

# PDTC114E series

NPN resistor-equipped transistors;  
R1 = 10 k $\Omega$ , R2 = 10 k $\Omega$

Rev. 12 — 21 December 2011

Product data sheet

## 1. Product profile

### 1.1 General description

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

Table 1. Product overview

Type number	Package			PNP complement	Package configuration
	NXP	JEITA	JEDEC		
PDTC114EE	SOT416	SC-75	-	PDTA114EE	ultra small
PDTC114EM	SOT883	SC-101	-	PDTA114EM	leadless ultra small
PDTC114ET	SOT23	-	TO-236AB	PDTA114ET	small
PDTC114EU	SOT323	SC-70	-	PDTA114EU	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 application 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

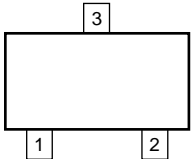
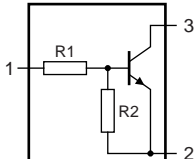
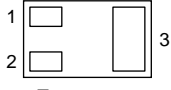
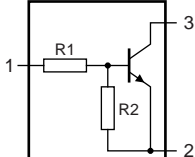
Table 2. Quick reference data

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)		7	10	13	k $\Omega$
R2/R1	bias resistor ratio		0.8	1.0	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
PDTC114EE	SC-75	plastic surface-mounted package; 3 leads	SOT416
PDTC114EM	SC-101	leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm	SOT883
PDTC114ET	-	plastic surface-mounted package; 3 leads	SOT23
PDTC114EU	SC-70	plastic surface-mounted package; 3 leads	SOT323

## 4. Marking

**Table 5. Marking codes**

Type number	Marking code <sup>[1]</sup>
PDTC114EE	09
PDTC114EM	DS
PDTC114ET	*16
PDTC114EU	*09

[1] \* = placeholder for manufacturing site code.

## 5. Limiting values

**Table 6. Limiting values**

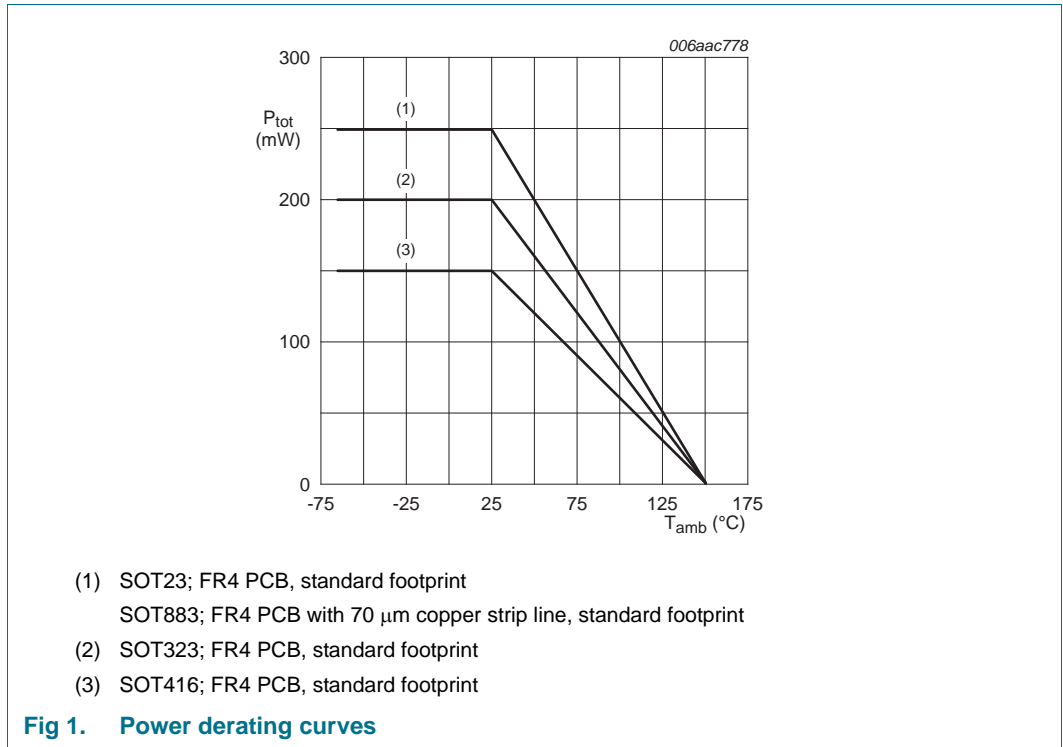
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

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		-	+40	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				
	PDTC114EE (SOT416)		[1][2]	-	150	mW
	PDTC114EM (SOT883)		[2][3]	-	250	mW
	PDTC114ET (SOT23)		[1]	-	250	mW
	PDTC114EU (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 μm copper strip line, standard footprint.



