TIDA-00427 DS280BR810 100G QSFP28 Test Setup

1 Software and Hardware Description and Setup

1.1 Procedure

The general procedure for setting up and testing with the TIDA-00427 reference design is as follows:

1. Verify the jumpers have been installed properly.
   - J3: Tie pins 1 and 3 and pins 2 and 4.
   - J22: Tie pins 1 and 3 and pins 2 and 4.
   - J20: Tie pins 1 and 2.
   - J21: Tie pins 1 and 2.
   - J8: For a 3.3-V power supply, remove jumper; for a 2.5-V power supply, tie pins 1 and 2.
   - J12: For a 3.3-V power supply, tie pins 1 and 2, 3 and 4, 5 and 6, 7 and 8, and 9 and 10. For a 2.5-V power supply, remove all jumpers on J12.
2. Connect power to the board. The TIDA-00427 reference design supports either a 2.5- or 3.3-V supply mode.
   - 3.3-V use case instructions (see Figure 1):
     (a) To enable the 3.3- to 2.5-V LDO, verify that there is NO jumper on J8 to enable the 3.3- to 2.5- LDO.
     (b) Verify that J12 has been configured for 3.3 V as described in step 1 so that the output of the LDO connects with the 2.5-V power plane of the board.
     (c) Connect a 3.3-V DC power supply (1000 mA max) between J10 (3.3 V) and J9 (GND).

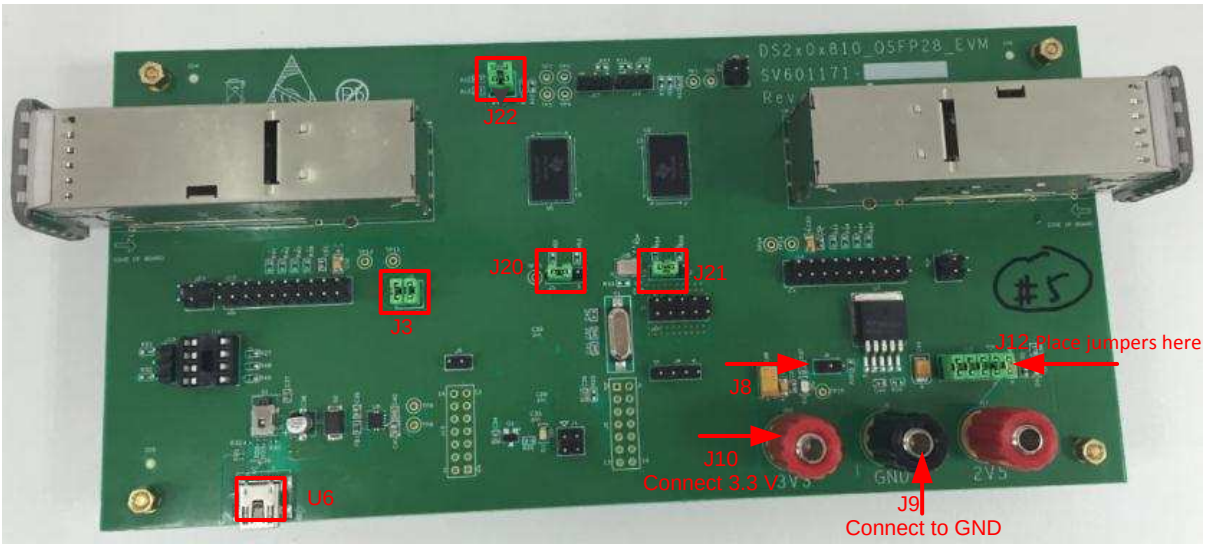

Figure 1. 3.3-V Mode Connections

- 2.5-V use case instructions (see Figure 2):
  (a) Place a jumper on J8 to disable the 3.3- to 2.5-V LDO.
  (b) Make sure that there are NO jumpers on J12.
  (c) Connect a 2.5-V DC power supply (1000 mA max) between J11 (2.5 V) and J9 (GND).

