

ADS42xx EVM

This is the user's guide for the ADS42xx EVM Rev B (EVM). The ADS42xx (dual channel, 12-bit and 14-bit, up to 250 MSPS) is a dual analog-to-digital converter family. This EVM is specifically suited for interfacing with TI's TSW1400 EVM to capture and display waveforms from the ADC. The EVM schematic, BOM, and layout files can be found in the design package in the ADS42xx EVM product folder on www.ti.com.

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1 Software Control

1.1 Installation Instructions

- Open the folder named: ADS58C28_ADS42xx_Installer_vxpx (where xpx represents the latest version).
- Double-click: **setup.exe**
- Follow on-screen instructions to complete GUI installation
 - Wait for *ADS42xx_58C28 GUI vxpx Installer* initializing screen to complete
 - Click *Next* to install files in the default destination directory
 - Select *I accept the License Agreement* and click *Next*
 - Select *Next* on the summary page
 - Wait for files to load and then click *Next*
 - Once all files are installed click *Next*
- If Windows® Logo Message window appears, click *Continue Anyway*.
- Once installed, launch by clicking on the ADS58C28_ADS42xx_GUI_vxpx program in Start→Texas Instruments ADCs
- When plugging in the USB cable for the first time, you are prompted to install the USB drivers
 - On the Welcome to the Found New Hardware Wizard window select *No, not at this time*
 - Select *Install the software automatically* button on the next window
 - Select *Continue Anyway* on the Windows Logo Message window
 - If computer cannot find the drivers automatically, then you can access them directly in the install directory: C:\Program Files\Texas Instruments\ADS58C28_ADS42xx\data\
 - Click *Finish* once completed

1.2 Software Operation

The software allows full programming control of the ADC device. [Figure 1](#) shows the GUI front panel that has two register tabs: *Top Level* and *Advanced*. The *Top Level* tab provides an interface to the most used registers. The *Advanced* tab includes less used registers and provides an option to manually input address and data values.

1.2.1 Top Level

[Figure 1](#) shows the *Top Level* tab of the register user interface. Below is a brief explanation of the controls. Refer to the ADS42xx ([SBAS533](#)) and ADS58C28([SBAS509](#)) datasheet for more detailed explanations of the register functions, as needed.

- Device selection: Device selection of ADS58C28 or ADS42xx for proper device.
- Reset: Device reset, click this switch to reset the registers in the device.
- PND Global: Device power down, click this switch on to power down the device.
- Data format: Device output data format, click it to set 2's complement or offset binary format.
- LVDS_CMOS Ctrl: Select this box for LVDS or CMOS output format.
- Digital Funct Ctrl: Enable or disable three digital functions:
 - SNRboost/Gain Disable – Gain, test patterns, and offset correction are disabled.
 - SNRboost Enable Only – Gain, test patterns and offset correction are disabled, SNRBoost enable.
 - SNRboost/Gain Enable – Gain, test patterns, offset correction are enabled, SNRBoost enable.
- Gain_chA: Set this box for gain of channel A.
- Gain_chB: Set this box for gain of channel B.
- Test Pattern: Select device test pattern.
- High Perf Mode: High performance mode enable or disable.

- High Freq Mode ChA: High frequency Mode enable for channel A.
- High Freq Mode ChB: High frequency Mode enable for channel B.
- Low Speed Mode En: Low speed mode enable or disable.
- Low Speed Mode ChA: Low speed mode for channel A.
- Low Speed Mode ChB: Low speed mode for channel B.
- LVDS Data Strength: Set the data strength from this switch.
- LVDS Clkout Strength: Set the output clock strength from this switch.
- CMOS Clk Strength: Set CMOS output clock strength from this switch.
- Offset Correction: Enable or disable the offset correction.
- Freeze Offset Correction: Set the freeze offset correction setting
- Offset Corr Time Constant: The offset correction loop time constant in number of clock cycles.
- ChA Offset Pedestal: Channel A offset pedestal selection
- ChB Offset Pedestal: Channel B offset pedestal selection

