

# PDTC144E series

NPN resistor-equipped transistors;  
 $R1 = 47 \text{ k}\Omega$ ,  $R2 = 47 \text{ k}\Omega$

Rev. 9 — 15 November 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		
PDTC144EE	SOT416	SC-75	-	PDTA144EE	ultra small
PDTC144EM	SOT883	SC-101	-	PDTA144EM	leadless ultra small
PDTC144ET	SOT23	-	TO-236AB	PDTA144ET	small
PDTC144EU	SOT323	SC-70	-	PDTA144EU	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

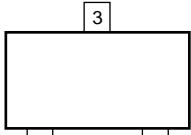
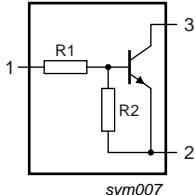
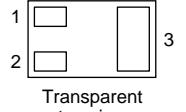
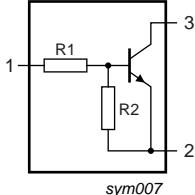
Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	50	V
$I_O$	output current		-	-	100	mA
R1	bias resistor 1 (input)		33	47	61	$\text{k}\Omega$
R2/R1	bias resistor ratio		0.8	1	1.2	

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## 2. Pinning information

Table 3. Pinning

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

## 3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PDTC144EE	SC-75	plastic surface-mounted package; 3 leads	SOT416
PDTC144EM	SC-101	leadless ultra small plastic package; 3 solder lands; body $1.0 \times 0.6 \times 0.5 \text{ mm}$	SOT883
PDTC144ET	-	plastic surface-mounted package; 3 leads	SOT23
PDTC144EU	SC-70	plastic surface-mounted package; 3 leads	SOT323

## 4. Marking

Table 5. Marking codes

Type number	Marking code <sup>[1]</sup>
PDTC144EE	08
PDTC144EM	E7
PDTC144ET	*08
PDTC144EU	*08

[1] \* = placeholder for manufacturing site code

## 5. Limiting values

**Table 6. Limiting values**

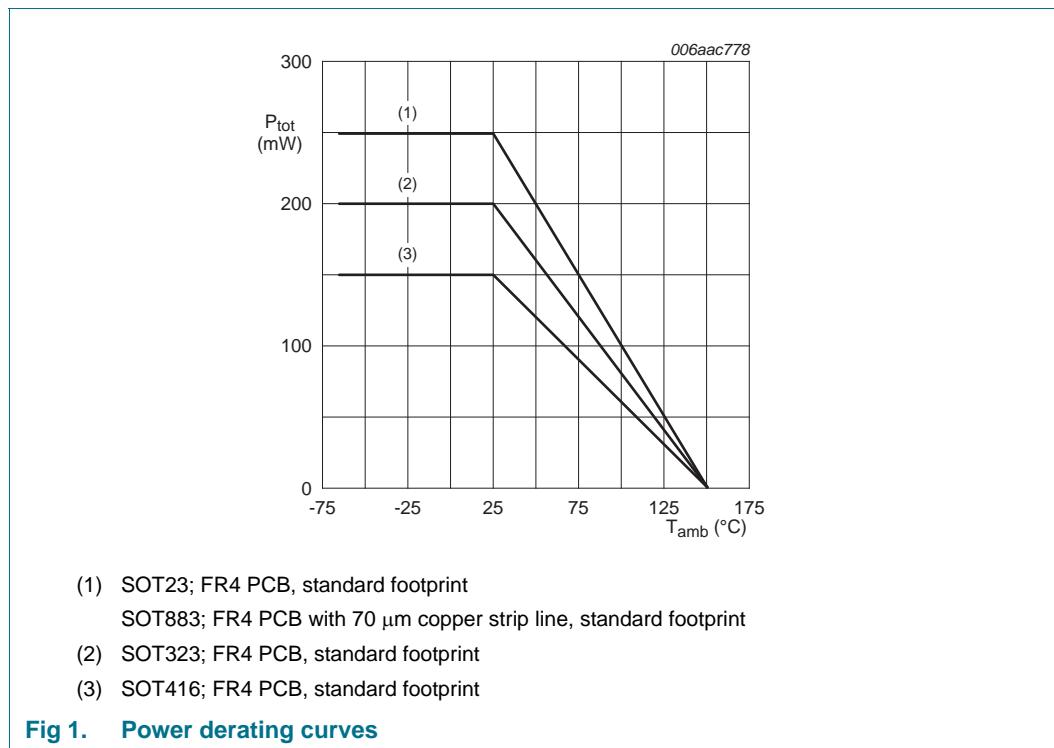
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	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				
	positive		-	+40	V
	negative		-	-10	V
$I_O$	output current		-	100	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1 \text{ ms}$	-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25 \text{ }^\circ\text{C}$			
	PDTC144EE (SOT416)		[1][2]	-	mW
	PDTC144EM (SOT883)		[2][3]	-	mW
	PDTC144ET (SOT23)		[1]	-	mW
	PDTC144EU (SOT323)		[1]	-	mW
$T_j$	junction temperature		-	150	$^\circ\text{C}$
$T_{amb}$	ambient temperature		-65	+150	$^\circ\text{C}$
$T_{stg}$	storage temperature		-65	+150	$^\circ\text{C}$

[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  $\mu\text{m}$  copper strip line, standard footprint.



