



PBSS304ND

80 V, 3 A NPN low V_{CEsat} (BISS) transistor

Rev. 01 — 7 April 2006

Product data sheet

1. Product profile

1.1 General description

NPN low V_{CEsat} Breakthrough In Small Signal (BISS) transistor in a SOT457 (SC-74) small Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS304PD.

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)
- Thin Film Transistor (TFT) backlight inverter
- 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	-	-	80	V
I_C	collector current		^[1] -	-	3	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	6	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 2$ A; $I_B = 200$ mA	^[2] -	68	88	m Ω

[1] Device mounted on a ceramic PCB, Al_2O_3 , standard footprint.

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

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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	-	80	V
V_{CEO}	collector-emitter voltage	open base	-	80	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current		[1] -	1	A
			[2] -	3	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	6	A
I_B	base current		-	0.8	A
I_{BM}	peak base current	single pulse; $t_p \leq 1$ ms	-	2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1] -	360	mW
			[3] -	600	mW
			[4] -	750	mW
			[2] -	1.1	W
			[1][5] -	2.5	W
T_j	junction temperature		-	150	°C
T_{amb}	ambient temperature		-65	+150	°C
T_{stg}	storage temperature		-65	+150	°C

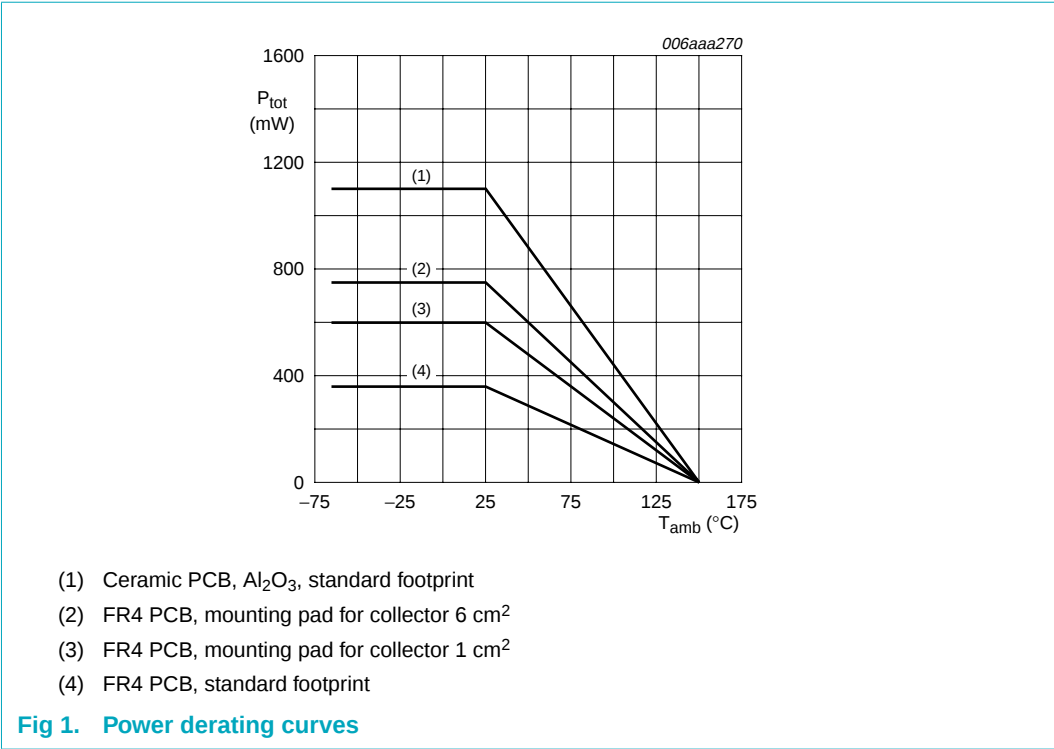
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on a ceramic PCB, Al_2O_3 , standard footprint.

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².

[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².

[5] Pulse test: $t_p \leq 10$ ms; $\delta \leq 10$ %.