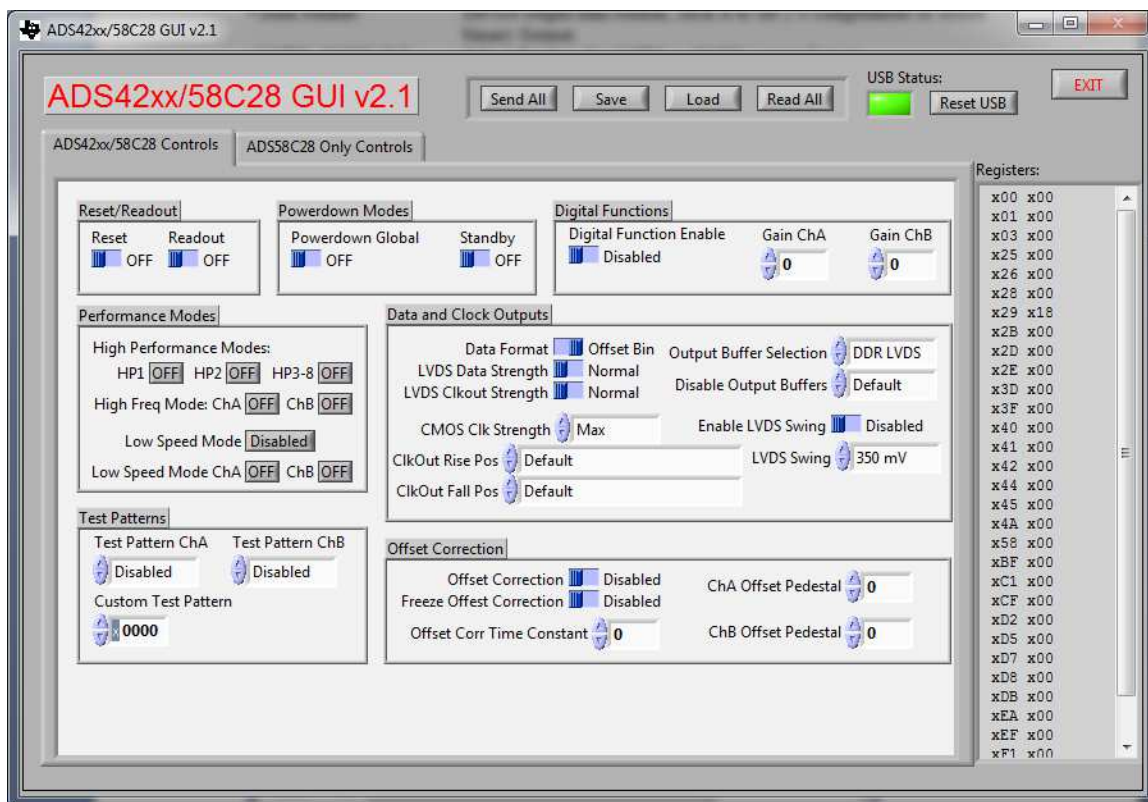


Figure 1. ADS42xx/58C28 GUI Front Panel

1.2.2 ADS58C28-Only Controls

Set the registers for the SNRBoost option on this panel, shown in [Figure 2](#). By enabling *SNRBoost Enable (DIGITAL MODE 2)*, select the SNRBoost mode from the *SNRBoost Filter Number*. For more detailed information, refer to Table 14 in the ADS58C28 datasheet ([SBAS509B](#)).

