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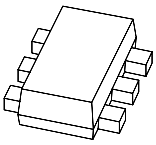
Kind regards,

Team Nexperia



PMBT3946VPN

40 V, 200 mA NPN/PNP switching transistor

Rev. 01 — 31 August 2009 Product data sheet

1. Product profile

1.1 General description

NPN/PNP double switching transistor in a SOT666 ultra small and flat lead Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number	Package		NPN/NPN complement	PNP/PNP complement
	NXP	JEITA		
PMBT3946VPN	SOT666	-	PMBT3904VS	PMBT3906VS

1.2 Features

- Double general-purpose switching transistor
- Board-space reduction
- Ultra small and flat lead SMD plastic package

1.3 Applications

- General-purpose switching and amplification

1.4 Quick reference data

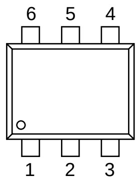
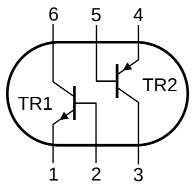
Table 2. Quick reference data

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
TR1 (NPN)						
h_{FE}	DC current gain	V_{CE} = 1 V; I_C = 10 mA	100	180	300	
TR2 (PNP)						
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		

sym019

3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PMBT3946VPN	-	plastic surface-mounted package; 6 leads	SOT666

4. Marking

Table 5. Marking codes

Type number	Marking code
PMBT3946VPN	ZE

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][2]	-	240	mW

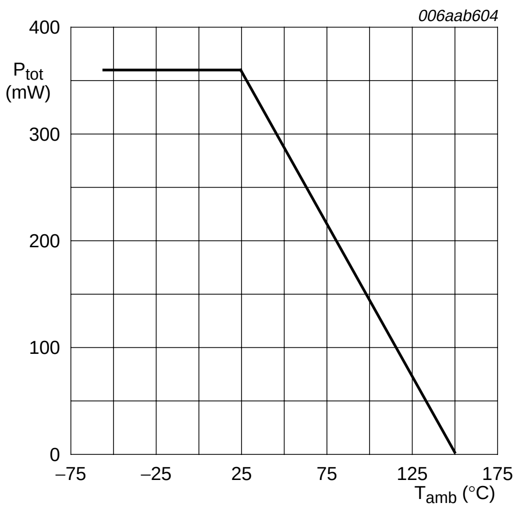
Table 6. Limiting values *...continued*

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1][2]	-	360	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			–55	+150	°C
T_{stg}	storage temperature			–65	+150	°C

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

[2] 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 curves SOT666

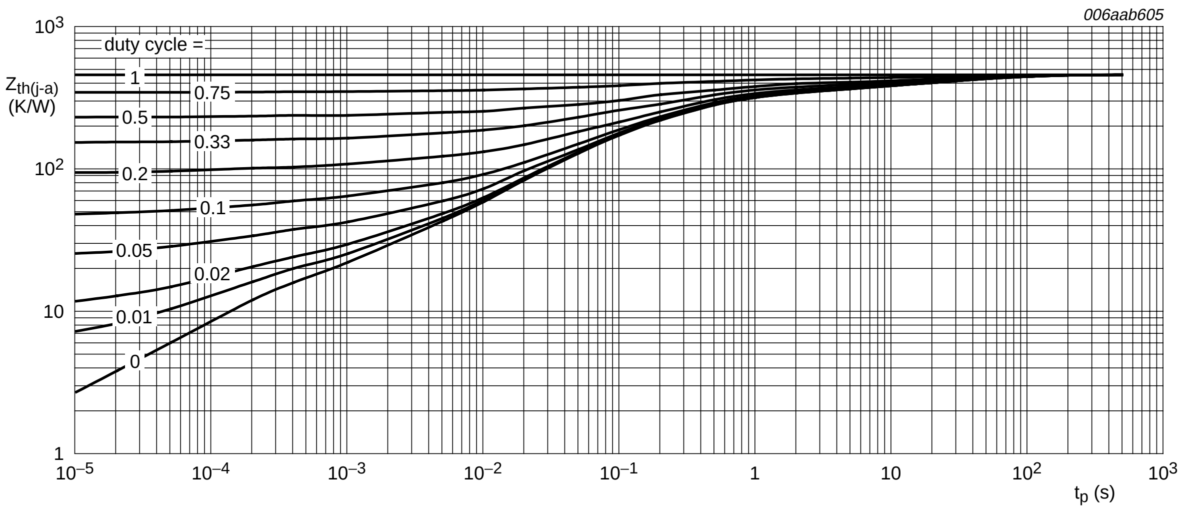
6. Thermal characteristics

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][2]	-	-	521	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	100	K/W
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1][2]	-	-	347	K/W

