EVLONE140W

Data brief

140W USB-PD 3.1 EPR certified reference design based on ST-ONEHP

Product status link
EVLONE140W
ST-ONEHP
LDO40LPURY
L6563S
MASTERGAN1
STL36N60M6

Features

- Universal input mains range: 90 Vac ÷ 264 Vac - Frequency 47 Hz ÷ 63 Hz
- Maximum output power: 140 W
- Dimensions: 85x55x23.5 mm, (L x W x H)
- Power density: 25 W/inch^3
- Efficiency: > 94 % @ full load
- Maximum current output: 5 A
- Output voltage range: 5 Vdc ÷ 28 Vdc
- Outputs:
- SPR: 5 V @ 3.75 A, 9 V @ 3.75 A, 15 V @ 3.75 A, 20 V @ 5 A
- EPR: 28 V @ 5 A
- AVS: 15 V÷28 V @ 5 A with 100 mV step
- USB-PD 3.1 EPR certified
- Protections: brownout, overcurrent protection, overtemperature protection, overvoltage protection, undervoltage protection

Description

The EVLONE140W is one of the first reference design to be certified according to the USB-PD 3.1 EPR standard. It supports a wide range of input voltages and can deliver four SPR outputs, an EPR output and an AVS output up to 28 V at 5 A.

This board is based on ST-ONEHP digital controller in companion with L6563S (PFC controller) and MasterGaN1 (600 V half-bridge GaN power stage), providing a solution with very high-power density exceeding 25 W/inch^3.

ST-ONEHP belongs to ST-ONE family of digital controllers, world's first embedding ARM Cortex M0+ core, an off-line programmable controller with synchronous rectification, and USB PD PHY in a single package.

Such a system is specifically designed to control ZVS non-complementary Active Clamp Flyback (ACF) converters to create high power density chargers and adapters with USB-PD EPR interface.

The device includes the ACF controller and its HV startup on the primary side, a microcontroller and all the peripherals required to control the conversion and the USB-PD communication on the secondary side. The two sides are connected through an embedded reinforced galvanically isolated dual communication channel.

High switching frequency operations in companion with MasterGaN1 power stage allow to use small size magnetic component and allow reaching a very high efficiency (greater than 94%).