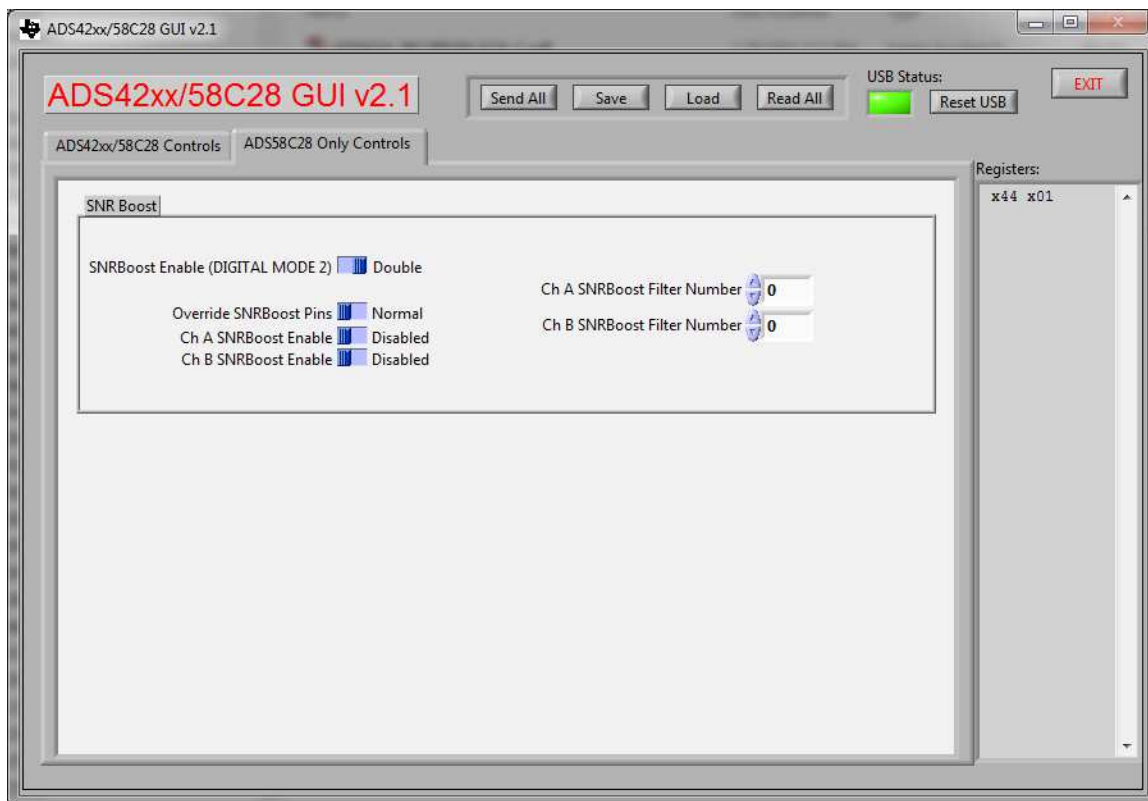


Figure 2. ADS58C28-Only GUI Panel

1.2.3 Register Control

- **Send All:** Sends all the register configurations on the panel to the device.
- **Read All:** Not active.
- **Save:** Saves the register configuration to text file.
- **Load:** Loads a register file from a text file. After load register, the relative switches and selecting boxes are automatically updated.
 - Select the *Load* button.
 - Double click on the desired register file.
 - Clicking *Send All* ensures all of the values are loaded properly.

1.2.4 Miscellaneous Settings

- **Device Selection:** Select ADS58C28 or ADS42xx for proper operation.
- **Reset USB:** Toggle this button if the USB port is not responding. This generates a new USB handle address.
- **Show USB Port:** Allows user to change USB port configuration. Default setting is appropriate for the EVM RevB.
- **Exit:** Stops the program

2 Basic Test Procedure

This section outlines the basic test procedure for testing the EVM.

2.1 Test Block Diagram

The test set-up for general testing of the EVM with the TSW1400 capture card is shown in [Figure 3](#).

