



PDTD1xxxT series

500 mA, 50 V NPN resistor-equipped transistors

Rev. 1 — 15 May 2014

Product data sheet

1. Product profile

1.1 General description

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

Table 1. Product overview

| Type number | Package | | | PNP complement | Package configuration |
|-------------|----------|-------|----------|----------------|-----------------------|
| | Nexperia | JEITA | JEDEC | | |
| PDTD143ET | SOT23 | - | TO-236AB | PDTB143ET | small |
| PDTD143XT | | | | PDTB143XT | |
| PDTD114ET | | | | PDTB114ET | |

1.2 Features

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

1.3 Applications

- IC inputs control
- Cost-saving alternative to BC807 or BC817 series transistors in digital applications
- Switching loads


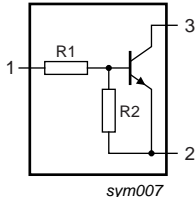
1.4 Quick reference data

Table 2. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|--------------------------------|------------|-----|-----|-----|------------|
| V_{CE0} | collector-emitter voltage | open base | - | - | 50 | V |
| I_O | output current | | - | - | 500 | mA |
| R1 | bias resistor 1 (input) | | | | | |
| | PDTD143ET | | | 4.7 | | k Ω |
| | PDTD143XT | | | 4.7 | | k Ω |
| | PDTD114ET | | | 10 | | k Ω |
| R2 | bias resistor 2 (base-emitter) | | | | | |
| | PDTD143ET | | | 4.7 | | k Ω |
| | PDTD143XT | | | 10 | | k Ω |
| | PDTD114ET | | | 10 | | k Ω |

2. Pinning information

Table 3. Pinning

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

3. Ordering information

Table 4. Ordering information

| Type number | Package | | Version |
|------------------|----------|--|---------|
| | Name | Description | |
| PDTD1xxxT series | TO-236AB | plastic surface-mounted package; 3 leads | SOT23 |

4. Marking

Table 5. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PDTD143ET | *4Z |
| PDTD143XT | *5Z |
| PDTD114ET | *10 |

[1] * = placeholder for manufacturing site code

5. Limiting values

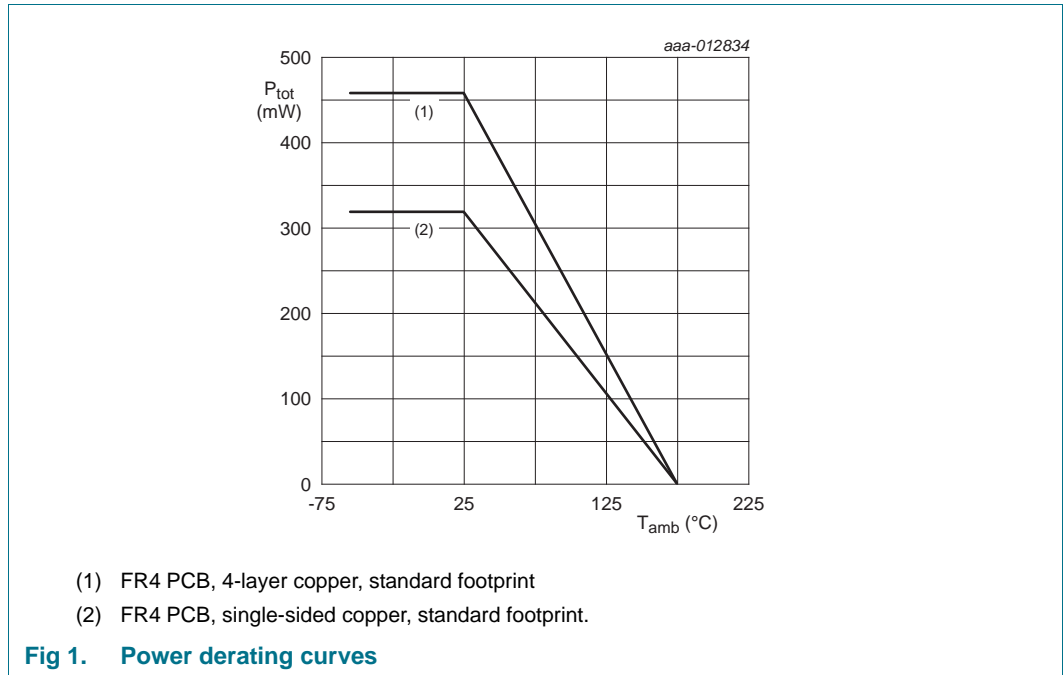
Table 6. Limiting values

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 | | | |
| | PDTD143ET | | - | 10 | V |
| | PDTD143XT | | - | 7 | V |
| | PDTD114ET | | - | 10 | V |
| V_I | input voltage | | | | |
| | PDTD143ET | | -10 | +30 | V |
| | PDTD143XT | | -7 | +30 | V |
| | PDTD114ET | | -10 | +50 | V |
| I_O | output current | | - | 500 | mA |
| P_{tot} | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | | | |
| | | [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 copper, tin-plated and standard footprint.

