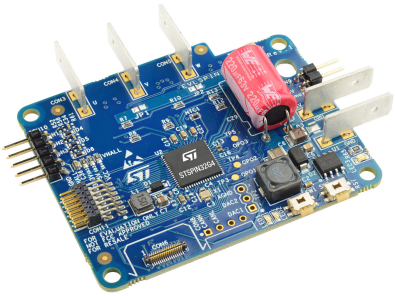
EVLSPIN32G4-ACT

Data brief

STSPIN32G4 reference design for next generation smart actuators



Features

- Power stage based on the STL60N10F7 power MOSFETs with output current up to 5 A_{rms} and protected to overcurrent condition
- Bus voltage from 10 V to 48 V with dedicated monitoring
- STSPIN32G4, high performance three-phase motor controller with embedded STSPIN32G431 MCU
- Triple-shunt or single-shunt differential current sensing using embedded operational amplifiers
- Inputs for speed/position feedback by digital Hall sensors or incremental quadrature endcoders
- Predisposition for CAN bus
- NTC sensor for power stage temperature monitoring
- Interface with STWIN.box and external sensor boards

Application

- Industrial and home automation
- IoT
- Condition monitoring
- Predictive maintenance
- 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

Product status link
EVLSPIN32G4-ACT

Description

The EVLSPIN32G4-ACT is a reference design for implementing next generation smart actuators, based on the STSPIN32G4, 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 a mixed signal STM32G431 microcontroller.

The board is designed to drive three-phase brushless motors up to 5 A_{rms} output current and 48 V supply input delivering a total power of 250 W in a very compact form factor (62 mm x 50 mm). Monitoring is available for the power stage in case of overheating, overvoltage, and overcurrent. The sensing of motor winding currents can be selected between three-shunt or single-shunt topology. The board is ready for FOC and 6-step control algorithms and can run in sensor-less and sensor-based mode using Hall sensors or quadrature encoder.

Thanks to a smooth interfacing with the STWIN.box development kit and a complete software and firmware ecosystem, the motor inverter is empowered by wired and wireless connectivity (RS485, UART, USB, CAN, and Bluetooth® Low Energy, Wi-Fi, NFC), a plethora of inertial end environmental sensors (accelerometer, gyroscope, inclinometer, magnetometer, humidity, temperature, pressure), and data storage onboard (microSD™ card) making the EVLSPIN32G4-ACT a perfect suit for cutting edge motor control solutions such as IoT, condition monitoring, and predictive maintenance.

1 Specifications

Ratings of the board can be found in Table 1. Schematics of the EVLSPIN32G4-ACT (from Figure 1 to Figure 4) and bill of material (Table 2) are reported below.

Table 1. EVLSPIN32G4-ACT specifications

Parameter		Value
Input voltage	Nominal	From 10 V to 48 V
Output current	Peak	7 A
	Continuous (1)	5 A_{rms}
Output power	Continuous (1)	250 W

