Half-bridge buck converter evaluation board using the EiceDRIVER™ 2EDL8x2x

Order code: EVAL_HB_2EDL8x2x

About this document

Scope and purpose

The 2EDL8x2x is the EiceDRIVER™ family of level-shift high-side and low-side drivers with 120 V maximum boot voltage. 2EDL802x takes in independent inputs while the 2EDL812x takes in differential inputs. Both have a 3 A or 4 A peak source current capability for both high-side and low-side, and a strong 5 A high-side and 6 A low-side sink current capability.

The half-bridge buck converter evaluation board described in this document is designed as a test platform for evaluating the performance of **2EDL8024G**.

Intended audience

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

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1 Introduction

The evaluation board provides the design engineer with a test platform for evaluating the performance of the **2EDL8024G** 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 to 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™ **2EDL8024G** 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 1 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 1 Board specifications

Parameter	Symbol	Value	Units
Input voltage	V_{in}	48	V
Output voltage	V_{out}	12	V
Output current	I_{out}	0 to 5	A
Switching frequency	F_{sw}	200	kHz
Dead-time	DT_{on}, DT_{off}	100	ns
Board dimensions	38.5 mm (L) x 47 mm (W)		

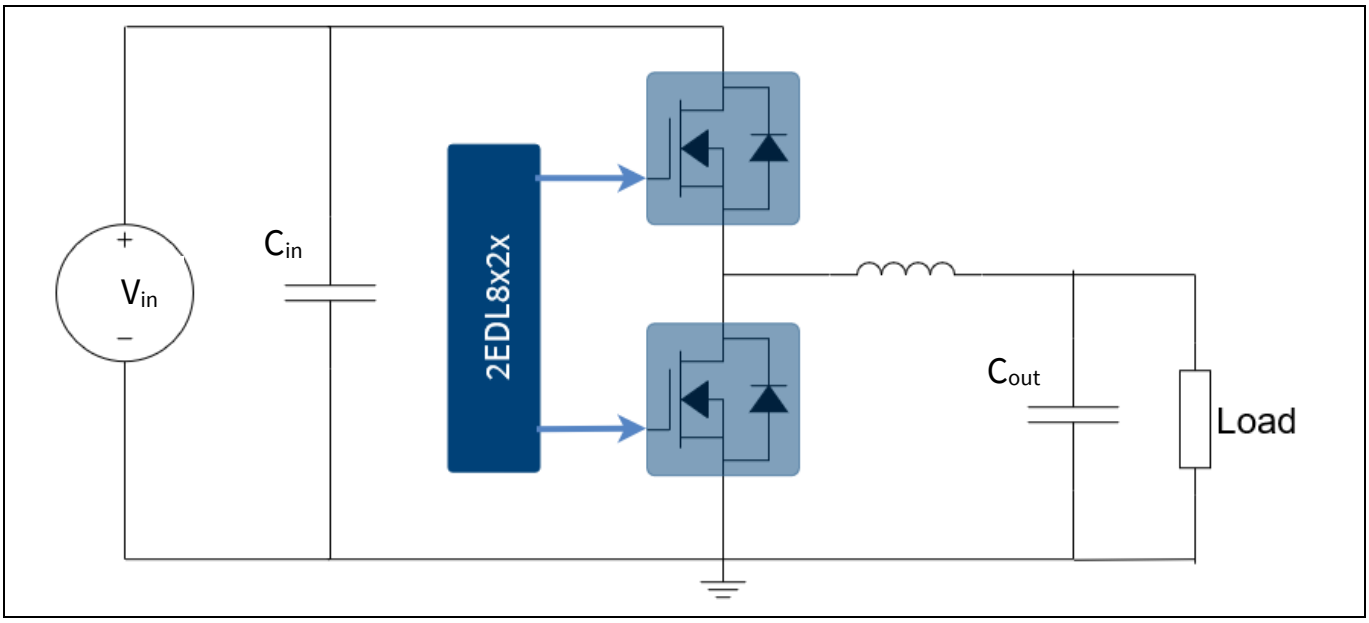

Figure 1 Block diagram of EVAL_HB_2EDL8x2x

2 Getting started with the hardware

2.1 Evaluation board

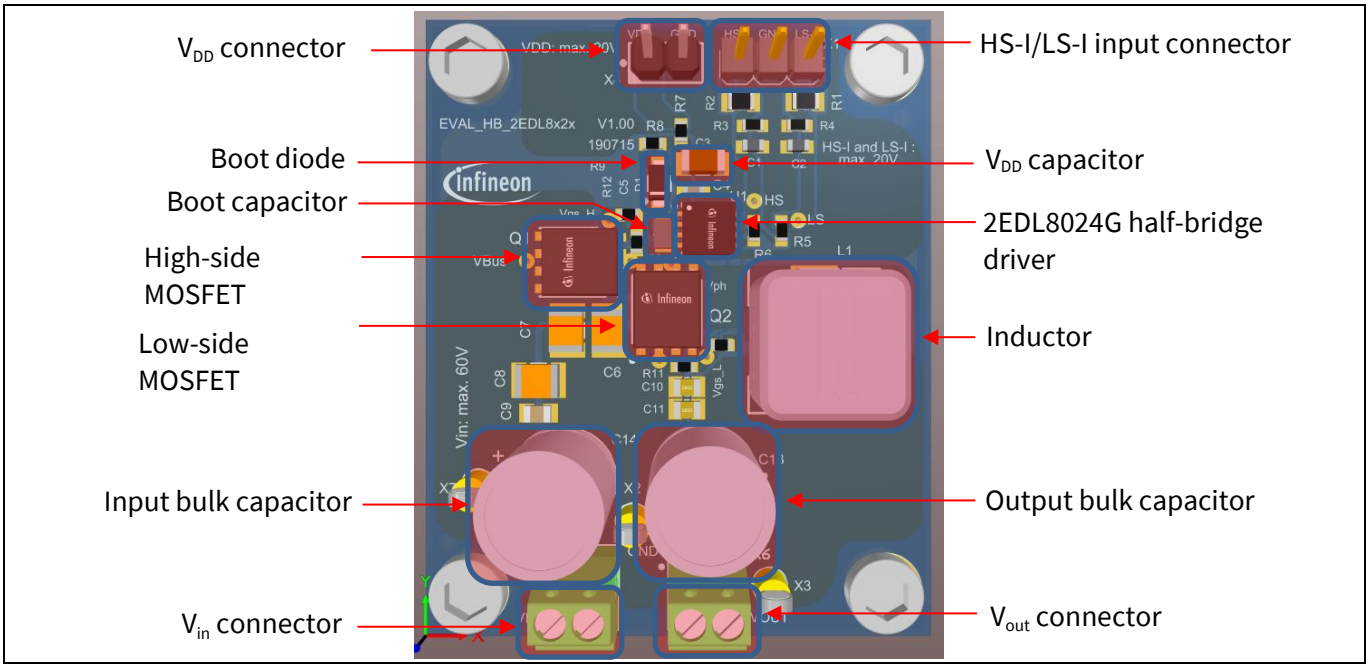

Figure 2 EVAL_HB_2EDL8x2x – top side

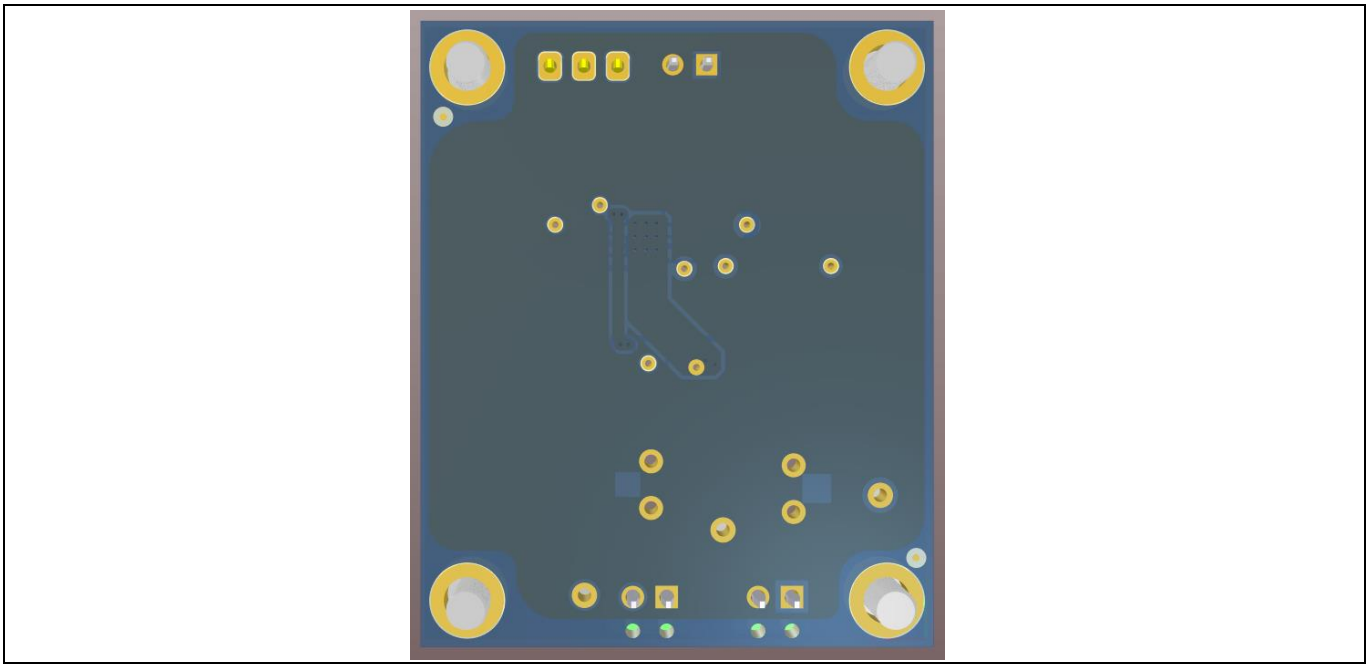

Figure 3 EVAL_HB_2EDL8x2x – bottom side

2.2 List of connection and test points

Table 2 Connection and test points – functional descriptions

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

2.3 Quick start guide

1. Input the PWM signals (LS-I and HS-I) using a function generator with the desired pulse width, dead-time and frequency through connector X1. When using the 2EDL802x, ensure that there is sufficient dead-time to avoid cross-conduction of the two MOSFETs. The 2EDL812x, on the other hand, has a built-in shoot-through protection that ensures low-side and high-side outputs are never on at the same time.
