



# PNS40010AER-Q

400 V, 1 A high power density, standard switching time recovery rectifier

3 June 2024

Product data sheet

## 1. General description

High power density, standard switching time recovery rectifier with high-efficiency planar technology, encapsulated in a small and flat lead SOD123W Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- Forward current  $I_F \leq 1$  A
- Reverse voltage  $V_R \leq 400$  V
- Standard switching time
- Low forward voltage
- Low reverse current
- Low inductance
- Small and flat lead SMD plastic package
- Package height typ. 1 mm
- High power capability
- Capable for reflow and wave soldering
- Qualified according to AEC-Q101 and recommended for use in automotive applications

## 3. Applications

- General-purpose rectification
- Reverse polarity protection
- Standard switching applications

## 4. Quick reference data


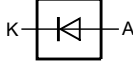
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$I_{F(AV)}$	average forward current	$\delta = 0.5$ ; $f = 20$ kHz; square wave; $T_{sp} \leq 166$ °C		-	-	1	A
$V_{RRM}$	repetitive peak reverse voltage			-	-	400	V
$V_R$	reverse voltage			-	-	400	V
$V_F$	forward voltage	$I_F = 0.5$ A; pulsed; $T_j = 25$ °C	[1]	-	0.89	1.05	V
		$I_F = 0.7$ A; pulsed; $T_j = 25$ °C	[1]	-	0.91	1.07	V
		$I_F = 1$ A; pulsed; $T_j = 25$ °C	[1]	-	0.93	1.1	V
$I_R$	reverse current	$V_R = 400$ V; pulsed; $T_j = -40$ °C	[1]	-	0.1	10	nA
		$V_R = 400$ V; pulsed; $T_j = 25$ °C	[1]	-	0.001	1	$\mu$ A

[1] Very short pulse, in order to maintain a stable junction temperature.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode	 CFP3 (SOD123W)	 006aab040
2	A	anode		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PNS40010AER-Q</a>	CFP3	plastic, surface mounted package; 2 terminals; 2.6 mm x 1.7 mm x 1 mm body	<a href="#">SOD123W</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PNS40010AER-Q	N2

## 8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{RRM}$	repetitive peak reverse voltage			-	400	V
$V_R$	reverse voltage			-	400	V
$I_F$	forward current	$T_{sp} \leq 163 \text{ }^\circ\text{C}$		-	1.4	A
$I_{F(AV)}$	average forward current	$\delta = 0.5$ ; $f = 20 \text{ kHz}$ ; square wave; $T_{sp} \leq 166 \text{ }^\circ\text{C}$		-	1	A
$I_{FSM}$	non-repetitive peak forward current	$t_p = 8.3 \text{ ms}$ ; half sine wave; $T_{j(\text{init})} = 25 \text{ }^\circ\text{C}$		-	30	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25 \text{ }^\circ\text{C}$	[1]	-	750	mW
			[2]	-	1.3	W
$T_j$	junction temperature			-	175	$^\circ\text{C}$
$T_{amb}$	ambient temperature			-55	175	$^\circ\text{C}$
$T_{stg}$	storage temperature			-65	175	$^\circ\text{C}$

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

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode  $1 \text{ cm}^2$ .

## 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]	-	-	200	K/W
			[2]	-	-	115	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[3]	-	-	15	K/W

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm<sup>2</sup>.
- [3] Soldering point of cathode tab.