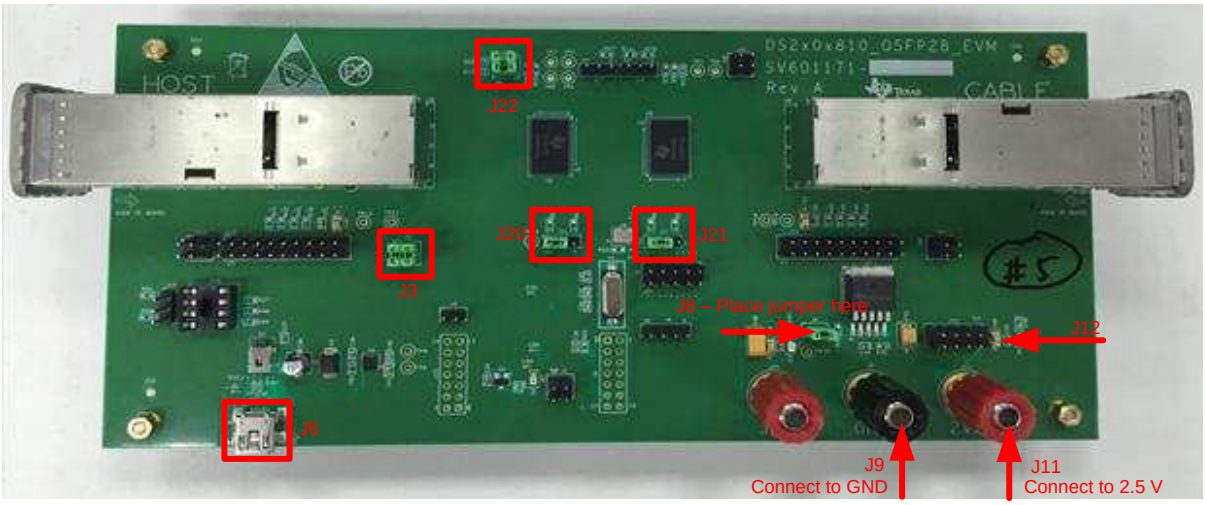

Figure 2. 2.5-V Mode Connections

3. Connect the TIDA-00427 device to a PC using the provided USB cable on J6.
4. Contact a Texas Instruments (TI) sales representative or send a request to the DS280BR810 product page to obtain a copy of the SigCon Architect tool, which supports the DS280BR810 linear repeater. Two options exist for the installation of this software:
   (a) SigCon Architect Installer (Run-Time Engine not embedded):
   For users that already have LabVIEW RTE installed or for users that do not have LabVIEW RTE but are installing SigCon Architect software on a PC with an active Internet connection.
   (b) SigCon Architect Installer wRTE (Run-Time Engine embedded):
   For users that do not have LabVIEW RTE and are installing SigCon Architect software on a PC without an active Internet connection.
   Install the SigCon Architect software using the step-by-step instructions. Refer to the user's guide for the SigCon Architect software at the following link (SNLU178).

5. Contact TI Application Support to obtain the profile for the DS280BR810 linear repeater, “DS280BR810 Updater.exe“. Double-click this file and install it step-by-step based on the pop-up information. Click the *Finish* button at the end of the installation to open the Sigcon Architect tool automatically (see Figure 3).

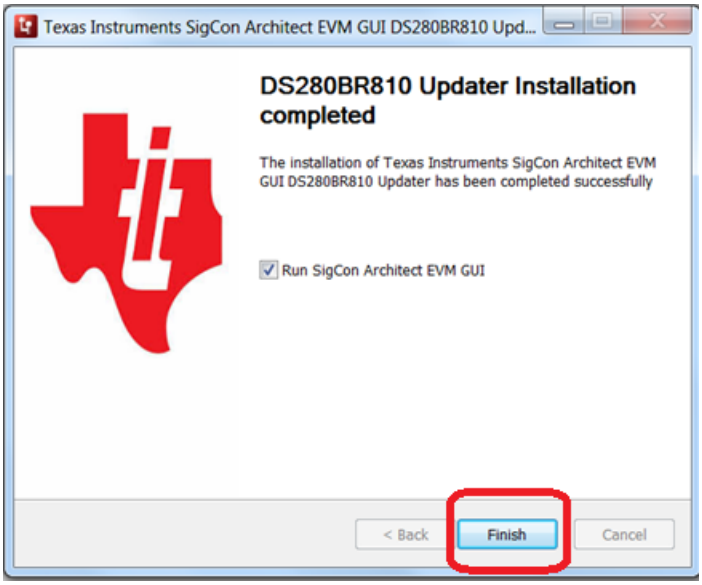

Figure 3. SigCon Updater Installation

6. Follow these steps to remove other profiles in the SigCon Architect tool so that only the DS280BR810 profile is visible in the graphical user interface (GUI).

