EiceDRIVER™ gate driver 1EDI3040AS evaluation board

Z8F80653277

About this document

Scope and purpose

This document describes the EiceDRIVER™ gate driver 1EDI3040AS evaluation board. The user is encouraged to refer to the corresponding datasheet and user manual for information on the product features and configurability. The evaluation board also supports a graphical user interface together with an Aurix™ TC375 shield buddy board to provide a simple, easy-to-use tool for getting familiar with the features and for high-voltage tests with power semiconductor devices.

Intended audience

The intended audiences for this document are design engineers, technicians, and developers of electronic systems.

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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 1000 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:** *ELECTRIC SHOCK HAZARD Contact can cause an electric shock. If a voltage above 60 V is applied to the evaluation board, then only persons trained in working with voltages above 60 V are allowed to handle the evaluation board. In addition, ensure that hazardous live parts are not accessible and that accessible live parts are not hazardous.*
	**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.*
	**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.*

Table of contents

1 EiceDRIVER™ gate driver 1EDI3040AS overview

The EiceDRIVER™ gate driver 1EDI3040AS is a high-voltage galvanic isolated gate driver for IGBTs and SiC MOSFETs designed for automotive traction inverter applications. The device is based on Infineon's Coreless Transformer (CT) technology, providing reinforced galvanic insulation between low voltage and high voltage domains. The device is designed to drive 600 V, 750 V and 1200 V IGBTs and SiC-MOSFETs directly. Short propagation delays and controlled internal tolerances minimize distortions of the PWM signal.

The device features a split output stage to achieve a slew rate control with an output stage of 20 A peak current capability. In addition, there is an integrated and external Miller clamping available to support highest dV/dT. A large panel of safety-related functions supports functional safety requirements at system level as per ISO 26262.

The fast and configurable desaturation protection in combination with the SOFTOFF pin enables the system to use IGBTs and SiC-MOSFETs to its limits for optimum system efficiency.

The device includes an 11-bit SAR-ADC, which can be multiplexed to two output pins to precisely monitor the DC-link voltage and the power semiconductor temperature. Moreover, the ADC also measures voltages at VCC2, VEE2, DESAT input and others. The gate timing capture functionality enables predictive maintenance of the system.

A flyback controller is integrated to support accurate and on-the-fly configurable secondary side supply voltage generation.

For more details regarding the features and the configurability of the device, the user is encouraged to refer to the product datasheet and user manual.

Type	Package	Marking
1EDI3040AS	PG-LDSO-36	1EDI3040AS

2 EiceDRIVER™ gate driver 1EDI3040AS evaluation board

The evaluation board is designed to be compatible with four components – Aurix™ TC375 shield buddy board, adapter board, HybridPACK™ Drive SiC Gen2 power module and a TO-247-4 adapter board. The evaluation board can be used as a standalone test board or as a combination with the above four components. In order to make use of complete configurability and flexibility of the gate drivers, it is recommended to use the evaluation board with the other four components. When used in combination with the Aurix™ TC375 shield buddy board, a graphical user interface is also available to provide the user an easy-to-use way to configure, control and test the gate drivers.

Each evaluation board consists of two 1EDI3040AS gate drivers connected in a half bridge configuration (further referred to in this document as “HS” and “LS” gate drivers respectively) with each gate driver having its own built-in flyback controller, which is used to generate the corresponding power supplies - VCC2 and VEE2. The system architecture of the 1EDI3040AS evaluation board together with the Aurix™ TC375 shield buddy board, adapter board and the HybridPACK™ Drive SiC Gen2 SiC power module is shown in Figure 1.

The evaluation boards and interface components can be orderd with your local Infineon sales representative with the corresponding SP order number. For the HybridPACK™ Drive Gen2 SiC module any Gen2 SiC module can be used, the one below is just given as an example of a power module that fits the layout of the evaluation board.

Component	SP Order Number	Order Name
1EDI3040AS evaluation board with adapter board	SP006071958	1EDI3040 EVAL BOARD
Aurix™ TC375 Shieldbuddy board	SP005432164	KIT_A2G_TC375_ARD_SB
HybridPACK™ Drive Gen2 SiC	SP005567339	FS01MR08A8MA2LBC
1EDI3040AS TO247-4 Adapter Board	SP006072082	1EDI304X TO247 BOARD

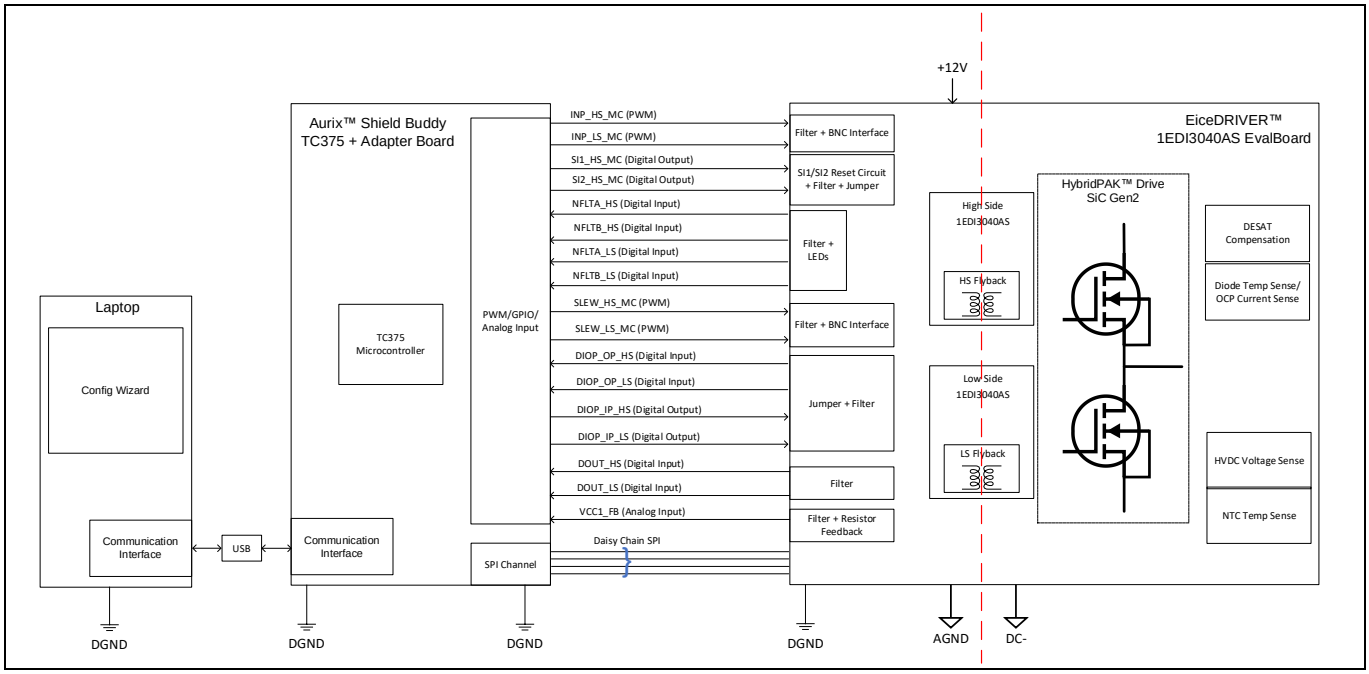

Figure 1 System architecture of 1EDI3040AS

2.1 PCB overview

This section provides an overview of all the connectors, LEDs and jumpers available on the 1EDI3040AS evaluation board.

2.1.1 Connectors

The 1EDI3040AS evaluation board has three banana connectors as shown in Figure 2 with the functionalities as mentioned in Table 1. Please see Chapter 2.1.5 for operating ranges of the connectors.

Table 1 Connectors

Connector # from Figure 2	Functionality
1	Primary power supply ground
2	+12 V primary power supply
3	Safety inputs (SI) control pin

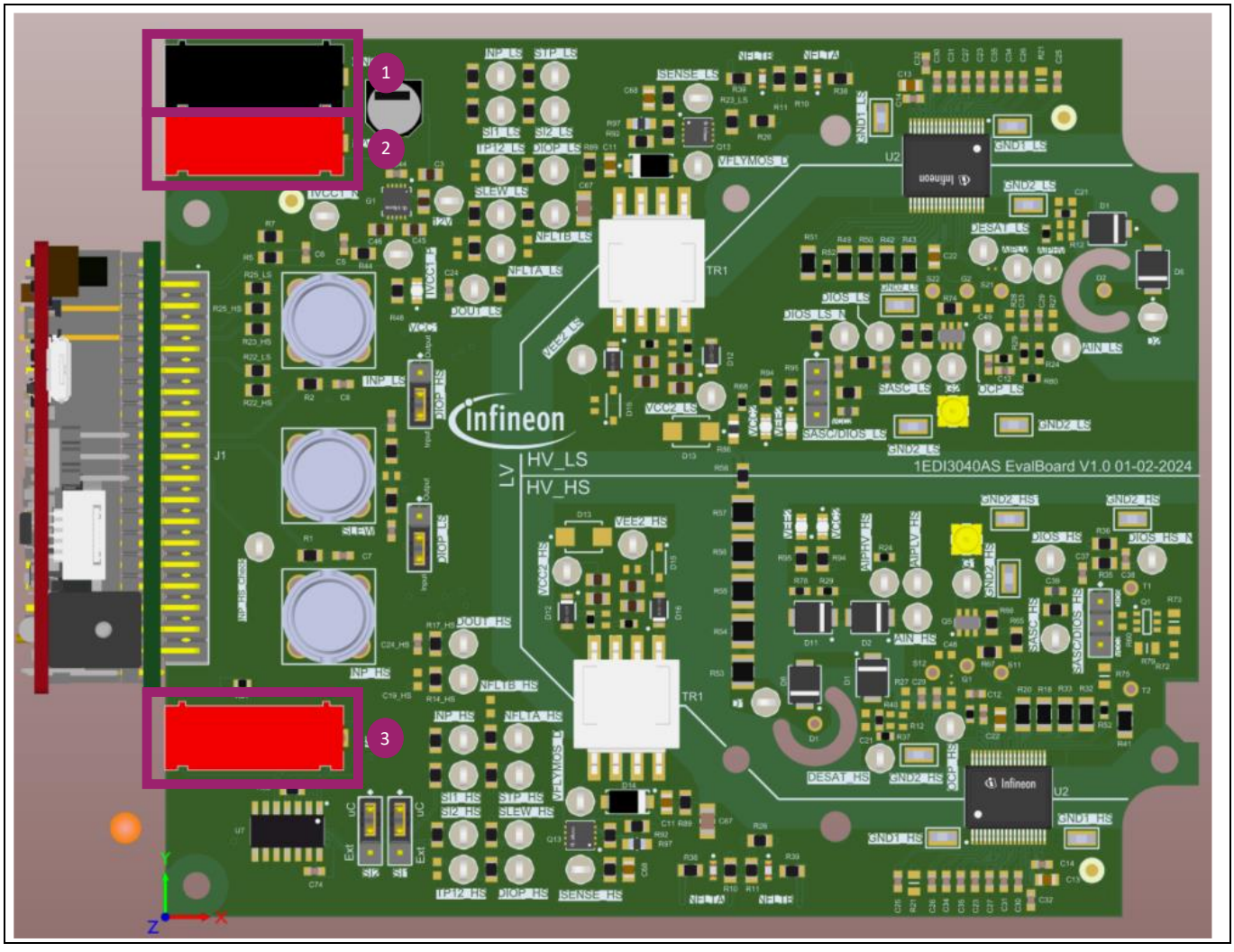

Figure 2 Connectors

2.1.2 LED indicators

The 1EDI3040AS evaluation board has the following LEDs on the board to signal important information.

Table 2 LED indicators

LED # from Figure 3	Functionality
1	VCC1 +5 V power supply
2	NFLTB_LS
3	NFLTA_LS
4	VCC2_LS
5	VEE2_LS
6	VEE2_HS
7	VCC2_HS
8	NFLTA_HS
9	NFLTB_HS

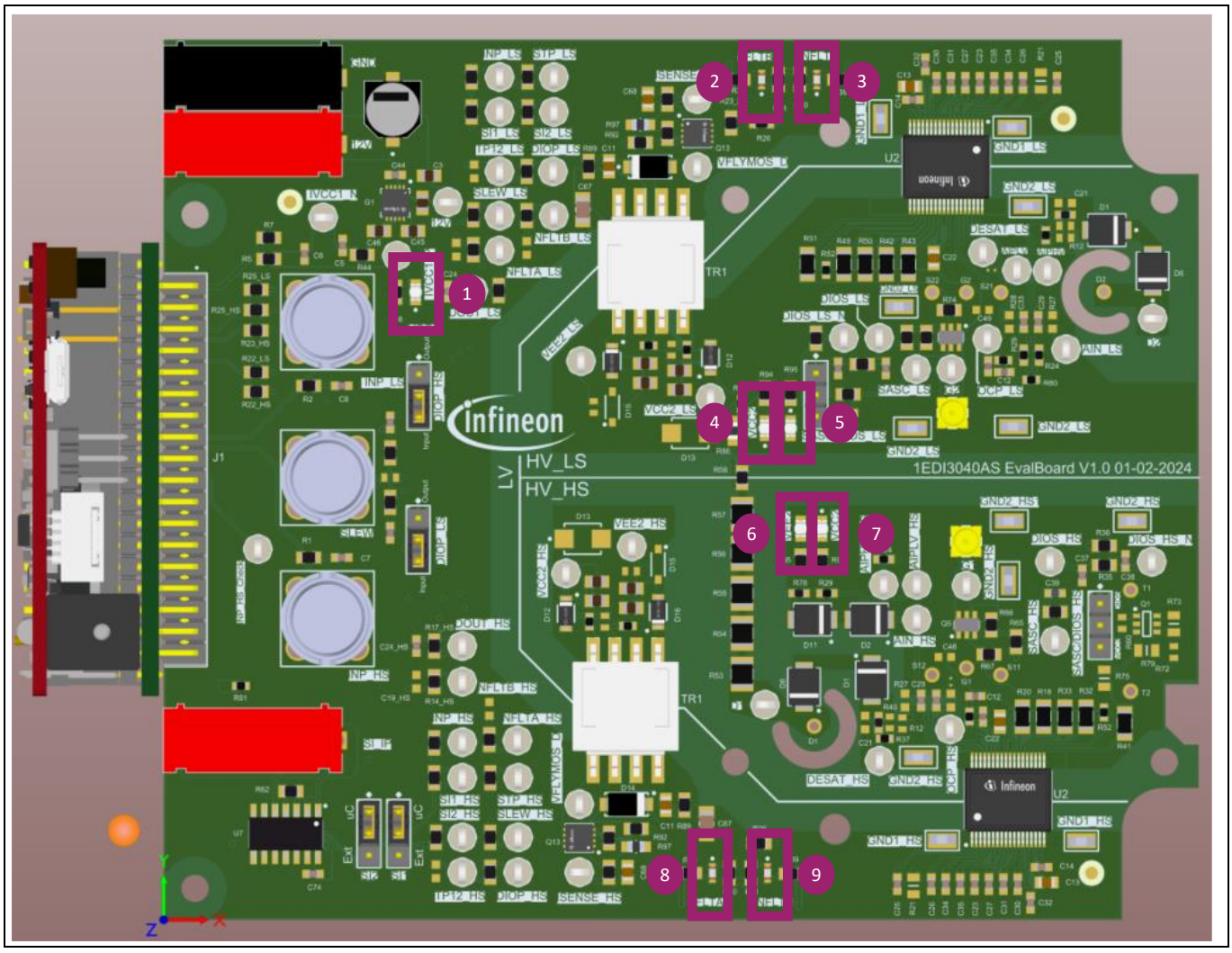

Figure 3 LED indicators

2.1.3 BNC connectors

The 1EDI3040AS evaluation board has the following BNC connectors to connect function generator inputs in case the Aurix™ TC375 shield buddy board and the graphical user interface are not used. Please see Chapter 2.1.5 for operating ranges of the BNC connectors.

