EVAL-1ED3330MC12M-SiC

Evaluation board description and getting started guide

About this document

Scope and purpose

This user guide is intended to introduce and provide an overview of the gate driver evaluation board EVAL-1ED3330MC12M-SiC featuring the Infineon EiceDRIVER™1ED3330MC12M gate driver integrated circuit (IC). It outlines the functionality and highlights the key features of this gate driver IC in a half-bridge topology.

The EVAL-1ED3330MC12M-SiC board is designed to evaluate the functionality and capability of 1ED3330MC12M gate driver IC. The board is designed with high-frequency decoupling capacitance to provide a low-inductive path in the commutation loop, ensuring optimal switching performance and minimizing switching noise. While the primary purpose of the decoupling capacitance is to support high-frequency operation, additional external high-voltage DC link capacitance is strongly recommended for double-pulse testing. To simplify this setup, the EVAL-1ED3330MC12M-SiC is designed to be compatible with the EVAL-DCLink-DPT board from the Infineon Infineon modular evaluation platform. Alternatively, users can connect any other suitable high-voltage capacitance externally to meet their specific testing requirements.

This user guide highlights the key features of the gate driver; however, for a complete understanding of the functionality and versatility of the 1ED3330MC12M gate driver and EVAL-1ED3330MC12M-SiC evaluation board, it is recommended to refer to the datasheet of the gate driver IC.

Intended audience

This document is intended for all technical specialists who want to evaluate the functionality, performance, and features of 1ED3330MC12M gate driver ICs. The evaluation board is intended to be used under laboratory conditions only by trained specialists.

It is a prerequisite to read the datasheet of the 1ED3330MC12M IC to become familiar with the features and the datasheet parameters of the gate driver.

Evaluation Board

This board is to be used during the design-in process for evaluating the functionality and the performance of the gate driver IC.

***Note**:* *The 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

	**Warning:** *The DC link potential of this board is up to 900 VDC. When measuring voltage waveforms by oscilloscope, high voltage differential probes must be used. Failure to do so may result in personal injury or death.*
	**Warning:** *The evaluation board contains DC bus capacitors which take time to discharge after removal of the main supply. Before working on the evaluation board, ensure with measurement on the high-voltage supply terminals that the capacitors are discharged to safe voltage levels. Failure to do so may result in personal injury or death. Darkened display LEDs are not an indication that capacitors have discharged to safe voltage levels.*
	**Warning:** *Remove or disconnect power from the circuit before you disconnect or reconnect wires, or perform maintenance work. Ensure the discharge of the bus capacitors after removing power to the board. Do not attempt to service the circuit until the bus capacitors have discharged to zero. Failure to do so may result in personal injury or death.*
	**Caution:** *Only personnel familiar with the circuit, 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.*
	**Caution:** *The evaluation 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.*
	**Caution:** *The evaluation 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.*

Revision history

Document version	Date of release	Description of changes
v1.00	2025-08-08	• Initial release

Table of contents

1 The board at a glance

The EVAL-1ED3330MC12M-SiC evaluation board is designed to be used by engineers to evaluate the 1ED3330MC12M EiceDRIVER™ isolated gate driver ICs and discrete power switches from Infineon in a half-bridge configuration. The evaluation board can be used to evaluate other pin-compatible ICs from the 1ED333xMC12M gate driver family by replacing the gate driver ICs on the board. Details about the 1ED3330MC12M gate driver can be found on our product pages or by using the product search.

The board includes two unassembled Infineon IMZC120R012M2H CoolSiC™ 1200 V SiC Trench MOSFETs in a TO247-4 package, as seen in Figure 1. These MOSFETs can be mounted on the board for testing or replaced with other compatible switches, such as Infineon IGBTs, CoolSiC™ or CoolMOS™ transistors with the same TO247-4 package. This flexibility allows users to evaluate various switches based on their specific application requirements.

The board has a size of 100 mm x 60 mm x 32 mm without any power switches assembled. Designed primarily for non-continuous evaluation, such as double-pulse testing (DPT), special consideration must be given to the current-carrying capabilities of the power tracks and proper cooling of the power switches, if the board is used in continuous testing mode. Additionally, high-voltage bulk capacitors must be added at the high-voltage input terminal for double-pulse testing. The board is designed to be compatible with the EVAL-DCLink-DPT board from the Infineon modular evaluation platform, which not only provides the necessary capacitance but also offers connection points to facilitate the setup of a double-pulse test. **Therefore, it is highly recommended to also include an EVAL-DCLink-DPT board in the initial order.**

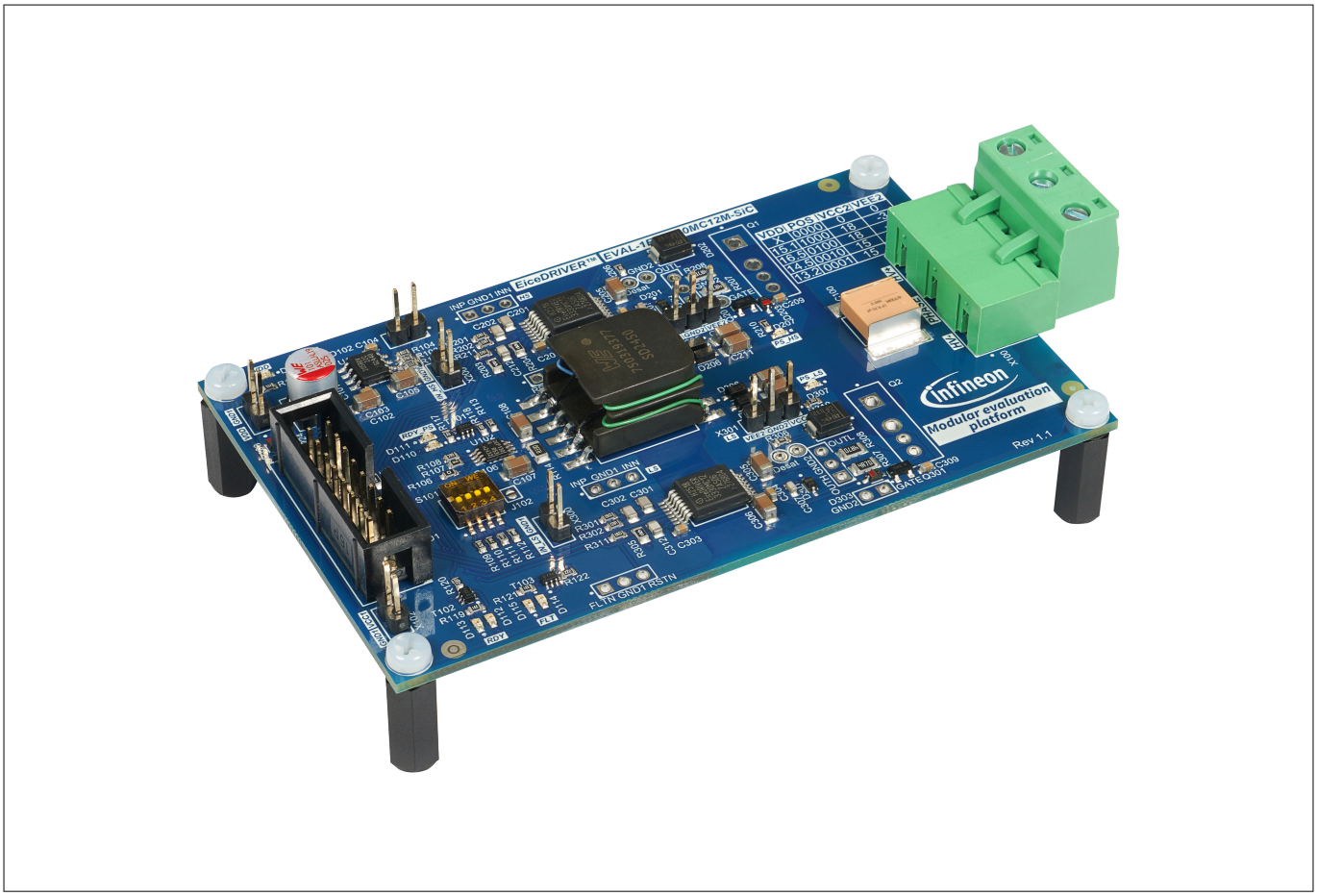

Figure 1 EVAL-1ED3330MC12M-SiC evaluation board

1.1 Scope of supply

The delivery contains:

- The evaluation board EVAL-1ED3330MC12M-SiC
- Two IMZC120R012M2H CoolSiC™ 1200 V SiC Trench MOSFETs for assembly
- High-voltage PCB connector (plugged on high-voltage PCB terminal header)

1.2 Block diagram

Figure 2 shows the block diagram of the EVAL-1ED3330MC12M-SiC evaluation board.

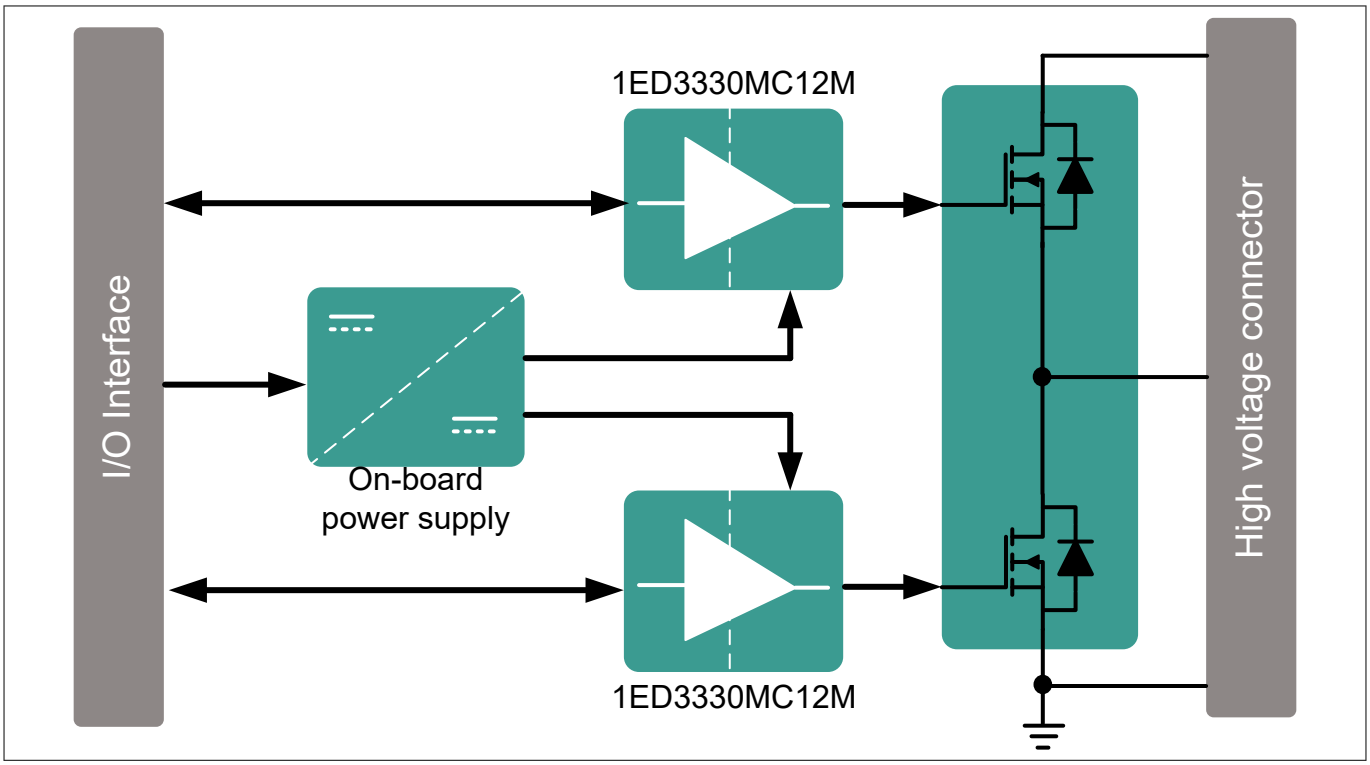

Figure 2 EVAL-1ED3330MC12M-SiC block diagram

1.3 Main features

The EVAL-1ED3330MC12M-SiC is an evaluation board for the 1ED3330MC12M gate driver ICs. It is built in a half-bridge configuration with a maximum DC-link voltage of 900 V. It is optimized for easy measurement and flexible adjustment of the gate driving components and the protection features.

