



PUMH2-Q

50 V, 100 mA NPN/NPN resistor-equipped transistor;
R1 = 47 k Ω , R2 = 47 k Ω

8 October 2021

Product data sheet

1. General description

NPN/NPN double 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

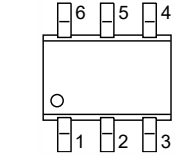
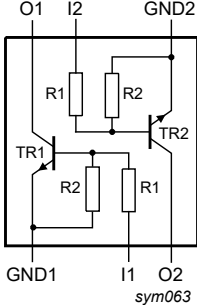
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|---------------------------|------------|-----|-----|-----|------------|
| Per transistor | | | | | | |
| V _{CEO} | collector-emitter voltage | open base | - | - | 50 | V |
| I _O | output current | | - | - | 100 | mA |
| R1 | bias resistor 1 | | [1] | 47 | 61 | k Ω |
| R2/R1 | bias resistor ratio | | [1] | 1 | 1.2 | |

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

50 V, 100 mA NPN/NPN resistor-equipped transistor; R1 = 47 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> |  <p><i>sym063</i></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 |
| PUMH2-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] |
|-------------|-----------------------------|
| PUMH2-Q | 2%H |

[1] % = placeholder for manufacturing site code

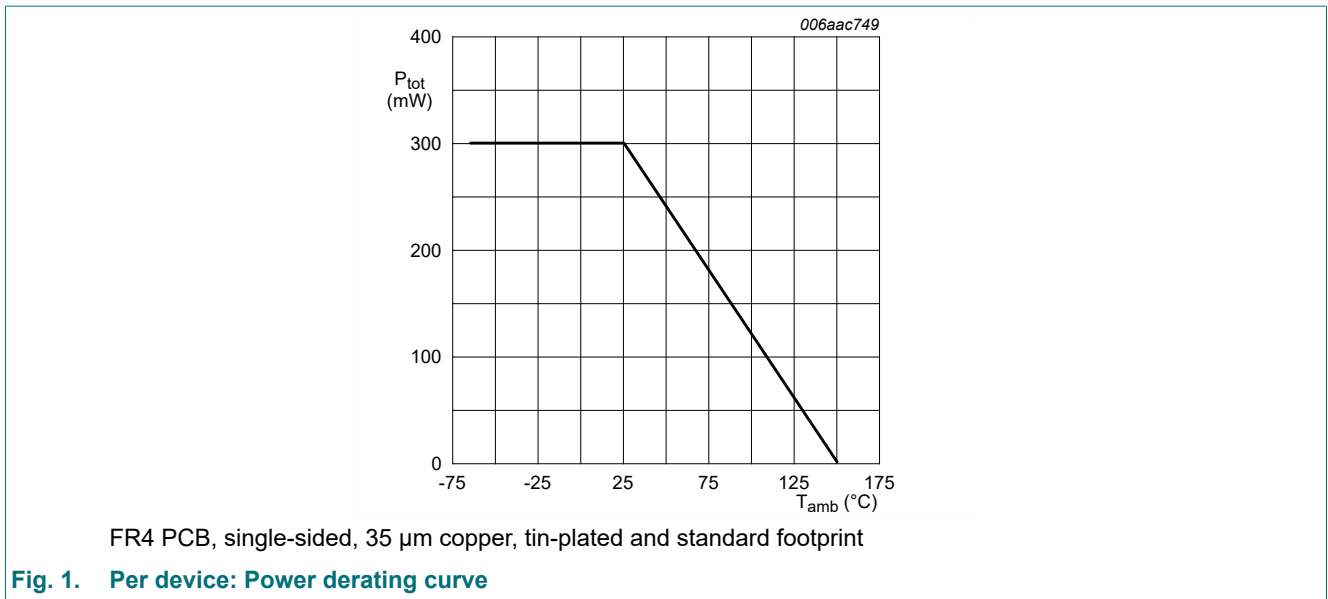
8. Limiting values

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 | | - | 10 | V |
| V _I | input voltage | positive | | - | 40 | V |
| | | negative | | - | -10 | V |
| I _O | output current | | | - | 100 | mA |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | [1] | - | 200 | mW |
| Per device | | | | | | |
| P _{tot} | total power dissipation | T _{amb} = 25 °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.

