

PBRP113ET-Q

40 V, 600 mA PNP PB RET; R1 = 1 kΩ, R2 = 1 kΩ

6 May 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: PBRN113ET-Q

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
- ± 10 % resistor ratio tolerance
- Qualified according to AEC-Q101 and recommended for use in automotive applications

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	kΩ
R2/R1	bias resistor ratio		[2]	0.9	1	1.1	

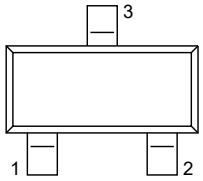
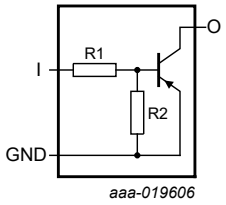
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 µm copper, tin-plated and standard footprint.
[2] See section "Test information" for resistor calculation and test conditions

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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 SOT23	
2	GND	ground (emitter)		
3	O	output (collector)		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBRP113ET-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[1]
PBRP113ET-Q	%7K

[1] % = placeholder for manufacturing site code

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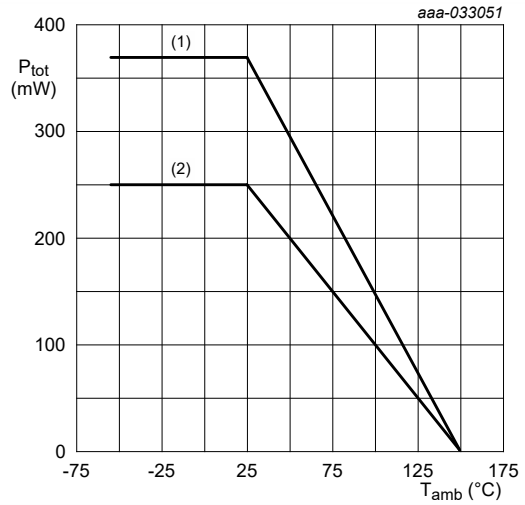
8. Limiting values

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		-	-40	V
V_{CEO}	collector-emitter voltage	open base		-	-40	V
V_{EBO}	emitter-base voltage	open collector		-	-10	V
V_I	input voltage	positive		-	10	V
		negative		-	-10	V
I_O	output current		[1]	-	-600	mA
I_{ORM}	repetitive peak output current	$t_p \leq 1$ ms; $\delta \leq 0.33$		-	-800	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	250	mW
			[2]	-	370	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			-55	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.
[2] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated, mounting pad for collector 1 cm^2.



(1) FR4 PCB, single-sided, 35 µm copper, tin-plated, mounting pad for collector 1 cm^2
(2) FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint

Fig. 1. Power derating curve

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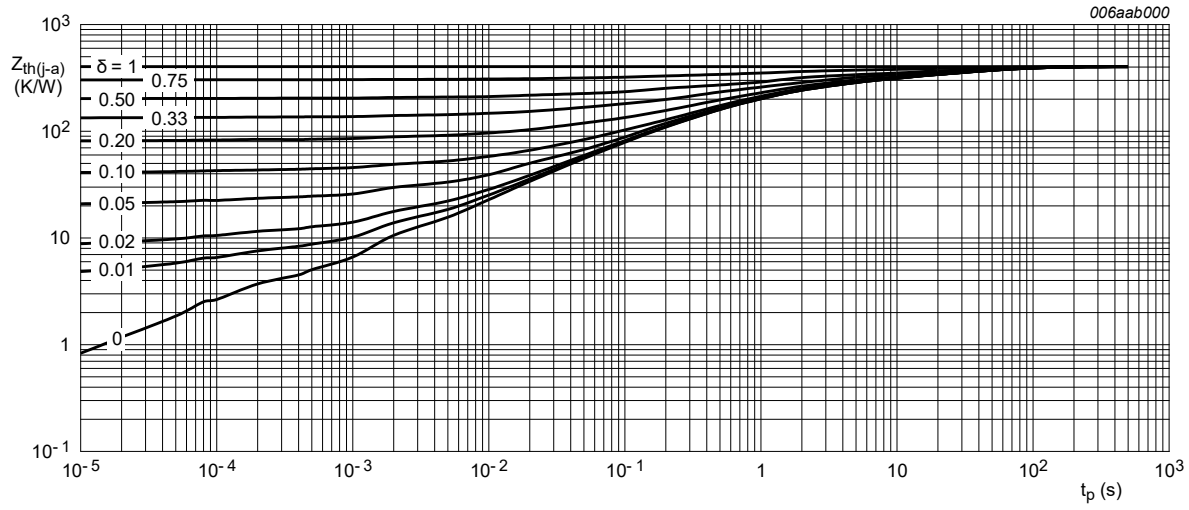
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9. Thermal characteristics

