

PNE20010EXD

200 V, 1 A hyperfast recovery rectifier

1 April 2022

Product data sheet

1. General description

High power density, hyperfast recovery rectifier with high-efficiency planar technology, encapsulated in a CFP2-HP (SOD323HP) power and flat lead Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- Reverse voltage: $V_R \leq 200$ V
- Forward current: $I_F \leq 1$ A
- Hyperfast recovery time: $t_{rr} \leq 25$ ns
- Planar die design with Pt doped life time control
- Low inductance
- Small and flat lead SMD plastic package, typical height 0.68 mm
- High power capability due to clip-bond technology

3. Applications

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

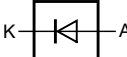
4. Quick reference data

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; $T_{sp} \leq 170$ °C	-	-	1	A
V_R	reverse voltage	$T_j = 25$ °C	-	-	200	V
V_F	forward voltage	$I_F = 1$ A; pulsed; $T_j = 25$ °C	-	880	1020	mV
I_R	reverse current	$V_R = 200$ V; pulsed; $T_j = 25$ °C	-	-	75	nA
		$V_R = 200$ V; pulsed; $T_j = 125$ °C	-	0.6	5	μ A

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode	 Transparent top view CFP2-HP (SOD323HP)	 006aab040
2	A	anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PNE20010EXD	CFP2-HP	SOD323HP: plastic surface-mounted package with solderable lead ends; 2.2 mm x 1.3 mm x 0.68 mm body	SOD323HP

7. Marking

Table 4. Marking codes

Type number	Marking code
PNE20010EXD	2K

8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_R	reverse voltage	$T_j = 25\text{ }^{\circ}\text{C}$		-	200	V
I_F	forward current	$\delta = 1; T_{sp} \leq 169\text{ }^{\circ}\text{C}$		-	1.4	A
$I_{F(AV)}$	average forward current	$\delta = 0.5; f = 20\text{ kHz}$; square wave; $T_{sp} \leq 170\text{ }^{\circ}\text{C}$		-	1	A
I_{FSM}	non-repetitive peak forward current	$t_p = 8.3\text{ ms}$; single half sine wave (applied at rated load condition); $T_{j(init)} = 25\text{ }^{\circ}\text{C}$		-	25	A
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ }^{\circ}\text{C}$	[1]	-	0.65	W
			[2]	-	1.2	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 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] [2]	-	-	230	K/W
			[1] [3]	-	-	125	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[4]	-	-	6	K/W

- [1] For Schottky barrier diodes thermal runaway has to be considered, as in some applications the reverse power losses PR 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 cm².
- [4] Soldering point of cathode tab.

