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
- ± 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

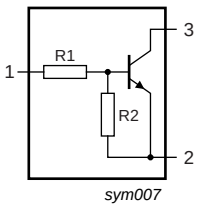
1.4 Quick reference data

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

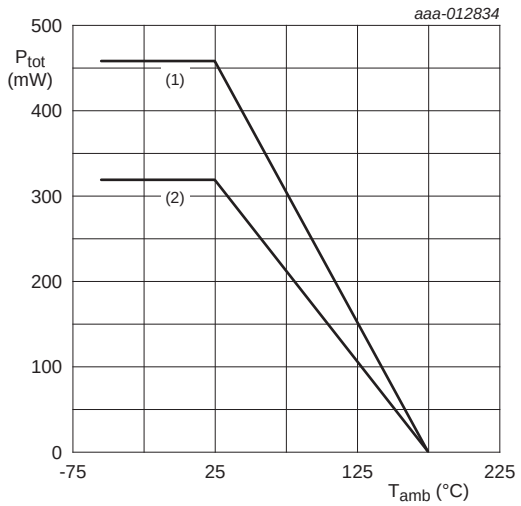
Table 6. Limiting values

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

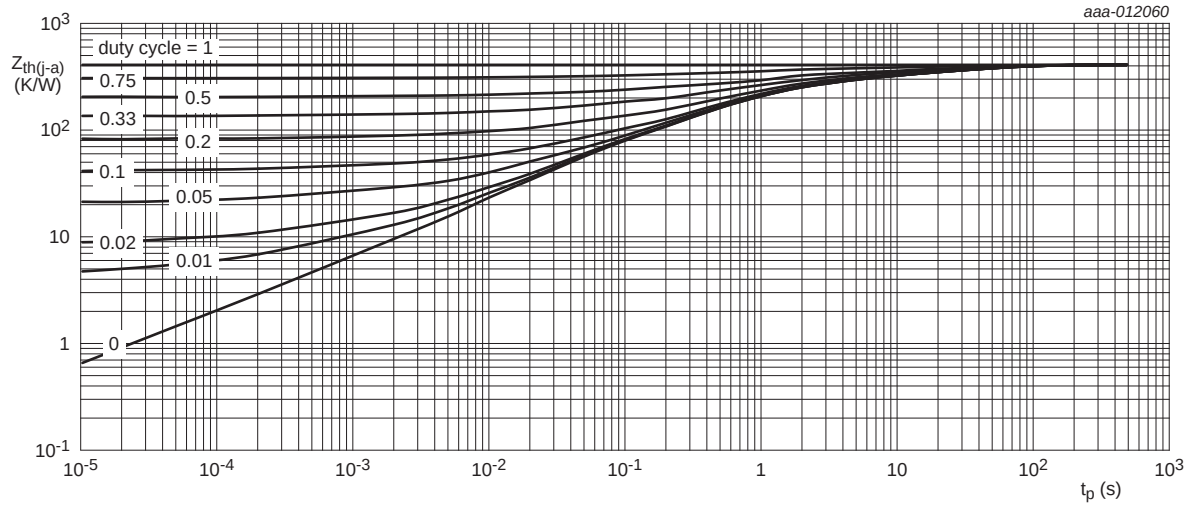
6. Thermal characteristics

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

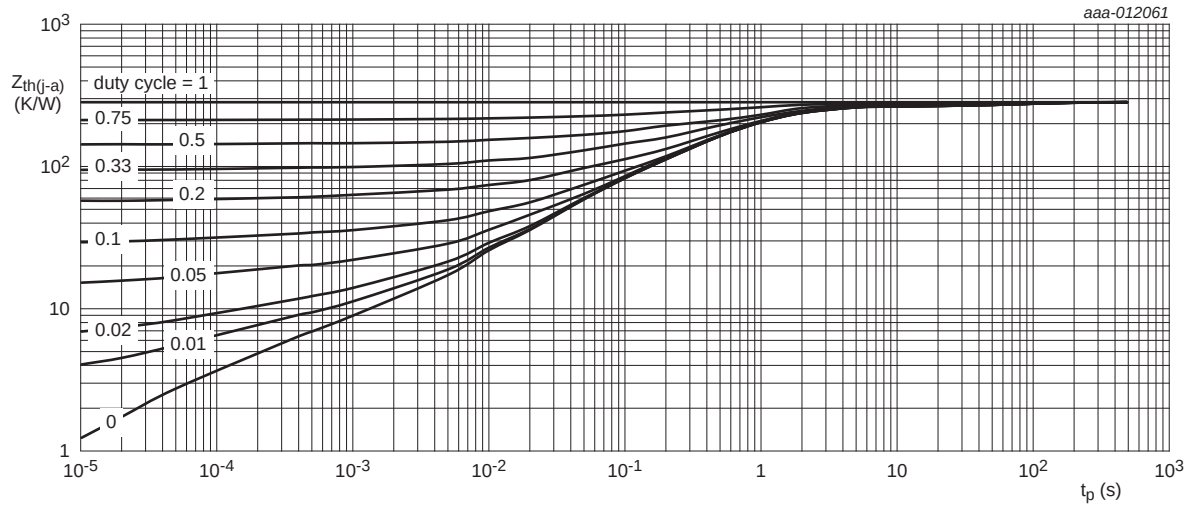
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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

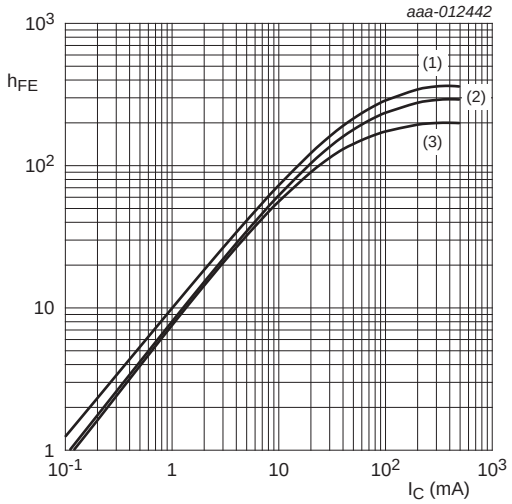
7. Characteristics

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.



