



# PTVSxP1UTP-Q series

High-temperature 600 W Transient Voltage Suppressor

29 September 2022

Product data sheet

## 1. General description

600 W unidirectional Transient Voltage Suppressor (TVS) in a SOD128 small and flat lead Surface-Mounted Device (SMD) plastic package, designed for transient overvoltage protection in high-temperature applications.

## 2. Features and benefits

- Rated peak pulse power:  $P_{PPM} = 600 \text{ W}$
- Reverse standoff voltage range:  $V_{RWM} = 3.3 \text{ V to } 64 \text{ V}$
- Reverse current:  $I_{RM} = 0.001 \mu\text{A}$
- Very low package height: 1 mm
- High temperature stability  $T_j \leq 185 \text{ }^\circ\text{C}$
- Small plastic package suitable for surface-mounted design
- Qualified according to AEC-Q101 and recommended for use in automotive applications

## 3. Applications

- Power supply protection
- Automotive application
- Industrial application
- Power management
- High-temperature applications

## 4. Quick reference data


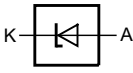
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$P_{PPM}$	rated peak pulse power		[1]	-	-	600	W
$V_{RWM}$	reverse standoff voltage	$T_j = 25 \text{ }^\circ\text{C}$		3.3	-	64	V

[1] In accordance with IEC 61643-321 (10/1000  $\mu\text{s}$  current waveform).

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode <sup>[1]</sup>	 CFP5 (SOD128)	 006aaa152
2	A	anode		

[1] The marking bar indicates the cathode.

## 6. Ordering information

Table 3. Ordering information

Type number <sup>[1]</sup>	Package		
	Name	Description	Version
PTVSxP1UTP-Q series	CFP5	plastic, surface mounted package; 2 terminals; 4 mm pitch; 3.8 mm x 2.6 mm x 1 mm body	SOD128

[1] The series consists of 35 types with reverse standoff voltages from 3.3 V to 64 V.

## 7. Marking

Table 4. Marking codes

Type number	Marking code	Type number	Marking code
PTVS3V3P1UTP-Q	C5	PTVS20VP1UTP-Q	CP
PTVS5V0P1UTP-Q	C6	PTVS22VP1UTP-Q	CR
PTVS6V0P1UTP-Q	C7	PTVS24VP1UTP-Q	CS
PTVS6V5P1UTP-Q	C8	PTVS26VP1UTP-Q	CT
PTVS7V0P1UTP-Q	C9	PTVS28VP1UTP-Q	CU
PTVS7V5P1UTP-Q	CA	PTVS30VP1UTP-Q	CV
PTVS8V0P1UTP-Q	CB	PTVS33VP1UTP-Q	CW
PTVS8V5P1UTP-Q	CC	PTVS36VP1UTP-Q	CX
PTVS9V0P1UTP-Q	CD	PTVS40VP1UTP-Q	CY
PTVS10VP1UTP-Q	CE	PTVS43VP1UTP-Q	CZ
PTVS11VP1UTP-Q	CF	PTVS45VP1UTP-Q	D1
PTVS12VP1UTP-Q	CG	PTVS48VP1UTP-Q	D2
PTVS13VP1UTP-Q	CH	PTVS51VP1UTP-Q	D3
PTVS14VP1UTP-Q	CJ	PTVS54VP1UTP-Q	D4
PTVS15VP1UTP-Q	CK	PTVS58VP1UTP-Q	D5
PTVS16VP1UTP-Q	CL	PTVS60VP1UTP-Q	D6
PTVS17VP1UTP-Q	CM	PTVS64VP1UTP-Q	D7
PTVS18VP1UTP-Q	CN	-	-

## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
$P_{PPM}$	rated peak pulse power		[1]	-	600	W
$I_{PPM}$	rated peak pulse current		[1]	-	see table 7 and 8	A
$I_{FSM}$	non-repetitive peak forward current	single half-sine wave; $t_p = 8.3$ ms		-	100	A
$T_j$	junction temperature			-	185	°C
$T_{amb}$	ambient temperature			-55	185	°C
$T_{stg}$	storage temperature			-65	185	°C
<b>ESD maximum ratings</b>						
$V_{ESD}$	electrostatic discharge voltage	IEC 61000-4-2; contact discharge	[2]	-	30	kV
		MIL-STD-883; human body model (HBM)		-	> 8	kV

[1] In accordance with IEC 61643-321 (10/1000  $\mu$ s current waveform).

