



# PDTB1xxxT series

500 mA, 50 V PNP resistor-equipped transistors

Rev. 1 — 13 May 2014

Product data sheet

## 1. Product profile

### 1.1 General description

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

Table 1. Product overview

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

### 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

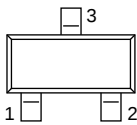
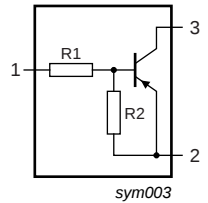
## 1.4 Quick reference data

Table 2. Quick reference data

| Symbol    | Parameter                      | Conditions | Min | Typ | Max  | Unit       |
|-----------|--------------------------------|------------|-----|-----|------|------------|
| $V_{CEO}$ | collector-emitter voltage      | open base  | -   | -   | -50  | V          |
| $I_O$     | output current                 |            | -   | -   | -500 | mA         |
| R1        | bias resistor 1 (input)        |            |     |     |      |            |
|           | PDTB143ET                      |            |     | 4.7 |      | k $\Omega$ |
|           | PDTB143XT                      |            |     | 4.7 |      | k $\Omega$ |
|           | PDTB114ET                      |            |     | 10  |      | k $\Omega$ |
| R2        | bias resistor 2 (base-emitter) |            |     |     |      |            |
|           | PDTB143ET                      |            |     | 4.7 |      | k $\Omega$ |
|           | PDTB143XT                      |            |     | 10  |      | k $\Omega$ |
|           | PDTB114ET                      |            |     | 10  |      | k $\Omega$ |

## 2. Pinning information

Table 3. Pinning

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

## 3. Ordering information

Table 4. Ordering information

| Type number      | Package  |                                          |         |
|------------------|----------|------------------------------------------|---------|
|                  | Name     | Description                              | Version |
| PDTB1xxxT series | TO-236AB | plastic surface-mounted package; 3 leads | SOT23   |

## 4. Marking

Table 5. Marking codes

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PDTB143ET   | *4X                         |
| PDTB143XT   | *4Y                         |
| PDTB114ET   | *09                         |

[1] \* = placeholder for manufacturing site code

## 5. Limiting values

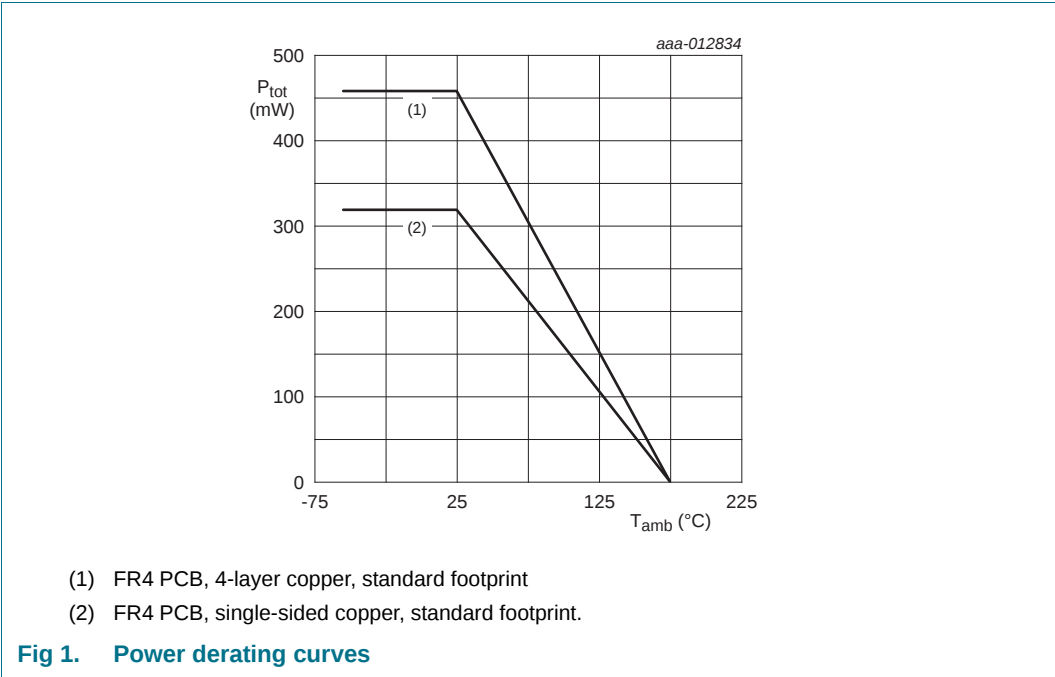
Table 6. Limiting values

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                             |     |      |      |
|           | PDTB143ET                 |                                            | -   | -10  | V    |
|           | PDTB143XT                 |                                            | -   | -7   | V    |
|           | PDTB114ET                 |                                            | -   | -10  | V    |
| $V_i$     | input voltage             |                                            |     |      |      |
|           | PDTB143ET                 |                                            | -30 | +10  | V    |
|           | PDTB143XT                 |                                            | -30 | +7   | V    |
|           | PDTB114ET                 |                                            | -50 | +10  | V    |
| $I_O$     | output current            |                                            | -   | -500 | mA   |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25\text{ °C}$ <sup>[1]</sup> | -   | 320  | mW   |
|           |                           | <sup>[2]</sup>                             | -   | 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.

