Using the UCC27611OLEVM-203

User's Guide

Literature Number: SLUUA64
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1 Introduction

This EVM is to aid in evaluating UCC27611. UCC27611 is a high-speed, single channel, low-side driver capable of driving eGANFETs. The UCC27611 device can accept a wide range VDD input (4 V to 18 V) and provide a regulated 5-V output which is well-suited to drive GaN FETs without exceeding their maximum gate-to-source voltage ratings.

2 Description

The EVM consists of a single UCC27611 device with all its pins accessible through test points. The EVM is designed to drive a capacitive load on the output of the device, but connectors are provided to offer flexibility to bring the output signal outside the board. The EVM allows user to evaluate the UCC27611 device standalone operation under different VDD bias voltages, capacitive loads, switching frequencies and with either non-inverting or inverting input signals. In summary, the EVM is an extremely useful tool for determining the drive circuit component parameters for the relevant end application.

2.1 Typical Applications

- Demonstrate driving eGaNFETs such as EPC2001 with 6-V gate-to-source voltage absolute maximum ratings.
- Determine UCC27611 gate drive circuit component parameters relevant for end application by emulating eGANFET Q_G with a fixed capacitive load and study performance.

2.2 Features

- All pins of UCC27611 accessible through test point.
- Test points, jumper heads, and switches to facilitate evaluation.
- Provision for testing under no load, 100 pF, 1 nF load or user selectable load (C6).

3 Electrical Performance Specifications

Table 1. UCC27611OLEVM-203 Electrical Specifications

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Characteristics					
Voltage range V_{DD}		4	10	18	V
Input current limit			1		A
Input PWM signal		>2.4		V_{DD}	V
Output Characteristics					
Output voltage	magnitude		5		V

Operational frequency subject to thermal consideration based on load and package power dissipation.

