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Kind regards,

Team Nexperia



# PBSS5440D

40 V PNP low  $V_{CEsat}$  (BISS) transistor

Rev. 02 — 14 December 2009

Product data sheet

## 1. Product profile

### 1.1 General description

PNP low  $V_{CEsat}$  Breakthrough in Small Signal (BISS) single bipolar PNP transistor in a SOT457 (SC-74) SMD plastic package.

NPN complement: PBSS4440D.

### 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

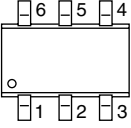
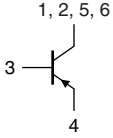
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	-40	V
$I_C$	collector current (DC)		[1]	-	-4	A
$I_{CM}$	peak collector current	$t = 1$ ms or limited by $T_{j(max)}$	-	-	-15	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -6$ A; $I_B = -600$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

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

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

## 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
PBSS5440D	SC-74	plastic surface mounted package; 6 leads	SOT457

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS5440D	71

## 5. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

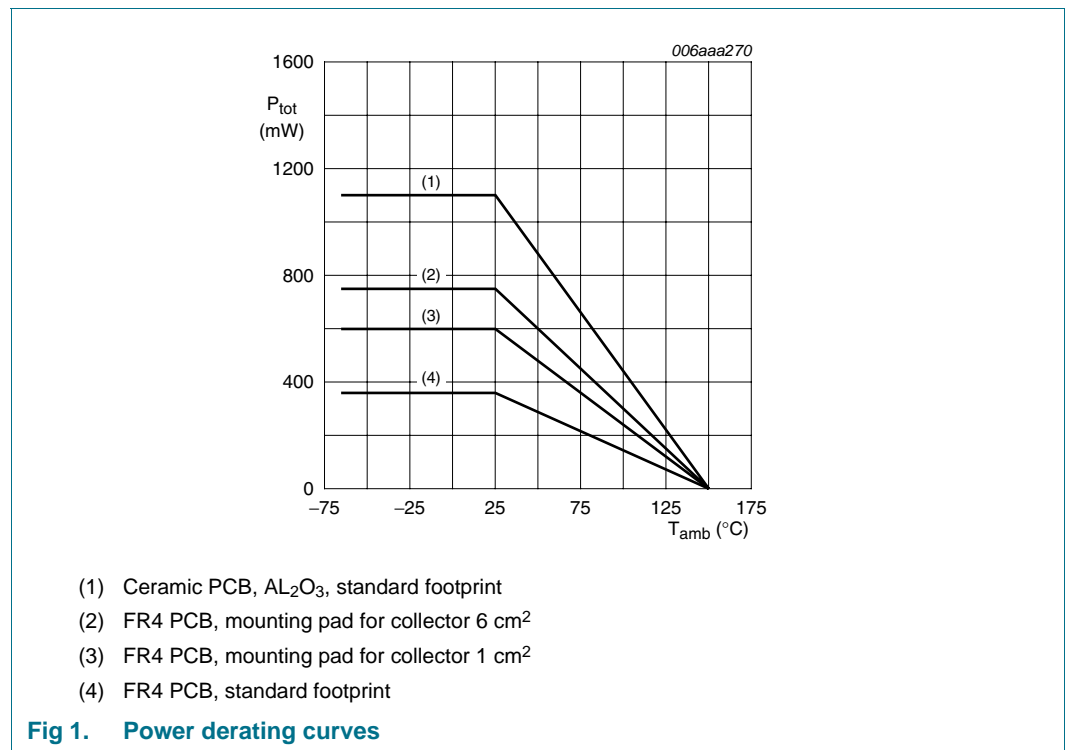
Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{CBO}$	collector-base voltage	open emitter	-	-40	V	
$V_{CEO}$	collector-emitter voltage	open base	-	-40	V	
$V_{EBO}$	emitter-base voltage	open collector	-	-5	V	
$I_C$	collector current (DC)		[1]	-4	A	
$I_{CM}$	peak collector current	$t = 1$ ms or limited by $T_{j(max)}$	-	-15	A	
$I_B$	base current (DC)		-	-0.8	A	
$I_{BM}$	peak base current	$t_p \leq 300$ $\mu$ s	-	-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.