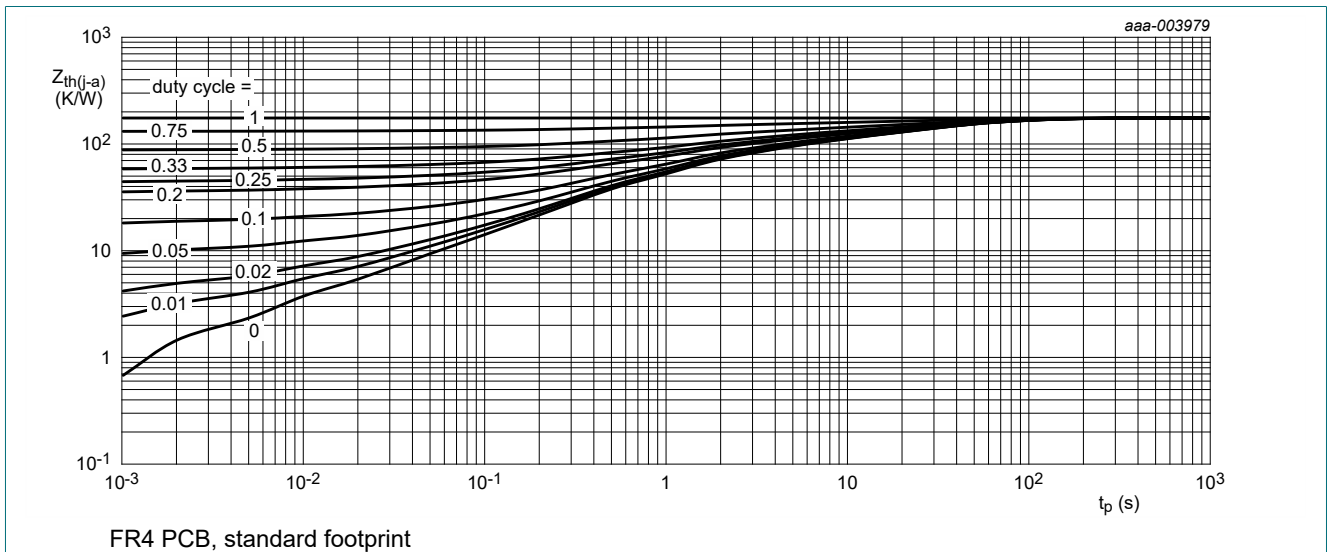


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

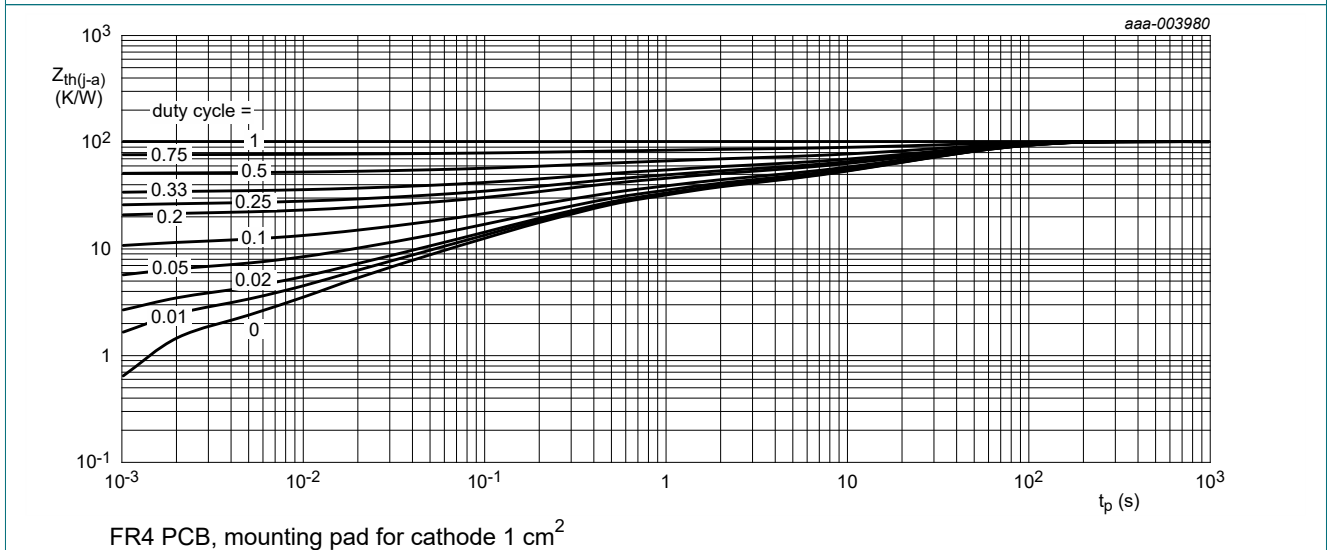


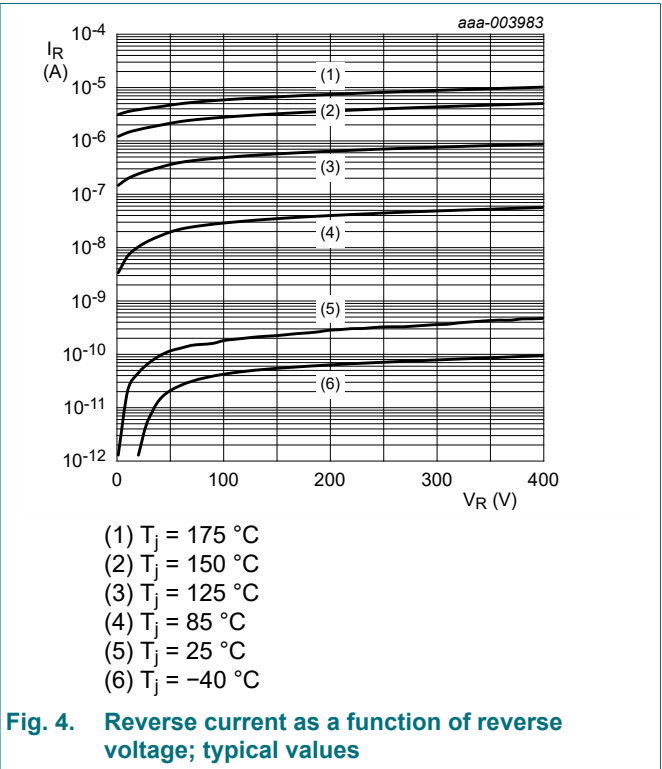
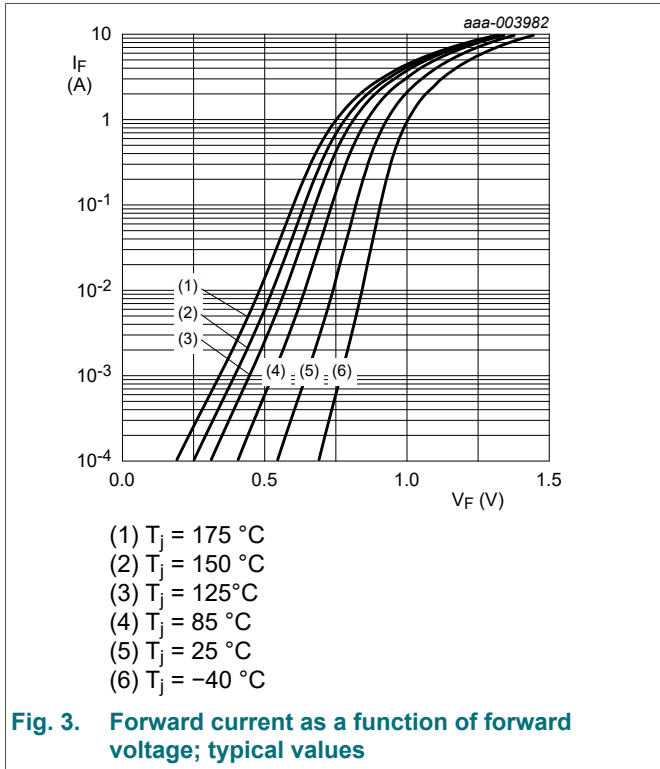
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