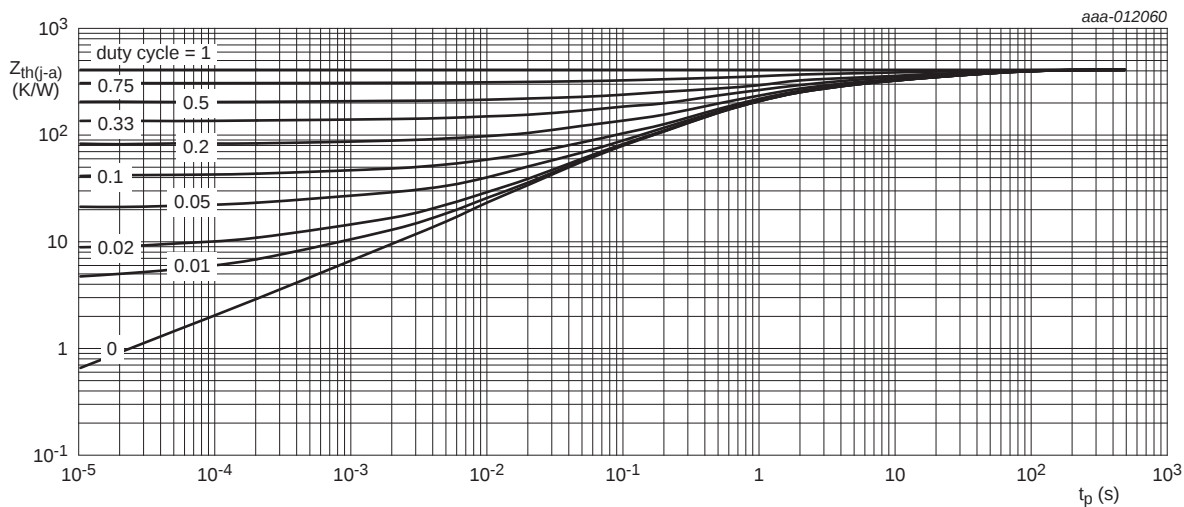


6. Thermal characteristics

Table 7. Thermal characteristics

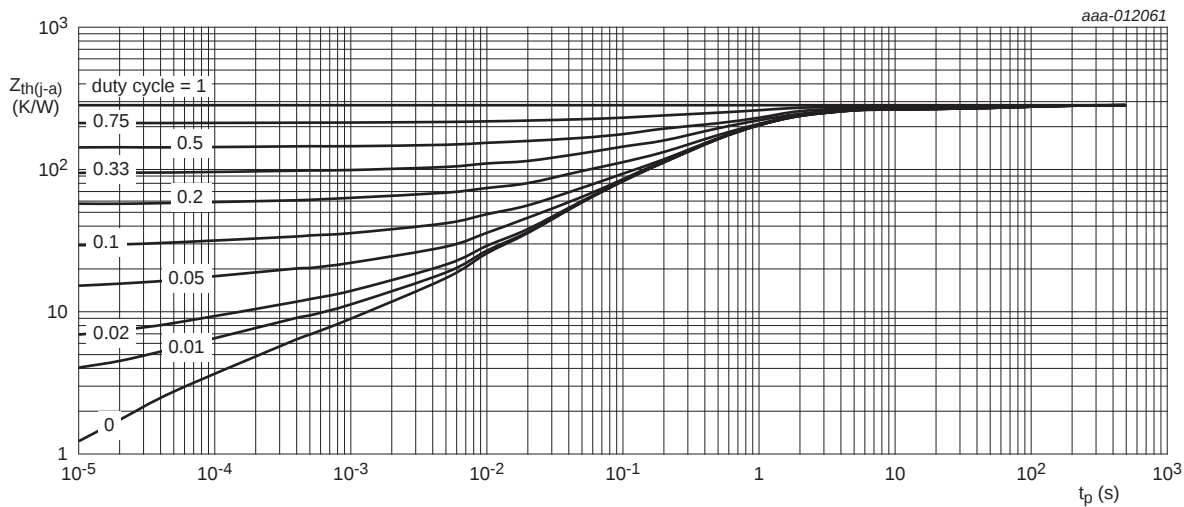
| Symbol        | Parameter                                   | Conditions  |     | Min | Typ | Max | Unit |
|---------------|---------------------------------------------|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] |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

