

PDTC123J series

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

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

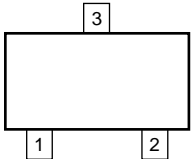
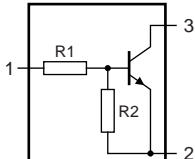
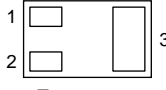
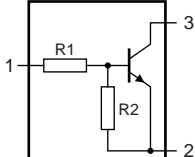
Table 2. Quick reference data

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	k Ω
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)	 <p>006aaa144</p>	 <p>sym007</p>
2	GND (emitter)		
3	output (collector)		
SOT883			
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
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.

5. Limiting values

Table 6. Limiting values

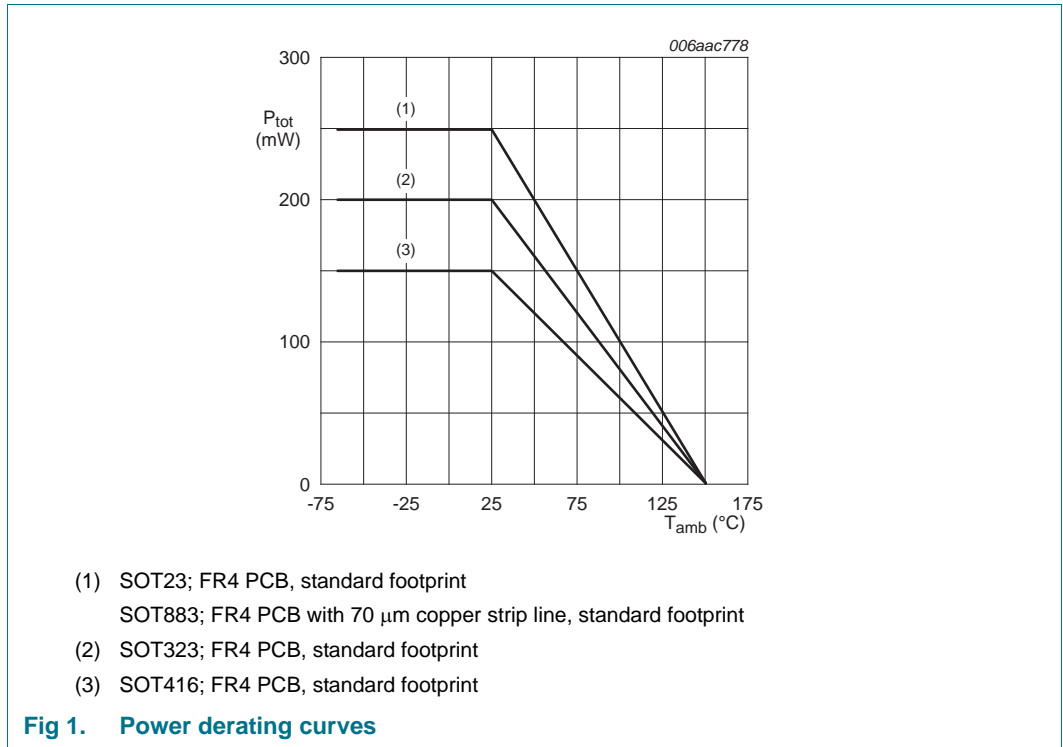
In accordance with the Absolute Maximum Rating System (IEC 60134).

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 ≤ 1 ms	-	100	mA
P _{tot}	total power dissipation	T _{amb} ≤ 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 μ m copper strip line, standard footprint.



