

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

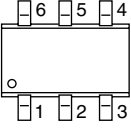
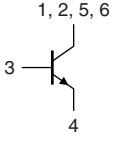
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	40	V
I_C	collector current (DC)		[1]	-	4	A
I_{CM}	peak collector current	$t = 1$ ms or limited by $T_{j(max)}$	-	-	15	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 6$ A; $I_B = 600$ mA	[2]	55	75	m Ω

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

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

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	collector		
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).

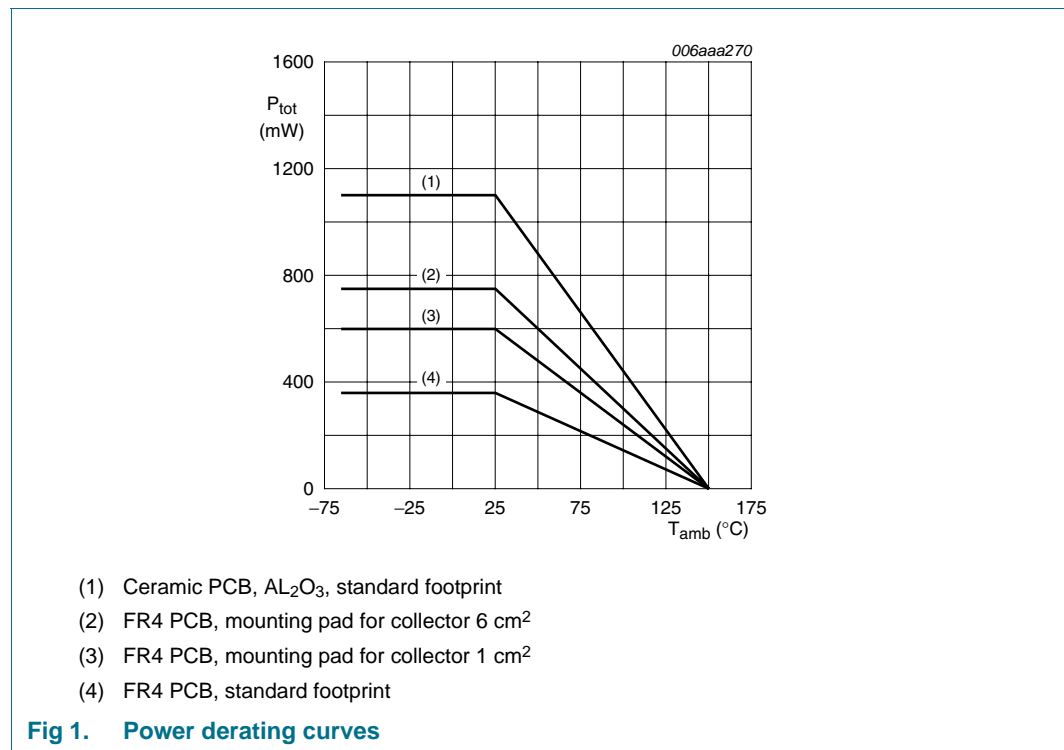
Symbol	Parameter	Conditions	Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter	-	60	V
V_{CEO}	collector-emitter voltage	open base	-	40	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current (DC)		[1]	4	A
I_{CM}	peak collector current	$t = 1 \text{ ms}$ or limited by $T_{j(max)}$	-	15	A
I_B	base current (DC)		-	0.8	A
I_{BM}	peak base current	$t_p \leq 300 \text{ } \mu\text{s}$	-	2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25 \text{ } ^\circ\text{C}$	[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 cm².
- [4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [5] Operated under pulsed conditions: Duty cycle $\delta \leq 10\%$ and pulse width $t_p \leq 10$ ms.

