

PBSS4160U

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

Rev. 03 — 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 SOT323 (SC-70) Surface Mounted Device (SMD) plastic package.

PNP complement: PBSS5160U.

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

- High voltage DC-to-DC conversion
- High voltage MOSFET gate driving
- High voltage motor control
- High voltage power switches (e.g. motors, fans)
- Automotive applications

1.4 Quick reference data

Table 1. Quick reference data

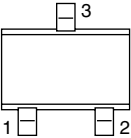
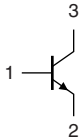
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	60	V
I_C	collector current (DC)		[1]	-	1	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	2	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 1$ A; $I_B = 100$ mA	[2]	-	230	$m\Omega$

[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	base		
2	emitter		
3	collector		

sym021

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4160U	SC-70	plastic surface mounted package; 3 leads	SOT323

4. Marking

Table 4. Marking codes

Type number	Marking code ^[1]
PBSS4160U	52*

- [1] * = -: made in Hong Kong
* = p: made in Hong Kong
* = t: made in Malaysia
* = W: made in China

5. Limiting values

Table 5. Limiting values

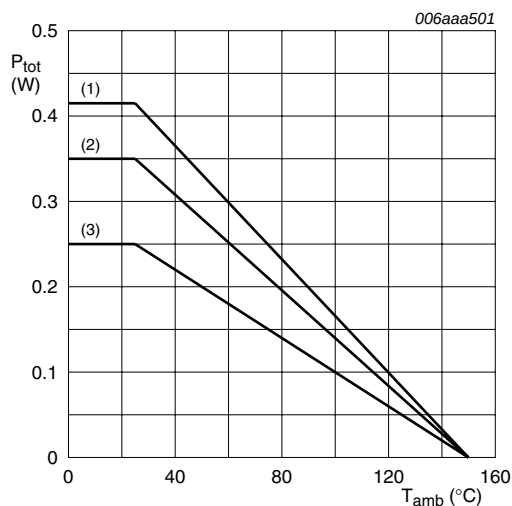
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter	-	80	V
V_{CEO}	collector-emitter voltage	open base	-	60	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current (DC)		[1] -	750	mA
			[2] -	930	mA
			[3] -	1	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	2	A
I_B	base current (DC)		-	300	mA
I_{BM}	peak base current	single pulse; $t_p \leq 1$ ms	-	1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1] -	250	mW
			[2] -	350	mW
			[3] -	415	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.



- (1) Ceramic PCB, Al₂O₃, standard footprint
- (2) FR4 PCB, mounting pad for collector 1 cm²
- (3) FR4 PCB, standard footprint