6. Thermal characteristics

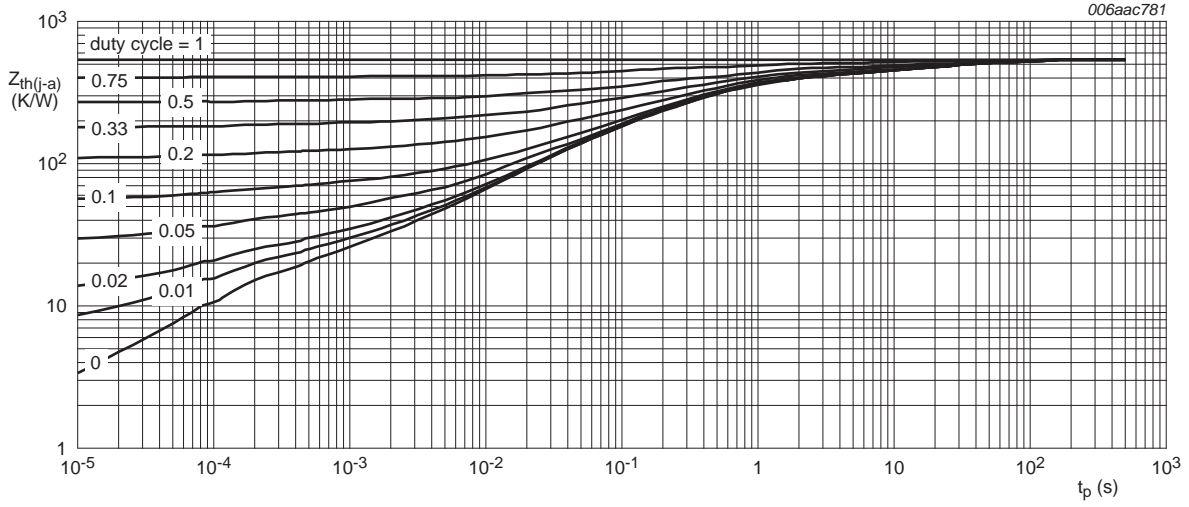
Table 7. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R _{th(j-a)}	thermal resistance from junction to ambient	in free air				
	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.

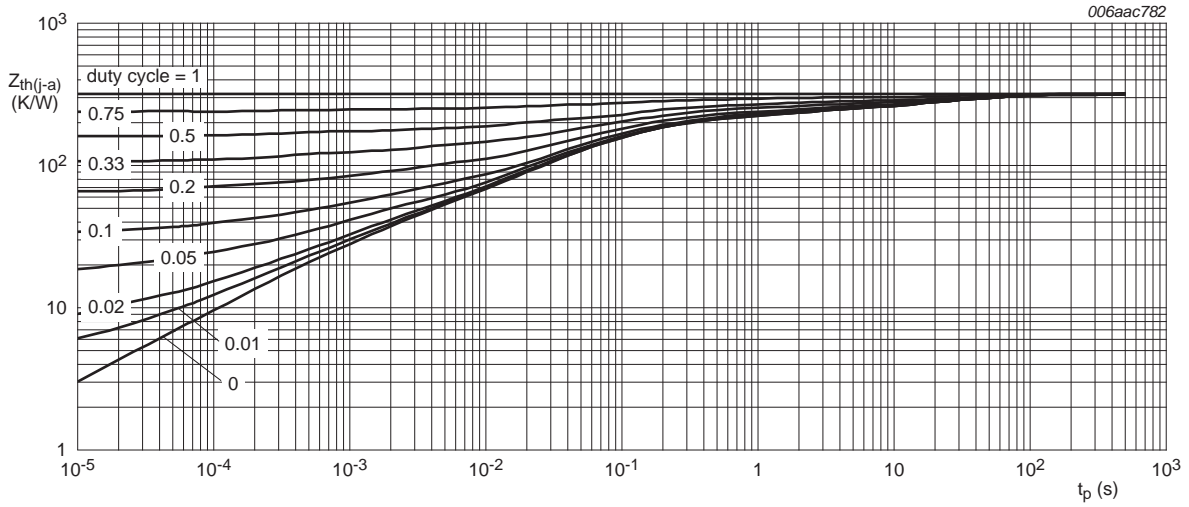
[2] Reflow soldering is the only recommended soldering method.