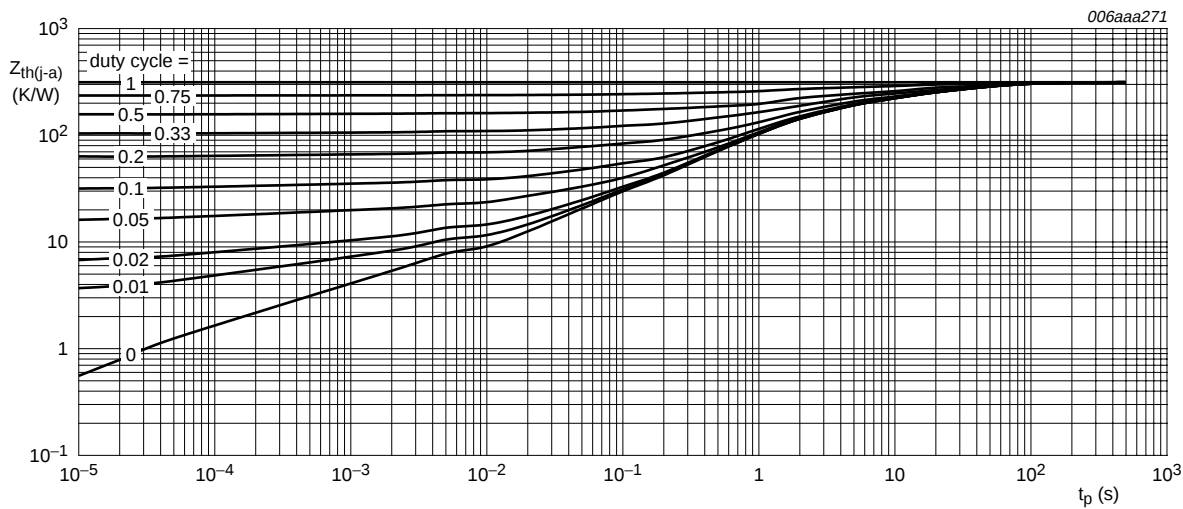


6. Thermal characteristics

Table 6. Thermal characteristics

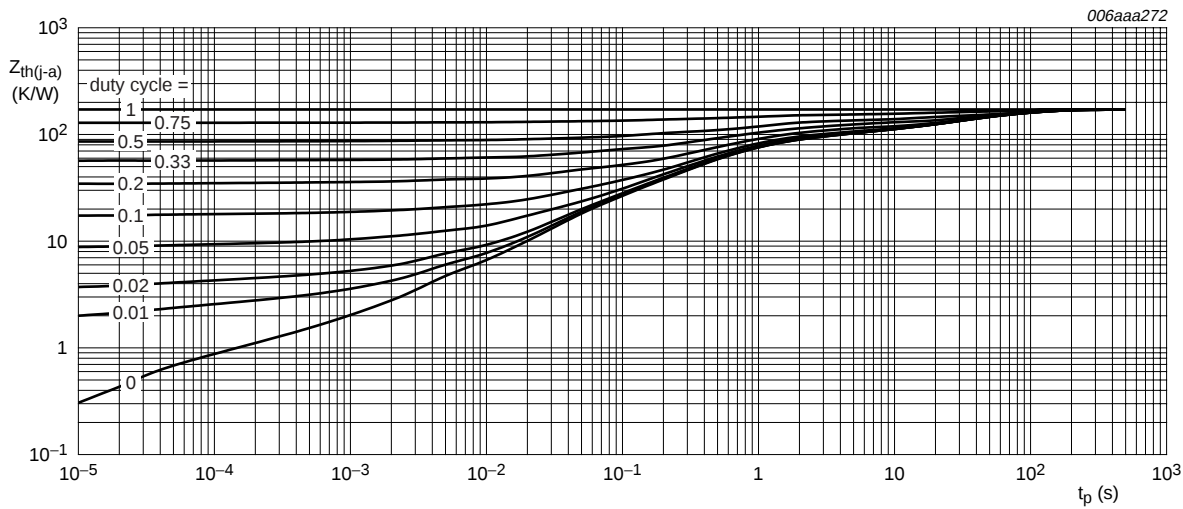
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] -	-	350	K/W
			[2] -	-	208	K/W
			[3] -	-	160	K/W
			[4] -	-	113	K/W
			[1][5] -	-	50	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	45	K/W

- [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.
[5] Pulse test: $t_p \leq 10$ ms; $\delta \leq 10$ %.



