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

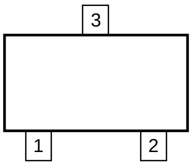
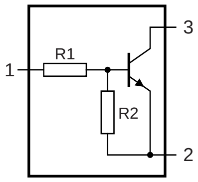
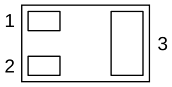
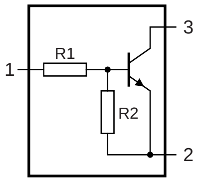
1.4 Quick reference data

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.

All information provided in this document is subject to legal disclaimers.
© NXP B.V. 2011. All rights reserved.

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

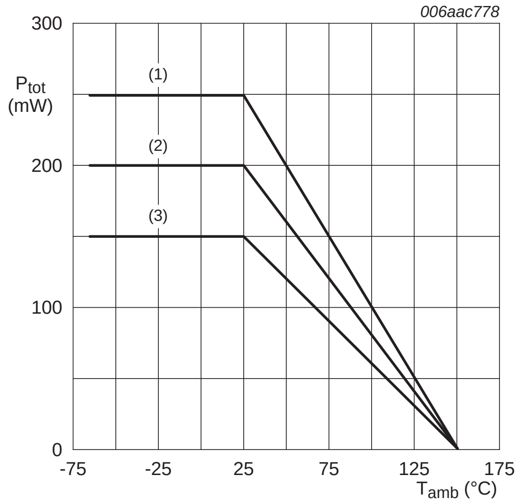
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

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

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

All information provided in this document is subject to legal disclaimers.

© NXP B.V. 2011. All rights reserved.



(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

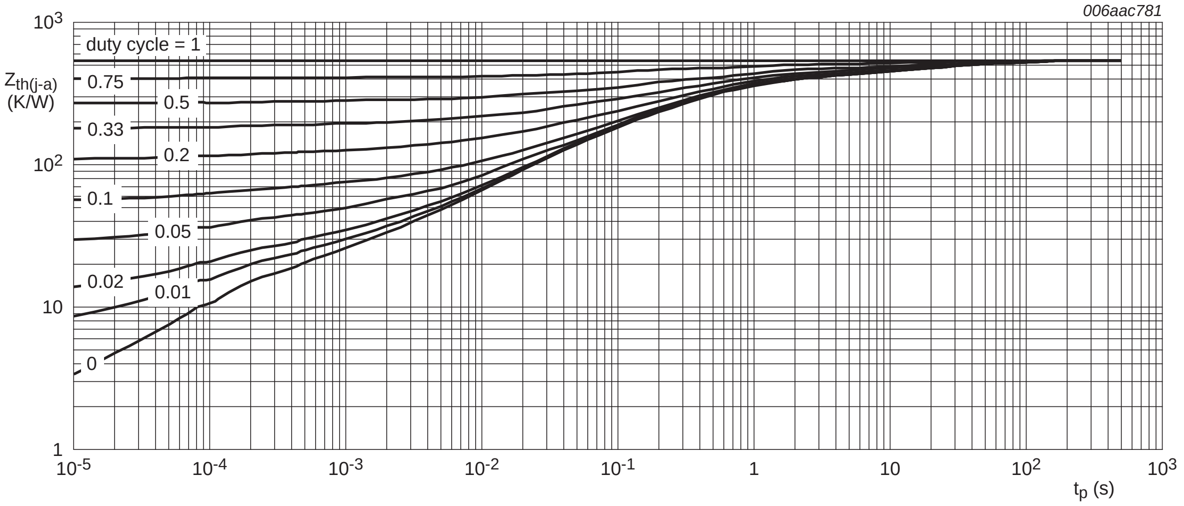
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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

