DS90UB924-Q1EVM

User's Guide

![Texas Instruments logo]

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DS90UB924-Q1EVM User's Guide

1.1 General Description

The DS90UB924-Q1EVM (Evaluation Module) helps system designers evaluate the operation and performance of the DS90UB924-Q1 FPD-Link III Deserializer. The device translates a high-speed serialized FPD-Link III interface transported over a single Shielded Twisted Pair (STP) cable into four FPD-Link (OpenLDI) compatible LVDS data output pairs and on LVDS clock. The DS90UB924-Q1 is in conjunction with the DS90UB921-Q1, DS90UB925Q-Q1, DS90UB927Q-Q1, DS90UB929-Q1,DS90UB949-Q1, and DS90UB947-Q1 Serializers.

The DS90UB924-Q1EVM board features a 20-position IDC connector for connecting to the FPD-Link (OpenLDI) outputs and a HSD Automotive Connector for connecting an automotive-grade STP cable to the FPD-Link III input. The included SMA connectors may also be configured as the FPD-Link III data input, enabling evaluation of other connectors and cable configurations.

The DS90UB924-Q1 supports clocks in the range of 5 MHz to 96 MHz.

WARNING

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.

1.2 Features

- Qualified for Automotive Applications AEC-Q100
    - Device Temperature Grade 2: -40°C to +105°C Ambient Operating Temperature Range
    - Device HBM ESD Classification Level ± 8 kV
    - Device CDM ESD Classification Level C6
- 5 MHz to 96 MHz Pixel Clock Support
- Bidirectional Control Channel Interface with I²C-Compatible Serial Control Bus
- Low EMI FPD-Link (OpenLDI) Video Output
- Supports High Definition (720p) Digital Video
- RGB888 + VS, HS, DE and I2S Audio Supported
- Up to 4 I2S Digital Audio Outputs for Surround Sound Applications
- 4 Bidirectional GPIO Channels With 2 Dedicated Pins
- Single 3.3 V supply with 1.8 V or 3.3 V Compatible LVCMOS I/O Interface
- AC-Coupled STP Interconnect Up to 10 Meters
- DC-Balanced and Scrambled Data with Embedded Clock
- Adaptive Cable Equalization
- Internal Pattern Generation
- Backward Compatible Modes

1.3 System Requirements

In order to demonstrate, the following is required:

1. FPD-Link III compatible serializer
   (a) DS90UB921-Q1, DS90UB929-Q1, DS90UB949-Q1, and DS90UB947-Q1 up to 96MHz
   (b) DS90UB925Q-Q1 and DS90UB927Q-Q1 up to 85MHz
2. Optional I²C controller
3. Power supply for 3.3 V or 5 V @ 1 A

1.4 Contents of the Demo Evaluation Kit

1. One EVM board with the DS90UB924-Q1
2. USB Cable

1.5 Applications Diagram
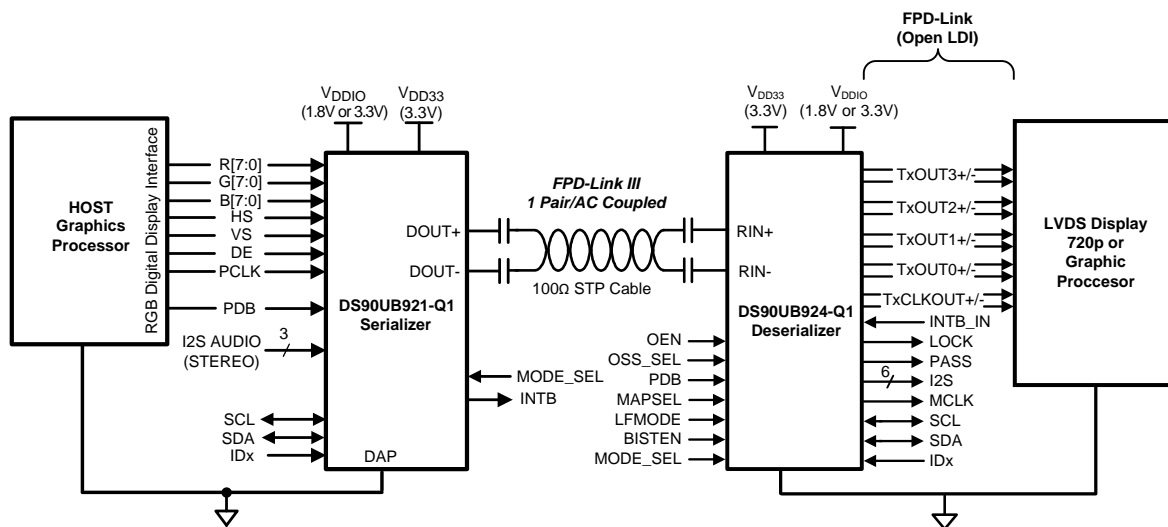
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Figure 1-1. Applications Diagram

1.6 Typical Configuration
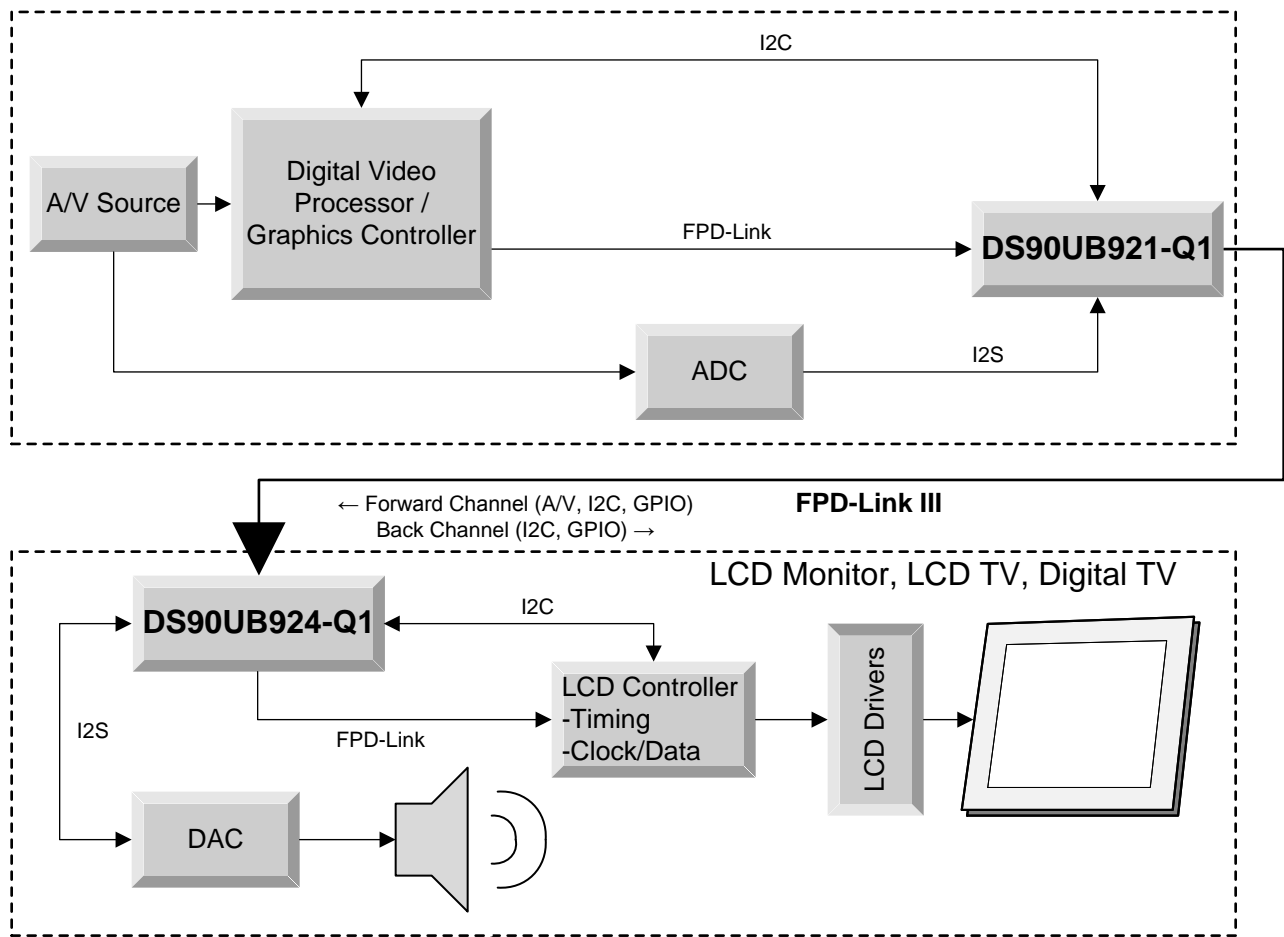
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Figure 1-2. Typical Configuration

Figure 1-1 and Figure 1-2 illustrate the use of the chipset in a display application.

1.7   Quick Start Guide

1. The DS90UB924-Q1EVM is configured for the differential operation by using STP cable.

2. Connect J4 to compatible Serializer e.g. DS90UB921-Q1, DS90UB925Q-Q1, DS90UB927Q-Q1, DS90UB929-Q1, DS90UB949-Q1, and DS90UB947-Q1.

