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Kind regards,

Team Nexperia



# PDTB113Z/123Y/143XQA series

50 V, 500 mA PNP resistor-equipped transistors

Rev. 1 — 6 January 2016

Product data sheet

## 1. Product profile

### 1.1 General description

PNP 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	Package NXP	NPN complement
PDTB113ZQA	1 kΩ	10 kΩ	DFN1010D-3 (SOT1215)	PDTD113ZQA
PDTB123YQA	2.2 kΩ	10 kΩ		PDTD123YQA
PDTB143XQA	4.7 kΩ	10 kΩ		PDTD143XQA

### 1.2 Features and benefits

- 500 mA output current capability
- Built-in bias resistors
- ± 10% resistor ratio tolerance
- Simplifies circuit design
- Reduces component count
- Reduced pick and place costs
- Low package height of 0.37 mm
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- AEC-Q101 qualified

### 1.3 Applications

- Digital applications
- Cost saving alternative for BC807/BC817 series in digital applications
- Controlling IC inputs
- Switching loads

### 1.4 Quick reference data

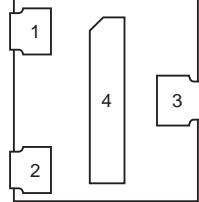
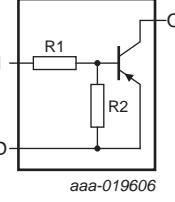
Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	-50	V
I <sub>O</sub>	output current		-	-	-500	mA



## 2. Pinning information

**Table 3. Pinning**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 Transparent top view	 <small>aaa-019606</small>
2	GND	GND (emitter)		
3	O	output (collector)		
4	O	output (collector)		

## 3. Ordering information

**Table 4. Ordering information**

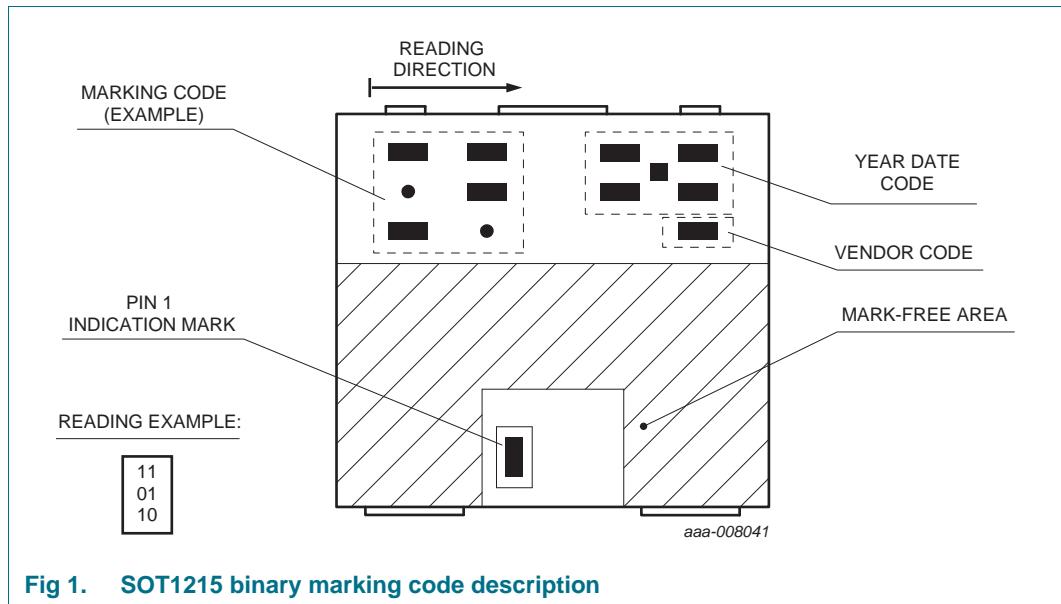
Type number	Package		
	Name	Description	Version
PDTB113ZQA	DFN1010D-3	plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body: 1.1 × 1.0 × 0.37 mm	SOT1215
PDTB123YQA			
PDTB143XQA			

## 4. Marking

**Table 5. Marking codes**

Type number	Marking code
PDTB113ZQA	01 11 10
PDTB123YQA	10 00 01
PDTB143XQA	10 01 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	open collector			
	PDTB113ZQA		-	-5	V
	PDTB123YQA		-	-5	V
	PDTB143XQA		-	-7	V