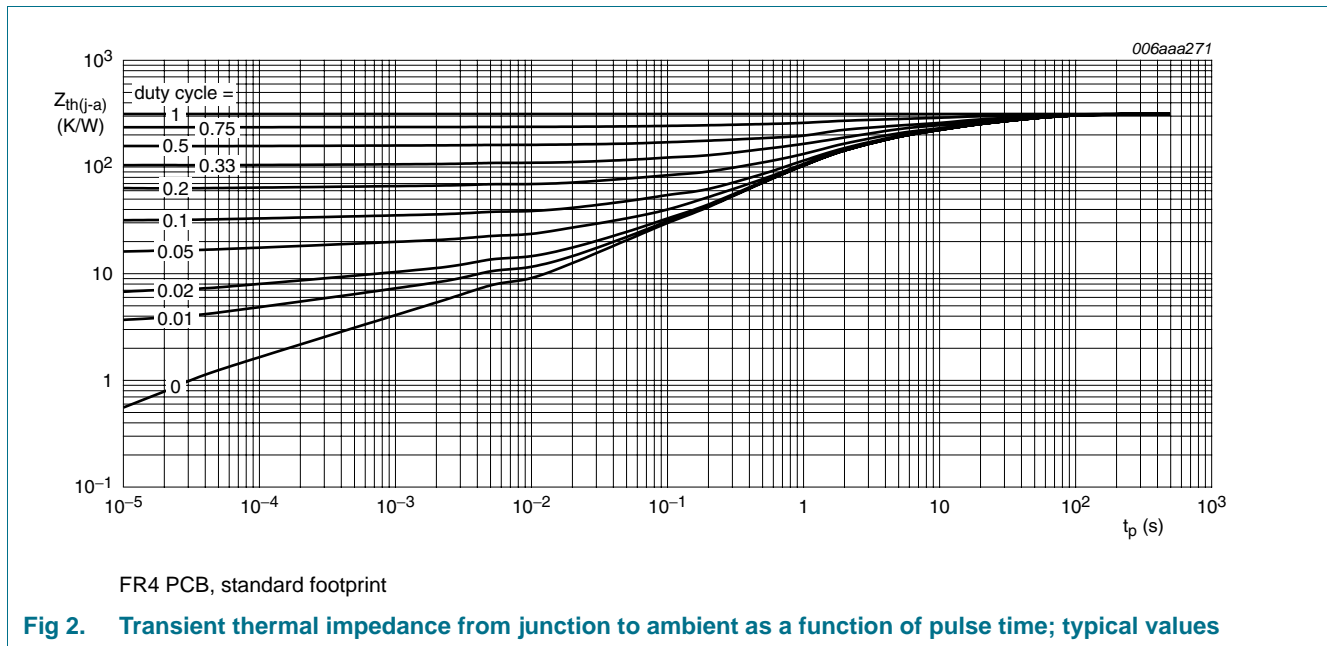


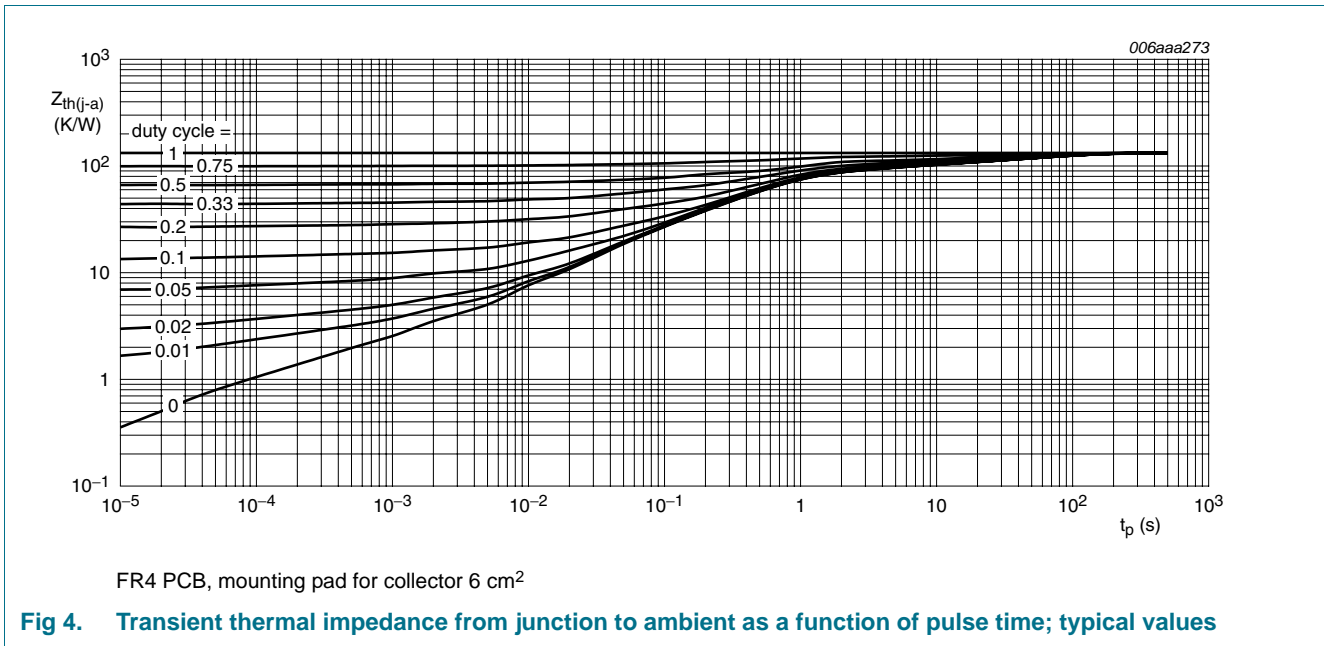
