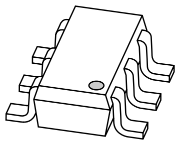


PBSS4440D

40 V NPN low V_{CEsat} (BISS) transistor

Rev. 02 — 11 December 2009 **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: PBSS5440D.

1.2 Features

- Ultra low collector-emitter saturation voltage V_{CEsat}
- 4 A continuous collector current capability I_C (DC)
- Up to 15 A peak current
- Very low collector-emitter saturation resistance
- 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	-	-	40	V
I_C	collector current (DC)	[1]	-	-	4	A
I_{CM}	peak collector current	t = 1 ms or limited by $T_{j(max)}$	-	-	15	A
R_{CEsat}	collector-emitter saturation resistance	I_C = 6 A; I_B = 600 mA [2]	-	55	75	mΩ

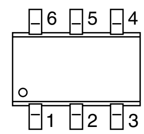
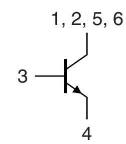
[1] Device mounted on a ceramic Printed-Circuit Board (PCB), AL_2O_3, standard footprint.

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

founded by 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
PBSS4440D	SC-74	plastic surface mounted package; 6 leads	SOT457

4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4440D	61

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		-	40	V
V_{EBO}	emitter-base voltage	open collector		-	5	V
I_C	collector current (DC)		[1]	-	4	A
I_{CM}	peak collector current	t = 1 ms or limited by $T_{j(max)}$		-	15	A
I_B	base current (DC)			-	0.8	A
I_{BM}	peak base current	$t_p \leq 300$ µs		-	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_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		-	150	°C
T_{amb}	ambient temperature		–65	+150	°C

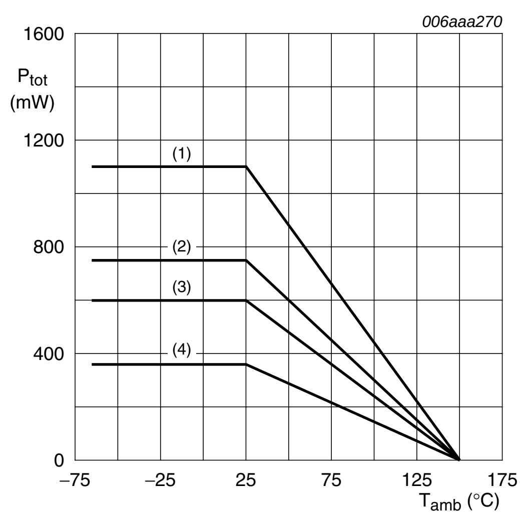
[1] Device mounted on a ceramic PCB, AL_2O_3, standard footprint.

[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, 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]	-	-	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

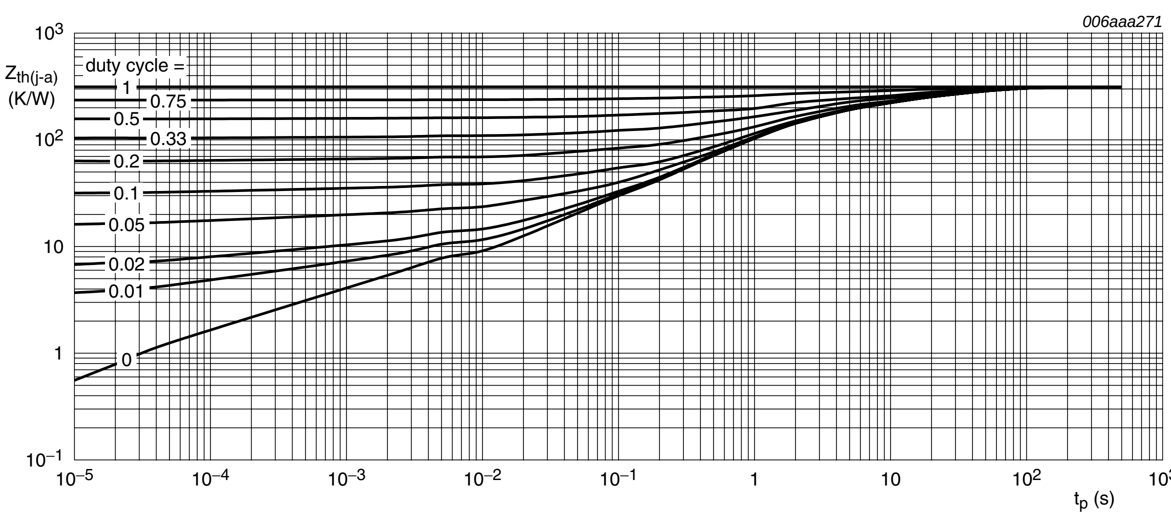
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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

