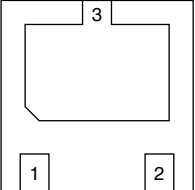
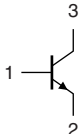
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	12	V
$I_C$	collector current		-	-	6	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	7	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = 6$ A; $I_B = 300$ mA	<a href="#">[1]</a> -	33	46	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	 <p>Transparent top view</p>	 <p>sym021</p>
2	emitter		
3	collector		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4612PA	HUSON3	plastic thermal enhanced ultra thin small outline package; no leads; three terminals; body $2 \times 2 \times 0.65$ mm	SOT1061

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4612PA	A5

## 5. Limiting values

Table 5. Limiting values

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

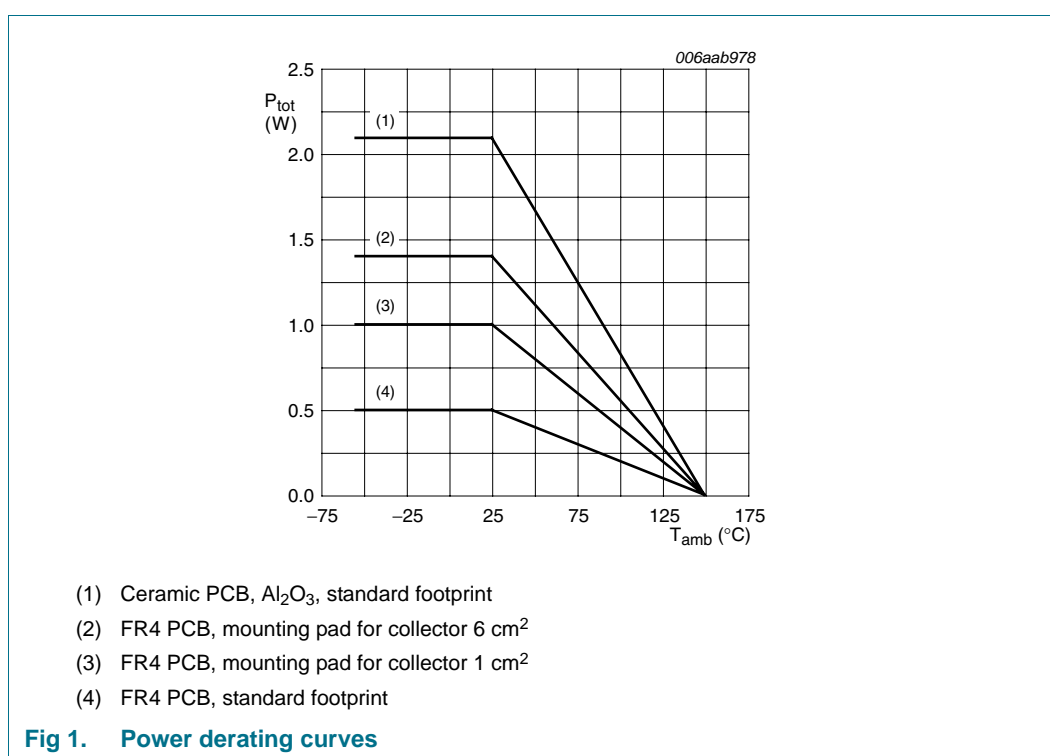
Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CBO</sub>	collector-base voltage	open emitter	-	12	V
V <sub>CEO</sub>	collector-emitter voltage	open base	-	12	V
V <sub>EBO</sub>	emitter-base voltage	open collector	-	6	V
I <sub>C</sub>	collector current		-	6	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms	-	7	A
I <sub>B</sub>	base current		-	600	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1] -	500	mW
			[2] -	1	W
			[3] -	1.4	W
			[4] -	2.1	W

**Table 5.** Limiting values ...continued

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

Symbol	Parameter	Conditions	Min	Max	Unit
$T_j$	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 an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.  
 [4] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

