



# PMBT2222AQA

40 V, 600 mA NPN switching transistor

21 September 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.

PNP complement: PMBT2907AQA

## 2. Features and benefits

- High current (max. 600 mA)
- Low voltage (max. 40V)
- Leadless ultra small SMD plastic package
- Low package height of 0.37 mm
- Suitable for Automatic Optical Inspection (AOI) of solder joint

## 3. Applications

- Switching and linear applications
- Mobile applications

## 4. Quick reference data

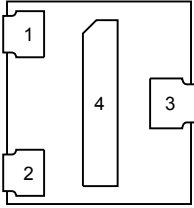
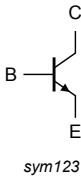
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CE0}$	collector-emitter voltage	open base	-	-	40	V
$I_C$	collector current		-	-	600	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	800	mA
$h_{FE}$	DC current gain	$V_{CE} = 10$ V; $I_C = 150$ mA	[1]	100	-	300
		$V_{CE} = 10$ V; $I_C = 500$ mA	[1]	40	-	-

[1] Pulsed test:  $t_p \leq 300$   $\mu$ s;  $\delta \leq 0.02$

### 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

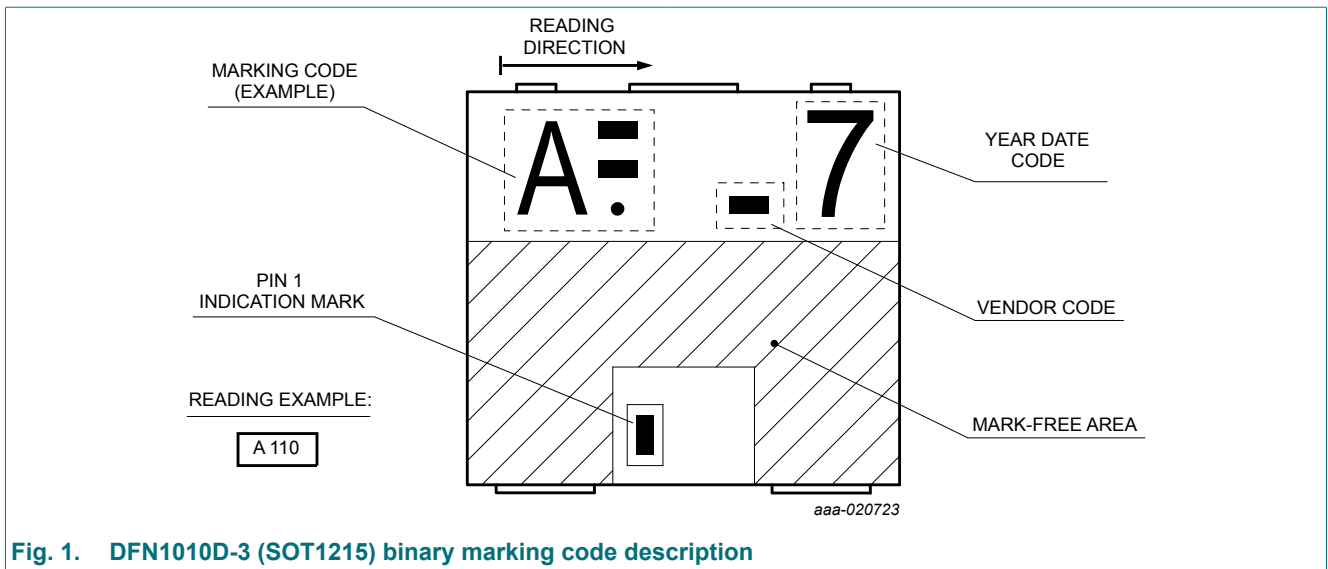
Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMBT2222AQA	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
PMBT2222AQA	X 100



