

TLD6098-1SEPIC_EVAL

User guide

LITIX™ Power Multitopology single-channel DC-DC controller

About this document

Product description

The TLD6098-1EP is an AEC qualified DC-DC boost controller, especially designed to drive LEDs. It embeds:

- Built-in diagnosis and protection features
- Pulse width modulator to implement a dimming function with reduced color shifting
- Coded faults to easily detect the root cause of load failures
- Voltage loop availability to implement constant output voltage power supply

The device also incorporates a spread spectrum modulator to reduce the electromagnetic emissions outside the allowed bands.

Scope and purpose

The scope of this user guide is to provide instructions on the use of TLD6098-1SEPIC_EVAL.

Intended audience

Hardware engineers, software engineers, system architects

Evaluation board

This board is to be used during the design-in process for evaluating and measuring characteristic curves, and for checking datasheet specifications.

Note: PCB and auxiliary circuits are NOT optimized for final customer design.

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Safety precautions

Note: Please note the following warnings regarding the hazards associated with development systems

Table 1 Safety precautions







	<p>Warning: Remove or disconnect power from the drive before you disconnect or reconnect wires, or perform maintenance work. Wait five minutes after removing power to discharge the bus capacitors. Do not attempt to service the drive until the bus capacitors have discharged to zero. Failure to do so may result in personal injury or death.</p>
	<p>Caution: The heat sink and device surfaces of the evaluation or reference board may become hot during testing. Hence, necessary precautions are required while handling the board. Failure to comply may cause injury.</p>
	<p>Caution: Only personnel familiar with the drive, power electronics and associated machinery should plan, install, commission and subsequently service the system. Failure to comply may result in personal injury and/or equipment damage.</p>
	<p>Caution: The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.</p>
	<p>Caution: A drive that is incorrectly applied or installed can lead to component damage or reduction in product lifetime. Wiring or application errors such as undersizing the motor, supplying an incorrect or inadequate AC supply, or excessive ambient temperatures may result in system malfunction.</p>
	<p>Caution: The evaluation or reference board is shipped with packing materials that need to be removed prior to installation. Failure to remove all packing materials that are unnecessary for system installation may result in overheating or abnormal operating conditions.</p>

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1 The board at a glance

TLD6098-1SEPIC_EVAL is a PCB board designed to supply high power LED with TLD6098-1EP in SEPIC topology.

In this configuration, the board can deliver up to 25 W. Auxiliary circuits, to protect the DC-DC and the load during the short to ground failure, are present and enabled.

Table 2 Performance summary

Parameter	Conditions	Value
Input supply voltage	Parameter degradation below 8 V	8 V to 27 V
Output current	–	1 A
Overvoltage protection threshold	–	48.6 V
Short to ground protection threshold	–	3 V
Switching frequency	Spread spectrum “ON”	400 kHz

The output current is fixed by R3. Change this resistor if different output current is needed.

The overvoltage protection and the short to ground protection thresholds are defined by R14 and R16.

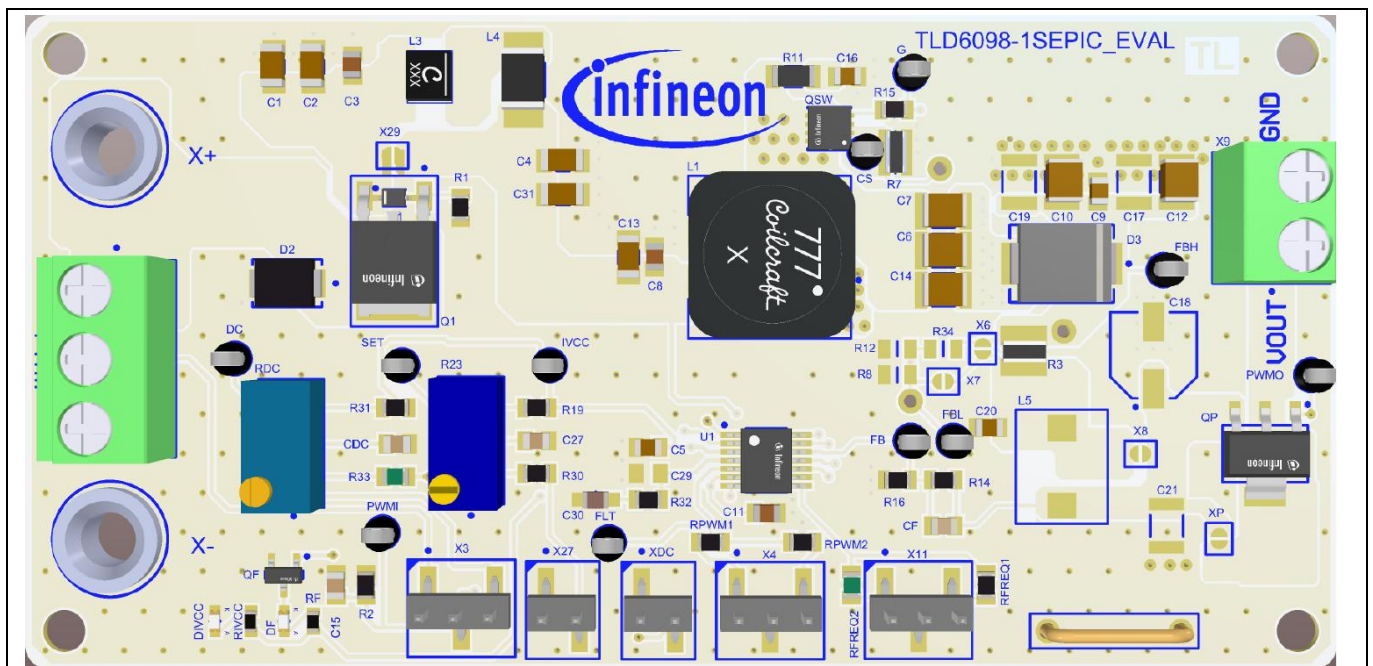


Figure 1 Representation of the TLD6098-1SEPIC_EVAL

The board at a glance

1.1 Scope of supply

The jumpers are positioned as follows:

Table 3 Jumper position

Jumper Number	Condition	Meaning
XDC	Open	PWM adjustment disabled
X3	Close 2-3	Internal biased to provide DC = 100% External dimming disabled
X27	Open	Output current analog adjustment disabled

The default configuration is depicted below.

