



**THE DATASHEET OF  
PBSS2515E,115**



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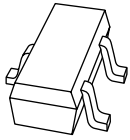
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Kind regards,

Team Nexperia



# 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

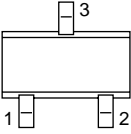
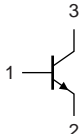
Table 1. Quick reference data

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;  $\delta \leq 0.02$ .

## 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		
	Name	Description	Version
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

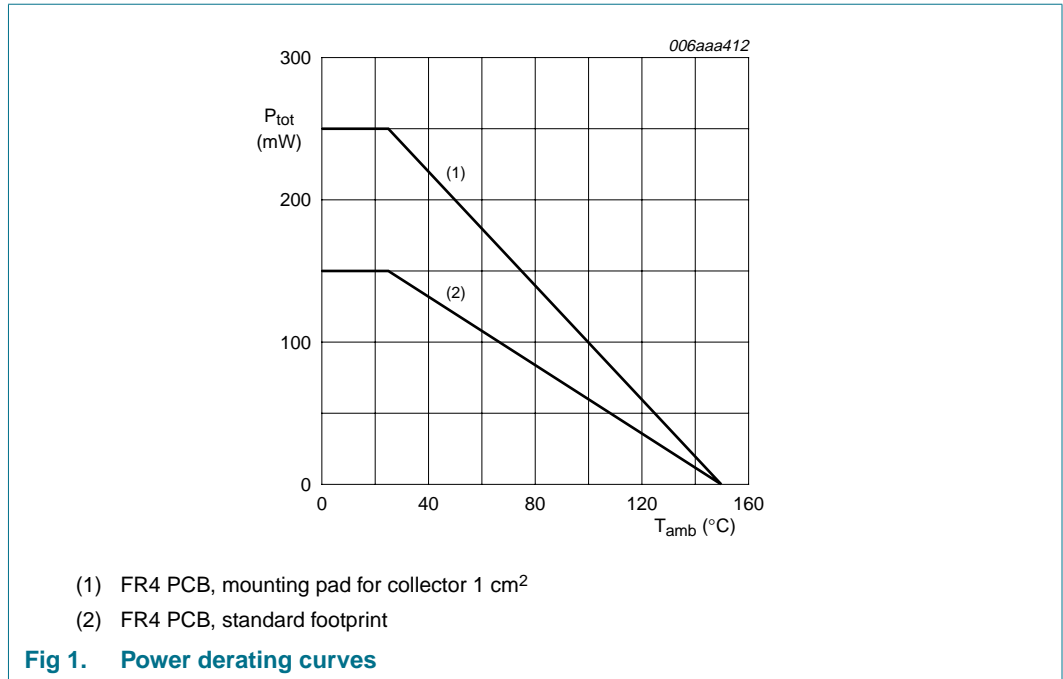
**Table 5. Limiting values**

*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]	150	mW
			[2]	250	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>.



