DS125DF1610EVM

User's Guide

Literature Number: SNLU159B
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DS125DF1610EVM

The following user guide details the functionality of DS125DF1610 Evaluation Board Module (EVM) as well as the Graphic User Interface (GUI) based tool SigCon Architect. The DS125DF1610 device profile can be used to read and write register settings via the SMBus. For a functional description of the DS125DF1610, refer to the DS125DF1610 data sheet.

Topic **Page**

1 Hardware Overview

The DS125DF1610 evaluation board can be powered from a 3.3 V or 2.5 V power supply via banana cables. There are 4 quads each with 4 channels for a total of 16 channels. Channels 8 – 11 are connected via SMA connectors. All other channels require MXP connectors that are sold separately and not included when purchasing the evaluation module. An external reference clock can be applied to speed up the lock process, but is not required. A 25 MHz, 125 MHz, or 312.5 MHz reference clock can be applied with the 2 former frequencies allowing a single-ended input (312.5 MHz must be differential). Refer to the datasheet for additional details. The DS125DF1610EVM as shown in Figure 1 is configured with default jumper settings. For a description of each jumpers function, refer to Table 1 below. Note that the jumper settings are not in numerical order, but instead are based on their location as you move clockwise around the edge of the board starting from the banana plugs.

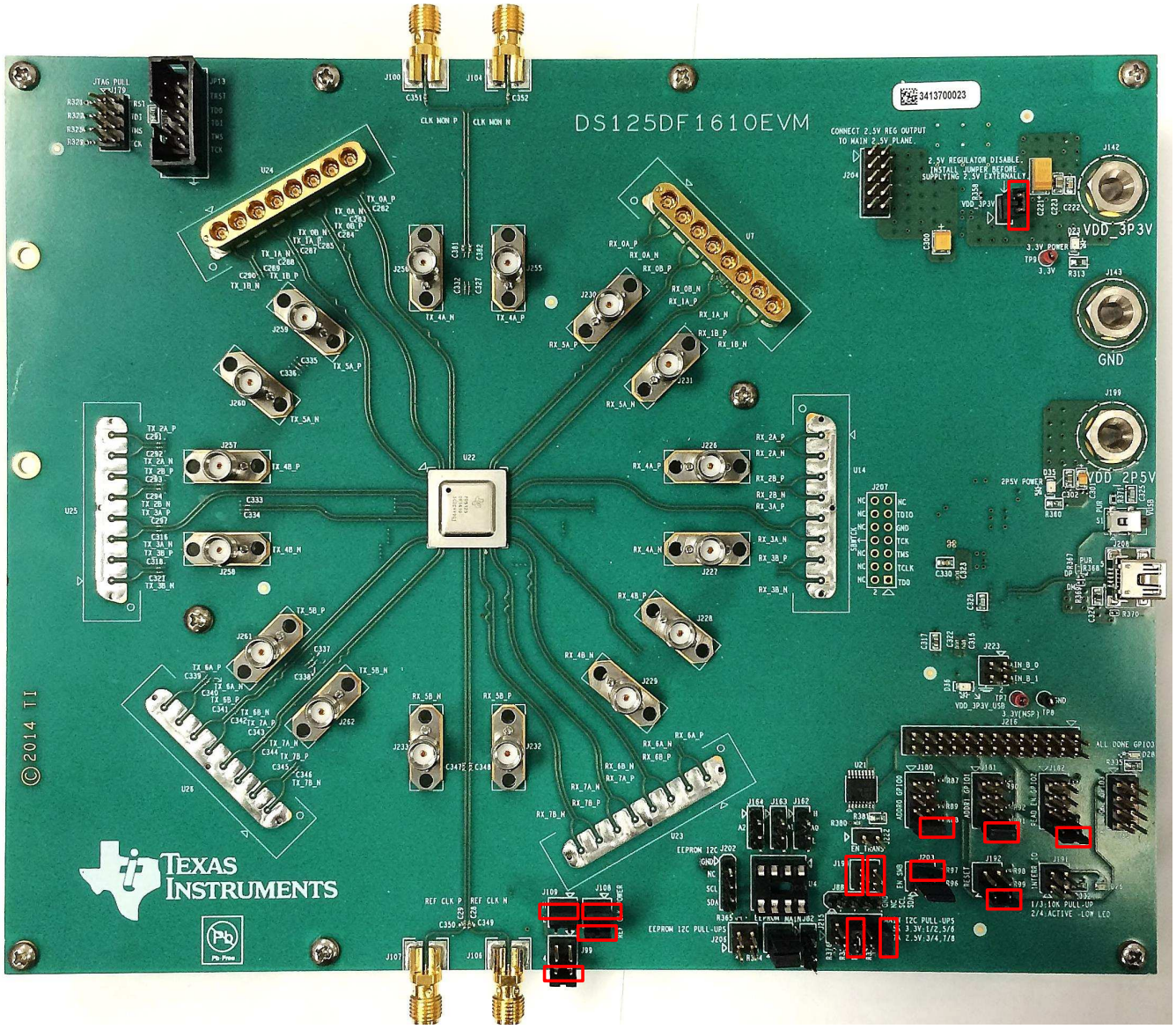

Figure 1. DS125DF1610Evaluation Board

Table 1. Default Jumper Settings

Jumper	Default Setting	Description
J207	All pins open	MSP430 Microcontroller Connections
J223	All pins open	MSP430 Microcontroller Connections
J216	All pins open	MSP430 Microcontroller Connections
J183	All pins open	All Done GPIO3
J182	Tie Pin 7 – 8	Read EN GPIO2
J191	All pins open	Interrupt I/O
J181	Tie Pin 7 – 8	Address Bit1, GPIO1
J192	Tie Pin 1 – 3	Reset I/O
J180	Tie Pin 7 – 8	Address Bit0, GPIO0
J203	Tie Pin 2 – 4	EN SMBus
J222	All pins open	TXB0107 Voltage Level Translator Output Enable
