



# PGMH10

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

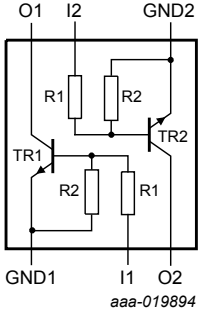
| Symbol                | Parameter                 | Conditions               |     | Min  | Typ | Max  | Unit       |
|-----------------------|---------------------------|--------------------------|-----|------|-----|------|------------|
| <b>Per transistor</b> |                           |                          |     |      |     |      |            |
| V <sub>CEO</sub>      | collector-emitter voltage | open base                |     | -    | -   | 50   | V          |
| I <sub>O</sub>        | output current            |                          |     | -    | -   | 100  | mA         |
| <b>Per transistor</b> |                           |                          |     |      |     |      |            |
| R1                    | bias resistor 1           | T <sub>amb</sub> = 25 °C | [1] | 1.54 | 2.2 | 2.86 | k $\Omega$ |
| R2/R1                 | bias resistor ratio       |                          | [1] | 17   | 21  | 26   |            |

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

NPN/NPN resistor-equipped transistors; R1 = 2.2 kΩ, R2 = 47 kΩ

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description            | Simplified outline                                                                                                                            | Graphic symbol                                                                                        |
|-----|--------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 1   | GND1   | GND (emitter) TR1      |  <p>Transparent top view<br/><b>DFN1010B-6 (SOT1216)</b></p> |  <p>aaa-019894</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

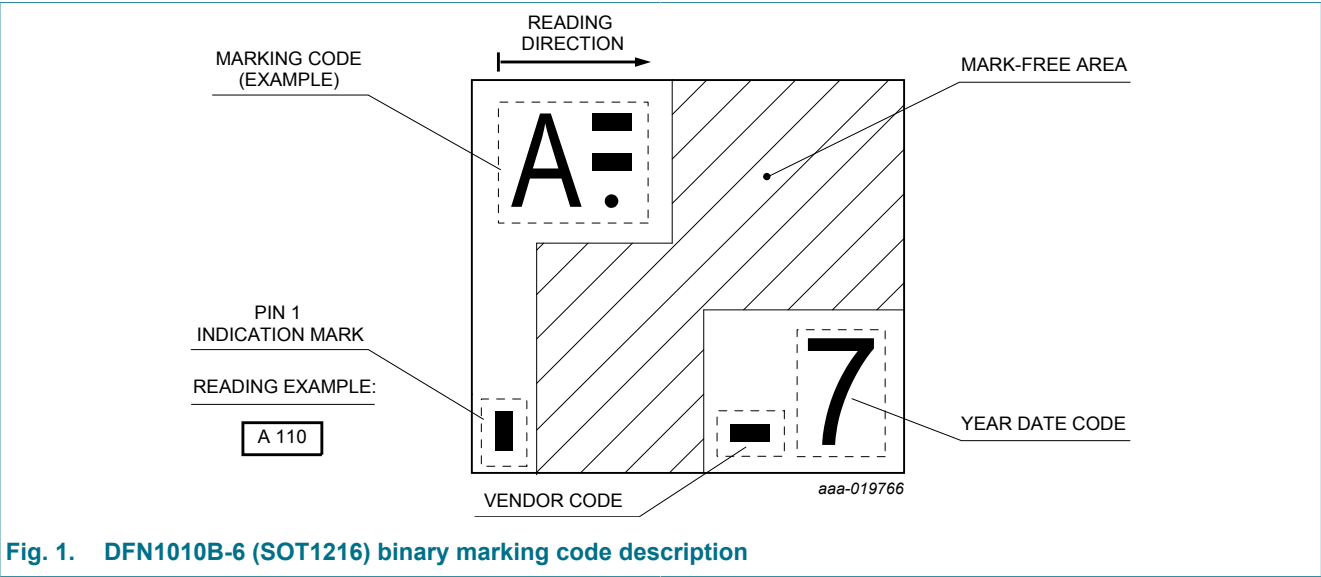
Table 3. Ordering information

| Type number | Package    |                                                                                              |         |
|-------------|------------|----------------------------------------------------------------------------------------------|---------|
|             | Name       | Description                                                                                  | Version |
| PQMH10      | 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 |
|-------------|--------------|
| PQMH10      | A 011        |

