



# 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
	NXP	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




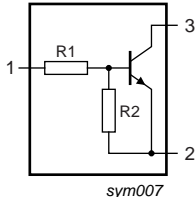
## 1.4 Quick reference data

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 $\Omega$
	PDTD143XT			4.7		k $\Omega$
	PDTD114ET			10		k $\Omega$
R2	bias resistor 2 (base-emitter)					
	PDTD143ET			4.7		k $\Omega$
	PDTD143XT			10		k $\Omega$
	PDTD114ET			10		k $\Omega$

## 2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	input (base)		 <p style="text-align: center;"><i>sym007</i></p>
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 <sup>[1]</sup>
PDTD143ET	*4Z
PDTD143XT	*5Z
PDTD114ET	*10

[1] \* = placeholder for manufacturing site code

## 5. Limiting values

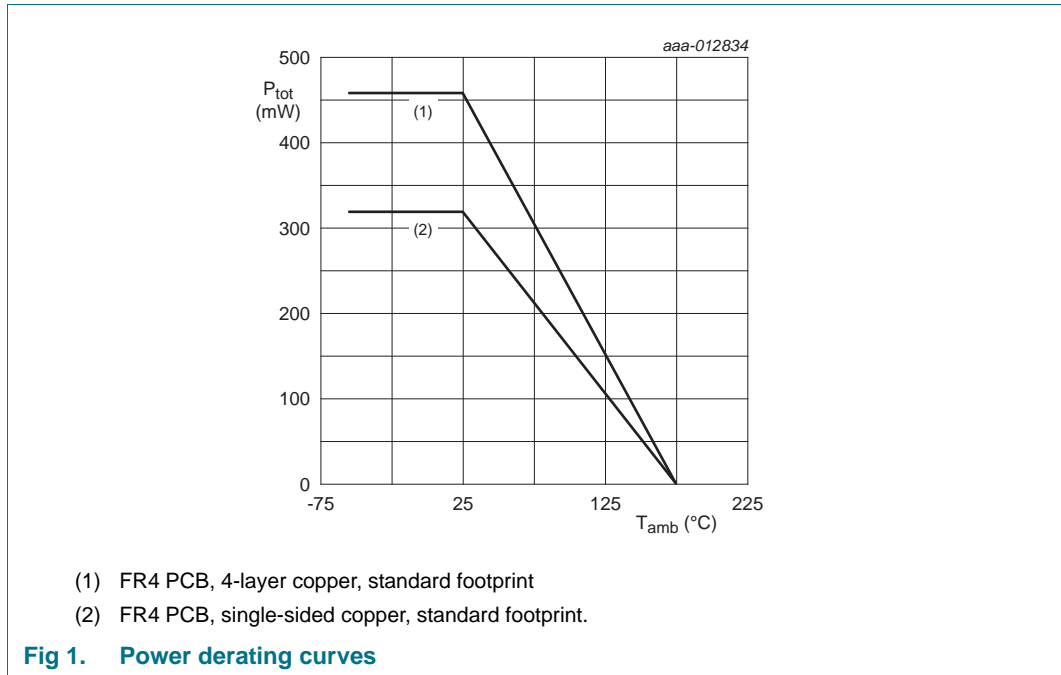
Table 6. Limiting values

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	$T_{amb} \leq 25\text{ °C}$ <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.