1. *With ambient temperature of 25 °C.*

1.1 Schematics

Figure 1. EVLSPIN32G4-ACT schematic (1 of 4): STSPIN32G4

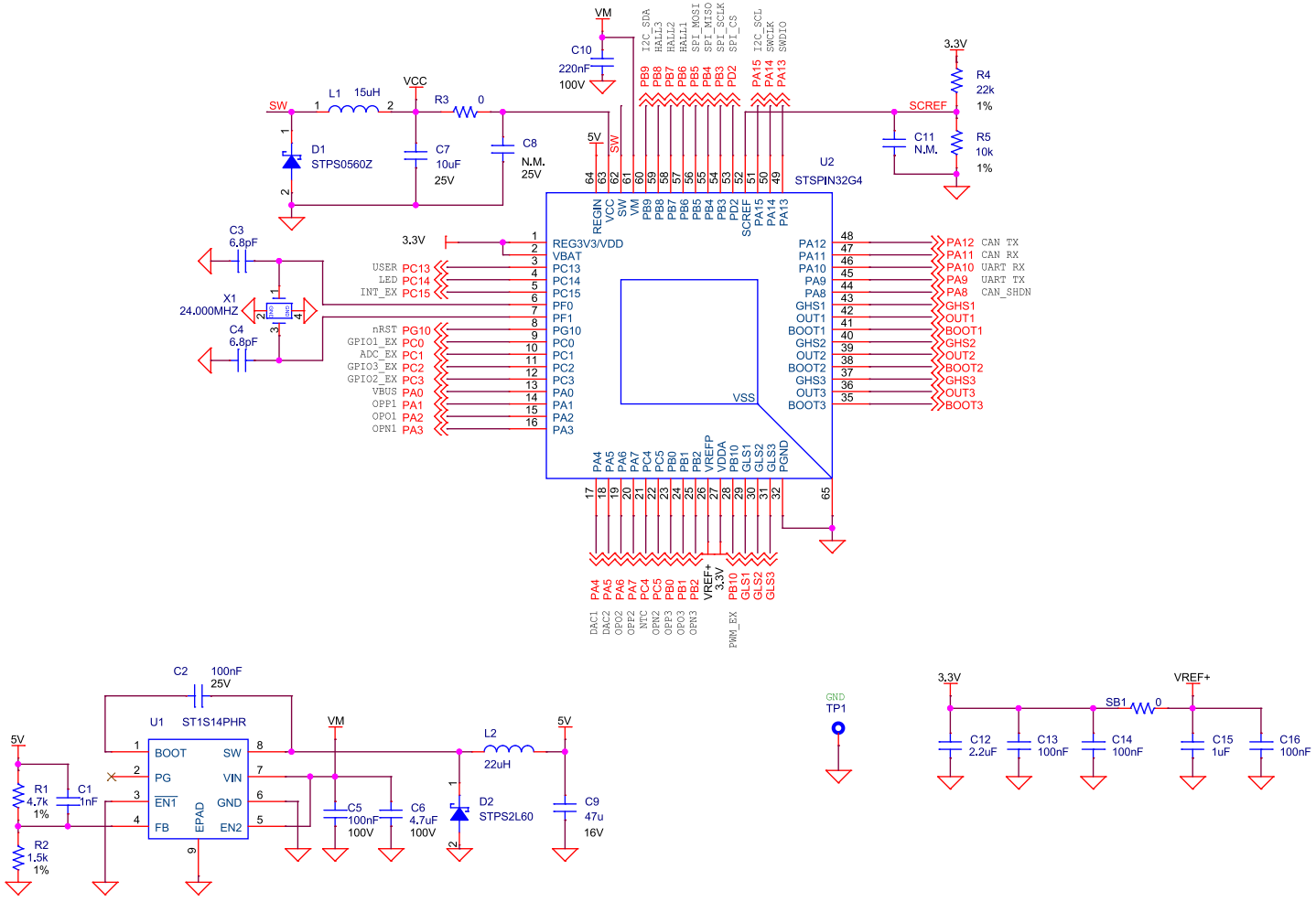


Figure 2. EVLSPIN32G4-ACT schematic (2 of 4): Power stage

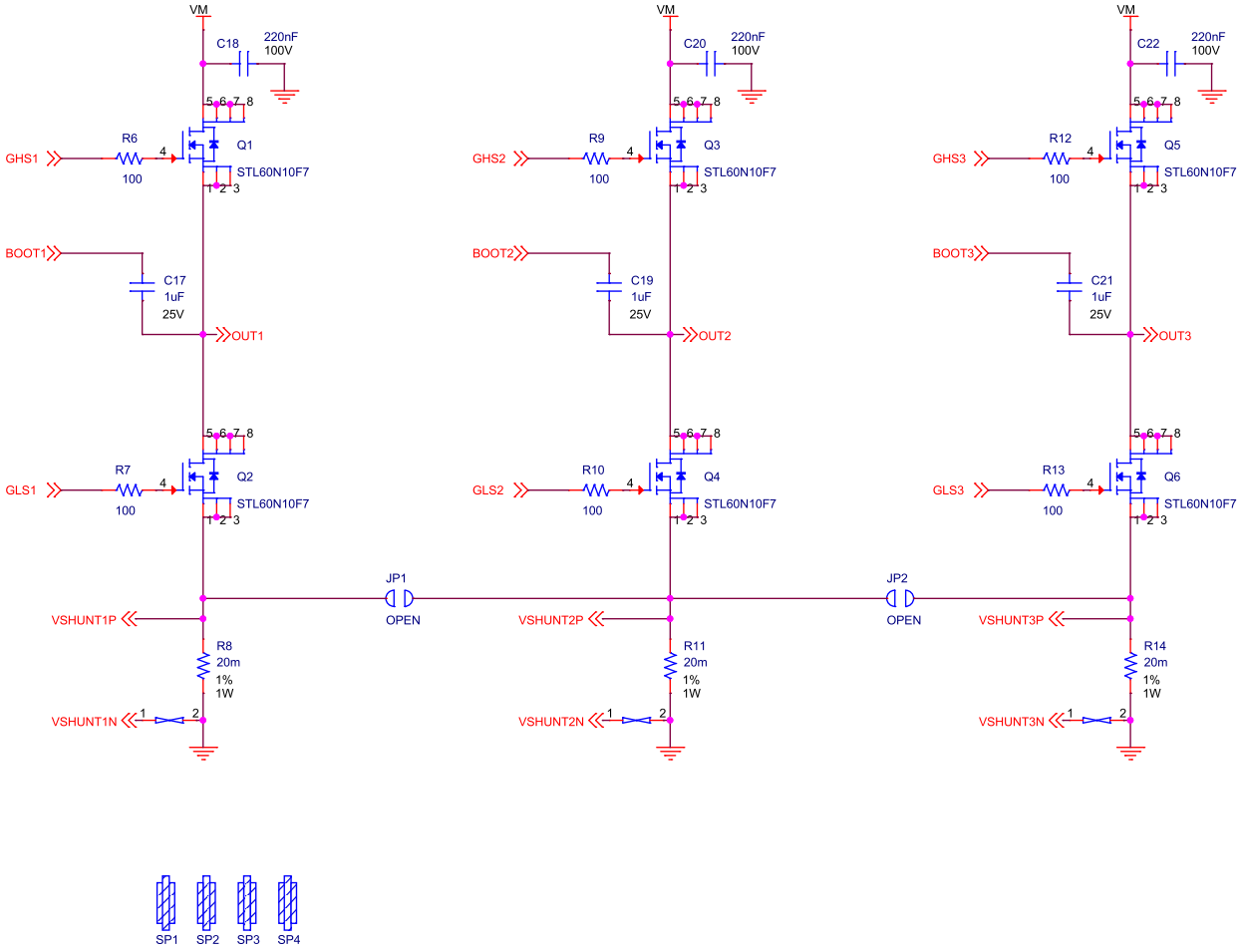