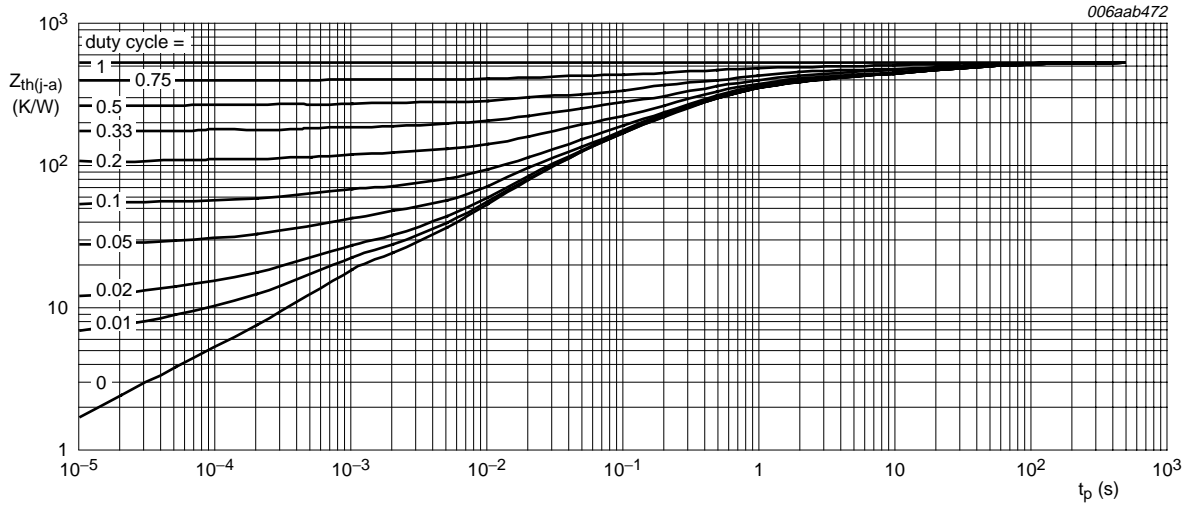
## 6. Thermal characteristics

**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	

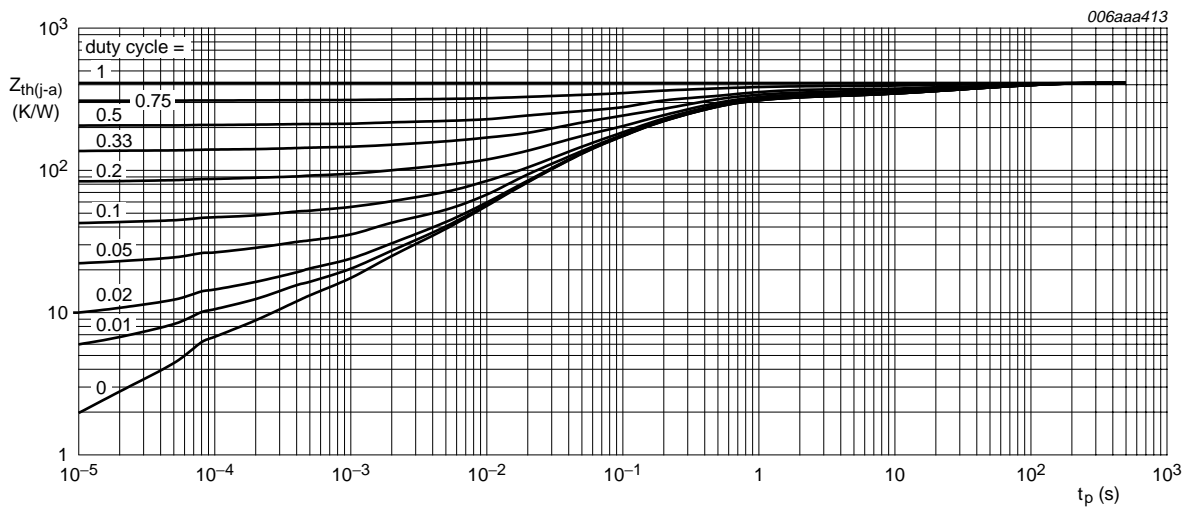
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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



FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

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

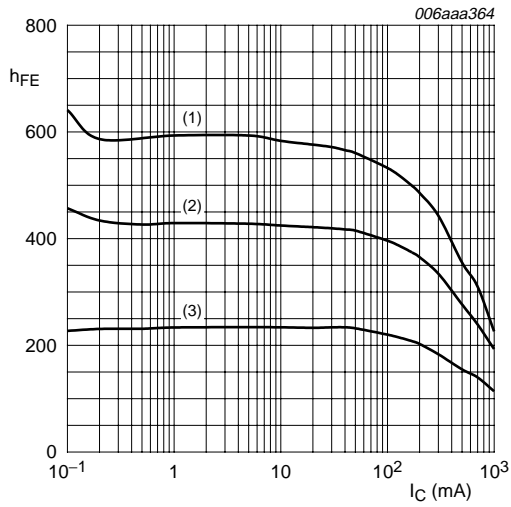
## 7. Characteristics

**Table 7. Characteristics**

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

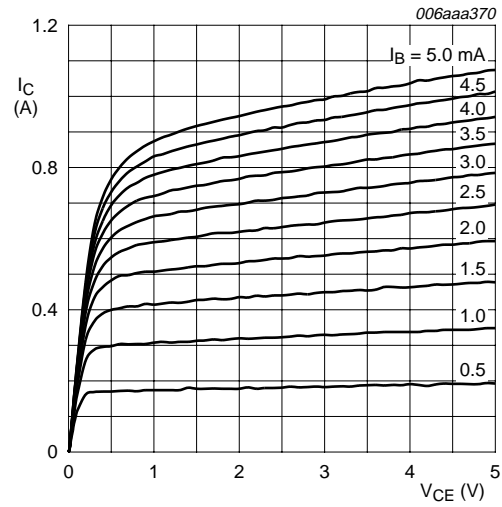
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 15\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 15\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	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	$\text{m}\Omega$
$V_{BEsat}$	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	$V_{CC} = 11\text{ V};$	-	10	-	ns
$t_r$	rise time	$I_C = 250\text{ mA};$	-	15	-	ns
$t_{on}$	turn-on time	$I_{Bon} = 12.5\text{ mA};$	-	25	-	ns
$t_s$	storage time	$I_{Boff} = -12.5\text{ mA}$	-	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	$\mu\text{F}$

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



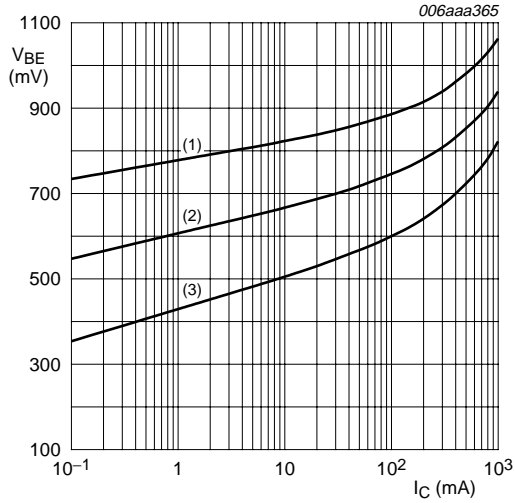
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



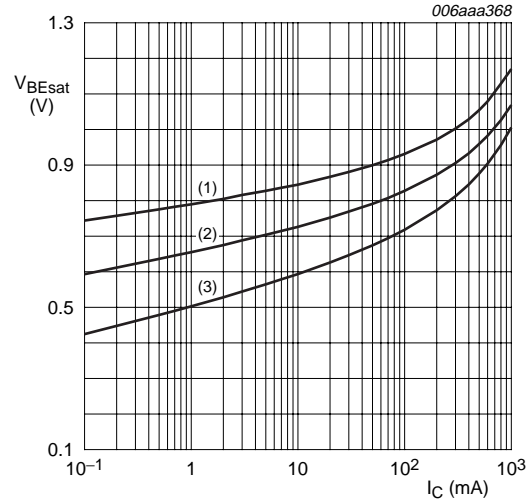
$T_{amb} = 25\text{ }^\circ\text{C}$

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



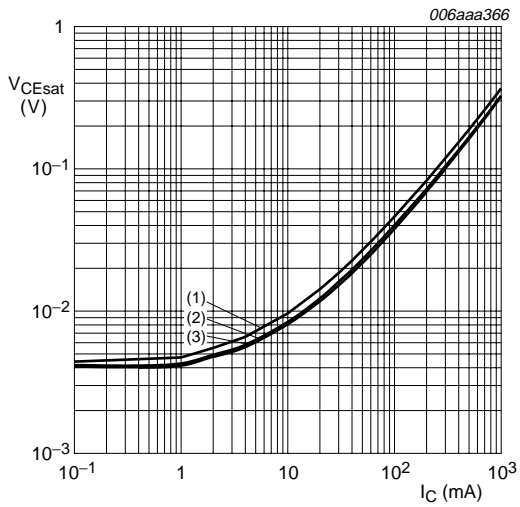
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



