



# PNE20020AER

200 V, 2 A hyperfast recovery rectifier

21 March 2023

Product data sheet

## 1. General description

High power density, hyperfast switching time recovery rectifier with high-efficiency planar technology, encapsulated in a CFP3 (SOD123W) small and flat lead Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- Reverse voltage  $V_R \leq 200$  V
- Forward current  $I_F \leq 2$  A
- Switching time  $t_{tr} \leq 25$  ns
- Low forward voltage
- Pt doped lifetime control
- High power capability due to clip-bond technology
- Planar die design
- Capable for reflow and wave soldering

## 3. Applications

- General-purpose rectification
- Reverse polarity protection
- Hyperfast switching
- Freewheeling applications

## 4. Quick reference data


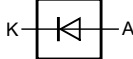
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$I_{F(AV)}$	average forward current	$\delta = 0.5$ ; $f = 20$ kHz; square wave; $T_{sp} \leq 164$ °C		-	-	2	A
$V_{RRM}$	repetitive peak reverse voltage	$T_j = 25$ °C		-	-	200	V
$V_R$	reverse voltage			-	-	200	V
$V_F$	forward voltage	$I_F = 2$ A; pulsed; $T_j = 25$ °C	[1]	-	880	950	mV
		$I_F = 2$ A; pulsed; $T_j = 125$ °C	[1]	-	735	820	mV
$I_R$	reverse current	$V_R = 200$ V; pulsed; $T_j = 25$ °C	[1]	-	-	1	$\mu$ A
		$V_R = 200$ V; pulsed; $T_j = 125$ °C	[1]	-	1	10	$\mu$ 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="#">PNE20020AER</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
PNE20020AER	MT

## 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	$T_j = 25\text{ °C}$		-	200	V
$V_R$	reverse voltage			-	200	V
$V_{RMS}$	RMS voltage			-	140	V
$I_F$	forward current	$\delta = 1; T_{sp} \leq 160\text{ °C}$		-	2.8	A
$I_{F(AV)}$	average forward current	$\delta = 0.5; f = 20\text{ kHz};$ square wave; $T_{sp} \leq 164\text{ °C}$		-	2	A
$I_{FSM}$	non-repetitive peak forward current	$t_p = 8.3\text{ ms};$ half sine wave; $T_{j(init)} = 25\text{ °C}$		-	55	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	-	882	mW
			[2]	-	1.43	W
$T_j$	junction temperature			-	175	°C
$T_{amb}$	ambient temperature			-55	175	°C
$T_{stg}$	storage temperature			-65	175	°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 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] [2]	-	-	170	K/W
			[1] [3]	-	-	105	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[4]	-	-	15	K/W

- [1] For Schottky barrier diodes thermal runaway has to be considered, as in some applications the reverse power losses  $P_R$  are a significant part of the total power losses.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm<sup>2</sup>.
- [4] Soldering point of cathode tab.

