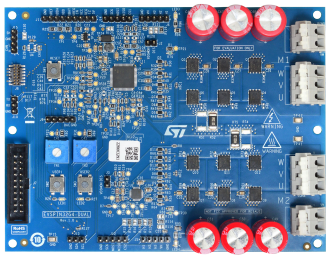
EVSPIN32G4-DUAL

Data brief

STSPIN32G4 & STDRIVE101 demonstration board for driving two BLDC motors



Product status link
EVSPIN32G4-DUAL
STSPIN32G4
STDRIVE101

Product label
SUSTAINABLE TECHNOLOGY

Features

- Two power stages based on the STL110N10F7 power MOSFETs with output current up to 10 A_{rms} and protected to overcurrent conditions.
- Independent bus voltage from 10 V to 74 V with dedicated monitoring.
- STSPIN32G4, high performance three-phase motor controller with embedded STSPIN32G431 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 hardware parity check
  - 2 x advanced timers for motor control, 16-bit with up to 6 x PWM channels each
  - 2 x ADCs 12-bit resolution (up to 19 channels) with 4 Msps conversion rate
  - 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
  - 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, short-circuit, and overload protections
  - 75 V rated gate drivers with 1A sink/source current and embedded bootstrap diodes
  - Drain-source voltage sensing of each power MOSFET
- STDRIVE101, triple half-bridge gate driver:
  - 75 V rated gate drivers with 600 mA sink/source current and embedded bootstrap diodes
  - Two input strategies: ENx/INx with adjustable deadtime generation or INHx/INLx with interlocking
  - Very short propagation delay of 40 ns, matched among channels
  - 12 V LDO linear regulator up to 50 mA
  - Drain-source voltage sensing of each power MOSFET
  - Overcurrent comparator
  - UVLO and thermal shutdown protections
  - Standby mode for low current consumption operations
- Single-shunt differential current sensing using embedded operational amplifiers.
- Inputs for speed/position feedback available for both motors:
  - Digital hall sensors
  - Incremental quadrature encoders
  - Absolute encoders
- Full set of communication interfaces: I²C, SPI, UART

- Predisposition for CAN bus
- NTC sensors for power stages temperature monitoring

Applications

- Industrial and home automation
- Home appliances such as vacuum cleaners, dryers and cleaning robots
- Servo drives and e-bikes
- Service and automation robots
- Power and garden tools
- Pumps and fans
- Drones and aeromodelling

Description

The EVSPIN32G4-DUAL is a demonstration board based on the STSPIN32G4 and STDRIVE101 for applications using two three-phase brushless motors.

The STSPIN32G4 is a system in package integrating 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 STDRIVE101 is a triple half-bridge gate driver in a compact 4x4 VFQPN package featuring 600 mA current capability and embedded protections.

The two power stages based on the STL110N10F7 power MOSFETs can simultaneously operate up to 10 Arm output current and 74 V supply, providing dedicated monitoring for temperature and bus voltage, drain-source voltage sensing of power MOSFETs and overcurrent protection.

The board allows sensor-less operation with single shunt current sensing taking advantage of operational amplifiers inside STSPIN32G4 as well as sensor-based control algorithms thanks to dedicated inputs for each motor among Hall sensors, quadrature encoder or absolute encoder with SSI communication interface.

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

Predisposition for CAN bus enables the EVSPIN32G4-DUAL to easily connect with master or slave modules and build complex motion control systems.

1 Specifications

Ratings of the board can be found in Table 1. Schematics of the EVSPIN32G4-DUAL (from Figure 1 to Figure 4) and bill of material (Table 2) are reported below.

