



PDTD143XT

50 V, 500 mA NPN resistor-equipped transistor;

R1 = 4.7 k Ω , R2 = 10 k Ω

13 October 2022

Product data sheet

1. General description

NPN Resistor-Equipped Transistor (RET) in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

PNP complement: PDTB143XT

2. Features and benefits

- 500 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- $\pm 10\%$ resistor ratio tolerance
- High temperature applications up to 175 °C
- AEC-Q101 qualified

3. Applications

- IC inputs control
- Cost-saving alternative to BC807 series transistors in digital applications
- Switching loads

4. Quick reference data

Table 1. Quick reference data

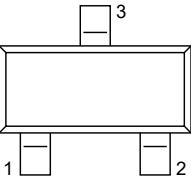
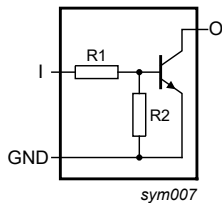
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|------------------|---------------------------|------------|-----|------|------|------|------------|
| V _{CEO} | collector-emitter voltage | open base | | - | - | 50 | V |
| I _O | output current | | | - | - | 500 | mA |
| R1 | bias resistor 1 (input) | | [1] | 3.3 | 4.7 | 6.1 | k Ω |
| R2/R1 | bias resistor ratio | | [1] | 1.91 | 2.13 | 2.34 | |

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

50 V, 500 mA NPN resistor-equipped transistor; R1 = 4.7 k Ω , R2 = 10 k Ω

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|--------------------|---|--|
| 1 | I | input (base) |  <p style="text-align: center;">SOT23</p> |  <p style="text-align: center;"><i>sym007</i></p> |
| 2 | GND | ground (emitter) | | |
| 3 | O | output (collector) | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|---------------------------|---------|--|-----------------------|
| | Name | Description | Version |
| PDTD143XT | 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] |
|-------------|-----------------------------|
| PDTD143XT | %5Z |

[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 | - | 7 | V | |
| V _I | input voltage | positive | -7 | 30 | V | |
| I _O | output current | | - | 500 | mA | |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | [1] | - | 320 | mW |
| | | | [2] | - | 460 | mW |
| T _j | junction temperature | | - | 175 | °C | |
| T _{amb} | ambient temperature | | -55 | 175 | °C | |
| T _{stg} | storage temperature | | -55 | 175 | °C | |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 μm copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

