PNE20020EXD-Q

200 V, 2 A hyperfast recovery rectifier

17 April 2024 **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: $I_F \leq 2$ 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	δ = 0.5; f = 20 kHz; square wave; $T_{sp} \leq$ 163 °C		-	-	2	A
V_R	reverse voltage	T_j = 25 °C		-	-	200	V
V_F	forward voltage	I_F = 2 A; pulsed; T_j = 25 °C	[1]	-	950	1085	mV
I_R	reverse current	V_R = 200 V; pulsed; T_j = 25 °C	[1]	-	-	75	nA
		V_R = 200 V; pulsed; T_j = 125 °C	[1]	-	0.6	5	µA

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

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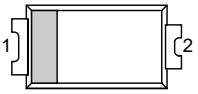
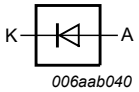
5. Pinning information

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
PNE20020EXD-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
PNE20020EXD-Q	8R

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 °C		-	200	V
I_F	forward current	δ = 1; T_{sp} ≤ 161 °C		-	2.8	A
$I_{F(AV)}$	average forward current	δ = 0.5; f = 20 kHz; square wave; T_{sp} ≤ 163 °C		-	2	A
I_{FSM}	non-repetitive peak forward current	t_p = 8.3 ms; single half sine wave (applied at reated load condition); $T_{j(init)}$ = 25 °C		-	25	A
P_{tot}	total power dissipation	T_{amb} ≤ 25 °C	[1]	-	0.65	W
			[2]	-	1.2	W
T_j	junction temperature			-	175	°C
T_{amb}	ambient temperature			-55	175	°C
T_{stg}	storage temperature			-65	175	°C

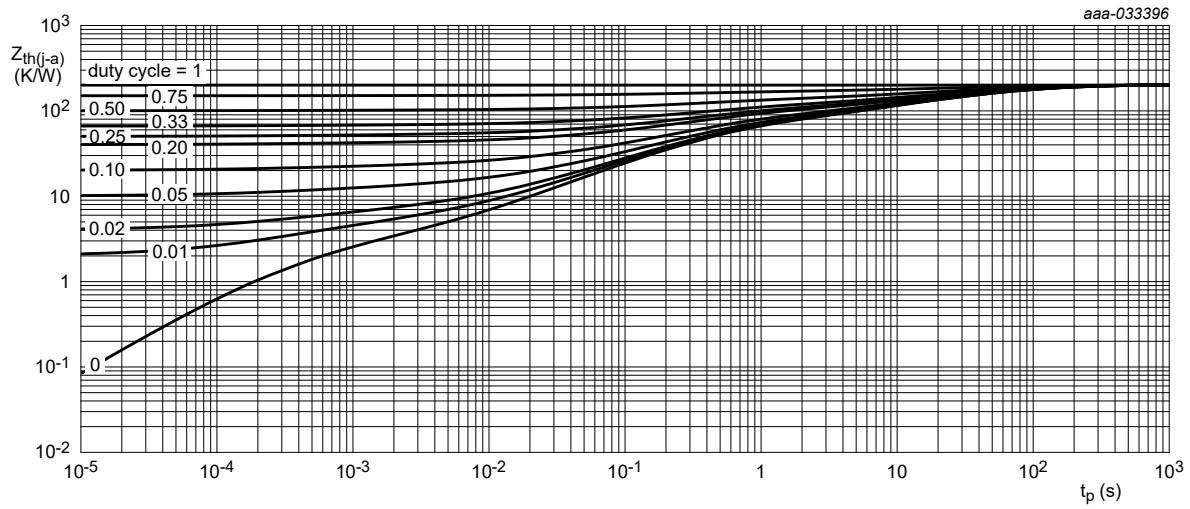
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm^2.