## 6. Thermal characteristics

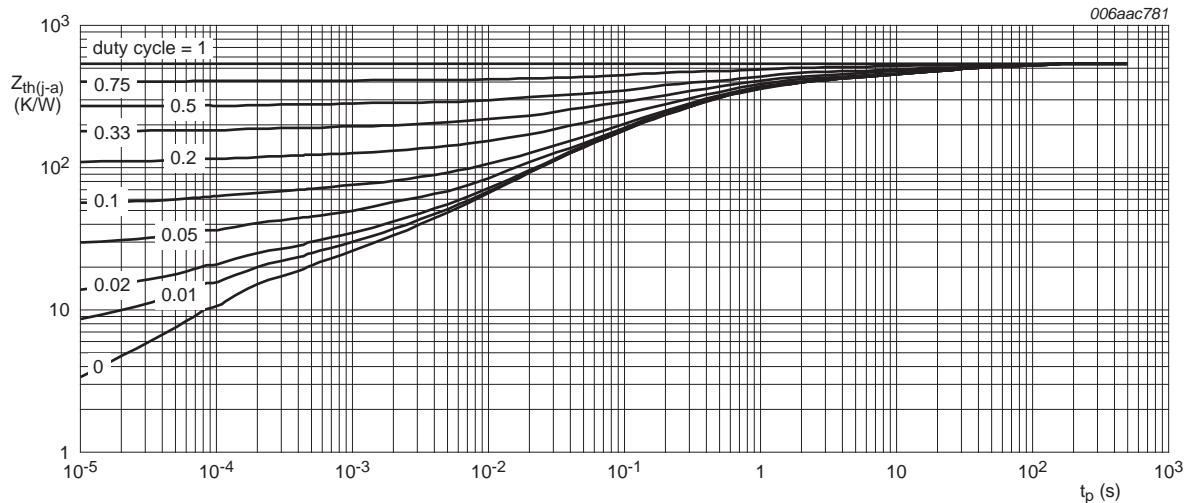
**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{\text{th(j-a)}}$	thermal resistance from junction to ambient	in free air				
	PDTC144EE (SOT416)	[1][2]	-	-	830	K/W
	PDTC144EM (SOT883)	[2][3]	-	-	500	K/W
	PDTC144ET (SOT23)	[1]	-	-	500	K/W
	PDTC144EU (SOT323)	[1]	-	-	625	K/W

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

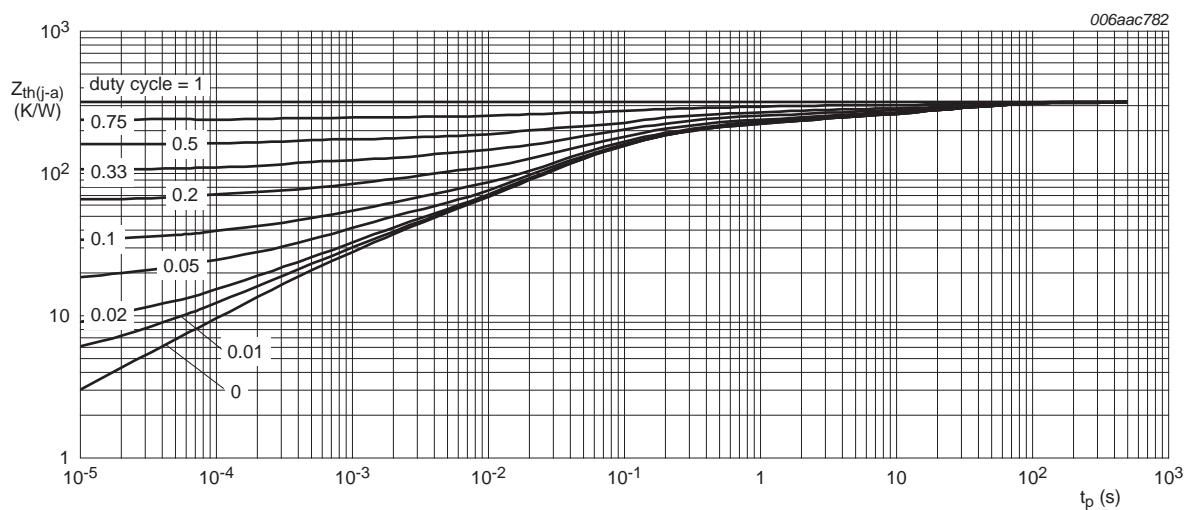
[2] Reflow soldering is the only recommended soldering method.

