Half-bridge buck converter evaluation board using the EiceDRIVER™ 2EDL803x

Order code: EVAL_HB_2EDL803x-G3C, EVAL_HB_2EDL803x-G4B, EVAL_HB_2EDL803x-G4C

About this document

Scope and purpose

The 2EDL803x is the EiceDRIVER™ family designed to drive both high-side and low-side MOSFETs in a half-bridge configuration. The floating high-side driver is capable of driving a high-side MOSFET operating at up to 120 V bootstrap voltage. Version 4 provides full 4 A current capability, while version 3 provides 3 A. The high-side bias voltage is generated using a bootstrap technique with an integrated bootstrap diode. The inputs of the driver are TTL logic compatible and can withstand input common mode swing from -10 V up to 20 V. Independent inputs allow controlling high- and low-side domains independently. Undervoltage lockout (UVLO) on both high- and low-side supplies forces the corresponding outputs low in case of insufficient supply. The 2EDL803x is available in SON-8 pins 4 mm x 4 mm, SON-10 pins 4 mm x 4 mm, and SON-10 pins 3 mm x 3 mm packages.

The half-bridge buck converter evaluation board described in this document is designed as a test platform for evaluating the performance of 2EDL8034_G3C. For evaluation of different packages, evaluation boards are available as shown in **Table 1**.

Table 1 Board specifications

Part number	Package	Body size	Evaluation board
2EDL803x-G3C	PG-VDSON-10-4	3 mm x 3 mm	**EVAL_HB_2EDL803x-G3C**
2EDL803x-G4B	PG-VSON-8-5	4 mm x 4 mm	**EVAL_HB_2EDL803x-G4B**
2EDL803x-G4C	PG-VDSON-10-2	4 mm x 4 mm	**EVAL_HB_2EDL803x-G4C**

Intended audience

Power supply designers, component engineers, hardware engineers, etc.

Table of contents

1 Introduction

The evaluation board provides the design engineer with a test platform for evaluating the performance of the 2EDL8034 gate driver – such as, but not limited to, its propagation delay, delay matching, and rise/fall time characteristics. The influence of the surrounding gate drive circuitry such as the external gate resistors on the MOSFET's switching behavior can also be evaluated. The board is configured as a half-bridge buck converter in an open-loop configuration and tested with 48 V typical input voltage and 12 V typical output voltage. The Infineon components used in this evaluation board are:

- EiceDRIVER™ 2EDL8034 as half-bridge driver for the low-side and high-side MOSFET
- OptiMOS™ 100 V 4 mΩ (**BSC040N10NS5**) in SuperSO8 package as the power MOSFET

Table 2 shows the typical board electrical specifications, but the user has the freedom to vary the input voltage (60 V maximum), output voltage, output current, switching frequency and dead time, because the board is configured in open-loop configuration. Care must be taken not to exceed the components' maximum voltage ratings and current ratings (e.g., the inductor's saturation current rating), as well as the devices' temperature ratings. Provide adequate airflow or forced air if necessary.

Table 2 Board specifications

Parameter	Symbol	Value	Unit
Input voltage	V_{in}	48	V
Output voltage	V_{out}	12	V
Output current	I_{out}	0 to 8	A
Switching frequency	F_{sw}	200	kHz
Dead time	DT_{on}, DT_{off}	100	ns
Board dimensions	88.0 mm (L) x 60.5 mm (W)		