### 10. Characteristics

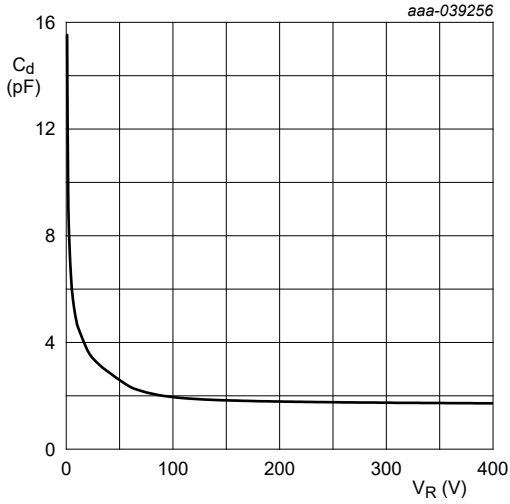
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
V <sub>F</sub>	forward voltage	I <sub>F</sub> = 0.5 A; pulsed; T <sub>j</sub> = 25 °C	[1]	-	0.89	1.05	V
		I <sub>F</sub> = 0.7 A; pulsed; T <sub>j</sub> = 25 °C	[1]	-	0.91	1.07	V
		I <sub>F</sub> = 1 A; pulsed; T <sub>j</sub> = 25 °C	[1]	-	0.93	1.1	V
		I <sub>F</sub> = 0.5 A; pulsed; T <sub>j</sub> = 125 °C	[1]	-	0.76	0.92	V
		I <sub>F</sub> = 0.7 A; pulsed; T <sub>j</sub> = 125 °C	[1]	-	0.78	0.95	V
		I <sub>F</sub> = 1 A; pulsed; T <sub>j</sub> = 125 °C	[1]	-	0.81	0.98	V
		I <sub>F</sub> = 1 A; pulsed; T <sub>j</sub> = -40 °C	[1]	-	1	1.18	V
		I <sub>F</sub> = 1 A; pulsed; T <sub>j</sub> = 150 °C	[1]	-	0.78	0.95	V
		I <sub>F</sub> = 1 A; pulsed; T <sub>j</sub> = 175 °C	[1]	-	0.75	0.92	V
I <sub>R</sub>	reverse current	V <sub>R</sub> = 400 V; pulsed; T <sub>j</sub> = -40 °C	[1]	-	0.1	10	nA
		V <sub>R</sub> = 400 V; pulsed; T <sub>j</sub> = 25 °C	[1]	-	0.001	1	μA
		V <sub>R</sub> = 400 V; pulsed; T <sub>j</sub> = 125 °C	[1]	-	1	50	μA
		V <sub>R</sub> = 400 V; pulsed; T <sub>j</sub> = 150 °C	[1]	-	5	250	μA
		V <sub>R</sub> = 400 V; pulsed; T <sub>j</sub> = 175 °C	[1]	-	10	500	μA
C <sub>d</sub>	diode capacitance	V <sub>R</sub> = 4 V; f = 1 MHz; T <sub>j</sub> = 25 °C	-	6	15	pF	
t <sub>rr</sub>	reverse recovery time	I <sub>F</sub> = 0.5 A; I <sub>R</sub> = 1 A; I <sub>R(meas)</sub> = 0.25 A; T <sub>j</sub> = 25 °C	-	0.5	1.5	μs	

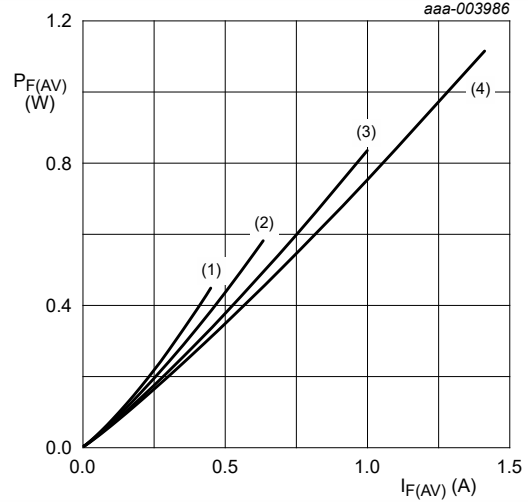
[1] Very short pulse, in order to maintain a stable junction temperature.



