



PDTC123YT-Q

NPN resistor-equipped transistor; $R1 = 2.2 \text{ k}\Omega$, $R2 = 10 \text{ k}\Omega$

17 April 2023

Product data sheet

1. General description

NPN Resistor-Equipped Transistor (RET) in a small SOT23 Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- 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

- General-purpose switching and amplification
- Inverter and interface circuits
- Circuit drivers

4. Quick reference data

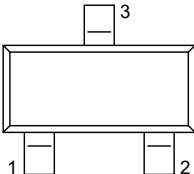
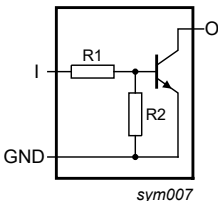
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------------------|------------|------|-----|------|------------------|
| 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 | $\text{k}\Omega$ |
| R2/R1 | bias resistor ratio | [1] | 3.6 | 4.5 | 5.5 | |

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

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|--------------------|--|---|
| 1 | I | input (base) |  SOT23 |  sym007 |
| 2 | GND | ground (emitter) | | |
| 3 | O | output (collector) | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-----------------------------|---------|--|-----------------------|
| | Name | Description | Version |
| PDTC123YT-Q | SOT23 | plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body | SOT23 |

7. Marking

Table 4. Marking codes

| Type number | Marking code[1] |
|-------------|-----------------|
| PDTC123YT-Q | %AL |

[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 |
|------------------|---------------------------|-------------------------------------|---------------------|-----|-----|------|
| 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 |
| I _{CM} | peak collector current | t _p ≤ 1 ms; single pulse | | - | 100 | mA |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | [1] | - | 250 | 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.

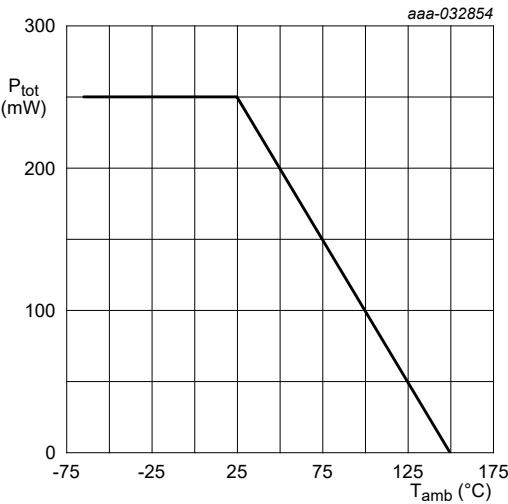


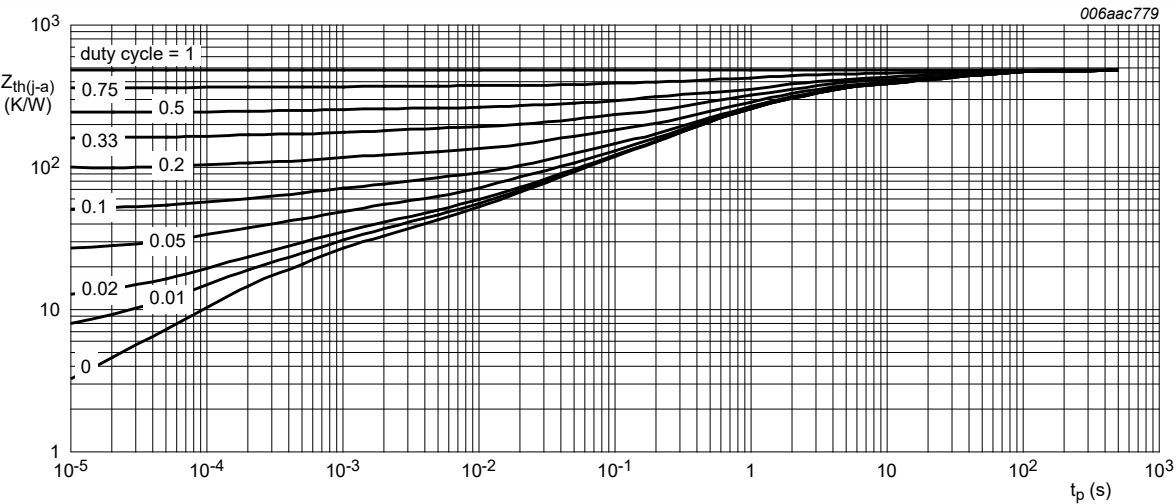
Fig. 1. Power derating curve

9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---------------|---|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 500 | K/W |

