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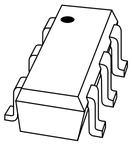


PMBT3946YPN

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

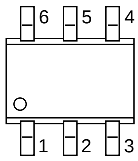
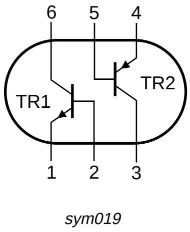
Table 2. Quick reference data

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

founded by Philips

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		

3. Ordering information

Table 4. Ordering information

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

4. Marking

Table 5. Marking codes

Type number	Marking code[1]
PMBT3946YPN	BB*

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

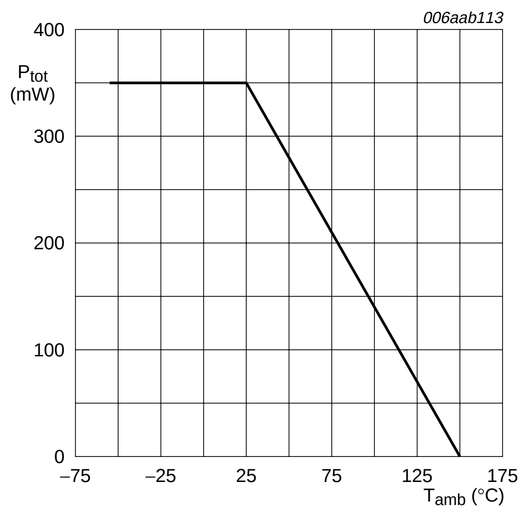
5. Limiting values

Table 6. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
TR1 (NPN)						
V_{CBO}	collector-base voltage	open emitter		-	60	V
TR2 (PNP)						
V_{CBO}	collector-base voltage	open emitter		-	–40	V
Per transistor; for the PNP transistor with negative polarity						
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; $t_p \leq 1$ ms		-	200	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]	-	230	mW
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	350	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			–55	+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.



FR4 PCB, standard footprint

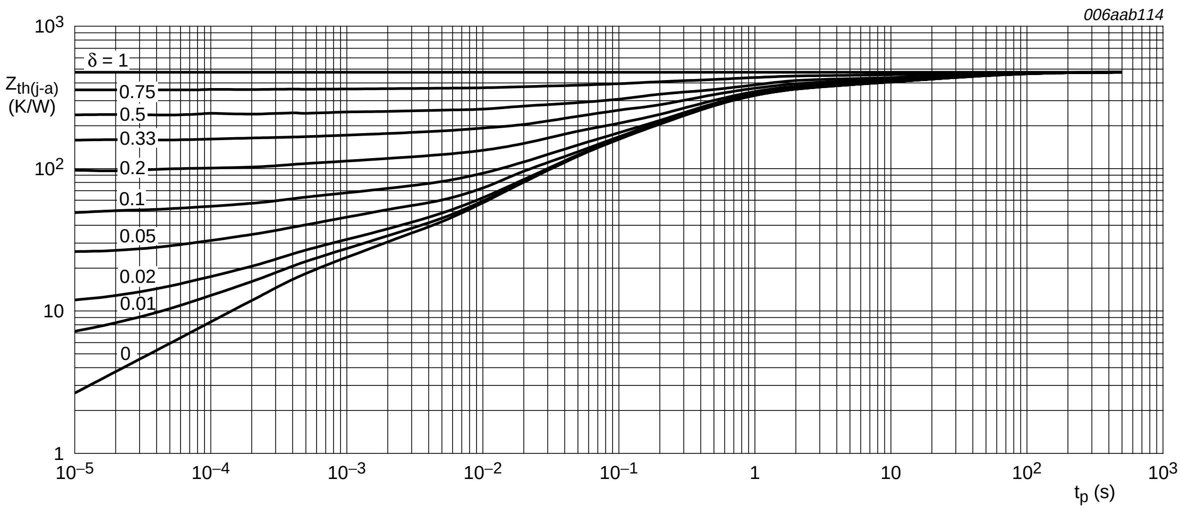
Fig 1. Per device: Power derating curve

6. Thermal characteristics

Table 7. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	543	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	290	K/W
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	357	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

