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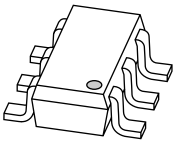
Team Nexperia



PBSS304PD

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

Rev. 02 — 24 March 2009 **Product data sheet**

1. Product profile

1.1 General description

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

NPN complement: PBSS304ND.

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		-	-	–5	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = -2$ A; $I_B = -200$ mA	[2]	-	75	100	mΩ

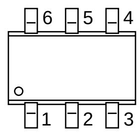
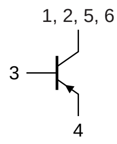
[1] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.

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

founded by Philips

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	collector		 sym030
2	collector		
3	base		
4	emitter		
5	collector		
6	collector		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS304PD	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457

4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS304PD	AJ

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		-	–5	A
I_B	base current			-	–800	mA
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

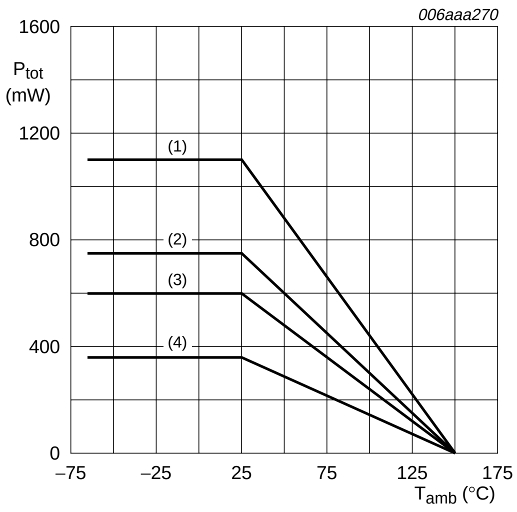
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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 cm^2.

[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.

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



(1) Ceramic PCB, Al_2O_3, standard footprint

(2) FR4 PCB, mounting pad for collector 6 cm^2

(3) FR4 PCB, mounting pad for collector 1 cm^2

(4) FR4 PCB, standard footprint

Fig 1. Power derating curves

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]	-	-	167	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

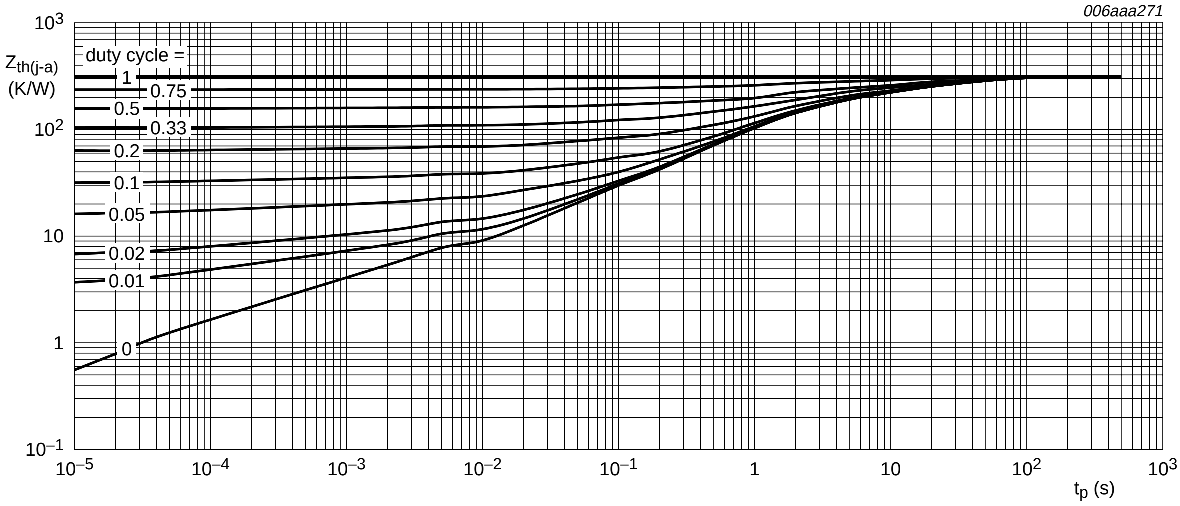
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm^2.

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.