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



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

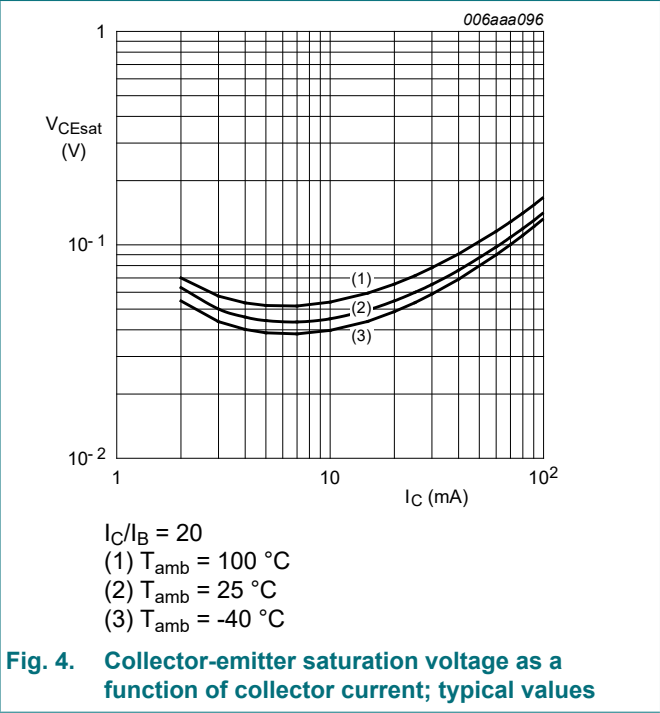
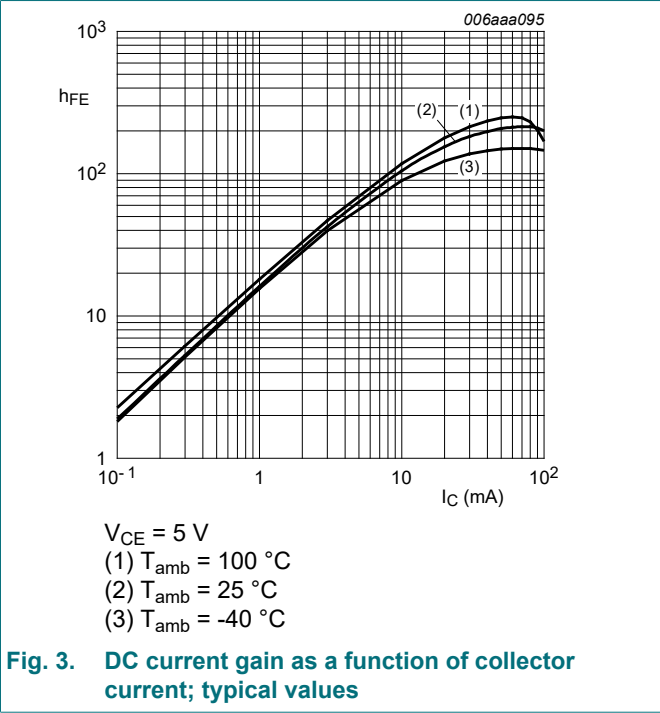
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

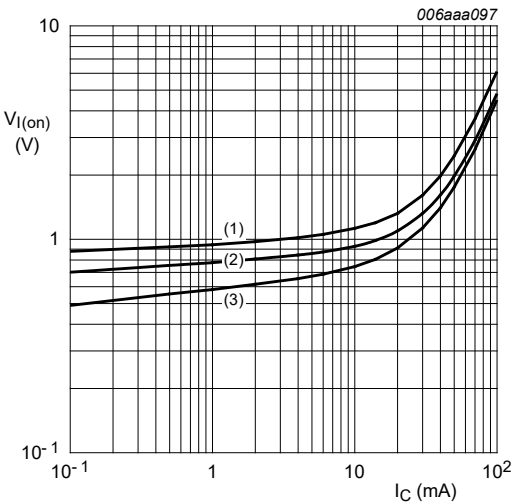
10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|--------------------------------------|--|------|------|------|---------------|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C = 100\text{ }\mu\text{A}$; $I_E = 0\text{ A}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | 50 | - | - | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C = 2\text{ mA}$; $I_B = 0\text{ A}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | 50 | - | - | V |
| I_{CBO} | collector-base cut-off current | $V_{CB} = 50\text{ V}$; $I_E = 0\text{ A}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | - | - | 100 | nA |
| I_{CEO} | collector-emitter cut-off current | $V_{CE} = 30\text{ V}$; $I_B = 0\text{ A}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | - | - | 100 | nA |
| | | $V_{CE} = 30\text{ V}$; $I_B = 0\text{ A}$; $T_j = 150\text{ }^\circ\text{C}$ | - | - | 5 | μA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5\text{ V}$; $I_C = 0\text{ A}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | - | - | 700 | μA |
| h_{FE} | DC current gain | $V_{CE} = 5\text{ V}$; $I_C = 5\text{ mA}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | 35 | - | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 10\text{ mA}$; $I_B = 0.5\text{ mA}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | - | - | 150 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE} = 5\text{ V}$; $I_C = 100\text{ }\mu\text{A}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | - | 0.75 | 0.3 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE} = 300\text{ mV}$; $I_C = 20\text{ mA}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | 2.5 | 1.15 | - | V |
| R1 | bias resistor 1 (input) | [1] | 1.54 | 2.2 | 2.86 | kΩ |
| R2/R1 | bias resistor ratio | [1] | 3.6 | 4.5 | 5.5 | |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}$; $I_E = 0\text{ A}$; $i_e = 0\text{ A}$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ }^\circ\text{C}$ | - | - | 2 | pF |