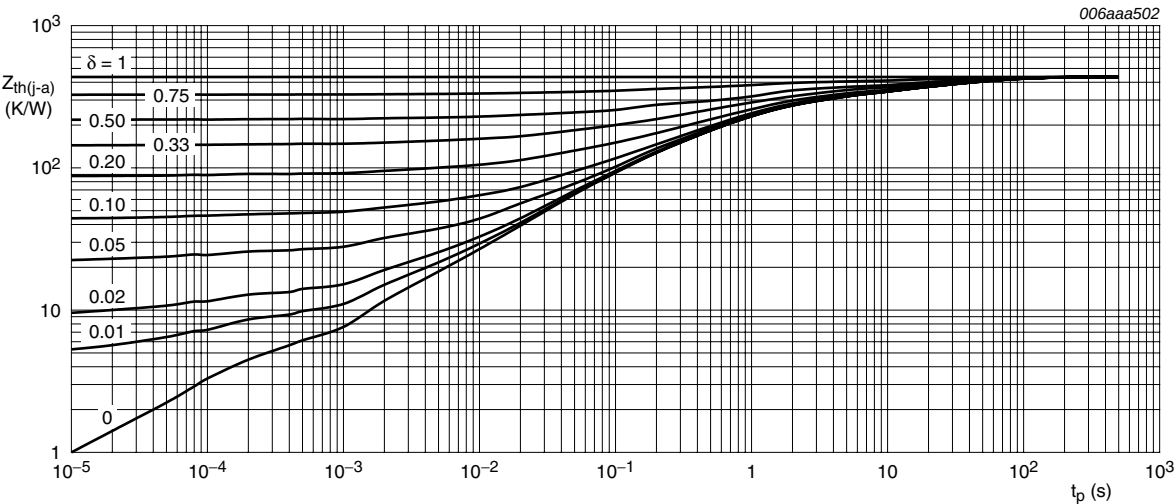
Fig 1. Power derating curves

6. Thermal characteristics

Table 6. Thermal characteristics

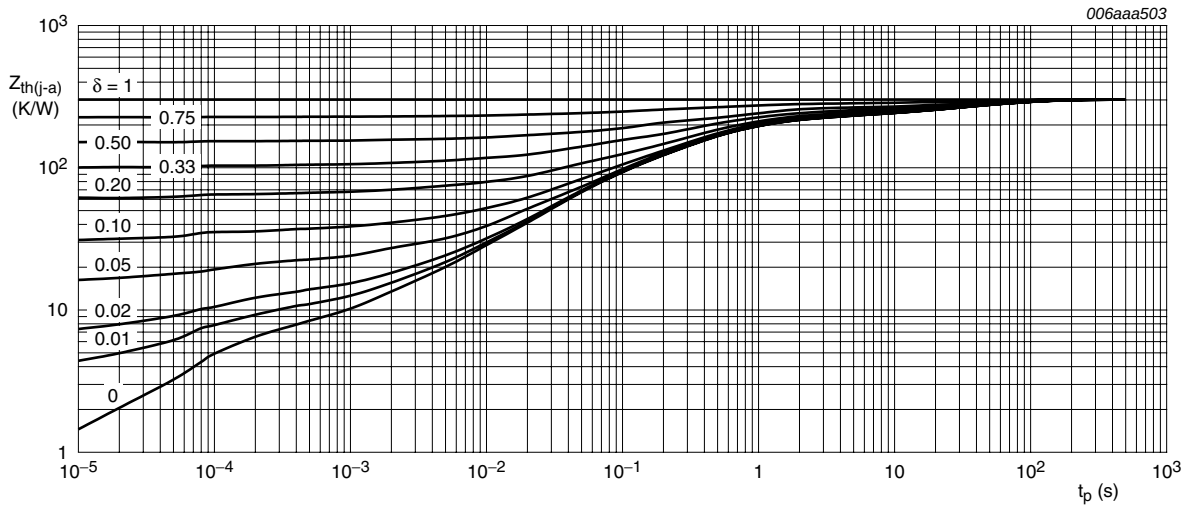
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] -	-	500	K/W
			[2] -	-	357	K/W
			[3] -	-	301	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	150	K/W

- [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.



