



PNE20020EP

200 V, 2 A hyperfast recovery rectifier

18 December 2019

Product data sheet

1. General description

High power density, hyperfast recovery rectifier with high-efficiency planar technology, encapsulated in a small and flat lead CFP5 (SOD128) 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
- Pt doped life time control
- Low inductance
- Small and flat lead SMD plastic package
- Package height typ. 1 mm
- High power capability due to clip-bond technology
- Planar die design
- Capable for reflow and wave soldering
- AEC-Q qualified

3. Applications

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

4. Quick reference data


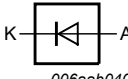
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$I_{F(AV)}$	average forward current	$\delta = 0.5$; $f = 20$ kHz; square wave; $T_{sp} \leq 157$ °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	825	mV
I_R	reverse current	$V_R = 200$ V; pulsed; $T_j = 25$ °C	[1]	-	-	1	μ A
		$V_R = 200$ V; pulsed; $T_j = 125$ °C	[1]	-	1	20	μ 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	 CFP5 (SOD128)	 006aab040
2	A	anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PNE20020EP	CFP5	plastic, surface mounted package; 2 terminals; 4 mm pitch; 3.8 mm x 2.6 mm x 1 mm body	SOD128

7. Marking

Table 4. Marking codes

Type number	Marking code
PNE20020EP	DF

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 601134).

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	$\delta = 1; T_{sp} \leq 151\text{ °C}$		-	2.8	A
$I_{F(AV)}$	average forward current	$\delta = 0.5; f = 20\text{ kHz};$ square wave; $T_{sp} \leq 157\text{ °C}$		-	2	A
I_{FSM}	non-repetitive peak forward current	$t_p = 8.3\text{ ms};$ single half sine wave (applied at rated load condition); $T_{j(\text{init})} = 25\text{ °C}$		-	50	A
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	-	1	W
			[2]	-	1.575	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 cm².

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]	-	-	150	K/W
			[2]	-	-	95	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[3]	-	-	10	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 cm².
- [3] Soldering point of cathode tab.

