



# PMBT3904QA

40 V, 200 mA NPN switching transistor

29 August 2018

Product data sheet

## 1. General description

NPN switching transistor in an ultra small DFN1010D-3 (SOT1215) leadless Surface-Mounted Device (SMD) plastic package with visible and solderable side pads.

## 2. Features and benefits

- Leadless ultra small SMD plastic package
- Low package height of 0.37 mm
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- Power dissipation comparable to SOT23

## 3. Applications

- General-purpose switching and amplification

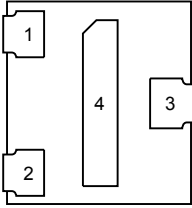
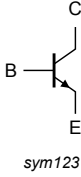
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	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	

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>Transparent top view DFN1010D-3 (SOT1215)</p>	 <p>sym123</p>
2	E	emitter		
3	C	collector		
4	C	collector		

## 6. Ordering information

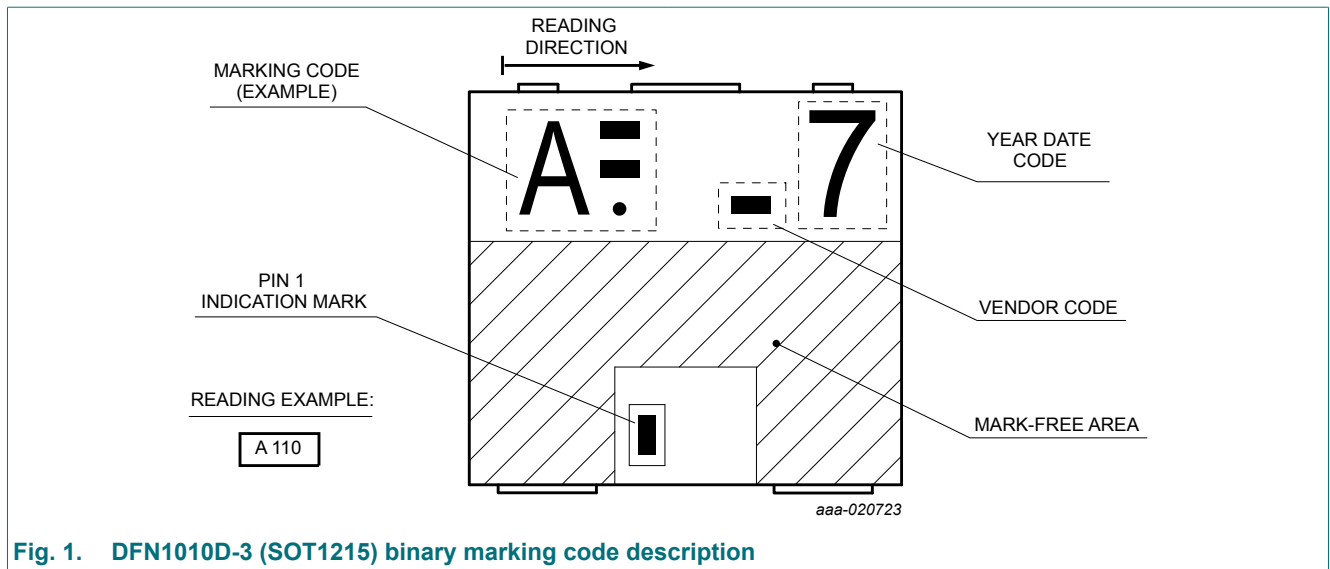
Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMBT3904QA	DFN1010D-3	plastic, leadless thermal enhanced ultra thin small outline package; 3 terminals; 0.75 mm pitch; 1.1 mm x 1 mm x 0.37 mm body	SOT1215

