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Team Nexperia



PGMH9

NPN/NPN resistor-equipped transistors;
R1 = 10 k Ω , R2 = 47 k Ω

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.

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

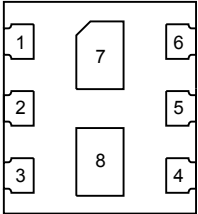
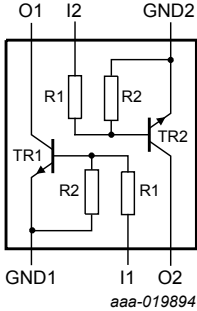
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|-----------------------|---------------------------|--------------------------|-----|-----|-----|------|------------|
| Per transistor | | | | | | | |
| V _{CEO} | collector-emitter voltage | open base | - | - | 50 | V | |
| I _O | output current | | - | - | 100 | mA | |
| Per transistor | | | | | | | |
| R1 | bias resistor 1 | T _{amb} = 25 °C | [1] | 7 | 10 | 13 | k Ω |
| R2/R1 | bias resistor ratio | | [1] | 3.7 | 4.7 | 5.7 | |

[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-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 |
| PQMH9 | 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 |
|-------------|--------------|
| PQMH9 | A 101 |

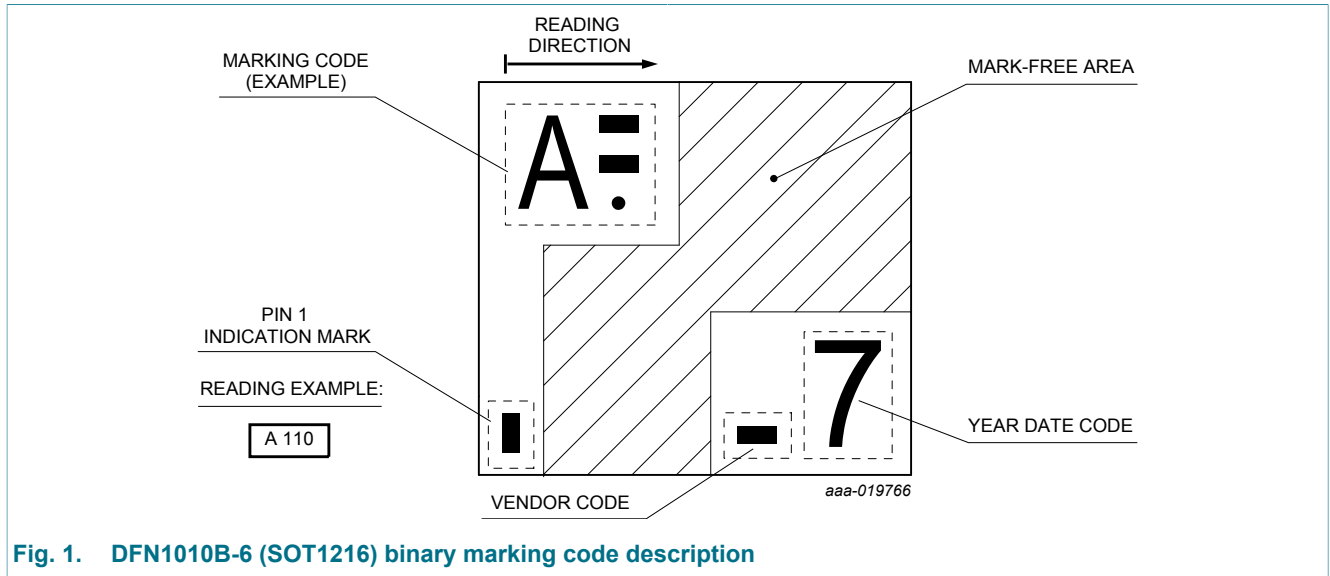


Fig. 1. DFN1010B-6 (SOT1216) binary marking code description

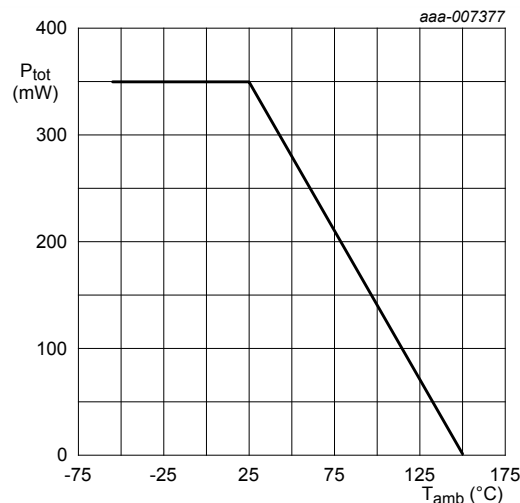
8. Limiting values

Table 5. Limiting values

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|-----------------------|---------------------------|-------------------------------------|-----|-----|-----|------|
| Per transistor | | | | | | |
| 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 | | - | 6 | V |
| V _I | input voltage | positive | | - | 40 | V |
| | | negative | | - | -6 | 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.



FR4 PCB, standard footprint

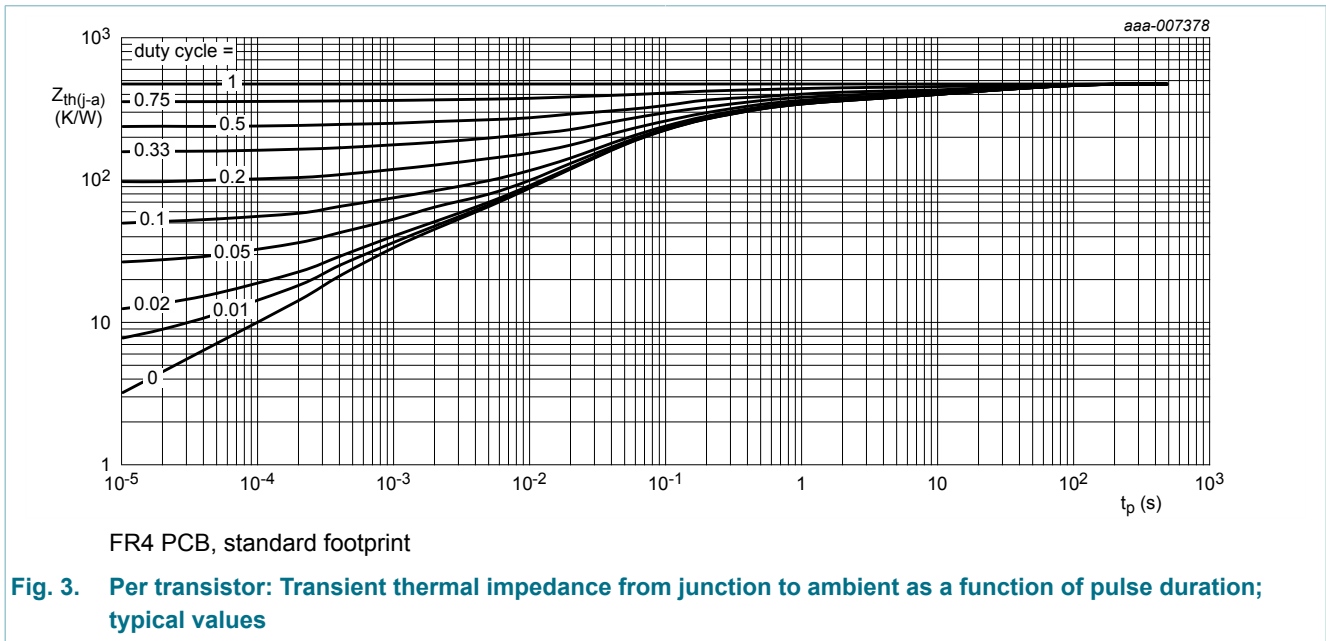
Fig. 2. Per device: Power derating curve

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.