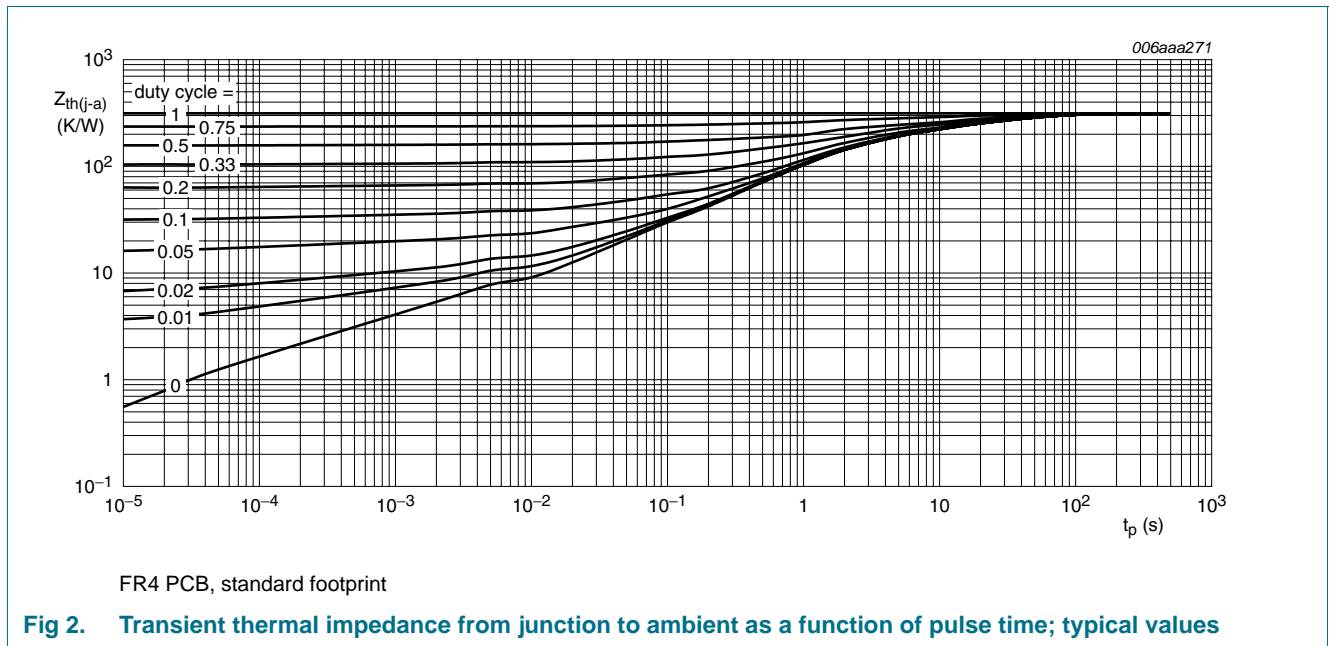


6. Thermal characteristics

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



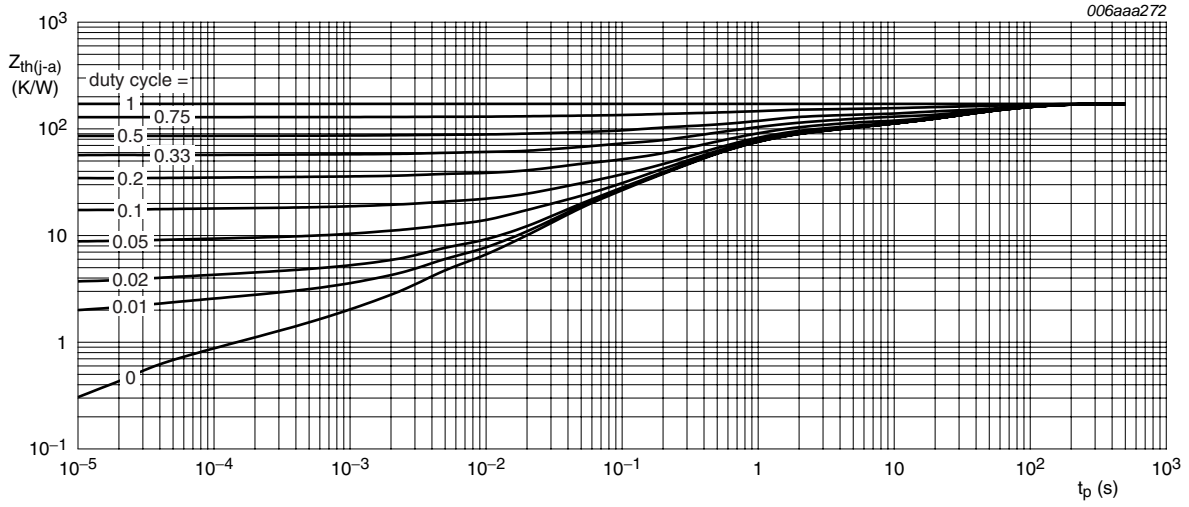


Fig 3. Transient thermal impedance from junction to ambient as a function of pulse time; typical values

