# 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
- ± 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

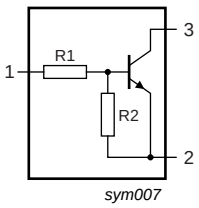
### 1.4 Quick reference data

**Table 2. Quick reference data**

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

## 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 | | |
|---|---|---|---|
| | Name | Description | Version |
| 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

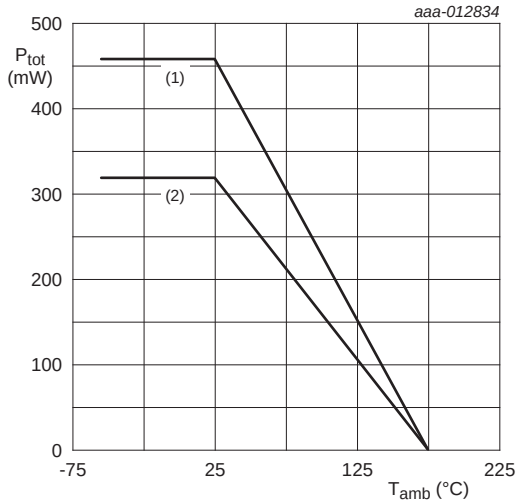
**Table 6. Limiting values**

*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 | $T_{amb} \leq 25$ °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.




(1) FR4 PCB, 4-layer copper, standard footprint

(2) FR4 PCB, single-sided copper, standard footprint.

