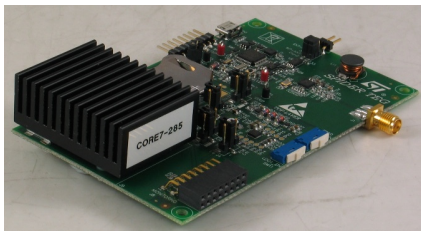
STDES-ERH001V1

Data brief

TEG harvester (based on SPV1050) and wireless transmission board of the kit STDES-IDS003V1



Features

- This board (STDES-ERH001V1), used with the STDES-ERH002V1 companion board, forms an autonomous wireless sensor node based on the SPV1050 ULP energy harvester and battery charger
- Typical use case with 3-axis accelerometer, temperature sensor and air pressure sensor on board
- TEG module soldered on bottom
- Lithium coin cell battery
- Compatible with the user-friendly STSW-IDS002V1 software for the remote reading of sensors and monitoring of electrical parameters
- Can be used with the STDES-ERH001D (power monitoring board) to monitor efficiency and all other fundamental electrical parameters
- All featured ST components are:
  - CE Certified
  - RoHS and China RoHS compliant
  - WEEE compliant

Description

The STDES-ERH001V1 is an application design example mounting a thermo-electric generator with heat-sink, a rechargeable 120 mA Li-Ion battery, a harvesting and power manager system based on the SPV1050 device, a set of temperature, air pressure and 3-axis accelerometer sensors, a low power microcontroller and a sub-1 GHz RF transmitter for wireless transmission.

When used in conjunction with the STDES-ERH002V1 companion board (found together in the STDES-IDS003V1 kit), they represent a design example for an autonomous wireless multi sensor node powered by a thermoelectric generator.

The dedicated STSW-IDS002V1 software provides a user-friendly GUI able to show the data sensed by the STDES-ERH001V1 and received by the STDES-ERH002V1.

The STDES-IDS003V1 kit includes another companion board, the STDES-ERH001D, which allows the GUI to also display electrical characteristics of the TEG module and battery, SPV1050 conversion efficiency and MPPT accuracy.

Product summary
STDES-IDS003V1: SPIDEr™ Autonomous wireless multi-sensor node powered by TEG and based on SPV1050
STDES-ERH001V1: TEG harvester (based on SPV1050) and wireless transmission board of the kit STDES-IDS003V1
STDES-ERH002V1: Wireless receiver board of the kits STDES-IDS003V1 and STDES-IDS002V1
STDES-ERH001D: Power monitoring board of the kits STDES-IDS003V1 and STDES-IDS002V1
STSW-IDS002V1: GUI for STEVAL-ISV021V1, STDES-IDS002V1 and STDES-IDS003V1
SPV1050: Ultra low power energy harvester and battery charger with embedded MPPT and LDOs