The main features of the evaluation board are:

- Infineon IMZC120R012M2H CoolSiC™ 1200 V SiC Trench MOSFETs in TO247-4 (unassembled) in a half-bridge configuration
- PCB layout designed to ensure optimal switching performance of the half-bridge
- Built-in configurable on-board isolated power supply for the gate driver output side, easily adjustable to generate typical bipolar driving voltages
- Built-in power supply for gate driver input side, easily configurable to generate 3.3 V or 5 V
- Fast short circuit protection and feedback
- UVLO for all the gate driver supply voltages
- Interlocked PWM inputs for shoot-through protection
- Test points for monitoring critical signals

The main features of the gate driver 1ED3330MC12M IC are:

- Pure-PMOS sourcing stage for optimal turn-on efficiency
- Integrated protection features, such as short-circuit protection (DESAT), soft-off fault turn-off, active Miller clamp driver, and active shutdown
- 12 A typical peak output current
- Separate source and sink outputs
- 35 V absolute maximum output supply voltage
- Undervoltage lockout for SiC MOSFETs on both the positive and negative supply rails
- 75 ns short propagation delay (typ.) and tight IC-to-IC propagation delay matching
- Very fast DESAT detection and notification
- High common-mode transient immunity CMTI > 200 kV/µs
- Fine pitch DSO-16 wide body package with 8 mm creepage for optimal PCB footprint
- Gate driver safety certification:
  - UL 1577 (planned) recognized with $V_{ISO,test}$ = 6840 V (rms) for 1 s, V_{ISO} = 5700 V (rms) for 60 s
  - Reinforced isolation as per IEC 60747-17 (planned) with V_{IORM} = 1767 V

The on-board isolated power supply is designed with the 2EP130R transformer driver IC. The main features of 2EP130R IC are:

- Wide input voltage range 4.5 V to 20 V
- Wide range of switching frequency from 50 kHz to 695 kHz
- High accuracy duty cycle adjustment from 10% to 50%
- Peak-current controlled soft-start
- Over-current and over-temperature protection
- Ready signal to indicate successful completion of soft-start

1.4 Board parameters and technical data

Table 2 Absolute maximum ratings

Parameter/Pin	Symbol	Conditions/Notes	Value			Unit
			Min.	Typ.	Max.	
Diode protected board input voltage	*VDD*	Referenced to *GND1*	-0.3		18	V
Input-side supply voltage	*VCC1*	Referenced to *GND1*	-0.3		6.5	V
Non-inverting PWM input for low-side gate driver	*IN_LS*	Referenced to *GND1*	-0.3		6.5	V
Non-inverting PWM input for high-side gate driver	*IN_HS*	Referenced to *GND1*	-0.3		6.5	V
Ready output of the gate drivers	*RDY*	Referenced to *GND1*	-0.3		6.5	V
Reset input for the gate drivers	*RSTN*	Referenced to *GND1*	-0.3		6.5	V
Fault input or output for the gate drivers	*FLTN*	Referenced to *GND1*	-0.3		6.5	V

(table continues...)

Table 2 (continued) Absolute maximum ratings

Parameter/Pin	Symbol	Conditions/Notes	Value			Unit
			Min.	Typ.	Max.	
Ready output of the power supply	*RDY PSU*	Referenced to *GND1*	-0.3		6.5	V
Clock signal for bypass mode of power supply	*PWM PSU*	Referenced to *GND1*	-0.3		6.5	V
DC link voltage	*HV+*	Referenced to *HV-* power terminal. Limited by component ratings and design clearances. For voltages above 60 V, special safety measures should be taken	-0.2		900	V
Half-bridge midpoint connection	*PHASE*	Midpoint connection for the half-bridge. Referenced to *HV-* power terminal	-0.2		900	V
Output-side positive supply voltage for high-side gate driver	*VCC2H*	Referenced to high-side *GND2* . To be used only when on-board power supply is deactivated	-0.3		35	V
Output-side positive supply voltage for low-side gate driver	*VCC2L*	Referenced to low-side *GND2* . To be used only when on-board power supply is deactivated	-0.3		35	V
Output-side negative supply voltages for high-side gate driver	*VEE2H*	Referenced to high-side *GND2* . To be used only when on-board power supply is deactivated	-35		0.3	V
Output-side negative supply voltages for low-side gate driver	*VEE2L*	Referenced to low-side *GND2* . To be used only when on-board power supply is deactivated	-35		0.3	V
Output-side differential supply voltage for high-side gate driver	*VCC2H*	Referenced to high-side *VEE2* . To be used only when on-board power supply is deactivated	-0.3		35	V
Output-side differential supply voltage for low-side gate driver	*VCC2L*	Referenced to low-side *VEE2* . To be used only when on-board power supply is deactivated	-0.3		35	V

Table 3 Recommended operating conditions

Parameter/Pin	Symbol	Conditions/Notes	Value			Unit
			Min.	Typ.	Max	
Diode protected board input voltage	*VDD*	Referenced to *GND1*	13	15.1	17	V
Input-side supply voltage	*VCC1*	Referenced to *GND1*	3	3.3	5.5	V
Non-inverting PWM input for low-side gate driver	*IN_LS*	Referenced to *GND1*	-0.1	V_{VCC1}	V_{VCC1}+0.1	V
Non-inverting PWM input for high-side gate driver	*IN_HS*	Referenced to *GND1*	-0.1	V_{VCC1}	V_{VCC1}+0.1	V
Reset input for the gate drivers	*RSTN*	Referenced to *GND1*	-0.1	V_{VCC1}	V_{VCC1}+0.1	V

(table continues...)

Table 3 (continued) Recommended operating conditions

Parameter/Pin	Symbol	Conditions/Notes	Value			Unit
			Min.	Typ.	Max	
Fault input for the gate drivers	*FLTN*	Referenced to *GND1*	-0.1	V_{VCC1}	V_{VCC1}+0.1	V
DC link voltage	*HV+*	Referenced to *HV-* power terminal.	0	-	800	V
Half-bridge midpoint connection	*PHASE*	Midpoint connection for the half-bridge. Referenced to *HV-*power terminal	0	-	800	V
Output-side positive supply voltage for high-side gate driver	*VCC2H*	Referenced to high-side *GND2* . To be used only when on-board power supply is deactivated	15		18	V
Output-side positive supply voltage for low-side gate driver	*VCC2L*	Referenced to low-side *GND2* . To be used only when on-board power supply is deactivated	15		18	V
Output-side negative supply voltages for high-side gate driver	*VEE2H*	Referenced to high-side *GND2* . To be used only when on-board power supply is deactivated	-5	-	-3	
Output-side negative supply voltages for low-side gate driver	*VEE2L*	Referenced to low-side *GND2* . To be used only when on-board power supply is deactivated	-5	-	-3	V

2 System and functional description

2.1 Getting started

The EVAL-1ED3330MC12M-SiC is designed for convenient testing of the gate driver functionality and switching performance of the gate driver and power transistor in a half-bridge configuration. All the necessary supply voltages required to power the gate driver, including both input-side and output-side voltages, are generated directly on the board. This eliminates the need for multiple external power supplies and reduces setup complexity, allowing users to focus on evaluation and testing.

The board is designed to support both 5 V and 3.3 V for the gate driver input-side supply voltage *VCC1*, featuring a built-in linear power supply circuit to generate the required input voltage. It is important to note that the threshold values for the primary-side input signals are ratiometric, scaling with the *VCC1* supply voltage.

For the output-side supply voltages of the high-side and low-side gate drivers, it is recommended to use the on-board isolated power supply. This configurable power supply is designed to generate the bipolar supply voltages typically used to drive SiC MOSFETs. The output of the on-board power supply can be configured using the DIP switch S101 position and by adjusting the board input voltage, *VDD*.

2.1.1 Prerequisites

- The EVAL-DCLink-DPT decoupling board or alternatively any other external high-voltage decoupling capacitor (>60 µF) connected across the high-voltage power terminals: X100 (*HV+*) and X100 (*HV-*)
- A low-voltage power supply for supplying the input voltage of the board, capable of supplying up to 20 V and 500 mA: X101 (*VDD*) and X101 (*GND1*)
- Suitable pulse generator for double-pulse pattern generation
- High-voltage power supply for supplying the power stage via the EVAL-DCLink-DPT terminal or: X100 (*HV+*) and X100 (*HV-*)
- A suitable inductive load for double-pulse testing

2.1.2 Integration with the Infineon modular evaluation platform

This board is designed to be part of the Infineon modular evaluation platform. Although the evaluation board, EVAL-1ED3330MC12M-SiC is equipped with a small DC link capacitance for high frequency-decoupling, additional bulk capacitance is required for testing high currents in the DPT. In order to enable convenient evaluation, the DC link board EVAL-DCLink-DPT, from the Infineon modular evaluation platform can be used.

The EVAL-DCLink-DPT board is specifically designed to complement the EVAL-1ED3330MC12M-SiC, enabling faster and easier evaluation by providing the necessary capacitance and seamless integration between the two boards. In addition to supplying the required capacitance, the EVAL-DCLink-DPT board also offers dedicated connection points to facilitate the setup of a double-pulse test. The Figure 3 shows the EVAL-DCLink-DPT board. A brief description of the connectors on the EVAL-DCLink-DPT is provided for a quick start. It is strongly recommended to refer to the user guide to become familiar with the DC link board's functionality. To integrate with the EVAL-DCLink-DPT, unplug the connector from the high-voltage PCB terminal, X100 of EVAL-1ED3330MC12M-SiC and connect the two boards together.

