

Data brief

STSPIN32G4 demonstration board for three-phase brushless motors



Features

- Input bus voltage from 10 V to 75 V with dedicated monitoring
- Power stage based on the STL110N10F7 power MOSFETs with output current up to 20 Arms (with heatsink mounted) and protected to overcurrent conditions
- STSPIN32G4, high performance three-phase motor controller with embedded STM32G431 MCU:
 - 32-bit ARM[®] Cortex[®]-M4 MCU+FPU
 - Up to 170 MHz clock frequency
 - CORDIC mathematical hardware accelerator for trigonometric functions
 - 128 kB Flash memory with proprietary code readout protection (PCROP), securable memory area, 1 kB OTP
 - 32 kB SRAM memory with HW parity check
 - 2 x advanced timers for motor control, 16-bit with up to 6 x PWM channels
 - 8 x general purpose timers
 - 2 x ADCs 12-bit resolution (up to 19 channels) with 4 Msps conversion rate
 - 4 x 12-bit DAC channels
 - 4 x ultra-fast rail-to-rail comparators
 - 3 x rail-to-rail operational amplifiers usable also in PGA mode
 - Internal high precision voltage reference
 - Up to 40 GPIOs
 - Full set of interfaces: I2C, SPI, UART and CAN
 - VCC buck converter up to 200 mA, with programmable output and embedded MOSFET
 - 3.3 V LDO linear regulator up to 150 mA
 - Low quiescent linear regulator for MCU supply in standby mode
 - Regulators with full set of protection features; thermal shutdown, shortcircuit and overload protections
 - 75 V rated gate drivers with 1 A sink/source current and embedded bootstrap diodes
 - Drain-source voltage sensing of each power MOSFET
- Three-shunt or single-shunt configurable current sensing
- · Digital Hall sensor and quadrature encored input
- ST-LINK/V2 programmer and debugger
- · Arduino UNO connector
- Predisposition for CAN bus
- · NTC sensor for power stage temperature monitoring

Application

- · Industrial and home automation
- Home appliances such as vacuum cleaners, dryers and cleaning robots
- · Servo drives and e-bikes
- · Service and automation robots

Product status link EVSPIN32G4 EVSPIN32G4NH STSPIN32G4



- Power and garden tools
- Pumps and fans
- · Drones and aeromodelling

Description

The EVSPIN32G4 is a demonstration board based on the STSPIN32G4 system in package and STL110N10F7 power MOSFETs. The STSPIN32G4 integrates in a 9x9 mm VFQFPN package, a triple high-performance half-bridge gate driver with a rich set of programmable features and one mixed signal STM32G431 microcontroller.

The integrated operational amplifiers for current sensing, the drain-source voltage sensing of each power MOSFET and comparators for overcurrent protection make it a fully integrated solution for motor control.

Thanks to the integrated voltage regulators both the gate driver and control logic supplies can be generated starting from the motor supply without dedicated circuitry.

The board ensures a full evaluation of the STSPIN32G4 and is designed for driving three-phase brushless DC motors and provides an easy-to-use solution for STSPIN32G4 evaluation in different applications such as power tools, e-Bikes, fans, and home appliances.

The board can be configured in three-shunt or single-shunt supporting both sensor-less and sensor-based control algorithms.

The Arduino connector enables the EVSPIN32G4 to be interfaced with expansion boards, such as MEMS sensors or Bluetooth transceivers, while predisposition for CAN bus allows interconnection with master or slave modules to build complex motion control systems.

The on-board ST-LINK/V2 programmer speeds up and simplifies the debugging of microcontroller firmware.

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1 Specifications

Table 1. EVSPIN32G4 specifications

Parameter		Value
Supply voltage	Nominal	From 10 V to 75 V
Maximum autout aureant with heatainly (EVSDIN22C4)	Peak	35 A
Maximum output current with heatsink (EVSPIN32G4)	Continuous ⁽¹⁾	20 Arms
Marie and the state of the stat	Peak	25 A
Maximum output current without heatsink (EVSPIN32G4NH)	Continuous ⁽¹⁾	15 Arms

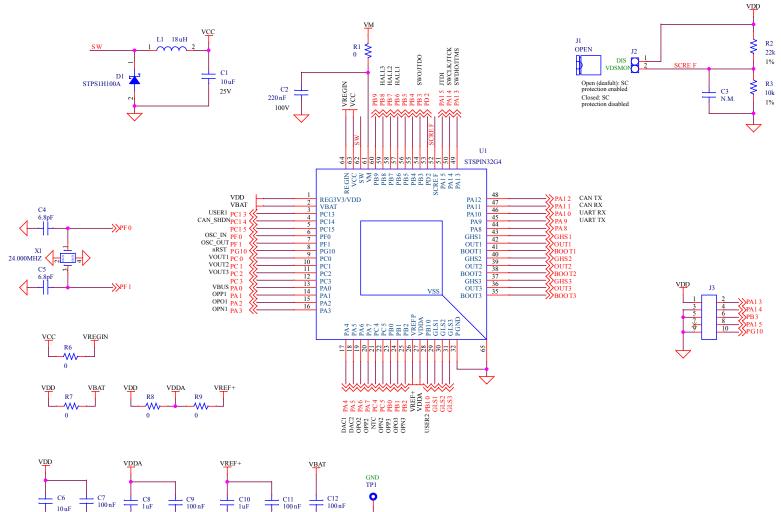
^{1.} Maximum current at ambient temperature of 25°C. Actual maximum current could be limited by power dissipation.

