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Team Nexperia



PQMD2

NPN/PNP resistor-equipped transistors;
R1 = 22 k Ω , R2 = 22 k Ω

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.

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

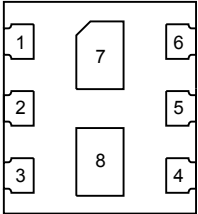
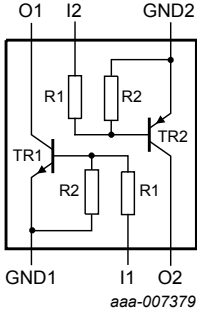
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Per transistor; for the PNP transistor with negative polarity							
V _{CEO}	collector-emitter voltage	open base	-	-	50	V	
I _O	output current		-	-	100	mA	
Per transistor; for the PNP transistor with negative polarity							
R1	bias resistor 1	T _{amb} = 25 °C	[1]	15.4	22	28.6	k Ω
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	

[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	 <p>Transparent top view DFN1010B-6 (SOT1216)</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
PQMD2	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
PQMD2	B 001

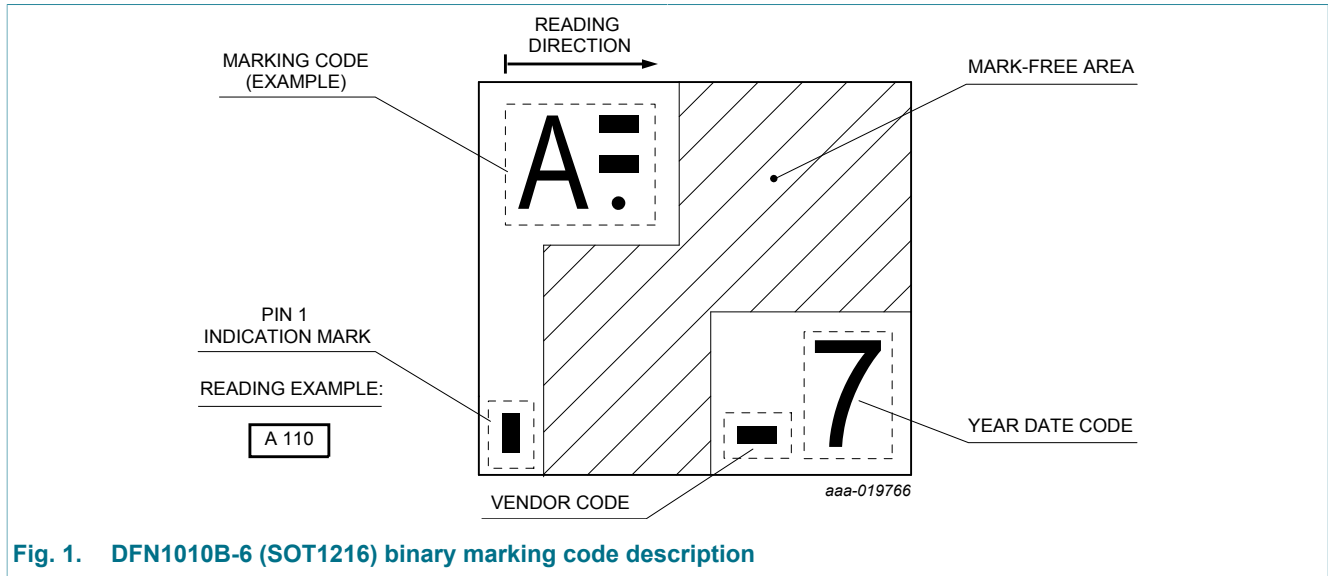


Fig. 1. DFN1010B-6 (SOT1216) binary marking code description

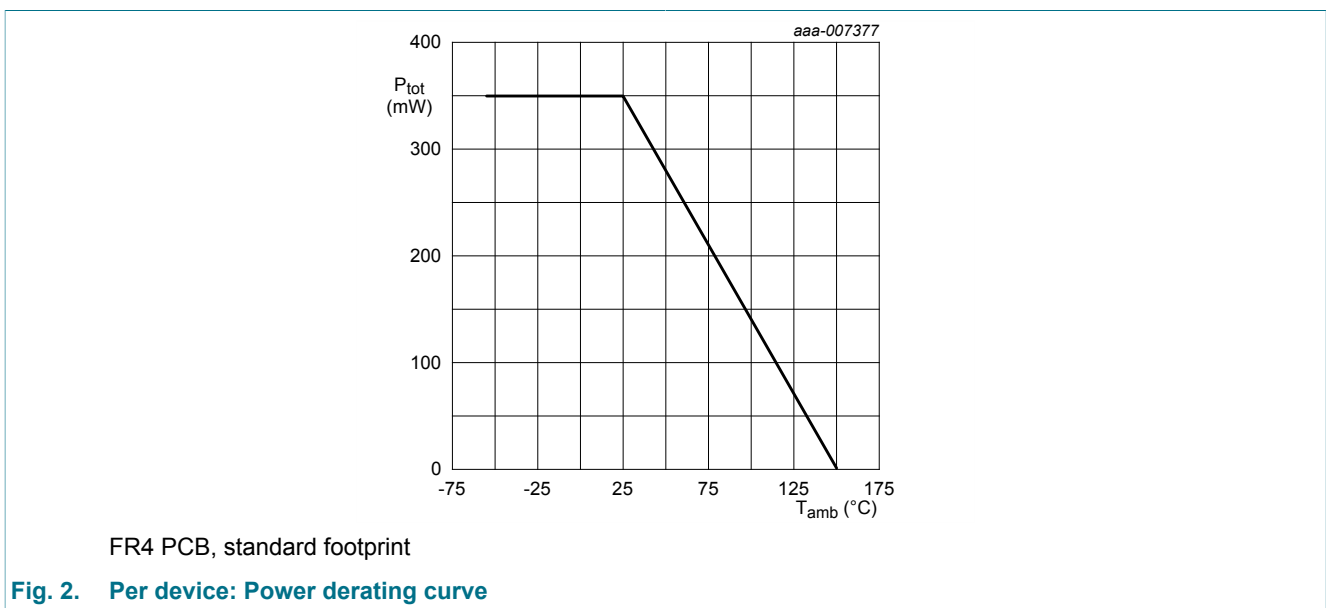
8. Limiting values

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		-	10	V
V _I	input voltage	TR1; positive		-	40	V
		TR1; negative		-	-10	V
		TR2; positive		-	10	V
		TR2; negative		-	-40	V
I _O	output current			-	100	mA
I _{CM}	peak collector current	t _p ≤ 1 ms; single pulse		-	100	mA
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	230	mW
Per device						
P _{tot}	total power dissipation	T _{amb} ≤ 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.

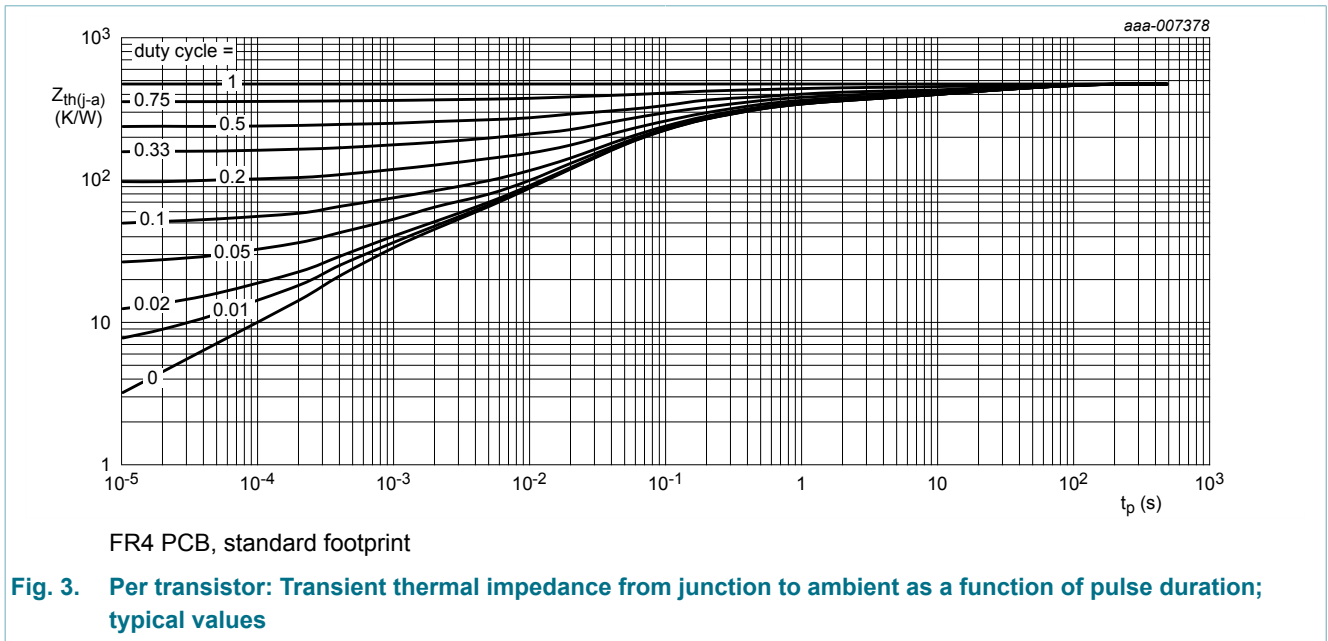


9. Thermal characteristics

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.



