



# PBRP113ZT

40 V, 600 mA PNP PB RET; R1 = 1 k $\Omega$ , R2 = 10 k $\Omega$

31 March 2021

Product data sheet

## 1. General description

PNP low  $V_{CEsat}$  Performance-Based (PB) Resistor-Equipped Transistor (RET) in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

NPN complement: PBRN113ZT

## 2. Features and benefits

- 600 mA output current capability
- Low collector-emitter saturation voltage  $V_{CEsat}$
- High current gain  $h_{FE}$
- Reduces component count
- Built-in bias resistors
- Reduces pick and place costs
- Simplifies circuit design
- $\pm 10\%$  resistor ratio tolerance

## 3. Applications

- Digital application in automotive and industrial segments
- Switching loads
- Medium current peripheral driver

## 4. Quick reference data

Table 1. Quick reference data

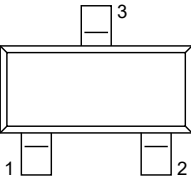
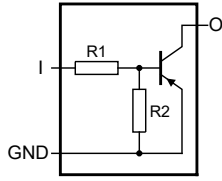
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base		-	-	-40	V
$I_O$	output current		[1]	-	-	-600	mA
R1	bias resistor 1		[2]	0.7	1	1.3	k $\Omega$
R2/R1	bias resistor ratio		[2]	9	10	11	

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35  $\mu$ m copper, tin-plated and standard footprint.

[2] See section "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>aaa-019606</i></p>
2	GND	ground (emitter)		
3	O	output (collector)		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBRP113ZT	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>
PBRP113ZT	%7M

[1] % = placeholder for manufacturing site code

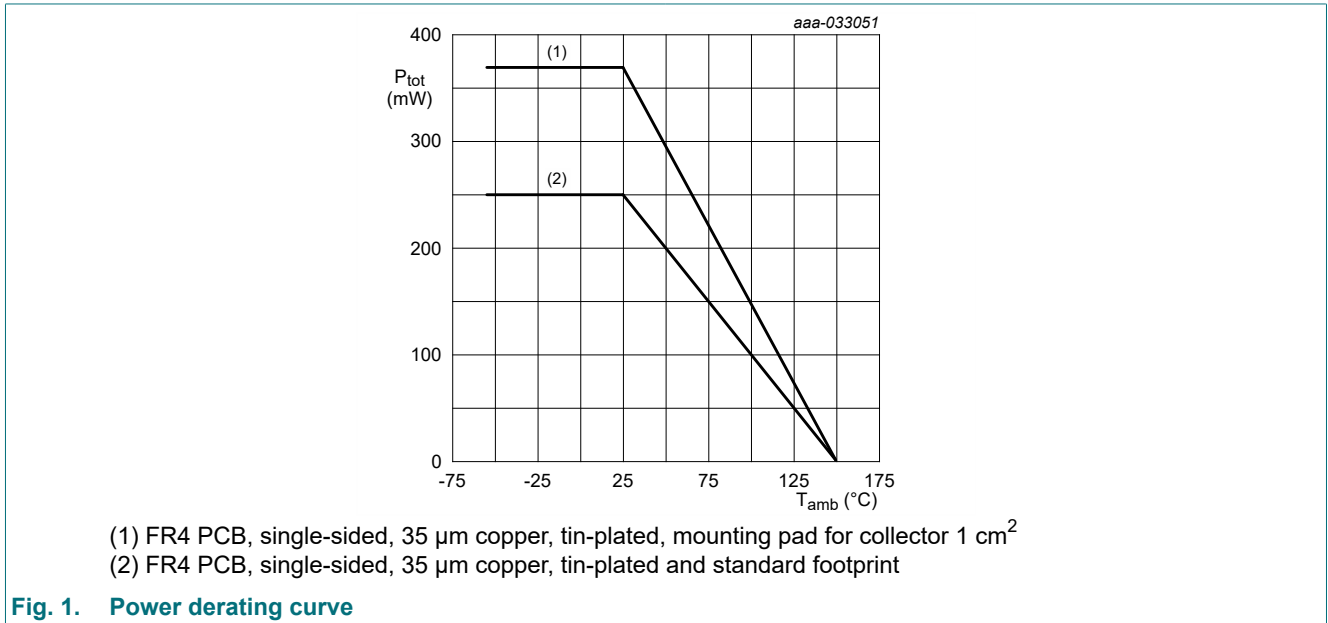
## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CBO</sub>	collector-base voltage	open emitter	-	-40	V
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-40	V
V <sub>EBO</sub>	emitter-base voltage	open collector	-	-5	V
V <sub>I</sub>	input voltage	positive	-	5	V
		negative	-	-10	V
I <sub>O</sub>	output current		[1]	-600	mA
I <sub>ORM</sub>	repetitive peak output current	t <sub>p</sub> ≤ 1 ms; δ ≤ 0.33	-	-800	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	250	mW
			[2]	370	mW
T <sub>j</sub>	junction temperature		-	150	°C
T <sub>amb</sub>	ambient temperature		-55	150	°C
T <sub>stg</sub>	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.
- [2] Device mounted on an FR4 PCB, single-sided, 35 μm copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



