

# PDTC143Z series

NPN resistor-equipped transistors;  
R1 = 4.7 k $\Omega$ , R2 = 47 k $\Omega$

Rev. 8 — 5 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
	Nexperia	JEITA	JEDEC		
PDTC143ZE	SOT416	SC-75	-	PDTA143ZE	ultra small
PDTC143ZM	SOT883	SC-101	-	PDTA143ZM	leadless ultra small
PDTC143ZT	SOT23	-	TO-236AB	PDTA143ZT	small
PDTC143ZU	SOT323	SC-70	-	PDTA143ZU	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

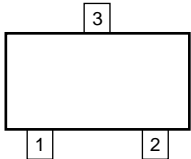
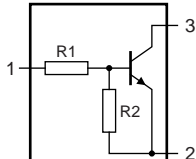
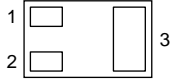
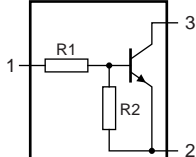
### 1.4 Quick reference data

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		8	10	12	

## 2. Pinning information

Table 3. Pinning

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

## 3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PDTC143ZE	SC-75	plastic surface-mounted package; 3 leads	SOT416
PDTC143ZM	SC-101	leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm	SOT883
PDTC143ZT	-	plastic surface-mounted package; 3 leads	SOT23
PDTC143ZU	SC-70	plastic surface-mounted package; 3 leads	SOT323

## 4. Marking

Table 5. Marking codes

Type number	Marking code <sup>[1]</sup>
PDTC143ZE	38
PDTC143ZM	E3
PDTC143ZT	*18
PDTC143ZU	*54

[1] \* = placeholder for manufacturing site code

## 5. Limiting values

**Table 6. Limiting values**

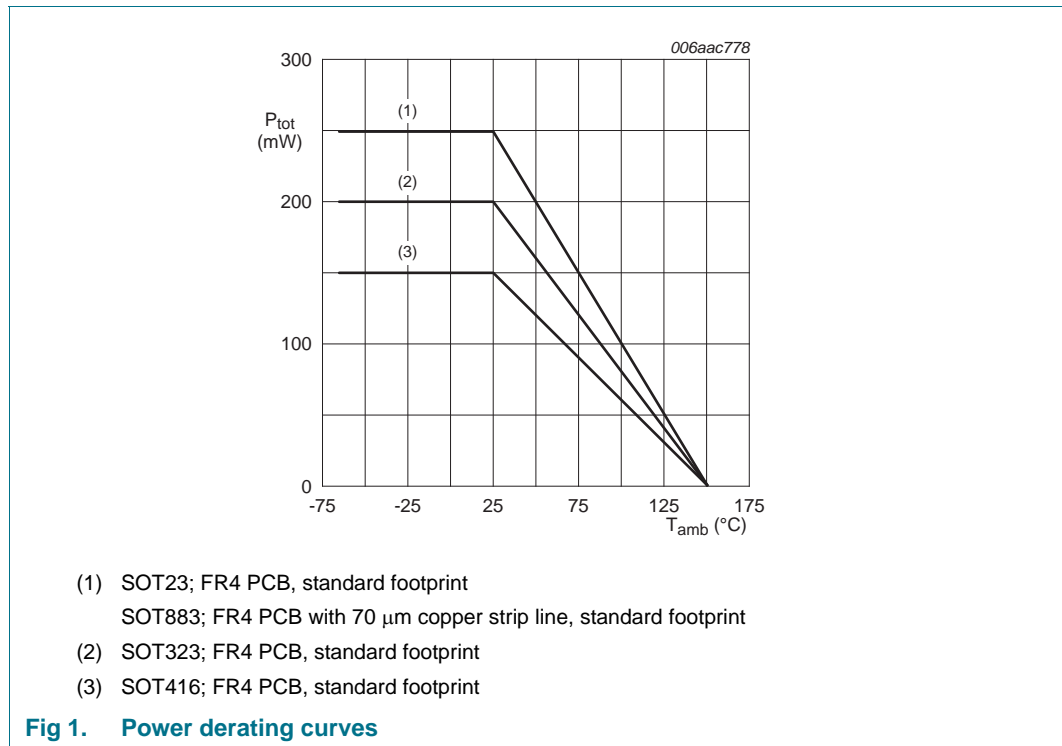
In accordance with the Absolute Maximum Rating System (IEC 60134).