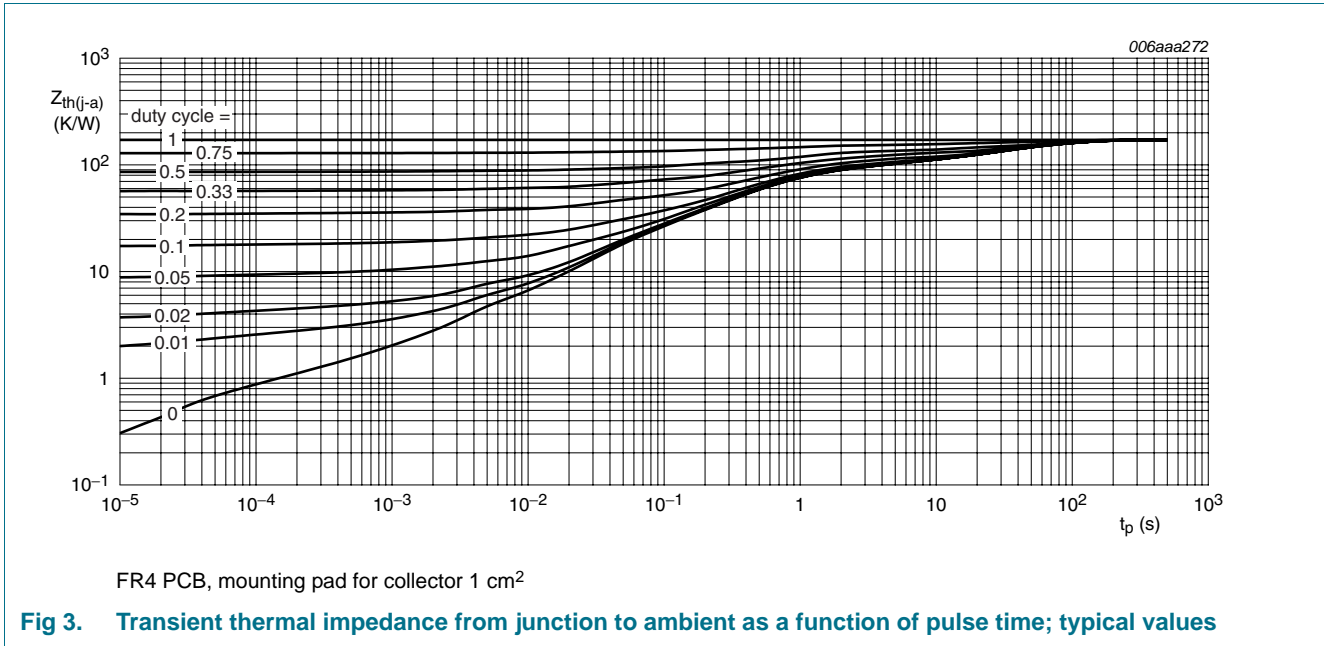
## 6. Thermal characteristics