1 Bill of material

Table 1. **STDES-ERH001V1 bill of materials**

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
1	1	BT1	Li-Ion, 3v6-120 mAh, 2450	Li-Ion battery	MULTICOMP	LIR2450
2a	1	U13		Battery holder	KEYSTONE	3008
2b	0	U13 (DNM, alternate part)		Thin film battery	ST	EFL700A39
3	9	C1,C2,C3,C7, C13,C15,C33, C42,C43	100nF	MLCC Capacitor	MURATA	GCM155R71C104KA55
4	1	C4	22µF	MLCC capacitor	TDK	C1608X5R0J226M
5	2	C5, C6	6pF	MLCC capacitors	MULTICOMP	MCCA000087
6	0	C8 (DNM)		MLCC Capacitors		
7	2	C9, C20	10µF	MLCC capacitors	MURATA	GRM188R60J106ME47D
8	5	C10,C14,C34, C35,C37	1µF	MLCC capacitors	MURATA	GCM188R71E105KA64
9	2	C38, C45	2.2µF	MLCC capacitors	MURATA	GRM188R61E225KA12D
10	1	C11	100pF	MLCC capacitors	MURATA	GRM1555C1H101JZ01D
11	3	C12,C16,C28	330pF	MLCC capacitors	YAGEO	CC0402KRX7R9BB331
12	0	C17, Ctun1 (DNM)		MLCC capacitors		
13	0	C18, C23 (DNM)		MLCC capacitors		
14	1	C19	220pF	MLCC Capacitors	AVX	06035A221JAT2A
15	2	C21, C31	220pF	MLCC Capacitors	MURATA	GRM1555C1H221JA01D
16	1	C22	7pF	MLCC Capacitors	MURATA	GRM1555C1H7R0BA01D
17	1	C24	2.4pF	MLCC Capacitors	MURATA	GRM1555C1H2R4BA01D
18	1	C25	3.6pF	MLCC Capacitors	MURATA	GRM1555C1H3R6CA01D
19	2	C26, C27	18pF	MLCC Capacitors	MULTICOMP	MC0402N180J500CT
20	1	C29	10nF	MLCC Capacitors	MURATA	GCM155R71H103KA55
21	1	C30	1.5pF	MLCC Capacitors	MURATA	GRM1555C1H1R5WA01D
22	1	C32	2pF	MLCC Capacitors	MULTICOMP	MC0402N2R0C500CT
23	1	C36	100nF	MLCC Capacitors	TDK	C1608X7R1H104K080AA
24	2	C39, C40	47µF	MLCC Capacitors	KEMET	C0805C476M9PACTU
25	1	C41	10nF	MLCC Capacitors	MURATA	GRM188R71H103KA01D
26	1	C44	470nF	MLCC Capacitors	MURATA	GRM188R71A474KA61D
27	1	CN1	1A	USB-MICRO-B	TE CONN	1981568-1
28	1	CN2	100 Mils 1 row, 2 ways	2 pins plug	MULTICOMP	MC34745
29	0	Ctun2 (DNM)		MLCC Capacitors		
30	1	CX1	2.2µF	MLCC Capacitors	KEMET	C0805C225K4RAC

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
31	4	D1,D2,D3,D4	0.1A, 100V	Diode	ST	TMMBAT41
32	1	D5	5v6	Zener	NXP	BZX384-B5V6
33	1	J1	5pin, 50Ω	Socket for Antenna	RS	526-5785
34	1	J2	1 row, 2 way	2 pins plug	TOPTECK	PH1S25-140GB 6/3-L
35	0	J4	1 row, 3 way	3 pins plug	FCI	95293-101-03LF
36	4	J3, J5, J6, J7	1 row, 3 ways	3 pins plug	FCI	95293-101-03LF
37	1	J8	2 rows, 8 ways	16 pins plug	SAMTEC	SMH-108-02-G-D
38	1	JP1	2 rows, 6 ways	6 pins plug	MOLEX	87758-0616
39	1	L1	10µH	Inductor	MURATA	LQM21FN100M70L
40	1	L2	27nH	Inductor	COILCRAFT	0402CS-27NXGLU
41	1	L3	100nH	Inductor	MURATA	LQG15HSR10J02
42	0	L4 (DNM)		Inductor		
43	1	L5	3.6nH	Inductor	MURATA	LQG15HN3N6S02
44	1	L6	5.1nH	Inductor	MURATA	LQG15HN5N1S02
45	1	L7	0Ω	Resistor	YAGEO	RC0402JR-070RL
46	1	L8	18nH	Inductor	MURATA	LQG15HN18NJ02
47	2	L9, L10	15nH	Inductor	MURATA	LQG15HN15NJ02
48	1	L11	4.7µH	Inductor	EPCOS	B82464A4472M
49	1	L12	22µH	Inductor	COILCRAFT	LPS4018-223
50	1	P1	1 row, 8 ways	8 ways connector	MULTICOMP	MC34753
51	13	R1,R2,R3,R4, R5,R16,R17, R18,R19,R20, R26, R27,R28	100Ω	Resistor	YAGEO	RC0402FR-07100RL
52	2	R6, R7	10Ω	Resistor	YAGEO	RC0402FR-0710RL
53	2	R8, R9	100kΩ	Resistor	YAGEO	RC0402FR-07100KL
54	4	R10,R11, R12,R13	10kΩ	Resistor	YAGEO	RC0402FR-0710KL
55	1	R14	560Ω	Resistor	YAGEO	RC0402FR-07560RL
56	1	R15	0Ω	Resistor	YAGEO	RC0402JR-070RL
57	2	R21, R29	750kΩ	Resistor	VISHAY	CRCW0603750KFKEA
58	1	R22	240kΩ	Resistor	VISHAY	CRCW0603240KFKEA
59	1	R23	120kΩ	Resistor	VISHAY	CRCW0603120KFKEA
60	1	R24	100kΩ	Resistor	YAGEO	RC0603FR-07100KL
61	1	R25	422kΩ	Resistor	PANASONIC	ERJ-3EKF4223V
62	2	R31, R32	2MΩ	Resistor	VISHAY	CRCW06032M00FKEA
63	1	R33	5.6MΩ	Resistor	VISHAY	CRCW06035M60FKEA
64	1	R34	1.8MΩ	Resistor	VISHAY	CRCW06031M80FKEA

