



# PQMD13

NPN/PNP resistor-equipped transistors;  
R1 = 4.7 k $\Omega$ , R2 = 47 k $\Omega$

4 November 2015

Product data sheet

## 1. General description

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

NPN/PNP complement: PQMH13

## 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
- AEC-Q101 qualified

## 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

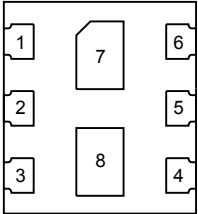
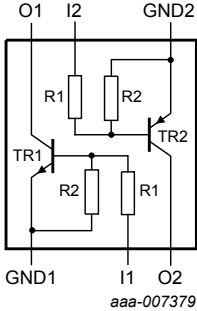
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>						
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	50	V
I <sub>O</sub>	output current		-	-	100	mA
<b>Per transistor; for the PNP transistor with negative polarity</b>						
R1	bias resistor 1	T <sub>amb</sub> = 25 °C	[1]	3.3	4.7	6.1 k $\Omega$
R2/R1	bias resistor ratio		[1]	8	10	12

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

NPN/PNP resistor-equipped transistors; R1 = 4.7 k $\Omega$ , R2 = 47 k $\Omega$ 

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	GND1	GND (emitter) TR1	 <p>Transparent top view <b>DFN1010B-6 (SOT1216)</b></p>	 <p>aaa-007379</p>
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
PQMD13	DFN1010B-6	DFN1010B-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals	SOT1216