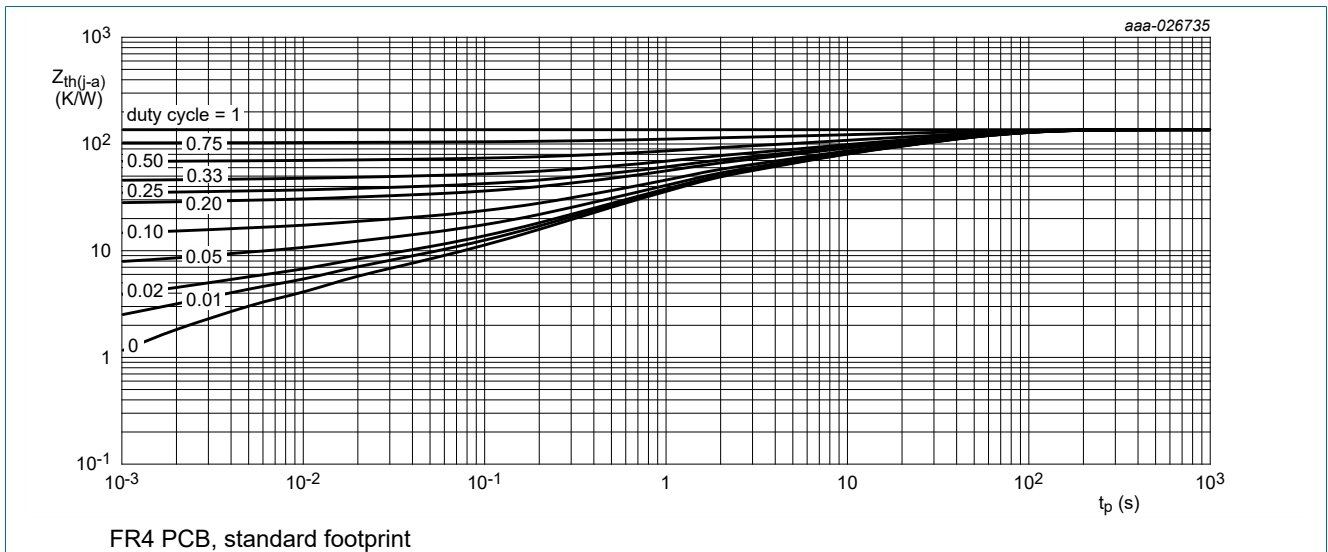


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

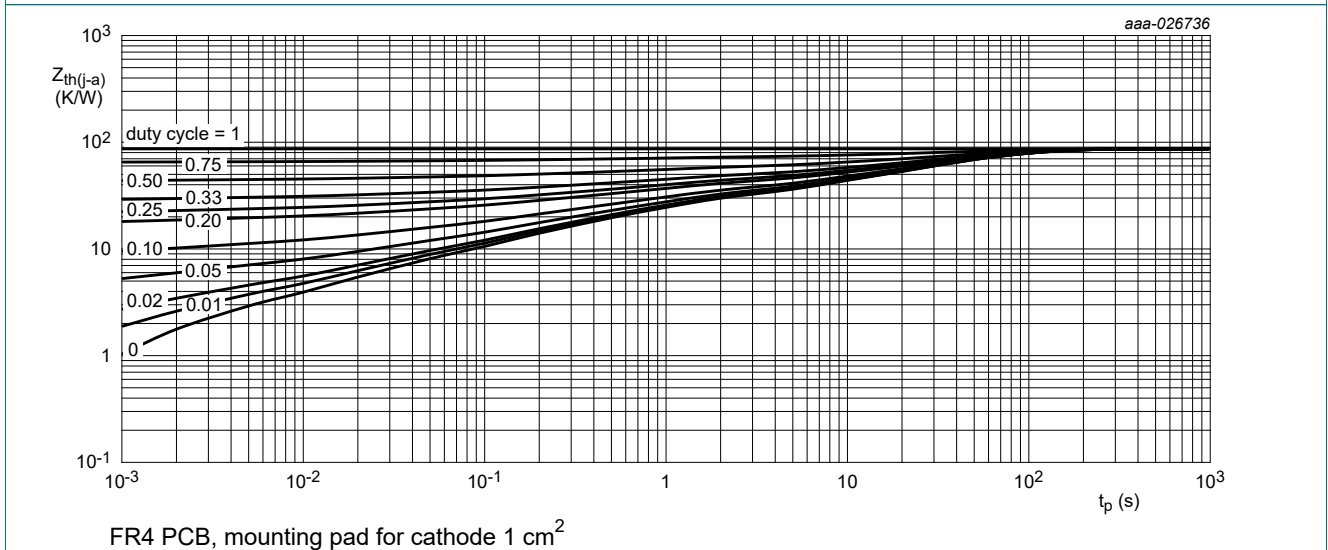


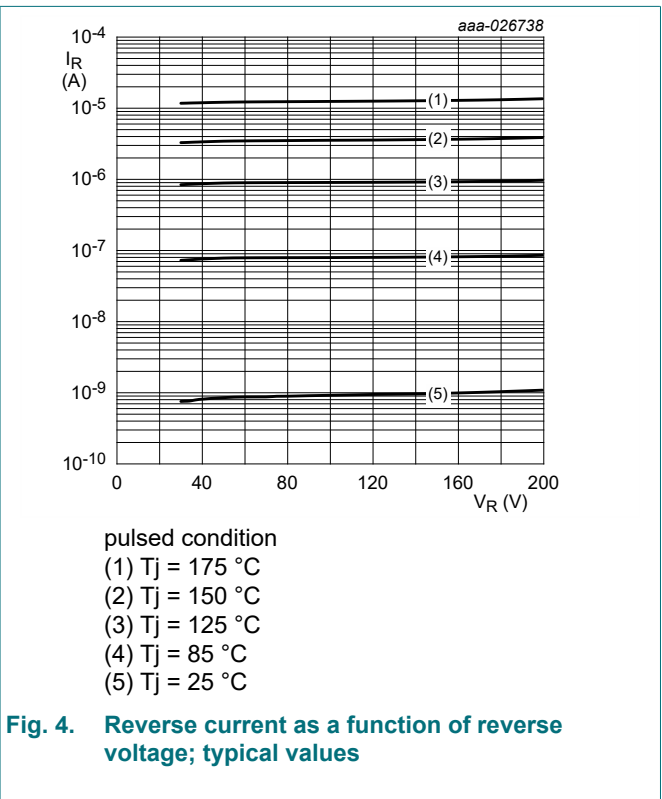
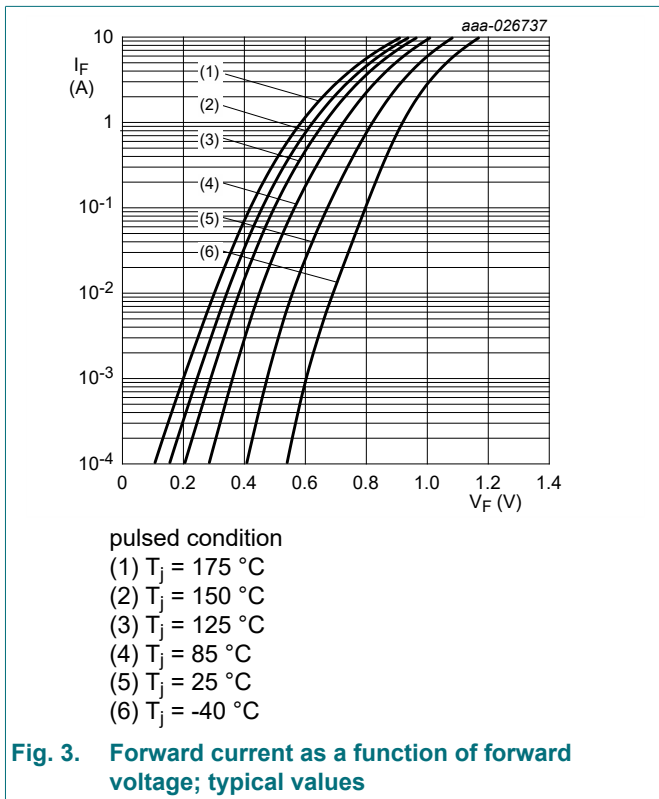
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 100 \mu\text{A}$; 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	825	mV
I_R	reverse current	$V_R = 200 \text{ V}$; pulsed; $T_j = 25 \text{ }^\circ\text{C}$	[1]	-	-	1	μA
		$V_R = 200 \text{ V}$; pulsed; $T_j = 125 \text{ }^\circ\text{C}$	[1]	-	1	20	μA
