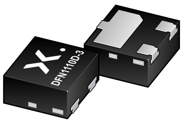


PDTC143X/123J/143Z/114Y/124XQB-Q series

50 V, 100 mA NPN resistor-equipped transistors

Rev. 1 — 1 October 2021 Product data sheet

1. General description

100 mA NPN Resistor-Equipped Transistor (RET) family in an ultra small DFN1110D-3 (SOT8015) leadless Surface-Mounted Device (SMD) plastic package with side-wettable flanks.

Table 1. Product overview

Type number	R1	R2	Package		PNP complement:
	kΩ	kΩ	Nexperia	JEDEC	
PDTC143XQB-Q	4.7	10	SOT8015	MO-340BA	PDTA143XQB-Q
PDTC123JQB-Q	2.2	47			PDTA123JQB-Q
PDTC143ZQB-Q	4.7	47			PDTA143ZQB-Q
PDTC114YQB-Q	10	47			PDTA114YQB-Q
PDTC124XQB-Q	22	47			PDTA124XQB-Q

2. Features and benefits

- 100 mA output current capability
- Built-in resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- Low package height of 0.5 mm
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

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

4. Quick reference data

Table 2. Quick reference data

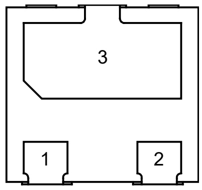
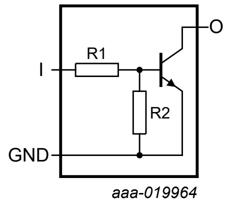
T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	50	V
I_O	output current		-	-	100	mA

nexperia

5. Pinning information

Table 3. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 Transparent top view	
2	GND	GND (emitter)		
3	O	output (collector)		

6. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PDTC143XQB-Q	DFN1110D-3	plastic leadless extremely thin small outline package with side-wettable flanks (SWF); 3 terminals; 0.65 mm pitch; body: 1.1 x 1.0 x 0.48 mm	SOT8015
PDTC123JQB-Q			
PDTC143ZQB-Q			
PDTC114YQB-Q			
PDTC124XQB-Q			

7. Marking

Table 5. Marking

Type number	Marking code
PDTC143XQB-Q	E7
PDTC123JQB-Q	E3
PDTC143ZQB-Q	E8
PDTC114YQB-Q	E2
PDTC124XQB-Q	E5

8. Limiting values

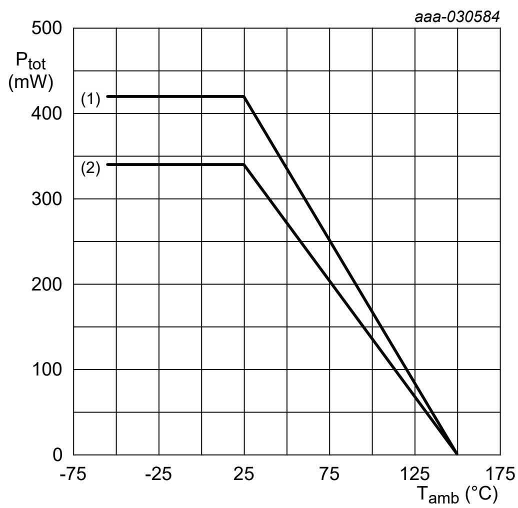
Table 6. Limiting values

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

T_{amb} = 25 °C unless otherwise specified.

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					
	PDTC143XQB-Q	open collector		-	7	V
	PDTC123JQB-Q			-	5	V
	PDTC143ZQB-Q			-	5	V
	PDTC114YQB-Q			-	6	V
	PDTC124XQB-Q			-	7	V
V_I	input voltage					
	PDTC143XQB-Q			-7	+30	V
	PDTC123JQB-Q			-5	+12	V
	PDTC143ZQB-Q			-5	+30	V
	PDTC114YQB-Q			-6	+40	V
	PDTC124XQB-Q			-7	+40	V
I_O	output current			-	100	mA
P_{tot}	total power dissipation	T_{amb} ≤ 25 °C	[1]	-	340	mW
			[2]	-	420	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; 35 µm copper; tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB; single-sided; 70 µm copper; tin-plated and standard footprint.



(1) FR4 PCB; single-sided; 70 µm copper; standard footprint
(2) FR4 PCB; single-sided; 35 µm copper; standard footprint

Fig. 1. Power derating curves

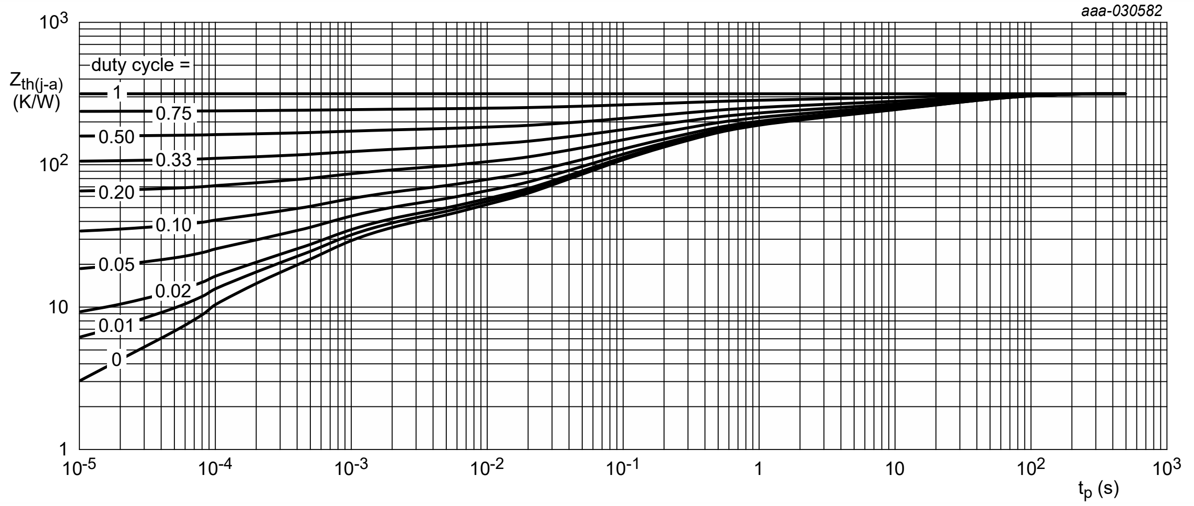
9. Thermal characteristics

Table 7. Thermal characteristics

T_{amb} = 25 °C unless otherwise specified.