J193	Tie pin 1 -2 Tie pin 3 -4	MSP430 Microcontroller Connections
J88	All pins open	SMBus Access
J215	Tie Pin 3 – 4 Tie Pin 7 – 8	Pull-Ups for SMBus
J162	All pins open	EEPROM Address Bit
J163	All pins open	EEPROM Address Bit
J164	All pins open	EEPROM Address Bit
J82	All pins open	EEPROM Write Protect Bit
J175	All pins open	EEPROM SMBus
J202	All pins open	EEPROM SMBus
J206	All pins open	EEPROM SMBus Pull-Ups
J108	Tie Pin 1 – 3 Tie Pin 2 – 4	Oscillator Power
J109	Tie Pin 1 – 3	Oscillator Output Enable
J99	Tie Pin 2 – 4	Oscillator Frequency Select
J179	All pins open	DS125DF1610 Retimer Connections
JP13	All pins open	DS125DF1610 Retimer Connections
J204	All pins open	2.5 V and LDO Power Plane Connection
J198	Tie Pin 1 – 2	LDO Enable Pull-Up

2 Required Software

- SigCon Architect
- DS125DF1610 Profile for SigCon Architect

3 Setup Instructions

- Navigate to the DS125DF1610EVM product page on TI.com.
- Follow the guide at SNLU178 to install the SigCon Architect software, and for ease of use, add the shortcut to the desktop. With the software still closed, run the device profile updater for the DS125DF1610 as indicated in the previous guide.
- Hook up the power supply to the DS125DF1610EVM with the output disabled.
- Using the USB2ANY, the USB cable can be connected directly to the USB port on the EVM board and the computer.
- Click the shortcut to open the SigCon Architect software. If prompted to run as administrator, select yes.

When starting SigCon architect, the graphic user interface should appear as in Figure 2 with the DS150DF1610 Retimer profile already loaded. In order to initiate reading and writing of the registers, the 'Demo Mode' box in the upper right hand corner must be deselected.

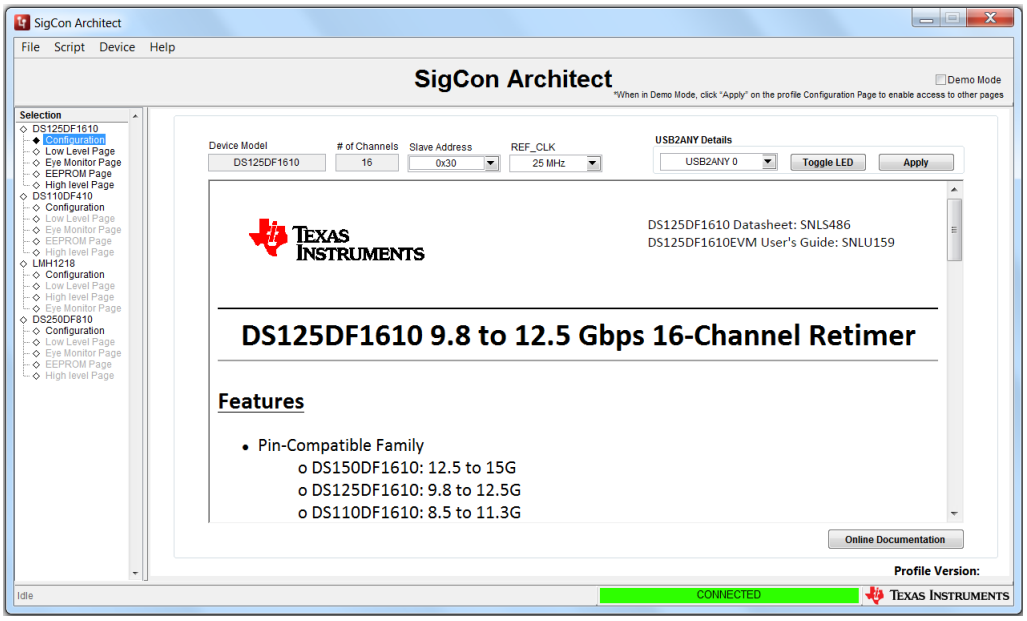

Figure 2. DS125DF1610 Profile GUI

4 Selection Sidebar

The 'selection' sidebar shows the current active device profiles. When the device is active and configurable, this will show the sub-pages that are used to control the device: Configuration, Low Level Page, Eye Monitor Page, EEPROM Page, and High Level Page.

