

HIP2210EVAL1Z

User's Manual: Evaluation Board

Industrial Analog and Power

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HIP2210EVAL1Z

Evaluation Board

The HIP2210EVAL1Z evaluation board is designed to provide a quick and comprehensive method for evaluating the [HIP2210](#) 100V 3A source, 4A sink high frequency half-bridge driver for driving the gates of two N-channel MOSFETs in a half-bridge configuration. Two N-channel MOSFETs (with dual footprint supporting multiple packages such as TO220 and DPAK) and an inductor-capacitor LC filter are included on the evaluation board to allow for the evaluation of a half-bridge driven load such as a synchronous buck switching regulator.

The HIP2210 half-bridge driver is offered in a 10 Ld DFN package (with enhanced thermal EPAD). The HIP2210EVAL1Z evaluation board operates from a supply voltage of 6V to 18V DC with the capability of driving both the high-side and low-side MOSFETs in a 100V half-bridge configuration ICs.

Key Features

- 3A source and 4A sink NMOS gate drivers
- Internal level shifter and bootstrap diode for gate driver on high-side NFET
- Up to 100V high-side bootstrap reference
- 6V to 18V bias supply operation
- Fast 15ns typical propagation delay and 2ns typical propagation delay match supports up to 1MHz operation

Specifications

This board is optimized for the following operating conditions:

- V_{DD} supply: 12V nominal
- V_{BRIDGE} supply input: 0V to 60V
- PWM switching frequency: 100kHz
- Peak gate drive current: 3A source and 4A sink

Ordering Information

| Part Number | Description |
|---------------|------------------------------------|
| HIP2210EVAL1Z | HIP2210 10 Ld DFN evaluation board |

Related Literature

For a full list of related documents, visit our website:

- [HIP2210](#), [HIP2211](#) device pages

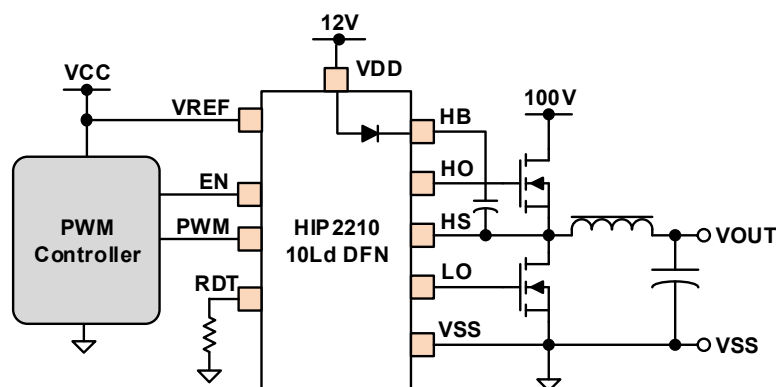


Figure 1. HIP2210 Typical Application Block Diagram

1. Functional Description

The HIP2210EVAL1Z is designed to provide a comprehensive and versatile platform for you to evaluate the functionality and prototype an application of the HIP2210 N-channel MOSFET half-bridge drivers. This evaluation board includes the MOSFETs (with dual footprint supporting for TO220 and DPAK) and an inductor-capacitor output filter for evaluating an open-loop type synchronous buck DC/DC converter where the output voltage is controlled through the duty cycle of the signals into the PWM pin.

1.1 Operating Range

The HIP2210EVAL1Z evaluation board is designed for 60V half-bridge applications with 12V supply to bias the VDD of the HIP2210 IC. While the HIP2210 voltage ratings for the bootstrap reference and VDD supply are much higher, you should monitor the transient voltages at the switching nodes for applications exceeding 60V on the half-bridge or 12V on the driver bias to ensure they do not violate the absolute maximum ratings of the HIP2210 driver.

The inductance and capacitance value of the output LC filter is chosen for a 100kHz switching operation. You can replace these components with different values if a different switching frequency is required.