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PMBT3904QA	X 110



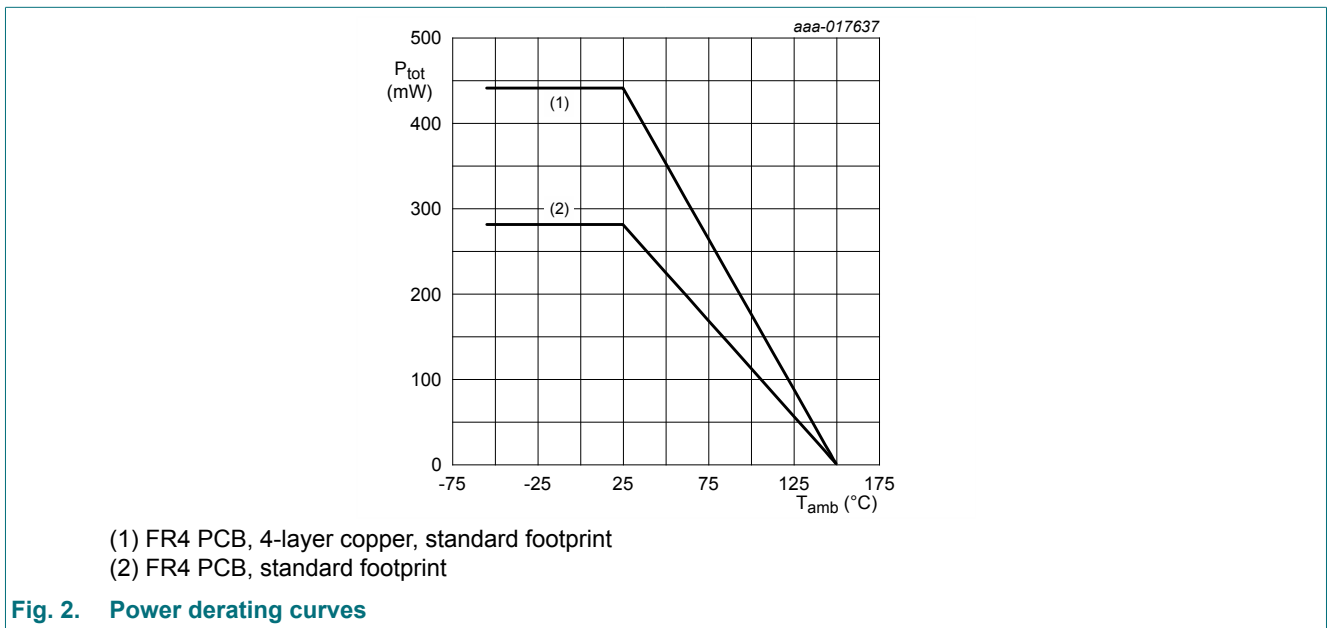
## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	60	V
$V_{CEO}$	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		-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1] [2]	280	mW
			[3] [2]	440	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.
- [2] Reflow soldering is the only recommended soldering method.
- [3] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.



## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] [2]	-	-	447	K/W
			[3] [2]	-	-	285	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.
- [3] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