Figure 3. EVLSPIN32G4-ACT schematic (3 of 4): Sensing

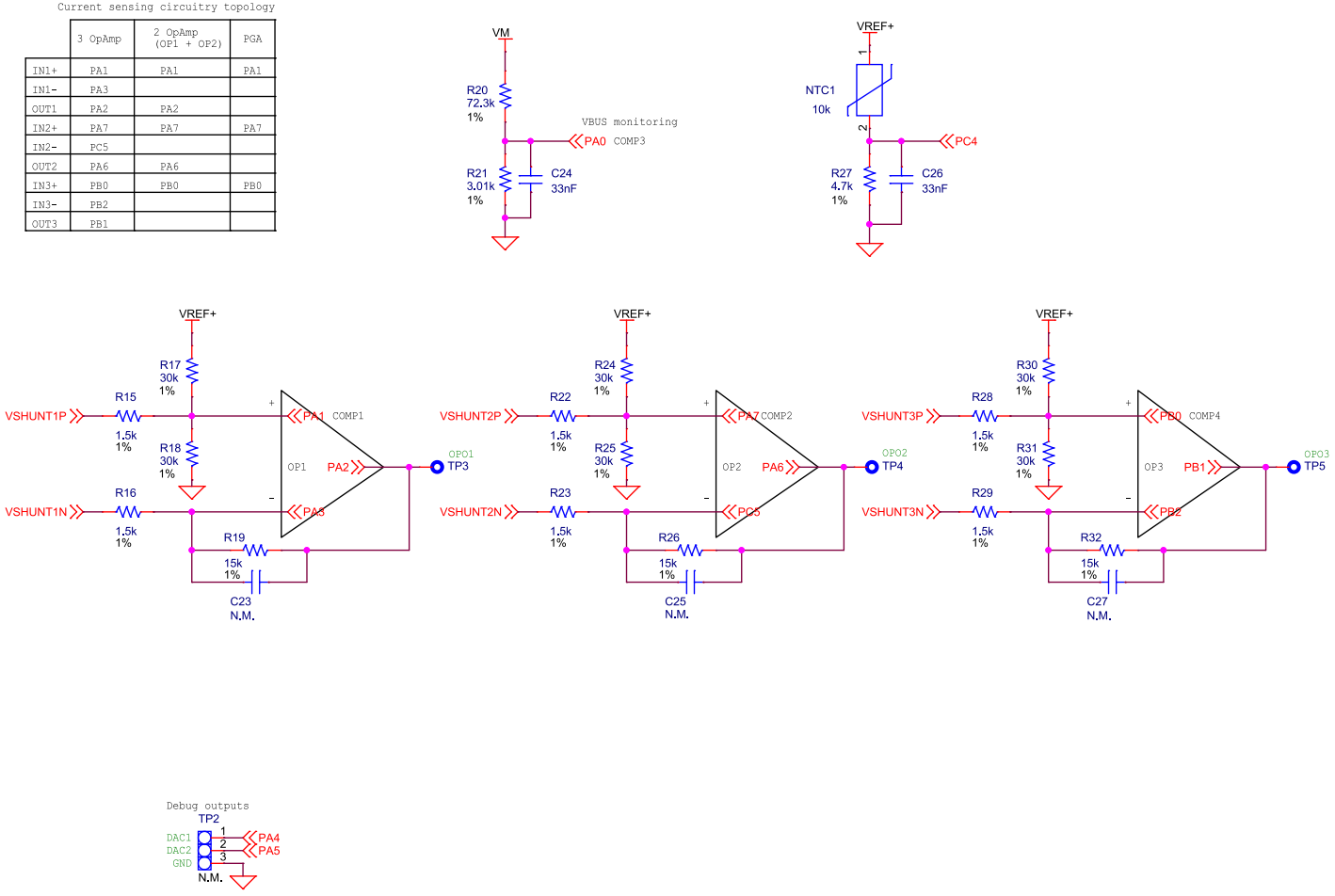
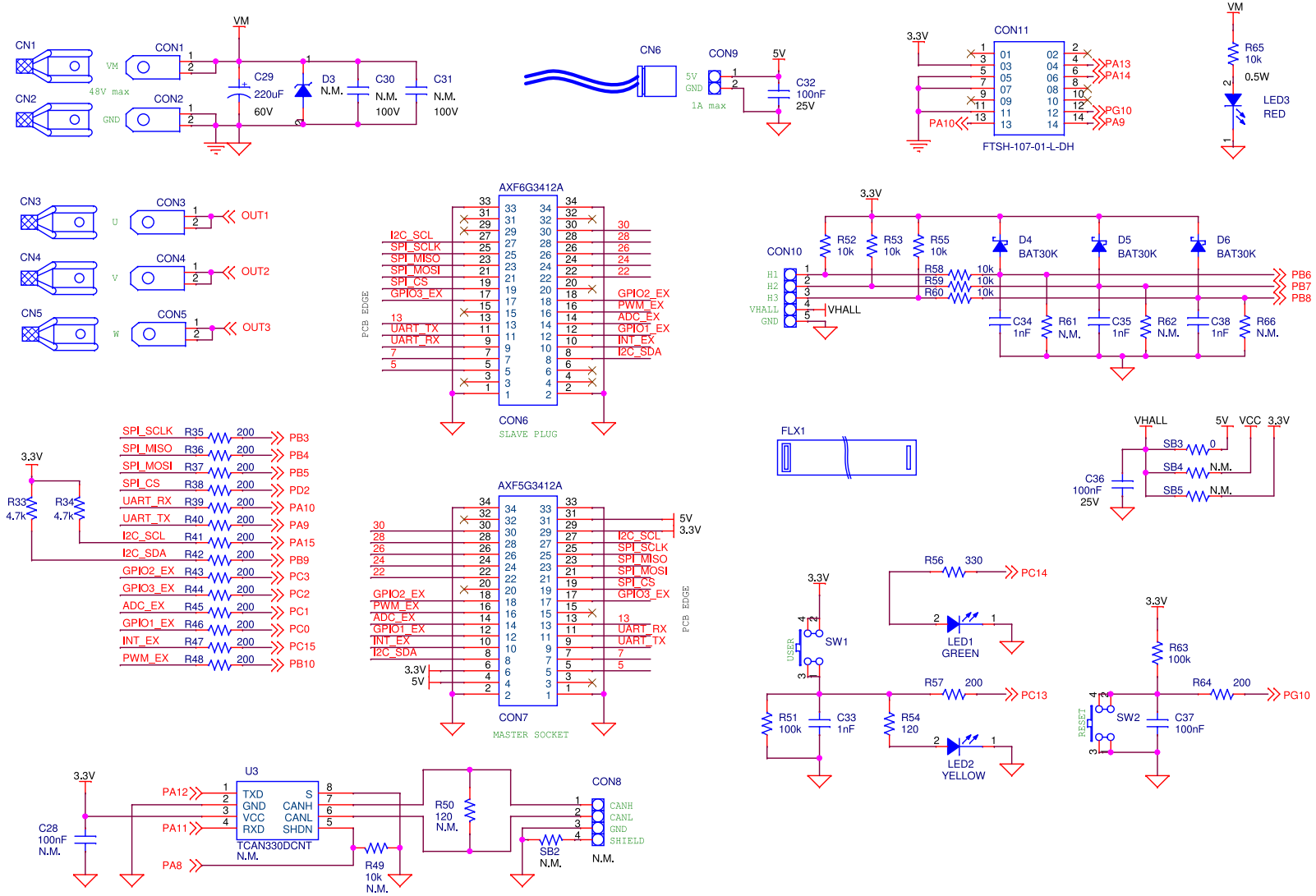