Ratings of the board can be found in Table 1. The EVSPIN32G4NH is the board version without heatsink. The schematic of the EVSPIN32G4 evaluation board (from Figure 1 to Figure 6) and bill of material (Table 2) are reported below.

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Figure 1. EVSPIN32G4 schematic (1 of 6): STSPIN32G4



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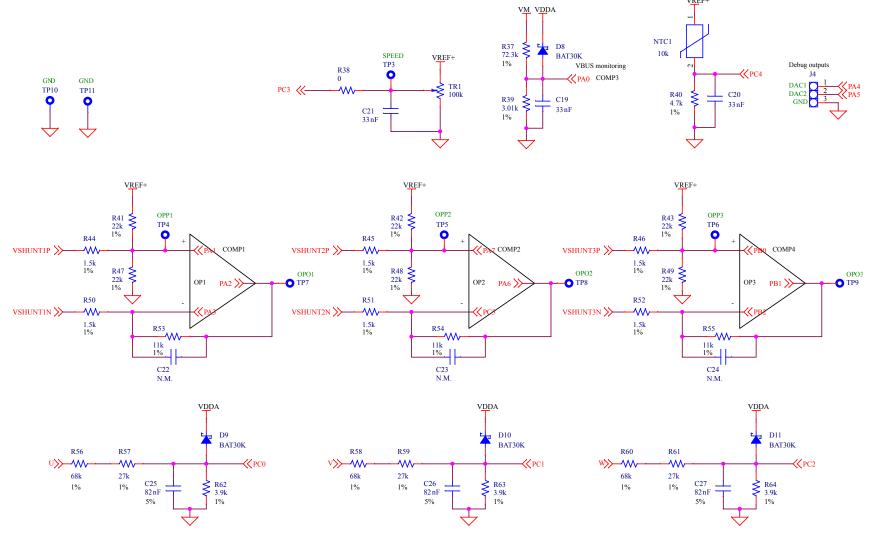


VM VMVM220 nF 100V 220 nF 100V 220 nF 100V C13 C14 C15 D2 BAT48 R10 D3 BAT48 R11 D4 BAT48 R12 0 R13 R14 R15 Figure 2. EVSPIN32G4 schematic (2 of 6): Power stage STL110N10F 7 GHS1 >> GHS2 >> GHS3 >> STL110N10F STL110N10F 33 33 33 R17 N.M. Q2 R16 N.M. Q1 R18 N.M. Q3 BOOT2>>> воотз >>> BOOT1 >>> C16 1uF C17 1uF 25V C18 1uF 25V 25V R19 R21 R20 OUT1 >> **->>**∪ OUT2 >>> **-**>>>∨ OUT3 >>> **->>**w 0 0 0 D5 BAT48 R22 D6 BAT48 R23 D7 BAT48 R24 0 R25 R26 R27 STL110N10F 7 STL110N10F STL110N10F GLS2 GLS3 33 33 33 R28 N.M. R29 N.M. Q5 Q4 R30 N.M. ⋛ JP2 JP1 VSHUNT2P << VSHUNTIP << OPEN OPEN VSHUNT3P << GND R31 10m 1% 3W R33 10m 1% 3W R32 10m 1% 3W R34 10m 1% 3W R35 10m 1% 3W R36 10m 1% 3W TP2 O VSHUNT2N < VSHUNT3N <<< 1 → 1 VSHUNTIN <

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Figure 3. EVSPIN32G4 schematic (3 of 6): Sensing



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Figure 4. EVSPIN32G4 schematic (4 of 6): Arduino connector

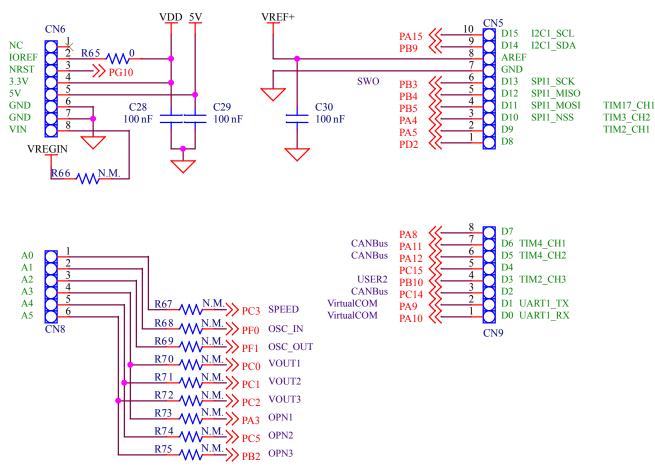
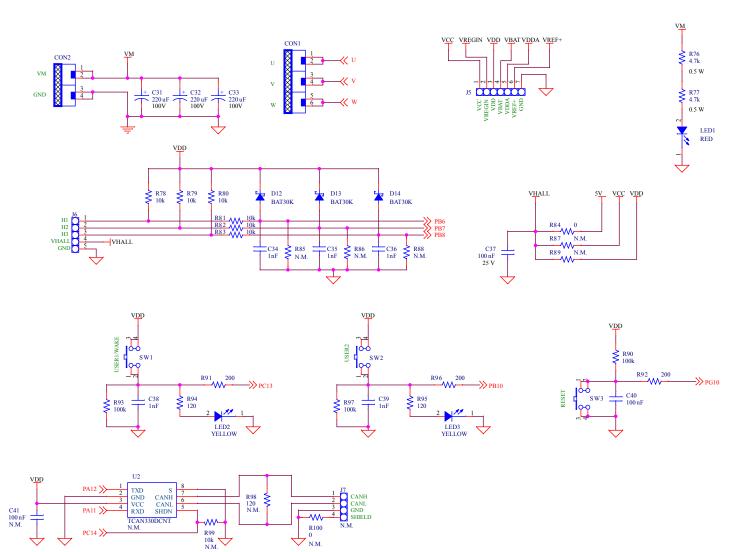




