User's Guide

Using the UCC27614EVM

ABSTRACT

This user's guide describes the characteristics, operation, and use of the UCC27614 Evaluation Module (EVM). A complete schematic diagram, PCB layouts, and BOM are included in this document. This family of devices provides high source and sink current drivers for driving Si MOSFETs, IGBTs, and SiC transistors

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Trademarks

1 Introduction

The UCC27614EVM is designed to primarily evaluate the UCC27614DSG performances. The UCC27614DSG is a 30-V, single channel low-side driver with 10-A peak source and 10-A peak sink current for driving Si/IGBTs/SiC and GaN FETs. The UCC27614EVM board can be used to evaluate other pin-to-pin compatible parts in the 2x2mm WSON package. The UCC27614EVM inputs can tolerate signals as high as 26 V regardless of the V_{DD} voltage which enhances device robustness.

2 Description

The UCC27614EVM is designed to primarily evaluate the UCC27614DSG. The driver's performance can be evaluated while driving capacitive loads and/or power devices with provisions for TO-220 footprints. The UCC27614DSG is a 30-V single channel, low-side driver with 10-A peak source and 10-A peak sink current for driving high gate charge MOSFETs. The UCC27614EVM evaluation board use surface-mount test points allowing connection to IN+, IN-, VDD and OUT to evaluate the UCC27614 in the 2x2 WSON package. The EVM is set up to evaluate the UCC27614DSG in an inverting (IN-) and non-inverting (IN+) configuration to drive various capacitive and resistive loads as well TO-220 Si/IGBTs/SiC MOSFETs with a default configuration using a 1.8nF capacitive load.

The UCC27614 has low propagation delays and fast rise (5 ns) and fall (4 ns) times at the driver outputs for reliable timing of the gate drive signals. The UCC27614 inputs can tolerate signals as high as 26-V (max recommended operating conditions) regardless of the VDD voltage which enhances device robustness. For detailed device informations, see the .

Related information

http://httpsSLUSE26

2.1 Features

The UCC27614EVM supports the following features:

- EVM for the low-voltage features of the UCC27614DSG gate driver
- 4.5-V to 26-V VCC power supply range
- 10-A source, 10-A sink current for the UCC27614EVM
- -10V input voltage capability.
- TTL-compatible inputs
- PCB layout optimized for bias supply bypassing cap, gate-drive resistance selection
- Capacitive load, external gate drive resistor and TO-220 footprint for N-ch MOSFETs gate drive network evaluation
- Available in 2mm x 2mm SON8 package
- Inverting or non-inverting configurations
- Test points allow probing all the key pins of the UCC27614DSG.

2.2 I/O Description

Table 2-1 details the connection descriptions.

Table 2-1. Connection Descriptions

Pins	Description
VCC	V_{CC} positive input test point. Powers IC VDD pin, use 4.5-V to 26-V range.
VDD	V_{DD} positive input of UCC27614DSG IC
GND	Multiple test points. V_{CC} negative input, HI_IN,LI_IN, and ENA_IN negative inputs, and ground at UCC27614DSG IC
INA_IN+	IN+ PWM signal
INB_IN-	IN- PWM signal
INA	IN+ input pin
INB	IN- input pin
Gate_A	OUT output at capacitive load and gate
OUTA	OUT outputs at driver's pin

3 Electrical Specifications

For the full range of recommended operating specifications and design guidelines for driving loads, see the UCC27614 30-V, 10-A single channel low-side driver datasheet.

CAUTION

The UCC27614EVM is designed for low-voltage evaluation only, and is not certified for evaluation with voltages beyond the absolute maximum listed in the electrical specifications. Do **not** evaluate high-voltage parameters with this board.

4 Test Summary

4.1 Definitions

This procedure details how to configure the UCC27614EVM evaluation boards. Within this test procedure, the following naming conventions are applied. See the UCC27614EVM *Bench Setup Diagram and Configuration*, Figure 4-1, for details.

DMM: Digital multimeter

EVM: Evaluation module

4.2 Equipment

4.2.1 Power Supply

DC power supply with voltage and current above 26 V and 1 A, for example: Agilent E3634A

4.2.2 Function Generator

Two-channel function generator over 10 MHz, for example: Tektronics AFG3252

4.2.3 DMM

DMM with voltage and current above 30V and 1 A, for example: Fluke 187

4.2.4 Oscilloscope

Four channel oscilloscope with 500 MHz or greater bandwidth, for example: DPO 7054

4.3 Equipment Setup

4.3.1 DC Power Supply Settings

- DC power supply #1
  - Voltage setting: 12 V
  - Current limit: 0.05 A

4.3.2 Digital Multi-Meter Settings

- DMM #1
  - DC current measurement, auto-range. Expected current is within 1 mA to 15 mA.

4.3.3 Two-Channel Function Generator Settings

The UCC27614EVM requires one function generator setting while grounding INB_IN-.

