

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

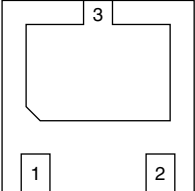
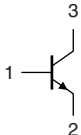
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	12	V
I_C	collector current		-	-	6	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	7	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 6$ A; $I_B = 300$ mA	[1] -	33	46	m Ω

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



2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	base	 Transparent top view	 sym021
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).

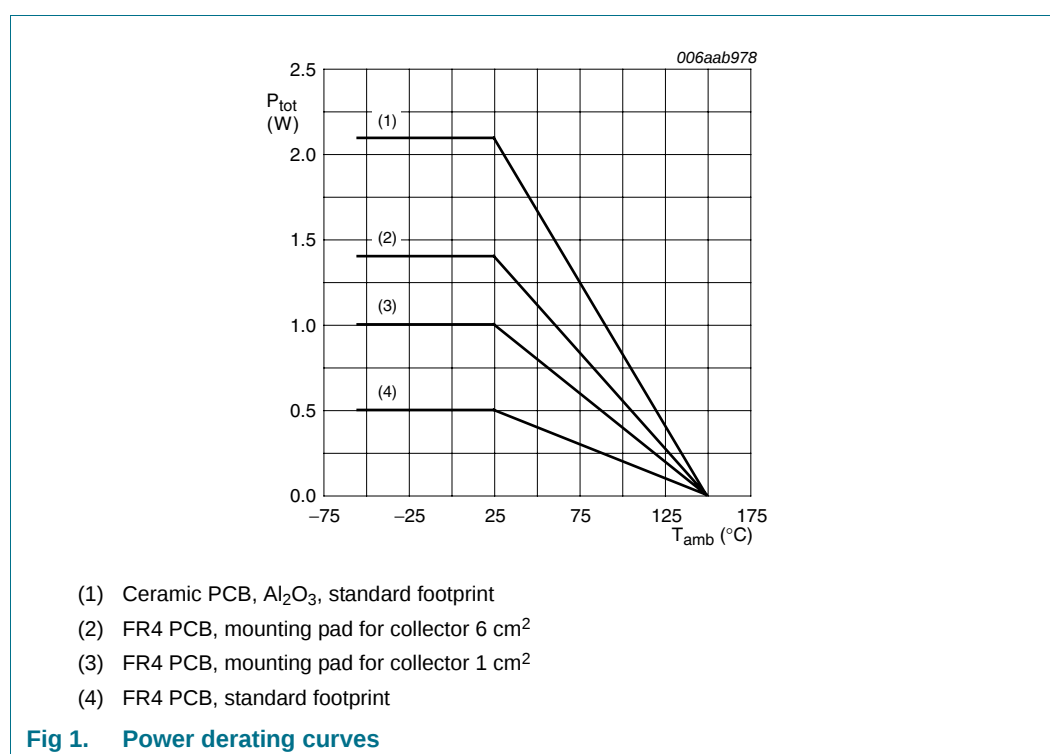
Symbol	Parameter	Conditions	Min	Max	Unit
V _{CBO}	collector-base voltage	open emitter	-	12	V
V _{CEO}	collector-emitter voltage	open base	-	12	V
V _{EBO}	emitter-base voltage	open collector	-	6	V
I _C	collector current		-	6	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms	-	7	A
I _B	base current		-	600	mA
P _{tot}	total power dissipation	T _{amb} ≤ 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 cm².
 [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
 [4] Device mounted on a ceramic PCB, Al₂O₃, 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 cm².
 [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
 [4] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