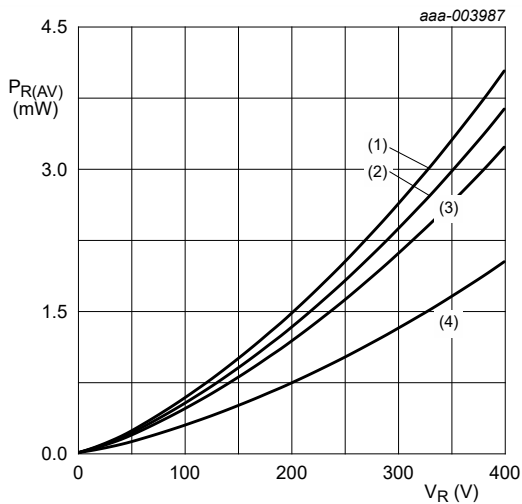
400 V, 1 A high power density, standard switching time recovery rectifier



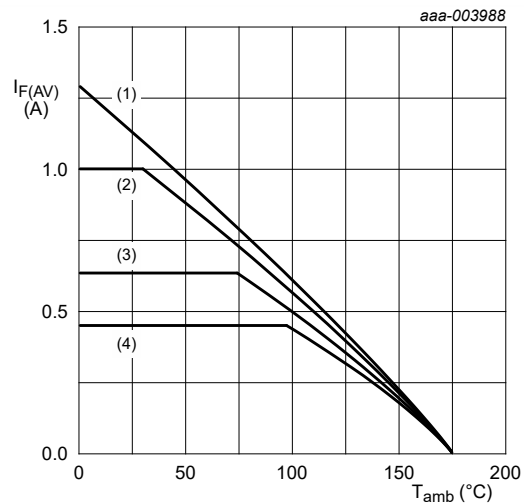
**Fig. 5. Diode capacitance as a function of reverse voltage; typical values**



**Fig. 6. Average forward power dissipation as a function of average forward current; typical values**

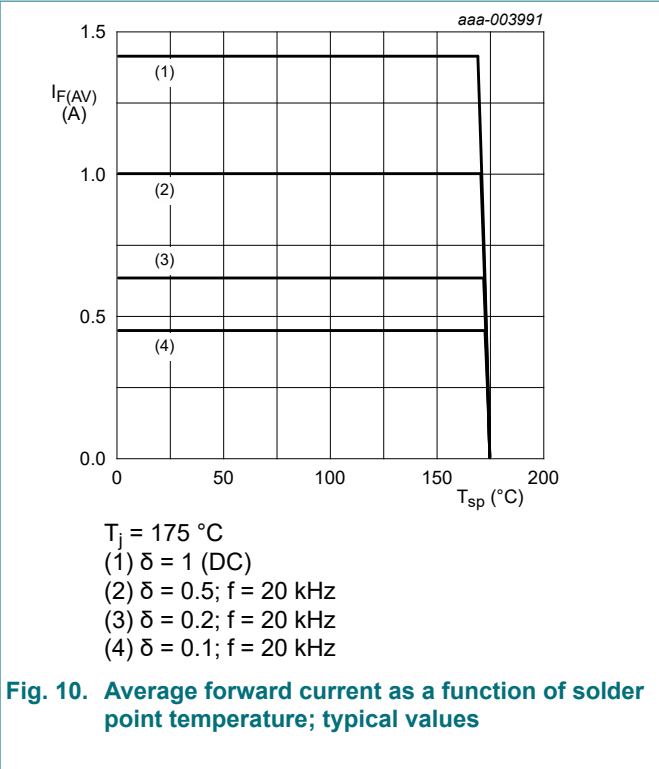
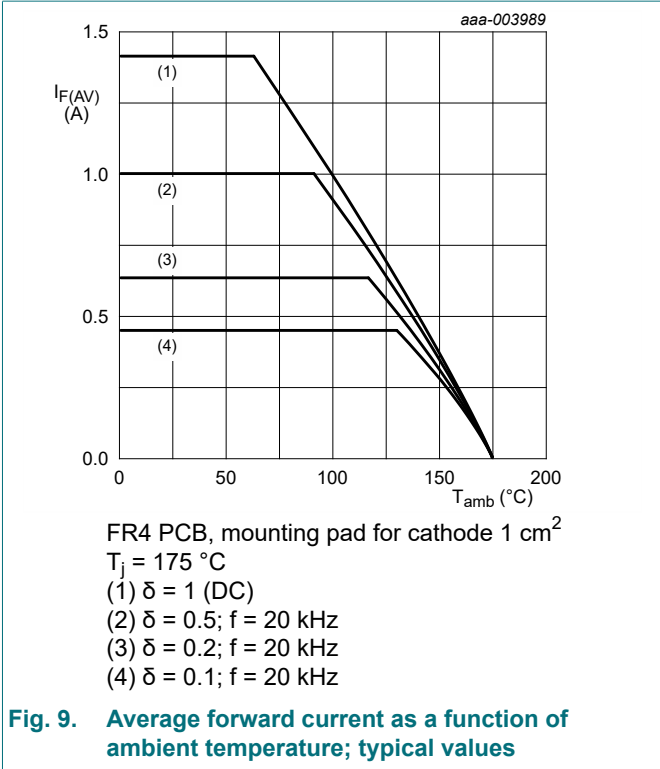