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PQMD13	B 011

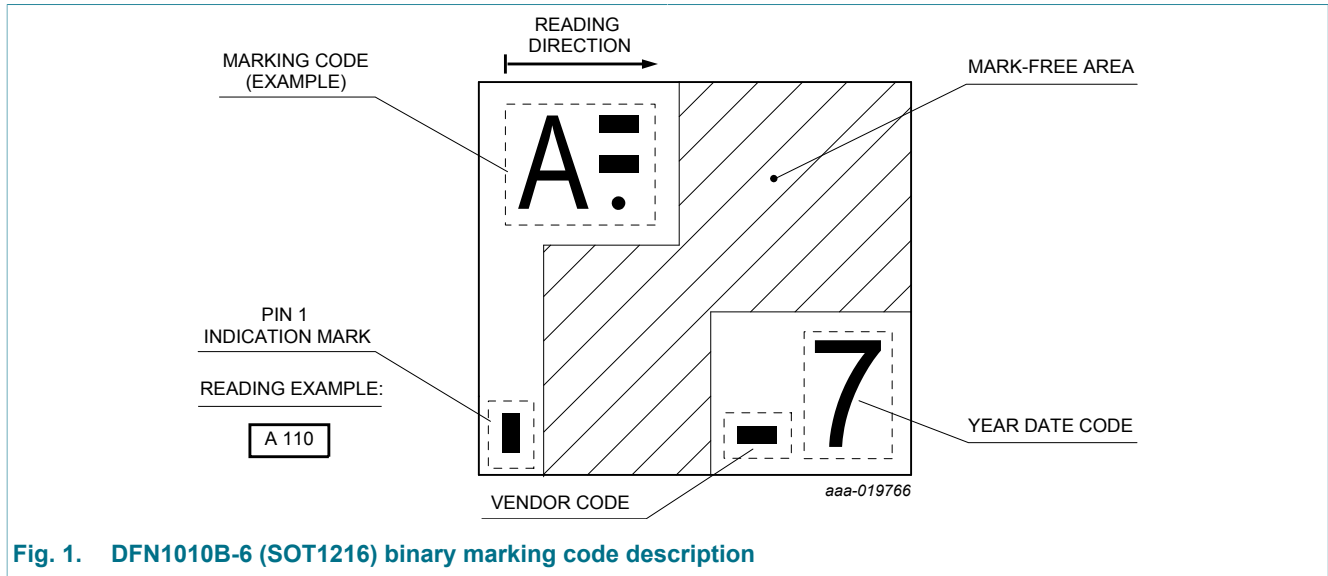


Fig. 1. DFN1010B-6 (SOT1216) binary marking code description

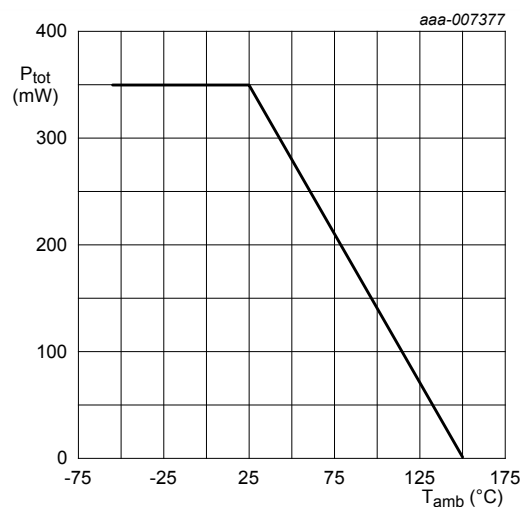
## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>						
V <sub>CBO</sub>	collector-base voltage	open emitter		-	50	V
V <sub>CEO</sub>	collector-emitter voltage	open base		-	50	V
V <sub>EBO</sub>	emitter-base voltage	open collector		-	5	V
V <sub>I</sub>	input voltage	TR1; positive		-	30	V
		TR1; negative		-	-5	V
		TR2; positive		-	5	V
		TR2; negative		-	-30	V
I <sub>O</sub>	output current			-	100	mA
I <sub>CM</sub>	peak collector current	t <sub>p</sub> ≤ 1 ms; single pulse		-	100	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	230	mW
<b>Per device</b>						
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	350	mW
T <sub>j</sub>	junction temperature			-	150	°C
T <sub>amb</sub>	ambient temperature			-55	150	°C
T <sub>stg</sub>	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

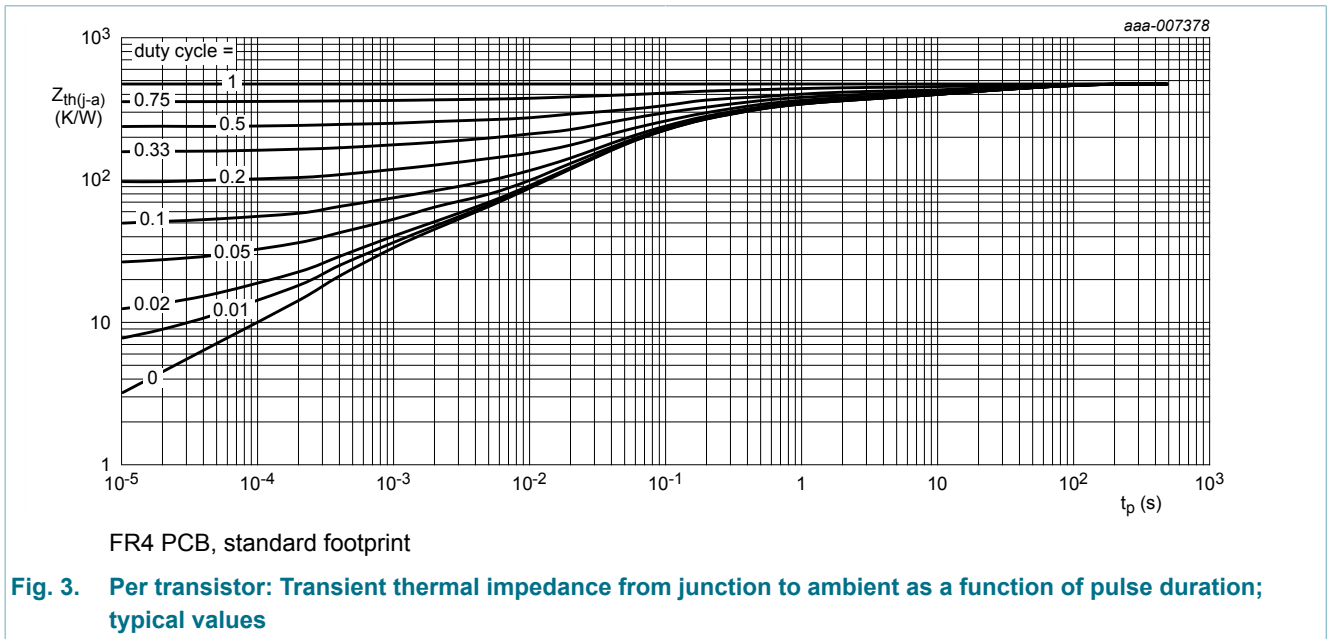
**Fig. 2. Per device: Power derating curve**