3. Configure switches S2, S3 and S5 to set I²C address (IDx) and the device configuration select (MODE_SEL).
    - S2 and S3: IDx = 0x58 (default factory setting)
    - S5: MODE_SEL = 1 (default factory setting)

4. Connect J8 to 3.3 V and J9 to GND.

    (a) Optional power options available, J7, 5 V (see Table 1-3)

5. Connect J6 with miniUSB cable to PC USB port

For details of pin-names and pin-functions, please refer to the DS90UB924-Q1 datasheet.
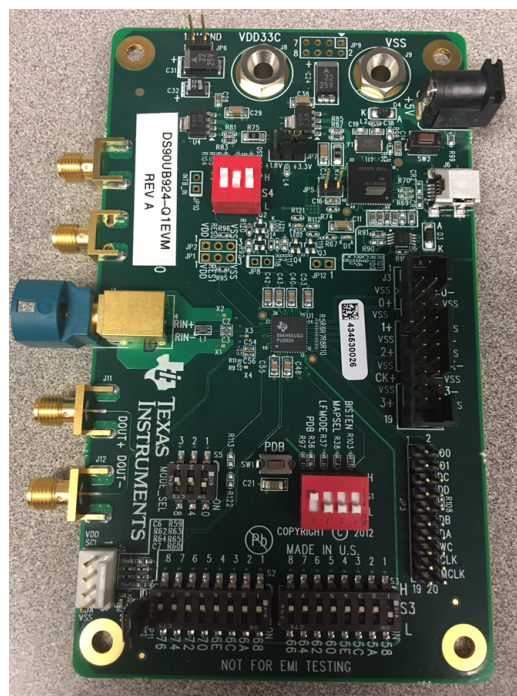
Figure 1-3. Interfacing to the EVM

1.8 Default Jumper Settings

Ensure that the board has the default board jumper settings:

Table 1-1. Default Board Jumper Settings

JUMPER	JUMPER SETTINGS
JP7	Connect jumper to select +3.3 V for VDDIO = VDD33 or +1.8 V for VDDIO = 1.8 V

1.9 Default Switch Settings

Ensure that the board has the default board switch settings:

Table 1-2. Default Board Switch Settings

SWITCH	SWITCH SETTINGS
S1	1 to 3 OFF, 4 ON
S2	1 to 8 OFF
S3	1 ON, 2 to 8 OFF
S4	1 ON, 2 OFF, 3 ON
S5	1 ON, 2 to 3 OFF

1.10 Demo Board Connections

Table 1-3. Power Supply

DESIGNATOR	SIGNAL	DESCRIPTION
J7	5 V	5 V power supply, 5 V power connector that supplies power to the entire board.
J8	3.3 V	3.3 V power supply, 3.3 V power connector that supplies power to the entire board.
J9	GND	Ground

Table 1-4. USB2ANY Connector

DESIGNATOR	DESCRIPTION
J6	mini USB 5 pin, USB Connector for USB-to-I2C Controller. Connect USB cable to host PC to use the ALP evaluation software with the EVM board.

Table 1-5. I2C Interface Header

DESIGNATOR	SIGNAL
J5.1	VDDI2C
J5.2	SCL
J5.3	SDA
J5.4	GND

Table 1-6. MODE SELECTION INPUTS (S1)

DESIGNATOR	DESCRIPTION
S1.1	BISTEN LOW: Normal operation. HIGH: Enable the Built-In Self-tet (BIST) mode.
S1.2	MAPSEL LOW: Assign LSBs to TxOUT3±. HIGH: Assign MSBs to TxOUT3±.
S1.3	LFMODE LOW: 5 MHz ≤ PCLK < 15 MHz. HIGH: 15 MHz < PCLK ≤ 96 MHz
S1.4	PDB LOW: The device enters low power mode and all register are reset. HIGH: Normal Operation.

Table 1-7. IDx Settings (S2 and S3)[1]

DESIGNATOR	MODE #	7-Bit ADDRESS	8-Bit ADDRESS
S2.1	3	0x34	0x68
S2.2	4	0x35	0x6A
S2.3	5	0x36	0x6C
S2.4	6	0x37	0x6E
S2.5	7	0x38	0x70
S2.6	8	0x39	0x72
S2.7	9	0x3A	0x74
S2.8	10	0x3B	0x76
S3.1 (Default)	1	0x2C	0x58
S3.8	2	0x33	0x66

[1] Only set one high.

Table 1-8. OUTPUT STATE SELECT (S4)

DESIGNATOR	DESCRIPTION
S4.1	OEN
S4.2	BISTC / INTB_IN
S4.3	OSS_SEL

Table 1-9. MODE_SEL Settings (S5) [1]

DESIGNATOR	MODE #	REPEAT	BKWD	I2S-B	LCBL
S5.1 (Default)	1	L	L	L	L
S5.2	7	H	L	L	H
S5.3	9	L	H	L	L

[1]   Only set one high.

1.11   ALP Software Setup

1.11.1   System Requirements

Operating System: Windows 7 64-bit
USB: USB2ANY
USB2ANY Firmware Version: 2.6.5.0

1.11.2   Download Contents

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.

Make sure J6 on the DS90UB924-Q1 EVM is connected to a PC USB port with USB cable and power is applied to the DS90UB924-Q1 EVM.

The following installation instructions are for the Windows 7 64-bit Operating System.

1.11.3   Installation of the ALP Software

Execute the ALP Setup Wizard program called "ALP_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.

Connect J6 USB jack of the DS90UB924-Q1 EVM board to a PC/laptop USB port using a Type A
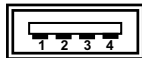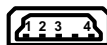
 A to mini-B **MINI** USB cable. The "Found New Hardware Wizard" will open on the PC/laptop.

1.11.4 Startup - 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 1-4. Launching ALP

1.11.4.1 Initial ALP Screen

The application should come up in the state shown in Figure 1-5. If it does not, see Section 1.12, "Troubleshooting ALP Software".

Under the Devices tab click on "DS90UB924" to select the device and open up the device profile and its associated tabs.
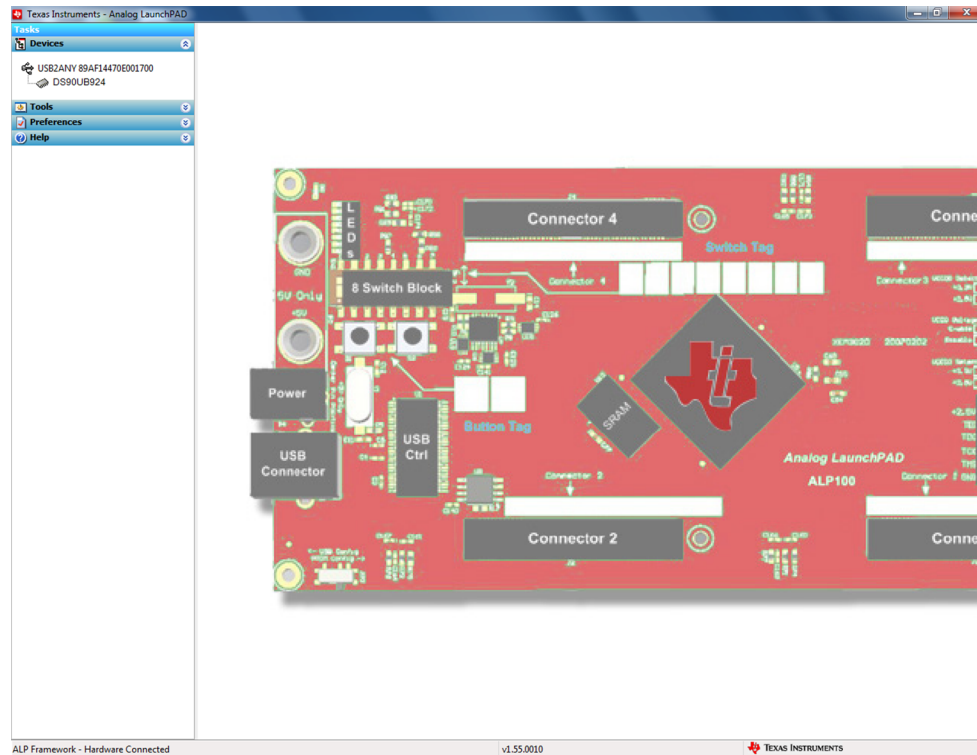

Figure 1-5. Initial ALP Screen

After selecting the DS90UB924, the following screen should appear.
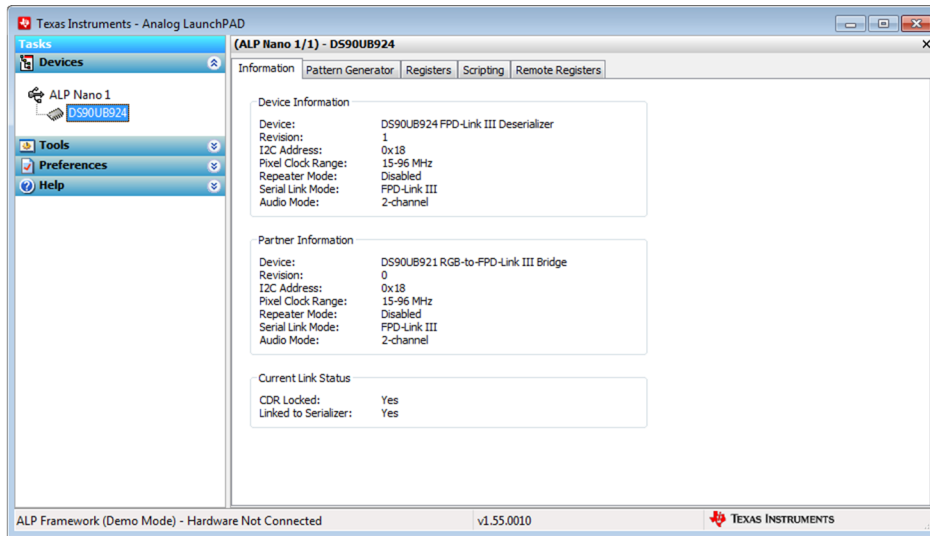

Figure 1-6. Follow-up Screen

1.11.5 Information Tab

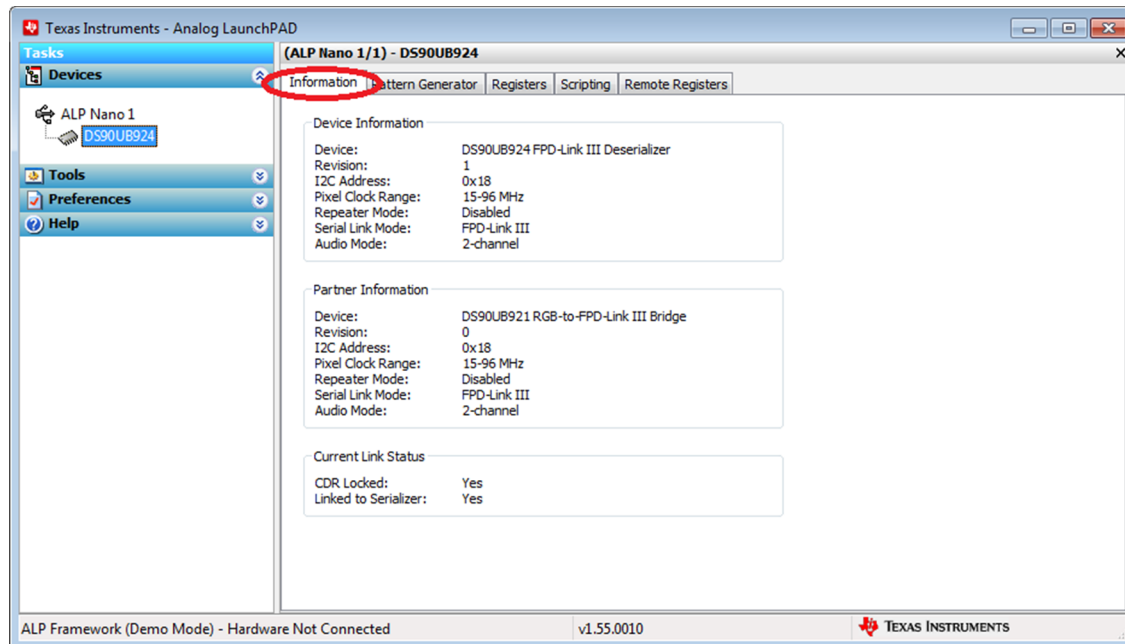The Information tab is shown below. Please note the device revision could be different.

