VCA5807 Development Guide

This development guide describes the characteristics, operation and use of the VCA5807EVM demonstration kit. This demonstration kit is an evaluation module for the VCA5807 device. The VCA5807 is an integrated Voltage Controlled Amplifier (VCA) that integrates a complete time-gain-control (TGC) imaging path and a continuous wave Doppler (CWD) path. The VCA5807 is intended for prototyping and evaluation. This user's guide includes a complete circuit description, schematic diagram, and bill of materials (BOM).

The following related documents are available through the Texas Instruments web site at http://www.ti.com.

Table 1. Related Document

Device	Literature Number
VCA5807	SLOS727

Contents

List of Figures

List of Tables

1 VCA5807 Overview

1.1 Important Disclaimer Information

CAUTION

The VCA5807EVM is intended for feasibility and evaluation testing only in laboratory and development environments. This product is not for diagnostic use.

Use the VCA5807 only under the following conditions:

- The VCA5807EVM is intended only for electrical evaluation of the features of the VCA5807 device in a laboratory, simulation, or development environment.
- The VCA5807EVM is not intended for direct interface with a patient, or patient diagnostics.
- The VCA5807EVM is intended only for development purposes. It is not intended to be used as all or part of an end-equipment application.
- The VCA5807EVM should be used only by qualified engineers and technicians who are familiar with the risks associated with handling electrical and mechanical components, systems, and subsystems.
- The user is responsible for the safety of themself, fellow employees, contractors, and coworkers when using or handling the VCA5807EVM. Furthermore, the user is fully responsible for the contact interface between the human body and electronics; consequently, the user is responsible for preventing electrical hazards such as shock, electrostatic discharge, and electrical overstress of electric circuit components.

2 Overview

2.1 Introduction

This document is intended as a step-by-step guide through the VCA5807 Evaluation Module (EVM) setup and test. The EVM is shipped with a default configuration from the manufacturer. With this configuration, the onboard CMOS clock is used for an analog-to-digital converter sampling clock; the onboard oscillator is used for CW mode operation. No external clock generator is required. The input signal for measurement from a signal generator must be provided.

A detailed explanation regarding the jumpers, connectors, and test points appears in Section 2.2. The graphical user interface (GUI) is available from the TI Web Site. Go to the software section of the product folder (VCA5807).

Throughout this document, the abbreviation EVM and the term evaluation module are synonymous with the VCA5807EVM.

2.2 Default Configuration

Figure 1 shows the default configuration of the EVM from the factory. The accompanying list identifies the basic components on the EVM board.

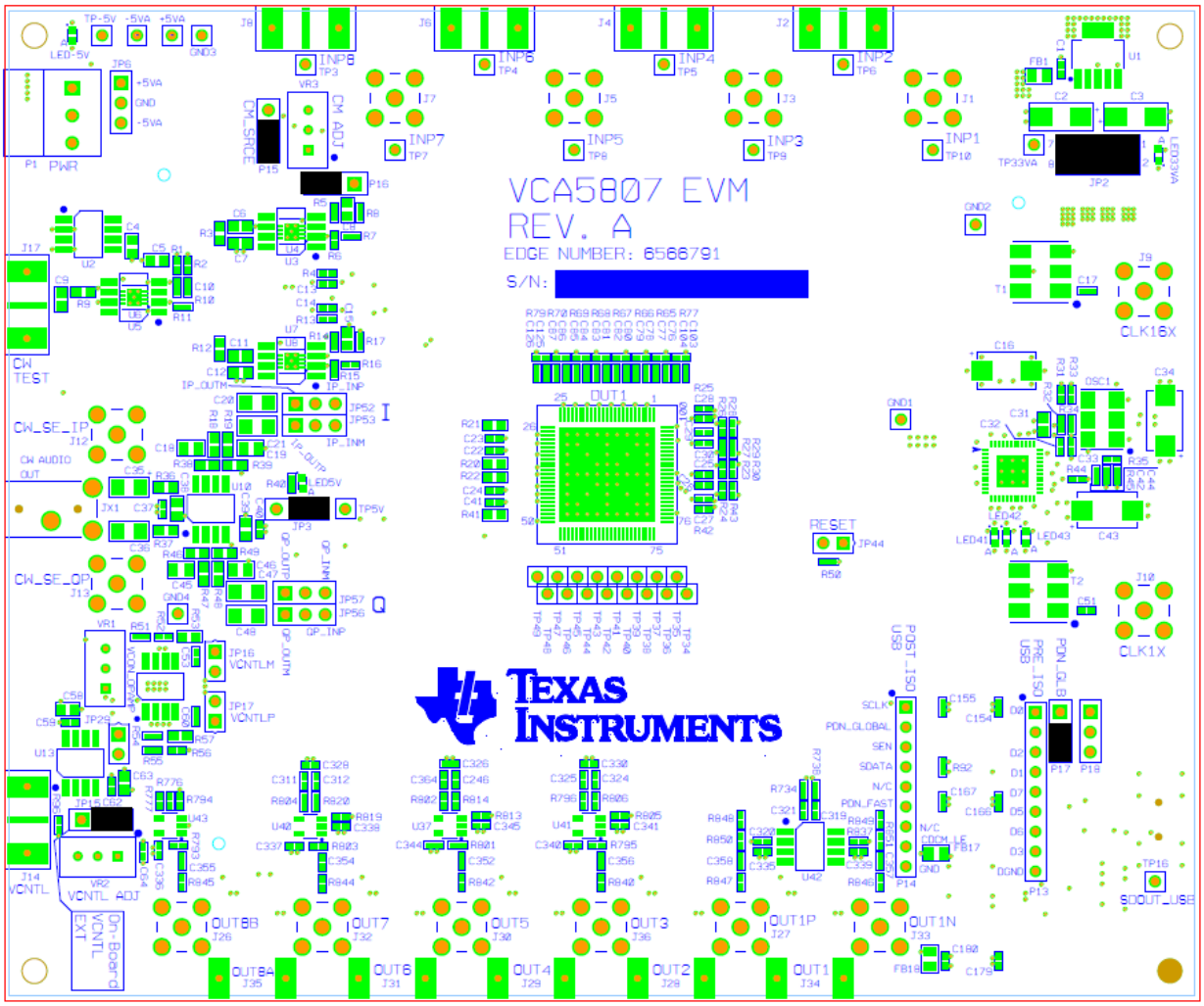

Figure 1. VCA5807EVM Basic Configuration

1. P1 – Power supplies connector
2. JP2, and JP3 are set to enable 3.3-V and 5-V power supplies to the device
3. JP15: Enables onboard VCNT
4. P17: Disables PDB_Global
5. P15: Chooses the device Common Mode for the I/V Amp Common Mode
6. P16: Chooses Vss as –5 V for low-side power supply on I/V Amp

3 Software Installation and Operation

3.1 Minimum Requirements

Before installing the software, verify that your PC meets the minimum requirements outlined in this section.

3.1.1 Required Setup for VCA5807EVM GUI Software

- PC-compatible computer
- Pentium® III or Celeron® processor, 866 MHz or equivalent
- Minimum 256 MB of RAM (512 MB or greater recommended)
- Hard disk drive with at least 200 MB free space
- Windows® XP operating system with SP2, or Windows 7 operating system
- 1280 × 1024 or greater display screen resolution
- Mouse or other pointing device
- Available USB input

3.1.2 Additional Requirements for Use with Hardware

- VCA5807EVM
- USB cable
- Power supply to supply ±5 V

3.2 Installing the Software (PC Application)

The GUI software to evaluate the VCA5807 device is available at the Texas Instruments web site at www.ti.com (VCA5807).

Before installing the software, make sure the VCA5807EVM is not connected to the PC. If using a machine with Windows 7, it is recommended to have administrator rights to avoid problems during installation.

Unzip the installer file to a temporary directory, and then double click setup.exe from the directory. The installation creates a program menu item to execute the software.

Windows should automatically install the correct device drivers, but if there are problems installing the device drivers please refer to this e2e post.
http://e2e.ti.com/support/other_analog/imaging_afes/f/239/p/213841/754871.aspx#754871

Follow these directions to ensure proper installation of the PC application.

3.3 GUI Overview

Every tab in the VCA5807EVM GUI has a software reset option available by clicking the **Software Reset** button located at the bottom right of the GUI.

The VCA *Introduction* tab: This tab gives a block diagram of the VCA5807 device.

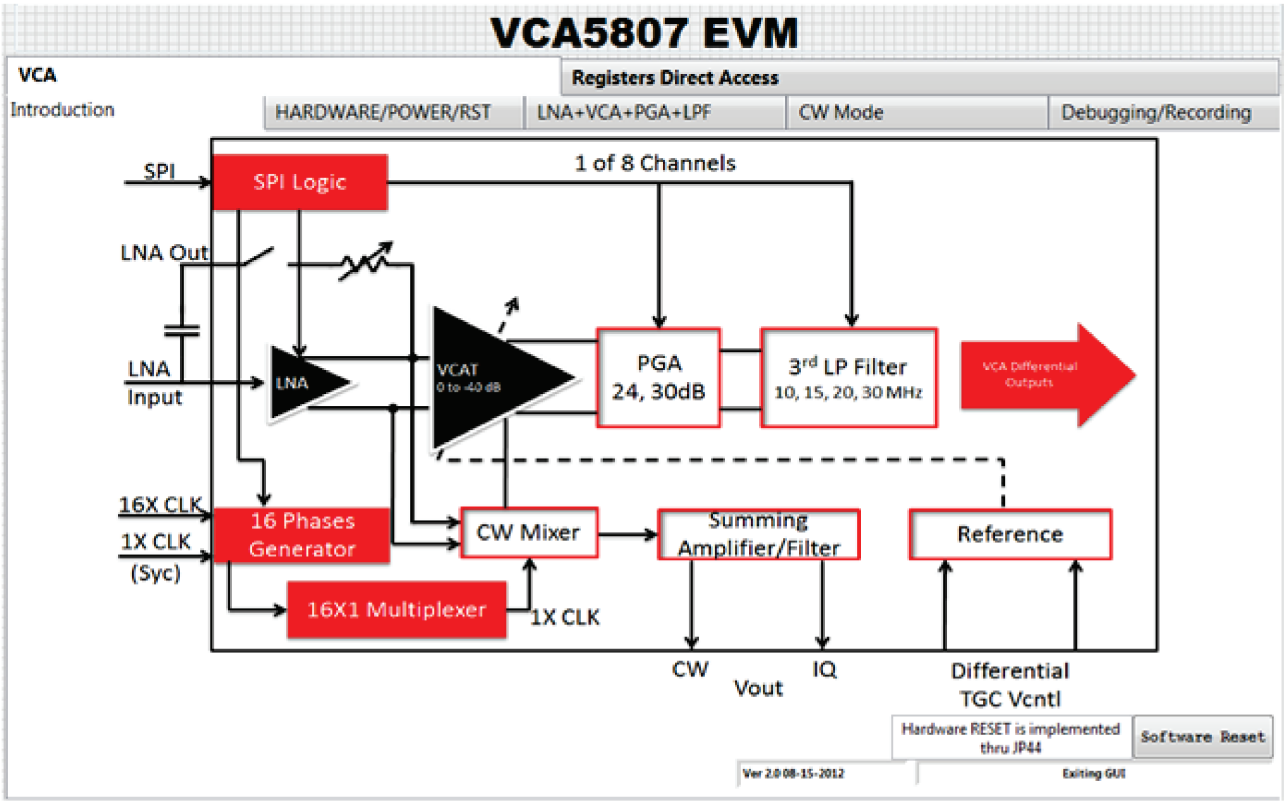

Figure 2. Introduction Tab of the VCA5807EVM GUI

The VCA *HARDWARE/POWER/RST* tab: This tab allows the execution of different power down options.

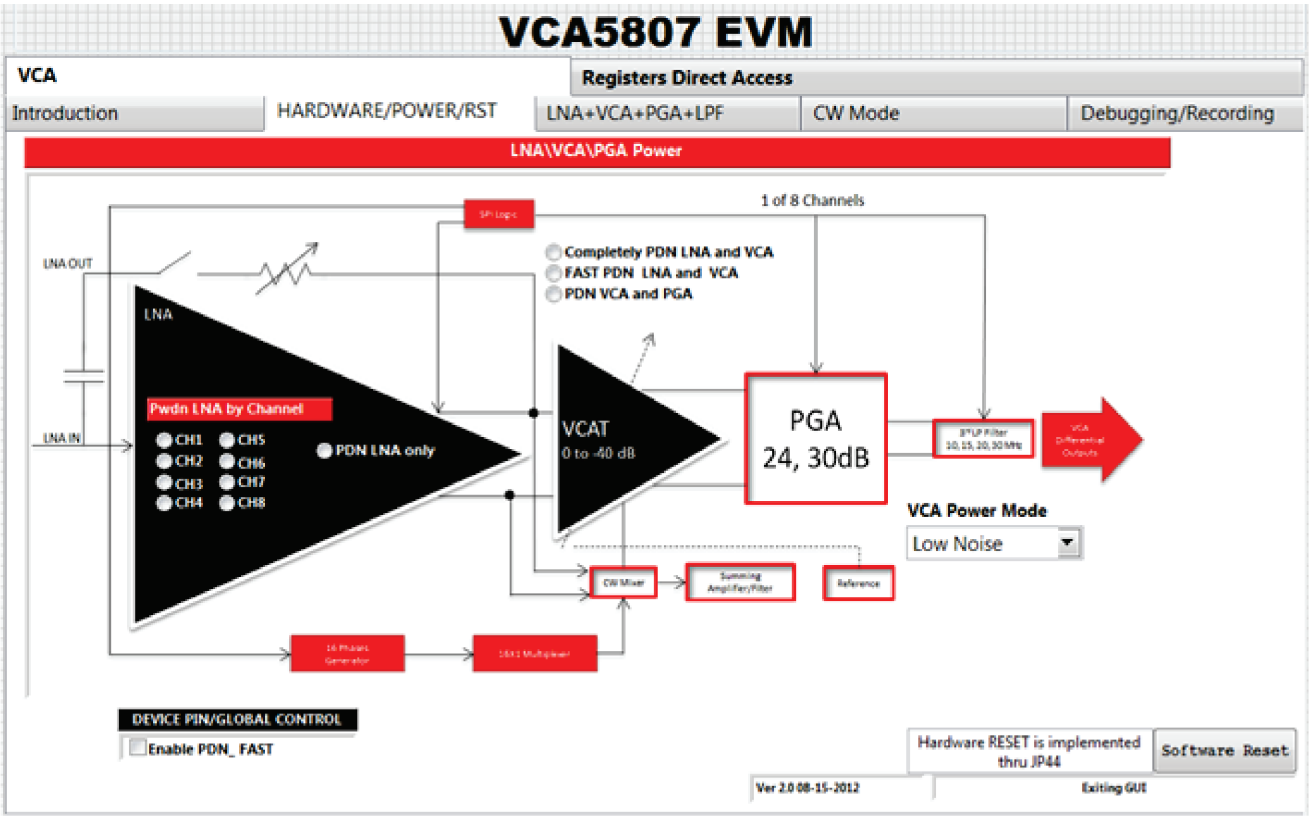

Figure 3. Hardware/Power/RST Tab of the VCA5807EVM GUI

The VCA *LNA+VCA+PGA+LPF* tab: The settings of the Low Noise Amplifier (LNA), VCA, Programmable Gain Amplifier (PGA), and the Low Pass Filter (LPF) are adjusted in this tab.