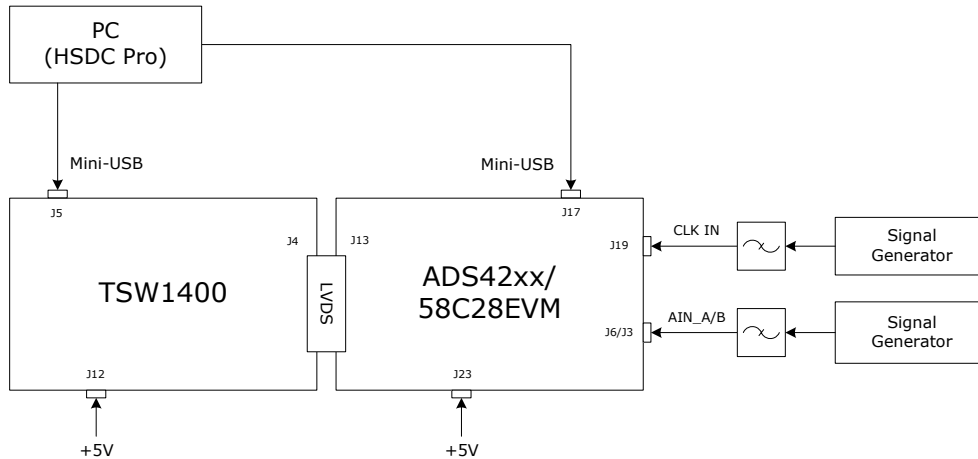


Figure 3. Test Set-Up Block Diagram

2.2 Verify Board Set-up

Verify jumper settings are in the correct position as outlined in [Table 1](#).

Table 1. Default ADS42xx/58C28 EVM Rev B Jumper Setting for Serial Interface⁽¹⁾

Jumper	Default position	Function
JP15	Short 1 - 2	DC supply
JP16	Short 1 - 2	DC supply
JP17	Short 2 - 3	DC supply, LDO
JP19	Short 3 - 2	DC supply, LDO
JP28	Short 3 - 2	DC supply, LDO
JP29	Short 3 - 2	DC supply, LDO
JP26	Open	DC supply for external buffer
JP27	Open	DC supply for external buffer
JP3	Short 2 - 3	OPA power down
JP4	Short 2 - 3	OPA power down
JP22	Open	SDOUT to FPGA
JP20	Short 1 - 2	CDC
JP21	Short 1 - 2	CDC
J14	Short 1 - 2	CDC power down
J18	Open	CDC, VCXO
JP8	Short 3 - 2	ADC SCLK for SPI
JP9	Short 3 - 2	ADC SDATA for SPI
JP10	Short 3 - 2	ADC SEN for SPI
JP11	Short 3 - 2	ADC for SPI, also reset
JP 12	Short 1 - 2	ADC low -speed mode disable

⁽¹⁾ The EVM schematic shows the default setting of JP8 to JP11 as parallel interface ([Table 2](#)), which is for EVM installation. After EVM tested and released, these jumpers are set as serial interface ([Table 1](#)).

Table 1. Default ADS42xx/58C28 EVM Rev B Jumper Setting for Serial Interface⁽¹⁾ (continued)

Jumper	Default position	Function
JP 13	Open	
JP14	Short 7 - 8	ADC 2's complement, DDR LVDS
JP5	Short 1 - 2	ADC CTRL3, normal operation
JP6	Short 1 - 2	ADC CTRL2, normal operation
JP7	Short 1 - 2	ADC CTRL1, normal operation
JP 18	Short 1 - 2	Ext Buffer
JP 23	Short 1 - 2	Ext Buffer
JP 24	Short 1 - 2	Ext Buffer
JP 25	Short 1 - 2	Ext Buffer

Table 2. Parallel Interface with Pin Control of the ADS42xx/58C28 EVM Rev B Jumper Setting

Jumper	Position	Function
JP8	Short 1 - 2	ADC SCLK for parallel control
JP9	Short 1 - 2	ADC SDATA for parallel control
JP10	Short 1 - 2	ADC SEN for parallel control
JP11	Short 1 - 2	ADC parallel control