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

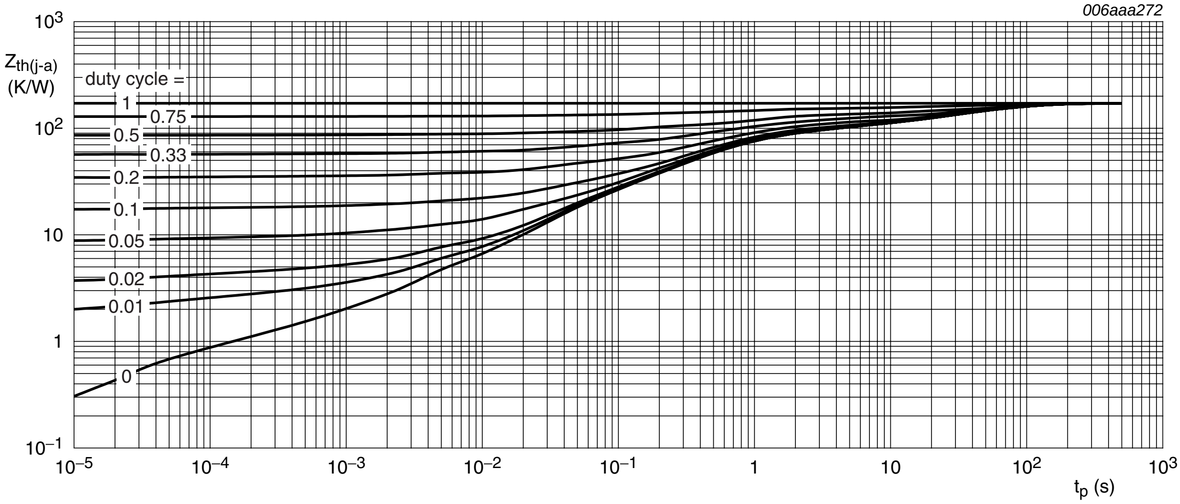
[4] Device mounted on a ceramic PCB, AL_2O_3, standard footprint.

[5] Operated under pulsed conditions: Duty cycle $\delta \leq 10\%$ and pulse width $t_p \leq 10$ ms.



