Important notice

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If you have any questions related to the data sheet, please contact our nearest sales office via e-mail or telephone (details via **salesaddresses@nexperia.com**). Thank you for your cooperation and understanding,

Kind regards,

Team Nexperia

PDTC123J series

NPN resistor-equipped transistors; R1 = 2.2 kΩ, R2 = 47 kΩ

Rev. 7 — 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		
PDTC123JE	SOT416	SC-75	-	PDTA123JE	ultra small
PDTC123JM	SOT883	SC-101	-	PDTA123JM	leadless ultra small
PDTC123JT	SOT23	-	TO-236AB	PDTA123JT	small
PDTC123JU	SOT323	SC-70	-	PDTA123JU	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

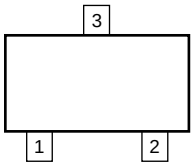
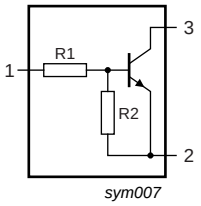
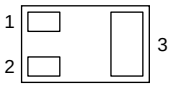
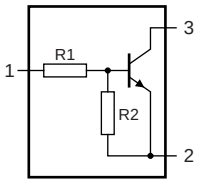
1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	50	V
I_O	output current		-	-	100	mA
R1	bias resistor 1 (input)		1.54	2.20	2.86	kΩ
R2/R1	bias resistor ratio		17	21	26	

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
PDTC123JE	SC-75	plastic surface-mounted package; 3 leads	SOT416
PDTC123JM	SC-101	leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm	SOT883
PDTC123JT	-	plastic surface-mounted package; 3 leads	SOT23
PDTC123JU	SC-70	plastic surface-mounted package; 3 leads	SOT323

4. Marking

Table 5. Marking codes

Type number	Marking code[1]
PDTC123JE	28
PDTC123JM	DW
PDTC123JT	*25
PDTC123JU	*49

[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			-	+12	V
	negative			-	−5	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				
	PDTC123JE (SOT416)		[1][2]	-	150	mW
	PDTC123JM (SOT883)		[2][3]	-	250	mW
	PDTC123JT (SOT23)		[1]	-	250	mW
	PDTC123JU (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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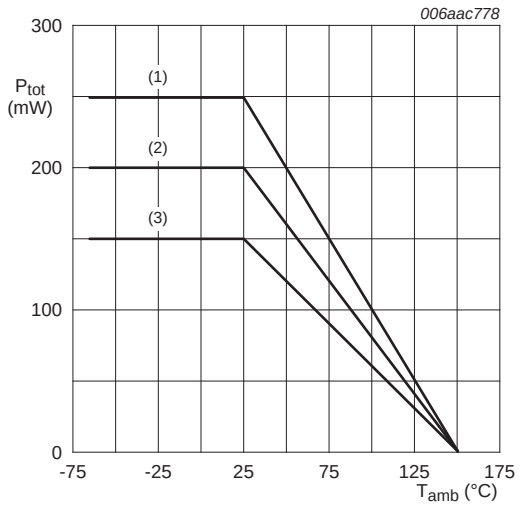

(1) SOT23; FR4 PCB, standard footprint
SOT883; FR4 PCB with 70 μm copper strip line, standard footprint