2. Supply V_{DD} voltage using an external auxiliary power supply between 8 V and 17 V through connector X4.
3. Supply the V_{in} voltage using an external power supply with 48 V (60 V maximum) through connector X5. 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, HS pin must be shorted to GND in order to have a charging path for the bootstrap capacitor.
4. Connect the V_{out} to the electronic load through connector X6 and increase the output current up to 5 A maximum. Care must be taken not to exceed the inductor's saturation limit.
5. 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 directly or near the driver pins to ensure accurate measurement of the driver's performance.
6. To power down the board, turn-off the load first and then turn-off the input voltage supply. 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 only the V_{DD} bias supplied (HS is shorted to GND).

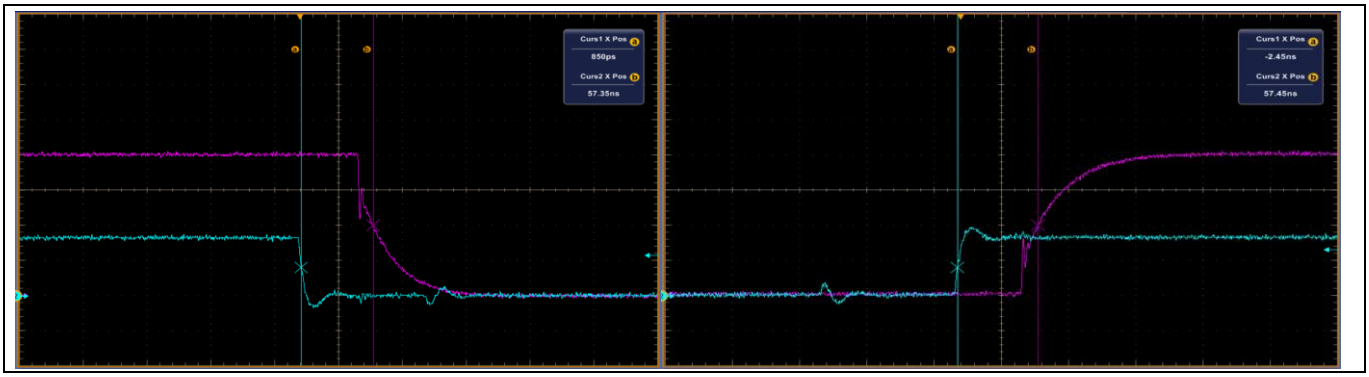

Figure 4 **LI-LO falling (56.5 ns) and rising (59.9 ns) propagation delay (V_{DD} = 12 V, V_{in} = 0 V, C_{load} = 4.1 nF)**

