Using the DS90UB934-Q1EVM Evaluation Module

The DS90UB934-Q1 is an FPD-Link III deserializer that converts a serialized camera data input to parallel LVCMOS output. When coupled with DS90UB913A/933 serializers, the DS90UB934-Q1 receives data from 1-Megapixel image sensors supporting 720p/800p/960p resolution at 30-Hz or 60-Hz frame rates. There is a 2:1 mux on the input that allows two cameras to be connected, with pin or register control of whichever camera is active. The EVM has two Rosenberger FAKRA connectors and configurable power-over-coax (POC) voltage for connecting the camera modules (not included). There is an onboard MSP430 which functions as a USB2ANY bridge for connecting a PC. This works with the Analog LaunchPAD GUI tool.

NOTE: *The demo board is not intended for EMI testing. The demo board was designed for easy accessibility to device pins with tap points for monitoring or applying signals, additional pads for termination, and multiple connector options.*

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1 General Description

1.1 Features

- Supports 1-Megapixel sensors with HD 720P/800P/960P resolution at 30-Hz/60-Hz frame rate (paired w/ DS90UB913A or DS90UB933)
- Parallel LVCMOS Video Output
- Supports Single-ended Coax cable and Power Over Coax
- Adaptive receive equalization
- Onboard USB2ANY Controller for I2C Access
- I^2C with Fast-mode Plus up to 1 Mbps
- Flexible GPIOs for camera sync and functional safety
- Single 12-V power supply for EVM

1.2 System Requirements

The major components of the DS90UB934-Q1EVM are:

- DS90UB934-Q1
- On-board POC interface
- Two Fakra coax connectors for digital video, power, control, and diagnostics
- On-board I^2C programming interface

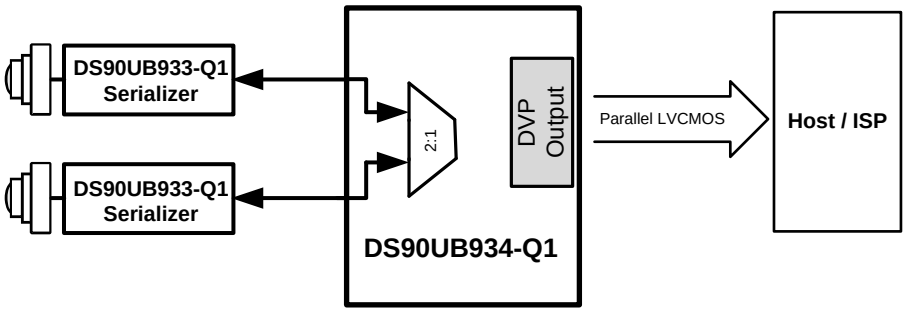
In order to demonstrate, the following is required (not included):

1. One Omnivision sensor board with DS90UB913A/DS90UB933 Serializer board
   (a) TI DS90UB913A-CXEVM OR TI SAT0088 'MiniSer', and
   (b) OV10635 P/N: OV10635-EAAE-AA0A OR OV10640 P/N: OV10640-EAAA-AA0A (DVP)
2. One DACAR/FAKRA coax cables
3. Power supply for 12 V at 1 A

1.3 Contents of the Demo Evaluation Kit

- One EVM board with the DS90UB934-Q1 (serializer board and cable not included)

1.4 Applications Diagram



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Figure 1. Applications Diagram

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2 Quick Start Guide

1. Connect mini USB J5 to USB port for register programming
2. **Optional :** Connect an external I^2C host adapter I^2C signals on J4 port for register programming
3. Configure switches S1 and SW1 to set operating modes of the device
4. Configure VFEED power supply for each channel on J14, J16, J32, J33, and J35 headers
5. Plug a sensor into the DS90UB913A/DS90UB933 serializer boards to create four camera modules
6. Connect the camera module to channels 1 or 2 using coax cables on CN1 or CN2
7. Interface parallel LVCMOS output signals (J2) to application processor
8. Provide power to board on J24 (+12VDC)
   (a) Optional 5-V DC power supply on J11 (remove jumper on J12 if +5VDC applied to J11)
   (b) Optional 1.8-V DC power supply on J28
   (c) Optional 3.3-V DC power supply on J29
9. For details of pin-names and pin-functions, refer to the DS90UB934-Q1 data sheet.

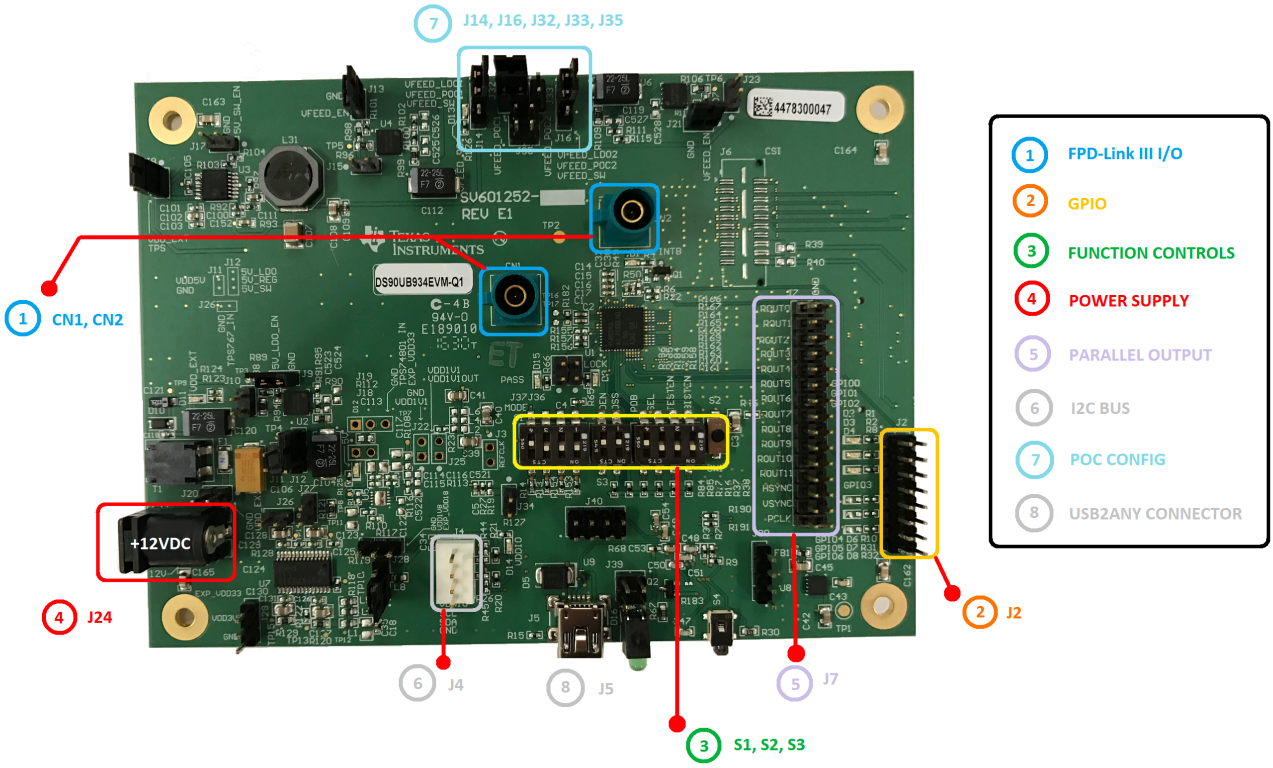


Figure 2. Interfacing to the EVM

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3 Demo Board Connections

3.1 Power Supply

Table 1. Power Supply

REFERENCE	SIGNAL	DESCRIPTION
J24.1	12 V	Main Power Single 12-V DC (nominal) power connector that supplies power to the entire board.
J11.1 (Optional)	5 V	5 V ±5% Alternative to main power
J28.2 (Optional)	1.8 V	1.8 V ±5% Alternative to main power
J29.2 (Optional)	3.3 V	3.3 V ±5% Alternative to main power

3.2 Power-Over-Coax Interface

The DS90UB934-Q1EVM offers two power-over-coax (POC) interfaces to connect cameras through a coaxial cable with FAKRA connectors. Power is delivered on the same conductor that is used to transmit video and control channel between the host and the camera. By default, 9-V power supply is applied over the coax cable. Refer Table 2 to for other POC configurations.

For POC on the EVM, the circuit uses a filter network as shown in Figure 3. The POC network frequency response corresponds to the bandwidth compatible with DS90UB913A / DS90UB933 chipsets.

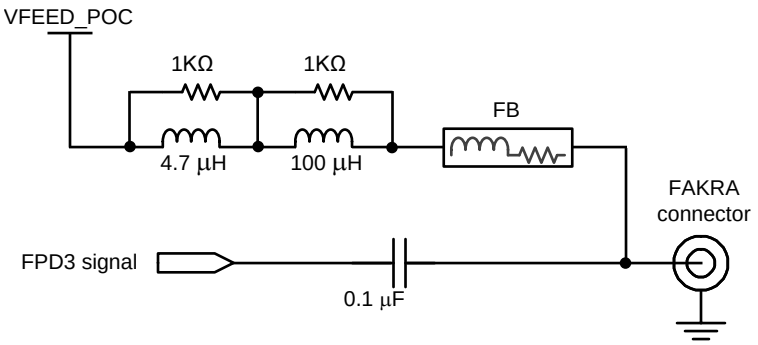


Figure 3. Power-Over-Coax Network

WARNING

Verify that the power voltage is properly set before plugging into CN1 or CN2. Power supply is not fused. Overvoltage causes damage to boards directly connected due to incorrect input power supplies.

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Table 2. POC Power Supply Feed Configuration

REFERENCE	SIGNAL	DESCRIPTION
J14	VFEED_POC1	POC Power Feed Selection 1
		Short pins 1-2: 9-V power supply from VFEED_LDO1 *(Default)*
		Short pins 2-3: 5-V power supply from 5V_SW
J16	VFEED_POC2	POC Power Feed Selection 2
		Short pins 1-2: 9-V power supply from VFEED_LDO2 *(Default)*
		Short pins 2-3: 5-V power supply from 5V_SW
J35	VDD_EXT	POC Power Feed using 12-V Main Power (J24) **Note: J16 and J14 must to left OPEN if using this configuration**
		Short pins 1-2: 12-V power supply to VFEED_POC1
		Short pins 2-3: 12-V power supply to VFEED_POC2
J32.1	VFEED1	Remote power supply connection to CN1
		Short J32.1-2: VFEED_POC1 *(Default)*
		Short J32.1 and J33.1: VFEED_POC2
J32.3	VFEED2	Remote power supply connection to CN2
		Short J32.3-4: VFEED_POC1 *(Default)*
		Short J32.3 and J33.2: VFEED_POC2

Table 3. Parallel LVCMOS Output Signals - J7 Pinout

PIN NUMBER	SIGNAL NAME	PIN NUMBER	SIGNAL NAME
1	ROUT0	2	GND
3	ROUT1	4	GND
5	ROUT2	6	GND
7	ROU3	8	GND
9	ROUT4	10	GND
11	ROUT5	12	GND
13	ROUT6	14	GND
15	ROUT7	16	GND
17	ROUT8	18	GND
19	ROUT9	20	GND
21	ROUT10	22	GND
23	ROUT11	24	GND
25	HSYNC	26	GND
27	VSYNC	28	GND
29	PCLK	30	GND

3.3 FPD-Link III Signals

Table 4. FPD-Link III Signals

REFERENCE	SIGNAL	DESCRIPTION
CN1	RIN0+	FAKRA connector
CN2	RIN1+	FAKRA connector

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3.4 I²C Interface

A standalone external I²C host can connect via J4 for programming purposes. Examples of external I²C host controllers are Texas Instruments USB2ANY and Total Phase Aardvark I²C/SPI host adapter (Total Phase Part#: TP240141).

I²C signal levels match VDDIO which can be configured through J1 to be at 1.8 V or 3.3 V when the I²C interface is accessed through connectors J4.

