

DS90UH925AQEVM

User's Guide



Literature Number: SNLU161
June 2014

Introduction

1.1 DS90UH925AQEVM

The Texas Instruments DS90UH925AQEVM evaluation module (EVM) helps system designers evaluate the operation and performance of the DS90UH925AQ 5MHz-85MHz FPD-Link III Serializer (SER). The device translates parallel RGB video data into a high-speed serialized FPD-Link III interface for transport over a single shielded twisted pair (STP) cable.

The DS90UH925AQEVM board features a 28 pin header at the LVCMOS inputs, and included SMA connectors at the FPD-Link III output. The (not-included) Rosenberger HSD Automotive Connector may also be configured as the FPD-Link III data output, enabling evaluation of other cable configurations.

The EVM contains one serializer (SER) device

Table 1-1. Device and Package Configurations

Reference	IC	Package
U1	DS90UH925AQ	WQFN 48

1.2 DS90UH925AQEVM Kit Contents

The DS90UH925AQEVM Kit contains the following items:

- DS90UH925AQEVM Evaluation Board
- USB Cable

1.3 System Requirements

The ALP software installation requires a PC with a USB interface running the Windows XP operating system. Download and install ALP from <http://www.ti.com/tool/ALP>

1.4 DS90UH925AQEVM Overview

The DS90UH925AQ HDCP serializer supports rich audiovisual applications in automotive navigation and rear seat entertainment systems. It transports parallel RGB video data, I2S audio, GPIO, and I2C control over a single shielded twisted pair cable. The evaluation board and freely available software enables easy evaluation of the serializer features, including:

- Support of 720p video applications with a pixel clock up to 85MHz
- Stereo I2S Digital Audio Applications with up to two I2S data inputs
- Content protection with the integrated HDCP cipher engine and on-chip key storage
- Bidirectional control channel including GPIO, interrupt, and I2C interface
- Up to 8 configurable I2C addresses
- Flexible 3.3V or 1.8V LVCMOS I/O interface
- Backwards compatibility mode to DS90UR906Q or DS90UR908Q
- Low-power modes
- Internal Pattern Generation

Quick Start Guide

2.1 Board Setup

This section describes how to quickly set up the DS90UH925AQEVM with an appropriate deserializer for evaluation of the chipset in HDCP display applications. The default switches and jumper positions have been set at the factory. This setup guide assumes the user has already installed and configured the ALP software from the web.

1. Connect 3.3V DC power and ground from a power supply to J6 (VDD33C) and J7 (VSS). If 1.8V VDDIO operation is desired, set the 1.8V position at JP2 and apply 1.8V DC at pin 1 of JP1. Alternatively, onboard 1.8V DC and 3.3V DC voltage regulators may be utilized by connecting 5V DC at the J9 barrel power jack (center positive).
2. Connect an applicable cable (not provided, SMA configured by default) from the DS90UH925AQ TX board FPD-Link III output to the FPD-Link III input of a compatible FPD-Link III RX board (DS90UH926Q or DS90UH928Q - not included in kit).
3. From the Video source, connect a flat cable (not included) to the TX board and connect the appropriate cable (not supplied) from the RX board (provided separately) to the panel.
4. Connect the included USB cable from a host computer running the included TI ALP software to the USB port (J3) on the TX board. See the included ALP software guide for further information on using the TI ALP tool.
5. (Optional) Connect I2S audio (not included) from an I2S audio source to TX board pins DA (data), CLK (clock), and WC (word clock) and from RX board pins DA, CLK, and WC to an I2S DAC or audio output.
6. (Optional) Connect any required GPIO interfaces. 18-bit video mode is required when using GPIOs, as the pins are shared with video inputs.
7. Jumpers and switches have been configured by TI; they should not require any changes for immediate operation of the board. See Configuration Settings section and the DS90UH925AQ device datasheet for further details.

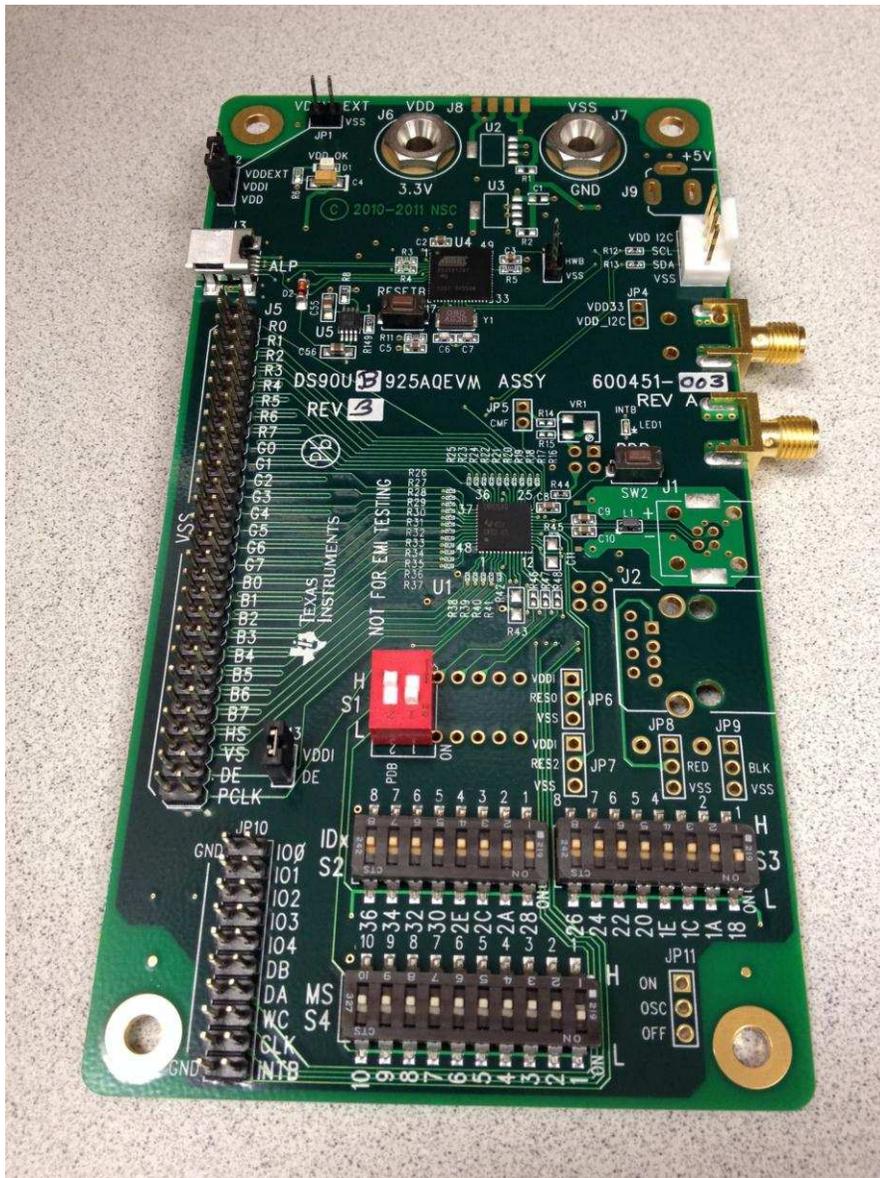


Figure 2-1. DS90UH925AQEVM

Evaluation Hardware Overview

3.1 Board Overview

The evaluation board includes circuits and interfaces facilitating the different device features of the DS90UH925AQ serializer, including power, video data, FPD-Link III interface, I2S audio, I2C control, connectors, and switches.

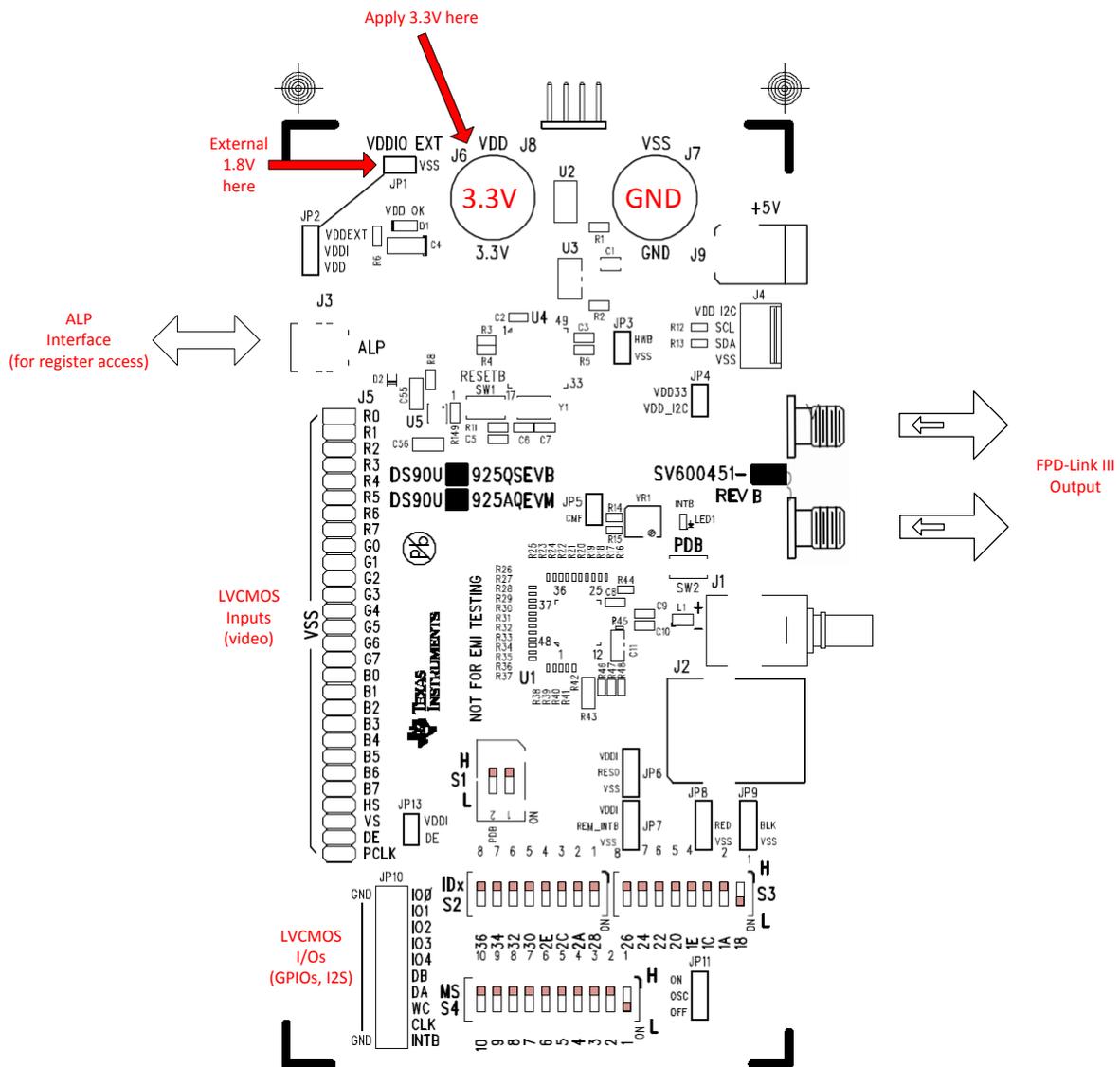


Figure 3-1. DS90UH925AQEVM Silk Screen

3.2 Power

Apply +3.3V DC through J7 and J8. If 1.8V VDDIO power supply operation is desired, connect +1.8V DC at JP1 and select 1.8V VDDIO power from JP2.

3.3 LVCMOS Video Data Input

The FPD-Link video data input accepts a 20-pin IDC cable or similar 0.1" spaced connector. Connect the clock and 4 FPD-Link (LVDS) data pairs here. The data channel mapping is determined from the MAPSEL switch, located on the mode select switch block.

3.4 FPD-Link III Interface

The high-speed FPD-Link interface is the point of output for the high-speed (up to 2.975Gbps) forward data channel, as well as the receive point for the low speed back channel. The default configuration features SMA connectors. The board also provides pads for a Rosenberger HSD connector. To use the Rosenberger connector, depopulate resistors R3 and R4.

The FPD-Link signal may be probed from the output capacitors. Use a high-bandwidth differential probe to observe the channel. See the device datasheet for additional details.

3.5 Controller

The onboard USB-to-I2C controller allows for easy evaluation of the DS90UH925AQ I2C interface without the need for a dedicated external tool. It interfaces with a host PC using the TI Analog LaunchPAD (ALP) software. The I2C bus may also be accessed by an external controller via the external I2C interface at J4.

3.6 I2C and Device Addressing

A row of switches is provided at S2 and S3 to set the IDx I2C address select. Only one I2C address may be selected at a time. Please see the device datasheet for details on which addresses are available on this device.

3.7 I2S and GPIO Interface

A 0.1" header block is provided for connections to the I2S and GPIO interfaces. All GPIOs may be configured as inputs or outputs, with GPIO[3:0] available for bidirectional transport. Signal levels should scale with VDDIO.

