

Very high power density board - 65W multi-port (USB Type-C and USB Type-A) power delivery



Product status link

EVLONEMP

Features

- Universal input mains range: 90 Vac to 265 Vac - Frequency 47 ÷ 63 Hz
- Maximum output power: 65 W
- Dimensions: 58x36x20mm, (L x W x H)
- Power density: 26 W/in³
- Efficiency: > 93 % @ full load
- Constant current output:
 - 3.75 A max. for USB Type-C® port
 - 2 A max. for USB Type-A port
- Output voltage range:
 - 3.3 ÷ 21 Vdc for USB Type-C port
 - 5 Vdc for USB Type-A port
- PD outputs on USB Type-C port (without load on USB Type-A port):
 - Five fixed PDOs: 5 V@3.75 A, 9 V@3.75 A, 12 V@3.75 A, 15 V@3.75 A, 20 V@3.25 A
 - Two APDOs (PPS): 3.3 V÷16 V@3.75 A, 3.3 V÷21 V@3.25 A
- PD outputs on USB Type-C port (with load on USB Type-A port):
 - Five fixed PDOs: 5 V@3.75 A, 9 V@3.75 A, 12 V@3.75 A, 15 V@3.33 A, 20 V@2.5 A
 - Two APDOs (PPS): 5 V÷16 V@3.3 A, 5 V÷21 V@2.5 A
- PPS mode: 20 mV step for CV, 50 mA step for CC
- Feedback loops: Constant Current and Constant Voltage
- Protections: Brown-out, Overcurrent protection, Overtemperature protection, Overvoltage protection, Undervoltage protection

Description

The EVLONEMP is one of the best power density USB Power Delivery multiport boards with a USB Type-A port and a USB Type-C® port supporting Programmable Power Supply (PPS). The design supports a wide range of input voltages and can deliver 10 W (5 V@2 A) on a Type-A port, and five fixed PDOs and two APDOs on a Type-C port.

This board is based on ST-ONEMP, the world's first digital controller embedding Arm® Cortex® M0+ core, an offline 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 converters to create high power density chargers and adapters with USB Power Delivery interface.

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

High switching operations in companion with MasterGaN power stage allow to use small size magnetic components and allow to reach a very high efficiency.

