



# PDTC114ET-Q

50 V, 100 mA NPN resistor-equipped transistor;  
R1 = 10 k $\Omega$ , R2 = 10 k $\Omega$

7 October 2021

Product data sheet

## 1. General description

NPN Resistor-Equipped Transistor (RET) in a small SOT23 Surface-Mounted Device (SMD) plastic package.

PNP complement: PDTA114ET-Q

## 2. Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- Qualified according to AEC-Q101 and recommended for use in automotive applications

## 3. Applications

- Digital application in automotive and industrial segments
- Cost-saving alternative for BC847-Q series in digital applications
- Controlling IC inputs
- Switching loads

## 4. Quick reference data

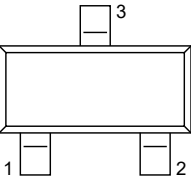
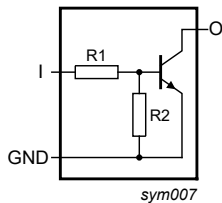
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base		-	-	50	V
I <sub>O</sub>	output current			-	-	100	mA
R1	bias resistor 1		[1]	7	10	13	k $\Omega$
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	

[1] See "Section 11: Test information" for resistor calculation and test conditions.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 <p style="text-align: center;"><b>SOT23</b></p>	 <p style="text-align: center;"><i>sym007</i></p>
2	GND	ground (emitter)		
3	O	output (collector)		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PDTC114ET-Q	SOT23	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	SOT23

## 7. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PDTC114ET-Q	%16

[1] % = placeholder for manufacturing site code

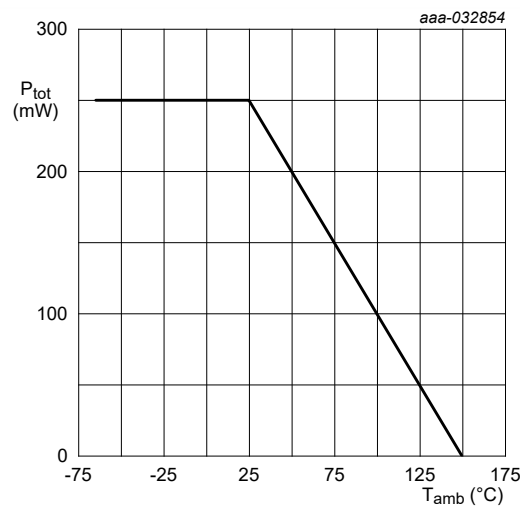
## 8. Limiting values

**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	positive	-	40	V
		negative	-	-10	V
$I_O$	output current		-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	250	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, 35 μm copper, tin-plated and standard footprint.



FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint

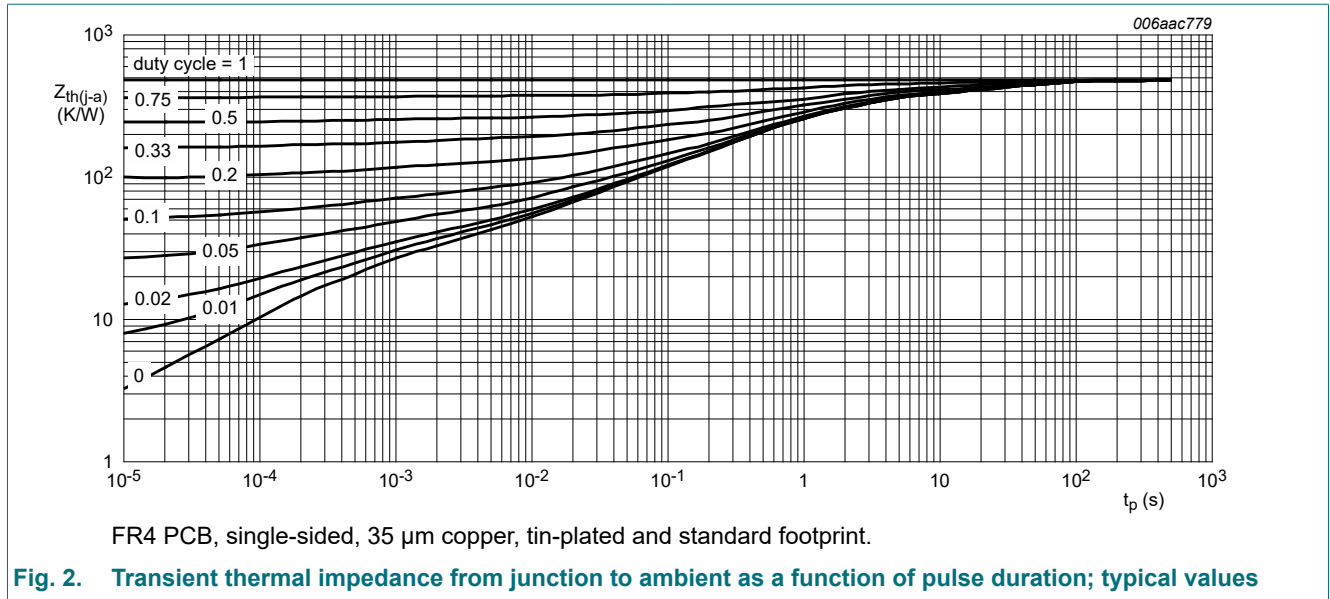
**Fig. 1. Power derating curve**

## 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

[1] Device mounted on an FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint.

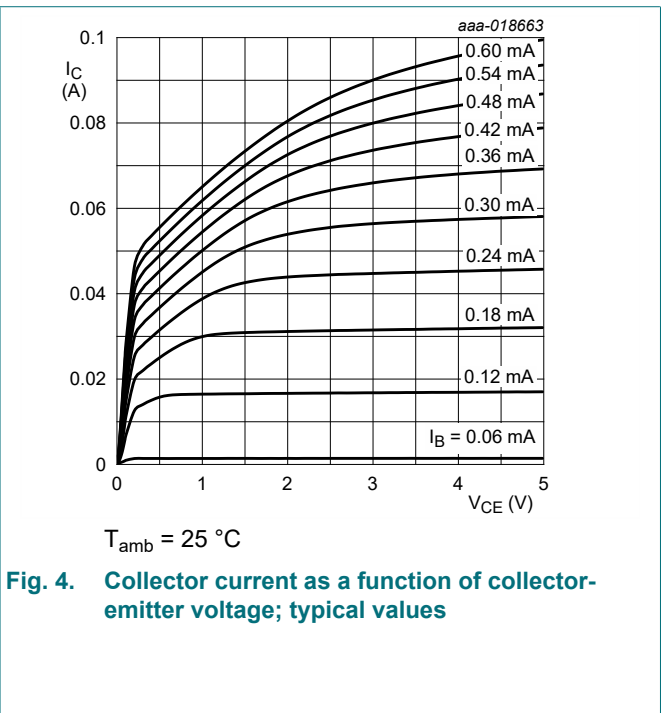
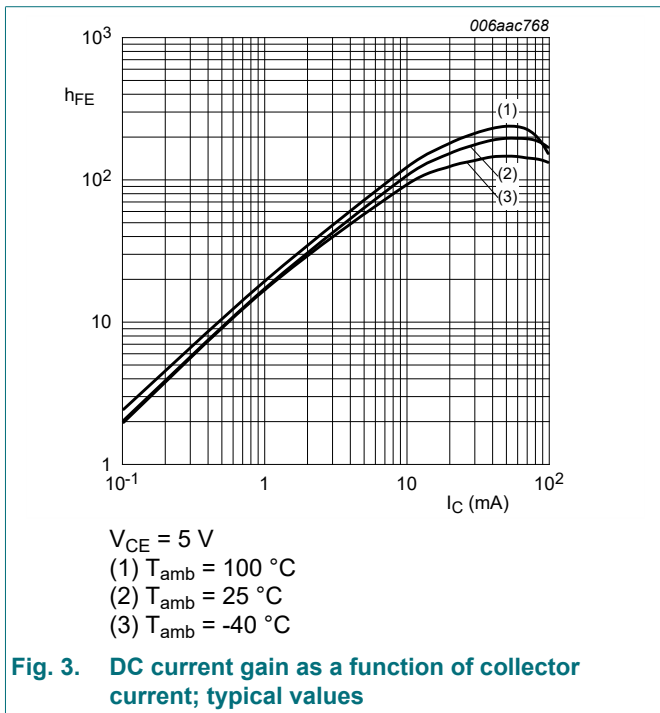


