

# PDTC124X series

NPN resistor-equipped transistors; R1 = 22 k $\Omega$ , R2 = 47 k $\Omega$

Rev. 07 — 16 November 2009

Product data sheet

## 1. Product profile

### 1.1 General description

NPN Resistor-Equipped Transistors (RET) family.

Table 1. Product overview

Type number	Package			PNP complement
	NXP	JEITA	JEDEC	
PDTC124XE	SOT416	SC-75	-	PDTA124XE
PDTC124XEF	SOT490	SC-89	-	PDTA124XEF
PDTC124XK	SOT346	SC-59A	TO-236	PDTA124XK
PDTC124XM	SOT883	SC-101	-	PDTA124XM
PDTC124XS <sup>[1]</sup>	SOT54	SC-43A	TO-92	PDTA124XS
PDTC124XT	SOT23	-	TO-236AB	PDTA124XT
PDTC124XU	SOT323	SC-70	-	PDTA124XU

[1] Also available in SOT54A and SOT54 variant packages (see [Section 2](#)).

### 1.2 Features

- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs

### 1.3 Applications

- General-purpose switching and amplification
- Inverter and interface circuits
- Circuit drivers

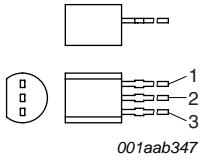
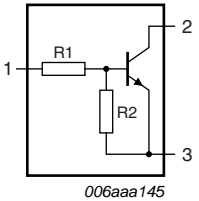
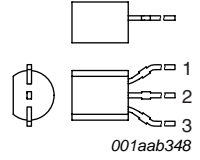
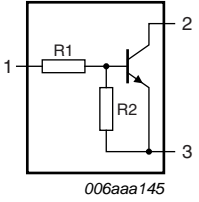
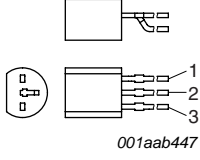
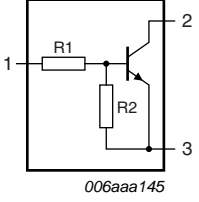
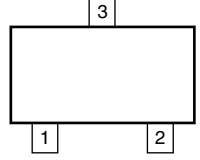
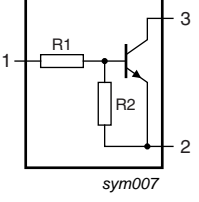
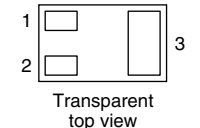
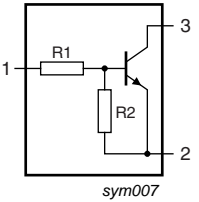
### 1.4 Quick reference data

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)		15.4	22	28.6	k $\Omega$
R2/R1	bias resistor ratio		1.7	2.1	2.6	

## 2. Pinning information

**Table 3. Pinning**

Pin	Description	Simplified outline	Symbol
<b>SOT54</b>			
1	input (base)	 001aab347	 006aaa145
2	output (collector)		
3	GND (emitter)		
<b>SOT54A</b>			
1	input (base)	 001aab348	 006aaa145
2	output (collector)		
3	GND (emitter)		
<b>SOT54 variant</b>			
1	input (base)	 001aab447	 006aaa145
2	output (collector)		
3	GND (emitter)		
<b>SOT23; SOT323; SOT346; SOT416; SOT490</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		Version
	Name	Description	
PDTC124XE	SC-75	plastic surface mounted package; 3 leads	SOT416
PDTC124XEF	SC-89	plastic surface mounted package; 3 leads	SOT490
PDTC124XK	SC-59A	plastic surface mounted package; 3 leads	SOT346
PDTC124XM	SC-101	leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm	SOT883
PDTC124XS <sup>[1]</sup>	SC-43A	plastic single-ended leaded (through hole) package; 3 leads	SOT54
PDTC124XT	-	plastic surface mounted package; 3 leads	SOT23
PDTC124XU	SC-70	plastic surface mounted package; 3 leads	SOT323

[1] Also available in SOT54A and SOT54 variant packages (see [Section 2](#) and [Section 9](#)).