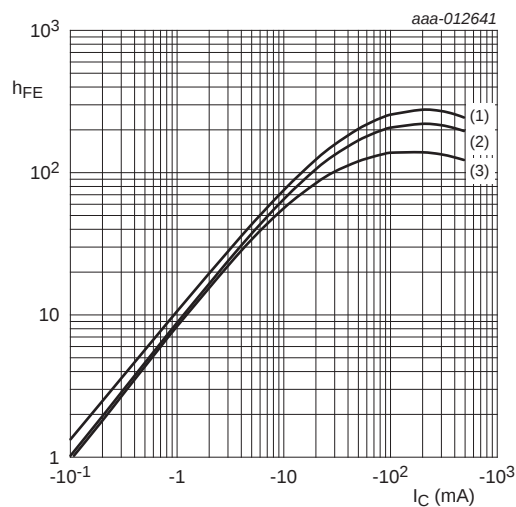
## 7. Characteristics

**Table 8. Characteristics**

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

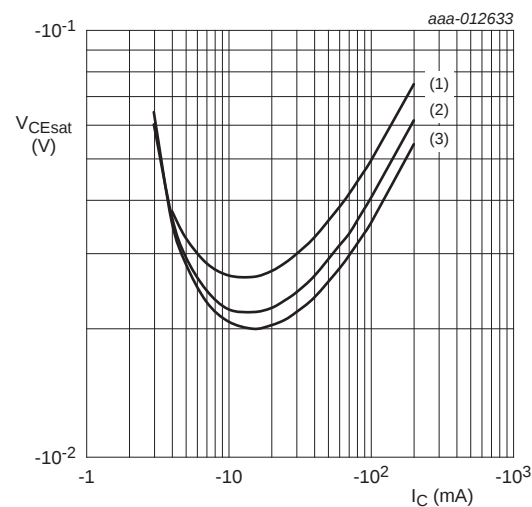
| Symbol       | Parameter                            | Conditions                                                                          | Min  | Typ   | Max  | Unit          |
|--------------|--------------------------------------|-------------------------------------------------------------------------------------|------|-------|------|---------------|
| $I_{CBO}$    | 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 | $\mu\text{A}$ |
| $I_{EBO}$    | emitter-base cut-off current         | $V_{EB} = -5\text{ V}; I_C = 0\text{ A}$                                            |      |       |      |               |
|              | PDTB143ET                            |                                                                                     | -    | -     | -0.9 | mA            |
|              | PDTB143XT                            |                                                                                     | -    | -     | -0.6 | mA            |
|              | PDTB114ET                            |                                                                                     | -    | -     | -0.4 | mA            |
| $h_{FE}$     | DC current gain                      | $V_{CE} = -5\text{ V}; I_C = -50\text{ mA}$                                         |      |       |      |               |
|              | PDTB143ET                            |                                                                                     | 60   | -     | -    |               |
|              | PDTB143XT                            |                                                                                     | 70   | -     | -    |               |
|              | PDTB114ET                            |                                                                                     | 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              | $V_{CE} = -5\text{ V}; I_C = -100\text{ }\mu\text{A}$                               |      |       |      |               |
|              | PDTB143ET                            |                                                                                     | -0.6 | -0.9  | -1.5 | V             |
|              | PDTB143XT                            |                                                                                     | -0.5 | -0.75 | -1.1 | V             |
|              | PDTB114ET                            |                                                                                     | -0.6 | -1.0  | -1.5 | V             |
| $V_{I(on)}$  | on-state input voltage               | $V_{CE} = -0.3\text{ V}; I_C = -20\text{ mA}$                                       |      |       |      |               |
|              | PDTB143ET                            |                                                                                     | -1.0 | -1.7  | -2.2 | V             |
|              | PDTB143XT                            |                                                                                     | -1.0 | -1.4  | -2.0 | V             |
|              | PDTB114ET                            |                                                                                     | -1.0 | -2.2  | -3.0 | V             |
| R1           | bias resistor 1 (input)              |                                                                                     |      |       |      |               |
|              | PDTB143ET                            |                                                                                     | 3.3  | 4.7   | 6.1  | k $\Omega$    |
|              | PDTB143XT                            |                                                                                     | 3.3  | 4.7   | 6.1  | k $\Omega$    |
|              | PDTB114ET                            |                                                                                     | 7.0  | 10    | 13   | k $\Omega$    |
| R2/R1        | bias resistor ratio                  |                                                                                     |      |       |      |               |
|              | PDTB143ET                            |                                                                                     | 0.9  | 1.0   | 1.1  |               |
|              | PDTB143XT                            |                                                                                     | 1.91 | 2.13  | 2.34 |               |
|              | PDTB114ET                            |                                                                                     | 0.9  | 1.0   | 1.1  |               |
| $C_c$        | collector capacitance                | $V_{CB} = -10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$                   | -    | 11    | -    | pF            |
| $f_T$        | transition frequency                 | $V_{CE} = -5\text{ V}; I_C = -50\text{ mA}; f = 100\text{ MHz}$ <a href="#">[1]</a> | -    | 140   | -    | MHz           |

[1] Characteristics of built-in transistor.