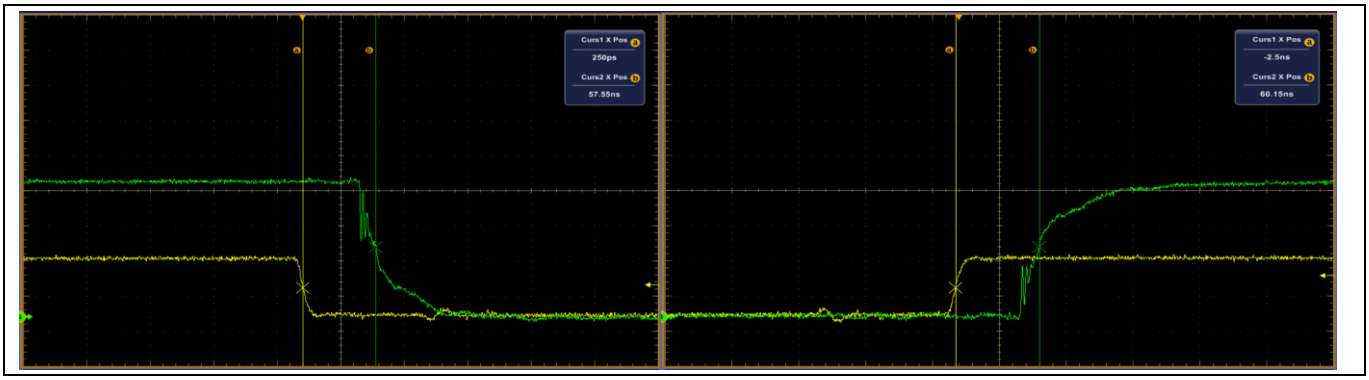

Figure 5 **HI-HO falling (57.3 ns) and rising (62.7 ns) propagation delay (V_{DD} = 12 V, V_{in} = 0 V, C_{load} = 4.1 nF)**

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 = 25 percent, F_{sw} = 200 kHz, load = 5 A and T_A = 25°C.