9. Thermal characteristics

Table 6. Thermal characteristics

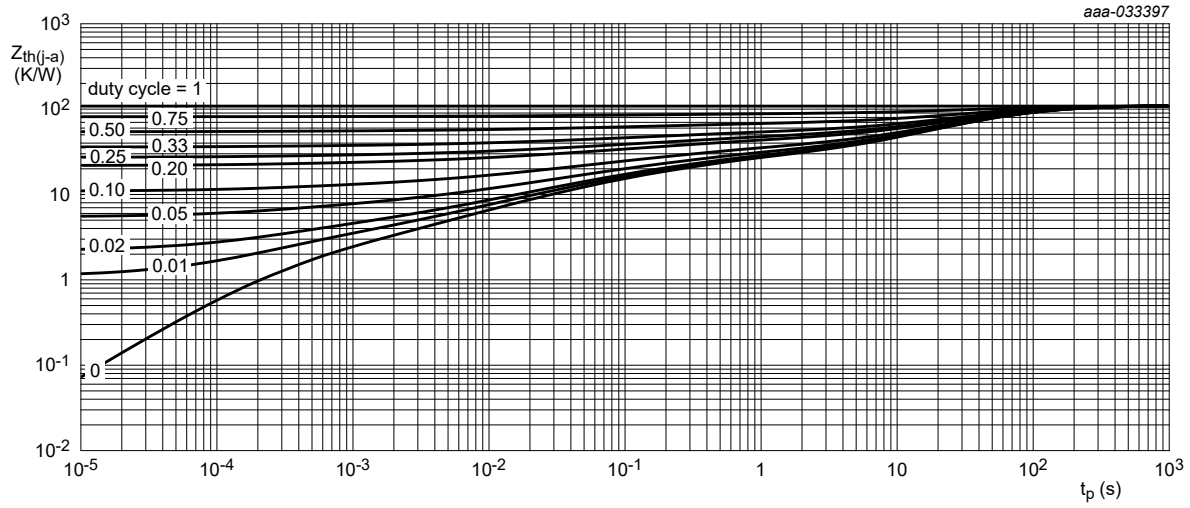
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] [2]	-	-	230	K/W
			[1] [3]	-	-	125	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[4]	-	-	6	K/W

[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 cm^2.
[4] Soldering point of cathode tab.



FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for cathode 1 cm^2

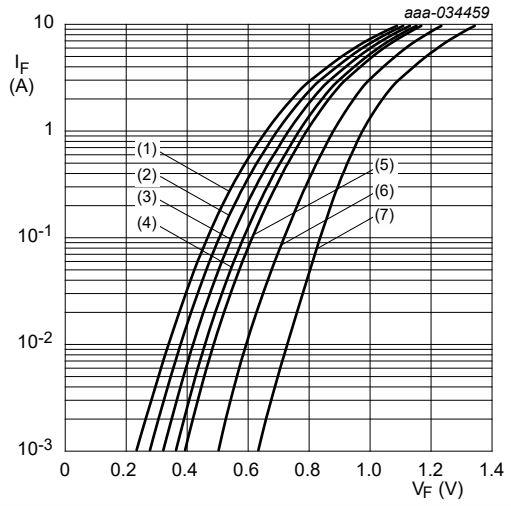
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

