



# PDTC143X/123J/143Z/114Y/124XQC 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 DFN1412D-3 (SOT8009) leadless Surface-Mounted Device (SMD) plastic package with side-wettable flanks.

Table 1. Product overview

Type number	R1	R2	Package		PNP complement:
	k $\Omega$	k $\Omega$	Nexperia	JEDEC	
PDTC143XQC	4.7	10	SOT8009	MO-340CA	PDTA143XQC
PDTC123JQC	2.2	47			PDTA123JQC
PDTC143ZQC	4.7	47			PDTA143ZQC
PDTC114YQC	10	47			PDTA114YQC
PDTC124XQC	22	47			PDTA124XQC

## 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

## 3. Applications

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

## 4. Quick reference data

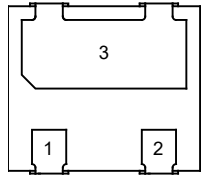
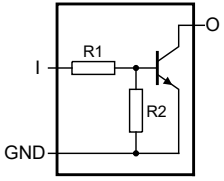
Table 2. Quick reference data

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

## 5. 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)		

## 6. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PDTC143XQC	DFN1412D-3	plastic leadless ultra small outline package with side-wettable flanks (SWF); 3 terminals; 0.8 mm pitch; body: 1.4 x 1.2 x 0.48 mm	SOT8009
PDTC123JQC			
PDTC143ZQC			
PDTC114YQC			
PDTC124XQC			

## 7. Marking

Table 5. Marking

Type number	Marking code
PDTC143XQC	8P
PDTC123JQC	8L
PDTC143ZQC	8Q
PDTC114YQC	8K
PDTC124XQC	6E

## 8. Limiting values

**Table 6. Limiting values**

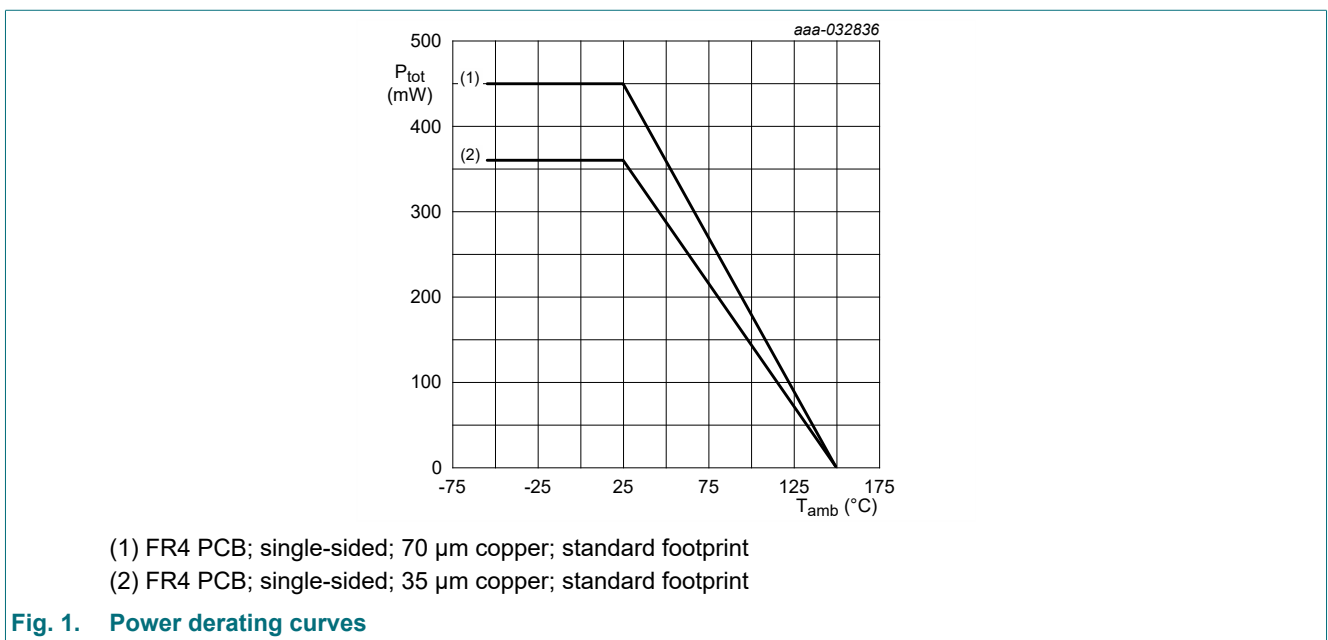
In accordance with the Absolute Maximum Rating System (IEC 60134).

$T_{amb} = 25\text{ °C}$  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					
	PDTC143XQC	open collector	-	7	V	
	PDTC123JQC		-	5	V	
	PDTC143ZQC		-	5	V	
	PDTC114YQC		-	6	V	
	PDTC124XQC		-	7	V	
$V_i$	input voltage					
	PDTC143XQC		-7	+30	V	
	PDTC123JQC		-5	+12	V	
	PDTC143ZQC		-5	+30	V	
	PDTC114YQC		-6	+40	V	
	PDTC124XQC		-7	+40	V	
$I_O$	output current		-	100	mA	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	-	360	mW
			[2]	-	450	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  $\mu\text{m}$  copper; tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB; single-sided; 70  $\mu\text{m}$  copper; tin-plated and standard footprint.



