



PDTD113EU

50 V, 500 mA NPN resistor-equipped transistor

17 April 2024

Product data sheet

1. General description

NPN Resistor-Equipped Transistor (RET) in a very small SOT323 (SC-70) Surface-Mounted Device (SMD) plastic package.

PNP complement: PDTB113EU

2. Features and benefits

- 500 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- $\pm 10\%$ resistor ratio tolerance
- High temperature applications up to 175 °C
- AEC-Q101 qualified

3. Applications

- Controlling IC inputs
- Cost-saving alternative to BC817 series in digital applications
- Switching loads

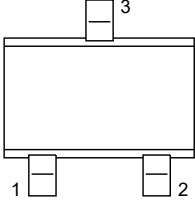
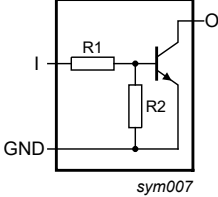
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CE0}	collector-emitter voltage	open base	-	-	50	V
I_O	output current		-	-	500	mA
R1	bias resistor 1 (input)		0.7	1	1.3	k Ω
R2/R1	bias resistor ratio		0.9	1	1.1	

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 <p>SC-70 (SOT323)</p>	 <p>sym007</p>
2	GND	ground (emitter)		
3	O	output (collector)		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PDTD113EU	SC-70	plastic, surface-mounted package; 3 leads; 1.3 mm pitch; 2 mm x 1.25 mm x 0.95 mm body	SOT323

7. Marking

Table 4. Marking codes

Type number	Marking code[1]
PDTD113EU	ZP%

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 5. 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		-10	10	V
I_O	output current		-	500	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	300	mW
			[2]	425	mW
T_j	junction temperature		-	175	°C
T_{amb}	ambient temperature		-55	175	°C
T_{stg}	storage temperature		-55	175	°C

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 µm copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

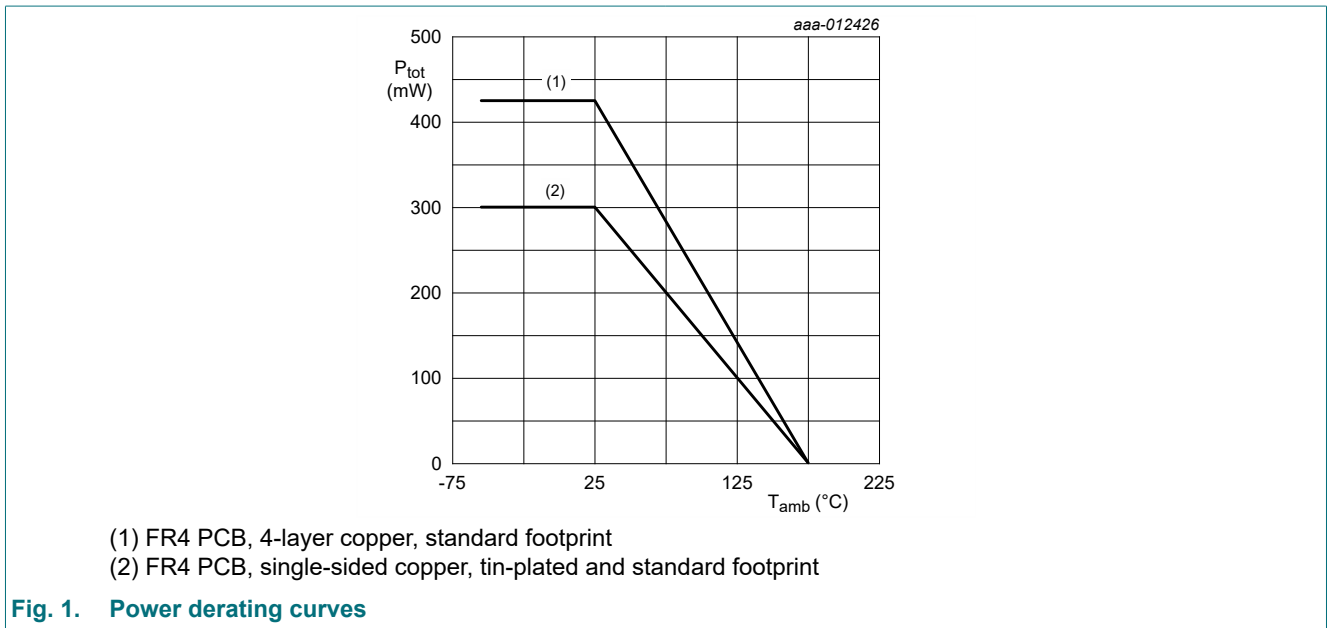


Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	500	K/W
			[2]	-	-	353	K/W

- [1] Device mounted on an FR4 PCB, single-sided, 35 μ m copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