[2] Device stressed with ten non-repetitive ESD pulses.

## 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]	-	-	200	K/W
			[2]	-	-	120	K/W
			[3]	-	-	60	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[4]	-	-	12	K/W

[1] Device mounted on an FR4 Printed-Circuit Board (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<sup>2</sup>.

[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

[4] Soldering point of cathode tab.

## 10. Characteristics

**Table 7. Characteristics per type; PTVS3V3P1UTP-Q to PTVS7V0P1UTP-Q**

$T_j = 25^\circ\text{C}$  unless otherwise specified.

Type number PTVSxP1UTP-Q	Reverse standoff voltage $V_{RWM}$ (V)	Breakdown voltage $V_{BR}$ (V)			Reverse leakage current $I_{RM}$ ( $\mu\text{A}$ )			Clamping voltage $V_{CL}$ (V)		Temperature coefficient $S_Z$ (mV/K)
		$I_R = 10\text{ mA}$			at $V_{RWM}$		at $V_{RWM}$ $T_j = 150^\circ\text{C}$	Max	$I_{PPM}$ (A)	$I_Z = 5\text{ mA}$
		Min	Typ	Max	Typ	Max	Typ			Typ
3V3	3.3	5.20	5.60	6.00	5	600	17	8.0	75.0	-1.0
5V0	5.0	6.40	6.70	7.00	5	400	17	9.2	65.2	2.5
6V0	6.0	6.67	7.02	7.37	5	400	17	10.3	58.3	3.2
6V5	6.5	7.22	7.60	7.98	5	250	17	11.2	53.6	3.6
7V0	7.0	7.78	8.20	8.60	3	100	9	12.0	50.0	4.3

**Table 8. Characteristics per type; PTVS7V5P1UTP-Q to PTVS64VP1UTP-Q**

$T_j = 25^\circ\text{C}$  unless otherwise specified.

Type number PTVSxP1UTP-Q	Reverse standoff voltage $V_{RWM}$ (V)	Breakdown voltage $V_{BR}$ (V)			Reverse leakage current $I_{RM}$ ( $\mu\text{A}$ )			Clamping voltage $V_{CL}$ (V)		Temperature coefficient $S_Z$ (mV/K)
		$I_R = 1\text{ mA}$			at $V_{RWM}$		at $V_{RWM}$ $T_j = 150^\circ\text{C}$	Max	$I_{PPM}$ (A)	$I_Z = 5\text{ mA}$
		Min	Typ	Max	Typ	Max	Typ			Typ
7V5	7.5	8.33	8.77	9.21	0.2	50	2.0	12.9	46.5	5.0
8V0	8.0	8.89	9.36	9.83	0.03	25	2.0	13.6	44.1	5.5
8V5	8.5	9.44	9.92	10.40	0.01	10	0.5	14.4	41.7	6.5
9V0	9.0	10.00	10.55	11.10	0.005	5	0.5	15.4	39.0	7.1
10V	10	11.10	11.70	12.30	0.005	2.5	0.5	17.0	35.3	8.1
11V	11	12.20	12.85	13.50	0.005	2.5	0.5	18.2	33.0	9.2
12V	12	13.30	14.00	14.70	0.005	2.5	0.5	19.9	30.2	10.3
13V	13	14.40	15.15	15.90	0.001	0.1	0.5	21.5	27.9	11.4
14V	14	15.60	16.40	17.20	0.001	0.1	0.5	23.2	25.9	13.2
15V	15	16.70	17.60	18.50	0.001	0.1	0.5	24.4	24.6	14.1
16V	16	17.80	18.75	19.70	0.001	0.1	0.5	26.0	23.1	15.9
17V	17	18.90	19.90	20.90	0.001	0.1	0.5	27.6	21.7	16.4
18V	18	20.00	21.00	22.10	0.001	0.1	0.5	29.2	20.5	18.5
20V	20	22.20	23.35	24.50	0.001	0.1	0.5	32.4	18.5	20.0
22V	22	24.40	25.60	26.90	0.001	0.1	0.5	35.5	16.9	23.8
24V	24	26.70	28.10	29.50	0.001	0.1	0.5	38.9	15.4	24.9
26V	26	28.90	30.40	31.90	0.001	0.1	0.5	42.1	14.3	29.1
28V	28	31.10	32.80	34.40	0.001	0.1	0.5	45.4	13.2	30.6
30V	30	33.30	35.10	36.80	0.001	0.1	0.5	48.4	12.4	34.4
33V	33	36.70	38.70	40.60	0.001	0.1	0.5	53.3	11.3	37.5
36V	36	40.00	42.10	44.20	0.001	0.1	0.5	58.1	10.3	42.3
40V	40	44.40	46.80	49.10	0.001	0.1	0.5	64.5	9.3	48.1
43V	43	47.80	50.30	52.80	0.001	0.1	0.5	69.4	8.6	51.6