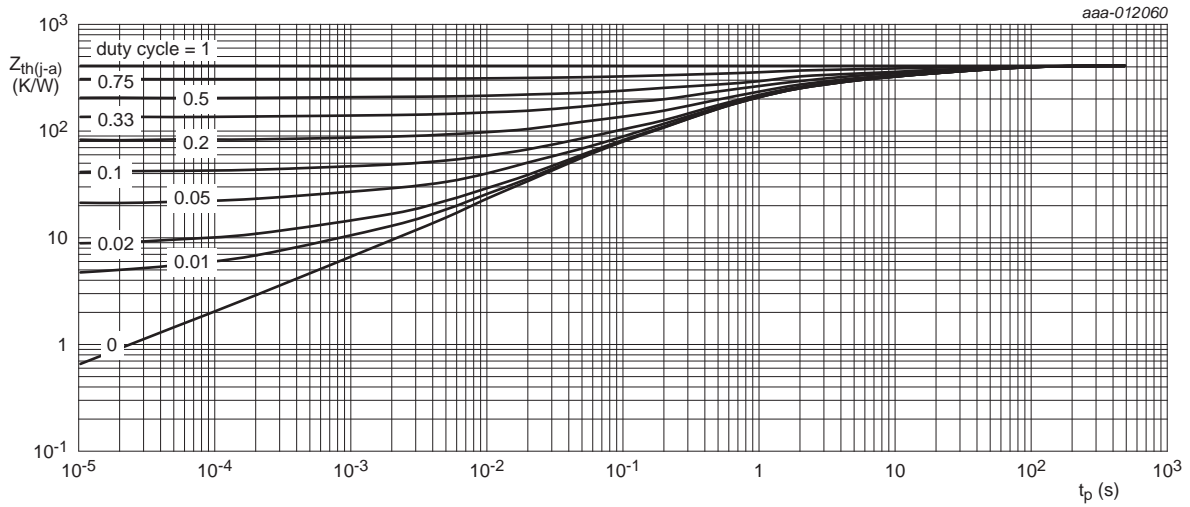
## 6. Thermal characteristics

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	470	K/W
			[2]	-	327	K/W

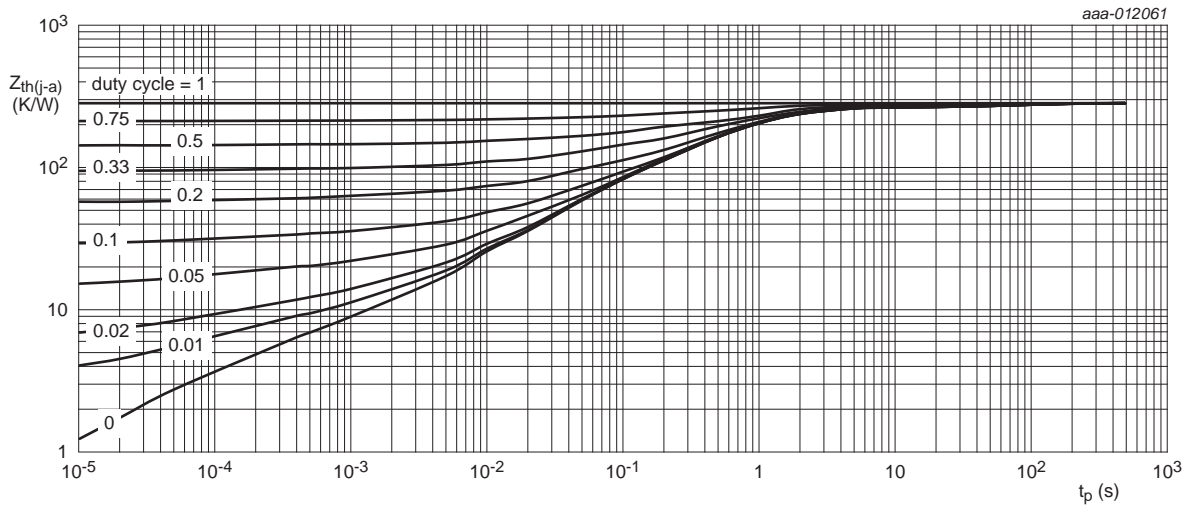
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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.

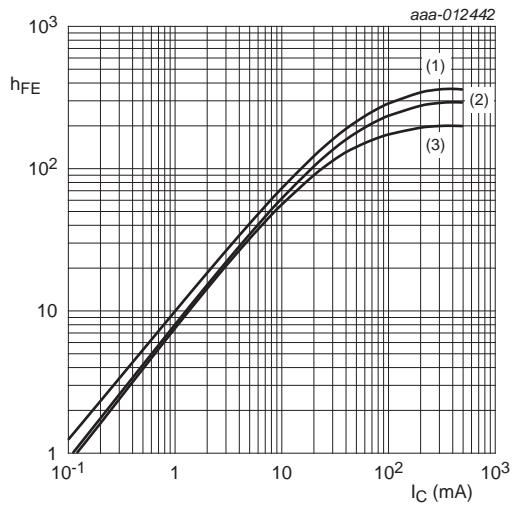
**Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT23/TO-236AB; typical values**

