



PDTC143X/123J/143Z/114Y/124XQC-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 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 Ω	k Ω	Nexperia	JEDEC	
PDTC143XQC-Q	4.7	10	SOT8009	MO-340CA	PDTA143XQC-Q
PDTC123JQC-Q	2.2	47			PDTA123JQC-Q
PDTC143ZQC-Q	4.7	47			PDTA143ZQC-Q
PDTC114YQC-Q	10	47			PDTA114YQC-Q
PDTC124XQC-Q	22	47			PDTA124XQC-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

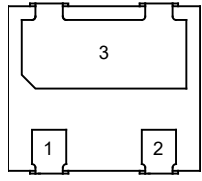
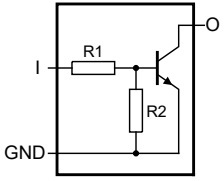
Table 2. Quick reference data

$T_{amb} = 25\text{ }^{\circ}\text{C}$ 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-Q	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-Q			
PDTC143ZQC-Q			
PDTC114YQC-Q			
PDTC124XQC-Q			

7. Marking

Table 5. Marking

Type number	Marking code
PDTC143XQC-Q	8P
PDTC123JQC-Q	8L
PDTC143ZQC-Q	8Q
PDTC114YQC-Q	8K
PDTC124XQC-Q	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	open collector	-	7	V	
	PDTC143XQC-Q			5	V	
	PDTC123JQC-Q			5	V	
	PDTC143ZQC-Q			6	V	
	PDTC114YQC-Q			7	V	
	PDTC124XQC-Q					
V_i	input voltage					
	PDTC143XQC-Q			-7	+30	V
	PDTC123JQC-Q			-5	+12	V
	PDTC143ZQC-Q			-5	+30	V
	PDTC114YQC-Q			-6	+40	V
	PDTC124XQC-Q			-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 μm copper; tin-plated and standard footprint.