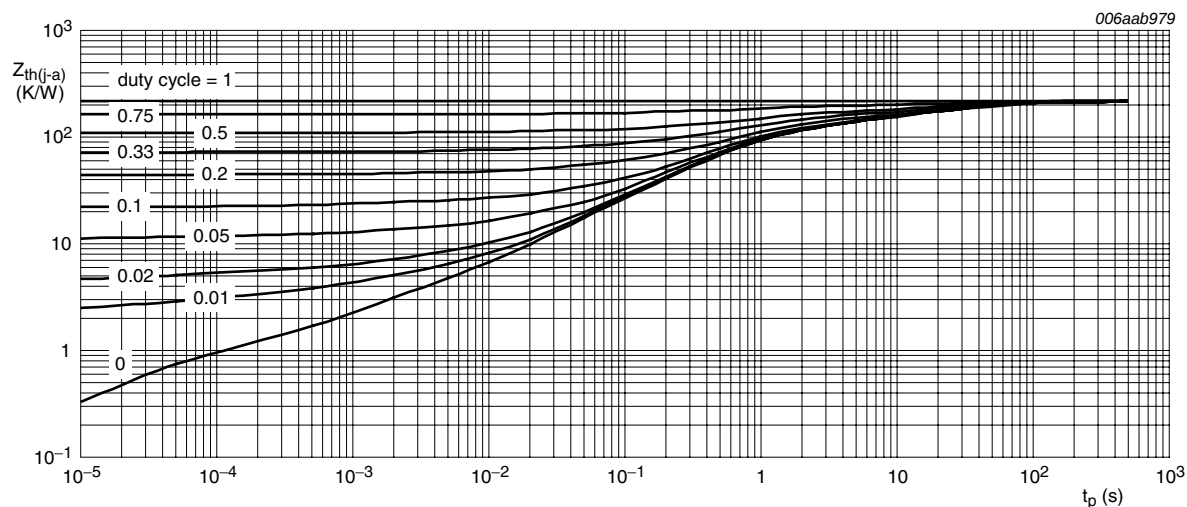


Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

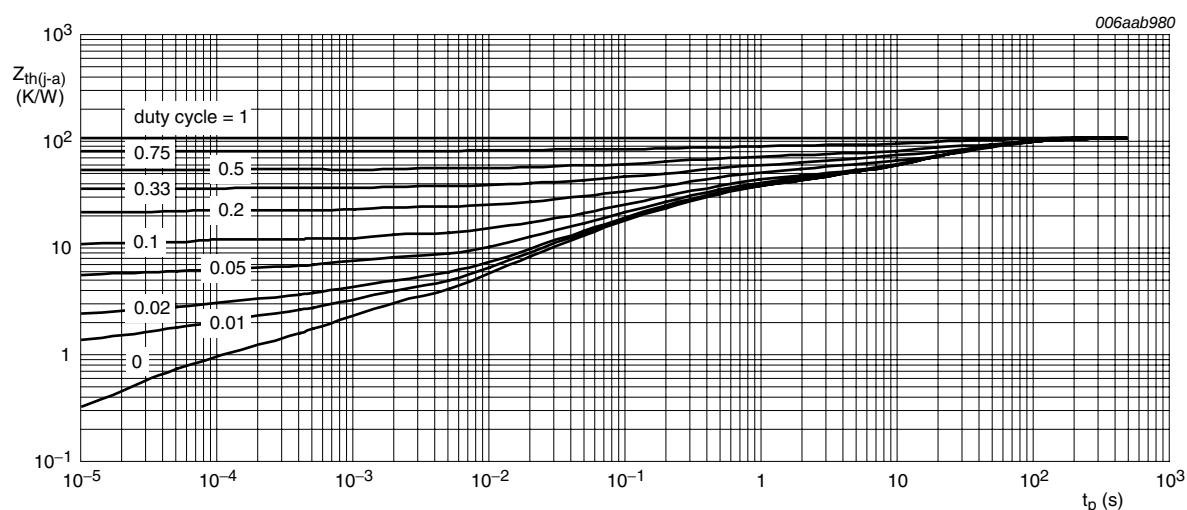


Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

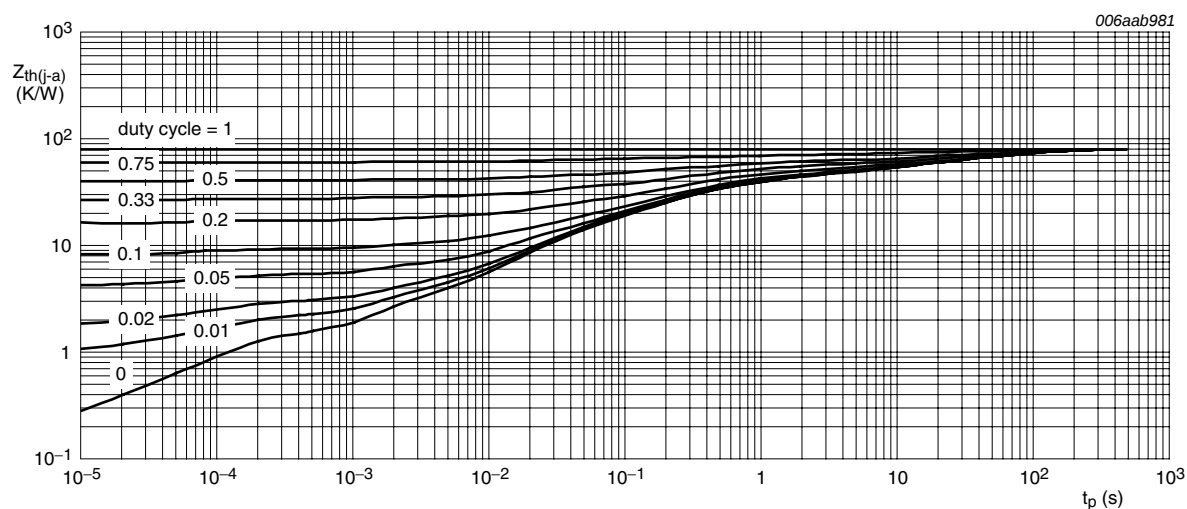


Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