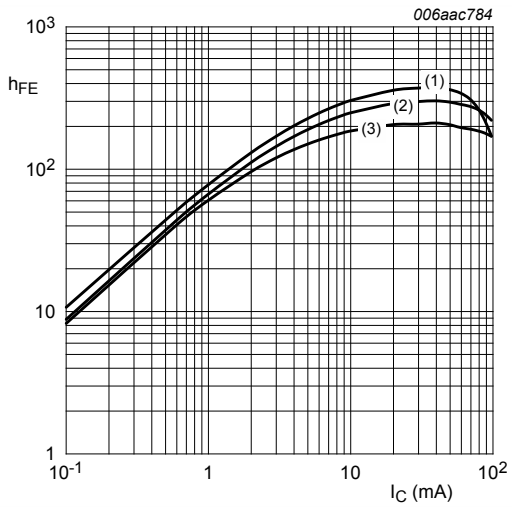
10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|-----------------------|---|---|-----|-----|-----|-----|---------------|
| Per transistor | | | | | | | |
| 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 | μA |
| | | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_{amb} = 150\text{ }^\circ\text{C}$ | | - | - | 5 | μA |
| I_{EBO} | emitter-base cut-off current (collector open) | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$ | | - | - | 150 | μA |
| h_{FE} | DC current gain | $V_{CE} = 5\text{ V}; I_C = 5\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$ | | 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 | $V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}; T_{amb} = 25\text{ }^\circ\text{C}$ | | - | 0.7 | 0.5 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE} = 0.3\text{ V}; I_C = 10\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$ | | 1.4 | 0.8 | - | V |
| R1 | bias resistor 1 | $T_{amb} = 25\text{ }^\circ\text{C}$ | [1] | 7 | 10 | 13 | kΩ |
| R2/R1 | bias resistor ratio | | [1] | 3.7 | 4.7 | 5.7 | |
| C_C | collector capacitance | $V_{CB} = 10\text{ V}; I_E = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$ | | - | - | 2.5 | pF |
| f_T | transition frequency | $V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$ | [2] | - | 230 | - | MHz |

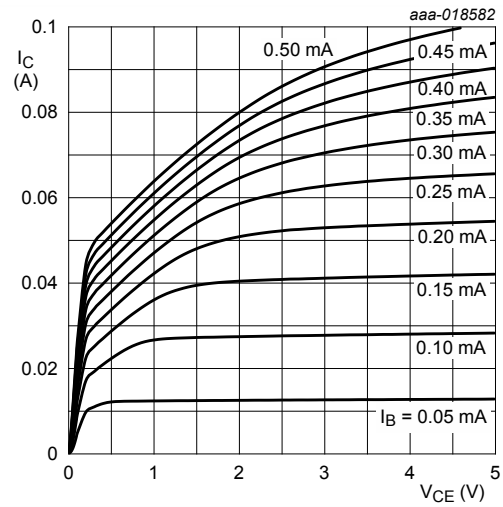
[1] See section "Test information" for resistor calculation and test conditions.

[2] Characteristics of built-in transistor



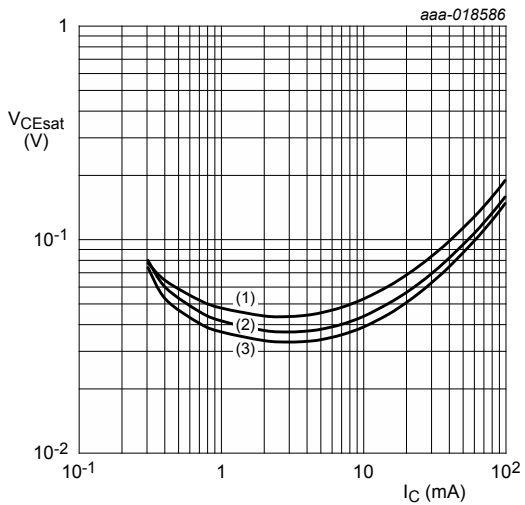
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -40\text{ °C}$