## 7. Characteristics

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

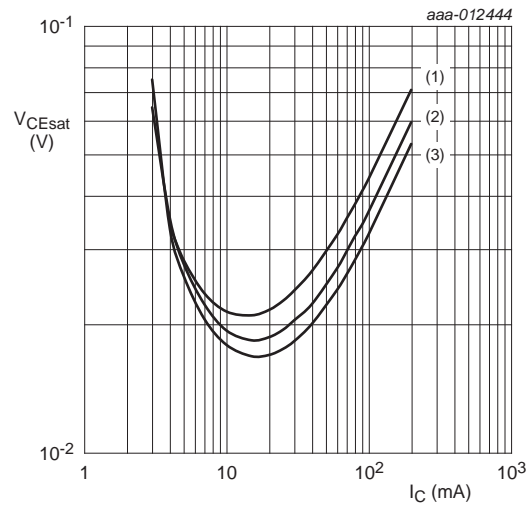
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 40\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 50\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 50\text{ V}; I_B = 0\text{ A}$	-	-	0.5	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$				
	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.



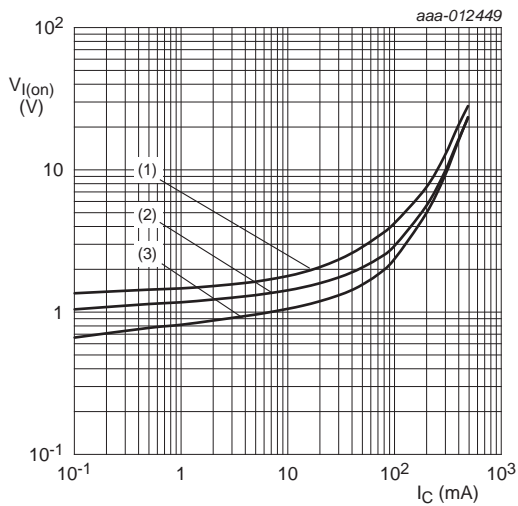
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

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



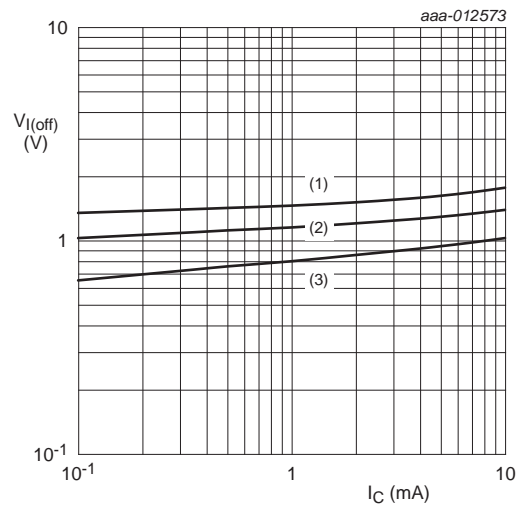
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

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



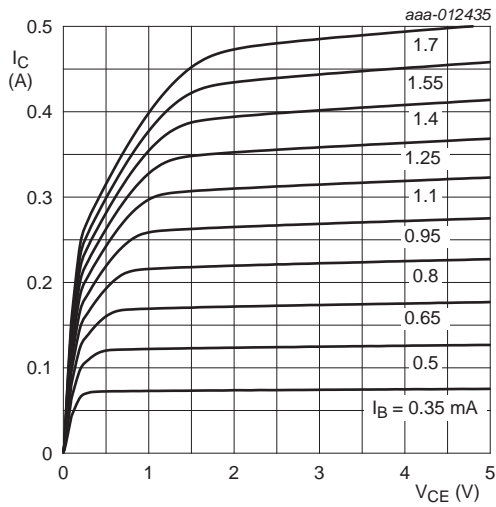
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

