

PBSS4160DS

60 V, 1 A NPN/NPN low V_{CEsat} (BISS) transistor

Rev. 04 — 11 December 2009

Product data sheet

1. Product profile

1.1 General description

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

PNP/PNP complement: PBSS5160DS.

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

- Dual low power switches (e.g. motors, fans)
- Automotive applications

1.4 Quick reference data

Table 1. Quick reference data

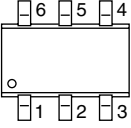
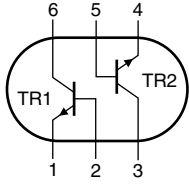
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
V_{CEO}	collector-emitter voltage	open base	-	-	60	V
I_C	collector current		[1]	-	1	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	2	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 1$ A; $I_B = 100$ mA	[2]	-	200	m Ω

[1] Device mounted on a ceramic 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	emitter TR1		 sym020
2	base TR1		
3	collector TR2		
4	emitter TR2		
5	base TR2		
6	collector TR1		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4160DS	SC-74	plastic surface mounted package (TSOP6); 6 leads	SOT457

4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4160DS	B8

5. Limiting values

Table 5. Limiting values

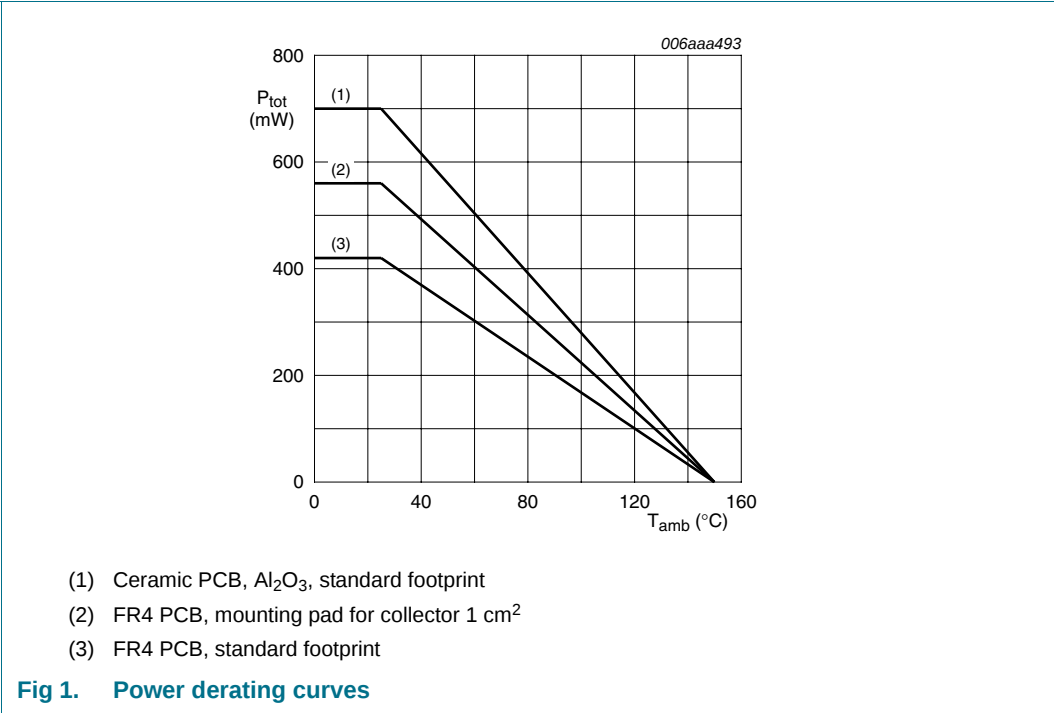
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
Per transistor					
V_{CBO}	collector-base voltage	open emitter	-	80	V
V_{CEO}	collector-emitter voltage	open base	-	60	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current	[1]	-	0.87	A
		[2]	-	1	A
		[3]	-	1	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	2	A
I_B	base current		-	300	mA
I_{BM}	peak base current	single pulse; $t_p \leq 1$ ms	-	1	A

Table 5. Limiting values ...continued
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1] -	290	mW
			[2] -	370	mW
			[3] -	450	mW
Per device					
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1] -	420	mW
			[2] -	560	mW
			[3] -	700	mW
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 an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².
[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

