

PBSS304NX

60 V, 4.7 A NPN low V_{CEsat} (BISS) transistor

Rev. 01 — 16 August 2006

Product data sheet

1. Product profile

1.1 General description

NPN low V_{CEsat} Breakthrough In Small Signal (BISS) transistor in a SOT89 (SC-62/TO-243) small and flat lead Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS304PX.

1.2 Features

- 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

- 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

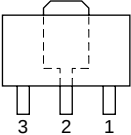
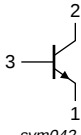
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	60	V
I_C	collector current		-	-	4.7	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	9.4	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 4$ A; $I_B = 200$ mA	[1] -	37	53	m Ω

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

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2. Pinning information

Table 2. Pinning			
Pin	Description	Simplified outline	Symbol
1	emitter		 sym042
2	collector		
3	base		

3. Ordering information

Table 3. Ordering information			
Type number	Package		
	Name	Description	Version
PBSS304NX	SC-62	plastic surface-mounted package; collector pad for good heat transfer; 3 leads	SOT89

4. Marking

Table 4. Marking codes	
Type number	Marking code ^[1]
PBSS304NX	*5E

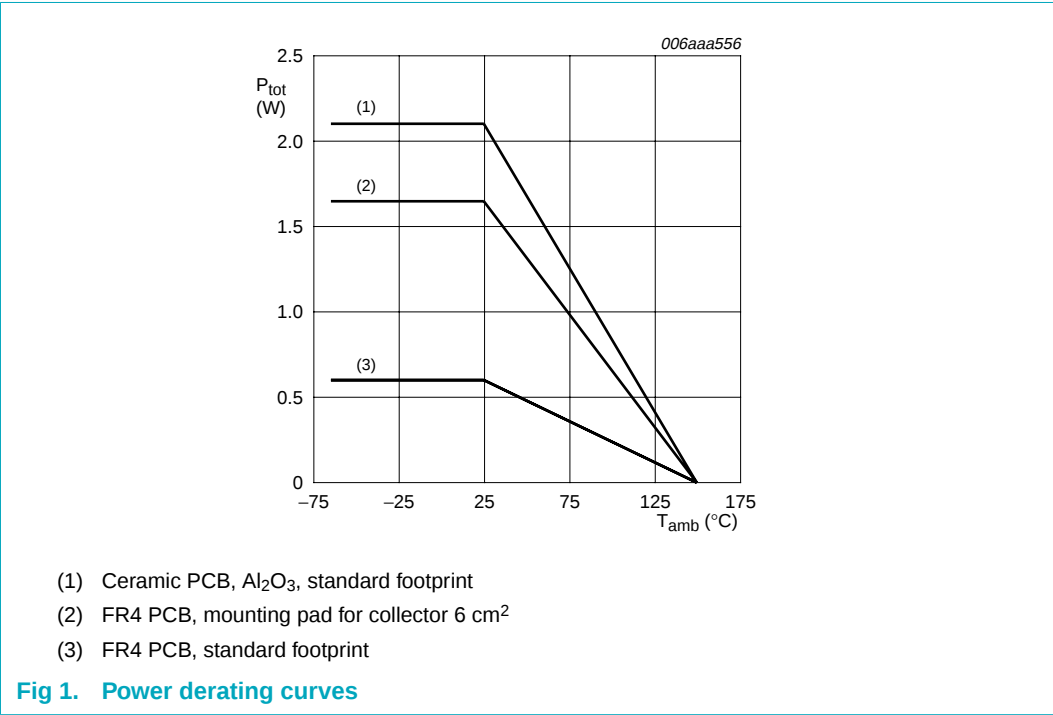
[1] * = -: made in Hong Kong
* = p: made in Hong Kong
* = t: made in Malaysia
* = W: made in China

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	-	60	V
V_{CEO}	collector-emitter voltage	open base	-	60	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current		-	4.7	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	9.4	A
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ }^{\circ}\text{C}$	[1] -	0.6	W
			[2] -	1.65	W
			[3] -	2.1	W
T_j	junction temperature		-	150	$^{\circ}\text{C}$
T_{amb}	ambient temperature		-65	+150	$^{\circ}\text{C}$
T_{stg}	storage temperature		-65	+150	$^{\circ}\text{C}$

- [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 cm².
[3] 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] -	-	208	K/W
			[2] -	-	76	K/W
			[3] -	-	60	K/W
R _{th(j-sp)}	thermal resistance from junction to solder point		-	-	20	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 cm².
- [3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

