PDTC124E series

NPN resistor-equipped transistors; R1 = 22 kΩ, R2 = 22 kΩ

Rev. 8 — 28 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
	NXP	JEITA	JEDEC		
PDTC124EE	SOT416	SC-75	-	PDTA124EE	ultra small
PDTC124EM	SOT883	SC-101	-	PDTA124EM	leadless ultra small
PDTC124ET	SOT23	-	TO-236AB	PDTA124ET	small
PDTC124EU	SOT323	SC-70	-	PDTA124EU	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

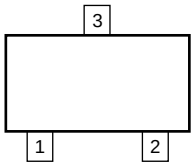
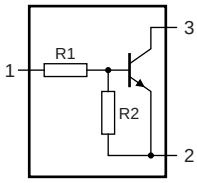
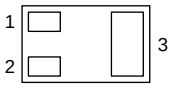
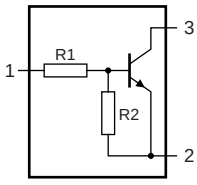
1.4 Quick reference data

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)		15.4	22	28.6	kΩ
R2/R1	bias resistor ratio		0.8	1	1.2	

2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
SOT23; SOT323; SOT416			
1	input (base)	 006aaa144	 sym007
2	GND (emitter)		
3	output (collector)		
SOT883			
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
PDTC124EE	SC-75	plastic surface-mounted package; 3 leads	SOT416
PDTC124EM	SC-101	leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm	SOT883
PDTC124ET	-	plastic surface-mounted package; 3 leads	SOT23
PDTC124EU	SC-70	plastic surface-mounted package; 3 leads	SOT323

4. Marking

Table 5. Marking codes

Type number	Marking code[1]
PDTC124EE	06
PDTC124EM	DX
PDTC124ET	*17
PDTC124EU	*06

[1] * = placeholder for manufacturing site code

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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; $t_p \leq 1$ ms		-	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C				
	PDTC124EE (SOT416)		[1][2]	-	150	mW
	PDTC124EM (SOT883)		[2][3]	-	250	mW
	PDTC124ET (SOT23)		[1]	-	250	mW
	PDTC124EU (SOT323)		[1]	-	200	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			−65	+150	°C
T_{stg}	storage temperature			−65	+150	°C

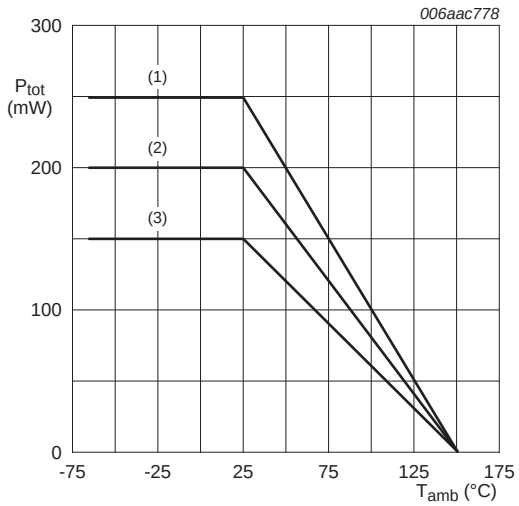
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

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

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

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(1) SOT23; FR4 PCB, standard footprint
SOT883; FR4 PCB with 70 μm copper strip line, standard footprint

(2) SOT323; FR4 PCB, standard footprint

(3) SOT416; FR4 PCB, standard footprint

Fig 1. Power derating curves

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					
	PDTC124EE (SOT416)		[1][2]	-	-	830	K/W
	PDTC124EM (SOT883)		[2][3]	-	-	500	K/W
	PDTC124ET (SOT23)		[1]	-	-	500	K/W
	PDTC124EU (SOT323)		[1]	-	-	625	K/W