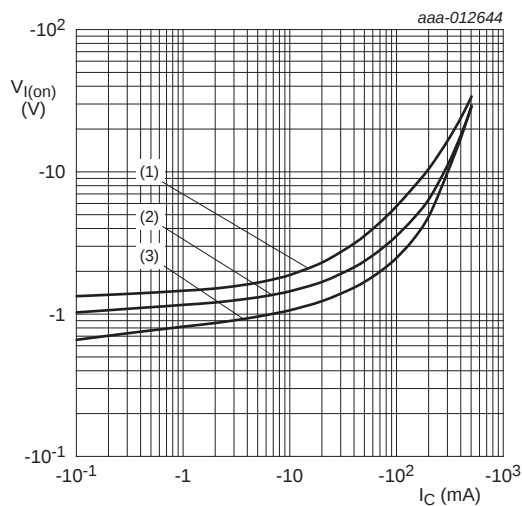
- $V_{CE} = -5$  V
- (1)  $T_{amb} = 100$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = -40$  °C

Fig 4. PDTB143ET: DC current gain as a function of collector current; typical values



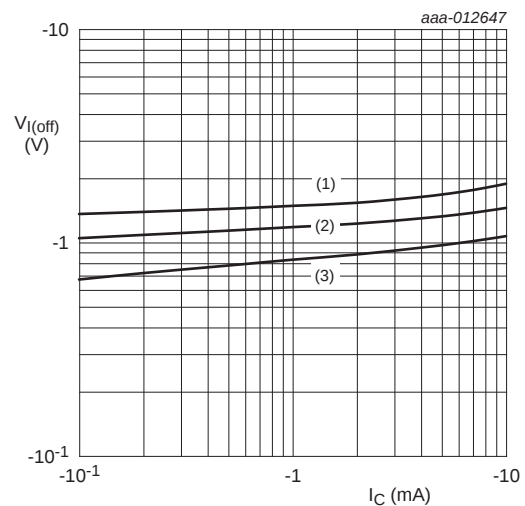
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = -40$  °C

Fig 5. PDTB143ET: Collector-emitter saturation voltage as a function of collector current; typical values



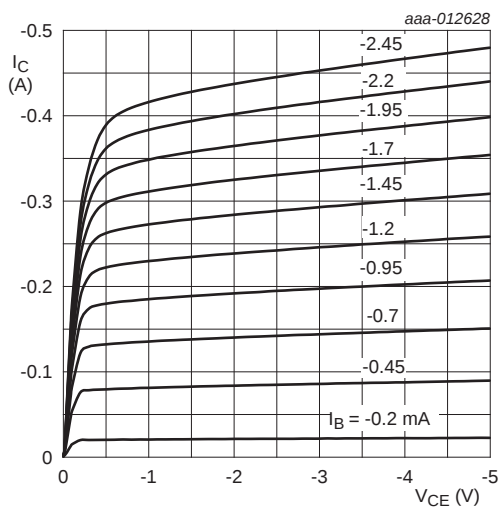
- $V_{CE} = -0.3$  V
- (1)  $T_{amb} = -40$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = 100$  °C

Fig 6. PDTB143ET: On-state input voltage as a function of collector current; typical values



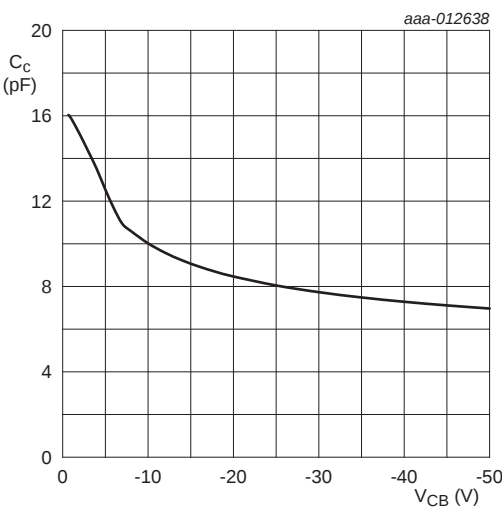
- $V_{CE} = -5$  V
- (1)  $T_{amb} = -40$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = 100$  °C

Fig 7. PDTB143ET: Off-state input voltage as a function of collector current; typical values



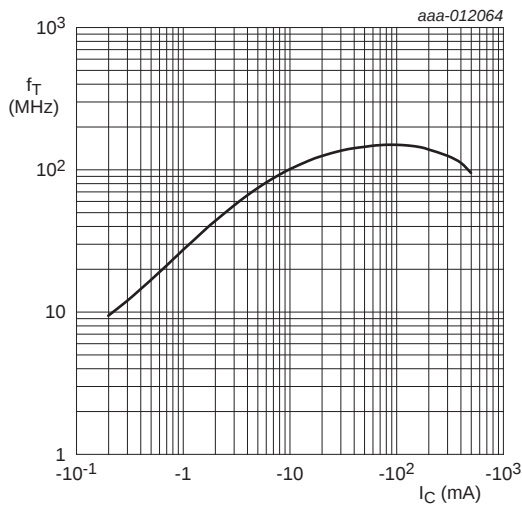
$T_{amb} = 25\text{ °C}$

Fig 8. PDTB143ET: Collector current as a function of collector-emitter voltage; typical values



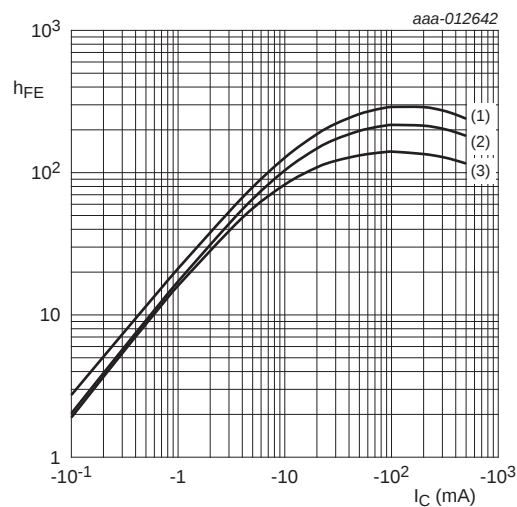
$f = 1\text{ MHz}$ ;  $T_{amb} = 25\text{ °C}$

