



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



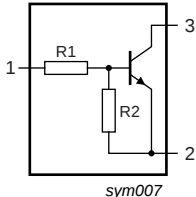
1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	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)		
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

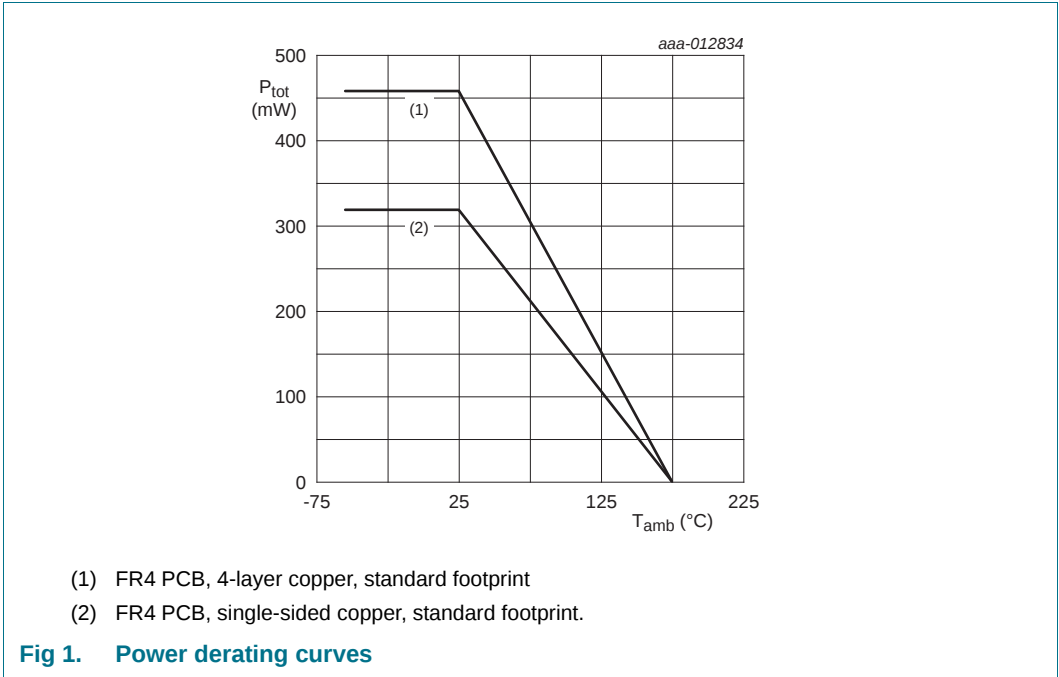
Table 6. Limiting values

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	$T_{amb} \leq 25\text{ °C}$ ^[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.