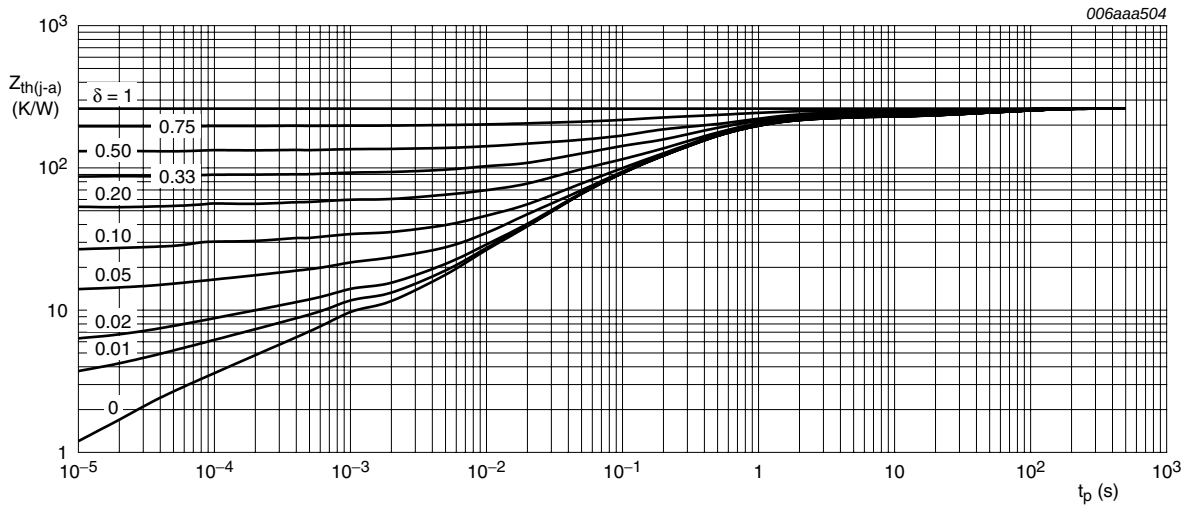
FR4 PCB, standard footprint

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

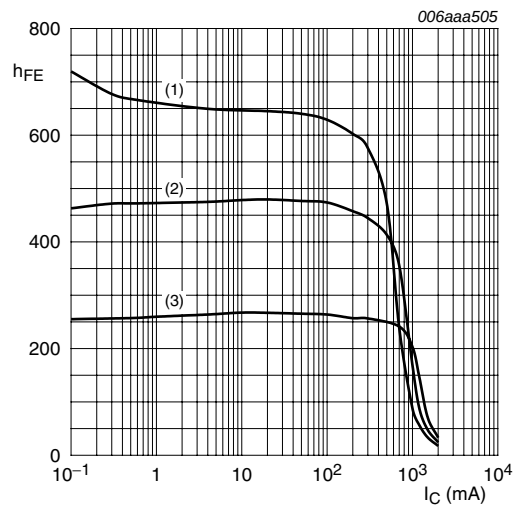
7. Characteristics

Table 7. Characteristics

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

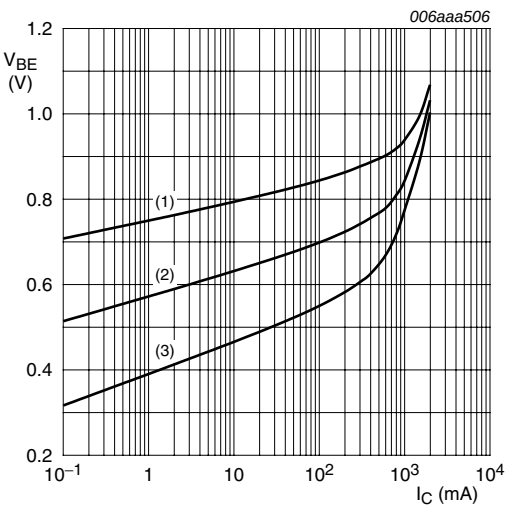
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 60\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_J = 150\text{ }^{\circ}\text{C}$	-	-	50	μA
I_{CES}	collector-emitter cut-off current	$V_{CE} = 60\text{ V}; V_{BE} = 0\text{ V}$	-	-	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	115	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	-	120	150	mV
		$I_C = 1\text{ A}; I_B = 100\text{ mA}$ [1]	-	230	280	mV
R_{CEsat}	collector-emitter saturation resistance	$I_C = 1\text{ A}; I_B = 100\text{ mA}$ [1]	-	230	280	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]	-	0.85	0.9	V
t_d	delay time	$I_C = 0.5\text{ A}; I_{Bon} = 25\text{ mA}; I_{Boff} = -25\text{ mA}$	-	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	$V_{CB} = 10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$	-	5.5	10	pF