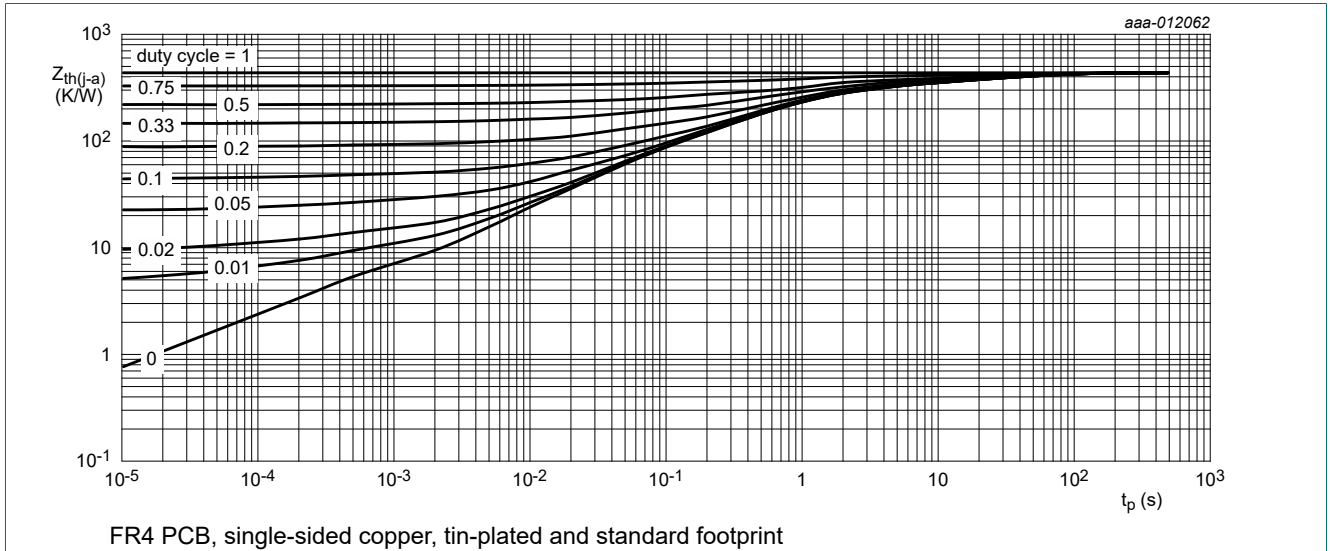


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT323/SC-70; typical values

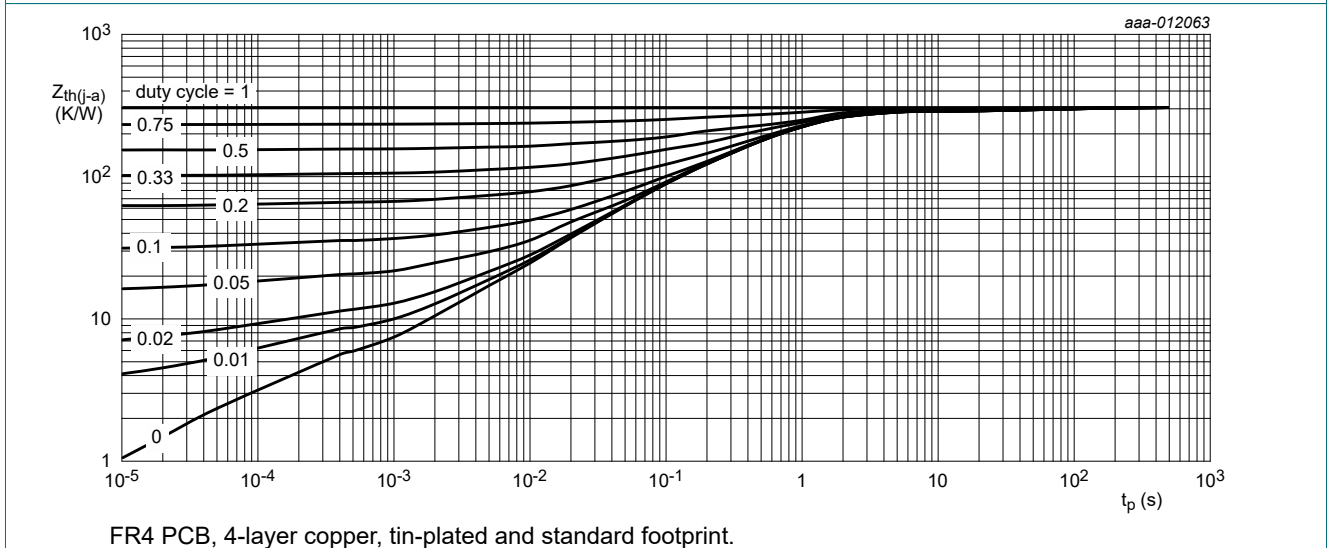