Figure 5. EVSPIN32G4 schematic (5 of 6): Inputs and outputs



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VUSB 5V 3V3_STLINK 3V3_STLINK ₹ R101 10k VUSB U3 _ C42 R102 100 nF USB_RENUM Q7 BC847B VIN OUT C43 100 nF C43 J8 U4 100 INHIBIT C44 C45 _ C46 USB DM 1uF 100 nF 1 VCQ 2 D-3 D+ 4 ID 5 GND I/O1#1 I/O1#6 ₹ R103 36k BYPASS GND 1uF ____ C47 LD3985M33R GND VBUS 10nF R104 Figure 6. EVSPIN32G4 schematic (6 of 6): ST-LINK/V2 USB_DP I/O2#3 I/O2#4 \leftarrow SH1 SH2 SH3 1.5k USBLC6-2SC6 SHIELD SHIELD SHIELD 3V3_STLINK Micro USB Type B R105 STM32F103CBT6 U5 1% STLINK_NRST ₹ R110 2.7k PA0- WKUP PB0 PB1 STLINK_UART_TX 12 PA0-19 20 × ₹ R106 4.7k PB2/BOOT1 PB3/JTDO PB4/JNTRST PA3 X 14 X 15 X 16 X 17 PA6 X 17 PA7 40 × 41 × 42 × 43 × 1% ₹ R107 4.7k PB5 R108 N.M. PB6 VDD PB7 STLINK_LED 30 PA8 PA9 R109 STLINK_UART_TX PA10 🖔 46 × 21 × 22 × STLINK SWDIO 26 STLINK SWCLK 27 SWDIO \triangle | STLINK LED | 30 | STLINK SWO 31 | PA9 | WISS DW | 32 | PA10 | WISS DW | 33 | PA11 | PA12 | PA12 | PA13 | PA14 | PA13 | PA14 | PA15 | PA15 | PA15 | PA15 | PA16 | PA16 | PA17 | PB9 STLINK_UART_RX PA9 PB10 PB11 PB12 PB13 PB14 PB15 R112 STLINK_SWCLK PA14 << R114 R113 C48 100pF STLINK_SWDIO 28 × PA13 🖔 PA15 STLINK_SWO 2 R11 6 10k 3 10k N.M. PB3 < NX3225CD-CR YSTAL PC13-TAMPER-RTC PC14-OSC32 IN OSCIN/PD0 OSCOUT/PD1 R118 STLINK_NRST PC15-OSC32 OUT PG10 << R119 100k C49 100pF BOOT0 F103 NRST 3V3_STLINK VBAT 24 VDD 1 36 VDD 2 VDD 2 VDD 3 VSS_1 VSS_2 VSS_3 35 ₹ R120 100k 3V3_STLINK 47 J9 3V3_STLINK 2 F103_S WDIO 4 F103 S WCLK LED4 VDDA VSSA R12 1 100 R122 C50 3V3_STLINK 10 F103_NRST 100 nF 100 STLINK_LED C53 C54 C51 C52 RED-GREEN LED 100 nF 100 nF 100 nF 100 nF

VUSB

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Table 2. EVSPIN32G4 bill of materials

