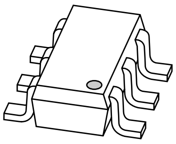


PBSS4420D

20 V, 4 A NPN low V_{CEsat} (BISS) transistor

Rev. 01 — 21 April 2005 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) SMD plastic package.

PNP complement: PBSS5420D.

1.2 Features

- Very low collector-emitter saturation resistance
- Ultra low collector-emitter saturation voltage
- 4 A continuous collector current
- Up to 15 A peak current
- High efficiency due to less heat generation

1.3 Applications

- Power management functions
- Charging circuits
- DC-to-DC conversion
- MOSFET gate driving
- Power switches (e.g. motors, fans)
- Thin Film Transistor (TFT) backlight inverter

1.4 Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base		-	-	20	V
I_C	collector current (DC)		[1]	-	-	4	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	-	15	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 4$ A; $I_B = 400$ mA	[2]	-	50	70	mΩ

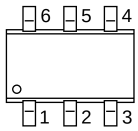
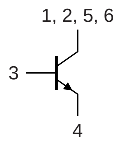
[1] Device mounted on a ceramic Printed-Circuit Board (PCB), Al_2O_3, standard footprint.

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

PHILIPS

2. Pinning information

Table 2: Pinning

Pin	Description	Simplified outline	Symbol
1	collector		 sym014
2	collector		
3	base		
4	emitter		
5	collector		
6	collector		

3. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
PBSS4420D	SC-74	plastic surface mounted package; 6 leads	SOT457

4. Marking

Table 4: Marking codes

Type number	Marking code
PBSS4420D	D4

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	-	20	V
V_{CEO}	collector-emitter voltage	open base	-	20	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current (DC)	[1]	-	4	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	15	A
I_B	base current (DC)		-	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 [2]	-	360	mW
		[3]	-	600	mW
		[4]	-	750	mW
		[1]	-	1.1	W
		[2] [5]	-	2.5	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		–65	+150	°C
T_{stg}	storage temperature		–65	+150	°C

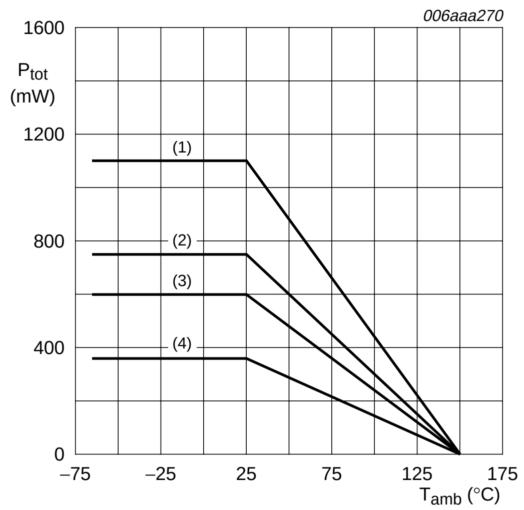
[1] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and 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] Operated under pulsed conditions: Duty cycle $\delta \leq 10$ % and pulse width $t_p \leq 10$ ms.



(1) Ceramic PCB, Al_2O_3, standard footprint

(2) FR4 PCB; 6 cm^2 collector mounting pad

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

(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	[2]	-	-	350	K/W
			[3]	-	-	208	K/W
			[4]	-	-	160	K/W
			[1]	-	-	113	K/W
			[2] [5]	-	-	50	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	45	K/W

