

Table 1: STEVAL-USBPD45P bill of materials

Item	Q.ty	Ref	Part / Value	Description	Manufacturer	Order code
1	1	CN1	IN-CON 300V _{AC}	5.08MM VERTICAL PCB HEADERS	WURTH ELEKTRONIK	691311500102
2	2	CN3,CN4	CON5	Through Hole Header 7x1 pitch 2.54mm	AMPHENOL FCI	76341-307LF
3	1	C1	2.2nF 1kV ±10%	Ceramic X7R	MURATA	GRM31BR73A222KW01L
4	1	C2	0.033µF 305V _{AC} ±20%	Polypropylene - EMI SUPPRESSION FILM CAPACITOR	EPCOS	B32921C3333M000
5	2	C3,C4	47µF 400V ±20%	ALUMINIUM ELCAP	Nichicon	UCY2G470MHD
6	3	C5,C7,C8	470µF 25V ±20%	ALUMINIUM ELCAP	Nichicon	UPM1E471MPD1TD
7	1	C6	1µF 50V ±10%	Ceramic X7R	WURTH ELEKTRONIK	885012207103
8	1	C9	1.5nF 100V ±10%	Ceramic X7R	ANY	ANY
9	3	C10,C18,C20	100nF 50V ±10%	Ceramic X7R	WURTH ELEKTRONIK	885012207098
10	1	C11	220pF 50V ±10%	Ceramic X7R	WURTH ELEKTRONIK	885012207082
11	1	C12	1nF 50V ±10%	Ceramic X7R	WURTH ELEKTRONIK	885012207086
12	1	C13	33nF 50V ±20%	Ceramic X7R	Multicomp	MC0402F333M500CT
13	2	C14,C17	22µF 50V ±20%	ELCAP	RUBYCON	50YXF22M5X11
14	2	C15,C21	100nF 50V ±10% (not mounted)	Ceramic X7R	WURTH ELEKTRONIK	885012207098
15	1	C16	2.2nF 250V _{AC} ±20%	Ceramic E	MURATA	DE2E3KY222MN3AM02F
16	1	C19	1µF 10V ±10%	Ceramic X7R	WURTH ELEKTRONIK	885012207022
17	1	C22	470pF 50V ±5%	Ceramic C0G / NP0	Multicomp	MC0402N471J500CT
18	1	D1	2KBP06M-E4/51	BRIDGE RECTIFIER	VISHAY	2KBP06M-E4/51
19	1	D2	800V	HIGH VOLTAGE ULTRAFast RECTIFIER	ST	STTH108A
20	2	D3,D4	70V	Schottky barrier	ST	BAS70KFILM
21	1	D5	-	Small Signal Schottky Diode	ST	BAR43SFILM
22	1	D6	-	SWITCHING DIODE	VISHAY	BAV103-GS18
23	1	D7	15V ±2%	ZENER DIODE	NEXPERIA	BZV55-B15
24	1	F1	2.5A-F-250V _{AC}	FUSE SS-5F SERIES FAST ACTING	Cooper Bussmann	SS-5F-2-5A-BK
25	1	L1	47µH	DRUM FILTER CHOKE	WURTH ELEKTRONIK	7447462470
26	1	L2	2x100µH 250V _{AC} ±30%	WE-CMB NiZn Common Mode Power Line Choke	WURTH ELEKTRONIK	744841210

Item	Q.ty	Ref	Part / Value	Description	Manufacturer	Order code
27	1	Q1	75V 10A	N-CHANNELPOWER MOSFET	ST	STL40N75LF3
28	1	Q2	800V 6A	N-CHANNEL POWER MOSFET	ST	STF7N80K5
29	1	Q3	-	SMALL SIGNAL NPN TRANSISTOR	NEXPERIA	BC847C
30	1	Q9	30V 6A	N-CHANNEL POWER MOSFET	ST	STL6N3LLH6
31	4	R1,R2,R3,R4	240K 1/2W ±5%	STAND. FILM RESISTOR 200ppm/°C	ANY	ANY
32	1	R5	33 1/4W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
33	1	R6	NTC 3.9Ω ±15%	Inrush Current Limiters	MURATA	NTPAD3R9LDNB0
34	2	R7,R18,R58	100K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
35	2	R8,R20	4.7 1/8W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
36	2	R9,R60,R61	0 1/8W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
37	1	R10	360 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
38	2	R11	30K 1/8W ±1% (not mounted)	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
39	2	R12,R13	0.51 1W ±1%	FILM RESISTOR 100ppm/°C	Panasonic	ERJB2BFR51V
40	1	R14	1K 1/8W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
41	1	R15	180K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
42	2	R16,R17	12K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
43	1	R19	1K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
44	1	R21	30k 1/8W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
45	1	R22	6.8K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
46	1	R23	240K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY

Item	Q.ty	Ref	Part / Value	Description	Manufacturer	Order code
47	2	R24,R25	4.7K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
48	1	R26	8.2K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
49	1	R27	56K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
50	1	R28	18K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
51	1	R29	300K 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
52	6	R44,R45,R46,R	499 750mW ±1%	FILM RESISTOR	VISHAY	CRCW1206499RFKEAHP
53	1	TP9	VOUT	TEST POINT	Vero Technologies	20-2137
54	1	TP10	GND	TEST POINT	Vero Technologies	20-2137
55	1	TP11	TEST POINT (not mounted)	TEST POINT	Vero Technologies	20-2137
56	1	T1	45W	Switch Mode RM10 Transformer	SUMIDA	T91413
57	1	U1	-	OFF-LINE CC MODE PRIMARY-SENSING SWITCHING CONTROLLER	ST	STCH03TR
58	1	U2	-	OPTO ISOLATOR	Vishay	SFH617A-2
59	1	U3	-	Shunt Voltage Reference	ST	TS3431CILT
60	1	U4	85mA	High input voltage LDO	ST	ST715PU33R
61	1	Heat-Sink	Heat-Sink 25C/W	heat sink	FISCHER ELEKTRONIK	FK 220 SA 220
62	1	CN5	IN-CON-PLUG 300Vac	5.08mm pitch straight pluggable terminal block, plug, cable mount, 2-way	WURTH ELEKTRONIK	691351500002

Table 2: STEVAL-USBPD45I bill of materials

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
1	1	CN1	HEADER 5	Through Hole Male Header 5x1 pitch 2.54mm	WURTH ELEKTRONIK	61300511121
2	1	CN2	USB TYPE-C	Type-C	WURTH ELEKTRONIK	632723300011
3	2	CN3, CN4	P-CONN	Through Hole Male Header 7x1 pitch 2.54mm	WURTH ELEKTRONIK	61300711121

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
4	1	CN5	UART (not mounted)	Through Hole Male Header 2x1 pitch 2.54mm	WURTH ELEKTRONIK	61300211121
5	4	C2, C7, C13, C14	10nF 10V ±10%	Ceramic X7R	WURTH ELEKTRONIK	885012205012
6	3	C4, C5, C20	100nF 16V ±10%	Ceramic X7R	WURTH ELEKTRONIK	885012205037
7	1	C6	4.7µF 10V ±20%	Ceramic X5R	Murata Electronics North America	GRM155R61A475MEAAD
8	5	C8, C15, C22, C23, C24	1µF 25V ±10%	Ceramic X5R	TDK	C1005X5R1V105K050BC
9	2	C10, C11	10pF 25V ±5% (not mounted)	Ceramic C0G, NP0	WURTH ELEKTRONIK	885012005040
10	3	C17, C18, C19	220nF 25V ±10%	Ceramic X5R	TDK	C1005X5R1E224K050BC
11	1	C21	4.7µF 50V ±10% (not mounted)	Ceramic X6S	TDK	C2012X6S1H475K125AC
12	1	D1	22V	Transil	ST	ESDA25P35-1U1M
13	2	D2, D3	-	Single line low capacitance ESD protection	ST	ESDALC20-1BF4
14	2	L1, L2	470 Ω 250 mA	EMI Suppression Ferrite Bead	WURTH ELEKTRONIK	7427927141
15	3	Q1, Q2, Q3	-	P-CHANNEL POWER MOSFET 30V 6A	ST	STL6P3LLH6
16	10	R1, R2, R8, R9, R11, R17, R25, R26, R27, R28	10k 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
17	3	R10, R12, R23	2.2k 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
18	3	R13, R18, R19	4.7k 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
19	1	R15	24k 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
20	2	R16, R20	470k 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
21	1	R21	47k 1/16W ±1%	STAND. FILM RESISTOR 100ppm/°C	ANY	ANY
22	1	R22	0.01 1W ±1%	FILM RESISTOR	Panasonic	ERJ8CWFR010V

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
23	1	R24	21k 1/16W \pm 1%	STAND. FILM RESISTOR 100ppm/ $^{\circ}$ C	ANY	ANY
24	1	R29	0 N.M. 1/16W \pm 1% (not mounted)	STAND. FILM RESISTOR 100ppm/ $^{\circ}$ C	ANY	ANY
25	1	R30	0 1/16W \pm 1%	STAND. FILM RESISTOR 100ppm/ $^{\circ}$ C	ANY	ANY
26	1	SW1	RST	PushButton SPST	TE CONNECTIVITY	1437566-3
27	8	TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10	(not mounted)	TEST POINT	Vero Technologies	20-2137
28	1	U1	-	32-bit ARM Cortex M0 48 MHz	ST	STM32F051K8U7
29	1	U2	-	Rail to rail input/ output op-amps	ST	TSV991AILT
30	1	U3	-	USB type-C interface	ST	STUSB1602A
31	1	Y1	8MHz 10ppm (not mounted)	Crystal	ABRACON	ABM3B-8.000MHZ-10-1-U-T