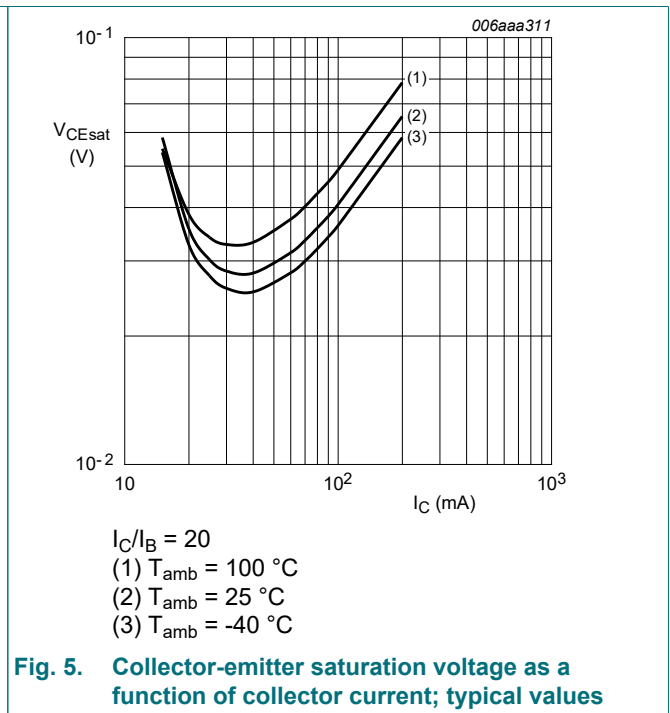
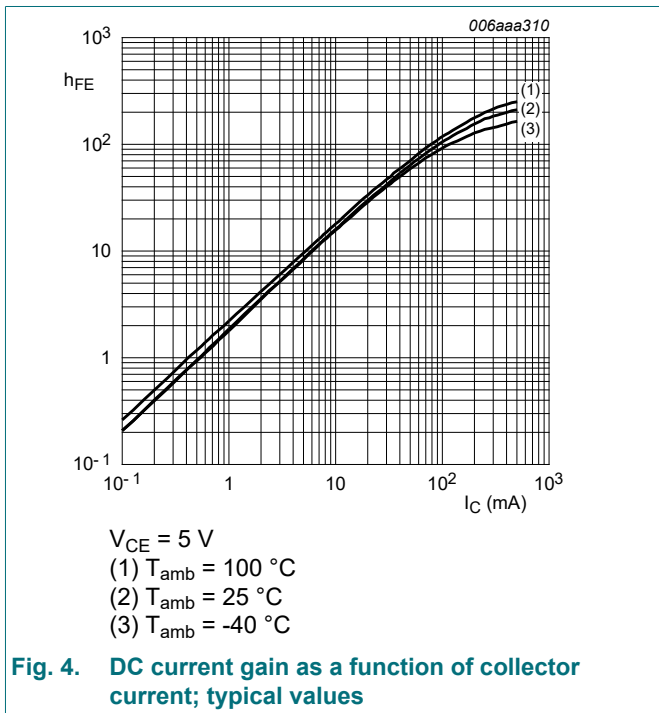
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT323/SC-70; typical values