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	-	5	V	
V <sub>I</sub>	input voltage					
	positive		-	+30	V	
	negative		-	-5	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				
	PDTC143ZE (SOT416)		[1][2]	-	150	mW
	PDTC143ZM (SOT883)		[2][3]	-	250	mW
	PDTC143ZT (SOT23)		[1]	-	250	mW
	PDTC143ZU (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

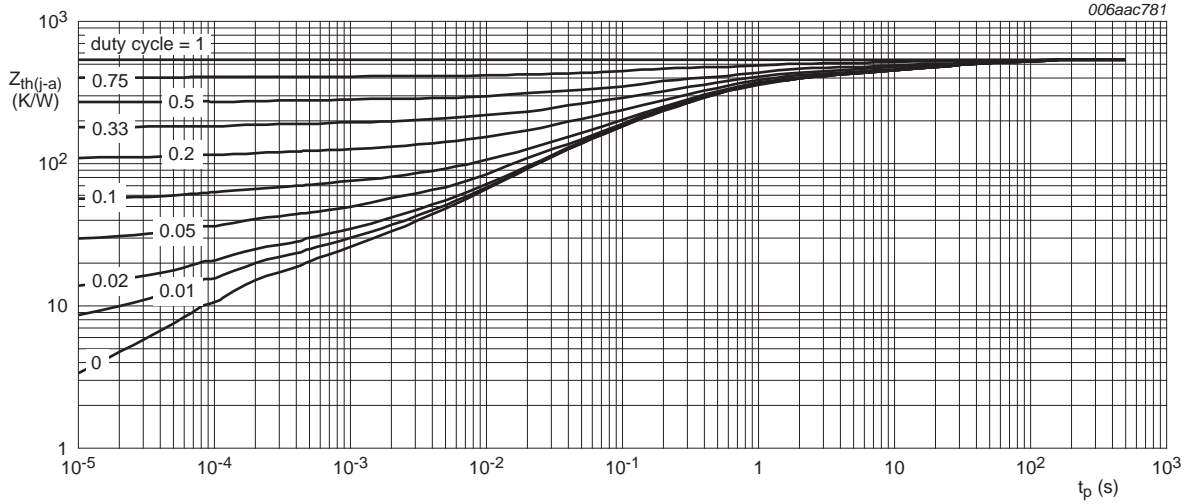
**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air				
	PDTC143ZE (SOT416)	[1][2]	-	-	830	K/W
	PDTC143ZM (SOT883)	[2][3]	-	-	500	K/W
	PDTC143ZT (SOT23)	[1]	-	-	500	K/W
	PDTC143ZU (SOT323)	[1]	-	-	625	K/W

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

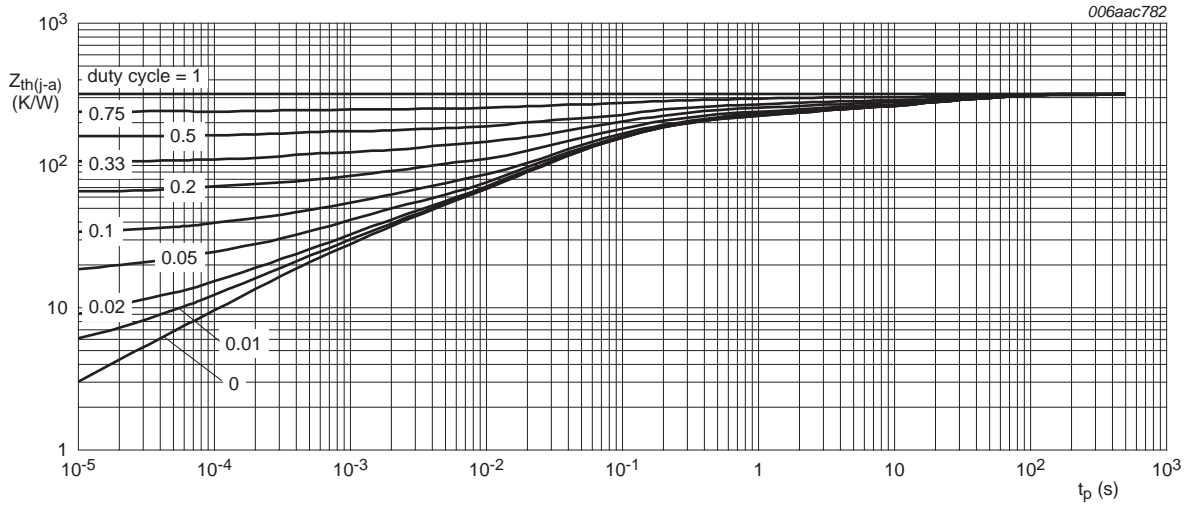
[2] Reflow soldering is the only recommended soldering method.