(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					
	PDTC123JE (SOT416)		[1][2]	-	-	830	K/W
	PDTC123JM (SOT883)		[2][3]	-	-	500	K/W
	PDTC123JT (SOT23)		[1]	-	-	500	K/W
	PDTC123JU (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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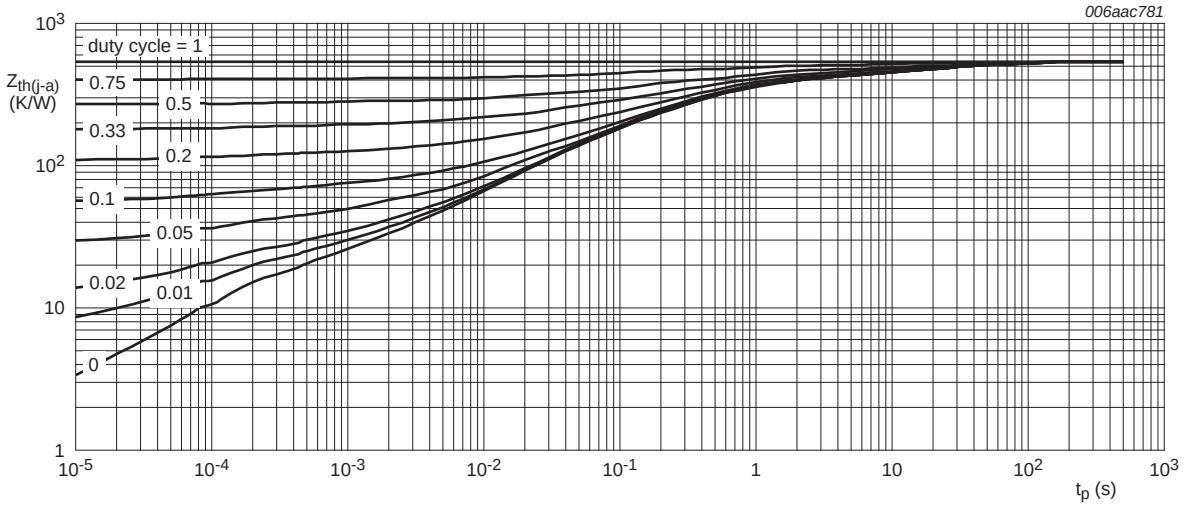
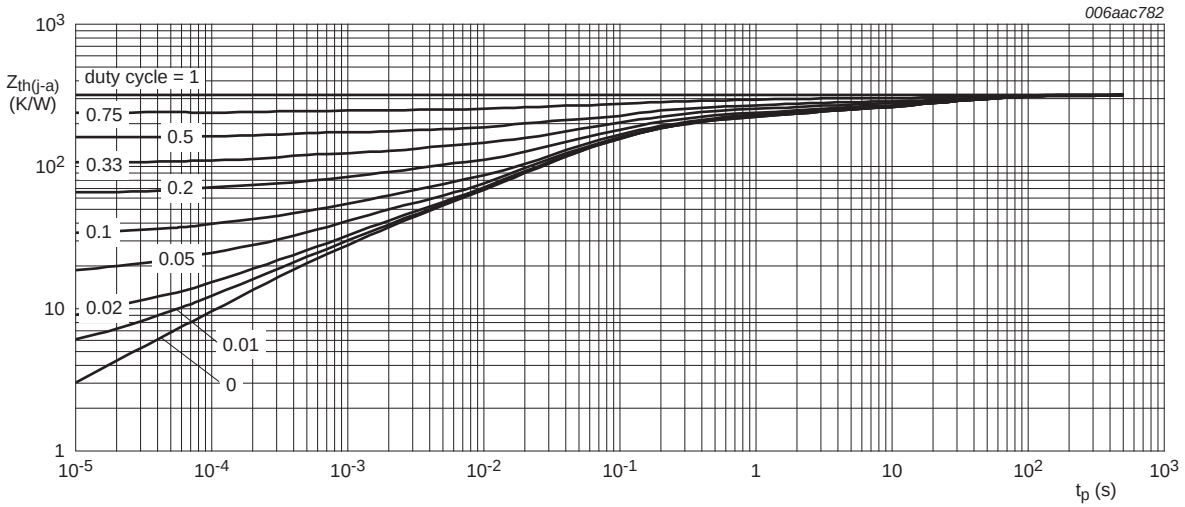


FR4 PCB, standard footprint

Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC123JE (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 PDTC123JM (SOT883); typical values

