

ADC14C105EB and ADC12C105EB Evaluation Boards

This User's guide applies to the ADC14C105EB and ADC12C105EB evaluation boards which are used to evaluate the ADC14C105 and ADC12C105 A/D Converters, respectively. These ADCs belong to a family of 12 and 14 bit converters that provide data at rates of up to 105MHz. Further reference in this manual to the ADC14C105 is meant to also include the other listed parts unless otherwise specified.

The evaluation board is designed to be used with the WaveVision5™ Data Capture Board which is connected to a personal computer through a USB port and running WaveVision5™ software, operating under Microsoft Windows. The software can perform an FFT on the captured data upon command and, in addition to a frequency domain plot, shows dynamic performance in the form of SNR, SINAD, THD SFDR and ENOB. The latest WaveVision 5 data capture board and WaveVision 5 Software is available through the Texas Instruments website.

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1 Board Assembly

The Evaluation Board comes pre-assembled. Refer to the [Bill of Materials in Section 7](#) for a description of components, to [Figure 1](#) for major component placement and to [Section 5](#) for the [Evaluation Board schematic](#).

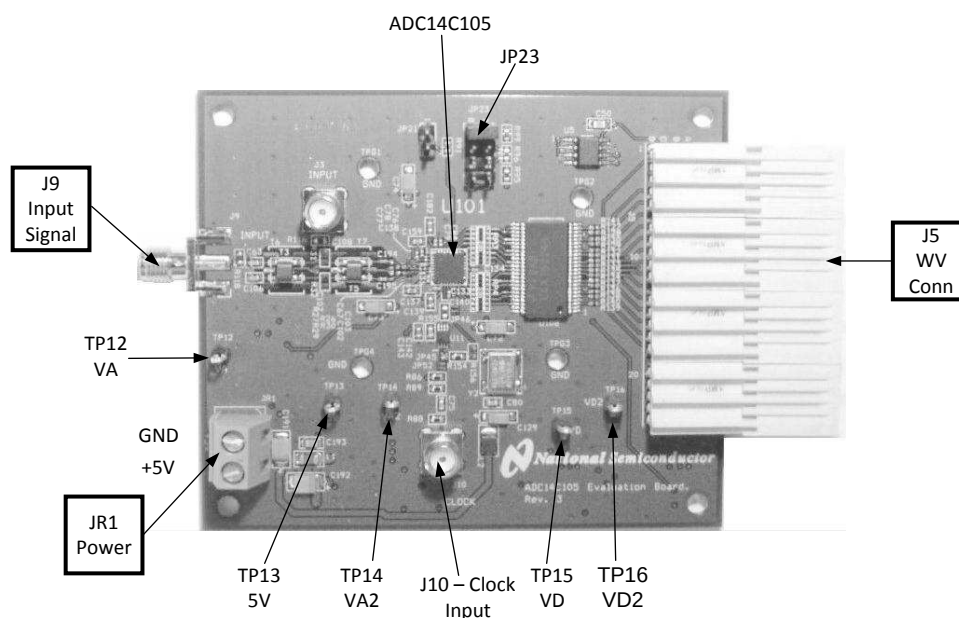


Figure 1. Major Component and Jumper Locations

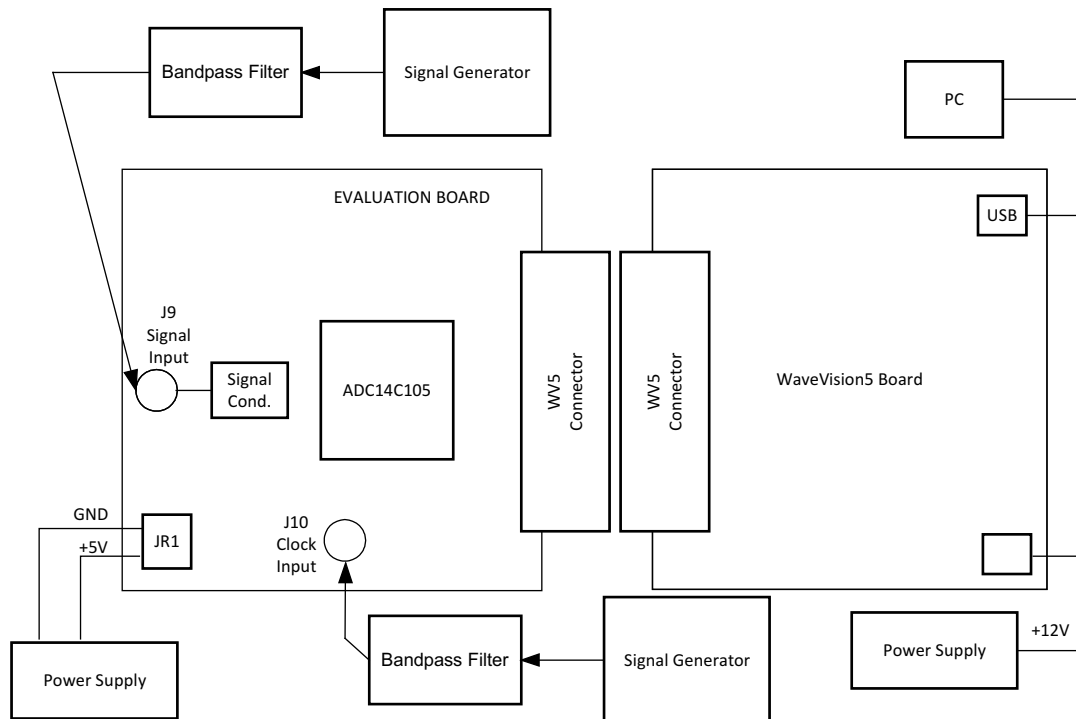


Figure 2. Test Set Up

2 Quick Start

Refer to [Figure 1](#) for locations of jumpers, test points and major components. Refer to [Figure 2](#) for the test set up. The board is configured by default to require an externally generated sampling clock. Refer to [Section 3.0](#) and [Appendix A](#) for more information on jumper settings. The input network of this board is configured for input frequencies greater than 70MHz. Refer to the [Analog Input section](#) for more information about input networks.

