



**THE DATASHEET OF  
PDTC143ET,215**



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Kind regards,

Team Nexperia

# PDTC143E series

NPN resistor-equipped transistors;  
R1 = 4.7 k $\Omega$ , R2 = 4.7 k $\Omega$

Rev. 10 — 8 December 2011

Product data sheet

## 1. Product profile

### 1.1 General description

NPN Resistor-Equipped Transistor (RET) family in Surface-Mounted Device (SMD) plastic packages.

Table 1. Product overview

Type number	Package			PNP complement	Package configuration
	NXP	JEITA	JEDEC		
PDTC143EE	SOT416	SC-75	-	PDTA143EE	ultra small
PDTC143EM	SOT883	SC-101	-	PDTA143EM	leadless ultra small
PDTC143ET	SOT23	-	TO-236AB	PDTA143ET	small
PDTC143EU	SOT323	SC-70	-	PDTA143EU	very small

### 1.2 Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- AEC-Q101 qualified

### 1.3 Applications

- Digital applications in automotive and industrial segments
- Control of IC inputs
- Cost-saving alternative for BC847/857 series in digital applications
- Switching loads

### 1.4 Quick reference data

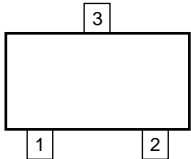
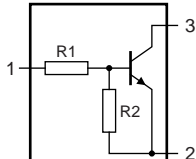
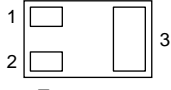
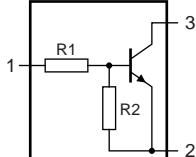
Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	50	V
I <sub>O</sub>	output current		-	-	100	mA
R1	bias resistor 1 (input)		3.3	4.7	6.1	k $\Omega$
R2/R1	bias resistor ratio		0.8	1	1.2	



## 2. Pinning information

**Table 3. Pinning**

Pin	Description	Simplified outline	Graphic symbol
<b>SOT23; SOT323; SOT416</b>			
1	input (base)	 <p>006aaa144</p>	 <p>sym007</p>
2	GND (emitter)		
3	output (collector)		
<b>SOT883</b>			
1	input (base)	 <p>Transparent top view</p>	 <p>sym007</p>
2	GND (emitter)		
3	output (collector)		

## 3. Ordering information

**Table 4. Ordering information**

Type number	Package		
	Name	Description	Version
PDTC143EE	SC-75	plastic surface-mounted package; 3 leads	SOT416
PDTC143EM	SC-101	leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm	SOT883
PDTC143ET	-	plastic surface-mounted package; 3 leads	SOT23
PDTC143EU	SC-70	plastic surface-mounted package; 3 leads	SOT323

## 4. Marking

**Table 5. Marking codes**

Type number	Marking code <sup>[1]</sup>
PDTC143EE	02
PDTC143EM	E1
PDTC143ET	*02
PDTC143EU	*02

[1] \* = placeholder for manufacturing site code

## 5. Limiting values

**Table 6. Limiting values**

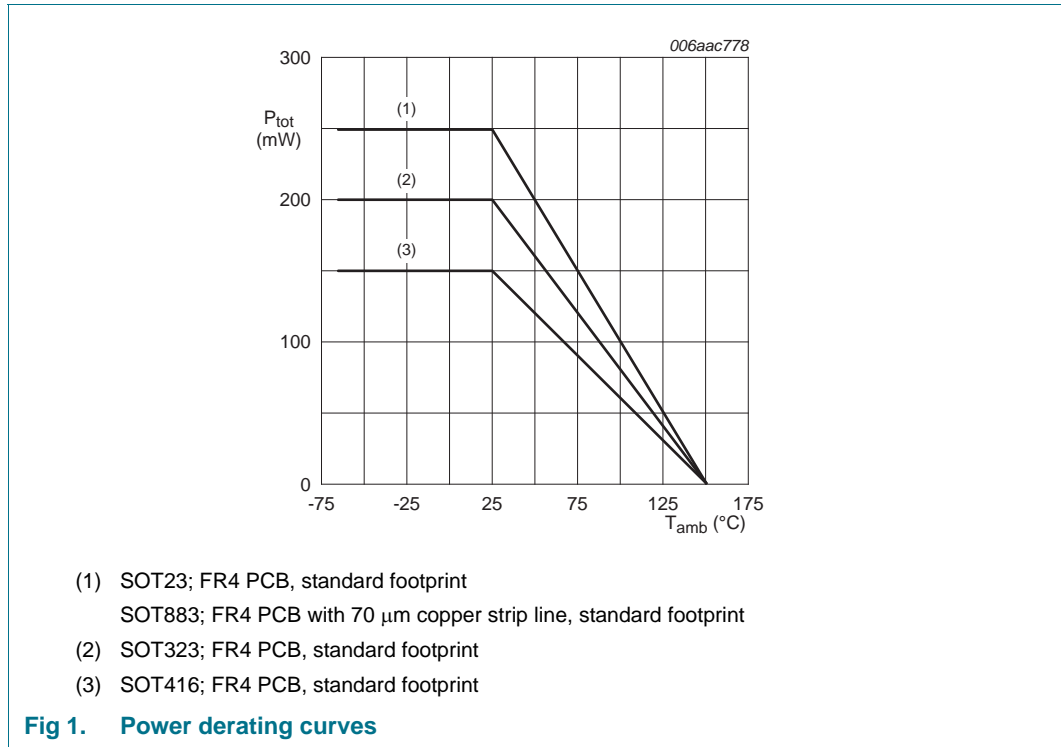
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit	
V <sub>CBO</sub>	collector-base voltage	open emitter	-	50	V	
V <sub>CEO</sub>	collector-emitter voltage	open base	-	50	V	
V <sub>EBO</sub>	emitter-base voltage	open collector	-	10	V	
V <sub>I</sub>	input voltage					
	positive		-	+30	V	
	negative		-	-10	V	
I <sub>O</sub>	output current		-	100	mA	
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms	-	100	mA	
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C				
	PDTC143EE (SOT416)		[1][2]	-	150	mW
	PDTC143EM (SOT883)		[2][3]	-	250	mW
	PDTC143ET (SOT23)		[1]	-	250	mW
	PDTC143EU (SOT323)		[1]	-	200	mW
T <sub>j</sub>	junction temperature		-	150	°C	
T <sub>amb</sub>	ambient temperature		-65	+150	°C	
T <sub>stg</sub>	storage temperature		-65	+150	°C	