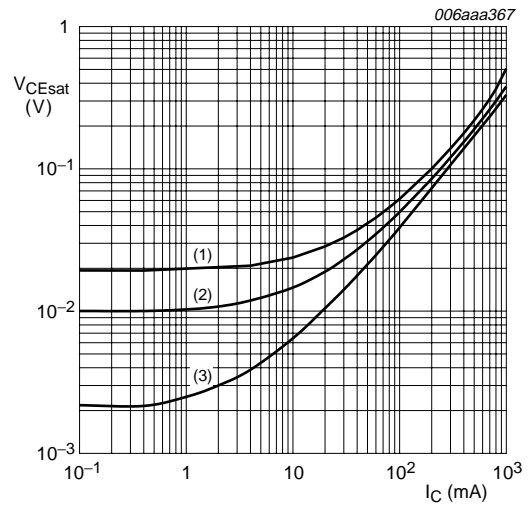
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



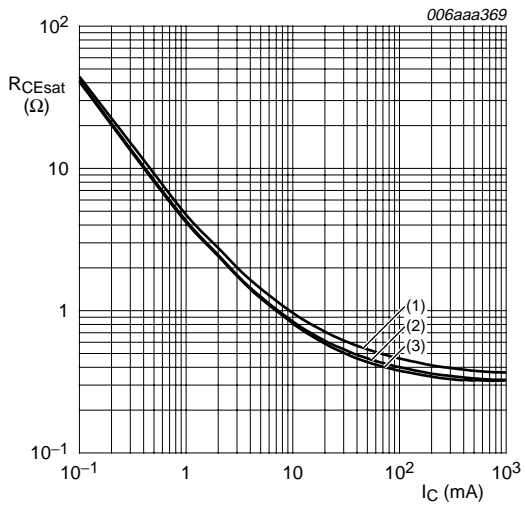
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ °C}$
  - (2)  $T_{amb} = 25\text{ °C}$
  - (3)  $T_{amb} = -55\text{ °C}$

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



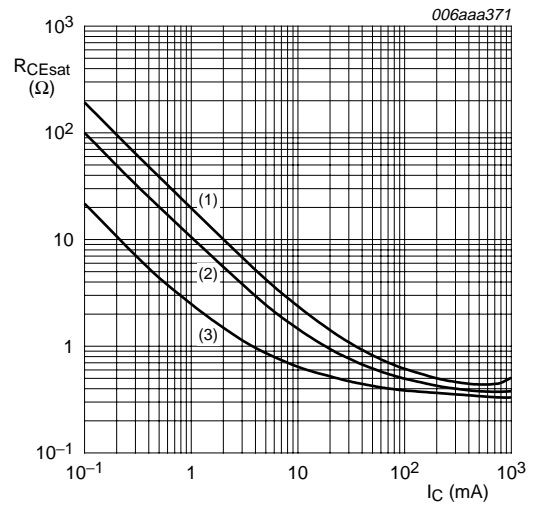
- $T_{amb} = 25\text{ °C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

