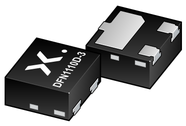


PDTC143/114/124/144EQB-Q series

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	
PDTC143EQB-Q	4.7	4.7	SOT8015	MO-340BA	PDTA143EQB-Q
PDTC114EQB-Q	10	10			PDTA114EQB-Q
PDTC124EQB-Q	22	22			PDTA124EQB-Q
PDTC144EQB-Q	47	47			PDTA144EQB-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

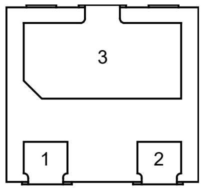
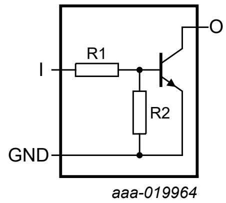
T_{amb} = 25 °C unless otherwise specified.

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
PDTC143EQB-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
PDTC114EQB-Q			
PDTC124EQB-Q			
PDTC144EQB-Q			

7. Marking

Table 5. Marking

Type number	Marking code
PDTC143EQB-Q	E6
PDTC114EQB-Q	D9
PDTC124EQB-Q	E4
PDTC144EQB-Q	E9

8. Limiting values

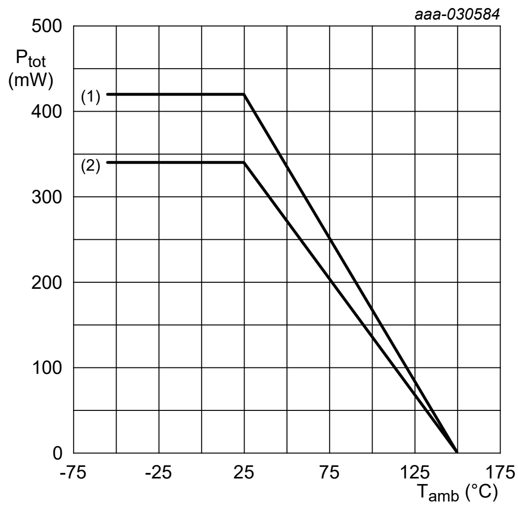
Table 6. Limiting values

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	open collector		-	10	V
V_I	input voltage					
	PDTC143EQB-Q			-10	+30	V
	PDTC114EQB-Q			-10	+40	V
	PDTC124EQB-Q			-10	+40	V
	PDTC144EQB-Q			-10	+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