   (a) As Figure 4 shows, when a pop-up message appears, click the *Continue on Demo Mode* button.

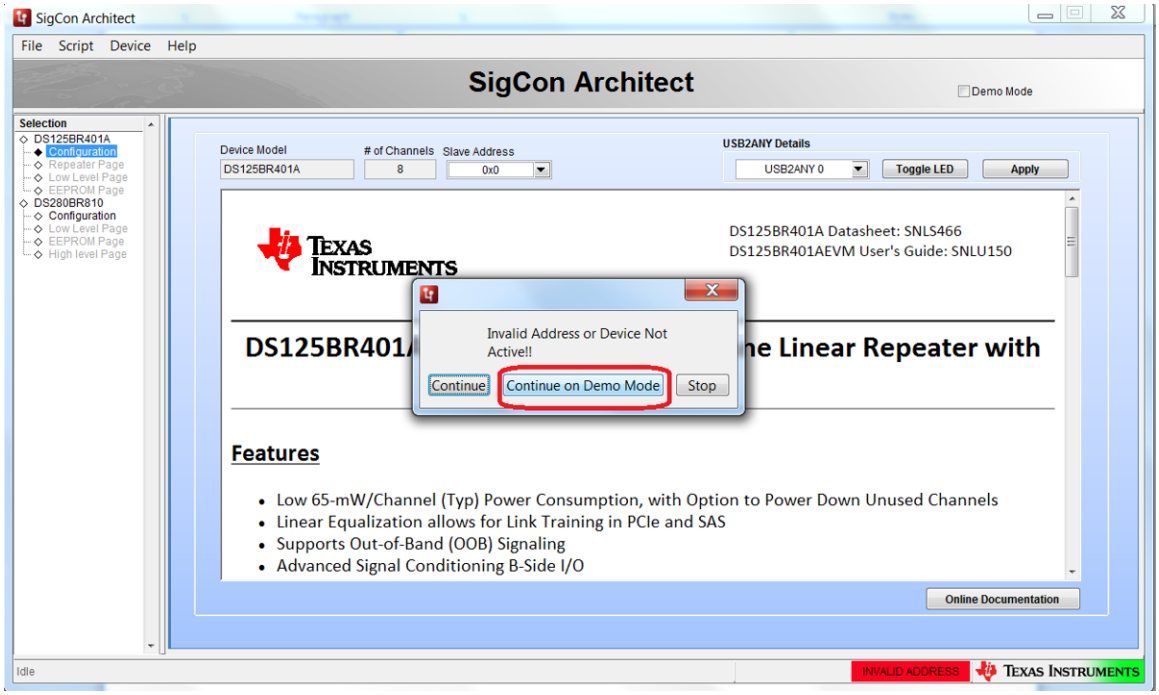

Figure 4. SigCon GUI—Demo Mode

(b) In the *File* menu, click the *Device* menu, select *Manage Devices*, then select *DS125BR401A* under the *List of Loaded Devices* panel, and delete the DS125BR401A profile by clicking the *X* icon (see Figure 5). Then click the *OK* button. After following these steps, the DS280BR810 profile becomes visible.