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



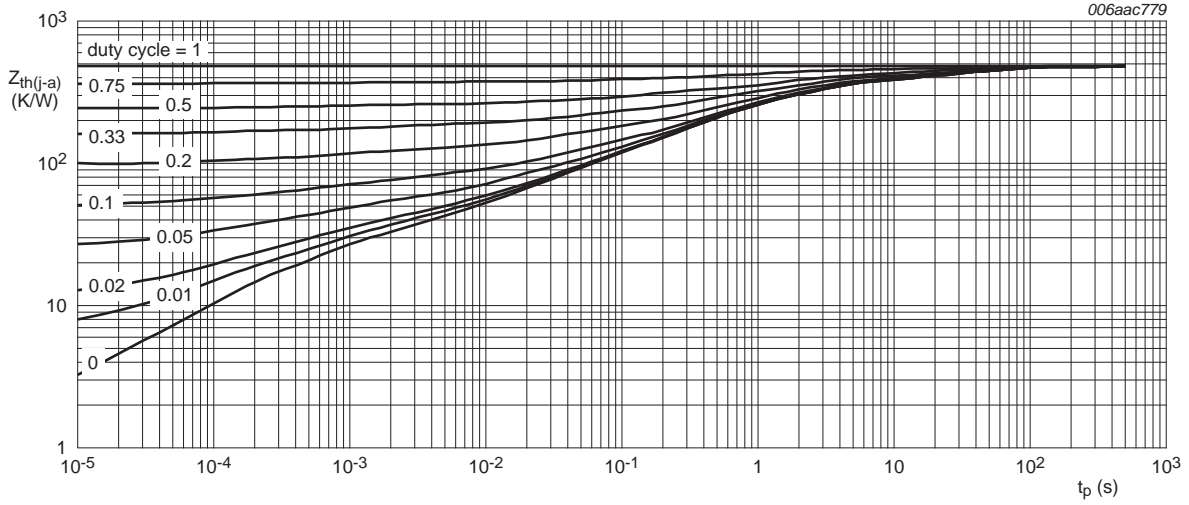
FR4 PCB, standard footprint

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



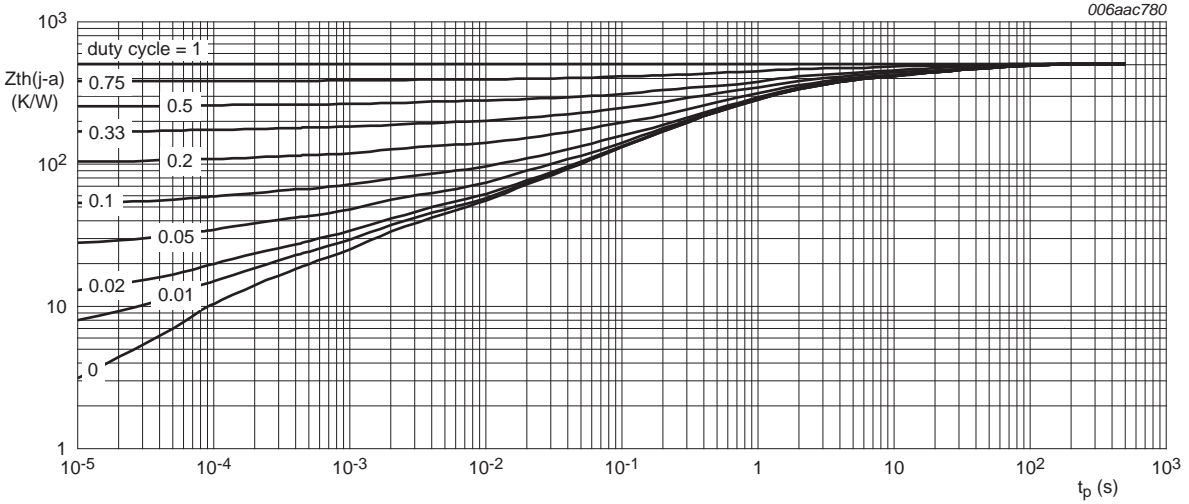
FR4 PCB, 70 μm copper strip line

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



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

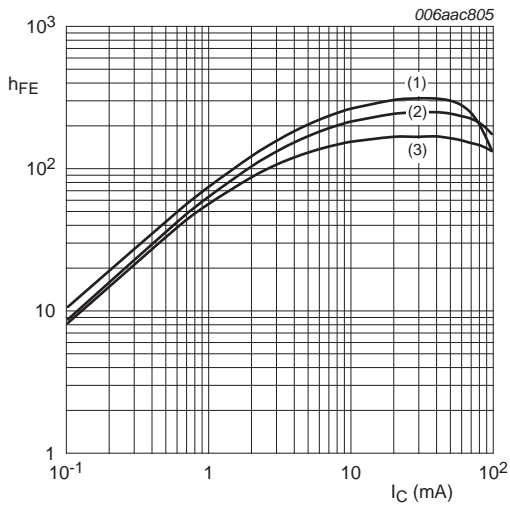
7. Characteristics

Table 8. Characteristics

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

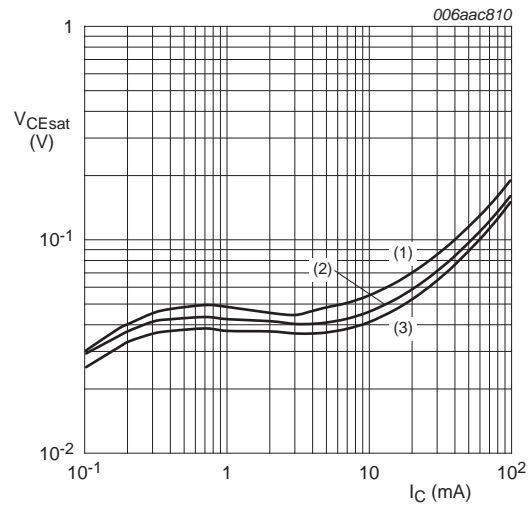
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
I_{CBO}	collector-base cut-off current	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}$	-	-	100	nA	
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; I_B = 0\text{ A}$	-	-	1	μA	
		$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	5	μA	
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	180	μA	