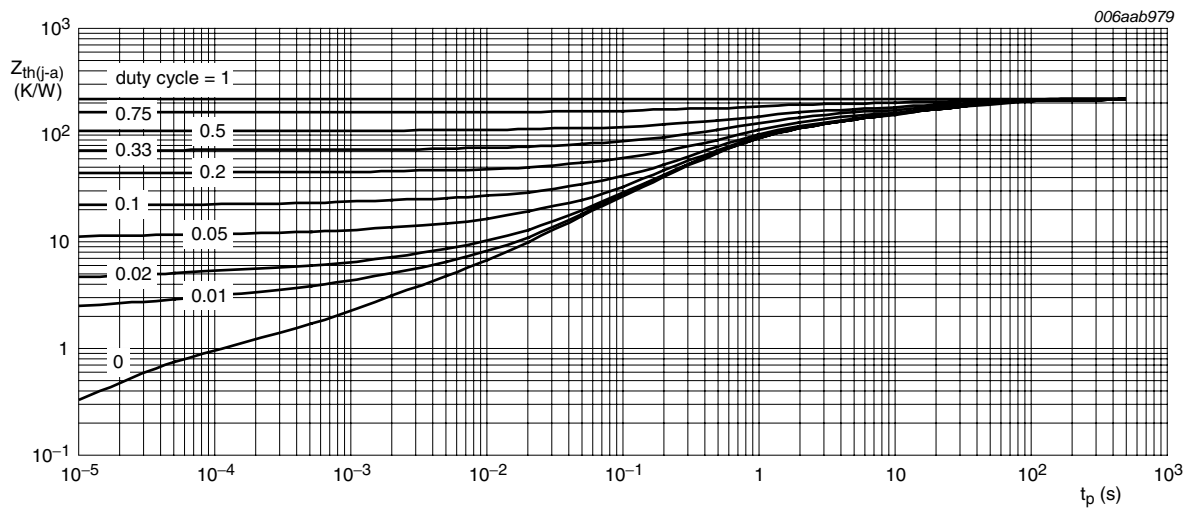


## 6. Thermal characteristics

**Table 6.** Thermal characteristics

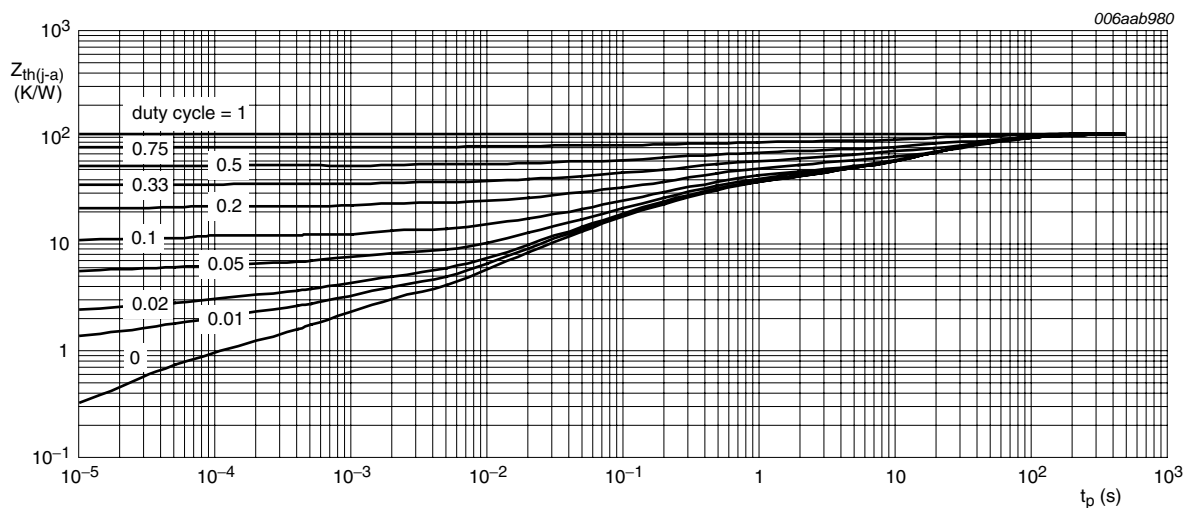
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	250	K/W
			[2]	-	125	K/W
			[3]	-	90	K/W
			[4]	-	60	K/W