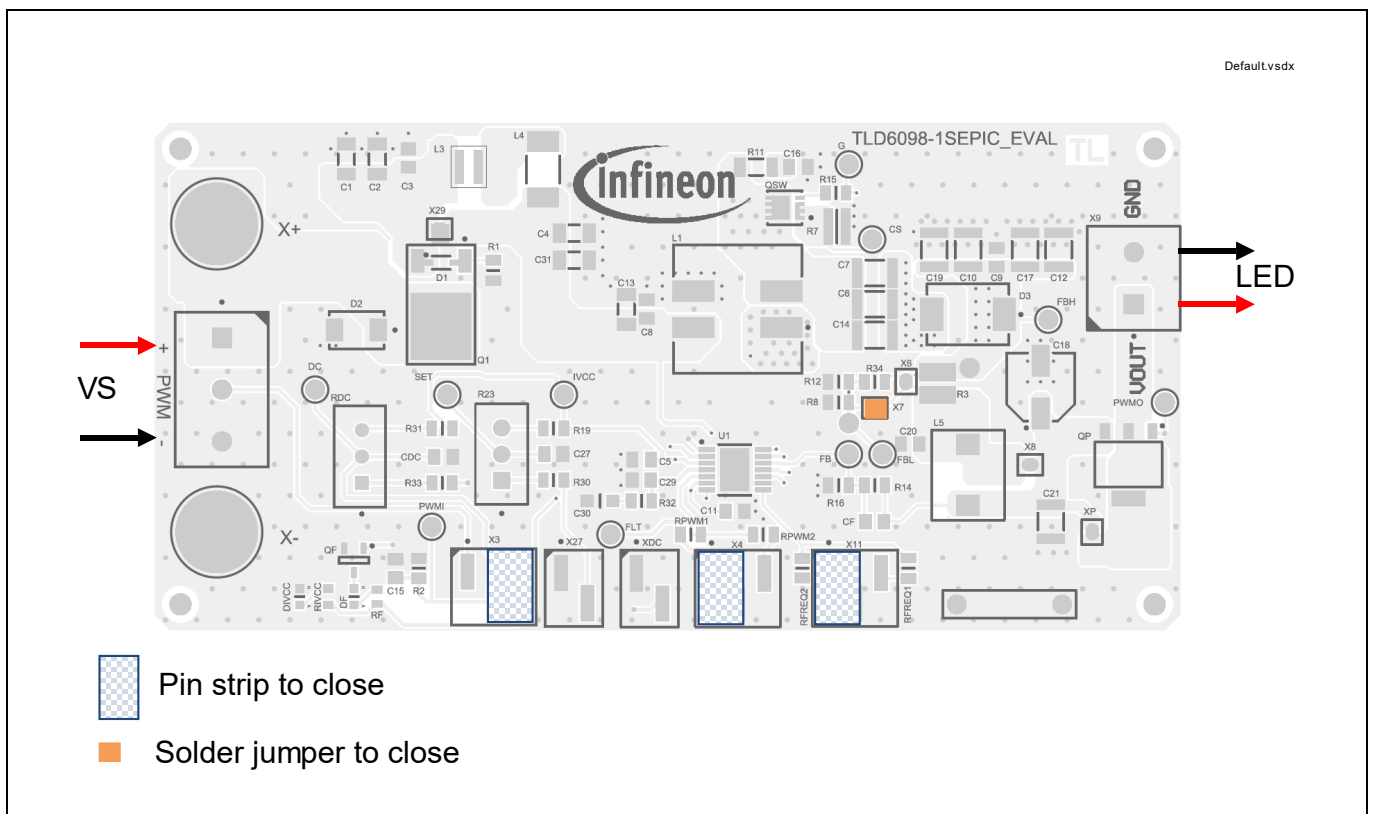


Figure 2 Default configuration of the board

2 System and functional description

2.1 Current adjustment

The output current adjustment is performed by adjusting the value of trimmer R14.

The feature is enabled when the jumper X10 is closed.

The output current can vary from 0% to 100% of the maximum output current.

Jumpers are positioned as follows:

Table 4 Jumper position

Jumper Number	Condition	Meaning
XDC	Open	PWM adjustment disabled
X3	Close 2-3	Internal biased to provide DC = 100% External dimming disabled
X27	Close	Output current analog adjustment enabled