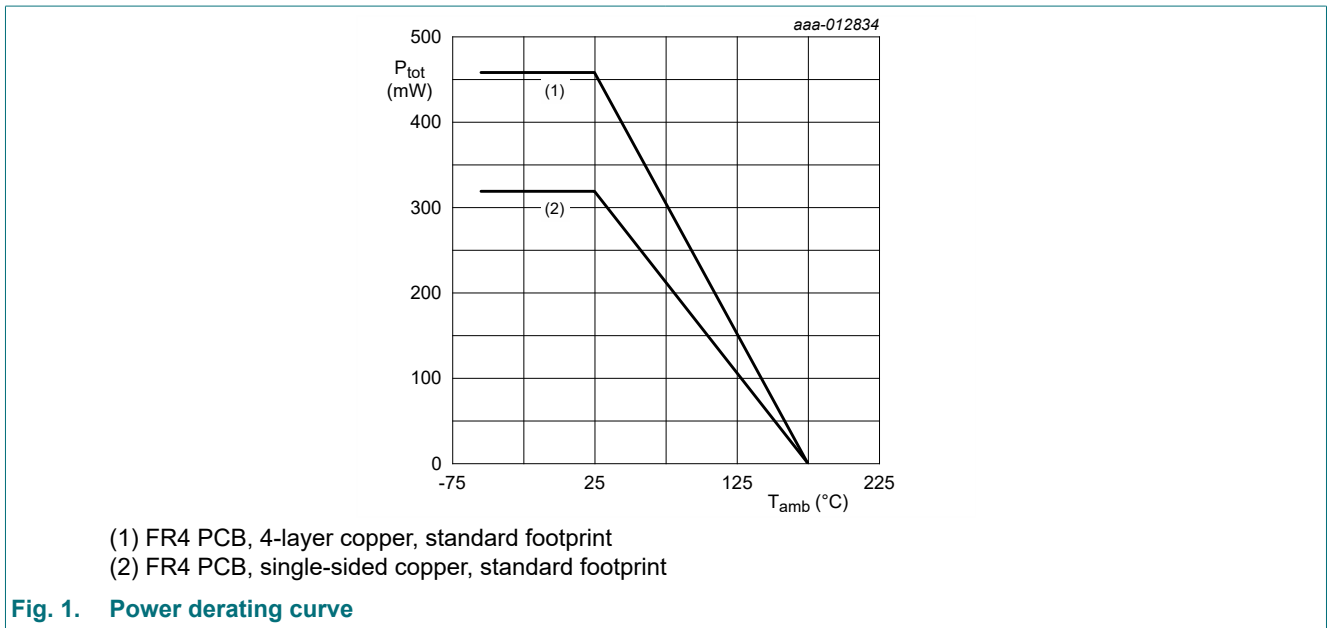


Fig. 1. Power derating curve

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] | - | - | 470 | K/W |
| | | | [2] | - | - | 327 | K/W |

- [1] Device mounted on an FR4 PCB, 35 μm copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

