



PUMH10-Q

NPN/NPN resistor-equipped double transistor;

R1 = 2.2 k Ω , R2 = 47 k Ω

25 October 2021

Product data sheet

1. General description

NPN/NPN Resistor-Equipped Transistor (RET) in a very small SOT363 (SC-88) Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- Low current peripheral driver
- Control of IC inputs
- Replaces general-purpose transistors in digital applications

4. Quick reference data

Table 1. Quick reference data

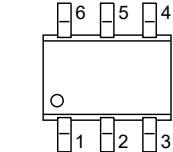
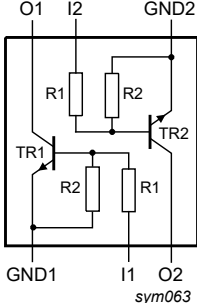
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|-----------------------|---------------------------|------------|-----|------|-----|------|------------|
| Per transistor | | | | | | | |
| V _{CEO} | collector-emitter voltage | open base | - | - | 50 | V | |
| I _O | output current | | - | - | 100 | mA | |
| R1 | bias resistor 1 (input) | | [1] | 1.54 | 2.2 | 2.86 | k Ω |
| R2/R1 | bias resistor ratio | | [1] | 17 | 21 | 26 | |

[1] See "Section 11: Test information" for resistor calculation and test conditions.

NPN/NPN resistor-equipped double transistor; 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>TSSOP6 (SOT363)</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 | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|---|---------|
| | Name | Description | Version |
| PUMH10-Q | TSSOP6 | plastic, surface-mounted package; 6 leads; 0.65 mm pitch; 2.1 mm x 1.25 mm x 0.95 mm body | SOT363 |

7. Marking

Table 4. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PUMH10-Q | H%0 |

[1] % = placeholder for manufacturing site code

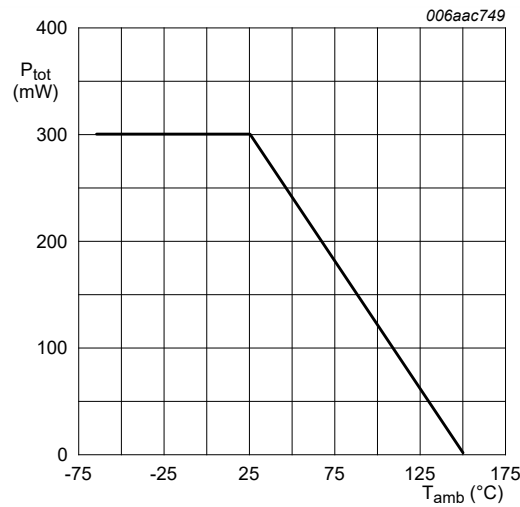
8. Limiting values

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 | | - | 5 | V |
| V_I | input voltage | positive | | - | 12 | V |
| | | negative | | - | -5 | V |
| I_O | output current | | | - | 100 | mA |
| P_{tot} | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | [1] | - | 200 | mW |
| Per device | | | | | | |
| P_{tot} | total power dissipation | $T_{amb} = 25\text{ °C}$ | [1] | - | 300 | mW |
| T_j | junction temperature | | | - | 150 | °C |
| T_{amb} | ambient temperature | | | -65 | 150 | °C |
| T_{stg} | storage temperature | | | -65 | 150 | °C |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 μm copper, tin-plated and standard footprint.



FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint

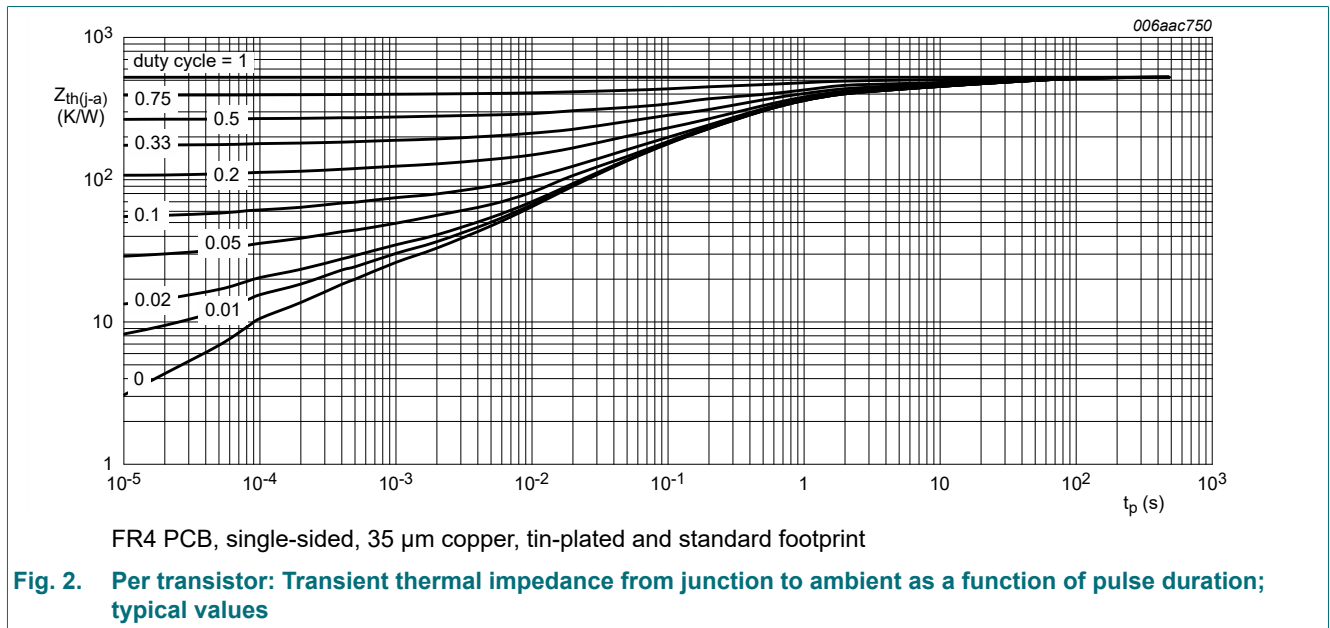
Fig. 1. Per device: Power derating curve

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] | - | - | 625 | K/W |
| Per device | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 417 | K/W |

[1] Device mounted on an FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint.



10. Characteristics

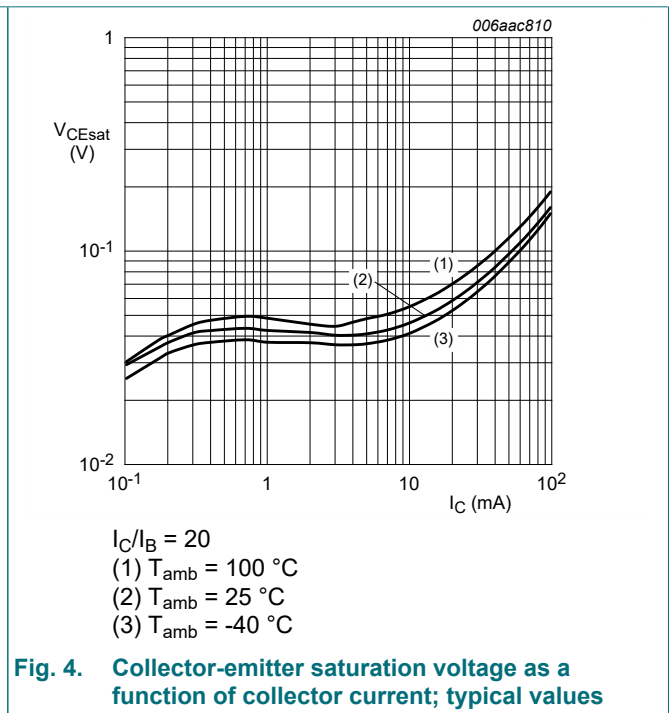
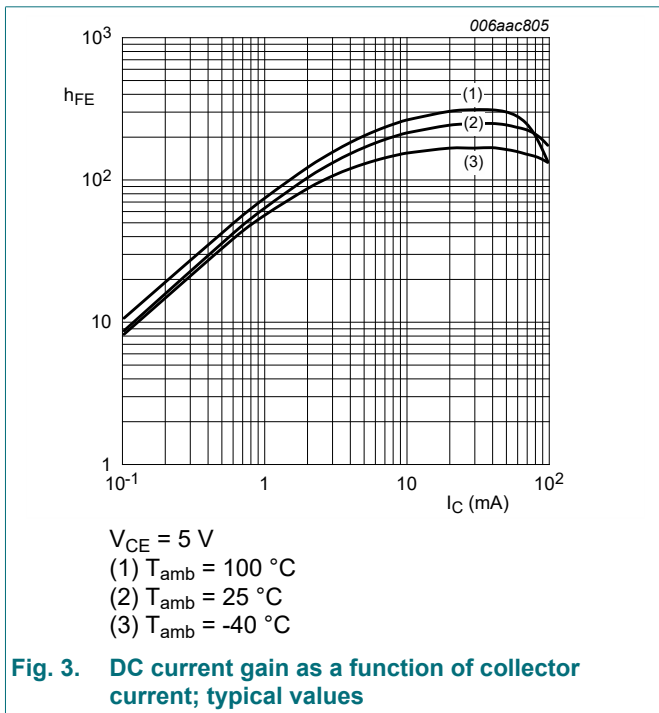
Table 7. Characteristics