4 Schematic

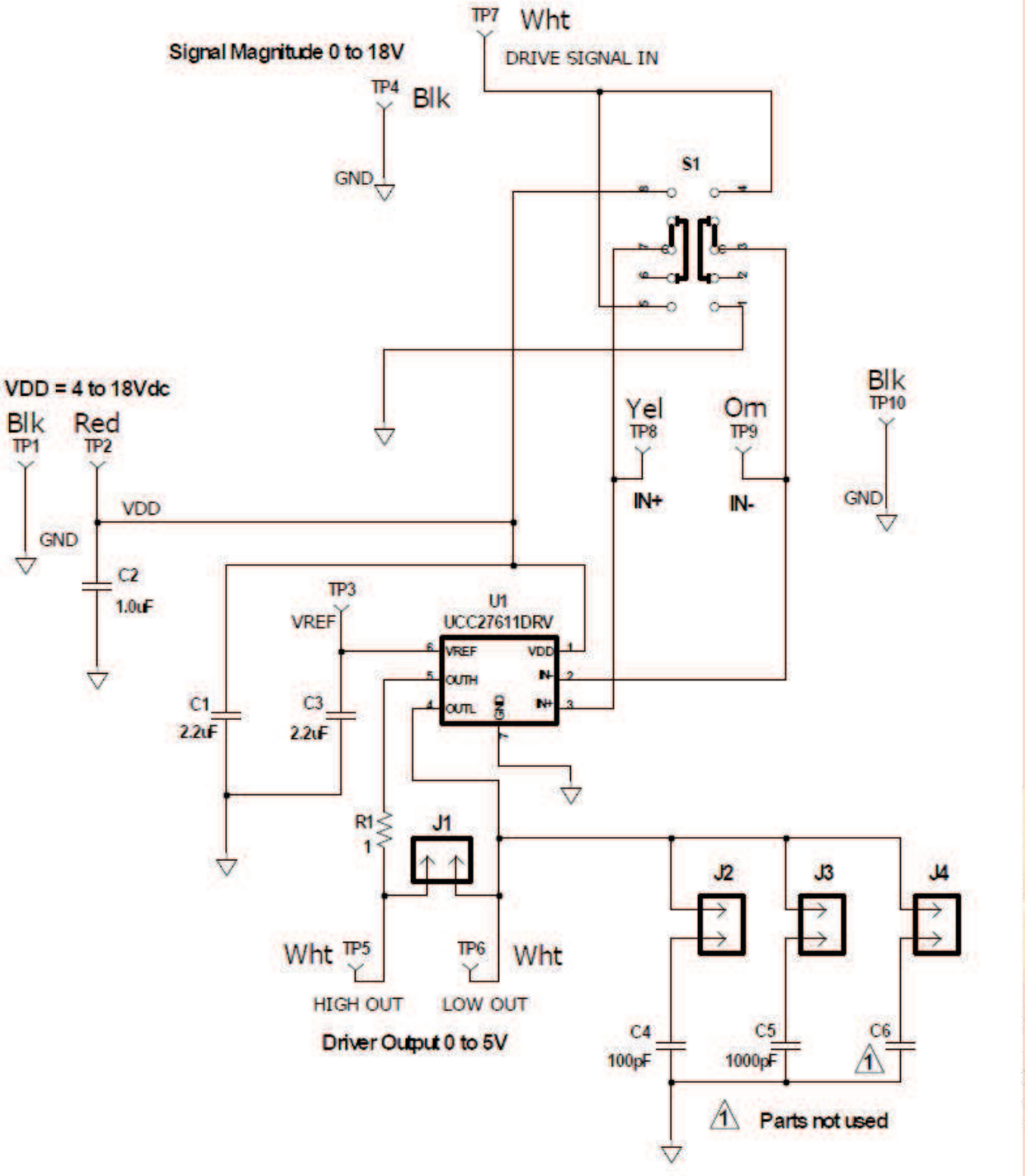

Figure 1. UCC27611OLEVM-203 Schematic

5 Test Setup

5.1 Test Equipment

Voltage Source for VDD: 10 V and 1 A.

Function Generator: 4 MHz, 50% duty cycle, 0-V to 5-V magnitude.

Oscilloscope: 350-MHz bandwidth, three channels, 2 V/div. and 5 ns/div.

Recommended Wire Gauge: AWG #18.

