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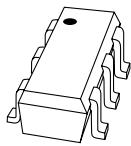
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Kind regards,

Team Nexperia



# PMBT3946YPN

40 V, 200 mA NPN/PNP general-purpose double transistor

Rev. 01 — 12 May 2009

Product data sheet

## 1. Product profile

### 1.1 General description

NPN/PNP general-purpose double transistor in a SOT363 (SC-88) very small Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number	Package		NPN/NPN complement	PNP/PNP complement	Package configuration
	NXP	JEITA			
PMBT3946YPN	SOT363	SC-88	PMBT3904YS	PMBT3906YS	very small

### 1.2 Features

- General-purpose double transistor
- Board-space reduction

### 1.3 Applications

- General-purpose switching and amplification

### 1.4 Quick reference data

Table 2. Quick reference data

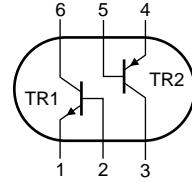
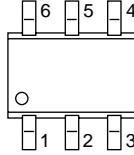
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	40	V
$I_C$	collector current		-	-	200	mA
$h_{FE}$	DC current gain	$V_{CE} = 1 \text{ V};$ $I_C = 10 \text{ mA}$	100	180	300	

## 2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	emitter TR1		
2	base TR1		
3	collector TR2		
4	emitter TR2		
5	base TR2		
6	collector TR1		

sym019



## 3. Ordering information

Table 4. Ordering information

Type number	Package			Version
	Name	Description		
PMBT3946YPN	SC-88	plastic surface-mounted package; 6 leads		SOT363