**Fig. 7. Average reverse power dissipation as a function of reverse voltage; typical values**



**Fig. 8. Average forward current as a function of ambient temperature; typical values**

400 V, 1 A high power density, standard switching time recovery rectifier



### 11. Test information

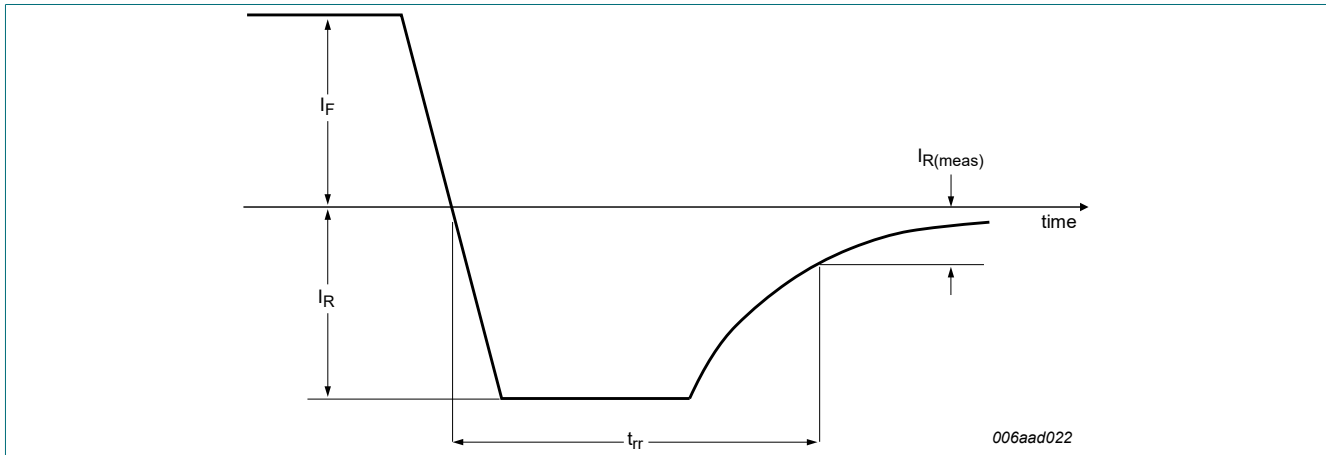


Fig. 11. Reverse recovery definition; step recovery

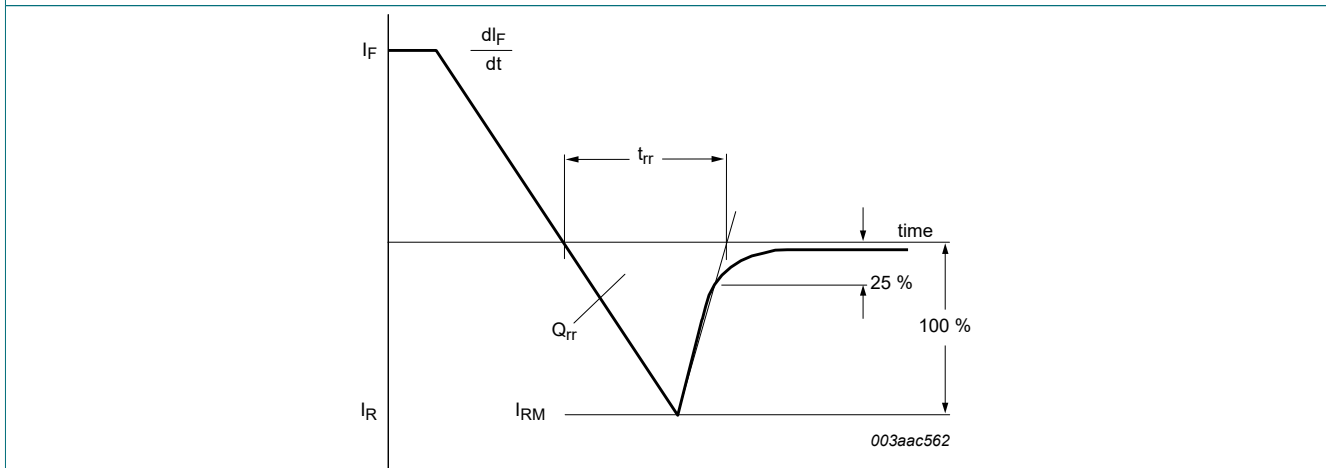


Fig. 12. Reverse recovery definition; ramp recovery

