

## PQMH10

# NPN/NPN resistor-equipped transistors; R1 = 2.2 k $\Omega$ , R2 = 47 k $\Omega$

4 November 2015

Product data sheet

## 1. General description

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

NPN/PNP complement: PQMD10.

## 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	Тур	Max	Unit	
Per transistor	Per transistor							
V <sub>CEO</sub>	collector-emitter voltage	open base		-	-	50	V	
I <sub>O</sub>	output current			-	-	100	mA	
Per transistor								
R1	bias resistor 1	T <sub>amb</sub> = 25 °C	[1]	1.54	2.2	2.86	kΩ	
R2/R1	bias resistor ratio	1		17	21	26		

<sup>[1]</sup> See section "Test information" for resistor calculation and test conditions.



NPN/NPN resistor-equipped transistors; R1 = 2.2 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	500	O1 I2 GND2
2	I1	input ( base) TR1	$\begin{bmatrix} 1 \\ 7 \end{bmatrix} \begin{bmatrix} 6 \\ \end{bmatrix}$	
3	O2	output (collector) TR2	2 5	R1 R2
4	GND2	GND (emitter) TR2		TR1 TR2
5	12	input ( base) TR2	3 4	R2 R1
6	O1	output (collector) TR1	Transparent top view	
7	O1	output (collector) TR1	DFN1010B-6 (SOT1216)	GND1 I1 O2 aaa-019894
8	O2	output (collector) TR2		dad 675557

## 6. Ordering information

Table 3. Ordering information

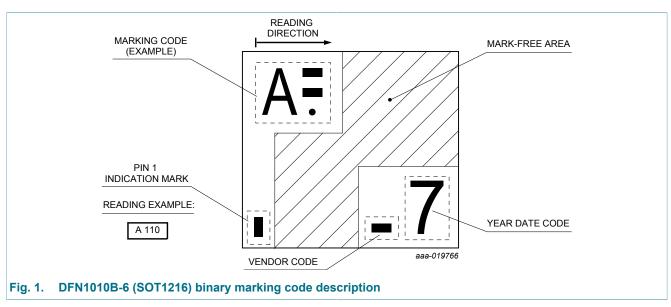
Type number	Package					
	Name	Description	Version			
PQMH10	DFN1010B-6	DFN1010B-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals	SOT1216			

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## 7. Marking

Table 4. Marking codes

Type number	Marking code
PQMH10	A 011



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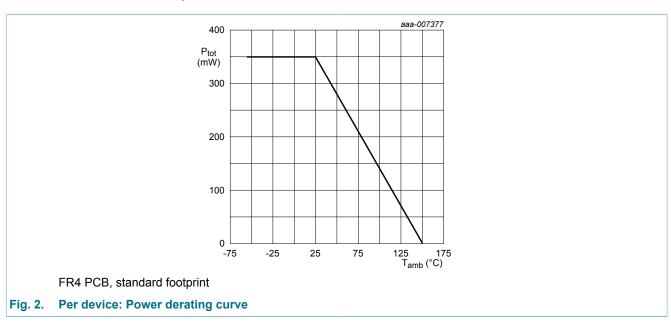
## 8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per transis	tor	'	'			
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
VI	input voltage	positive		-	12	V
		negative		-	-5	V
I <sub>O</sub>	output current			-	100	mA
I <sub>CM</sub>	peak collector current			-	100	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	230	mW
Per device	<u> </u>	,	,	'		
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	350	mW
Tj	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.



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## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	543	K/W
Per device							
$R_{th(j-a)}$	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.