## 4. Marking

Table 5. Marking codes

Type number	Marking code <sup>[1]</sup>
PMBT3946YPN	BB*

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

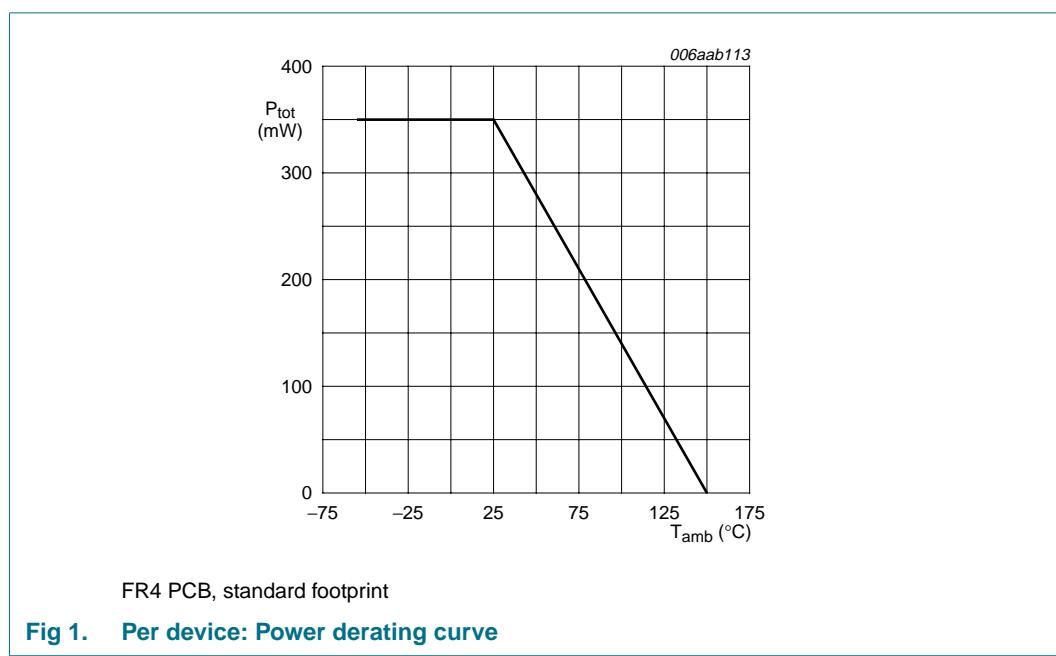
## 5. Limiting values

**Table 6. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
<b>TR1 (NPN)</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	60	V
<b>TR2 (PNP)</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	-40	V
<b>Per transistor; for the PNP transistor with negative polarity</b>					
$V_{CEO}$	collector-emitter voltage	open base	-	40	V
$V_{EBO}$	emitter-base voltage	open collector	-	6	V
$I_C$	collector current		-	200	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1 \text{ ms}$	-	200	mA
$I_{BM}$	peak base current	single pulse; $t_p \leq 1 \text{ ms}$	-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25 \text{ }^{\circ}\text{C}$	[1]	-	230 mW
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25 \text{ }^{\circ}\text{C}$	[1]	-	350 mW
$T_j$	junction temperature		-	150	$^{\circ}\text{C}$
$T_{amb}$	ambient temperature		-55	+150	$^{\circ}\text{C}$
$T_{sig}$	storage temperature		-65	+150	$^{\circ}\text{C}$

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

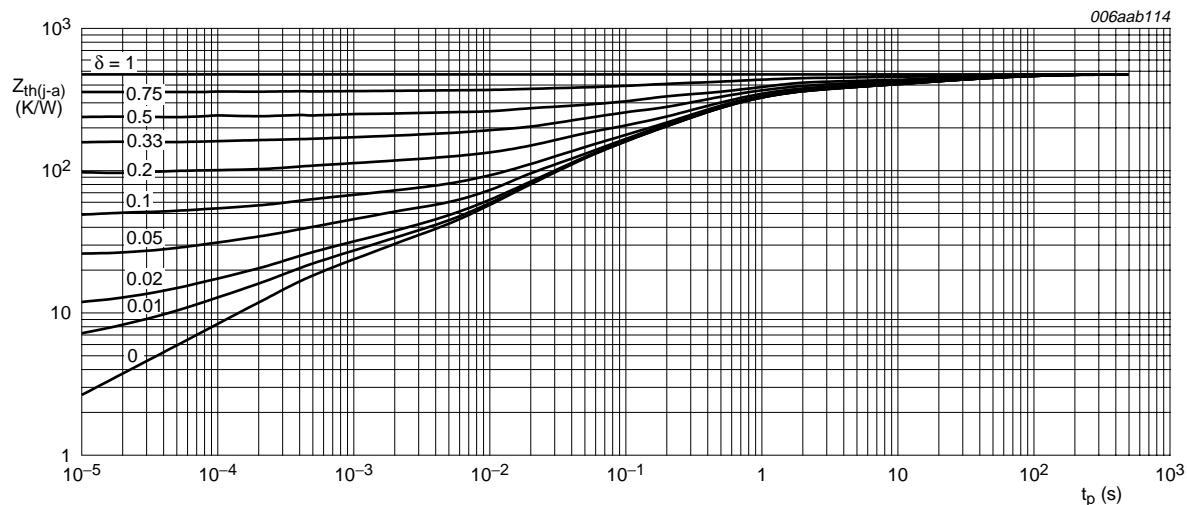


## 6. Thermal characteristics

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	290	K/W
<b>Per device</b>						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	K/W