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



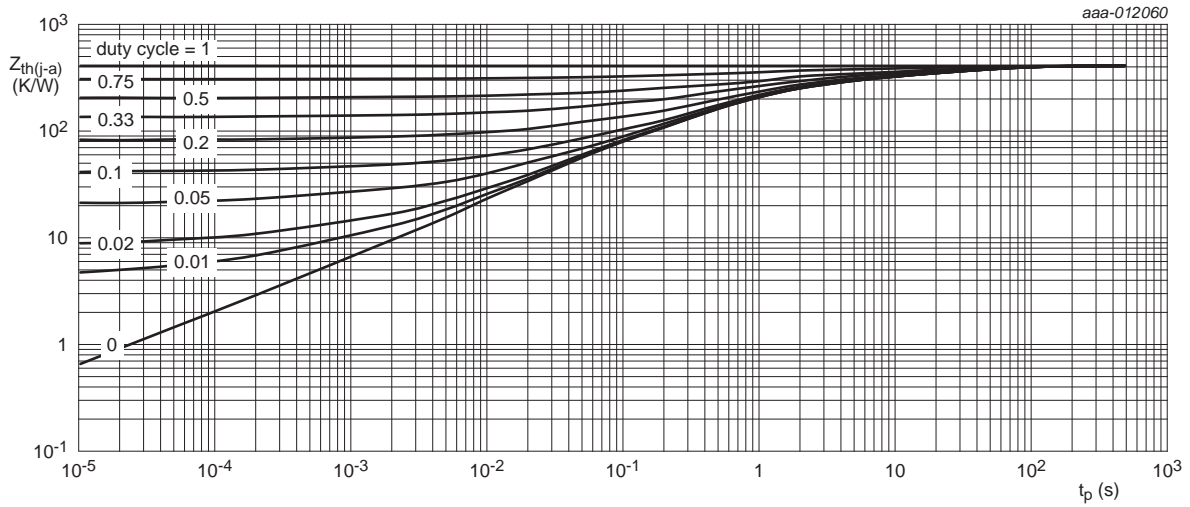
6. Thermal characteristics

Table 7. 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 |

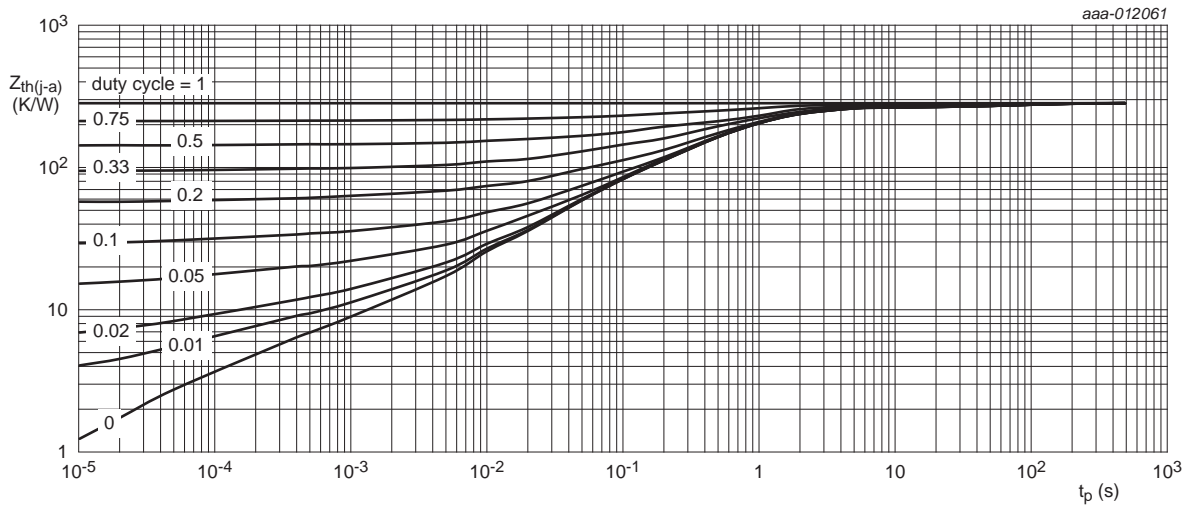
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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



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

Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT23/TO-236AB; typical values



FR4 PCB, 4-layer copper, tin-plated and standard footprint.

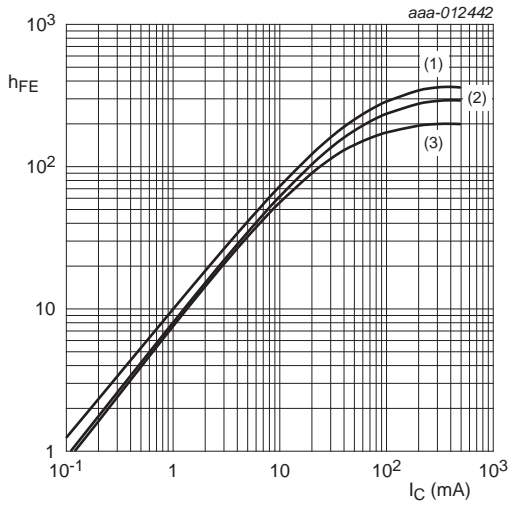
Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT23/TO-236AB; typical values

