



PDTC143X/123J/143Z/114Y/124XQB-Q series

50 V, 100 mA NPN resistor-equipped transistors

Rev. 1 — 1 October 2021

Product data sheet

1. General description

100 mA NPN Resistor-Equipped Transistor (RET) family in an ultra small DFN1110D-3 (SOT8015) leadless Surface-Mounted Device (SMD) plastic package with side-wettable flanks.

Table 1. Product overview

| Type number | R1 | R2 | Package | | PNP complement: |
|--------------|------------|------------|----------|----------|-----------------|
| | k Ω | k Ω | Nexperia | JEDEC | |
| PDTC143XQB-Q | 4.7 | 10 | SOT8015 | MO-340BA | PDTA143XQB-Q |
| PDTC123JQB-Q | 2.2 | 47 | | | PDTA123JQB-Q |
| PDTC143ZQB-Q | 4.7 | 47 | | | PDTA143ZQB-Q |
| PDTC114YQB-Q | 10 | 47 | | | PDTA114YQB-Q |
| PDTC124XQB-Q | 22 | 47 | | | PDTA124XQB-Q |

2. Features and benefits

- 100 mA output current capability
- Built-in resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- Low package height of 0.5 mm
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

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

4. Quick reference data

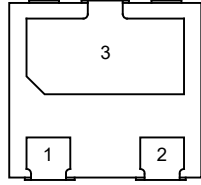
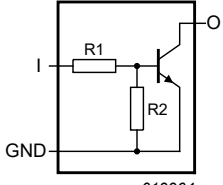
Table 2. Quick reference data

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------------------|------------|-----|-----|-----|------|
| V_{CEO} | collector-emitter voltage | open base | - | - | 50 | V |
| I_O | output current | | - | - | 100 | mA |

5. Pinning information

Table 3. Pinning

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|--------------------|--|---|
| 1 | I | input (base) |  <p>Transparent top view</p> |  <p>aaa-019964</p> |
| 2 | GND | GND (emitter) | | |
| 3 | O | output (collector) | | |

6. Ordering information

Table 4. Ordering information

| Type number | Package | | |
|--------------|------------|--|---------|
| | Name | Description | Version |
| PDTC143XQB-Q | DFN1110D-3 | plastic leadless extremely thin small outline package with side-wettable flanks (SWF); 3 terminals; 0.65 mm pitch; body: 1.1 x 1.0 x 0.48 mm | SOT8015 |
| PDTC123JQB-Q | | | |
| PDTC143ZQB-Q | | | |
| PDTC114YQB-Q | | | |
| PDTC124XQB-Q | | | |

7. Marking

Table 5. Marking

| Type number | Marking code |
|--------------|--------------|
| PDTC143XQB-Q | E7 |
| PDTC123JQB-Q | E3 |
| PDTC143ZQB-Q | E8 |
| PDTC114YQB-Q | E2 |
| PDTC124XQB-Q | E5 |

8. Limiting values

Table 6. Limiting values

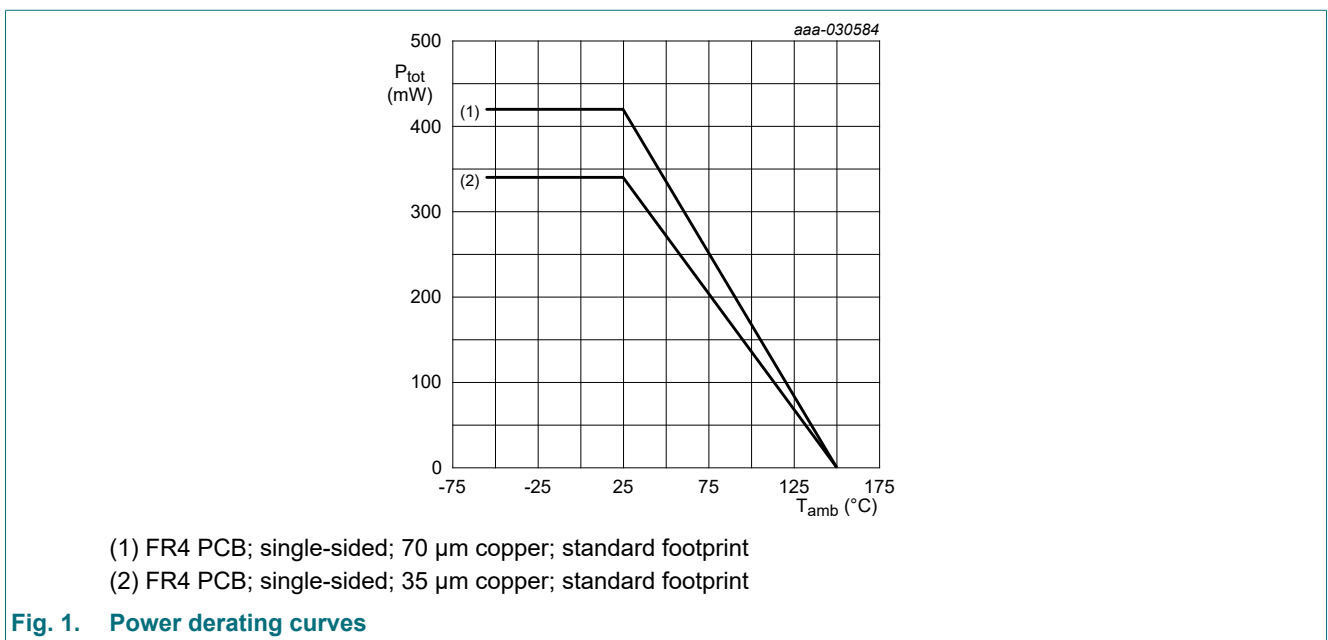
In accordance with the Absolute Maximum Rating System (IEC 60134).

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

| 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 | |
| | PDTC143XQB-Q | | | 5 | V | |
| | PDTC123JQB-Q | | | 5 | V | |
| | PDTC143ZQB-Q | | | 6 | V | |
| | PDTC114YQB-Q | | | 7 | V | |
| | PDTC124XQB-Q | | | | | |
| V_i | input voltage | | | | | |
| | PDTC143XQB-Q | | -7 | +30 | V | |
| | PDTC123JQB-Q | | -5 | +12 | V | |
| | PDTC143ZQB-Q | | -5 | +30 | V | |
| | PDTC114YQB-Q | | -6 | +40 | V | |
| | PDTC124XQB-Q | | -7 | +40 | V | |
| I_O | output current | | - | 100 | mA | |
| P_{tot} | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | [1] | - | 340 | mW |
| | | | [2] | - | 420 | mW |
| T_j | junction temperature | | - | 150 | °C | |
| T_{amb} | ambient temperature | | -55 | 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.

[2] Device mounted on an FR4 PCB; single-sided; 70 μm copper; tin-plated and standard footprint.



(1) FR4 PCB; single-sided; 70 μm copper; standard footprint
(2) FR4 PCB; single-sided; 35 μm copper; standard footprint

Fig. 1. Power derating curves

9. Thermal characteristics

Table 7. Thermal characteristics

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|---------------|---|-------------|-----|-----|-----|------|-----|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 368 | K/W |
| | | | [2] | - | - | 298 | K/W |

- [1] Device mounted on an FR4 PCB; single-sided; 35 μm copper; tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB; single-sided; 70 μm copper; tin-plated and standard footprint.