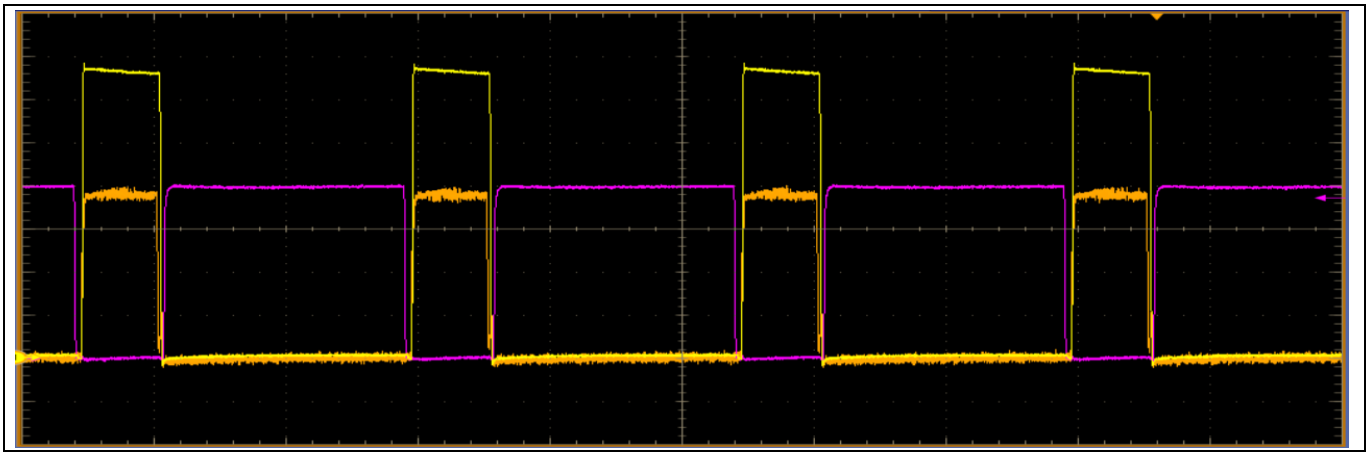

Figure 6 **LO (pink), HO (orange), HS (yellow) waveforms**

Figure 7 shows the inherent shoot-through protection of 2EDL812x with only V_{DD} bias supplied (HS shorted to GND). The driver outputs are low when both inputs are high.