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



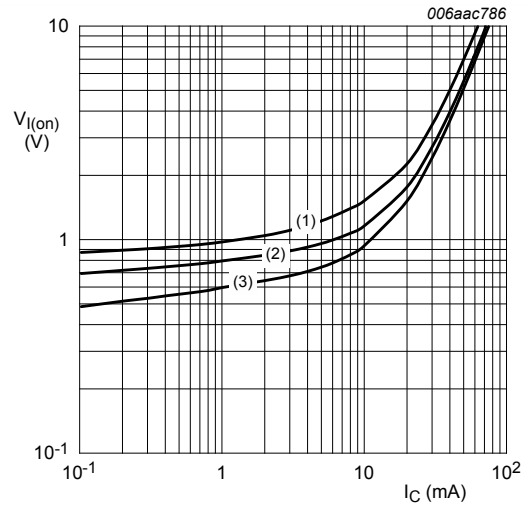
$T_{amb} = 25\text{ °C}$

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



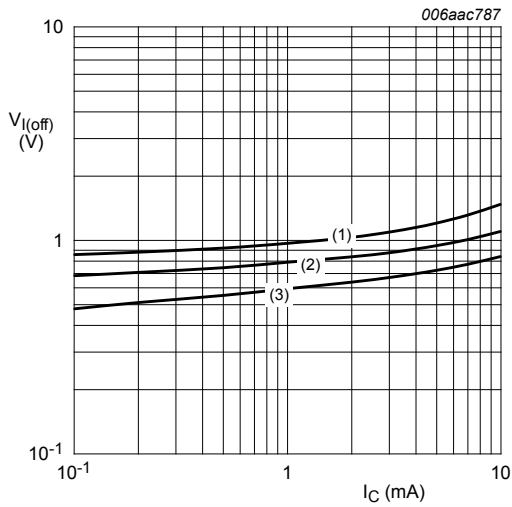
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -40\text{ °C}$

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



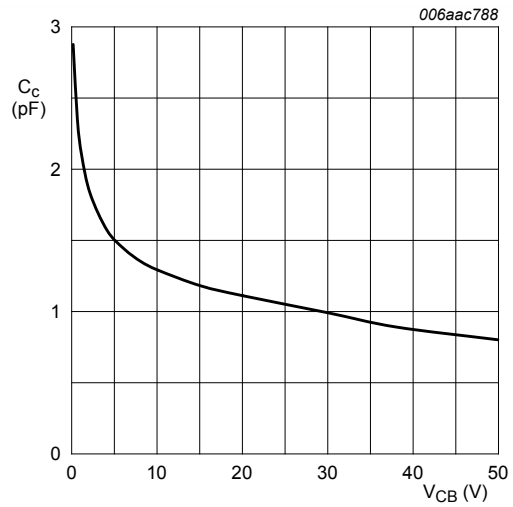
$V_{CE} = 0.3\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



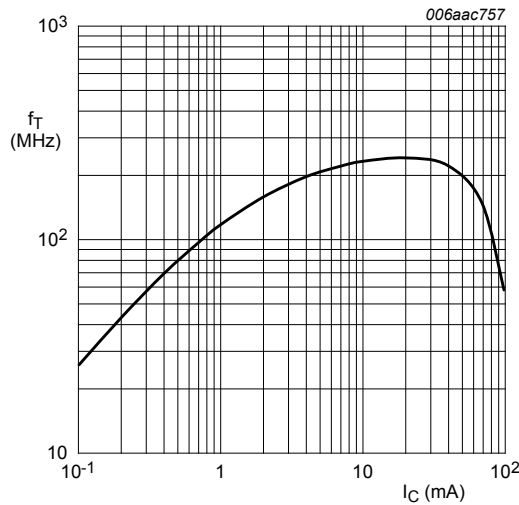
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



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

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



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

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)

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

- Calculation of bias resistor ratio (R2/R1)