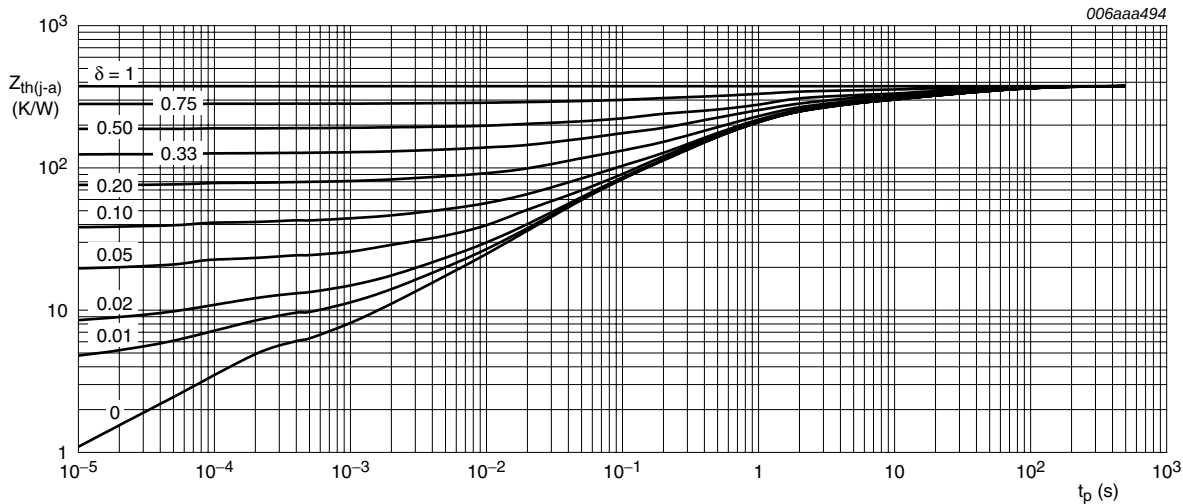


6. Thermal characteristics

Table 6. Thermal characteristics

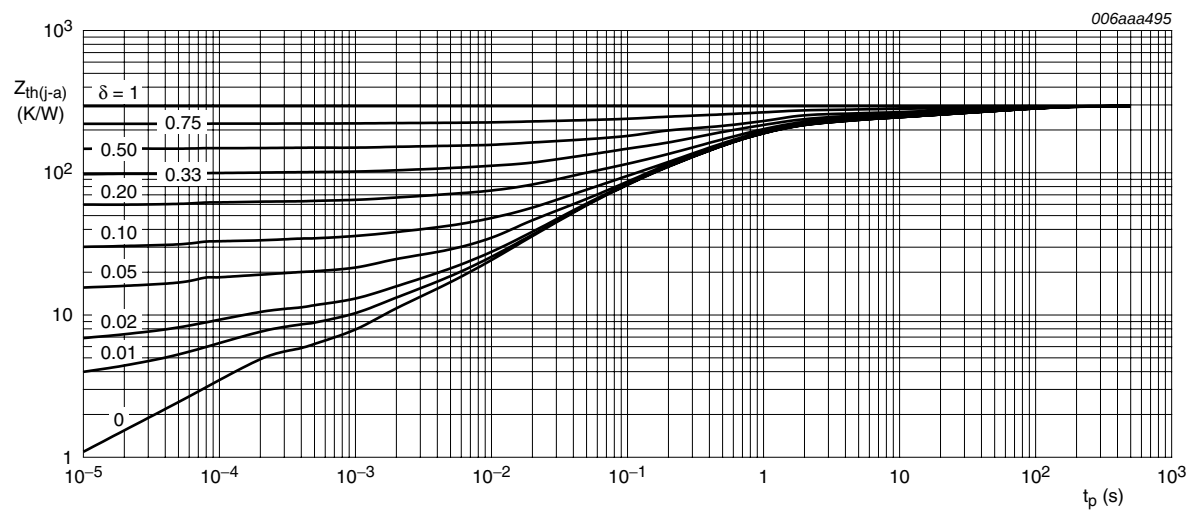
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] -	-	431	K/W
			[2] -	-	338	K/W
			[3] -	-	278	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	105	K/W
Per device						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] -	-	298	K/W
			[2] -	-	223	K/W
			[3] -	-	179	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 a ceramic PCB, Al₂O₃, standard footprint.



