

# PBLS4005Y; PBLS4005V

40 V PNP BISS loadswitch

Rev. 03 — 16 February 2009

Product data sheet

## 1. Product profile

### 1.1 General description

PNP low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor and NPN Resistor-Equipped Transistor (RET) in one package.

Table 1. Product overview

Type number	Package	
	NXP	JEITA
PBLS4005Y	SOT363	SC-88
PBLS4005V	SOT666	-

### 1.2 Features

- Low  $V_{CEsat}$  (BISS) and resistor-equipped transistor in one package
- Low threshold voltage (<1 V) compared to MOSFET
- Low drive power required
- Space-saving solution
- Reduction of component count

### 1.3 Applications

- Supply line switches
- Battery charger switches
- High-side switches for LEDs, drivers and backlights
- Portable equipment

### 1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1; PNP low <math>V_{CEsat}</math> transistor</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	-40	V
$I_C$	collector current		-	-	-500	mA
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -500$ mA; $I_B = -50$ mA	<a href="#">[1]</a> -	440	700	m $\Omega$
<b>TR2; NPN resistor-equipped transistor</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	50	V

Table 2. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_O$	output current		-	-	100	mA
R1	bias resistor 1 (input)		33	47	61	k $\Omega$
R2/R1	bias resistor ratio		0.8	1	1.2	

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

## 2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	emitter TR1	<p>001aab555</p>	<p>sym036</p>
2	base TR1		
3	output (collector) TR2		
4	GND (emitter) TR2		
5	input (base) TR2		
6	collector TR1		

## 3. Ordering information

Table 4. Ordering information

Type number	Package		Version
	Name	Description	
PBLS4005Y	SC-88	plastic surface-mounted package; 6 leads	SOT363
PBLS4005V	-	plastic surface-mounted package; 6 leads	SOT666

## 4. Marking

Table 5. Marking codes

Type number	Marking code <sup>[1]</sup>
PBLS4005Y	S5*
PBLS4005V	K5

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

## 5. Limiting values

**Table 6. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
<b>TR1; PNP low <math>V_{CEsat}</math> transistor</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	-40	V
$V_{CEO}$	collector-emitter voltage	open base	-	-40	V
$V_{EBO}$	emitter-base voltage	open collector	-	-6	V
$I_C$	collector current		-	-500	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-1	A
$I_B$	base current		-	-50	mA
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	-100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	200	mW
<b>TR2; NPN resistor-equipped transistor</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	50	V
$V_{CEO}$	collector-emitter voltage	open base	-	50	V
$V_{EBO}$	emitter-base voltage	open collector	-	10	V
$V_I$	input voltage				
	positive		-	+40	V
	negative		-	-10	V
$I_O$	output current		-	100	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	200	mW
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	-	300	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 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

## 6. Thermal characteristics

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per device</b>						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air				
	SOT363		[1]	-	416	K/W
	SOT666		[1][2]	-	416	K/W

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

[2] Reflow soldering is the only recommended soldering method.