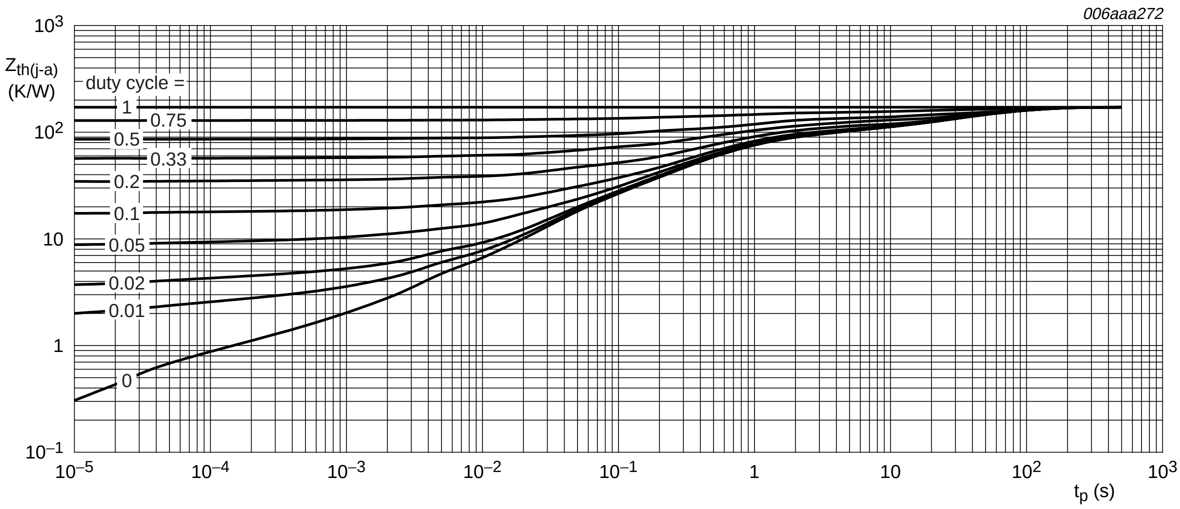
[4] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.