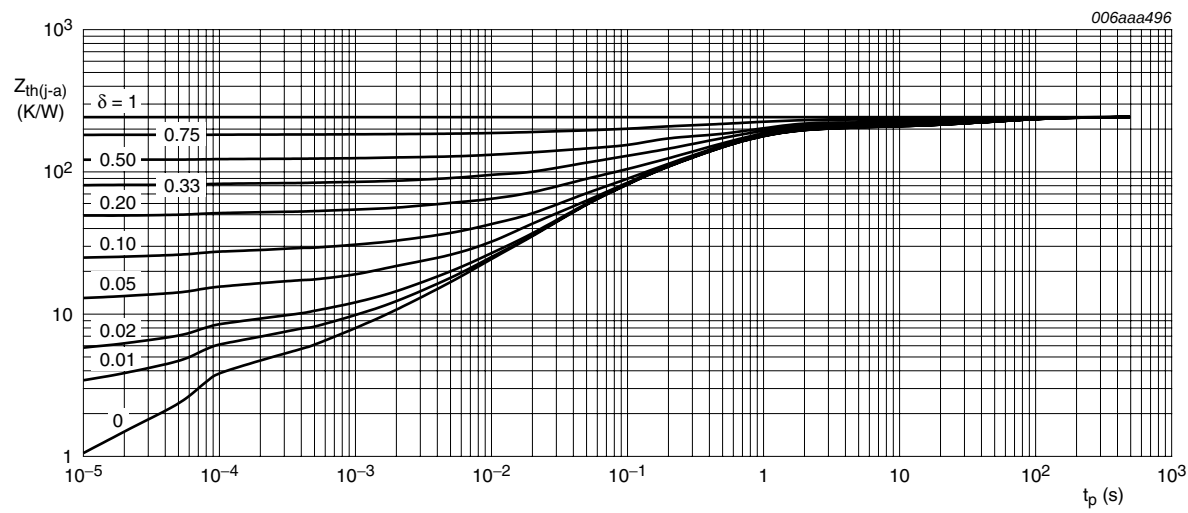
FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 1 cm²