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

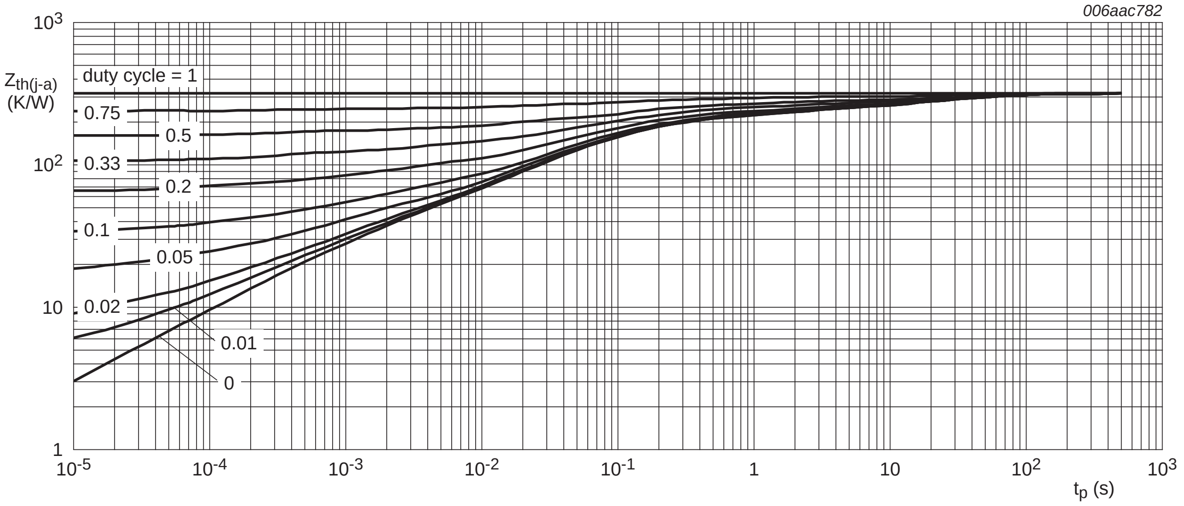
All information provided in this document is subject to legal disclaimers.

© NXP B.V. 2011. All rights reserved.



FR4 PCB, standard footprint

Fig 2. **Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC123JE (SOT416); typical values**

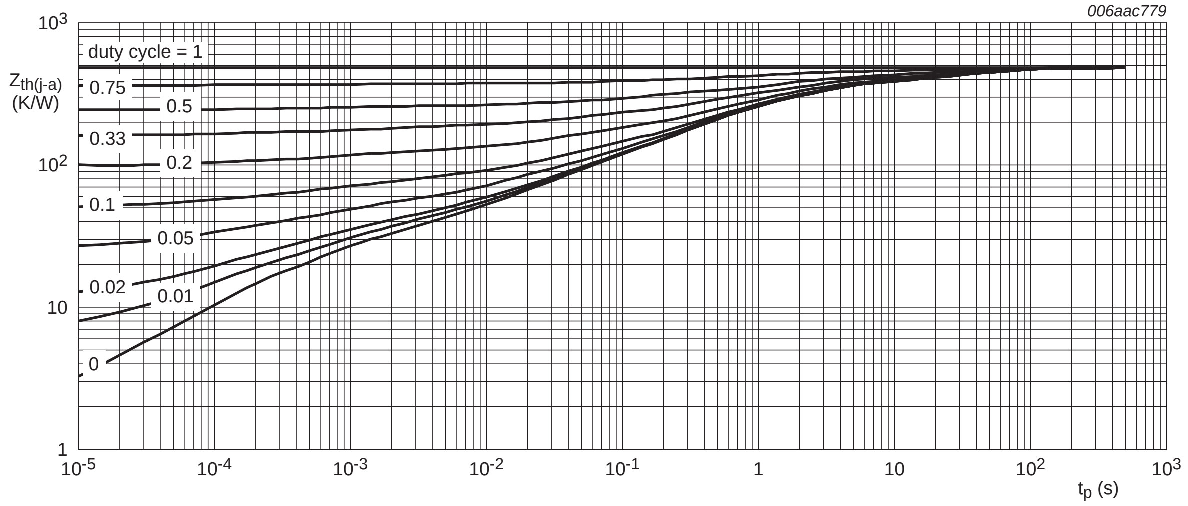


FR4 PCB, 70 µm copper strip line

Fig 3. **Transient thermal impedance from junction to ambient as a function of pulse duration for PDTC123JM (SOT883); typical values**