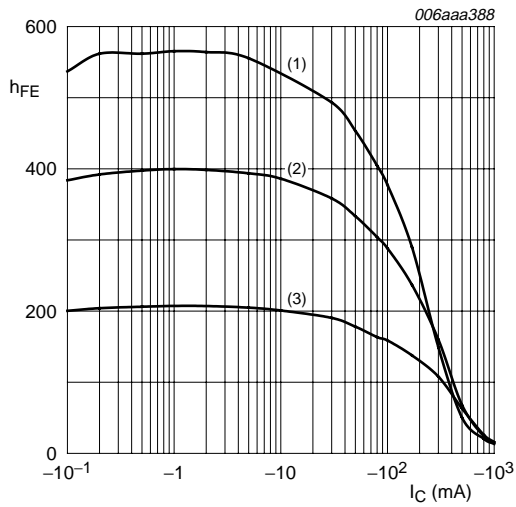
**7. Characteristics**

**Table 8. Characteristics**

*T<sub>amb</sub> = 25 °C unless otherwise specified.*

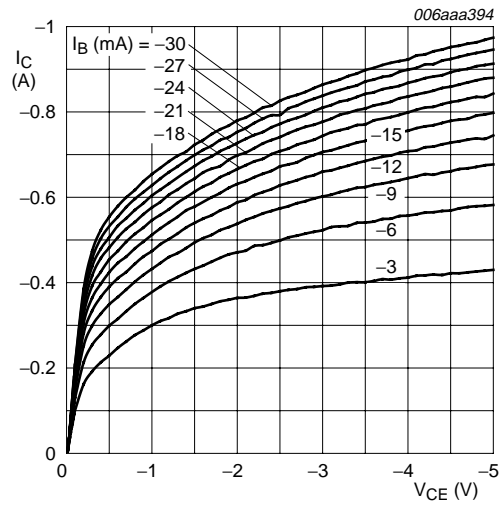
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1; PNP low V<sub>CEsat</sub> transistor</b>						
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = -40 V; I <sub>E</sub> = 0 A	-	-	-100	nA
		V <sub>CB</sub> = -40 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	-50	μA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = -5 V; I <sub>C</sub> = 0 A	-	-	-100	nA
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = -2 V; I <sub>C</sub> = -10 mA	200	-	-	
		V <sub>CE</sub> = -2 V; I <sub>C</sub> = -100 mA	[1] 150	-	-	
		V <sub>CE</sub> = -2 V; I <sub>C</sub> = -500 mA	[1] 40	-	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = -10 mA; I <sub>B</sub> = -0.5 mA	-	-	-50	mV
		I <sub>C</sub> = -100 mA; I <sub>B</sub> = -5 mA	-	-	-130	mV
		I <sub>C</sub> = -200 mA; I <sub>B</sub> = -10 mA	-	-	-200	mV
		I <sub>C</sub> = -500 mA; I <sub>B</sub> = -50 mA	[1] -	-	-350	mV
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = -500 mA; I <sub>B</sub> = -50 mA	[1] -	440	700	mΩ
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = -500 mA; I <sub>B</sub> = -50 mA	[1] -	-	-1.2	V
V <sub>BEon</sub>	base-emitter turn-on voltage	V <sub>CE</sub> = -2 V; I <sub>C</sub> = -100 mA	[1] -	-	-1.1	V
f <sub>T</sub>	transition frequency	I <sub>C</sub> = -100 mA; V <sub>CE</sub> = -5 V; f = 100 MHz	100	300	-	MHz
C <sub>c</sub>	collector capacitance	V <sub>CB</sub> = -10 V; I <sub>E</sub> = i <sub>e</sub> = 0 A; f = 1 MHz	-	-	10	pF
<b>TR2; NPN resistor-equipped transistor</b>						
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 50 V; I <sub>E</sub> = 0 A	-	-	100	nA
I <sub>CEO</sub>	collector-emitter cut-off current	V <sub>CE</sub> = 30 V; I <sub>B</sub> = 0 A	-	-	1	μA
		V <sub>CE</sub> = 30 V; I <sub>B</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	50	μA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A	-	-	90	μA
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 5 mA	80	-	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = 10 mA; I <sub>B</sub> = 0.5 mA	-	-	150	mV
V <sub>I(off)</sub>	off-state input voltage	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 100 μA	-	1.2	0.8	V
V <sub>I(on)</sub>	on-state input voltage	V <sub>CE</sub> = 0.3 V; I <sub>C</sub> = 5 mA	3	1.6	-	V
R1	bias resistor 1 (input)		33	47	61	kΩ
R2/R1	bias resistor ratio		0.8	1	1.2	
C <sub>c</sub>	collector capacitance	V <sub>CB</sub> = 10 V; I <sub>E</sub> = i <sub>e</sub> = 0 A; f = 1 MHz	-	-	2.5	pF

[1] Pulse test: t<sub>p</sub> ≤ 300 μs; δ ≤ 0.02.



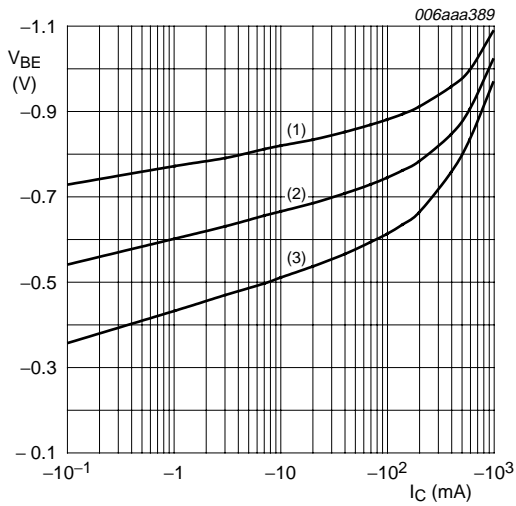
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 1. TR1 (PNP): DC current gain as a function of collector current; typical values**



