Voltage-mode SEPIC evaluation kit

TLD5098EP

About this document

Description

The TLD5098EP is an AEC qualified DC-DC boost controller, especially designed to drive LEDs.

- Built-in diagnosis and protection features
- Designed to support multiple topologies such as Boost, Buck, Buck-Boost, SEPIC and Flyback

Scope and purpose

Scope of this user manual is to provide instructions on the usage of TLD5098EP voltage-mode SEPIC evaluation board.

Intended audience

This document is intended for engineers who need to perform measurements and check performances with TLD5098EP voltage-mode SEPIC evaluation board.

Table of contents

1 Description

Evaluation board for medium power application with TLD5098EP configured in voltage-mode SEPIC topology, which can be implemented as DC-DC power supply with constant voltage output.

The default configuration of the board is voltage-mode SEPIC topology without any additional features enabled. In this configuration it can deliver up to 12 W to the load with an efficiency above 86%. Auxiliary circuits, which protect the DC-DC and the load during short to ground forcing the current to zero, are not present. The short to ground current is limited to a few amps by the embedded current control loop.

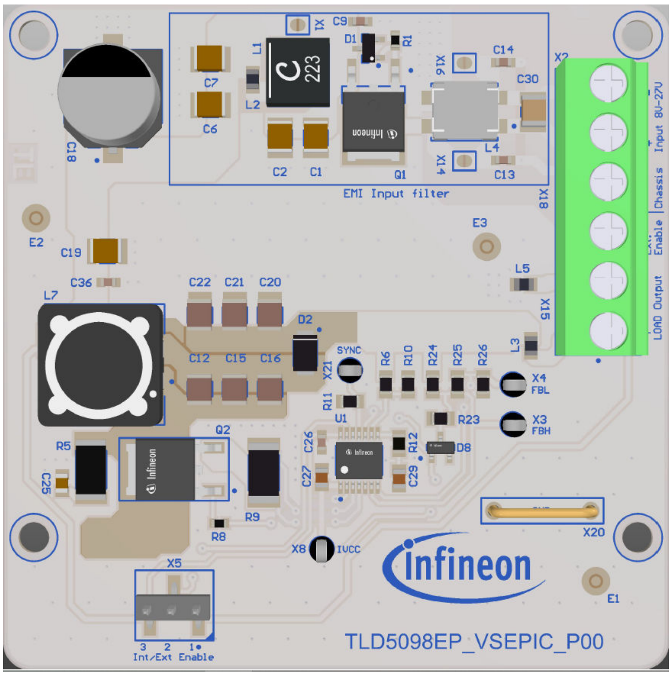

Figure 1 **Board picture**

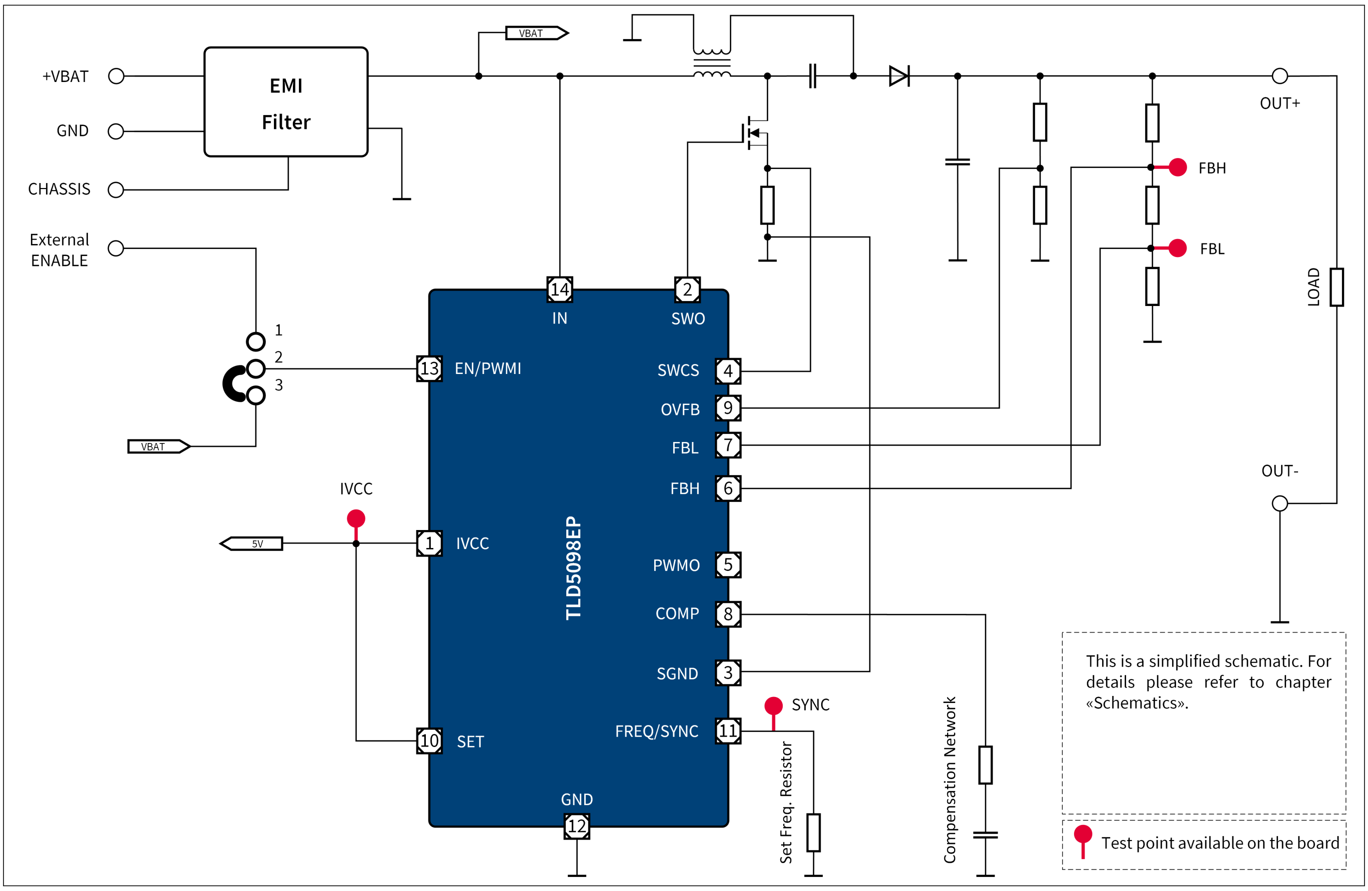

Figure 2 **Simplified schematic**

Table 1 **Performance summary**

Parameter	Conditions	Value
Input supply voltage	Parameter degradation below 6.5 V	8 V to 27 V (Down to 6.5 V for less than 2 s)
Maximum output current	Resistive load	1 A
Switching frequency	V_{IN} = 13.2 V, spread spectrum "on"	400 kHz
Efficiency	Measured with a 12 Ω power resistor as load	> 86%
Output voltage range	Output voltage related to ground	12 V
Output overvoltage protection	Output voltage related to ground	16 V

2 Quick start procedure

The default configuration of the board has all additional features disabled. The jumper is placed in 1-2 position. In this configuration the enable signal has to be applied on X18 (max. 45 V). If another output voltage is required, change the values of the voltage divider resistors R24, R25, and R26 according to the following equation:

$$\frac{V_{\mathrm{OUT}}}{R24 + R25 + R26} \cdot R25 = V_{\mathrm{REF}} \tag{1}$$

where V_{OUT} is the desired output voltage and V_{REF} = 300 mV is the feedback reference voltage.
Correct device functioning is achieved if voltages V_{FBH} and V_{FBL} on both terminals of R25 are greater than 3 V respect to ground.