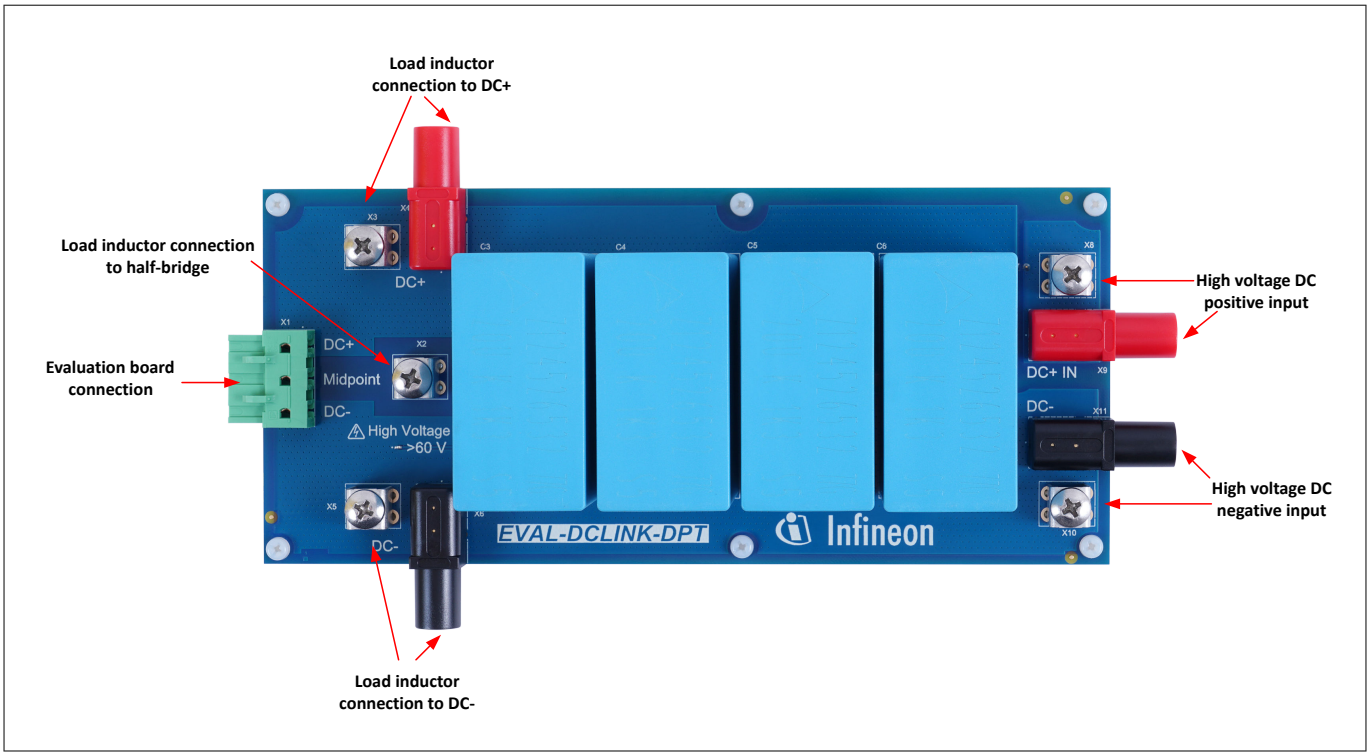

Figure 3 EVAL-DCLink-DPT

2.1.3 Power-up sequence

1. Mount the unassembled IMZC120R012M2H SiC MOSFETs or any other switches with the same package on the EVAL-1ED3330MC12M-SiC board.
2. Connect the double-pulse signal generator to the input pins of the board. For evaluating the low-side switching capability, connect the signal generator to the connector X300 (*IN_LS*) and X300 (*GND1*) and short the pins on the connector X200 (*IN_HS*) and X200 (*GND1*). For evaluation of the high-side switching capability, connect the signal generator to X200 (*IN_HS*) and X200 (*GND1*) and short X300 (*IN_LS*) to X300 (*GND1*).
3. High-voltage power supply and load connections:
   a. When used with the optional EVAL-DCLink-DPT board, the high voltage power supply and the load should be connected on the DC link board. For more information, please refer the user guide of the DC link board.
   b. When used as stand-alone, connect one end of the inductive load to terminal X100 (*PHASE*) and the other end, depending on the double-pulse test requirements, to either X100 (*HV+*) for the low-side testing or X100 (*HV-*) for the high-side testing. Connect the high-voltage power supply to the X100 (*HV+*) terminal and the power ground to the X100 (*HV-*) terminal.
4. Connect the low-voltage input supply for the board, *VDD* at the connector X101, and configure the four pole DIP switch, S101 based on the required gate driver supply voltages. The gate driver output-side power supply voltages can be configured as:

Table 4 Gate driver output-side supply voltage selection

***VDD* [V]**	**DIP switch configuration**	***VCC2* [V]**	***VEE2* [V]**
X	0000 (Deactivated)	0	0

(table continues...)

Table 4 (continued) Gate driver output-side supply voltage selection

VDD [V]	DIP switch configuration	*VCC2* [V]	*VEE2* [V]
15.1	1000	18	-3
16.5	0100	18	-5
14.5	0010	15	-5
13.2	0001	15	-3

***Note**: The DIP switch configuration 1 implies the pole is in the ON position.*

5. If the gate drivers are to be supplied with external voltages, deactivate the on-board power supply using the DIP switch configuration explained in the previous step and supply the external voltages for the high-side gate driver on connector X201 and the low-side gate driver on the connector X301. Please note that the supply voltages for the high-side and the low-side gate drivers should be functionally isolated from each other.
6. The internally generated *VCC1* supply can be tailored for different signal and supply voltages by the jumper J101. The default configuration (jumper open) sets *VCC1* to 3.3 V. This can be changed to 5 V by bridging the jumper J101.
7. After the board is powered up, the following green LEDs will turn on indicating that the board is ready for operation:

Table 5

LED	Symbol	Indication
D101	*VDD*	Board input-side supply voltage available
D102	*VCC1*	Gate drivers input-side supply voltage available
D207	*PS_HS*	High-side gate driver output-side supply voltage available
D307	*PS_LS*	Low-side gate driver output-side supply voltage available
D110	*RDY_PS*	On-board isolated power supply ready
D112	*RDY*	Gate drivers ready for operation
D114	*FLT*	No DESAT fault in the system

8. The board is now fully configured and ready for double-pulse evaluation.

2.2 Sample measurement results

The switches IMZC120R012M2H are assembled on the EVAL-1ED3330MC12M-SiC board which is connected to the DC link board, EVAL-DCLink-DPT. The gate drivers are supplied with the on-board power supply as described in Chapter 2.1.3.

2.2.1 Startup behavior

The board is powered up with the gate drivers in a non-switching state.

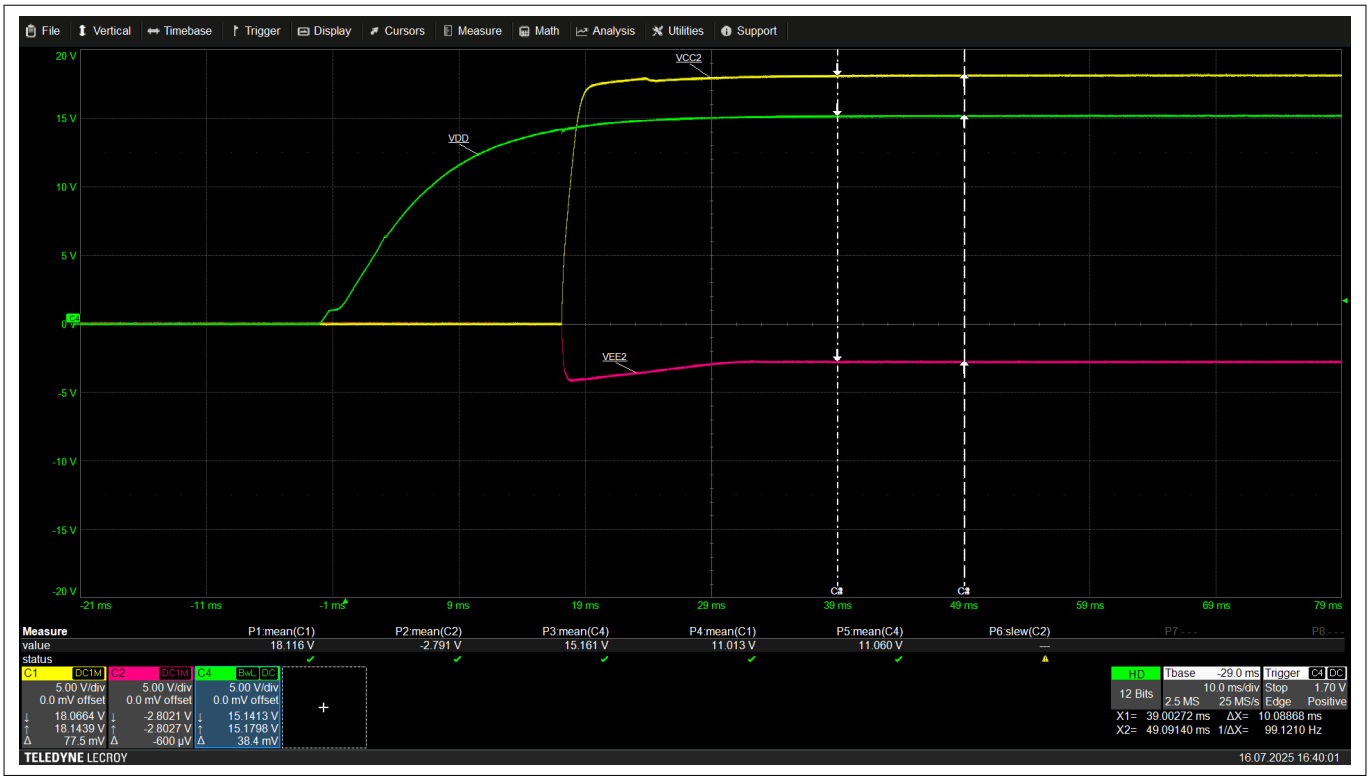

Figure 4 **EVAL-1ED3330MC12M-SiC – Gate driver output-side supply voltages startup**

Table 6 **Measurement signals and scaling**

Channel	Color	Signal	Vertical scale	Horizontal scale
Channel 1	Yellow	V_{VCC2_LS} - V_{GND2_LS}	5 V/div	10 ms/div
Channel 2	Red	V_{VEE2_LS} - V_{GND2_LS}	5 V/div	10 ms/div
Channel 4	Green	*VDD*	5 V/div	10 ms/div

Figure 4 shows the ramp-up of the output-side supply voltages of the low-side gate driver at startup. The positive supply voltage and the negative supply voltage reach 18 V and -2.8 V, respectively after the soft-start.

2.2.2 Double-pulse test

On this evaluation board, the double pulse test is conducted on the low-side switch to evaluate its switching performance and the gate driver's control functionality. The EVAL-DCLink-DPT board is connected to EVAL-1ED3330MC12M-SiC board to provide the bulk capacitance for the testing. The on-board isolated power supply is configured to provide +18 V and -3 V for the output side of the gate drivers. A 201 µH inductor is connected between the terminals X4 (*DC+*) and X2 (*Midpoint)* on the EVAL-DCLink-DPT board to act as the load. During the test, an 800 V DC voltage is applied across the power terminals X9 (*DC+IN*) and the X9 (*DC-*) of the EVAL-DCLink-DPT board. This voltage appears across the X100 (*HV+*) and X100 (*HV-*) terminals. The block diagram of the measurement setup is shown in Figure 5.

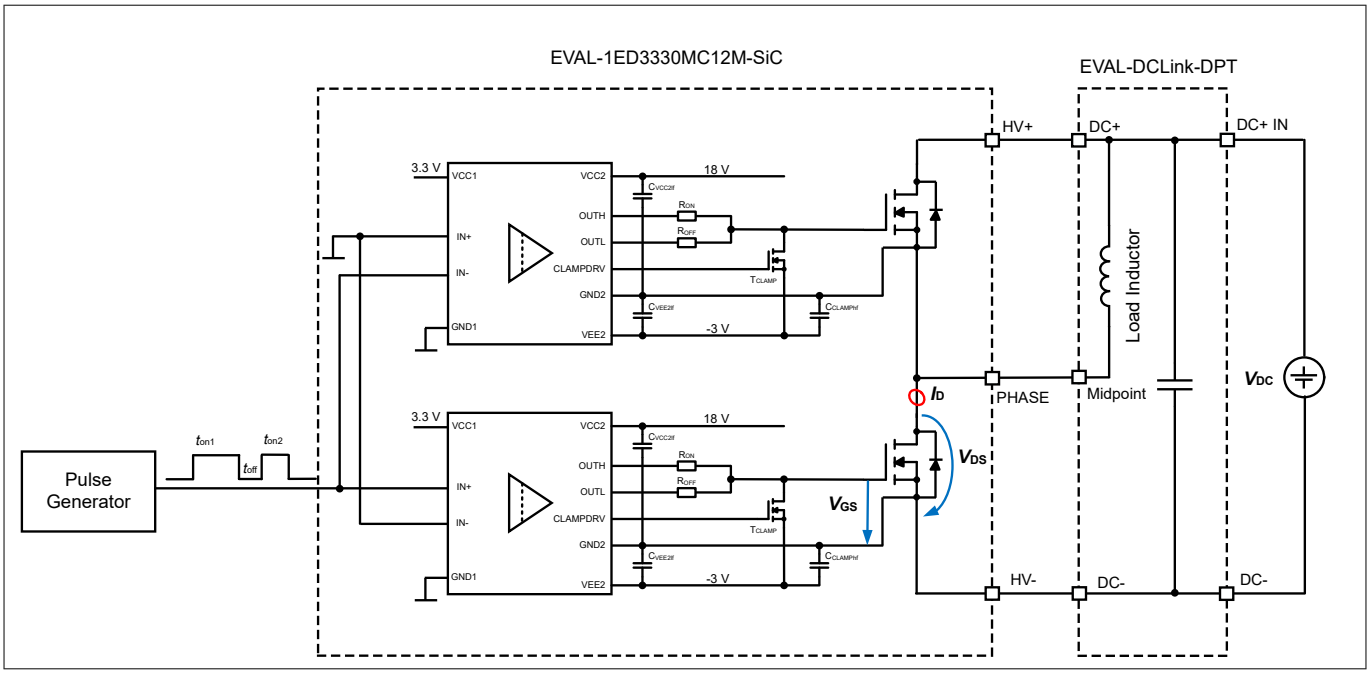

Figure 5 Measurement setup for the double-pulse test

Figure 6, Figure 7 and Figure 8 show the results of the double-pulse test on the EVAL-1ED3330MC12M-SiC board. During the test, the sequence of events is a follows:

1. When the first pulse is applied, the low-side switch turns on, causing the DC voltage to be applied across the load inductor, which leads to a steady ramp-up of the inductor current.
2. By the end of the first pulse, the low-side switch reaches the test current level and it is turned off. For this measurement, a test current of 60 A is chosen.
3. After the turn-off of the low-side switch, the inductor current commutates to the body diode of the high-side switch, allowing the current to continue freewheeling through the circuit.
4. When the low-side switch turns on again, the inductor current commutates from the body diode of the high-side switch back to the low-side switch, enabling the current to continue its natural ramp-up due to the applied DC voltage. At turn-on, the current in the low-side switch is close to the test level of 60 A as a result of the freewheeling process.