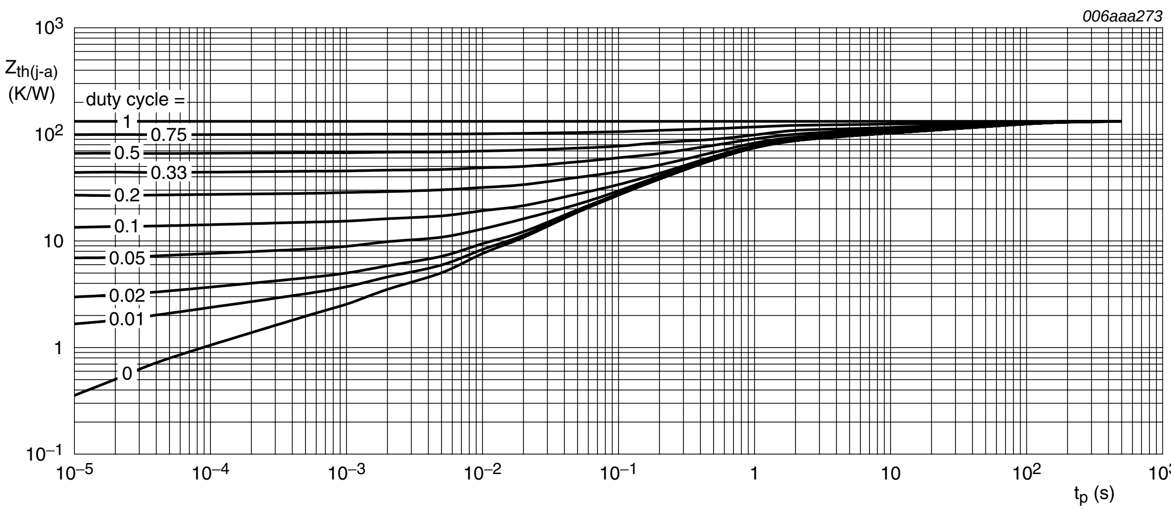
FR4 PCB, standard footprint

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

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

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

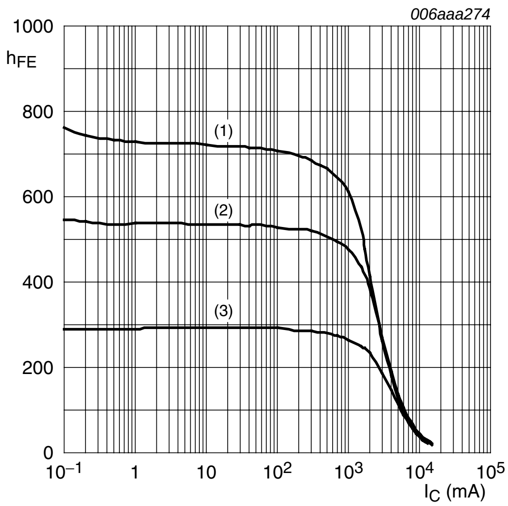
7. Characteristics

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} = 40 V; I_E = 0 A		-	-	0.1	µA
		V_{CB} = 40 V; I_E = 0 A; T_j = 150 °C		-	-	50	µA
I_{CES}	collector-emitter cut-off current	V_{CE} = 30 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	-	-	
		V_{CE} = 2 V; I_C = 1 A	[1]	300	-	-	
		V_{CE} = 2 V; I_C = 2 A	[1]	250	-	-	
		V_{CE} = 2 V; I_C = 4 A	[1]	100	-	-	
		V_{CE} = 2 V; I_C = 6 A	[1]	50	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 0.5 A; I_B = 50 mA		-	35	60	mV
		I_C = 1 A; I_B = 50 mA		-	65	110	mV
		I_C = 2 A; I_B = 200 mA		-	115	180	mV
		I_C = 4 A; I_B = 400 mA	[1]	-	220	300	mV
		I_C = 6 A; I_B = 600 mA	[1]	-	330	450	mV
R_{CEsat}	collector-emitter saturation resistance	I_C = 6 A; I_B = 600 mA	[1]	-	55	75	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	1.0	V
t_d	delay time	V_{CC} = 10 V; I_C = 2 A; I_{Bon} = 0.1 A; I_{Boff} = −0.1 A		-	12	-	ns
t_r	rise time			-	52	-	ns
t_{on}	turn-on time			-	64	-	ns
t_s	storage time			-	390	-	ns
t_f	fall time			-	120	-	ns
t_{off}	turn-off time			-	510	-	ns
f_T	transition frequency	V_{CE} = 10 V; I_C = 0.1 A; f = 100 MHz		-	150	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	30	-	pF