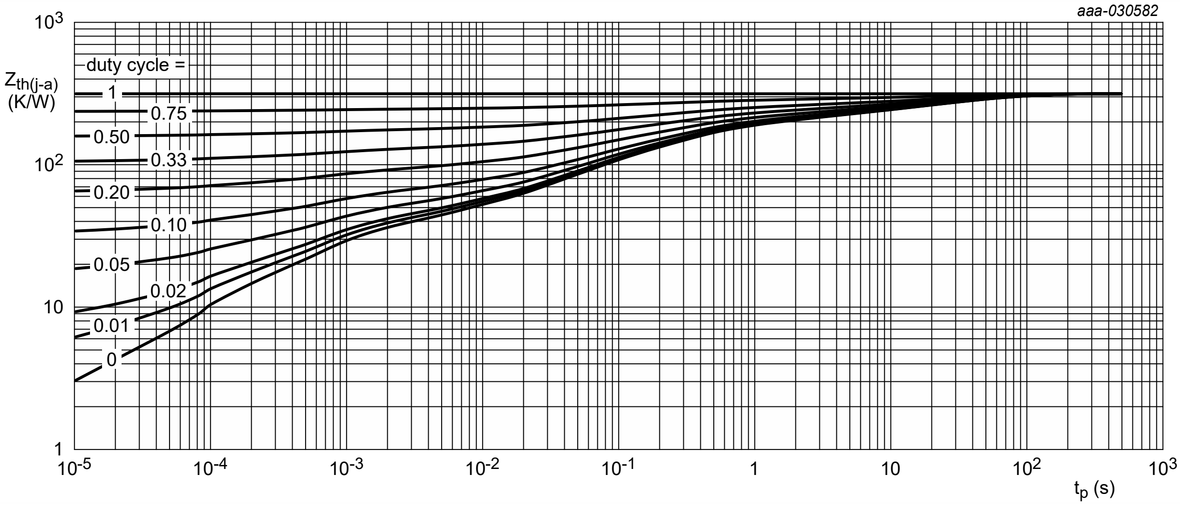
9. Thermal characteristics

Table 7. Thermal characteristics

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

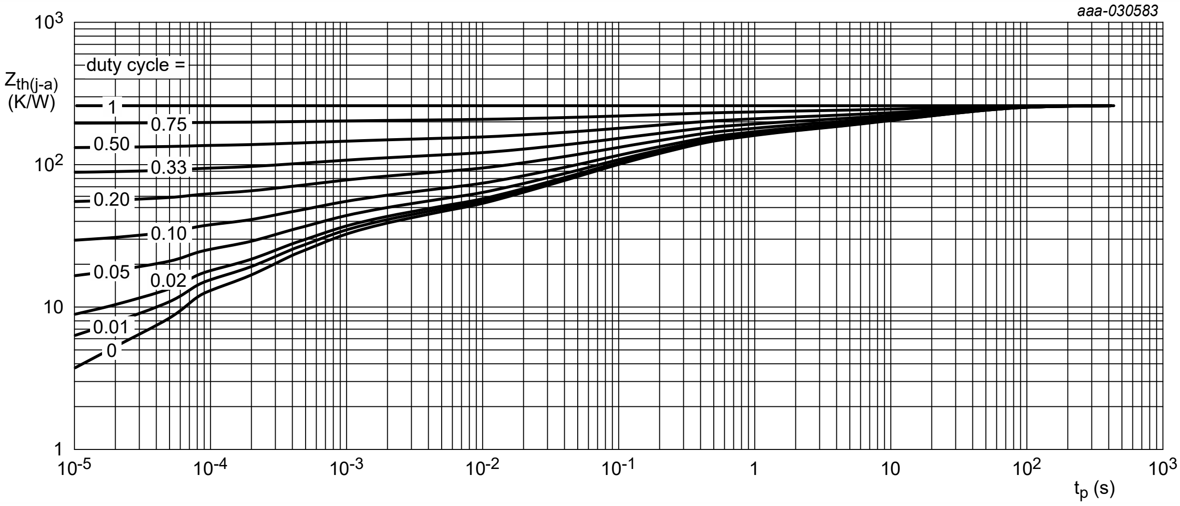
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	368	K/W
			[2]	-	-	298	K/W

[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

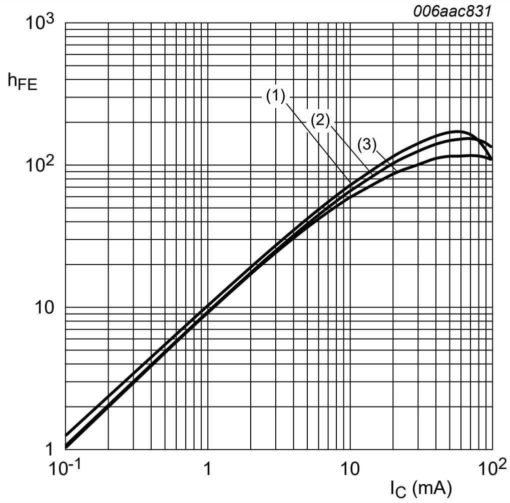
10. Characteristics

Table 8. Characteristics

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

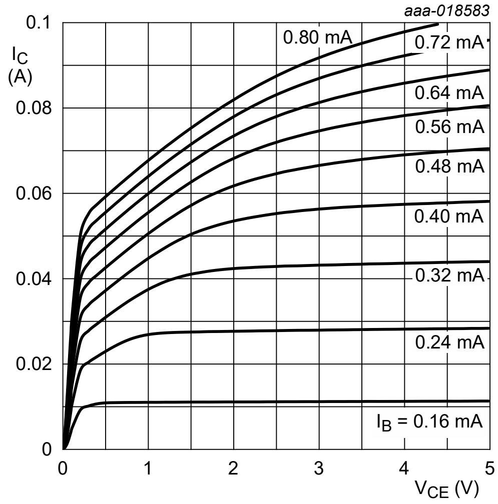
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 100 μA; I_E = 0 A		50	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 2 mA; I_B = 0 A		50	-	-	V
I_{CBO}	collector-base cut-off current	V_{CB} = 50 V; I_E = 0 A		-	-	100	nA
I_{CEO}	collector-emitter 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						
	PDTC143EQB-Q	V_{EB} = 5 V; I_C = 0 A		-	-	900	μA
	PDTC114EQB-Q			-	-	400	μA
	PDTC124EQB-Q			-	-	180	μA
	PDTC144EQB-Q					90	μA
h_{FE}	DC current gain						
	PDTC143EQB-Q	V_{CE} = 5 V; I_C = 10 mA		30	-	-	
	PDTC114EQB-Q	V_{CE} = 5 V; I_C = 5 mA		30	-	-	
	PDTC124EQB-Q			60	-	-	
	PDTC144EQB-Q			80	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA		-	-	100	mV
$V_{I(off)}$	off-state input voltage						
	PDTC143EQB-Q	V_{CE} = 5 V ; I_C = 100 μA		-	1.1	0.5	V
	PDTC114EQB-Q			-	1.1	0.8	V
	PDTC124EQB-Q			-	1.1	0.8	V
	PDTC144EQB-Q			-	1.2	0.8	V
$V_{I(on)}$	on-state input voltage						
	PDTC143EQB-Q	V_{CE} = 0.3 V ; I_C = 20 mA		2.5	1.9	-	V
	PDTC114EQB-Q	V_{CE} = 0.3 V ; I_C = 10 mA		2.5	1.8	-	V
	PDTC124EQB-Q	V_{CE} = 0.3 V ; I_C = 5 mA		2.5	1.7	-	V
	PDTC144EQB-Q	V_{CE} = 0.3 V ; I_C = 2 mA		3.0	1.6	-	V
R1	bias resistor 1 (input)						
	PDTC143EQB-Q		[1]	3.3	4.7	6.1	kΩ
	PDTC114EQB-Q			7	10	13	kΩ
	PDTC124EQB-Q			15.4	22	28.6	kΩ
	PDTC144EQB-Q			33	47	61	kΩ
R2/R1	bias resistor ratio			0.8	1	1.2	
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