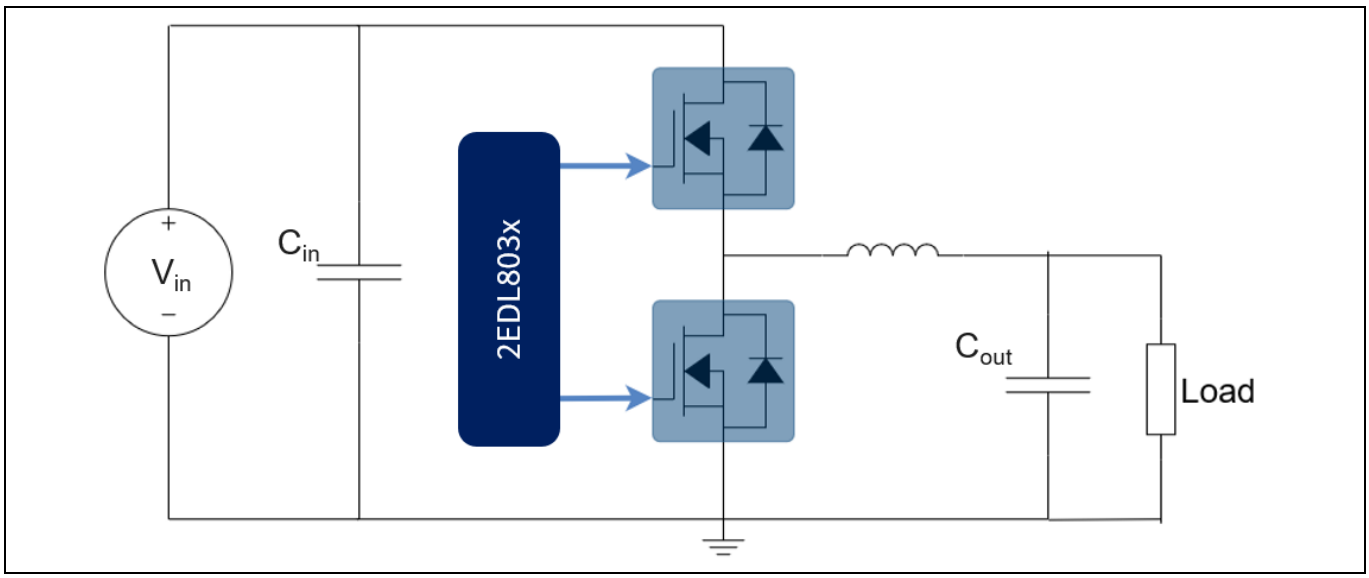

Figure 1 Block diagram of EVAL_HB_2EDL803x

2 Getting started with the hardware

2.1 Evaluation board

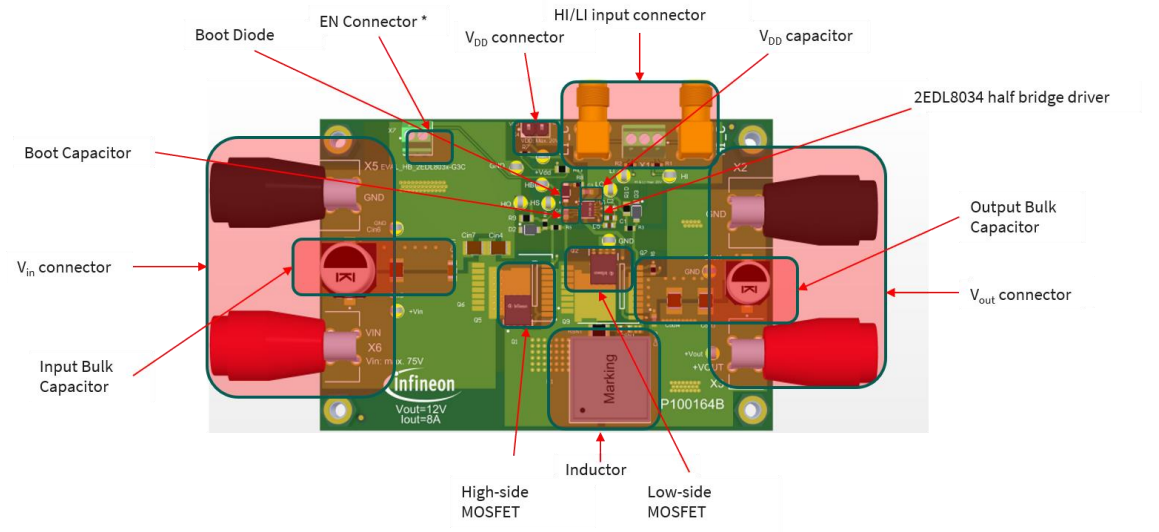

Figure 2 EVAL_HB_2EDL803x – top side

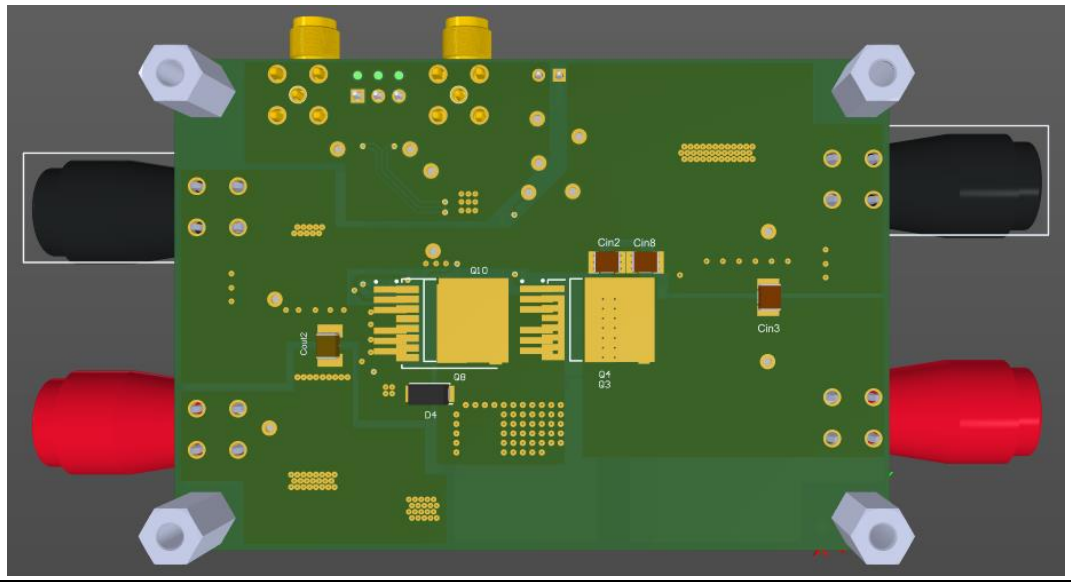

Figure 3 EVAL_HB_2EDL803x – bottom side

2.2 List of connection and test points

Table 3 Connection and test points – functional descriptions

Connection/test point	Description
X1	HI and LI PWM input
X2	Input GND
X3	V_{out} connector
X4	V_{DD} connector
X5	Output GND
X6	V_{in} connector
X7*	EN connector
$+V_{in}$	V_{in} sense point
$+V_{out}$	V_{out} sense point

Note: EN connector (X7) is only available on board EVAL_2EDL803x-G3C

2.3 Quick start guide

1. Input the PWM signals (LI and HI) using a function generator with the desired pulse width, dead time and frequency through connector X1. Ensure that there is sufficient dead time to avoid cross-conduction of the two MOSFETs.
2. Supply V_{DD} voltage using an external auxiliary power supply between 8 V and 17 V through connector X4.
3. For 2EDL803x-G3C, enable signal should be supplied between 3 V and V_{DD} + 0.3 V through connector X7. Other drivers don't require enable signal.
4. Supply the V_{in} voltage using an external power supply with 48 V (60 V maximum) through connector X6 (V_{in}) and X2 (GND). If verifying the gate driver IC characteristics only, such as propagation delay, there is no need to supply the V_{in} voltage. In this case, the HS pin must be shorted to GND in order to have a charging path for the bootstrap capacitor.
5. Connect the V_{out} to the electronic load through connector X3 (V_{out}) and X5 (GND) and increase the output current up to 8 A maximum. Care must be taken not to exceed the inductor's saturation limit.
6. The V_{DD}, LI, HI, LO, and HS pin of the gate driver can be measured by a low-voltage single-ended probe, while the HO-HS and HB-HS should be measured using low-voltage differential probes. Probing loops should be as short as possible to avoid any induced ringing, and probes should be placed near the driver pins to ensure accurate measurement of the driver's performance.
7. To power down the board, turn off the load first and then turn off the input voltage supply. Then turn off the enable signal in the case of 2EDL80x-G3C. Finally, turn off the driver bias supply.

3 Test results

Figure 4 and **Figure 5** show the falling and rising propagation delay of the low-side and high-side drives with the V_{DD} bias supplied and V_{in} = 48 V with no load on output.

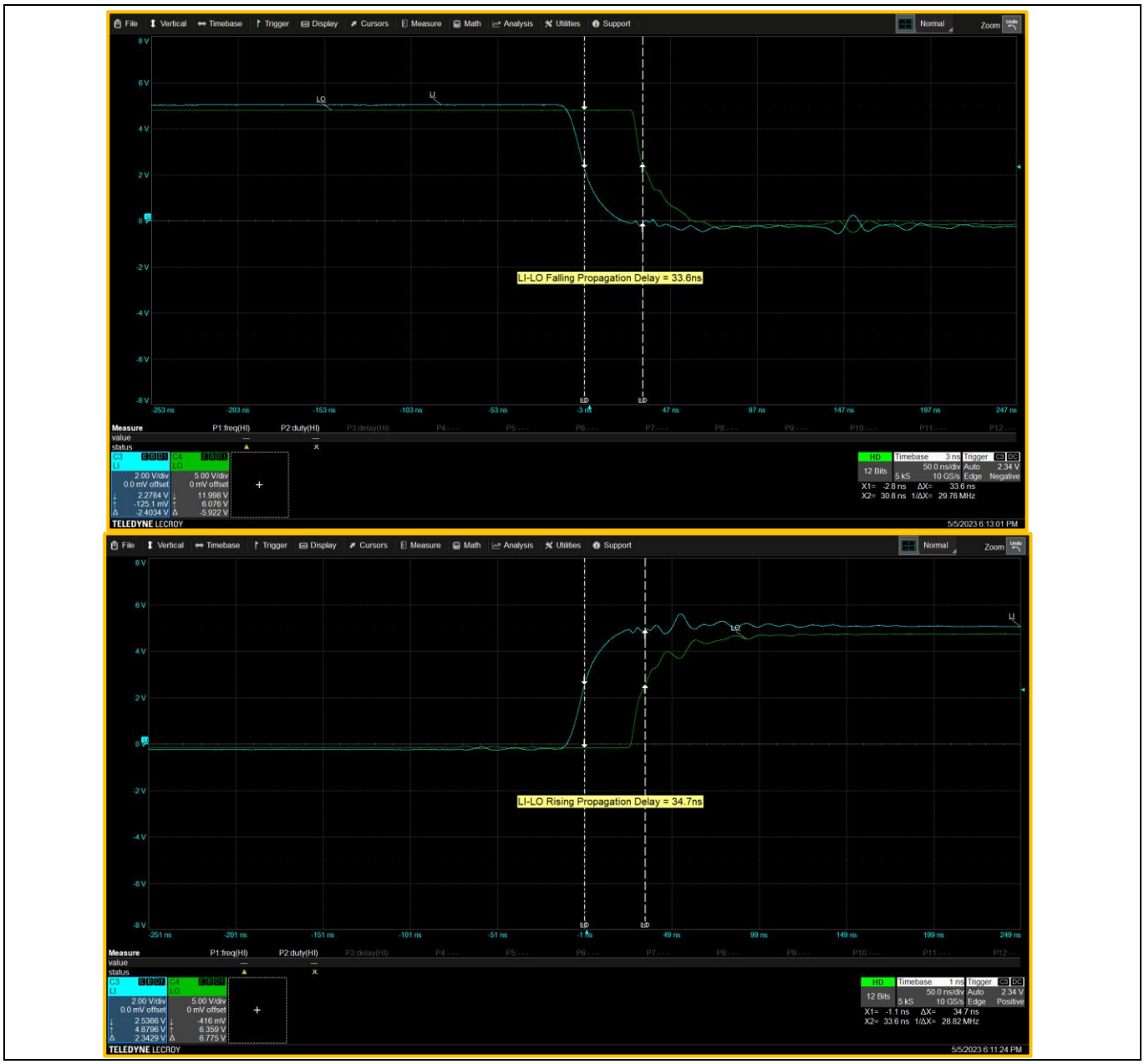

Figure 4 LI-LO falling (33.6 ns) and rising (34.7 ns) propagation delay (V_{DD} = 12 V, V_{in} = 48 V, C_{load} = 4.1 nF)

