



# PDTC143X/123J/143Z/114YQA series

50 V, 100 mA NPN resistor-equipped transistors

Rev. 1 — 30 October 2015

Product data sheet

## 1. Product profile

### 1.1 General description

100 mA NPN Resistor-Equipped Transistor (RET) family in a leadless ultra small DFN1010D-3 (SOT1215) Surface-Mounted Device (SMD) plastic package with visible and solderable side pads.

Table 1. Product overview

Type number	R1	R2	Nexperia	PNP complement
PDTC143XQA	4.7 k $\Omega$	10 k $\Omega$	DFN1010D-3 (SOT1215)	PDTA143XQA
PDTC123JQA	2.2 k $\Omega$	47 k $\Omega$		PDTA123JQA
PDTC143ZQA	4.7 k $\Omega$	47 k $\Omega$		PDTA143ZQA
PDTC114YQA	10 k $\Omega$	47 k $\Omega$		PDTA114YQA

### 1.2 Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduced pick and place costs
- Low package height of 0.37 mm
- AEC-Q101 qualified
- Suitable for Automatic Optical Inspection (AOI) of solder joint

### 1.3 Applications

- Digital applications
- Cost saving alternative for BC847/BC857 series in digital applications
- Controlling IC inputs
- Switching loads

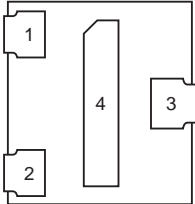
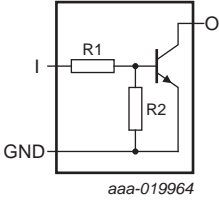
### 1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	50	V
I <sub>O</sub>	output current		-	-	100	mA

## 2. Pinning information

Table 3. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 <p>Transparent top view</p>	 <p>aaa-019964</p>
2	GND	GND (emitter)		
3	O	output (collector)		
4	O	output (collector)		

## 3. Ordering information

Table 4. Ordering information

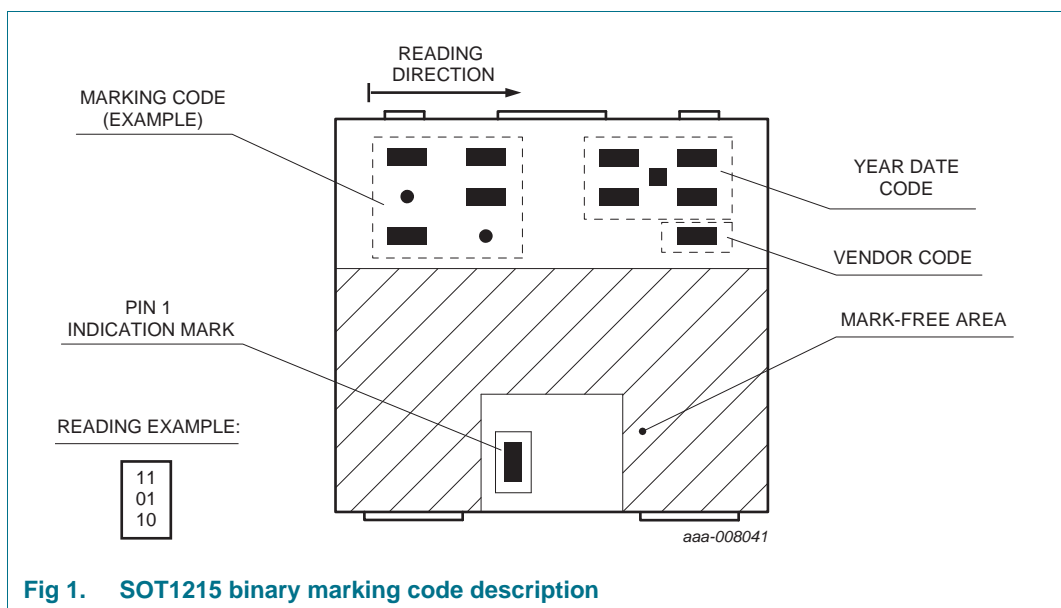
Type number	Package		
	Name	Description	Version
PDTC143XQA	DFN1010D-3	plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body: 1.1 × 1.0 × 0.37 mm	SOT1215
PDTC123JQA			
PDTC143ZQA			
PDTC114YQA			

## 4. Marking

Table 5. Marking codes

Type number	Marking code
PDTC143XQA	11 11 01
PDTC123JQA	10 11 11
PDTC143ZQA	11 00 11
PDTC114YQA	11 10 01

### 4.1 Binary marking code description



## 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				
	PDTC143XQA		-	7	V
	PDTC123JQA		-	5	V
	PDTC143ZQA		-	5	V
	PDTC114YQA		-	6	V

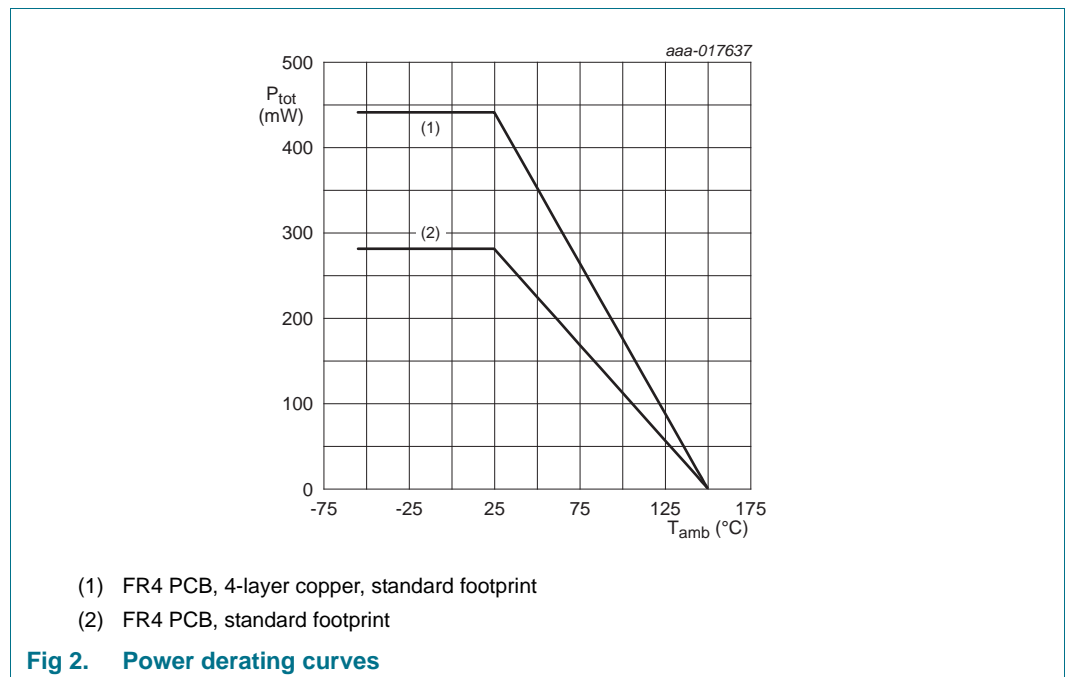
**Table 6.** Limiting values ...continued