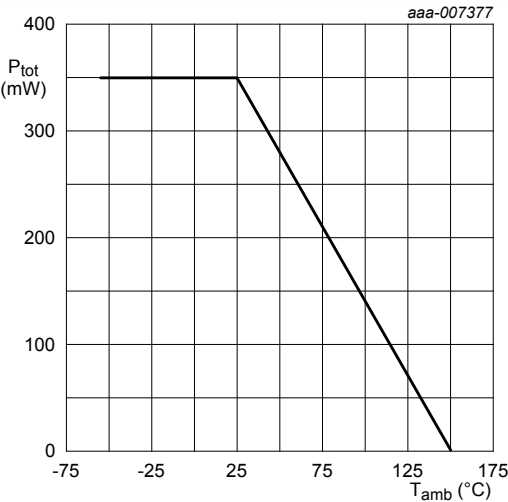


8. Limiting values

Table 5. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol           | Parameter                 | Conditions               |     | Min | Max | Unit |
|------------------|---------------------------|--------------------------|-----|-----|-----|------|
| Per transistor   |                           |                          |     |     |     |      |
| 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             | 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       |                           |                          |     |     |     |      |
| 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

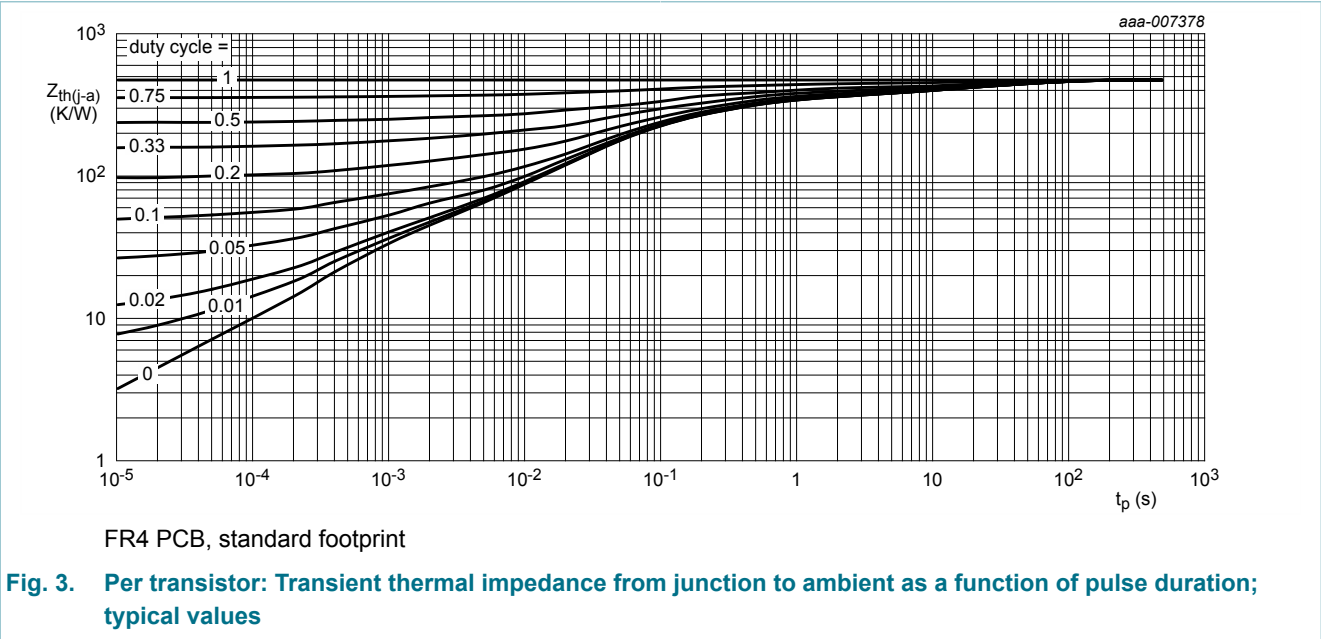
Fig. 2. Per device: Power derating curve