h_{FE}	DC current gain	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}$	100	-	-		
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5\text{ mA}; I_B = 0.25\text{ mA}$	-	-	100	mV	
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}$	-	0.6	0.5	V	
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}; I_C = 5\text{ mA}$	1.1	0.75	-	V	
R1	bias resistor 1 (input)		1.54	2.20	2.86	k Ω	
R2/R1	bias resistor ratio		17	21	26		
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.



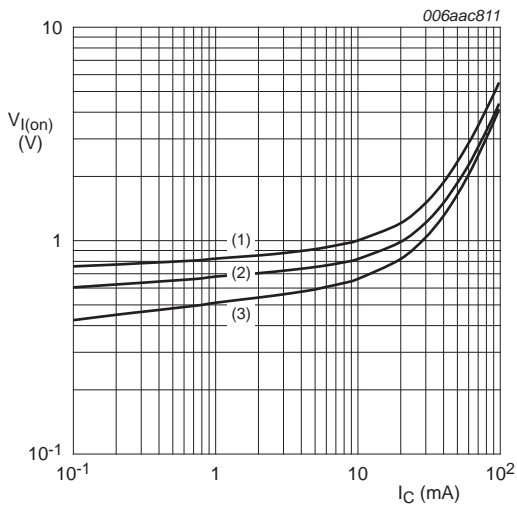
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



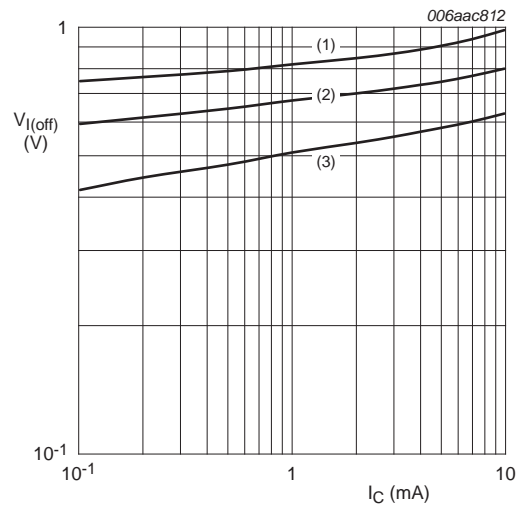
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



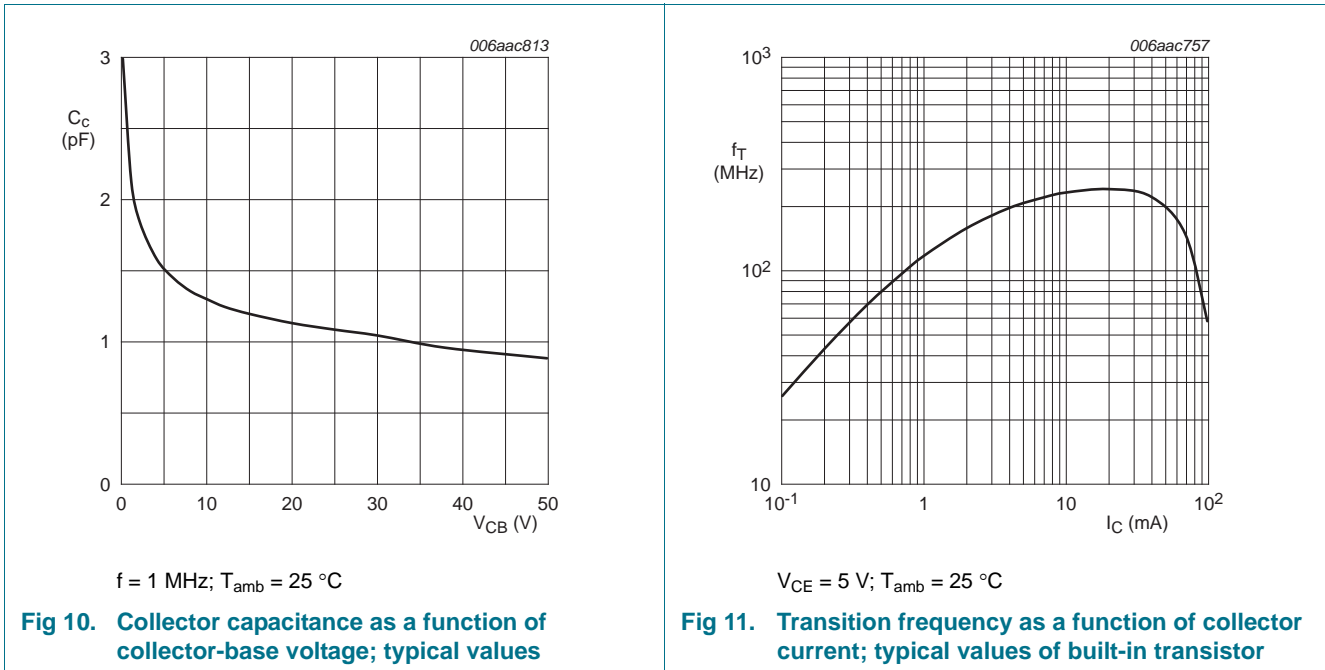
$V_{CE} = 0.3\text{ V}$
 (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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