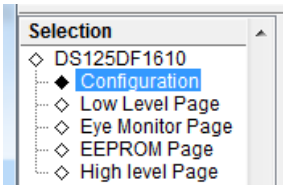

Figure 3. Selection Sidebar

The content on each of these sub-pages will be detailed in each of the following sections.

5 Configuration Tab

The configuration tab's main purpose is to specify the slave address for successful communication with the DS125DF1610EVM. The default address is hex 0x30 as shown in Figure 4. If the ADDR0 (GPIO0) or ADDR1 (GPIO1) jumper settings are altered, the SMBus address will need to be changed. Refer to the datasheet for additional information.

Figure 4. Configuration Tab

After selecting the proper slave address, the board can be connected by clicking the apply button. If the USB2ANY details drop down box does not show any values, then the board is not correctly connected to your computer.

Make sure to set the REF_CLK value to the 312.5 MHz value, as this is the default for this board.

6 Low Level Tab

In this tab, the user can find all of the register values that are on the DS125DF1610 board, including both shared values and values unique to each of the input and output channels.

The Expand / Collapse all buttons can be used to show and hide all of the registers on the list. In order to read the most recent settings from the board, use the Read All button to update the state of each of the registers. In order to update only one of the registers, use the Read Register.

In order to adjust all of the registers in bulk, 4 additional buttons are available. The load config and save config buttons will load and save the contents of all registers on the board. These .cfg files store all registers in order with data in hexadecimal. The file can be edited in your favorite text editor. A simple way to restore custom settings is to load your saved config files. The reset device button will reset the registers and the board to their original configuration.

The fourth button is the broadcast button, which the user can utilize when it is necessary to change a channel register on each of the 16 channels simultaneously.

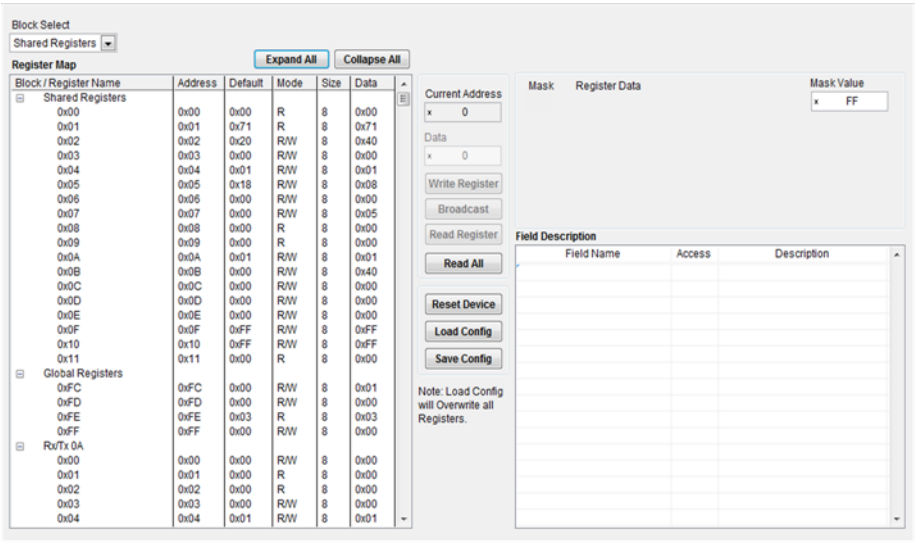

Figure 5. Low Level Tab

7 EEPROM Tab

If the desired shared register settings are stored in EEPROM the ‘Device from Slot’ push button should be selected in order to write to the retimer registers. To write the current shared register settings in the GUI to EEPROM, the ‘Slot from Device’ push button should be selected.

Saving and loading the EEPROM configuration hex file can be performed with the Load from Hex File, and Write to EEPROM Hex buttons.