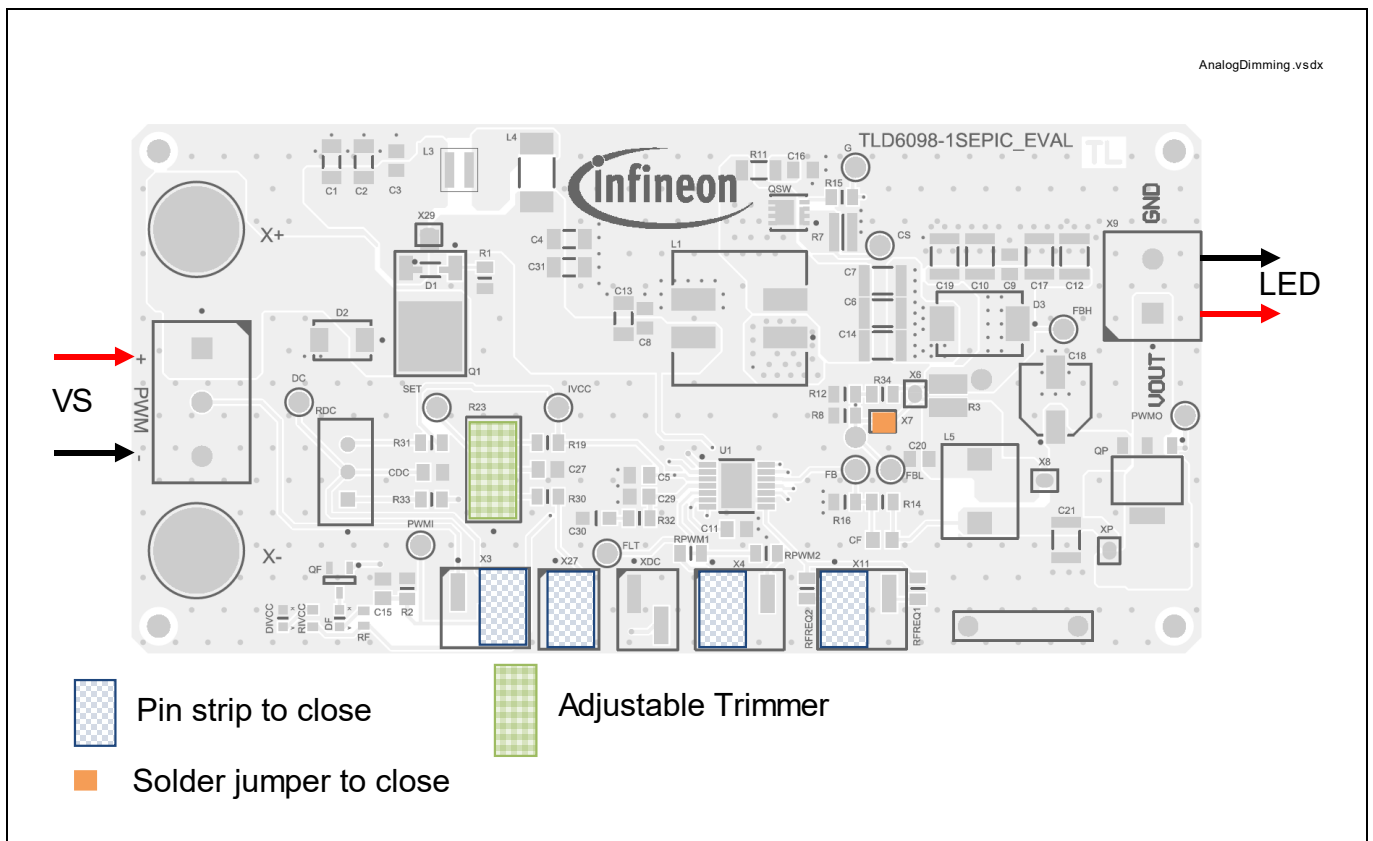


Figure 3 Current adjustment

2.2 Embedded PWM engine

The embedded PWM engine provides an internal PWM signal without any external dimming signal required.

To enable the feature the jumper XDC is closed.

RDC trimmer adjusts the dimming duty cycle by changing the voltage on the respective DC/PWMI pin.

The PWM dimming frequency is set to 410 Hz. If another PWM frequency is needed, the respective RPWM1 and/or RPWM2 must be changed to a proper value (please refer to the TLD6098-1EP datasheet [1] for more information).

Jumpers are positioned as follows:

Table 5 Jumper position

Jumper Number	Condition	Meaning
XDC	Close	PWM adjustment enabled
X3	Close2-3	Internal biased to provide DC = 100% External dimming disabled
X27	Open	Output current analog adjustment disabled

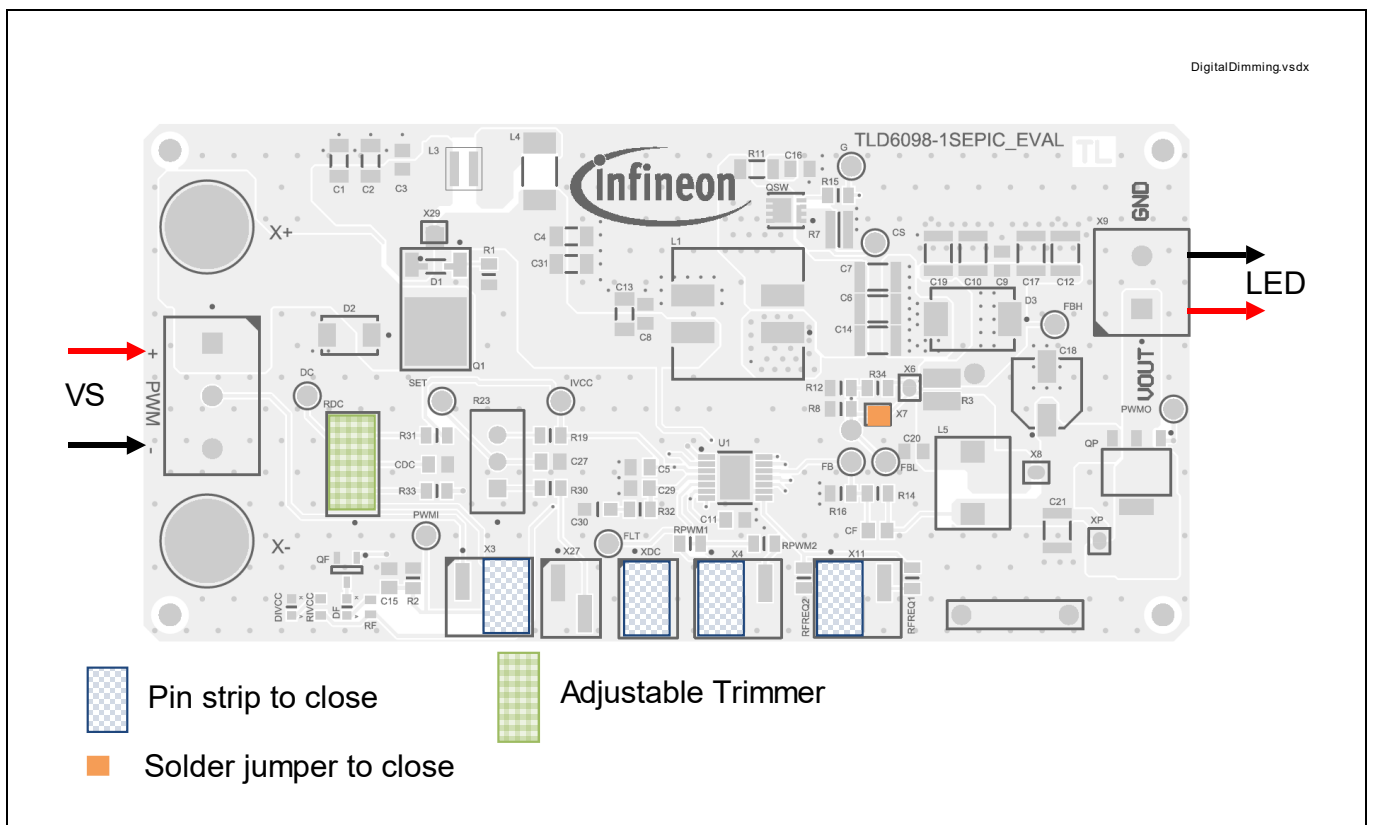


Figure 4 Embedded PWM engine

2.3 External dimming and output adjustment

The analog output adjustment and the dimming signals can be provided by external sources.