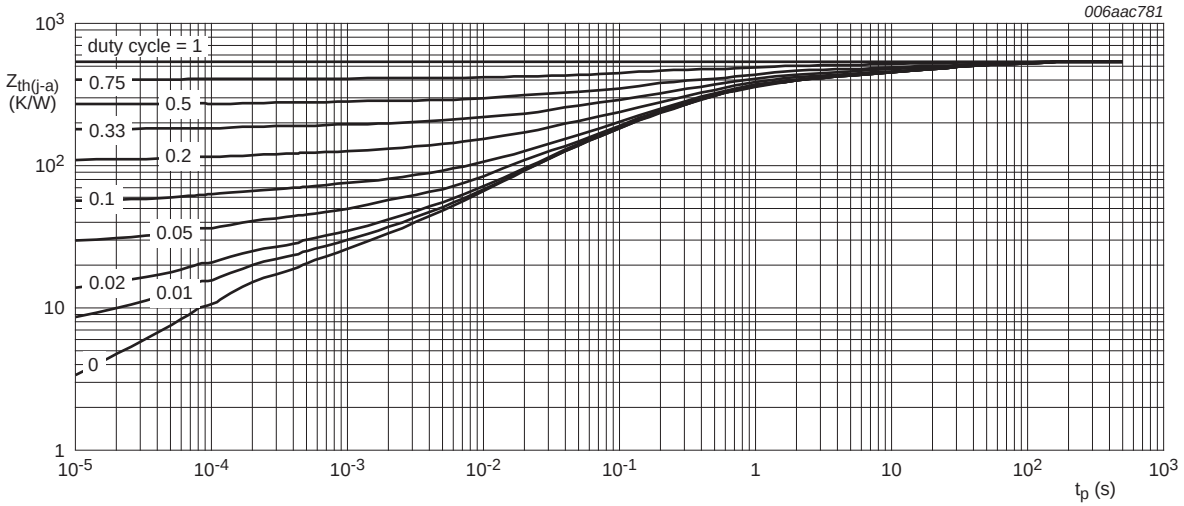
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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

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

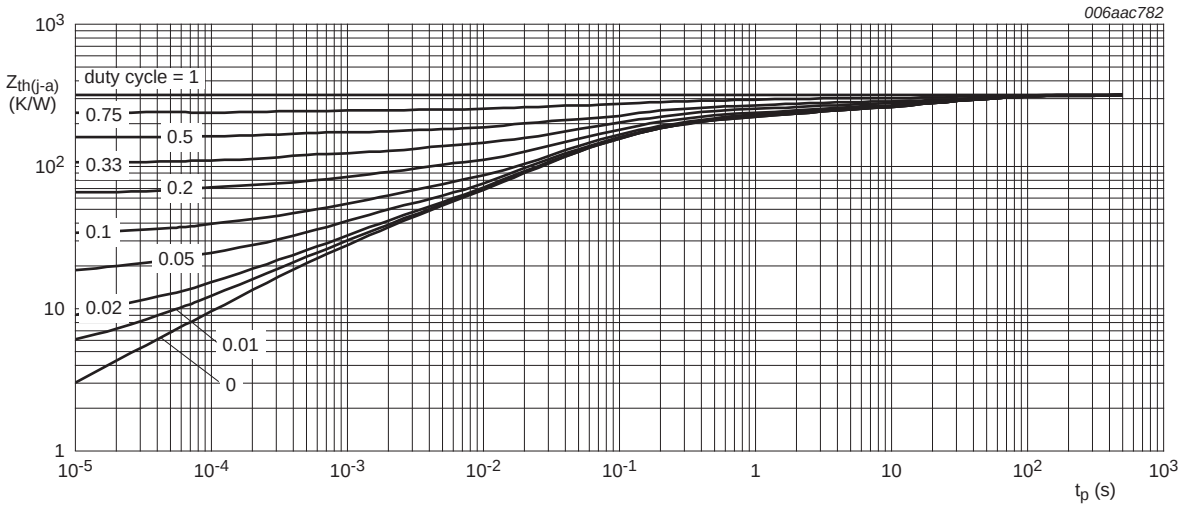
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FR4 PCB, standard footprint

Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC124EE (SOT416); typical values

