

# PBSS2515E

15 V, 0.5 A NPN low  $V_{CEsat}$  (BISS) transistor

Rev. 02 — 21 April 2009

Product data sheet

## 1. Product profile

### 1.1 General description

NPN low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in an ultra small SOT416 (SC-75) Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS3515E.

### 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

- DC-to-DC conversion
- MOSFET gate driving
- Motor control
- Charging circuits
- Low power switches (e.g. motors, fans)
- Portable applications

### 1.4 Quick reference data

Table 1. Quick reference data

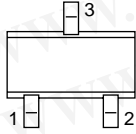
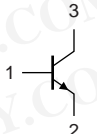
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	15	V
$I_C$	collector current		-	-	0.5	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	1	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = 500$ mA; $I_B = 50$ mA	[1]	300	500	m $\Omega$

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

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## 2. Pinning information

**Table 2. Pinning**

Pin	Description	Simplified outline	Graphic symbol
1	base		
2	emitter		
3	collector		

*sym021*

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
PBSS2515E	SC-75	plastic surface-mounted package; 3 leads	SOT416

## 4. Marking

**Table 4. Marking codes**

Type number	Marking code
PBSS2515E	1Q

## 5. Limiting values

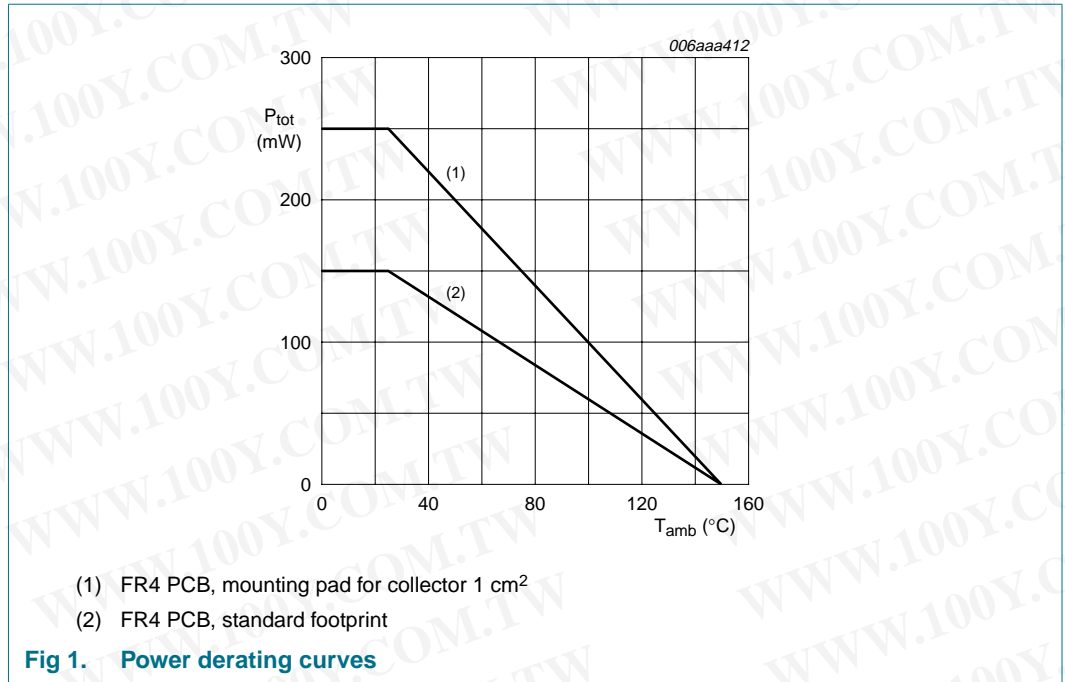
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	15	V
$V_{CEO}$	collector-emitter voltage	open base	-	15	V
$V_{EBO}$	emitter-base voltage	open collector	-	6	V
$I_C$	collector current		-	0.5	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	1	A
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1] - [2] -	150 250	mW 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 cm<sup>2</sup>.