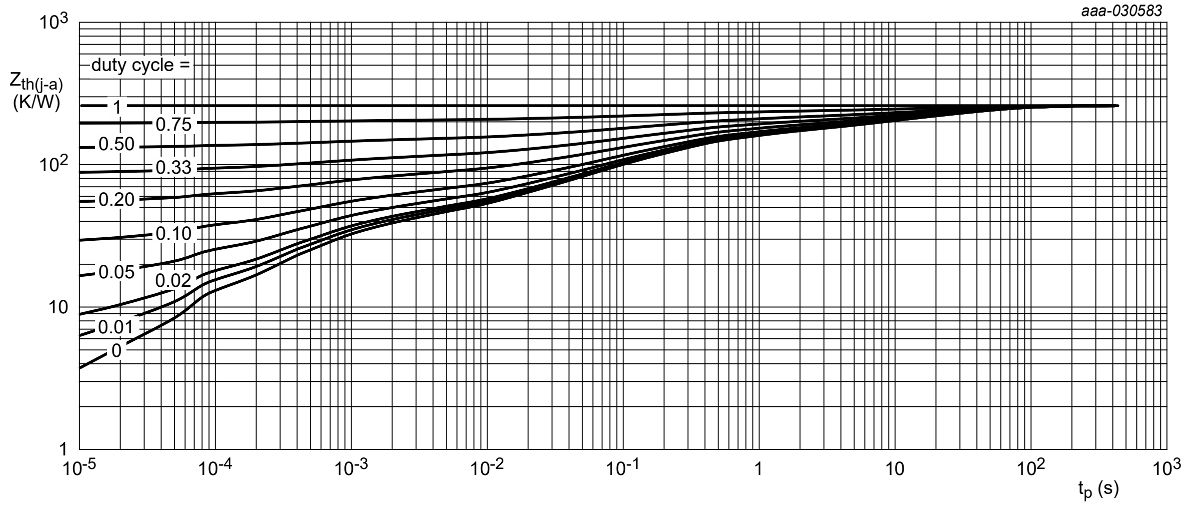
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	368	K/W
			[2]	-	-	298	K/W

[1] Device mounted on an FR4 PCB; single-sided; 35 µm copper; tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB; single-sided; 70 µm copper; tin-plated and standard footprint.



FR4 PCB; single-sided; 35 µm copper; tin-plated and standard footprint.

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB; single-sided; 70 µm copper; tin-plated and standard footprint.

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

10. Characteristics

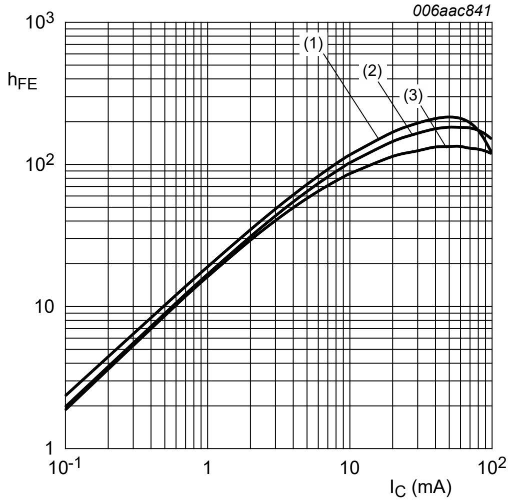
Table 8. Characteristics

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 100 µA; I_E = 0 A		50	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 2 mA; I_B = 0 A		50	-	-	V
I_{CBO}	collector-base cut-off current	V_{CB} = 50 V; I_E = 0 A		-	-	100	nA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 30 V; I_B = 0 A		-	-	100	nA
		V_{CE} = 30 V; I_B = 0 A; T_j = 150 °C		-	-	5	µA
I_{EBO}	emitter-base cut-off current						
	PDTC143XQB-Q	V_{EB} = 5 V; I_C = 0 A		-	-	600	µA
	PDTC123JQB-Q			-	-	180	µA
	PDTC143ZQB-Q			-	-	170	µA
	PDTC114YQB-Q			-	-	150	µA
	PDTC124XQB-Q			-	-	120	µA
h_{FE}	DC current gain						
	PDTC143XQB-Q	V_{CE} = 5 V; I_C = 10 mA		50	-	-	
	PDTC123JQB-Q			100	-	-	
	PDTC143ZQB-Q			100	-	-	
	PDTC114YQB-Q	V_{CE} = 5 V; I_C = 5 mA		100	-	-	
	PDTC124XQB-Q			80	-	-	
V_{CEsat}	collector-emitter saturation voltage						
	PDTC143XQB-Q	I_C = 10 mA; I_B = 0.5 mA		-	-	100	mV
	PDTC123JQB-Q	I_C = 5 mA; I_B = 0.25 mA		-	-	100	mV
	PDTC143ZQB-Q			-	-	100	mV
	PDTC114YQB-Q			-	-	100	mV
	PDTC124XQB-Q	I_C = 10 mA; I_B = 0.5 mA		-	-	100	mV
$V_{I(off)}$	off-state input voltage						
	PDTC143XQB-Q	V_{CE} = 5 V ; I_C = 100 µA		-	0.8	0.3	V
	PDTC123JQB-Q			-	0.6	0.5	V
	PDTC143ZQB-Q			-	0.6	0.5	V
	PDTC114YQB-Q			-	0.7	0.5	V
	PDTC124XQB-Q			-	0.8	0.5	V
$V_{I(on)}$	on-state input voltage						
	PDTC143XQB-Q	V_{CE} = 0.3 V ; I_C = 20 mA		2.5	1.5	-	V
	PDTC123JQB-Q	V_{CE} = 0.3 V ; I_C = 5 mA		1.1	0.75	-	V
	PDTC143ZQB-Q	V_{CE} = 0.3 V ; I_C = 5 mA		1.3	0.9	-	V
	PDTC114YQB-Q	V_{CE} = 0.3 V ; I_C = 1 mA		1.4	0.8	-	V
	PDTC124XQB-Q	V_{CE} = 0.3 V ; I_C = 2 mA		2.0	1.1	-	V