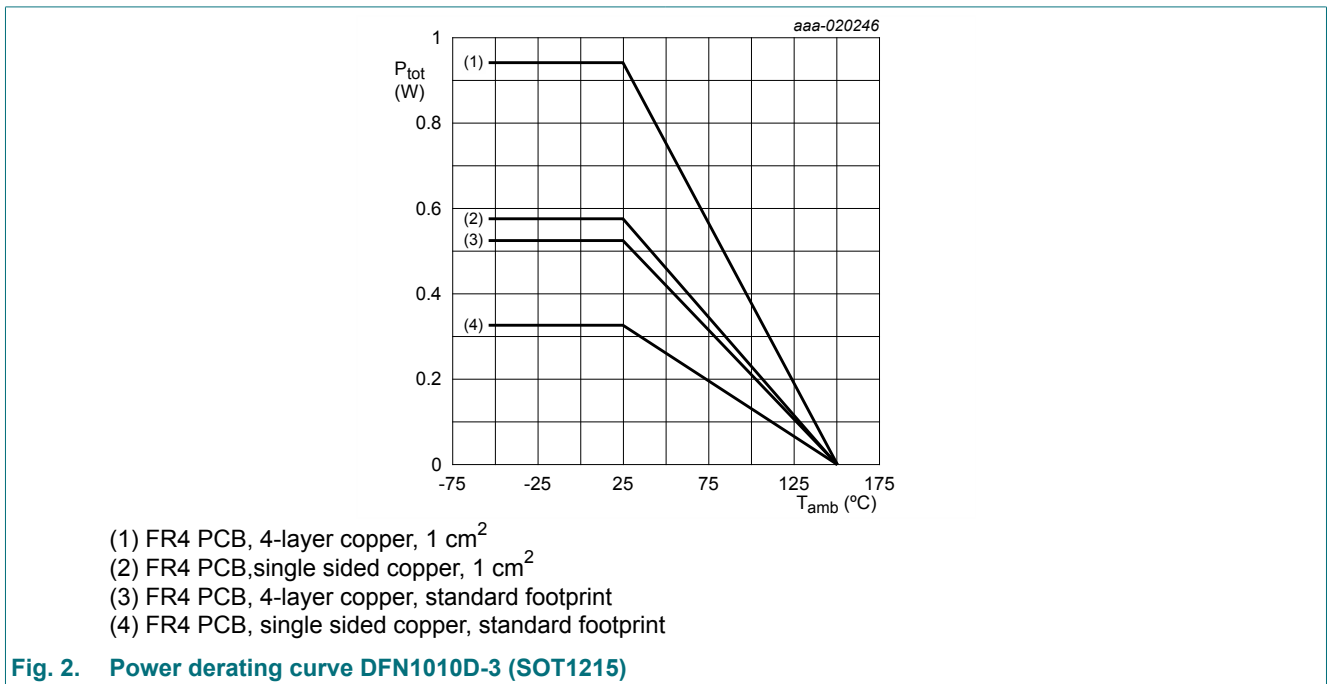
## 8. Limiting values

**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		-	75	V
$V_{CEO}$	collector-emitter voltage	open base		-	40	V
$V_{EBO}$	emitter-base voltage	open collector		-	6	V
$I_C$	collector current			-	600	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms		-	800	mA
$I_{BM}$	peak base current			-	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	325	mW
			[2]	-	575	mW
			[3]	-	525	mW
			[4]	-	940	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] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.



## 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]	-	-	385	K/W
			[2]	-	-	218	K/W
			[3]	-	-	239	K/W
			[4]	-	-	133	K/W

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.