### 4. Marking

Table 5. Marking codes

Type number	Marking code <sup>[1]</sup>
PDTC124XE	32
PDTC124XEF	32
PDTC124XK	51
PDTC124XM	DZ
PDTC124XS	TC124X
PDTC124XT	*46
PDTC124XU	*51

[1] \* = -: made in Hong Kong  
 \* = p: made in Hong Kong  
 \* = t: made in Malaysia  
 \* = W: made in China

## 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	-	7	V	
V <sub>I</sub>	input voltage					
	positive		-	+40	V	
	negative		-	-7	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				
	SOT416		[1]	-	150	mW
	SOT490		[1][2]	-	250	mW
	SOT346		[1]	-	250	mW
	SOT883		[2][3]	-	250	mW
	SOT54		[1]	-	500	mW
	SOT23		[1]	-	250	mW
	SOT323		[1]	-	200	mW
T <sub>stg</sub>	storage temperature		-65	+150	°C	
T <sub>j</sub>	junction temperature		-	150	°C	
T <sub>amb</sub>	ambient 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 60  $\mu$ 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				
	SOT416		[1] -	-	833	K/W
	SOT490		[1][2] -	-	500	K/W
	SOT346		[1] -	-	500	K/W
	SOT883		[2][3] -	-	500	K/W
	SOT54		[1] -	-	250	K/W
	SOT23		[1] -	-	500	K/W
	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.

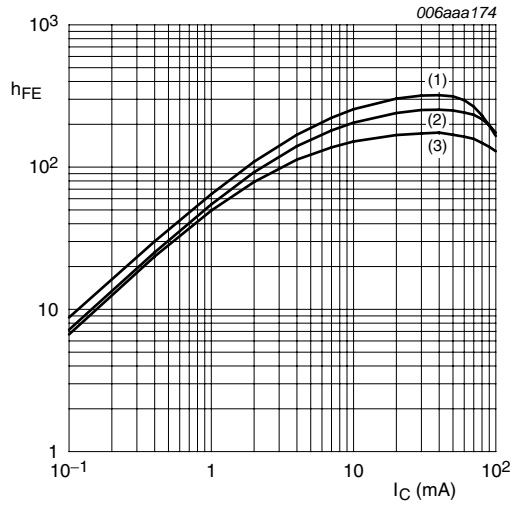
[3] Device mounted on an FR4 PCB with 60  $\mu$ m copper strip line, standard footprint.

## 7. Characteristics

**Table 8. Characteristics**

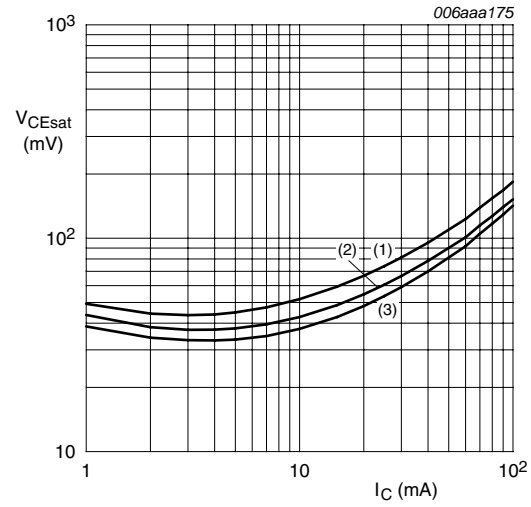
$T_{amb} = 25$  °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	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	-	-	1	$\mu$ A
		$V_{CE} = 30$ V; $I_B = 0$ A; $T_j = 150$ °C	-	-	50	$\mu$ A
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5$ V; $I_C = 0$ A	-	-	120	$\mu$ A
$h_{FE}$	DC current gain	$V_{CE} = 5$ V; $I_C = 5$ mA	80	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	-	-	150	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5$ V; $I_C = 100$ $\mu$ A	-	0.8	0.5	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 300$ mV; $I_C = 2$ mA	2	1.1	-	V
R1	bias resistor 1 (input)		15.4	22	28.6	k $\Omega$
R2/R1	bias resistor ratio		1.7	2.1	2.6	
$C_c$	collector capacitance	$V_{CB} = 10$ V; $I_E = i_e = 0$ A; $f = 1$ MHz	-	-	2.5	pF



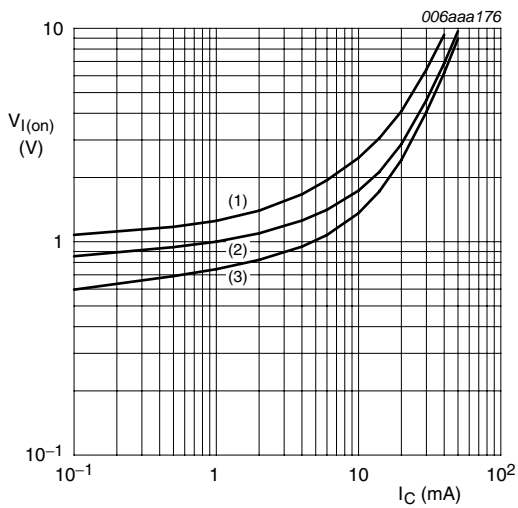
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 1. DC current gain as a function of collector current; typical values**