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)	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ °C}$	-	-	100	nA	
I_{CEO}	collector-emitter cut-off current (base open)	$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_{amb} = 25\text{ °C}$	-	-	1	μA	
		$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_{amb} = 150\text{ °C}$	-	-	5	μA	
I_{EBO}	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_{FE}	DC current gain	$V_{CE} = 5\text{ V}; I_C = 5\text{ mA}; T_{amb} = 25\text{ °C}$	60	-	-		
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}; T_{amb} = 25\text{ °C}$	-	-	150	mV	
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}; I_C = 100\text{ μA}; T_{amb} = 25\text{ °C}$	-	1.1	0.8	V	
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}; I_C = 5\text{ mA}; T_{amb} = 25\text{ °C}$	2.5	1.7	-	V	
R1	bias resistor 1	$T_{amb} = 25\text{ °C}$	[1]	15.4	22	28.6	kΩ
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	
C_C	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ °C}; TR1\text{ (NPN)}$	-	-	2.5	pF	
		$V_{CB} = -10\text{ V}; I_E = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ °C}; TR2\text{ (PNP)}$	-	-	3	pF	
f_T	transition frequency	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ °C}; TR1\text{ (NPN)}$	[2]	-	230	-	MHz
		$V_{CE} = -5\text{ V}; I_C = -10\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ °C}; TR2\text{ (PNP)}$	[2]	-	180	-	MHz

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

[2] Characteristics of built-in transistor

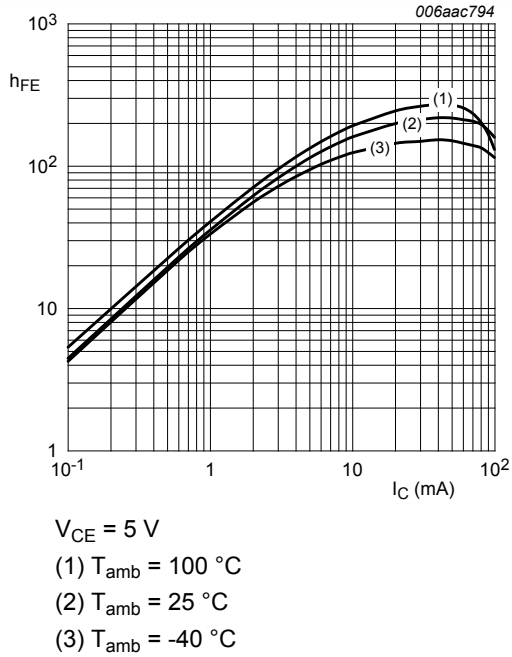


Fig. 4. NPN transistor: DC current gain as a function of collector current; typical values

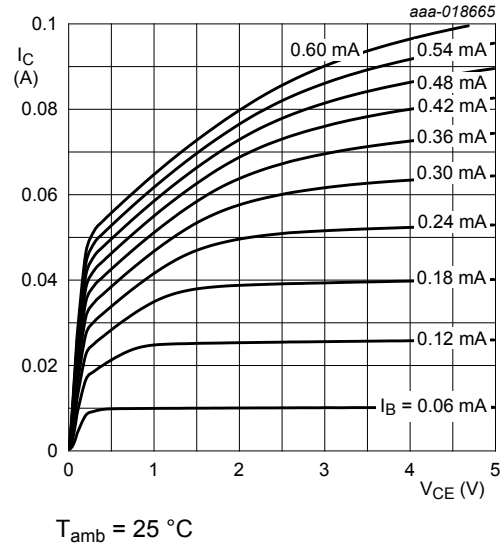


Fig. 5. NPN transistor: Collector current as a function of collector-emitter voltage; typical values