Table 3 BNC connectors

BNC label from Figure 4	Functionality
1	INP PWM signal for LS gate driver
2	SLEW PWM signal for both LS and HS gate drivers
3	INP PWM for HS gate driver

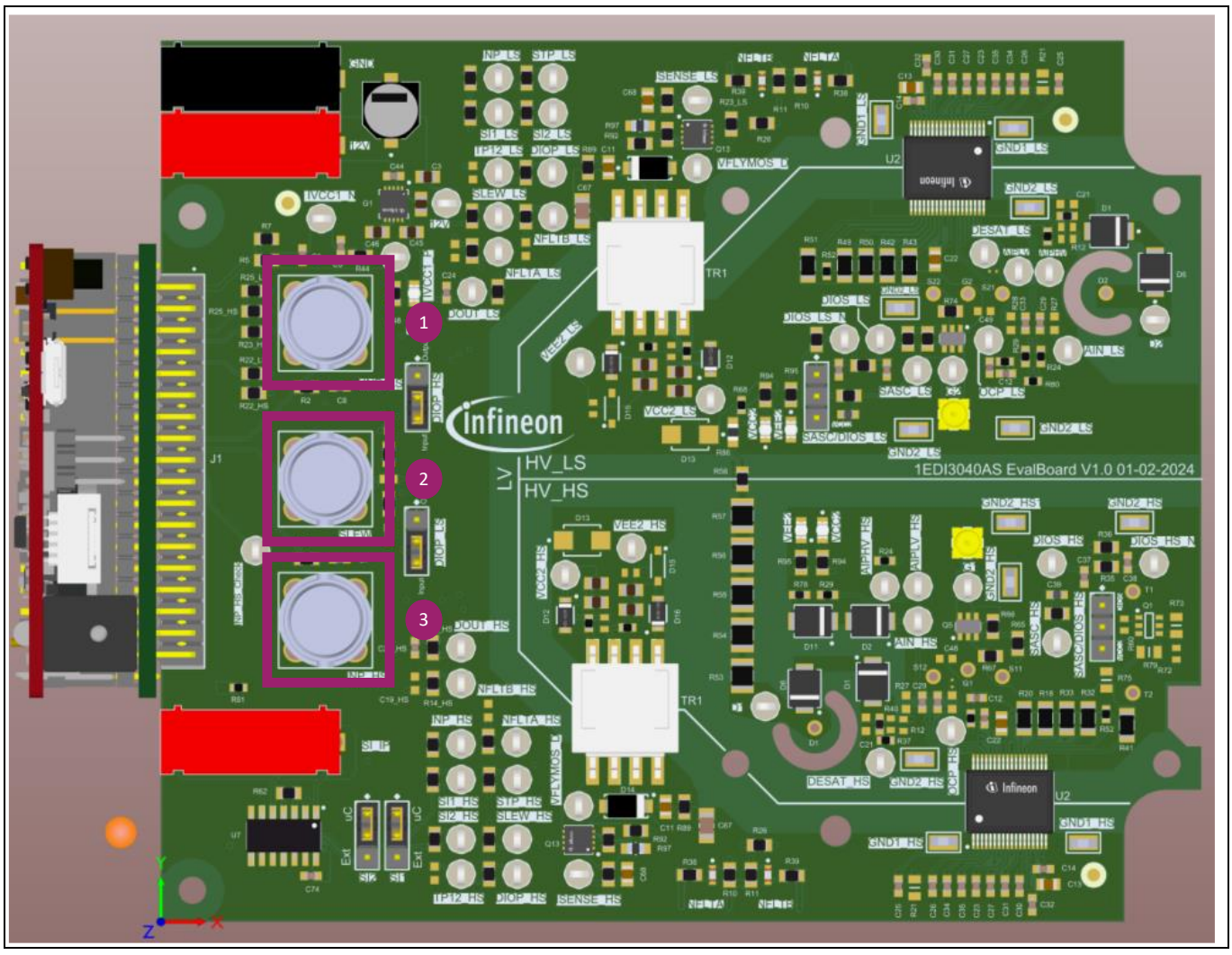

Figure 4 BNC connectors

2.1.4 Jumper configurations

The 1EDI3040AS evaluation board provides the following configuration options with jumpers:

1. DIOP_HS and DIOP_LS

- This jumper provides flexibility to use the DIOP pins of both the HS and LS device either as an input or output when using the 1EDI3040AS evaluation board in combination with the Aurix™ shield buddy board and the graphical user interface

Table 4 Jumper configuration options for DIOP_HS and DIOP_LS

Jumper configuration	Functionality
1-2	DIOP used as input
2-3	DIOP used as output

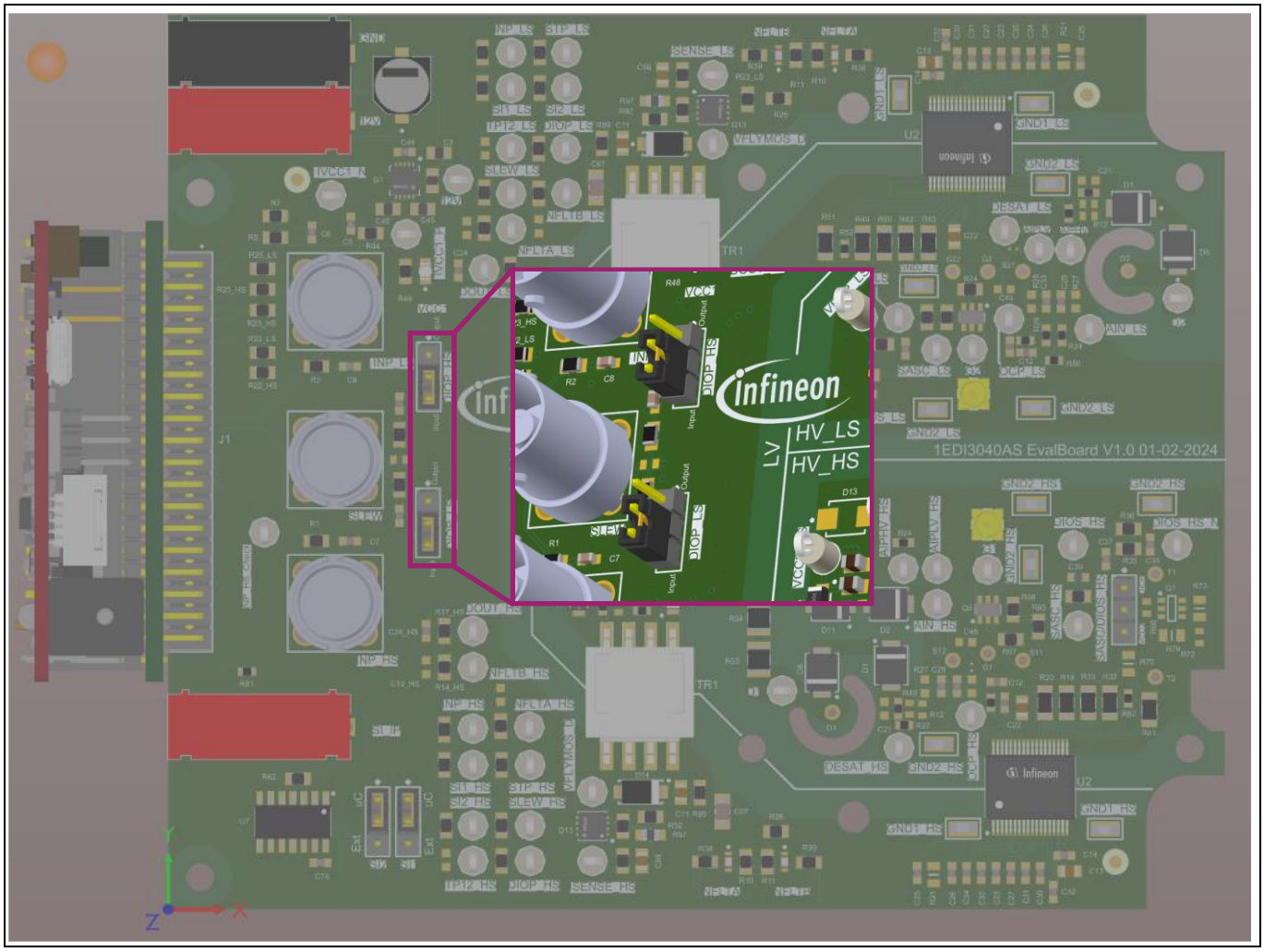

Figure 5 DIOP_HS and DIOP_LS jumpers configured as inputs

2. SASC/DIOS_HS and SASC/DIOS_LS

- This jumper provides the following configuration options:

Table 5 Jumper configuration for SASC/DIOS_HS and SASC/DIOS_LS

Jumper configuration	Functionality
Open – no jumper placed	DIOS: input or output as configured SASC: inactive
1-2	DIOS: output SASC: controlled by DIOS
2-3	DIOS: input or output as configured SASC: connected to VCC2

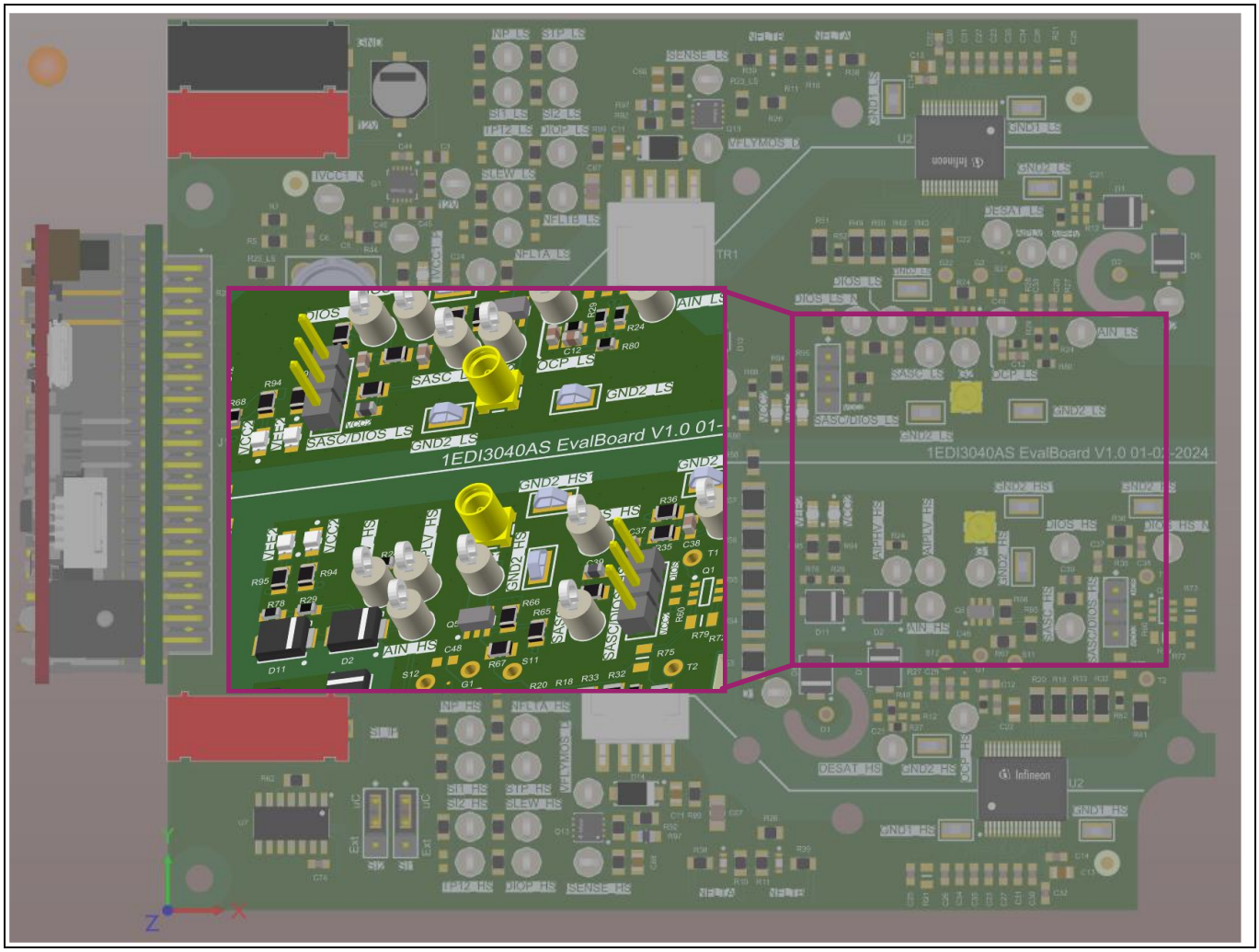

Figure 6 SASC jumpers left open

3. SI1 and SI2

   - These jumpers are used to select if the SI1 and SI2 signals are controlled by the Aurix™ TC375 Shieldbuddy board or through the SI reset circuit connected to the banana connector SI_IP

Table 6 Jumper configuration for SI1 and SI2

Jumper configuration	Functionality
1-2	SI1 and SI2 controlled by the micrcontroller
2-3	SI1 and SI2 controlled by banana connector SI_IP

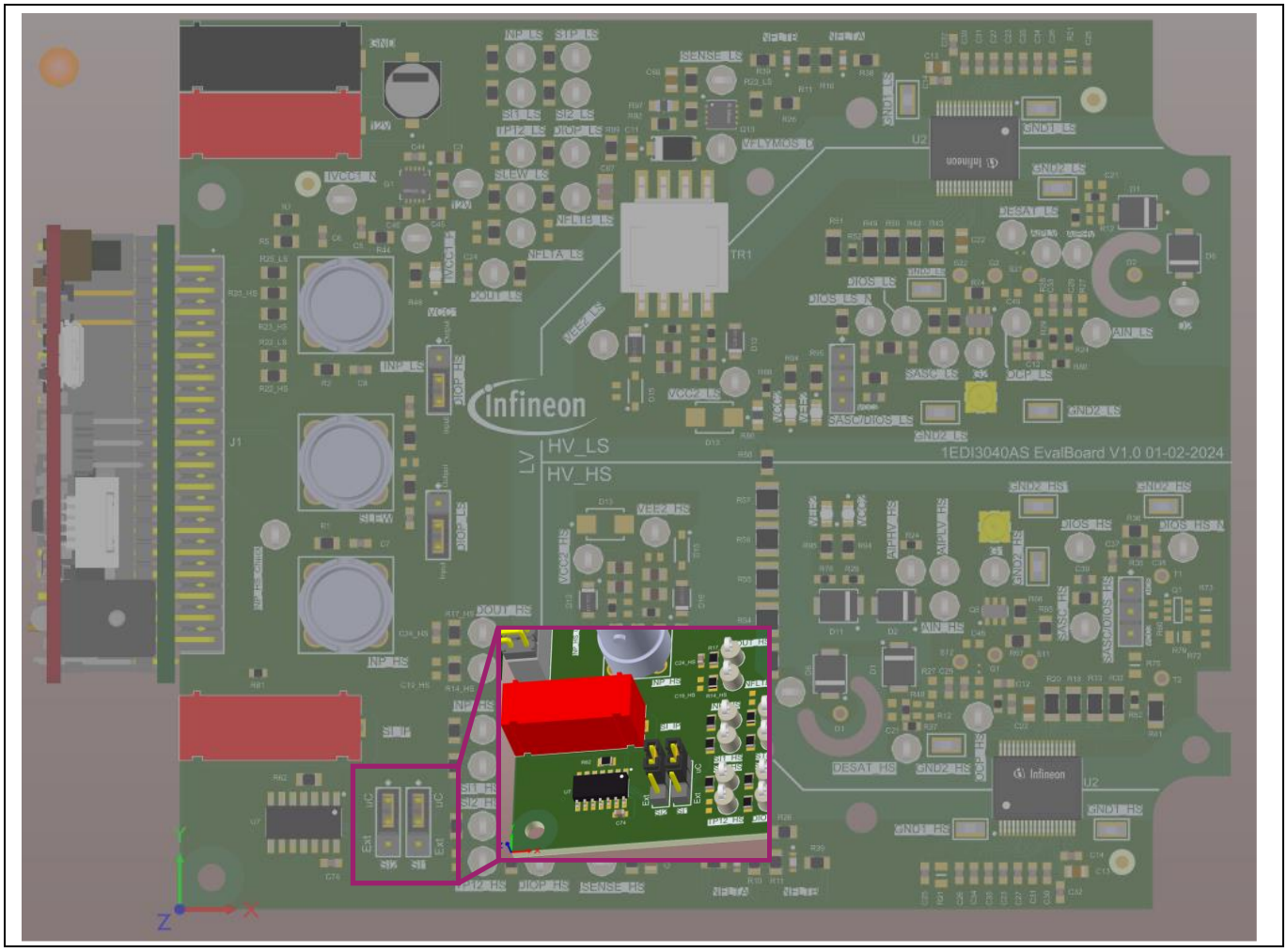

Figure 7 SI1 and SI2 jumpers configured to be controlled by the microcontroller

2.1.5 Operating conditions

Please make sure that the operating ranges defined in Table 7 are maintained to avoid electrical damage of the product.

Table 7 Operating conditions

Parameter	Pin	Values		Unit	Note
		Min.	Max.		
$V_{primary}$	Between banana sockets “+12 V” and “GND”	6	26	V	Limited by input voltage requirement from Flyback controller and linear voltage regulator
V_{SI_IP}	Between banana sockets “SI_IP” and “GND”	0	5	V	Limited by SI reset circuitry supplied by VCC1
V_{BNC}	All BNC connectors	-0.3	5	V	Limited by VCC1 voltage
V_{AIPLV}	Voltage nodes NTC_LS and DESAT_COMP_HS	0	3.3	V	Please see schematic of the evaluation board. Limited by internal clamping structure of the gate driver

2.2 Schematic

Figure 8, Figure 9, Figure 10, Figure 11, Figure 12, Figure 13 and Figure 14 show the EiceDRIVER™ gate driver 1EDI3040AS evaluation board schematics.