1 Schematic diagram and bill of material

Figure 1. **EVLONE140W ACF section schematic (main board)**

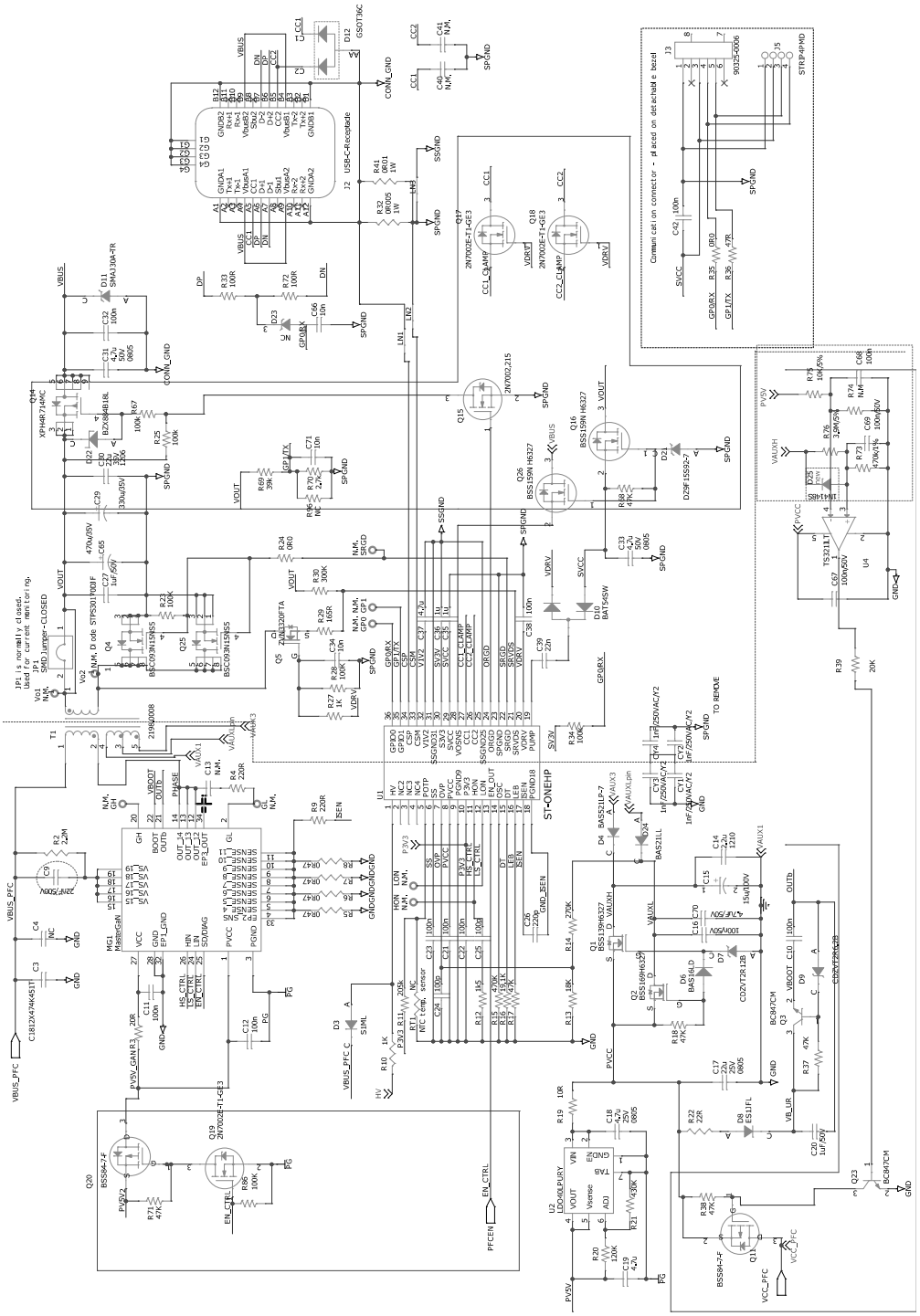

Figure 2. **EVLONE140W PFC section schematic (main board)**

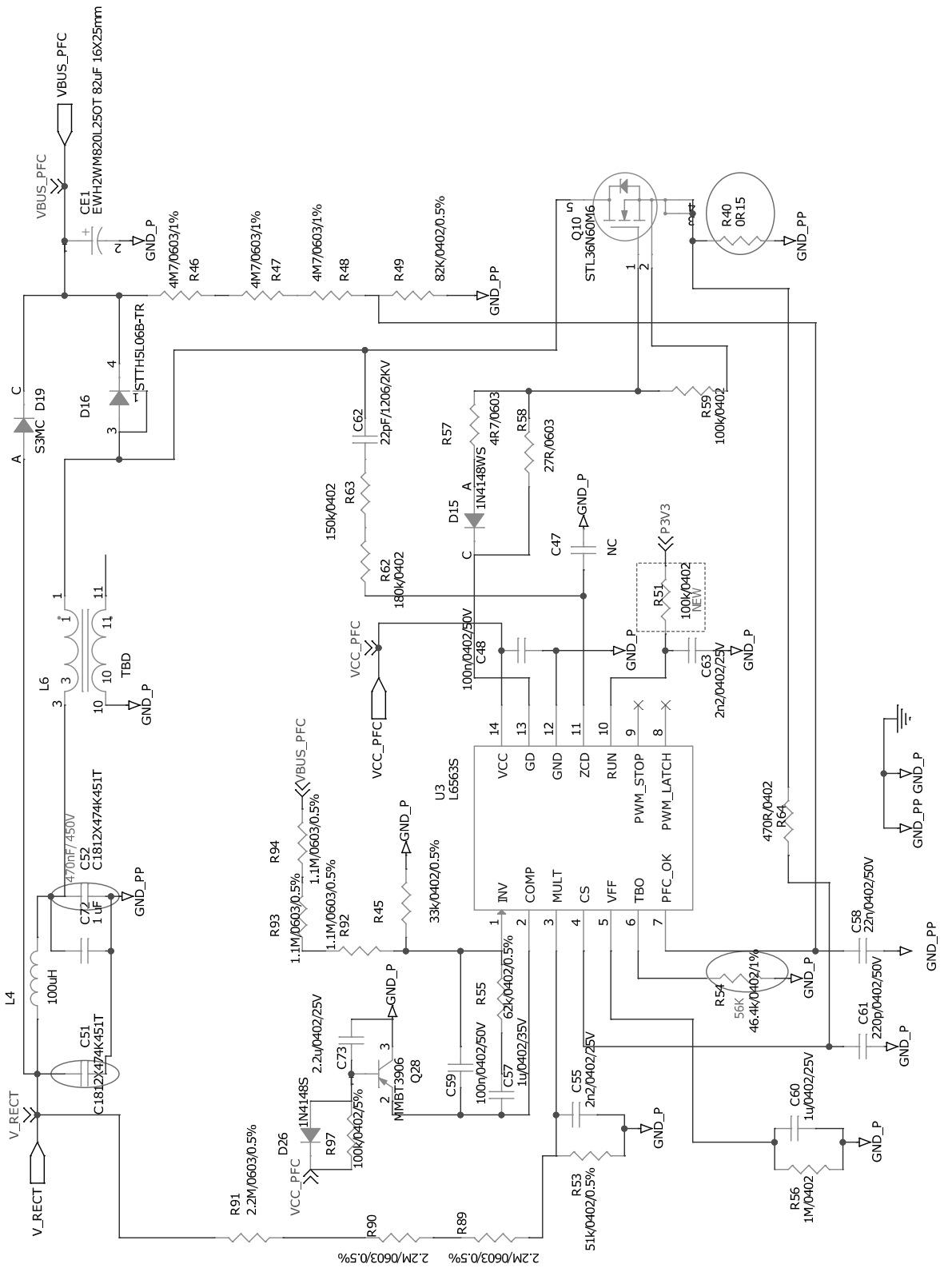

Figure 3. **EVLONE140W bridge diode section schematic (daughterboard)**

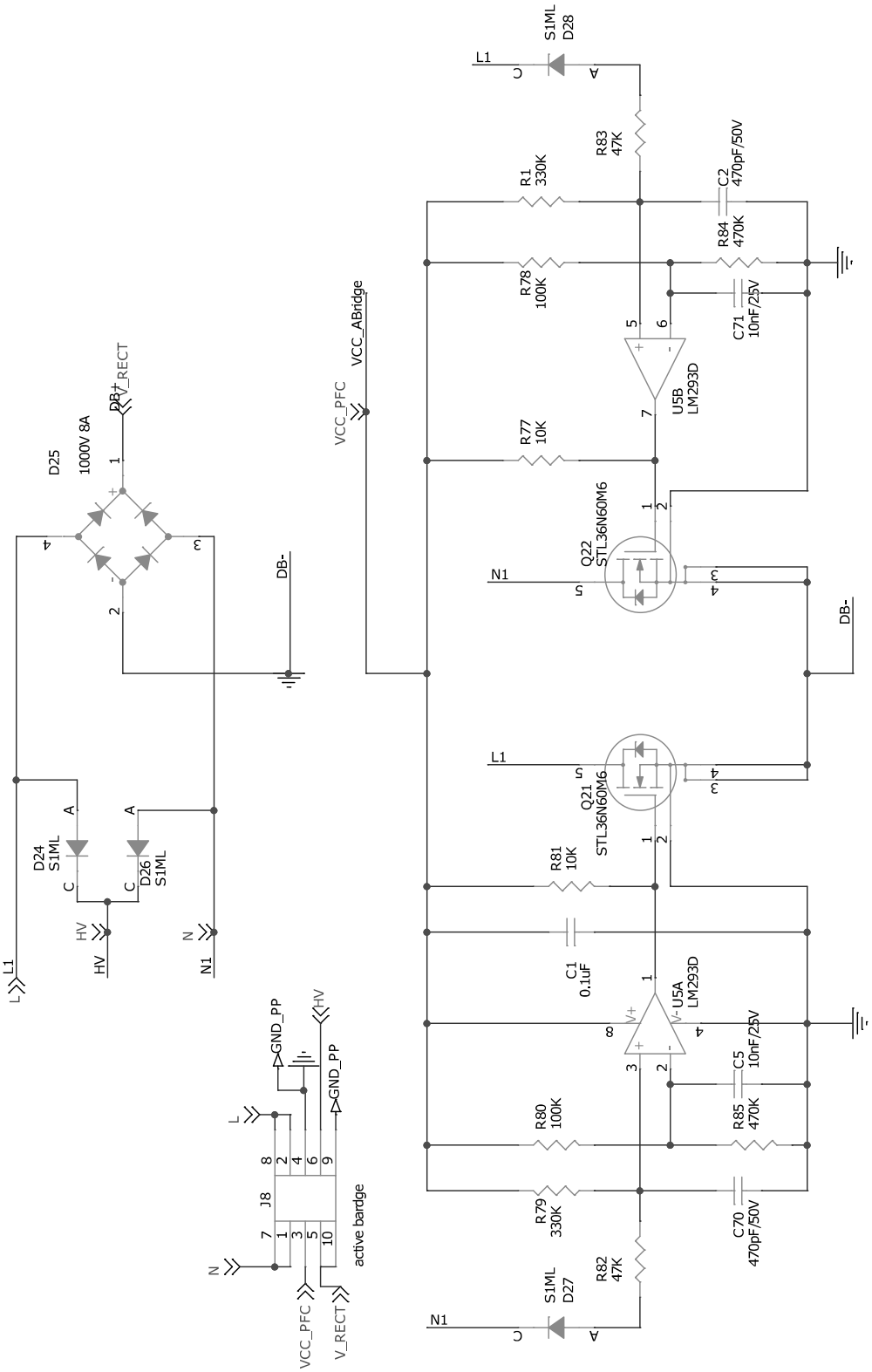

Figure 4. **EVLONE140W input section schematic (main board)**

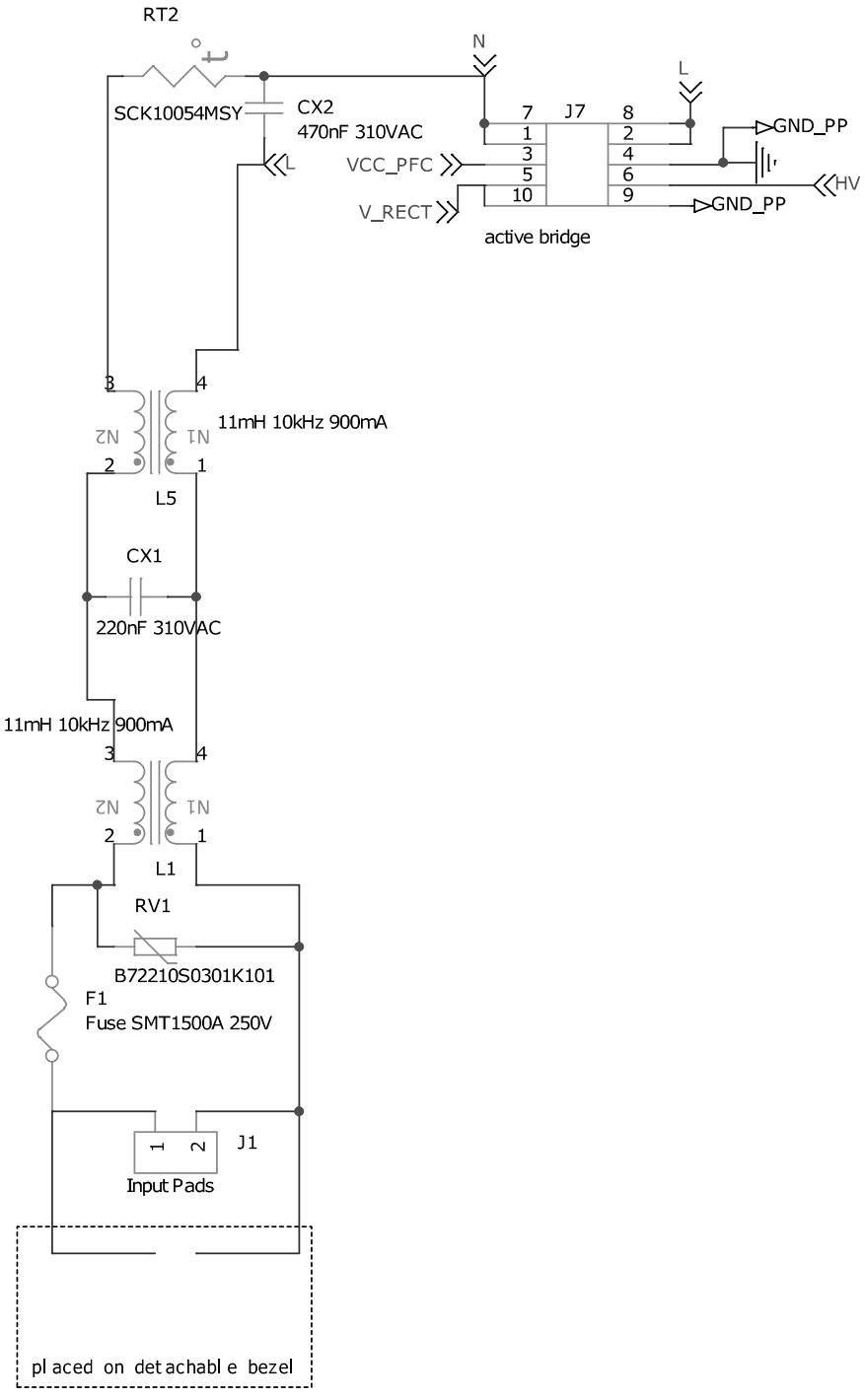

Table 1. Bill of material EVLONE140W main board