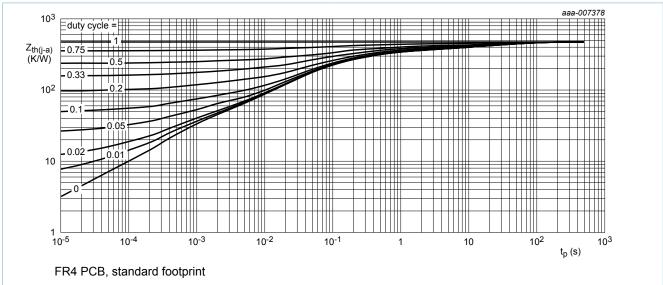


Fig. 3. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

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## 10. Characteristics

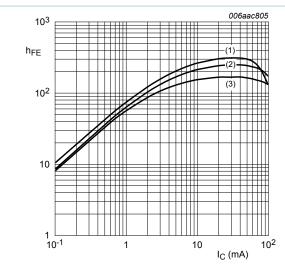
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Per transist	or						
I <sub>CBO</sub>	collector-base cut-off current (emitter open)	$V_{CB} = 50 \text{ V}; I_{E} = 0 \text{ A}; T_{amb} = 25 \text{ °C}$		-	-	100	nA
I <sub>CEO</sub>	collector-emitter cut-off	V <sub>CE</sub> = 30 V; I <sub>B</sub> = 0 A; T <sub>amb</sub> = 25 °C		-	-	1	μA
	current (base open)	V <sub>CE</sub> = 30 V; I <sub>B</sub> = 0 A; T <sub>amb</sub> = 150 °C		-	-	5	μA
I <sub>EBO</sub>	emitter-base cut-off current (collector open)	$V_{EB} = 5 \text{ V}; I_{C} = 0 \text{ A}; T_{amb} = 25 \text{ °C}$		-	-	180	μA
h <sub>FE</sub>	DC current gain	$V_{CE}$ = 5 V; $I_{C}$ = 10 mA; $T_{amb}$ = 25 °C		100	-	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage	$I_C = 5 \text{ mA}; I_B = 0.25 \text{ mA}; T_{amb} = 25 \text{ °C}$		-	-	100	mV
$V_{I(off)}$	off-state input voltage	$V_{CE}$ = 5 V; $I_{C}$ = 100 $\mu$ A; $T_{amb}$ = 25 °C		-	0.6	0.5	V
$V_{I(on)}$	on-state input voltage	$V_{CE}$ = 0.3 V; $I_{C}$ = 5 mA; $T_{amb}$ = 25 °C		1.1	0.75	-	V
R1	bias resistor 1	T <sub>amb</sub> = 25 °C	[1]	1.54	2.2	2.86	kΩ
R2/R1	bias resistor ratio		[1]	17	21	26	
C <sub>C</sub>	collector capacitance	$V_{CB}$ = 10 V; $I_{E}$ = 0 A; f = 1 MHz; $T_{amb}$ = 25 °C		-	-	2.5	pF
f <sub>T</sub>	transition frequency	$V_{CE} = 5 \text{ V; } I_{C} = 10 \text{ mA; } f = 100 \text{ MHz;}$ $T_{amb} = 25 \text{ °C}$	[2]	-	230	-	MHz

<sup>[1]</sup> See section "Test information" for resistor calculation and test conditions.

<sup>[2]</sup> Characteristics of built-in transistor

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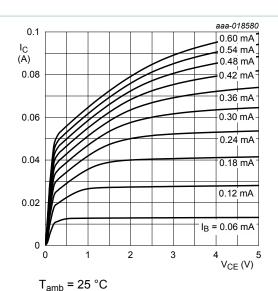
$$V_{CE} = 5 V$$

(1) 
$$T_{amb} = 100 \, ^{\circ}C$$

(2) 
$$T_{amb} = 25 \, ^{\circ}C$$

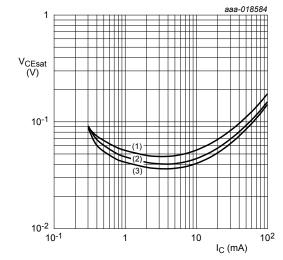
(3) 
$$T_{amb} = -40 \, ^{\circ}C$$

Fig. 4. DC current gain as a function of collector current; typical values



amb = 0

Fig. 5. Collector current as a function of collectoremitter voltage; typical values



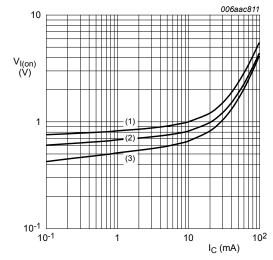
$$I_{\rm C}/I_{\rm B} = 20$$

(1) 
$$T_{amb}$$
 = 100 °C

(2) 
$$T_{amb}$$
 = 25 °C

(3) 
$$T_{amb} = -40 \, ^{\circ}C$$

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



$$V_{CE} = 0.3 \text{ V}$$

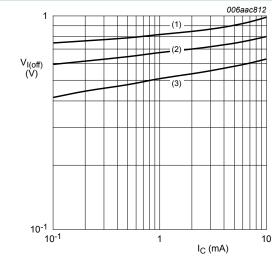
(1) 
$$T_{amb} = -40 \, ^{\circ}C$$

(2) 
$$T_{amb}$$
 = 25 °C

(3) 
$$T_{amb} = 100 \, ^{\circ}C$$

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

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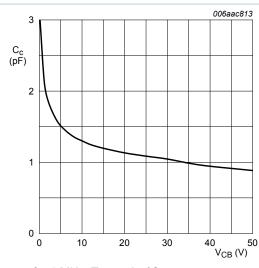
$$V_{CE} = 5 V$$

(1) 
$$T_{amb} = -40 \, ^{\circ}C$$

(2) 
$$T_{amb} = 25 \, ^{\circ}C$$

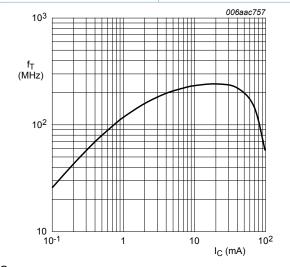
(3)  $T_{amb}$  = 100 °C

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



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

Fig. 9. Collector capacitance as a function of collectorbase voltage; typical values



 $V_{CE}$  = 5 V;  $T_{amb}$  = 25 °C

Fig. 10. 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.