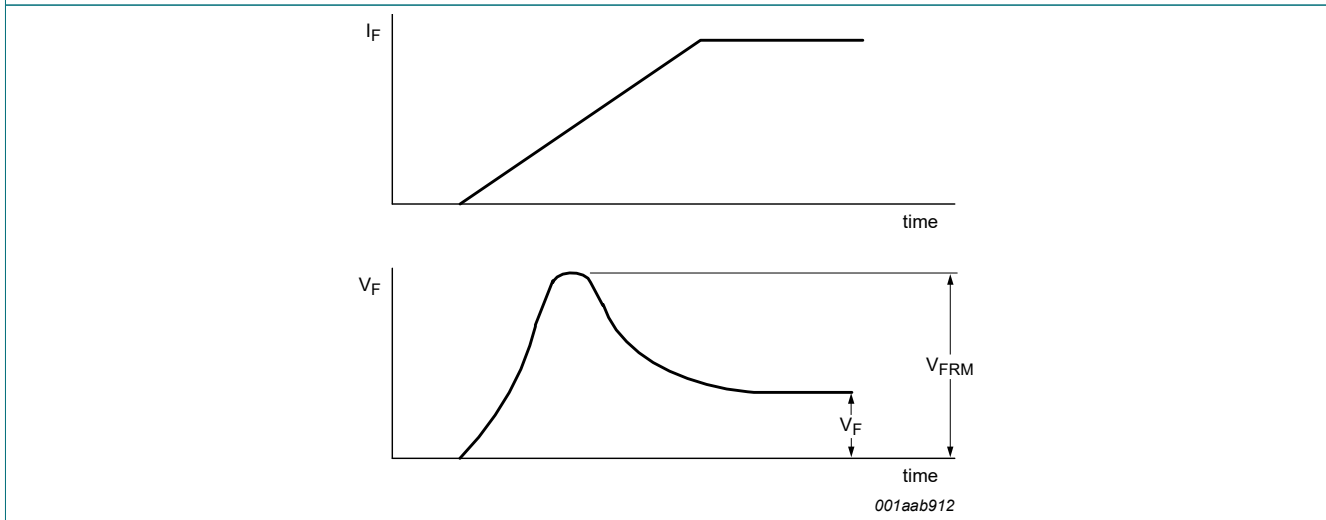


Fig. 13. Forward recovery definition

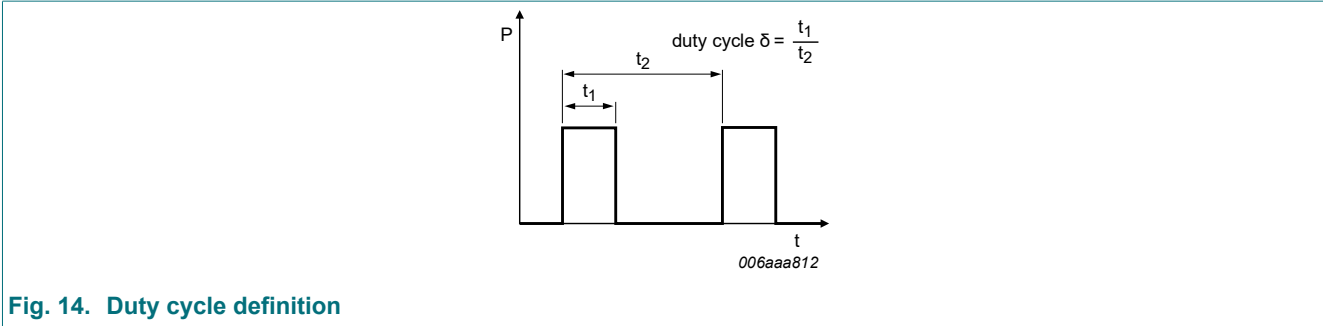


Fig. 14. Duty cycle definition

The current ratings for the typical waveforms are calculated according to the equations:

$$I_{F(AV)} = I_M \times \delta$$

with  $I_M$  defined as peak current

$$I_{RMS} = I_{F(AV)} \text{ at DC, and } I_{RMS} = I_M \times \sqrt{\delta}$$

with  $I_{RMS}$  defined as RMS current.