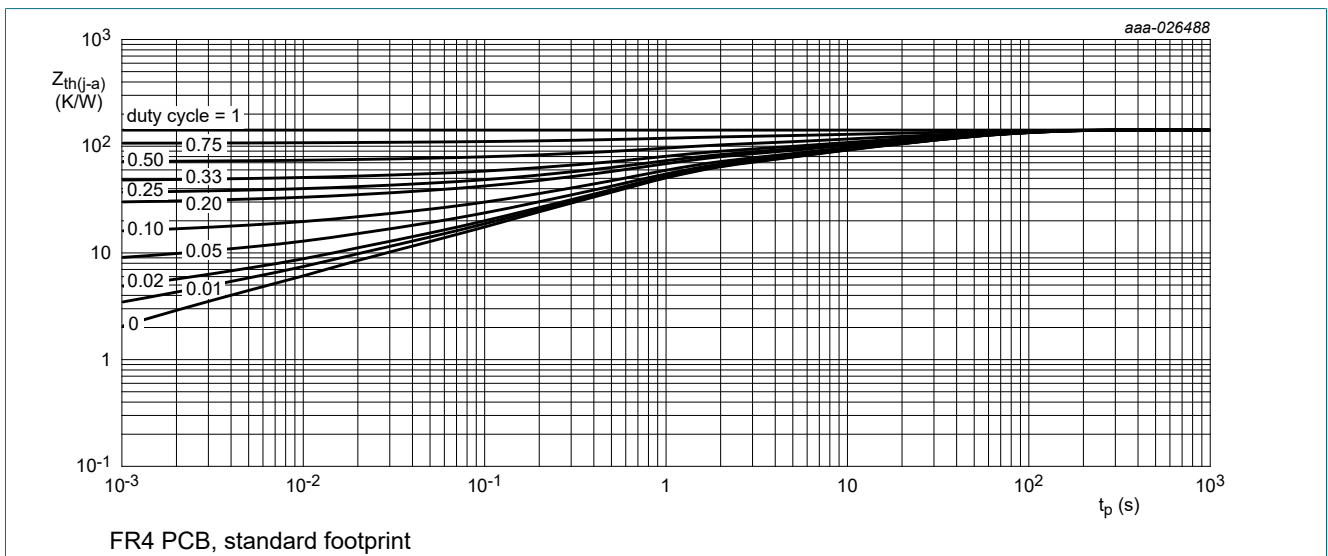


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

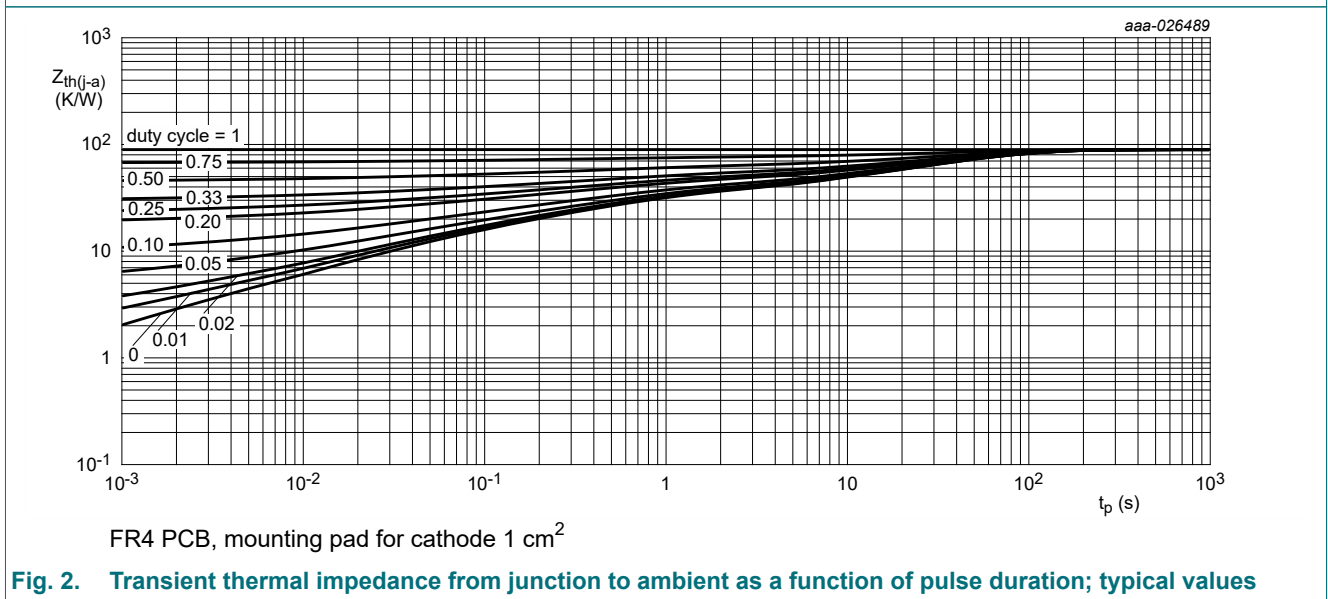


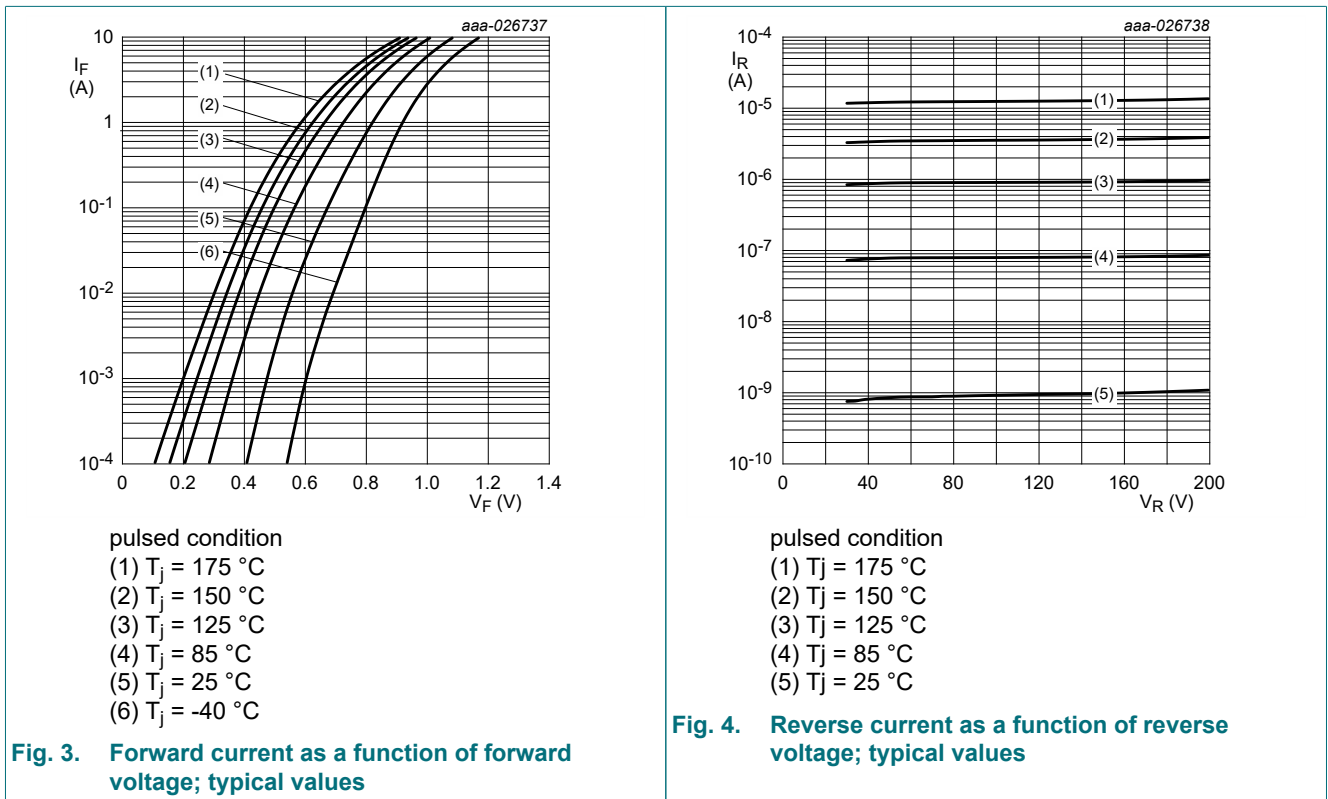
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

