PQMD13

NPN/PNP resistor-equipped transistors; R1 = 4.7 kΩ, R2 = 47 kΩ

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/NPN 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

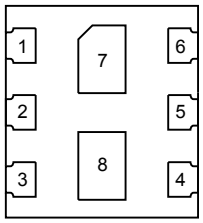
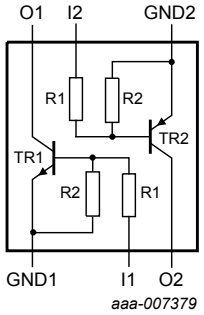
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor; for the PNP transistor with negative polarity							
V_{CEO}	collector-emitter voltage	open base		-	-	50	V
I_O	output current			-	-	100	mA
Per transistor; for the PNP transistor with negative polarity							
R1	bias resistor 1	T_{amb} = 25 °C	[1]	3.3	4.7	6.1	kΩ
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	 Transparent top view **DFN1010B-6 (SOT1216)**	
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

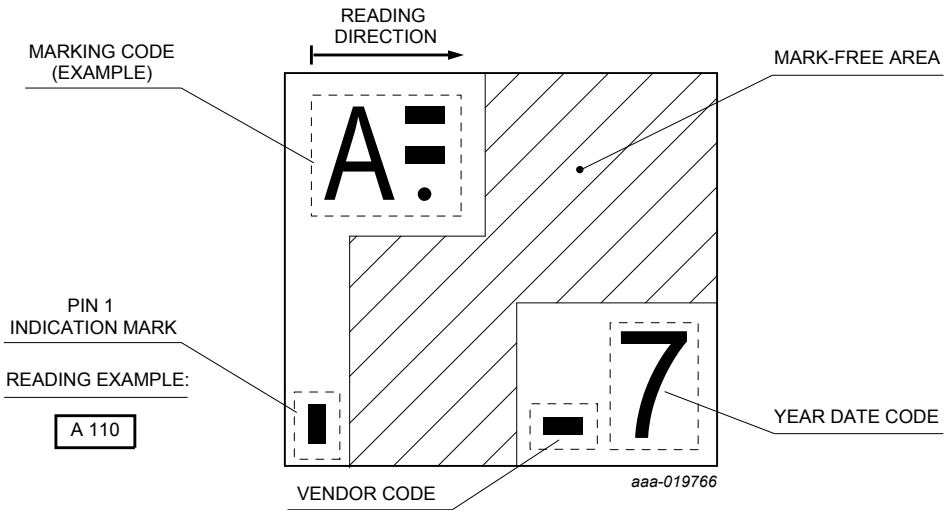


Fig. 1. DFN1010B-6 (SOT1216) binary marking code description

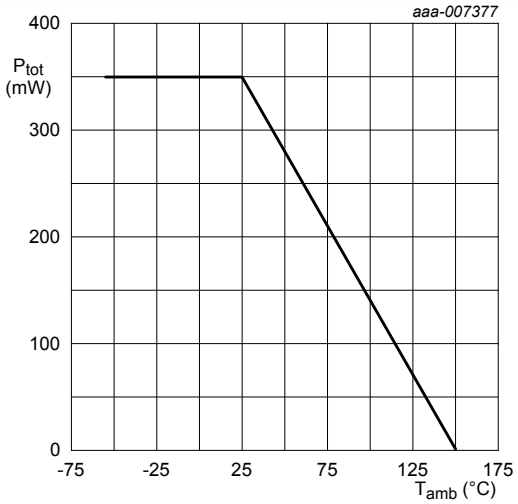
8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per transistor; for the PNP transistor with negative polarity						
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	TR1; positive		-	30	V
		TR1; negative		-	-5	V
		TR2; positive		-	5	V
		TR2; negative		-	-30	V
I_O	output current			-	100	mA
I_{CM}	peak collector current	$t_p \leq 1$ ms; single pulse		-	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	230	mW
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	350	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.