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[2] Reflow soldering is the only recommended soldering method.

[3] Device mounted on an FR4 PCB with 70  $\mu$ m copper strip line, standard footprint.



## 6. Thermal characteristics

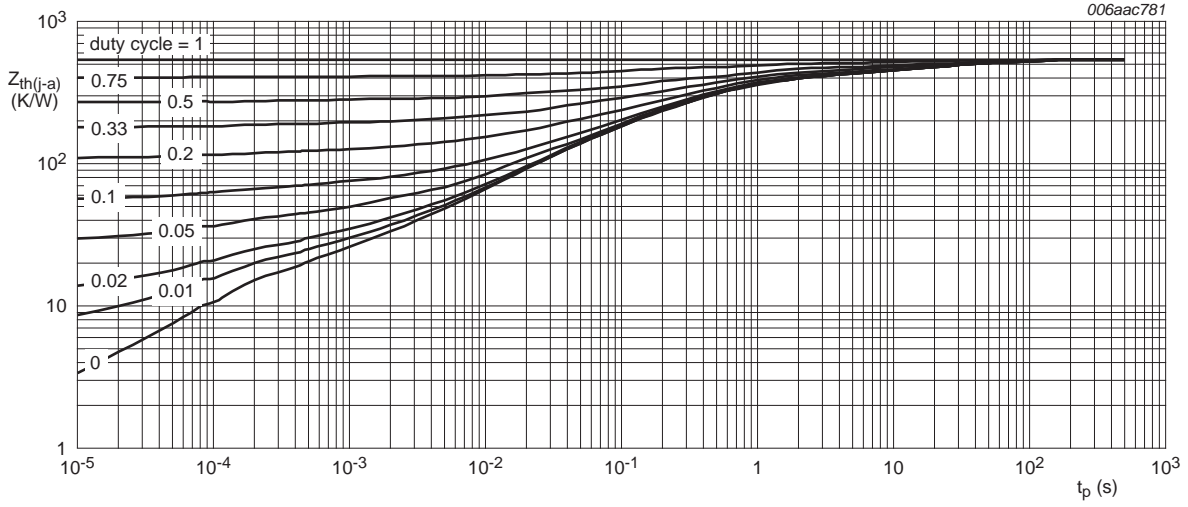
**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air				
	PDTC143EE (SOT416)	[1][2]	-	-	830	K/W
	PDTC143EM (SOT883)	[2][3]	-	-	500	K/W
	PDTC143ET (SOT23)	[1]	-	-	500	K/W
	PDTC143EU (SOT323)	[1]	-	-	625	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

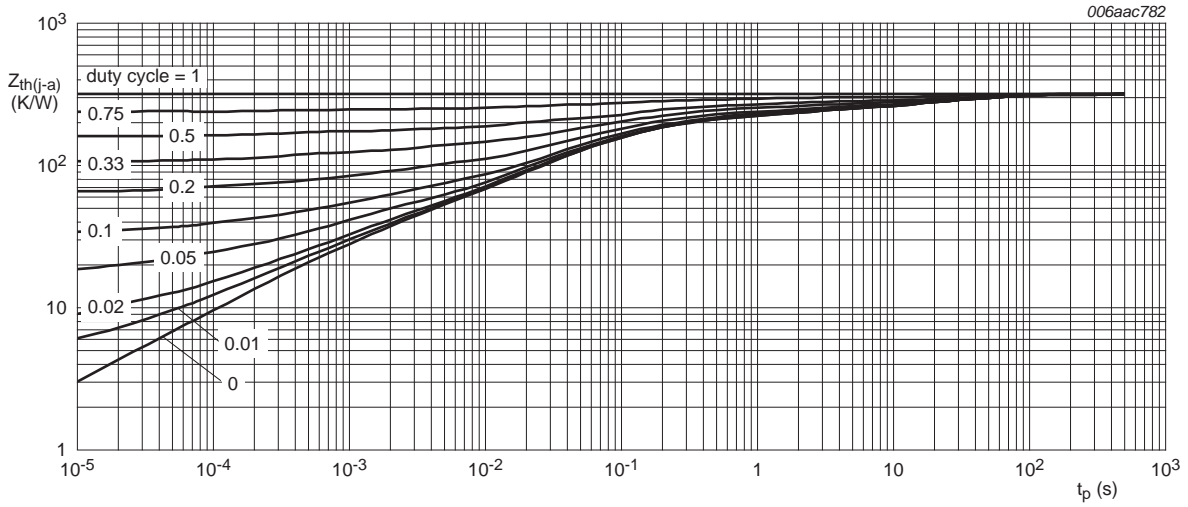
[2] Reflow soldering is the only recommended soldering method.