## 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.



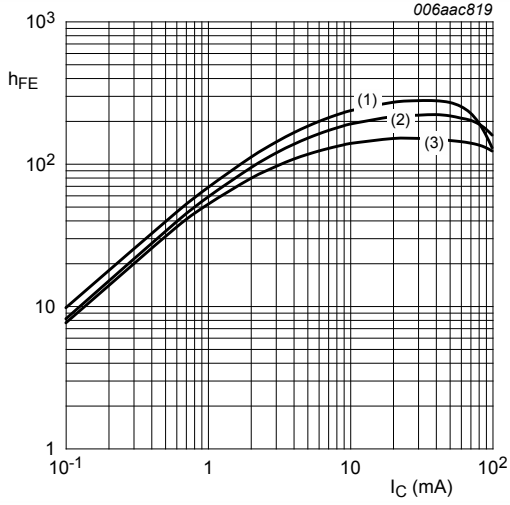
## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>							
$I_{CBO}$	collector-base cut-off current (emitter open)	$V_{CB} = 50 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$		-	-	100	nA
$I_{CEO}$	collector-emitter cut-off current (base open)	$V_{CE} = 30 \text{ V}; I_B = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$		-	-	1	$\mu\text{A}$
		$V_{CE} = 30 \text{ V}; I_B = 0 \text{ A}; T_{amb} = 150 \text{ }^\circ\text{C}$		-	-	5	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current (collector open)	$V_{EB} = 5 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$		-	-	170	$\mu\text{A}$
$h_{FE}$	DC current gain	$V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$		100	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 5 \text{ mA}; I_B = 0.25 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$		-	-	100	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5 \text{ V}; I_C = 100 \text{ } \mu\text{A}; T_{amb} = 25 \text{ }^\circ\text{C}$		-	0.6	0.5	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3 \text{ V}; I_C = 5 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$		1.3	0.9	-	V
R1	bias resistor 1	$T_{amb} = 25 \text{ }^\circ\text{C}$	[1]	3.3	4.7	6.1	kΩ
R2/R1	bias resistor ratio		[1]	8	10	12	
$C_C$	collector capacitance	$V_{CB} = 10 \text{ V}; I_E = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}; \text{TR1 (NPN)}$		-	-	2.5	pF
		$V_{CB} = -10 \text{ V}; I_E = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}; \text{TR2 (PNP)}$		-	-	3	pF
$f_T$	transition frequency	$V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}; \text{TR1 (NPN)}$	[2]	-	230	-	MHz
		$V_{CE} = -5 \text{ V}; I_C = -10 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}; \text{TR2 (PNP)}$	[2]	-	180	-	MHz

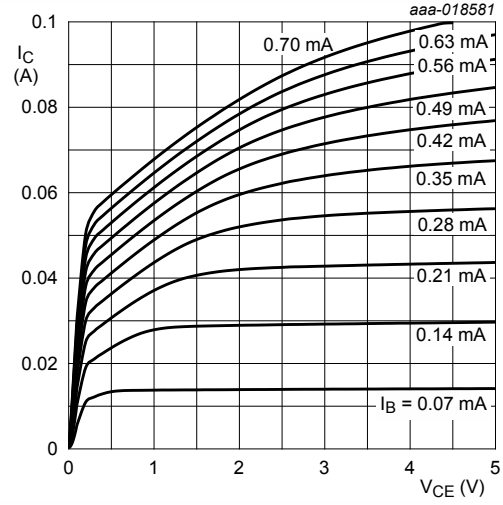
[1] See section "Test information" for resistor calculation and test conditions.

[2] Characteristics of built-in transistor



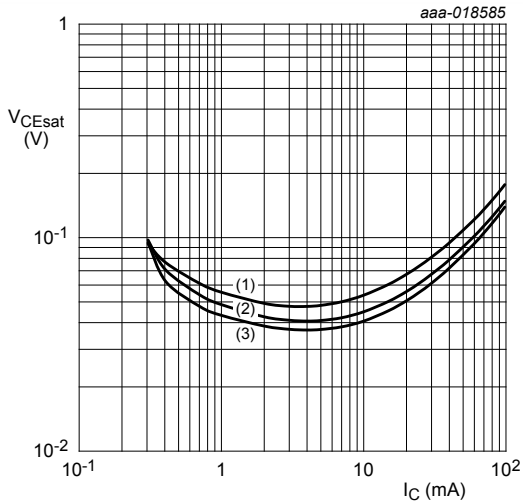
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -40\text{ °C}$