Note: The red asterisk ‘’ represents unfitted components*

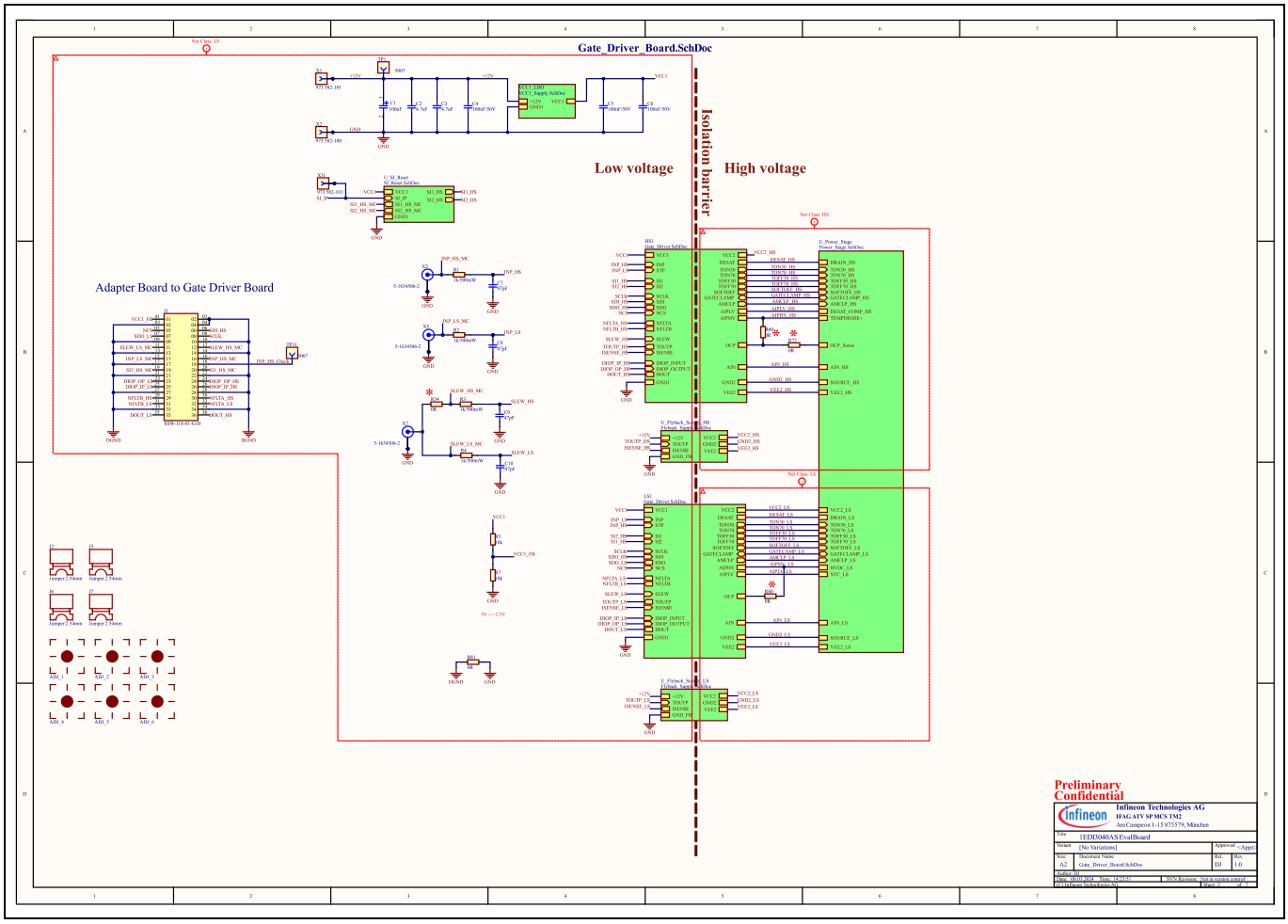

Figure 8 Top-level schematic overview

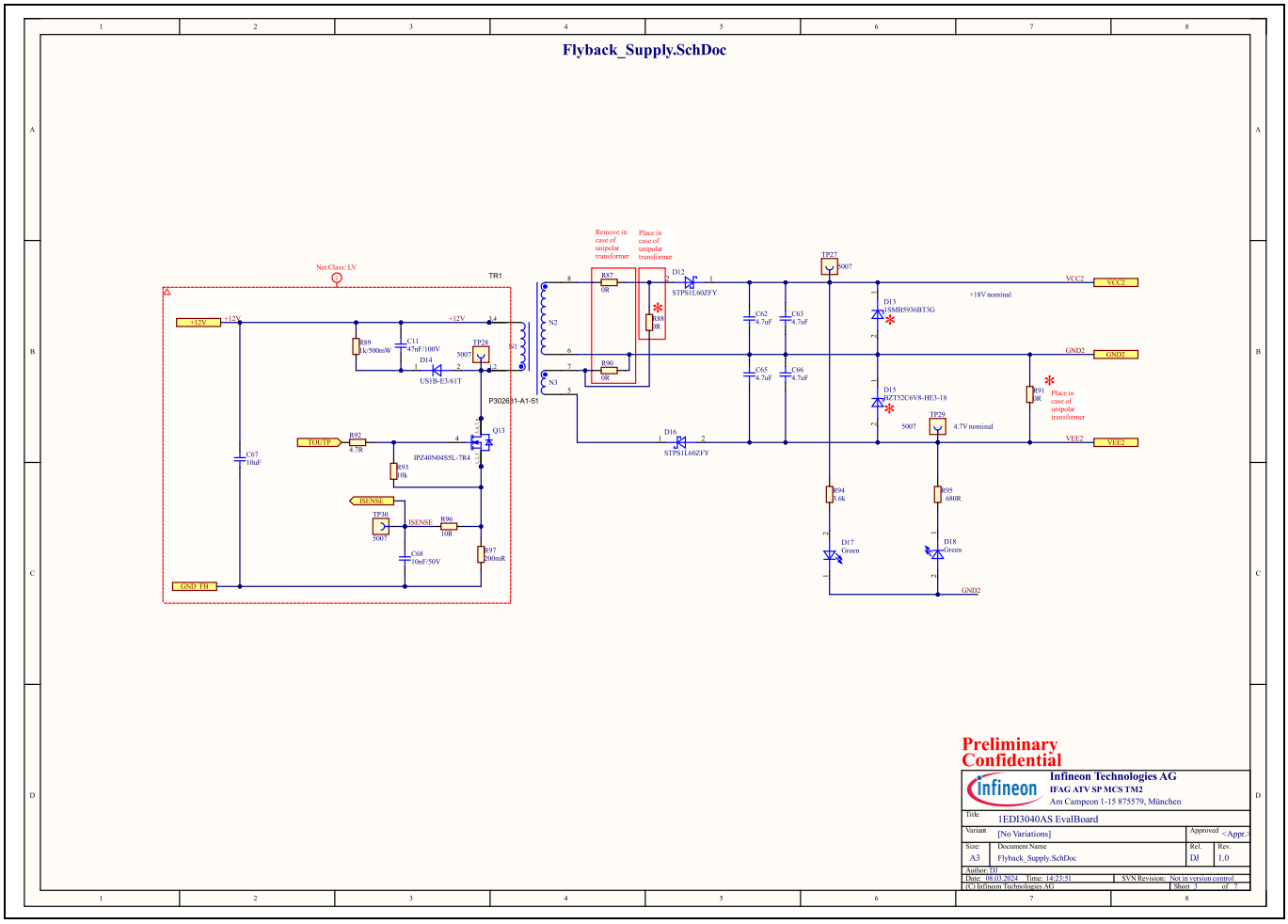

Figure 9 Flyback power supply schematic

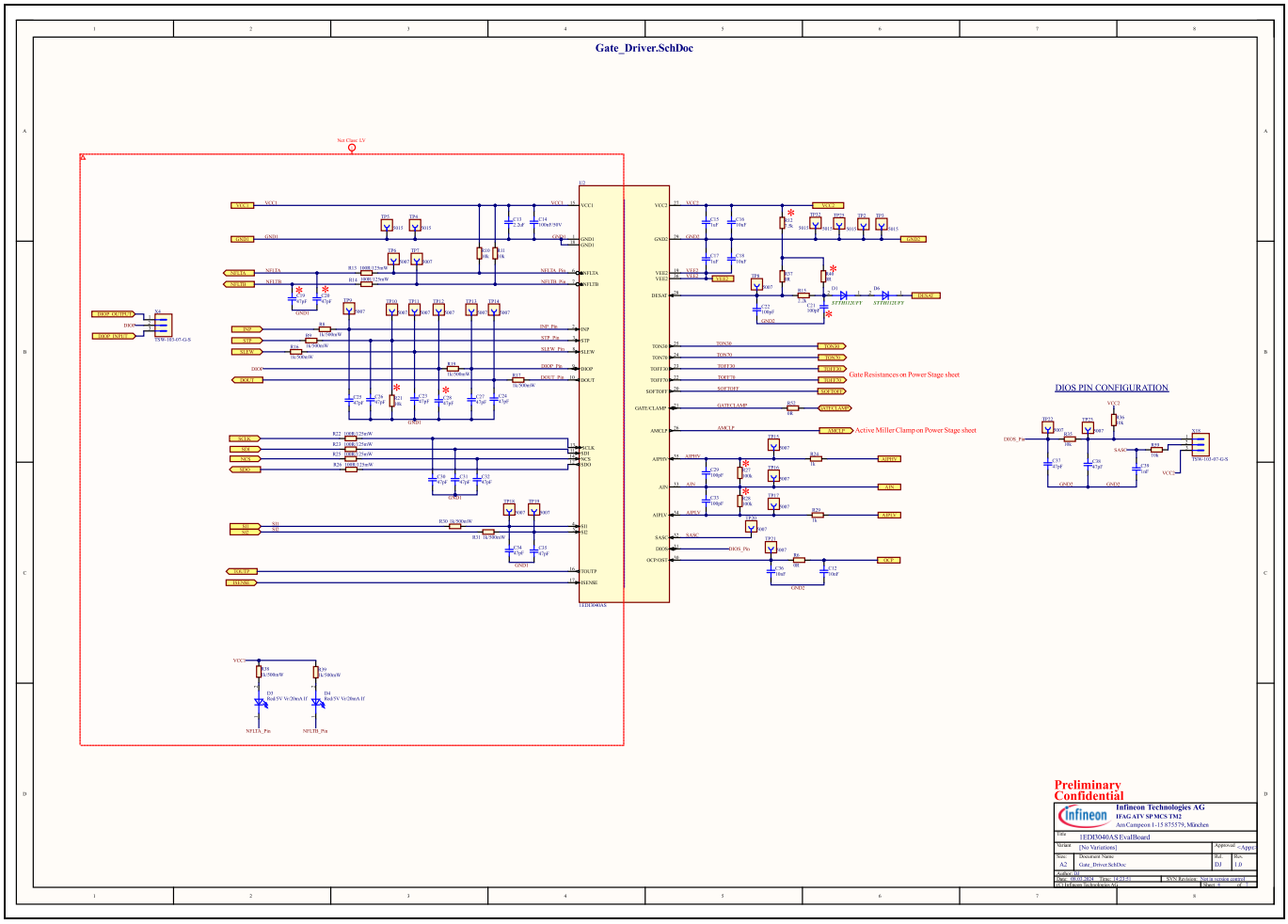

Figure 10 Gate driver schematic

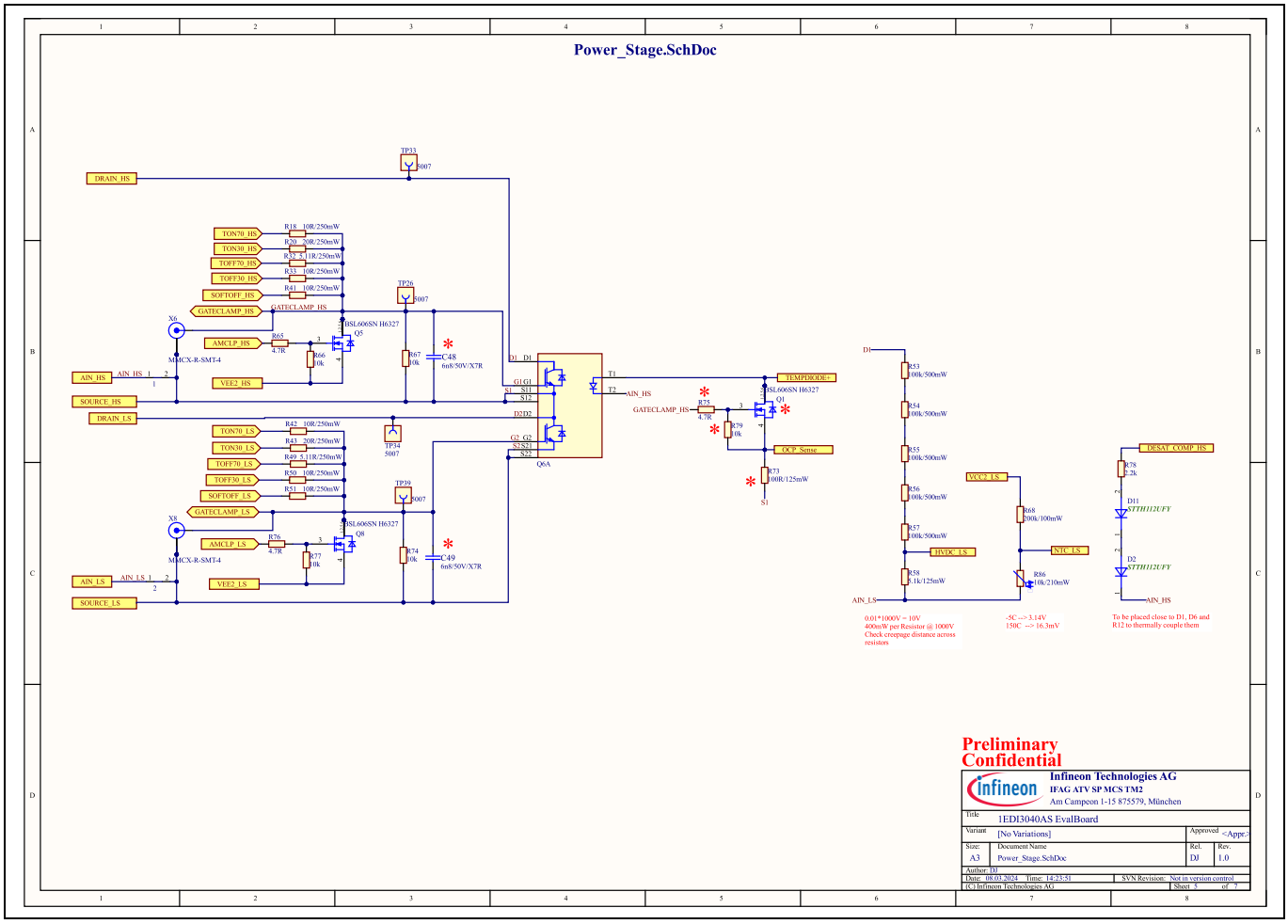

Figure 11 HybridPACK™ Drive power stage schematic

EiceDRIVER™ gate driver 1EDI3040AS evaluation board

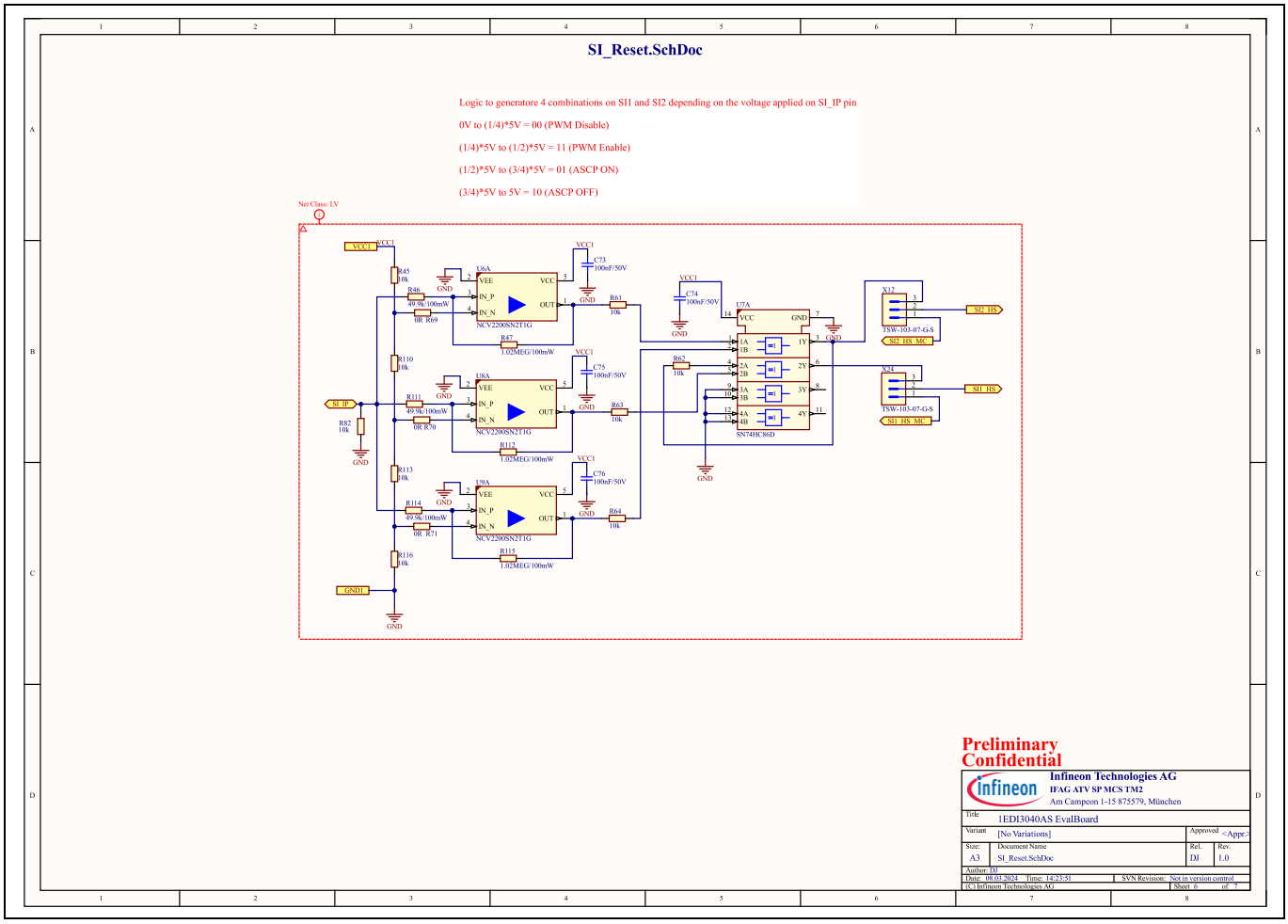

Figure 12 Safety inputs reset schematic

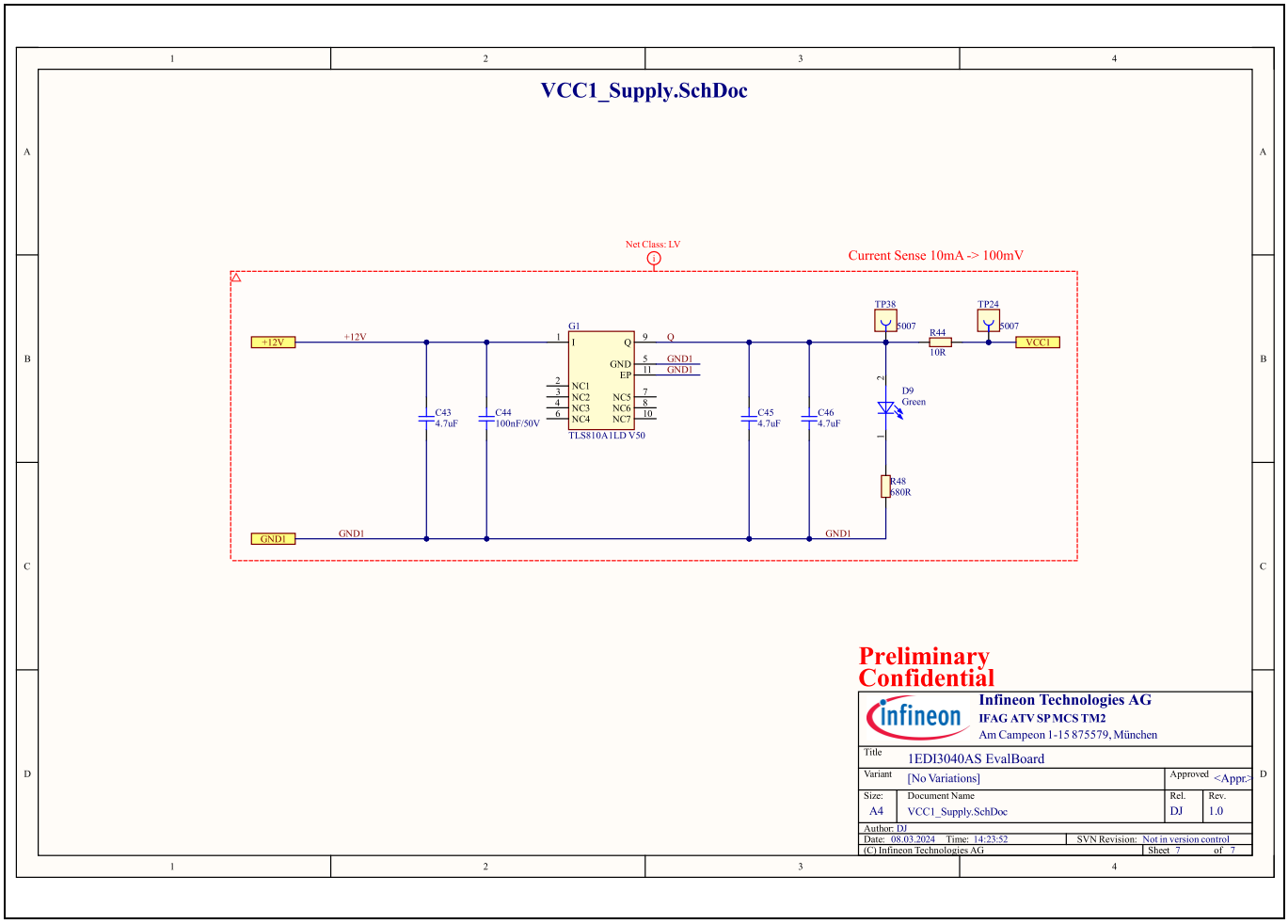

Figure 13 VCC1 power supply schematic

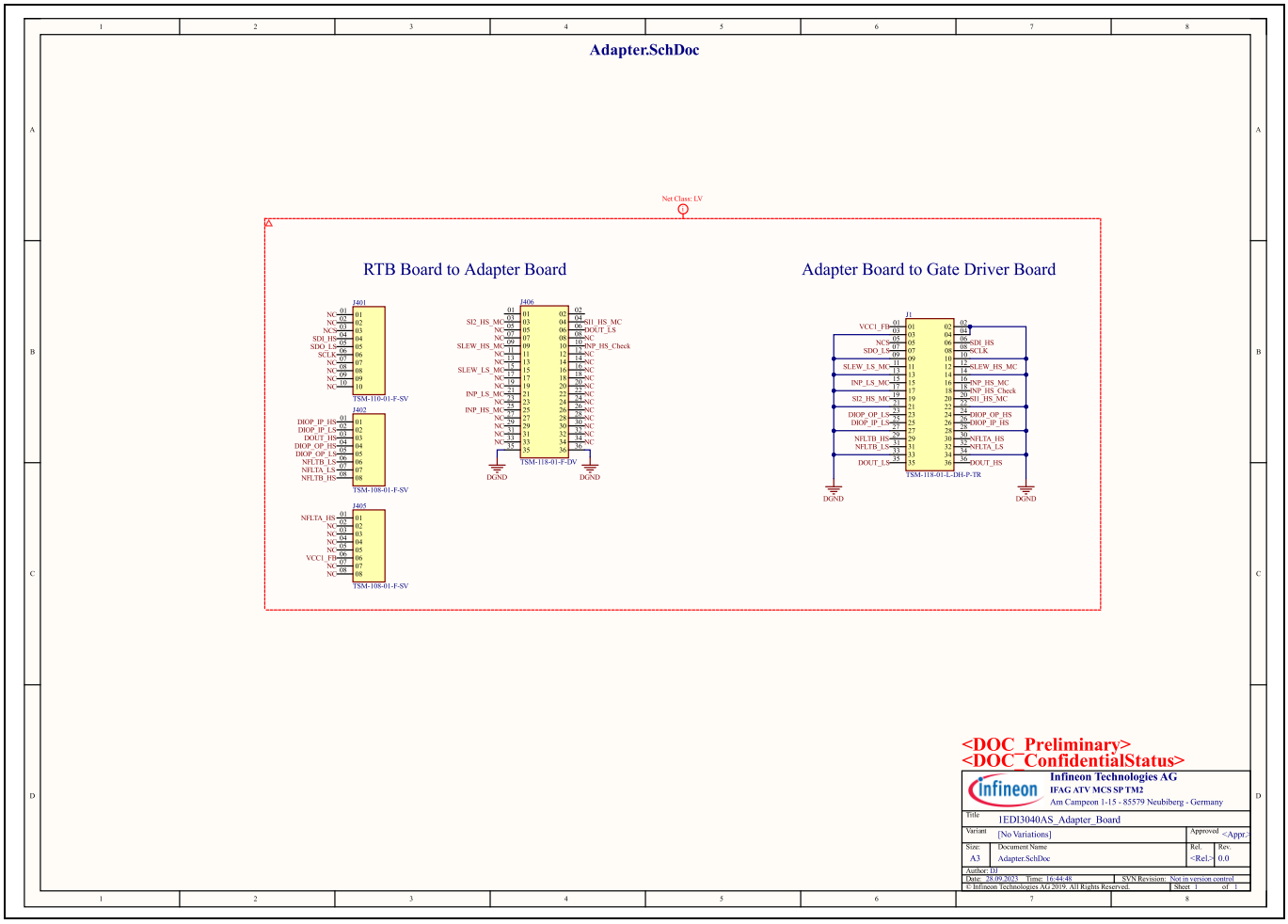

Figure 14 Adapter board schematic

2.3 Layout

The 1EDI3040AS gate driver evaluation board PCB consists of four layers as shown in Figure 15, Figure 16, Figure 17, Figure 18 and Figure 19. Figure 20 shows the assembly overview.