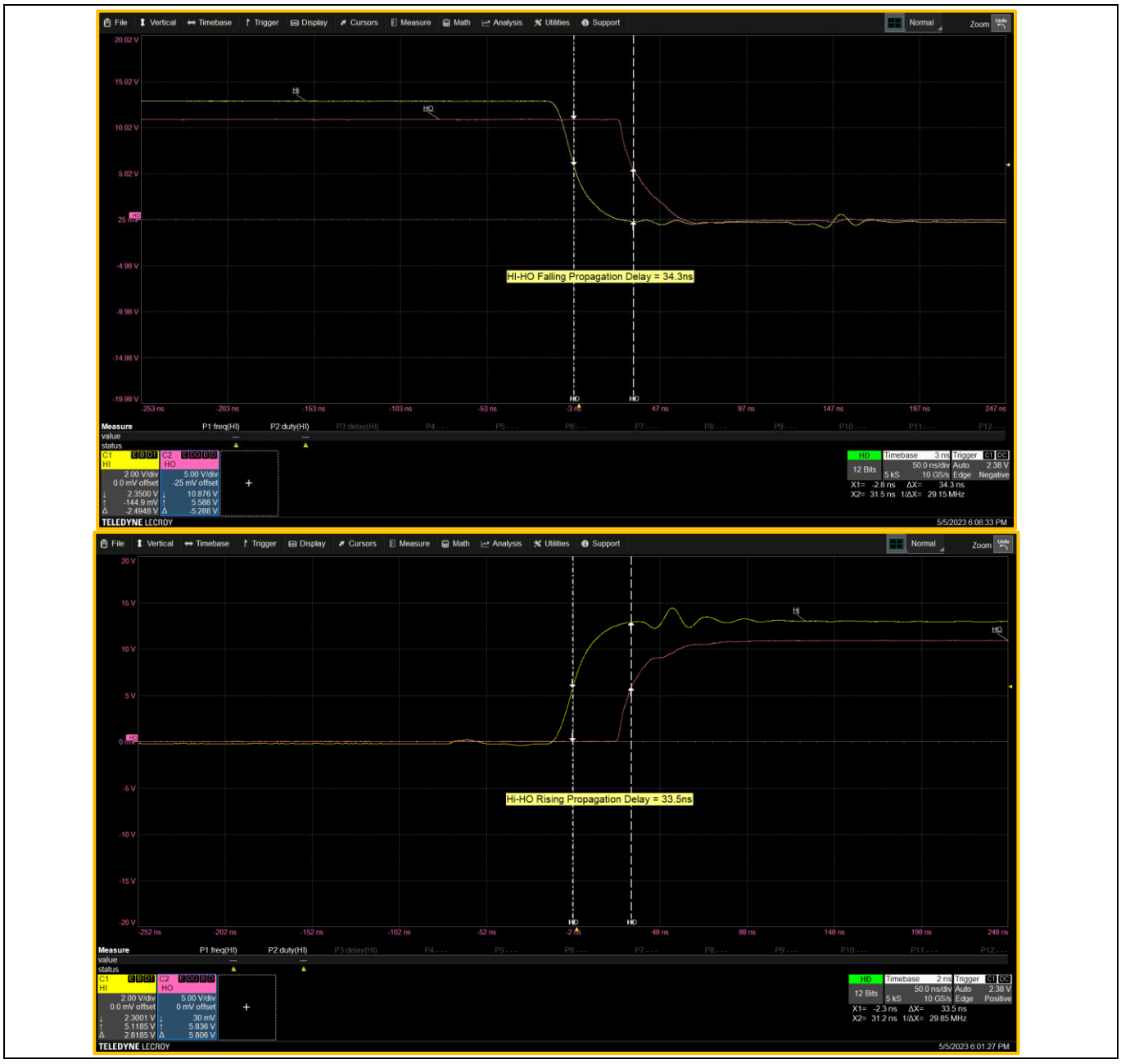

Figure 5 HI-HO falling (34.3 ns) and rising (33.5 ns) propagation delay (V_{DD} = 12 V, V_{in} = 48 V, C_{load} = 4.1 nF)

Figure 6 shows the high-side and low-side output waveforms together with the switch node waveforms at V_{in} = 48 V, V_{DD} = 12 V, duty = 23 percent, F_{sw} = 200 kHz, load = 8 A, and T_A = 25°C.

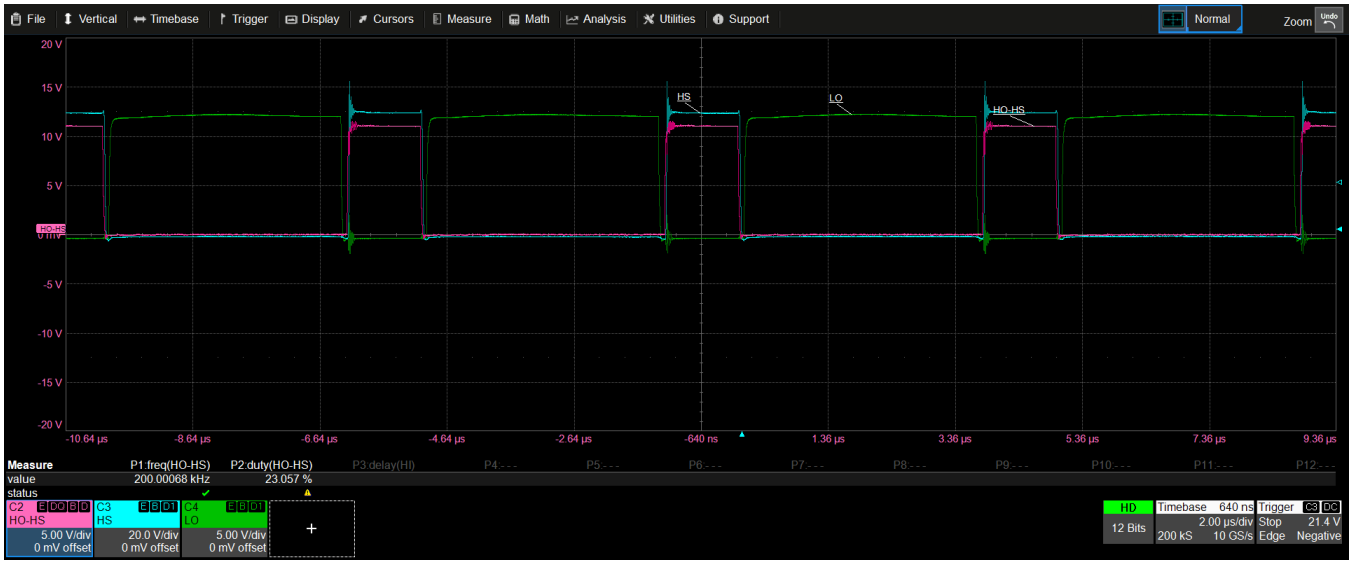

Figure 6 LO (green), HO (pink), HS (yellow) waveforms

4 Footprint selection for different FETs

The evaluation board allows the user to test the performance of the driver IC with different FETs available in various footprints. **Table 4** lists all the footprints supported on this board.