### 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 100 \mu A$ ; pulsed; $T_j = 25 \text{ }^\circ\text{C}$	[1]	200	-	V	
$V_F$	forward voltage	$I_F = 2 \text{ A}$ ; pulsed; $T_j = 25 \text{ }^\circ\text{C}$	[1]	-	880	950	mV
		$I_F = 2 \text{ A}$ ; pulsed; $T_j = 125 \text{ }^\circ\text{C}$	[1]	-	735	820	mV
$I_R$	reverse current	$V_R = 200 \text{ V}$ ; pulsed; $T_j = 25 \text{ }^\circ\text{C}$	[1]	-	-	1	$\mu\text{A}$
		$V_R = 200 \text{ V}$ ; pulsed; $T_j = 125 \text{ }^\circ\text{C}$	[1]	-	1	10	$\mu\text{A}$
$C_d$	diode capacitance	$V_R = 4 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	21	-	pF	
$t_{rr}$	reverse recovery time ; step recovery	$I_F = 0.5 \text{ A}$ ; $I_R = 1 \text{ A}$ ; $I_{R(\text{meas})} = 0.25 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	10	25	ns	
		$I_F = 1 \text{ A}$ ; $dI_F/dt = 50 \text{ A}/\mu\text{s}$ ; $V_R = 30 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	20	-	ns	
		$I_F = 1 \text{ A}$ ; $dI_F/dt = 100 \text{ A}/\mu\text{s}$ ; $V_R = 30 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	16	-	ns	
$I_{RM}$	peak reverse recovery current	$T_j = 25 \text{ }^\circ\text{C}$	-	1	-	A	
$Q_{rr}$	reverse recovery charge		-	9	-	nC	
$V_{FRM}$	peak forward recovery voltage	$I_F = 1 \text{ A}$ ; $dI_F/dt = 50 \text{ A}/\mu\text{s}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	900	-	mV	

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



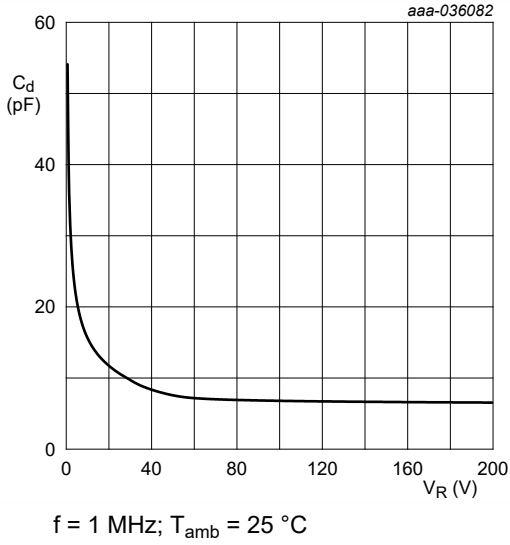


Fig. 5. Diode capacitance as a function of reverse voltage; typical values

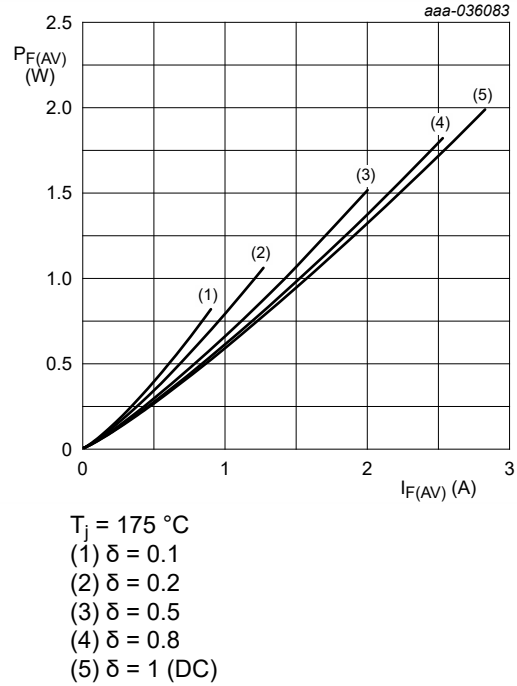


Fig. 6. Average forward power dissipation as a function of average forward current; typical values

