

# PMP4501V; PMP4501G; PMP4501Y

NPN/NPN matched double transistors

Rev. 03 — 19 September 2006

Product data sheet

## 1. Product profile

### 1.1 General description

NPN/NPN matched double transistors in small Surface-Mounted Device (SMD) plastic packages. The transistors in the SOT666 and SOT363 (SC-88) packages are fully isolated internally.

Table 1. Product overview

Type number	Package		NPN/NPN $h_{FE1}/h_{FE2}$ 0.98 complement	PNP/PNP complement
	Philips	JEITA		
PMP4501V	SOT666	-	PMP4201V	PMP5501V
PMP4501G	SOT353	SC-88A	PMP4201G	PMP5501G
PMP4501Y	SOT363	SC-88	PMP4201Y	PMP5501Y

### 1.2 Features

- Current gain matching
- Base-emitter voltage matching
- Common emitter configuration for SOT353 types
- Application-optimized pinout

### 1.3 Applications

- Current mirror
- Differential amplifier

### 1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	45	V
$I_C$	collector current		-	-	100	mA
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V};$ $I_C = 2\text{ mA}$	200	290	450	

**Table 2. Quick reference data ...continued**

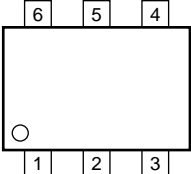
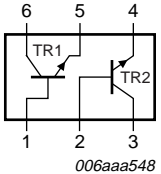
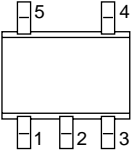
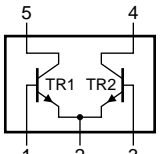
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per device</b>						
$h_{FE1}/h_{FE2}$	$h_{FE}$ matching	$V_{CE} = 5\text{ V};$ $I_C = 2\text{ mA}$	[1] 0.95	1	-	
$V_{BE1}-V_{BE2}$	$V_{BE}$ matching	$V_{CE} = 5\text{ V};$ $I_C = 2\text{ mA}$	[2] -	-	2	mV

[1] The smaller of the two values is taken as the numerator.

[2] The smaller of the two values is subtracted from the larger value.

## 2. Pinning information

**Table 3. Pinning**

Pin	Description	Simplified outline	Symbol
<b>SOT666; SOT363</b>			
1	base TR1		
2	base TR2		
3	collector TR2		
4	emitter TR2		
5	emitter TR1		
6	collector TR1		
<b>SOT353</b>			
1	base TR1		
2	emitter TR1, TR2		
3	base TR2		
4	collector TR2		
5	collector TR1		

## 3. Ordering information

**Table 4. Ordering information**

Type number	Package		Version
	Name	Description	
PMP4501V	-	plastic surface-mounted package; 6 leads	SOT666
PMP4501G	SC-88A	plastic surface-mounted package; 5 leads	SOT353
PMP4501Y	SC-88	plastic surface-mounted package; 6 leads	SOT363

## 4. Marking

**Table 5. Marking codes**

Type number	Marking code <sup>[1]</sup>
PMP4501V	EB
PMP4501G	R6*
PMP4501Y	S8*

- [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>Per transistor</b>					
$V_{CB0}$	collector-base voltage	open emitter	-	50	V
$V_{CEO}$	collector-emitter voltage	open base	-	45	V
$V_{EBO}$	emitter-base voltage	open collector	-	6	V
$I_C$	collector current		-	100	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C			
	SOT666		<sup>[1][2]</sup> -	200	mW
	SOT353		<sup>[1]</sup> -	200	mW
	SOT363		<sup>[1]</sup> -	200	mW
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C			
	SOT666		<sup>[1][2]</sup> -	300	mW
	SOT353		<sup>[1]</sup> -	300	mW
	SOT363		<sup>[1]</sup> -	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.

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

## 6. Thermal characteristics

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Per transistor</b>							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air					
	SOT666		[1][2]	-	-	625	K/W
	SOT353		[1]	-	-	625	K/W
SOT363		[1]	-	-	625	K/W	
<b>Per device</b>							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air					
	SOT666		[1][2]	-	-	416	K/W
	SOT353		[1]	-	-	416	K/W
SOT363		[1]	-	-	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**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30\text{ V};$ $I_E = 0\text{ A}$	-	-	15	nA
		$V_{CB} = 30\text{ V};$ $I_E = 0\text{ A};$ $T_j = 150\text{ }^{\circ}\text{C}$	-	-	5	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V};$ $I_C = 0\text{ A}$	-	-	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V};$ $I_C = 10\text{ }\mu\text{A}$	-	250	-	
		$V_{CE} = 5\text{ V};$ $I_C = 2\text{ mA}$	200	290	450	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA};$ $I_B = 0.5\text{ mA}$	-	50	200	mV
		$I_C = 100\text{ mA};$ $I_B = 5\text{ mA}$	-	200	400	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10\text{ mA};$ $I_B = 0.5\text{ mA}$	[1]	-	760	mV
		$I_C = 100\text{ mA};$ $I_B = 5\text{ mA}$	[1]	-	910	mV