FR4 PCB, standard footprint

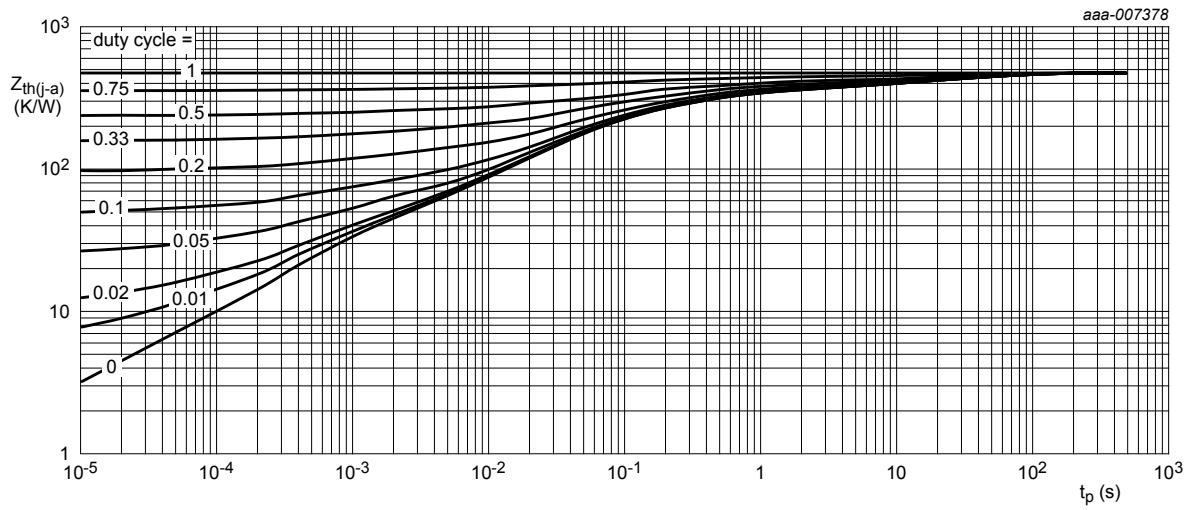
Fig. 2. Per device: Power derating curve

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
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.



FR4 PCB, standard footprint

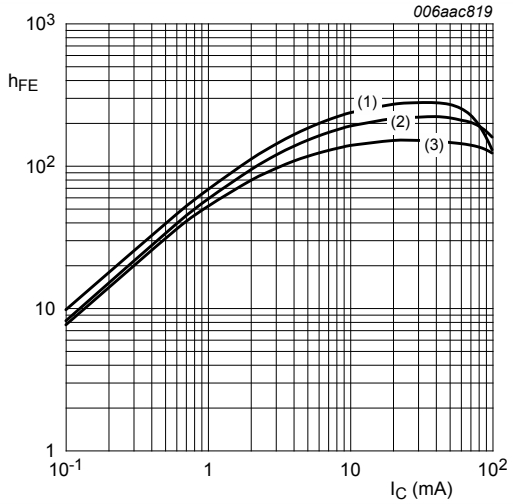
Fig. 3. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor; for the PNP transistor with negative polarity							
I_{CBO}	collector-base cut-off current (emitter open)	V_{CB} = 50 V; I_E = 0 A; T_{amb} = 25 °C		-	-	100	nA
I_{CEO}	collector-emitter cut-off current (base open)	V_{CE} = 30 V; I_B = 0 A; T_{amb} = 25 °C		-	-	1	µA
		V_{CE} = 30 V; I_B = 0 A; T_{amb} = 150 °C		-	-	5	µA
I_{EBO}	emitter-base cut-off current (collector open)	V_{EB} = 5 V; I_C = 0 A; T_{amb} = 25 °C		-	-	170	µA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 10 mA; T_{amb} = 25 °C		100	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.25 mA; T_{amb} = 25 °C		-	-	100	mV
$V_{I(off)}$	off-state input voltage	V_{CE} = 5 V; I_C = 100 µA; 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		1.3	0.9	-	V
R1	bias resistor 1	T_{amb} = 25 °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 V; I_E = 0 A; f = 1 MHz; T_{amb} = 25 °C; TR1 (NPN)		-	-	2.5	pF
		V_{CB} = -10 V; I_E = 0 A; f = 1 MHz; T_{amb} = 25 °C; TR2 (PNP)		-	-	3	pF
f_T	transition frequency	V_{CE} = 5 V; I_C = 10 mA; f = 100 MHz; T_{amb} = 25 °C; TR1 (NPN)	[2]	-	230	-	MHz
		V_{CE} = -5 V; I_C = -10 mA; f = 100 MHz; T_{amb} = 25 °C; TR2 (PNP)	[2]	-	180	-	MHz