Table 6. Thermal characteristics

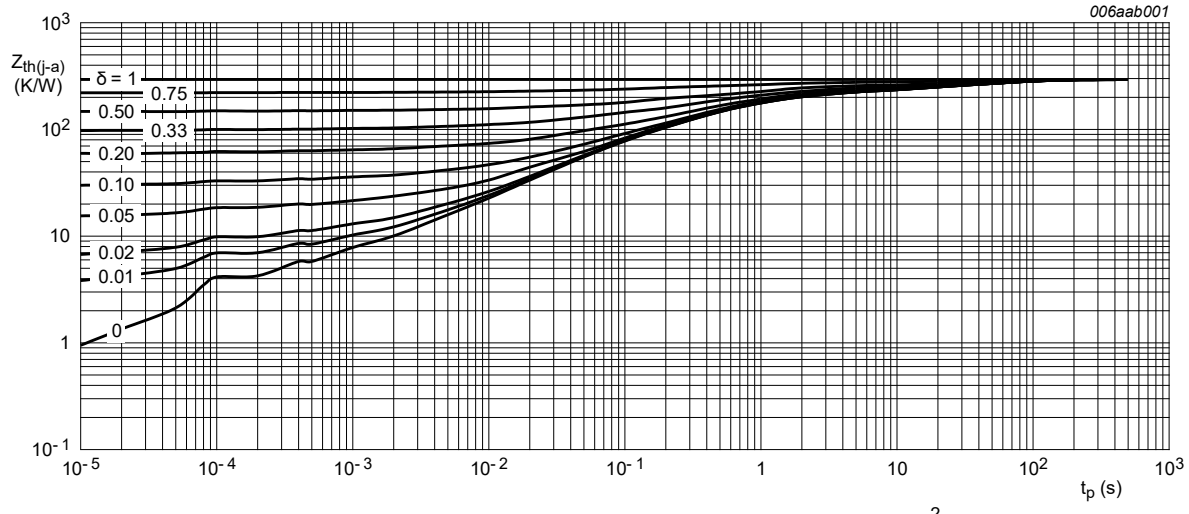
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	500	K/W
			[2]	-	-	338	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	105	K/W

[1] Device mounted on an FR4 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^2.



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

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



FR4 PCB, single-sided, 35 µm copper, tin-plated, mounting pad for collector 1 cm^2.