- LNA: Adjusts the gain of each channel, adjust the active termination resistors, and disable the LNA offset Integrator
- VCA: Adjusts the digital Time Gain Control (TGC) Attenuator
- PGA: Adjusts the PGA gain, Clamp Level, and disable both the overload clamp and the offset integrator
- LPF: Adjusts the LPF frequency

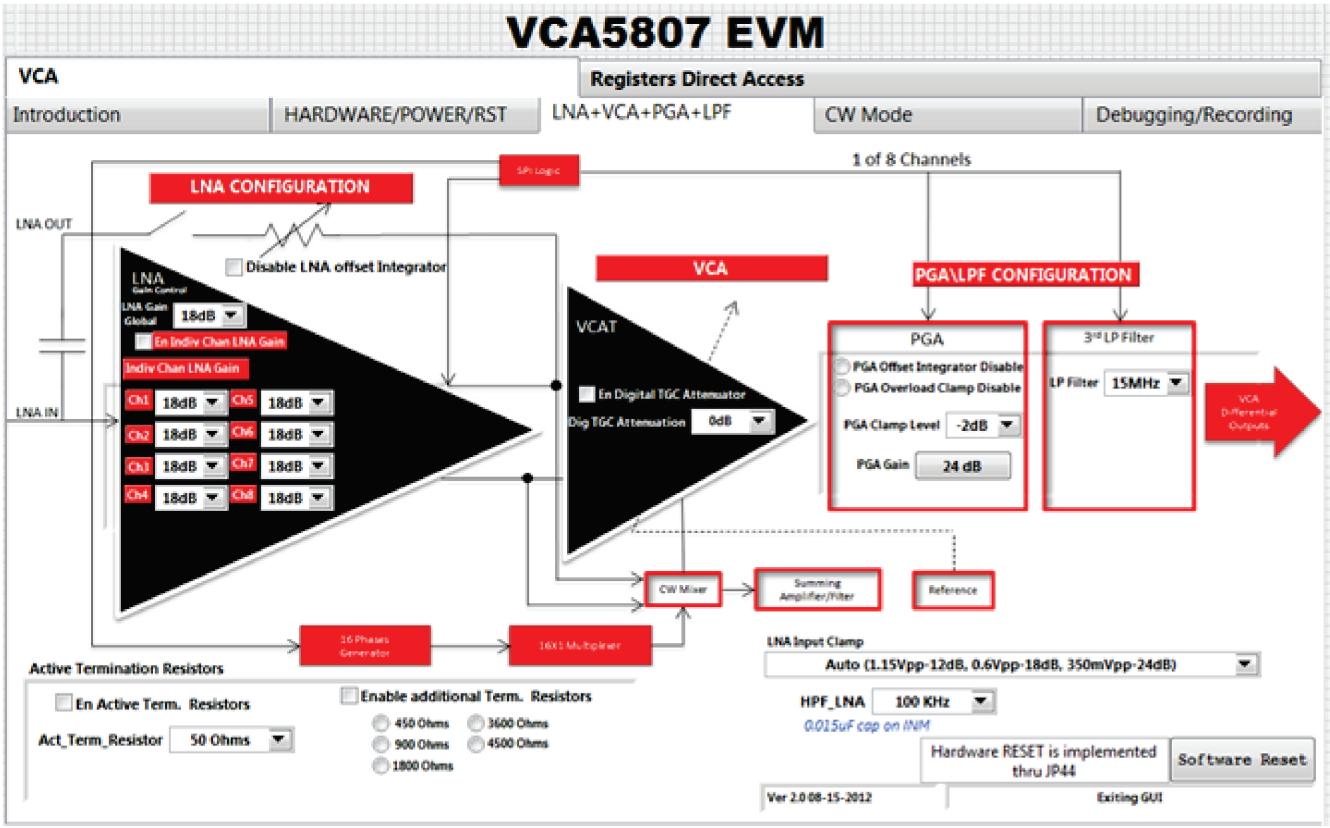

Figure 4. VCA LNA+VCA+PGA+LPF Tab of the VCA5807EVM GUI

The VCA *CW Mode* tab: The Continuous-wave (CW) Doppler mode is adjusted in this tab as well as the phases of each CW channel (1-8), the CW CLK, and the feedback resistors to control the gain. CH7 and CH8 are brought to the CW pins by using the PGA Test Mode.

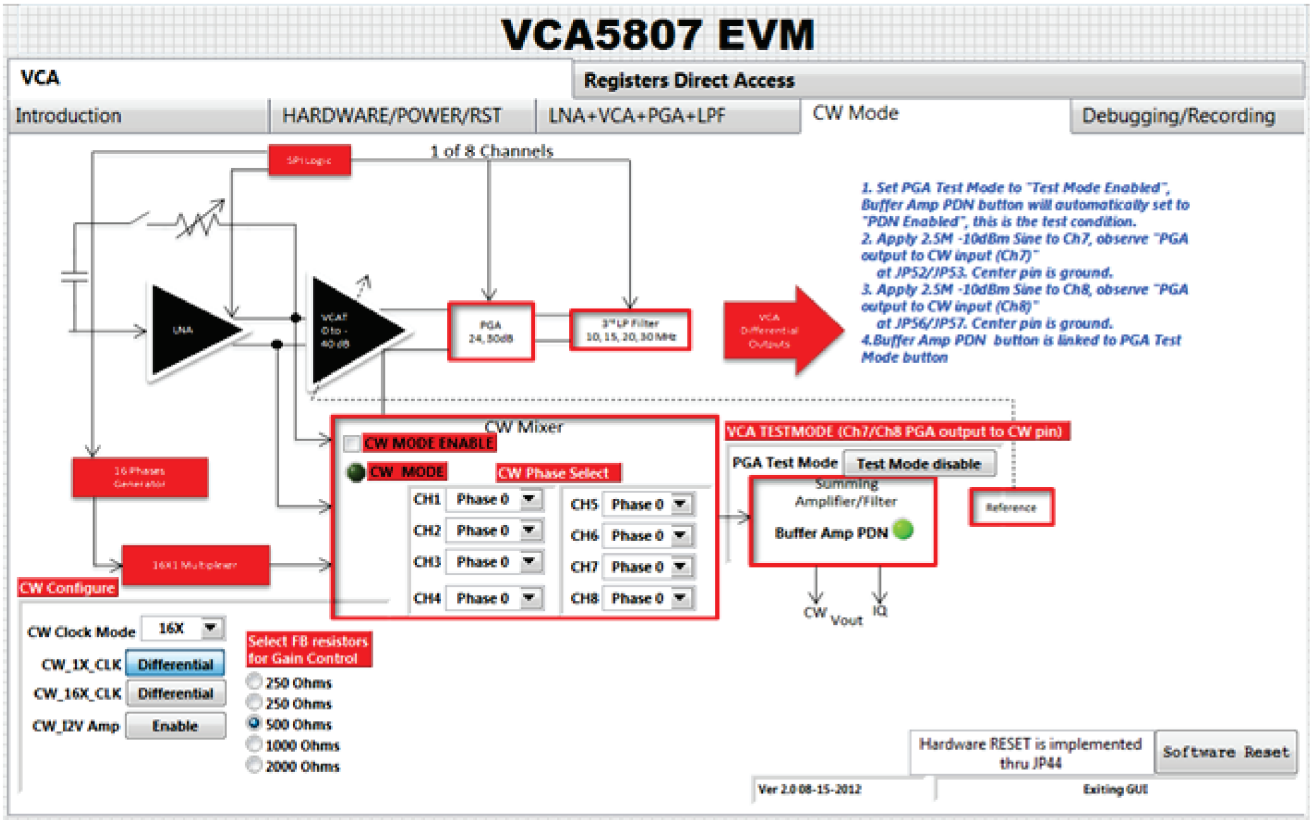

Figure 5. VCA CW Mode Tab

The VCA *Debugging/Recording* tab: Command executions are saved to a file in this tab. The file can be played back at any time by clicking on the **Exec CMD File** button. This tab also displays the Write Status, and the ability to see the digital waveform of the SCLK, SDATA, and SEN pins.

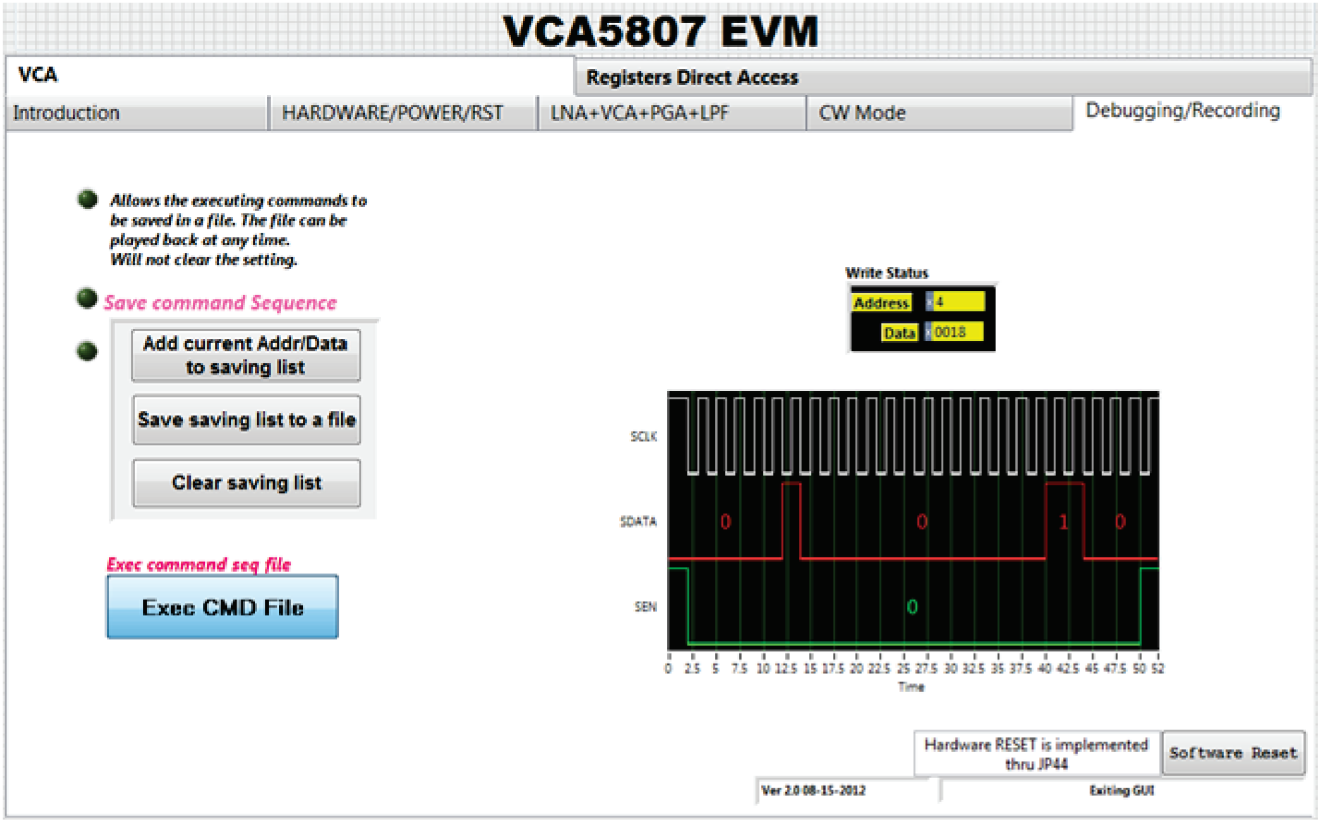

Figure 6. VCA Debugging/Recording Tab

4 Hardware

4.1 Introduction

The following illustration shows the setup of the VCA5807EVM and external connectors. For the default configuration as shown in Figure 1, it is unnecessary to have an external sampling clock and external Vcntl supply. The onboard CMOS clock and onboard Vcntl are used.

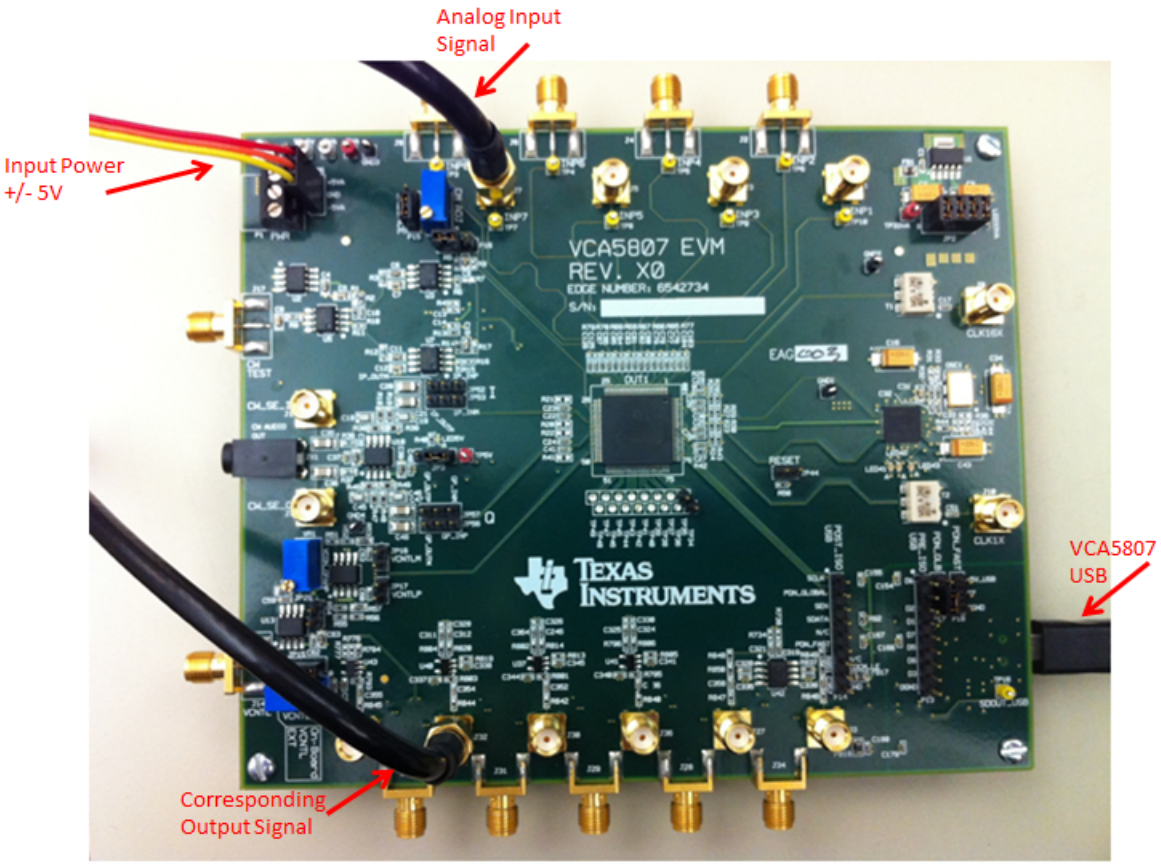

Figure 7. HW Setup

4.2 Board Configuration

Power up the VCA5807EVM by applying +5 V and –5 V to the P1 connector. After power up is complete, three green LEDs and three red LEDs (LED 41, LED42, and LED 43) are turned. Locations of LEDs are shown in Figure 8.