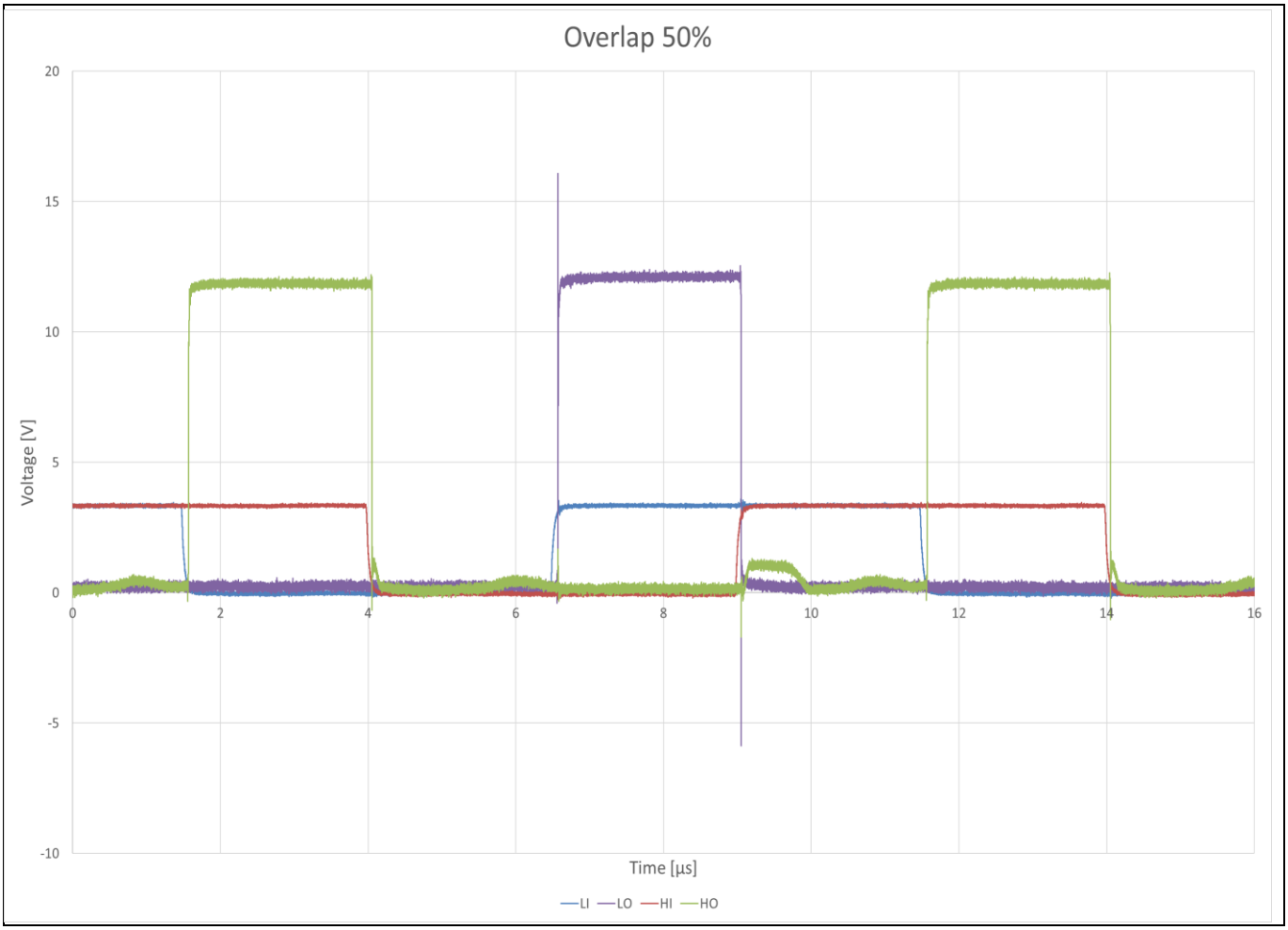

Figure 7 2EDL812x inherent shoot-through protection

4 Addendum

4.1 Schematic

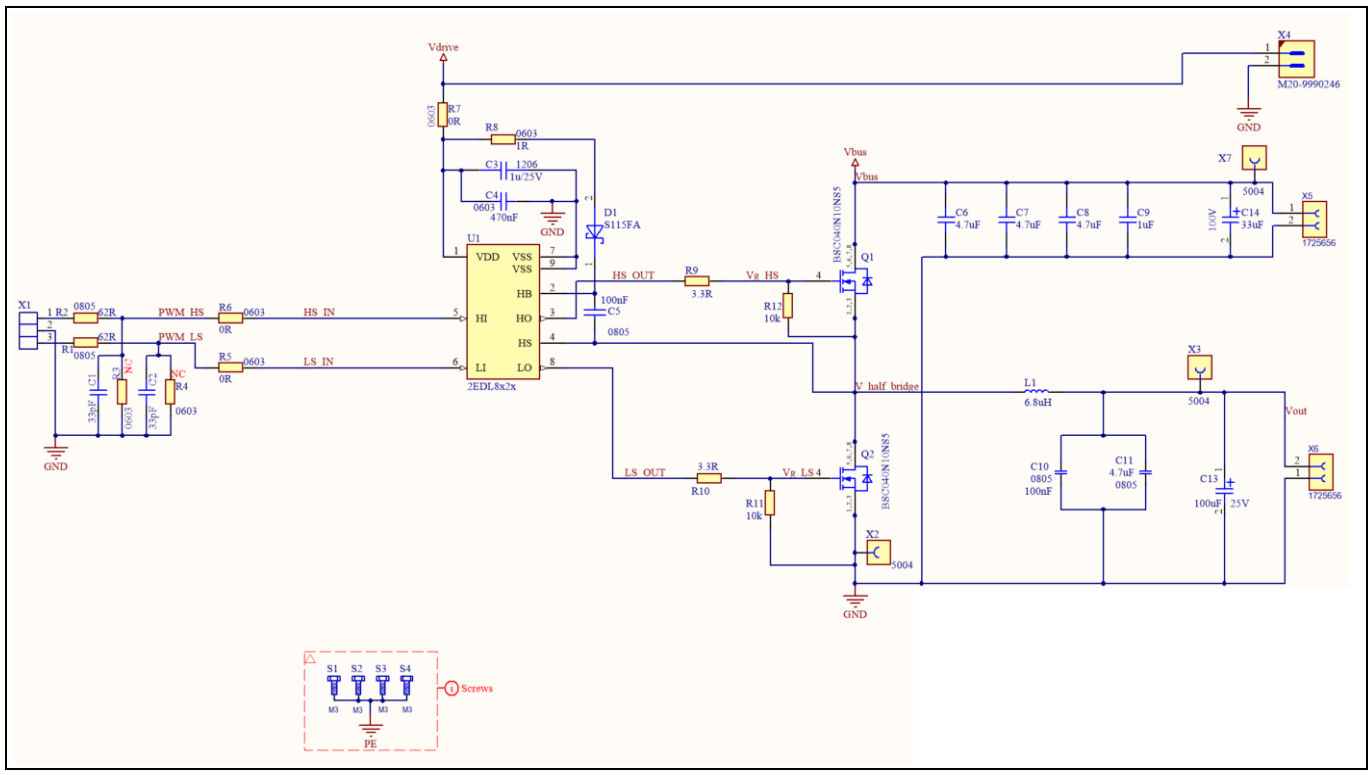

Figure 8 EVAL_HB_2EDL8x2x board schematic

4.2 Layout

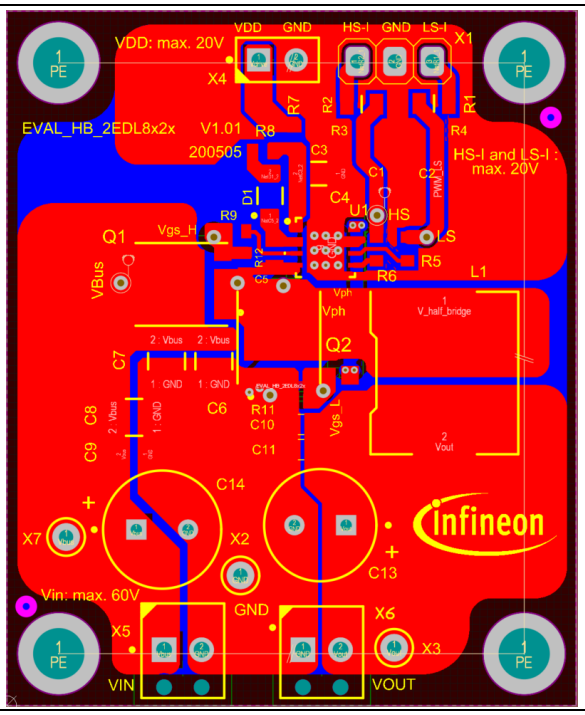

Figure 9 EVAL_HB_2EDL8x2x board layout

4.3 Bill of materials (BOM)

Part Number	Value	Part Description	Package	Manufacturer	Manufacturer Order Number
C1, C2	33pF	MLCC - X7R - 10V	0603	Taiyo Yuden	
C3	1u	MLCC- X7R - 25V	1206	Taiyo Yuden	
C4	470n	MLCC - X7R - 35V	0603	Taiyo Yuden	
C5	100n	MLCC - X7R - 25V	0805	Taiyo Yuden	
C6, C7, C8	4.7uF	MLCC 100V 10% X7S	1210	Taiyo Yuden	HMK325C7475KN-TE
C9	1uF	MLCC 100V X7S +/-10%	0805	Murata	GRJ21BC72A105KE11L
C10	100nF	MLCC 25V X7R 20% Tol	0805	AVX	08053C104M4T4A
C11	4.7uF	MLCC 25V X7R 20%TOL	0805	AVX	08053C475MAT2A
C13	100uF	Electrolytic cap - 25V			
C14	33uF	Electrolytic cap - 100V	Radial;3.50mm C X 0.60mm W 8.25mm Dia X 13.00mm H		
D1	S115FA	Schottky Barrier Diode, 150V - 1A	SOD123-FL	OnSemi	
L1	6.8uH	WE-HCC SMT High Current Cube Inductor, IR 11.5A, RDC 15mO, fres 40MHz	SMD	Wurth Elektronik	7443330680
Q1, Q2	BSC040N10NS5	OptiMOS5 Power-MOSFET 100V 4mΩ	PG-TDSON-8-1	Infineon Technologies	BSC040N10NS5