Fig 9. PDTB143ET: Collector capacitance as a function of collector-base voltage; typical values



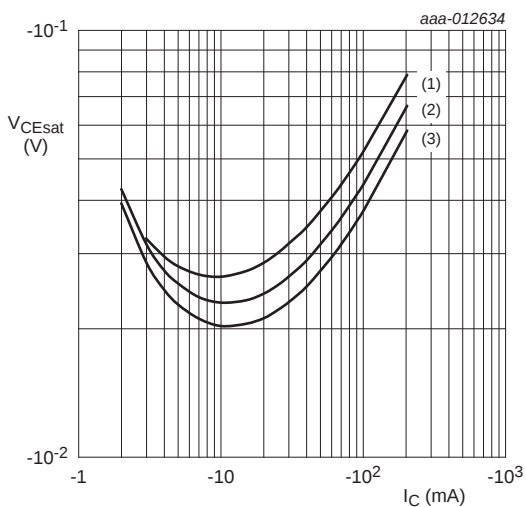
$V_{CE} = -5\text{ V}$ ;  $T_{amb} = 25\text{ °C}$

Fig 10. PDTB143ET: Transition frequency as a function of collector current; typical values of built-in transistor



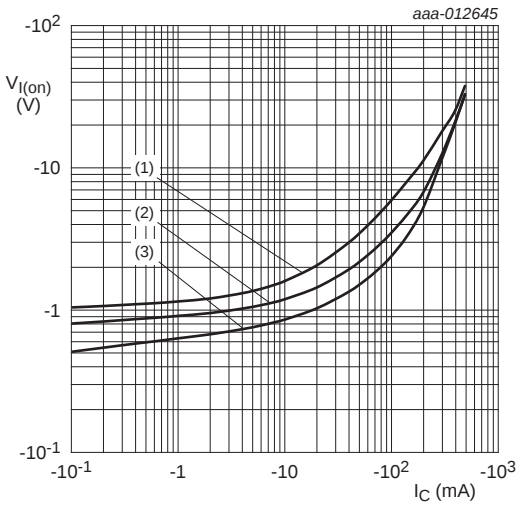
$V_{CE} = -5$  V  
(1)  $T_{amb} = 100$  °C  
(2)  $T_{amb} = 25$  °C  
(3)  $T_{amb} = -40$  °C

Fig 11. PDTB143XT: DC current gain as a function of collector current; typical values



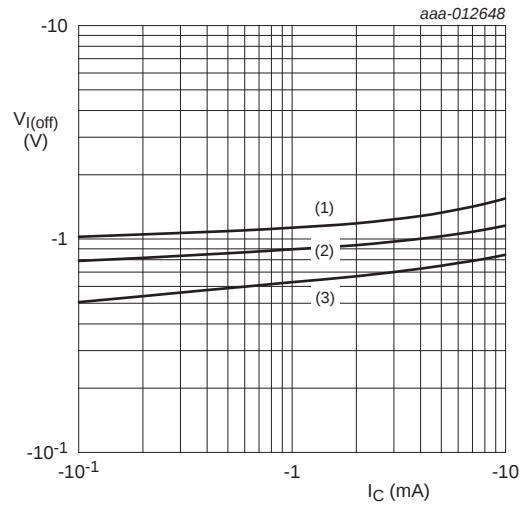
$I_C/I_B = 20$   
(1)  $T_{amb} = 100$  °C  
(2)  $T_{amb} = 25$  °C  
(3)  $T_{amb} = -40$  °C

Fig 12. PDTB143XT: 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. PDTB143XT: 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. PDTB143XT: Off-state input voltage as a function of collector current; typical values

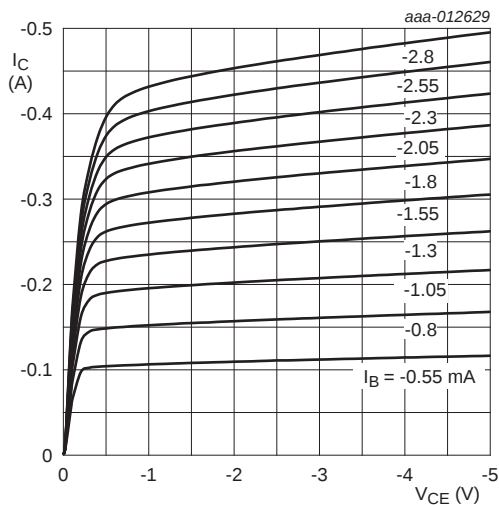


Fig 15. PDTB143XT: Collector current as a function of collector-emitter voltage; typical values