Attention: ***On this board V_{OUT} is set to 12 V by default. Increasing V_{OUT} over the default level may damage some components irreversibly.***

The default configuration is depicted below:

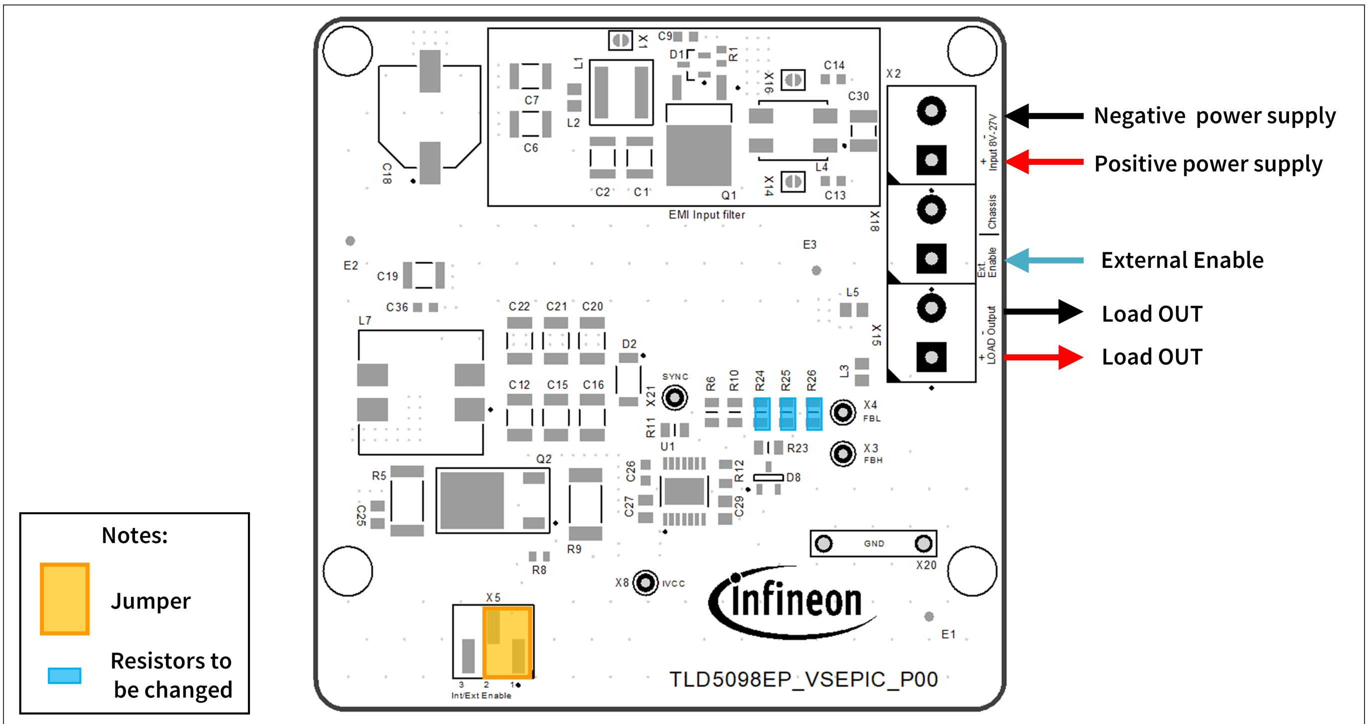

Figure 3 **Default configuration of the board**

3 Auto-enable configuration

By placing the jumper X5 on the position 2-3, the device starts without any external enable signal because pin EN (Enable) is connected directly to the positive rail. See ***Chapter 4*** for details.

