



# PUMH13-Q

NPN/NPN double Resistor-Equipped Transistor (RET);

R1= 4.7 k $\Omega$ , R2 = 47 k $\Omega$

15 May 2023

Product data sheet

## 1. General description

NPN/NPN double Resistor-Equipped Transistor (RET) in a SOT363 (SC-88) very small 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

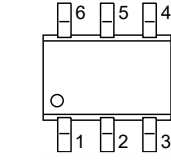
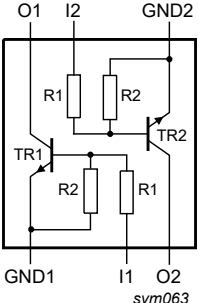
| Symbol                | Parameter                 | Conditions | Min | Typ | Max | Unit       |
|-----------------------|---------------------------|------------|-----|-----|-----|------------|
| <b>Per transistor</b> |                           |            |     |     |     |            |
| V <sub>CEO</sub>      | collector-emitter voltage | open base  | -   | -   | 50  | V          |
| I <sub>O</sub>        | output current            |            | -   | -   | 100 | mA         |
| R1                    | bias resistor 1 (input)   |            | [1] | 4.7 | 6.1 | k $\Omega$ |
| R2/R1                 | bias resistor ratio       |            | [1] | 10  | 12  |            |

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

NPN/NPN double Resistor-Equipped Transistor (RET); R1= 4.7 kΩ, R2 = 47 kΩ

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description            | Simplified outline  | Graphic symbol   |
|-----|--------|------------------------|---|--|
| 1   | GND1   | GND (emitter) TR1      |  <p><b>TSSOP6 (SOT363)</b></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                |
| <a href="#">PUMH13-Q</a> | TSSOP6  | plastic, surface-mounted package; 6 leads; 0.65 mm pitch; 2.1 mm x 1.25 mm x 0.95 mm body | <a href="#">SOT363</a> |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PUMH13-Q    | H0%                         |