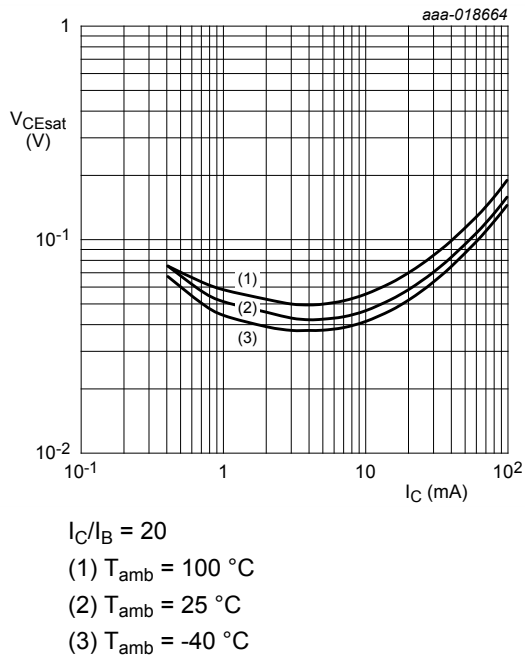


Fig. 6. NPN transistor: Collector-emitter saturation voltage as a function of collector current; typical values

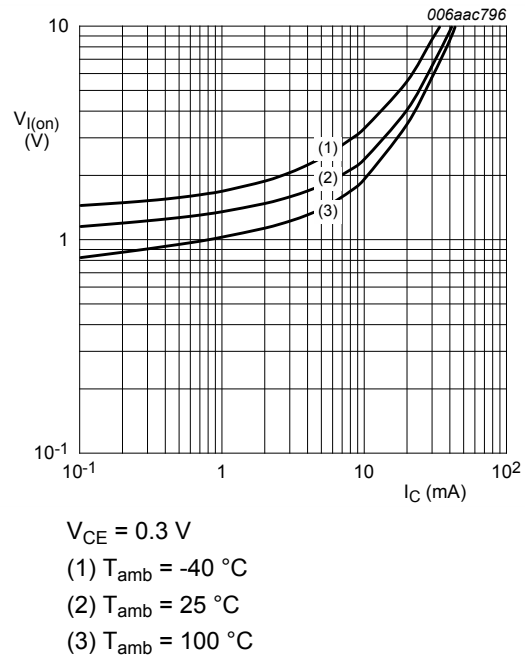
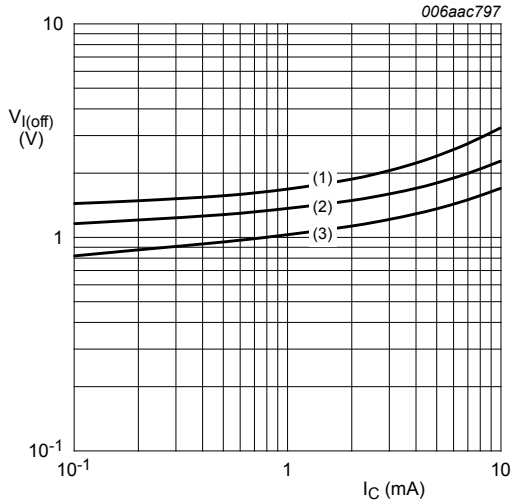
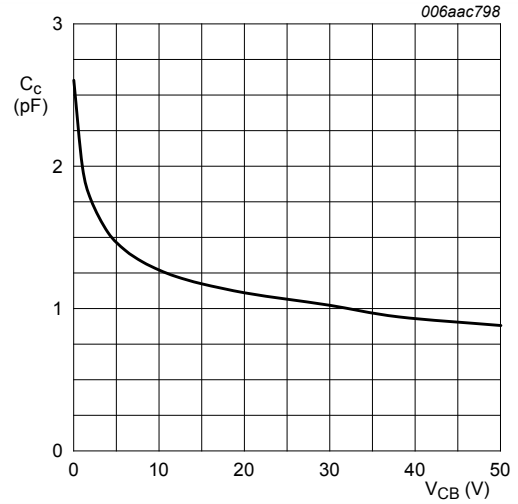


Fig. 7. NPN transistor: On-state input voltage as a function of collector current; typical values



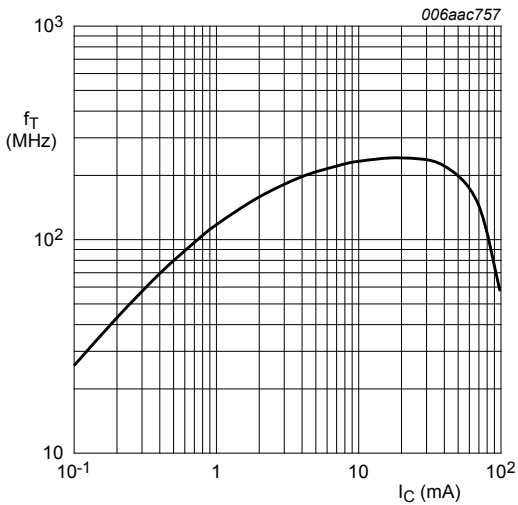
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