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

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10. Characteristics

Table 7. Characteristics

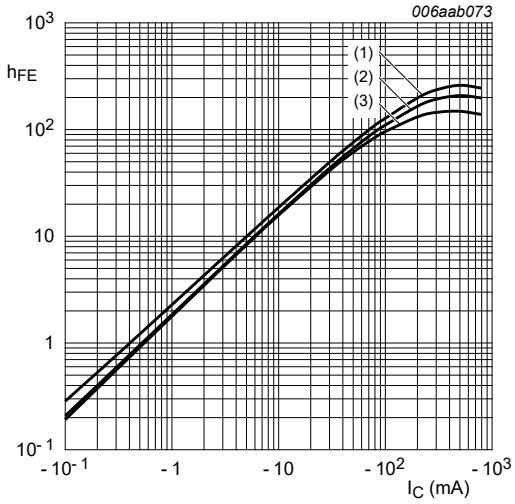
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = -100 µA; I_E = 0 A; T_{amb} = 25 °C		-40	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = -10 mA; I_B = 0 A; T_{amb} = 25 °C		-40	-	-	V
I_{CBO}	collector-base cut-off current	V_{CB} = -30 V; I_E = 0 A; T_{amb} = 25 °C		-	-	-100	nA
I_{CEO}	collector-emitter cut-off current	V_{CE} = -30 V; I_B = 0 A; T_{amb} = 25 °C		-	-	-0.5	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = -5 V; I_C = 0 A; T_{amb} = 25 °C		-	-	-4	mA
h_{FE}	DC current gain	V_{CE} = -5 V; I_C = -50 mA; T_{amb} = 25 °C		40	65	-	
		V_{CE} = -5 V; I_C = -300 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		130	190	-	
		V_{CE} = -5 V; I_C = -600 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		140	210	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = -50 mA; I_B = -2.5 mA; T_{amb} = 25 °C		-	-35	-45	mV
		I_C = -200 mA; I_B = -10 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-70	-100	mV
		I_C = -500 mA; I_B = -10 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-200	-300	mV
		I_C = -600 mA; I_B = -6 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-450	-750	mV
$V_{I(off)}$	off-state input voltage	V_{CE} = -5 V; I_C = -100 µA; T_{amb} = 25 °C		-0.6	-1	-1.5	V
$V_{I(on)}$	on-state input voltage	V_{CE} = -0.3 V; I_C = -20 mA; T_{amb} = 25 °C		-1	-1.3	-1.8	V
R1	bias resistor 1		[1]	0.7	1	1.3	kΩ
R2/R1	bias resistor ratio		[1]	0.9	1	1.1	
C_c	collector capacitance	V_{CB} = -10 V; I_E = 0 A; i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	11	-	pF

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

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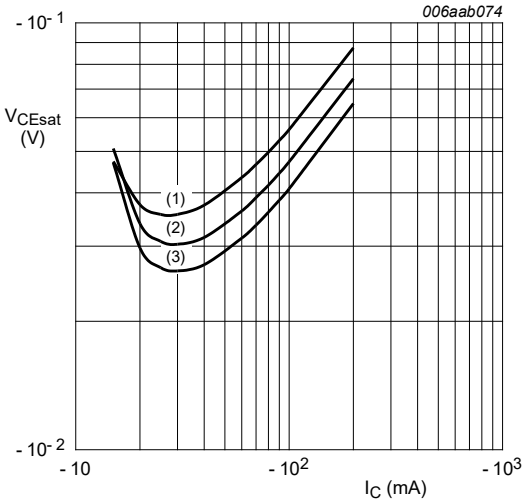
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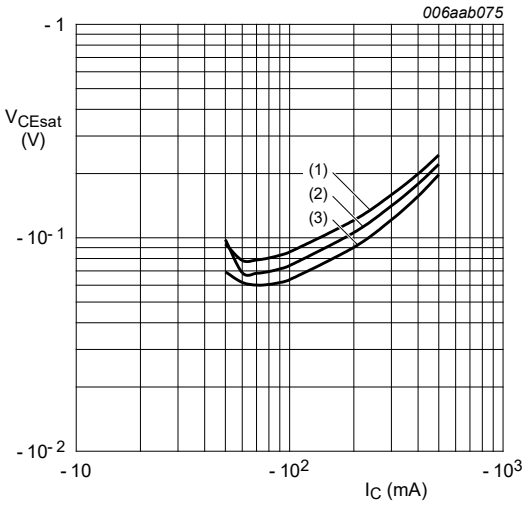
V_{CE} = -5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −40 °C

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



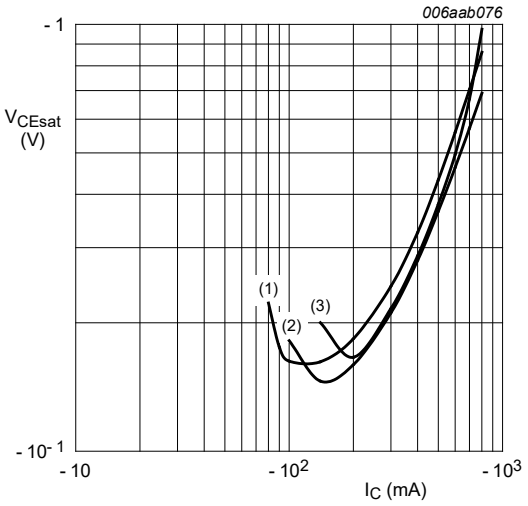
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −40 °C