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



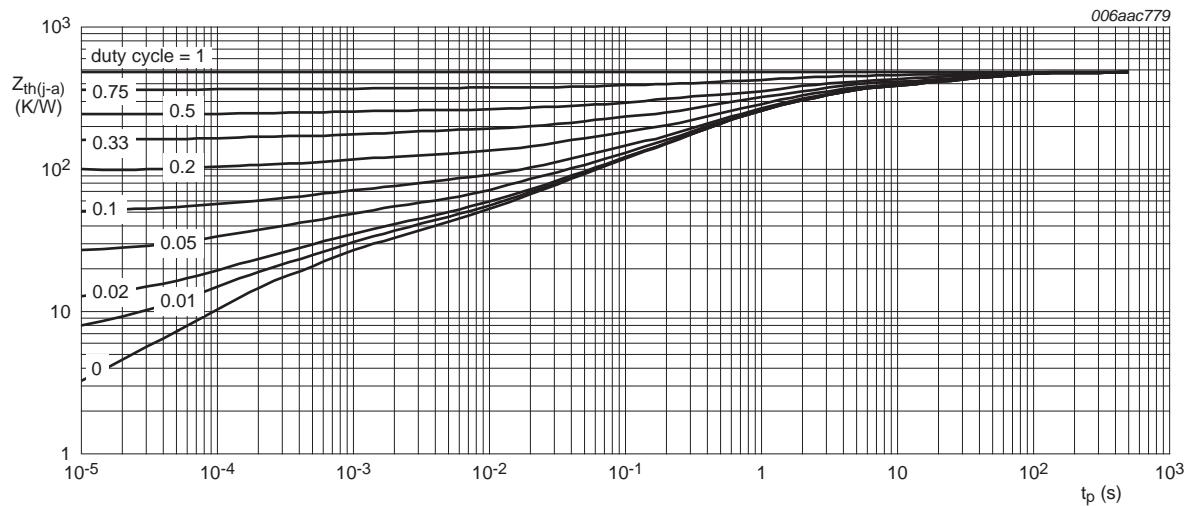
FR4 PCB, standard footprint

**Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC144EE (SOT416); typical values**



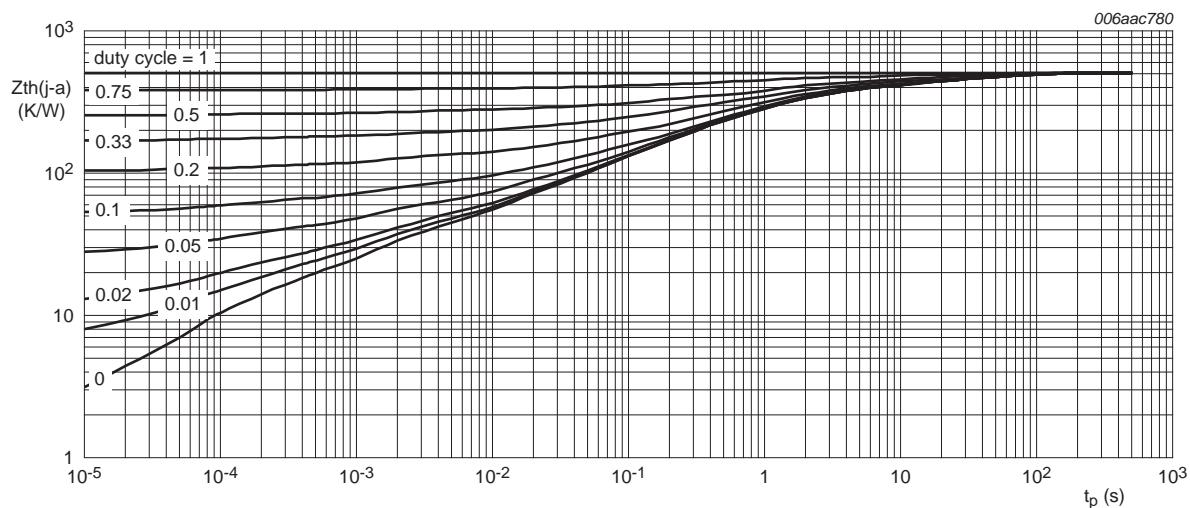
FR4 PCB, 70  $\mu\text{m}$  copper strip line

**Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC144EM (SOT883); typical values**



FR4 PCB, standard footprint

**Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC144ET (SOT23); typical values**



FR4 PCB, standard footprint

**Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC144EU (SOT323); typical values**

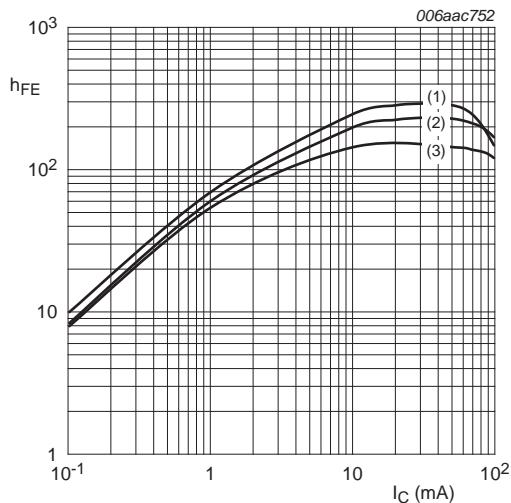
## 7. Characteristics

**Table 8. Characteristics**

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

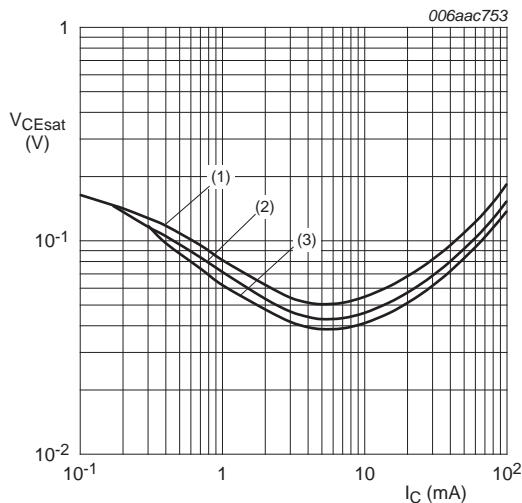
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50 \text{ V}$ ; $I_E = 0 \text{ A}$	-	-	100	nA	
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30 \text{ V}$ ; $I_B = 0 \text{ A}$	-	-	1	$\mu\text{A}$	
		$V_{CE} = 30 \text{ V}$ ; $I_B = 0 \text{ A}$ ; $T_j = 150^\circ\text{C}$	-	-	5	$\mu\text{A}$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5 \text{ V}$ ; $I_C = 0 \text{ A}$	-	-	90	$\mu\text{A}$	
$h_{FE}$	DC current gain	$V_{CE} = 5 \text{ V}$ ; $I_C = 5 \text{ mA}$	80	-	-		
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10 \text{ mA}$ ; $I_B = 0.5 \text{ mA}$	-	-	150	mV	
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5 \text{ V}$ ; $I_C = 100 \mu\text{A}$	-	1.2	0.8	V	
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3 \text{ V}$ ; $I_C = 2 \text{ mA}$	3	1.6	-	V	
$R1$	bias resistor 1 (input)		33	47	61	$\text{k}\Omega$	
$R2/R1$	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



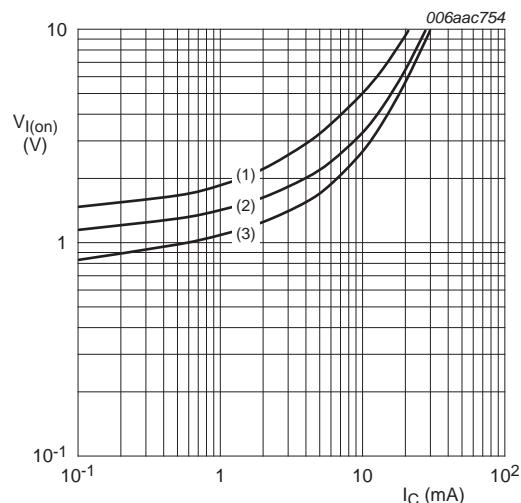
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^{\circ}\text{C}$

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



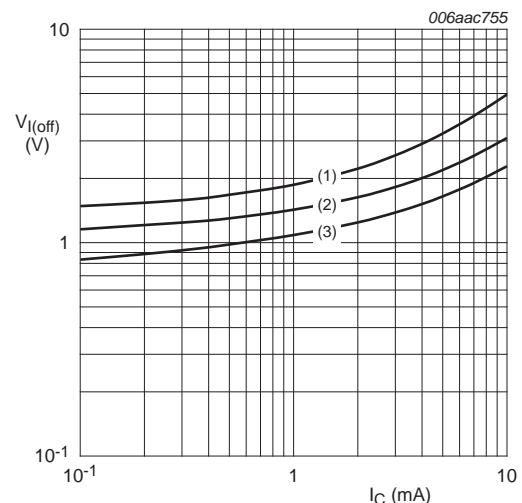
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^{\circ}\text{C}$

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



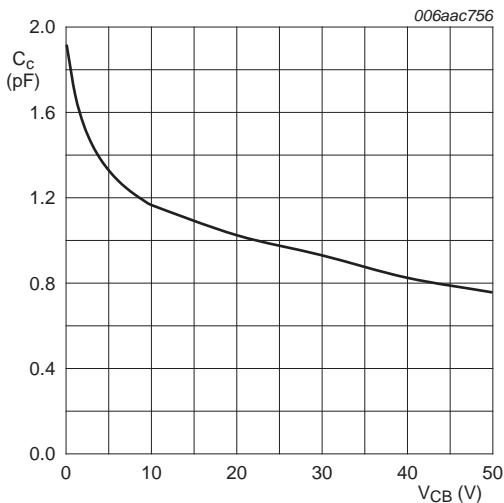
$V_{CE} = 0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$