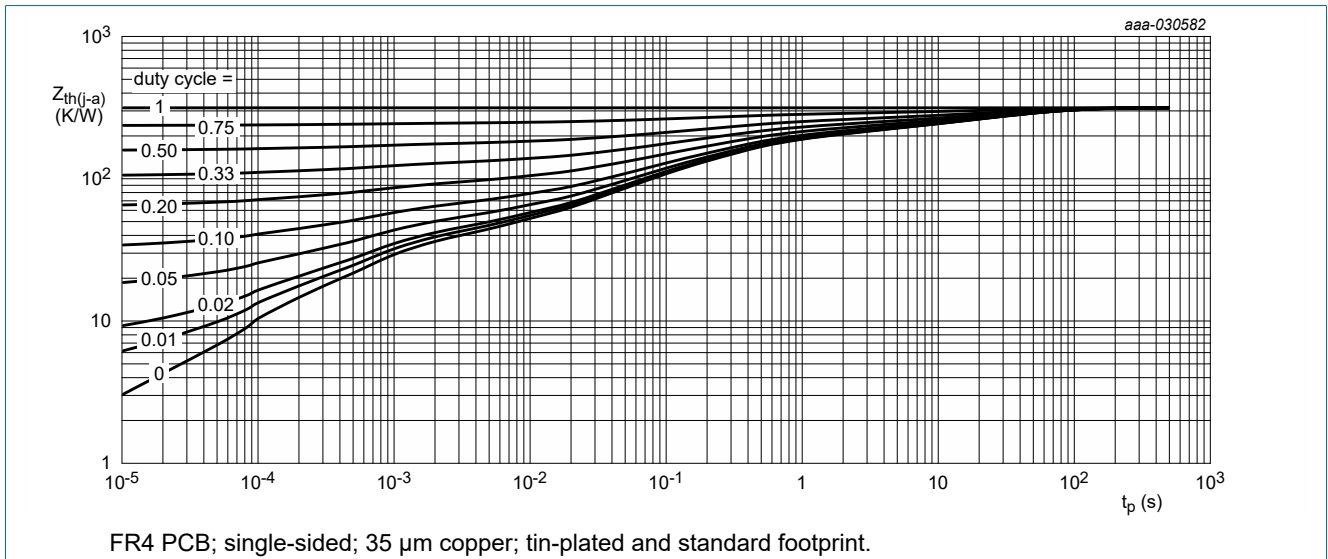


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

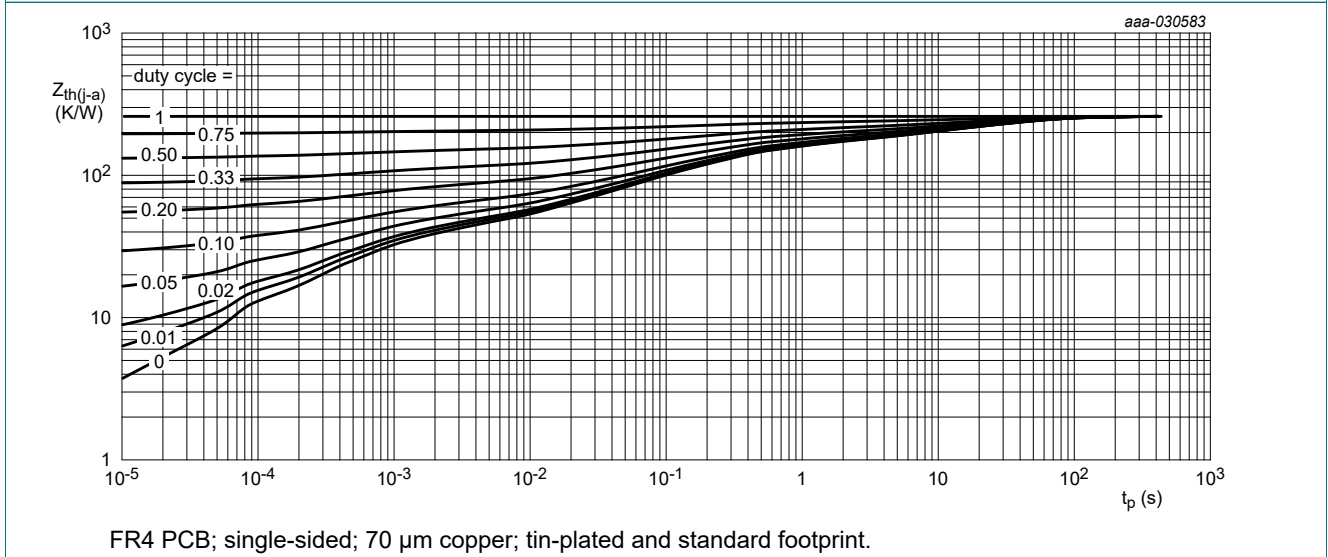


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

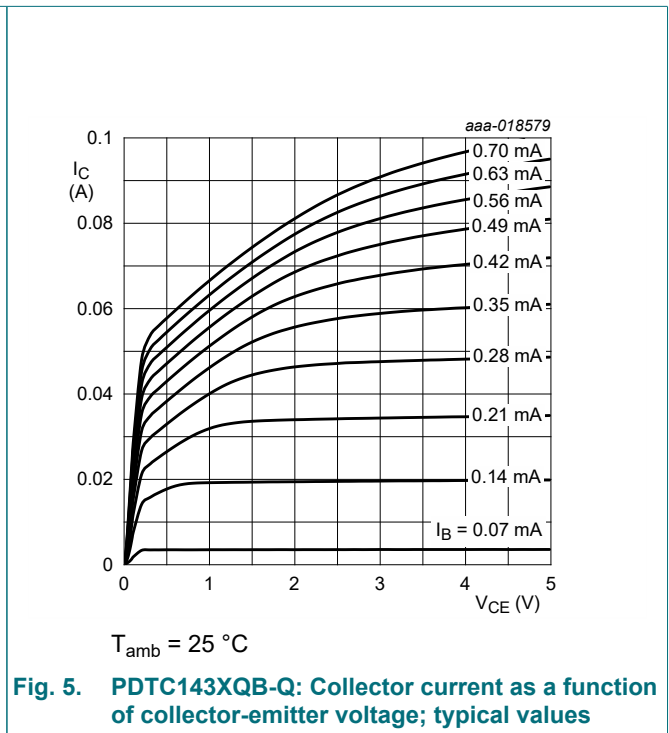
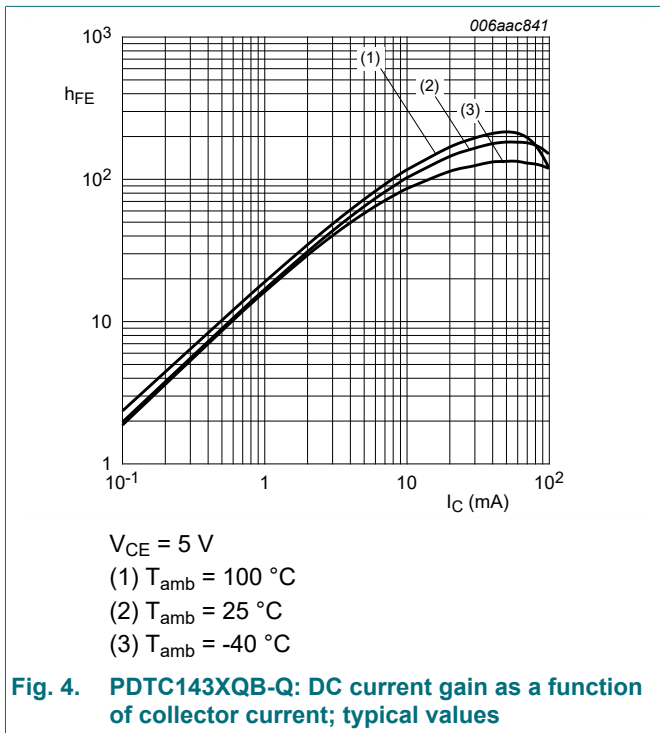
Table 8. Characteristics
 $T_{amb} = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|--------------------------------------|---|-----|------|-----|---------------|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C = 100\ \mu\text{A}$; $I_E = 0\ \text{A}$ | 50 | - | - | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C = 2\ \text{mA}$; $I_B = 0\ \text{A}$ | 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 | $V_{CE} = 30\ \text{V}$; $I_B = 0\ \text{A}$ | - | - | 100 | nA |
| | | $V_{CE} = 30\ \text{V}$; $I_B = 0\ \text{A}$; $T_j = 150\text{ °C}$ | - | - | 5 | μA |
| I_{EBO} | emitter-base cut-off current | | | | | |
| | PDTC143XQB-Q | $V_{EB} = 5\ \text{V}$; $I_C = 0\ \text{A}$ | - | - | 600 | μA |
| | PDTC123JQB-Q | | - | - | 180 | μA |
| | PDTC143ZQB-Q | | - | - | 170 | μA |
| | PDTC114YQB-Q | | - | - | 150 | μA |
| | PDTC124XQB-Q | | - | - | 120 | μA |
| h_{FE} | DC current gain | | | | | |
| | PDTC143XQB-Q | $V_{CE} = 5\ \text{V}$; $I_C = 10\ \text{mA}$ | 50 | - | - | |
| | PDTC123JQB-Q | | 100 | - | - | |
| | PDTC143ZQB-Q | | 100 | - | - | |
| | PDTC114YQB-Q | $V_{CE} = 5\ \text{V}$; $I_C = 5\ \text{mA}$ | 100 | - | - | |
| | PDTC124XQB-Q | | 80 | - | - | |
| V_{CEsat} | collector-emitter saturation voltage | | | | | |
| | PDTC143XQB-Q | $I_C = 10\ \text{mA}$; $I_B = 0.5\ \text{mA}$ | - | - | 100 | mV |
| | PDTC123JQB-Q | | - | - | 100 | mV |
| | PDTC143ZQB-Q | $I_C = 5\ \text{mA}$; $I_B = 0.25\ \text{mA}$ | - | - | 100 | mV |
| | PDTC114YQB-Q | | - | - | 100 | mV |
| | PDTC124XQB-Q | $I_C = 10\ \text{mA}$; $I_B = 0.5\ \text{mA}$ | - | - | 100 | mV |
| $V_{I(off)}$ | off-state input voltage | | | | | |
| | PDTC143XQB-Q | $V_{CE} = 5\ \text{V}$; $I_C = 100\ \mu\text{A}$ | - | 0.8 | 0.3 | V |
| | PDTC123JQB-Q | | - | 0.6 | 0.5 | V |
| | PDTC143ZQB-Q | | - | 0.6 | 0.5 | V |
| | PDTC114YQB-Q | | - | 0.7 | 0.5 | V |
| | PDTC124XQB-Q | | - | 0.8 | 0.5 | V |
| $V_{I(on)}$ | on-state input voltage | | | | | |
| | PDTC143XQB-Q | $V_{CE} = 0.3\ \text{V}$; $I_C = 20\ \text{mA}$ | 2.5 | 1.5 | - | V |
| | PDTC123JQB-Q | $V_{CE} = 0.3\ \text{V}$; $I_C = 5\ \text{mA}$ | 1.1 | 0.75 | - | V |
| | PDTC143ZQB-Q | $V_{CE} = 0.3\ \text{V}$; $I_C = 5\ \text{mA}$ | 1.3 | 0.9 | - | V |
| | PDTC114YQB-Q | $V_{CE} = 0.3\ \text{V}$; $I_C = 1\ \text{mA}$ | 1.4 | 0.8 | - | V |
| | PDTC124XQB-Q | $V_{CE} = 0.3\ \text{V}$; $I_C = 2\ \text{mA}$ | 2.0 | 1.1 | - | V |