**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<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on a ceramic PCB, AL<sub>2</sub>O<sub>3</sub>, standard footprint.
- [5] Operated under pulsed conditions: Duty cycle  $\delta \leq 10\%$  and pulse width  $t_p \leq 10$  ms.



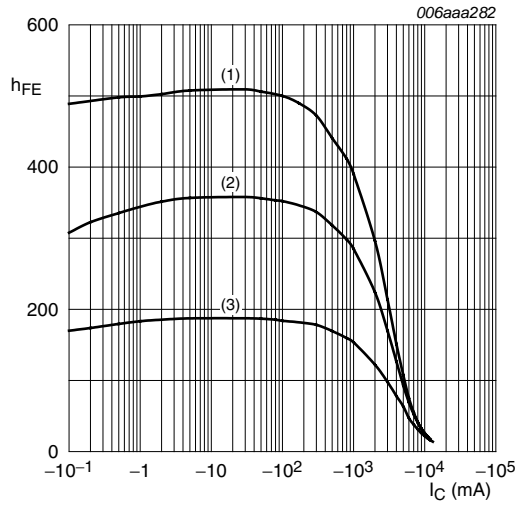


## 7. Characteristics

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

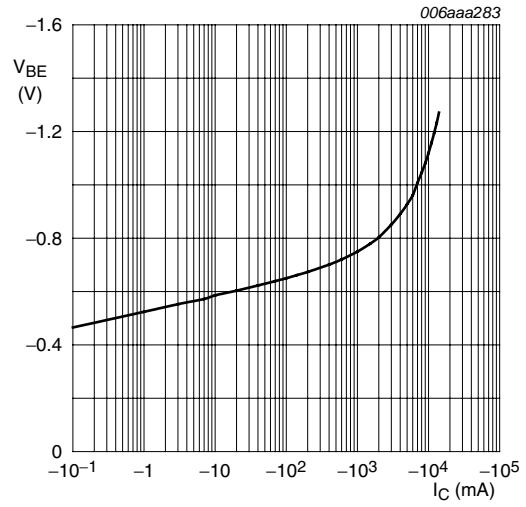
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -30\text{ V}; I_E = 0\text{ A}$	-	-	-0.1	$\mu\text{A}$
		$V_{CB} = -30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	-50	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = -30\text{ V}; V_{BE} = 0\text{ V}$	-	-	-0.1	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}$	-	-	-0.1	$\mu\text{A}$
$h_{FE}$	DC current gain	$V_{CE} = -2\text{ V}; I_C = -0.5\text{ A}$	200	-	-	
		$V_{CE} = -2\text{ V}; I_C = -1\text{ A}$	[1] 200	-	-	
		$V_{CE} = -2\text{ V}; I_C = -2\text{ A}$	[1] 175	-	-	
		$V_{CE} = -2\text{ V}; I_C = -4\text{ A}$	[1] 80	-	-	
		$V_{CE} = -2\text{ V}; I_C = -6\text{ A}$	[1] 30	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -0.5\text{ A}; I_B = -50\text{ mA}$	-	-46	-60	mV
		$I_C = -1\text{ A}; I_B = -50\text{ mA}$	-	-70	-110	mV
		$I_C = -2\text{ A}; I_B = -200\text{ mA}$	-	-120	-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] -	-320	-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	$I_C = -0.5\text{ A}; I_B = -50\text{ mA}$	-	-0.8	-0.85	V
		$I_C = -1\text{ A}; I_B = -50\text{ mA}$	-	-0.84	-0.9	V
		$I_C = -1\text{ A}; I_B = -100\text{ mA}$	[1] -	-0.84	-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	$V_{CE} = -2\text{ V}; I_C = -2\text{ A}$	-	-0.8	-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		-	43	-	ns
$t_{on}$	turn-on time		-	55	-	ns
$t_s$	storage time		-	240	-	ns
$t_f$	fall time		-	80	-	ns
$t_{off}$	turn-off time		-	320	-	ns
$f_T$	transition frequency	$V_{CE} = -10\text{ V}; I_C = -0.1\text{ A};$ $f = 100\text{ MHz}$	-	110	-	MHz
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = I_e = 0\text{ A};$ $f = 1\text{ MHz}$	-	50	-	pF