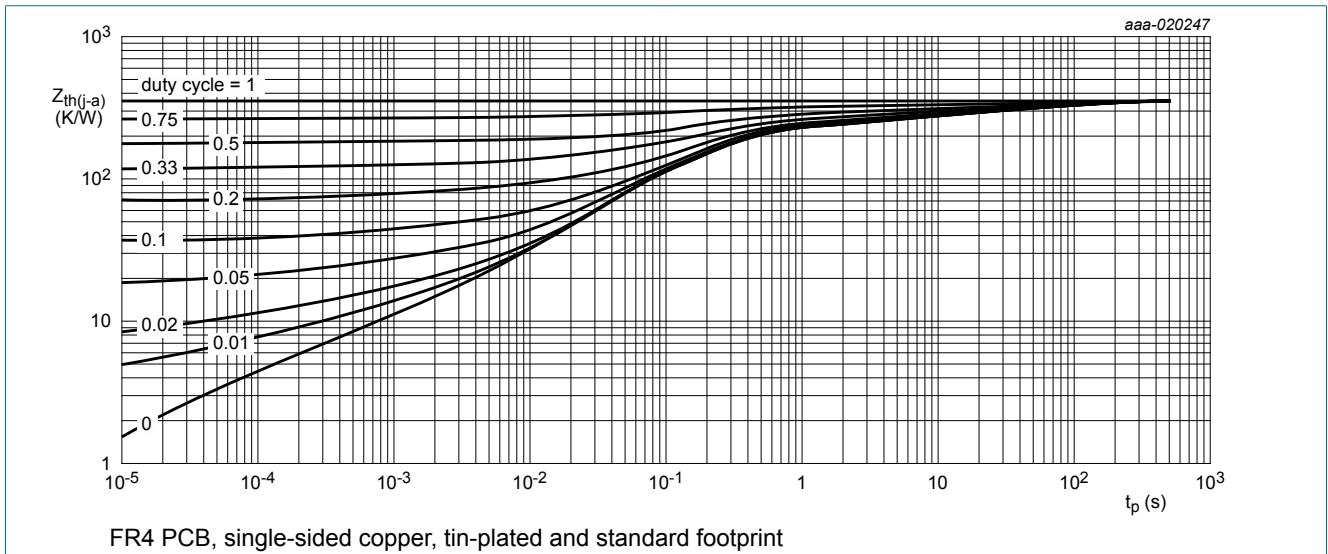


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

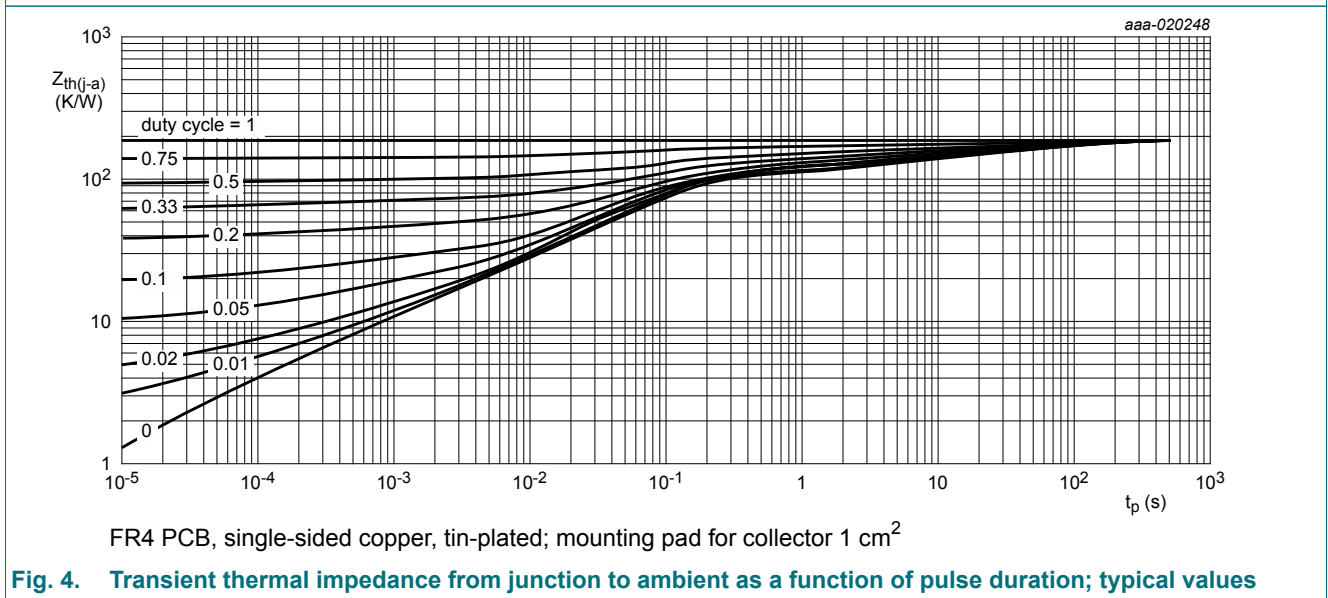


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