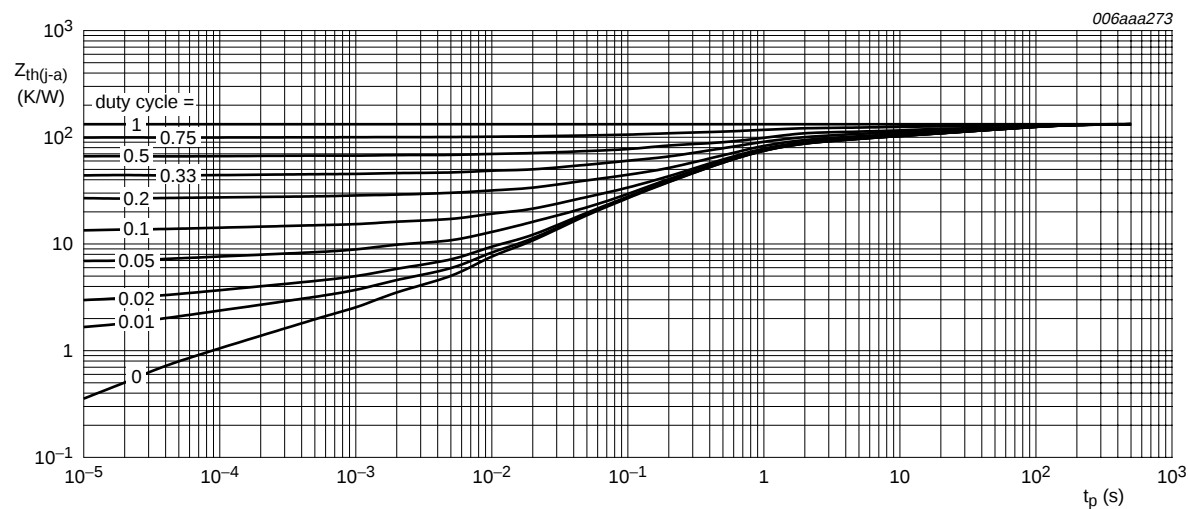
FR4 PCB, standard footprint

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



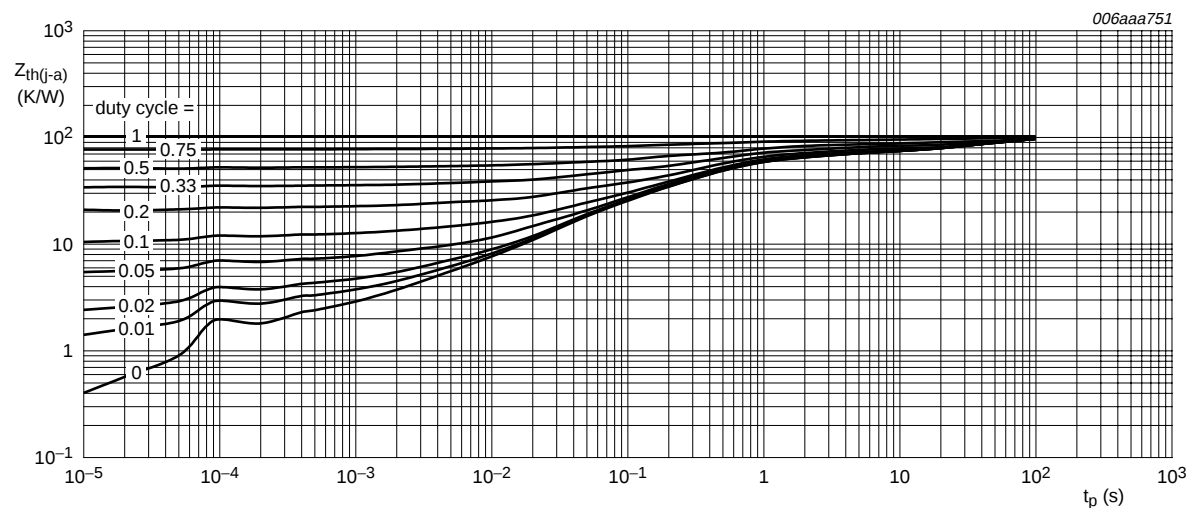
FR4 PCB, mounting pad for collector 1 cm²