Therefore, the double-pulse test enables the characterization of the switch's turn-on and turn-off behavior and allows for the evaluation of the gate driver's ability to control high-current switching events.

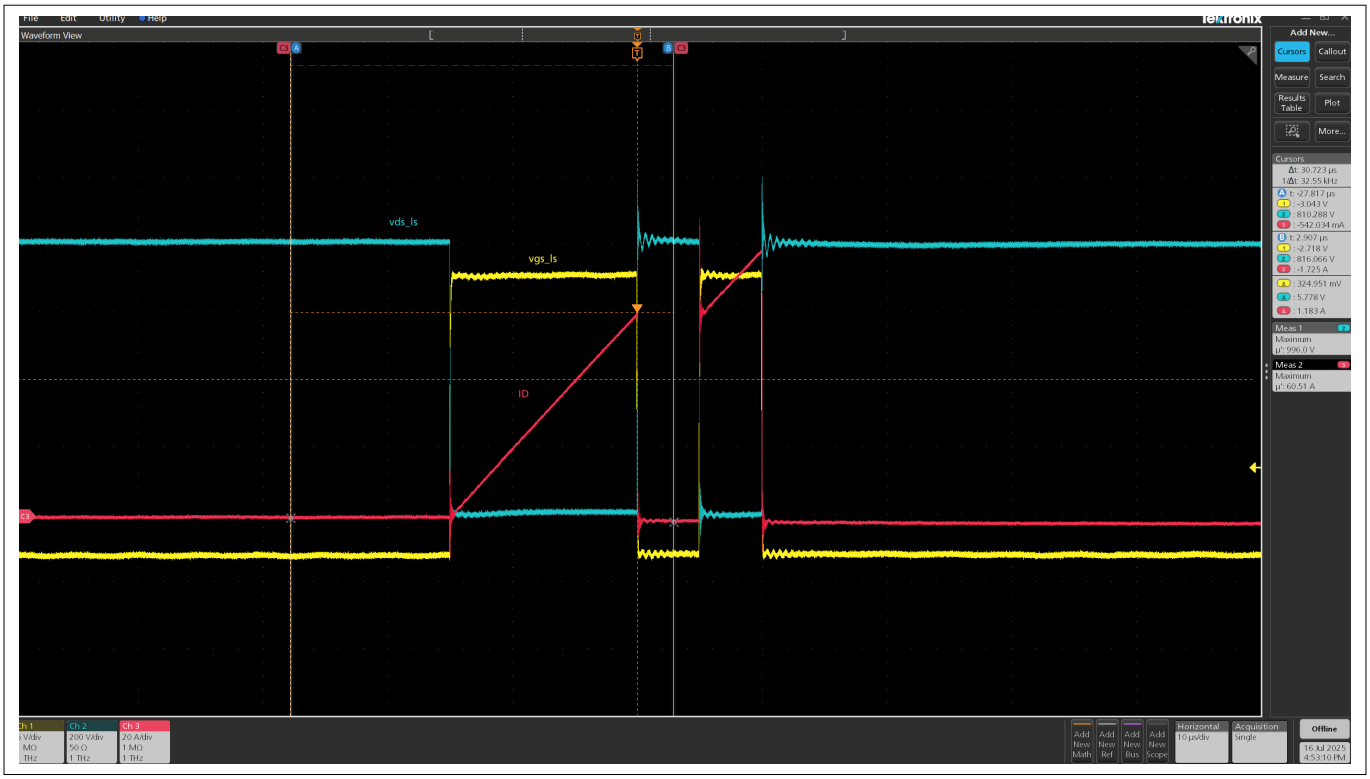

Figure 6 **EVAL-1ED3330MC12M-SiC– Double-pulse test of the low-side switch**

Table 7 **Measurement signals and scaling**

Channel	Color	Signal	Vertical scale	Horizontal scale
Channel 1	Yellow	V_{GS_LS}	5 V/div	10 µs/div
Channel 2	Blue	V_{DS_LS}	200 V/div	10 µs/div
Channel 3	Red	I_{D_LS}	20 A/div	10 µs/div

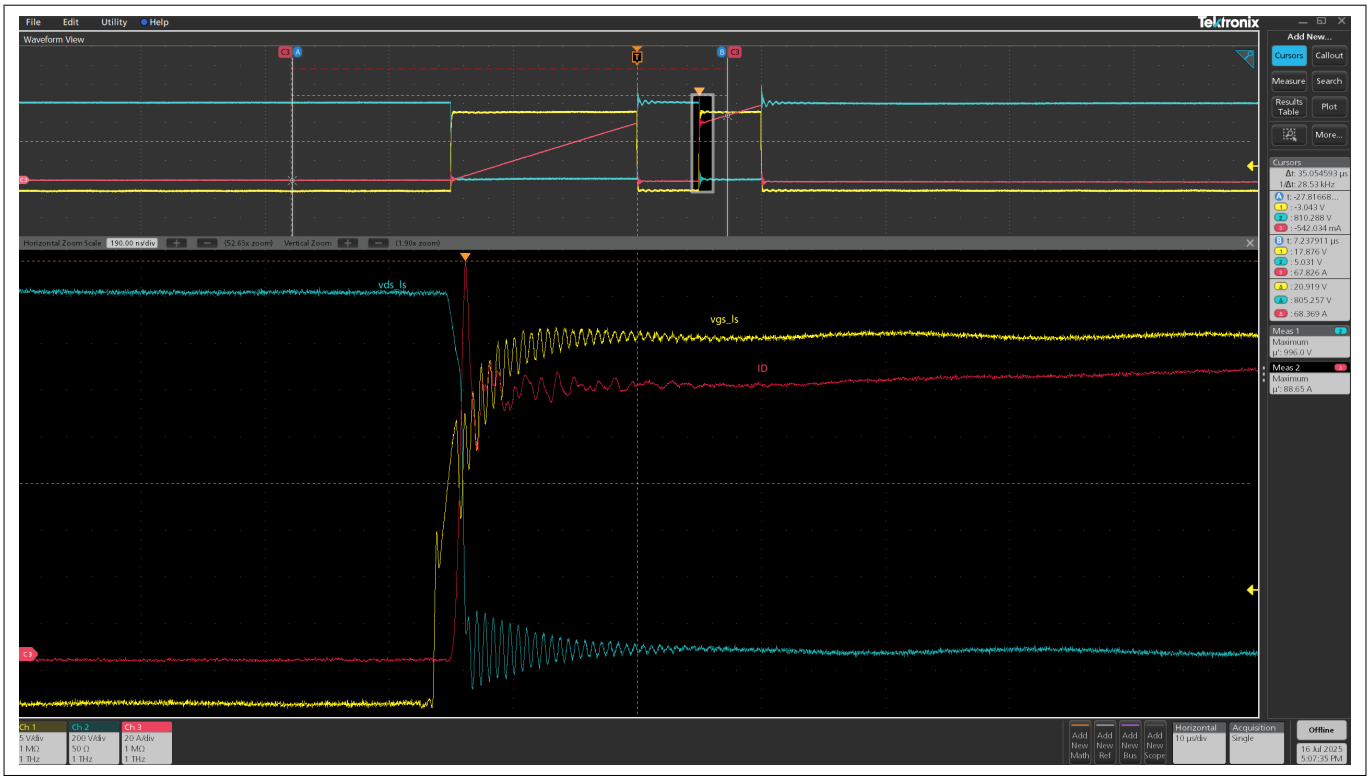

Figure 7 **EVAL-1ED3330MC12M-SiC– Turn-on of the low-side switch**

Table 8 **Measurement signals and scaling**

Channel	Color	Signal	Vertical scale	Horizontal scale
Channel 1	Yellow	V_{GS_LS}	5 V/div	190 ns/div
Channel 2	Blue	V_{DS_LS}	200 V/div	190 ns/div
Channel 3	Red	I_{D_LS}	20 A/div	190 ns/div

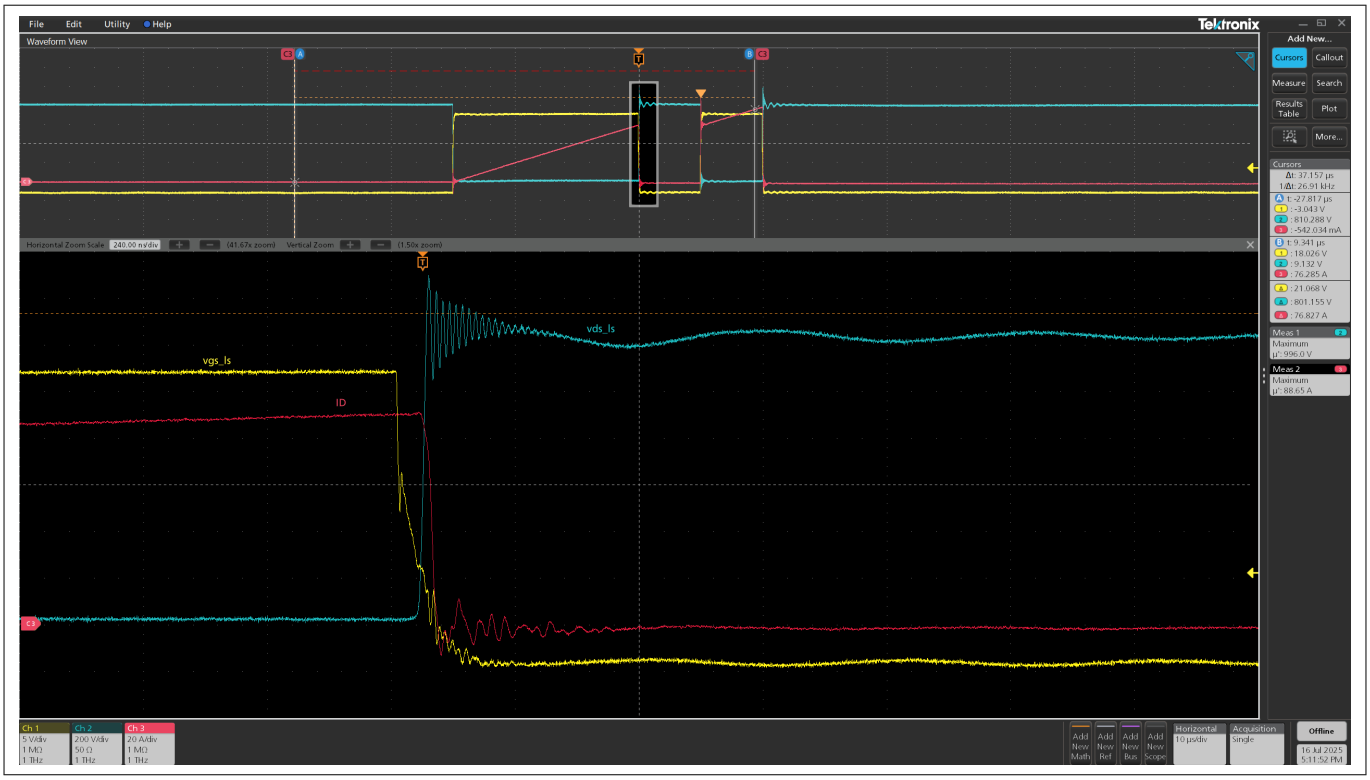

Figure 8 **EVAL-1ED3330MC12M-SiC– Turn-off of the low-side switch**

Table 9 **Measurement signals and scaling**

Channel	Color	Signal	Vertical scale	Horizontal scale
Channel 1	Yellow	V_{GS_LS}	5 V/div	190 ns/div
Channel 2	Blue	V_{DS_LS}	200 V/div	190 ns/div
Channel 3	Red	I_{D_LS}	20 A/div	190 ns/div

2.2.3 Short circuit test

The type 1 short circuit test demonstrates the functionality and robustness of the gate driver, particularly its DESAT (desaturation) protection mechanism, which protects the switch during fault conditions. On the evaluation board, the type 1 short circuit test is conducted on the low-side switch. In this test, the on-board power supply is configured to generate 15 V and -5 V for the output side of the gate drivers. An 800 V DC voltage is applied to the power terminals of the EVAL-DCLink-DPT board. The short circuit condition on the high-side switch is simulated by directly shorting its drain and source terminals. Under this condition, the low-side switch is actively turned on to allow current to flow through the short circuit. This test replicates the severe electrical and thermal stresses encountered during a fault, allowing evaluation of the gate driver's ability to detect the short circuit and protect the power semiconductor device through DESAT protection.