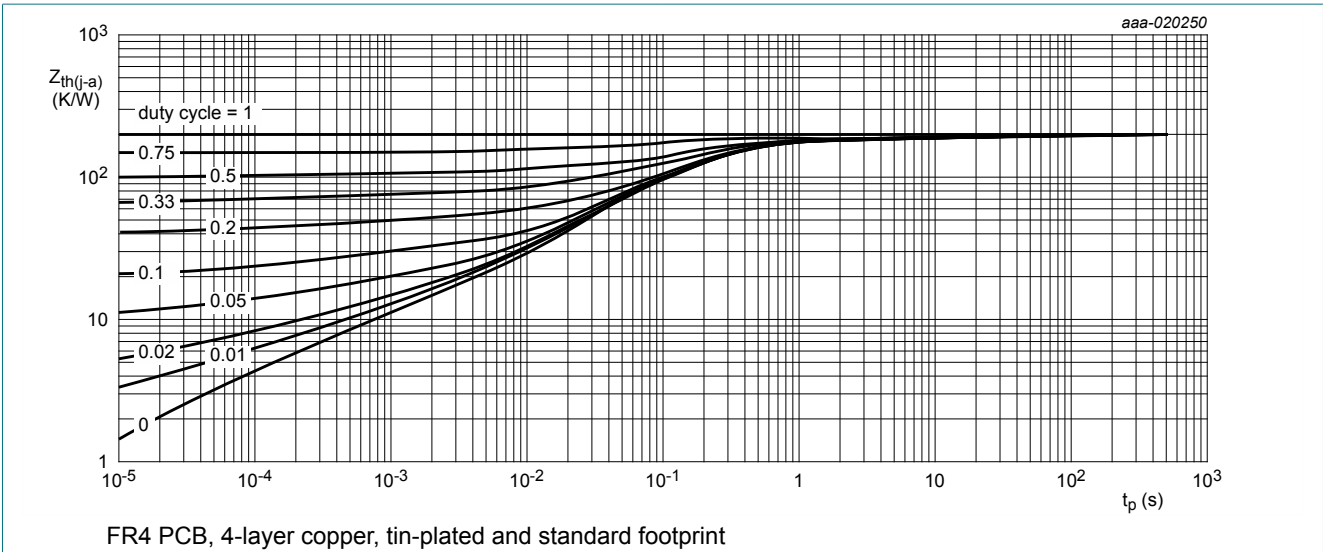


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

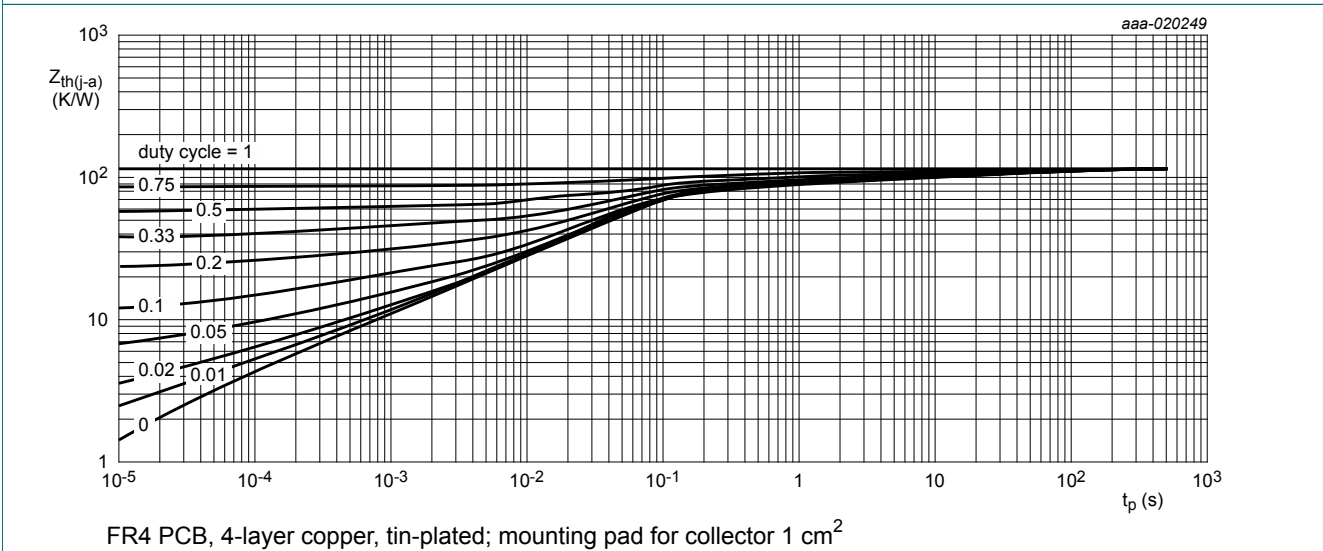


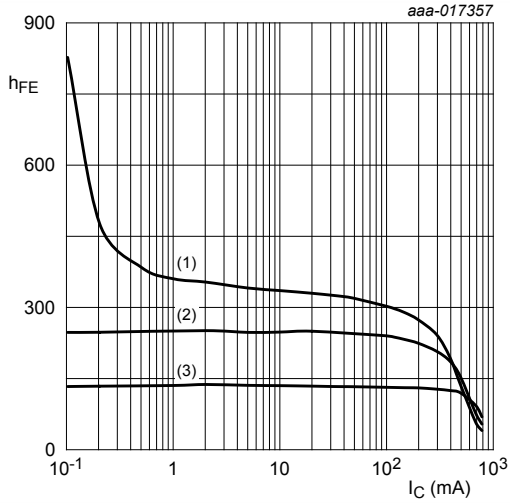
Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