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

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

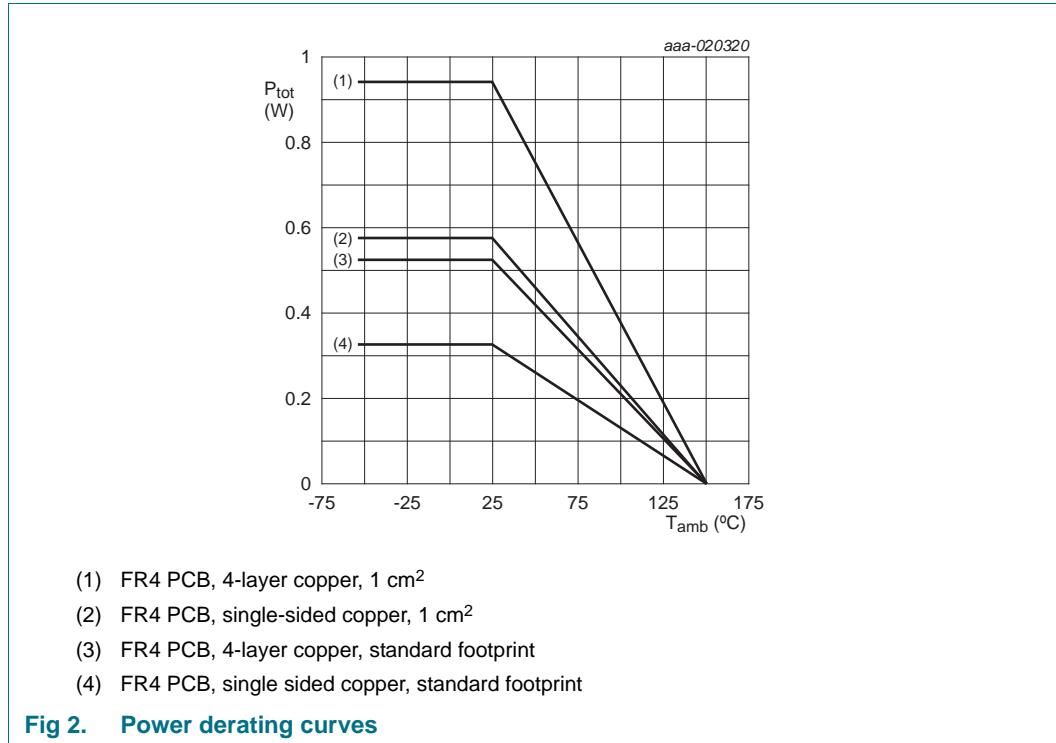
Symbol	Parameter	Conditions	Min	Max	Unit
$V_I$	input voltage	$T_{amb} \leq 25^\circ\text{C}$	-10	+5	V
	PDTB113ZQA		-12	+5	V
	PDTB123YQA		-30	+7	V
$I_O$	output current		-	-500	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25^\circ\text{C}$	[1]	-	325 mW
			[2]	-	575 mW
			[3]	-	525 mW
			[4]	-	940 mW
$T_j$	junction temperature		-	150	°C
$T_{amb}$	ambient temperature		-55	+150	°C
$T_{stg}$	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, single-sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.

**Fig 2. Power derating curves**

## 6. Thermal characteristics

**Table 7. Thermal characteristics**

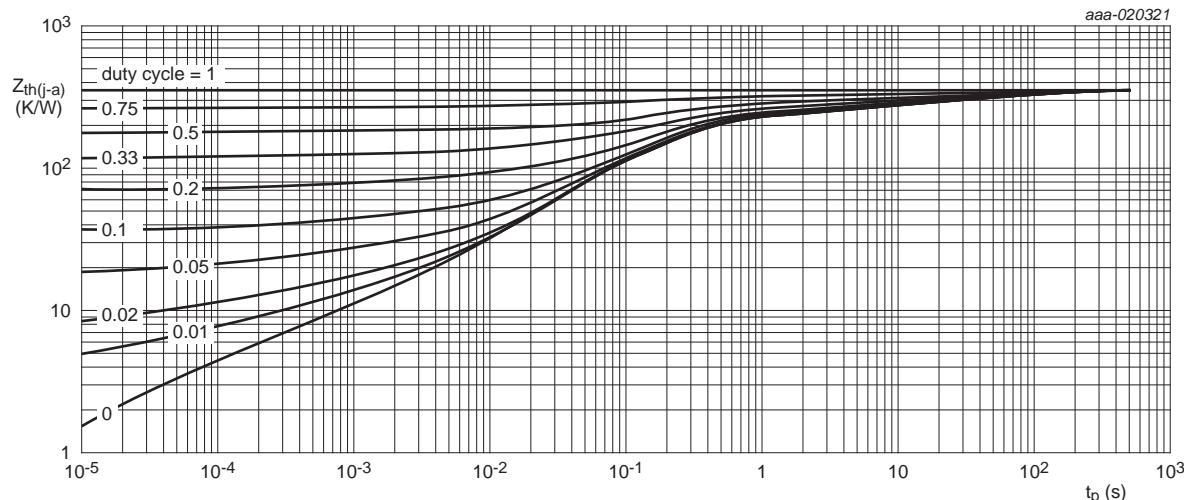
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	385	K/W
			[2]	-	218	K/W
			[3]	-	239	K/W
			[4]	-	133	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	40	K/W

[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, single-sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.

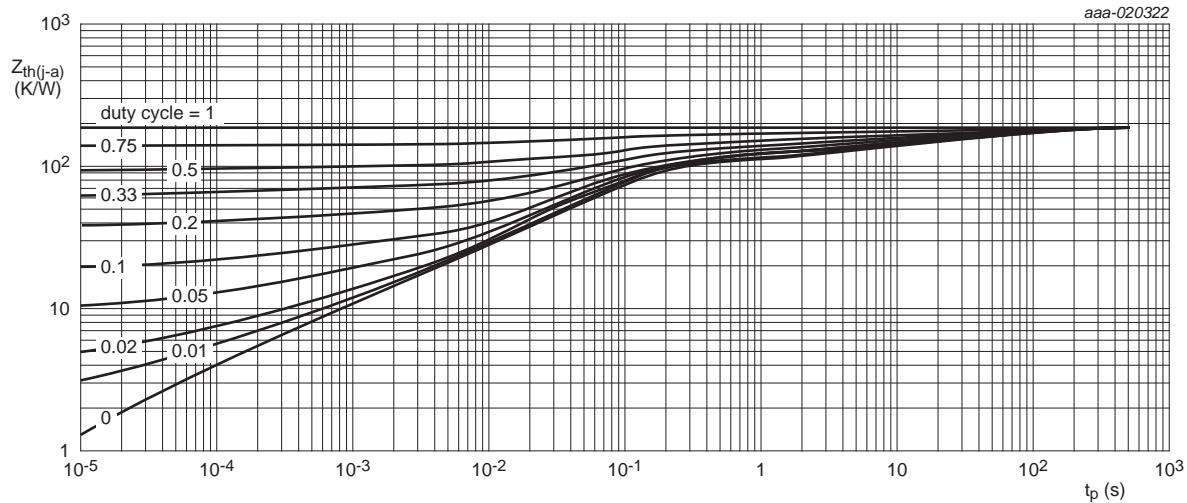
[3] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.