## 6. Thermal characteristics

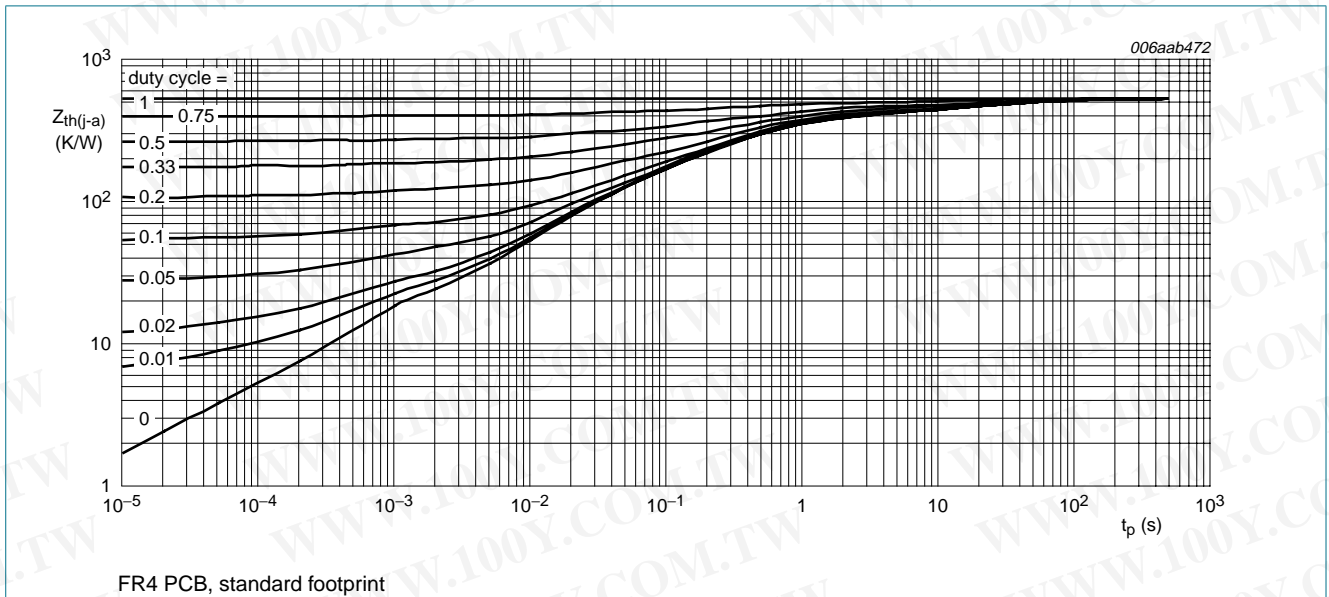
**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	833	K/W
			[2]	-	-	500	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	170	K/W	

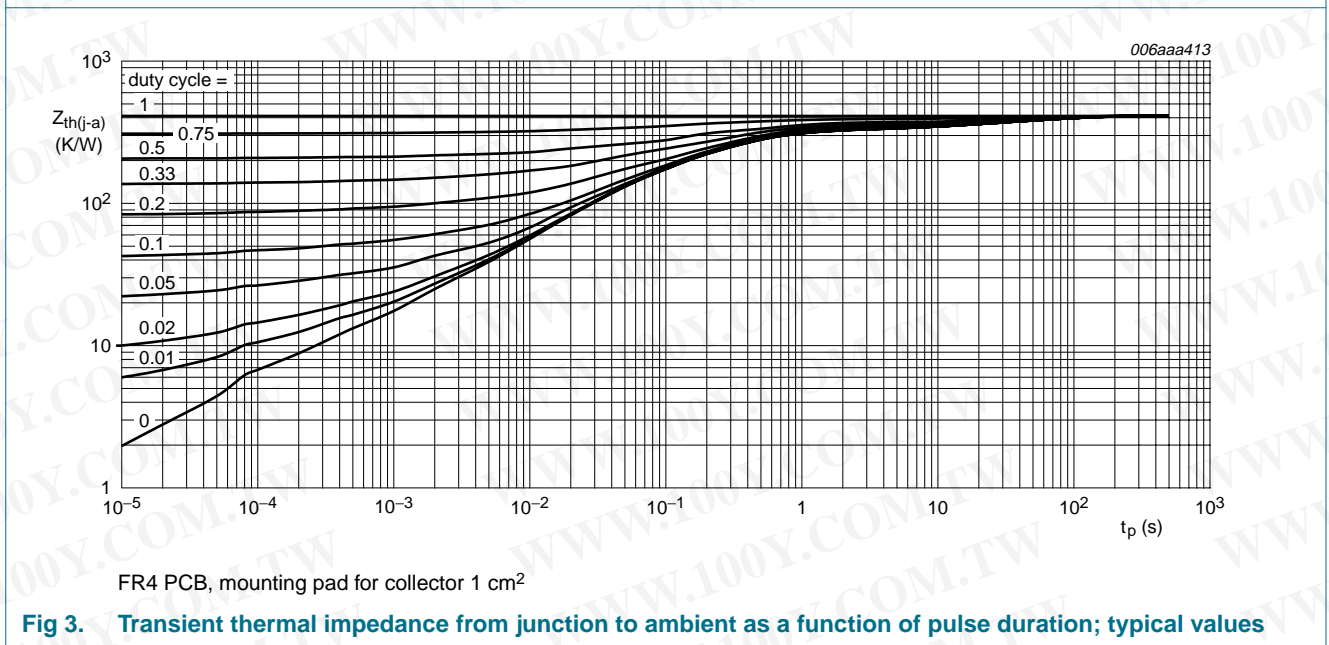
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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