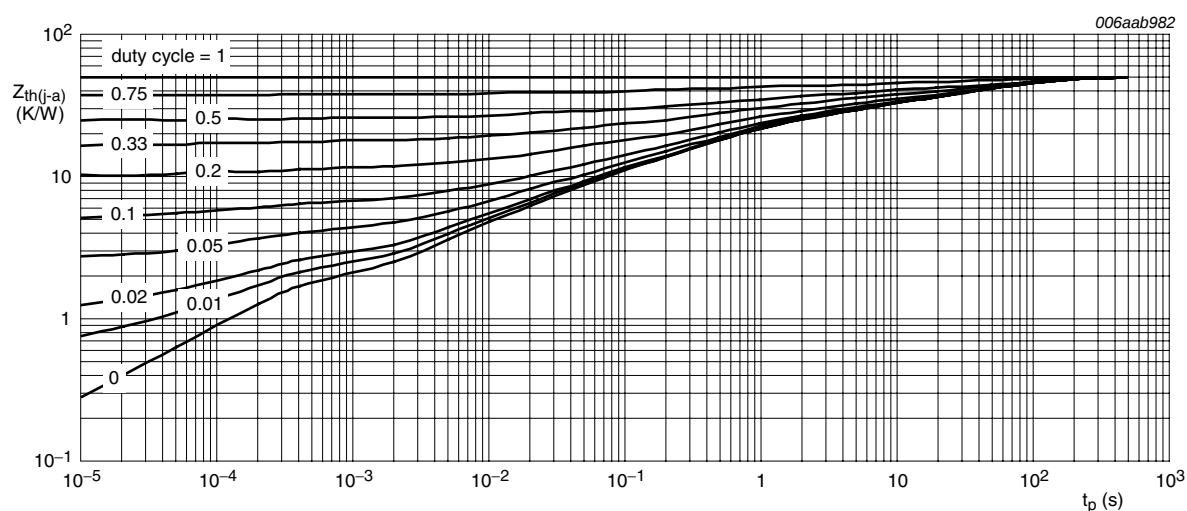


Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

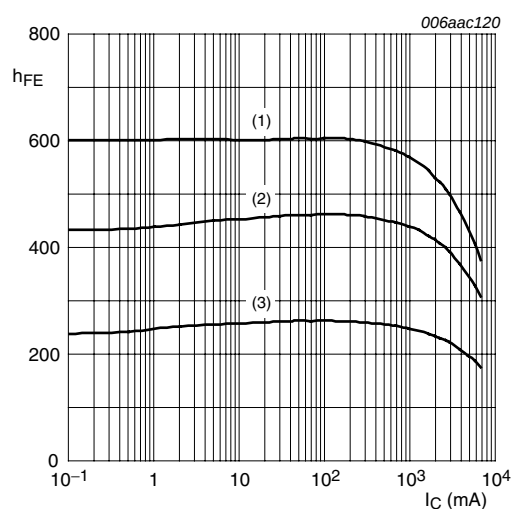
7. Characteristics

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	μA
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: $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$.