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



Ceramic PCB, Al₂O₃, standard footprint

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

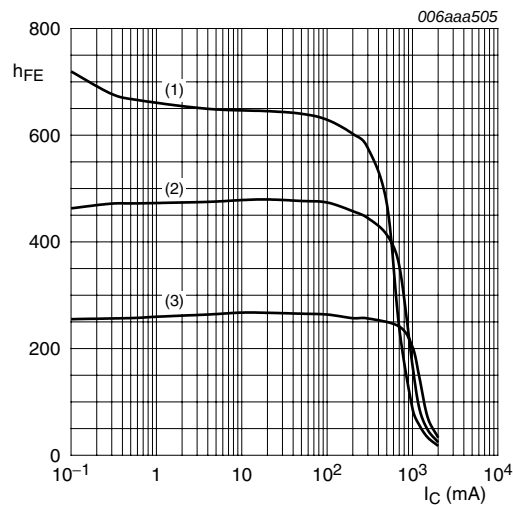
7. Characteristics

Table 7. Characteristics

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

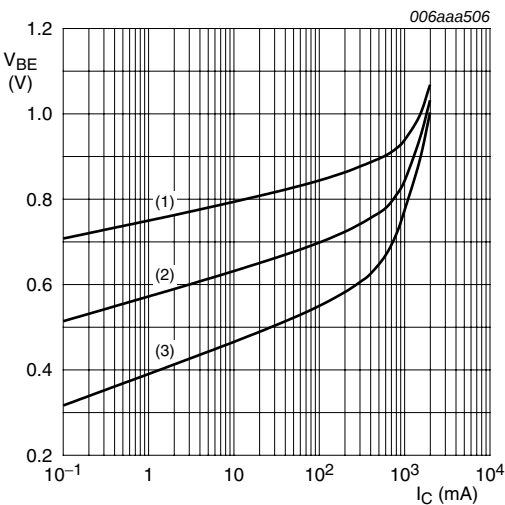
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
I_{CBO}	collector-base cut-off current	$V_{CB} = 60\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	μA
I_{CES}	collector-emitter cut-off current	$V_{CE} = 60\text{ V}; V_{BE} = 0\text{ V}$	-	-	100	nA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
h_{FE}	DC current gain	$V_{CE} = 5\text{ V}; I_C = 1\text{ mA}$	250	500	-	
		$V_{CE} = 5\text{ V}; I_C = 500\text{ mA}$	[1] 200	420	-	
		$V_{CE} = 5\text{ V}; I_C = 1\text{ A}$	[1] 100	180	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 100\text{ mA}; I_B = 1\text{ mA}$	-	90	110	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	-	115	140	mV
		$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1] -	200	250	mV
R_{CEsat}	collector-emitter saturation resistance	$I_C = 1\text{ A}; I_B = 100\text{ mA}$	[1] -	200	250	m Ω
V_{BEsat}	base-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 50\text{ mA}$	[1] -	0.95	1.1	V
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = 5\text{ V}; I_C = 1\text{ A}$	[1] -	0.82	0.9	V
t_d	delay time	$I_C = 0.5\text{ A}; I_{B(on)} = 25\text{ mA}; I_{B(off)} = -25\text{ mA}$	-	11	-	ns
t_r	rise time		-	78	-	ns
t_{on}	turn-on time		-	90	-	ns
t_s	storage time		-	340	-	ns
t_f	fall time		-	160	-	ns
t_{off}	turn-off time		-	500	-	ns
f_T	transition frequency	$V_{CE} = 10\text{ V}; I_C = 50\text{ mA}; f = 100\text{ MHz}$	150	220	-	MHz
C_C	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$	-	5.5	10	pF

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



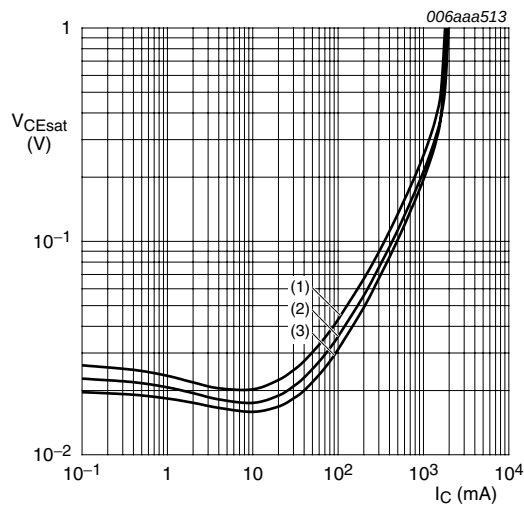
- $V_{CE} = 5\text{ V}$
- (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



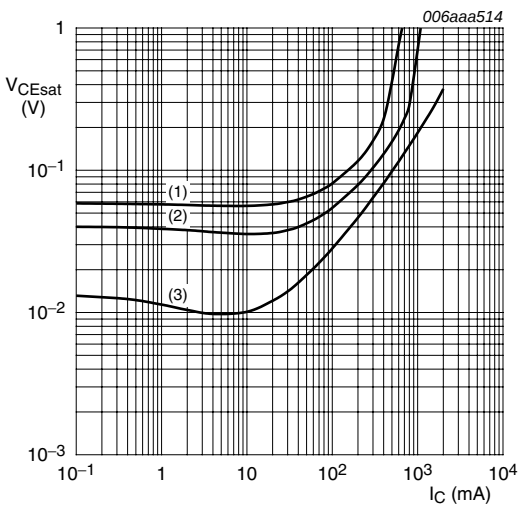
- $V_{CE} = 5\text{ V}$
- (1) $T_{amb} = -55\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



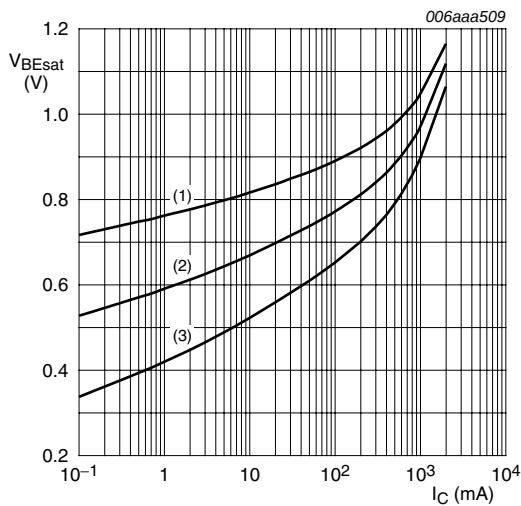
- $I_C/I_B = 20$
- (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