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



FR4 PCB, mounting pad for collector 6 cm²

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



Ceramic PCB, Al₂O₃, standard footprint

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

7. Characteristics

Table 7. Characteristics

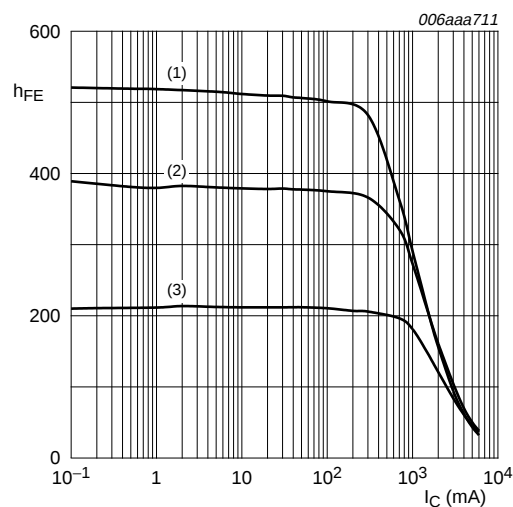
$T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 80\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 80\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	μA
I_{CES}	collector-emitter cut-off current	$V_{CE} = 64\text{ V}; V_{BE} = 0\text{ V}$	-	-	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	$V_{CE} = 2\text{ V}; I_C = 0.5\text{ A}$	240	360	-	
		$V_{CE} = 2\text{ V}; I_C = 1\text{ A}$	[1] 190	280	-	
		$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	[1] 115	165	-	
		$V_{CE} = 2\text{ V}; I_C = 3\text{ A}$	[1] 70	105	-	
		$V_{CE} = 2\text{ V}; I_C = 4\text{ A}$	[1] 45	75	-	
		$V_{CE} = 2\text{ V}; I_C = 5\text{ A}$	[1] 35	55	-	
		$V_{CE} = 2\text{ V}; I_C = 6\text{ A}$	[1] 25	40	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 50\text{ mA}$	-	40	55	mV
		$I_C = 1\text{ A}; I_B = 50\text{ mA}$	-	80	105	mV
		$I_C = 2\text{ A}; I_B = 200\text{ mA}$	[1] -	135	175	mV
		$I_C = 3\text{ A}; I_B = 150\text{ mA}$	[1] -	215	275	mV
		$I_C = 3\text{ A}; I_B = 300\text{ mA}$	[1] -	200	255	mV
		$I_C = 4\text{ A}; I_B = 400\text{ mA}$	[1] -	265	335	mV
		$I_C = 5\text{ A}; I_B = 0.5\text{ A}$	[1] -	335	415	mV
R_{CEsat}	collector-emitter saturation resistance	$I_C = 6\text{ A}; I_B = 0.6\text{ A}$	[1] -	400	505	mV
		$I_C = 2\text{ A}; I_B = 200\text{ mA}$	[1] -	68	88	$\text{m}\Omega$
V_{BEsat}	base-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 50\text{ mA}$	-	0.79	0.87	V
		$I_C = 1\text{ A}; I_B = 50\text{ mA}$	-	0.81	0.89	V
		$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1] -	0.84	0.92	V
		$I_C = 3\text{ A}; I_B = 150\text{ mA}$	[1] -	0.92	1	V
		$I_C = 3\text{ A}; I_B = 300\text{ mA}$	[1] -	0.95	1.03	V
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	-	0.81	1	V

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

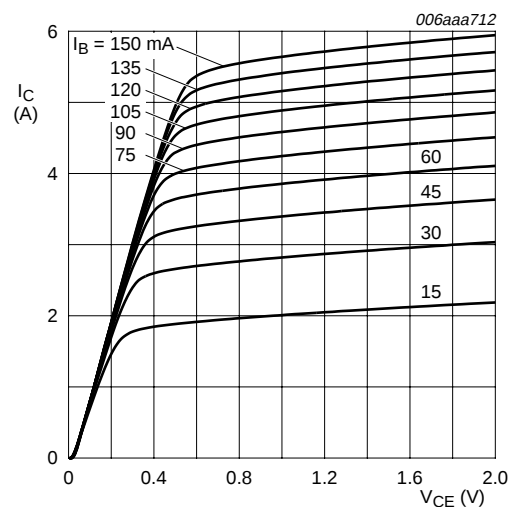
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_d	delay time	$V_{CC} = 9.2\text{ V}; I_C = 2\text{ A};$	-	13	-	ns
t_r	rise time	$I_{Bon} = 0.1\text{ A};$	-	167	-	ns
t_{on}	turn-on time	$I_{Boff} = -0.1\text{ A}$	-	180	-	ns
t_s	storage time		-	352	-	ns
t_f	fall time		-	231	-	ns
t_{off}	turn-off time		-	583	-	ns
f_T	transition frequency	$V_{CE} = 10\text{ V}; I_C = 100\text{ mA};$ $f = 100\text{ MHz}$	-	140	-	MHz
C_c	collector capacitance	$V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A};$ $f = 1\text{ MHz}$	-	18	-	pF