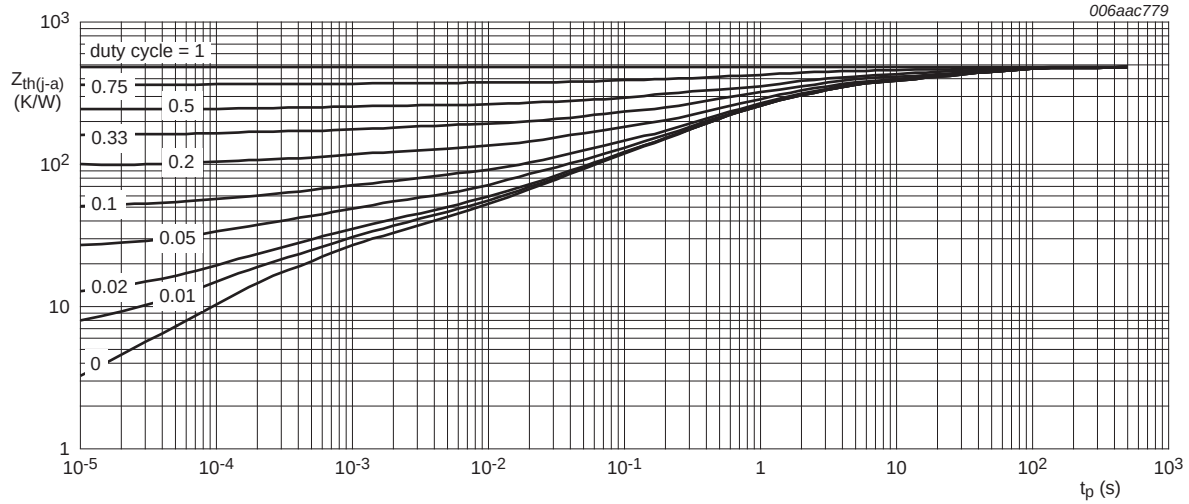


FR4 PCB, 70 μm copper strip line

Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC124EM (SOT883); typical values

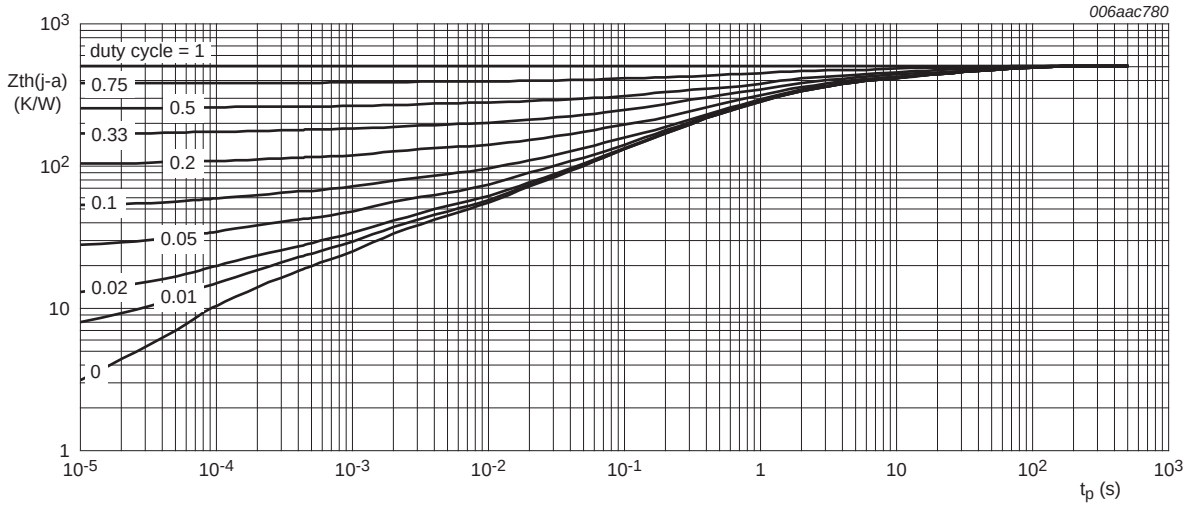
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FR4 PCB, standard footprint

Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC124ET (SOT23); typical values



FR4 PCB, standard footprint

Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC124EU (SOT323); typical values

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7. Characteristics

Table 8. Characteristics

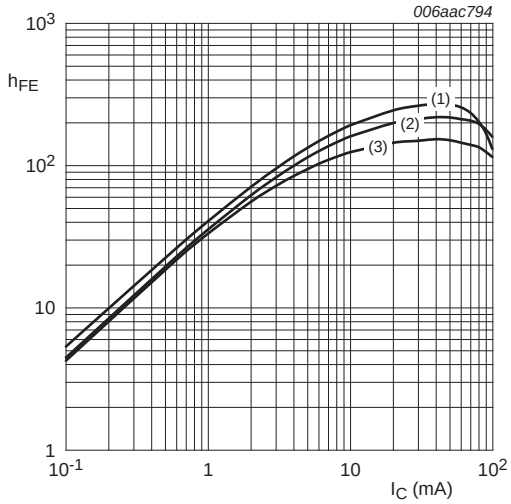
T_{amb} = 25 °C unless otherwise specified.