C_d	diode capacitance	$V_R = 4 \text{ V}$; $f = 1 \text{ MHz}$; $T_j = 25 \text{ }^\circ\text{C}$	-	20	-	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.



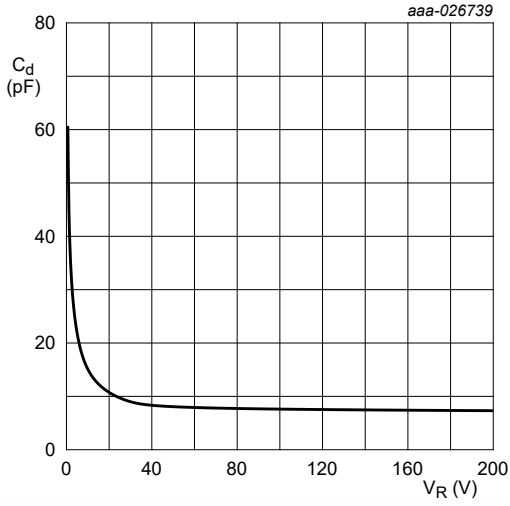


Fig. 5. Diode capacitance as a function of reverse voltage; typical values

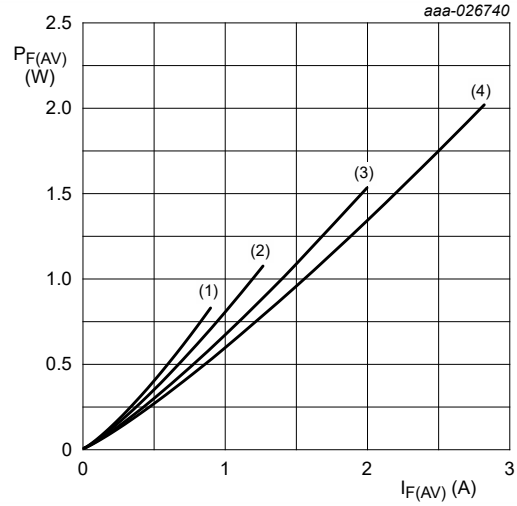


Fig. 6. Average forward power dissipation as a function of average forward current; typical values

$T_j = 175\text{ °C}$
 (1) $\delta = 0.1$
 (2) $\delta = 0.2$
 (3) $\delta = 0.5$
 (4) $\delta = 1$ (DC)