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

[2] 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

Table 8. Characteristics *...continued*

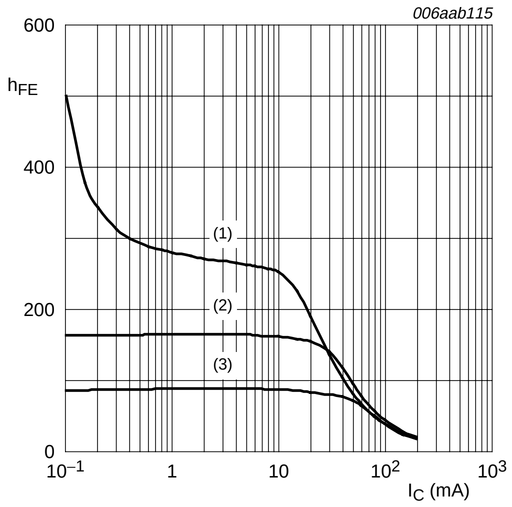
T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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
C_c	collector capacitance	V_{CB} = 5 V; I_E = i_e = 0 A; f = 1 MHz	-	-	4	pF
C_e	emitter capacitance	V_{EB} = 500 mV; I_C = i_c = 0 A; f = 1 MHz	-	-	8	pF
f_T	transition frequency	V_{CE} = 20 V; I_C = 10 mA; f = 100 MHz	300	-	-	MHz
NF	noise figure	V_{CE} = 5 V; I_C = 100 μA; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	-	-	5	dB
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
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
C_c	collector capacitance	V_{CB} = –5 V; I_E = i_e = 0 A; f = 1 MHz	-	-	4.5	pF

Table 8. Characteristics *...continued*

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_e	emitter capacitance	V_{EB} = –500 mV; $I_C = i_c$ = 0 A; f = 1 MHz	-	-	10	pF
f_T	transition frequency	V_{CE} = –20 V; I_C = –10 mA; f = 100 MHz	250	-	-	MHz
NF	noise figure	V_{CE} = –5 V; I_C = –100 µA; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	-	-	4	dB