9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter                                   | Conditions  |     | Min | Typ | Max | Unit |
|----------------|---------------------------------------------|-------------|-----|-----|-----|-----|------|
| 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 |
|-----------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------|-----|------|------|------|------|
| <b>Per transistor</b> |                                               |                                                                                                    |     |      |      |      |      |
| $I_{CBO}$             | 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                               | $V_{CE} = 5 \text{ V}$ ; $I_C = 10 \text{ mA}$ ; $T_{amb} = 25 \text{ °C}$                         |     | 100  | -    | -    |      |
| $V_{CEsat}$           | 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                       | $V_{CE} = 5 \text{ V}$ ; $I_C = 100 \text{ μA}$ ; $T_{amb} = 25 \text{ °C}$                        |     | -    | 0.6  | 0.5  | V    |
| $V_{I(on)}$           | on-state input voltage                        | $V_{CE} = 0.3 \text{ V}$ ; $I_C = 5 \text{ mA}$ ; $T_{amb} = 25 \text{ °C}$                        |     | 1.1  | 0.75 | -    | V    |
| R1                    | bias resistor 1                               | $T_{amb} = 25 \text{ °C}$                                                                          | [1] | 1.54 | 2.2  | 2.86 | kΩ   |
| R2/R1                 | bias resistor ratio                           |                                                                                                    | [1] | 17   | 21   | 26   |      |
| $C_C$                 | collector capacitance                         | $V_{CB} = 10 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $f = 1 \text{ MHz}$ ; $T_{amb} = 25 \text{ °C}$    |     | -    | -    | 2.5  | pF   |
| $f_T$                 | transition frequency                          | $V_{CE} = 5 \text{ V}$ ; $I_C = 10 \text{ mA}$ ; $f = 100 \text{ MHz}$ ; $T_{amb} = 25 \text{ °C}$ | [2] | -    | 230  | -    | MHz  |

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

[2] Characteristics of built-in transistor

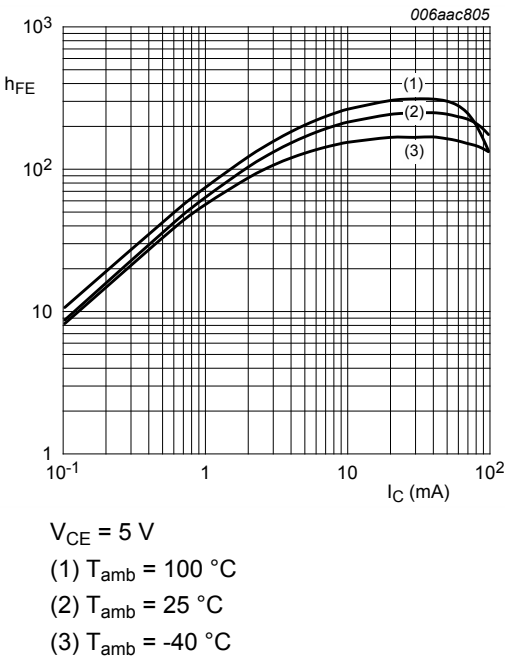


Fig. 4. DC current gain as a function of collector current; typical values

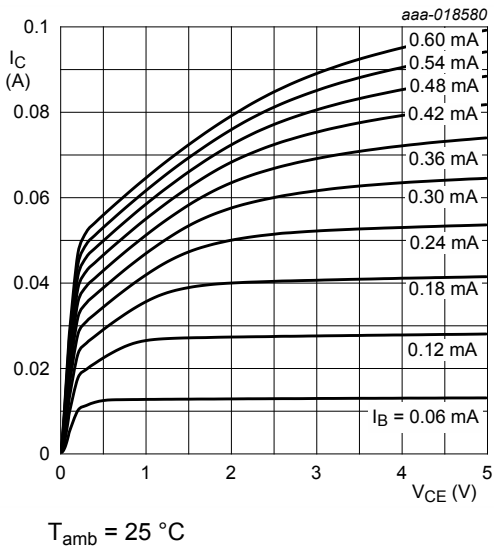


Fig. 5. Collector current as a function of collector-emitter voltage; typical values

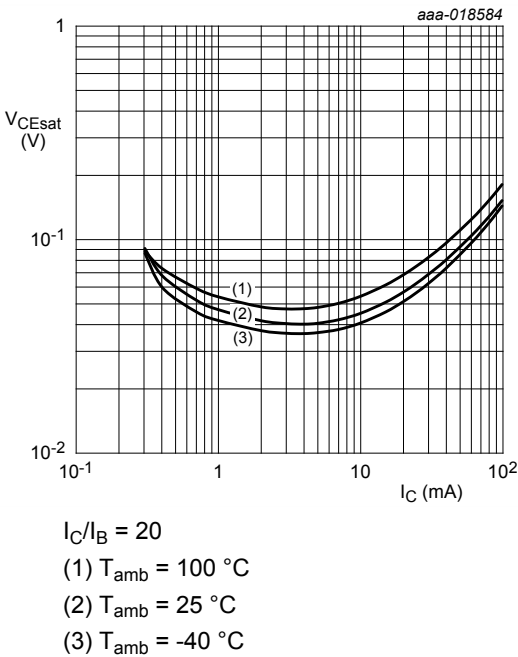


Fig. 6. Collector-emitter saturation voltage as a function of collector current; typical values