**Fig 1. Power derating curves**

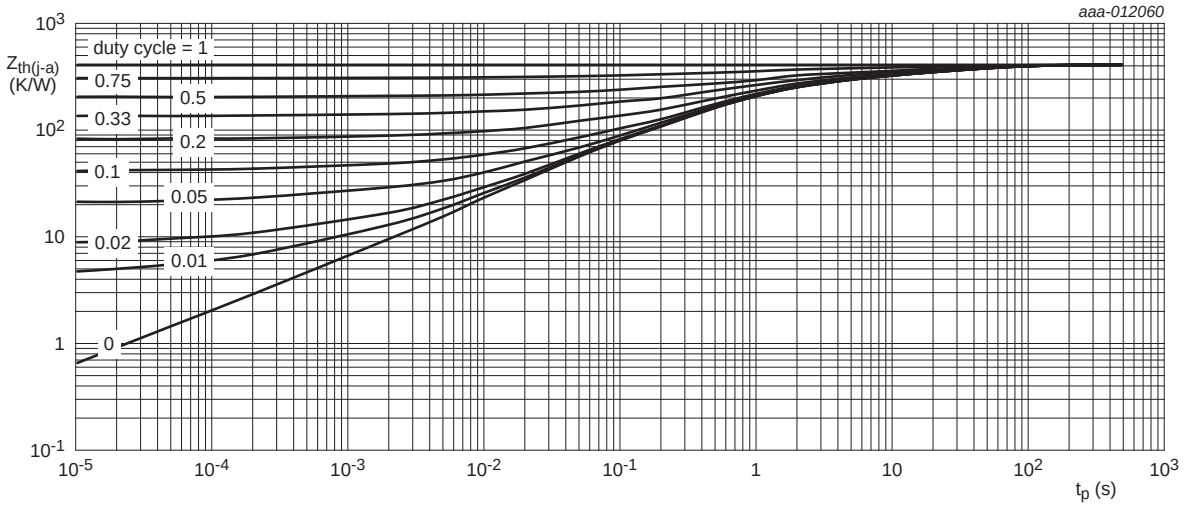
## 6. Thermal characteristics

**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 |

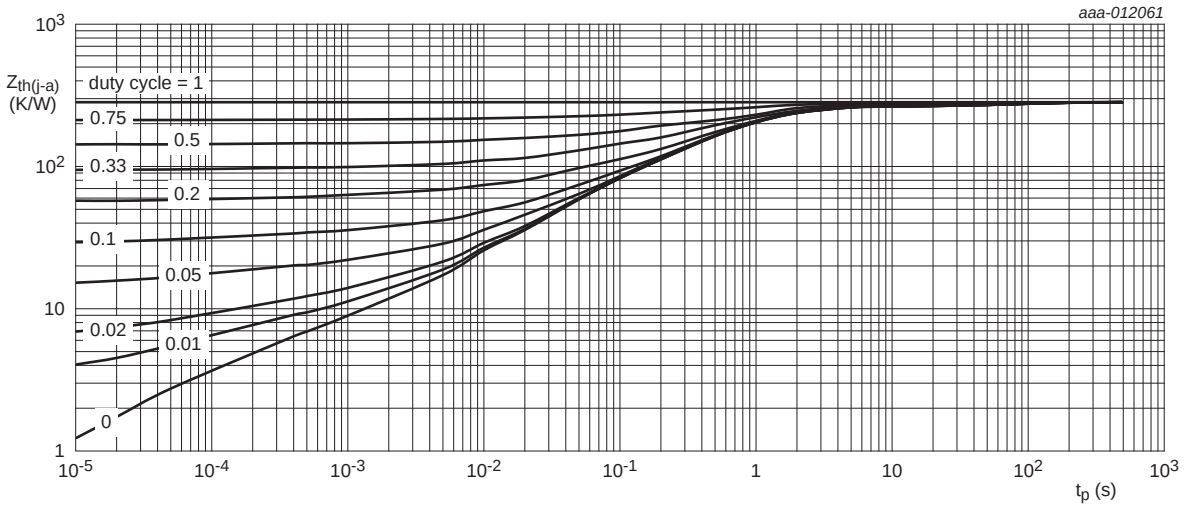
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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**

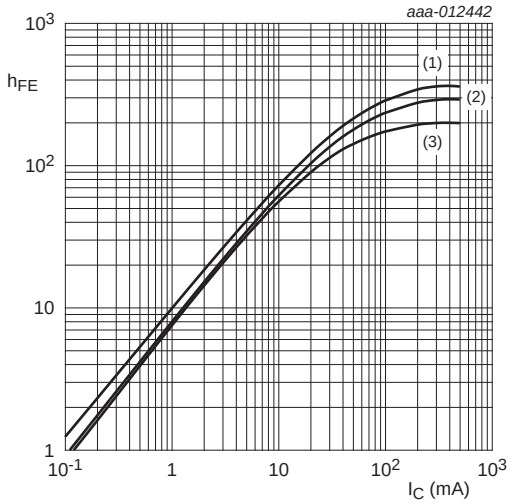
# 7. Characteristics

**Table 8. Characteristics**

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = 40 V; $I_E$ = 0 A | - | - | 100 | nA |
| | | $V_{CB}$ = 50 V; $I_E$ = 0 A | - | - | 100 | nA |
| $I_{CEO}$ | collector-emitter cut-off current | $V_{CE}$ = 50 V; $I_B$ = 0 A | - | - | 0.5 | µA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = 5 V; $I_C$ = 0 A | | | | |
| | PDTD143ET | | - | - | 0.9 | mA |
| | PDTD143XT | | - | - | 0.6 | mA |
| | PDTD114ET | | - | - | 0.4 | mA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 50 mA | | | | |
| | PDTD143ET | | 60 | - | - | |
| | PDTD143XT | | 70 | - | - | |
| | PDTD114ET | | 70 | - | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 50 mA; $I_B$ = 2.5 mA | - | - | 100 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE}$ = 5 V; $I_C$ = 100 µA | | | | |
| | 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 V; $I_C$ = 20 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 | kΩ |
| | PDTD143XT | | 3.3 | 4.7 | 6.1 | kΩ |
| | PDTD114ET | | 7.0 | 10 | 13 | kΩ |
| 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 V; $I_E$ = $i_e$ = 0 A; f = 1 MHz | - | 7 | - | pF |
| $f_T$ | transition frequency | $V_{CE}$ = 5 V; $I_C$ = 50 mA; f = 100 MHz [1] | - | 225 | - | MHz |

[1] Characteristics of built-in transistor.