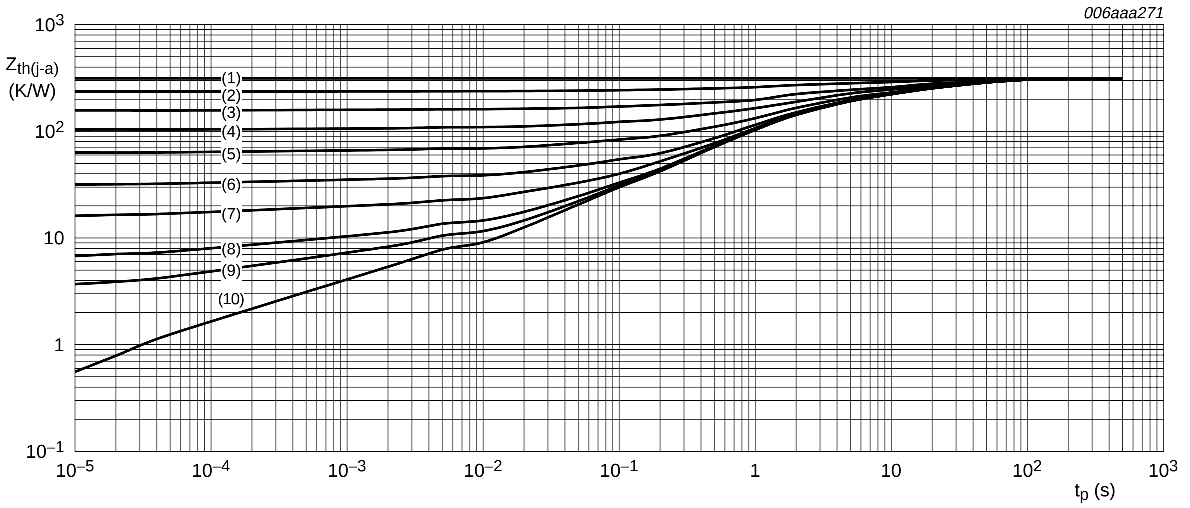
[1] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and 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] Operated under pulsed conditions: Duty cycle $\delta \leq 10$ % and pulse width $t_p \leq 10$ ms.