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



FR4 PCB, standard footprint

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

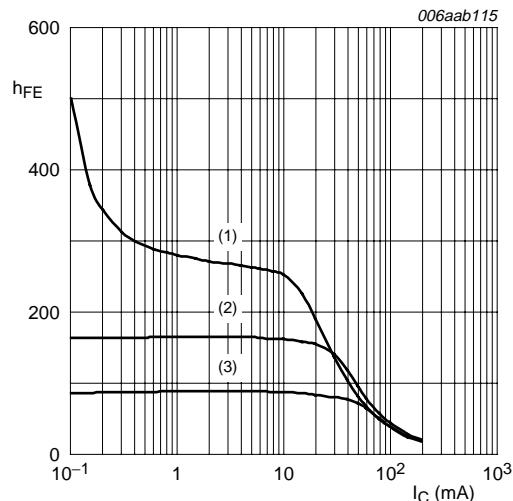
## 7. Characteristics

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

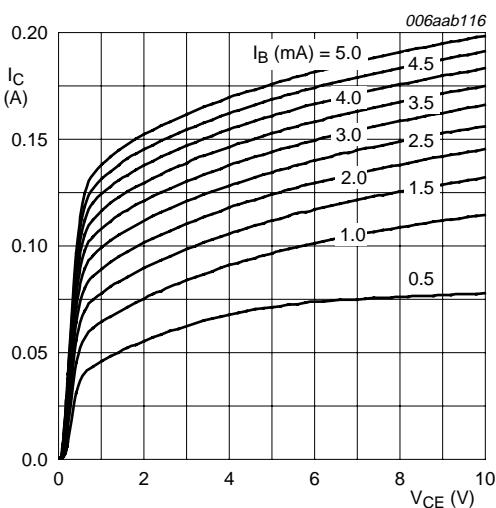
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1 (NPN)</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30 \text{ V}; I_E = 0 \text{ A}$	-	-	50	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 6 \text{ V}; I_C = 0 \text{ A}$	-	-	50	nA
$h_{FE}$	DC current gain	$V_{CE} = 1 \text{ V}$			-	
		$I_C = 0.1 \text{ mA}$	60	180	-	
		$I_C = 1 \text{ mA}$	80	180	-	
		$I_C = 10 \text{ mA}$	100	180	300	
		$I_C = 50 \text{ mA}$	60	105	-	
		$I_C = 100 \text{ mA}$	30	50	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10 \text{ mA}; I_B = 1 \text{ mA}$	-	75	200	mV
		$I_C = 50 \text{ mA}; I_B = 5 \text{ mA}$	-	120	300	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10 \text{ mA}; I_B = 1 \text{ mA}$	650	750	850	mV
		$I_C = 50 \text{ mA}; I_B = 5 \text{ mA}$	-	850	950	mV
$f_T$	transition frequency	$V_{CE} = 20 \text{ V}; I_C = 10 \text{ mA}; f = 100 \text{ MHz}$	300	-	-	MHz
$C_c$	collector capacitance	$V_{CB} = 5 \text{ V}; I_E = i_e = 0 \text{ A}; f = 1 \text{ MHz}$	-	-	4	pF
$C_e$	emitter capacitance	$V_{BE} = 0.5 \text{ V}; I_C = i_c = 0 \text{ A}; f = 1 \text{ MHz}$	-	-	8	pF
NF	noise figure	$V_{CE} = 5 \text{ V}; I_C = 100 \mu\text{A}; R_S = 1 \text{ k}\Omega; f = 10 \text{ Hz to } 15.7 \text{ kHz}$	-	-	5	dB
$t_d$	delay time	$V_{CC} = 3 \text{ V}; I_C = 10 \text{ mA}; I_{Bon} = 1 \text{ mA}, I_{Boff} = -1 \text{ mA}$	-	-	35	ns
$t_r$	rise time		-	-	35	ns
$t_{on}$	turn-on time		-	-	70	ns
$t_s$	storage time		-	-	200	ns
$t_f$	fall time		-	-	50	ns
$t_{off}$	turn-off time		-	-	250	ns

