PNE20030EP

200 V, 3 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 $I_F \leq 3$ A
- Switching time $t_{rr} \leq 30$ 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-Q101 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	δ = 0.5; f = 20 kHz; square wave; $T_{sp} \leq$ 155 °C		-	-	3	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 = 3 A; T_j = 25 °C	[1]	-	875	980	mV
		I_F = 3 A; T_j = 125 °C	[1]	-	730	820	mV
I_R	reverse current	V_R = 200 V; T_j = 25 °C	[1]	-	-	1	µA
		V_R = 200 V; T_j = 125 °C	[1]	-	1.5	35	µA

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

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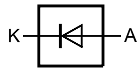
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode	 **CFP5 (SOD128)**	 *006aab040*
2	A	anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	**Description**	**Version**
PNE20030EP	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
PNE20030EP	DG

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 °C		-	200	V
V_R	reverse voltage			-	200	V
V_{RMS}	RMS voltage			-	140	V
I_F	forward current	δ = 1; T_{sp} ≤ 150 °C		-	4.2	A
$I_{F(AV)}$	average forward current	δ = 0.5; f = 20 kHz; square wave; T_{sp} ≤ 155 °C		-	3	A
I_{FSM}	non-repetitive peak forward current	t_p = 8.3 ms; single half sine wave (applied at rated load condition); $T_{j(init)}$ = 25 °C		-	75	A
P_{tot}	total power dissipation	T_{amb} ≤ 25 °C	[1]	-	0.81	W
			[2]	-	1.3	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.

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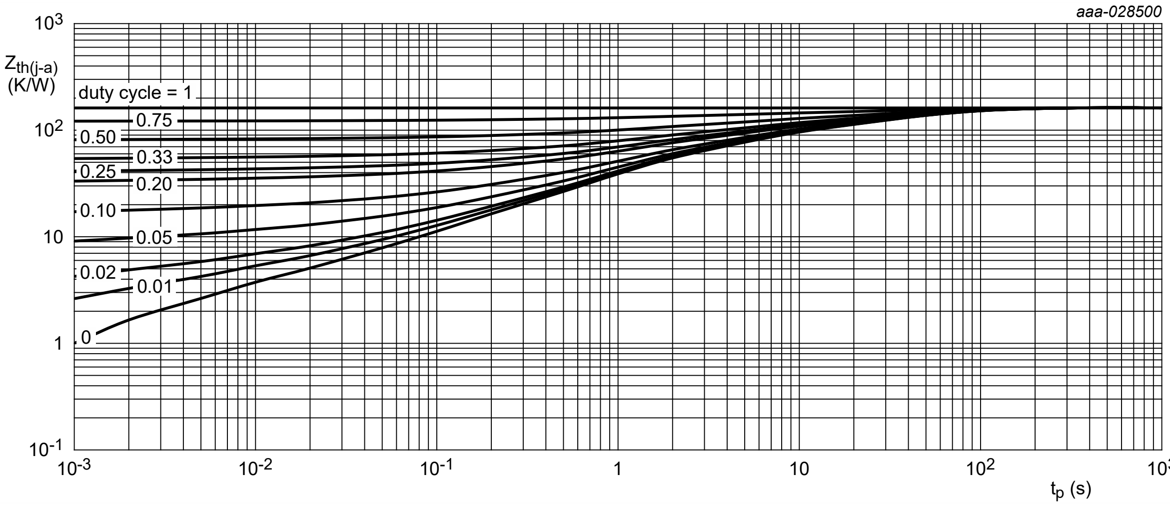
9. Thermal characteristics