7. Characteristics

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

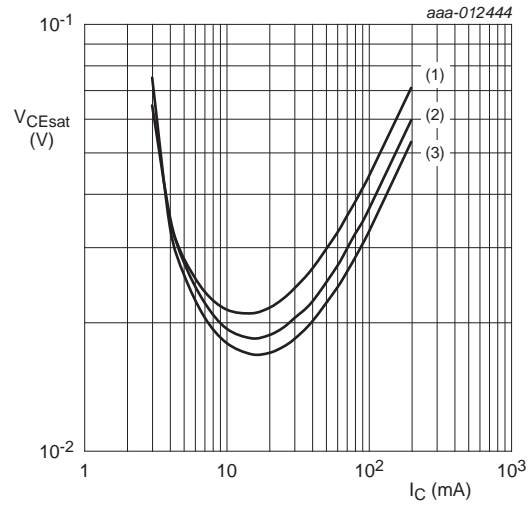
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------|--------------------------------------|---|------|------|------|------------------|
| I_{CBO} | collector-base cut-off current | $V_{CB} = 40\text{ V}; I_E = 0\text{ A}$ | - | - | 100 | nA |
| | | $V_{CB} = 50\text{ V}; I_E = 0\text{ A}$ | - | - | 100 | nA |
| I_{CEO} | collector-emitter cut-off current | $V_{CE} = 50\text{ V}; I_B = 0\text{ A}$ | - | - | 0.5 | μA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$ | | | | |
| | PDTD143ET | | - | - | 0.9 | mA |
| | PDTD143XT | | - | - | 0.6 | mA |
| | PDTD114ET | | - | - | 0.4 | mA |
| h_{FE} | DC current gain | $V_{CE} = 5\text{ V}; I_C = 50\text{ mA}$ | | | | |
| | PDTD143ET | | 60 | - | - | |
| | PDTD143XT | | 70 | - | - | |
| | PDTD114ET | | 70 | - | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 50\text{ mA}; I_B = 2.5\text{ mA}$ | - | - | 100 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}$ | | | | |
| | PDTD143ET | | 0.6 | 0.9 | 1.5 | V |
| | PDTD143XT | | 0.5 | 0.75 | 1.1 | V |
| | PDTD114ET | | 0.6 | 1.0 | 1.5 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE} = 0.3\text{ V}; I_C = 20\text{ mA}$ | | | | |
| | PDTD143ET | | 1.0 | 1.6 | 2.2 | V |
| | PDTD143XT | | 1.0 | 1.25 | 2.0 | V |
| | PDTD114ET | | 1.0 | 1.9 | 3.0 | V |
| R1 | bias resistor 1 (input) | | | | | |
| | PDTD143ET | | 3.3 | 4.7 | 6.1 | $\text{k}\Omega$ |
| | PDTD143XT | | 3.3 | 4.7 | 6.1 | $\text{k}\Omega$ |
| | PDTD114ET | | 7.0 | 10 | 13 | $\text{k}\Omega$ |
| R2/R1 | bias resistor ratio | | | | | |
| | PDTD143ET | | 0.9 | 1 | 1.1 | |
| | PDTD143XT | | 1.91 | 2.13 | 2.34 | |
| | PDTD114ET | | 0.9 | 1.0 | 1.1 | |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}; I_E = I_e = 0\text{ A};$ $f = 1\text{ MHz}$ | - | 7 | - | pF |
| f_T | transition frequency | $V_{CE} = 5\text{ V}; I_C = 50\text{ mA};$ $f = 100\text{ MHz}$ | [1] | 225 | - | MHz |

[1] Characteristics of built-in transistor.



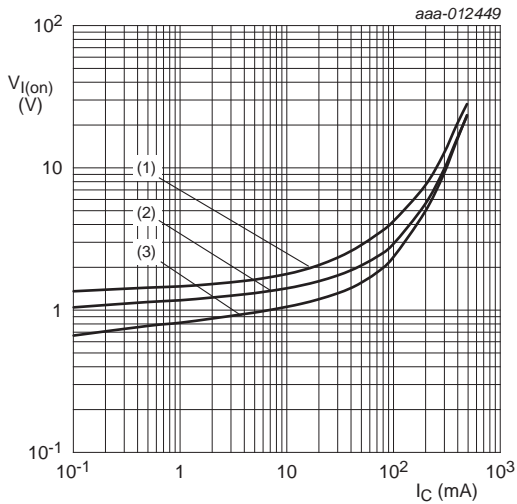
$V_{CE} = 5 \text{ V}$
 (1) $T_{amb} = 100 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = -40 \text{ }^\circ\text{C}$

Fig 4. PDTD143ET: DC current gain as a function of collector current; typical values



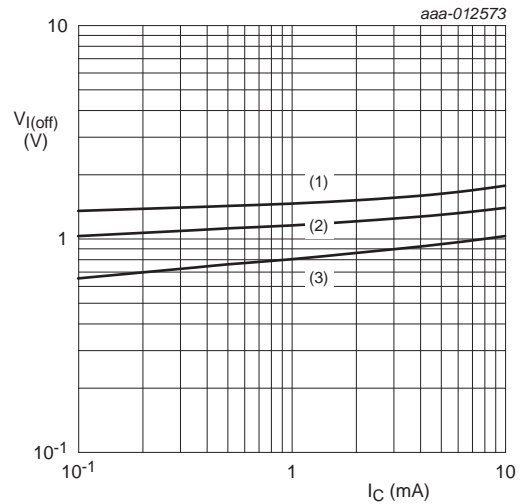
$I_C/I_B = 20$
 (1) $T_{amb} = 100 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = -40 \text{ }^\circ\text{C}$

