VCA2615EVM User's Guide

This document provides the information needed to set up and operate the VCA2615EVM evaluation module (EVM). For a more detailed description of the VCA2615, please refer to the product datasheet available from the Texas Instruments web site at http://www.ti.com. Throughout this document, the acronym *EVM* and the phrase *evaluation module* are synonymous with the VCA2615EVM. This user's guide includes setup and configuration instructions, information regarding operating procedures and input/output connections, an electrical schematic, printed circuit board (PCB) layout drawings, and a parts list for the EVM.

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1 Description

The VCA2615EVM is designed to provide ease of use in evaluating the performance of the VCA2615 variable gain amplifier. By using the 0Ω jumpers and DIP-switches, the VCA2615EVM can be configured to accommodate several different modes of operation. Before starting the evaluation, it is recommended to review the state of each of the switches to verify the desired configuration.

2 Power Supply Requirements

The VCA2615EVM requires a +5V DUT supply (at connector JP1) for the VCA2615, and separate ±5V supplies (at connector JP2) for the output amplifiers (U1 and U2). This configuration allows for the monitoring of supply currents to the VCA2615 independent of the rest of the evaluation board. If monitoring the supplies is not required, a single +5V supply can be substituted for the two separate +5V supplies. In this case, the –5V supply is still required.

2.1 Voltage Limits Warning

CAUTION

Exceeding the maximum input voltages can damage EVM components. Undervoltage conditions may cause improper operation of some or all of the EVM components.

3 Input Signals

The input signals can be applied to SMA connectors J1 (LNP_IN_A) and J2 (LNP_IN_B). The inputs represent high impedance inputs and are ac-coupled into the VCA2615 through 0.01µF capacitors.

In addition to the LNP inputs, the user has the option to apply inputs signal directly into the VCA section of the VCA2615; for this configuration, use SMA connectors J3 (VCA_IN_A) and J4 (VCA_IN_B). In order to operate the VCA2615 in this mode, the VCA_{IN}SEL-pin must be pulled high, which can be done using position 4 of DIP-switch SW2.

4 LNP Gain Settings

DIP-switch SW1 allows the control of the LNP gain setting bits (G1 and G2). Table 1 shows the four different gain settings.

Table 1. LNP Gain Selections

G1	G2	LNP Gain (dB)
0	0	3
0	1	12
1	0	18
1	1	22

5 LNP Input Impedance Configuration

The LNP section of the VCA2615 includes an array of feedback resistors that allow the user to operate the VCA with or without active termination, and to optimize the LNP input impedance to match the source impedance. This feedback resistor array is controlled by four selection bits: FB1, FB2, FB3, and FB4. On the EVM, the selection bits can be controlled by setting DIP-switch SW2. Please refer to the VCA2615 product datasheet for more detailed information.

6 VCA Control Voltage (V_{CNTL})

The gain control signal is applied to the input SMA connector, J7. In the standard configuration, solder-switch SJP1 should be open. This signal can be a dc voltage or a customer-specific waveform. The typical range for the control voltage, as specified in the VCA2615 datasheet, is from 0.2V to 2.5V.

7 Output Configuration

The differential outputs of the VCA2615 are fed into an amplifier stage. Using the 0Ω jumpers (R27-R30), this stage can be configured in two different ways:

- as single-ended inverter with a gain of 0.5V/V; or
- as difference amplifier.

After the amplifier stage, the signal outputs are provided at SMA connectors J5 (VGA_OUT_A) and J6 (VGA_OUT_B).

The differential outputs of the VCA2615 can be terminated with 500Ω on each output, and the output signals can then be checked at test points TP1 and TP2 and test points TP3 and TP4, respectively.

8 Clamping Voltage

The VCA2615 allows for a user to limit the output voltage swing to a defined level. For this limiting, the desired clamping voltage level is applied to the V_{CLMP} pin of the VCA2615. The EVM includes a 3.3V reference (U3) that supplies a stable voltage. Using potentiometer RP1, the clamping voltage can be adjusted to the desired value.