Table 1. EVSPIN32G4-DUAL specifications

Parameter		Value
Supply voltage	Nominal	From 10 V to 74 V
Maximum current for each power stage	Peak	17 A
	Continuous (1)	10 A_{rms}

1. *Maximum current at ambient temperature of 25 °C with both power stages active. Actual maximum current could be limited by power dissipation.*

1.1 Schematics

Figure 1. EVSPIN32G4-DUAL schematic: STSPIN32G4 and STDRIVE101

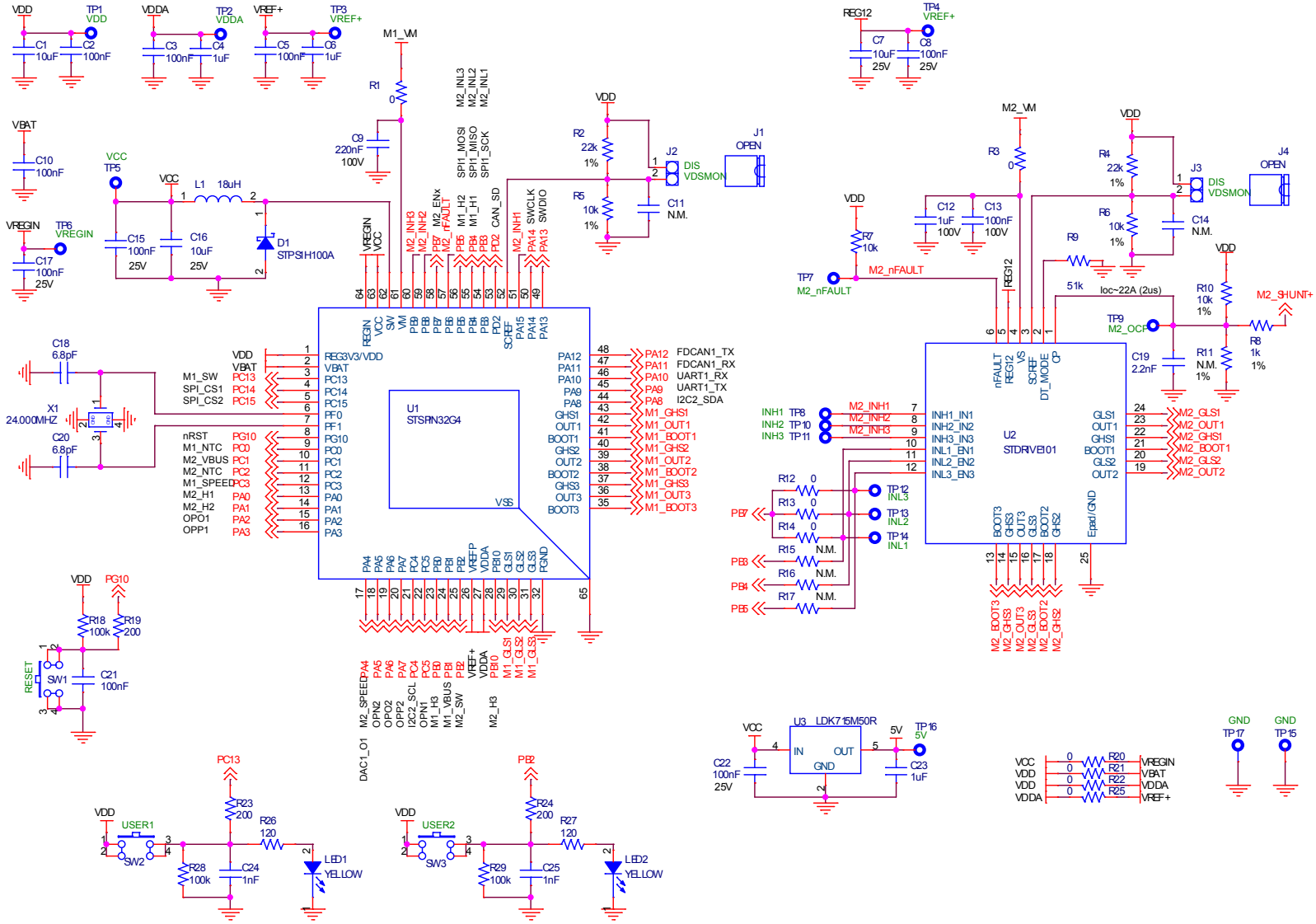


Figure 2. EVSPIN32G4-DUAL schematic: power stages