[3] Device mounted on an FR4 PCB with 70 μm copper strip line, standard footprint.



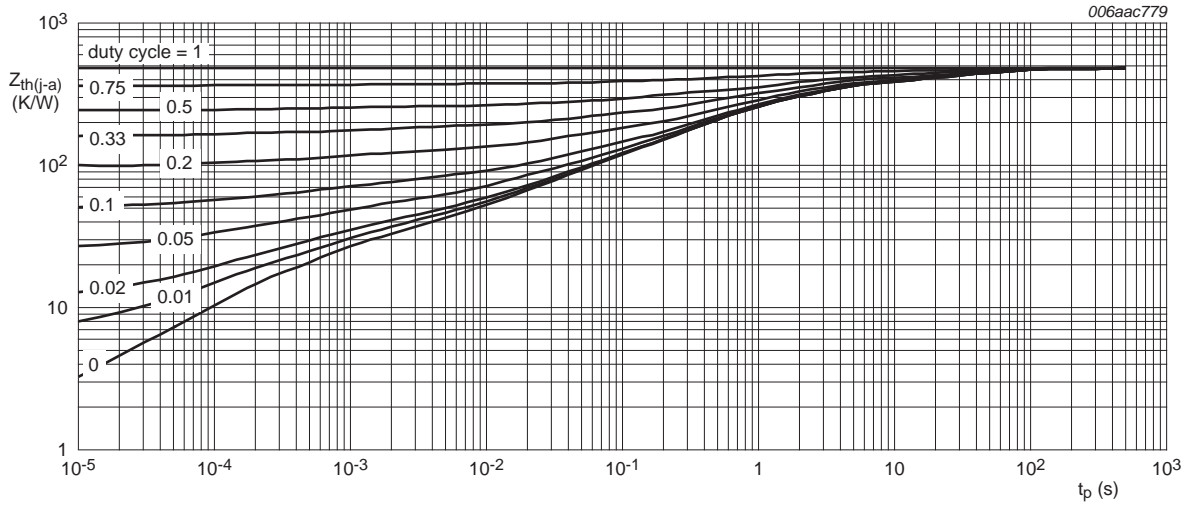
FR4 PCB, standard footprint

**Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC143EE (SOT416); typical values**



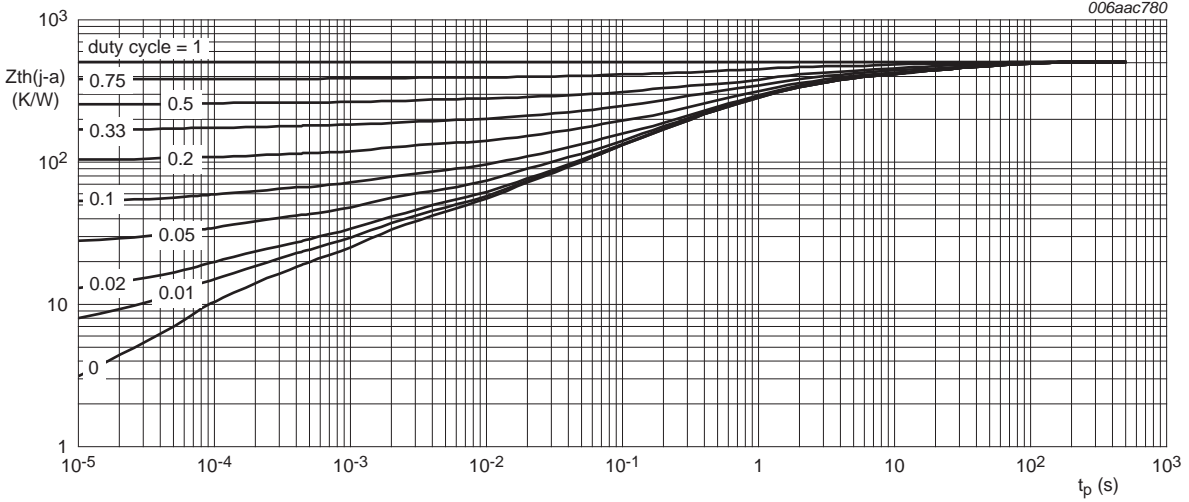
FR4 PCB, 70 μm copper strip line

**Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC143EM (SOT883); typical values**



FR4 PCB, standard footprint

Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC143ET (SOT23); typical values



FR4 PCB, standard footprint

Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC143EU (SOT323); typical values