**Table 8. Characteristics ...continued** $T_{amb} = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{BE}$	base-emitter voltage	$V_{CE} = 5\text{ V};$ $I_C = 2\text{ mA}$	[2] 610	660	710	mV
		$V_{CE} = 5\text{ V};$ $I_C = 10\text{ mA}$	[2] -	-	770	mV
$C_c$	collector capacitance	$V_{CB} = 10\text{ V};$ $I_E = i_e = 0\text{ A};$ $f = 1\text{ MHz}$	-	-	1.5	pF
$C_e$	emitter capacitance	$V_{EB} = 0.5\text{ V};$ $I_C = i_c = 0\text{ A};$ $f = 1\text{ MHz}$	-	11	-	pF
$f_T$	transition frequency	$V_{CE} = 5\text{ V};$ $I_C = 10\text{ mA};$ $f = 100\text{ MHz}$	100	250	-	MHz
NF	noise figure	$V_{CE} = 5\text{ V};$ $I_C = 0.2\text{ mA};$ $R_S = 2\text{ k}\Omega;$ $f = 10\text{ Hz to}$ $15.7\text{ kHz}$	-	2.8	-	dB
		$V_{CE} = 5\text{ V};$ $I_C = 0.2\text{ mA};$ $R_S = 2\text{ k}\Omega;$ $f = 1\text{ kHz};$ $B = 200\text{ Hz}$	-	3.3	-	dB
<b>Per device</b>						
$h_{FE1}/h_{FE2}$	$h_{FE}$ matching	$V_{CE} = 5\text{ V};$ $I_C = 2\text{ mA}$	[3] 0.95	1	-	
$V_{BE1}-V_{BE2}$	$V_{BE}$ matching	$V_{CE} = 5\text{ V};$ $I_C = 2\text{ mA}$	[4] -	-	2	mV

[1]  $V_{BEsat}$  decreases by about 1.7 mV/K with increasing temperature.[2]  $V_{BE}$  decreases by about 2 mV/K with increasing temperature.

[3] The smaller of the two values is taken as the numerator.

[4] The smaller of the two values is subtracted from the larger value.

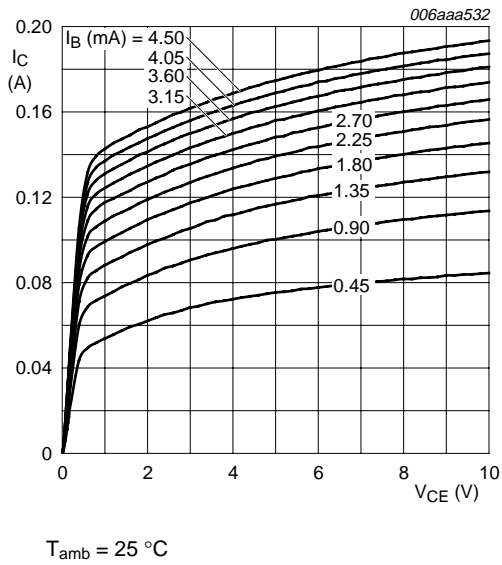


Fig 1. Collector current as a function of collector-emitter voltage; typical values