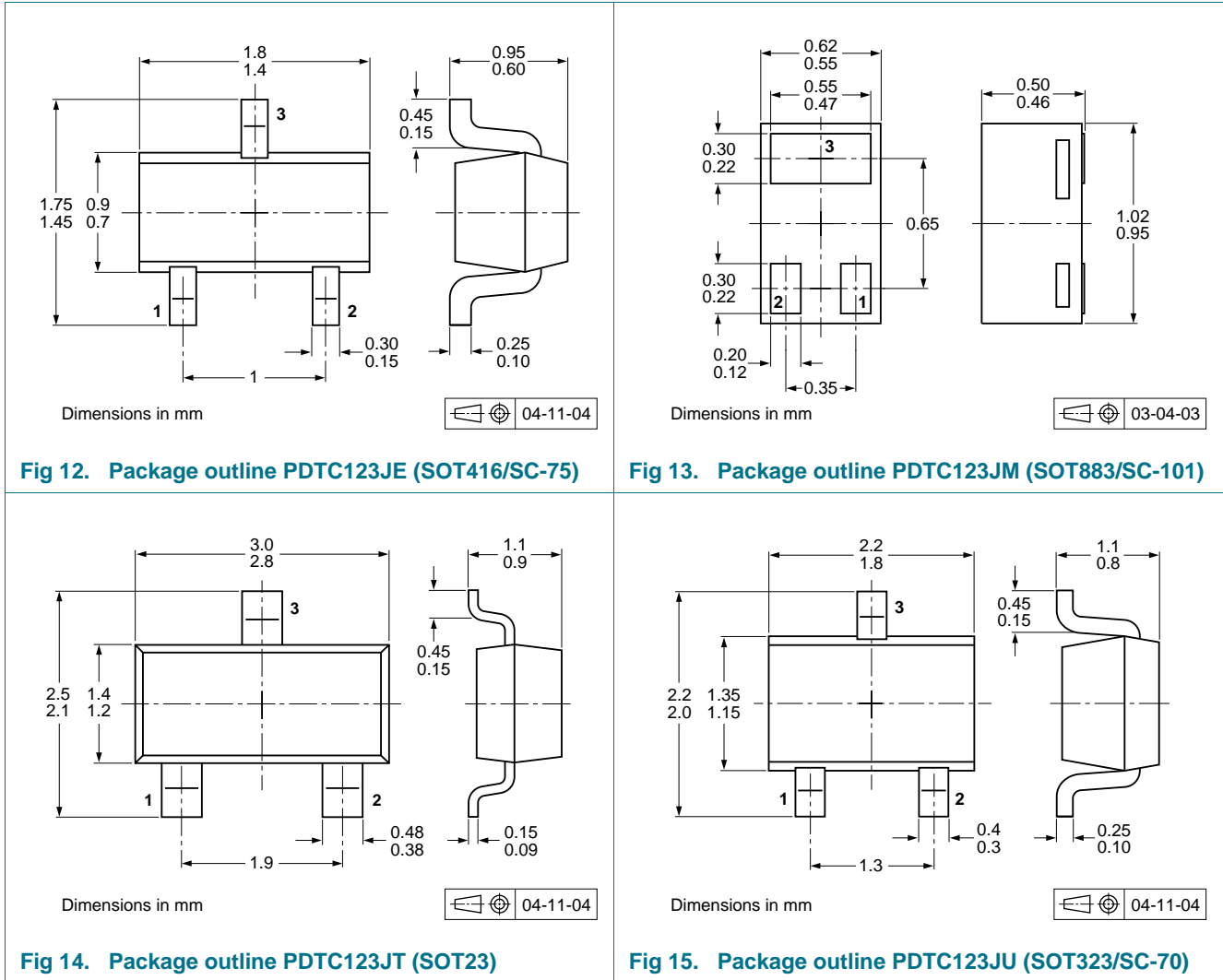


8. Test information

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

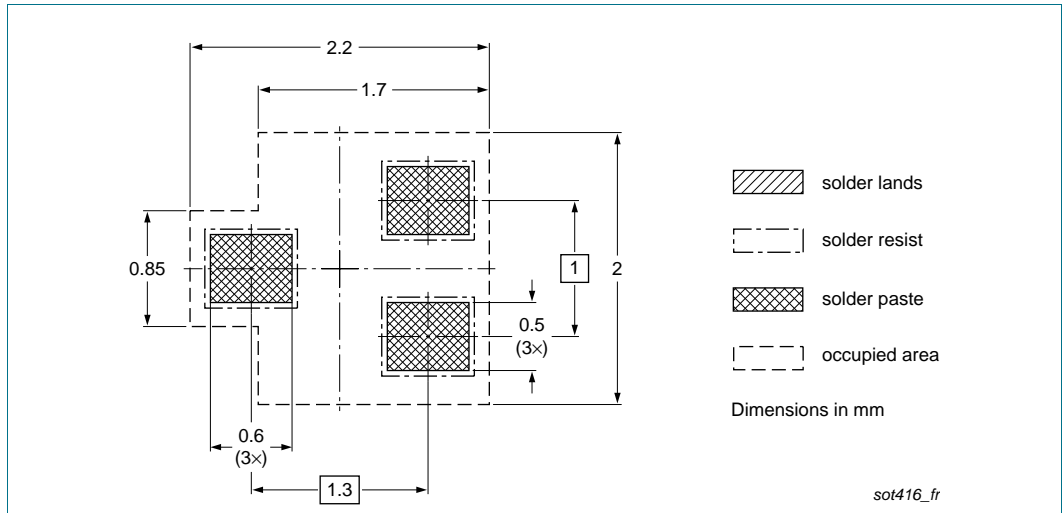
Table 9. Packing methods