Fig 5. PDTD143ET: Collector-emitter saturation voltage as a function of collector current; typical values



$V_{CE} = 0.3 \text{ V}$
 (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 6. PDTD143ET: 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 7. PDTD143ET: Off-state input voltage as a function of collector current; typical values

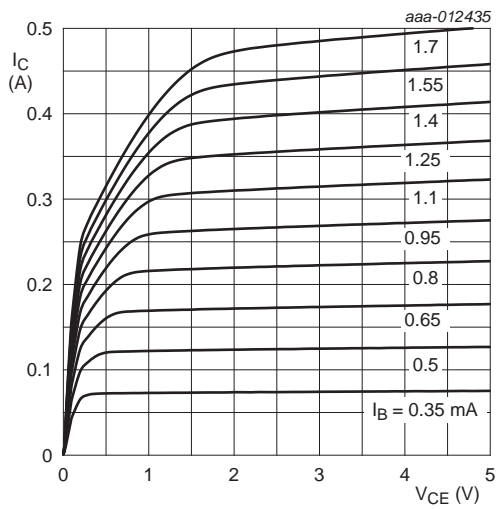


Fig 8. PDTD143ET: Collector current as a function of collector-emitter voltage; typical values

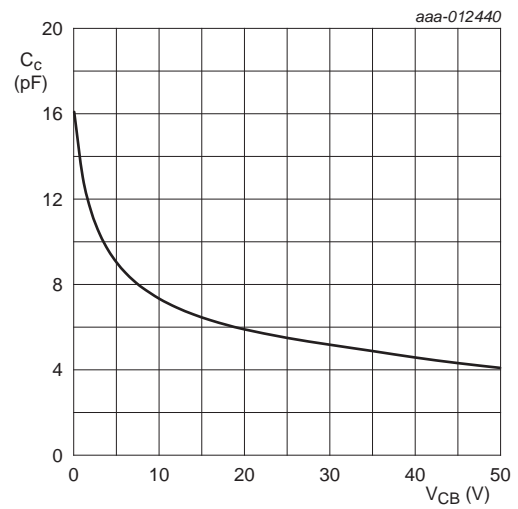
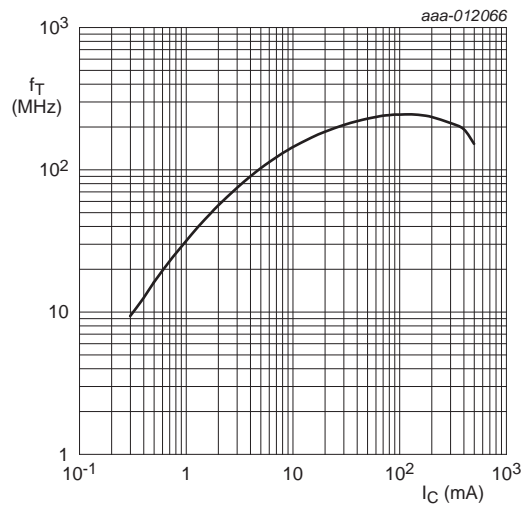
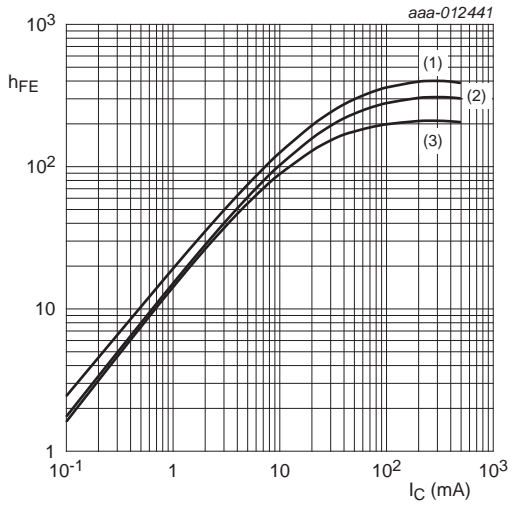


Fig 9. PDTD143ET: Collector capacitance as a function of collector-base voltage; typical values



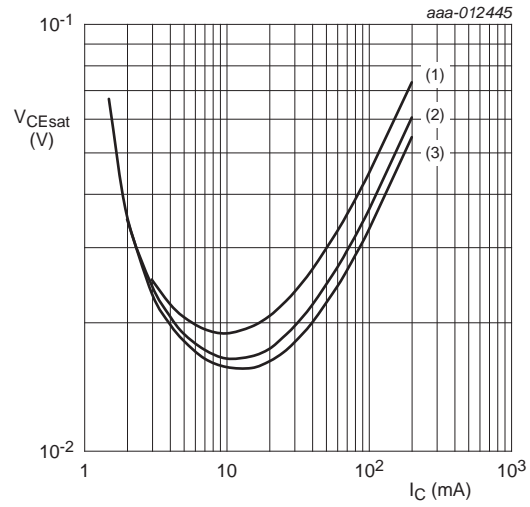
$V_{CE} = 5\text{ V}; T_{amb} = 25^\circ\text{C}$