**Fig. 1. Power derating curves**

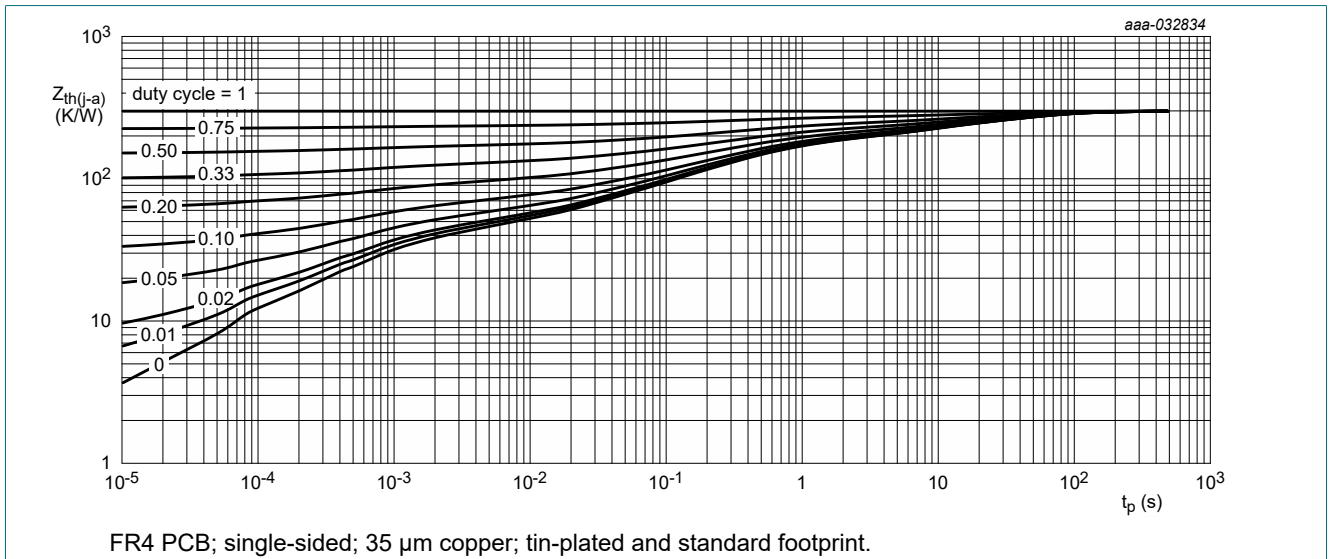
## 9. Thermal characteristics

**Table 7. Thermal characteristics**

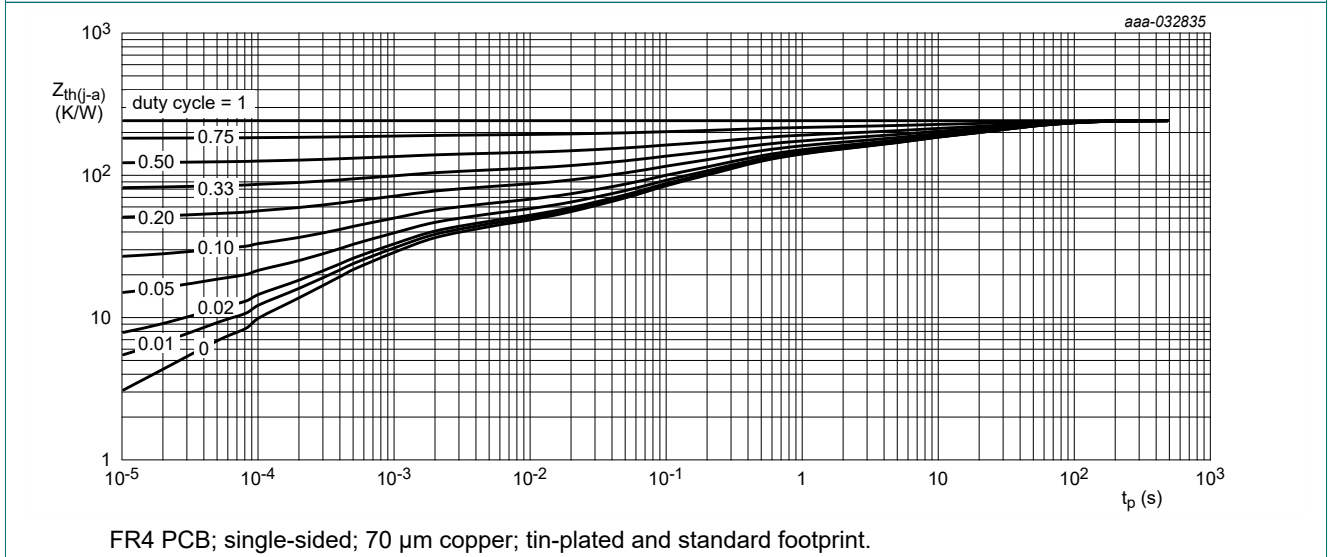
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	348	K/W
			[2]	-	-	278	K/W

- [1] Device mounted on an FR4 PCB; single-sided; 35  $\mu\text{m}$  copper; tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB; single-sided; 70  $\mu\text{m}$  copper; tin-plated and standard footprint.



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



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

## 10. Characteristics

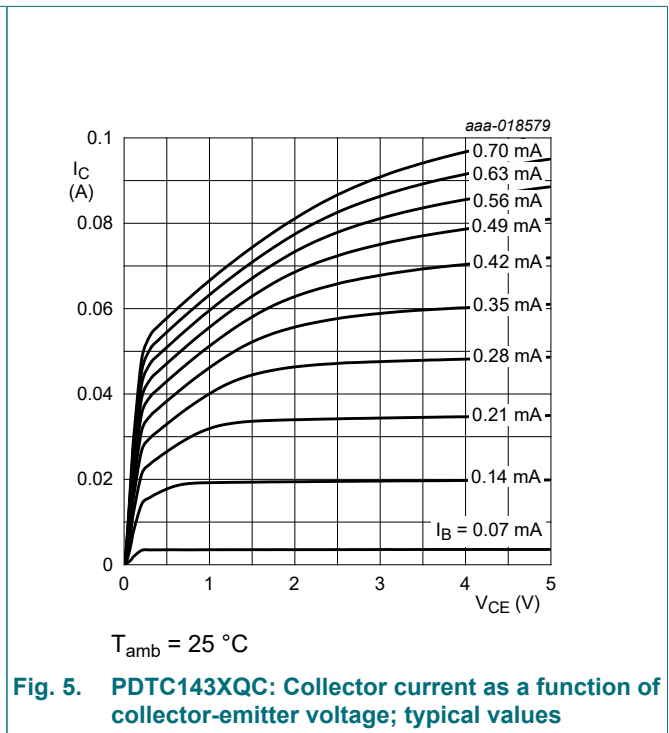
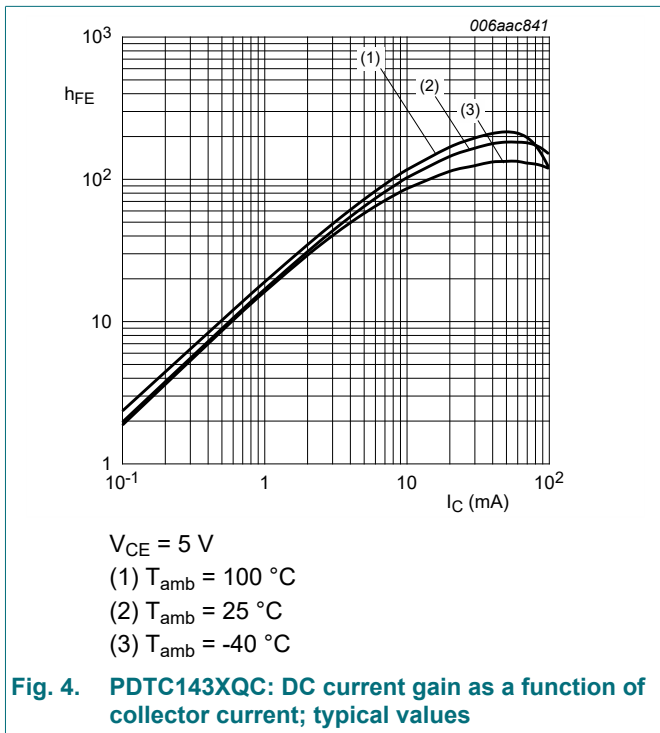
**Table 8. Characteristics**
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\text{ }\mu\text{A}$ ; $I_E = 0\text{ A}$	50	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2\text{ mA}$ ; $I_B = 0\text{ A}$	50	-	-	V
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50\text{ V}$ ; $I_E = 0\text{ A}$	-	-	100	nA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30\text{ V}$ ; $I_B = 0\text{ A}$	-	-	100	nA
		$V_{CE} = 30\text{ V}$ ; $I_B = 0\text{ A}$ ; $T_j = 150\text{ }^{\circ}\text{C}$	-	-	5	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current					
	PDTC143XQC	$V_{EB} = 5\text{ V}$ ; $I_C = 0\text{ A}$	-	-	600	$\mu\text{A}$
	PDTC123JQC		-	-	180	$\mu\text{A}$
	PDTC143ZQC		-	-	170	$\mu\text{A}$
	PDTC114YQC		-	-	150	$\mu\text{A}$
	PDTC124XQC		-	-	120	$\mu\text{A}$
$h_{FE}$	DC current gain					
	PDTC143XQC	$V_{CE} = 5\text{ V}$ ; $I_C = 10\text{ mA}$	50	-	-	
	PDTC123JQC		100	-	-	
	PDTC143ZQC		100	-	-	
	PDTC114YQC	$V_{CE} = 5\text{ V}$ ; $I_C = 5\text{ mA}$	100	-	-	
	PDTC124XQC		80	-	-	
$V_{CEsat}$	collector-emitter saturation voltage					
	PDTC143XQC	$I_C = 10\text{ mA}$ ; $I_B = 0.5\text{ mA}$	-	-	100	mV
	PDTC123JQC		-	-	100	mV
	PDTC143ZQC	$I_C = 5\text{ mA}$ ; $I_B = 0.25\text{ mA}$	-	-	100	mV
	PDTC114YQC		-	-	100	mV
	PDTC124XQC		-	-	100	mV
$V_{I(off)}$	off-state input voltage					
	PDTC143XQC	$V_{CE} = 5\text{ V}$ ; $I_C = 100\text{ }\mu\text{A}$	-	0.8	0.3	V
	PDTC123JQC		-	0.6	0.5	V
	PDTC143ZQC		-	0.6	0.5	V
	PDTC114YQC		-	0.7	0.5	V
	PDTC124XQC		-	0.8	0.5	V
$V_{I(on)}$	on-state input voltage					
	PDTC143XQC	$V_{CE} = 0.3\text{ V}$ ; $I_C = 20\text{ mA}$	2.5	1.5	-	V
	PDTC123JQC	$V_{CE} = 0.3\text{ V}$ ; $I_C = 5\text{ mA}$	1.1	0.75	-	V
	PDTC143ZQC	$V_{CE} = 0.3\text{ V}$ ; $I_C = 5\text{ mA}$	1.3	0.9	-	V
	PDTC114YQC	$V_{CE} = 0.3\text{ V}$ ; $I_C = 1\text{ mA}$	1.4	0.8	-	V
	PDTC124XQC	$V_{CE} = 0.3\text{ V}$ ; $I_C = 2\text{ mA}$	2.0	1.1	-	V