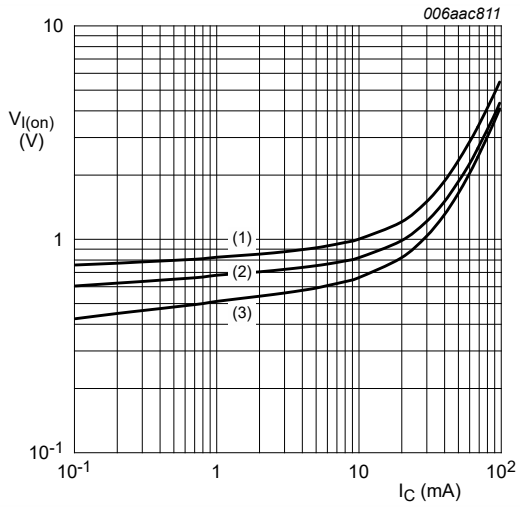
$T_{amb} = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|--------------------------------------|---|-----|------|------|---------------|
| Per transistor | | | | | | |
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C = 100\text{ }\mu\text{A}$; $I_E = 0\text{ A}$; $T_{amb} = 25\text{ °C}$ | 50 | - | - | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C = 2\text{ mA}$; $I_B = 0\text{ A}$; $T_{amb} = 25\text{ °C}$ | 50 | - | - | V |
| I_{CBO} | collector-base cut-off current | $V_{CB} = 50\text{ V}$; $I_E = 0\text{ A}$ | - | - | 100 | nA |
| I_{CEO} | collector-emitter cut-off current | $V_{CE} = 30\text{ V}$; $I_B = 0\text{ A}$ | - | - | 100 | nA |
| | | $V_{CE} = 30\text{ V}$; $I_B = 0\text{ A}$; $T_J = 150\text{ °C}$ | - | - | 5 | μA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5\text{ V}$; $I_C = 0\text{ A}$ | - | - | 180 | μA |
| h_{FE} | DC current gain | $V_{CE} = 5\text{ V}$; $I_C = 10\text{ mA}$ | 100 | - | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 5\text{ mA}$; $I_B = 0.25\text{ mA}$ | - | - | 100 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE} = 5\text{ V}$; $I_C = 100\text{ }\mu\text{A}$ | - | 0.6 | 0.5 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE} = 0.3\text{ V}$; $I_C = 5\text{ mA}$ | 1.1 | 0.75 | - | V |
| R1 | bias resistor 1 (input) | | [1] | 2.2 | 2.86 | kΩ |
| R2/R1 | bias resistor ratio | | [1] | 21 | 26 | |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}$; $I_E = 0\text{ A}$; $i_e = 0\text{ A}$; $f = 1\text{ MHz}$ | - | - | 2.5 | pF |
| f_T | transition frequency | $V_{CE} = 5\text{ V}$; $I_C = 10\text{ mA}$; $f = 100\text{ MHz}$ | [2] | 230 | - | MHz |

[1] See "Section 11: Test information" for resistor calculation and test conditions.