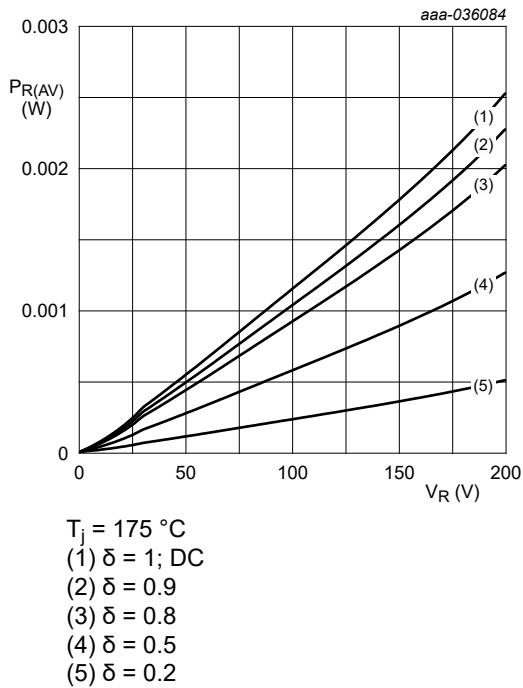


Fig. 7. Average reverse power dissipation as a function of reverse voltage; typical values

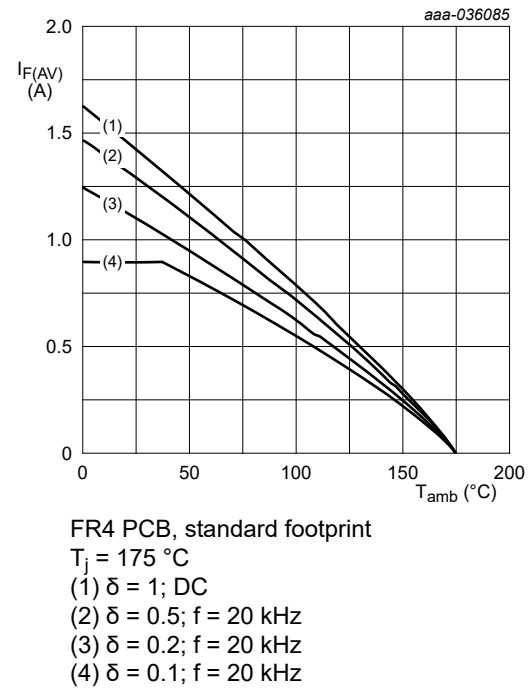
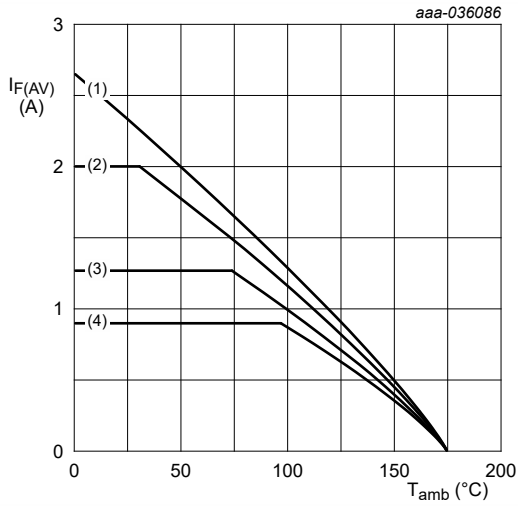
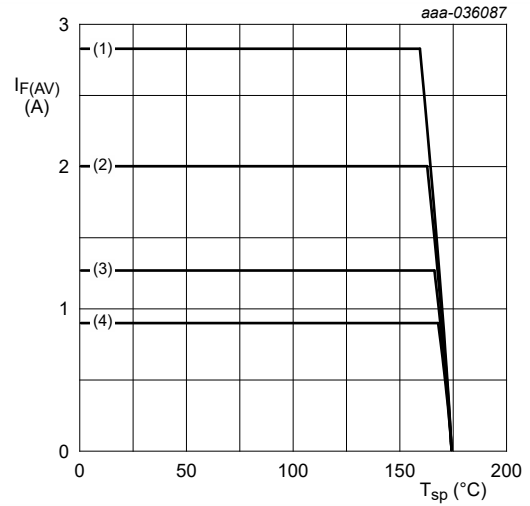


Fig. 8. Average forward current as a function of ambient temperature; typical values