2 2 CN6, CN9 Sil socket straight 8 pos. 2.54 mm Strip-P2_54-8P-female 3 1 CN8 Sil socket straight 6 pos. 2.54 mm Strip-P2_54-8P-female 4 1 CON1	Item	Q.ty	Reference	Description	Value
Strip-P2_54-6P-female	1	1	CN5	Sil socket straight 10 pos, 2.54 mm	Strip-P2_54-10P-female
4 1 CON1 5.0 mm horizontal entry screwless connector 2834082-2-TE 5 1 CON2 5.0 mm horizontal entry screwless connector 2834082-1-TE 6 1 CON2 5.0 mm horizontal entry screwless connector 2834082-1-TE 6 1 C1 SMT ceramic capacitor 0805 10 uF, 25 V, 10% 7 4 C2, C13, C14, C15 SMT ceramic capacitor 0805 220 nF, 100 V, 10% 8 4 C3, C22, C23, C24 SMT ceramic capacitor 0603 N.M. 9 2 C4, C5 SMT ceramic capacitor 0402 6.8 pF, 6.3 V, 0.25 pF 10 1 C6 SMT ceramic capacitor 0805 10 uF, 6.3 V, 10% 11 16 C7, C9, C11, C12, C28, C29, C30, C40, C42, C43, C45, C59, C51, C52, C53, C54, C55, C55, C55, C55, C55, C55, C55	2	2	CN6, CN9	Sil socket straight 8 pos, 2.54 mm	Strip-P2_54-8P-female
5 1 CON2 5.0 mm horizontal entry screwless connector 2834082-1-TE 6 1 C1 SMT ceramic capacitor 0805 10 uF, 25 V, 10% 7 4 C2, C13, C14, C15 SMT ceramic capacitor 0805 220 nF, 100 V, 10% 8 4 C3, C22, C23, C24 SMT ceramic capacitor 0803 N.M. 9 2 C4, C5 SMT ceramic capacitor 0402 6.8 pF, 6.3 V, 0.25 pF 10 1 C6 SMT ceramic capacitor 0805 10 uF, 6.3 V, 10% 11 18 C7, C9, C11, C12, C28, C29, C30, C40, C50, C51, C52, C53, C54 SMT ceramic capacitor 0603 100 nF, 6.3 V, 10% 12 4 C8, C10, C44, C46 SMT ceramic capacitor 0805 1 uF, 6.3 V, 10% 13 3 C16, C17, C18 SMT ceramic capacitor 0803 1 uF, 6.3 V, 10% 14 3 C19, C20, C21 SMT ceramic capacitor 0803 32 nF, 6.3 V, 5% 15 3 C25, C26, C27 SMT ceramic capacitor 0803 82 nF, 6.3 V, 5% 16 3 C31, C32, C33 THT electrolytic capacitor 0603 1 nF, 6.3 V, 10% <	3	1	CN8	Sil socket straight 6 pos, 2.54 mm	Strip-P2_54-6P-female
6 1 C1 SMT ceramic capacitor 0805 10 uF, 25 V, 10% 7 4 C2, C13, C14, C15 SMT ceramic capacitor 0805 220 nF, 100 V, 10% 8 4 C3, C22, C23, C24 SMT ceramic capacitor 0803 N.M. 9 2 C4, C5 SMT ceramic capacitor 0402 6.8 pF, 6.3 V, 0.25 pF 10 1 C6 C7, C9, C11, C12, C28, C29, C30, C40, C42, C43, C45, C50, C51, C52, C53, C54 SMT ceramic capacitor 0803 100 nF, 6.3 V, 10% 11 16 C28, C29, C30, C40, C44, C46 SMT ceramic capacitor 0603 1 uF, 6.3 V, 10% 12 4 C8, C10, C44, C46 SMT ceramic capacitor 0805 1 uF, 6.3 V, 10% 13 3 C16, C17, C18 SMT ceramic capacitor 0803 1 uF, 25 V, 10% 14 3 C19, C20, C21 SMT ceramic capacitor 0603 82 nF, 6.3 V, 10% 15 3 C31, C32, C33 THT electrolytic capacitor 0500p200 220 uF, 100 V, 20% 17 5 C34, C35, C36, C38, C38 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C37 SMT ceramic capaci	4	1	CON1	5.0 mm horizontal entry screwless connector	2834082-2-TE
7 4 C2, C13, C14, C15 SMT ceramic capacitor 0805 220 nF, 100 V, 10% 8 4 C3, C22, C23, C24 SMT ceramic capacitor 0603 N.M. 9 2 C4, C5 SMT ceramic capacitor 0402 6.8 pF, 6.3 V, 0.25 pF 10 1 C6 SMT ceramic capacitor 0805 10 uF, 6.3 V, 10% 11 16 C7, C9, C11, C12, C28, C29, C30, C40, C42, C43, C45, C50, C51, C52, C53, C54 SMT ceramic capacitor 0603 100 nF, 6.3 V, 10% 12 4 C8, C10, C44, C46 SMT ceramic capacitor 0603 1 uF, 6.3 V, 10% 13 3 C16, C17, C18 SMT ceramic capacitor 0603 3 nF, 6.3 V, 10% 14 3 C19, C20, C21 SMT ceramic capacitor 0603 82 nF, 6.3 V, 5% 15 3 C25, C26, C27 SMT ceramic capacitor 05009200 220 uF, 100 V, 20% 17 5 C34, C35, C36, C38, SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C37 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C41 SMT ceramic capacitor 0603 N.M. 20	5	1	CON2	5.0 mm horizontal entry screwless connector	2834082-1-TE
8 4 C3, C22, C23, C24 SMT ceramic capacitor 0603 N.M. 9 2 C4, C5 SMT ceramic capacitor 0402 6.8 pF, 6.3 V, 0.25 pF 10 1 C6 SMT ceramic capacitor 0805 10 uF, 6.3 V, 10% 11 16 C7, C9, C11, C12, C28, C29, C30, C40, C42, C43, C45, C54, C54 12 4 C8, C10, C44, C46 SMT ceramic capacitor 0603 100 nF, 6.3 V, 10% 13 3 C16, C17, C18 SMT ceramic capacitor 0603 1 uF, 6.3 V, 10% 14 3 C19, C20, C21 SMT ceramic capacitor 0603 3 nF, 6.3 V, 10% 15 3 C25, C26, C27 SMT ceramic capacitor 0603 82 nF, 6.3 V, 5% 16 3 C31, C32, C33 THT electrolytic capacitor 0503 220 uF, 100 V, 20% 17 5 C34, C35, C36, C38, C38 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C37 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 19 1 C41 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 N.M. 20 1 C47 SMT ceramic capacitor 0603 N.M. 21 2 C48, C49 SMT ceramic capacitor 0603 100 nF, 6.3 V, 10% 22 1 D1 High voltage power schettky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 24 7 D8, D9, D10, D11, Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, Small signal schottky diodes BAT30K, 30 V 25 1 HS1 ⁽¹⁾ Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Strip 2x5 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x5 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x5 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x5 31 1 J5 Strip connector 4 pos, 2.54 mm Strip 1x5 31 1 J6 Strip connector 4 pos, 2.54 mm Strip 1x5 31 1 J6 Strip connector 4 pos, 2.54 mm Strip 1x5 31 1 J6 Strip connector 4 pos, 2.54 mm Strip 1x5 31 1 J8 USB receptacle-MINI B Micro USB type B	6	1	C1	SMT ceramic capacitor 0805	10 uF, 25 V, 10%