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



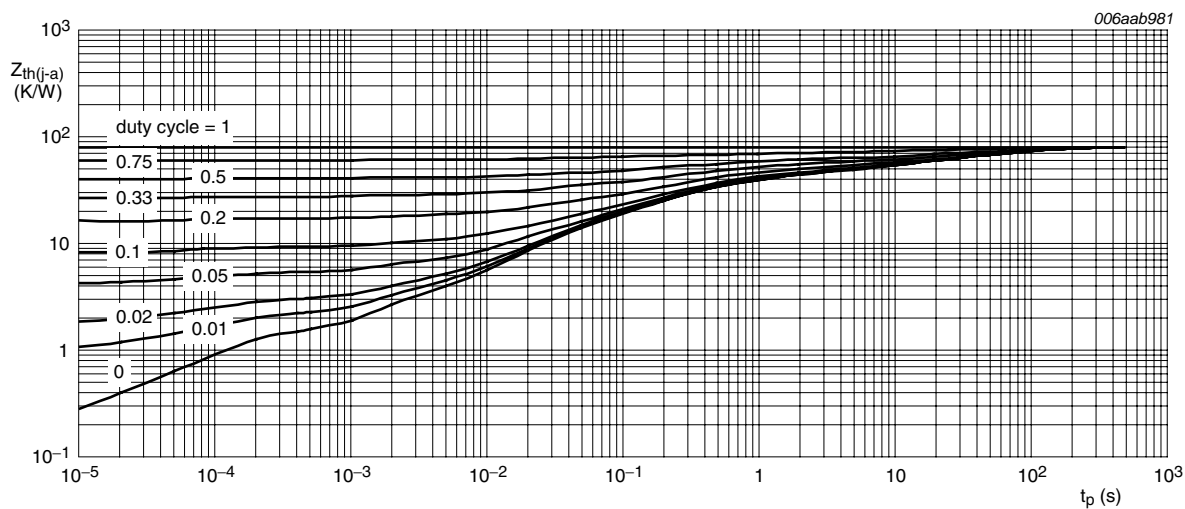
FR4 PCB, standard footprint

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



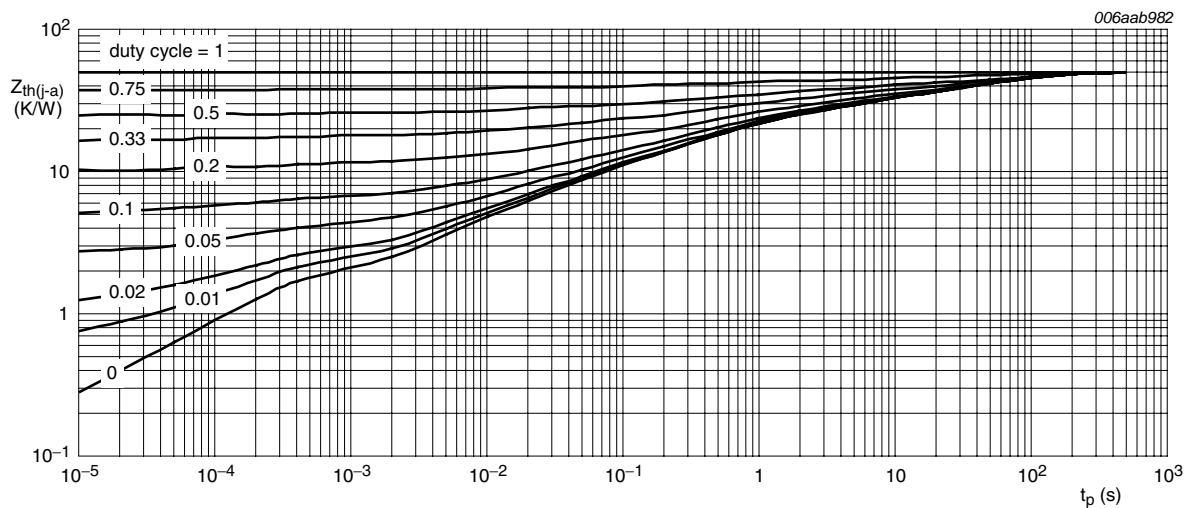
FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