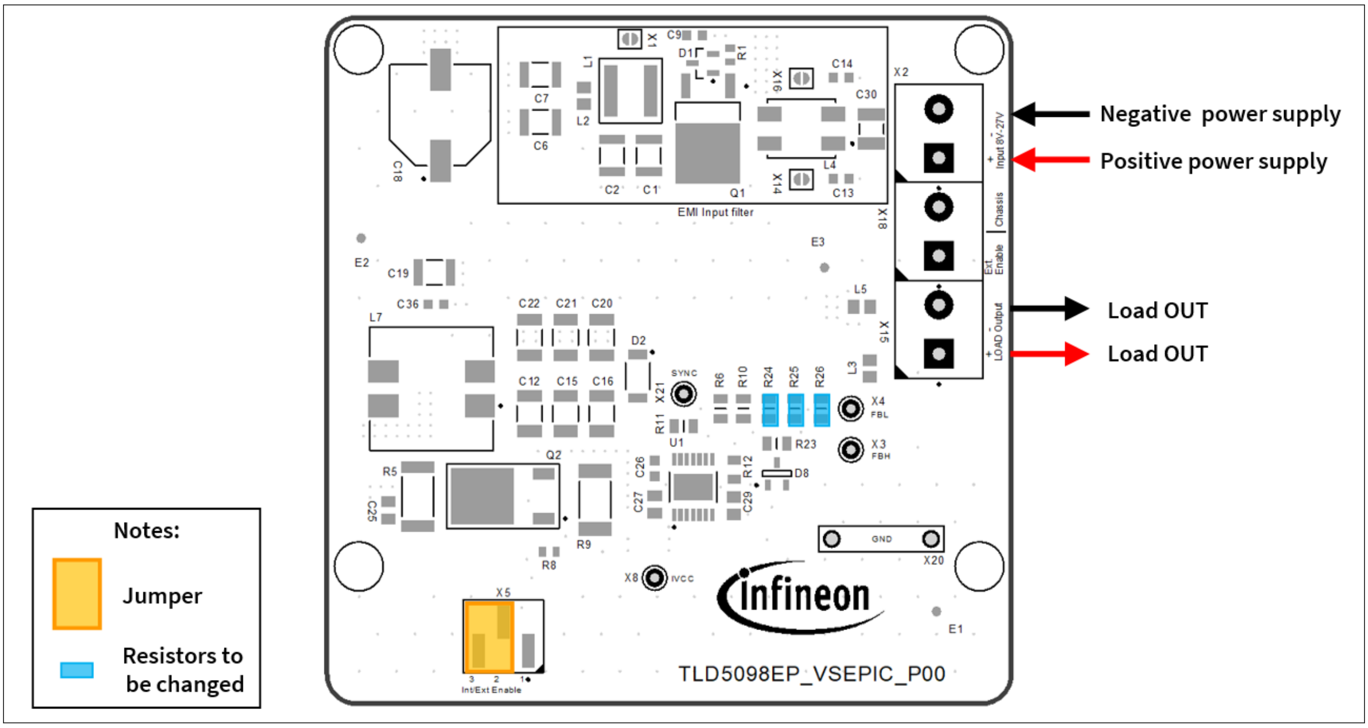

Figure 4 **Auto-enable configuration**

4 Schematics

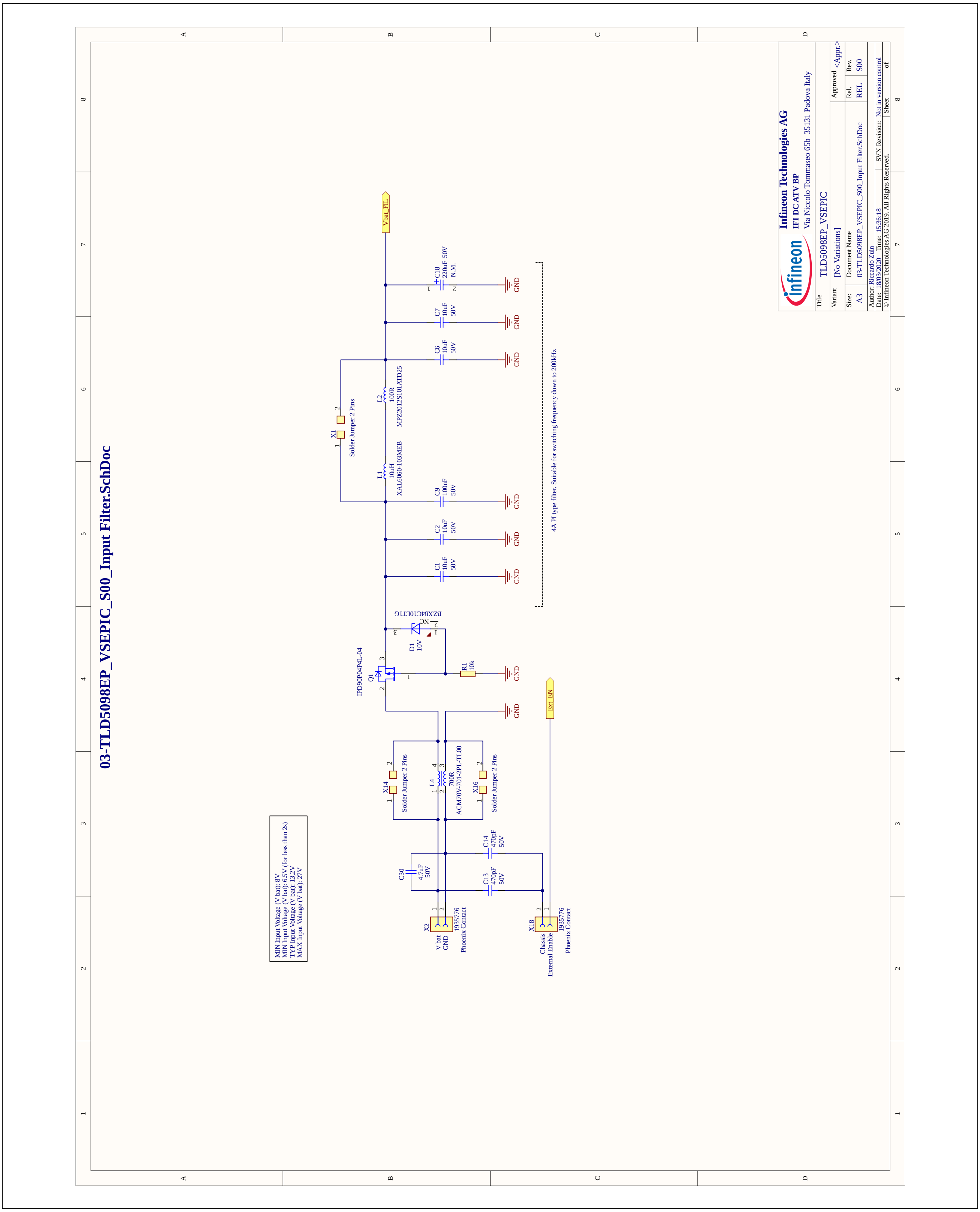

Figure 5 Input filter

4 Schematics

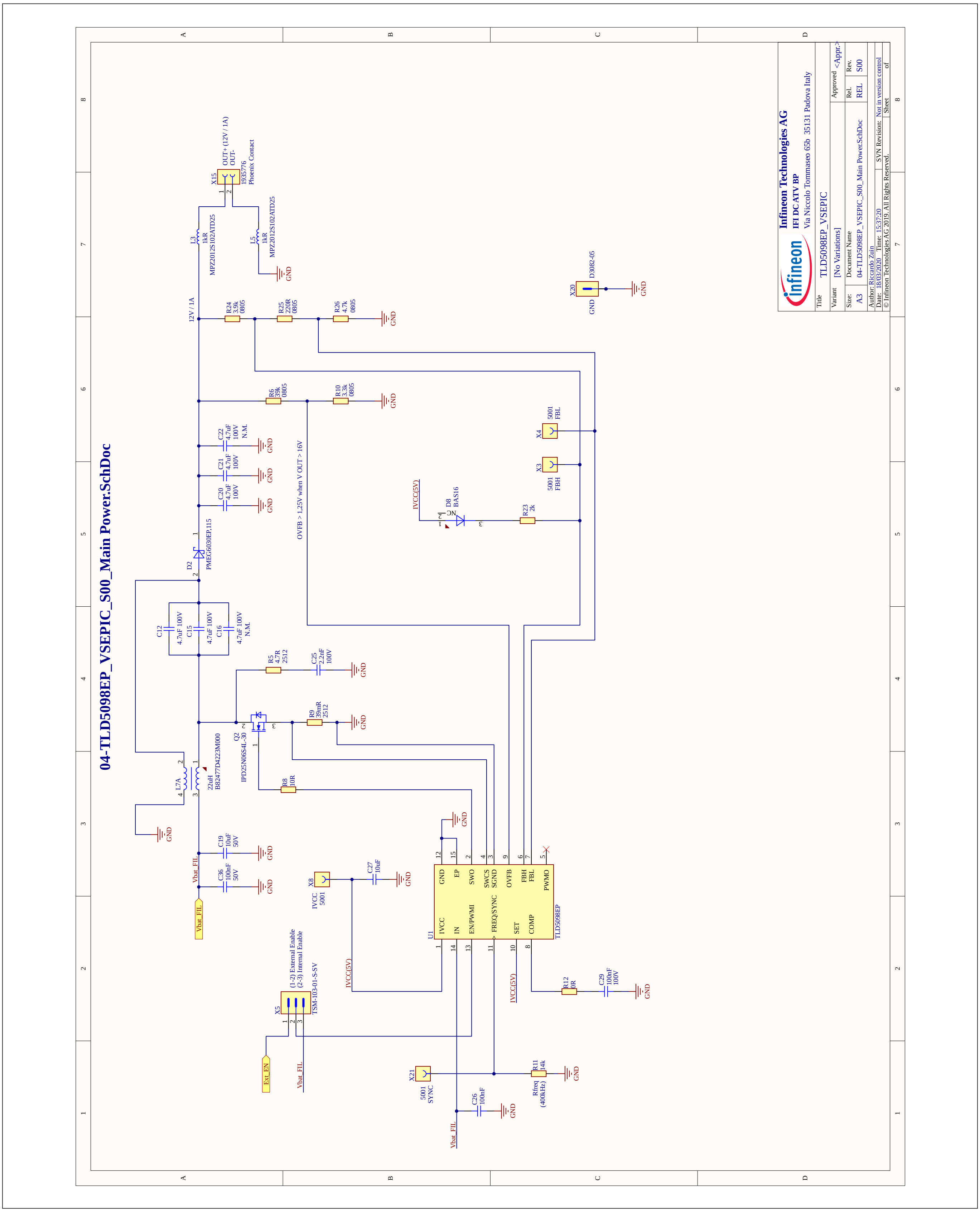

Figure 6 Main power

5 PCB layout

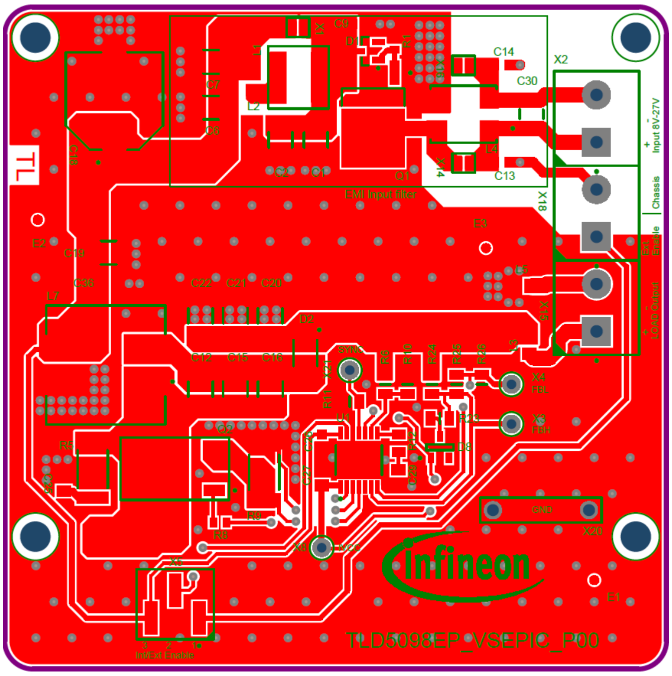

Figure 7 PCB layout top view

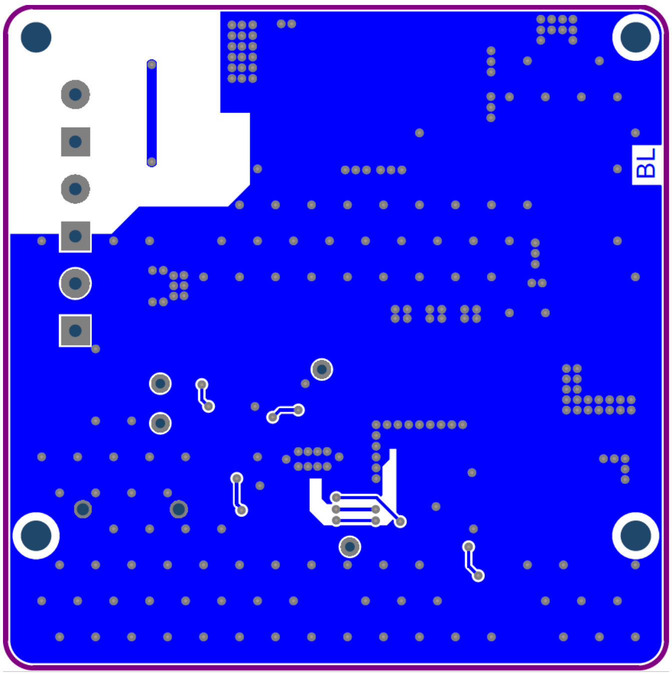

Figure 8 PCB layout bottom view

6 Bill of material

Table 2 Bill of material

Designator	Value	Manufacturer	Manufacturer order number