5.2 Recommended Test Setup

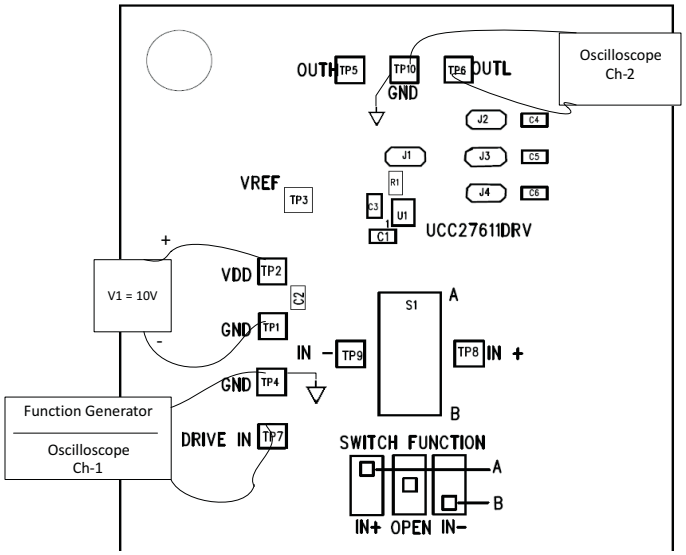

Figure 2. Recommended Test Set Up

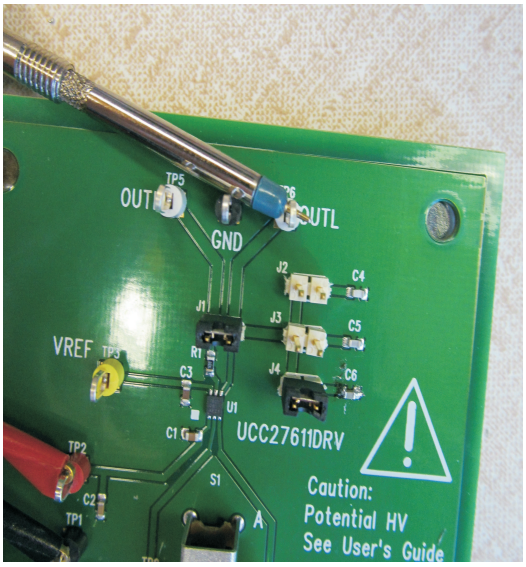

Figure 3. Recommended Probe Set Up for the measurements on TPS 6

5.3 List of Test Points

Table 2. Test Point Functions

TEST POINTS	NAME	DESCRIPTION
TP1	GND	Ground
TP2	VDD	UCC27611 pin 1
TP3	VREF	Reference voltage
TP4	GND	Ground
TP5	OUTH	UCC27611 pin 5
TP6	OUTL	UCC27611 pin 4
TP7	DrIn	Drive Signal Input
TP8	IN+	UCC27611 pin 3
TP9	IN-	UCC27611 pin 2
TP10	GND	Ground
J1		Jump connection of internal totem pole output
J2		100-pF output capacitance selection
J3		1000-pF output capacitance selection
J4		No load or user selectable load (C6)

6 Test Procedure

Set up the EVM based on Figure 2.

6.1 Output and Input Relationship

1. Connect voltage source 10 V to TP1 and TP2 to bias UCC27611.
2. Connect function generator to TP4 and TP7 and set up 4 MHz, 50% duty cycle, and magnitude between 0 V and 5 V.
3. Test under no load, place a jumper on J1 and Verify J2, J3 and J4 are open.
4. Connect oscilloscope channel one to input drive signal between TP7 signal and TP4 ground.
5. Connect oscilloscope channel two to output drive signal between TP6 signal and TP10 ground using the method shown in Figure 3.
6. Connect oscilloscope channel three to the V_{REF} signal between TP3 signal and TP10 ground.
7. Power on V1 set switch S1 on position A for non-inverting output.
8. Record reference waveform as shown in Figure 4 through Figure 6.
9. Set switch S1 on position B, and record inverting output as shown in Figure 7 through Figure 9 .

6.2 Equipment Shutdown

1. Power off 10-V voltage source.
2. Power off function generator.

7 Typical Characteristic

The following figures show the operation of the driver. The first series of three scope shots show the operation of the device with the non-inverting operation and no load on the output. The bottom trace is the input voltage and the top trace is the output. The middle trace is the output of the internal reference. The next two images measure the delay of both the leading edge and training edge of the incoming signal to the leading and trailing edge of the output.

7.1 Non-inverting Output

Figure 4 through Figure 6 show the operation with no load on the output and non-inverting input.