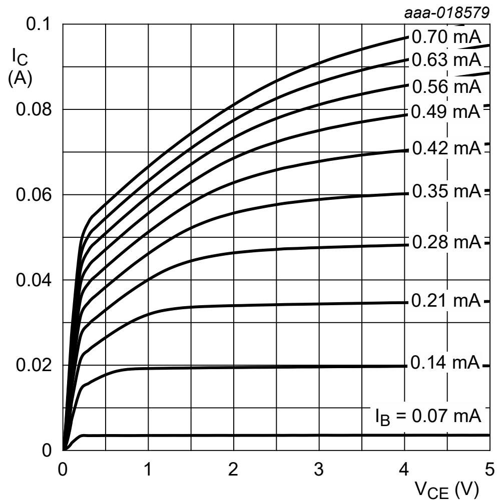
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R1	bias resistor 1 (input)						
	PDTC143XQB-Q		[1]	3.3	4.7	6.1	kΩ
	PDTC123JQB-Q			1.54	2.2	2.86	kΩ
	PDTC143ZQB-Q			3.3	4.7	6.1	kΩ
	PDTC114YQB-Q			7	10	13	kΩ
	PDTC124XQB-Q			15.4	22	28.6	kΩ
R2/R1	bias resistor ratio						
	PDTC143XQB-Q		[1]	1.7	2.13	2.6	
	PDTC123JQB-Q			17	21	26	
	PDTC143ZQB-Q			8	10	12	
	PDTC114YQB-Q			3.7	4.7	5.7	
	PDTC124XQB-Q			1.7	2.13	2.6	
f_T	transition frequency	V_{CE} = 5 V; I_C = 10 mA; f = 100 MHz	[2]	-	230	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	-	2.5	pF

[1] See "Section 11: Test information" for resistor calculation and test conditions
[2] Characteristics of built-in transistor



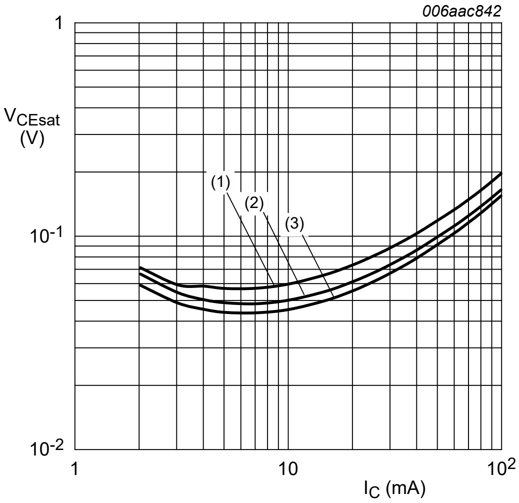
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 4. PDTC143XQB-Q: DC current gain as a function of collector current; typical values



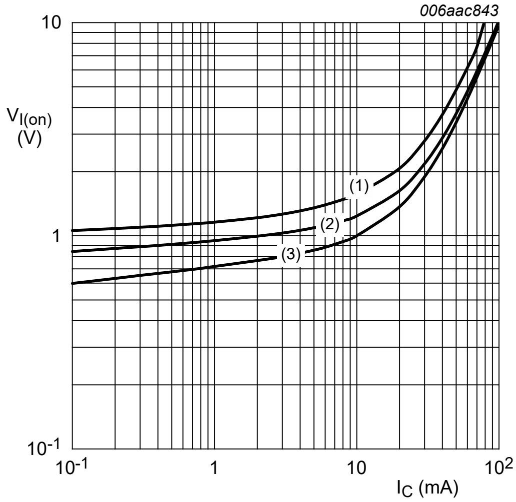
T_{amb} = 25 °C

Fig. 5. PDTC143XQB-Q: Collector current as a function of collector-emitter voltage; typical values



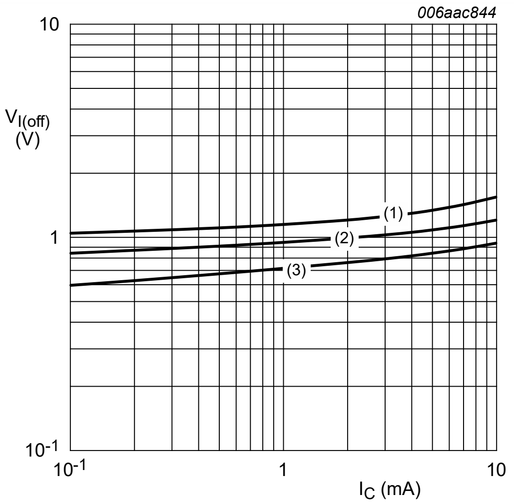
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 6. PDTC143XQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



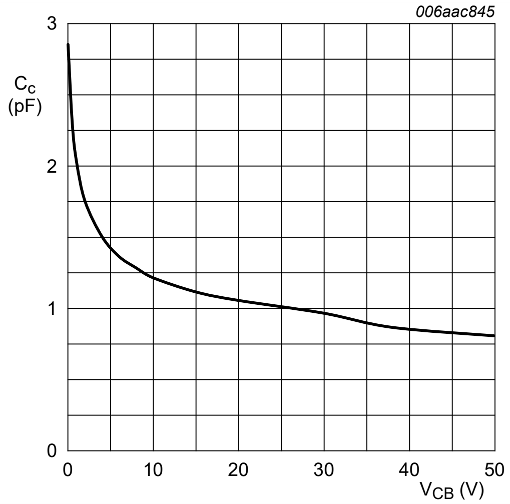
V_{CE} = 0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 7. PDTC143XQB-Q: On-state input voltage as a function of collector current; typical values