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



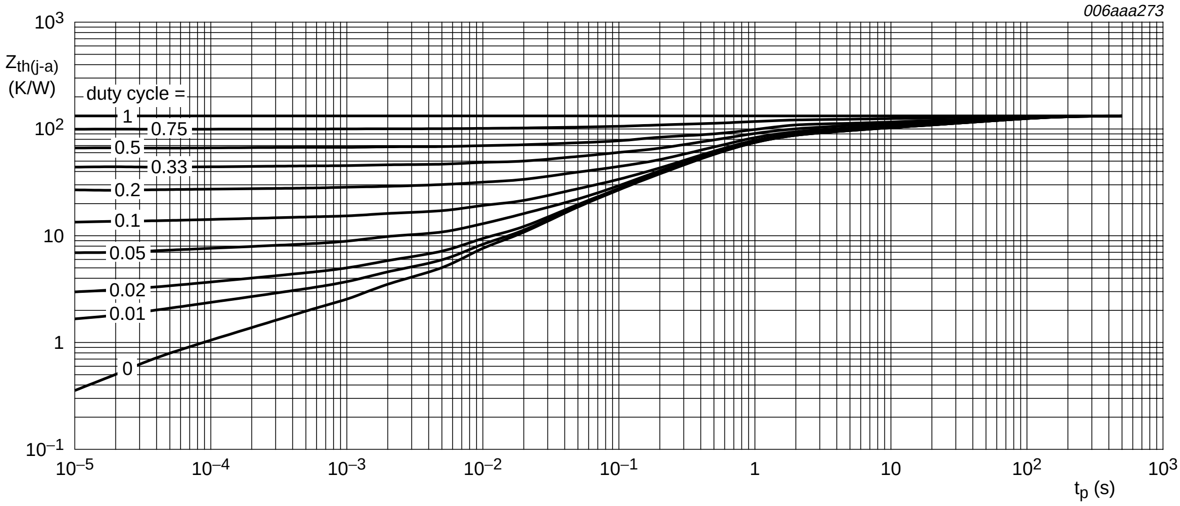
FR4 PCB, standard footprint

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



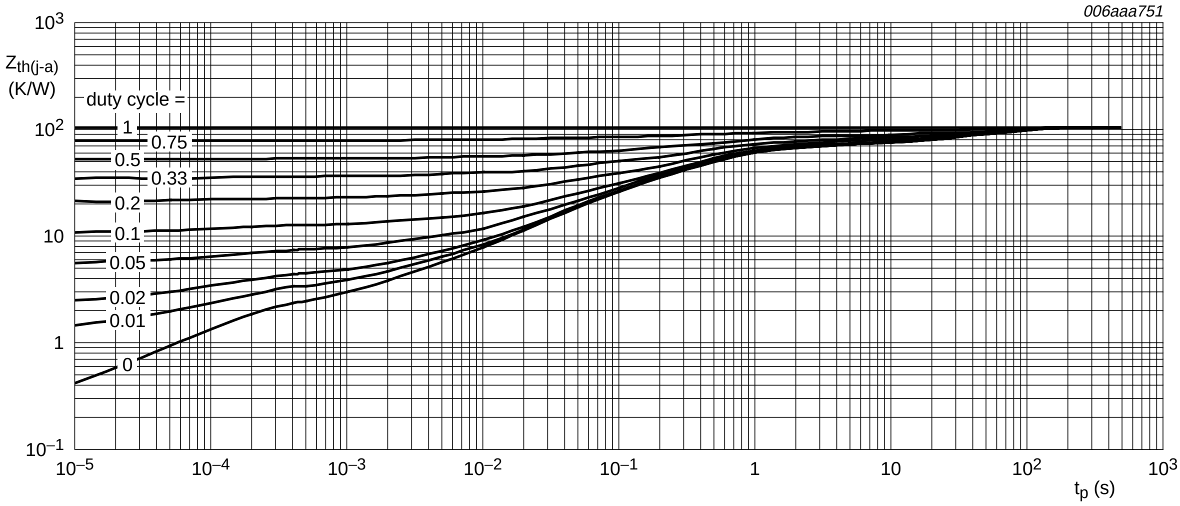
FR4 PCB, mounting pad for collector 1 cm^2