[1] % = placeholder for manufacturing site code

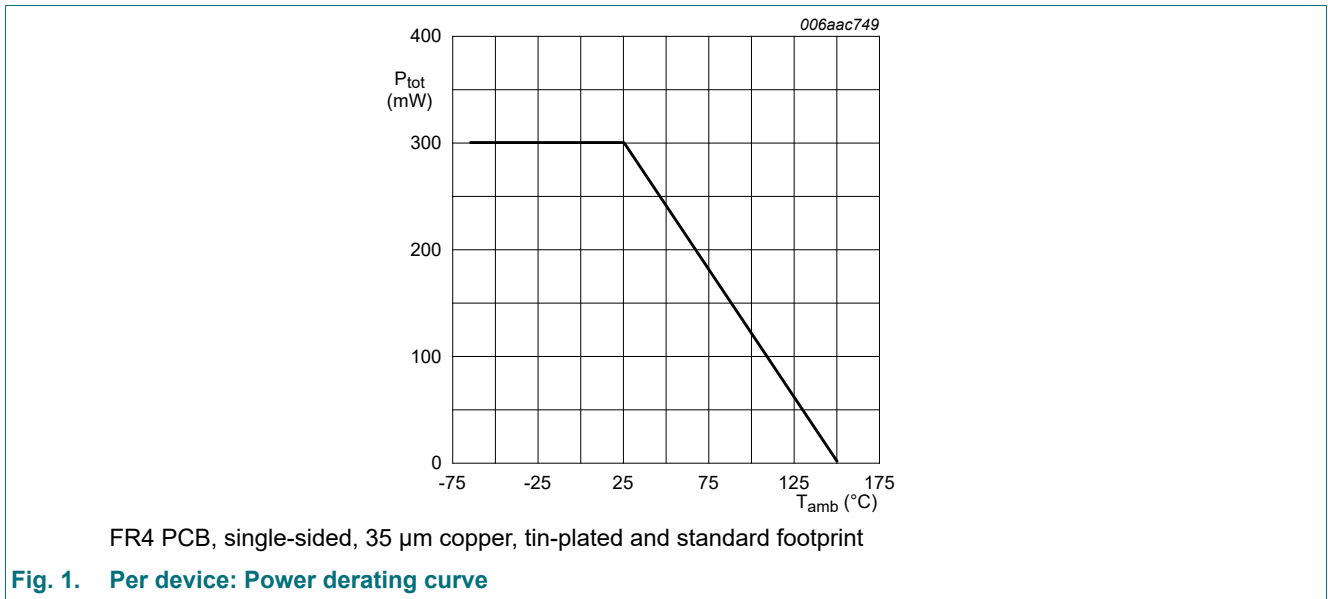
## 8. Limiting values

**Table 5. Limiting values**

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

| Symbol                | Parameter                 | Conditions               |     | Min | Max | Unit |
|-----------------------|---------------------------|--------------------------|-----|-----|-----|------|
| <b>Per transistor</b> |                           |                          |     |     |     |      |
| 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             |                          |     | -5  | 30  | V    |
| I <sub>O</sub>        | output current            |                          |     | -   | 100 | mA   |
| P <sub>tot</sub>      | total power dissipation   | T <sub>amb</sub> ≤ 25 °C | [1] | -   | 200 | mW   |
| <b>Per device</b>     |                           |                          |     |     |     |      |
| P <sub>tot</sub>      | total power dissipation   | T <sub>amb</sub> ≤ 25 °C | [1] | -   | 300 | mW   |
| T <sub>j</sub>        | junction temperature      |                          |     | -   | 150 | °C   |
| T <sub>amb</sub>      | ambient temperature       |                          |     | -65 | 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.

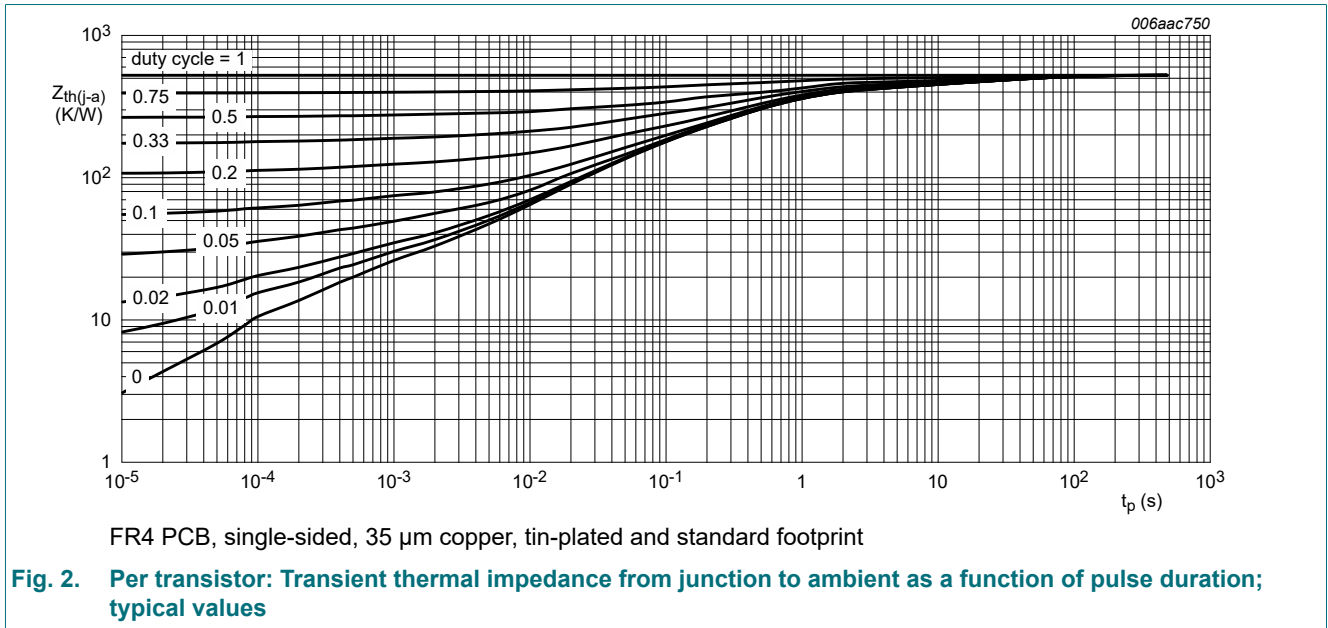


### 9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol                | Parameter                                   | Conditions  |     | Min | Typ | Max | Unit |
|-----------------------|---|-------------|-----|-----|-----|-----|------|
| <b>Per transistor</b> |   |             |     |     |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient | in free air | [1] | -   | -   | 625 | K/W  |
| <b>Per device</b>     |   |             |     |     |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient | in free air | [1] | -   | -   | 417 | K/W  |

