

**Bill of materials**
**Table 1. BOM**

Item	Qty	Ref.	Part / Value	Description	Manufacturer	Order code
1	5	B+1 B-1 OUT_U1 OUT_V1 OUT_W1	CON1	.375" VENTED PIN FOR PLATED THRO		5459-0-00-15-00-00-03-0
2	3	C1 C4 C7	82nF	CAPACITOR CERAMIC SMD 0201		GRM033R61C823KE84D
3	3	C2 C6 C12	1nF	CAPACITOR CERAMIC SMD 0201	Würth Elektronik	885012204006
4	4	C3 C8 C10 C13	2.2nF	CAPACITOR CERAMIC SMD 0201	Würth Elektronik	885012205008
5	2	C5 C9	20p	CAPACITOR CERAMIC SMD 0201		CBR02C200F5GAC
6	7	C11 C15 C16 C17 C18 C22 C19	100nF	CAPACITOR CERAMIC SMD 0201	Würth Elektronik	885012104002
7	2	C14 C21	1uF	CAPACITOR CERAMIC SMD 0201	Würth Elektronik	885012105012
8	1	C20	10uF	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012105022
9	3	C23 C24 C25	2n2	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012205008
10	1	C26	100nF	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012205018
11	3	C27 C34 C39	220nF	CAPACITOR CERAMIC SMD 0805	Würth Elektronik	885012207100
12	1	C28	100uF	Cap Alu Electrolytic SMD; 8 mm D X 10.00 mm H body	Würth Elektronik	865060653010
13	1	C29	4.7uF	CAPACITOR CERAMIC SMD 0805	Würth Elektronik	885012207053
14	1	C30	100nF	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012205037
15	5	C40 C41 C43 C58 C60	100nF	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012105001
16	2	C31,C50	100nF	CAPACITOR CERAMIC SMD 0603	Würth Elektronik	885012206095
17	6	C32 C33 C35 C36 C54 C56	1uF	CAPACITOR CERAMIC SMD 0805	Würth Elektronik	885012207103
18	3	C37 C44 C53	NM	CAPACITOR CERAMIC SMD 0402		DESIGNATOR C37,C44,C53
19	1	C38	1nF	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012205044
20	1	C42	3.3nF	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012205009
21	1	C45	10pF	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012005007

Item	Qty	Ref.	Part / Value	Description	Manufacturer	Order code
22	2	C46 C49	10uF/50V	CAPACITOR CERAMIC SMD 1206	Würth Elektronik	885012108022
23	1	C47	1uF/50V	CAPACITOR CERAMIC SMD 0805	Würth Elektronik	885012207103
24	1	C48	22uF	CAPACITOR CERAMIC SMD 1210	Würth Elektronik	885012209006
25	1	C51	1uF	CAPACITOR CERAMIC SMD 0603	Würth Elektronik	885012206026
26	1	C52	10nF	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012205012
27	2	C55 C57	100nF	CAPACITOR CERAMIC SMD 0805	Würth Elektronik	885012207016
28	1	C59	4.7nF	CAPACITOR CERAMIC SMD 0402	Würth Elektronik	885012205010
29	9	D1 D2 D3 D6 D7 D8 D16 D18 D19	ESDALC6V1-1U2	TVS DIODE 3VWM ST0201	ST	<a href="#">ESDALC6V1-1U2</a>
30	1	D4	LED RED	DIO, Rectangle with Flat Top, 1.00mm x 0.50mm, LED YELLOW-GREEN, 20mA, --, --, 0402 (1005 Metric)	Würth Elektronik	150040RS73240
31	1	D5	LED GREEN	DIO, Rectangle with Flat Top, 1.00mm x 0.50mm, LED YELLOW-GREEN, 20mA, --, --, 0402 (1005 Metric)	Würth Elektronik	150040VS73240
32	6	D9 D10 D11 D12 D13 D14	BAT54K	DIODE SCHOTTKY 40V 300MA SOD523	ST	<a href="#">BAT54KFILM</a>
33	1	D15	BZV55-B15,115	DIODE ZENER 15V 500MW SOD80C		BZV55-B15,115
34	1	D17	BAT30F4	DIODE SCHOTTKY 30V 300MA 0201	ST	<a href="#">BAT30F4</a>
35	2	F1 F2	250mA	FUSE BOARD MNT 250MA 32VDC 0402		0435.250KRS
36	6	FIDUCIAL1T1 FIDUCIAL2T1 FIDUCIAL3T1 FIDUCIAL4B1 FIDUCIAL5B1 FIDUCIAL6B1	Fiducial	Fiducial circle 0.3mm - 1.00mm - 1.50mm - square 1.00mm		FIDUCIAL
37	1	J1	FTSH_WR-BHD_1.27mm_Box Header	WR-BHD Male THT Box Header Straight	Würth Elektronik	62701421621
38	2	J2,J12	HALL_SENSOR	CONN HEADER .100 STR 5POS	Würth Elektronik	61300511121
39	4	J3 J4 J5 J6	EN	CONN HEADER .100 STR 1POS	Würth Elektronik	61300111121
40	4	J7 J8 J10 J11	0 ohm	Thick Film Resistors - SMD 0 Ohms 125 mW 0805 1%		RC0805FR-070RL
41	1	J9	GRPB021VWVN-RC	CONN HEADER .050" 2POS PCB GOLD		GRPB021VWVN-RC
42	10	JP1 JP2 JP3 JP4 JP5 JP6 JP7 JP8 JP9 JP10	NET_TIE	2 PIN SHORTED TO CONNECT DIFFERENT NETS		RC0201FR-070RL
43	1	L1	BEAD	INDUCTOR SMD 0402	Würth Elektronik	74279271