Table 6. Thermal characteristics

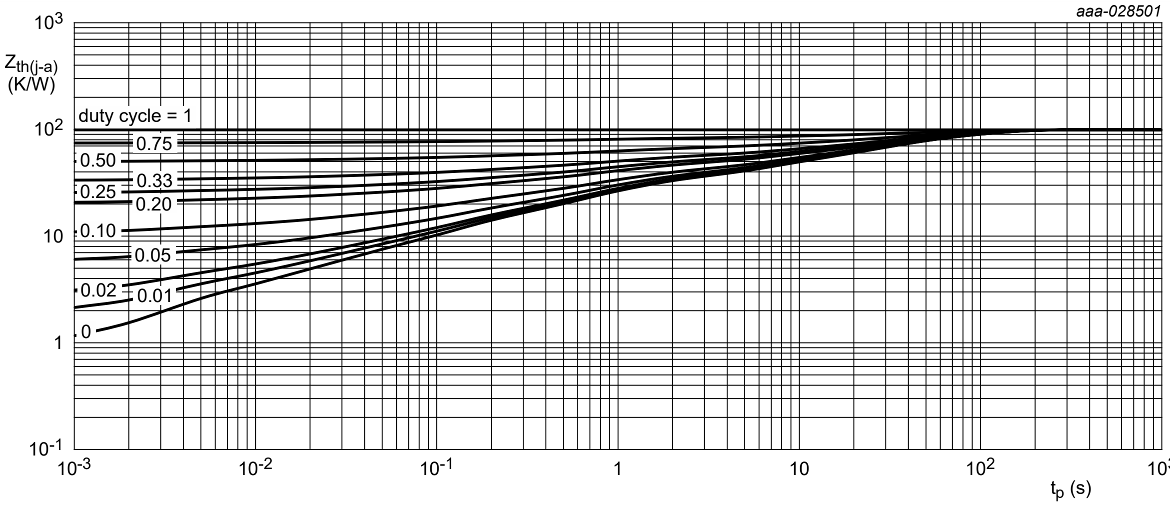
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	185	K/W
			[2]	-	-	115	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[3]	-	-	8	K/W

[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 cm^2.
[3] 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

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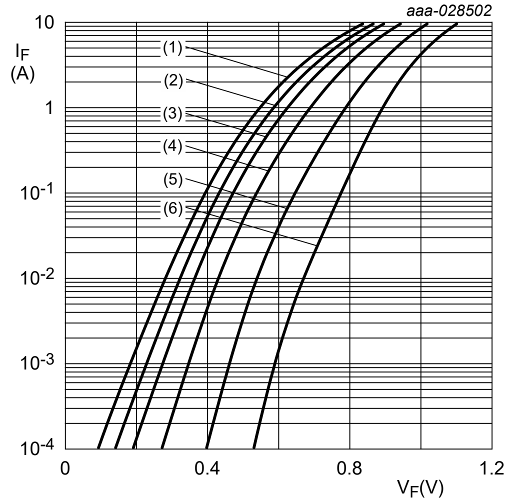
10. Characteristics

Table 7. Characteristics

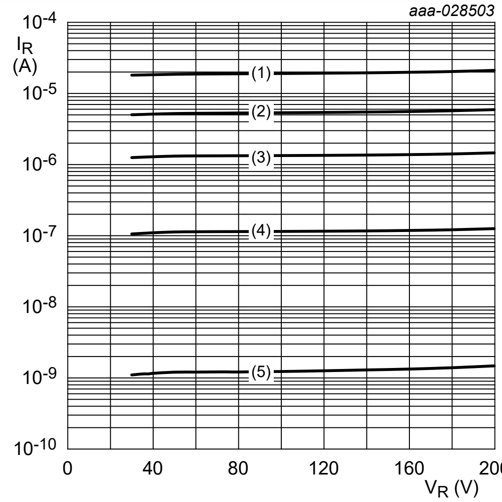
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)R}$	reverse breakdown voltage	I_R = 100 µA; T_j = 25 °C	[1]	200	-	-	V
V_F	forward voltage	I_F = 3 A; T_j = 25 °C	[1]	-	875	980	mV
		I_F = 3 A; T_j = 125 °C	[1]	-	730	820	mV
I_R	reverse current	V_R = 200 V; T_j = 25 °C	[1]	-	-	1	µA
		V_R = 200 V; T_j = 125 °C	[1]	-	1.5	35	µA
C_d	diode capacitance	V_R = 4 V; f = 1 MHz; T_j = 25 °C		-	32	-	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		-	13	30	ns
	reverse recovery time ; ramp recovery	I_F = 1 A; dI_F/dt = 50 A/µs; V_R = 30 V; T_j = 25 °C		-	22	-	ns
		I_F = 1 A; dI_F/dt = 100 A/µs; V_R = 30 V; T_j = 25 °C		-	17	-	ns
I_{RM}	peak reverse recovery current			-	1	-	A
Q_{rr}	reverse recovery charge			-	16	-	nC
V_{FRM}	peak forward recovery voltage	I_F = 1 A; dI_F/dt = 50 A/µs; T_j = 25 °C		-	820	-	mV