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

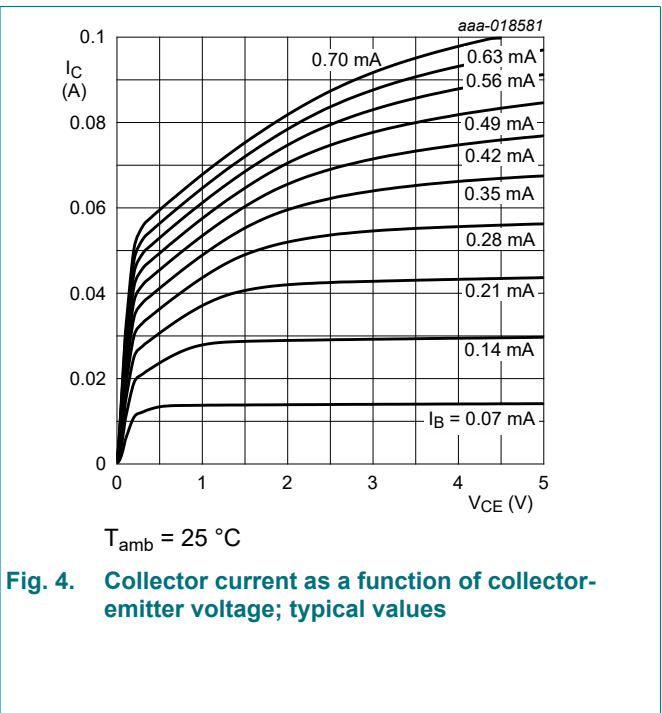
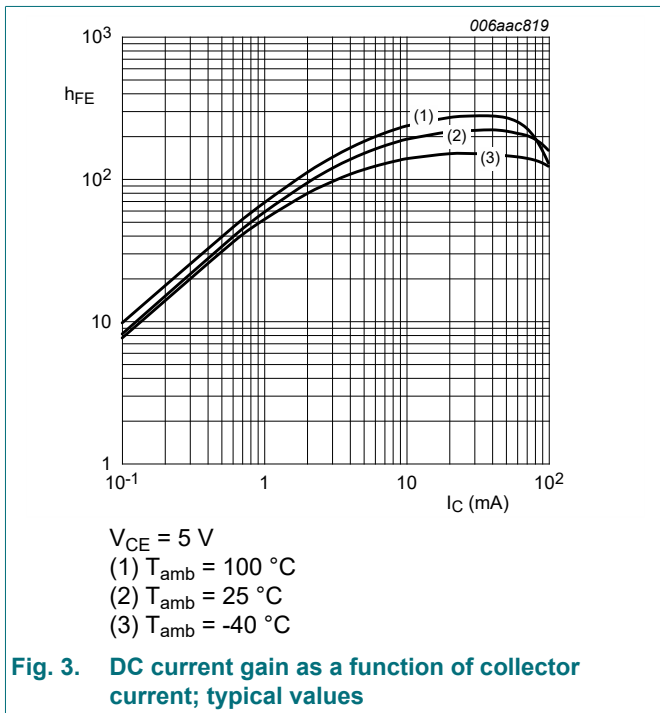