**Fig. 4. NPN transistor: DC current gain as a function of collector current; typical values**



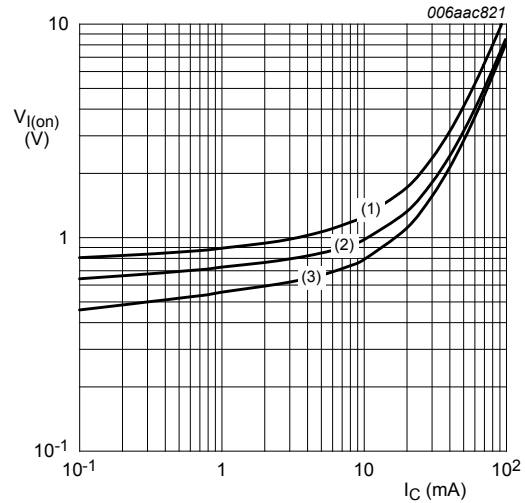
$T_{amb} = 25\text{ °C}$

**Fig. 5. NPN transistor: Collector current as a function of collector-emitter voltage; typical values**



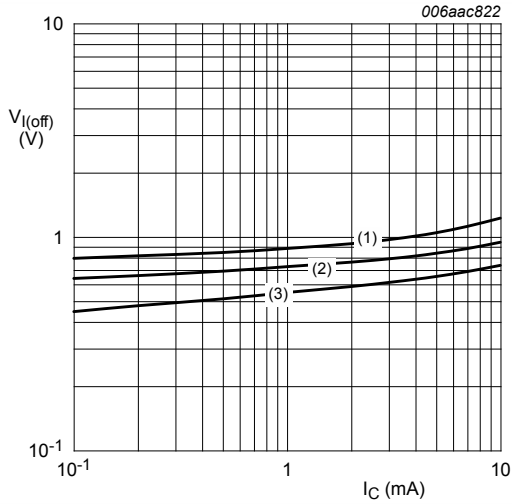
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -40\text{ °C}$

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



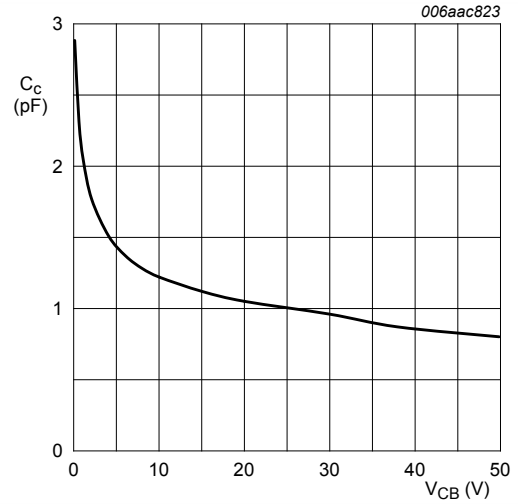
$V_{CE} = 0.3\text{ V}$   
 (1)  $T_{amb} = -40\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



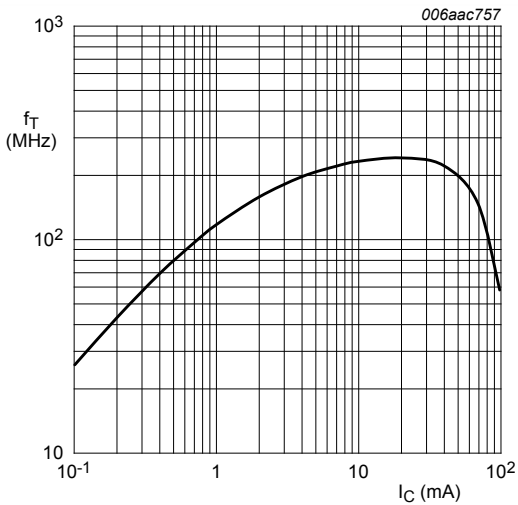
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -40\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



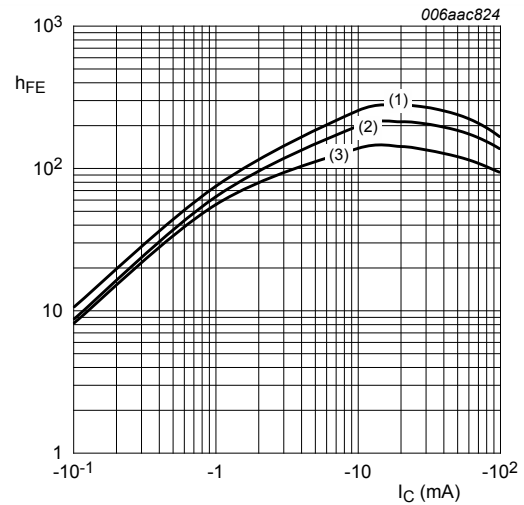
$f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$