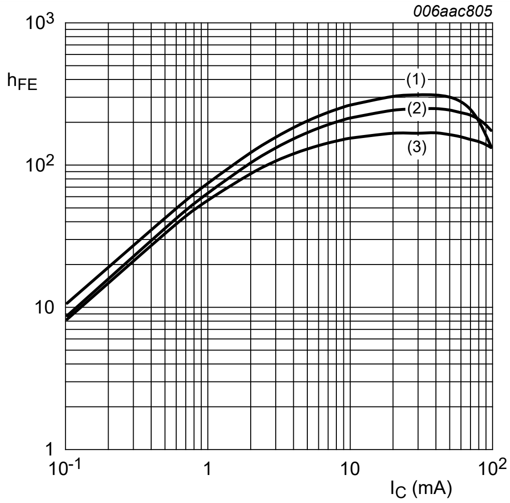
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 8. PDTC143XQB-Q: Off-state input voltage as a function of collector current; typical values



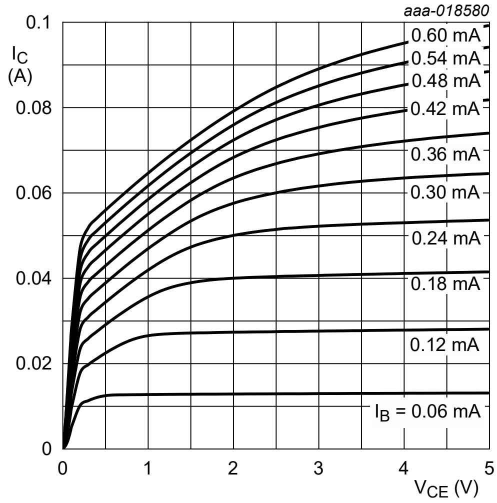
f = 1 MHz
T_{amb} = 25 °C

Fig. 9. PDTC143XQB-Q: Collector capacitance as a function of collector-base voltage; typical values



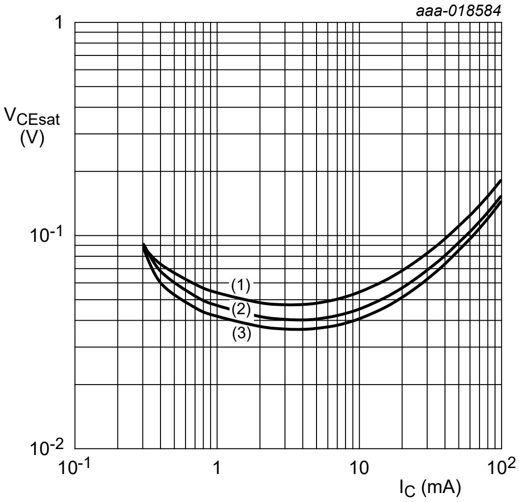
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 10. PDTC123JQB-Q: DC current gain as a function of collector current; typical values



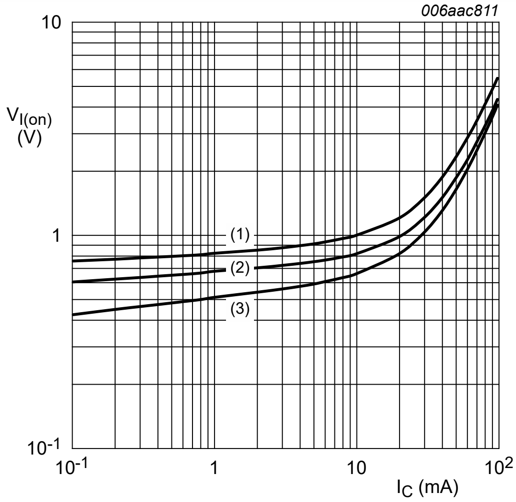
T_{amb} = 25 °C

Fig. 11. PDTC123JQB-Q: Collector current as a function of collector-emitter voltage; typical values



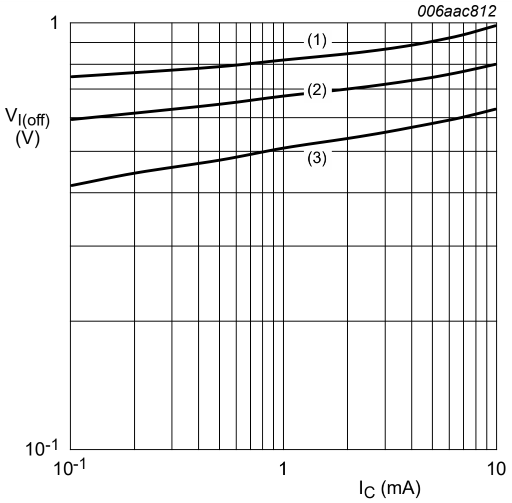
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 12. PDTC123JQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



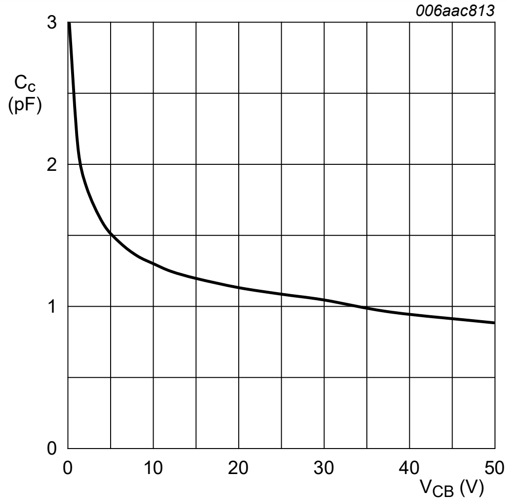
V_{CE} = 0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 13. PDTC123JQB-Q: On-state input voltage as a function of collector current; typical values



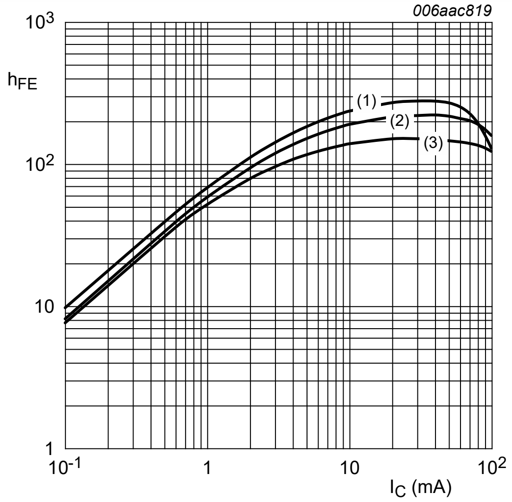
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 14. PDTC123JQB-Q: Off-state input voltage as a function of collector current; typical values