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

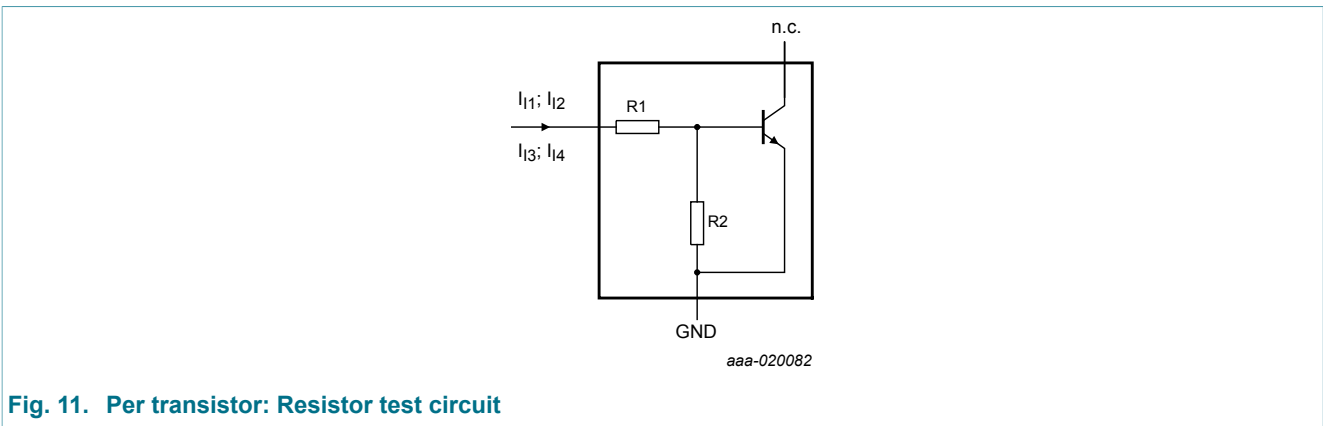


Fig. 11. Per transistor: Resistor test circuit

11.3 Resistor test conditions

Table 8. Resistor test conditions

| R1 (kΩ) | R2 (kΩ) | Test conditions | | | |
|---------|---------|-----------------|-----------------|-----------------|-----------------|
| | | I ₁₁ | I ₁₂ | I ₁₃ | I ₁₄ |
| 10 | 47 | 90 μA | 140 μA | -55 μA | -105 μA |

12. Package outline

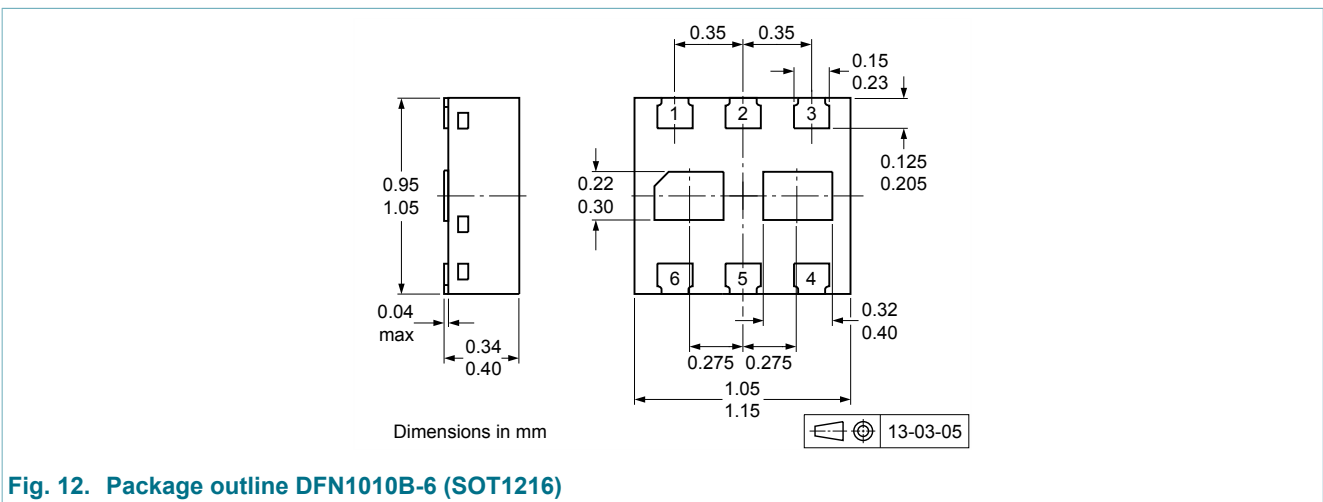


Fig. 12. Package outline DFN1010B-6 (SOT1216)