3.8 Device Address, Reset and Mode Selection Inputs

The Mode Select inputs determine the specific mode or state of device operation, including:

- **PDB** When set LOW, the device enters a low-power mode and all registers are reset. Set HIGH for normal operation.
- **MAPSEL** Set LOW to assign LSBs to RxIN3±, set HIGH to assign MSBs to RxIN3±. See device datasheet for details.
- **LFMODE** Set HIGH for $5\text{MHz} \leq \text{PCLK} < 15\text{MHz}$. Set LOW for $15\text{MHz} \leq \text{PCLK} \leq 85\text{MHz}$
- **BKWD** Set HIGH to interface with DS90UR906Q, DS90UR908Q, DS90UR910Q, or DS90UR916Q. Set LOW to interface with DS90UH926Q and DS90UH928Q.
- **REPEAT** Set HIGH to activate HDCP Repeater Mode. Set LOW for normal operation.

These mode settings are selectable from the following switches and buttons:

- **S4** (Mode Selection Inputs): Set PDB, LFMODE, MAPSEL, BKWD, and REPEAT. See DS90UH925AQ datasheet additional detail.
- **S2/S3** (IDx Select Inputs): Select required I2C address level for IDx input. Set only one switch to 'L' (0x18 is default address).
- **SW2** (PDB Reset Button): PDB pull-down switch. Press to perform a DS90UH927Q (U1) device PDB reset.

- **SW1** (Onboard I2C Bridge Reset): Press to reset the onboard USB-to-I2C bridge controller.

3.9 Indicators

The INTB interrupt state may be observed from the on-board LED indicator. The LED turns off when an interrupt is indicated (INTB = LOW).

3.10 Input/Output Connectors

The following jumpers and connectors are provided on the board:

- **J1 FPD-Link III HSD Automotive Output (Optional)** – Connect to automotive-grade STP cable here. To use, depopulate R3 and R4.
- **J3 USB Connector for USB-to-I2C Controller** – Connect USB cable to host PC to use EVM board with ALP evaluation software.
- **J4 4-pin I2C Input/Output** – Connect SDA, SCL, VSS, and VDD33 to external I2C peripherals or controls here. The EVM board provides the recommended 4.7K Ω pull-up resistors.
- **J5 28-pin LVCMOS Input** – Connect parallel data and clock here. See DS90UH925AQ device datasheet for input electrical characteristics and requirements.
- **J6 +3.3V VDD33 Power Input** – Connect to 3.3V power supply.
- **J7 VSS Power** – Connect to system GND.
- **J9 5V External Power Input (optional)** – Connect +5V center-positive 2.1mm barrel connector here to supply board power. Onboard regulators will supply the board with 3.3V VDDIO and 3.3V/1.8V VDDIO supplies. Do not connect J6/J7 if this connector is used.
- **J10/J11 FPD-Link III SMA Output** – These outputs may be used to evaluate the FPD-Link III serial link with different STP or micro-coax configurations.
- **JP1 VDDIO_EXT Power Input** – Connect to independent external VDDIO supply if VDDIO = 1.8V
- **JP2 VDDIO Select** – Connect jumper to select VDDIO=VDD33 [2-3] or VDDIO=VDDIO_EXT [1-2]
- **JP4 VDD_I2C Power Enable** – Short to provide 3.3V power to on-board I2C pull-ups.
- **JP5 Reserved** – Do not short or connect to external inputs/outputs
- **JP6/JP7 Reserved** – Do not populate or connect to external inputs/outputs
- **JP10 I2S/GPIO Input/output Header** – Connect to I2S input pins or bidirectional GPIO pins. See DS90UH925AQ datasheet for detailed I2S and GPIO usage.

ALP Software

4.1 Overview

The available Analog Launch PAD (ALP) software allows evaluation of the I2C control interface of the DS90UH925AQ serializer. The tool provides a graphical interface for reading/writing the device registers. It also features several useful tools for manipulating advanced device-specific features, including HDCP authentication and internal pattern generation.

System Requirements:

Operating System: Windows XP or Vista

USB version: 2.0

4.2 Installation

Download and install ALP from <http://www.ti.com/tool/ALP>

The following installation instructions are for the Windows XP Operating System:

Install the ALP Software

Execute the ALP Setup Wizard program called "Setup.exe".

1. Click "Next"
2. Select "I accept the agreement"
3. Click "Next"
4. Select the location to install the ALP software and click "Next"
5. Select the location for the Start Menu shortcut and click "Next"
6. Create a desktop shortcut icon and Quick Launch button (optional). Click "Next"
7. Click "Install." The software will be extracted and installed to the system.
8. Uncheck "Launch Analog LaunchPAD" and click "Finish." The ALP software should not be launched until the USB driver is installed.

Install the USB Driver

To install the ALP hardware USB driver:

1. Select "No, not at this time" then click "Next"
2. Click "Install from a list or specific location" then click "Next"
3. Click "Search for the best driver in these locations". Uncheck "Search removable media" and check "Include this location in the search."
4. Browse to the Install Directory which is typically located at "C:\Program Files\National Semiconductor Corp\Analog LaunchPAD\vx.x.x\Drivers" and select the "Next" button. Windows should find the driver.
5. Click "Continue Anyway".
6. Click "Finish"

The software installation is now complete. The ALP software may now be launched.

4.3 Usage

Startup

Make sure all the software has been installed and the hardware is powered on and connected to the PC. Execute “Analog LaunchPAD” from the start menu. The default start menu location is “Programs\National Semiconductor Corp\Analog LaunchPAD vx.x.x\Analog LaunchPAD”.

The application should come up in the state shown below. If it does not, see “Trouble Shooting” at the end of this document. Under the Devices tab click on “DS90UH92x” to select the device and open up the device profile and its associated tabs.