Item	Qty	Ref.	Part / Value	Description	Manufacturer	Order code
44	1	L2	33uH	Fixed Inductors 33uH Shld 10% 4.8A 103mOhms	Wurth Elektronik	74437368330
45	1	NTC1	10k	CHIP RESISTOR SMD 1% 1/8W 0805		TX08F103F3435ER
46	6	Q1 Q2 Q3 Q4 Q5 Q6	STL220N6F7	N-channel 60 V, 1.9 mO typ., 120 A STripFET™ F7	ST	STL180N6F7
47	1	Q7	SI2325DS-T1-E3	MOSFET P-CH 150V 0.53A SOT23-3		BSS84AHZGT116
48	1	Q8	BSS123L	MOSFET N-CH 100V 0.17A SOT-23		BSS123LT1G
49	12	R1 R7 R9 R10 R12 R18 R19 R20 R23 R28 R29 R31	30k	RES SMD 0.1% 1/20W 0201		RC0201FR-0730KL
50	6	R2 R8 R13 R40 R43 R45	27k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-0727KL
51	6	R3 R6 R14 R17 R24 R26	1k	RES SMD 0.1% 1/20W 0201		RC0201FR-071KL
52	3	R4 R11 R15	3.9k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-073K9L
53	6	R5 R16 R21 R25 R27 R30	220	RES SMD 1% 1/20W 0201		RC0201FR-07220RL
54	1	R22	10k			CR0805-FX-1002ELF
55	2	R32 R33	2k2			CR0805-FX-2201ELF
56	1	R34	2k2	RES SMD 1 OHM 5% 1/8W 0805		ERJ-6GEYJ1R0V
57	3	R35 R36 R37	100R			CR0805-FX-1000ELF
58	1	R38	51R			CR0805-FX-51R0ELF
59	6	R39 R44 R48 R51 R56 R61	22R	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-0722RL
60	6	R41 R46 R49 R54 R59 R63	4R7	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-074R7L
61	8	R42 R47 R50 R53 R55 R60 R64 R78	22k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-0722KL
62	1	R52	39k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-0739KL
63	2	R57 R79	10k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-0710KL
64	1	R58	NM	CHIP RESISTOR SMD 1% 1/16W 0402		DESIGNATOR R58
65	1	R62	1k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-071KL
66	2	R65 R68	1.5k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-071K5L
67	5	R66 R70 R87 R91 R92	100R	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-07100RL
68	3	R67 R89 R90	3mOhm-3W			CRE2512-FZ-R003E-3
69	2	R69 R71	6.8k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-076K8L
70	3	R72 R81 R86	33k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-0733KL