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



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

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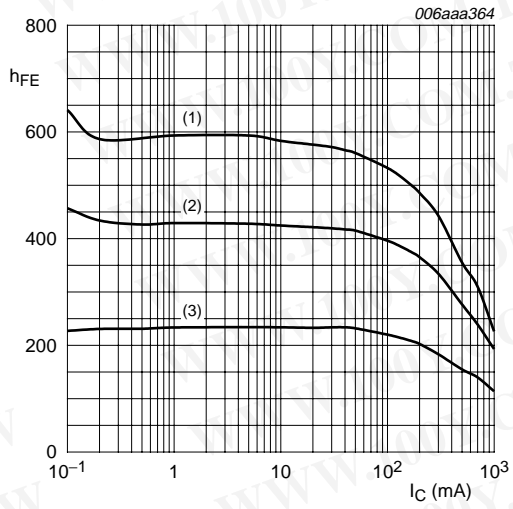
## 7. Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 15\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 15\text{ V}; I_E = 0\text{ A}; T_j = 150^\circ\text{C}$	-	-	50	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 2\text{ V}; I_C = 10\text{ mA}$	200	-	-	
		$V_{CE} = 2\text{ V}; I_C = 100\text{ mA}$	[1] 150	-	-	
		$V_{CE} = 2\text{ V}; I_C = 500\text{ mA}$	[1] 90	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$	-	-	25	mV
		$I_C = 200\text{ mA}; I_B = 10\text{ mA}$	-	-	150	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	[1] -	-	250	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	[1] -	300	500	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 500\text{ mA}; I_B = 50\text{ mA}$	[1] -	-	1.1	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 100\text{ mA}$	[1] -	-	0.9	V
$t_d$	delay time	$V_{CC} = 11\text{ V}; I_C = 250\text{ mA}; I_{Bon} = 12.5\text{ mA}; I_{Boff} = -12.5\text{ mA}$	-	10	-	ns
$t_r$	rise time		-	15	-	ns
$t_{on}$	turn-on time		-	25	-	ns
$t_s$	storage time		-	215	-	ns
$t_f$	fall time		-	34	-	ns
$t_{off}$	turn-off time		-	249	-	ns
$f_T$	transition frequency	$V_{CE} = 5\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}$	250	420	-	MHz
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$	-	4.4	6	pF

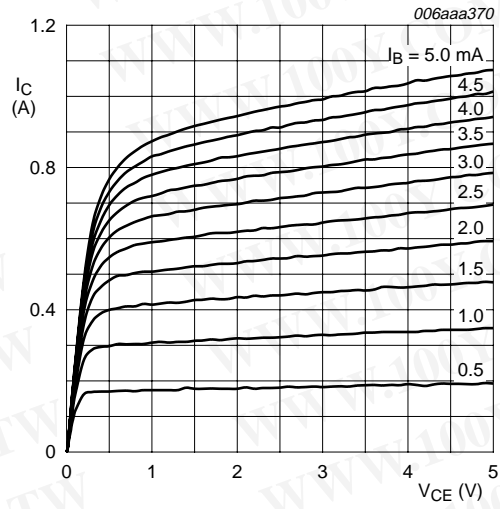
 [1] Pulse test:  $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02$ .

