

## 65W USB-PD certified reference design based on ST-ONE



Product status link

[EVLONE65W](#)

### Features

- Universal input mains range: 90 Vac to 265 Vac - Frequency 47 ÷ 63 Hz
- Maximum output power: 65 W
- Dimensions: 58x32x20 mm, (L x W x H)
- Power density: 30 W/in<sup>3</sup>
- Efficiency: > 93 % @ full load
- Constant current output: 3.75 A max
- Output voltage range: 3.3 ÷ 21 Vdc
- PD output:
  - 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
- PPS mode: 20 mV step for CV, 50 mA step for CC
- Certified USB power delivery 3.1.1.2 power brick
- Feedback loops: constant current and constant voltage
- Protections: brown out, over current protection, over temperature protection, over voltage protection, under voltage protection

### Description

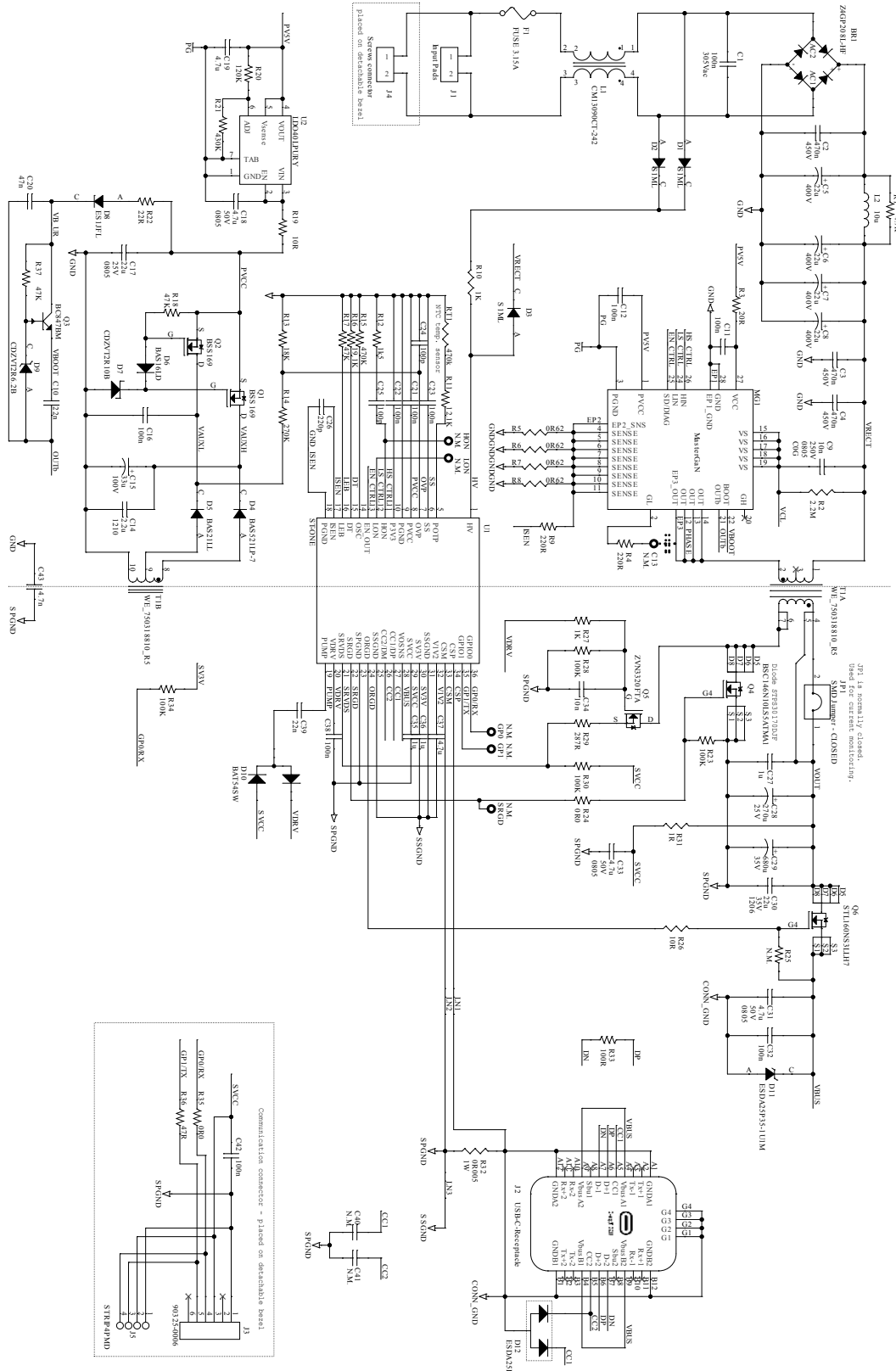
The **EVLONE65W** is a high power density USB-PD board supporting Programmable Power Supply (PPS). The design supports wide range input voltage and can deliver five fixed PDOs and two APDOs.