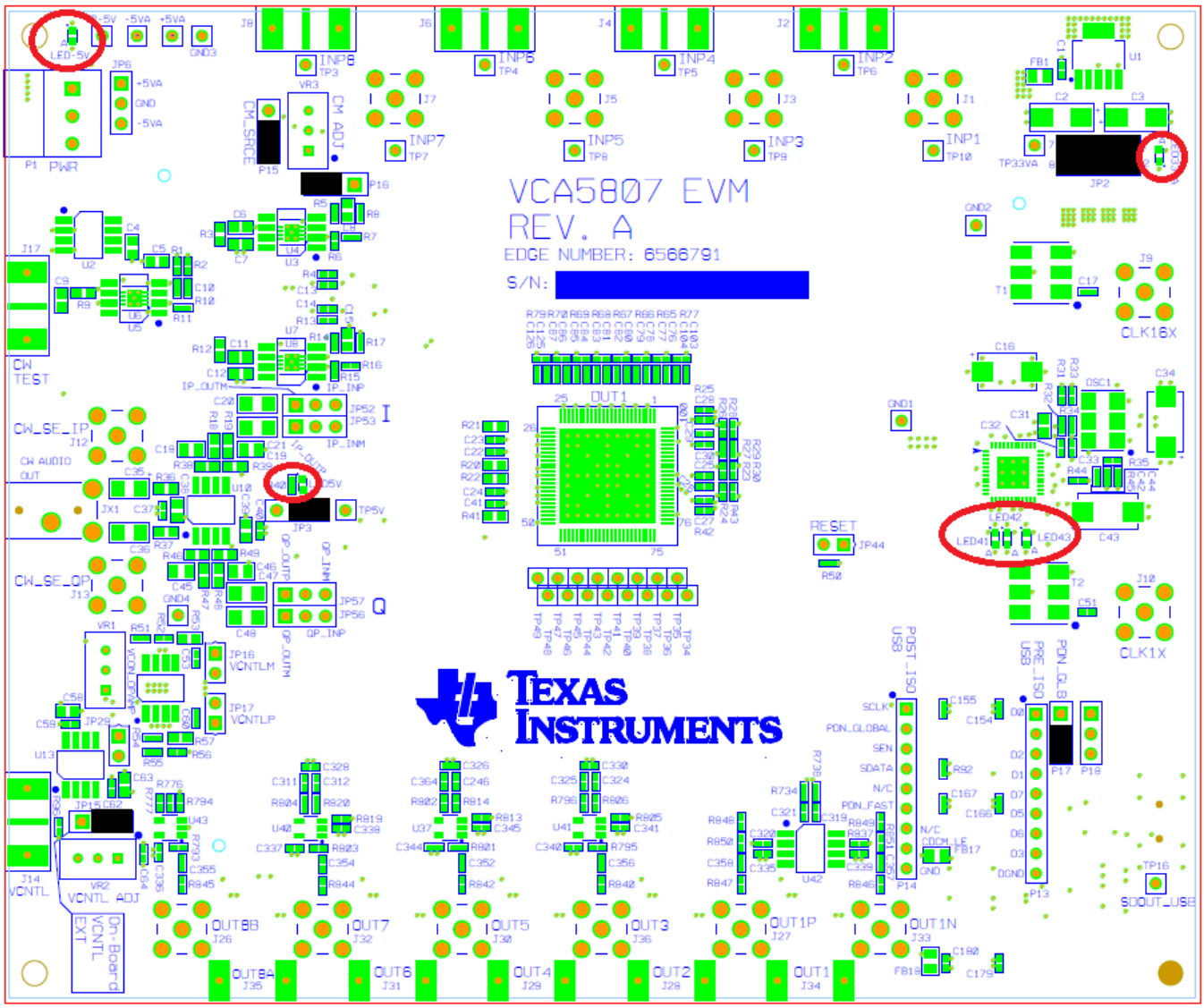

Figure 8. PCB Layout With Jumper Positions

4.3 Power

The power configuration of the board is shown in Figure 18, page 1 of the schematic. Refer to Table 2 for a list of important power components.

Table 2. Power Table

Connector	Description
P1/JP6	P1 is the +5-V and –5-V power supply connector. JP6 is the test point for +5-V/-5-V power supply.
JP3	Onboard 5-V enable. The configuration must be set up as shown in Figure 7 in order to use onboard 5-V supply.
TP-5V	-5-V supply test point
+5VA	+5-V supply test point
JP2	Onboard 3.3-VA enable. The configuration must be set up as shown in Figure 7 in order to use the onboard 3.3 V.
TP33VA	+3.3-VA supply test point
TP1 through TP4	Ground test points

4.4 Clock Buffer

The clock buffer drives the VCA5807 device. Each clock buffer output should only drive one VCA5807. Do not use one clock to drive multiple VCA5807s. This is due to the fact that the clock buffer's load capacitance increases by a factor of N, which then results in degraded falling and rising times. Select different clock inputs in the GUI. LEDs 41 and 42 demonstrate the PLL status of the clock buffer.

4.5 VCA Inputs

J1 through J8 are the analog input signals for CH1 through CH8. Connect to a signal generator. If the signal is too noisy, apply a bandpass filter between the generator and the SMA to get a better result. Use TP3-TP10 to see the input signal to the board.

4.6 VCA5807 Device

The VCA5807 device is a suitable ultrasound analog front end solution for high-end systems and portable systems. This device contains eight channels of VCA, and CW mixer. The VCA includes an LNA, Voltage-controlled Attenuator (VCAT), PGA, and an LPF. Each of these features is adjusted via the VCA5807 EVM GUI. For a more detailed explanation of the VCA5807 device please refer to the datasheet. The datasheet is found on the TI product folder at www.ti.com. (SLOS727)

4.7 VCA Outputs

J26 through J36 are the output signals for CH1 through CH8. All channels have a single-ended output through an OPA842 buffer amplifier. However, CH1 has the option of a fully differential output signal through a THS4130 amplifier. In order to use this amplifier, install R734 and R738 and remove R837, C317, and C318. CH8 also provides an added feature by allowing the choice of the OPA830 as the buffer amplifier. In order to use this amplifier, install R776 and R777 and remove U35.

4.8 CW Mode

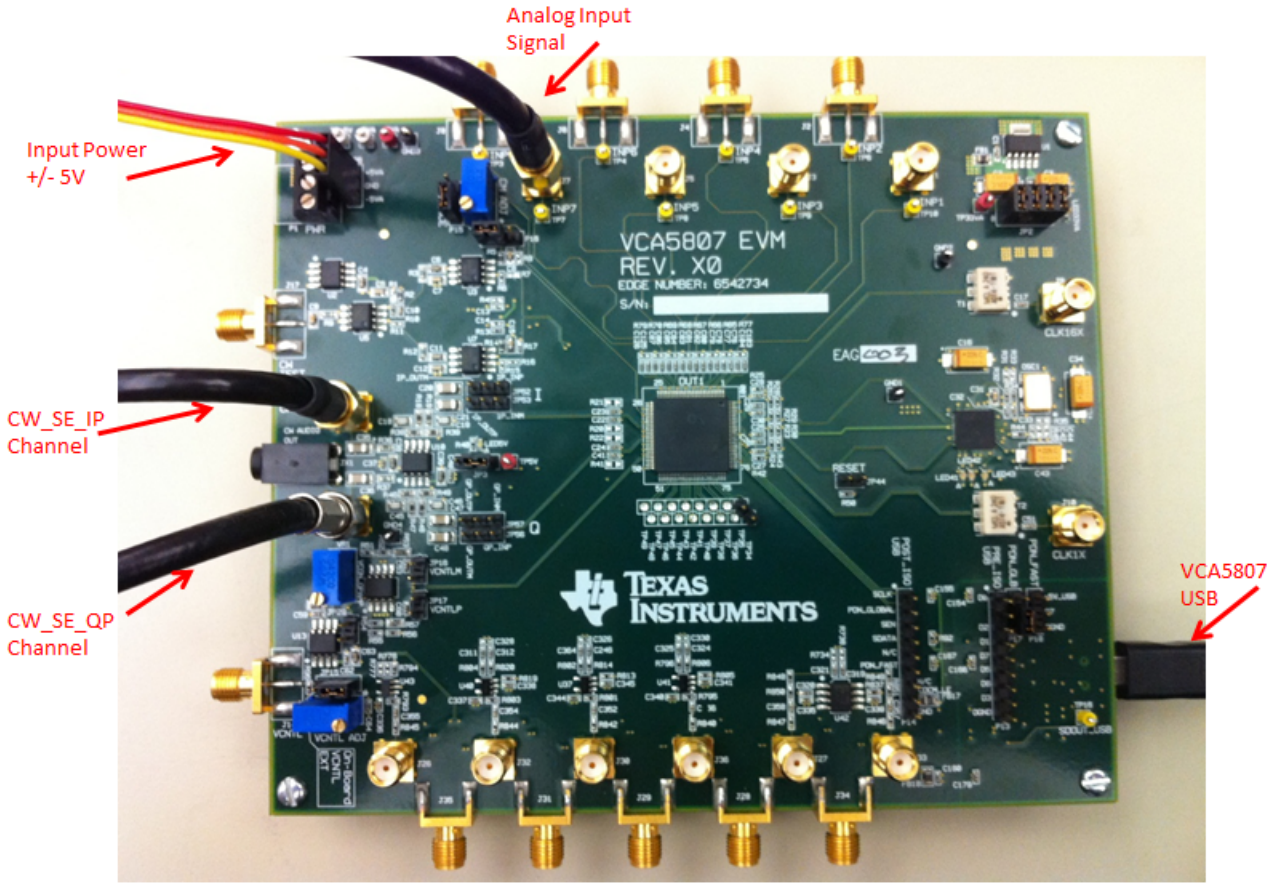

Figure 9. CW Mode Hardware Configuration

- Go to the *CW Mode* tab on the GUI.
- Check CW MODE ENABLE. LED41, LED42, and LED43 on the VCA5807EVM should all illuminate.
- Select 500 Ω for the gain control feedback resistor.

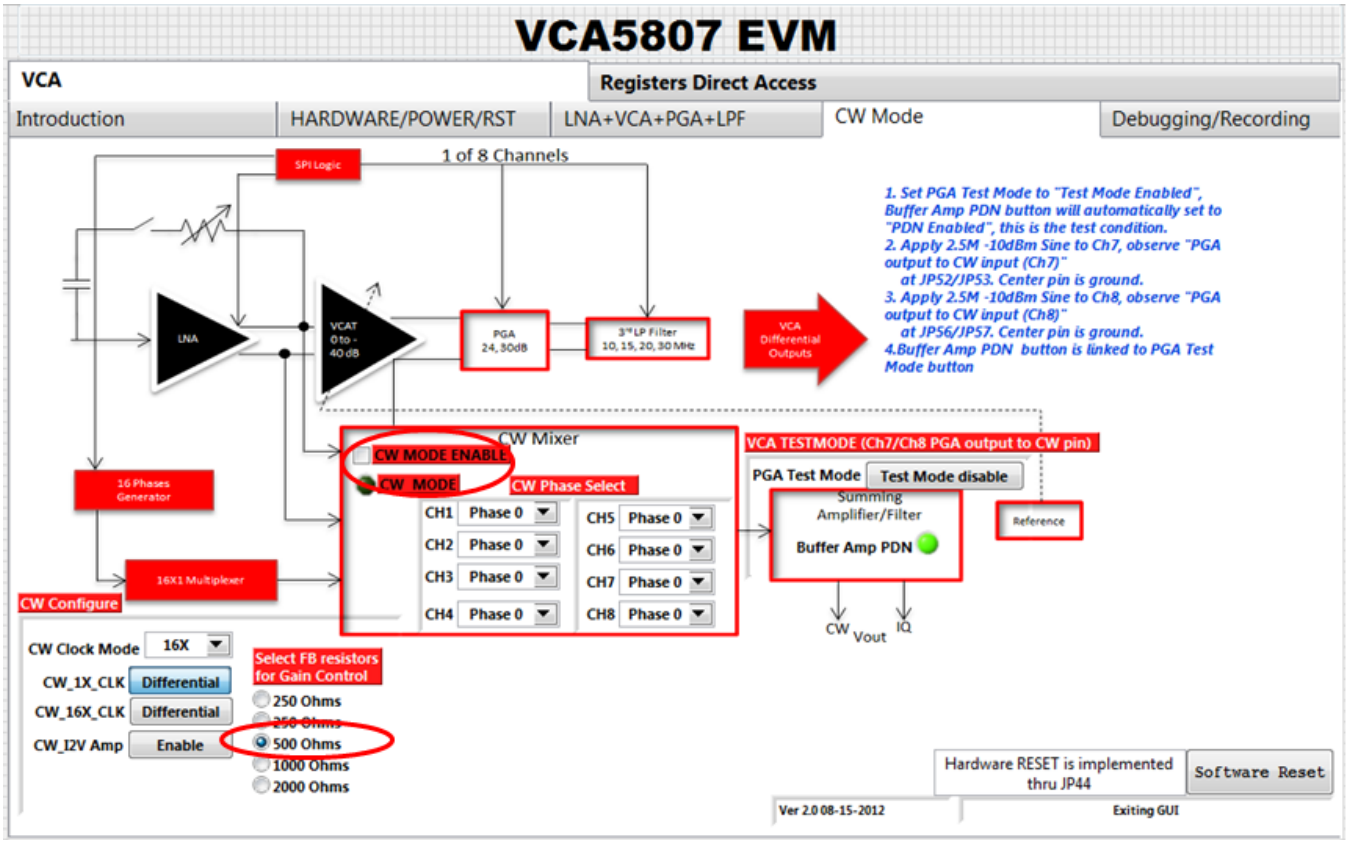

Figure 10. Switching to CW Mode

- Apply an analog signal (2.51 MHz, –10 dBm) to any analog input SMA.
- The CW outputs (J12, J13) display the frequency I and Q signals at 10 kHz as shown in Figure 11. The GUI Gain Control Feedback Resistor can vary the amplitude of the outputs.

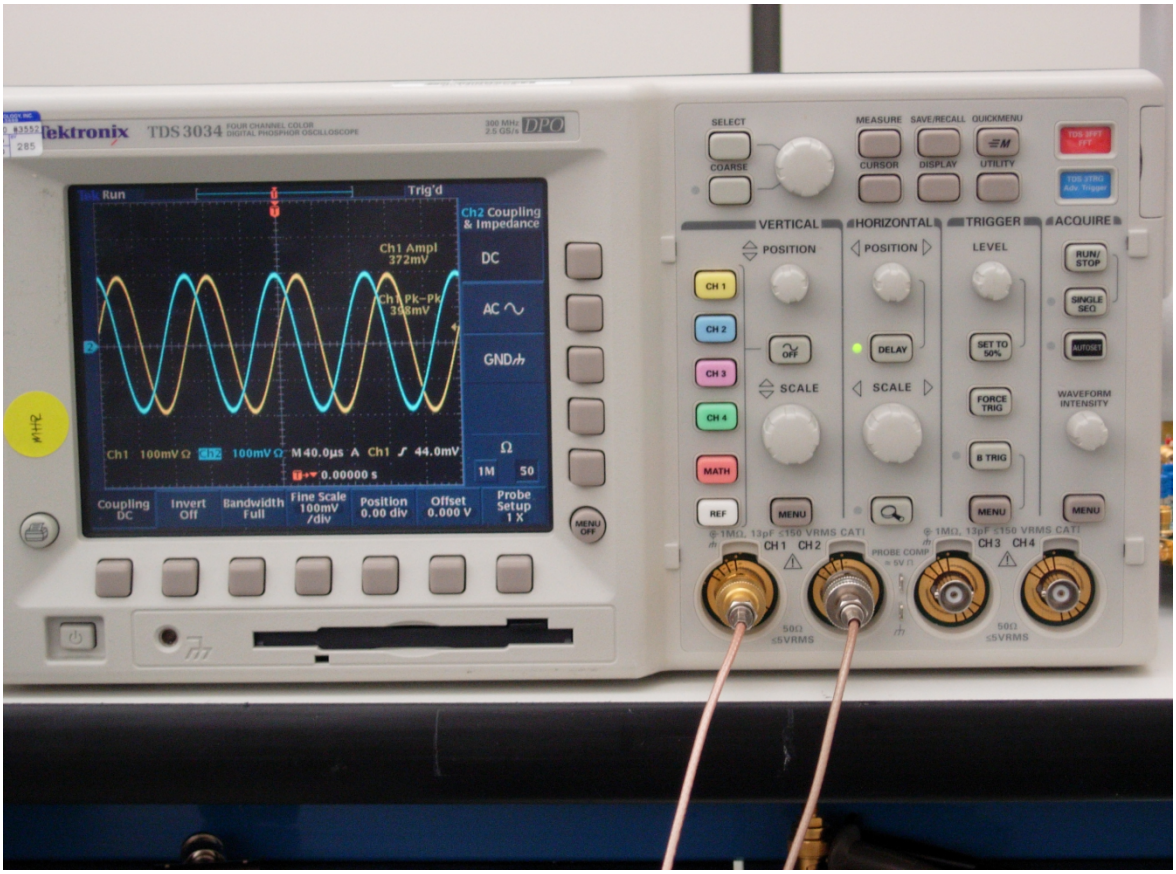

Figure 11. Oscilloscope

4.9 VControl

Switch between using the onboard Vcntl or the external Vcntl by using JP15. External Vcntl can range from 0 V to 1.5 V. If using the external Vcntl, then a DC voltage source must be connected to J14. The default setup uses onboard Vcntl. VR2 is used to make onboard Vcntl adjustments.

4.10 Serial Interface

The serial interface of the board is located on the bottom right-hand side. USB1 is the USB interface connector. P13 and P14 are test points for the USB data bus: From pin 1 to pin 9, the signals are D0, D4, D2, D1, D7, D5, D6, D3, and DGND. P14 on the VCA5807EVM is not installed.

5 Quick Start

This section assumes all engineering knowledge on the device and basic overview of the VCA5807EVM.

5.1 Test Setup

Connect the EVM as shown in . Typical input signals are 5 MHz at –32 dBm. This can be applied to any VCA input (J1-J8). If the signal is noisy, consider using a 5-MHz filter. Connect a scope or a spectrum analyzer to the corresponding VCA output in order to measure the gain on the channel.