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

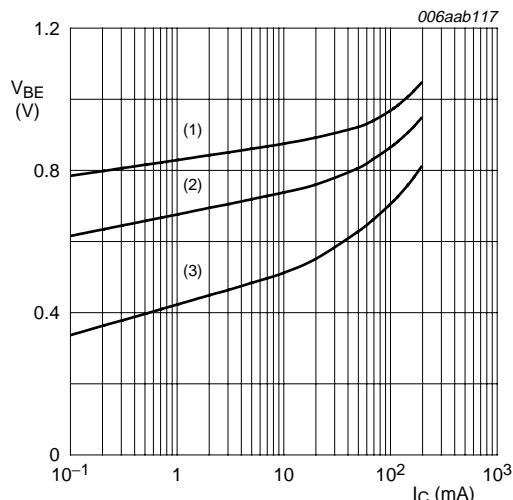
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR2 (PNP)</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -30 \text{ V}; I_E = 0 \text{ A}$	-	-	-50	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -6 \text{ V}; I_C = 0 \text{ A}$	-	-	-50	nA
$h_{FE}$	DC current gain	$V_{CE} = -1 \text{ V}$				
		$I_C = -0.1 \text{ mA}$	60	180	-	
		$I_C = -1 \text{ mA}$	80	180	-	
		$I_C = -10 \text{ mA}$	100	180	300	
		$I_C = -50 \text{ mA}$	60	130	-	
		$I_C = -100 \text{ mA}$	30	50	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -10 \text{ mA}; I_B = -1 \text{ mA}$	-	-100	-250	mV
		$I_C = -50 \text{ mA}; I_B = -5 \text{ mA}$	-	-165	-400	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -10 \text{ mA}; I_B = -1 \text{ mA}$	-	-750	-850	mV
		$I_C = -50 \text{ mA}; I_B = -5 \text{ mA}$	-	-850	-950	mV
$f_T$	transition frequency	$V_{CE} = -20 \text{ V}; I_C = -10 \text{ mA}; f = 100 \text{ MHz}$	250	-	-	MHz
$C_c$	collector capacitance	$V_{CB} = -5 \text{ V}; I_E = i_e = 0 \text{ A}; f = 1 \text{ MHz}$	-	-	4.5	pF
$C_e$	emitter capacitance	$V_{CB} = -0.5 \text{ V}; I_C = i_c = 0 \text{ A}; f = 1 \text{ MHz}$	-	-	10	pF
NF	noise figure	$V_{CE} = -5 \text{ V}; I_C = -100 \mu\text{A}; R_S = 1 \text{ k}\Omega; f = 10 \text{ Hz to } 15.7 \text{ kHz}$	-	-	4	dB
$t_d$	delay time	$V_{CC} = -3 \text{ V}; I_C = -10 \text{ mA}; I_{Bon} = -1 \text{ mA}; I_{Boff} = 1 \text{ mA}$	-	-	35	ns
$t_r$	rise time		-	-	35	ns
$t_{on}$	turn-on time		-	-	70	ns
$t_s$	storage time		-	-	225	ns
$t_f$	fall time		-	-	75	ns
$t_{off}$	turn-off time		-	-	300	ns



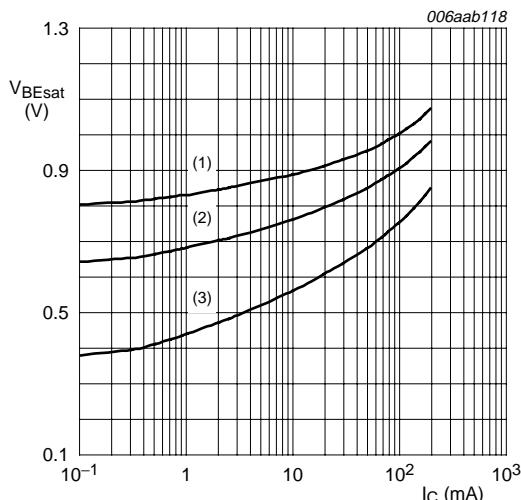
**Fig 3.** TR1 (NPN): DC current gain as a function of collector current; typical values