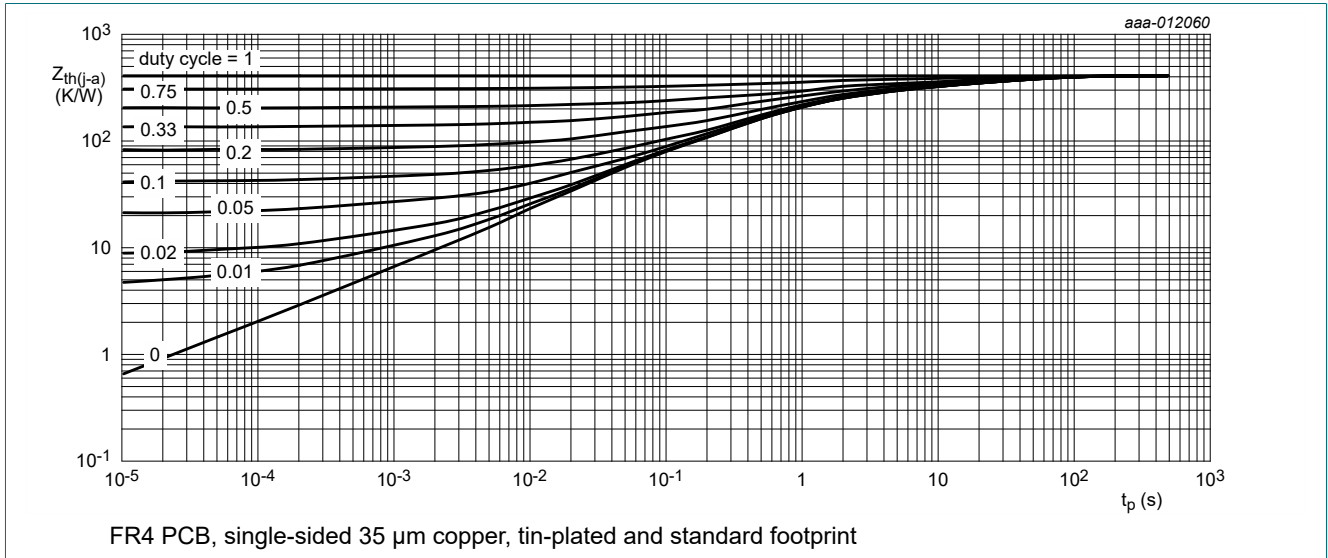


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

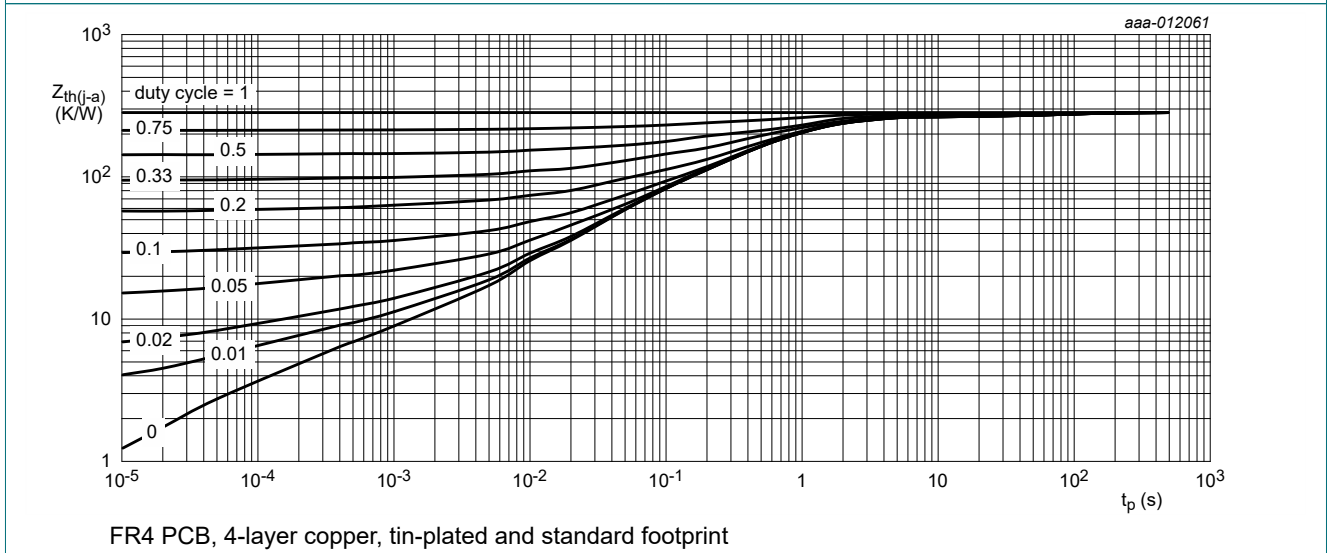


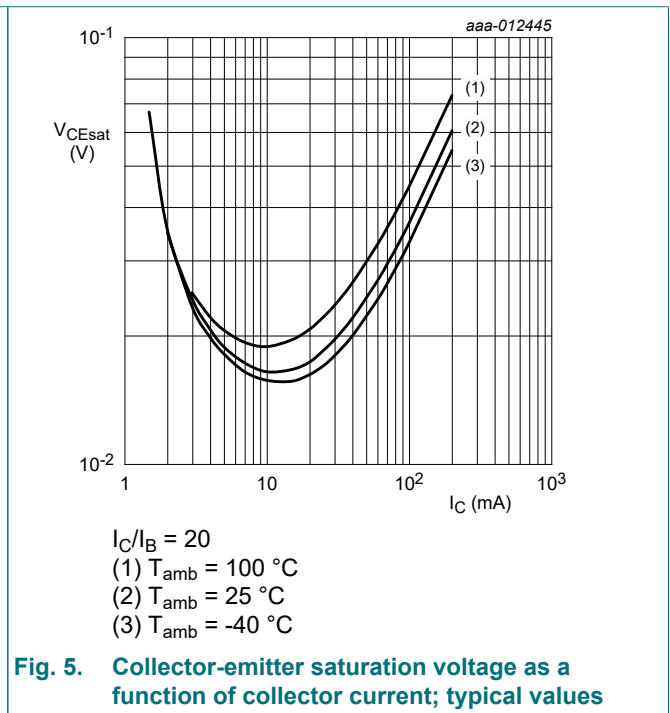
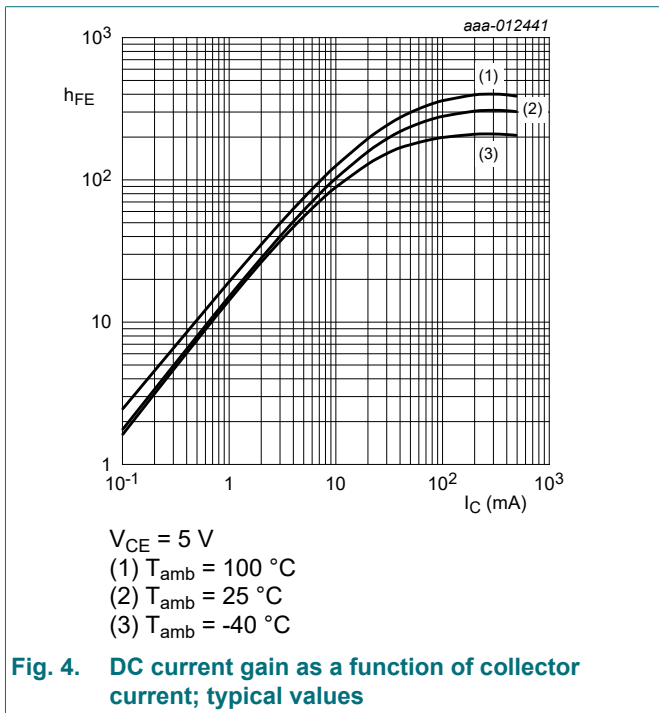
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