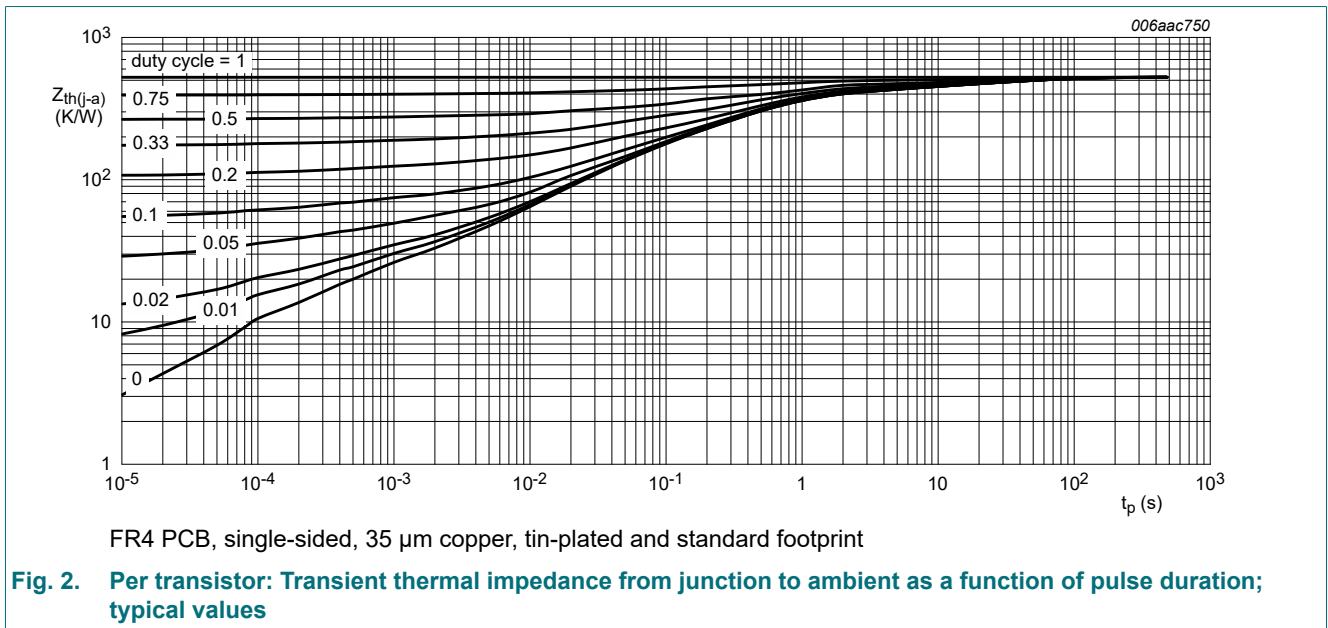


9. Thermal characteristics

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

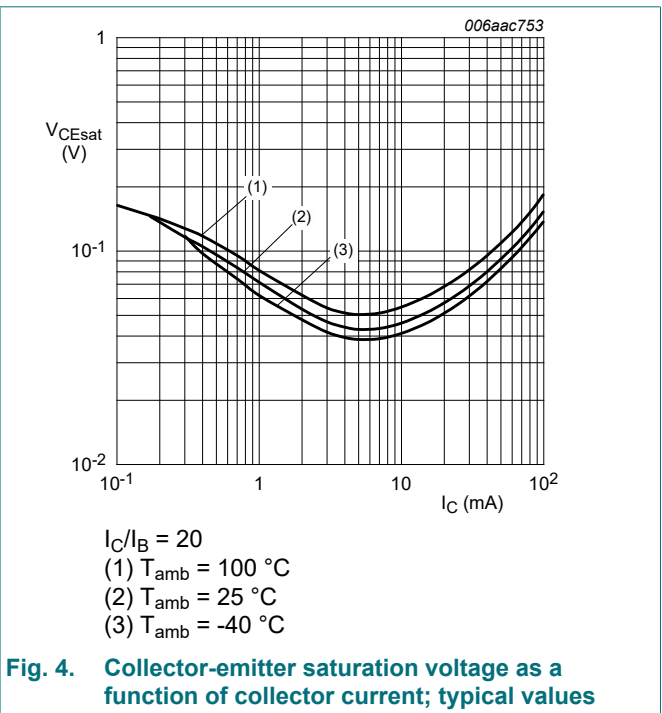
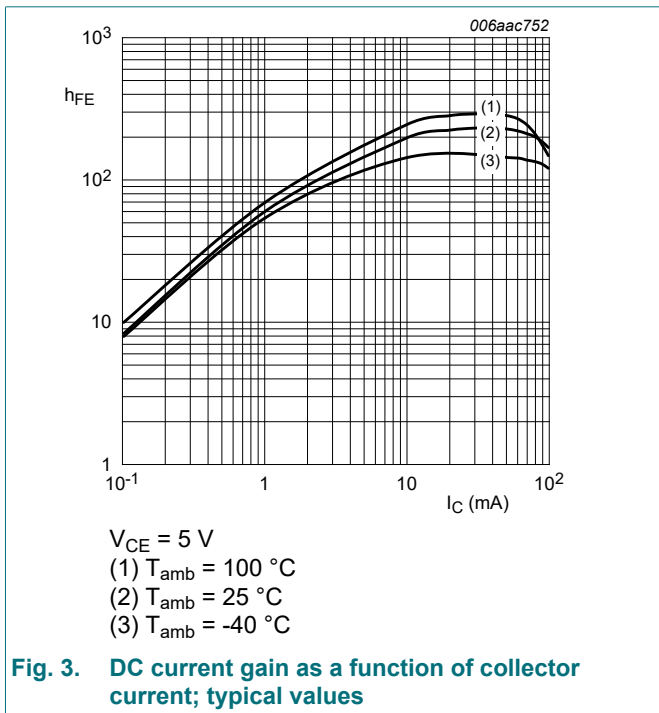
Table 7. Characteristics

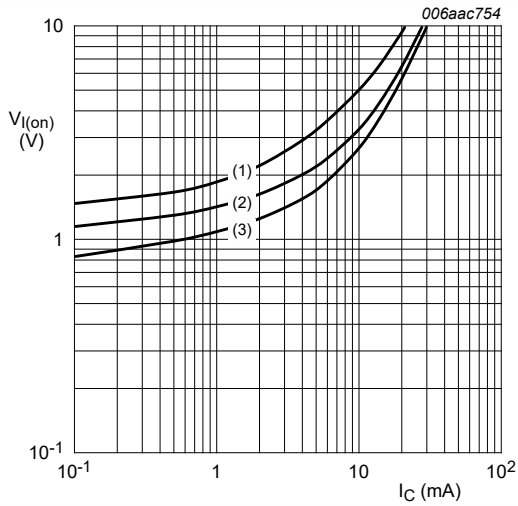
$T_{amb} = 25\text{ °C}$ unless otherwise specified.

| 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 | $V_{CE} = 30\text{ V}$; $I_B = 0\text{ A}$ | - | - | 1 | μA |
| | | $V_{CE} = 30\text{ V}$; $I_B = 0\text{ A}$; $T_J = 150\text{ °C}$ | - | - | 5 | μA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5\text{ V}$; $I_C = 0\text{ A}$ | - | - | 90 | μA |
| h_{FE} | DC current gain | $V_{CE} = 5\text{ V}$; $I_C = 5\text{ mA}$ | 80 | - | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 10\text{ mA}$; $I_B = 0.5\text{ mA}$ | - | - | 150 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE} = 5\text{ V}$; $I_C = 100\text{ }\mu\text{A}$ | - | 1.2 | 0.8 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE} = 0.3\text{ V}$; $I_C = 2\text{ mA}$ | 3 | 1.6 | - | V |
| R1 | bias resistor 1 | | [1] | 47 | 61 | kΩ |
| R2/R1 | bias resistor ratio | | [1] | 1 | 1.2 | |
| 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.