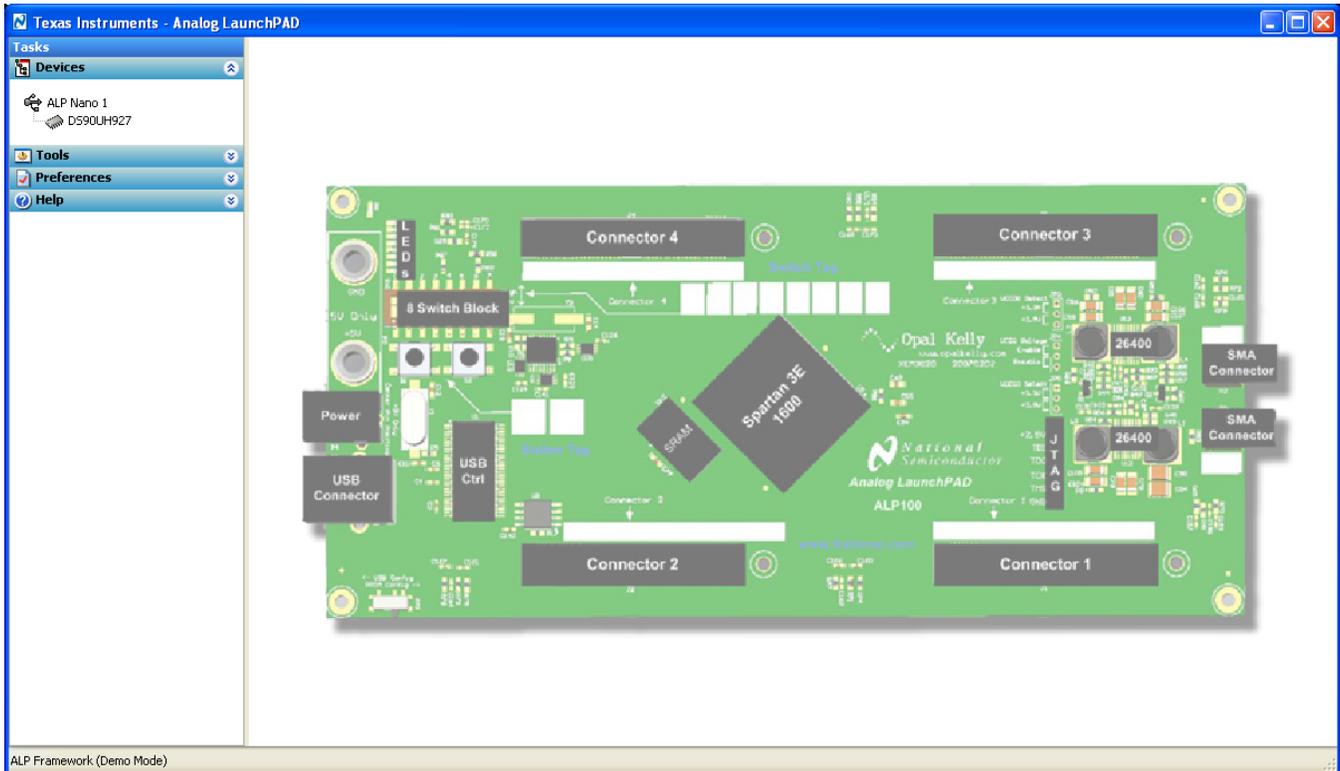


Figure 4-1. ALP Startup Screen

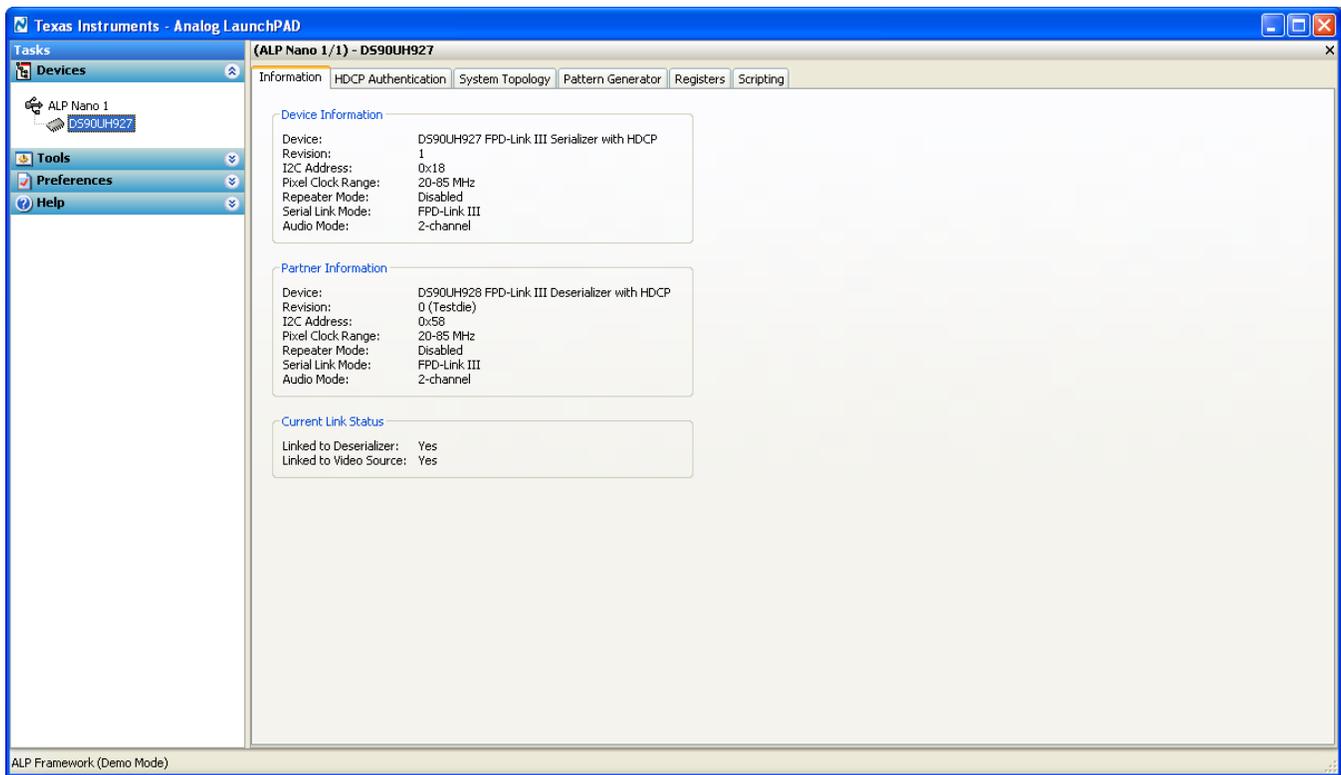


Figure 4-2. Information Tab

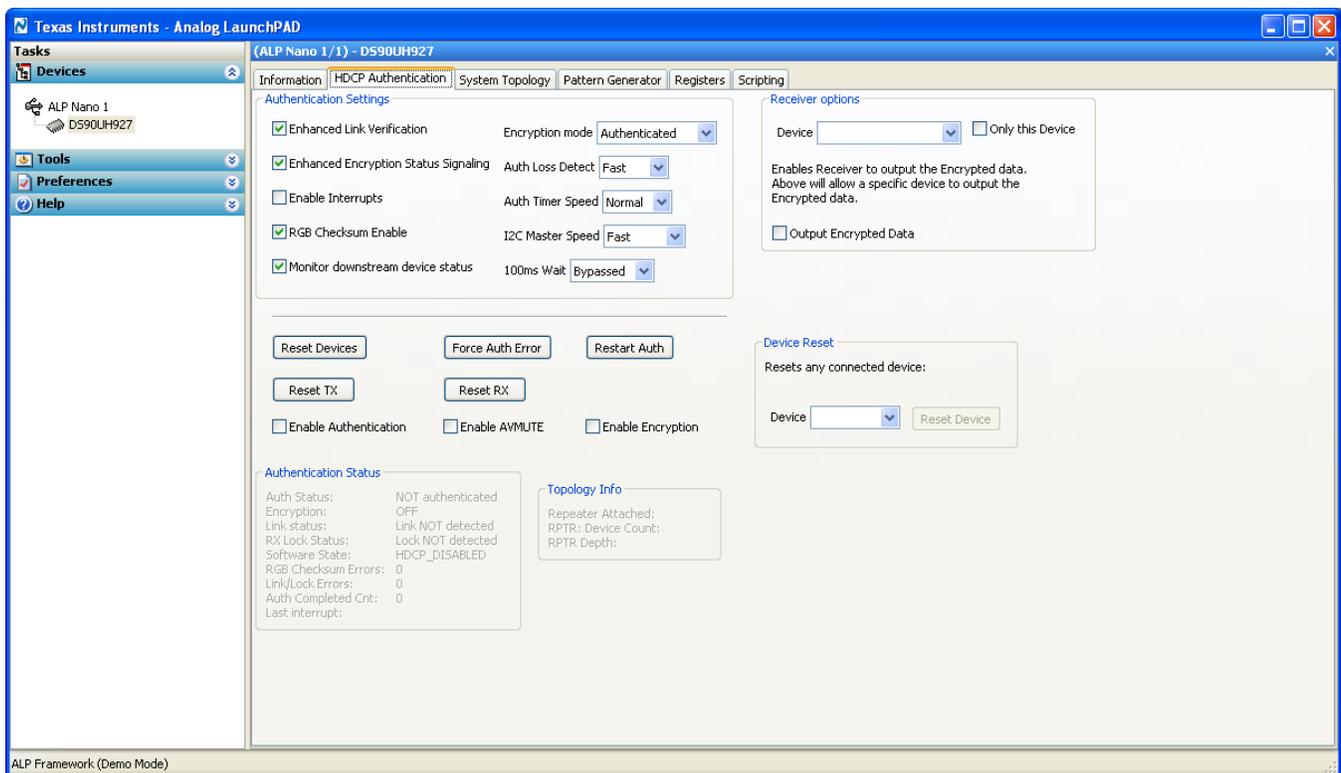


Figure 4-3. HDCP Tab

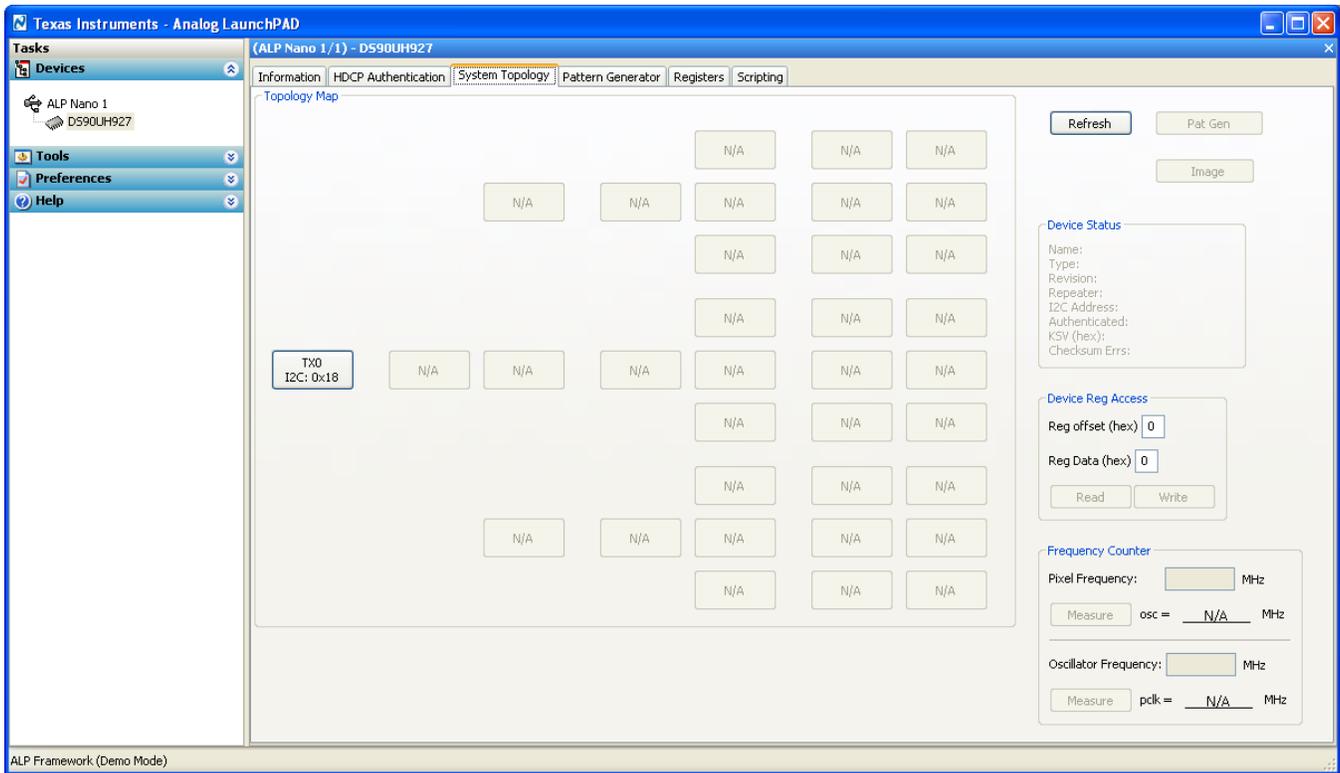


Figure 4-4. System Topology Tab

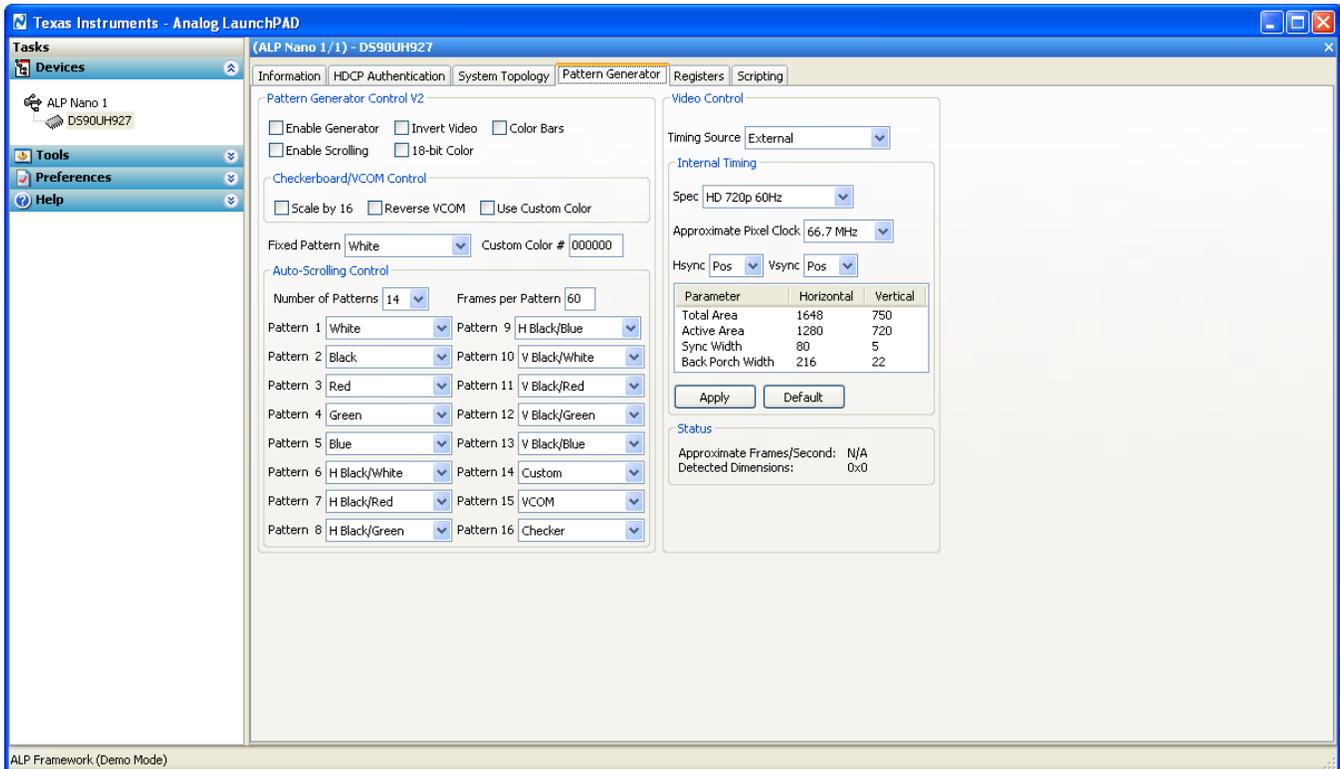


Figure 4-5. Pattern Generator Tab

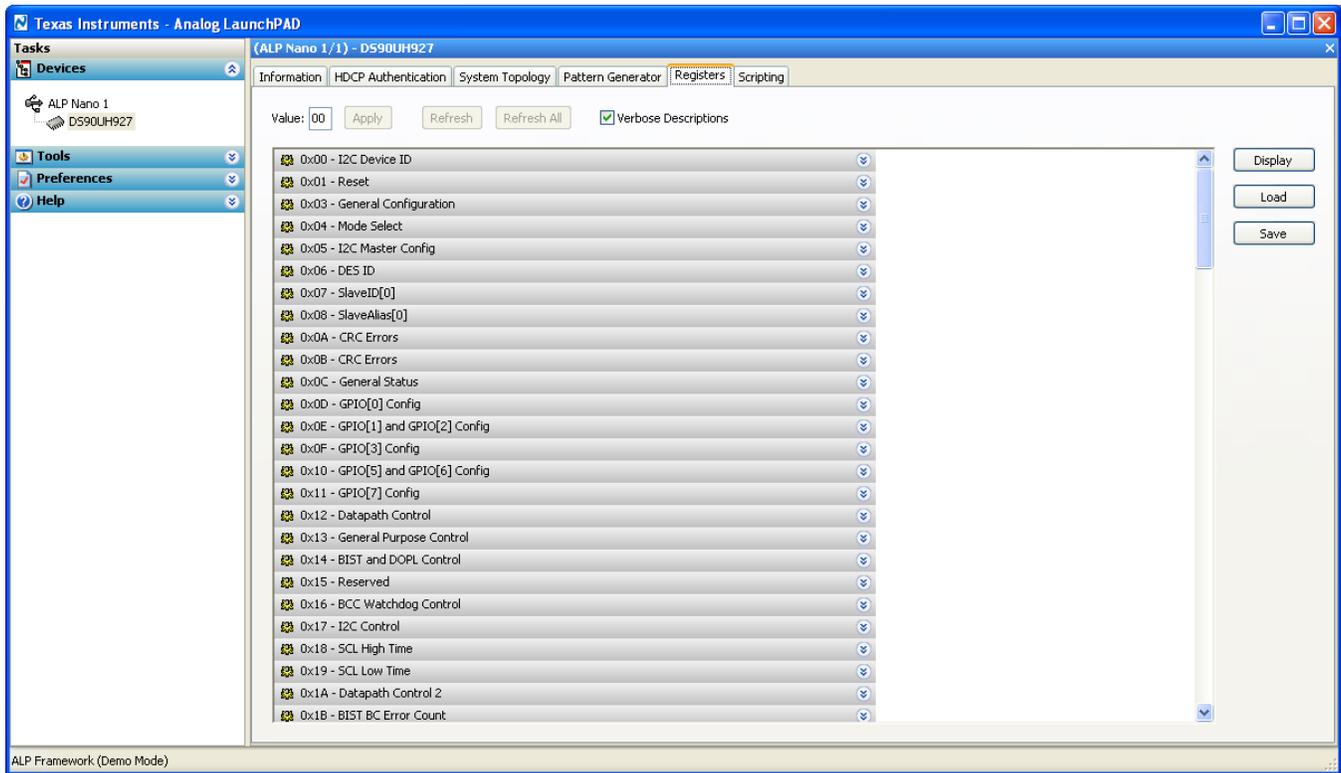


Figure 4-6. Register Tab

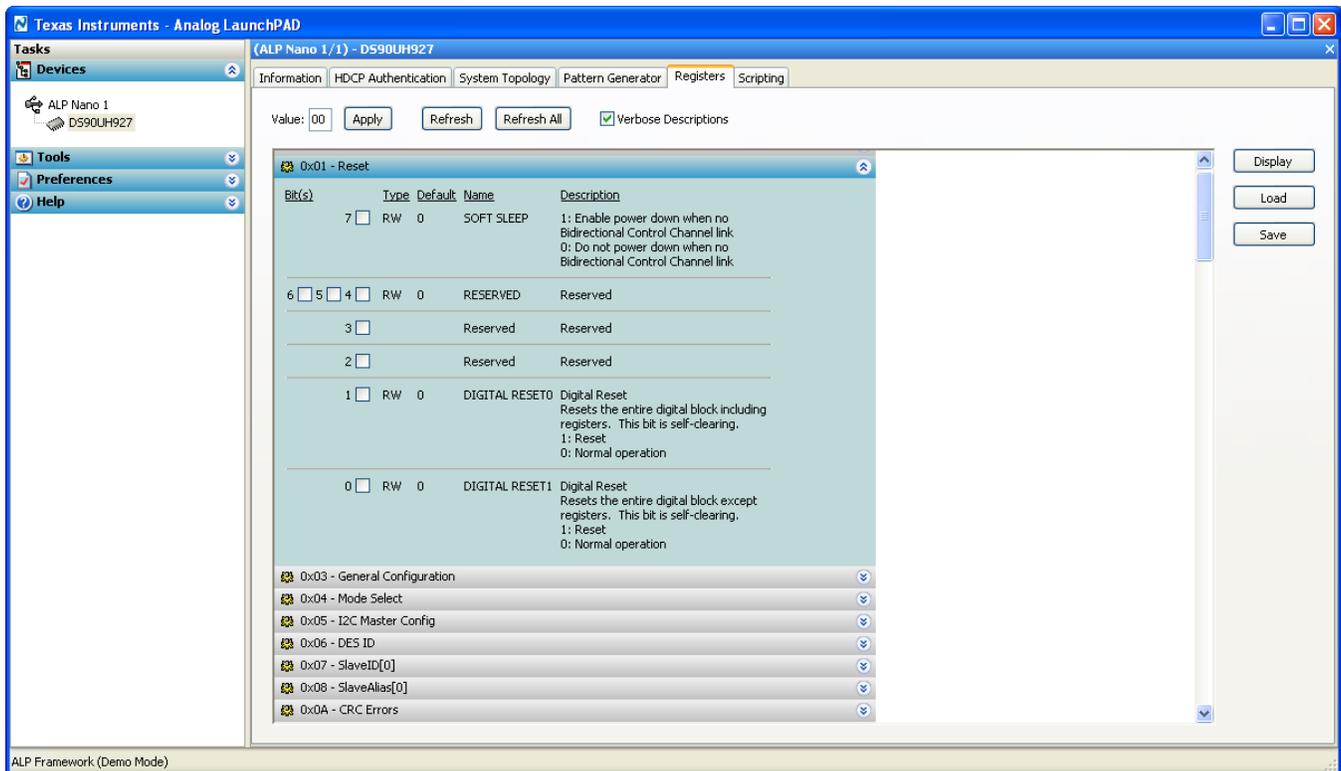


Figure 4-7. Register Tab with expanded register description

4.3.1 Information Tab

The information tab gives basic device state information, including local device information, partner device information, and current link status. For both the local device and partner device, the tab gives the following information:

- Device Name
- Device Revision
- I2C address
- Pixel clock range (set by LFMODE)
- Repeater Status (set by REPEAT)
- Serial Link Mode (set by BKWD)
- Audio mode (set by configuration registers)

4.3.2 HDCP Authentication Tab

The HDCP Authentication Tab allows control of the onboard HDCP cipher and authentication features. HDCP authentication may be activated by clicking the “enable authentication” checkbox. The Authentication Status and Topology Info panels report on the authentication state and number of authenticated devices in the repeater tree (if repeater mode is active).

4.3.3 System Topology Tab

The System Topology Tab gives an overview of all devices downstream from the deserializer. Individual devices may be clicked on for individual I2C access. The user may read/write to a specific device from the Device Reg Access panel.

4.3.4 Pattern Generator Tab

The Pattern Generator Tab enables interactive control of the internal pattern generator features. The pane controls timing information and different pattern settings, including a scrolling function. Timing information is configured from the Video Control panel, and supports the following timing/clocking sources:

- External
- Internal
- Internal w/ Ext. Clock

The Internal timing option allows evaluation of the link performance without the need for an external source. The Video Control panel also provides several timing and pixel clock options, including several presets covering common video resolutions.

4.3.5 Registers Tab

The Registers Tab allows for direct reading/writing of individual registers or register bits located on the local device. Each register drop-down shows the name and description of individual bits or groupings of bits. Use the check boxes to set individual bits, and commit the register write by clicking the “Apply” button. Click the “Refresh” or “Refresh All” buttons to read an update of the selected register or all registers respectively.

4.4 Troubleshooting

If the following window opens after starting the ALP software, double check the hardware setup and that the board USB port is connected to the host PC.

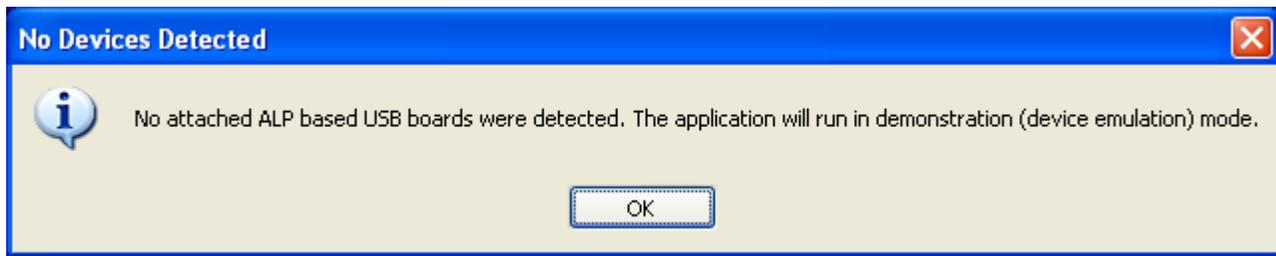


Figure 4-8. No Devices error message

The USB driver may not be installed. Check the device manager. There should be a device named "NSC ALP Nano Atmel" device under the "Universal Serial Bus Controllers" as shown below.

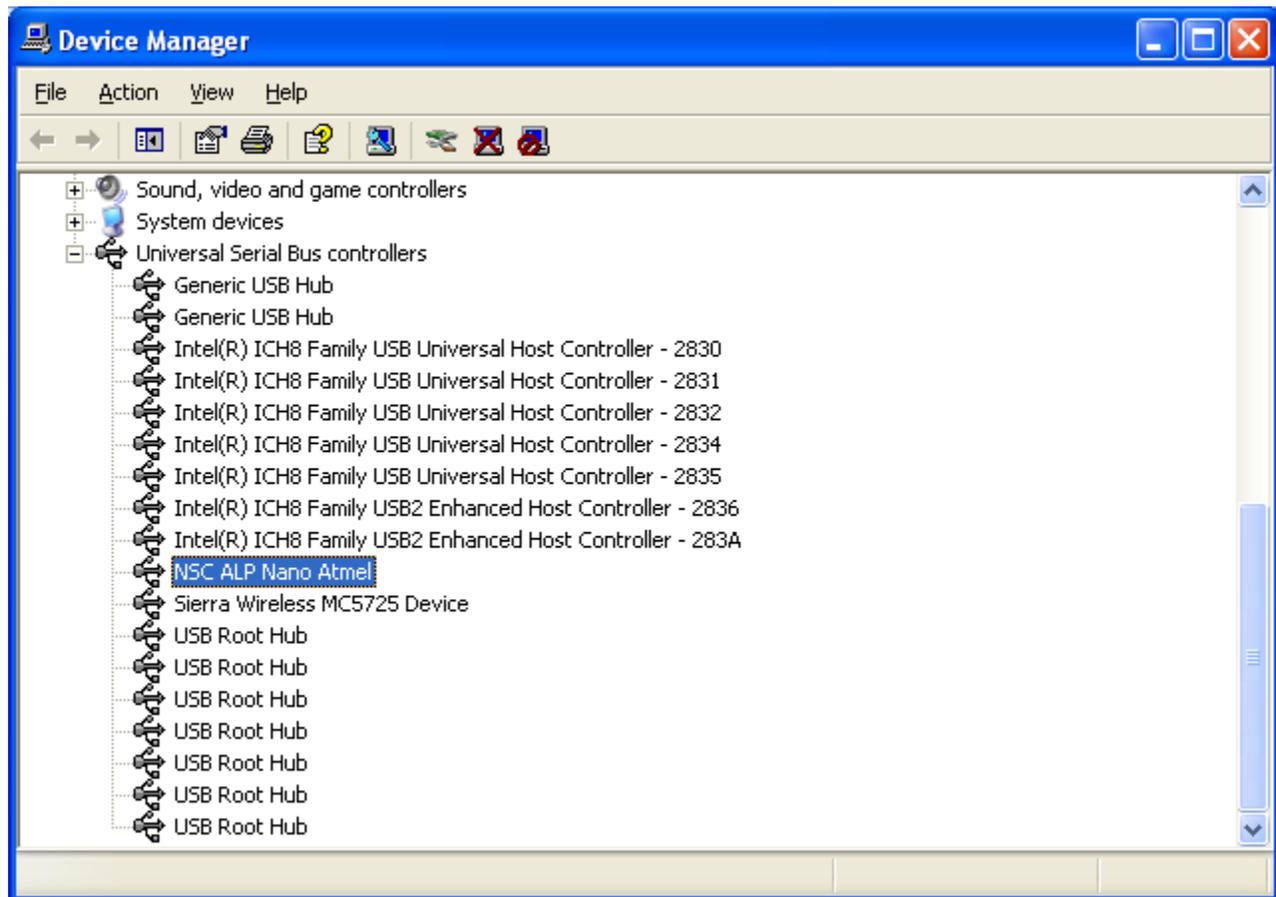


Figure 4-9. Windows XP Analog LaunchPAD USB Driver

The software should start with only "DS90UH92x" 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.

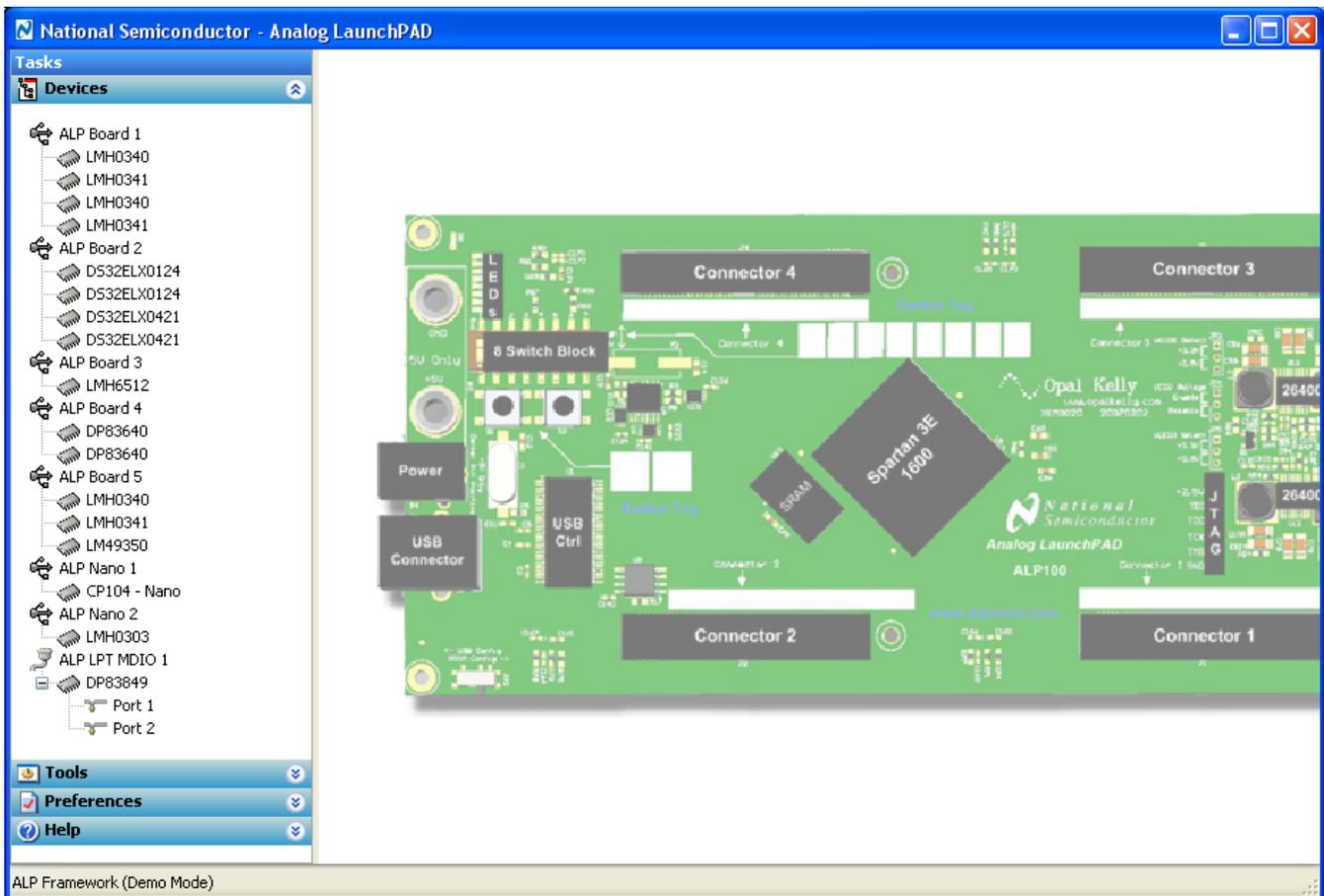


Figure 4-10. Analog LaunchPAD in Demo Mode

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

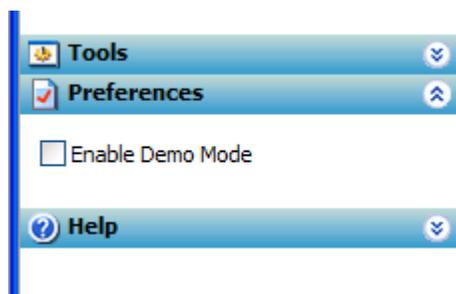


Figure 4-11. Analog LaunchPAD Preferences Menu

After demo mode is disabled, the ALP software will poll the ALP hardware. The ALP software will update and have only “DS90UH92x” under the “Devices” pull down menu.