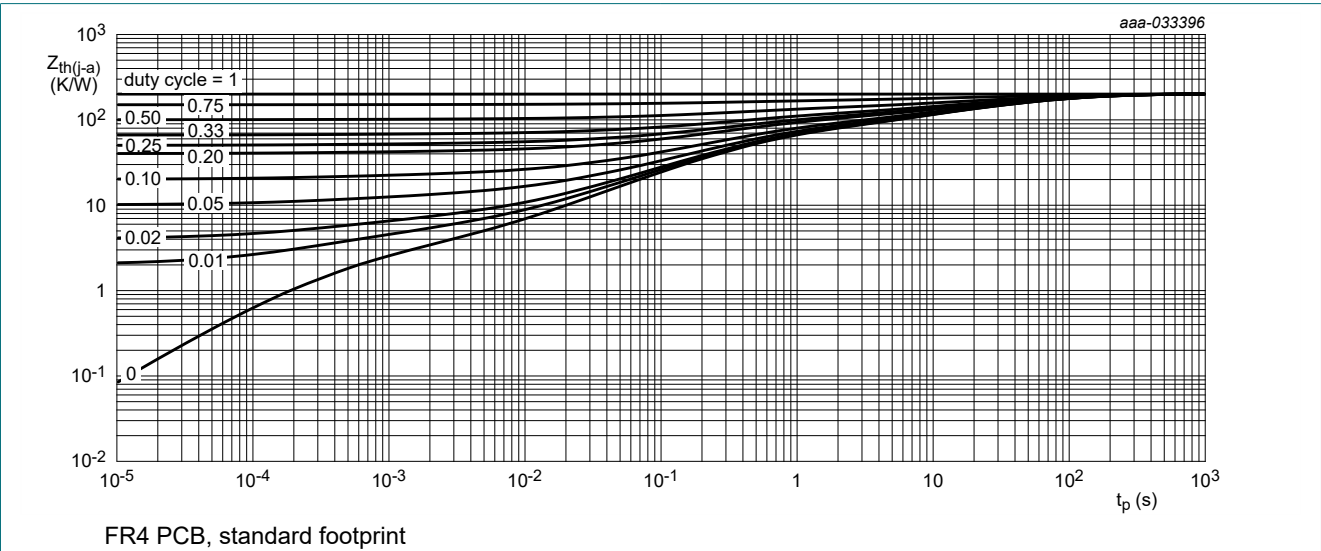


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

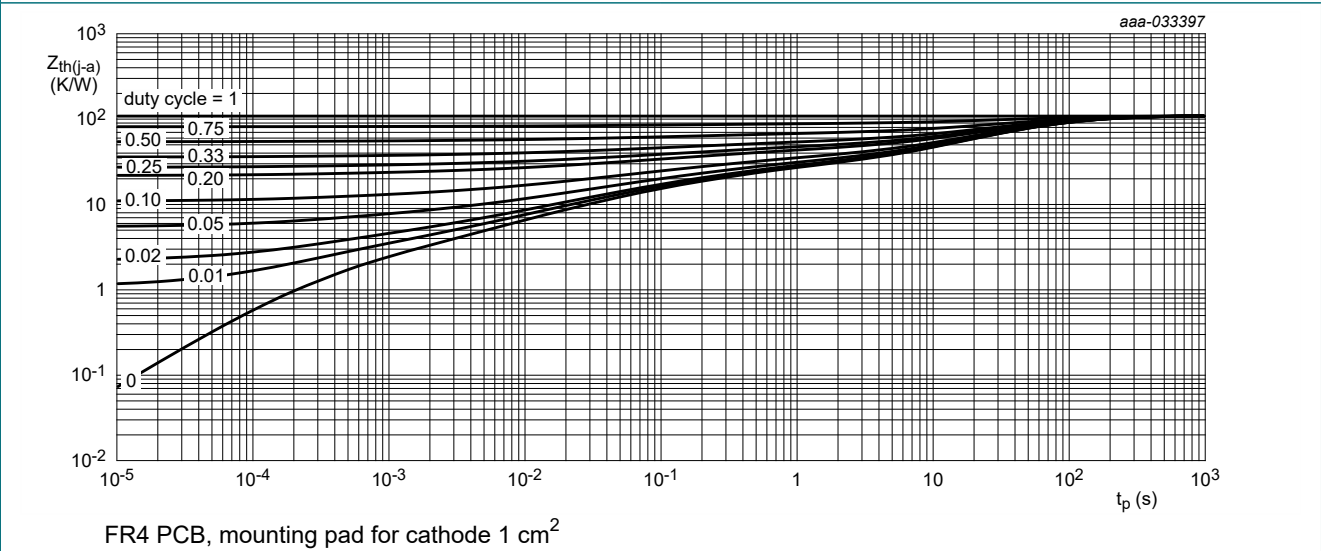


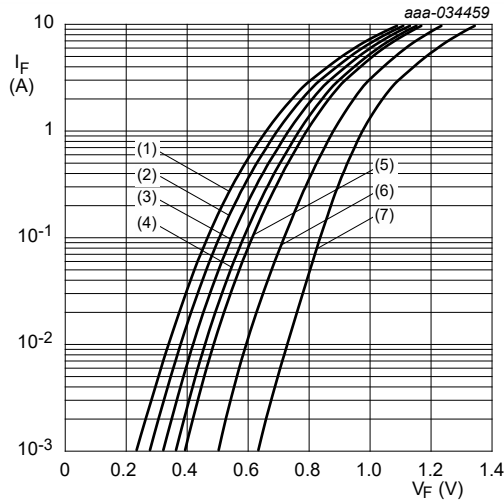
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 0.1 \text{ mA}$; pulsed; $T_j = 25 \text{ }^\circ\text{C}$	[1]	200	-	-	V
V_F	forward voltage	$I_F = 0.1 \text{ A}$; pulsed; $T_j = 25 \text{ }^\circ\text{C}$	[1]	-	720	840	mV
		$I_F = 0.5 \text{ A}$; pulsed; $T_j = 25 \text{ }^\circ\text{C}$	[1]	-	825	935	mV
		$I_F = 1 \text{ A}$; pulsed; $T_j = 25 \text{ }^\circ\text{C}$		-	880	1020	mV
		$I_F = 1 \text{ A}$; pulsed; $T_j = -40 \text{ }^\circ\text{C}$		-	975	1100	mV
		$I_F = 1 \text{ A}$; pulsed; $T_j = 125 \text{ }^\circ\text{C}$		-	730	870	mV
I_R	reverse current	$V_R = 200 \text{ V}$; pulsed; $T_j = 25 \text{ }^\circ\text{C}$		-	-	75	nA
		$V_R = 200 \text{ V}$; pulsed; $T_j = 125 \text{ }^\circ\text{C}$		-	0.6	5	μA
		$V_R = 200 \text{ V}$; pulsed; $T_j = 150 \text{ }^\circ\text{C}$		-	2.5	15	μA
C_d	diode capacitance	$V_R = 4 \text{ V}$; $f = 1 \text{ MHz}$; $T_j = 25 \text{ }^\circ\text{C}$		-	10	-	pF