This board is based on ST-ONE, the world's first digital controller embedding an 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-PD 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-PD communication on the secondary side. The two sides are connected through an embedded galvanically isolated dual communication channel.

High switching frequency operations in companion with a MasterGaN4 power stage allows use of small size magnetic components while reaching a very high efficiency.

# 1 Schematic diagram and bill of material

**Figure 1. EVLONE65W schematic diagram**


**Table 1. EVLONE65W bill of material**

| Reference                                       | Part Number              | Value | Description                        | Package                       | Manufacturer |
|---|--------------------------|-------|------------------------------------|-------------------------------|--------------|
| BR1   | Z4GP208L-HF              |       | RECT BRIDGE GP<br>800V 2A Z4       | Z4                            | Comchip      |
| C1  | B32921C3104M             | 100nF | Radial polypropylene<br>film cap.  | Plastic<br>radial             | TDK          |
| C2, C3, C4                                      | CGA8N4X7T2W474K230K<br>A | 470nF | SMD multilayer<br>ceramic cap.     | 1812                          | TDK          |
| C5, C6, C7,<br>C8                               | 860021374027             | 22μF  | Aluminum electrolytic<br>capacitor | D8, h16,<br>pitch 3.5<br>mm   | Würth        |
| C9  | C2012C0G2E103J125AA      | 10nF  | SMD multilayer<br>ceramic cap.     | 0805                          | TDK          |
| C10, C39  | 885012205052             | 22nF  | SMD multilayer<br>ceramic cap.     | 0402                          | Würth        |
| C11, C12,<br>C21, C22,<br>C23, C32,<br>C38, C42 | 885012205085             | 100nF | SMD multilayer<br>ceramic cap.     | 0402                          | Würth        |
| C13   | DNM                      | N.M.  | Not mounted                        |                               |              |
| C14   | 885012209071             | 2.2μF | SMD multilayer<br>ceramic cap.     | 1210                          | Würth        |
| C15   | ECA2AAM330X              | 33μF  | Aluminum electrolytic<br>capacitor | D8, h11.5,<br>pitch 3.5<br>mm | Panasonic    |
| C16   | 885012206120             | 100nF | SMD multilayer<br>ceramic cap.     | 0603                          | Würth        |
| C17   | CL21A226MAQNNNE          | 22μF  | SMD multilayer<br>ceramic cap.     | 0805                          | Samsung      |
| C18, C31,<br>C33                                | C2012X7R1H475K           | 4.7μF | SMD multilayer<br>ceramic cap.     | 0805                          | TDK          |
| C19   | 885012107018             | 4.7μF | SMD multilayer<br>ceramic cap.     | 0805                          | Würth        |
| C20   | C1608X7R1H473K080AA      | 47nF  | SMD multilayer<br>ceramic cap.     | 0603                          | TDK          |
| C24, C25  | 885012205055             | 100pF | SMD multilayer<br>ceramic cap.     | 0402                          | Würth        |
| C26   | 885012005063             | 220pF | SMD multilayer<br>ceramic cap.     | 0402                          | Würth        |
| C27   | UMK107AB7105KA-T         | 1μF   | SMD multilayer<br>ceramic cap.     | 0603                          | Taiyo Yuden  |
| C28   | 25SEK270M                | 270μF | Aluminum polymer<br>capacitor      | Radial                        | Panasonic    |
| C29   | EEH-ZS1V681UP            | 680μF | Aluminum polymer<br>capacitor      | 10 mm SMD                     | Panasonic    |
| C30   | C3216X5R1V226M160AC      | 22μF  | SMD multilayer<br>ceramic cap.     | 1206                          | TDK          |
| C34   | 885012205050             | 10nF  | SMD multilayer<br>ceramic cap.     | 0402                          | Würth        |
| C35   | C1005X5R1V105K050BC      | 1μF   | SMD multilayer<br>ceramic cap.     | 0402                          | TDK          |
| C36   | 885012105012             | 1μF   | SMD multilayer<br>ceramic cap.     | 0402                          | Würth        |