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



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

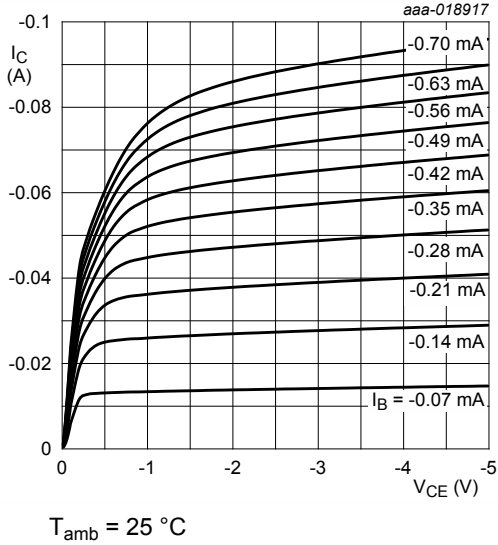
**Fig. 10. NPN transistor: Transition frequency as a function of collector current; typical values of built-in transistor**



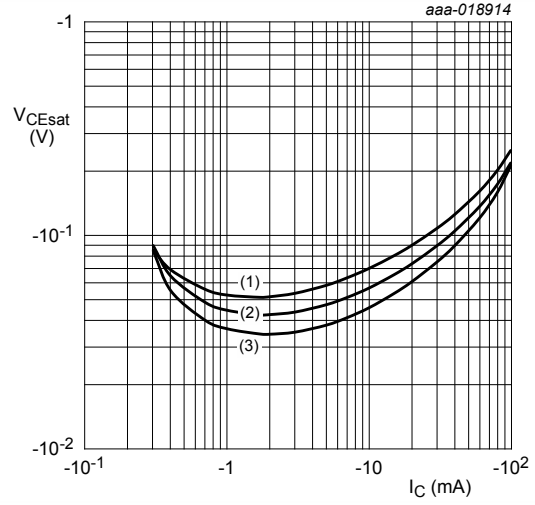
$V_{CE} = -5\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -40\text{ °C}$