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

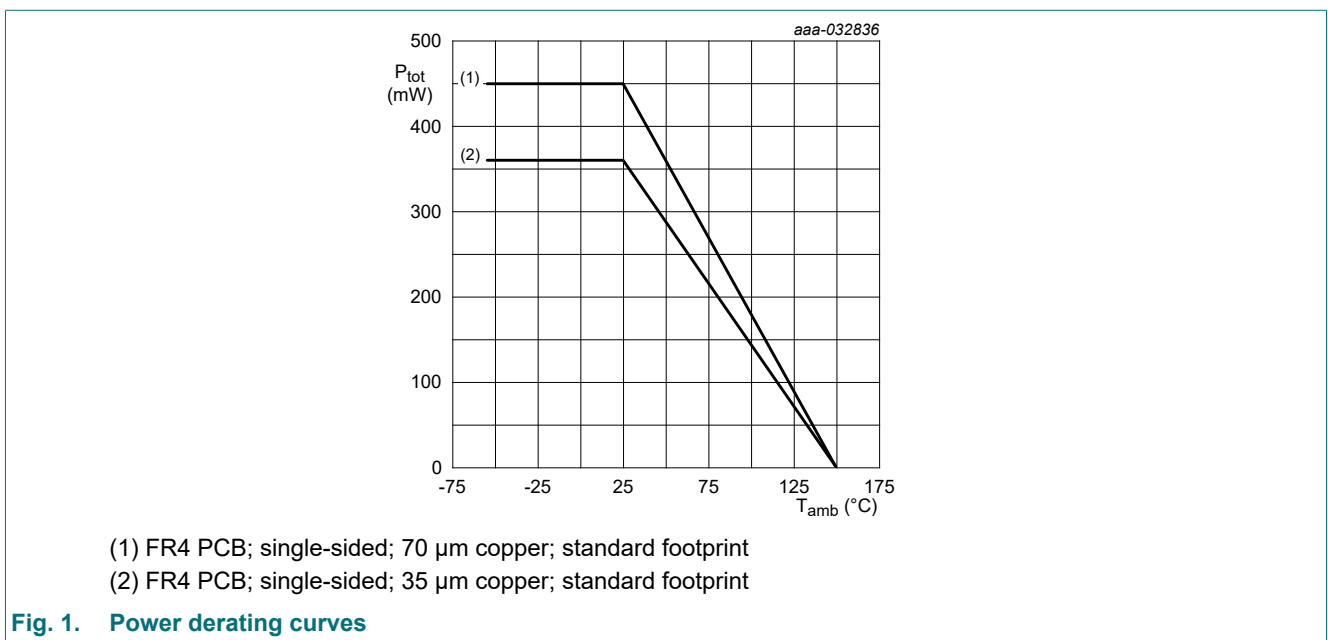


Fig. 1. Power derating curves

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

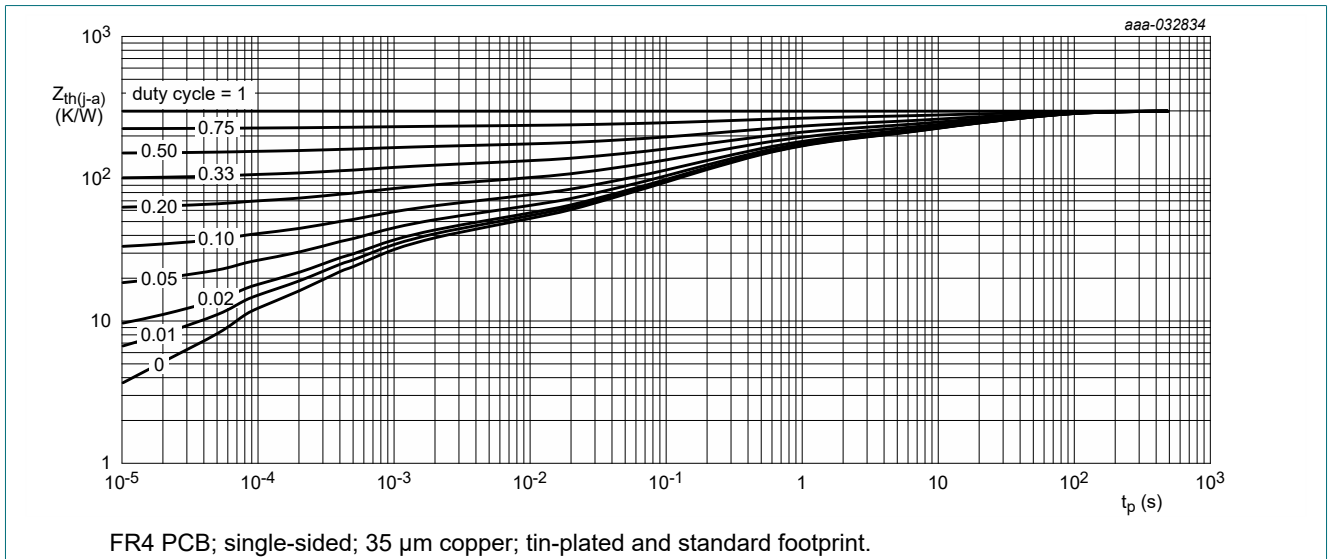


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

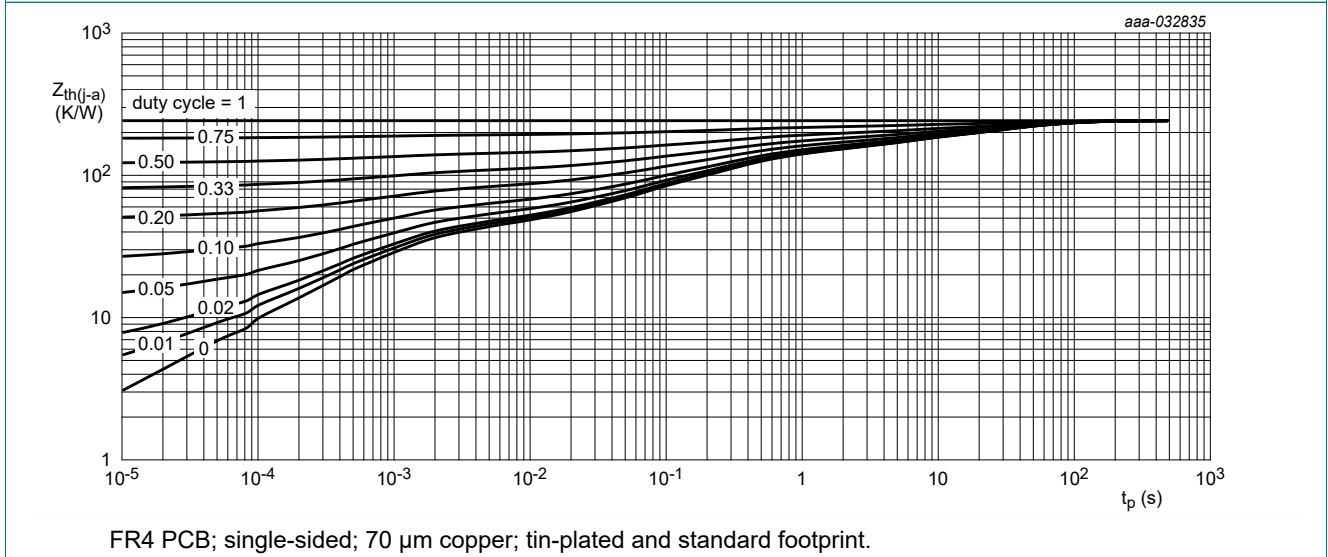


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

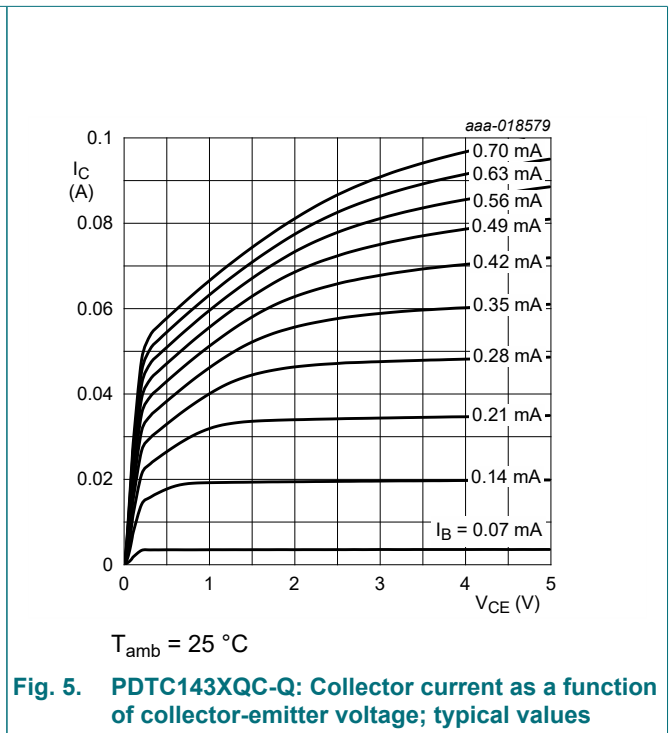
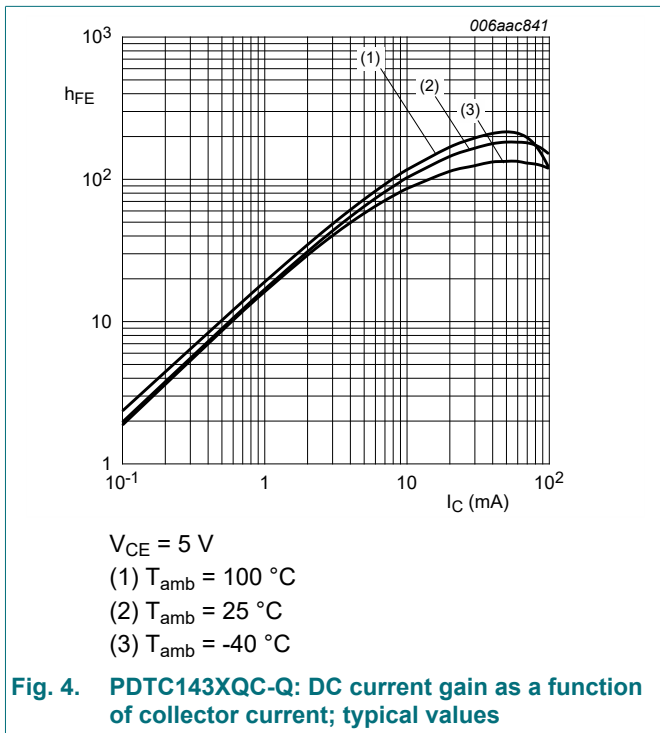
Table 8. Characteristics
 $T_{amb} = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\ \mu\text{A}$; $I_E = 0\ \text{A}$	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
		$V_{CE} = 30\ \text{V}$; $I_B = 0\ \text{A}$; $T_j = 150\text{ °C}$	-	-	5	μA
I_{EBO}	emitter-base cut-off current					
	PDTC143XQC-Q	$V_{EB} = 5\ \text{V}$; $I_C = 0\ \text{A}$	-	-	600	μA
	PDTC123JQC-Q		-	-	180	μA
	PDTC143ZQC-Q		-	-	170	μA
	PDTC114YQC-Q		-	-	150	μA
	PDTC124XQC-Q		-	-	120	μA
h_{FE}	DC current gain					
	PDTC143XQC-Q	$V_{CE} = 5\ \text{V}$; $I_C = 10\ \text{mA}$	50	-	-	
	PDTC123JQC-Q		100	-	-	
	PDTC143ZQC-Q		100	-	-	
	PDTC114YQC-Q	$V_{CE} = 5\ \text{V}$; $I_C = 5\ \text{mA}$	100	-	-	
	PDTC124XQC-Q		80	-	-	
V_{CEsat}	collector-emitter saturation voltage					
	PDTC143XQC-Q	$I_C = 10\ \text{mA}$; $I_B = 0.5\ \text{mA}$	-	-	100	mV
	PDTC123JQC-Q		-	-	100	mV
	PDTC143ZQC-Q	$I_C = 5\ \text{mA}$; $I_B = 0.25\ \text{mA}$	-	-	100	mV
	PDTC114YQC-Q		-	-	100	mV
	PDTC124XQC-Q		-	-	100	mV
$V_{I(off)}$	off-state input voltage					
	PDTC143XQC-Q	$V_{CE} = 5\ \text{V}$; $I_C = 100\ \mu\text{A}$	-	0.8	0.3	V
	PDTC123JQC-Q		-	0.6	0.5	V
	PDTC143ZQC-Q		-	0.6	0.5	V
	PDTC114YQC-Q		-	0.7	0.5	V
	PDTC124XQC-Q		-	0.8	0.5	V
$V_{I(on)}$	on-state input voltage					
	PDTC143XQC-Q	$V_{CE} = 0.3\ \text{V}$; $I_C = 20\ \text{mA}$	2.5	1.5	-	V
	PDTC123JQC-Q	$V_{CE} = 0.3\ \text{V}$; $I_C = 5\ \text{mA}$	1.1	0.75	-	V
	PDTC143ZQC-Q	$V_{CE} = 0.3\ \text{V}$; $I_C = 5\ \text{mA}$	1.3	0.9	-	V
	PDTC114YQC-Q	$V_{CE} = 0.3\ \text{V}$; $I_C = 1\ \text{mA}$	1.4	0.8	-	V
	PDTC124XQC-Q	$V_{CE} = 0.3\ \text{V}$; $I_C = 2\ \text{mA}$	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-Q		[1] 3.3	4.7	6.1	kΩ
	PDTC123JQC-Q		1.54	2.2	2.86	kΩ
	PDTC143ZQC-Q		3.3	4.7	6.1	kΩ
	PDTC114YQC-Q		7	10	13	kΩ
PDTC124XQC-Q	15.4		22	28.6	kΩ	
R2/R1	bias resistor ratio					
	PDTC143XQC-Q		[1] 1.7	2.13	2.6	
	PDTC123JQC-Q		17	21	26	
	PDTC143ZQC-Q		8	10	12	
	PDTC114YQC-Q		3.7	4.7	5.7	
PDTC124XQC-Q	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