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



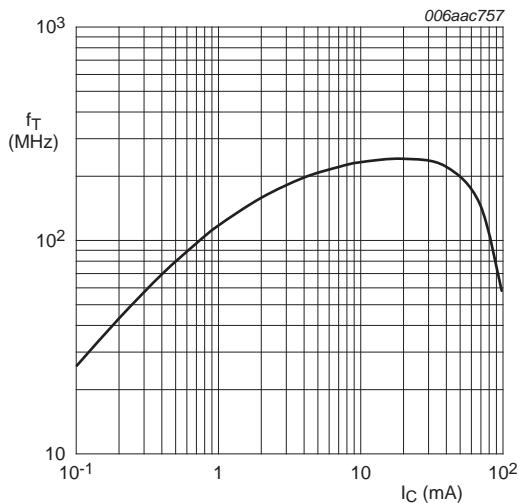
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$

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



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

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



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

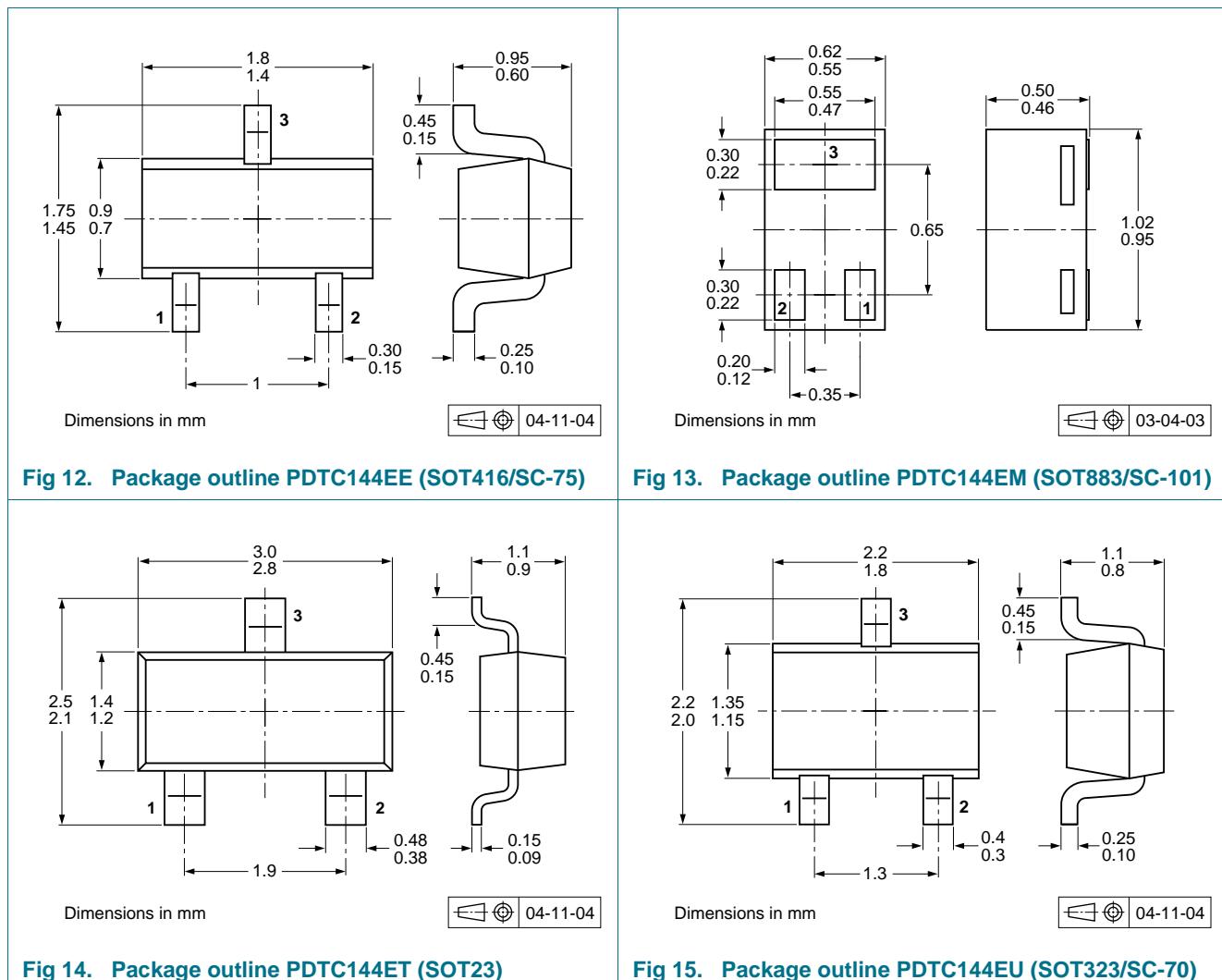
**Fig 11.** Transition frequency as a function of collector current; typical values of built-in transistor