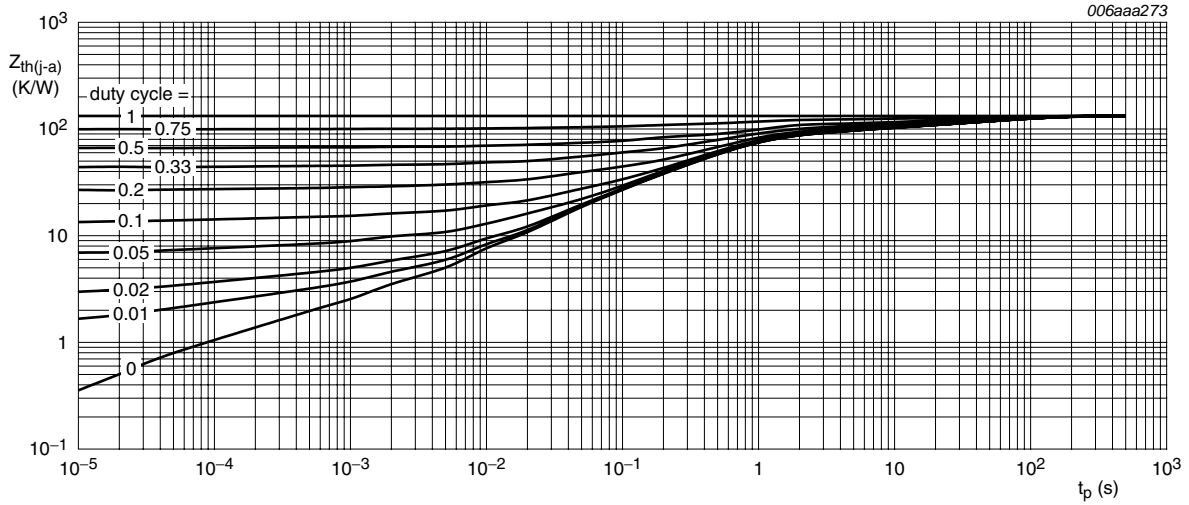


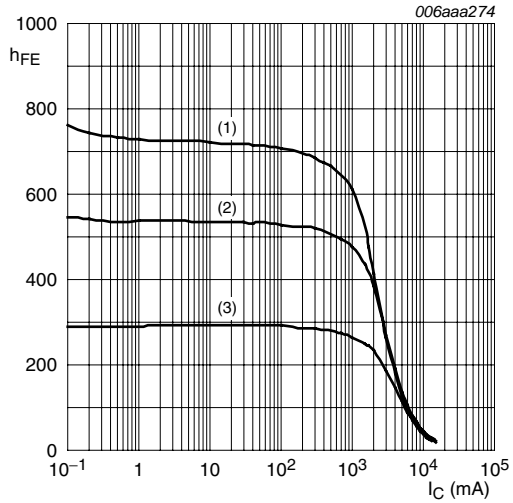
Fig 4. Transient thermal impedance from junction to ambient as a function of pulse time; typical values

7. Characteristics

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

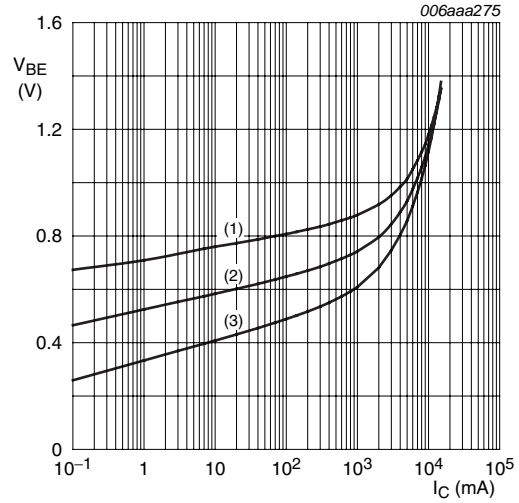
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 40\text{ V}; I_E = 0\text{ A}$	-	-	0.1	μA
		$V_{CB} = 40\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	μA
I_{CES}	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; V_{BE} = 0\text{ V}$	-	-	0.1	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	0.1	μA
h_{FE}	DC current gain	$V_{CE} = 2\text{ V}; I_C = 0.5\text{ A}$	300	-	-	
		$V_{CE} = 2\text{ V}; I_C = 1\text{ A}$	[1] 300	-	-	
		$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	[1] 250	-	-	
		$V_{CE} = 2\text{ V}; I_C = 4\text{ A}$	[1] 100	-	-	
		$V_{CE} = 2\text{ V}; I_C = 6\text{ A}$	[1] 50	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 50\text{ mA}$	-	35	60	mV
		$I_C = 1\text{ A}; I_B = 50\text{ mA}$	-	65	110	mV
		$I_C = 2\text{ A}; I_B = 200\text{ mA}$	-	115	180	mV
		$I_C = 4\text{ A}; I_B = 400\text{ mA}$	[1] -	220	300	mV
		$I_C = 6\text{ A}; I_B = 600\text{ mA}$	[1] -	330	450	mV
R_{CEsat}	collector-emitter saturation resistance	$I_C = 6\text{ A}; I_B = 600\text{ mA}$	[1] -	55	75	$\text{m}\Omega$
V_{BEsat}	base-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 50\text{ mA}$	-	0.79	0.85	V
		$I_C = 1\text{ A}; I_B = 50\text{ mA}$	-	0.81	0.9	V
		$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1] -	0.83	1	V
		$I_C = 4\text{ A}; I_B = 400\text{ mA}$	[1] -	1.0	1.1	V
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	-	0.79	1.0	V
t_d	delay time	$V_{CC} = 10\text{ V}; I_C = 2\text{ A}; I_{Bon} = 0.1\text{ A};$ $I_{Boff} = -0.1\text{ A}$	-	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	$V_{CE} = 10\text{ V}; I_C = 0.1\text{ A};$ $f = 100\text{ MHz}$	-	150	-	MHz
C_c	collector capacitance	$V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	30	-	pF