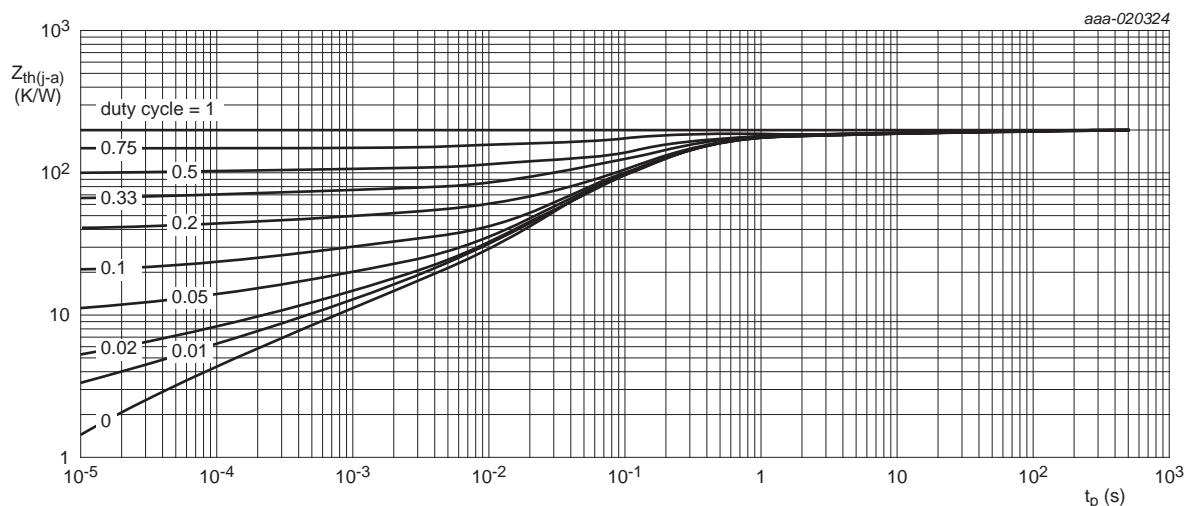
FR4 PCB, single-sided copper, tin-plated and standard footprint.

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



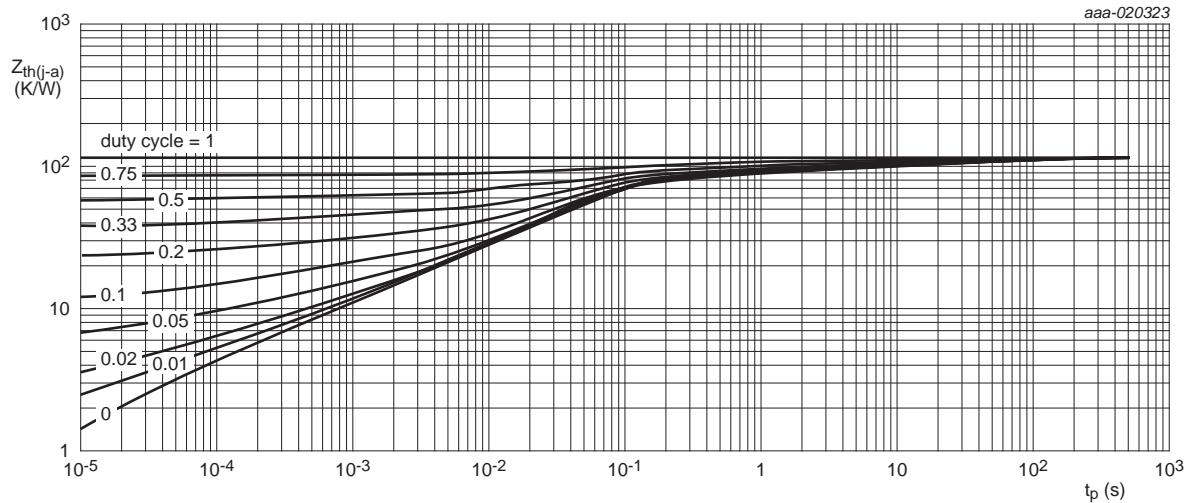
FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

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



FR4 PCB, 4-layer copper, tin-plated and standard footprint.