## 6. Thermal characteristics

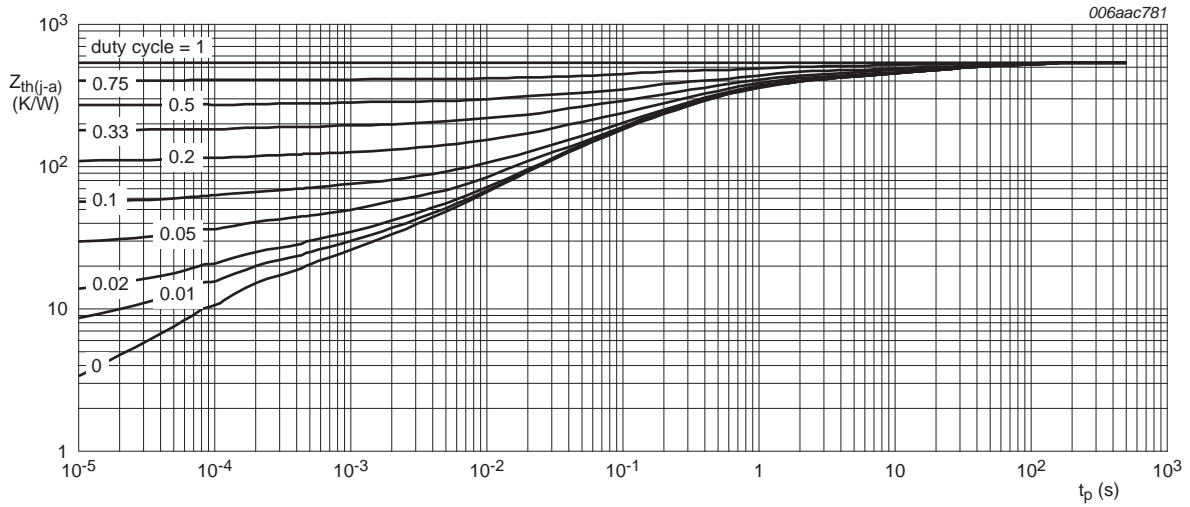
**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air				
	PDTC114EE (SOT416)	[1][2]	-	-	830	K/W
	PDTC114EM (SOT883)	[2][3]	-	-	500	K/W
	PDTC114ET (SOT23)	[1]	-	-	500	K/W
	PDTC114EU (SOT323)	[1]	-	-	625	K/W

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

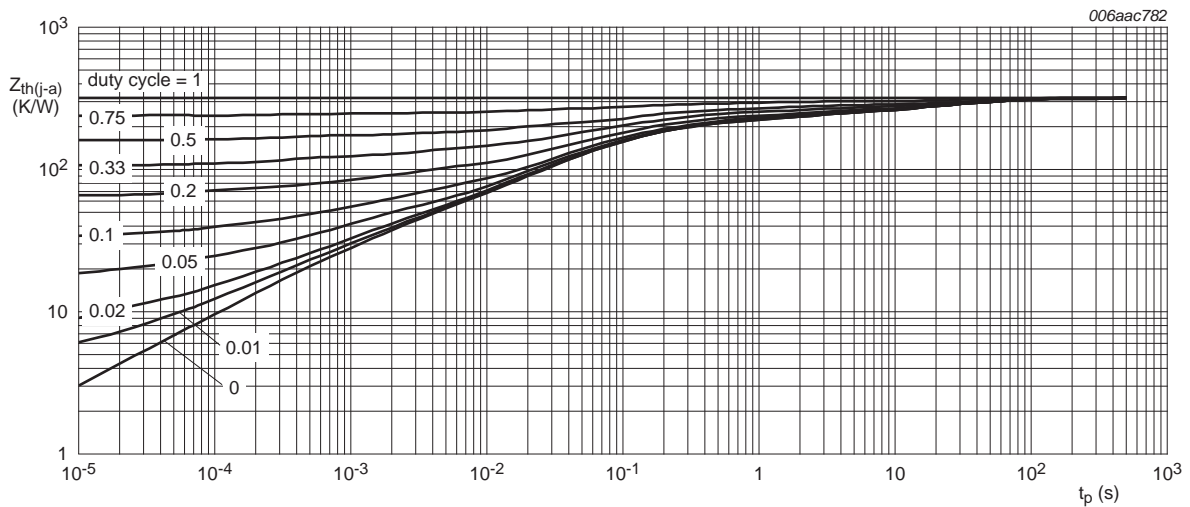
[2] Reflow soldering is the only recommended soldering method.