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



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

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



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

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

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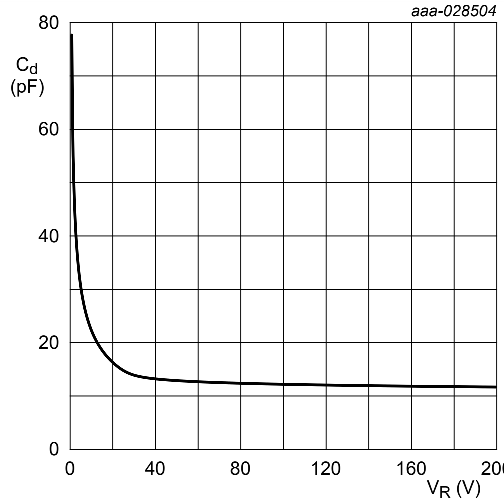
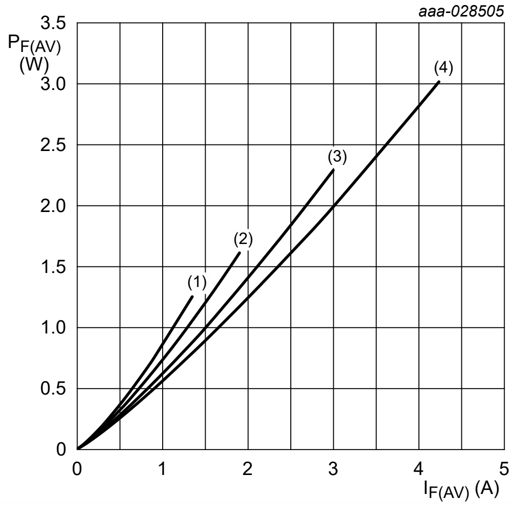


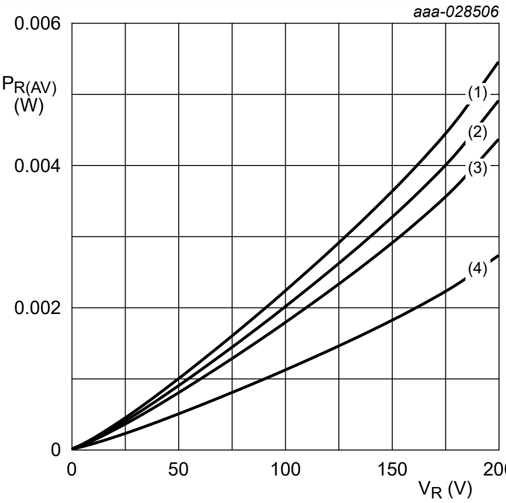
f = 1 MHz; T_{amb} = 25 °C

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



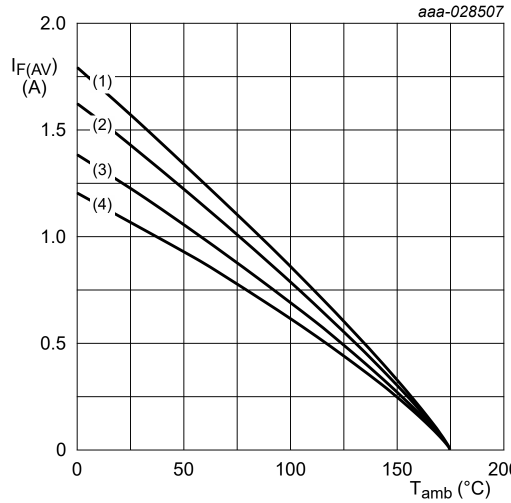
T_j = 175 °C
(1) δ = 0.1
(2) δ = 0.2
(3) δ = 0.5
(4) δ = 1 (DC)