9 Physical Description

This section describes the physical characteristics and PCB layout of the evaluation module, and lists the components used in theVCA2615EVM.

9.1 PCB Layout

The EVM is constructed on a four-layer, 4.5in x 3.5in PCB using FR-4 material. Figure 1 shows the schematic of the VCA2615EVM. A brief description of the individual layers is given in Figure 2 through Figure 5.

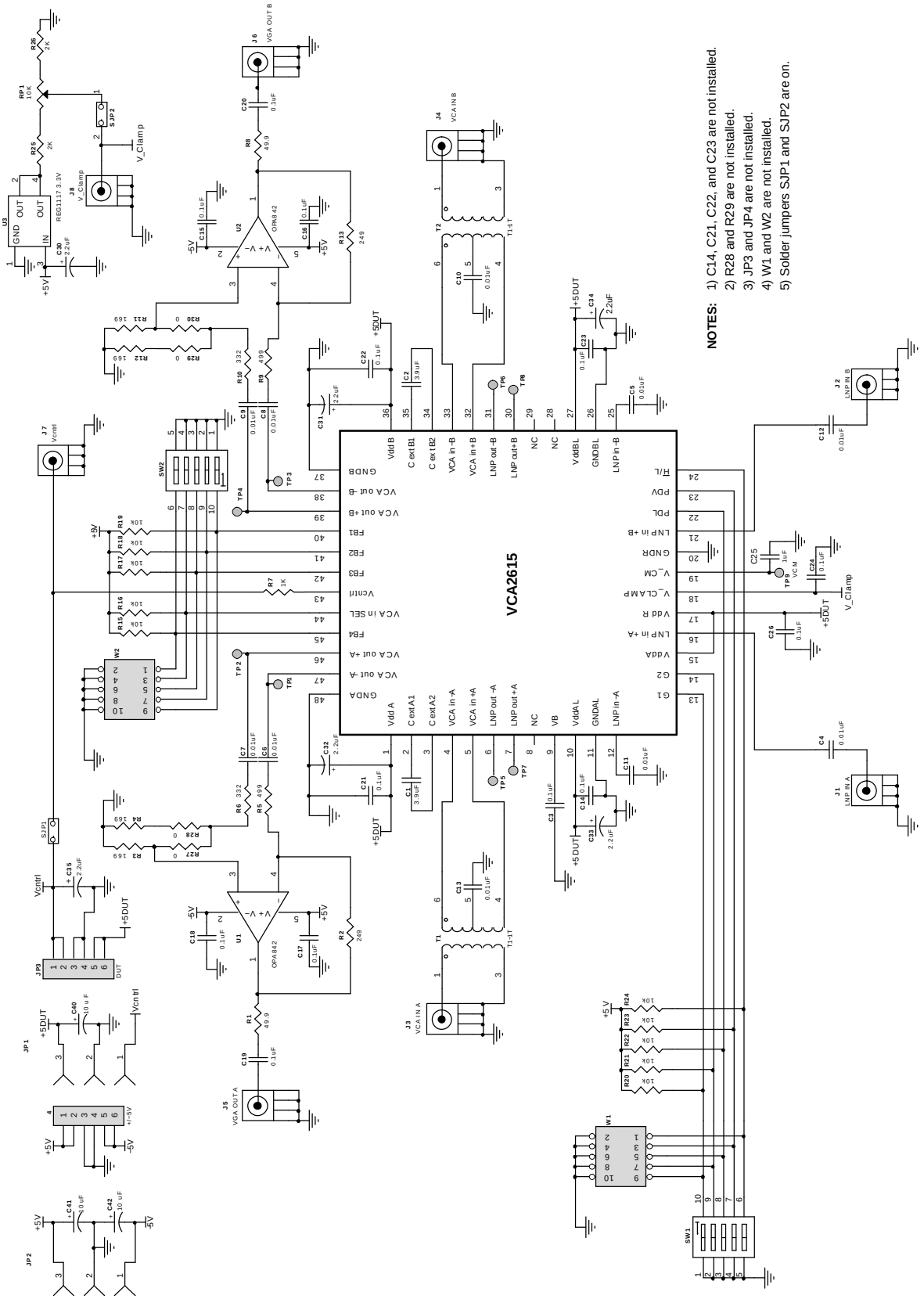

Figure 1. VCA2615EVM Schematic

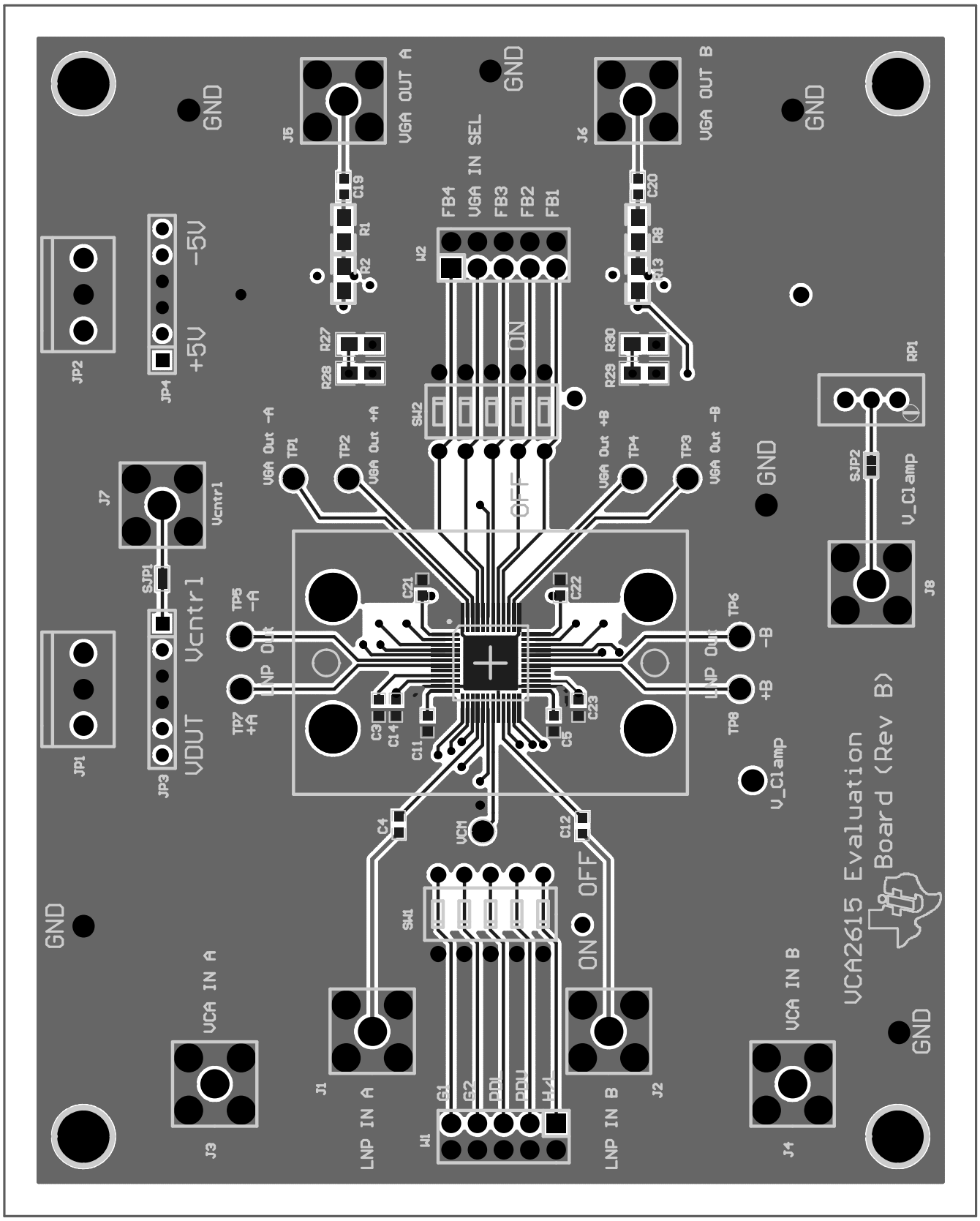

Figure 2. VCA2615EVM PCB Top Layer (Top View)