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



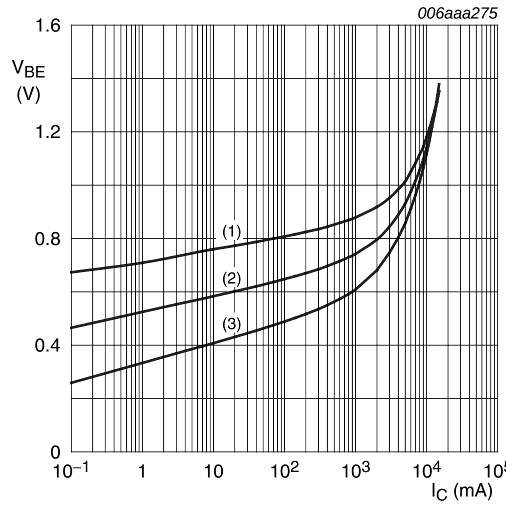
V_{CE} = 2 V

(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



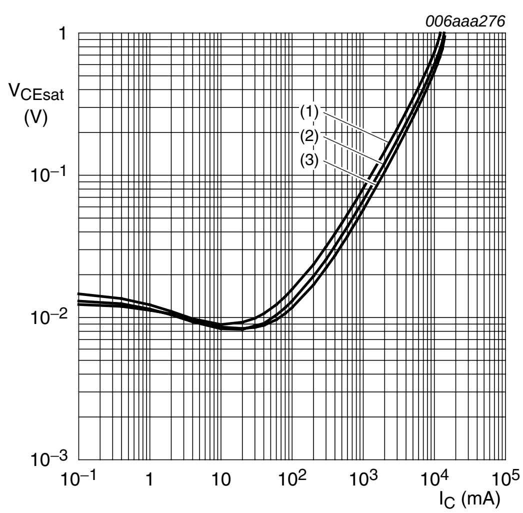
V_{CE} = 2 V

(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



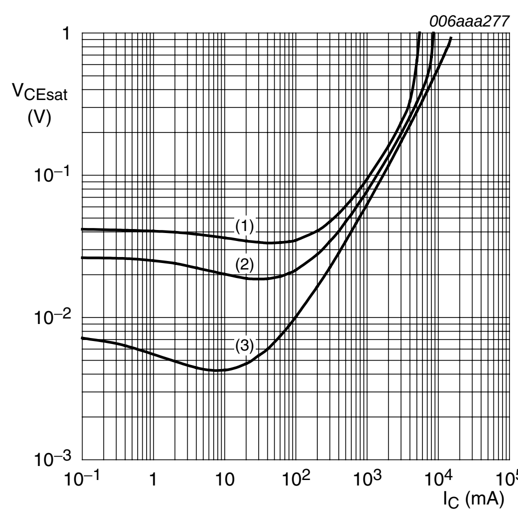
I_C/I_B = 20

(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



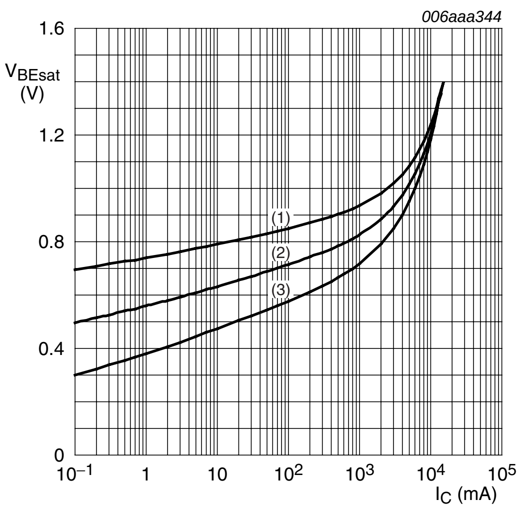
T_{amb} = 25 °C

(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



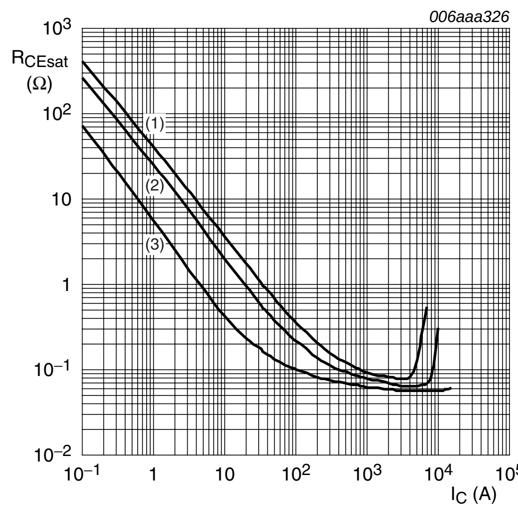
$I_C/I_B = 20$

(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



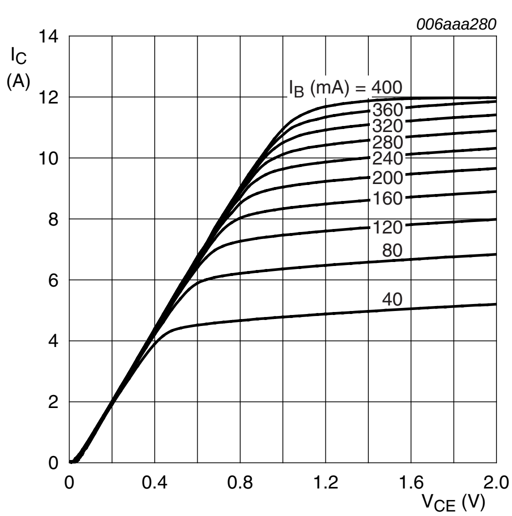
$T_{amb} = 25$ °C

(1) $I_C/I_B = 100$

(2) $I_C/I_B = 50$

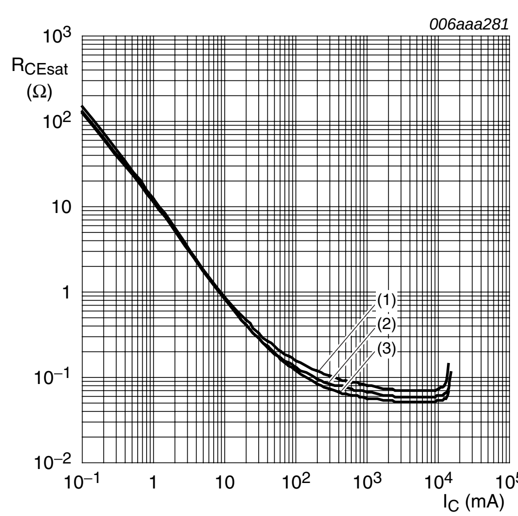
(3) $I_C/I_B = 10$

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