Fig 10. PDTD143ET: Transition frequency as a function of collector current; typical values of built-in transistor



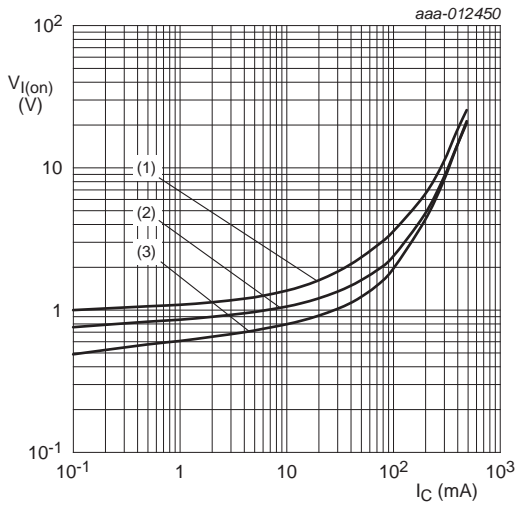
$V_{CE} = 5 \text{ V}$
 (1) $T_{amb} = 100 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = -40 \text{ }^\circ\text{C}$

Fig 11. PDTD143XT: DC current gain as a function of collector current; typical values



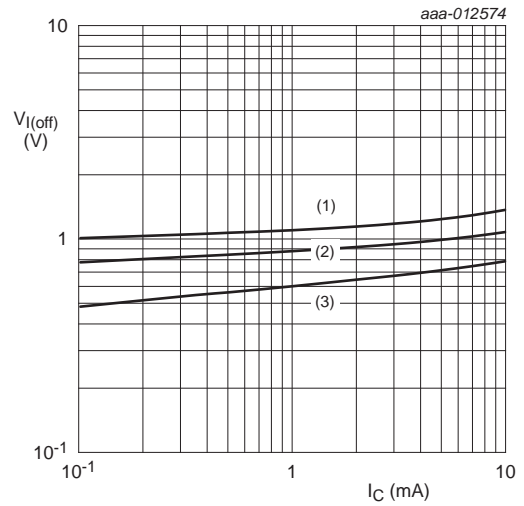
$I_C/I_B = 20$
 (1) $T_{amb} = 100 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = -40 \text{ }^\circ\text{C}$

Fig 12. PDTD143XT: Collector-emitter saturation voltage as a function of collector current; typical values



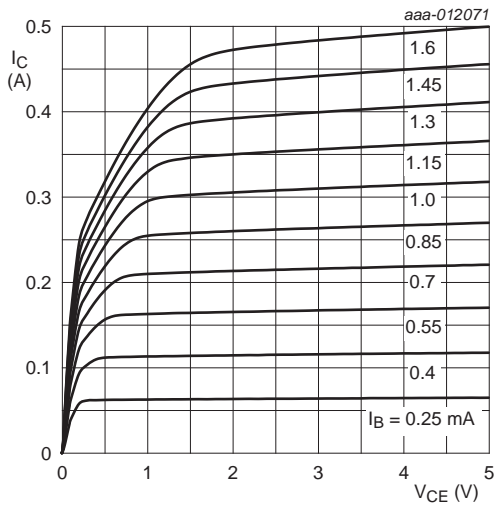
$V_{CE} = 0.3 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig 13. PDTD143XT: On-state input voltage as a function of collector current; typical values



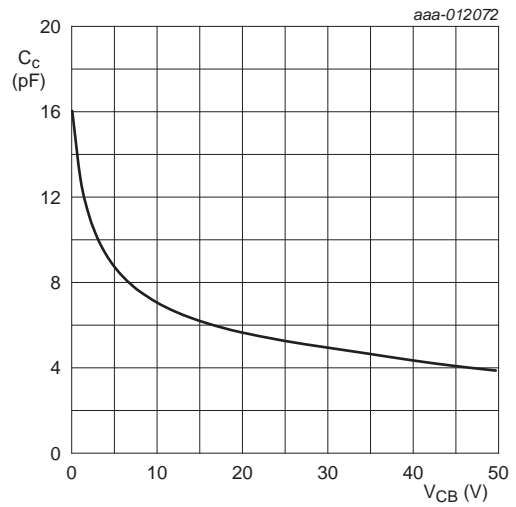
$V_{CE} = 5 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig 14. PDTD143XT: Off-state input voltage as a function of collector current; typical values