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



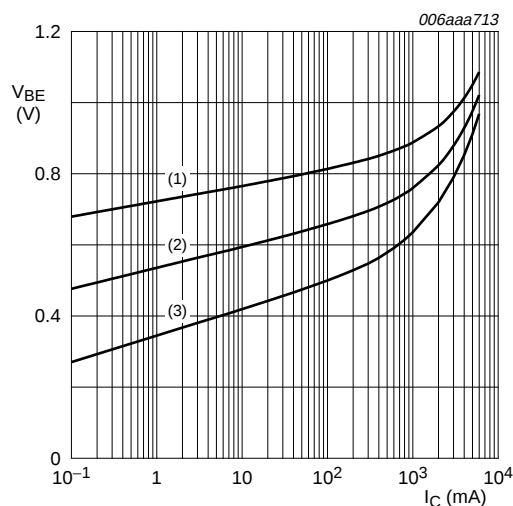
$V_{CE} = 2\text{ V}$
(1) $T_{amb} = 100^\circ C$
(2) $T_{amb} = 25^\circ C$
(3) $T_{amb} = -55^\circ C$

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



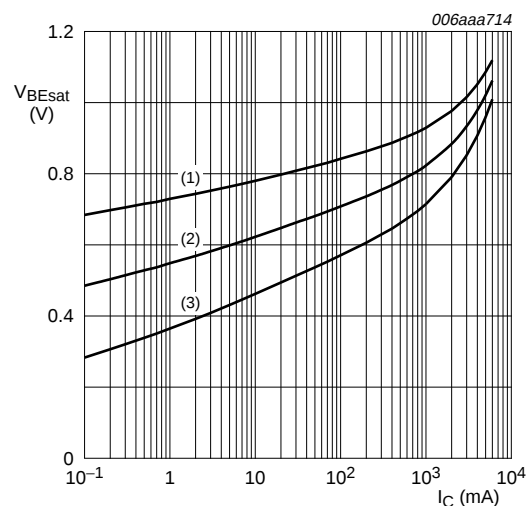
$T_{amb} = 25^\circ C$

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



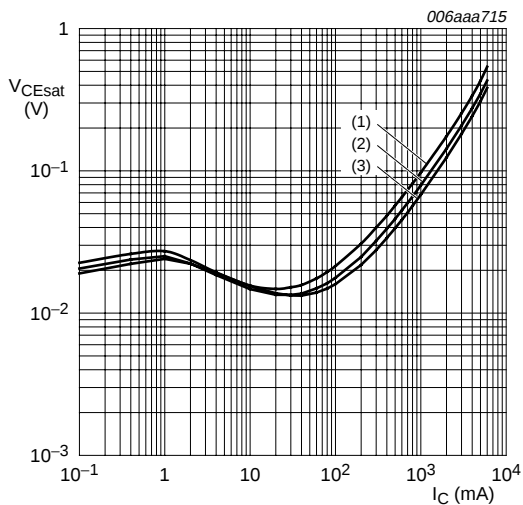
$V_{CE} = 2\text{ V}$
(1) $T_{amb} = -55^\circ C$
(2) $T_{amb} = 25^\circ C$
(3) $T_{amb} = 100^\circ C$

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



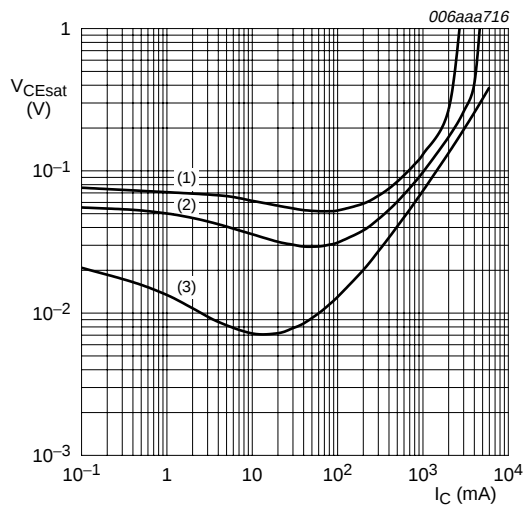
$I_C/I_B = 20$
(1) $T_{amb} = -55^\circ C$
(2) $T_{amb} = 25^\circ C$
(3) $T_{amb} = 100^\circ C$