1 Schematic diagram and bill of material

Figure 1. Motherboard schematic diagram

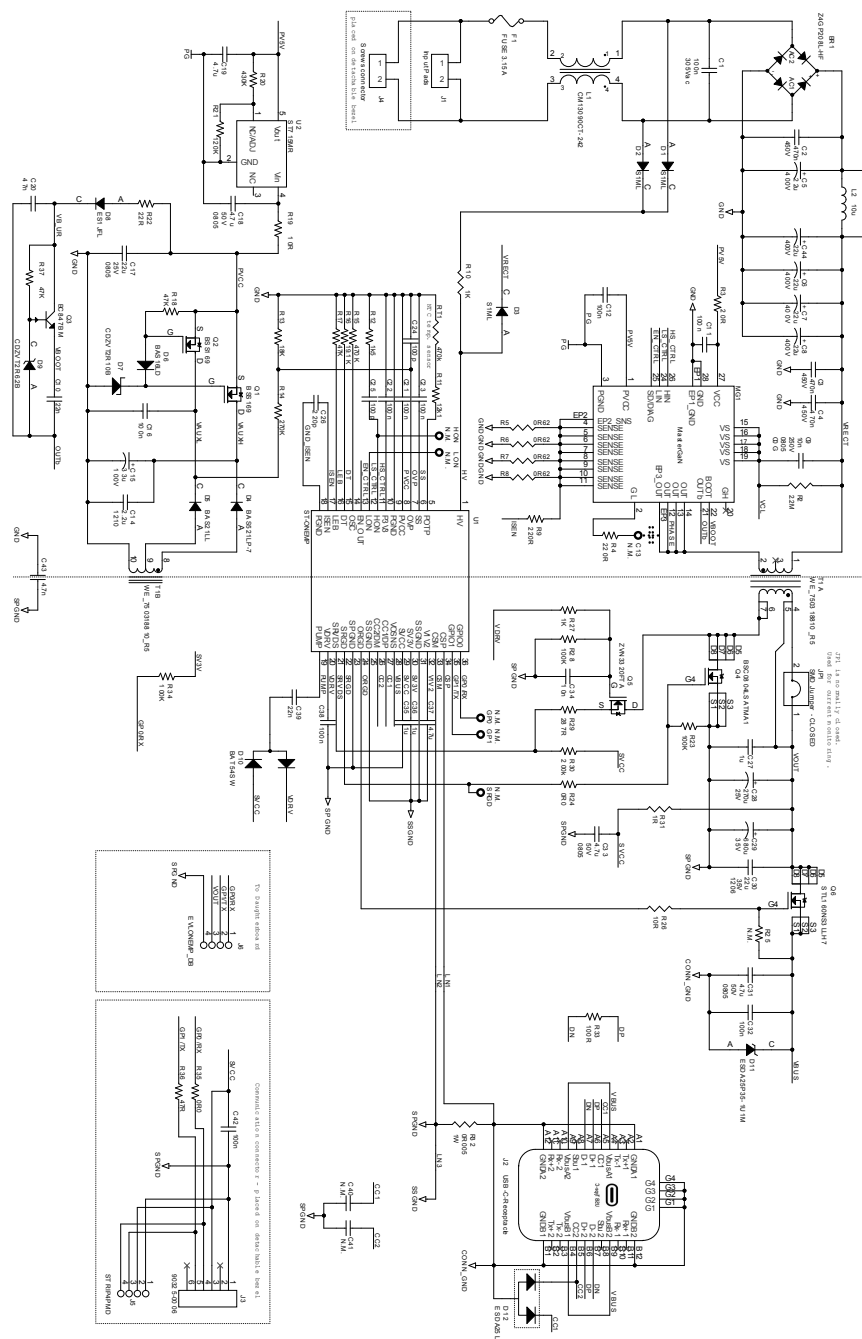


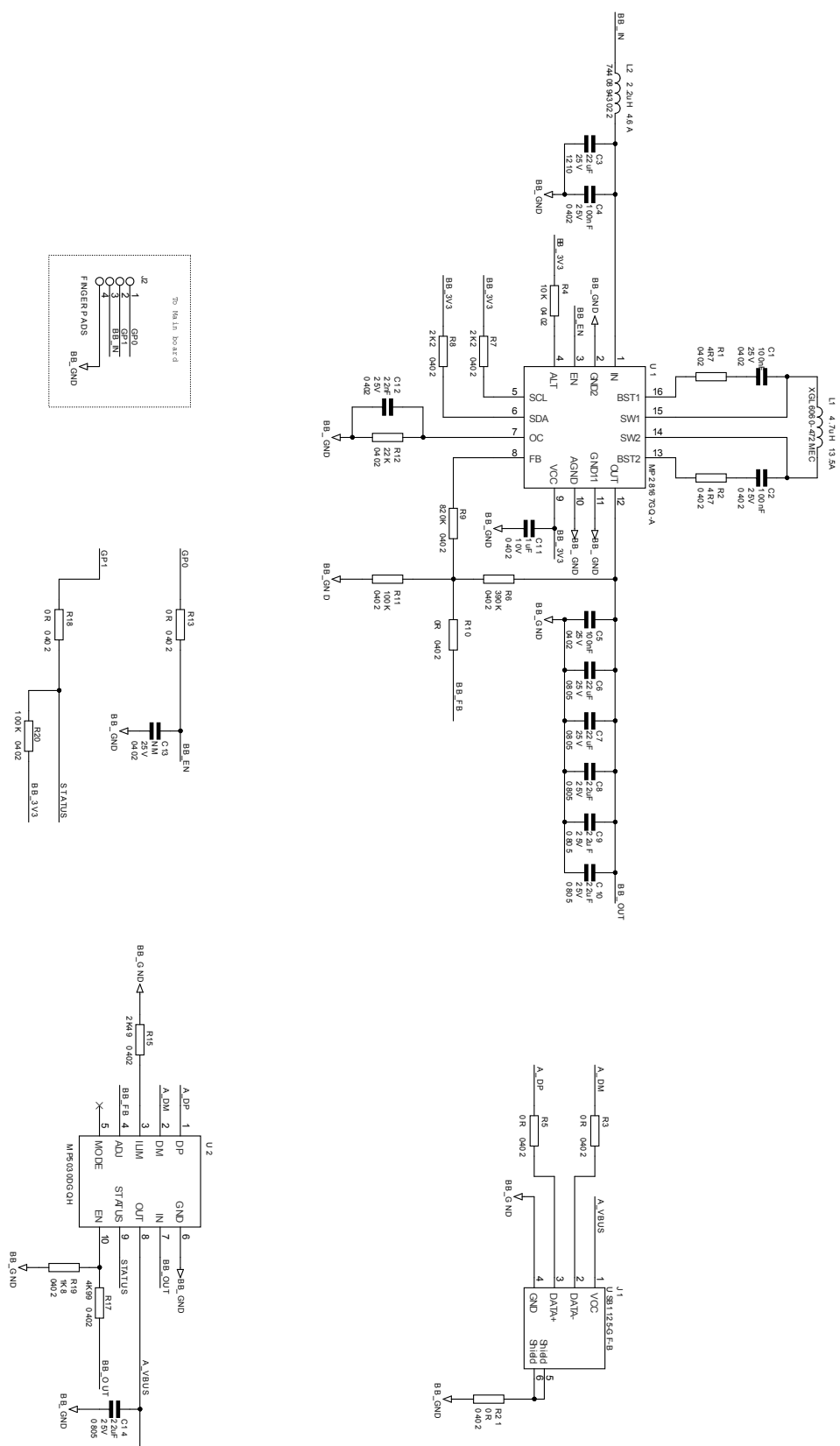
Figure 2. Daughterboard schematic diagram