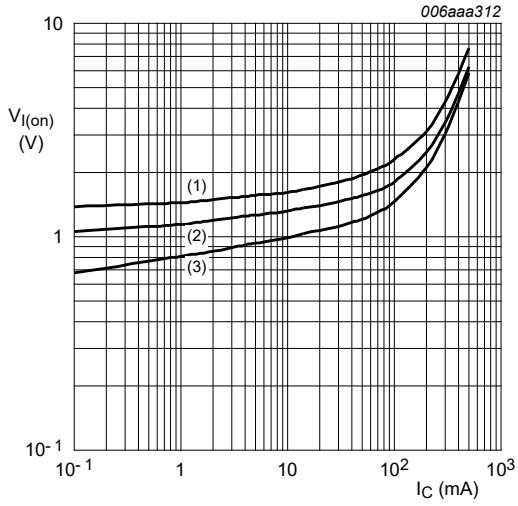
10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 40\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ °C}$	-	-	100	nA
		$V_{CB} = 50\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ °C}$	-	-	100	nA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 50\text{ V}; I_B = 0\text{ A}; T_{amb} = 25\text{ °C}$	-	-	0.5	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ °C}$	-	-	4	mA
h_{FE}	DC current gain	$V_{CE} = 5\text{ V}; I_C = 50\text{ mA}; T_{amb} = 25\text{ °C}$	33	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 50\text{ mA}; I_B = 2.5\text{ mA}; T_{amb} = 25\text{ °C}$	-	-	100	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}; T_{amb} = 25\text{ °C}$	0.6	1.1	1.5	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}; I_C = 20\text{ mA}; T_{amb} = 25\text{ °C}$	1	1.4	1.8	V
R1	bias resistor 1 (input)		0.7	1	1.3	k Ω
R2/R1	bias resistor ratio		0.9	1	1.1	
C_c	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$	-	7	-	pF
f_T	transition frequency	$V_{CE} = 5\text{ V}; I_C = 50\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ °C}$	[1]	225	-	MHz

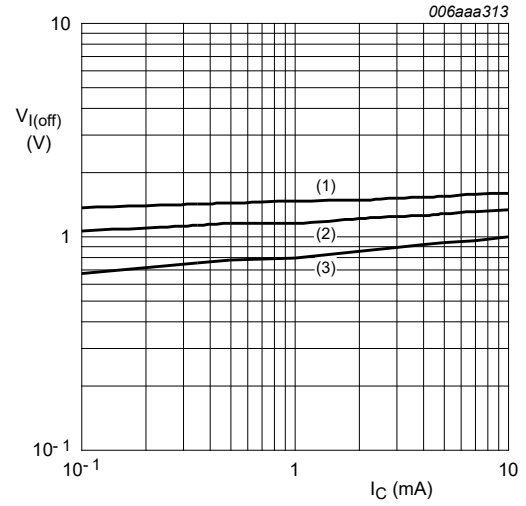
[1] Characteristics of built-in transistor.





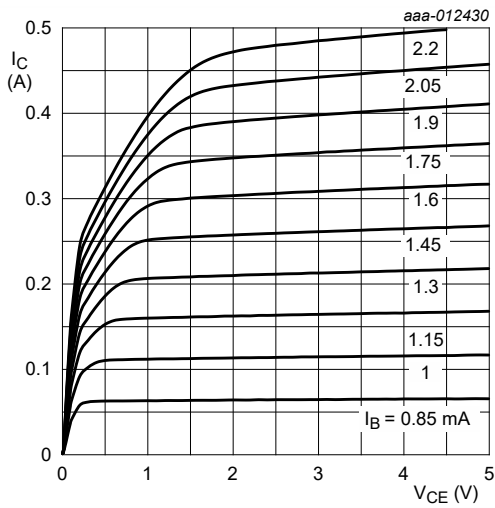
$V_{CE} = 0.3 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig. 6. On-state input voltage as a function of collector current; typical values