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^2

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



Ceramic PCB, Al_2O_3, standard footprint

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

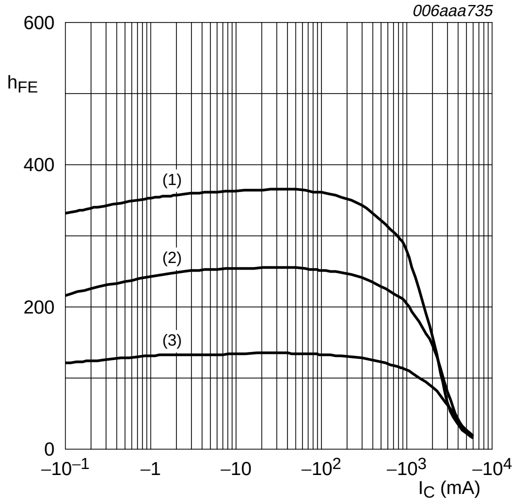
7. Characteristics

Table 7. Characteristics

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = –80 V; I_E = 0 A		-	-	–100	nA
		V_{CB} = –80 V; I_E = 0 A; T_j = 150 °C		-	-	–50	μA
I_{CES}	collector-emitter cut-off current	V_{CE} = –64 V; V_{BE} = 0 V		-	-	–100	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = –5 V; I_C = 0 A		-	-	–100	nA
h_{FE}	DC current gain	V_{CE} = –2 V; I_C = –500 mA		155	225	-	
		V_{CE} = –2 V; I_C = –1 A	[1]	140	200	-	
		V_{CE} = –2 V; I_C = –2 A	[1]	105	145	-	
		V_{CE} = –2 V; I_C = –3 A	[1]	60	85	-	
		V_{CE} = –2 V; I_C = –4 A	[1]	30	45	-	
		V_{CE} = –2 V; I_C = –5 A	[1]	20	25	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = –500 mA; I_B = –50 mA		-	–55	–75	mV
		I_C = –1 A; I_B = –50 mA		-	–110	–145	mV
		I_C = –2 A; I_B = –200 mA	[1]	-	–150	–200	mV
		I_C = –3 A; I_B = –150 mA	[1]	-	–315	–415	mV
		I_C = –3 A; I_B = –300 mA	[1]	-	–215	–290	mV
		I_C = –4 A; I_B = –400 mA	[1]	-	–295	–390	mV
		I_C = –5 A; I_B = –500 mA	[1]	-	–410	–540	mV
R_{CEsat}	collector-emitter saturation resistance	I_C = –2 A; I_B = –200 mA	[1]	-	75	100	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = –500 mA; I_B = –50 mA		-	–0.78	–0.87	V
		I_C = –1 A; I_B = –50 mA		-	–0.80	–0.89	V
		I_C = –1 A; I_B = –100 mA	[1]	-	–0.83	–0.91	V
		I_C = –3 A; I_B = –150 mA	[1]	-	–0.92	–0.99	V
		I_C = –3 A; I_B = –300 mA	[1]	-	–0.94	–1.01	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = –2 V; I_C = –2 A		-	–0.80	–1.00	V
t_d	delay time	V_{CC} = –9.2 V; I_C = –2 A; I_{Bon} = –0.1 A; I_{Boff} = 0.1 A		-	13	-	ns
t_r	rise time			-	77	-	ns
t_{on}	turn-on time			-	90	-	ns
t_s	storage time			-	210	-	ns
t_f	fall time			-	102	-	ns
t_{off}	turn-off time			-	312	-	ns
f_T	transition frequency	V_{CE} = –10 V; I_C = –100 mA; f = 100 MHz		-	110	-	MHz
C_c	collector capacitance	V_{CB} = –10 V; I_E = i_e = 0 A; f = 1 MHz		-	45	-	pF

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



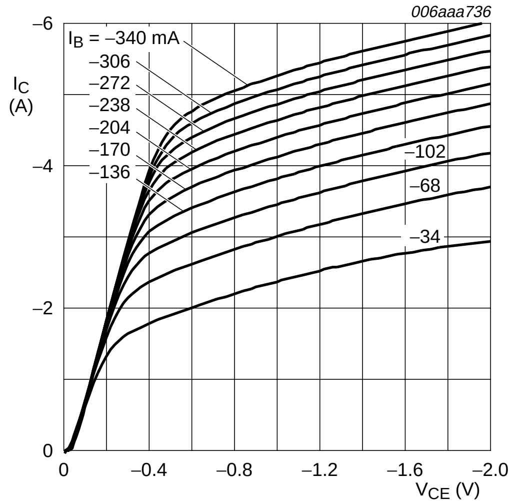
$V_{CE} = -2$ V

(1) $T_{amb} = 100$ °C

(2) $T_{amb} = 25$ °C

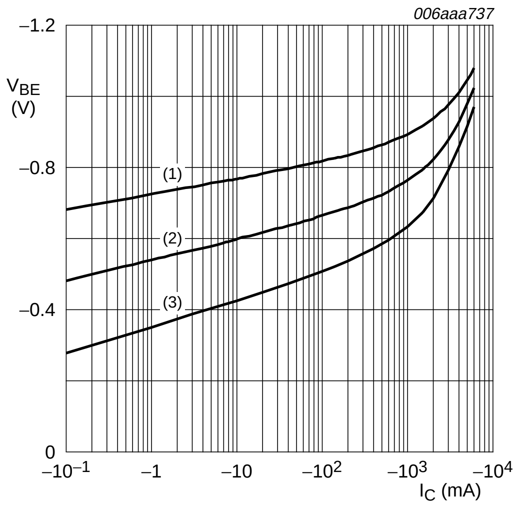
(3) $T_{amb} = -55$ °C

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



$T_{amb} = 25$ °C

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



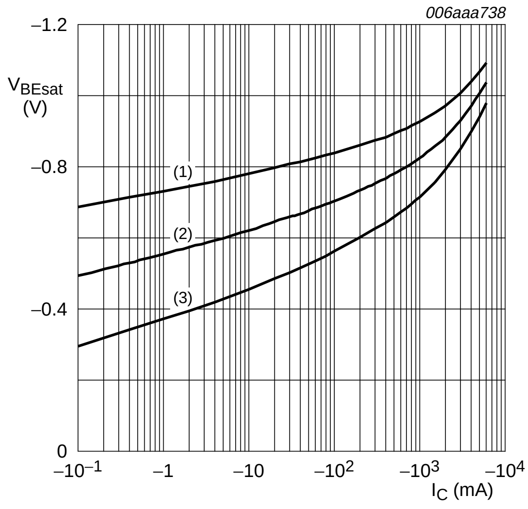
$V_{CE} = -2$ V

(1) $T_{amb} = -55$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = 100$ °C