Figure 9 shows the type 1 short circuit on EVAL-1ED3330MC12M-SiC. When the low-side switch turns on, the drain current through the MOSFET rises rapidly and the drain-to-source voltage falls. After the gate driver's leading-edge blanking time has elapsed, the gate driver's internal DESAT current source begins charging the DESAT capacitor. As the drain current continues to increase, it reaches its maximum value before leveling off due to the saturation of the MOSFET. With the increasing current, the MOSFET's drain-to-source voltage starts to rise again. This rise in the drain-to-source voltage (*dV/dt*) further contributes to the charging of the DESAT capacitor via the junction capacitance of the DESAT diode. Consequently, the voltage on the DESAT capacitor reaches the threshold value, triggering the gate driver's DESAT protection. The gate driver activates the DESAT

protection by initiating a soft turn-off at the output. This ensures a controlled turn-off of the switch that minimizes the overshoot of the drain to source voltage caused by switching off the short circuit current. Finally, the gate driver latches into a fault state and the *FLTN* signal transitions to a LOW state, indicating the fault condition to the input side of the system.

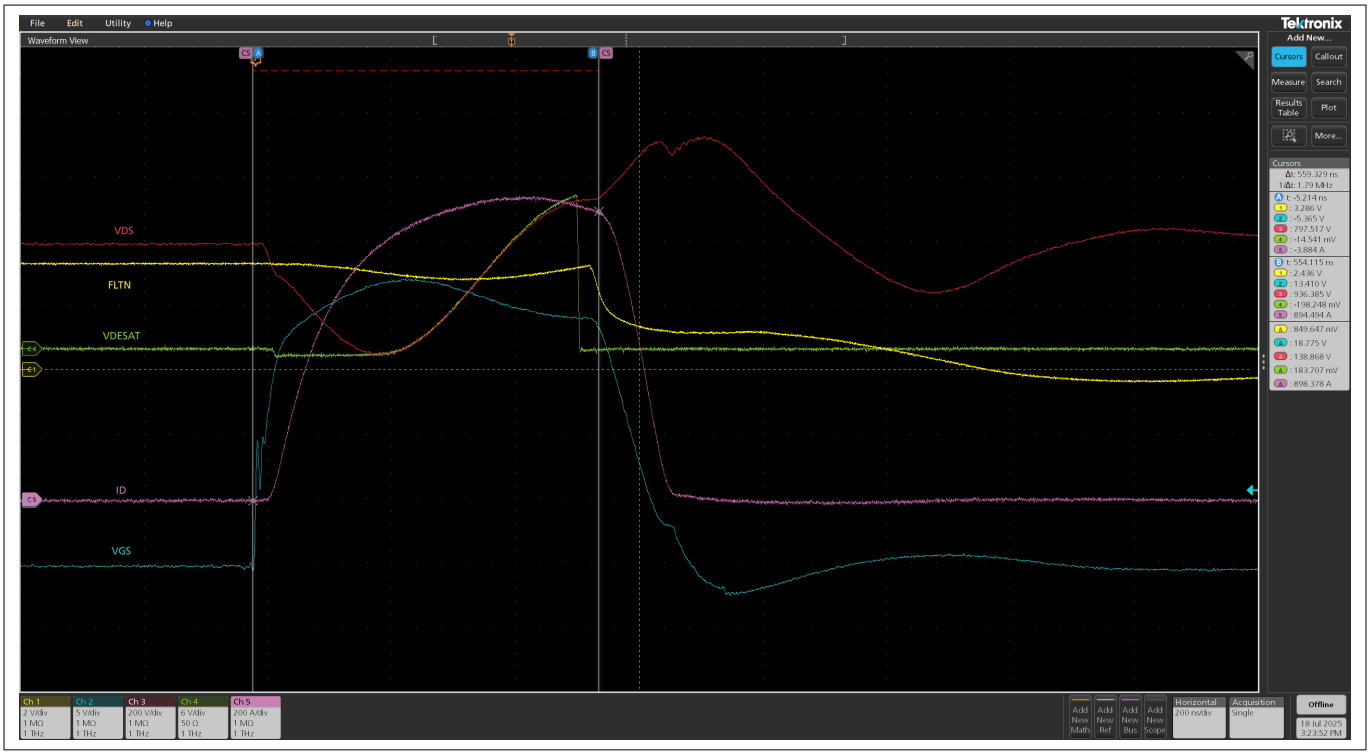

Figure 9 **EVAL-1ED3330MC12M-SiC– Type 1 short circuit test of the low-side switch**

Table 10 **Measurement signals and scaling**

Channel	Color	Signal	Vertical scale	Horizontal scale
Channel 1	Yellow	V_{FLTN}	2 V/div	200 ns/div
Channel 2	Blue	V_{GS_LS}	5 V/div	200 ns/div
Channel 3	Red	V_{DS_LS}	200 V/div	200 ns/div
Channel 4	Green	V_{DESAT_LS}	6 V/div	200 ns/div
Channel 5	Magenta	I_{D_LS}	200 A/div	200 ns/div

3 System design

The EVAL-1ED3330MC12M-SiC evaluation board is designed to evaluate the 1ED3330MC12M gate driver IC. To assist the user in quickly getting started with the design, this section provides the schematic, PCB layout details and the bill of materials (BOM). Furthermore, the schematic, the gerber files, the BOM and the complete Altium Designer project files are available for download on the EVAL-1ED3330MC12M-SiC evaluation board's homepage for comprehensive design support.

3.1 Schematics

This section presents the schematics of the evaluation board.

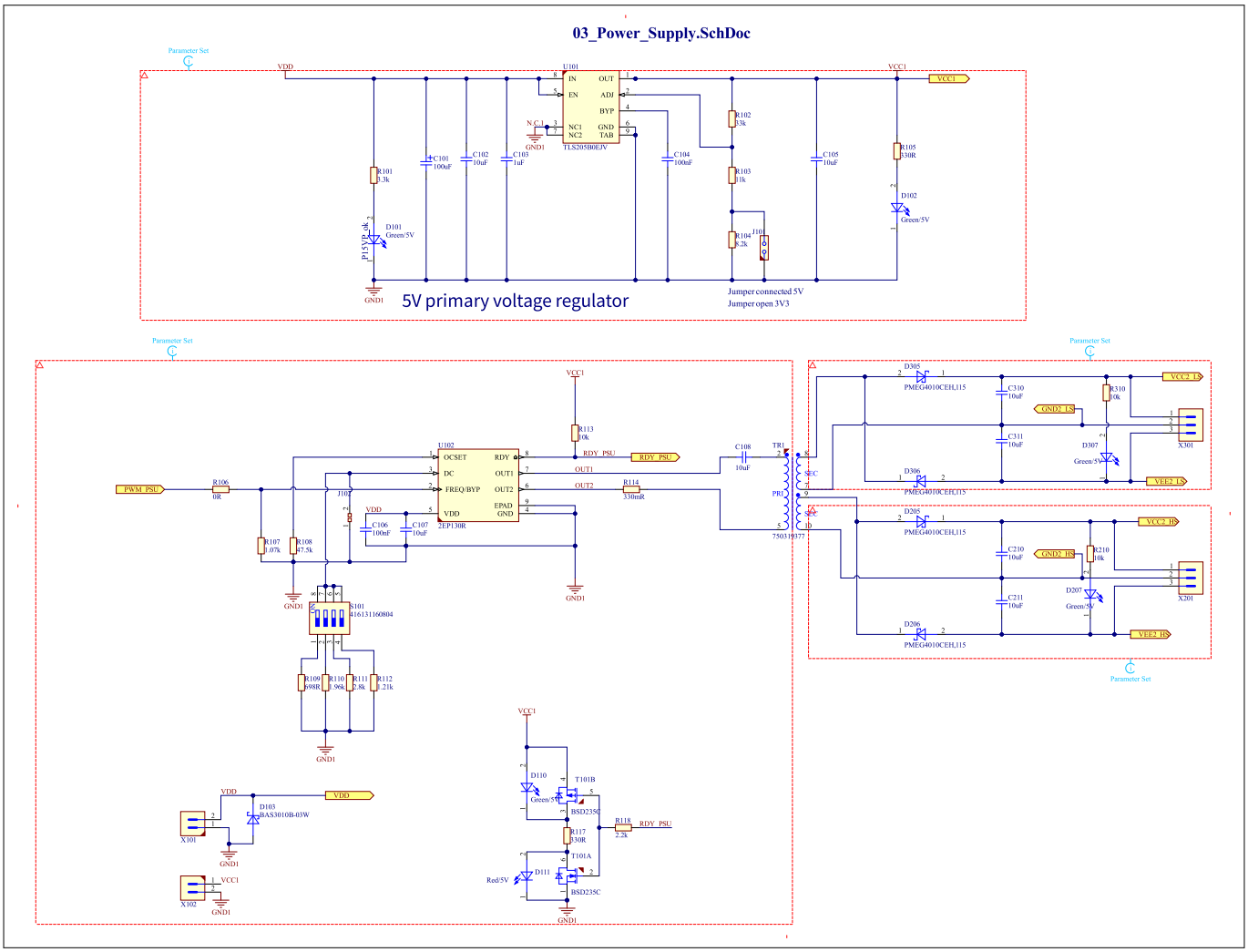

Figure 10 Power supply circuit schematic

3 System design

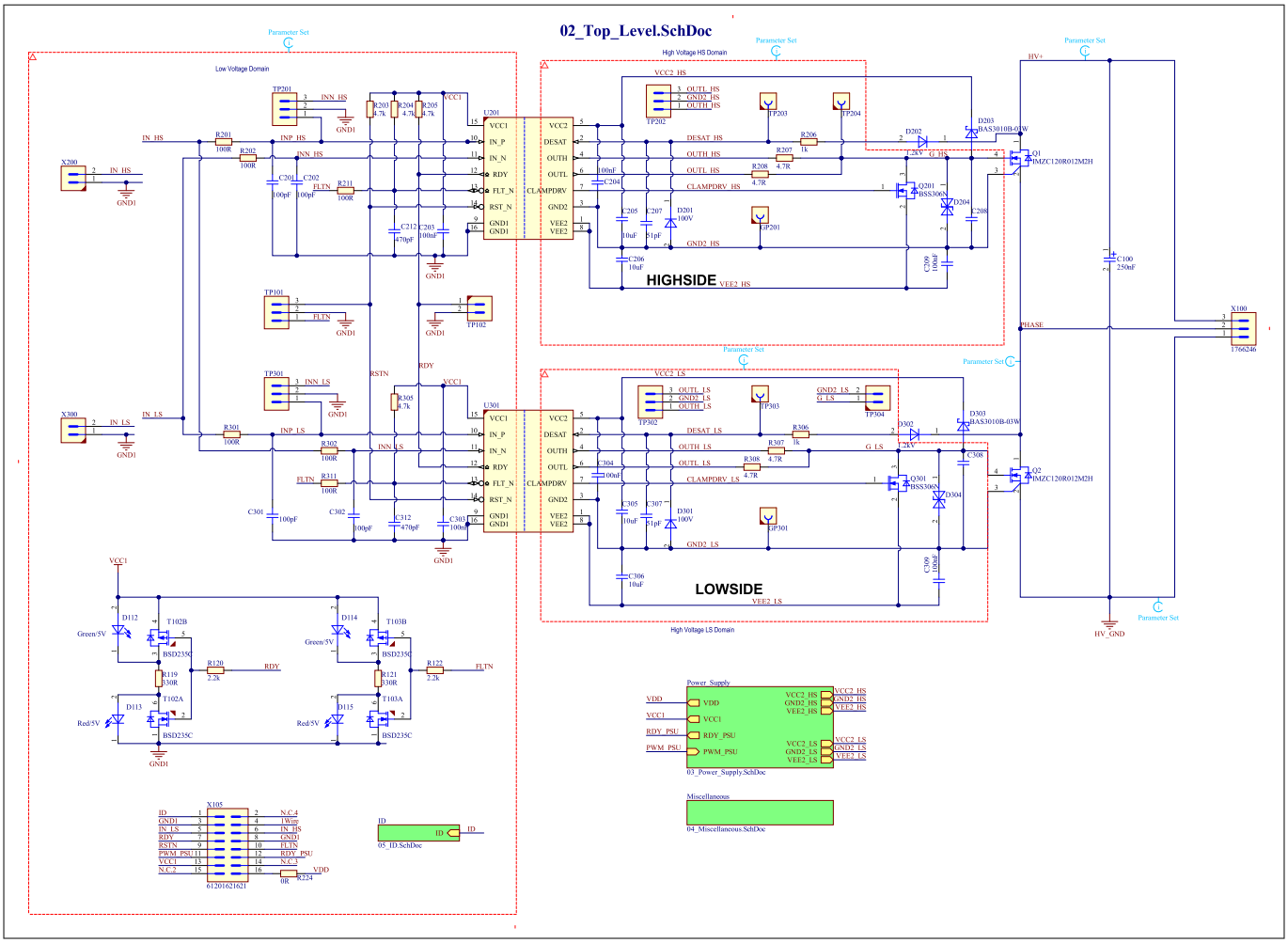

Figure 11 **Circuit schematic of the half-bridge featuring SiC MOSFETs and gate driver circuitry**

