



# PDTTC143EU

50 V, 100 mA NPN resistor-equipped transistor;  
R1 = 4.7 k $\Omega$ , R2 = 4.7 k $\Omega$

1 April 2023

Product data sheet

## 1. General description

NPN Resistor-Equipped Transistor (RET) in a very small SOT323 (SC-70) Surface-Mounted Device (SMD) plastic package.

PNP complement: PDTA143EU

## 2. Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs

## 3. Applications

- Digital application in industrial segments
- Cost-saving alternative for BC847 series in digital applications
- Controlling IC inputs
- Switching loads

## 4. Quick reference data

Table 1. Quick reference data

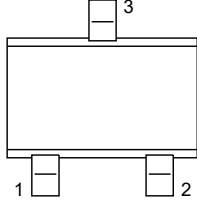
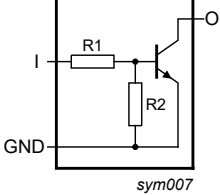
| Symbol           | Parameter                 | Conditions | Min | Typ | Max | Unit       |
|------------------|---------------------------|------------|-----|-----|-----|------------|
| V <sub>CEO</sub> | collector-emitter voltage | open base  | -   | -   | 50  | V          |
| I <sub>O</sub>   | output current            |            | -   | -   | 100 | mA         |
| R1               | bias resistor 1 (input)   | [1]        | 3.3 | 4.7 | 6.1 | k $\Omega$ |
| R2/R1            | bias resistor ratio       | [1]        | 0.8 | 1   | 1.2 |            |

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

50 V, 100 mA NPN resistor-equipped transistor; R1 = 4.7 kΩ, R2 = 4.7 kΩ

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description        | Simplified outline  | Graphic symbol  |
|-----|--------|--------------------|---|---|
| 1   | I      | input (base)       | <br>SC-70 (SOT323) | <br>sym007 |
| 2   | GND    | ground (emitter)   |   |   |
| 3   | O      | output (collector) |   |   |

## 6. Ordering information

Table 3. Ordering information

| Type number               | Package |  |                        |
|---------------------------|---------|--|------------------------|
|                           | Name    | Description  | Version                |
| <a href="#">PDTC143EU</a> | SC-70   | plastic, surface-mounted package; 3 leads; 1.3 mm pitch; 2 mm x 1.25 mm x 0.95 mm body | <a href="#">SOT323</a> |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code[1] |
|-------------|-----------------|
| PDTC143EU   | %02             |

[1] % = placeholder for manufacturing site code

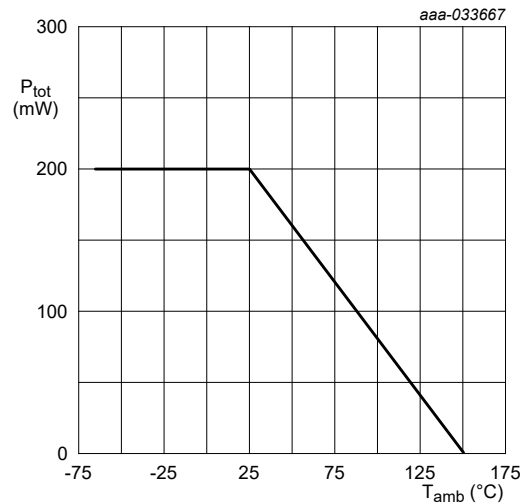
## 8. Limiting values

**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              | -   | 10  | V    |
| $V_I$     | input voltage             |                             | -10 | 30  | V    |
| $I_O$     | output current            |                             | -   | 100 | mA   |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25\text{ °C}$ | [1] | 200 | 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