Table 5. IDx I²C Device Address Select - J34

REFERENCE	SIGNAL	DESCRIPTION
J34	IDX	Selects I²C Device Address
		Open: 0x30 (7'b) or 0x60 (8'b)
		Short: 0x3D (7'b) or 0x7A (8'b)*(Default)*

Table 6. I²C Interface Header - J4

REFERENCE	SIGNAL	DESCRIPTION
J4.1	VDDIO	I²C bus voltage (tied to VDDIO)
J4.2	I2C_SCL	I²C Clock Interface for primary I²C bus
J4.3	I2C_SDA	I²C Data Interface for primary I²C bus
J4.4	GND	Ground

3.5 Control Interface

Table 7. VDDIO Interface Header - J1

REFERENCE	SIGNAL	DESCRIPTION
J1	VDDIO	Selects VDDIO bus voltage
		Short pins 1-2: 3.3-V IO *(Default)*
		Short pins 2-3: 1.8-V IO

Table 8. GPIO Interface Header - J2

REFERENCE	SIGNAL	DESCRIPTION
J2.1	GPIO0	General Purpose Input/Output 0
J2.3	GPIO1	General Purpose Input/Output 1
J2.5	GPIO2	General Purpose Input/Output 2
J2.7	GPIO3	General Purpose Input/Output 3
J2.9	NC	Not connected
J2.11	NC	Not connected
J2.13	NC	Not connected
J2.15	NC	Not connected

Table 9. CMLOUTP Output Signals

REFERENCE	SIGNAL	DESCRIPTION
TP16	CMLOUTP	Test Pad for Channel Monitor Loop-through Driver
TP17	CMLOUTN	Test Pad for Channel Monitor Loop-through Driver

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Table 10. Mode SW-DIP4 - S1(1)

REFERENCE	MODE	DESCRIPTION
S1.1	1	Reserved
S1.2	2	RAW12 / LF
S1.3	3	RAW12 / HF
S1.4	4	RAW10 *(Default)*

(1) Only set one ON.

Table 11. Control SW-DIP4 - SW1

REFERENCE	SIGNAL	INPUT = L	INPUT = H	DESCRIPTION
SW1.1	BISTEN	For Normal operation *(Default)*	BIST Mode enable	Test Mode
SW1.2	RES	Tied to GND*(Default)*	N/A	Reserved
SW1.3	SEL	FPD-Link III on Port 0 (CN1) *(Default)*	FPD-Link III on Port 1 (CN2)	Port Select
SW1.4	PDB	Device is powered down	Device is enabled *(Default)*	Power-down Mode

Table 12. LEDs

REFERENCE	LED NAME	DESCRIPTION
D2	GPIO0	Illuminates if GPIO0 is ON
D3	GPIO1	Illuminates if GPIO1 is ON
D4	GPIO2	Illuminates if GPIO2 is ON
D1	GPIO3/INTB	Illuminates if GPIO3 is ON
D9	LOCK	Illuminates if device is Locked to a serializer
D15	PASS	Illuminates if device is receiving error free data
D11	VDD_EXT	Illuminates if 12V Power is applied to DC-IN J24
D12	VDD5V	Illuminates on +5V
D13	VFEED_POC	Illuminates if VFEED_POC Power is ON
D14	VDDIO	Illuminates on VDDIO Power

3.6 Enable and Reset

There are two device enable and reset/power-down options for the EVM.

- RC timing option: The C3 external capacitor and R17 pullup resistor connected to the PDB pin ramp time after the device is powered on.
- External control option: A push-button (S2) or SW1 position 4 is available for the manual control of the PBD signal.

4 ALP Software Setup

4.1 System Requirements

Operating System: Windows® 7 64-bit
USB: USB2ANY
USB2ANY Firmware Version: 2.5.2.0
USB: Aardvark I^2C/SPI host adapter p/n TP240141

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4.2 Download Contents

Latest TI Analog LaunchPAD can be downloaded from: http://www.ti.com/tool/alp.

Download and extract the zip file to a temporary location that can be deleted later.

The following installation instructions are for a PC running Windows 7 64-bit operating system.

4.3 Installation of the ALP Software

Execute the ALP Setup Wizard program called “ALPF_setup_v_x_x_x.exe” that was extracted to a temporary location on the local drive of your PC.

There are 7 steps to the installation once the setup wizard is started:

1. Select the "Next" button.
2. Select “I accept the agreement” and then select the “Next” button.
3. Select the location to install the ALP software and then select the “Next” button.
4. Select the location for the start menu shortcut and then select the “Next” button.
5. There will then be a screen that allows the creation of a desktop icon. After selecting the desired choices select the “Next” button.
6. Select the “Install” button, and the software will then be installed to the selected location.
7. Uncheck “Launch Analog LaunchPAD” and select the “Finish” button. The ALP software will start if “Launch Analog LaunchPAD” is checked, but it will not be useful until the USB driver is installed and board is attached.

Power the DS90UB934-Q1 EVM board with a 12 VDC power supply.

4.4 Start-up - Software Description

Make sure all the software has been installed and the hardware is powered on and connected to the PC. Execute “Analog LaunchPAD” shortcut from the start menu. The default start menu location is under All Programs > Texas Instruments > Analog LaunchPAD vx.x.x > Analog LaunchPAD to start MainGUI.exe.



Figure 4. Launching ALP

The application should come up in the state shown in the figure below. If it does not, see Section 5, “Troubleshooting ALP Software”.

Under the Devices tab click on “DS90UB934” to select the device and open up the device profile and its associated tabs.

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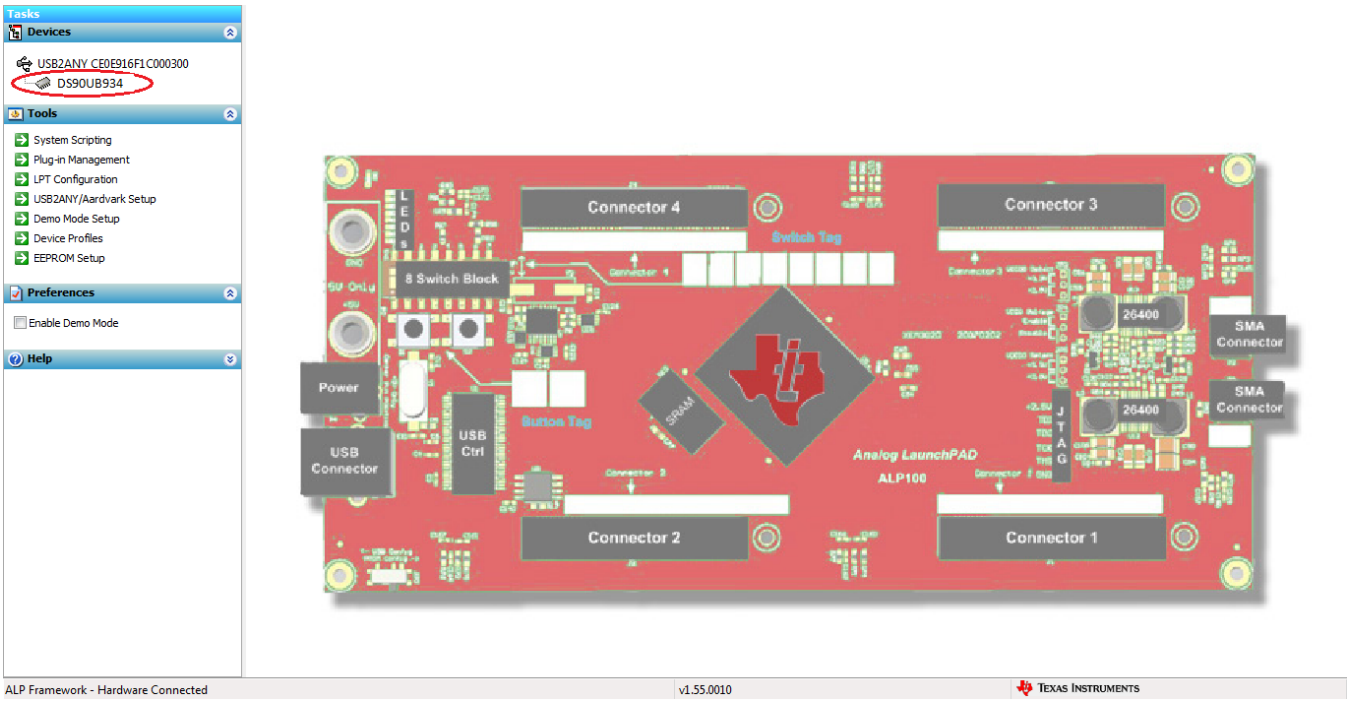


Figure 5. Initial ALP Screen

After selecting the DS90UB934, the following screen shown in Figure 6 should appear.

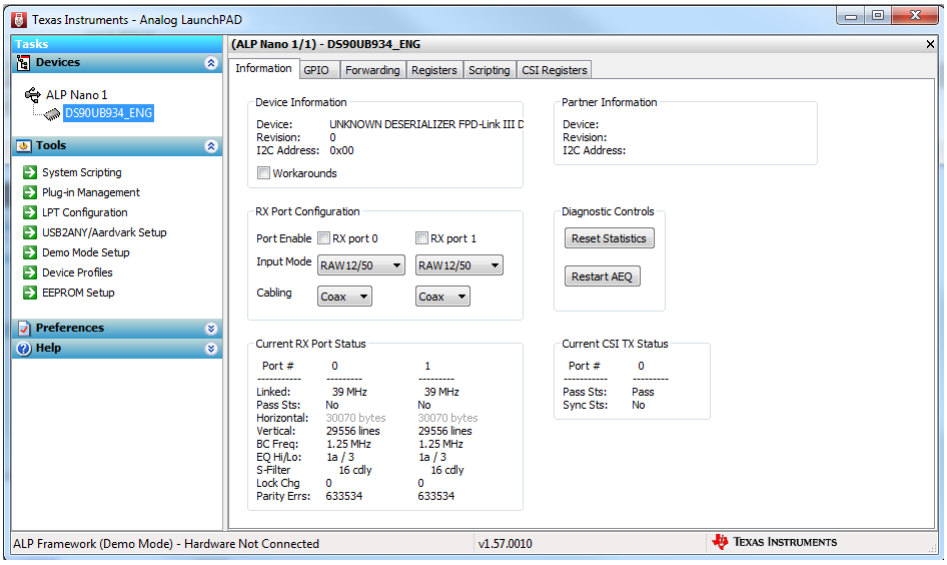


Figure 6. Follow-up Screen

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4.5 Information Tab

The Information tab is shown in Figure 7.

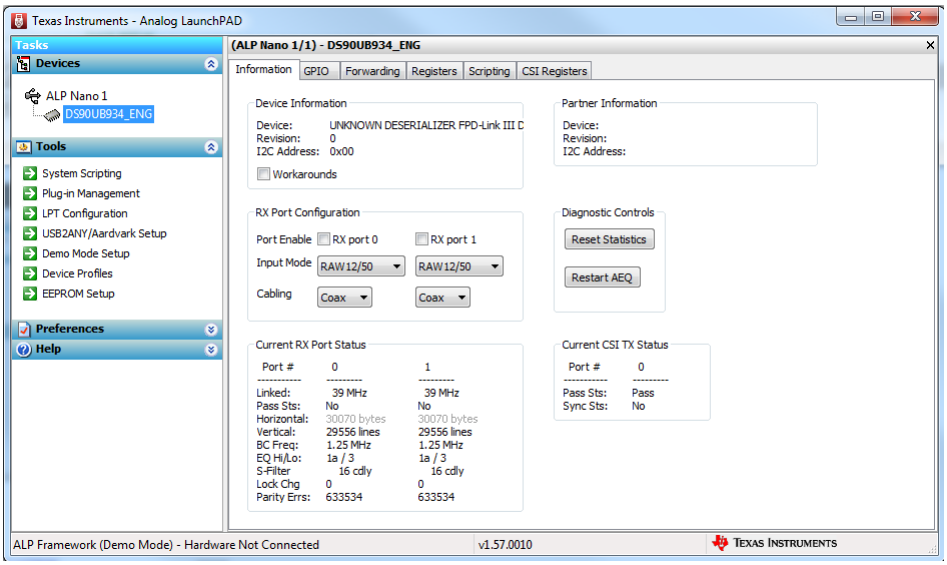


Figure 7. ALP Information Tab

4.6 Registers Tab

The Register tab is shown in Figure 8.

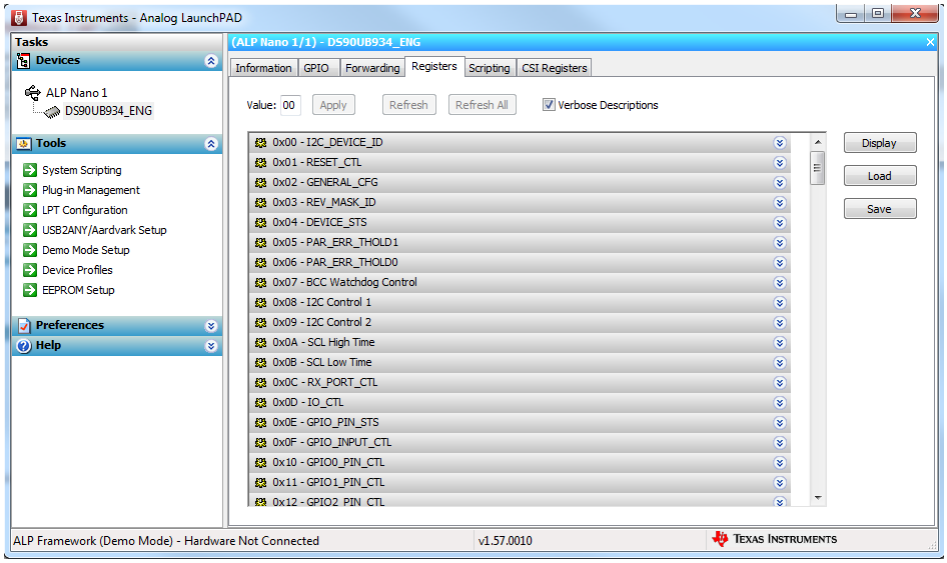


Figure 8. ALP Registers Tab

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4.7 Registers Tab - Address 0x00 Selected

Address 0x00 is selected as shown in Figure 9. Note that the “Value:” box, 

now shows the hex value of that register.