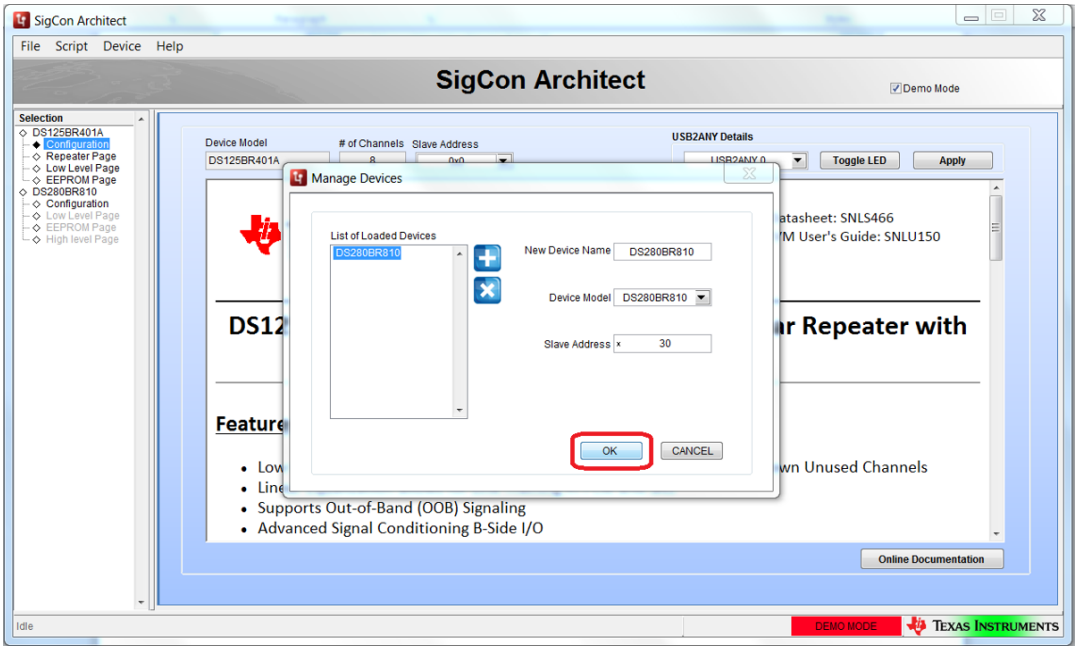

Figure 5. SigCon GUI—Profile Removal

(c) To show the updated preferences, the tool restarts automatically. The green *CONNECTED* indicator on the bottom right of the application shows whether a successful connection has been made or not (see Figure 6). This indication means that the tool is communicating with the U1 correctly, which has the default slave address of 0x30. The user can change the slave address to 0x36 to control the U2 device.

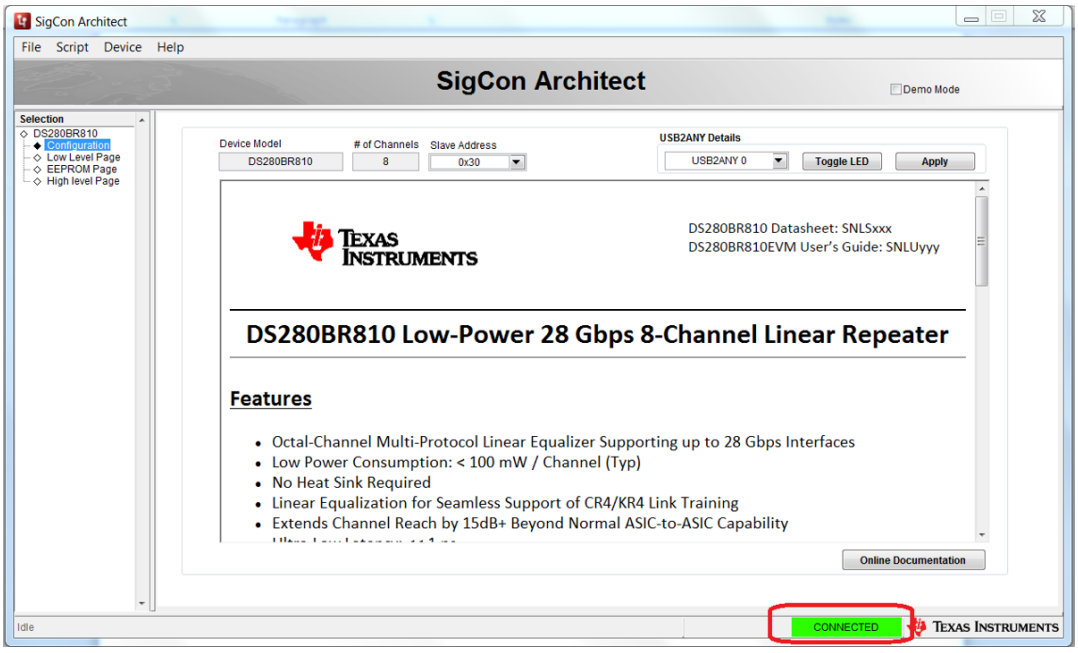

Figure 6. SigCon GUI—*CONNECTED* Indication

(d) If the message to update the *USB2ANY Firmware Requirement* appears, follow the instructions in the pop-up message step-by-step to update (see Figure 7).