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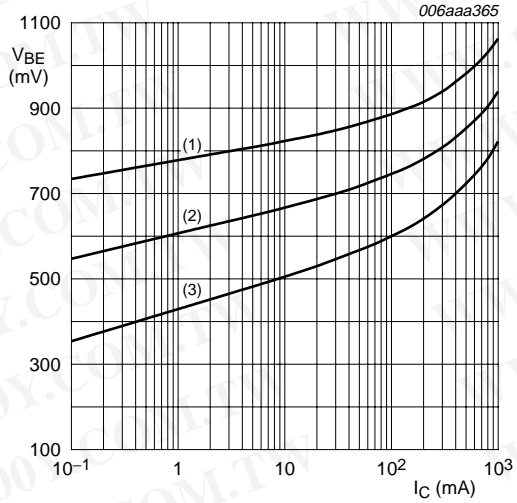
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

**Fig. 4. DC current gain as a function of collector current; typical values**



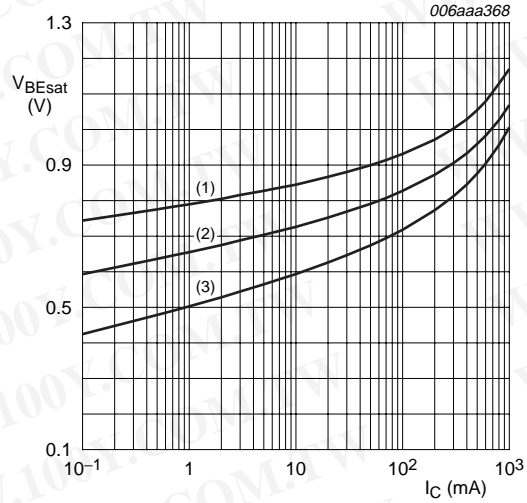
$T_{amb} = 25\text{ }^{\circ}\text{C}$

**Fig. 5. Collector current as a function of collector-emitter voltage; typical values**



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

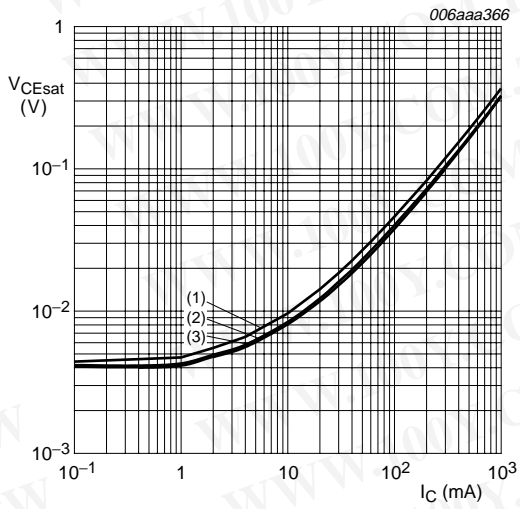
**Fig. 6. Base-emitter voltage as a function of collector current; typical values**



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

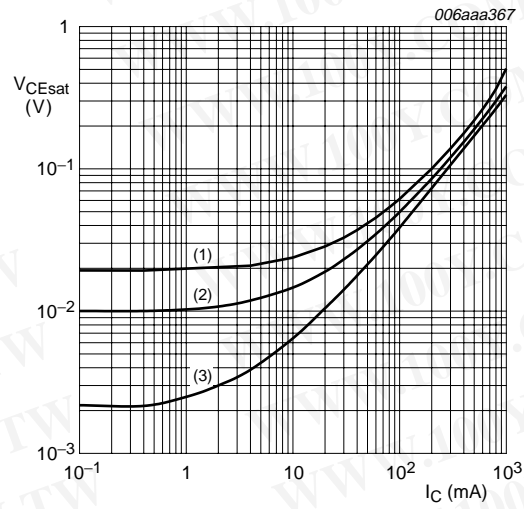
**Fig. 7. Base-emitter saturation voltage as a function of collector current; typical values**