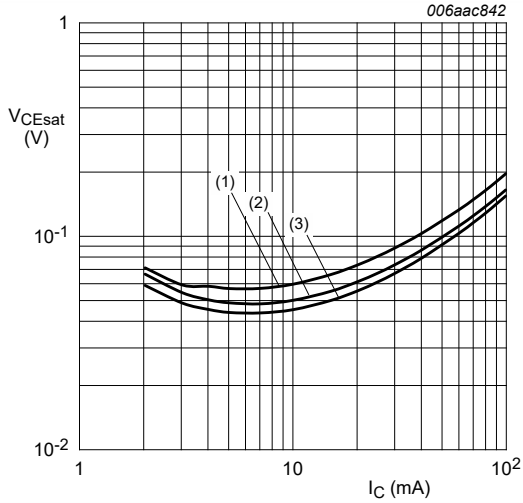
**50 V, 100 mA NPN resistor-equipped transistors**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R1	bias resistor 1 (input)					
	PDTC143XQC		[1] 3.3	4.7	6.1	kΩ
	PDTC123JQC		1.54	2.2	2.86	kΩ
	PDTC143ZQC		3.3	4.7	6.1	kΩ
	PDTC114YQC		7	10	13	kΩ
	PDTC124XQC		15.4	22	28.6	kΩ
R2/R1	bias resistor ratio					
	PDTC143XQC		[1] 1.7	2.13	2.6	
	PDTC123JQC		17	21	26	
	PDTC143ZQC		8	10	12	
	PDTC114YQC		3.7	4.7	5.7	
	PDTC124XQC		1.7	2.13	2.6	
$f_T$	transition frequency	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$	[2] -	230	-	MHz
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	-	2.5	pF

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



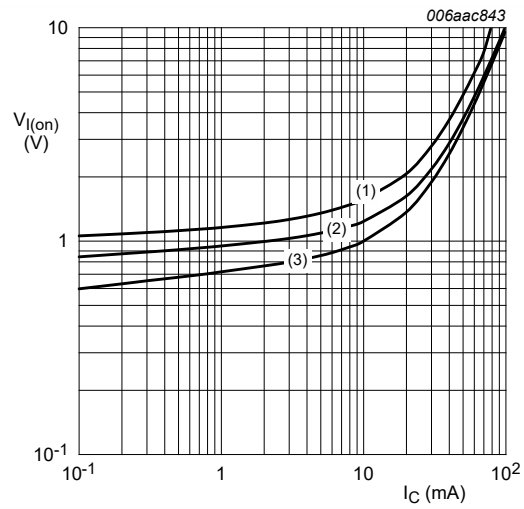
50 V, 100 mA NPN resistor-equipped transistors



$I_C/I_B = 20$

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

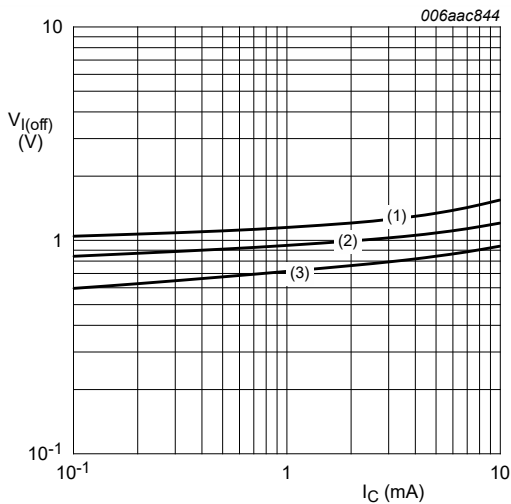
**Fig. 6. PDTC143XQC: Collector-emitter saturation voltage as a function of collector current; typical values**



$V_{CE} = 0.3\text{ V}$

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

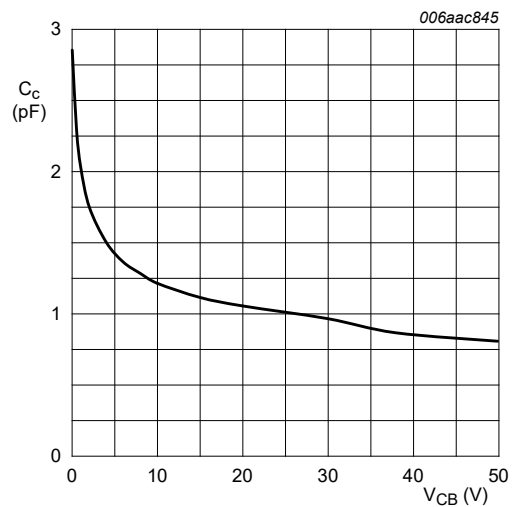
**Fig. 7. PDTC143XQC: On-state input voltage as a function of collector current; typical values**