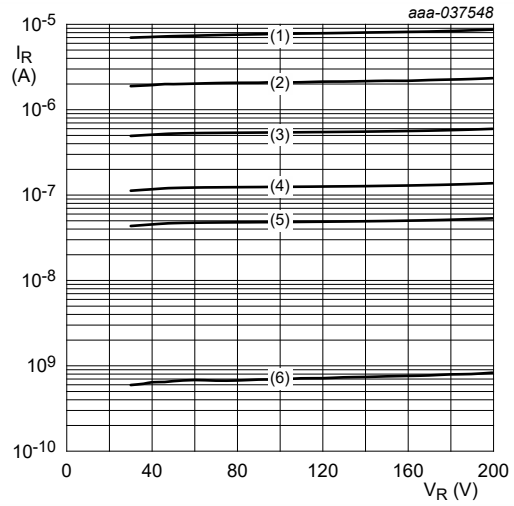
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)R}$	reverse breakdown voltage	I_R = 0.1 mA; pulsed; T_j = 25 °C	[1]	200	-	-	V
V_F	forward voltage	I_F = 0.1 A; pulsed; T_j = 25 °C	[1]	-	720	840	mV
		I_F = 0.5 A; pulsed; T_j = 25 °C	[1]	-	825	935	mV
		I_F = 1 A; pulsed; T_j = 25 °C	[1]	-	880	1020	mV
		I_F = 2 A; pulsed; T_j = 25 °C	[1]	-	950	1085	mV
		I_F = 2 A; pulsed; T_j = -40 °C	[1]	-	1050	1190	mV
		I_F = 2 A; pulsed; T_j = 125 °C	[1]	-	810	950	mV
I_R	reverse current	V_R = 200 V; pulsed; T_j = 25 °C	[1]	-	-	75	nA
		V_R = 200 V; pulsed; T_j = 125 °C	[1]	-	0.6	5	µA
		V_R = 200 V; pulsed; T_j = 150 °C	[1]	-	2.5	15	µA
C_d	diode capacitance	V_R = 4 V; f = 1 MHz; T_j = 25 °C		-	10	-	pF
		V_R = 10 V; f = 1 MHz; T_j = 25 °C		-	8	-	pF
t_{rr}	reverse recovery time ; step recovery	I_F = 0.5 A; I_R = 1 A; $I_{R(meas)}$ = 0.25 A; T_j = 25 °C		-	9	25	ns
	reverse recovery time ; ramp recovery	I_F = 1 A; dI_F/dt = 50 A/µs; V_R = 30 V; T_j = 25 °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 A; dI_F/dt = 50 A/µs; T_j = 25 °C		-	1	-	V

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



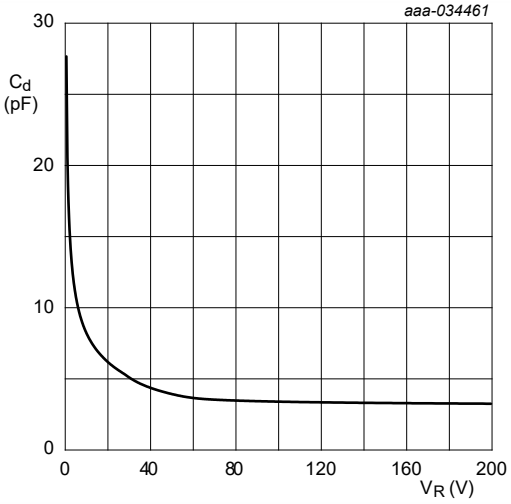
pulsed condition
(1) Tj = 175 °C
(2) Tj = 150 °C
(3) Tj = 125 °C
(4) Tj = 100 °C
(5) Tj = 85 °C
(6) Tj = 25 °C
(7) Tj = -40 °C

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



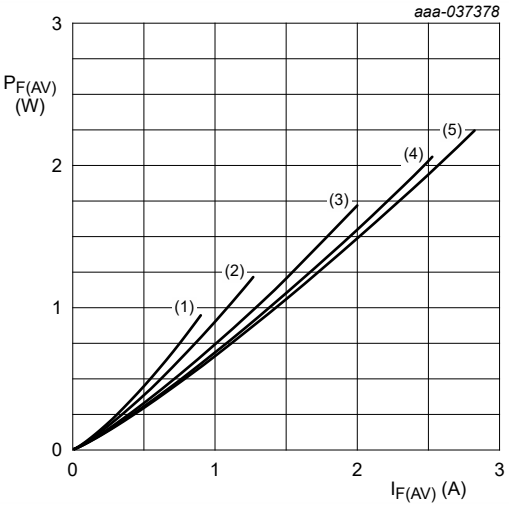
pulsed condition
(1) T_j = 175 °C
(2) T_j = 150 °C
(3) T_j = 125 °C
(4) T_j = 100 °C
(5) T_j = 85 °C
(6) T_j = 25 °C