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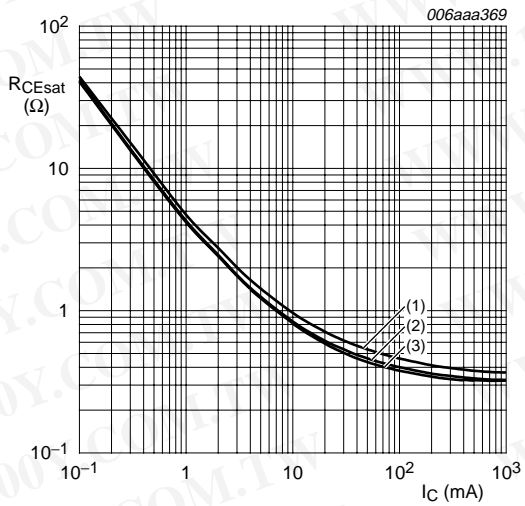
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ °C}$
  - (2)  $T_{amb} = 25\text{ °C}$
  - (3)  $T_{amb} = -55\text{ °C}$

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



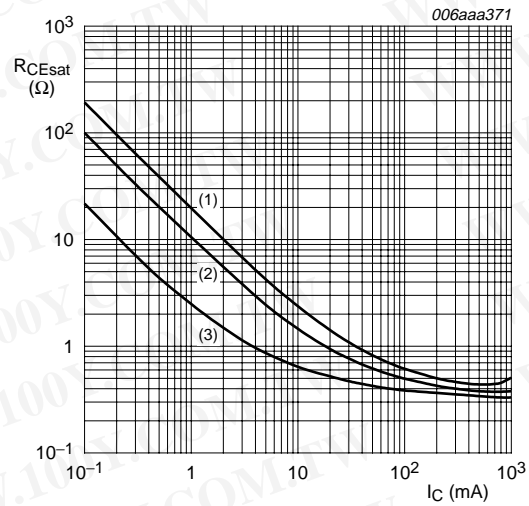
- $T_{amb} = 25\text{ °C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