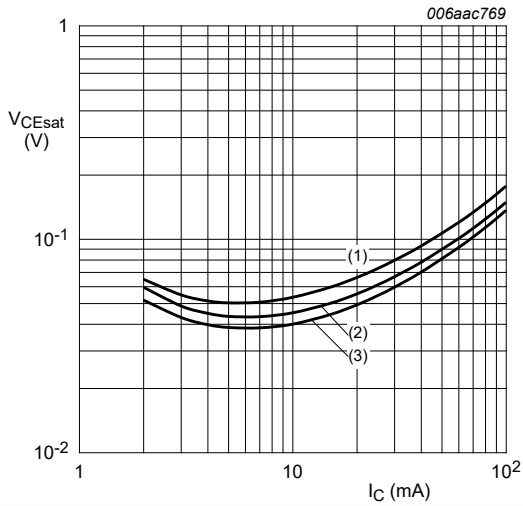
### 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100 \mu A; I_E = 0 A; T_{amb} = 25 \text{ }^\circ C$	50	-	-	V	
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2 \text{ mA}; I_B = 0 A; T_{amb} = 25 \text{ }^\circ C$	50	-	-	V	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50 \text{ V}; I_E = 0 A; T_{amb} = 25 \text{ }^\circ C$	-	-	100	nA	
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30 \text{ V}; I_B = 0 A; T_{amb} = 25 \text{ }^\circ C$	-	-	100	nA	
		$V_{CE} = 30 \text{ V}; I_B = 0 A; T_j = 150 \text{ }^\circ C$	-	-	5	$\mu A$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5 \text{ V}; I_C = 0 A; T_{amb} = 25 \text{ }^\circ C$	-	-	400	$\mu A$	
$h_{FE}$	DC current gain	$V_{CE} = 5 \text{ V}; I_C = 5 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$	30	-	-		
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10 \text{ mA}; I_B = 0.5 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$	-	-	100	mV	
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5 \text{ V}; I_C = 100 \mu A; T_{amb} = 25 \text{ }^\circ C$	-	1.1	0.8	V	
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ C$	2.5	1.8	-	V	
R1	bias resistor 1		[1]	7	10	13	kΩ
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	
$C_c$	collector capacitance	$V_{CB} = 10 \text{ V}; I_E = 0 A; i_e = 0 A; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ C$	-	-	2.5	pF	
$f_T$	transition frequency	$V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ C$	[2]	-	230	-	MHz

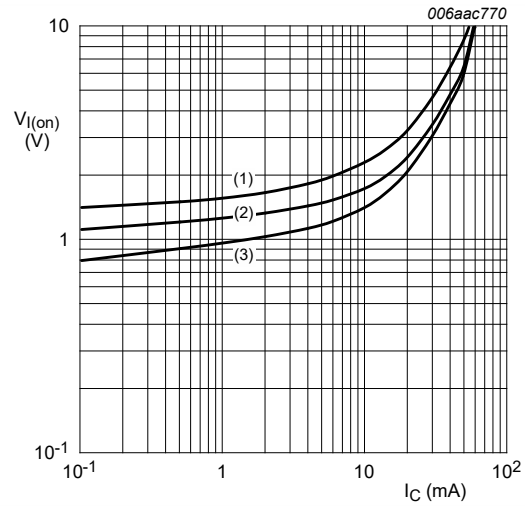
[1] See "Section 11: Test information" for resistor calculation and test conditions.  
 [2] Characteristics of built-in transistor.