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



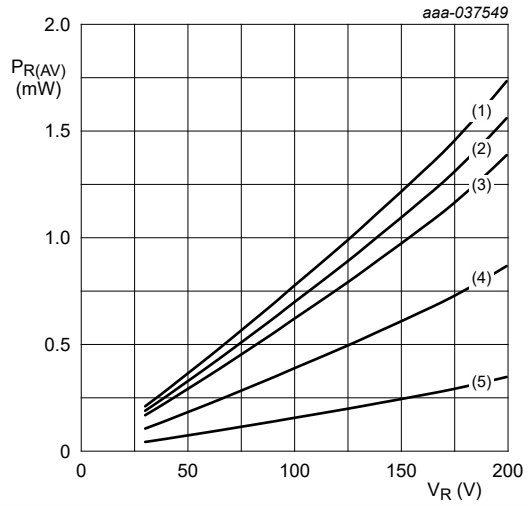
f = 1 MHz; T_{amb} = 25 °C

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



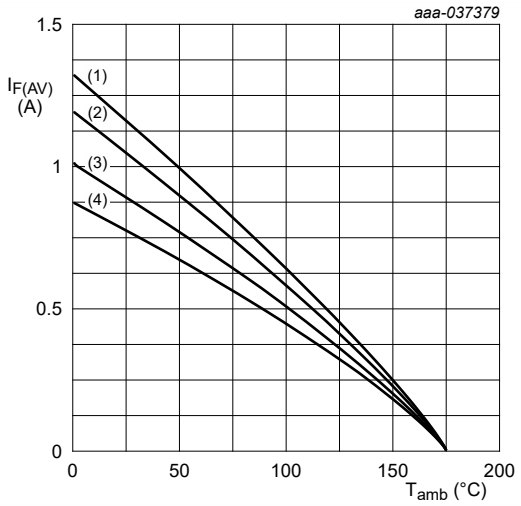
T_j = 175 °C
(1) δ = 0.1
(2) δ = 0.2
(3) δ = 0.5
(4) δ = 0.8
(5) δ = 1; DC

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



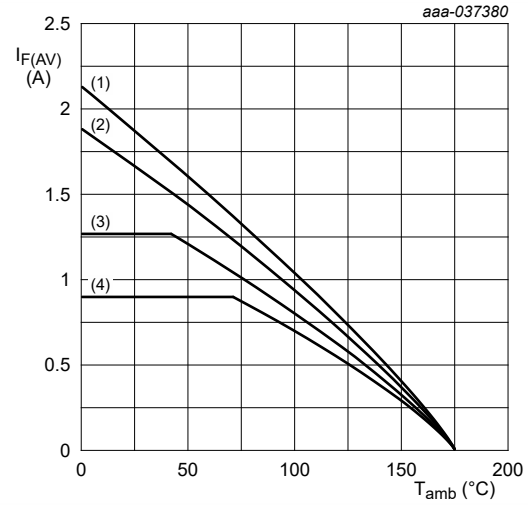
T_j = 175 °C
(1) δ = 1
(2) δ = 0.9
(3) δ = 0.8
(4) δ = 0.5
(5) δ = 0.2

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



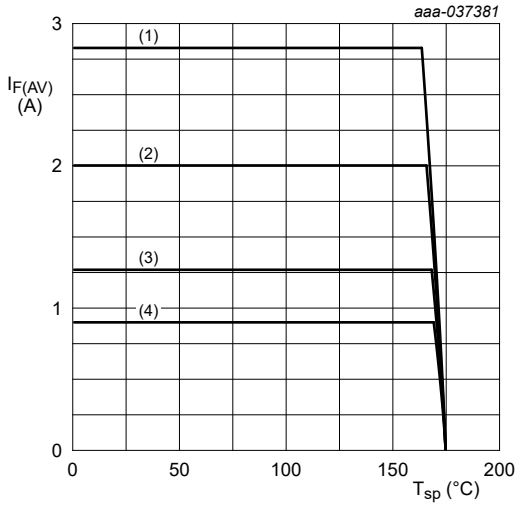
FR4 PCB, standard footprint
T_j = 175 °C
(1) δ = 1; DC
(2) δ = 0.5; f = 20 kHz
(3) δ = 0.2; f = 20 kHz
(4) δ = 0.1; f = 20 kHz

