

PNE20010EXD-Q

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
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

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

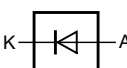
4. Quick reference data

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	µA

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-Q	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-Q	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); $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$		-	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 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] [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.

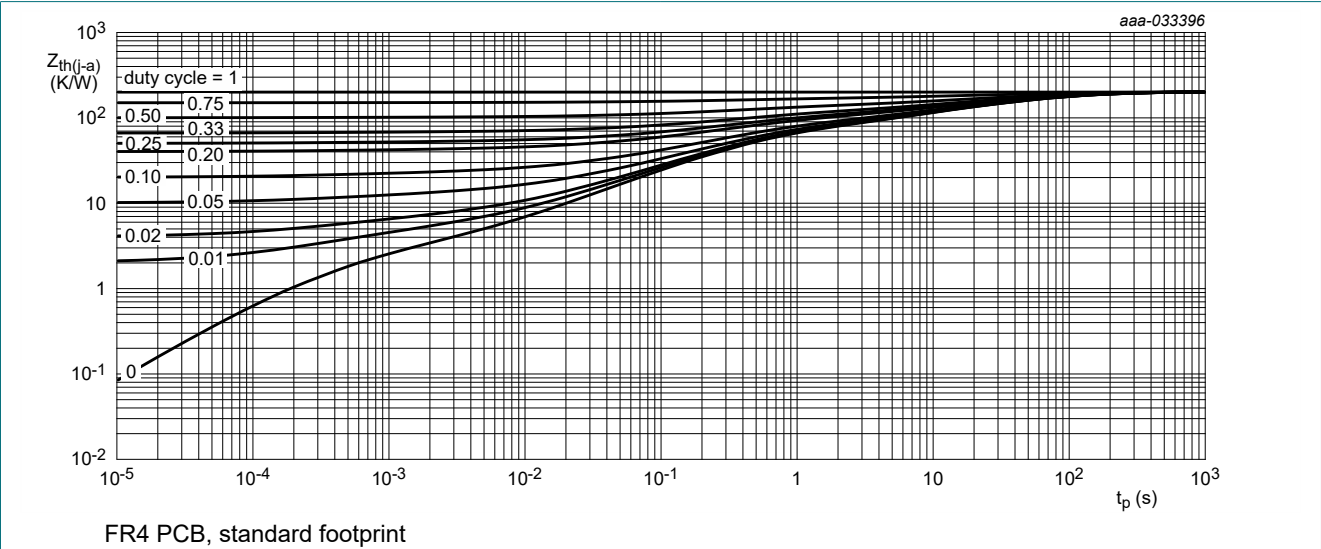