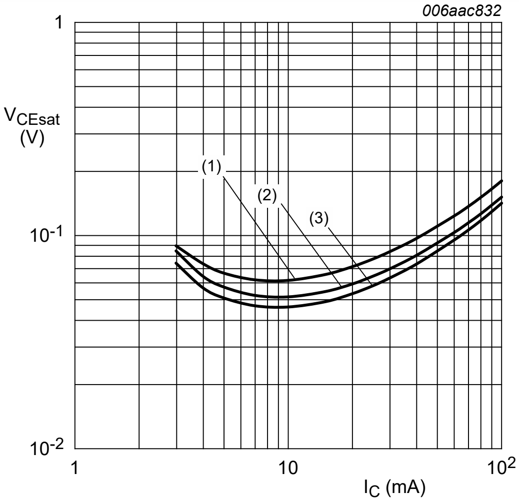
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 4. PDTC143EQB-Q: DC current gain as a function of collector current; typical values



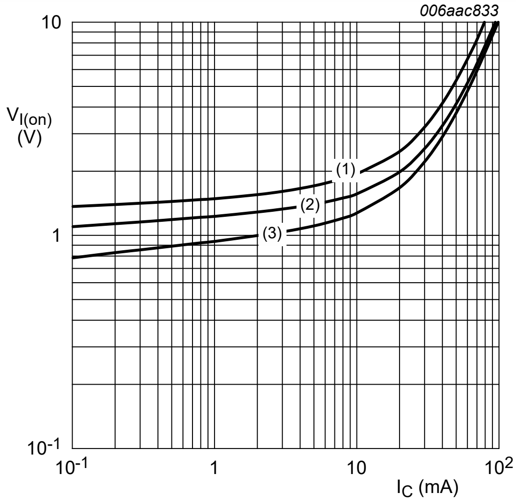
T_{amb} = 25 °C

Fig. 5. PDTC143EQB-Q: Collector current as a function of collector-emitter voltage; typical values



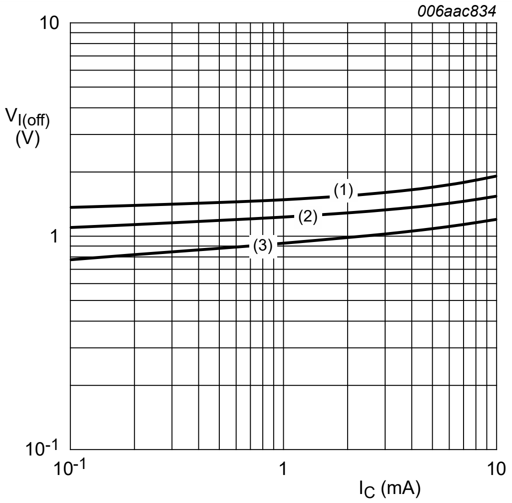
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 6. PDTC143EQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



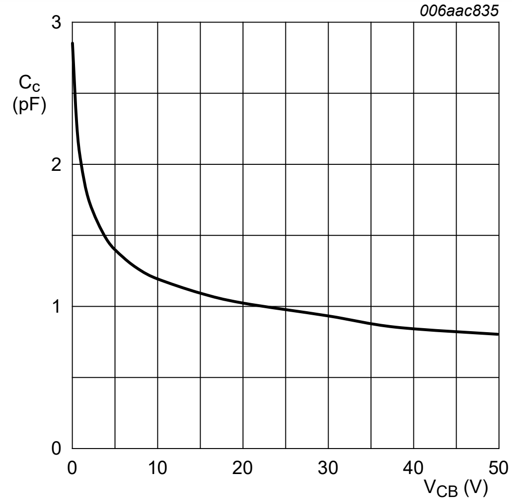
V_{CE} = 0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 7. PDTC143EQB-Q: On-state input voltage as a function of collector current; typical values



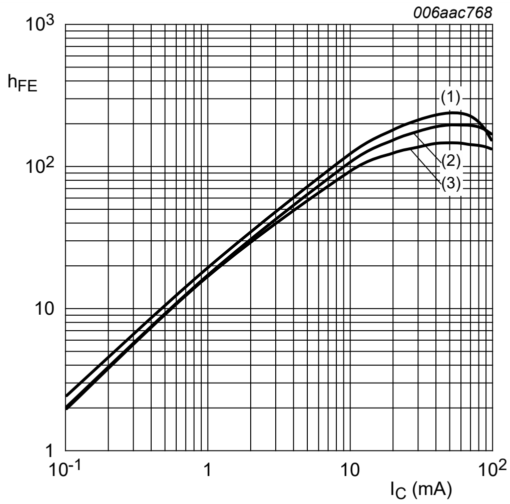
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 8. PDTC143EQB-Q: Off-state input voltage as a function of collector current; typical values