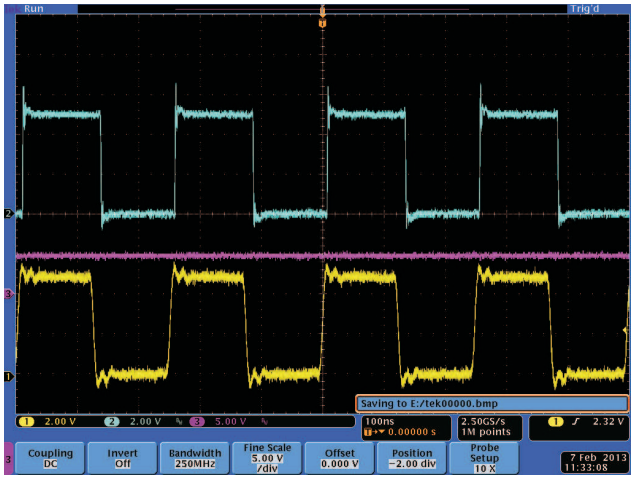

Figure 4. Non-Inverting Output

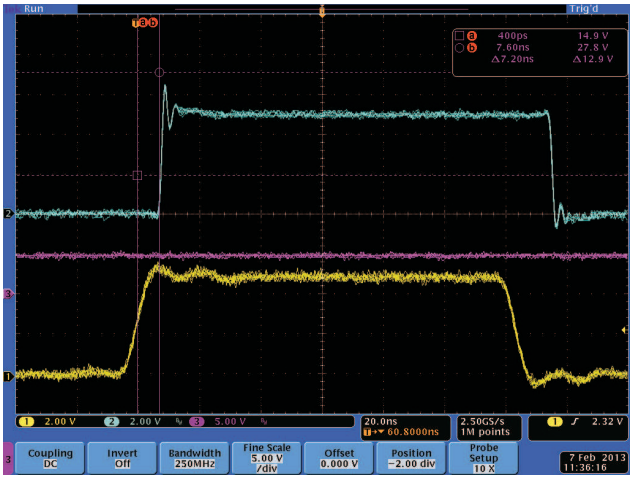

Figure 5. Non-inverting Output, Input Rising Edge Propagation Delay

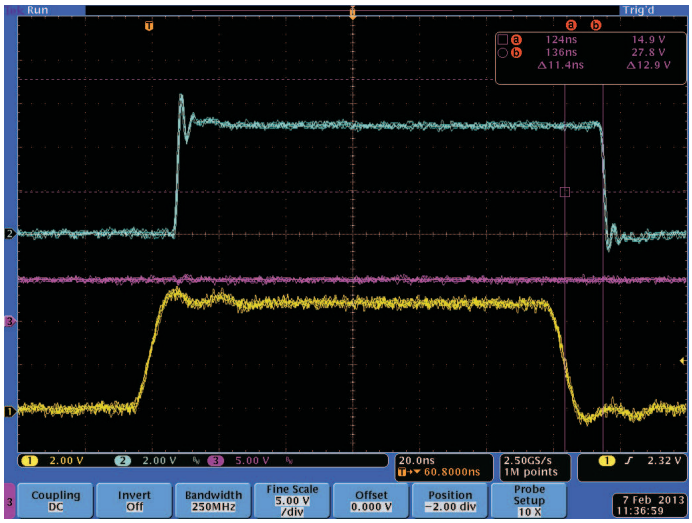

Figure 6. Non-inverting Output, Input Falling Edge Propagation Delay

7.2 Inverting Output

Figure 7 through Figure 9 have the same conditions as the above but with the input signal going into the inverting input and the operation has with no load on the output and inverting input.