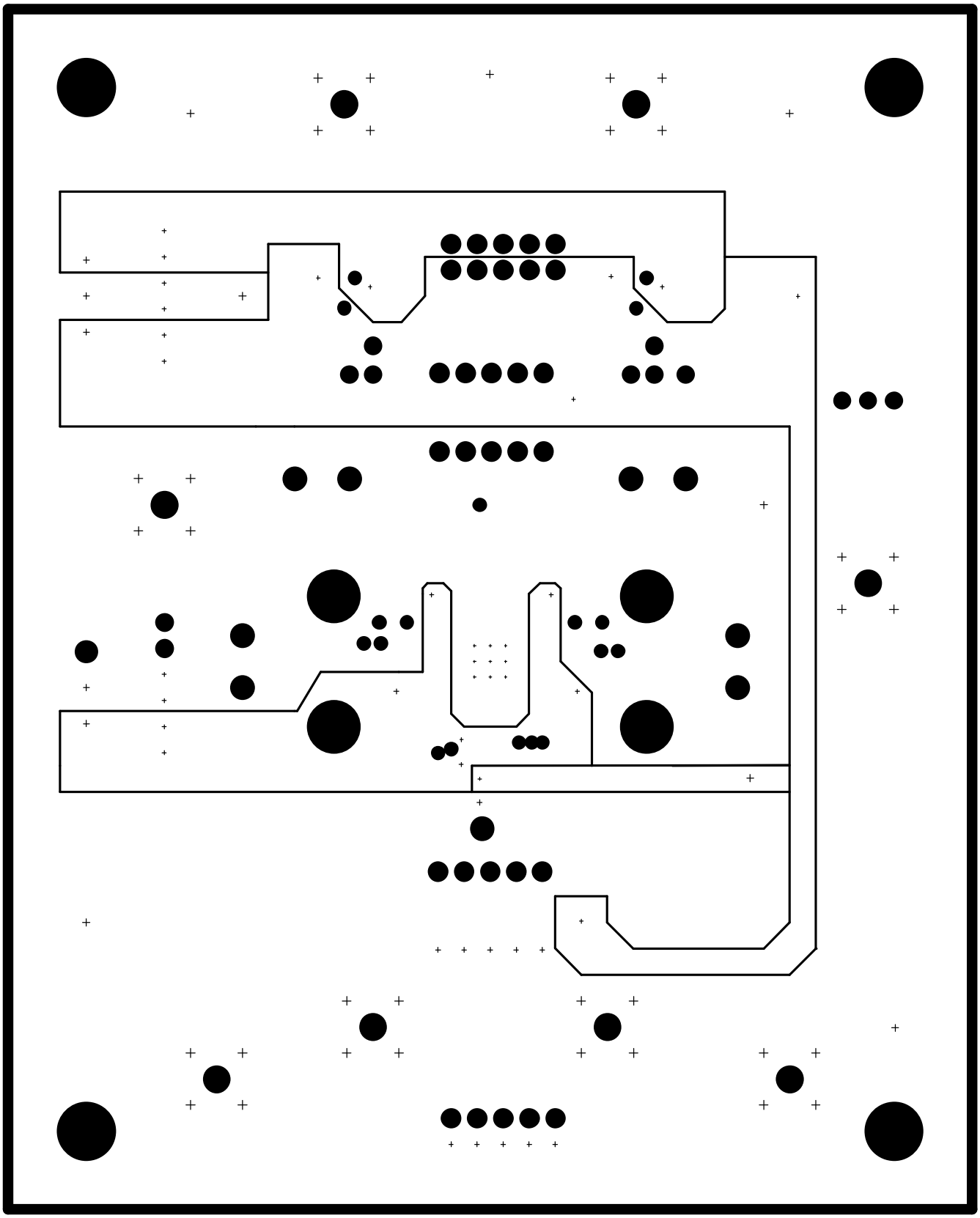

Figure 3. VCA2615EVM PCB Power Layer (Top View)