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



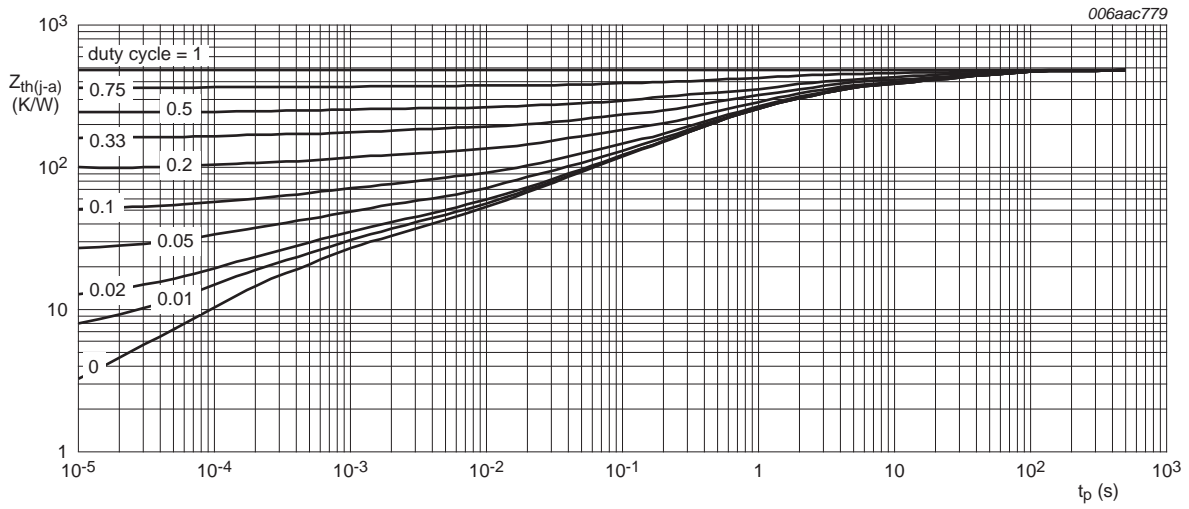
FR4 PCB, standard footprint

Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC143ZE (SOT416); typical values



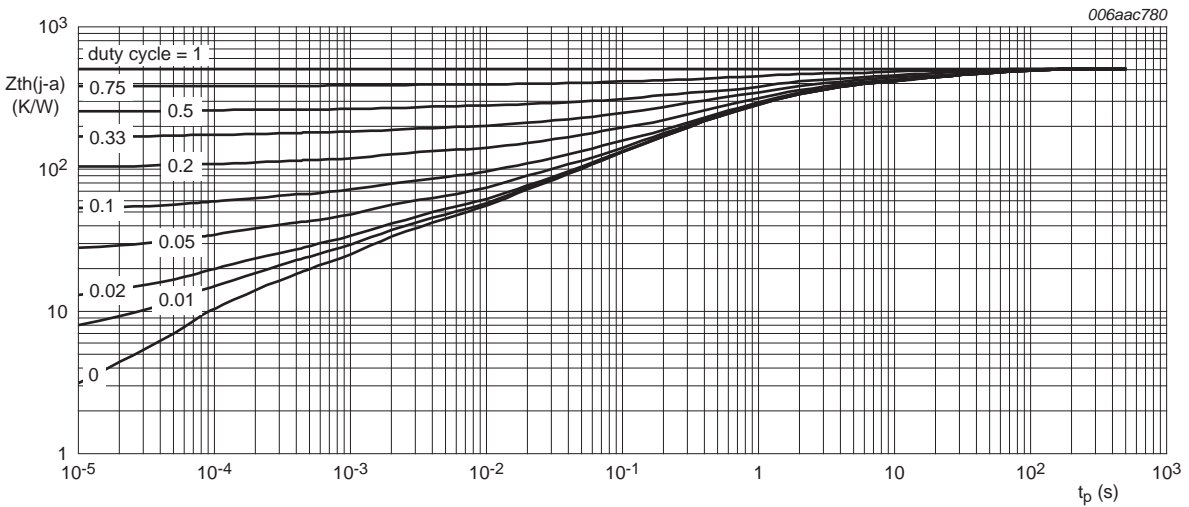
FR4 PCB, 70 μm copper strip line

Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC143ZM (SOT883); typical values