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



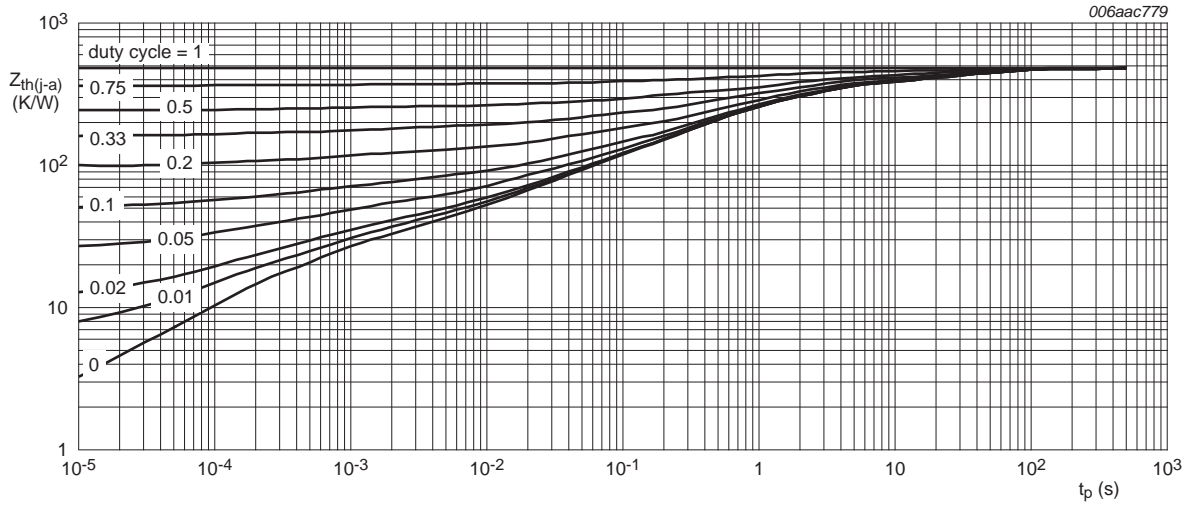
FR4 PCB, standard footprint

**Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC114EE (SOT416); typical values**



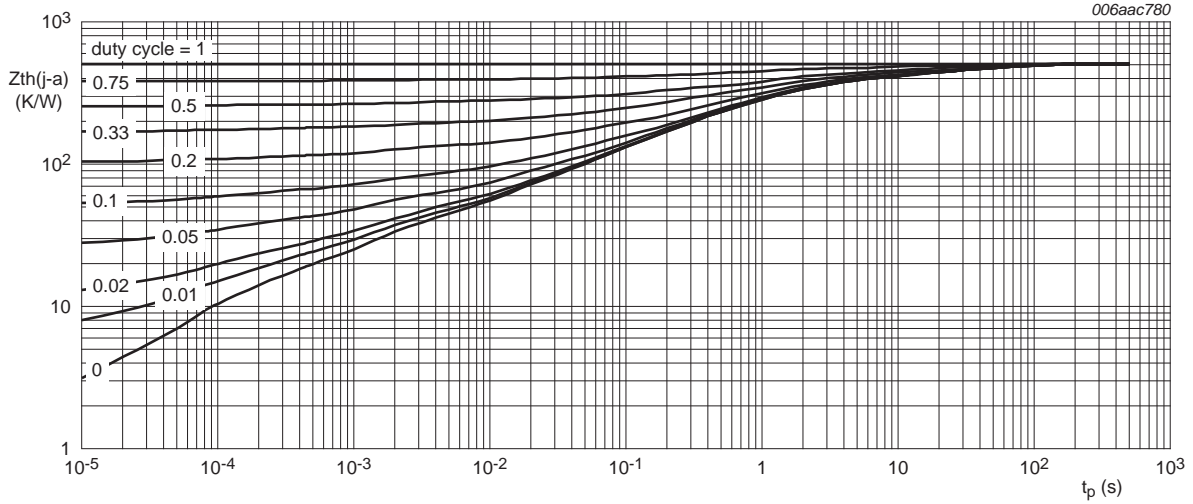
FR4 PCB, 70 μm copper strip line

**Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC114EM (SOT883); typical values**



FR4 PCB, standard footprint

**Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC114ET (SOT23); typical values**



FR4 PCB, standard footprint

**Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC114EU (SOT323); typical values**

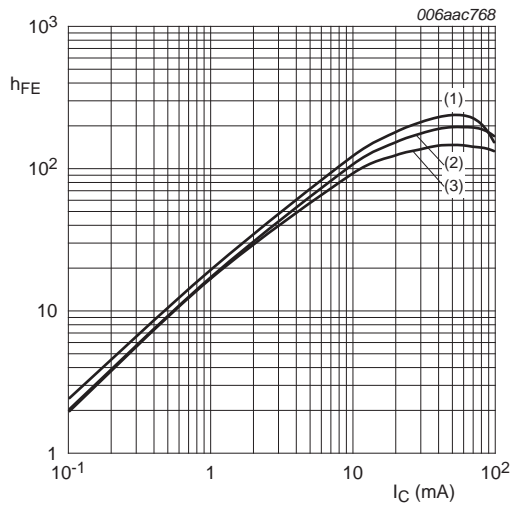
## 7. Characteristics

**Table 8. Characteristics**

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

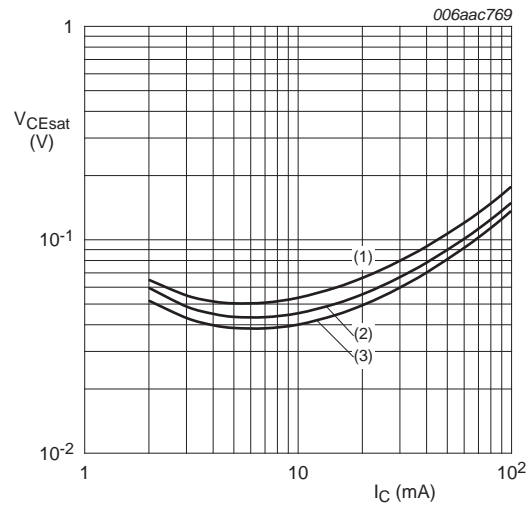
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}$	-	-	100	nA	