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



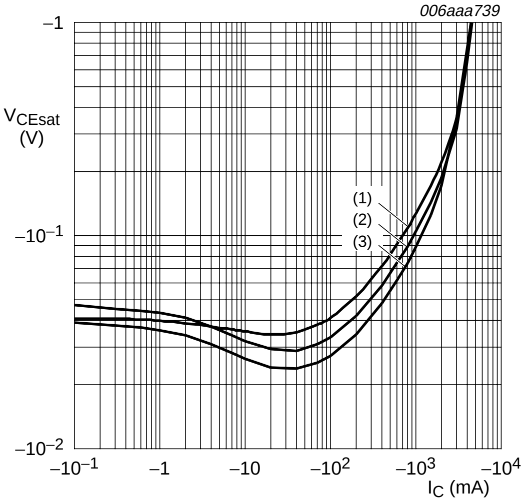
$I_C/I_B = 20$

(1) $T_{amb} = -55$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = 100$ °C

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



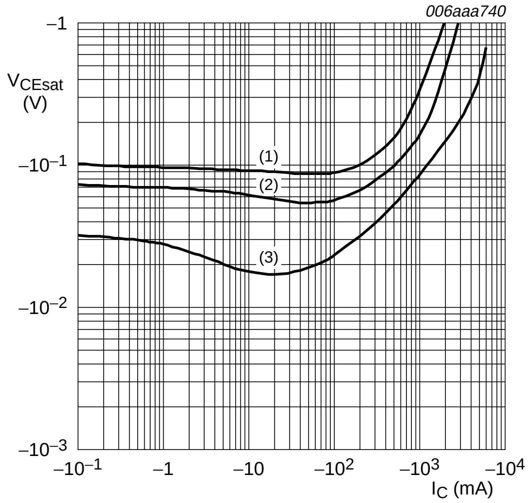
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

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



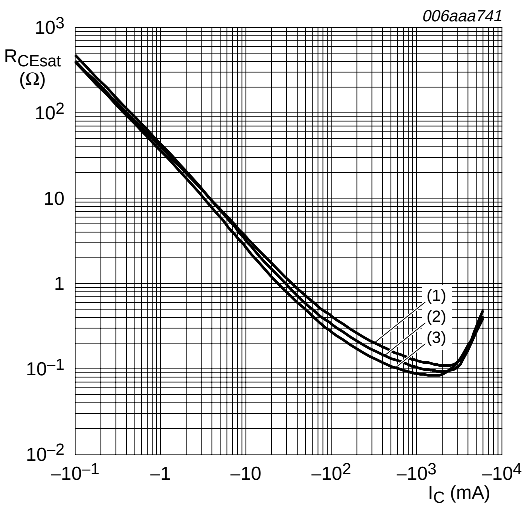
T_{amb} = 25 °C

(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



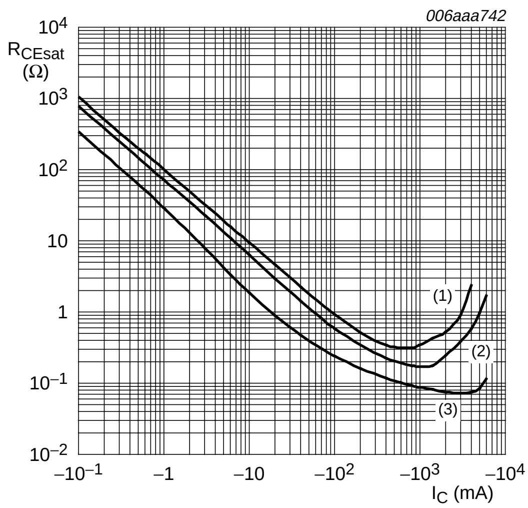
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