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



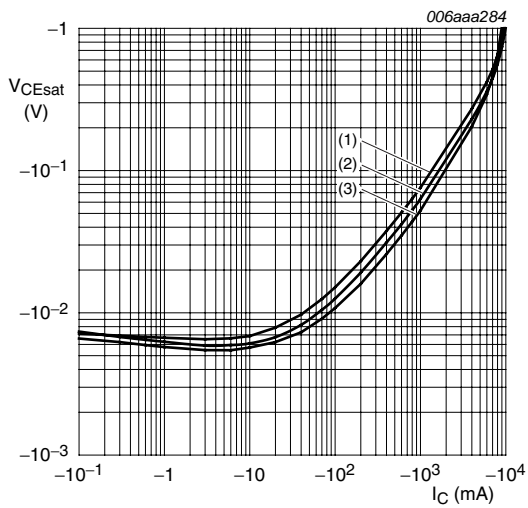
$V_{CE} = -2$  V  
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -55^\circ C$

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



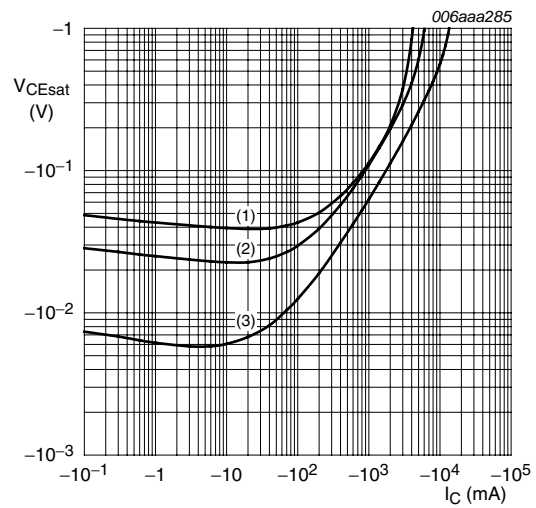
$V_{CE} = -2$  V  
 $T_{amb} = 25^\circ C$

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



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

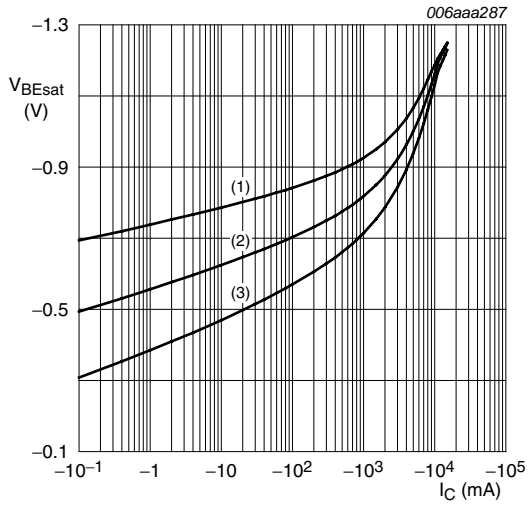
**Fig 7. Collector-emitter saturation voltage as a function of collector current; typical values**