		$V_R = 10 \text{ V}$; $f = 1 \text{ MHz}$; $T_j = 25 \text{ }^\circ\text{C}$		-	8	-	pF
t_{rr}	reverse recovery time ; step recovery	$I_F = 0.5 \text{ A}$; $I_R = 1 \text{ A}$; $I_{R(\text{meas})} = 0.25 \text{ A}$; $T_j = 25 \text{ }^\circ\text{C}$		-	9	25	ns
	reverse recovery time ; ramp recovery	$I_F = 1 \text{ A}$; $dI_F/dt = 50 \text{ A}/\mu\text{s}$; $V_R = 30 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$		-	15	-	ns
I_{RM}	peak reverse recovery current			-	0.45	-	A
Q_{rr}	reverse recovery charge			-	4	-	nC
V_{FRM}	peak forward recovery voltage	$I_F = 1 \text{ A}$; $dI_F/dt = 50 \text{ A}/\mu\text{s}$; $T_j = 25 \text{ }^\circ\text{C}$		-	1	-	V

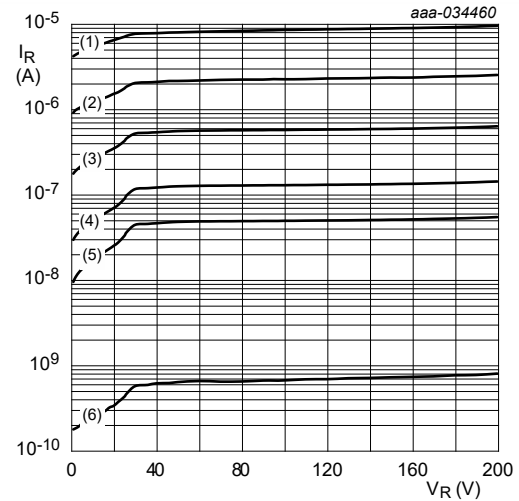
[1] Very short pulse, in order to maintain a stable junction temperature.



pulsed condition

- (1) $T_j = 175\text{ °C}$
- (2) $T_j = 150\text{ °C}$
- (3) $T_j = 125\text{ °C}$
- (4) $T_j = 100\text{ °C}$
- (5) $T_j = 85\text{ °C}$
- (6) $T_j = 25\text{ °C}$
- (7) $T_j = -40\text{ °C}$

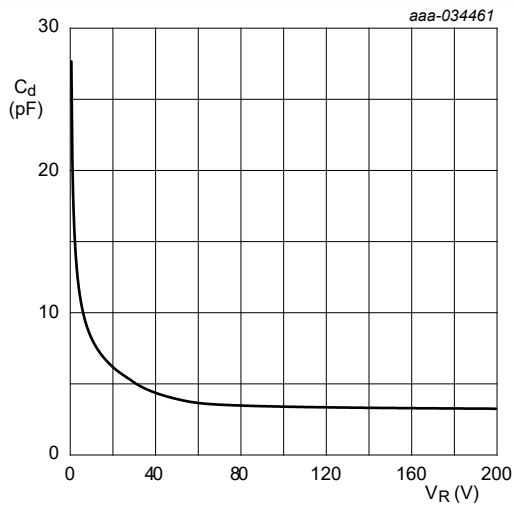
Fig. 3. Forward current as a function of forward voltage; typical values