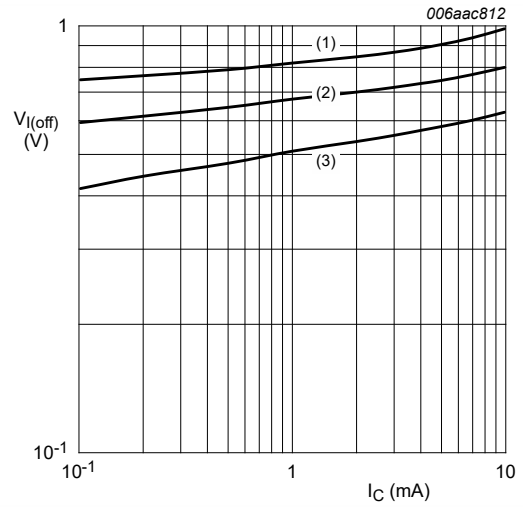
[2] Characteristics of built-in transistor





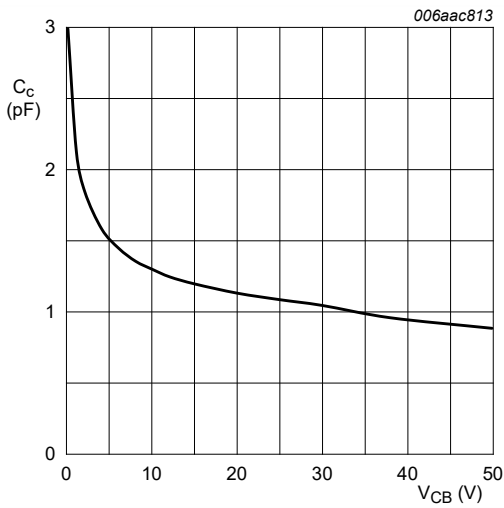
$V_{CE} = 0.3 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig. 5. On-state input voltage as a function of collector current; typical values



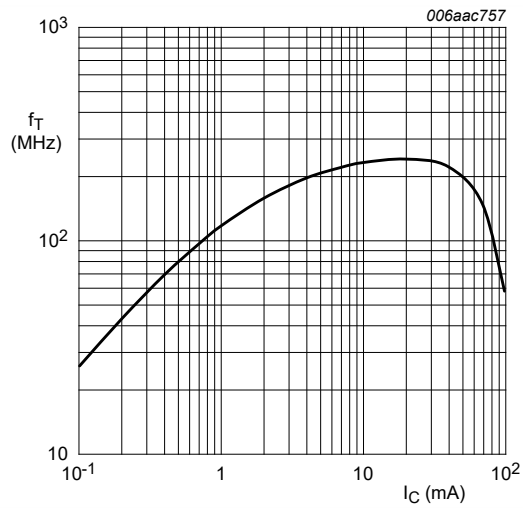
$V_{CE} = 5 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig. 6. Off-state input voltage as a function of collector current; typical values



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

Fig. 7. Collector capacitance as a function of collector-base voltage; typical values



$f = 100 \text{ MHz}$
 $T_{amb} = 25 \text{ }^\circ\text{C}$
 $V_{CE} = 5 \text{ V}$

Fig. 8. Transition frequency as a function of collector current; typical values of built-in transistor

11. Test information

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.

Resistor calculation

- Calculation of bias resistor 1 (R1)

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

- Calculation of bias resistor ratio (R2/R1)