Figure 1-7. ALP Information Tab

1.11.6 Pattern Generator Tab

The Pattern Generator tab is shown below.
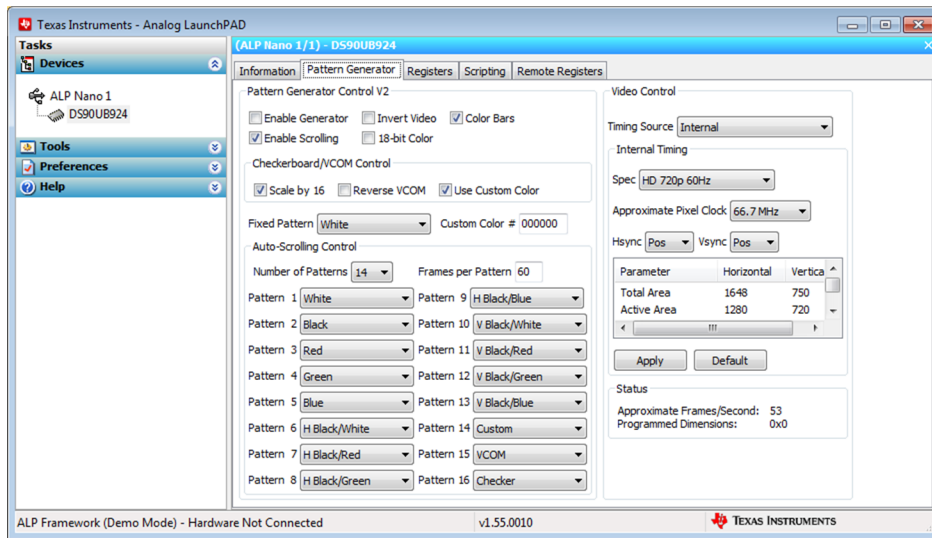
Figure 1-8. ALP Pattern Generator Tab

1.11.7 Registers Tab

The Registers tab is shown below.

Figure 1-9. ALP Registers Tab

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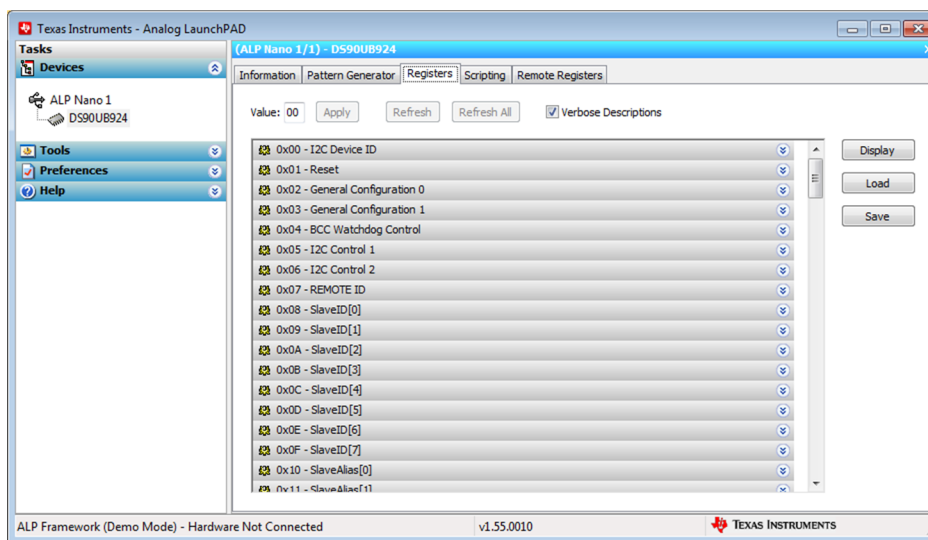
1.11.8 Registers Tab - Address 0x00 selected

Address 0x00 selected as shown below. Note that the "Value:" box, Value: 58 , will now show the hex value of that register.
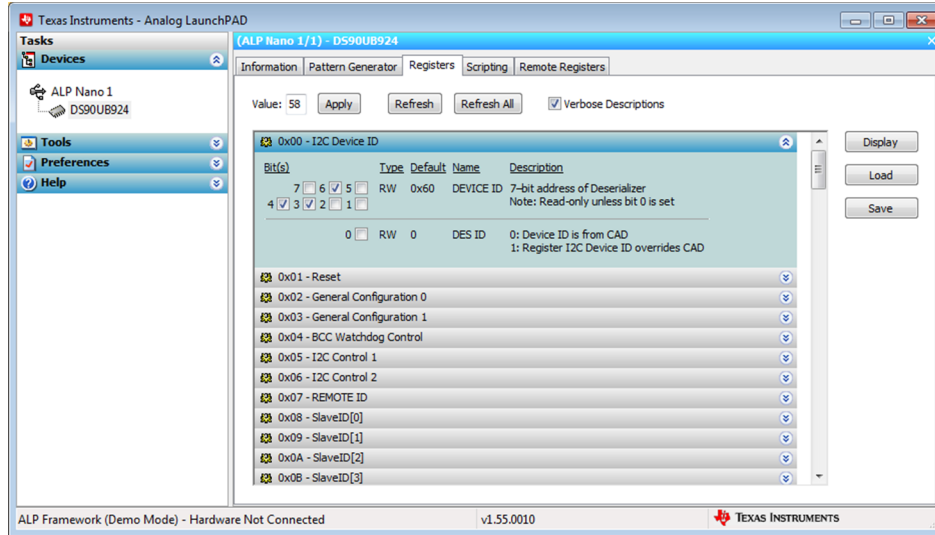
Figure 1-10. ALP Device ID Selected

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.

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 un-checking 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.

1.11.9 Scripting Tab

The Scripting tab is shown below.
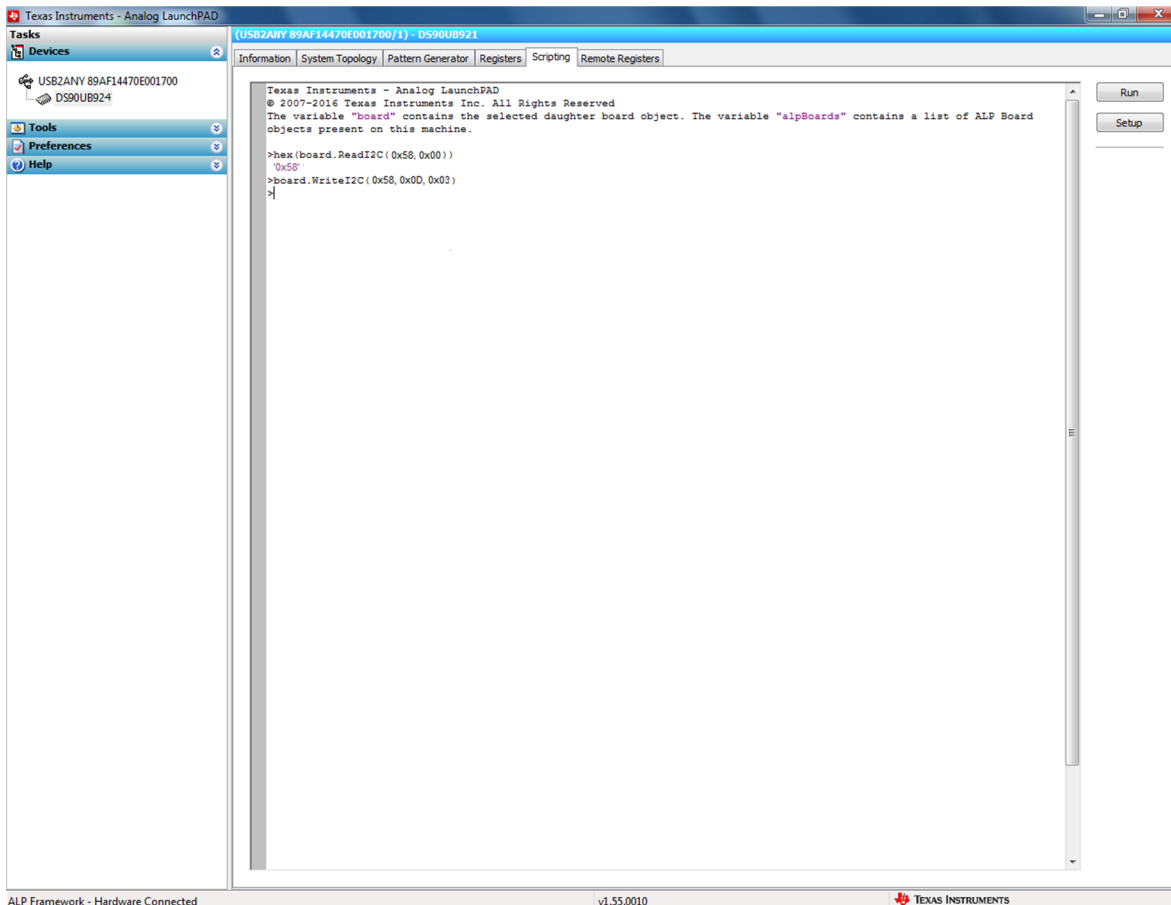
Figure 1-11. ALP Scripting Tab