5.2 Power Up VCA5807EVM

Connect ±5-V power to the board. No other power connection is needed.

5.3 Launch the VCA5807 GUI

Launch the VCA5807EVM GUI. Execute a software reset with the GUI and verify the current consumption drops from ≈0.762 A to ≈0.646 A. Enable the Active Termination Resistor of 50 Ohms (check the box) on the *LNA+VCA+PGA+LPF* tab. This tab is also used to vary the gain on each channel. However, with the default settings as shown in , the gain should be 42 dB overall. Therefore, with an input signal of 5 MHz at –32 dBm, load resistance of 50 Ω, and an overall gain of 42 dB, the output should read ≈4 dBm or 1 Vpp.

For more details and other modes for testing and evaluating the VCA5807 device, please refer to the previous pages of this development guide.

Appendix A Bill of Materials (BOM)

This section contains Table 3, the BOM for the VCA5807EVM.

Table 3. Bill of Materials

Item	Qty	MFG	MFG Part#	REF DES	Description	Value or Function
1	41	AVX	0402YC104KAT2A	C17, C25, C26, C29, C30, C33, C37, C40, C51, C59, C62, C64, C76, C78, C80, C82, C84, C86, C94, C95, C96, C97, C98, C99, C101, C103, C125, C130, C131, C132, C133, C134, C135, C136, C137, C138, C139, C140, C141, C154, C155	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,16V,10%,0.1uF
2	2	AVX	0402YC471KAT2A	C53,C60	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,16V,10%,470pF
3	40		0402YC104KAT2A	C160, C162, C163, C165, C166, C167, C170, C171, C173, C174, C177, C178, C179, C180, C246, C265, C267, C294, C295, C308, C309, C310, C311, C312, C313, C314, C315, C316, C317, C318, C319, C320, C321, C322, C323, C324, C325, C364, C365, C366		
4	2	AVX	0402YC222KAT2A	C10, C74	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,16V,10%,2200pF
5	11	KEMET	C0402C103K3RACTU	C290, C350, C351, C352, C353, C354, C355, C356, C357, C358, C363	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,0.01uF,25V,10%,X7R
6	23	KEMET	C0402C104K8PAC	C1, C68, C69, C152, C291, C333, C334, C335, C336, C337, C338, C339, C340, C341, C342, C343, C344, C345, C346, C347, C360, C361, C362	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,0.1uF,10V,10%,X5R
7	2	KEMET	C0402C152J5GACTU	C73, C89	CAP,SMT,0402	CAPACITOR,SMT,0402,CERAMIC,1500pF,50V,5%,C0G/NP0
8	8	TDK	C1005X5R0J105M	C77, C79, C81, C83, C85, C87, C104, C126	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,1.0uF,6.3V,20%,X5R
9	2	AVX	0402ZD105KAT2A	C71, C72	CAP,SMT,0402	CAPACITOR,SMT,0402,CERAMIC,1.0uF,10V,20%,X5R
10	8	AVX	0402YC153KAT2A	C107, C108, C109, C116, C118, C119, C121, C123	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,15000pF,16V,10%,X7R
11	1	AVX	04025C102KAT2A	C32	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,1000pF,50V,10%,X7R
12	4	AVX	04025C332KAT2A	C22, C23, C24, C41	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,3300pF,50V,10%,X7R
13	2	AVX	04025A470JAT2A	C175, C176	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,47pF,50V,5%,NPO
14	7	AVX	06033C104JAT2A	C5, C7, C8, C12, C15, C88, C90	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,0.1uF,25V,5%,X7R
15	7	AVX	0603YD105KAT2A	C38, C39, C58, C63, C159, C161, C172	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,1.0uF,16V,10%,X5R
16	1	TAIYO YUDEN	AMK107BJ226MA-T	C9	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,22uF,4V,20%,X5R
17	1	AVX	06036D106MAT2A	C4	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,10uF,6.3V,20%,X5R
18	2	AVX	0603YD105KAT2A	C75, C129	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,1.0uF,16V,10%,X5R
19	2	MURATA	GRM188C80G475KE19	C6, C11	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,4.7uF,4V,10%,X6S (TI-F)
20	3	TAIYO YUDEN	JMK107BJ106MA-T	C31, C348, C349	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,10uF,6.3V,20%,X5R
21	4	KEMET	C0805C332F3GACTU	C18, C19, C45, C46	CAP,SMT,0805	CAPACITOR,SMT,0805,CERAMIC,3300pF,25V,1%,C0G(NP0)
22	6	AVX	1206YD226KAT2A	C20, C21, C35, C36, C47, C48	CAP,SMT,1206	CAPACITOR,SMT,1206,CERAMIC,22uF,10V,10%,X5R
23	4	VISHAY SPRAGE	293D226X9016D2TE3	C16, C34, C43, C128	CAP,SMT,7343	CAP,TAN,SMT, 22uF,16V,+/-10%,-55~85C
24	4	AVX	TPSC226K016R0375	C2, C3, C70, C151	CAPACITOR,SMT,TANT	10%, 16V, 22uF
25	14	AMPHENOL	901-144-8	J1, J3, J5, J7, J9, J10, J12, J13, J26, J27, J30, J32, J33, J36	CONNECTOR,SMA	SMA COAX STRAIGHT PCB CURRENT P/N IS 901-144-8RFX

Table 3. Bill of Materials (continued)

Item	Qty	MFG	MFG Part#	REF DES	Description	Value or Function
26	12	STEWARD	HI0805R800R-00	FB1, FB6, FB7, FB8, FB9, FB10, FB11, FB12, FB13, FB14, FB17, FB18	FERRITE BEAD,SMT,2P	FERRITE,SMT,0805,80 OHM@100MHz,5A
27	1	MOLEX	39357-0003	P1	HEADER, THRU, 3P	HEADER, THRU, POWER, 3P,3.5MM, EUROSTYLE
28	1	SAMTEC	TSW-104-07-G-D	JP2	HEADER,THU	HEADER,THU,8P,2X4,MALE,DUAL ROW,100LS,100TL
29	1		PBC09SAAN	P13	HEADER,THU,9P	HEADER,THU,MALE,0.1LS,9P,1X9,335H,120TL
30	4	TYCO ELECTRONICS	4-103239-0x2	JP16, JP17, JP29, JP44	HEADER,THU,JUMPER	MALE,2PIN,.100CC MAKE FROM 4-103239-0x2
31	11	TYCO ELECTRONICS	4-103239-0x3	JP3, JP6, JP15, JP52, JP53, JP56, JP57, P15, P16, P17, P18	HEADER,THU,JUMPER	MAKE FROM 4-103239-0
32	3	NATIONAL SEMI	LME49990MA/NOPB	U3, U5, U7	IC,SMT,8P	ULTRA LOW DISTORTION ULTRA LOW NOISE OPAMP
33	1	TI	THS4130CD	U42	IC,SMT,8P	HI-SPEED,LOW NOISE,FULL-DIFF,1I/O AMP,SO-8
34						
35	1	TEXAS INSTRUMENTS	CDCM7005RGZ	CLK_BUF	IC,SMT,QFN-48	3.3-V HIGH PERFORMANCE CLOCK SYNTHESIZER AND JITTER CLEANER
36	3	TI	ISO7240MDW	U16, U20, U21	IC,SMT,SOIC-16W	QUAD DIGITAL ISOLATORS
37	1	TI / BURR-BROWN	OPA211AID	U13	IC,SMT,SOIC-8	1.1nV/Hz NOISE LOW POWER PRECISION OPERATIONAL AMPLIFIER
38	1	TI	OPA2614ID	U10	IC,SMT,SOIC-8	DUAL HI GAIN BWIDTH HI OUTPUT CURRENT OPAMP WITH CURRENT LIMIT
39	1	BURR-BROWN / TI	REF5025AID	U2	IC,SMT,SOIC-8	LOW-NOISE VERY LOW DRIFT PRECISION VOLTAGE REFERENCE,2.5V
40	2	TI	THS4131ID	U15, VCON_OPAMP	IC,SMT,SOIC-8	HIGH-SPEED LOW NOISE DIFFERENTIAL I/O AMPLIFIERS
41	1	TI	TPS79633DCQR	U1	IC,SMT,SOT223-6	ULTRALOW-NOISE HI PSRR FAST RF 1-A LDO LINEAR REGULATOR,3.3V
42	1	TI / BURR-BROWN	OPA830IDBV	U43	IC,SMT,SOT23-5	LOW POWER SINGLE SUPPLY WIDEBAND OPAMP
43	8	TI / BURR-BROWN	OPA842IDBV	U35, U36, U37, U38, U39, U40, U41, U44	IC,SMT,SOT23-5	WIDEBAND,LOW DIST,UNITY-GAIN STABLE,VOLTAGE-FEEDBACK OPAMP
44	1	FUTURE TECHNOLOGY DEVICE INT.	FT245RL	U19	IC,SMT,SSOP-28	USB FIFO IC INCORPORATE FTDICHIP-ID SECURITY DONGLE
45	3	PANASONIC	LNJ208R82RA	LED41, LED42, LED43	LED,SMT,0603	LED,SMT,0603,ULTRA BRIGHT RED,1.92V
46	3	PANASONIC	LNJ308G8PRA	LED-5V, LED33VA, LED5V	LED,SMT,0603	LED,SMT,0603,PURE GREEN,2.03V
47						
48						
49	6	VENKEL	CR0402-16W-000T	R2, R5, R14, R63, R71, R93	RES,SMT,0402	RESISTOR,SMT,0402,0 OHM,1/16W,ZERO JUMPER
50	17	VISHAY	CRCW0402000Z	R821, R822, R823, R824, R825, R826, R827, R828, R829, R830, R831, R832, R833, R834, R835, R836, R837	RES,SMT,0402	ZERO OHM JUMPER,SMT,0402,THICK FILM,0 OHM,1/16W,5%
51	2	VISHAY	CRCW04021001F100	R50, R92	RES,SMT,0402	RESISTOR,SMT,0402,1K,1/16W,1%,100ppm
52	1	VISHAY	CRCW04021002F100	R95	RES,SMT,0402	RESISTOR,SMT,0402,10K,1/16W,1%,100ppm
53	2	VISHAY	CRCW04022002F100	R44, R91	RES,SMT,0402	RESISTOR,SMT,0402,20K,1/16W,1%,100ppm
54						
55	37	VISHAY	CRCW04024990F100	R80, R81, R82, R730, R731, R736, R793, R794, R795, R796, R797, R798, R799, R800, R801, R802, R803, R804, R805, R806, R807, R808, R809, R810, R811, R812, R813, R814, R815, R816, R817, R818, R819, R820, R852, R853, R854	RES,SMT,0402	RES,SMT,499 OHM,1/16W,1%,100ppm

Table 3. Bill of Materials (continued)

Item	Qty	MFG	MFG Part#	REF DES	Description	Value or Function
56	11	VISHAY	CRCW040249R9F100	R838, R839, R840, R841, R842, R843, R844, R845, R846, R847, R855	RES,SMT,0402	RES,SMT,49.9 OHM,1/16W,1%,100ppm
57	1	VISHAY	CRCW04025110F100	R58	RES,SMT,0402	RESISTOR,SMT,0402,511 OHM,1/16W,1%,100ppm
58	1	PANASONIC	ERJ-2GE0R00X	R56	RES,SMT,0402	RESISTOR/JUMPER,SMT,0402,0 OHM,5%,1/16W
59	5	PANASONIC	ERJ-2GEJ131	R28, R29, R30, R32, R43	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,5%,1/16W,130
60						
61	4	PANASONIC	ERJ-2GEJ391	R51, R52, R54, R55	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,5%,1/16W,390
62						
63	5	PANASONIC	ERJ-2GEJ820	R23, R24, R26, R27, R34	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,5%,1/16W,82
64	5	PANASONIC	ERJ-2RKF1000X	R25, R40, R42, R76, R78	RES,SMT,0402	RESISTOR,SMT,0402,100 OHM,1%,1/10W
65	2	PANASONIC	ERJ-2RKF2001X	R850, R851	RES,SMT,0402	RESISTOR,SMT,0402,2.00K,1%,1/16 W
66	1	PANASONIC	ERJ-2RKF3320X	R59	RES,SMT,0402	RESISTOR,SMT,0402,332 OHM,1%,1/16W
67	2	PANASONIC	ERJ-2RKF4020X	R848, R849	RES,SMT,0402	RESISTOR,SMT,0402,402 OHM,1%,1/16W
68	1	PANASONIC	ERJ-2RKF49R9X	R96	RES,SMT,0402	RESISTOR,SMT,0402,49.9 OHM,1%,1/16W
71	2	VISHAY/DALE	CRCW0603200RFKEA	R53, R57	RES,SMT,0603	RESISTOR,SMT,0603,1%,1/10W,200 OHM
73	1	PANASONIC	ERJ-3GSYJ153	R60	RES,SMT,0603	RESISTOR,SMT,0603,5%,1/10W,15K
74	2	VISHAY	TNPW0603475RBEEA	R3, R12	RES,SMT,0603	RESISTOR,SMT,0603,THIN FILM,475 OHM 0.1%,1/10W,25ppm
75	8	VISHAY	TNPW0603499RBEEA	R18, R19, R38, R39, R46, R47, R48, R49	RES,SMT,0603	RESISTOR,SMT,0603,THIN FILM,499 OHM 0.1%,1/10W,25ppm
76	3	VISHAY	TNPW060349R9BEEA	R9, R36, R37	RES,SMT,0603	RESISTOR,SMT,0603,THIN FILM,49.9 OHM,0.1%,1/10W
77	1	KYCON	STX-3000	JX1	STEREO PHONE JACK,THU,3 PIN	STEREO PHONE JACK,THU,3 PIN,3.5mm
78	3	KEYSTONE ELECTRONICS	5000	TP2, TP33VA, TP5V	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS, 120TL, RED
79	4	KEYSTONE ELECTRONICS	5001	GND1, GND2, GND3, GND4	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS, 120TL, BLACK
80	2	KEYSTONE ELECTRONICS	5002	TP1, TP-5V	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS, 120TL, WHITE
81	9	KEYSTONE ELECTRONICS	5004	TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP16	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS, 120TL, YELLOW
82						
83	2	MINI-CIRCUITS	ADT4-1WT	T1, T2	TRANSF,SMT,6P	RF TRANSFORMER WIDEBAND, 2-775 MHz, 50 OHM
84	2	BOURNS	3296W-1-103	VR2, VR3	TRIMPOT,THU,3P	TRIMPOT,THU,10K,10%,0.5W,100ppm,25T
85	1	BOURNS	3296W-1-205	VR1	TRIMPOT,THU,3P	TRIMPOT,THU,2M,10%,0.5W,100ppm,25T
86	2	PANASONIC	ERA-2AEB152X	R10, R64	RES,SMT,0402	RESISTOR,SMT,0402,THIN FILM,1.5K,0.1%,1/16W,10ppm, **Tolerance important**
87	2	PANASONIC	ERA-2AEB202X	R61, R74	RES,SMT,0402	RESISTOR,SMT,0402,THIN FILM,2K,0.1%,1/16W,10ppm, **Tolerance important**
88	8	PANASONIC	ERJ-2GEJ49R9(UN)	R65, R66, R67, R68, R69, R70, R77, R79	RES,SMT,0402	(UNINSTALLED PART)
89	4	PANASONIC	ERJ-3GSYJ102(UN)	R20, R21, R22, R41	UNINSTALLED	(UNINSTALLED PART)
90	12	UNINSTALLED	CRCW04020000Z0ED(UN)	R1, R6, R7, R8, R11, R15, R16, R17, R62, R72, R73, R75	UNINSTALLED	UNINSTALLED
91	1		PBC09SAAN	P14	UNINSTALLED	HEADER,THU,MALE,0.1LS,9P,1X9,335H,120TL
92						
93	4	AVX	0402YC104KAT2A(UN)	C27, C28,C100, C102	UNINSTALLED	**UNINSTALLED**
94	2	TAIYO YUDEN	LMK105BJ104KV- F	C42, C44	CAP,SMT,0402	CAPACITOR,SMT,0402,CERAMIC,10V,Y5V,0.1uF,20%

Table 3. Bill of Materials (continued)