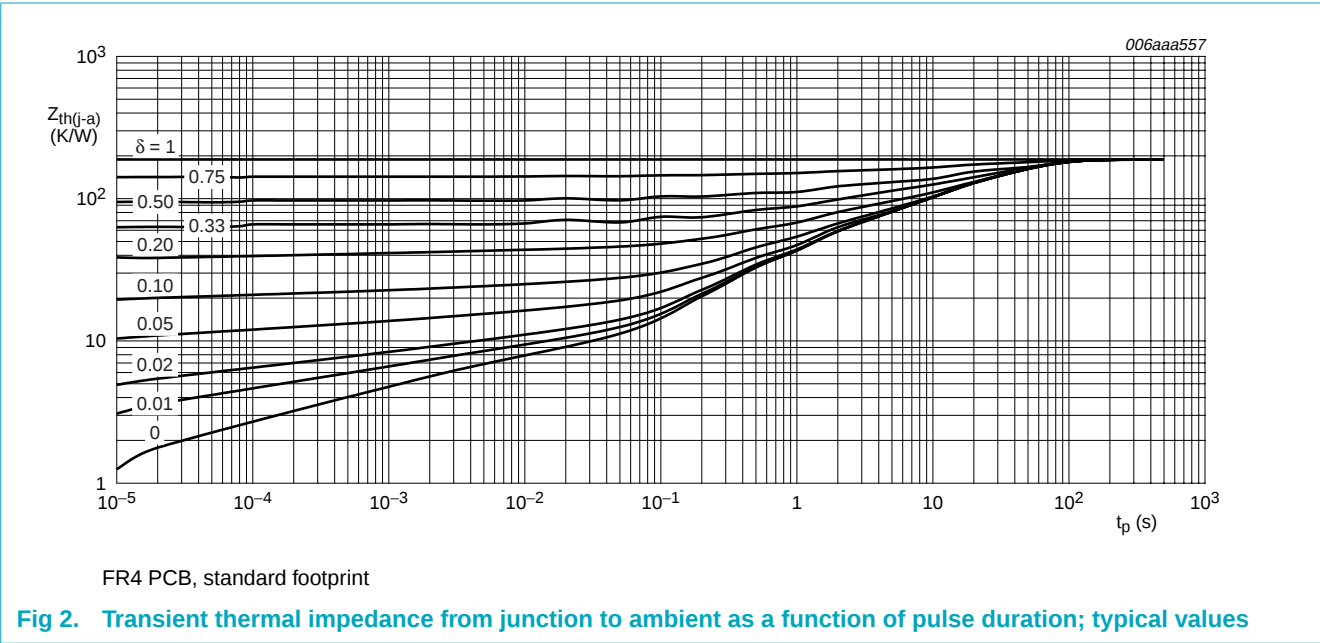
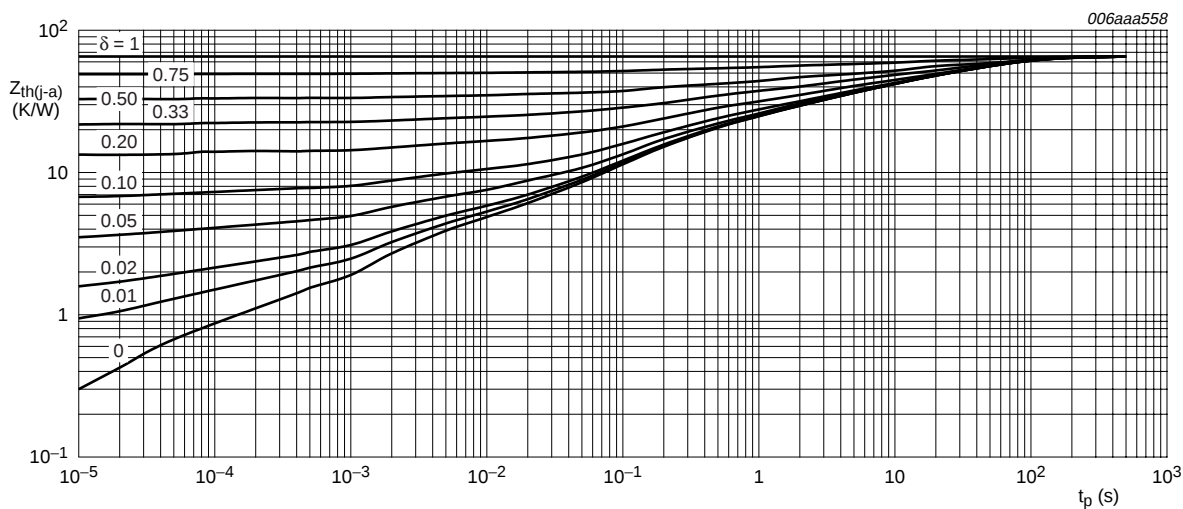
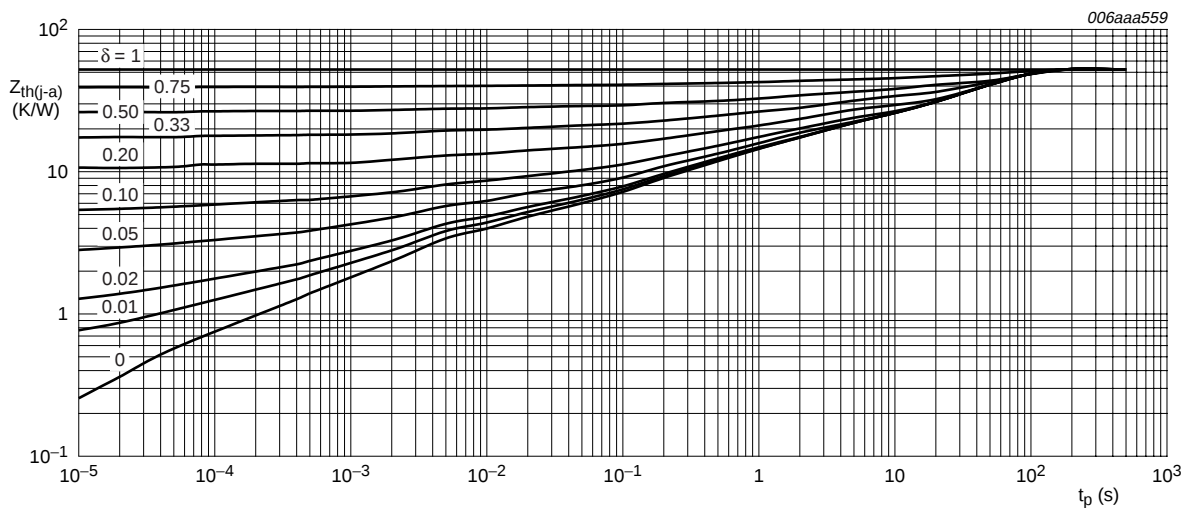


Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, mounting pad for collector 6 cm²

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



Ceramic PCB, Al₂O₃, standard footprint

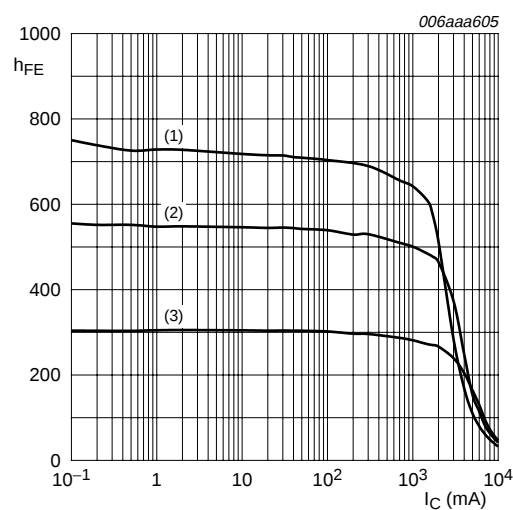
Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

7. Characteristics

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

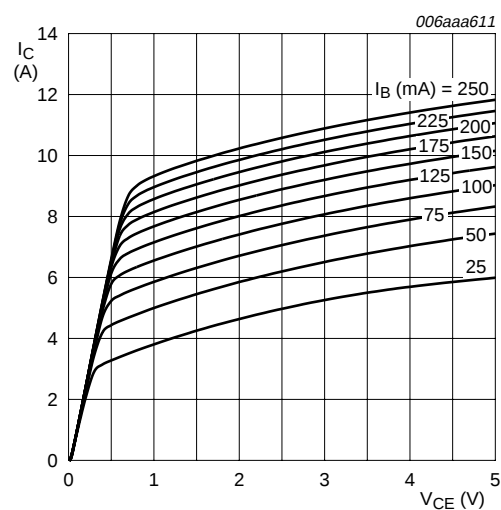
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 60\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 150^\circ\text{C}$	-	-	50	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
h_{FE}	DC current gain	$V_{CE} = 2\text{ V}; I_C = 0.5\text{ A}$	[1]	300	520	-
		$V_{CE} = 2\text{ V}; I_C = 1\text{ A}$	[1]	300	500	-
		$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	[1]	250	470	-
		$V_{CE} = 2\text{ V}; I_C = 4\text{ A}$	[1]	150	250	-
		$V_{CE} = 2\text{ V}; I_C = 6\text{ A}$	[1]	75	115	-
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 50\text{ mA}$	[1]	-	25	35 mV
		$I_C = 1\text{ A}; I_B = 50\text{ mA}$	[1]	-	50	70 mV
		$I_C = 1\text{ A}; I_B = 10\text{ mA}$	[1]	-	85	120 mV
		$I_C = 2\text{ A}; I_B = 40\text{ mA}$	[1]	-	105	150 mV
		$I_C = 4\text{ A}; I_B = 200\text{ mA}$	[1]	-	145	210 mV
		$I_C = 4\text{ A}; I_B = 400\text{ mA}$	[1]	-	140	200 mV
		$I_C = 4\text{ A}; I_B = 80\text{ mA}$	[1]	-	190	290 mV