[1] See section "Test information" for resistor calculation and test conditions.
[2] Characteristics of built-in transistor



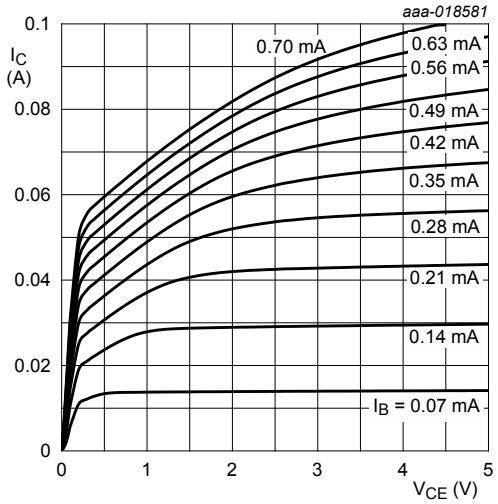
V_{CE} = 5 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

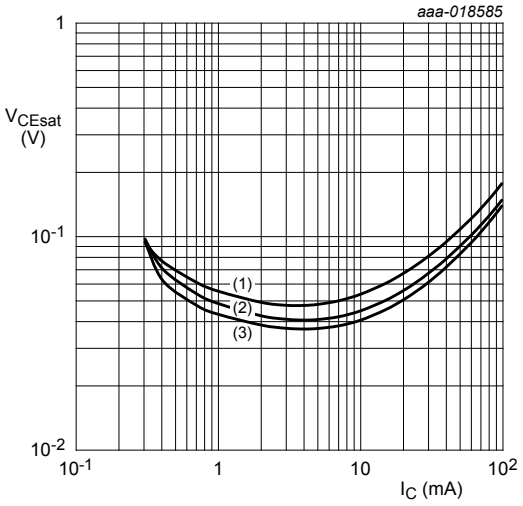
(3) T_{amb} = -40 °C

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



T_{amb} = 25 °C

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



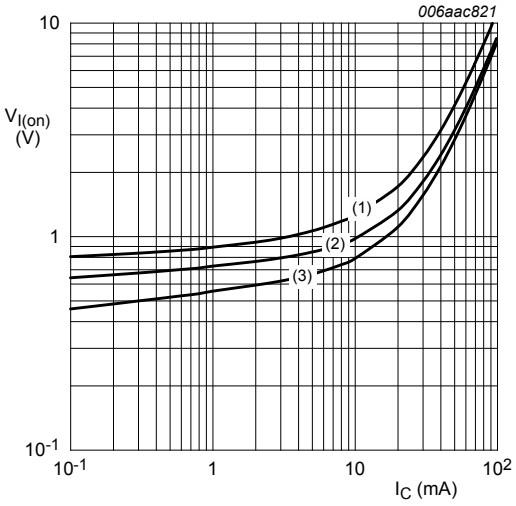
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = -40 °C