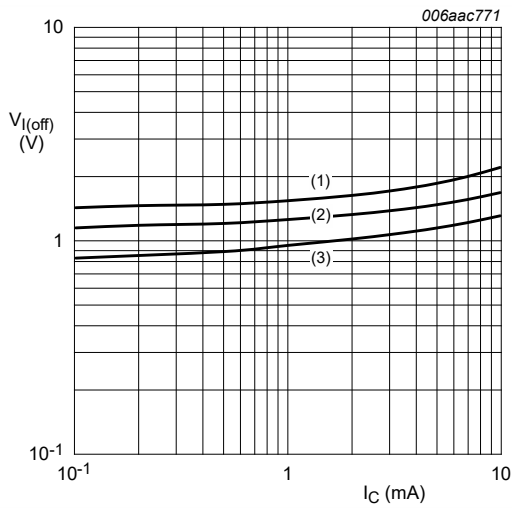
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40\text{ }^\circ\text{C}$

**Fig. 5. Collector-emitter saturation voltage as a function of collector current; typical values**



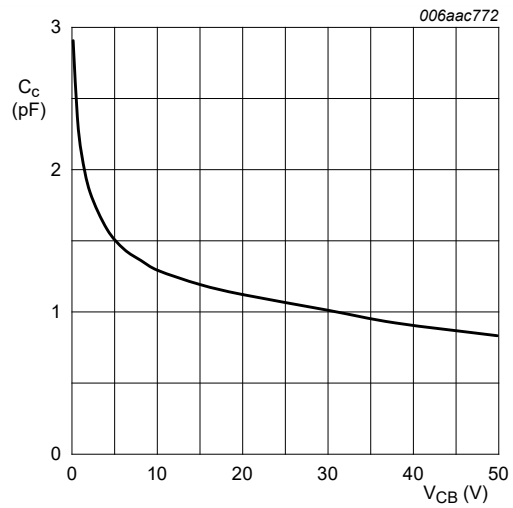
$V_{CE} = 0.3\text{ V}$   
 (1)  $T_{amb} = -40\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

**Fig. 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)  $T_{amb} = 100\text{ }^\circ\text{C}$

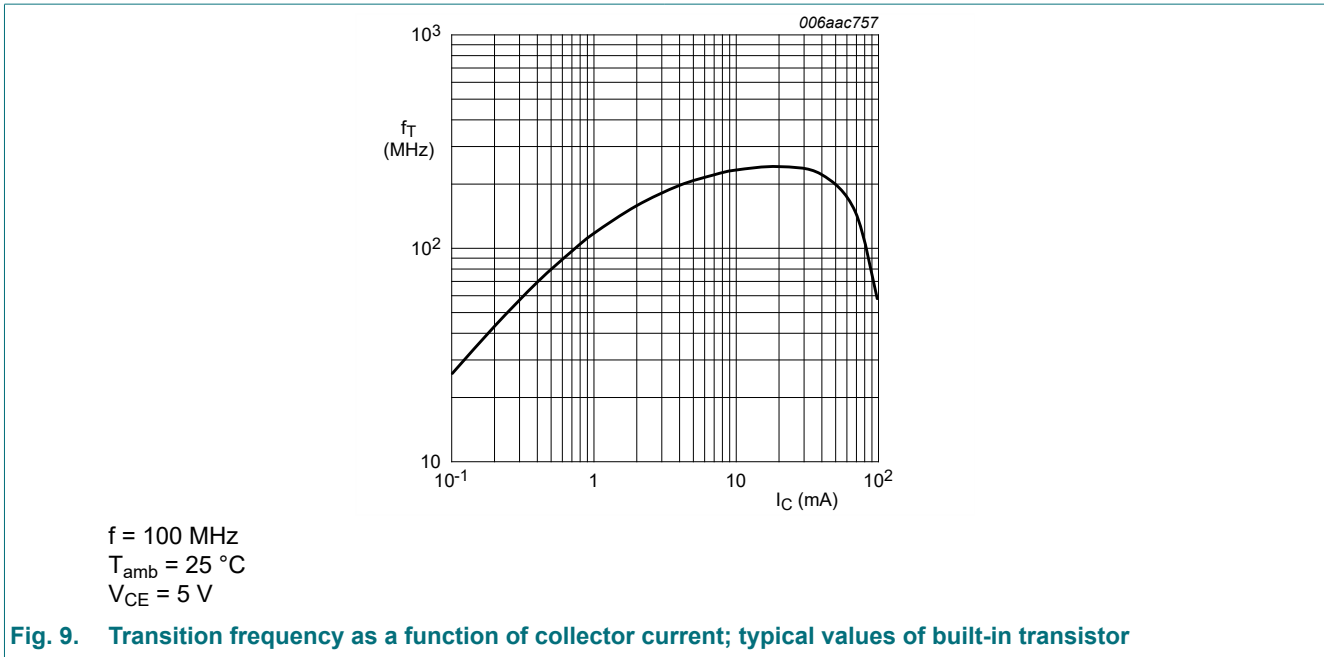
**Fig. 7. Off-state input voltage as a function of collector current; typical values**