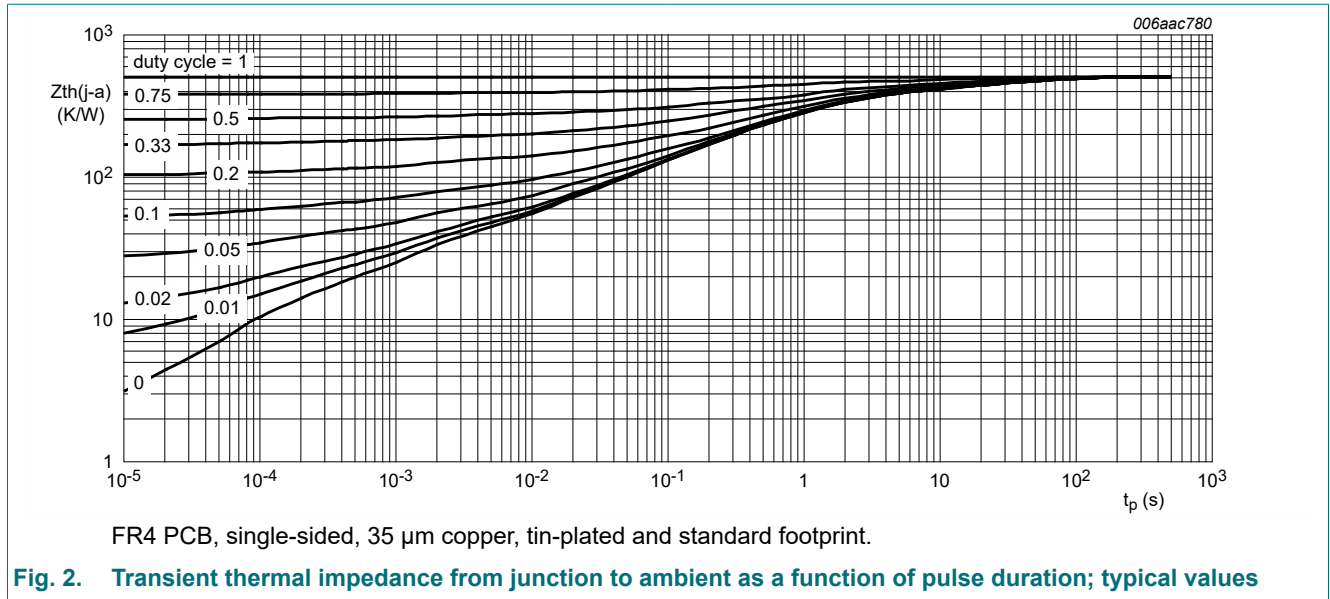
**Fig. 1. Power derating curve**

## 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] | -   | -   | 625 | K/W  |

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

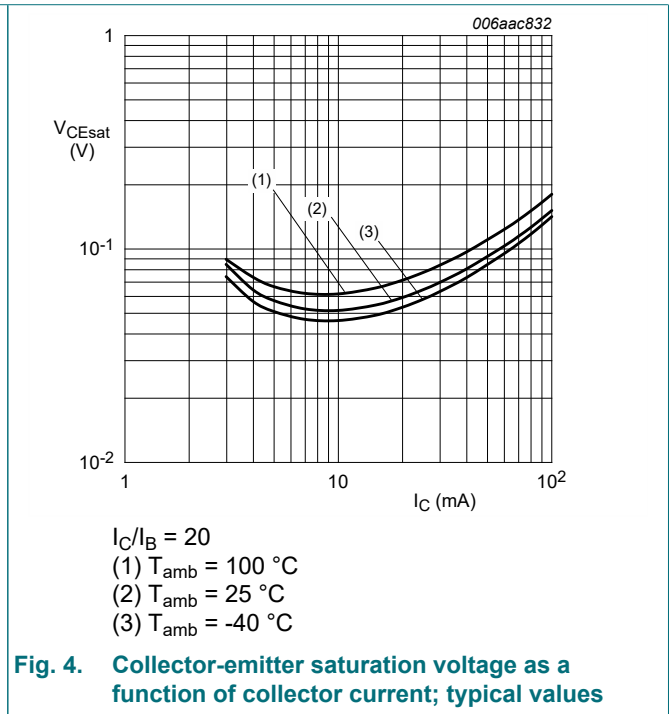
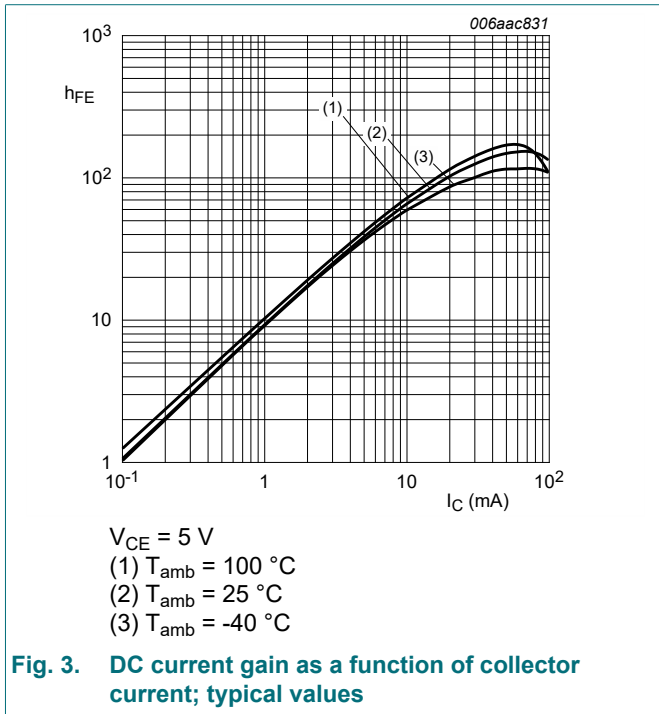