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; I_B = 0\text{ A}$	-	-	1	μA	
		$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ °C}$	-	-	5	μA	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	400	μA	
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 5\text{ mA}$	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	0.8	V	
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}; I_C = 10\text{ mA}$	2.5	1.8	-	V	
R1	bias resistor 1 (input)		7	10	13	kΩ	
R2/R1	bias resistor ratio		0.8	1.0	1.2		
$C_c$	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.



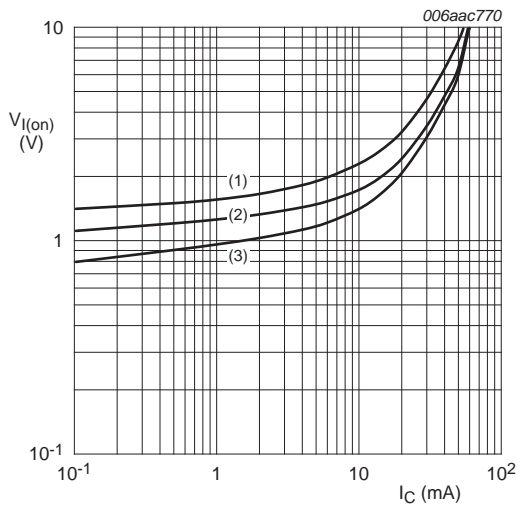
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



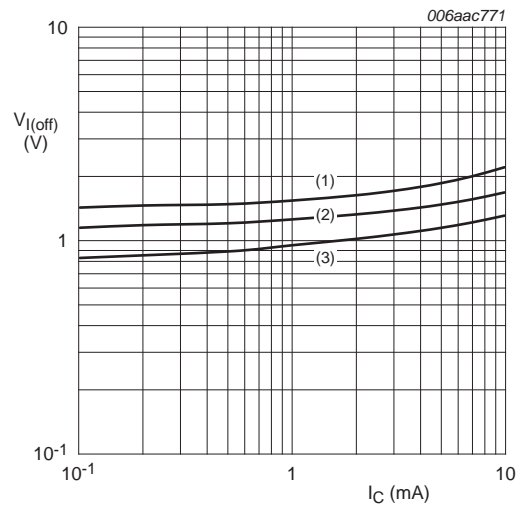
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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

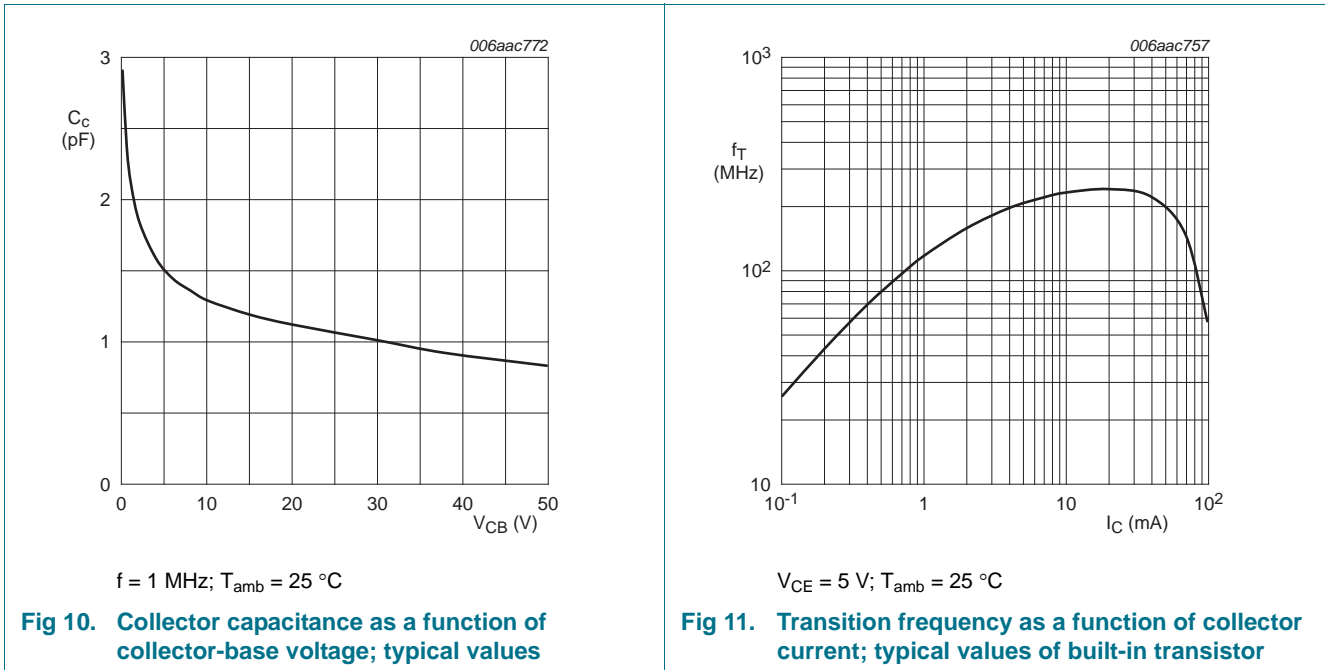
**Fig 8. On-state input voltage as a function of collector current; typical values**