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit	
V <sub>I</sub>	input voltage					
	PDTC143XQA		-7	+30	V	
	PDTC123JQA		-5	+12	V	
	PDTC143ZQA		-5	+30	V	
	PDTC114YQA		-6	+40	V	
I <sub>O</sub>	output current		-	100	mA	
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	280	mW
			[2]	-	440	mW
T <sub>j</sub>	junction temperature		-	150	°C	
T <sub>amb</sub>	ambient temperature		-55	+150	°C	
T <sub>stg</sub>	storage temperature		-65	+150	°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]	-	-	446	K/W
			[2]	-	-	284	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.

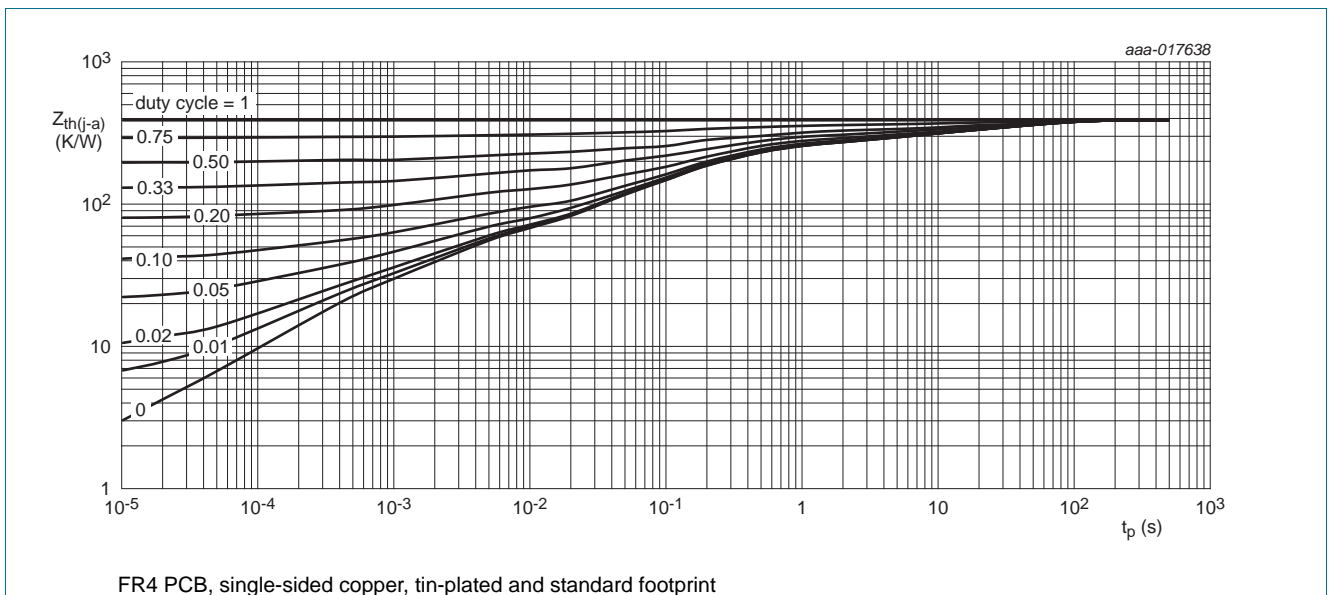


Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

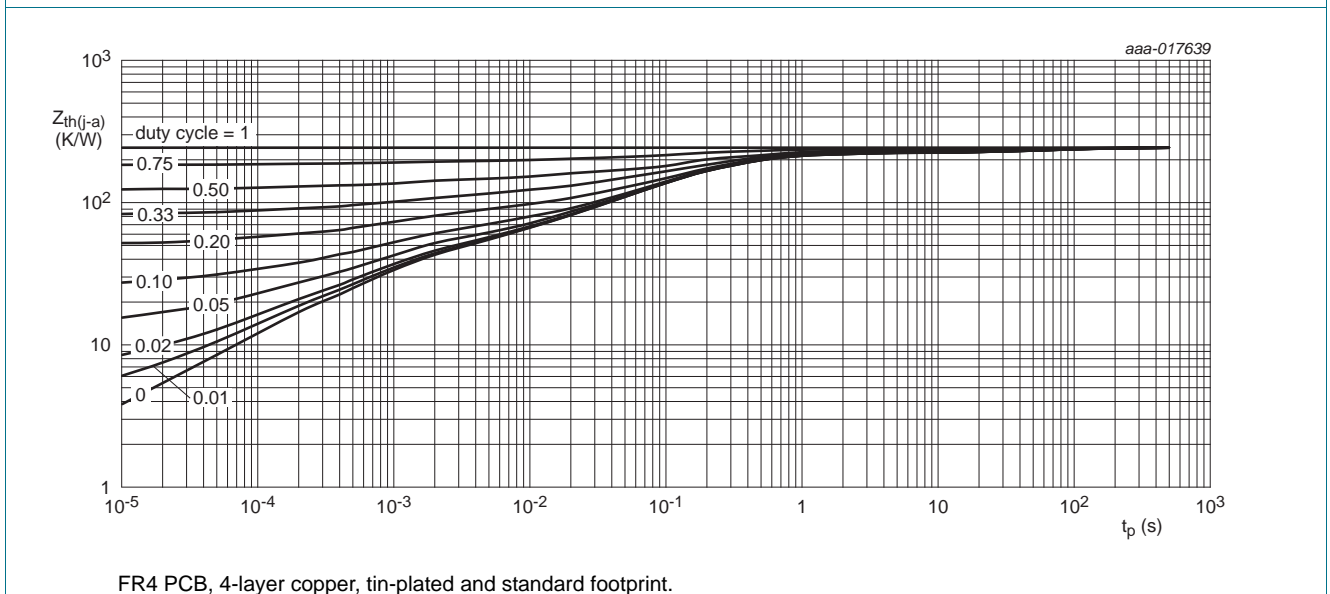


Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. Characteristics

**Table 8. Characteristics**
*T<sub>amb</sub> = 25 °C unless otherwise specified.*

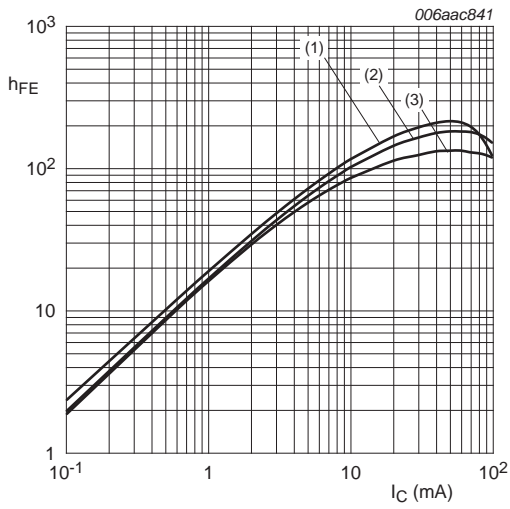
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 50 V; I <sub>E</sub> = 0 A	-	-	100	nA
I <sub>CEO</sub>	collector-emitter cut-off current	V <sub>CE</sub> = 30 V; I <sub>B</sub> = 0 A	-	-	1	μA
		V <sub>CE</sub> = 30 V; I <sub>B</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	5	μA
I <sub>EBO</sub>	emitter-base cut-off current					
	PDTC143XQA	V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A	-	-	600	μA
	PDTC123JQA		-	-	180	μA
	PDTC143ZQA		-	-	170	μA
	PDTC114YQA		-	-	150	μA
h <sub>FE</sub>	DC current gain					
	PDTC143XQA	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 10 mA	50	-	-	
	PDTC123JQA	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 10 mA	100	-	-	
	PDTC143ZQA	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 10 mA	100	-	-	