To enable the control from external sources the jumpers are positioned as follows:

Table 6 Jumper position

Jumper Number	Condition	Meaning
XDC	Close 1-2	External signal enabled
X3	Close 1-2	External signal enabled
X27	Open	Output current analog adjustment disabled

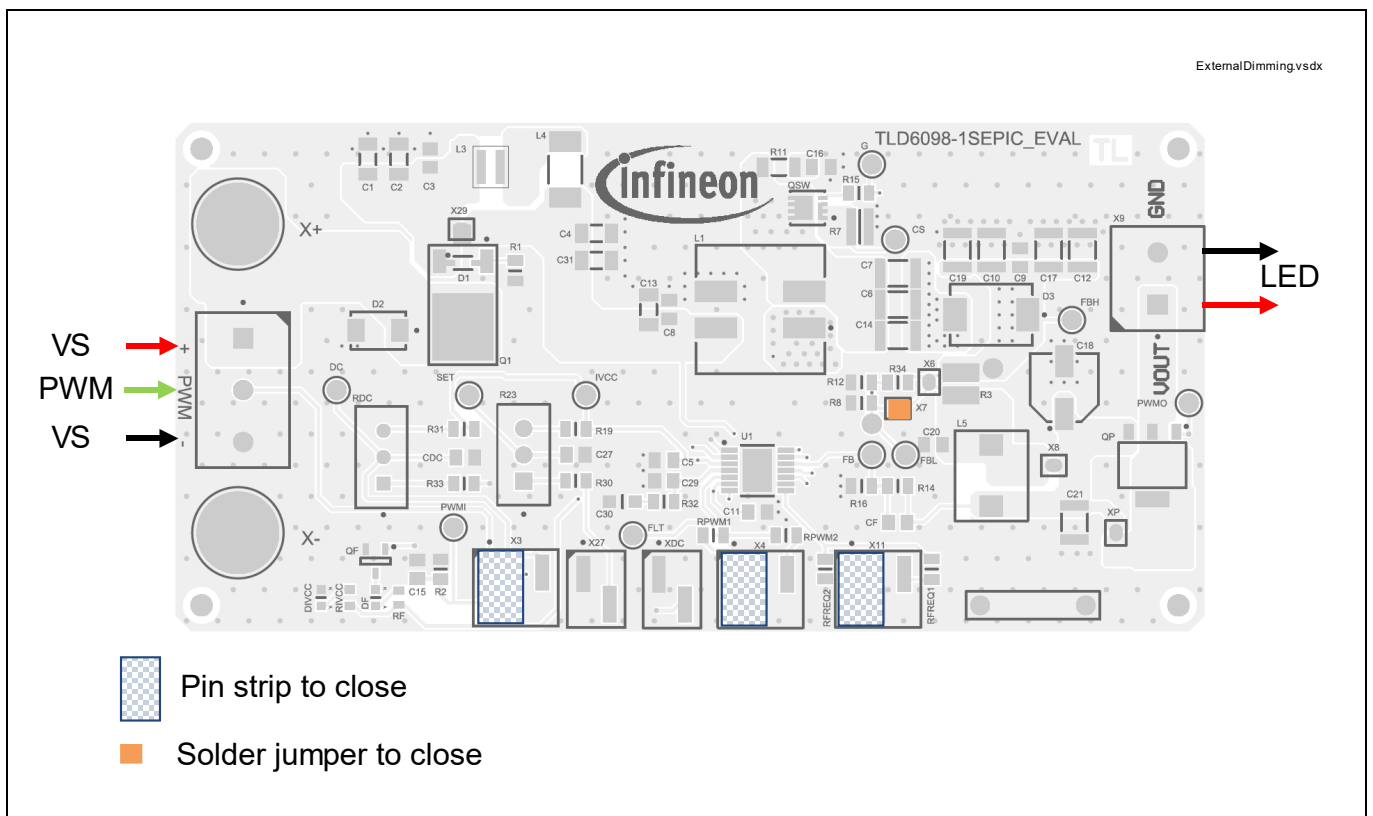


Figure 5 External dimming and output adjustment

2.4 Faults

The system has been designed to use hard threshold for overvoltage detection. With this option, once the threshold is reached, the gate driver is disabled until the output voltage goes below the reset threshold.

This behavior is selected with a resistor on FPWM/FAULT pin in range 18 kΩ to 90 kΩ.

In this case each fault type is reported by the FPWM/FAULT pin with a dedicated PWM waveform. Typical values for these waveforms are

Table 7 Coded PWM pulses on FPWM/FAULT pin

	PWM period	DC (ON time)
Overtemperature	10 ms	100% (10 ms)
Short to ground	10 ms	80% (8 ms)
Overvoltage on FBH pin	10 ms	60 % (6 ms)
Overvoltage on VFB pin	10 ms	40% (4 ms)
Output overcurrent (> 200%)	10 ms	20% (2 ms)