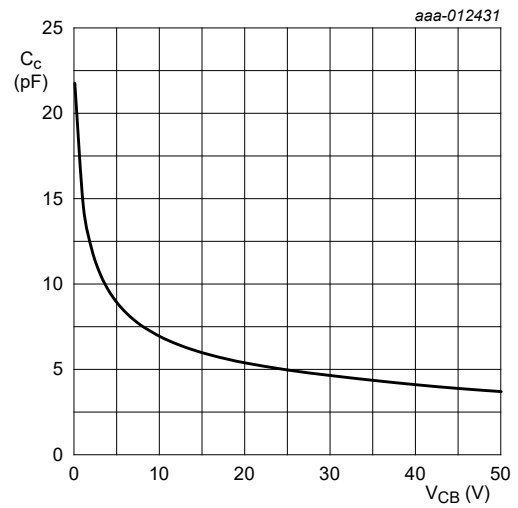
$V_{CE} = 5 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig. 7. Off-state input voltage as a function of collector current; typical values



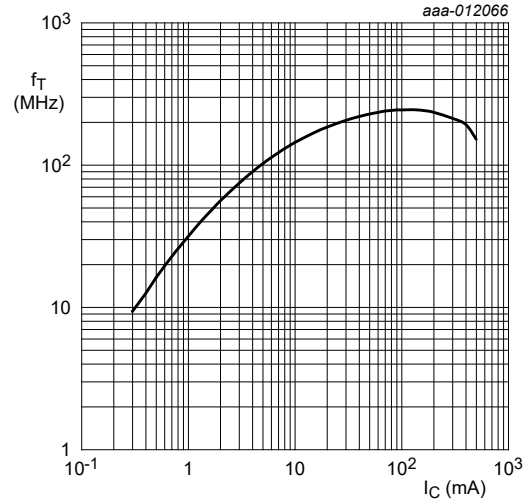
$T_{amb} = 25 \text{ }^\circ\text{C}$

Fig. 8. Collector current as a function of collector-emitter voltage; typical values



$f = 1 \text{ MHz}$
 $T_{amb} = 25 \text{ }^\circ\text{C}$

Fig. 9. Collector capacitance as a function of collector-base voltage; typical values



$T_{amb} = 25\text{ °C}$
 $V_{CE} = 5\text{ V}$

Fig. 10. Transition frequency as a function of collector current; typical values of built-in transistor

11. Test information

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.

12. Package outline

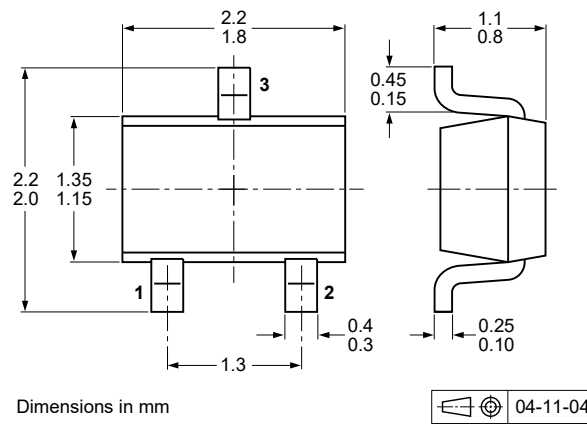


Fig. 11. Package outline SC-70 (SOT323)