Additional Information

5.1 Related Documents

Additional information may be found in the device product folder at www.ti.com

- DS90UH925AQ device datasheet
- DS90UH926Q device datasheet
- DS90UH928Q device datasheet
- TI Application Note AN-2173
- TI Application Note AN-2198

5.2 Document Revision History

- 06/23/14 -- Initial Release

Board Schematic

A.1 Board Stackup

LAYOUT NOTES:

- 1) 4 layer board.
- 2) Use standard ISOLA-410 or equivalent.
- 3) 10% total or +/-5% 100 ohm differential impedance tolerance.
- 4) Minimum 4 standoffs on each corner of board. (0.156 X 4).

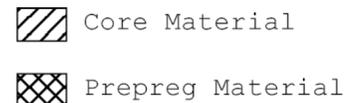
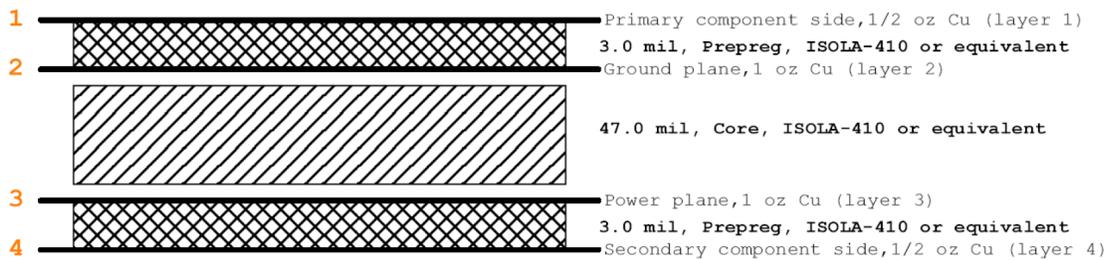


Figure A-1. Board Stackup

A.2 DS90UH925AQ Serializer

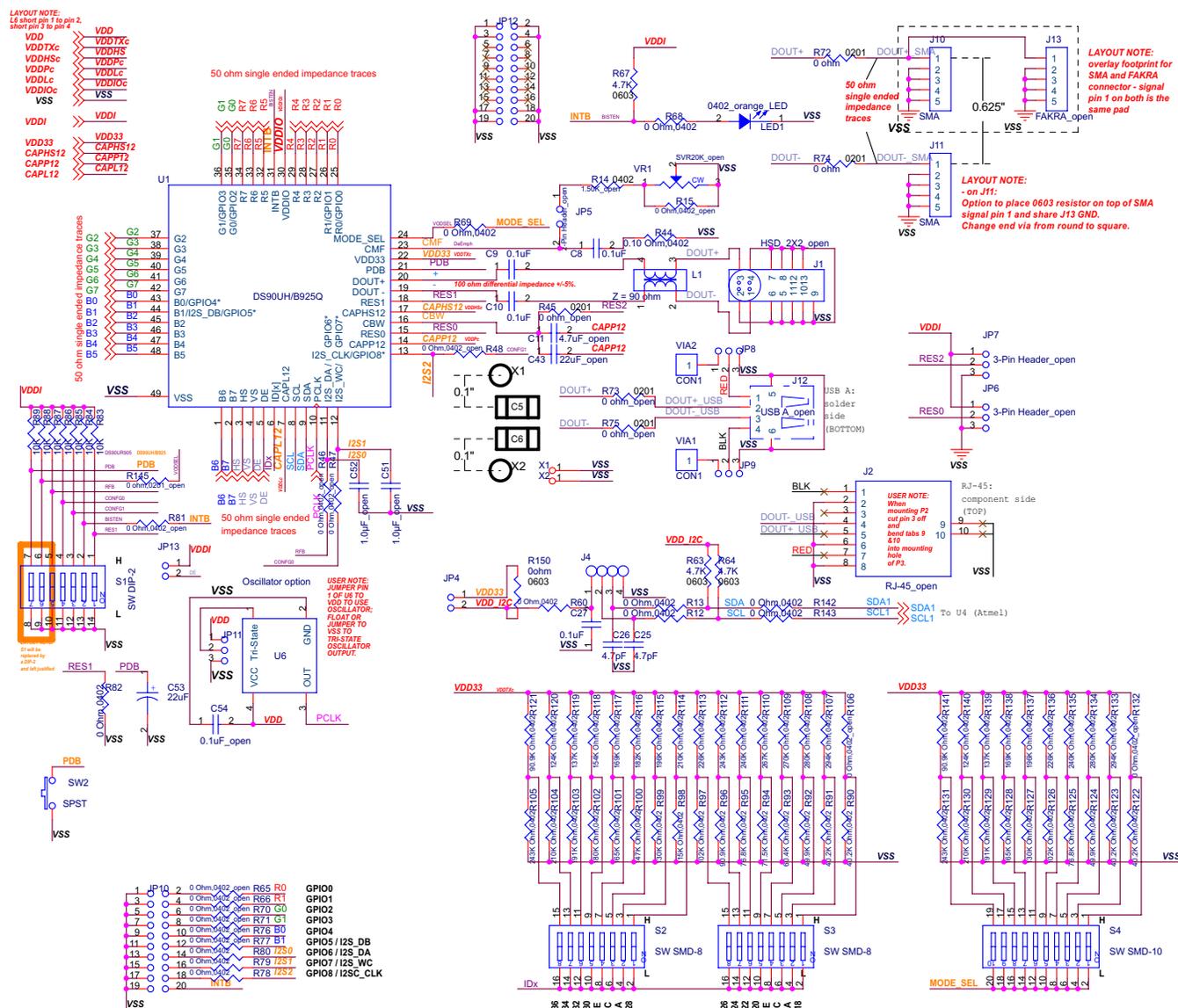


Figure A-2. DS90UH925AQ Serializer

A.3 USB-to-I2C Controller

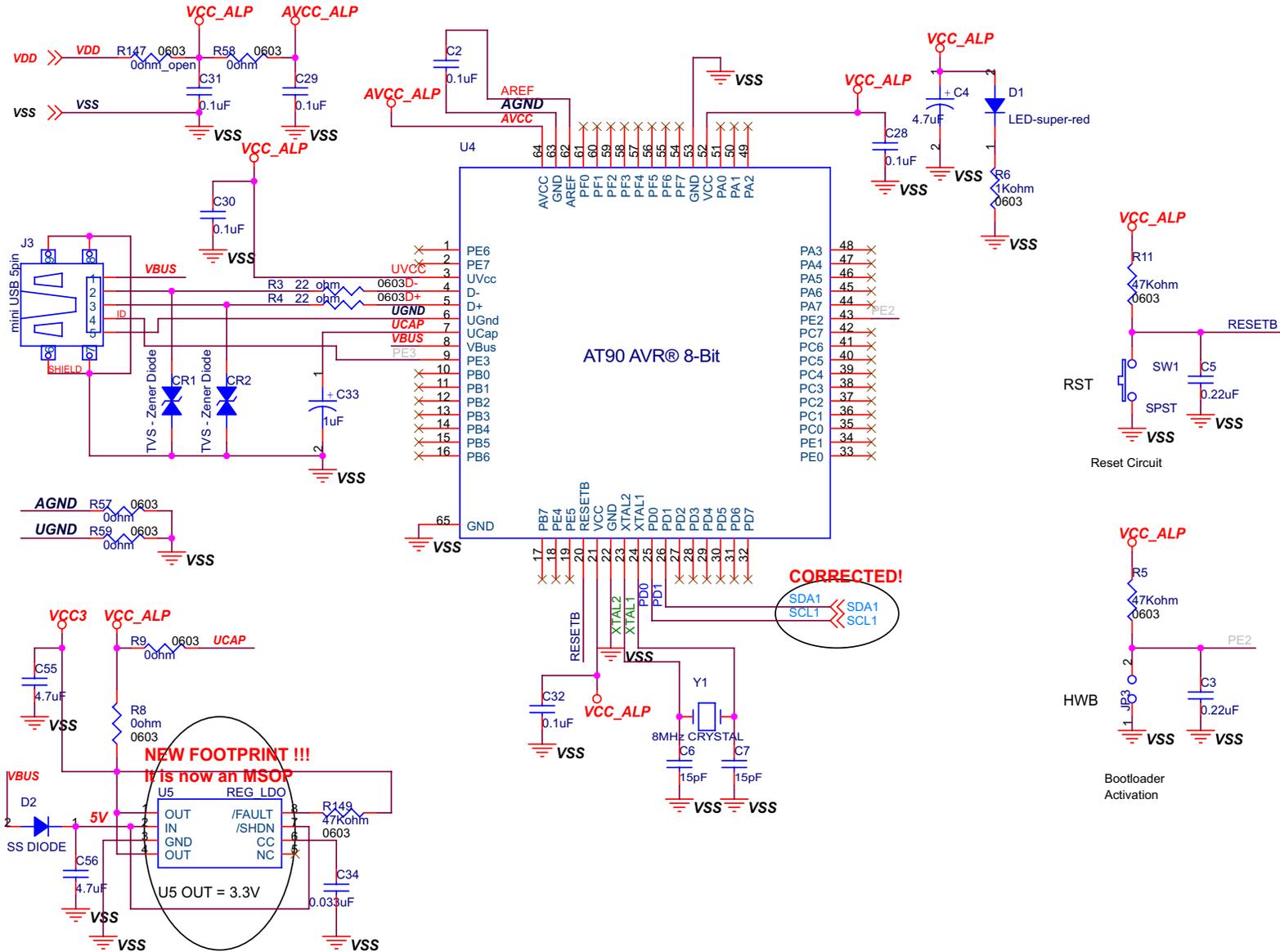
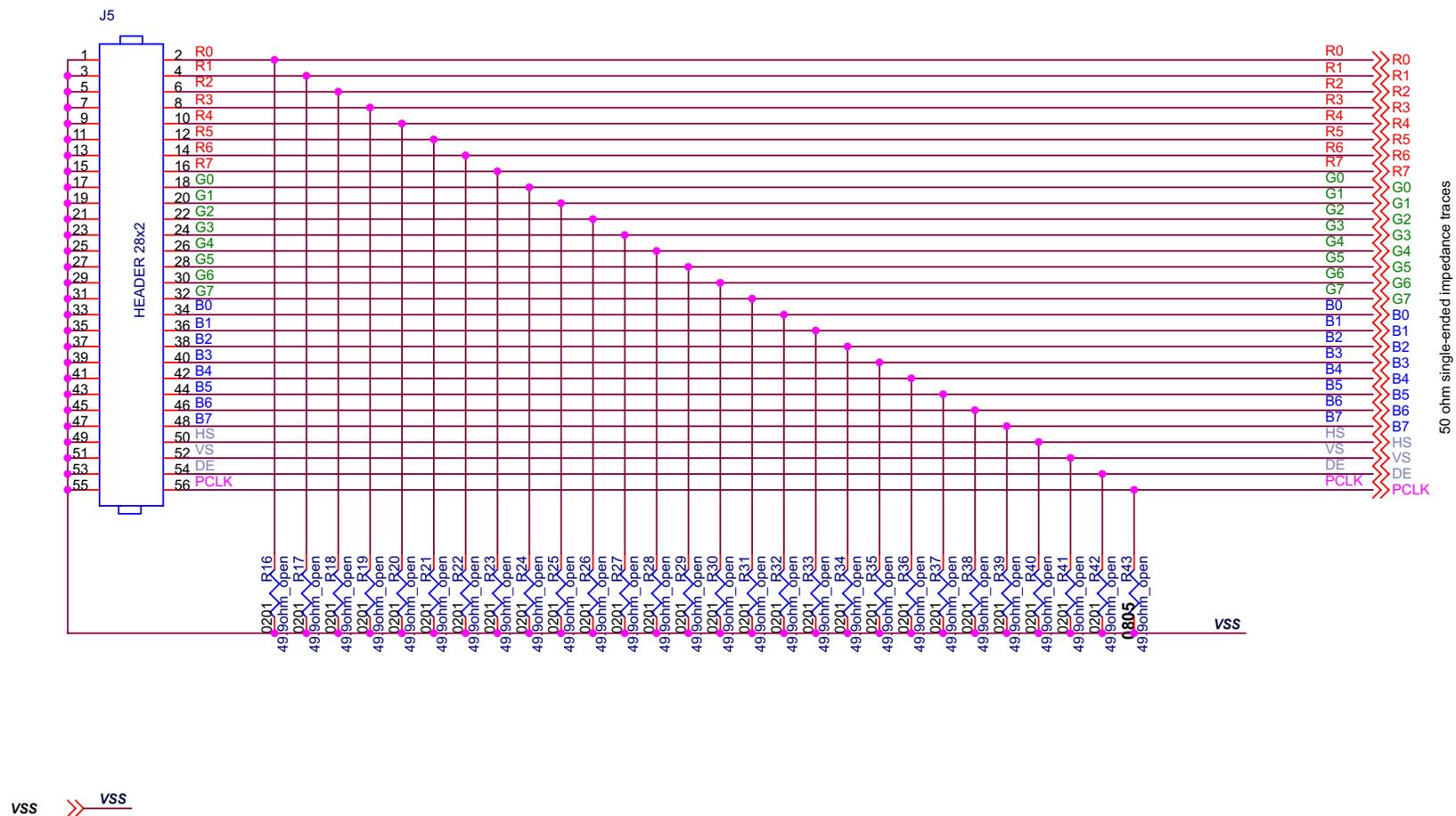