Figure 4. EVLSPIN32G4-ACT schematic (4 of 4): Inputs and outputs



1.2 Bill of material

Table 2. EVLSPIN32G4-ACT bill of materials

Item	Q.ty	Reference	Description	Value
1	5	CN1, CN2, CN3, CN4, CN5	Insulated female Faston wire to board connector, 6.35 x 0.8mm Tab size, 1.5mm² to 2.5mm²	267-4170
2	1	CN6	Wire jumper, pitch 2.54mm, length 10mm, 26 - 20 AWG	
3	5	CON1, CON2, CON3, CON4, CON5	Tab FASTON .250 Series	928814-1
4	1	CON6	High current connectors for board-to-FPC/for board-to-board P4SP (0.4mm pitch)	AXF6G3412A
5	1	CON7	High current connectors for board-to-FPC/for board-to-board P4SP (0.4mm pitch)	AXF5G3412A
6	1	CON8	2.54mm pitch C-Grid III header, single row, right-angle, 4 circuits, 0.38µm gold selective plating	N.M.
7	1	CON9	2.54mm pitch C-Grid III header, single row, right-angle, 2 circuits, 0.38µm gold selective plating	61300211021
8	1	CON10	2.54mm pitch C-Grid III header, single row, right-angle, 5 circuits, 0.38µm gold selective plating	61300511021
9	1	CON11	Surface mount micro header (1.27mm) .050" pitch FTSH series	FTSH-107-01-L-DH
10	1	C1	SMT ceramic capacitor 0402	1nF, 25V, 10%
11	1	C2	SMT ceramic capacitor 0603	100nF, 25V, 10%
12	2	C3, C4	SMT ceramic capacitor 0402	6.8pF, 6.3V, 0.25pF
13	1	C5	SMT ceramic capacitor 0805	100nF, 100V, 10%
14	1	C6	SMT ceramic capacitor 1210	4.7uF, 100V, 10%
15	1	C7	SMT ceramic capacitor 0805	10uF, 25V, 10%
16	1	C8	SMT ceramic capacitor 0402	N.M.
17	1	C9	SMT ceramic capacitor 1210	47u, 16V, 20%
18	4	C10, C18, C20, C22	SMT ceramic capacitor 0805	220nF, 100V, 10%
19	4	C11, C23, C25, C27	SMT ceramic capacitor 0402	N.M.
20	1	C12	SMT ceramic capacitor 0603	2.2uF, 6.3V, 10%
21	4	C13, C14, C16, C37	SMT ceramic capacitor 0402	100nF, 6.3V, 10%
22	1	C15	SMT ceramic capacitor 0603	1uF, 6.3V, 10%
23	3	C17, C19, C21	SMT ceramic capacitor 0603	1uF, 25V, 10%
24	2	C24, C26	SMT ceramic capacitor 0402	33nF, 6.3V, 10%
25	1	C28	SMT ceramic capacitor 0402	100nF, 6.3V, 10%
26	1	C29	THT electrolytic capacitor	220uF, 60V, 20%
27	2	C30, C31	SMT ceramic capacitor 0603	10nF, 100V, 10%
28	2	C32, C36	SMT ceramic capacitor 0603	100nF, 25V, 10%
29	4	C33, C34, C35, C38	SMT ceramic capacitor 0402	1nF, 6.3V, 10%
30	1	D1	Schottky rectifier SOD-123	STPS0560Z
31	1	D2	Low drop power Schottky rectifier SMA	STPS2L60