13. Soldering

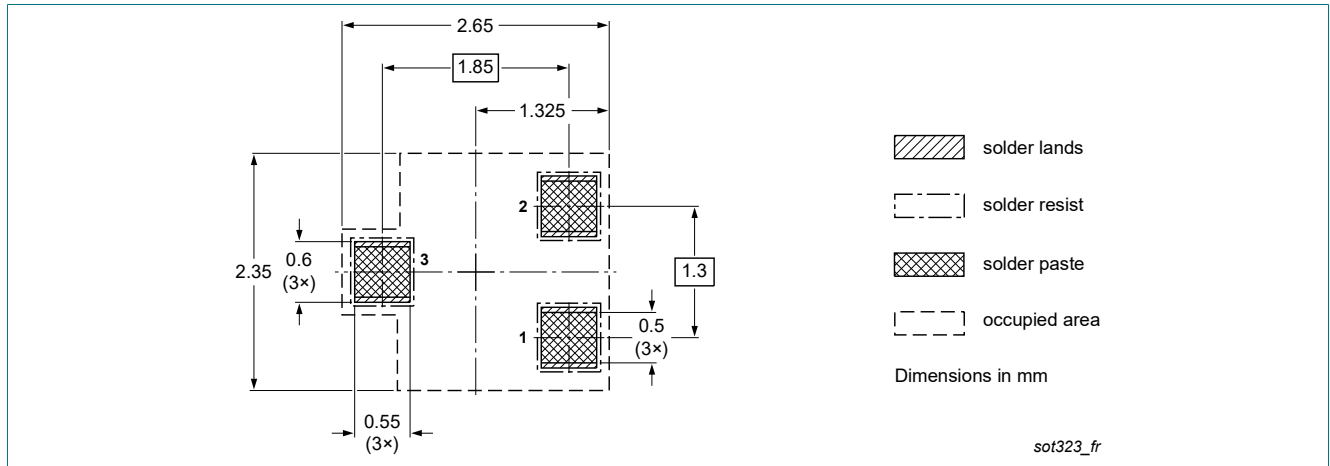


Fig. 12. Reflow soldering footprint for SC-70 (SOT323)

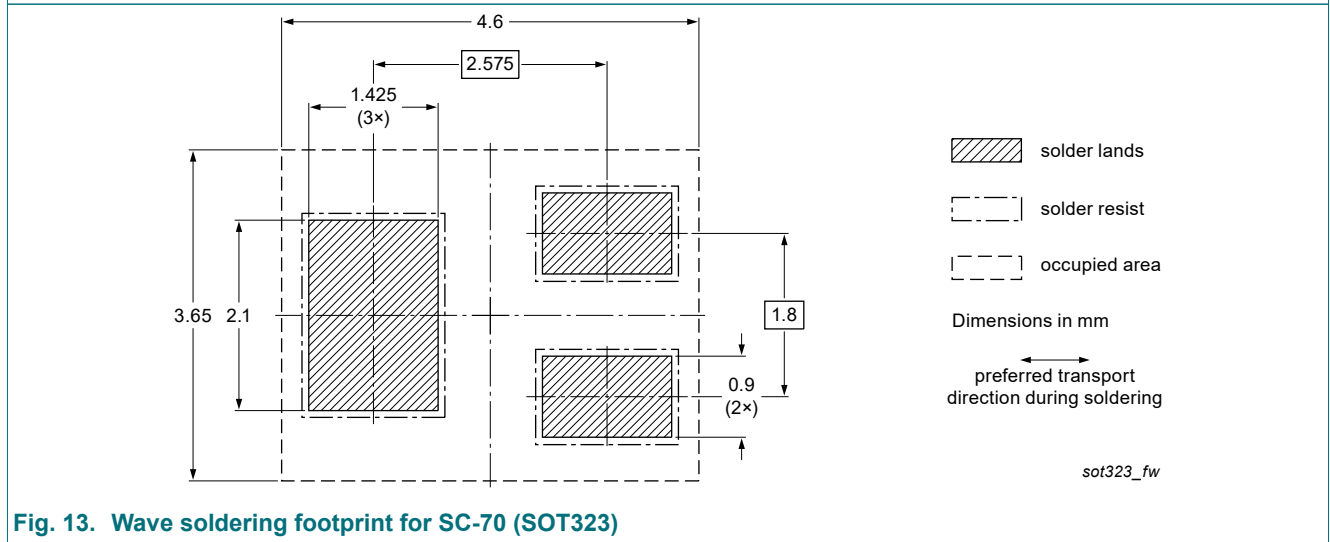


Fig. 13. Wave soldering footprint for SC-70 (SOT323)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PDTD113EU v.2	20240417	Product data sheet	-	PDTD1XXXU_SER v.1
Modifications:	• Family data sheet reduced to single type data sheet.			
PDTD1XXXU_SER v.1	20140513	Product data sheet	-	-

15. Legal information

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 <https://www.nexperia.com>.

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