System design

2.5 Schematics

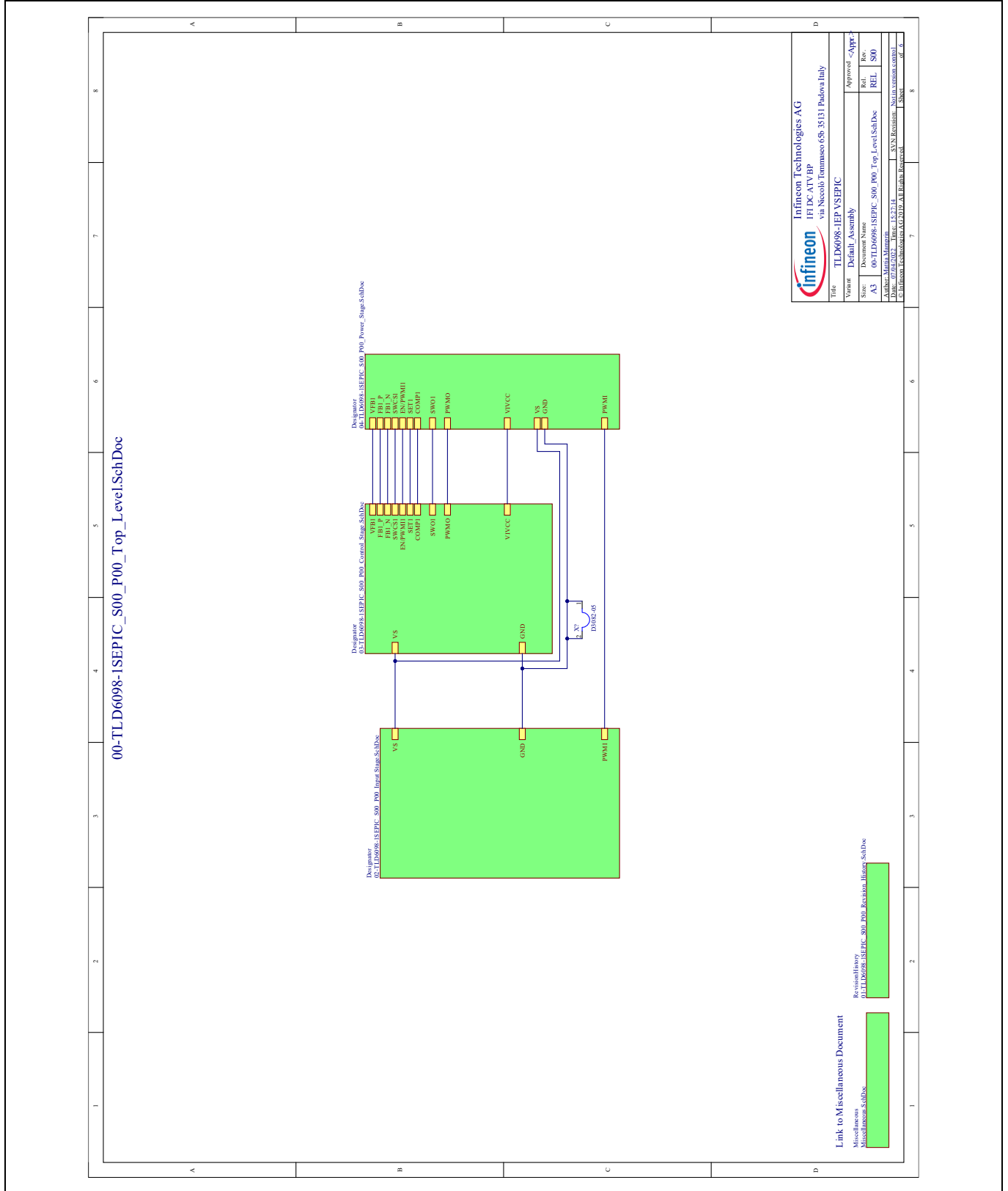


Figure 6 Schematic Top level

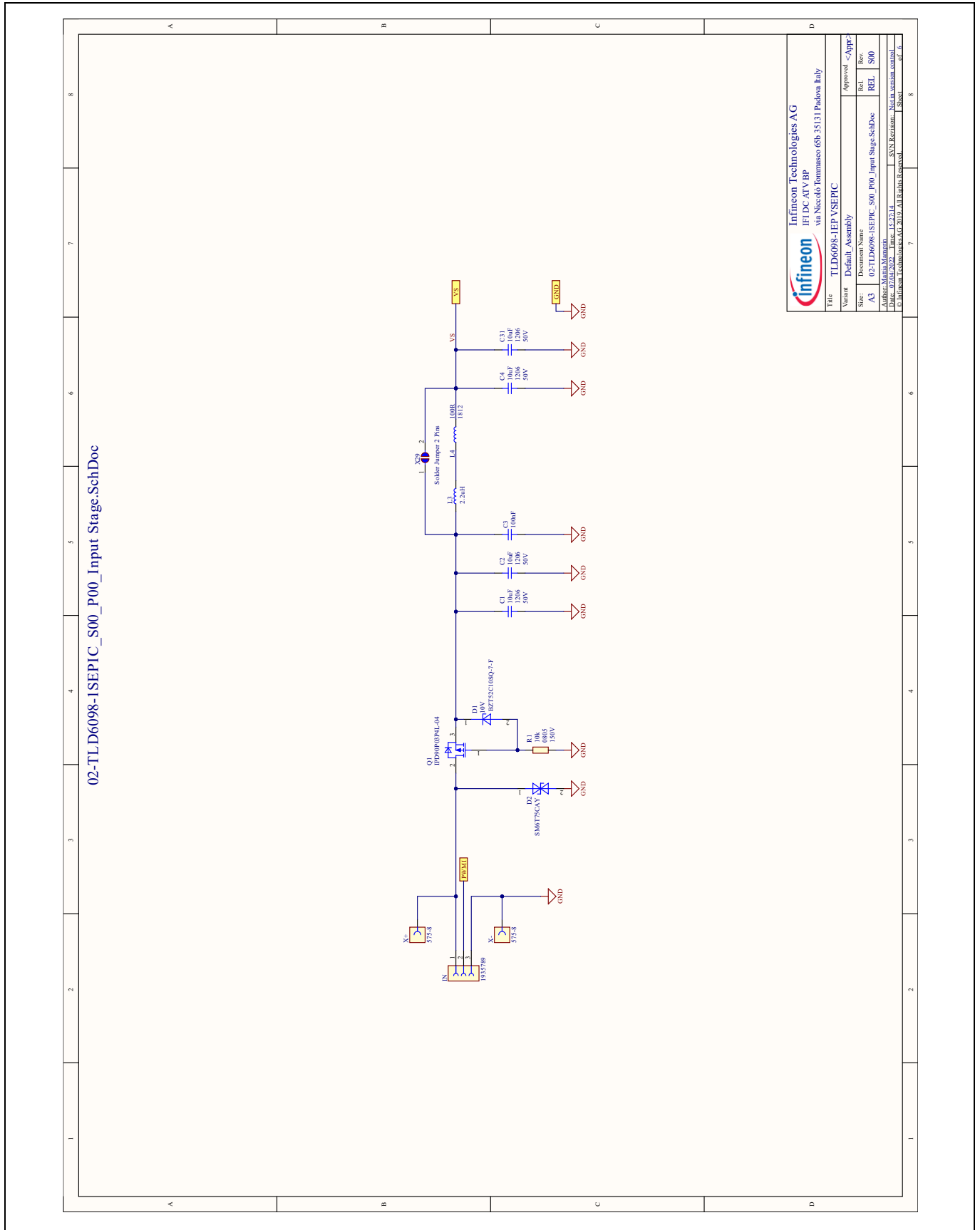
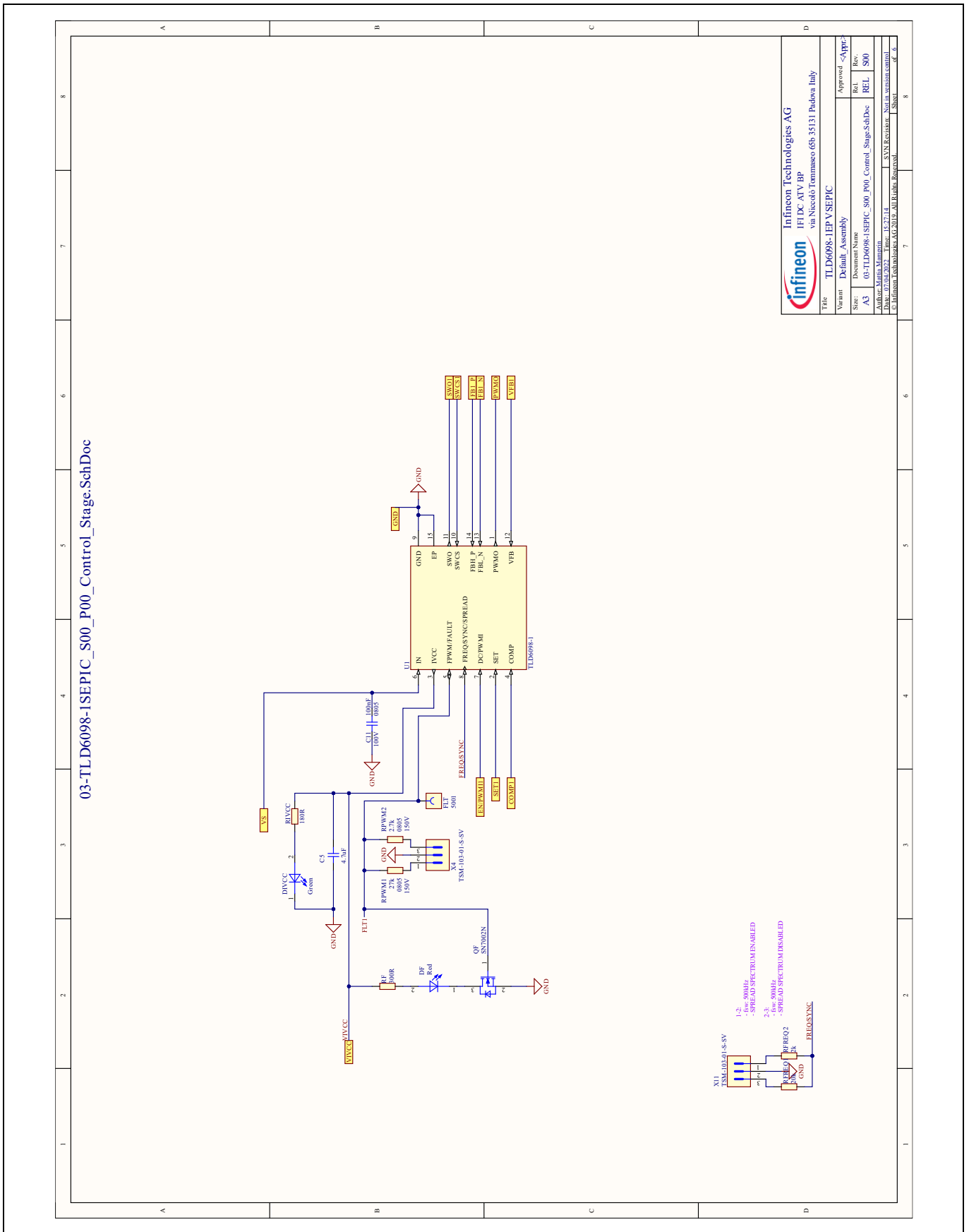


Figure 7 Schematic Input stage



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IFI DC ATV BP		Rel:
via Niccolò Tommaseo 666-35131 Padova Italy		Rev:
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Author	Mattia Mammì	
Release	15/27/14	
Customer	Stal in via S. Maria del Monte	
Sheet	1 of 6	