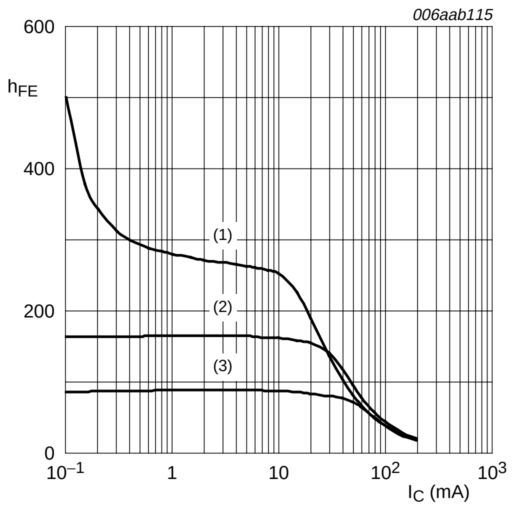
T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR1 (NPN)						
I_{CBO}	collector-base cut-off current	V_{CB} = 30 V; I_E = 0 A	-	-	50	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = 6 V; I_C = 0 A	-	-	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V			-	
		I_C = 0.1 mA	60	180	-	
		I_C = 1 mA	80	180	-	
		I_C = 10 mA	100	180	300	
		I_C = 50 mA	60	105	-	
		I_C = 100 mA	30	50	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	-	75	200	mV
		I_C = 50 mA; I_B = 5 mA	-	120	300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	650	750	850	mV
		I_C = 50 mA; I_B = 5 mA	-	850	950	mV
f_T	transition frequency	V_{CE} = 20 V; I_C = 10 mA; f = 100 MHz	300	-	-	MHz
C_c	collector capacitance	V_{CB} = 5 V; I_E = i_e = 0 A; f = 1 MHz	-	-	4	pF
C_e	emitter capacitance	V_{BE} = 0.5 V; I_C = i_c = 0 A; f = 1 MHz	-	-	8	pF
NF	noise figure	V_{CE} = 5 V; I_C = 100 µA; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	-	-	5	dB
t_d	delay time	V_{CC} = 3 V; I_C = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 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 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR2 (PNP)						
I_{CBO}	collector-base cut-off current	V_{CB} = –30 V; I_E = 0 A	-	-	–50	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = –6 V; I_C = 0 A	-	-	–50	nA
h_{FE}	DC current gain	V_{CE} = –1 V				
		I_C = –0.1 mA	60	180	-	
		I_C = –1 mA	80	180	-	
		I_C = –10 mA	100	180	300	
		I_C = –50 mA	60	130	-	
		I_C = –100 mA	30	50	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA	-	–100	–250	mV
		I_C = –50 mA; I_B = –5 mA	-	–165	–400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA	-	–750	–850	mV
		I_C = –50 mA; I_B = –5 mA	-	–850	–950	mV
f_T	transition frequency	V_{CE} = –20 V; I_C = –10 mA; f = 100 MHz	250	-	-	MHz
C_c	collector capacitance	V_{CB} = –5 V; I_E = i_e = 0 A; f = 1 MHz	-	-	4.5	pF
C_e	emitter capacitance	V_{CB} = –0.5 V; I_C = i_c = 0 A; f = 1 MHz	-	-	10	pF
NF	noise figure	V_{CE} = –5 V; I_C = –100 µA; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	-	-	4	dB
t_d	delay time	V_{CC} = –3 V; I_C = –10 mA; I_{Bon} = –1 mA; I_{Boff} = 1 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