Item	Qty	MFG	MFG Part#	REF DES	Description	Value or Function
95	2	KEMET	C0402C152J5GACTU	C13, C14	CAP,SMT,0402	CAPACITOR,SMT,0402,CERAMIC,1500pF,50V,5%,C0G/NP0
96	2	SUSUMU	RG1005N202B	R4, R13	UNINSTALLED	RESISTOR,SMT,0402,THIN FILM,2K,0.1%,1/16W,10ppm,**(UNINSTALLED)**
97	1	PANASONIC	ERJ-2GEJ820	R33	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,5%,1/16W,82 **(UNINSTALLED)**
98	1	PANASONIC	ERJ-2GEJ131	R31	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,5%,1/16W,130 **(UNINSTALLED)**
99	1	PANASONIC	ERJ-2GEJ161	R35	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,5%,1/16W,160 **(UNINSTALLED)**
100	3	TI	LMH6629SDE/NOPB	U4, U6, U8	IC,SMT,DFN-8	ULTRA-LOW NOISE,PRECISION OPERATIONAL AMPLIFIERS
101	8	PANASONIC	ECJ-0EC1H470J	C332, C329, C330, C331, C326, C327, C328, C359	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,47pF,50V,5%,NPO
102	2	AVX	06033C104JAT2A	C91, C92	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,0.1uF,25V,5%,X7R
103	1	PANASONIC	ECJ-1VB1C105K	C93	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,1.0uF,16V,10%,X5R
104	1	VISHAY	CRCW04024701F100	R45	RES,SMT,0402	RESISTOR,SMT,0402,4.7K,1/16W,1%,100ppm
105	1	TYCO ELECTRONICS	4-103239-0x3	P18	UNINSTALLED	MAKE FROM 4-103239-0, DNI
106	4	Vishay	CRCW04020000Z0ED(UN)	R734, R738, R776, R777	UNINSTALLED	VISHAY_0402_1x0.5x0.35mm_016H
107	16	COMPONENTS CORP	TP105-01-04	TP34, TP35, TP36, TP37, TP38, TP39, TP40, TP41, TP42, TP43, TP44, TP45, TP46, TP47, TP48, TP49	UNINSTALLED	TEST POINTS,THU,SMALL,TL-70, YELLOW, DNI
108	1	ADVANCED CONNECTEK	MNE20-5K5P10	USB1	CONN,SMT,5P	MINI-AB USB OTG RECEPTACLE R/A SMT TYPE, **Use 670-1523-1-ND instead.**
109	11	EFJOHNSON	142-0721-891	J2, J4, J6, J8, J14, J17, J28, J29, J31, J34, J35	CONN,THU,SMA JACK	SMA JACK END LAUNCH, 0.080 PCB THICK, **Use J630-ND for board thickness of .042 or J502-ND for .062 or J992-ND for .068**
110	1	CONNOR WINFIELD	CWX813-10.0M	X1	OSC,SMT,4P	OSCILLATOR,SMT,4P,3.3V,+/-25ppm,-20~70C,10.000 MHz, **Use FVXO-PC73B-640-ND instead**
111	1		VCA5807PZP	DUT1	Customer Supplied	"IC, Fully Integrated, 8-Channel Voltage Controlled Amplifier for Ultrasound with Passive CW Mixer, 0.75 nV/rtHz, 99 mW/CH "
112	1	OSC,SMT,6P	VX-7040-ECE-KXX-0-640M000	OSC1	OSC,SMT,6P	VCXO,SMT,3.3V,40Mhz 5.0x7.5x1.8mm (Customer Supply)
113	15	Molex	15-29-1025		SHUNT-JUMPER	CONN SHUNT CLOSED TOP .100 GOLD
	Special Instructions and Notes:					
	1. Include extra Shunt-Jumpers with board.				* Alternative Part suggested	
					* Orange=Tolerance is significant	
	Note: Asterisk(*) next to part manufacturer's name denotes possible long lead time item.				* Green= Exact part, No Substitutions	
					* Blue= Uninstalled	
					* Yellow= TI Provided part	

Appendix B PCB Layout and Schematics

B.1 PCB Layout

Figure 12 through Figure 17 show the PCB layouts for this EVM.