| Reference                | Part Number       | Value                      | Description                                     | Package              | Manufacturer         |
|--------------------------|-------------------|----------------------------|---|----------------------|----------------------|
| C37                      | 885012105008      | 4.7µF                      | SMD multilayer ceramic cap.                     | 0402                 | Würth                |
| C40, C41                 |                   | N.M.                       | SMD multilayer ceramic cap.                     | 0402                 |                      |
| C43                      | VY1472M51Y5VQ63V0 | 4.7nF                      | CAP CER 4700PF 500 VAC Y5 V RADIAL              |                      | Vishay               |
| D1, D2, D3               | S1ML R3G          |                            | SMD diode                                       | DO-219AB             | Taiwan Semiconductor |
| 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     |
| 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             | STMicroelectronics   |
| D12                      | ESDA25L           |                            | SMD TVS diode                                   | SOT23                | STMicroelectronics   |
| F1                       | 39213150000       | FUSE 3.15 A                | Radial lead time lag fuse                       | 8.5X4                | Littelfuse           |
| HON, LON, SRGD, GP0, GP1 |                   | N.M.                       | Test point pad                                  |                      |                      |
| J1                       |                   | Input pads                 | Plated holes for cable.                         |                      |                      |
| J2                       | 2012670005        |                            | USB-C Receptacle                                |                      | Molex                |
| J3                       | 90325-0006        |                            | Conn flat male 6 pins, straight, pitch 1.27 mm  |                      | Molex                |
| J4                       | 282837-2          | Screws connector           | Screw connector, single row, 5.08 pitch, 13.5 A | 5.08 mm              | TE Connectivity      |
| J5                       | M20-9993645       |                            | Male strip 4 pins pitch 2.54 180°               |                      | Harwin Inc.          |
| JP1                      |                   | SMD Jumper / <b>CLOSED</b> | Jumper_SMD - <b>CLOSE with solder drop</b>      | 2 p medium           |                      |
| L1                       | CM13090CT-242     |                            | Common mode choke                               |                      | Bourns               |
| L2                       | 744779100         | 10µH                       | Radial leaded wire wound inductor               | Radial               | Würth Elektronik     |
| LN1, LN2, LN3            |                   | LINK                       | PCB link: ignore                                |                      |                      |
| MG1                      | MASTERGAN4        |                            | GaN half-bridge w. driver                       | 31VFQFPN 9 x 9 x 1.0 | STMicroelectronics   |
| Q1, Q2                   | BSS169H6327XTSA1  |                            | SMD N-ch MOSFET                                 | SOT23                | Infineon             |
| Q3                       | BC847BM           |                            | NPN Transistor general purpose                  | SOT883               | Nexperia             |
| Q4                       | BSC146N10LS5ATMA1 |                            | SMD N-ch power MOSFET                           | PowerFLAT            | Infineon             |