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

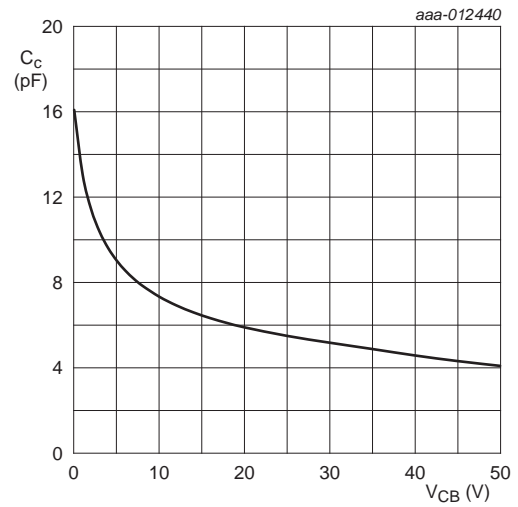


$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

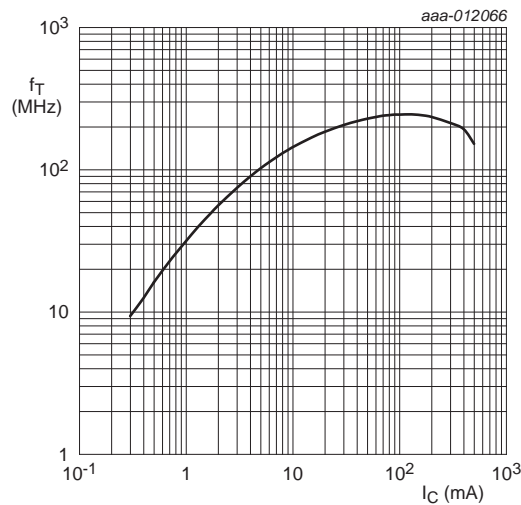
**Fig 7. PDTD143ET: Off-state input voltage as a function of collector current; typical values**



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



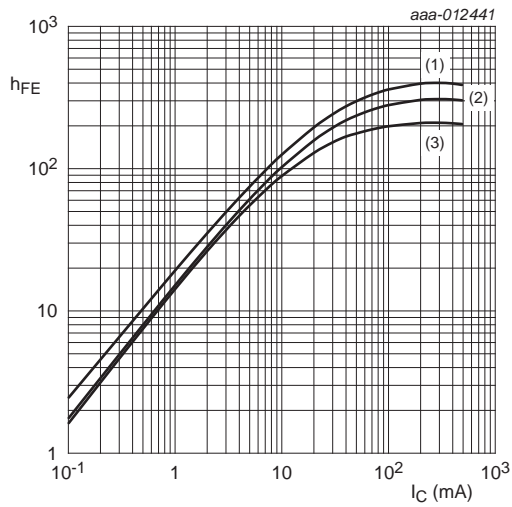
**Fig 9. PDTD143ET: Collector capacitance as a function of collector-base voltage; typical values**



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

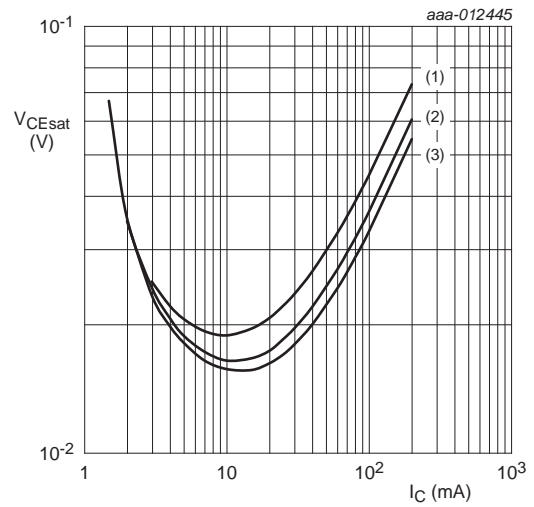
**Fig 10. PDTD143ET: Transition frequency as a function of collector current; typical values of built-in transistor**





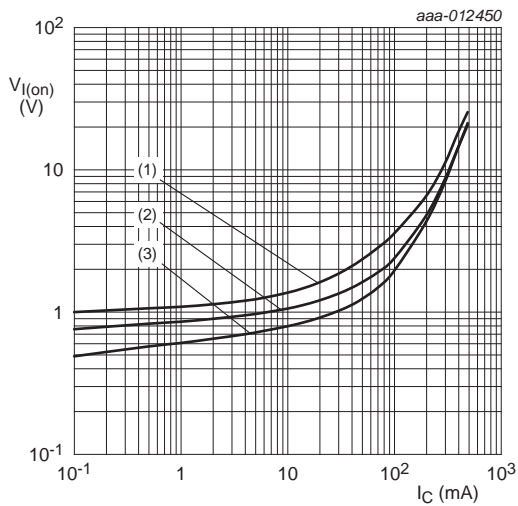
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