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.**

1.12 Troubleshooting ALP Software

1.12.1 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.
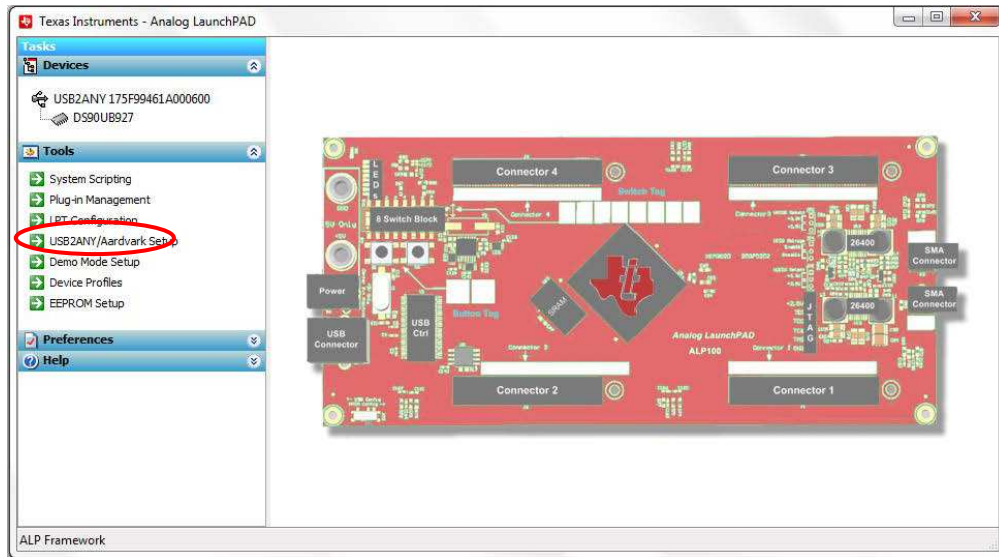
Figure 1-12. USB2ANY Setup

Highlight the incorrect profile in the Defined ALP Devices list and press the remove button.
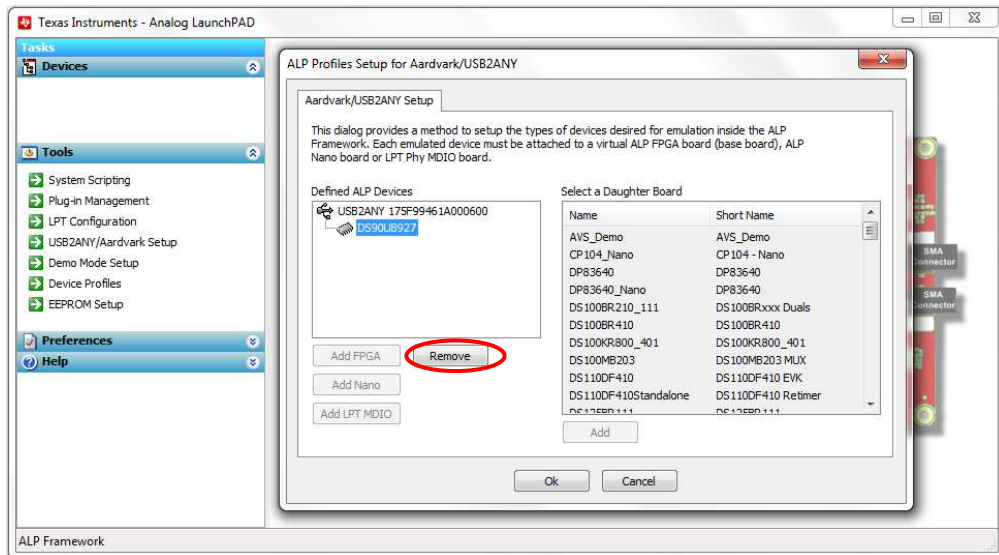
Figure 1-13. Remove Incorrect Profile

Find the correct profile under the Select a Daughter Board list, highlight the profile and press Add.
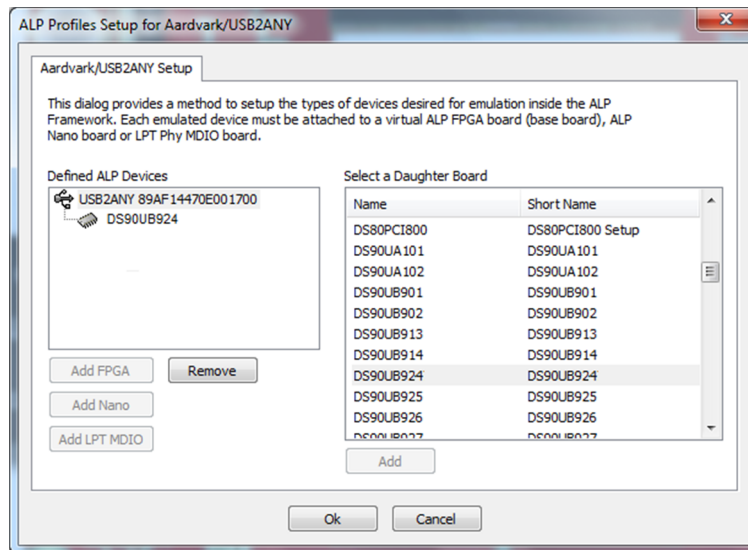
Figure 1-14. Add Correct Profile

Select Ok and the correct profile should now be loaded.

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1.12.2 ALP does not detect the EVM

If the following window opens after starting the ALP software, double check the hardware setup.
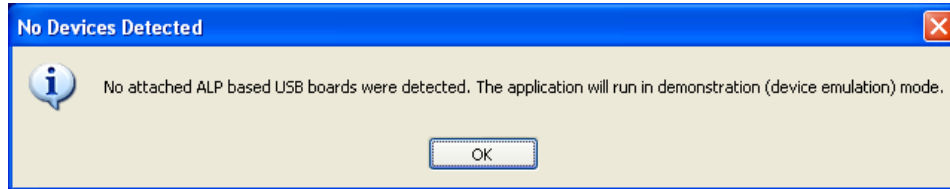
Figure 1-15. ALP No Devices Error

It may also be that the USB driver is not installed. Check the device manager. There should be a "HID-compliant device" under the "Human Interface Devices" as shown below.
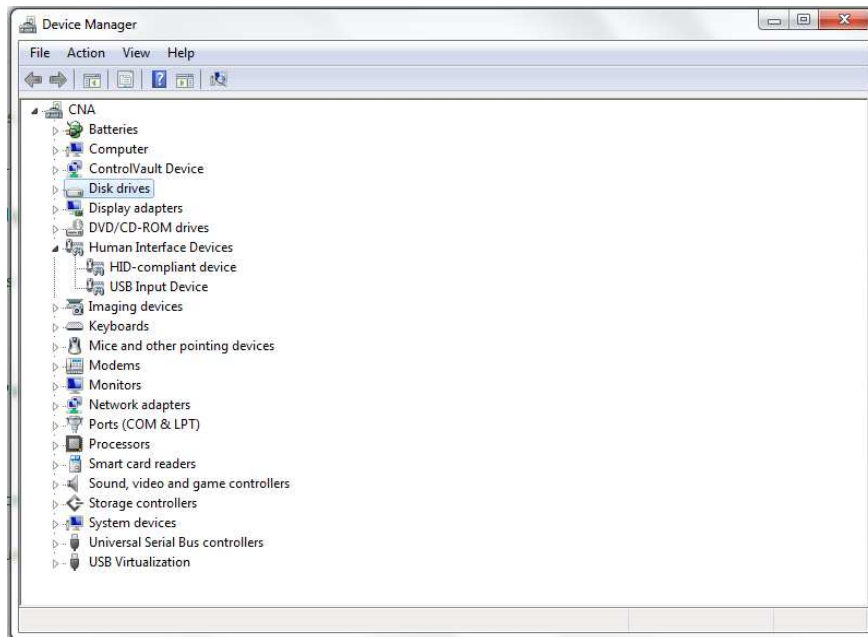
Figure 1-16. Windows 7, ALP USB Driver

The software should start with only "DS90UB924" in the "Devices" pull down 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.
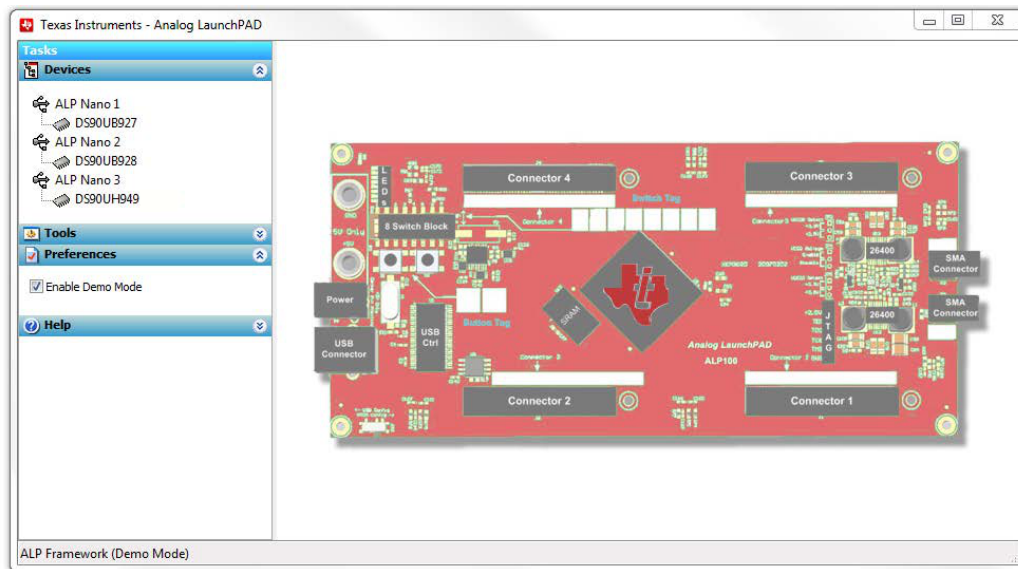
Figure 1-17. ALP in Demo Mode

Disable the demo mode by selecting the "Preferences" pull down menu and un-checking "Enable Demo Mode".
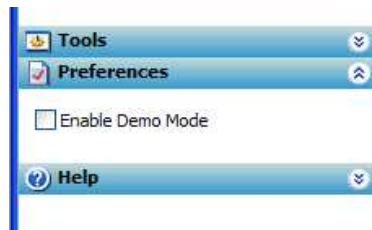
Figure 1-18. ALP Preferences Menu

After demo mode is disabled, the ALP software will poll the ALP hardware. The ALP software will update and have only "DS90UB924" under the "Devices" pull down menu.

1.13 Typical Connection and Test Equipment

The following is a list of typical test equipment that may be used to generate signals for the Serializer inputs:

1. Digital Video Source – for generation of specific display timing such as Digital Video Processor, OpenLDI or Graphics Controller (GPU).