### 10. Characteristics

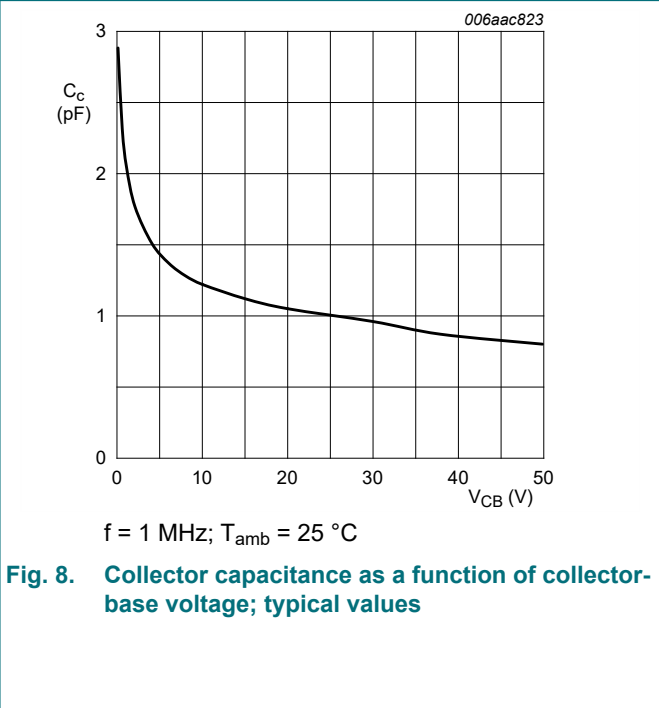
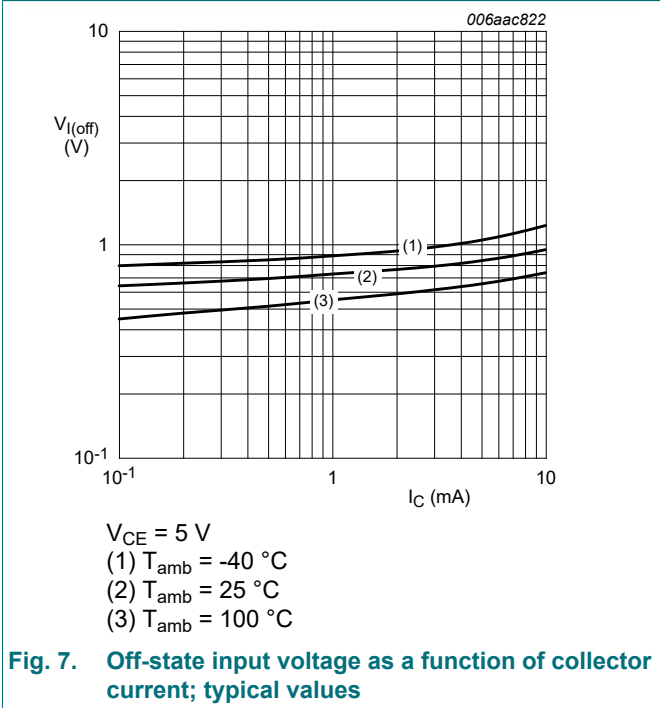
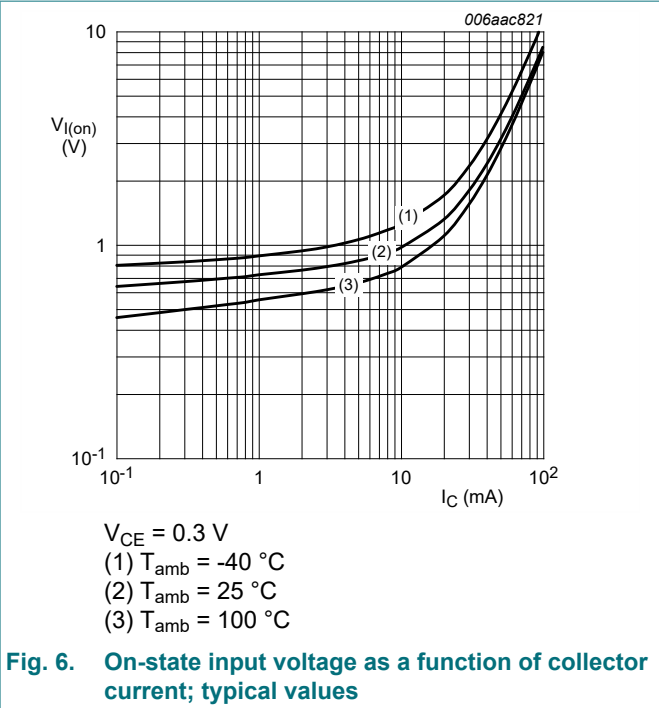
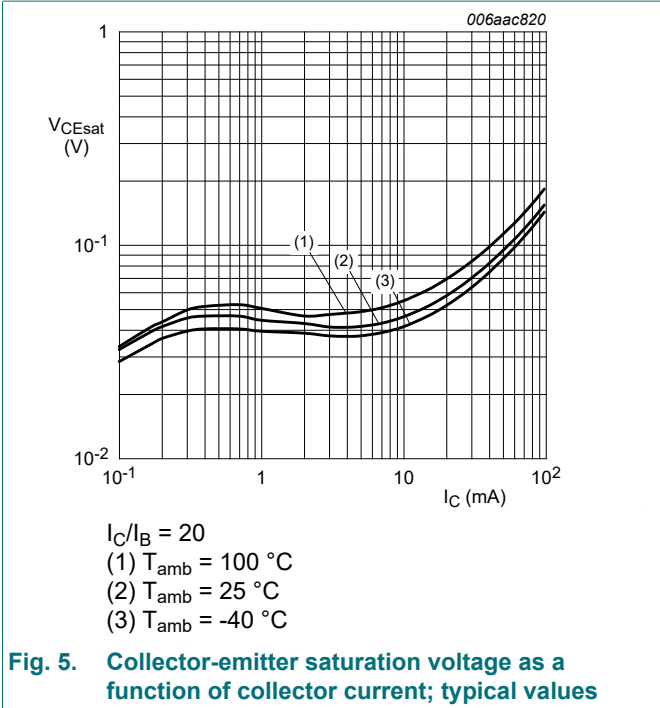
Table 7. Characteristics