## 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

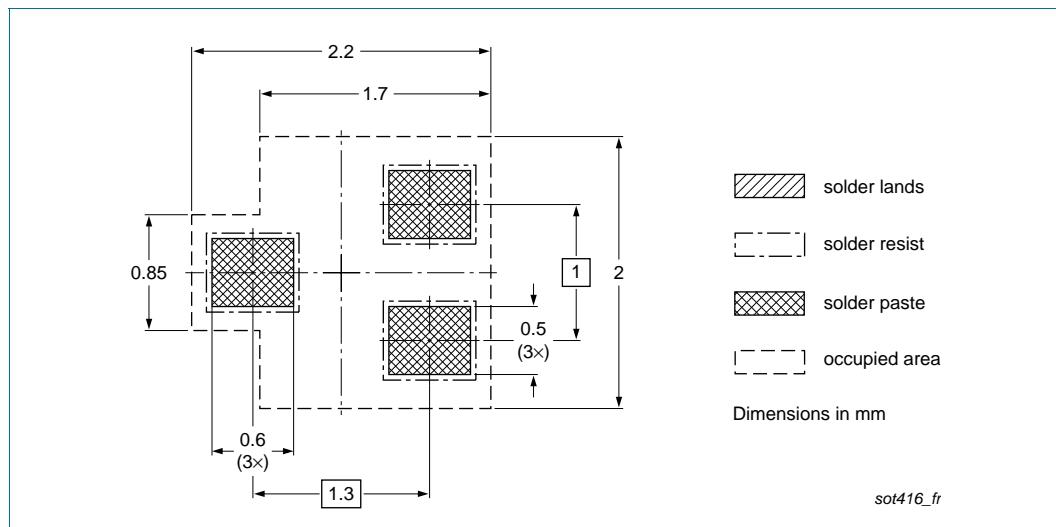
**Table 9. Packing methods**

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
PDTC144EE	SOT416	4 mm pitch, 8 mm tape and reel	-115	-	-135
PDTC144EM	SOT883	2 mm pitch, 8 mm tape and reel	-	-	-315
PDTC144ET	SOT23	4 mm pitch, 8 mm tape and reel	-215	-	-235
PDTC144EU	SOT323	4 mm pitch, 8 mm tape and reel	-115	-	-135

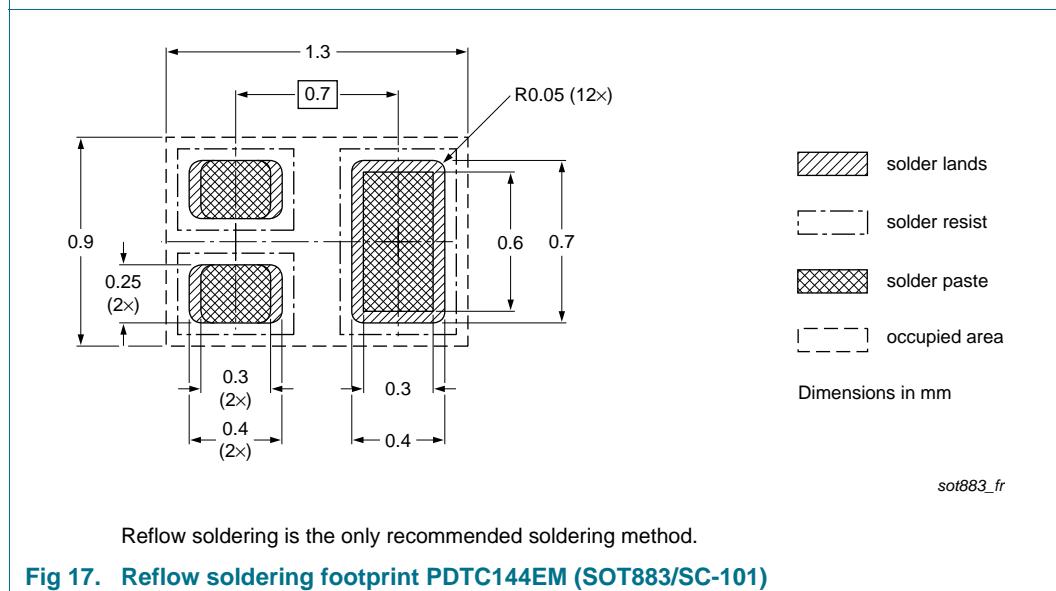
[1] For further information and the availability of packing methods, see [Section 14](#).