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By using this evaluation board or kit (together with all related software, firmware, components, and documentation provided by ST, "Evaluation Board"), You ("You") are agreeing to be bound by the terms and conditions of this Evaluation Board License Agreement ("Agreement"). Do not use the Evaluation Board until You have read and agreed to this Agreement. Your use of the Evaluation Board constitutes Your acceptance of this Agreement.

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STMicroelectronics ("ST") grants You the right to use the enclosed Evaluation Board offering limited features only to evaluate and test ST products solely for Your evaluation and testing purposes in a research and development setting. The Evaluation Board shall not be, in any case, directly or indirectly assembled as a part in any production of Yours as it is solely developed to serve evaluation purposes and has no direct function and is not a finished product. If software and/or firmware is accompanied by a separate end user license agreement ("EULA"), then such software and/or firmware shall be governed by such EULA.

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RESTRICTIONS AND WARNINGS

Before You handle or use the Evaluation Board, you must carefully review any related documentation provided by ST. Such documentation may contain important warnings. You shall comply with all such warnings and other instructions and employ reasonable safety precautions in using the Evaluation Board. Failure to do so may result in death, personal injury, or property damage. If You have any questions regarding the safe usage of the Evaluation Board, You should contact ST for guidance. You may not sell, assign, sublicense, lease, rent or otherwise distribute the Evaluation Board for commercial purposes, in whole or in part, or use Evaluation Board in a production system, with the exception that if You are an authorized ST distributor, you may resell the Evaluation Board in compliance with the applicable terms and conditions. Except as provided in this Agreement or as explicitly permitted in the documentation of the Evaluation Board, You may not reproduce the Evaluation Board or modify, reverse engineer, de-compile or disassemble its software and/or firmware, in whole or in part. You shall not use the Evaluation Board in any safety critical or functional safety testing, including but not limited to testing of life supporting, military or nuclear applications. ST expressly disclaims any responsibility for such usage which shall be made at Your sole risk, even if ST has been informed in writing of such usage. Unless expressly designated in writing by ST as suitable for use in testing automotive or aerospace applications, You shall not use the Evaluation Boards in such testing. According to European Semiconductor Industry Association (ESIA) letter, "ESIA Response on WEEE Review (May 2008) of the Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE)"; Semiconductor products and evaluation and demonstration boards are not in the scope of the Directive 2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE). Consequently aforementioned products do not have to be registered nor are they subject to the subsequent obligations.

Notice applicable to Evaluation Boards not FCC-Approved

This kit is designed to allow:

1. Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and
2. Software developers to write software applications for use with the end product.

This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of 47 CFR, Chapter I ("FCC Rules"), the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

For Evaluation Boards annotated as FEDERAL COMMUNICATIONS COMMISSION (FCC) Part 15 Compliant

- **FCC Interference Statement for Class A Evaluation Boards:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction

manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

- **FCC Interference Statement for Class B Evaluation Boards:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
 - Reorient or relocate the receiving antenna.
 - Increase the separation between the equipment and receiver.
 - Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
 - Consult the dealer or an experienced radio/TV technician for help.
- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

WARRANTY

ST WARRANTS THAT IT HAS THE RIGHT TO PROVIDE THE EVALUATION BOARD TO YOU. THIS WARRANTY IS PROVIDED BY ST IN LIEU OF ALL OTHER WARRANTIES, WRITTEN OR ORAL, STATUTORY, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY AS TO MERCHANTABILITY, NON-INFRINGEMENT, FITNESS FOR ANY PARTICULAR PURPOSE, OR UNINTERRUPTED OR ERROR-FREE OPERATION, ALL OF WHICH ARE EXPRESSLY DISCLAIMED. THE EVALUATION BOARD IS PROVIDED "AS IS".

YOU WARRANT TO ST THAT YOU WILL ENSURE THE EVALUATION BOARD IS USED ONLY BY ELECTRONICS EXPERTS WHO UNDERSTAND THE DANGERS OF HANDLING AND USING SUCH ITEMS, YOU ASSUME ALL RESPONSIBILITY AND LIABILITY FOR ANY IMPROPER OR UNSAFE HANDLING OR USE OF THE EVALUATION BOARD BY YOU, YOUR EMPLOYEES, AFFILIATES, CONTRACTORS, AND DESIGNEES.