9 2 C4, C5 SMT ceramic capacitor 0402 6.8 p. F, 6.3 V, 0.25 p. F 10 1 C6 SMT ceramic capacitor 0805 10 u. F, 6.3 V, 10% 11 16 C7, C9, C11, C12, C28, C29, C30, C40, C42, C43, C45, C50, C51, C52, C53, C54 12 4 C8, C10, C44, C46 SMT ceramic capacitor 0603 1u. F, 6.3 V, 10% 13 3 C16, C17, C18 SMT ceramic capacitor 0805 1u. F, 25 V, 10% 14 3 C19, C20, C21 SMT ceramic capacitor 0805 1u. F, 25 V, 10% 15 3 C25, C26, C27 SMT ceramic capacitor 0603 3n. F, 6.3 V, 10% 15 3 C31, C32, C33 THT electrolytic capacitor 0603 82 n. F, 6.3 V, 5% 16 3 C31, C32, C33 THT electrolytic capacitor 0503 82 n. F, 6.3 V, 5% 17 5 C34, C35, C36, C38, SMT ceramic capacitor 0603 1n. F, 6.3 V, 10% 18 1 C37 SMT ceramic capacitor 0603 1n. F, 6.3 V, 10% 19 1 C41 SMT ceramic capacitor 0603 1n. F, 6.3 V, 10% 20 1 C47 SMT ceramic capacitor 0603 1n. M. 20 1 C47 SMT ceramic capacitor 0603 1n. F, 6.3 V, 10% 21 2 C48, C49 SMT ceramic capacitor 0603 1n. F, 6.3 V, 10% 22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1 ⁽¹⁾ Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x5 31 1 J6 Strip connector 7 pos, 2.54 mm Strip 1x5 31 1 J8 USB receptacle-MINI B Micro USB type B	7	4	C2, C13, C14, C15	SMT ceramic capacitor 0805	220 nF, 100 V, 10%
10 1 C6 SMT ceramic capacitor 0805 10 uF, 6.3 V, 10% C7, C9, C11, C12, C28, C29, C30, C40, C42, C43, C45, C50, C51, C52, C53, C54 SMT ceramic capacitor 0603 100 nF, 6.3 V, 10% 12 4 C8, C10, C44, C46 SMT ceramic capacitor 0805 1 uF, 25 V, 10% 13 3 C16, C17, C18 SMT ceramic capacitor 0805 1 uF, 25 V, 10% 14 3 C19, C20, C21 SMT ceramic capacitor 0603 3 nF, 6.3 V, 10% 15 3 C25, C26, C27 SMT ceramic capacitor 0603 3 nF, 6.3 V, 10% 15 3 C25, C26, C27 SMT ceramic capacitor 0603 2 c20 uF, 100 V, 20% 15 3 C31, C32, C33 THT electrolytic capacitor 0500 220 uF, 100 V, 20% 17 5 C34, C35, C36, C38, C39 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 17 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C37 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 100 nF, 6.3 V, 10% 100 nF	8	4	C3, C22, C23, C24	SMT ceramic capacitor 0603	N.M.
11	9	2	C4, C5	SMT ceramic capacitor 0402	6.8 pF, 6.3 V, 0.25 pF
11 16 C28, C29, C30, C30, C40, C51, C52, C53, C54 SMT ceramic capacitor 0603 100 nF, 6.3 V, 10% 12 4 C8, C10, C44, C46 SMT ceramic capacitor 0603 1 uF, 6.3 V, 10% 13 3 C16, C17, C18 SMT ceramic capacitor 0603 3 nF, 6.3 V, 10% 14 3 C19, C20, C21 SMT ceramic capacitor 0603 32 nF, 6.3 V, 10% 15 3 C25, C26, C27 SMT ceramic capacitor 05003 82 nF, 6.3 V, 5% 16 3 C31, C32, C33 THT electrolytic capacitor 050020 220 uF, 100 V, 20% 17 5 C34, C35, C36, C38, C38, C39 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C37 SMT ceramic capacitor 0603 10 nF, 6.3 V, 10% 19 1 C41 SMT ceramic capacitor 0603 10 nF, 6.3 V, 10% 20 1 C47 SMT ceramic capacitor 0603 10 nF, 6.3 V, 10% 21 2 C48, C49 SMT ceramic capacitor 0603 10 nF, 6.3 V, 10% 22 1 D1 High voitage power schottky rectifier STPS1H100A, 100 V <tr< td=""><td>10</td><td>1</td><td>C6</td><td>SMT ceramic capacitor 0805</td><td>10 uF, 6.3 V, 10%</td></tr<>	10	1	C6	SMT ceramic capacitor 0805	10 uF, 6.3 V, 10%
13 3 C16, C17, C18 SMT ceramic capacitor 0805 1 u.f., 25 V, 10% 14 3 C19, C20, C21 SMT ceramic capacitor 0603 33 n.f., 6.3 V, 10% 15 3 C25, C26, C27 SMT ceramic capacitor 0603 82 n.f., 6.3 V, 5% 16 3 C31, C32, C33 THT electrolytic capacitor D500p200 220 u.f., 100 V, 20% 17 5 C34, C35, C36, C38, SMT ceramic capacitor 0603 100 n.f., 25 V, 10% 18 1 C37 SMT ceramic capacitor 0603 100 n.f., 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 N.M. 20 1 C47 SMT ceramic capacitor 0603 10 n.f., 6.3 V, 10% 21 2 C48, C49 SMT ceramic capacitor 0603 100 p.f., 6.3 V, 10% 22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diode BAT48, 40 V 25 1 HS1(1) Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 2 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 6 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	11	16	C28, C29, C30, C40, C42, C43, C45, C50,	SMT ceramic capacitor 0603	100 nF, 6.3 V, 10%
14 3 C19, C20, C21 SMT ceramic capacitor 0603 33 nF, 6.3 V, 10% 15 3 C25, C26, C27 SMT ceramic capacitor 0603 82 nF, 6.3 V, 5% 16 3 C31, C32, C33 THT electrolytic capacitor D500p200 220 uF, 100 V, 20% 17 5 C34, C35, C36, C38, C38, C39 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C37 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 N.M. 20 1 C47 SMT ceramic capacitor 0603 10 nF, 6.3 V, 10% 21 2 C48, C49 SMT ceramic capacitor 0603 100 nF, 6.3 V, 10% 22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D6, D7 Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1 ⁽¹⁾ Heatsink RAWA410-0 26 2	12	4	C8, C10, C44, C46	SMT ceramic capacitor 0603	1 uF, 6.3 V, 10%
15 3 C25, C26, C27 SMT ceramic capacitor 0603 82 nF, 6.3 V, 5% 16 3 C31, C32, C33 THT electrolytic capacitor D500p200 220 uF, 100 V, 20% 17 5 C34, C35, C36, C38, C38, C39 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C37 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 N.M. 20 1 C47 SMT ceramic capacitor 0603 10 nF, 6.3 V, 10% 21 2 C48, C49 SMT ceramic capacitor 0603 100 pF, 6.3 V, 10% 22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1(1) Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper	13	3	C16, C17, C18	SMT ceramic capacitor 0805	1 uF, 25 V, 10%
16 3 C31, C32, C33 THT electrolytic capacitor D500p200 220 uF, 100 V, 20% 17 5 C34, C35, C36, C38, C39 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C37 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 N.M. 20 1 C47 SMT ceramic capacitor 0603 100 pF, 6.3 V, 10% 21 2 C48, C49 SMT ceramic capacitor 0603 100 pF, 6.3 V, 10% 22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1(1) Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2	14	3	C19, C20, C21	SMT ceramic capacitor 0603	33 nF, 6.3 V, 10%