Fig 3. 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 4. 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 5. 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
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 9.6\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 9.6\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 9.6\text{ V}; V_{BE} = 0\text{ V}$	-	-	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]			
		$I_C = 0.5\text{ A}$	280	440	-	
		$I_C = 1\text{ A}$	270	430	-	
		$I_C = 2\text{ A}$	260	415	-	
		$I_C = 6\text{ A}$	200	330	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 50\text{ mA}$	[1]	-	20	30 mV
		$I_C = 1\text{ A}; I_B = 50\text{ mA}$	[1]	-	37	55 mV
		$I_C = 1\text{ A}; I_B = 10\text{ mA}$	[1]	-	50	70 mV
		$I_C = 2\text{ A}; I_B = 20\text{ mA}$	[1]	-	85	120 mV
		$I_C = 3\text{ A}; I_B = 30\text{ mA}$	[1]	-	120	170 mV
		$I_C = 4\text{ A}; I_B = 400\text{ mA}$	[1]	-	135	185 mV
		$I_C = 6\text{ A}; I_B = 300\text{ mA}$	[1]	-	200	275 mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = 6\text{ A}; I_B = 300\text{ mA}$	[1]	-	33	46 $\text{m}\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 10\text{ mA}$	[1]	-	0.75	0.9 V
		$I_C = 6\text{ A}; I_B = 300\text{ mA}$	[1]	-	0.97	1.1 V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	[1]	-	0.74	0.9 V
$t_d$	delay time	$V_{CC} = 9\text{ V}; I_C = 2\text{ A}; I_{Bon} = 0.1\text{ A}; I_{Boff} = -0.1\text{ A}$	-	25	-	ns
$t_r$	rise time		-	55	-	ns
$t_{on}$	turn-on time		-	80	-	ns
$t_s$	storage time		-	285	-	ns
$t_f$	fall time		-	50	-	ns
$t_{off}$	turn-off time		-	335	-	ns
$f_T$	transition frequency	$V_{CE} = 10\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}$	50	80	-	MHz
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$	-	80	95	pF

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

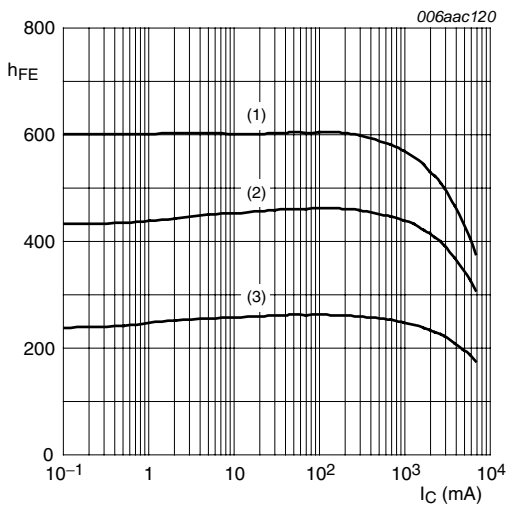


Fig 6. DC current gain as a function of collector current; typical values

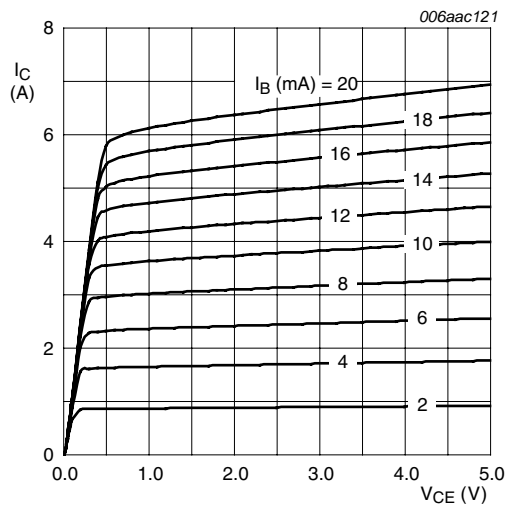


Fig 7. Collector current as a function of collector-emitter voltage; typical values