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

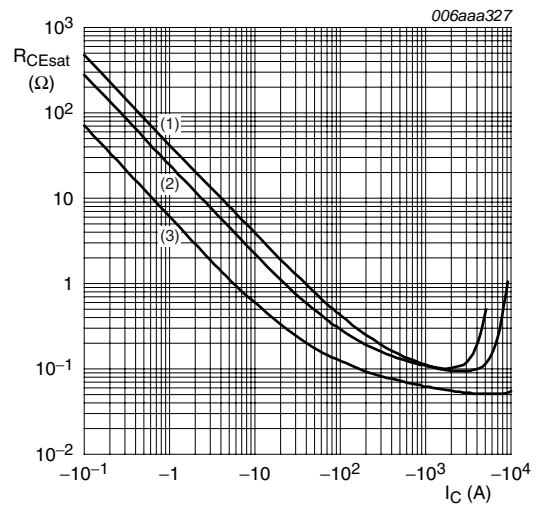
**Fig 8. Collector-emitter saturation voltage as a function of collector current; typical values**





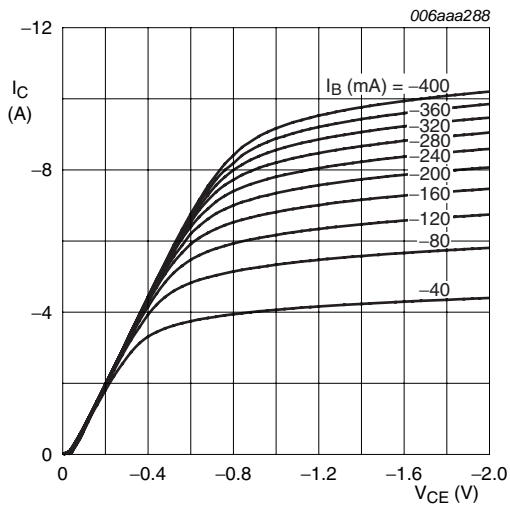
- $I_C/I_B = 20$
- (1)  $T_{amb} = -55\text{ }^\circ\text{C}$
  - (2)  $T_{amb} = 25\text{ }^\circ\text{C}$
  - (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



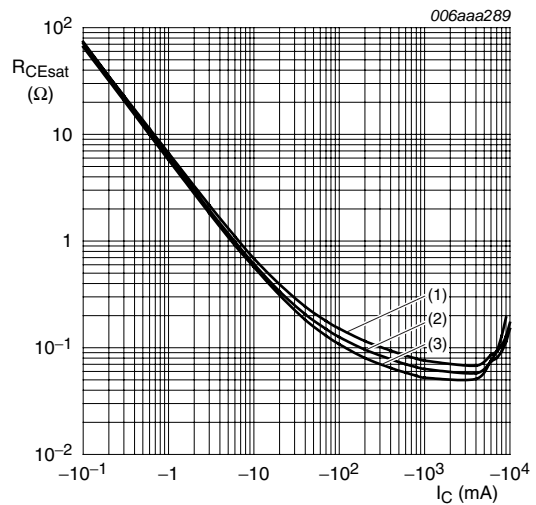
- $T_{amb} = 25\text{ }^\circ\text{C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