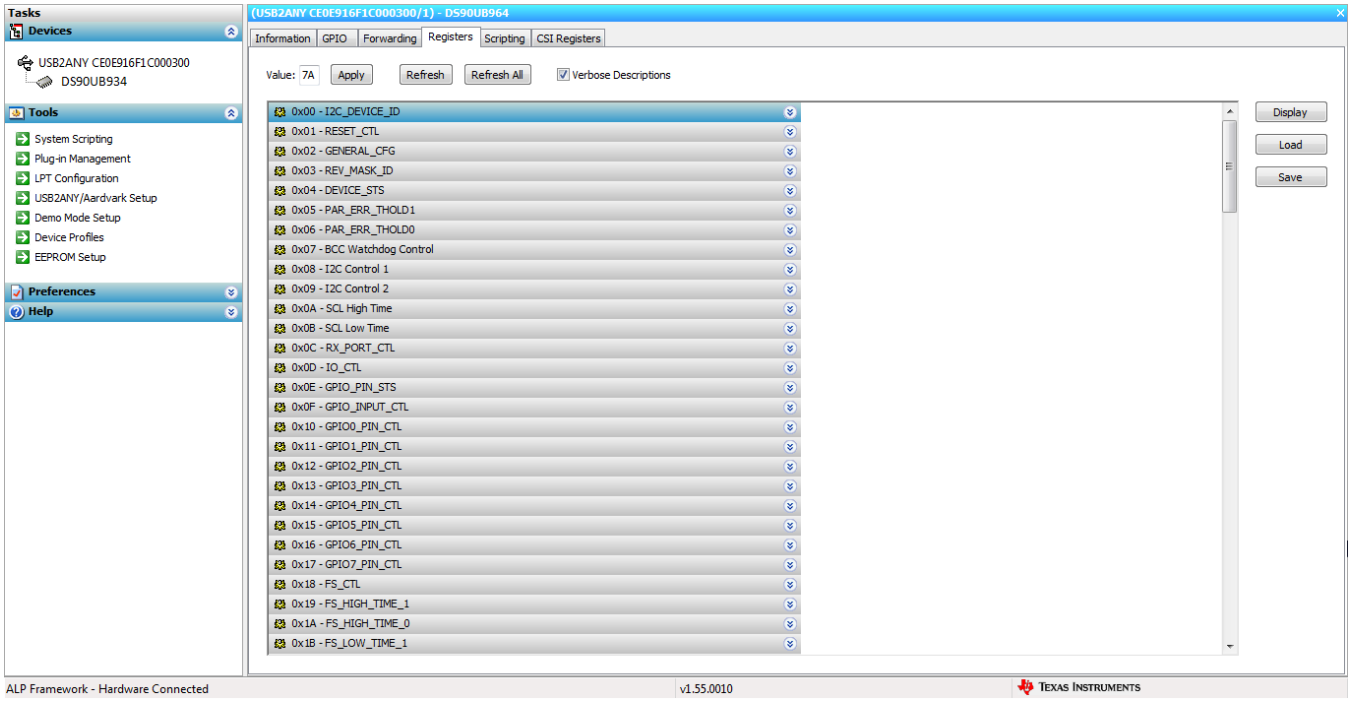


Figure 9. ALP Device ID Selected

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4.8 Registers Tab - Address 0x00 Expanded

By double clicking on the Address bar



or a single click on  Address 0x00 expanded reveals contents by bits. Any register address displayed can be expanded.

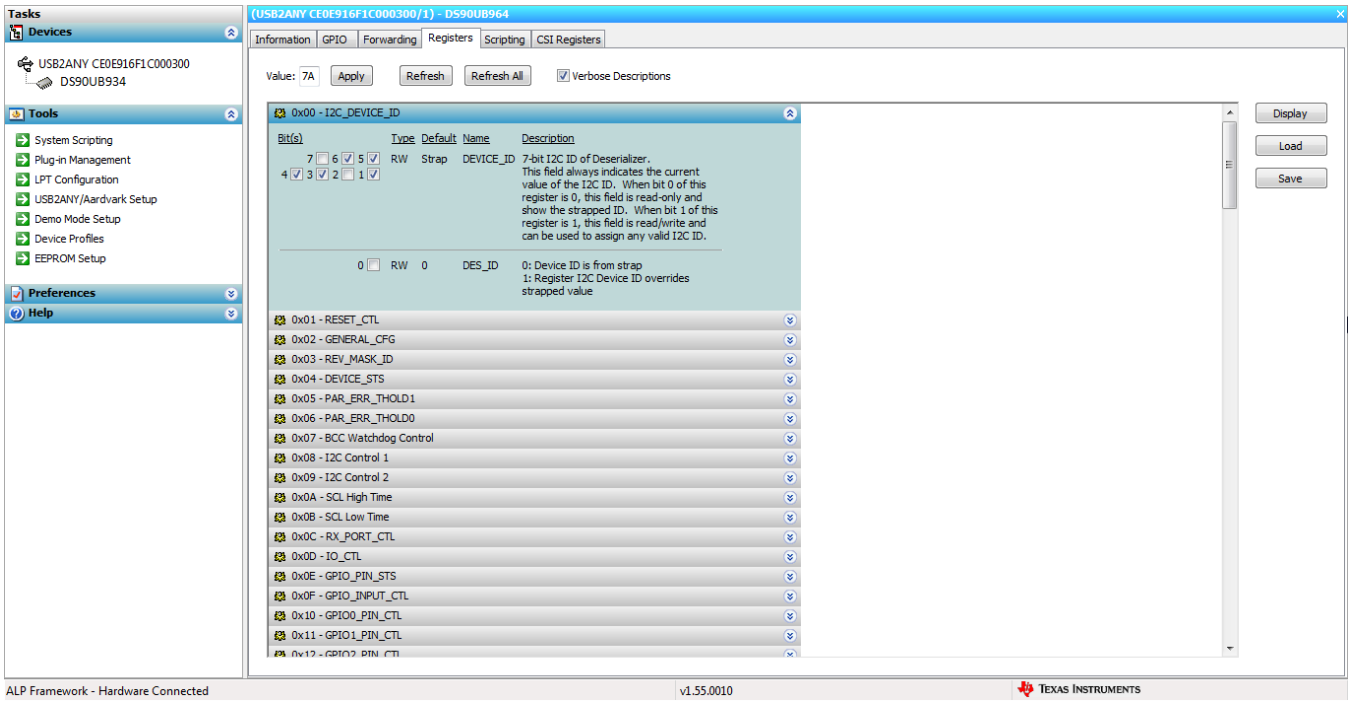
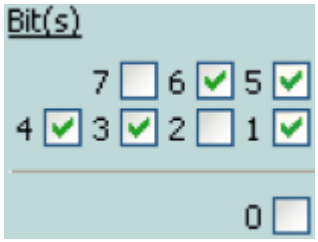


Figure 10. ALP Device ID Expanded

Any RW Type register, 

, can be written into by writing the hex value into the “Value:” box, 

or putting the pointer into the individual register bit(s) box by a left mouse click to put a check mark (indicating a 1) or unchecking to remove the check mark (indicating a 0). Click the “Apply” button to write to the register, and “refresh” to see the new value of the selected (highlighted) register.



The box toggles on every mouse click.

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4.9 Scripting Tab

The Scripting tab is shown below.

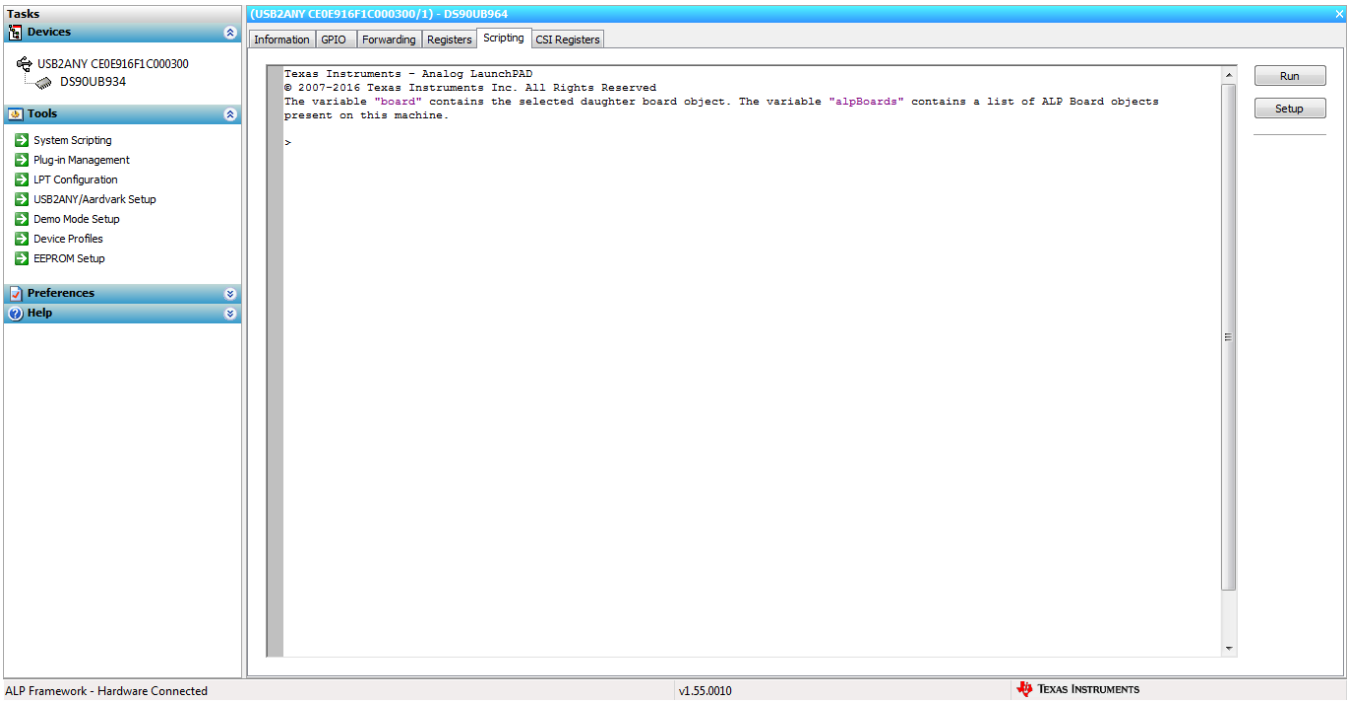


Figure 11. ALP Scripting Tab

The script window provides a full Python scripting environment which can be for running scripts and interacting with the device in an interactive or automated fashion.

WARNING

Directly interacting with devices either through register modifications or calling device support library functions can effect the performance and/or functionality of the user interface and may even crash the ALP Framework application.

4.10 Sample ALP Python Script

4.10.1 Initialization

```
board.WriteI2C(0x7A, 0x4C, 0x01) #enable to write to PORT0 registers
board.WriteI2C(0x7A, 0x58, 0x58) #enable I2C pass-through
board.WriteI2C(0x7A, 0x5D, 0x60) #set slave ID to 0x62
board.WriteI2C(0x7A, 0x65, 0x68) #set slave alias to 0x62
```


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5 Troubleshooting ALP Software

5.1 ALP Loads the Incorrect Profile

If ALP opens with the incorrect profile loaded the correct profile can be loaded from the USB2ANY/Aardvark Setup found under the tools menu.