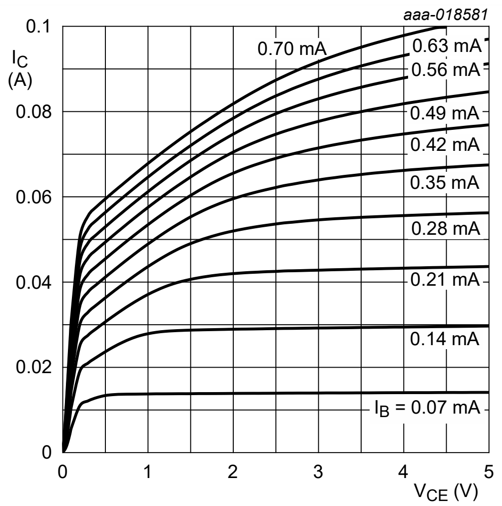
f = 1 MHz
T_{amb} = 25 °C

Fig. 15. PDTC123JQB-Q: Collector capacitance as a function of collector-base voltage; typical values



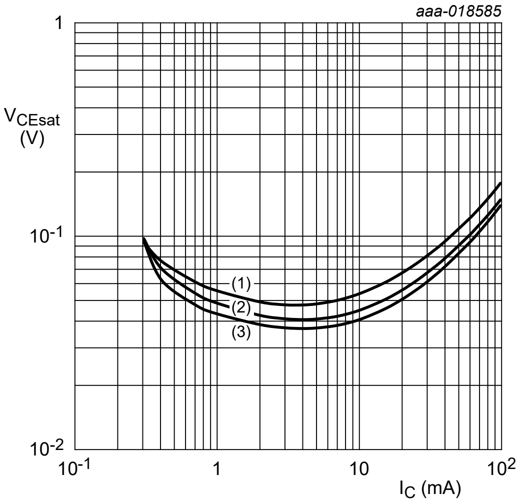
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 16. PDTC143ZQB-Q: DC current gain as a function of collector current; typical values



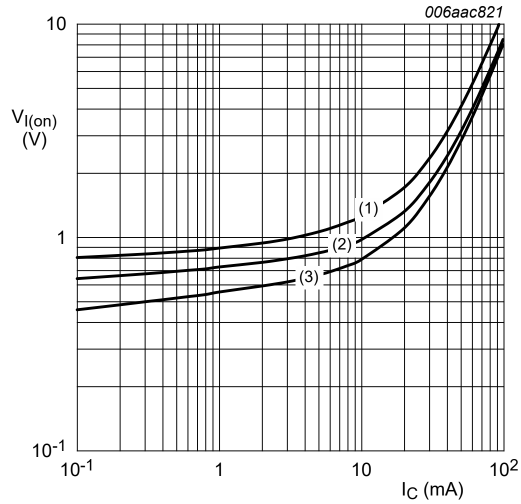
T_{amb} = 25 °C

Fig. 17. PDTC143ZQB-Q: Collector current as a function of collector-emitter voltage; typical values



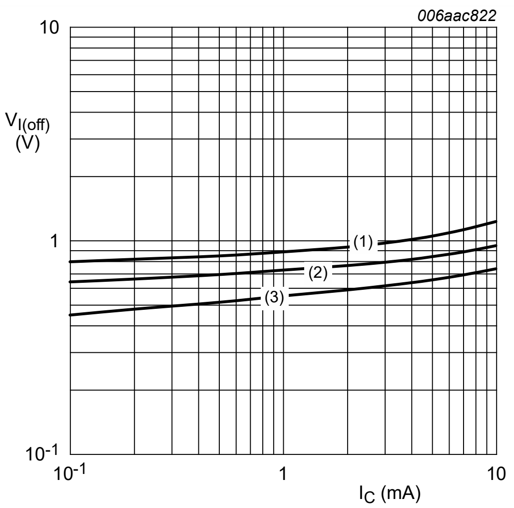
$I_C/I_B = 20$
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 18. PDTC143ZQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



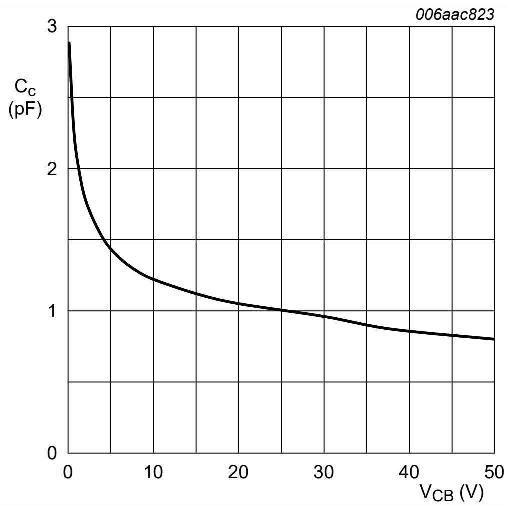
V_{CE} = 0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 19. PDTC143ZQB-Q: On-state input voltage as a function of collector current; typical values



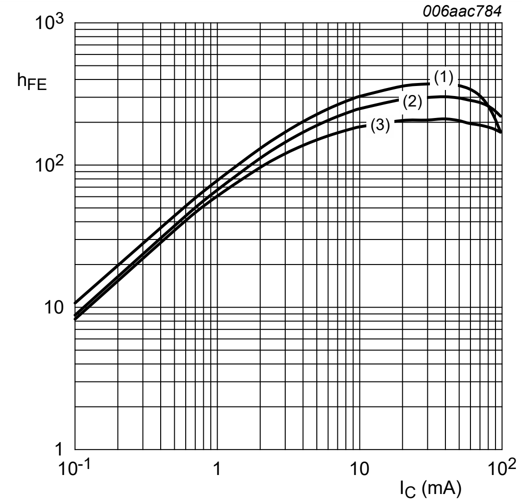
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 20. PDTC143ZQB-Q: Off-state input voltage as a function of collector current; typical values