| Symbol                | Parameter                            | Conditions  | Min | Typ | Max | Unit    |    |
|-----------------------|--------------------------------------|---|-----|-----|-----|---------|----|
| <b>Per transistor</b> |                                      |   |     |     |     |         |    |
| $V_{(BR)CBO}$         | collector-base breakdown voltage     | $I_C = 100 \mu A; I_E = 0 A; T_{amb} = 25 \text{ }^\circ C$                                     | 50  | -   | -   | V       |    |
| $V_{(BR)CEO}$         | collector-emitter breakdown voltage  | $I_C = 2 \text{ mA}; I_B = 0 A; T_{amb} = 25 \text{ }^\circ C$                                  | 50  | -   | -   | V       |    |
| $I_{CBO}$             | collector-base cut-off current       | $V_{CB} = 50 \text{ V}; I_E = 0 A; T_{amb} = 25 \text{ }^\circ C$                               | -   | -   | 100 | nA      |    |
| $I_{CEO}$             | collector-emitter cut-off current    | $V_{CE} = 30 \text{ V}; I_B = 0 A; T_{amb} = 25 \text{ }^\circ C$                               | -   | -   | 100 | nA      |    |
|                       |                                      | $V_{CE} = 30 \text{ V}; I_B = 0 A; T_j = 150 \text{ }^\circ C$                                  | -   | -   | 5   | $\mu A$ |    |
| $I_{EBO}$             | emitter-base cut-off current         | $V_{EB} = 5 \text{ V}; I_C = 0 A; T_{amb} = 25 \text{ }^\circ C$                                | -   | -   | 170 | $\mu A$ |    |
| $h_{FE}$              | DC current gain                      | $V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$                      | 100 | -   | -   |         |    |
| $V_{CEsat}$           | collector-emitter saturation voltage | $I_C = 5 \text{ mA}; I_B = 0.25 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$                      | -   | -   | 100 | mV      |    |
| $V_{I(off)}$          | off-state input voltage              | $V_{CE} = 5 \text{ V}; I_C = 100 \mu A; T_{amb} = 25 \text{ }^\circ C$                          | -   | 0.6 | 0.5 | V       |    |
| $V_{I(on)}$           | on-state input voltage               | $V_{CE} = 0.3 \text{ V}; I_C = 5 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$                     | 1.3 | 0.9 | -   | V       |    |
| R1                    | bias resistor 1 (input)              |   | [1] | 3.3 | 4.7 | 6.1     | kΩ |
| R2/R1                 | bias resistor ratio                  |   | [1] | 8   | 10  | 12      |    |
| $C_c$                 | collector capacitance                | $V_{CB} = 10 \text{ V}; I_E = 0 A; i_e = 0 A; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ C$ | -   | -   | 2.5 | pF      |    |
| $f_T$                 | transition frequency                 | $V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ C$ | [2] | 230 | -   | MHz     |    |