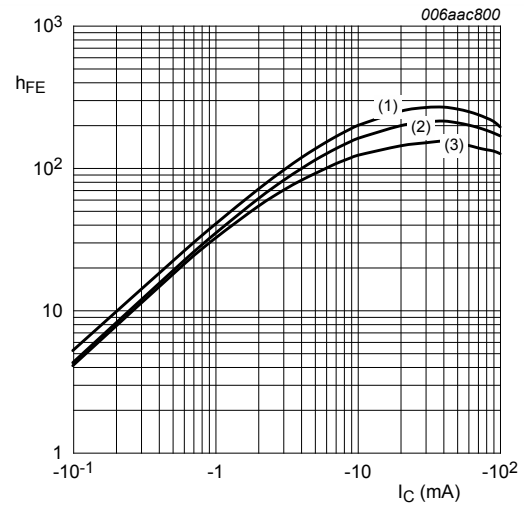
$f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$

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



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

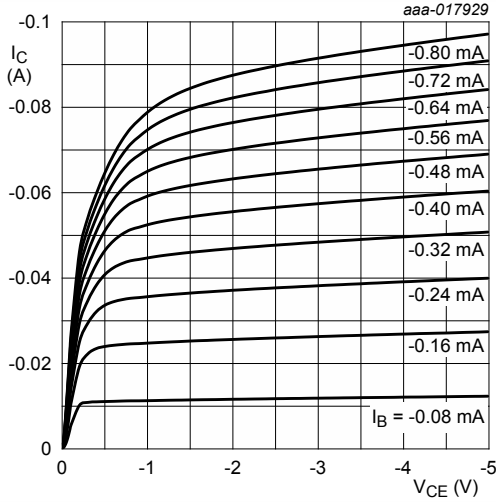
Fig. 10. NPN transistor: Transition frequency as a function of collector current; typical values of built-in transistor



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

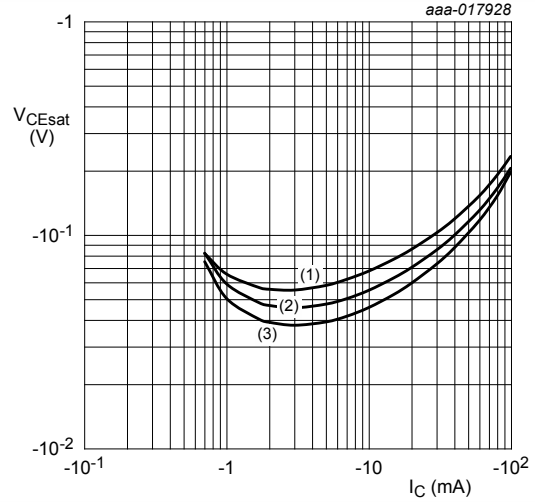
Fig. 11. PNP transistor: DC current gain as a function of collector current; typical values

NPN/PNP resistor-equipped transistors; R1 = 22 kΩ, R2 = 22 kΩ



$T_{amb} = 25\text{ °C}$

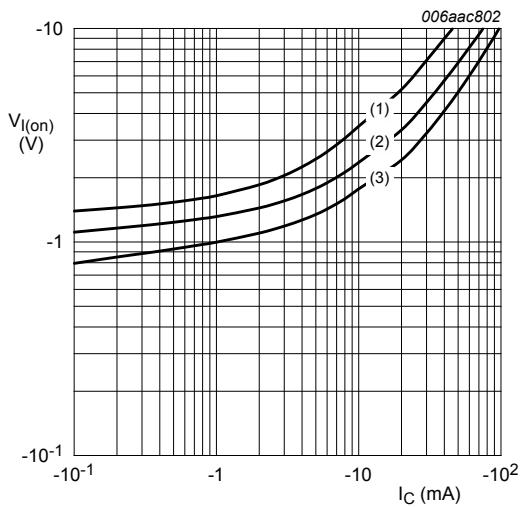
Fig. 12. PNP transistor: Collector current as a function of collector-emitter voltage; typical values



$I_C/I_B = 20$

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

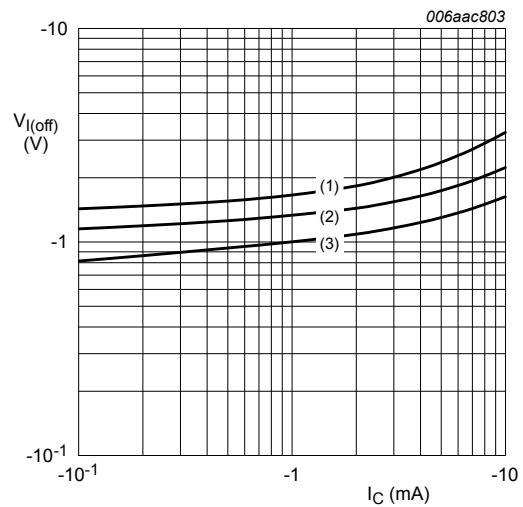
Fig. 13. PNP transistor: Collector-emitter saturation voltage as a function of collector current; typical values