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



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

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

8. Test information

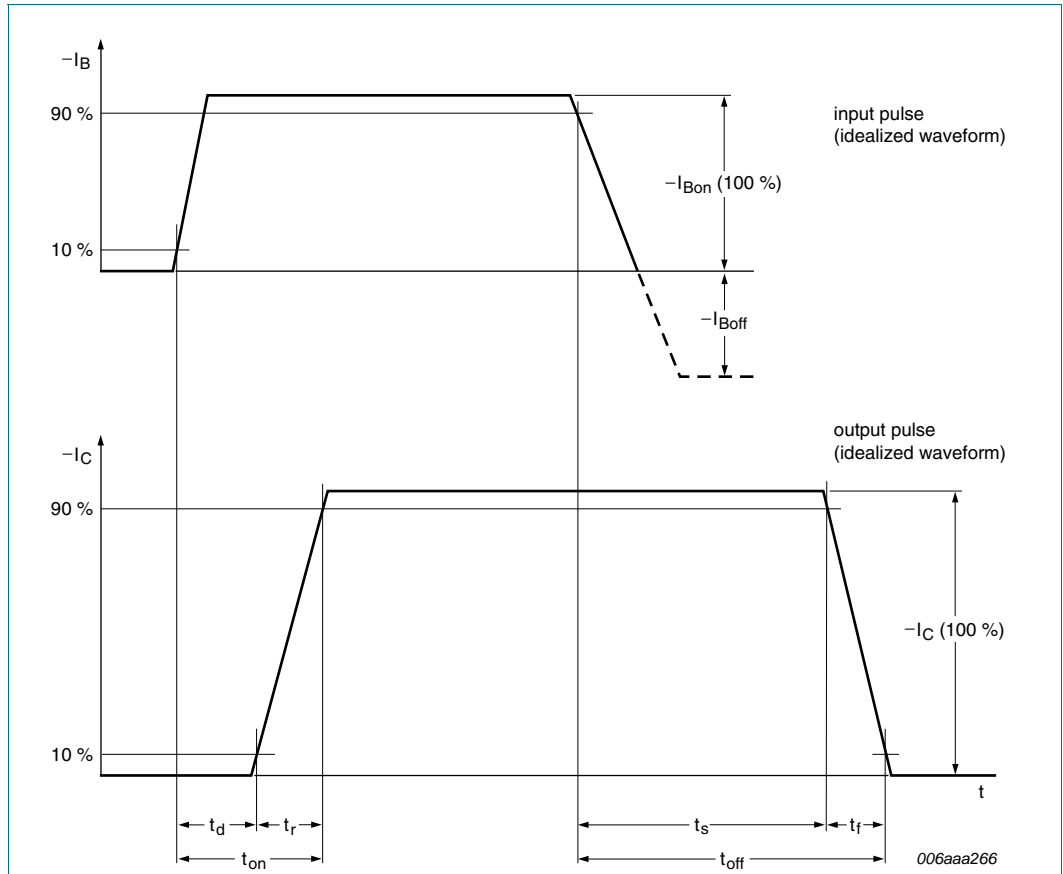
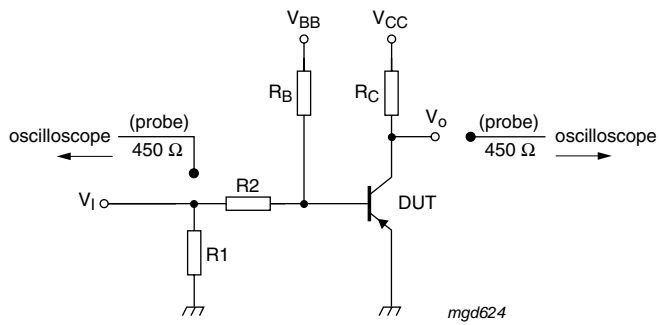