## 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]	-	-	338	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	105	K/W

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

[2] Device mounted on an FR4 PCB, single-sided, 35 μm copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

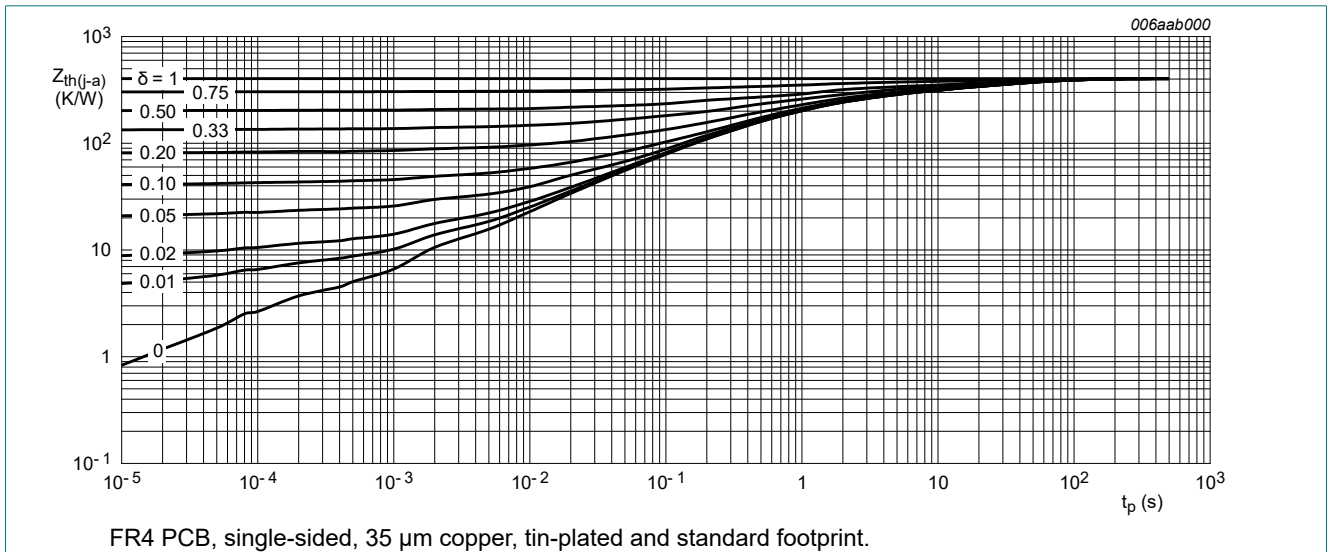


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

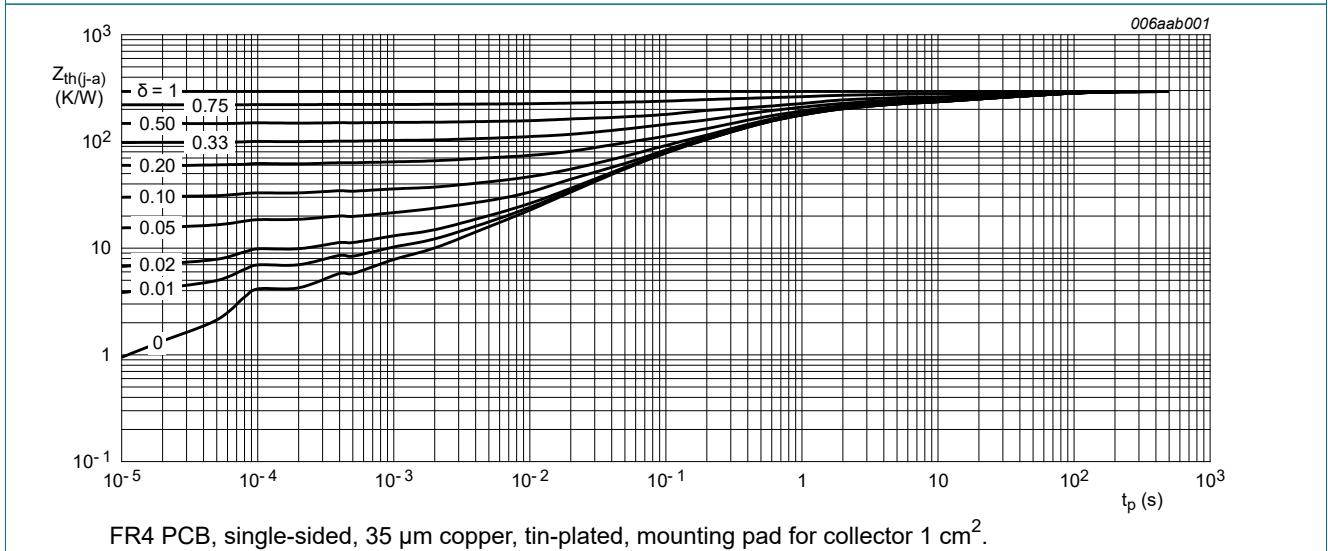


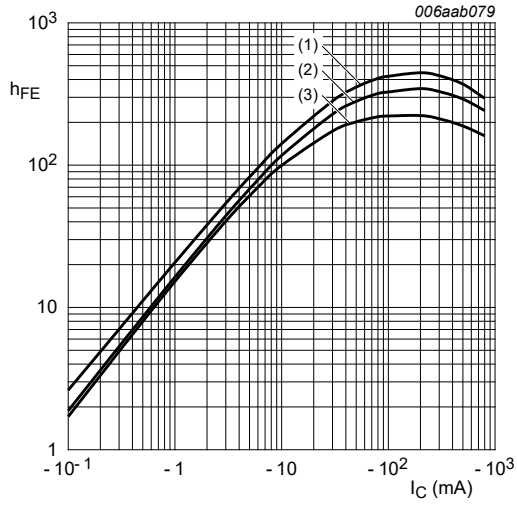
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

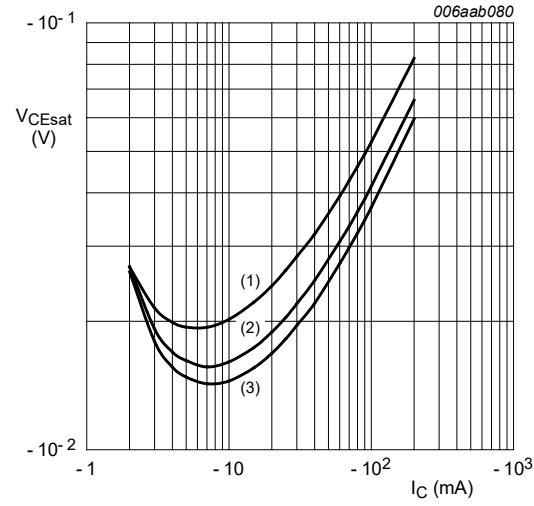
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = -100 \mu\text{A}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-40	-	-	V	
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = -10 \text{ mA}$ ; $I_B = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-40	-	-	V	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -30 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	-100	nA	
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = -30 \text{ V}$ ; $I_B = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	-0.5	$\mu\text{A}$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5 \text{ V}$ ; $I_C = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	-0.8	mA	
$h_{FE}$	DC current gain	$V_{CE} = -5 \text{ V}$ ; $I_C = -50 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	190	270	-		