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

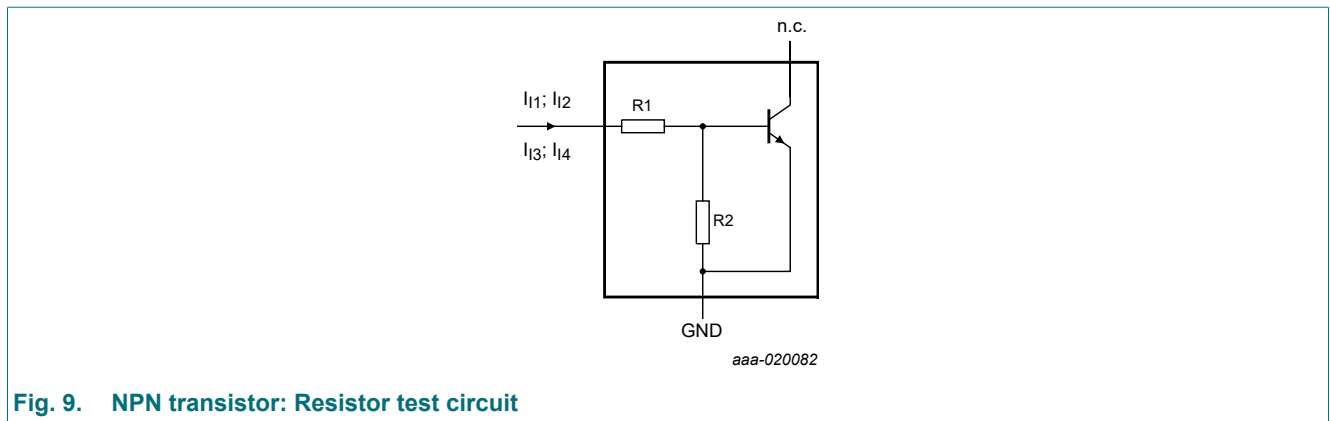


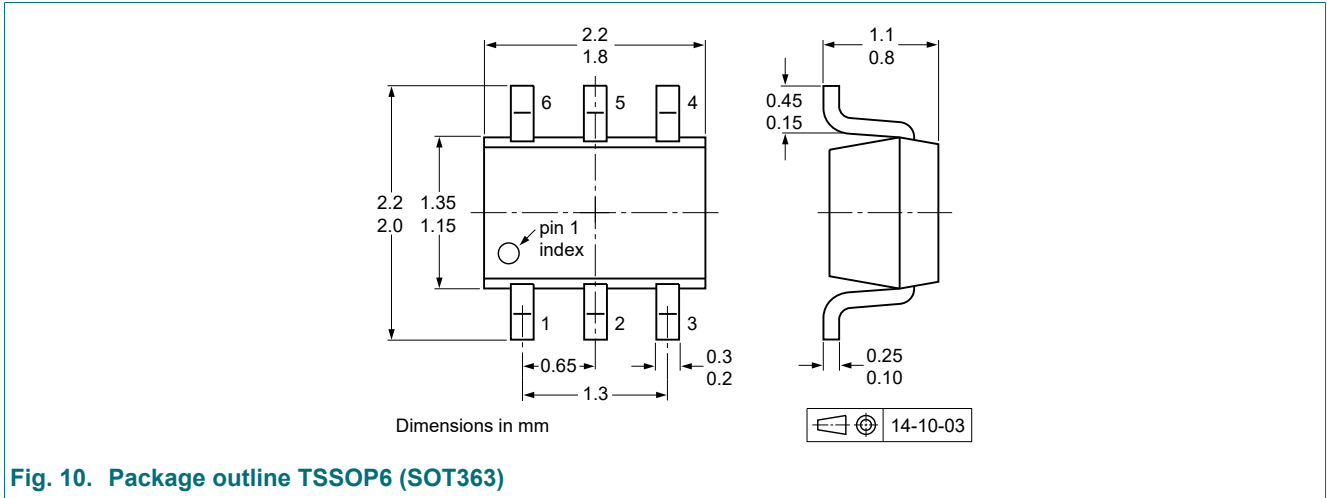
Fig. 9. NPN transistor: Resistor test circuit

Resistor test conditions

Table 8. Resistor test conditions

| Type number | Test conditions | | | |
|-------------|-----------------|--------|--------|---------|
| | I11 | I12 | I13 | I14 |
| PUMH10-Q | 90 μA | 140 μA | -55 μA | -105 μA |