13. Soldering

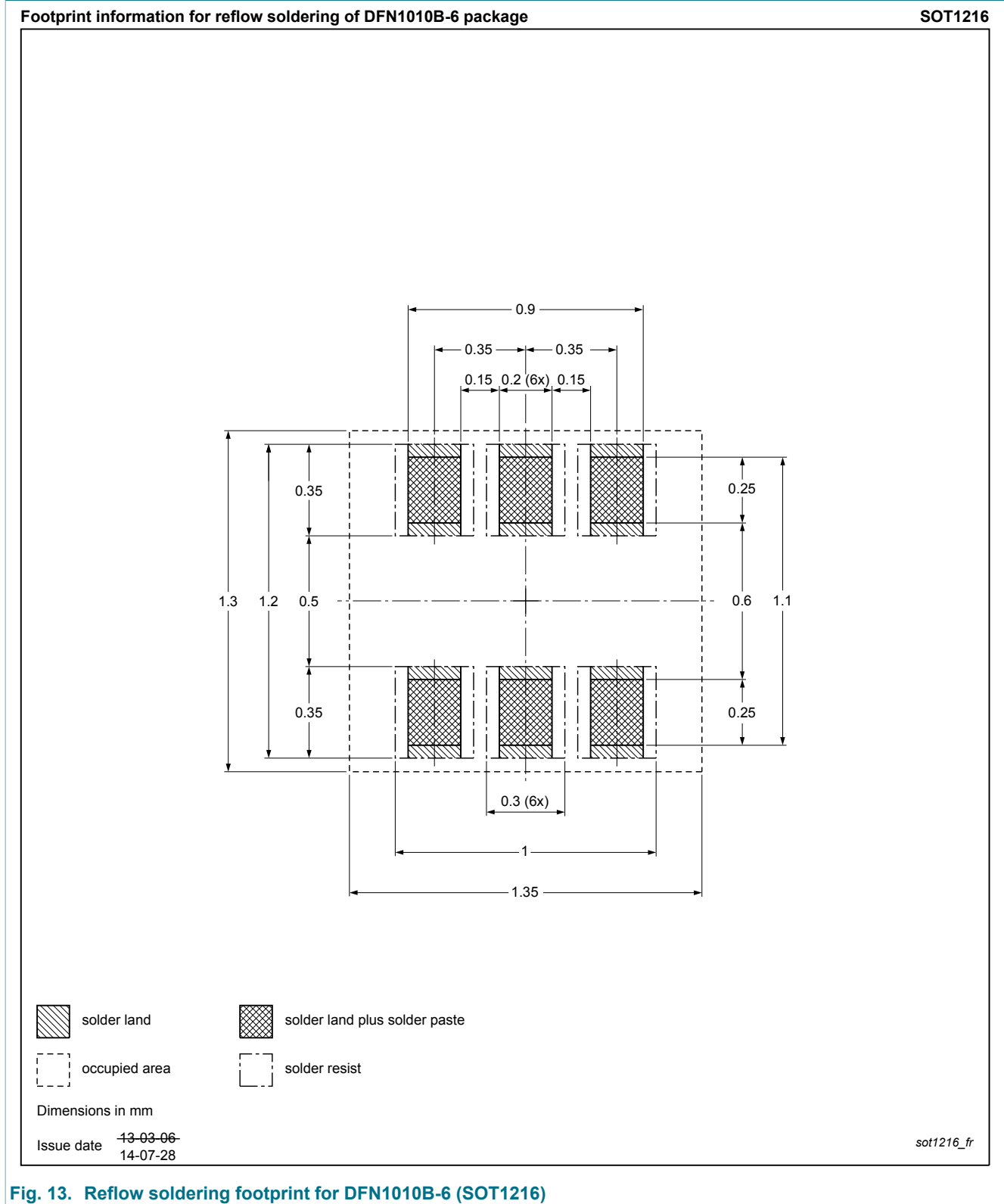


Fig. 13. Reflow soldering footprint for DFN1010B-6 (SOT1216)

14. Revision history

Table 9. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PQMH9 v.1 | 20151104 | Product data sheet | - | - |

15. Legal information

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| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
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| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
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