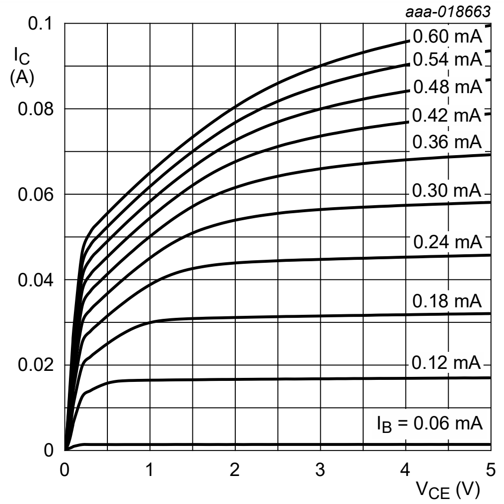
f = 1 MHz
T_{amb} = 25 °C

Fig. 9. PDTC143EQB-Q: Collector capacitance as a function of collector-base voltage; typical values



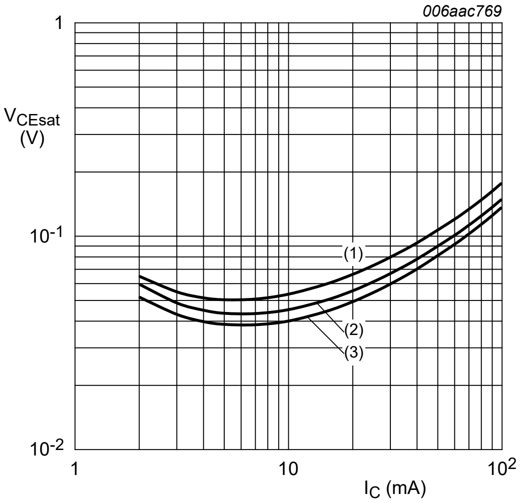
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 10. PDTC114EQB-Q: DC current gain as a function of collector current; typical values



T_{amb} = 25 °C

Fig. 11. PDTC114EQB-Q: Collector current as a function of collector-emitter voltage; typical values



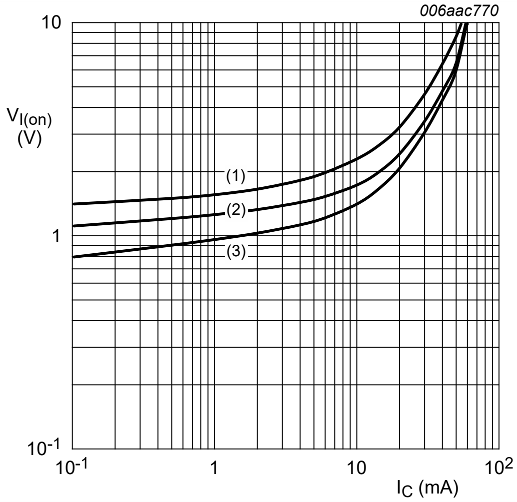
$I_C/I_B = 20$

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = -40 °C

Fig. 12. PDTC114EQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



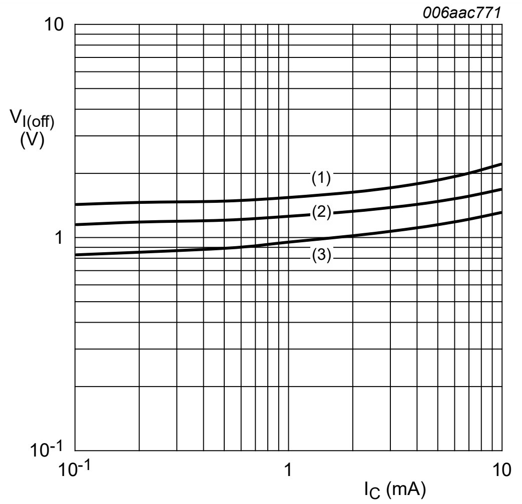
V_{CE} = 0.3 V

(1) T_{amb} = -40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

Fig. 13. PDTC114EQB-Q: On-state input voltage as a function of collector current; typical values