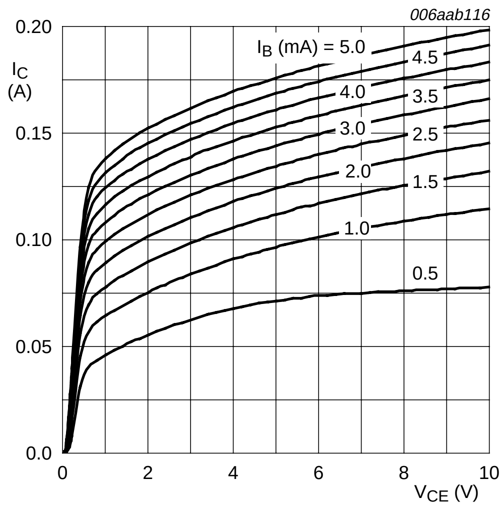
V_{CE} = 1 V

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

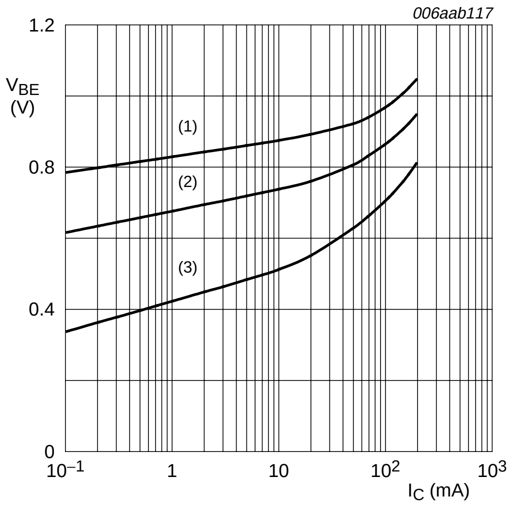
(3) T_{amb} = –55 °C

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



T_{amb} = 25 °C

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



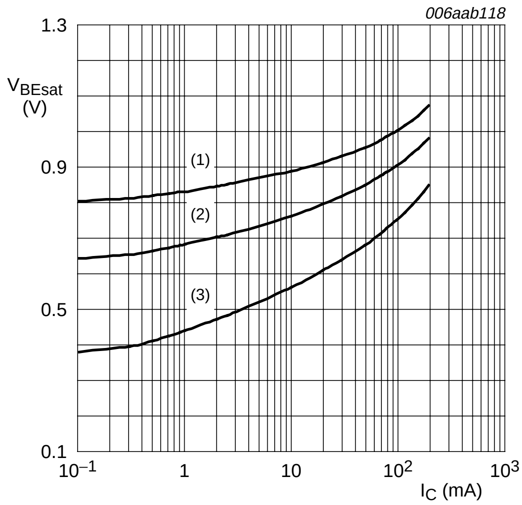
V_{CE} = 1 V

(1) T_{amb} = –55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 150 °C

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



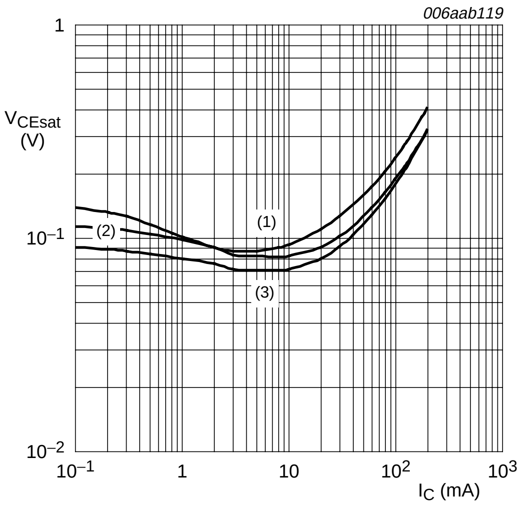
I_C/I_B = 10

(1) T_{amb} = –55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 150 °C

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



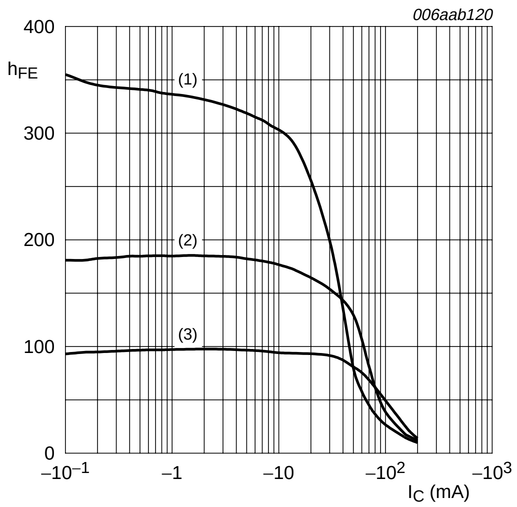
$I_C/I_B = 10$

(1) $T_{amb} = 150\ °C$

(2) $T_{amb} = 25\ °C$

(3) $T_{amb} = -55\ °C$