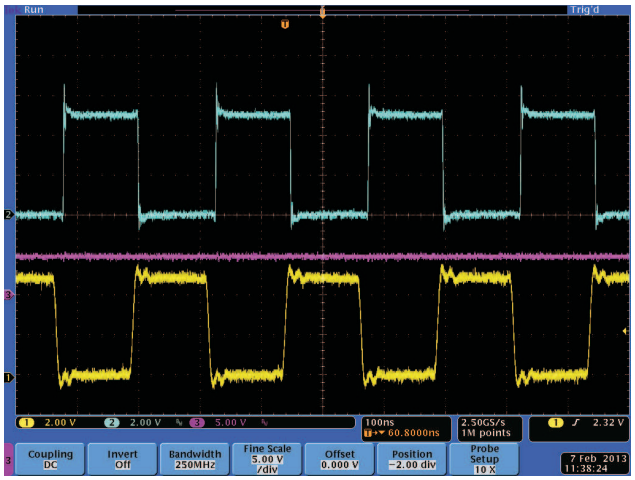

Figure 7. Inverting Output

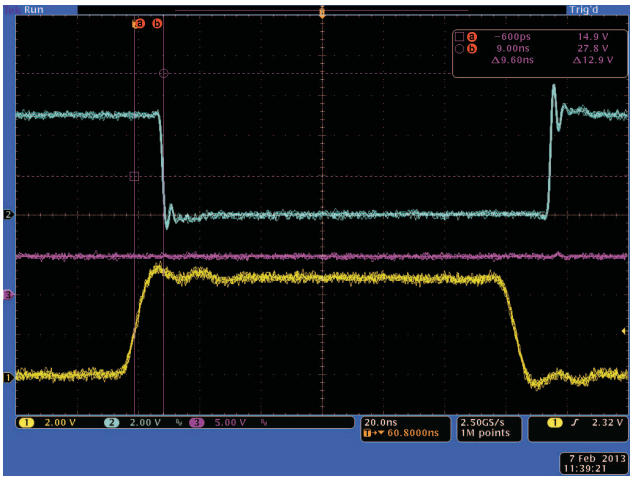

Figure 8. Inverting Output Input Rising Edge Propagation Delay

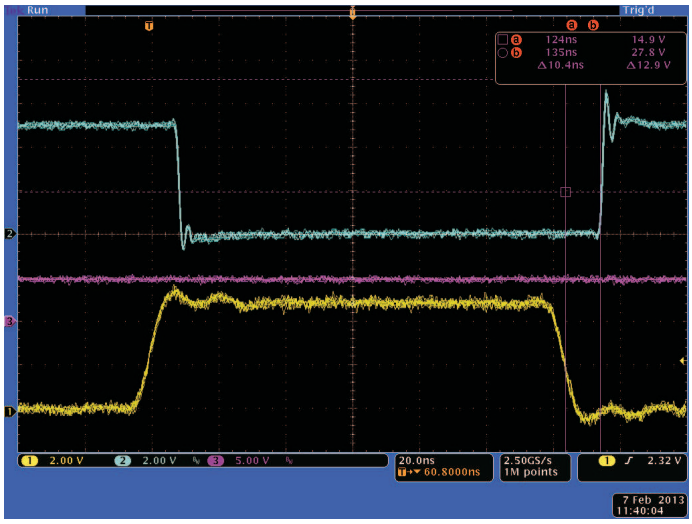

Figure 9. Inverting Output Input Falling Edge Propagation Delay

8 EVM Assembly Drawing and PCB Layout

The following figures (Figure 10 through Figure 12) show the design of the UCC27611OLEVM-203 printed circuit board. PCB dimensions: L x W = 2.8 inch x 3.5 inch, PCB material: FR402 or compatible, two layers and 2oz copper on each layer.

