



# PQMH13

NPN/NPN resistor-equipped double transistor;  
 $R1 = 4.7 \text{ k}\Omega$ ,  $R2 = 47 \text{ k}\Omega$

8 October 2024

Product data sheet

## 1. General description

NPN/NPN Resistor-Equipped Transistor (RET) in a leadless ultra small DFN1010B-6 (SOT1216) Surface-Mounted Device (SMD) plastic package.

NPN/PNP complement: PQMD13

## 2. Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Low package height of 0.37 mm
- Reduces component count
- Reduces pick and place costs

## 3. Applications

- Low current peripheral driver
- Control of IC inputs
- Replaces general-purpose transistors in digital applications
- Mobile applications

## 4. Quick reference data

Table 1. Quick reference data

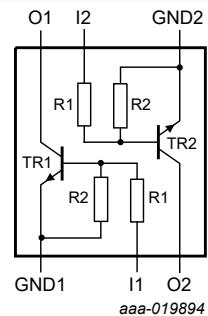
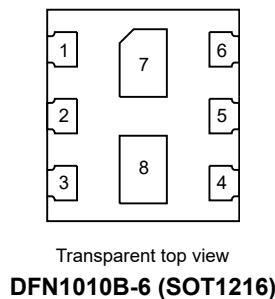
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor</b>							
$V_{CEO}$	collector-emitter voltage	open base		-	-	50	V
$I_O$	output current			-	-	100	mA
$R1$	bias resistor 1 (input)	$T_{amb} = 25 \text{ }^\circ\text{C}$	[1]	3.3	4.7	6.1	$\text{k}\Omega$
$R2/R1$	bias resistor ratio		[1]	8	10	12	

[1] See section "Test information" for resistor calculation and test conditions.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	GND1	GND (emitter) TR1		
2	I1	input (base) TR1		
3	O2	output (collector) TR2		
4	GND2	GND (emitter) TR2		
5	I2	input (base) TR2		
6	O1	output (collector) TR1		
7	O1	output (collector) TR1		
8	O2	output (collector) TR2		



## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PQMH13	DFN1010B-6	plastic, leadless thermal enhanced ultra thin small outline package; 6 terminals; 0.35 mm pitch; 1.1 mm x 1 mm x 0.37 mm body	<a href="#">SOT1216</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PQMH13	A 100