		$V_{CE} = -5 \text{ V}$ ; $I_C = -300 \text{ mA}$ ; pulsed; $t_p \leq 300 \mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	230	320	-		
		$V_{CE} = -5 \text{ V}$ ; $I_C = -600 \text{ mA}$ ; pulsed; $t_p \leq 300 \mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	190	270	-		
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -50 \text{ mA}$ ; $I_B = -2.5 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-35	-45	mV	
		$I_C = -200 \text{ mA}$ ; $I_B = -10 \text{ mA}$ ; pulsed; $t_p \leq 300 \mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-70	-100	mV	
		$I_C = -500 \text{ mA}$ ; $I_B = -10 \text{ mA}$ ; pulsed; $t_p \leq 300 \mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-200	-300	mV	
		$I_C = -600 \text{ mA}$ ; $I_B = -6 \text{ mA}$ ; pulsed; $t_p \leq 300 \mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-450	-750	mV	
$V_{I(off)}$	off-state input voltage	$V_{CE} = -5 \text{ V}$ ; $I_C = -100 \mu\text{A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-0.3	-0.5	-1	V	
$V_{I(on)}$	on-state input voltage	$V_{CE} = -0.3 \text{ V}$ ; $I_C = -20 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-0.4	-0.7	-1.4	V	
R1	bias resistor 1		[1]	0.7	1	1.3	kΩ
R2/R1	bias resistor ratio		[1]	9	10	11	
$C_c$	collector capacitance	$V_{CB} = -10 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $i_e = 0 \text{ A}$ ; $f = 1 \text{ MHz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	11	-	pF	