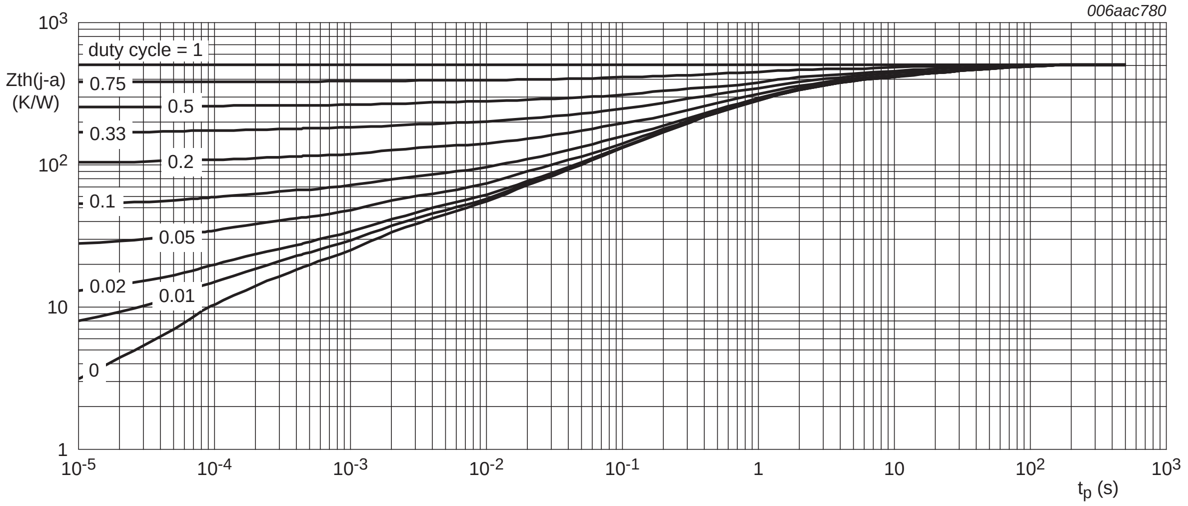
All information provided in this document is subject to legal disclaimers.

© NXP B.V. 2011. All rights reserved.



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

All information provided in this document is subject to legal disclaimers.
© NXP B.V. 2011. All rights reserved.

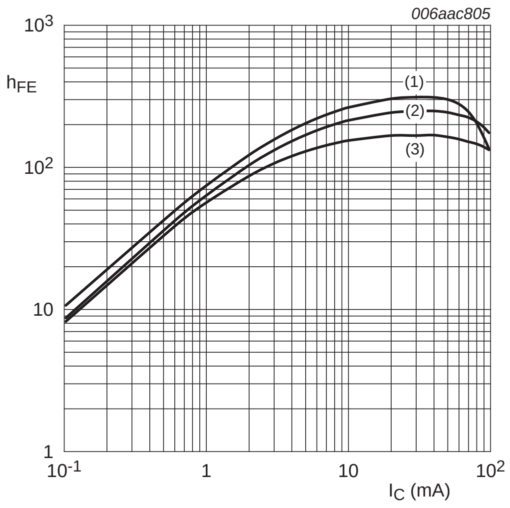
7. Characteristics

Table 8. Characteristics

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

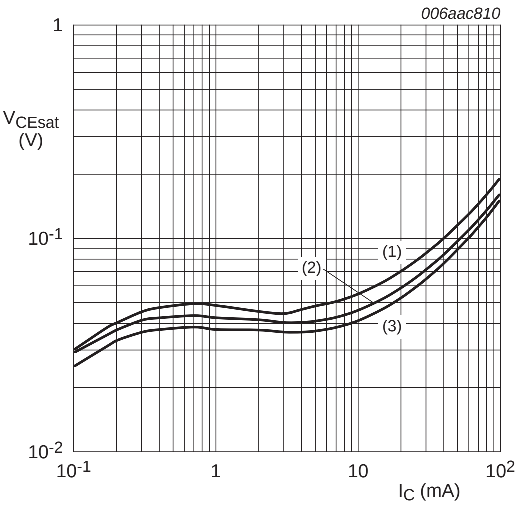
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = 50 V; I_E = 0 A		-	-	100	nA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 30 V; I_B = 0 A		-	-	1	µA
		V_{CE} = 30 V; I_B = 0 A; T_j = 150 °C		-	-	5	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; 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.