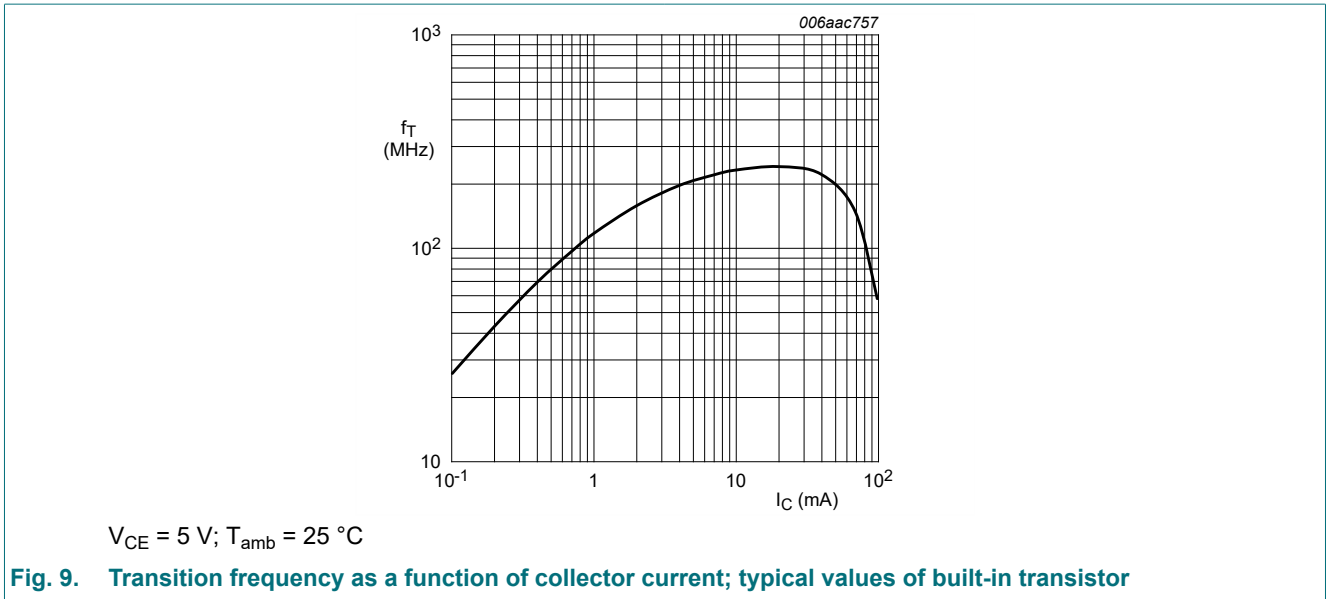
[1] See section "Test information" for resistor calculation and test conditions.  
 [2] Characteristics of built-in transistor



NPN/NPN double Resistor-Equipped Transistor (RET); R1= 4.7 kΩ, R2 = 47 kΩ



NPN/NPN double Resistor-Equipped Transistor (RET); R1= 4.7 kΩ, R2 = 47 kΩ



## 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)

$$R_1 = \frac{V(I_2) - V(I_1)}{I_2 - I_1}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R_2}{R_1} = \frac{V(I_4) - V(I_3)}{R_1 \cdot (I_4 - I_3)} - 1$$