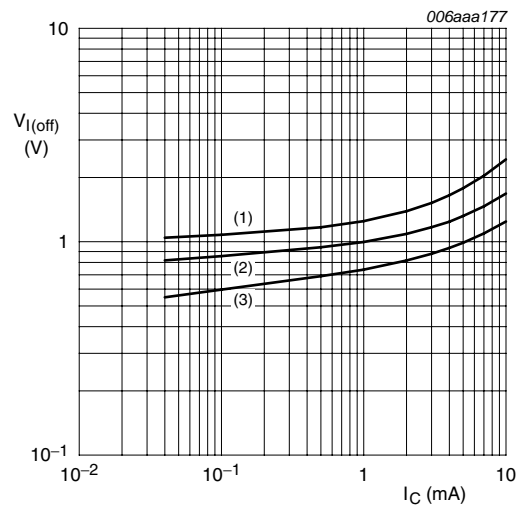
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig 2. 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)  $T_{amb} = 100 \text{ }^\circ\text{C}$

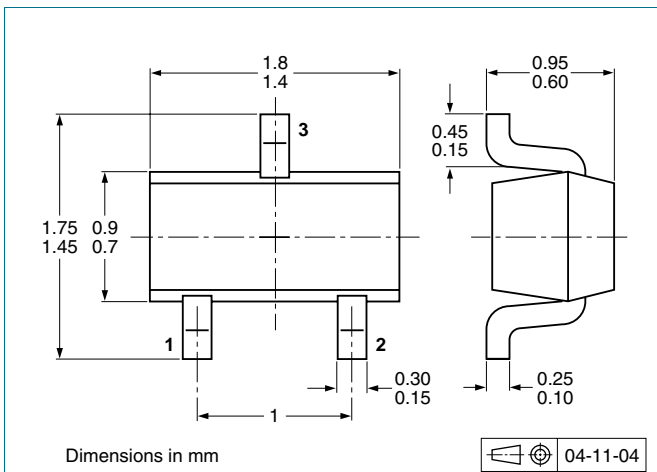
**Fig 3. On-state input voltage as a function of collector current; typical values**



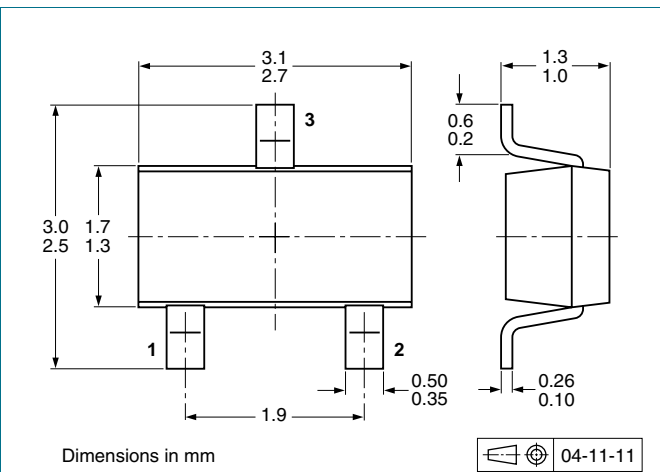
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 4. Off-state input voltage as a function of collector current; typical values**