| Reference      | Part Number        | Value  | Description                                    | Package   | Manufacturer        |
|----------------|--------------------|--------|--|-----------|---------------------|
| Q5             | ZVN3320FTA         |        | SMD N-ch MOSFET                                | SOT23     | Diodes Incorporated |
| Q6             | STL160NS3LLH7      |        | SMD N-ch power MOSFET                          | PowerFLAT | STMicroelectronics  |
| R1             |                    | 4.7kΩ  | SMD resistor                                   | 0603      |                     |
| R2             | RC0805FR-072M2L    | 2.2MΩ  | SMD resistor                                   | 0805      | Yageo               |
| R3             | RC0603FR-0720RL    | 20Ω    | SMD resistor                                   | 0603      | Yageo               |
| R4, R9         | RC0402FR-07220RL   | 220Ω   | SMD resistor                                   | 0402      | Yageo               |
| R5, R6, R7, R8 | UCR03EVPFLR620     | 0.62Ω  | SMD current sense resistor                     | 0603      | ROHM                |
| R10            | RC0603FR-071KL     | 1kΩ    | SMD resistor                                   | 0603      | Yageo               |
| R11            | CRCW04024K70FKEDC  | 12.1kΩ | SMD resistor                                   | 0402      | Vishay              |
| R12            | RC0402FR-071K5L    | 1.5kΩ  | SMD resistor                                   | 0402      | Yageo               |
| R13            | RC0402FR-0718KL    | 18kΩ   | SMD resistor                                   | 0402      | Yageo               |
| R14            | RC0402FR-07270KL   | 270kΩ  | SMD resistor                                   | 0402      | Yageo               |
| R15            | RC0402FR-07470KL   | 470kΩ  | SMD resistor                                   | 0402      | Yageo               |
| R16            | ERJ-2RKF1912X      | 19.1kΩ | SMD resistor                                   | 0402      | Panasonic           |
| R17, R18, R37  | RC0402FR-0747KL    | 47kΩ   | SMD resistor                                   | 0402      | Yageo               |
| R19, R26       | CRCW040210R0JNED   | 10Ω    | SMD resistor                                   | 0402      | Vishay              |
| R20            | RC0402FR-07120KL   | 120kΩ  | SMD resistor                                   | 0402      | Yageo               |
| R21            | RC0402FR-07430KL   | 430kΩ  | SMD resistor                                   | 0402      | Yageo               |
| R22            | RC0402FR-0722RL    | 22Ω    | SMD resistor                                   | 0402      | Yageo               |
| R23, R28, R30  | RC0402FR-07100KL   | 100kΩ  | SMD resistor                                   | 0402      | Yageo               |
| R24, R35       | MCR01MZPJ000       | 0Ω     | SMD resistor                                   | 0402      | ROHM                |
| R25            |                    | N.M.   | SMD resistor                                   | 0402      |                     |
| R27            | RC0402JR-071KL     | 1kΩ    | SMD resistor                                   | 0402      | Yageo               |
| R29            | RC0402FR-07287RL   | 287Ω   | SMD resistor                                   | 0402      | Yageo               |
| R31            | RC0402FR-071RL     | 1Ω     | SMD resistor                                   | 0402      | Yageo               |
| R32            | WSLP08055L000FEA18 | 5mΩ    | SMD very high power, low value resistor        | 0805      | Vishay              |
| R33            | RC0402FR-07100RL   | 100Ω   | SMD resistor                                   | 0402      | Yageo               |
| R34            | CRG0603F100K       | 100kΩ  | SMD resistor                                   | 0603      | TE Connectivity     |
| R36            |                    | 47Ω    | SMD resistor                                   | 0402      |                     |
| RT1            | NCP15WM474J03RC    | 470kΩ  | SMD thermistor NTC                             | 0402      | Murata              |
| T1             | 750318810_R5       |        | RM8 extended rail transformer                  |           | Würth               |
| U1             | ST-ONE             |        | Fully integrated controller for smart chargers | SSOP36    | STMicroelectronics  |
| U2             | LDO40LPURY         |        | Low drop out regulator                         | 6-DFN     | STMicroelectronics  |

## Revision history

**Table 2. Document revision history**

| Date        | Version | Changes             |
|-------------|---------|---------------------|
| 23-May-2022 | 1       | Initial release.    |
| 06-Mar-2023 | 2       | Title modification. |



## Contents

|   |          |
|---|----------|
| <b>1 Schematic diagram and bill of material .....</b> | <b>2</b> |
| <b>Revision history .....</b>                         | <b>6</b> |
| <b>List of tables .....</b>                           | <b>8</b> |
| <b>List of figures.....</b>                           | <b>9</b> |



## List of tables

|                 |                                      |   |
|-----------------|--------------------------------------|---|
| <b>Table 1.</b> | EVLONE65W bill of material . . . . . | 3 |
| <b>Table 2.</b> | Document revision history . . . . .  | 6 |



## List of figures

**Figure 1.** EVLONE65W schematic diagram ..... 2

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