pulsed condition

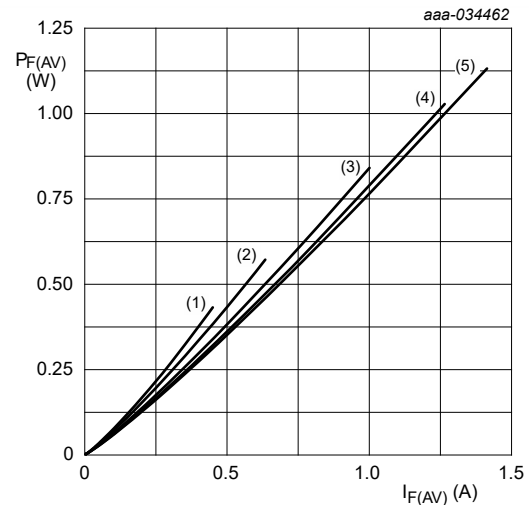
- (1) $T_j = 175\text{ °C}$
- (2) $T_j = 150\text{ °C}$
- (3) $T_j = 125\text{ °C}$
- (4) $T_j = 100\text{ °C}$
- (5) $T_j = 85\text{ °C}$
- (6) $T_j = 25\text{ °C}$

Fig. 4. Reverse current as a function of reverse voltage; typical values



$f = 1\text{ MHz}$; $T_{\text{amb}} = 25\text{ °C}$

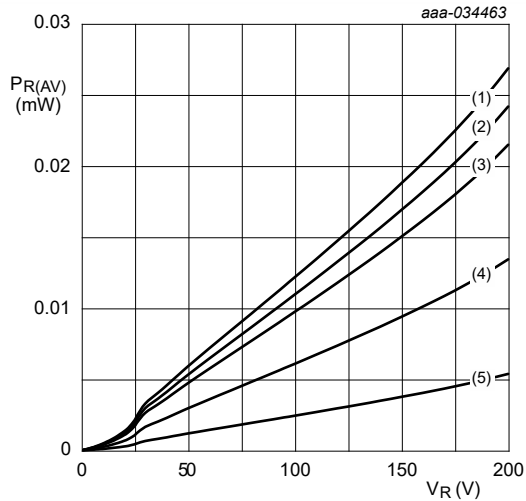
Fig. 5. Diode capacitance as a function of reverse voltage; typical values



$T_j = 100\text{ °C}$

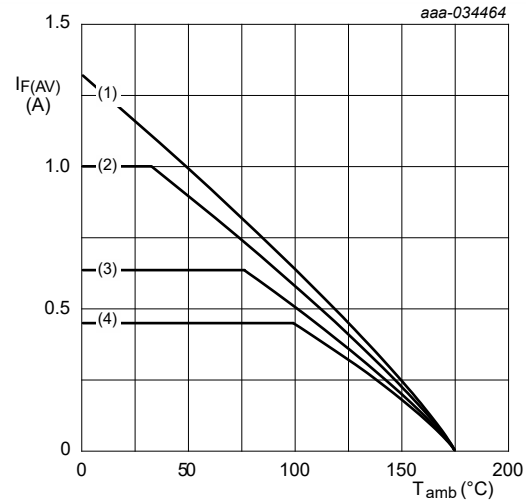
- (1) $\delta = 0.1$
- (2) $\delta = 0.2$
- (3) $\delta = 0.5$
- (4) $\delta = 0.8$
- (5) $\delta = 1$; DC

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



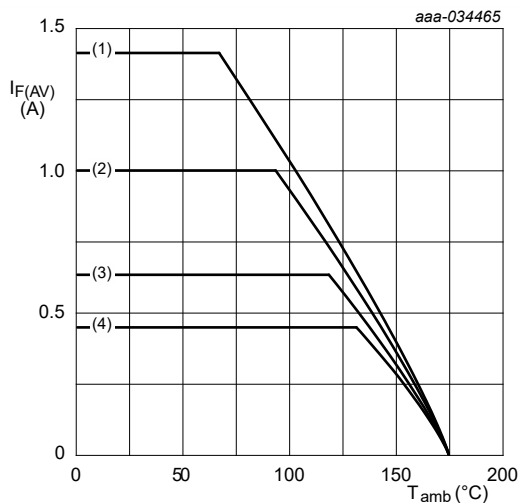
$T_j = 100\text{ °C}$
 (1) $\delta = 1$; DC
 (2) $\delta = 0.9$
 (3) $\delta = 0.8$
 (4) $\delta = 0.5$
 (5) $\delta = 0.2$