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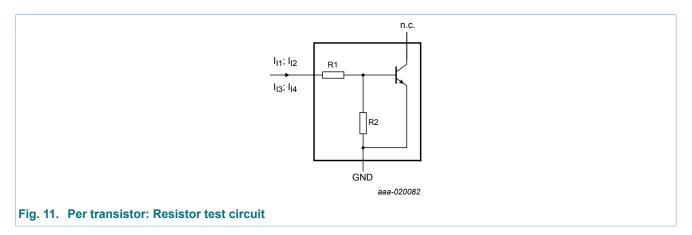
## 11.2 Resistor calculation

Calculation of bias resistor 1 (R1)

$$R1 = \frac{V(I12) - V(I11)}{I12 - I11}$$

Calculation of bias resistor ratio (R2/R1)

$$\frac{R2}{R1} = \frac{V(I14) - V(I13)}{R1 \cdot (I14 - I13)} - 1$$

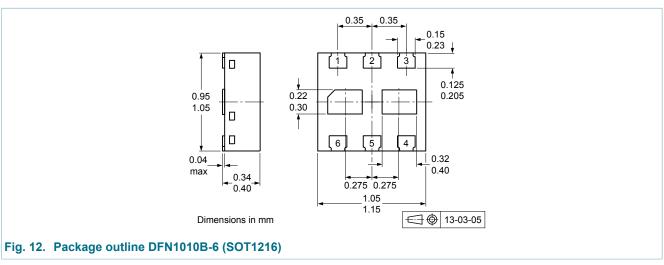


#### 11.3 Resistor test conditions

Table 8. Resistor test conditions

Tubic 0.	11031310	test conditions				
R1 (kΩ)		R2 (kΩ)	Test conditions			
			I <sub>I1</sub>	I <sub>I2</sub>	I <sub>I3</sub>	I <sub>I4</sub>
2.2		47	90 μΑ	140 μΑ	-55 µA	-105 μA

## 12. Package outline

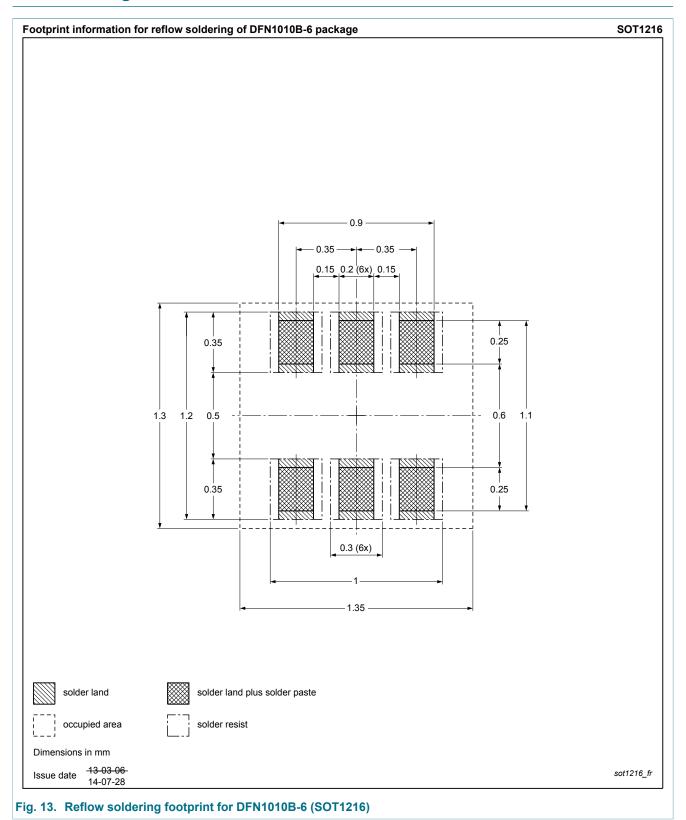


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## 13. Soldering



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## 14. Revision history

#### Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PQMH10 v.1	20151104	Product data sheet	-	-

#### NPN/NPN resistor-equipped transistors; R1 = 2.2 k $\Omega$ , R2 = 47 k $\Omega$

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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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