Figure A-3. USB-to-I2C Controller

A.4 Connector



USER NOTE:
 1) R(0-7),G(0-7),B(0-7),HS,VS,DE, & PCLK are matched length 50 ohm single-ended impedance traces.
 2) R16-R43 parallel 50 ohm termination option for 50 ohm driving source.
 Do not load otherwise.

LAYOUT NOTE:
 1) 50 ohm single-ended impedance requirement on these traces.
 2) Matched trace length on R(0-7),G(0-7),B(0-7),HS,VS,DE, & PCLK.
 3) Mount R16-R43 as close as physically possible to U1.

Figure A-4. Parallel Video Connector

A.5 Power

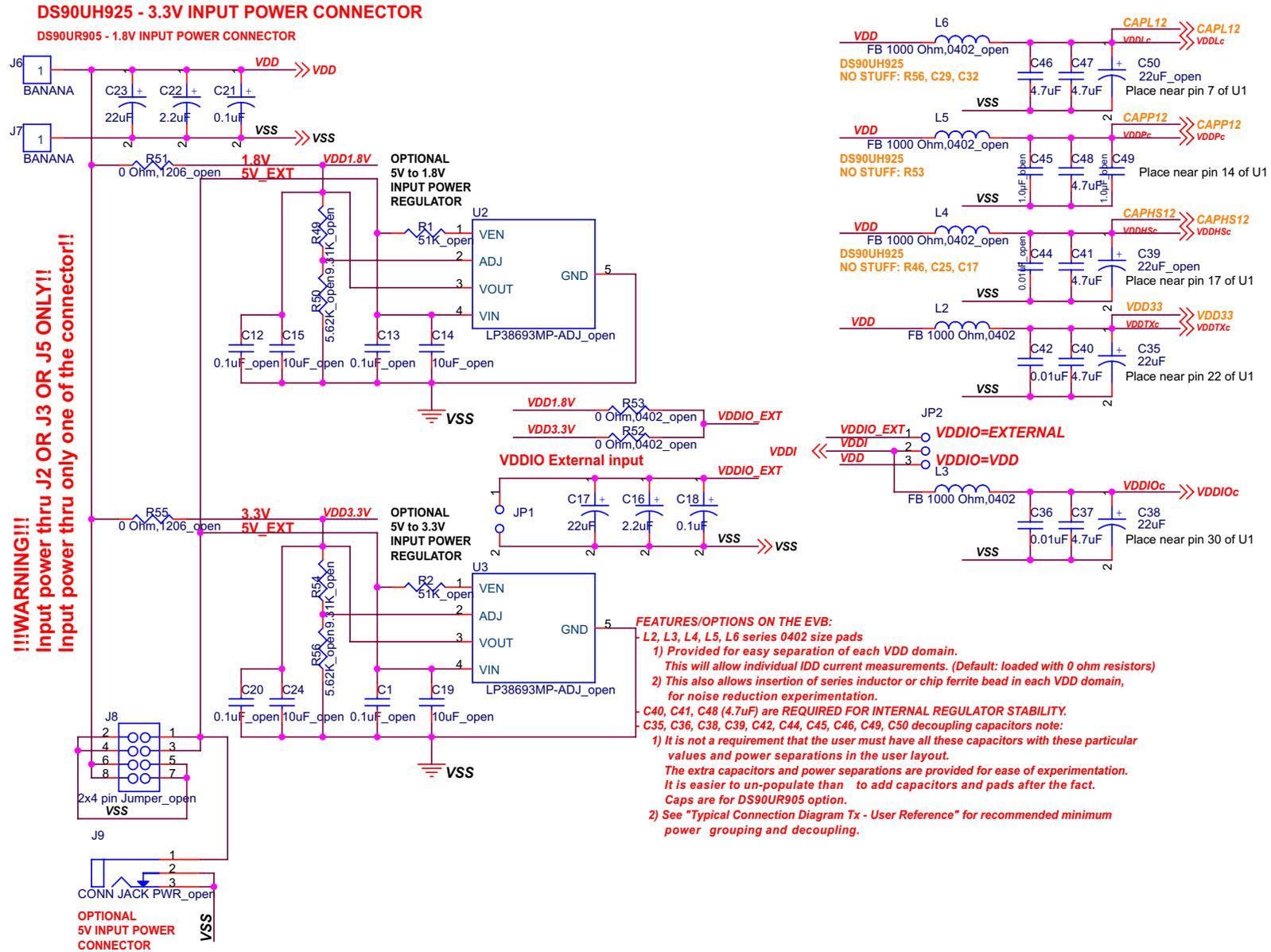


Figure A-5. Power

Bill of Materials

B.1 DS90UH925AQEVM BOM

Qty	Reference	Part	PCB Footprint	Comments	MFR	MFR Part#
2	CR2,CR1	TVS - Zener Diode	0603 (1608 metric)	SUPPRESSOR ESD 24VDC 0603 SMD	Littelfuse Inc	PGB1010603MR
5	C2,C28,C29,C30,C32	0.1uF	CAP/HDC-0603	CAP CER .1UF 50V 10% X7R 0603	Murata Electronics North America	GRM188R71H104KA93D
2	C5,C3	0.22uF	CAP/HDC-0603	CAP CER .22UF 50V Y5V 0603	TDK Corporation	C1608Y5V1H224Z
1	C4	4.7uF	CAP/3216-18 (EIA) 1206	CAPACITOR TANT 4.7UF 16V 10% SMD	Kemet	T491A475K016AT
2	C6,C7	15pF	CAP/HDC-0603	CAP CERAMIC 15PF 50V NP0 0603	Kemet	C0603C150J5GACTU
4	C8,C9,C10,C27	0.1uF	CAP/HDC-0603	CAP CER .1UF 50V X7R 0603	Murata	GCM188R71H104KA57D
2	C16,C22	2.2uF	3528-21_EIA	CAPACITOR TANT 2.2UF 20V 10% SMD	KEMET	T491B225K020AT
2	C17,C23	22uF	CAP/N	CAP TANTALUM 22UF 25V 20% SMD	nichicon	F931E226MNC
2	C21,C18	0.1uF	CAP/HDC-1206	CAP .10UF 50V CERAMIC X7R 1206	KEMET	C1206C104K5RACTU
2	C25,C26	4.7pF	CAP/HDC-0402	CAP CERAMIC 4.7PF 25V COG 0402	Panasonic	ECD-G0E4R7C
1	C31	0.1uF	CAP/HDC-0603	CAP CER .1UF 50V 10% X7R 0603	Murata Electronics North America	GRM188R71H104KA93Dn
1	C33	1uF	CAP/3216-18 (EIA) 1206	CAPACITOR TANT 1.0UF 16V 10% SMD	Kemet	T491A105K016AT
1	C34	0.033uF	CAP/HDC-0603	CAP CERM 33000PF 5% 50V X7R 0603	AVX Corporation	06035C333JAT2A
3	C35,C38,C53	22uF	CAP/EIA-B 3528-21	CAPACITOR TANT 22UF 16V 20% SMD	Kemet	T494B226M016AT
2	C36,C42	0.01uF	CAP/HDC-0603	CAP CERAMIC .01UF 100V X7R 0603	KEMET	C0603C103K1RACTU
8	C37,C40,C41,C46,C47,C48,C55,C56	4.7uF	CAP/HDC-0805	CAP CER 4.7UF 16V X7R 0805	Murata	490-5332-1-ND
1	D1	LED-super-red	SMT/0805 (2012 Metric)	LED TOPLED 630NM SUP RED CLR SMD	Osram Opto Semiconductors Inc	LS M67K-H2L1-1-0-2-R18-Z
1	D2	SS DIODE	MELF (LL-34)	DIODE HI CONDUCTANCE 100V LL-34	Fairchild Semiconductor Corporation	FDLL4148
3	JP1,JP3,JP13	2-Pin Header	Header/2P	CONN HEADER VERT .100 2POS 30AU	AMP/Tyco	87220-2
1	JP2	3-Pin Header	Header/3P	CONN HEADER VERT .100 3POS 15AU	AMP/Tyco	87224-3
1	JP10	2X10-Pin Header	Header/2X10P	CONN HEADER VERT .100 20POS 30AU	AMP/TYCO	87215-7