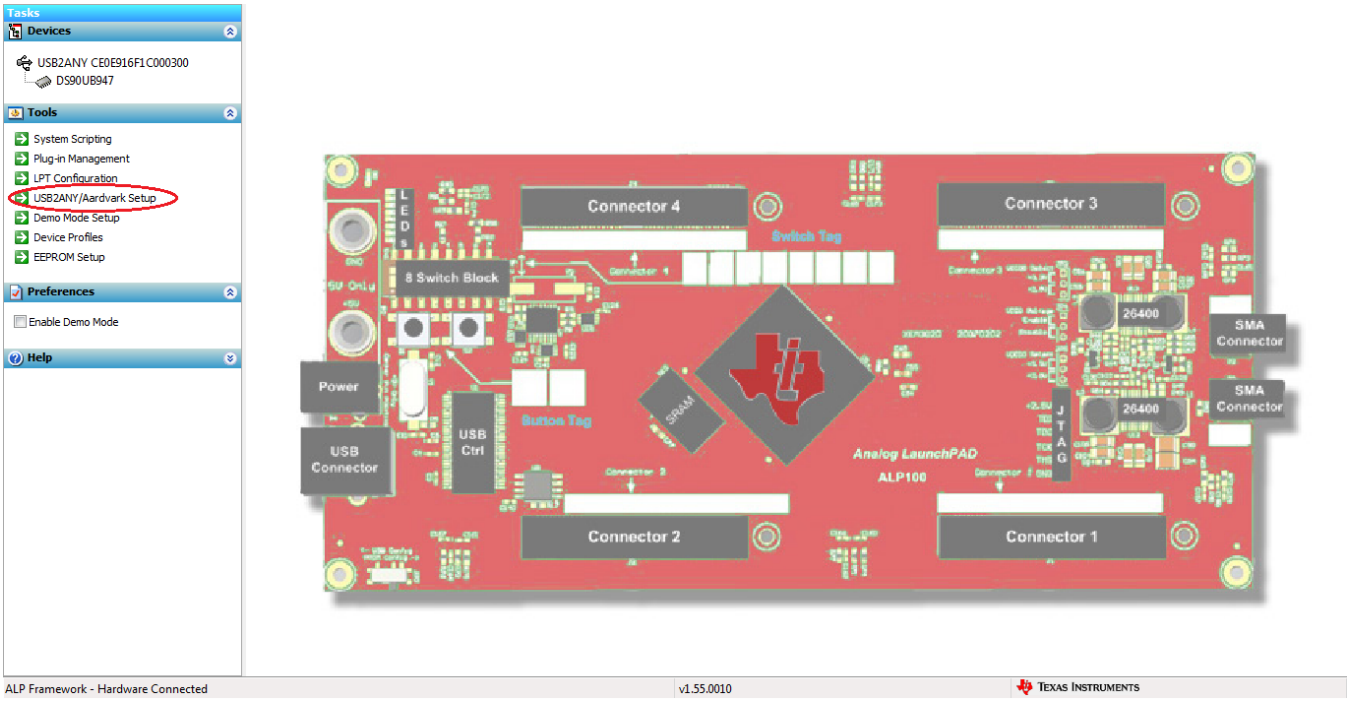


Figure 12. USB2ANY Setup

Highlight the incorrect profile in the Defined ALP Devices list and press the remove button.

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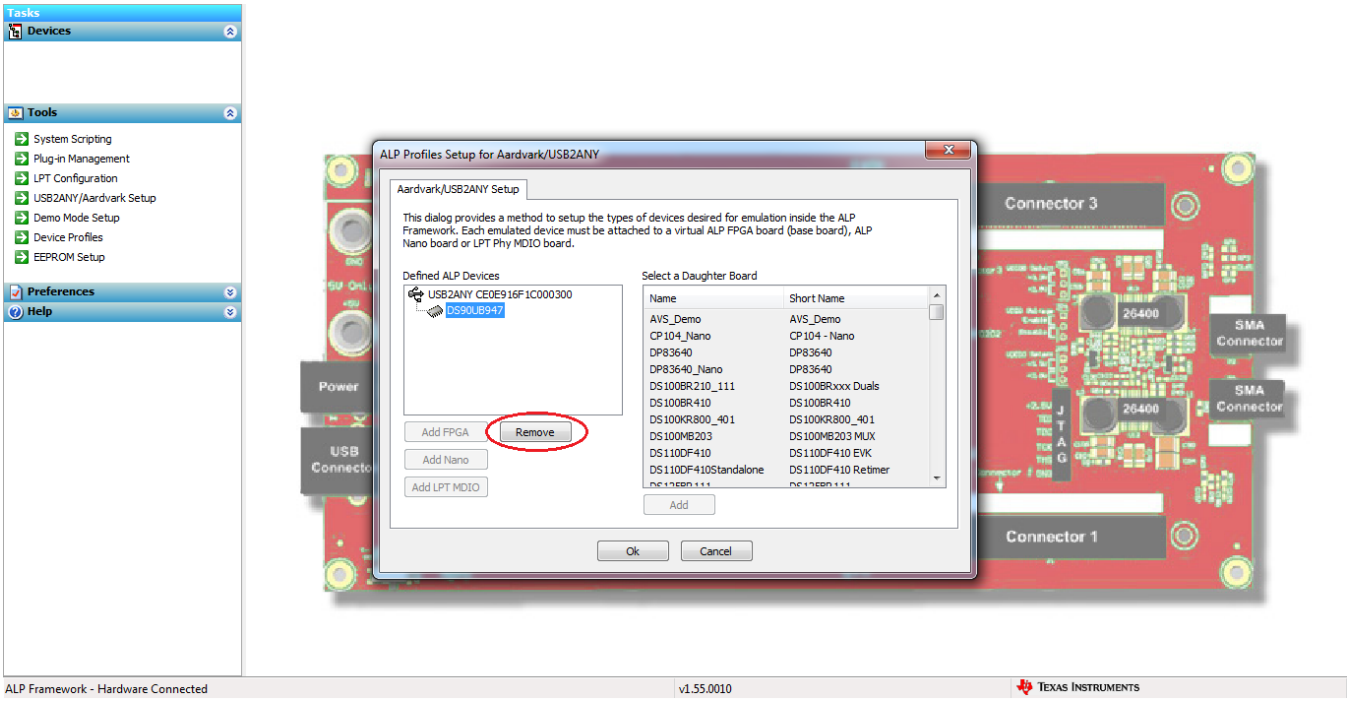


Figure 13. Remove Incorrect Profile

Find the correct profile under the Select a Daughter Board list, highlight the profile and press Add.

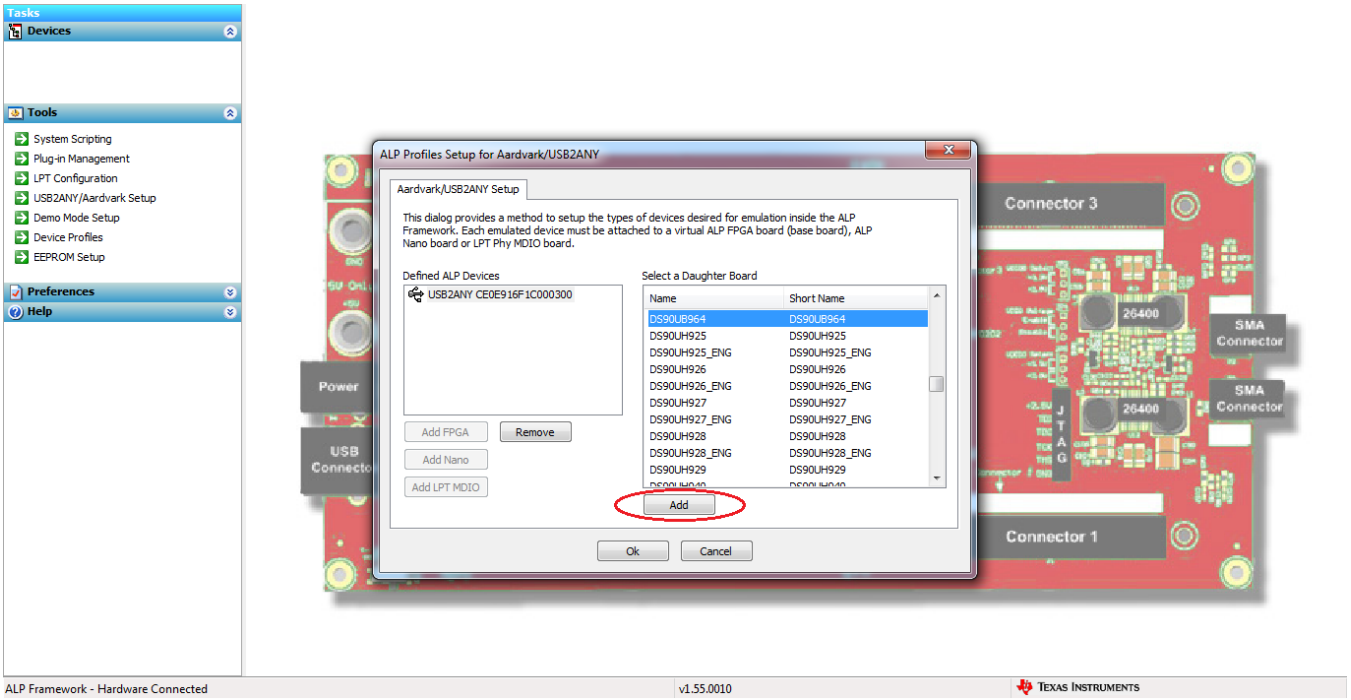


Figure 14. Add Correct Profile

Select Ok and the correct profile should now be loaded.

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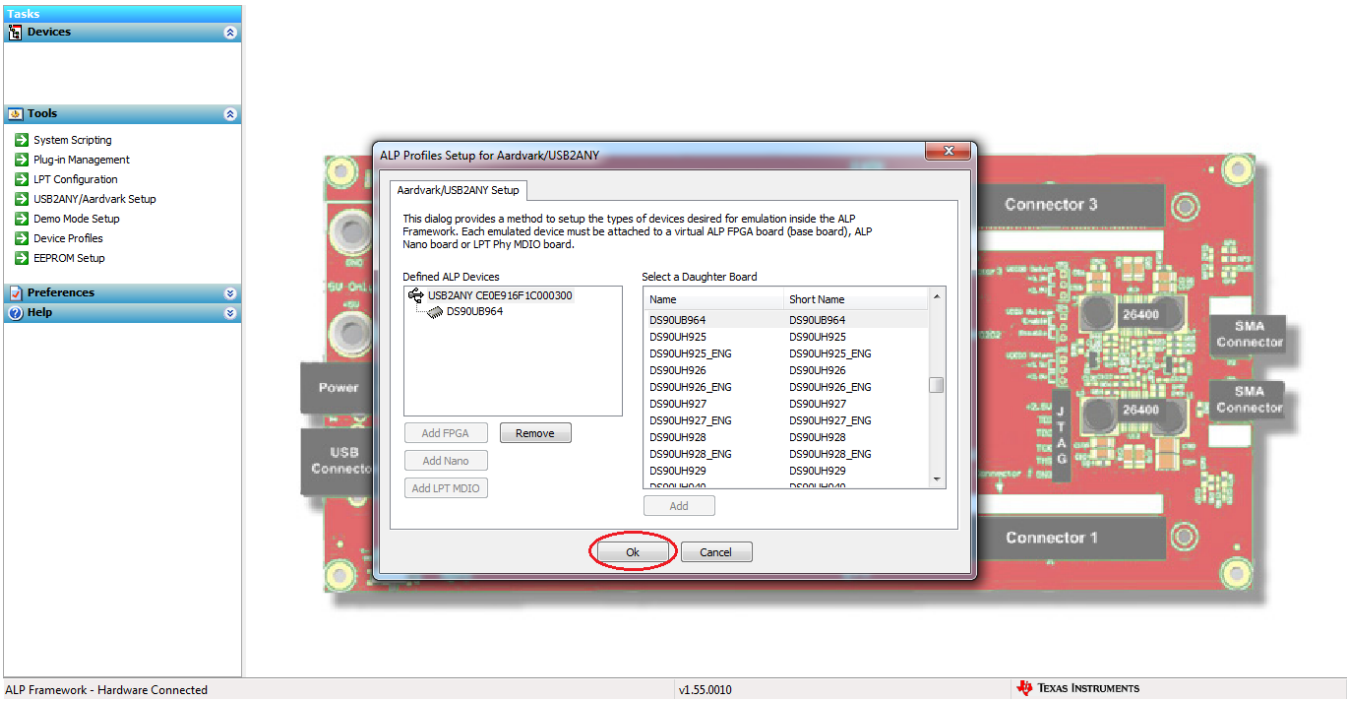


Figure 15. Finish Setup

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5.2 What to do if ALP Does Not Detect the EVM

If the following window opens after starting the ALP software, double check the hardware setup.

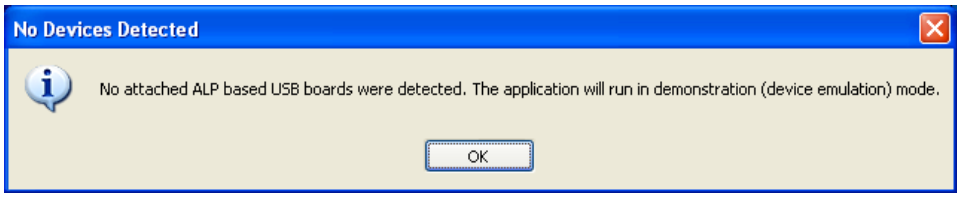


Figure 16. ALP No Devices Error

It may also be that the USB2ANY driver is not installed. Check the device manager. There should be a "HID-compliant device" under the "Human Interface Devices" as shown below.