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

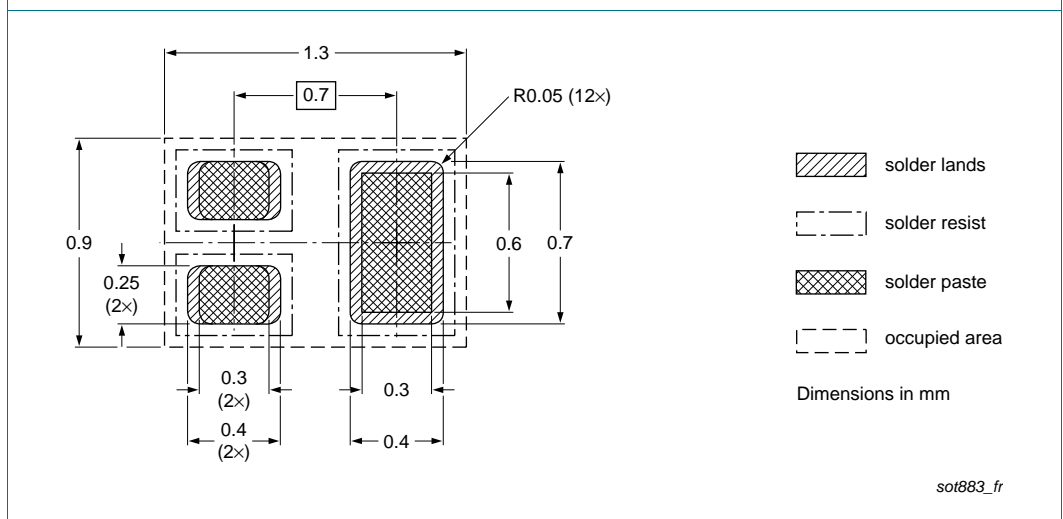
[1] For further information and the availability of packing methods, see [Section 14](#).