**Fig 5.** Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, 4-layer copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>

**Fig 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

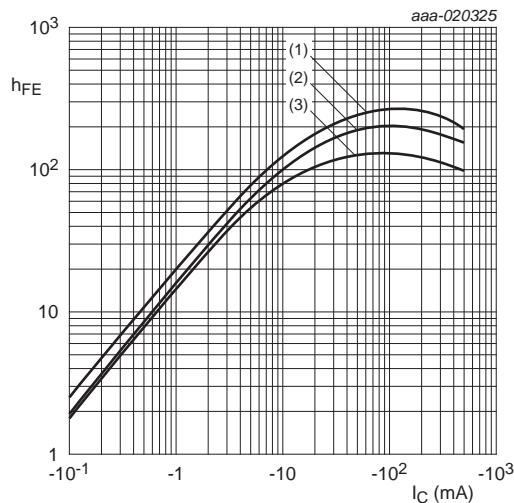
## 7. Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -50\text{ V}; I_E = 0\text{ A}$	-	-	-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	PDTB113ZQA PDTB123YQA PDTB143XQA	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}$	-	-0.8	mA	
$-$				-	-0.65	mA	
$-$				-	-0.6	mA	
$h_{FE}$	DC current gain	$V_{CE} = -5\text{ V}; I_C = -50\text{ mA}$	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						
	PDTB113ZQA	$V_{CE} = -5\text{ V}; I_C = -100\text{ }\mu\text{A}$	-0.3	-0.65	-1	V	
	PDTB123YQA		-0.4	-0.65	-1	V	
	PDTB143XQA		-0.5	-0.75	-1.1	V	
$V_{I(on)}$	on-state input voltage						
	PDTB113ZQA	$V_{CE} = -0.3\text{ V}; I_C = -20\text{ mA}$	-0.4	-0.8	-1.4	V	
	PDTB123YQA		-0.5	-1	-1.4	V	
	PDTB143XQA		-1	-1.4	-2	V	
R1	bias resistor 1 (input)		[1]				
	PDTB113ZQA		0.7	1	1.3	k $\Omega$	
	PDTB123YQA		1.54	2.2	2.86	k $\Omega$	
	PDTB143XQA		3.3	4.7	6.1	k $\Omega$	
R2/R1	bias resistor ratio		[1]				
	PDTB113ZQA		9	10	11		
	PDTB123YQA		4.1	4.55	5		
	PDTB143XQA		1.91	2.13	2.34		
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	7	-	pF	
$f_T$	transition frequency	$V_{CE} = -5\text{ V}; I_C = -50\text{ mA}; f = 100\text{ MHz}$	[2]	-	150	-	MHz

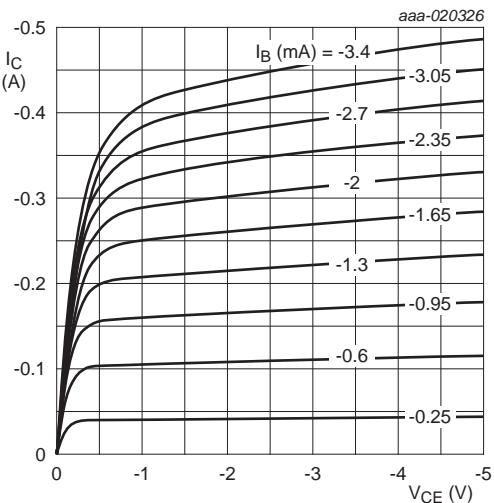
[1] See section test information for resistor calculation and test conditions.

[2] Characteristics of built-in transistor.



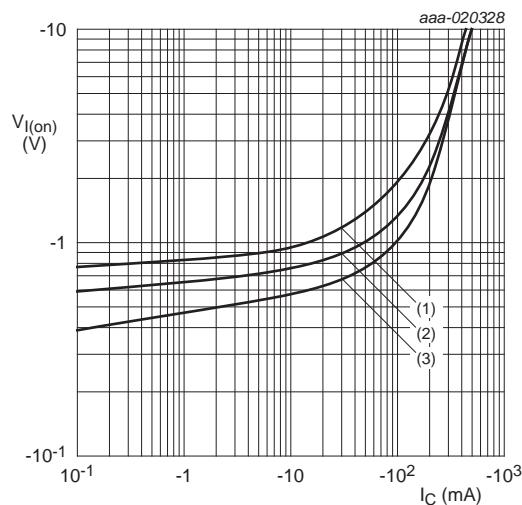
$V_{CE} = -5\text{ V}$   
(1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

**Fig 7.** PDCB113ZQA: DC current gain as a function of collector current; typical values



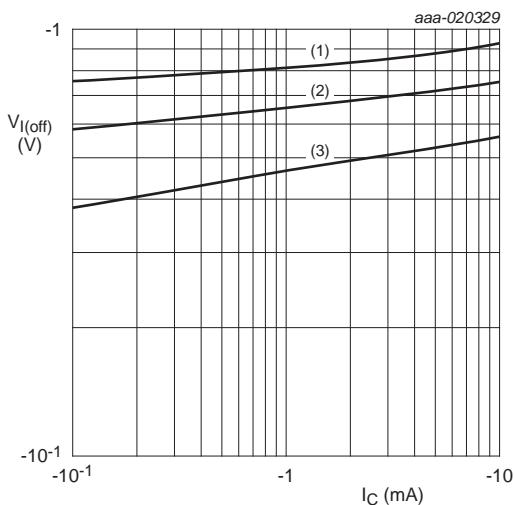
$T_{amb} = 25\text{ }^{\circ}\text{C}$

**Fig 8.** PDTB113ZQA: Collector current as a function of collector-emitter voltage; typical values



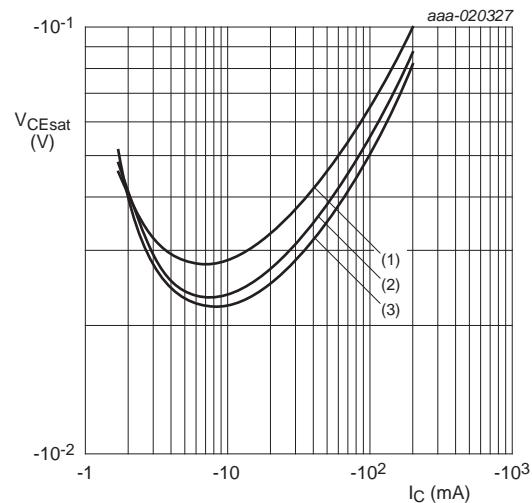
$V_{CE} = -0.3\text{ V}$   
(1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**Fig 9.** PDTB113ZQA: On-state input voltage as a function of collector current; typical values