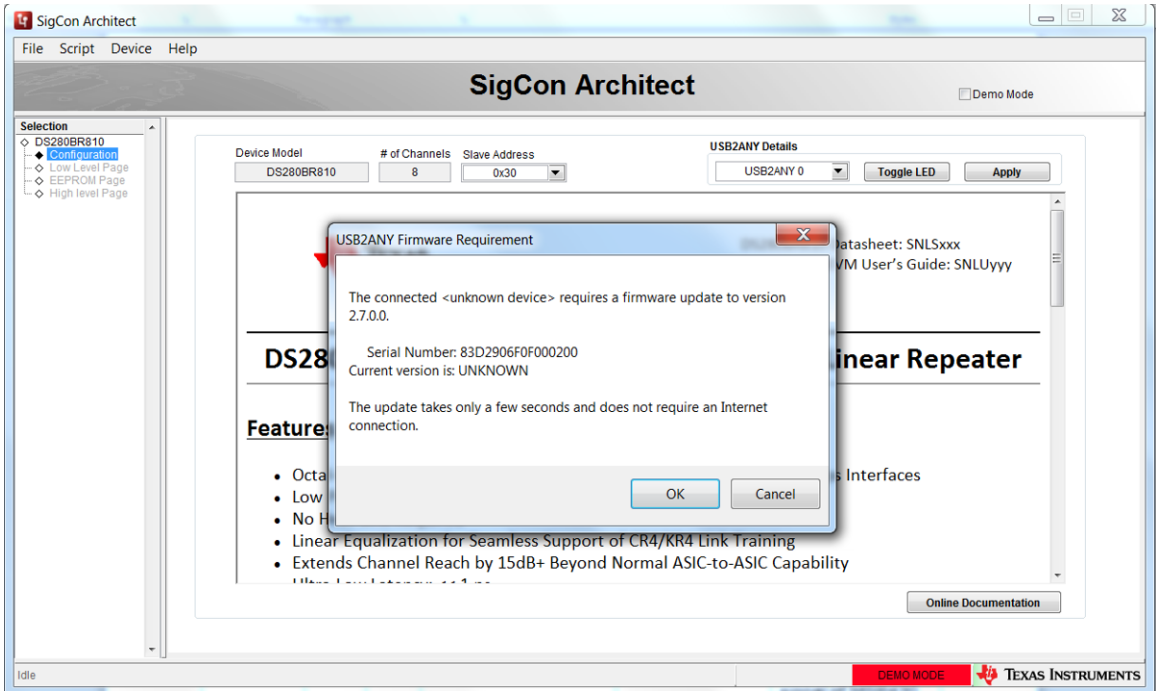

Figure 7. SigCon GUI—*USB2ANY Firmware Update* Pop-up

(e) After the firmware has been successfully loaded and the USB2ANY has been recognized by the PC, a single ”Human Interface Devices” entry becomes visible within the *Device Manager* window on the PC (see Figure 8). The right-side window in Figure 8 shows how the *Device Manager* appears if the board has not been successfully connected to the PC