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)

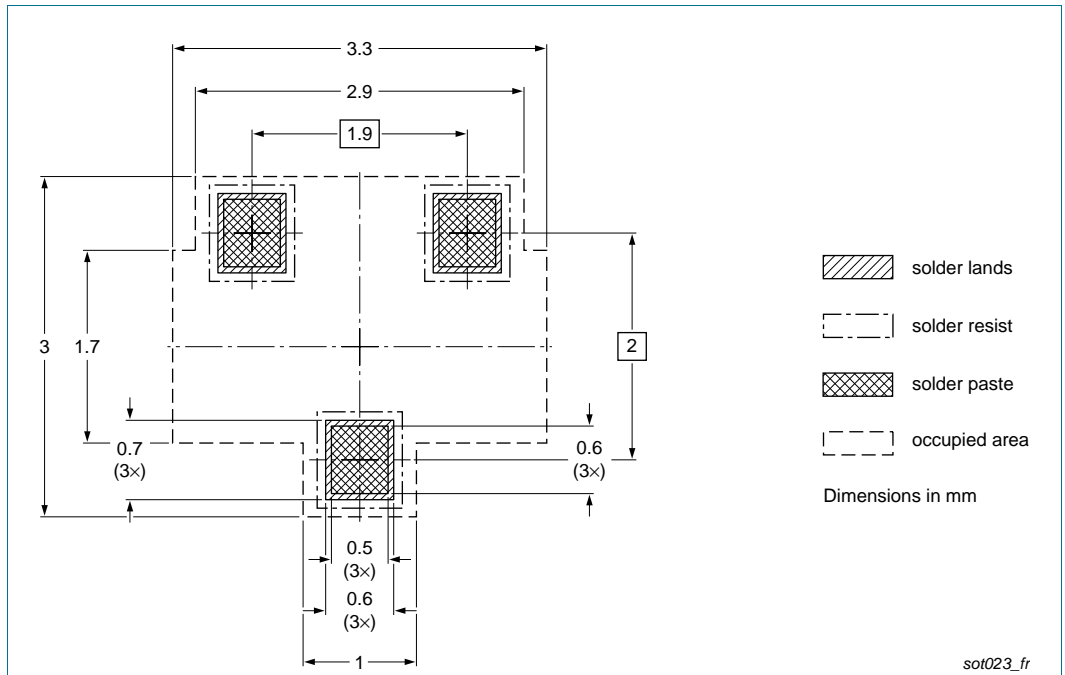


Fig 18. Reflow soldering footprint PDTC123JT (SOT23)

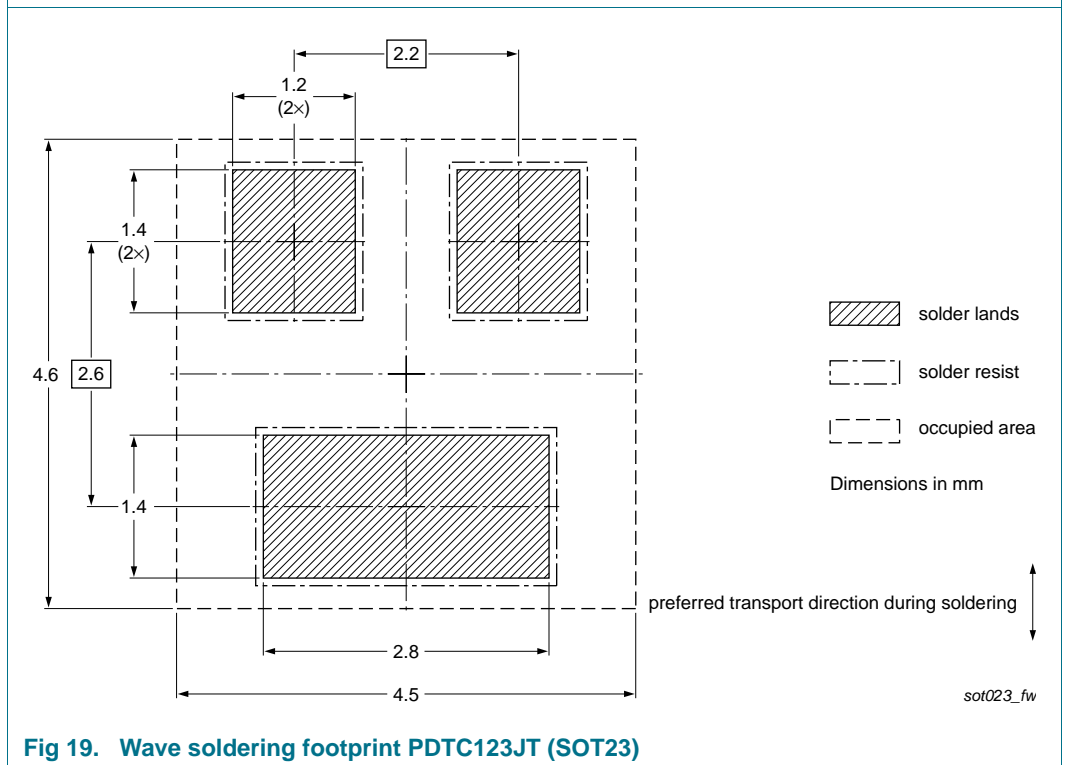


Fig 19. Wave soldering footprint PDTC123JT (SOT23)