 $V_{CE} = 2 \text{ V}$

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

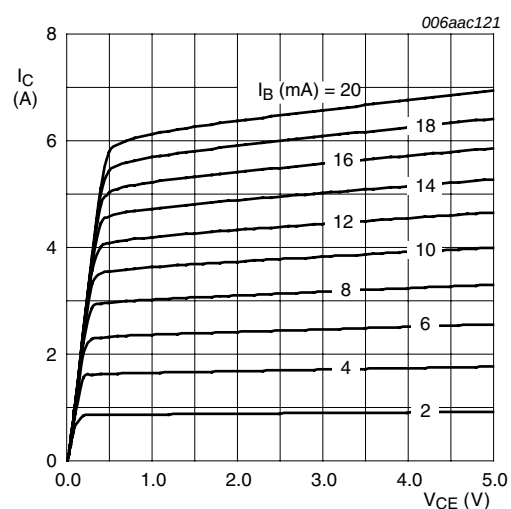
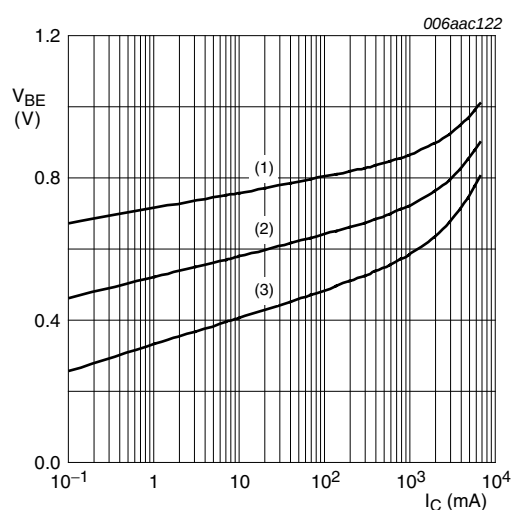
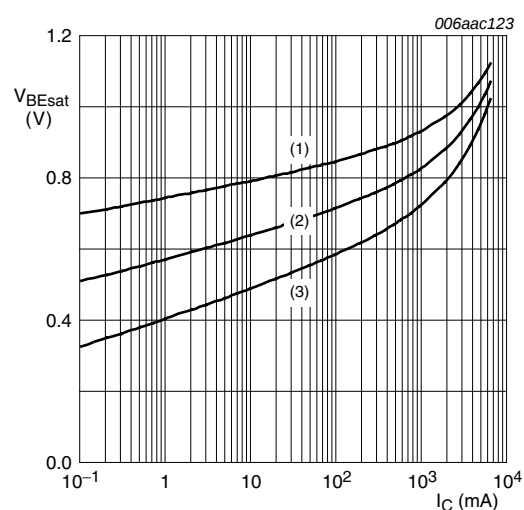

 $T_{amb} = 25 \text{ }^{\circ}\text{C}$

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


 $V_{CE} = 2 \text{ V}$

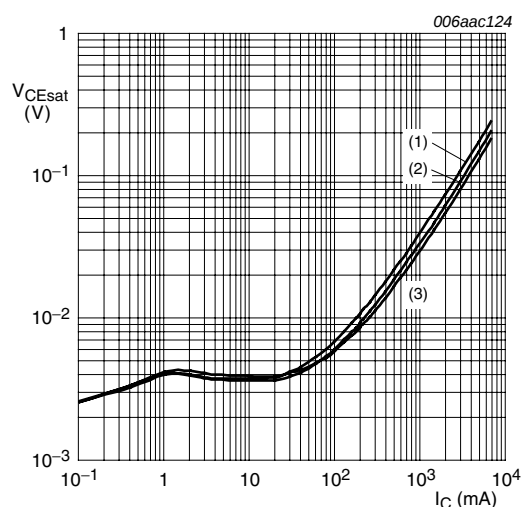
- (1) $T_{amb} = -55 \text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 25 \text{ }^{\circ}\text{C}$
- (3) $T_{amb} = 100 \text{ }^{\circ}\text{C}$

Fig 8. 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) $T_{amb} = 100 \text{ }^{\circ}\text{C}$