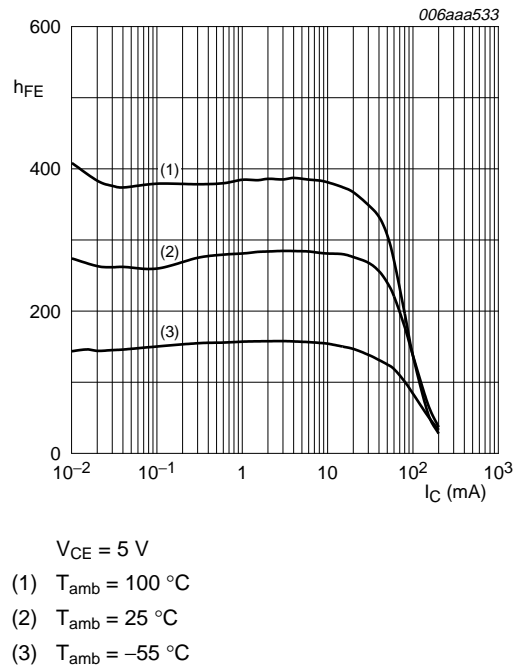


Fig 2. DC current gain as a function of collector current; typical values

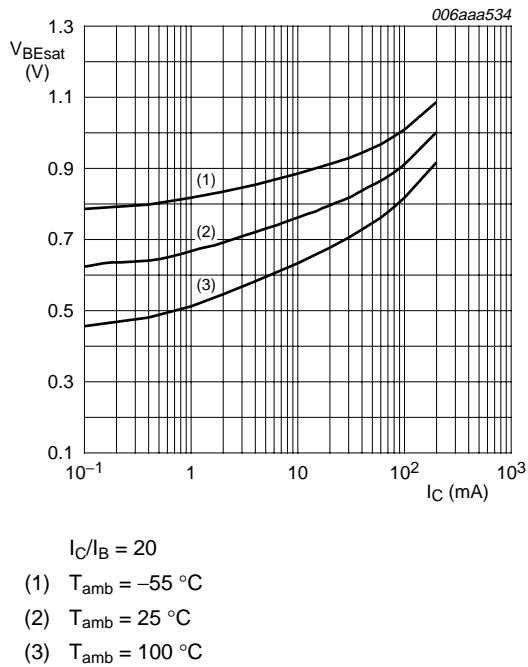


Fig 3. Base-emitter saturation voltage as a function of collector current; typical values

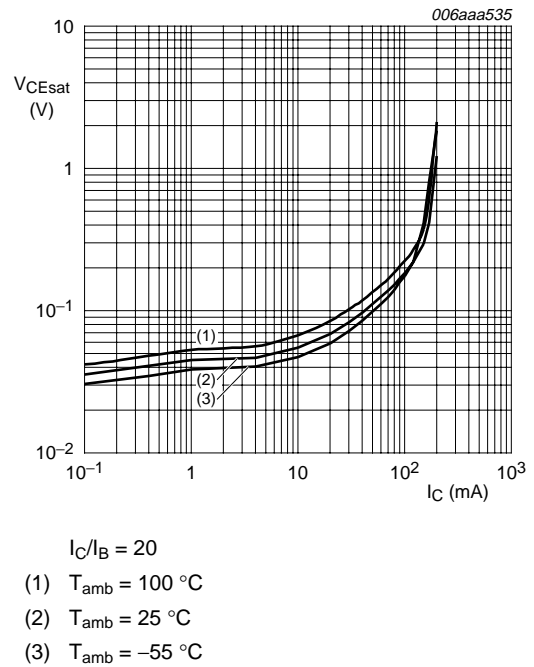
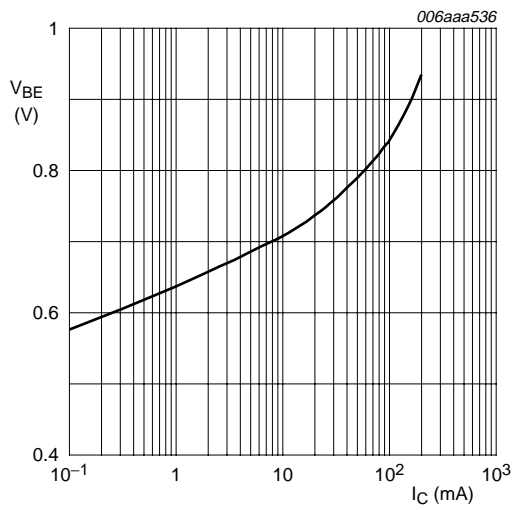
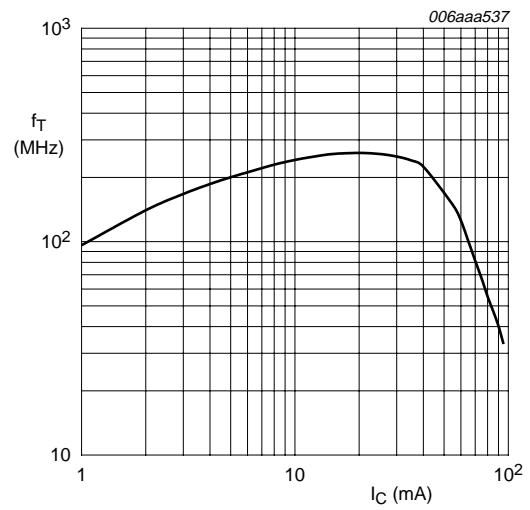