High-temperature 600 W Transient Voltage Suppressor

Type number PTVSxP1UTP-Q	Reverse standoff voltage $V_{RWM}$ (V)	Breakdown voltage $V_{BR}$ (V)			Reverse leakage current $I_{RM}$ ( $\mu$ A)			Clamping voltage $V_{CL}$ (V)		Temperature coefficient $S_Z$ (mV/K)
		$I_R = 1$ mA			at $V_{RWM}$		at $V_{RWM}$ $T_j = 150$ °C	Max	$I_{PPM}$ (A)	$I_Z = 5$ mA
		Min	Typ	Max	Typ	Max	Typ			
45V	45	50.00	52.65	55.30	0.001	0.1	0.5	72.7	8.3	55.2
48V	48	53.30	56.10	58.90	0.001	0.1	0.5	77.4	7.8	58.2
51V	51	56.70	59.70	62.70	0.001	0.1	0.5	82.4	7.3	62.5
54V	54	60.00	63.15	66.30	0.001	0.1	0.5	87.1	6.9	66.1
58V	58	64.40	67.80	71.20	0.001	0.1	0.5	93.6	6.4	71.4
60V	60	66.70	70.20	73.70	0.001	0.1	0.5	96.8	6.2	74.1
64V	64	71.10	74.85	78.60	0.001	0.1	0.5	103.0	5.8	80.0

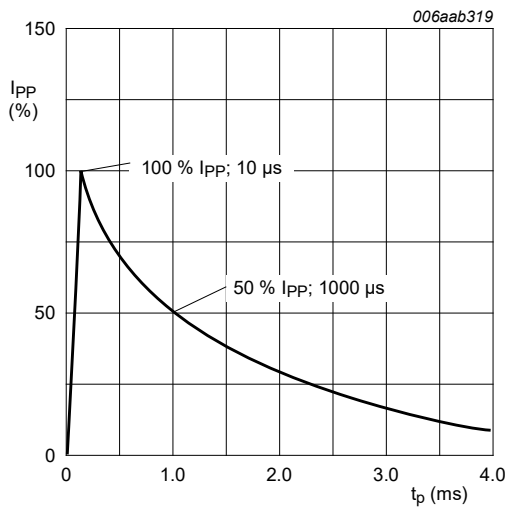


Fig. 1. 10/1000  $\mu$ s pulse waveform according to IEC 61643-321

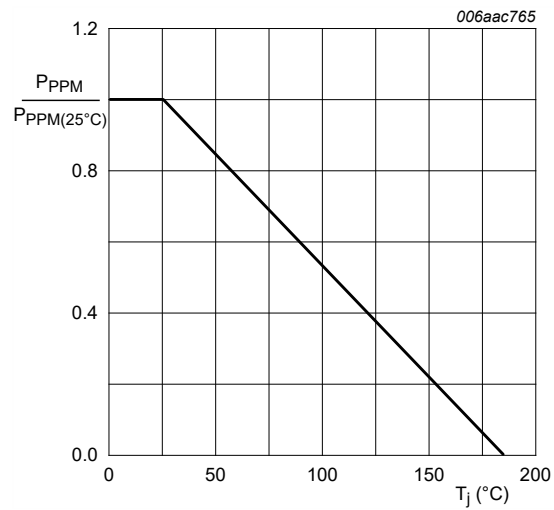
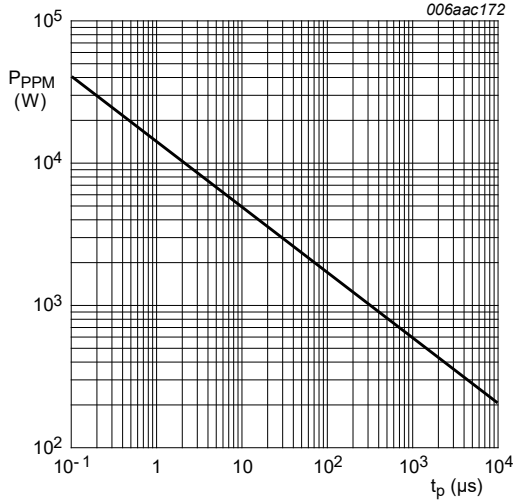
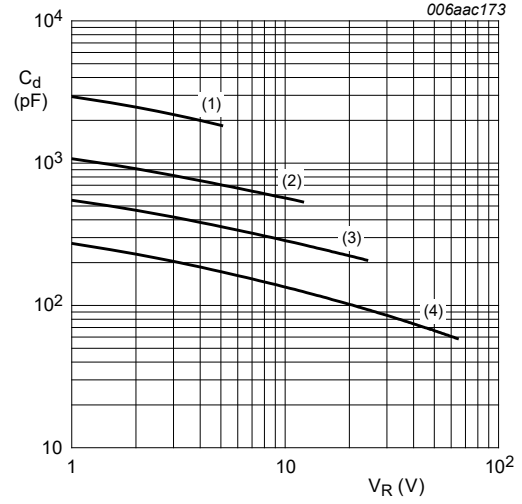