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

**Fig. 8. Collector capacitance as a function of collector-base voltage; typical values**

50 V, 100 mA NPN resistor-equipped transistor; R1 = 10 kΩ, R2 = 10 kΩ



## 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.

### Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R1 = \frac{V(I12) - V(I11)}{I12 - I11}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R2}{R1} = \frac{V(I14) - V(I13)}{R1 \cdot (I14 - I13)} - 1$$

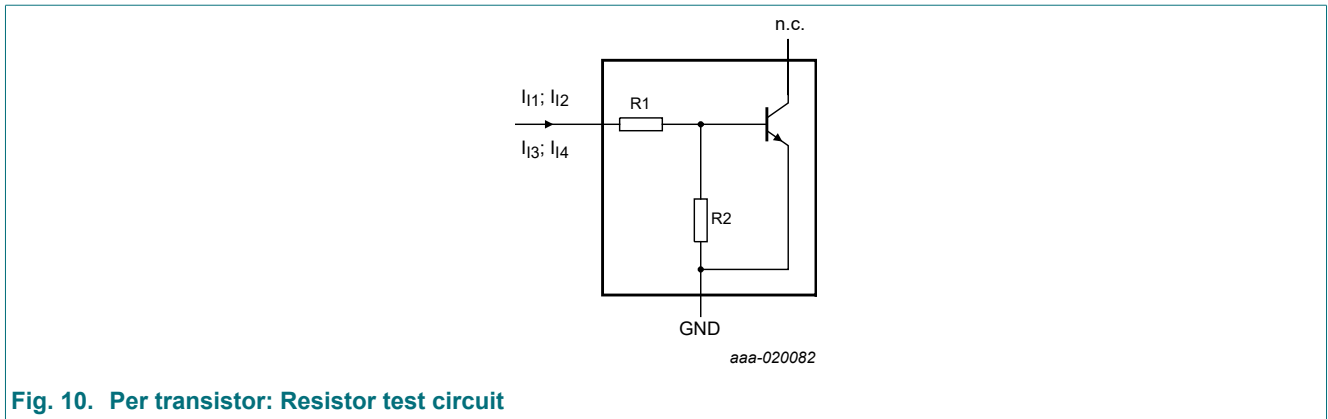


Fig. 10. Per transistor: Resistor test circuit

### Resistor test conditions

Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I <sub>11</sub>	I <sub>12</sub>	I <sub>13</sub>	I <sub>14</sub>
PDTC114ET-Q	10	10	350 μA	450 μA	-350 μA	-450 μA