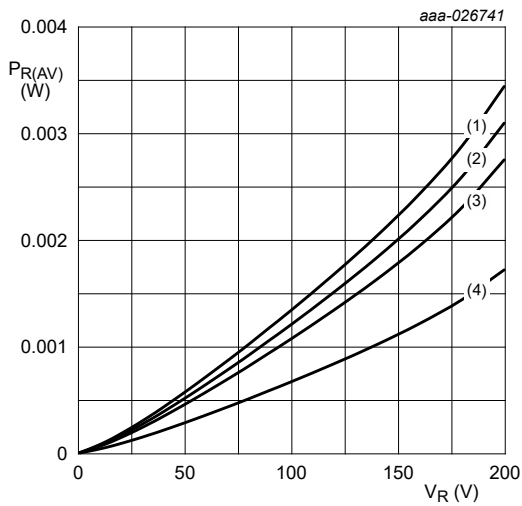


Fig. 7. Average reverse power dissipation as a function of reverse voltage; typical values

$T_j = 175\text{ °C}$
 (1) $\delta = 1$; DC
 (2) $\delta = 0.9$
 (3) $\delta = 0.8$
 (4) $\delta = 0.5$

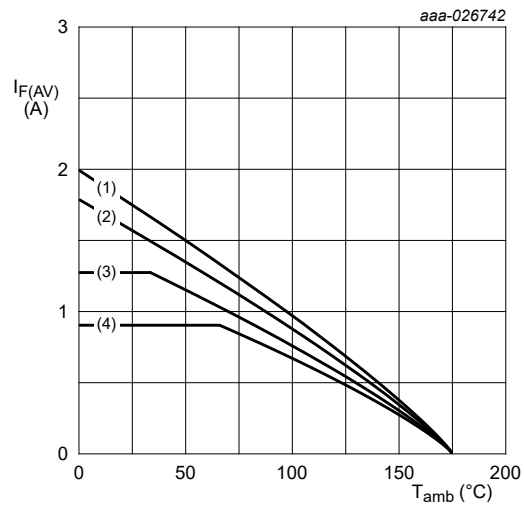


Fig. 8. Average forward current as a function of ambient temperature; typical values

FR4 PCB, standard footprint
 $T_j = 175\text{ °C}$
 (1) $\delta = 1$; DC
 (2) $\delta = 0.5$; $f = 20\text{ kHz}$
 (3) $\delta = 0.2$; $f = 20\text{ kHz}$
 (4) $\delta = 0.1$; $f = 20\text{ kHz}$

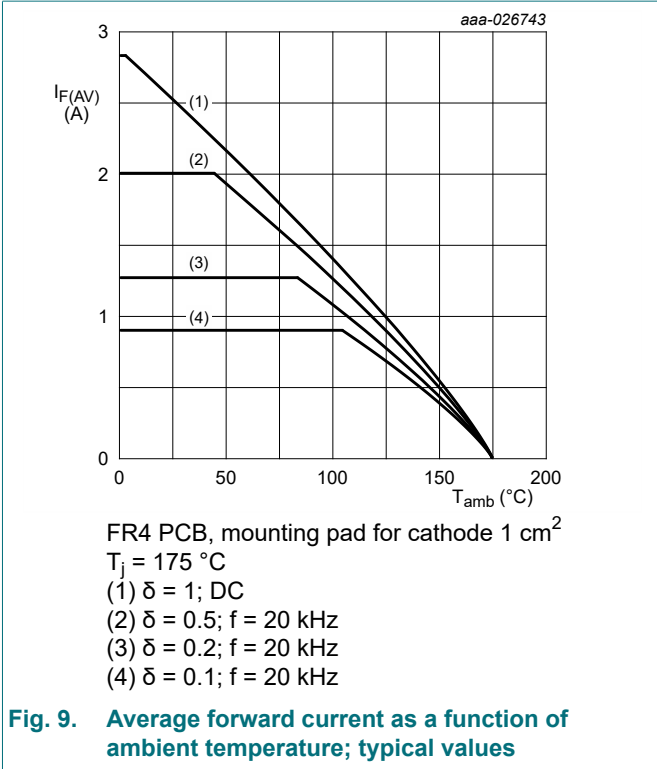


Fig. 9. Average forward current as a function of ambient temperature; typical values