2. Any other signal generator / video source - This video generator may be used for video signal sources.

3. Any other signal / video generator that provides the correct input levels as specified in the datasheet.

The picture below shows a typical test set up using a Graphics Controller and display.
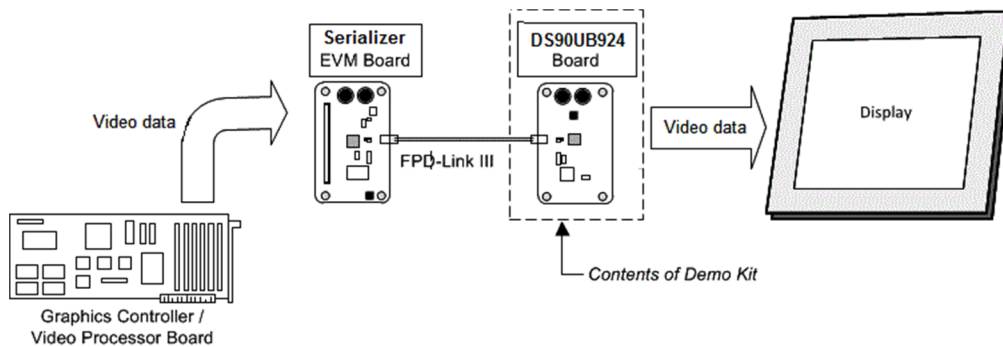
Figure 1-19. Typical Test Setup for Video Application

The picture below shows a typical test set up using a video generator and logic analyzer.
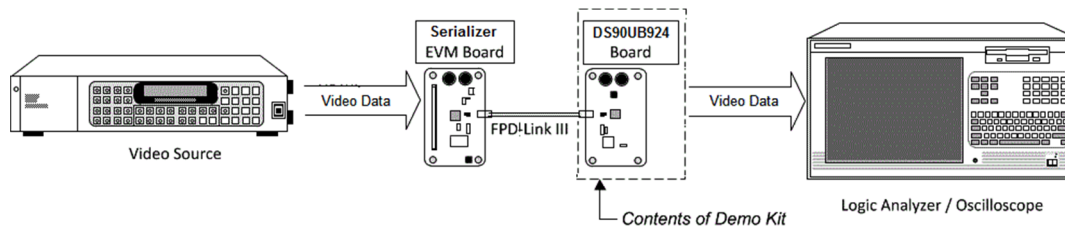
Figure 1-20. Typical Test Setup for Evaluation

1.14 Equipment References

> **NOTE:** Please note that 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.

Digital Video Pattern Generator:

Astrodesign

www.astro-americas.com

Logic Analyzer:

keysight Technologies

www.keysight.com

Corelis CAS-1000-I2C/E I2C Bus Analyzer and Exerciser Products:

www.corelis.com/products/I2C-Analyzer.htm

Aardvark I2C/SPI Host Adapter Part Number: TP240141

www.totalphase.com/products/aardvark_i2cspi

1.15 Cable References

TI recommends Shielded Twisted Pair (STP) 100ohm differential impedance and 24 AWG (or larger diameter) cable for high-speed data applications.

Leoni Dacar 535-2 series cable:

www.leoni-automotive-cables.com

Rosenberger HSD connector:

www.rosenberger.de/en/Products/35_Automotive_HSD.php

Bill of Materials

Table 2-1. Bill of Materials

Item	Qty	Reference	Description	Manufacturer	Part Number
1	2	CR1,CR2	SUPPRESSOR ESD 24VDC 0603 SMD	Littelfuse Inc	PGB1010603MR
2	16	C1,C5,C8,C9,C10,C12, C13,C14,C16,C17,C22, C26,C28,C33,C35,C37	CAP CER .1UF 50V 10% X7R 0603	Murata Electronics North America	GRM188R71H104KA93D
3	4	C2,C3,C54,C56	CAP CER .1UF 16V X7R 0402	Murata	GCM155R71C104KA55D
4	2	C6,C7	CAP CERAMIC 4.7PF 25V C0G 0402	Panasonic	ECD-G0E4R7C
5	5	C11,C27,C29,C36,C38	CAP CER 10UF 16V X7R 10% 1206.	TDK	C3216X7R1C106K
6	1	C15	CAPACITOR TANT 1.0UF 16V 10% SMD	Kemet	T491A105K016AT
7	2	C18,C19	CAP CERAMIC 15PF 50V NP0 0603	Kemet	C0603C150J5GACTU
8	1	C21	CAP CER 22UF 6.3V 10% X7R 1206	Murata	GCM31CR70J226KE23L
9	2	C23,C32	CAPACITOR TANT 2.2UF 20V 10% SMD	KEMET	T491B225K020AT
10	2	C24,C31	CAP TANTALUM 22UF 25V 20% SMD	nichicon	F931E226MNC
11	12	C25,C40,C41,C42,C43, C44,C45,C46,C51,C52, C53,C55	CAP CER 4.7UF 16V X7R 0805	Murata	490-5332-1-ND
12	1	C30	CAP CERM 33000PF 5% 50V X7R 0603	AVX Corporation	06035C333JAT2A
13	2	D1,LED2	LED ORN/CLEAR 610NM 0402 SMD	Lumex Opto/ Components Inc	SML-LX0402SOC-TR
14	2	D3,D4	DIODE SCHOTTKY 400MW 20V SOD123	Diodes Inc.	SD103CW-13-F
15	1	JP3	CONN HEADER 20POS .100 STR 15AU	FCI	67997-220HLF
16	3	JP5,JP6,JP11	CONN HEADER VERT .100 2POS 30AU	AMP/Tyco	87220-2
17	1	JP7	CONN HEADER VERT .100 3POS 15AU	AMP/Tyco	87224-3
18	4	J1,J2,J11,J12	End Launch Jack Receptacle - Tab Contact	Johnson Components	142-0701-851
19	1	J3	CONN HEADER 20 POS STRGHT GOLD.	3M	N2520-6002RB
20	1	J4	Automotive HSD Connector - Right Angle Plug	Rosenberger	D4S20B-40ML5-Y
21	1	J5	CONN HEADER 4POS .100 VERT GOLD	Molex/Waldom Electronics Corp	22-11-2042
22	1	J6	CONN RECEPT MINI USB2.0 5POS	Hirose	UX60-MB-5ST
23	1	J7	CONN POWER JACK 2.1MM.	CPU Inc	PJ-002A
24	2	J8,J9	BANANA-female (non-insulated)	Johnson	108-0740-001
25	1	LED1	LED GREEN 0.2MM 13MCD 0402 SMD	Rohm	SML-P12PTT86
26	1	L1	CHOKE COIL COMMON MODE 280MA SMD	Murata	DLW21SN900HQ2L
27	2	L2,L4	FERRITE CHIP 1000 OHM 0402	Murata	BLM15AX102SN1D
28	2	R9,R11	RES 0.0 OHM 1/20W 5% 0201 SMD	Panasonic	ERJ-1GE0R00C
29	2	R18,R52	RES 90.9K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF9092X
30	1	R19	RES 137K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1373X
31	1	R20	RES 150K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1503X
32	1	R21	RES 154K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1543X
33	1	R22	RES 174K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1743X
34	1	R23	RES 187K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1873X
35	1	R24	RES 200K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2003X
36	1	R25	RES 215K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2153X
37	1	R26	RES 226K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2263X

Table 2-1. Bill of Materials (continued)

Item	Qty	Reference	Description	Manufacturer	Part Number
38	2	R27,R43	RES 243K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2433X
39	1	R28	RES 240K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2403X
40	1	R29	RES 267K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2673X
41	1	R30	RES 270K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2703X
42	1	R31	RES 280K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2803X
43	1	R32	RES 294K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2943X
44	7	R37,R38,R97,R103,R104,R105,R106	RES 10.0K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF1002V
45	2	R44,R114	RES 210K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2103X
46	1	R45	RES 191K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1913X
47	1	R46	RES 165K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1653X
48	1	R47	RES 158K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1583X
49	1	R48	RES 140K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1403X
50	1	R49	RES 127K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1273X
51	1	R50	RES 113K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1133X
52	1	R51	RES 97.6K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF9762X
53	1	R53	RES 76.8K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF7682X
54	1	R54	RES 71.5K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF7152X
55	1	R55	RES 60.4K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF6042X
56	1	R56	RES 49.9K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF4992X
57	2	R57,R58	RES 40.2K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF4022X
58	2	R59,R60	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ472V
59	8	R62,R63,R64,R65,R95,R96,R120,R121	RES ZERO OHM 1/16W 5% 0402 SMD	Panasonic	ERJ-2GEJ0R00X
60	4	R66,R91,R99,R101	RES ZERO OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEY0R00V
61	2	R67,R119	RES 68 OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ680X
62	5	R68,R74,R82,R86,R102	RES 100K OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ104X
63	2	R69,R70	RES 22 OHM 1/16W 3300PPM 5% 0603	Panasonic	ERA-V33J220V
64	2	R75,R76	RES ZERO OHM 1/4W 5% 1206 SMD	Panasonic	ERJ-8GEY0R00V
65	1	R81	RES 2.49K OHM 1/10W 1% 0603 SMD	Vishay/Dale	CRCW06032K49FKEA
66	2	R83,R87	RES 5.62K OHM 1/10W 1% 0603 SMD.	Vishay	CRCW06035K62FKEA
67	1	R85	RES 9.31K OHM 1/10W 1% 0603 SMD	Vishay/Dale	CRCW06039K31FKEA
68	1	R109	RES 124K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF1243V
69	1	R119	RES 255K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF2553V
70	1	R115	RES 49.9K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF4992V
71	1	R116	RES 40.2K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF4022V
72	1	R118	RES 56 OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ560X
73	2	SW1,SW2	SWITCH TACT	APEM Components	ADTSM31NV
74	1	S1	SWITCH DIP EXTENDED SEALED 4POS	Grayhill	78B04ST
75	2	S2,S3	SWITCH TAPE SEAL 8 POS SMD	CTS Electrocomponents	219-8MST
76	1	S4	SWITCH DIP EXTENDED UNSEAL 3POS	Grayhill	78B03T
77	1	S5	SWITCH TAPE SEAL 3 POS SMD	CTS Electrocomponents	219-3MST
78	1	U1	FPD-Link III Deserializer LVDS	TI	DS90UB924-Q1
79	1	U2	IC AVR MCU 128K 64QFN	Atmel	AT90USB1287-16MU
80	2	U4,U5	IC REG LDO 500MA ADJ SOT223-4	TI	LP38693MP-ADJ/NOPB
81	1	U6	IC REG LDO 300MA 3.3V 8MSOP	TI	LP3982IMM-3.3/NOPB
82	1	Y1	CRYSTAL 8.000 MHZ 18PF SMD	Abracon Corporation	ABM3-8.000MHZ-D2Y-T