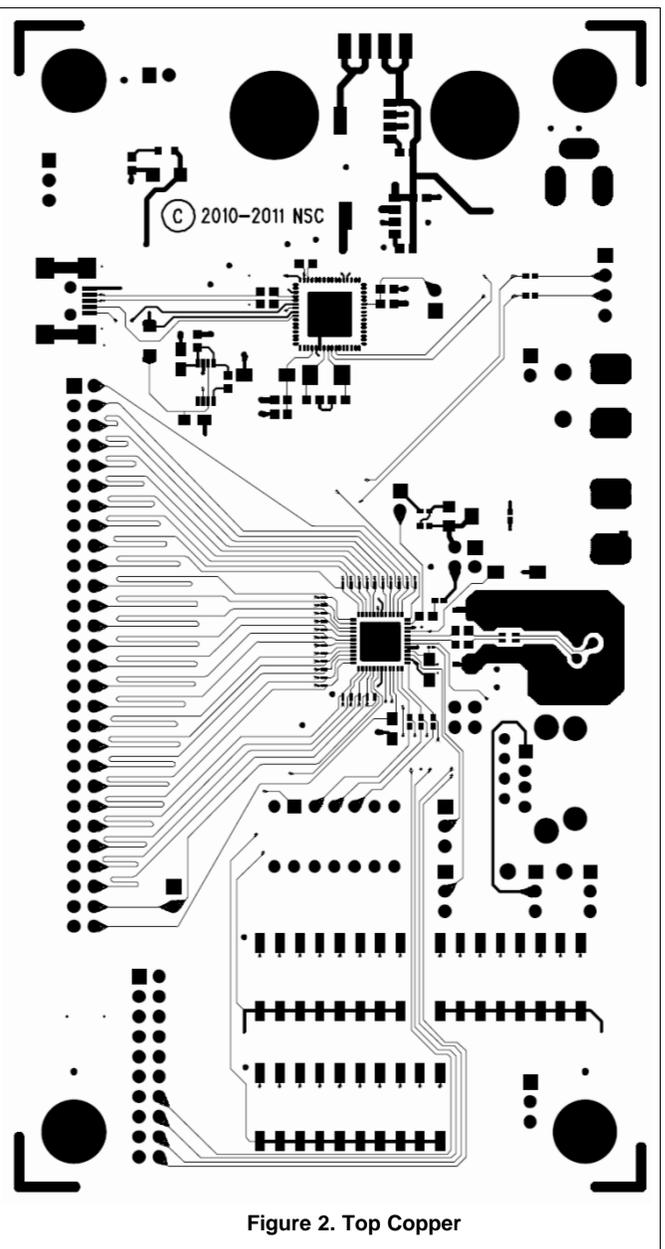
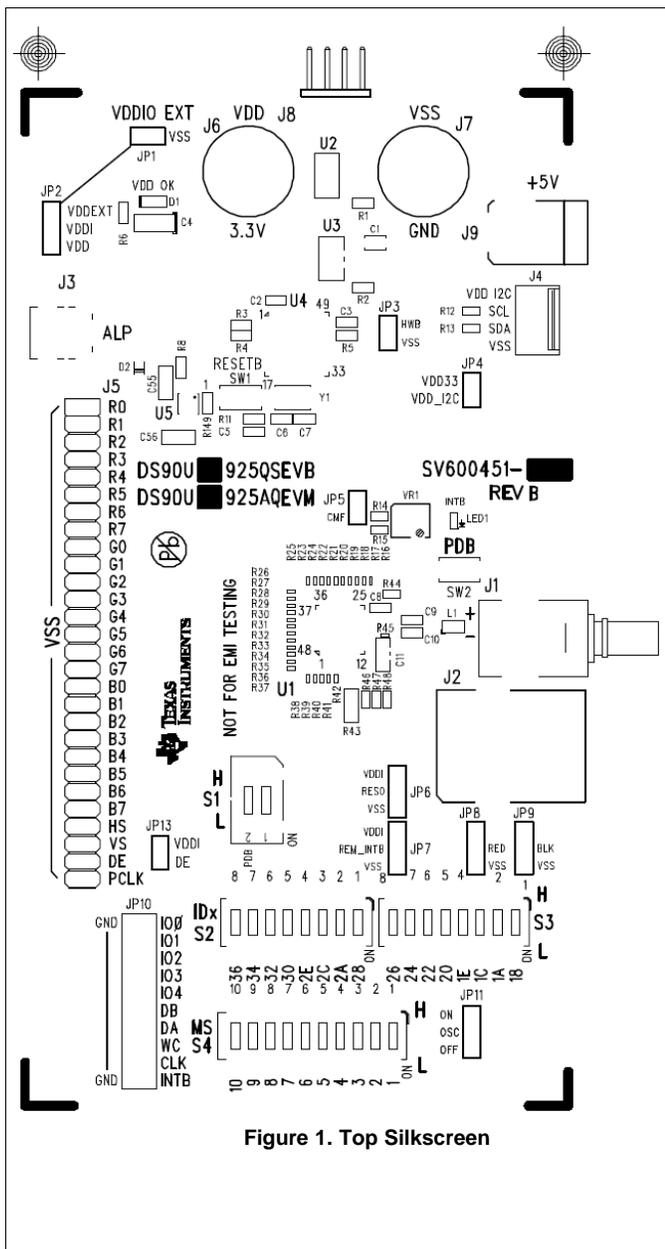
Qty	Reference	Part	PCB Footprint	Comments	MFR	MFR Part#
1	J3	mini USB 5pin	mini_B_USB_surf ace_mount	CONN RECEPT MINI USB2.0 5POS	Hirose	UX60-MB-5ST
1	J4	IDC1X4	IDC-1x4	CONN HEADER 4POS .100 VERT GOLD	Molex/Waldom Electronics Corp	22-11-2042
1	J5	HEADER 28x2	2x28 0.1"	CONN HDR BRKWAY .100 80POS VERT. Cut to fit.	TE Connectivity	9-146261-0
2	J6,J7	BANANA	CON/BANANA-S	BANANA-female (non- insulated)	Johnson	108-0740-001
2	J11,J10	SMA	Edge mount	End Launch Jack Receptacle - Tab Contact	Johnson Components	142-0701-851
1	LED1	0402_orange _LED	0402 SMT	LED ORN/CLEAR 610NM 0402 SMD	Lumex Opto/Componen ts Inc	SML- LX0402SOC-TR
1	L1	Z = 90 ohm	L/HDC-0805	CHOKE COIL COMMON MODE 280MA SMD	Murata	DLW21SN900HQ 2L
2	L3,L2	FB 1000 Ohm,0402	RES_HDC-0402	FERRITE CHIP 1000 OHM 0402	Murata	BLM15AX102SN1 D
2	R3,R4	22_ohm	RES/HDC-0603	RES 22 OHM 1/16W 3300PPM 5% 0603	Panasonic	ERA-V33J220V
2	R5,R11	47Kohm	RES/HDC-0603	RES 47K OHM 1/16W .1% 0603 SMD	Panasonic	ERA-3AEB473V
1	R6	1Kohm	RES/HDC-0603	RES 1.0K OHM 1/16W .1% 0603 SMD	Panasonic	ERA-3AEB102V
6	R8,R9,R57,R58, R59,R150	0ohm	RES/HDC-0603	RES ZERO OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEY0R00V
11	R12,R13,R60,R 68,R69,R78,R79 ,R80,R82,R142, R143	0 Ohm,0402	RES/HDC-0402	RES ZERO OHM 1/16W 5% 0402 SMD	Panasonic	ERJ-2GEJ0R00X
1	R44	0.10 Ohm,0402	RES/HDC-0402	RESISTOR .10 OHM 1/8W 1% 0402	Panasonic	ERJ-2BSFR10X
3	R63,R64,R67	4.7K	RES/HDC-0603	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ472V
2	R72,R74	0 ohm	RES/HDC-0201	RES 0.0 OHM 1/20W 5% 0201 SMD	Panasonic	ERJ-1GE0R00C
7	R83,R84,R85,R 86,R87,R88,R89	10K	RES/HDC-0603	RES 10.0K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF1002V
4	R90,R91,R122, R123	40.2K Ohm,0402	RES/HDC-0402	RES 40.2K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF4022X
2	R92,R124	49.9K Ohm,0402	RES/HDC-0402	RES 49.9K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF4992X
1	R93	60.4K Ohm,0402	RES/HDC-0402	RES 60.4K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF6042X
1	R94	71.5K Ohm,0402	RES/HDC-0402	RES 71.5K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF7152X
2	R125,R95	76.8K Ohm,0402	RES/HDC-0402	RES 76.8K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF7682X
3	R96,R121,R141	90.9K Ohm,0402	RES/HDC-0402	RES 90.9K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF9092X
2	R126,R97	102K Ohm,0402	RES/HDC-0402	RES 102K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1023X
1	R98	115K Ohm,0402	RES/HDC-0402	RES 115K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1153X
2	R99,R127	130K Ohm,0402	RES/HDC-0402	RES 130K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1303X
1	R100	147K Ohm,0402	RES/HDC-0402	RES 147K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1473X
2	R101,R128	165K Ohm,0402	RES/HDC-0402	RES 165K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1653X

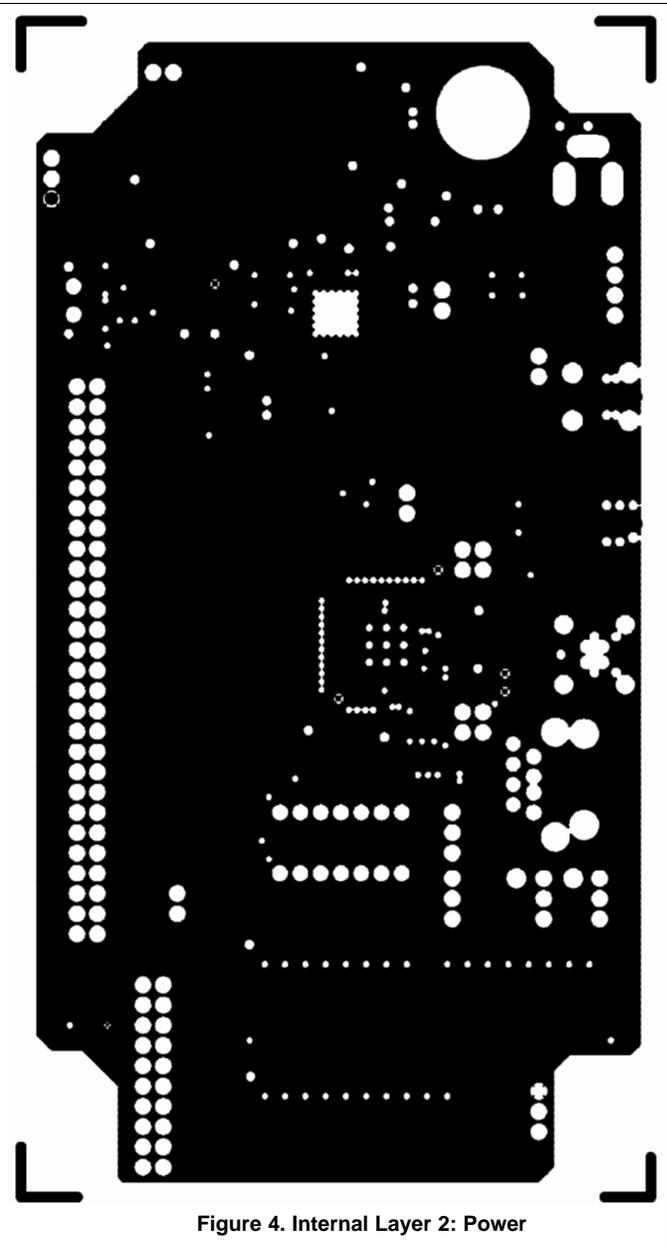
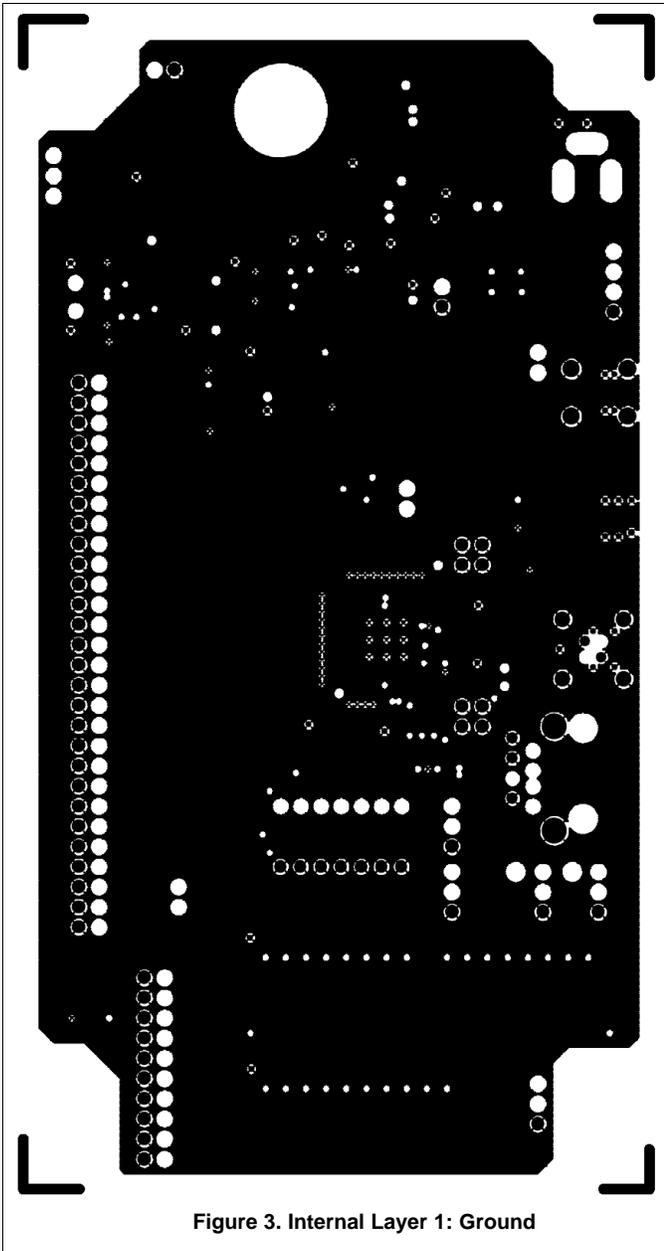
Qty	Reference	Part	PCB Footprint	Comments	MFR	MFR Part#
1	R102	180K Ohm,0402	RES/HDC-0402	RES 180K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1803X
2	R129,R103	191K Ohm,0402	RES/HDC-0402	RES 191K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1913X
3	R104,R114,R130	210K Ohm,0402	RES/HDC-0402	RES 210K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2103X
3	R105,R112,R131	243K Ohm,0402	RES/HDC-0402	RES 243K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2433X
2	R107,R133	294K Ohm,0402	RES/HDC-0402	RES 294K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2943X
2	R134,R108	280K Ohm,0402	RES/HDC-0402	RES 280K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2803X
1	R109	270K Ohm,0402	RES/HDC-0402	RES 270K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2703X
1	R110	267K Ohm,0402	RES/HDC-0402	RES 267K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2673X
2	R135,R111	240K Ohm,0402	RES/HDC-0402	RES 240K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2403X
2	R113,R136	226K Ohm,0402	RES/HDC-0402	RES 226K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2263X
2	R115,R137	196K Ohm,0402	RES/HDC-0402	RES 196K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1963X
1	R116	182K Ohm,0402	RES/HDC-0402	RES 182K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1823X
2	R138,R117	169K Ohm,0402	RES/HDC-0402	RES 169K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1693X
1	R118	154K Ohm,0402	RES/HDC-0402	RES 154K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1543X
2	R119,R139	137K Ohm,0402	RES/HDC-0402	RES 137K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1373X
2	R140,R120	124K Ohm,0402	RES/HDC-0402	RES 124K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1243X
1	R149	47Kohm	RES/HDC-0603	RES 47K OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ473V
2	SW1,SW2	SPST		SWITCH TACT	APEM Components	ADTSM31NV
1	S1	SW DIP-2	DIP-4	SWITCH DIP EXTENDED SEALED 2POS	Grayhill	78B02ST
2	S2,S3	SW SMD-8	SMD-20	SWITCH TAPE SEAL 8 POS SMD	CTS Electrocomponents	219-8MST
1	S4	SW SMD-10	SMD-20	SWITCH TAPE SEAL 10 POS SMD	CTS Electrocomponents	219-10MST
1	U1	DS90UH925AQ	48ld TQFP	IC SERIALIZER FPD-LINK III	TI	DS90UH925ATR HSTQ1
1	U4	AT90 AVR@ 8-Bit	64QFN	IC AVR MCU 128K 64QFN	Atmel	AT90USB1287- 16MU
1	U5	REG_LDO	SMT/8-MSOP	IC REG LDO 300MA 3.3V 8MSOP	TI	LP3982IMM- 3.3/NOPB
1	Y1	8MHz CRYSTAL	5.0mm x 3.2mm	CRYSTAL 8.000 MHZ 18PF SMD	Abracon Corporation	ABM3-8.000MHZ- D2Y-T