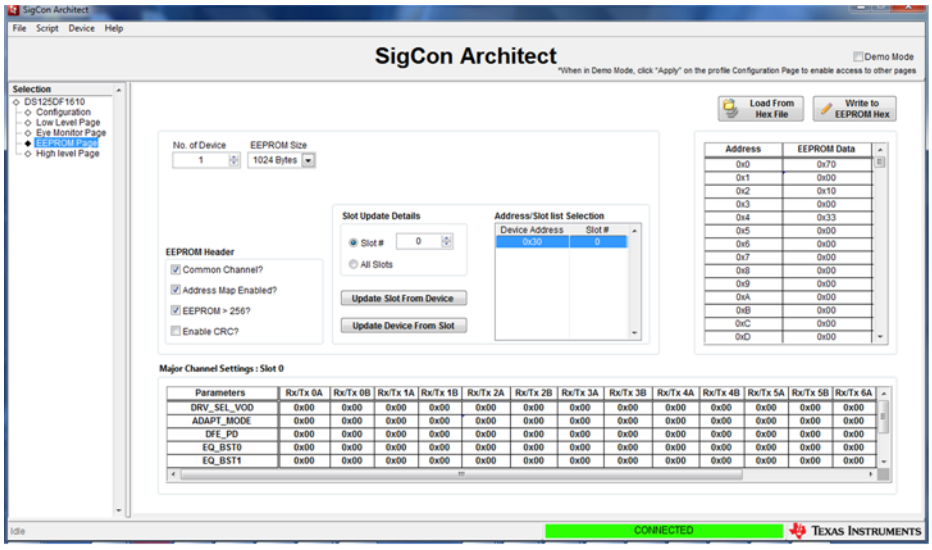

Figure 6. EEPROM Tab

8 Eye Monitor Tab

The internal eye monitor functionality can be controlled by the Eye Monitor Tab as shown in Figure 7. Under the Channel Indicators (in Red) the CDR must be locked and a signal detected before the eye monitor can be turned on. Prior to turning on the Eye Monitor, the Eye Monitor Voltage must be selected, as well as the Channel Selected (Blue). The eye monitor plot must then be turned on with either the single capture or continuous capture modes. A device reset is also included in this tab. After acquiring the data from the eye monitor, the horizontal and vertical eye openings, HEO and VEO, can be viewed under EYE opening values.

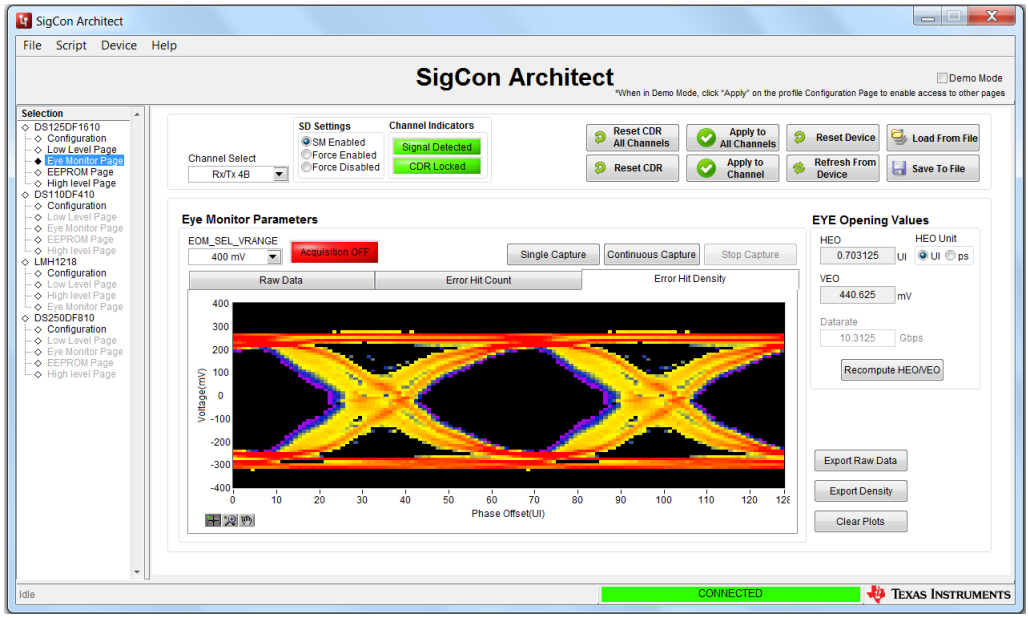

Figure 7. Internal Eye Monitor Tab

On the bottom right hand side of the monitor are the three buttons used to manipulate the data within the monitor. The export raw data button allows the user to export this collected data as an excel spreadsheet with values to interpret the darkness of the eye monitor. The export density button allows the user to export the collected density values from the eye monitor plot, again as an excel spreadsheet with the values of density as the cell values. The clear plots button allows the user to clear the eye monitor before capturing the next set of data.

9 Device Status Tab

This tab gives a brief summary of the status on all of the channels in the device. This includes whether there is a signal or a lock on each channel, as well as a summary of the CTLE, DFE, EOM, and transmit settings for the channel.

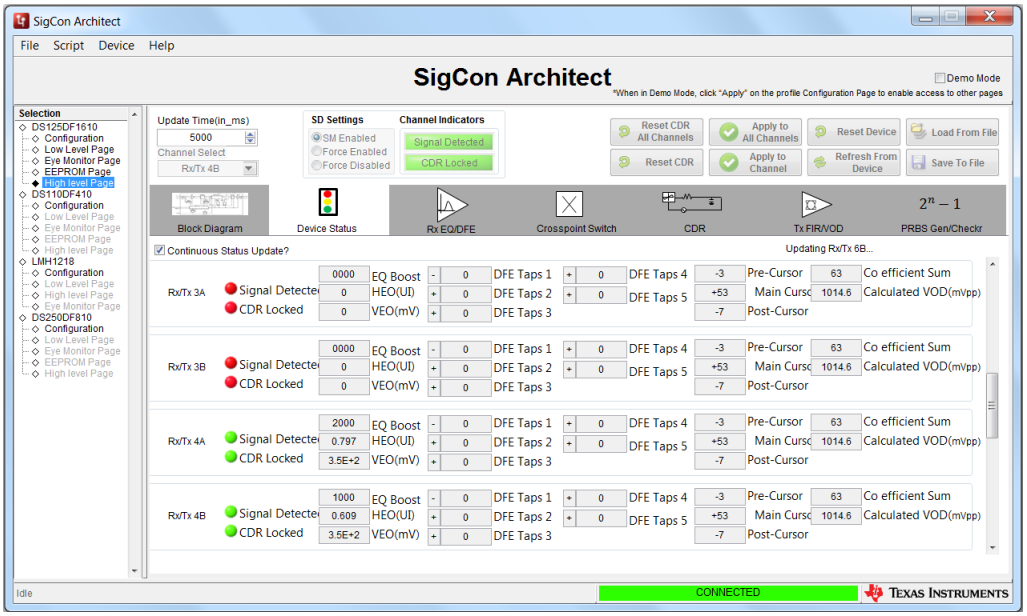

Figure 8. Device Status Tab

10 Transmitter Tab

The transmitter tab controls the various level settings for VOD, the 3 taps of the FIR filter, and in addition has indicators for when a signal is detected as well as when the CDR locks for all 16 transmitter channels as shown in Figure 9.