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



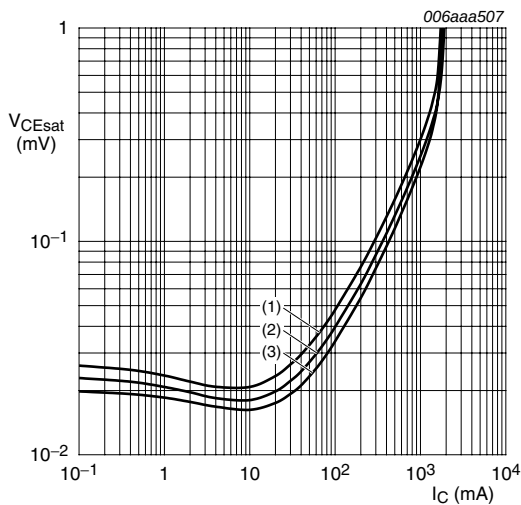
$V_{CE} = 5\text{ V}$
(1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



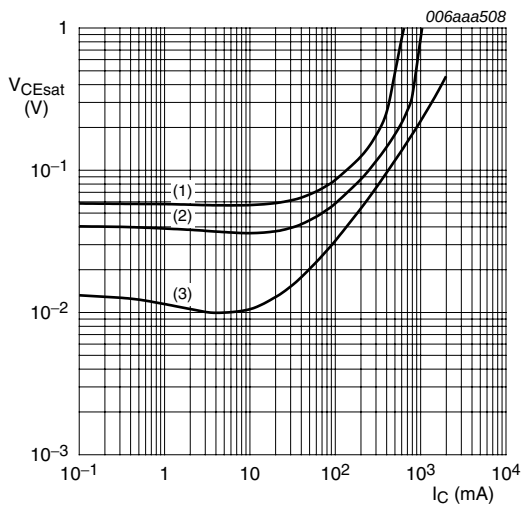
$V_{CE} = 5\text{ V}$
(1) $T_{amb} = -55\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



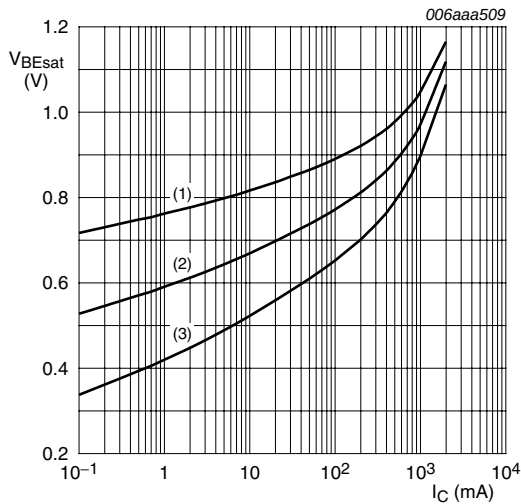
$I_C/I_B = 20$
(1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



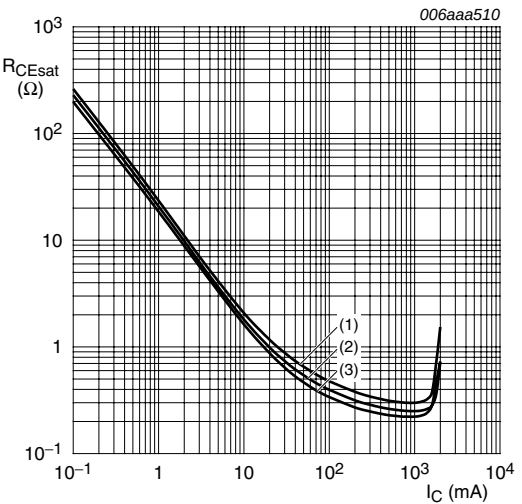
$T_{amb} = 25\text{ }^{\circ}\text{C}$
(1) $I_C/I_B = 100$
(2) $I_C/I_B = 50$
(3) $I_C/I_B = 10$