**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**

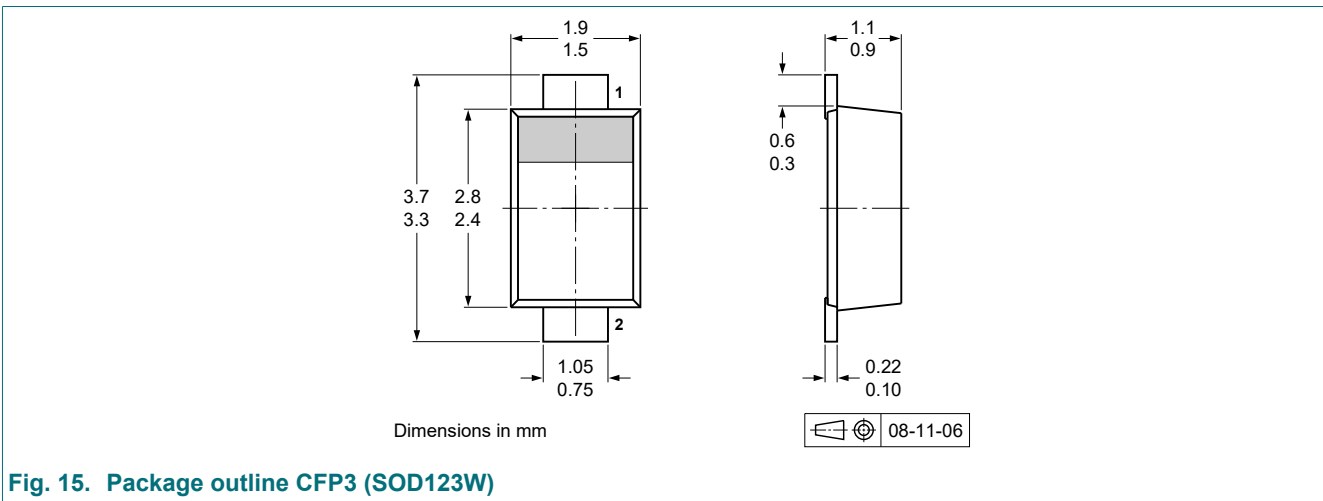


Fig. 15. Package outline CFP3 (SOD123W)