EVM PCB Schematics

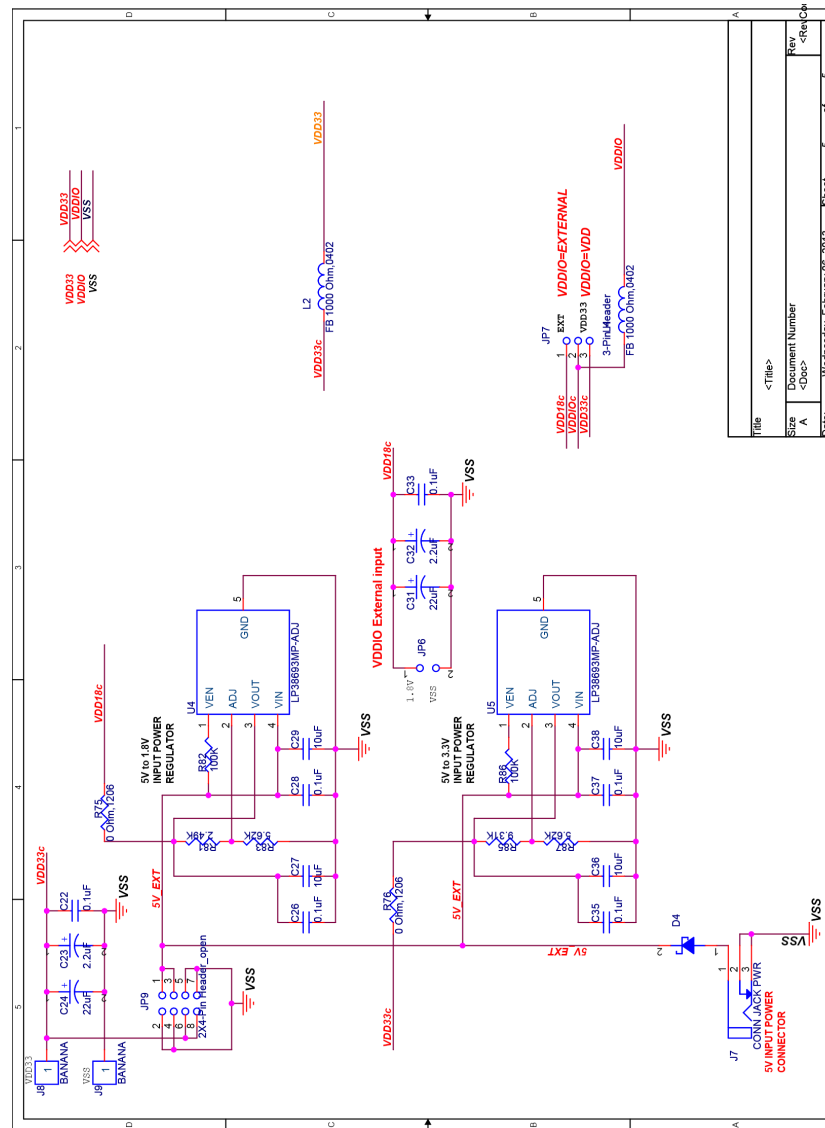## A.1 Board Stackup
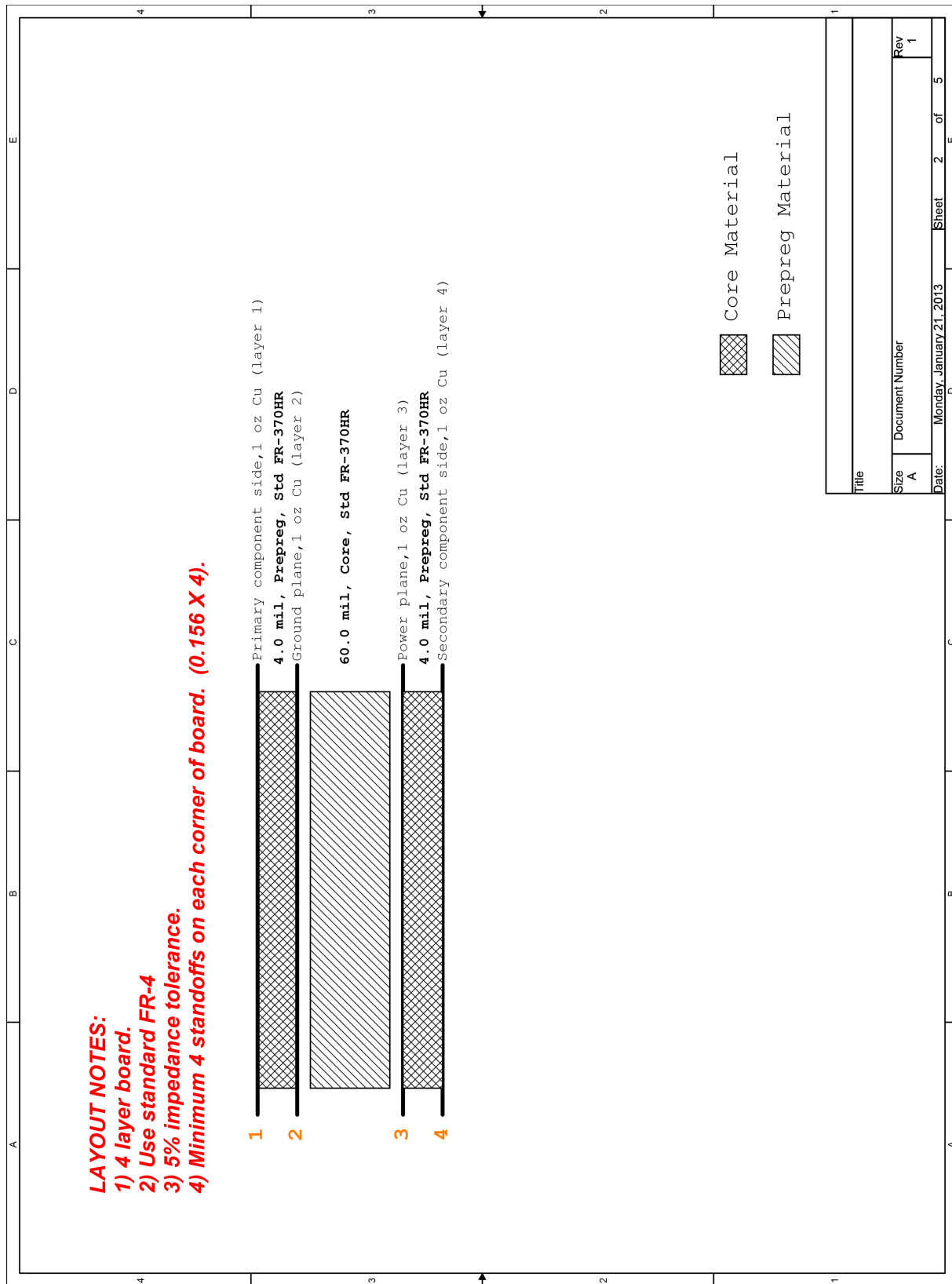
Figure A-1. Board Stackup