[1] See section "Test information" for resistor calculation and test conditions



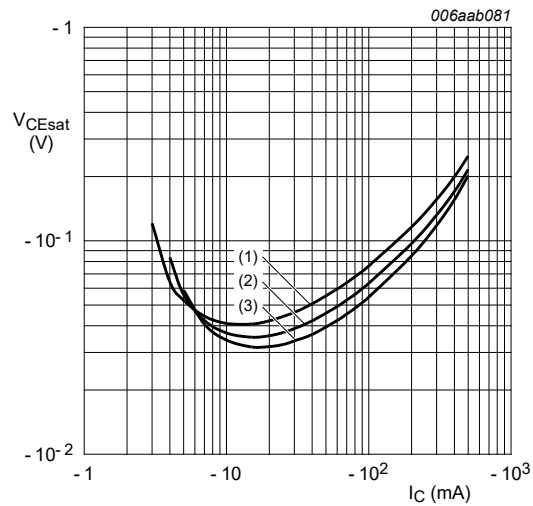
$V_{CE} = -5 V$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -40^\circ C$

**Fig. 4. DC current gain as a function of collector current; typical values**



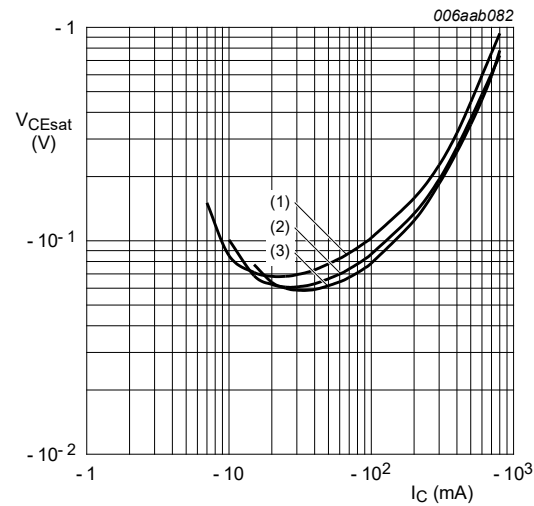
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -40^\circ C$