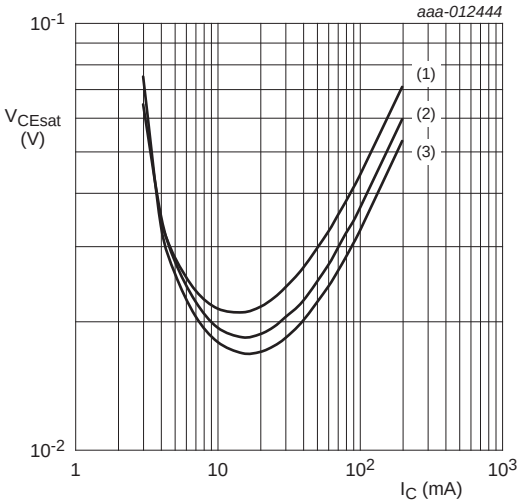
V_{CE} = 5 V

(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



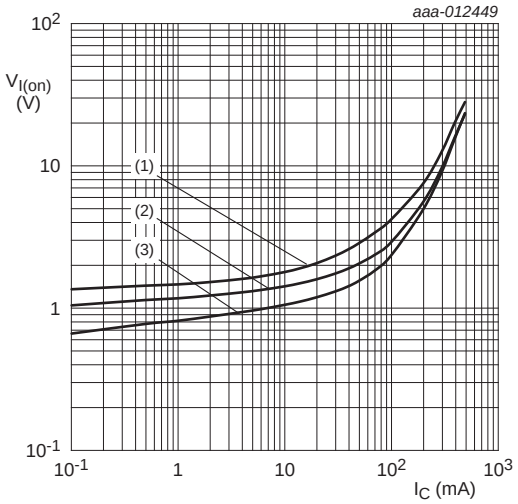
I_C/I_B = 20

(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



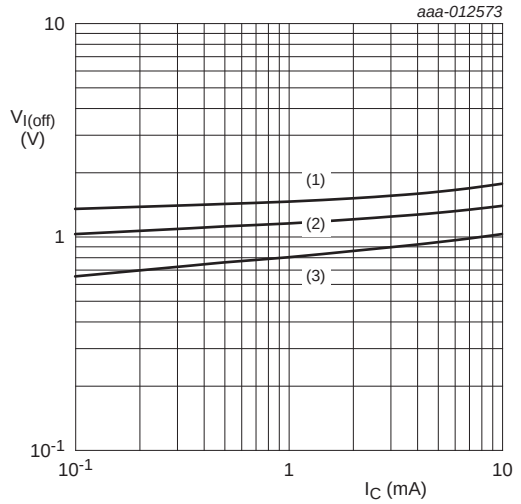
V_{CE} = 0.3 V

(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



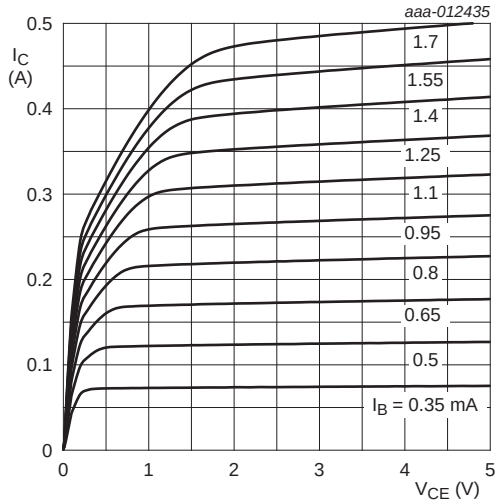
V_{CE} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = 25 °C