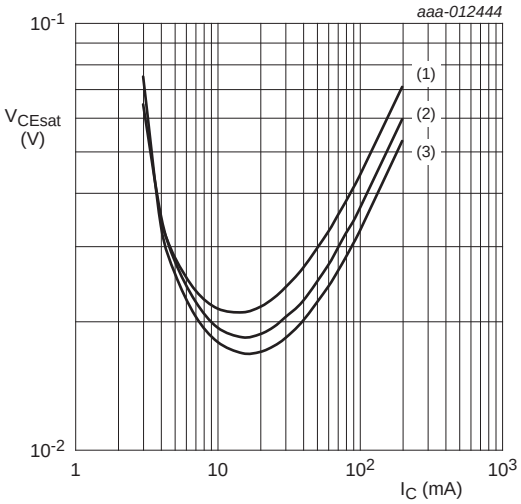

$V_{CE}$ = 5 V

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −40 °C

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



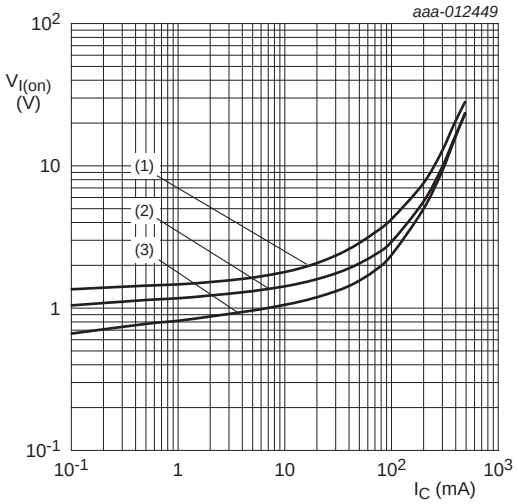

$I_C/I_B$ = 20

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −40 °C

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



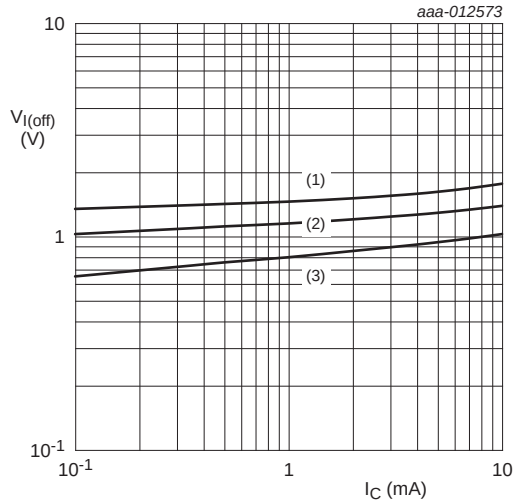

$V_{CE}$ = 0.3 V

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

**Fig 6. PDTD143ET: On-state input voltage as a function of collector current; typical values**



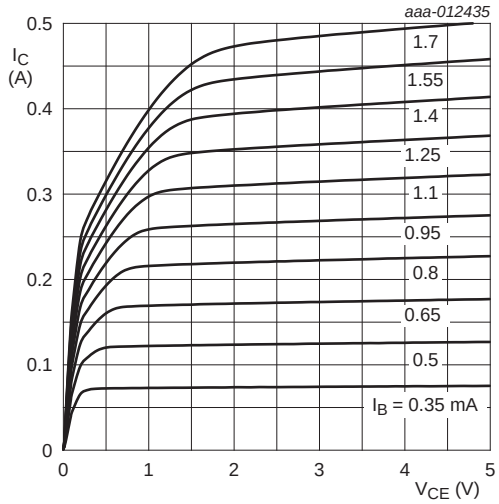

$V_{CE}$ = 5 V

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = 25 °C

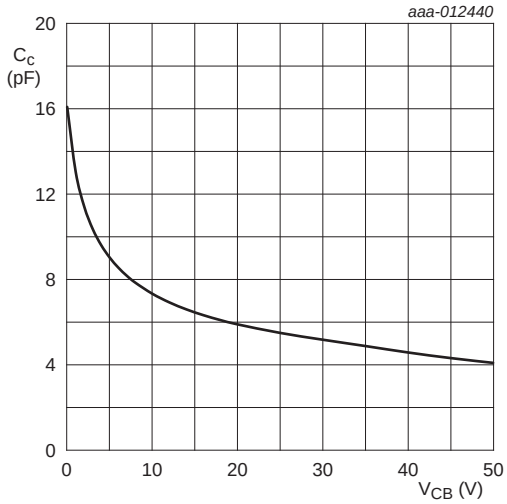
(3) $T_{amb}$ = 100 °C

**Fig 7. PDTD143ET: Off-state input voltage as a function of collector current; typical values**



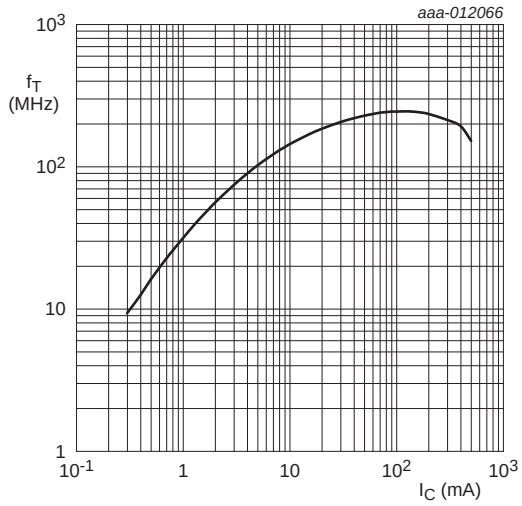