$V_{CE} = 5\text{ V}$

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

**Fig. 8. PDTC143XQC: Off-state input voltage as a function of collector current; typical values**



$f = 1\text{ MHz}$

$T_{amb} = 25\text{ °C}$

**Fig. 9. PDTC143XQC: Collector capacitance as a function of collector-base voltage; typical values**

50 V, 100 mA NPN resistor-equipped transistors

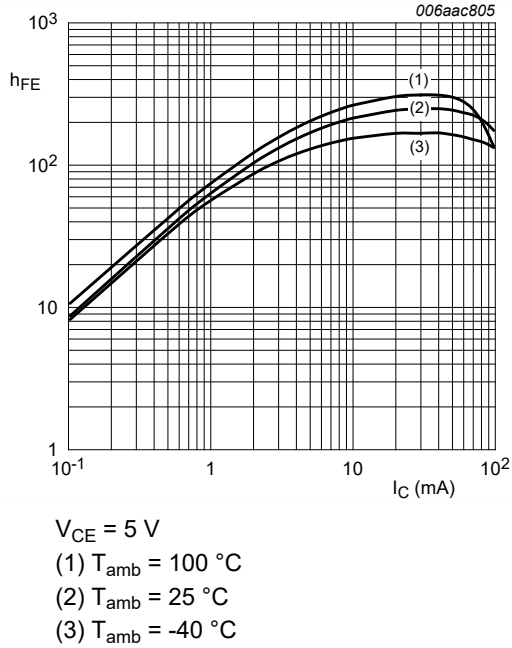


Fig. 10. PDTC123JQC: DC current gain as a function of collector current; typical values

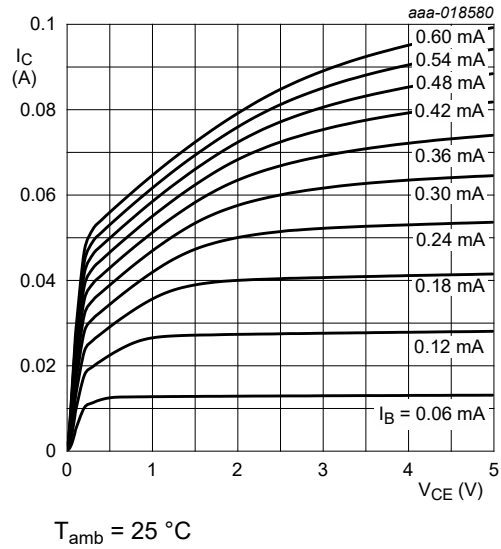


Fig. 11. PDTC123JQC: Collector current as a function of collector-emitter voltage; typical values

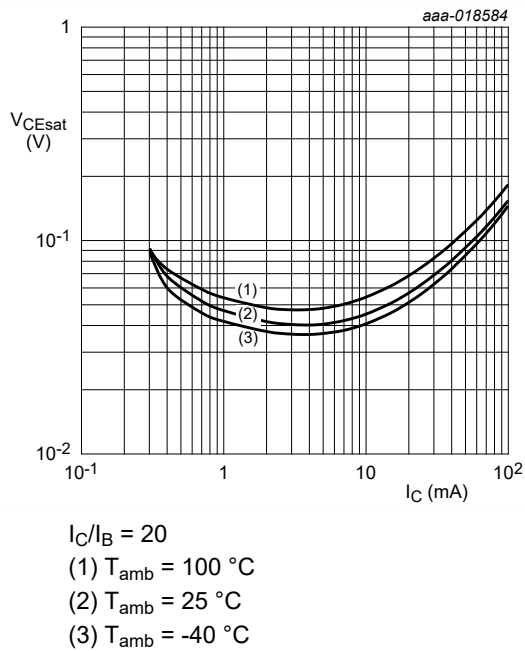


Fig. 12. PDTC123JQC: Collector-emitter saturation voltage as a function of collector current; typical values

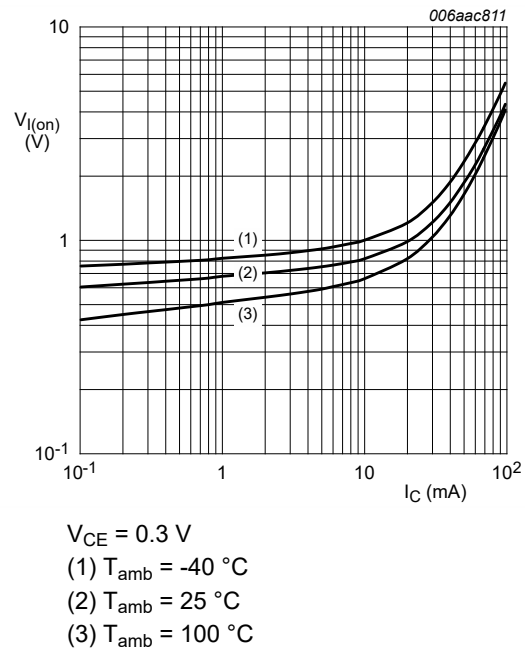


Fig. 13. PDTC123JQC: On-state input voltage as a function of collector current; typical values



50 V, 100 mA NPN resistor-equipped transistors

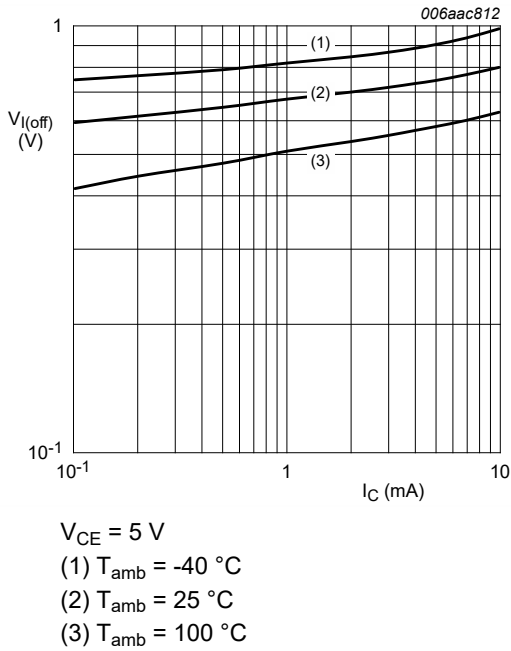


Fig. 14. PDTC123JQC: Off-state input voltage as a function of collector current; typical values

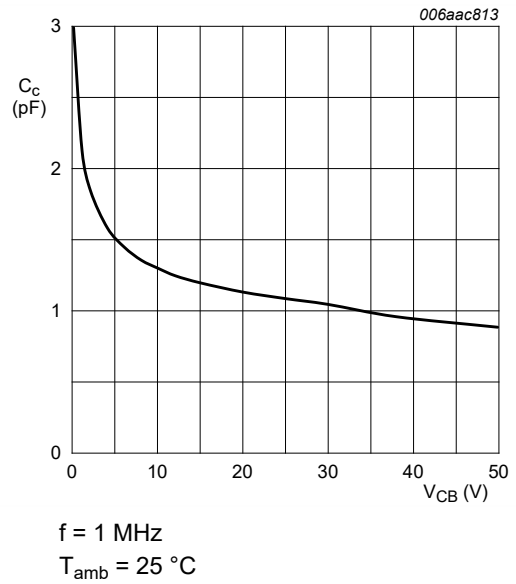


Fig. 15. PDTC123JQC: Collector capacitance as a function of collector-base voltage; typical values