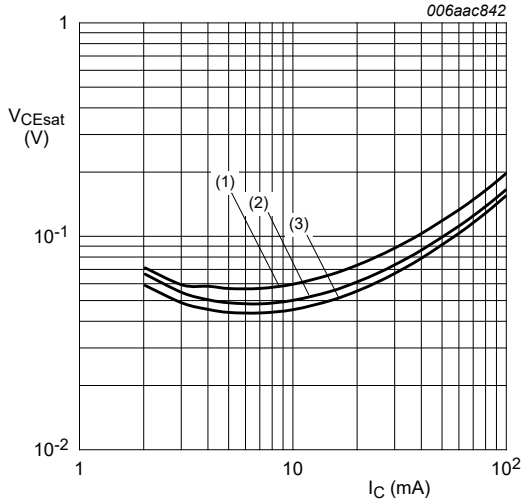
50 V, 100 mA NPN resistor-equipped transistors

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------|-------------------------|--|---------|------|------|------|
| R1 | bias resistor 1 (input) | | | | | |
| | PDTC143XQB-Q | | [1] 3.3 | 4.7 | 6.1 | kΩ |
| | PDTC123JQB-Q | | 1.54 | 2.2 | 2.86 | kΩ |
| | PDTC143ZQB-Q | | 3.3 | 4.7 | 6.1 | kΩ |
| | PDTC114YQB-Q | | 7 | 10 | 13 | kΩ |
| | PDTC124XQB-Q | | 15.4 | 22 | 28.6 | kΩ |
| R2/R1 | bias resistor ratio | | | | | |
| | PDTC143XQB-Q | | [1] 1.7 | 2.13 | 2.6 | |
| | PDTC123JQB-Q | | 17 | 21 | 26 | |
| | PDTC143ZQB-Q | | 8 | 10 | 12 | |
| | PDTC114YQB-Q | | 3.7 | 4.7 | 5.7 | |
| | PDTC124XQB-Q | | 1.7 | 2.13 | 2.6 | |
| f_T | transition frequency | $V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$ | [2] - | 230 | - | MHz |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$ | - | - | 2.5 | pF |

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



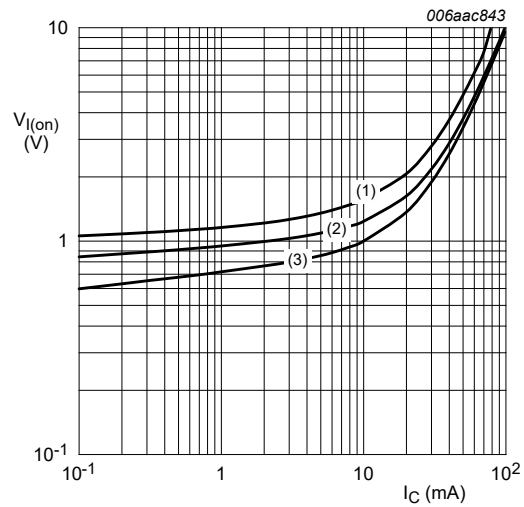
50 V, 100 mA NPN resistor-equipped transistors



$I_C/I_B = 20$

- (1) $T_{amb} = 100\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = -40\text{ °C}$

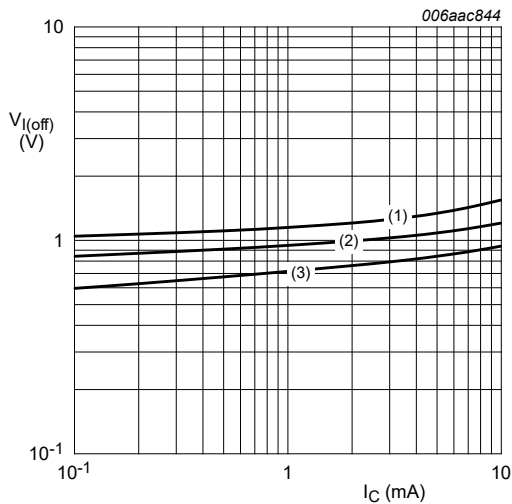
Fig. 6. PDTC143XQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



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

- (1) $T_{amb} = -40\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = 100\text{ °C}$

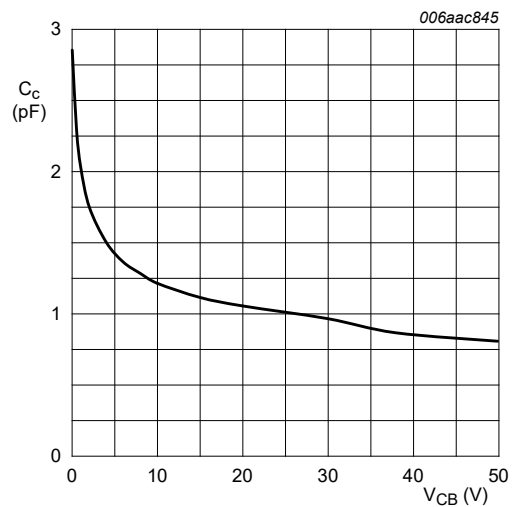
Fig. 7. PDTC143XQB-Q: On-state input voltage as a function of collector current; typical values