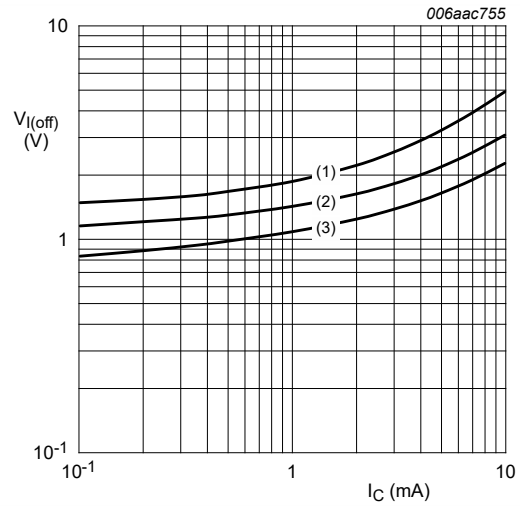
[2] Characteristics of built-in transistor





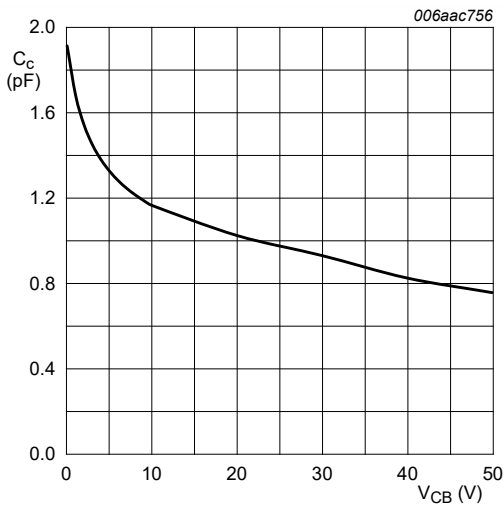
$V_{CE} = 0.3\text{ V}$
 (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



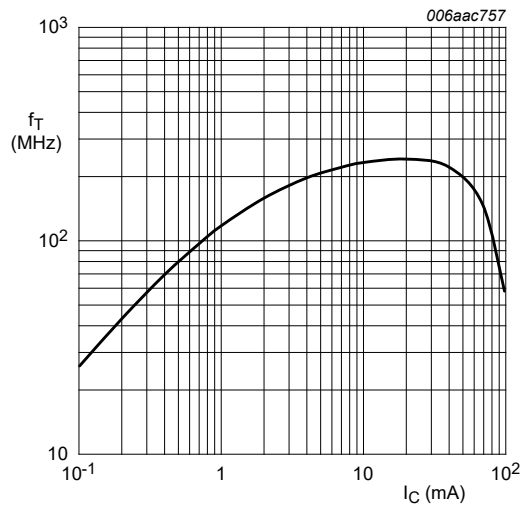
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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. NPN transistor: 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)