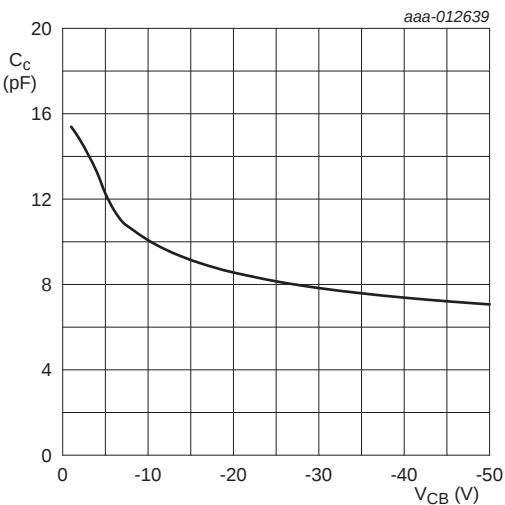


Fig 16. PDTB143XT: Collector capacitance as a function of collector-base voltage; typical values

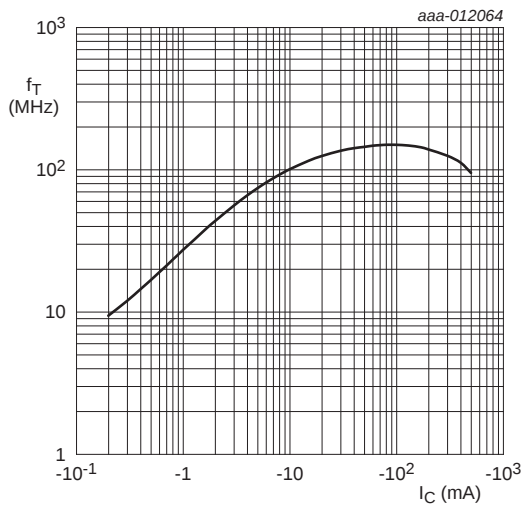
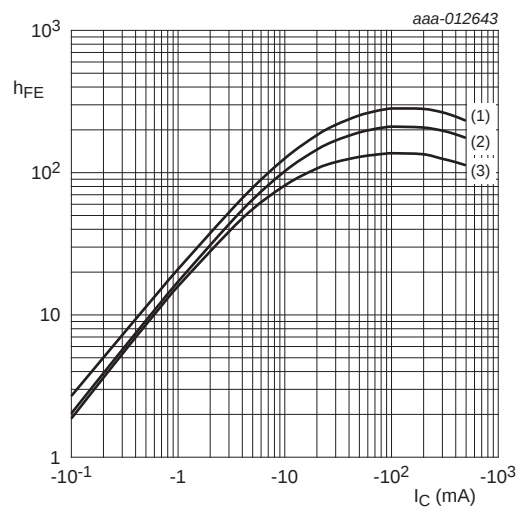
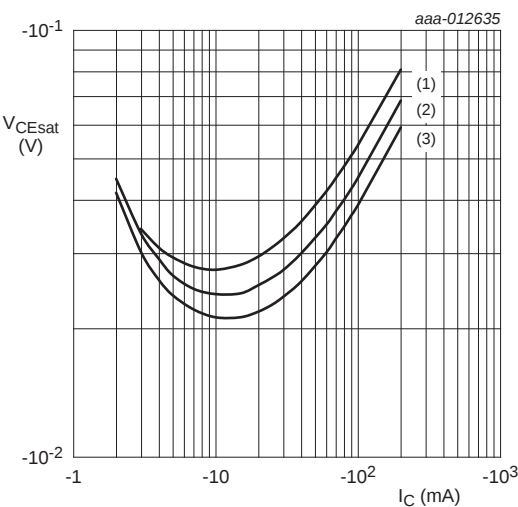


Fig 17. PDTB143XT: Transition frequency as a function of collector current; typical values of built-in transistor



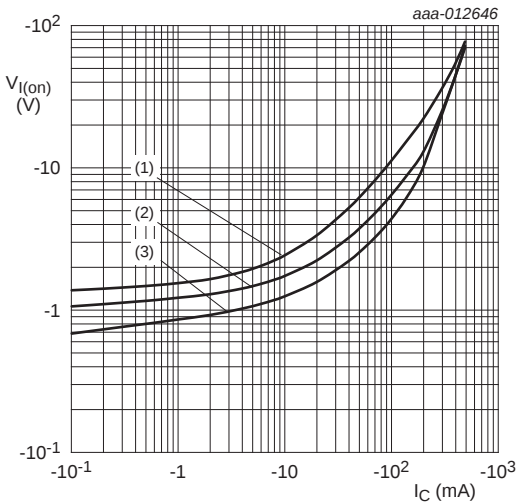
$V_{CE} = -5$  V  
(1)  $T_{amb} = 100$  °C  
(2)  $T_{amb} = 25$  °C  
(3)  $T_{amb} = -40$  °C

Fig 18. PDTB114ET: DC current gain as a function of collector current; typical values