$V_{CE} = 5\text{ V}$

- (1) $T_{amb} = -40\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = 100\text{ °C}$

Fig. 8. PDTC143XQB-Q: Off-state input voltage as a function of collector current; typical values



$f = 1\text{ MHz}$

$T_{amb} = 25\text{ °C}$

Fig. 9. PDTC143XQB-Q: Collector capacitance as a function of collector-base voltage; typical values

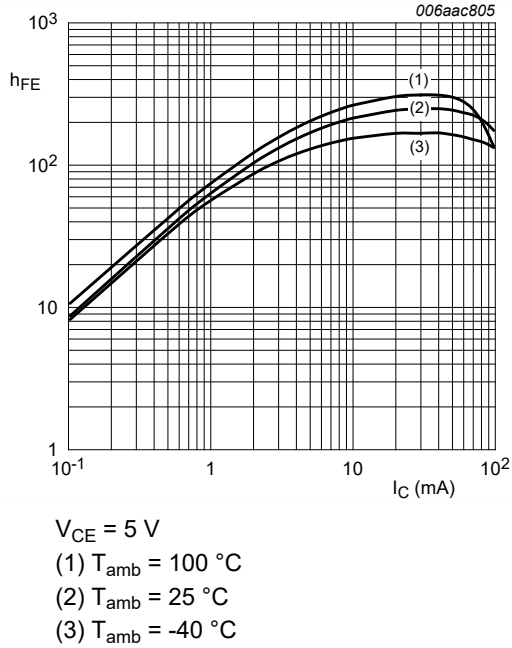


Fig. 10. PDTC123JQB-Q: DC current gain as a function of collector current; typical values

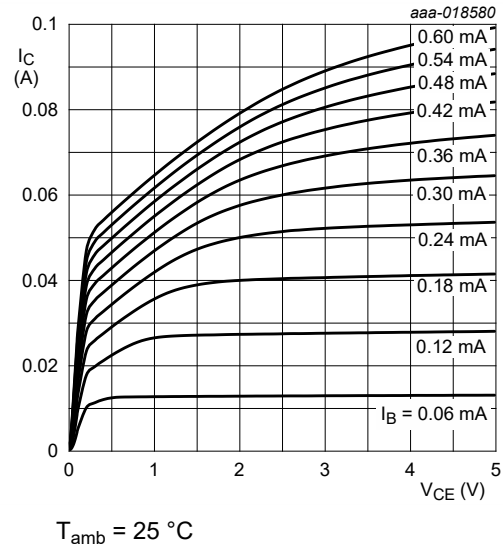


Fig. 11. PDTC123JQB-Q: Collector current as a function of collector-emitter voltage; typical values

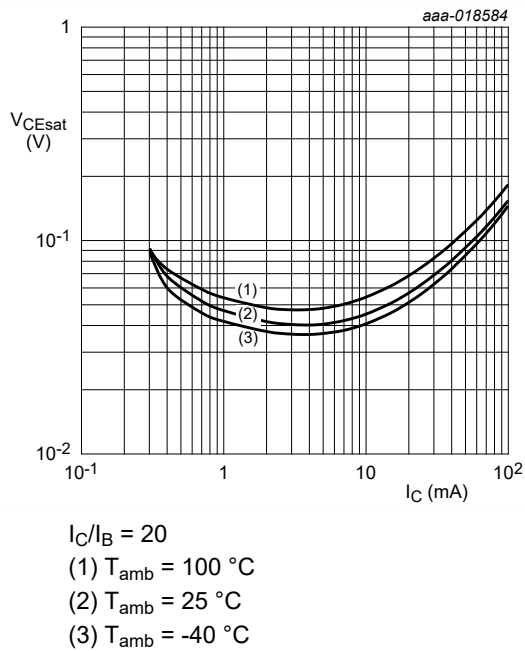


Fig. 12. PDTC123JQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values

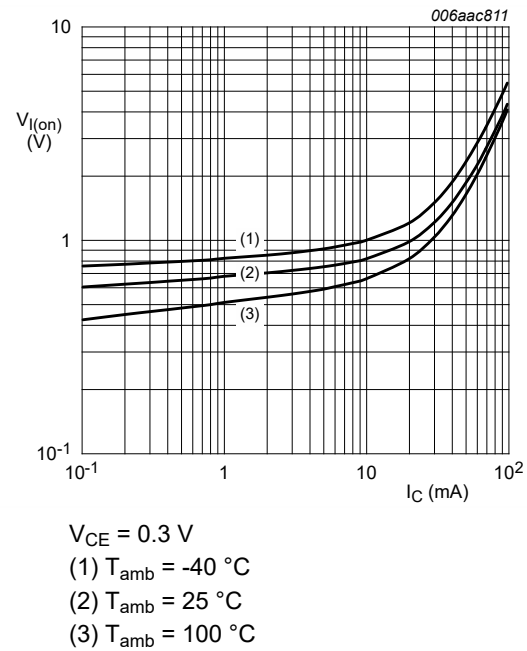


Fig. 13. PDTC123JQB-Q: On-state input voltage as a function of collector current; typical values

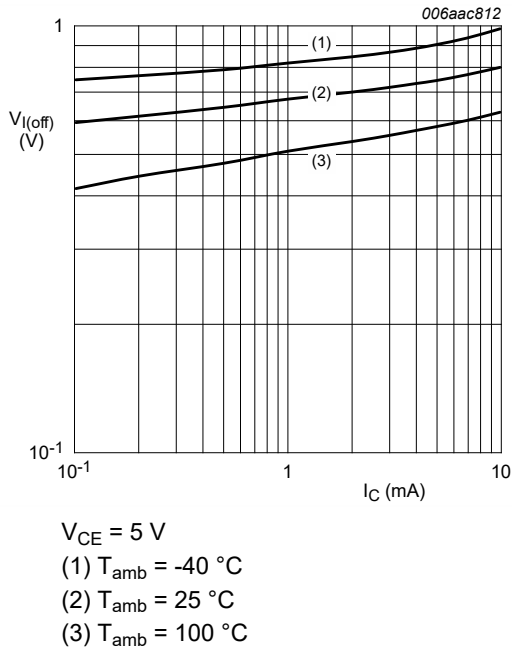


Fig. 14. PDTC123JQB-Q: Off-state input voltage as a function of collector current; typical values

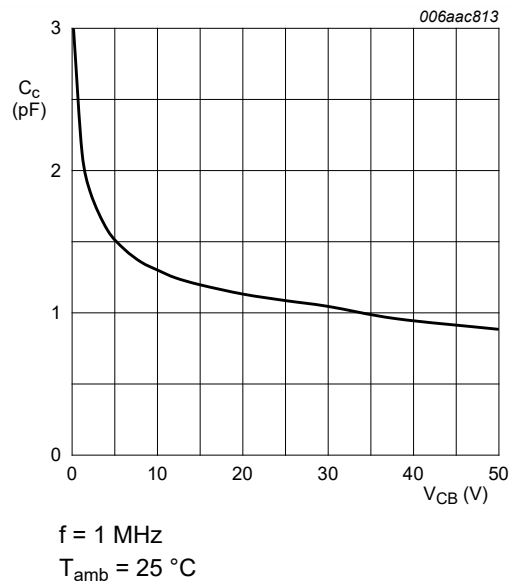


Fig. 15. PDTC123JQB-Q: Collector capacitance as a function of collector-base voltage; typical values