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



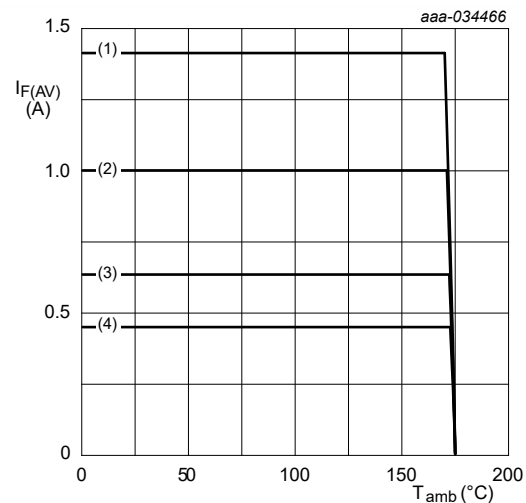
FR4 PCB, standard footprint
 $T_j = 175\text{ °C}$
 (1) $\delta = 1$; DC
 (2) $\delta = 0.5$; $f = 20\text{ kHz}$
 (3) $\delta = 0.2$; $f = 20\text{ kHz}$
 (4) $\delta = 0.1$; $f = 20\text{ kHz}$

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



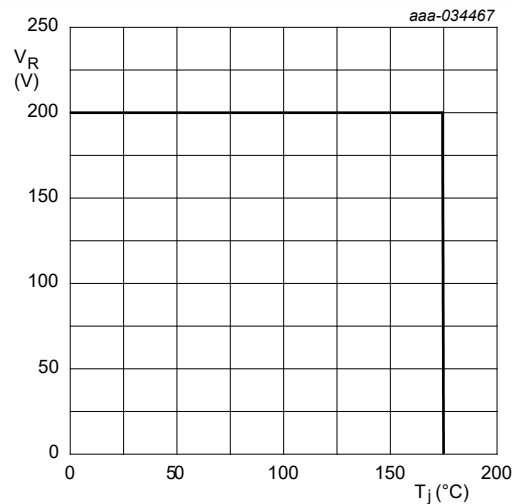
FR4 PCB, mounting pad for cathode 1 cm^2
 $T_j = 175\text{ °C}$
 (1) $\delta = 1$; DC
 (2) $\delta = 0.5$; $f = 20\text{ kHz}$
 (3) $\delta = 0.2$; $f = 20\text{ kHz}$
 (4) $\delta = 0.1$; $f = 20\text{ kHz}$

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



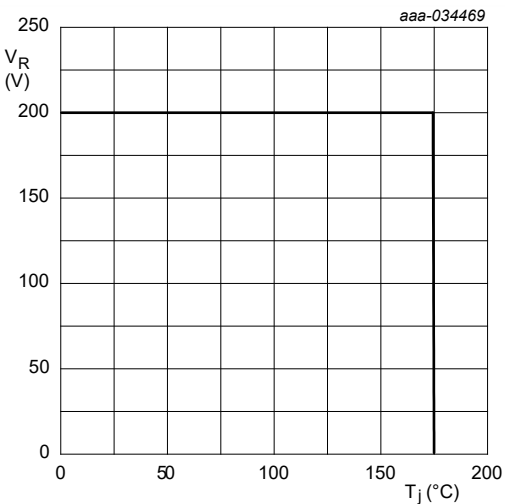
$T_j = 175\text{ °C}$
 (1) $\delta = 1$; DC
 (2) $\delta = 0.5$; $f = 20\text{ kHz}$
 (3) $\delta = 0.2$; $f = 20\text{ kHz}$
 (4) $\delta = 0.1$; $f = 20\text{ kHz}$