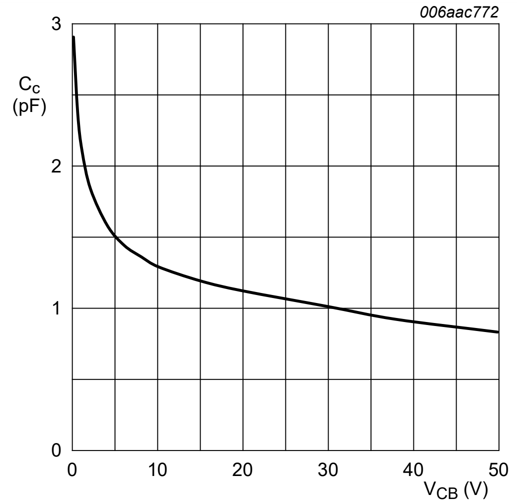
V_{CE} = 5 V

(1) T_{amb} = -40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

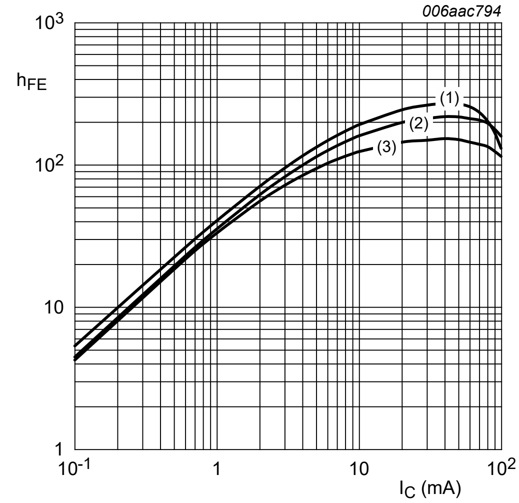
Fig. 14. PDTC114EQB-Q: Off-state input voltage as a function of collector current; typical values



f = 1 MHz

T_{amb} = 25 °C

Fig. 15. PDTC114EQB-Q: Collector capacitance as a function of collector-base voltage; typical values



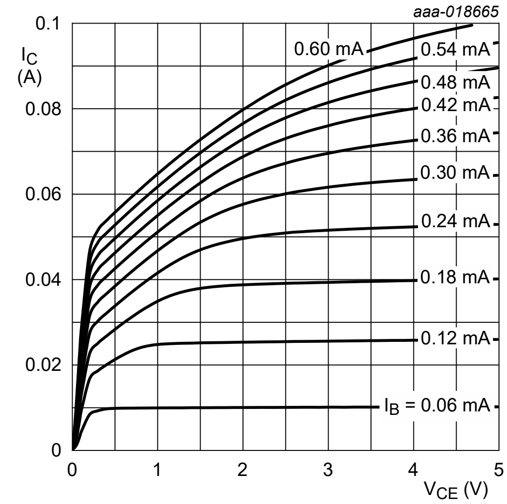
V_{CE} = 5 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

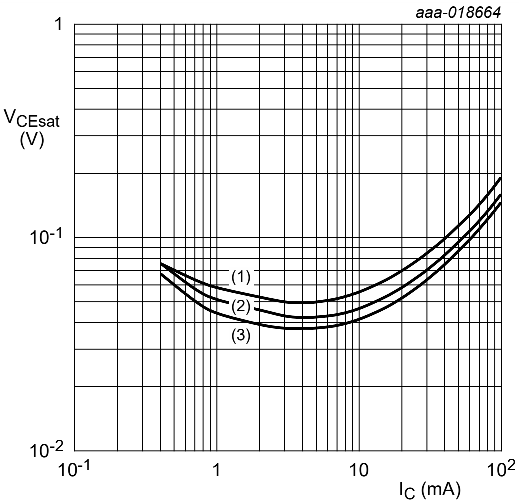
(3) T_{amb} = -40 °C

Fig. 16. PDTC124EQB-Q: DC current gain as a function of collector current; typical values



T_{amb} = 25 °C

Fig. 17. PDTC124EQB-Q: Collector current as a function of collector-emitter voltage; typical values



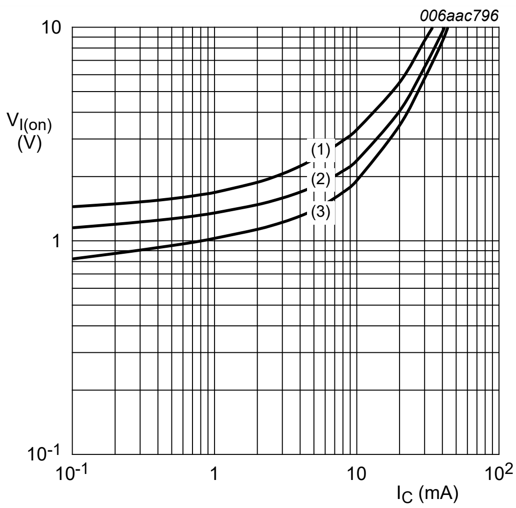
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = -40 °C

Fig. 18. PDTC124EQB-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. PDTC124EQB-Q: On-state input voltage as a function of collector current; typical values