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



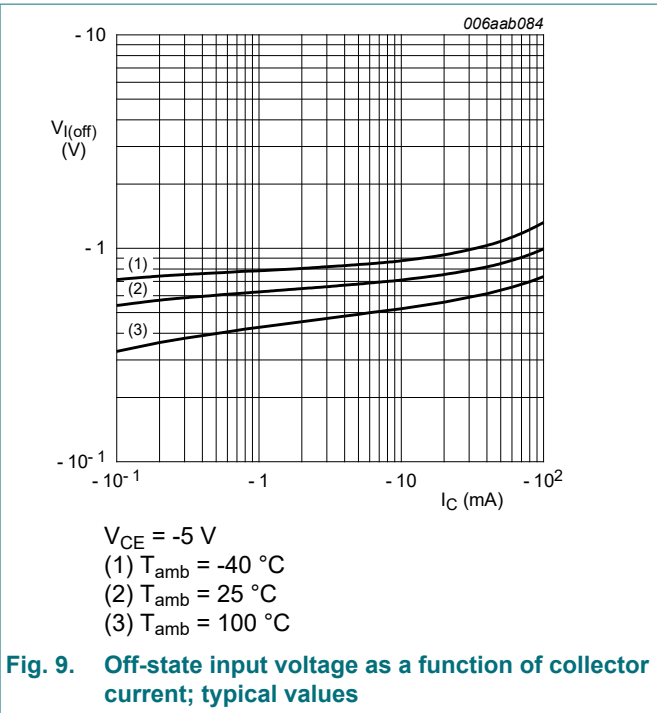
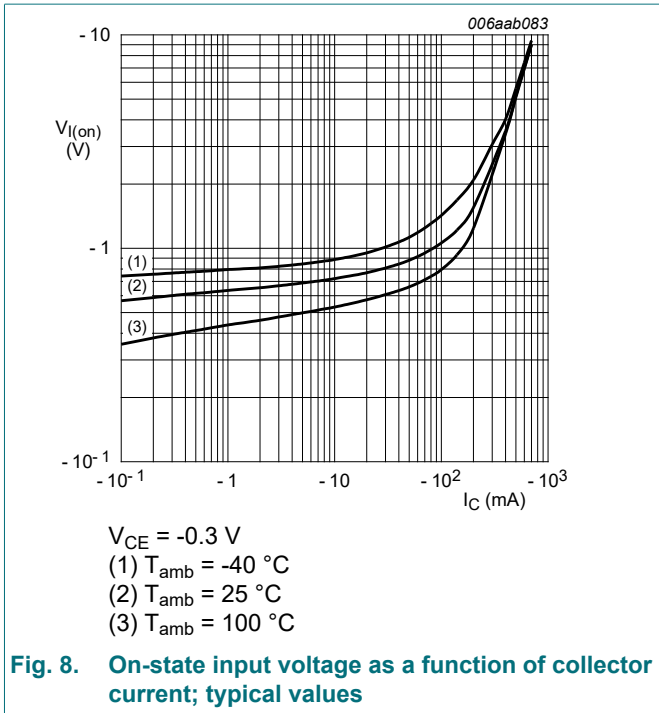
$I_C/I_B = 50$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -40^\circ C$

**Fig. 6. Collector-emitter saturation voltage as a function of collector current; typical values**



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

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



## 11. Test information

### Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R1 = \frac{V(I_{I2}) - V(I_{I1})}{I_{I2} - I_{I1}}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R2}{R1} = \frac{V(I_{I3})}{R1 \cdot I_{I3}} - 1$$

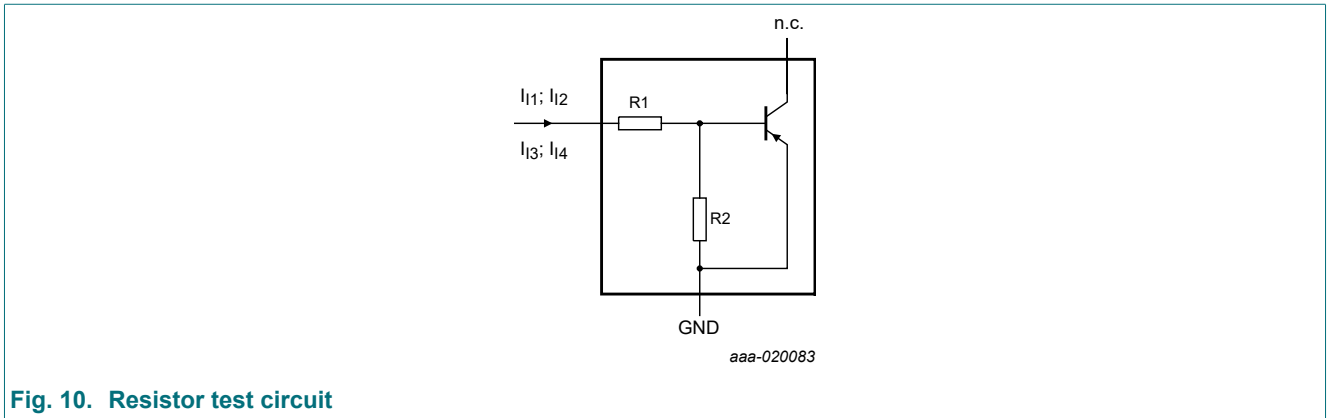


Fig. 10. Resistor test circuit

### Resistor test conditions

Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions		
			I <sub>I1</sub>	I <sub>I2</sub>	I <sub>I3</sub>
PBRP113ZT	1	10	-700 μA	-800 μA	750 μA