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



T_j = 175 °C
(1) δ = 1; DC
(2) δ = 0.9
(3) δ = 0.8
(4) δ = 0.5

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

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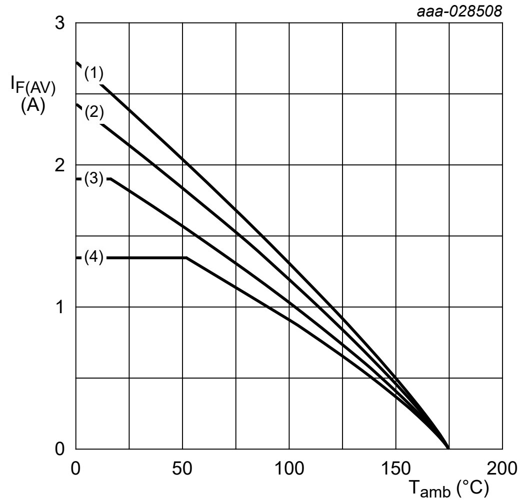
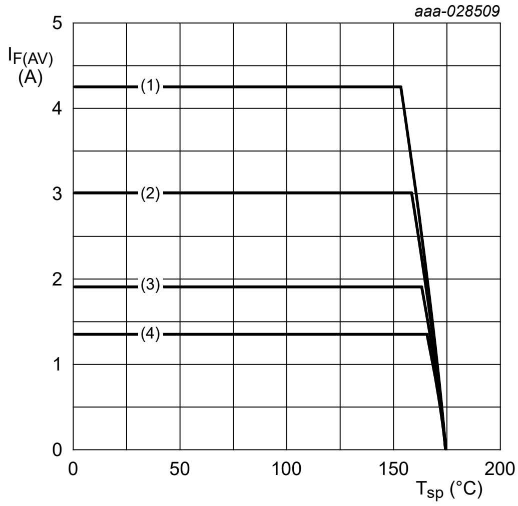


FR4 PCB, mounting pad for cathode 1 cm^2
T_j = 175 °C
(1) δ = 1; DC
(2) δ = 0.5; f = 20 kHz
(3) δ = 0.2; f = 20 kHz
(4) δ = 0.1; f = 20 kHz

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

11. Test information

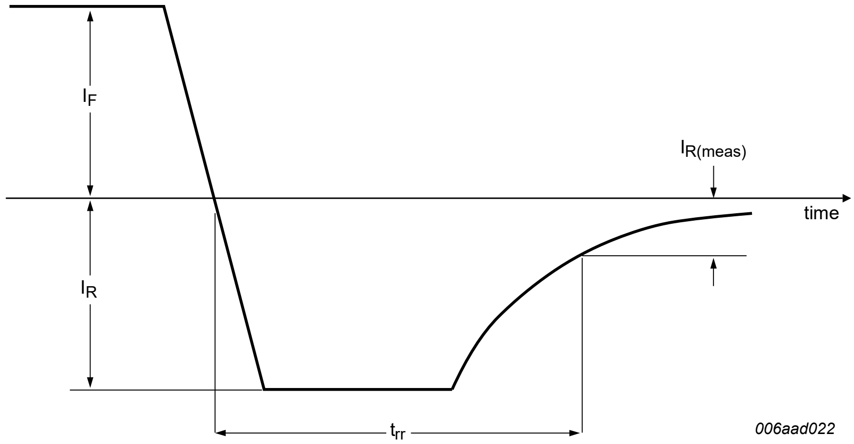


Fig. 11. Reverse recovery definition; step recovery

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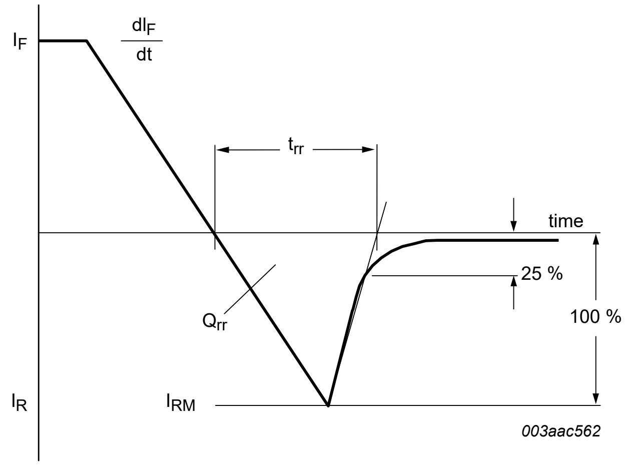