Fig 4. Collector-emitter saturation voltage as a function of collector current; typical values



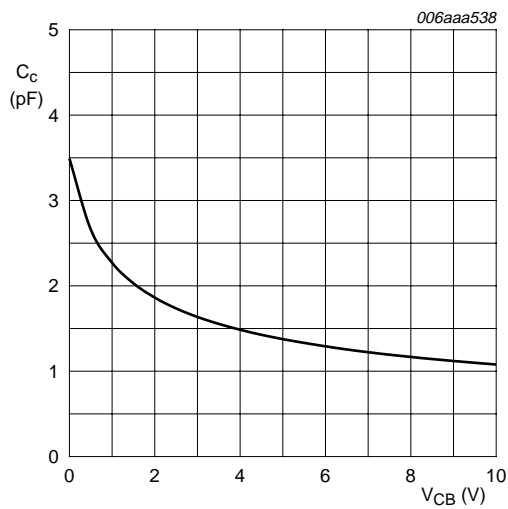
$V_{CE} = 5$  V;  $T_{amb} = 25$  °C

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



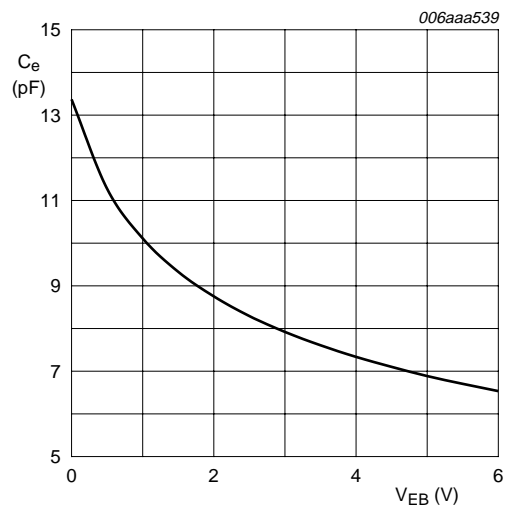
$V_{CE} = 5$  V;  $T_{amb} = 25$  °C

**Fig 6. Transition frequency as a function of collector current; typical values**



$f = 1$  MHz;  $T_{amb} = 25$  °C

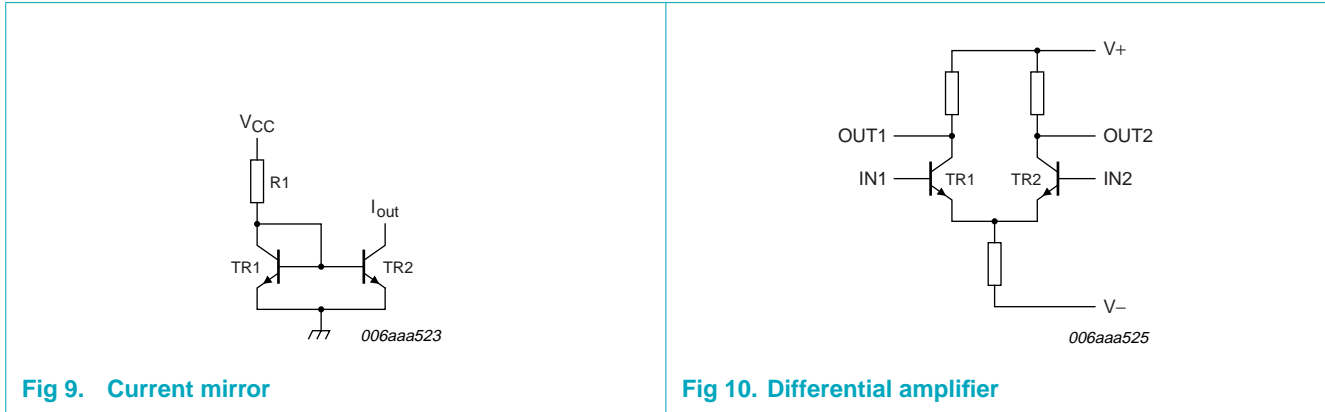
**Fig 7. Collector capacitance as a function of collector-base voltage; typical values**