FR4 PCB, standard footprint

**Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC143ZT (SOT23); typical values**



FR4 PCB, standard footprint

**Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC143ZU (SOT323); typical values**

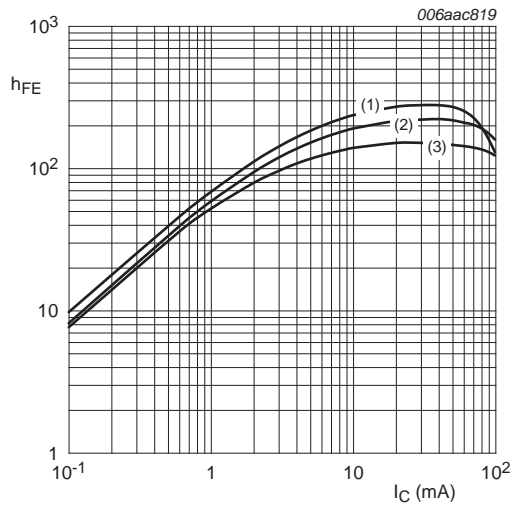
## 7. Characteristics

**Table 8. Characteristics**

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

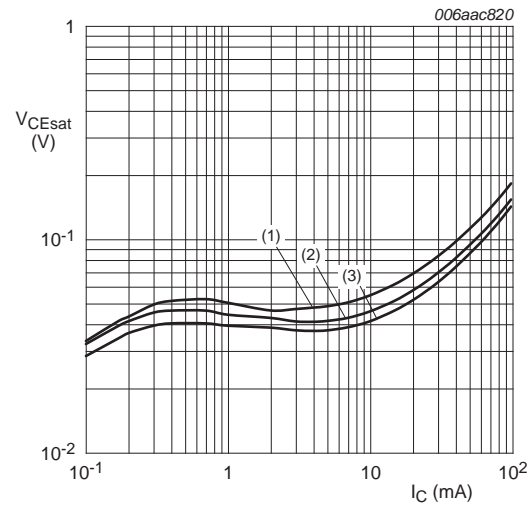
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; I_B = 0\text{ A}$	-	-	1	μA
		$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ °C}$	-	-	5	μA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	170	μA
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}$	100	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 5\text{ mA}; I_B = 0.25\text{ mA}$	-	-	100	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}; I_C = 100\text{ μA}$	-	0.6	0.5	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}; I_C = 5\text{ mA}$	1.3	0.9	-	V
R1	bias resistor 1 (input)		3.3	4.7	6.1	kΩ
R2/R1	bias resistor ratio		8	10	12	
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$	-	-	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



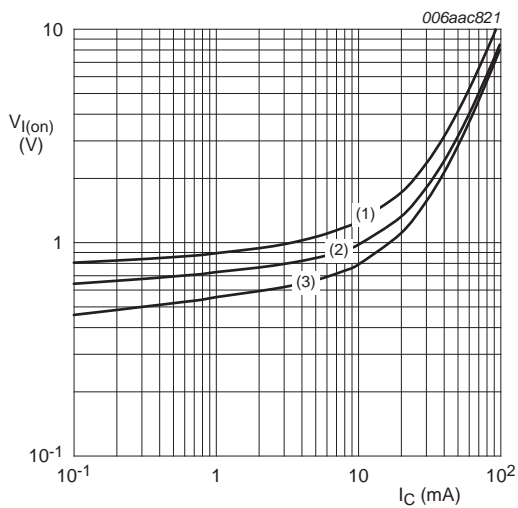
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

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



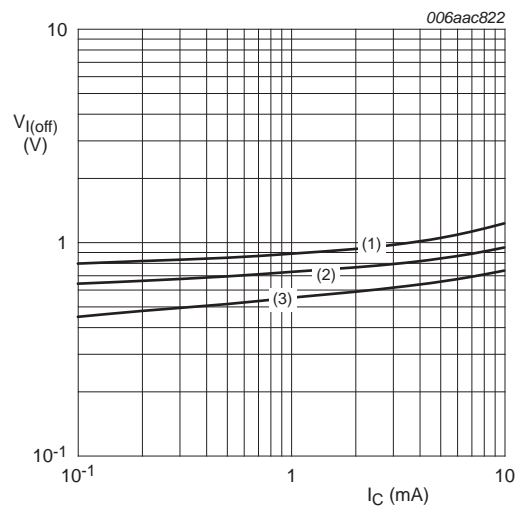
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**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)  $T_{amb} = 100 \text{ }^\circ\text{C}$

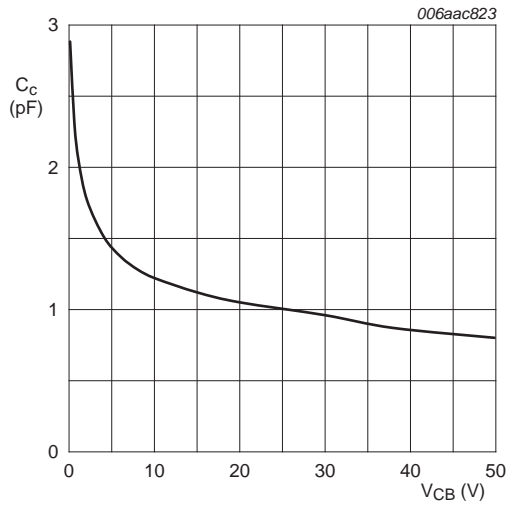
**Fig 8. On-state input voltage as a function of collector current; typical values**