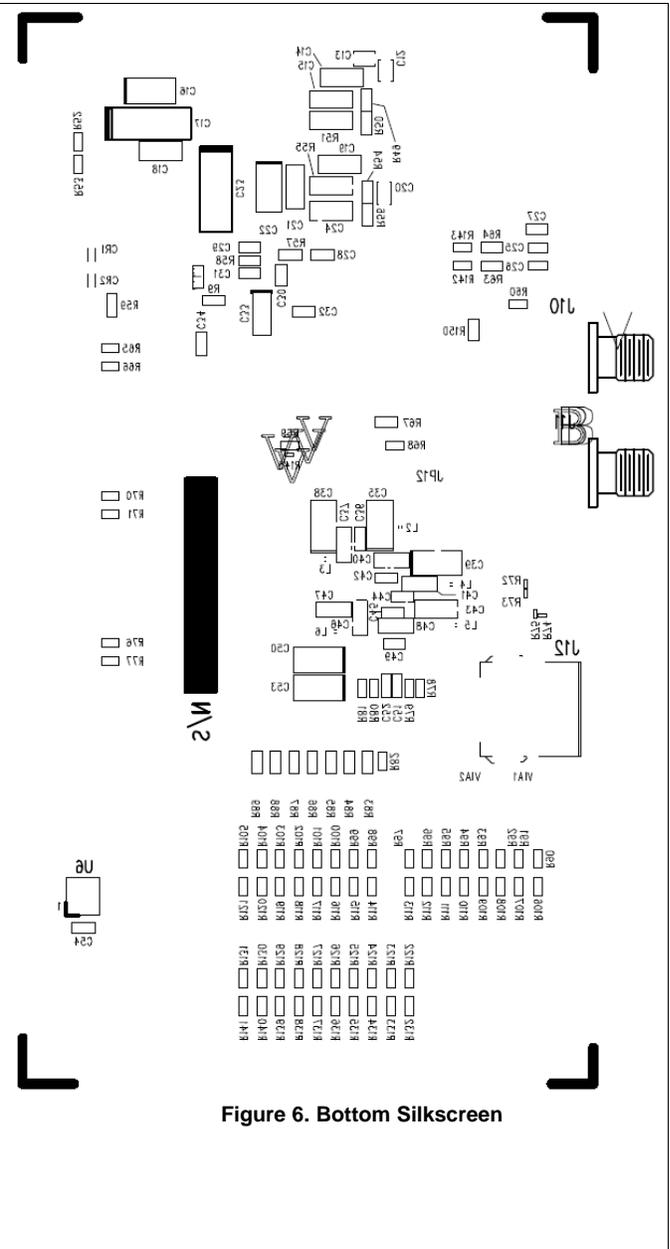
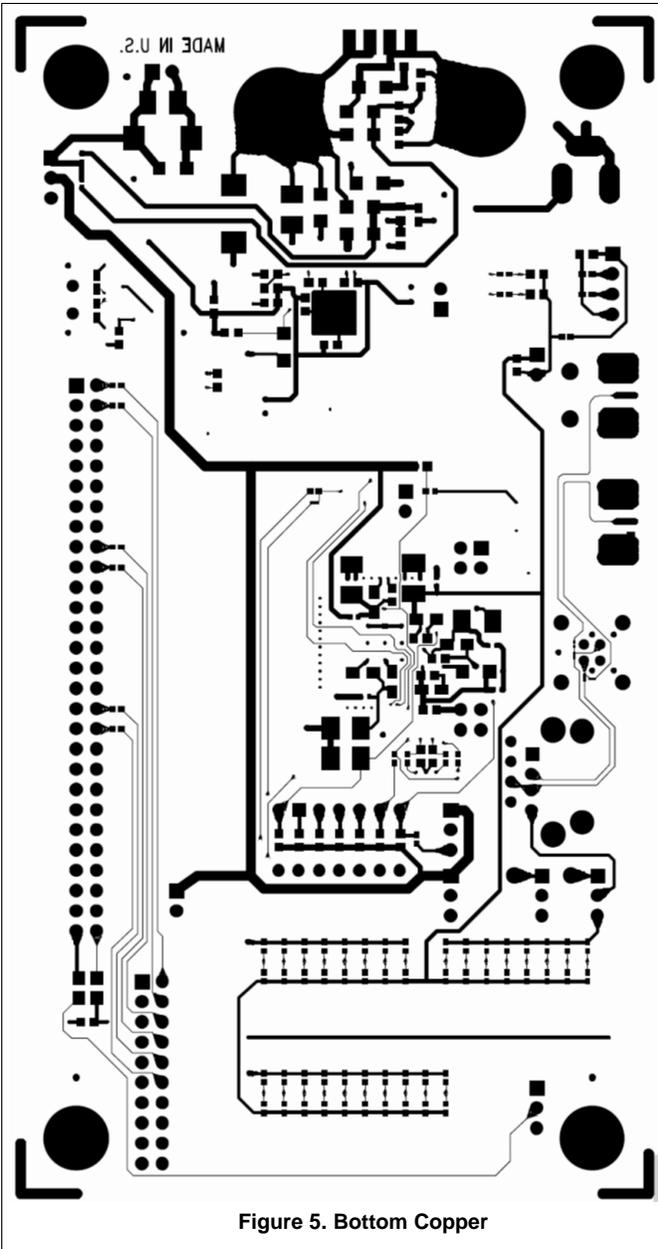
Board Layout

C.1 Board Layers

The following mechanical drawings illustrate the physical layout and stack-up of the 4-layer DS90UH925AQEVM evaluation board:







ADDITIONAL TERMS AND CONDITIONS, WARNINGS, RESTRICTIONS, AND DISCLAIMERS FOR EVALUATION MODULES

Texas Instruments Incorporated (TI) markets, sells, and loans all evaluation boards, kits, and/or modules (EVMs) pursuant to, and user expressly acknowledges, represents, and agrees, and takes sole responsibility and risk with respect to, the following:

1. User agrees and acknowledges that EVMs are intended to be handled and used for feasibility evaluation only in laboratory and/or development environments. Notwithstanding the foregoing, in certain instances, TI makes certain EVMs available to users that do not handle and use EVMs solely for feasibility evaluation only in laboratory and/or development environments, but may use EVMs in a hobbyist environment. All EVMs made available to hobbyist users are FCC certified, as applicable. Hobbyist users acknowledge, agree, and shall comply with all applicable terms, conditions, warnings, and restrictions in this document and are subject to the disclaimer and indemnity provisions included in this document.
2. Unless otherwise indicated, EVMs are not finished products and not intended for consumer use. EVMs are intended solely for use by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.
3. User agrees that EVMs shall not be used as, or incorporated into, all or any part of a finished product.
4. User agrees and acknowledges that certain EVMs may not be designed or manufactured by TI.
5. User must read the user's guide and all other documentation accompanying EVMs, including without limitation any warning or restriction notices, prior to handling and/or using EVMs. Such notices contain important safety information related to, for example, temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.
6. User assumes all responsibility, obligation, and any corresponding liability for proper and safe handling and use of EVMs.
7. Should any EVM not meet the specifications indicated in the user's guide or other documentation accompanying such EVM, the EVM may be returned to TI within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY TI TO USER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. TI SHALL NOT BE LIABLE TO USER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RELATED TO THE HANDLING OR USE OF ANY EVM.
8. No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which EVMs might be or are used. TI currently deals with a variety of customers, and therefore TI's arrangement with the user is not exclusive. TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services with respect to the handling or use of EVMs.
9. User assumes sole responsibility to determine whether EVMs may be subject to any applicable federal, state, or local laws and regulatory requirements (including but not limited to U.S. Food and Drug Administration regulations, if applicable) related to its handling and use of EVMs and, if applicable, compliance in all respects with such laws and regulations.
10. User has sole responsibility to ensure the safety of any activities to be conducted by it and its employees, affiliates, contractors or designees, with respect to handling and using EVMs. Further, user is responsible to ensure that any interfaces (electronic and/or mechanical) between EVMs 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.
11. User shall employ reasonable safeguards to ensure that user's use of EVMs will not result in any property damage, injury or death, even if EVMs should fail to perform as described or expected.
12. User shall be solely responsible for proper disposal and recycling of EVMs consistent with all applicable federal, state, and local requirements.

Certain Instructions. User shall operate EVMs within TI's recommended specifications and environmental considerations per the user's guide, accompanying documentation, and any other applicable requirements. Exceeding the specified ratings (including but not limited to input and output voltage, current, power, and environmental ranges) for EVMs may cause property damage, personal injury or death. If there are questions concerning these ratings, user should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the applicable EVM user's guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using EVMs' schematics located in the applicable EVM user's guide. When placing measurement probes near EVMs during normal operation, please be aware that EVMs may become very warm. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use EVMs.

Agreement to Defend, Indemnify and Hold Harmless. User agrees to defend, indemnify, and hold TI, its directors, officers, employees, agents, representatives, affiliates, licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of, or in connection with, any handling and/or use of EVMs. User's indemnity shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if EVMs fail to perform as described or expected.

Safety-Critical or Life-Critical Applications. If user intends to use EVMs in evaluations of safety critical applications (such as life support), and a failure of a TI product considered for purchase by user for use in user's product would reasonably be expected to cause severe personal injury or death such as devices which are classified as FDA Class III or similar classification, then user must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

RADIO FREQUENCY REGULATORY COMPLIANCE INFORMATION FOR EVALUATION MODULES

Texas Instruments Incorporated (TI) evaluation boards, kits, and/or modules (EVMs) and/or accompanying hardware that is marketed, sold, or loaned to users may or may not be subject to radio frequency regulations in specific countries.

General Statement for EVMs Not Including a Radio

For EVMs not including a radio and not subject to the U.S. Federal Communications Commission (FCC) or Industry Canada (IC) regulations, TI intends EVMs to be used only for engineering development, demonstration, or evaluation purposes. EVMs are not finished products typically fit for general consumer use. EVMs may nonetheless generate, use, or radiate radio frequency energy, but have not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or the ICES-003 rules. Operation of such EVMs may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: For EVMs including a radio, the radio included in such EVMs is intended for development and/or professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability in such EVMs and their development application(s) must comply with local laws governing radio spectrum allocation and power limits for such EVMs. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by TI unless user has obtained appropriate experimental and/or development licenses from local regulatory authorities, which is the sole responsibility of the user, including its acceptable authorization.

U.S. Federal Communications Commission Compliance

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 could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at its own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Industry Canada Compliance (English)

For EVMs Annotated as IC – INDUSTRY CANADA Compliant:

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs Including Radio Transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs Including Detachable Antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Canada Industry Canada Compliance (French)

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2014, Texas Instruments Incorporated

Important Notice for Users of EVMs Considered “Radio Frequency Products” in Japan

EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If user uses EVMs in 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.

<http://www.tij.co.jp>

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】本開発キットは技術基準適合証明を受けておりません。本製品のご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。

日本テキサス・インスツルメンツ株式会社

東京都新宿区西新宿6丁目24番1号

西新宿三井ビル

<http://www.tij.co.jp>

Texas Instruments Japan Limited

(address) 24-1, Nishi-Shinjuku 6 chome, Shinjuku-ku, Tokyo, Japan

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com