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
65	3	R35, R37, R38	3MΩ	Resistor	VISHAY	CRCW06033M00FKEA
66	1	R36	750kΩ	Resistor	VISHAY	CRCW0603750KFKEA
67	1	R39	5.36kΩ	Resistor	PANASONIC	ERA-3AEB5361V
68	1	R40	2.05kΩ	Resistor	VISHAY	CRCW06032K05FKEA
69	1	SW1	50mA push button	Push button	OMRON	B3U-1100P-B
70	4	SW2,SW4,SW6,SW7	5Ω Dual SPDT switch/2:1 Multiplexer	Dual SPDT switch/2:1 Multiplexer	ST	STG3682QTR
71	4	SW3,SW5,SW8,SW9	0.5Ω Dual SPDT switch	0.5 Ω dual SPDT switch	ST	STG5223QTR
72	2	SW10,SW11	0.5A slide switch	1 row, 3 ways slide switch	WURTH	450302014072
73	3	TP1, TP3, TP17	BLACK	TEST POINT	KEYSTONE	5001
74	2	TP2, TP4	RED	TEST POINT	KEYSTONE	5000
75	0	TP5 to TP16, TP18 (DNM)	TEST POINT	TEST POINT	-	-
76	1	U1	MCU	STM32 MCU	ST	STM32F103CBT6
77	1	U2	12 bits, 0.0625°C resolution	T-SENSOR	ST	STTS751-0DP3F
78	1	U3	±2g to ±16g Accelerometer	MEMS	ST	LIS3DHTR
79	1	U4	260-1260 hPa Pressure sensor	MEMS	ST	LPS25HTR
80	1	U5	Sub 1GHz transceiver	Wireless Transceiver	ST	SPIRIT1QTR
81	1	U6	8192 × 8 bits (I2C mode)	E2PROM	ST	M24LR64E-RDW6T/2
82	1	U7	50mA voltage regulator	Voltage regulator	ST	STLQ50C-R
83	1	U9	85mA voltage regulator	Voltage regulator	ST	ST715MR
84	1	U10	150mA voltage regulator	Voltage regulator	ST	STLQ015M25R
85	1	U11	Harvester and battery charger	Harvester and battery charger	ST	SPV1050TTR
86	1	U12	Thermo-Electric Generator	Thermo-Electric Generator	MicroPelt	TGP-651
87	1	X1	4MHz Oscillator	Crystal Oscillator	MURATA	CSTCR4M00G53Z-R0

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
88	1	X2	32MHz Crystal Oscillator	Crystal Oscillator	ABRACON CORPORATION	ABS07-32.768KHZ-6-T
89	1	XTAL1	50MHz Crystal	Crystal Oscillator	TXC	7M-50.000MAAJ-T
90	1	J9	HEAT Sinker (25.8x33x8 mm3)	HEAT Sinker	FISCHER	SK486
91	1	J10	Magnet	Magnet	Eclipse	E860
92	1	-	USB Cable (A, micro USB B)	USB Cable (A, micro USB B)		
93	1	J_1	868MHz to 915MHz SMA ANTENNA	ANTENNA	LPRS	ANT-WR868-90