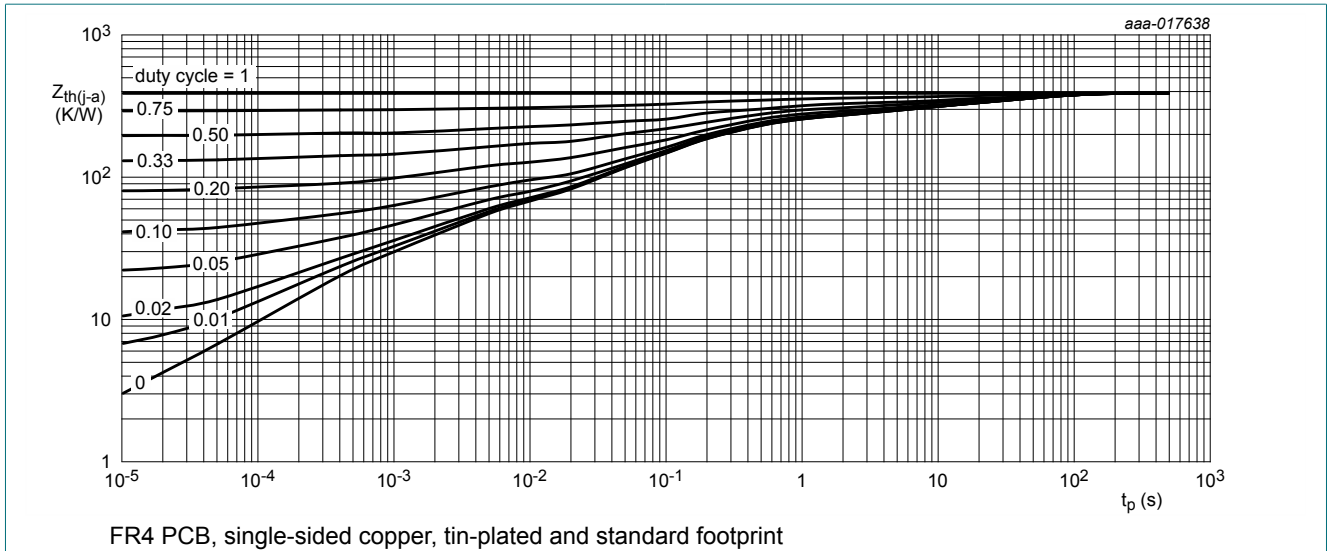


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

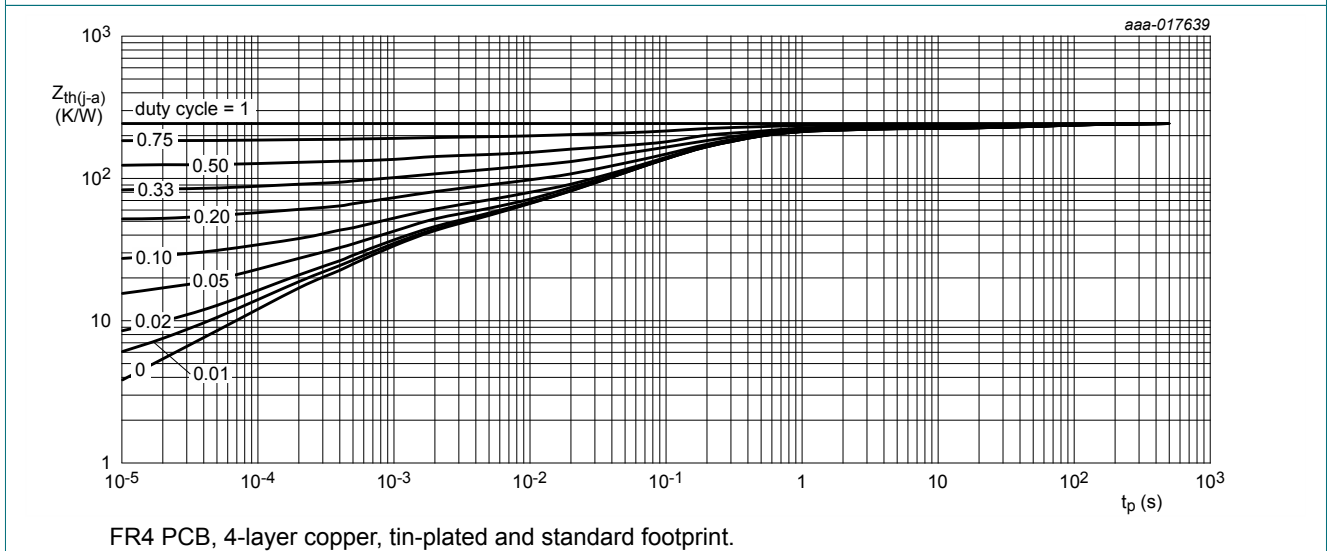
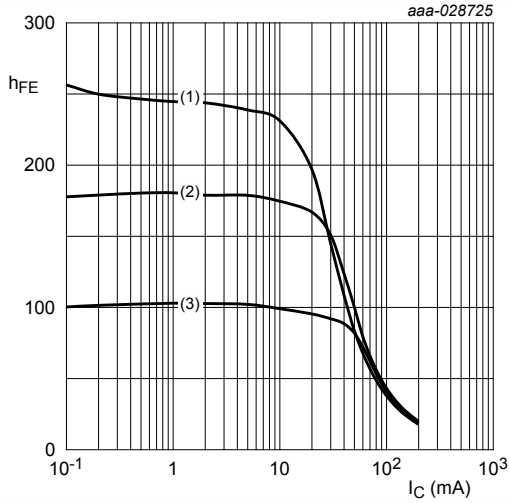