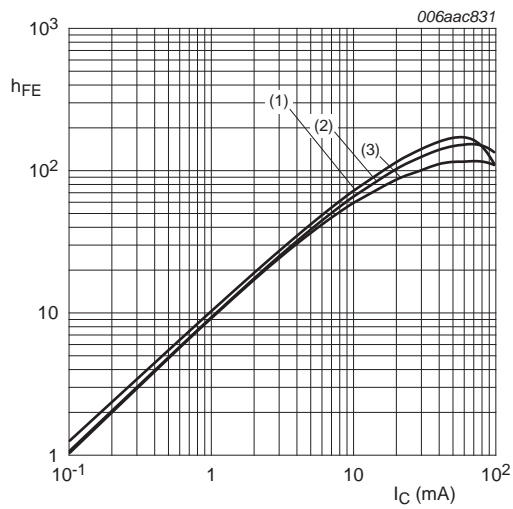
## 7. Characteristics

**Table 8. Characteristics**

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

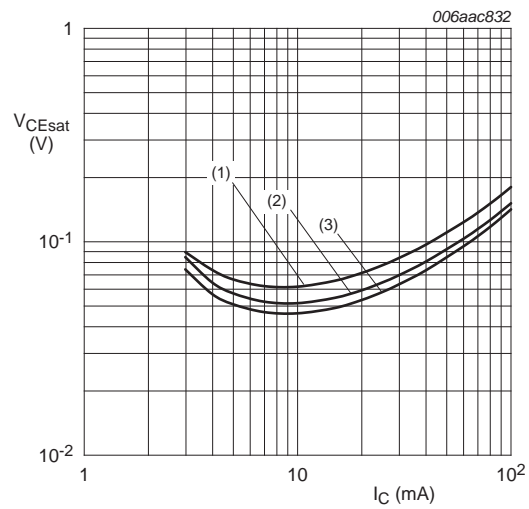
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; I_B = 0\text{ A}$	-	-	1	μA
		$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ °C}$	-	-	5	μA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	900	μA
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}$	30	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$	-	-	150	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}; I_C = 100\text{ μA}$	-	1.1	0.5	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}; I_C = 20\text{ mA}$	2.5	1.9	-	V
R1	bias resistor 1 (input)		3.3	4.7	6.1	kΩ
R2/R1	bias resistor ratio		0.8	1	1.2	
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	-	2.5	pF
$f_T$	transition frequency	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$	[1]	-	230	MHz

[1] Characteristics of built-in transistor



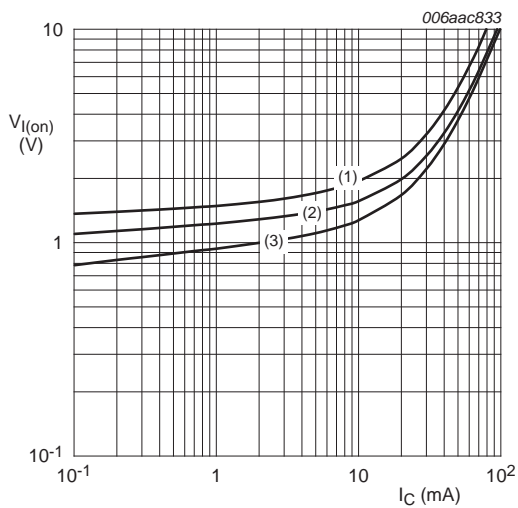
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 6. DC current gain as a function of collector current; typical values**



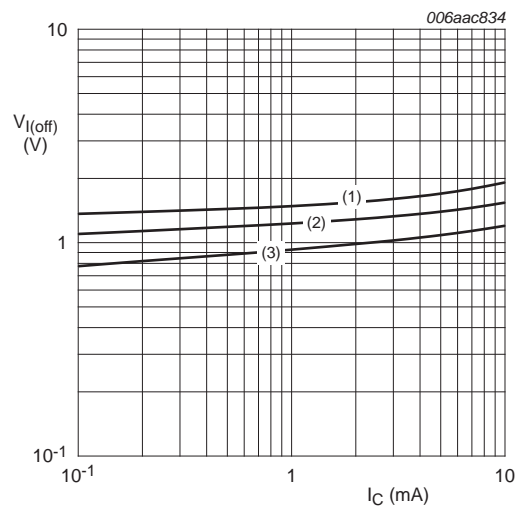
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 7. Collector-emitter saturation voltage as a function of collector current; typical values**