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



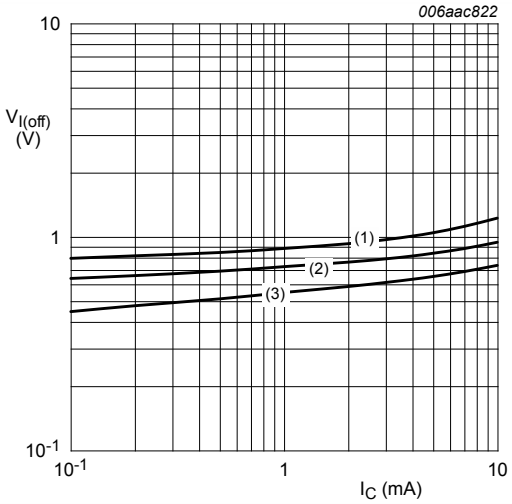
V_{CE} = 0.3 V

(1) T_{amb} = -40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



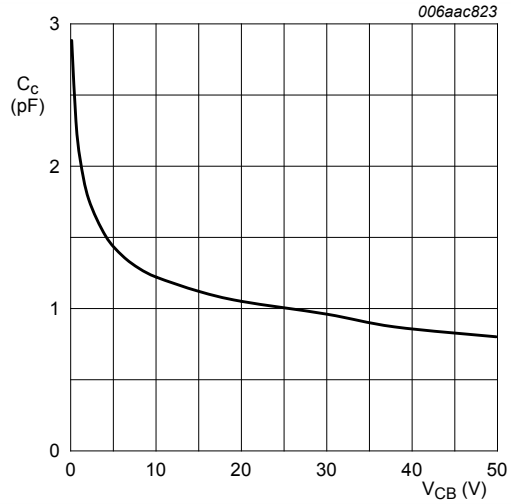
V_{CE} = 5 V

(1) T_{amb} = -40 °C

(2) T_{amb} = 25 °C

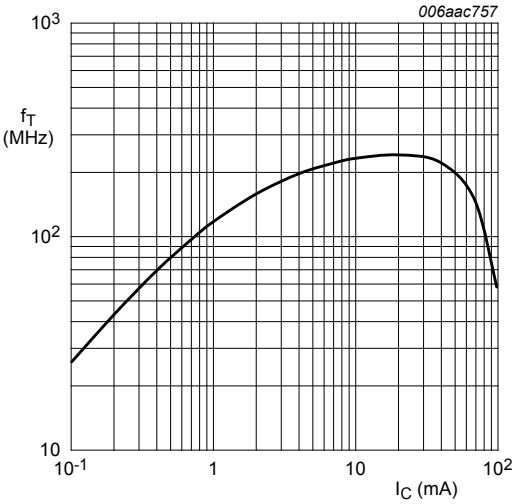
(3) T_{amb} = 100 °C

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



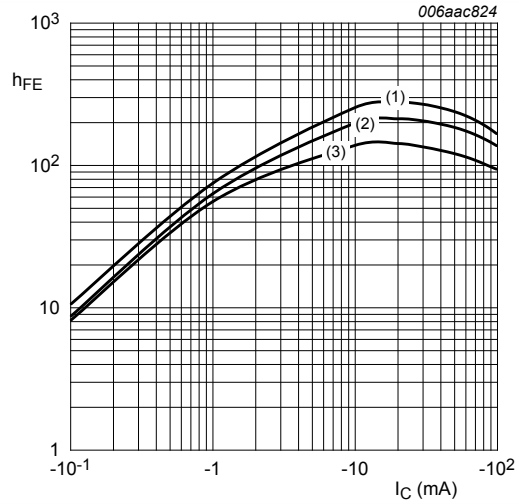
f = 1 MHz; T_{amb} = 25 °C

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