Item	Q.ty	Reference	Description	Value
32	1	D3	Transient voltage suppressor diode SMA	N.M.
33	3	D4, D5, D6	Small signal Schottky diodes SOD-523	BAT30K
34	1	FLX1	Flexible cable for STWIN.box, 40mm length	STEVAL-FLTCB04
35	2	JP1, JP2	SMT jumper 0805	Open
36	1	LED1	Chip LED 0603	Green
37	1	LED2	Chip LED 0603	Yellow
38	1	LED3	Chip LED 0805	Red
39	1	L1	WE-LQS SMT semi-shielded power inductor	15uH, 1.4A, 20%
40	1	L2	Robust SMT shielded power inductor	22uH, 1.41A, 20%
41	3	NET1, NET2, NET3	PCB short	N.M.
42	1	NTC1	NTC thermistor 0603	10k, 1%
43	6	Q1, Q2, Q3, Q4, Q5, Q6	N-channel 100V, 14.5 mohm typ., 12A, STripFET F7 DeepGATE power MOSFET	STL60N10F7
44	2	R1, R27	SMT resistor 0402	4.7k, 0.064W, 1%
45	7	R2, R15, R16, R22, R23, R28, R29	SMT resistor 0402	1.5k, 0.064W, 1%
46	1	R3	SMT resistor 0603	0, 0.1W, 5%
47	1	R4	SMT resistor 0402	22k, 0.064W, 1%
48	1	R5	SMT resistor 0402	10k, 0.064W, 1%
49	6	R6, R7, R9, R10, R12, R13	SMT resistor 0603	100, 0.1W, 5%
50	3	R8, R11, R14	SMT resistor 1206	20m, 1W, 1%
51	6	R17, R18, R24, R25, R30, R31	SMT resistor 0402	30k, 0.064W, 1%
52	3	R19, R26, R32	SMT resistor 0402	15k, 0.064W, 1%
53	1	R20	SMT resistor 0402	72.3k, 0.064W, 1%
54	1	R21	SMT resistor 0402	3.01k, 0.064W, 1%
55		R33, R34	SMT resistor 0402	4.7k, 0.064W, 5%
56	16	R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R57, R64	SMT resistor 0402	200, 0.064W, 5%
57	1	R49	SMT resistor 0402	10k, 0.064W, 5%
58	1	R50	SMT resistor 0402	N.M.
59	2	R51, R63	SMT resistor 0402	100k, 0.064W, 5%
60	6	R52, R53, R55, R58, R59, R60	SMT resistor 0402	10k, 0.064W, 5%
61	1	R54	SMT resistor 0402	120, 0.064W, 5%
62	1	R56	SMT resistor 0402	330, 0.064W, 5%
63	3	R61, R62, R66	SMT resistor 0402	N.M.
64	1	R65	SMT resistor 0805	10k, 0.5W, 5%
65	2	SB1, SB3	SMT resistor 0603	0, 0.1W, 5%

Item	Q.ty	Reference	Description	Value
66	3	SB2, SB4, SB5	SMT resistor 0603	N.M.
67	4	SP1, SP2, SP3, SP4	Nylon spacer	701514000
68	2	SW1, SW2	WS-TASU SMT tact switch	434351045816
69	1	TP1	40x71 mils SMD PAD	S1751-46
70	1	TP2	Strip connector 3 pos, 2.54mm	N.M.
71	3	TP3, TP4, TP5	Test point - PCB 1.5mm diameter	N.M.
72	1	U1	Step-down switching regulator	ST1S14PHR
73	1	U2	**Three-phase brushless motor controller embedding STM32G4 MCU**	**STSPIN32G4**
74	1	U3	TCAN33x 3.3-V CAN transceivers with CAN FD	N.M.
75	1	X1	Low profile quartz crystal	24MHz

Revision history

Table 3. **Document revision history**

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

Contents

List of tables

List of figures

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