		$I_C = 4.7\text{ A}; I_B = 235\text{ mA}$	[1]	-	170	245 mV
R_{CEsat}	collector-emitter saturation resistance	$I_C = 4\text{ A}; I_B = 200\text{ mA}$	[1]	-	37	53 m Ω
		$I_C = 4\text{ A}; I_B = 80\text{ mA}$	[1]	-	48	73 m Ω
V_{BEsat}	base-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1]	-	0.82	0.9 V
		$I_C = 4\text{ A}; I_B = 400\text{ mA}$	[1]	-	0.94	1.05 V
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	[1]	-	0.75	0.85 V
t_d	delay time	$V_{CC} = 12.5\text{ V}; I_C = 3\text{ A}; I_{Bon} = 0.15\text{ A}; I_{Boff} = -0.15\text{ A}$	-	15	-	ns
t_r	rise time		-	95	-	ns
t_{on}	turn-on time		-	110	-	ns
t_s	storage time		-	360	-	ns
t_f	fall time		-	195	-	ns
t_{off}	turn-off time		-	555	-	ns
f_T	transition frequency	$V_{CE} = 10\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}$	-	130	-	MHz
C_c	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$	-	48	70	pF

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



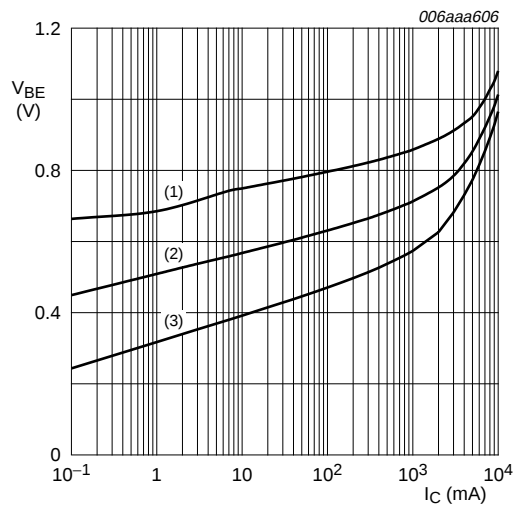
- $V_{CE} = 2$ V
- (1) $T_{amb} = 100$ °C
 - (2) $T_{amb} = 25$ °C
 - (3) $T_{amb} = -55$ °C

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



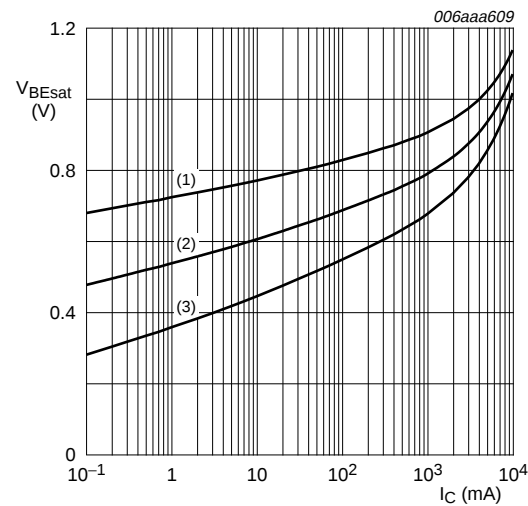
$T_{amb} = 25$ °C

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



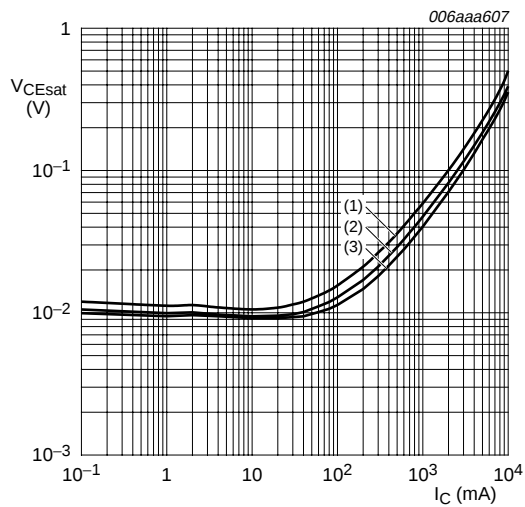
- $V_{CE} = 2$ V
- (1) $T_{amb} = -55$ °C
 - (2) $T_{amb} = 25$ °C
 - (3) $T_{amb} = 100$ °C