Fig. 2. Relative variation of rated peak pulse power as a function of junction temperature; typical values



$T_{amb} = 25\text{ °C}$

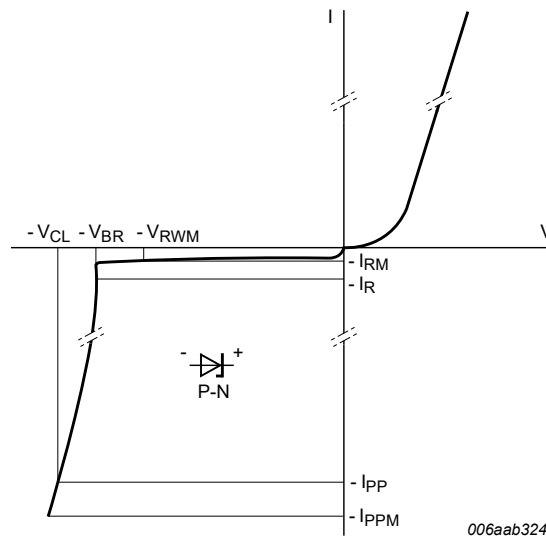
**Fig. 3. Rated peak pulse power as a function of pulse duration; typical values**



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

- (1) PTVS5V0P1UTP-Q
- (2) PTVS12VP1UTP-Q
- (3) PTVS24VP1UTP-Q
- (4) PTVS64VP1UTP-Q

**Fig. 4. Diode capacitance as a function of reverse voltage; typical values**



**Fig. 5. V-I characteristics for a unidirectional TVS protection diode**

## 11. Test information

### 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

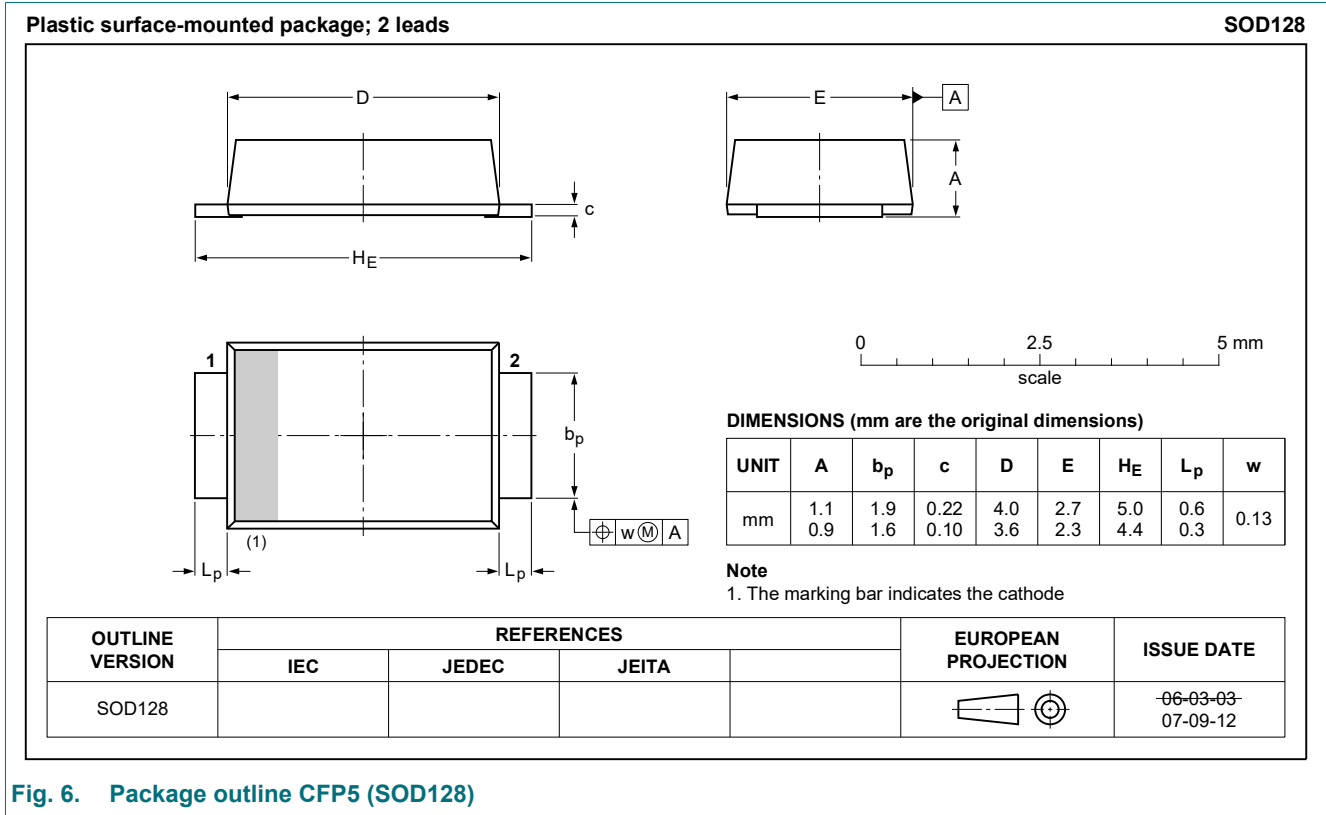


Fig. 6. Package outline CFP5 (SOD128)