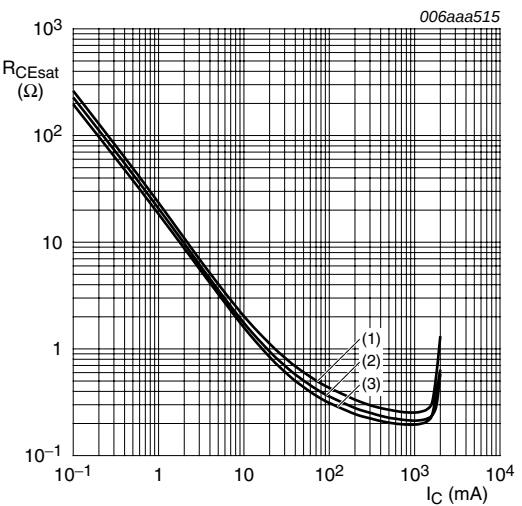
- $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (1) $I_C/I_B = 100$
 - (2) $I_C/I_B = 50$
 - (3) $I_C/I_B = 10$

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



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

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



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

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

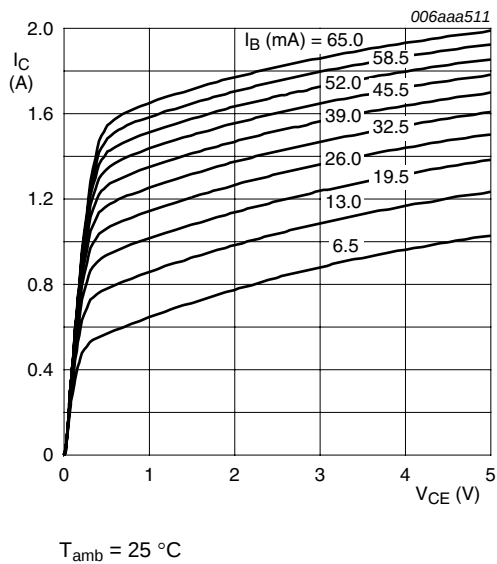
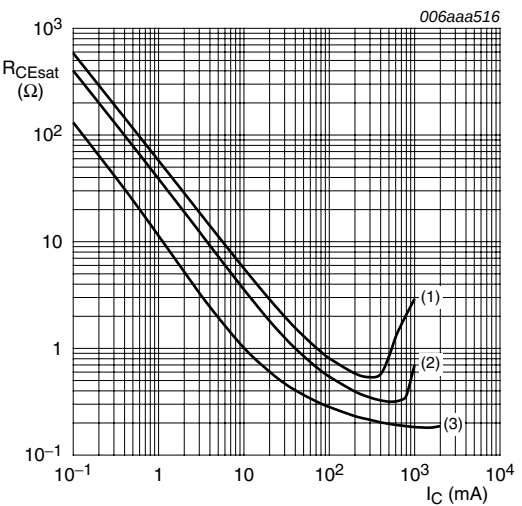


Fig 11. Collector current as a function of collector-emitter voltage; typical values