R1, R2	62R	Standard Thick Film Chip Resistor	0805	Yageo	
R5, R6, R7	0R	General Purpose Chip Resistor	0603	Yageo	
R8	1R	Standard Thick Film Chip Resistor	0603	Yageo	
R9, R10	3.3R	Standard Thick Film Chip Resistor	0603	Yageo	
R11, R12	10k	Standard Thick Film Chip Resistor	0603	Yageo	
U1	2EDL8024G	EiceDRIVER, Level-shift high-side low-side driver	VDSON-8	Infineon Technologies	2EDL8024G
X1	4-103321-5	Pin Header 3 contacts, 2.54mm pitch	3 pins header, 1 row, 2.54 mm pitch	TE Connectivity	4-103321-5
X2, X3, X7	5004	Test Point THT, Yellow		Keystone	5004
X4	M20-9990246	2.54mm Pitch SIL Vertical PC Tail Pin Header, 2 pins, 1 row, 2 pins per row		Harwin	M20-9990246
X5, X6	1725656	PCB Terminal Block, Nominal Current 6A, Nominal Voltage 160V, 2.54mm Pitch, 2 Pins		Phoenix Contact	1725656

Figure 10 EVAL_HB_2EDL8x2x board BOM

Revision history

Document version	Date of release	Description of changes
V 1.0	04-12-2020	First release

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Edition 2020-12-04

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about this document?

Email: erratum@infineon.com

Document reference
UM_2007_PL88_2008_104603

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