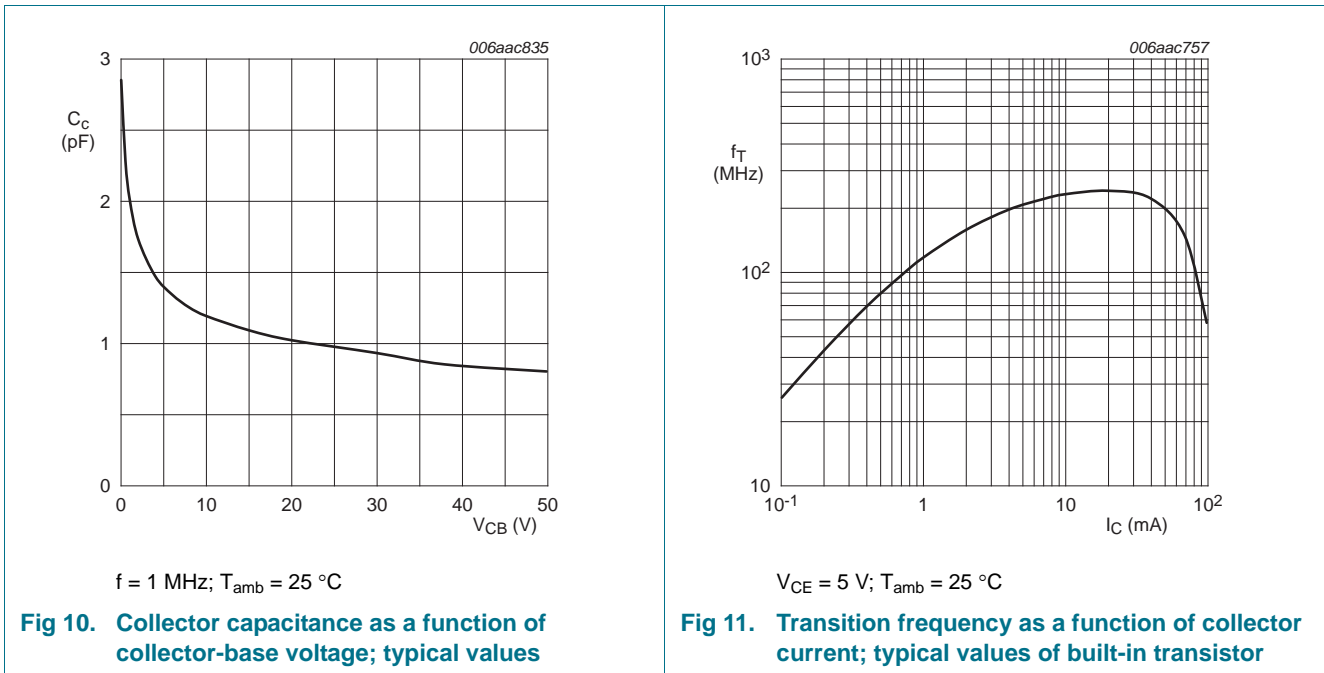
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 8. 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 9. Off-state input voltage as a function of collector current; typical values**



**Fig 10. Collector capacitance as a function of collector-base voltage; typical values**

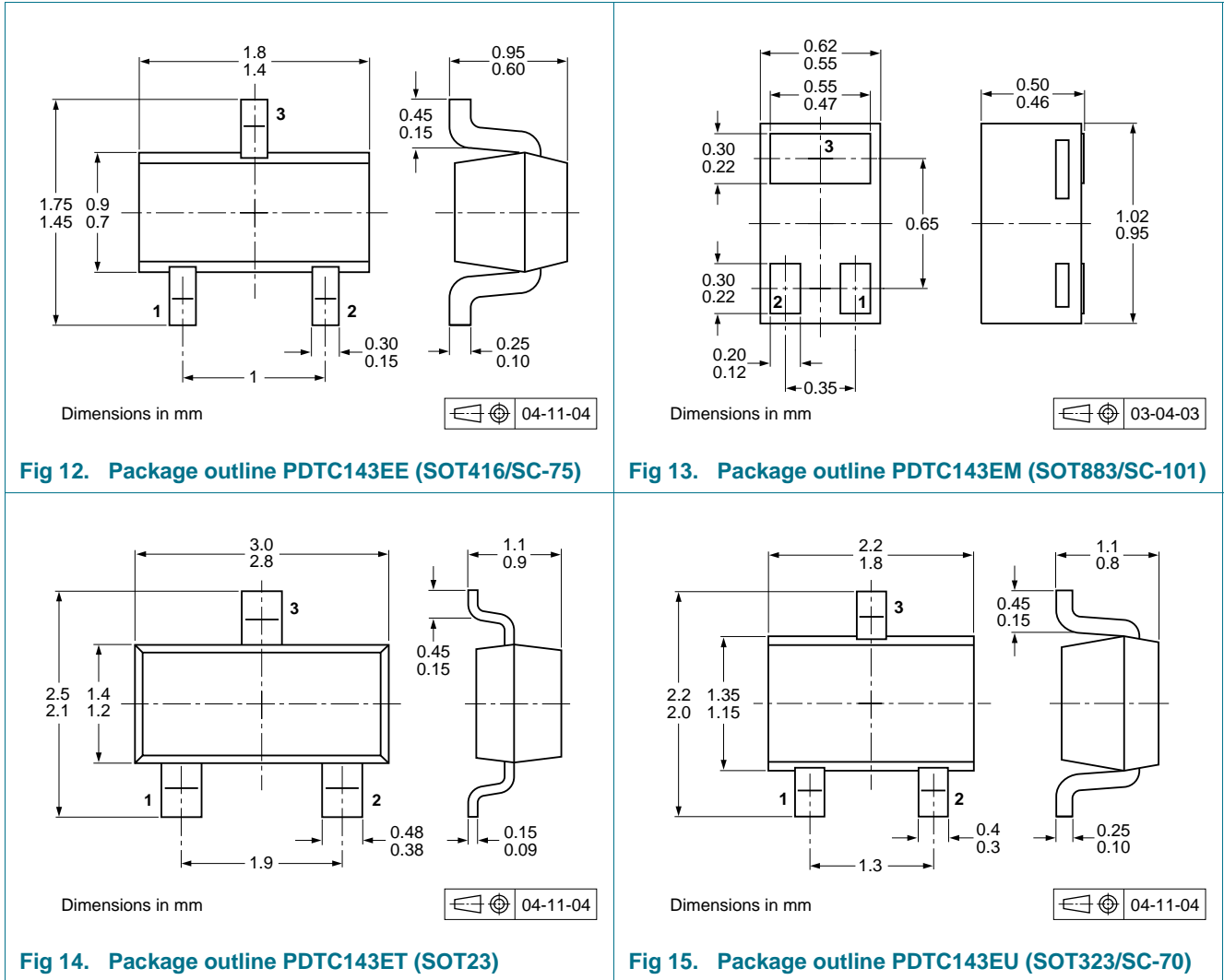
**Fig 11. Transition frequency as a function of collector current; typical values of built-in transistor**