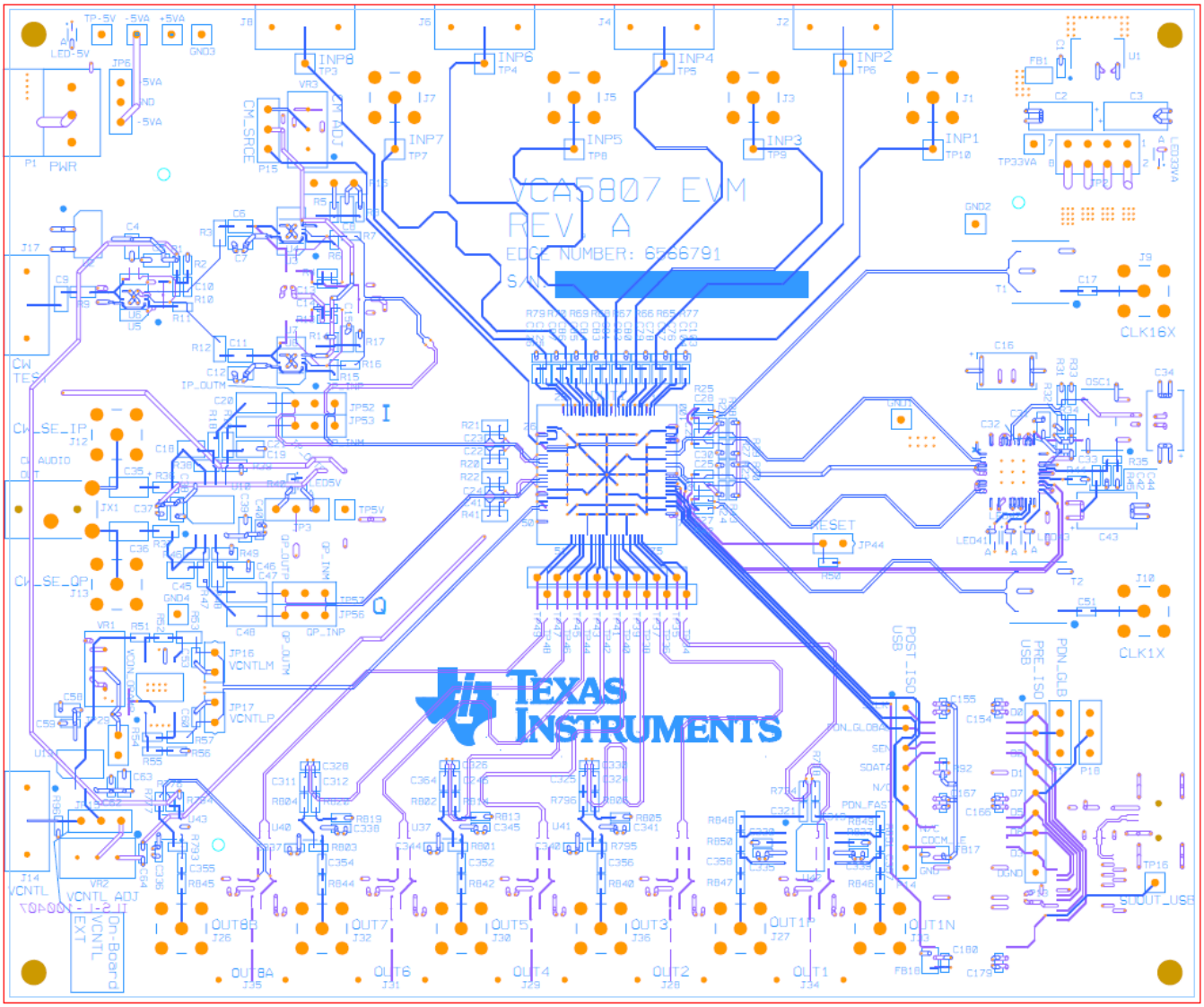

Figure 12. Top Layer - Signal

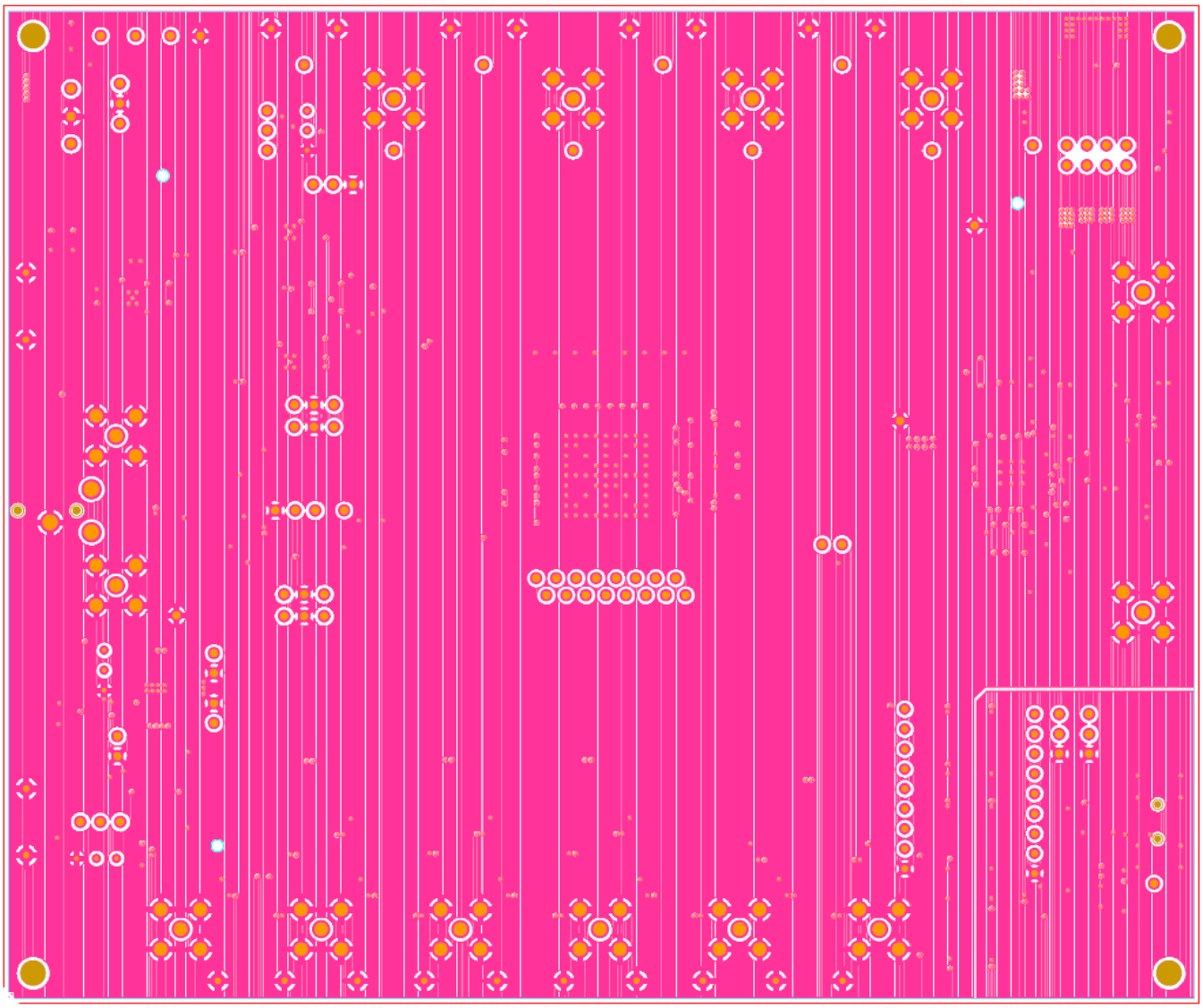

Figure 13. Second Layer - Ground

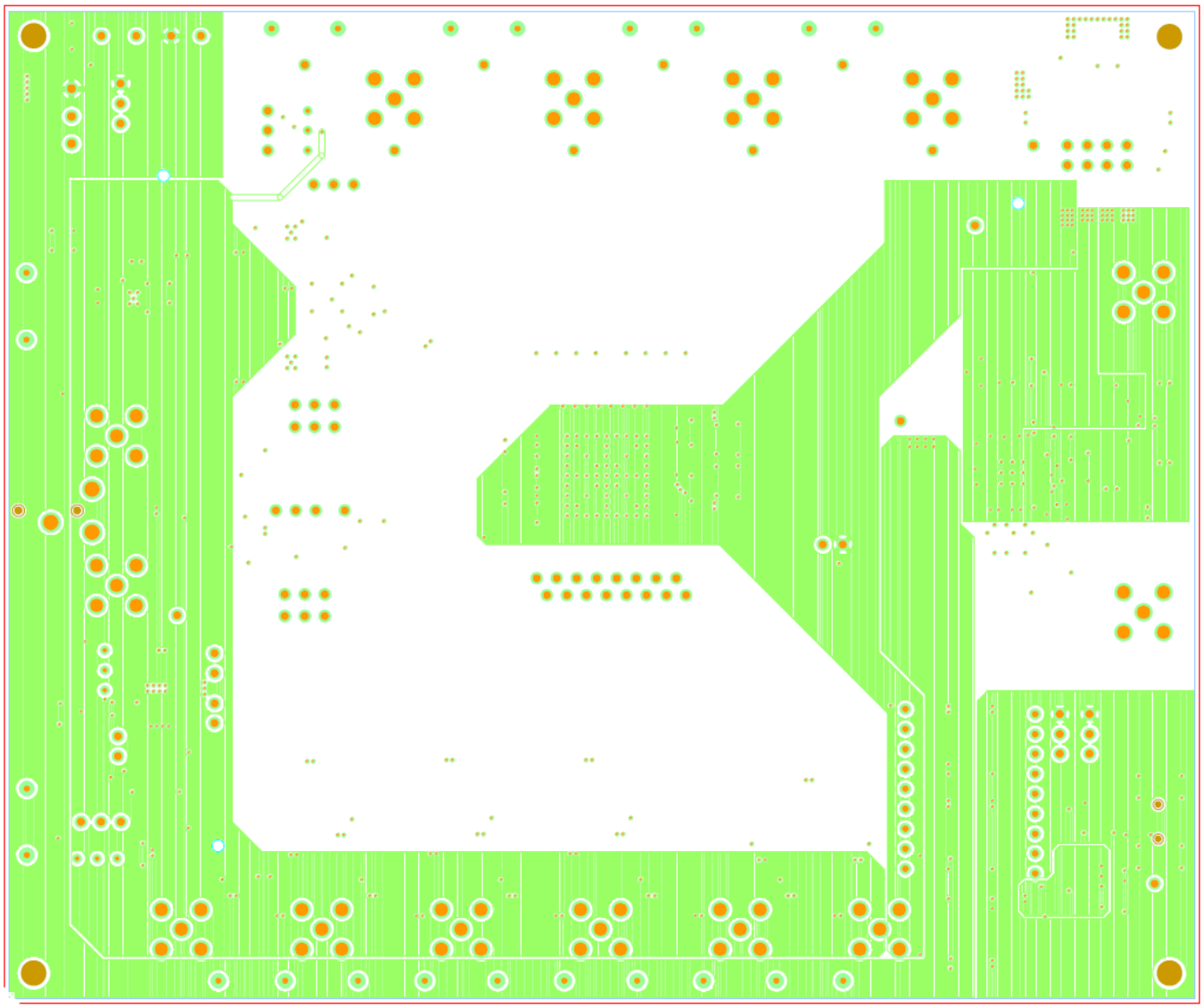

Figure 14. Third Layer - Power

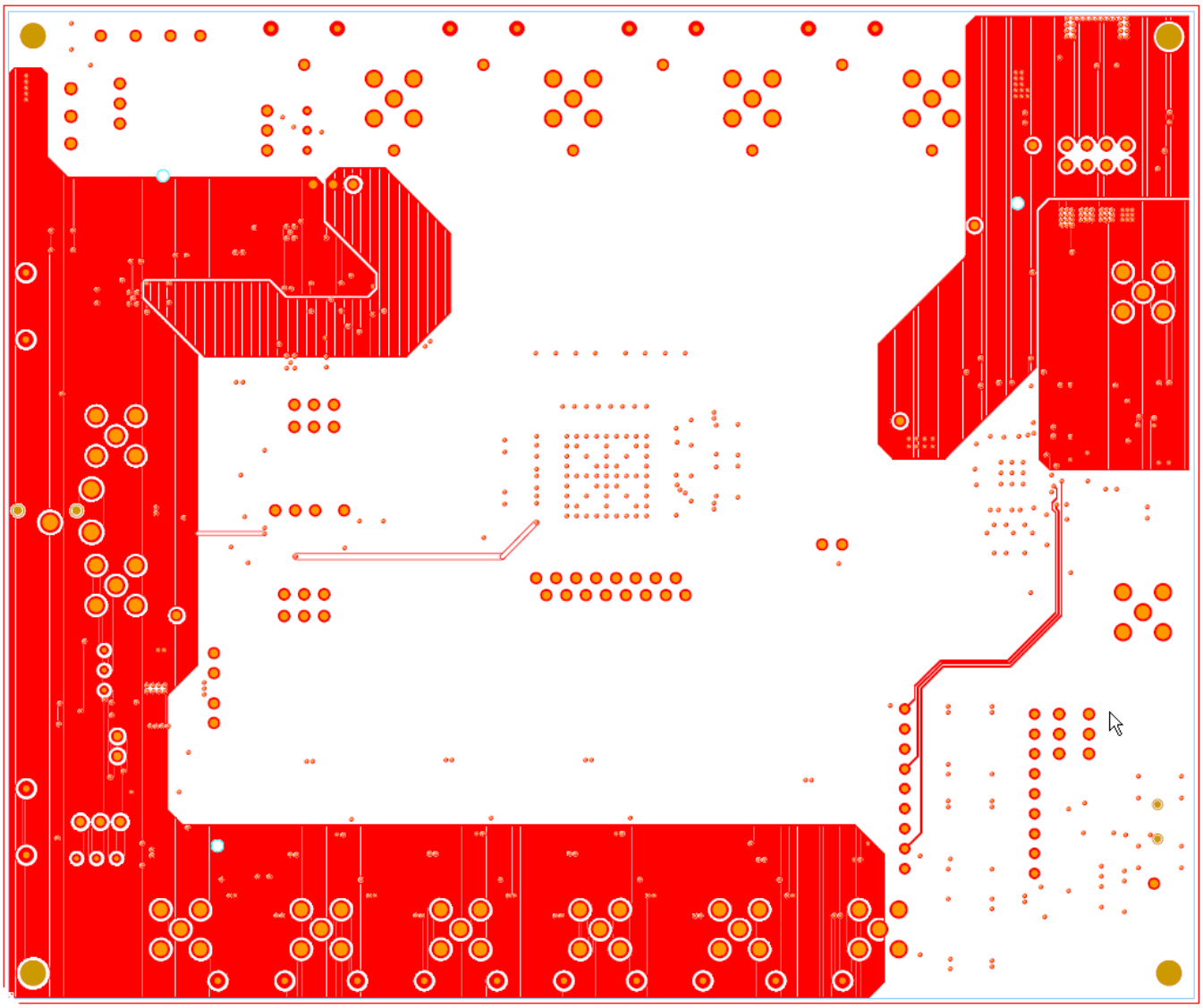

Figure 15. Fourth Layer - Signal

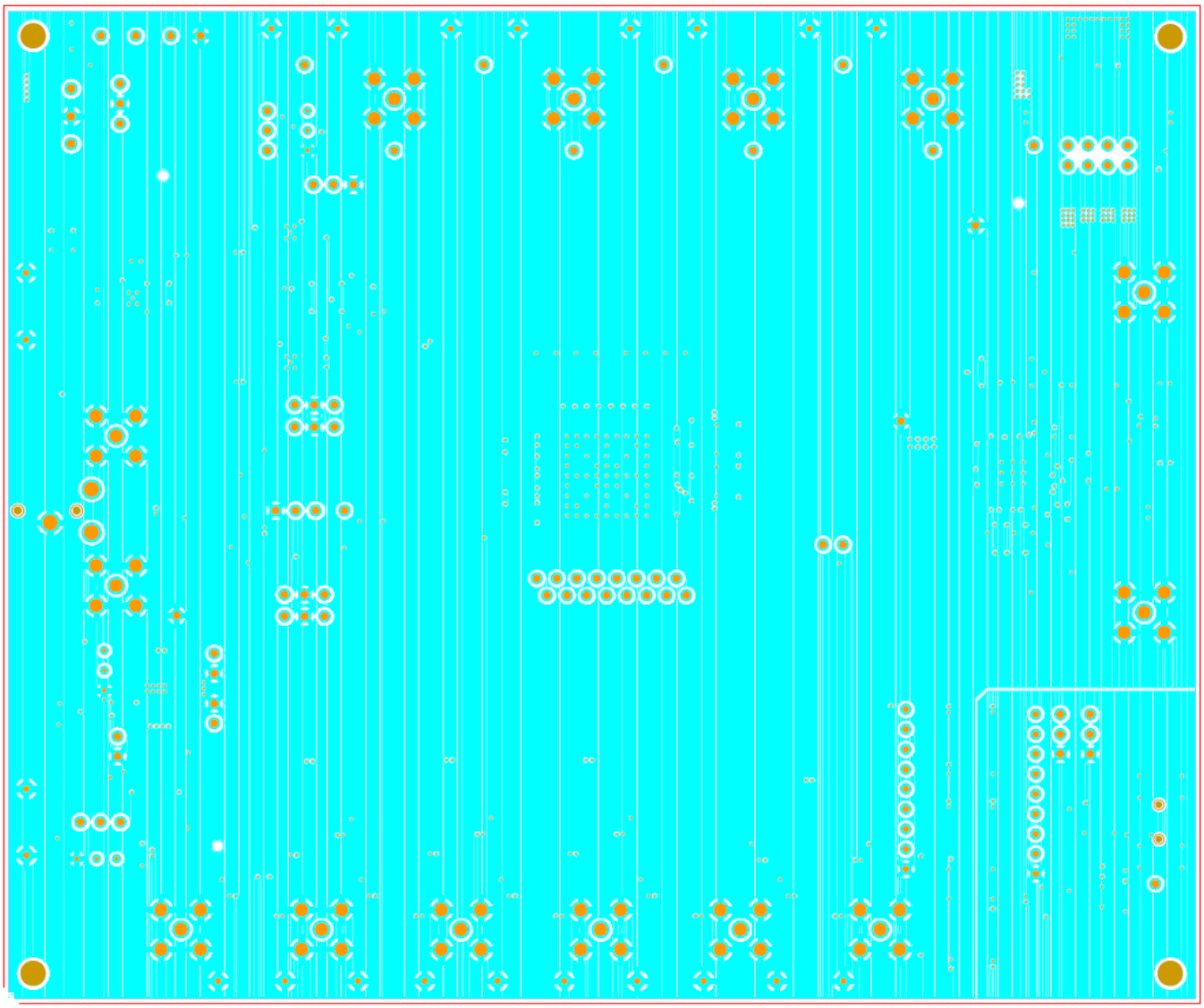

Figure 16. Fifth Layer - Ground

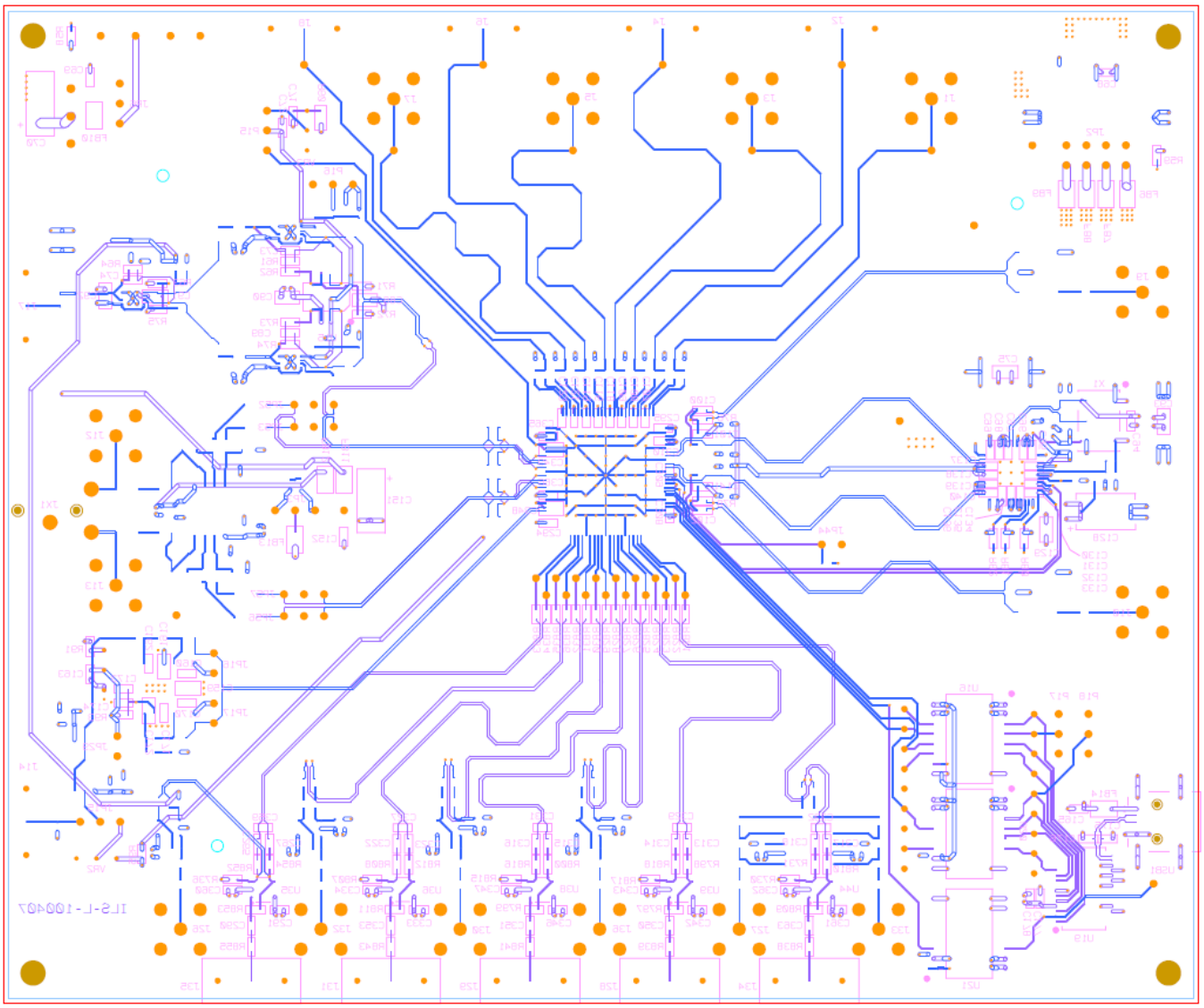

Figure 17. Bottom Layer - Signal

B.2 Schematics

Figure 18 through Figure 27 show the schematics for this EVM in landscape mode, for readability.