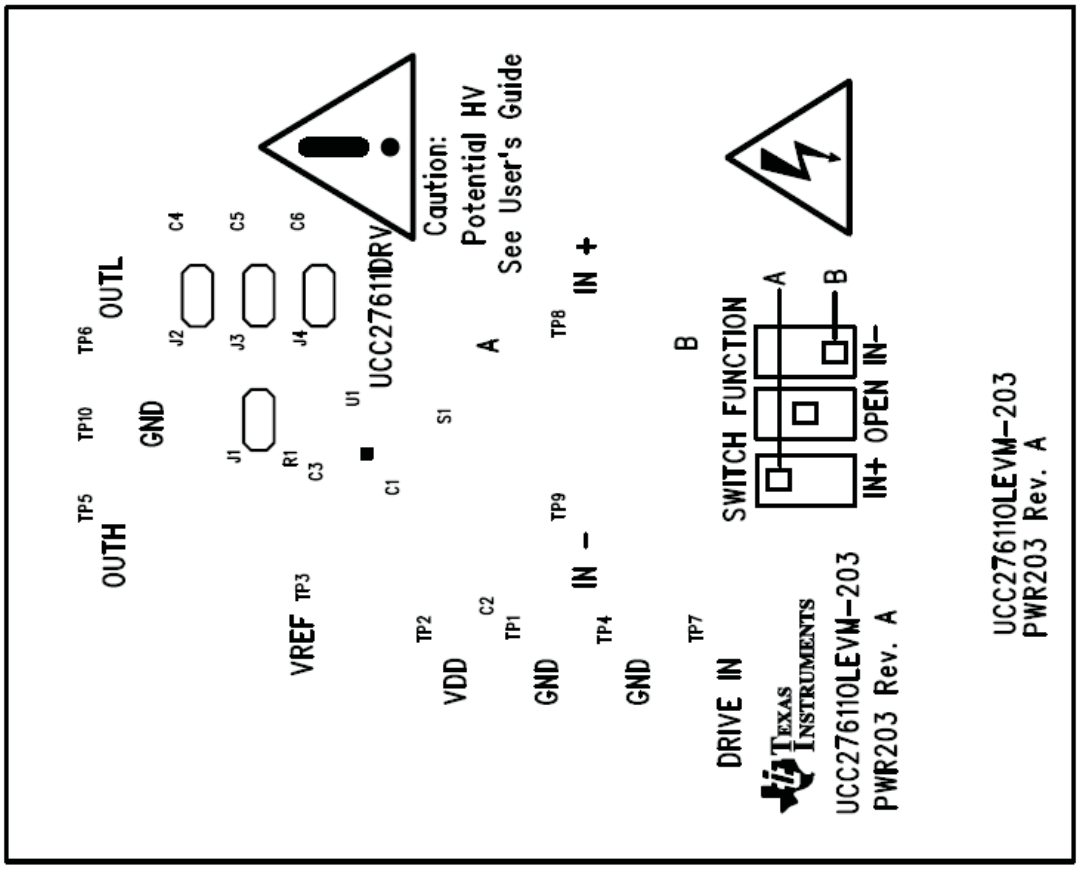

Figure 10. UCC27611OLEVM-203 Top Layer Assembly Drawing (top view)

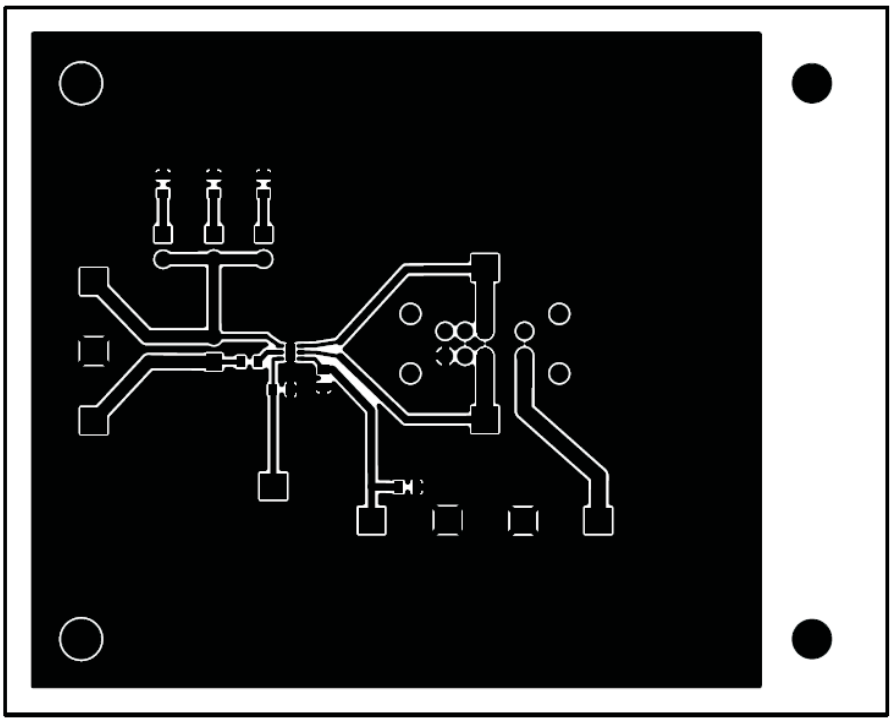

Figure 11. UCC27611OLEVM-203 Top Copper (top view)