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



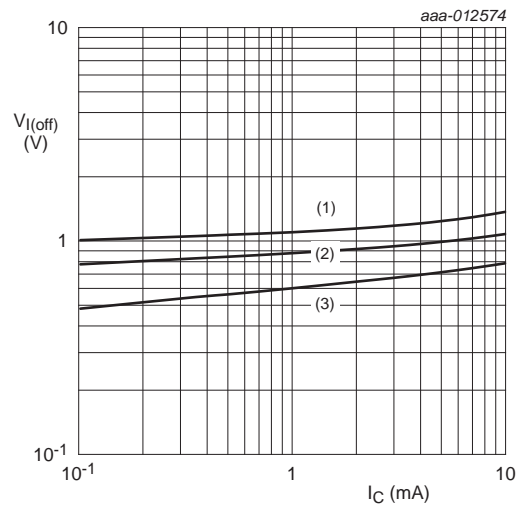
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

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



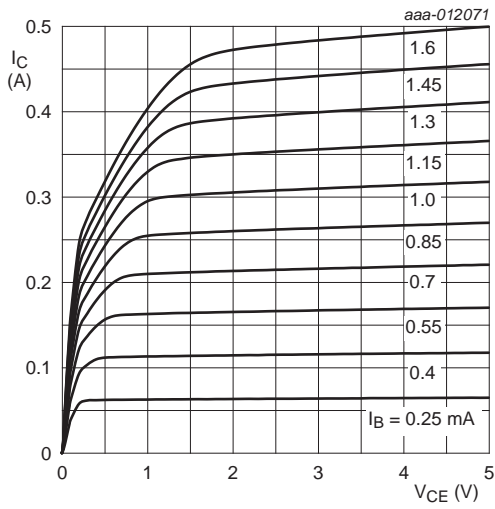
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

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



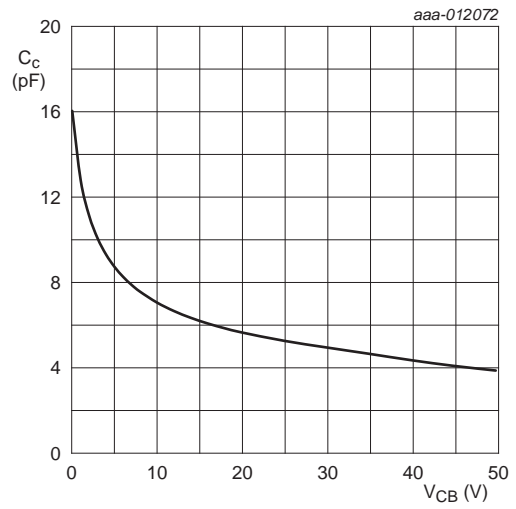
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