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



I_C/I_B = 50
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −40 °C

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



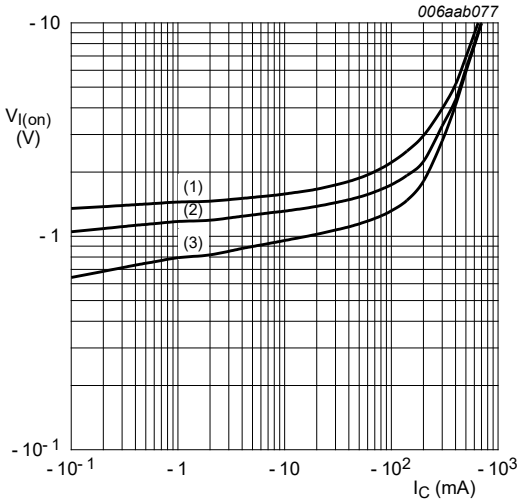
I_C/I_B = 100
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −40 °C

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

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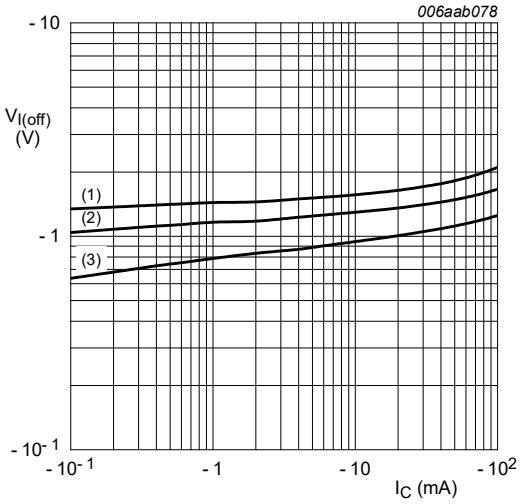
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V_{CE} = -0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

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

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11. Test information

Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R_1 = \frac{V(I_{I2}) - V(I_{I1})}{I_{I2} - I_{I1}}$$

- Calculation of bias resistor ratio (R2/R1)

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

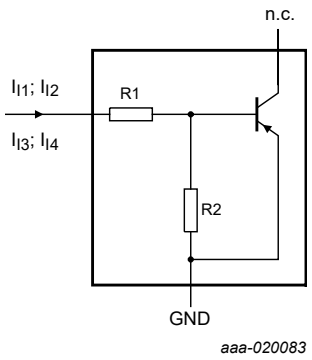


Fig. 10. Resistor test circuit

Resistor test conditions

Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions		
			I_{I1}	I_{I2}	I_{I3}
PBRP113ET	1	1	-1.6 mA	-1.7 mA	1.65 mA

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.