You must have version the WaveVision5™ data capture board and WaveVision 5 software to properly test this board. You can download the latest version from:

<http://www.ti.com/tool/wavevision5>

<http://www.ti.com/tool/wavevsn-brd-5.1>

1. Apply power to the WaveVision5™ board and connect it to the computer using a USB cable. See the WaveVision5™ Board Manual for operation of that board. Connect the evaluation board to the WaveVision5™ Data Capture Board.
NOTE: power to the WaveVision5 Data Capture Board should be applied before the power to the Evaluation Board to insure that the FPGA on the WaveVision5 Data Capture Board is not damaged.
2. Connect a clean +5V power supply to pin 2 of Power Connector JR1. Pin 1 is ground.
3. Connect a signal from a 50-Ω source to connector J9. Be sure to use a bandpass filter before the Evaluation Board to filter out noise and distortion from the clock signal generator.
4. Connect a signal from a 50-Ω source to connector J10. Set the amplitude to +14dBm and the frequency to the desired sampling rate. This signal power must result in >2Vpp signal at the SMA input to the EVM. Be sure to use a bandpass filter before the Evaluation Board to filter out noise and distortion from the clock signal generator. See [Section 3.3](#) for more information on signal filtering and appropriate signal generators.
5. Adjust the input signal amplitude as needed to ensure that the signal does not over-range by examining a histogram of the output data with the WaveVision™ software.

3 Functional Description

The Evaluation Board schematic is shown in the [Hardware Schematic Section](#). A list of test points and jumper settings can be found in [Appendix A](#).

3.1 Analog Input

To obtain the best distortion results the analog input network must be optimized for the signal frequency being applied. The Evaluation Board comes configured for input frequencies greater than 70MHz as seen in [Figure 3](#). The input network is intended to accept a low-noise sine wave signal of up to 2V peak-to-peak amplitude. To accurately evaluate the dynamic performance of this converter, the input test signal will have to be passed through a high-quality bandpass filter.

For input frequencies below 70MHz the circuit of [Figure 3](#) may be used.

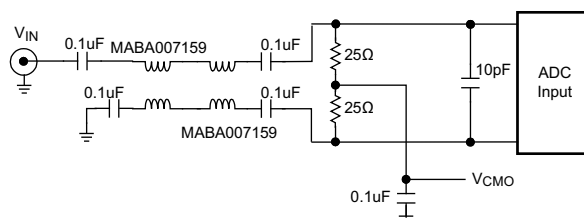


Figure 3. Analog Input Network for $F_{IN} > 70\text{MHz}$

For input frequencies below 70MHz the circuit of [Figure 4](#) may be used.

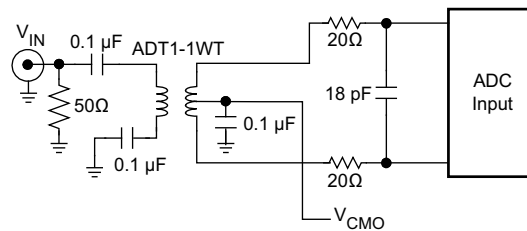


Figure 4. Analog Input Network for $F_{IN} < 70\text{MHz}$

3.2 ADC Reference Circuitry

The ADC14C105 can use an internal or external 1.2V reference. This Evaluation Board is configured to use the internal reference.

3.3 ADC Clock Circuit

Solder jumpers are used to select the path of the clock to the ADC. While not as convenient as pin-type jumpers, these introduce less noise into the clock signal.

By default, the board requires an external signal generator to provide a low noise clock at connector J10. The clock signal must be filtered by a bandpass filter to remove noise and distortion. On the board, the signal is buffered by U11 (NC7WV125) and applied to the ADC's clock input pin.

This EVM requires a 2.0-3.3 V_{pp} signal swing at the clock SMA which translates to +10-14.4dBm signal power into the J10 (50-Ω) input. The chosen bandpass filter in the clock path attenuates the signal power from the signal generator, so the generator power must set to overcome the attenuation. Different filters have different attenuations (insertion losses). Setting +17dBm assumes a 4dB insertion loss and +13dBm at the SMA input. The recommendation of +14dBm assumes a filter attenuation of less than 4dB.

As an option, a Pletronics SM7745 or Vectron VCC1 type device crystal clock may be placed on the board. For this option open the pins of solder jumper JP52 and short the pins of JP45.

3.4 Digital Data Output

The digital output data is available at pins B4 (MSB) through B17 of the WaveVision™ connector J5.

3.5 Data Format/Duty Cycle Stabilizer

Output data format and the duty cycle stabilizer (DCS) are controlled by jumper JP23.

Shorting pins 1-2 of JP23 sets the output format to 2's complement with DCS Off.

Shorting pins 3-4 of JP23 sets the output format to 2's complement with DCS On.

Shorting pins 5-6 of JP23 sets the output format to offset binary with DCS On.

Shorting pins 7-8 of JP23 sets the output format to offset binary with DCS Off. This is the default setting.

3.6 Power Supply Connections

Power to this board is supplied through power connector JR1. The only supply needed is +5V at pin 2 plus ground at pin 1.