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



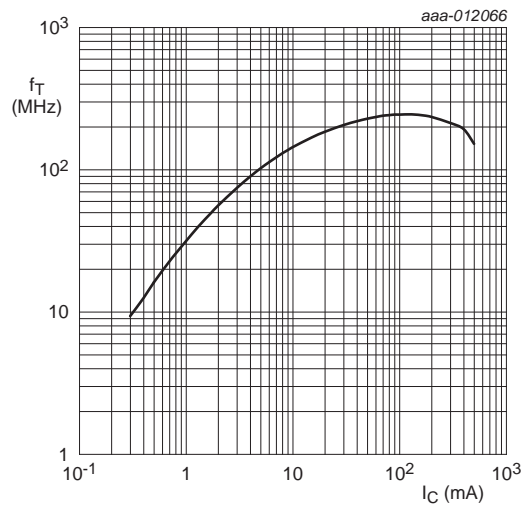
$T_{amb} = 25$  °C

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



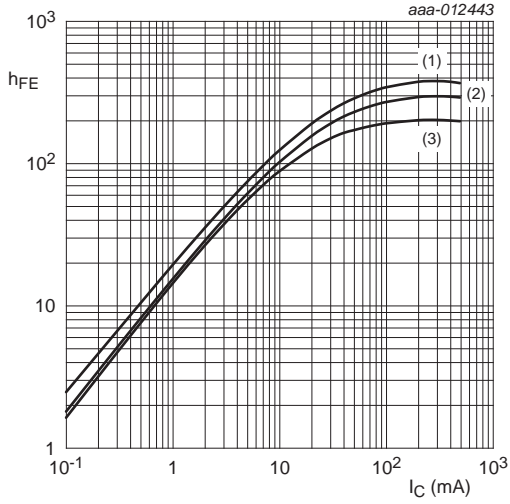
$f = 1$  MHz;  $T_{amb} = 25$  °C

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



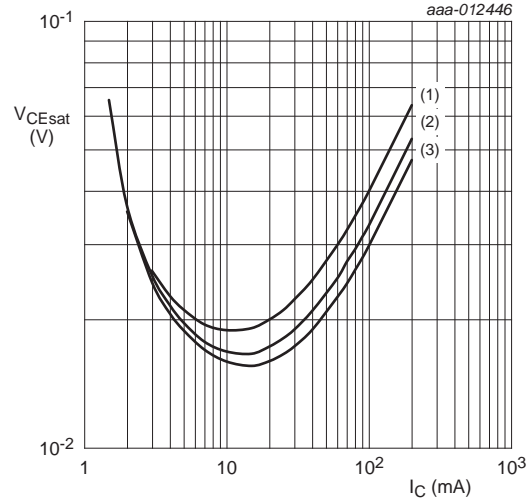
$V_{CE} = 5$  V;  $T_{amb} = 25$  °C

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



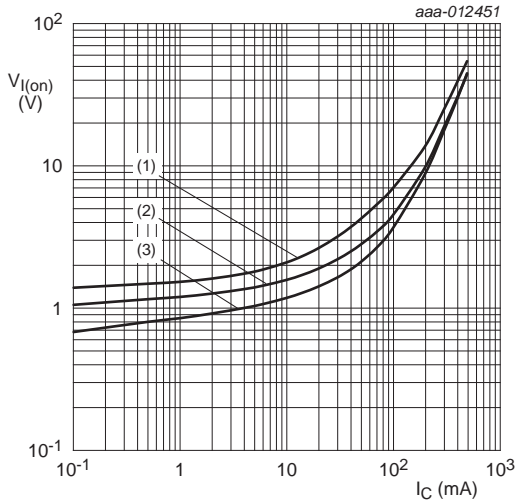
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

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



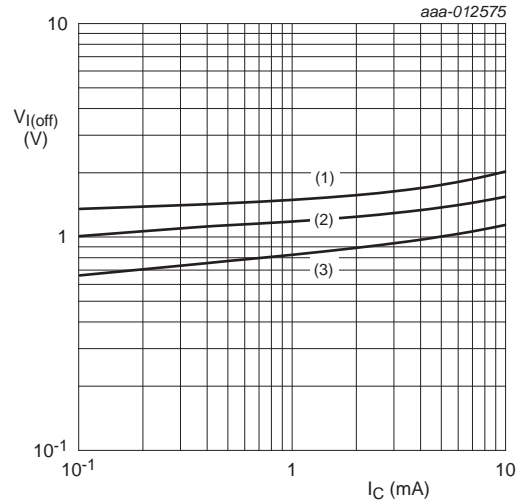
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

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



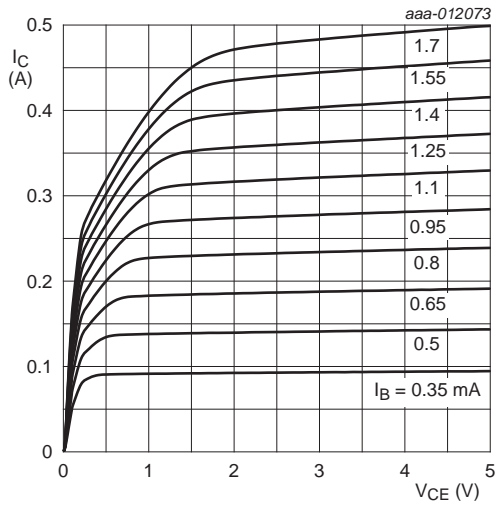
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