The ‘Channel Select’ pull down menu is used to select which of the 16 channels is being modified. For the Channel Indicators box, when a signal is detected the ‘Signal Detect’ indicator will switch from being red and reading No Signal to green and should read Signal Detected. If the CDR locks to the applied data rate, the indicator should switch to green and read CDR Locked. The ‘Reset’ push button is used to reset the default transmitter settings. By default the ‘SM Enabled’ icon should be selected to enable the state machine. In order to force the channel in question to be active as opposed to relying on signal detect, ‘Force Enabled’ can be selected. Conversely, in order to disable a channel regardless of whether a signal is detected ‘Force Disabled’ can be selected.

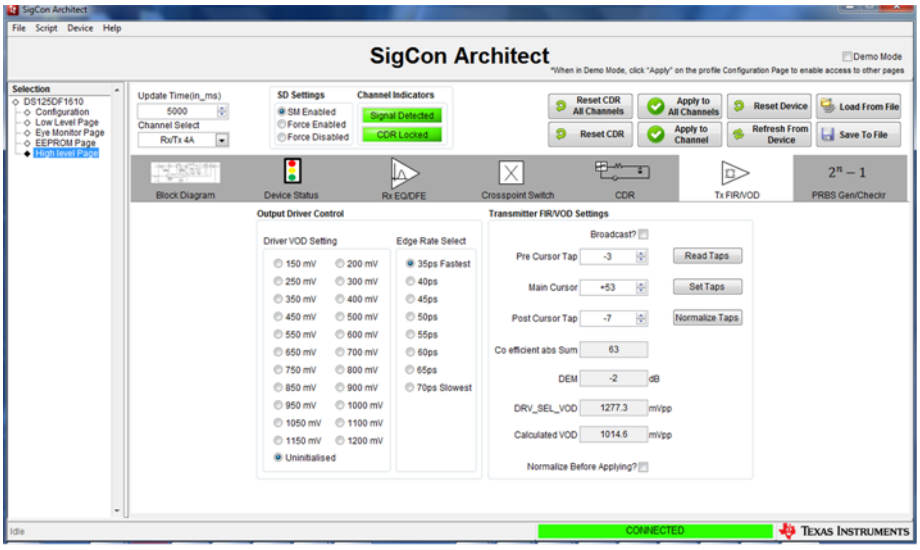

Figure 9. Transmitter Tab

The DS125DF1610 output driver has 22 VOD level settings ranging from 150 mV to 1200 mV in 50 mV increments. When the retimer is reset, the VOD level will return to the default value of 1000 mV. The 'Edge Rate Select' option allows the user to adjust the rise and fall time for the output signal, with the default setting being the fastest rise/fall time.

The 'Transmit FIR Control' section consists of 3 FIR taps; pre-cursor, main-cursor, and post-cursor. The pre-cursor and post-cursor taps emphasize the output voltage level to account for high frequency losses. The main cursor primarily is used to balance the other two taps in order to sum to the appropriate normalized sum value which based on the selected VOD setting. The pre-cursor, main cursor, and post-cursor taps of the FIR filter are each adjusted on a scale of 0 – 63 but should be normalized based on the selected VOD setting. Normalizing the taps can be performed either by selecting the Normalize before applying checkbox, or by clicking the normalize taps button.

However, each of the 3 taps can be set to any of the 64 levels without being normalized. This is not recommended as a starting point, but is a feature that can be utilized. To write the tap settings to the register without normalizing them, 'Normalize Before Applying' must be deselected.

The 'Normalize Taps' push button will adjust the main cursor in order to sum the 3 taps to the value predefined by the VOD setting the user selects. However, if the 'Normalize Before Applying' checkbox is selected the 3 taps will be normalized when writing them to the register. The 'Read Taps' push button will populate the current register settings for the pre, post, and main cursor taps into the corresponding fields. 'Set Taps' will write the pre, main, and post cursor settings into the register.

11 Receiver Tab

The Receiver tab controls all the relevant functionality associated with the 16 receiver channels of the DS125DF1610EVM. The 'Signal Detect' and 'CDR Lock' indicators are identical to the Transmitter Tab, reflecting when a signal is detected or when the CDR locks. 'Channel Select,' 'Update Time,' and 'Reset' are all similar to the Transmitter Tab.