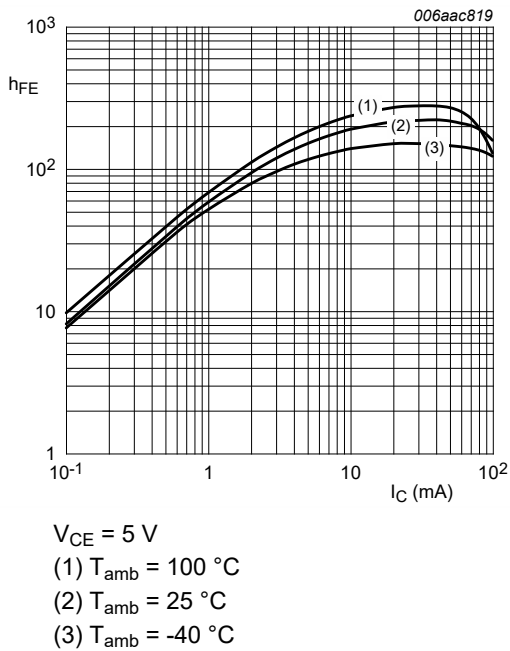


Fig. 16. PDTC143ZQC: DC current gain as a function of collector current; typical values

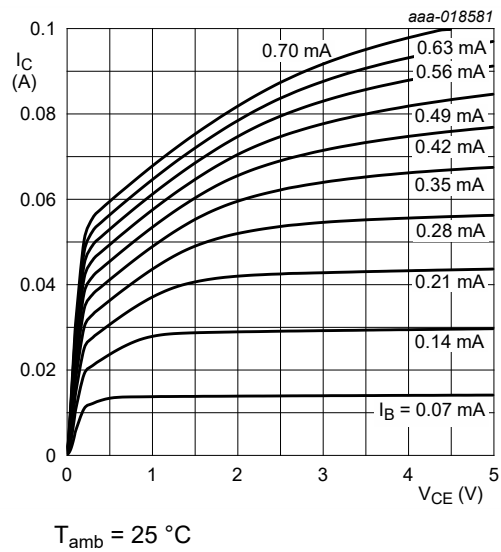
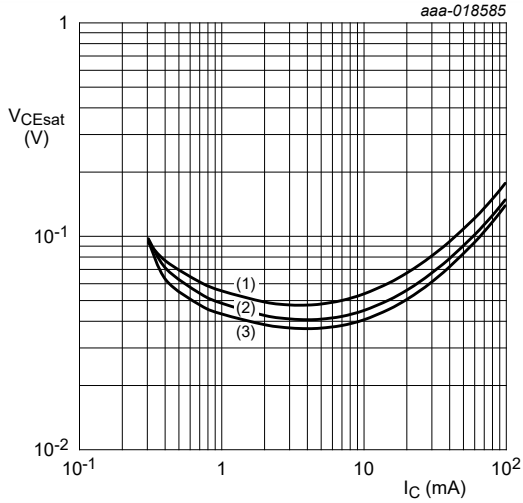


Fig. 17. PDTC143ZQC: Collector current as a function of collector-emitter voltage; typical values

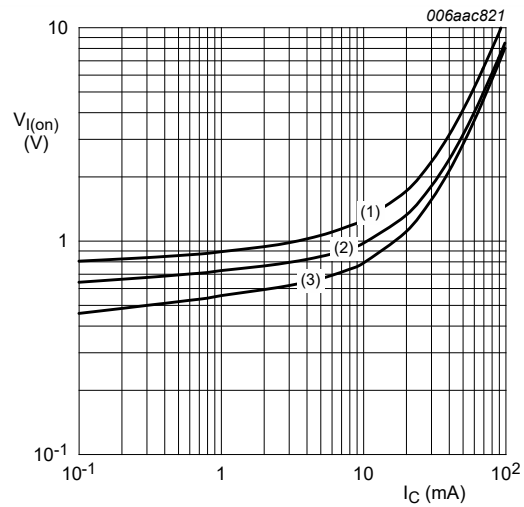
50 V, 100 mA NPN resistor-equipped transistors



$I_C/I_B = 20$

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

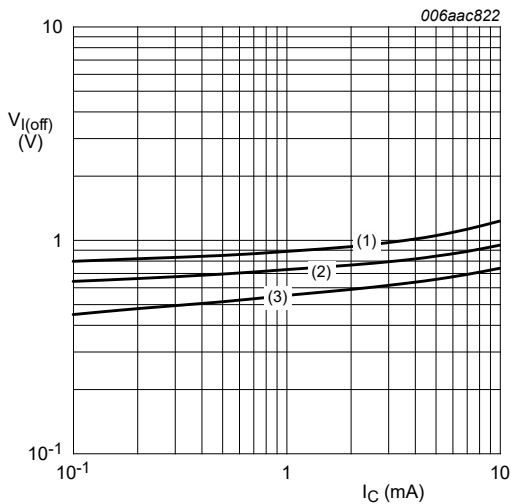
**Fig. 18. PDTC143ZQC: Collector-emitter saturation voltage as a function of collector current; typical values**



$V_{CE} = 0.3\text{ V}$

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

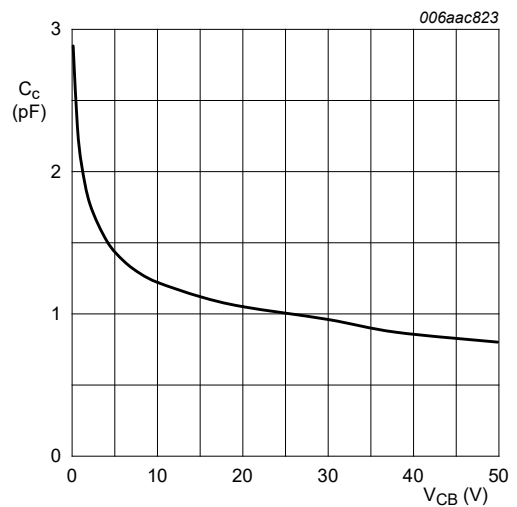
**Fig. 19. PDTC143ZQC: On-state input voltage as a function of collector current; typical values**



$V_{CE} = 5\text{ V}$

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

**Fig. 20. PDTC143ZQC: Off-state input voltage as a function of collector current; typical values**



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

**Fig. 21. PDTC143ZQC: Collector capacitance as a function of collector-base voltage; typical values**

50 V, 100 mA NPN resistor-equipped transistors

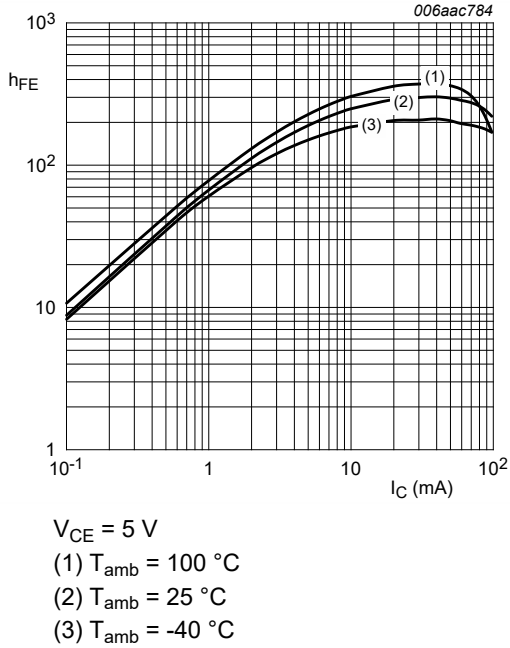


Fig. 22. PDTC114YQC: DC current gain as a function of collector current; typical values