FR4 PCB; standard footprint

(1) $\delta = 1$

(2) $\delta = 0.75$

(3) $\delta = 0.5$

(4) $\delta = 0.33$

(5) $\delta = 0.2$

(6) $\delta = 0.1$

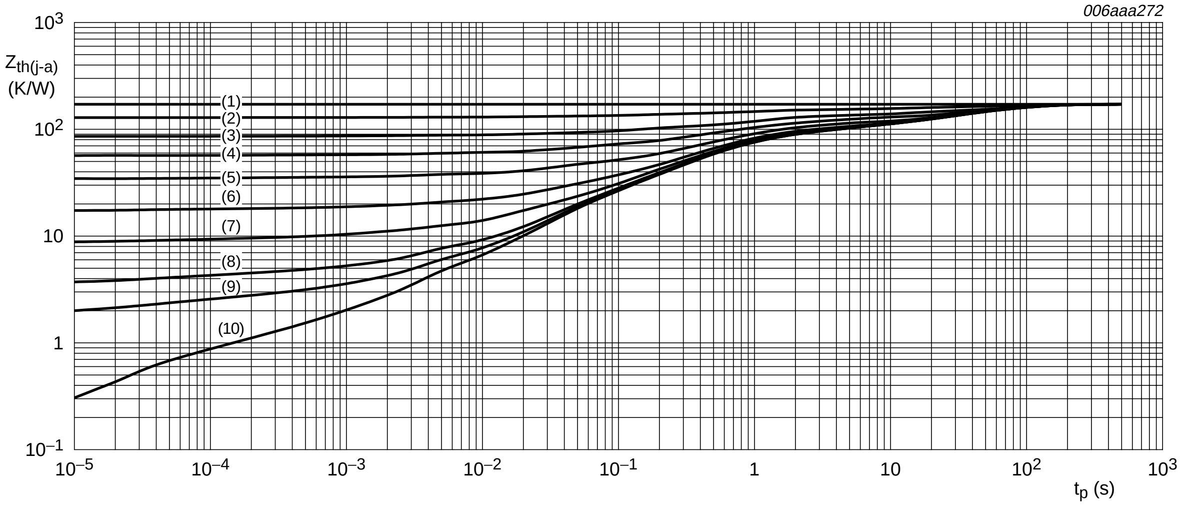
(7) $\delta = 0.05$

(8) $\delta = 0.02$

(9) $\delta = 0.01$

(10) $\delta = 0$

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



FR4 PCB; mounting pad for collector 1 cm^2

(1) $\delta = 1$

(2) $\delta = 0.75$

(3) $\delta = 0.5$

(4) $\delta = 0.33$

(5) $\delta = 0.2$

(6) $\delta = 0.1$

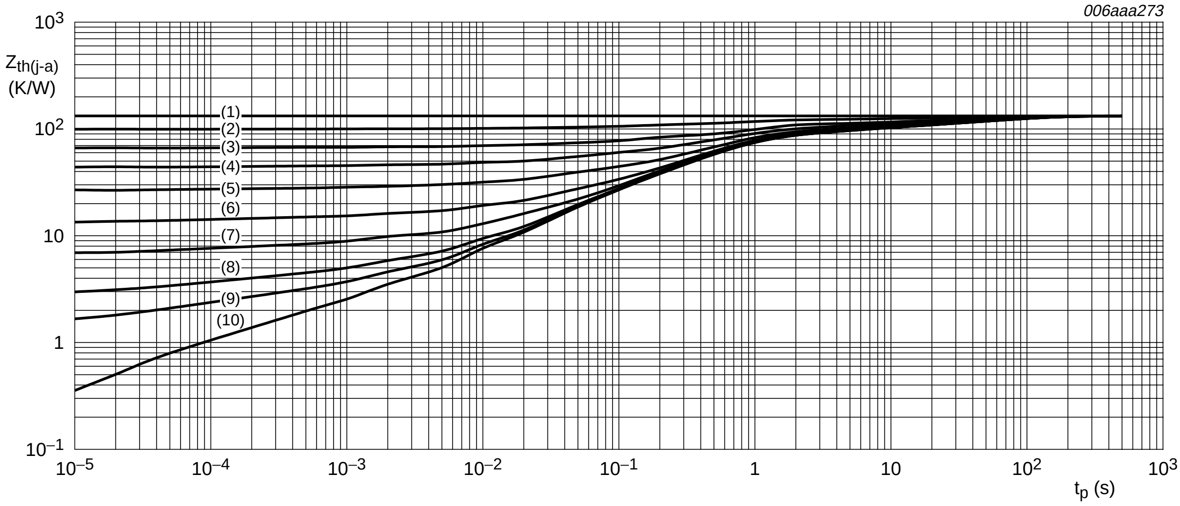
(7) $\delta = 0.05$

(8) $\delta = 0.02$

(9) $\delta = 0.01$

(10) $\delta = 0$

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



FR4 PCB; mounting pad for collector 6 cm^2

(1) $\delta = 1$

(2) $\delta = 0.75$

(3) $\delta = 0.5$

(4) $\delta = 0.33$

(5) $\delta = 0.2$

(6) $\delta = 0.1$

(7) $\delta = 0.05$

(8) $\delta = 0.02$

(9) $\delta = 0.01$

(10) $\delta = 0$

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

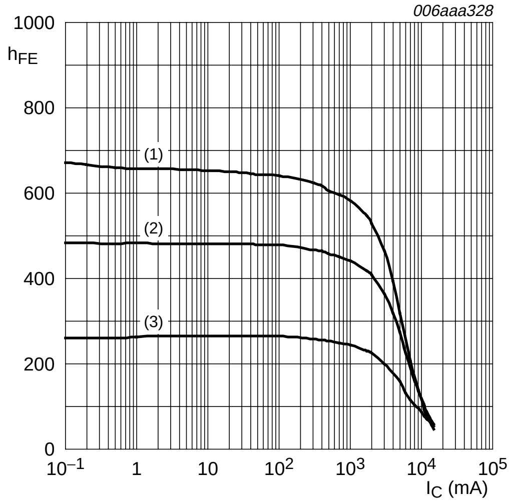
7. Characteristics

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} = 20 V; I_E = 0 A		-	-	0.1	µA
		V_{CB} = 20 V; I_E = 0 A; T_j = 150 °C		-	-	50	µA
I_{CES}	collector-emitter cut-off current	V_{CE} = 20 V; V_{BE} = 0 V		-	-	0.1	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A		-	-	0.1	µA
h_{FE}	DC current gain	V_{CE} = 2 V; I_C = 0.5 A		300	450	-	
		V_{CE} = 2 V; I_C = 1 A	[1]	300	430	-	
		V_{CE} = 2 V; I_C = 2 A	[1]	250	400	-	
		V_{CE} = 2 V; I_C = 4 A	[1]	200	310	-	