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



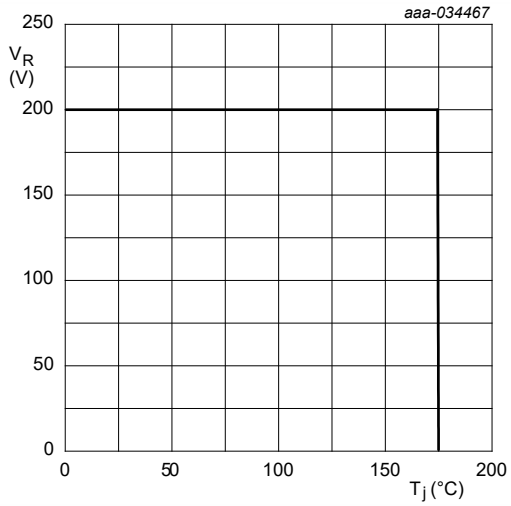
FR4 PCB, mounting pad for cathode 1 cm^2
T_j = 175 °C
(1) δ = 1; DC
(2) δ = 0.5; f = 20 kHz
(3) δ = 0.2; f = 20 kHz
(4) δ = 0.1; f = 20 kHz

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



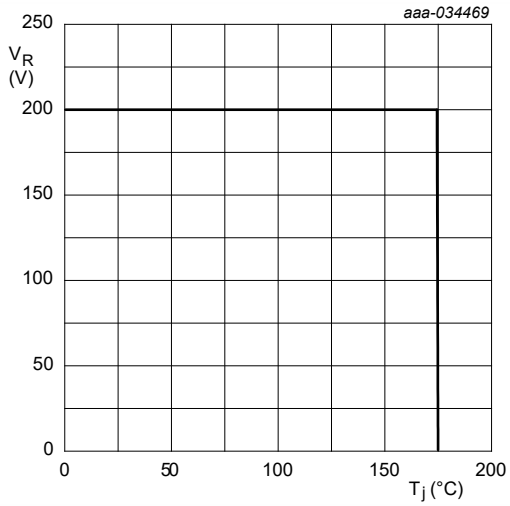
T_j = 175 °C
(1) δ = 1; DC
(2) δ = 0.5; f = 20 kHz
(3) δ = 0.2; f = 20 kHz
(4) δ = 0.1; f = 20 kHz

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



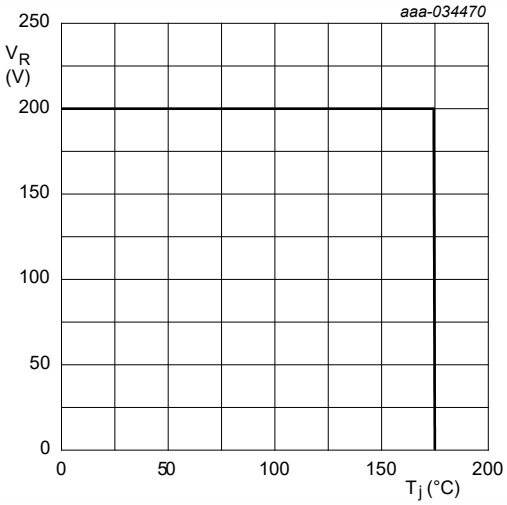
FR4 PCB, standard footprint
R_{th} = 230 K/W