Table 4 FET footprints supported on the evaluation board

Package	Ref. designator	Preferred FET	Figure
PG-TDSON-8-1 (SuperSO8)	Q1 and Q2	BSC040N10NS5	**Figure 7**
TO263-7-3	Q3 and Q10	IPB032N10N5	**Figure 8**
PG-HSOF-8-1	Q4 and Q9	IPT020N10N3	**Figure 9**
PG-HSOG-8-1	Q5 and Q8	IAUS300N10S5N014	**Figure 10**
PG-HDSOP-16-2	Q6 and Q7	IAUS260N10S5N019T	**Figure 11**

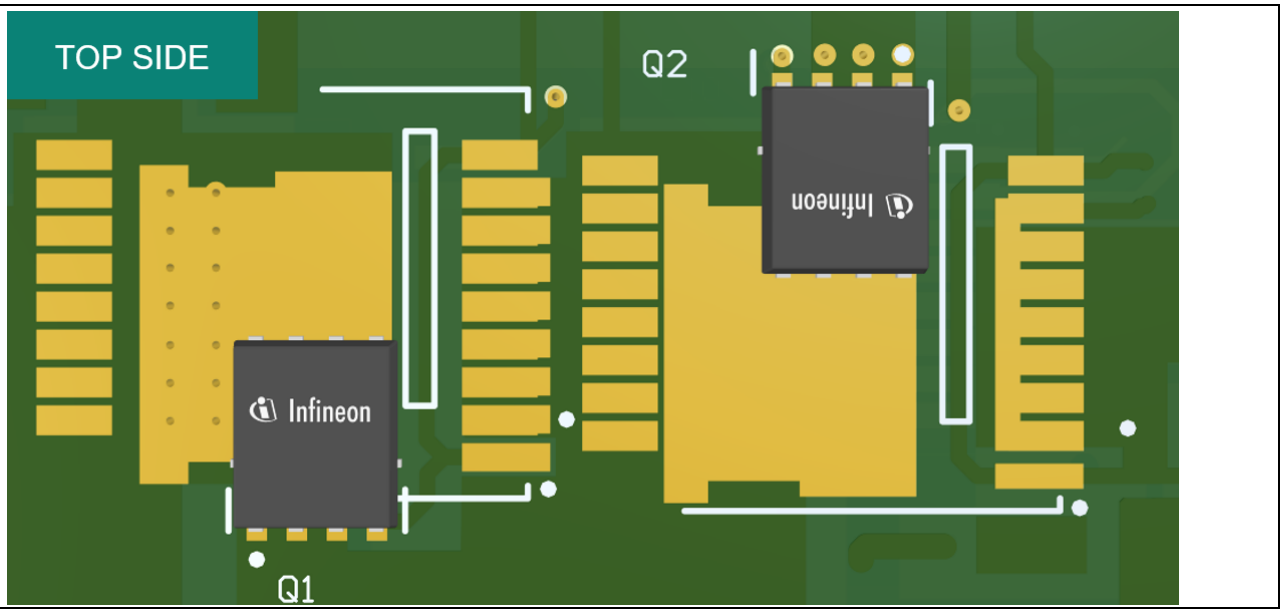

Figure 7 PG-TDSON-8-1 (SuperSO8) package

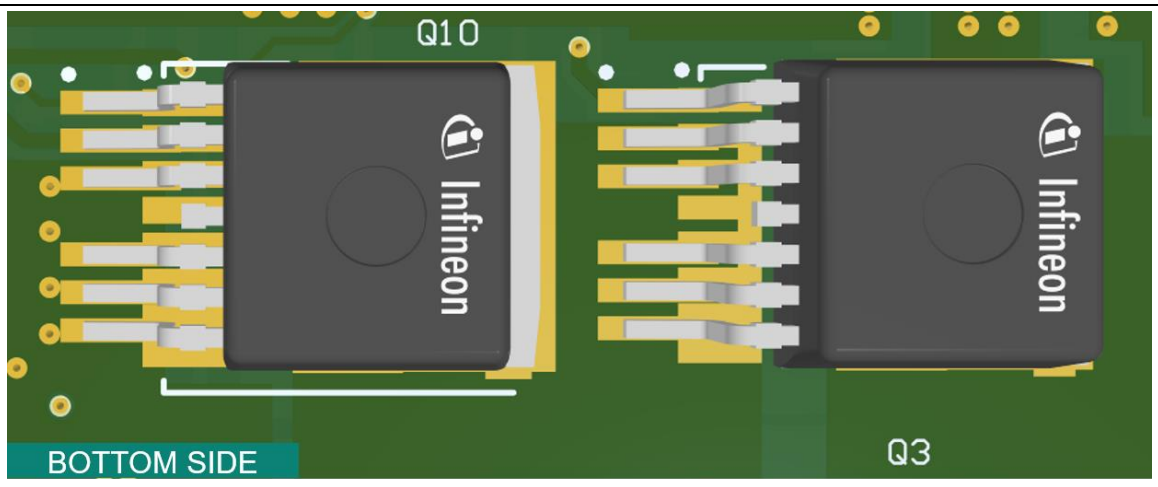

Figure 8 TO263-7-3 package

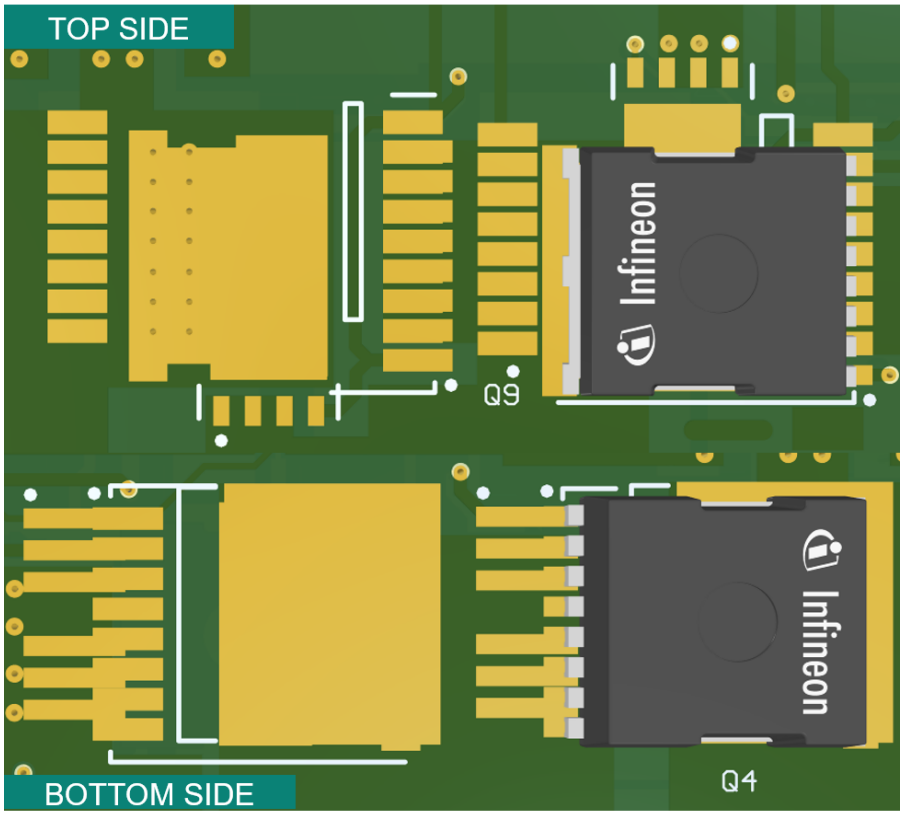

Figure 9 PG-HSOF-8-1 package

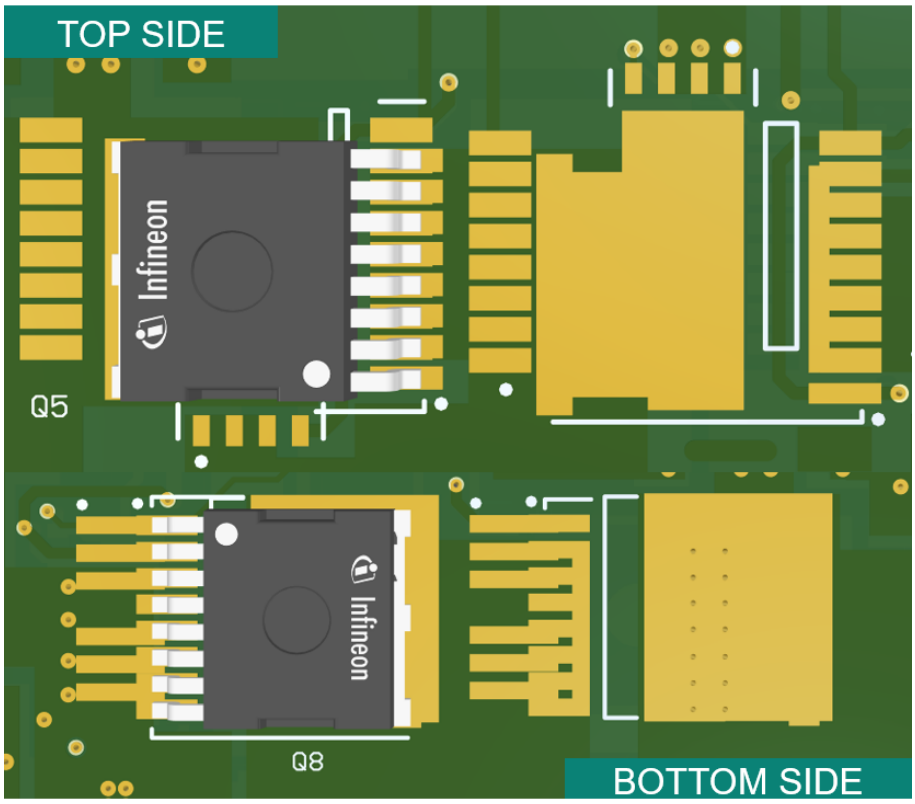

Figure 10 PG-HSOG-8-1 package

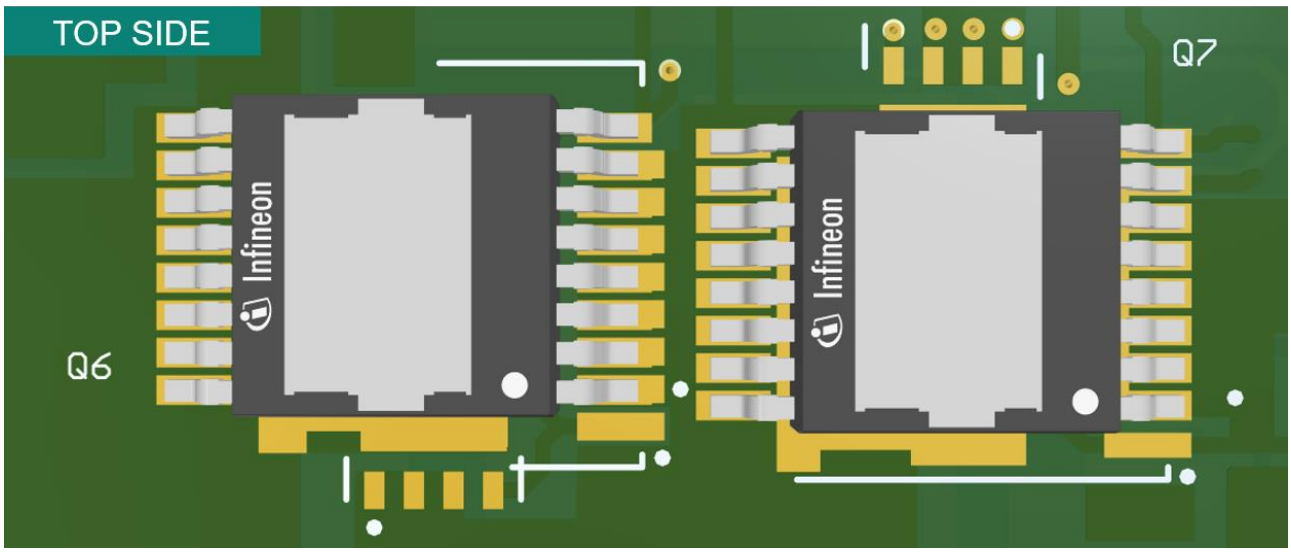

Figure 11 PG-HDSOP-16-2 package

5 Addendum

5.1 Schematic

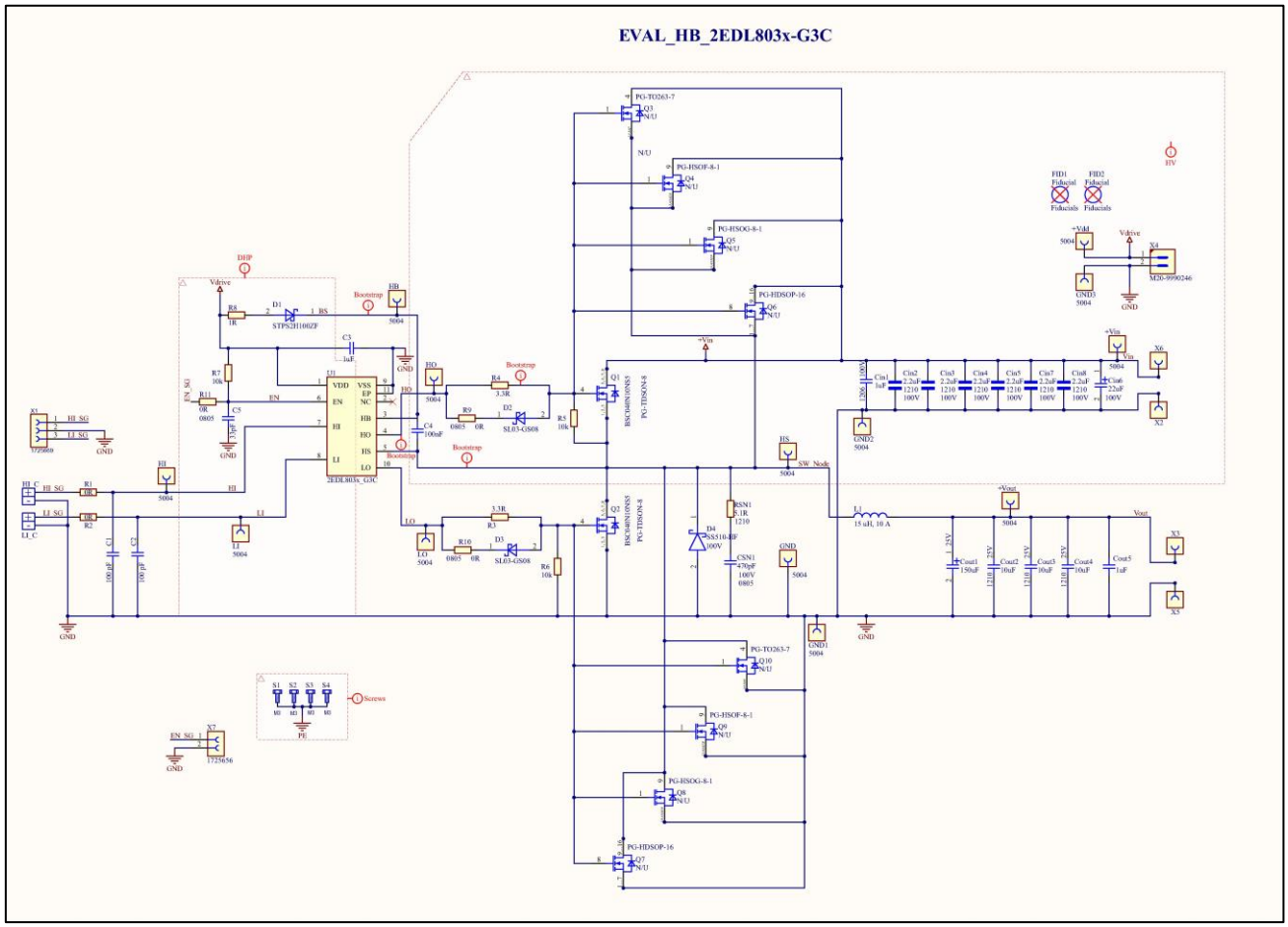

Figure 12 EVAL_HB_2EDL803x-G3C board schematic

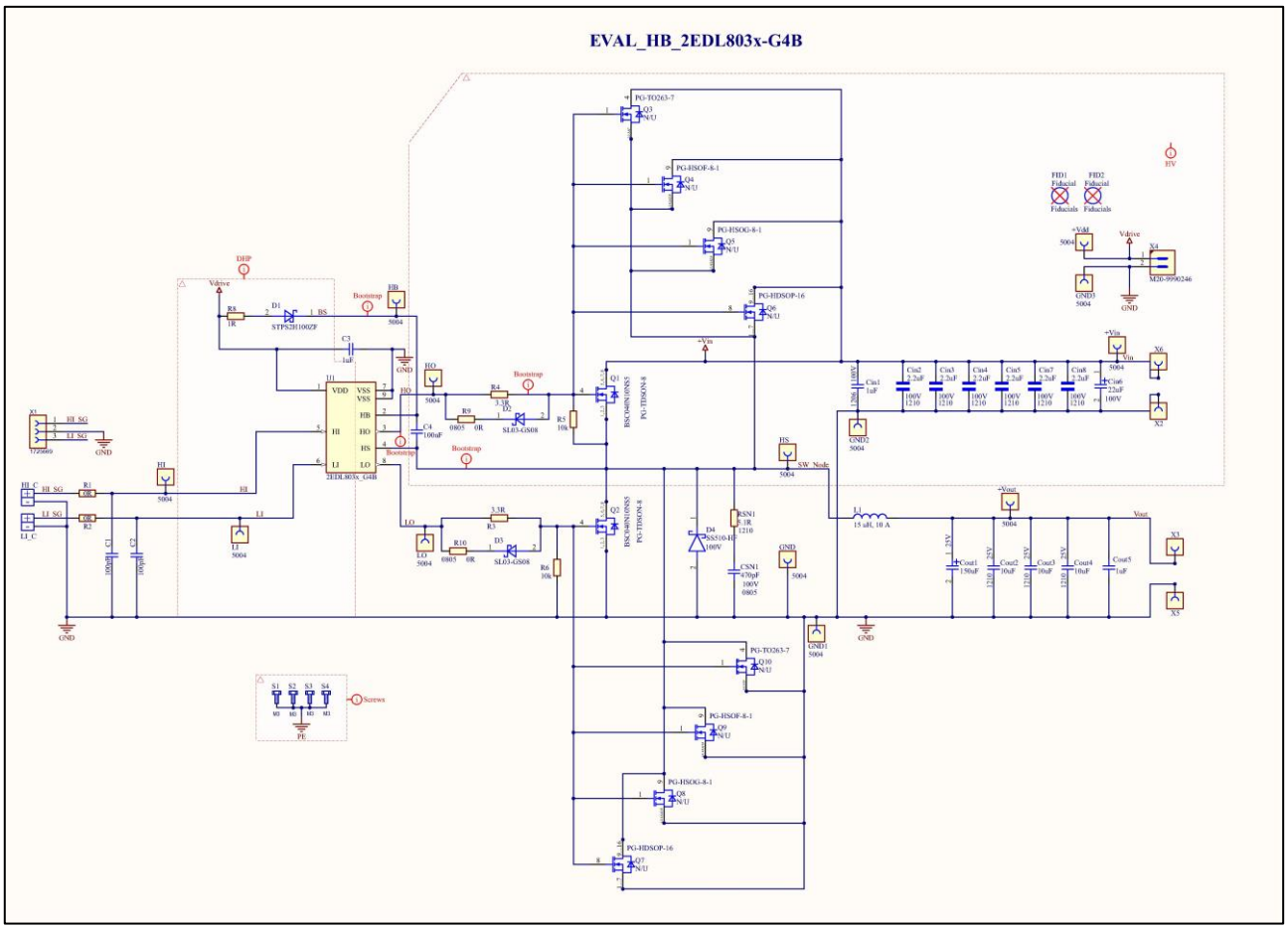