Voltage and current requirements for the ADC14C105 Evaluation Board are:

- +5.0V at 500 mA

4 Installing the ADC14C105 Evaluation Board

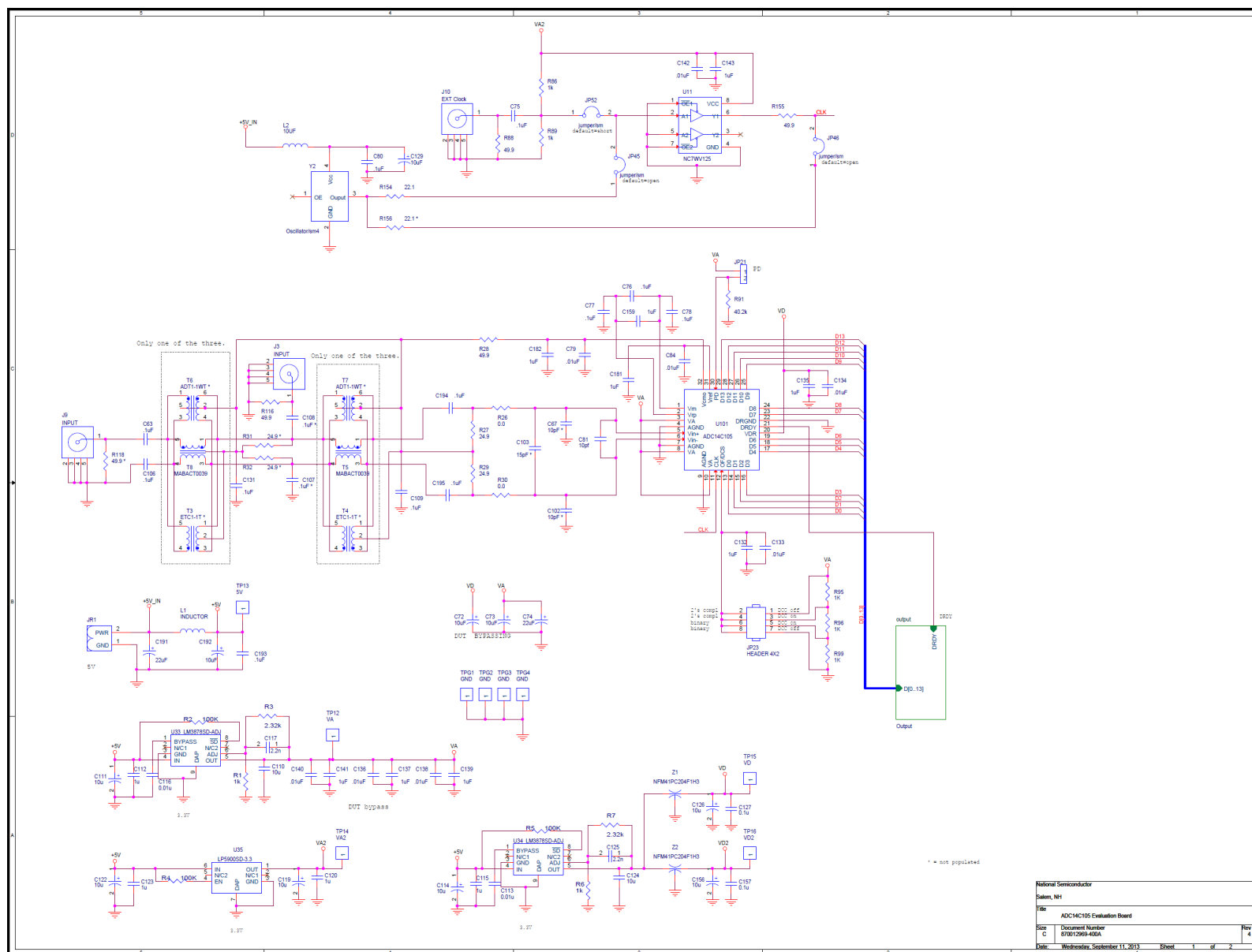
The evaluation board requires a single power supply as described in [Power Supply Connections](#).

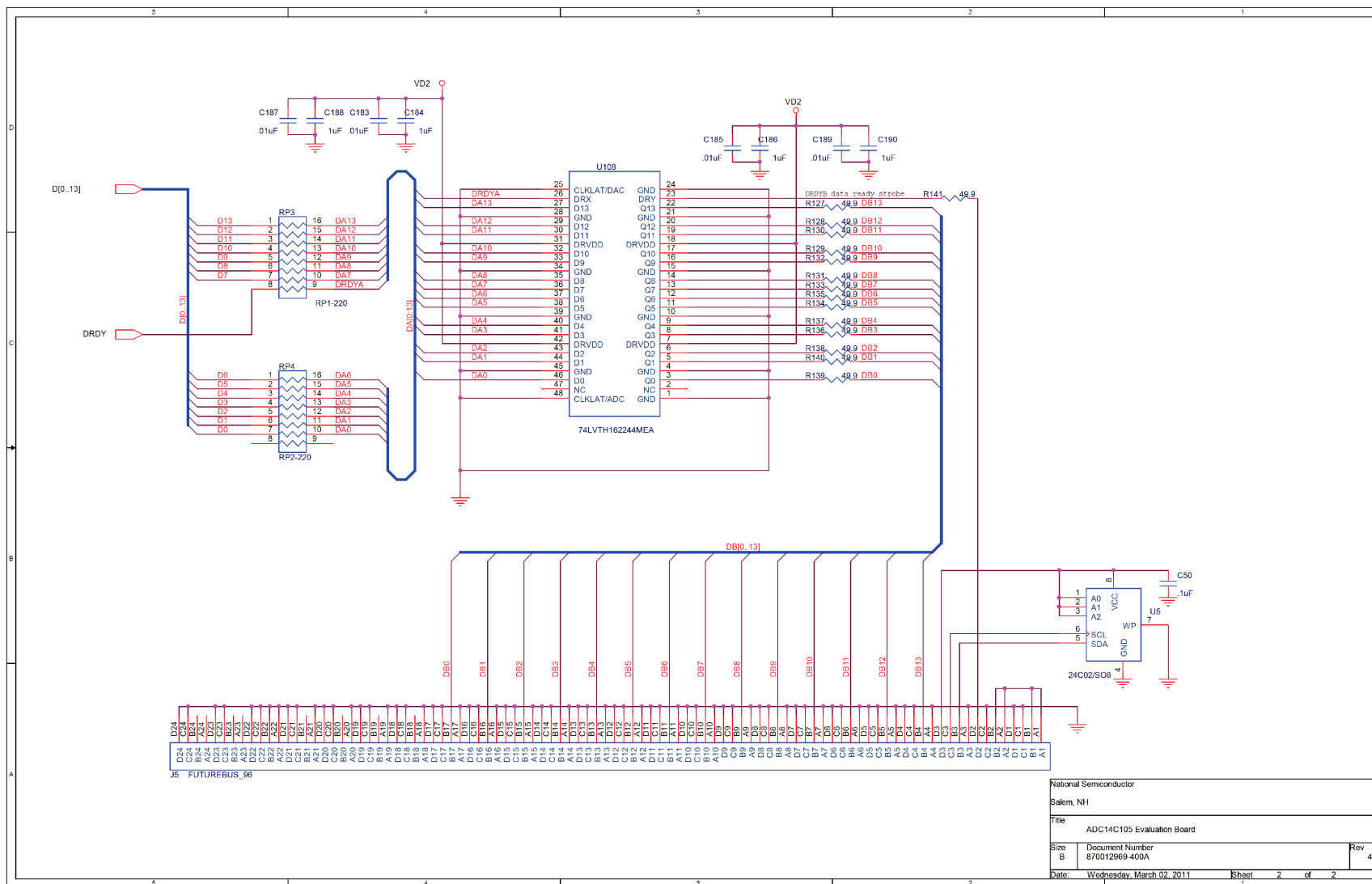
NOTE: power to the WaveVision 5 Data Capture Board should be applied before the power to the ADC14C105 Evaluation Board to insure that the FPGA on the WaveVision5 Data Capture Board is not damaged.