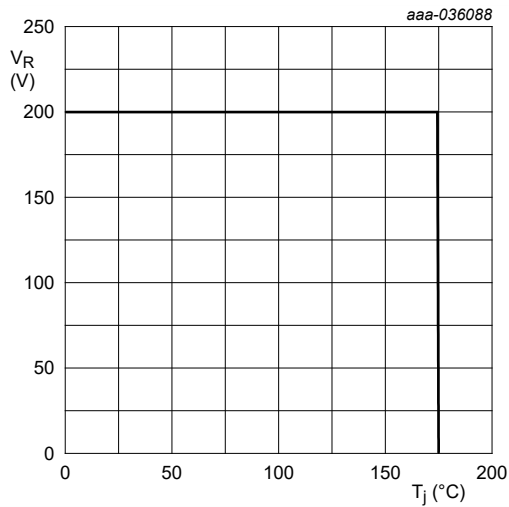
FR4 PCB, mounting pad for cathode 1 cm<sup>2</sup>  
 $T_j = 175$  °C  
 (1)  $\delta = 1$ ; DC  
 (2)  $\delta = 0.5$ ;  $f = 20$  kHz  
 (3)  $\delta = 0.2$ ;  $f = 20$  kHz  
 (4)  $\delta = 0.1$ ;  $f = 20$  kHz

Fig. 9. Average forward current as a function of ambient temperature; typical values



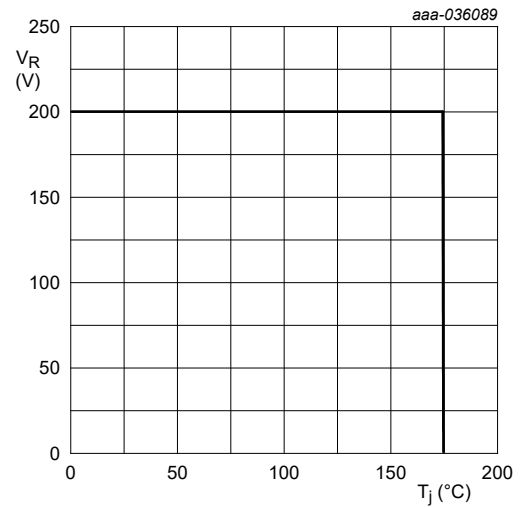
$T_j = 175$  °C  
 (1)  $\delta = 1$ ; DC  
 (2)  $\delta = 0.5$ ;  $f = 20$  kHz  
 (3)  $\delta = 0.2$ ;  $f = 20$  kHz  
 (4)  $\delta = 0.1$ ;  $f = 20$  kHz

Fig. 10. Average forward current as a function of solder point temperature; typical values



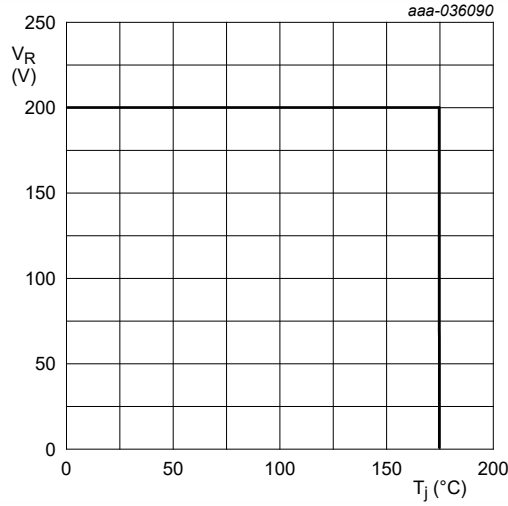
FR4 PCB, standard footprint  
 $R_{th} = 170$  K/W

Fig. 11. Derated maximum reverse voltage as a function of junction temperature; typical values



FR4 PCB, mounting pad for cathode 1 cm<sup>2</sup>  
 $R_{th} = 105$  K/W

Fig. 12. Derated maximum reverse voltage as a function of junction temperature; typical values



Soldering point of cathode tab  
 $R_{th} = 15 \text{ K/W}$

Fig. 13. Derated maximum reverse voltage as a function of junction temperature; typical values