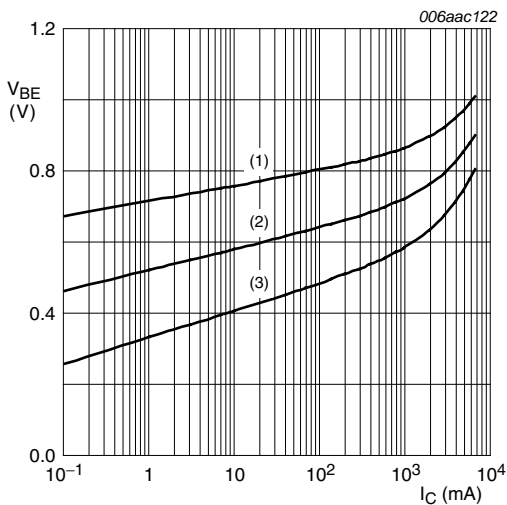


Fig 8. Base-emitter voltage as a function of collector current; typical values

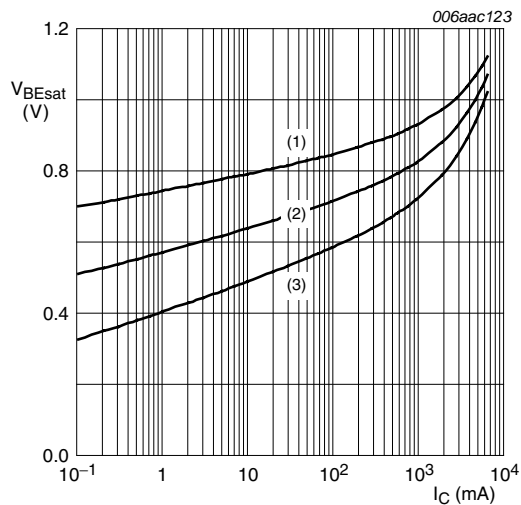
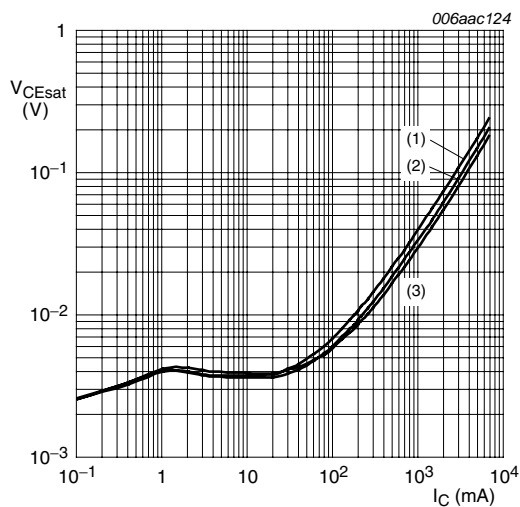
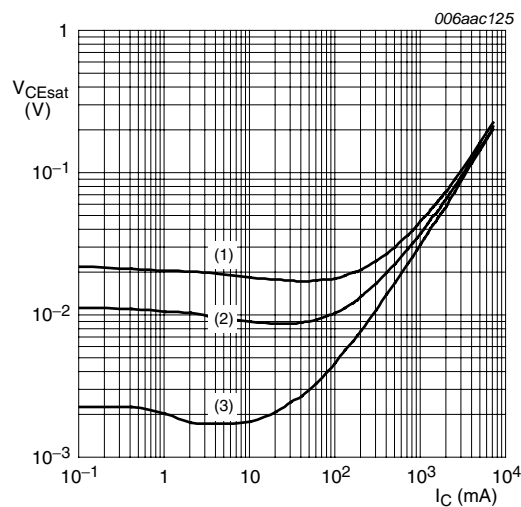


Fig 9. Base-emitter saturation voltage as a function of collector current; typical values