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

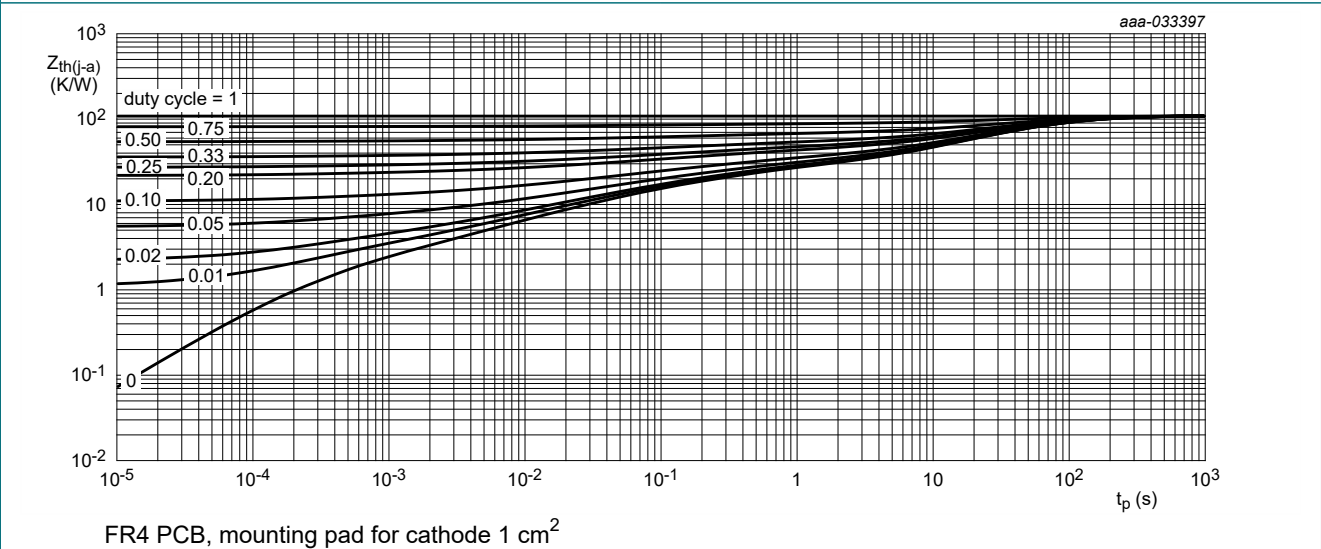


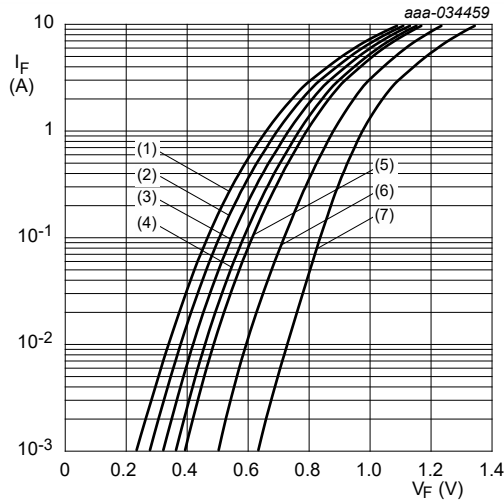
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

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

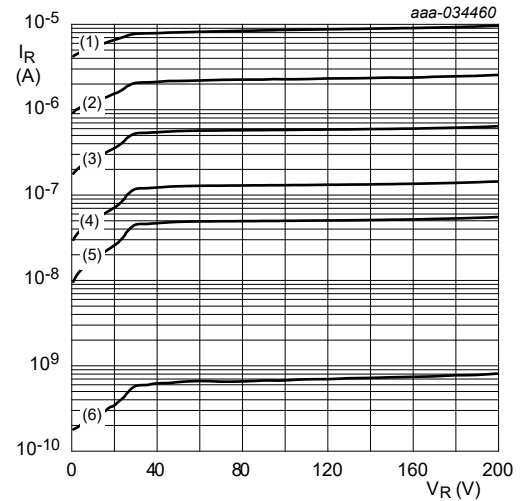
[1] Very short pulse, in order to maintain a stable junction temperature.



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) $T_j = -40\text{ °C}$

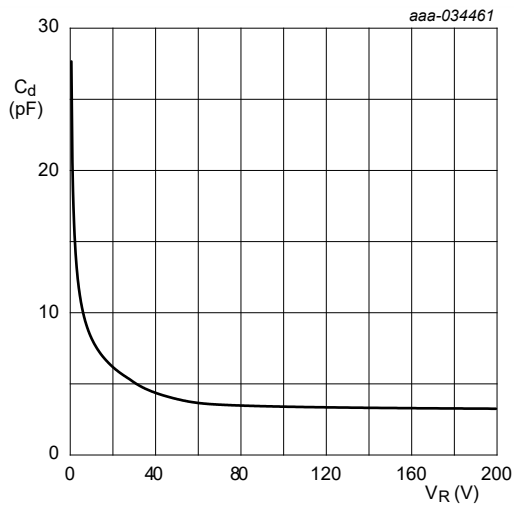
Fig. 3. Forward current as a function of forward voltage; typical values



pulsed condition

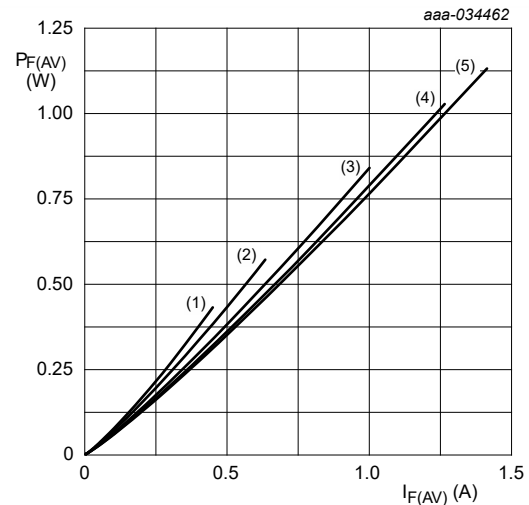
- (1) $T_j = 175\text{ °C}$
- (2) $T_j = 150\text{ °C}$
- (3) $T_j = 125\text{ °C}$
- (4) $T_j = 100\text{ °C}$
- (5) $T_j = 85\text{ °C}$
- (6) $T_j = 25\text{ °C}$