**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)  $T_{amb} = -55\text{ °C}$

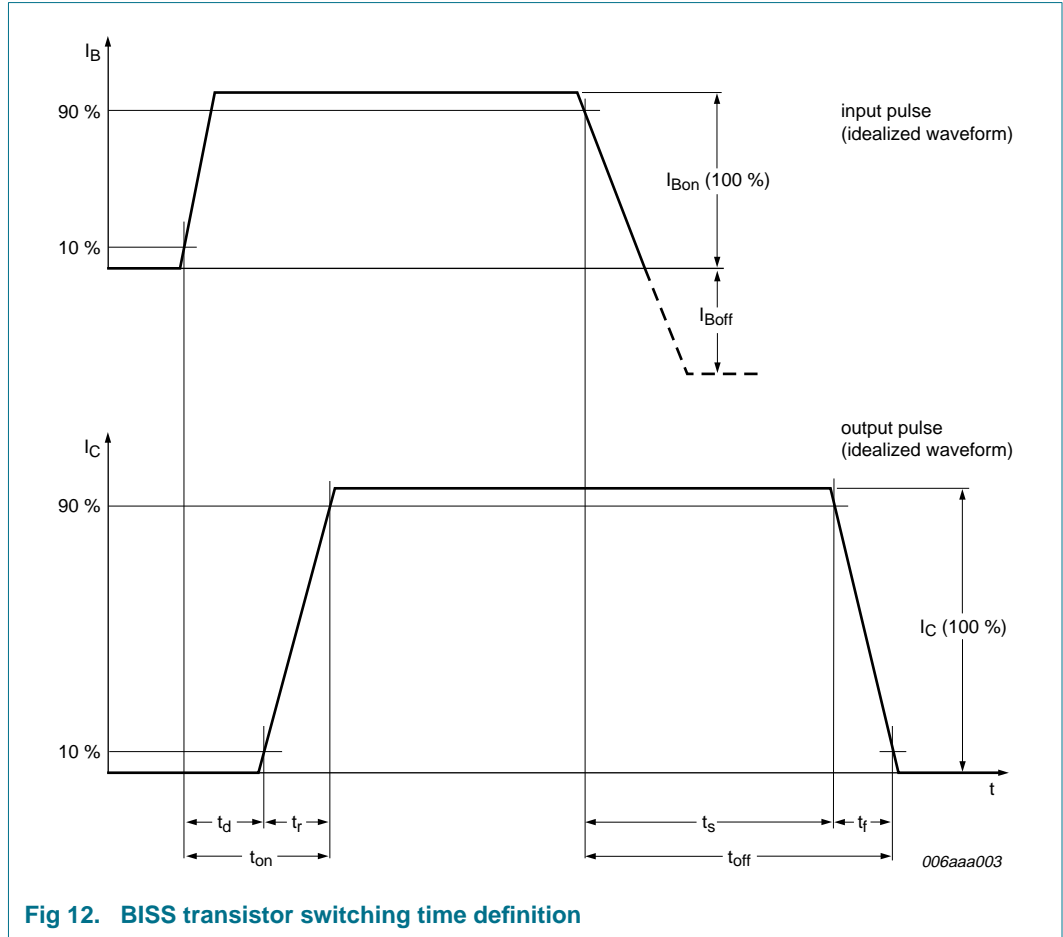
**Fig 10. Collector-emitter saturation resistance as a function of collector current; typical values**



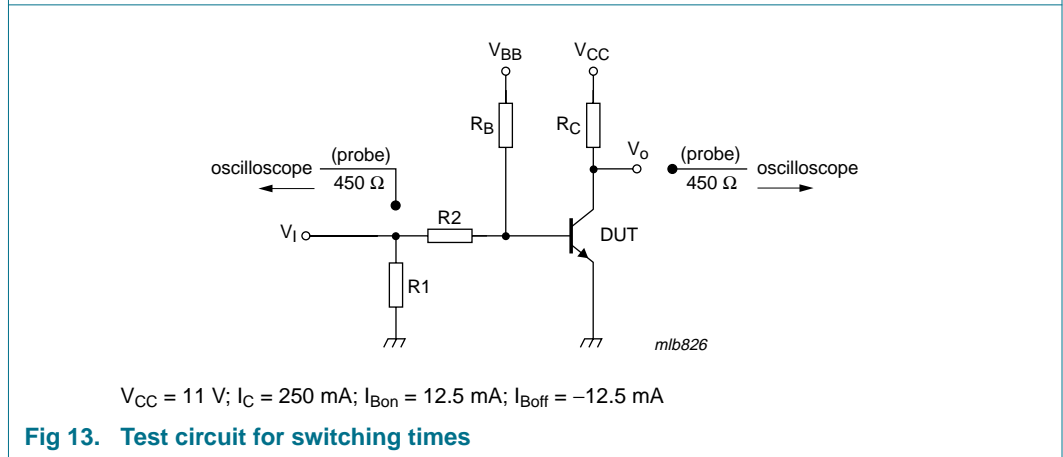
- $T_{amb} = 25\text{ °C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