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



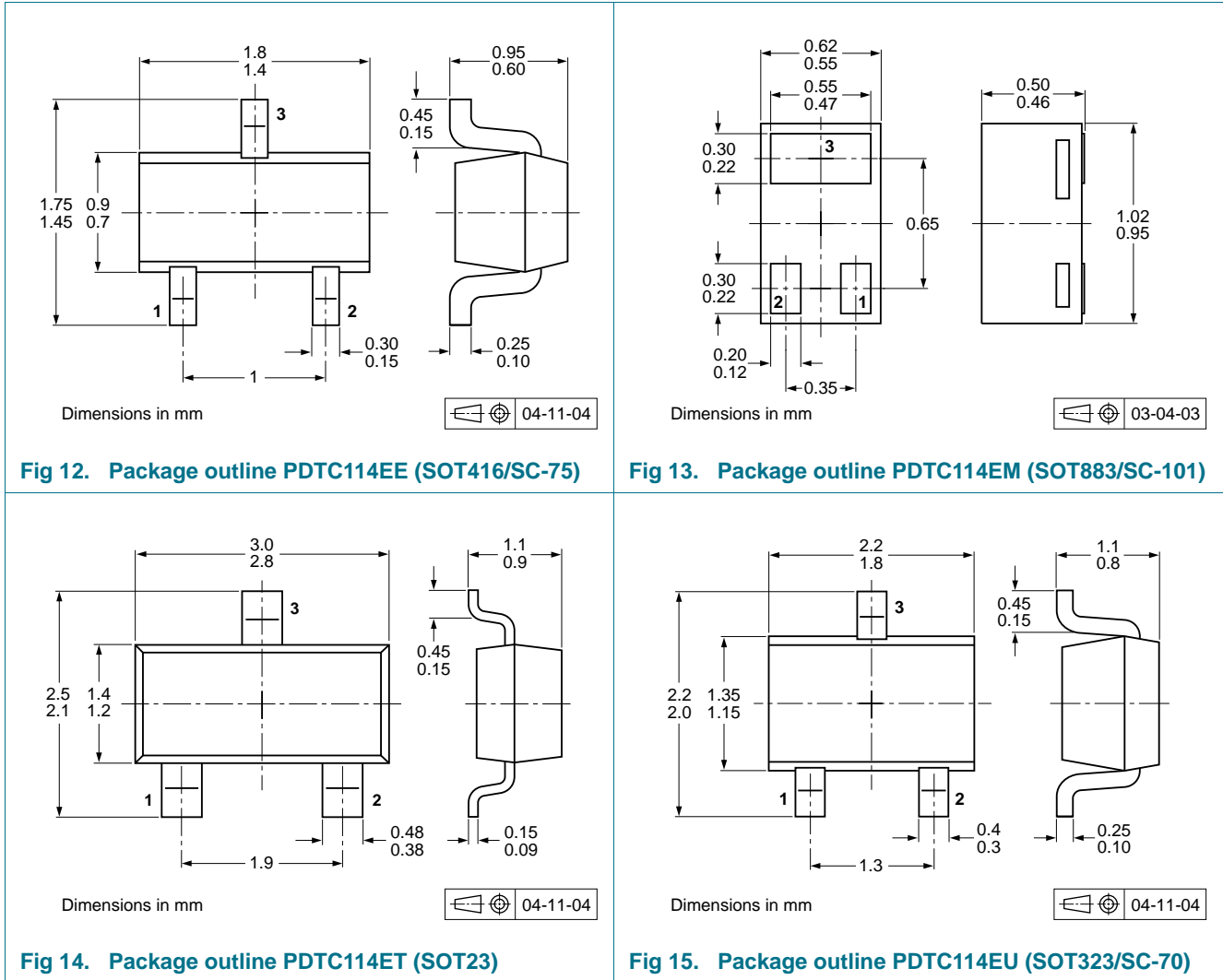


## 8. Test information

### 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**

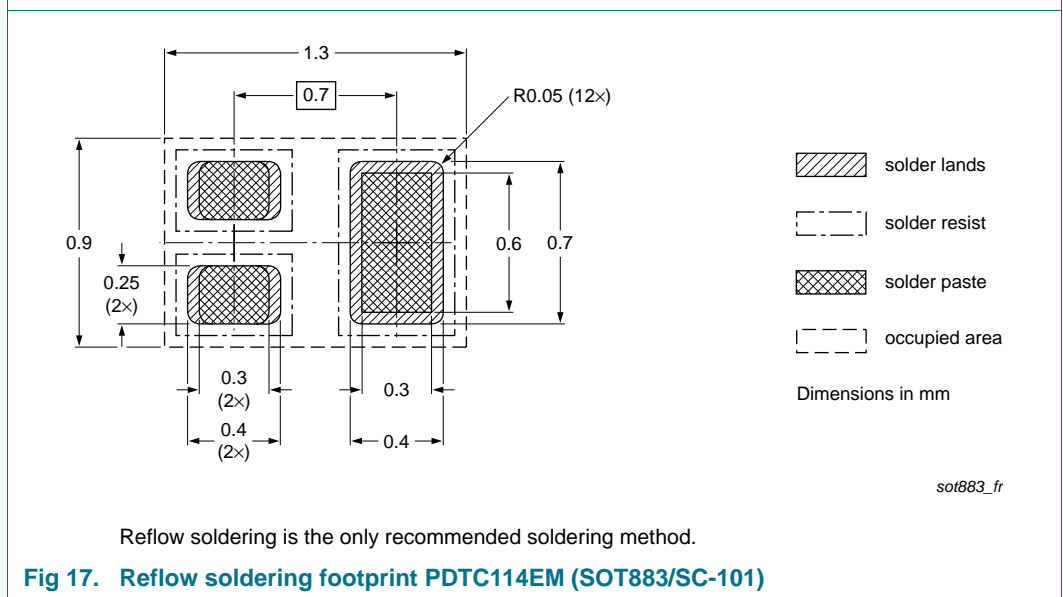
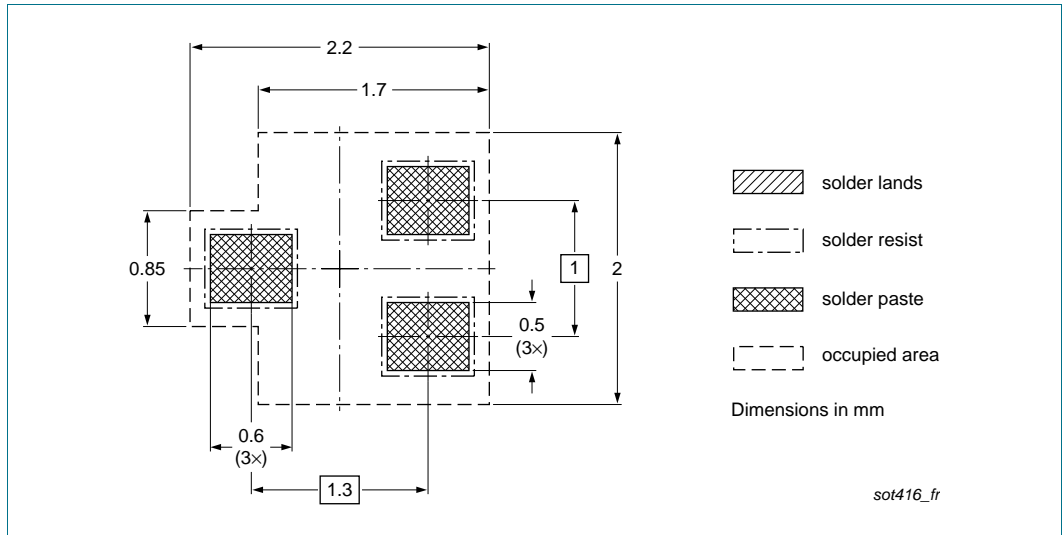
**Table 9. Packing methods**

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

Type number	Package	Description	Packing quantity	
			3000	10000
PDTC114EE	SOT416	4 mm pitch, 8 mm tape and reel	-115	-135
PDTC114EM	SOT883	2 mm pitch, 8 mm tape and reel	-	-315
PDTC114ET	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235
PDTC114EU	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**