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

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

8. Test information

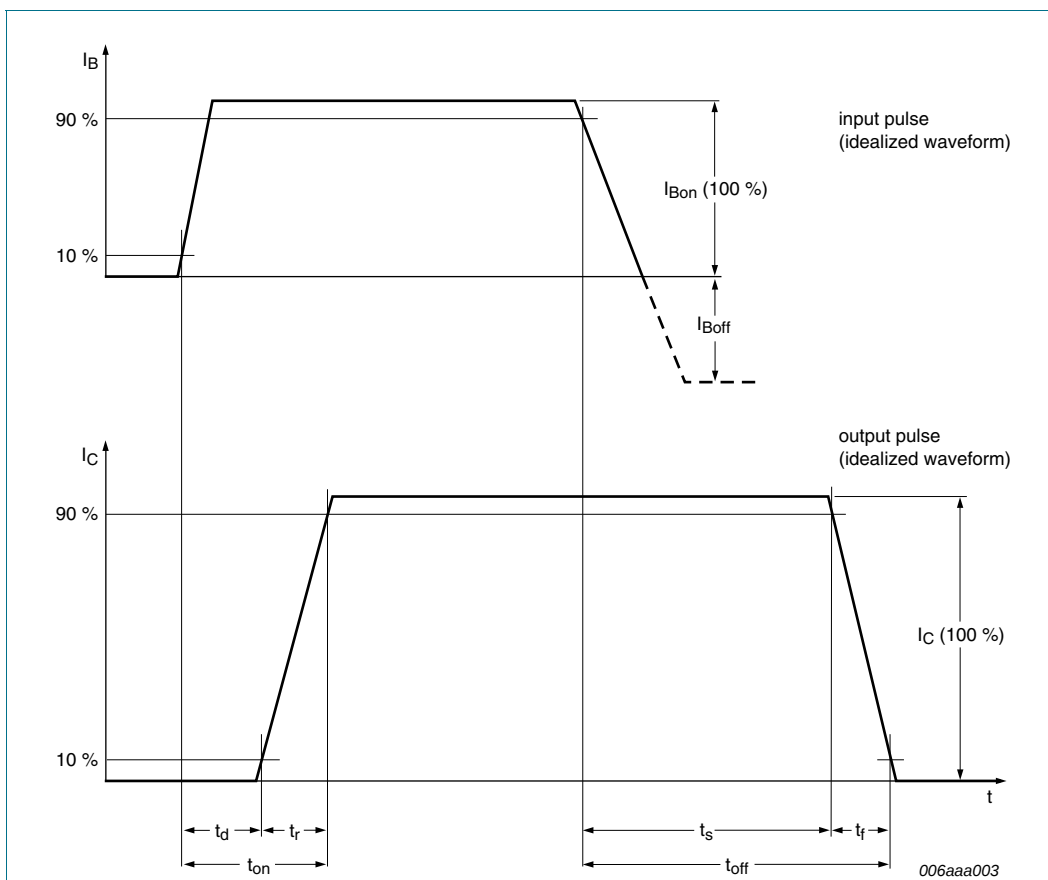
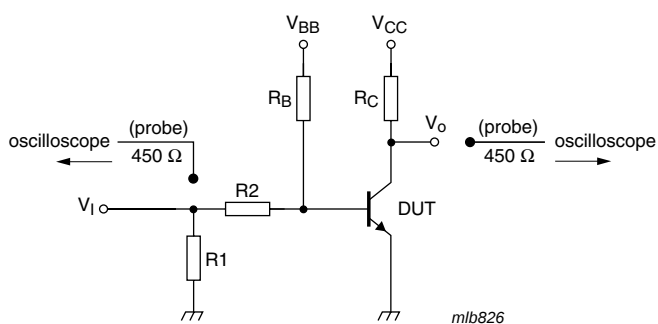


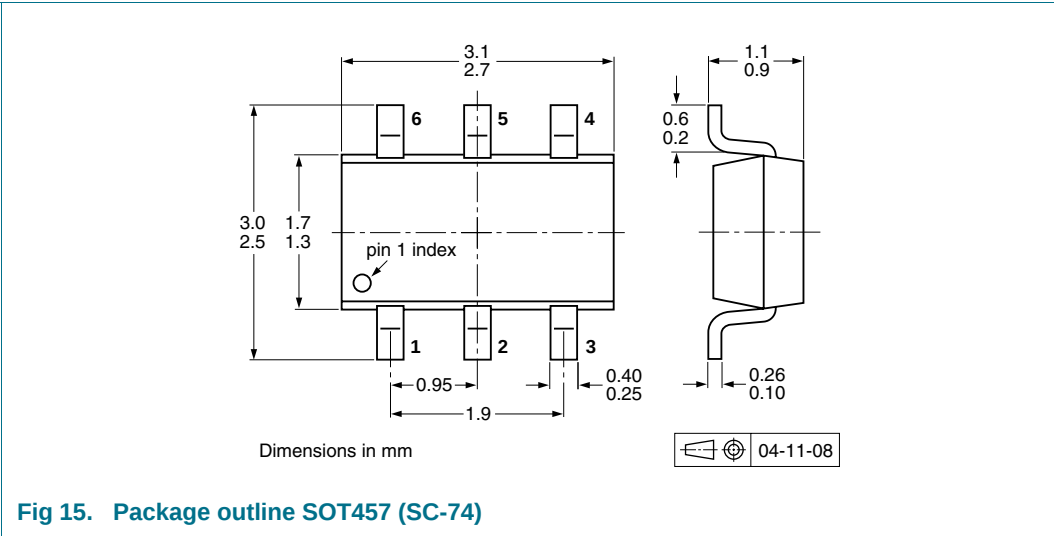
Fig 13. BISS transistor switching time definition