Figure 13 EVAL_HB_2EDL803x-G4B board schematic

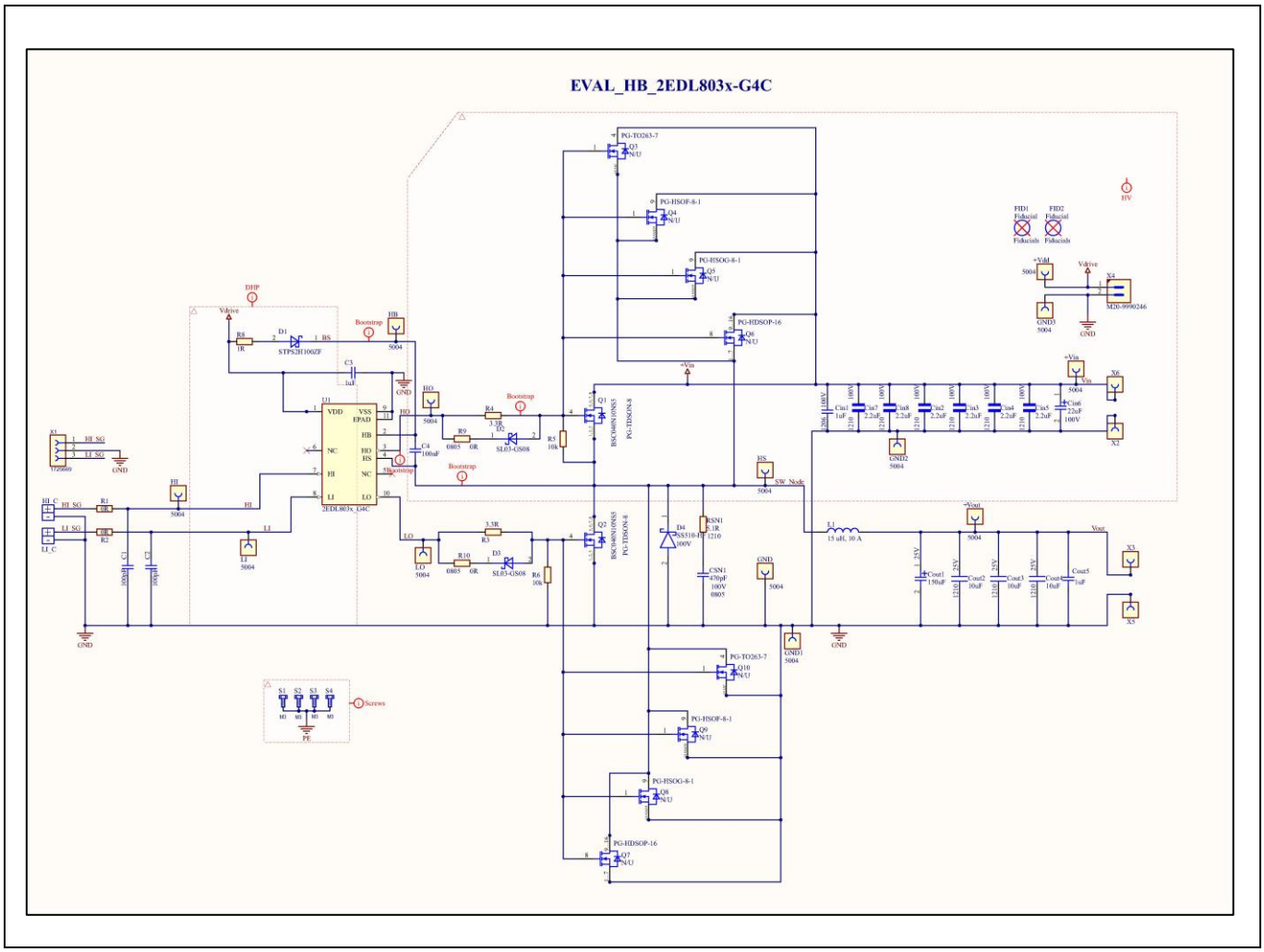

Figure 14 EVAL_HB_2EDL803x-G4C board schematic

5.2 Layout

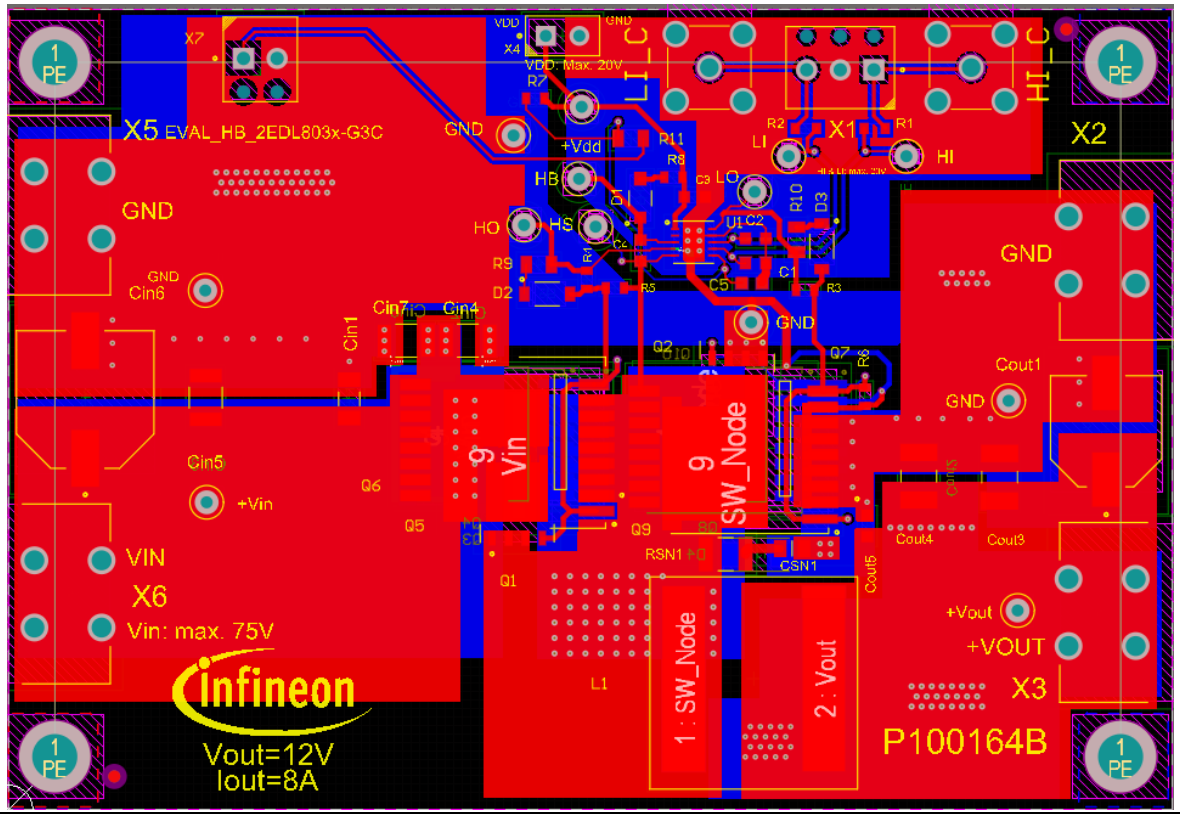

Figure 15 EVAL_HB_2EDL803x-G3C board layout

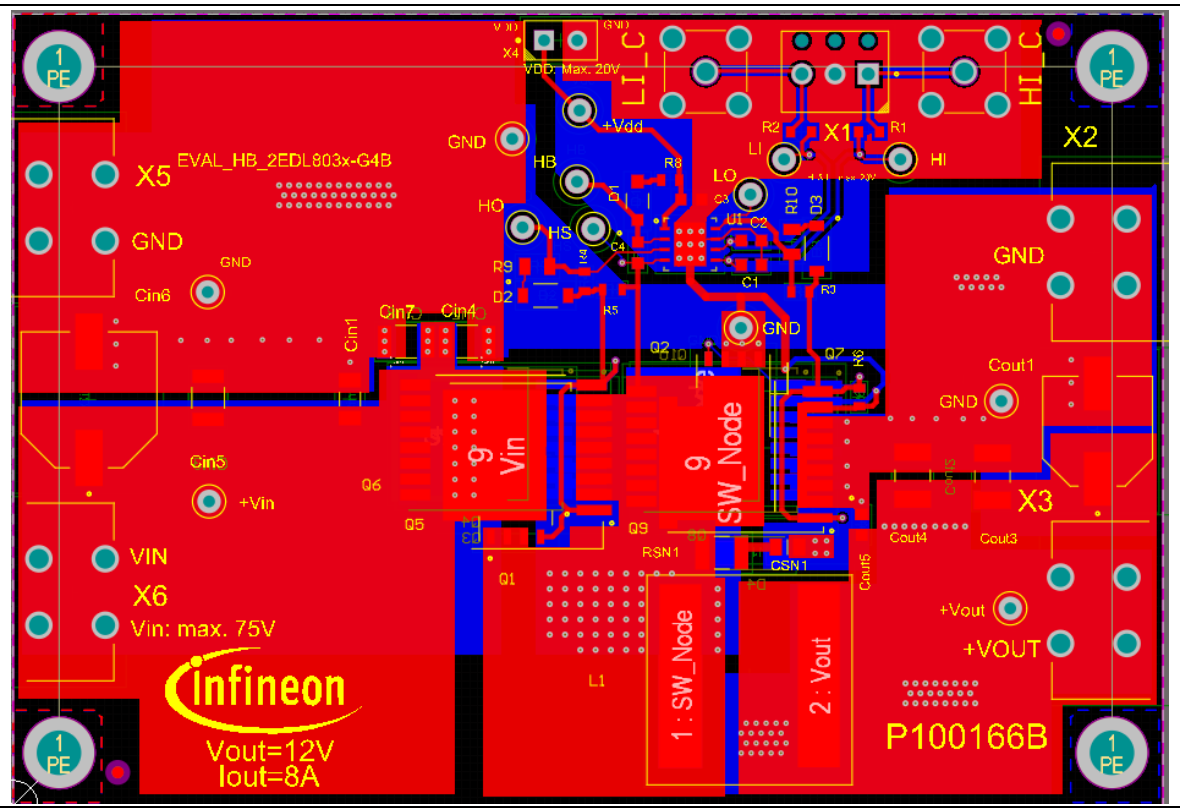

Figure 16 EVAL_HB_2EDL803x-G4B board layout

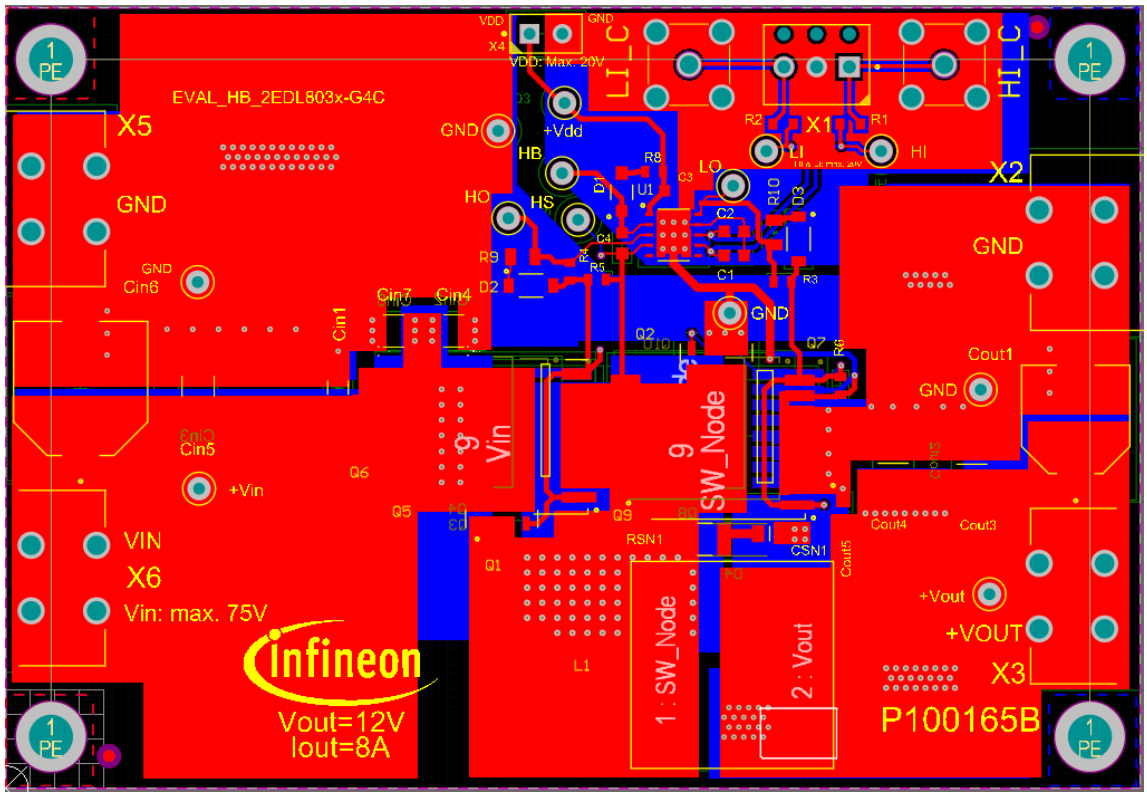

Figure 17 EVAL_HB_2EDL803x-G4C board layout

5.3 Bill of materials (BOM)

Designator	Value	Part Description	Package	Manufacturer	Manufacturer Order Number
+Vdd, +Vin, +Vout, GND, HB, HI, HO, HS, LI, LO, GND1, GND2, GND3	5004	Circuit Board Hardware - PCB TEST POINT YELLOW		Keystone	5004
C1, C2	100 pF	MLCC - X7R - 25V	0603	MuRata	GCM033R71E101KA03
C5*	33 pF	MLCC - X7R - 25V	0603	Kemet	C0603C330K3RACTU
C3, Cout5	1 µF	MLCC - X7R - 25V	0603	Samsung	CL10B105KA8VPNC
C4	100 nF	MLCC - X5R - 25V	CAPC1608X90N	Kemet	C0603C104K3PAC7867