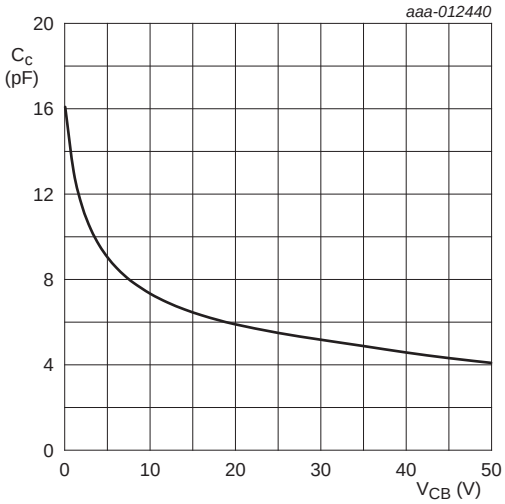
(3) T_{amb} = 100 °C

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



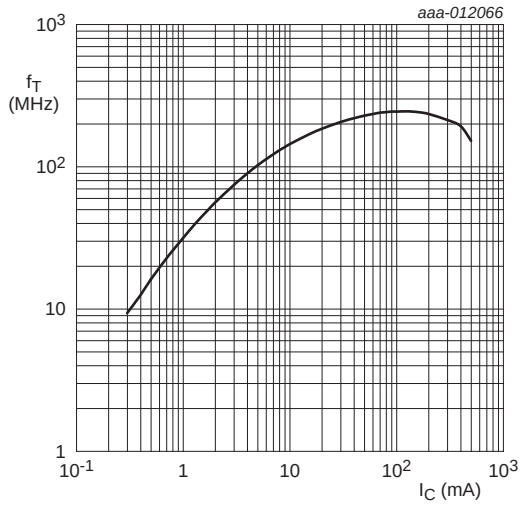
T_{amb} = 25 °C

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



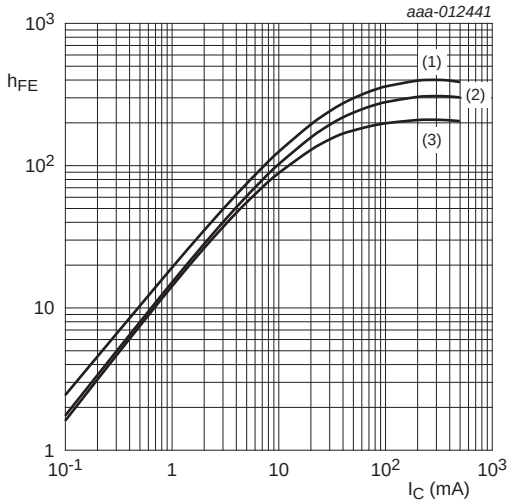
f = 1 MHz; T_{amb} = 25 °C

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



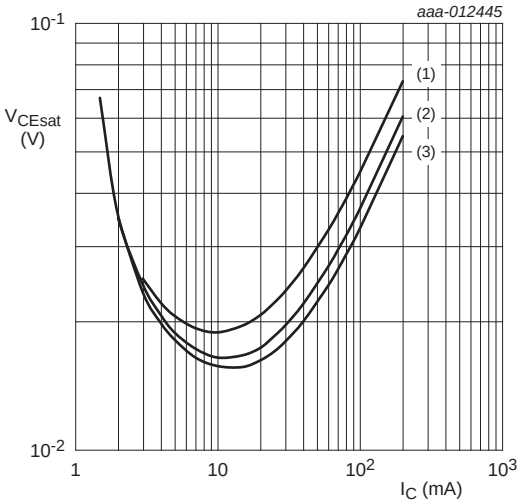