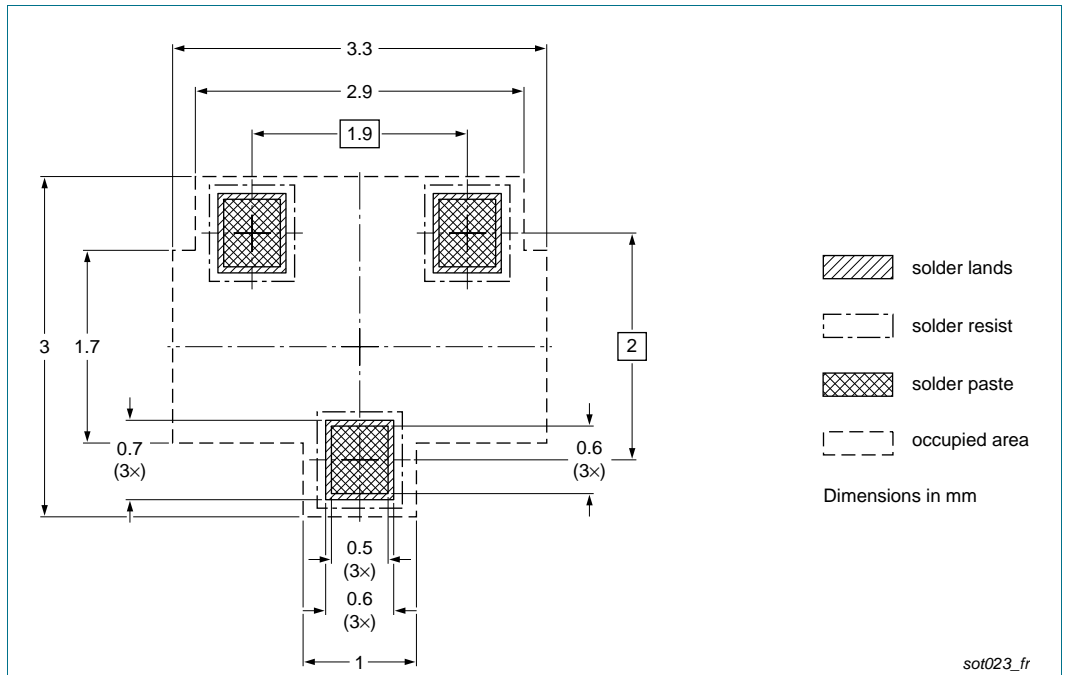


Fig 18. Reflow soldering footprint PDTC114ET (SOT23)