## 13. Soldering

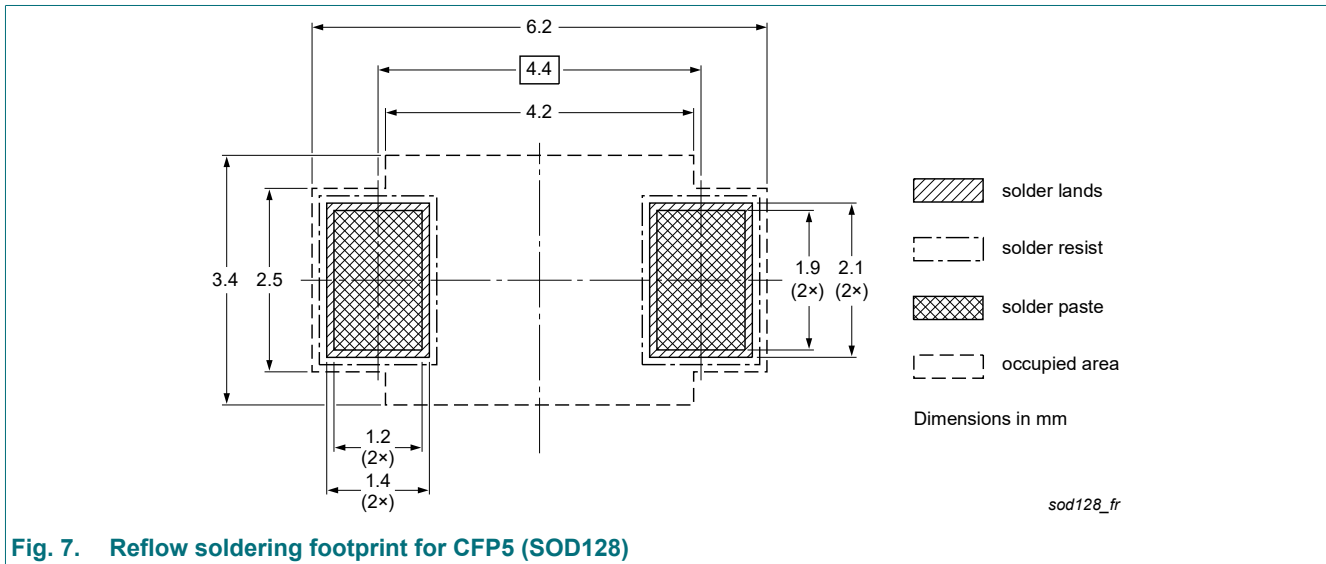
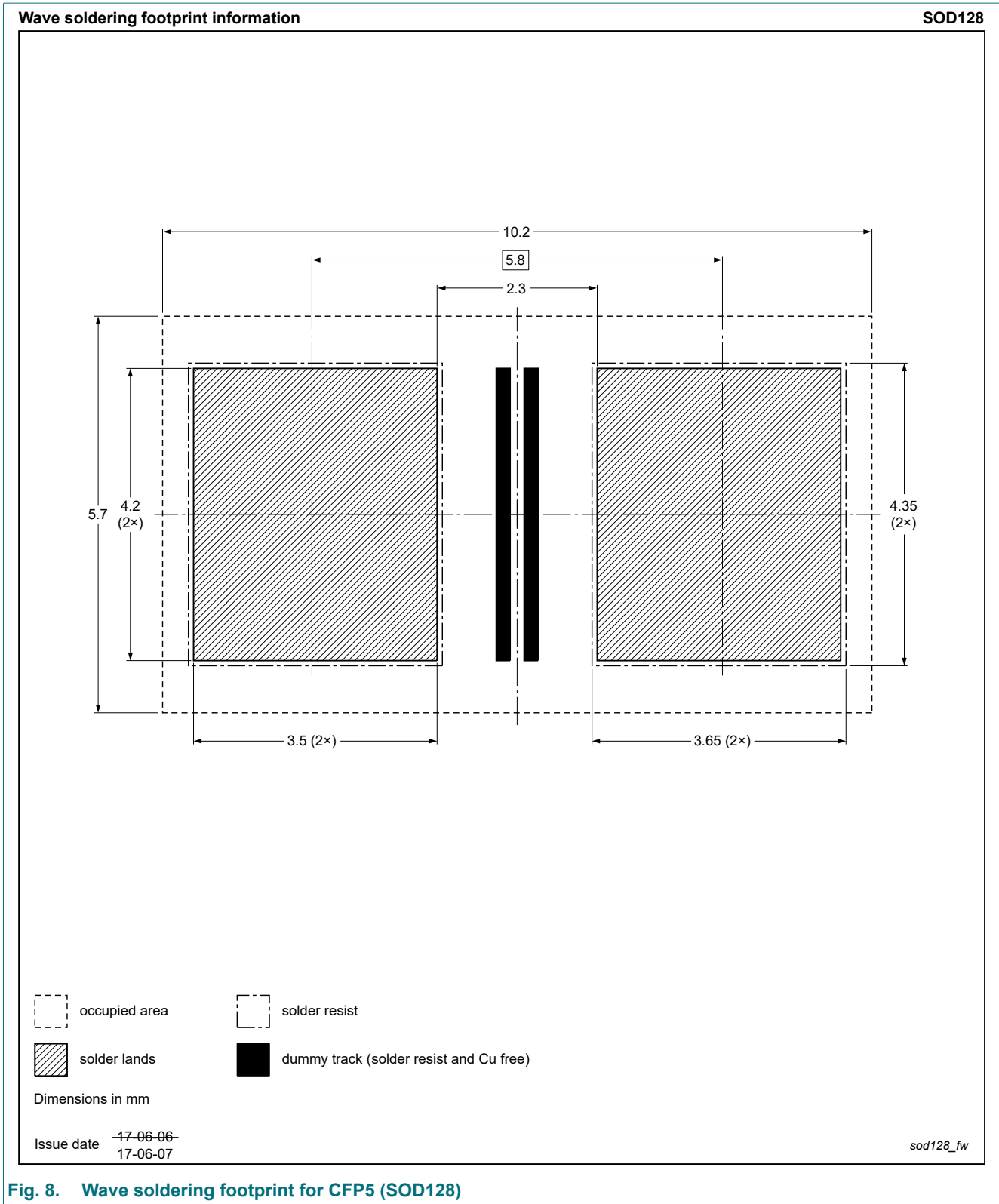


Fig. 7. Reflow soldering footprint for CFP5 (SOD128)



**Fig. 8. Wave soldering footprint for CFP5 (SOD128)**



## 14. Revision history

**Table 9. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PTVSxP1UTP-Q_SER v.1	20220929	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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- [2] The term 'short data sheet' is explained in section "Definitions".
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