**Fig. 11. PNP transistor: DC current gain as a function of collector current; typical values**

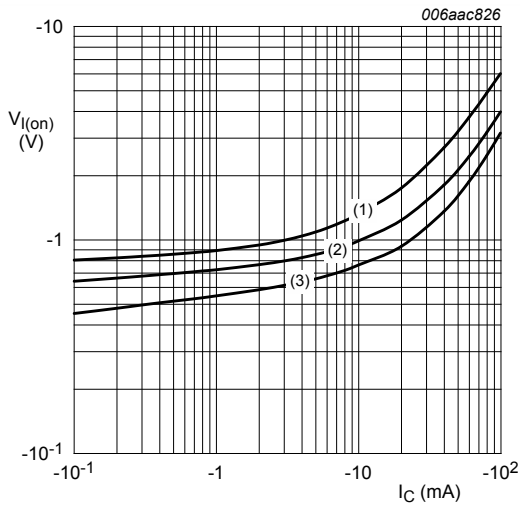




**Fig. 12. PNP transistor: Collector current as a function of collector-emitter voltage; typical values**

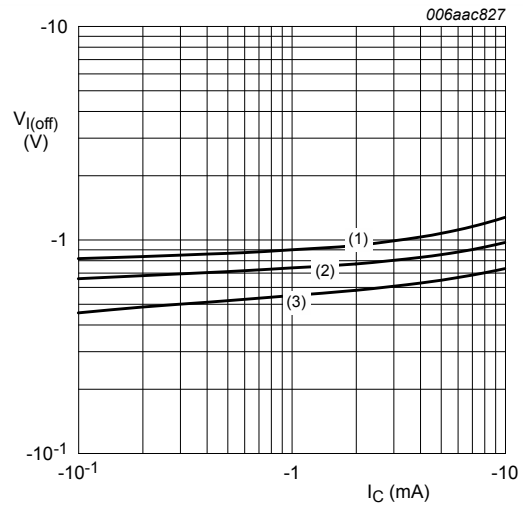


**Fig. 13. PNP transistor: Collector-emitter saturation voltage as a function of collector current; typical values**



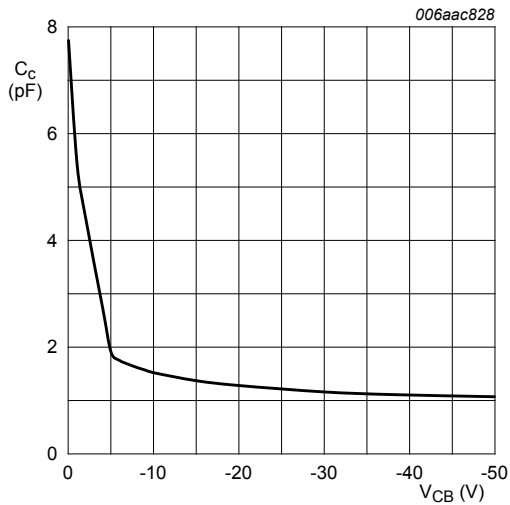
$V_{CE} = -0.3\text{ V}$   
 (1)  $T_{amb} = -40\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

**Fig. 14. PNP transistor: On-state input voltage as a function of collector current; typical values**



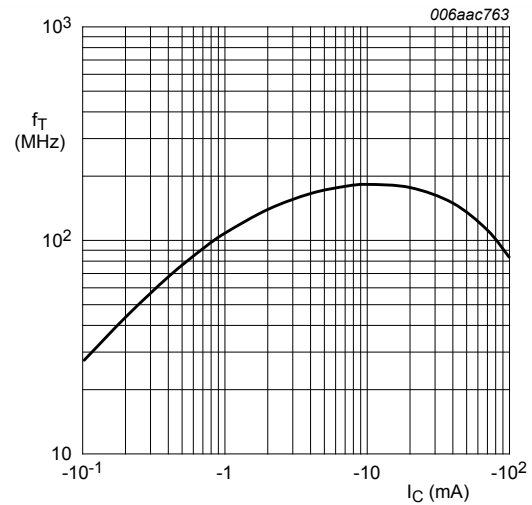
$V_{CE} = -5\text{ V}$   
 (1)  $T_{amb} = -40\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

**Fig. 15. PNP transistor: 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. 16. PNP transistor: Collector capacitance as a function of collector-base voltage; typical values**



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

**Fig. 17. PNP transistor: Transition frequency as a function of collector current; typical values of built-in transistor**

## 11. Test information

### 11.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

### 11.2 Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R1 = \frac{V(I_{I2}) - V(I_{I1})}{I_{I2} - I_{I1}}$$

- Calculation of bias resistor ratio (R2/R1)