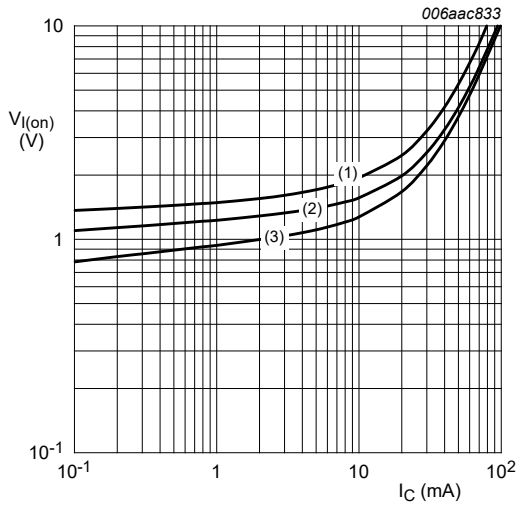
## 10. Characteristics

Table 7. Characteristics

| Symbol        | Parameter                            | Conditions  | Min | Typ | Max | Unit    |
|---------------|--------------------------------------|---|-----|-----|-----|---------|
| $V_{(BR)CBO}$ | 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    | $V_{CE} = 30 \text{ V}; I_B = 0 A; T_{amb} = 25 \text{ }^\circ C$                               | -   | -   | 1   | $\mu A$ |
|               |                                      | $V_{CE} = 30 \text{ V}; I_B = 0 A; T_j = 150 \text{ }^\circ C$                                  | -   | -   | 5   | $\mu A$ |
| $I_{EBO}$     | emitter-base cut-off current         | $V_{EB} = 5 \text{ V}; I_C = 0 A; T_{amb} = 25 \text{ }^\circ C$                                | -   | -   | 900 | $\mu A$ |
| $h_{FE}$      | DC current gain                      | $V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$                      | 30  | -   | -   |         |
| $V_{CEsat}$   | collector-emitter saturation voltage | $I_C = 10 \text{ mA}; I_B = 0.5 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$                      | -   | -   | 150 | mV      |
| $V_{I(off)}$  | off-state input voltage              | $V_{CE} = 5 \text{ V}; I_C = 100 \mu A; T_{amb} = 25 \text{ }^\circ C$                          | -   | 1.1 | 0.5 | V       |
| $V_{I(on)}$   | on-state input voltage               | $V_{CE} = 0.3 \text{ V}; I_C = 20 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$                    | 2.5 | 1.9 | -   | V       |
| R1            | bias resistor 1 (input)              |   | [1] | 4.7 | 6.1 | kΩ      |
| R2/R1         | bias resistor ratio                  |   | [1] | 1   | 1.2 |         |
| $C_c$         | 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     |

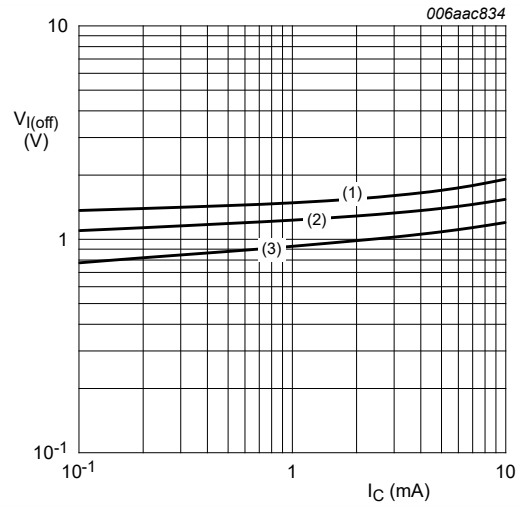
- [1] See "Section 11: Test information" for resistor calculation and test conditions.  
 [2] Characteristics of built-in transistor.