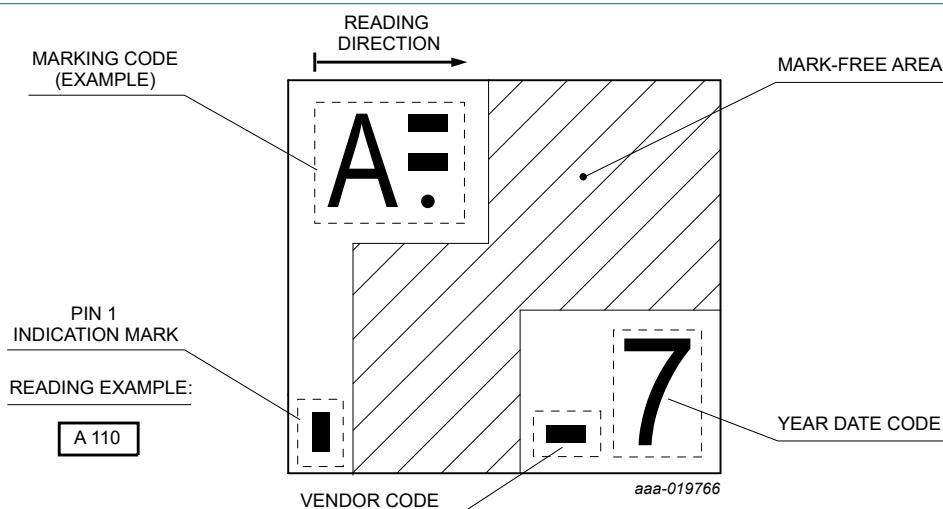


Fig. 1. DFN1010B-6 (SOT1216) binary marking code description

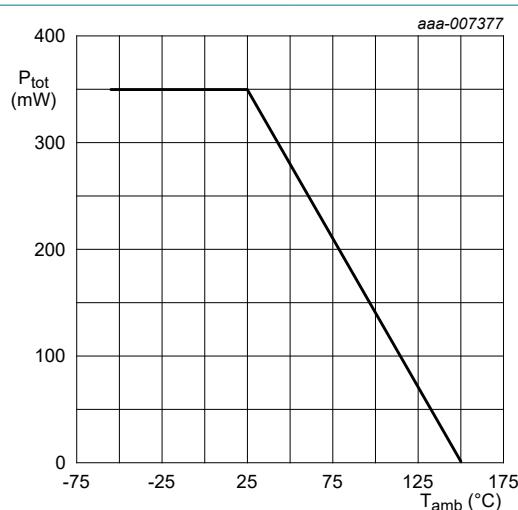
## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
<b>Per transistor</b>						
$V_{CBO}$	collector-base voltage	open emitter		-	50	V
$V_{CEO}$	collector-emitter voltage	open base		-	50	V
$V_{EBO}$	emitter-base voltage	open collector		-	5	V
$V_I$	input voltage			-5	30	V
$I_o$	output current			-	100	mA
$I_{CM}$	peak collector current			-	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	$^{\circ}\text{C}$
$T_{stg}$	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.



FR4 PCB, standard footprint

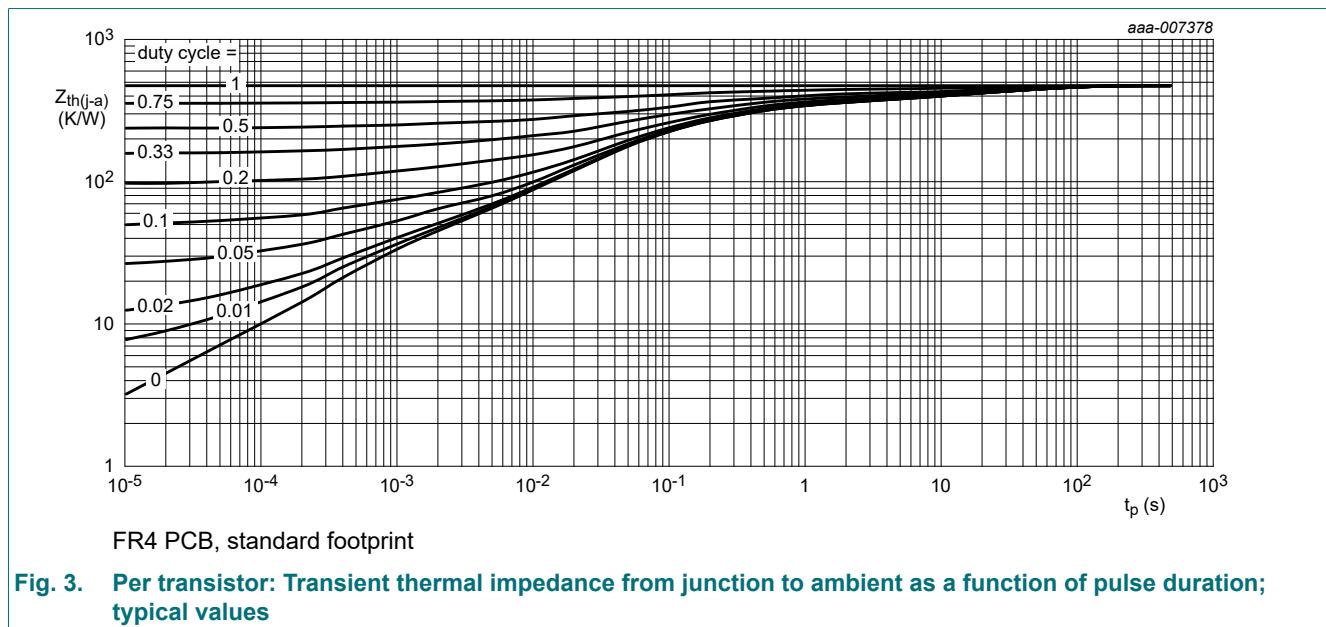
**Fig. 2. Per device: Power derating curve**

## 9. Thermal characteristics

Table 6. 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]	-	-	543	K/W
<b>Per device</b>							
$R_{th(j-a)}$	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.