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

**8. Test information**



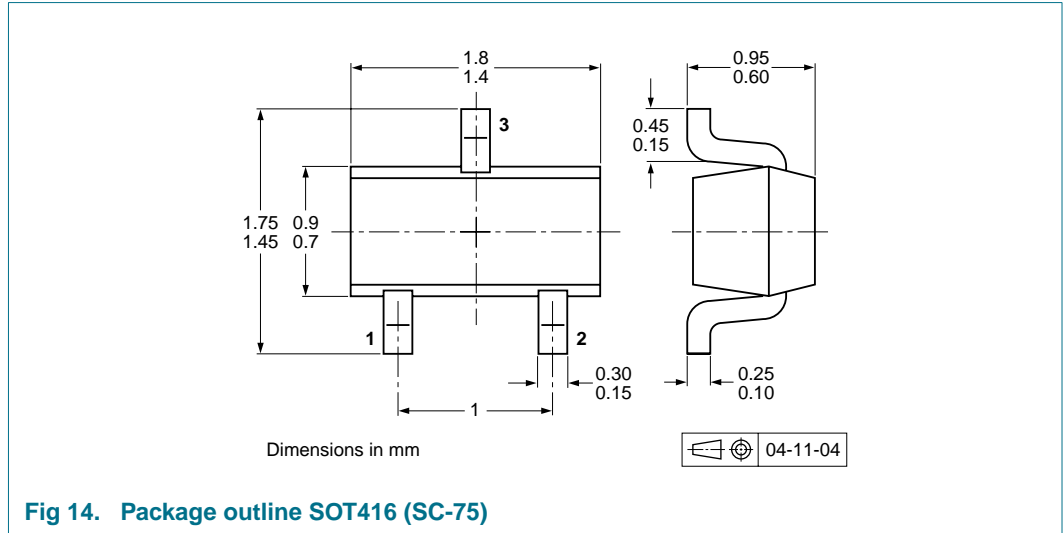
**Fig 12. BISS transistor switching time definition**



$V_{CC} = 11\text{ V}; I_C = 250\text{ mA}; I_{Bon} = 12.5\text{ mA}; I_{Boff} = -12.5\text{ mA}$

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

**9. Package outline**



**10. Packing information**

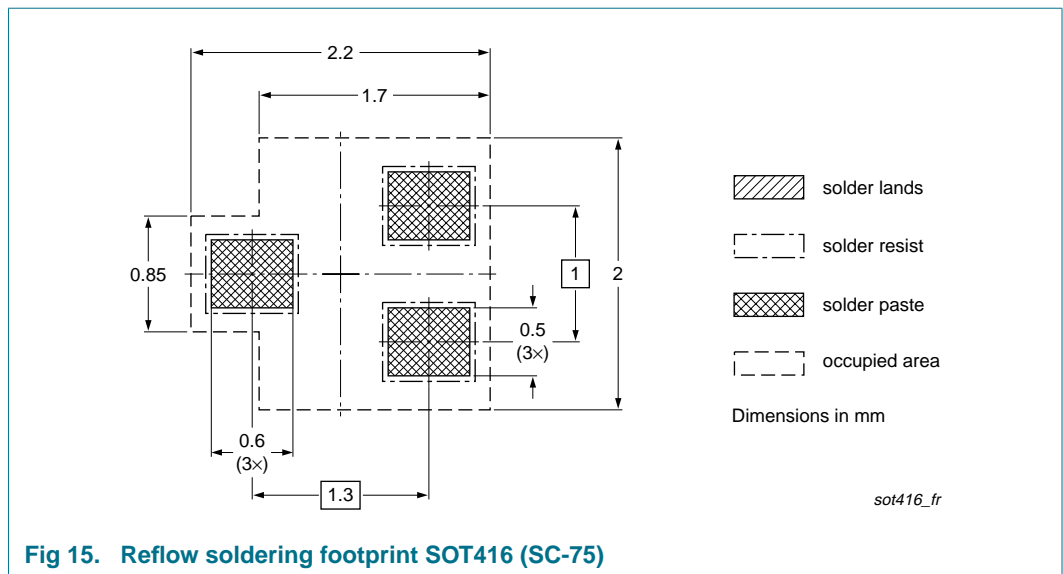
**Table 8. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<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	-	-

## 13. Legal information

### 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".

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