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

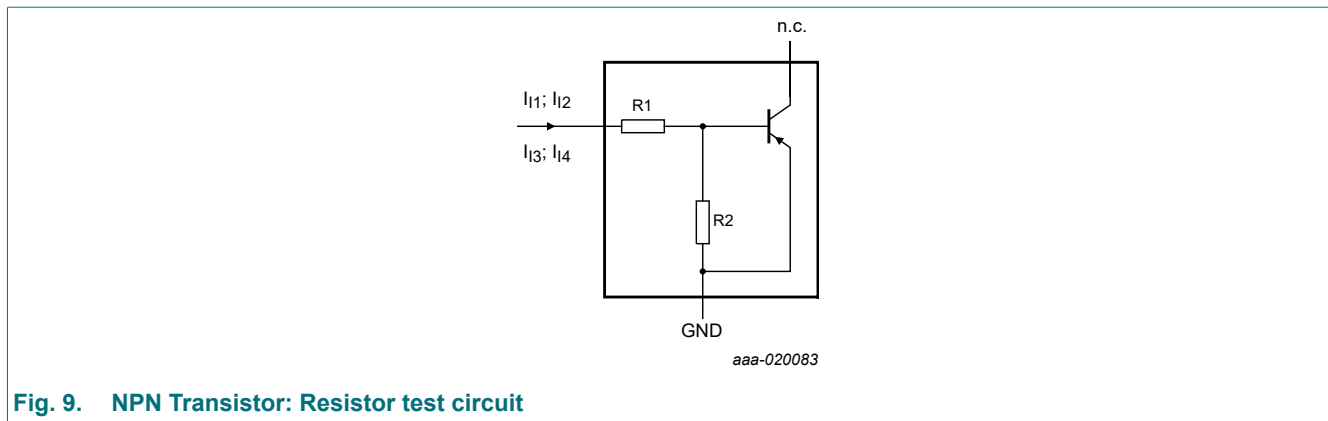


Fig. 9. NPN Transistor: Resistor test circuit

Resistor test conditions

Table 8. Resistor test conditions

| Type number | Test conditions | | | |
|-------------|-----------------|-----------------|-----------------|-----------------|
| | I ₁₁ | I ₁₂ | I ₁₃ | I ₁₄ |
| PUMH2-Q | -55 μA | -105 μA | 55 μA | 105 μA |

12. Package outline

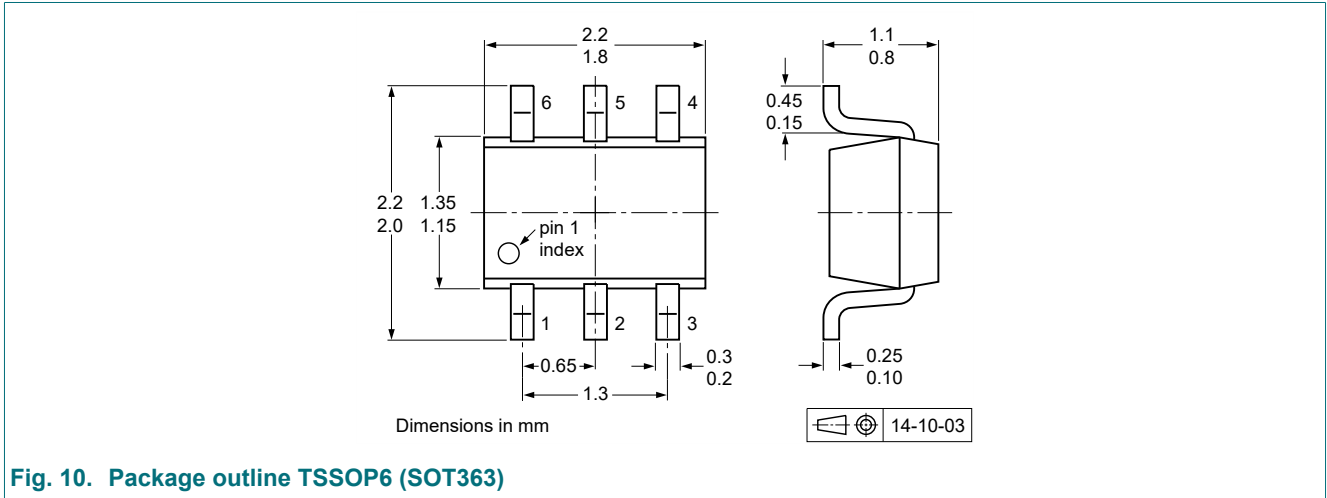


Fig. 10. Package outline TSSOP6 (SOT363)