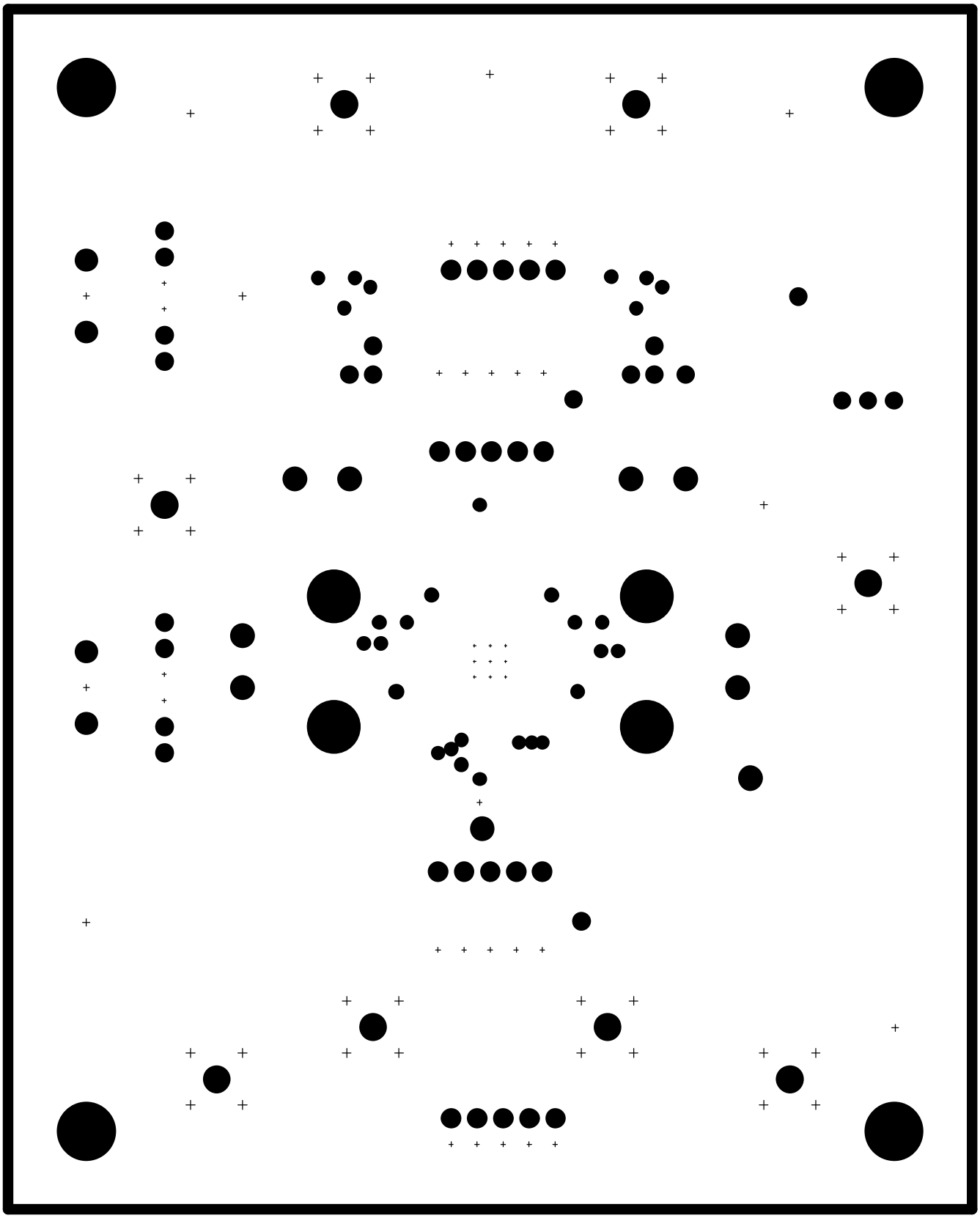

Figure 4. VCA2615EVM PCB Ground Layer (Top View)