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



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

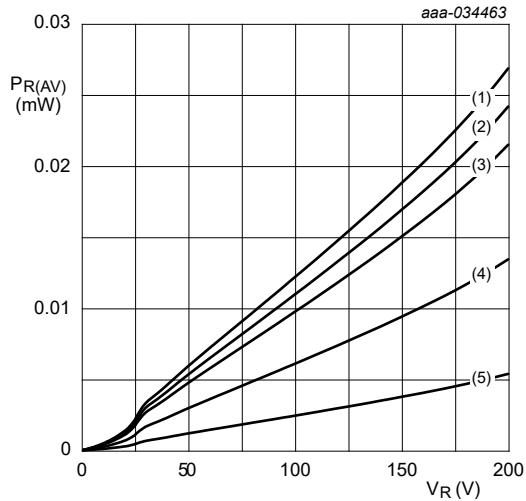
Fig. 5. Diode capacitance as a function of reverse voltage; typical values



$T_j = 100\text{ °C}$

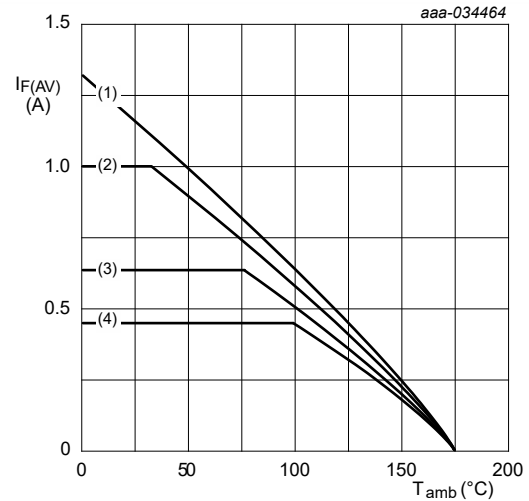
- (1) $\delta = 0.1$
- (2) $\delta = 0.2$
- (3) $\delta = 0.5$
- (4) $\delta = 0.8$
- (5) $\delta = 1$; DC

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



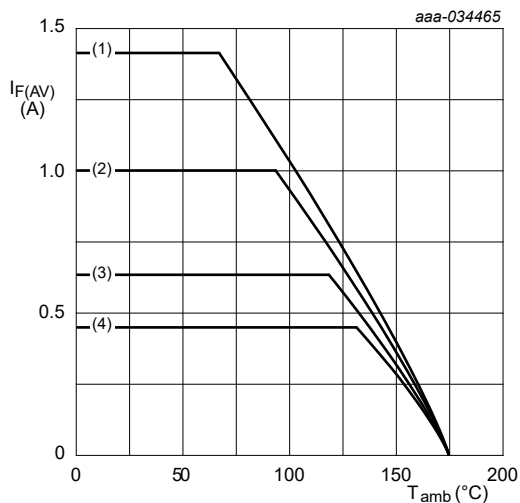
$T_j = 100\text{ °C}$
 (1) $\delta = 1$; DC
 (2) $\delta = 0.9$
 (3) $\delta = 0.8$
 (4) $\delta = 0.5$
 (5) $\delta = 0.2$

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



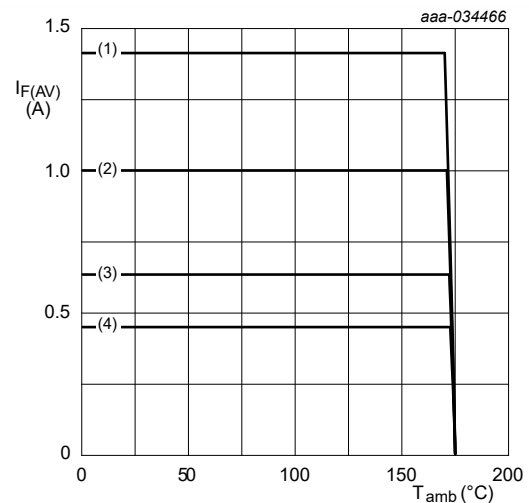
FR4 PCB, standard footprint
 $T_j = 175\text{ °C}$
 (1) $\delta = 1$; DC
 (2) $\delta = 0.5$; $f = 20\text{ kHz}$
 (3) $\delta = 0.2$; $f = 20\text{ kHz}$
 (4) $\delta = 0.1$; $f = 20\text{ kHz}$