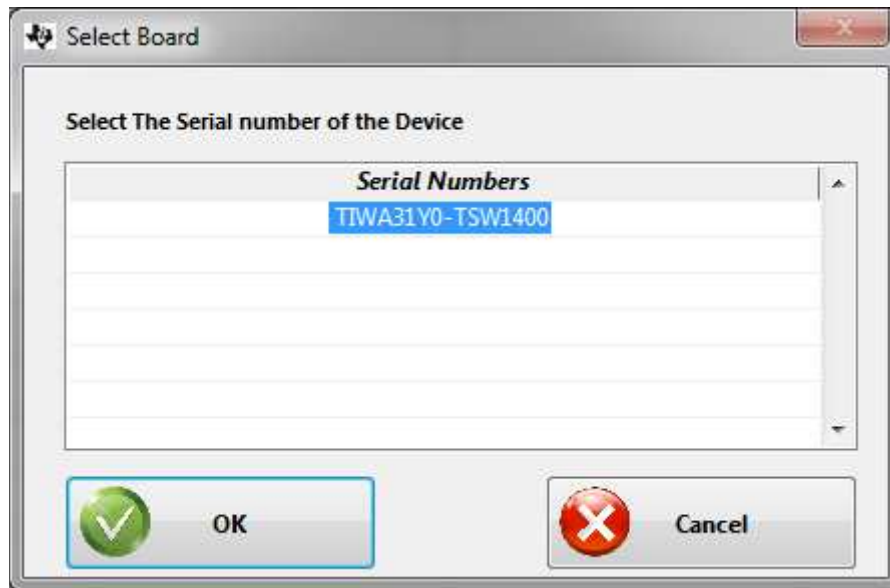
2.3 Test Set-up Connections

- Connect the ADS42xx/ADS58C28 EVM to the TSW1400 EVM
- Connect 5-V power to the banana jack at J10; connect ground to J12
- Connect the USB cable to the programming computer at J17
- Connect the USB and power supply jack to TSW1400
- Connect clock signal through appropriate BPF to J19
- Connect input signal through appropriate BPF to J6, J3

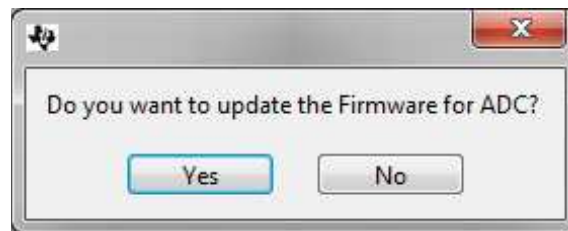
2.4 TSW1400 Quick start Operation

See the TSW1400 user's guide ([SLWU079B](#)) for a more detailed explanation of the TSW1400 set-up and operation. This document assumes the TSW1400 software is installed and functioning properly. The front panel of the TSW1400 is shown in [Figure 4](#).

- Download and install *TSW1400 GUI (High Speed Data Converter Pro GUI Installer, vx.x (Rev.E))* and *TSW140xEVM .ini File Update List* from www.ti.com/tool/tsw1400evm
- Open *High Speed Data Converter Pro*



- Select OK
- Select ADS422x or ADS424x from Select ADC of GUI



- Select Yes to update the firmware from ADC selection
- Select the ADS422x or the ADS424x device name from the TI ADC Selection pull-down menu
 - If this option is not available, download the latest ADS422x.ini or ADS424x.ini file from the product folder of the TSW1400 at www.ti.com/tool/tsw1400evm
 - Place updated *.ini files in the TSW1400 product directory located at C:\Program Files (x86)\Texas Instruments\High Speed Data Converter Pro\1400 Details\ADC files
- Select *Single Tone* FFT from the *Test Selection* pull-down menu