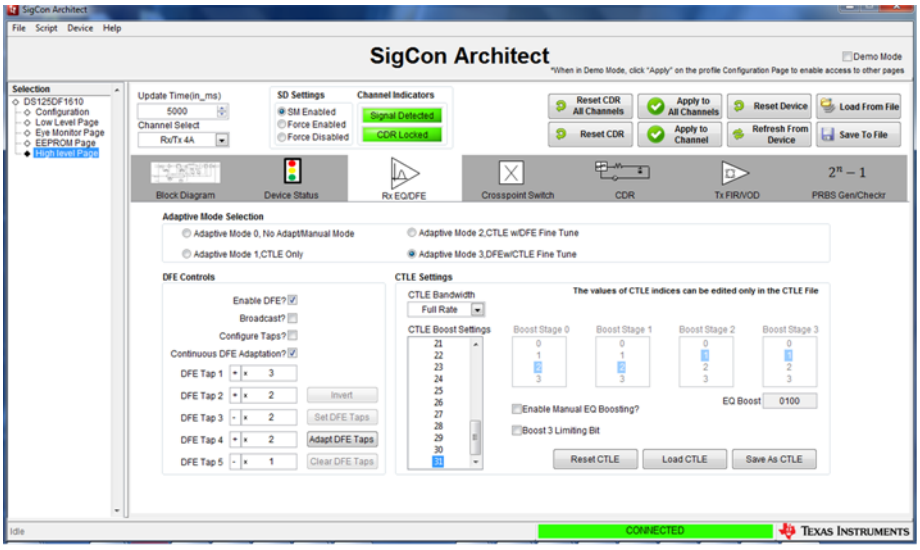

Figure 10. Receiver Tab

The ‘Adapt Mode Selection’ section is for the setting the adapt mode of the DS125DF1610. Refer to Table 2 for explanations of each adapt mode.

Table 2. Adapt Mode Descriptions

Adapt Mode	Description
0	Manual Setting of CTLE and DFE, no adaptation
1	Adapt CTLE only
2	Adapt CTLE until optimal, then DFE, then CTLE again
3	Adapt CTLE until lock, then DFE, then CTLE until optimal

The EQ boost settings are divided into 4 stages, each with 2-bit boost control for a total of 256 different stage-boost combinations. In order to select the EQ boost settings, the device must be in Adapt Mode 0. In the other Adapt modes the CTLE will adapt through 32 of these stage-boost combinations. The CTLE adaptation can be set to limiting mode by selecting the ‘Boost 3: Limiting Bit’ check box. The ‘Load CTLE Table’ push button is used to specify the 32 EQ settings that the CTLE should cycle through.

The ‘DFE Control’ area of the Receiver Tab is used for setting the 5 taps of the DFE. Tap 1 has 32 settings from 0 to 224 mV in 7 mV increments. See Table 3 for details. These values should be entered in hex from 0x00 to 0x1F. Taps 2 through 5 have 16 settings each from 0 to 112 mV in 7 mV increments and should be entered in hex from 0x00 to 0x0F. The polarity of each tap can also be adjusted, with a negative polarity representing boost and positive representing an attenuation of the data. In order to set the DFE Taps manually (only Adapt Mode 0), ‘Enable Manual Tap Control’ must be selected and ‘DFE Enable’ must also be turned on. ‘Clear Taps’ will reset all of the tap values to 0mV (0x00). When in an adapt mode where the DFE will adapt automatically, it can be configured to adapt only during lock acquisition or to adapt continuously with the “Continuous DFE Adaptation” checkbox.

Table 3. DFE Tap Parameters

DFE Parameter	Value (mV)
Tap 1 Weight Range	0 - 224
Tap 2-5 Weight Range	0 - 112
Tap Weight Step Size	7

12 CDR Tab

Within the ‘Mode Selection’ section there are two options for setting the data rate that the DS125DF1610 expects to receive – ‘Standard Rate’ and ‘Manual Mode.’ ‘Standard rate’ gives the user the option to select the data rate they are running at for a defined set of protocols, without having to manually program the expected data rate. See Table 4 for additional details.

Table 4. Standard Mode Data Rates

Channel Register 0x2F[7:4] Setting	Standard	Data Rates (Gbps)	First Group Divider Settings	Second Group Divider Settings
0x6	Custom	11.5	1	1
0x7	Interlaken	12.5, 6.25, 3.125	1, 2, 4	1, 2, 4
0x8	CPRI 1	9.8304, 4.9152, 2.4576	1, 2, 4	1, 2, 4
0x9	CPRI 2	6.144, 3.072	2, 4	2, 4
0xA	Infiniband	10, 5, 2.5	1, 2, 4	1, 2, 4
0xB	Ethernet	10.3125, 1.25	8	1

The alternative to ‘Standard Rate’ mode is to program the expected data rate in ‘Manual Mode.’ In manual mode the desired data rate and corresponding VCO frequency must be entered into Group One or Group Two. Refer to the datasheet Register Map for setting the 0x2F [7:4] register bits. The bits should be set based on the expected date rate, taking into account which divider will be required. For example if a data rate of 1.25 Gbps is entered into the desired VCO frequency for Group One, 0x0C should be selected due to it having an 8 divider since 1.25 Gbps is a division of 10.3125 Gbps by 8. When a date rate is manually entered into the ‘Desired VCO Frequency’ field the ‘Write Rate Reg’ push button must be selected to write it to the register. The desired ppm tolerance is used to adjust the lock range of the CDR for the receiver channel in question. The VCO count and PPM delta count fields are automatically populated based on the specified data rate.