Fig. 12. Reverse recovery definition; ramp recovery

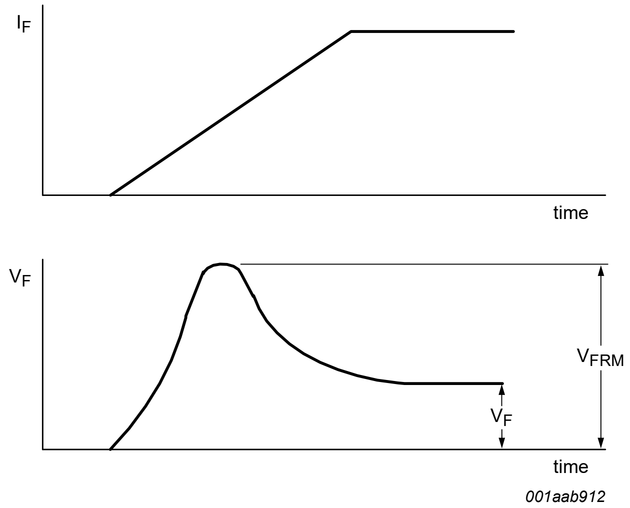

Fig. 13. Forward recovery definition

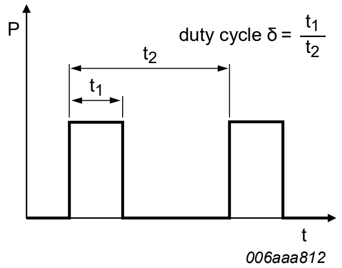

Fig. 14. Duty cycle definition

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

$I_{F(AV)}=I_M \times \delta$ 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.

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12. Package outline

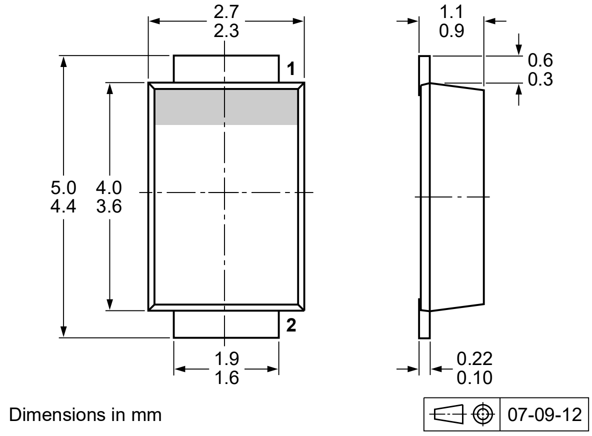

Fig. 15. Package outline CFP5 (SOD128)

13. Soldering

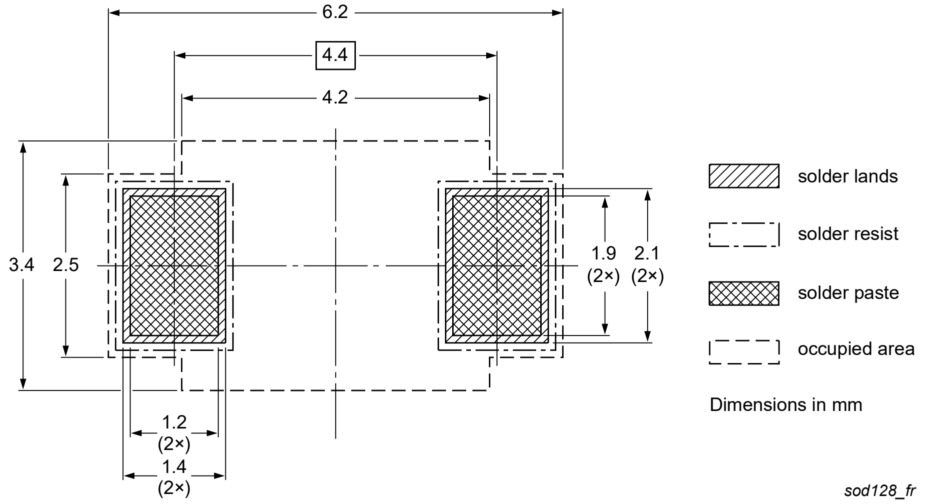

Fig. 16. Reflow soldering footprint for CFP5 (SOD128)

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Wave soldering footprint information **SOD128**