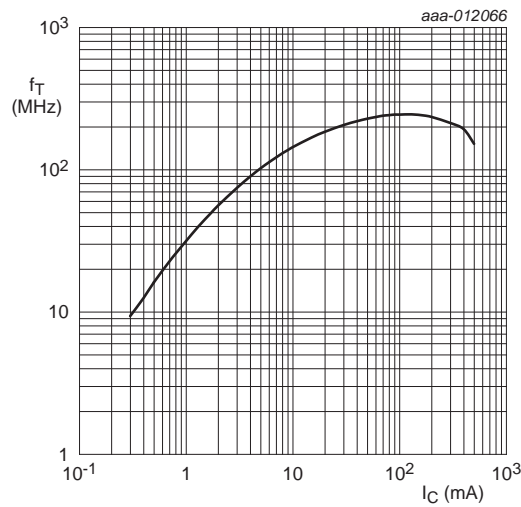
$T_{amb} = 25\text{ }^\circ\text{C}$

Fig 15. PDTD143XT: Collector current as a function of collector-emitter voltage; typical values



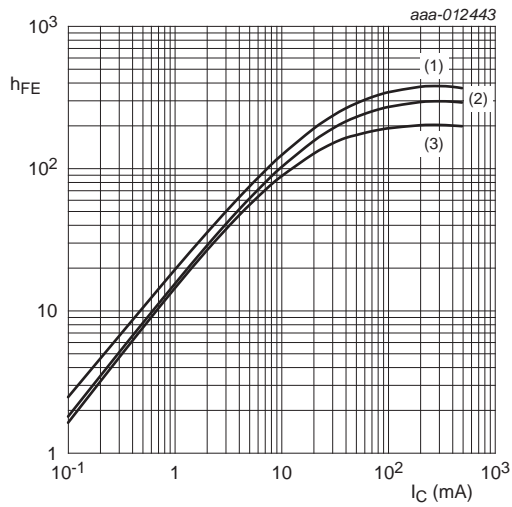
$f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$

Fig 16. PDTD143XT: Collector capacitance as a function of collector-base voltage; typical values



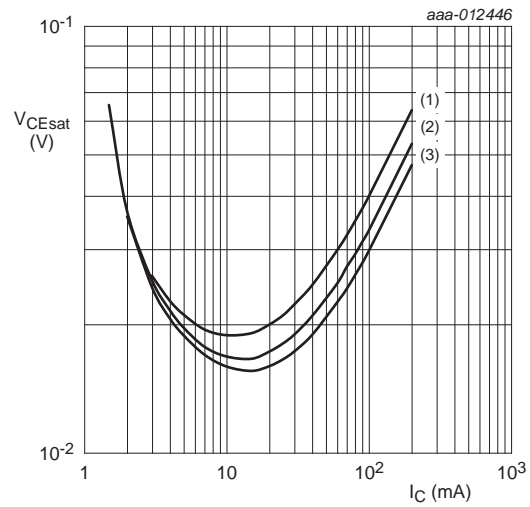
$V_{CE} = 5\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$

Fig 17. PDTD143XT: Transition frequency as a function of collector current; typical values of built-in transistor



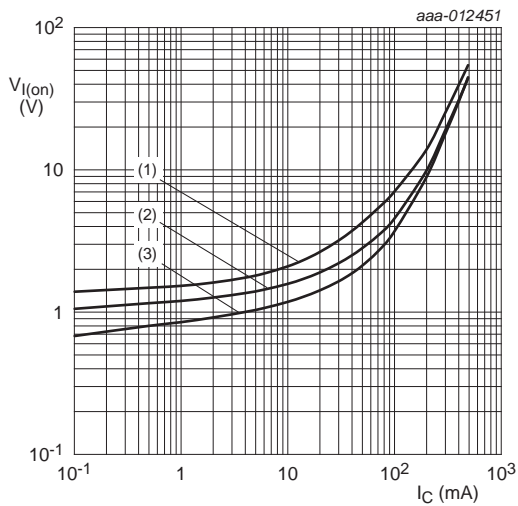
$V_{CE} = 5 \text{ V}$
 (1) $T_{amb} = 100 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = -40 \text{ }^\circ\text{C}$

Fig 18. PDTD114ET: DC current gain as a function of collector current; typical values



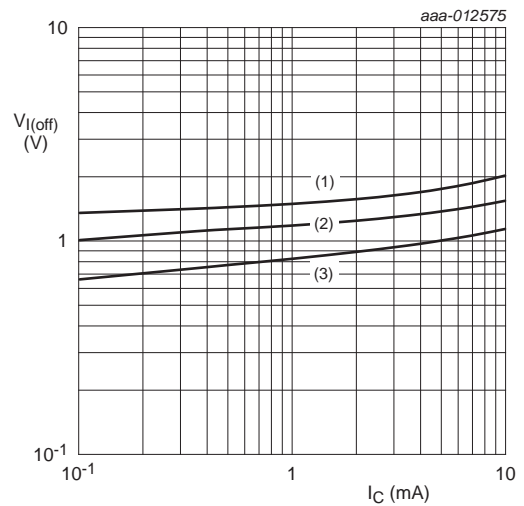
$I_C/I_B = 20$
 (1) $T_{amb} = 100 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = -40 \text{ }^\circ\text{C}$

Fig 19. PDTD114ET: Collector-emitter saturation voltage as a function of collector current; typical values