Item	Qty	Ref.	Part / Value	Description	Manufacturer	Order code
71	1	R73	10M	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-0710ML
72	1	R74	82.5K	CHIP RESISTOR SMD 1% 1/16W 0402		CR0402-FX-8252GLF
73	1	R75	402K	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-07402KL
74	1	R76	27k	CHIP RESISTOR SMD 1% 1/10W 0603		CR0603-FX-2702ELF
75	1	R77	121K	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-07121KL
76	1	R80	3.9k	CHIP RESISTOR SMD 1% 1/10W 0603		CR0603-FX-3901ELF
77	1	R82	470k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-07470KL
78	1	R83	4.7k	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-074K7L
79	2	R84 R85	75R	CHIP RESISTOR SMD 1% 1/16W 0402		RC0402FR-0775RL
80	1	R88	2.2k	CHIP RESISTOR SMD 1% 1/16W 0402		CR0402-FX-2201GLF
81	1	TP1	PA4	TEST POINT 1MM SMD PADSTASCK		DESIGNATOR TP1
82	1	TP2	PB10	TEST POINT 1MM SMD PADSTASCK		DESIGNATOR TP2
83	1	U1	STM32G431RBT6, LQFP 64 10x10x1.4 mm	Arm® Cortex®-M4 32b MCU+FPU, 512KB Flash, 150 MHz, 128KB SRAM	ST	<a href="#">STM32G431RBT6</a>
84	1	U2	STDRIVE101, QFN-24L	STDRIVE101 - Three-phase gate driver	ST	<a href="#">STDRIVE101</a>
85	1	U3	TSV911AILT, SOT23-5	IC OPAMP GP 1 CIRCUIT SOT23-5	ST	<a href="#">TSV911AILT</a>
86	1	U4	TS861, SOT23-5L	IC COMPARATOR SGL LP SOT-23-5	ST	<a href="#">TS391RILT</a>
87	1	U5	L6981NDR, SO-8	38 V, 1.5 A SYNCHRONOUS STEP-DOWN	ST	<a href="#">L6981NDR</a>
88	1	U6	LDL112PV33R, DFN6 3x3	IC REG LINEAR 3.3V 1A 6DFN	ST	<a href="#">LD39100PU33R</a>
89	1	Y1	8MHz	CRYSTAL 8MHZ 18PF SMD		ABM8AIG-8.000MHZ-1Z-T

## Evaluation board license agreement

**Important:** All information on this document is subject to this Evaluation Board License Agreement.

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.

### LICENSE

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.

### EVALUATION BOARD STATUS

The Evaluation Board offers limited features allowing You only to evaluate and test the ST products. The Evaluation Board is not intended for consumer or household use. You are not authorized to use the Evaluation Board in any production system, and it may not be offered for sale or lease, or sold, leased or otherwise distributed for commercial purposes. If the Evaluation Board is incorporated in an evaluation system, the evaluation system may be used by You solely for Your evaluation and testing purposes. Such evaluation system may not be offered for sale or lease or sold, leased or otherwise distributed for commercial purposes and must be accompanied by a conspicuous notice as follows: "This device is not, and may not be, offered for sale or lease, or sold or leased or otherwise distributed for commercial purposes".

### OWNERSHIP AND COPYRIGHT

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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 Board in such testing.

### Notice applicable to Evaluation Boards according to European Regulation

For the European Regulation of the Evaluation Board, the applicable EU directives are considered, with a particular attention to the Low Voltage Directive (LVD) 2014/35/EU, the Electromagnetic Compatibility (EMC) Directive 2014/30/EU, and the Radio Equipment Directive (RED) 2014/53/EU. If the Evaluation Board is outside the scope of the foregoing Directives, then the General Product Safety Directive (GPSD) 2001/95/EC and Council Directive 93/68/EEC, amending Directive 73/23/EEC on electrical equipment designed for use within certain voltage limits, are applicable.

The Evaluation Board meets the requirements of the Restriction of Hazardous Substances (RoHS 2 or RoHS recast) Directive 2011/65/EU, Annex II, as amended by Directive 2015/863/EU.

### 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.

**WASTE AND RECYCLING**

**The Evaluation Board is not to be disposed of as urban waste. At the end of its life cycle, differentiated waste collection must be followed.** Consult the local authorities for more information on the proper disposal channels. It is mandatory to separately collect the Evaluation Board and make sure it is delivered it to the appropriate waste management and recycling centers.

As of 15 August 2018, in all the countries belonging to the European Union, the Evaluation Board is subject to the WEEE Directive 2012/19/EU requirement; therefore, it is forbidden to dispose of the Evaluation Board as undifferentiated waste or with other domestic wastes. Consult the local authorities for more information on the proper recycling centers.

Disposing of the Evaluation Board incorrectly may cause damage to the environment and may be subject to fines based on specific countries' rules.



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