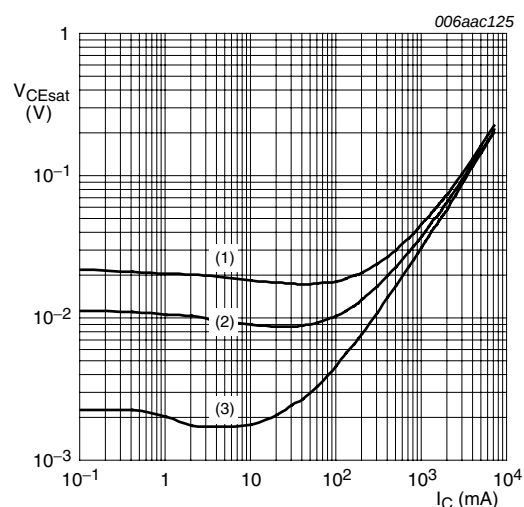
Fig 9. Base-emitter saturation voltage as a function of collector current; typical values



$$I_C/I_B = 20$$

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

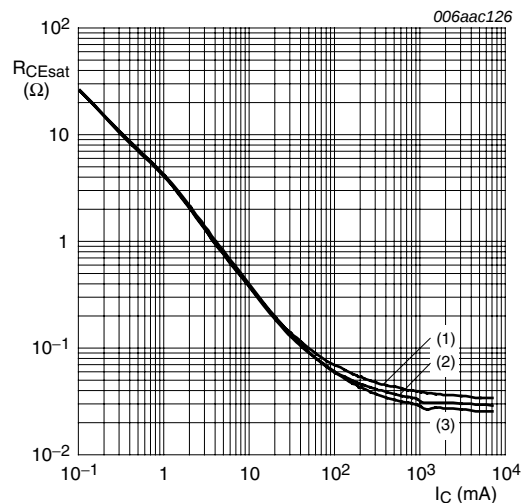
Fig 10. Collector-emitter saturation voltage as a function of collector current; typical values



$$T_{amb} = 25\text{ °C}$$

- (1) $I_C/I_B = 100$
- (2) $I_C/I_B = 50$
- (3) $I_C/I_B = 10$

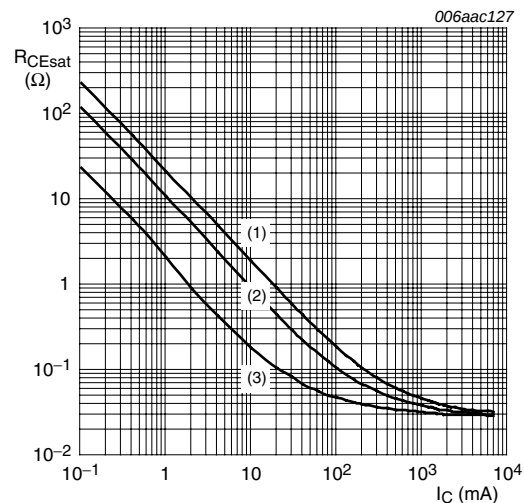
Fig 11. Collector-emitter saturation voltage as a function of collector current; typical values