	PDTC114YQA	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 5 mA	100	-	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage					
	PDTC143XQA	I <sub>C</sub> = 10 mA; I <sub>B</sub> = 0.5 mA	-	-	100	mV
	PDTC123JQA	I <sub>C</sub> = 5 mA; I <sub>B</sub> = 0.25 mA	-	-	100	mV
	PDTC143ZQA	I <sub>C</sub> = 5 mA; I <sub>B</sub> = 0.25 mA	-	-	100	mV
	PDTC114YQA	I <sub>C</sub> = 5 mA; I <sub>B</sub> = 0.25 mA	-	-	100	mV
V <sub>I(off)</sub>	off-state input voltage					
	PDTC143XQA	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 100 μA	-	0.8	0.3	V
	PDTC123JQA		-	0.6	0.5	V
	PDTC143ZQA		-	0.6	0.5	V
	PDTC114YQA		-	0.7	0.5	V
V <sub>I(on)</sub>	on-state input voltage					
	PDTC143XQA	V <sub>CE</sub> = 0.3 V; I <sub>C</sub> = 20 mA	2.5	1.5	-	V
	PDTC123JQA	V <sub>CE</sub> = 0.3 V; I <sub>C</sub> = 5 mA	1.1	0.75	-	V
	PDTC143ZQA	V <sub>CE</sub> = 0.3 V; I <sub>C</sub> = 5 mA	1.3	0.9	-	V
	PDTC114YQA	V <sub>CE</sub> = 0.3 V; I <sub>C</sub> = 1 mA	1.4	0.8	-	V
R1	bias resistor 1 (input) <a href="#">[1]</a>					
	PDTC143XQA		3.3	4.7	6.1	kΩ
	PDTC123JQA		1.54	2.2	2.86	kΩ
	PDTC143ZQA		3.3	4.7	6.1	kΩ
	PDTC114YQA		7	10	13	kΩ

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R2/R1	bias resistor ratio		[1]			
	PDTC143XQA		1.7	2.1	2.6	
	PDTC123JQA		17	21	26	
	PDTC143ZQA		8	10	12	
	PDTC114YQA		3.7	4.7	5.7	
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	-	2.5	pF
$f_T$	transition frequency	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$	[2]	230	-	MHz

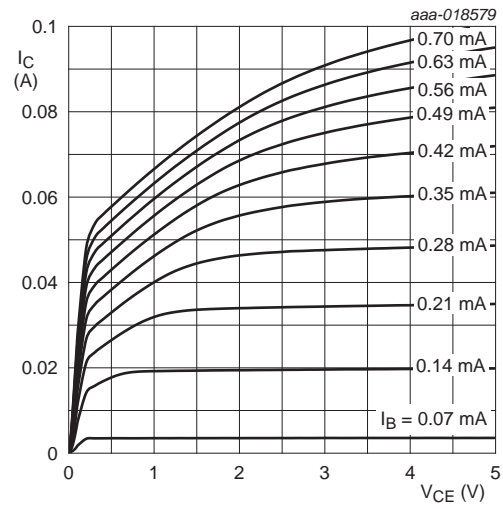
[1] See [Section 8 "Test information"](#) for resistor calculation and test conditions.

[2] Characteristics of built-in transistor.