### 11. Test information

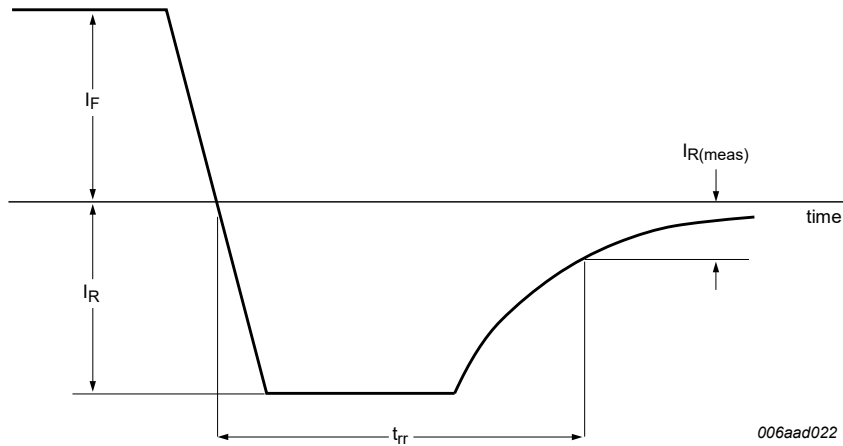


Fig. 14. Reverse recovery definition; step recovery

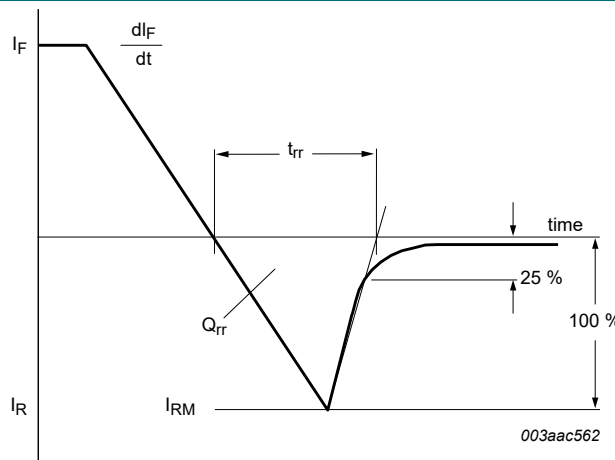


Fig. 15. Reverse recovery definition; ramp recovery

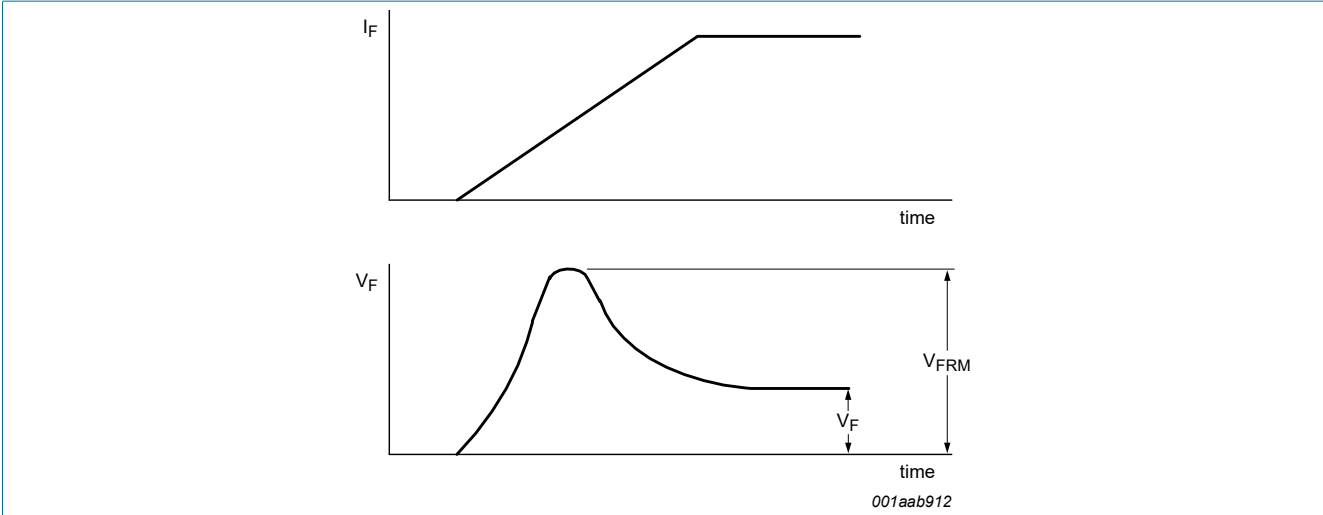


Fig. 16. Forward recovery definition

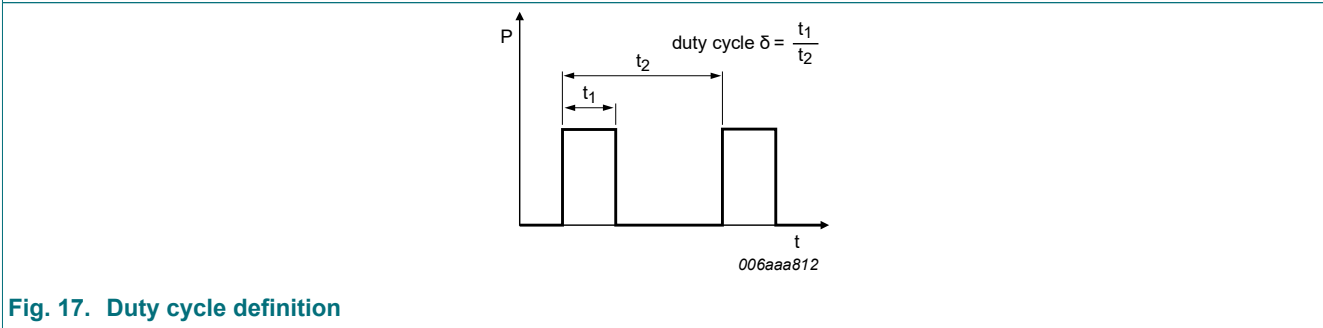


Fig. 17. Duty cycle definition

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

$$I_{F(AV)} = I_M \times \delta \text{ with } I_M \text{ defined as peak current}$$