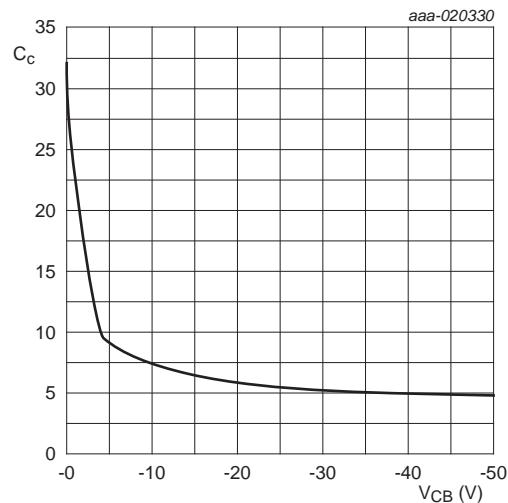


$V_{CE} = -5\text{ V}$   
(1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

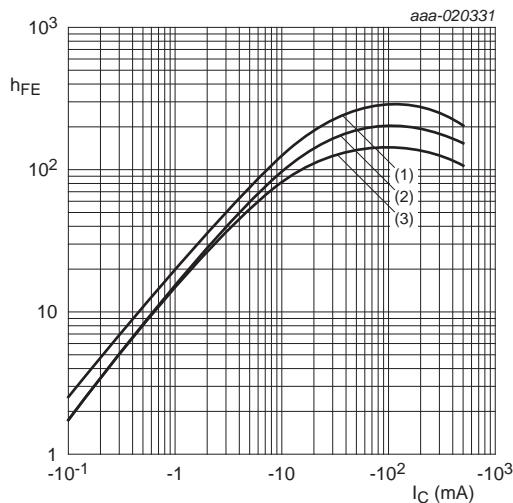
**Fig 10.** PDTB113ZQA: Off-state input voltage as a function of collector current; typical values



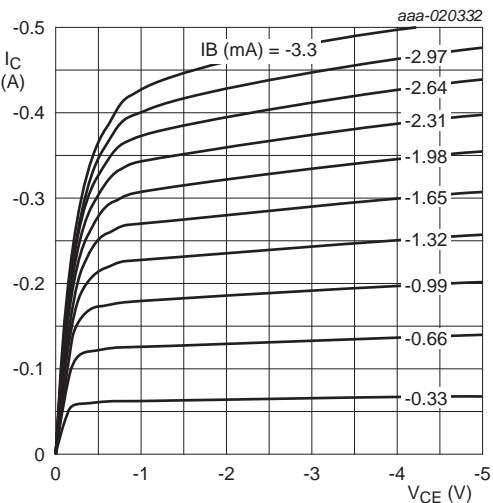
**Fig 11.** PDTB113ZQA: Collector-emitter saturation voltage as a function of collector current; typical values



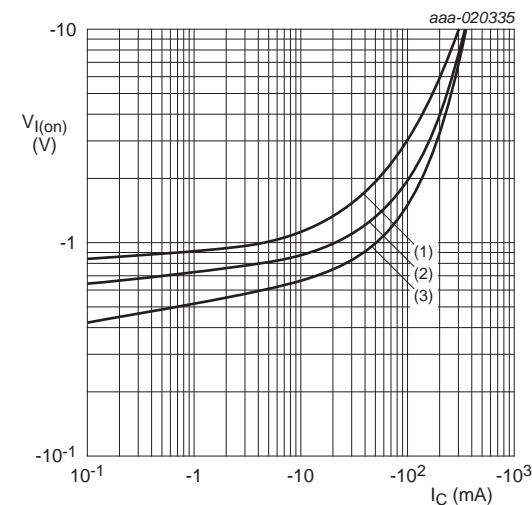
**Fig 12.** PDTB113ZQA: Collector capacitance as a function of collector-base voltage; typical values



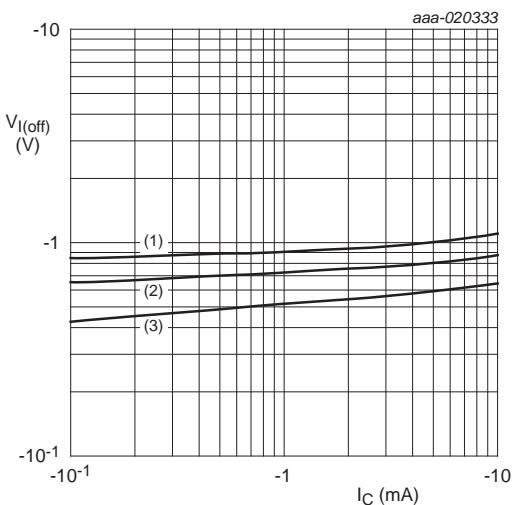
**Fig 13.** PDTB123YQA: DC current gain as a function of collector current; typical values