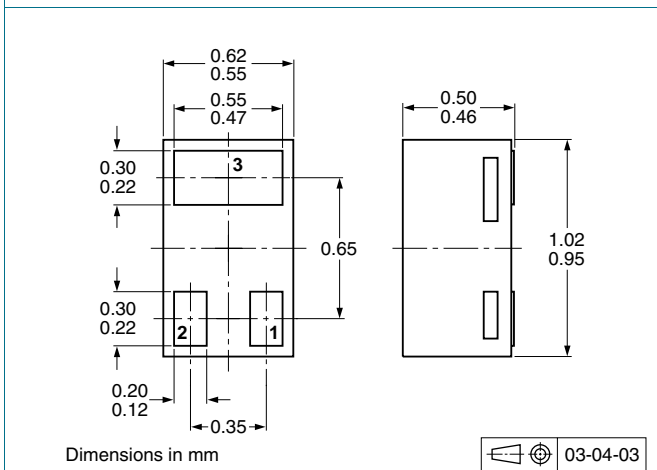
## 8. Package outline



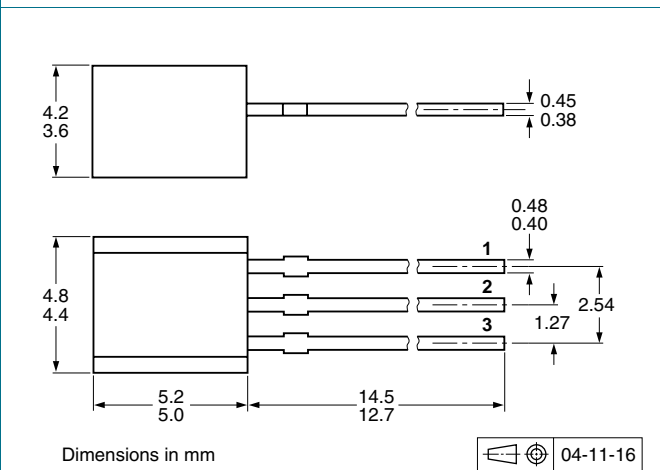
**Fig 5. Package outline SOT416 (SC-75)**



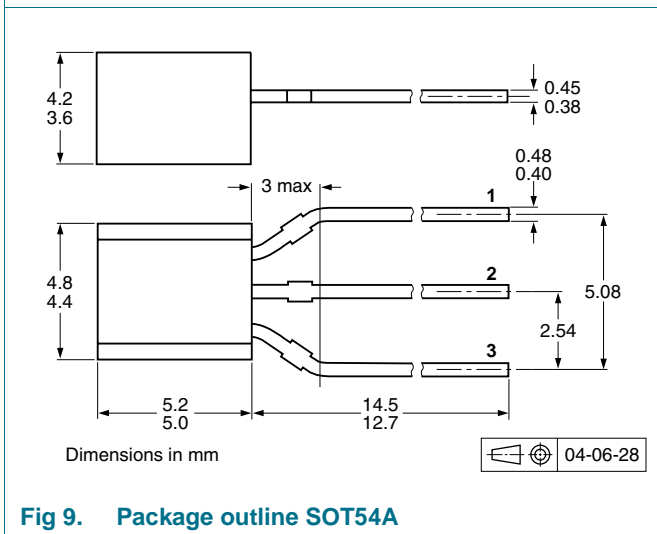
**Fig 6. Package outline SOT346 (SC-59A/TO-236)**



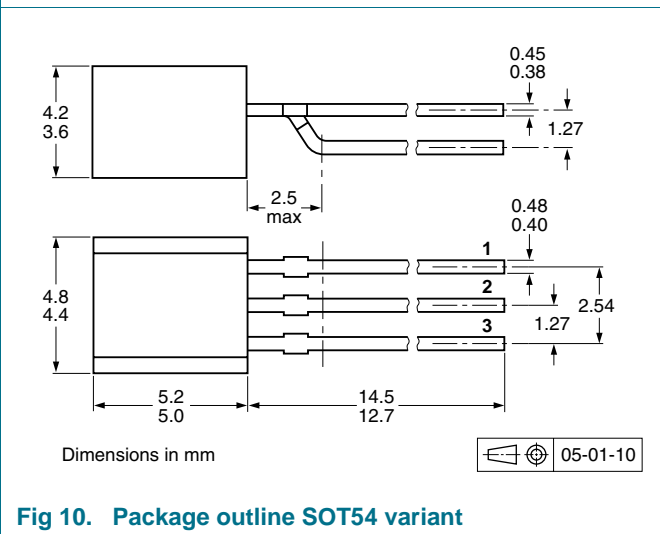
**Fig 7. Package outline SOT883 (SC-101)**



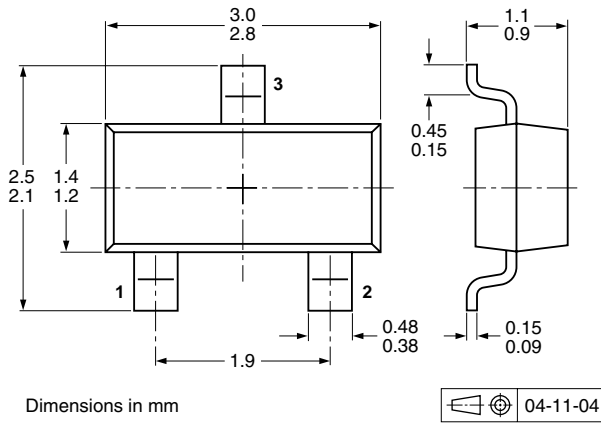
**Fig 8. Package outline SOT54 (SC-43A/TO-92)**