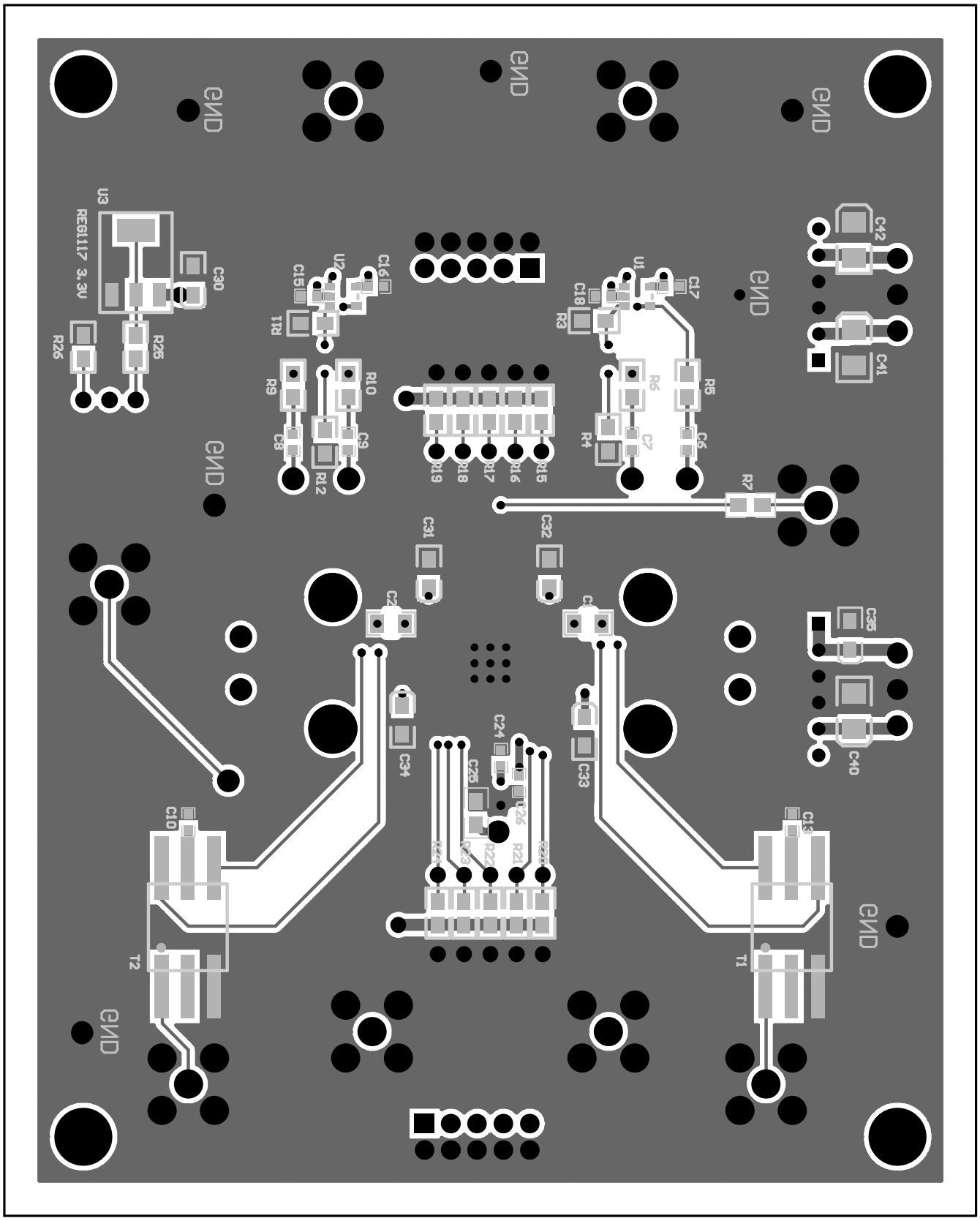

Figure 5. VCA2615EVM PCB Bottom Layer (Bottom View)