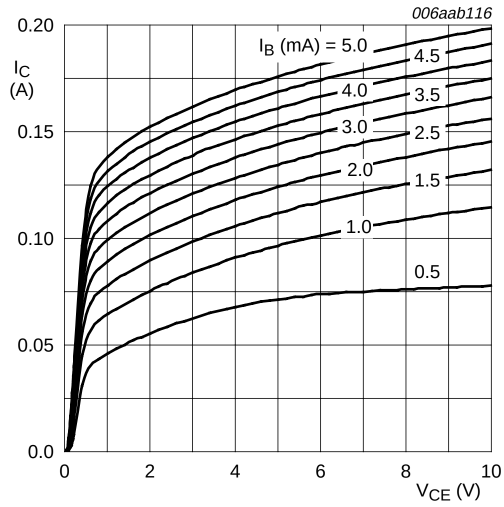
V_{CE} = 1 V

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

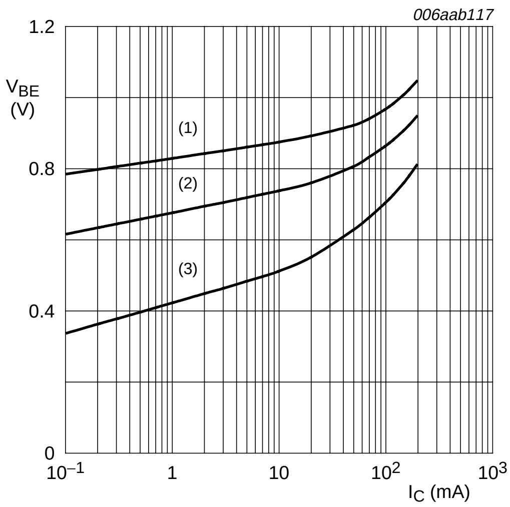
(3) T_{amb} = –55 °C

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



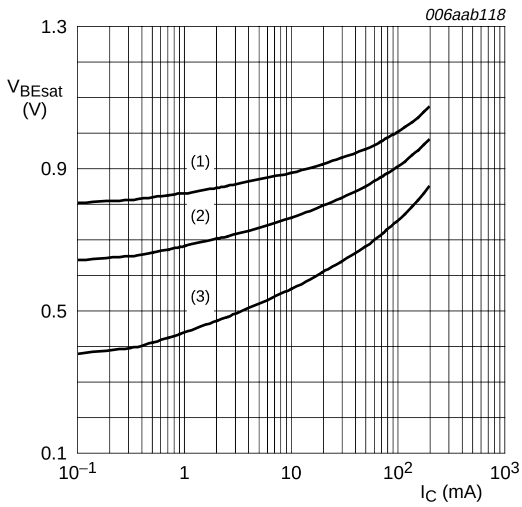
V_{CE} = 1 V

(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



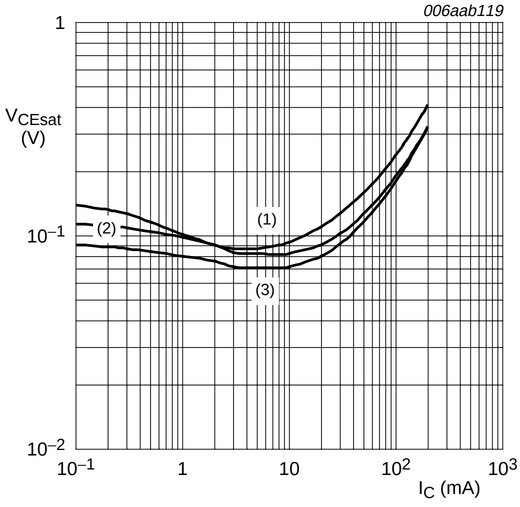
I_C/I_B = 10

(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



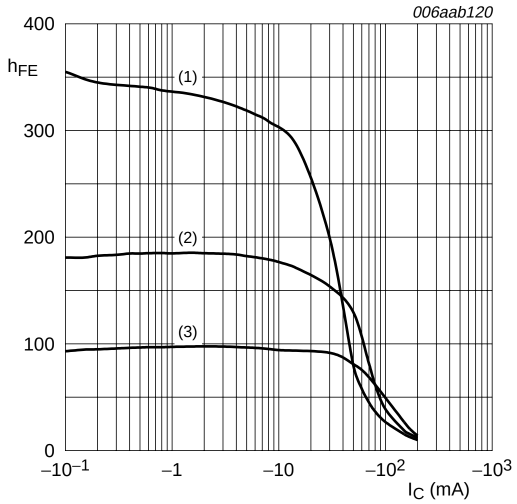
I_C/I_B = 10

(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



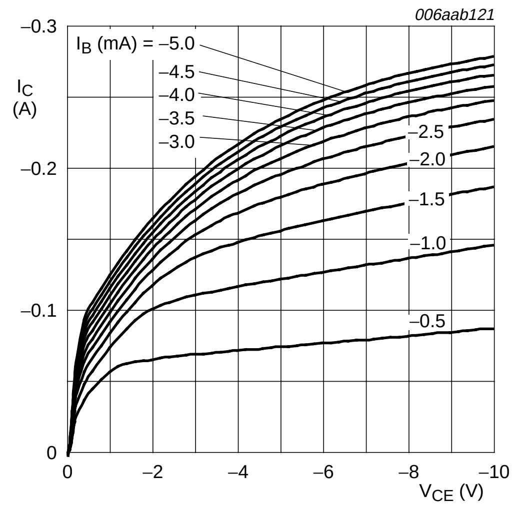
V_{CE} = −1 V