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

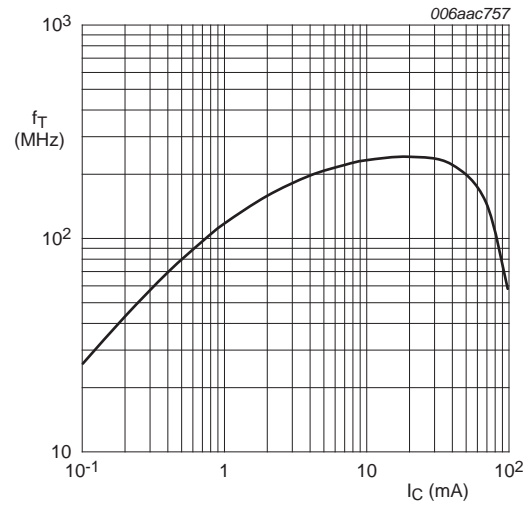
**Fig 9. Off-state input voltage as a function of collector current; typical values**





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

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



$V_{CE} = 5 \text{ V}$ ;  $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$

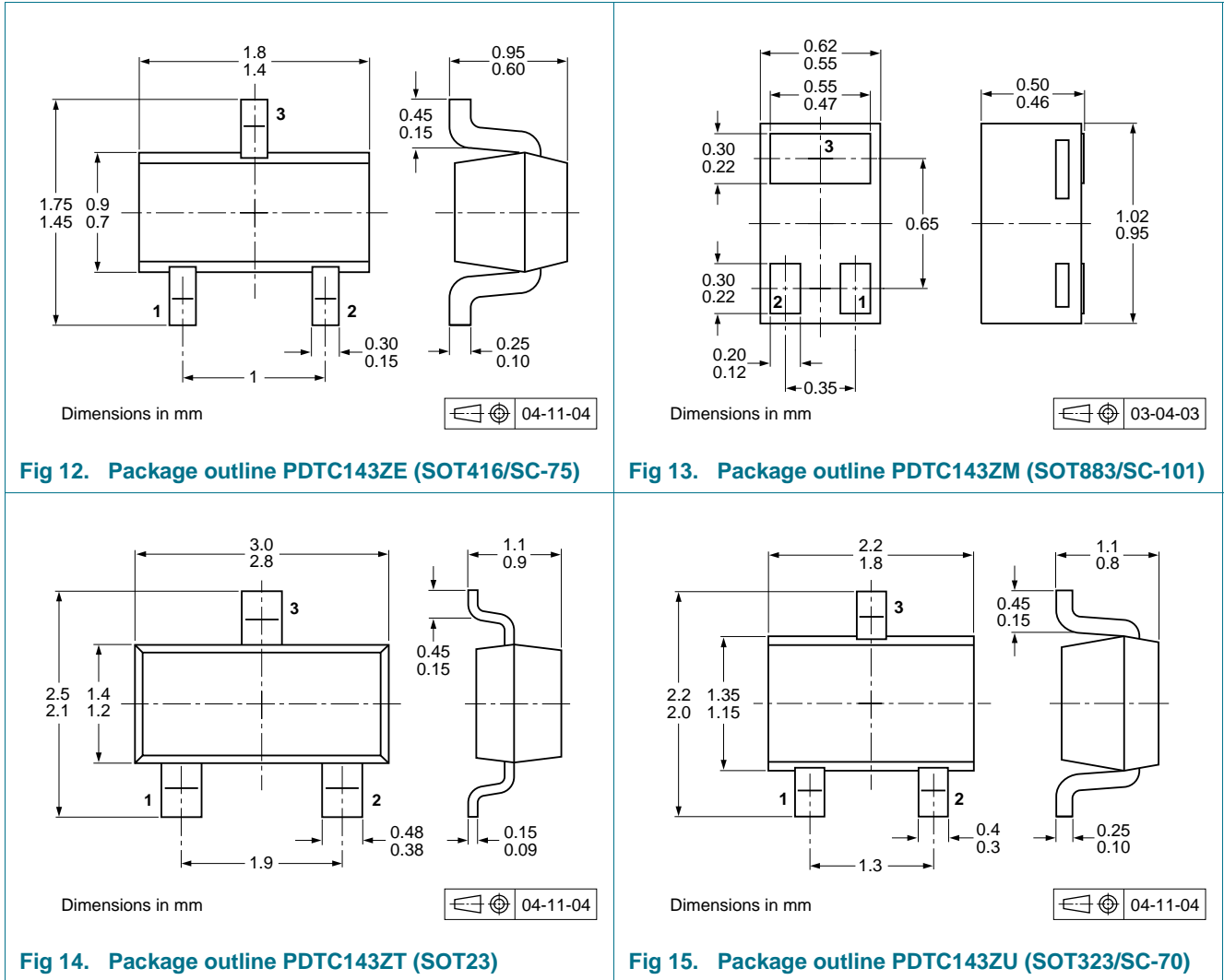
**Fig 11.** Transition frequency as a function of collector current; typical values of built-in transistor