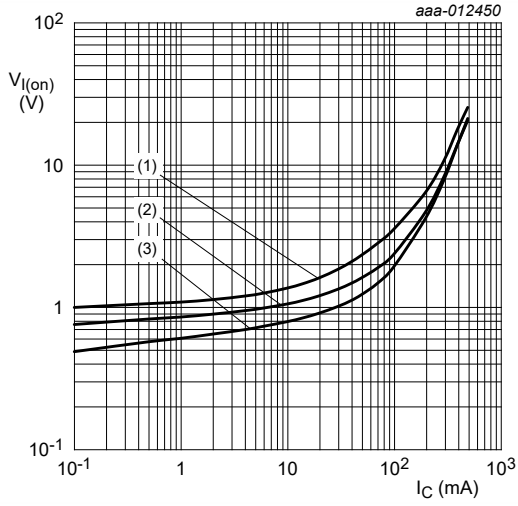
10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|---------------|--------------------------------------|---|-----|------|------|---------|----|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C = 100 \mu A; I_E = 0 A; T_{amb} = 25 \text{ }^\circ C$ | 50 | - | - | V | |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C = 10 \text{ mA}; I_B = 0 A; T_{amb} = 25 \text{ }^\circ C$ | 50 | - | - | V | |
| I_{CBO} | collector-base cut-off current | $V_{CB} = 40 \text{ V}; I_E = 0 A; T_{amb} = 25 \text{ }^\circ C$ | - | - | 100 | nA | |
| | | $V_{CB} = 50 \text{ V}; I_E = 0 A; T_{amb} = 25 \text{ }^\circ C$ | - | - | 100 | nA | |
| I_{CEO} | collector-emitter cut-off current | $V_{CE} = 50 \text{ V}; I_B = 0 A; T_{amb} = 25 \text{ }^\circ C$ | - | - | 0.5 | μA | |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5 \text{ V}; I_C = 0 A; T_{amb} = 25 \text{ }^\circ C$ | - | - | 0.6 | mA | |
| h_{FE} | DC current gain | $V_{CE} = 5 \text{ V}; I_C = 50 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$ | 70 | - | - | | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 50 \text{ mA}; I_B = 2.5 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$ | - | - | 100 | mV | |
| $V_{I(off)}$ | off-state input voltage | $V_{CE} = 5 \text{ V}; I_C = 100 \mu A; T_{amb} = 25 \text{ }^\circ C$ | 0.5 | 0.75 | 1.1 | V | |
| $V_{I(on)}$ | on-state input voltage | $V_{CE} = 0.3 \text{ V}; I_C = 20 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$ | 1 | 1.25 | 2 | V | |
| R1 | bias resistor 1 (input) | | [1] | 3.3 | 4.7 | 6.1 | kΩ |
| R2/R1 | bias resistor ratio | | [1] | 1.91 | 2.13 | 2.34 | |
| C_c | collector capacitance | $V_{CB} = 10 \text{ V}; I_E = 0 A; i_e = 0 A; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ C$ | - | 7 | - | pF | |
| f_T | transition frequency | $V_{CE} = 5 \text{ V}; I_C = 50 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ C$ | [2] | 225 | - | MHz | |

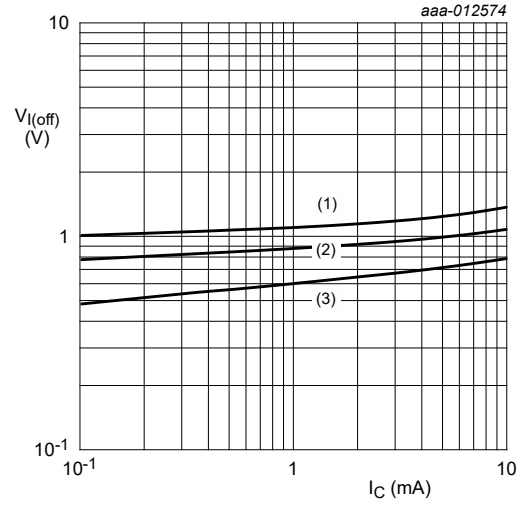
- [1] See "Section 11: Test information" for resistor calculation and test conditions.
- [2] Characteristics of built-in transistor.