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



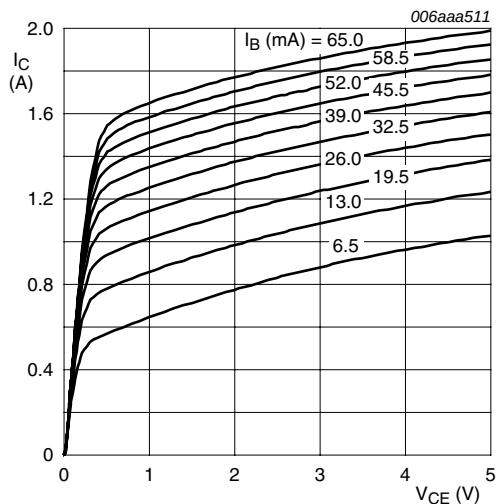
- $I_C/I_B = 20$
- (1) $T_{amb} = -55^\circ\text{C}$
 - (2) $T_{amb} = 25^\circ\text{C}$
 - (3) $T_{amb} = 100^\circ\text{C}$

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



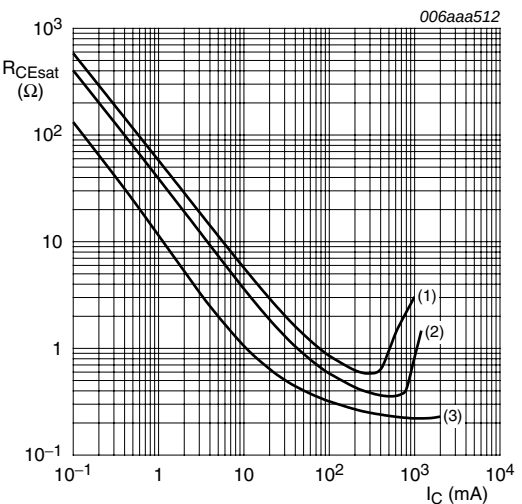
- $I_C/I_B = 20$
- (1) $T_{amb} = 100^\circ\text{C}$
 - (2) $T_{amb} = 25^\circ\text{C}$
 - (3) $T_{amb} = -55^\circ\text{C}$