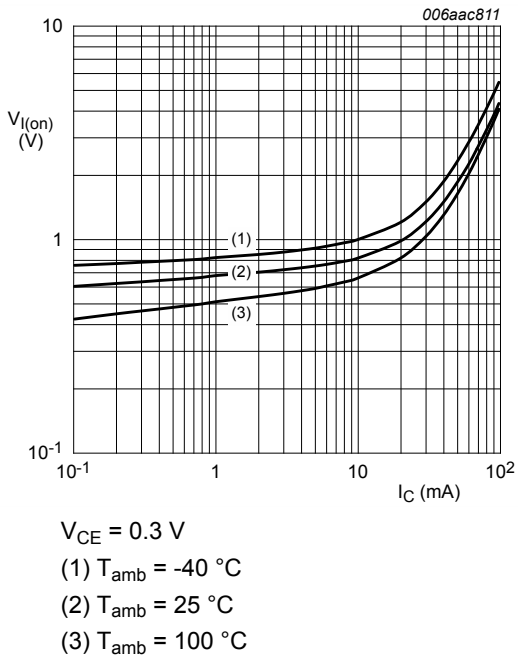
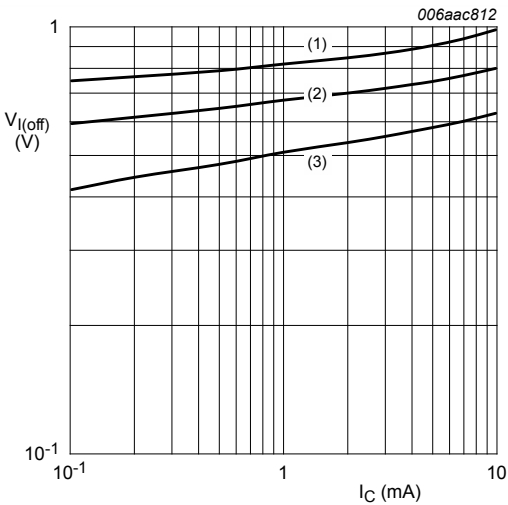
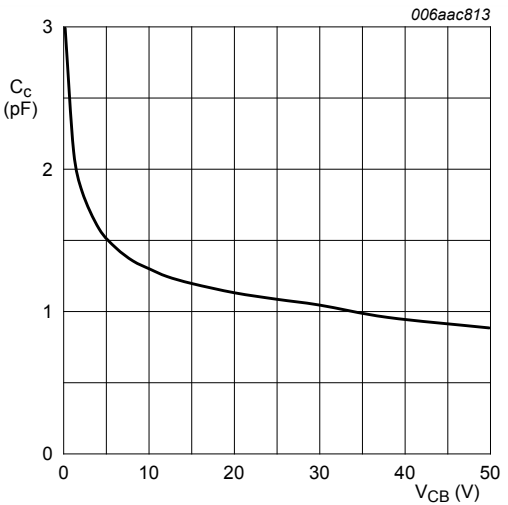


Fig. 7. On-state input voltage as a function of collector current; typical values



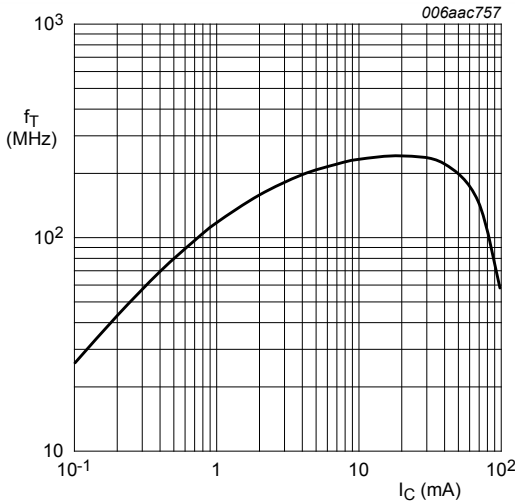
$V_{CE} = 5\text{ V}$   
(1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