17 5 C34, C35, C36, C38, C39 SMT ceramic capacitor 0603 1 nF, 6.3 V, 10% 18 1 C37 SMT ceramic capacitor 0603 100 nF, 25 V, 10% 19 1 C41 SMT ceramic capacitor 0603 N.M. 20 1 C47 SMT ceramic capacitor 0603 10 nF, 6.3 V, 10% 21 2 C48, C49 SMT ceramic capacitor 0603 100 pF, 6.3 V, 10% 22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1(1) Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 2x5 30 1	15	3	C25, C26, C27	SMT ceramic capacitor 0603	82 nF, 6.3 V, 5%
17	16	3	C31, C32, C33	THT electrolytic capacitor D500p200	220 uF, 100 V, 20%
19 1 C41 SMT ceramic capacitor 0603 N.M. 20 1 C47 SMT ceramic capacitor 0603 10 nF, 6.3 V, 10% 21 2 C48, C49 SMT ceramic capacitor 0603 100 pF, 6.3 V, 10% 22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1 ⁽¹⁾ Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x7 32 1 J6 Strip connector 4 pos, 2.54 mm N.M. 34 1	17	5		SMT ceramic capacitor 0603	1 nF, 6.3 V, 10%
20 1 C47 SMT ceramic capacitor 0603 10 nF, 6.3 V, 10% 21 2 C48, C49 SMT ceramic capacitor 0603 100 pF, 6.3 V, 10% 22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1(1) Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 2x5, pitch 2.54 mm Strip 2x5 30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x7 32 1 J6 Strip connector 5 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear	18	1	C37	SMT ceramic capacitor 0603	100 nF, 25 V, 10%
21 2 C48, C49 SMT ceramic capacitor 0603 100 pF, 6.3 V, 10% 22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1(1) Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 2x5, pitch 2.54 mm Strip 2x5 30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x7 31 1 J5 Strip connector 5 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red <td>19</td> <td>1</td> <td>C41</td> <td>SMT ceramic capacitor 0603</td> <td>N.M.</td>	19	1	C41	SMT ceramic capacitor 0603	N.M.
22 1 D1 High voltage power schottky rectifier STPS1H100A, 100 V 23 6 D2, D3, D4, D5, D6, D7 Small signal schottky diode BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1(1) Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 2x5, pitch 2.54 mm Strip 2x5 30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	20	1	C47	SMT ceramic capacitor 0603	10 nF, 6.3 V, 10%
23 6 D2, D3, D4, D5, D6, D7, D6, D7, D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT48, 40 V 24 7 D8, D9, D10, D11, D12, D13, D14 Small signal schottky diodes BAT30K, 30 V 25 1 HS1(1) Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 2x5, pitch 2.54 mm Strip 2x5 30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	21	2	C48, C49	SMT ceramic capacitor 0603	100 pF, 6.3 V, 10%
D7 Small signal schottky diode BAT48, 40 V	22	1	D1	High voltage power schottky rectifier	STPS1H100A, 100 V
24 7 D12, D13, D14 Small signal schottky diodes BAT3UK, 30 V 25 1 HS1(1) Heatsink RAWA410-0 26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 2x5, pitch 2.54 mm Strip 2x5 30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x7 32 1 J6 Strip connector 5 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	23	6		Small signal schottky diode	BAT48, 40 V
26 2 JP1, JP2 SMT jumper Open 27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 2x5, pitch 2.54 mm Strip 2x5 30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x7 32 1 J6 Strip connector 5 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	24	7		Small signal schottky diodes	BAT30K, 30 V
27 1 J1 Jumper Open 28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 2x5, pitch 2.54 mm Strip 2x5 30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x7 32 1 J6 Strip connector 5 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	25	1	HS1 ⁽¹⁾	Heatsink	RAWA410-0
28 1 J2 Strip connector 2 pos, 2.54 mm Strip 1x2 29 2 J3, J9 Strip connector 2x5, pitch 2.54 mm Strip 2x5 30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x7 32 1 J6 Strip connector 5 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	26	2	JP1, JP2	SMT jumper	Open
29 2 J3, J9 Strip connector 2x5, pitch 2.54 mm Strip 2x5 30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x7 32 1 J6 Strip connector 5 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	27	1	J1	Jumper	Open
30 1 J4 Strip connector 3 pos, 2.54 mm Strip 1x3 31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x7 32 1 J6 Strip connector 5 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	28	1	J2	Strip connector 2 pos, 2.54 mm	Strip 1x2
31 1 J5 Strip connector 7 pos, 2.54 mm Strip 1x7 32 1 J6 Strip connector 5 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	29	2	J3, J9	Strip connector 2x5, pitch 2.54 mm	Strip 2x5
32 1 J6 Strip connector 5 pos, 2.54 mm Strip 1x5 33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	30	1	J4	Strip connector 3 pos, 2.54 mm	Strip 1x3
33 1 J7 Strip connector 4 pos, 2.54 mm N.M. 34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	31	1	J5	Strip connector 7 pos, 2.54 mm	Strip 1x7
34 1 J8 USB receptacle-MINI B Micro USB type B 35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	32	1	J6	Strip connector 5 pos, 2.54 mm	Strip 1x5
35 1 LED1 WL-SMCW SMT Mono-color chip LED Waterclear Red	33	1	J7	Strip connector 4 pos, 2.54 mm	N.M.
·	34	1	J8	USB receptacle-MINI B	Micro USB type B
36 2 LED2, LED3 WL-SMCW SMT Mono-color chip LED Waterclear Yellow	35	1	LED1	WL-SMCW SMT Mono-color chip LED Waterclear	Red
	36	2	LED2, LED3	WL-SMCW SMT Mono-color chip LED Waterclear	Yellow