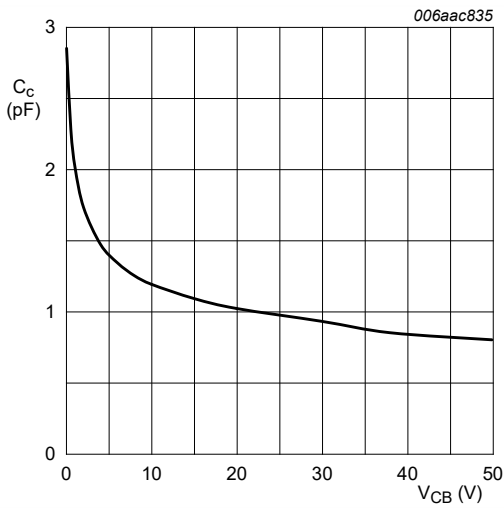
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

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



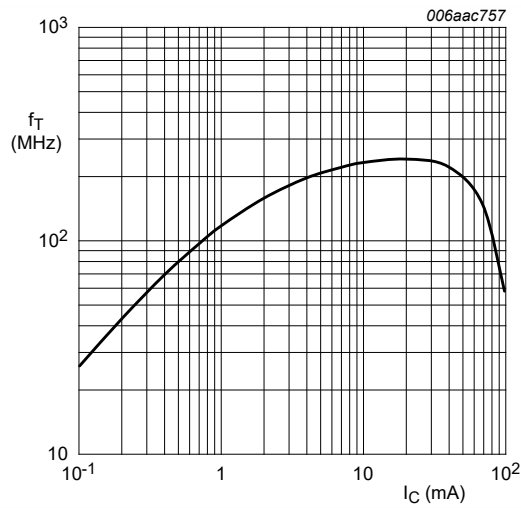
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**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**



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

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

## 11. Test information

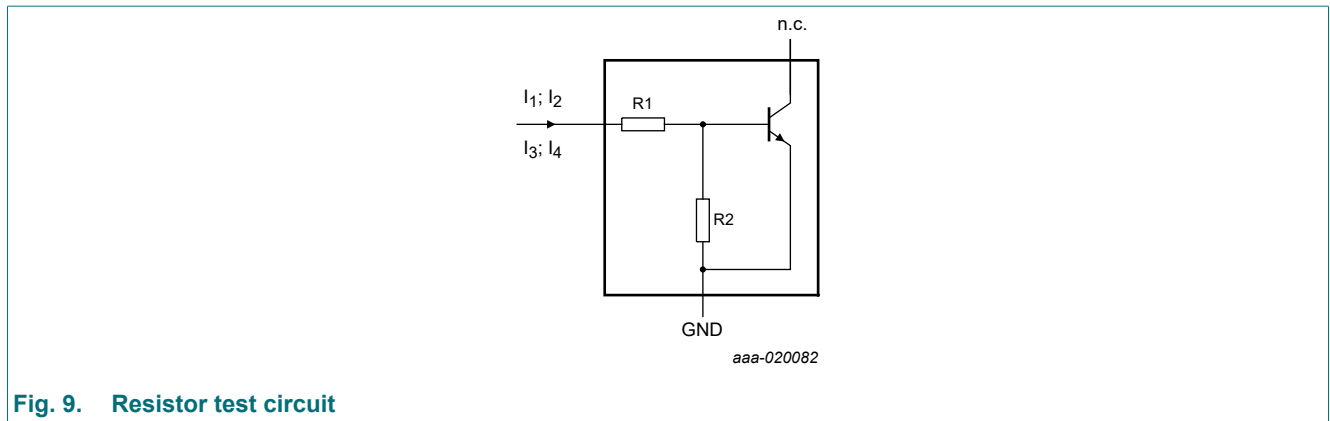
### Resistor calculation

- 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. 9. Resistor test circuit**