## 11. Soldering



Reflow soldering is the only recommended soldering method.

**Fig 16. Reflow soldering footprint PDTC144EE (SOT416/SC-75)**



Reflow soldering is the only recommended soldering method.

**Fig 17. Reflow soldering footprint PDTC144EM (SOT883/SC-101)**

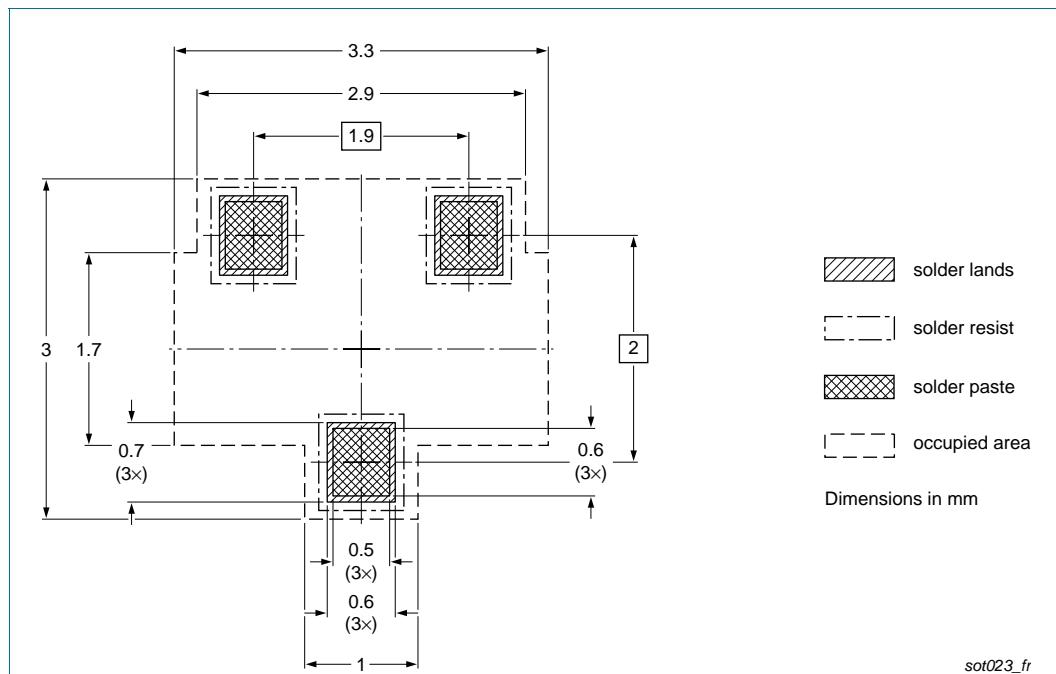


Fig 18. Reflow soldering footprint PDTC144ET (SOT23)

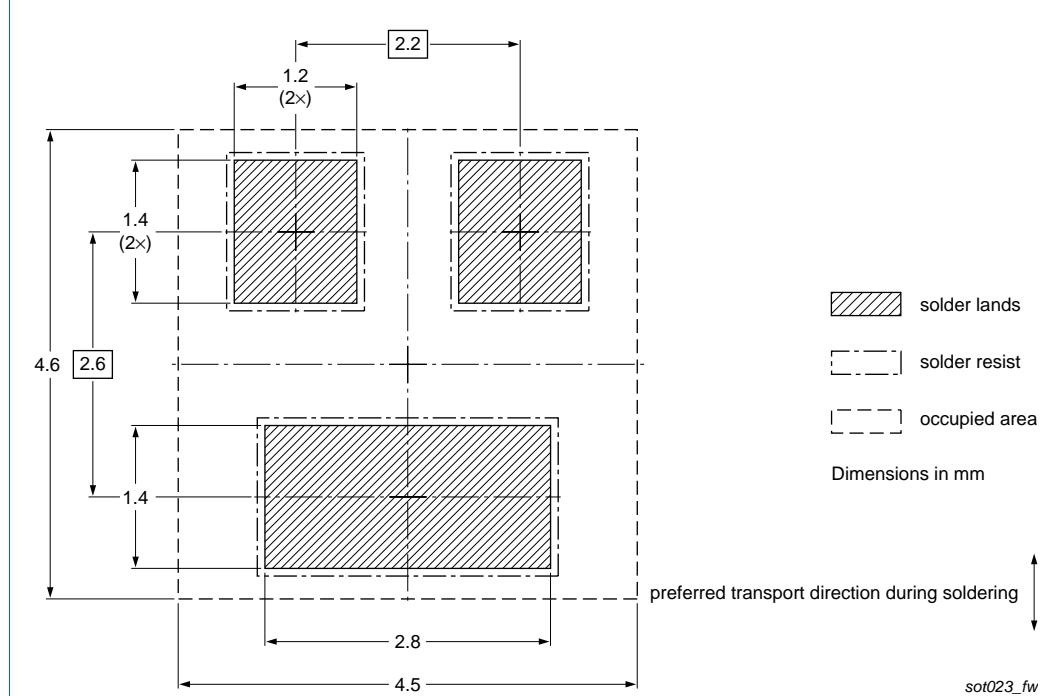


Fig 19. Wave soldering footprint PDTC144ET (SOT23)