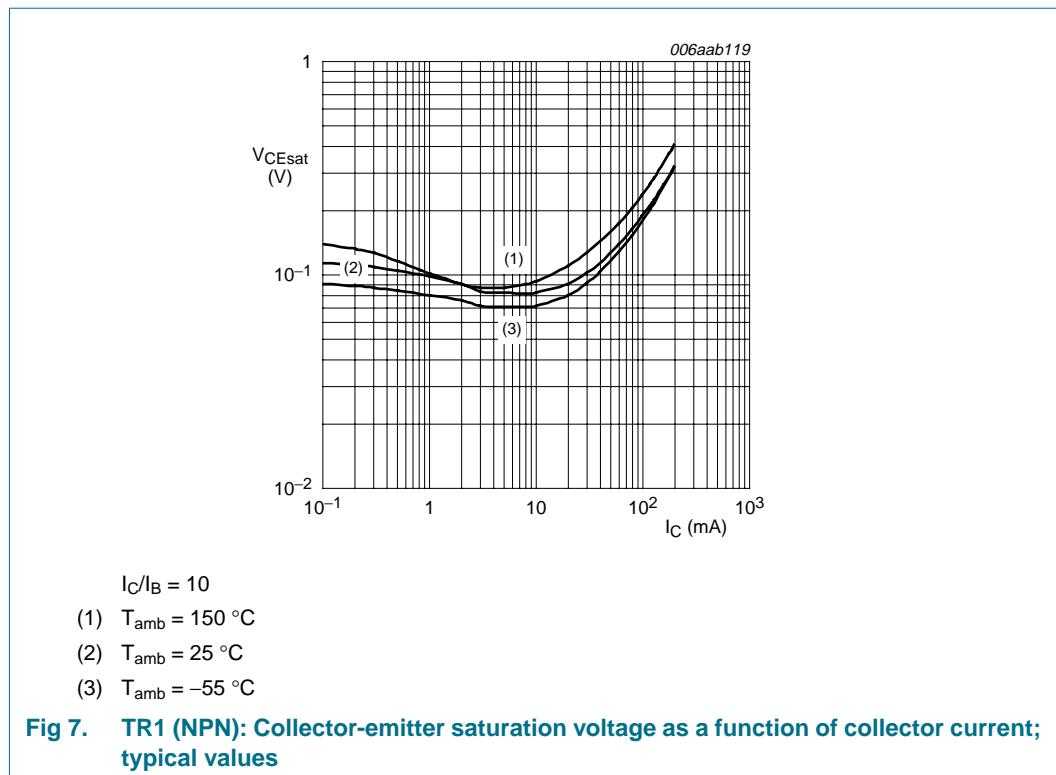
**Fig 4.** TR1 (NPN): Collector current as a function of collector-emitter voltage; typical values