## 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**

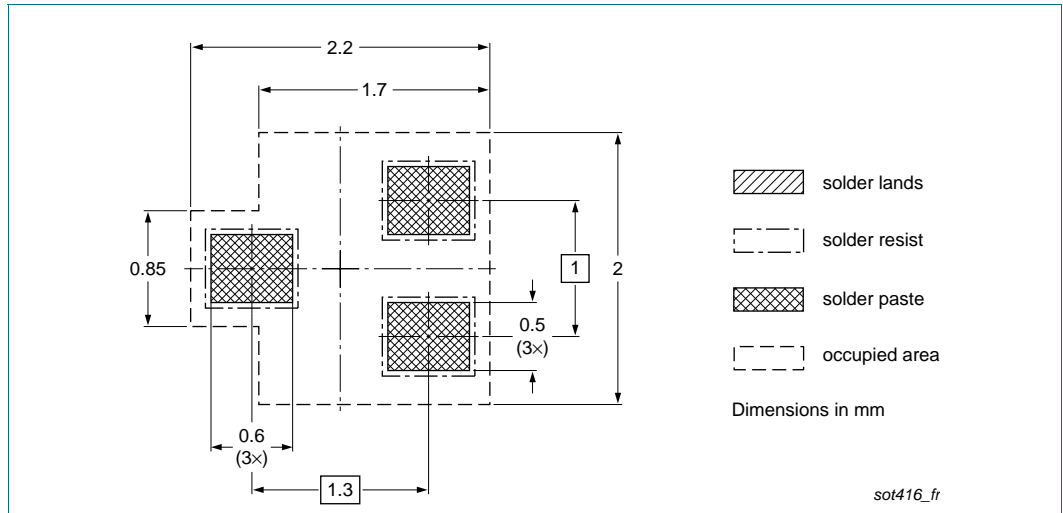
**Table 9. Packing methods**

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
PDTC143ZE	SOT416	4 mm pitch, 8 mm tape and reel	-115	-	-135
PDTC143ZM	SOT883	2 mm pitch, 8 mm tape and reel	-	-	-315
PDTC143ZT	SOT23	4 mm pitch, 8 mm tape and reel	-215	-	-235
PDTC143ZU	SOT323	4 mm pitch, 8 mm tape and reel	-115	-	-135

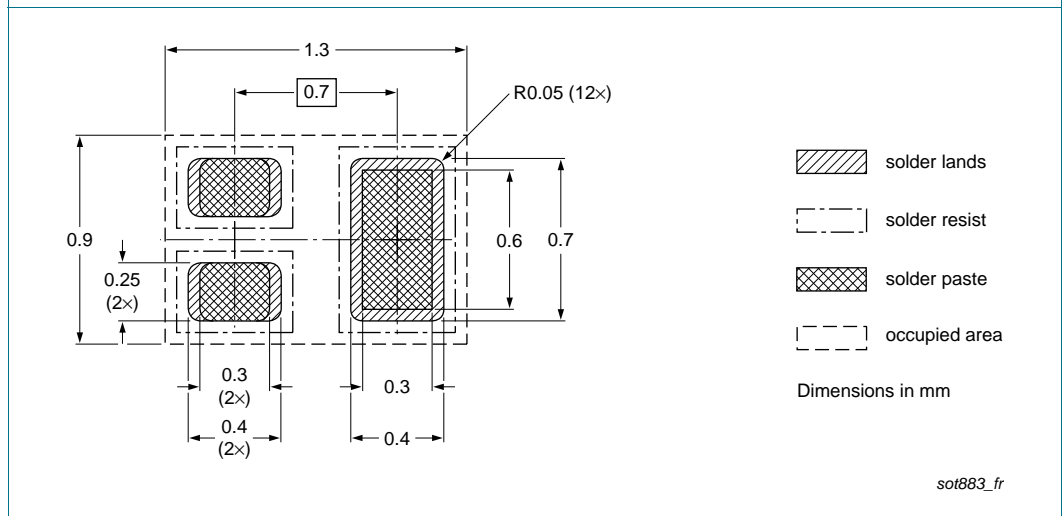
[1] For further information and the availability of packing methods, see [Section 14](#).