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



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

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

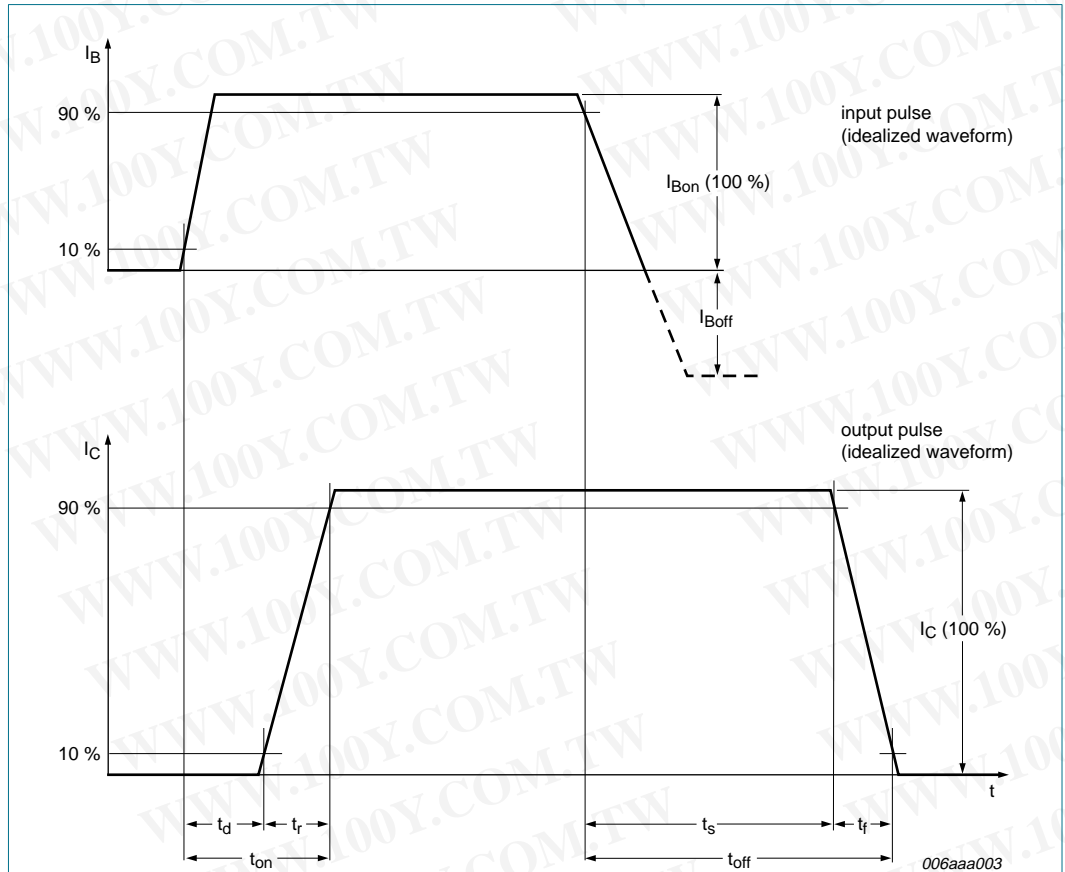


- $T_{amb} = 25\text{ °C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

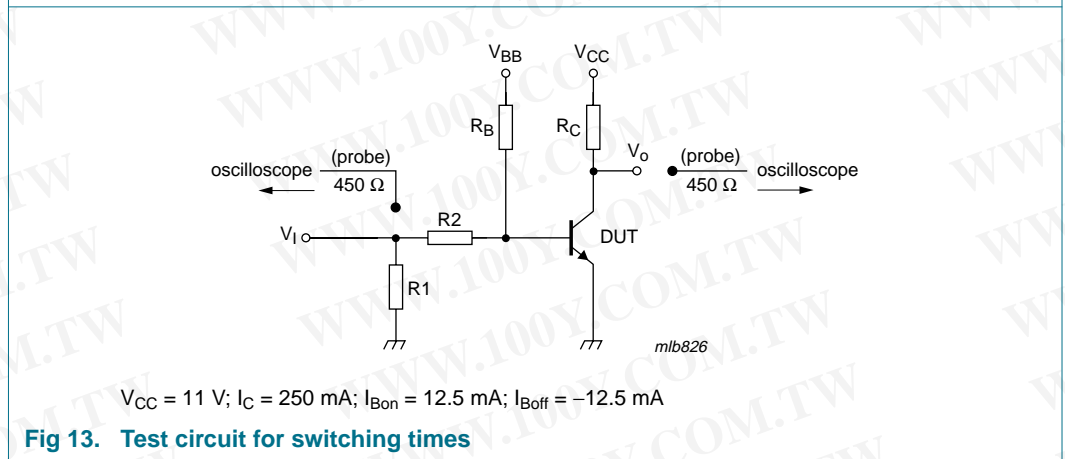
**Fig 11. Collector-emitter saturation resistance as a function of collector current; typical values**