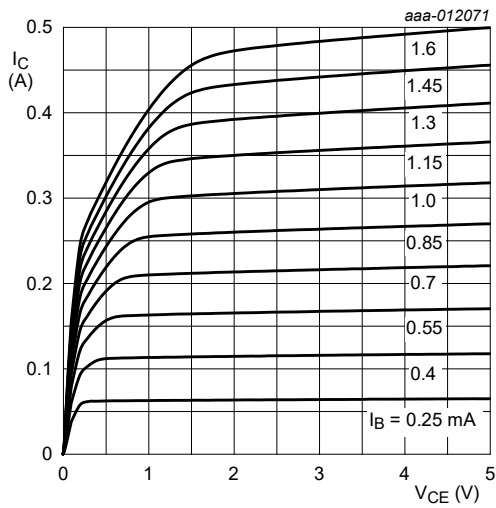
$V_{CE} = 0.3$ V
 (1) $T_{amb} = -40$ °C
 (2) $T_{amb} = 25$ °C
 (3) $T_{amb} = 100$ °C

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



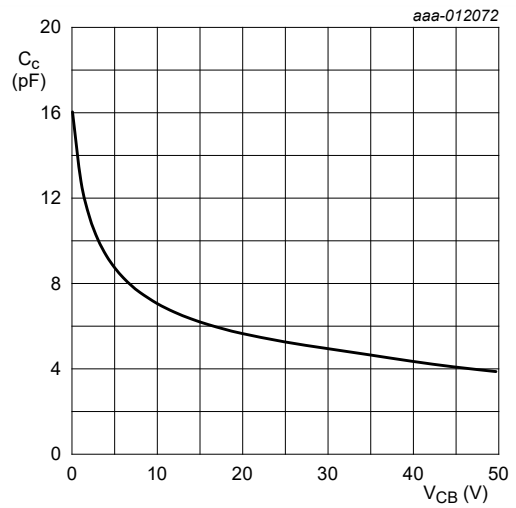
$V_{CE} = 5$ V
 (1) $T_{amb} = -40$ °C
 (2) $T_{amb} = 25$ °C
 (3) $T_{amb} = 100$ °C

Fig. 7. Off-state input voltage as a function of collector current; typical values