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



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

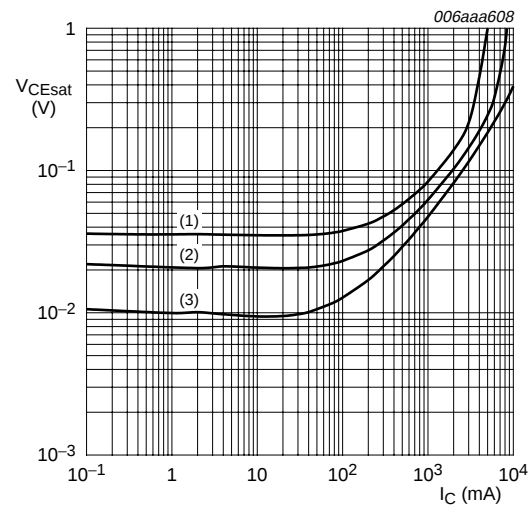
Fig 8. Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

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

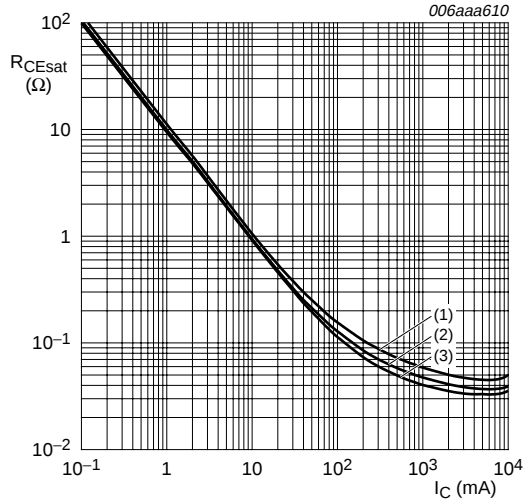
Fig 9. Collector-emitter saturation voltage as a function of collector current; typical values



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

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

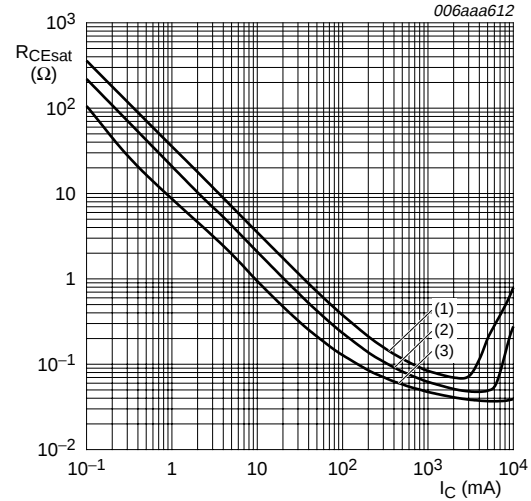
Fig 10. Collector-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