Fig. 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 collector-base voltage; typical values



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

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

## 11. Test information

### 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.

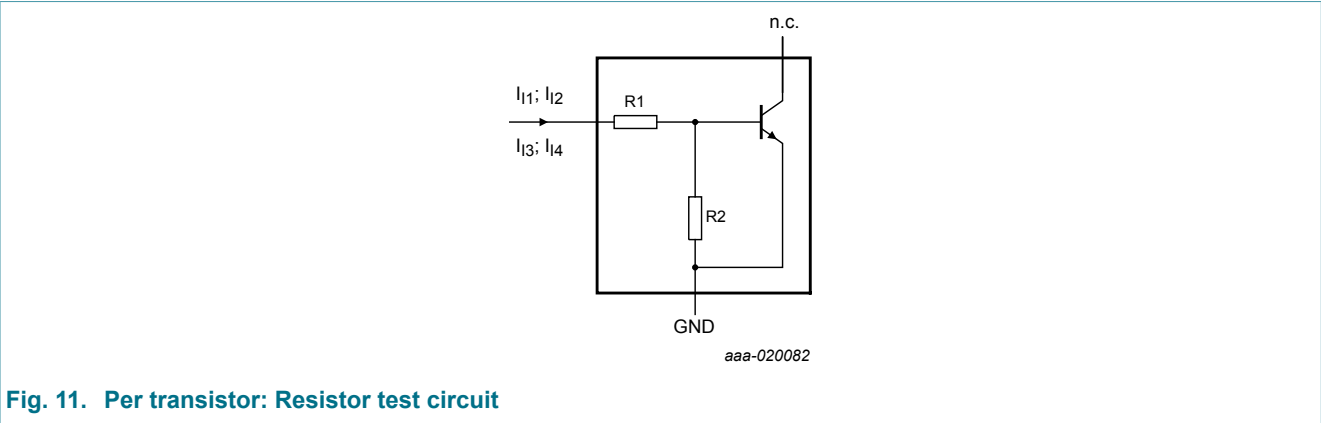
11.2 Resistor calculation

- 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)