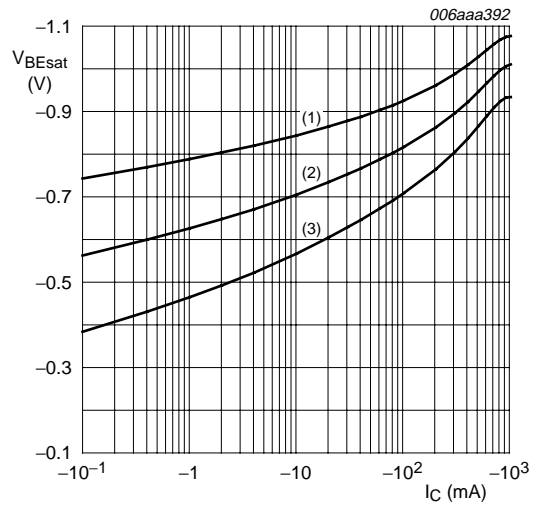
$T_{amb} = 25\text{ °C}$

**Fig 2. TR1 (PNP): Collector current as a function of collector-emitter voltage; typical values**



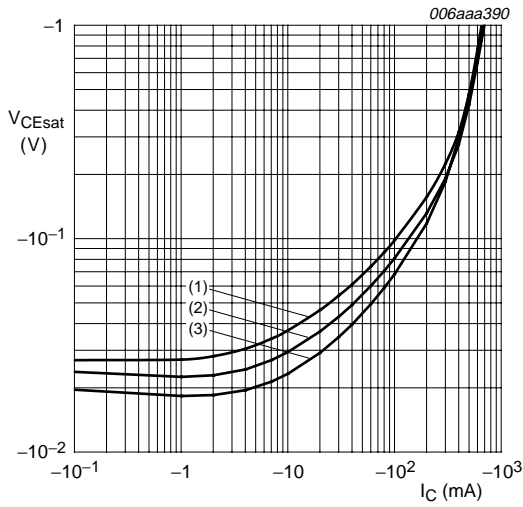
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 3. TR1 (PNP): Base-emitter voltage as a function of collector current; typical values**



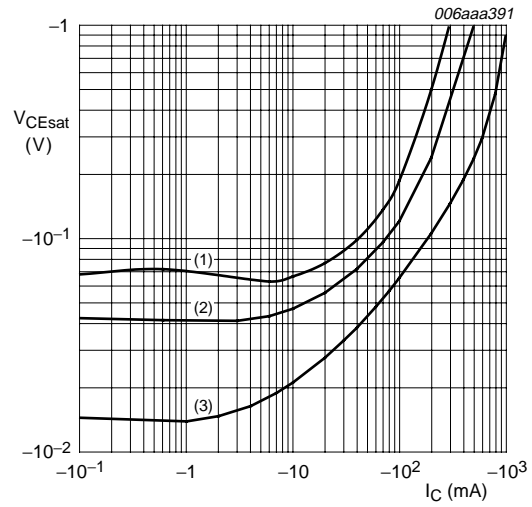
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 4. TR1 (PNP): Base-emitter saturation voltage as a function of collector current; typical values**



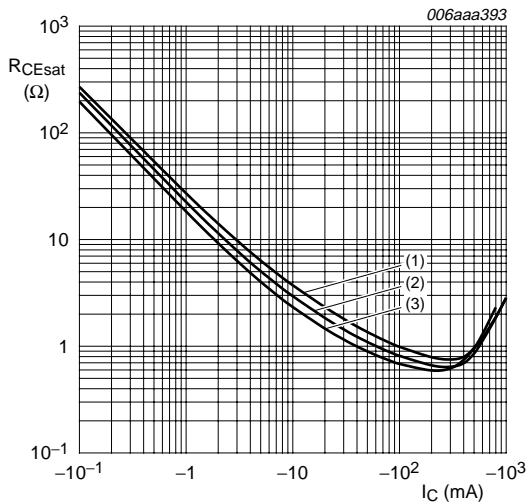
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 5. TR1 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values**