## 12. Package outline

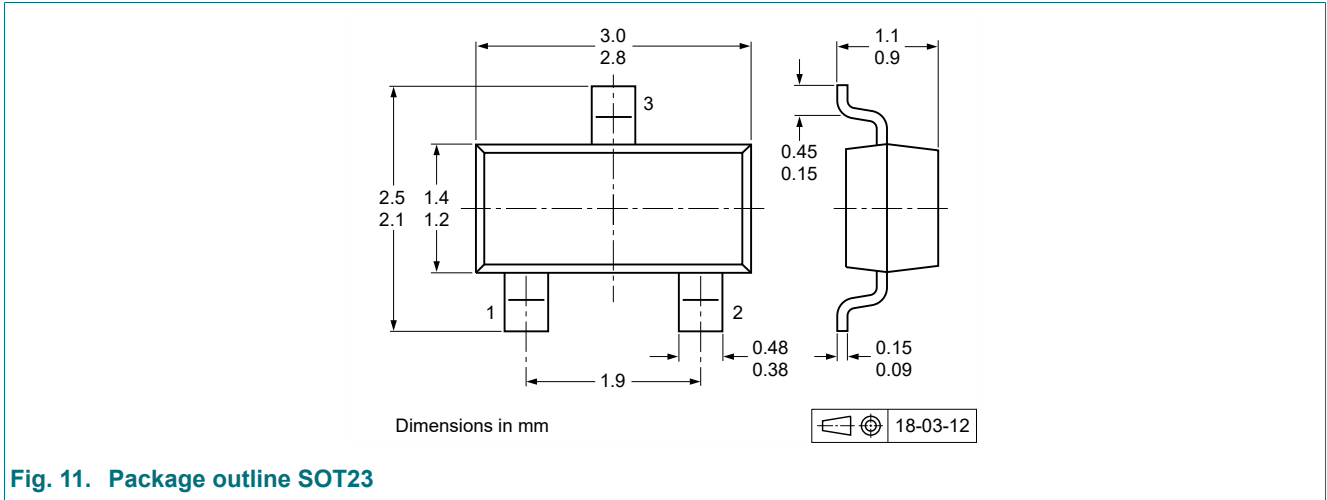


Fig. 11. Package outline SOT23

### 13. Soldering

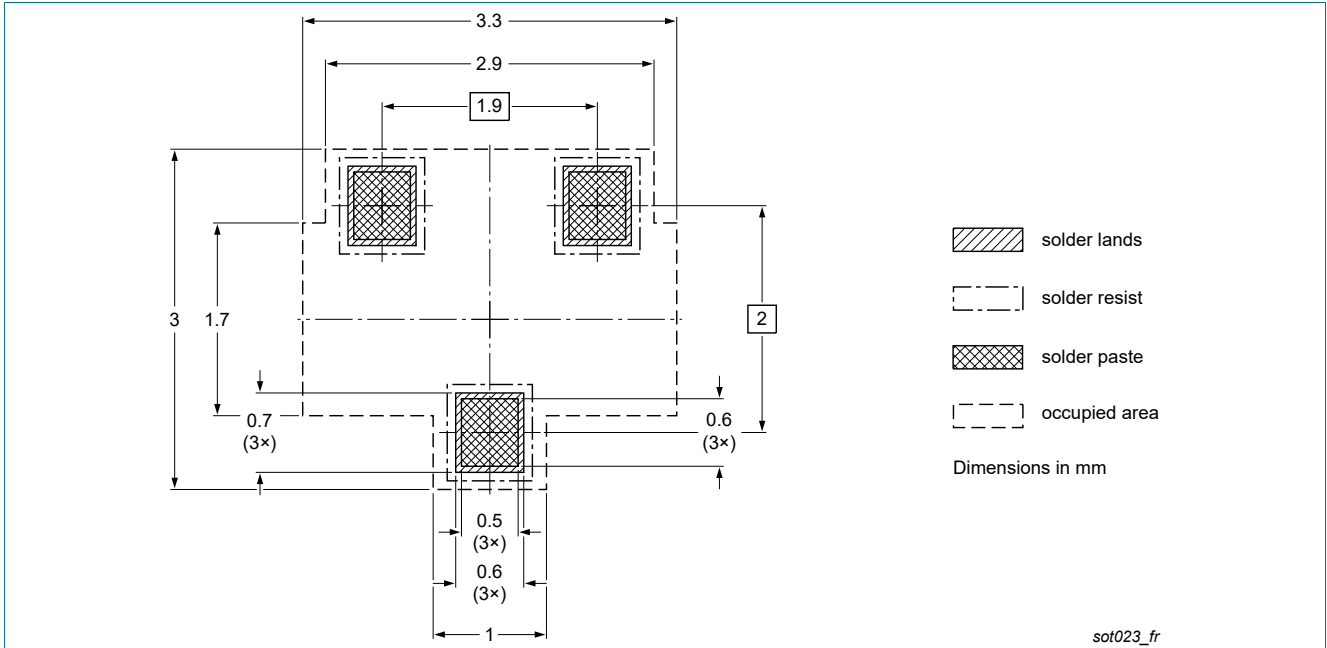


Fig. 12. Reflow soldering footprint for SOT23

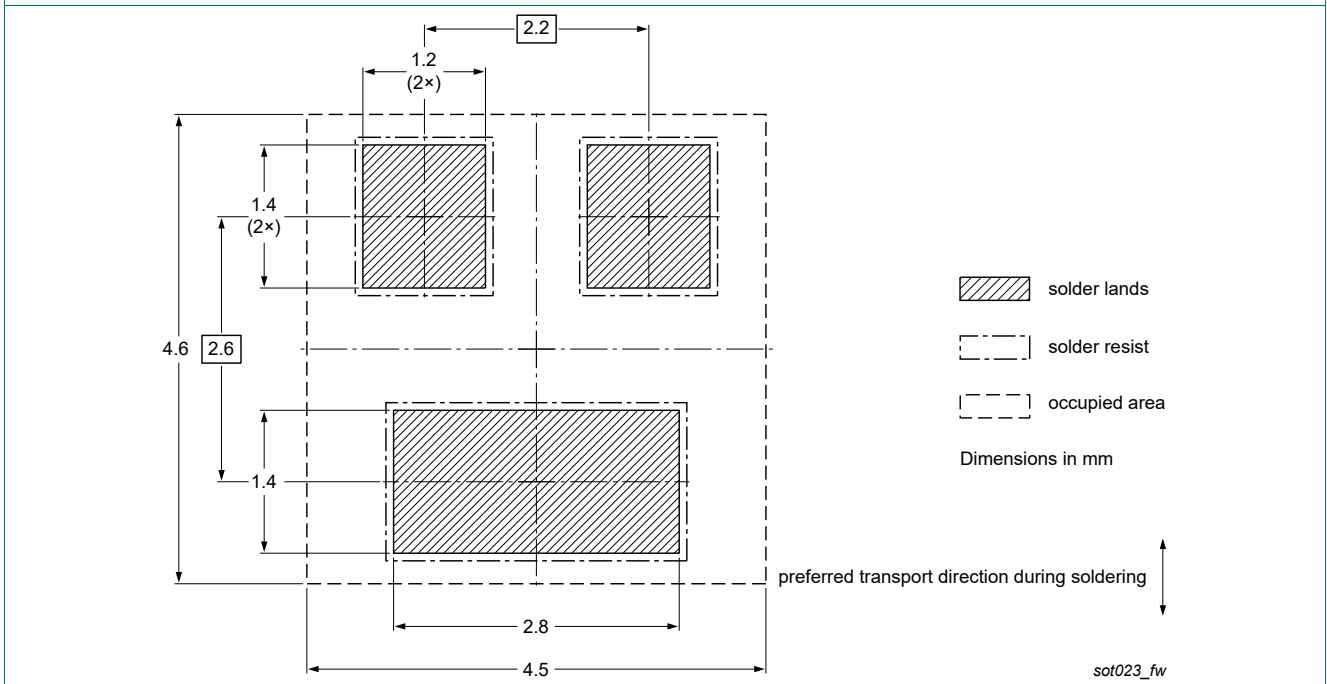


Fig. 13. Wave soldering footprint for SOT23

## 14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PDTC114ET-Q v.2	20211007	Product data sheet	-	PDTC114ET-Q v.1
Modification:	<ul style="list-style-type: none"> <li>• Complete rework</li> <li>• General description: added new line at the end</li> <li>• Applications: Clarification updated</li> <li>• Limiting values: deleted parameter <math>I_{CM}</math></li> <li>• Characteristics: <math>I_{CEO}</math> max limit is updated to 100 nA</li> <li>• Characteristics: <math>V_{CEsat}</math> limit is now updated to 100 mV</li> <li>• Characteristics: added new graphics</li> <li>• Characteristics: Updated the graphics conditions</li> <li>• Characteristics: <math>V_{(BR)EBO}</math> values is removed</li> <li>• Test information: Included resistor calculation, resistor test circuit and resistor test condition</li> </ul>			
PDTC114ET-Q v.1	20210625	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".
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Date of release: 7 October 2021