$f = 1$  MHz;  $T_{amb} = 25$  °C

**Fig 8. Emitter capacitance as a function of emitter-base voltage; typical values**

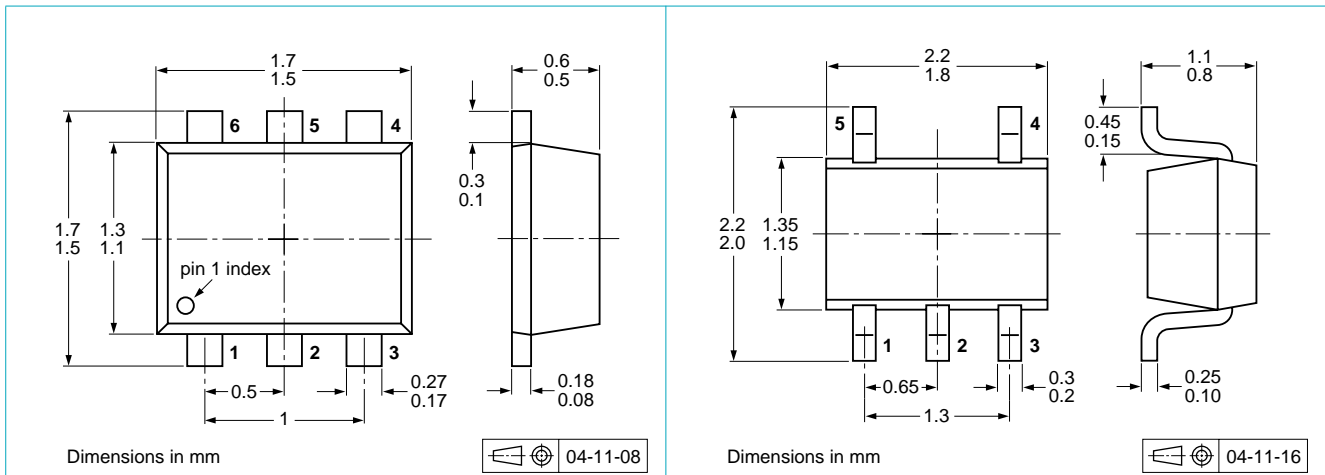
**8. Application information**



**Fig 9. Current mirror**

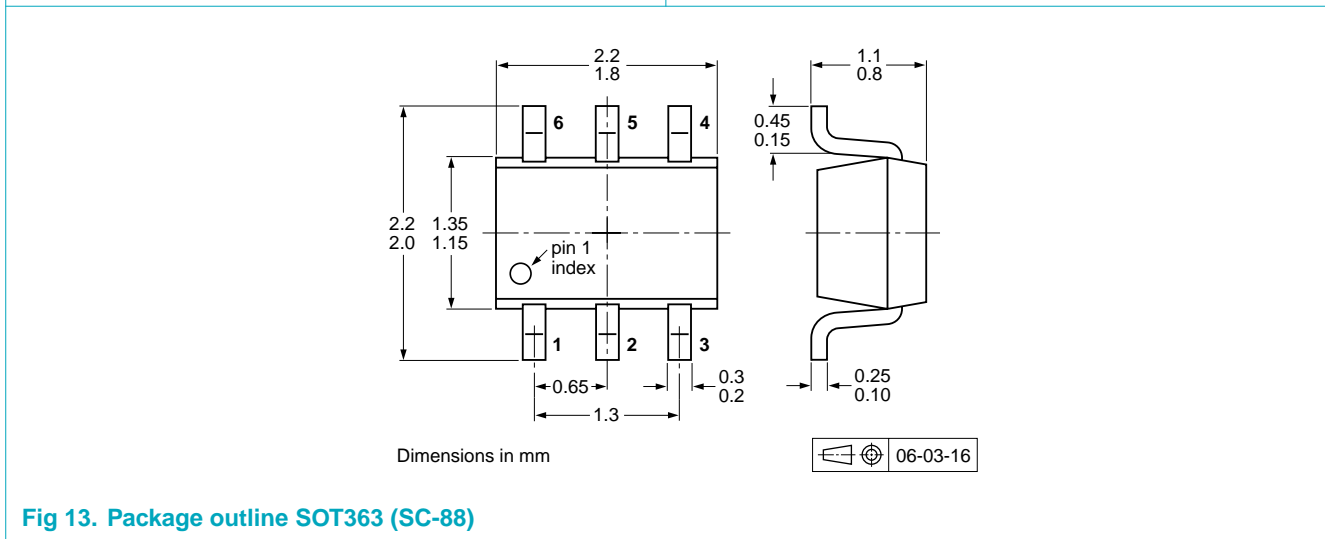
**Fig 10. Differential amplifier**

**9. Package outline**



**Fig 11. Package outline SOT666**

**Fig 12. Package outline SOT353 (SC-88A)**



**Fig 13. Package outline SOT363 (SC-88)**



## 10. Packing information

**Table 9. Packing methods**

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