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



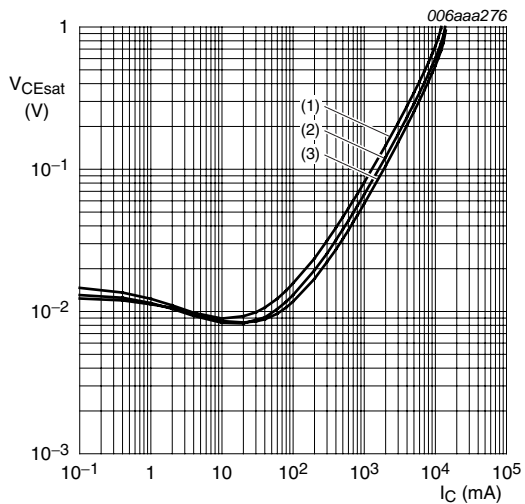
$V_{CE} = 2\text{ V}$
 (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



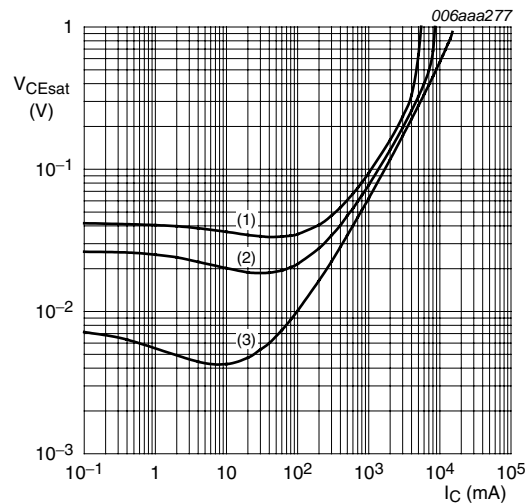
$V_{CE} = 2\text{ V}$
 (1) $T_{amb} = -55\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



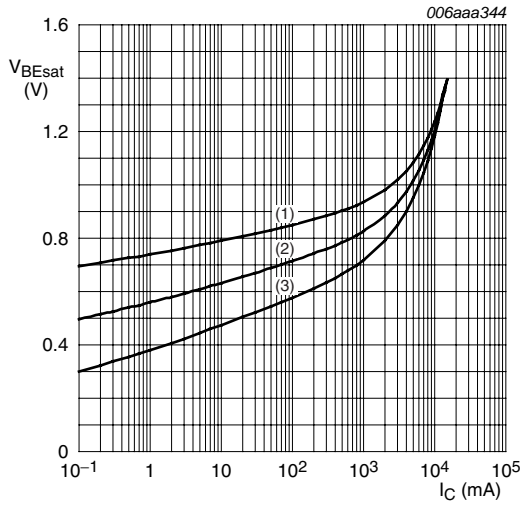
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