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

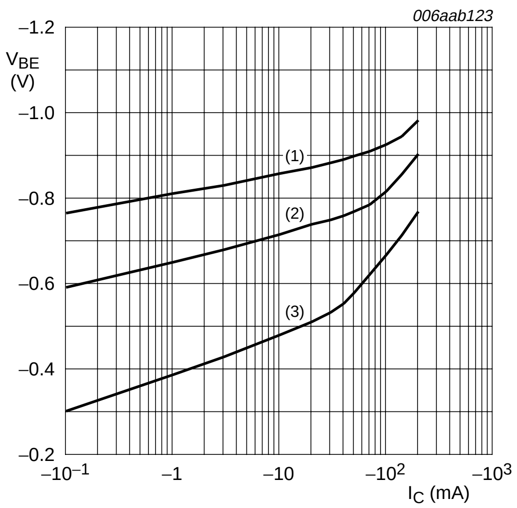
(3) T_{amb} = −55 °C

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



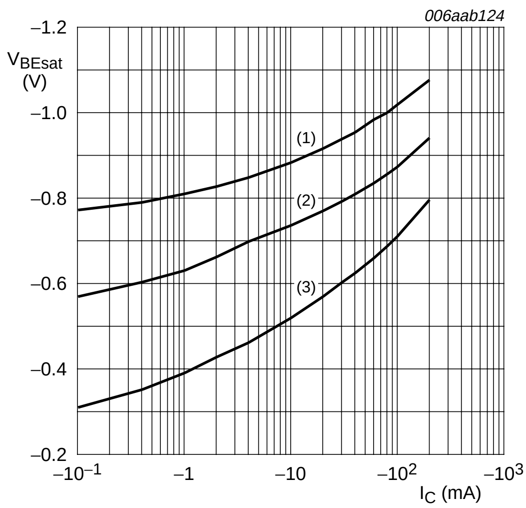
V_{CE} = −1 V

(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



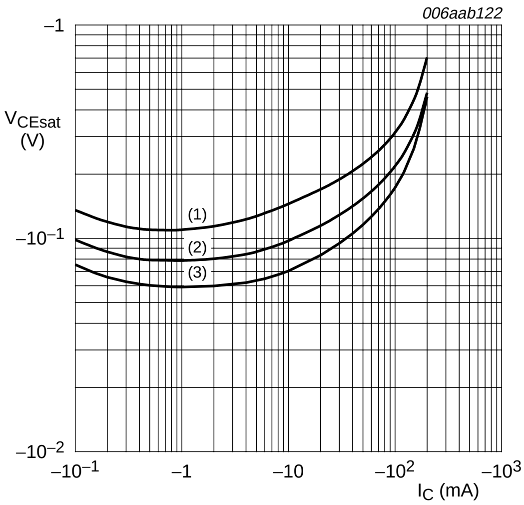
I_C/I_B = 10

(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



$I_C/I_B = 10$

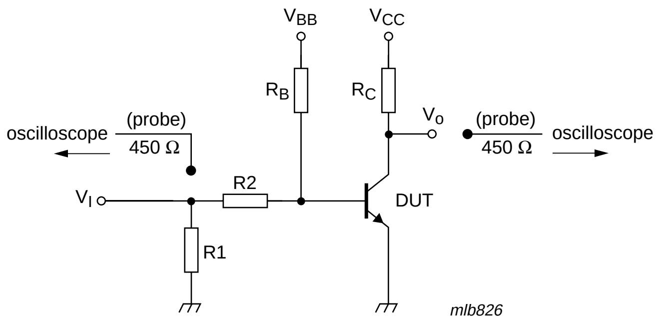
(1) $T_{amb} = 150$ °C

(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



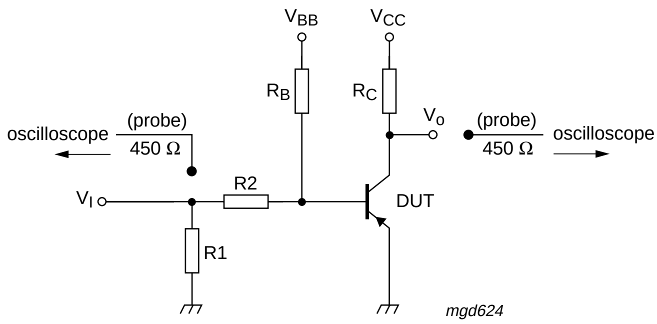
$V_I = 5$ V; t = 600 µs; $t_p = 10$ µs; $t_r = t_f \leq 3$ ns