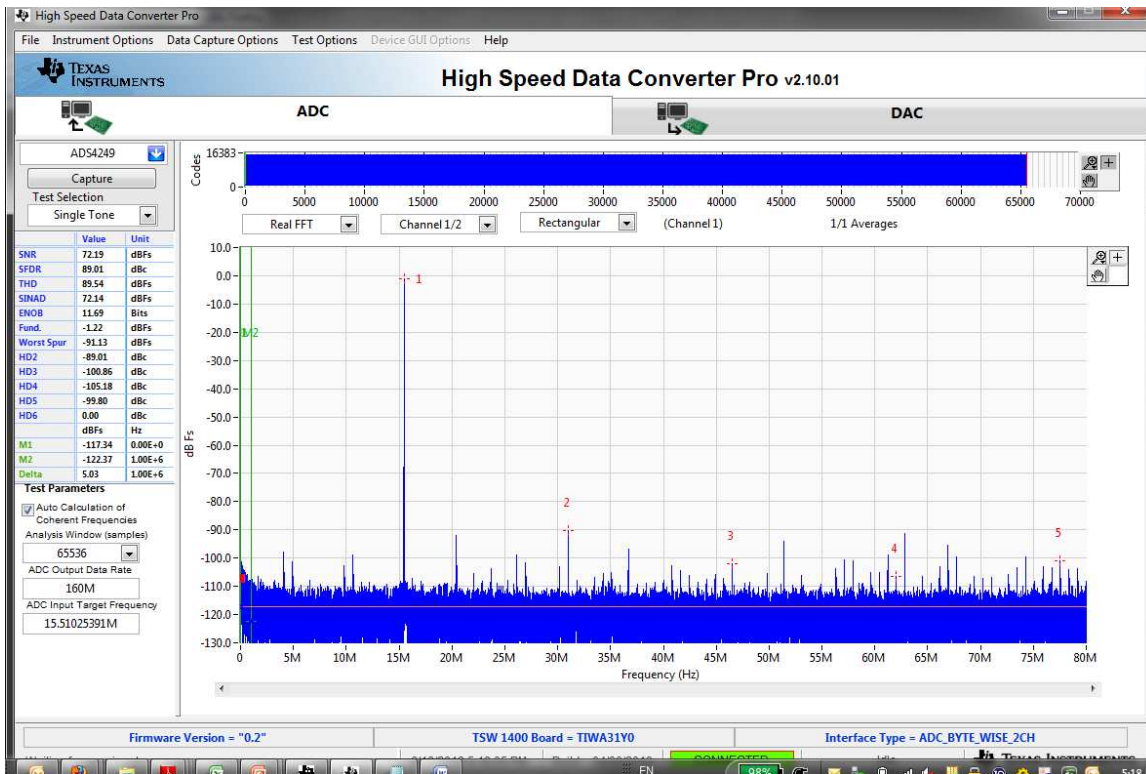


Figure 4. FFT Plot: 160-MHz Clock, 15.5-MHz Input

- Select the desired channel (that is, Channel A or B) from the Channel Display pull-down menu
- Change the ADC sampling rate to the desired value (that is, 250 M)
- Change the input frequency to the desired value (that is, 15.5M)
- Select *Rectangular* of windowing option after checking *Auto Calculation of Coherent Frequencies*
- Set the same frequency of signal generator as *ADC Input Target Frequency*
- Press the *Capture* button to initiate a data capture

2.5 ADS42xx Test Procedure

- Switch on the 5-V power supply on the ADC EVM. Verify source current is about 330 mA \pm 30 mA, with the clock and TSW1400 connected at EVM default (that is, connected at 250 MHz).
- Connect clock signal at J19 through an appropriate BPF
 - Adjust the signal generator amplitude output to 0.6 Vrms to provide approximately 0.8 Vpp at J19 through a BPF with about 5 dB attenuation, plus cable losses.
 - Use a high quality, low-phase noise generator for this input to ensure proper device evaluation
- Connect the input signal through an appropriate BPF at either J6 or J3 (Channel A or B, that is, 170 MHz)
 - Adjust the frequency of the generator to match the coherent frequency displayed in the TSW1400 GUI
 - Select the proper *Display Channel* on the TSW1400 GUI software that corresponds to the input connection
 - Adjust the signal generator amplitude output to achieve -1 dBFS on FFT plot.
 - Use a high quality, low-phase noise generator for this input to ensure proper device evaluation.
- Initiate a capture by pressing the *Capture* button on the TSW1400 GUI.