Cin1	1 µF	MLCC - X7R - 100V	1206	MuRata	GRM31CR72A105KA01
Cin2, Cin3, Cin4, Cin5, Cin7, Cin8	2.2 uF	MLCC - X7R - 100V	1210	TDK Corporation	C3225X7R2A225K230AB
Cin6	22 µF	Al Polymer Cap	Radial: 10x12.6mm	Panasonic	100SXV22M
Cout1	150 µF	Al Polymer Cap	SMD	Kemet	A768KE157M1ELAE029
Cout2, Cout3, Cout4	10 µF	MLCC - X7R - 25V	1210	MuRata	GRM32DR71E106KA12K
CSN1	470 pF	MLCC - C0G - 100V	0805	MuRata	GRM219R72A471KA01
D1	STPS2H100ZF	Schottky Barrier Diode 100 V - 2 A	SOD123 Flat	STMicroelectronics	STPS2H100ZF
D2, D3	SL03-GS08	Schottky Diodes & Rectifiers 1.1A .395V	DO-219AB (SMF)	Vishay	SL03-GS08
D4	SS510-HF	Schottky Barrier Diode 100 V - 5 A	DO-214AC (SMA)	Comchip Technology	SS510-HF
HI_C, LI_C		RF Connectors / Coaxial Connectors SMA R/A JACK PCB DIECAST		Amphenol RF	132225
L1	15 µH	15 µH Shielded Drum Core, Wirewound Inductor 10 A 11.3 mΩ Nonstandard		Wuerth Elektronik	74439370150