$T_{amb} = 25$ °C

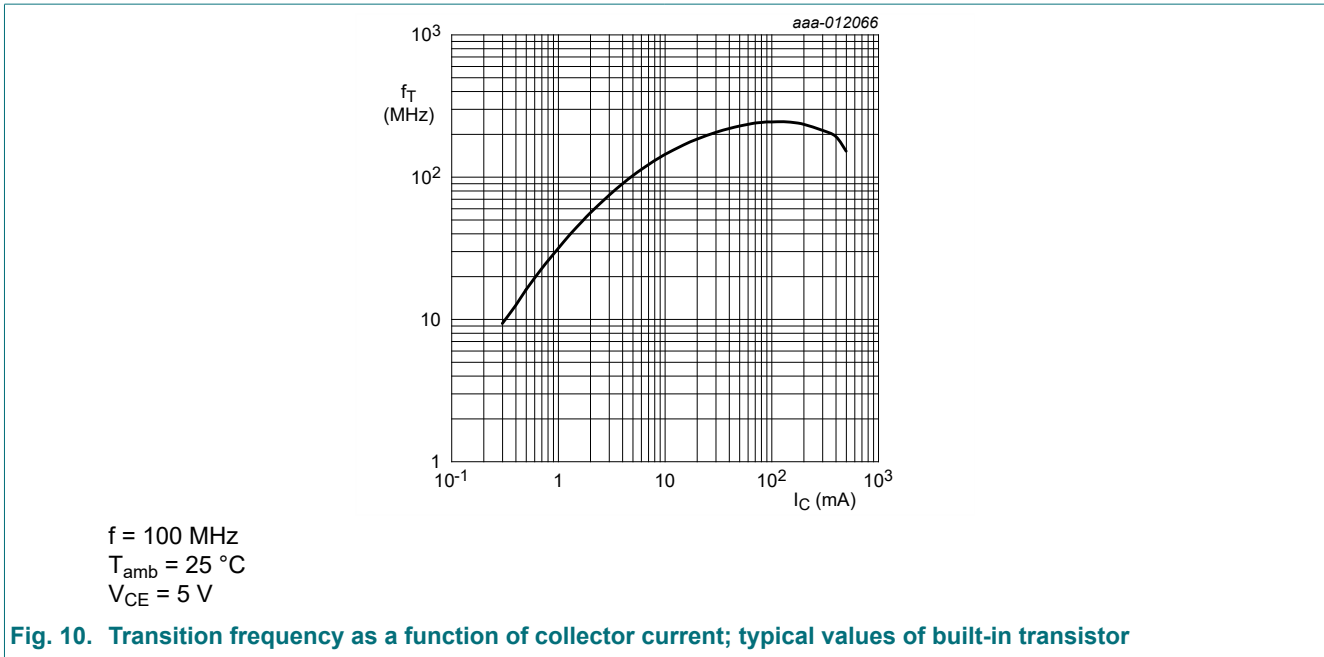
Fig. 8. Collector current as a function of collector-emitter voltage; typical values



$f = 1$ MHz
 $T_{amb} = 25$ °C

Fig. 9. Collector capacitance as a function of collector-base voltage; typical values

50 V, 500 mA NPN resistor-equipped transistor; R1 = 4.7 kΩ, R2 = 10 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)