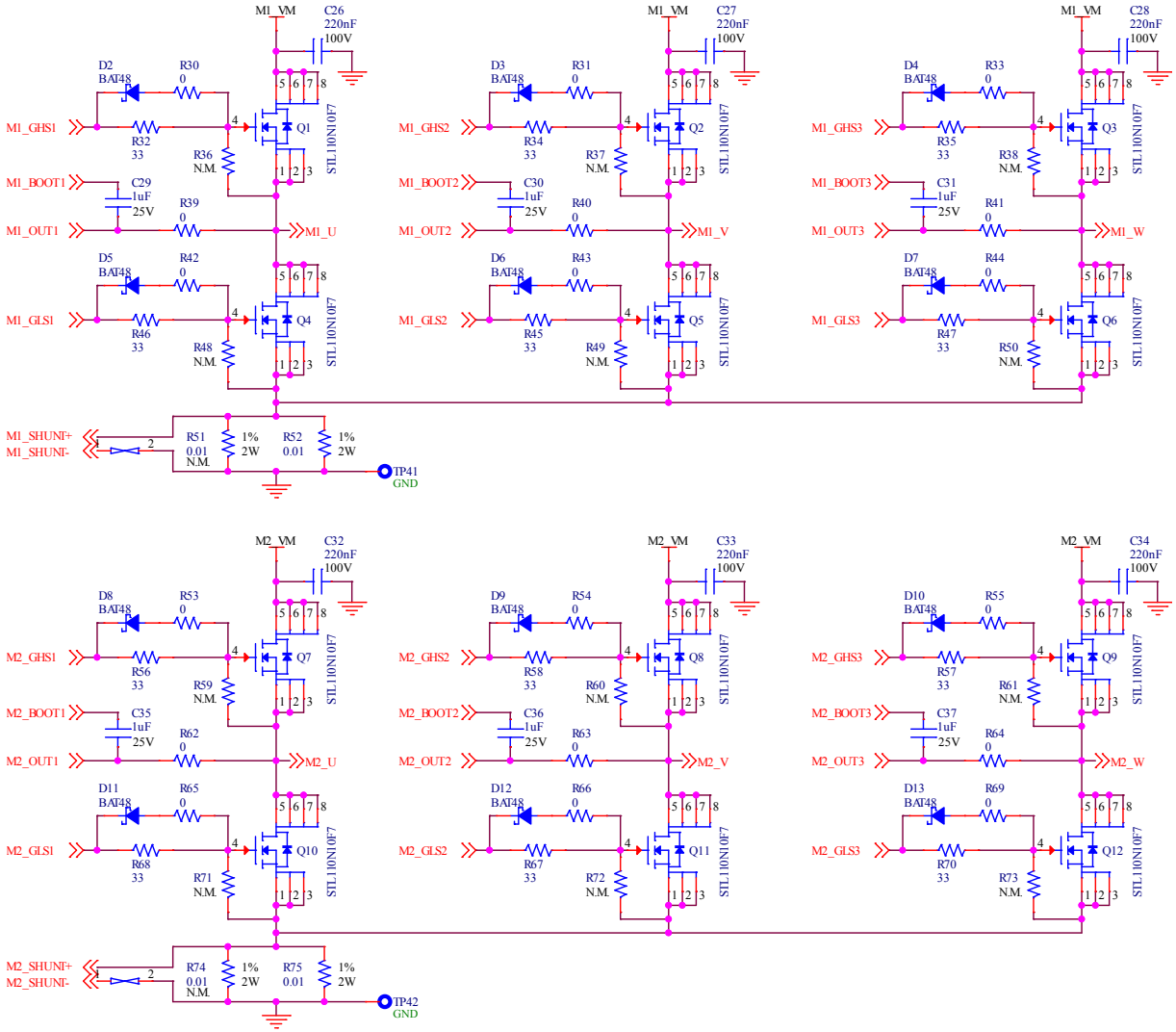


Figure 3. EVSPIN32G4-DUAL schematic: sensing

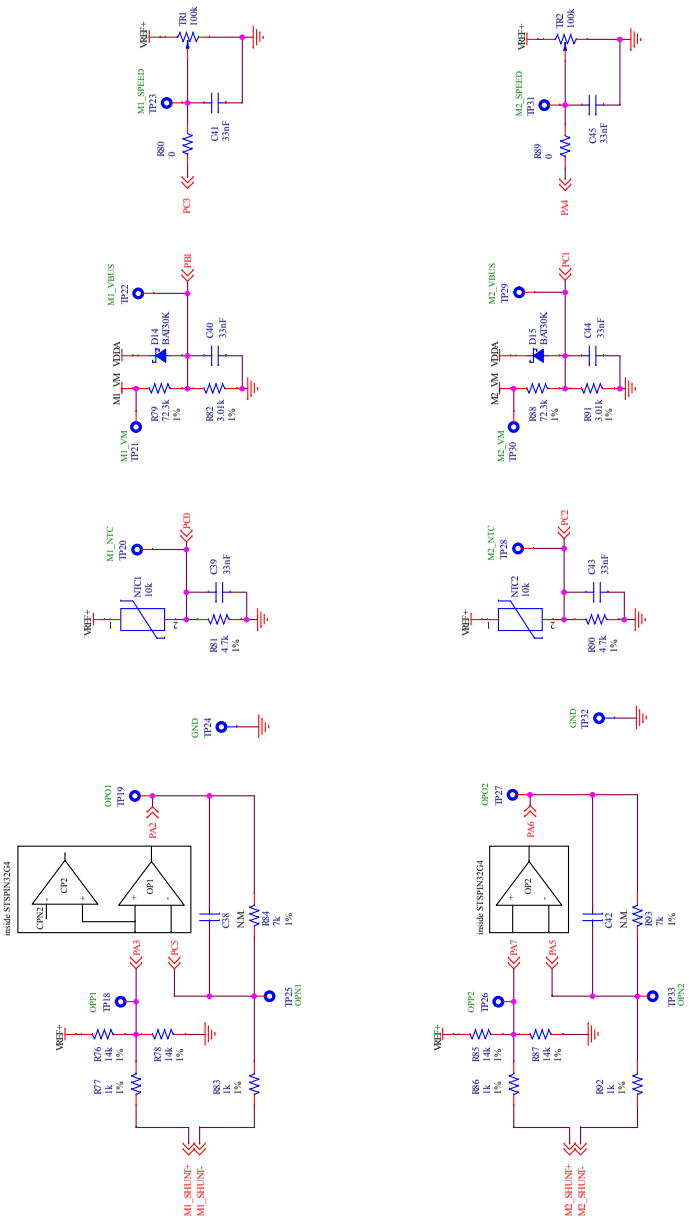
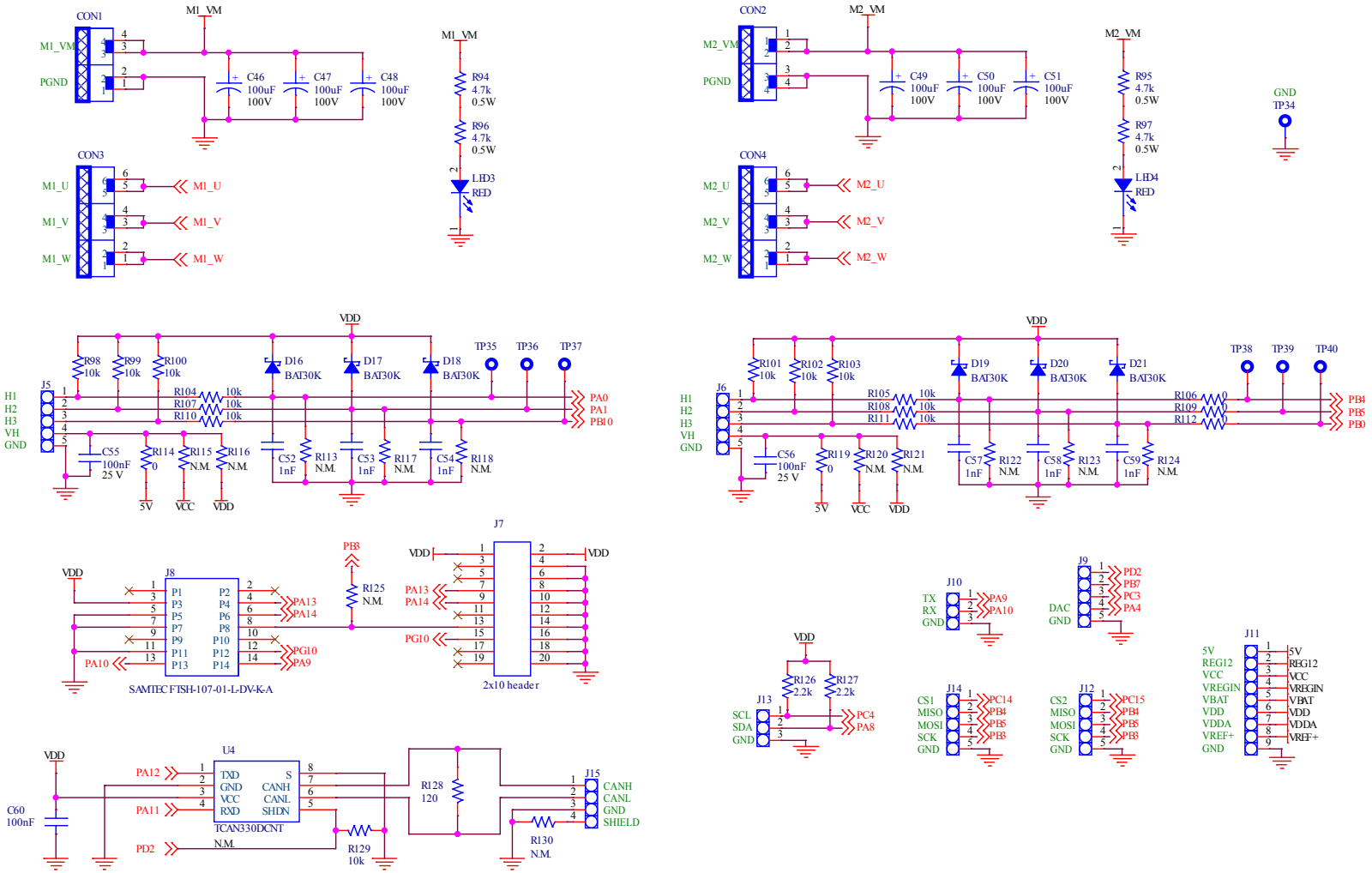