$$I_C/I_B = 20$$

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

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

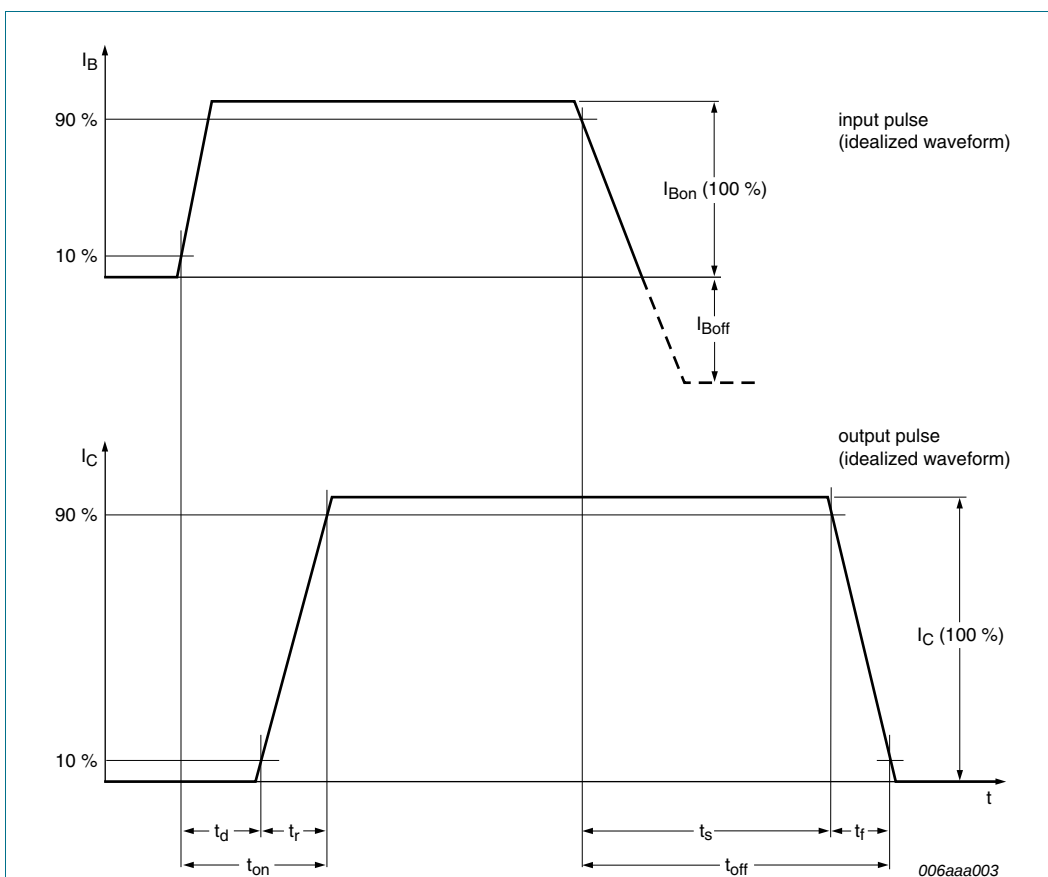
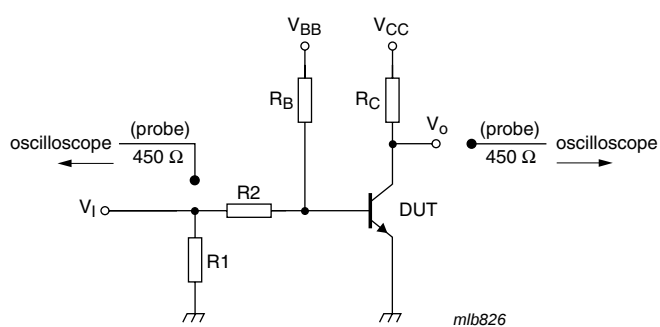