Reference	Manufacturer code	Value	Package	Manufacturer
CY1,CY2,CY3,CY4	SCC1808X102k502T	1nF	C_1808	IHHEC
C3	C4532X7T2W474KT000N	470n	C_1812	TDK
C9	CC1206KKX7RBBB223	22n	C_1206	Yageo
C10,C11,C12,C21,C22,C23,C38,C48,C59,C68	C1005X7R1H104KT000F	100n	C_0402	TDK
C13	CC1206JKNPOCBN100	10pF	C_1206	Yageo
C14	885012209071	2.2u	C_1210	Wurth
C16,C32,C42,C67,C69	885012206120	100n	C_0603	Wurth
C17,C30	GRT21BR61E226ME13L	22u	C_0805	Murata
C18,C19,C31,C33,C37	CGA4J3X5R1H475KT0Y0N	4.7u	C_0805	TDK
C24,C25	CGA2B2C0G1H101JT0Y0F	100p	C_0402	TDK
C26	GRM155R71H221JA01D	220p	C_0402	Murata
C20, C27	CC0603KRX7R9BB105	1u	C_0603	Yageo
C30	C3216X5R1V226M160AC	22u	C_1206	TDK
C34,C66,C74	CGA2B3X7R1H103KT0Y0F	10n	C_0402	TDK
C35,C36	C1005X5R1E105KT000E	1u	C_0402	TDK
C39	C1005X7R1E223KT000F	22n	C_0402	TDK
C52	C2220X105K451T	1uF	C_2220	IHHEC
C55,C63	GRM155R61E222KA01D	2n2	C_0402	Murata
C29, C65	SPZ1VM821G18O00RAXXX	820u	Pitch = 5mm, D*H = 10mm*12.5mm	Aishi
C57	C1005X5R1V105KT000E	1u	C_0402	TDK
C58	GCM155R71H223KA55D	22n	C_0402	Murata
C60	GRM155R61E105MA12D	1u	C_0402	Murata
C61	GCM1555G1H221JA16D	220p	C_0402	Murata
C62		10pF/2KV	C_1206	
C73	C1005X5R1V225K050BE	2.2u	C_0402	TDK
C75	C2012X7R1H475K125AE	4.7uF	C_0805	TDK
D3	S1ML R3G		DO-219AB	Taiwan Semi
D4	BAS521LP-7		SOD-882	Diodes
D5	BAS21LLYL		SOD-882	Nexperia
D6	BAS16LD,315		SOD-882	Nexperia
D7	CDZVT2R12B		SOD-923	Rohm Semi
D8	ES1JFL		SOD-123FL	Onsemi
D9	CDZVT2R6.2B		SOD-923	Rohm Semi
D10	BAT54SWT1G		SOT-323-D	Onsemi
D12	GSOT36C-E3-08		SOT-23	Vishay