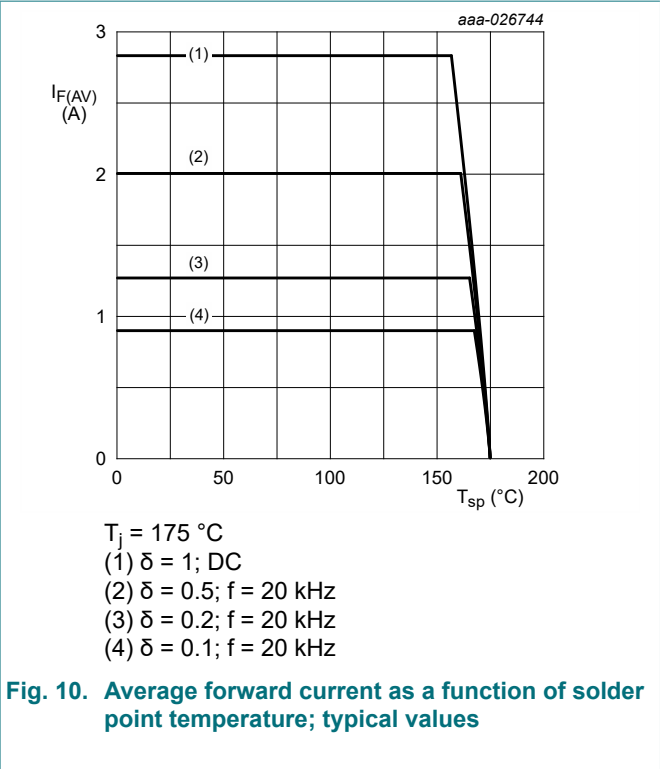


Fig. 10. Average forward current as a function of solder point temperature; typical values