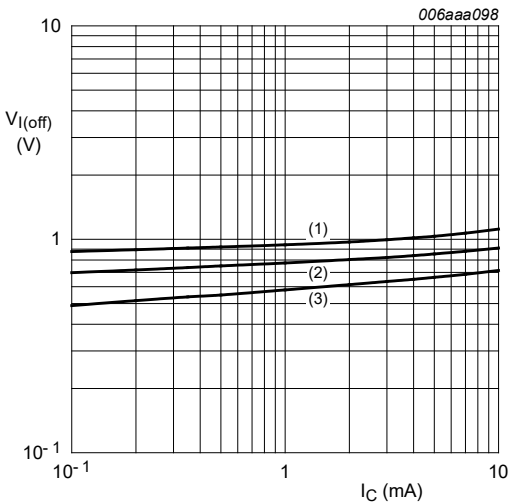
[1] See "Section 11: Test information" for resistor calculation and test conditions.





$V_{CE} = 0.3\text{ V}$
(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

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)

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

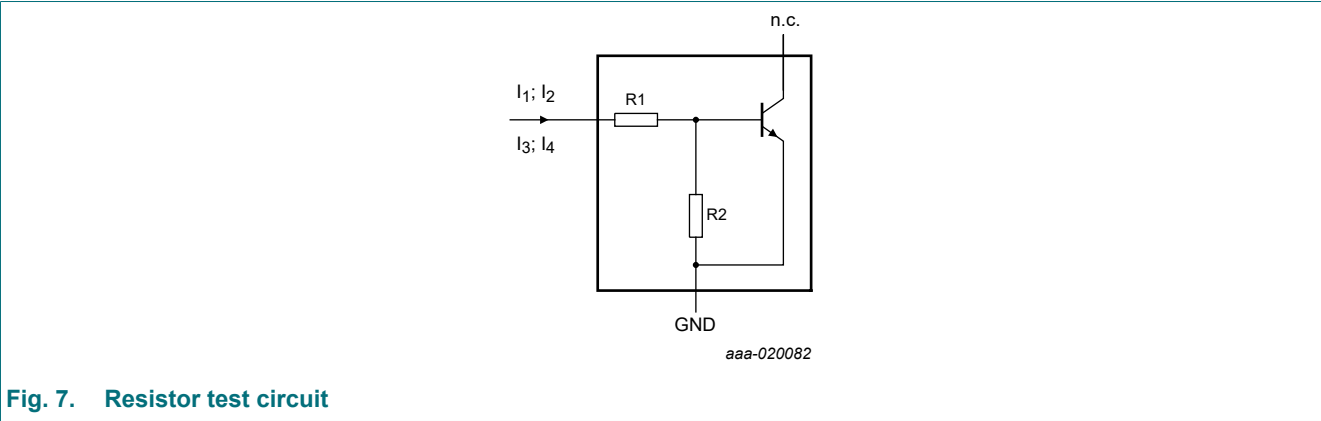


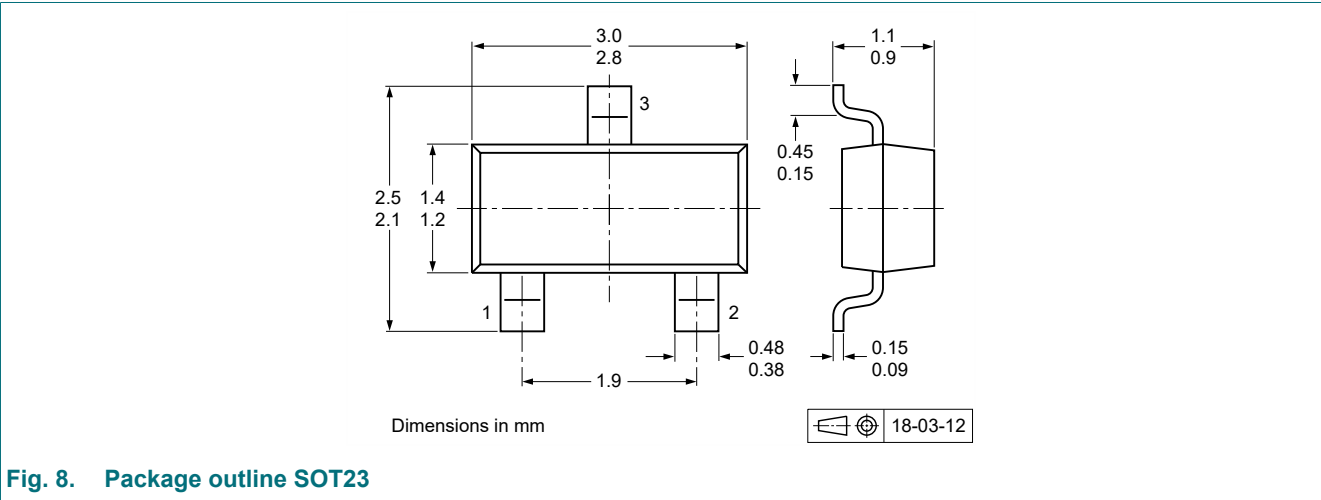
Fig. 7. Resistor test circuit

Resistor test conditions