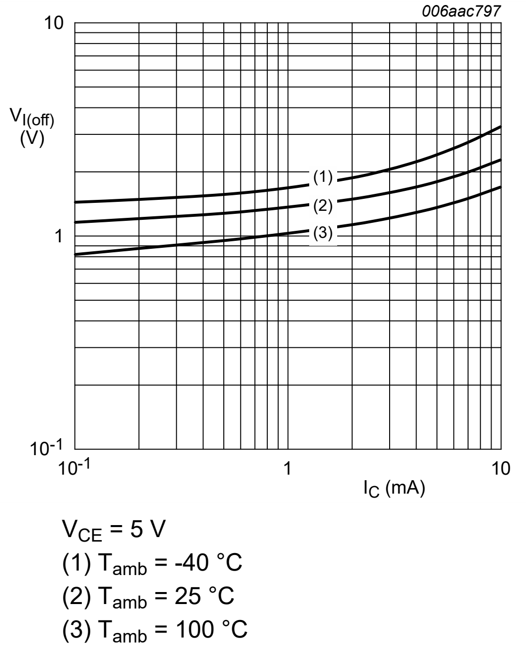


Fig. 20. PDTC124EQB-Q: Off-state input voltage as a function of collector current; typical values

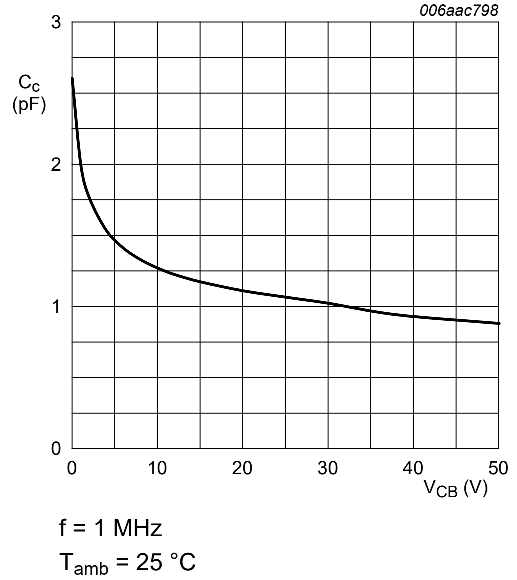


Fig. 21. PDTC124EQB-Q: Collector capacitance as a function of collector-base voltage; typical values

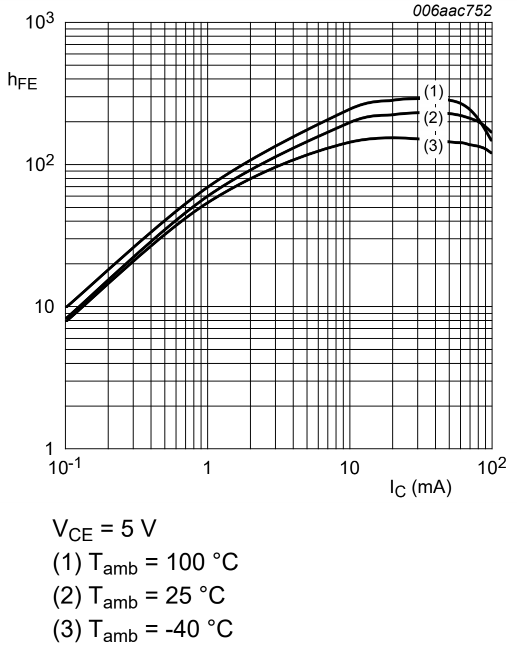


Fig. 22. PDTC144EQB-Q: DC current gain as a function of collector current; typical values

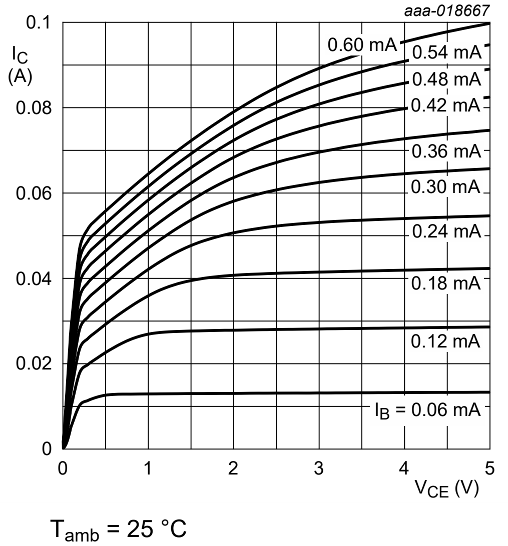
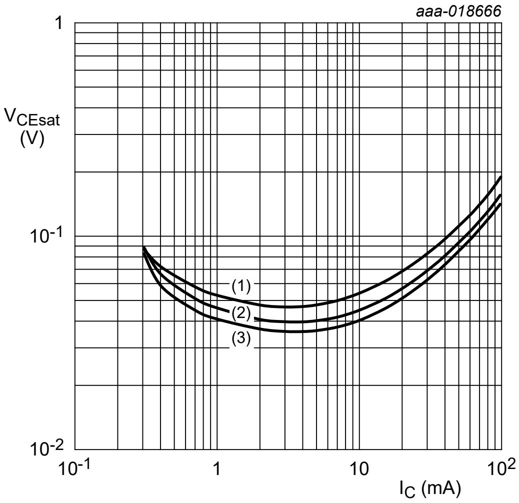
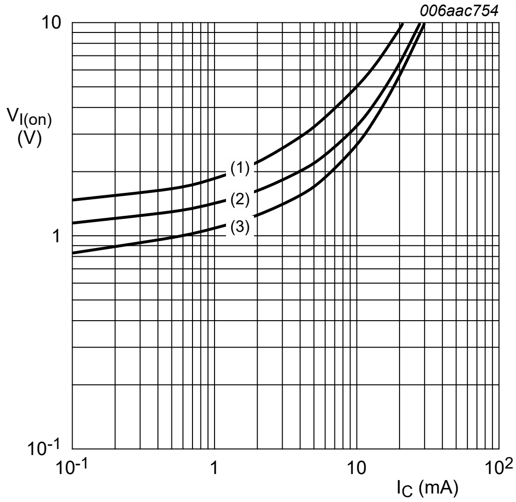