Table 4-1. Two-Channel Function Generator Settings

	Mode	Frequency	Width	Delay	High	Low	Output Impedance
Channel A	Pulse	100 kHz	2.5 µs	0 us	5 V	0 V	High Z

4.3.4

4.3.5 Oscilloscope Settings

Table 4-2 details the oscilloscope settings.

Table 4-2. Oscilloscope Settings

	Bandwidth	Coupling	Termination	Scale Settings	Inverting
Channel A	500 MHz or above	DC	1 MΩ or automatic	10 × or automatic	OFF
Channel B					

4.3.6 Bench Setup Diagram

The bench setup diagram includes the function generator and oscilloscope connections.

Use the following connection procedure, refer to Figure 4-1.

- For the UCC27614EVM, connection procedure is as follow:
- First, make sure the output of the function generator and power supplies are disabled before connection.
- Apply function generator channel-A on INA_IN+ to GND.
- Function generator Ch-A channel applied on INA_IN, see in Figure 6.2;
- Power supply #1: positive node connected to input of DMM #1 and DMM #1 output connected to test point marked as VCC, negative node of Power Supply #1 connected directly to test point marked as GND; see in Figure 6.2;
- Connect oscilloscope Ch-1 probes to test points marked as Gate_A ßà GND, smaller measurement loop is preferred; see in Figure 6.2;