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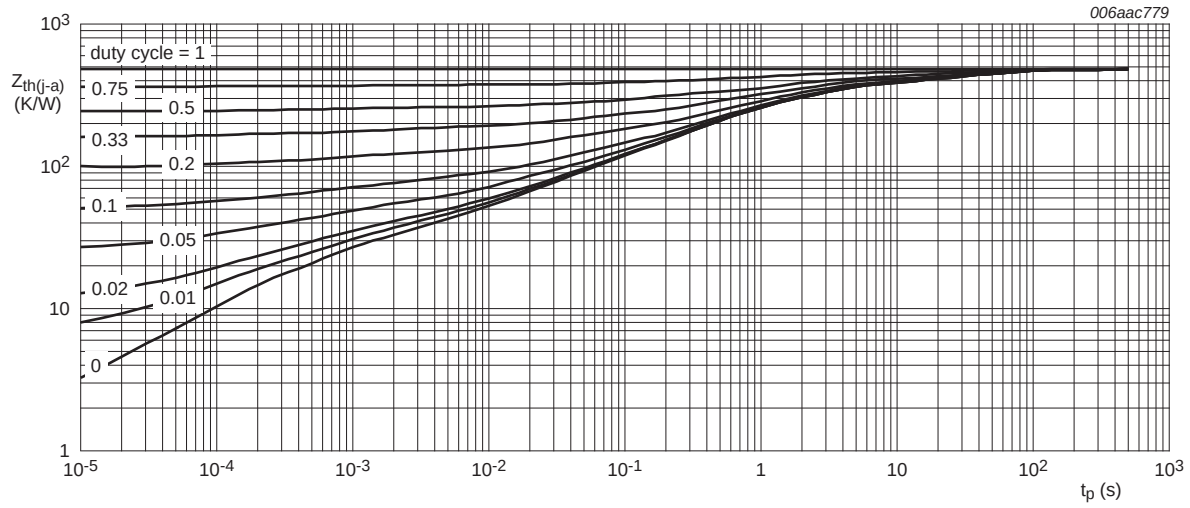
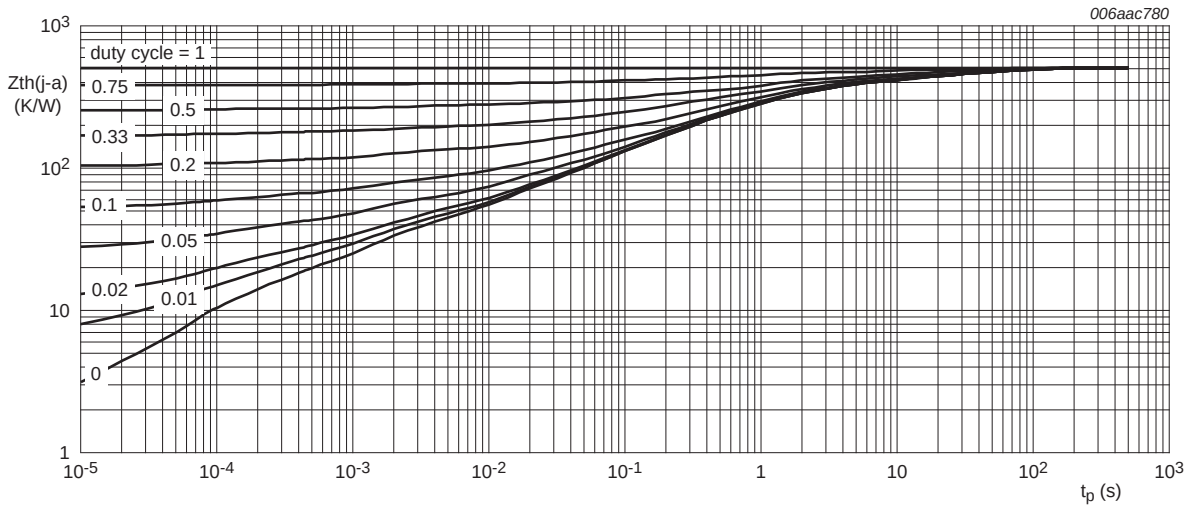


FR4 PCB, standard footprint

Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC123JT (SOT23); typical values