A.2 DS90UB924-Q1 Deserializer

Figure A-2. Deserializer

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A.3   USB-to-I2C Controller

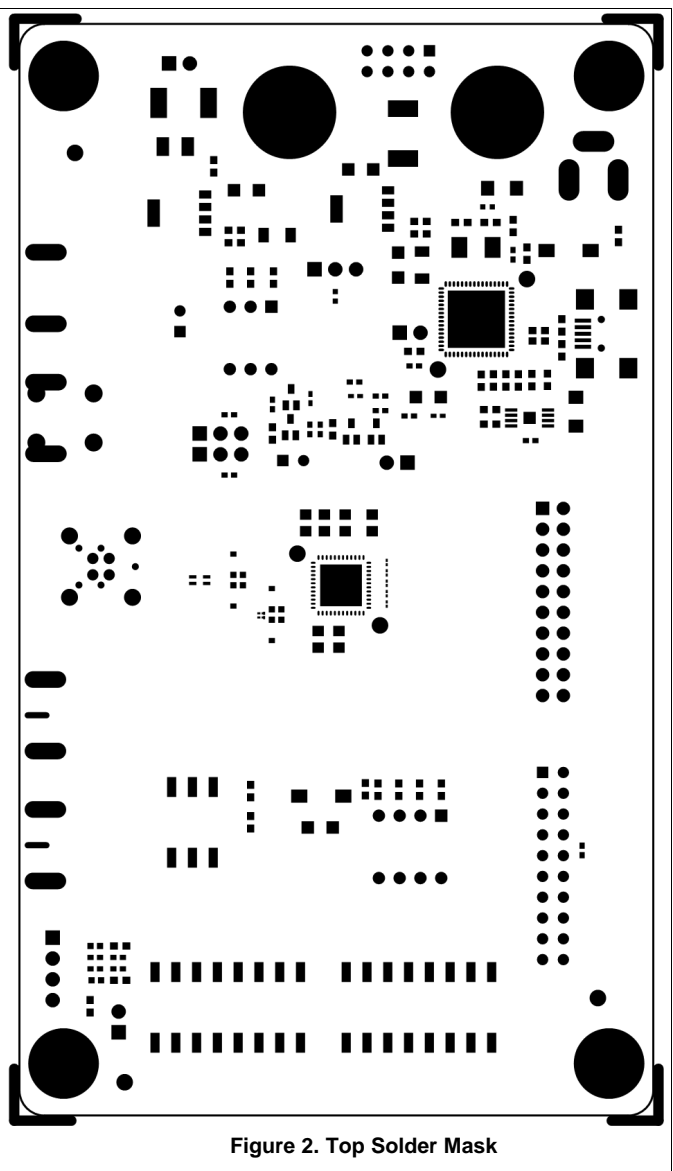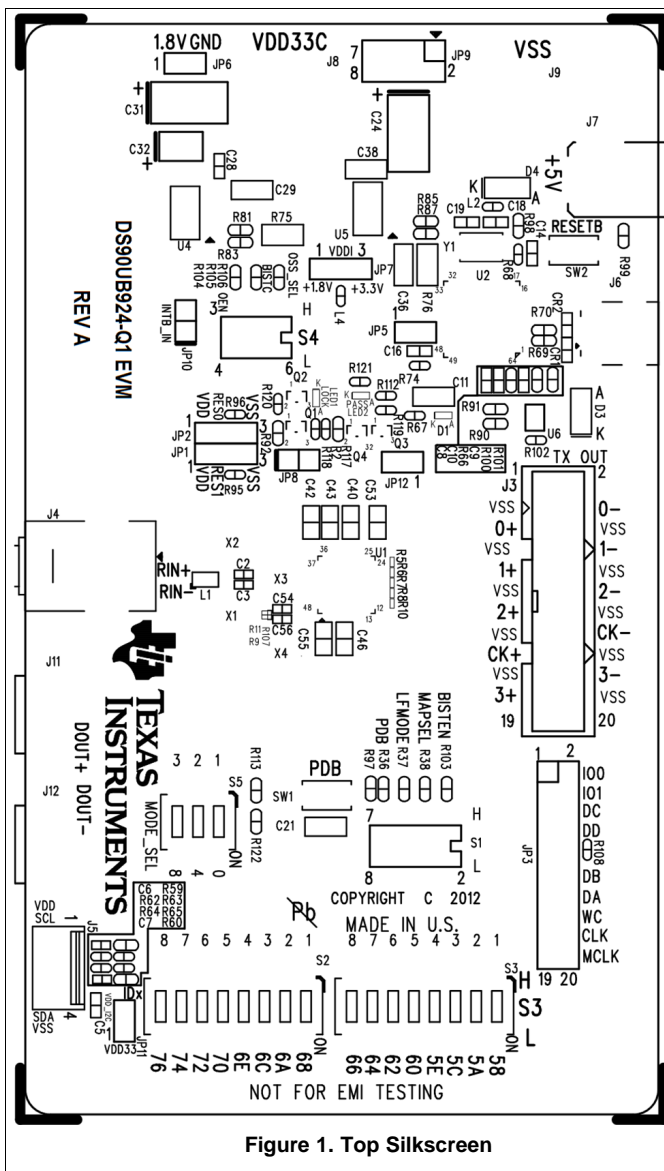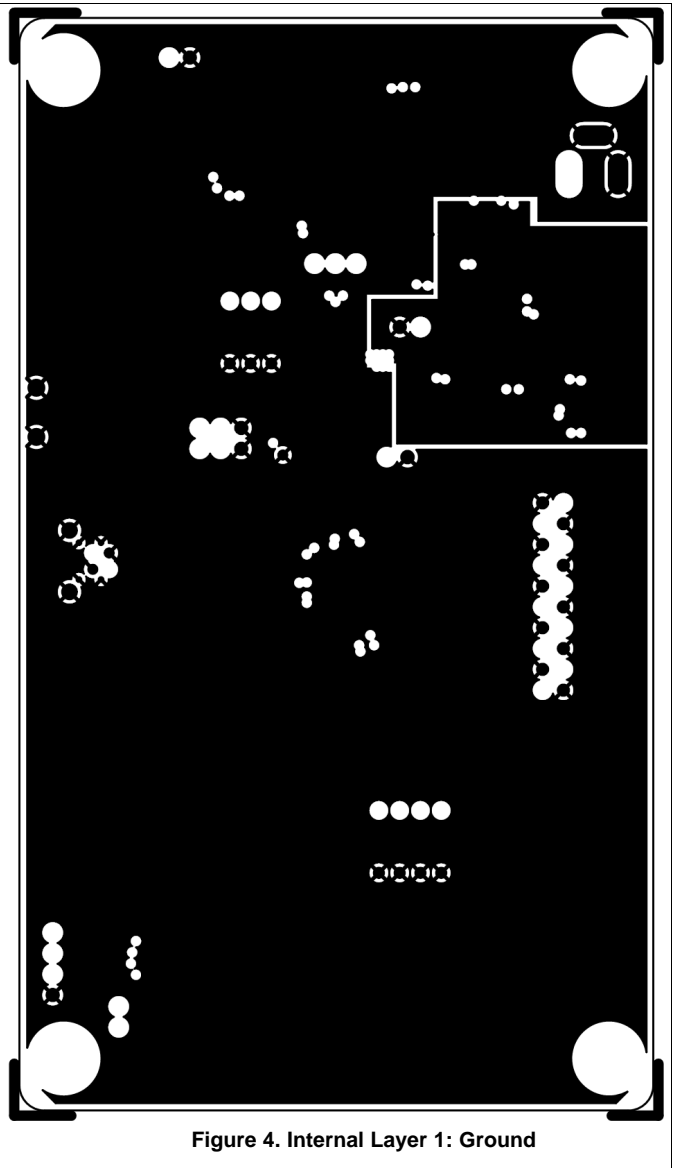**Figure A-3. USB-to-I2C Controller**
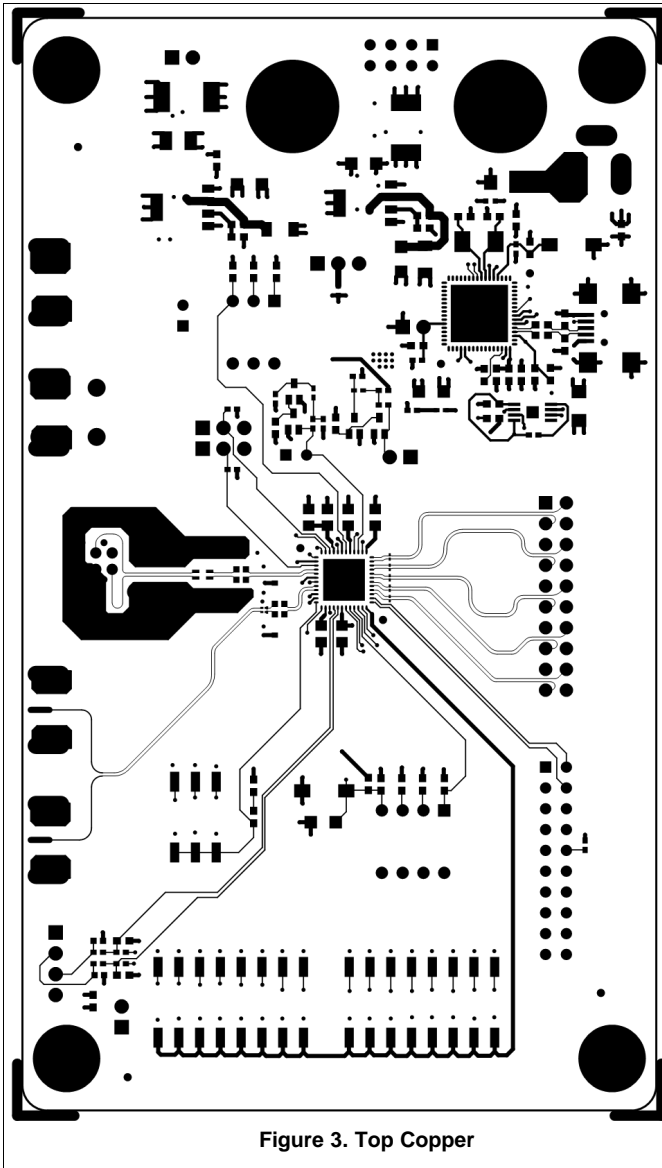
A.4 Power

Figure A-4. Power

Board Layout

B.1 Board Layers

The following mechanical drawings (not to scale) illustrate the physical layout and stack-up of the 4-layer evaluation board:
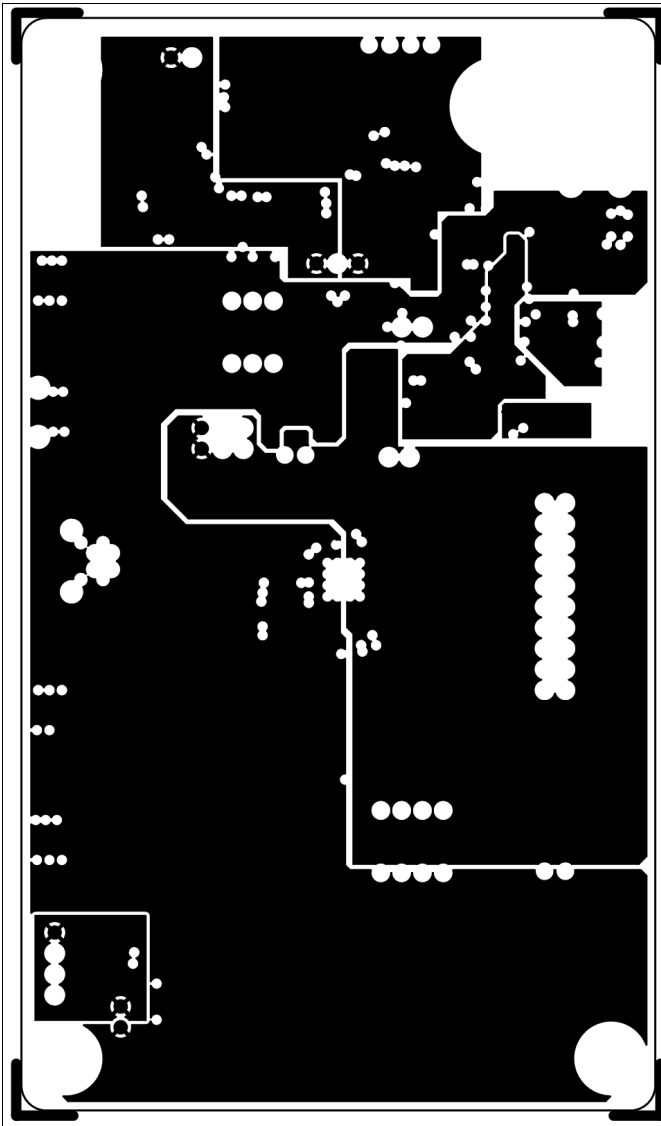