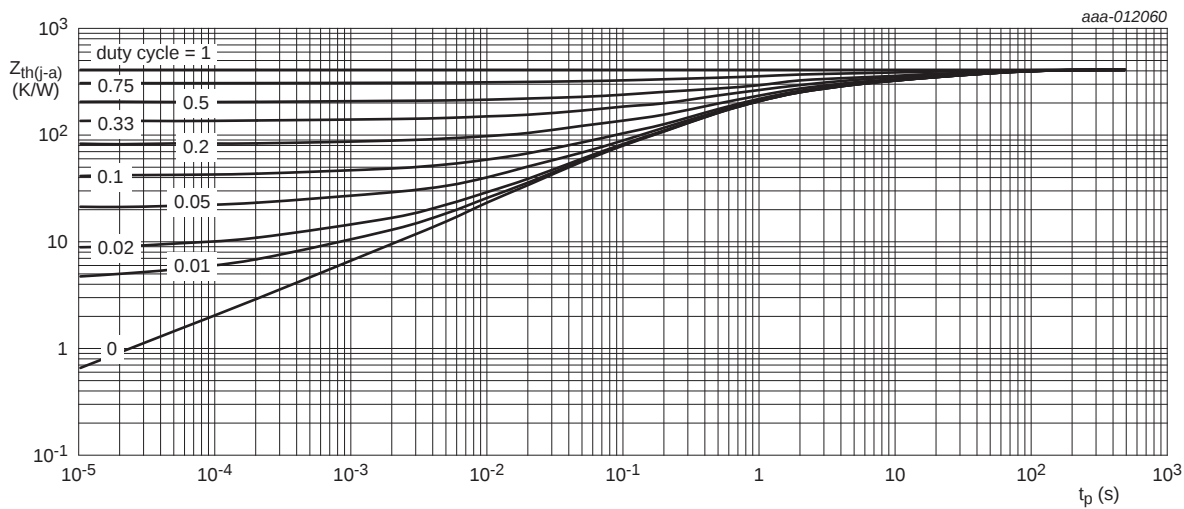


6. Thermal characteristics

Table 7. Thermal characteristics

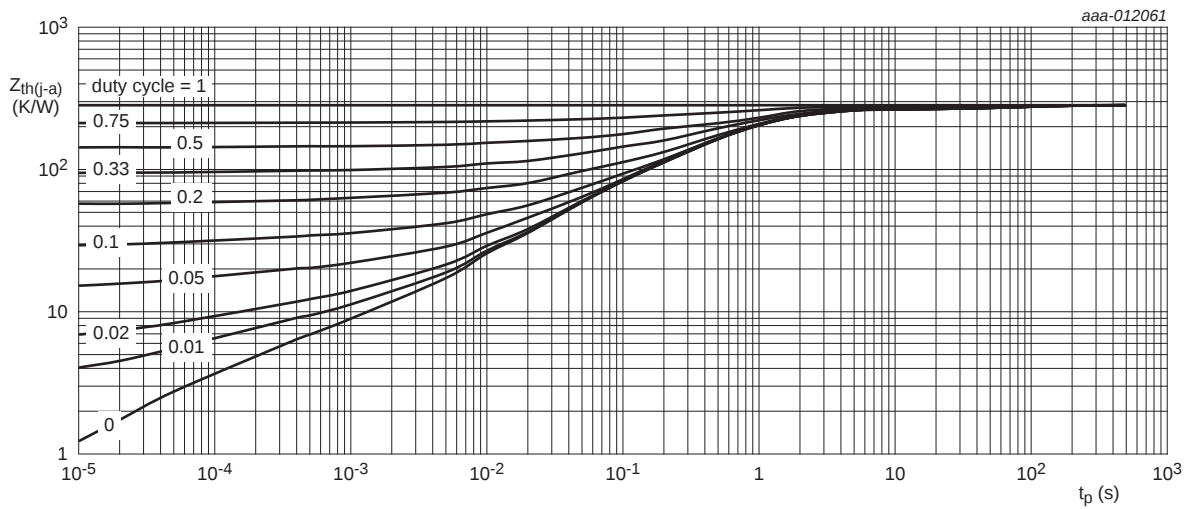
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	470	K/W
			[2]	-	327	K/W

- [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

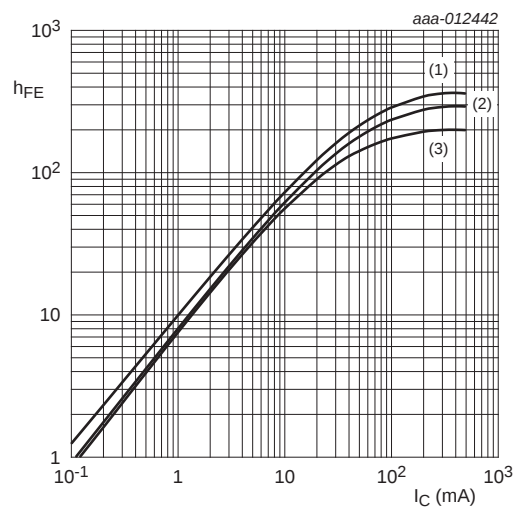
7. Characteristics

Table 8. Characteristics

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

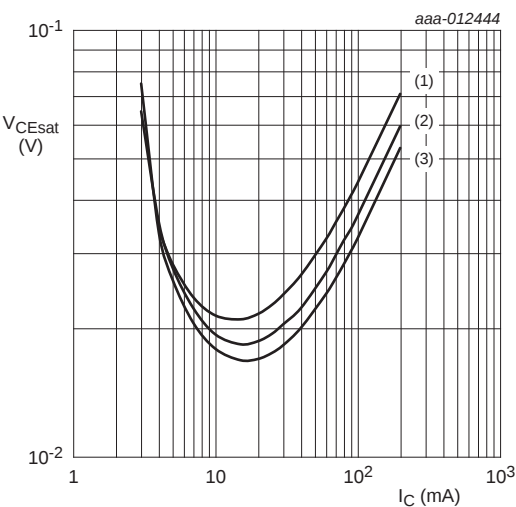
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 40\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 50\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 50\text{ V}; I_B = 0\text{ A}$	-	-	0.5	μA
I_{EBO}	emitter-base 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	$k\Omega$
	PDTD143XT		3.3	4.7	6.1	$k\Omega$
	PDTD114ET		7.0	10	13	$k\Omega$
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.