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



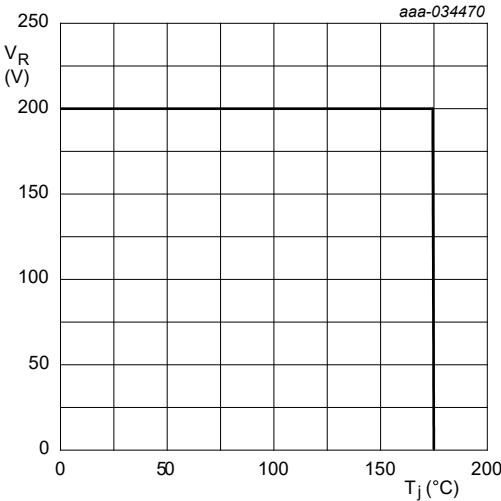
FR4 PCB, standard footprint
 $R_{th} = 230 \text{ K/W}$

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



FR4 PCB, mounting pad for cathode 1 cm^2
 $R_{th} = 125 \text{ K/W}$

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



Soldering point of cathode tab
 $R_{th} = 6 \text{ K/W}$

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

11. Test information

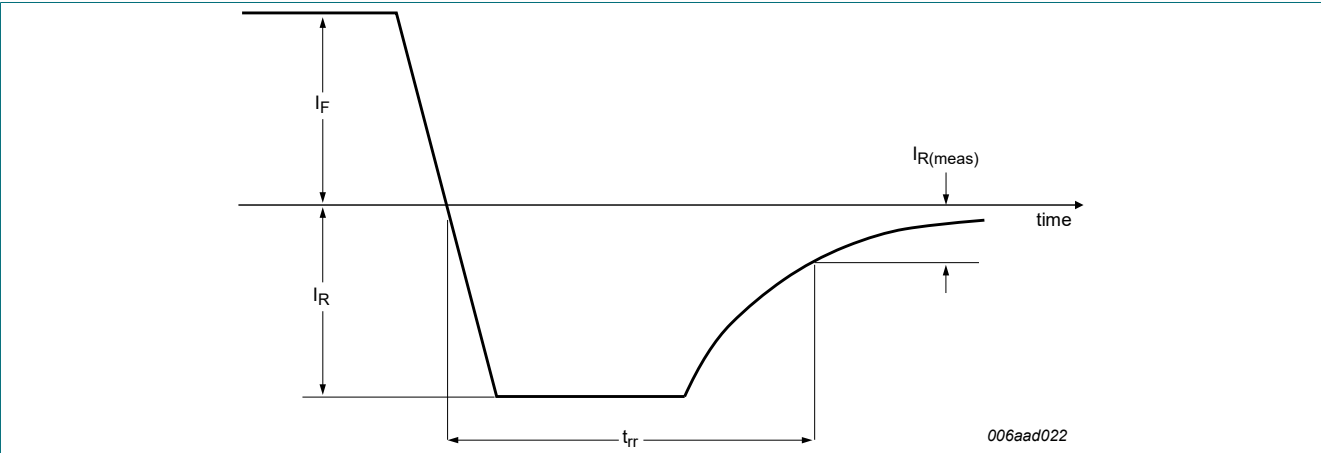


Fig. 14. Reverse recovery definition; step recovery