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



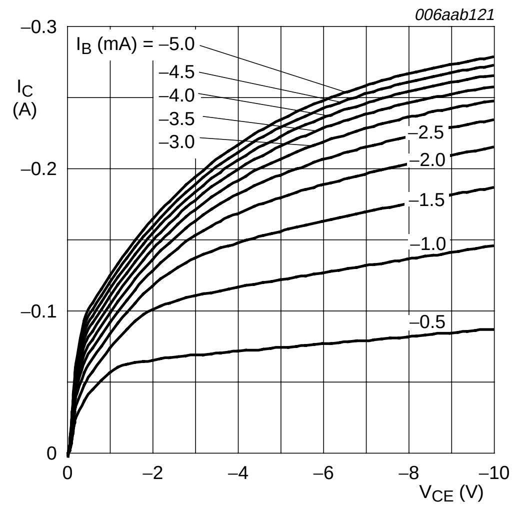
$V_{CE} = -1$ V

(1) $T_{amb} = 150$ °C

(2) $T_{amb} = 25$ °C

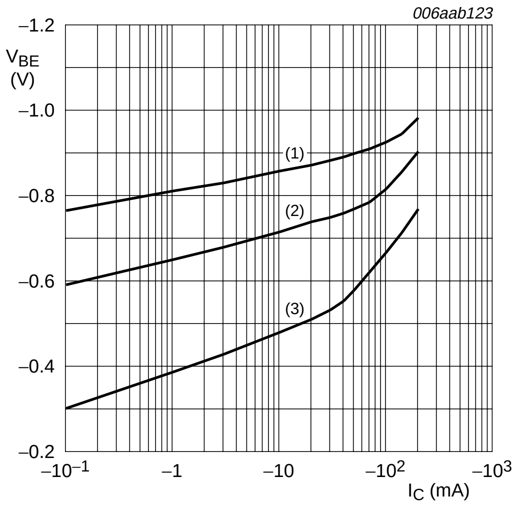
(3) $T_{amb} = -55$ °C

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



$T_{amb} = 25$ °C

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



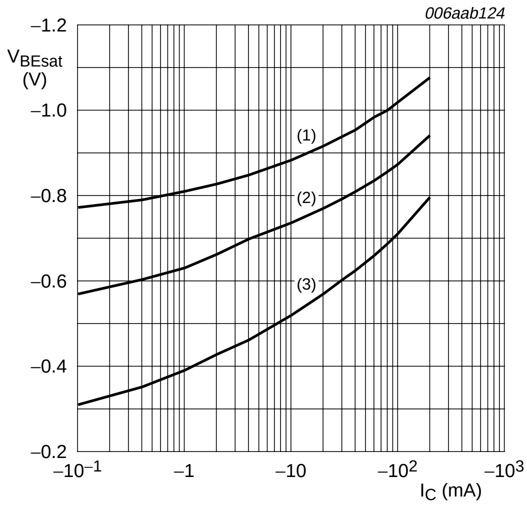
$V_{CE} = -1$ V

(1) $T_{amb} = -55$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = 150$ °C

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



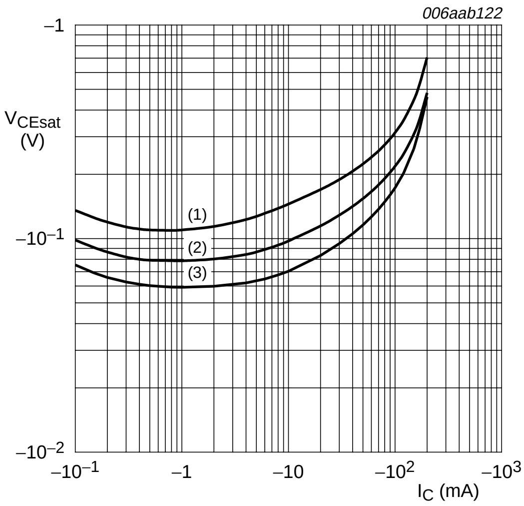
$I_C/I_B = 10$

(1) $T_{amb} = -55$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = 150$ °C

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



$I_C/I_B = 10$

(1) $T_{amb} = 150$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = -55$ °C