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

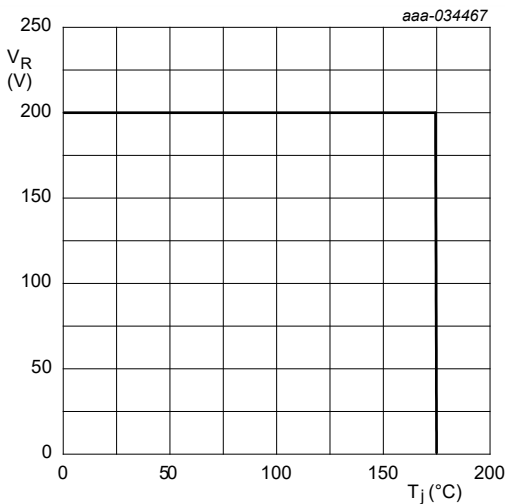


Fig. 11. Derated maximum reverse voltage as a function of junction temperature; typical values

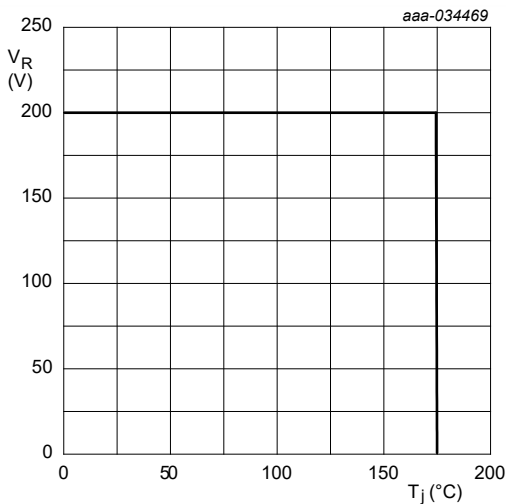


Fig. 12. Derated maximum reverse voltage as a function of junction temperature; typical values

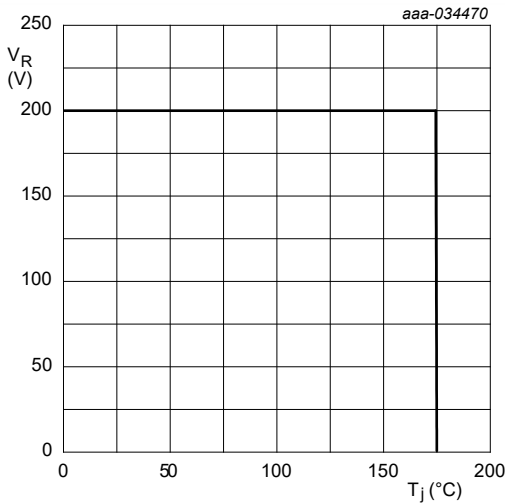


Fig. 13. Derated maximum reverse voltage as a function of junction temperature; typical values

11. Test information



Fig. 14. Reverse recovery definition; step recovery



Fig. 15. Reverse recovery definition; ramp recovery



Fig. 16. Forward recovery definition

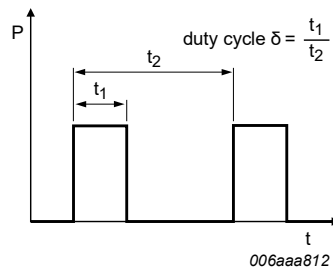


Fig. 17. Duty cycle definition

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.