An appropriate signal source should be connected to the Signal Input SMA connector J9. When evaluating dynamic performance, an appropriate signal generator (such as the HP8644B or the R&S SMA100A) with 50 Ω source impedance should be connected to the Analog Input connector through an appropriate bandpass filter as even the best signal generator available can not produce a signal pure enough to evaluate the dynamic performance of an ADC. The signal used for the clock has similar requirements and must also be bandpass filtered.

If this board is used in conjunction with the the WaveVision5™ Data Capture Board and WaveVision5™ software, a USB cable must be connected between the Data Capture Board and the host. See the WaveVision5™ Data Capture Board manual for details.

5 Hardware Schematic





6 Bill of Materials

Table 1. Bill of Materials

Item	Qty	Part Reference	Value	PCB Footprint	Manufactured by	Part No.	Distributor	Distributor Part No.	Notes
1	1	C81	10pF	sm/c_0201_no_ss	Murata Electronics	GRM0335C1E100JD01D	Digikey	490-3142-1-ND	
2	2	C117, C125	2.2nF	sm/c_0603	AVX Corporation	06031C222JAT2A	Digikey	478-3705-1-ND	
3	7	C79, C84, C133, C134, C136, C138, C140	0.01uF	sm/c_0402_no_ss	Murata Electronics	GRM155R71E103KA01D	Digikey	490-1312-1-ND	
4	5	C113, C116, C142, C183, C185, C187, C189	0.01uF	sm/c_0603	Murata Electronics	GRM188R71H103KA01D	Digikey	490-1512-1-ND	
5	2	C50, C193	0.1uF	sm/c_0805	Murata Electronics	GRM21BR71E104KA01L	Digikey	490-1673-1-ND	
6	8	C63, C75, C80, C106, C109, C127, C131, C157	0.1uF	sm/c_0603	Murata Electronics	GRM188R71E104KA01D	Digikey	490-1524-1-ND	
7	1	C76	0.1uF	sm/c_0201_no_ss	Murata Electronics	GRM033R61A104ME15D	Digikey	490-5405-1-ND	
8	4	C77, C78, C194, C195	0.1uF	sm/c_0402_no_ss	Murata Electronics	GRM155R71C104KA88D	Digikey	490-3261-1-ND	
9	4	C112, C115, C120, C123	1uF	SM/C_1206	Murata Electronics	GRM31MF51E105ZA01L	Digikey	490-1832-1-ND	
10	13	C132, C135, C137, C139, C141, C143, C159, C181, C182, C184, C186, C188, C190	1uF	sm/c_0603	Murata Electronics	GRM188R61A105MA61D	Digikey	490-1544-1-ND	
11	3	C72, C73, C129	10uF	sm/ct_3216_12	Kemet	T491A106K006AT	Digikey	399-3683-2-ND	
12	8	C110, C111, C114, C119, C122, C124, C126, C156	10uF	SM/C_1206	Murata Electronics	GRM31MF51A106ZA01L	Digikey	490-1843-1-ND	
13	1	C192	10uF	sm/ct_3528_12	Kemet	T491B106K010AT	Digikey	399-3705-1-ND	
14	1	C74	22uF	sm/ct_3216_12	Kemet	T491A226M010AT	Digikey	399-3692-1-ND	
15	1	C191	22uF	sm/ct_3528_12	Kemet	T494B226M016AT	Digikey	399-3835-1-ND	
16	2	R26, R30	0.0	sm/r_0402_no_ss	Panasonic - ECG	ERJ-2GE0R00X	Digikey	P0.0JCT-ND	
17	1	R154	22.1	sm/r_0603	Panasonic - ECG	ERJ-3EKF22R1V	Digikey	P22.1HCT-ND	
18	2	R27, R29	24.9	sm/r_0402_no_ss	Panasonic - ECG	ERJ-2RKF24R9X	Digikey	P24.9LCT-ND	
19	4	R28, R88, R116, R155	49.9	sm/r_0603	Panasonic - ECG	ERJ-3EKF49R9V	Digikey	P49.9HCT-ND	
20	15	R127, R128, R129, R130, R131, R132, R133, R134, R135, R136, R137, R138, R139, R140, R141	49.9	sm/r_0402_no_ss	Panasonic - ECG	ERJ-2RKF49R9X	Digikey	P49.9LCT-ND	
21	7	R1, R6, R86, R89, R95, R96, R99	1k	sm/r_0603	Panasonic - ECG	ERJ-3EKF1001V	Digikey	P1.00KHCT-ND	
22	2	R3, R7	2.32k	sm/R_0603	Panasonic - ECG	ERJ-2RKF2321X	Digikey	P2.32KLCT-ND	
23	1	R91	40.2k	sm/r_0603	Panasonic - ECG	ERJ-3EKF4022V	Digikey	P40.2KHCT-ND	
24	3	R2, R4, R5	100K	sm/R_0603	Panasonic - ECG	ERJ-2GEJ104X	Digikey	P100KJCT-ND	
25	2	RP3, RP4	RP1-220	sm/rpak_50m/16/wg.071/I.252	CTS Resistor Products	742C163220JPTR	Digikey	742C163220JPCT-ND	
26	1	L1	INDUCTOR	sm/l_1206	Murata Electronics	BLM31PG500SN1L	Digikey	490-1055-1-ND	
27	1	L2	10uH	sm/l_1210	Murata Electronics	LQH32CN100K53L	Digikey	490-4059-1-ND	
28	2	Z1, Z2	NFM41PC204F1H3	nfm41p	Murata Electronics	NFM41PC204F1H3L	Digikey	490-2550-1-ND	
29	2	J3, J10	INPUT, EXT Clk	rf/sma/v_clr	Amphenol-RF	901-144-8RFX	Digikey	ARFX1231-ND	