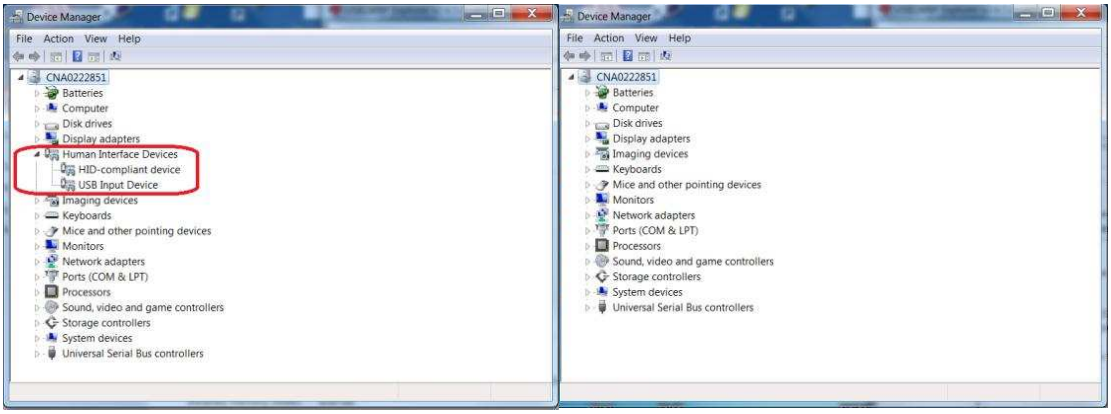

Figure 8. Device Manager

7. Upon successfully establishing communication between the SigCon Architect tool and the device, select the ”High Level Page” entry under the *Selection* panel and then select the *Block Diagram* bar. Figure 9 shows this process in the blue boxes. The user can then set the values for the equalizer and FIR parameters, as the red boxes show. By default, the channel is set to ”Channel 0”, but the user can change the settings to the current selected channel only or apply to all eight channels, as the green boxes show. Contact a Texas Instruments (TI) sales representative or send a request to the DS280BR810 product page to obtain a copy of the *DS280BR810 Programmer's Guide* (SNLU188), which lists the applicable settings to use.

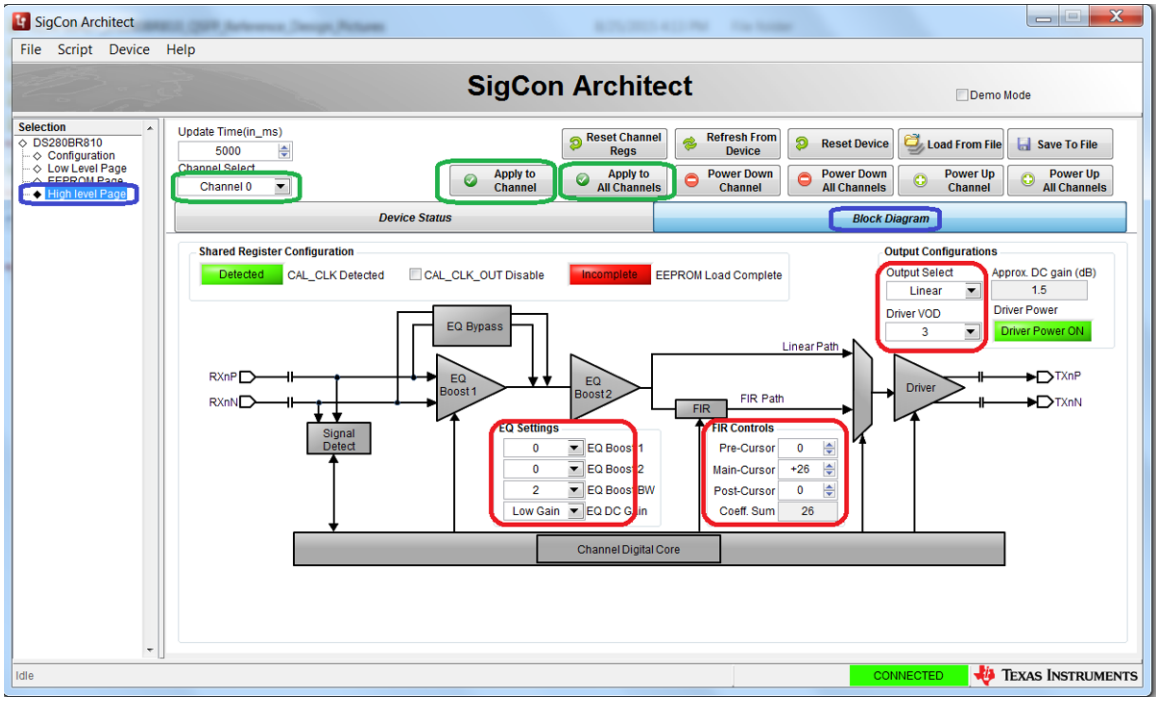

Figure 9. SigCon GUI—High Level Page Configuration

1.2 Connectors and Recommended Settings

This reference design board uses 2.54-mm connectors to support different modes of operation as required. The following Table 1 lists the available connectors, their functions, recommended default settings, and comments.

If the user is following the recommended settings, the board uses a 3.3-V power supply and the jumper settings must appear identical to the setup in Figure 1.