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 K/W

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



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

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

11. Test information

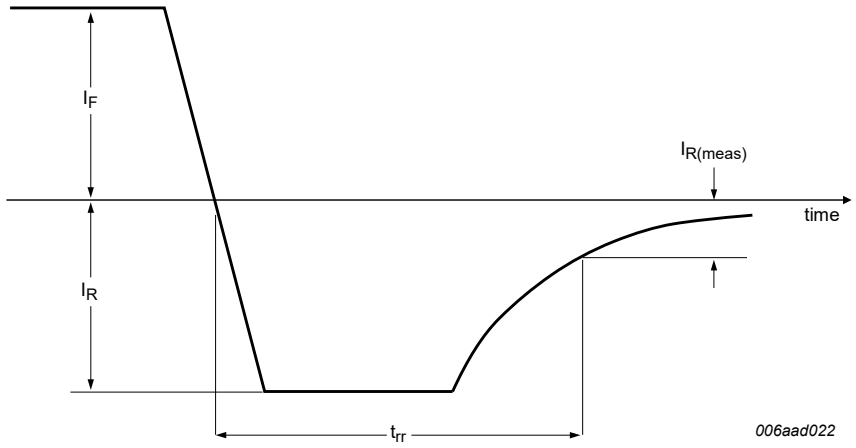


Fig. 14. Reverse recovery definition; step recovery

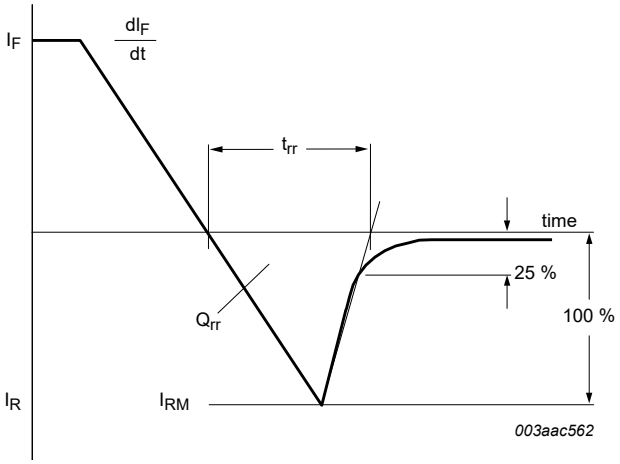


Fig. 15. Reverse recovery definition; ramp recovery

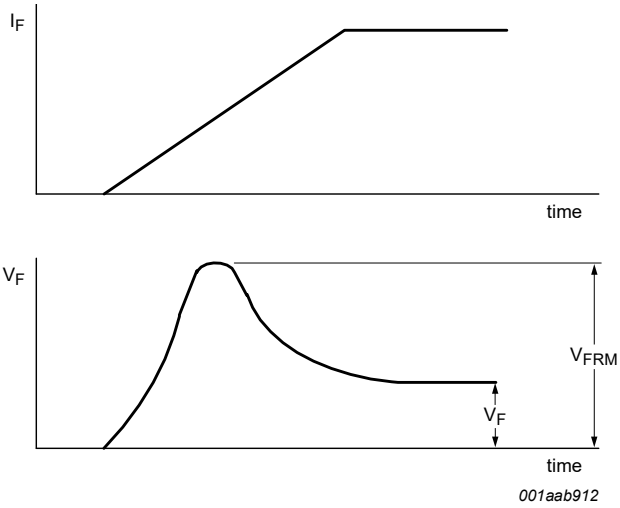


Fig. 16. Forward recovery definition

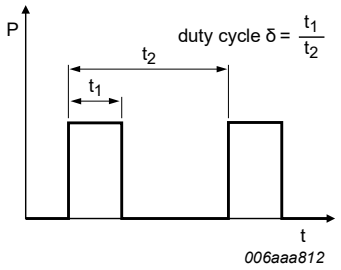


Fig. 17. Duty cycle definition

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.

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

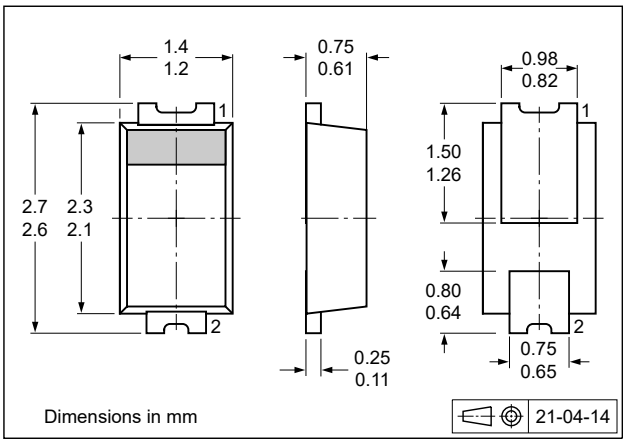


Fig. 18. Package outline CFP2-HP (SOD323HP)