V_{CE} = 5 V

(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



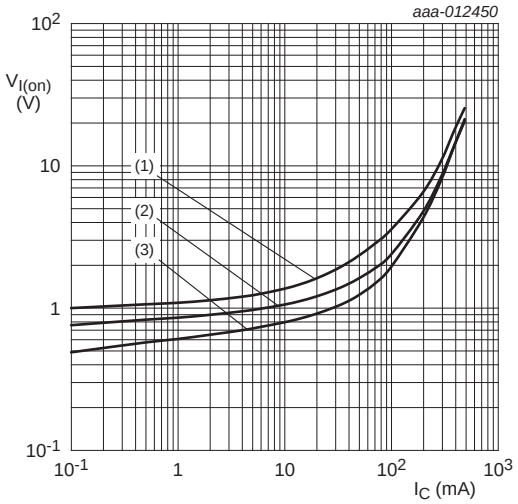
I_C/I_B = 20

(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



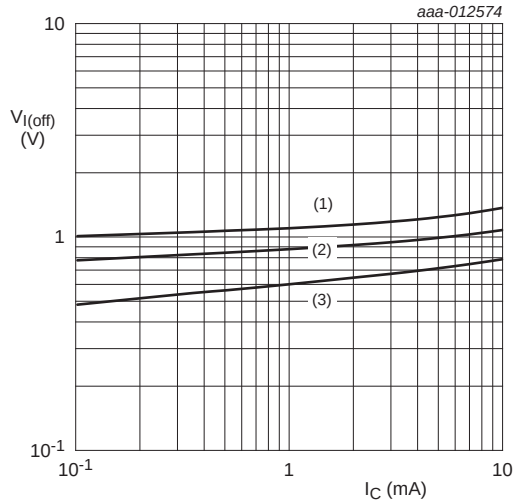
V_{CE} = 0.3 V

(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



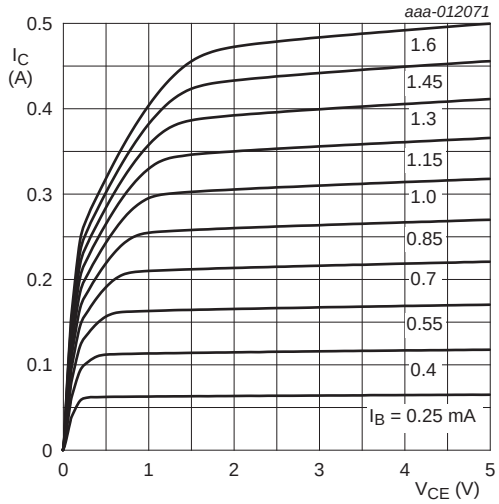
V_{CE} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = 25 °C