Figure 1. Top Silkscreen

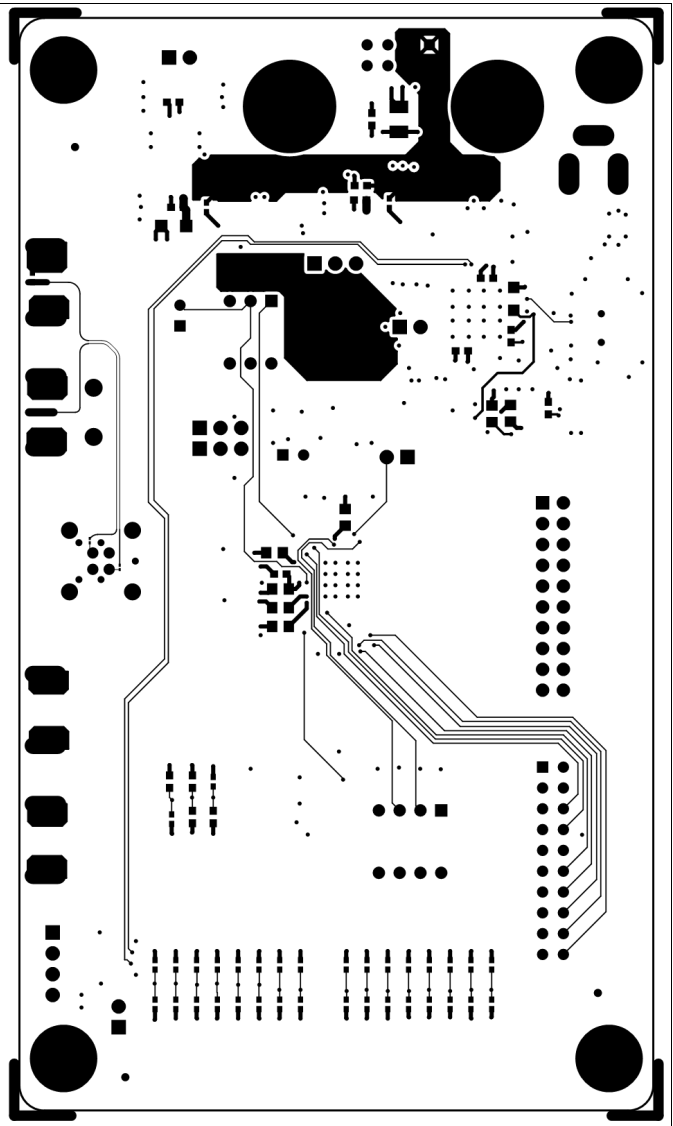
Figure 2. Top Solder Mask

Figure 3. Top Copper

Figure 4. Internal Layer 1: Ground

Figure 5. Internal Layer 2: Power

Figure 6. Bottom Copper
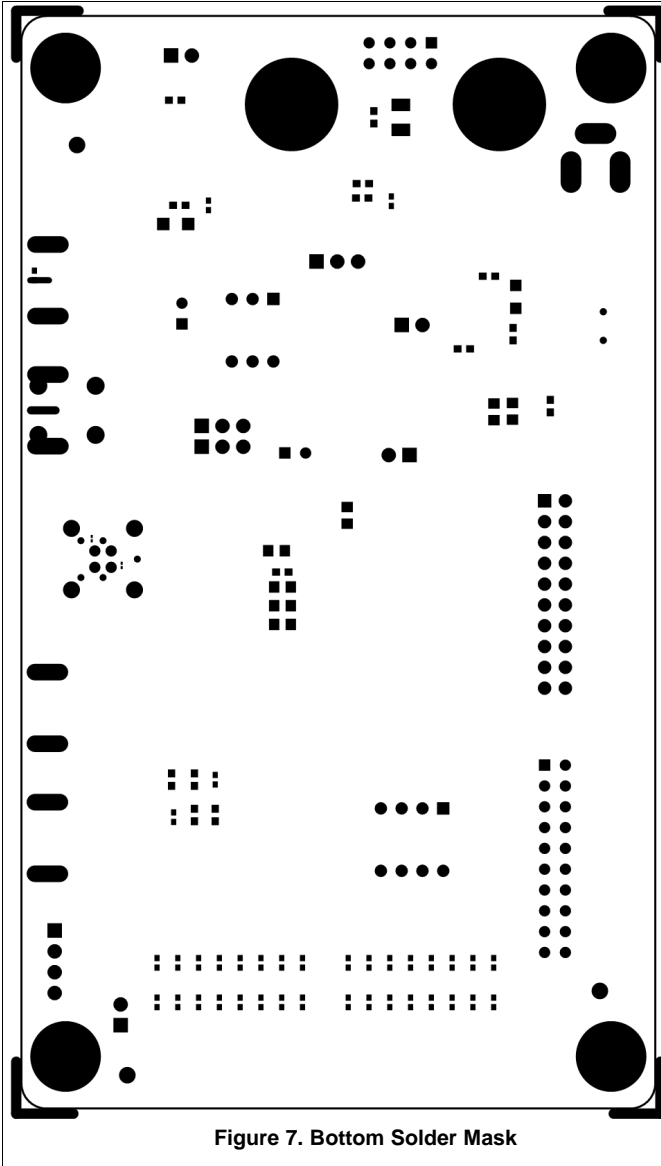
Figure 7. Bottom Solder Mask

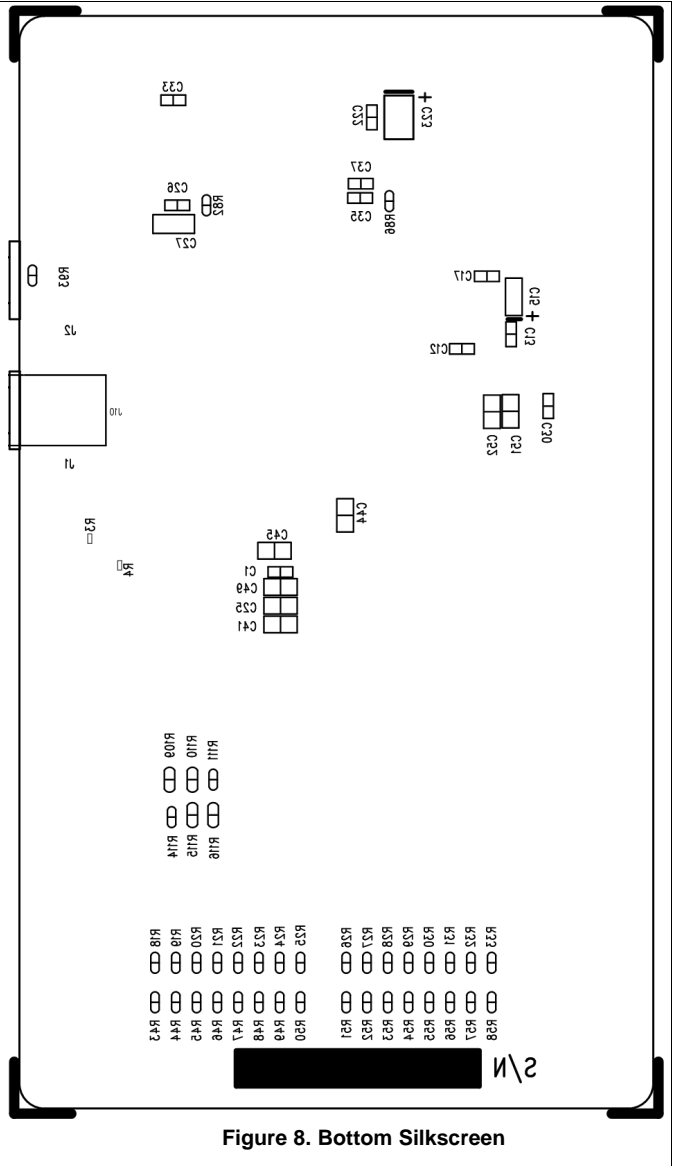**Figure 8. Bottom Silkscreen**

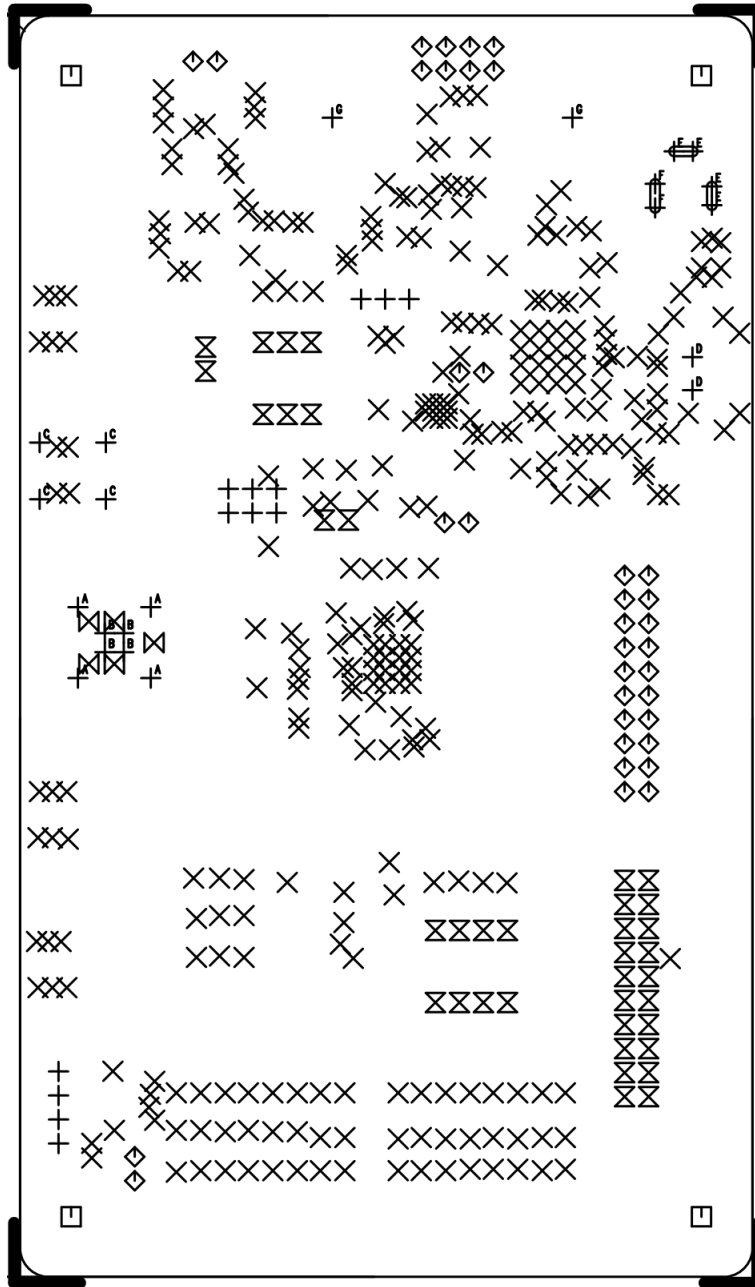Copyright © 2016, Texas Instruments Incorporated

Figure 9. Drill

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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.*

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  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

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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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