$I_C = 0.5 \text{ A}$; $I_{B_{on}} = 25 \text{ mA}$; $I_{B_{off}} = -25 \text{ mA}$; $R_1 = \text{open}$; $R_2 = 100 \Omega$; $R_B = 300 \Omega$; $R_C = 20 \Omega$

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	10000
PBSS4160DS	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

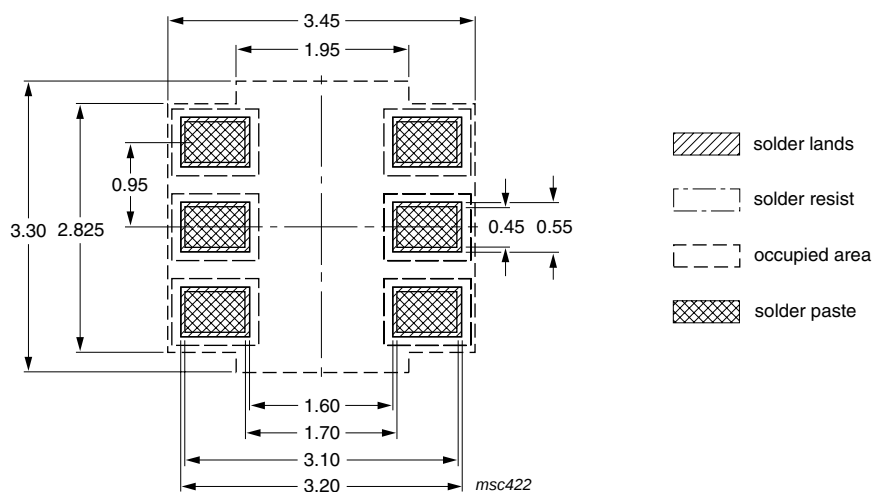


Fig 16. Reflow soldering footprint

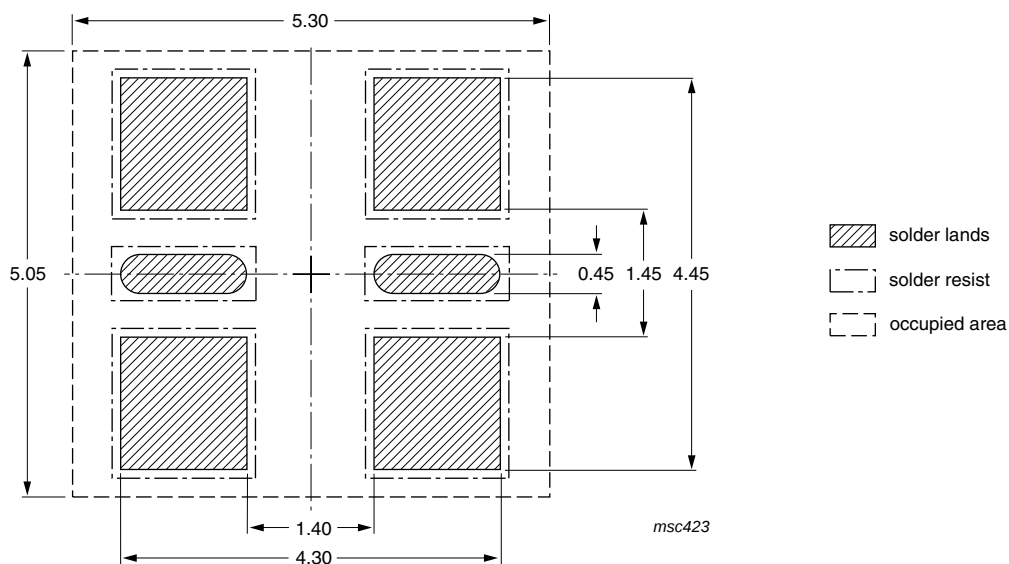


Fig 17. Wave soldering footprint

12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4160DS_4	20091211	Product data sheet	-	PBSS4160DS_3
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 17 "Wave soldering footprint": updated			
PBSS4160DS_3	20060209	Product data sheet	-	PBSS4160DS_2
PBSS4160DS_2	20050627	Product data sheet	-	PBSS4160DS_1
PBSS4160DS_1	20040426	Objective 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".

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Date of release: 11 December 2009

Document identifier: PBSS4160DS_4