Fig. 23. PDTC144EQB-Q: Collector current as a function of collector-emitter voltage; typical values



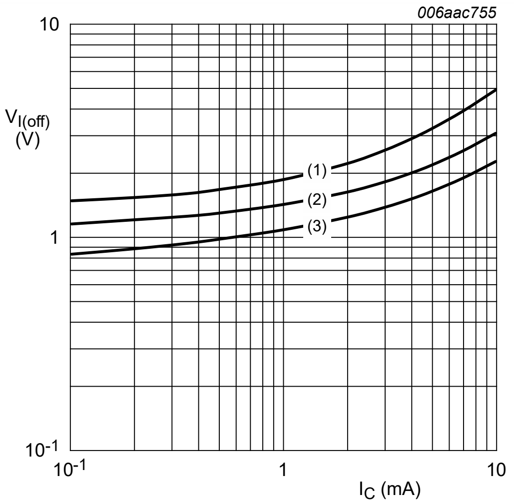
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 24. PDTC144EQB-Q: Collector-emitter saturation voltage as a function of collector current; typical values



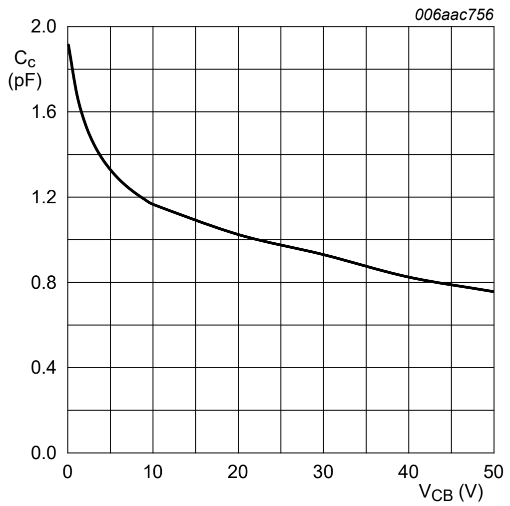
V_{CE} = 0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 25. PDTC144EQB-Q: On-state input voltage as a function of collector current; typical values



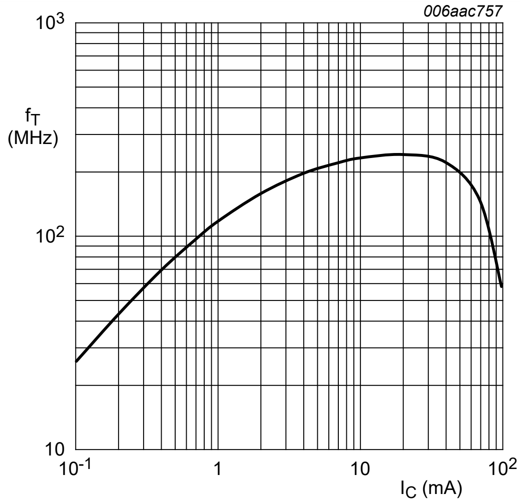
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 26. PDTC144EQB-Q: Off-state input voltage as a function of collector current; typical values



f = 1 MHz
T_{amb} = 25 °C

Fig. 27. PDTC144EQB-Q: Collector capacitance as a function of collector-base voltage; typical values



f = 100 MHz
T_{amb} = 25 °C
V_{CE} = 5 V

Fig. 28. Transition frequency as a function of collector current; typical values

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)

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

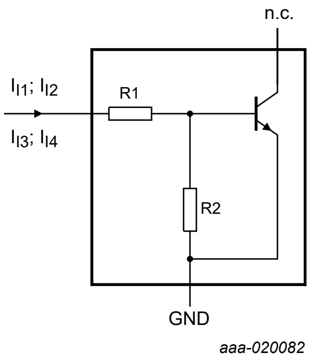


Fig. 29. Resistor test circuit

Resistor test conditions

Table 9. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I_{I1}	I_{I2}	I_{I3}	I_{I4}
PDTC143EQB-Q	4.7	4.7	600 µA	700 µA	-600 µA	-700 µA
PDTC114EQB-Q	10	10	350 µA	450 µA	-350 µA	-450 µA
PDTC124EQB-Q	22	22	150 µA	230 µA	-150 µA	-230 µA
PDTC144EQB-Q	47	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