### Resistor test conditions

**Table 8. Resistor test conditions**

| Type number | R1 (kΩ) | R2 (kΩ) | Test conditions |        |         |         |
|-------------|---------|---------|-----------------|--------|---------|---------|
|             |         |         | I1              | I2     | I3      | I4      |
| PDTC143EU   | 4.7     | 4.7     | 600 μA          | 700 μA | -600 μA | -700 μA |

## 12. Package outline

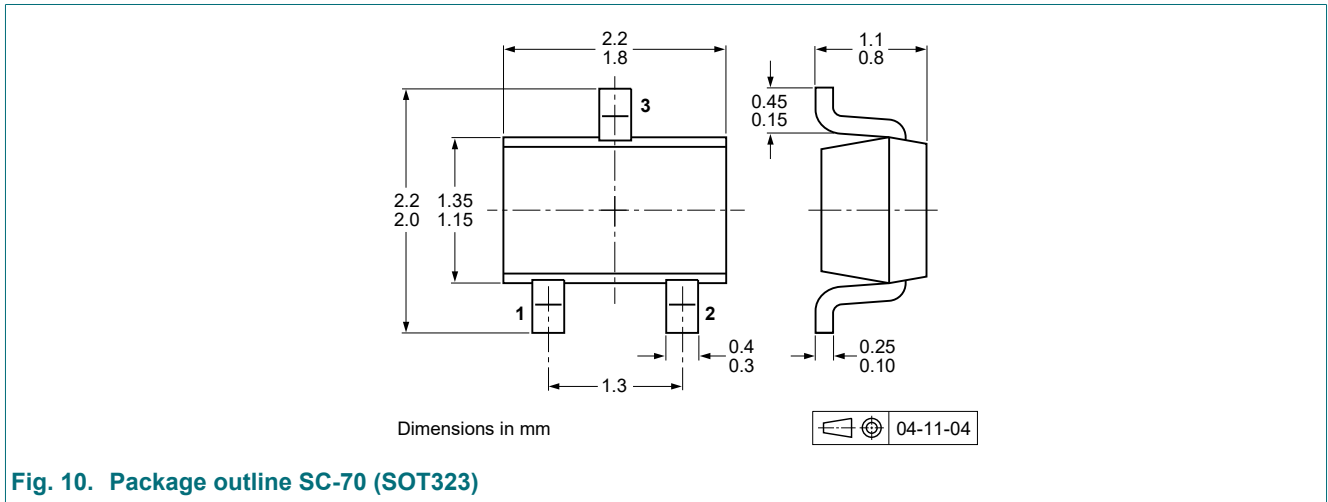


Fig. 10. Package outline SC-70 (SOT323)

## 13. Soldering

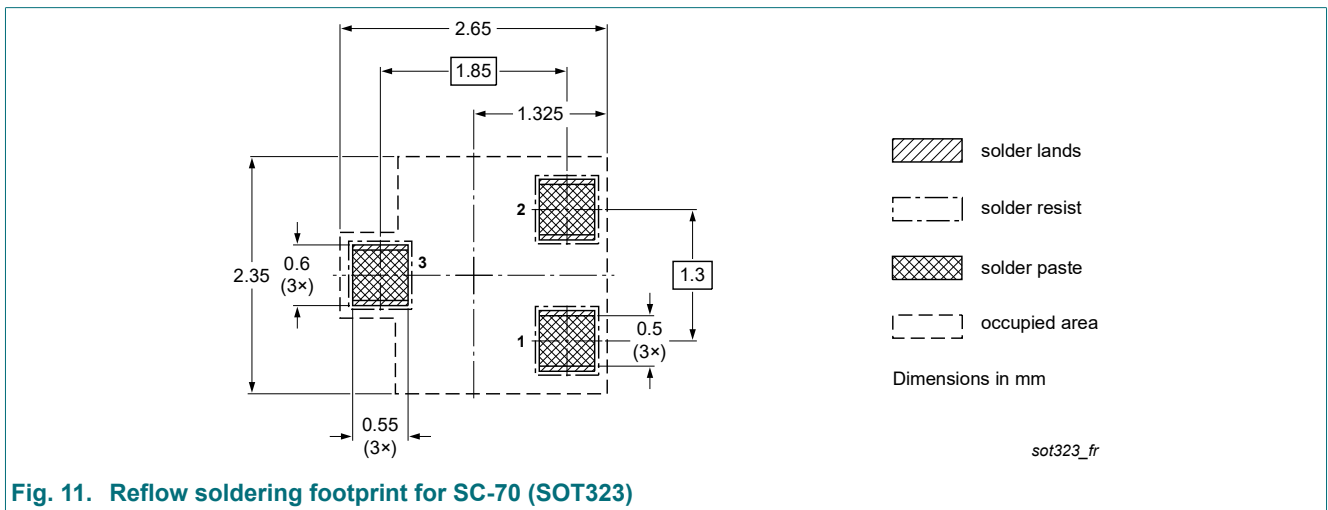


Fig. 11. Reflow soldering footprint for SC-70 (SOT323)