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



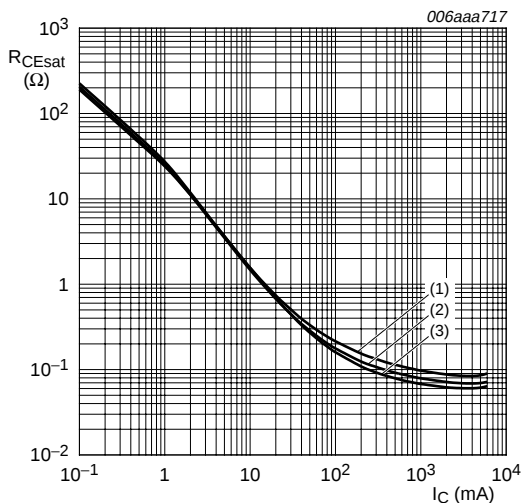
- $I_C/I_B = 20$
- (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



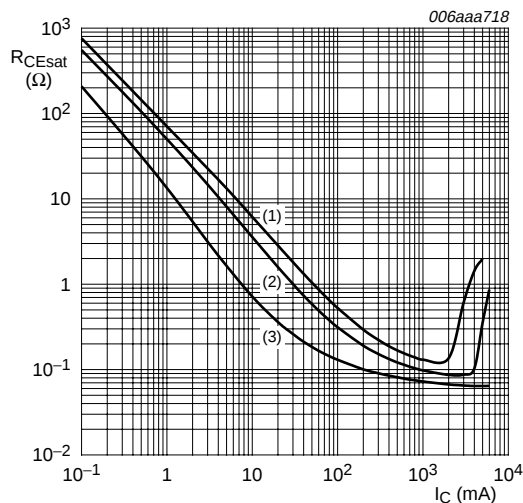
- $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (1) $I_C/I_B = 100$
 - (2) $I_C/I_B = 50$
 - (3) $I_C/I_B = 10$

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

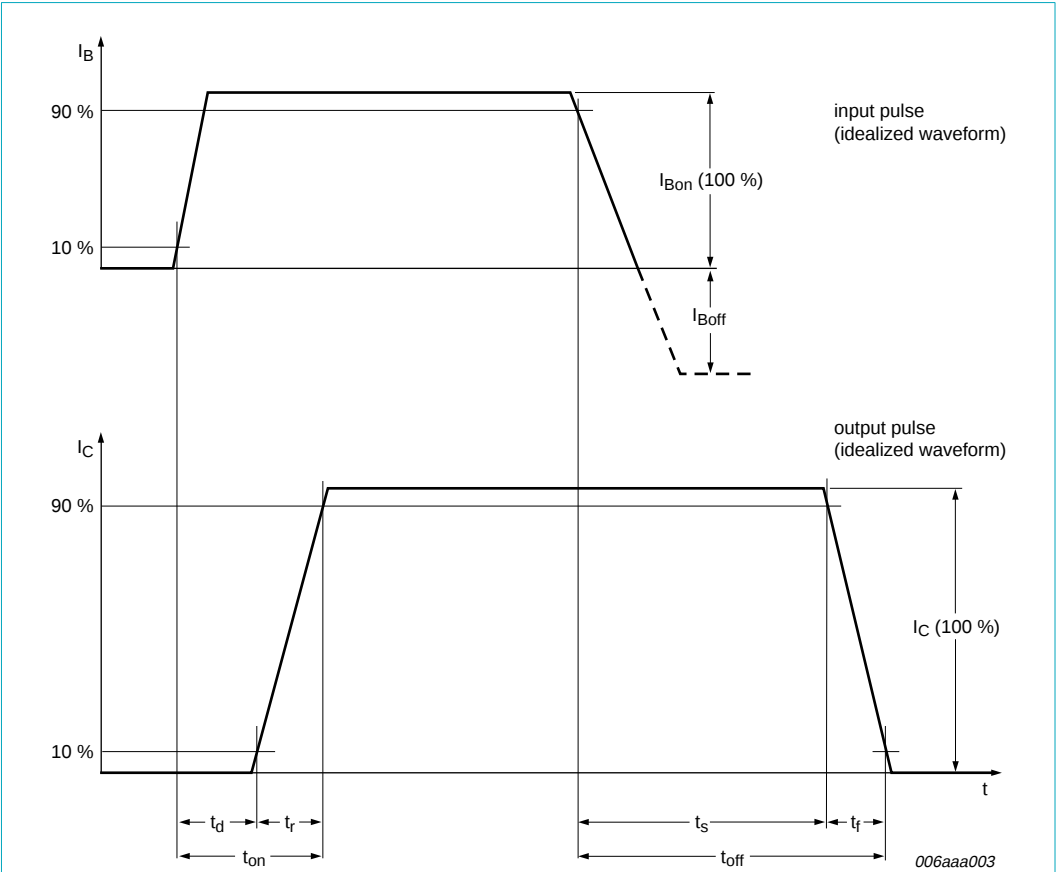
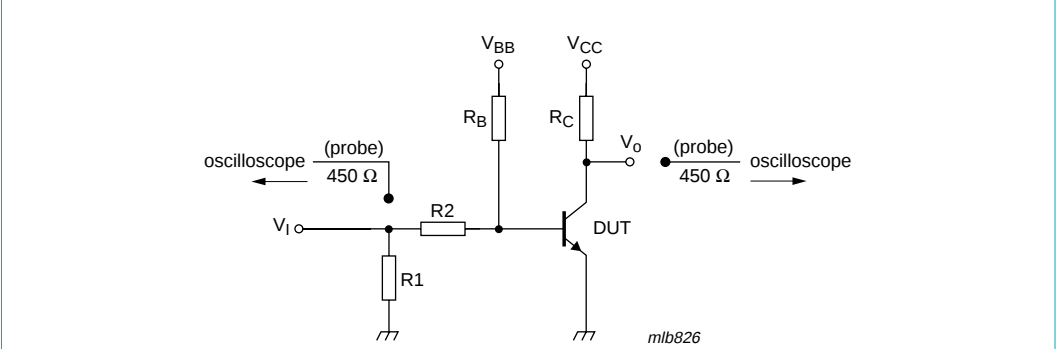