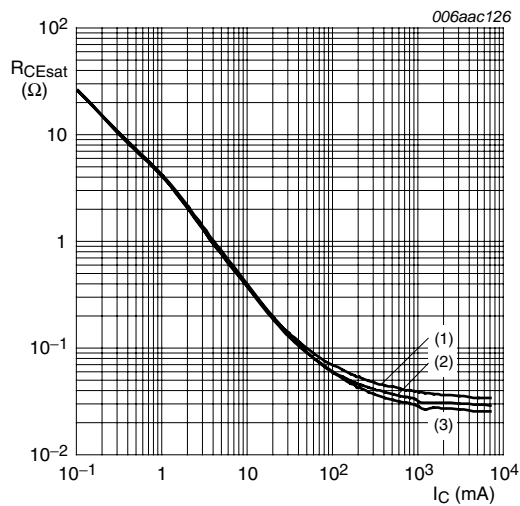
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



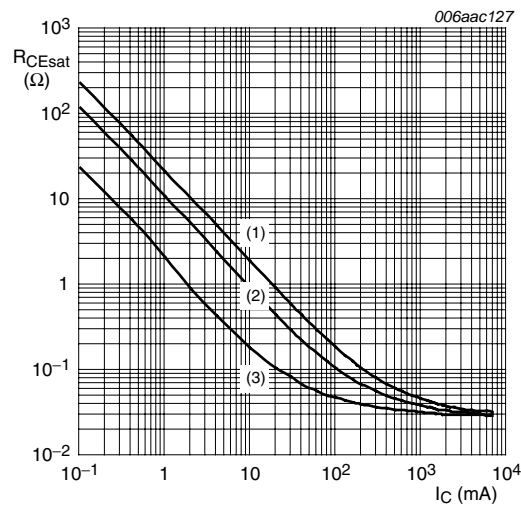
- $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

Fig 11. 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 12. 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 13. Collector-emitter saturation resistance as a function of collector current; typical values



8. Test information

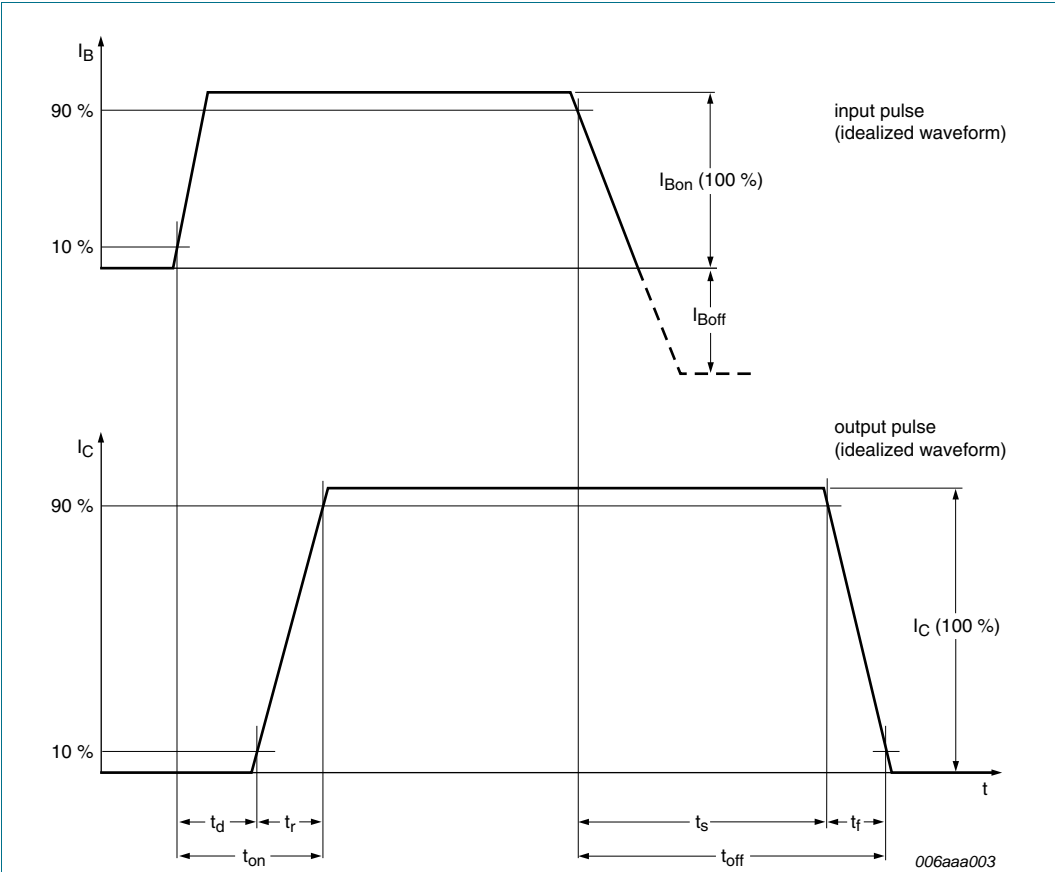
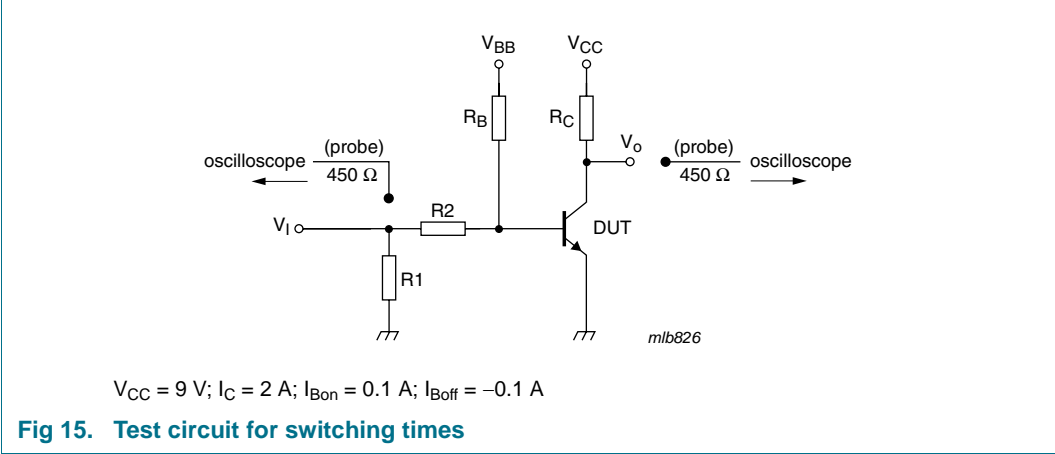