$T_{amb} = 25$ °C

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

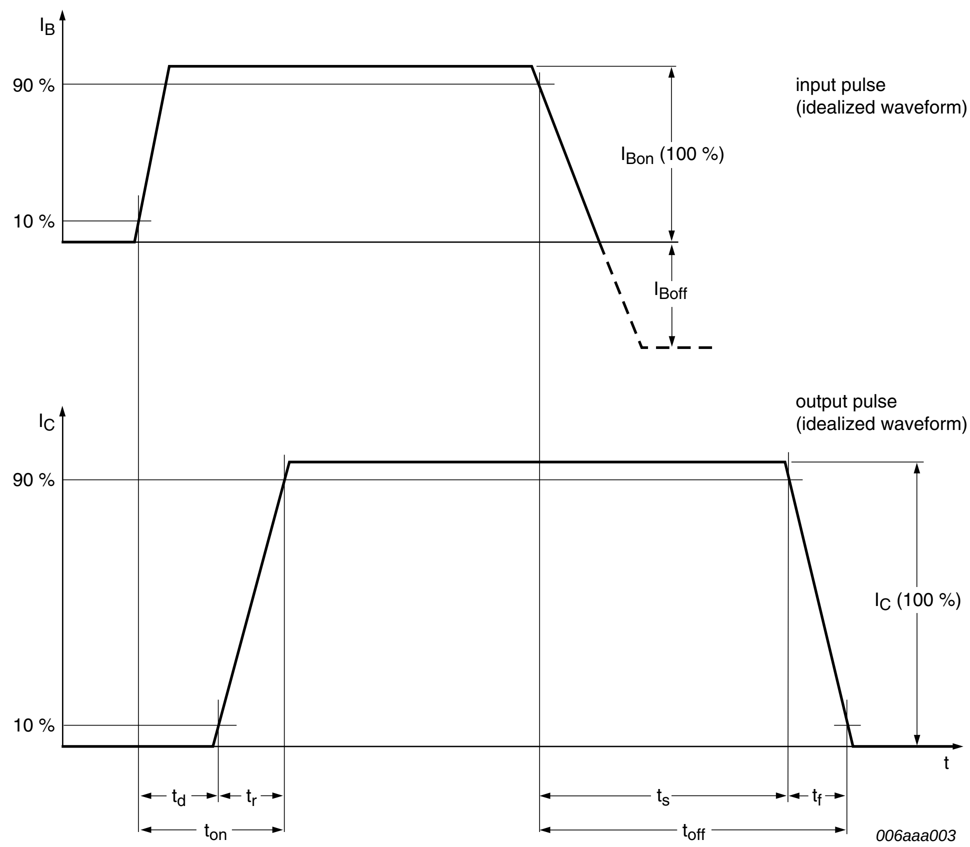
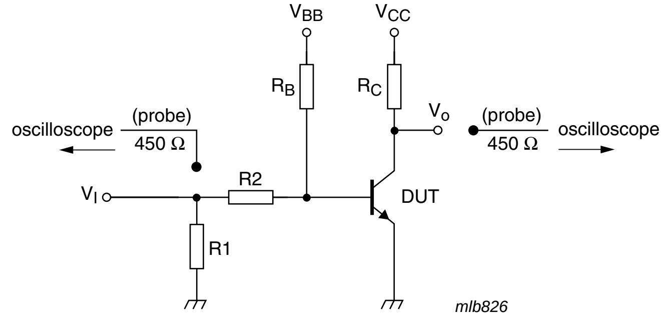


Fig 13. BISS transistor switching time definition



(1) V_{CC} = 10 V; I_C = 2 A; I_{Bon} = 0.1 A; I_{Boff} = −0.1 A

Fig 14. Test circuit for switching times

9. Package outline

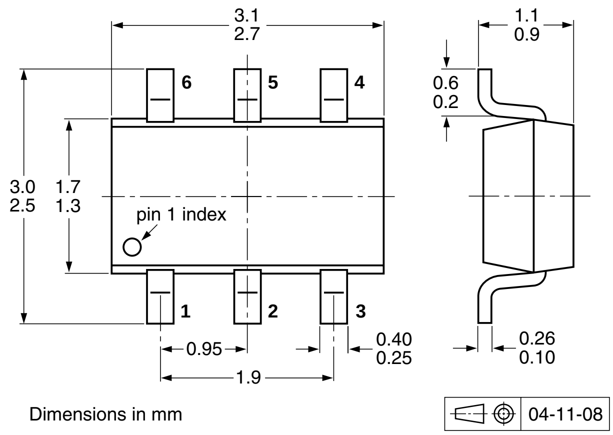


Fig 15. Package outline SOT457 (SC-74)

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	5000	10000
PBSS4440D	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 13.

[2] T1: normal taping

[3] T2: reverse taping

11. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4440D_2	20091211	Product data sheet	-	PBSS4440D_1
Modifications:	• This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content. • Figure 2 "Transient thermal impedance from junction to ambient as a function of pulse time; typical values": updated • Figure 3 "Transient thermal impedance from junction to ambient as a function of pulse time; typical values": updated • Figure 4 "Transient thermal impedance from junction to ambient as a function of pulse time; typical values": updated • Figure 11 "Collector current as a function of collector-emitter voltage; typical values": updated			
PBSS4440D_1	20050421	Product data sheet	-	-

12. Legal information

12.1 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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For more information, please visit: **http://www.nxp.com**

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14. Contents

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