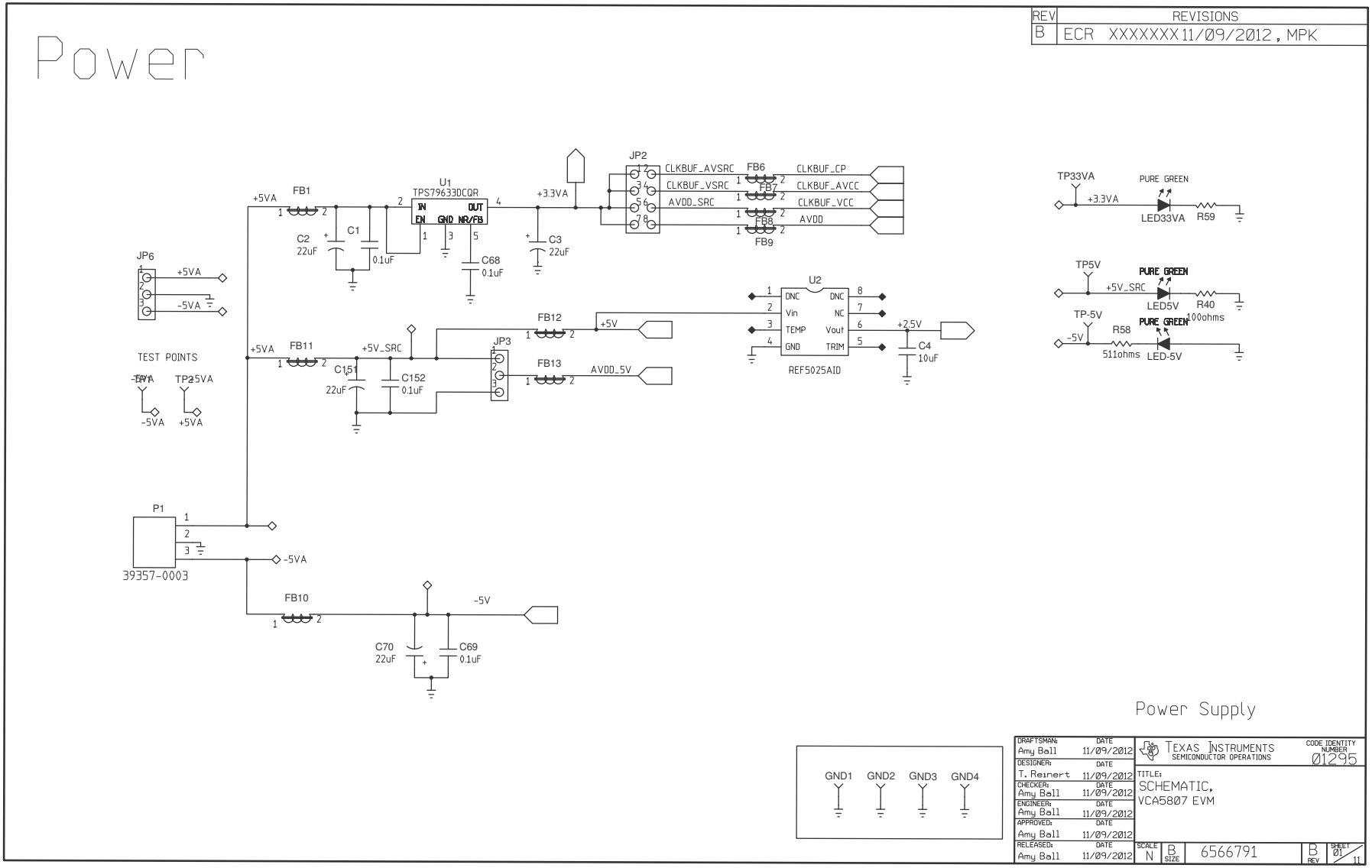

Figure 18. Schematic 1 of 10

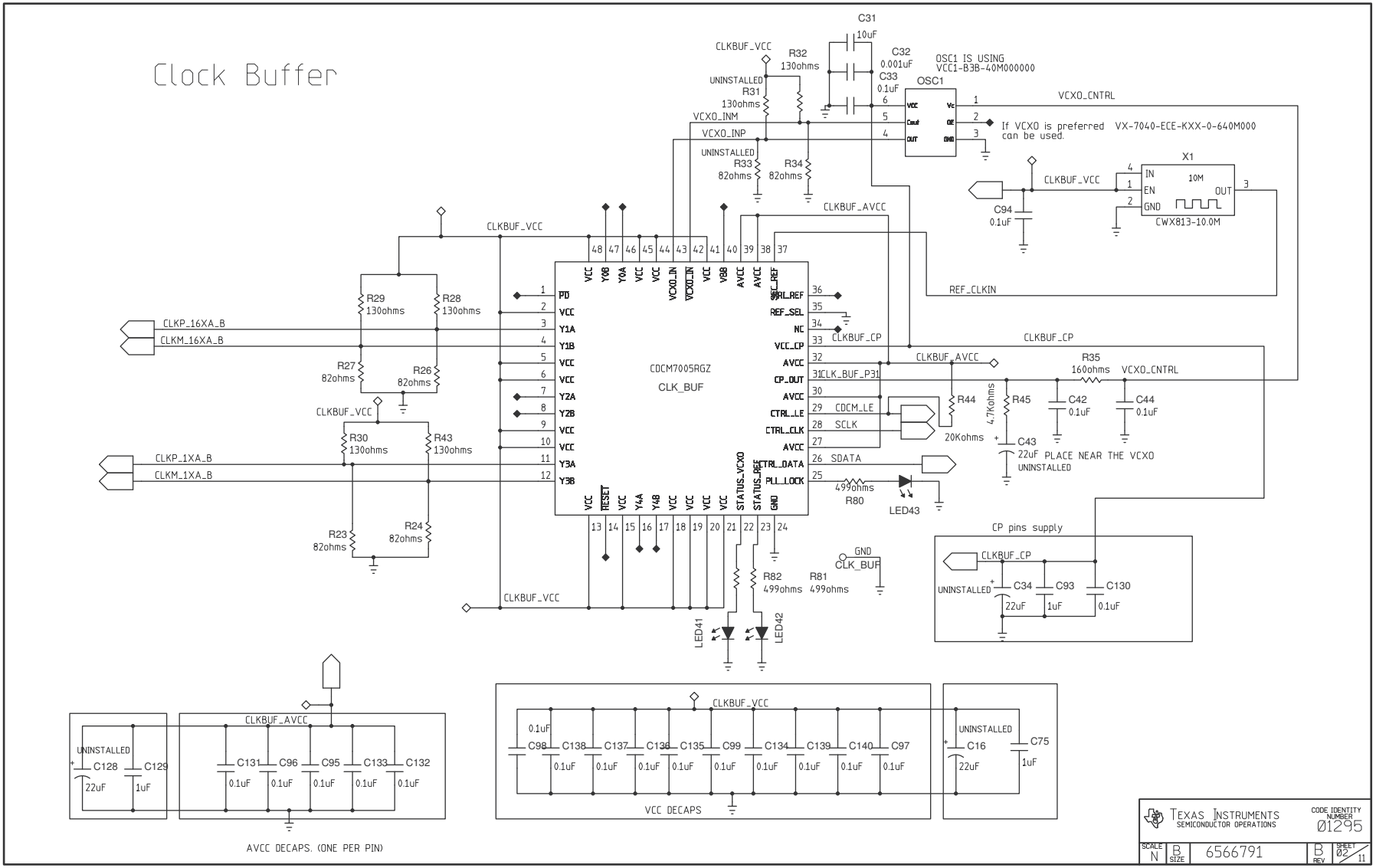

Figure 19. Schematic 2 of 10

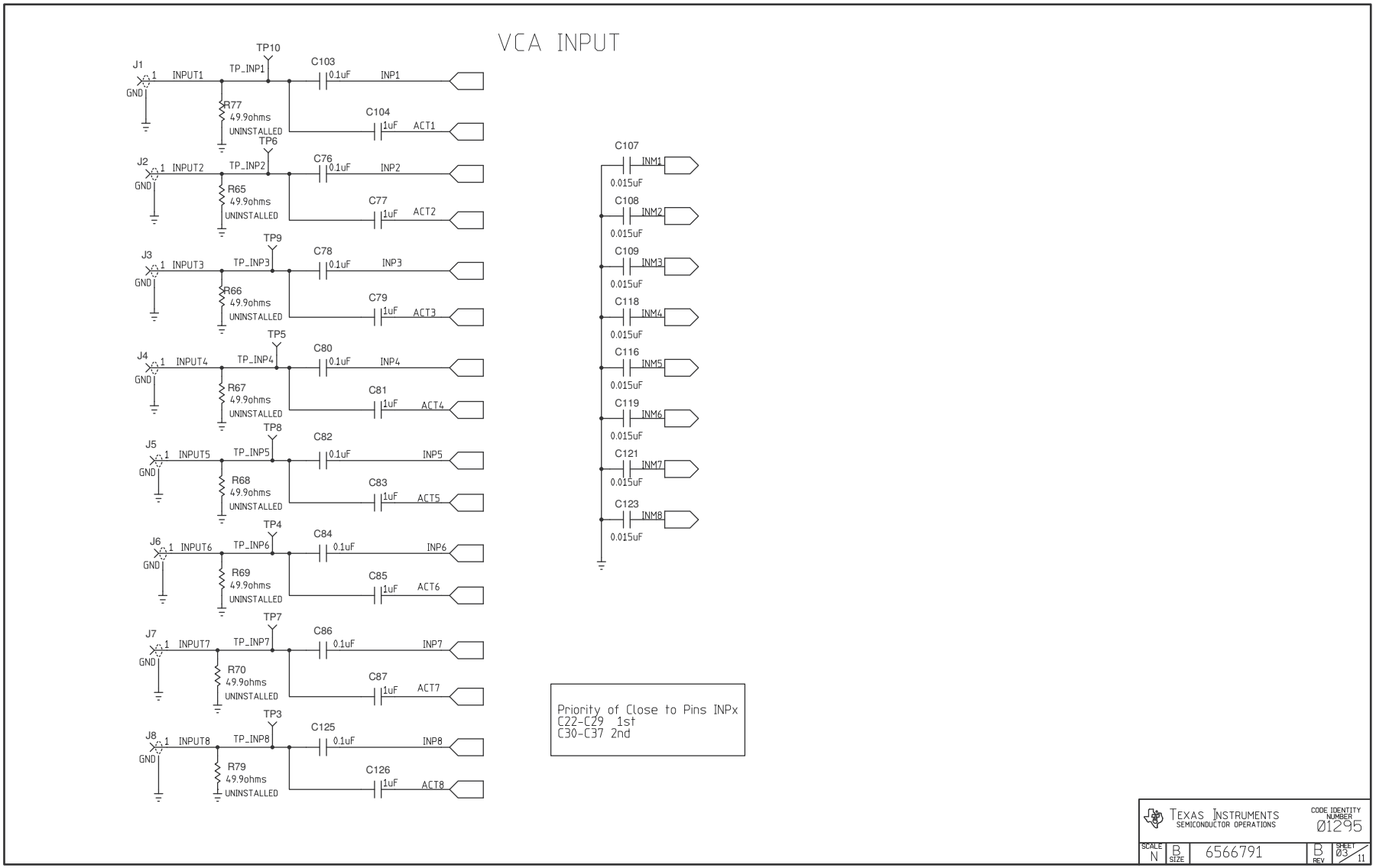

Figure 20. Schematic 3 of 10

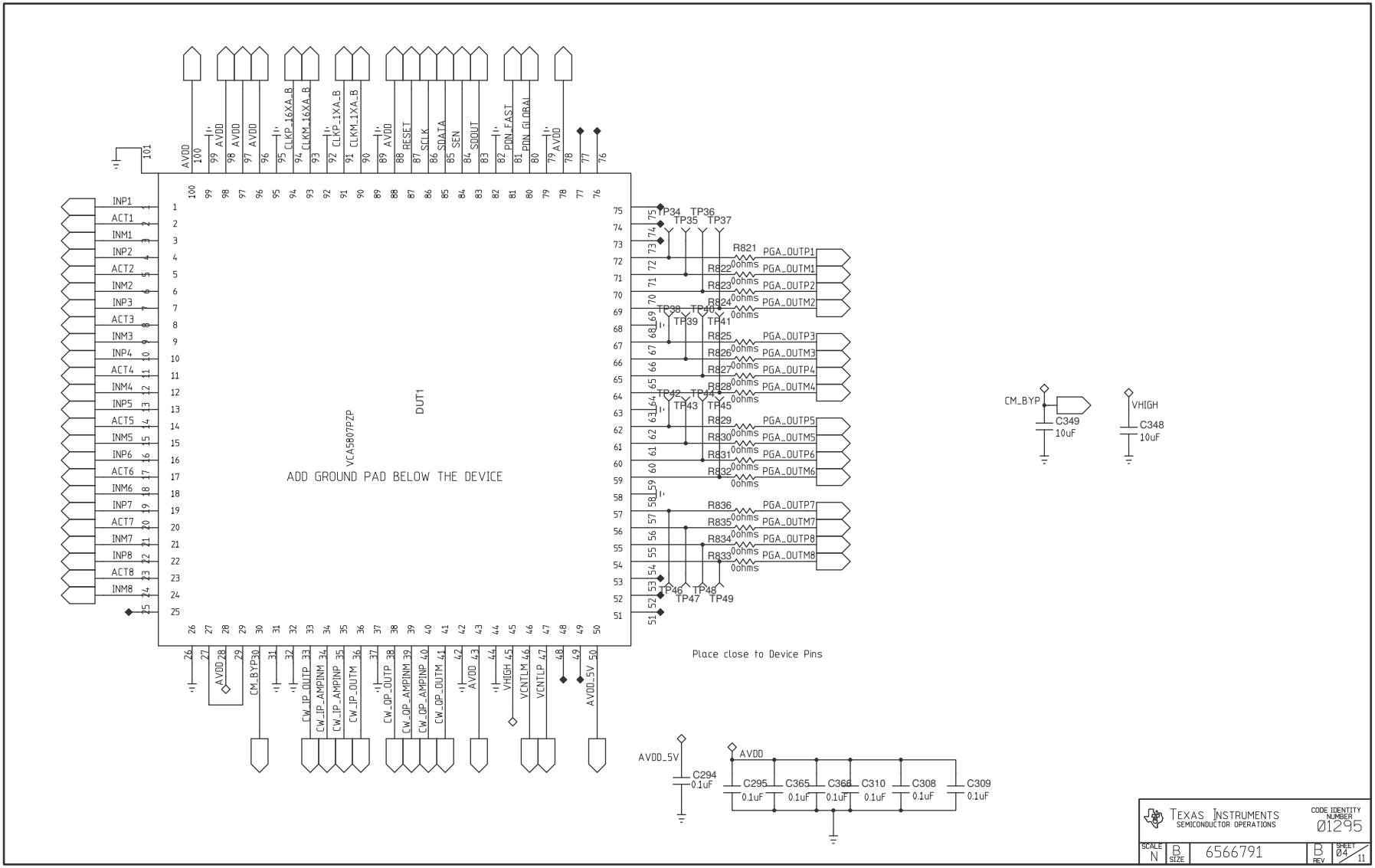

Figure 21. Schematic 4 of 10

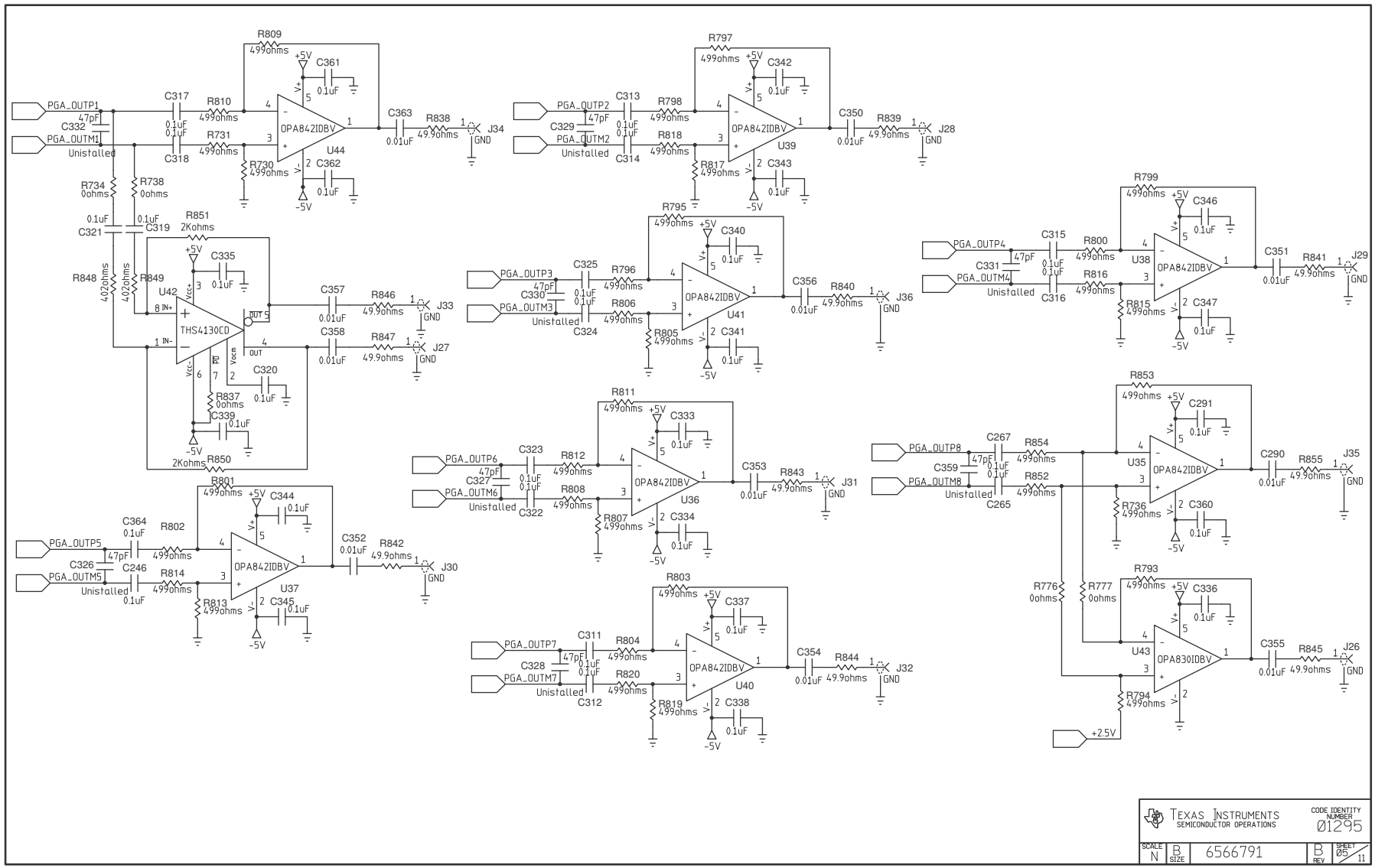

Figure 22. Schematic 5 of 10

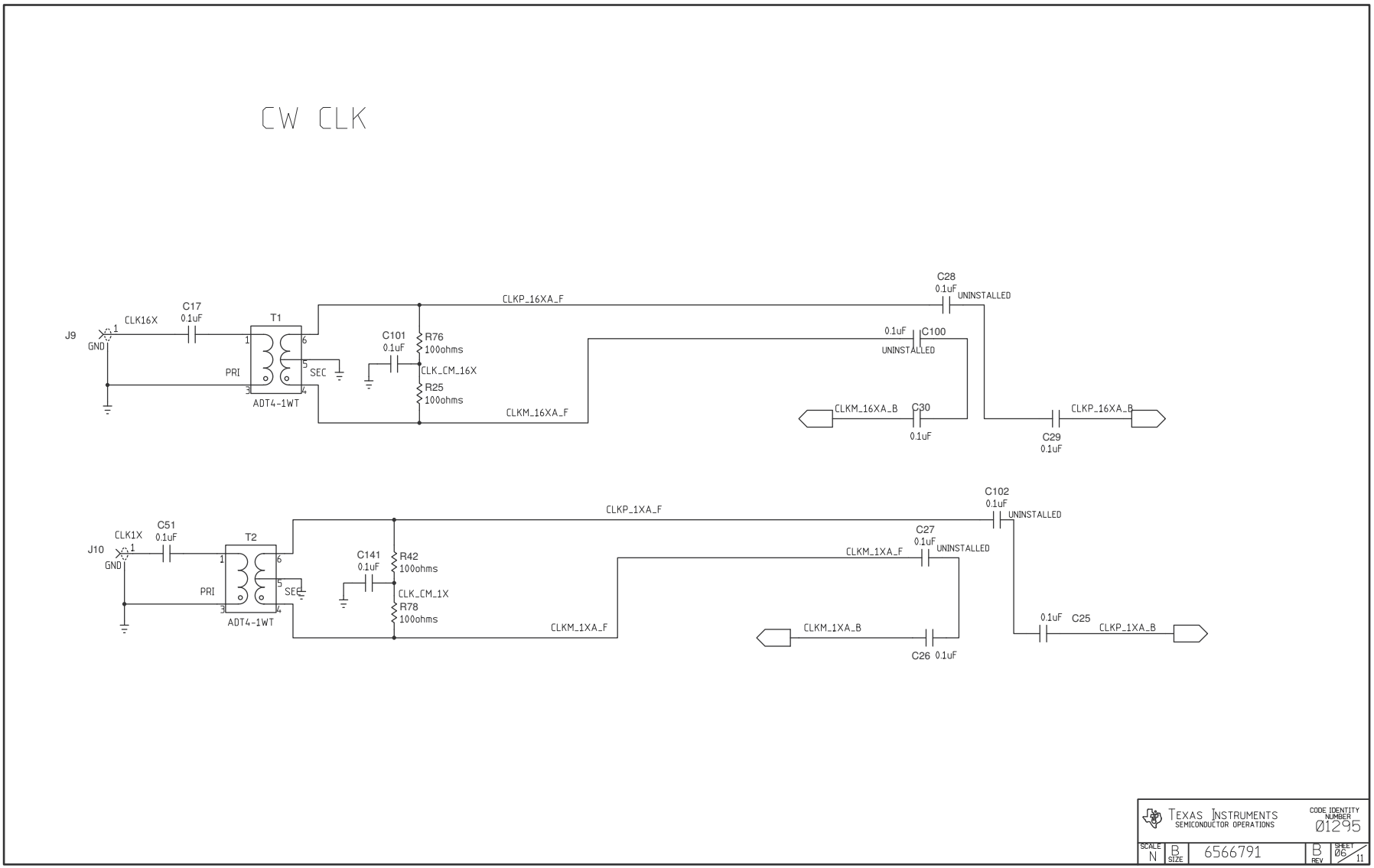