## 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.

**9. Package outline**



**10. Packing information**

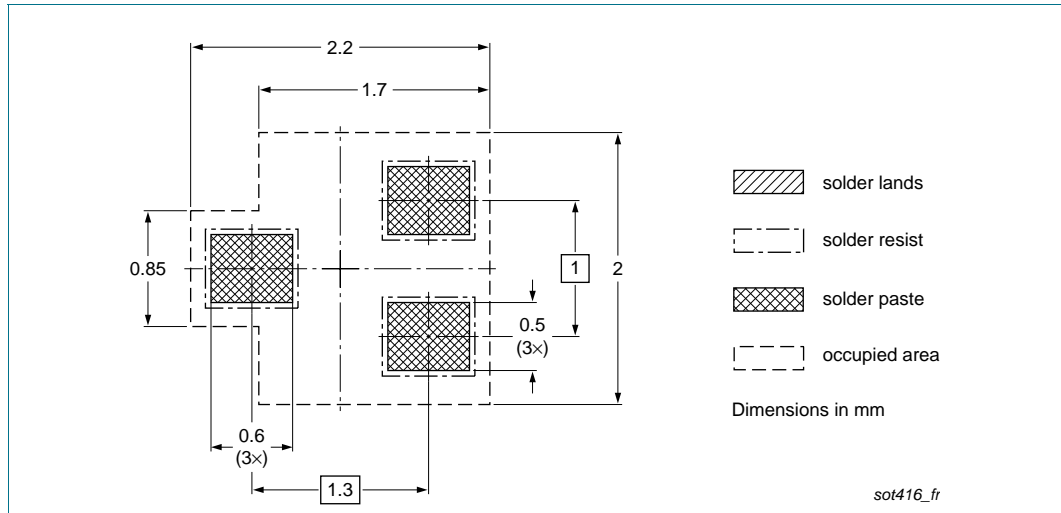
**Table 9. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

Type number	Package	Description	Packing quantity		
			3000	5000	10000
PDTC143EE	SOT416	4 mm pitch, 8 mm tape and reel	-115	-	-135
PDTC143EM	SOT883	2 mm pitch, 8 mm tape and reel	-	-	-315
PDTC143ET	SOT23	4 mm pitch, 8 mm tape and reel	-215	-	-235
PDTC143EU	SOT323	4 mm pitch, 8 mm tape and reel	-115	-	-135

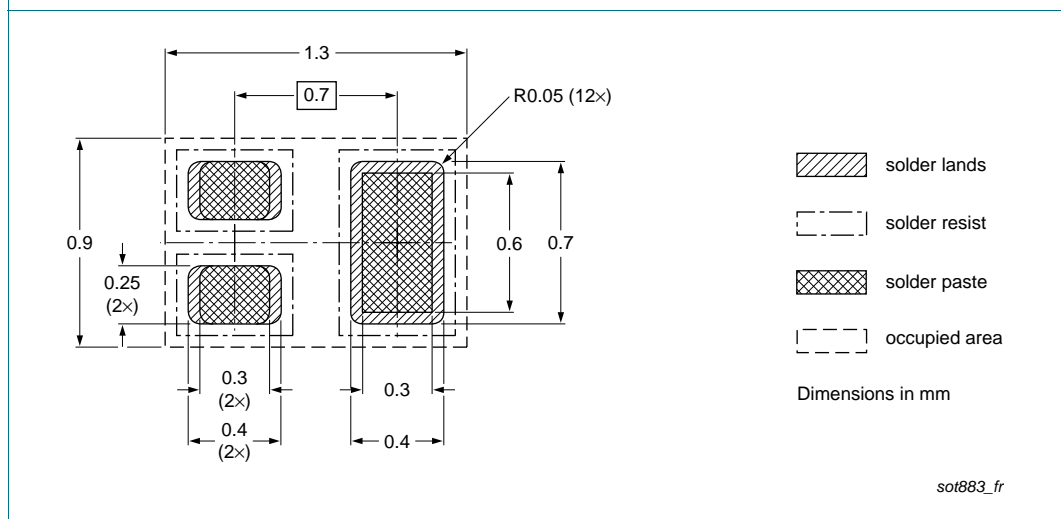
[1] For further information and the availability of packing methods, see [Section 14](#).