Table 1. Bill of material motherboard

Reference	Manufacturer code	Value	Description	Package	Manufacturer
BR1	Z4GP208L-HF		Rect bridge GP 800V 2A Z4	Z4	Comchip
C1	B32921C3104M	100n	Radial polypropylene film cap.	Plastic Radial	TDK
C2, C3, C4	CGA8N4X7T2W474K230KA	470n	SMD multilayer ceramic cap.	1812	TDK
C5, C6, C7, C8, C44	860021374027	22u	Aluminum electrolytic capacitor PTH	D8, h16, pitch 3.5mm	Wuerth
C9	C2012C0G2E103J125AA	10n	SMD multilayer ceramic cap.	0805	TDK
C10, C39	885012205052	22n	SMD multilayer ceramic cap.	0402	Wuerth
C11, C12, C21, C22, C23, C32, C38, C42	885012205085	100n	SMD multilayer ceramic cap.	0402	Wuerth
C13, GP0, GP1		N.M.	PTH test point pad. Ignore.		
C14	885012209071	2.2u	SMD multilayer ceramic cap.	1210	Wuerth
C15	ECA2AAM330X	33u	Aluminum electrolytic capacitor PTH	D8, h11.5, pitch 3.5mm	Panasonic
C16	885012206120	100n	SMD multilayer ceramic cap.	0603	Wuerth
C17	CL21A226MAQNNNE	22u	SMD multilayer ceramic cap.	0805	Samsung
C18, C31, C33	C2012X7R1H475K	4.7u	SMD multilayer ceramic cap.	0805	TDK
C19	885012107018	4.7u	SMD multilayer ceramic cap.	0805	Wuerth
C20	C1608X7R1H473K080AA	47n	SMD multilayer ceramic cap.	0603	TDK
C24, C25	885012205055	100p	SMD multilayer ceramic cap.	0402	Wuerth
C26	885012005063	220p	SMD multilayer ceramic cap.	0402	Wuerth
C27	UMK107AB7105KA-T	1u	SMD multilayer ceramic cap.	0603	Taiyo Yuden
C28	25SEK270M	270u	Aluminum polymer capacitor PTH	Radial	Panasonic
C29	EEH-ZS1V681UP	680u	Aluminum polymer capacitor SMD	10mm SMD	Panasonic
C30	C3216X5R1V226M160AC	22u	SMD multilayer ceramic cap.	1206	TDK
C34	885012205050	10n	SMD multilayer ceramic cap.	0402	Wuerth
C35	C1005X5R1V105K050BC	1u	SMD multilayer ceramic cap.	0402	TDK
C36	885012105012	1u	SMD multilayer ceramic cap.	0402	Wuerth
C37	885012105008	4.7u	SMD multilayer ceramic cap.	0402	Wuerth
C40, C41		N.M.	SMD multilayer ceramic cap.	0402	
C43	VY1472M51Y5VQ63V0	4.7n	CAP CER 4700PF 500VAC Y5V radial		Vishay
D1, D2, D3	S1ML R3G		SMD diode	DO-219AB	Taiwan Semi
D4	BAS521LP-7		High-voltage switching diode	SOD-882	Nexperia
D5	BAS21LLYL		High-voltage switching diode	SOD-882	Nexperia
D6	BAS16LD		SMD fast switching rectifier	SOD-882	NXP
D7	CDZVT2R10B		SMD Zener diode	SOD-923	ROHM
D8	ES1JFL		SMD diode	SOD-123F	On Semiconductor