11. Test information

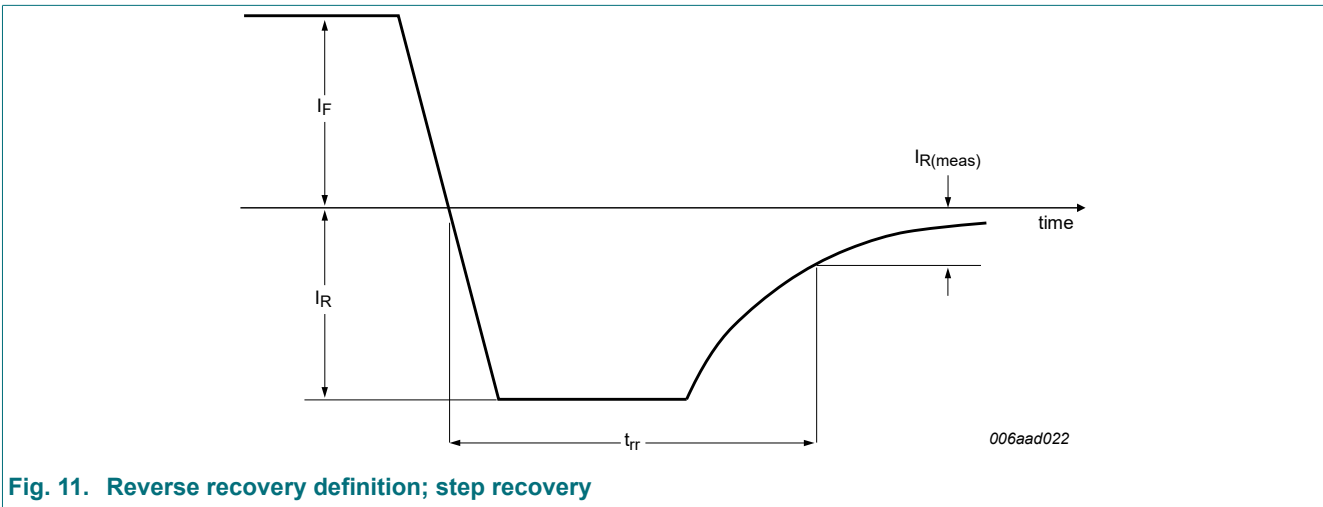


Fig. 11. Reverse recovery definition; step recovery

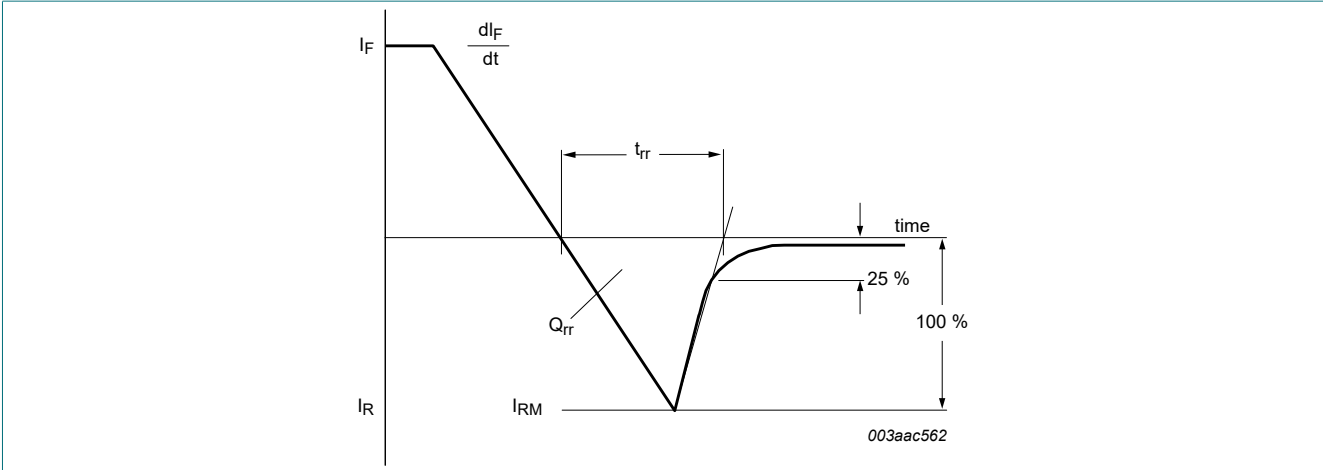


Fig. 12. Reverse recovery definition; ramp recovery

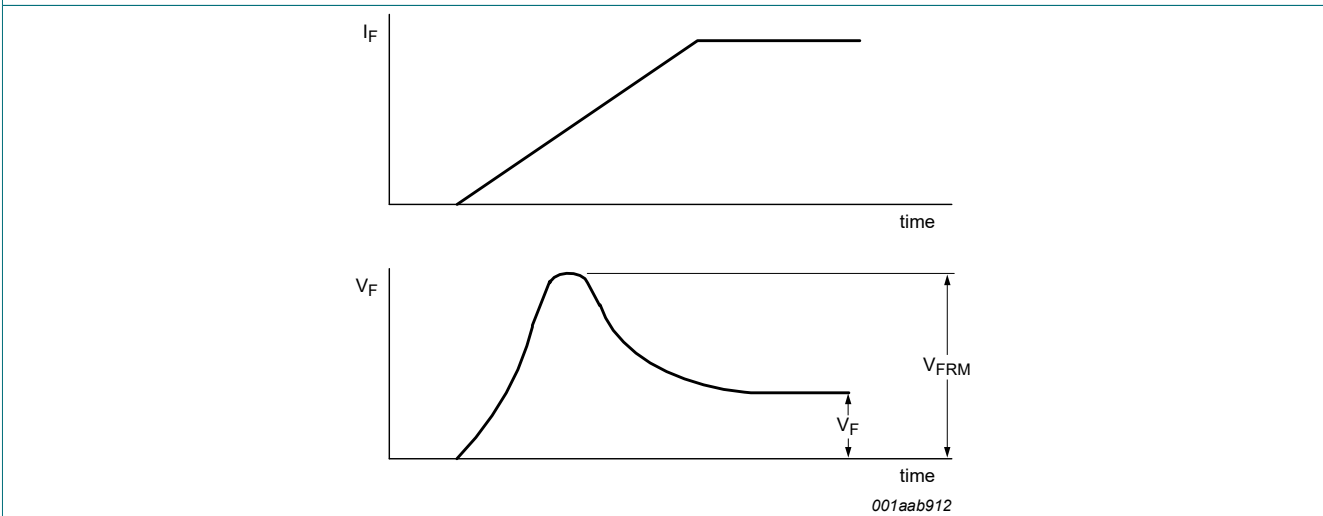


Fig. 13. Forward recovery definition



Fig. 14. Duty cycle definition

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

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

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

with I_{RMS} defined as RMS current.