1.2 Recommended Equipment

- A power supply that can deliver 12V or higher with at least 2A source current capability
- A power supply that can deliver 5V or higher
- A power supply that can deliver 60V or higher to bias the half bridge
- A square wave or pulse generator with 0V to 5V logic levels output and 100kHz capability
- Minimum 4-channel oscilloscope to monitor LI, HI, LO, HO, and HS signals
- Optional: A DC electronic load to draw current out of the LC filter output

1.3 Quick Start Guide

1. The programmable dead time of the HO and LO signal is set to around 35ns with a 10k Ω resistor from the RDT pin to GND. To change the dead time, replace the resistor at R₂ with the value corresponding to the required dead time.
2. Ensure that the enable switch (SW₁) is set to the off position.
3. Connect a 6V to 18V supply to the VDD terminals {J2 (+) and J3 (-)}.
4. Connect a 5V supply to VREF terminal {TP3}.
5. Connect a power supply capable of 60V or higher and 10A to the V_BRIDGE terminals {J18(+), and J17(-)}.
6. Connect a 0V to 5V 100kHz square wave signal to the PWM BNC connector J13.
Note: The magnitude of the square wave signal needs to match VREF.
7. Turn on the VDD supply to 12V. Turn on the VREF supply to 5V.
8. Turn on the 0V to 5V 100kHz square wave signal.
9. Turn on the bridge voltage supply V_BRIDGE to the required voltage (such as 48V).
10. Toggle the enable switch (SW₁) to the on position.
11. Verify the HO and LO outputs are switching. LO switches between GND and VDD (12V in this case) phase inverted from the PWM. HO switches between GND and VHB+V_BRIDGE in phase with PWM.

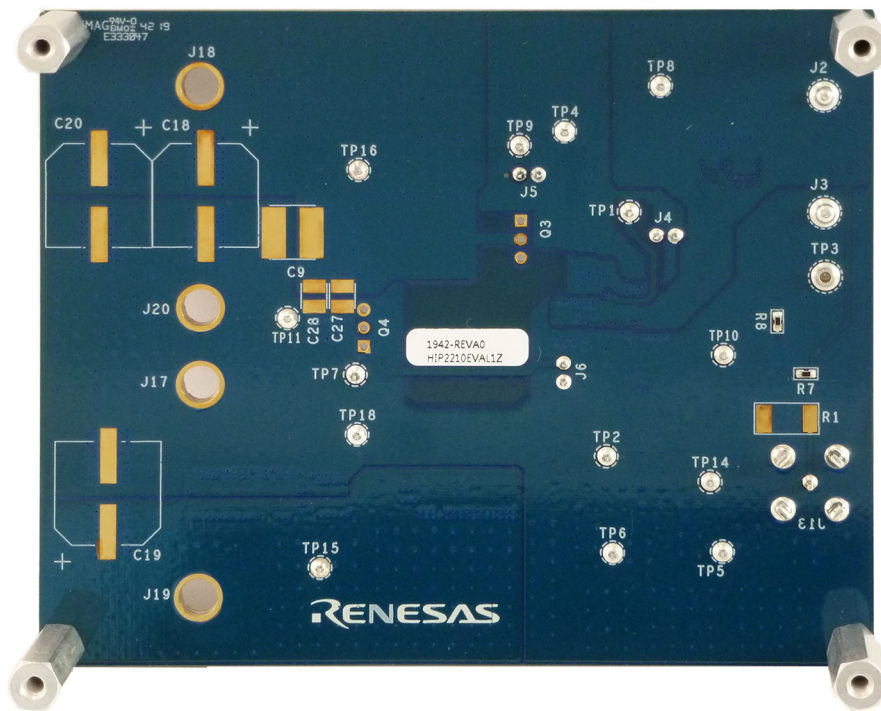


Figure 3. HIP2210EVAL1Z Evaluation Board (Bottom)