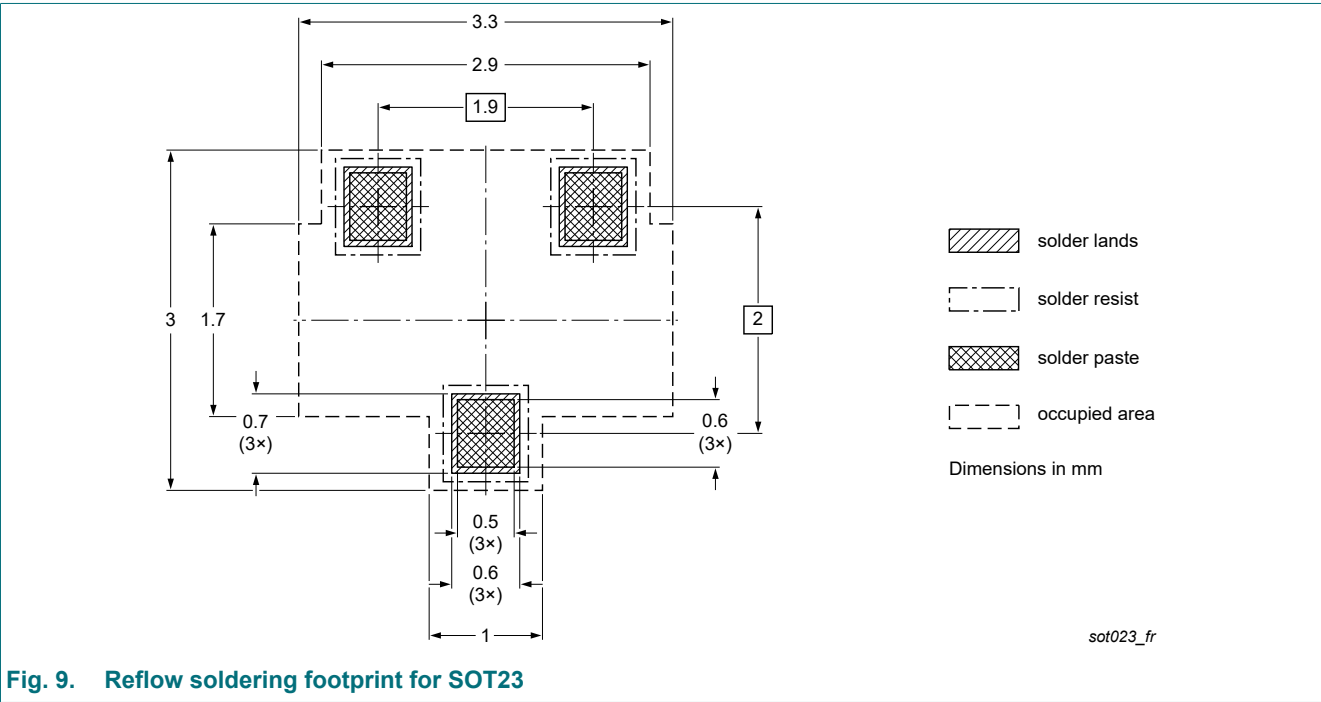
Table 8. Resistor test conditions

| PDTC123YT-Q | R1 (kΩ) | R2 (kΩ) | Test conditions | | | |
|-------------|---------|---------|-----------------|----------------|----------------|----------------|
| | | | I ₁ | I ₂ | I ₃ | I ₄ |
| NPN | 2.2 | 10 | 1300 μA | 1500 μA | -350 μA | -450 μA |

12. Package outline



13. Soldering



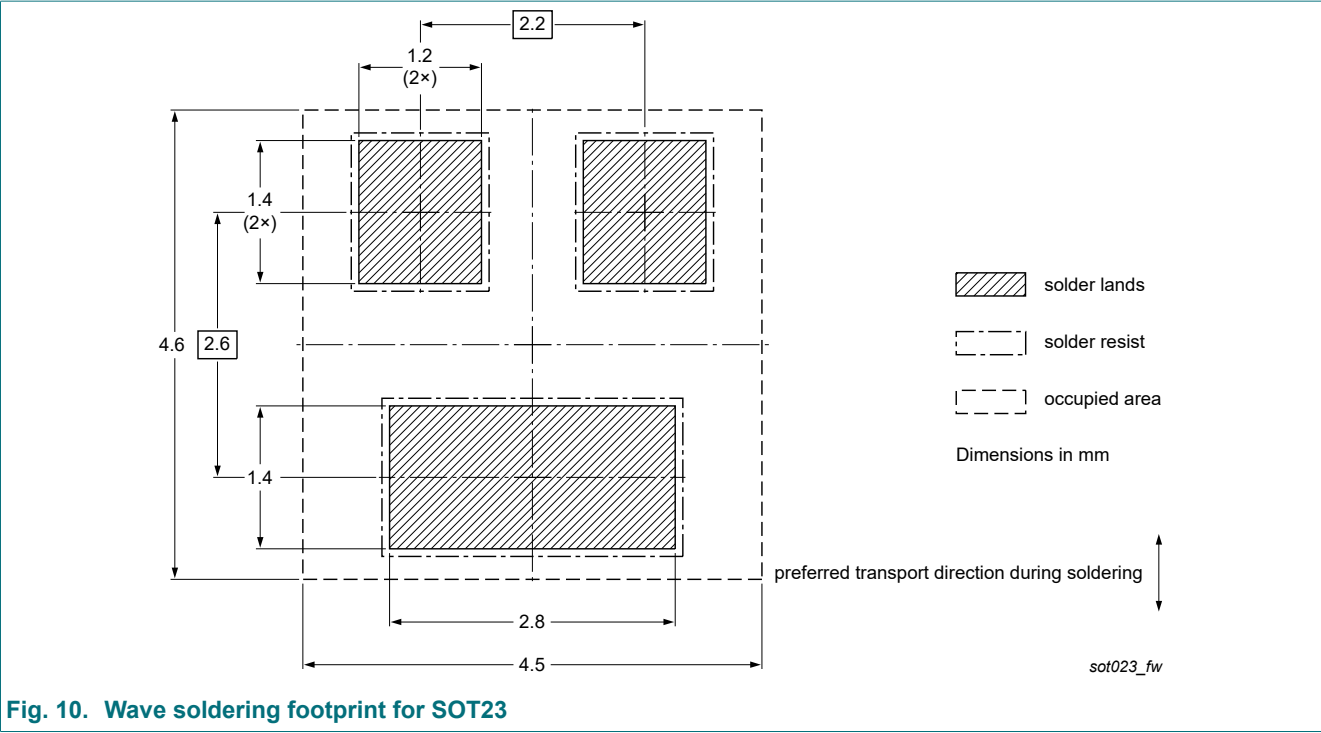


Fig. 10. Wave soldering footprint for SOT23

14. Revision history

Table 9. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|--------------|--------------------|---------------|------------|
| PDTC123YT-Q v.1 | 20230417 | 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. |
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| Product [short] data sheet | Production | This document contains the product specification. |

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