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

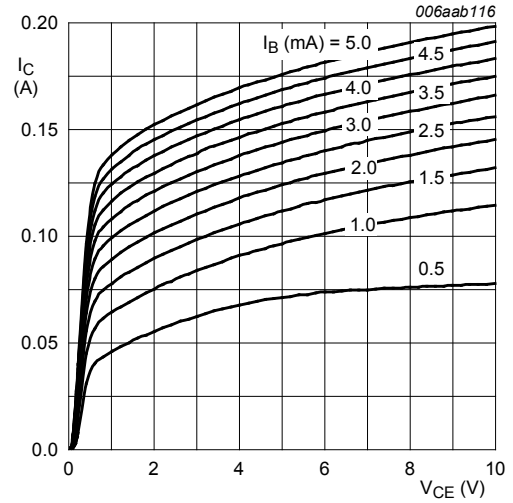
**Table 7. Characteristics**
 $T_{amb} = 25\text{ °C}$  unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\ \mu\text{A}$ ; $I_E = 0\ \text{A}$	60	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 1\ \text{mA}$ ; $I_B = 0\ \text{A}$	40	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_C = 0\ \text{A}$ ; $I_E = 100\ \mu\text{A}$	6	-	-	V
$I_{CBO}$	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	$V_{CE} = 1\ \text{V}$ ; $I_C = 100\ \mu\text{A}$	60	180	-	
		$V_{CE} = 1\ \text{V}$ ; $I_C = 1\ \text{mA}$	80	180	-	
		$V_{CE} = 1\ \text{V}$ ; $I_C = 10\ \text{mA}$	100	180	300	
		$V_{CE} = 1\ \text{V}$ ; $I_C = 50\ \text{mA}$	60	105	-	
		$V_{CE} = 1\ \text{V}$ ; $I_C = 100\ \text{mA}$ ; pulsed; $t_p \leq 300\ \mu\text{s}$ ; $\delta \leq 0.02$	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
$t_d$	delay time	$I_C = 10\ \text{mA}$ ; $I_{Bon} = 1\ \text{mA}$ ; $I_{Boff} = -1\ \text{mA}$	-	-	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
$C_c$	collector capacitance		$V_{CB} = 5\ \text{V}$ ; $I_E = 0\ \text{A}$ ; $i_e = 0\ \text{A}$ ; $f = 1\ \text{MHz}$	-	-	4
$C_e$	emitter capacitance	$V_{EB} = 500\ \text{mV}$ ; $I_C = 0\ \text{A}$ ; $i_c = 0\ \text{A}$ ; $f = 1\ \text{MHz}$	-	-	8	pF
$f_T$	transition frequency	$V_{CE} = 20\ \text{V}$ ; $I_C = 10\ \text{mA}$ ; $f = 100\ \text{MHz}$	300	-	-	MHz



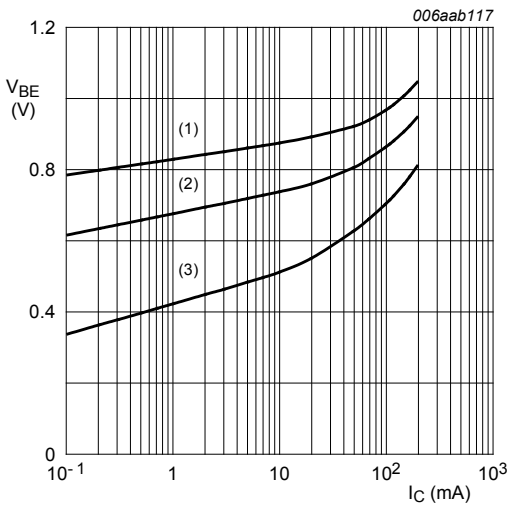
$V_{CE} = 1 V$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -55^\circ C$