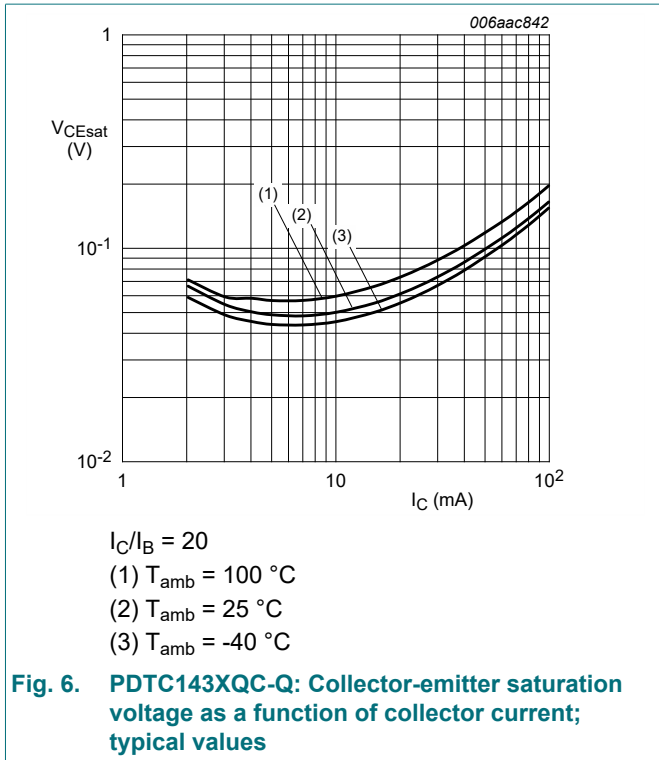


Fig. 6. PDTC143XQC-Q: Collector-emitter saturation voltage as a function of collector current; typical values

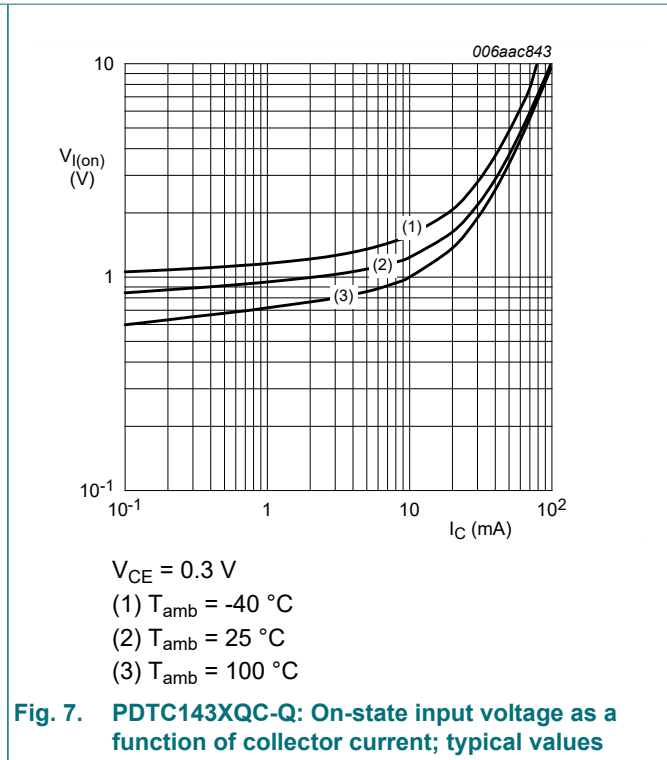


Fig. 7. PDTC143XQC-Q: On-state input voltage as a function of collector current; typical values

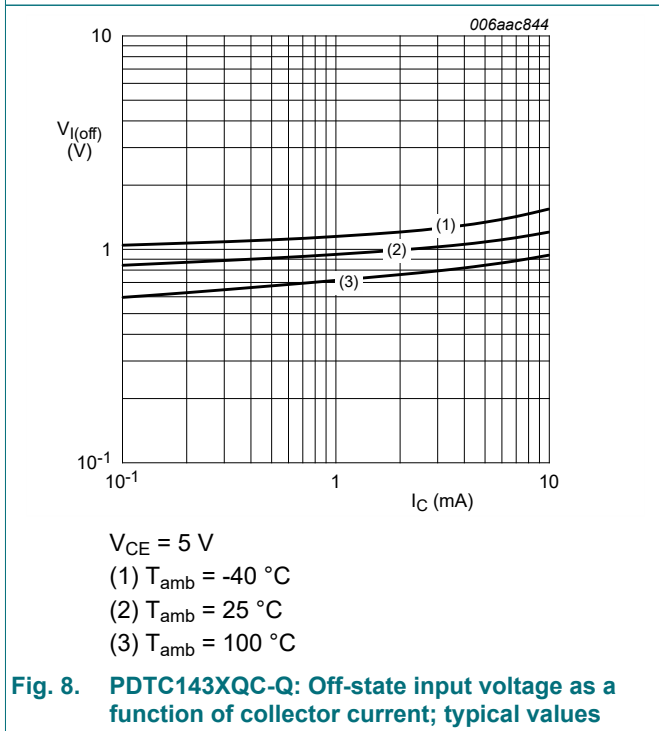


Fig. 8. PDTC143XQC-Q: Off-state input voltage as a function of collector current; typical values

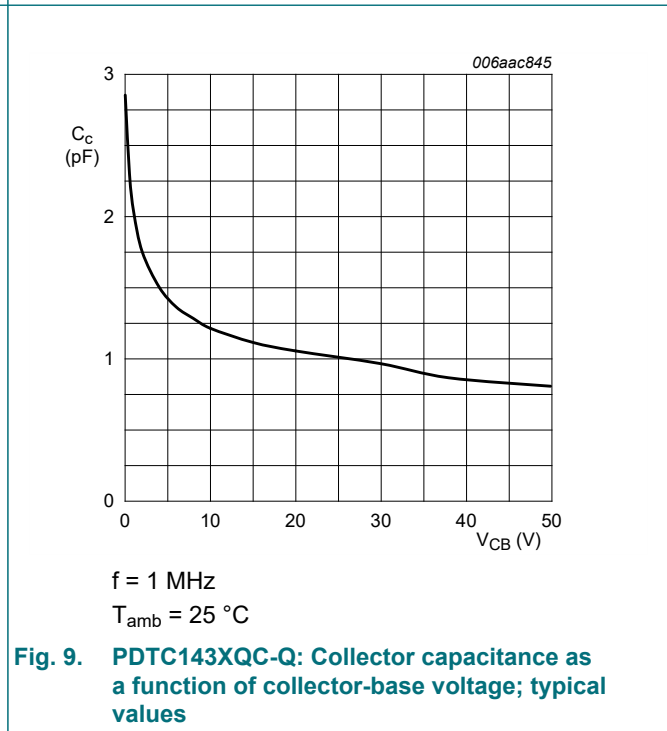


Fig. 9. PDTC143XQC-Q: Collector capacitance as a function of collector-base voltage; typical values