Table 1. Bill of Materials (continued)

Item	Qty	Part Reference	Value	PCB Footprint	Manufactured by	Part No.	Distributor	Distributor Part No.	Notes
30	1	J9	INPUT	RF/SMA/END_LAUNCH/W.375	Emerson Network Power Connectivity Solutions	142-0701-801	Digikey	J502-ND	
31	1	J5	FUTUREBUS_96	fbus/rs/96_ecl	Tyco Electronics	5223514-1			Provided by TI
32	1	JP21	Header2	blkcon.100/vh/tm1sq/s/w.100/2	Samtec	MTSW-102-07-T-S-240			Can break apart 8-pin MTSW-108-07-T-S-240
33	1	JP23	HEADER 4X2	blkcon.100/vh/tm2oe/w.200/8	Samtec	MTSW-104-07-T-D-240			
34	1	JP52	Solder jumper	solder jumper	N/A	N/A	N/A		Create a solder bridge to short pads together
35	5	TP12, TP13, TP14, TP15, TP16	VDD Test Points	tp_500X	Keystone Electronics	5002	Digikey	5002K-ND	
36	4	TPG1, TPG2, TPG3, TPG4	GND Test Points	tp_500X_125	Keystone Electronics	5011	Digikey	5011K-ND	
37	1	JR1	VA / VD Power	MSTBVA2.5/2-G-5.8	Phoenix Contact	1715721	Digikey	277-1263-ND	
38	1		jumper/sm	N/A	FCI	68786-302LF	Arrow Electronics	68786-302LF	Short pins 7-8 of headers JP23
39	2	T5, T8	Transformer	sm/sot23-5/l.150/wg.150	MA/COM	MABA-007159-000000	Mouser		Pin 1 of T5 and T8 (Xformer secondary) faces U101
40	1	U5	24C02/SO8	sog.050/8/wg.244/l.200	STMicroelectronics	M24C02-RMN6TP	Digikey	497-8633-1-ND	
41	1	U11	NC7WV125	SOG.50M/8/WG3.10/L2.00	Fairchild Semiconductor	NC7WV125K8X	Mouser	512-NC7WV125K8X	
42	2	U33, U34	LP3878SD-ADJ	sc-mkt-sdc08a_llp	Texas Instruments	LP3878SD-ADJ/NOPB	Digikey	LP3878SD-ADJCT-ND	
43	1	U35	LP5900SD-3.3	llp6_65m_wg2p5_l2p2_ep	Texas Instruments	LP5900SD-3.3/NOPB	Digikey	LP5900SD-3.3CT-ND	
44	1	U101	ADC14C105	LLP.50M/32/WG5.00	Texas Instruments	ADC14C105CISQ	Digikey	ADC14C105CISQE/NOPB CT-ND	
45	1	U108	74LVTH162244MEA	sog.025/48/wg.420/l.650	Texas Instruments	SN74LVTH162244DLR	Digikey	296-1259-1-ND	
DO NOT PLACE									
47	2	C67,C102	10pF *	sm/c_0402_no_ss					
48	1	C103	15pF *	sm/c_0402_no_ss					
49	2	C107,C108	.1uF *	sm/c_0603					
50	2	R31,R32	24.9 *	sm/r_0402_no_ss					
51	1	R118	49.9 *	sm/r_0603					
52	1	R156	22.1 *	sm/r_0603					
53	2	T3,T4	ETC1-1T *	sm/sot23-5/l.150/wg.150					
54	2	T6,T7	ADT1-1WT *	adt4_6wt_xfmr					
55	2	JP46, JP45	Solder jumper						
46	1	Y2	Oscillator/sm4	SM/CRYSTAL/5X7	Pletronics	SM7745DV-105.0M	Online Components	SM7745DV800MT250	Long Lead Item