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

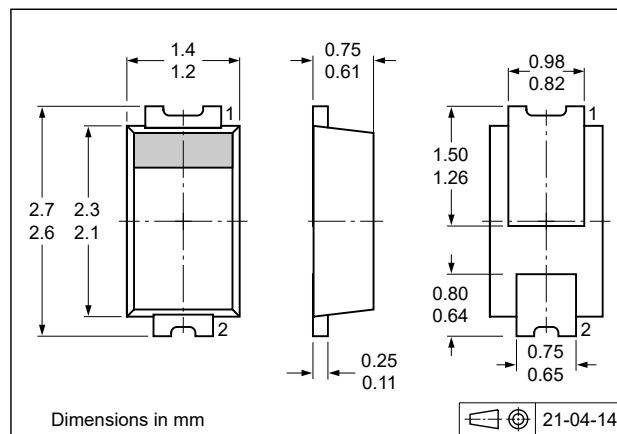
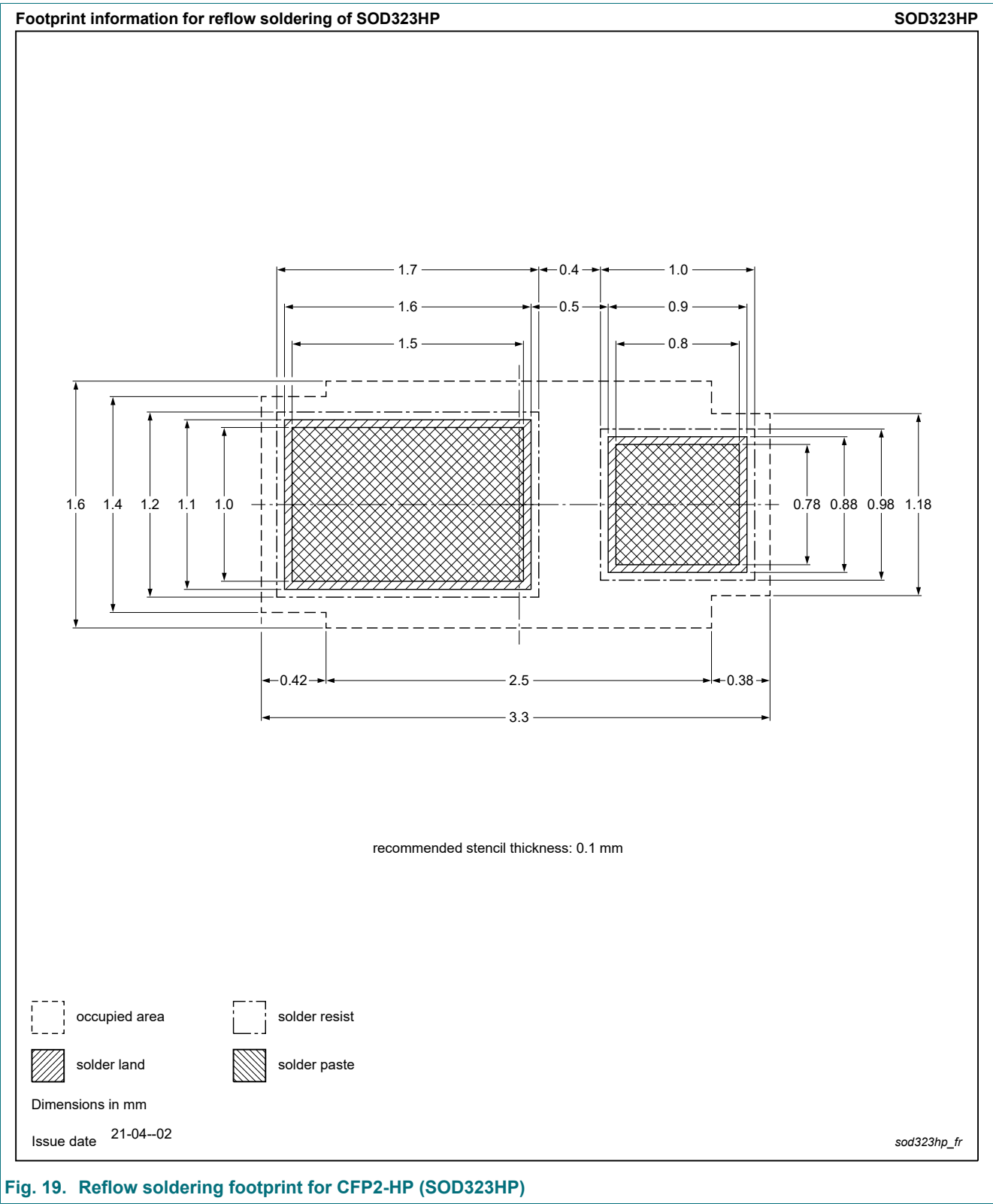


Fig. 18. Package outline CFP2-HP (SOD323HP)

13. Soldering



14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PNE20010EXD-Q v.1	20220401	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.
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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