If powering the board with a 2.5-V power supply, the jumper settings must appear identical to the setup in Figure 2.

Table 1. Jumper and Settings

CONNECTOR	PIN CONNECTION		FUNCTION	RECOMMENDED DEFAULT SETTINGS	COMMENTS
	FROM	TO			
J1	—	—	MSP430 Related	Do not connect	Reserved for debug purposes
J2	—	—	MSP430 Related	Do not connect	Reserved for debug purposes
J3	1	3	SCL signal	Install jumper	Connect SCL signal of MSP430 with that of U1 and U2
J3	2	4	SDA signal	Install jumper	Connect SDA signal of MSP430 with that of U1 and U2
J4	—	—	SCL (Pin3), SDA (Pin4), and GND (Pin1)	Do not connect	Reserved to connect with external I^2C master
J5	—	—	MSP430 Related	No connection	Reserved for debug purposes
J6	—	—	Mini USB interface	Connect this interface with PC	—

Table 1. Jumper and Settings (continued)

CONNECTOR	PIN CONNECTION		FUNCTION	RECOMMENDED DEFAULT SETTINGS	COMMENTS
	FROM	TO			
J7	1	2	3.3-V power supply for the QSFP modules	No connection when connecting with QSFP passive cable assembly	Install jumpers when connecting with optical QSFP modules
	3	4			
	5	6			
	7	8			
	9	10			
J8	1	2	Enable the 3.3- to 2.5-V LDO	No connection; LDO is enabled by default	When powering the board with external 2.5 V from J11; install jumper here to disable the 2.5-V LDO
J9	—	—	Power ground	Connecting with ground of the external power supply	—
J10	—	—	3.3-V power supply	Connecting with the external 3.3-V power supply	Do not connect, if 2.5-V power supply is offered on J11
J11	—	—	2.5-V power supply	Connecting with the external 2.5-V power supply	Do not connect, if 3.3-V power supply is offered on J10
J12	1	2	Connecting the 2.5-V output of the 3.3- to 2.5-V LDO with 2.5-V power plane	Install jumpers	Install jumpers if powering from external 3.3 V (J10); do not connect if powering from 2.5 V (J11)
	3	4			
	5	6			
	7	8			
	9	10			
J13	—	—	Low-speed IOs of QSFP modules	Do not connect	Reserved for debug purposes
J14	—	—	Low-speed IOs of QSFP modules	Do not connect	Reserved for debug purposes
J15	—	—	MSP430 related	Do not connect	Reserved for debug purposes
J16	—	—	READ_EN pin of U1	Do not connect	Reserved for debug purposes
J17	—	—	READ_EN pin of U2	Do not connect	Reserved for debug purposes
J18	—	—	EEPROM socket	No EEPROM	Reserved for SMBUS master mode
J19	—	—	WP pin of the EEPROM	Do not connect	Reserved for SMBUS master mode
J20	1	2	ENSMB Pin of U2	Install jumper	SMBUS mode settings; SMBUS slave mode after installing the jumper
J21	1	2	ENSMB Pin of U1	Install jumper	SMBUS mode settings; SMBUS slave mode after installing the jumper
J22	1	3	SDA	Install jumper	Pulling resistor for SDA signal
	2	4	SCL	Install jumper	Pulling resistor for SCL signal
J23	1	3	SDA	Do not connect	This is for connecting with the SDA signal with the QSFP module on the host side
	2	4	SCL	Do not connect	This is for connecting with the SCL signal with the QSFP module on the host side
J24	1	3	SDA	Do not connect	This is for connecting with the SDA signal with that of the QSFP module on the cable side
	2	4	SCL	Do not connect	This is for connecting with the SCL signal with that of the QSFP module on the cable side
J25	—	—	Low-speed IOs of QSFP modules	—	Reserved for debug purposes

2 Test Results

See the following Table 2 for the CAUI-4 spec compliance test results of this reference design. Refer to the *Two-Port 40- and 100-GbE QSFP28 Signal Conditioner Reference Design* (TIDUBG6) for more details on the test. This document also lists the settings of the DS280BR810 linear repeater utilized for testing.