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

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

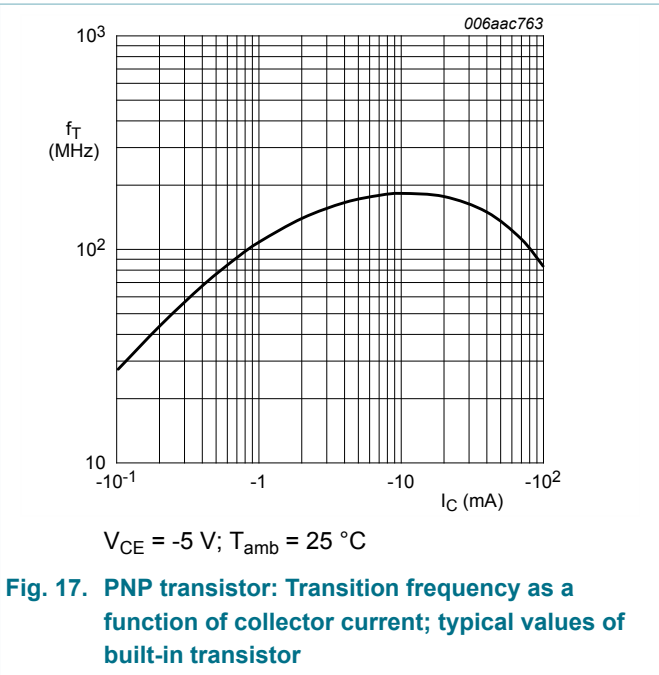
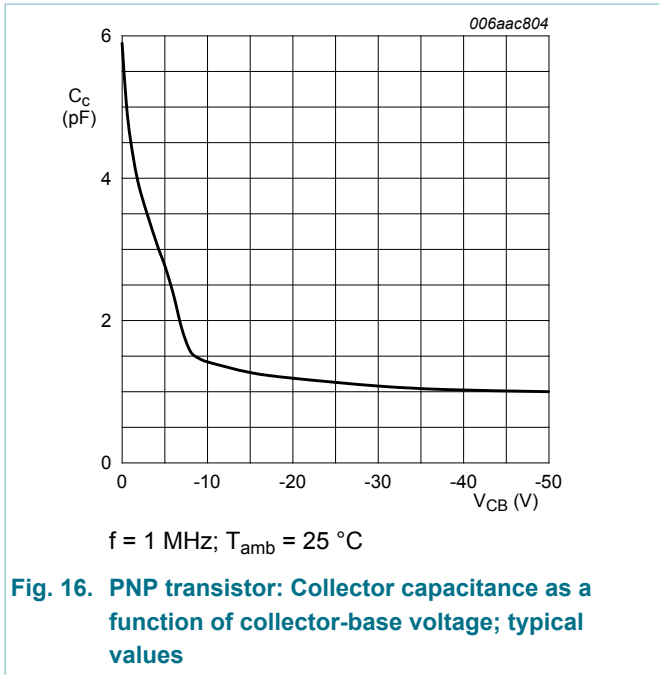
Fig. 14. PNP transistor: On-state input voltage as a function of collector current; typical values



$V_{CE} = -5\text{ V}$

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

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



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)

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

- Calculation of bias resistor ratio (R2/R1)