Fig 13. BISS transistor switching time definition



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

Fig 14. Test circuit for switching times

## 9. Package outline

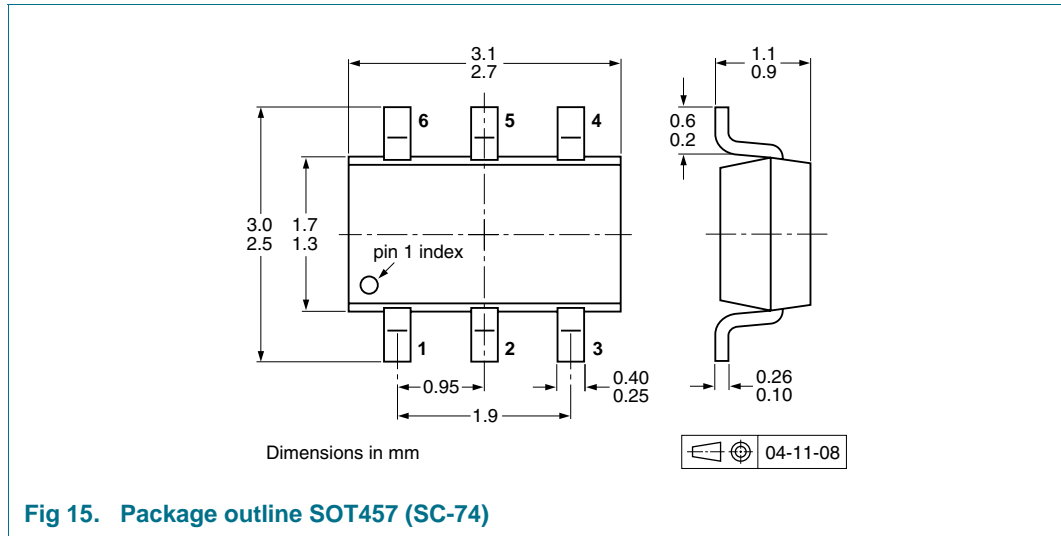


Fig 15. Package outline SOT457 (SC-74)

## 10. Packing information

**Table 8. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

Type number	Package	Description	Packing quantity		
			3000	5000	10000
PBSS5440D	SOT457	4 mm pitch, 8 mm tape and reel; T1 <sup>[2]</sup>	-115	-	-135
		4 mm pitch, 8 mm tape and reel; T2 <sup>[3]</sup>	-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
PBSS5440D_2	20091214	Product data sheet	-	PBSS5440D_1
Modifications:	<ul style="list-style-type: none"> <li>• 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.</li> <li>• <a href="#">Figure 2 “Transient thermal impedance from junction to ambient as a function of pulse time; typical values”</a>: updated</li> <li>• <a href="#">Figure 3 “Transient thermal impedance from junction to ambient as a function of pulse time; typical values”</a>: updated</li> <li>• <a href="#">Figure 4 “Transient thermal impedance from junction to ambient as a function of pulse time; typical values”</a>: updated</li> <li>• <a href="#">Figure 6 “Base-emitter voltage as a function of collector current; typical values”</a>: updated</li> <li>• <a href="#">Figure 11 “Collector current as a function of collector-emitter voltage; typical values”</a>: updated</li> </ul>			
PBSS5440D_1	20050427	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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## 14. Contents

<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description . . . . .	1
1.2	Features . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data . . . . .	1
<b>2</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Marking</b> . . . . .	<b>2</b>
<b>5</b>	<b>Limiting values</b> . . . . .	<b>2</b>
<b>6</b>	<b>Thermal characteristics</b> . . . . .	<b>4</b>
<b>7</b>	<b>Characteristics</b> . . . . .	<b>6</b>
<b>8</b>	<b>Test information</b> . . . . .	<b>9</b>
<b>9</b>	<b>Package outline</b> . . . . .	<b>10</b>
<b>10</b>	<b>Packing information</b> . . . . .	<b>10</b>
<b>11</b>	<b>Revision history</b> . . . . .	<b>11</b>
<b>12</b>	<b>Legal information</b> . . . . .	<b>12</b>
12.1	Data sheet status . . . . .	12
12.2	Definitions . . . . .	12
12.3	Disclaimers . . . . .	12
12.4	Trademarks . . . . .	12
<b>13</b>	<b>Contact information</b> . . . . .	<b>12</b>
<b>14</b>	<b>Contents</b> . . . . .	<b>13</b>

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