C1, C2, C6, C7, C19	10 uF	Murata	GCM32EC71H106KA03
C9, C26, C36	100 nF	AVX	06035C104K4Z2A
C12, C15, C20, C21	4.7 uF	TDK	CGA6M3X7S2A475K200AE
C13, C14	470 pF	Murata	GCM1885C1H471JA16
C16, C22	4.7 uF	TDK	CGA6M3X7S2A475K200AE
C18	220 uF	Panasonic	EEEFK1H221P
C25	2.2 nF	Murata	GCM2165C2A222FA16
C27	10 uF	TDK	CGA4J1X7S1C106K125AC
C29	100 nF	TDK	CGA4J2X7R2A104M125AE
C30	4.7 uF	Kemet	C1210C475K5RACAUTO
D1	10 V	ON Semiconductor	BZX84C10LT1G
D2	PMEG6030EP,115	Nexperia	PMEG6030EP,115
D8	BAS16	Infineon Technologies	BAS16
L1	10 uH	Coilcraft	XAL6060-103MEB
L2	100 Ω @ 100 MHz	TDK	MPZ2012S101ATD25
L3, L5	1 kΩ @ 100 MHz	TDK	MPZ2012S102ATD25
L4		TDK	ACM70V-701-2PL-TL00
L7	22 uH	TDK	B82477D4223M000
Q1	IPD90P04P4L-04	Infineon Technologies	IPD90P04P4L-04
Q2	IPD25N06S4L-30	Infineon Technologies	IPD25N06S4L-30
R1	10 kΩ	Vishay	CRCW060310K0FK
R5	4.7 Ω	Vishay	CRCW25124R70FK
R6	39 kΩ	Vishay	CRCW080539K0FK
R8	10 Ω	Vishay	CRCW060310R0FK
R9	39 mΩ	Vishay	WSL2512R0390FEA
R10	3.3 kΩ	Vishay	CRCW08053K30FK
R11	14 kΩ	Vishay	CRCW080514K0FK
R12	0 Ω	Yageo	AC0805JR-070RL
R23	2 kΩ	Vishay	CRCW08052K00FK
R24	3.9 kΩ	Vishay	CRCW08053K90FK
R25	220 Ω	Vishay	CRCW0805220RFK
R26	4.7 kΩ	Vishay	CRCW08054K70FK
U1	TLD5098EP	Infineon Technologies	TLD5098EP
X1, X14, X16	Solder Jumper 2 Pins		Solder Jumper 2 Pins

Table 2 Bill of material (continued)

Designator	Value	Manufacturer	Manufacturer order number
X2, X15, X18	1935776	Phoenix Contact	1935776
X3, X4, X8, X21	5001	Keystone	5001
X5	TSM-103-01-S-SV	Samtec	TSM-103-01-S-SV
X20	D3082-05	Harwin	D3082-05