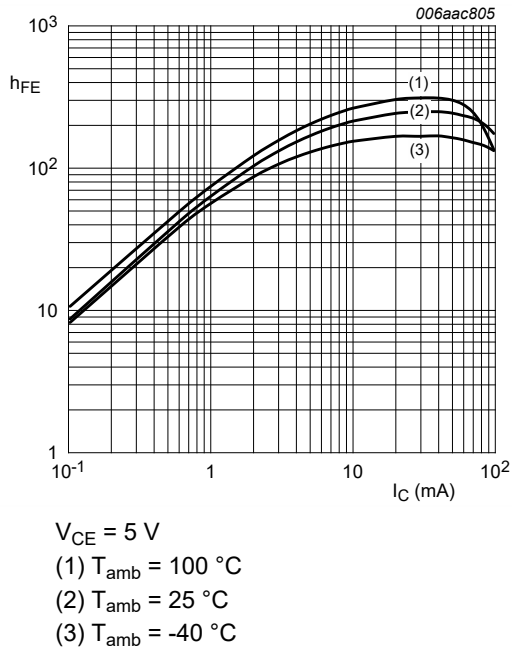


Fig. 10. PDTC123JQC-Q: DC current gain as a function of collector current; typical values

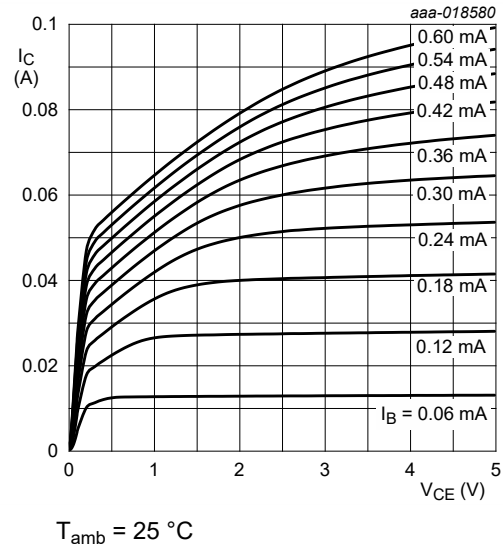


Fig. 11. PDTC123JQC-Q: Collector current as a function of collector-emitter voltage; typical values

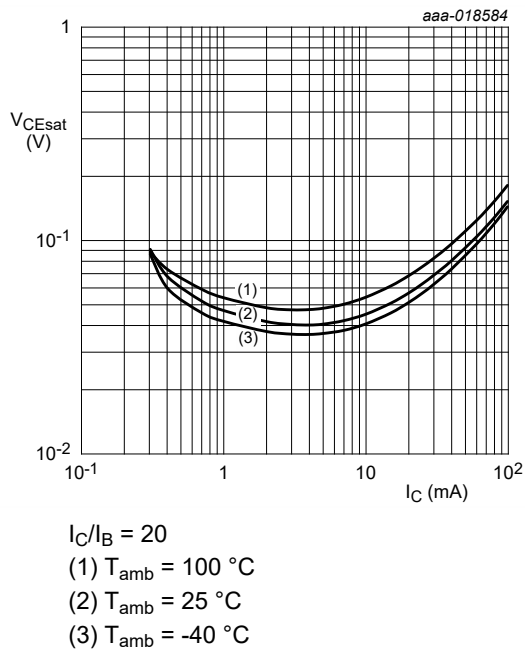


Fig. 12. PDTC123JQC-Q: Collector-emitter saturation voltage as a function of collector current; typical values

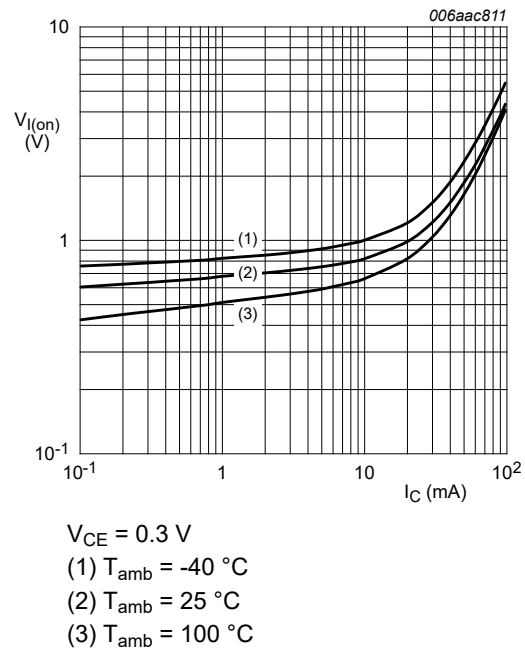


Fig. 13. PDTC123JQC-Q: On-state input voltage as a function of collector current; typical values

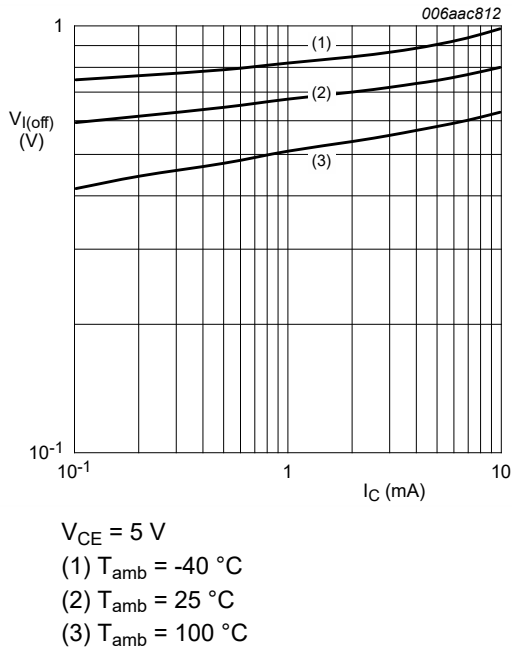


Fig. 14. PDTC123JQC-Q: Off-state input voltage as a function of collector current; typical values

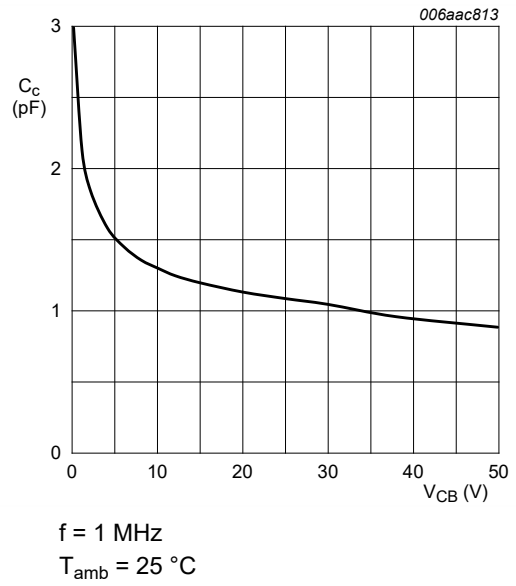


Fig. 15. PDTC123JQC-Q: Collector capacitance as a function of collector-base voltage; typical values