$$T_{amb} = 25\text{ °C}$$

- (1) $I_C/I_B = 100$
- (2) $I_C/I_B = 50$
- (3) $I_C/I_B = 10$

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

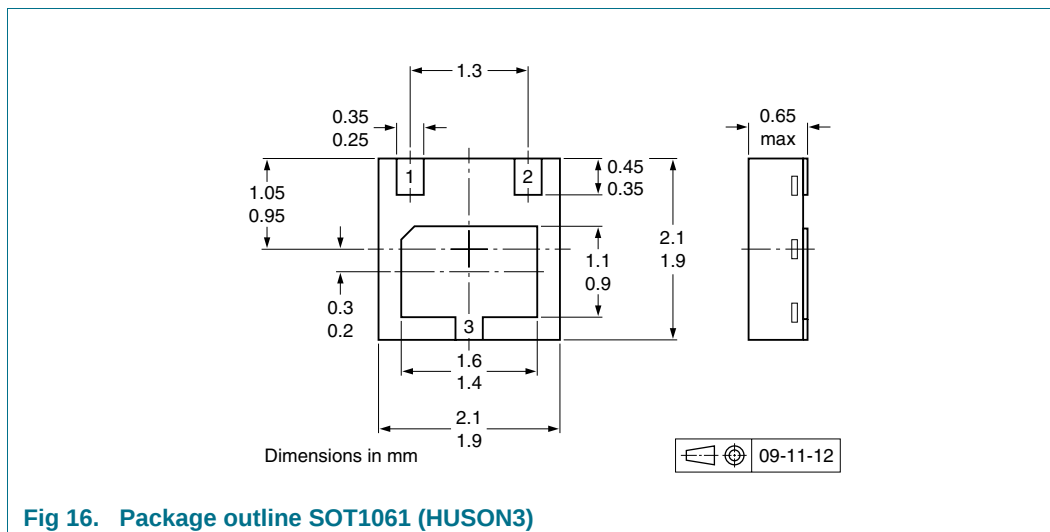
8. Test information

**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

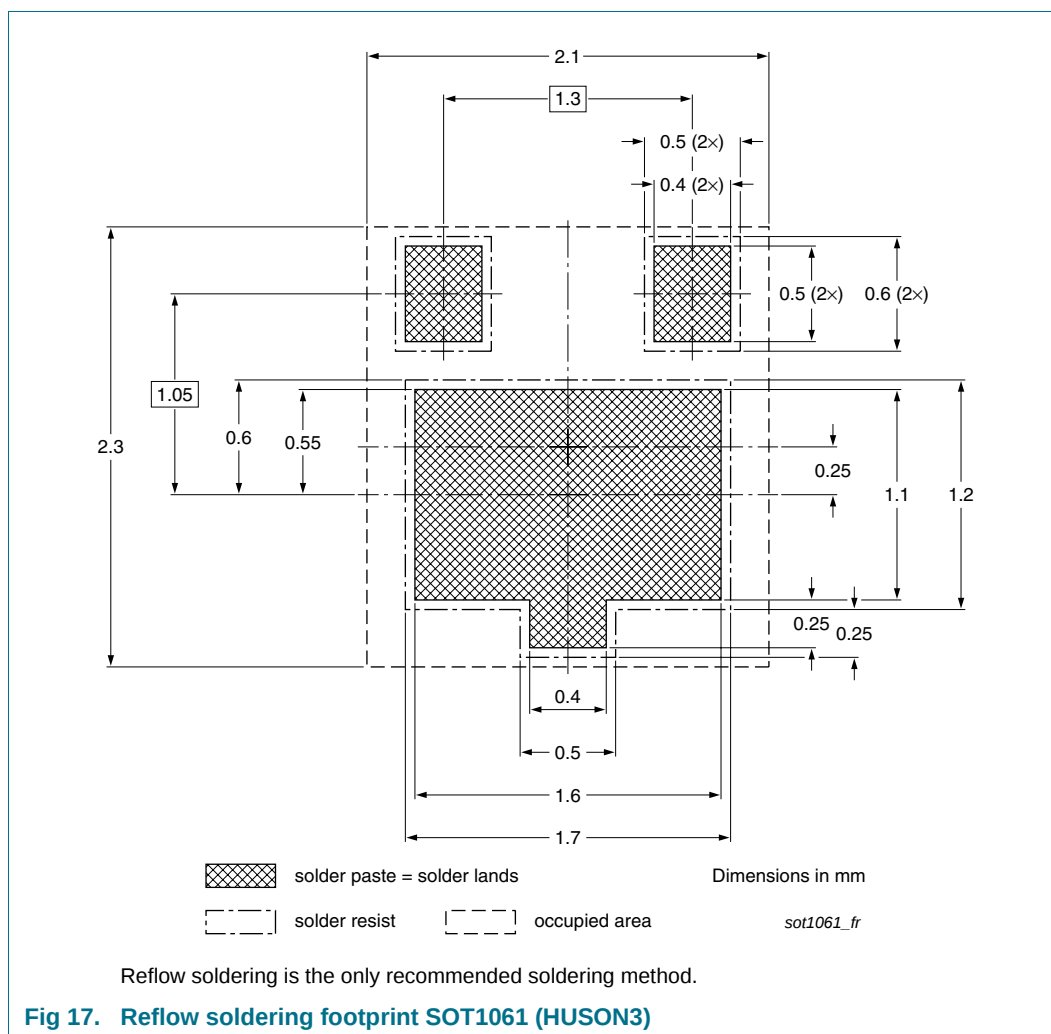
Table 8. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.^[1]

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 ^{[1][2]}	Product status ^[3]	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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