13. Soldering

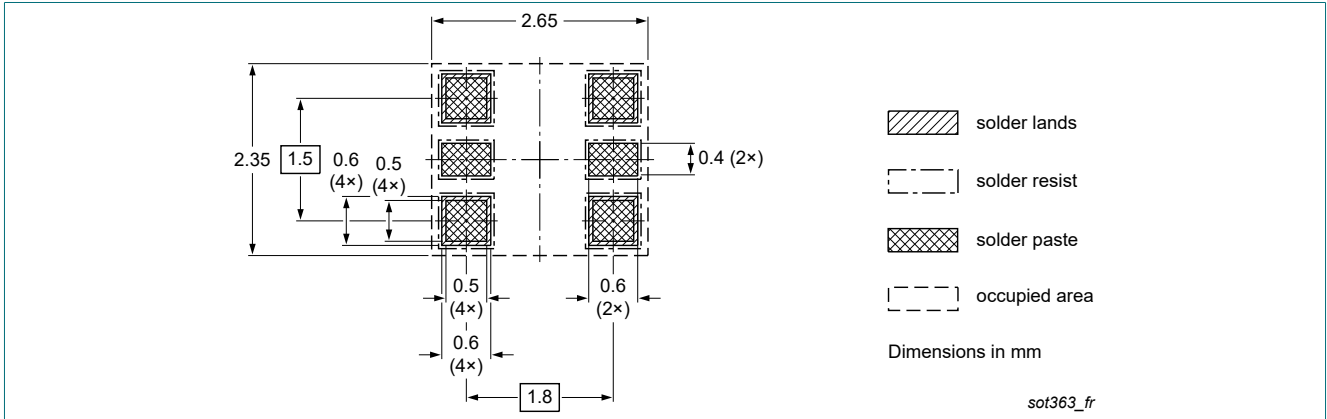


Fig. 11. Reflow soldering footprint for TSSOP6 (SOT363)

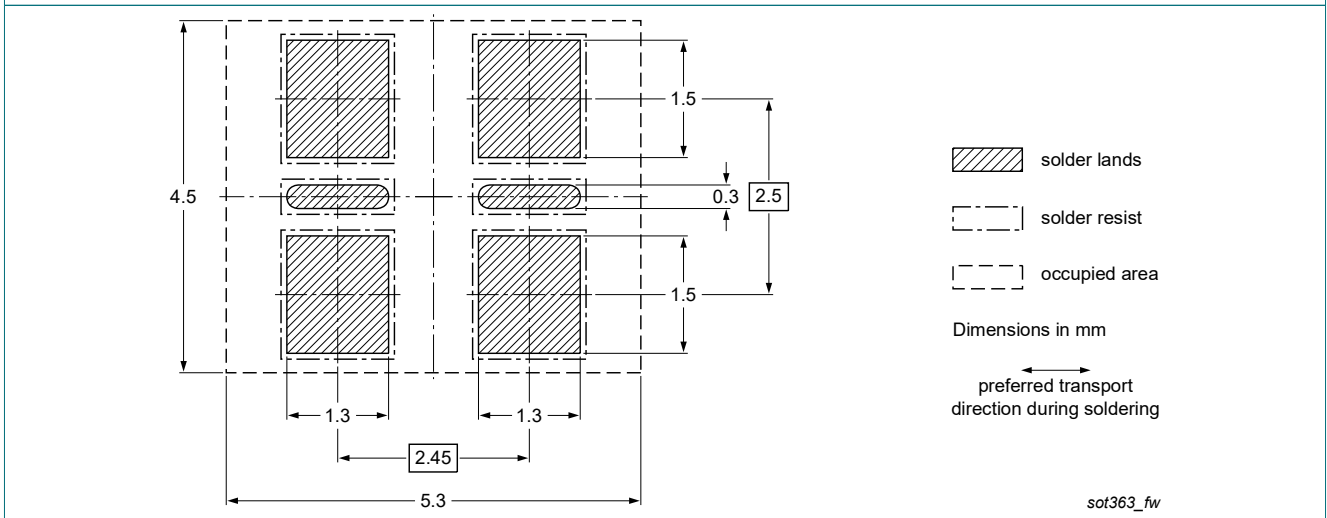


Fig. 12. Wave soldering footprint for TSSOP6 (SOT363)

50 V, 100 mA NPN/NPN resistor-equipped transistor; R1 = 47 k Ω , R2 = 47 k Ω

14. Revision history

Table 9. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PUMH2-Q v.1 | 20211008 | 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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