R1 = 56 Ω; R2 = 2.5 kΩ; $R_B = 3.9$ kΩ; $R_C = 270$ Ω

$V_{BB} = -1.9$ V; $V_{CC} = 3$ V

Oscilloscope: input impedance $Z_i = 50$ Ω

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



$V_I = 5$ V; t = 600 µs; $t_p = 10$ µs; $t_r = t_f \leq 3$ ns

R1 = 56 Ω; R2 = 2.5 kΩ; $R_B = 3.9$ kΩ; $R_C = 270$ Ω

$V_{BB} = 1.9$ V; $V_{CC} = -3$ V

Oscilloscope: input impedance $Z_i = 50$ Ω

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

9. Package outline

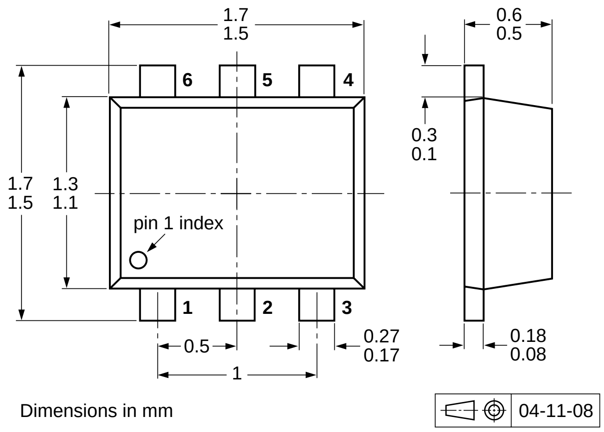


Fig 15. Package outline SOT666

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	
			4000	8000
PMBT3946VPN	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 14.

11. Soldering

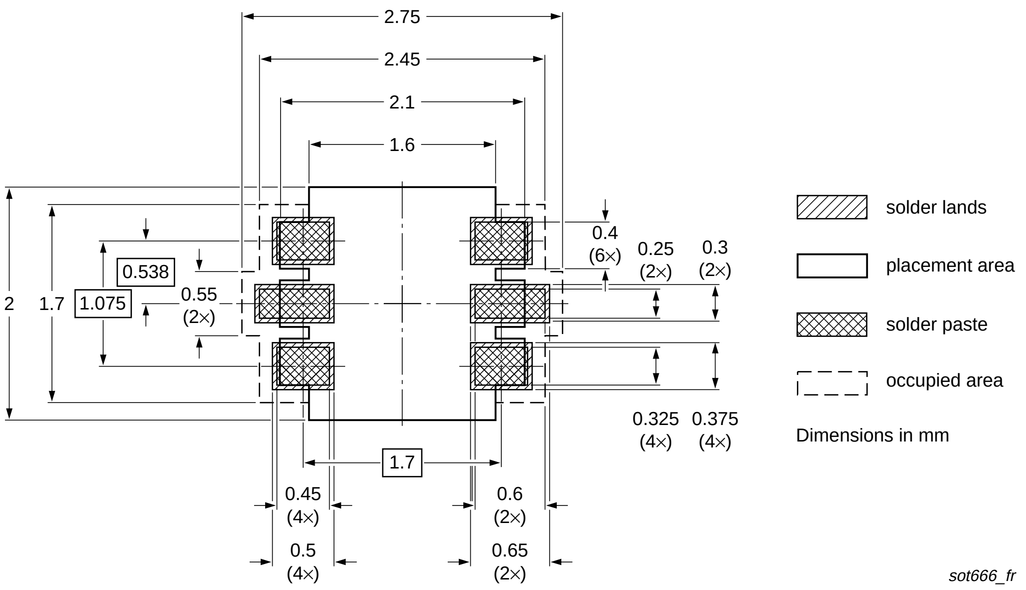


Fig 16. Reflow soldering footprint SOT666

12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMBT3946VPN_1	20090831	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.

[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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15. Contents

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Date of release: 31 August 2009
Document identifier: PMBT3946VPN_1

OCEAN CHIPS
Океан Электроники
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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
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- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А