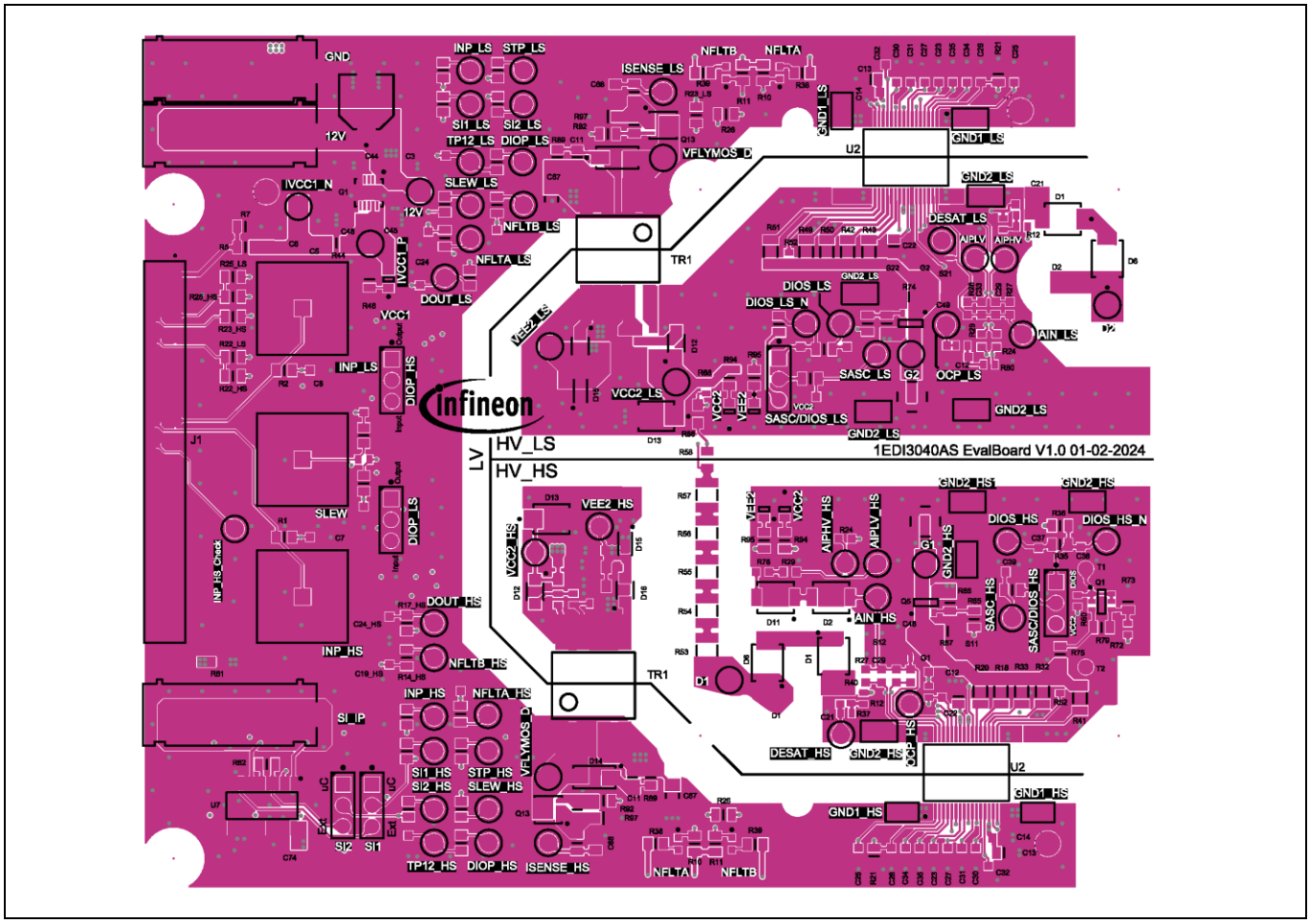

Figure 15 Top layer

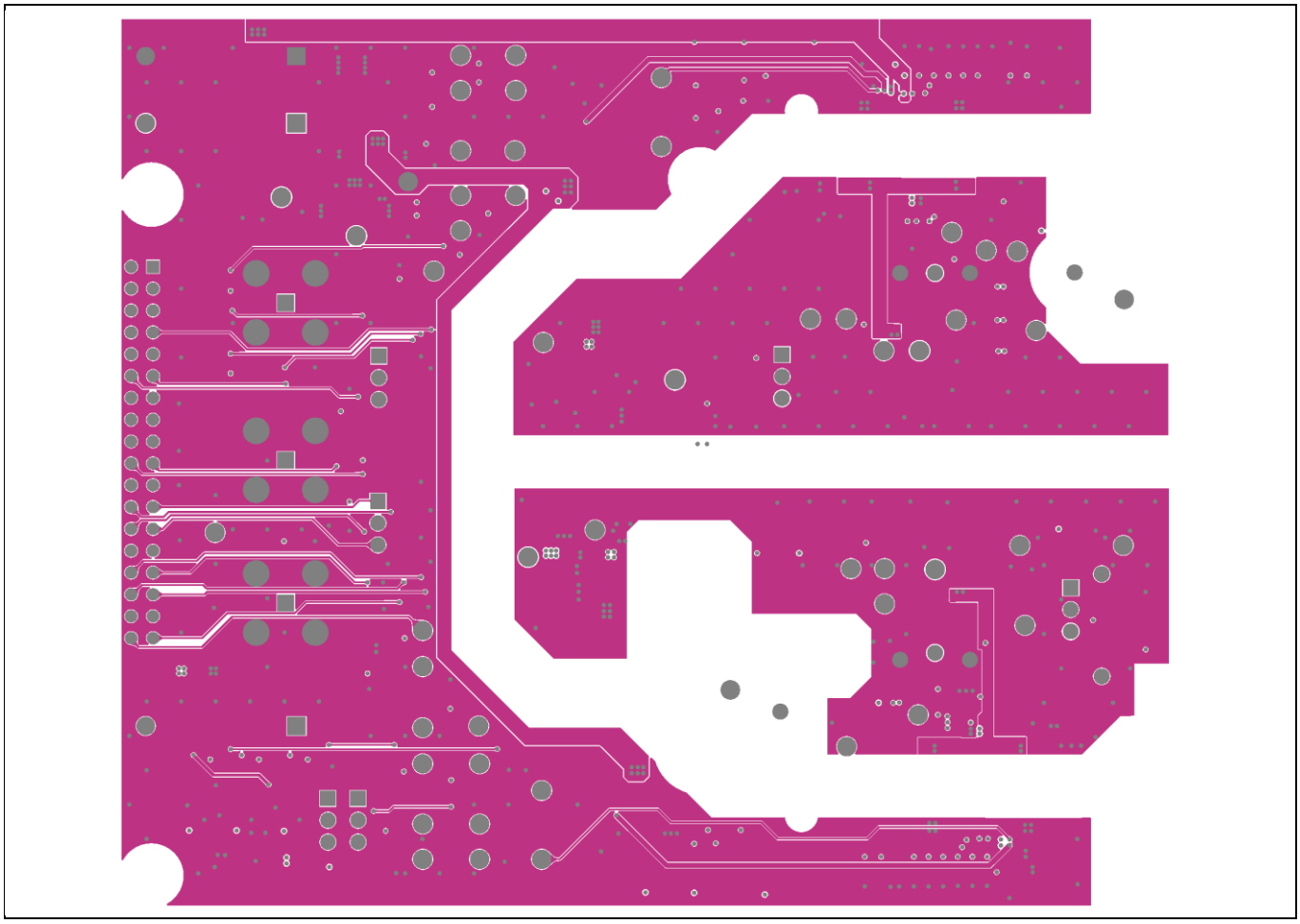

Figure 16 Layer 2

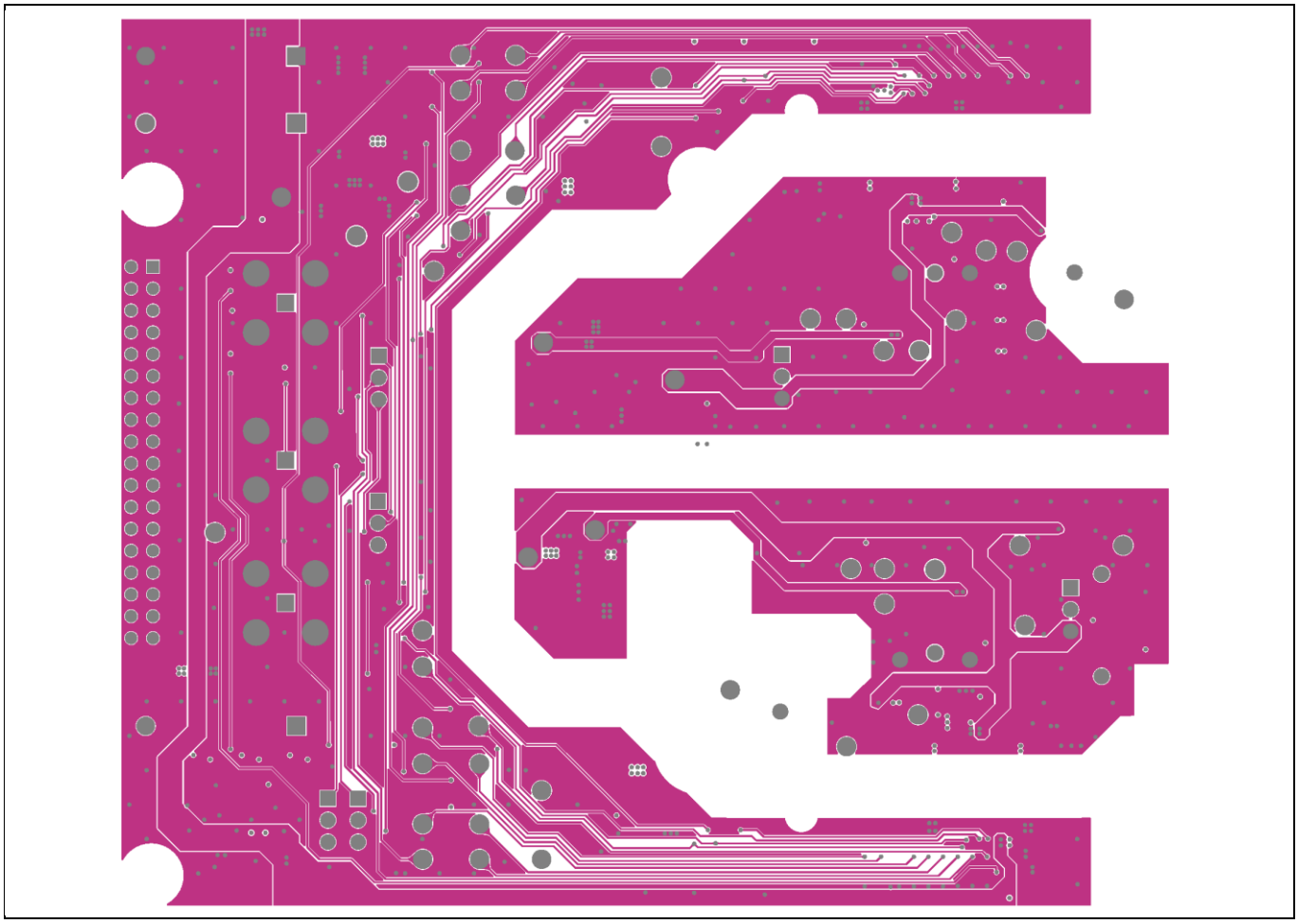

Figure 17 Layer 3

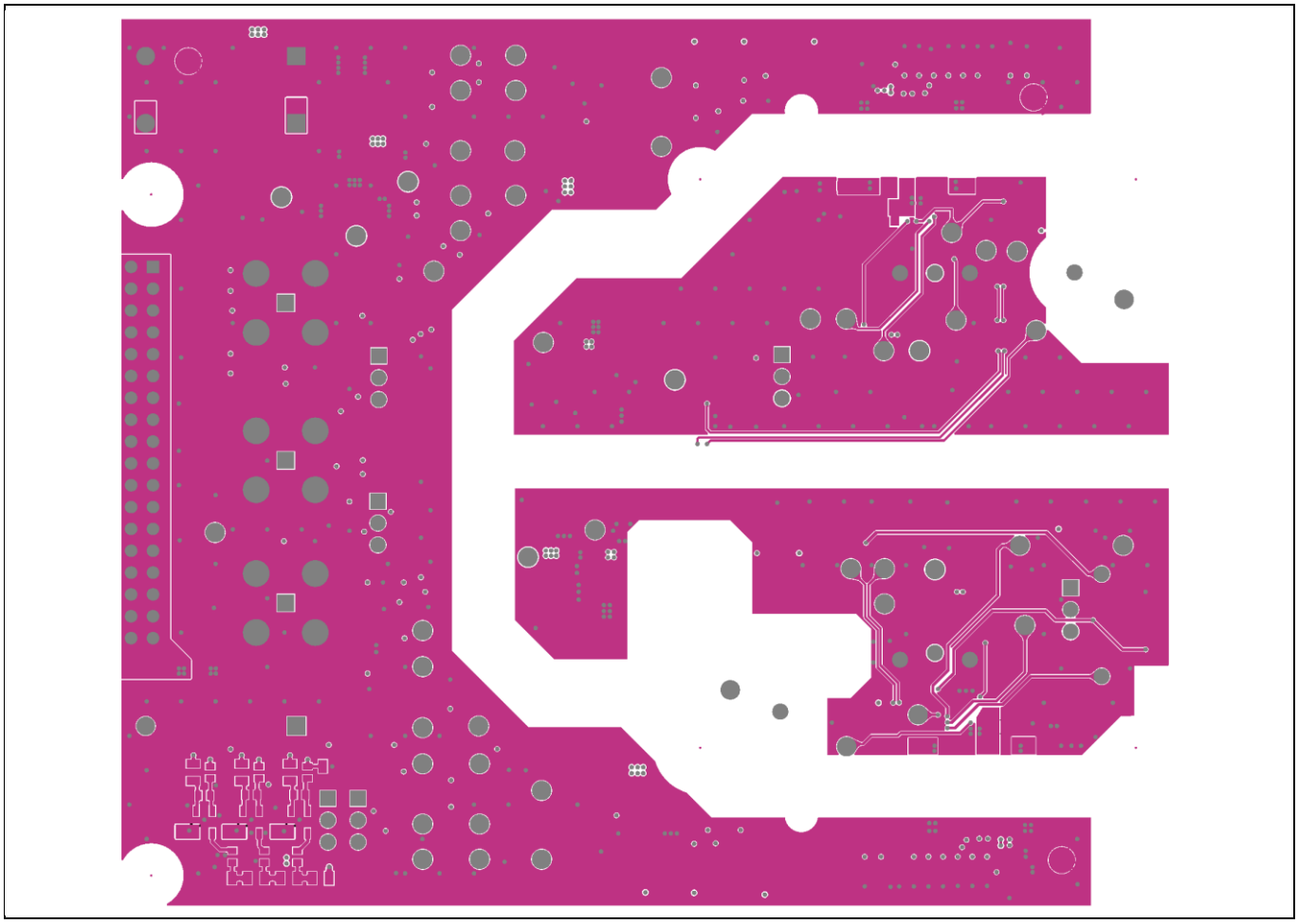

Figure 18 Bottom layer

EiceDRIVER™ gate driver 1EDI3040AS evaluation board

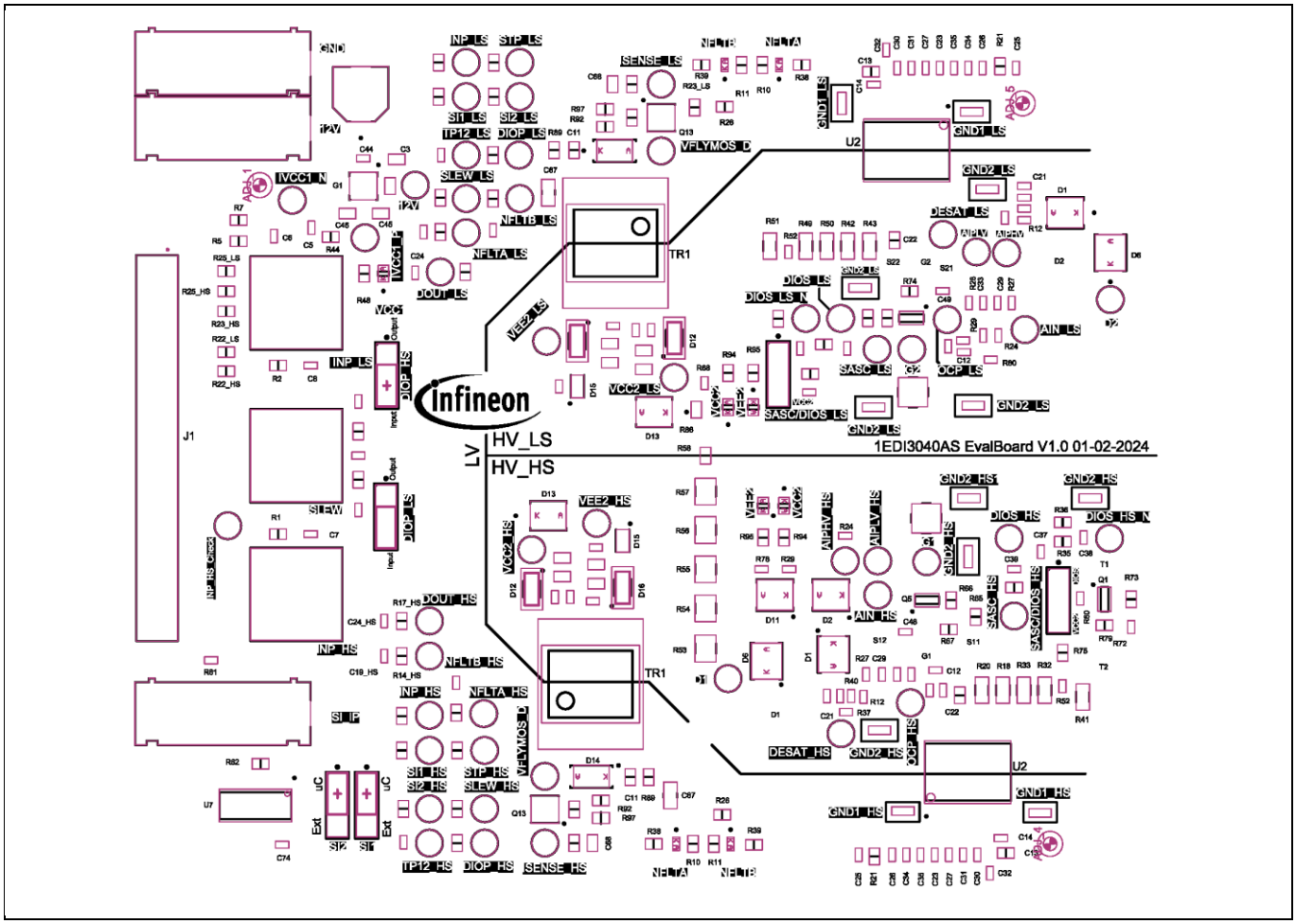

Figure 19 Top assembly

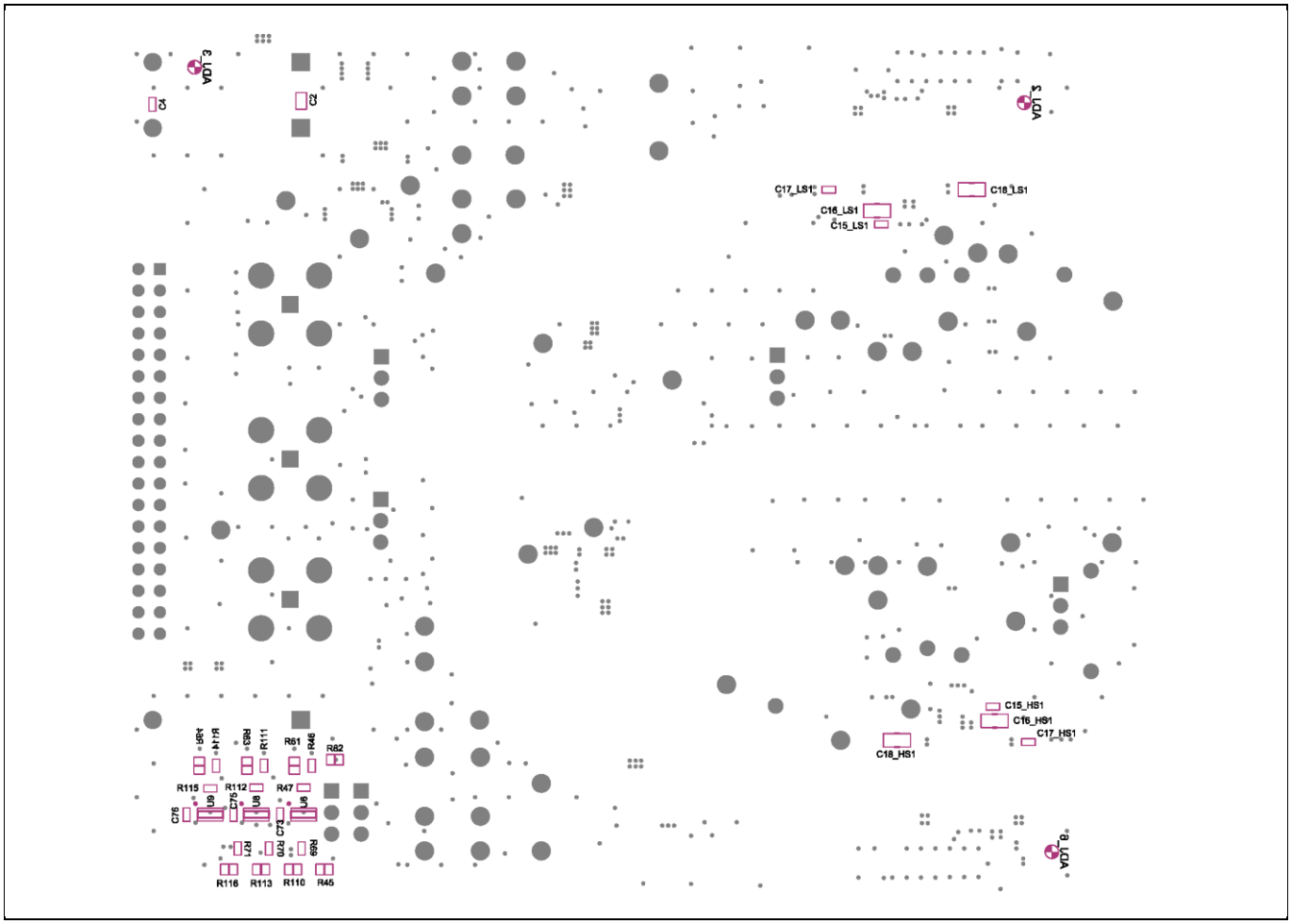

Figure 20 Bottom assembly

2.4 Bill of materials

Table 8 shows the bill of materials for the gate driver 1EDI3040AS evaluation board and adapter board. The HybridPACK™ Drive SiC Gen2 module is not included.

Table 8 BOM of the most important/critical parts of the evaluation or reference board (example)

Quantity	Ref Designator	Description	Manufacturer	Manufacturer P/N
1	C1	CAP / ELCO / 100uF / 50V / 20% / Aluminiumelectrolytic / -55°C to 105°C / 6.60mm L X 6.60mm W X 8.00mm H / SMD / -	Panasonic	EEEFTH101XAP
13	C2, C3, C43, C45, C46, C62_U_Flyback_Supply_HS, C62_U_Flyback_Supply_LS, C63_U_Flyback_Supply_HS, C63_U_Flyback_Supply_LS,	CAP / CERA / 4.7uF / 25V / 10% / X7R (EIA) / -55°C to 125°C / 0805 / SMD / -	Taiyo Yuden	TMK212AB7475KG-T

Quantity	Ref Designator	Description	Manufacturer	Manufacturer P/N
	C65_U_Flyback_Supply_HS, C65_U_Flyback_Supply_LS, C66_U_Flyback_Supply_HS, C66_U_Flyback_Supply_LS			