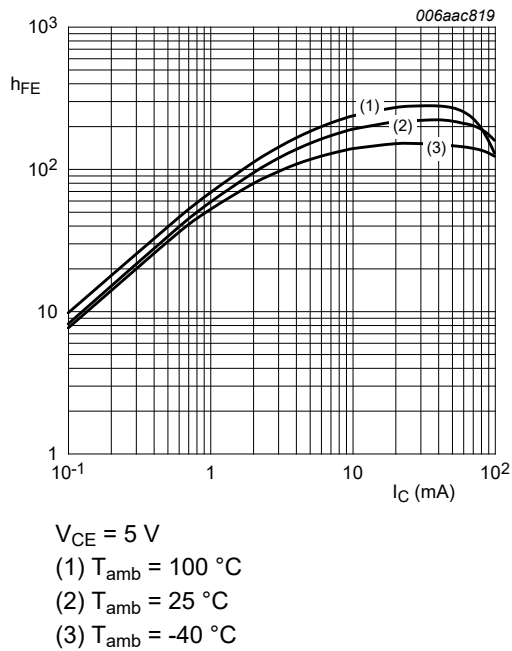


Fig. 16. PDTC143ZQB-Q: DC current gain as a function of collector current; typical values

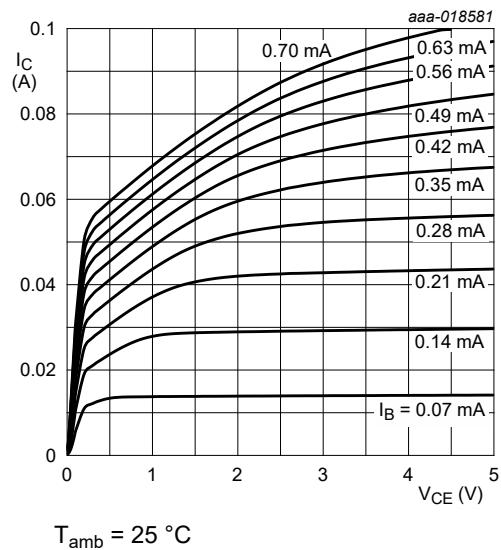
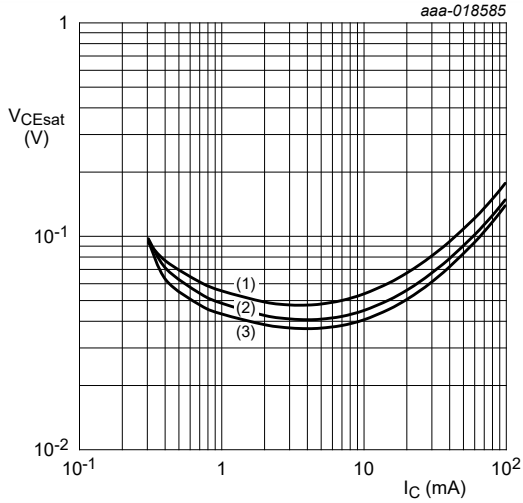


Fig. 17. PDTC143ZQB-Q: Collector current as a function of collector-emitter voltage; typical values

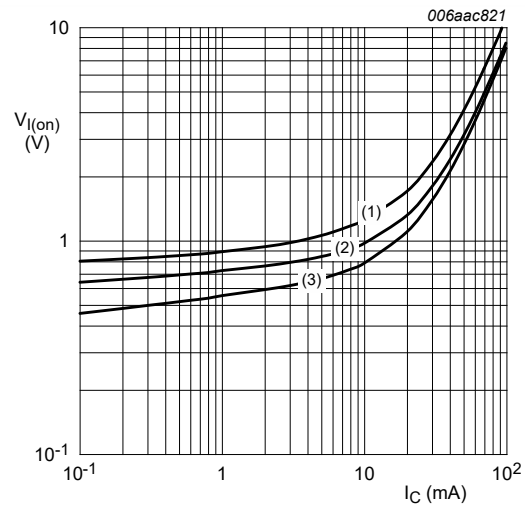
50 V, 100 mA NPN resistor-equipped transistors



$I_C/I_B = 20$

- (1) $T_{amb} = 100\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = -40\text{ °C}$

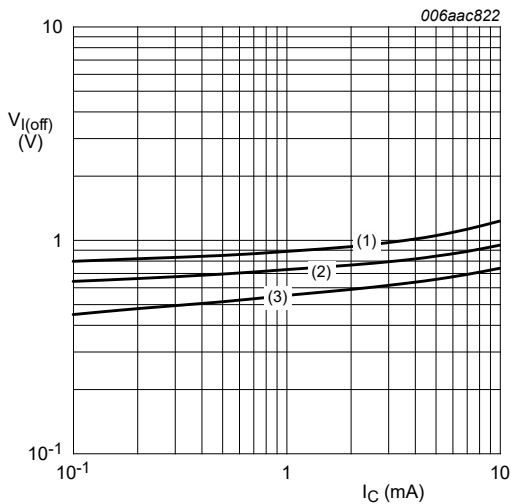
Fig. 18. PDTC143ZQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



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

- (1) $T_{amb} = -40\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = 100\text{ °C}$

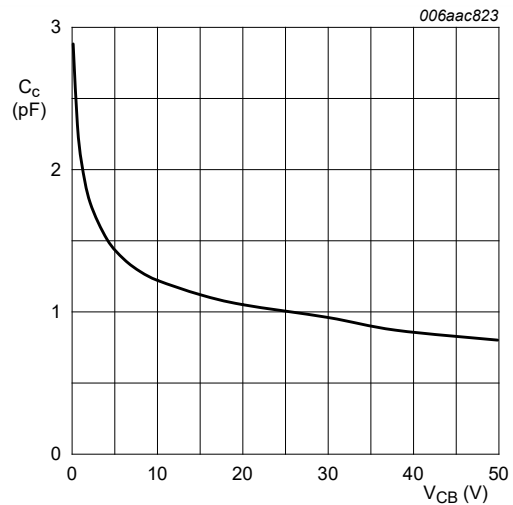
Fig. 19. PDTC143ZQB-Q: On-state input voltage as a function of collector current; typical values



$V_{CE} = 5\text{ V}$

- (1) $T_{amb} = -40\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = 100\text{ °C}$

Fig. 20. PDTC143ZQB-Q: Off-state input voltage as a function of collector current; typical values



$f = 1\text{ MHz}$

$T_{amb} = 25\text{ °C}$

Fig. 21. PDTC143ZQB-Q: Collector capacitance as a function of collector-base voltage; typical values

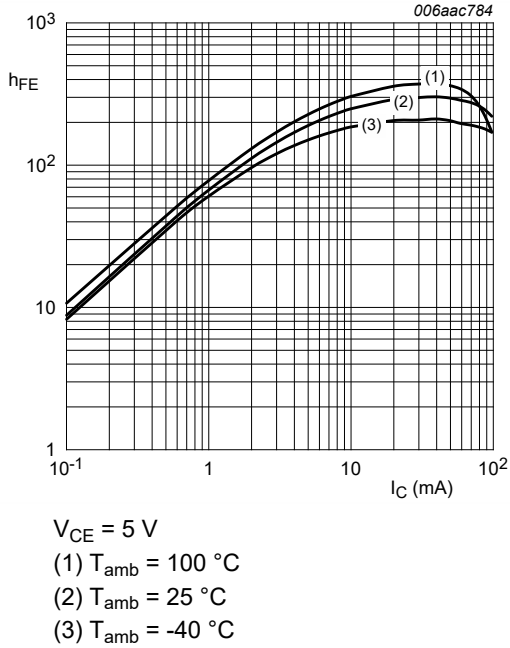


Fig. 22. PDTC114YQB-Q: DC current gain as a function of collector current; typical values

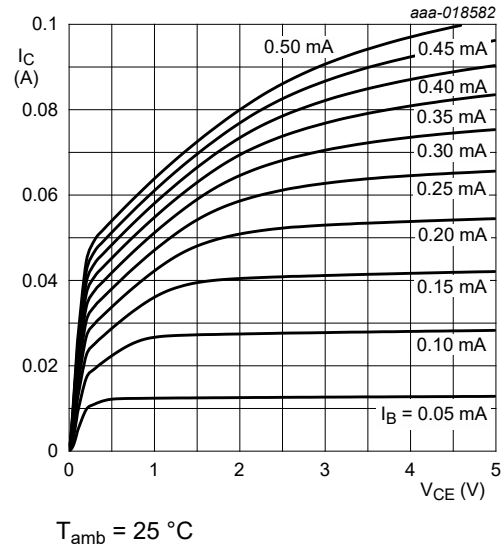


Fig. 23. PDTC114YQB-Q: Collector current as a function of collector-emitter voltage; typical values