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

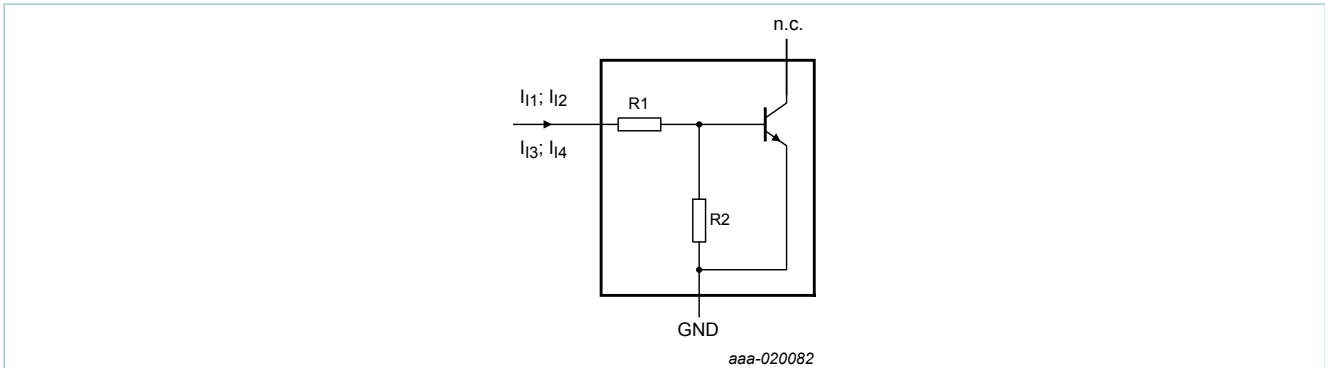


Fig. 18. NPN transistor: Resistor test circuit

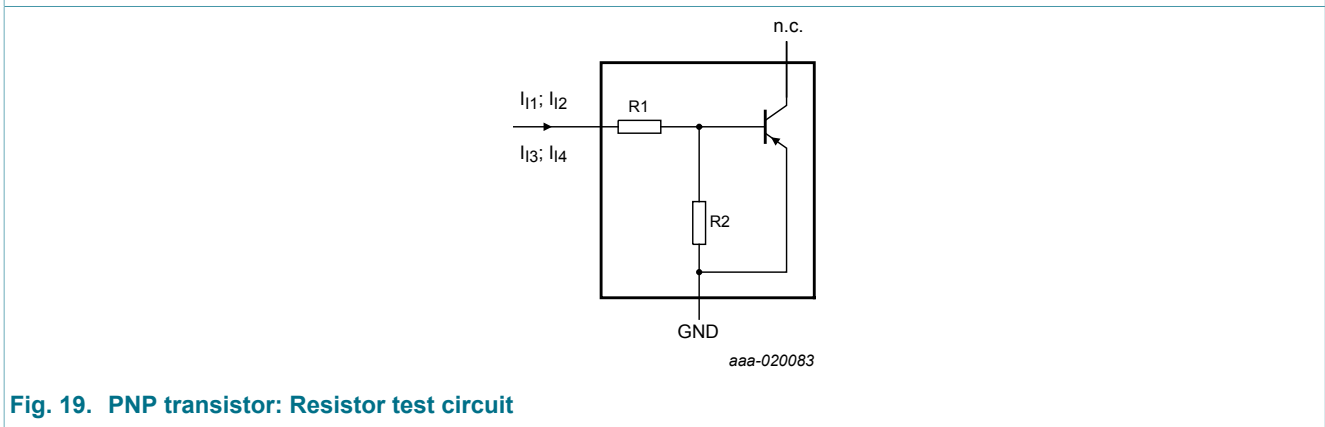


Fig. 19. PNP transistor: Resistor test circuit

### 11.3 Resistor test conditions

Table 8. Resistor test conditions

Per transistor; for the PNP transistor with negative polarity

R1 (kΩ)	R2 (kΩ)	Test conditions			
		I <sub>I1</sub>	I <sub>I2</sub>	I <sub>I3</sub>	I <sub>I4</sub>
4.7	47	90 μA	140 μA	-55 μA	-105 μA

## 12. Package outline

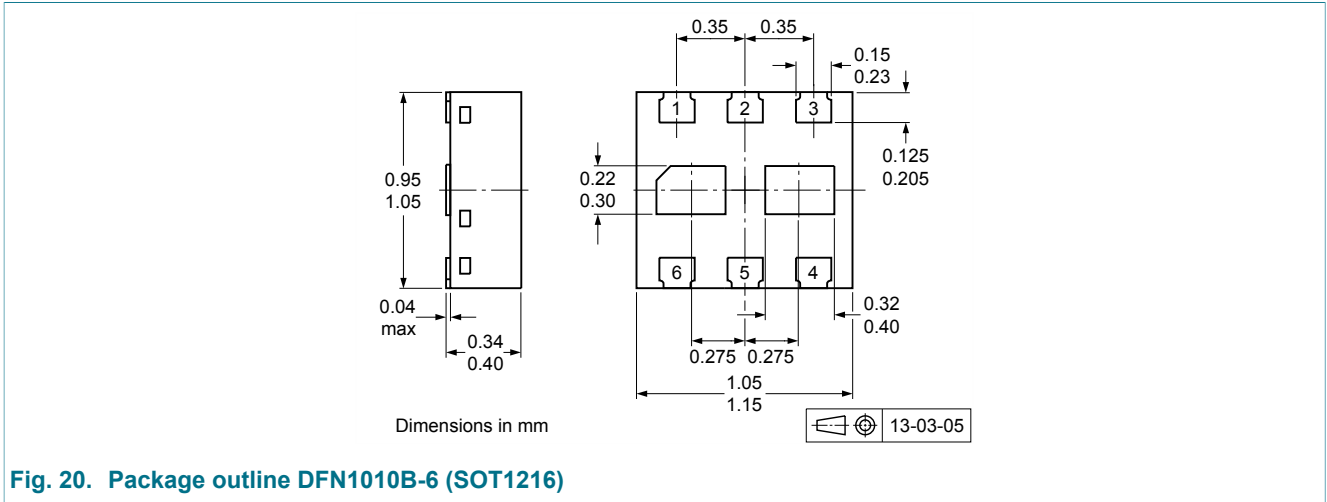


Fig. 20. Package outline DFN1010B-6 (SOT1216)