Figure 4. EVSPIN32G4-DUAL schematic: Inputs and outputs



1.2 Bill of materials

Table 2. EVSPIN32G4-DUAL bill of materials

Item	Q.ty	Reference	Description	Value
1	2	CON1, CON2	SERIE 4147 - 5.00 MM SCREWLESS 45° ENTRY 2.00 MM² WIRES WR-TBL	691414720002B
2	2	CON3, CON4	SERIE 4147 - 5.00 MM SCREWLESS 45° ENTRY 2.00 MM² WIRES WR-TBL	691414720003B
3	1	C1	SMT ceramic capacitor 0805	10 µF, 6.3 V, 10%
4	6	C2, C3, C5, C10, C21, C60	SMT ceramic capacitor 0603	100 nF, 6.3 V, 10%
5	3	C4, C6, C23	SMT ceramic capacitor 0603	1 µF, 6.3 V, 10%
6	2	C7, C16	SMT ceramic capacitor 0805	10 µF, 25 V, 10%
7	1	C8	SMT ceramic capacitor 0603	100 nF, 25 V, 10%
8	7	C9, C26, C27, C28, C32, C33, C34	SMT ceramic capacitor 0805	220 nF, 100 V, 10%
9	4	C11, C14, C38, C42	SMT ceramic capacitor 0603	N.M.
10	1	C12	SMT ceramic capacitor 0805	1 µF, 100 V, 10%
11	1	C13	SMT ceramic capacitor 0805	100 nF, 100 V, 10%
12	3	C15, C17, C22	SMT ceramic capacitor 0805	100 nF, 25 V, 10%
13	2	C18, C20	SMT ceramic capacitor 0402	6.8 pF, 6.3 V, 0.25 pF
14	1	C19	SMT ceramic capacitor 0603	2.2 nF, 6.3 V, 10%
15	8	C24, C25, C52, C53, C54, C57, C58, C59	SMT ceramic capacitor 0603	1 nF, 6.3 V, 10%
16	6	C29, C30, C31, C35, C36, C37	SMT ceramic capacitor 0805	1 µF, 25 V, 10%
17	6	C39, C40, C41, C43, C44, C45	SMT ceramic capacitor 0603	33 nF, 6.3 V, 10%
18	6	C46, C47, C48, C49, C50, C51	THT electrolytic capacitor D500p200	100 µF, 100 V, 20%
19	2	C55, C56	SMT ceramic capacitor 0603	100 nF, 25 V, 10%
20	1	D1	High voltage power schottky rectifier	STPS1H100A, 100 V
21	12	D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13	Small signal Schottky diode	BAT48, 40 V
22	8	D14, D15, D16, D17, D18, D19, D20, D21	Small signal Schottky diodes	BAT30K, 30 V
23	2	J1, J4	Jumper	OPEN
24	2	J2, J3	Strip connector 2 pos, 2.54 mm	STRIP 1x2
25	5	J5, J6, J9, J12, J14	Strip connector 5 pos, 2.54 mm	STRIP 1x5
26	1	J7	Male box header	2x10 header
27	1	J8	SMT micro header pitch 1.27 mm	SAMTEC FTSH-107-01-L-DV-K-A
28	2	J10, J13	Strip connector 3 pos, 2.54 mm	STRIP 1x3
29	1	J11	Strip connector 9 pos, 2.54 mm	STRIP 1x9
30	1	J15	Strip connector 4 pos, 2.54 mm	STRIP 1x4
31	2	LED1, LED2	WL-SMCW SMT Mono-color Chip LED Waterclear	YELLOW
32	2	LED3, LED4	WL-SMCW SMT Mono-color Chip LED Waterclear	RED
33	1	L1	WE-PD2 SMT Power Inductor	18 µH, 1 A
34	2	NET2, NET3	PCB Net	N.M.