FR4 PCB, standard footprint

Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC123JU (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		-	-	1	μA
		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 = 10 mA		100	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.25 mA		-	-	100	mV
$V_{I(off)}$	off-state input voltage	V_{CE} = 5 V; I_C = 100 μA		-	0.6	0.5	V
$V_{I(on)}$	on-state input voltage	V_{CE} = 0.3 V; I_C = 5 mA		1.1	0.75	-	V
R1	bias resistor 1 (input)			1.54	2.20	2.86	kΩ
R2/R1	bias resistor ratio			17	21	26	
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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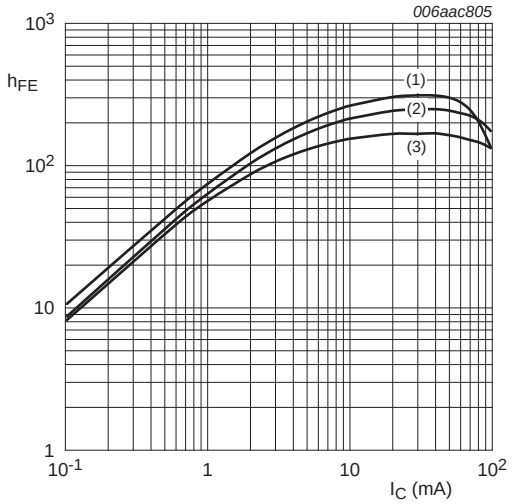