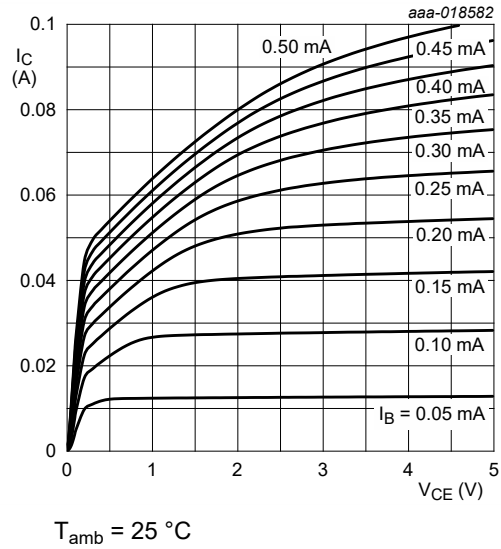


Fig. 23. PDTC114YQC: Collector current as a function of collector-emitter voltage; typical values

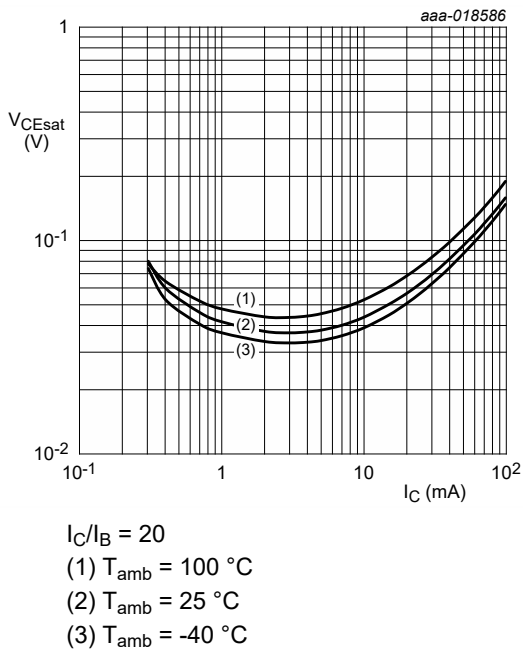


Fig. 24. PDTC114YQC: Collector-emitter saturation voltage as a function of collector current; typical values

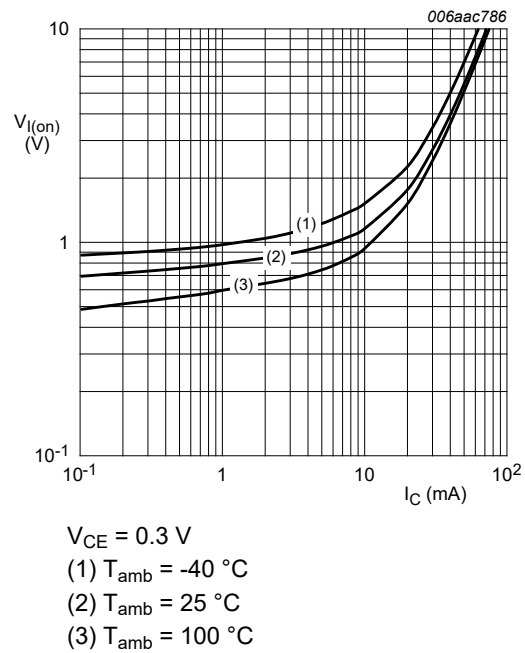
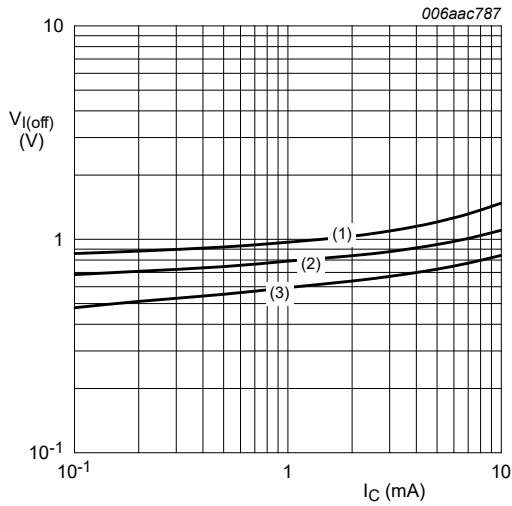


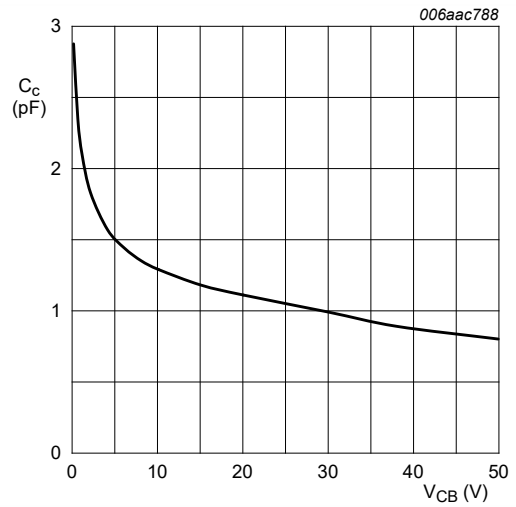
Fig. 25. PDTC114YQC: On-state input voltage as a function of collector current; typical values

50 V, 100 mA NPN resistor-equipped transistors



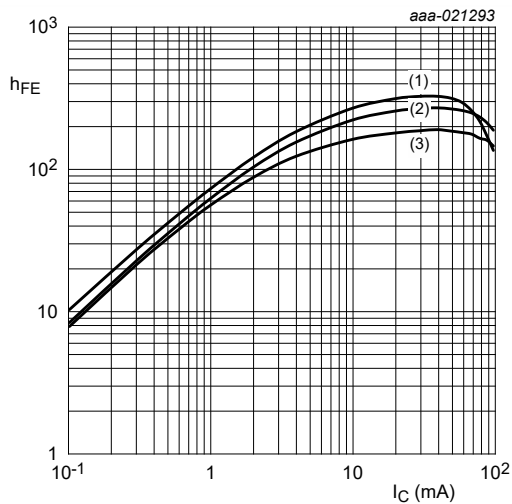
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -40^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 100^\circ\text{C}$

Fig. 26. PDTC114YQC: Off-state input voltage as a function of collector current; typical values



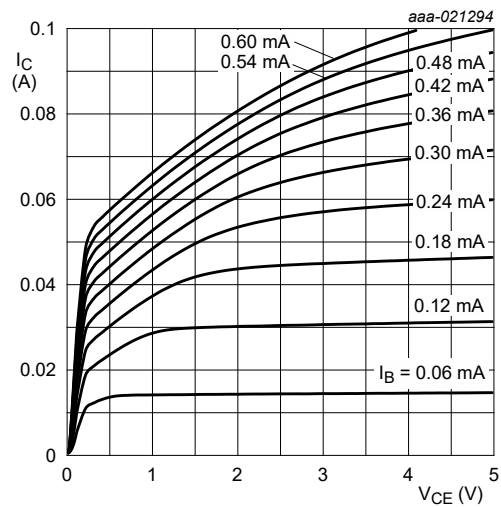
$f = 1\text{ MHz}$   
 $T_{amb} = 25^\circ\text{C}$

Fig. 27. PDTC114YQC: Collector capacitance as a function of collector-base voltage; typical values