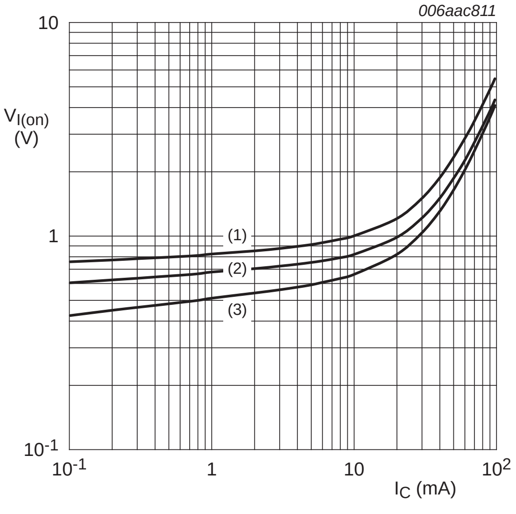
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = –40 °C

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



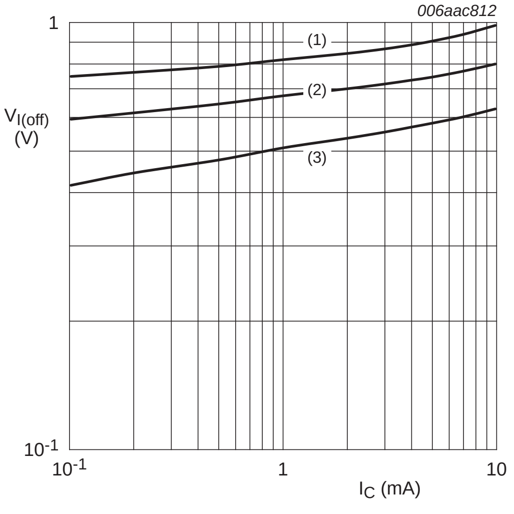
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = –40 °C

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

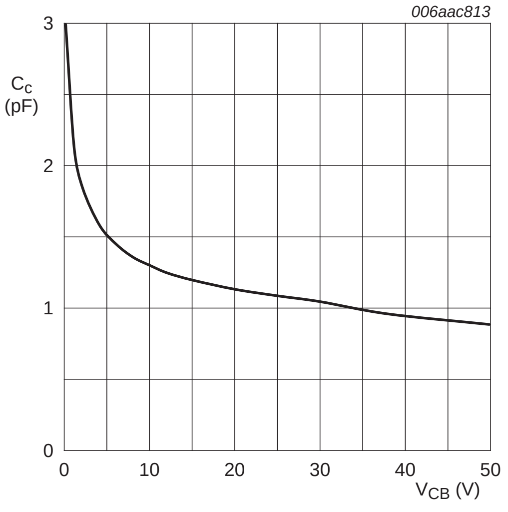
Fig 8. On-state input voltage as a function of collector current; typical values



V_{CE} = 5 V
(1) T_{amb} = –40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

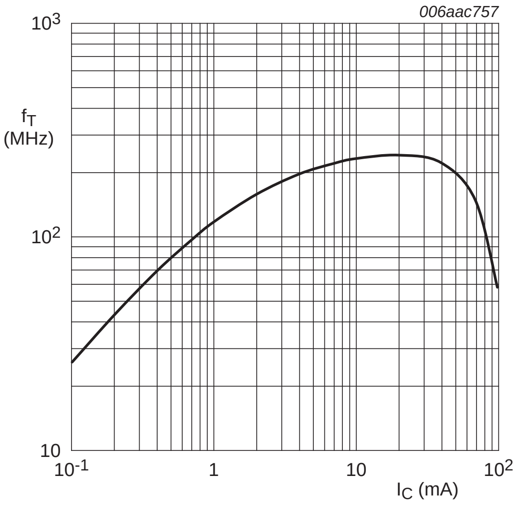
Fig 9. Off-state input voltage as a function of collector current; typical values

All information provided in this document is subject to legal disclaimers.
© NXP B.V. 2011. All rights reserved.