Fig 12. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values

8. Test information

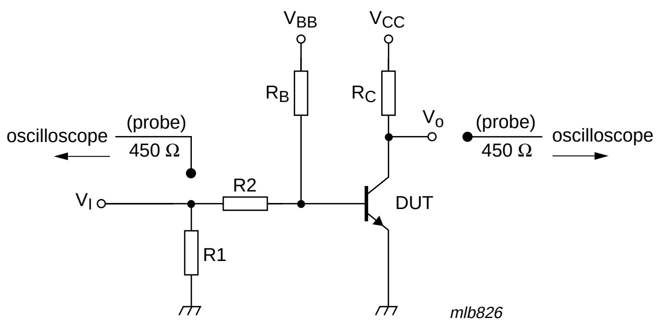


Fig 13. TR1 (NPN): Test circuit for switching times

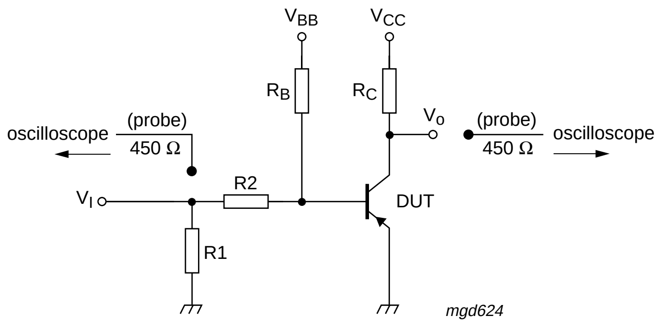


Fig 14. TR2 (PNP): Test circuit for switching times

9. Package outline

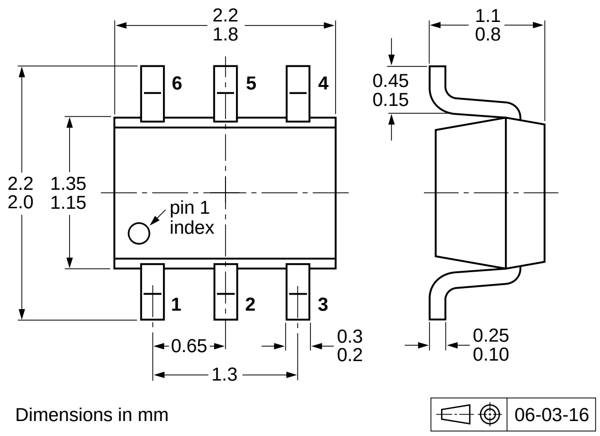


Fig 15. Package outline SOT363 (SC-88)

10. Packing information

Table 9. Packing methods

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

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

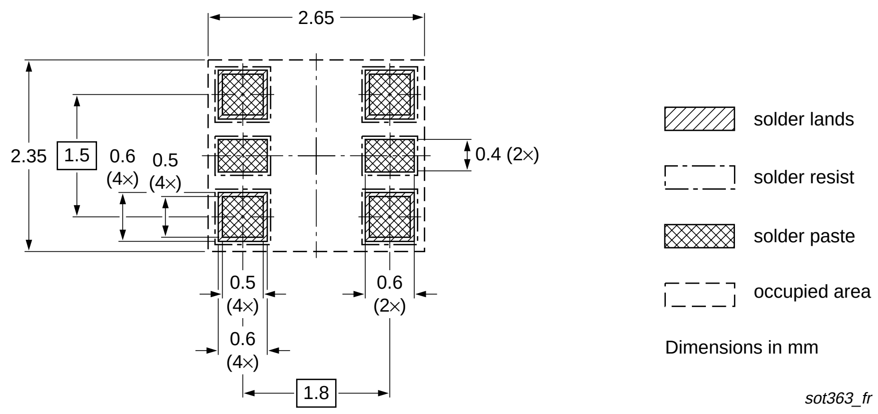


Fig 16. Reflow soldering footprint SOT363 (SC-88)

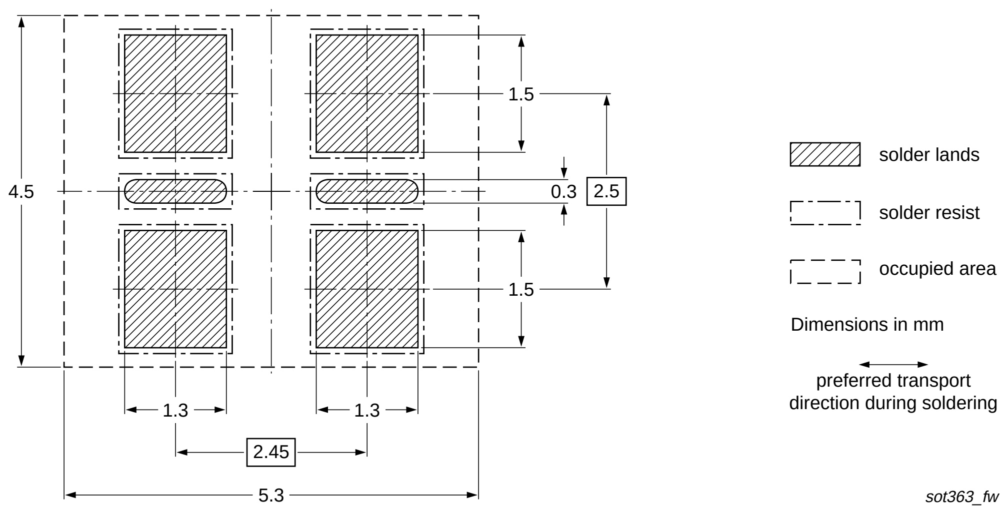


Fig 17. Wave soldering footprint SOT363 (SC-88)

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[1][2]	Product status[3]	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.

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15. Contents

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