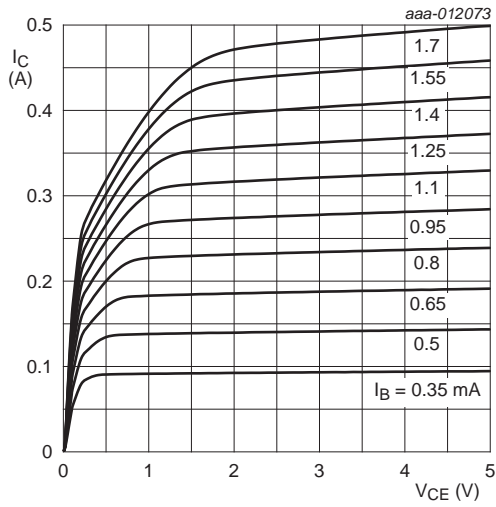
$V_{CE} = 0.3 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig 20. PDTD114ET: On-state input voltage as a function of collector current; typical values



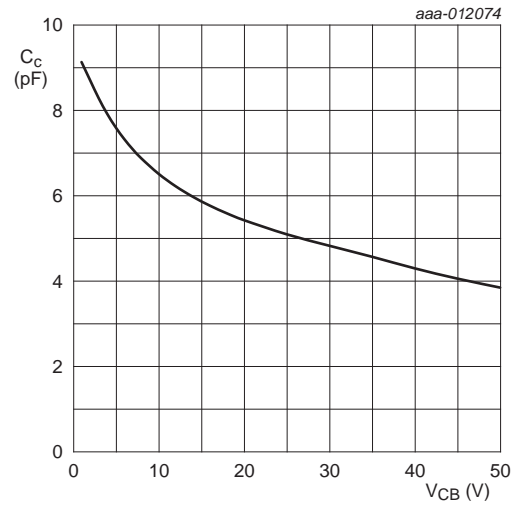
$V_{CE} = 5 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig 21. PDTD114ET: Off-state input voltage as a function of collector current; typical values



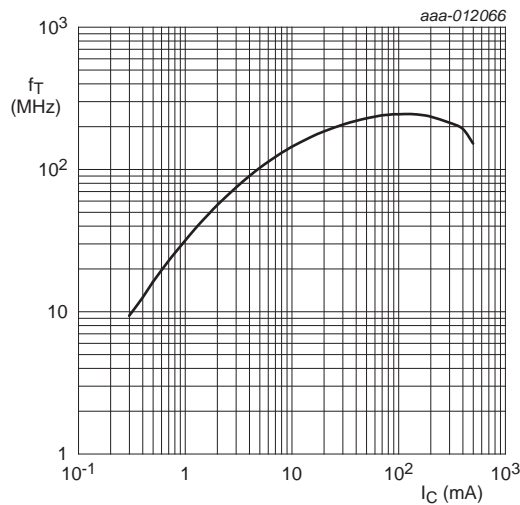
$T_{amb} = 25\text{ }^\circ\text{C}$

Fig 22. PDTD114ET: Collector current as a function of collector-emitter voltage; typical values



$f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$

Fig 23. PDTD114ET: Collector capacitance as a function of collector-base voltage; typical values



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

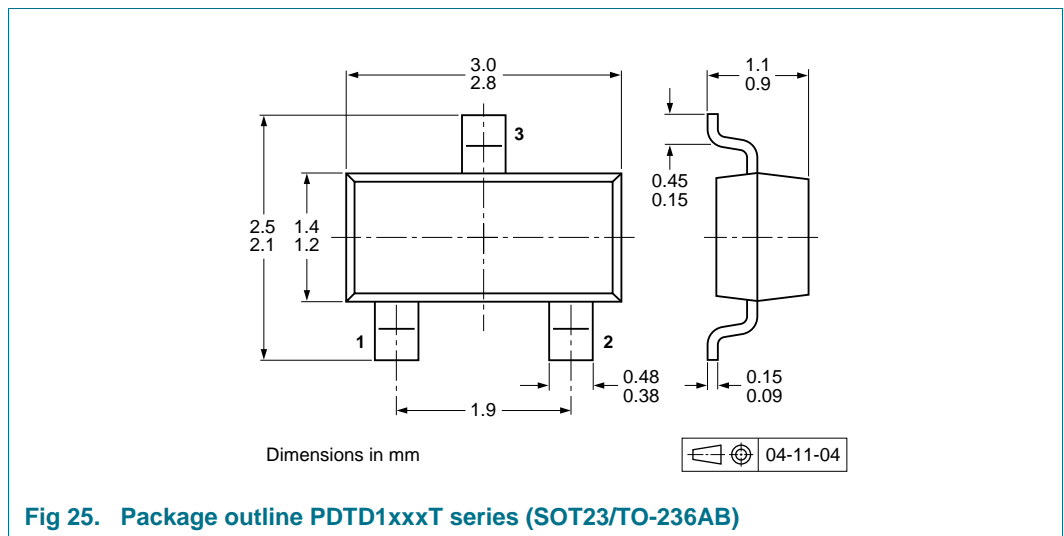
Fig 24. PDTD114ET: Transition frequency as a function of collector current; typical values of built-in transistor

8. Test information

8.1 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.