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

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

## 12. Package outline

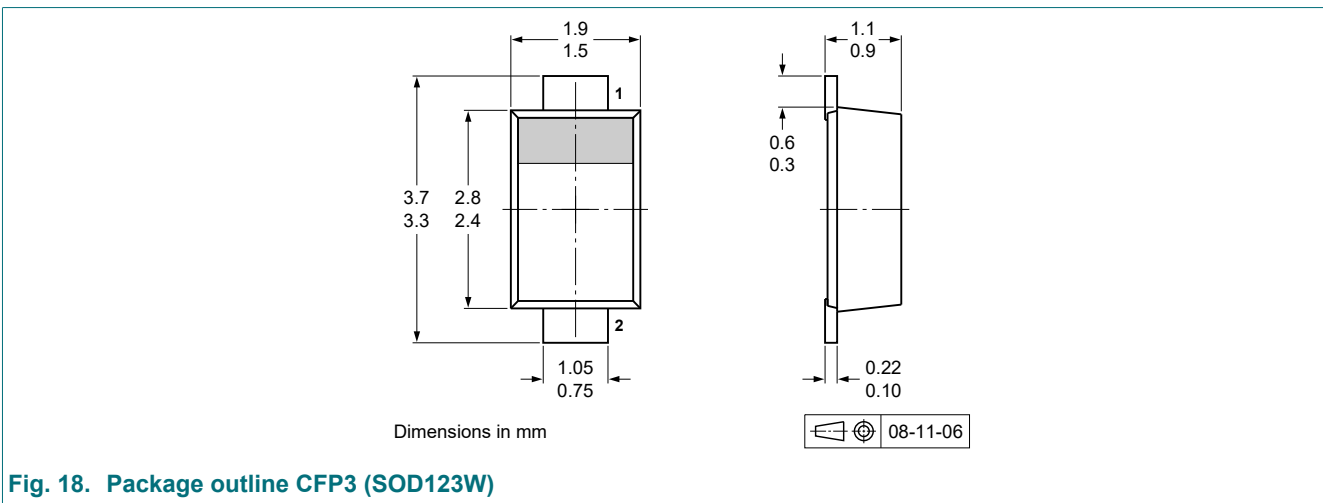
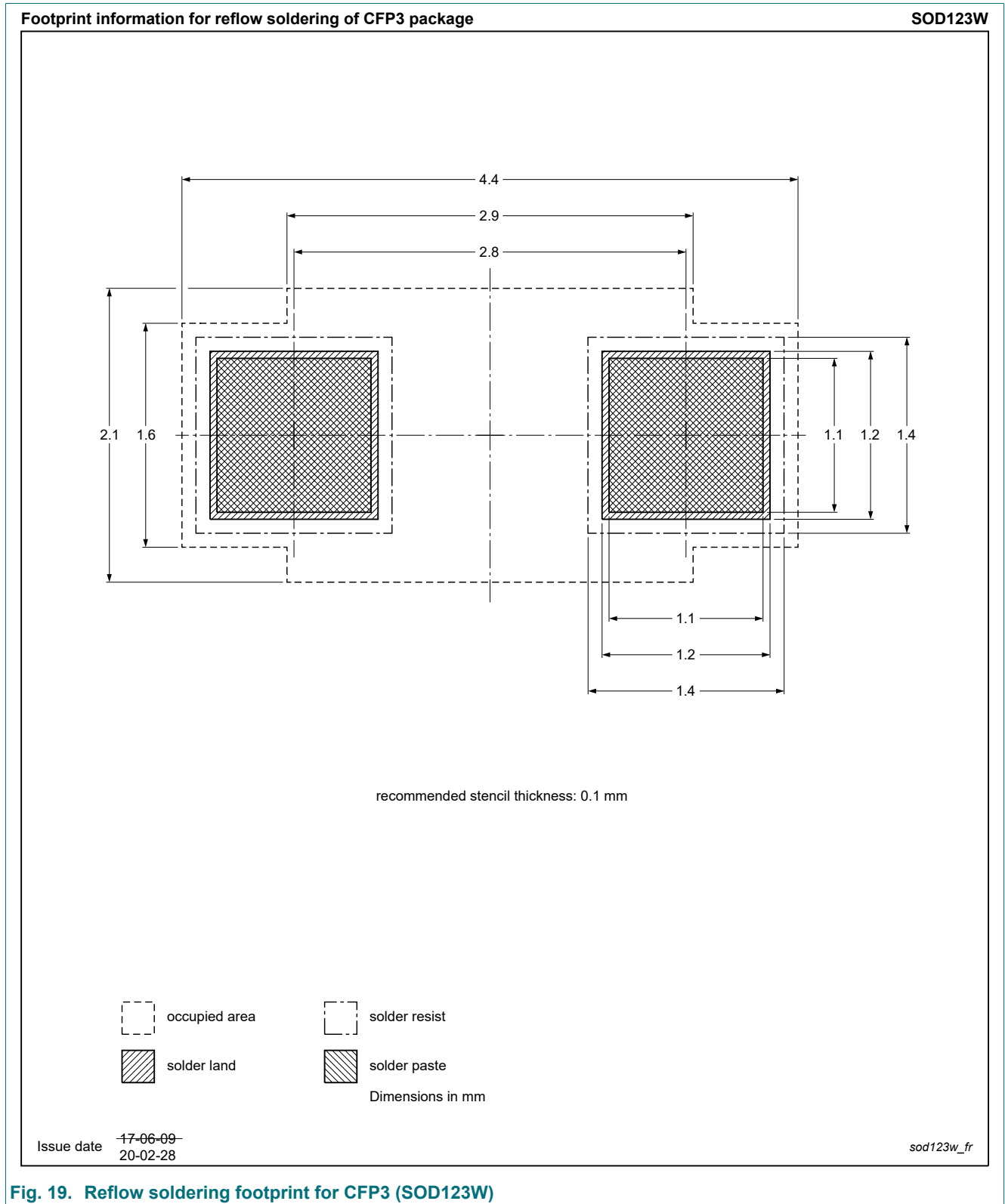