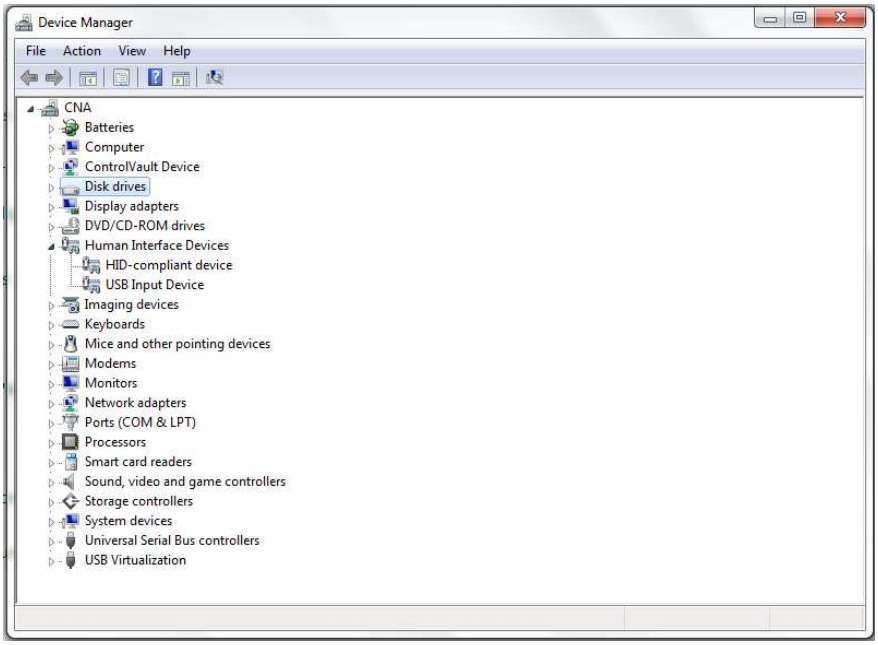


Figure 17. Windows 7, ALP USB2ANY Driver

The software should start with only "DS90UB96X" in the "Devices" pulldown menu. If there are more devices then the software is most likely in demo mode. When the ALP is operating in demo mode there is a "(Demo Mode)" indication in the lower left of the application status bar as shown below.

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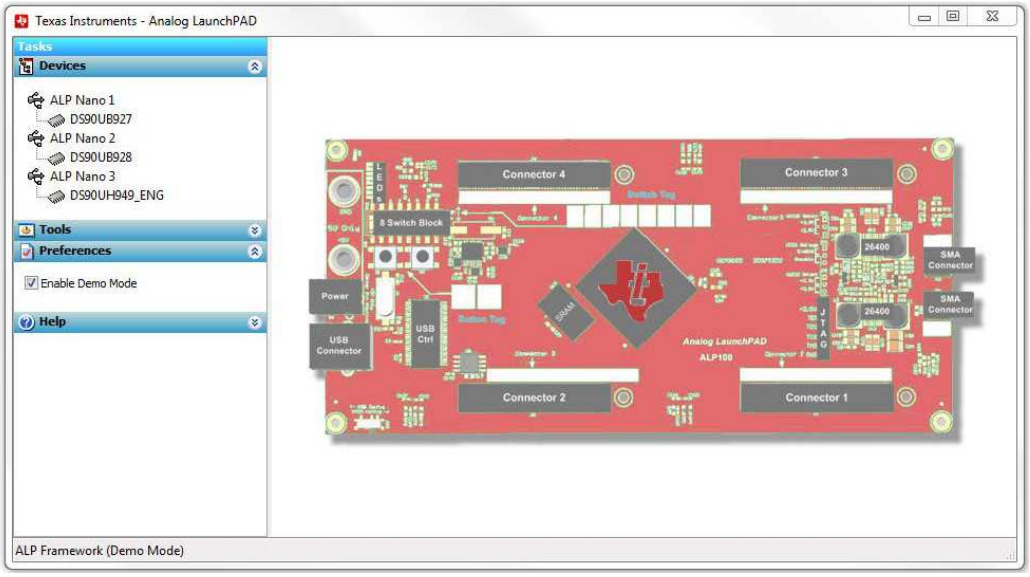


Figure 18. ALP in Demo Mode

Disable the demo mode by selecting the “Preferences” pull down menu and un-checking “Enable Demo Mode”.

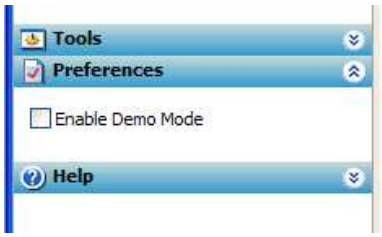


Figure 19. ALP Preferences Menu

After demo mode is disabled, the ALP software polls the ALP hardware. The ALP software updates and have only “DS90UB96X” under the “Devices” pulldown menu.

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6 Equipment References

NOTE: The following references are supplied only as a courtesy to our valued customers. It is not intended to be an endorsement of any particular equipment or supplier.

Logic Analyzer:

Keysight Technologies

www.keysight.com

Aardvark I²C/SPI Host Adapter Part Number: TP240141

www.totalphase.com/products/aardvark_i2cspi

6.1 Cable References

FAKRA coaxial cable:

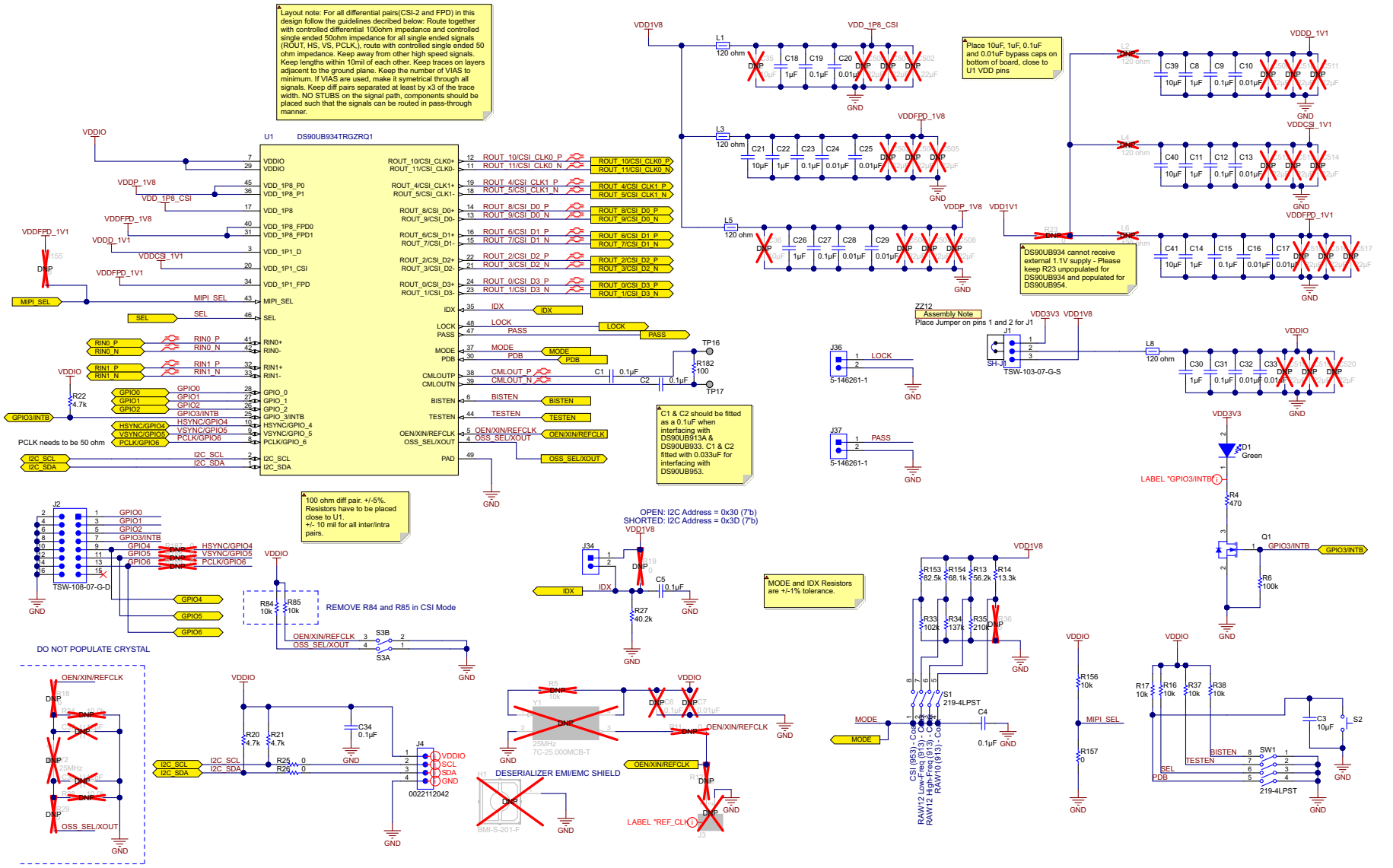
www.leoni-automotive-cables.com

Rosenberger FAKRA connector:

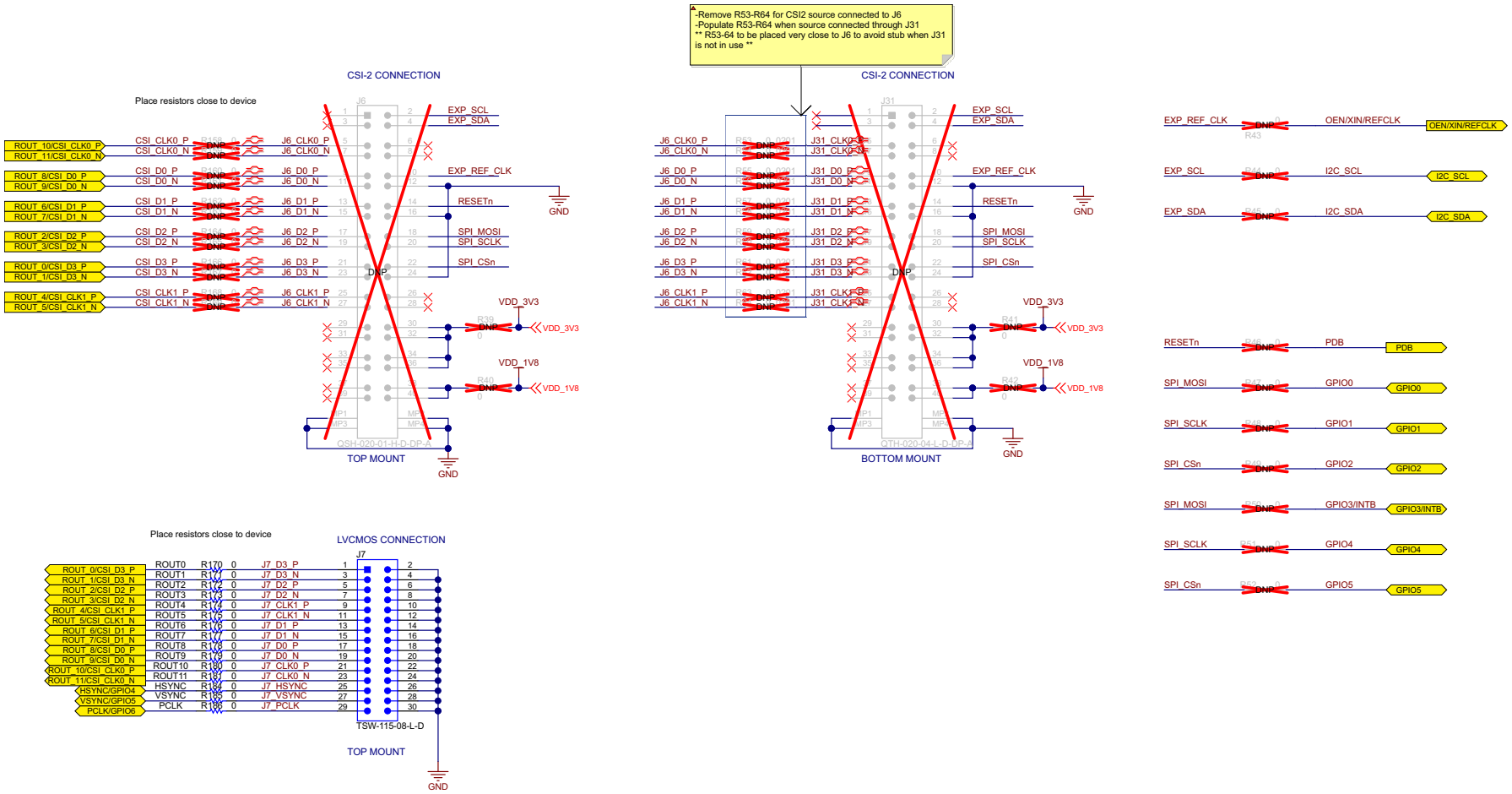
http://www.rosenberger.com/en/products/automotive/fakra.php