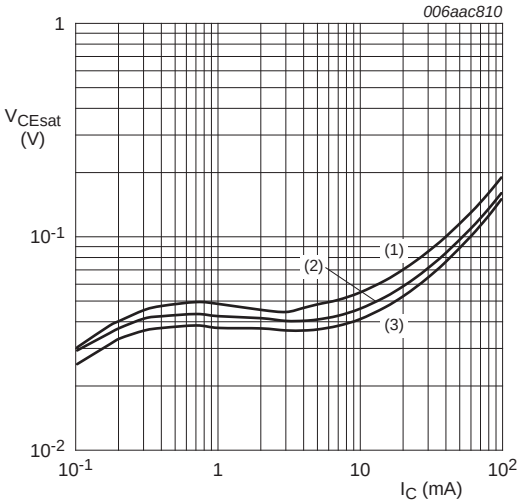
V_{CE} = 5 V

(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



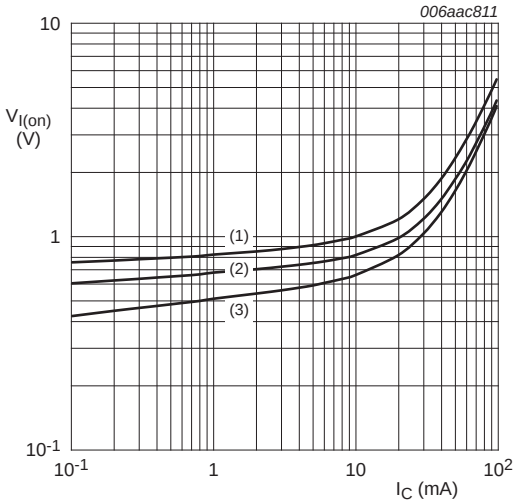
I_C/I_B = 20

(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



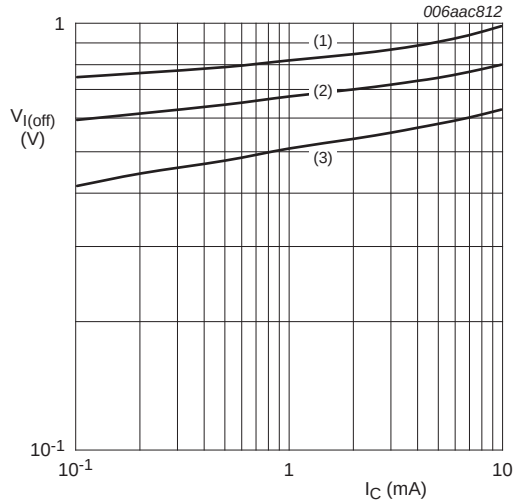
V_{CE} = 0.3 V

(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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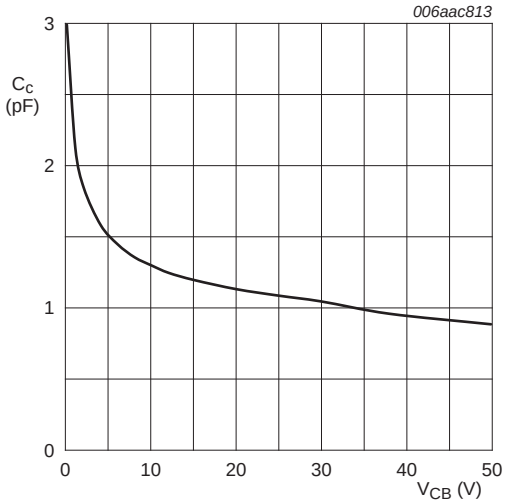
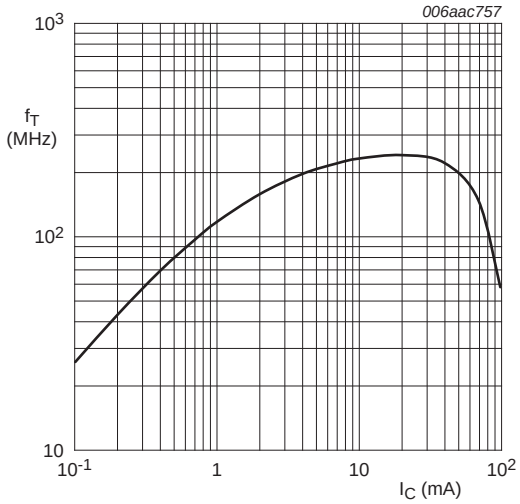


f = 1 MHz; T_{amb} = 25 °C

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

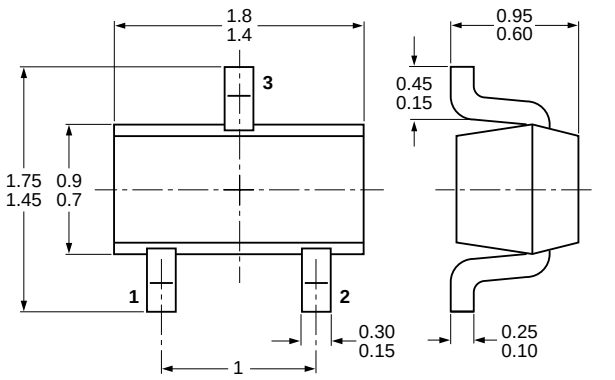

Fig 12. Package outline PDTC123JE (SOT416/SC-75)

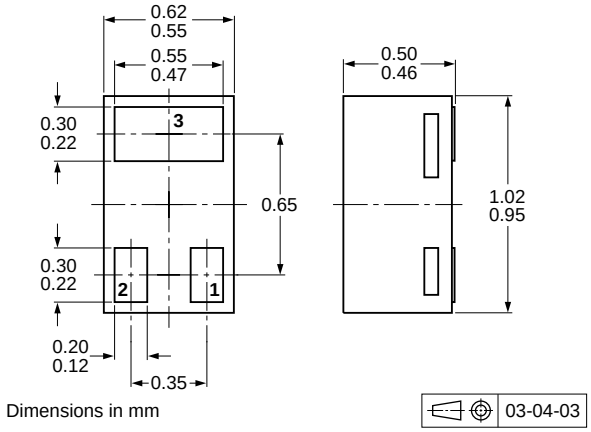

Fig 13. Package outline PDTC123JM (SOT883/SC-101)

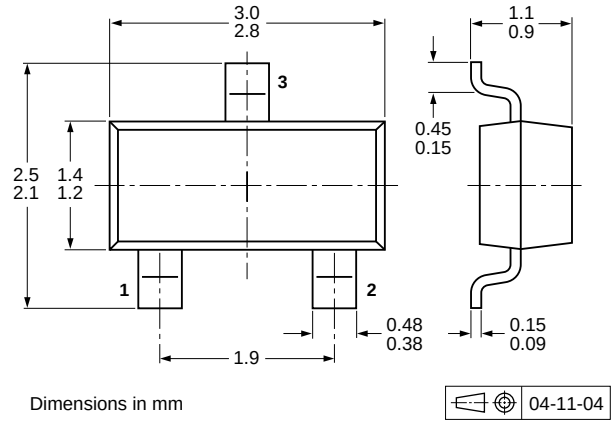

Fig 14. Package outline PDTC123JT (SOT23)