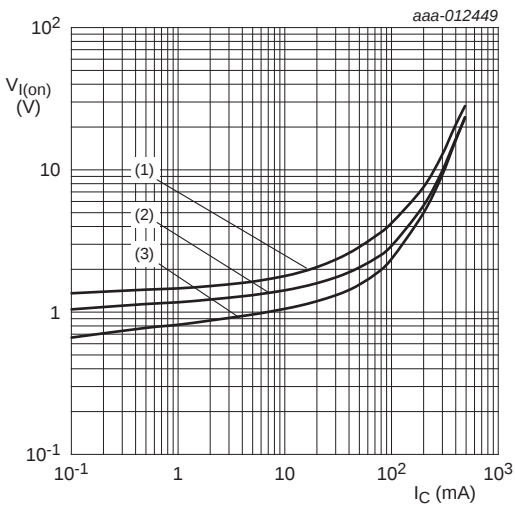
$V_{CE} = 5\text{ V}$
(1) $T_{amb} = 100^\circ\text{C}$
(2) $T_{amb} = 25^\circ\text{C}$
(3) $T_{amb} = -40^\circ\text{C}$

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



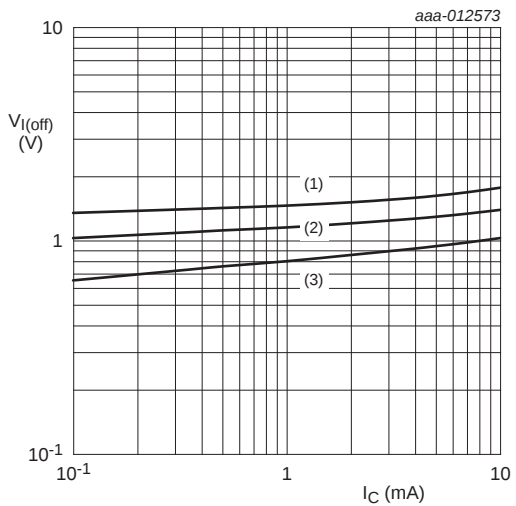
$I_C/I_B = 20$
(1) $T_{amb} = 100^\circ\text{C}$
(2) $T_{amb} = 25^\circ\text{C}$
(3) $T_{amb} = -40^\circ\text{C}$

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



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

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



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

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

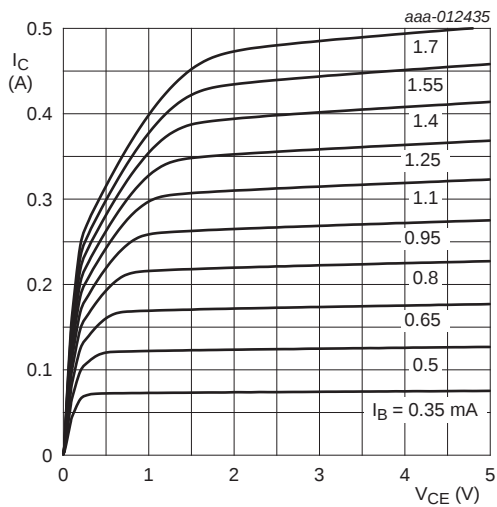


Fig 8. PDTD143ET: Collector current as a function of collector-emitter voltage; typical values

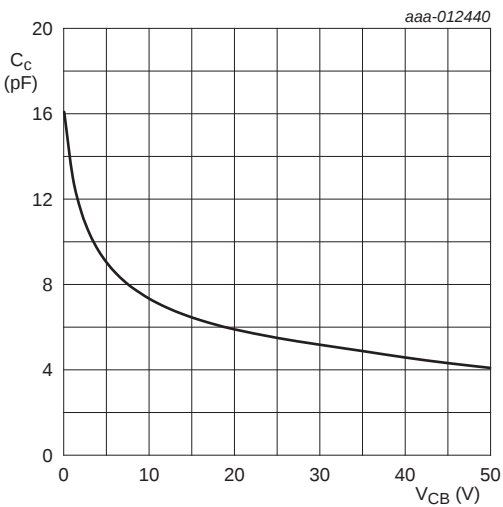


Fig 9. PDTD143ET: Collector capacitance as a function of collector-base voltage; typical values