10	C4, C5, C6, C14_HS1, C14_LS1, C44, C73, C74, C75, C76	CAP / CERA / 100nF/50V / 50V / 10% / X7R (EIA) / -55°C to 125°C / 0603(1608) / SMD / -	AVX	06035C104K4Z2A
28	C7, C8, C9, C10, C23_HS1, C23_LS1, C24_HS1, C24_LS1, C25_HS1, C25_LS1, C26_HS1, C26_LS1, C27_HS1, C27_LS1, C30_HS1, C30_LS1, C31_HS1, C31_LS1, C32_HS1, C32_LS1, C34_HS1, C34_LS1, C35_HS1, C35_LS1, C37_HS1, C37_LS1, C38_HS1, C38_LS1	CAP / CERA / 47pF / 50V / 2% / C0G (EIA) / NP0 / -55°C to 125°C / 0603(1608) / SMD / -	MuRata	GRM1885C1H470GA01
2	C11_U_Flyback_Supply_HS, C11_U_Flyback_Supply_LS	CAP / CERA / 47nF/100V / 100V / 10% / X7R (EIA) / -55°C to 125°C / 0805(2012) / SMD / -	MuRata	GRM21BR72A473KA01
4	C12_HS1, C12_LS1, C36_HS1, C36_LS1	CAP / CERA / 10nF / 100V / 5% / C0G (EIA) / NP0 / -55°C to 125°C / 0603(1608) / SMD / -	TDK Corporation	CGA3EAC0G2A103J080AC
2	C13_HS1, C13_LS1	CAP / CERA / 2.2uF / 16V / 10% / X7R (EIA) / -55°C to 125°C / 0805(2012) / SMD / -	MuRata	GRM21BR71C225KA12
4	C15_HS1, C15_LS1, C17_HS1, C17_LS1	CAP / CERA / 1uF / 35V / 20% / X7R (EIA) / -55°C to 125°C / 0603(1608) / SMD / -	MuRata	GRM188R7YA105MA12
6	C16_HS1, C16_LS1, C18_HS1, C18_LS1, C67_U_Flyback_Supply_HS, C67_U_Flyback_Supply_LS	CAP / CERA / 10uF / 25V / 10% / X7R (EIA) / -55°C to 125°C / 1206(3216) / SMD / -	TDK Corporation	C3216X7R1E106K160AB
2	C22_HS1, C22_LS1	CAP / CERA / 100pF / 50V / 2% / C0G (EIA) / NP0 / -55°C to 125°C / 0805(2012) / SMD / -	MuRata	GRM2165C1H101GA01