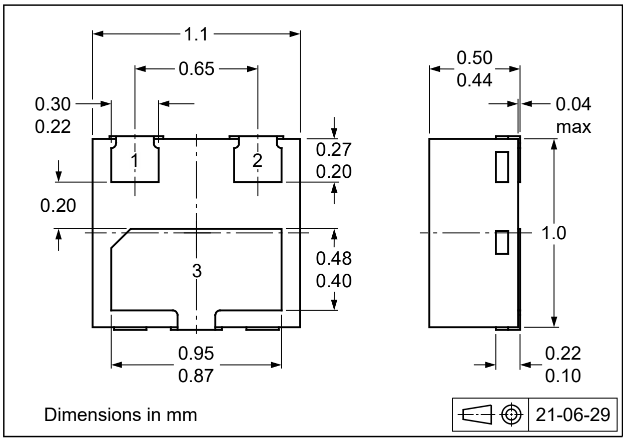


Fig. 30. Package outline DFN1110D-3 (SOT8015)

13. Soldering

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

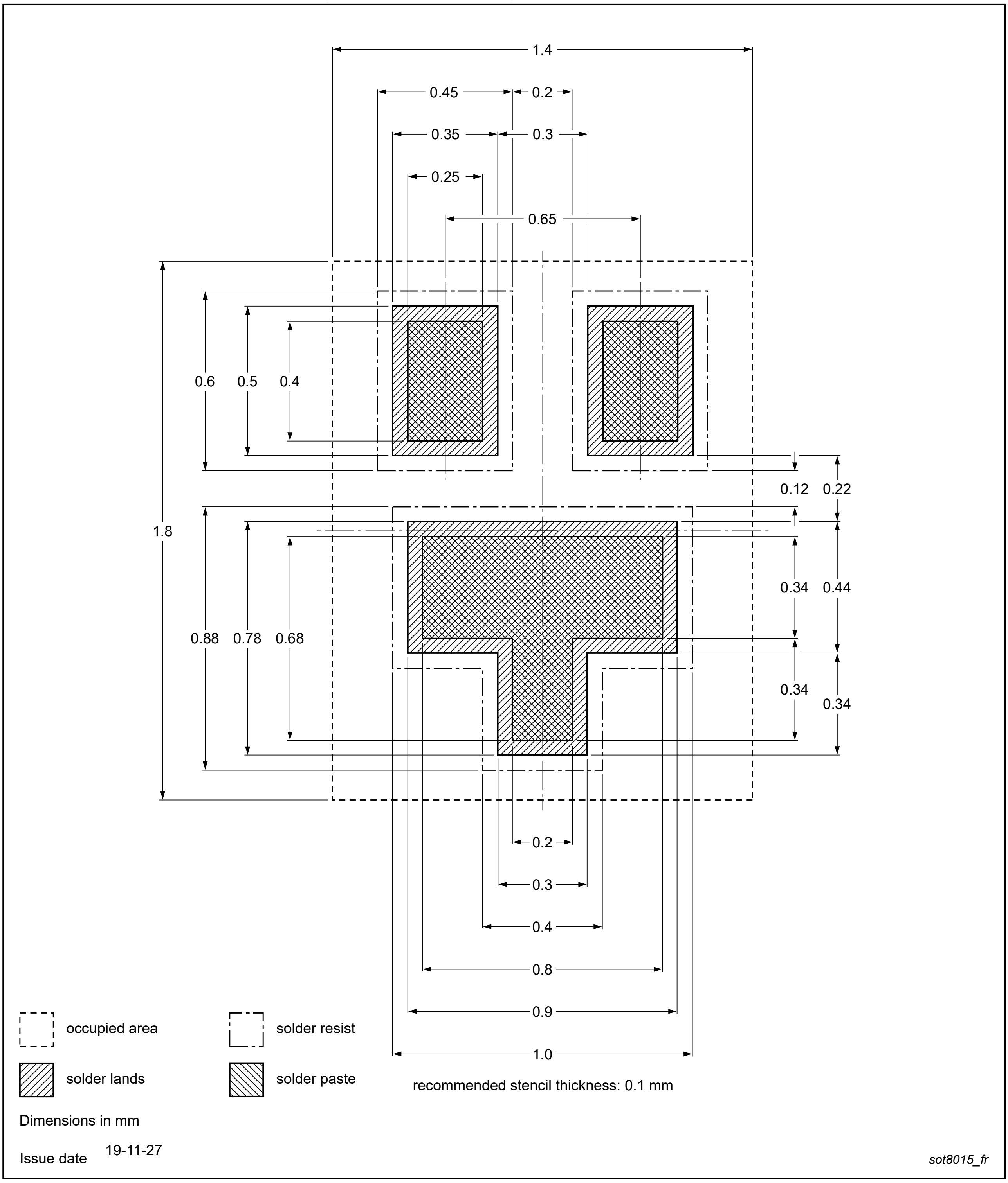


Fig. 31. Reflow soldering footprint DFN1110D-3 (SOT8015)

14. Revision history

Table 10. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PDTC143_114_124_144EQB-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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