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**8. Test information**



**Fig 12. BISS transistor switching time definition**

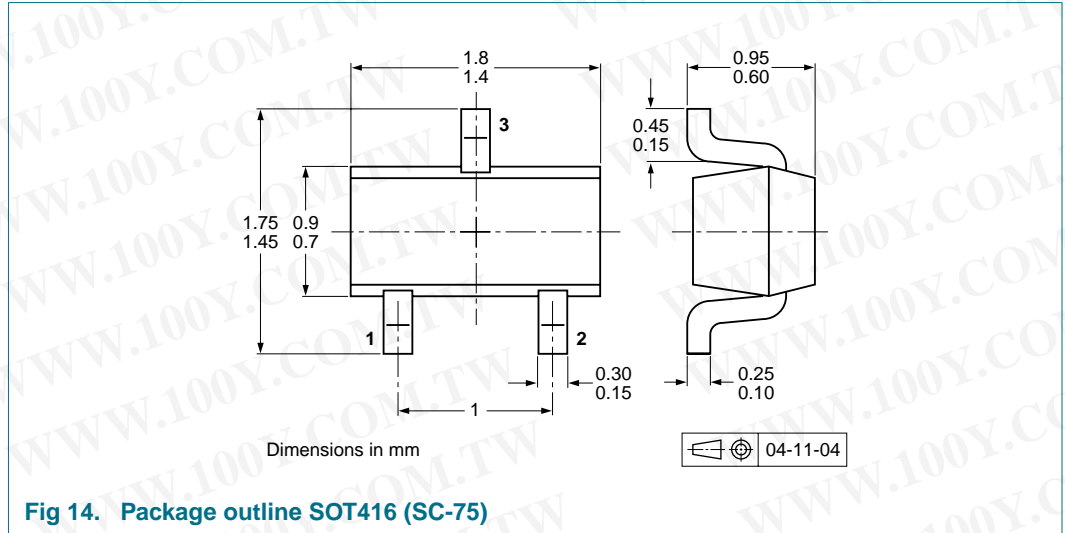


**Fig 13. Test circuit for switching times**

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**9. Package outline**



**10. Packing information**

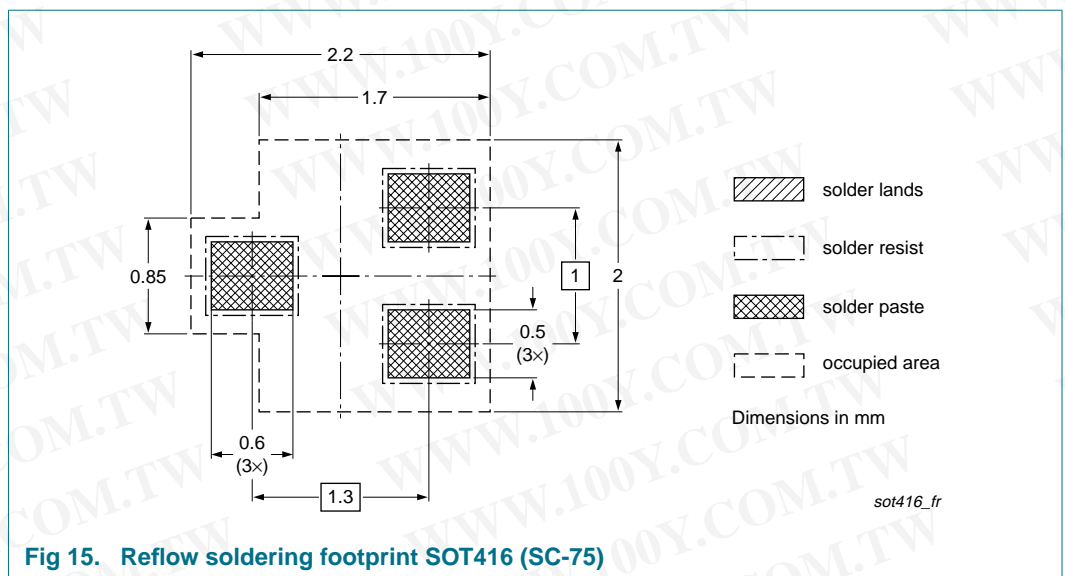
**Table 8. Packing methods**

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

Type number	Package	Description	Packing quantity	
			3000	10000
PBSS2515E	SOT416	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**



## 12. Revision history

**Table 9. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS2515E_2	20090421	Product data sheet	-	PBSS2515E_1
Modifications:				
<ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Figure 2</a>: added</li> <li>• <a href="#">Table 6 "Thermal characteristics"</a>: enhanced</li> <li>• <a href="#">Table 7 "Characteristics"</a>: switching times added</li> <li>• <a href="#">Figure 8</a> and <a href="#">9</a>: amended</li> <li>• <a href="#">Section 13 "Legal information"</a>: updated</li> </ul>				
PBSS2515E_1	20050418	Product data sheet	-	-

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### 13.1 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.
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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Date of release: 21 April 2009  
 Document identifier: PBSS2515E\_2