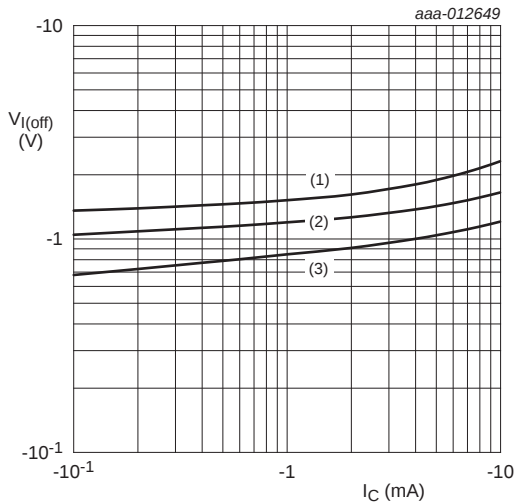
$I_C/I_B = 20$   
(1)  $T_{amb} = 100$  °C  
(2)  $T_{amb} = 25$  °C  
(3)  $T_{amb} = -40$  °C

Fig 19. PDTB114ET: 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. PDTB114ET: 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. PDTB114ET: Off-state input voltage as a function of collector current; typical values

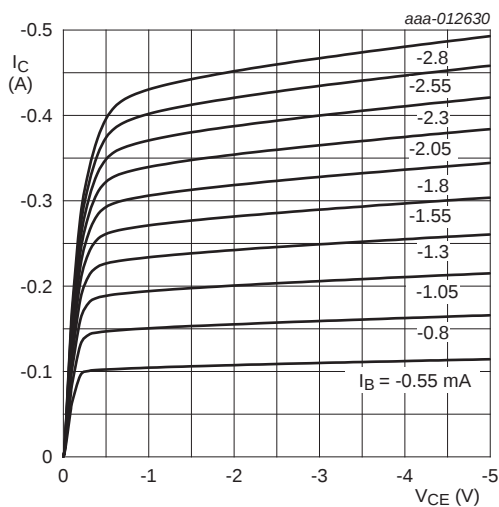


Fig 22. PDTB114ET: Collector current as a function of collector-emitter voltage; typical values

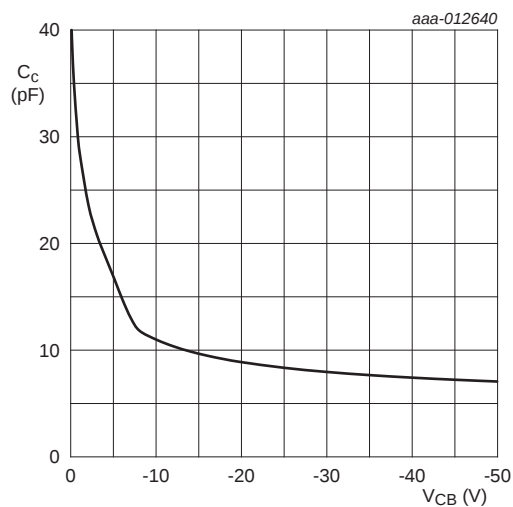


Fig 23. PDTB114ET: Collector capacitance as a function of collector-base voltage; typical values of built-in transistor

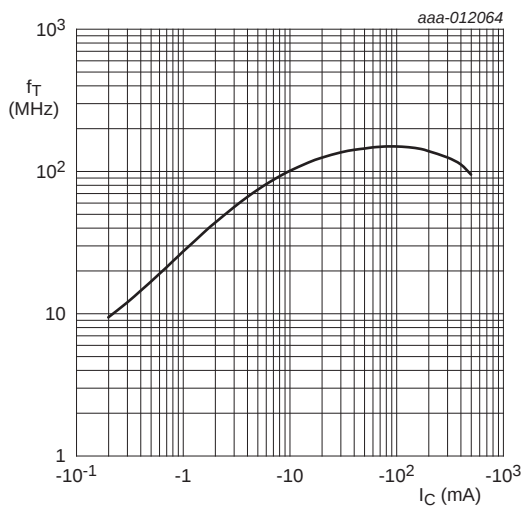


Fig 24. PDTB114ET: Transition frequency as a function of collector current; typical values of built-in transistor

## 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

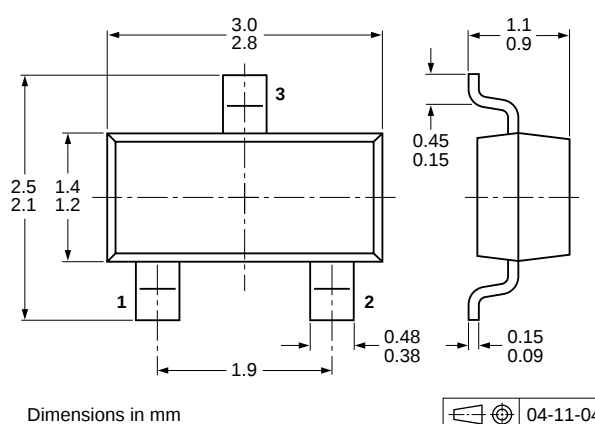


Fig 25. Package outline PDTB1xxxT series (SOT23/TO-236AB)