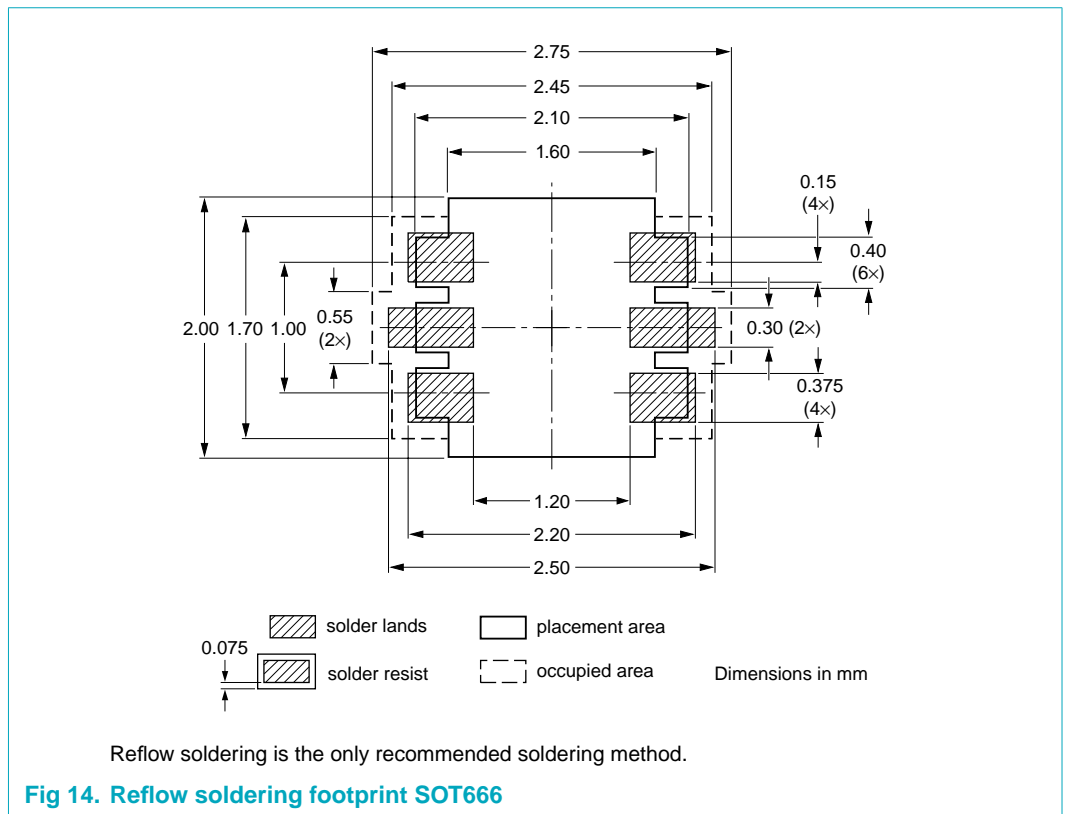
Type number	Package	Description	Packing quantity			
			3000	4000	8000	10000
PMP4501V	SOT666	2 mm pitch, 8 mm tape and reel	-	-	-315	-
		4 mm pitch, 8 mm tape and reel	-	-115	-	-
PMP4501G	SOT353	4 mm pitch, 8 mm tape and reel	-115	-	-	-135
PMP4501Y	SOT363	4 mm pitch, 8 mm tape and reel; T1 <sup>[2]</sup>	-115	-	-	-135
		4 mm pitch, 8 mm tape and reel; T2 <sup>[3]</sup>	-125	-	-	-165