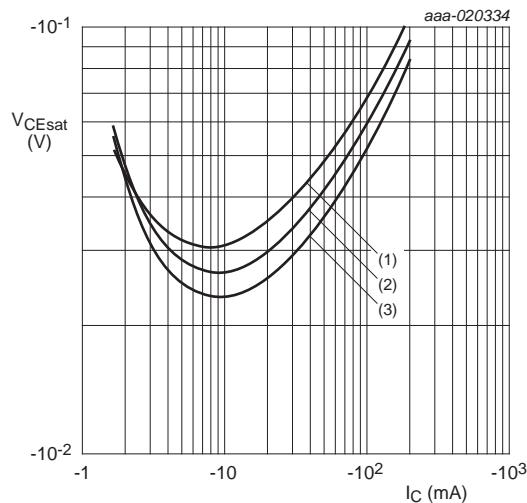
**Fig 14.** PDTB123YQA: Collector current as a function of collector-emitter voltage; typical values



**Fig 15.** PDTB123YQA: On-state input voltage as a function of collector current; typical values

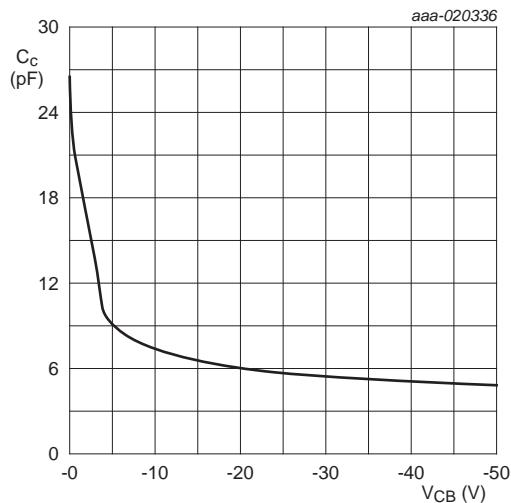


**Fig 16.** PDTB123YQA: Off-state input voltage as a function of collector current; typical values

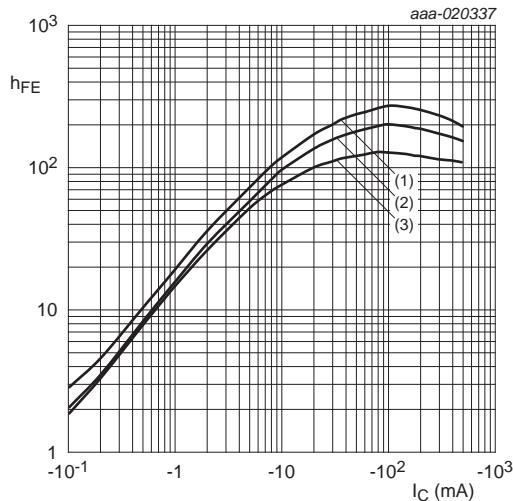
 $I_C/I_B = 20$ 

- (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 17. PDTB123YQA: Collector-emitter saturation voltage as a function of collector current; typical values**

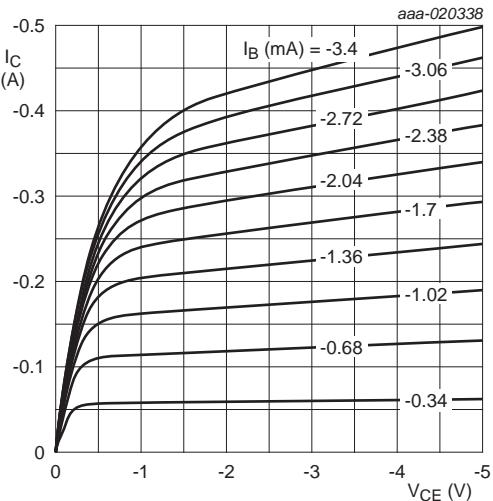
 $f = 1\text{ MHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$ 

**Fig 18. PDTB123YQA: Collector capacitance as a function of collector-base voltage; typical values**



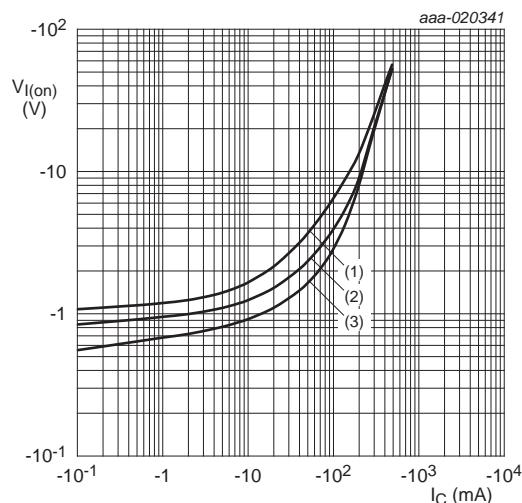
$V_{CE} = -5\text{ V}$   
(1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