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



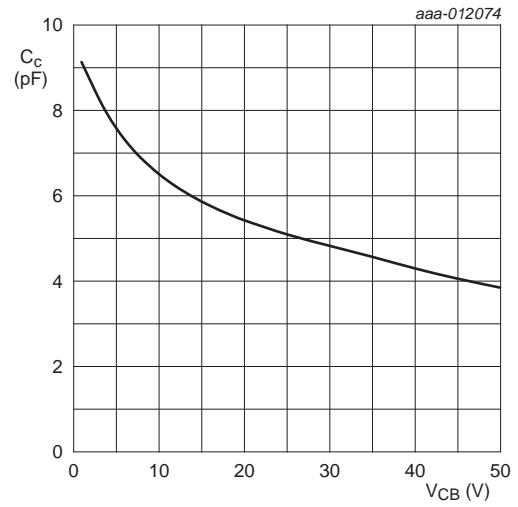
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

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



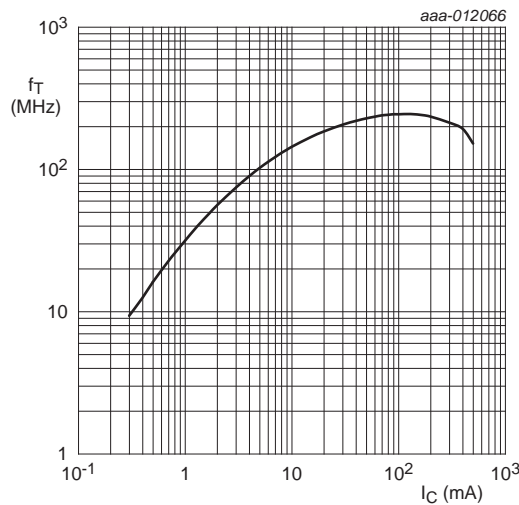
$T_{amb} = 25 \text{ }^\circ\text{C}$

**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**



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

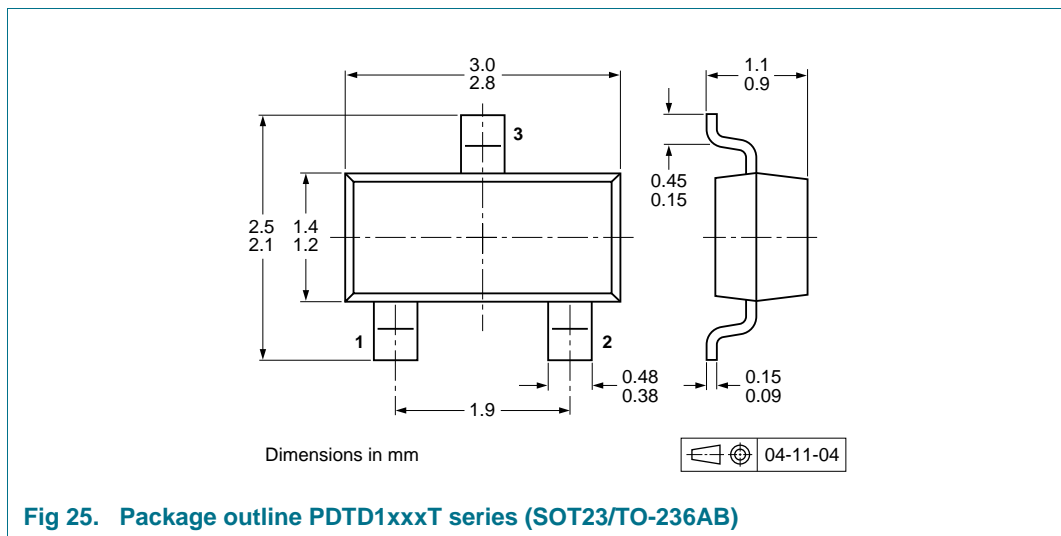
**Fig 24. PDTD114ET: Transition frequency as a function of collector current; typical values of built-in transistor**