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



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

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

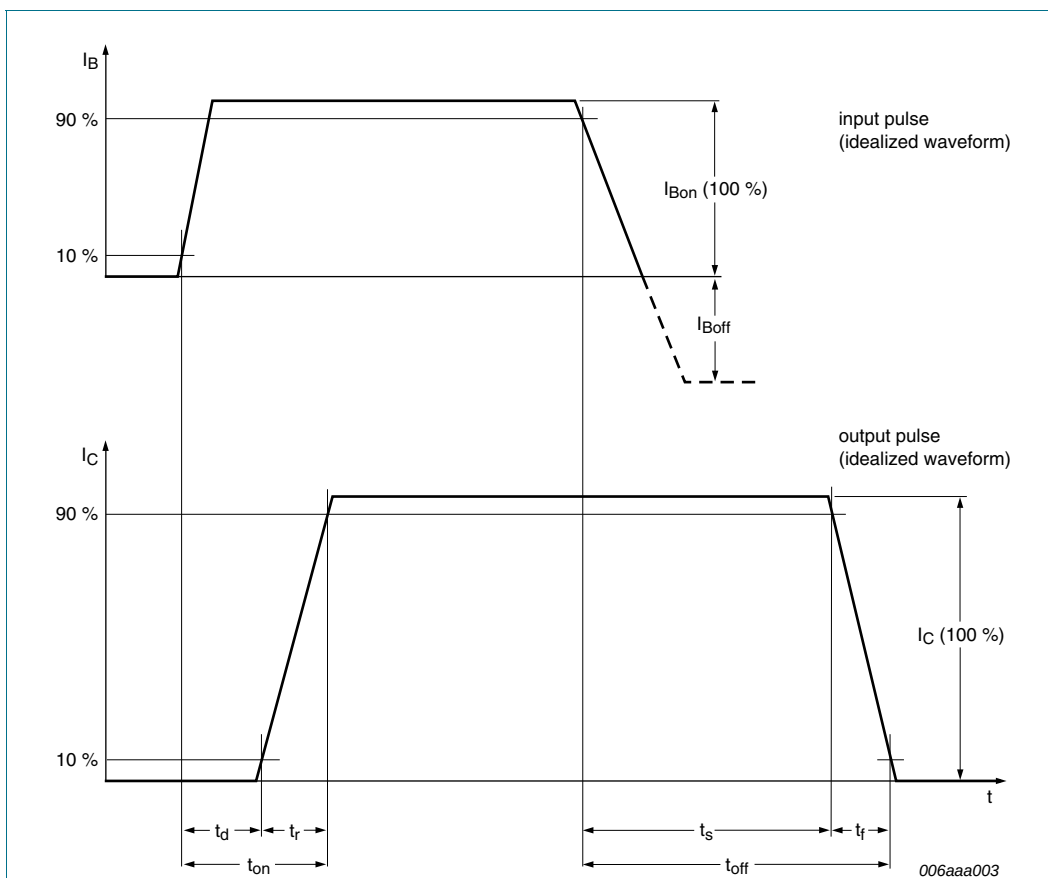
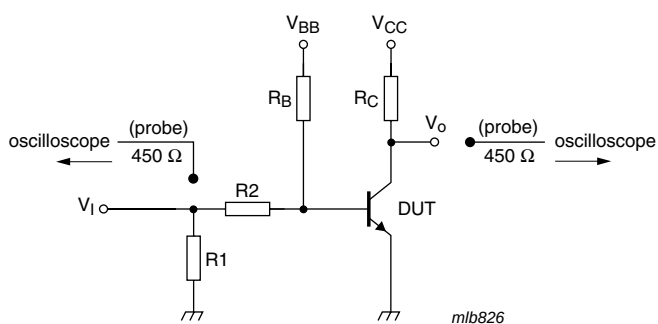


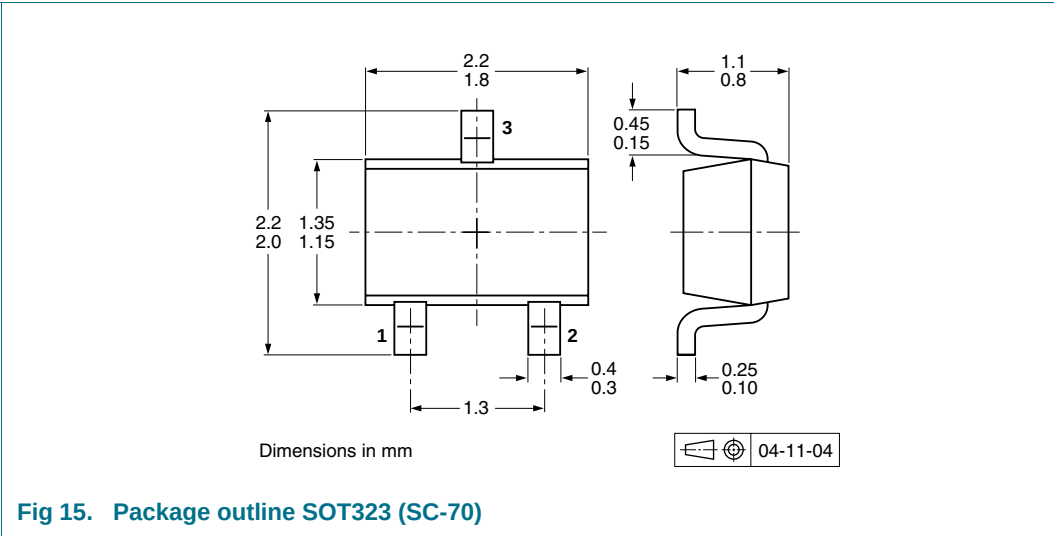
Fig 13. BISS transistor switching time definition



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

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
PBSS4160U	SOT323	4 mm pitch, 8 mm tape and reel	-115	-135

[1] For further information and the availability of packing methods, see [Section 14](#).