- (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

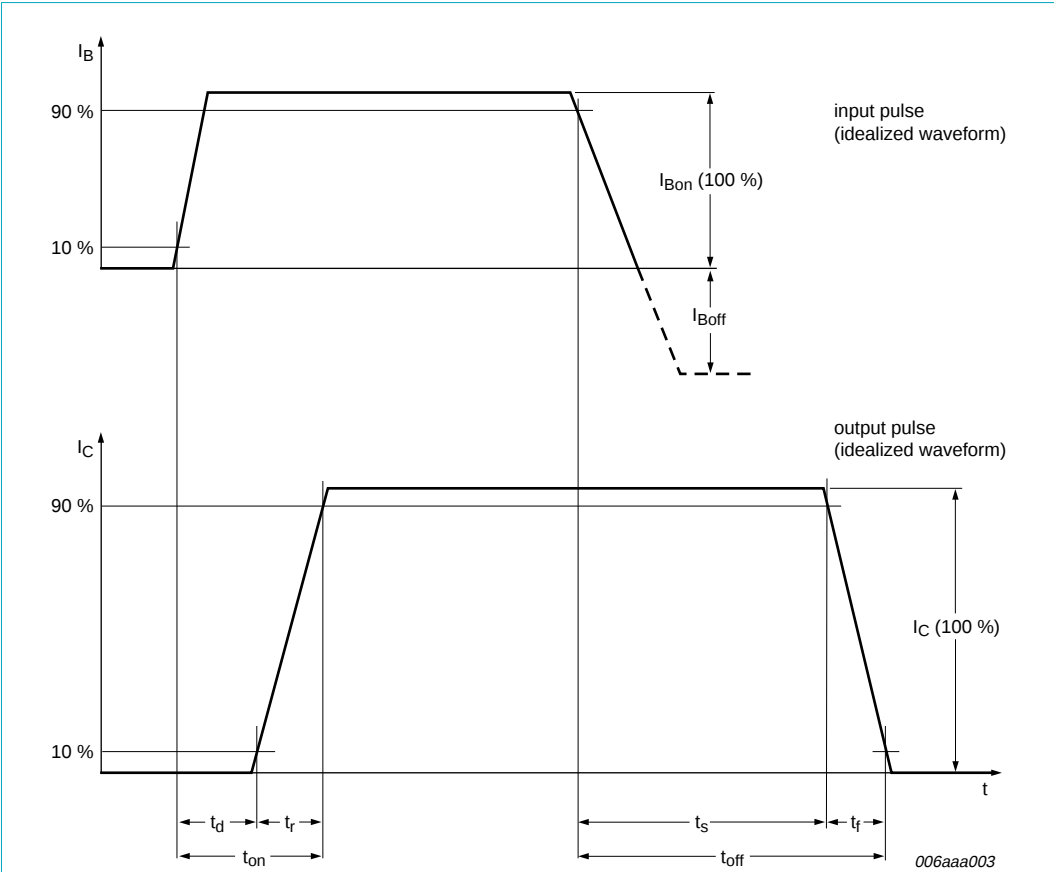
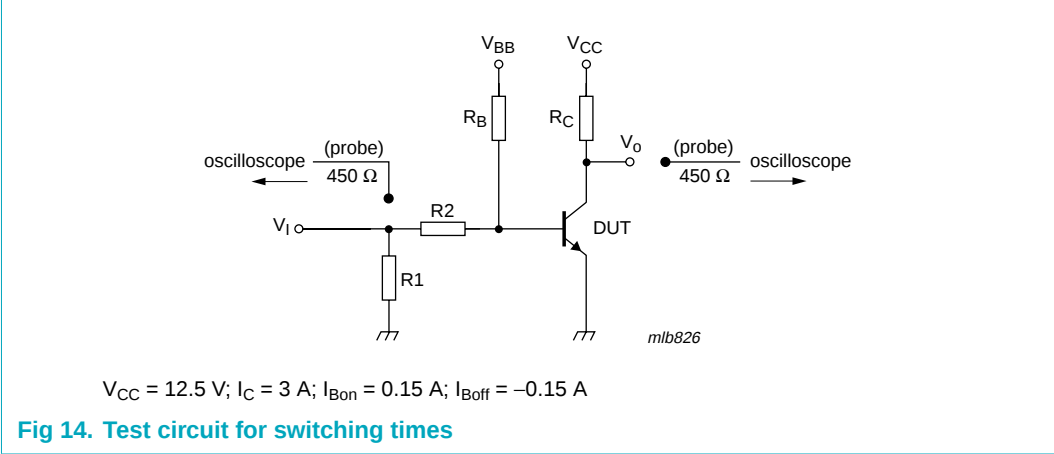
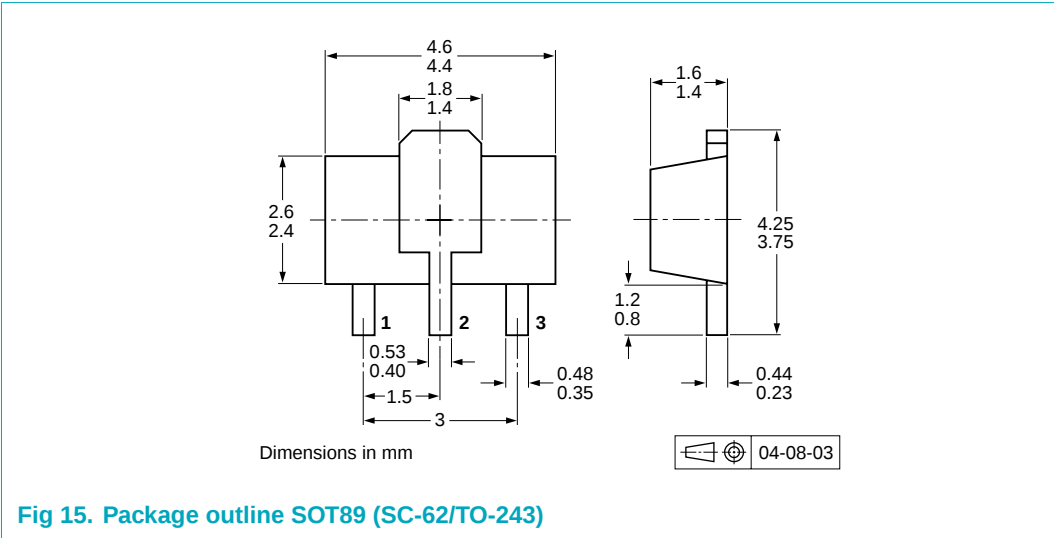