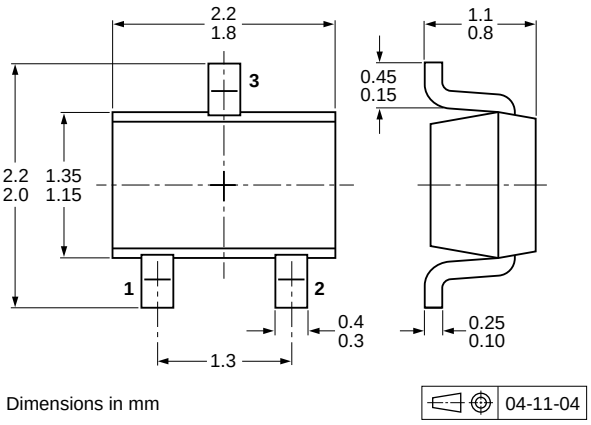

Fig 15. Package outline PDTC123JU (SOT323/SC-70)

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	10000
PDTC123JE	SOT416	4 mm pitch, 8 mm tape and reel	-115	-135
PDTC123JM	SOT883	2 mm pitch, 8 mm tape and reel	-	-315
PDTC123JT	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235
PDTC123JU	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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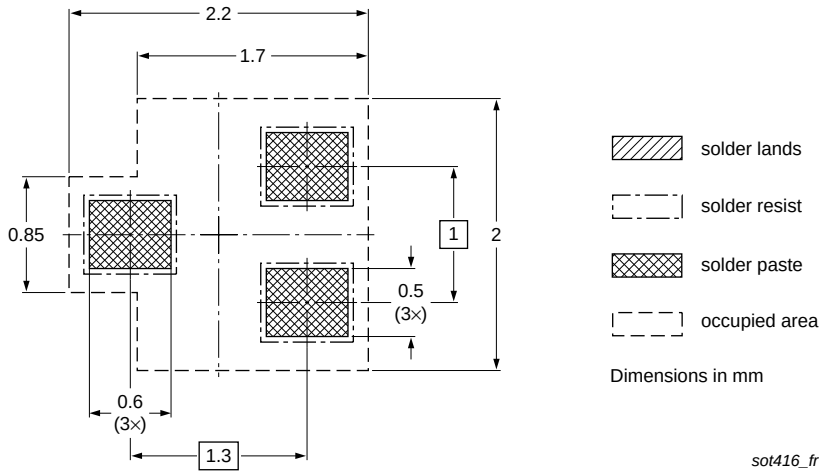
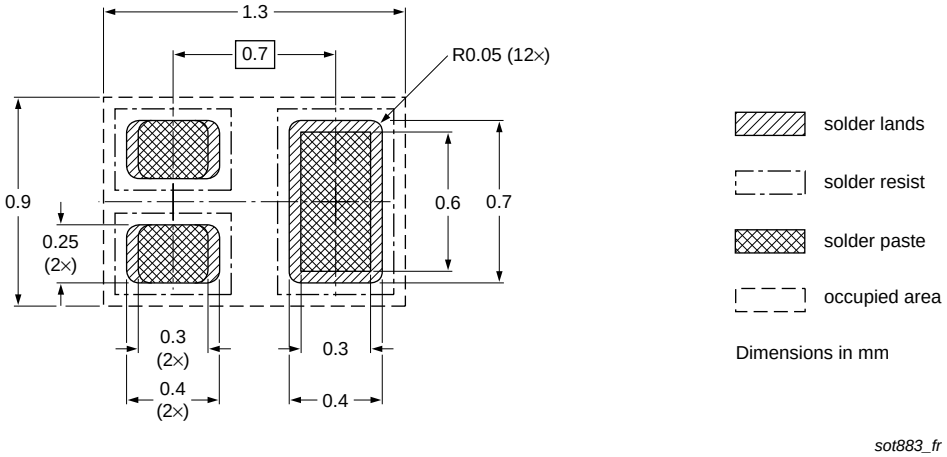
11. Soldering



Reflow soldering is the only recommended soldering method.

Fig 16. Reflow soldering footprint PDTC123JE (SOT416/SC-75)



Reflow soldering is the only recommended soldering method.