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



T_{amb} = 25 °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

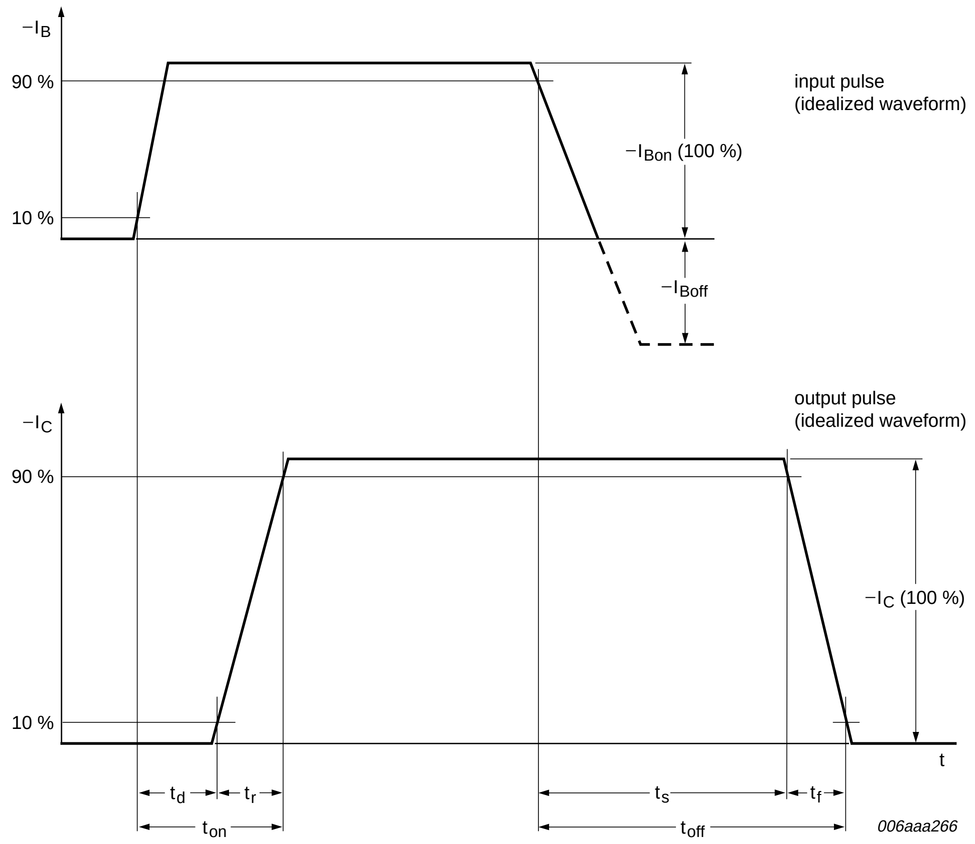
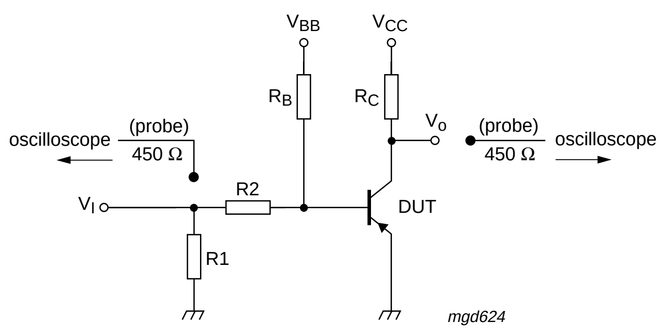


Fig 14. BISS transistor switching time definition



V_{CC} = –9.2 V; I_C = –2 A; I_{Bon} = –0.1 A; I_{Boff} = 0.1 A

Fig 15. Test circuit for switching times

9. Package outline

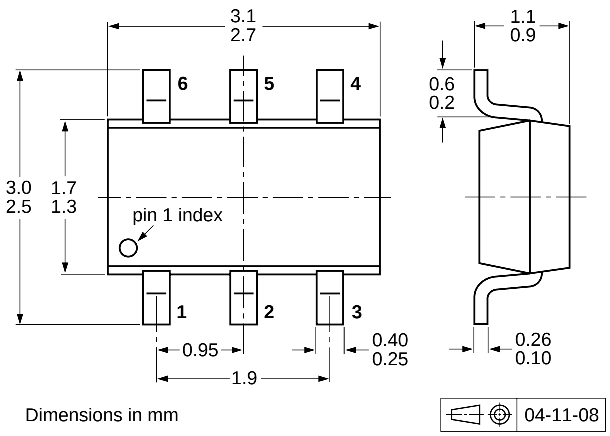


Fig 16. Package outline SOT457 (SC-74)