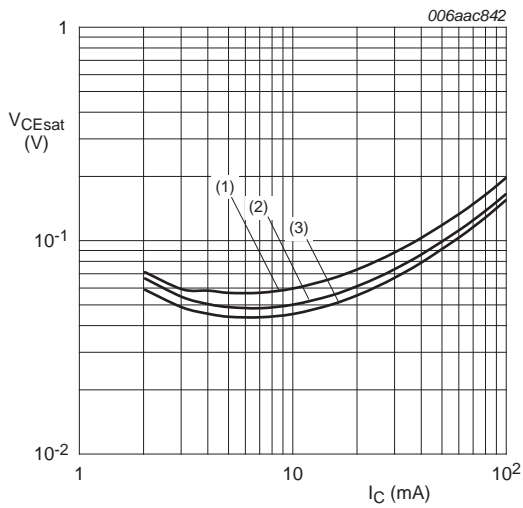
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 5. PDTC143XQA: DC current gain as a function of collector current; typical values**



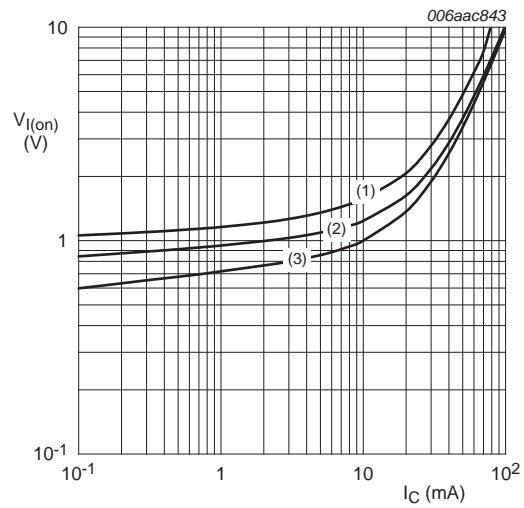
$T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig 6. PDTC143XQA: Collector current as a function of collector-emitter voltage; typical values**



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

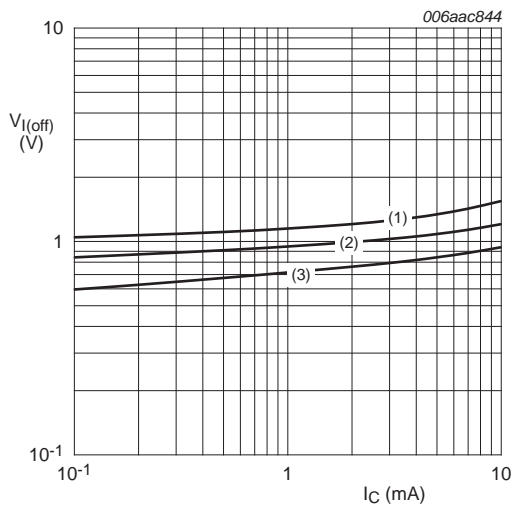
**Fig 7. PDTC143XQA: Collector-emitter saturation voltage as a function of collector current; typical values**



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

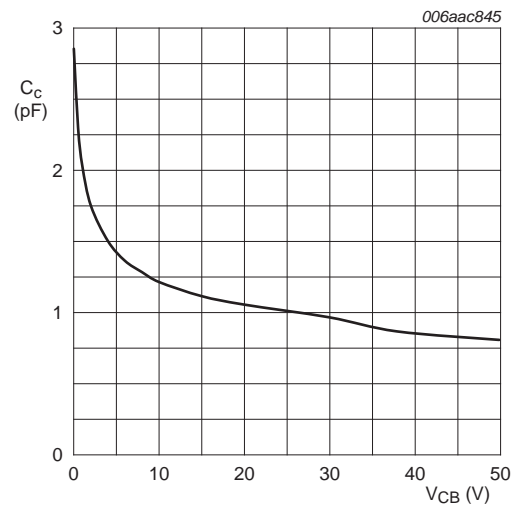
**Fig 8. PDTC143XQA: On-state input voltage as a function of collector current; typical values**





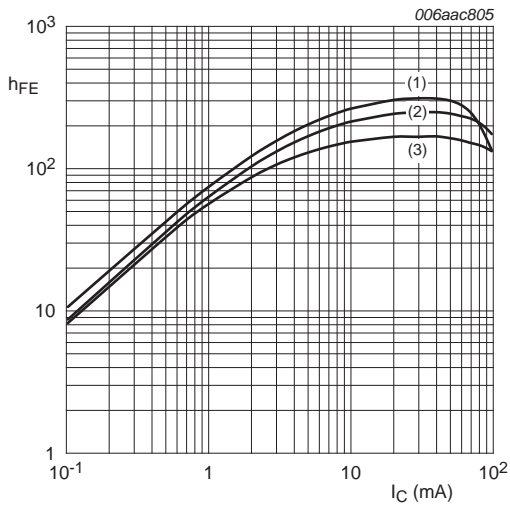
- $V_{CE} = 5\text{ V}$
- (1)  $T_{amb} = -40\text{ °C}$
  - (2)  $T_{amb} = 25\text{ °C}$
  - (3)  $T_{amb} = 100\text{ °C}$

**Fig 9. PDTC143XQA: Off-state input voltage as a function of collector current; typical values**



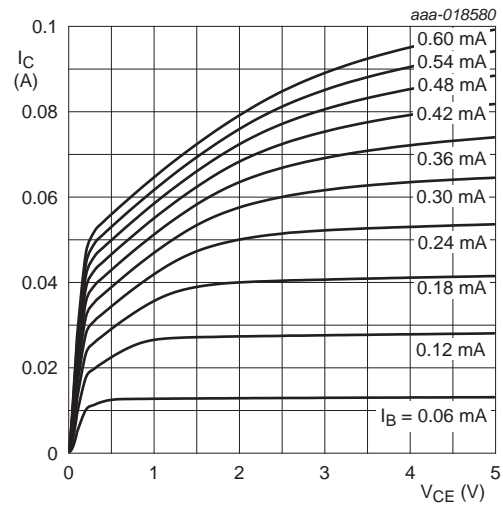
$f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$

**Fig 10. PDTC143XQA: Collector capacitance as a function of collector-base voltage; typical values**



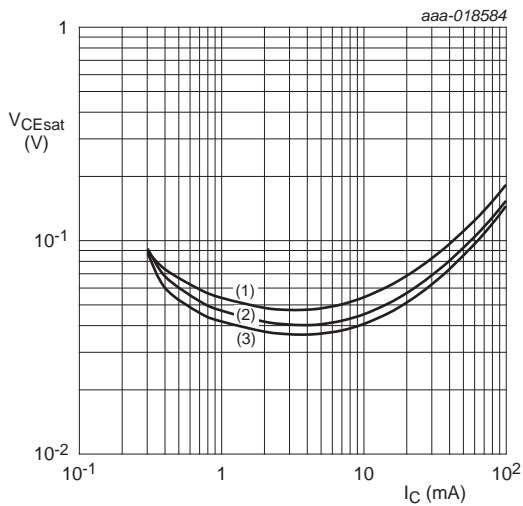
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 11. PDTC123JQA: DC current gain as a function of collector current; typical values**