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		-	-	100	nA
		V_{CE} = 30 V; I_B = 0 A; T_j = 150 °C		-	-	5	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A		-	-	180	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 5 mA		60	-	-	
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 μA		-	1.1	0.8	V
$V_{I(on)}$	on-state input voltage	V_{CE} = 0.3 V; I_C = 5 mA		2.5	1.7	-	V
R1	bias resistor 1 (input)			15.4	22	28.6	kΩ
R2/R1	bias resistor ratio			0.8	1	1.2	
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	-	2.5	pF
f_T	transition frequency	V_{CE} = 5 V; I_C = 10 mA; f = 100 MHz	[1]	-	230	-	MHz

[1] Characteristics of built-in transistor

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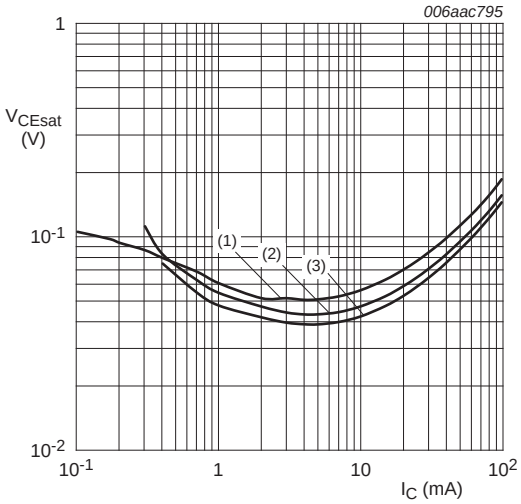
V_{CE} = 5 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

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



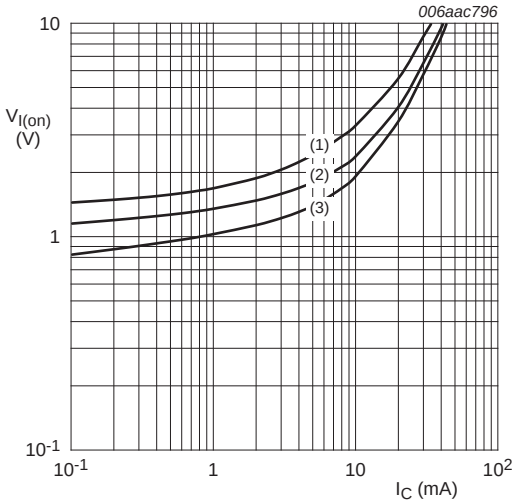
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

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



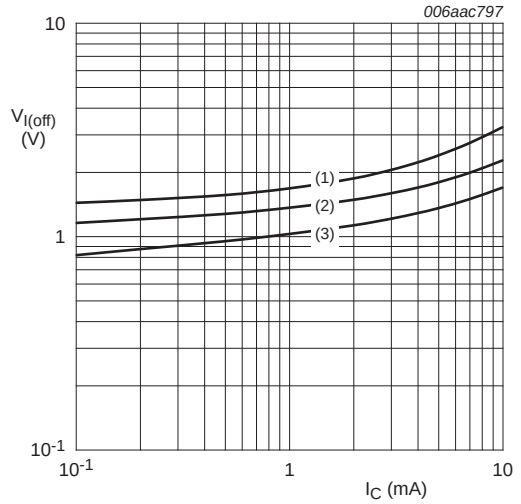
V_{CE} = 0.3 V

(1) T_{amb} = −40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



V_{CE} = 5 V

(1) T_{amb} = −40 °C

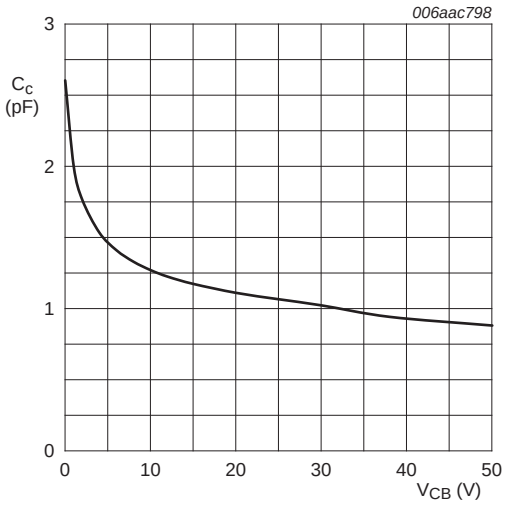
(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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