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

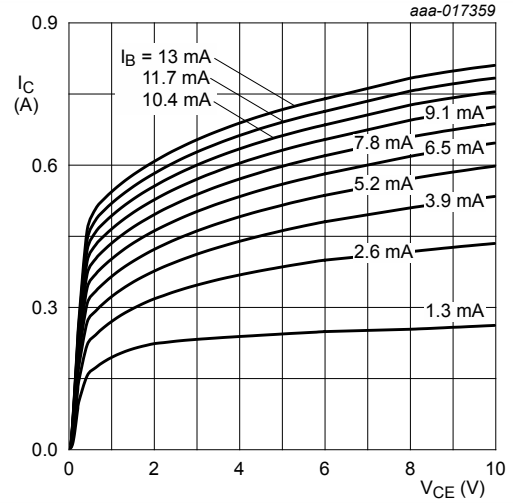
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\ \mu\text{A}$ ; $I_E = 0\ \text{A}$	75	-	-	V	
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2\ \text{mA}$ ; $I_B = 0\ \text{A}$	40	-	-	V	
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_C = 0\ \text{A}$ ; $I_E = 100\ \mu\text{A}$	6	-	-	V	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60\ \text{V}$ ; $I_E = 0\ \text{A}$	-	-	10	nA	
		$V_{CB} = 60\ \text{V}$ ; $I_E = 0\ \text{A}$ ; $T_J = 125\text{ °C}$	-	-	10	$\mu\text{A}$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\ \text{V}$ ; $I_C = 0\ \text{A}$	-	-	10	nA	
$h_{FE}$	DC current gain	$V_{CE} = 10\ \text{V}$ ; $I_C = 100\ \mu\text{A}$	35	-	-		
		$V_{CE} = 10\ \text{V}$ ; $I_C = 1\ \text{mA}$	50	-	-		
		$V_{CE} = 10\ \text{V}$ ; $I_C = 10\ \text{mA}$	75	-	-		
		$V_{CE} = 10\ \text{V}$ ; $I_C = 10\ \text{mA}$ ; $T_{amb} = -55\text{ °C}$	35	-	-		
		$V_{CE} = 10\ \text{V}$ ; $I_C = 150\ \text{mA}$	[1]	100	-	300	
		$V_{CE} = 1\ \text{V}$ ; $I_C = 150\ \text{mA}$	[1]	50	-	-	
		$V_{CE} = 10\ \text{V}$ ; $I_C = 500\ \text{mA}$	[1]	40	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 150\ \text{mA}$ ; $I_B = 15\ \text{mA}$	[1]	-	300	mV	
		$I_C = 500\ \text{mA}$ ; $I_B = 50\ \text{mA}$	[1]	-	1	V	
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 150\ \text{mA}$ ; $I_B = 15\ \text{mA}$	[1]	0.6	1.2	V	
		$I_C = 500\ \text{mA}$ ; $I_B = 50\ \text{mA}$	[1]	-	2	V	
$t_d$	delay time	$I_C = 150\ \text{mA}$ ; $I_{B(on)} = 15\ \text{mA}$ ; $I_{B(off)} = -15\ \text{mA}$	-	-	15	ns	
$t_r$	rise time		-	-	20	ns	
$t_{on}$	turn-on time		-	-	35	ns	
$t_s$	storage time		-	-	200	ns	
$t_f$	fall time		-	-	60	ns	
$t_{off}$	turn-off time		-	-	260	ns	
$C_c$	collector capacitance		$V_{CB} = 10\ \text{V}$ ; $I_E = 0\ \text{A}$ ; $i_e = 0\ \text{A}$ ; $f = 1\ \text{MHz}$	-	-	8	pF
$C_e$	emitter capacitance	$V_{EB} = 500\ \text{mV}$ ; $I_C = 0\ \text{A}$ ; $i_c = 0\ \text{A}$ ; $f = 1\ \text{MHz}$	-	-	25	pF	
$f_T$	transition frequency	$V_{CE} = 20\ \text{V}$ ; $I_C = 20\ \text{mA}$ ; $f = 100\ \text{MHz}$	[1]	-	340	MHz	

[1] Pulsed test:  $t_p \leq 300\ \mu\text{s}$ ;  $\delta \leq 0.02$



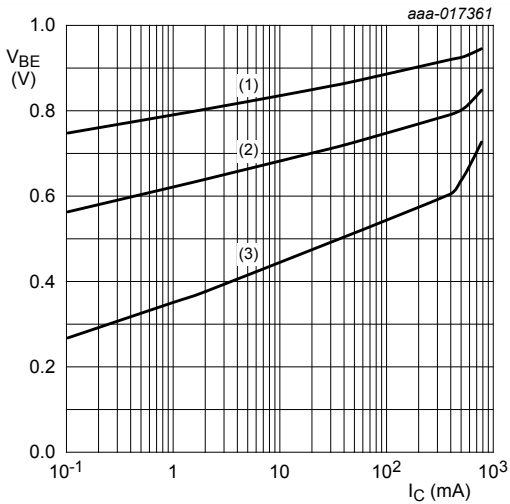
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -55^\circ C$

Fig. 7. DC current gain as a function of collector current; typical values



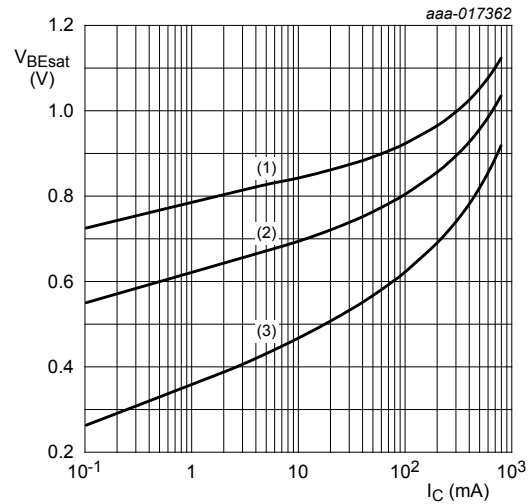
$T_{amb} = 25^\circ C$

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



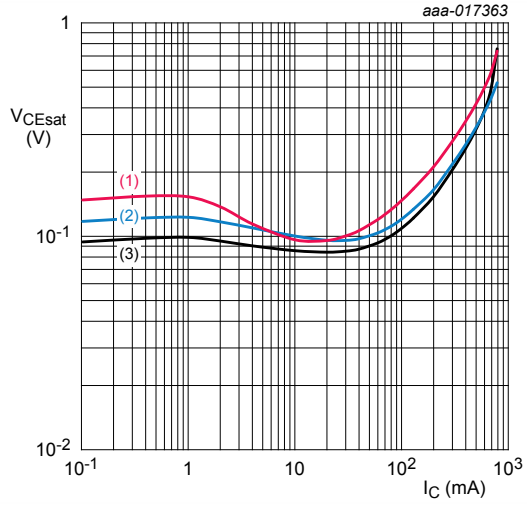
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 150^\circ C$