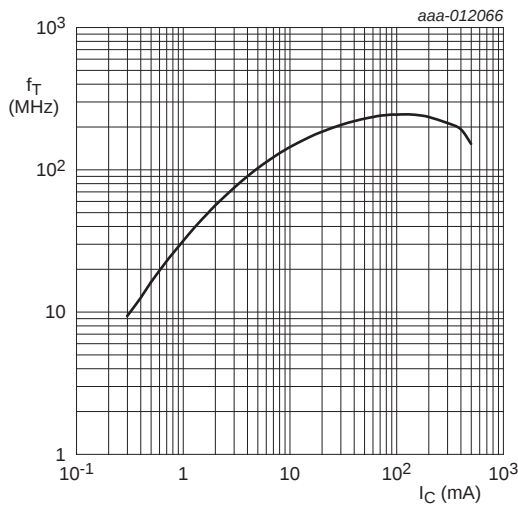
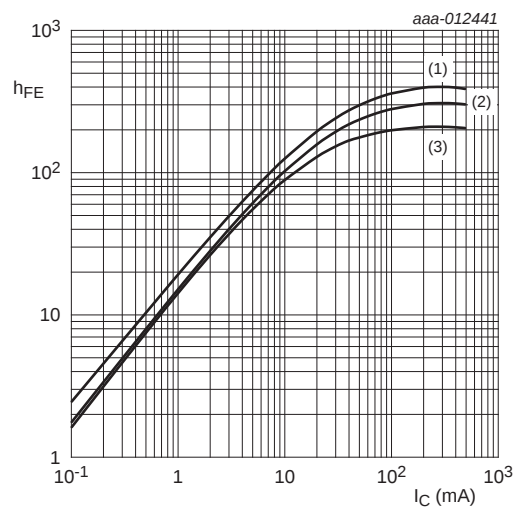
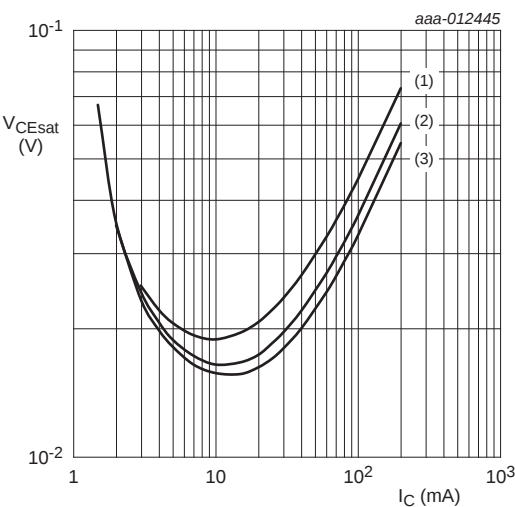


Fig 10. PDTD143ET: Transition frequency as a function of collector current; typical values of built-in transistor



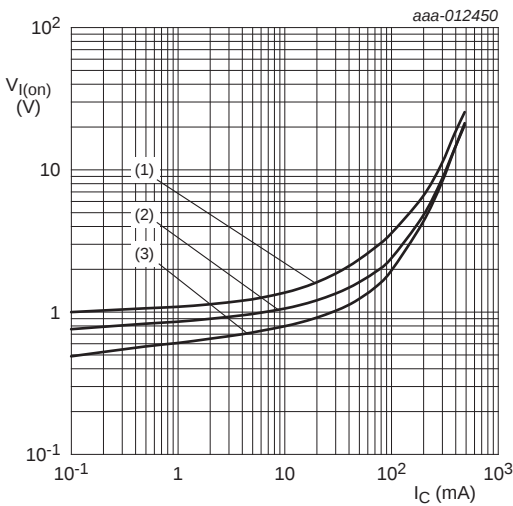
- $V_{CE} = 5\text{ V}$
- (1) $T_{amb} = 100^\circ\text{C}$
 - (2) $T_{amb} = 25^\circ\text{C}$
 - (3) $T_{amb} = -40^\circ\text{C}$