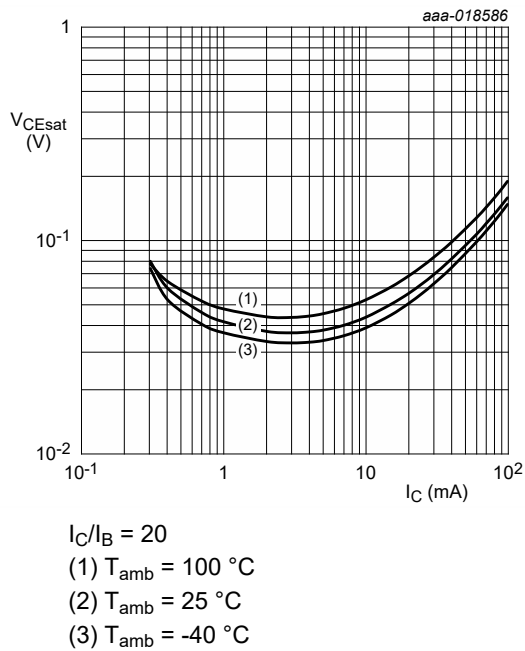


Fig. 24. PDTC114YQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values

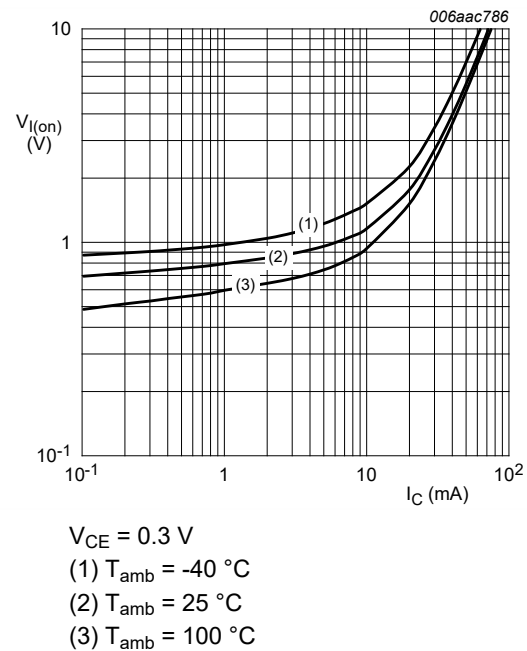


Fig. 25. PDTC114YQB-Q: On-state input voltage as a function of collector current; typical values

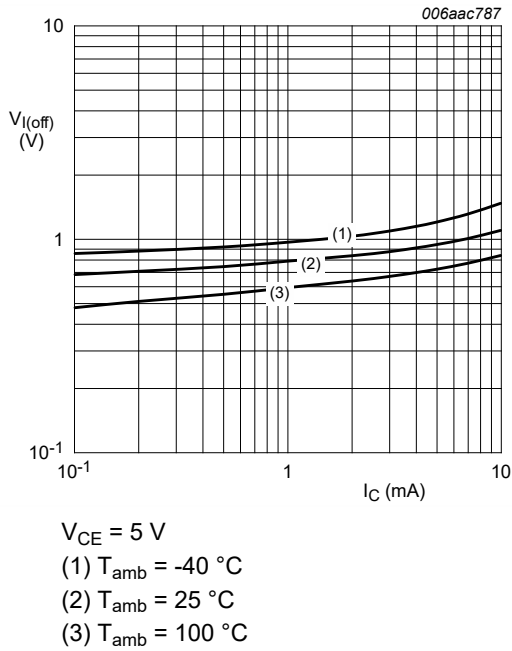


Fig. 26. PDTC114YQB-Q: Off-state input voltage as a function of collector current; typical values

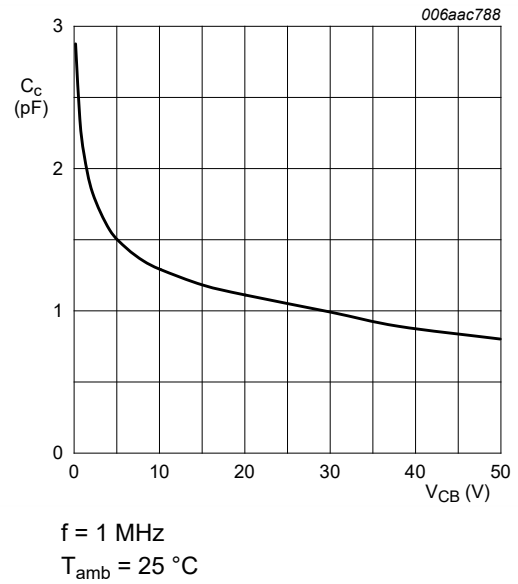


Fig. 27. PDTC114YQB-Q: Collector capacitance as a function of collector-base voltage; typical values

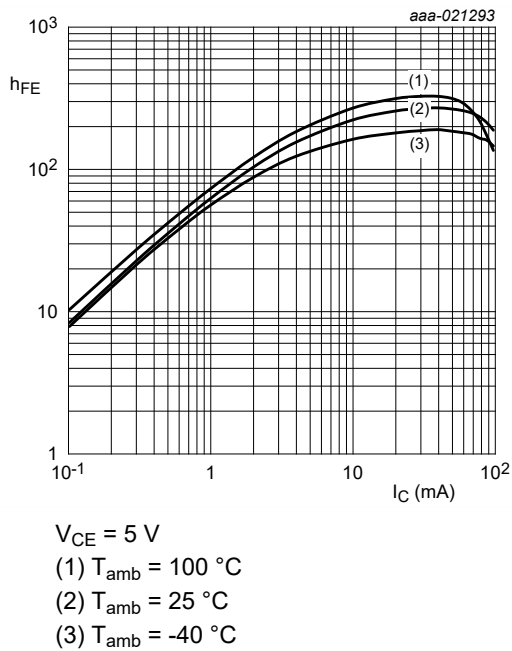


Fig. 28. PDTC124XQB-Q: DC current gain as a function of collector current; typical values

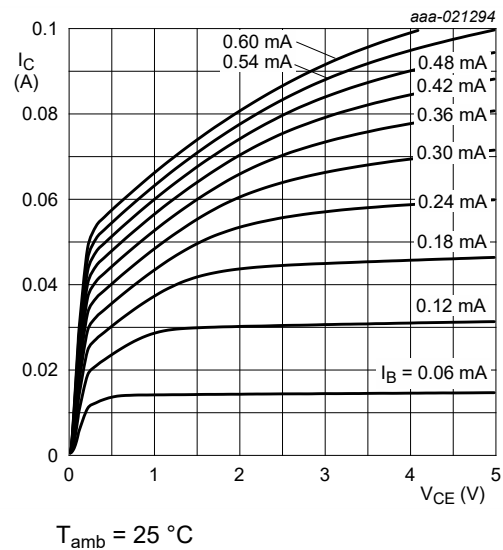
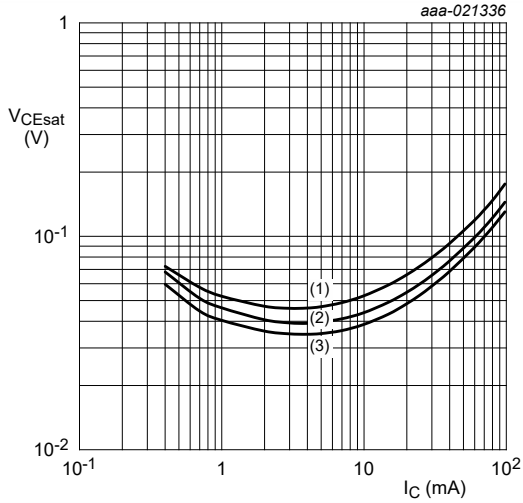