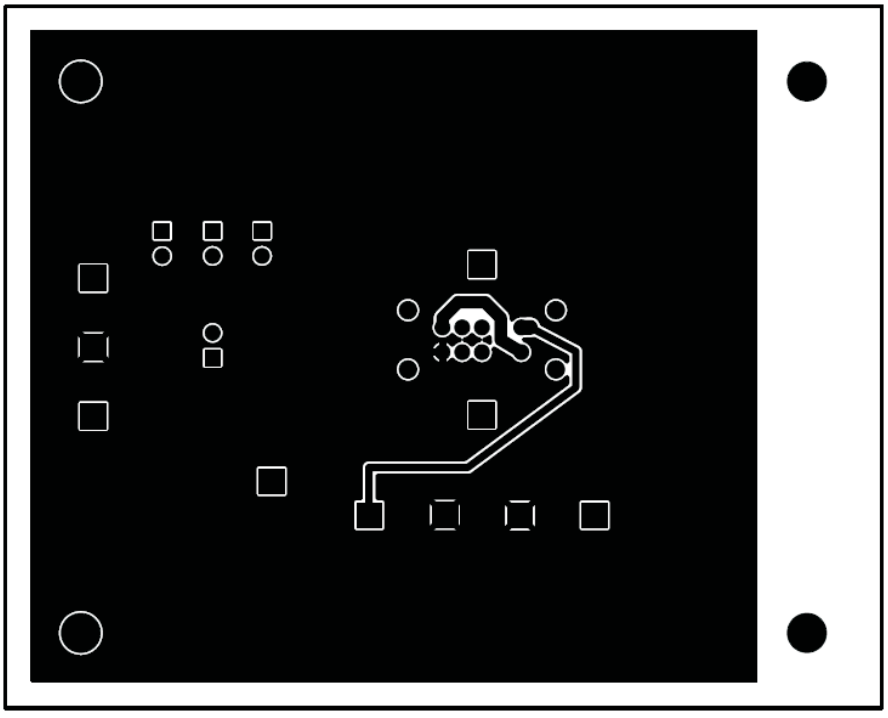

Figure 12. UCC27611OLEVM-203 Bottom Copper (top view)

9 Listof Materials

The EVM components list according to the schematics shown in Figure 1.

Table 3. UCC27611OLEVM-203 List of Materials

QTY	REF DES	DESCRIPTION	PART NUMBER	MFR
2	C1, C3	Capacitor, ceramic, 25 V, X5R, 10%, 2.2 µF, 603	STD	STD
1	C2	Capacitor, ceramic, 25 V, X5R, 10%, 1.0 µF, 603	STD	STD
1	C4	Capacitor, ceramic, 50 V, X7R, 10%, 100 pF, 603	STD	STD
1	C5	Capacitor, ceramic, 50 V, X7R, 10%, 1000 pF, 603	STD	STD
0	C6	Capacitor, ceramic, 50 V, X7R, 10%, OPEN, 603	STD	STD
4	J1, J2, J3, J4	Header, male 2-pin, 100-milimeter spacing, 0.100 inch x 2 inch	PEC02SAAN	Sullins
1	R1	Surface mount, I Ω, 603	STD	STD
1	S1	Switch, slide DP3T, 6.5 mm x 16 mm	EG2301A	E-Switch
1	U1	4-A and 8-A Single Channel High-Speed Low-Side Gate Drivers, SOT23-6	UCC27611DRV	TI

10 References

1. *Driving eGaNTM Transistors for Maximum Performance*, http://epc-co.com/epc/documents/articles/EPC_Driving_eGaN_Transistors_fro_Maximum_Performance.pdf
2. UCC27611, *4-A and 6-A High-Speed 5-V Drive Optimized Single Gate Driver*, (Texas Instruments Literature Number SLUSBA5)

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- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

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Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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      CAUTION

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      Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

      FCC Interference Statement for Class A EVM devices

      NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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2. 実験局の免許を取得後ご使用いただく。
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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

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4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

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