$T_{amb}$ = 25 °C

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



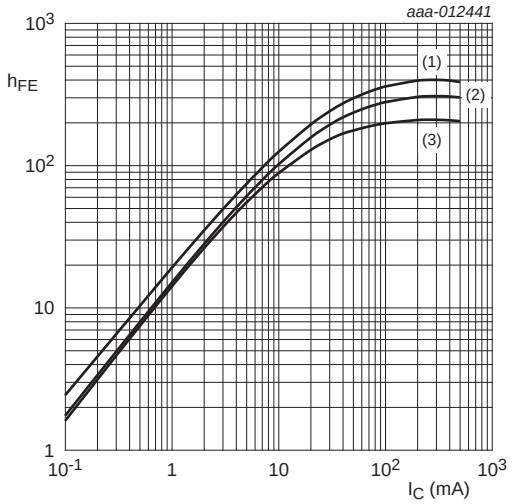

f = 1 MHz; $T_{amb}$ = 25 °C

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




$V_{CE}$ = 5 V; $T_{amb}$ = 25 °C

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



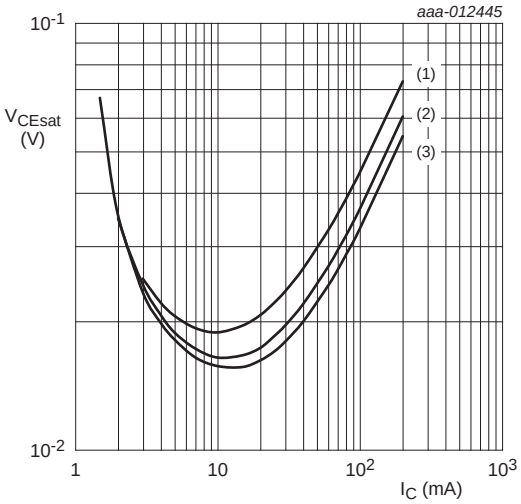

$V_{CE}$ = 5 V

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −40 °C

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



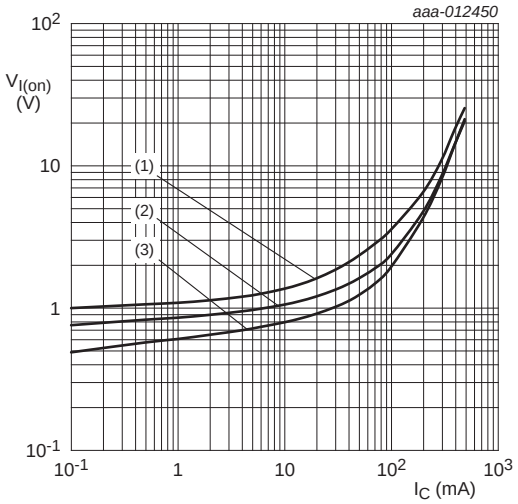

$I_C/I_B$ = 20

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −40 °C

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



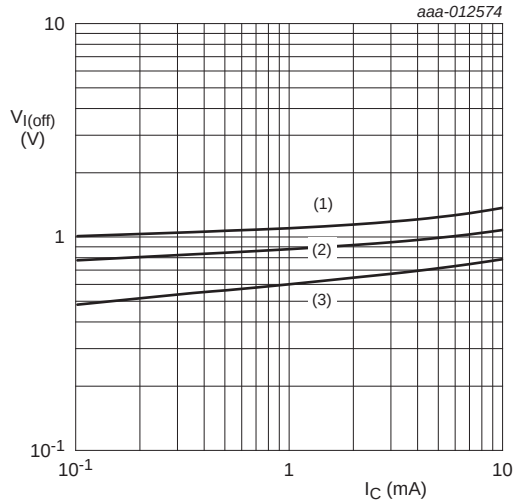

$V_{CE}$ = 0.3 V

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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