		V_{CE} = 2 V; I_C = 6 A	[1]	100	230	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 0.5 A; I_B = 50 mA		-	30	50	mV
		I_C = 1 A; I_B = 50 mA		-	60	90	mV
		I_C = 2 A; I_B = 200 mA		-	110	150	mV
		I_C = 4 A; I_B = 400 mA	[1]	-	200	280	mV
		I_C = 6 A; I_B = 600 mA	[1]	-	300	420	mV
R_{CEsat}	collector-emitter saturation resistance	I_C = 4 A; I_B = 400 mA	[1]	-	50	70	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = 0.5 A; I_B = 50 mA		-	0.79	0.85	V
		I_C = 1 A; I_B = 50 mA		-	0.81	0.9	V
		I_C = 1 A; I_B = 100 mA	[1]	-	0.83	1	V
		I_C = 4 A; I_B = 400 mA	[1]	-	1.0	1.1	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = 2 V; I_C = 2 A		-	0.79	1	V
t_d	delay time	V_{CC} = 12.5 V; I_C = 3 A; I_{Bon} = 0.15 A; I_{Boff} = −0.15 A		-	12	-	ns
t_r	rise time			-	36	-	ns
t_{on}	turn-on time			-	48	-	ns
t_s	storage time			-	230	-	ns
t_f	fall time			-	50	-	ns
t_{off}	turn-off time			-	280	-	ns
f_T	transition frequency	V_{CE} = 10 V; I_C = 0.1 A; f = 100 MHz		-	100	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	60	-	pF

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



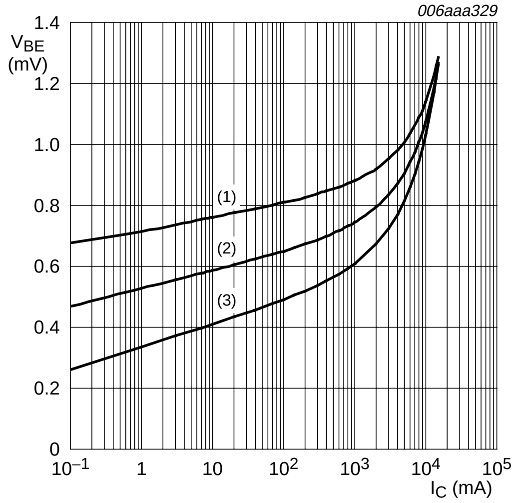
V_{CE} = 2 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

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



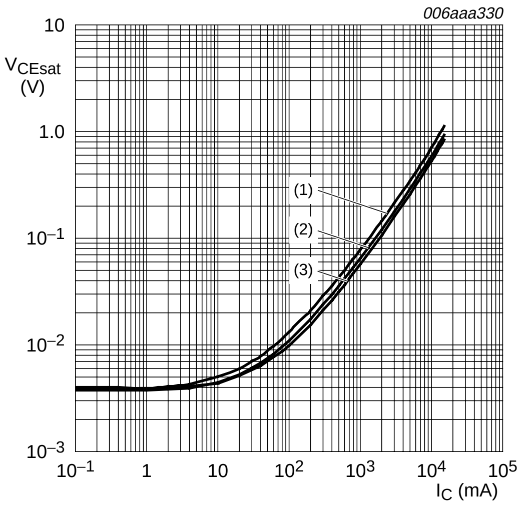
V_{CE} = 2 V

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



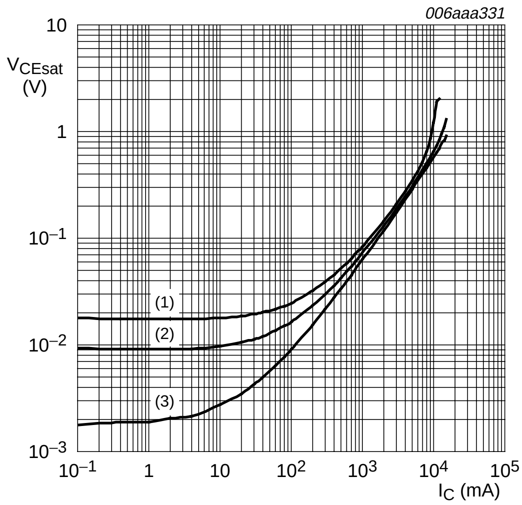
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