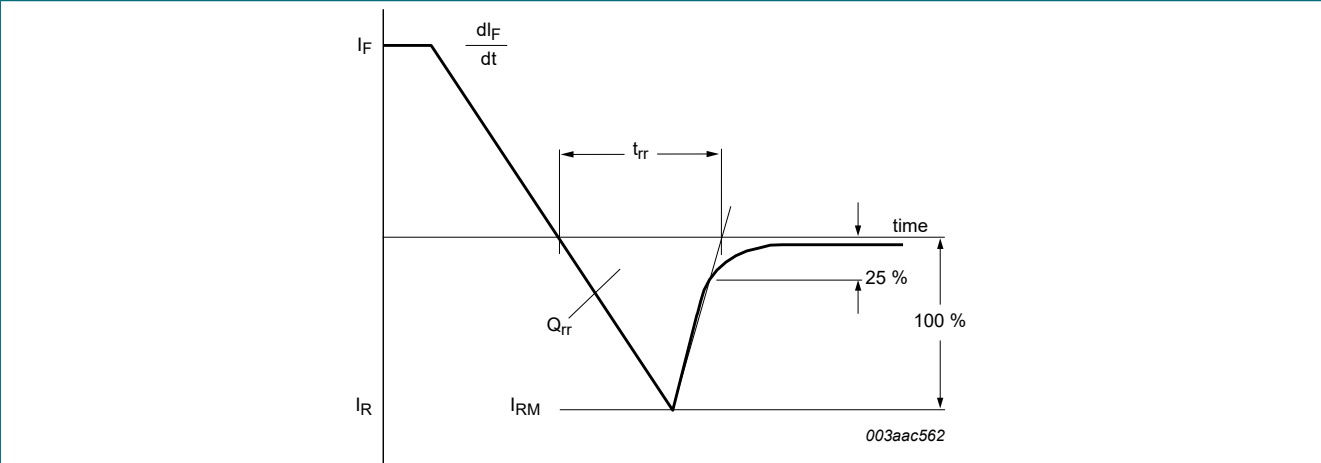


Fig. 15. Reverse recovery definition; ramp recovery

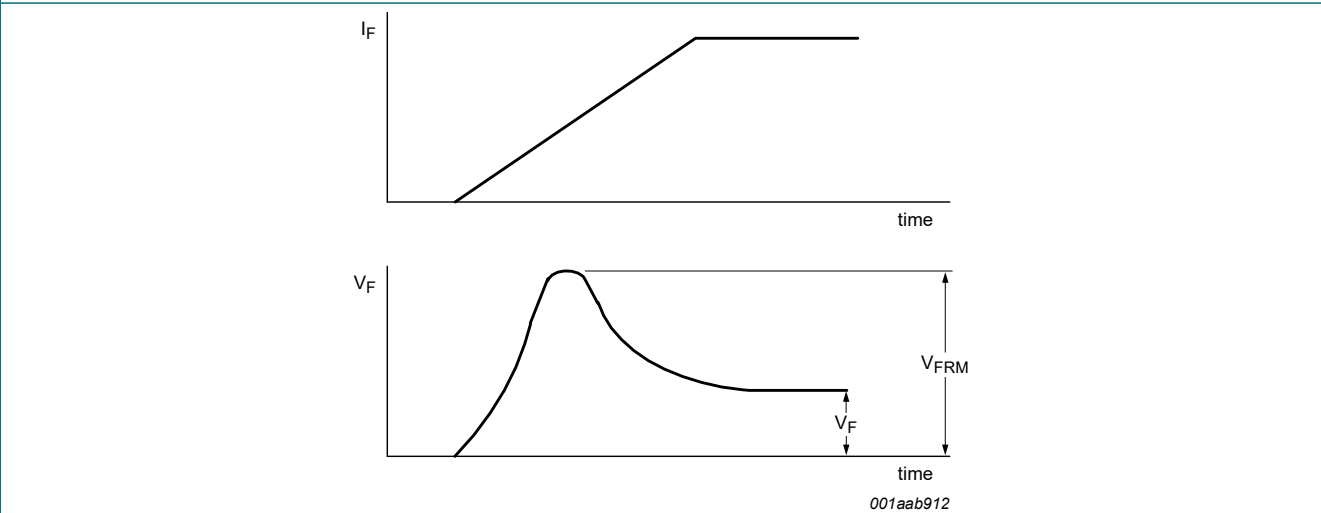


Fig. 16. Forward recovery definition

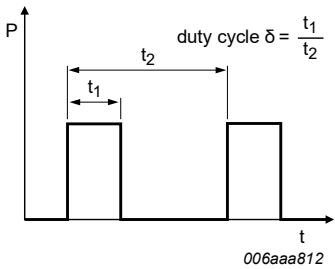


Fig. 17. Duty cycle definition

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

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

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

with I_{RMS} defined as RMS current.

12. Package outline

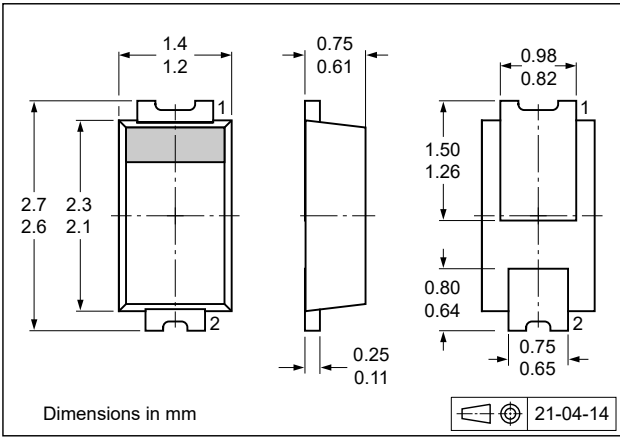


Fig. 18. Package outline CFP2-HP (SOD323HP)