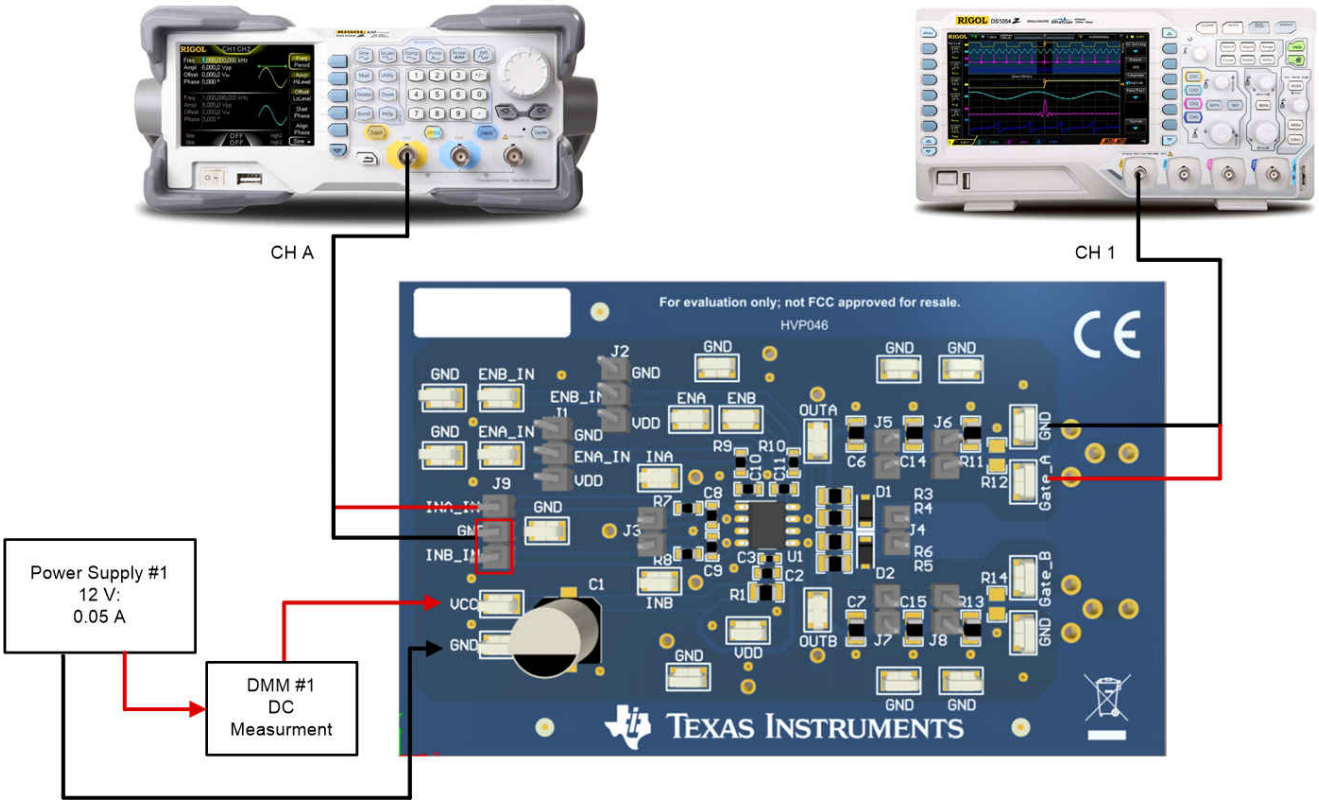

Figure 4-1. Bench Setup Diagram and Configuration

5 Power Up and Power Down Procedure

5.1 Power Up

1. Before beginning the power up test procedure, verify the connections with Figure 4-1.
2. Connect INB_IN test point to GND test point with jumper if the UCC27614EVM is being evaluated in non-inverting configuration.
3. Enable supply #1, if the current on DMM1 is more than 0.25 mA and less than 0.71 mA, everything is set correctly.
4. The following conditions should be present:
   a. Stable pulse output on channel-1 and channel-2 of the oscilloscope, refer to Figure 5-1
   b. Stable pulse output on the Ch-A of the oscilloscope, as per **Figure 2.**
   c. Frequency measurement should be 100 kHz, ±5 kHz or equal to the programmed function generator frequency
   d. DMM #1 should display around 4.6 mA, ±2 mA with the default load capacitance of 1.0 nF. For more information about operating current, see the *UCC27614 Single Channel 30V 10A High Speed Low Side Gate Driver Data Sheet*.

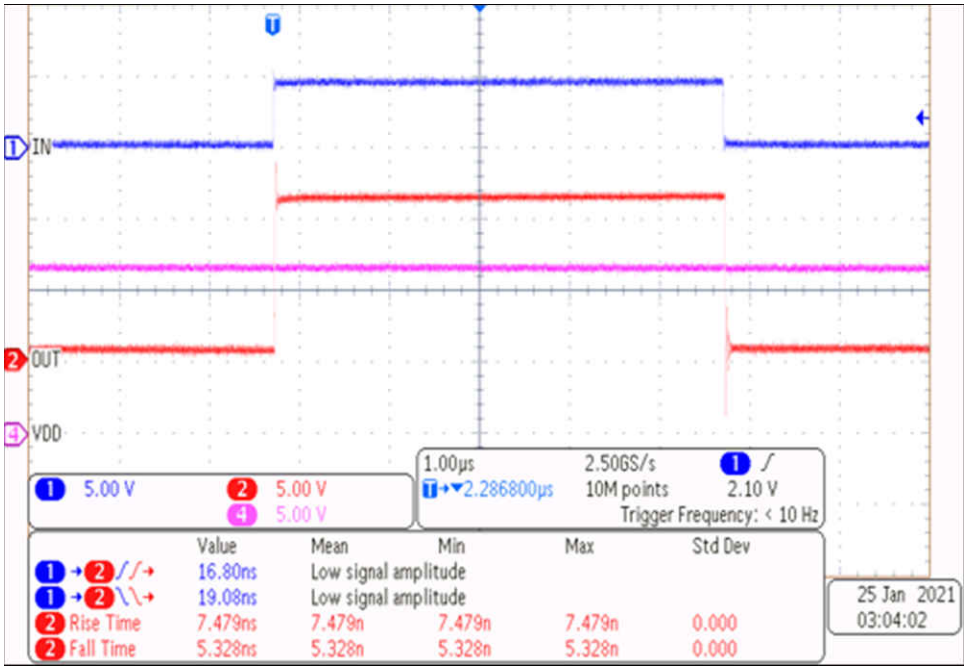

Figure 5-1. Example Input and Output Waveforms (Green and Magenta are PWM Inputs, Yellow and Blue are Driver Outputs)

5.2 Power Down

Use the following steps to power down the EVM:

1. Disable function generator
2. Disable power supply #1
3. Disconnect cables and probes

6 Typical Performance Waveforms (C_L = 1800 pF)

6.1 Propagation Delays

The following waveforms illustrate the INA input and OUTA output, and the INB input and OUTB output on the in each plot.

To evaluate propagation delays and rising and falling details, it is recommended to have scope probe connections with short ground leads, see Rise Time and Rising Propagation Delay and Fall Time and Falling Propagation Delay.