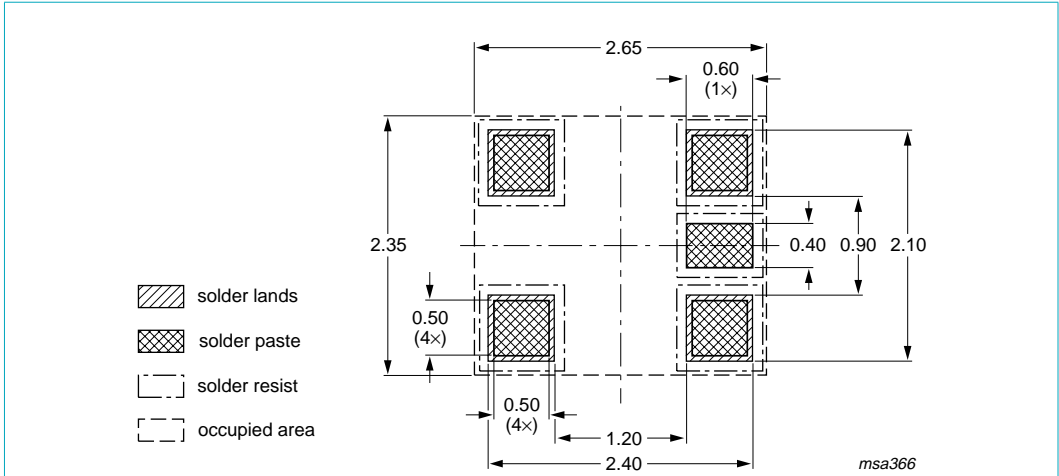
[1] For further information and the availability of packing methods, see [Section 14](#).