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.

All information provided in this document is subject to legal disclaimers.

© NXP B.V. 2011. All rights reserved.

9. Package outline

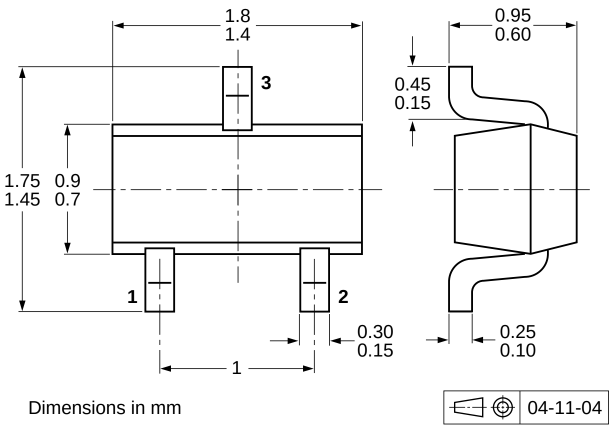


Fig 12. Package outline PDTC123JE (SOT416/SC-75)

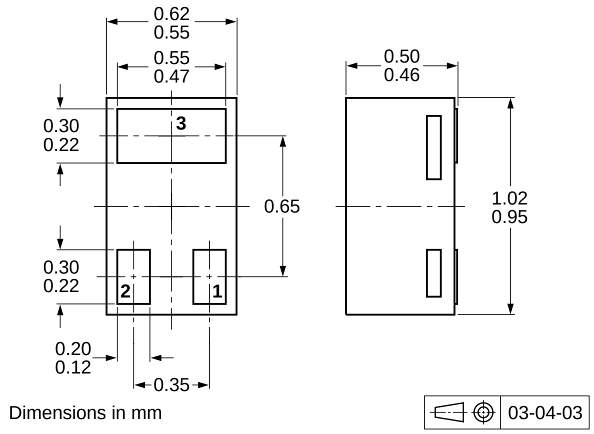


Fig 13. Package outline PDTC123JM (SOT883/SC-101)

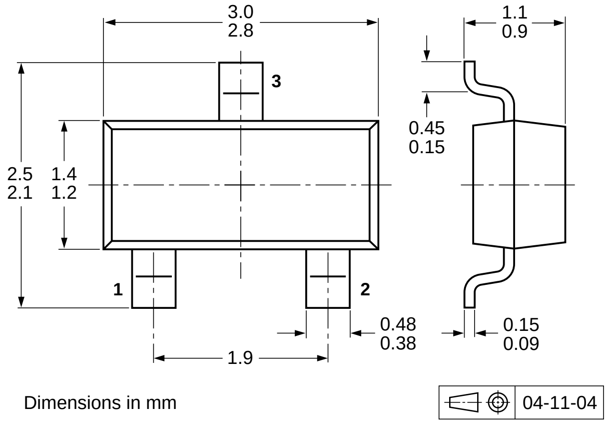


Fig 14. Package outline PDTC123JT (SOT23)

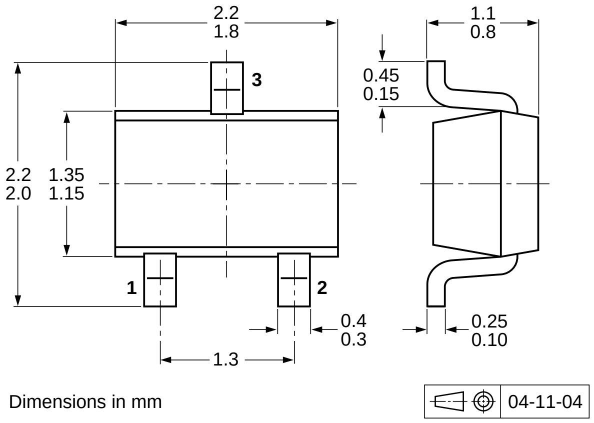


Fig 15. Package outline PDTC123JU (SOT323/SC-70)