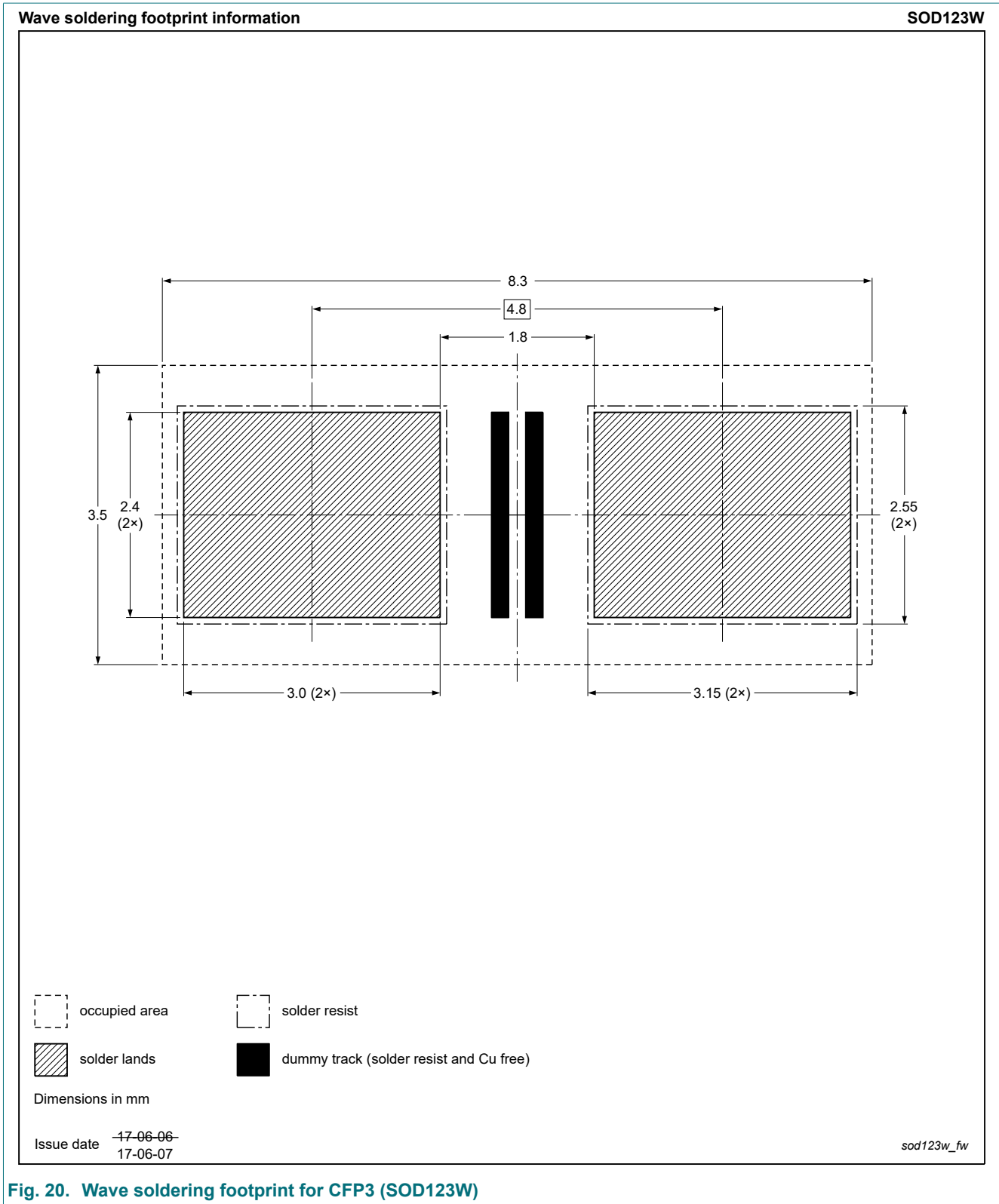
Fig. 18. Package outline CFP3 (SOD123W)



### 13. Soldering



**Fig. 19. Reflow soldering footprint for CFP3 (SOD123W)**



**Fig. 20. Wave soldering footprint for CFP3 (SOD123W)**

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PNE20020AER v.1	20230321	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.
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Product [short] data sheet	Production	This document contains the product specification.

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