12. Package outline



13. Soldering

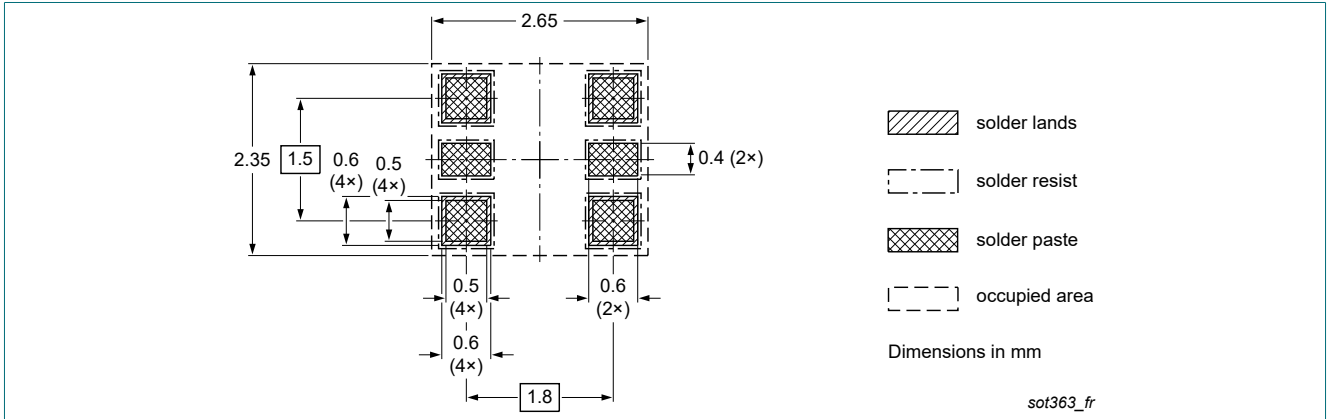


Fig. 11. Reflow soldering footprint for TSSOP6 (SOT363)

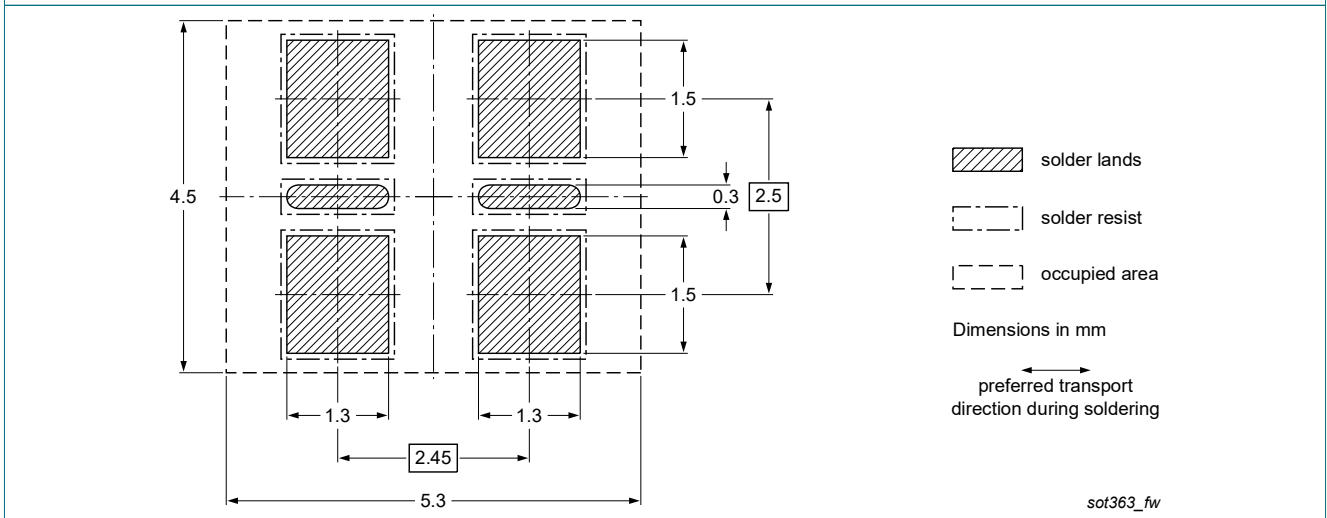


Fig. 12. Wave soldering footprint for TSSOP6 (SOT363)

14. Revision history

Table 9. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PUMH10-Q v.1 | 20211025 | Product data sheet | - | - |

15. Legal information

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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For sales office addresses, please send an email to: salesaddresses@nexperia.com
Date of release: 25 October 2021