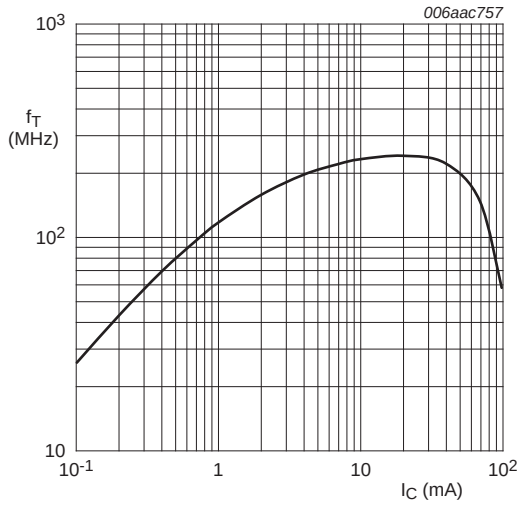
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f = 1 MHz; T_{amb} = 25 °C

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



V_{CE} = 5 V; T_{amb} = 25 °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.

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9. Package outline

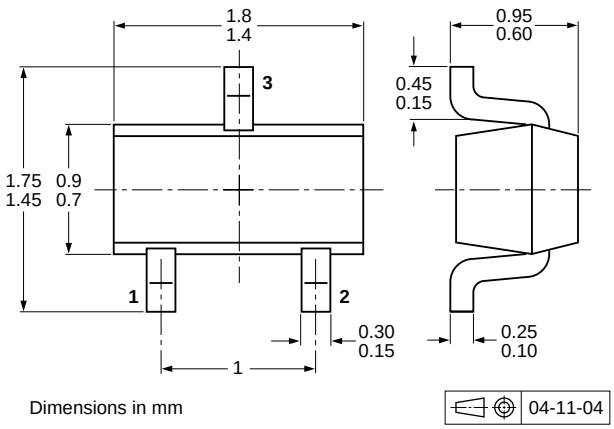


Fig 12. Package outline PDTC124EE (SOT416/SC-75)

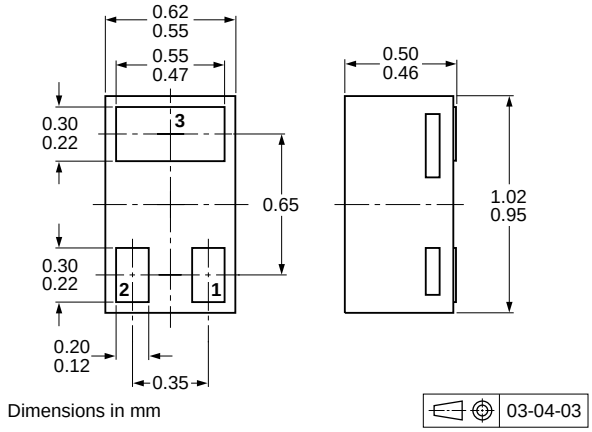


Fig 13. Package outline PDTC124EM (SOT883/SC-101)

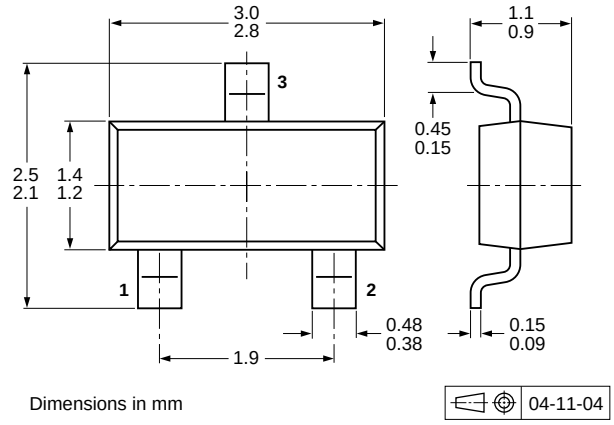


Fig 14. Package outline PDTC124ET (SOT23)

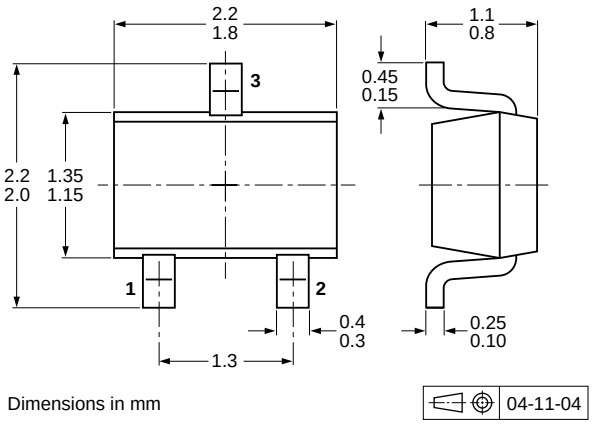


Fig 15. Package outline PDTC124EU (SOT323/SC-70)