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



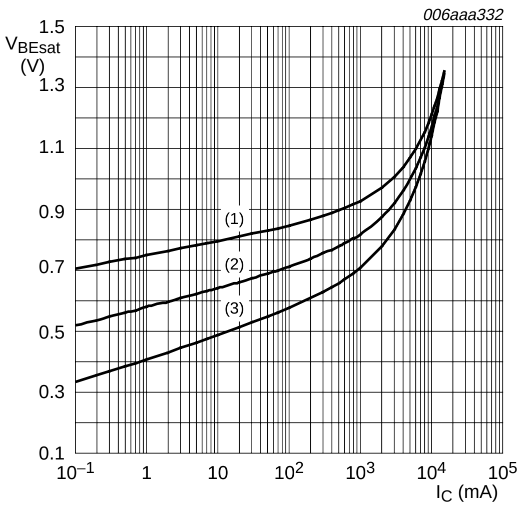
T_{amb} = 25 °C

(1) I_C/I_B = 100

(2) I_C/I_B = 50

(3) I_C/I_B = 10

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



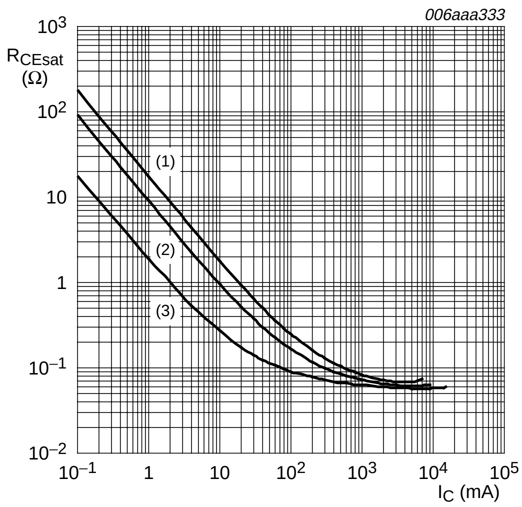
$I_C/I_B = 20$

(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



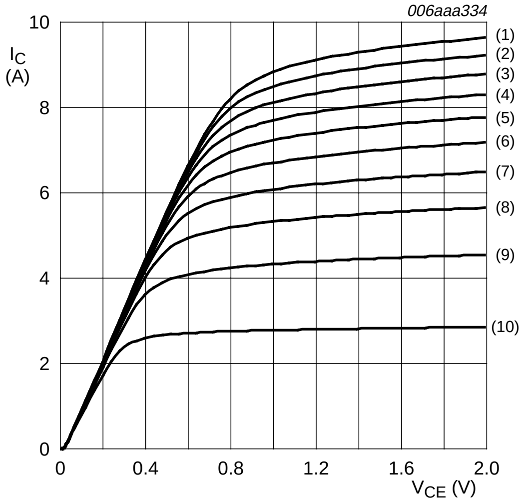
$T_{amb} = 25$ °C

(1) $I_C/I_B = 100$

(2) $I_C/I_B = 50$

(3) $I_C/I_B = 10$