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7 PCB Schematics

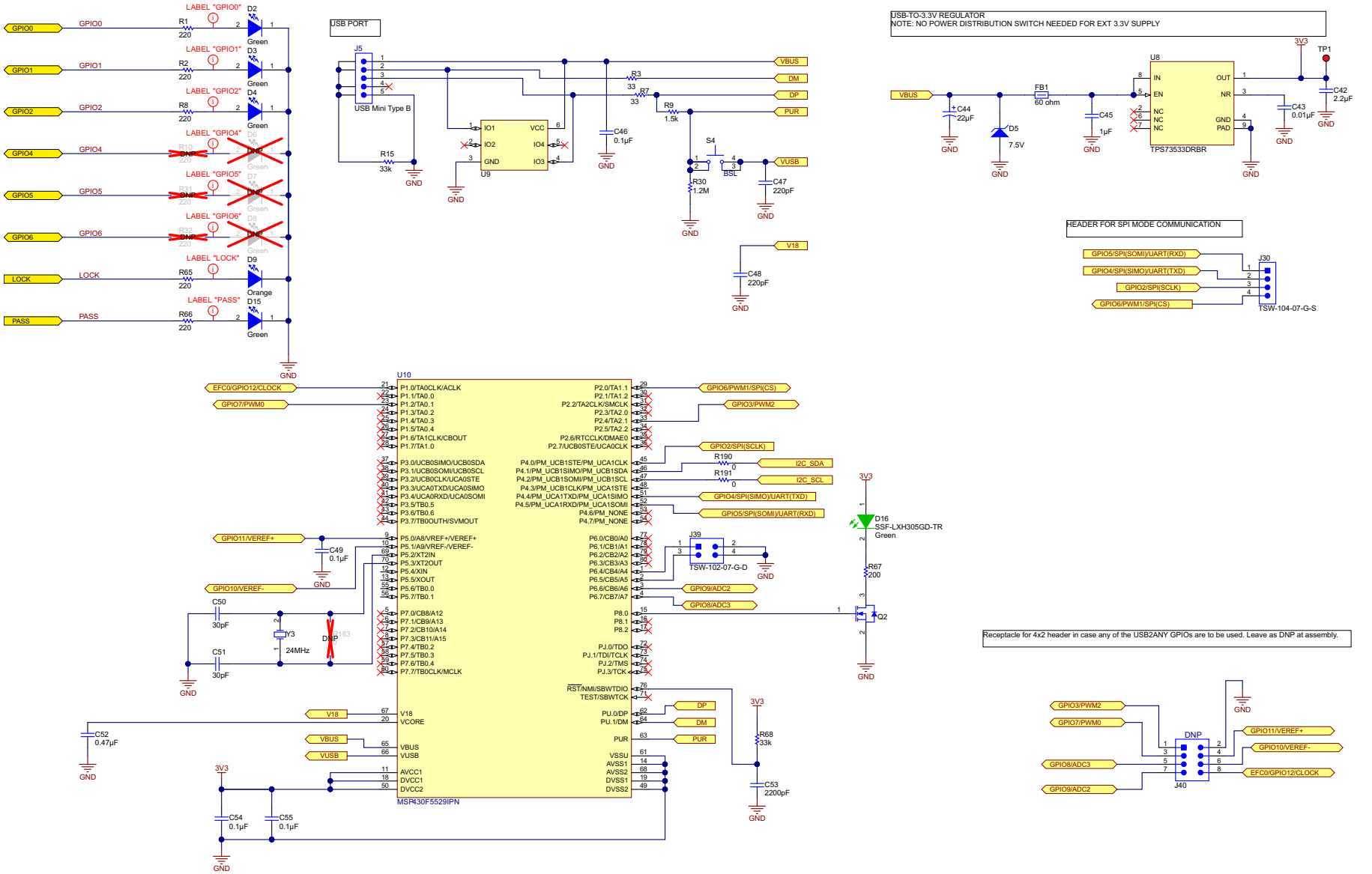


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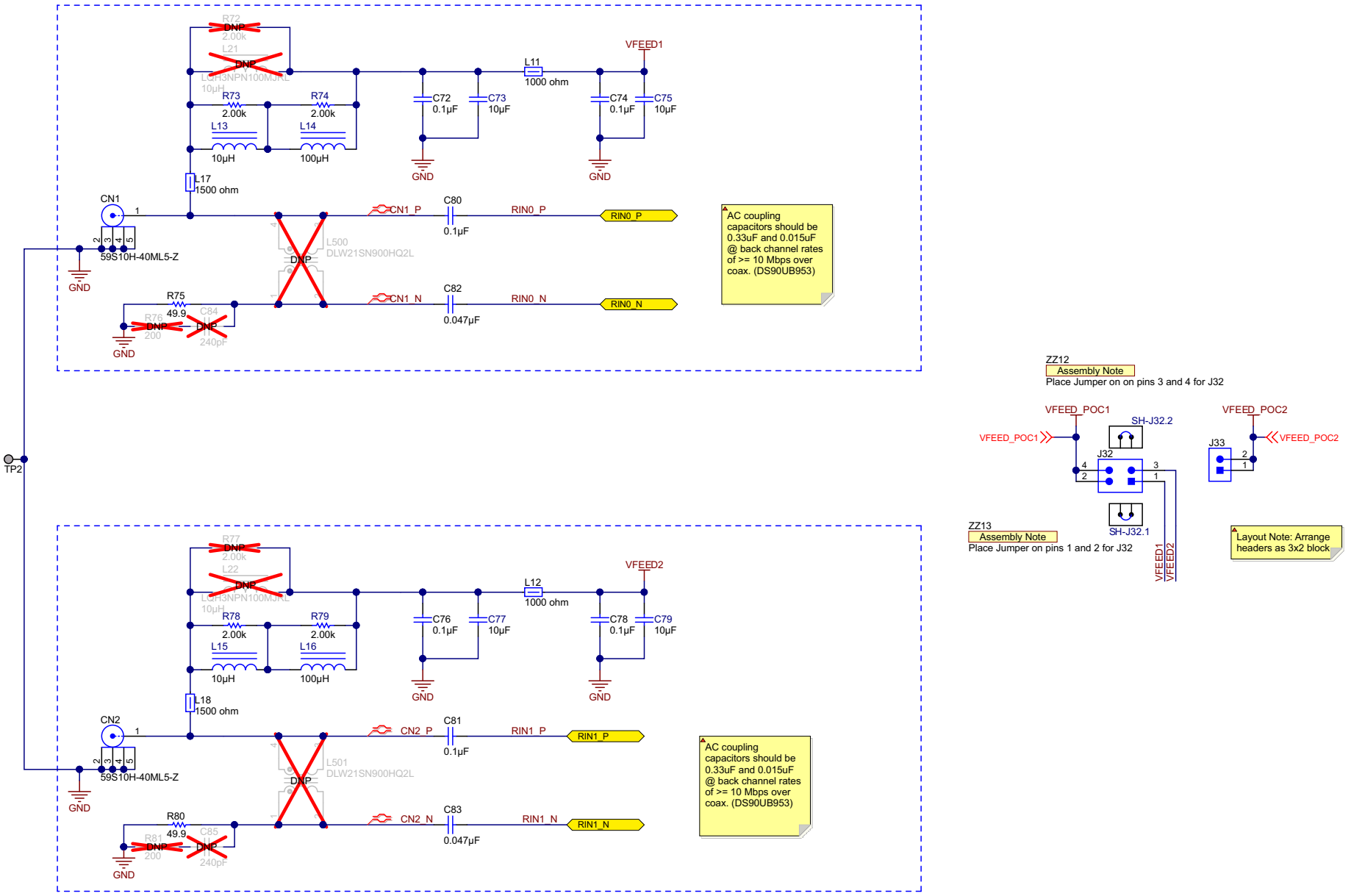
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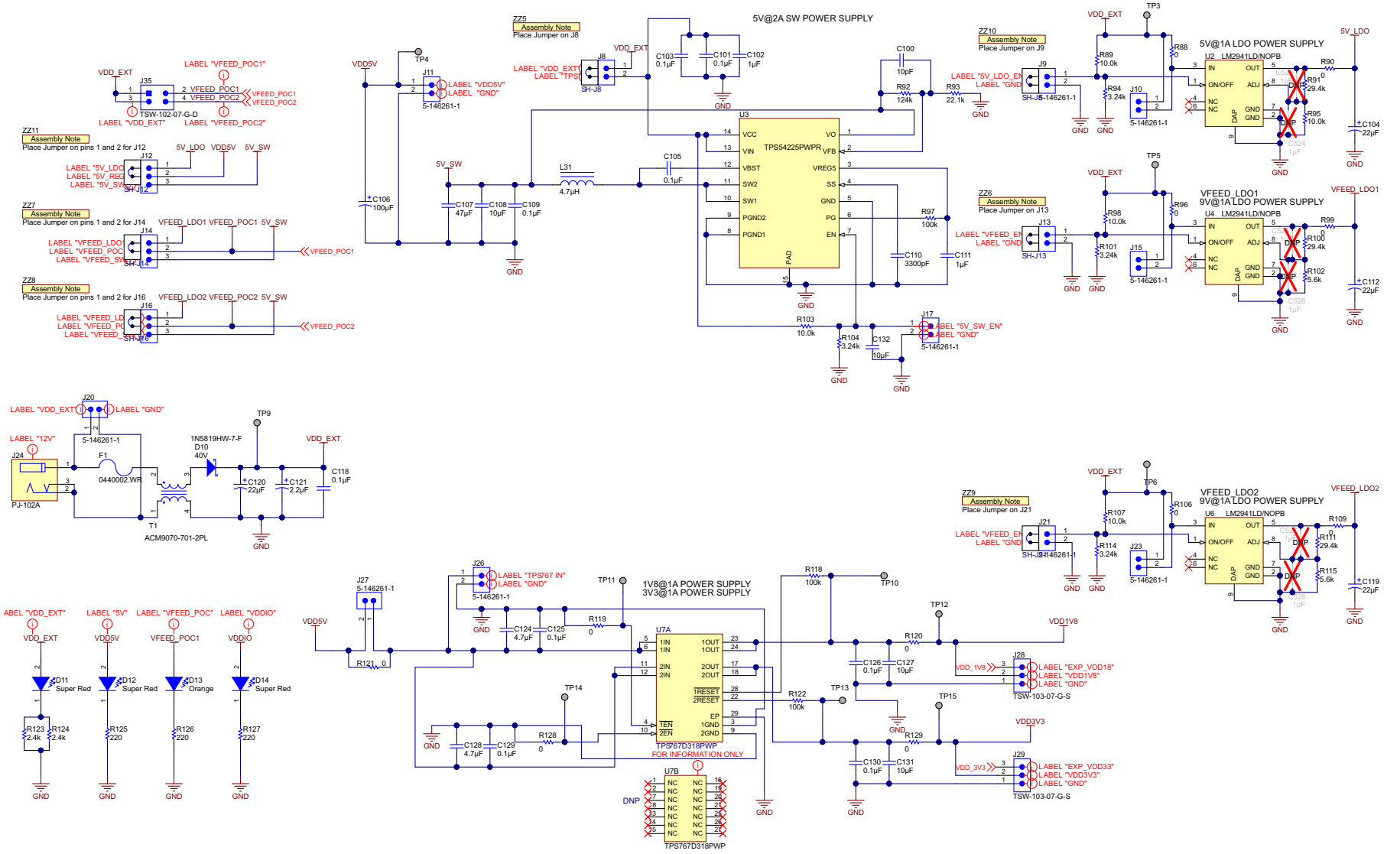
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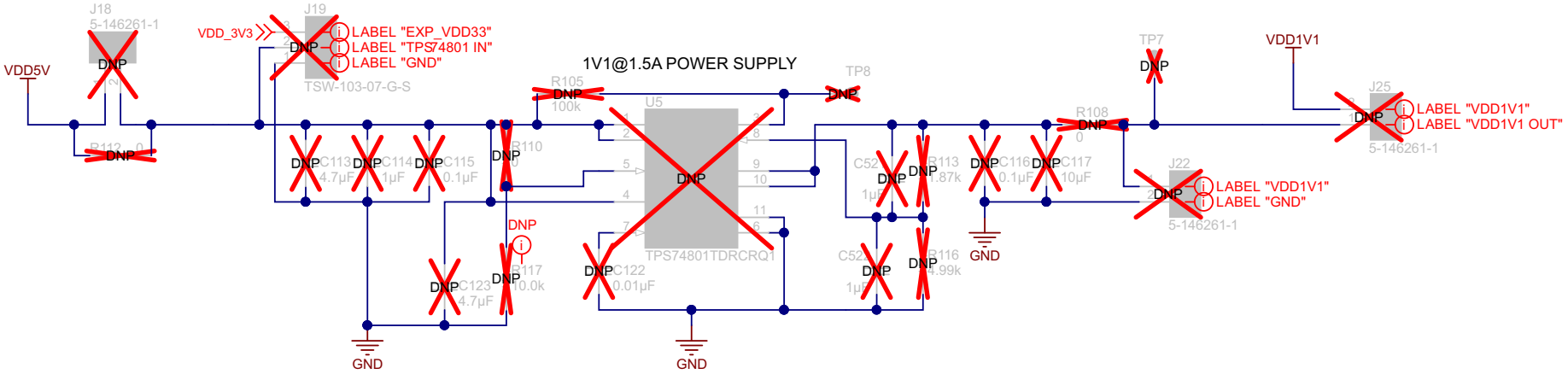