LIMITATION OF LIABILITIES

IN NO EVENT SHALL ST BE LIABLE TO YOU, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, OR ANY OTHER LEGAL THEORY, FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, INCIDENTAL, PUNITIVE, OR EXEMPLARY DAMAGES WITH RESPECT TO ANY MATTERS RELATING TO THIS AGREEMENT, REGARDLESS OF WHETHER ST HAS BEEN ADVISED OF THE POSSIBILITY OF THE SAME. IN NO EVENT SHALL ST'S LIABILITY ARISING OUT OF THIS AGREEMENT IN THE AGGREGATE EXCEED THE AMOUNT PAID BY YOU UNDER THIS AGREEMENT FOR THE PURCHASE OF THE EVALUATION BOARD, OR TEN UNITED STATES DOLLARS (\$10.00) IF NO PURCHASE PRICE WAS PAID.

INDEMNIFICATION

You shall, at Your expense, defend ST and its Affiliates against a claim or action brought by a third party for infringement or misappropriation of any patent, copyright, trade secret or other intellectual property right of a third party to the extent resulting from (1) Your combination of the Evaluation Board with any other component, system, software, or firmware, (2) Your modification of the Evaluation Board, or (3) Your use of the Evaluation Board in a manner not permitted under this Agreement. You shall indemnify ST and its Affiliates against and pay any resulting costs and damages finally awarded against ST or its Affiliates or agreed to in any settlement, provided that You have sole control of the defense and settlement of the claim or action, and ST cooperates in the defense and furnishes all related evidence under its control at Your expense. ST will be entitled to participate in the defense of such claim or action and to employ counsel at its own expense.

"Affiliates" means any corporation or other entity directly or indirectly controlled by, controlling or under common control with the entity in question, for so long as such ownership exists. "Control" means the direct or indirect beneficial ownership of more than fifty (50%) percent of the stock or other equity interests entitled to vote for the election of directors or an equivalent governing body. Any such corporation or other legal entity shall be deemed to be an Affiliate of such Party only as long as such Control exists.

TERMINATION

ST may terminate this Agreement without notice if You breach this Agreement. Upon termination, You shall immediately destroy or return all copies of the software, firmware, and documentation of the Evaluation Board to ST and certify in writing to ST that You have done so.

APPLICABLE LAW AND JURISDICTION

This Agreement shall be governed, construed and enforced in accordance with the laws of Switzerland, without regard to its conflict of laws rules. The UN Convention on Contracts for the International Sale of Goods shall not apply to this Agreement. In case of dispute and in the absence of an amicable settlement, the only competent jurisdiction shall be the Courts of Geneva, Switzerland. Any breach of this Agreement by You may result in irreparable damage to ST for which ST will not have an adequate remedy at law. Accordingly, in addition to any other remedies and damages available, You acknowledge and agree that ST may immediately seek enforcement of this Agreement in any jurisdiction by means of specific performance or injunction, without any requirement to post a bond or other security.

SEVERABILITY

If any provision of this agreement is or becomes, at any time or for any reason, unenforceable or invalid, no other provision of this agreement shall be affected thereby, and the remaining provisions of this agreement shall continue with the same force and effect as if such unenforceable or invalid provisions had not been inserted in this Agreement. In addition, any unenforceable or invalid provision shall be deemed replaced by a provision that is valid and enforceable and that comes closest to expressing the intention of the unenforceable or invalid provision.

WAIVER

The waiver by either party of any breach of any provision of this Agreement shall not operate or be construed as a waiver of any other or a subsequent breach of the same or a different provision.

RELATIONSHIP OF THE PARTIES

Nothing in this Agreement shall create, or be deemed to create, any joint venture, partnership, principal-agent, employer-employee or other relationship between the Parties, except that of independent contractors. Neither Party has the authority or power to bind, to contract in the name of, or to create a liability for the other in any way or for any purpose.

SURVIVAL

Any provision of this Agreement which imposes an obligation after termination of this Agreement shall survive the termination of this Agreement.

SECTION HEADINGS

Section headings are inserted for convenience only and shall not be used to interpret this Agreement.

RECYCLING

The Evaluation Board is not to be disposed as an urban waste. At the end of its life cycle, differentiated waste collection must be followed, as stated in the directive 2002/96/EC. In all the countries belonging to the European Union (EU Dir. 2002/96/EC) and those following differentiated recycling, the Evaluation Board is subject to differentiated recycling at the end of its life cycle, therefore: It is forbidden to dispose the Evaluation Board as an undifferentiated waste or with other domestic wastes. Consult the local authorities for more information on the proper disposal channels. It is mandatory to sort the Evaluation Board and deliver it to the appropriate collection centers, or, when possible, return the Evaluation Board to the seller. An incorrect Evaluation Board disposal may cause damage to the environment and is punishable by the law.