3.2 Layout

The evaluation board EVAL-1ED3330MC12M-SiC is designed on a 4 layer PCB with 35 µm copper thickness. The top and the bottom view of the PCB layout as well as the copper layers of the PCB are shown below.

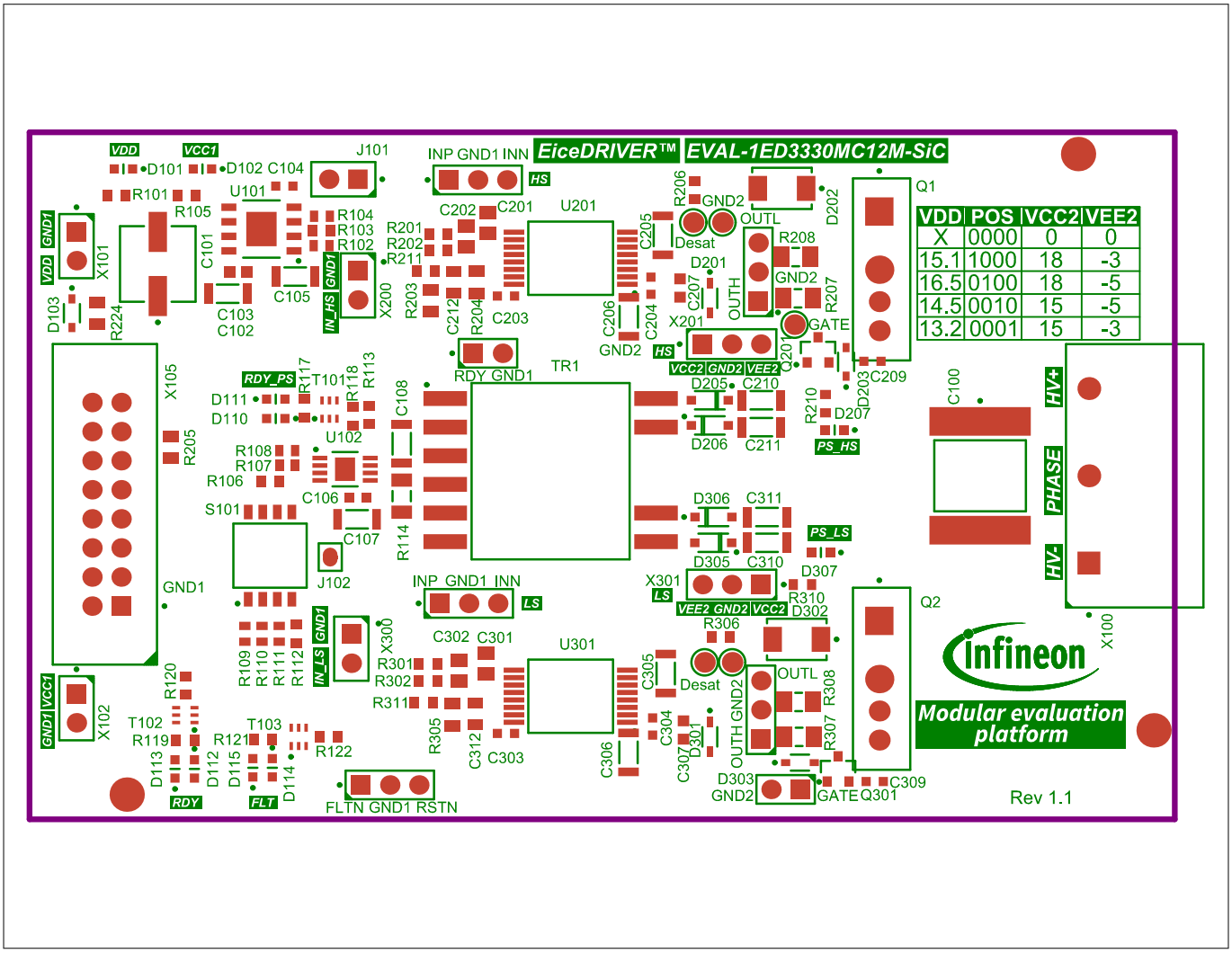

Figure 12 PCB top overlay

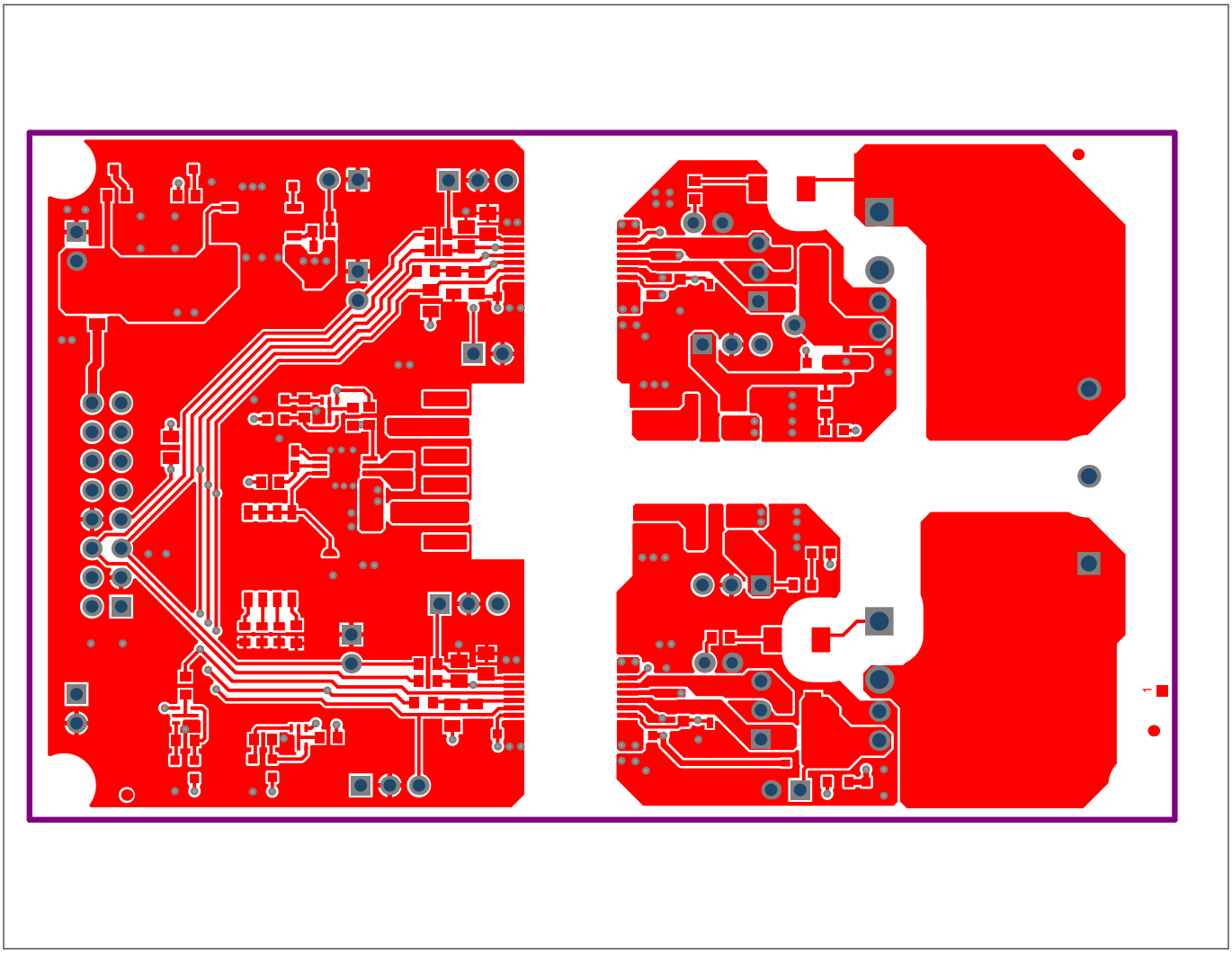

Figure 13 **PCB top copper layer**

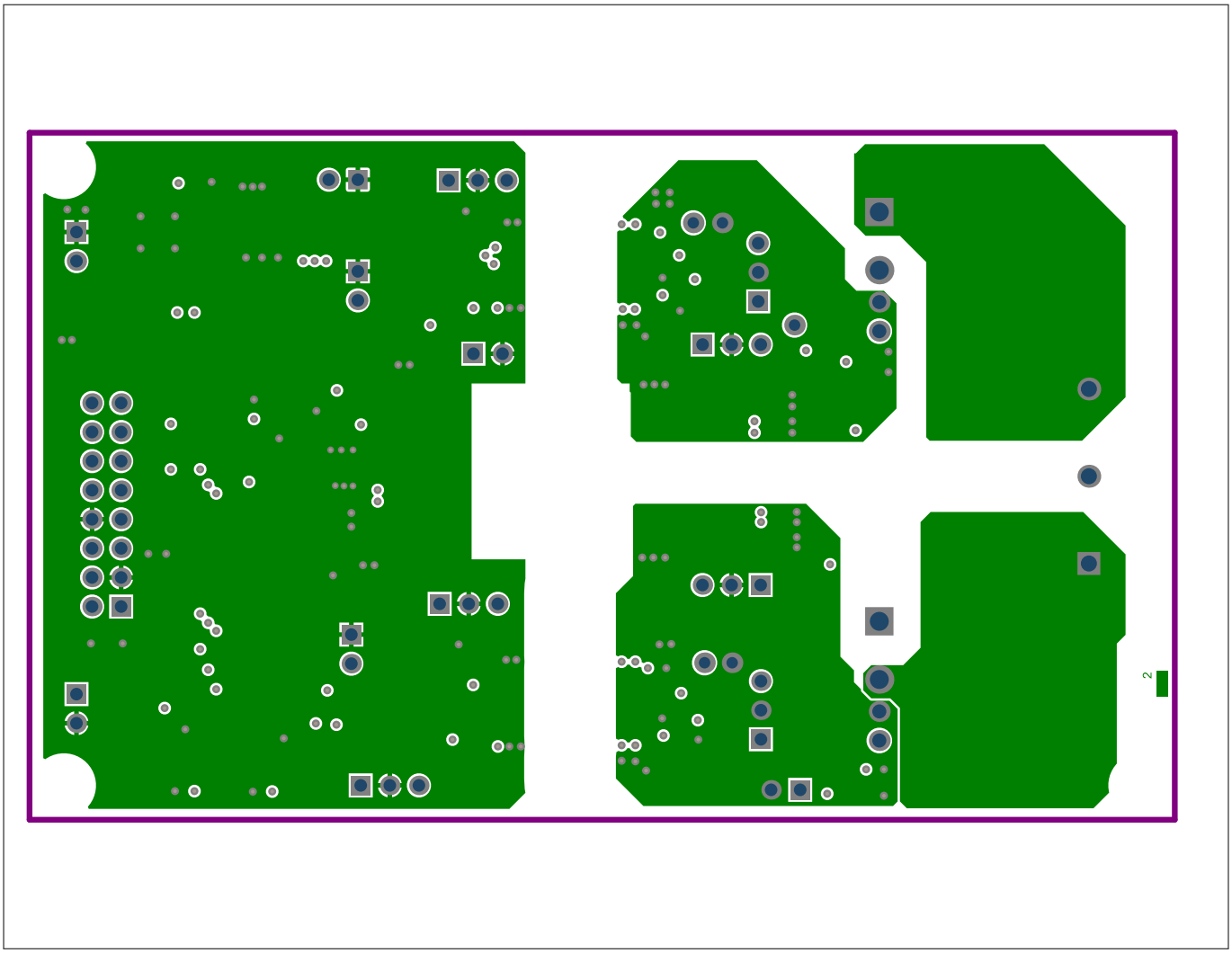

Figure 14 **PCB inner copper layer 1**

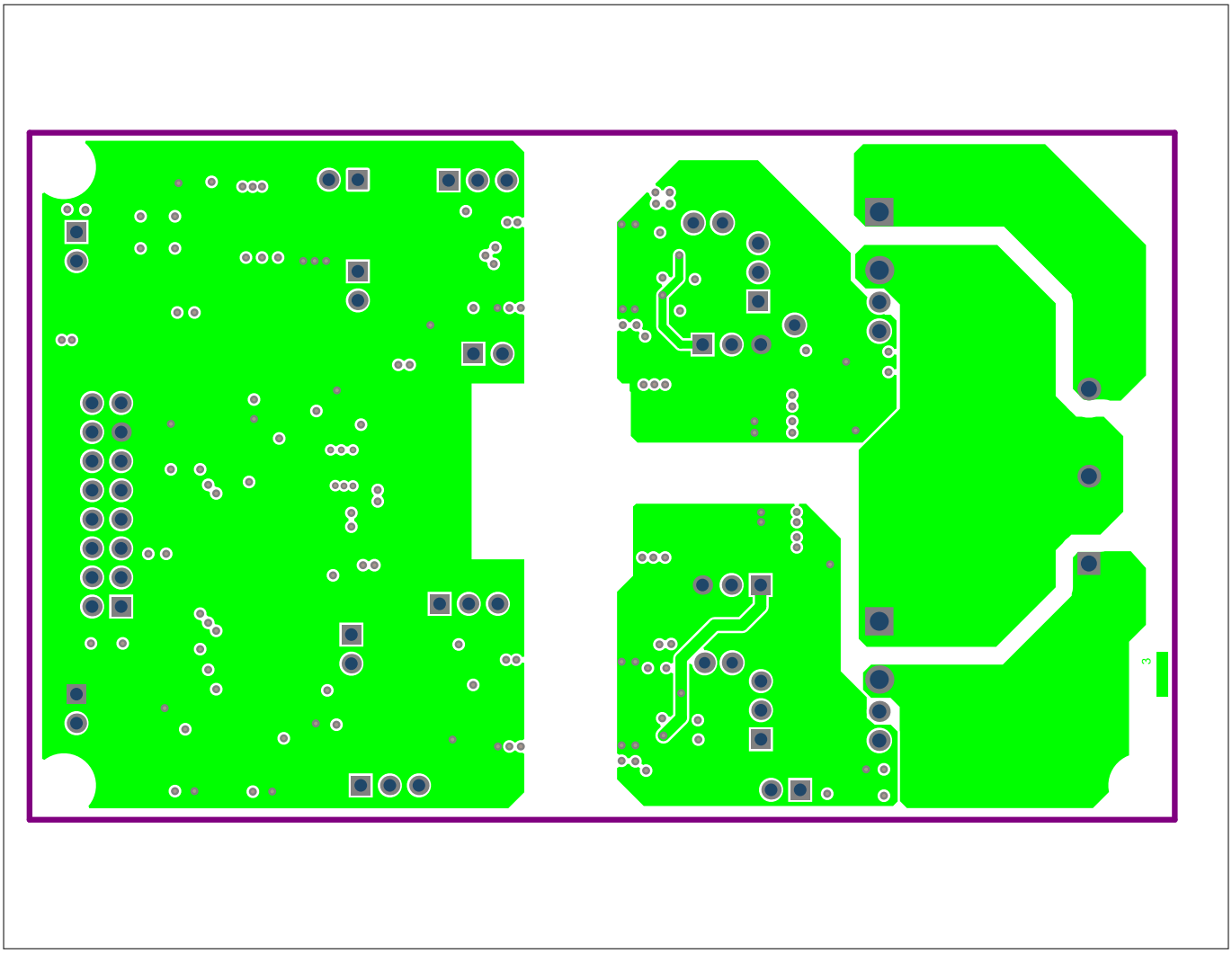

Figure 15 **PCB inner copper layer 2**

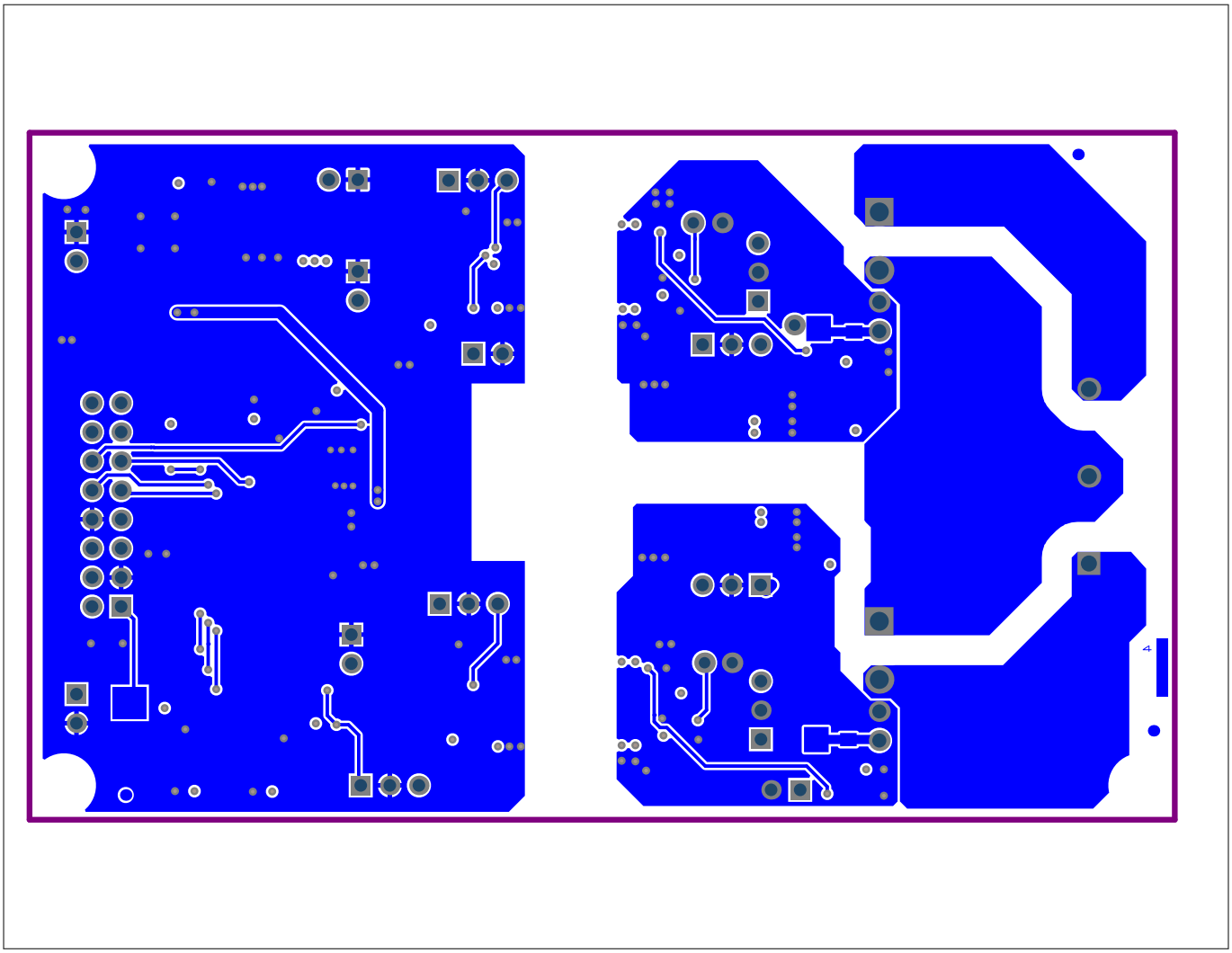

Figure 16 **PCB bottom copper layer**

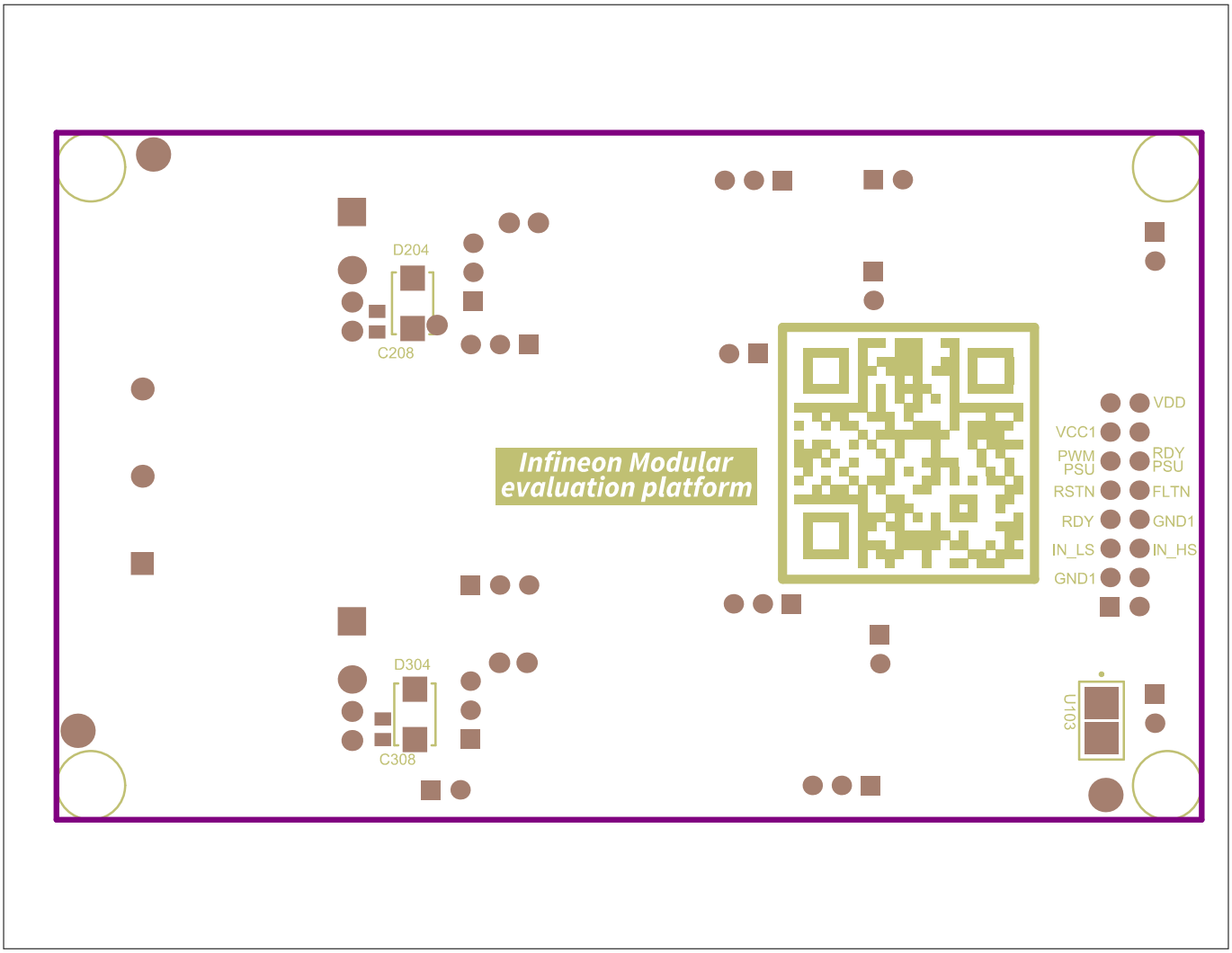

Figure 17 **PCB bottom overlay(mirrored)**

3.3 Bill of materials

This chapter provides the Bill of Materials (BOM) table, detailing all components, part numbers and quantities required for the evaluation board

Table 11 **Bill of materials**

Designator	Quantity	Description	Manufacturer	Manufacturer P/N
C100	1	Capacitor, 250nF	TDK Corporation	B58031I9254M062
C101	1	Capacitor, 100uF	Wurth Elektronik	865090445008
C102, C105, C107, C108, C205, C206, C210, C211, C305, C306, C310, C311	12	Capacitor, 10uF, 1206 (3216)	TDK Corporation	C3216X7R1H106K160AC
C103	1	Capacitor, 1uF, 0603 (1608)	Wurth Elektronik	885012206076
C104, C106, C203, C204, C209, C303, C304, C309	8	Capacitor, 100nF, 0603 (1608)	Wurth Elektronik	885012206095

(table continues...)