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
PBSS304PD	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

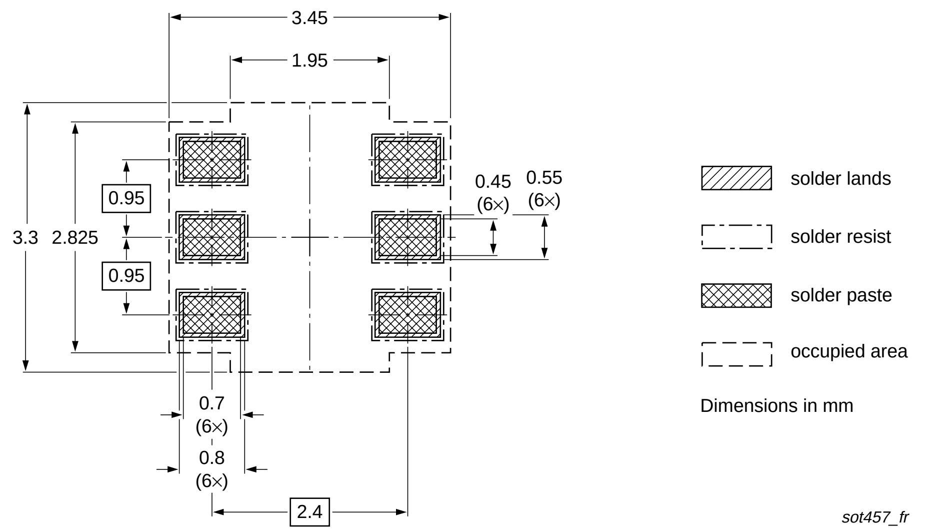


Fig 17. Reflow soldering footprint SOT457 (SC-74)

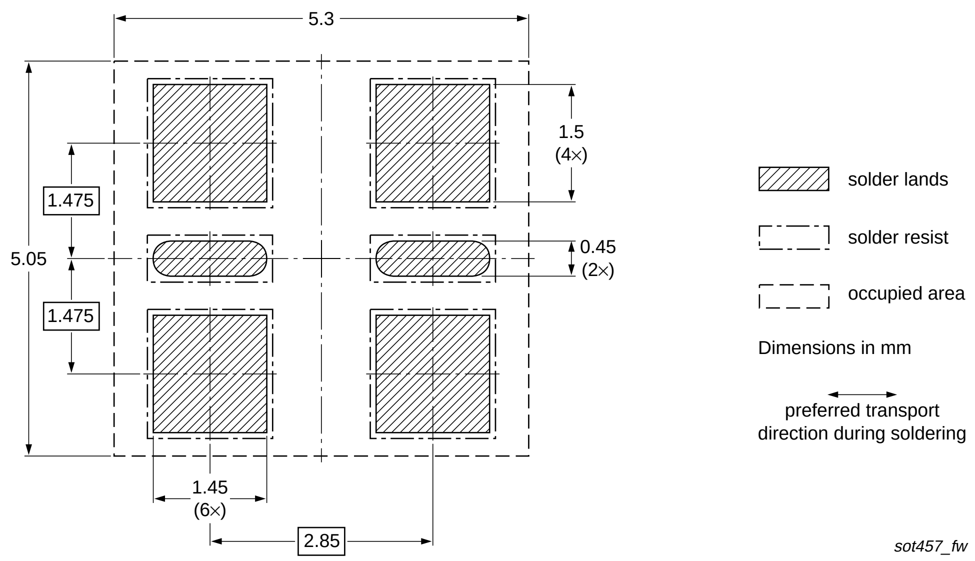


Fig 18. Wave soldering footprint SOT457 (SC-74)

12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS304PD_2	20090324	Product data sheet	-	PBSS304PD_1
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Figure 5 and 13: amended • Section 13 "Legal information": updated			
PBSS304PD_1	20060530	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.nxp.com.

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15. Contents

Date of release: 24 March 2009
Document identifier: PBSS304PD_2