10. Packing information

Table 9. Packing methods

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

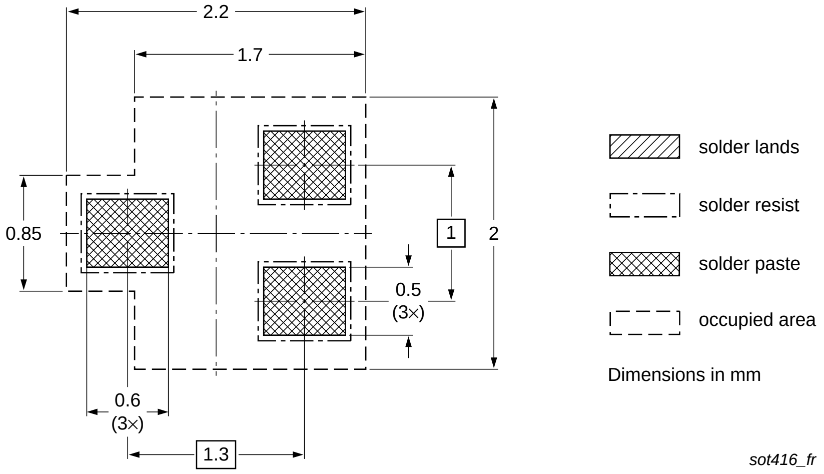
Type number	Package	Description	Packing quantity	
			3000	**10000**
PDTC123JE	SOT416	4 mm pitch, 8 mm tape and reel	-115	-135
PDTC123JM	SOT883	2 mm pitch, 8 mm tape and reel	-	-315
PDTC123JT	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235
PDTC123JU	SOT323	4 mm pitch, 8 mm tape and reel	-115	-135

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

All information provided in this document is subject to legal disclaimers.

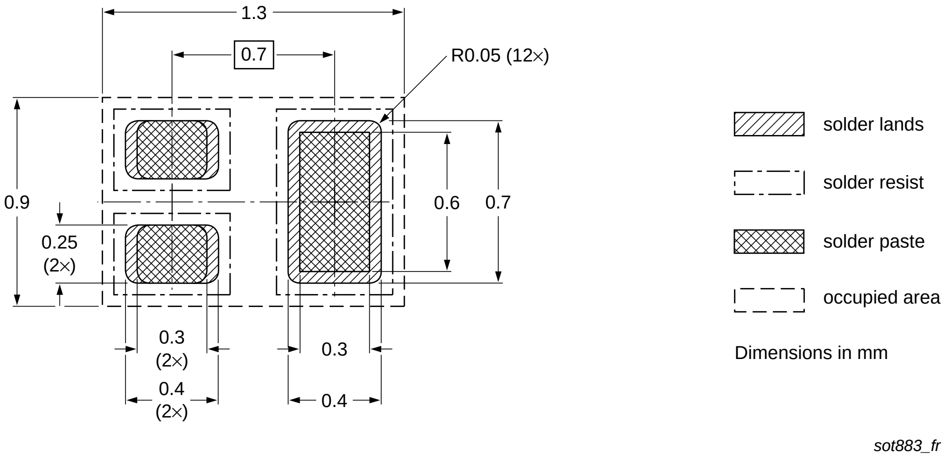
© NXP B.V. 2011. All rights reserved.

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)

All information provided in this document is subject to legal disclaimers.

© NXP B.V. 2011. All rights reserved.