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

NPN/PNP resistor-equipped transistors; R1 = 22 kΩ, R2 = 22 kΩ

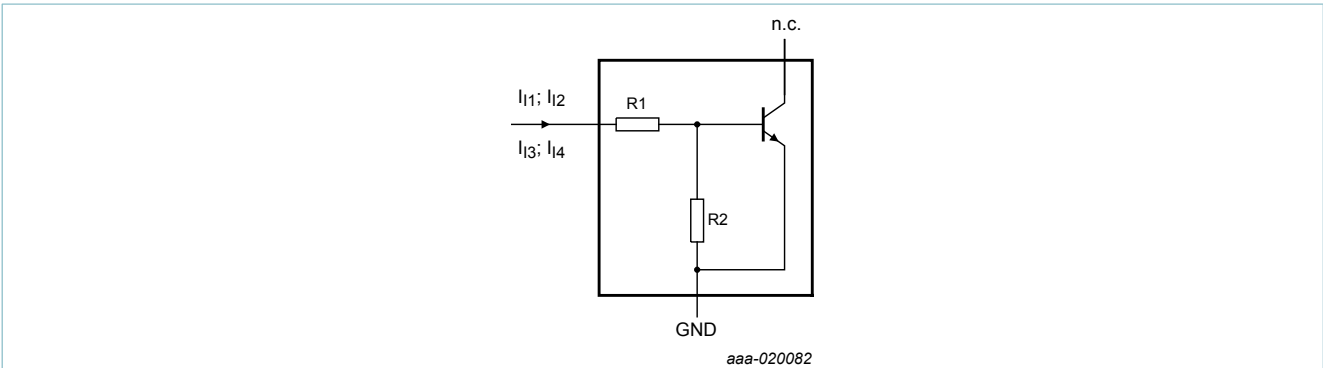


Fig. 18. NPN transistor: Resistor test circuit

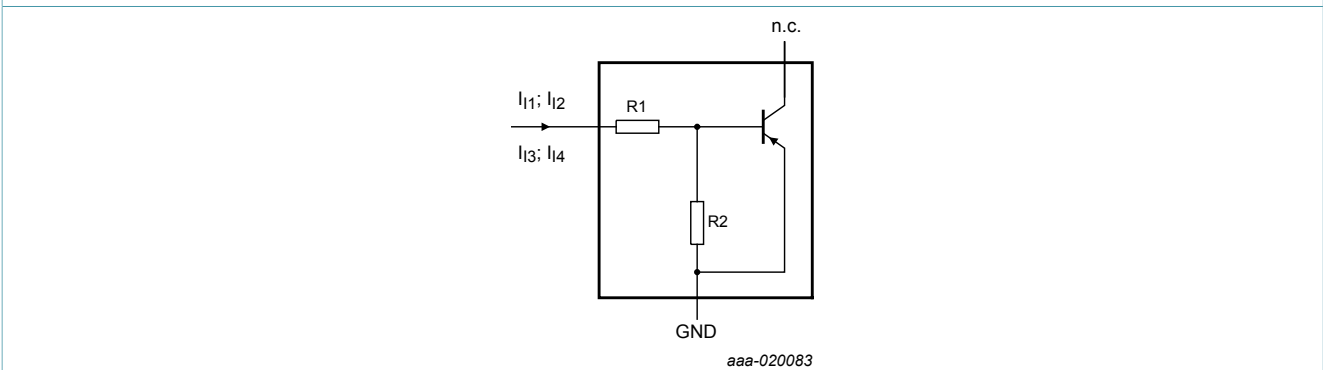


Fig. 19. PNP transistor: Resistor test circuit

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 ₁₁	I ₁₂	I ₁₃	I ₁₄
22	22	150 μA	230 μA	-150 μA	-230 μA

12. Package outline

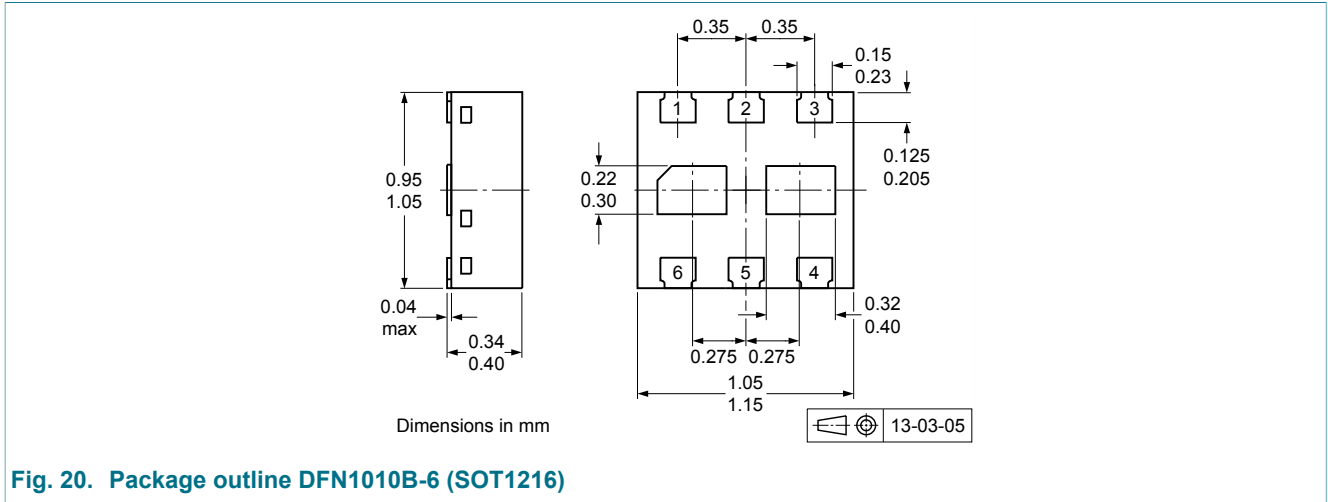


Fig. 20. Package outline DFN1010B-6 (SOT1216)