Q1, Q2	BSC040N10NS5	OptiMOS5 Power-MOSFET 100V 4mΩ	PG-TDSON-8-1	Infineon Technologies	BSC040N10NS5
R1, R2	0R	Standard Thick Film Chip Resistor	0603	Yageo	AC0603FR-070RL
R3, R4	3.3R	General Purpose Chip Resistor	0603	Yageo	RT0603FRD073R3L
R5, R6, R7*	10K	Standard Thick Film Chip Resistor	0603	Yageo	RC0603FR-0710KL
R8	1R	Standard Thick Film Chip Resistor	0603	Vishay	CRCW06031R00FK
R9, R10, R11*	0R	Standard Thick Film Chip Resistor	0805	Yageo	RC0805FR-070RL, RC0805JR-070RL
RSN1	5.1R	Standard Thick Film Chip Resistor	1210	Panasonic	ERJ-14YJ5R1U
U1*	2EDL8034_G3C	EiceDRIVER™ 2EDL803x, Junction-Isolated High-Side and Low-Side gate driver IC	PG-VSON-10-4	Infineon Technologies	2EDL8034_G3C
X1	1725669	Fixed Terminal Blocks 3P 2.54mm 90DEG		Phoenix Contact	1725669
X5, X2	CT3151SP-0	Test Plugs & Test Jacks SafetyJack,Horz PCB, Black		Cal Test Electronics	CT3151SP-0
X3, X6	CT3151SP-2	Test Plugs & Test Jacks SafetyJack,Horz PCB, Red		Cal Test Electronics	CT3151SP-2
X4	M20-9990246	Headers & Wire Housings 02 SIL VERTICAL PIN HEADER TIN		Harwin	M20-9990246
X7*	1725656	Fixed Terminal Blocks 2P 2.54mm 90DEG		Phoenix Contact	1725656

*Note: For other eval boards, U1 used is the corresponding gate driver IC Package and C5, R7, R11 and X7 are not available

Figure 18 EVAL_HB_2EDL803x board BOM

Revision history

Document version	Date of release	Description of changes
V 1.0	2023-06-07	Initial release

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Edition 2023-06-07
Published by
Infineon Technologies AG
81726 Munich, Germany

Do you have a question about this document?
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Document reference
UM_2305_PL88_2305_223554

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