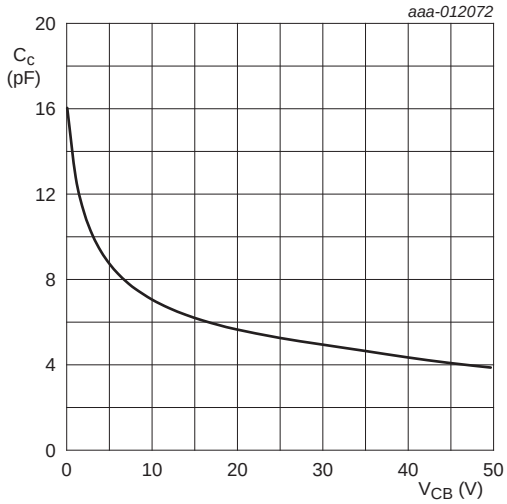
(3) T_{amb} = 100 °C

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



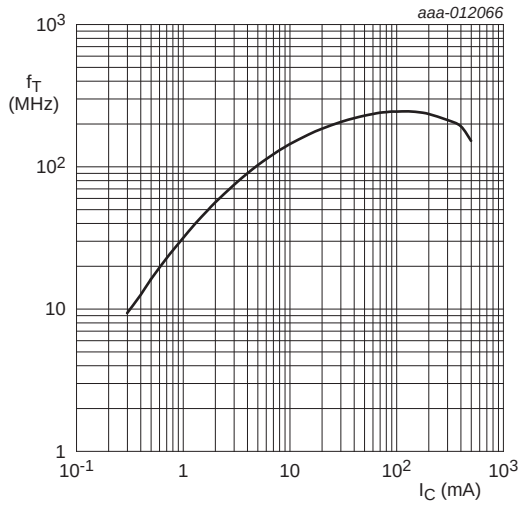
T_{amb} = 25 °C

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



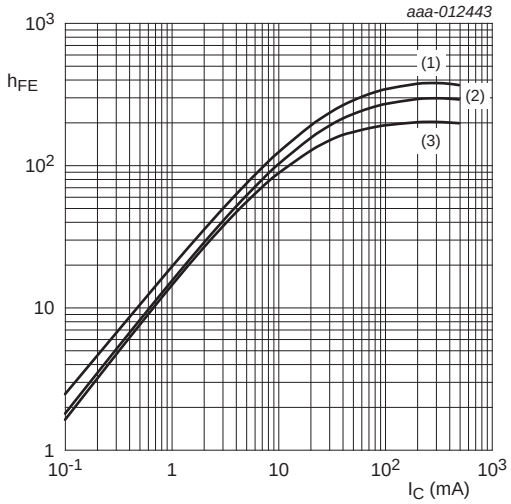
f = 1 MHz; T_{amb} = 25 °C

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



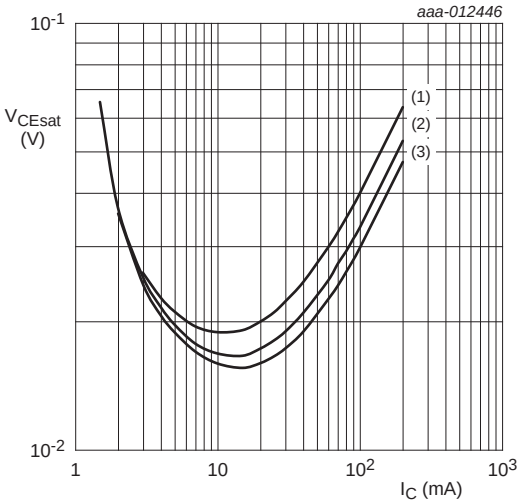
V_{CE} = 5 V

(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



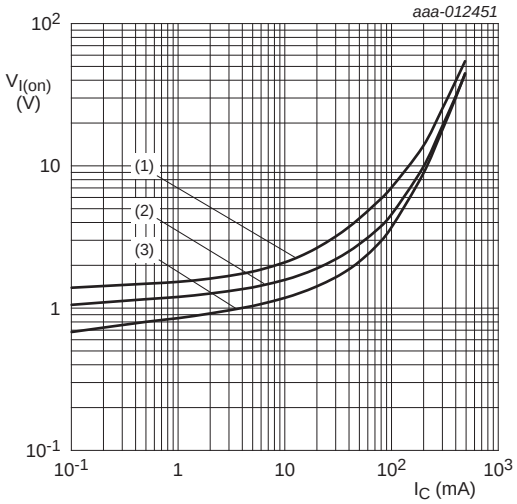
I_C/I_B = 20

(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



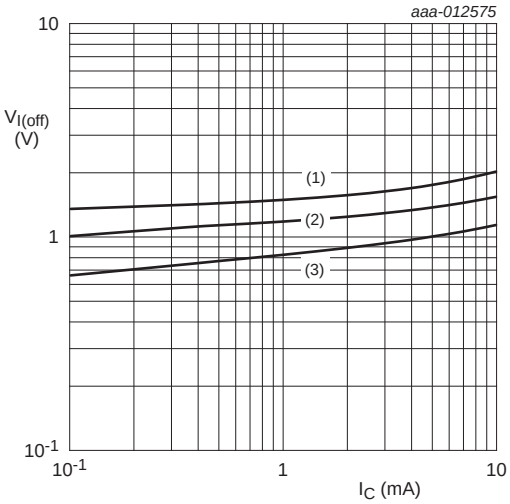
V_{CE} = 0.3 V

(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



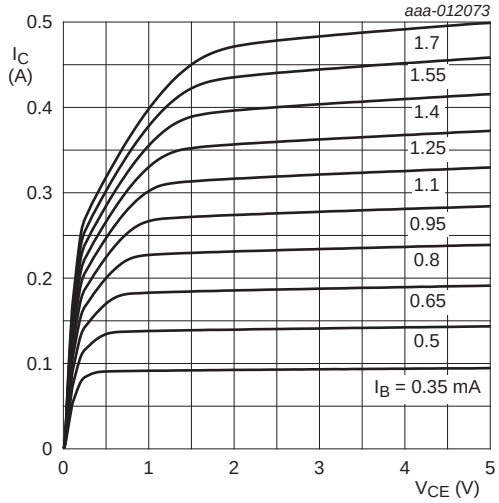
V_{CE} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = 25 °C