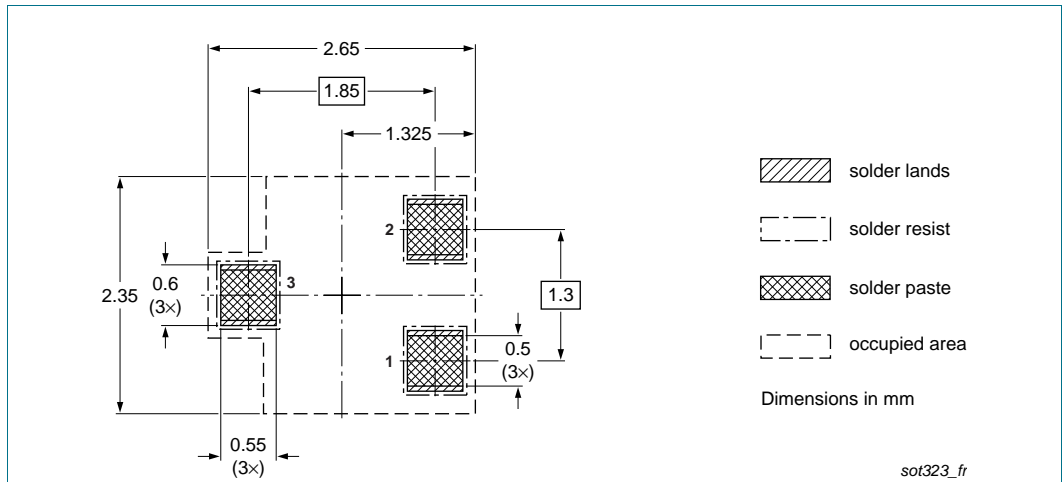


Fig 20. Reflow soldering footprint PDTC123JU (SOT323/SC-70)

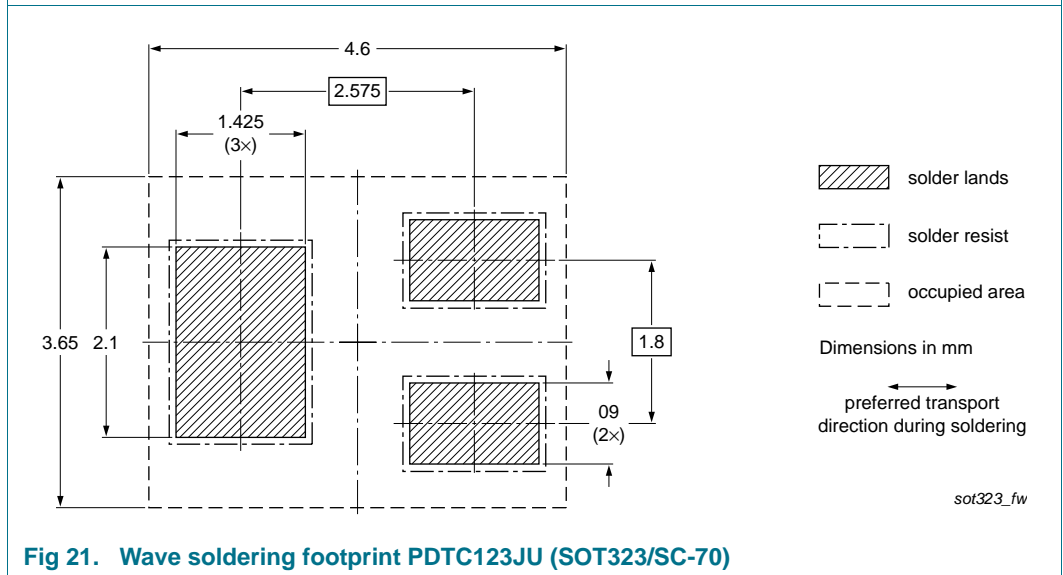


Fig 21. Wave soldering footprint PDTC123JU (SOT323/SC-70)

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".

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