Fig. 5. DC current gain as a function of collector current; typical values



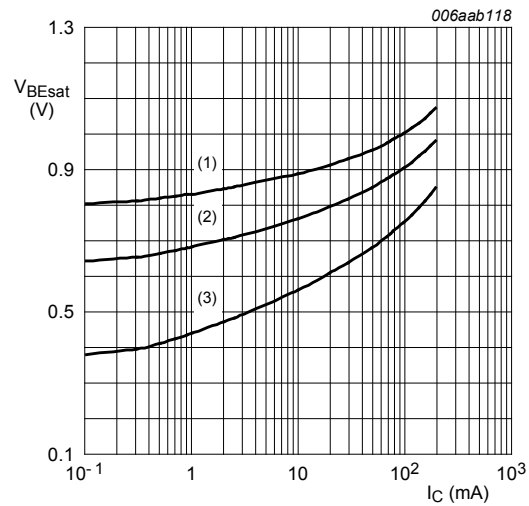
$T_{amb} = 25^\circ C$

Fig. 6. Collector current as a function of collector-emitter voltage; typical values



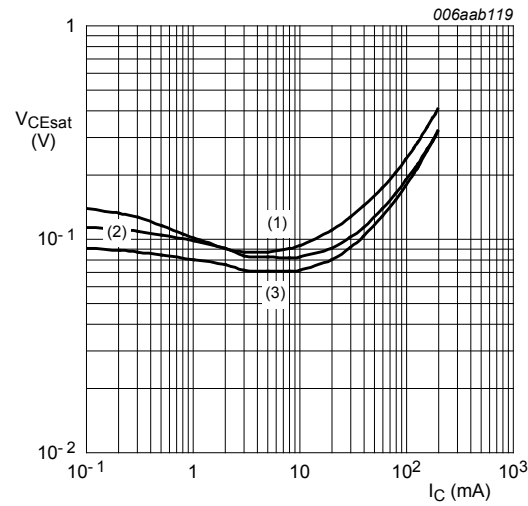
$V_{CE} = 1 V$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 150^\circ C$

Fig. 7. Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 10$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 150^\circ C$

Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 10$   
 (1)  $T_{amb} = 150^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = -55^\circ\text{C}$

Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values

11. Test information

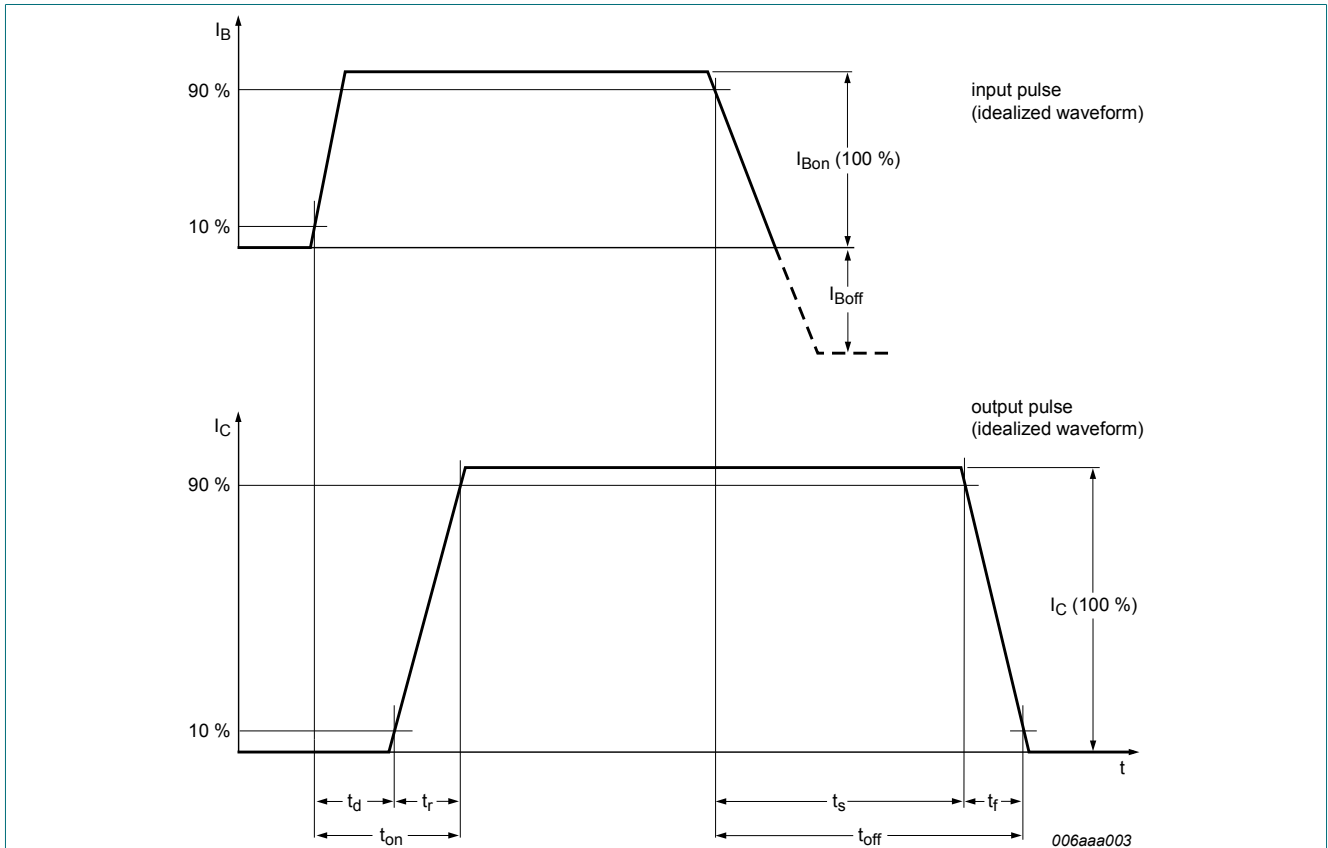


Fig. 10. Transistor switching time definition

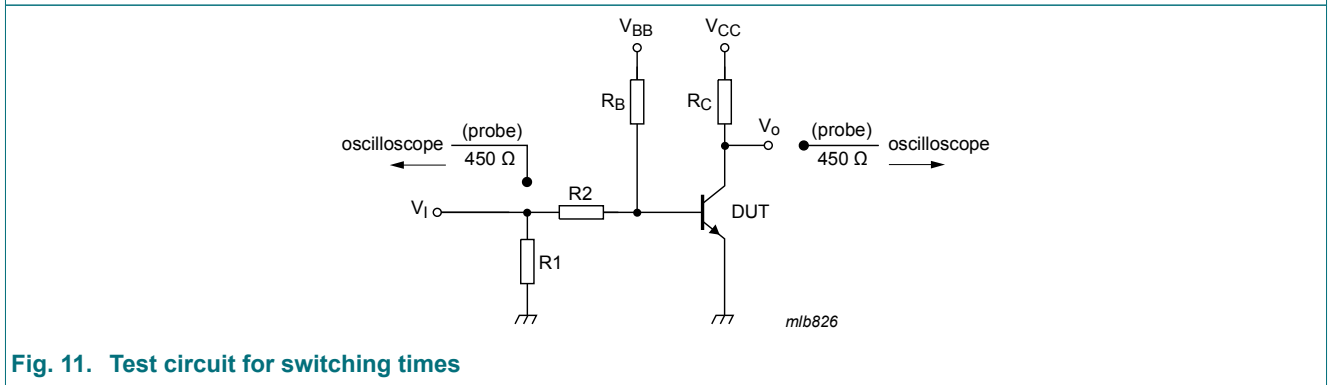


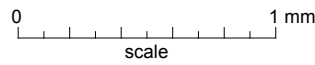
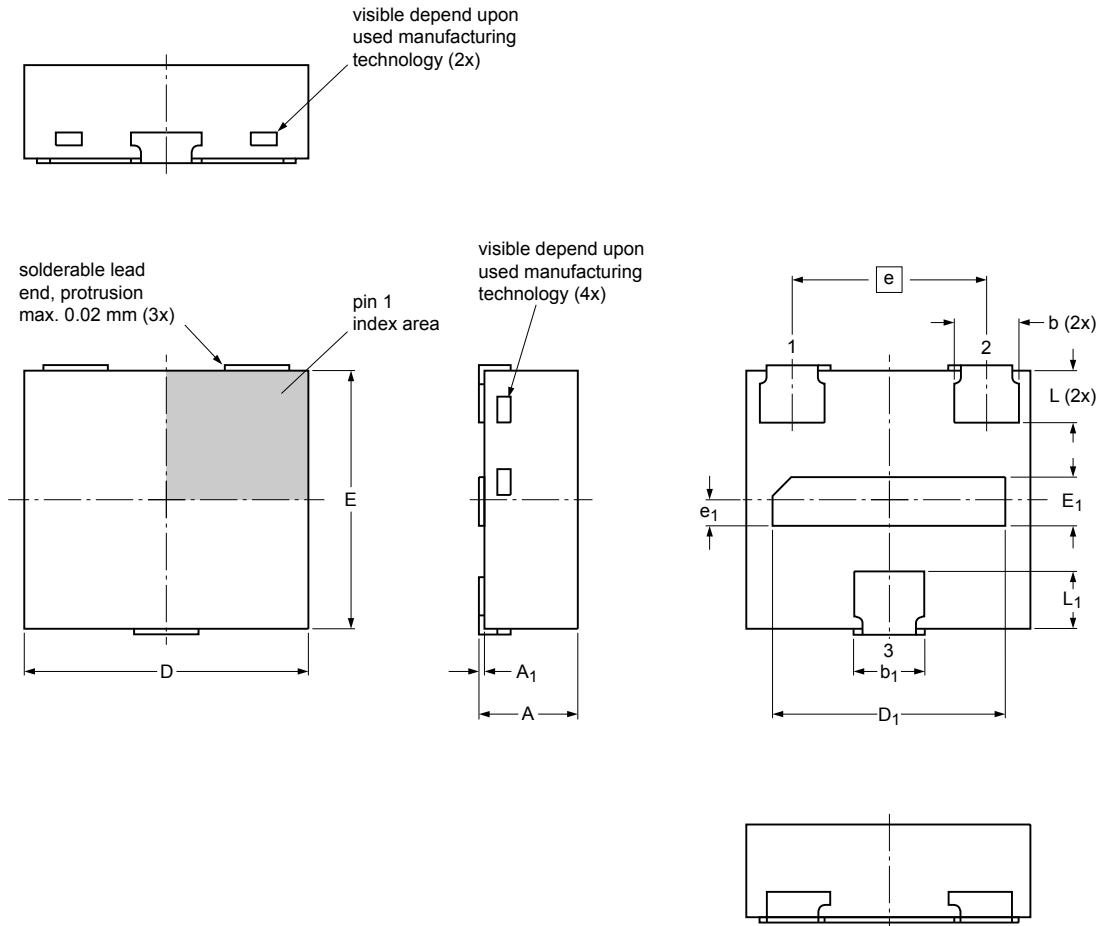
Fig. 11. Test circuit for switching times



## 12. Package outline

DFN1010D-3: plastic thermal enhanced ultra thin small outline package; no leads;  
3 terminals; body: 1.1 x 1.0 x 0.37 mm

SOT1215



Dimensions (mm are the original dimensions)

Unit	A	A <sub>1</sub>	b	b <sub>1</sub>	D	D <sub>1</sub>	E	E <sub>1</sub>	e	e <sub>1</sub>	L	L <sub>1</sub>
min	0.34		0.22	0.245	1.05	0.87	0.95	0.16			0.17	0.195
mm nom	0.37		0.25	0.275	1.10	0.90	1.00	0.19	0.75	0.1	0.20	0.225
max	0.40	0.04	0.30	0.325	1.15	0.95	1.05	0.24			0.25	0.275

Note

1. Dimension A is including plating thickness.

sot1215\_po

Outline version	References			European projection	Issue date
	IEC	JEDEC	JEITA		
SOT1215					13-03-05 13-03-06

Fig. 12. Package outline DFN1010D-3 (SOT1215)