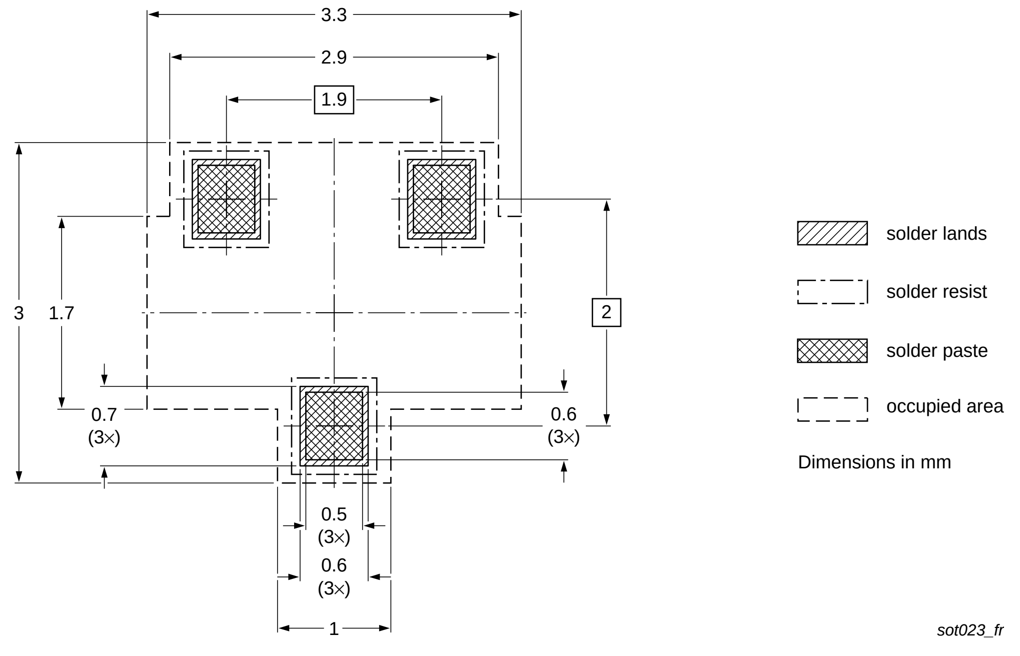


Fig 18. Reflow soldering footprint PDTC123JT (SOT23)

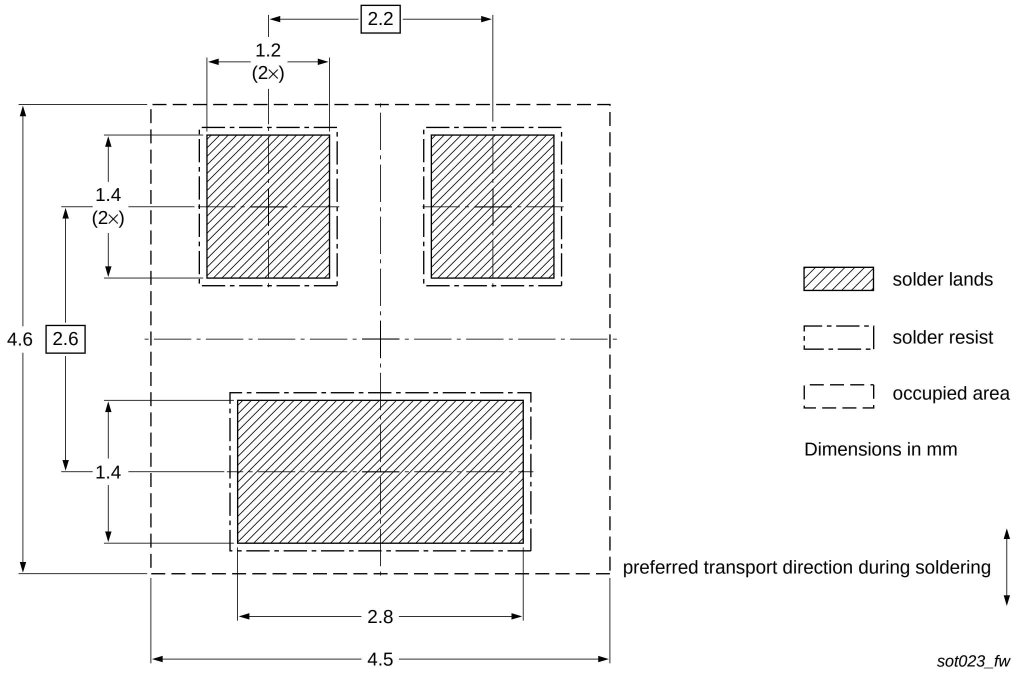


Fig 19. Wave soldering footprint PDTC123JT (SOT23)