2 STDES-ERH001V1 schematic diagrams

Figure 1. **STDES-ERH001V1 board schematic (1 of 4)**

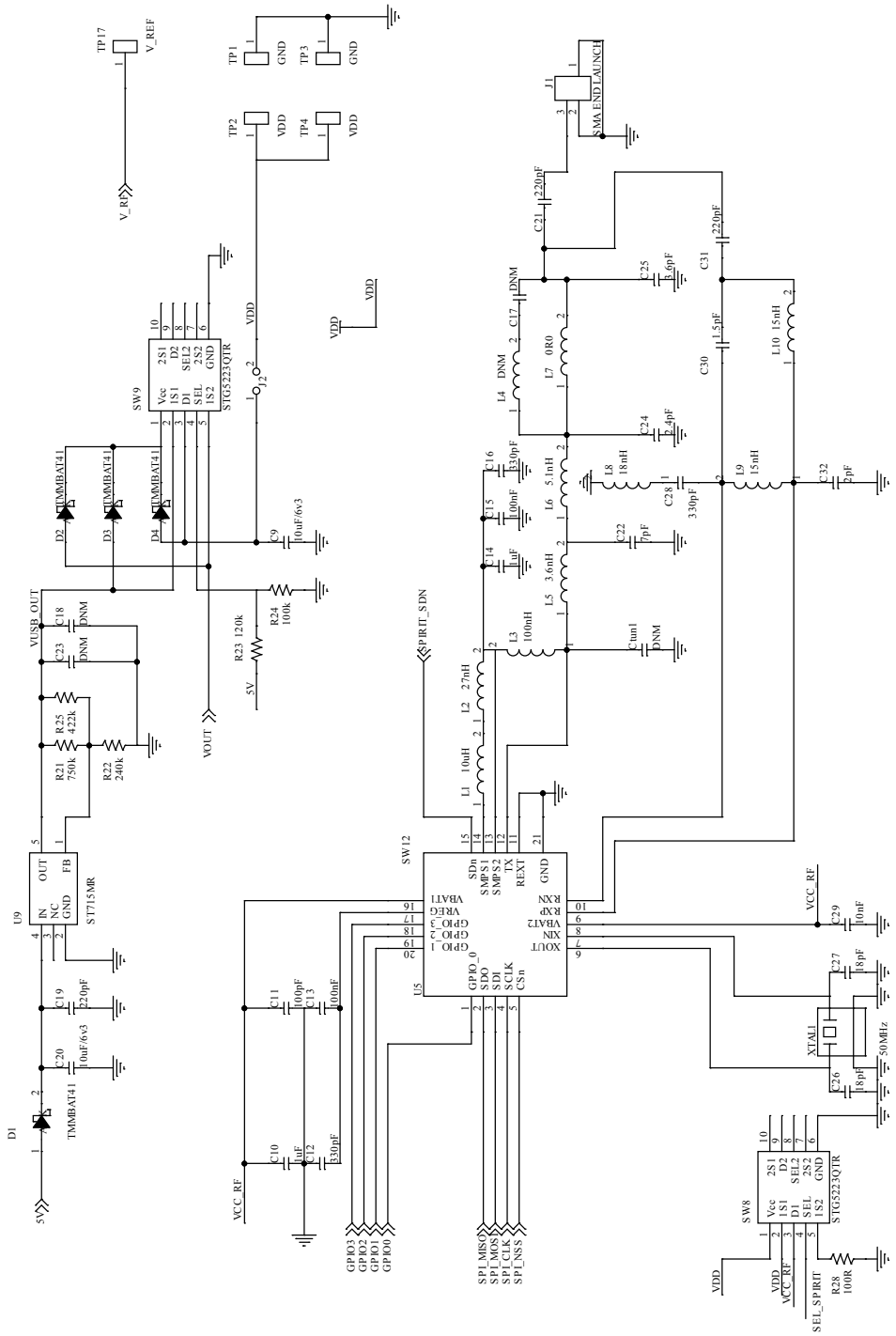