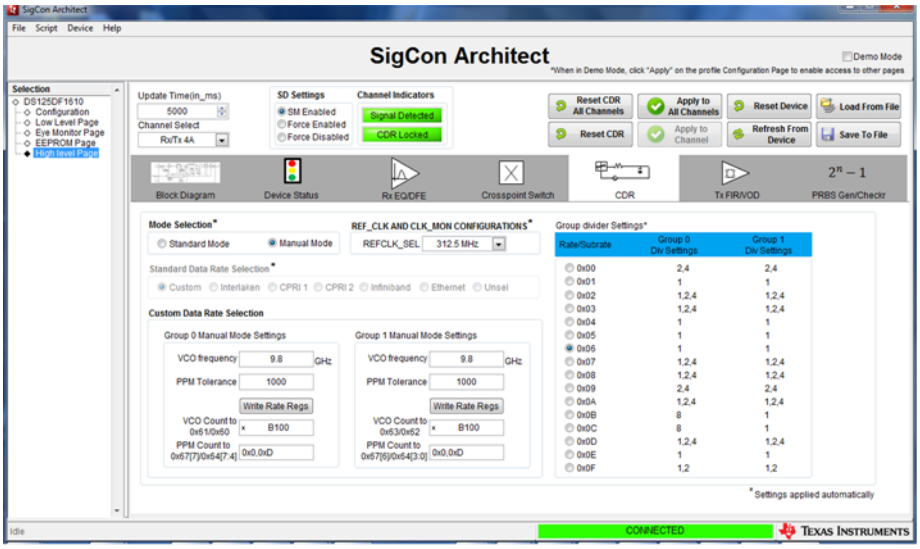

Figure 11. CDR Tab

13 PRBS Generator/Checker Tab

The DS125DF1610 is equipped with an on-board PRBS generator as well as a PRBS checker. The PRBS generator and PRBS checker should be operated from different channels. The PRBS generator can generate a pseudo-random bit sequence on the transmit side of a channel. It can then be run through a cable or backplane, and checked by the receiver channel that is configured for the PRBS checker. The PRBS Checker must be enabled in the 'PRBS Checker Enable/Disable Selection' section. In order to reset the PRBS sequence, the 'Reset PRBS' push button can be selected. In the 'PRBS Pattern Status' section the checker will read the PRBS pattern whether that be PRBS31, PRBS15, PRBS9, or PRBS7. It will populate the inverted or non-inverted field, as well as provide the error count, bit count, and the error rate. The 'PRBS Generator' section is where the PRBS sequence length can be set. However instead of generating a PRBS sequence, an 8-bit user pattern can be created and also inverted if desired.

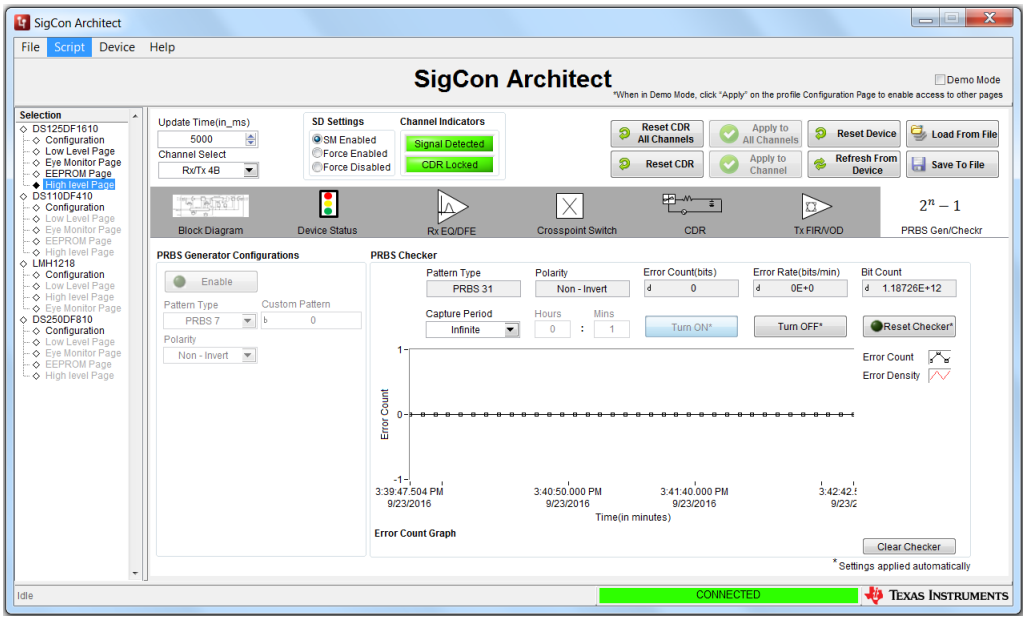

Figure 12. PRBS Generator/Checker Tab

14 Cross Point Switch Tab

In this tab the cross point functionality of the DS125DF1610EVM can be configured. It is divided up into 4 quads or switch matrices, each with 4 channels. By default, the DS125DF1610EVM has no cross-point enabled and the receiver channel will route to the same transmit channel. The cross point functionality can be used to create point to point links, or operate in broadcast mode. In point to point switching, one input channel will be routed to only one output channel. When using broadcast mode, one input can be routed to two, three, or four output channels. Refer to the DS125DF1610 datasheet for additional information. The 'TX CH x Select' section controls the associations between receive channel and transmit channel. When setting up point to point switching, the 'Broadcast Channel section is not used. The 'Signal Detected and CDR locked' will indicate when a receiver channel is detecting a signal, as well as indicate when the CDR locks for a selected transmit channel. When operating the broadcast function, a master must be selected in order to dictate which output channel will send back its adapt data to the CTLE. Refer to the datasheet for additional information. Only one master transmit (output) channel should be selected, as there cannot be more than one master channel in a broadcast network.