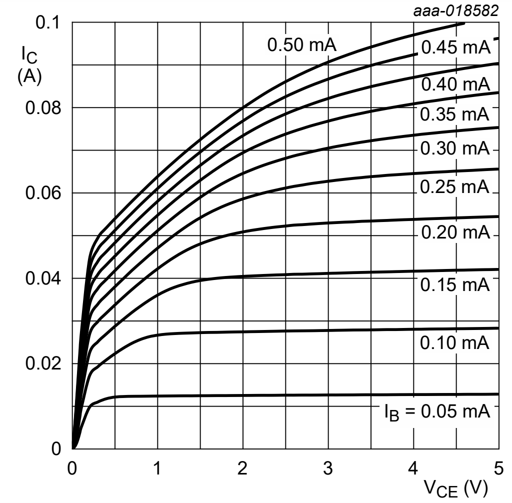
f = 1 MHz
T_{amb} = 25 °C

Fig. 21. PDTC143ZQB-Q: Collector capacitance as a function of collector-base voltage; typical values



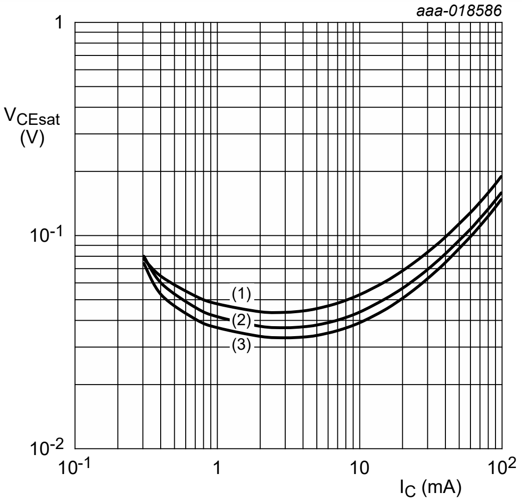
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 22. PDTC114YQB-Q: DC current gain as a function of collector current; typical values



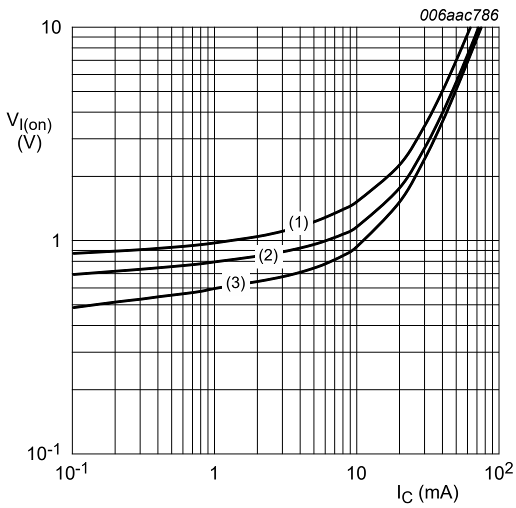
T_{amb} = 25 °C

Fig. 23. PDTC114YQB-Q: Collector current as a function of collector-emitter voltage; typical values



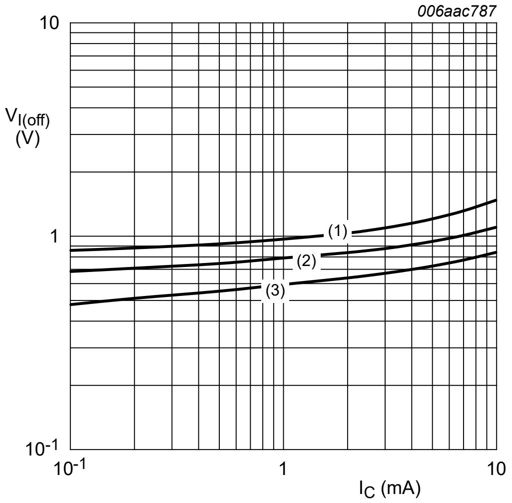
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 24. PDTC114YQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



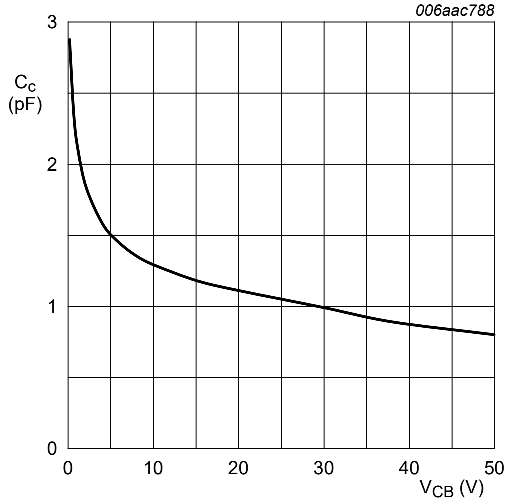
V_{CE} = 0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 25. PDTC114YQB-Q: On-state input voltage as a function of collector current; typical values



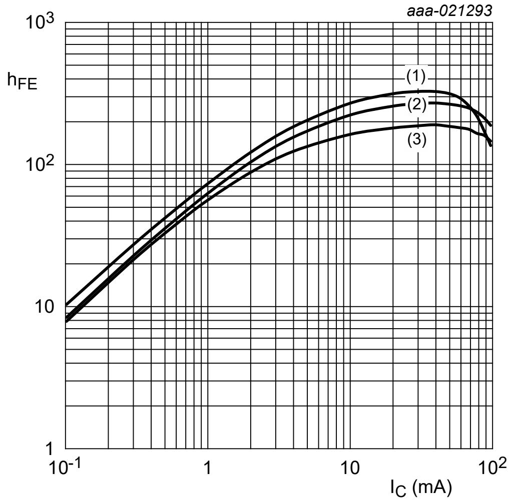
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 26. PDTC114YQB-Q: Off-state input voltage as a function of collector current; typical values