10. Soldering

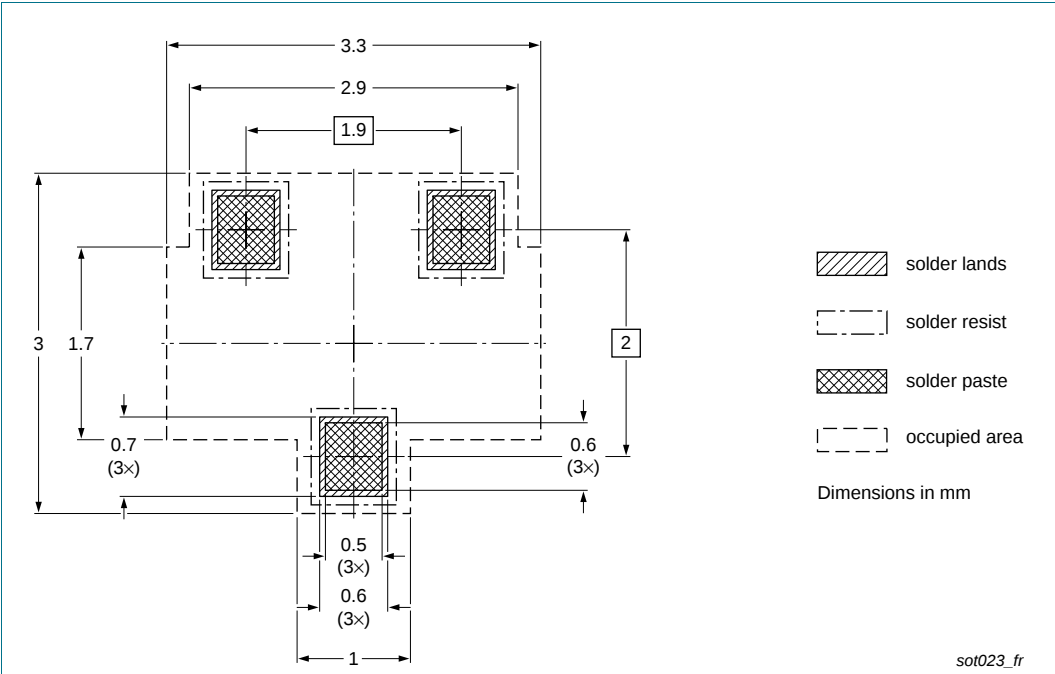


Fig 26. Reflow soldering footprint PDTB1xxxT series (SOT23/TO-236AB)

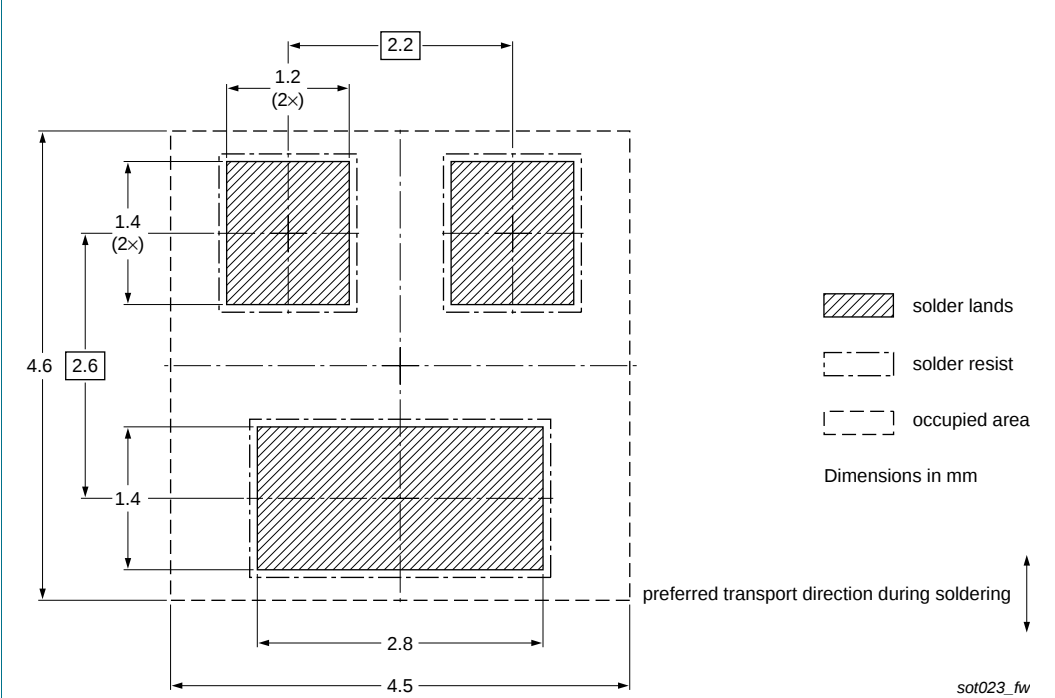


Fig 27. Wave soldering footprint PDTB1xxxT series (SOT23/TO-236AB)

## 11. Revision history

Table 9. Revision history

| Document ID       | Release date | Data sheet status  | Change notice | Supersedes |
|-------------------|--------------|--------------------|---------------|------------|
| PDTB1XXXT_SER v.1 | 20140513     | Product data sheet | -             | -          |

## 12. Legal information

### 12.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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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For more information, please visit: <http://www.nexperia.com>

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