Fig. 29. PDTC124XQB-Q: Collector current as a function of collector-emitter voltage; typical values

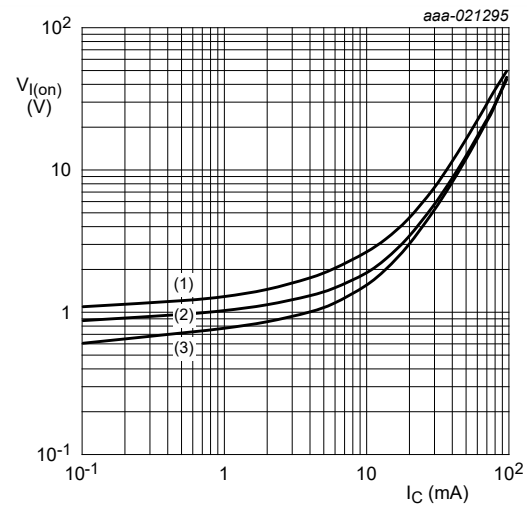
50 V, 100 mA NPN resistor-equipped transistors



$I_C/I_B = 20$

- (1) $T_{amb} = 100\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = -40\text{ °C}$

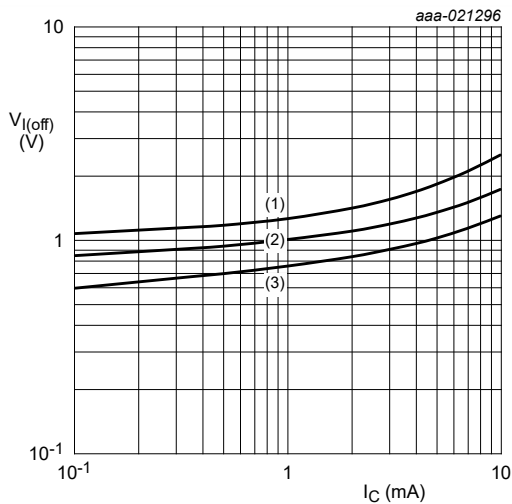
Fig. 30. PDTC124XQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



$V_{CE} = 0.5\text{ V}$

- (1) $T_{amb} = -40\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = 100\text{ °C}$

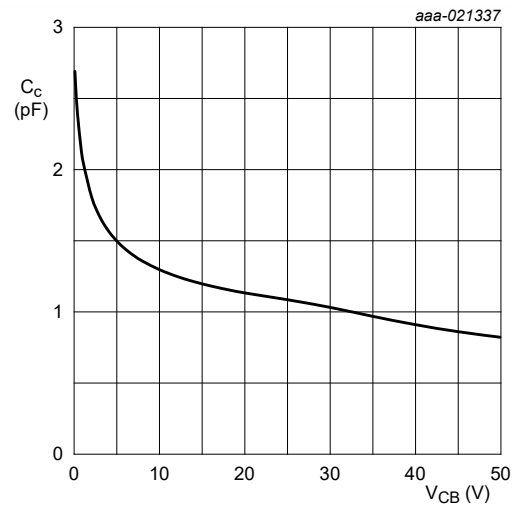
Fig. 31. PDTC124XQB-Q: On-state input voltage as a function of collector current; typical values



$V_{CE} = 5\text{ V}$

- (1) $T_{amb} = -40\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = 100\text{ °C}$

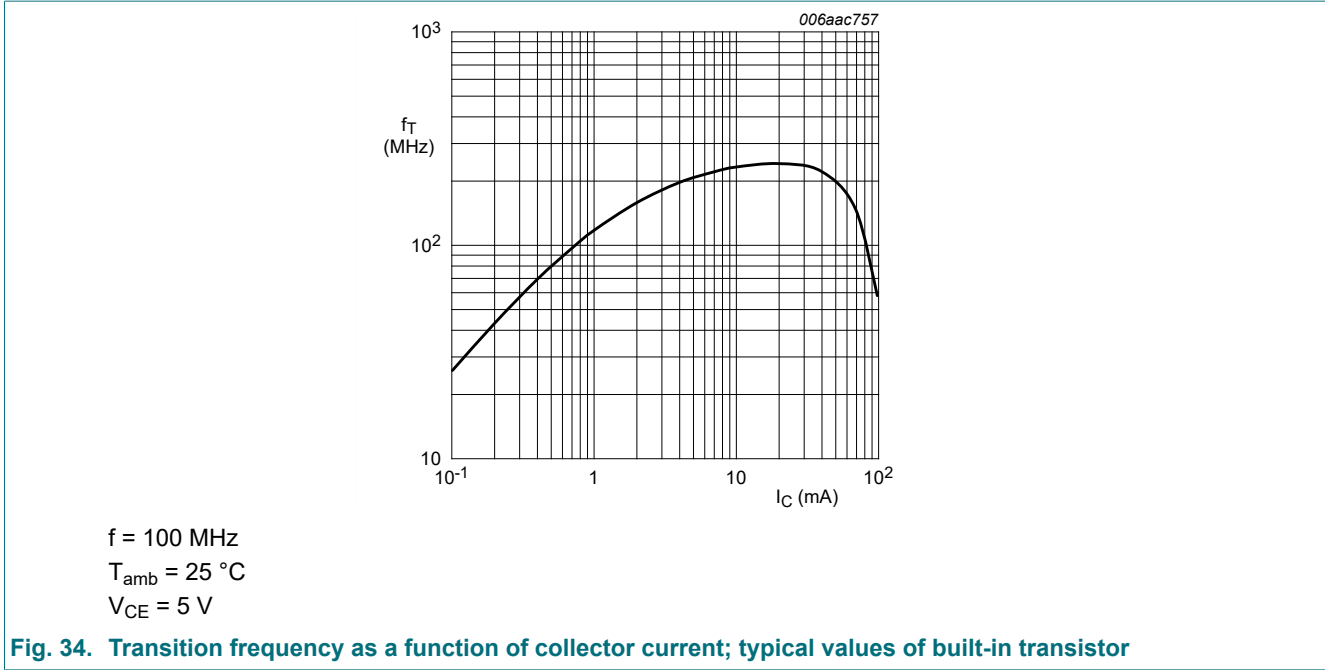
Fig. 32. PDTC124XQB-Q: Off-state input voltage as a function of collector current; typical values



$f = 1\text{ MHz}$
 $T_{amb} = 25\text{ °C}$

Fig. 33. PDTC124XQB-Q: Collector capacitance as a function of collector-base voltage; typical values

50 V, 100 mA NPN resistor-equipped transistors



11. Test information

Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R1 = \frac{V(I12) - V(I11)}{I12 - I11}$$

- Calculation of bias resistor ratio (R2/R1)