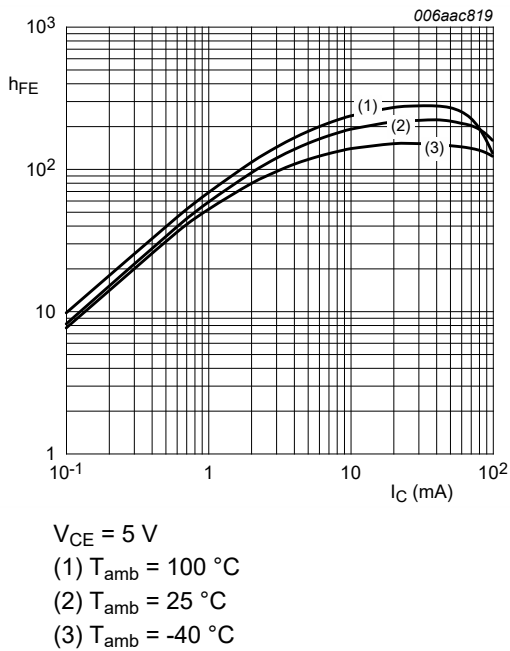


Fig. 16. PDTC143ZQC-Q: DC current gain as a function of collector current; typical values

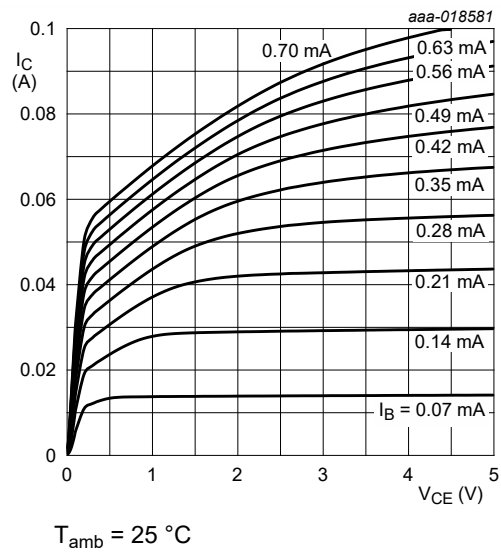
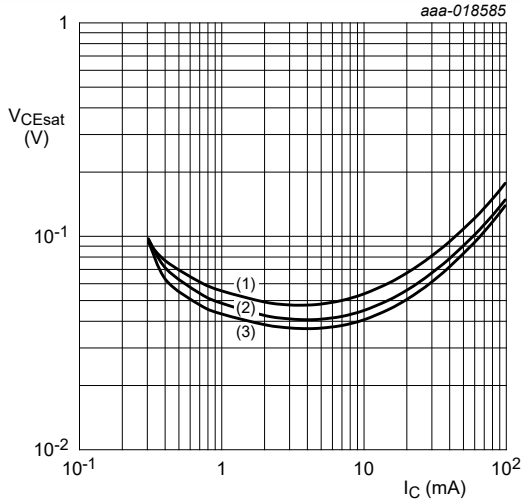


Fig. 17. PDTC143ZQC-Q: Collector current as a function of collector-emitter voltage; typical values

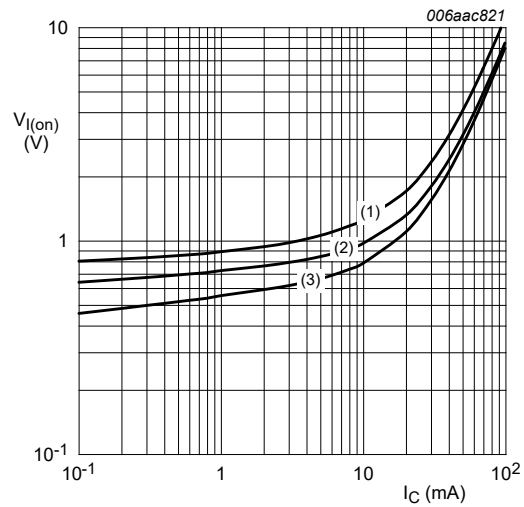
50 V, 100 mA NPN resistor-equipped transistors



$I_C/I_B = 20$

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

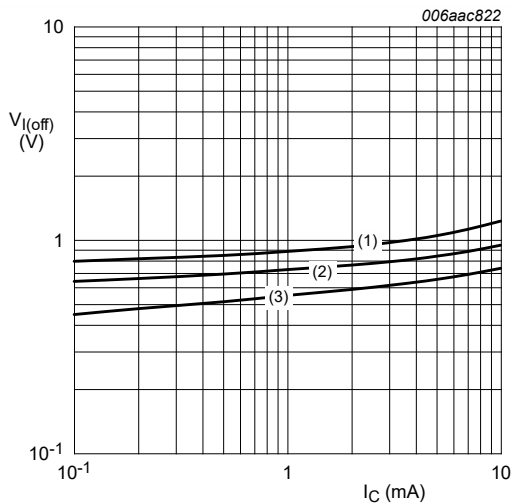
Fig. 18. PDTC143ZQC-Q: Collector-emitter saturation voltage as a function of collector current; typical values



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

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

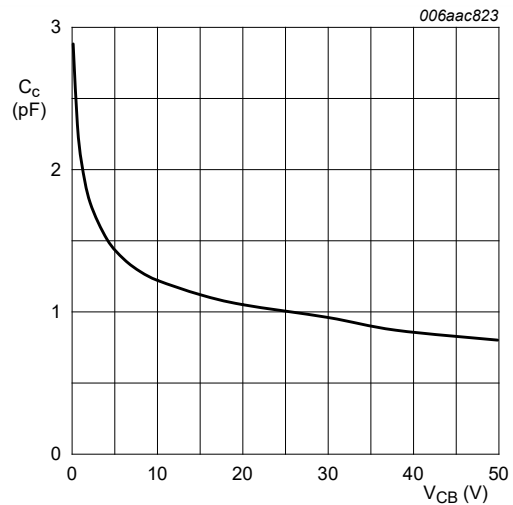
Fig. 19. PDTC143ZQC-Q: On-state input voltage as a function of collector current; typical values



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

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

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



$f = 1\text{ MHz}$

$T_{amb} = 25\text{ °C}$

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

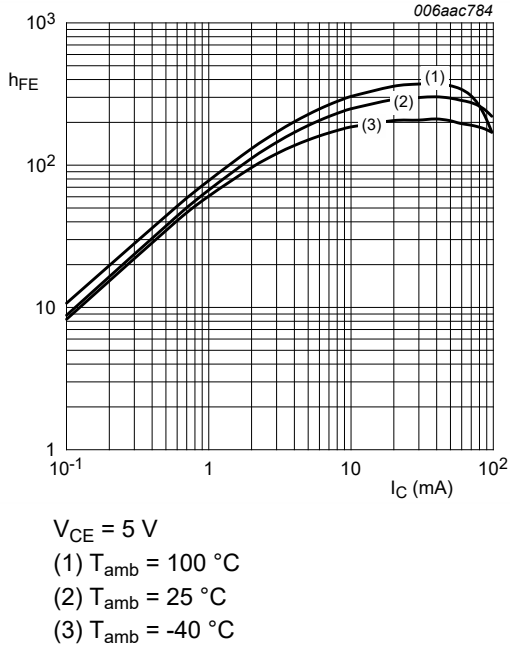


Fig. 22. PDTC114YQC-Q: DC current gain as a function of collector current; typical values