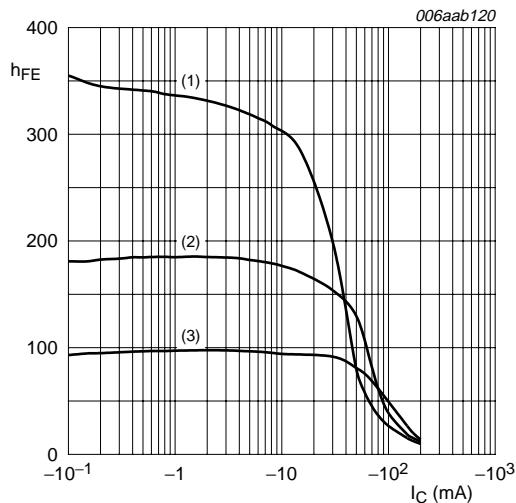


**Fig 5.** TR1 (NPN): Base-emitter voltage as a function of collector current; typical values

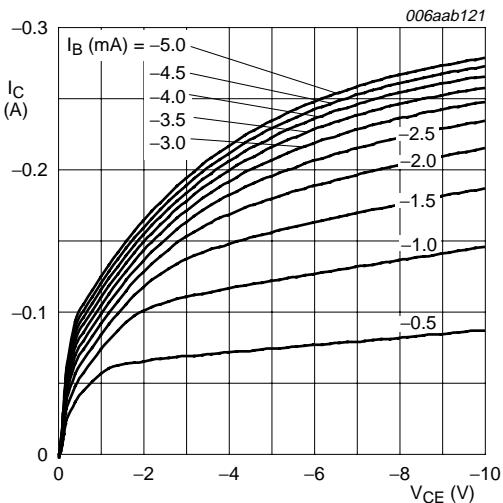


**Fig 6.** TR1 (NPN): Base-emitter saturation voltage as a function of collector current; typical values

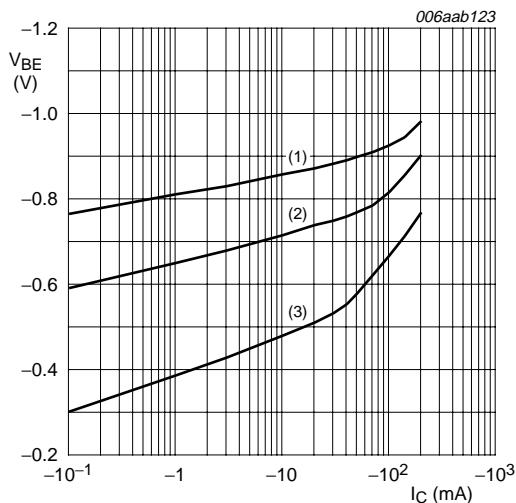




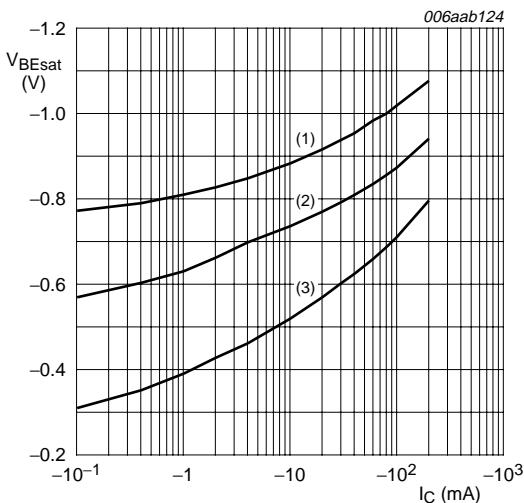
**Fig 8.** TR2 (PNP): DC current gain as a function of collector current; typical values



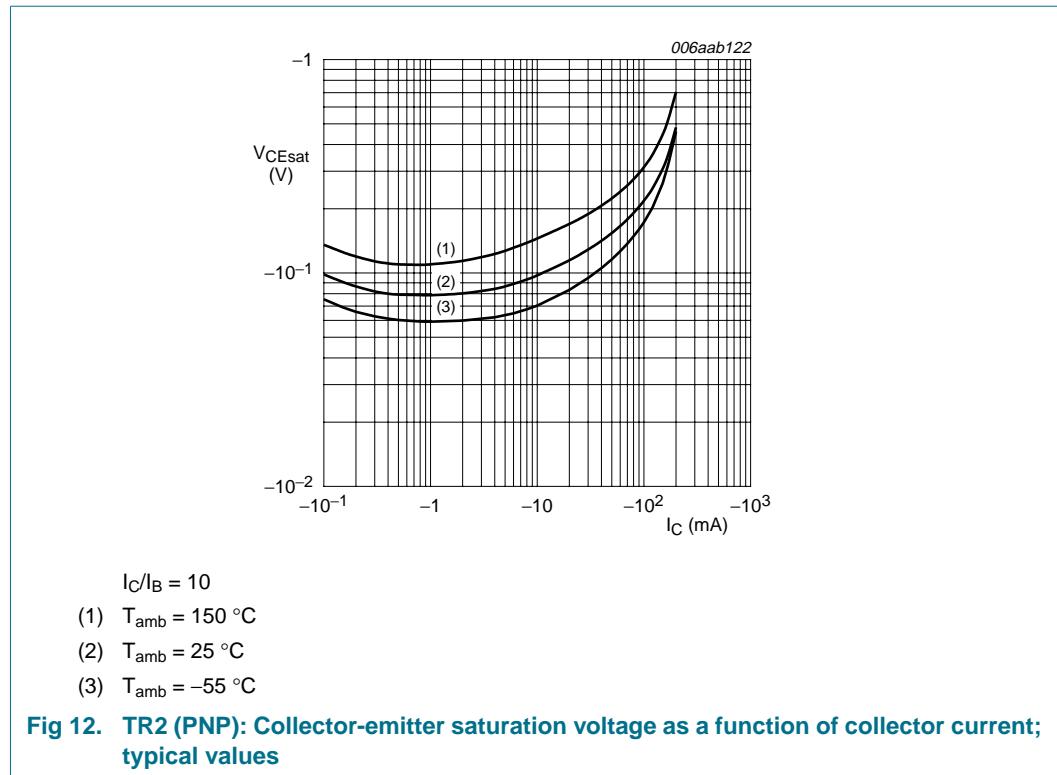
**Fig 9.** TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values