9.2 Parts List

The Parts List, showing the components used in the assembly of the VCA2615EVM, is given in Table 2.

Table 2. VCA2615EVM Parts List

Designator	Value	Quantity	Description	Footprint	Part Number	Note
C1, C2	3.9µF	2	Multilayer Ceramic - Variable Footprint	0805 / 1206	C1206C395K3PACTU	
C3–C13	0.01µF	11		0603	399-1-92-1-ND	
C15-C20, C24-C26	0.1µF	9		0603	399-1282-1-ND	
C14, C21-C23	0.1µF	4		0603		Not Installed
C30–C35	2.2µF	6	Low Profile Tantalum Capacitor	3216	TAJA225K016R	
C40–C42	10µF	3	Low Profile Tantalum Capacitor	3528	TAJB106K016R	
R1, R8	49.9Ω	2	1/10W 0805 Chip Resistor	0805		
R2, R13	249Ω	2	1/10W 0805 Chip Resistor	0805		
R3, R4, R11, R12	169Ω	4	1/10W 0805 Chip Resistor	0805		
R5, R9	499Ω	2	1/10W 0805 Chip Resistor	0805		
R6, R10	332Ω	2	1/10W 0805 Chip Resistor	0805		
R7	1kΩ	1	1/10W 0805 Chip Resistor	0805		
R15–R24	10kΩ	10	1/10W 0805 Chip Resistor	0805		
R25, R26	2kΩ	2	1/10W 0805 Chip Resistor	0805		
R27, R30	0Ω	2	1/10W 0805 Chip Resistor	0805		
R28, R29	0Ω	2	1/10W 0805 Chip Resistor	0805		Not Installed
RP1	10kΩ	1	Bourns 3296 Series Pot	0.4in (9.52mm) Square		
J1–J8		8	SMA	SMA_JACK	901-144-8RFX	
JP1, JP2		2	Terminal Block, 3.5mm, 3-Pos PCB	3P-TERM	Digi-Key # ED1515-ND	
JP3, JP4		2	6-Pin Right-Angle Connector	SIP6		Not Installed
SJP1, SJP2		2	Solder Jumper	SJP2		
Stand Offs		4	Spacer, Self-Retain #4 Screw 1/2in		Digi-Key # SRS4-8-01-ND	
SW9, SW10		2	Switch, 5-Pos Dip, Ext, Rock Sealed	5POS_SPST_DIP	Digi-Key # GH1005-ND	
T1, T2		2	RF Transformer Mini-Circuits T1-1T	TTWB	T1-1T-KK81	
TP1-TP9		9	Test Point - Single 0.025in Pin	test_point_85mil	Digi-Key # 5007K-ND	Not Installed
W1, W2		2	Pin Strips Header 5x2	5X2X.1	TSW-105-07-L-D	Not Installed
DUT		1	VCA2615	48-pin QFN	TI, VCA2615 RGZ	
U1, U2		2	OPA842 or Equivalent	SOT23	TI, OPA842DBV	
U3		1	REG1117, 3.3V Voltage Regulator	SOT223	TI, REG1117-3.3	

FCC Warnings

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

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It is user’s responsibility to ensure that persons handling the EVM and the product have electronics training and observe good laboratory practice standards.

By providing user with this EVM, product and services, TI is NOT granting user any license in any patent or other intellectual property right.

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of ±5V and the output voltage range of ±5V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 50°C. The EVM is designed to operate properly with certain components above 50°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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