3 Optional Configurations

3.1 THS4509 Input Op-Amp Configuration

The default analog input configuration is a transformer coupling through T1 and T2 for channel A, and T3 and T4 for channel B. The optional configuration for analog input is through an Operational-Amplifier (OPA), THS4509. The changes required to modify the transformer coupled input to the OPA-driven input are shown in [Table 3](#).

Table 3. Jumper Setting for Transformer-Coupled or OPA-Driven Input

Jumpers or 0 Ω	Transformer-Coupled Input (default)	OPA-Driven Input
R119	Install	Do not install
R123	Install	Do not install
R120	Do not install	install
R129	Do not install	install
R143	Install	Do not install
R141	Install	Do not install
R131	Do not install	Install
R132	Do not install	Install
R93	Install	Do not install
R94	Install	Do not install
R95	Do not install	Install
R96	Do not install	Install
R97	Install	Do not install
R98	Install	Do not install
R99	Do not install	Install
R114	Do not install	Install
SJP3	Shunt 2 - 3, default	Shunt 1 - 2
SJP4	Shunt 2 - 3, default	Shunt 1 - 2

J11 and J13 are the power supply for THS4509. An on-board layout option for an LPF or BPF is available between the amplifier and the ADC. By default, the filter is bypassed allowing the flexibility of designing according to the desired specifications.

3.2 On-Board CDCE72010 Clock

The default clock input configuration is 1:4 transformer coupling through T6. The optional configuration is through clock driver CDCE72010. The changes required to modify the transformer coupled clock input to clock driver input are shown in [Table 4](#).

Table 4. Jumper Setting for Transformer-Coupled or CDCE72010 Input

Jumper	Transformer-Coupled (Default)	CDCE72010
J14	shunt	open
JP20	Shunt 1 - 2	Shunt 1 - 2
JP21	Shunt 1 - 2	Shunt 1 - 2
J18	open	open
R121	0 Ω	DNI
R122	DNI	0 Ω
SJP7	Short 1 - 2	Short 3 - 4
SJP6	Short 3 - 4	Short 5 - 6

The on-board layout is available for the option of VCXO and crystal BPF. The CDCE72010 comes with a default configuration. See the CDCE72010 data sheet ([SCAS858](#)) for details about device default configuration. With a 10-MHz primary reference at J19 and a 983.04-MHz VCXO on-board, the CDC outputs a LVCMOS clock at U0P (pin 7) at 245.76 MHz. With a 491.52-MHz VCXO, the CDC outputs a LVCMOS clock at U0P at 122.88 MHz. The clock goes through an on-board crystal BPF (Y0) and is used as the input clock to the ADC through SJP6.

3.3 Parallel CMOS Output

The default ADC output is configured as DDR LVDS output on the EVM. The layout provides an option of 1.8-V parallel CMOS output from the ADC. The changes required to modify from DDR LVDS output to parallel CMOS output are shown in [Table 5](#).

Table 5. Jumper and Component Setting for DDR LVDS Output and Parallel CMOS Output

Jumper or Component	DDR LVDS Output	Parallel CMOS
U12 (SN74AVC16T245)	DNI	Installed
U13 (SN74AVC16T245)	DNI	Installed
RN5 to RN8	Installed	DNI
RN9 to RN12	Installed	DNI
JP26	Open	Shunt
JP27	Open	Shunt

The CMOS output data is output from the EVM board at 40-pin connectors J1 (ch A) and J2 (ch B).

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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.

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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.

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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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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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