**11. Soldering**



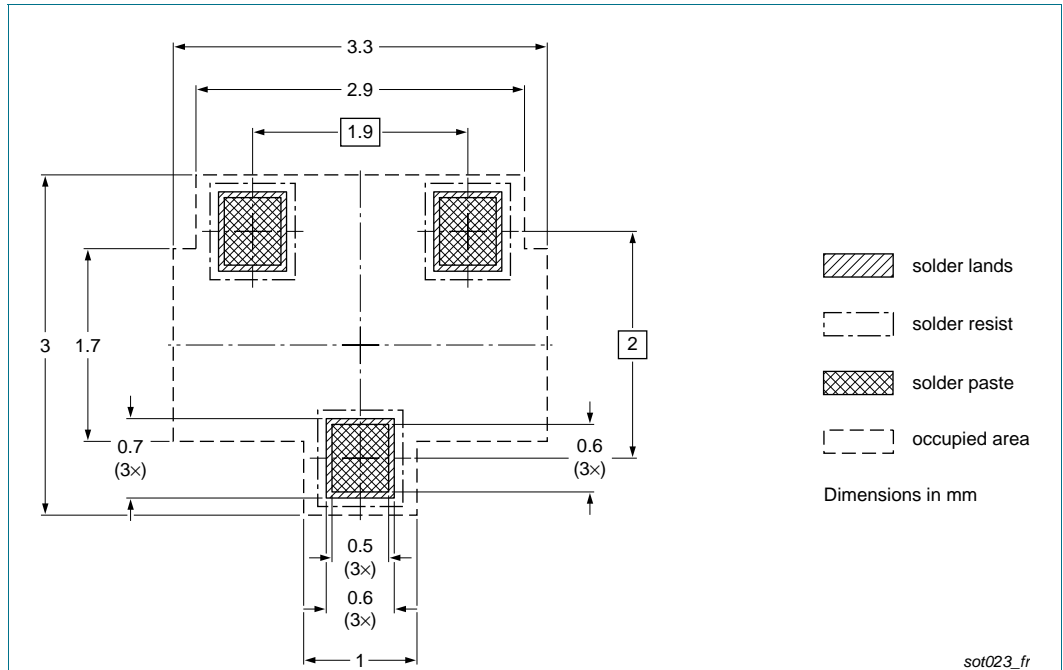
Reflow soldering is the only recommended soldering method.

**Fig 16. Reflow soldering footprint PDTC143ZE (SOT416/SC-75)**

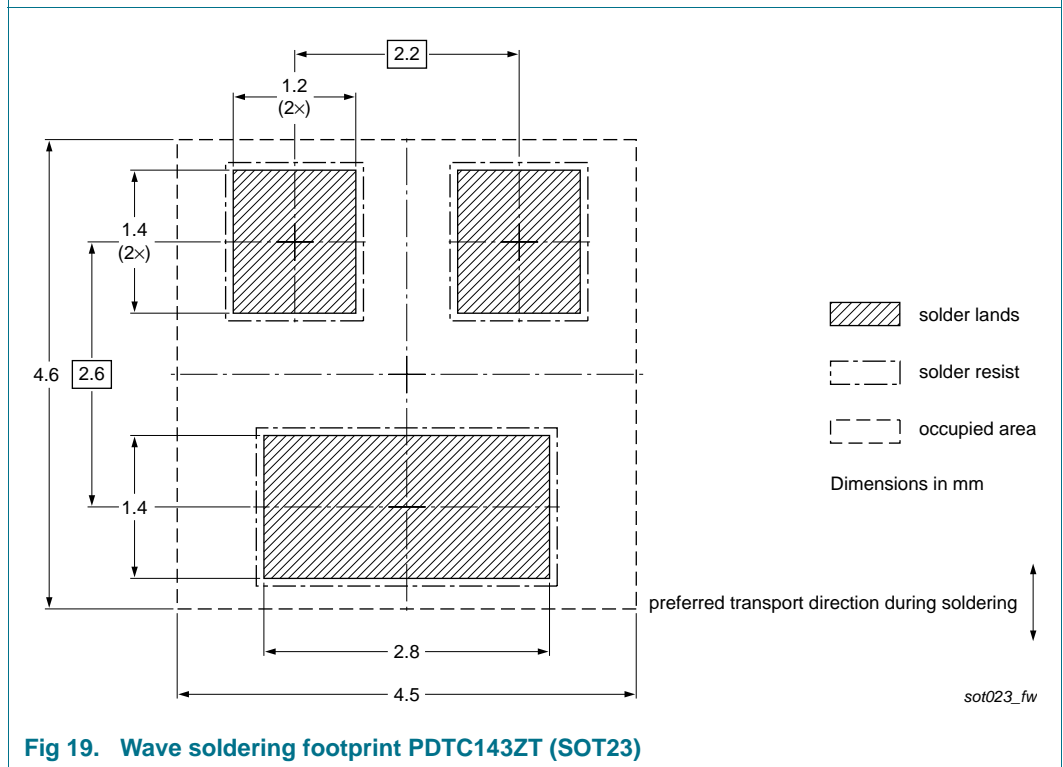


Reflow soldering is the only recommended soldering method.