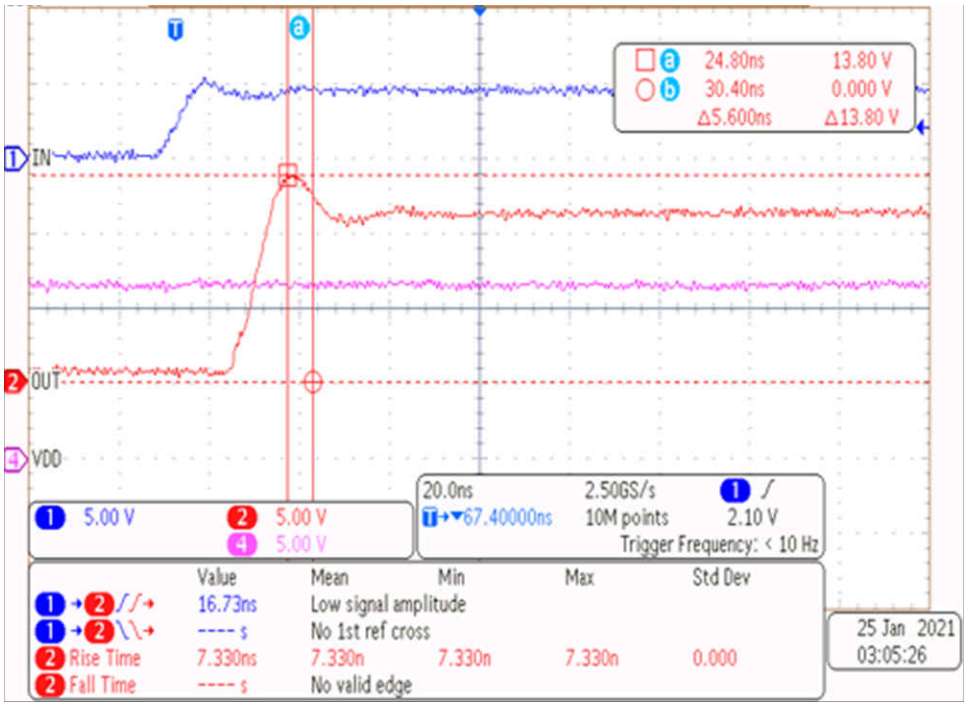

Figure 6-1. Rise Time and Rising Propagation Delay

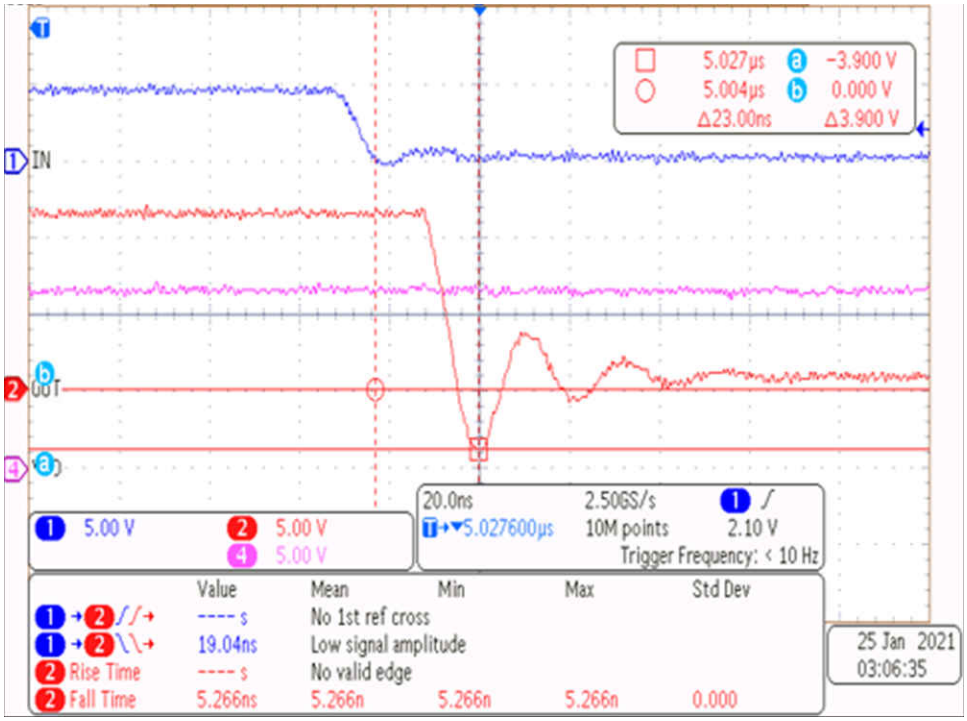

Figure 6-2. Fall Time and Falling Propagation Delay

7 Schematic

Figure 7-1 shows the UCC27614EVM schematic diagram.