2.2 HIP2210EVAL1Z Circuit Schematic

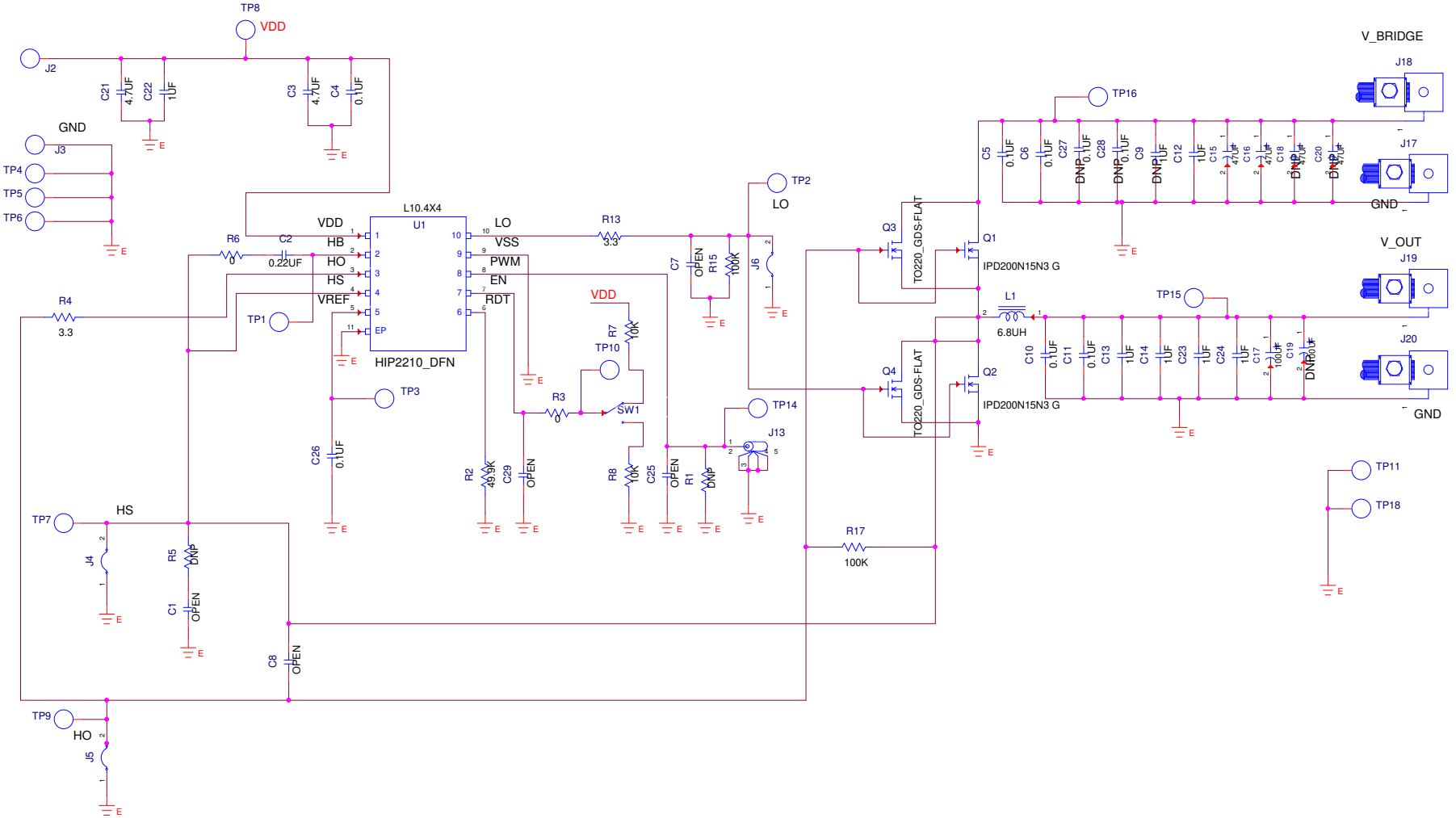


Figure 4. HIP2210EVAL1Z Schematic

2.3 Bill of Materials

| Qty | Reference Designator | Description | Manufacturer | Manufacturer Part |
|-----|---|---|--------------------------------|----------------------------------|
| 1 | | PWB-PCB, HIP2210EVAL1Z, REVA, ROHS | IMAGINEERING INC | HIP2210EVAL1ZREVA PCB |
| 2 | C5, C6 | CAP, SMD, 1210, 0.1 μ F, 200V, 20%, X7R, ROHS | KEMET | C1210C104K2RAC |
| 1 | C12 | CAP, SMD, 2225, 1.0 μ F, 200V, 10%, X7R, ROHS | KEMET | C2225C105K2RAC7800 |
| 1 | C26 | CAP, SMD, 0603, 0.1 μ F, 16V, 10%, X7R, ROHS | MURATA | GCM188R71C104KA37D |
| 1 | C4 | CAP, SMD, 0603, 0.1 μ F, 50V, 10%, X7R, ROHS | AVX | 06035C104KAT2A |
| 1 | C2 | CAP, SMD, 0603, 0.22 μ F, 50V, 10%, X7R, ROHS | MURATA | GCM188R71H224KA64D (AEC-Q200) |
| 2 | C10, C11 | CAP, SMD, 0805, 0.1 μ F, 100V, 10%, X7R, ROHS | TDK | C2012X7R2A104K |
| 1 | C22 | CAP, SMD, 0805, 1.0 μ F, 50V, 10%, X7R, ROHS | MURATA | GRM21BR71H105KA12L |
| 4 | C13, C14, C23, C24 | CAP, SMD, 1210, 1.0 μ F, 100V, 10%, X7R, ROHS | VENKEL | C1210X7R101-105KNE |
| 2 | C3, C21 | CAP, SMD, 1210, 4.7 μ F, 50V, 10%, X7R, ROHS | MURATA | GRM32ER71H475KA88L |
| 3 | J2, J3, TP3 | CONN-TURRET, TERMINAL POST, TH, ROHS | KEYSTONE | 1514-2 |
| 1 | J13 | CONN-BNC, RECEPTACLE, TH, 4 POST, 50 Ω , SILVERCONTACT, ROHS | AMPHENOL | 31-5329-51RFX |
| 14 | TP1, TP2, TP4-TP11, TP14, TP15, TP16, TP18 | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS | KEYSTONE | 5002 |
| 3 | J4, J5, J6 | CONN-HEADER, 1x2, RETENTIVE, 2.54mm, 0.230x 0.120, ROHS | BERG/FCI | 69190-202HLF |