Quantity	Ref Designator	Description	Manufacturer	Manufacturer P/N
4	C29_HS1, C29_LS1, C33_HS1, C33_LS1	CAP / CERA / 100pF / 100V / 5% / C0G (EIA) / NP0 / -55°C to 125°C / 0603(1608) / SMD / -	MuRata	GRM1885C2A101JA01
2	C39_HS1, C39_LS1	CAP / CERA / 1nF / 10V / 2% / C0G (EIA) / NP0 / -55°C to 125°C / 0603(1608) / SMD / -	Kemet	C0603C102G8GAC
2	C68_U_Flyback_Supply_HS, C68_U_Flyback_Supply_LS	CAP / CERA / 10nF/50V / 50V / 1% / C0G (EIA) / NP0 / -55°C to 125°C / 0805(2012) / SMD / -	MuRata	GCM2195C1H103FA16
6	D1_HS1, D1_LS1, D2, D6_HS1, D6_LS1, D11	Automotive high voltage ultrafast rectifier	STMicroelectronics	STTH112UFY
4	D3_HS1, D3_LS1, D4_HS1, D4_LS1	LED RED CLEAR CHIP SMD	LiteOn Optoelectronics	LTST-C190CKT
5	D9, D17_U_Flyback_Supply_HS, D17_U_Flyback_Supply_LS, D18_U_Flyback_Supply_HS, D18_U_Flyback_Supply_LS	CHIPLED, Green Colour, 570nm	OSRAM Opto Semiconductors	LG R971-KN-1
4	D12_U_Flyback_Supply_HS, D12_U_Flyback_Supply_LS, D16_U_Flyback_Supply_HS, D16_U_Flyback_Supply_LS	Schottky Rectifier, 1A/60V	ST	STPS1L60ZFY
2	D14_U_Flyback_Supply_HS, D14_U_Flyback_Supply_LS	Surface Mount Ultrafast Rectifier 1.0A/100V	Vishay	US1B-E3/61T
1	G1	Ultra Low Quiescent Current Linear Voltage Regulator, 5µA, 5V Voltage Output	Infineon Technologies	TLS810A1LD V50
1	J1	SSW - .100" (2,54mm) Flat/Solder Tail, Tiger Buy Contact Socket Strip, Through Hole	Samtec	
4	J2, J3, J6, J7	Headers & Wire Housings JUMPER SOCKET OPEN TOP RED	Harwin Inc.	M7581-05
2	Q5, Q8	OptiMOS-3 Small Signal N-Channel Enhancement Transistor	Infineon Technologies	BSL606SN H6327

Quantity	Ref Designator	Description	Manufacturer	Manufacturer P/N
2	Q13_U_Flyback_Supply_HS, Q13_U_Flyback_Supply_LS	OptiMOS-5 N-Channel Enhancement Mode Power-Transistor, VDS 40V	Infineon Technologies	IPZ40N04S5L-7R4
24	R1, R2, R3, R4, R8_HS1, R8_LS1, R9_HS1, R9_LS1, R16_HS1, R16_LS1, R17_HS1, R17_LS1, R19_HS1, R19_LS1, R30_HS1, R30_LS1, R31_HS1, R31_LS1, R38_HS1, R38_LS1, R39_HS1, R39_LS1, R89_U_Flyback_Supply_HS, R89_U_Flyback_Supply_LS	RES / STD / 1k/500mW / 500mW / 5% / 200ppm/K / -55°C to 155°C / 0805(2012) / SMD / -	Panasonic	ERJ-P06J102V
27	R5, R7, R10_HS1, R10_LS1, R11_HS1, R11_LS1, R35_HS1, R35_LS1, R36_HS1, R36_LS1, R45, R59_HS1, R59_LS1, R61, R62, R63, R64, R66, R67, R74, R77, R82, R93_U_Flyback_Supply_HS, R93_U_Flyback_Supply_LS, R110, R113, R116	RES / STD / 10k / 125mW / 1% / 100ppm/K / -55°C to 155°C / 0805 / SMD / -	Vishay	CRCW080510K0FK
15	R6_HS1, R6_LS1, R37_HS1, R37_LS1, R52_HS1, R52_LS1, R69, R70, R71, R80, R81, R87_U_Flyback_Supply_HS, R87_U_Flyback_Supply_LS, R90_U_Flyback_Supply_HS, R90_U_Flyback_Supply_LS	RES / STD / 0R / - / 0% / - / -55°C to 155°C / 0603(1608) / SMD / -	Vishay	CRCW06030000Z0EA
12	R13_HS1, R13_LS1, R14_HS1, R14_LS1, R22_HS1, R22_LS1, R23_HS1, R23_LS1, R25_HS1, R25_LS1, R26_HS1, R26_LS1	RES / STD / 100R/125mW / 125mW / 1% / 100ppm/K / -55°C to 155°C / 0805(2012) / SMD / -	Vishay	CRCW0805100RFK

Quantity	Ref Designator	Description	Manufacturer	Manufacturer P/N
3	R15_HS1, R15_LS1, R78	RES / STD / 2.2k / 100mW / 1% / 100ppm/K / -55°C to 155°C / 0603(1608) / SMD / -	ROHM Semiconductors	MCR03EZPFX2201
6	R18, R33, R41, R42, R50, R51	RES / STD / 10R/250mW / 250mW / 1% / 100ppm/K / -55°C to 155°C / 1206(3216) / SMD / -	Vishay	CRCW120610R0FKEA
2	R20, R43	RES / STD / 20R/250mW / 250mW / 1% / 100ppm/K / -55°C to 155°C / 1206(3216) / SMD / -	Vishay	CRCW120620R0FK
4	R24_HS1, R24_LS1, R29_HS1, R29_LS1	RES / STD / 1k / 125mW / 1% / 100ppm/K / - / 0603(1608) / SMD / -	Multicomp	MCHP03W8F1001T5E
2	R32, R49	RES / STD / 5.11R/250mW / 250mW / 1% / 100ppm/K / -55°C to 155°C / 1206(3216) / SMD / -	Vishay	CRCW12065R11FK
3	R44, R96_U_Flyback_Supply_HS, R96_U_Flyback_Supply_LS	RES / STD / 10R / 125mW / 1% / 100ppm/K / -55°C to 155°C / 0805 / SMD / -	Vishay	CRCW080510R0FK
3	R46, R111, R114	RES / STD / 49.9k/100mW / 100mW / 1% / 100ppm/K / -55°C to 155°C / 0603(1608) / SMD / -	Vishay	CRCW060349K9FK
3	R47, R112, R115	RES / STD / 1.02MEG/100mW / 100mW / 1% / 100ppm/K / -55°C to 155°C / 0603(1608) / SMD / -	Vishay	CRCW06031M02FK
3	R48, R95_U_Flyback_Supply_HS, R95_U_Flyback_Supply_LS	RES / STD / 680R / 125mW / 1% / 100ppm/K / -55°C to 155°C / 0805 / SMD / -	Vishay	CRCW0805680RFK
5	R53, R54, R55, R56, R57	RES / STD / 100k/500mW / 500mW / 1% / 100ppm/K / -55°C to 155°C / 1210(3225) / SMD / -	Vishay	CRCW1210100KFK
1	R58	RES / STD / 5.1k/125mW / 125mW / 1% / 100ppm/K / -55°C to 155°C / 0805(2012) / SMD / -	Vishay	CRCW08055K10FK
4	R65, R76, R92_U_Flyback_Supply_HS, R92_U_Flyback_Supply_LS	RES / STD / 4.7R / 125mW / 1% / 100ppm/K / -55°C to 155°C / 0805 / SMD / -	Vishay	CRCW08054R70FK
1	R68	RES / STD / 200k/100mW / 100mW / 1% / 100ppm/K / -	Vishay	CRCW0603200KFK

Quantity	Ref Designator	Description	Manufacturer	Manufacturer P/N
		55°C to 155°C / 0603(1608) / SMD / -		
1	R86	RES / NTC / 10k/210mW / 210mW / - / - / -55°C to 125°C / 0805(2012) / SMD / -	TDK Corporation	B57421V2103J062
2	R94_U_Flyback_Supply_HS, R94_U_Flyback_Supply_LS	RES / STD / 3.6k / 125mW / 1% / 100ppm/K / -55°C to 155°C / 0805 / SMD / -	Vishay	CRCW08053K60FK
2	R97_U_Flyback_Supply_HS, R97_U_Flyback_Supply_LS	RES / STD / 200mR / 250mW / 1% / 100ppm/K / -55°C to 155°C / 0805(2012) / SMD / -	Vishay	RCWE0805R200FKEA
52	TP1, TP6_HS1, TP6_LS1, TP7_HS1, TP7_LS1, TP8_HS1, TP8_LS1, TP9_HS1, TP9_LS1, TP10_HS1, TP10_LS1, TP11_HS1, TP11_LS1, TP12_HS1, TP12_LS1, TP13_HS1, TP13_LS1, TP14_HS1, TP14_LS1, TP15_HS1, TP15_LS1, TP16_HS1, TP16_LS1, TP17_HS1, TP17_LS1, TP18_HS1, TP18_LS1, TP19_HS1, TP19_LS1, TP20_HS1, TP20_LS1, TP21_HS1, TP21_LS1, TP22_HS1, TP22_LS1, TP23_HS1, TP23_LS1, TP24, TP26, TP27_U_Flyback_Supply_HS, TP27_U_Flyback_Supply_LS, TP28_U_Flyback_Supply_HS, TP28_U_Flyback_Supply_LS, TP29_U_Flyback_Supply_HS, TP29_U_Flyback_Supply_LS, TP30_U_Flyback_Supply_HS, TP30_U_Flyback_Supply_LS, TP31, TP33, TP34, TP38, TP39	PC Test Point-Compact THT, White	Keystone Electronics Corp.	5007

Quantity	Ref Designator	Description	Manufacturer	Manufacturer P/N
12	TP2_HS1, TP2_LS1, TP3_HS1, TP3_LS1, TP4_HS1, TP4_LS1, TP5_HS1, TP5_LS1, TP25_HS1, TP25_LS1, TP32_HS1, TP32_LS1	Test Point, Miniature, Surface Mount, Finish- Silver Plate	Keystone Electronics Corp.	5015
2	TR1_U_Flyback_Supply_HS, TR1_U_Flyback_Supply_LS	TDK Transformer with E13 core for bipolar output	TDK	B78308A2464A003
2	U2_HS1, U2_LS1	Single channel isolated IGBT/SiC driver	Infineon Technologies	1EDI3040AS
3	U6, U8, U9	Comparator Complementary Push-Pull Output	ON Semiconductor	NCV2200SN2T1G
1	U7	Quadruple 2-Input XOR Gates	Texas Instruments	SN74HC86D
2	X1, X11	Banana Socket, Red, 17.5mm Pitch	Hirschmann Test & Measurement	973 582-101
1	X2	Banana Socket, black, 17.5mm Pitch	Hirschmann Test & Measurement	973 582-100
3	X3, X5, X7	BNC Straight PCB Socket	TE Connectivity	5-1634506-2
6	X4_HS1, X4_LS1, X12, X18_HS1, X18_LS1, X24	2.54mm Pitch KK Header, Breakaway, Vertical, 3 Circuits, 0.38µm Gold Selective Plating, Mating Pin Length 6.09mm	Samtec	TSW-103-07-G-S
2	X6, X8	Ultra-small Push-on Coaxial Connector	Hirose Connectors	MMCX-R-SMT-4
1	C1	CAP / ELCO / 100uF / 50V / 20% / Aluminiumelectrolytic / -55°C to 105°C / 6.60mm L X 6.60mm W X 8.00mm H / SMD / -	Panasonic	EEEFTH101XAP
1	Q6	HybridPACK Drive Gen2 SIC Module	Infineon Technologies	FS02MR12A8MA2B

Table 9 Adapter board bill of materials

Quantity	Ref Designator	Description	Manufacturer	Part number
1	J1	Through hole .025 SQ Post Header, 2.54mm pitch, 36 pin, vertical, double row, right angle	Samtec	TSW-118-08-L-D-RA
1	J401	Through hole .025 SQ Post Header, 2.54mm pitch, 10 pin, vertical, single row	Samtec	TSW-110-07-L-S
1	J402	Through hole .025 SQ Post Header, 2.54mm pitch, 8 pin, vertical, single row	Samtec	TSW-108-07-L-S
1	J405	Through hole .025 SQ Post Header, 2.54mm pitch, 8 pin, vertical, single row	Samtec	TSW-108-07-L-S
1	J406	Through hole .025 SQ Post Header, 2.54mm pitch, 36 pin, vertical, double row	Samtec	TSW-118-07-L-D

3 EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board

This chapter gives a detailed description of the EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board, which plays the same role as the HPDrive Gen2 SiC module, providing a half bridge.

3.1 PCB overview

This section provides an overview of all the components on the EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board.

3.1.1 Connectors

The EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board has six banana connectors, as shown in Figure 21 and Figure 22, with the functionalities as mentioned in Table 13.

Table 10 Connectors on TO247-4 adapter board

Connector # from Figure 21 & Figure 22	Functionality
1	VDC+ & Inductance connection for double pulse test
2	VDC-
3	Inductance connection for double pulse test

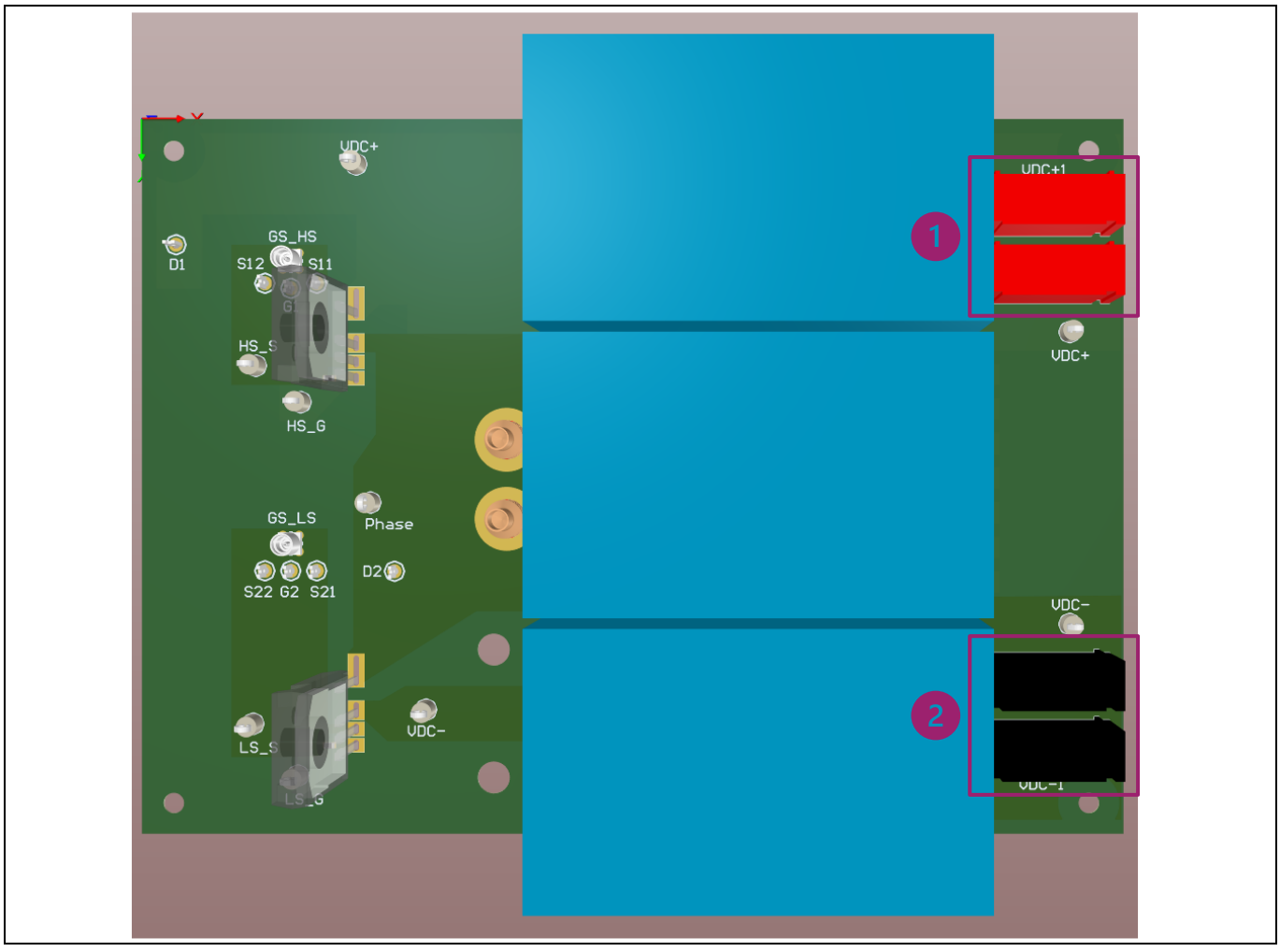

Figure 21 Connectors – bottom view

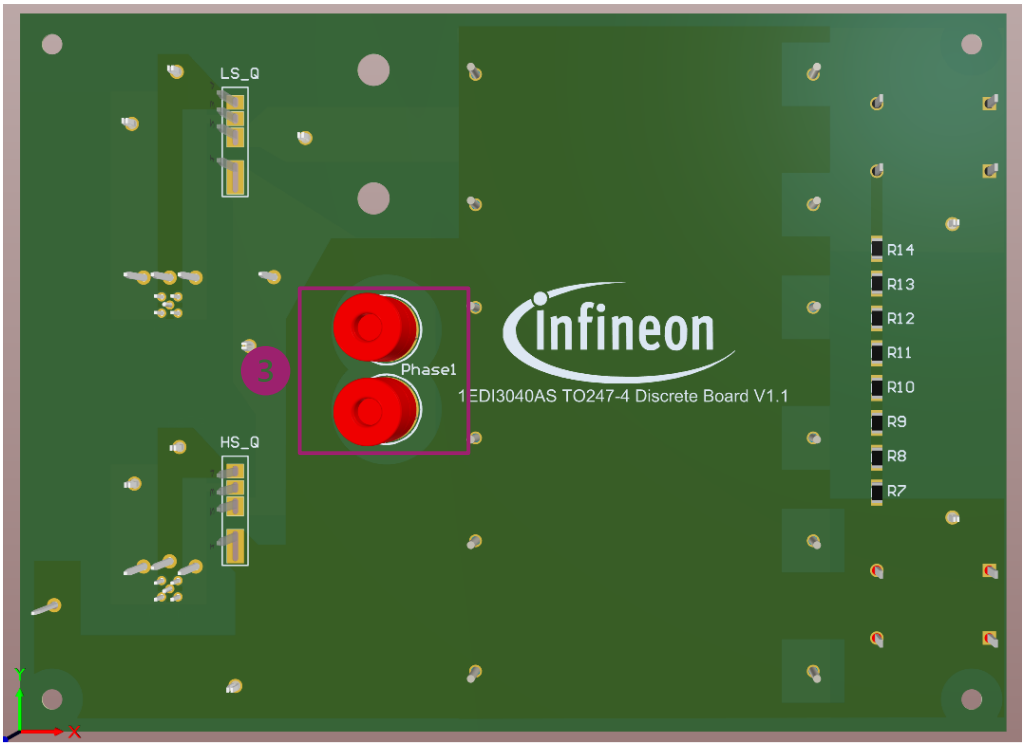

Figure 22 Connectors – top view

3.1.2 Terminals

There are in total eight terminals shown in Figure 23, which are used to connect the EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board with the evaluation board. Figure 28 shows exactly how the connection looks like.