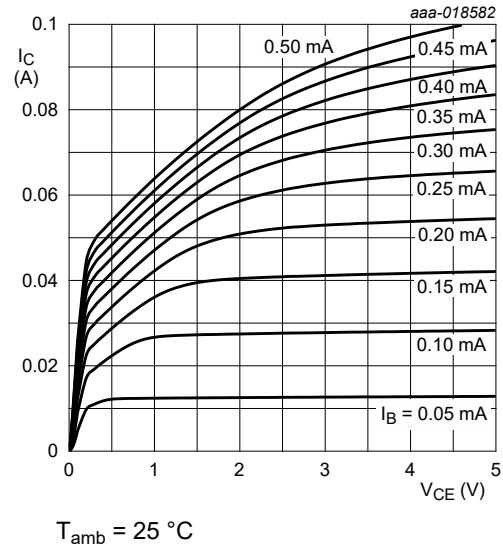


Fig. 23. PDTC114YQC-Q: Collector current as a function of collector-emitter voltage; typical values

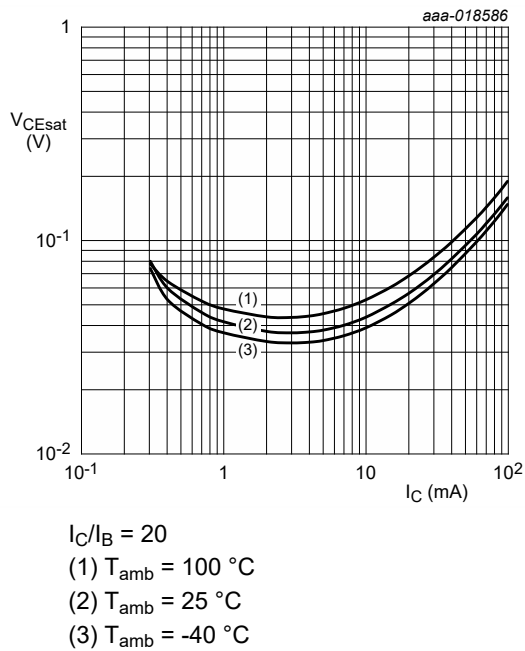


Fig. 24. PDTC114YQC-Q: Collector-emitter saturation voltage as a function of collector current; typical values

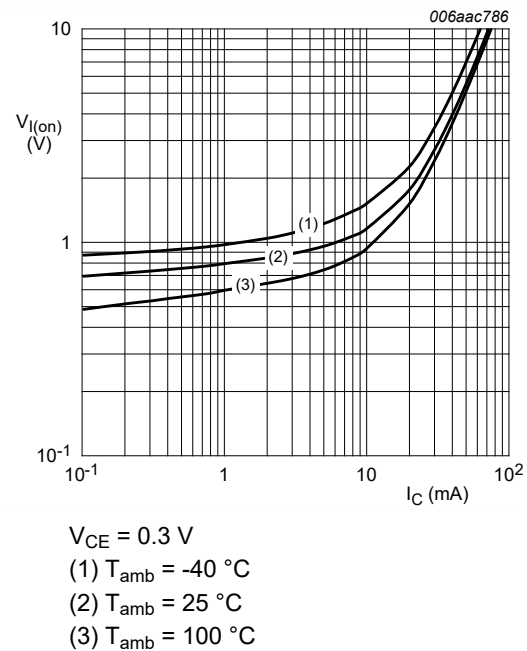


Fig. 25. PDTC114YQC-Q: On-state input voltage as a function of collector current; typical values

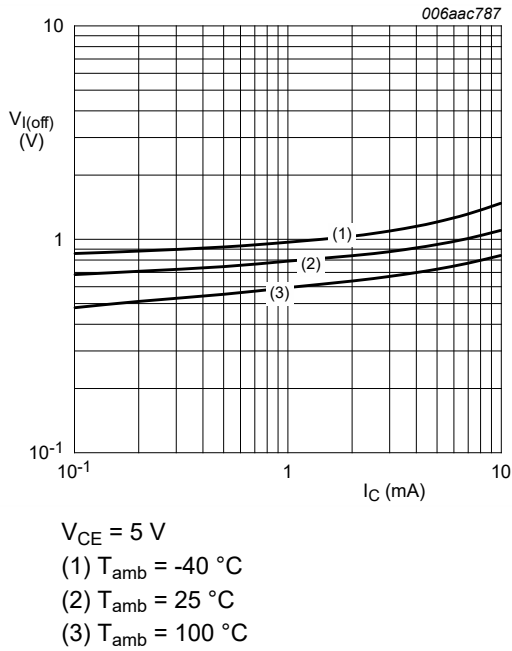


Fig. 26. PDTC114YQC-Q: Off-state input voltage as a function of collector current; typical values

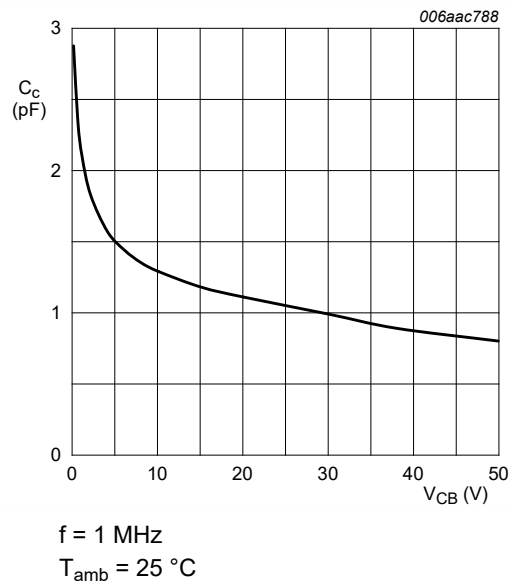


Fig. 27. PDTC114YQC-Q: Collector capacitance as a function of collector-base voltage; typical values

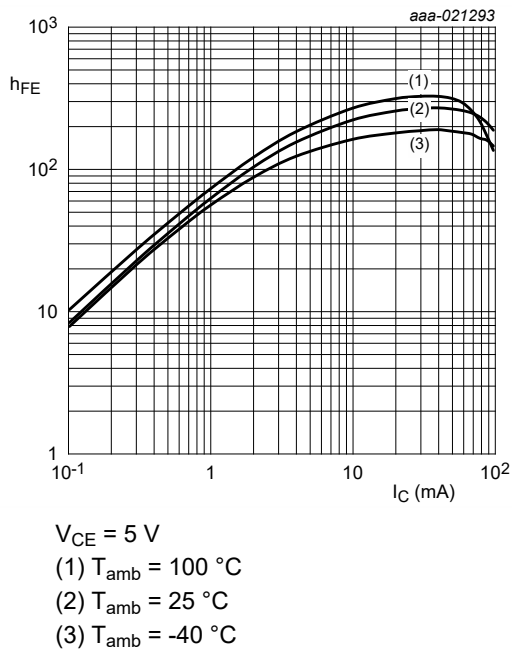


Fig. 28. PDTC124XQC-Q: DC current gain as a function of collector current; typical values