Figure 23. Schematic 6 of 10

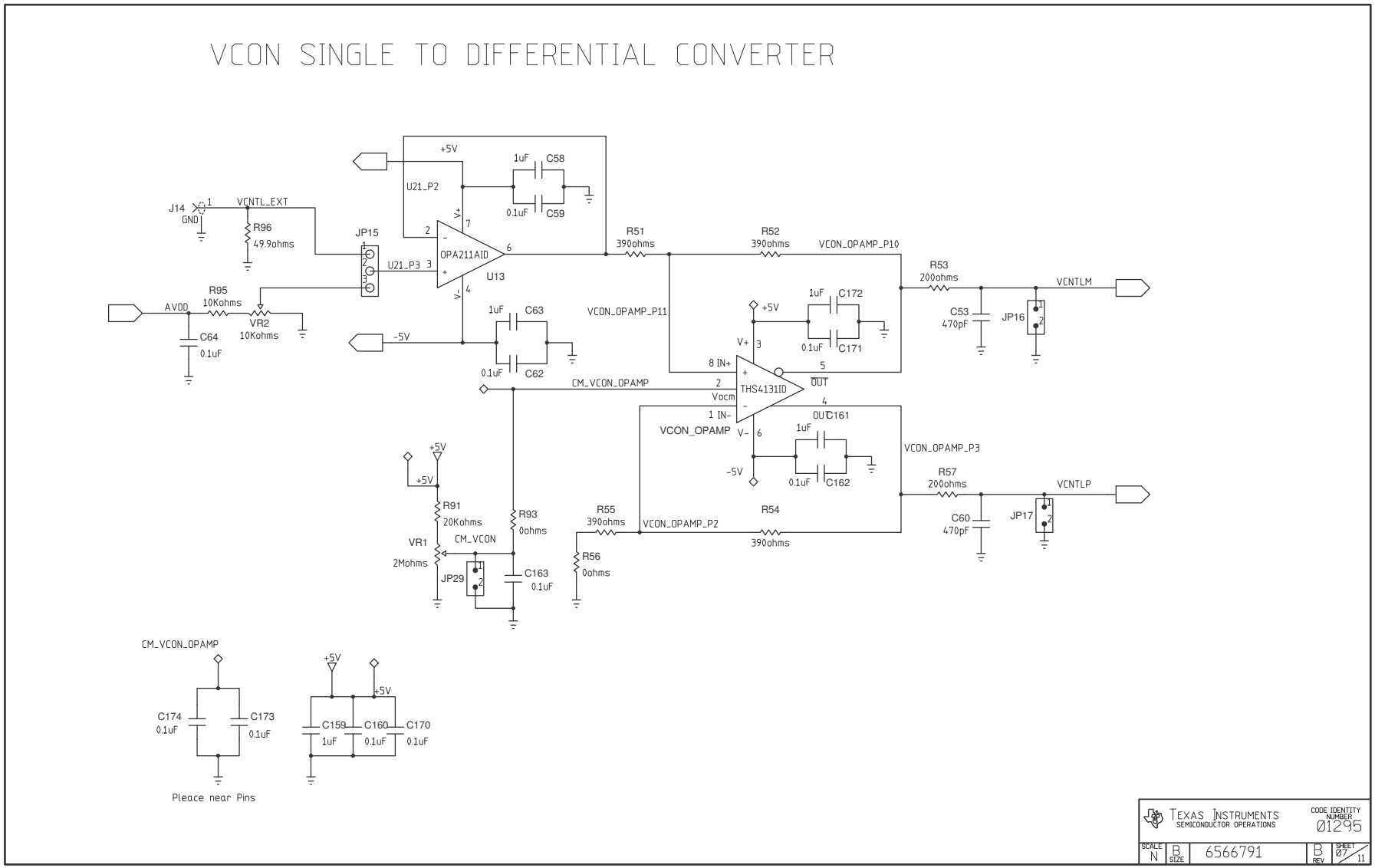

Figure 24. Schematic 7 of 10

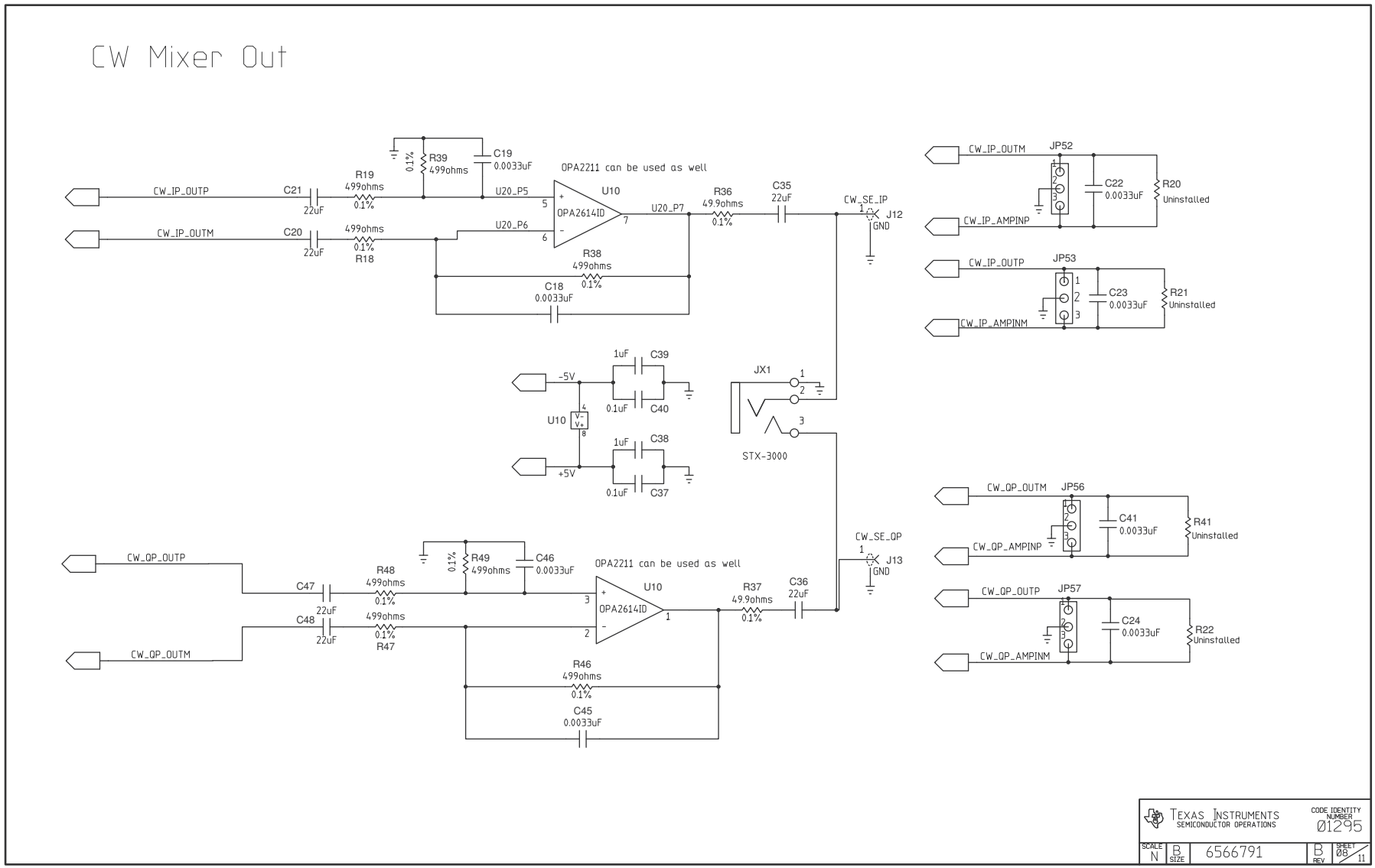

Figure 25. Schematic 8 of 10

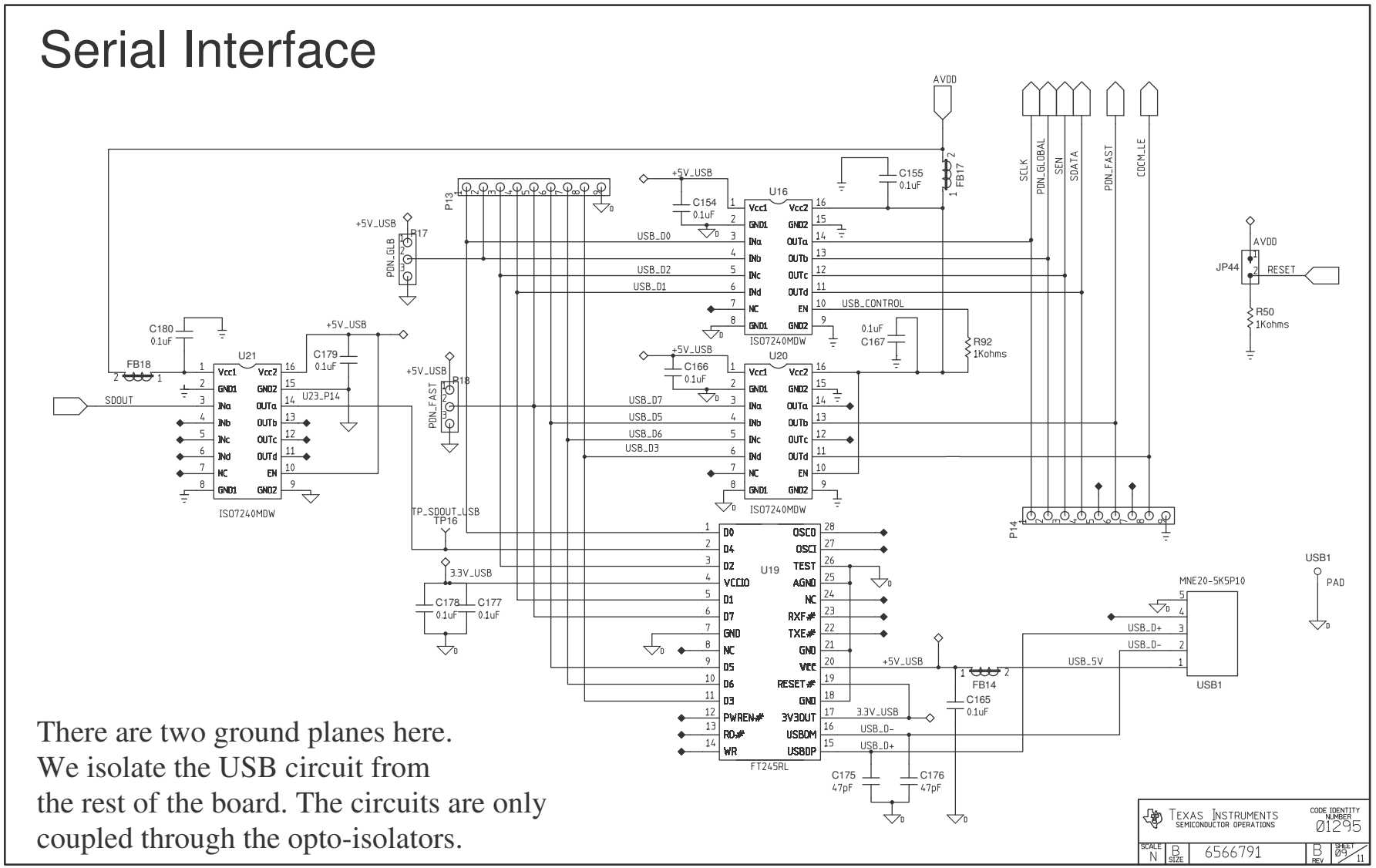

Figure 26. Schematic 9 of 10

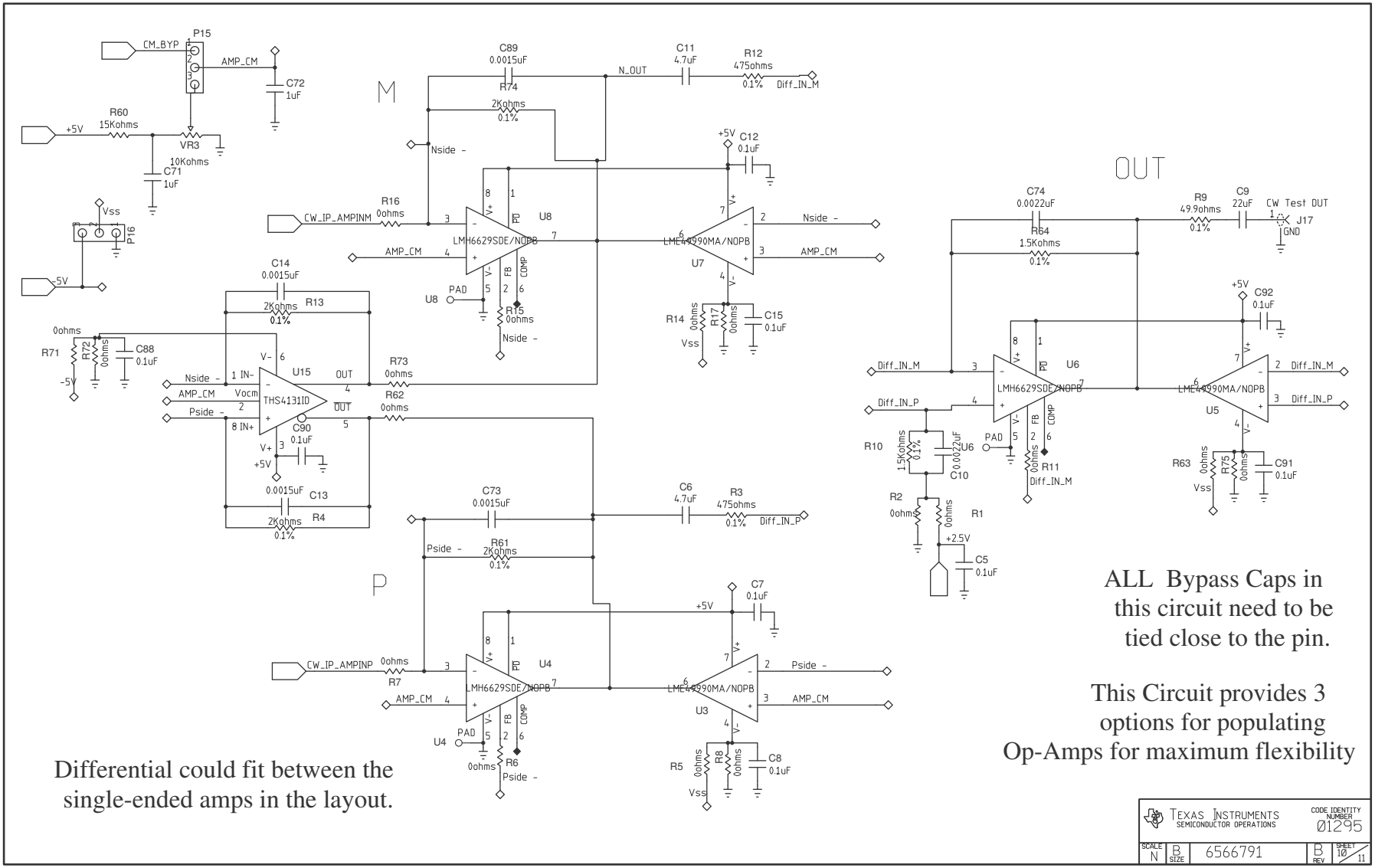

Figure 27. Schematic 10 of 10

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