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



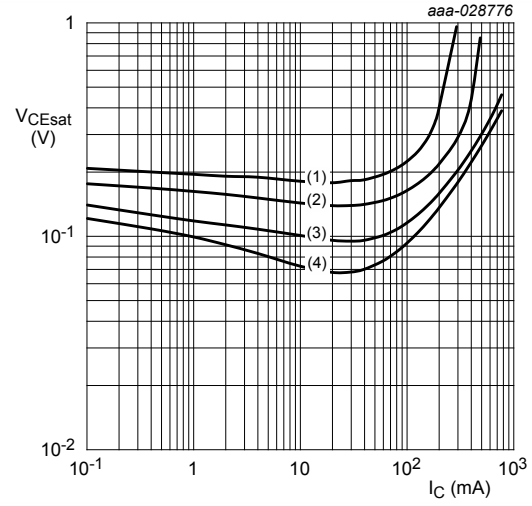
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 150^\circ C$

Fig. 10. Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$   
 (1)  $T_{amb} = 150\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

**Fig. 11. Collector-emitter saturation voltage as a function of collector current; typical values**



$T_{amb} = 25\text{ }^\circ\text{C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 20$   
 (4)  $I_C/I_B = 10$

**Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values**



11. Test information

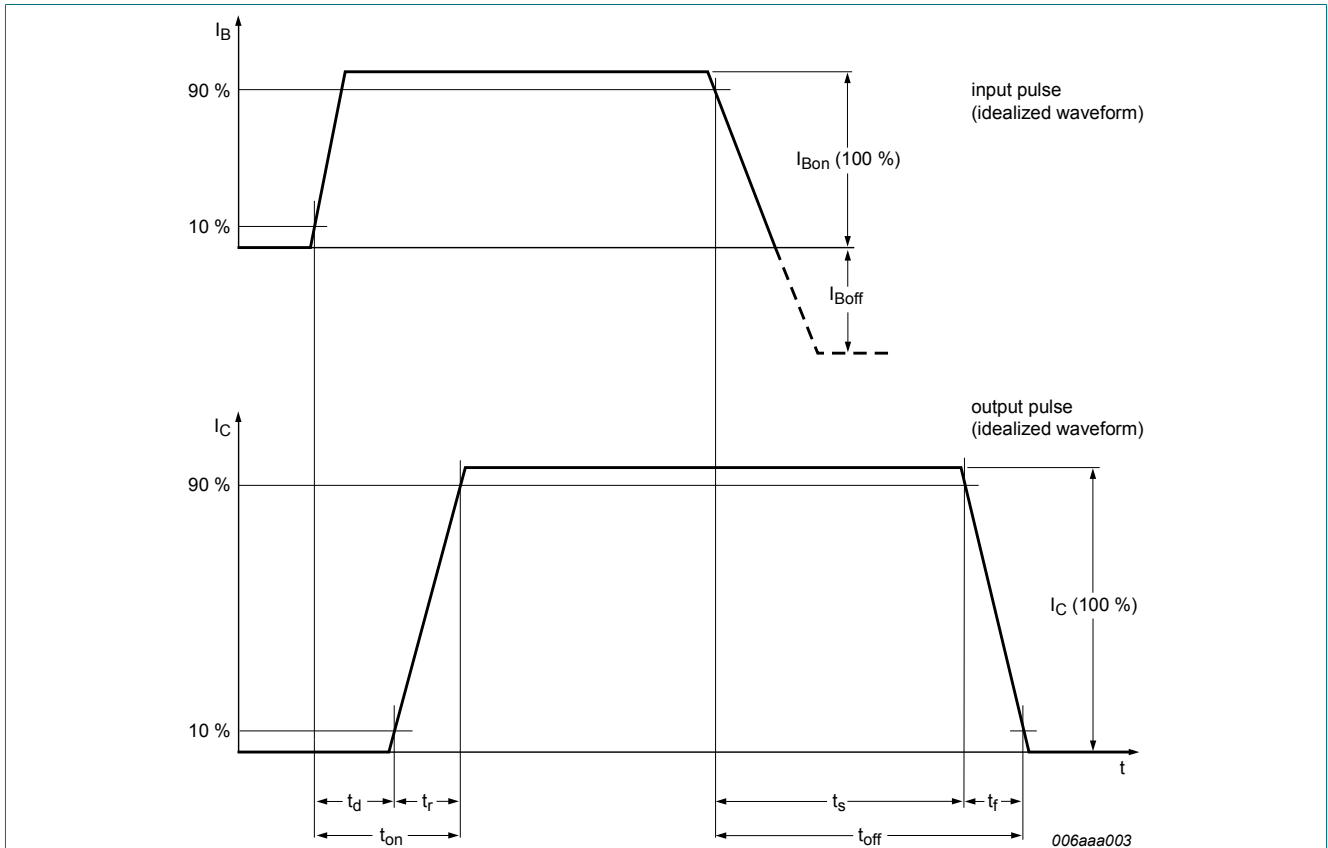


Fig. 13. Transistor switching time definition

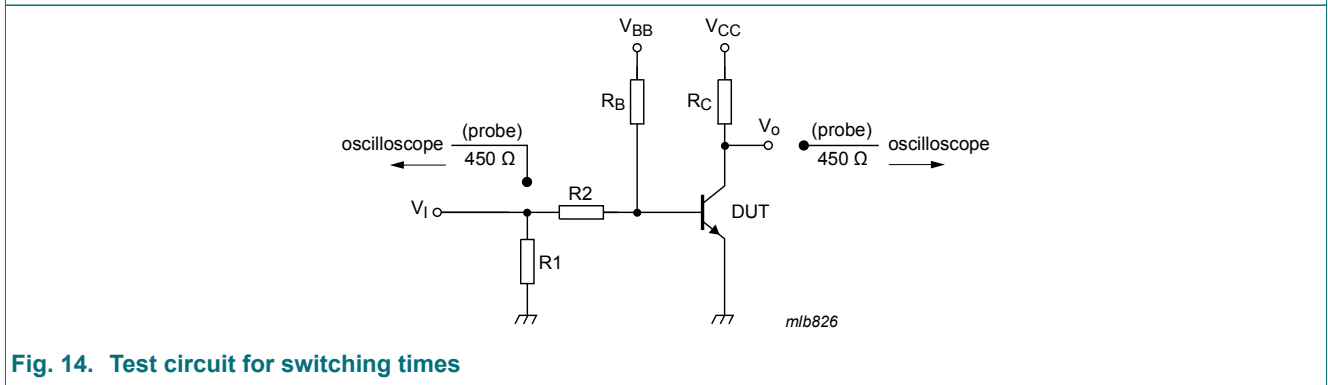


Fig. 14. Test circuit for switching times

## 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

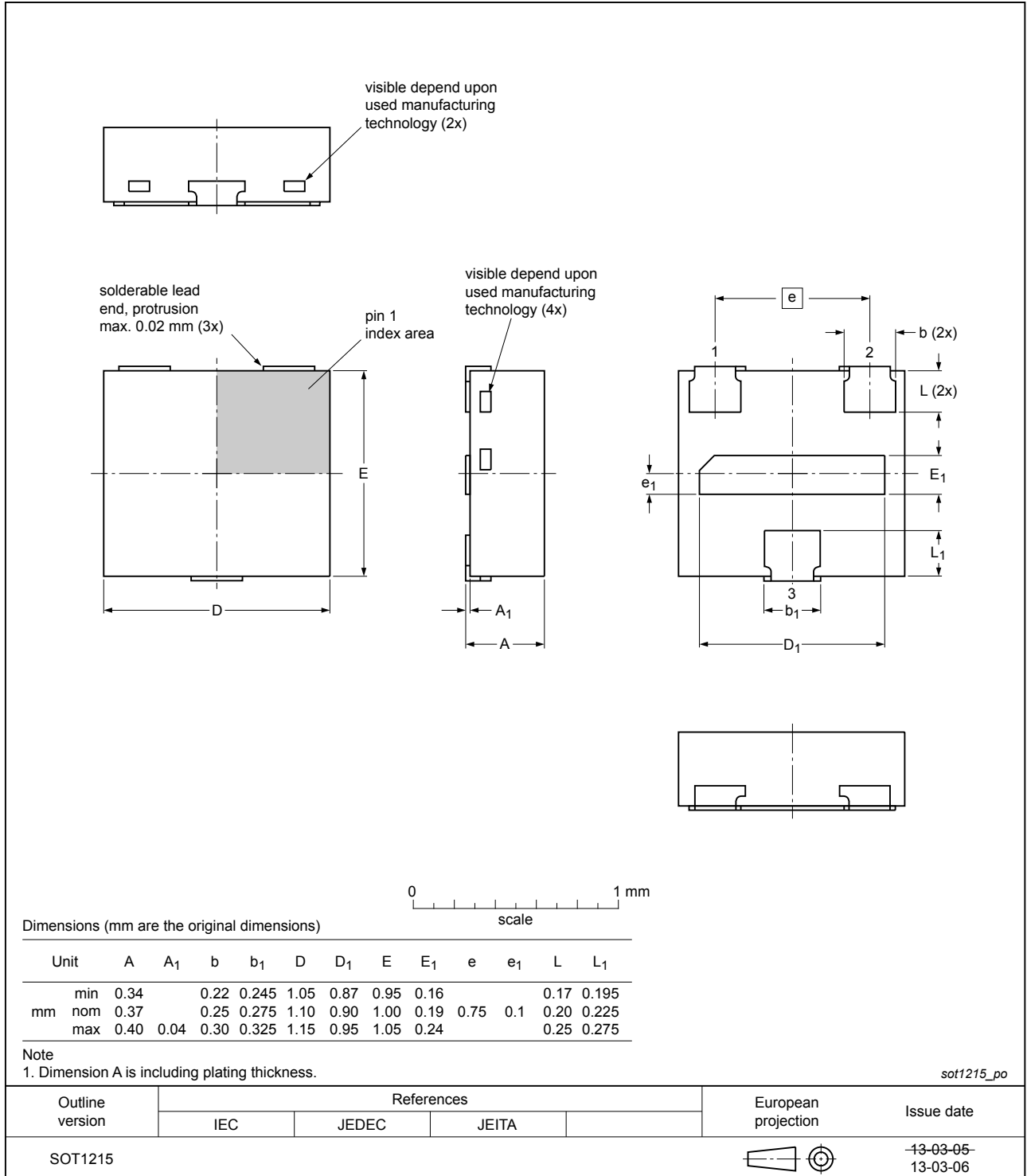


Fig. 15. Package outline DFN1010D-3 (SOT1215)