## 12. Package outline

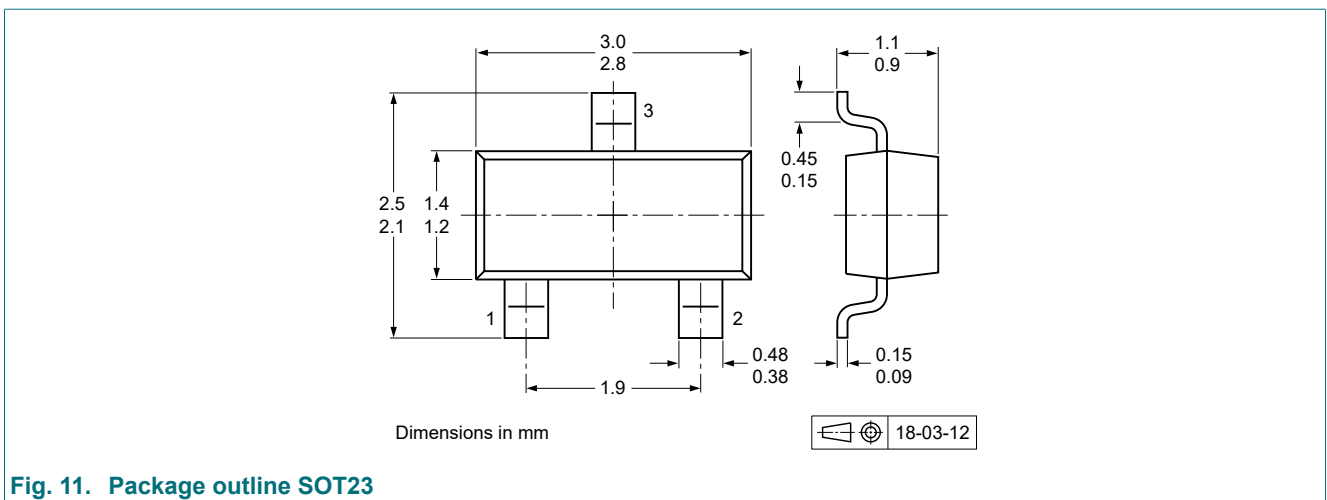
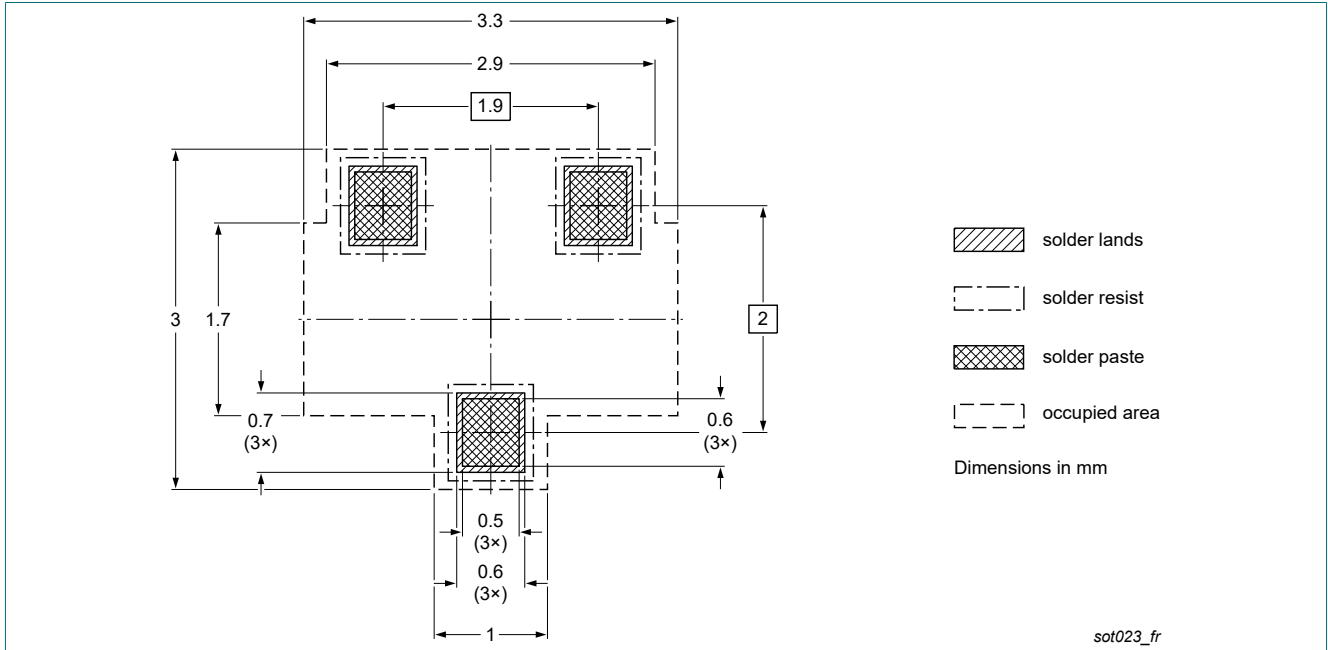