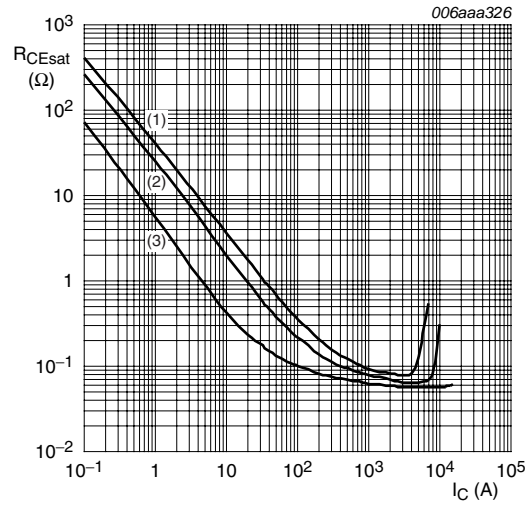
$T_{amb} = 25\text{ }^{\circ}\text{C}$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 10$

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



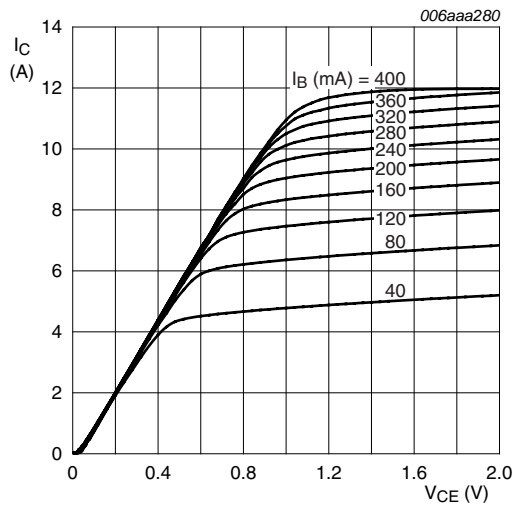
- $I_C/I_B = 20$
- (1) $T_{amb} = -55^\circ C$
 - (2) $T_{amb} = 25^\circ C$
 - (3) $T_{amb} = 100^\circ C$

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



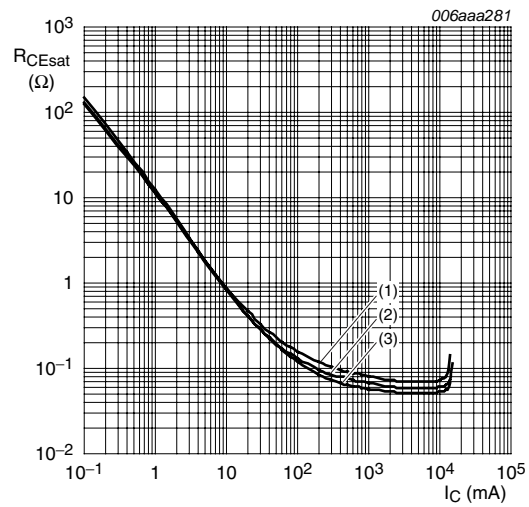
- $T_{amb} = 25^\circ C$
- (1) $I_C/I_B = 100$
 - (2) $I_C/I_B = 50$
 - (3) $I_C/I_B = 10$