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Item	Q.ty	Reference	Description	Value
37	1	LED4	LED indicators, PLCC-4 red/yellow green	Red-green
38	1	L1	WE-PD2 SMT power inductor	18uH, 1A
39	3	NET1, NET2, NET3	PCB short	N.M.
40	1	NTC1	NTC thermistor 0603	10k, 1%
41	6	Q1, Q2, Q3, Q4, Q5, Q6	N-channel 100 V, 5 m Ω typ., 107 A STripFET F7 Power MOSFET	STL110N10F7
42	1	Q7	NPN general purpose transistor	BC847B
43	13	R1, R6, R7, R8, R9, R38, R65, R84, R109, R111, R112, R113, R118	SMT resistor 0805	0, 0.1 W, 5%
44	7	R2, R41, R42, R43, R47, R48, R49	SMT resistor 0603	22k, 0.1W, 1%
45	1	R3	SMT resistor 0603	10k, 0.1 W, 1%
46	9	R10, R11, R12, R19, R20, R21, R22, R23, R24	SMT resistor 0603	0, 0.1 W, 5%
47	6	R13, R14, R15, R25, R26, R27	SMT resistor 0603	33, 0.1 W, 5%
48	6	R16, R17, R18, R28, R29, R30	SMT resistor 0805	N.M.
49	6	R31, R32, R33, R34, R35, R36	SMT resistor 2512	10 m, 3 W, 1%
50	1	R37	SMT resistor 0603	72.3k, 0.1 W, 1%
51	1	R39	SMT resistor 0603	3.01k, 0.1 W, 1%
52	3	R40, R105, R106	SMT resistor 0603	4.7k, 0.1 W, 1%
53	6	R44, R45, R46, R50, R51, R52	SMT resistor 0603	1.5k, 0.1 W, 1%
54	3	R53, R54, R55	SMT resistor 0603	11k, 0.1 W, 1%
55	3	R56, R58, R60	SMT resistor 0603	68k, 0.1 W, 1%
56	3	R57, R59, R61	SMT resistor 0603	27k, 0.1 W, 1%
57	3	R62, R63, R64	SMT resistor 0603	3.9k, 0.1 W, 1%
58	15	R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R87, R89, R100, R108, R115	SMT resistor 0805	N.M.
59	2	R76, R77	SMT resistor 0805	4.7k, 0.5 W, 5%
60	8	R78, R79, R80, R81, R82, R83, R101, R116	SMT resistor 0603	10k, 0.1 W, 5%
61	4	R85, R86, R88, R117	SMT resistor 0603	N.M.
62	5	R90, R93, R97, R119, R120	SMT resistor 0603	100k, 0.1 W, 5%
63	3	R91, R92, R96	SMT resistor 0603	200, 0.1 W, 5%
64	2	R94, R95	SMT resistor 0603	120, 0.1 W, 5%
65	1	R98	SMT resistor 0603	120, 0.1 W, 5%
66	1	R99	SMT resistor 0603	10k, 0.1 W, 5%