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

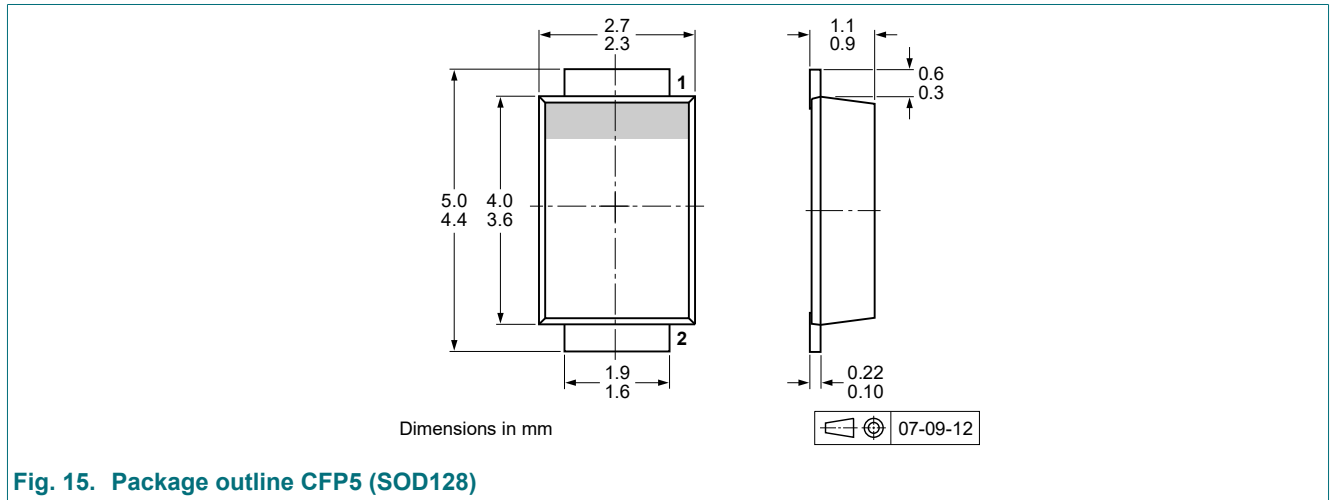


Fig. 15. Package outline CFP5 (SOD128)

13. Soldering

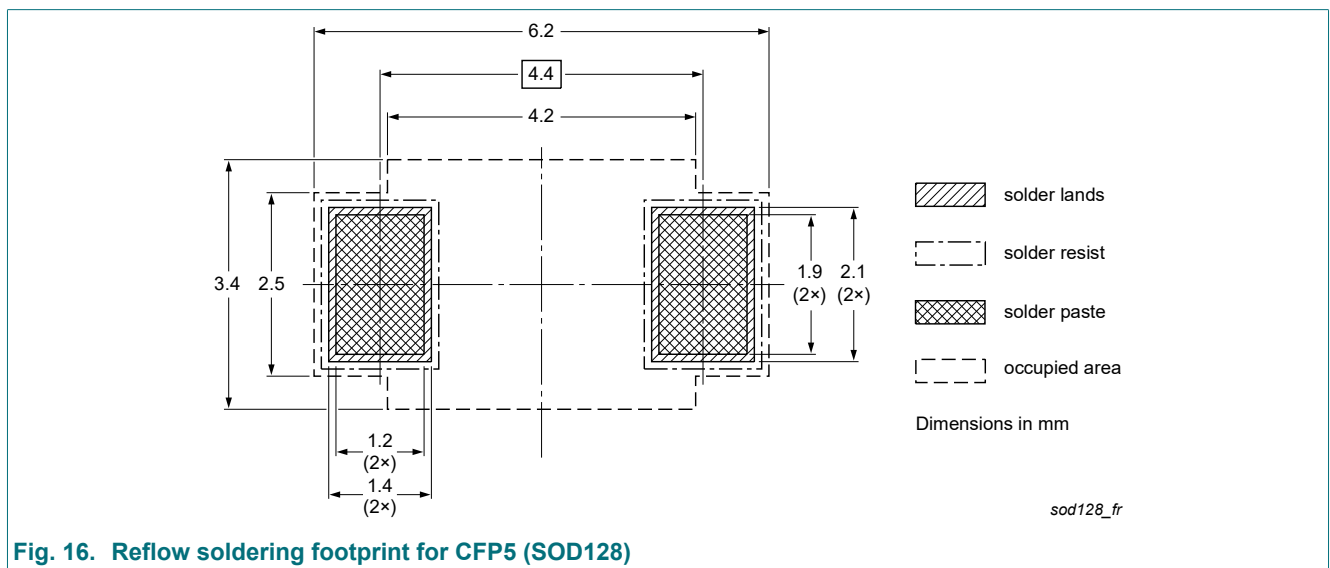


Fig. 16. Reflow soldering footprint for CFP5 (SOD128)