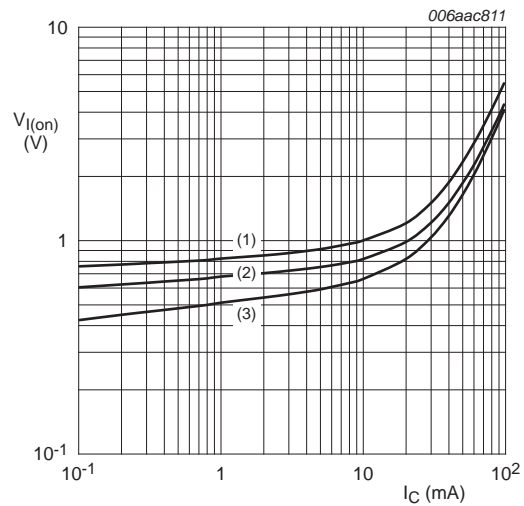
$T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig 12. PDTC123JQA: Collector current as a function of collector-emitter voltage; typical values**



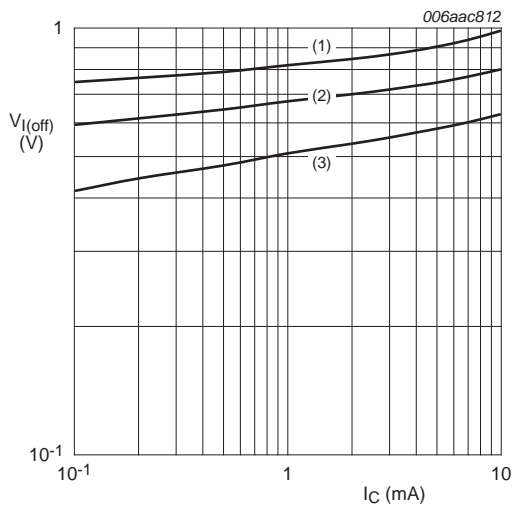
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 13. PDTC123JQA: Collector-emitter saturation voltage as a function of collector current; typical values**



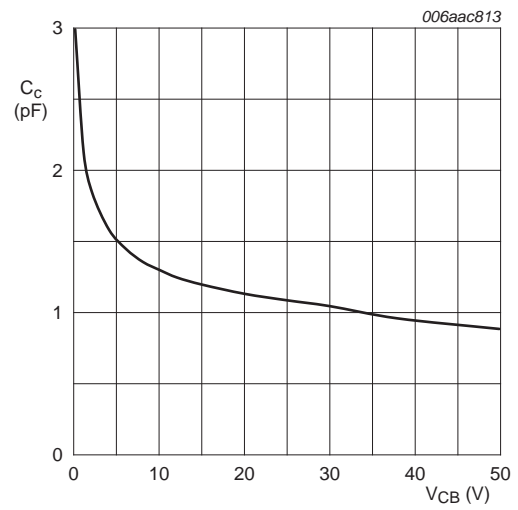
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 14. PDTC123JQA: On-state input voltage as a function of collector current; typical values**



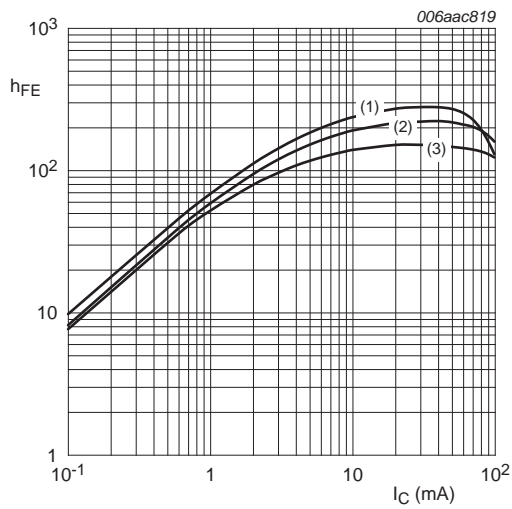
- $V_{CE} = 5 \text{ V}$
- (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$
  - (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$
  - (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 15. PDTC123JQA: Off-state input voltage as a function of collector current; typical values**



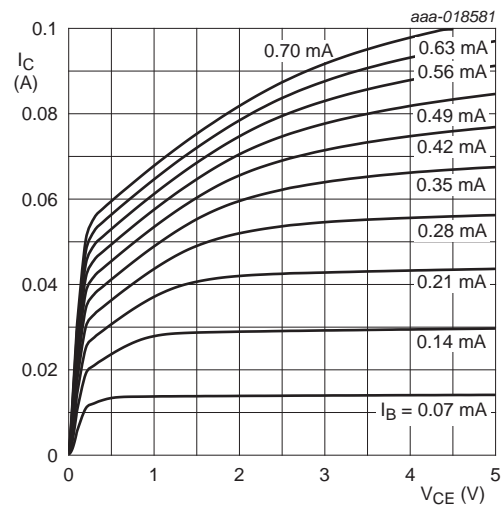
$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig 16. PDTC123JQA: Collector capacitance as a function of collector-base voltage; typical values**



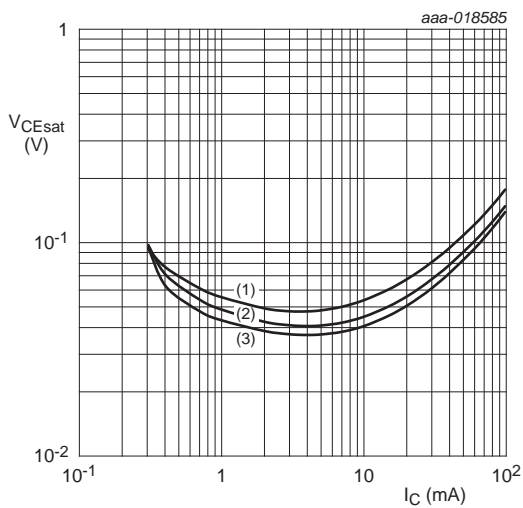
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 17. PDTC143ZQA: DC current gain as a function of collector current; typical values**