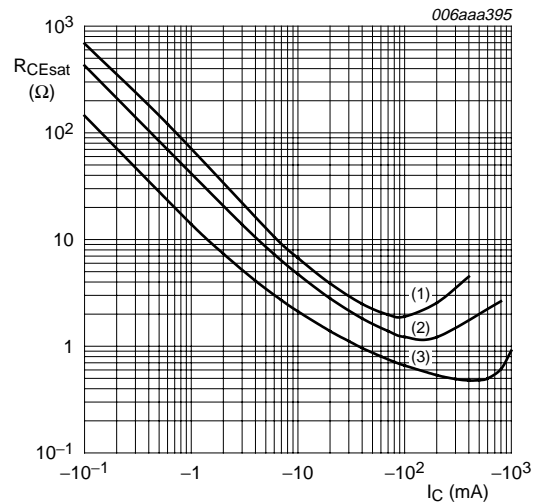
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig 6. TR1 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values**



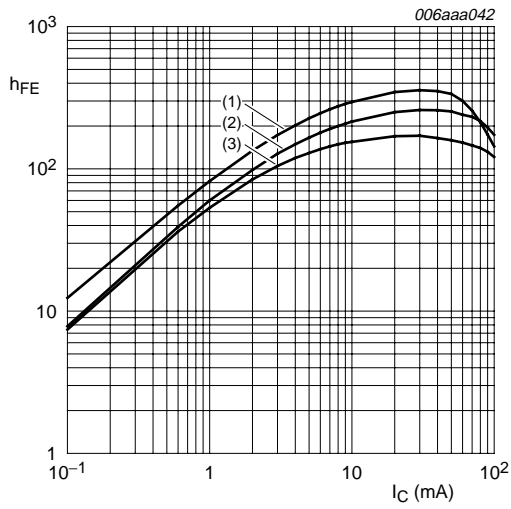
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 7. TR1 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values**



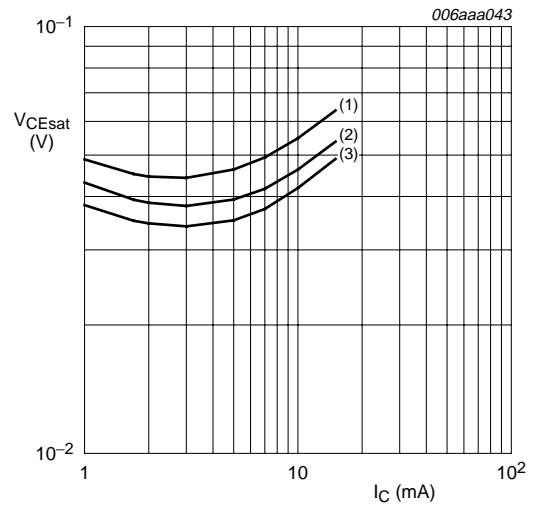
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig 8. TR1 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values**



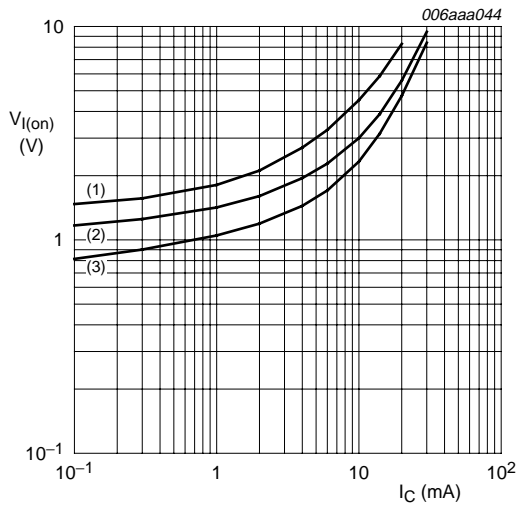
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 9. TR2 (NPN): DC current gain as a function of collector current; typical values**