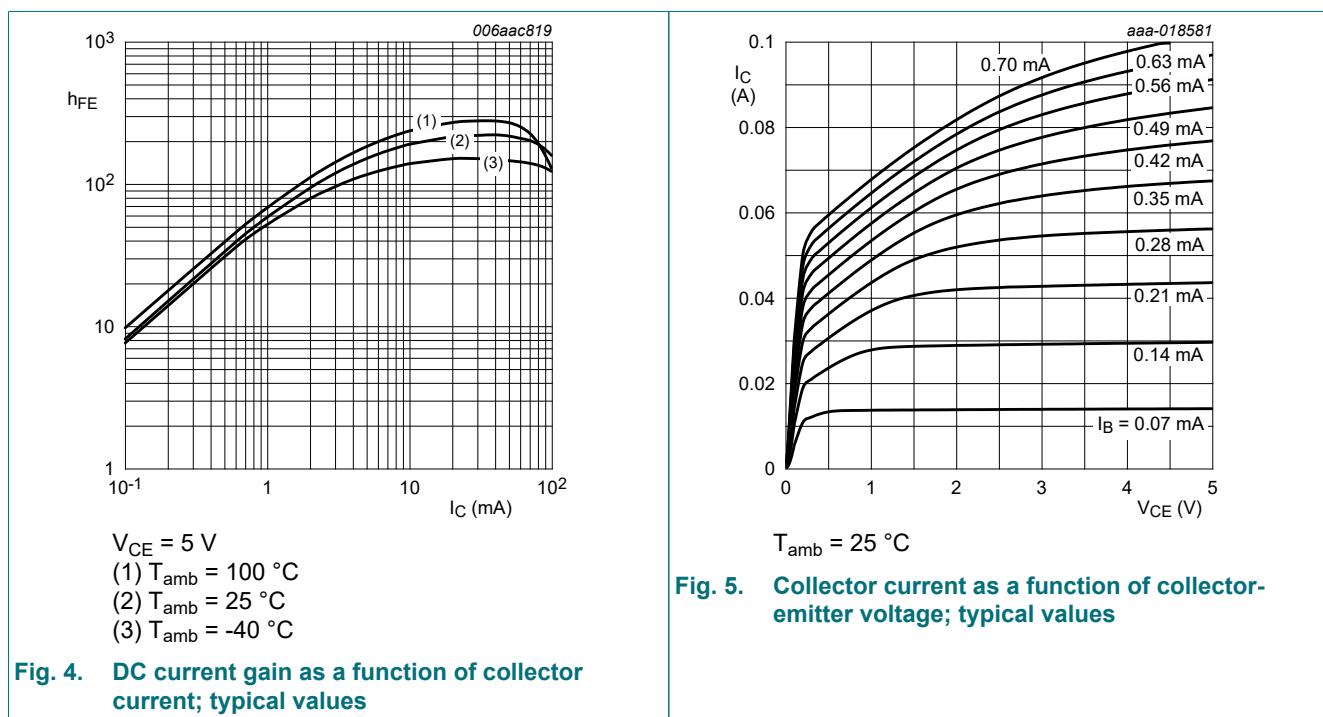
## 10. Characteristics

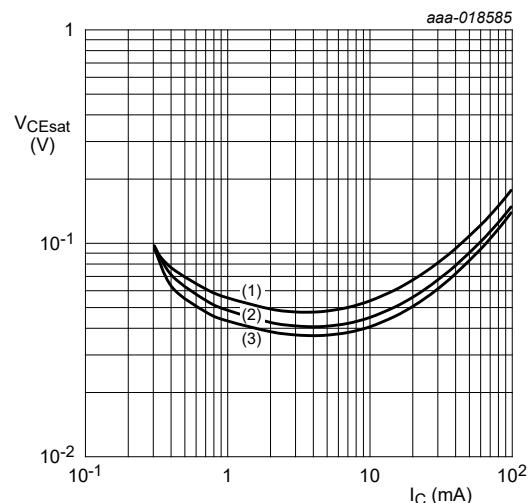
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor</b>							
$V_{(\text{BR})\text{CBO}}$	collector-base breakdown voltage	$I_C = 100 \mu\text{A}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		50	-	-	V
$V_{(\text{BR})\text{CEO}}$	collector-emitter breakdown voltage	$I_C = 2 \text{ mA}$ ; $I_B = 0 \text{ A}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		50	-	-	V
$I_{\text{CBO}}$	collector-base cut-off current	$V_{\text{CB}} = 50 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		-	-	100	nA
$I_{\text{CEO}}$	collector-emitter cut-off current	$V_{\text{CE}} = 30 \text{ V}$ ; $I_B = 0 \text{ A}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		-	-	100	nA
		$V_{\text{CE}} = 30 \text{ V}$ ; $I_B = 0 \text{ A}$ ; $T_j = 150^\circ\text{C}$		-	-	5	$\mu\text{A}$
$I_{\text{EBO}}$	emitter-base cut-off current	$V_{\text{EB}} = 5 \text{ V}$ ; $I_C = 0 \text{ A}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		-	-	170	$\mu\text{A}$
$h_{\text{FE}}$	DC current gain	$V_{\text{CE}} = 5 \text{ V}$ ; $I_C = 10 \text{ mA}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		100	-	-	