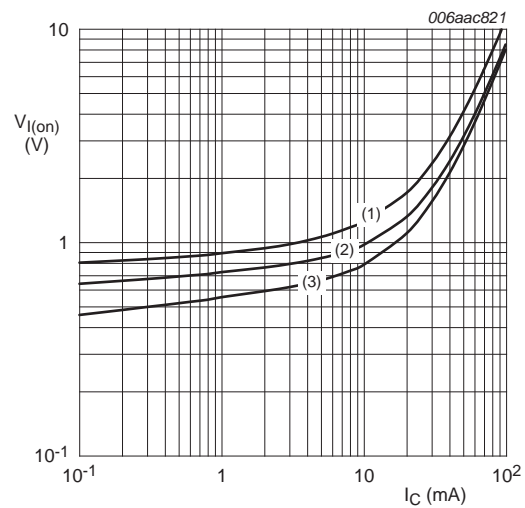
$T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig 18. PDTC143ZQA: Collector current as a function of collector-emitter voltage; typical values**



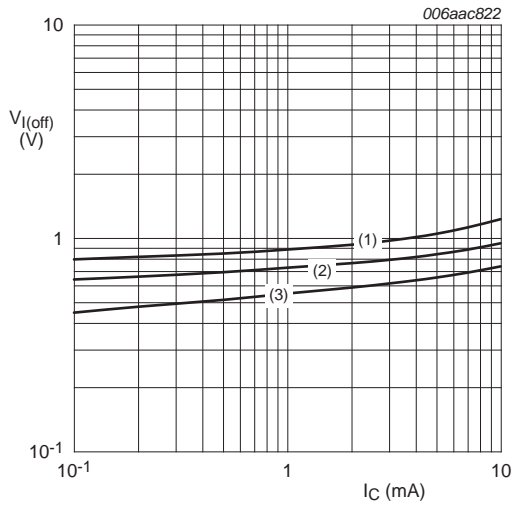
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 19. PDTC143ZQA: Collector-emitter saturation voltage as a function of collector current; typical values**



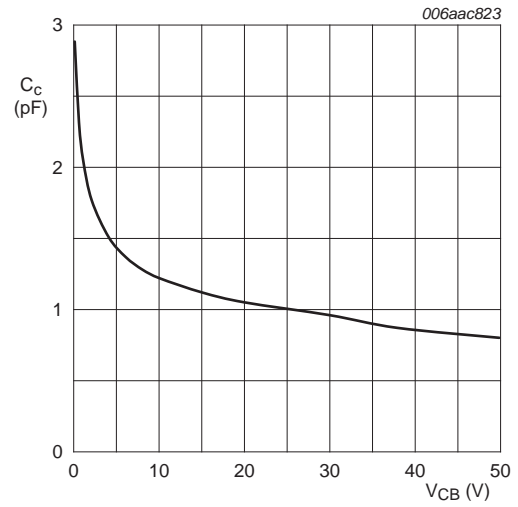
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 20. PDTC143ZQA: On-state input voltage as a function of collector current; typical values**



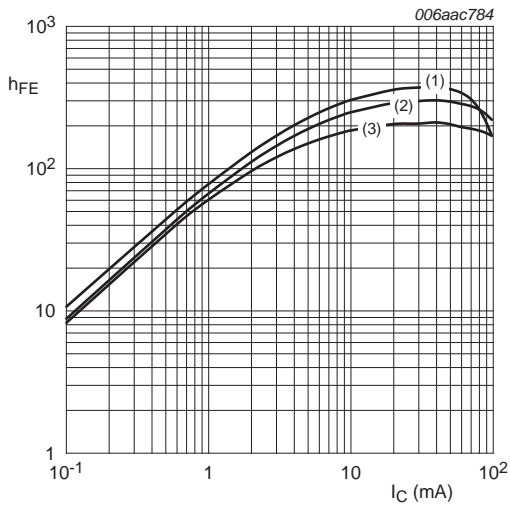
- $V_{CE} = 5\text{ V}$
- (1)  $T_{amb} = -40\text{ °C}$
  - (2)  $T_{amb} = 25\text{ °C}$
  - (3)  $T_{amb} = 100\text{ °C}$

**Fig 21. PDTC143ZQA: Off-state input voltage as a function of collector current; typical values**



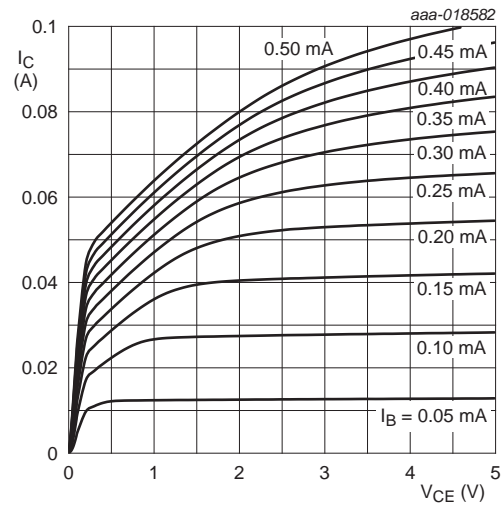
$f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$

**Fig 22. PDTC143ZQA: Collector capacitance as a function of collector-base voltage; typical values**



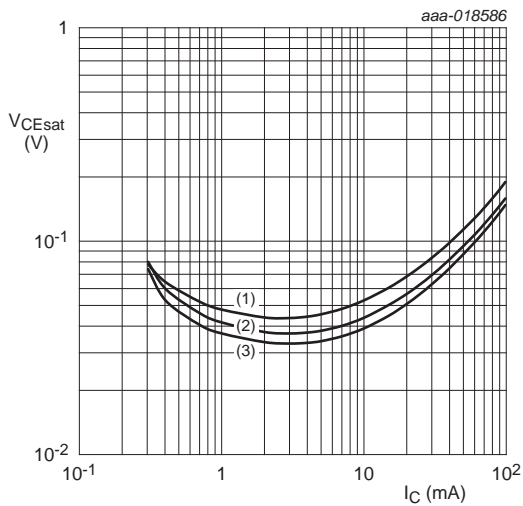
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 23. PDTC114YQA: DC current gain as a function of collector current; typical values**