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

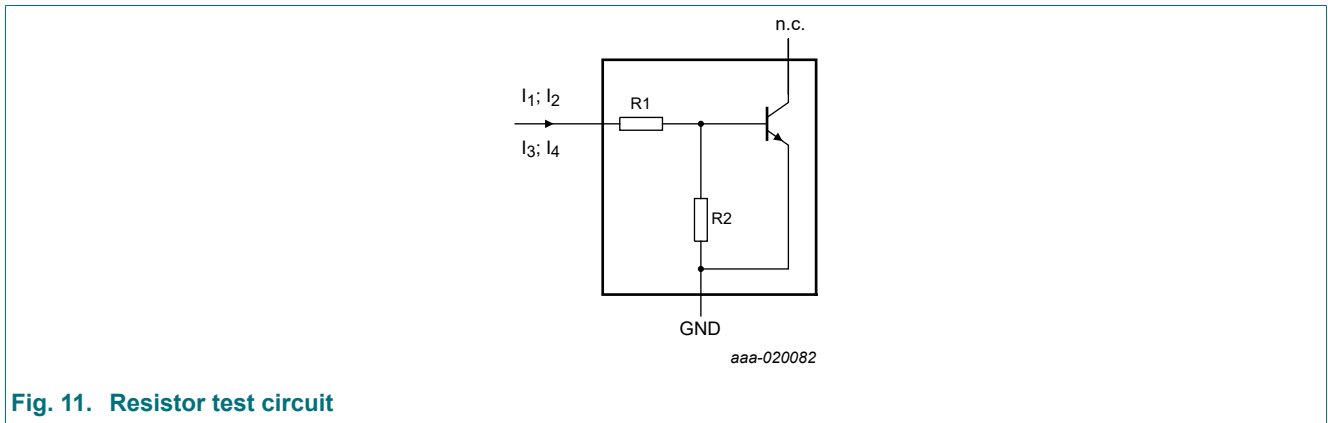


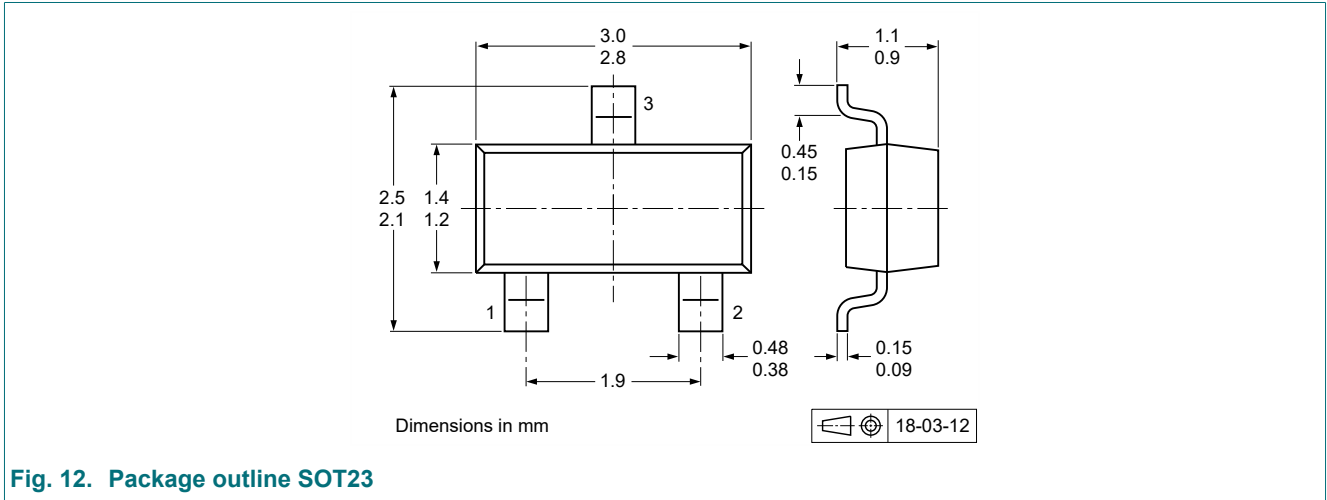
Fig. 11. Resistor test circuit

Resistor test conditions

Table 8. Resistor test conditions

| Type number | R1 (kΩ) | R2 (kΩ) | Test conditions | | | |
|-------------|---------|---------|-----------------|----------------|----------------|----------------|
| | | | I ₁ | I ₂ | I ₃ | I ₄ |
| PDTD143XT | 4.7 | 10 | 1.3 mA | 1.5 mA | -0.45 mA | -0.55 mA |