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Item	Q.ty	Reference	Description	Value
67	4	R102, R114, R121, R122	SMT resistor 0603	100, 0.1 W, 5%
68	1	R103	SMT resistor 0603	36k, 0.1 W, 5%
69	1	R104	SMT resistor 0603	1.5k, 0.1 W, 5%
70	1	R107	SMT resistor 0603	4.7k, 0.1 W, 5%
71	1	R110	SMT resistor 0603	2.7k, 0.1 W, 5%
72	8	SC1, SC2, SC3, SC4, SC5, SC6, SC7, SC8	M3 Cheese-head screw	M3
73	4	SP1, SP2, SP3, SP4	M3 F-F Hexagonal spacer 20 mm	222424
74	3	SW1, SW2, SW3	Tactile switches - 6x6 J-bend SMT	6x6 J-bend SMT
75	1	TIM1 ⁽¹⁾	Thermally conductive Gap filler, 150x150 mm sp.0,5 mm.	7074645
76	2	TP1, TP2	40x71 mils SMD PAD	TP-SMD-S1751-46R
77	7	TP3, TP4, TP5, TP6, TP7, TP8, TP9	Test point - PCB 1.5 mm diameter	N.M.
78	2	TP10, TP11	TP for Probe	N.M.
79	1	TR1	3/8 Square Trimpot trimming potentiometer, side adjust	100k
80	1	U1	3-phase brushless motor controller embedding STM32G431 MCU	STSPIN32G4
81	1	U2	TCAN33x 3.3-V CAN Transceivers with CAN FD (Flexible Data Rate)	N.M.
82	1	U3	Ultra-low drop and low noise BiCMOS voltage regulators	LD3985M33R
83	1	U4	Very low capacitance ESD protection	USBLC6-2SC6
84	1	U5	Medium-density performance line ARM®-based 32-bit MCU with 128 Kb Flash, USB, CAN, 7 timers, 2 ADCs, 9 com. interfaces	STM32F103CBT6
85	1	X1	IoT optimized low profile quartz crystal	24.000 MHz
86	1	X2	Crystal 8.0000MHz 8PF SMD	8.0000 MHz

^{1.} Not provided with EVSPIN32G4NH

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2 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 and recycling centers. It is mandatory to collect separately the evaluation board and make sure it is delivered to the appropriate waste management and recycling centers. As of 15 August 2018, in all countries belonging to the European Union, the evaluation board is subject to the requirements of WEEE Directive 2012/19/EU, and therefore it is forbidden to dispose of the evaluation board as undifferentiated waste or with other domestic waste. Incorrect disposal of the evaluation board may cause damage to the environment and may incur fines based on specific countries' rules, regulations, and laws.

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Revision history

Table 3. Document revision history

Date	Version	Changes
15-Mar-2021	1	Initial release.

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