Fig 17. Reflow soldering footprint PDTC123JM (SOT883/SC-101)

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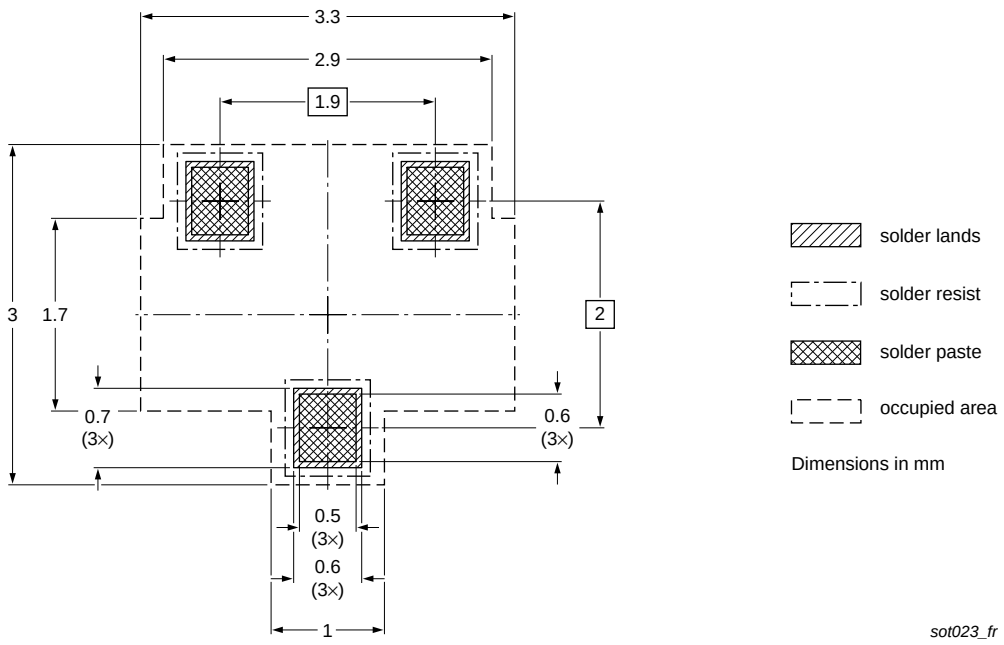

Fig 18. Reflow soldering footprint PDTC123JT (SOT23)

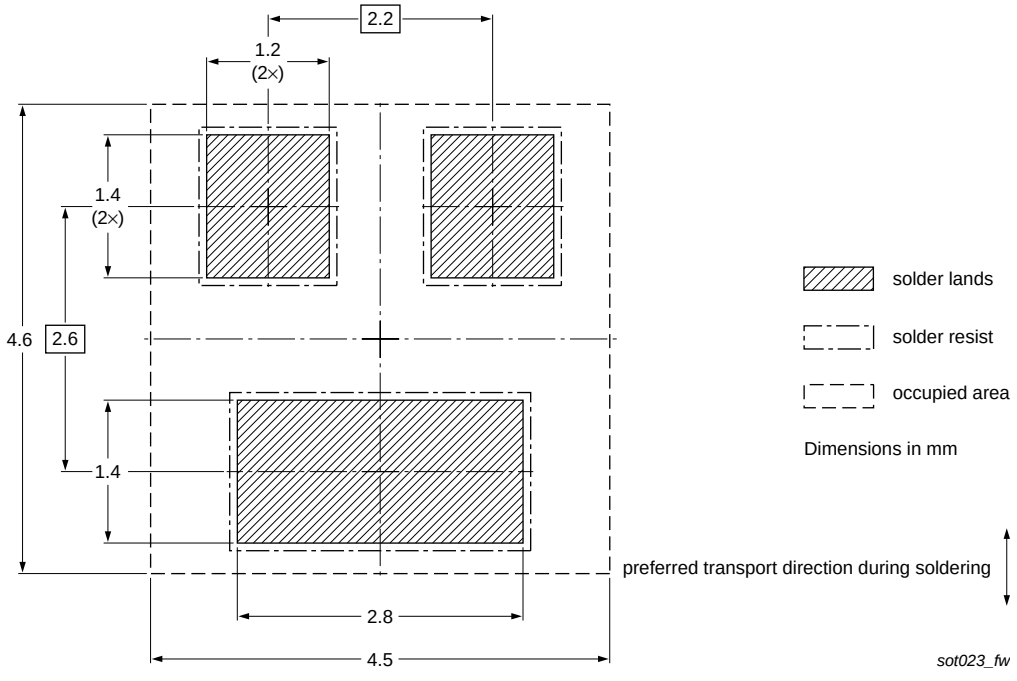

Fig 19. Wave soldering footprint PDTC123JT (SOT23)