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12. Package outline

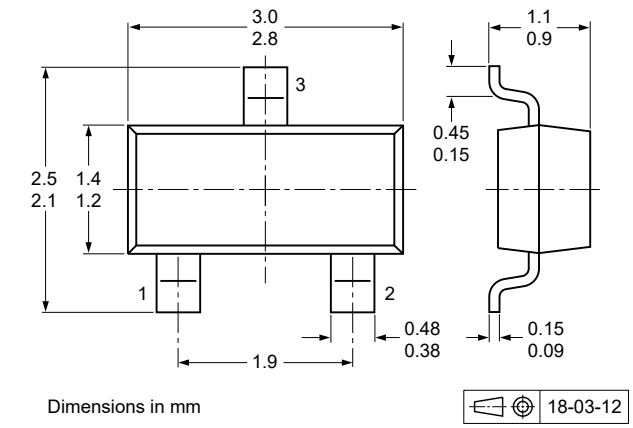


Fig. 11. Package outline SOT23

13. Soldering

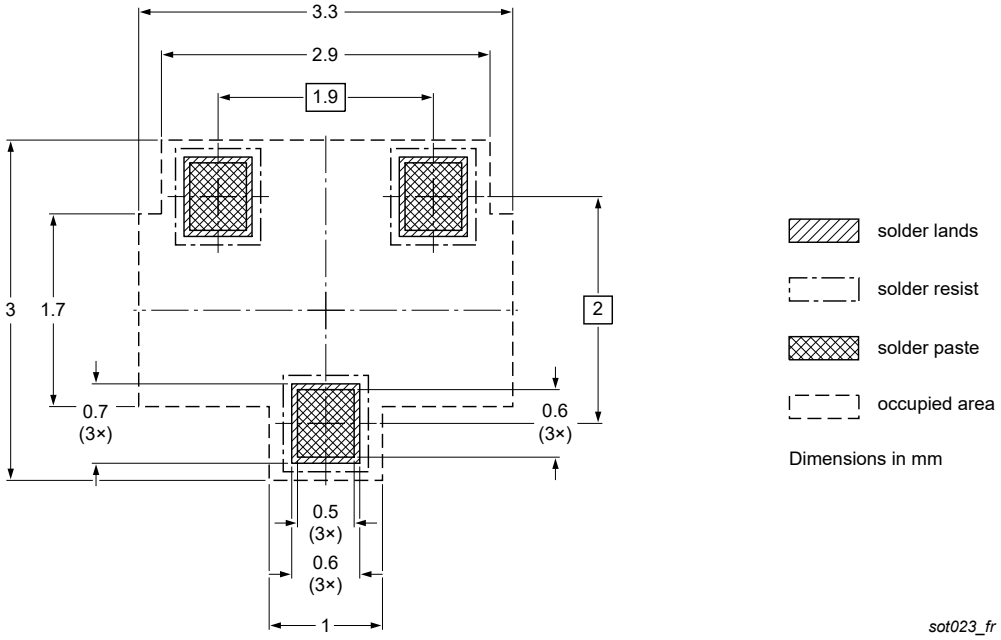


Fig. 12. Reflow soldering footprint for SOT23

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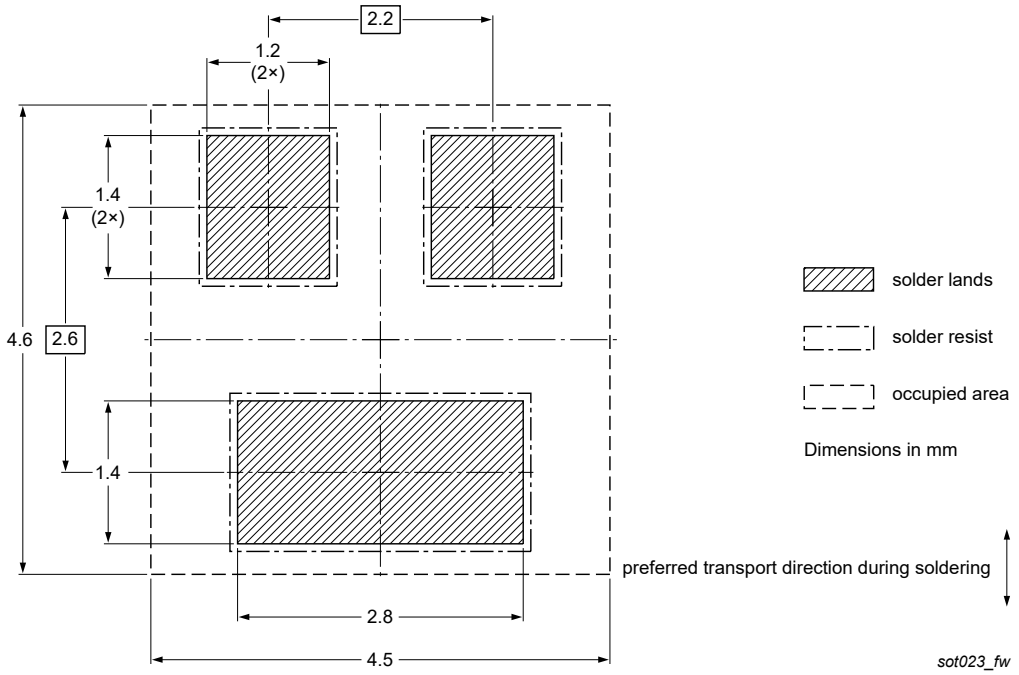


Fig. 13. Wave soldering footprint for SOT23

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14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBRP113ET-Q v.2	20210506	Product data sheet	-	PBRP113ET-Q v.1
Modifications:	• Features and benefits: added recommendation for automotive applications			
PBRP113ET-Q v.1	20210331	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.
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