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



T_{amb} = 25 °C

(1) I_B = 80 mA

(2) I_B = 72 mA

(3) I_B = 64 mA

(4) I_B = 56 mA

(5) I_B = 48 mA

(6) I_B = 40 mA

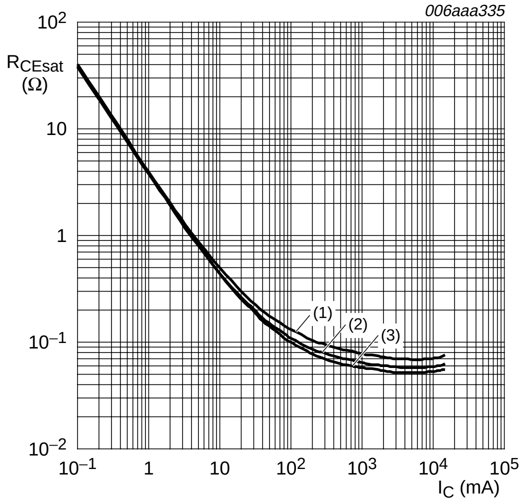
(7) I_B = 32 mA

(8) I_B = 24 mA

(9) I_B = 16 mA

(10) I_B = 8 mA

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

8. Test information

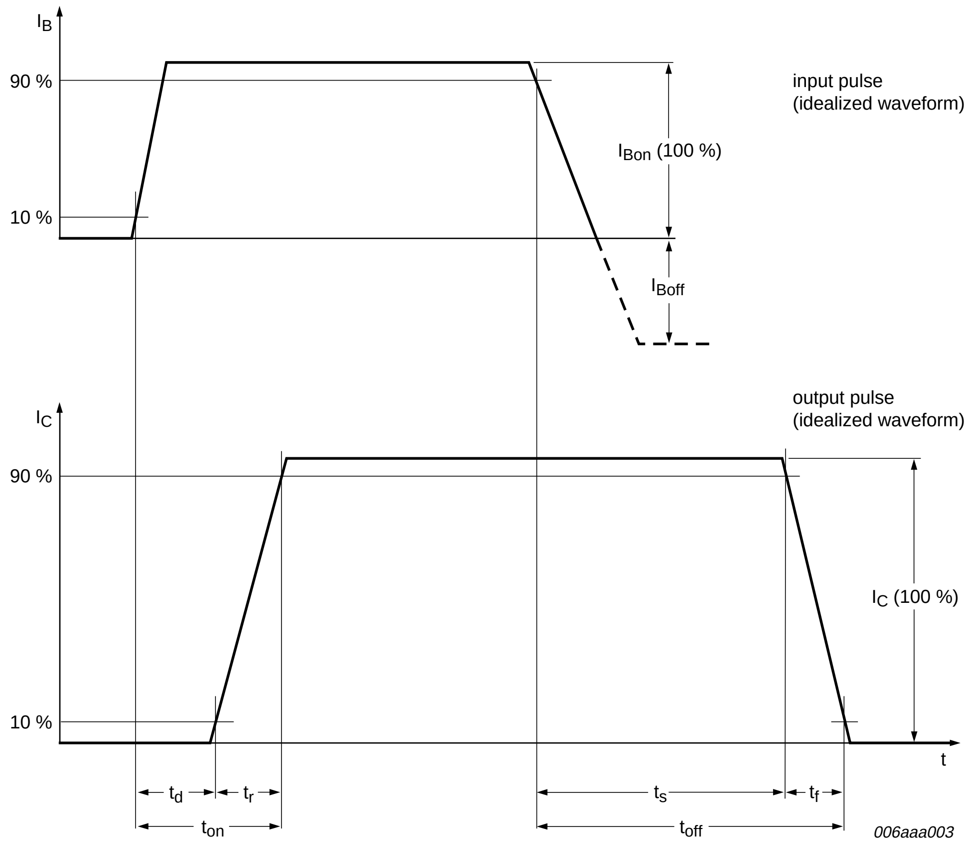
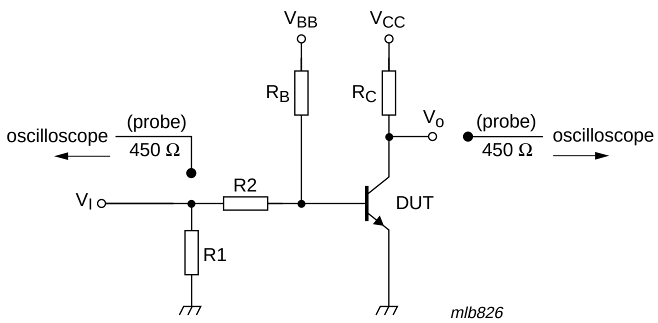