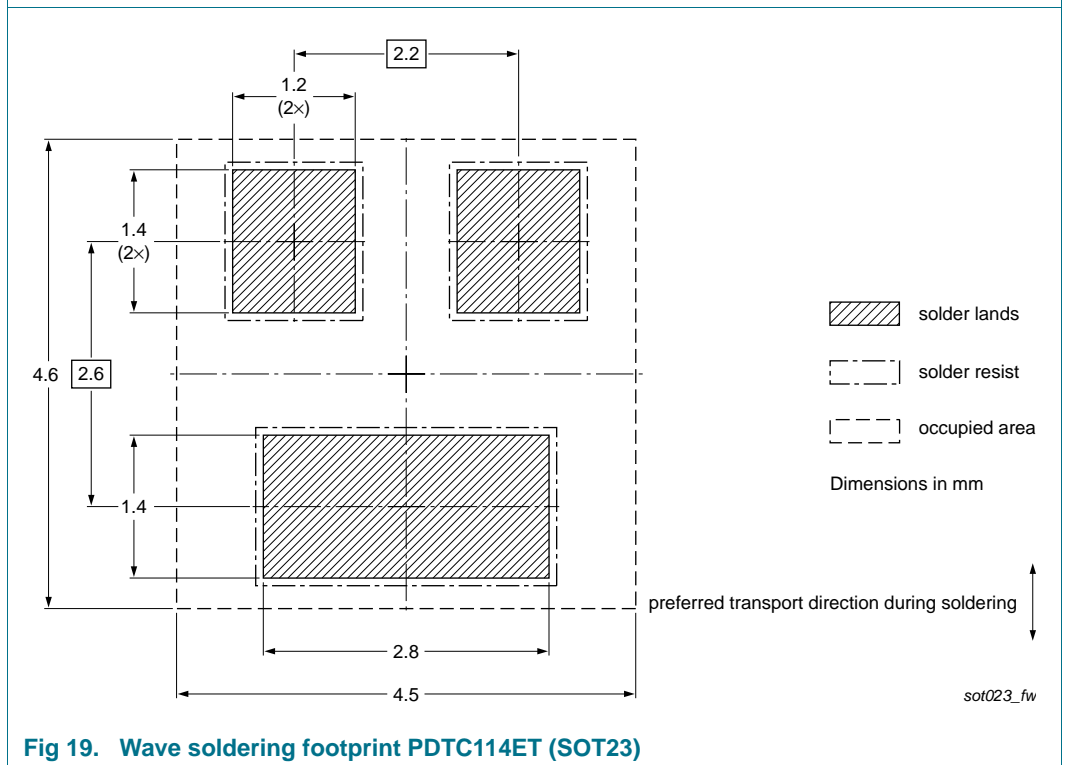
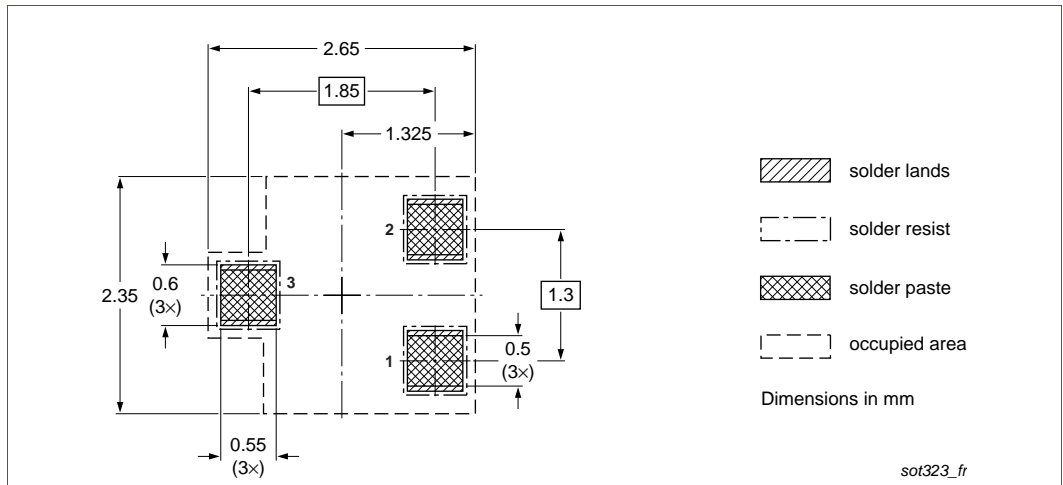
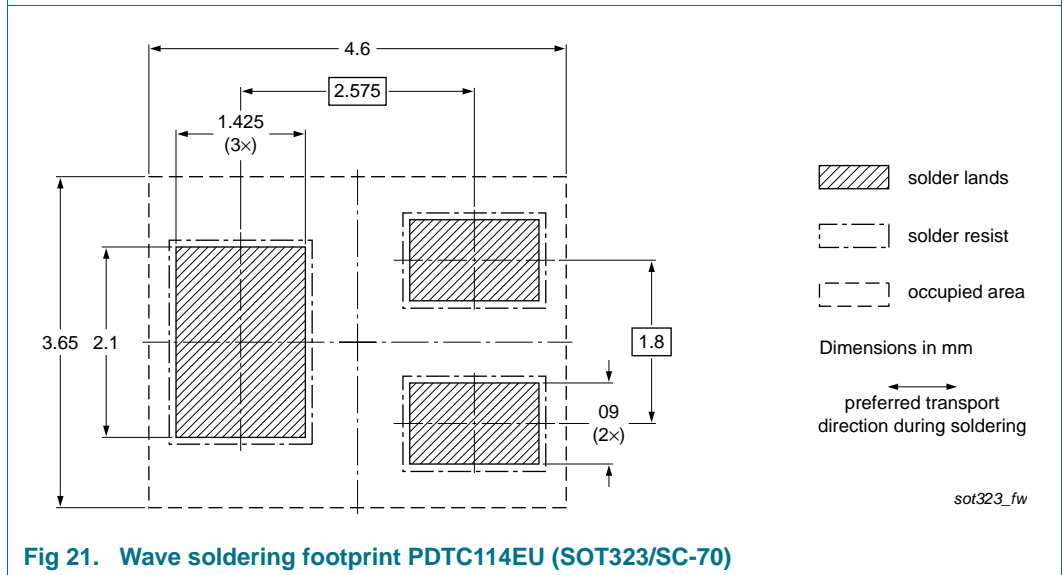


Fig 19. Wave soldering footprint PDTC114ET (SOT23)



**Fig 20. Reflow soldering footprint PDTC114EU (SOT323/SC-70)**



**Fig 21. Wave soldering footprint PDTC114EU (SOT323/SC-70)**

## 12. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PDTC114E_SER v.12	20111221	Product data sheet	-	PDTC114E_SER v.11
Modifications:	• <a href="#">Figure 3</a> and <a href="#">5</a> : corrected			
PDTC114E_SER v.11	20111121	Product data sheet	-	PDTC114E_SERIES v.10
PDTC114E_SERIES v.10	20040805	Product specification	-	PDTC114E_SERIES v.9
PDTC114E_SERIES v.9	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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