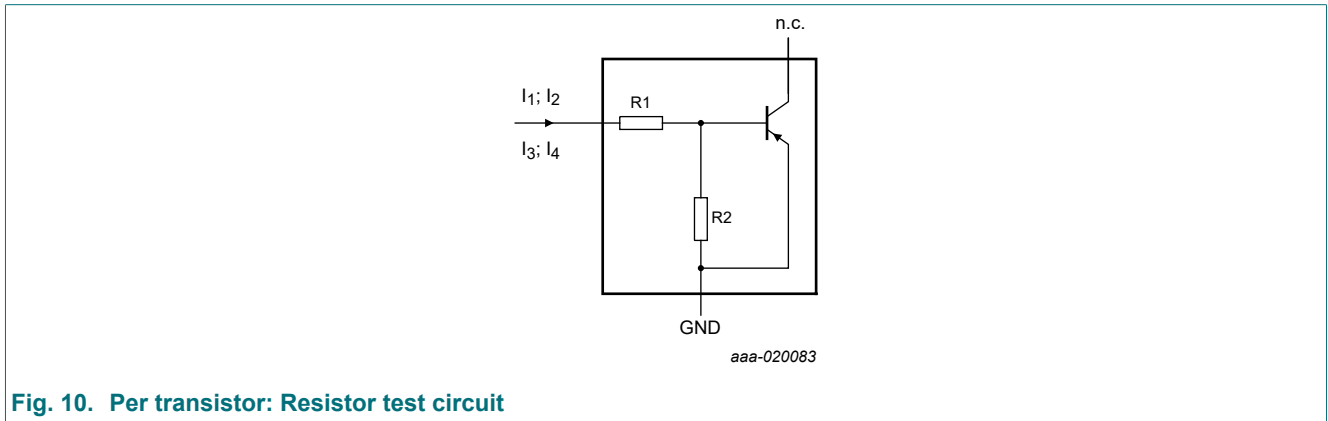


Fig. 10. Per transistor: Resistor test circuit

### Resistor test conditions

Table 8. Resistor test conditions

| Type number | R1 (kΩ) | R2 (kΩ) | Test conditions |                |                |                |
|-------------|---------|---------|-----------------|----------------|----------------|----------------|
|             |         |         | I <sub>1</sub>  | I <sub>2</sub> | I <sub>3</sub> | I <sub>4</sub> |
| PUMH13-Q    | 4.7     | 47      | 90 μA           | 140 μA         | -55 μA         | -105 μA        |



### 12. Package outline

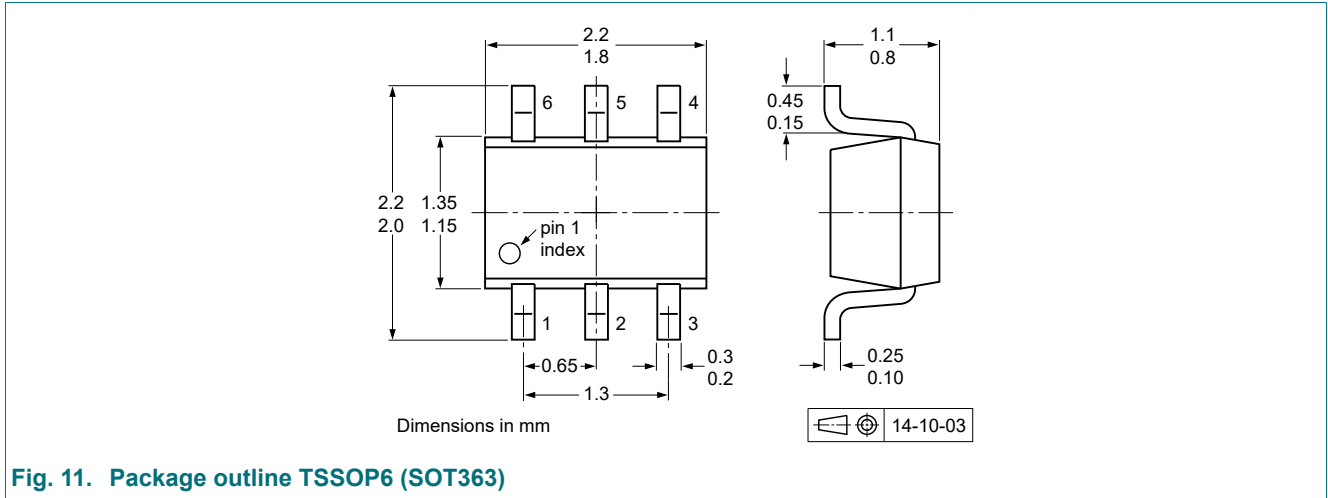


Fig. 11. Package outline TSSOP6 (SOT363)