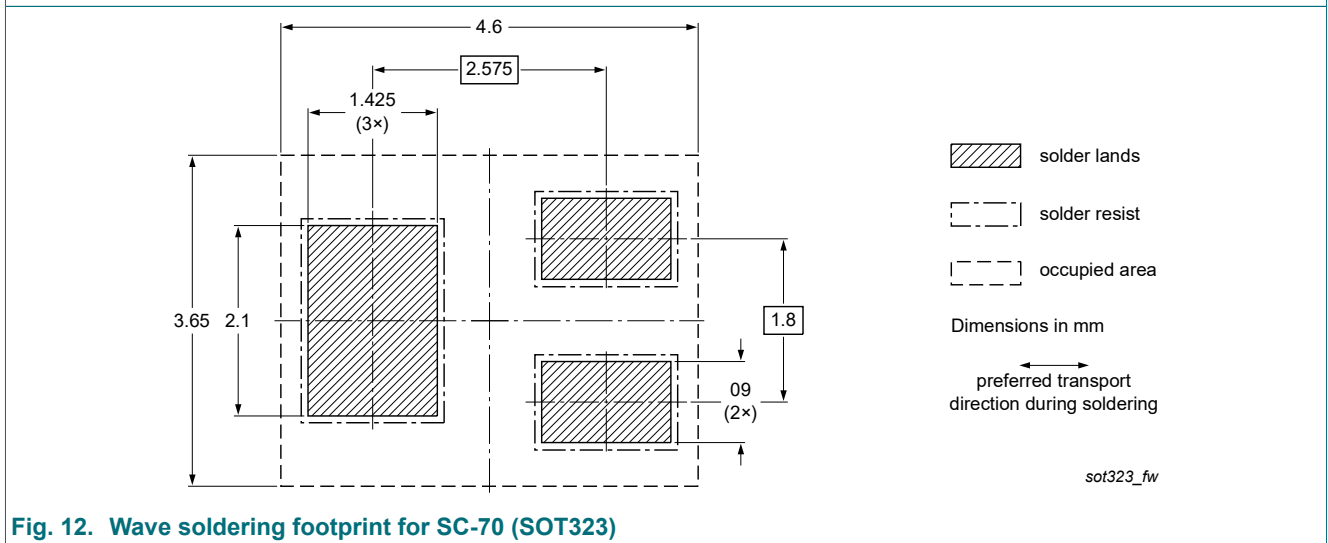


Fig. 12. Wave soldering footprint for SC-70 (SOT323)



## 14. Revision history

Table 9. Revision history

| Data sheet ID        | Release date   | Data sheet status     | Change notice | Supersedes           |
|----------------------|--|-----------------------|---------------|----------------------|
| PDTC143EU v.11       | 20230401   | Product data sheet    | -             | PDTC143E_SERIES v.10 |
| Modification:        | <ul style="list-style-type: none"> <li>Family data sheet reduced to single type data sheet.</li> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Product changed to non automotive. Please refer to the automotive product(s) with -Q.</li> <li>Packing information removed.</li> </ul> |                       |               |                      |
| PDTC143E_SERIES v.10 | 20111208   | Product data sheet    | -             | PDTC143E_SERIES v.9  |
| PDTC143E_SERIES v.9  | 20040805   | Product data sheet    | -             | PDTC143E_SERIES v.8  |
| PDTC143E_SERIES v.8  | 20040318   | Product specification | -             | PDTC143E_SERIES v.7  |
| PDTC143E_SERIES v.7  | 20040112   | Product specification | -             | PDTC143E_SERIES v.6  |
| PDTC143E_SERIES v.6  | 20030910   | Product specification | -             | PDTC143E_SERIES v.5  |
| PDTC143E_SERIES v.5  | 20030410   | Product specification | -             | -                    |

## 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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