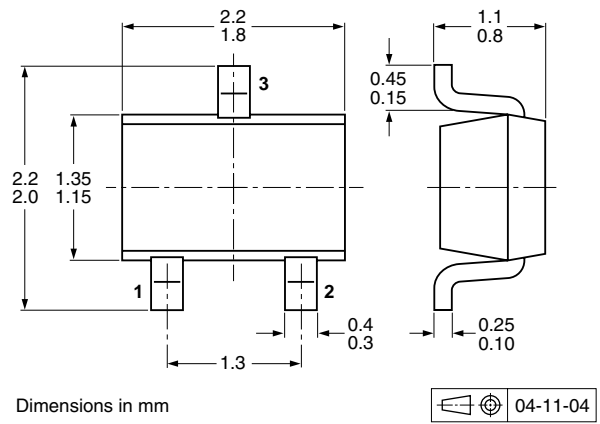
**Fig 9. Package outline SOT54A**



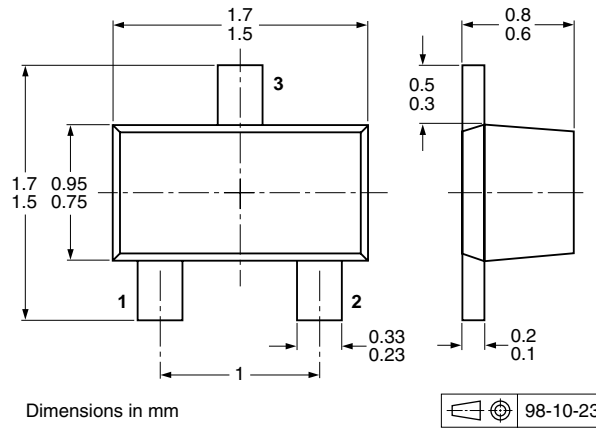
**Fig 10. Package outline SOT54 variant**



**Fig 11. Package outline SOT23 (TO-236AB)**



**Fig 12. Package outline SOT323 (SC-70)**



**Fig 13. Package outline SOT490 (SC-89)**



## 9. 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	4000	5000	10000
PDTC124XE	SOT416	4 mm pitch, 8 mm tape and reel	-115	-	-	-135
PDTC124XEF	SOT490	4 mm pitch, 8 mm tape and reel	-	-115	-	-
PDTC124XK	SOT346	4 mm pitch, 8 mm tape and reel	-115	-	-	-135
PDTC124XM	SOT883	2 mm pitch, 8 mm tape and reel	-	-	-	-315
PDTC124XS	SOT54	bulk, straight leads	-	-	-412	-
	SOT54A	tape and reel, wide pitch	-	-	-	-116
		tape ammopack, wide pitch	-	-	-	-126
	SOT54 variant	bulk, delta pinning	-	-	-112	-
PDTC124XT	SOT23	4 mm pitch, 8 mm tape and reel	-215	-	-	-235
PDTC124XU	SOT323	4 mm pitch, 8 mm tape and reel	-115	-	-	-135

[1] For further information and the availability of packing methods, see [Section 12](#).

## 10. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PDTC124X_SER_7	20091116	Product data sheet	-	PDTC124X_SER_6
Modifications:	<ul style="list-style-type: none"> <li>This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content.</li> </ul>			
PDTC124X_SER_6	20050714	Product data sheet	-	PDTC124X_SERIES_5
PDTC124X_SERIES_5	20040813	Product specification	-	PDTC124X_SERIES_4
PDTC124X_SERIES_4	20030410	Product specification	-	PDTC124XEF_2 PDTC124XE_3
PDTC124XE_3	19990518	Product specification	-	PDTC124XE_2
PDTC124XE_2	19980921	Product specification	-	PDTC124XE_1
PDTC124XE_1	19971215	Product specification	-	-
PDTC124XEF_2	19990518	Preliminary specification	-	PDTC124XEF_1
PDTC124XEF_1	19981111	Preliminary specification	-	-

## 11. Legal information

### 11.1 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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