### 13. Soldering

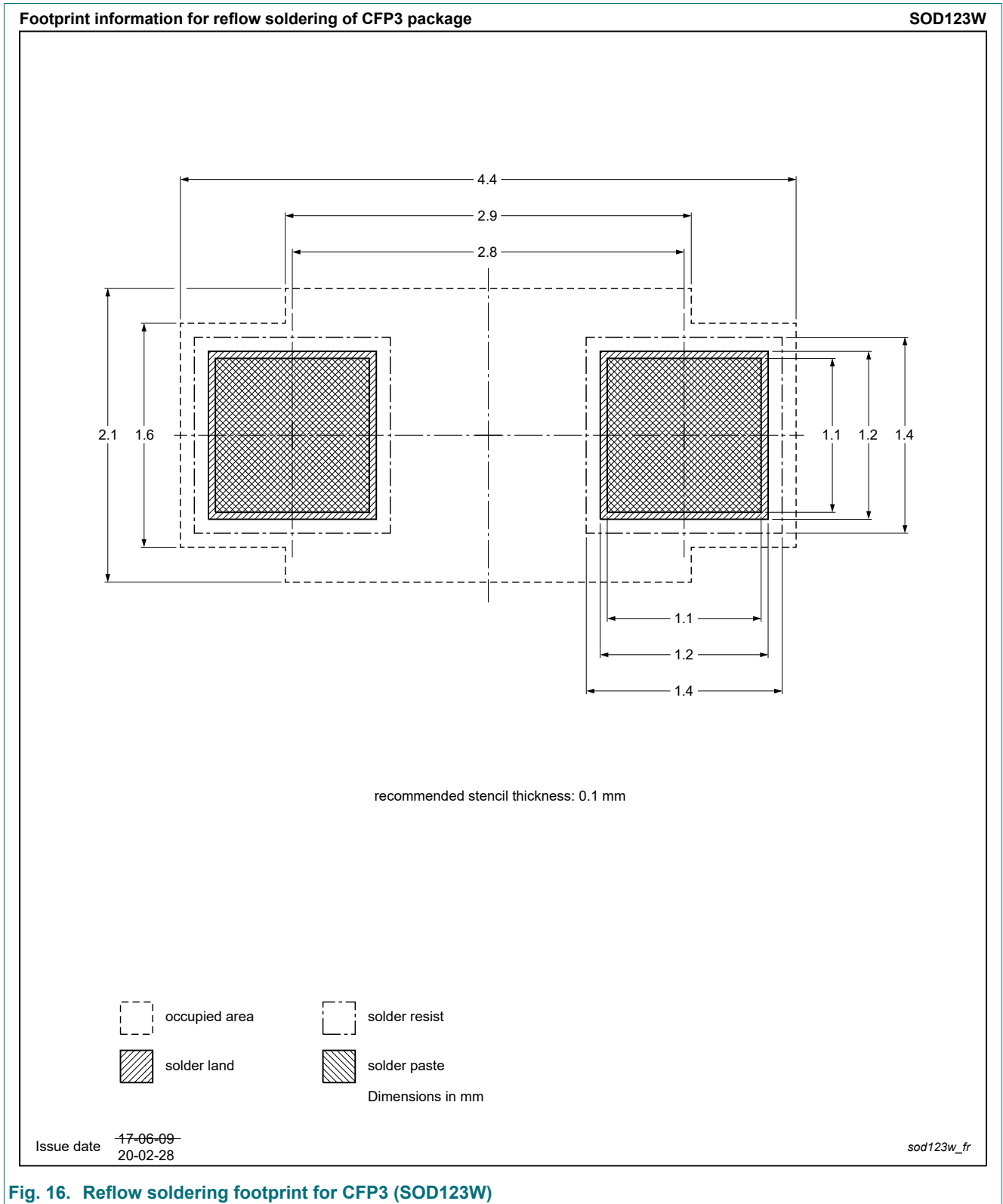
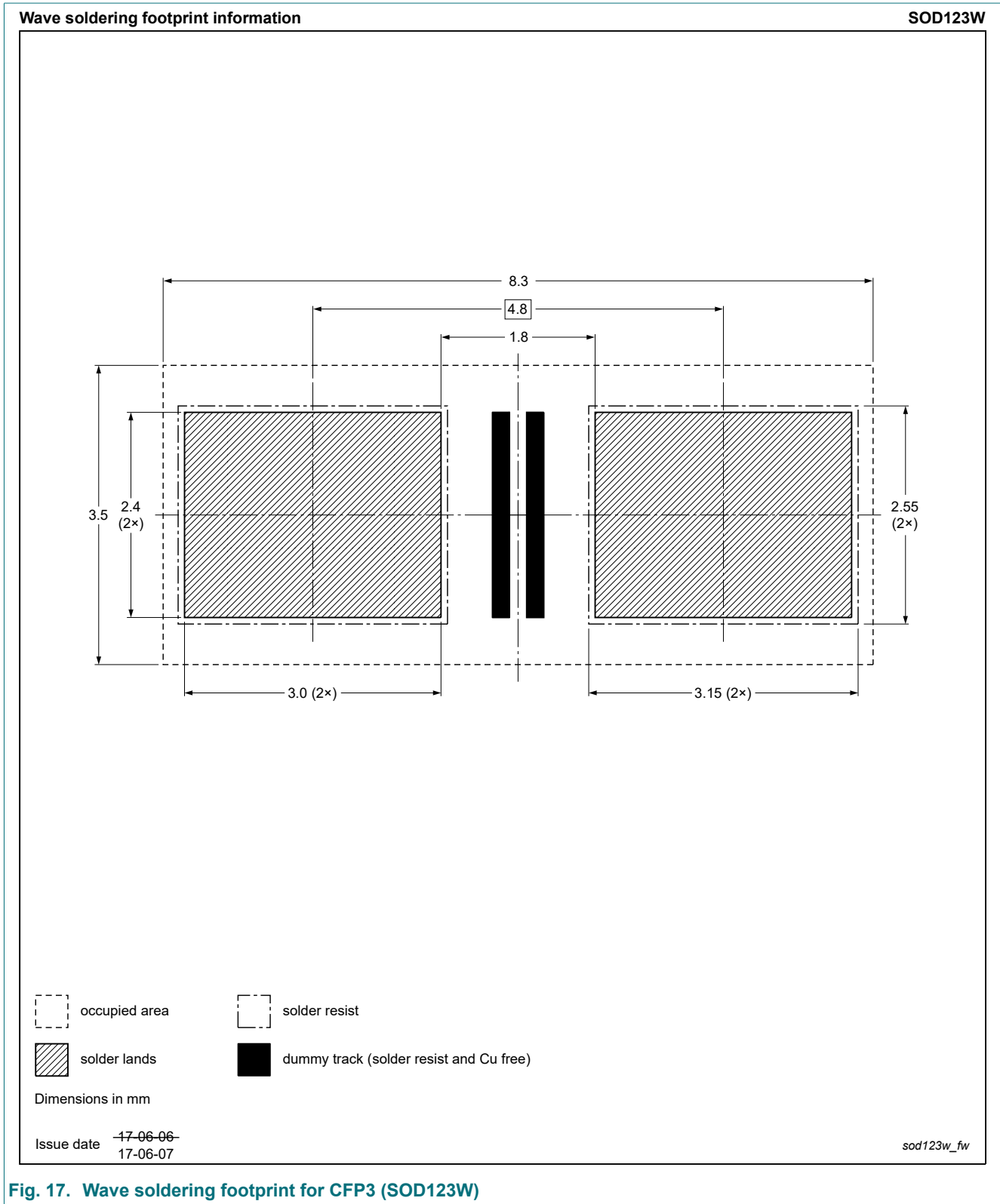


Fig. 16. Reflow soldering footprint for CFP3 (SOD123W)



**Fig. 17. Wave soldering footprint for CFP3 (SOD123W)**

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PNS40010AER-Q v.2	20240603	Product data sheet	-	PNS40010AER-Q v.1
Modifications	• Product status changed			
PNS40010AER-Q v.1	20240319	Preliminary 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.

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- [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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## 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.....	2
9. Thermal characteristics.....	3
10. Characteristics.....	4
11. Test information.....	7
12. Package outline.....	8
13. Soldering.....	9
14. Revision history.....	11
15. Legal information.....	12

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