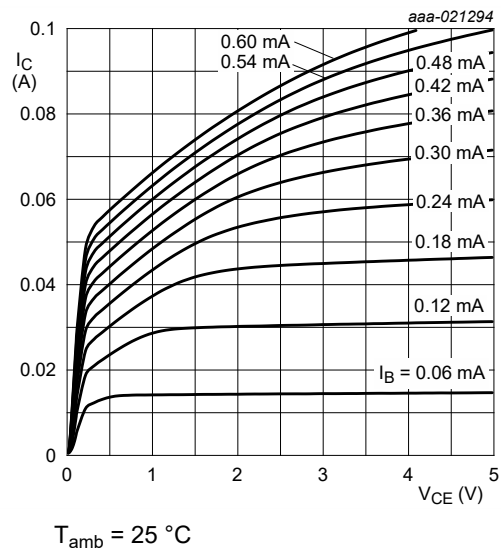
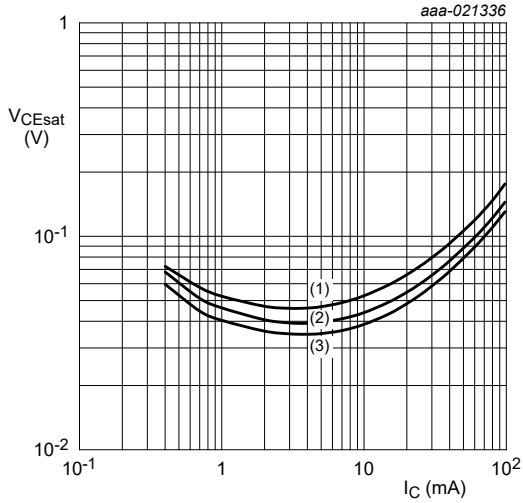


Fig. 29. PDTC124XQC-Q: Collector current as a function of collector-emitter voltage; typical values

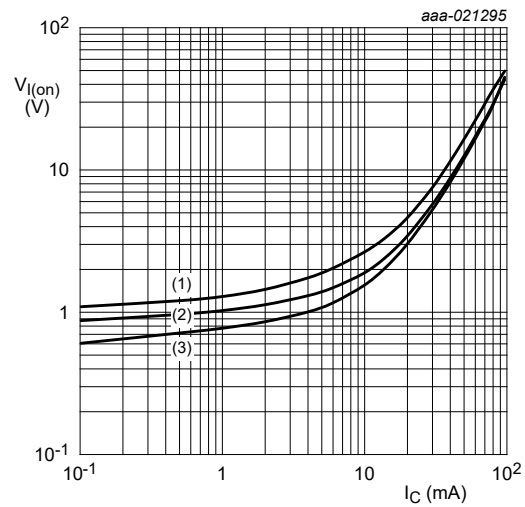
50 V, 100 mA NPN resistor-equipped transistors



$I_C/I_B = 20$

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

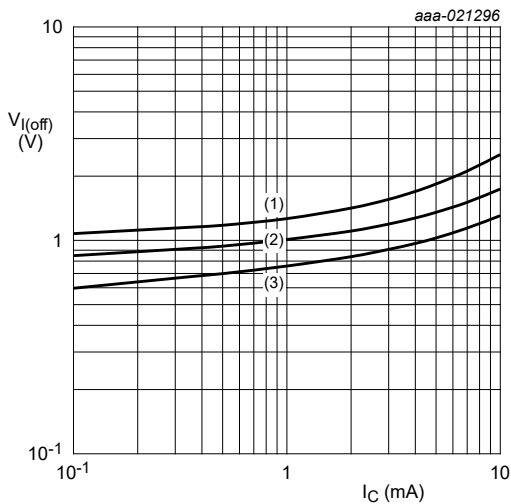
Fig. 30. PDTC124XQC-Q: Collector-emitter saturation voltage as a function of collector current; typical values



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

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

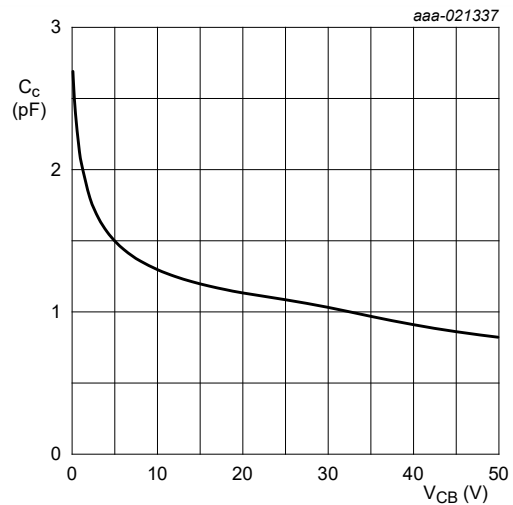
Fig. 31. PDTC124XQC-Q: On-state input voltage as a function of collector current; typical values



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

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

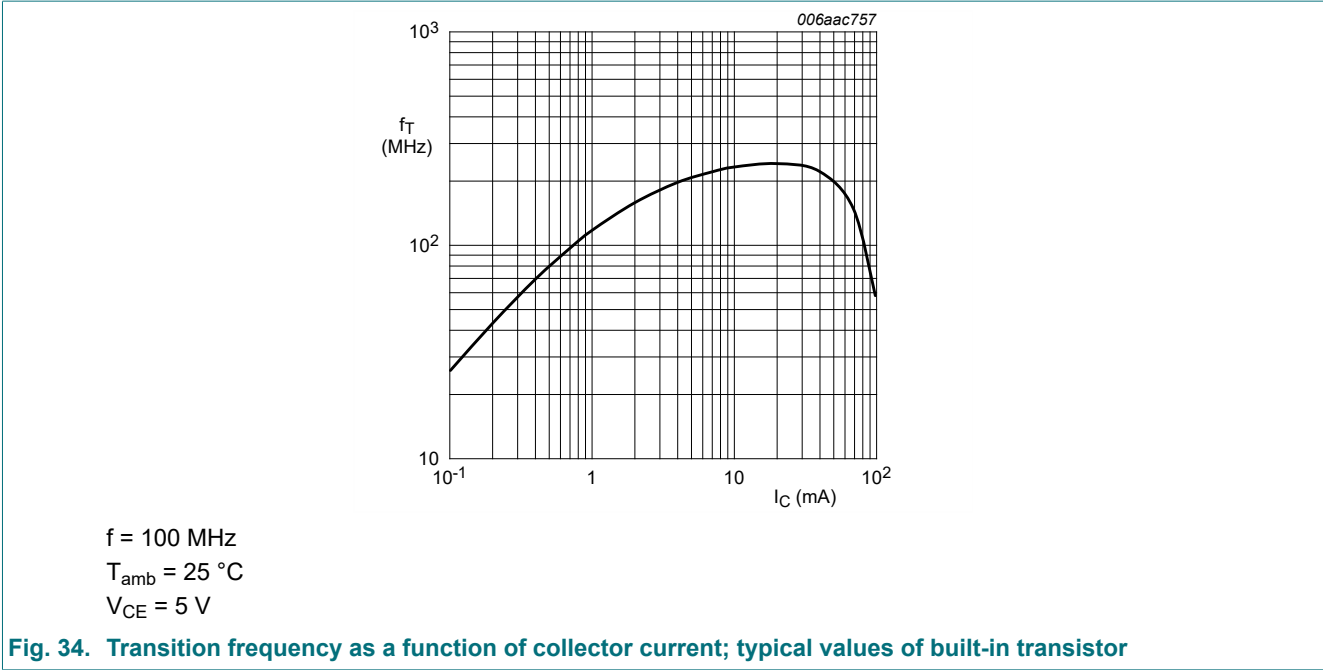
Fig. 32. PDTC124XQC-Q: Off-state input voltage as a function of collector current; typical values



$f = 1\text{ MHz}$

$T_{amb} = 25\text{ °C}$

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



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)