Reference	Manufacturer code	Value	Package	Manufacturer
D15	1N4148WS		SOD-323	
D19	S3MC		D_SMC	MDD
D21	DZ9F15S92-7		SOD-923	Diodes
D22	BZX884B18L-HG3-08		SOD-882	Vishay
D26, D27	1N4148SOD-323		8SOD-323	JKSemi
J2	2012670005	USB-C-Receptacle	USB-C-MOLEX-2012670005	Molex
Q1	BSS139H6327		SOT-23	Infineon
Q2	CPC3703CTR		SOT-89-3	IXYS
Q3,Q23	BC847CM,315		SOT-883	Nexperia
Q4,Q25	BSC093N15NS5ATMA1		power_flat_5x6	Infineon
Q5	ZVN3320FTA		SOT-23	Diodes
Q11,Q20	BSS84-7-F		SOT-23-3	Onsemi
Q14	RS1G201A FDWS9508L-F085 XPH3R114MC,L1XHQ SIR681DP-T1-RE3	4.8mohm P-MOSFET	POWER 5*6	ROHM
Q15	2N7002,215		SOT-23	Nexperia
Q17,Q18,Q19	2N7002E-T1-GE3		SOT-23-3	Vishay
Q16,Q26	BSS159N H6327		SOT-23-3	Infineon
Q28	BC807-40W,115		SOT-323-3	Nexperia
RT1		NC	r_0402	
R15	RC0402FR-07470KL	470K	r_0402	Yageo
R2	AC0805JR-072M2L	2.2M	r_0805	Yageo
R3	RC0603FR-0720RL	20R	r_0603	Yageo
R4,R9	RC0402FR-07220RL	220R	r_0402	Yageo
R5,R6,R7,R8	SR731JTTDR470F	0R47	r_0603	KOA
R10	RC0603FR-071KL	1K	r_0603	Yageo
R11	RC0402FR-07205KL	205k	r_0402	Yageo
R12	0402WGJ0152TCE	1k5	r_0402	UNI-Royal
R13	RC0402JR-0718KL	18K	r_0402	Yageo
R14	CRCW0402270KJNED	270K	r_0402	Vishay
R15	ERJ2GEJ474X	470K	r_0402	Panasonic
R16,R18,R37,R38,R68,R71	RC0402FR-0747KL	47K	r_0402	Yageo
R17		93k	r_0402	
R19	CRCW040210R0FKTD	10R	r_0402	Vishay
R20	AC0402JR-07120KL	120K/1%	r_0402	Yageo
R21	RC0402FR-07430KL	430K/1%	r_0402	Yageo
R22	RC0805JR-7W22RL	22R	r_0805	Yageo

Reference	Manufacturer code	Value	Package	Manufacturer
R23,R25,R28,R34,R67,R86	RC0402FR-07100KL	100k	r_0402	Yageo
R24,R35	MCR01MZPJ000	0R0	r_0402	ROHM
R29		165R	r_0402	
R30		300k	r_0402	
R32		0R005/1W	r_0805	
R33,R72	RC0402FR-07100RL	100R	r_0402	Yageo
R36	0402WGJ0470TCE	47R	r_0402	UNI-Royal
R39	ERJ3GEYJ203V	20k	r_0603	Panasonic
R40	PT2512FK-7W0R22L	0R15/1%/2W	r_2512	Yageo
R41	WSLP0805R0100FEA18	0R01/1W	r_0805	Vishay
R45		33k/0.5%	r_0402	
R46,R47 R48	0603WAF4704T5E	4M7/1%	r_0603	UNI-Royal
R49		82K/0.5%	r_0402	
R50	RC0402JR-0747KL	47k	r_0402	Yageo
R51,R59	CRCW0402100KJNEDC	100k	r_0402	Vishay
R53	AC0402DR-0751KL	51k/0.5%	r_0402	Yageo
R54		56k/1%	r_0402	
R55	0402WGD6202TCE	62k/0.5%	r_0402	UNI-Royal
R56	CQ02WGJ0105TCE	1M	r_0402	UNI-Royal
R57	0603WAJ047JT5E	4R7	r_0603	UNI-Royal
R58	0603WAJ0270T5E	27R	r_0603	UNI-Royal
R62		51k	r_0402	
R63		51k	r_0402	
R64	RC0402JR-07470RL	470R	r_0402	Yageo
R69		39k/0.5%	r_0402	
R70		2.7k/0.5%	r_0402	
R73		470k/1%	r_0402	
R74		N.M.	r_0402	
R75		10k/5%	r_0402	
R76		3.9M/5%	r_0402	
R89,R90,R91		2.2M/0.5%	r_0603	
R92,R93,R94		1.1M/0.5%	r_0603	
R97		100k/5%	r_0402	
Vo1, Vo2		N.M.	EQ30Vout	
U1	ST-ONEHP		ssop36-no-ep_0_8	STMicroelectronics
U2	LDO40LPURY		son7p95_300x300x100l40x34t23-1	STMicroelectronics
U3	L6563S		SOIC14P127_865X600X175L83X42N	STMicroelectronics
U4	TS321ILT		SOT23_5P	STMicroelectronics