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

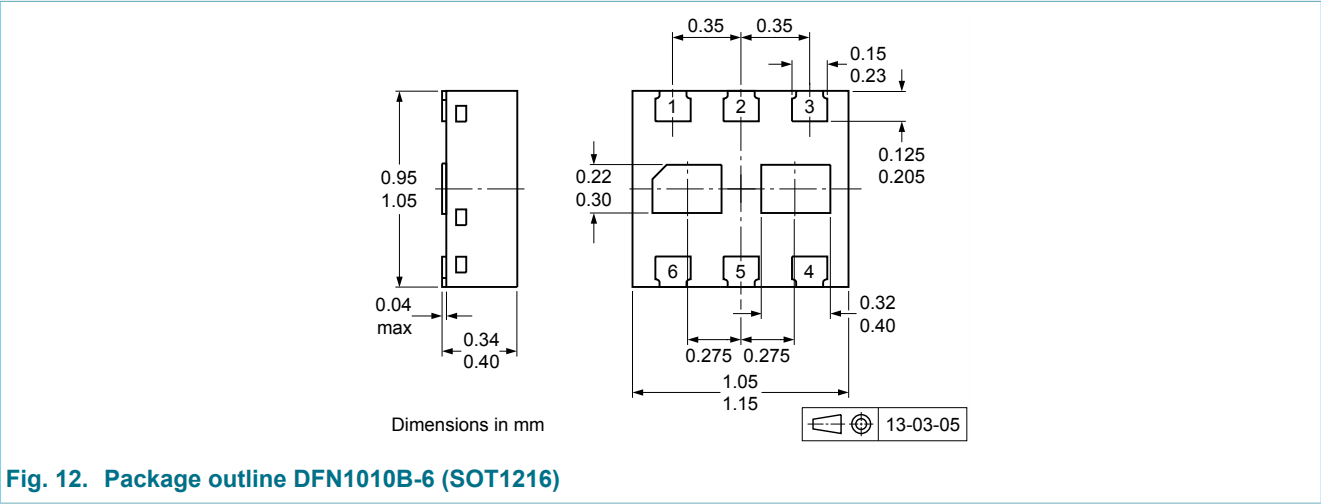


11.3 Resistor test conditions

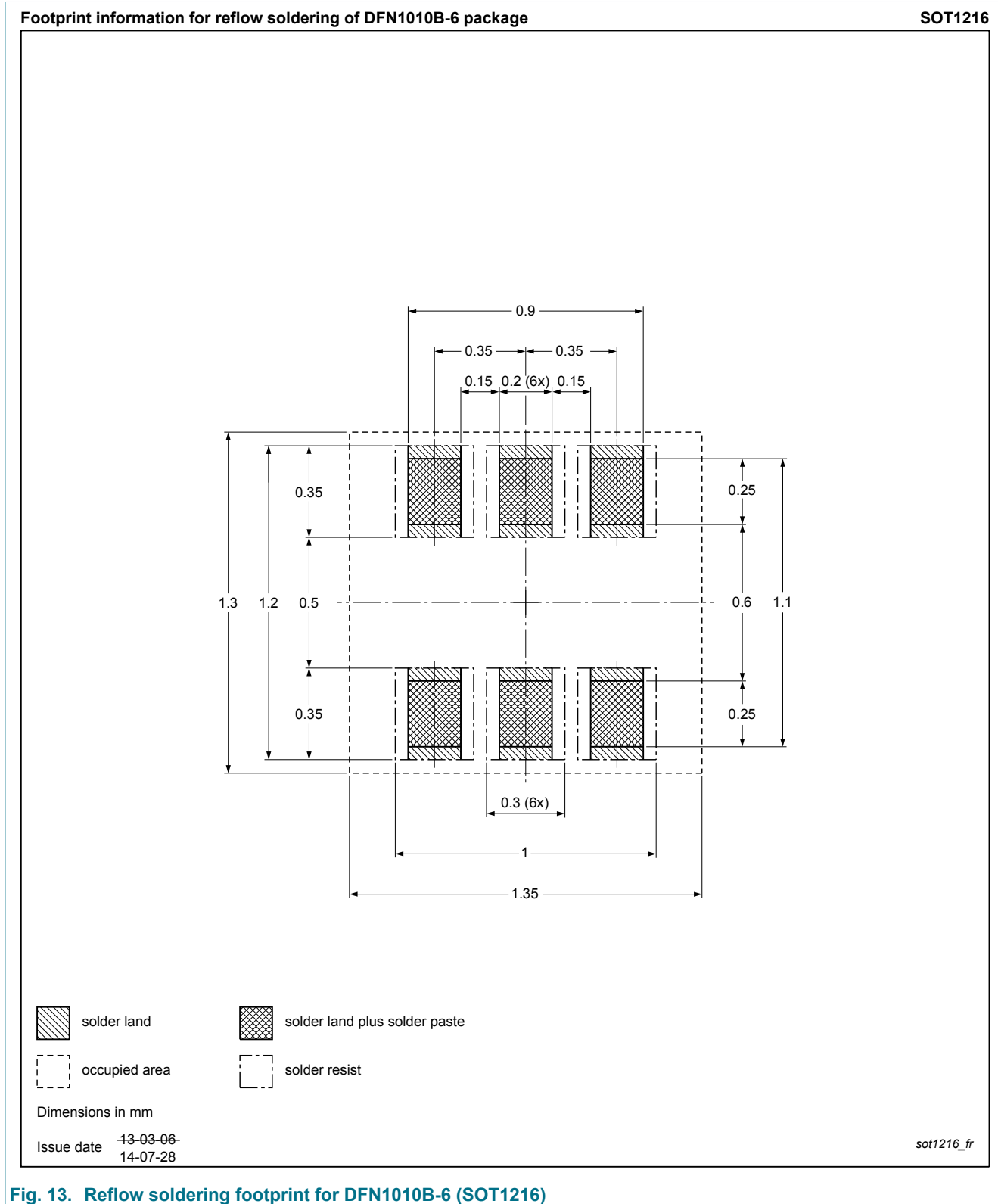
Table 8. Resistor test conditions

| 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 μA           | 140 μA          | -55 μA          | -105 μA         |  |

12. Package outline



## 13. Soldering



**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 |
|---------------|--------------|--------------------|---------------|------------|
| PQMH10 v.1    | 20151104     | Product data sheet | -             | -          |

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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. |
| 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: 04 November 2015

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