Figure 2. **STDES-ERH001V1 board schematic (2 of 4)**

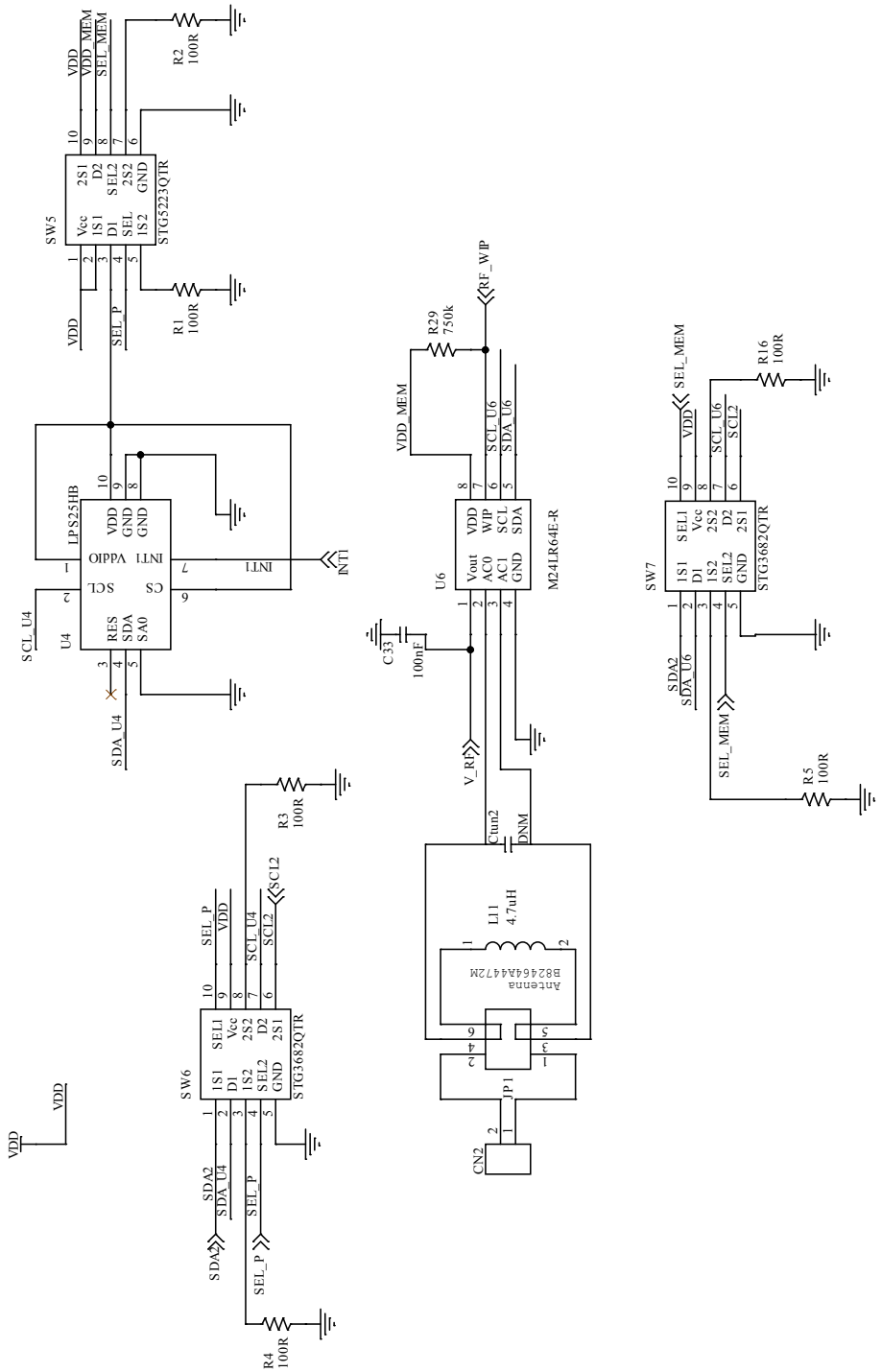


Figure 3. **STDES-ERH001V1 board schematic (3 of 4)**