### 13. Soldering

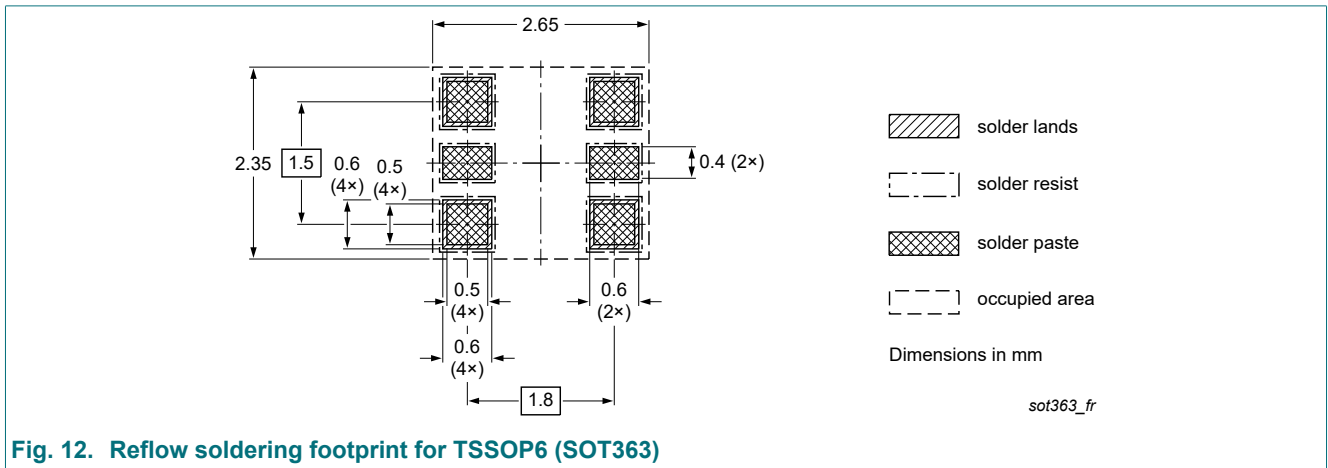


Fig. 12. Reflow soldering footprint for TSSOP6 (SOT363)

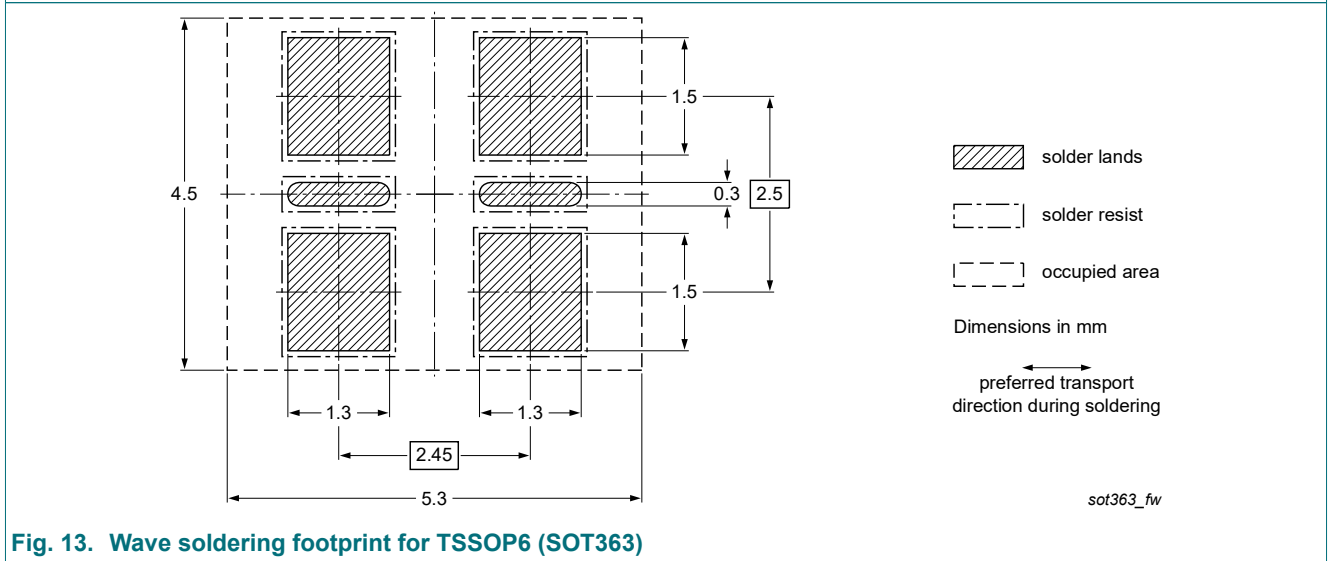


Fig. 13. Wave soldering footprint for TSSOP6 (SOT363)

## 14. Revision history

**Table 9. Revision history**

| Data sheet ID  | Release date  | Data sheet status  | Change notice | Supersedes   |
|----------------|---|--------------------|---------------|--------------|
| PUMH13-Q v.2   | 20230515  | Product data sheet | -             | PUMH13-Q v.1 |
| Modifications: | • Characteristics: I <sub>CEO</sub> value corrected |                    |               |              |
| PUMH13-Q v.1   | 20220128  | 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.                                     |

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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