V_{CE} = 5 V; T_{amb} = 25 °C

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



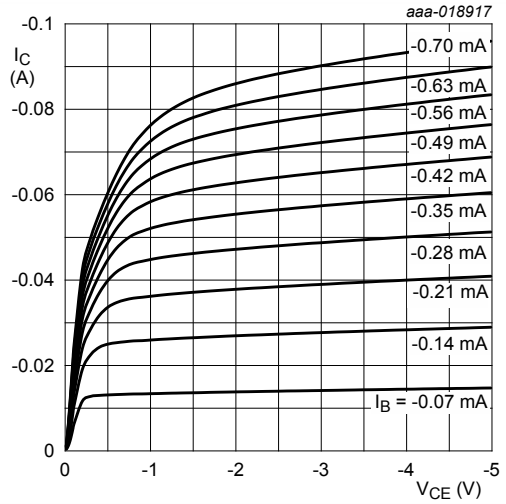
V_{CE} = -5 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

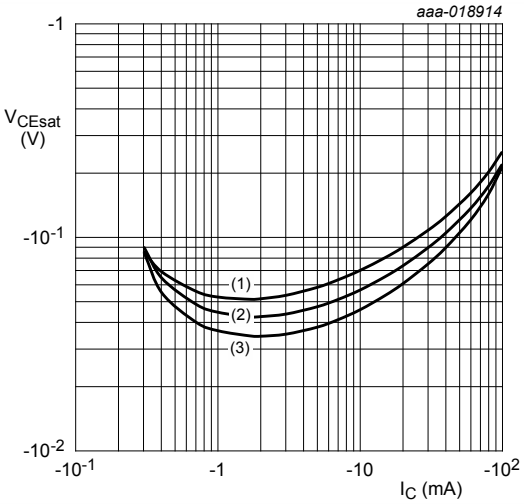
(3) T_{amb} = -40 °C

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



T_{amb} = 25 °C

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



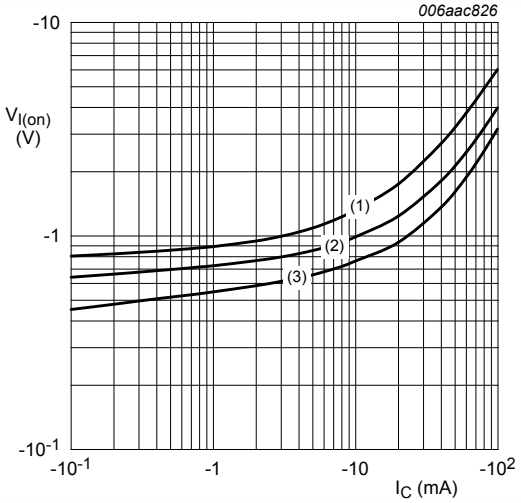
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = -40 °C