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

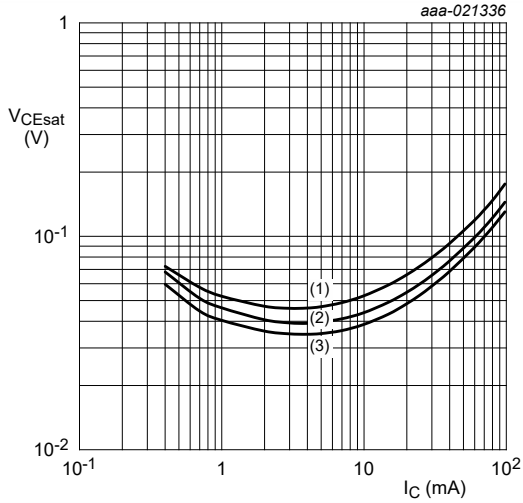
Fig. 28. PDTC124XQC: DC current gain as a function of collector current; typical values



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

Fig. 29. PDTC124XQC: Collector current as a function of collector-emitter voltage; typical values

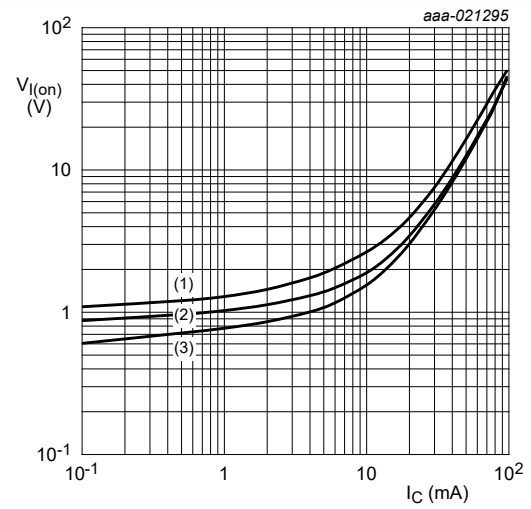
50 V, 100 mA NPN resistor-equipped transistors



$I_C/I_B = 20$

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

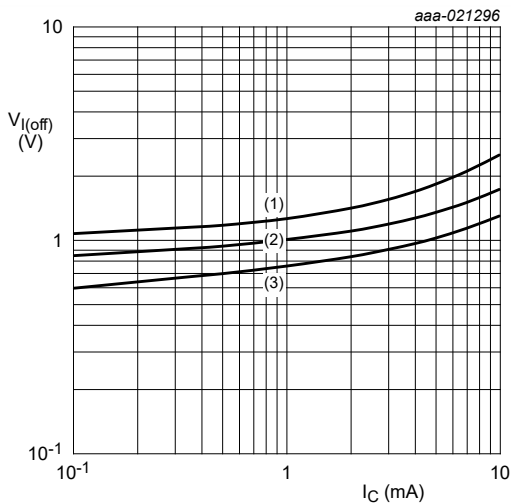
**Fig. 30. PDTC124XQC: Collector-emitter saturation voltage as a function of collector current; typical values**



$V_{CE} = 0.5\text{ V}$

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

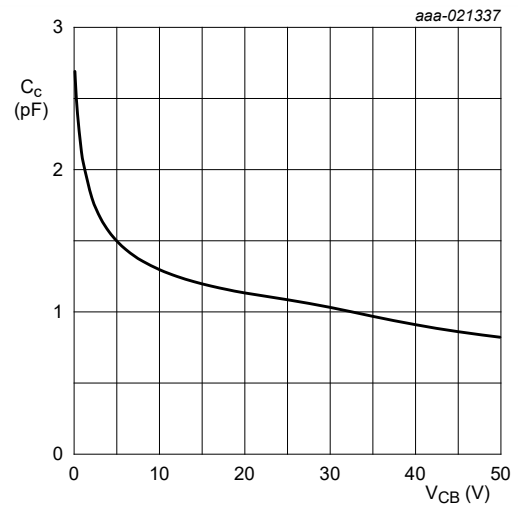
**Fig. 31. PDTC124XQC: On-state input voltage as a function of collector current; typical values**



$V_{CE} = 5\text{ V}$

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

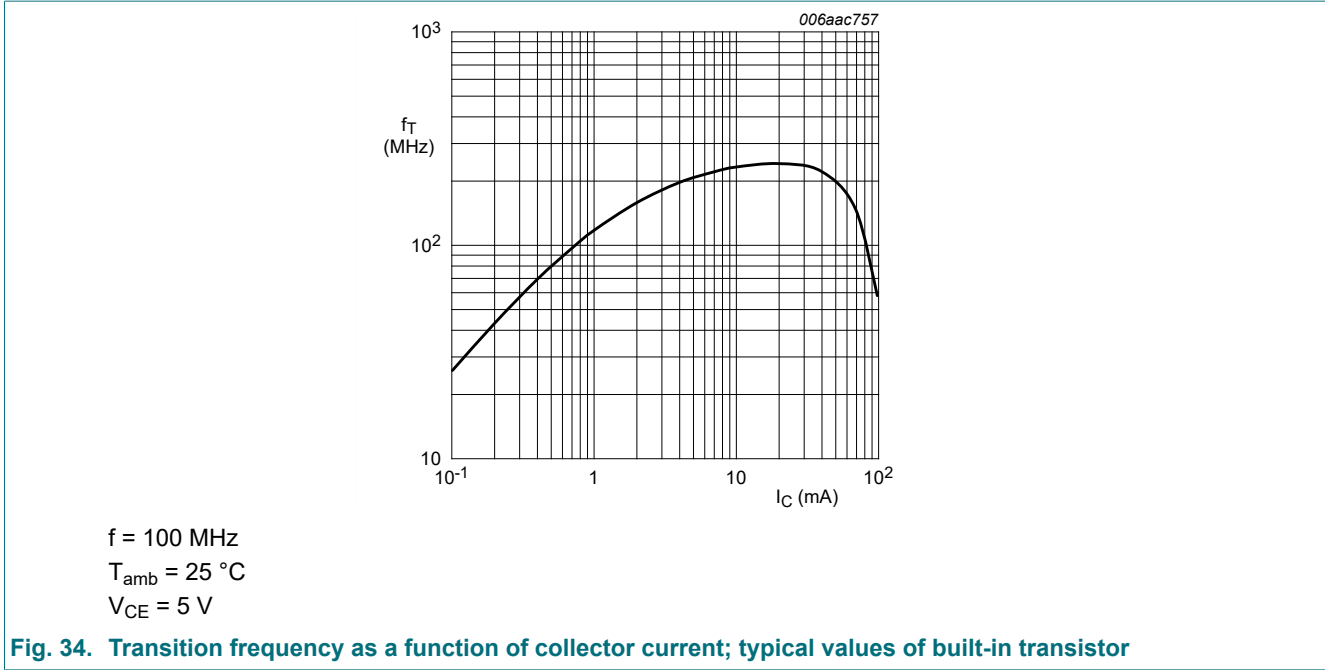
**Fig. 32. PDTC124XQC: Off-state input voltage as a function of collector current; typical values**



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

**Fig. 33. PDTC124XQC: Collector capacitance as a function of collector-base voltage; typical values**

50 V, 100 mA NPN resistor-equipped transistors



## 11. Test information

### Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R1 = \frac{V(I12) - V(I11)}{I12 - I11}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R2}{R1} = \frac{V(I14) - V(I13)}{R1 \cdot (I14 - I13)} - 1$$