9. Package outline



10. Soldering

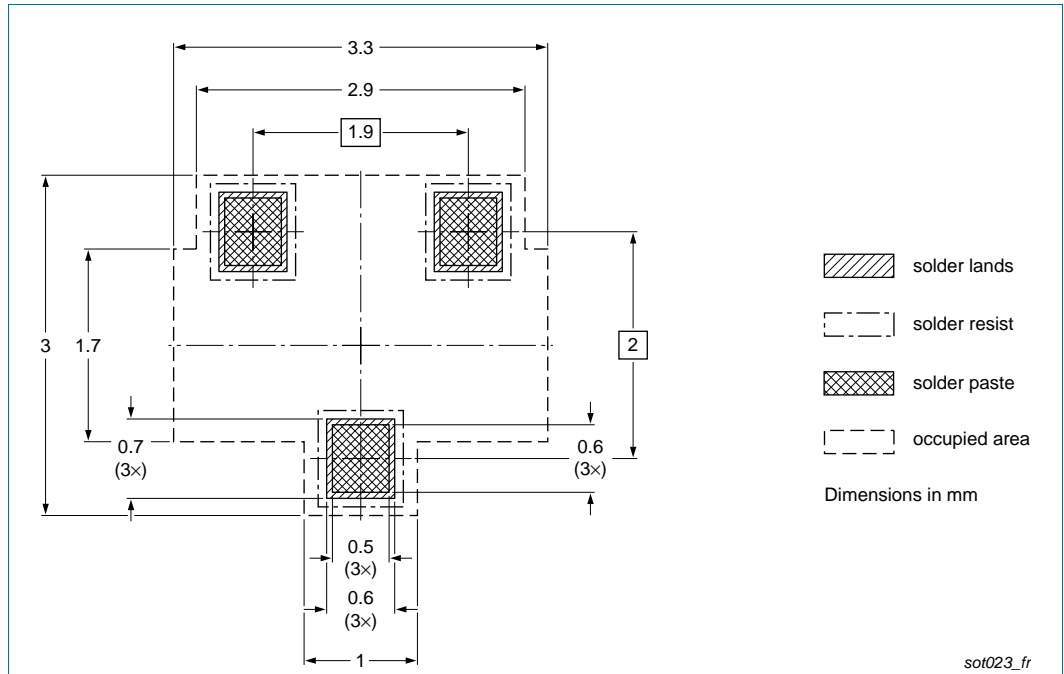


Fig 26. Reflow soldering footprint PDTD1xxxT series (SOT23/TO-236AB)

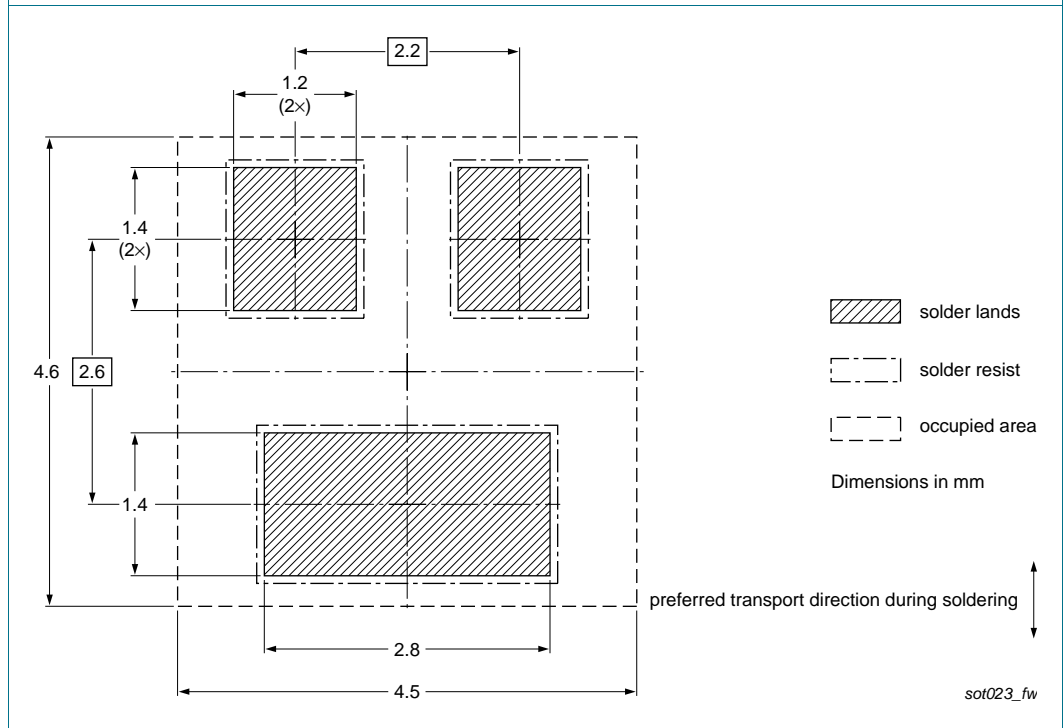


Fig 27. Wave soldering footprint PDTD1xxxT series (SOT23/TO-236AB)

11. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|--------------|--------------------|---------------|------------|
| PDTD1XXXT_SER v.1 | 20140515 | Product data sheet | - | - |

12. Legal information

12.1 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 URL <http://www.nexperia.com>.

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13. Contact information

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For sales office addresses, please send an email to: salesaddresses@nexperia.com

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Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.