$V_{\text{CEsat}}$	collector-emitter saturation voltage	$I_C = 5 \text{ mA}$ ; $I_B = 0.25 \text{ mA}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		-	-	100	mV
$V_{I(\text{off})}$	off-state input voltage	$V_{\text{CE}} = 5 \text{ V}$ ; $I_C = 100 \mu\text{A}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		-	0.6	0.5	V
$V_{I(\text{on})}$	on-state input voltage	$V_{\text{CE}} = 0.3 \text{ V}$ ; $I_C = 5 \text{ mA}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		1.3	0.9	-	V
$R1$	bias resistor 1 (input)	$T_{\text{amb}} = 25^\circ\text{C}$	[1]	3.3	4.7	6.1	$\text{k}\Omega$
$R2/R1$	bias resistor ratio		[1]	8	10	12	
$C_c$	collector capacitance	$V_{\text{CB}} = 10 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $i_e = 0 \text{ A}$ ; $f = 1 \text{ MHz}$ ; $T_{\text{amb}} = 25^\circ\text{C}$		-	-	2.5	pF
$f_T$	transition frequency	$V_{\text{CE}} = 5 \text{ V}$ ; $I_C = 10 \text{ mA}$ ; $f = 100 \text{ MHz}$ ; $T_{\text{amb}} = 25^\circ\text{C}$	[2]	-	230	-	MHz

[1] See section "Test information" for resistor calculation and test conditions.

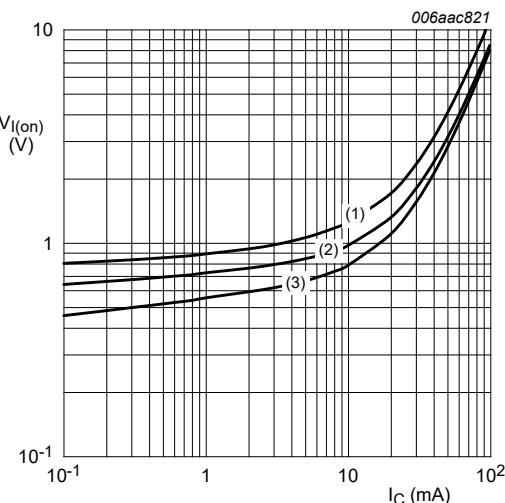
[2] Characteristics of built-in transistor