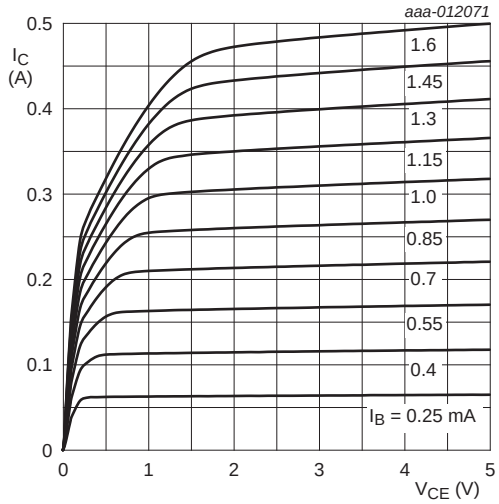

$V_{CE}$ = 5 V

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = 25 °C

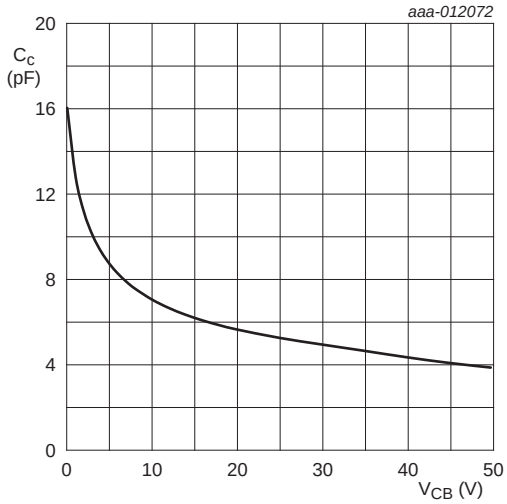
(3) $T_{amb}$ = 100 °C

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



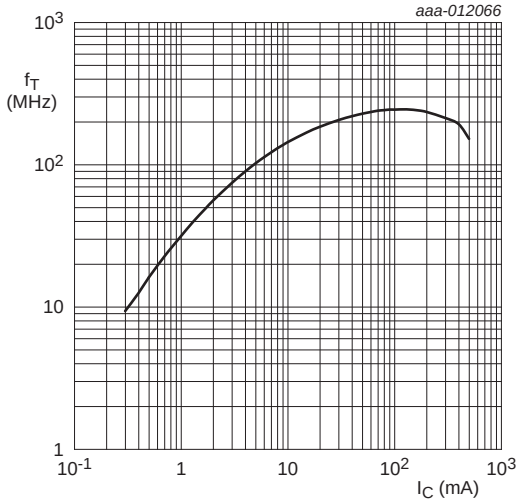

$T_{amb}$ = 25 °C

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



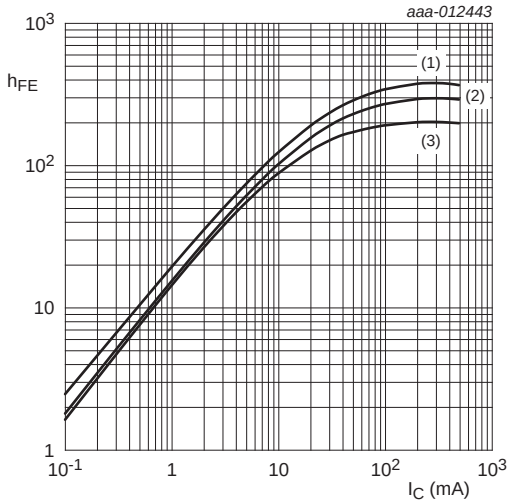

f = 1 MHz; $T_{amb}$ = 25 °C

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




$V_{CE}$ = 5 V; $T_{amb}$ = 25 °C

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



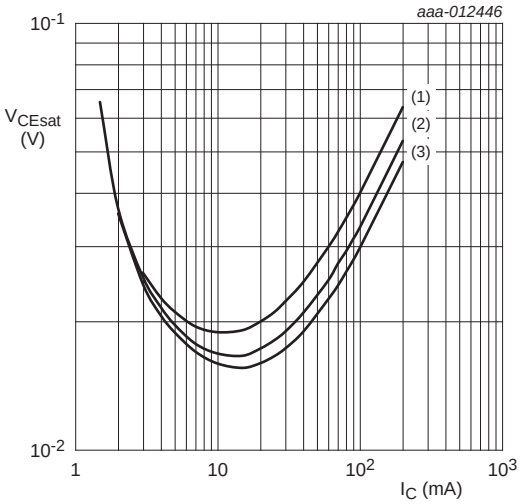

$V_{CE}$ = 5 V

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −40 °C

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



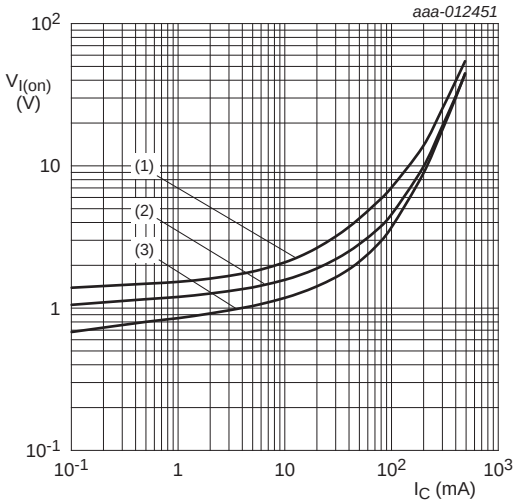

$I_C/I_B$ = 20

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −40 °C

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



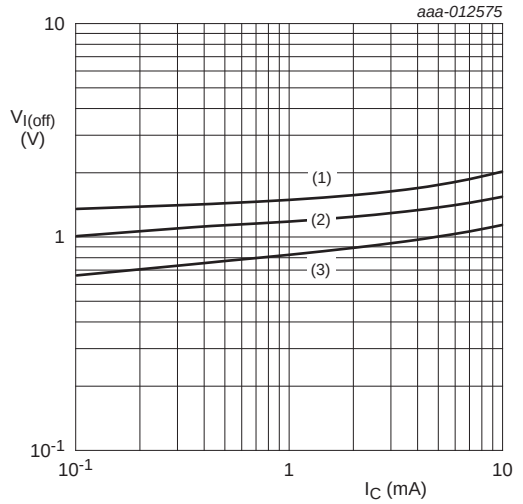

$V_{CE}$ = 0.3 V

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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