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



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

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



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

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

8. Test information

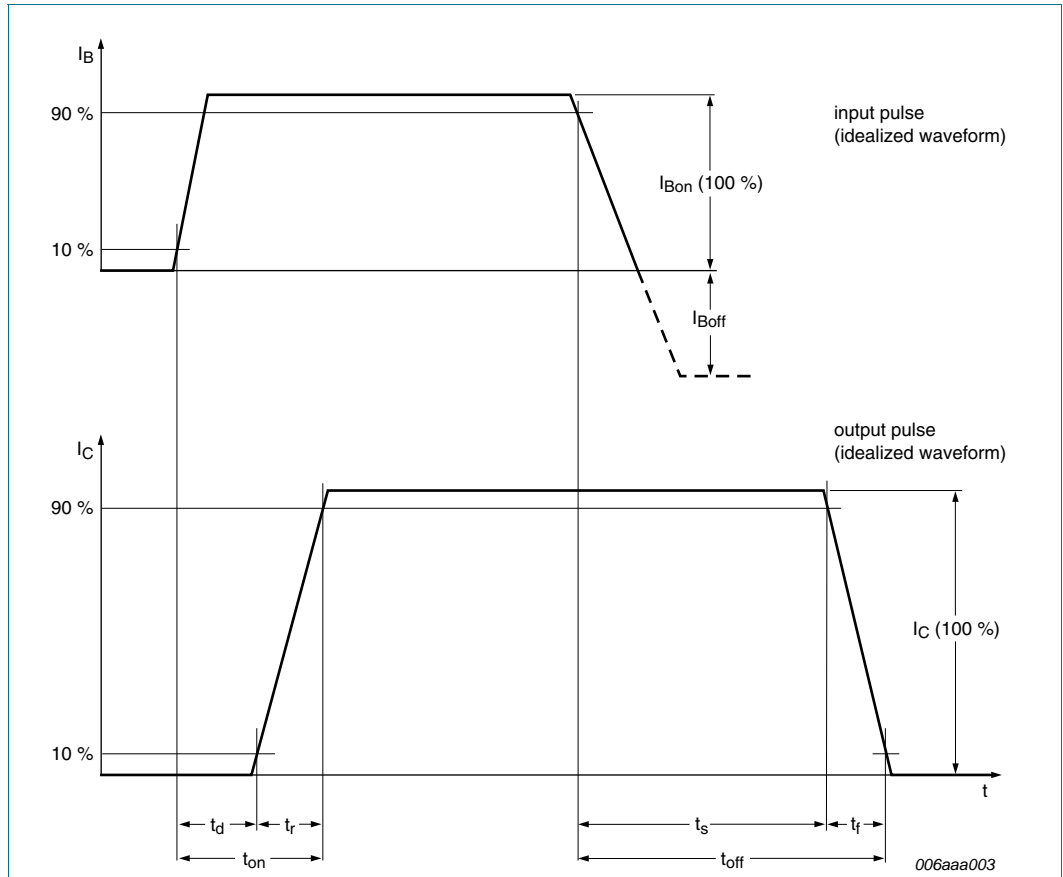
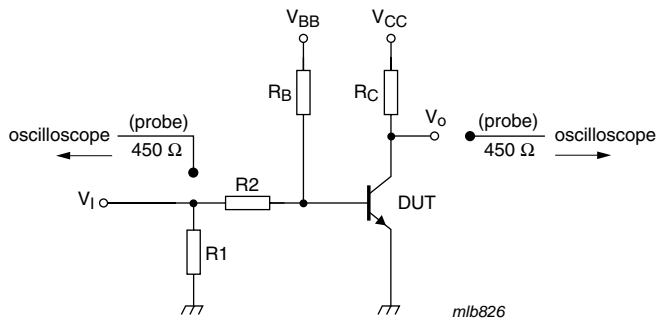


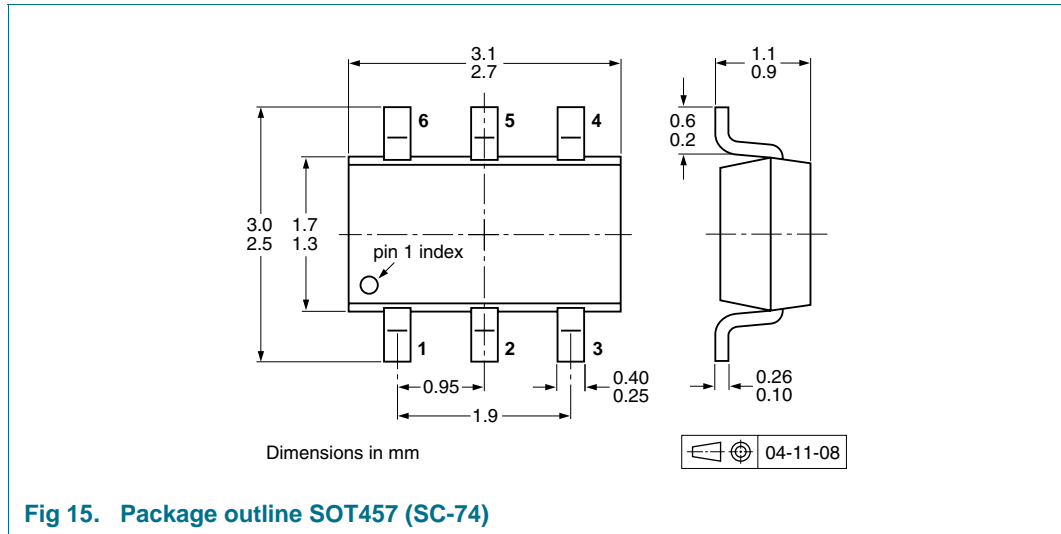
Fig 13. BISS transistor switching time definition



(1) $V_{CC} = 10\text{ V}$; $I_C = 2\text{ A}$; $I_{B(on)} = 0.1\text{ A}$; $I_{B(off)} = -0.1\text{ A}$

Fig 14. 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	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:	<ul style="list-style-type: none"> • 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.
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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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