**11. Soldering**



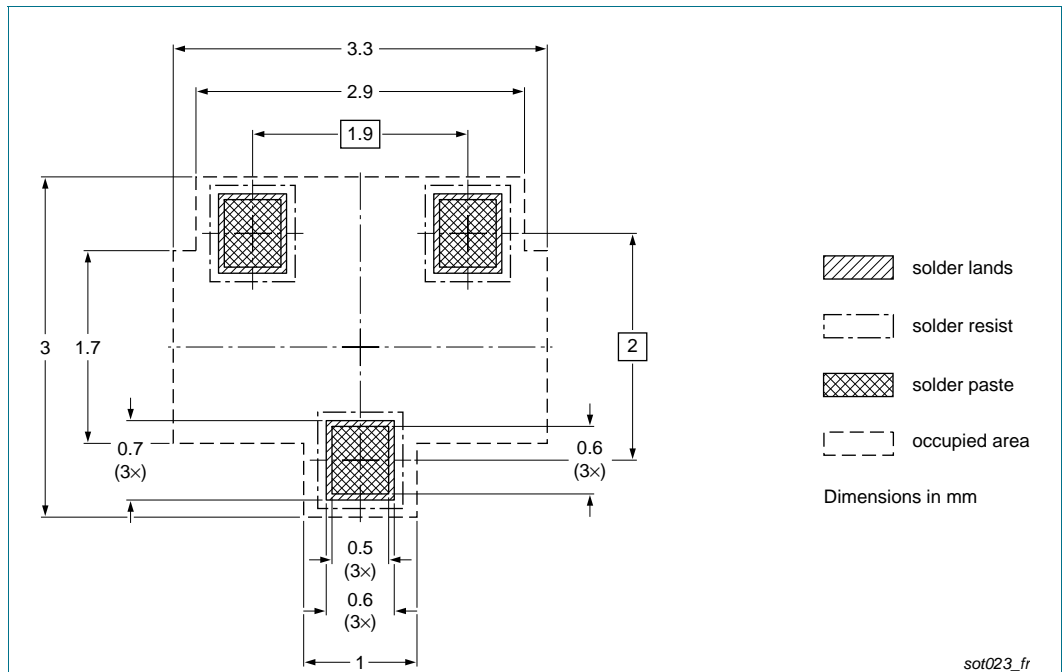
Reflow soldering is the only recommended soldering method.

**Fig 16. Reflow soldering footprint PDTC143EE (SOT416/SC-75)**

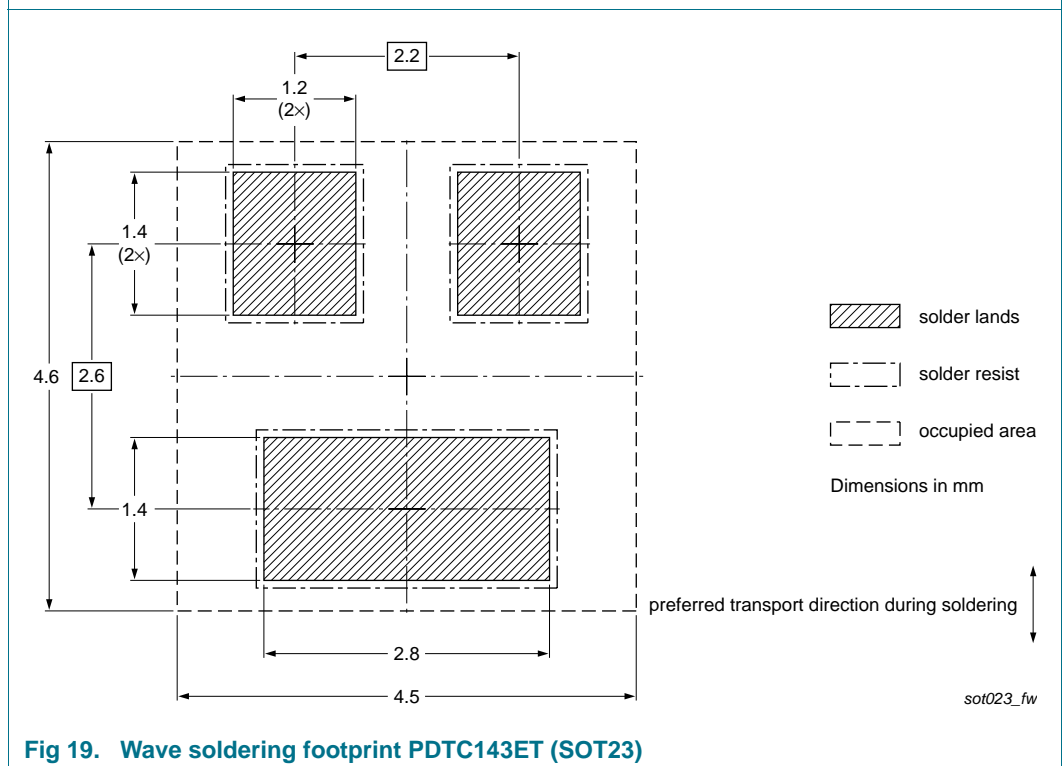


Reflow soldering is the only recommended soldering method.