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8 Board Layout

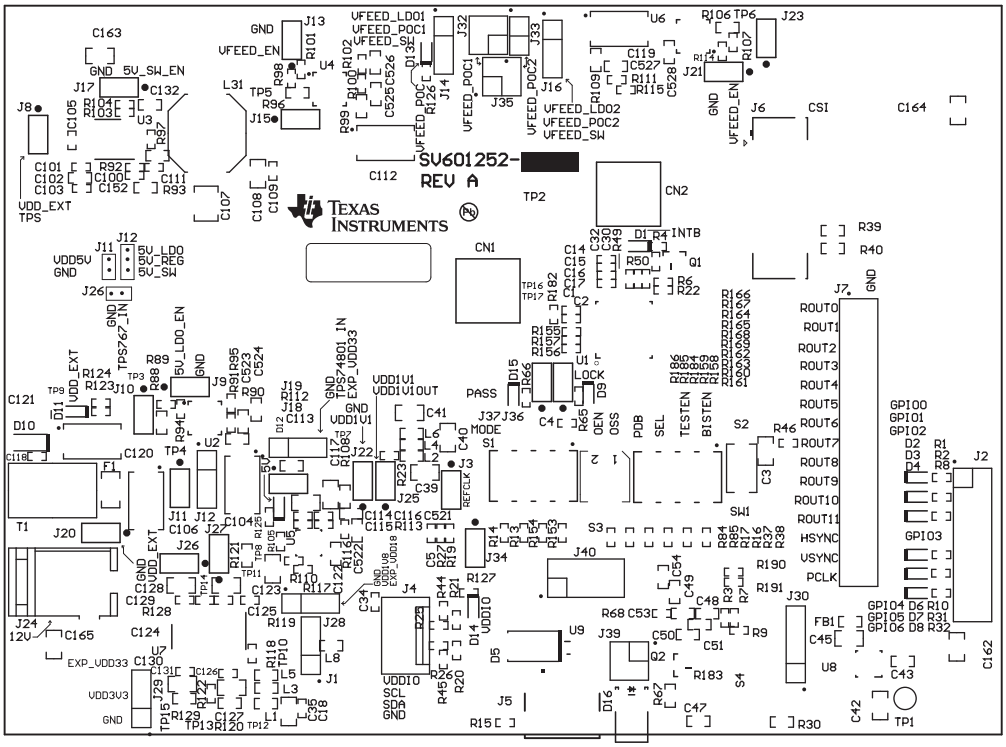


Figure 20. Top Overlay

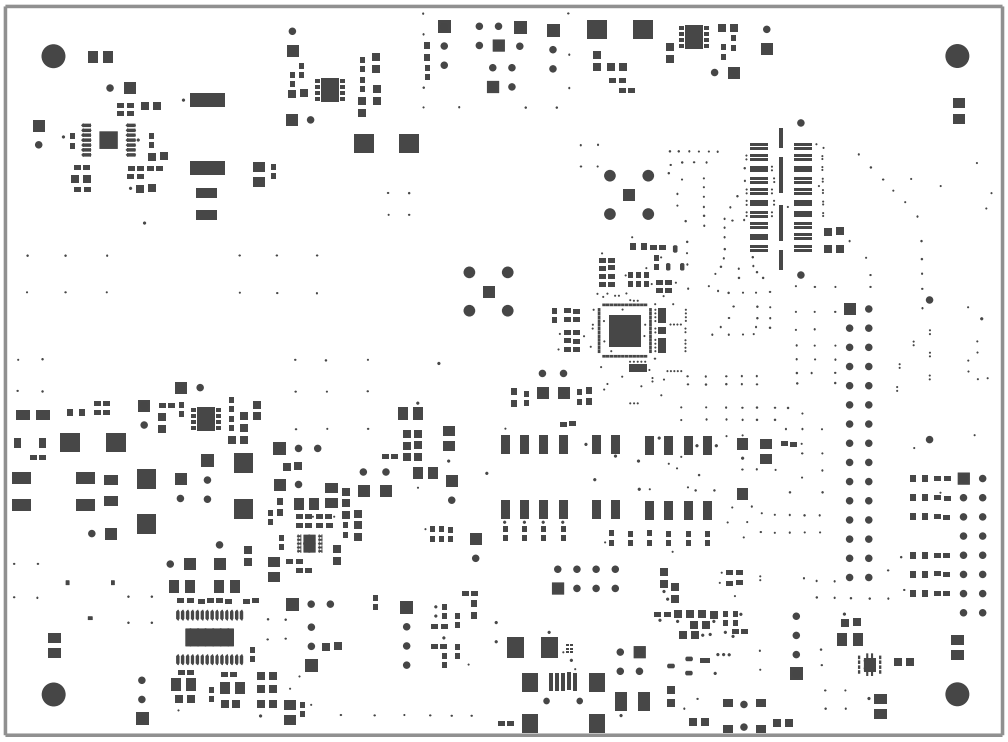


Figure 21. Top Solder

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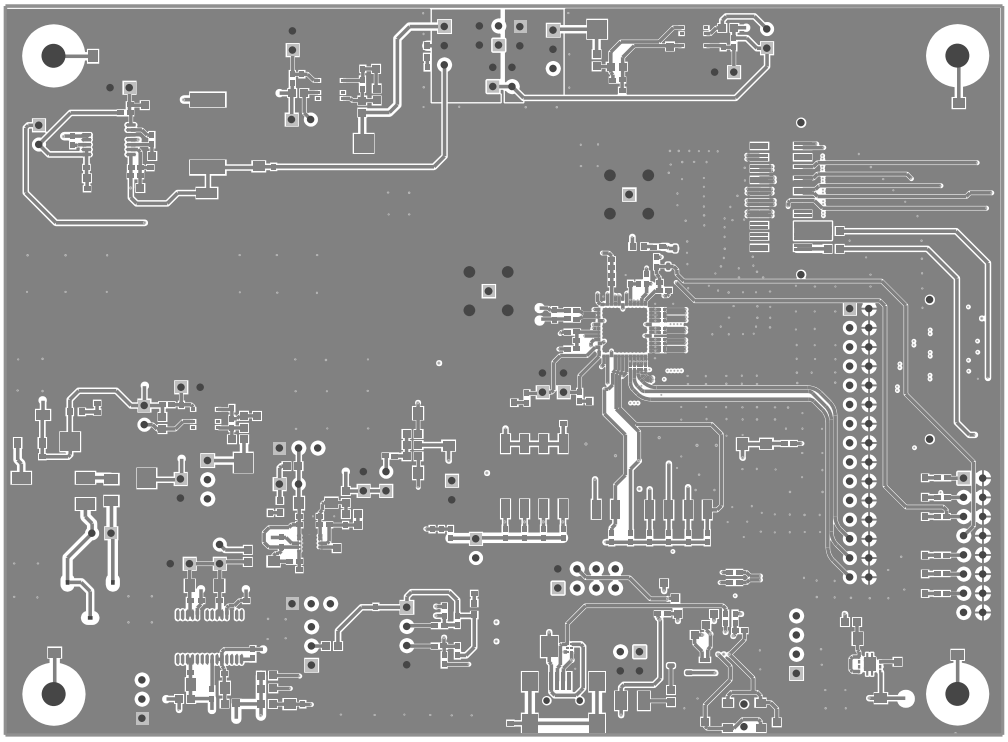


Figure 22. Top Layer 1

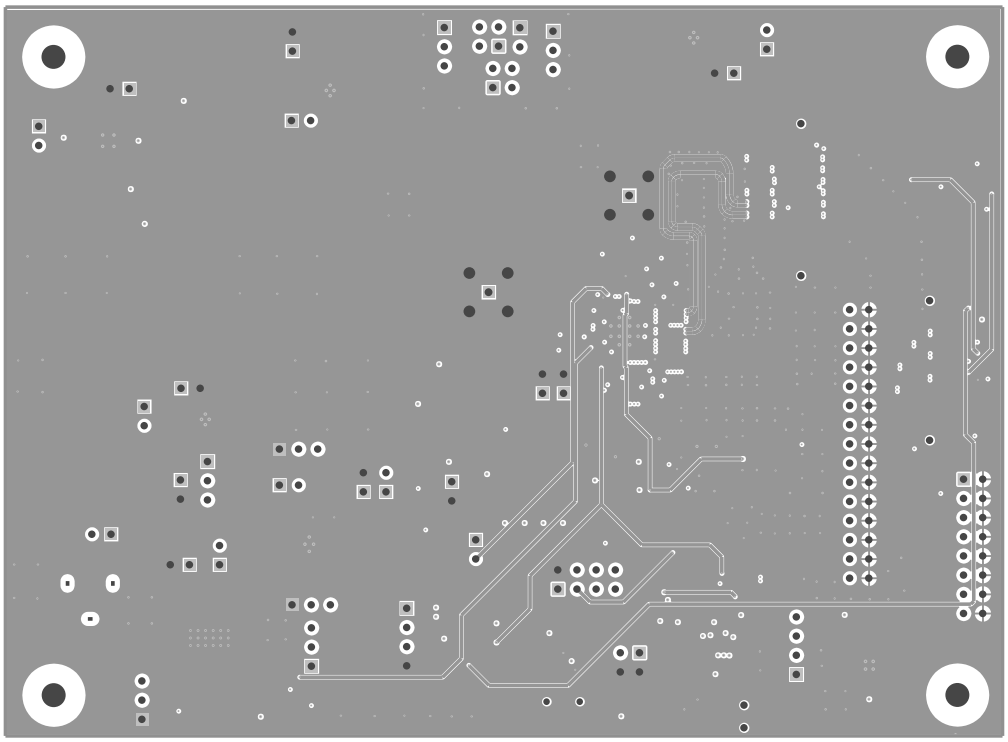


Figure 23. Layer 2

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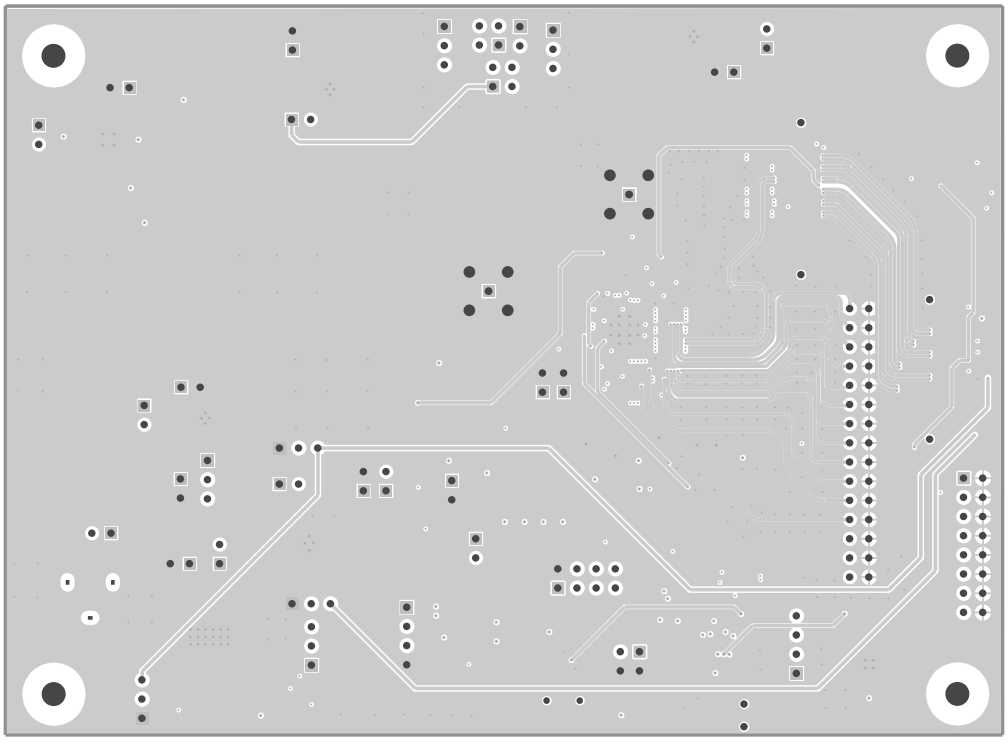