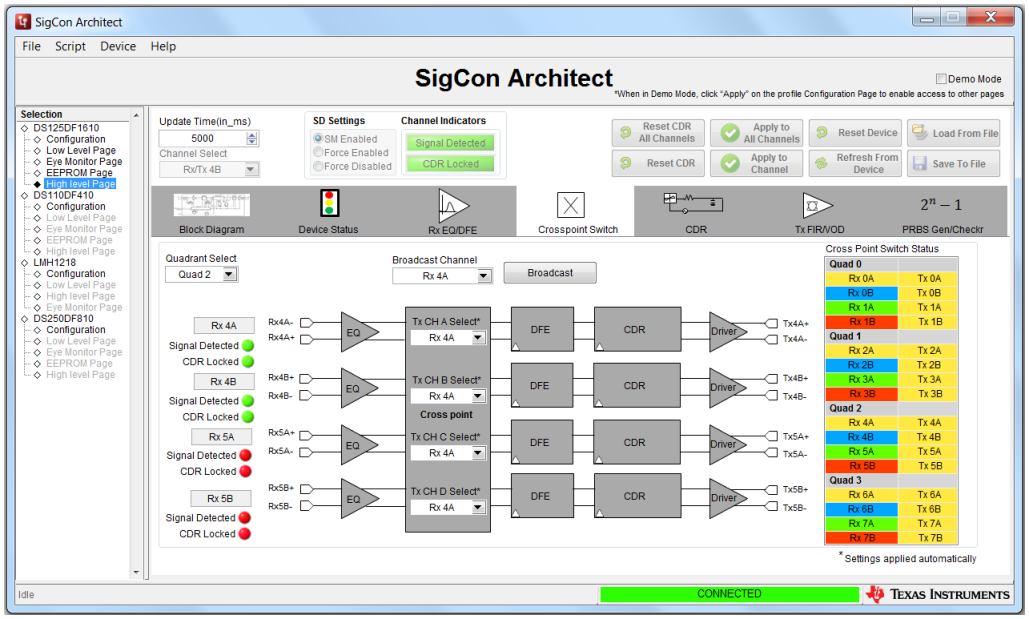

Figure 13. Cross Point Switch Control Tab

15 Scripting Tab

The scripting tab is a Python-based script for coding channel and shared register settings. To access the scripting function click the Script button on the upper menu bar. Click launch window and start recording to save a process of configuration into a Python script. After finished, select stop recording from the same menu.

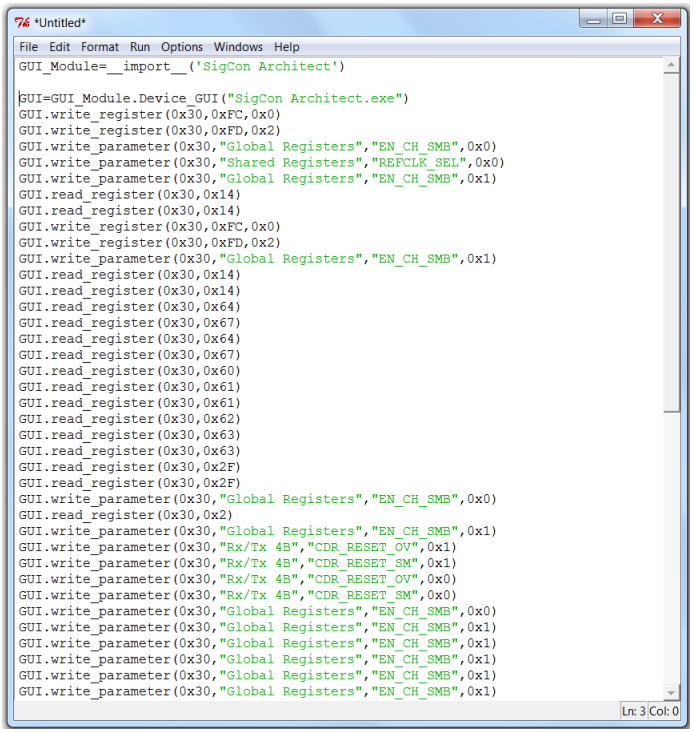

Figure 14. Scripting Tab

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from A Revision (January 2017) to B Revision **Page**

- Changed J193 all pins open to tie 1-2 and 3-4 4

Changes from Original (April 2014) to A Revision **Page**

- Changed picture in Figure 1 3
- Changed sections 2-15 from supporting Analog Launch Pad to Sigcon Architect 4

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