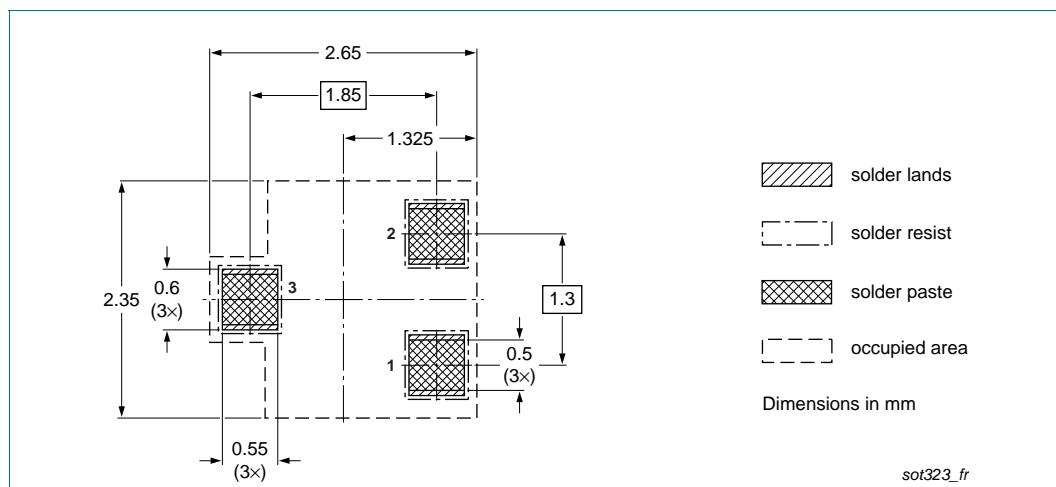


Fig 20. Reflow soldering footprint PDTC144EU (SOT323/SC-70)

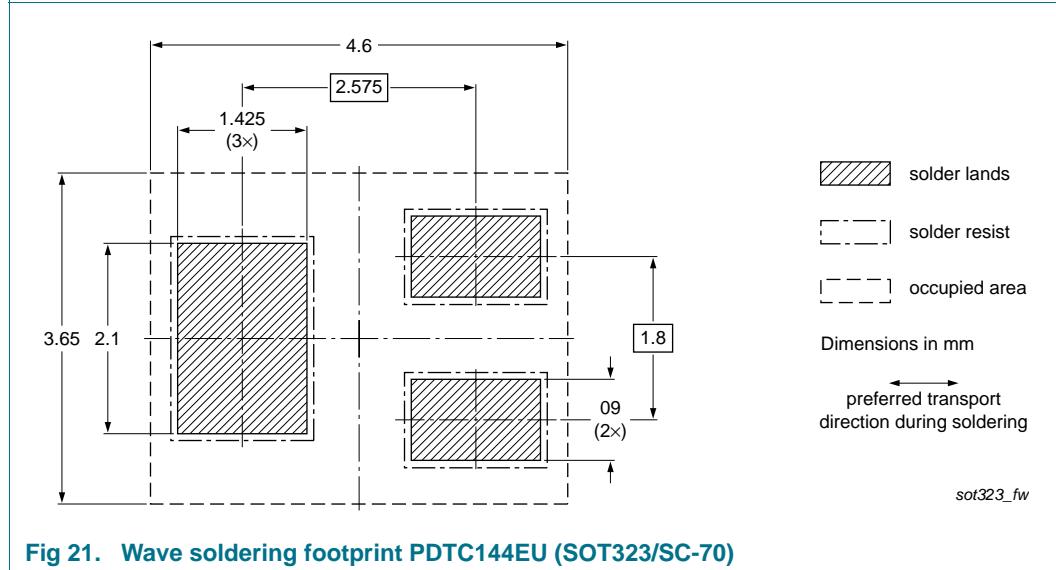


Fig 21. Wave soldering footprint PDTC144EU (SOT323/SC-70)

## 12. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PDTC144E_SER v.9	20111115	Product data sheet	-	PDTC144E_SERIES v.8
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 PDTC144EEF, PDTC144EK and PDTC144ES removed.</li> <li><a href="#">Section 1 "Product profile"</a>: updated</li> <li><a href="#">Section 3 "Ordering information"</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>		
PDTC144E_SERIES v.8	20040817	Product data sheet	-	PDTC144E_SERIES v.7
PDTC144E_SERIES v.7	20040323	Product specification	-	PDTC144E_SERIES v.6
PDTC144E_SERIES v.6	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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### 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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