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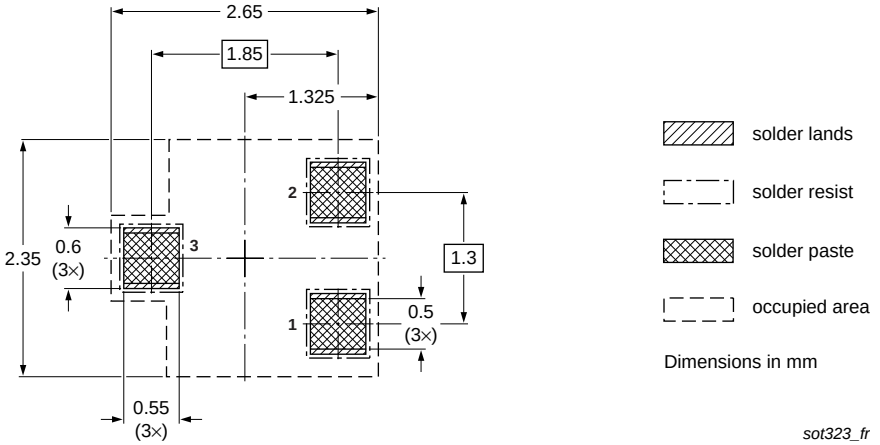

Fig 20. Reflow soldering footprint PDTC123JU (SOT323/SC-70)

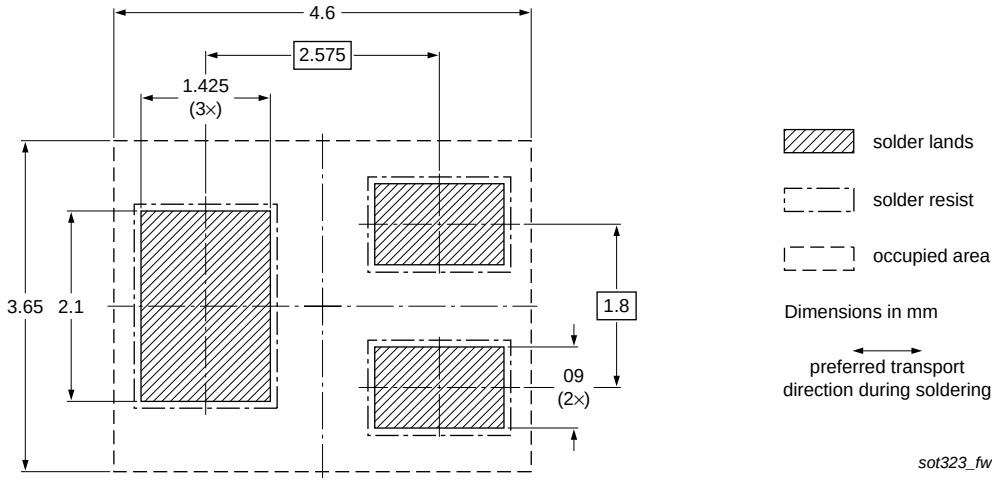

Fig 21. Wave soldering footprint PDTC123JU (SOT323/SC-70)

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12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PDTC123J_SER v.7	20111221	Product data sheet	-	PDTC123J_SER v.6
Modifications:	• Figure 3 and 5: corrected			
PDTC123J_SER v.6	20111215	Product data sheet	-	PDTC123J_SERIES v.5
PDTC123J_SERIES v.5	20040813	Product data sheet	-	PDTC123J_SERIES v.4
PDTC123J_SERIES v.4	20030410	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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