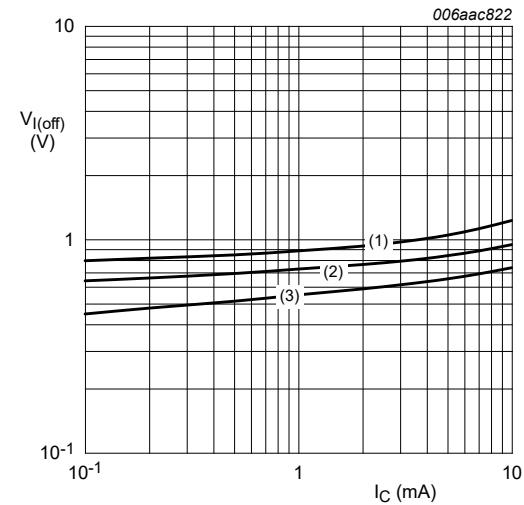
$I_C/I_B = 20$   
 (1)  $T_{\text{amb}} = 100 \text{ }^{\circ}\text{C}$   
 (2)  $T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{\text{amb}} = -40 \text{ }^{\circ}\text{C}$

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



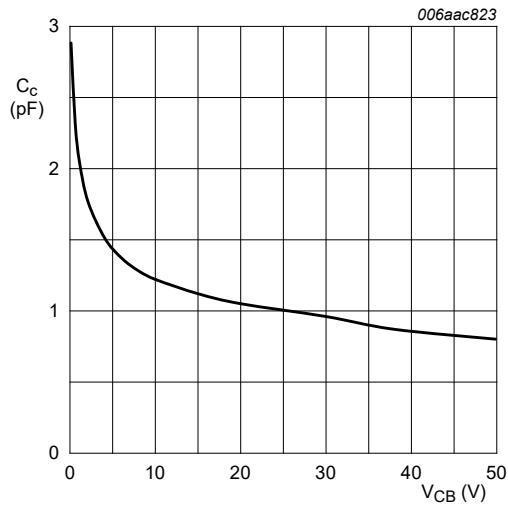
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{\text{amb}} = -40 \text{ }^{\circ}\text{C}$   
 (2)  $T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{\text{amb}} = 100 \text{ }^{\circ}\text{C}$

**Fig. 7. On-state input voltage as a function of collector current; typical values**



$V_{CE} = 5 \text{ V}$   
 (1)  $T_{\text{amb}} = -40 \text{ }^{\circ}\text{C}$   
 (2)  $T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{\text{amb}} = 100 \text{ }^{\circ}\text{C}$

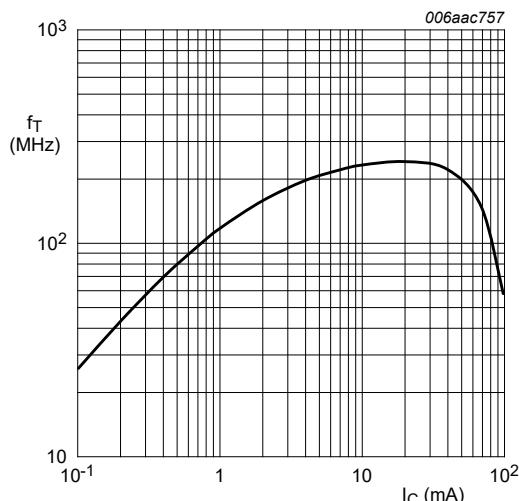
**Fig. 8. Off-state input voltage as a function of collector current; typical values**



$f = 1 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$

**Fig. 9. Collector capacitance as a function of collector-base voltage; typical values**

NPN/NPN resistor-equipped double transistor;  $R1 = 4.7\text{ k}\Omega$ ,  $R2 = 47\text{ k}\Omega$



$$V_{CE} = 5 \text{ V}; T_{amb} = 25 \text{ }^{\circ}\text{C}$$

**Fig. 10. Transition frequency as a function of collector current; typical values of built-in transistor**

## 11. Test information

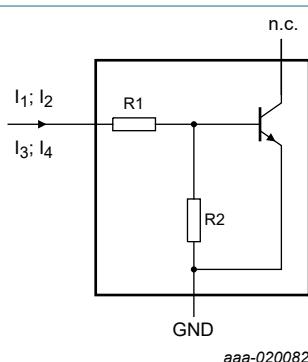
## Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R_I = \frac{V(I_2) - V(I_1)}{I_2 - I_1}$$