[2] T1: normal taping

[3] T2: reverse taping

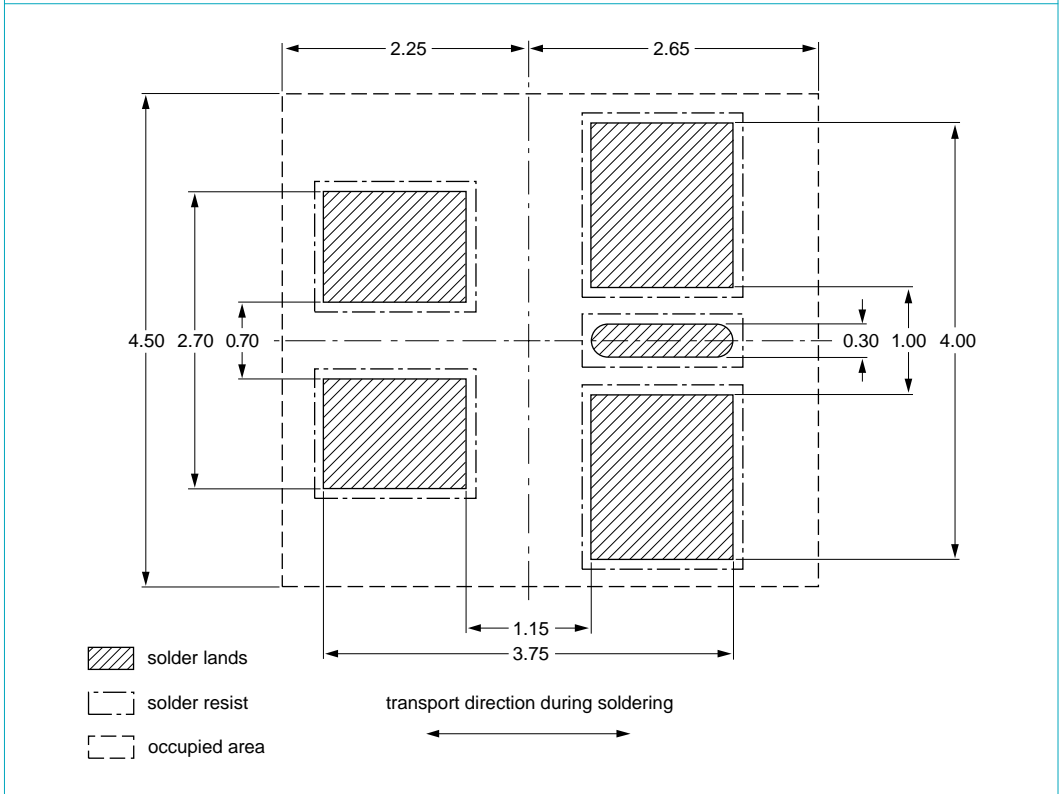
## 11. Soldering





Dimensions in mm

**Fig 15. Reflow soldering footprint SOT353 (SC-88A)**



Dimensions in mm

**Fig 16. Wave soldering footprint SOT353 (SC-88A)**

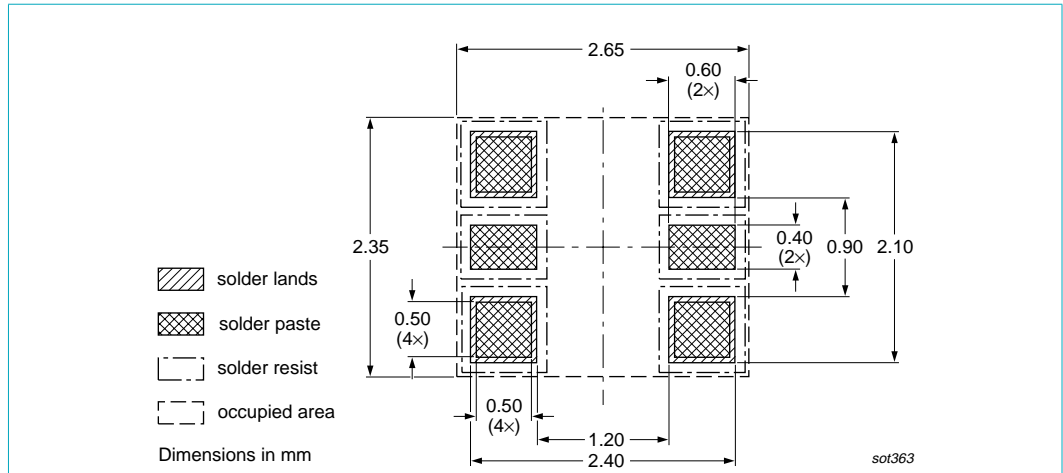


Fig 17. Reflow soldering footprint SOT363 (SC-88)

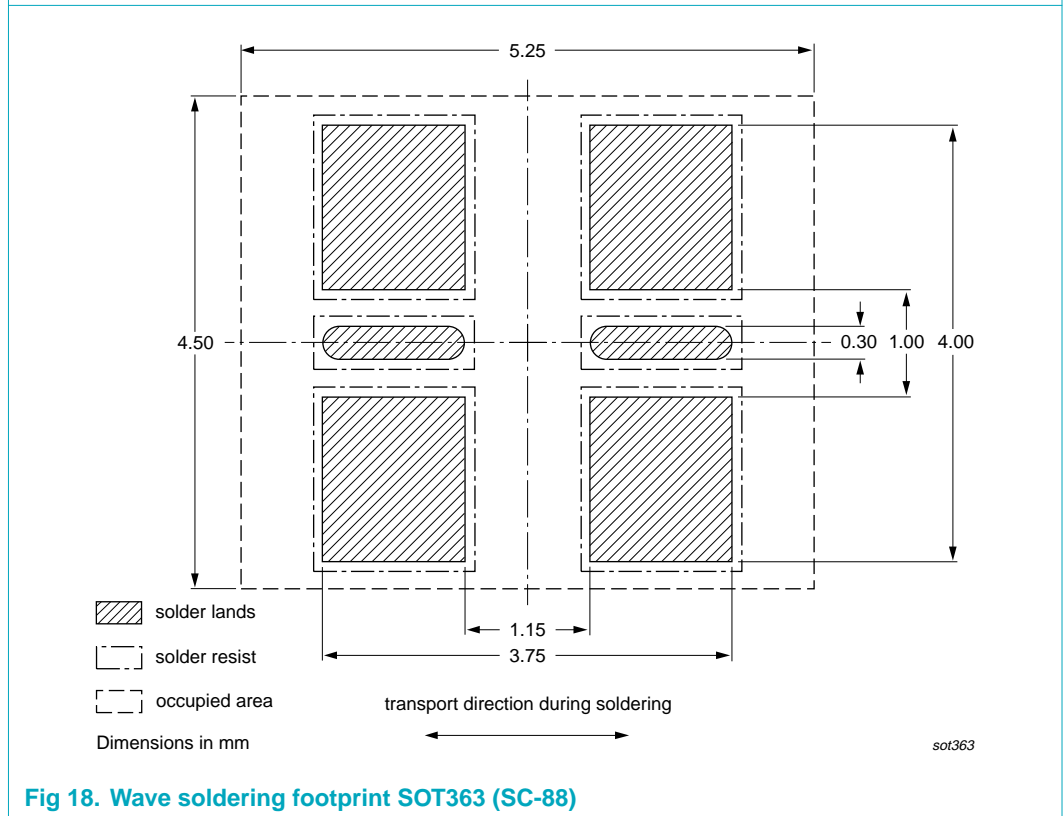


Fig 18. Wave soldering footprint SOT363 (SC-88)

## 12. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMP4501V_G_Y_3	20060919	Product data sheet	-	PMP4501G_Y_2
Modifications:	<ul style="list-style-type: none"><li>Type number PMP4501V added</li><li><a href="#">Section 13 "Legal information"</a>: updated</li></ul>			
PMP4501G_Y_2	20060214	Product data sheet	-	PMP4501G_Y_1
PMP4501G_Y_1	20060202	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".

[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.semiconductors.philips.com>.

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