11. Soldering

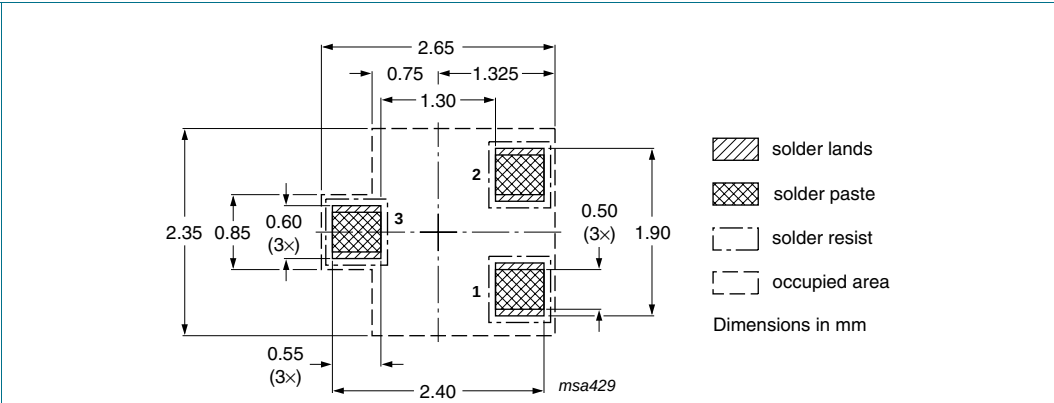


Fig 16. Reflow soldering footprint

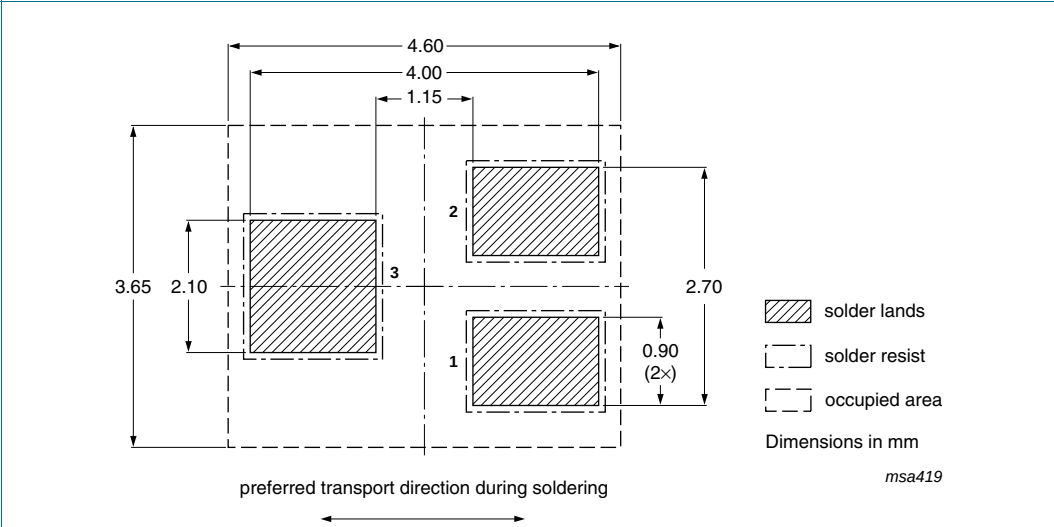


Fig 17. Wave soldering footprint

12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4160U_3	20091211	Product data sheet	-	PBSS4160U_2
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 16 "Reflow soldering footprint": updated • Figure 17 "Wave soldering footprint": updated			
PBSS4160U_2	20050719	Product data sheet	-	PBSS4160U_1
PBSS4160U_1	20040423	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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