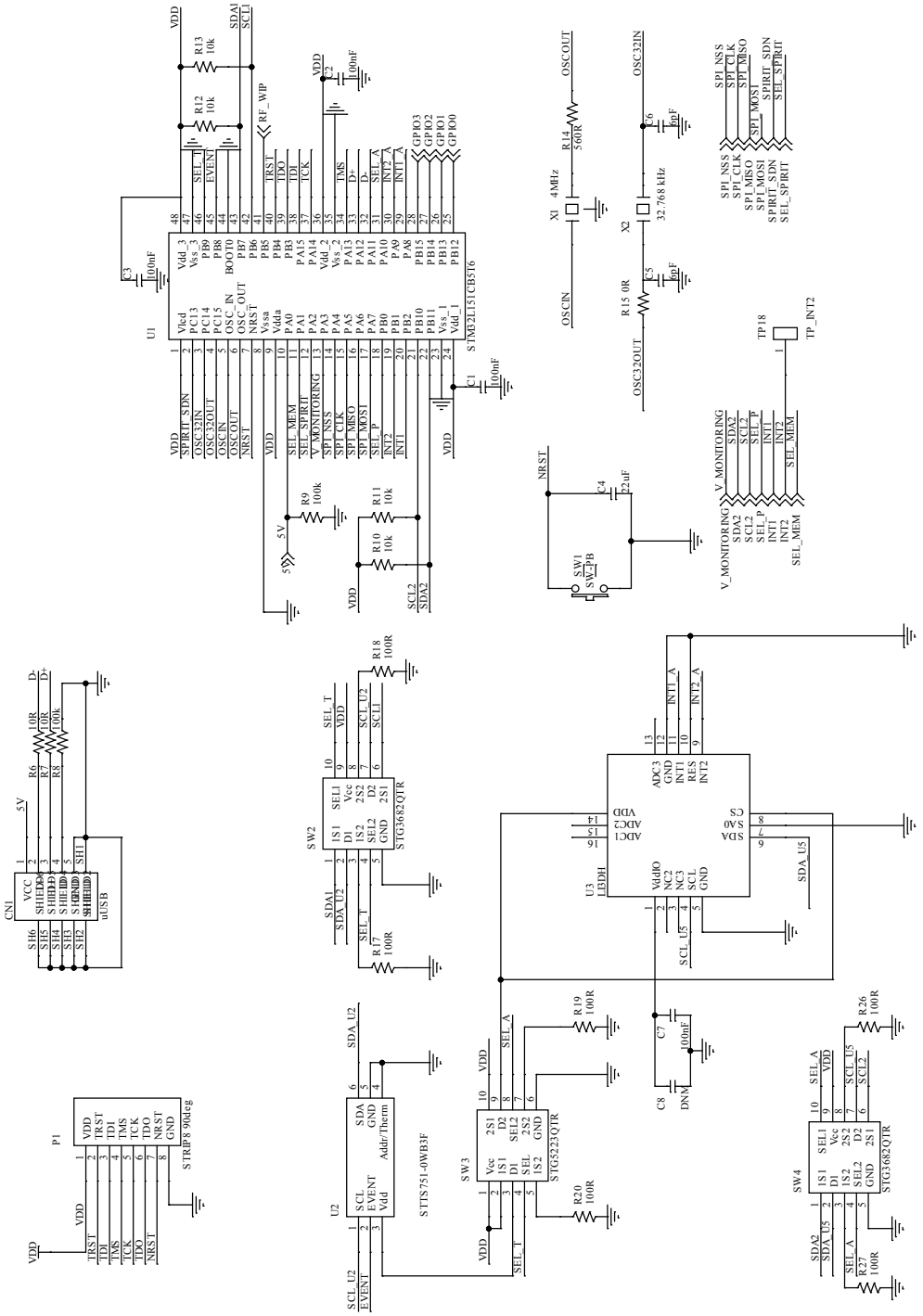
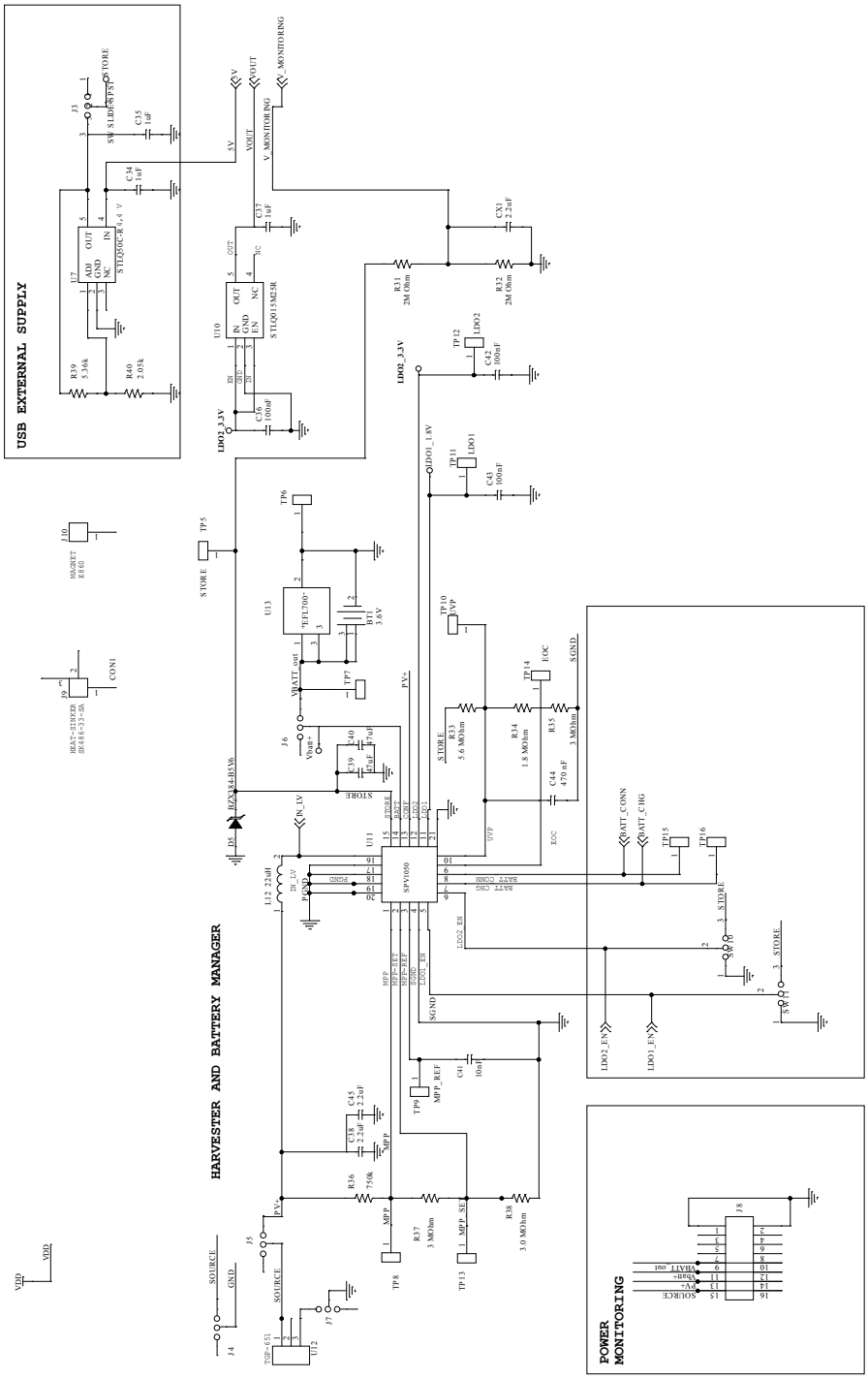


Figure 4. **STDES-ERH001V1 board schematic (4 of 4)**



Revision history

Table 2. Document revision history

Date	Version	Changes
08-Oct-2018	1	Initial release.
04-Feb-2019	2	Updated link in Section 1 Bill of material