10. Packing information

Table 9. Packing methods

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

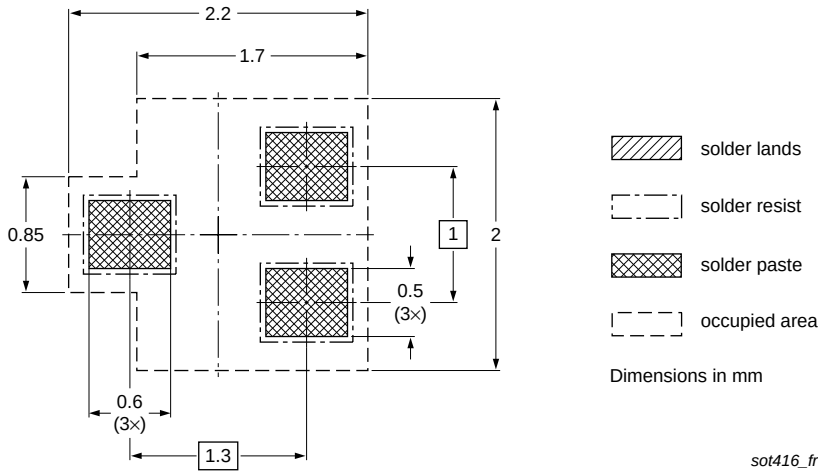
Type number	Package	Description	Packing quantity		
			3000	5000	10000
PDTC124EE	SOT416	4 mm pitch, 8 mm tape and reel	-115	-	-135
PDTC124EM	SOT883	2 mm pitch, 8 mm tape and reel	-	-	-315
PDTC124ET	SOT23	4 mm pitch, 8 mm tape and reel	-215	-	-235
PDTC124EU	SOT323	4 mm pitch, 8 mm tape and reel	-115	-	-135

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

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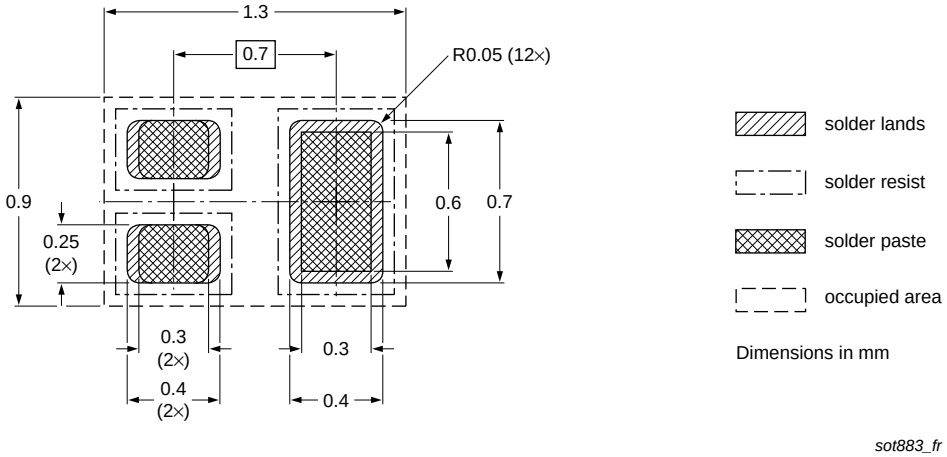
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11. Soldering



Reflow soldering is the only recommended soldering method.

Fig 16. Reflow soldering footprint PDTC124EE (SOT416/SC-75)



Reflow soldering is the only recommended soldering method.

Fig 17. Reflow soldering footprint PDTC124EM (SOT883/SC-101)