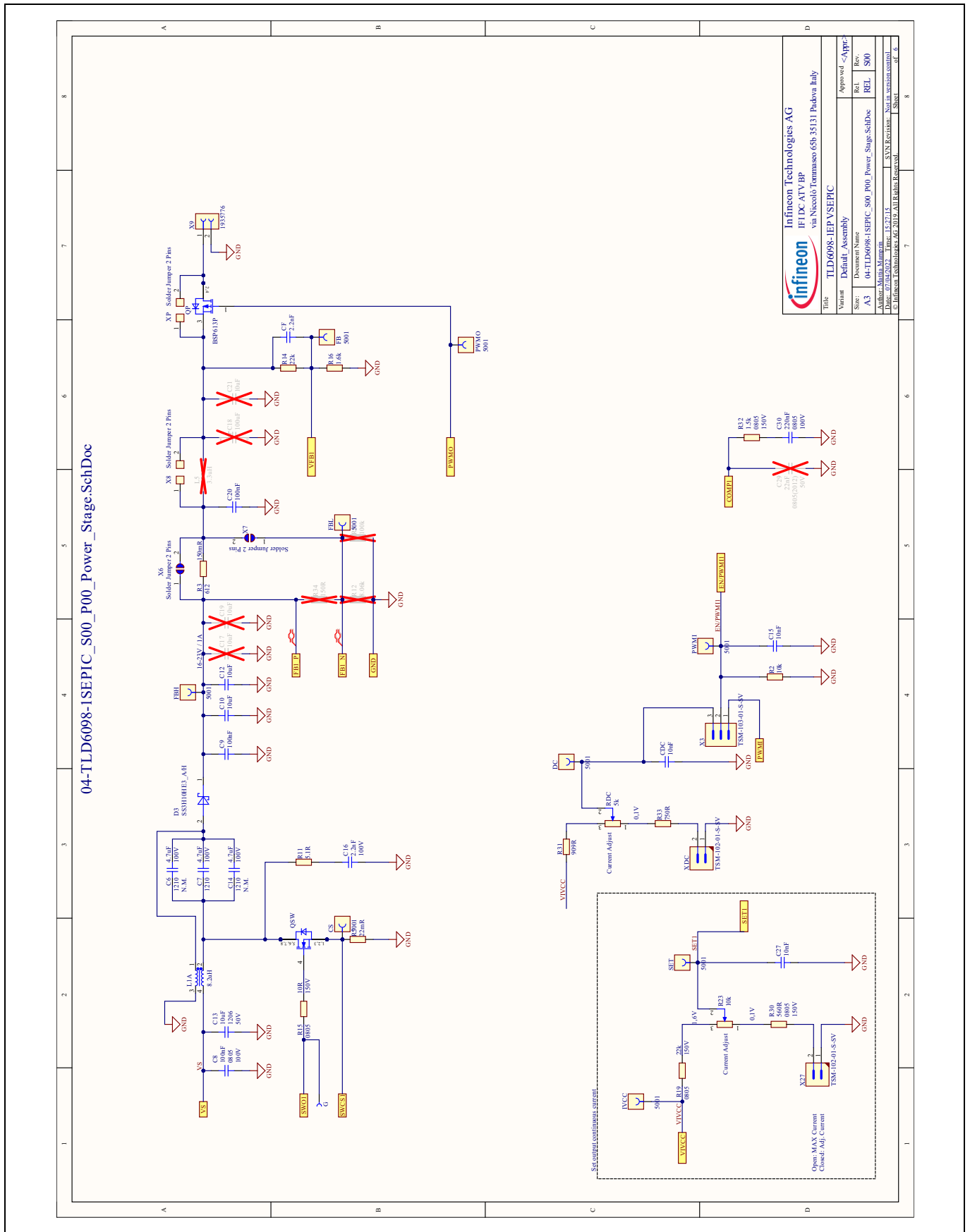


Figure 9 Schematic Power stage

2.6 PCB Layout

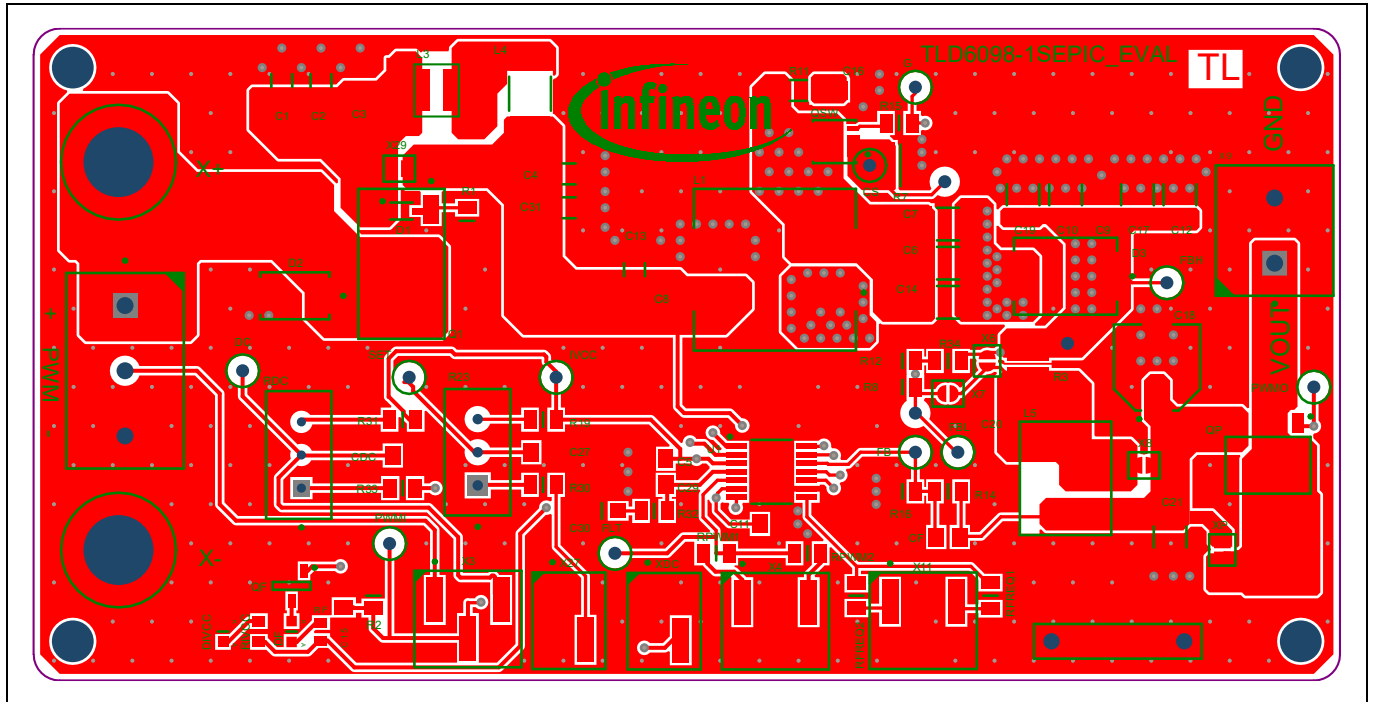


Figure 10 PCB layout top view

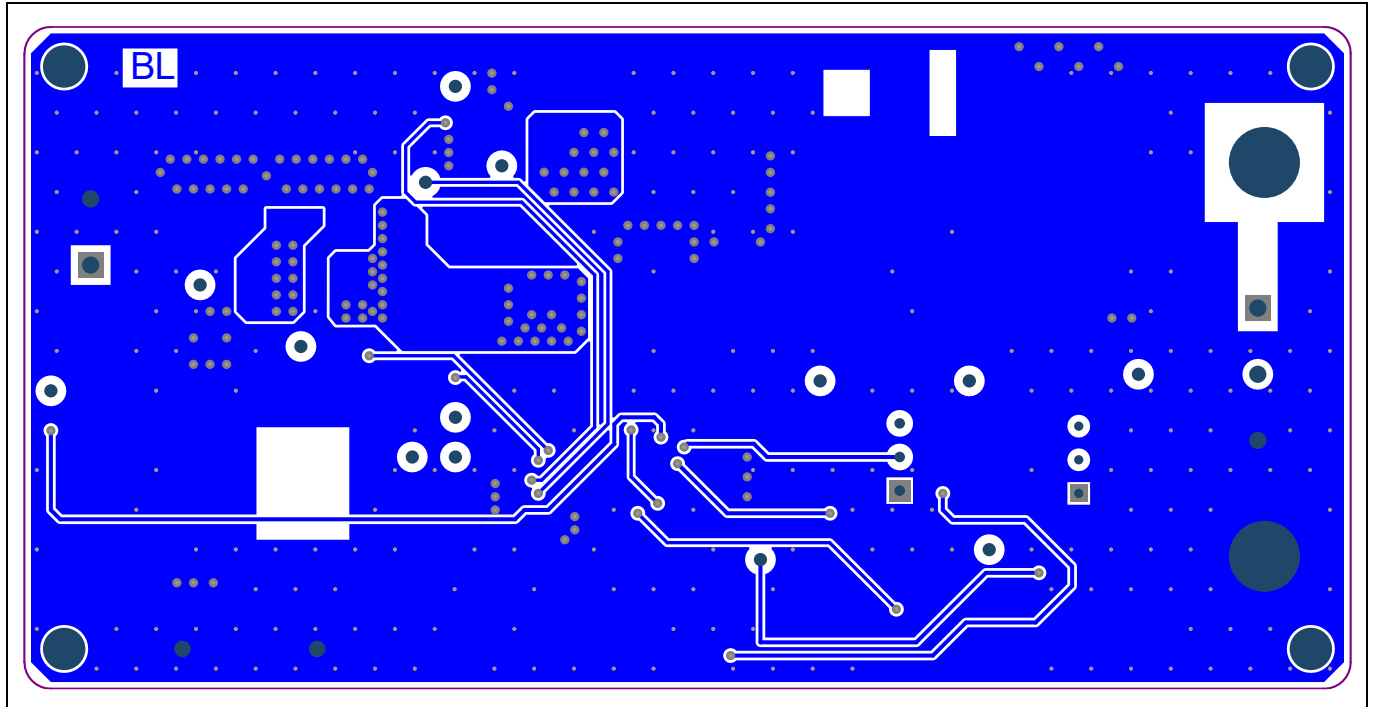


Figure 11 PCB layout bottom view

2.7 Bill of material

Table 8 Bill of material

Designator	Value	Manufacturer	Manufacturer order number
C1, C2, C4, C13, C31	10 μ F	MuRata	GRT31CR61H106KE01L
C3, C8, C11	100 nF	TDK Corporation	CGA4J2X7R2A104M125AE
C5	4.7 μ F	MuRata	GCM21BR71C475KA73
C6, C7, C14	4.7 μ F	TDK Corporation	CGA6M3X7S2A475K200AB
C9, C20	100 nF	MuRata	GCM21BR72A104JA37
C10, C12	10 μ F	MuRata	GCM32EC71H106MA03
C15, C27, CDC	10 nF	Kemet	C0805C103K5RACAUTO
C16	2.2 nF	MuRata	GCM2165C2A222FA16
C30	220 nF	TDK Corporation	CGA4F3X7S2A224K085AE
CF	2.2 nF	MuRata	GRM21AR72D222KW01
CS, DC, FB, FBH, FBL, FLT, G, IVCC, PWMI, PWMO, SET	5001	Keystone Electronics Corp., Keystone	5001
D1	10 V	DIODES	BZT52C10SQ-7-F
D2	SM6T75CAY	STMicroelectronics	SM6T75CAY
D3	SS3H10HE3_A/H	Vishay	SS3H10HE3_A/H
DF	Red	Würth Elektronik	150060RS75000
DIVCC	Green	Würth Elektronik	150060GS75000
IN	1935789	Phoenix Contact	1935789
L1	8.2 μ H	Coilcraft	MSD1278T-822MLD
L3	2.2 μ H	Coilcraft	XGL3520-222MED
L4	100 Ω	Würth Elektronik	74279226101
Not Used1	0 Ω	Vishay	
Q1	IPD90P03P4L-04	Infineon Technologies	IPD90P03P4L-04
QF	SN7002N	Infineon Technologies	SN7002N
QP	BSP613P	Infineon Technologies	BSP613P
QSW	IAUZ30N06S5L140	Infineon Technologies	IAUZ30N06S5L140
R1	10 k Ω	Vishay	CRCW080510K0FK