Fig 13. BISS transistor switching time definition

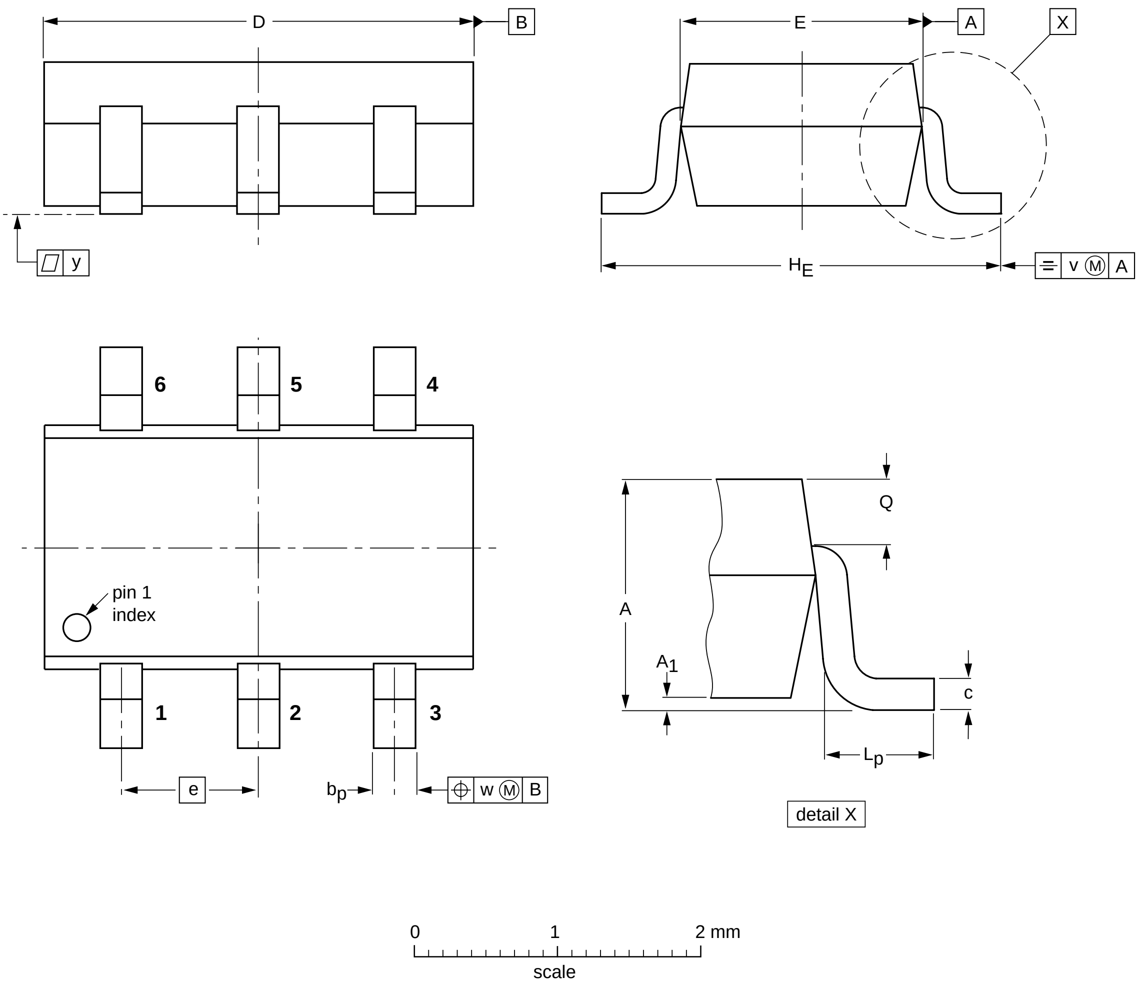


V_{CC} = 12.5 V; I_C = 3 A; I_{Bon} = 0.15 A; I_{Boff} = –0.15 A

Fig 14. Test circuit for switching times

9. Package outline

Plastic surface mounted package; 6 leads **SOT457**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.1 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT457			SC-74			~~01-05-04~~ 04-11-08

Fig 15. 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**
PBSS4420D	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 15.

[2] T1: normal taping

[3] T2: reverse taping

11. Revision history

Table 9: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PBSS4420D_1	20050421	Product data sheet	-	9397 750 14028	-

12. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

13. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

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16. Contents

Date of release: 21 April 2005
Document number: 9397 750 14028

Published in The Netherlands