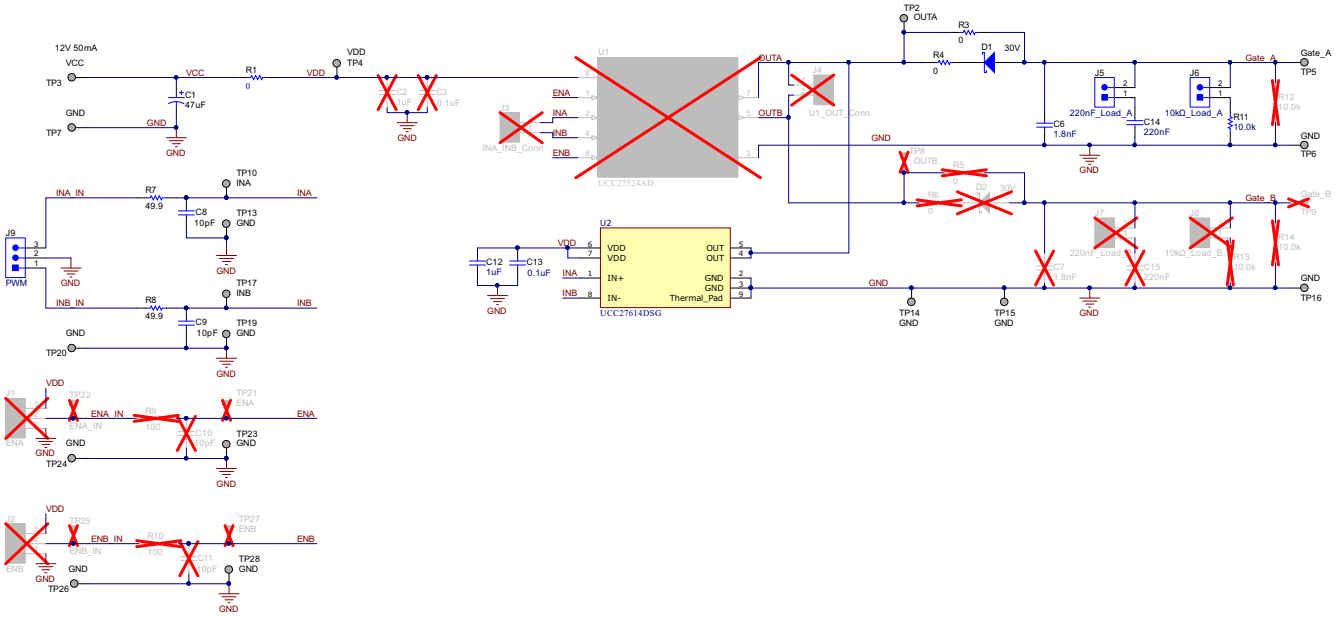

Figure 7-1. UCC27614EVM Schematic

U1 is not installed since it is an alternate driver IC used on a different board assembly variation.

8 Layout Diagrams

Figure 8-1 through Figure 8-6 show the PCB layout information for the UCC27614EVM.