7 Evaluation Board Layout

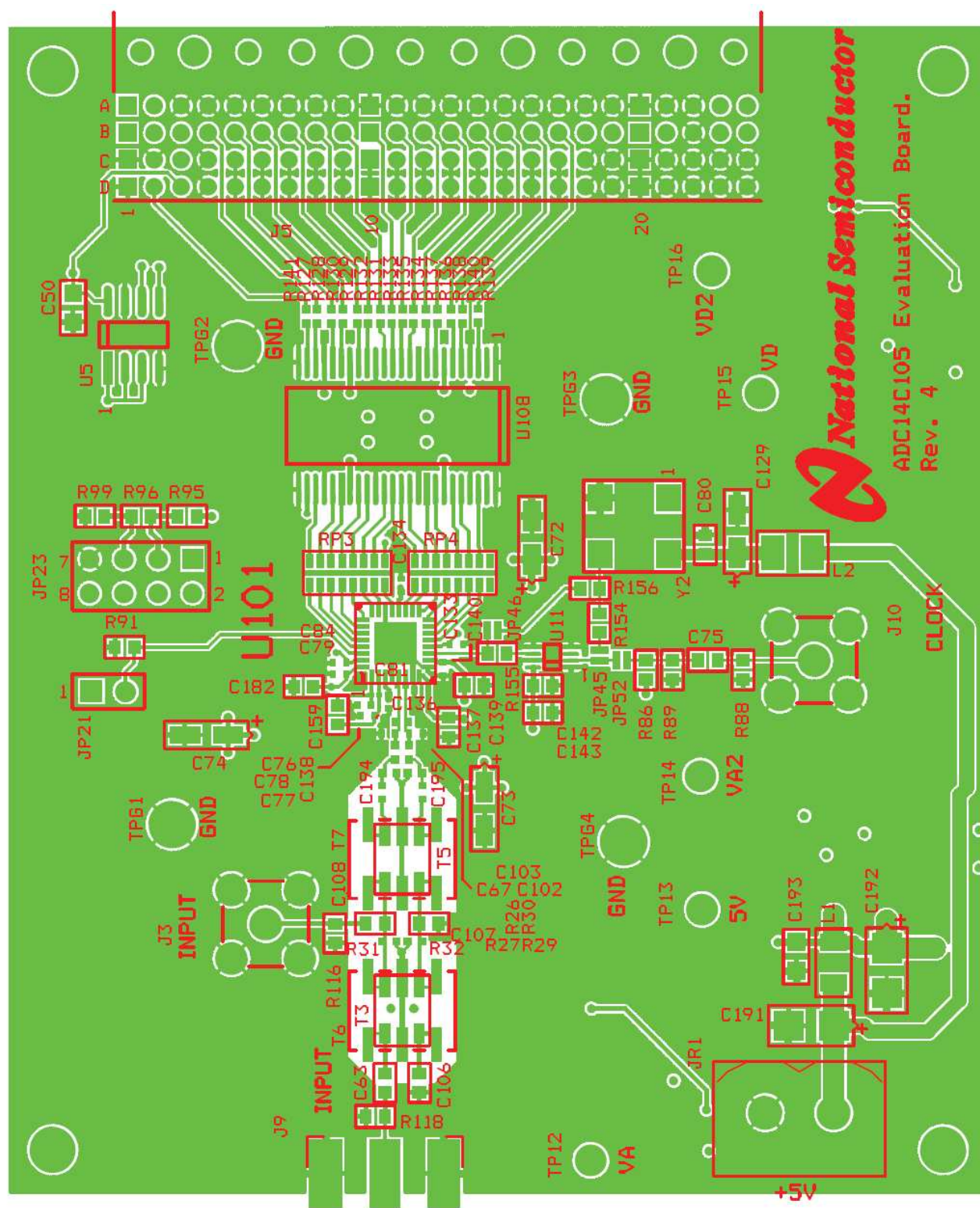


Figure 5. Layer 1: Component Side

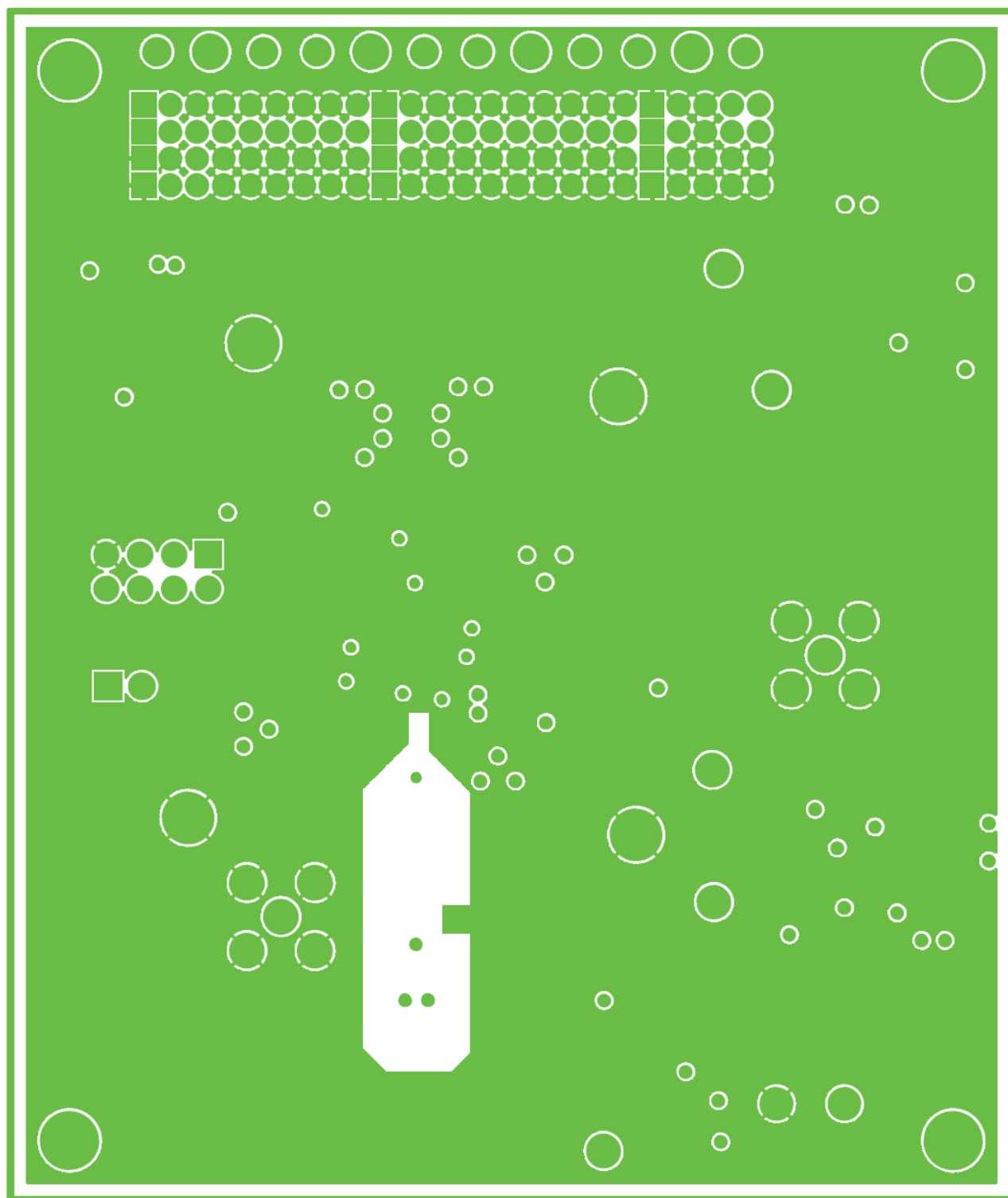


Figure 6. Layer 2: Ground

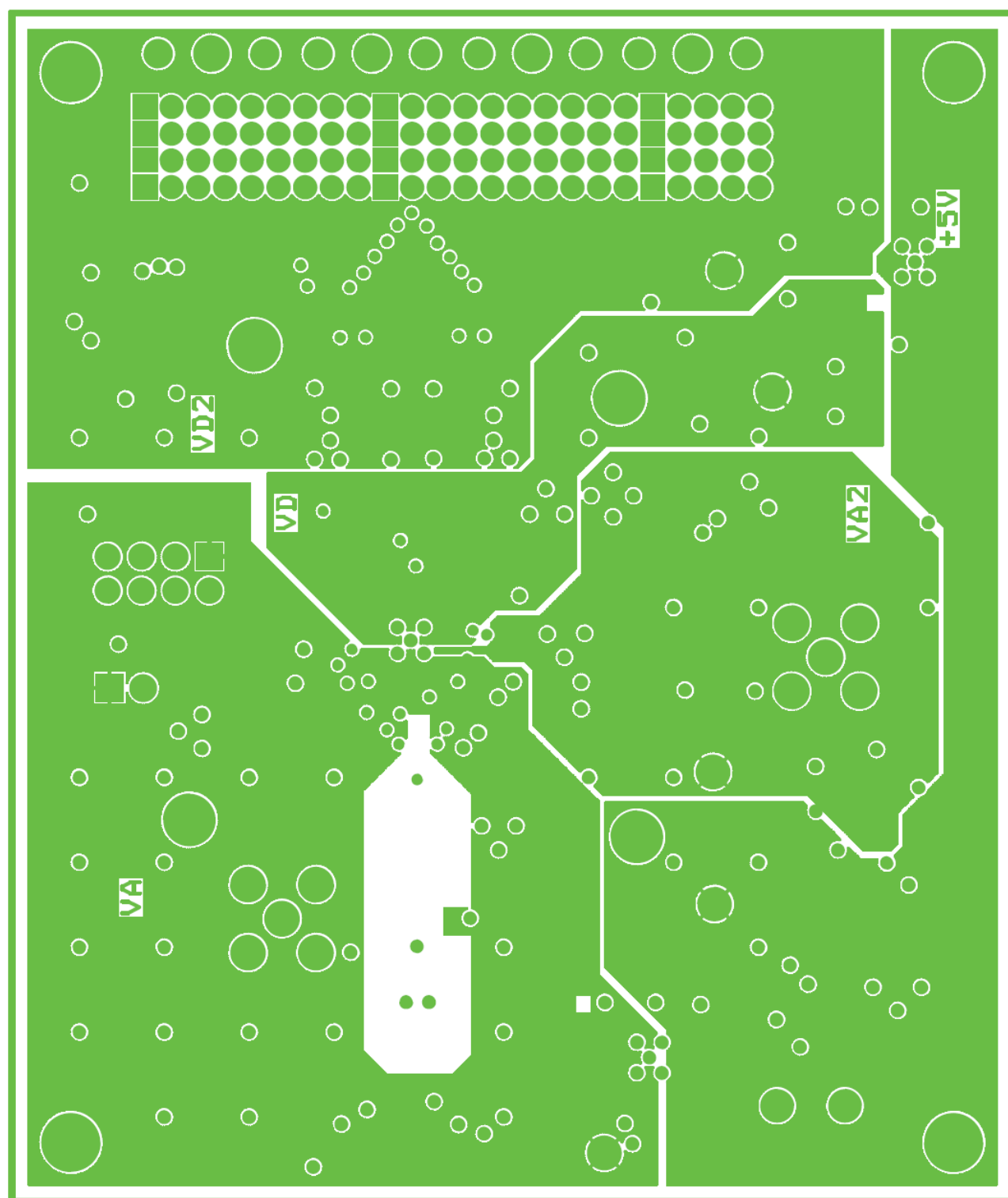


Figure 7. Layer 3: Power

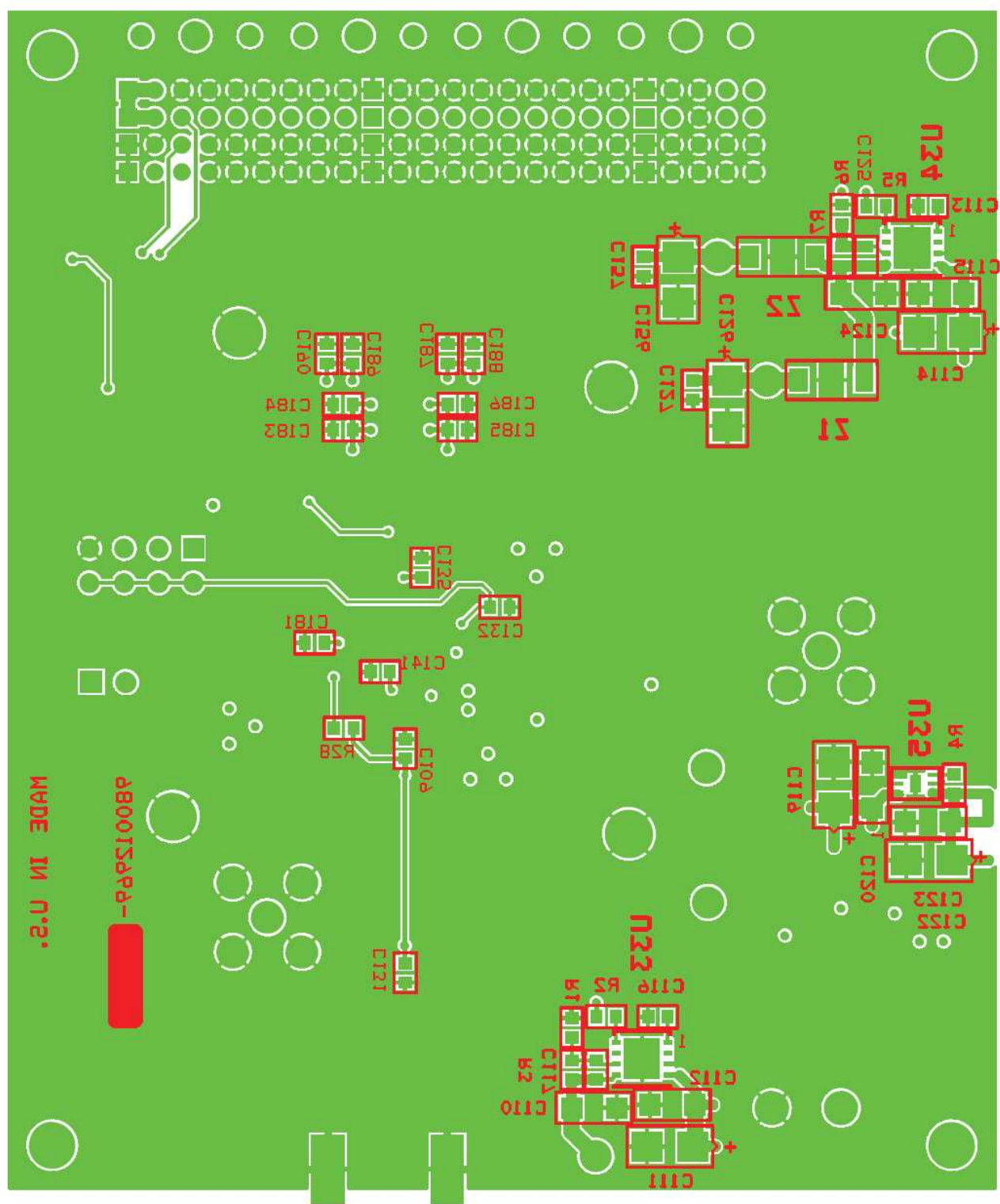


Figure 8. Layer 4: Circuit Side

Appendix A

A.1 Operating with the WaveVision Hardware and Software

The ADC14C105 Evaluation Board is compatible with the WaveVision5™ Data Capture Board and WaveVision5™ software. When connected to the WaveVision5™ Board, data capture is easily controlled from a personal computer operating in the Windows environment. The data samples that are captured can be observed on the PC video monitor in the time and frequency domains. The FFT analysis of the captured data yields insight into system noise and distortion sources and estimates of ADC dynamic performance such as SINAD, SNR, THD, SFDR and ENOB.

A.2 Summary Tables of Test Points, Connectors, and Jumper Settings

A.2.1 Connectors

JR1 Connector - Power Supply Connections		
1	GND	Power Supply Ground
2	+5V	+5V Power Supply

A.2.2 Jumper Settings

Note: Default settings are in **bold**

JP21 : Power Down	
Connect 1-2	The ADC Channel A is powered down
1-2 OPEN	The ADC is in normal operation

JP23 : Output Data Format and Duty Cycle Stabilizer	
Connect 1-2	Output format of 2's complement, DCS is OFF
Connect 3-4	Output format of 2's complement, DCSr is ON
Connect 5-6	Output format of offset binary, DCS is ON
Connect 7-8	Output format of offset binary, DCS is OFF

A.2.3 Clock Circuit Solder Jumper settings

Solder jumpers are used to select the path of the clock to the ADC. While not as convenient as pin-type jumpers, these introduce less noise into the clock signal.

By default the following jumpers are OPEN: JP46, JP45

By default the following jumpers are shorted: JP52

EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

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REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment 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.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

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.

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.

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.

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.

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.

【Important Notice for Users of EVMs for RF Products in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. 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 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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