13. Soldering

Footprint information for reflow soldering of SOD323HP **SOD323HP**

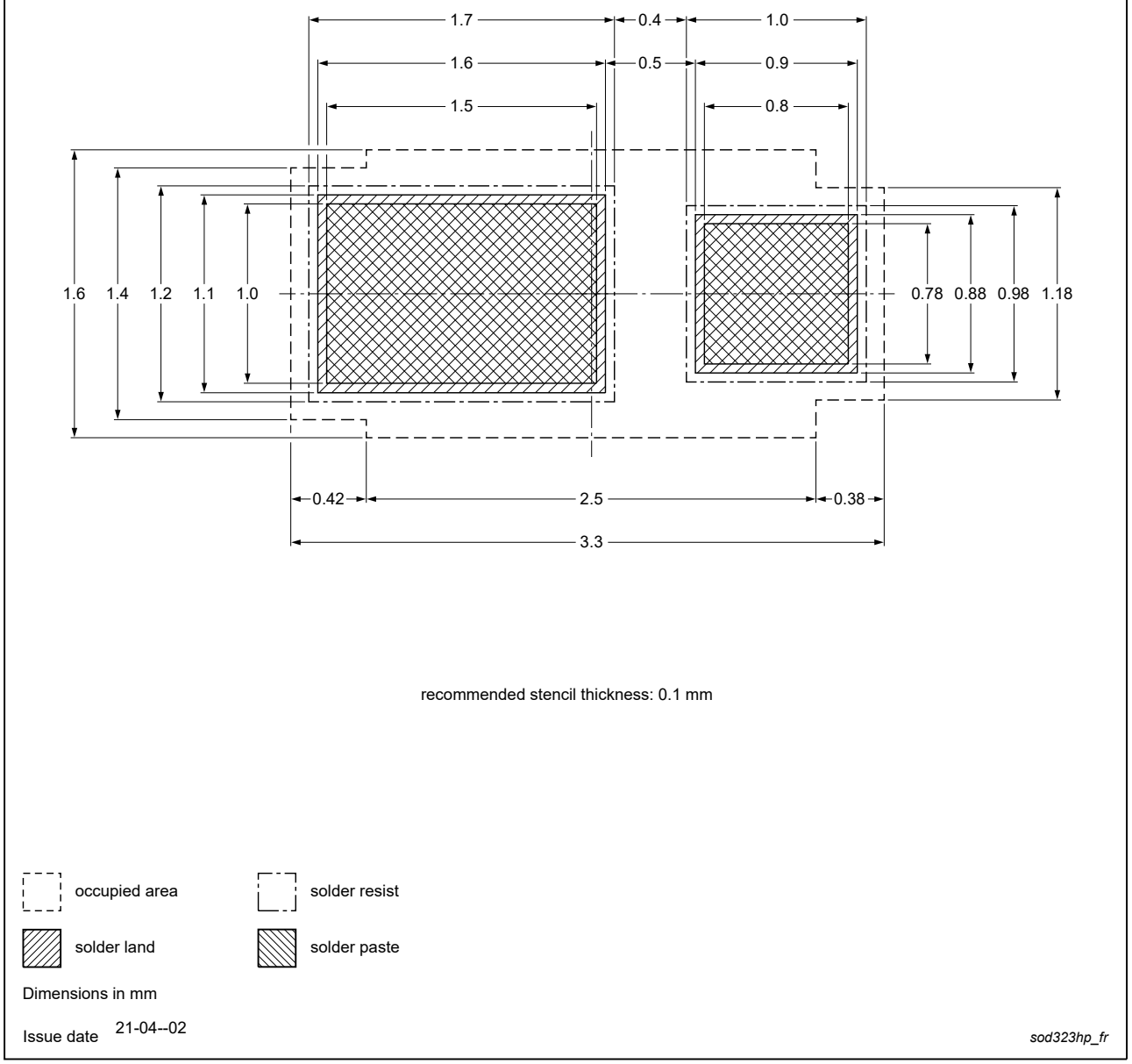


Fig. 19. Reflow soldering footprint for CFP2-HP (SOD323HP)