Table 11 (continued) Bill of materials

Designator	Quantity	Description	Manufacturer	Manufacturer P/N
C201, C202, C301, C302	4	Capacitor, 100pF 0805 (2012)	MuRata	GCM2165C2A101FA16
C207, C307	2	Capacitor, 51pF, 0603 (1608)	MuRata	GRM1885C1H510JA01
C212, C312	2	Capacitor, 470pF, 0805 (2012)	Wurth Elektronik	885012007061
D101, D102, D110, D112, D114, D207, D307	7	Diode, Green/5V, SMD	Wurth Elektronik	150060VS75000
D103, D203, D303	3	Diode, BAS3010B-03W, SOD323	Infineon Technologies	BAS3010B-03W
D111, D113, D115	3	Diode, Red/5V, 0603 (1608)	Wurth Elektronik	150060RS75000
D201, D301	2	Diode, 100V, SOD-323 (SC-76)	Nexperia	BAS316Z
D202, D302	2	Diode, 1.2kV, SMB (DO-214AA)	STMicroelectronics	STTH112U
D205, D206, D305, D306	4	Diode, PMEG4010CEH,115, SOD123F	Nexperia	PMEG4010CEH,115
J101, X101, X102, X200, X300	5	Connector, 61300211121, THT	Wurth Elektronik	61300211121
MP1, MP2, MP3, MP4	4	Screw, D00688	Duratool	D00688
MP5, MP6, MP7, MP8	4	Standoff, 970150365	Wurth Elektronik	970150365
Q3, Q4	2	CoolSiC™ MOSFET, IMZC120R012M2H, PG-TO247-4-17	Infineon Technologies	IMZC120R012M2H
Q201, Q301	2	OptiMOS™ MOSFET, BSS306N, PG-SOT23-3-5	Infineon Technologies	BSS306N
R101	1	Resistor, 3.3k, 0603 (1608)	Wurth Elektronik	560112116047
R102	1	Resistor, 33k, 603	Vishay	CRCW060333K0FK
R103	1	Resistor, 11k, 0603 (1608)	Wurth Elektronik	560112116147
R104	1	Resistor, 8.2k, 603	Vishay	CRCW06038K20FK
R105, R117, R119, R121	4	Resistor, 330R, 0603 (1608)	Wurth Elektronik	560112116020
R106	1	Resistor, 0R, 0603 (1608)	Yageo	RC0603JR-070RL
R107	1	Resistor, 1.07k, 0603 (1608)	Vishay	CRCW06031K07FK
R108	1	Resistor, 47.5k, 0603 (1608)	Vishay	CRCW060347K5FK
R109	1	Resistor, 698R, 0603 (1608)	Vishay	CRCW0603698RFK
R110	1	Resistor, 1.96k, 0603 (1608)	Vishay	CRCW06031K96FK
R111	1	Resistor, 2.8k, 0603 (1608)	Vishay	CRCW06032K80FK
R112	1	Resistor, 1.21k, 0603 (1608)	Wurth Elektronik	560112116120
R113, R210, R310	3	Resistor, 10k, 0603 (1608)	Yageo	RC0603FR-0710KL

(table continues...)

Table 11 (continued) Bill of materials

Designator	Quantity	Description	Manufacturer	Manufacturer P/N
R114	1	Resistor, 330mR, 1206 (3216)	Bourns	CRM1206-FX-R330 E LF
R118, R120, R122	3	Resistor, 2.2k, 0603 (1608)	Wurth Elektronik	560112116098
R201, R202, R211, R301, R302, R311	6	Resistor, 100R, 0603 (1608)	Yageo	RC0603FR-07100RL
R203, R204, R205, R305	4	Resistor, 4.7k, 0805 (2012)	Wurth Elektronik	560112120030
R206, R306	2	Resistor, 1k, 0603 (1608)	Wurth Elektronik	560112116016
R207, R208, R307, R308	4	Resistor, 4.7R, 1206 (3216)	Vishay	RCS12064R70FKEA
R224	1	Resistor, 0R, 0805 (2012)	Yageo	RC0805JR-070RL
S101	1	DIP Switch, 416131160804, SMD	Wurth Elektronik	416131160804
T101, T102, T103	3	OptiMOS™ MOSFET, BSD235C, PG-SOT-363	Infineon Technologies	BSD235C
TR1	1	Transformer, 750319377, SMD	Wurth Elektronik	750319377 R00
U101	1	Power Supply, TLS205B0EJV, PG-DSO-8-52	Infineon Technologies	TLS205B0EJV
U102	1	Full-bridge transformer driver, 2EP130R, PG-TSSOP-8-2	Infineon Technologies	2EP130R
U201, U301	2	Single-channel isolated gate driver with DESAT, Soft-off,and CLAMP driver, 1ED3330MC12M, PG-DSO 16	Infineon Technologies	1ED3330MC12M
X1	1	Connector, 1767012, Terminal Block	Phoenix Contact	1767012
X100	1	Connector, 1766246, THT	Phoenix Contact	1766246
X105	1	Connector, 61201621621, THT	Wurth Elektronik	61201621621

3.4 Connectors

General information about the input and output connectors of the EVAL-1ED3330MC12M-SiC evaluation board is provided in this section.

This table shows the pinout of the input-side low-voltage connectors. It includes the connectors X101, X102, X105, X200 and X300

Table 12 Input side connectors pinout

Connector	Pin	Symbol	Function
X101	1	*GND1*	Common ground reference for the input side
X101	2	*VDD*	Supply voltage for the input side of the board
X102	1	*VCC1*	Supply voltage for the input side of the gate drivers
X102	2	*GND1*	Common ground reference for the input side
X105	1		Not connected
X105	2		Not connected
X105	3	*GND1*	Common ground reference for the input side
X105	4		Not connected
X105	5	*IN_LS*	Non-inverting input for the low-side gate driver
X105	6	*IN_HS*	Non-inverting input for the high-side gate driver
X105	7	*RDY*	Ready state of the gate drivers, active high signal
X105	8	*GND1*	Common ground reference for the input side
X105	9	*RSTN*	**1.** Enable/shutdown input signal for the gate drivers **2.** Reset signal for the fault latch state of the gate drivers in case of DESAT protection activation, active low signal
X105	10	*FLTN*	Fault output signal of the gate drivers indicating DESAT fault, active low signal
X105	11	*PWM_PSU*	External PWM signal for bypass mode of the on-board isolated power supply circuit. Remove the resistor R107 and bridge the solder jumper J102 for bypass mode.
X105	12	*RDY_PSU*	Ready state of the transformer driver 2EP130R, active high signal
X105	13	*VCC1*	Supply voltage for the input side of the gate drivers
X105	14		Not connected
X105	15		Not connected
X105	16	*VDD*	Supply voltage for the input side of the board
X200	1	*GND1*	Common ground reference for the input side
X200	2	*IN_HS*	Non-inverting input for the high-side gate driver
X300	1	*GND1*	Common ground reference for the input side
X300	2	*IN_LS*	Non-inverting input for the low-side gate driver

This table shows the pinout of the output-side gate driver power supply connectors X201 and X301. Use these connectors only if the on-board isolated power supply circuit is deactivated.

Table 13 Output side power supply connectors pinout

Connector	Pin	Symbol	Function
X201	1	*VCC2*	Positive supply voltage for the high-side gate driver
X201	2	*GND2*	Ground reference for the supply voltage of the high-side gate driver
X201	3	*VEE2*	Negative supply voltage for the high-side gate driver
X301	1	*VCC2*	Positive supply voltage for the low-side gate driver
X301	2	*GND2*	Ground reference for the supply voltage of the low-side gate driver
X301	3	*VEE2*	Negative supply voltage for the low-side gate driver

This table shows the pinout of the high-voltage power terminal connector X100.

Table 14 High-voltage terminal connector pinout

Connector	Pin	Symbol	Function
X100	1	*HV-*	High-voltage DC ground connection
X100	2	*Phase*	Half-bridge midpoint for connecting to the load inductor
X100	3	*HV+*	High-voltage DC positive input

3.5 Test points

This chapter provides an overview of all test points available on the evaluation board, detailing their functions and intended measurements.

This table summarizes all the test points available on the evaluation board for measurement of signals on the input side

Table 15 Input side test points

Test point	Pin	Symbol	Function
TP101	1	*FLTN*	Common fault output signal of the high-side and low-side gate drivers indicating DESAT fault
TP101	2	*GND1*	Common input-side ground reference
TP101	3	*RSTN*	Common reset signal for the high-side and low-side gate drivers
TP102	1	*RDY*	Common ready state of the high-side and low-side gate drivers
TP102	2	*GND1*	Common input-side ground reference
TP201	1	*INP*	Non-inverting input for the high-side gate driver
TP201	2	*GND1*	Common input-side ground reference
TP201	3	*INN*	Inverting input for the high-side gate driver
TP301	1	*INP*	Non-inverting input for the low-side gate driver
TP301	2	*GND1*	Common input-side ground reference
TP301	3	*INN*	Inverting input for the low-side gate driver

This table summarizes all the test points available on the evaluation board for measurement of signals on the output side

Table 16 Output side test points

Test point	Pin	Symbol	Function
GP201		*GND2*	Output-side ground reference for high-side gate driver
TP202	1	*OUTH*	Sourcing output of high-side gate driver
TP202	2	*GND2*	Output-side ground reference for high-side gate driver
TP202	3	*OUTL*	Sinking output of high-side gate driver
TP203		*Desat*	DESAT signal of the high-side gate driver
TP204		*GATE*	Gate voltage of the high-side switch
GP301		*GND2*	Output-side ground for low-side gate driver
TP302	1	*OUTH*	Sourcing output of low-side gate driver
TP302	2	*GND2*	Output side ground for low-side gate driver
TP302	3	*OUTL*	Sinking output of low-side gate driver
TP303		*Desat*	DESAT signal of the low-side gate driver
TP304	1	*GATE*	Gate voltage of the low-side switch
TP304	2	*GND2*	Output-side ground for low-side gate driver

4 References and appendices

4.1 References

[1] Datasheet of EiceDRIVER™ 1ED3330MC12M
[2] Datasheet of EiceDRIVER™ Power 2EP130R
[3] User guide of EVAL-2EP130R-PR-SiC
[4] Datasheet of CoolSiC™ IMZC120R012M2H

4.2 Ordering information

Base Part Number	Package	Standard Pack		Orderable Part Number
EVAL-1ED3330MC12M-SiC	-	Boxed	1	EVAL1ED3330MC12MSICTOBO1
1ED3330MC12M	DSO-16	TAPE & REEL	1000	1ED3330MC12MXUMA1
2EP130R	PG-TSSOP-8	TAPE & REEL	1000	2EP130RXTMA1
IMZC120R012M2H	PG-TO247-4	Tube	240	IMZC120R012M2HXKSA1

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Edition 2025-08-08

Published by

Infineon Technologies AG

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Document reference
IFX-euj1748854882795

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