The results show that the DS280BR810 linear repeater can enable CAUI-4 TX compliance for channels with up to 22 dB of insertion loss between the Host TX and the DS280BR810 input. The CAUI-4 specification normally limits the insertion loss between the host transmitter and the front-port cage to 7.3 dB. The tests in this report demonstrate that the DS280BR810 linear repeater enables a host PCB loss three times greater than the CAUI-4 specifications, extending the channel from 7.3 dB to approximately 22 dB.

Table 2. Host Transmit Output Eye Height and Eye Width Results for CAUI-4

					DS250DF810 TRANSMITTER[1]			DS280BR810 SETTING[2]				100-GbE CAUI-4		
												DIFFERENTIAL INNER EYE HEIGHT AT 1E-15 PROBABILITY (mV pk-pk)	DIFFERENTIAL OUTER EYE HEIGHT AT 1E-15 PROBABILITY (mV pk-pk)	EYE WIDTH AT 1E-15 PROBABILITY (UI pk-pk)
ISI SETTING	INPUT LOSS	OUTPUT LOSS	TOTAL LOSS	PORT	PRE	MAIN	PST	BW	BST1	BST2	VOD	≥ 95	≤ 900	≥ 0.46
None	10.1	6.4	16.5	BOT	–3	17	0	3	3	0	2	233	837	0.59
				TOP	–3	17	0	3	3	0	2	232	819	0.60
2	13.5	6.4	19.9	BOT	–3	13	0	3	3	0	2	147	711	0.53
				TOP	–3	13	0	3	3	0	2	153	682	0.53
7	15	6.4	21.4	BOT	–5	15	0	3	5	0	2	199	751	0.54
				TOP	–5	15	0	3	5	0	2	189	740	0.52
12	17.2	6.4	23.6	BOT	–3	17	0	3	5	0	2	149	818	0.54
				TOP	–3	17	0	3	5	0	2	137	805	0.52
18	19	6.4	25.4	BOT	–3	15	2	3	5	2	2	129	809	0.55
				TOP	–3	15	2	3	5	2	2	134	792	0.55
23	20.4	6.4	26.8	BOT	–4	16	0	3	5	2	2	120	749	0.53
				TOP	–4	16	0	3	5	2	2	119	740	0.55
29	22.4	6.4	28.8	BOT	–6	14	0	3	5	3	3	127	766	0.49
				TOP	–6	14	0	3	5	3	3	124	754	0.52

(1) DS280BR810 is configured as eq_high_gain=1 and linear mode when performing the CAUI-4 tests.

(2) The pre, main, and post cursor setting of DS250DF810 determines the output amplitude and dB of de-emphasis. Reference the datasheet of DS250DF810 for further details.

3 Tips and Miscellaneous

- Without connecting any external QSFP cable assembly or optical module, the current that the board draws is approximately 90 mA after powering up.
- If the user forces the signal detect result to 1 by setting the channel register 0x05 as 0x84 for all channels, then the current increases up to an approximate 340 mA for one device and an approximate 570 mA for two devices.
- Some users may experience difficulties removing the host compliance board (HCB) from the cage because of the retention feature. In this situation, using a set of tweezers to bend the retention feature on the cage is acceptable (red circle in Figure 10).

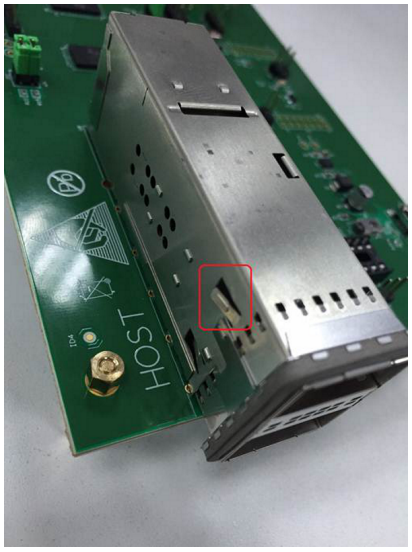

Figure 10. QSFP28 Board

- The board has been designed in such a way that the top port of the *HOST* side (check the mark on the silk layer) communicates with the top port of the *CABLE* side (check the mark on the silk layer) and the bottom port of the *HOST* side communicates with the bottom port of the *CABLE* side.
- This reference design offers the flexible option of updating from a DS280BR810 linear repeater to the pin-compatible DS250DF810 retimer.

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