Reference	Manufacturer code	Value	Description	Package	Manufacturer
D9	CDZVT2R6.2B		SMD Zener diode	SOD-923	ROHM
D10	BAT54SWFILM		SMD Schottky rectifiers Array	SOT-323	STMicroelectronics
D11	ESDA25P35-1U1M		TVS diode	QFN-1610	ST
D12	ESDA25L		SMD TVS diode	SOT23	ST
F1	39213150000	FUSE 3.15A	Radial lead time-Lag fuse	8.5X4	LittellFuse
HON, LON, SRGD		N.M.	SMD test point pad. Ignore.		
J1		Input pads	Plated holes for cable. Ignore.		
J2	2012670005		Conn SMD USB Type-C®		Molex
J3	90325-0006		Conn flat male 6 pins, straight, pitch 1.27mm		Molex
J4	282837-2		Screw conn. term., single row, 5.08 pitch, 8 depth, 10 height, AWG 16-28, 13.5A	5.08mm	TE Connectivity
J5	M20-9993645		Male strip 4 pins pitch 2.54 180°		Harwin Inc.
J6			Pads for DB module		
JP1		SMD jumper - Closed	Jumper_SMD - Close with solder drop	2p medium	
L1	CM13090CT-242		2 line common mode choke		Bourns
L2	744779100	10uH	WE-TI radial leaded wirewound inductor	Radial	Würth Elektronik
LN1, LN2, LN3		LINK	PCB LINK. Ignore.		
MG1	MASTERGAN4		High-density power driver, H.V. enhance. mode GaN half-bridge	31VFQFPN 9 x 9 x 1.0	STMicroelectronics
Q1, Q2	BSS169H6327XTSA1		SMD N-ch MOSFET	SOT23	Infineon
Q3	BC847BM		SMD NPN transistor general purpose	SOT883	Nexperia USA Inc.
Q4	BSC0804LSATMA1		SMD N-ch power MOSFET	PowerFLAT	Infineon
Q5	ZVN3320FTA		SMD N-ch MOSFET	SOT23	Diodes Incorporated
Q6	STL160NS3LLH7		SMD N-ch power MOSFET	PowerFLAT	STMicroelectronics
R1		4.7K	SMD resistor	0603	
R2	RC0805FR-072M2L	2.2M	SMD resistor	0805	Yageo
R3	RC0603FR-0720RL	20R	SMD resistor	0603	Yageo
R4, R9	RC0402FR-07220RL	220R	SMD resistor	0402	Yageo
R5, R6, R7, R8	UCR03EVPFLR620	0R62	SMD current sense resistor	0603	ROHM
R10	RC0603FR-071KL	1K	SMD resistor	0603	Yageo
R11	RC0402FR-0712K1L	12k1	SMD resistor	0402	Yageo
R12	RC0402FR-071K5L	1k5	SMD resistor	0402	Yageo
R13	RC0402FR-0718KL	18K	SMD resistor	0402	Yageo