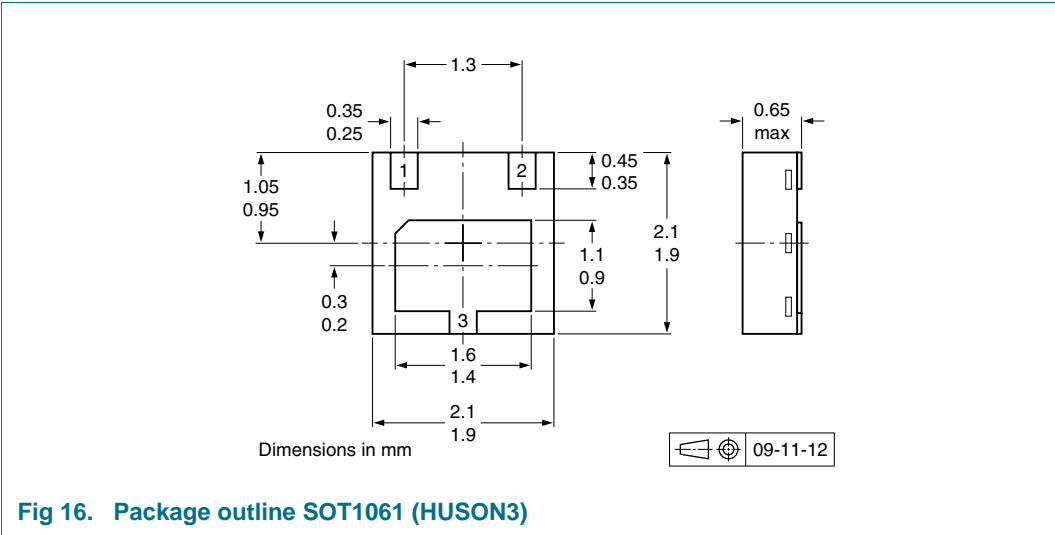
Fig 14. BISS transistor switching time definition