R2	10 k Ω	Panasonic	ERJP06J103V
R3	150 m Ω	ROHM Semiconductors	LTR18EZPFLR150
R7	22 m Ω	Vishay	RCWE061222L0JMEA
R11	5.1 Ω	KOA Speer Electronics Inc.	SG732BTDD5R1K

Designator	Value	Manufacturer	Manufacturer order number
R14, R19	22 k Ω	Vishay	CRCW080522K0FK
R15	10 Ω	Vishay	CRCW080510R0FK
R16	1.6 k Ω	Vishay	CRCW08051K60FK
R23	10 k Ω	Vishay	T93YA103KT20
R30	560 Ω	Vishay	CRCW0805560RFK
R31	909 Ω	Vishay	CRCW0805909RFK
R32	1.5 k Ω	Vishay	CRCW08051K50FK
R33	750 Ω	Vishay	TNPW0805750RBY
RDC	5 k Ω	Vishay	T93YA502KT20
RF	300 Ω	Vishay	CRCW0603300RFK
RFREQ1	20 k Ω	Vishay	CRCW080520K0FK
RFREQ2	2 k Ω	Vishay	TNPW08052K00BEEA
RIVCC	180 Ω	Yageo	RC0603FR-07180RL
RPWM1	27 k Ω	Vishay	CRCW080527K0FK
RPWM2	2.7 k Ω	Vishay	CRCW08052K70FK
U1	TLD6098-1	Infineon Technologies	TLD6098-1
X3, X4, X11	TSM-103-01-S-SV	Samtec	TSM-103-01-S-SV
X6, X7, X8, X29, XP	Solder Jumper 2 Pins	Infineon Technologies AG, Infineon Technologies	Solder Jumper 2 Pins
X9	1935776	Phoenix Contact	1935776
X27, XDC	TSM-102-01-S-SV	Samtec	TSM-102-01-S-SV
X-, X+	575-8	Keystone Electronics Corp.	575-8
X?	D3082-05	Harwin	D3082-05

References

- [1] Infineon: TLD6098-1EP Datasheet; <https://www.infineon.com/cms/en/product/power/lighting-ics/litix-automotive-led-driver-ic/litix-power/tld6098-1ep/#!/documents>

Revision history

Document revision	Date	Description of changes
Revision 1.00	2023-01-28	Initial release for evaluation board SEPIC S00_P00

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