| 1 | L1 | COIL-INDUCTOR, AEC-Q200, SMD, 16.9mm, 6.8 μ H, 20%, 19A, ROHS | BOURNS | SRP1770TA-6R8M |
| 1 | U1 | IC-100V 4A HALF BRIDGE DRIVER, 10P, TDFN, 4x4, ROHS | RENESAS ELECTRONICS AMERICA | HIP2210FRTZ |
| 2 | Q1, Q2 | TRANSIST-MOS, N-CHANNEL, SMD, 3P, TO-252-3, 150V, 50A, ROHS | INFINEON TECHNOLOGY | IPD200N15N3GATMA1 |
| 1 | R6 | RES, SMD, 0603, 0 Ω , 1/10W, TF, ROHS | VENKEL | CR0603-10W-000T |
| 2 | R7, R8 | RES, SMD, 0603, 10k, 1/10W, 1%, TF, ROHS | VENKEL | CR0603-10W-1002FT |
| 2 | R15, R17 | RES, SMD, 0603, 100k, 1/10W, 1%, TF, ROHS | VENKEL | CR0603-10W-1003FT |
| 1 | R2 | RES, SMD, 0603, 49.9k, 1/10W, 1%, TF, ROHS | VENKEL | CR0603-10W-4992FT |
| 2 | R4, R13 | RES, SMD, 0805, 3.3 Ω , 1/8W, 1%, TF, ROHS | PANASONIC | ERJ-6RQF3R3V |
| 1 | R3 | RES, SMD, 0805, 0 Ω , 1/8W, TF, ROHS | YAGEO | RC0805JR-070RL |

| Qty | Reference Designator | Description | Manufacturer | Manufacturer Part |
|-----|----------------------|---|-----------------------------|-------------------|
| 1 | SW1 | SWITCH-TOGGLE, SMD, 6PIN, SPDT, 2POS, ON-NONE-ON, ROHS | ITT INDUSTRIES/C&K DIVISION | GT11MSCBE |
| 4 | Four corners | SCREW, 4-40x1/4in, PHILLIPS, PANHEAD, STAINLESS, ROHS | BUILDING FASTENERS | PMSSS 440 0025 PH |
| 4 | Four corners | STANDOFF, 4-40x3/4in, F/F, HEX, ALUMINUM, 0.25 OD, ROHS | KEYSTONE | 2204 |
| 4 | J17, J18, J19, J20 | HDWARE, MTG, CABLE TERMINAL, 6-14AWG, LUG&SCREW, ROHS | BERG/FCI | KPA8CTP |
| 1 | C17 | CAP, SMD, 12.5x16, 100µF, 100V, 20%, ALUM.ELEC., ROHS | NICHICON | UUG2A101MNQ1MS |
| 2 | C15, C16 | CAP, SMD, 13.6mm, 47µF, 160V, 20%, ALUM.ELEC., ROHS | NICHICON | UUG2C470MNL1MS |