Wave soldering footprint information for CFP2-HP package **SOD323HP**

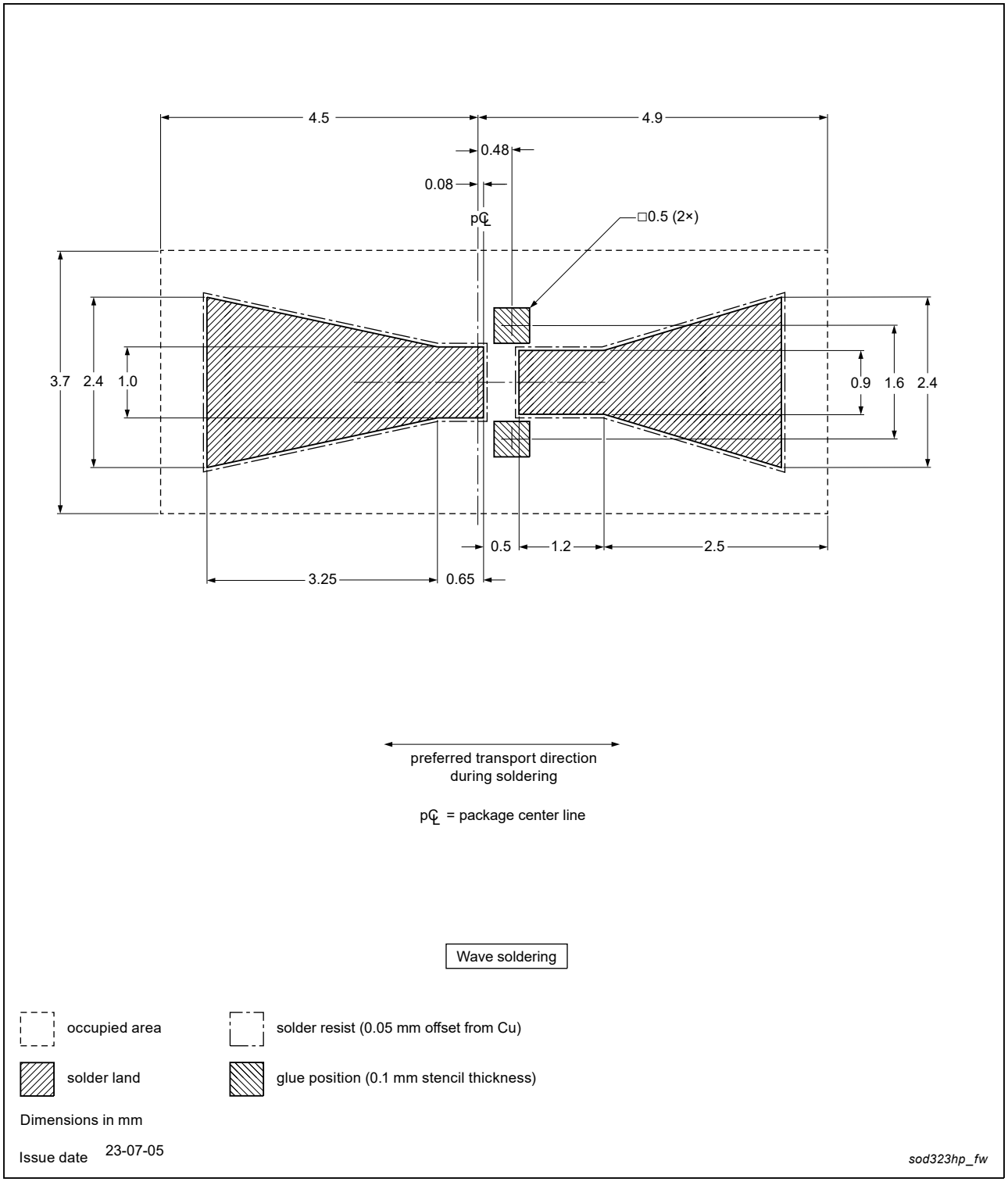


Fig. 20. Wave soldering footprint for CFP2-HP (SOD323HP)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PNE20020EXD-Q v.1	20240417	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.

[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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Contents

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Date of release: 17 April 2024