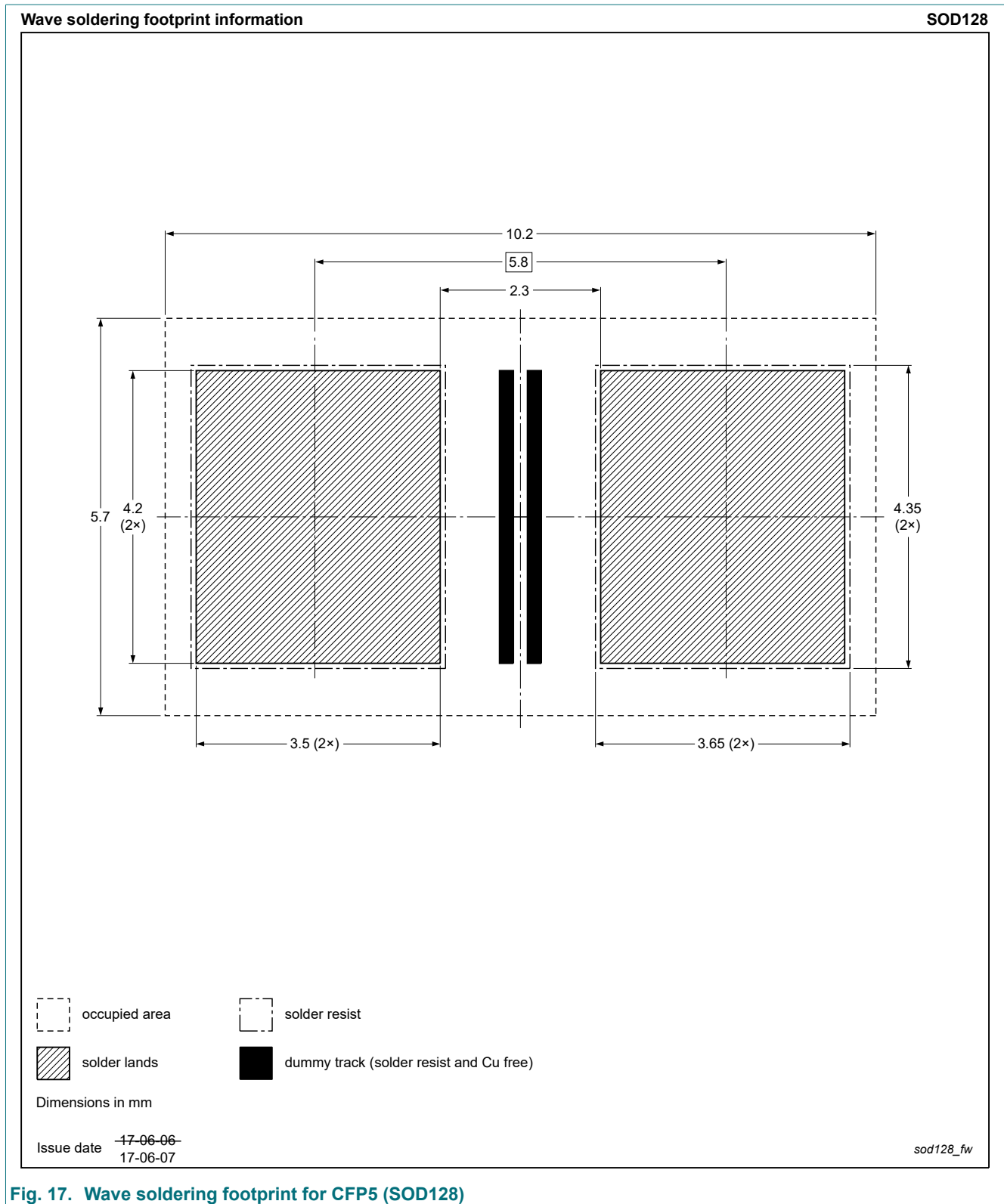


Fig. 17. Wave soldering footprint for CFP5 (SOD128)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PNE20020EP v.5	20191218	Product data sheet	-	PNE20020EP v.4
Modifications:	• Product achieved AEC-Q101 qualification			
PNE20020EP v.4	20191120	Product data sheet	-	PNE20020EP v.3
PNE20020EP v.3	20170830	Product data sheet		PNE20020EP v.2
PNE20020EP v.2	20170519	Preliminary data sheet	-	PNE20020EP v.1
PNE20020EP v.1	20161102	Objective 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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