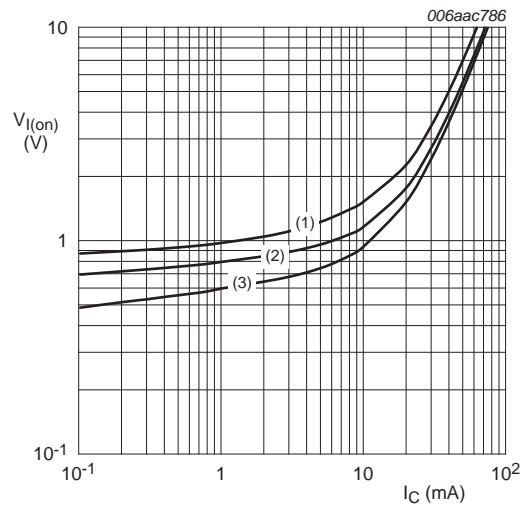
$T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig 24. PDTC114YQA: Collector current as a function of collector-emitter voltage; typical values**



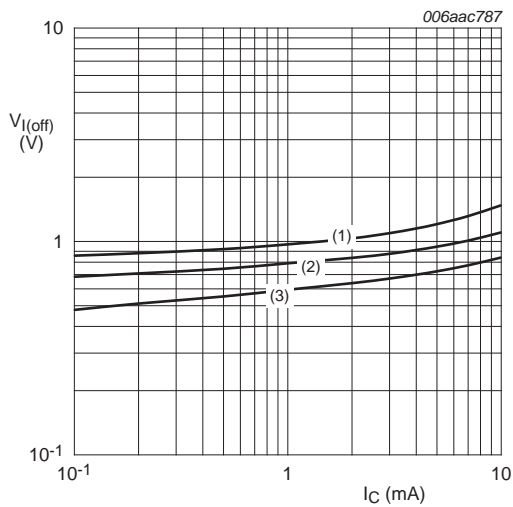
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 25. PDTC114YQA: Collector-emitter saturation voltage as a function of collector current; typical values**



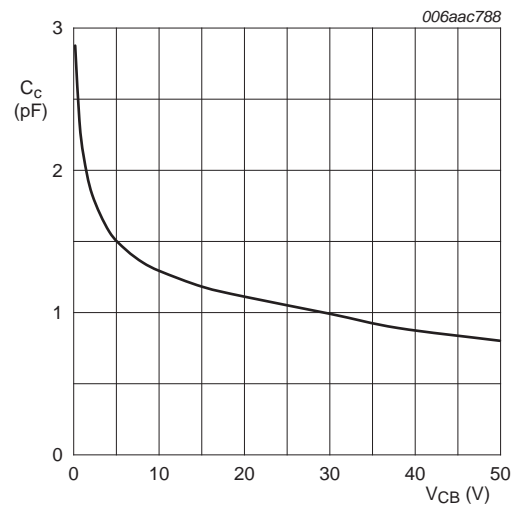
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 26. PDTC114YQA: On-state input voltage as a function of collector current; typical values**



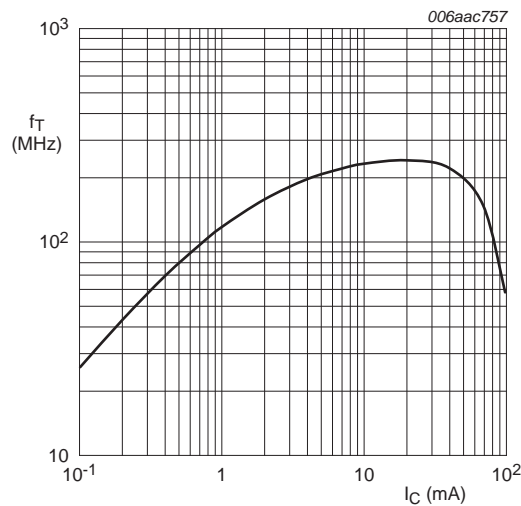
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -40\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 27. PDTC114YQA: Off-state input voltage as a function of collector current; typical values**



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

**Fig 28. PDTC114YQA: Collector capacitance as a function of collector-base voltage; typical values**



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

**Fig 29. 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.

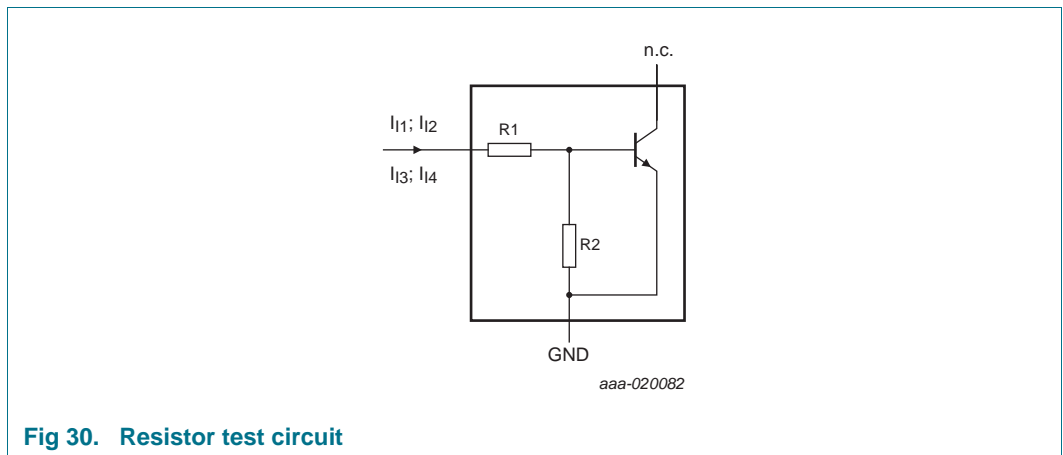
### 8.2 Resistor calculation

- Calculation of bias resistor 1 (R1):

$$R1 = \frac{V(I_{I2}) - V(I_{I1})}{I_{I2} - I_{I1}}$$

- Calculation of bias resistor ratio (R2/R1):

$$\frac{R2}{R1} = \frac{V(I_{I4}) - V(I_{I3})}{R1 \cdot (I_{I4} - I_{I3})} - 1$$



**Fig 30. Resistor test circuit**

### 8.3 Resistor test conditions

**Table 9. Resistor test conditions**

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I <sub>I1</sub>	I <sub>I2</sub>	I <sub>I3</sub>	I <sub>I4</sub>
PDTC143XQA	4.7	10	350 μA	450 μA	-350 μA	-450 μA
PDTC123JQA	2.2	47	90 μA	140 μA	-55 μA	-105 μA
PDTC143ZQA	4.7	47	90 μA	140 μA	-55 μA	-105 μA
PDTC114YQA	10	47	90 μA	140 μA	-55 μA	-105 μA