- Calculation of bias resistor ratio ( $R_2/R_1$ )

$$\frac{R2}{R1} = \frac{V(I4) - V(I3)}{R1 \cdot (I4 - I3)} - 1$$



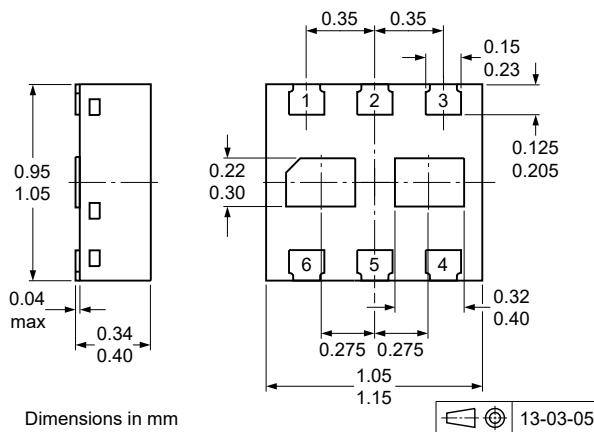
**Fig. 11. Per transistor: Resistor test circuit**

## Resistor test conditions

**Table 8. Resistor test conditions**

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	I <sub>4</sub>
PQMH13	4.7	47	90 µA	140 µA	-55 µA	-105 µA

## 12. Package outline

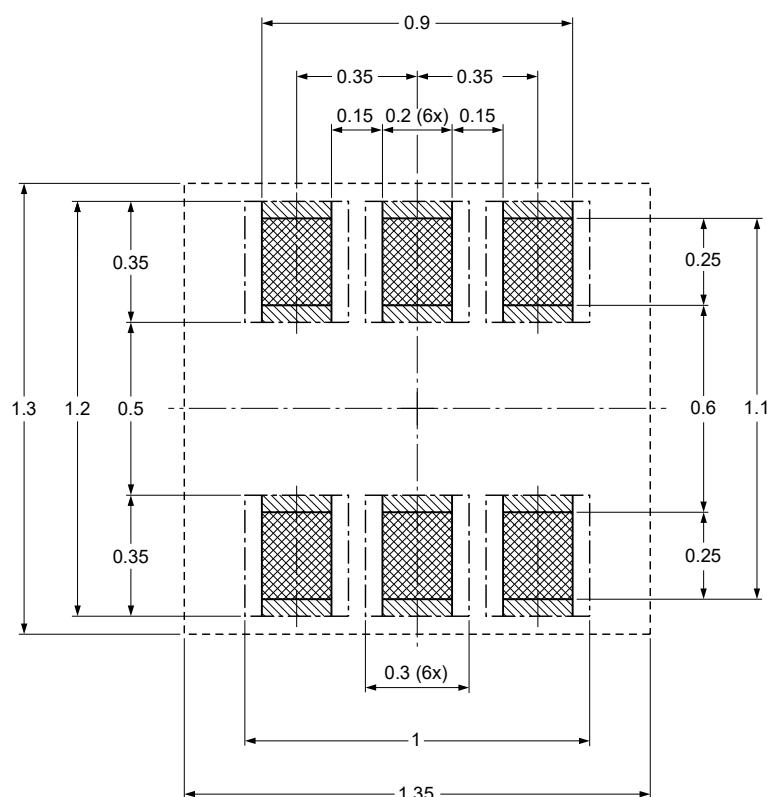


**Fig. 12. Package outline DFN1010B-6 (SOT1216)**

## 13. Soldering

Footprint information for reflow soldering of DFN1010B-6 package

SOT1216



solder paste



solder land plus solder paste



occupied area



solder resist

Dimensions in mm

Issue date 14-07-28  
17-03-31

sot1216\_fr

**Fig. 13. Reflow soldering footprint for DFN1010B-6 (SOT1216)**

## 14. Revision history

**Table 9. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PQMH13 v.2	20241008	Product data sheet	-	PQMH13 v.1
Modifications:	<ul style="list-style-type: none"><li>Product(s) changed to non-automotive qualification. Please refer to <a href="http://nexperia.com">nexperia.com</a> for automotive (-Q) product alternative(s).</li></ul>			
PQMH13 v.1	20151104	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.

- [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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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