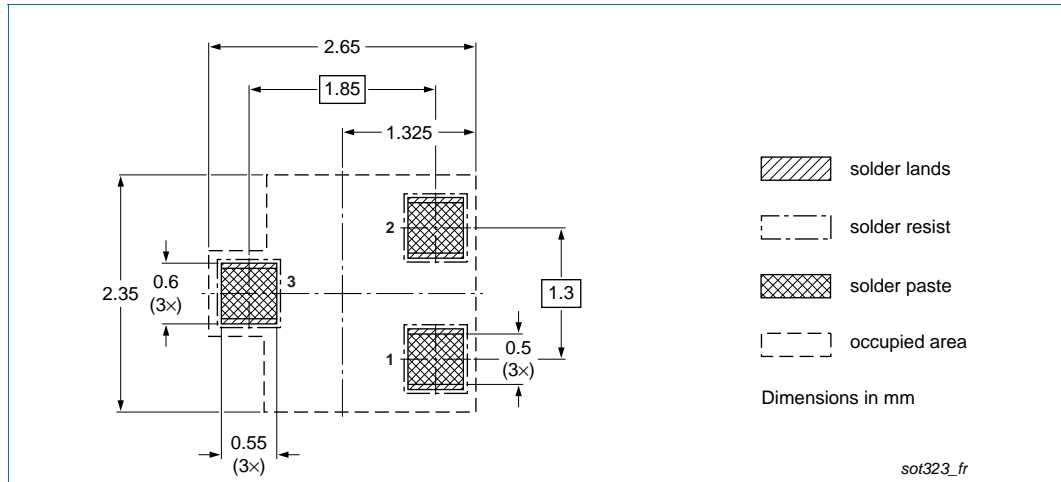
**Fig 17. Reflow soldering footprint PDTC143ZM (SOT883/SC-101)**



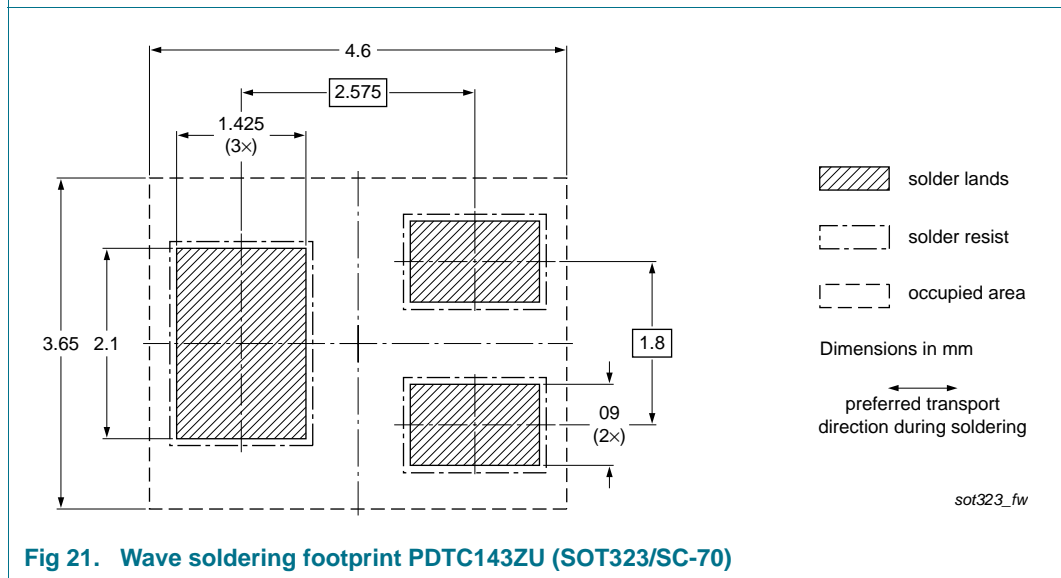
**Fig 18. Reflow soldering footprint PDTC143ZT (SOT23)**



**Fig 19. Wave soldering footprint PDTC143ZT (SOT23)**



**Fig 20. Reflow soldering footprint PDTC143ZU (SOT323/SC-70)**



**Fig 21. Wave soldering footprint PDTC143ZU (SOT323/SC-70)**

## 12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PDTC143Z_SER v.8	20111205	Product data sheet	-	PDTC143Z_SERIES v.7
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 PDTC143ZEF, PDTC143ZK and PDTC143ZS removed.</li> <li>• <a href="#">Section 1 “Product profile”</a>: updated</li> <li>• <a href="#">Section 3 “Ordering information”</a>: added</li> <li>• <a href="#">Section 4 “Marking”</a>: updated</li> <li>• <a href="#">Figure 1</a> to <a href="#">11</a>: added</li> <li>• <a href="#">Table 6 “Limiting values”</a>: updated</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>			
PDTC143Z_SERIES v.7	20040816	Product data sheet	-	PDTC143Z_SERIES v.6
PDTC143Z_SERIES v.6	20040406	Product specification	-	PDTC143Z_SERIES v.5
PDTC143Z_SERIES v.5	20030910	Product specification	-	PDTC143Z_SERIES v.4
PDTC143Z_SERIES v.4	20030414	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".

[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 URL <http://www.nexperia.com>.

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**Quick reference data** — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

## 13.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

## 14. Contact information

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For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)



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