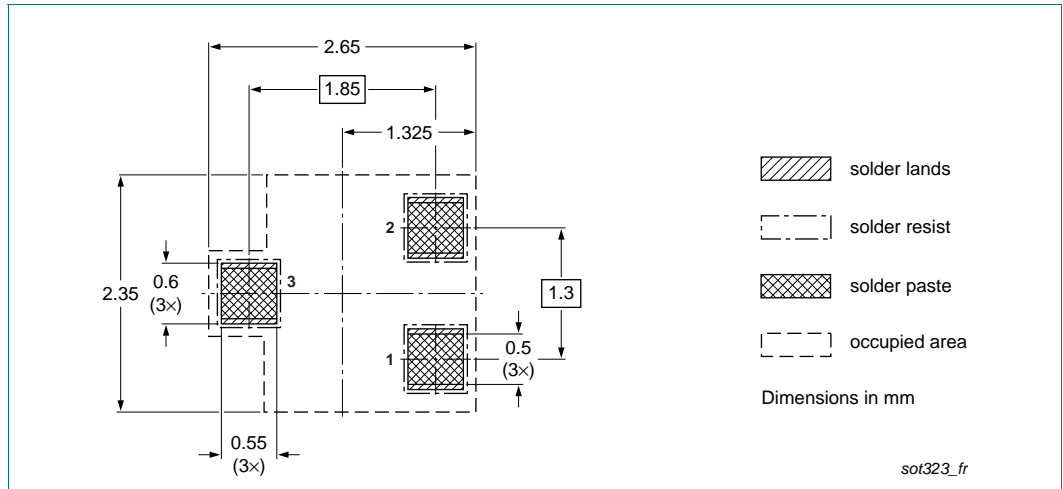
**Fig 17. Reflow soldering footprint PDTC143EM (SOT883/SC-101)**



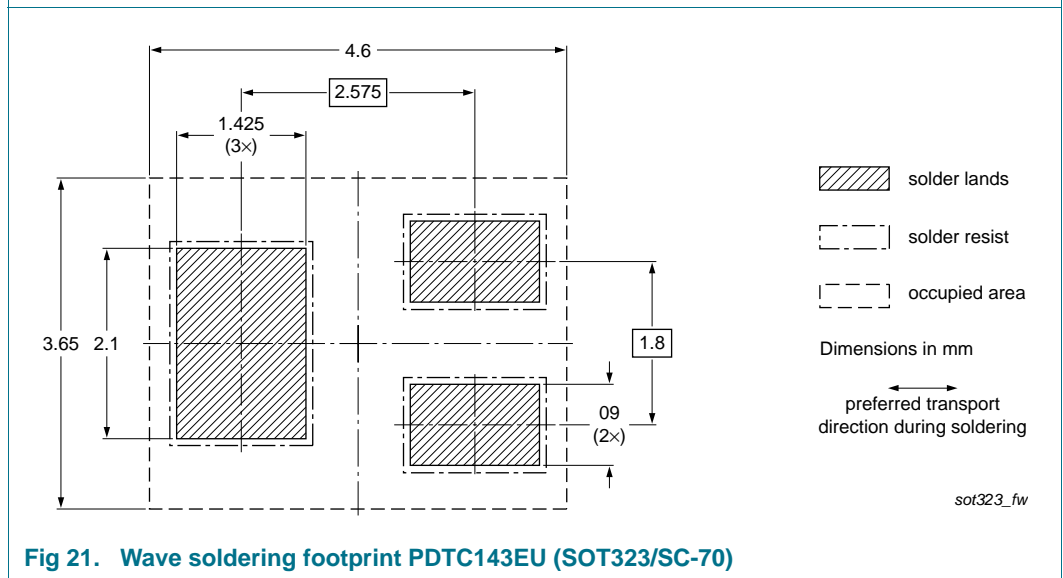
**Fig 18. Reflow soldering footprint PDTC143ET (SOT23)**



**Fig 19. Wave soldering footprint PDTC143ET (SOT23)**



**Fig 20. Reflow soldering footprint PDTC143EU (SOT323/SC-70)**



**Fig 21. Wave soldering footprint PDTC143EU (SOT323/SC-70)**

## 12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PDTC143E_SER v.10	20111208	Product data sheet	-	PDTC143E_SERIES v.9
Modifications:	<ul style="list-style-type: none"> <li>• The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• Type numbers PDTC143EEF, PDTC143EK and PDTC143ES removed.</li> <li>• <a href="#">Section 1 "Product profile"</a>: updated</li> <li>• <a href="#">Section 4 "Marking"</a>: updated</li> <li>• <a href="#">Figure 1 to 11</a>: added</li> <li>• <a href="#">Section 6 "Thermal characteristics"</a>: updated</li> <li>• <a href="#">Table 8 "Characteristics"</a>: <math>V_{i(on)}</math> redefined to <math>V_{I(on)}</math> on-state input voltage, <math>V_{i(off)}</math> redefined to <math>V_{I(off)}</math> off-state input voltage, <math>I_{CEO}</math> updated, <math>f_T</math> added</li> <li>• <a href="#">Section 8 "Test information"</a>: added</li> <li>• <a href="#">Section 9 "Package outline"</a>: superseded by minimized package outline drawings</li> <li>• <a href="#">Section 10 "Packing information"</a>: added</li> <li>• <a href="#">Section 11 "Soldering"</a>: added</li> <li>• <a href="#">Section 13 "Legal information"</a>: updated</li> </ul>			
PDTC143E_SERIES v.9	20040805	Product data sheet	-	PDTC143E_SERIES v.8
PDTC143E_SERIES v.8	20040318	Product specification	-	PDTC143E_SERIES v.7
PDTC143E_SERIES v.7	20040112	Product specification	-	PDTC143E_SERIES v.6
PDTC143E_SERIES v.6	20030910	Product specification	-	PDTC143E_SERIES v.5
PDTC143E_SERIES v.5	20030410	Product specification	-	-

## 13. Legal information

### 13.1 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".

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Date of release: 8 December 2011  
 Document identifier: PDTC143E\_SER

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