Reference	Manufacturer code	Value	Package	Manufacturer
MG1	MASTERGAN1		QFN_9x9	STMicroelectronics
Q10	STL36N60M6		PowerFLAT™ 8x8 HV	STMicroelectronics
D11	SMAJ33A-TR		SMA	STMicroelectronics
D16	STTH5L06B-TR		TO-252-3	STMicroelectronics
T1		2198.0008	Wurth_RM8_10P	Wurth
J3	90325-0006		CONN_MOLEX_903250006	Molex
J5	M2510V-04P	STRIP4PMD	sip-4p-2_54	XFCN
J7		Active bridge	61300621121	
JP1		SMD jumper - CLOSED	JUMPER_GOCCIA	
L1	744841247	47uH 100kHz 2A	Pitch = 4.5mm*10mm	Wurth
L4	7447031	100uH 10kHz 2A	Pitch = 6mm	Wurth
L5		TBD		
L6		TBD	Wurth_rm8_4pPFC20220720	Wurth
F1	39213150000	Fuse 3.15A 250V	Pitch = 5.08mm, L*W*H = 8.5*4*8	LittelFuse
CE1	EWH2WM820L25OT	82uF	Pitch = 7.5mm, D*H = 16mm*25mm	Aishi
CX1	890334025027CS	0.22uF	Pitch = 15mm, W*H = 18mm*14mm	Wurth
CX2	890334025039	0.47uF	Pitch = 15mm, W*H = 18mm*11.5mm	Wurth
C15	LKMC1102A270MF	27u	Pitch = 2.5mm, D*H = 6.3mm*11mm	Ymin
RT2	SCK10054MSY		Pitch = 5mm	TKS
RV1	820513011		Pitch = 7.5mm*1.5mm, D*H = 12.5mm*16mm	Wurth

Table 2. Bill of material EVLONE140W daughterboard

Reference	Manufacturer code	Value	Package	Manufacturer
C1	CC0402KRX7R7BB104	0.1uF	C_0402	Yageo
C2,C70	CC0402KRX7R9BB471	470pF/50V	C_0402	Yageo
C5,C71	GRM155R71E103KA01D	10nF/25V	C_0402	Murata
C51	C2220X105K451T	1uF	C_2220	IHHEC
D24,D26,D27,D28	S1ML		SOD-123FL	
D25	TT8MF	1000V 8A	microdiode_tt8mf	MDD
R1,R79	RK73B1ETTP334J	330K	r_0402	KOA
R77,R81	RC0603JR-0710KL	10K	r_0603	Yageo
R78,R80	RC0402JR-07100KL	100K	r_0402	Yageo
R82,R83	0603WAJ0473T5E	47K	r_0603	UNI-Royal
R84,R85	AC0402JR-07470KL	470K	r_0402	Yageo
U5	LM293D		SO-8	STMicroelectronics
Q21,Q22	STL36N60M6		PowerFLAT™ 8x8 HV	STMicroelectronics

Revision history

Table 3. **Document revision history**

Date	Version	Changes
24-Feb-2023	1	Initial release.

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