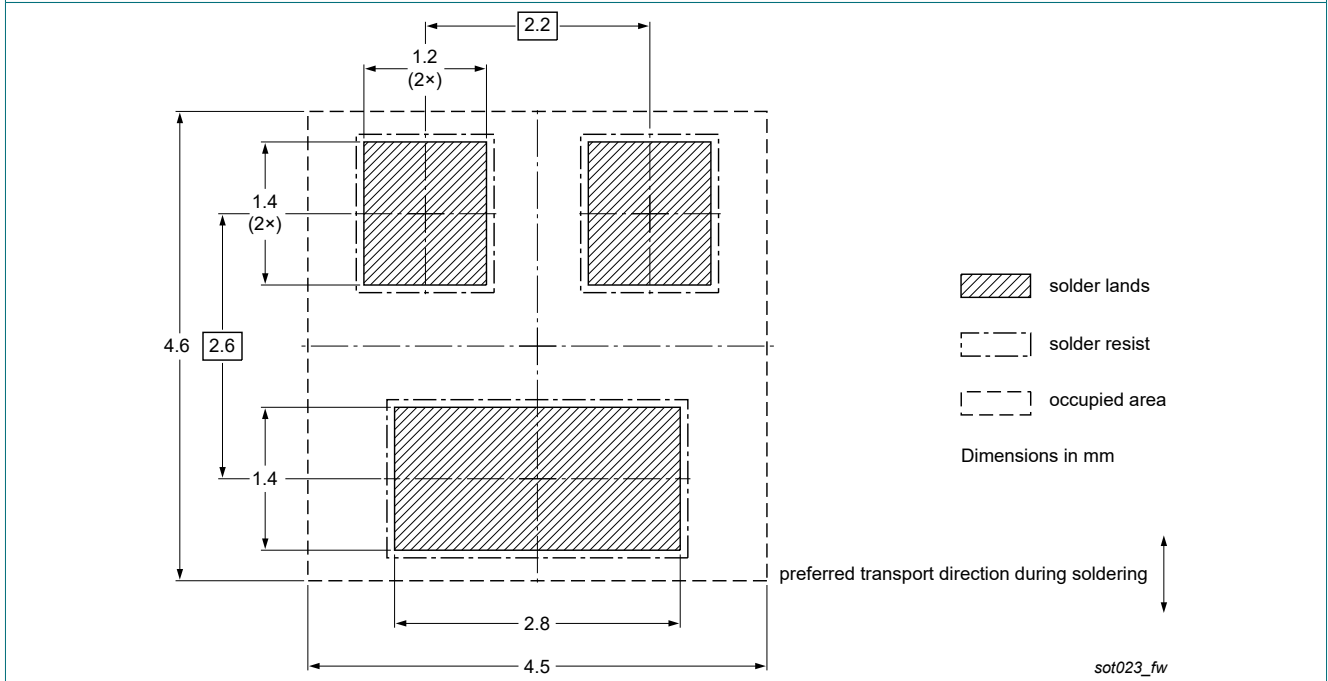
Fig. 11. Package outline SOT23



### 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
PBRP113ZT v.2	20210331	Product data sheet	-	PBRP113ZT v.1
Modifications:	<ul style="list-style-type: none"><li>• Product description changed from BISS to PB RET</li><li>• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li></ul>			
PBRP113ZT v.1	20080116	Product data sheet	-	-

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### 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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## Contents

---

1. General description.....	1
2. Features and benefits.....	1
3. Applications.....	1
4. Quick reference data.....	1
5. Pinning information.....	2
6. Ordering information.....	2
7. Marking.....	2
8. Limiting values.....	3
9. Thermal characteristics.....	4
10. Characteristics.....	5
11. Test information.....	8
12. Package outline.....	8
13. Soldering.....	9
14. Revision history.....	10
15. Legal information.....	11

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Date of release: 31 March 2021

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