13. Soldering

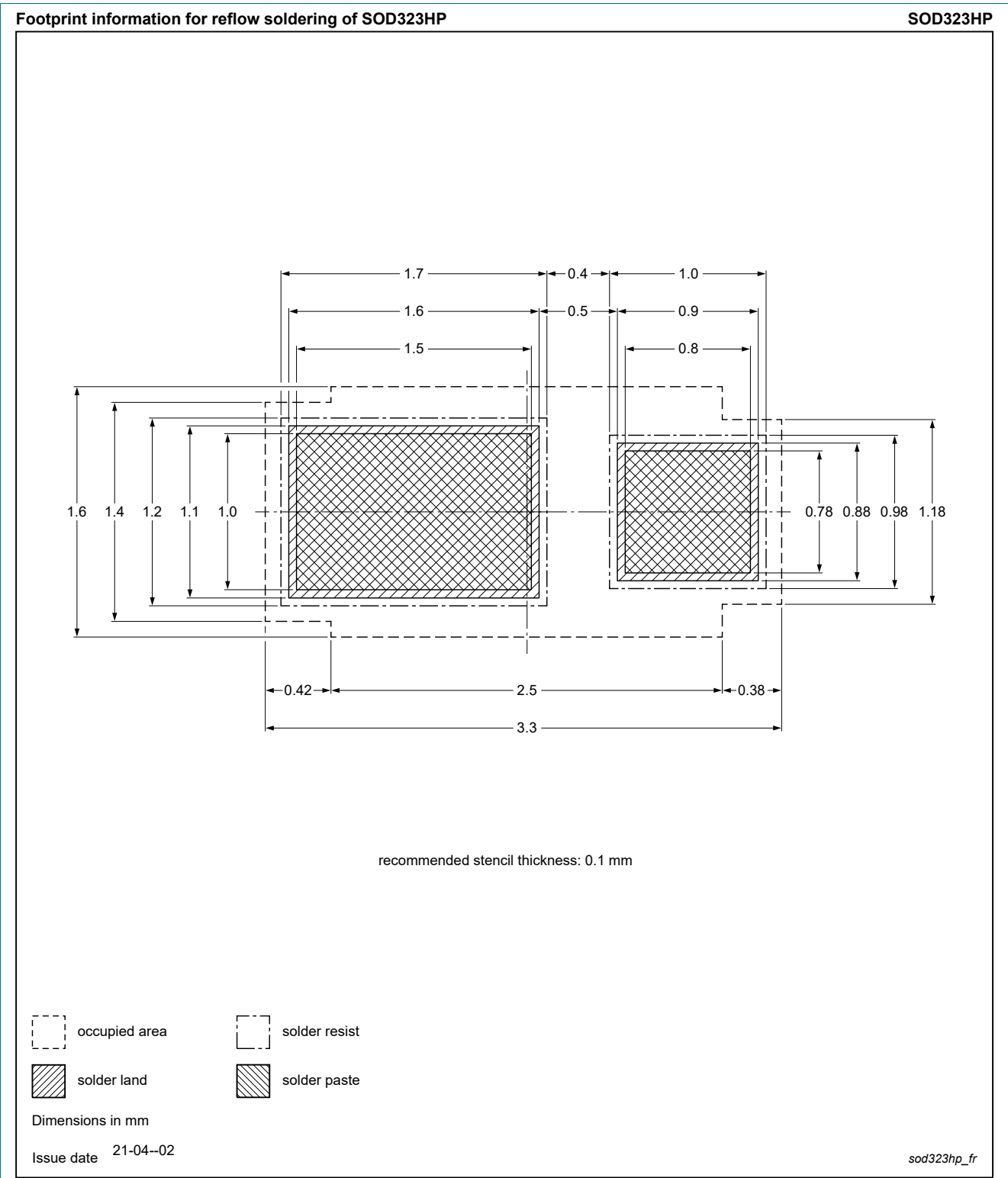


Fig. 19. Reflow soldering footprint for CFP2-HP (SOD323HP)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PNE20010EXD v.2	20220401	Product data sheet	-	PNE20010EXD v.1
Modifications:	• Product status changed			
PNE20010EXD v.1	20220218	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.

- [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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