Fig 13. BISS transistor switching time definition



9. Package outline



10. Packing information

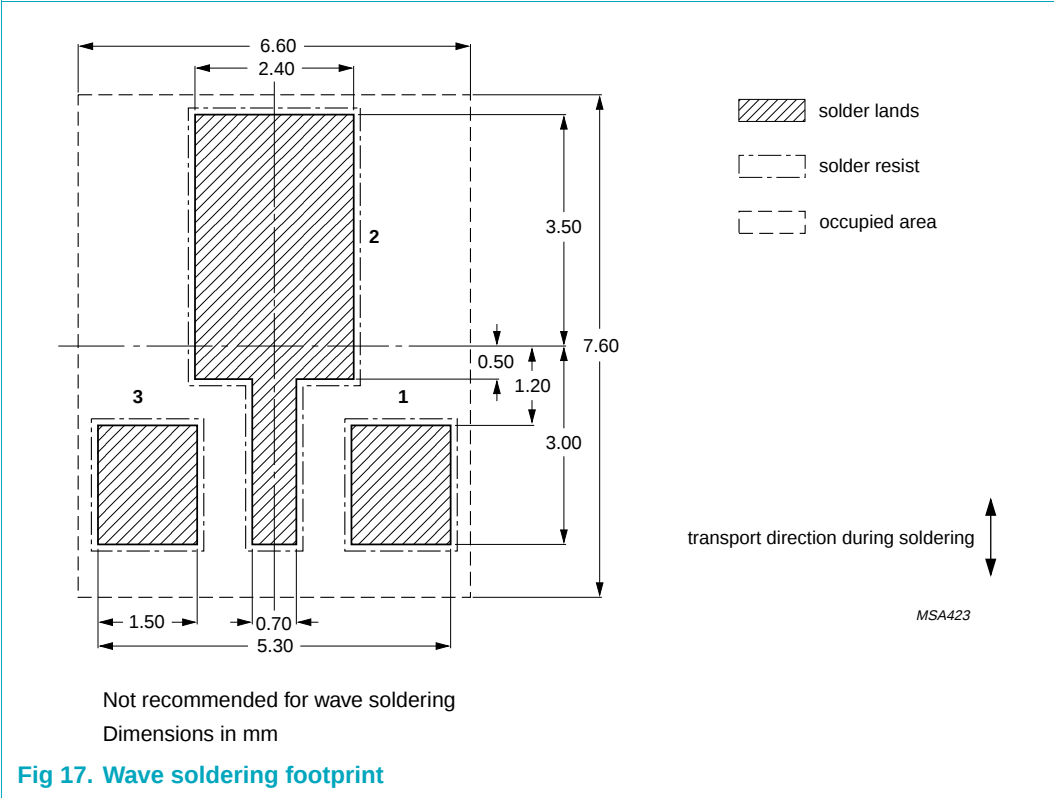
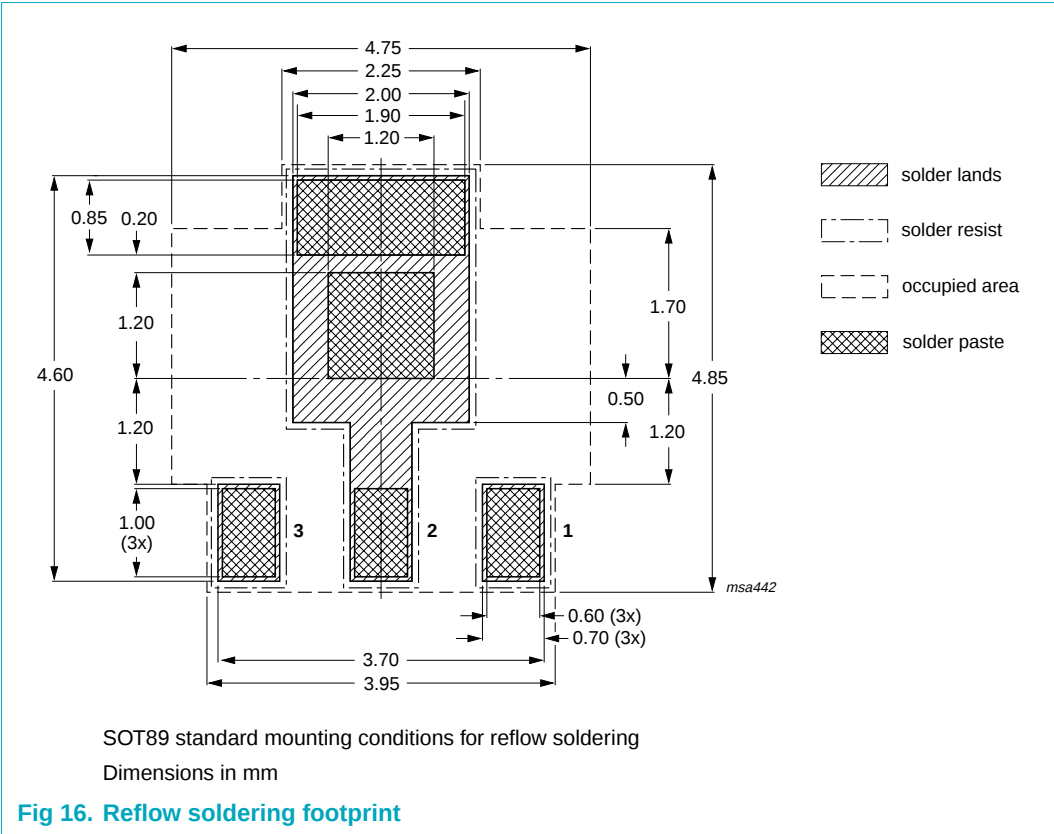
Table 8. Packing methods