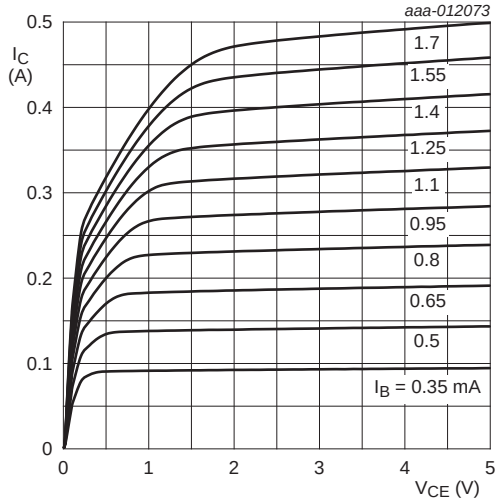

$V_{CE}$ = 5 V

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = 25 °C

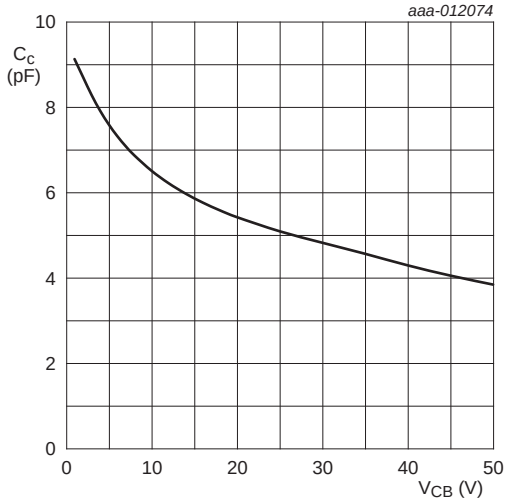
(3) $T_{amb}$ = 100 °C

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



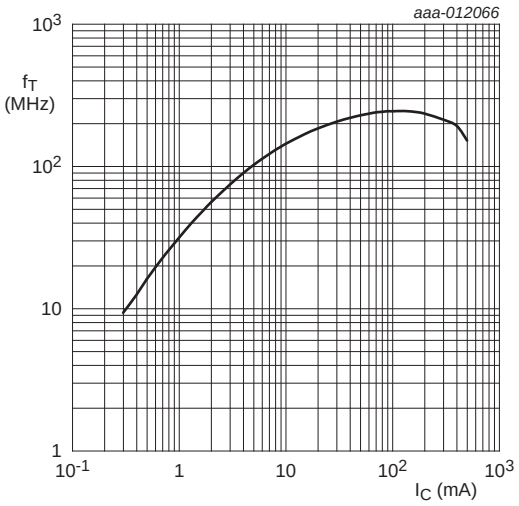

$T_{amb}$ = 25 °C

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




f = 1 MHz; $T_{amb}$ = 25 °C

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




$V_{CE}$ = 5 V; $T_{amb}$ = 25 °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

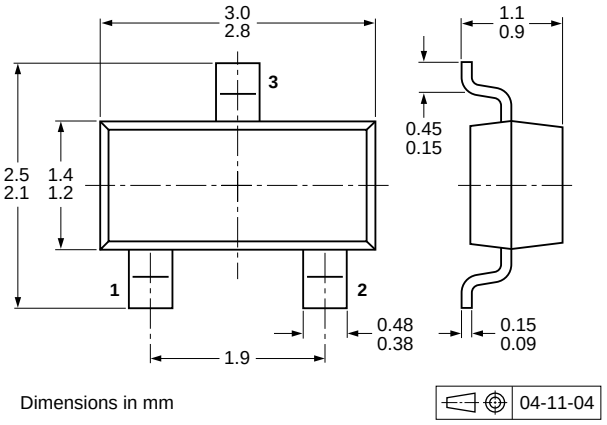
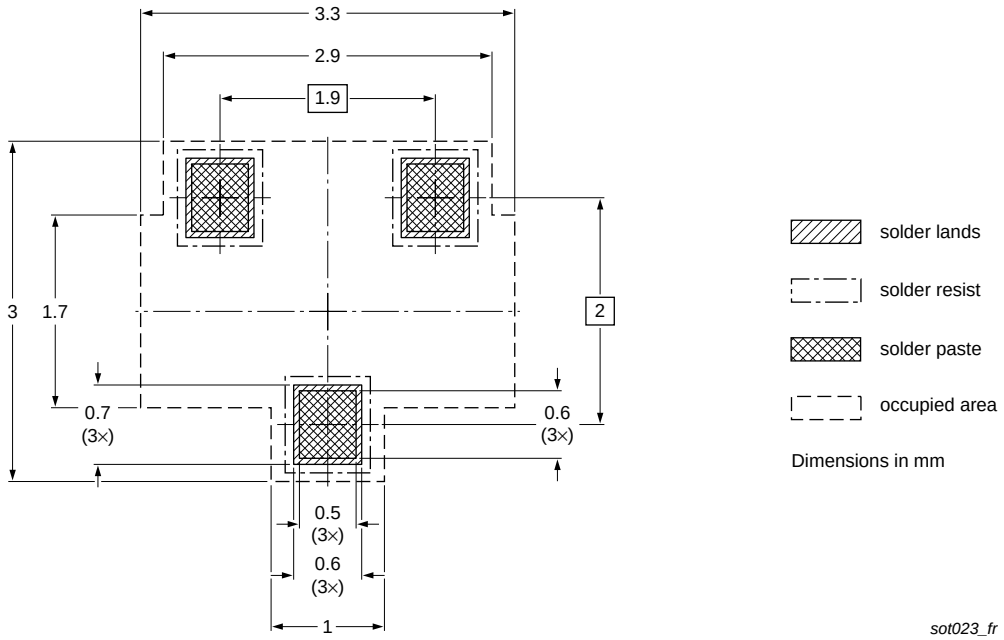