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



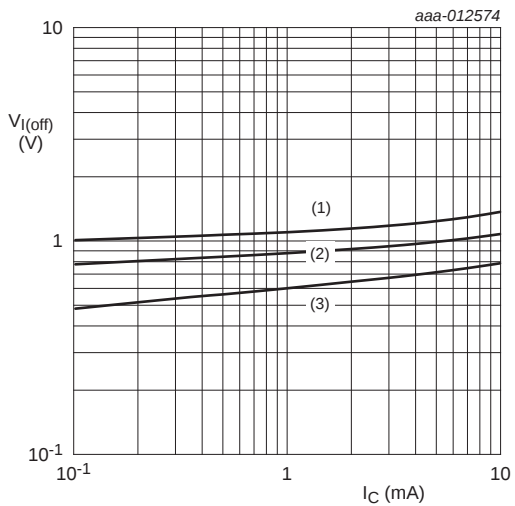
- $I_C/I_B = 20$
- (1) $T_{amb} = 100^\circ\text{C}$
 - (2) $T_{amb} = 25^\circ\text{C}$
 - (3) $T_{amb} = -40^\circ\text{C}$

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



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

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



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

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

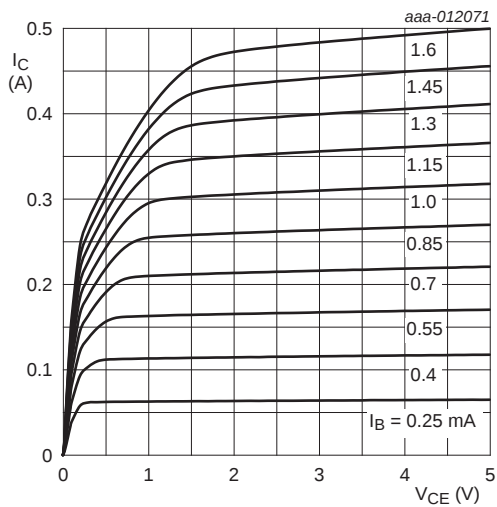


Fig 15. PDTD143XT: Collector current as a function of collector-emitter voltage; typical values

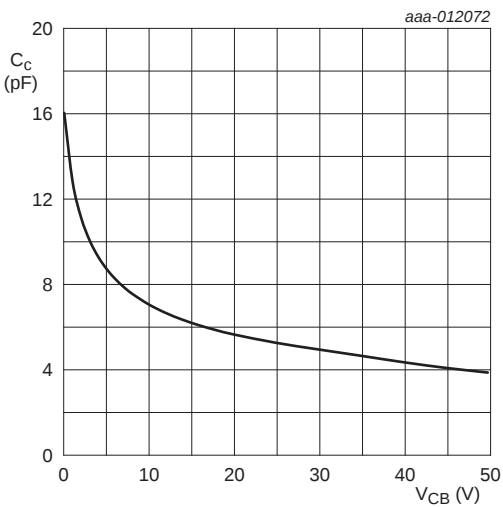


Fig 16. PDTD143XT: Collector capacitance as a function of collector-base voltage; typical values

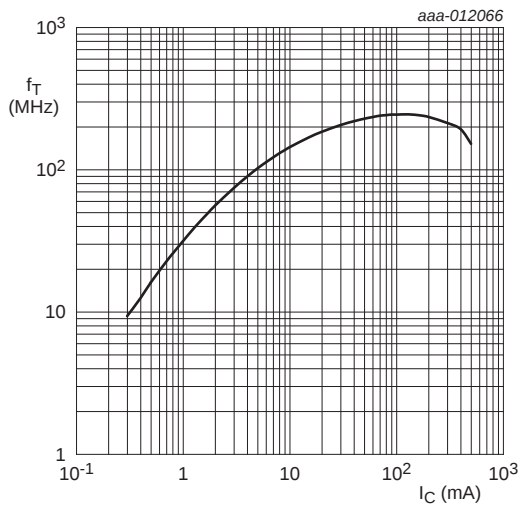
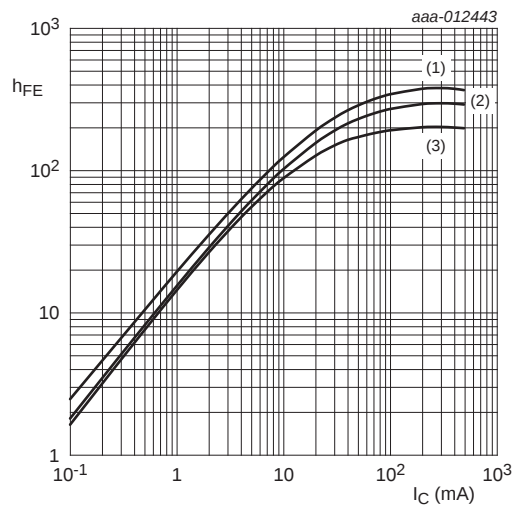
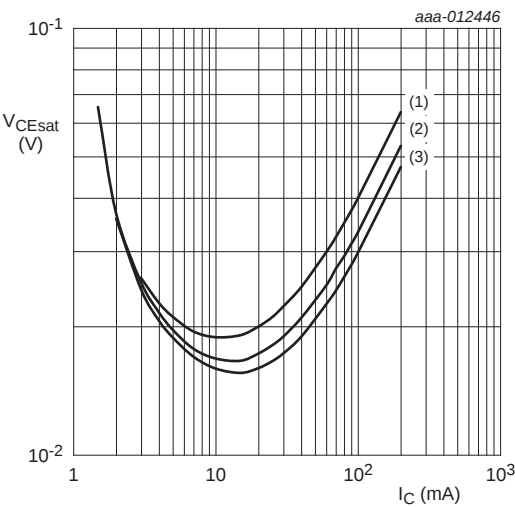