13. Soldering

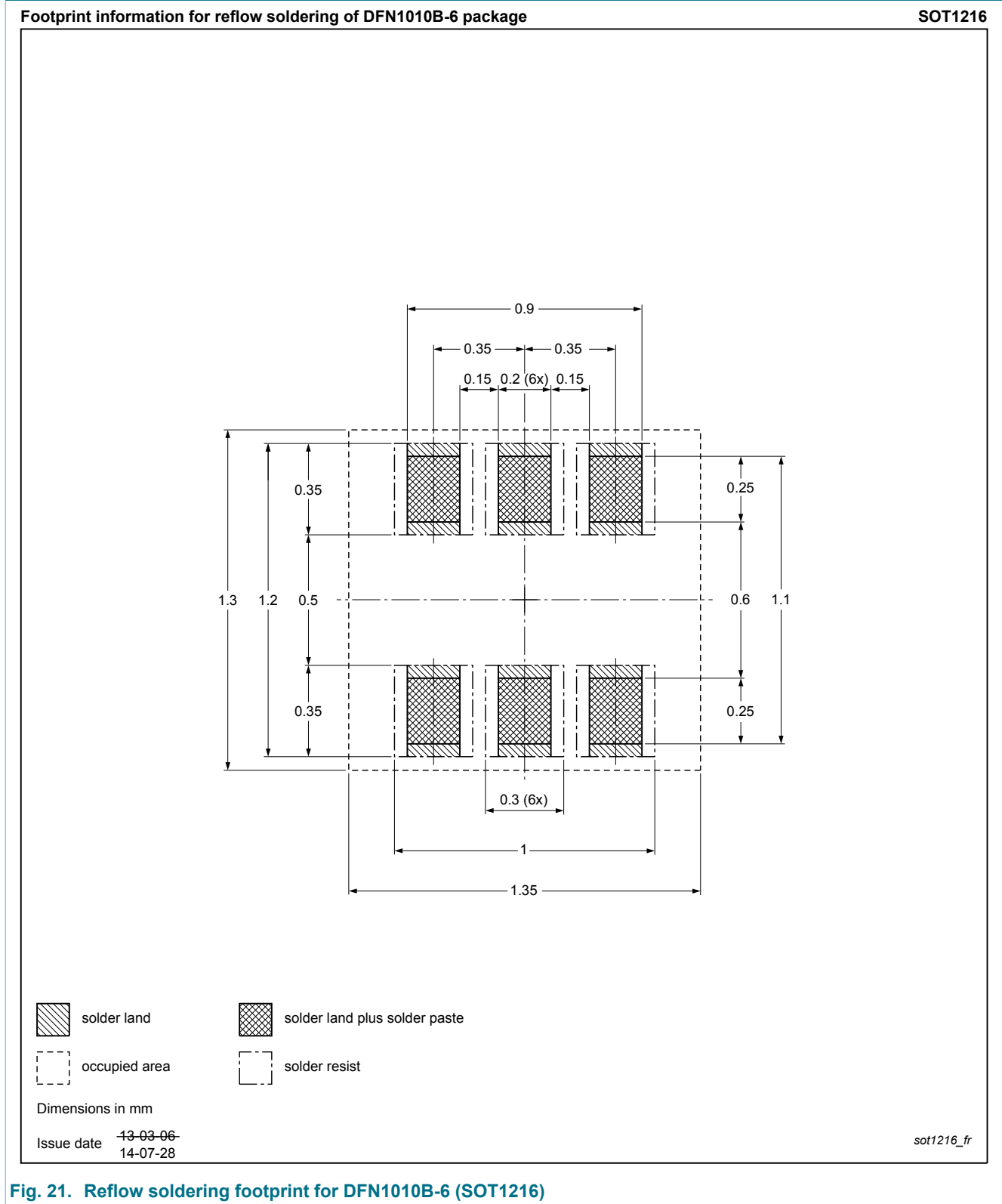


Fig. 21. Reflow soldering footprint for DFN1010B-6 (SOT1216)

14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PQMD2 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.

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 Date of release: 4 November 2015