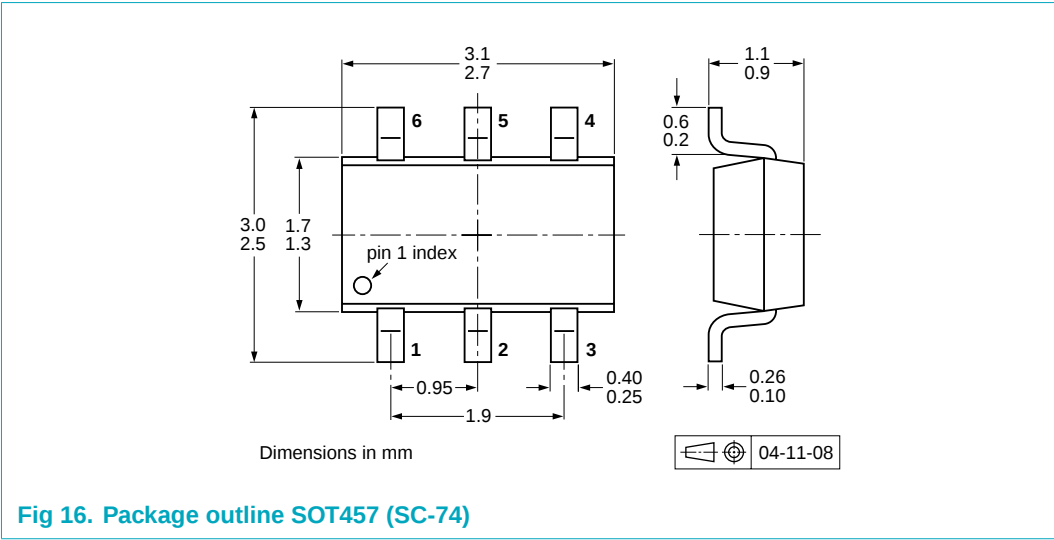
Fig 14. BISS transistor switching time definition



$V_{CC} = 9.2 \text{ V}$; $I_C = 2 \text{ A}$; $I_{Bon} = 0.1 \text{ A}$; $I_{Boff} = -0.1 \text{ A}$

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]