Fig 17. PDTD143XT: Transition frequency as a function of collector current; typical values of built-in transistor



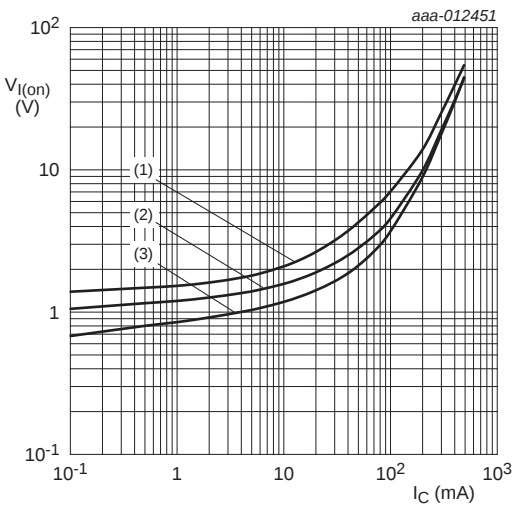
- $V_{CE} = 5\text{ V}$
- (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



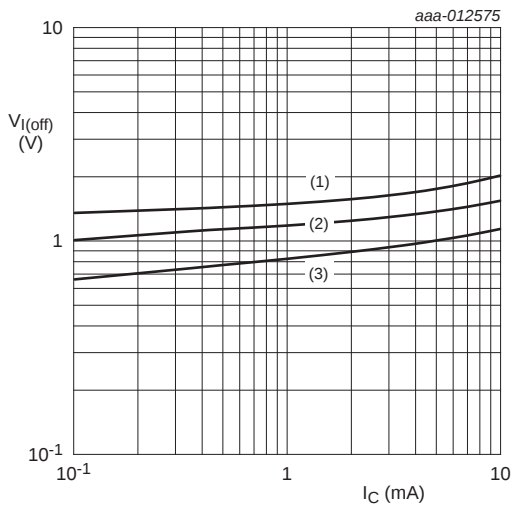
- $I_C/I_B = 20$
- (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = -40\text{ }^{\circ}\text{C}$

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

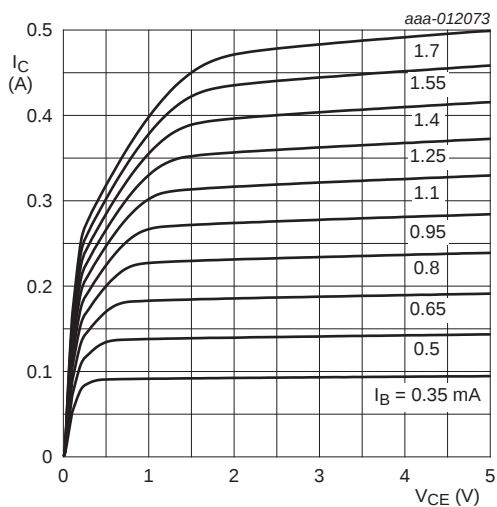


Fig 22. PDTD114ET: Collector current as a function of collector-emitter voltage; typical values