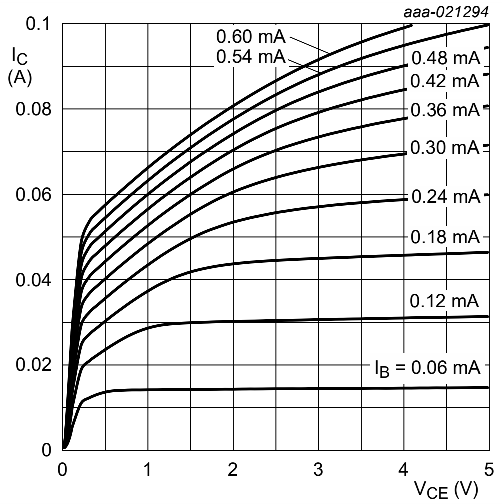
f = 1 MHz
T_{amb} = 25 °C

Fig. 27. PDTC114YQB-Q: Collector capacitance as a function of collector-base voltage; typical values



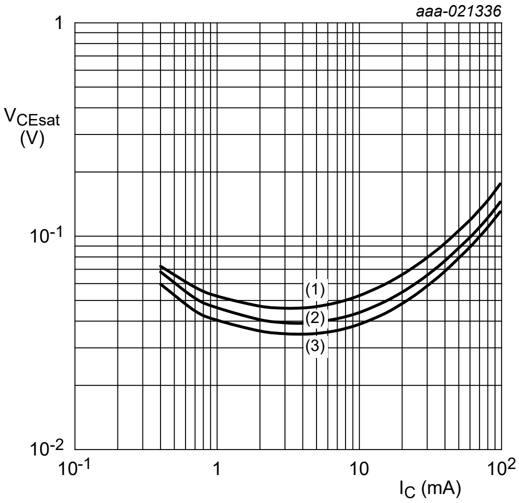
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 28. PDTC124XQB-Q: DC current gain as a function of collector current; typical values



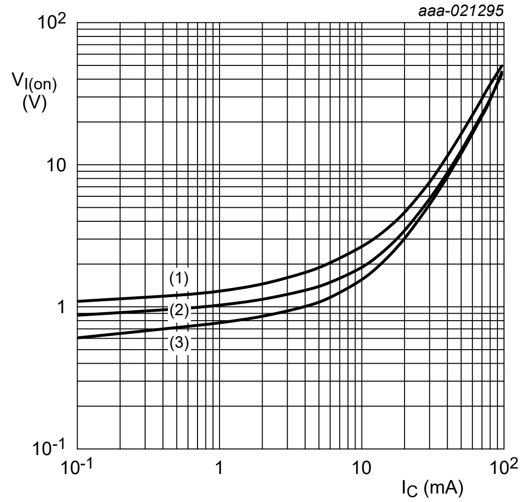
T_{amb} = 25 °C

Fig. 29. PDTC124XQB-Q: Collector current as a function of collector-emitter voltage; typical values



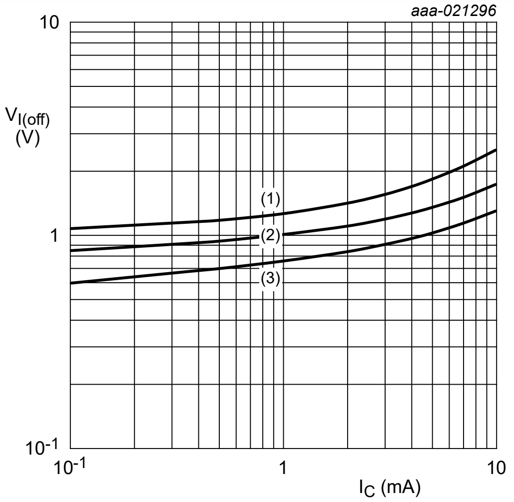
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 30. PDTC124XQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



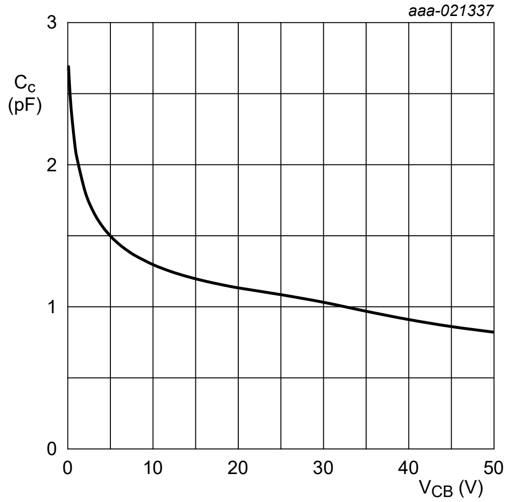
V_{CE} = 0.5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 31. PDTC124XQB-Q: On-state input voltage as a function of collector current; typical values



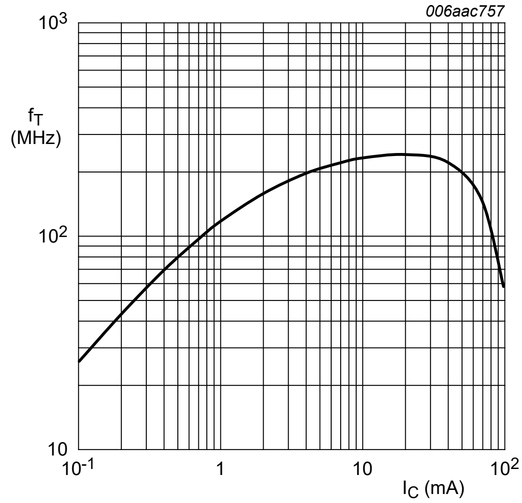
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 32. PDTC124XQB-Q: Off-state input voltage as a function of collector current; typical values



f = 1 MHz
T_{amb} = 25 °C

Fig. 33. PDTC124XQB-Q: Collector capacitance as a function of collector-base voltage; typical values



f = 100 MHz

T_{amb} = 25 °C

V_{CE} = 5 V

Fig. 34. Transition frequency as a function of collector current; typical values of built-in transistor

11. Test information

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)

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

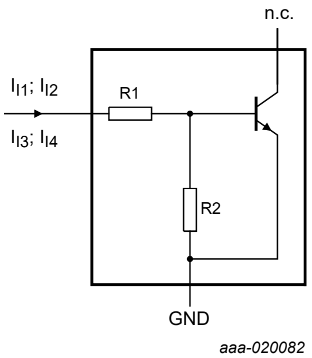


Fig. 35. Resistor test circuit

Resistor test conditions

Table 9. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I_{I1}	I_{I2}	I_{I3}	I_{I4}
PDTC143XQB-Q	4.7	10	350 µA	450 µA	-350 µA	-450 µA
PDTC123JQB-Q	2.2	47	90 µA	140 µA	-55 µA	-105 µA
PDTC143ZQB-Q	4.7	47	90 µA	140 µA	-55 µA	-105 µA
PDTC114YQB-Q	10	47	90 µA	140 µA	-55 µA	-105 µA
PDTC124XQB-Q	22	47	55 µA	105 µA	-55 µA	-105 µA

11.1. 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.