**Fig 19.** PDTB143XQA: DC current gain as a function of collector current; typical values



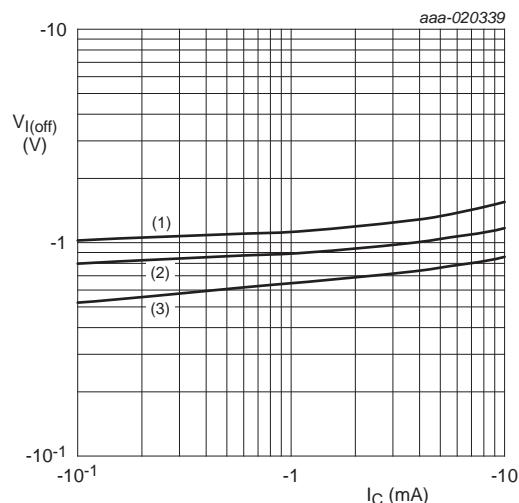
$T_{amb} = 25\text{ }^{\circ}\text{C}$

**Fig 20.** PDTB143XQA: Collector current as a function of collector-emitter voltage; typical values



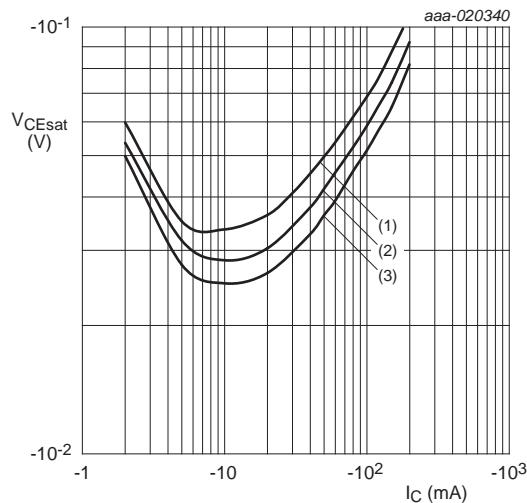
$V_{CE} = -0.3\text{ V}$   
(1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**Fig 21.** PDTB143XQA: On-state input voltage as a function of collector current; typical values

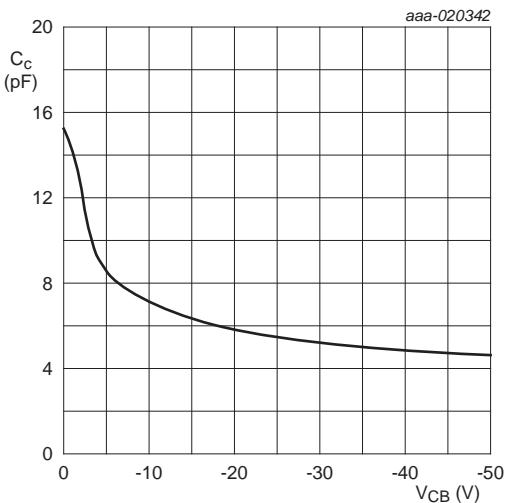


$V_{CE} = -5\text{ V}$   
(1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

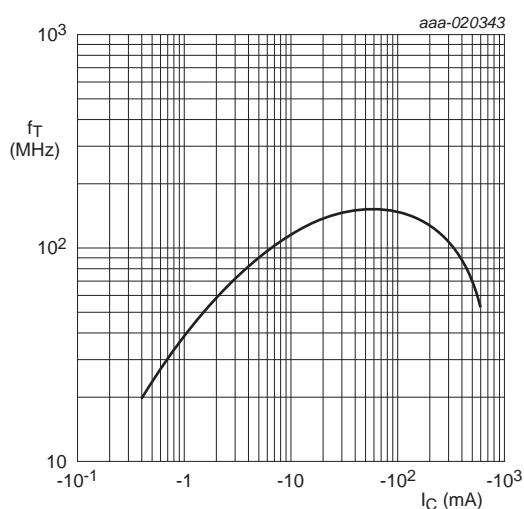
**Fig 22.** PDTB143XQA: Off-state input voltage as a function of collector current; typical values



**Fig 23.** PDTB143XQA: Collector-emitter saturation voltage as a function of collector current; typical values



**Fig 24.** PDTB143XQA: Collector capacitance as a function of collector-base voltage; typical values



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

**Fig 25.** 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.

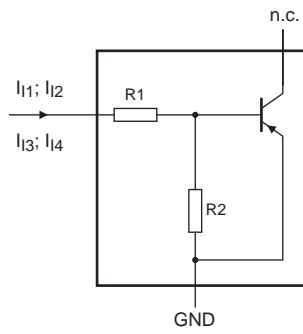
### 8.2 Resistor calculation

- Calculation of bias resistor 1 (R1):

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

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

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



aaa-020083

**Fig 26. Resistor test circuit**

### 8.3 Resistor test conditions

**Table 9. Resistor test conditions**

Type number	R1	R2	Test conditions			
	kΩ	kΩ	I_I1	I_I2	I_I3	I_I4
PDTB113ZQA	1	10	-0.7 mA	-0.8 mA	0.45 mA	0.55 mA
PDTB123YQA	2.2	10	-0.7 mA	-0.8 mA	0.45 mA	0.55 mA
PDTB143XQA	4.7	10	-1.3 mA	-1.5 mA	0.45 mA	0.55 mA