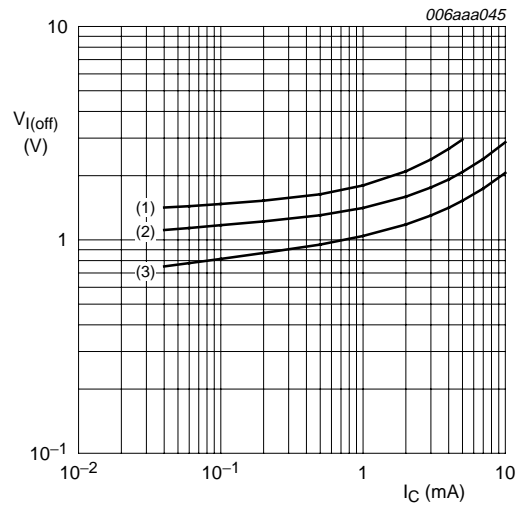
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 10. TR2 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values**



$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 11. TR2 (NPN): On-state input voltage as a function of collector current; typical values**



$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 12. TR2 (NPN): Off-state input voltage as a function of collector current; typical values**

### 8. Package outline

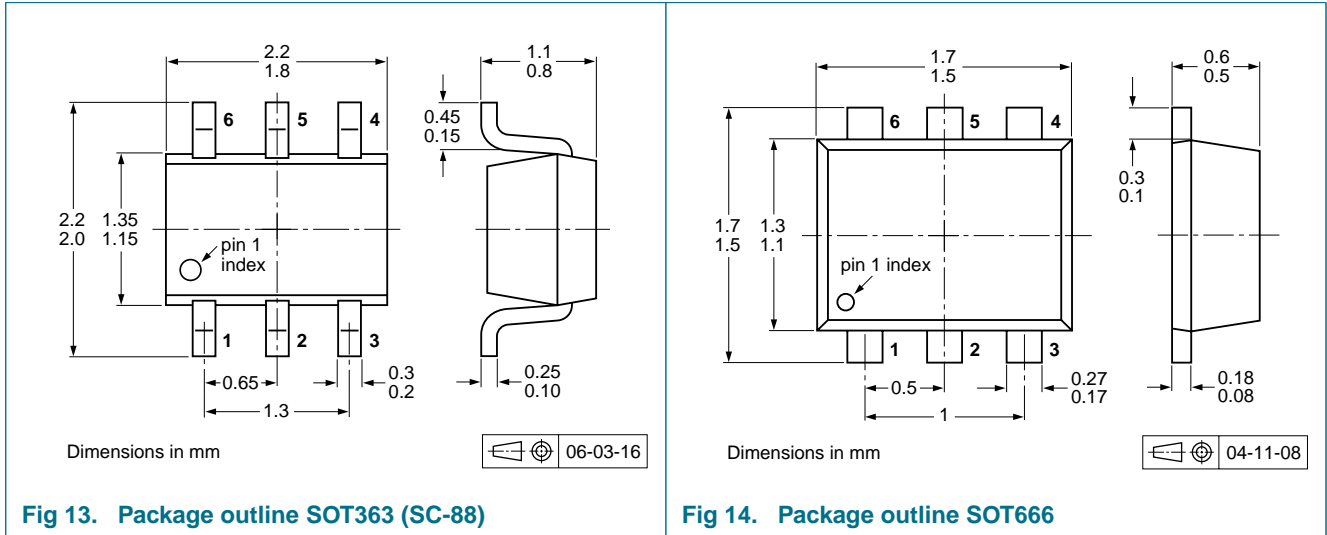


Fig 13. Package outline SOT363 (SC-88)

Fig 14. Package outline SOT666

### 9. Packing information

Table 9. 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	4000	8000	10000
PBLS4005Y	SOT363	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
PBLS4005V	SOT666	2 mm pitch, 8 mm tape and reel	-	-	-315	-
		4 mm pitch, 8 mm tape and reel	-	-115	-	-

[1] For further information and the availability of packing methods, see [Section 12](#).

[2] T1: normal taping

[3] T2: reverse taping



## 10. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBLS4005Y_PBLS4005V_3	20090216	Product data sheet	-	PBLS4005Y_PBLS4005V_2
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 5</a>: y-axis value unit amended</li> <li>• <a href="#">Figure 6</a>: y-axis value unit amended</li> <li>• <a href="#">Section 11 “Legal information”</a>: updated</li> </ul>				
PBLS4005Y_PBLS4005V_2	20050713	Product data sheet	-	PBLS4005Y_PBLS4005V_1
PBLS4005Y_PBLS4005V_1	20041206	Product data sheet	-	-

## 11. Legal information

### 11.1 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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