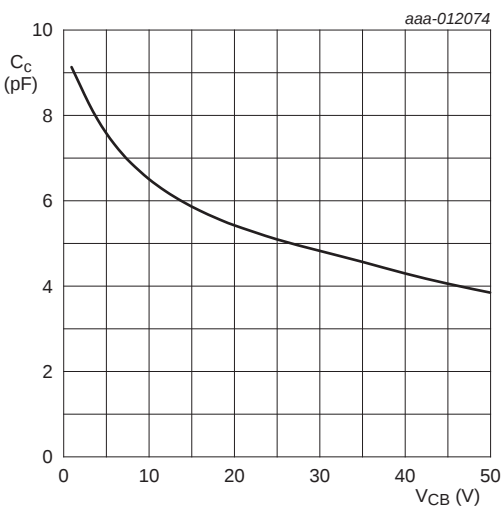


Fig 23. PDTD114ET: Collector capacitance as a function of collector-base voltage; typical values

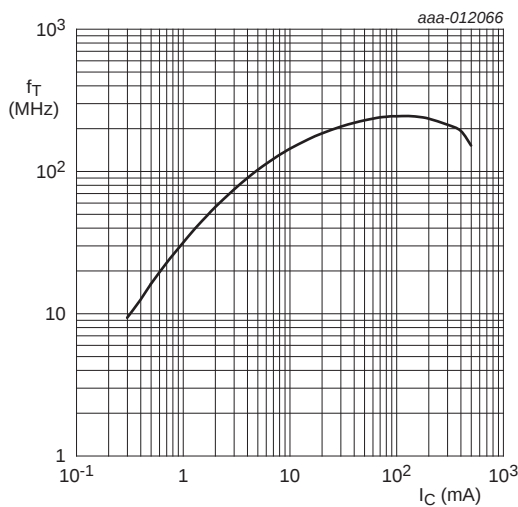


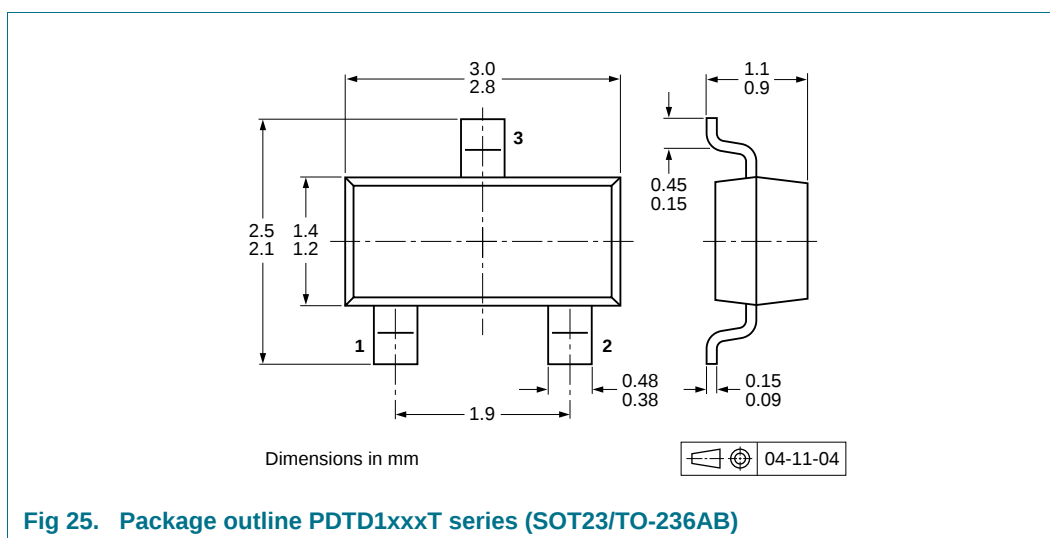
Fig 24. PDTD114ET: Transition frequency as a function of collector current; typical values of built-in transistor