Reference	Manufacturer code	Value	Description	Package	Manufacturer
R14	RC0402FR-07270KL	270K	SMD resistor	0402	Yageo
R15	RC0402FR-07470KL	470K	SMD resistor	0402	Yageo
R16	ERJ-2RKF1912X	19.1K	SMD resistor	0402	Panasonic
R17, R18, R37	RC0402FR-0747KL	47K	SMD resistor	0402	Yageo
R19, R26	CRCW040210R0JNED	10R	SMD resistor	0402	Vishay
R20	RC0402FR-07430KL	430K	SMD resistor	0402	Yageo
R21	RC0402FR-07120KL	120K	SMD resistor	0402	Yageo
R22	RC0402FR-0722RL	22R	SMD resistor	0402	Yageo
R23, R28	RC0402FR-07100KL	100K	SMD resistor	0402	Yageo
R24, R35	MCR01MZPJ000	0R0	SMD resistor	0402	ROHM
R25		N.M.	SMD resistor	0402	
R27	RC0402JR-071KL	1K	SMD resistor	0402	Yageo
R29	RC0402FR-07287RL	287R	SMD resistor	0402	Yageo
R30	RC0402FR-07200KL	200k	SMD resistor	0402	Yageo
R31	RC0402FR-071RL	1R	SMD resistor	0402	Yageo
R32	WSLP08055L000FEA18	0R005	SMD very high power, low value resistor	0805	VISHAY
R33	RC0402FR-07100RL	100R	SMD resistor	0402	Yageo
R34	CRG0603F100K	100K	SMD resistor	0603	TE Connectivity
R36		47R	SMD resistor	0402	
RT1	NCP15WM474J03RC	470k	SMD thermistor NTC	0402	MURATA
T1	750318810_R5		RM8_FLYingWires transformer		Würth
U1	ST-ONEMP		STONE, SSOP36, 0.8mm pitch	SSOP36	STMicroelectronics
U2	ST715MR		SMD high input voltage - 85mA LDO linear regulator ADJ	SOT-23-5	ST Microelectronics

Table 2. Bill of material daughterboard

Reference	Manufacturer code	Value	Description	Package	Manufacturer
C1, C2, C4, C5	CC0402KRX7R8BB104	100nF	SMD multilayer ceramic cap.	0402	Yageo
C3	CGA6P3X7R1E226M250AE	22uF	SMD multilayer ceramic cap.	1210	TDK
C6, C7, C8, C9, C10, C14	CL21A226MAQNNNE	22uF	SMD multilayer ceramic cap.	0805	Samsung
C11	885012105012	1uF	SMD multilayer ceramic cap.	0402	Würth
C12	885012205052	22nF	SMD multilayer ceramic cap.	0402	Würth
C13		NM	SMD multilayer ceramic cap.	0402	
J1	USB1125-GF-B		Conn RCPT USB2.0 TYPEA 4POS R/A HI-LIFE compact size		GCT
J2			Pads for main board connection		
L1	XGL6060-472MEC	4.7uH	SMD shielded power inductor - automotive		Coilcraft
L2	74408943022	2.2uH	SMD shielded power inductor		Würth
R1, R2	RMCF0402FT4R70	4R7	SMD resistor	0402	Stcakupole
R3, R5, R10, R13, R18, R21		0R	SMD resistor	0402	
R4	RC0402FR-0710KL	10K	SMD resistor	0402	Yageo
R6	RMCF0402FT390K	390K	SMD resistor	0402	Stcakupole
R7, R8	RC0402FR-072K2L	2K2	SMD resistor	0402	Yageo
R9	RC0402FR-07820KL	820K	SMD resistor	0402	Yageo
R11, R20	RC0402FR-07100KL	100K	SMD resistor	0402	Yageo
R12	ERJ-2RK22202X	22K	SMD resistor	0402	Panasonic
R15	RC0402FR-072K49L	2K49	SMD resistor	0402	Yageo
R17	RC0402FR-074K99L	4K99	SMD resistor	0402	Yageo
R19	RC0402FR-071K8L	1K8	SMD resistor	0402	Yageo
U1	MP28167GQ-A-P		SMD integrated buck-boost converter with FB pin	QFN16_3X3	MPS
U2	MP5030DGQH-Z		USB charging port controller with load detection	10-QFN (1.5x2.0)	MPS

Revision history

Table 3. Document revision history

Date	Version	Changes
06-Nov-2022	1	Initial release.

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