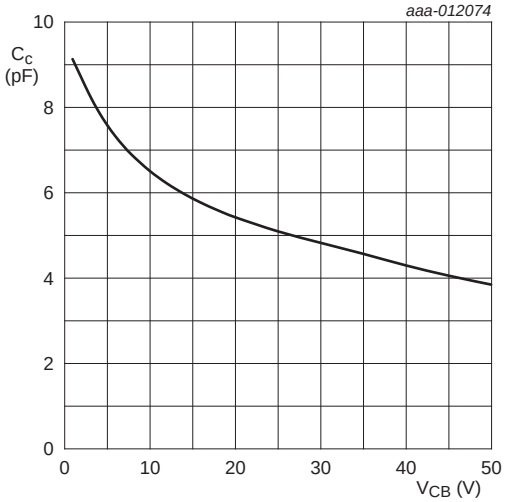
(3) T_{amb} = 100 °C

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



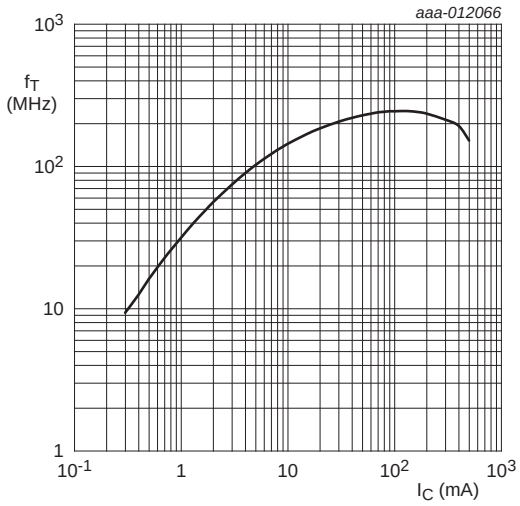
T_{amb} = 25 °C

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

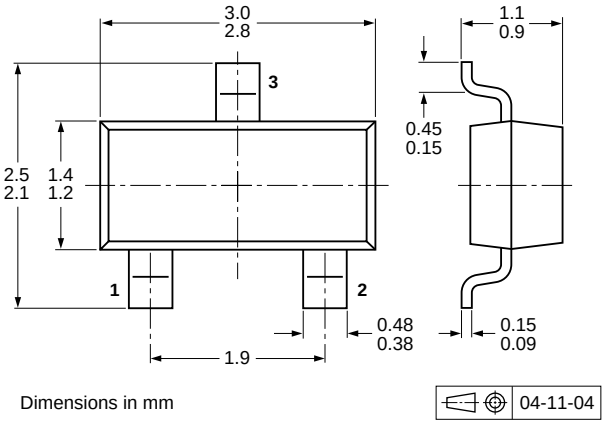
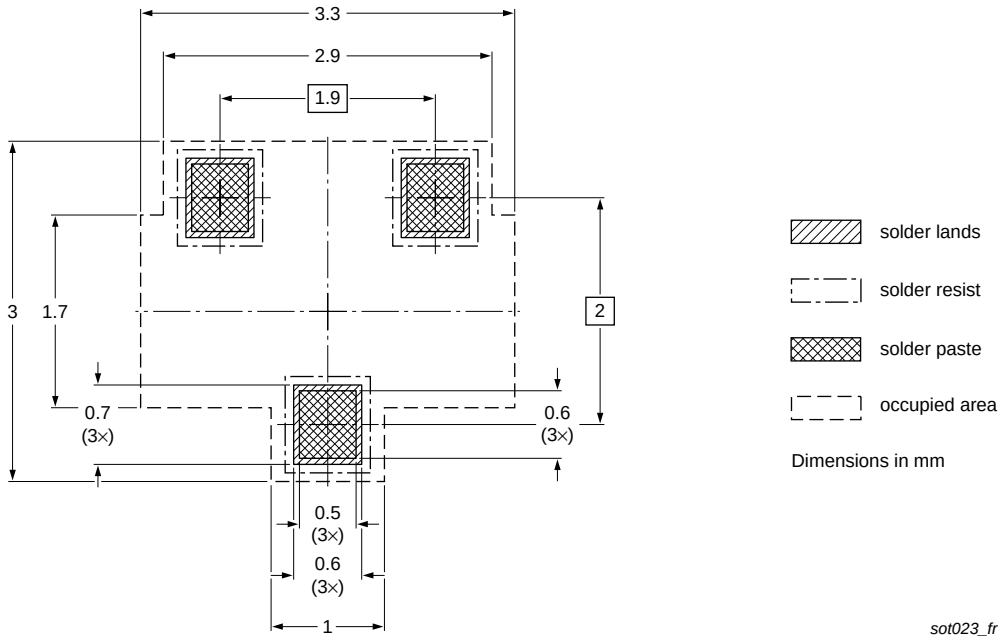


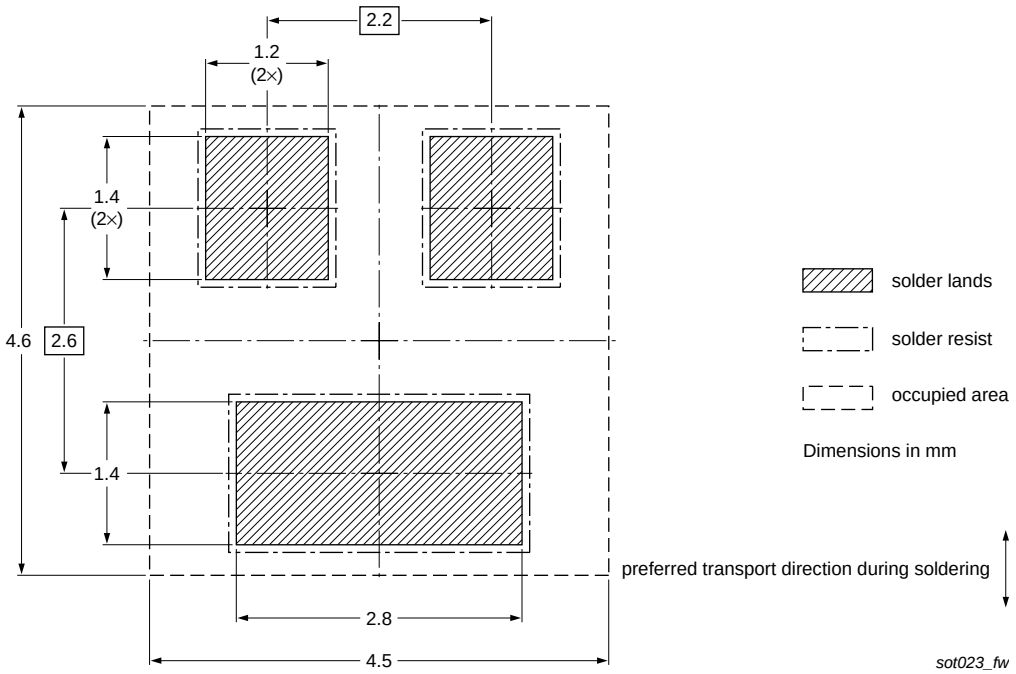
Fig 25. Package outline PDTD1xxxT series (SOT23/TO-236AB)

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.nxp.com.

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13. Contact information

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

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

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