## 9. Package outline

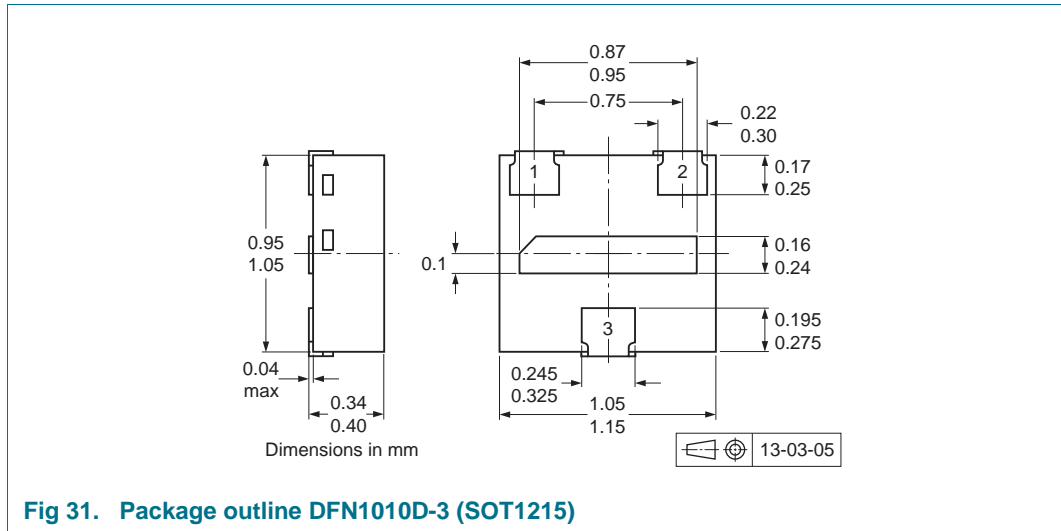


Fig 31. Package outline DFN1010D-3 (SOT1215)

## 10. Soldering

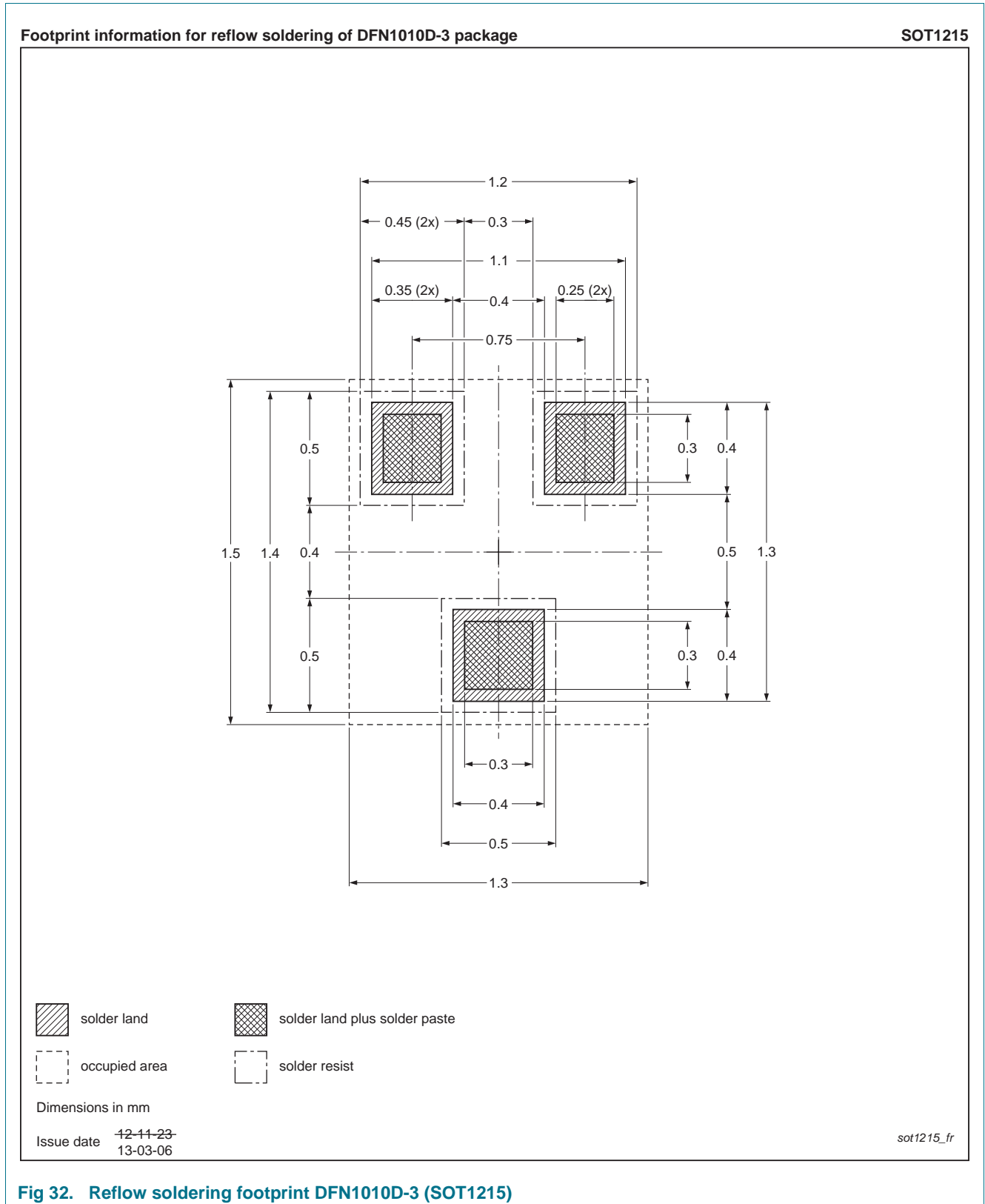


Fig 32. Reflow soldering footprint DFN1010D-3 (SOT1215)

## 11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PDTC143X_123J_143Z_114YQA_SER v.1	20151030	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.

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