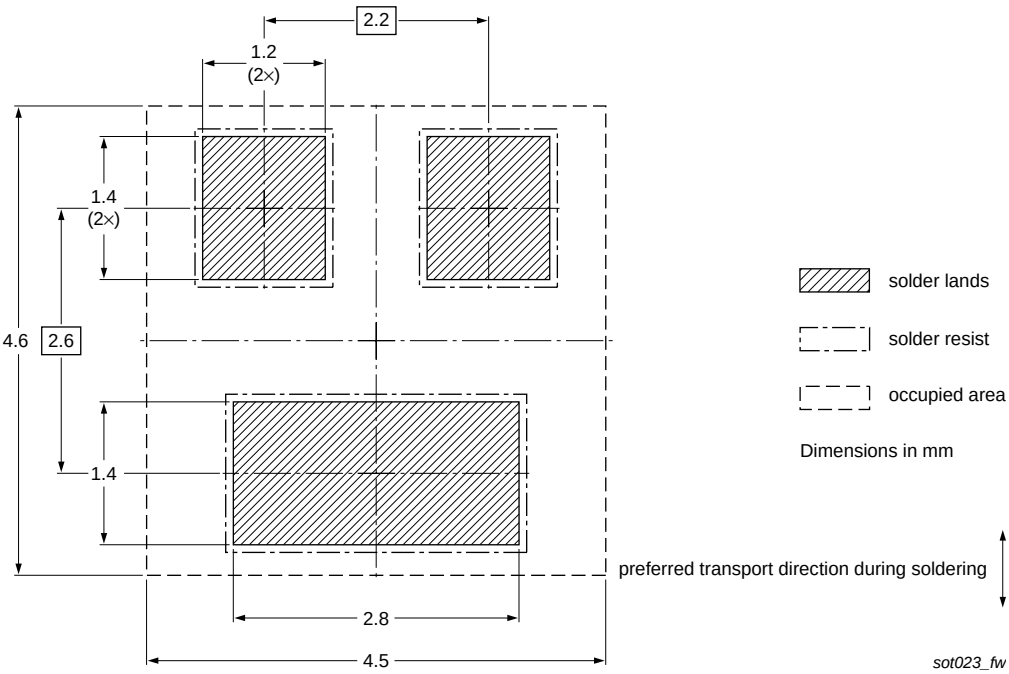

**Fig 25. Package outline PDTD1xxxT series (SOT23/TO-236AB)**

## 10. Soldering




Dimensions in mm

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




Dimensions in mm

**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.

## 12.2 Definitions

**Draft —** The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet —** A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

**Product specification —** The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

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## 13. Contact information

For more information, please visit: **http://www.nexperia.com**

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# OCEAN CHIPS
## Океан Электроники
## Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
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- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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AVIC JONHON

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FORSTAR®

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