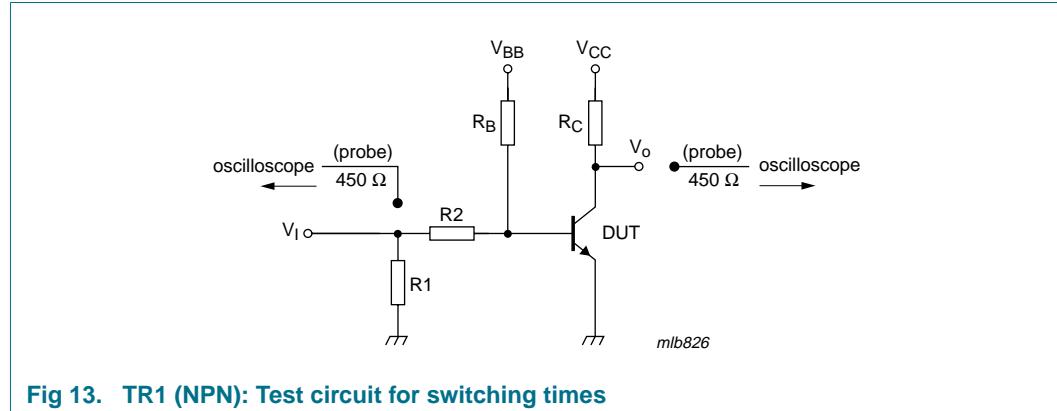
**Fig 10.** TR2 (PNP): Base-emitter voltage as a function of collector current; typical values



**Fig 11.** TR2 (PNP): Base-emitter saturation voltage as a function of collector current; typical values



## 8. Test information



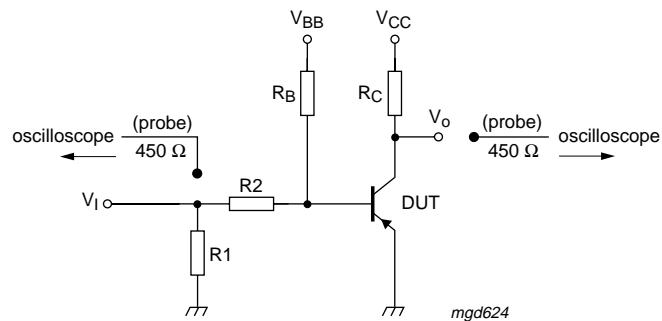


Fig 14. TR2 (PNP): Test circuit for switching times

## 9. Package outline

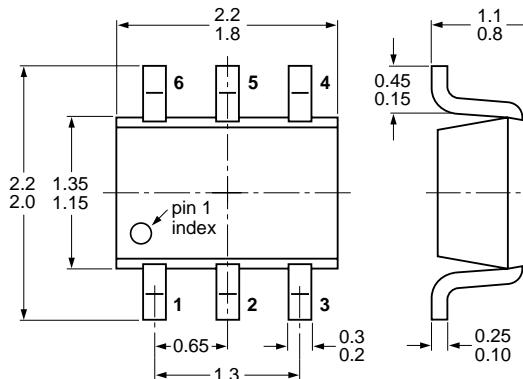


Fig 15. Package outline SOT363 (SC-88)

## 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   10000
PMBT3946YPN	SOT363	4 mm pitch, 8 mm tape and reel; T1	[2] -115 -135
		4 mm pitch, 8 mm tape and reel; T2	[3] -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