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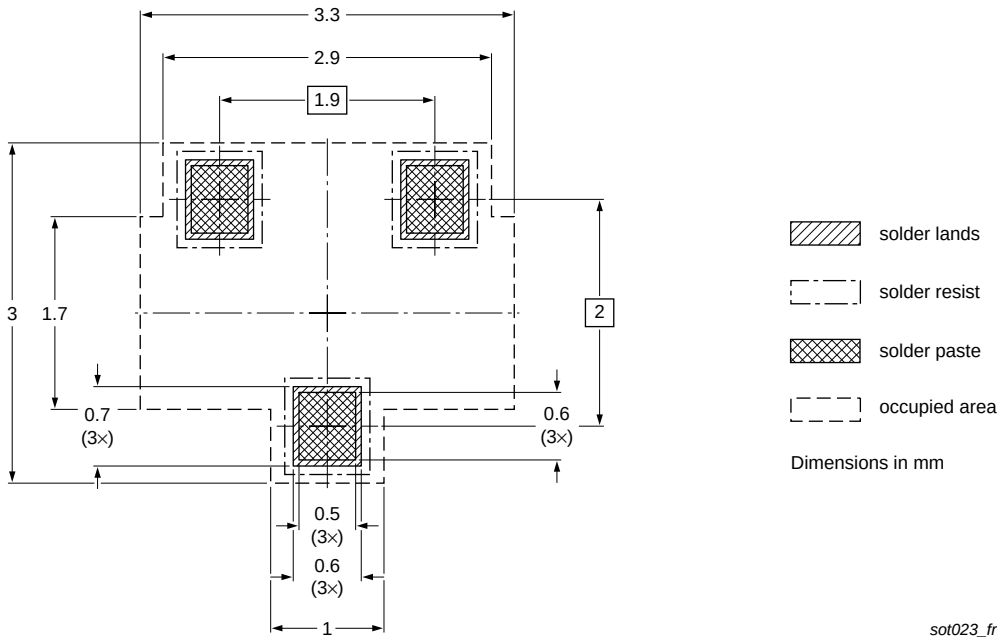


Fig 18. Reflow soldering footprint PDTC124ET (SOT23)

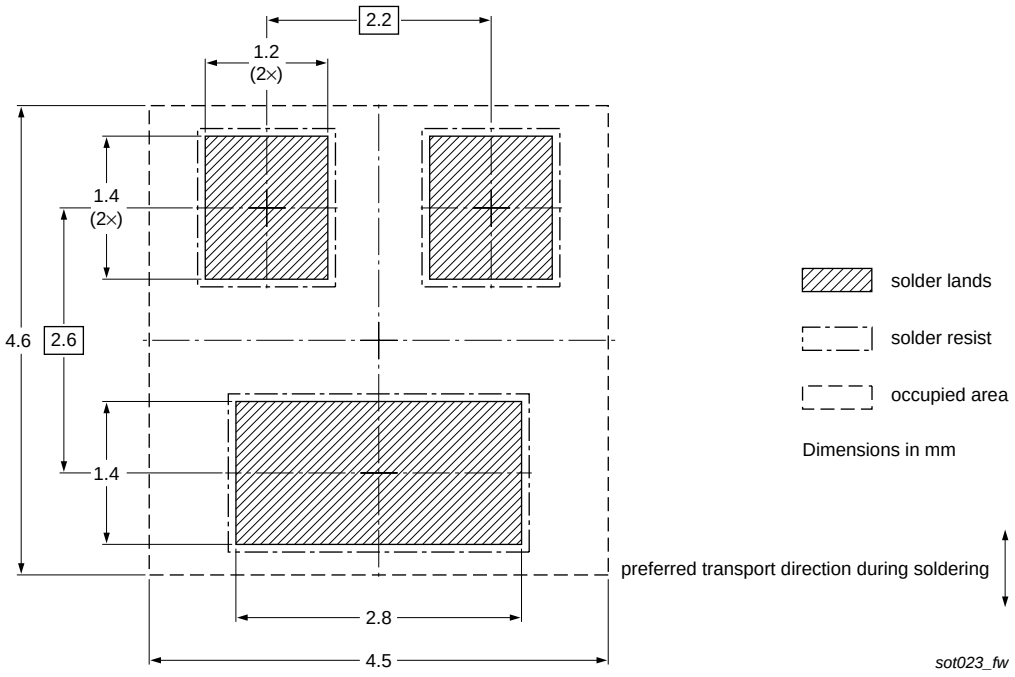


Fig 19. Wave soldering footprint PDTC124ET (SOT23)