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

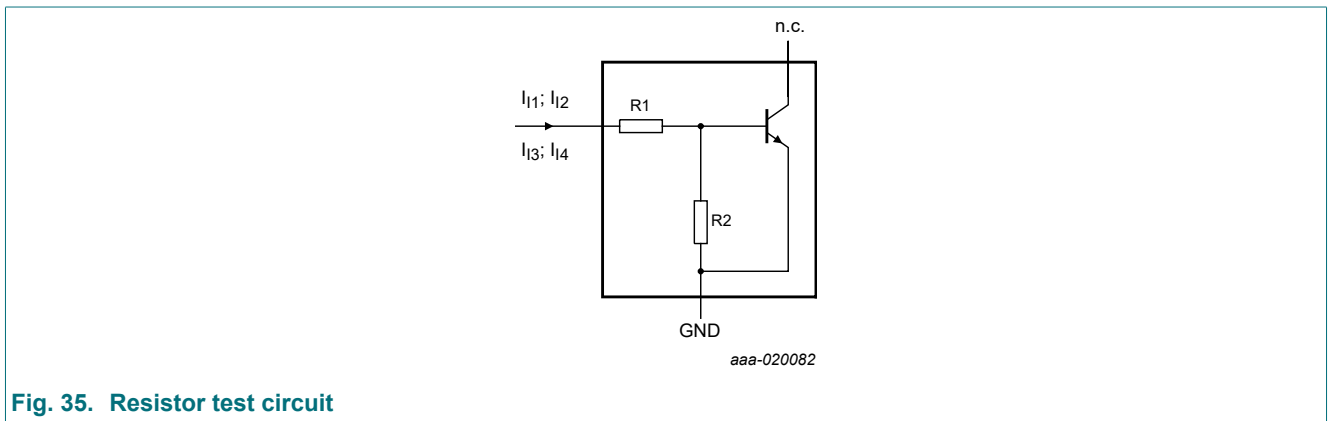


Fig. 35. Resistor test circuit

Resistor test conditions

Table 9. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I11	I12	I13	I14
PDTC143XQC-Q	4.7	10	350 μA	450 μA	-350 μA	-450 μA
PDTC123JQC-Q	2.2	47	90 μA	140 μA	-55 μA	-105 μA
PDTC143ZQC-Q	4.7	47	90 μA	140 μA	-55 μA	-105 μA
PDTC114YQC-Q	10	47	90 μA	140 μA	-55 μA	-105 μA
PDTC124XQC-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

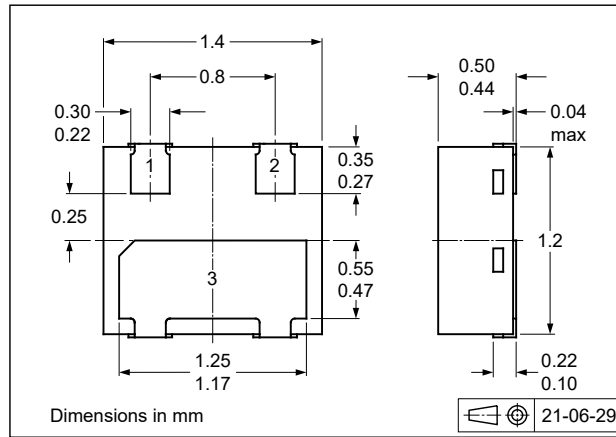


Fig. 36. Package outline DFN1412D-3 (SOT8009)

13. Soldering

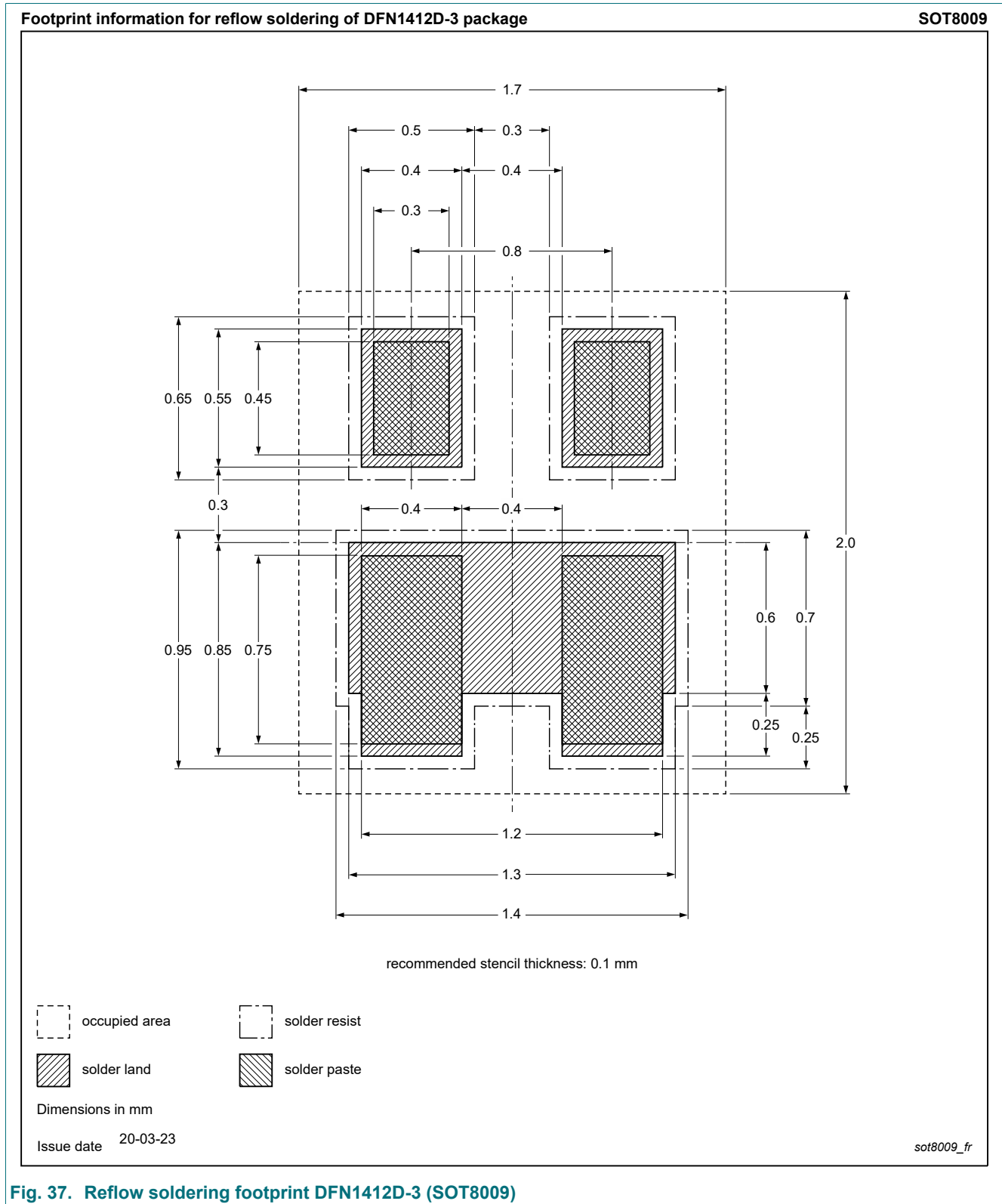


Fig. 37. Reflow soldering footprint DFN1412D-3 (SOT8009)

14. Revision history

Table 10. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PDTC143X_to_124XQC-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".
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50 V, 100 mA NPN resistor-equipped transistors

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