2.4 Board Layout

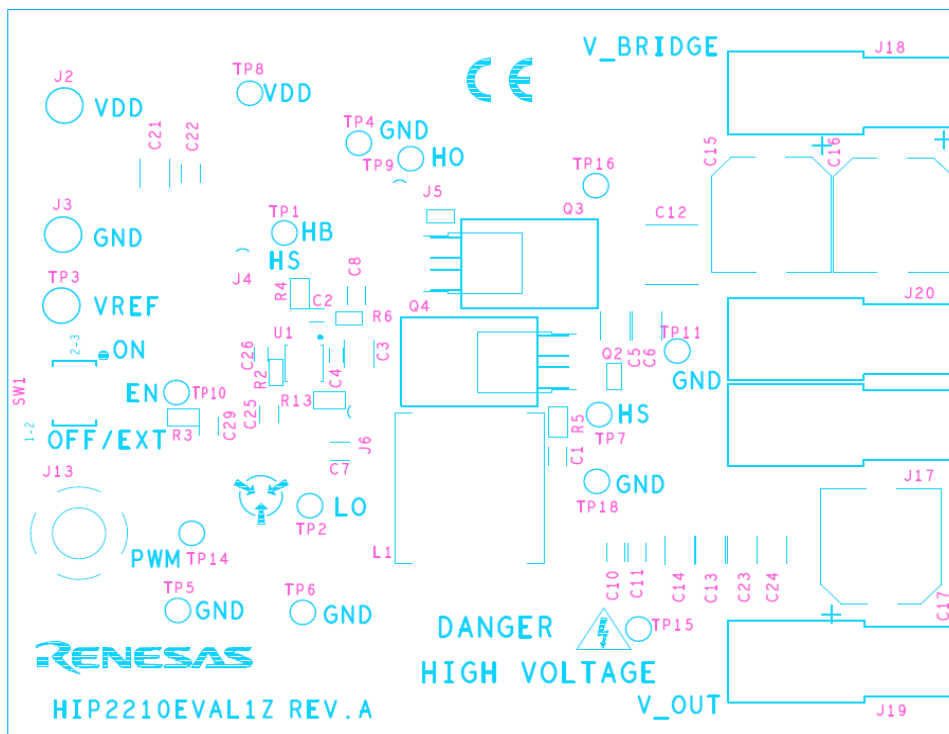


Figure 5. Silkscreen Top Layer

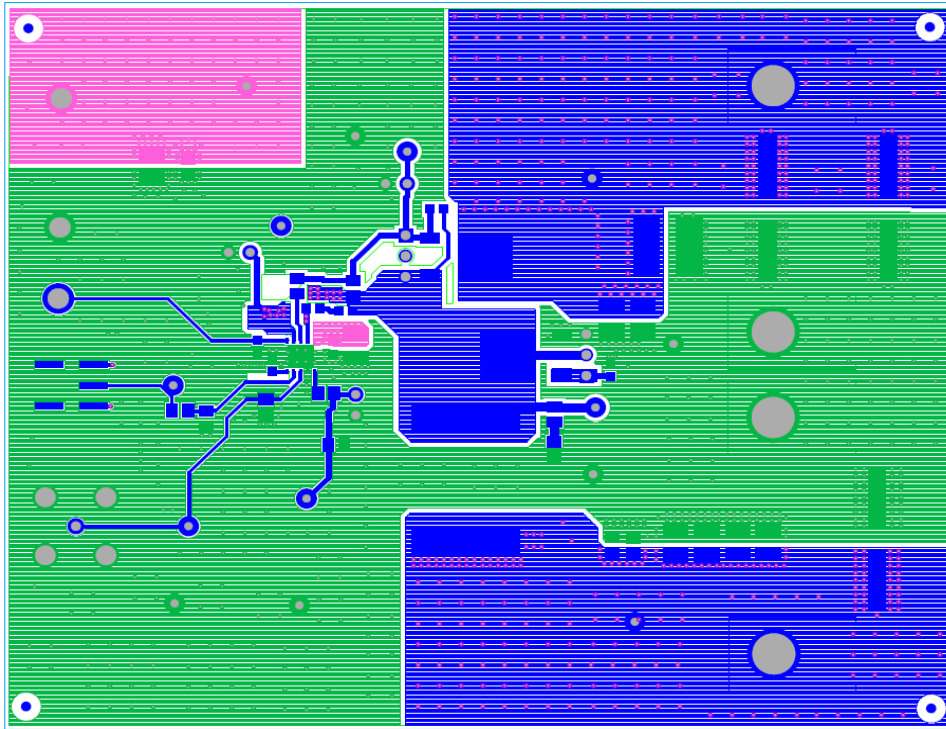


Figure 6. Layer 1

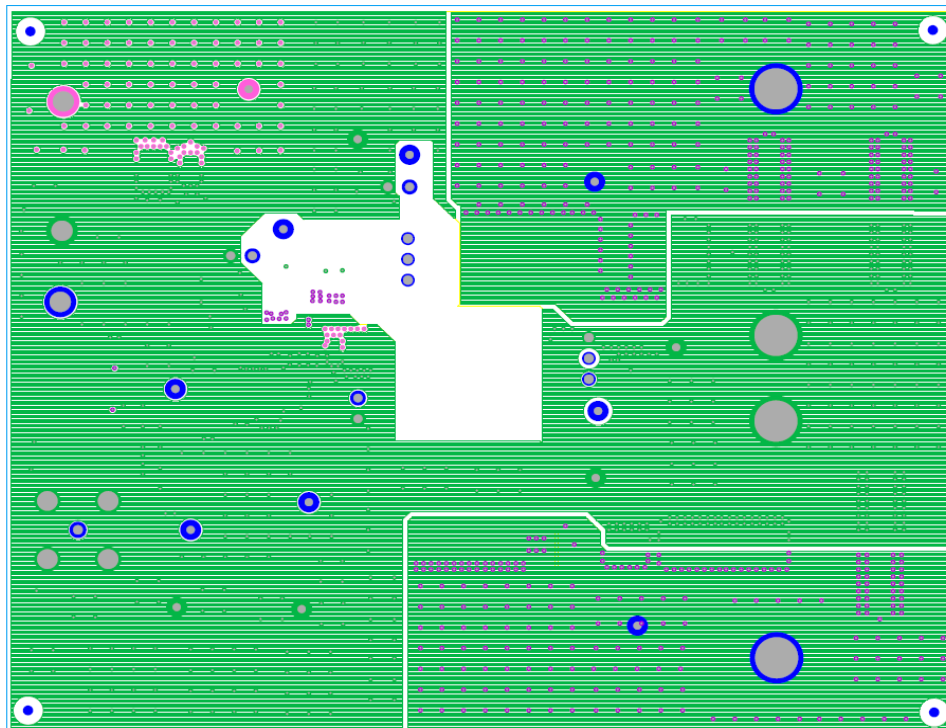


Figure 7. Layer 2

3. Typical Performance Curves

Unless noted: $V_{DD} = 12V$, $V_{BRIDGE} = 48V$, PWM = 100kHz square wave, 0V to 5V, 35% duty cycle, $T_A = +25^\circ C$