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

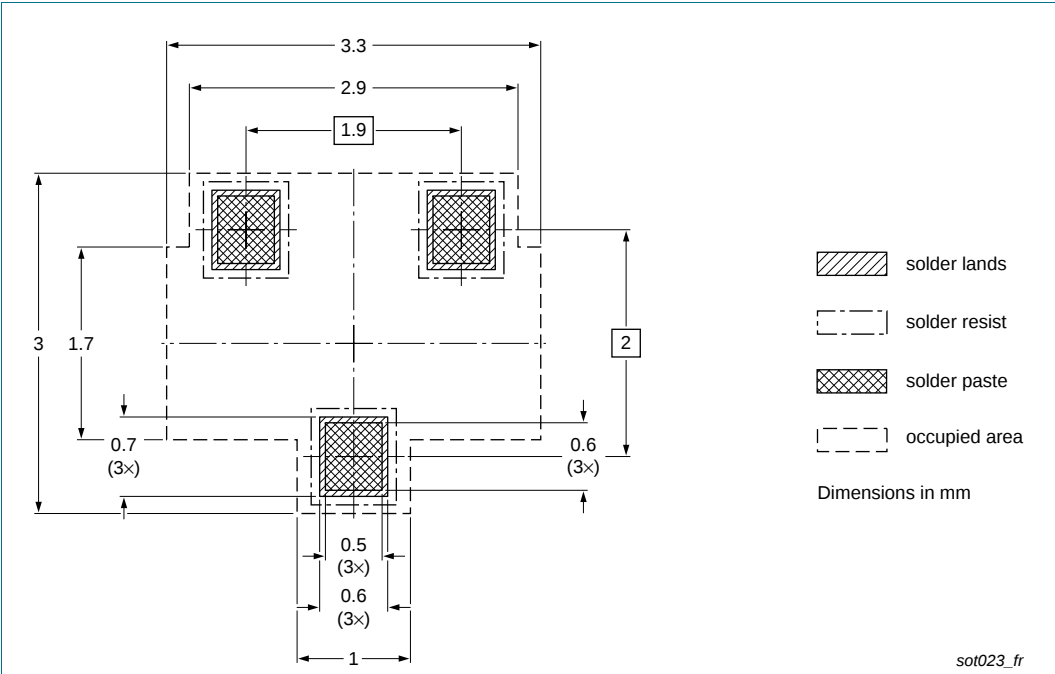


Fig 26. Reflow soldering footprint PDTD1xxxT series (SOT23/TO-236AB)

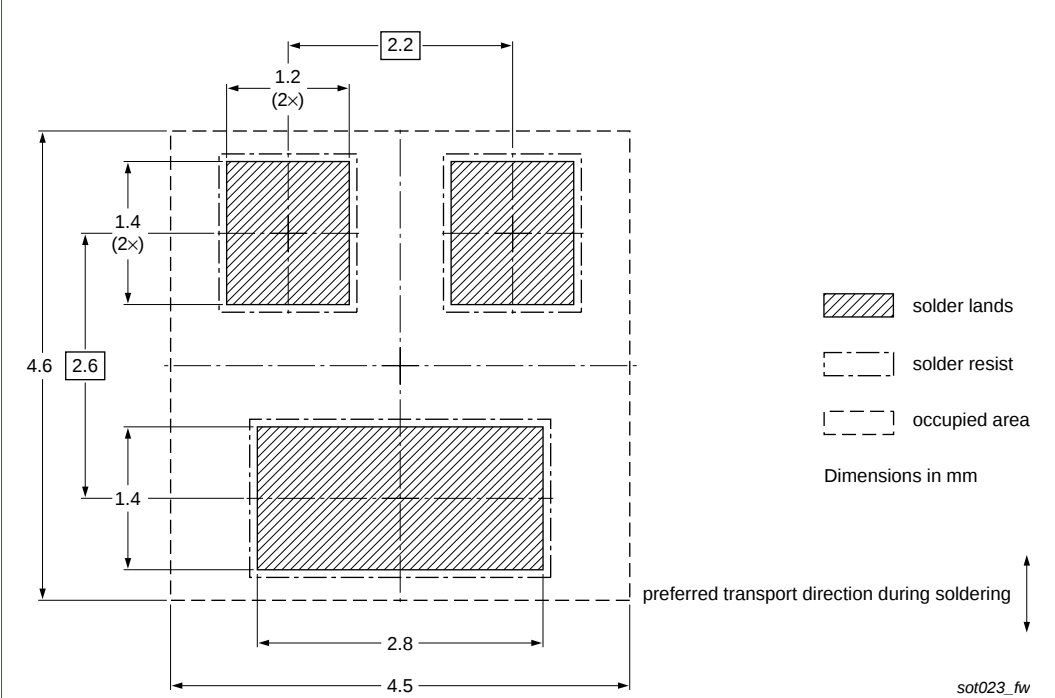


Fig 27. Wave soldering footprint PDTD1xxxT series (SOT23/TO-236AB)

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".

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Date of release: 15 May 2014

Document identifier: PDTD1XXXT_SER