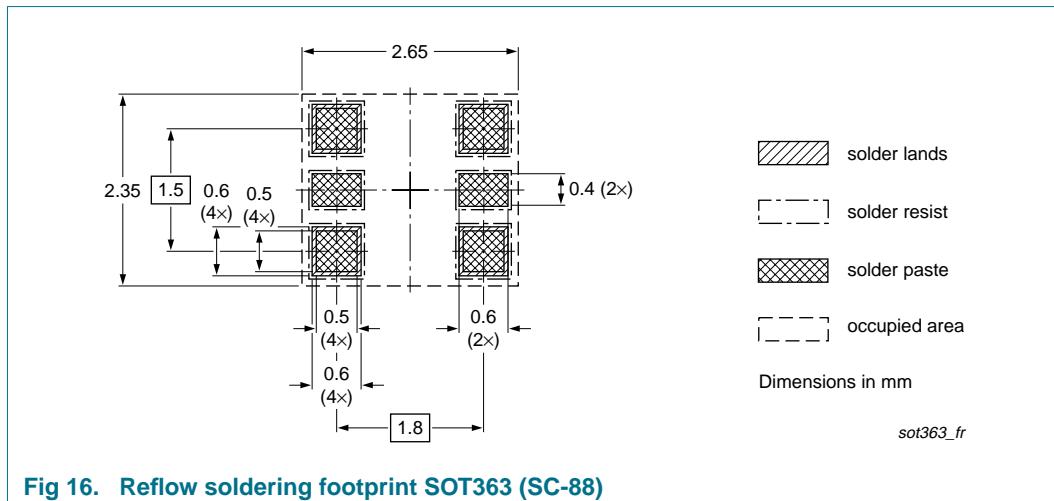


Fig 16. Reflow soldering footprint SOT363 (SC-88)

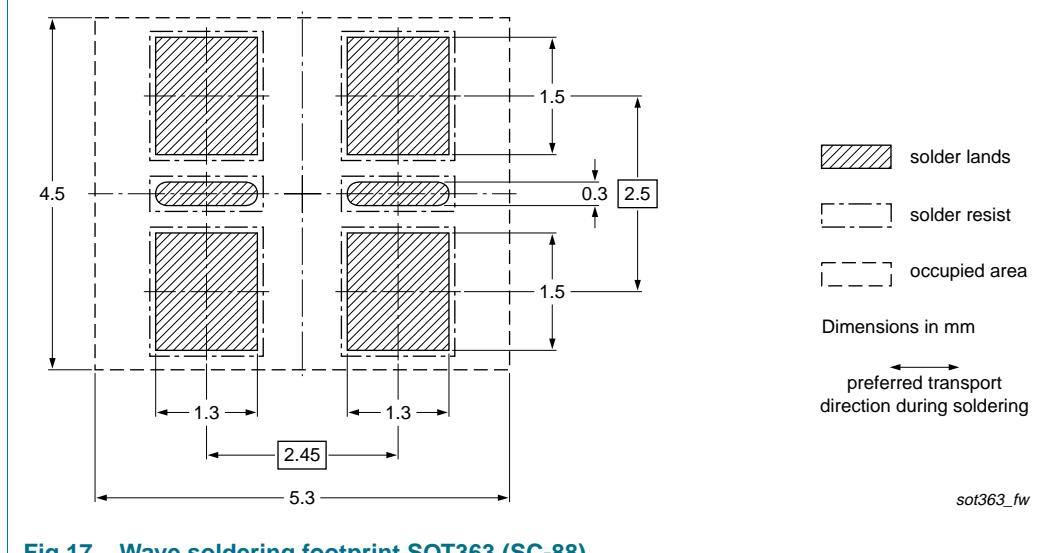


Fig 17. Wave soldering footprint SOT363 (SC-88)

## 12. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMBT3946YPN_1	20090512	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.
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Date of release: 12 May 2009

Document identifier: PMBT3946YPN\_1



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#### Как с нами связаться

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