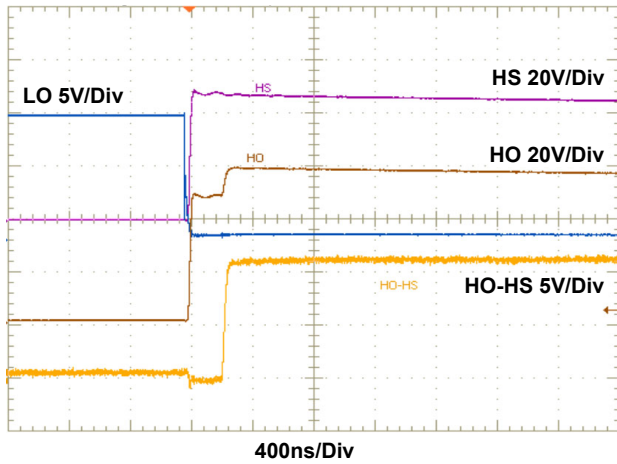


Figure 11. Dead Time LO Falling to HO Rising

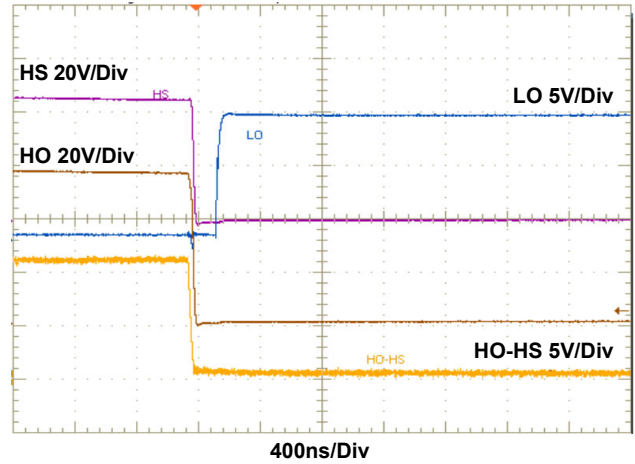


Figure 12. Dead Time HO Falling to LO Rising

4. Revision History

| Rev. | Date | Description |
|------|-----------|-----------------|
| 1.00 | Feb.11.20 | Initial release |

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