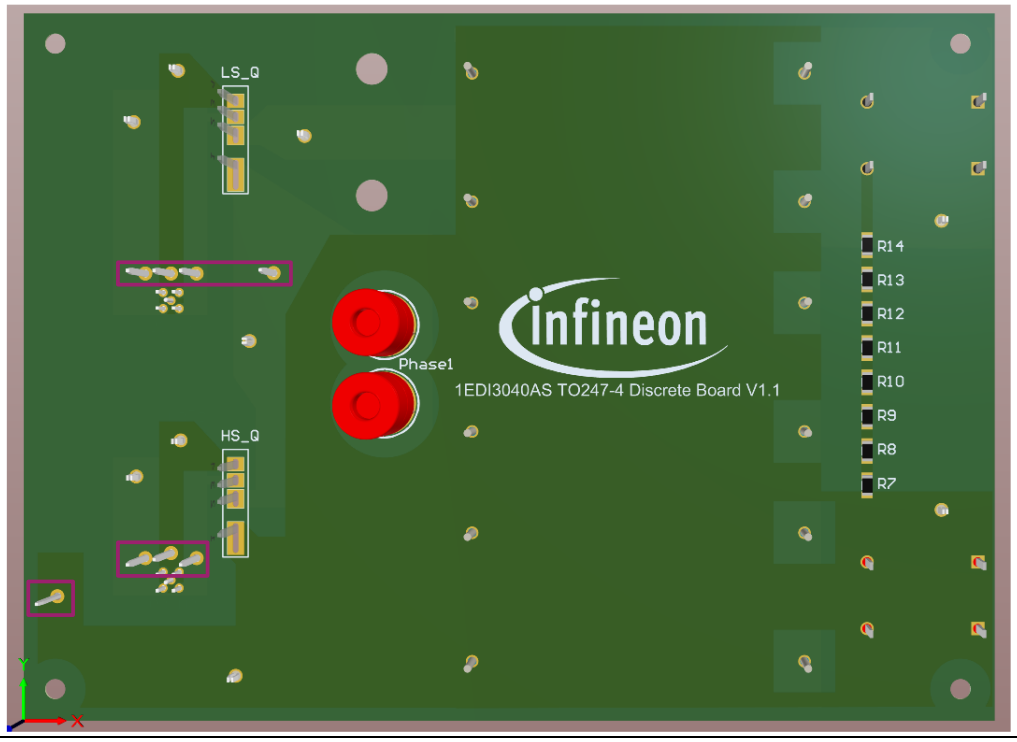

Figure 23 Eight terminals for connection of the TO247-4 adapter board and the evaluation board

3.1.3 Operating conditions

Please make sure that the operating range of VDC+, VDC-, defined in Table 11, is maintained to avoid electrical damage of the product.

Table 11 Operating conditions of TO247-4 adapter board

Parameter	Pin	Values		Unit	Note
		Min.	Max.		
V_{DC}	Between banana sockets “VDC+” and “VDC-”	0	800	V	Limited by the DC link capacitor

Note: The EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board can also work with V_{DC} above 800 V. Please replace the existing DC link capacitors accordingly.

3.2 Schematic

Figure 24 shows the EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board schematic.

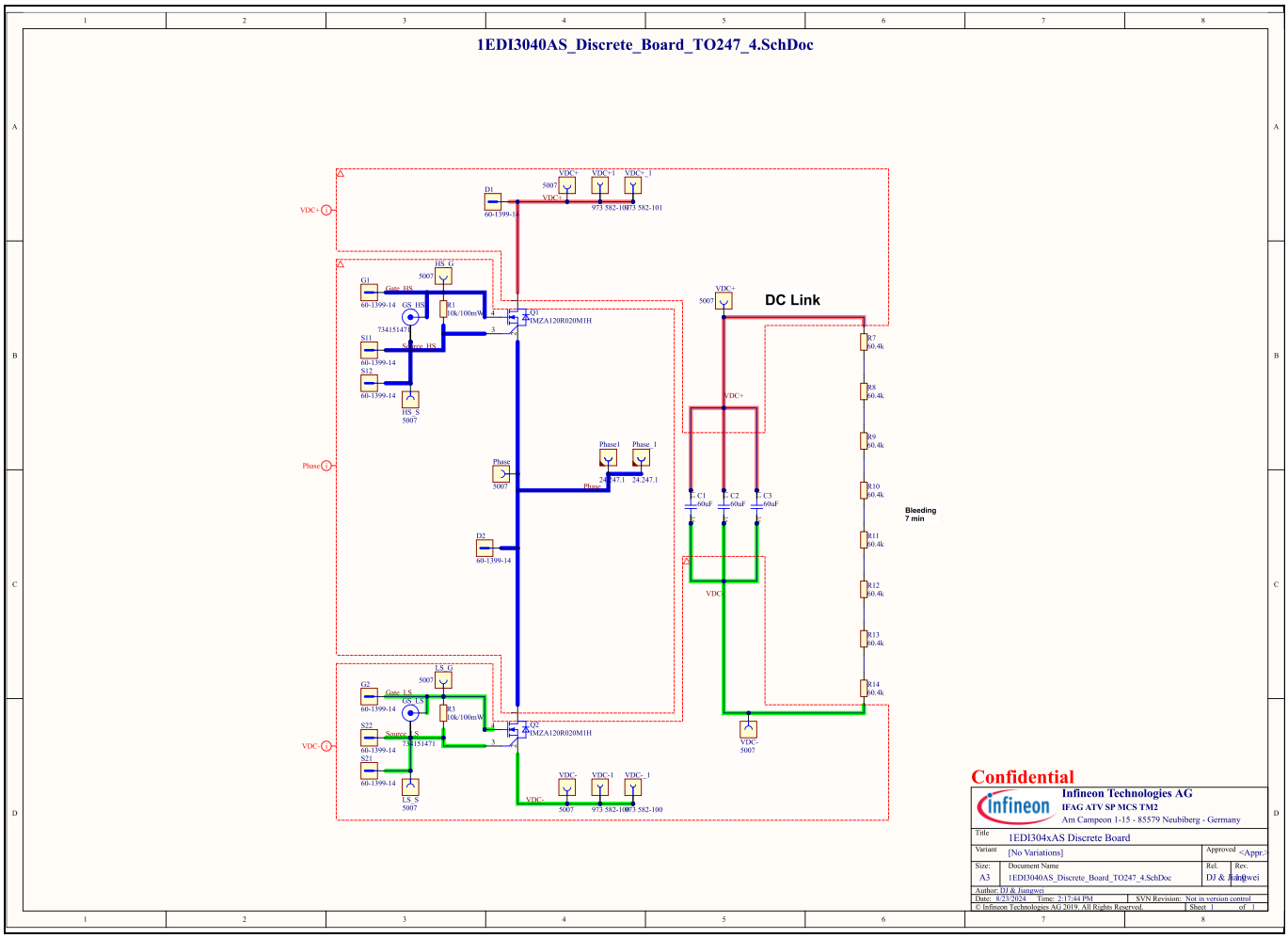

Figure 24 Schematic of the EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board

3.3 Layout

The EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board consists of two layers as shown in Figure 25 and Figure 26.

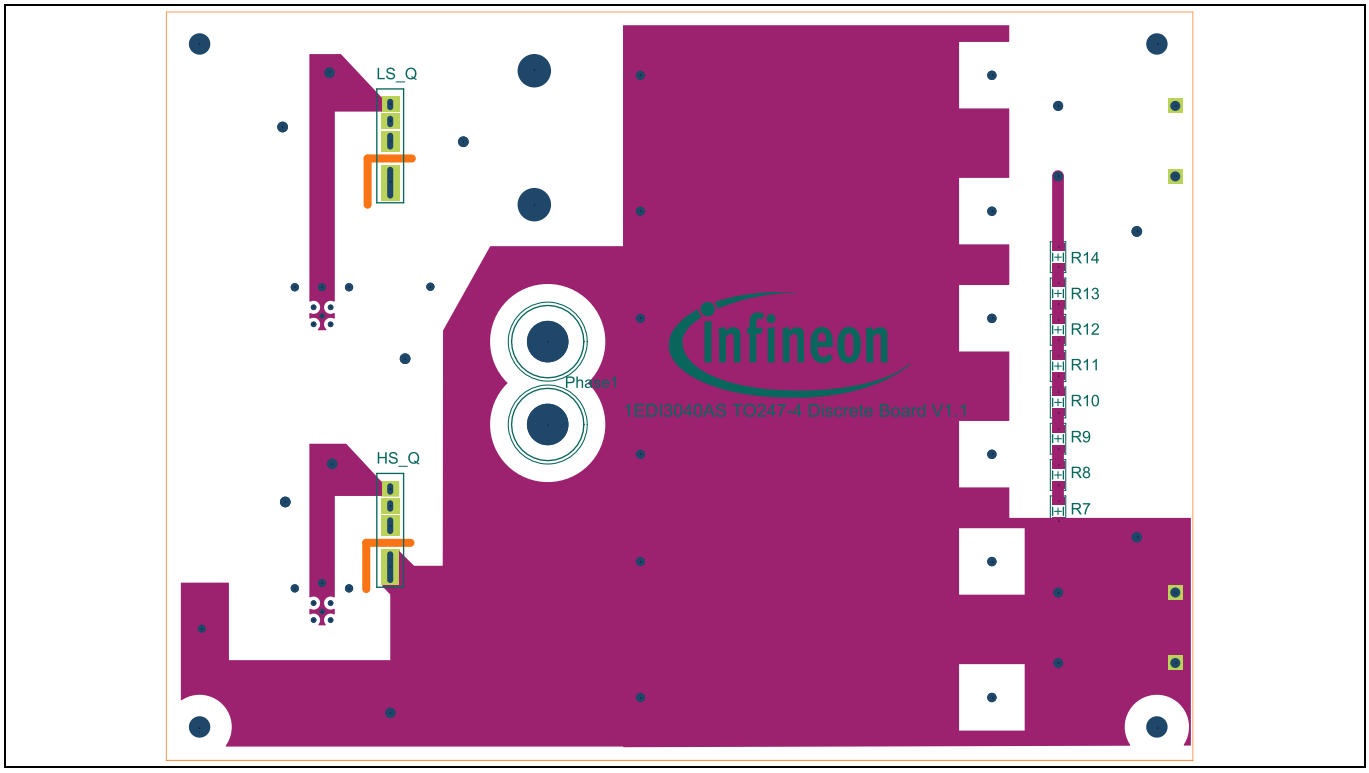

Figure 25 Top layer

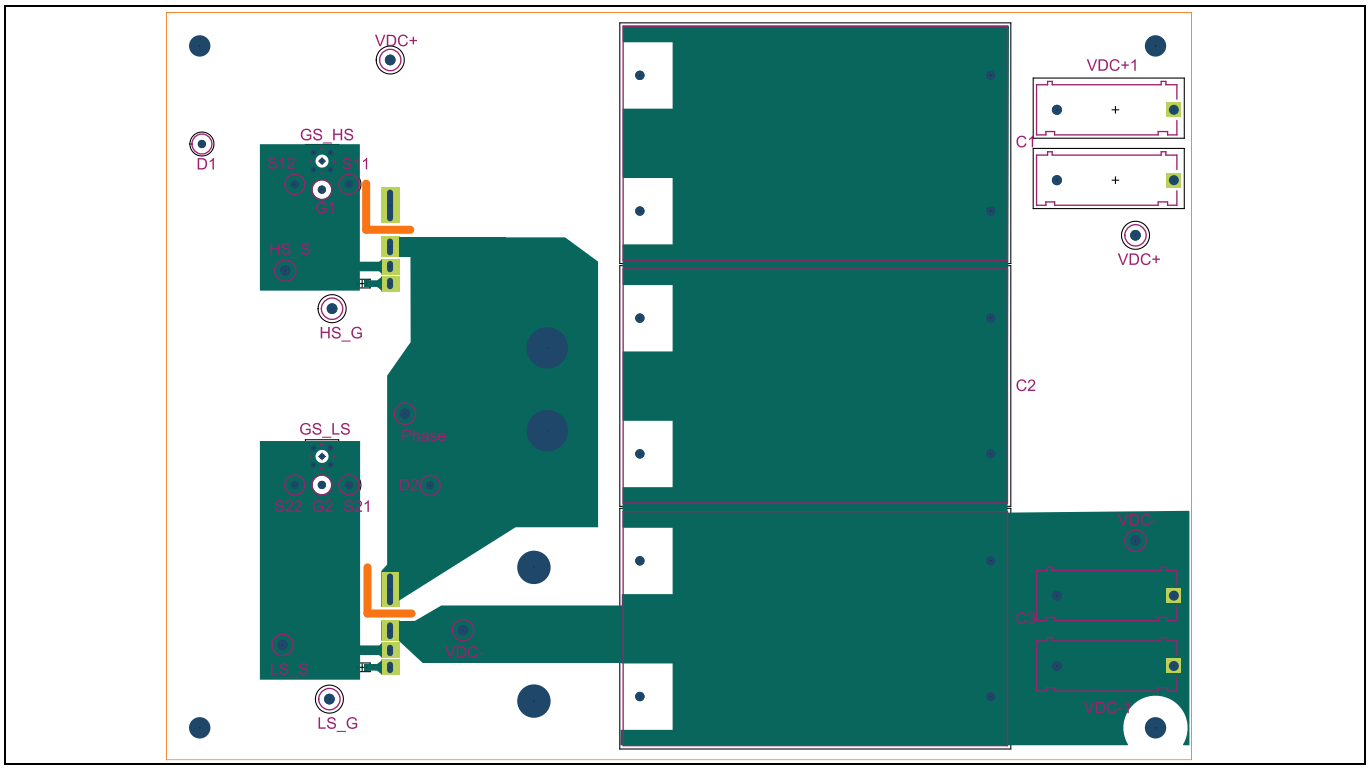

Figure 26 Bottom layer

3.4 Bill of materials

Table 12 shows the bill of materials for the EiceDRIVER™ gate driver 1EDI3040AS TO247-4 adapter board. The TO247-4 power devices are not included.

Table 12 Bill of material of the TO247-4 adapter board

Quantity	Ref Designator	Description	Manufacturer	Manufacturer P/N
3	C1, C2, C3	CAP / FILM / 60uF / 800V / 10% / MKP (Metallized Polypropylene) / -40°C to 105°C / 20.30mm Lead Span, 52.50mm Pitch / THT / -	Epcos	B32778G8606K000
8	D1, D2, G1, G2, S11, S12, S21, S22	Test Point THT, Straight PCB Terminal	Osterrath	60-1399-14
2	GS_HS, GS_LS	MMCX Vertical Jack	Molex	734151471
9	HS_G, HS_S, LS_G, LS_S, Phase, VDC-, VDC+	PC Test Point-Compact THT, White	Keystone Electronics Corp.	5007
2	Phase1, Phase_1	4mm Panel-mount Socket	Multicomp	24.247.1
2	R1, R3	RES / STD / 10k/100mW / 100mW / 1% / 100ppm/K / -55°C to 155°C / 0603(1608) / SMD / -	Vishay	CRCW060310K0FKEA
8	R7, R8, R9, R10, R11, R12, R13, R14	RES / STD / 60.4k / 250mW / 1% / 100ppm/K / -55°C to 155°C / 1206(3216) / SMD / -	Vishay	CRCW120660K4FK
2	VDC-1, VDC-_1	Banana Socket, black, 17.5mm Pitch	Hirschmann Test & Measurement	973 582-100
2	VDC+1, VDC+_1	'Banana Socket, Red, 17.5mm Pitch	Hirschmann Test & Measurement	973 582-101

4 Using the 1EDI3040AS evaluation board without a software GUI

In this section, details on getting started and operating the evaluation board as a standalone test board without the Aurix™ TC375 Shieldbuddy board and a graphical user interface is described.