Figure 24. Layer 3

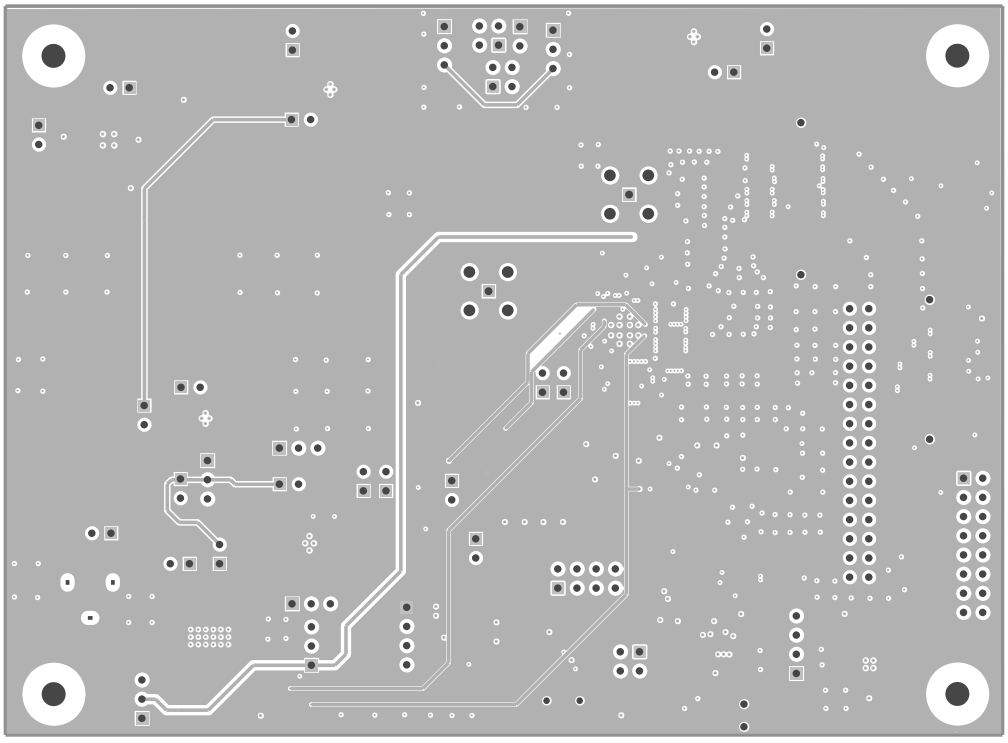


Figure 25. Layer 4

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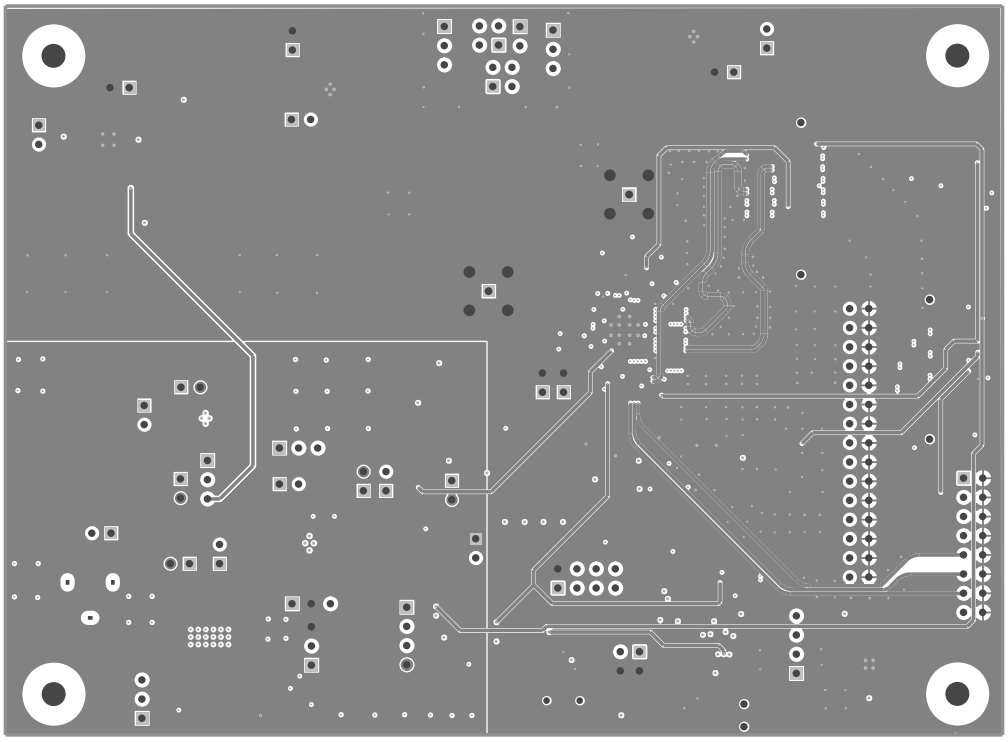


Figure 26. Layer 5

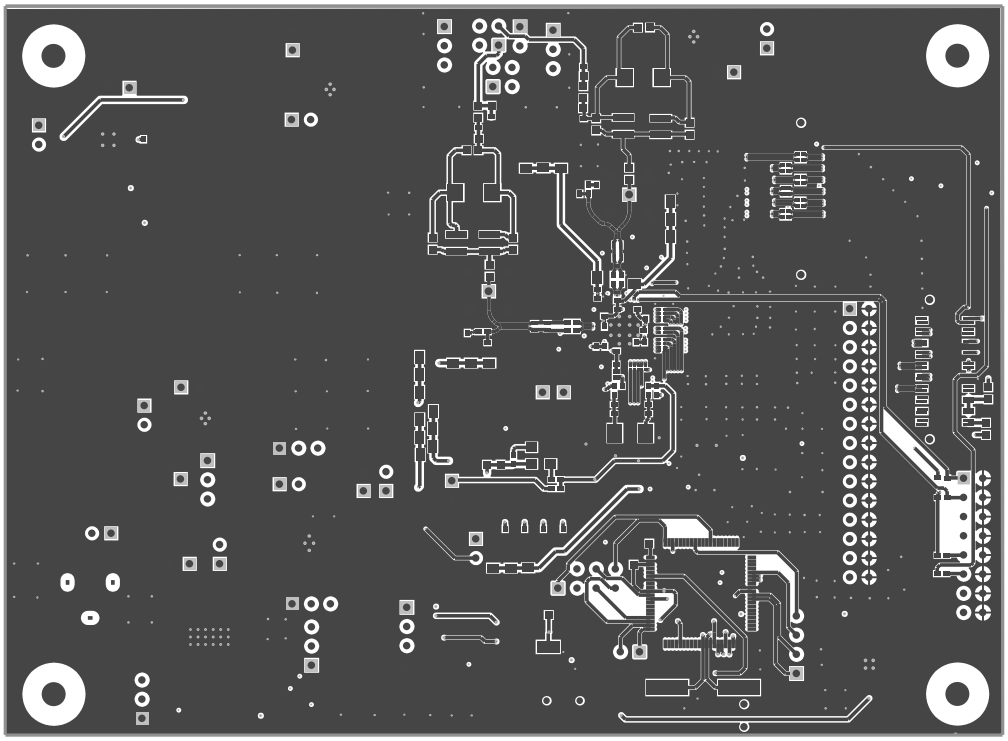


Figure 27. Bottom Layer 6

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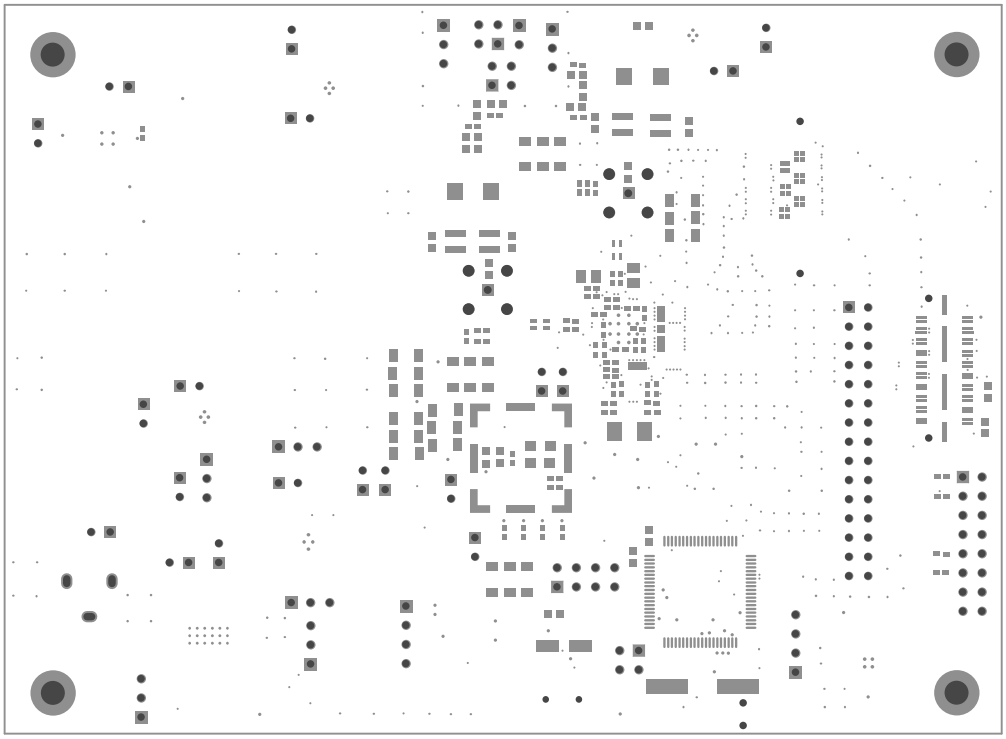


Figure 28. Bottom Solder

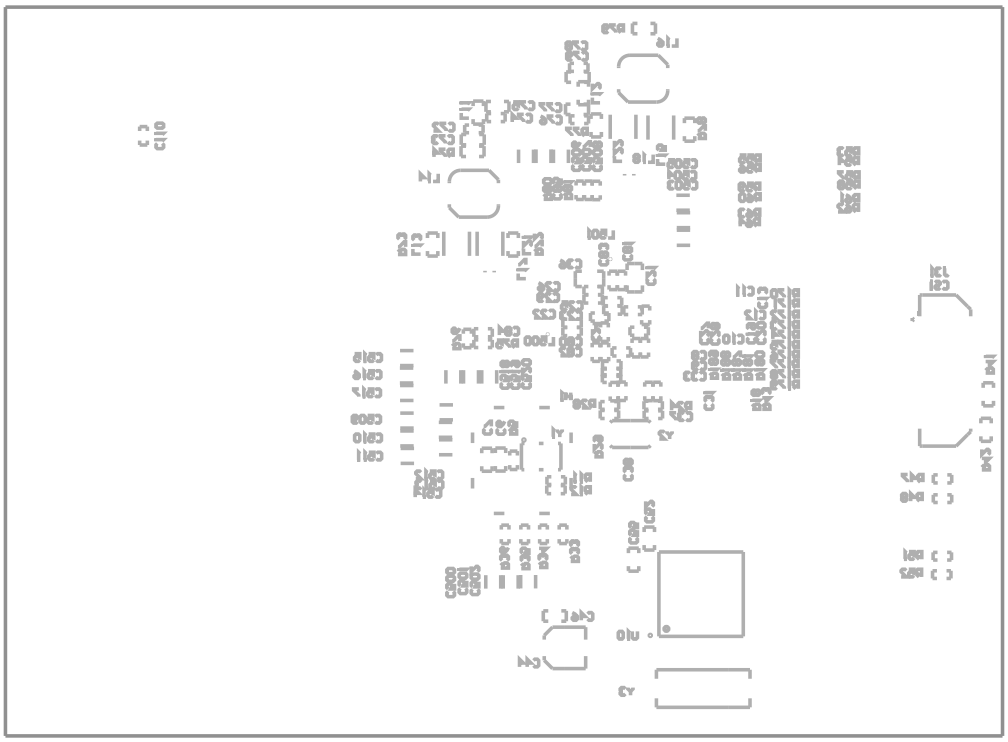


Figure 29. Bottom Overlay

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3 *Regulatory Notices:*

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      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

      3.1.2 *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

      NOTE: 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

NOTE: 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.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-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.

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.

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.

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

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs 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 EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

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4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure 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. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

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