## 9. Package outline

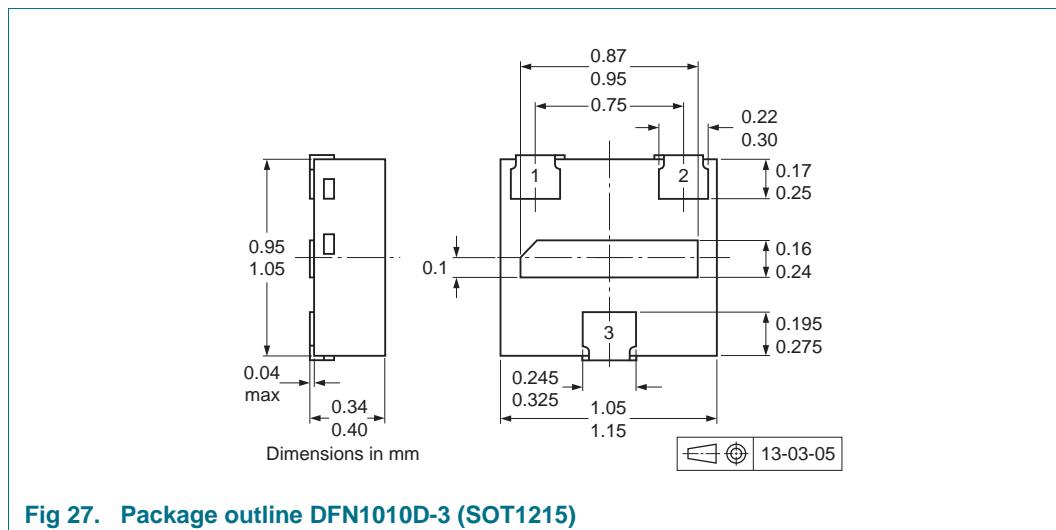


Fig 27. Package outline DFN1010D-3 (SOT1215)

## 10. Soldering

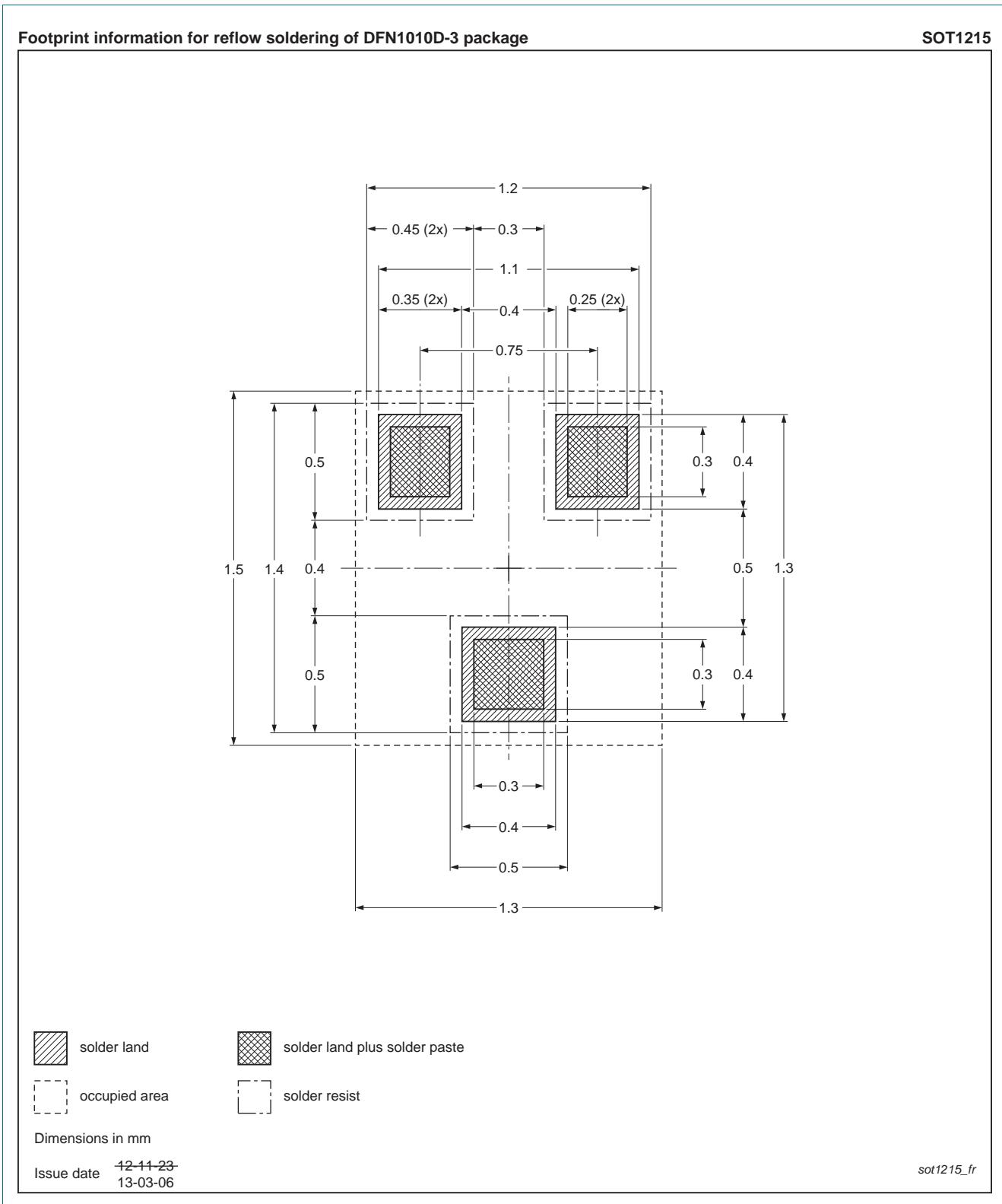


Fig 28. Reflow soldering footprint DFN1010D-3 (SOT1215)

## 11. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PDTB113Z_123Y_143XQA_SER v.1	20160106	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>.

### 12.2 Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet** — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

**Product specification** — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

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