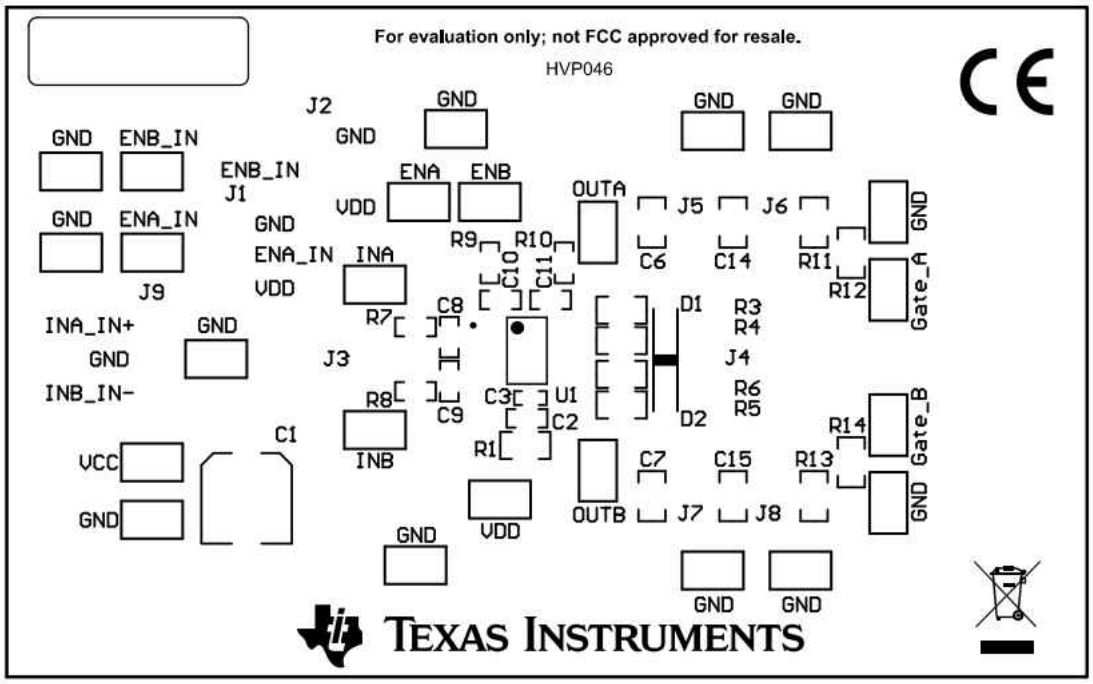

Figure 8-1. Top Overlay

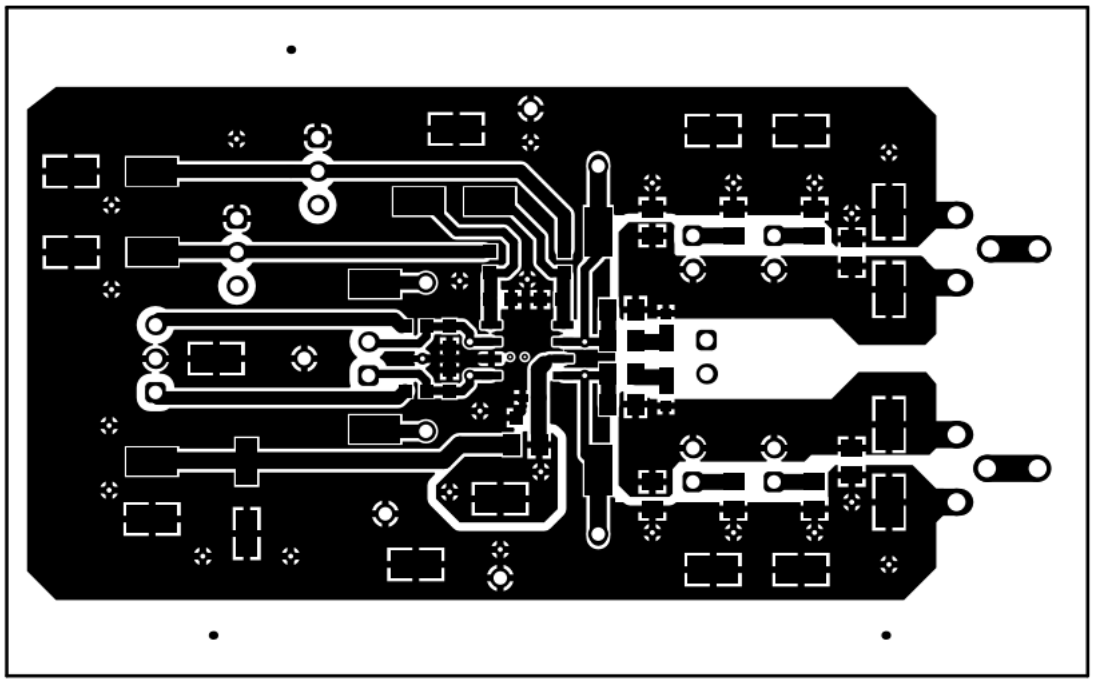

Figure 8-2. Top Layer

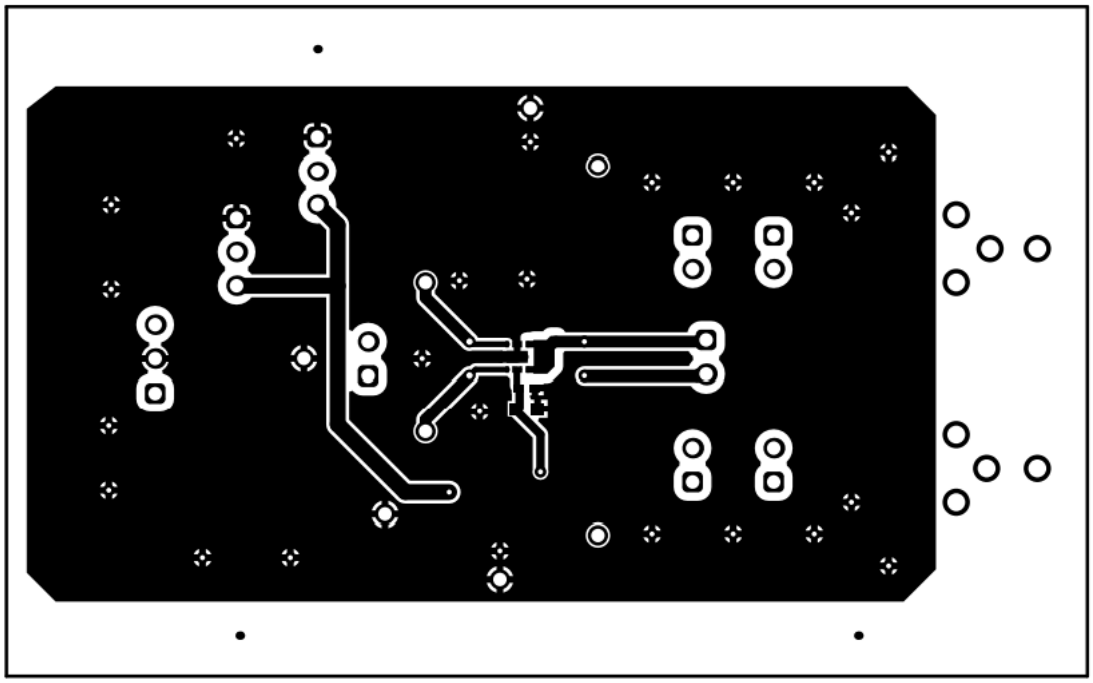

Figure 8-3. Bottom Layer

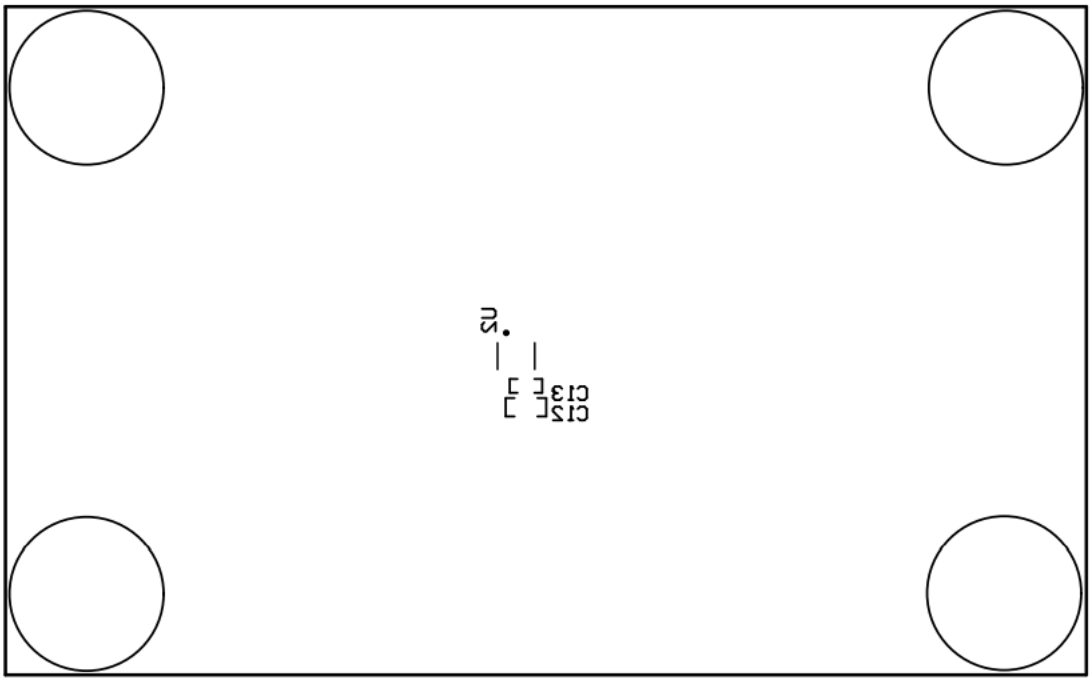

Figure 8-4. Bottom Overlay

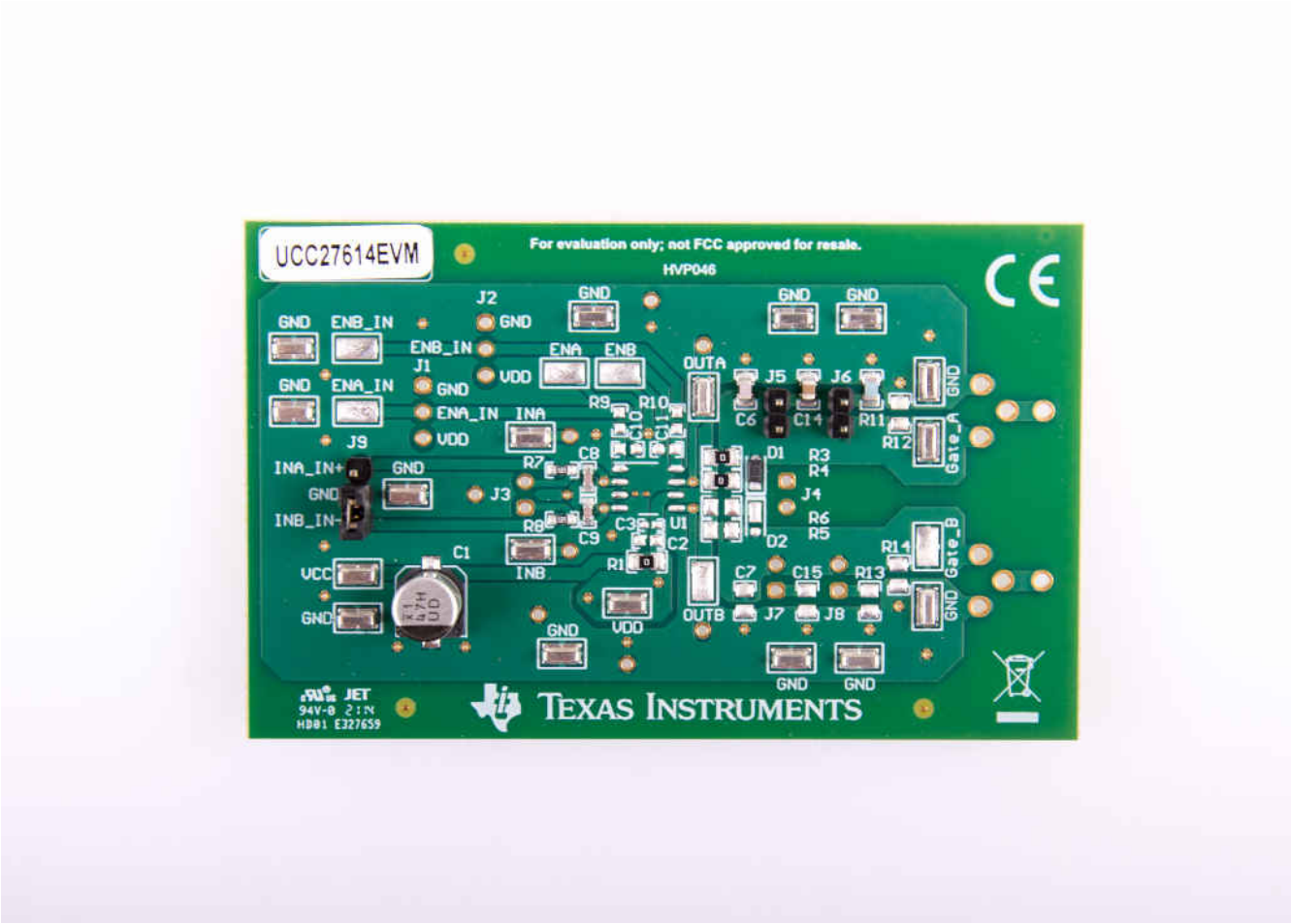

Figure 8-5. Top Image

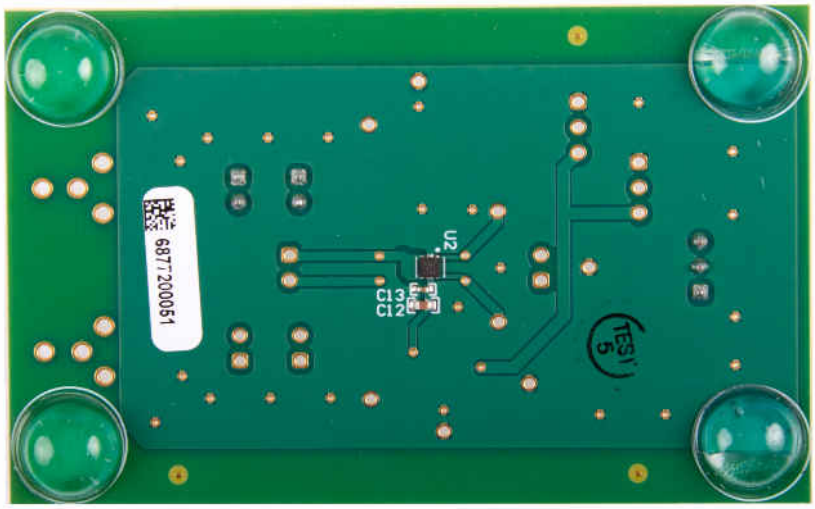

Figure 8-6. Bottom Image

9 List of Materials

UCC27614EVM list of materials.

Table 9-1. UCC27614EVM List of Materials

QUANTITY	DESIGNATOR	DESCRIPTION