### 13. Soldering

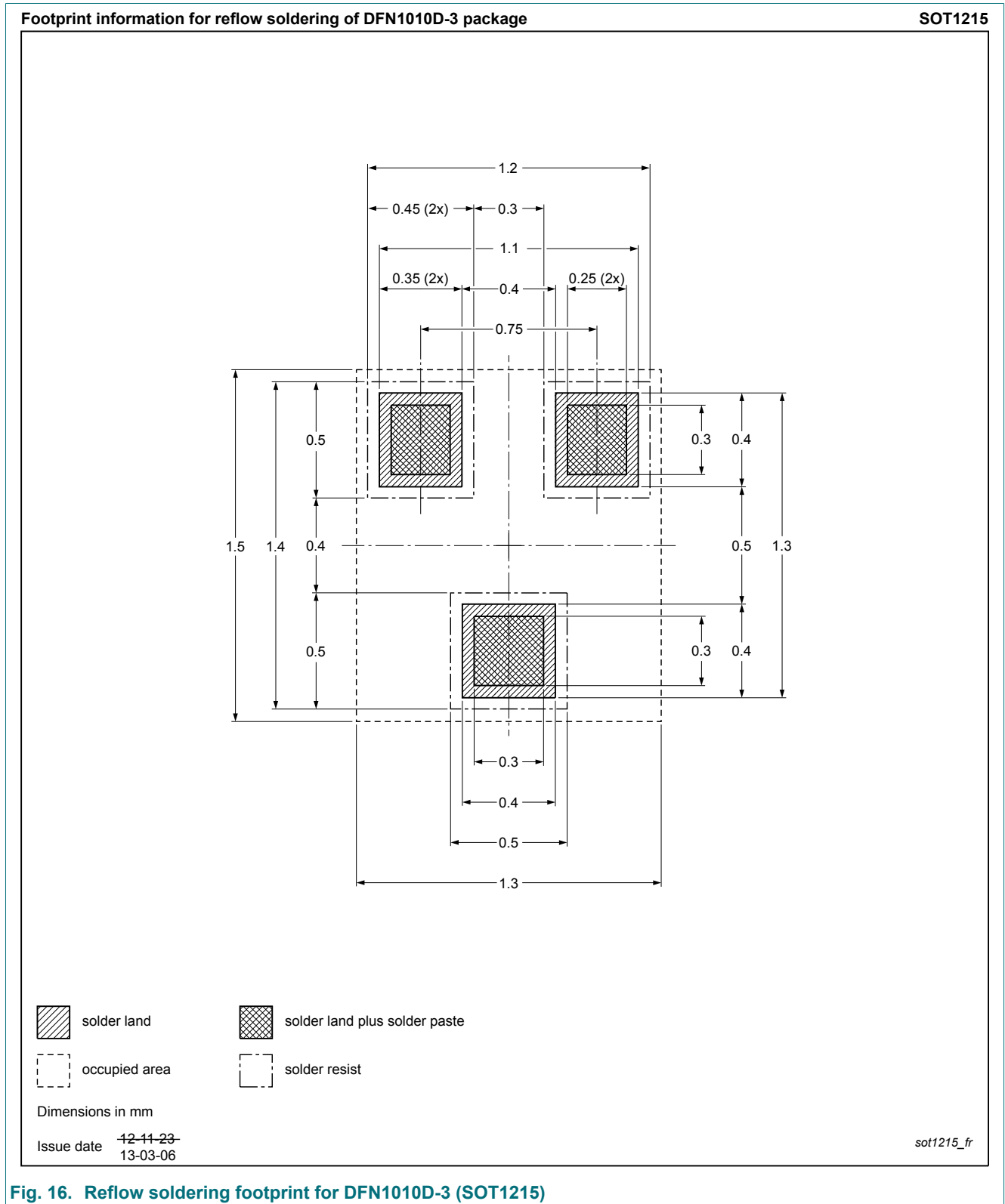


Fig. 16. Reflow soldering footprint for DFN1010D-3 (SOT1215)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT2222AQA v.1	20180921	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.
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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- [2] The term 'short data sheet' is explained in section "Definitions".
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