### 13. Soldering

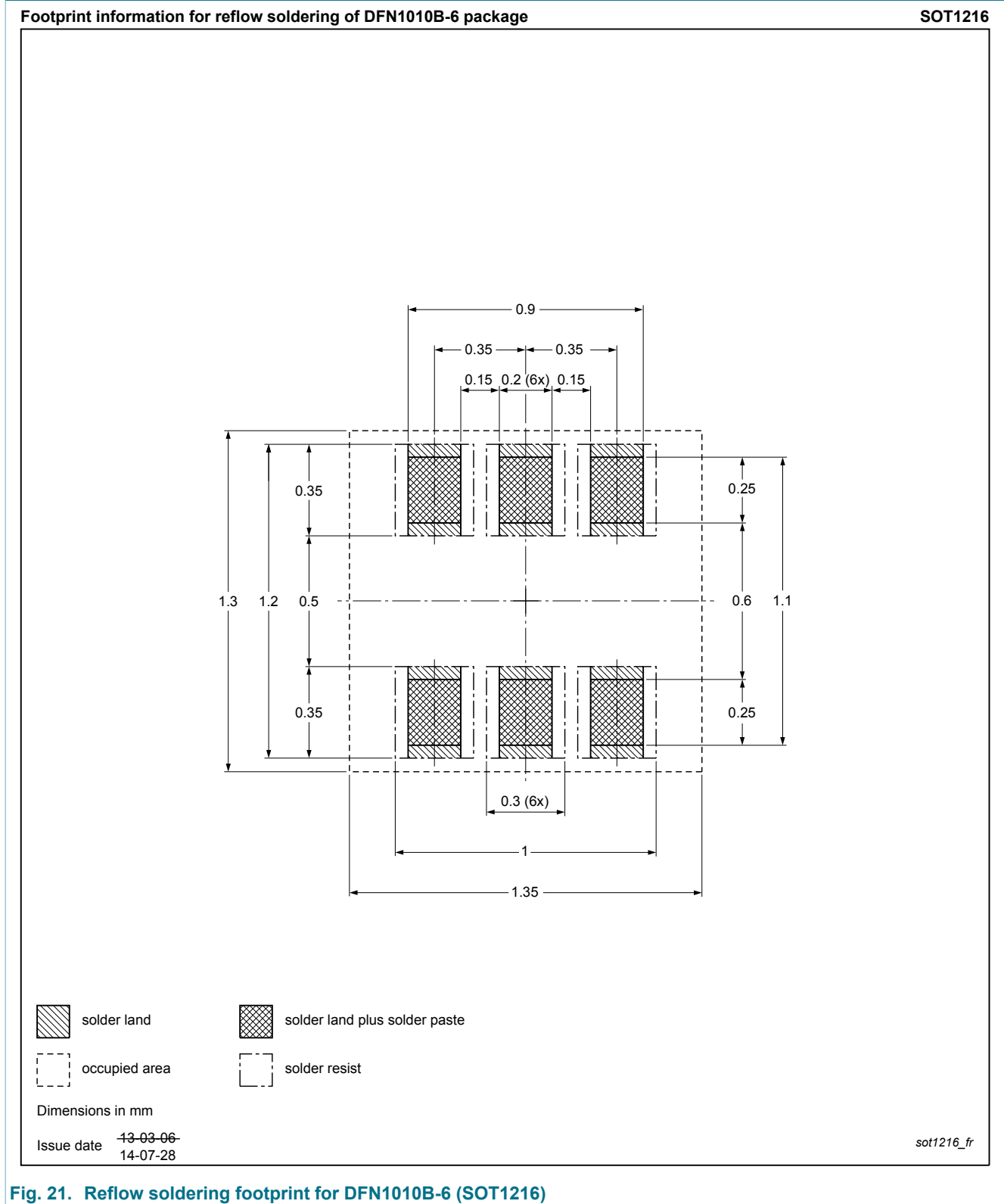


Fig. 21. Reflow soldering footprint for DFN1010B-6 (SOT1216)

## 14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PQMD13 v.1	20151104	Product data sheet	-	-

## 15. Legal information

### 15.1 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".
- [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 URL <http://www.nexperia.com>.

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