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



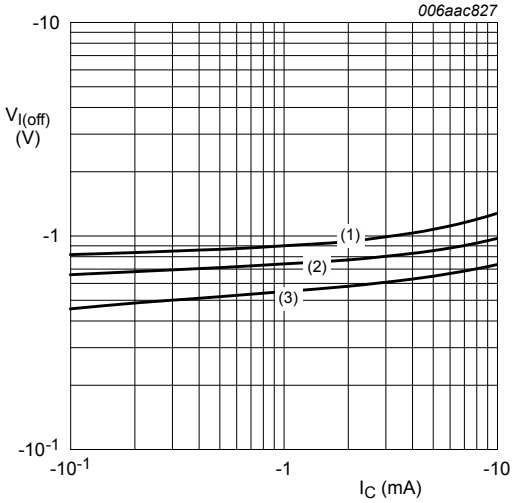
V_{CE} = -0.3 V

(1) T_{amb} = -40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



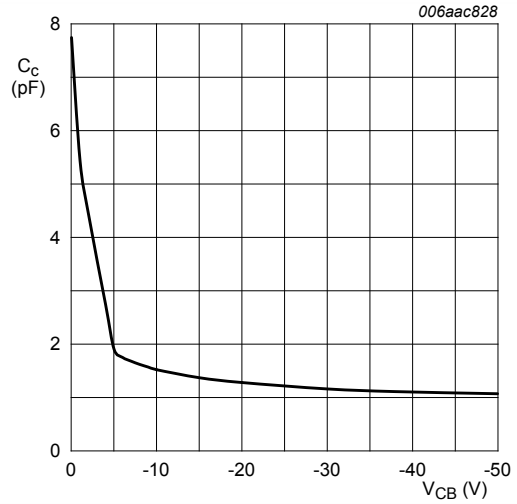
V_{CE} = -5 V

(1) T_{amb} = -40 °C

(2) T_{amb} = 25 °C

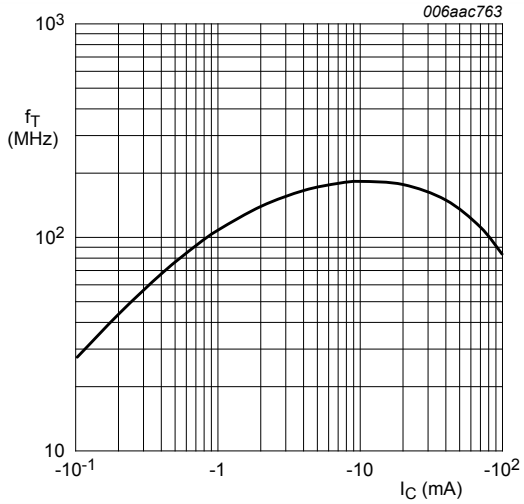
(3) T_{amb} = 100 °C

Fig. 15. PNP transistor: Off-state input voltage as a function of collector current; typical values



f = 1 MHz; T_{amb} = 25 °C

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



V_{CE} = -5 V; T_{amb} = 25 °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)

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

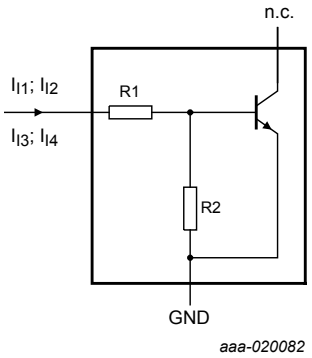


Fig. 18. NPN transistor: Resistor test circuit

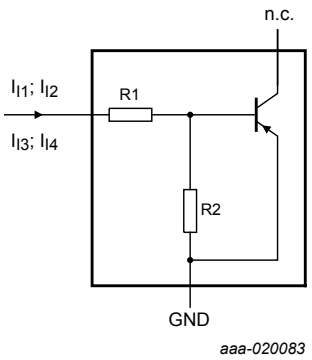


Fig. 19. PNP transistor: Resistor test circuit

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_{I1}	I_{I2}	I_{I3}	I_{I4}
4.7	47	90 µA	140 µA	-55 µA	-105 µA

12. Package outline

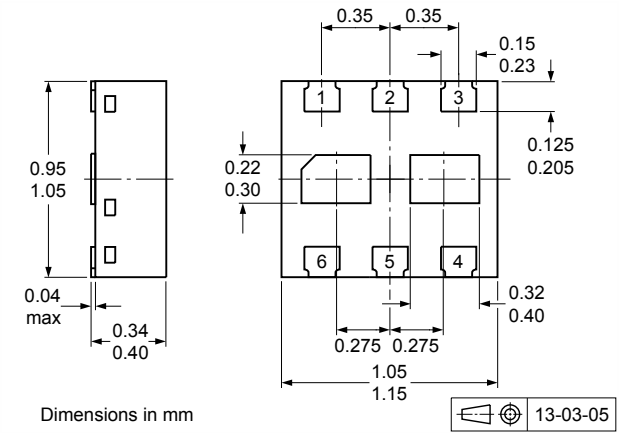


Fig. 20. Package outline DFN1010B-6 (SOT1216)