$V_{CC} = 9\text{ V}$ ;  $I_C = 2\text{ A}$ ;  $I_{B\text{on}} = 0.1\text{ A}$ ;  $I_{B\text{off}} = -0.1\text{ A}$

Fig 15. Test circuit for switching times

9. Package outline



10. Packing information

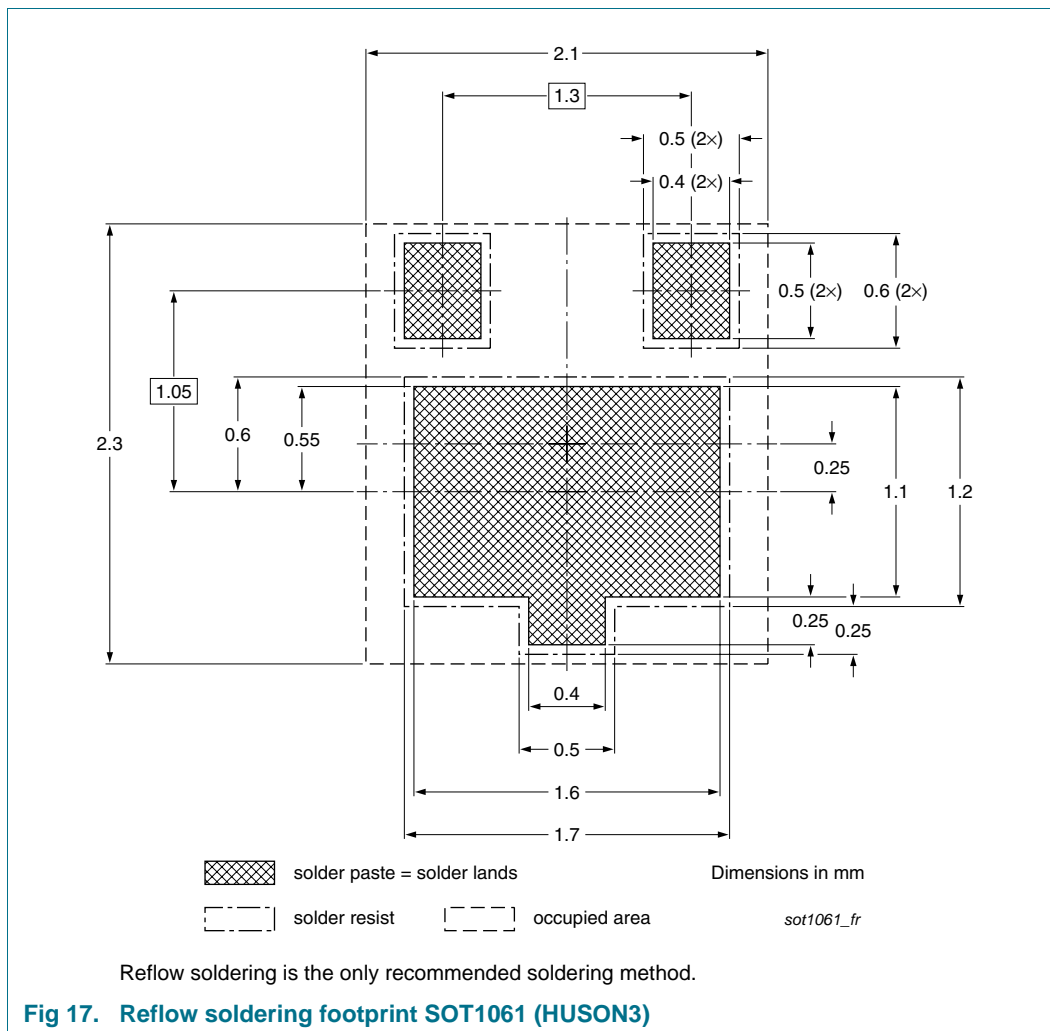
Table 8. Packing methods

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

Type number	Package	Description	Packing quantity
			3000
PBSS4612PA	SOT1061	4 mm pitch, 8 mm tape and reel	-115

[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
PBSS4612PA v.1	20100507	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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