### 13. Soldering

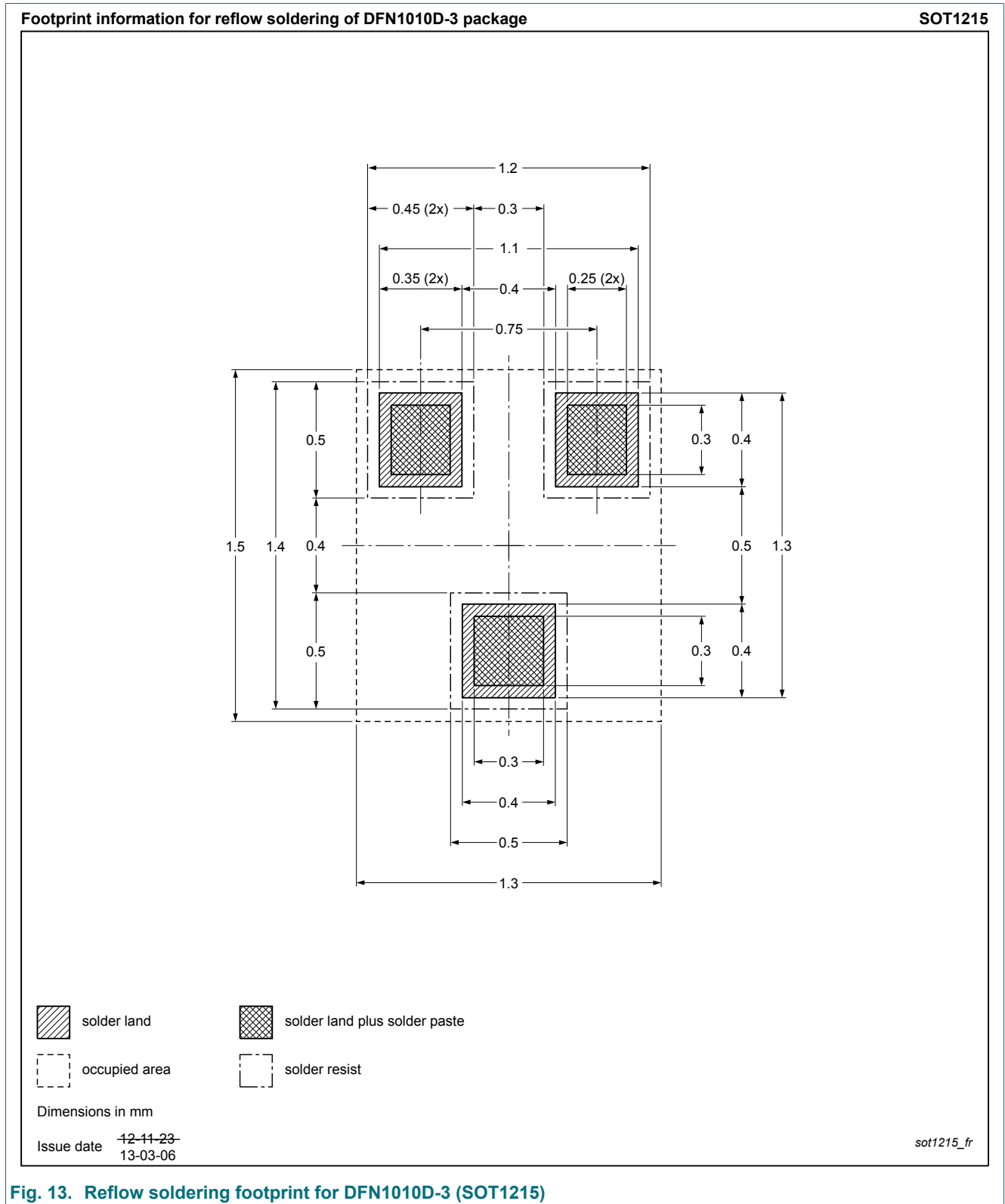


Fig. 13. Reflow soldering footprint for DFN1010D-3 (SOT1215)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT3904QA v.1	20180829	Product data sheet	-	-

## 15. Legal information

### 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.
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Product [short] data sheet	Production	This document contains the product specification.

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