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

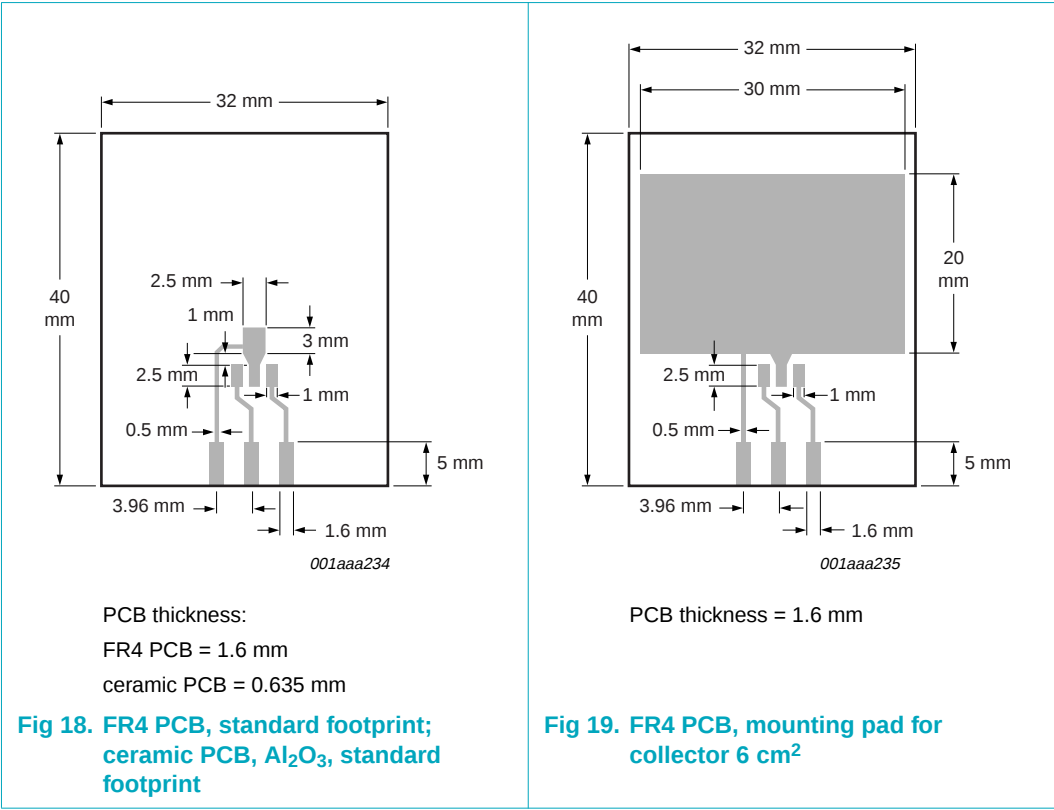
Type number	Package	Description	Packing quantity	
			1000	4000
PBSS304NX	SOT89	8 mm pitch, 12 mm tape and reel	-115	-135

[1] For further information and the availability of packing methods, see [Section 15](#).

11. Soldering



12. Mounting



13. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS304NX_1	20060816	Product data sheet	-	-

14. Legal information

14.1 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.
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[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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