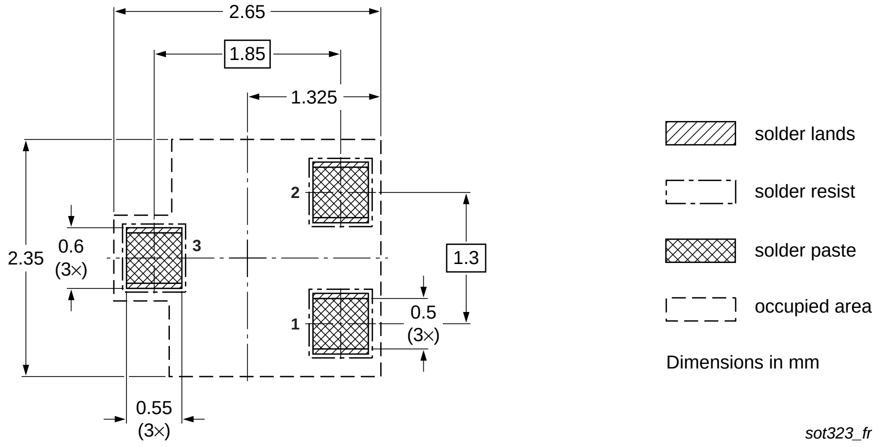


Fig 20. Reflow soldering footprint PDTC123JU (SOT323/SC-70)

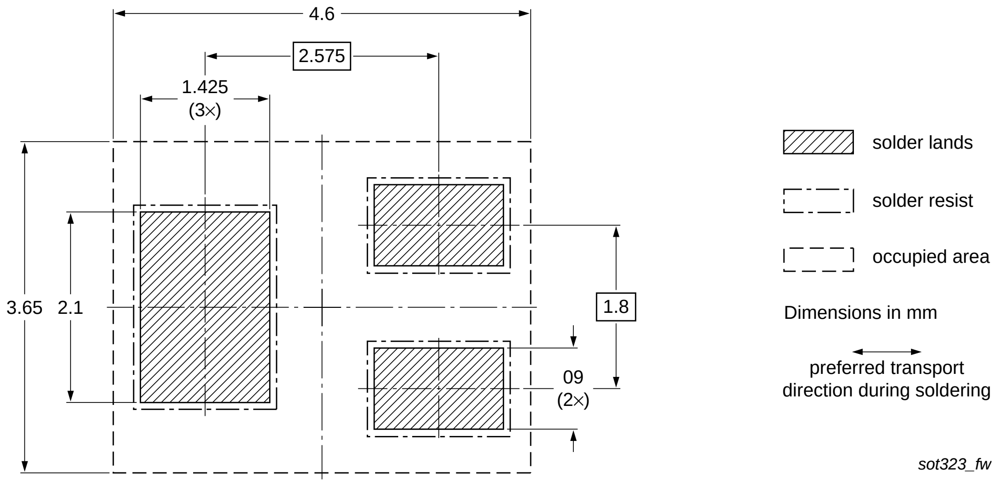


Fig 21. Wave soldering footprint PDTC123JU (SOT323/SC-70)

All information provided in this document is subject to legal disclaimers.

© NXP B.V. 2011. All rights reserved.

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	-	-

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.

13.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

13.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

13.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

14. Contact information

For more information, please visit: **http://www.nxp.com**

For sales office addresses, please send an email to: **salesaddresses@nxp.com**

All information provided in this document is subject to legal disclaimers.

© NXP B.V. 2011. All rights reserved.

15. Contents

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section ‘Legal information’.

© NXP B.V. 2011. All rights reserved.

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 21 December 2011
Document identifier: PDTC123J_SER