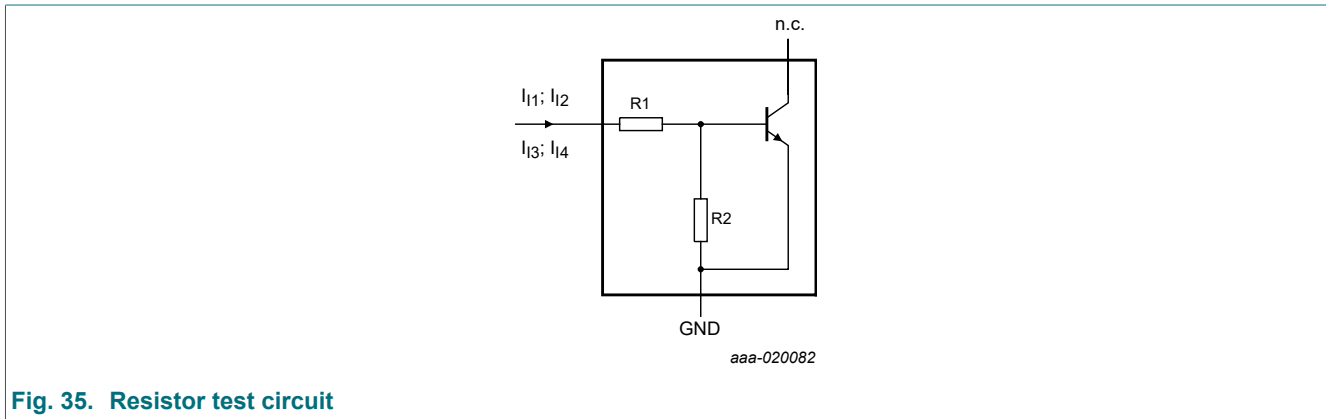


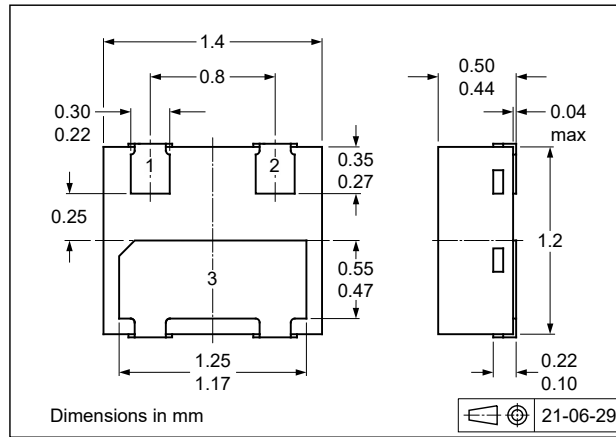
Fig. 35. Resistor test circuit

### Resistor test conditions

Table 9. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I <sub>11</sub>	I <sub>12</sub>	I <sub>13</sub>	I <sub>14</sub>
PDTC143XQC	4.7	10	350 μA	450 μA	-350 μA	-450 μA
PDTC123JQC	2.2	47	90 μA	140 μA	-55 μA	-105 μA
PDTC143ZQC	4.7	47	90 μA	140 μA	-55 μA	-105 μA
PDTC114YQC	10	47	90 μA	140 μA	-55 μA	-105 μA
PDTC124XQC	22	47	55 μA	105 μA	-55 μA	-105 μA

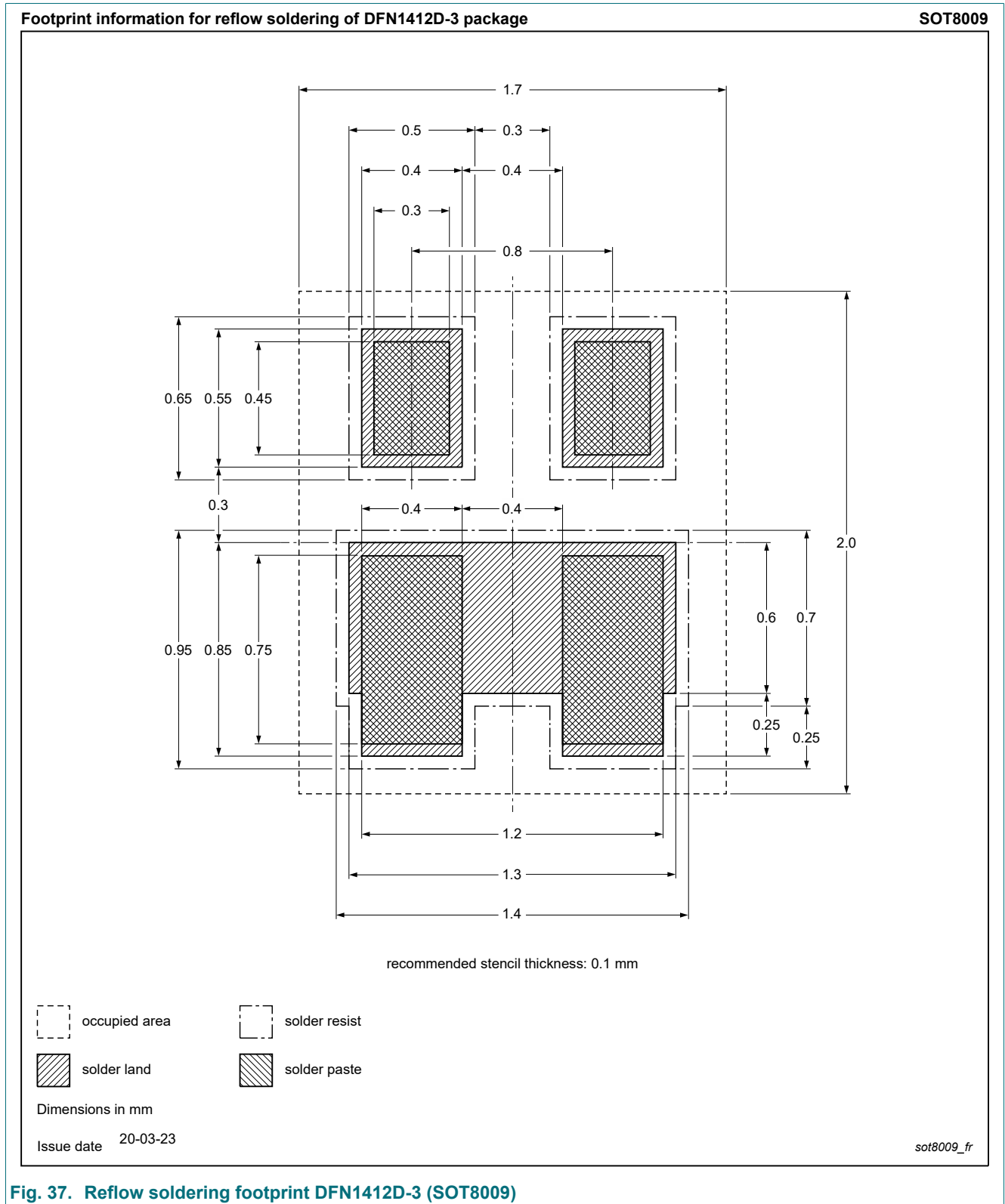
## 12. Package outline



**Fig. 36. Package outline DFN1412D-3 (SOT8009)**



### 13. Soldering



## 14. Revision history

Table 10. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PDTC143X_to_124XQ_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".
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