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

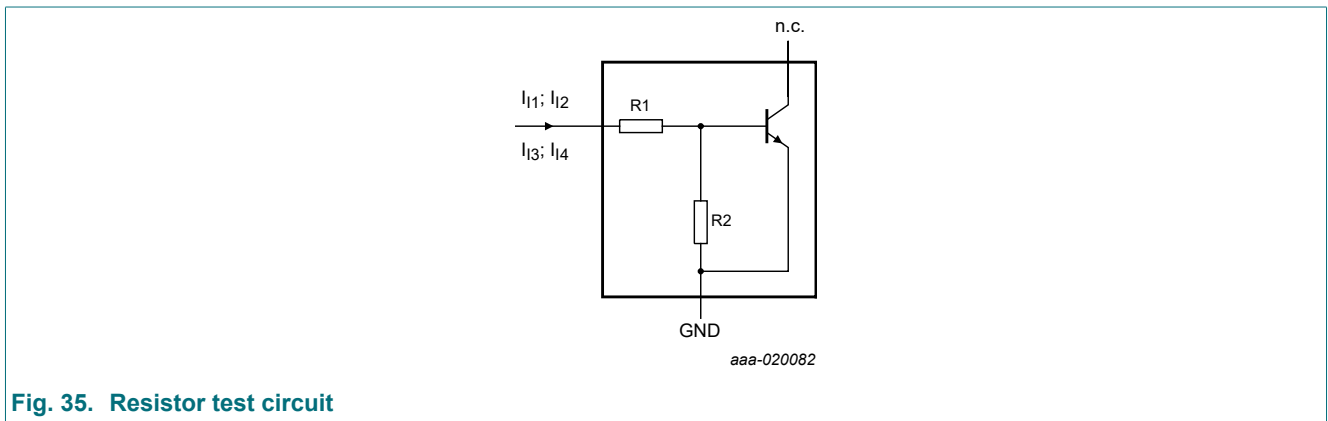


Fig. 35. Resistor test circuit

Resistor test conditions

Table 9. Resistor test conditions

| Type number | R1 (kΩ) | R2 (kΩ) | Test conditions | | | |
|--------------|---------|---------|-----------------|-----------------|-----------------|-----------------|
| | | | I ₁₁ | I ₁₂ | I ₁₃ | I ₁₄ |
| PDTC143XQB-Q | 4.7 | 10 | 350 μA | 450 μA | -350 μA | -450 μA |
| PDTC123JQB-Q | 2.2 | 47 | 90 μA | 140 μA | -55 μA | -105 μA |
| PDTC143ZQB-Q | 4.7 | 47 | 90 μA | 140 μA | -55 μA | -105 μA |
| PDTC114YQB-Q | 10 | 47 | 90 μA | 140 μA | -55 μA | -105 μA |
| PDTC124XQB-Q | 22 | 47 | 55 μA | 105 μA | -55 μA | -105 μA |

11.1. 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.

12. Package outline

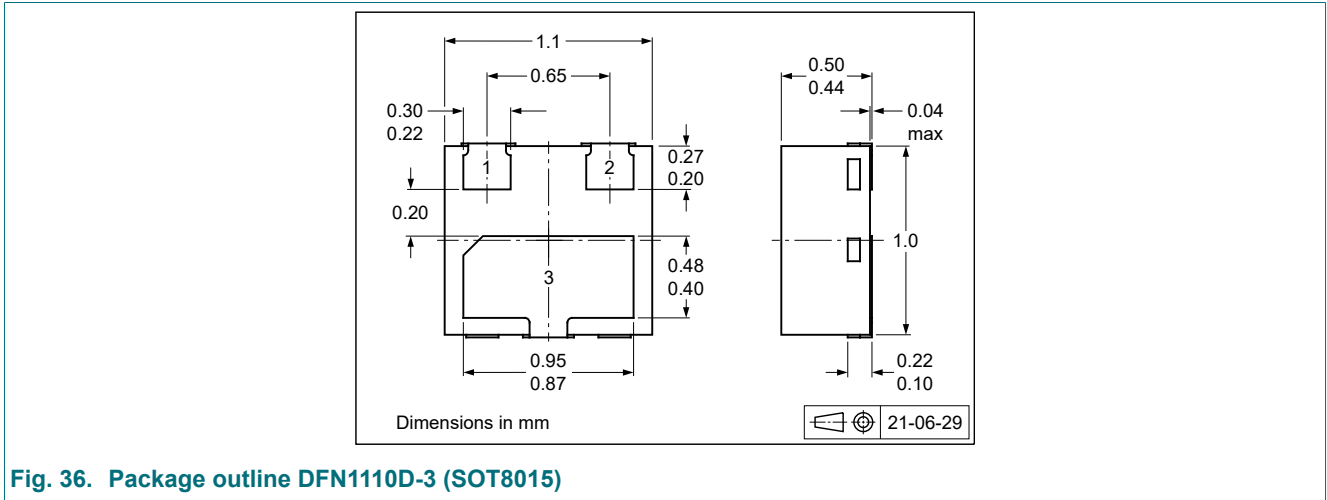


Fig. 36. Package outline DFN1110D-3 (SOT8015)

13. Soldering

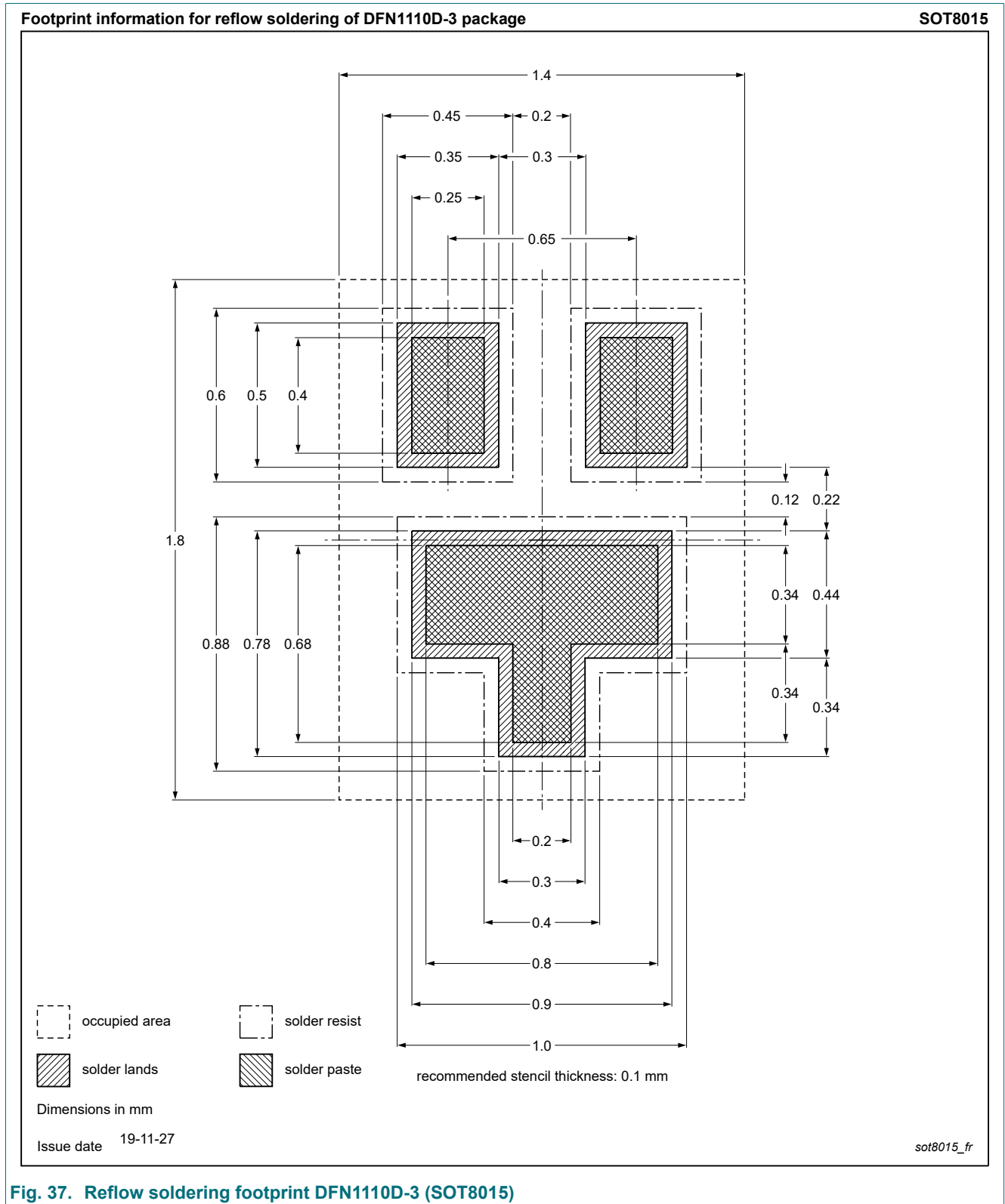


Fig. 37. Reflow soldering footprint DFN1110D-3 (SOT8015)

14. Revision history

Table 10. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------------------|--------------|--------------------|---------------|------------|
| PDTC143X_TO_124XQB-Q_SER v.1 | 20211001 | 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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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