**8. Test information**

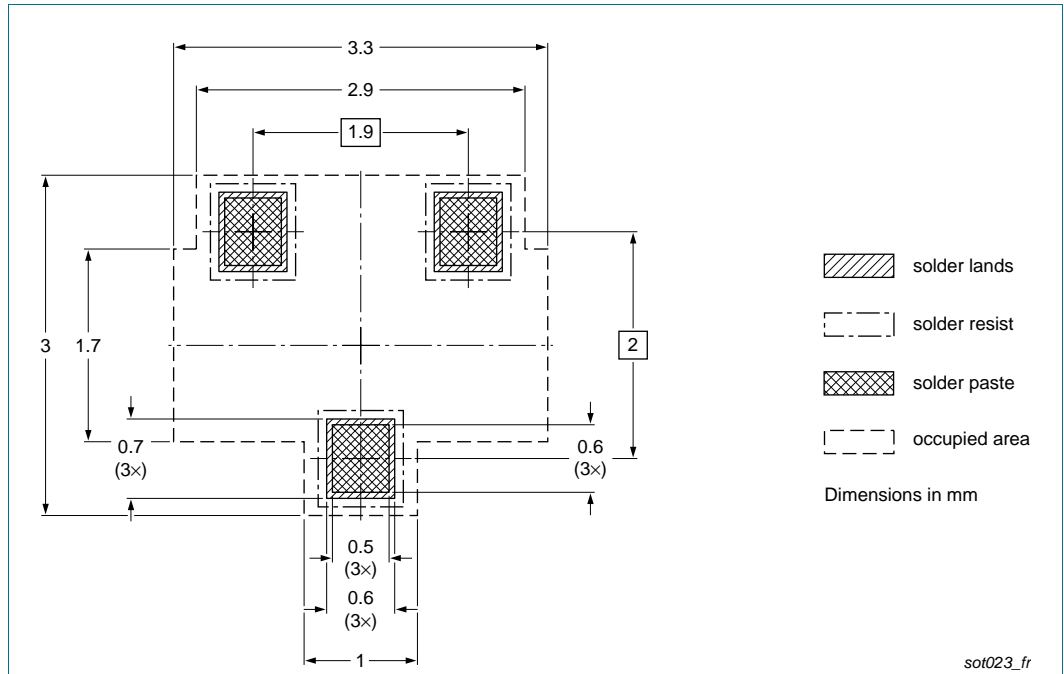
**8.1 Quality information**

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**

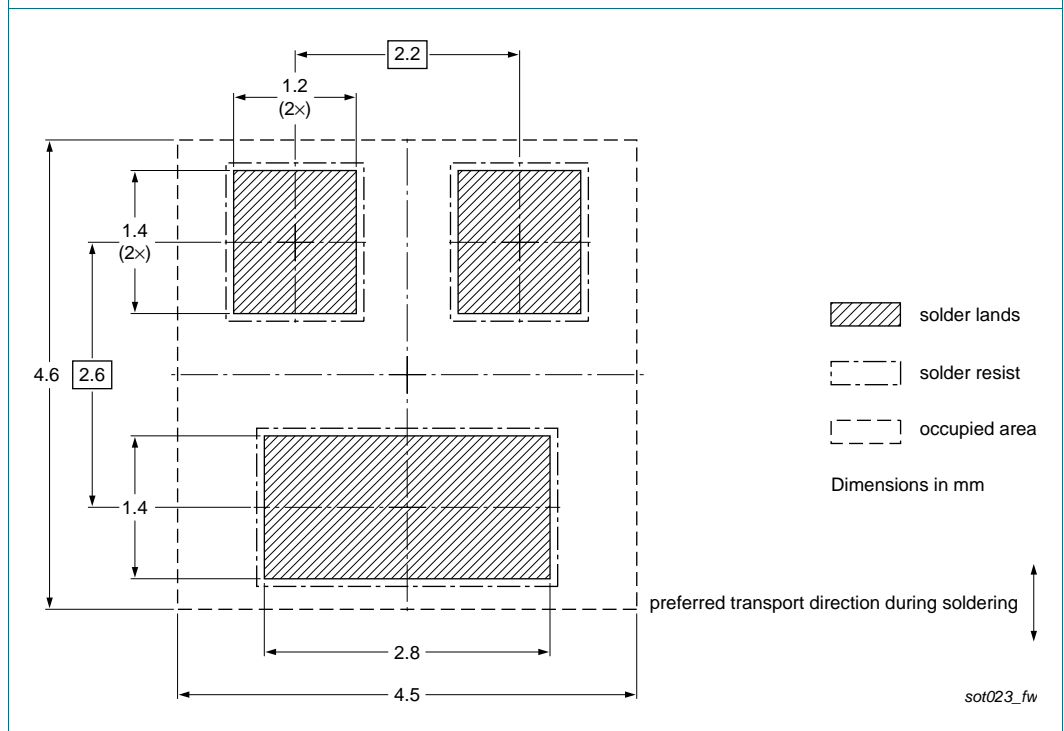


**10. Soldering**



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

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**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 <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.nxp.com>.

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