7 Efficiency measurements

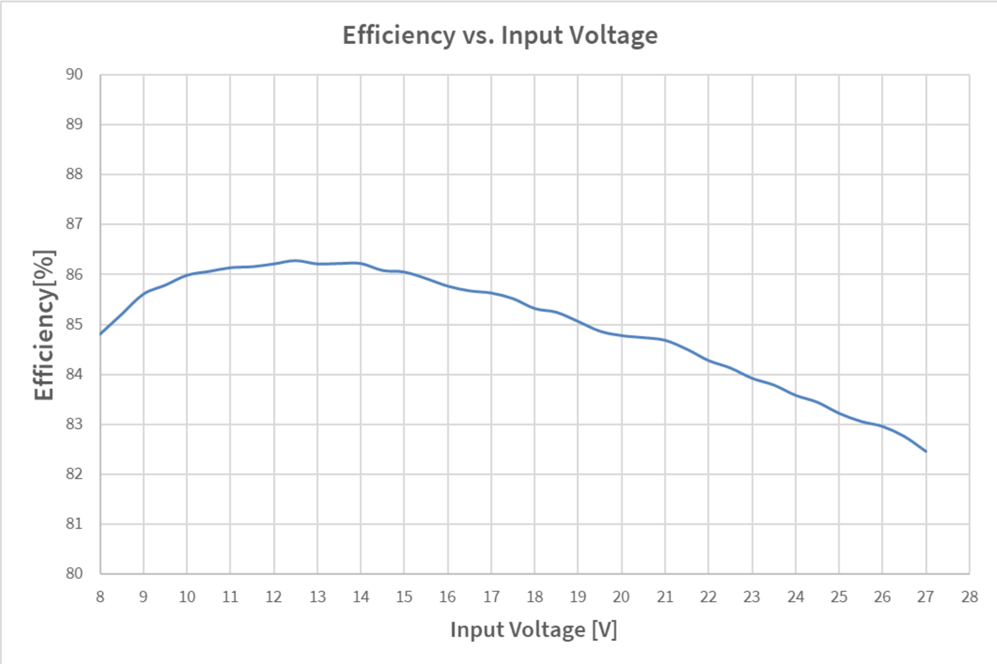

Figure 9 Efficiency vs. input voltage

This efficiency performance has been obtained with:

Table 3 Parameters influencing efficiency

Output load:	12 Ω power resistor
EMI filter	Totally bypassed by closing the jumpers X1, X14 and X16

Efficiency performances can be increased, see ***Chapter 8***.

8 Maximizing efficiency

This evaluation board has been designed to reach a fair compromise between efficiency performance and EM emissions compliance.

Nevertheless, if the maximum efficiency is needed, the following actions are suggested:

1. Remove the snubber circuit consisting of R5 and C25, or choose a lower value for the capacitor C25 (for example 1 nF)
2. Bypass the whole EMI filter by bridging the jumpers X1, X14 and X16
3. Bypass the output ferrite beads L3 and L5
4. Replace the main inductor L7 with one that boasts a lower parasitic DC resistance, for example
   - TDK model B82477C6223M603
   - TDK model B82477D6223M603
5. Bypass gate resistor R8

9 Minimizing EM emissions

This evaluation board has been designed to reach a fair compromise between efficiency performance and conducted EM emissions compliance from 150 kHz to 108 MHz.

Nevertheless, if the minimum EM emission is required, the following actions should be considered:

1. Choose a higher value for the capacitor C25 (for example 2.7 or 3.3 nF)
2. Include the whole EMI filter by removing bridges from the jumpers X1, X14 and X16
3. Replace the 10 Ω resistor R8 with a higher value such as 22 Ω or 33 Ω
4. Connect the CHASSIS terminal with a short piece of wire as close as possible to the test ground where the board is placed

10 Revision history

Document version	Date of release	Description of changes
Rev. 1.00	2020-09-17	First release related to evalboard S00_P00

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Edition 2020-09-17

Published by

Infineon Technologies AG

81726 Munich, Germany

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Document reference
IFX-kvd1595918745679