13. Soldering

Footprint information for reflow soldering of DFN1010B-6 package **SOT1216**

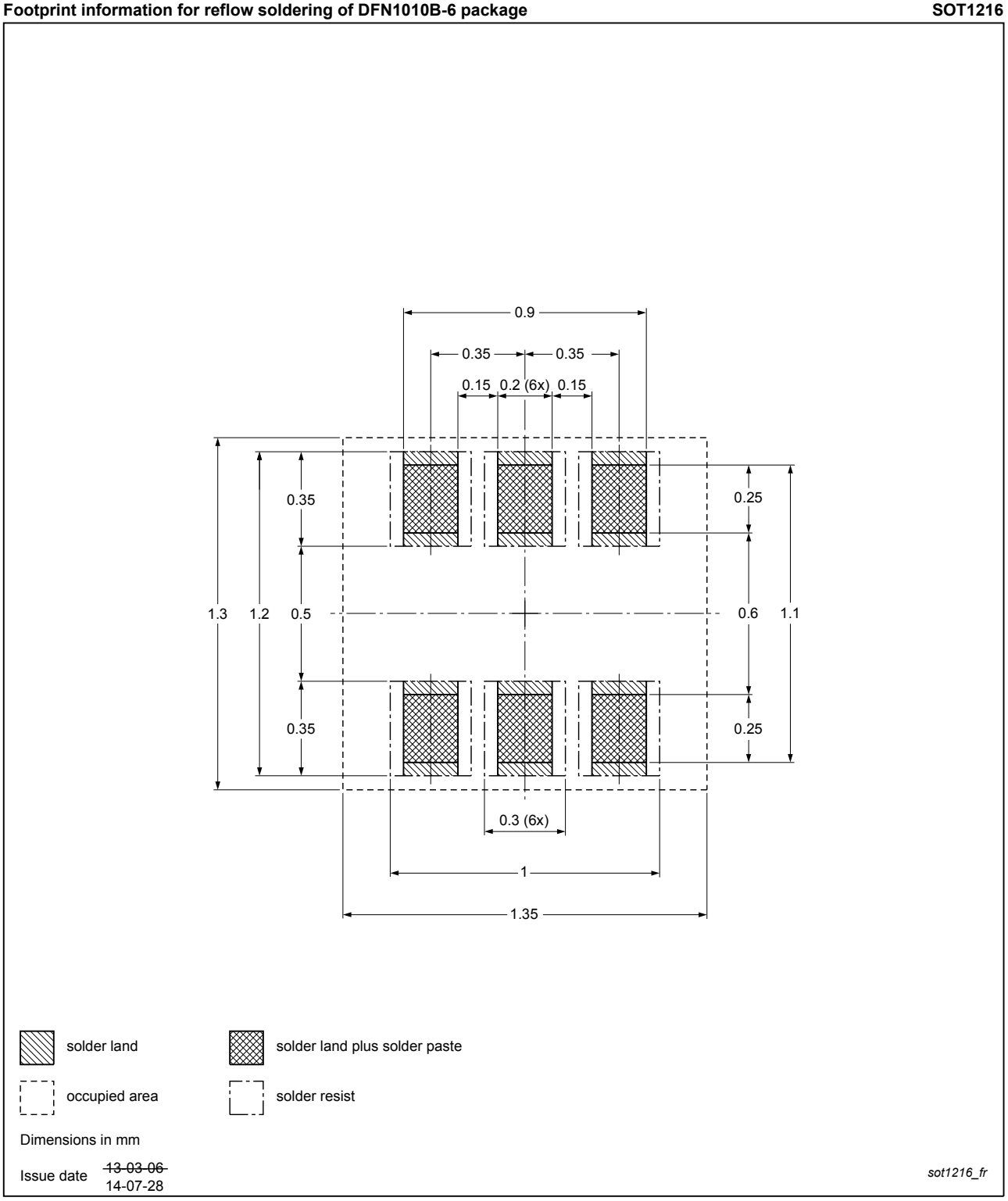


Fig. 21. Reflow soldering footprint for DFN1010B-6 (SOT1216)

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".
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16. Contents

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Date of release: 04 November 2015

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