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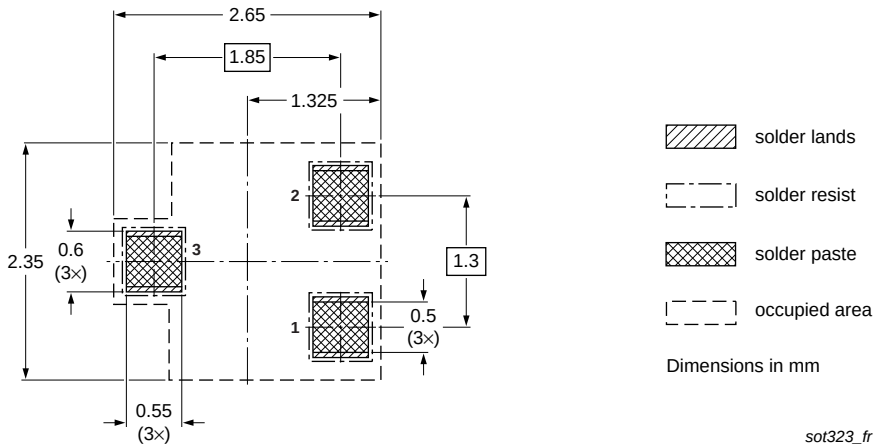


Fig 20. Reflow soldering footprint PDTC124EU (SOT323/SC-70)

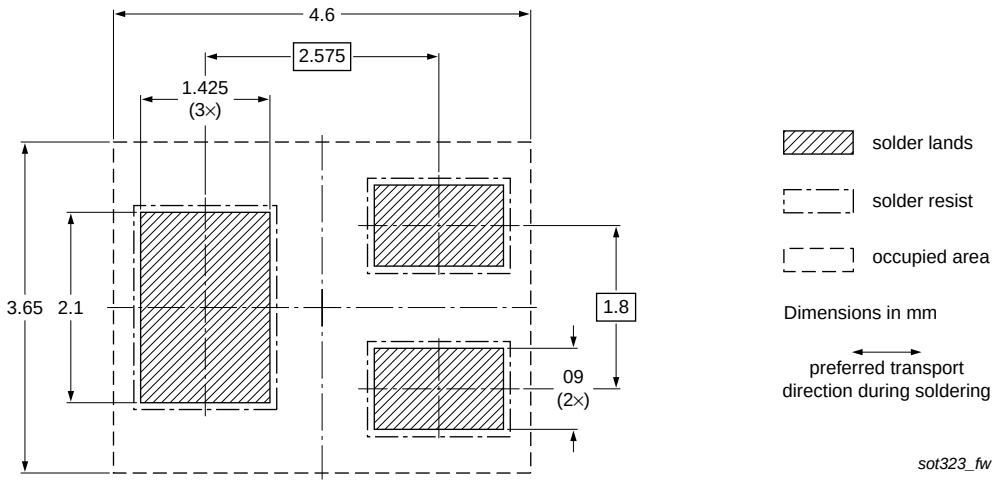


Fig 21. Wave soldering footprint PDTC124EU (SOT323/SC-70)

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12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PDTC124E_SER v.8	20111128	Product data sheet	-	PDTC124E_SERIES v.7
Modifications:	• The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Type numbers PDTC124EEF, PDTC124EK and PDTC124ES removed. • Section 1 “Product profile”: updated • Section 3 “Ordering information”: added • Figure 1 to 11: added • Table 6 “Limiting values”: updated • Section 6 “Thermal characteristics”: updated • Table 8 “Characteristics”: $V_{i(on)}$ redefined to $V_{I(on)}$ on-state input voltage, $V_{i(off)}$ redefined to $V_{I(off)}$ off-state input voltage, I_{CEO} updated, f_T added • Section 8 “Test information”: added • Section 9 “Package outline”: superseded by minimized package outline drawings • Section 10 “Packing information”: added • Section 11 “Soldering”: added • Section 13 “Legal information”: updated			
PDTC124E_SERIES v.7	20040817	Product data sheet	-	PDTC124E_SERIES v.6
PDTC124E_SERIES v.6	20030414	Product specification	-	-

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13. Legal information

13.1 Data sheet status

Document status[1][2]	Product status[3]	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.nxp.com.

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15. Contents

1	**Product profile**	**1**
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
1.4	Quick reference data	1
2	**Pinning information**	**2**
3	**Ordering information**	**2**
4	**Marking**	**2**
5	**Limiting values**	**3**
6	**Thermal characteristics**	**4**
7	**Characteristics**	**7**
8	**Test information**	**9**
8.1	Quality information	9
9	**Package outline**	**10**
10	**Packing information**	**10**
11	**Soldering**	**11**
12	**Revision history**	**14**
13	**Legal information**	**15**
13.1	Data sheet status	15
13.2	Definitions	15
13.3	Disclaimers	15
13.4	Trademarks	16
14	**Contact information**	**16**
15	**Contents**	**17**

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