Item	Q.ty	Reference	Description	Value
35	2	NTC1, NTC2	NTC Thermistor	10 kΩ, 1%
36	12	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12	N-channel 100 V, 5 mΩ typ., 107 A STripFET F7 Power MOSFET	STL110N10F7
37	16	R1, R3, R12, R13, R14, R20, R21, R22, R25, R80, R89, R106, R109, R112, R114, R119	SMT resistor 0805	0 Ω, 0.1 W, 5%
38	2	R2, R4	SMT resistor 0603	22 kΩ, 0.1 W, 1%
39	3	R5, R6, R10	SMT resistor 0603	10 kΩ, 0.1 W, 1%
40	14	R7, R98, R99, R100, R101, R102, R103, R104, R105, R107, R108, R110, R111, R129	SMT resistor 0603	10 kΩ, 0.1 W, 5%
41	5	R8, R77, R83, R86, R92	SMT resistor 0603	1 kΩ, 0.1 W, 1%
42	1	R9	SMT resistor 0603	51 kΩ, 0.1 W, 5%
43	1	R11	SMT resistor 0603	N.M.
44	9	R15, R16, R17, R115, R116, R120, R121, R125, R130	SMT resistor 0805	N.M.
45	3	R18, R28, R29	SMT resistor 0603	100 kΩ, 0.1 W, 5%
46	3	R19, R23, R24	SMT resistor 0603	200 Ω, 0.1 W, 5%
47	3	R26, R27, R128	SMT resistor 0603	120 Ω, 0.1 W, 5%
48	18	R30, R31, R33, R39, R40, R41, R42, R43, R44, R53, R54, R55, R62, R63, R64, R65, R66, R69	SMT resistor 0603	0 Ω, 0.1 W, 5%
49	12	R32, R34, R35, R45, R46, R47, R56, R57, R58, R67, R68, R70	SMT resistor 0603	33 Ω, 0.1 W, 5%
50	12	R36, R37, R38, R48, R49, R50, R59, R60, R61, R71, R72, R73	SMT resistor 0603	N.M.
51	2	R51, R74	SMT resistor 2512	N.M.
52	2	R52, R75	SMT resistor 2512	0.01 Ω, 2 W, 1%
53	4	R76, R78, R85, R87	SMT resistor 0603	14 kΩ, 0.1 W, 1%
54	2	R79, R88	SMT resistor 0603	72.3 kΩ, 0.1 W, 1%
55	2	R81, R90	SMT resistor 0603	4.7 kΩ, 0.1 W, 1%
56	2	R82, R91	SMT resistor 0603	3.01 kΩ, 0.1 W, 1%
57	2	R84, R93	SMT resistor 0603	7 kΩ, 0.1 W, 1%
58	4	R94, R95, R96, R97	SMT resistor 0805	4.7 kΩ, 0.5 W, 5%
59	6	R113, R117, R118, R122, R123, R124	SMT resistor 0603	N.M.
60	2	R126, R127	SMT resistor 0603	2.2 kΩ, 0.1 W, 5%
61	6	SC1, SC2, SC3, SC4, SC5, SC6	M3 cheese-head screw	M3
62	6	SP1, SP2, SP3, SP4, SP5, SP6	M3 F-F hexagonal spacer 20 mm	222424
63	3	SW1, SW2, SW3	Tactile switches - 6x6 J-bend SMT	430483025816
64	35	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP16, TP18, TP19, TP20, TP21, TP22, TP23, TP25, TP26, TP27, TP28, TP29, TP30, TP31, TP33, TP35, TP36, TP37, TP38, TP39, TP40	Test point PCB - 1.5 mm diameter	N.M.
65	3	TP15, TP41, TP42	40x71 mils SMD PAD	TP-SMD-S1751-46R

Item	Q.ty	Reference	Description	Value
66	4	TP17, TP24, TP32, TP34	Test Point PCB	N.M.
67	2	TR1, TR2	3/8 Square trimpot trimming potentiometer, side adjust	100 kΩ
68	1	**U1**	3-phase brushless motor controller embedding STM32G4 MCU	STSPIN32G4
69	1	U2	Three-phase gate driver	STDRIVE101
70	1	U3	High input voltage 85 mA LDO linear regulator	LDK715M50R
71	1	U4	TCAN33x 3.3-V CAN Transceivers with CAN FD (Flexible Data Rate)	N.M.
72	1	X1	Low profile quartz crystal	24.000 MHZ

Revision history

Table 3. **Document revision history**

Date	Version	Changes
07-Sep-2023	1	Initial release.

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