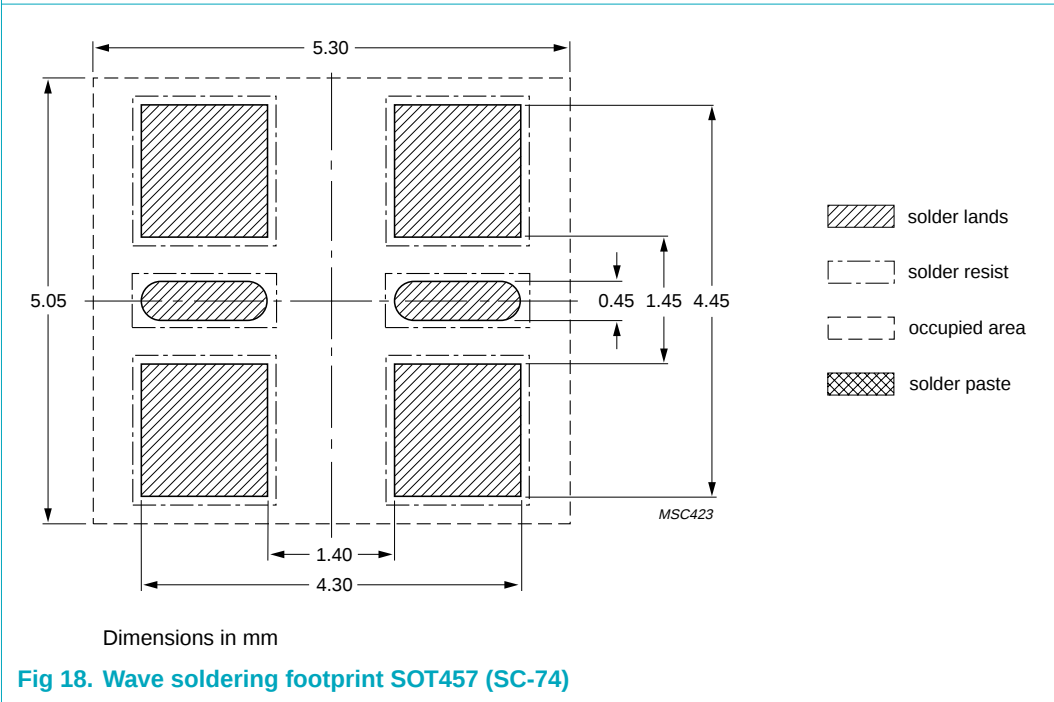
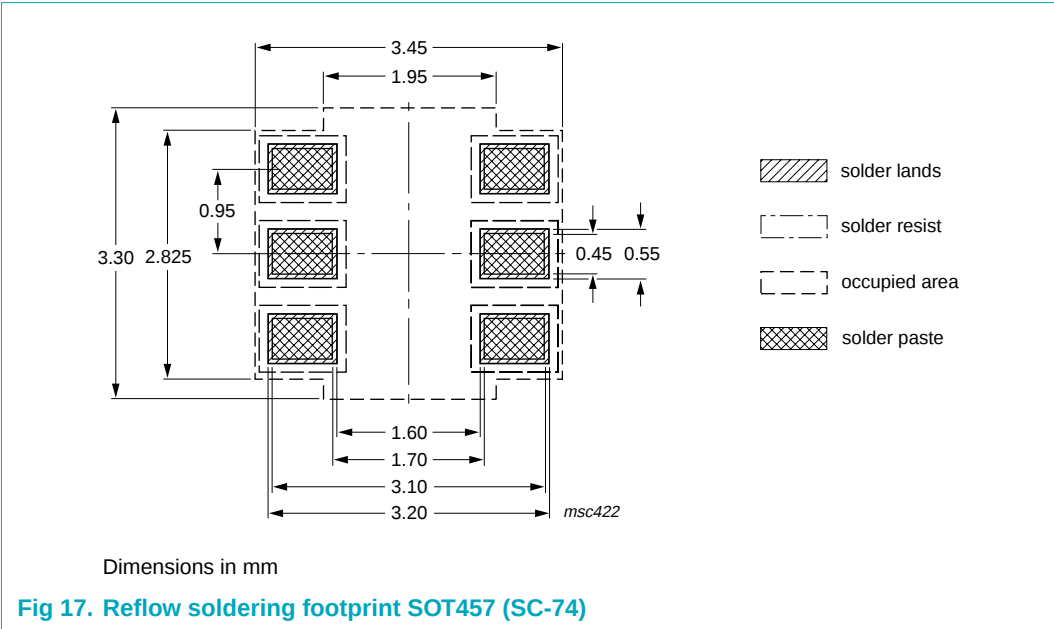
Type number	Package	Description	Packing quantity	
			3000	10000
PBSS304ND	SOT457	4 mm pitch, 8 mm tape and reel; T1	^[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	^[3] -125	-165

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

[2] T1: normal taping

[3] T2: reverse taping

11. Soldering



12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS304ND_1	20060407	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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.semiconductors.philips.com>.

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