4.1 Getting started

- Disconnect the Aurix™ TC375 Shieldbuddy board and the adapter board from the main evalboard
    - To minimize interaction between the boards, it is recommended to disconnect the TC375 Aurix™ Shield Buddy board when using the 1EDI3040AS evaluation board as a standalone test board
- Connect a HybridPACK™ Drive Fusion Gen2 SiC module or the 1EDI3040AS TO247-4 adapter board to the 1EDI3040AS evaluation board
    - Since the HybridPACK™ Drive module consists of PressFIT pins, it is recommended to use pin receptables, as shown in Figure 27, in order to provide flexibility to disconnect and reconnect the power module
- When no power module is connected to the evaluation board, the device will have a DESAT fault due to floating DESAT pins. To prevent a DESAT error, connect the testpoints “DESAT_LS” and “DESAT_HS” to GND2 with the help of alligator connectors
- Set jumpers SI1 and SI2 to position “2-3”
- Populate 0 Ohm resistor to R34 as shown in Figure 29
- For the OCP functionality of the gate drivers, the evalution board offers different possibilities to connect the OCP pin:
    - High side gate driver
        - OCP can be connected to the anode of the temperature diode of the HybridPACK™ Drive module through resistor R60
    - Low side gate driver
        - OCP can be connected to the HVDC measurement resistors through resistor R80
    - Please populate resistors R60 or R80 according to your requirements
    - If OCP will be unused, please connect the OCP_LS and OCP_HS pins to GND2 with alligator clips
- Connect a function generator input to BNC connector “INP_HS” and “INP_LS” to control the INP PWM for the HS and LS gate drivers respectively
    - In case the shoot-through-protection feature needs to be disabled in hardware, the corresponding “INP_x” BNC of the gate driver needs to be connected to GND
    - Apply a PWM within the frequency range mentioned in the datasheet
- Connect a function generator input to BNC connector “SLEW” for a PWM to control the slew rate
    - Apply a PWM within the frequency range mentioned in the datasheet
- Connect the 12 V supply to the evaluation board through banana connectors “+12 V” and “GND”

- Connect a 5 V supply to the banana connectors “SI_IP” and “GND” to control the safety inputs of the gate driver

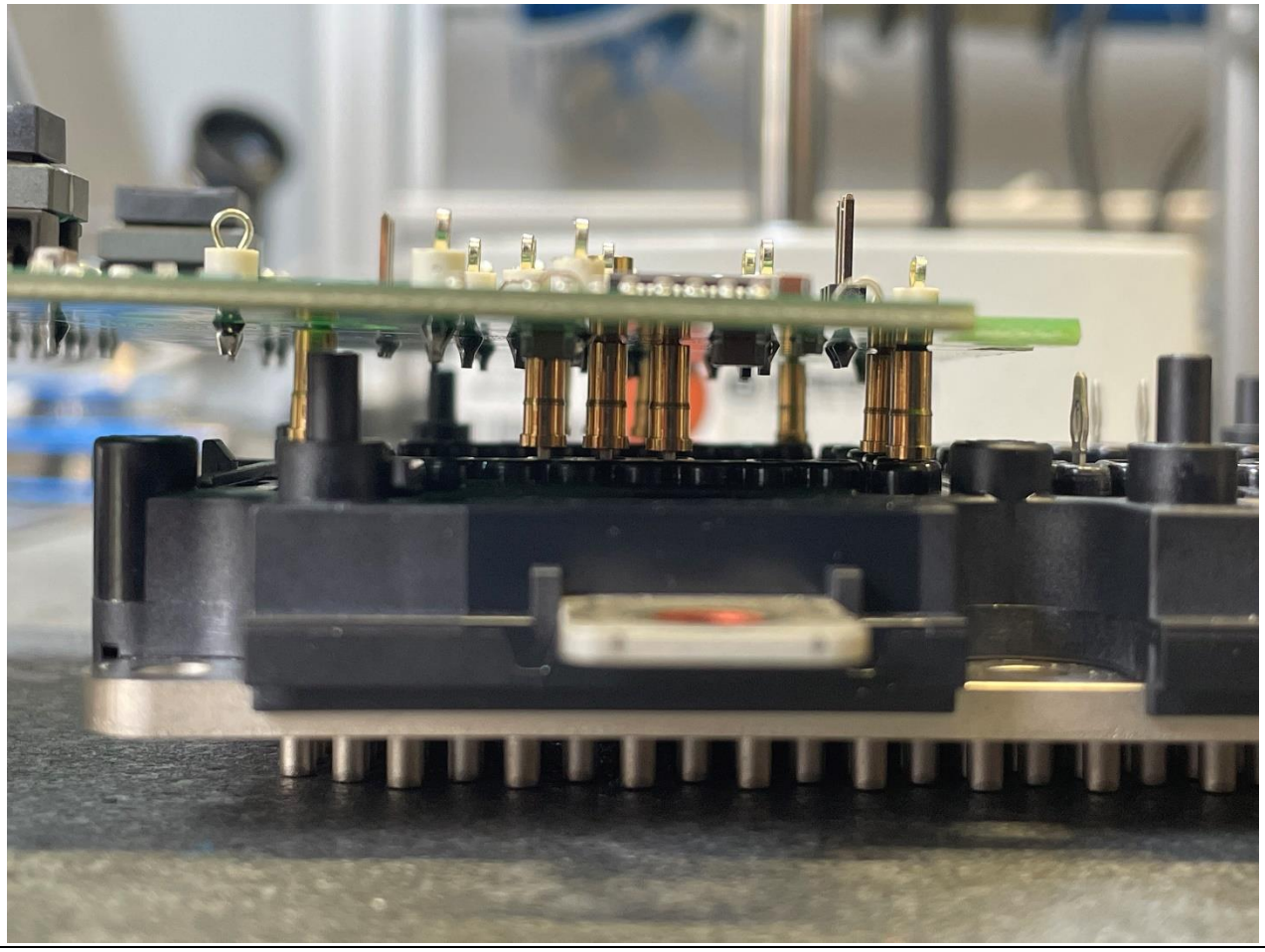

Figure 27 Connection to HPDrive Gen2 SiC module using terminal connectors

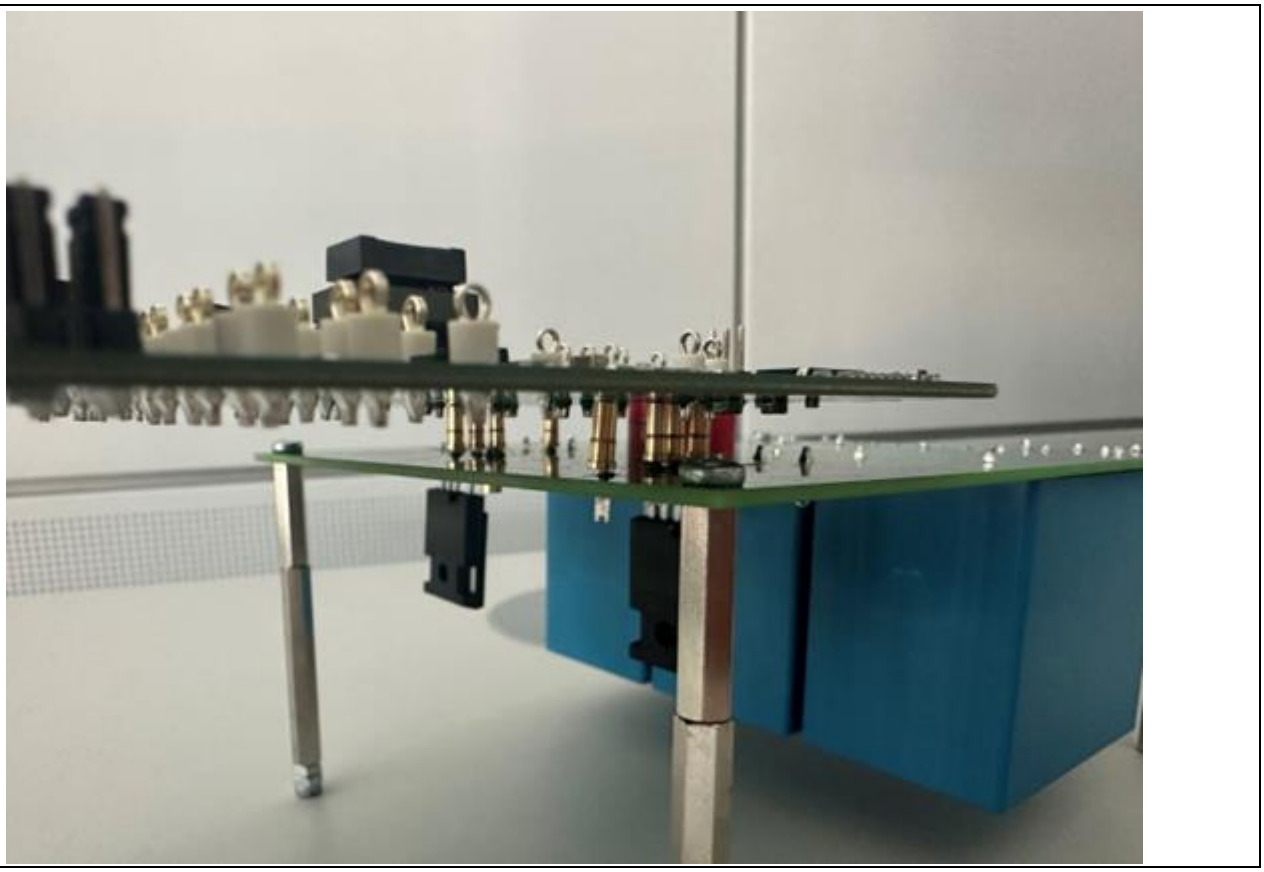

Figure 28 Connection to 1EDI3040AS TO247-4 adapter board

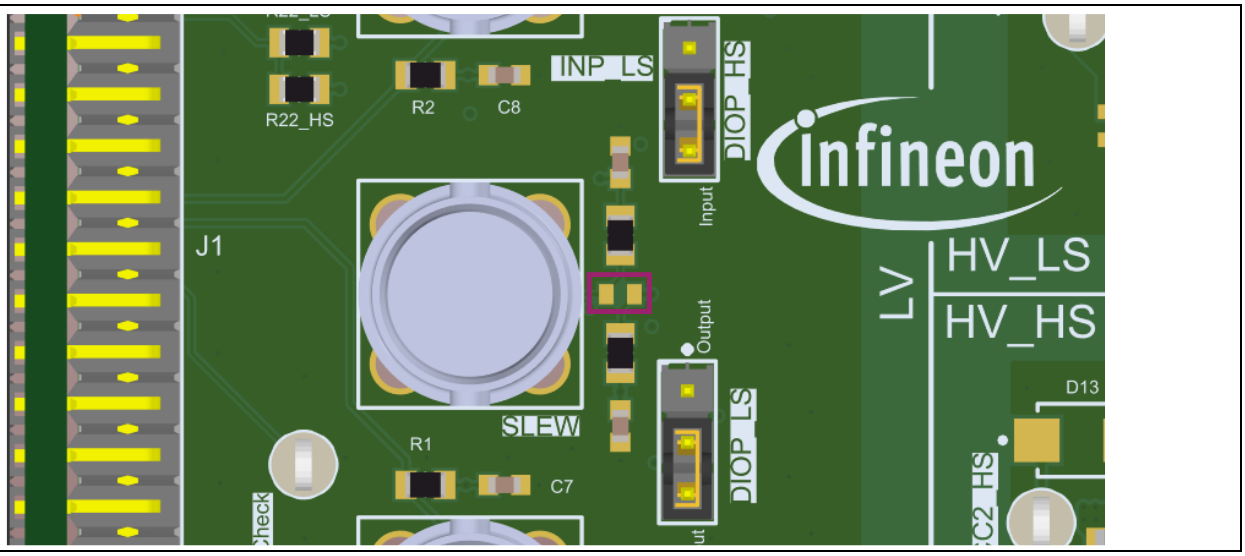

Figure 29 Populate R34 in the location shown

- Turn on both the 12 V and 5 V power supplies
- LED “VCC1” should turn green indicating that VCC1 has successfully powered-up
- LEDs “VCC2” and “VEE2” for both the HS and LS drivers should turn green indicating the VCC2 and VEE2 have powered-up succesfully

- Once the devices have powered-up completely, LEDs “NFLTA” for both HS and LS should turn red indicating that the device is in “Configuration and Error” mode
- Depending on the operating mode required, apply a corresponding voltage according to Table 13 to 5 V power supply connected to banana connector “SI_IP”
    - Safety inputs to both the highside and low side gate drivers are cross-connected
    - The voltage ranges mentioned below are typical values as per design and component tolerances need to be considered in practice. Hence to ensure a valid command to the safety inputs, please select a voltage at the midpoint of the voltage ranges below. For example, for PWM enable mode, set a voltage in the range of 1.8 V
- Set the voltage of the “SI_IP” banana connector to PWM enable mode. This should clear all errors if the errors are no longer present and the devices should enter PWM enable mode with output switching between VCC2 and VEE2

Table 13 Voltage ranges for safety input transitions

Voltage on SI_IP (Typ)	Operating mode
0 … 1.25 V	Configuration and Error
1.25 …. 2.5 V	PWM enable
2.5 … 3.75 V	ASCP ON
3.75 … 5 V	ASCP OFF

4.2 Modifying slew rate during operation

- Ensure that all steps in Chapter 4.1 have been followed and the device has successfully powered up
- Since the gate drivers are operating without a software GUI, the register configurations are their default values. Please refer to the datasheet and user manual for default register settings
- Modify the duty cycle of the function generator connected to the BNC connector “SLEW” to change the slew rate configuration
- Observe the switching transitions on the power device gate terminals

4.3 Generating a secondary active short-circuit

- Ensure that all steps in Chapter 4.1 have been followed and the device has successfully powered up
- Connect jumper SASC/DIOS_x in position “2-3” for either the HS or LS gate driver as shown in Figure 30
    - *Note: connecting jumpers SASC/DIOS_LS and SASC/DIOS_HS in position “2-3” will result in a DC bus short!*
- Confirm that the corresponding output of the gate driver is HIGH
- Since by default register configuration, SASC is configured as an error, LED “NFLTB” should light up
- Removing the jumper will remove SASC and reconnecting the jumper will initiate SASC again

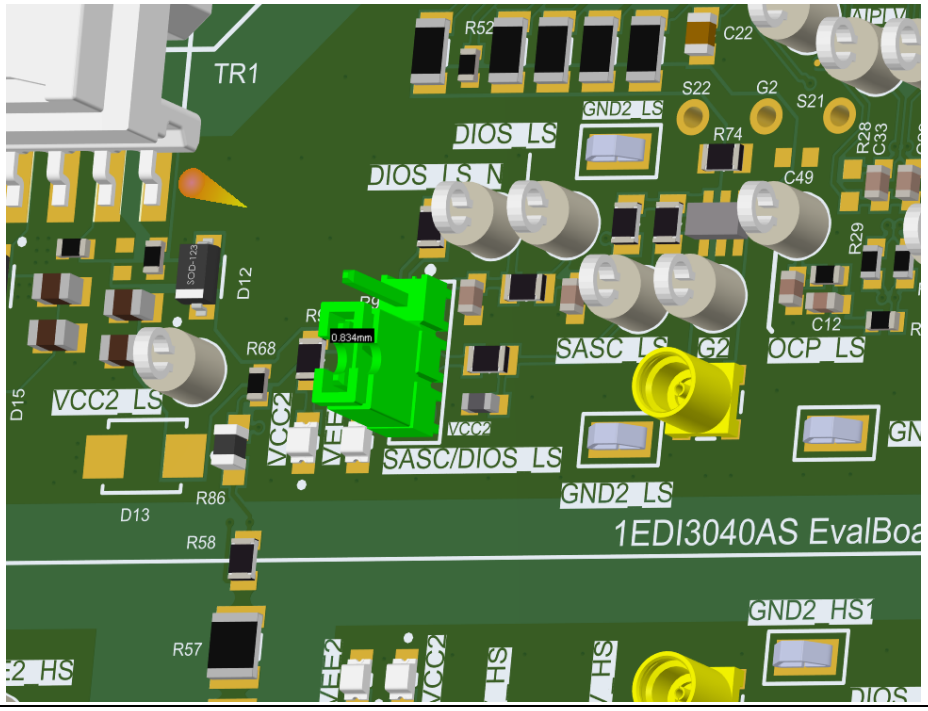

Figure 30 Jumper connection for triggering SASC

4.4 Generating a primary active short-circuit

- Ensure that all steps in Chapter 4.1 have been followed and the device has successfully powered up
- Enter “Configuration and Error” mode by first setting “SI_IP” to 0 V
- Set “SI_IP” input to a voltage between 2.5 … 3.75 V to enter ASCP ON mode for the HS gate driver
    - *Note: confirm the selected mode by ensuring SI1 = 0 and SI2 = 1 for the HS gate driver*
- Since the HS and LS gate driver safety input pins are cross-connected, setting one device to ASCP_ON mode sets the other device automatically in ASCP_OFF mode
- Confirm that the HS gate driver has entered ASCP_ON mode by observing the output of the gate driver to be HIGH

5 Using the Config Wizard for EiceDRIVER™ AMC gate drivers

The user is encouraged to refer to the **Infineon-EiceDRIVER_AMC_gate_driver_Configuration_Wizard-UG** for details on using the configuration wizard GUI.

Revision history

Document revision	Date	Description of changes
1.0	2024-07-31	Initial version
1.01	2024-07-31	1) Increased resolution of schematic figures 8,9,10,11,12,13,14 2) Added order numbers in Chapter 2
1.02	2024-08-29	Added information about 1EDI3040AS TO247-4 adapter board
1.03	2024-11-05	Added new chapter about 1EDI3040AS TO247-4 adapter board
1.04	2024-11-07	Fixed typo in Chapter 2 on SP number for TO274-4 adapter board

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