12. Package outline

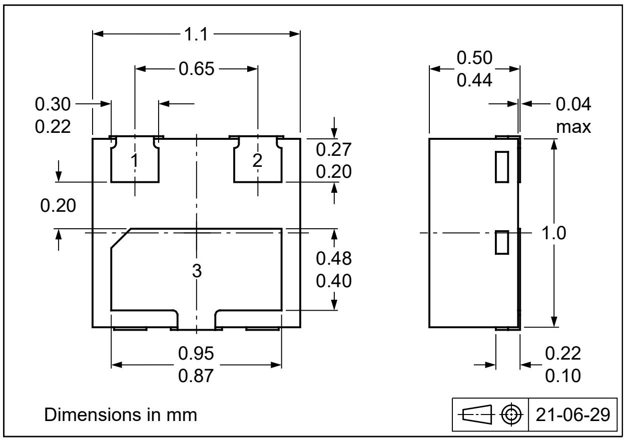


Fig. 36. Package outline DFN1110D-3 (SOT8015)

13. Soldering

Footprint information for reflow soldering of DFN1110D-3 package **SOT8015**

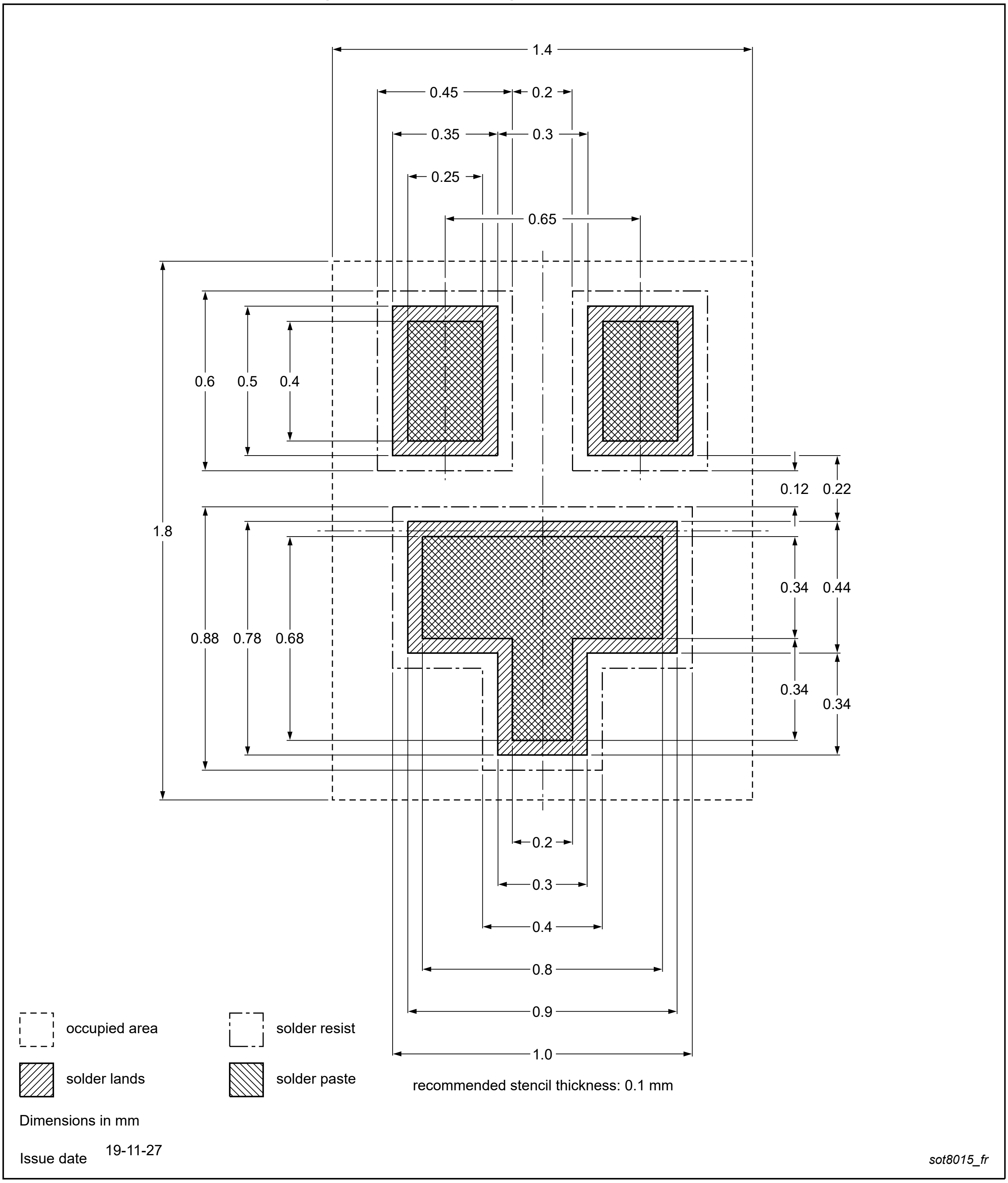


Fig. 37. Reflow soldering footprint DFN1110D-3 (SOT8015)

14. Revision history

Table 10. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PDTC143X_TO_124XQB-Q_SER v.1	20211001	Product data sheet	-	-

15. Legal information

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 https://www.nexperia.com.

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