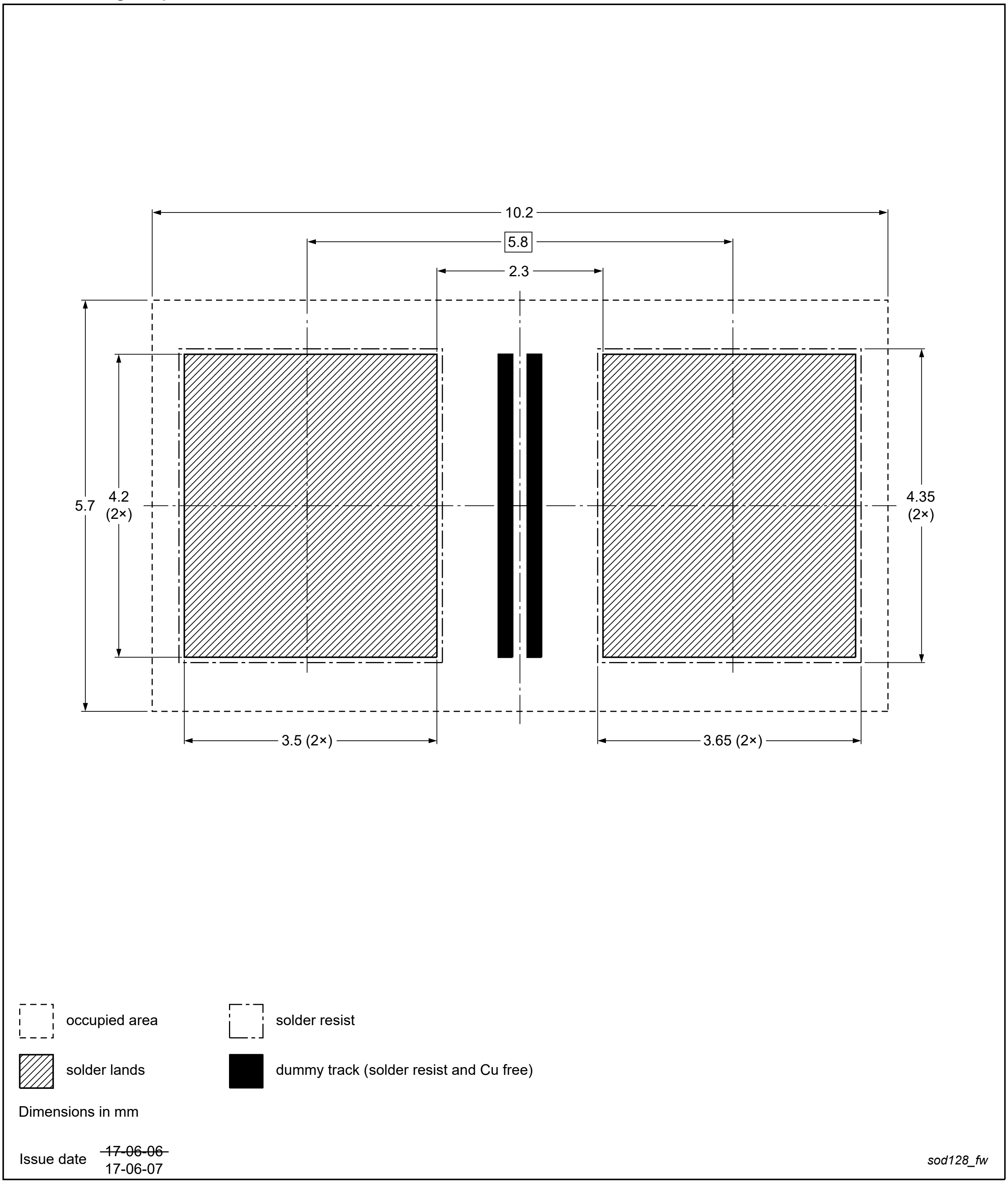

Fig. 17. Wave soldering footprint for CFP5 (SOD128)

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14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PNE20030EP v.4	20191218	Product data sheet	-	PNE20030EP v.3
Modifications:	• Preliminary version of the AEC-Q101 qualified data sheet reached Product data sheet status			
PNE20030EP v.3	20191125	Preliminary data sheet	-	PNE20030EP v.2
PNE20030EP v.2	20191120	Product data sheet	-	PNE20030EP v.1
PNE20030EP v.1	20190227	Objective data sheet	-	-

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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

1. General description..1
2. Features and benefits.. 1
3. Applications.. 1
4. Quick reference data..1
5. Pinning information..2
6. Ordering information..2
7. Marking...2
8. Limiting values... 2
9. Thermal characteristics... 3
10. Characteristics..4
11. Test information..6
12. Package outline.. 8
13. Soldering.. 8
14. Revision history..10
15. Legal information..11

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