1	C1	CAP, AL, 47 uF, 50 V, +/- 20%, 0.68 ohm, SMD
1	C6	CAP, CERM, 1800 pF, 50 V, +/- 10%, X7R, 0805
2	C8, C9	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0, 0603
1	C12	CAP, CERM, 1 uF, 50 V, +/- 10%, X6S, 0603
1	C13	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0402
1	C14	CAP, CERM, 0.22 uF, 50 V, +/- 10%, X7R, 0805
1	D1	Diode, Schottky, 30 V, 1 A, AEC-Q101, MicroSMP
1	J5	Header, 2.54 mm, 2x1, Tin, TH
1	J6	Header, 2.54 mm, 2x1, Tin, TH
1	J9	Header, 2.54 mm, 3x1, Tin, TH
1	R1	RES, 0, 5%, 0.125 W, AEC-Q200 Grade 0, 0805
2	R3, R4	RES, 0, 5%, 0.125 W, 0805
2	R7, R8	RES, 49.9, 1%, 0.1 W, AEC-Q200 Grade 0, 0603
1	R11	RES, 10.0 k, 1%, 0.2 W, 0805
1	TP2	Test Point, Miniature, SMT
1	TP3	Test Point, Miniature, SMT
1	TP4	Test Point, Miniature, SMT
1	TP5	Test Point, Miniature, SMT
12	TP6, TP7, TP13, TP14, TP15, TP16, TP19, TP20, TP23, TP24, TP26, TP28	Test Point, Miniature, SMT
1	TP10	Test Point, Miniature, SMT
1	TP17	Test Point, Miniature, SMT
1	U2	UCC27614DSG single channel 30V 10A High Speed Low Side Gate Driver

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