12. Package outline



13. Soldering

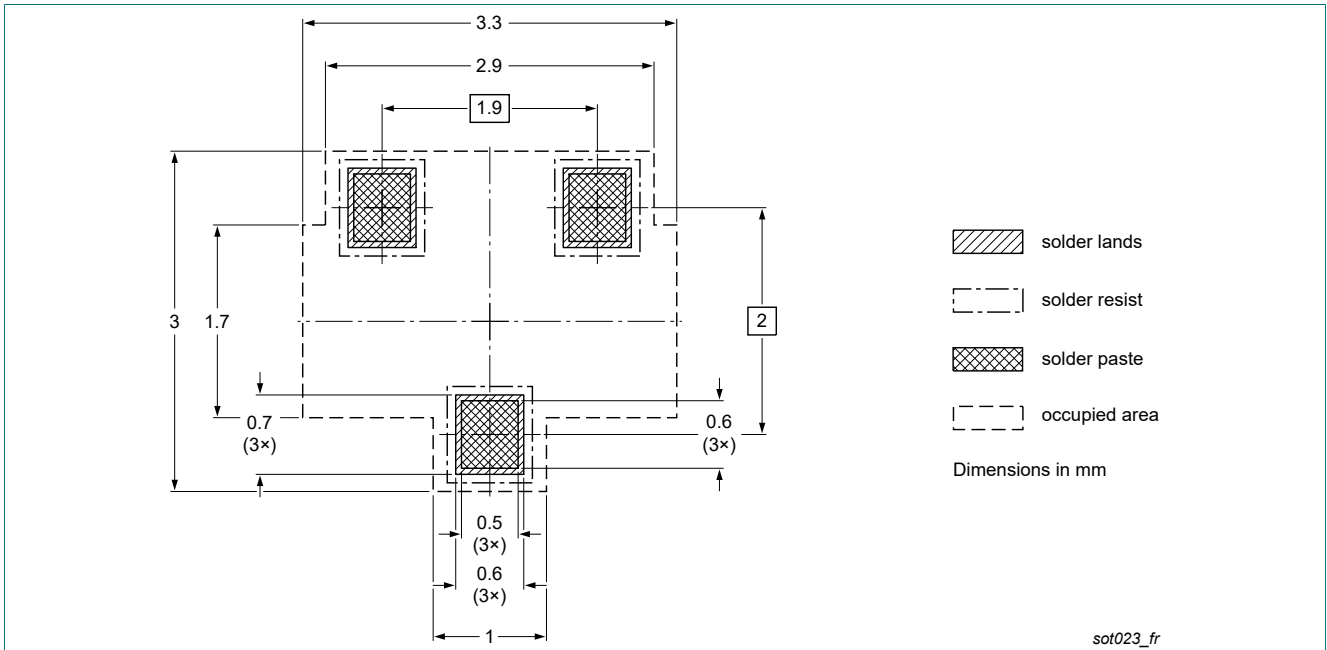


Fig. 13. Reflow soldering footprint for SOT23

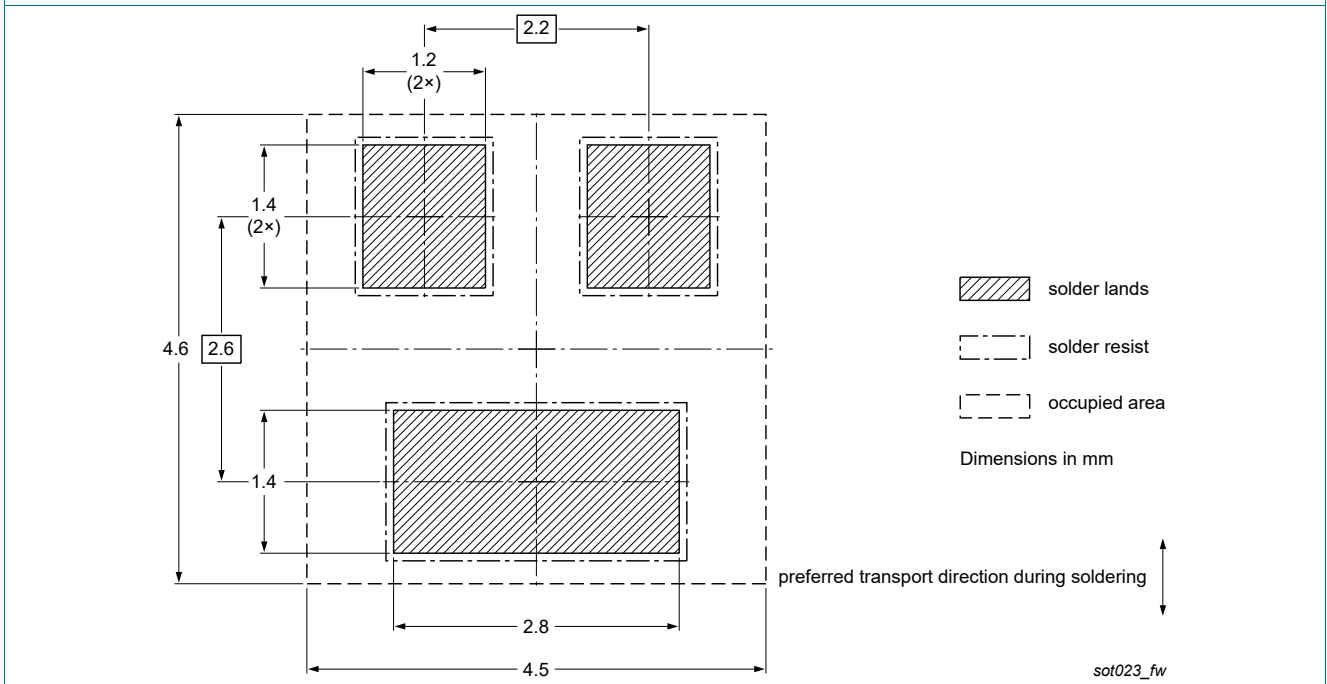


Fig. 14. Wave soldering footprint for SOT23

14. Revision history

Table 9. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|--------------------|--|--------------------|---------------|--------------------|
| PDTD143XT v.2 | 20221013 | Product data sheet | - | PDTD1XXXXT_SER v.1 |
| Modifications: | • Family data sheet reduced to single type data sheet. | | | |
| PDTD1XXXXT_SER v.1 | 20140515 | 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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