SERDESUR-916ROS User's Guide

LIST OF FIGURES

LIST OF TABLES

1. Introduction

The Texas Instruments SERDESUR-916ROS evaluation kit (EVK) provides an easy way to evaluate the operation and performance of the DS90UR916Q 1.82Gbps FPD-Link II deserializer.

1.1. Contents of EVM:

1) DS90UR916Q evaluation board
2) CD with ALP software
3) USB cable

1.2. Highlights of EVB

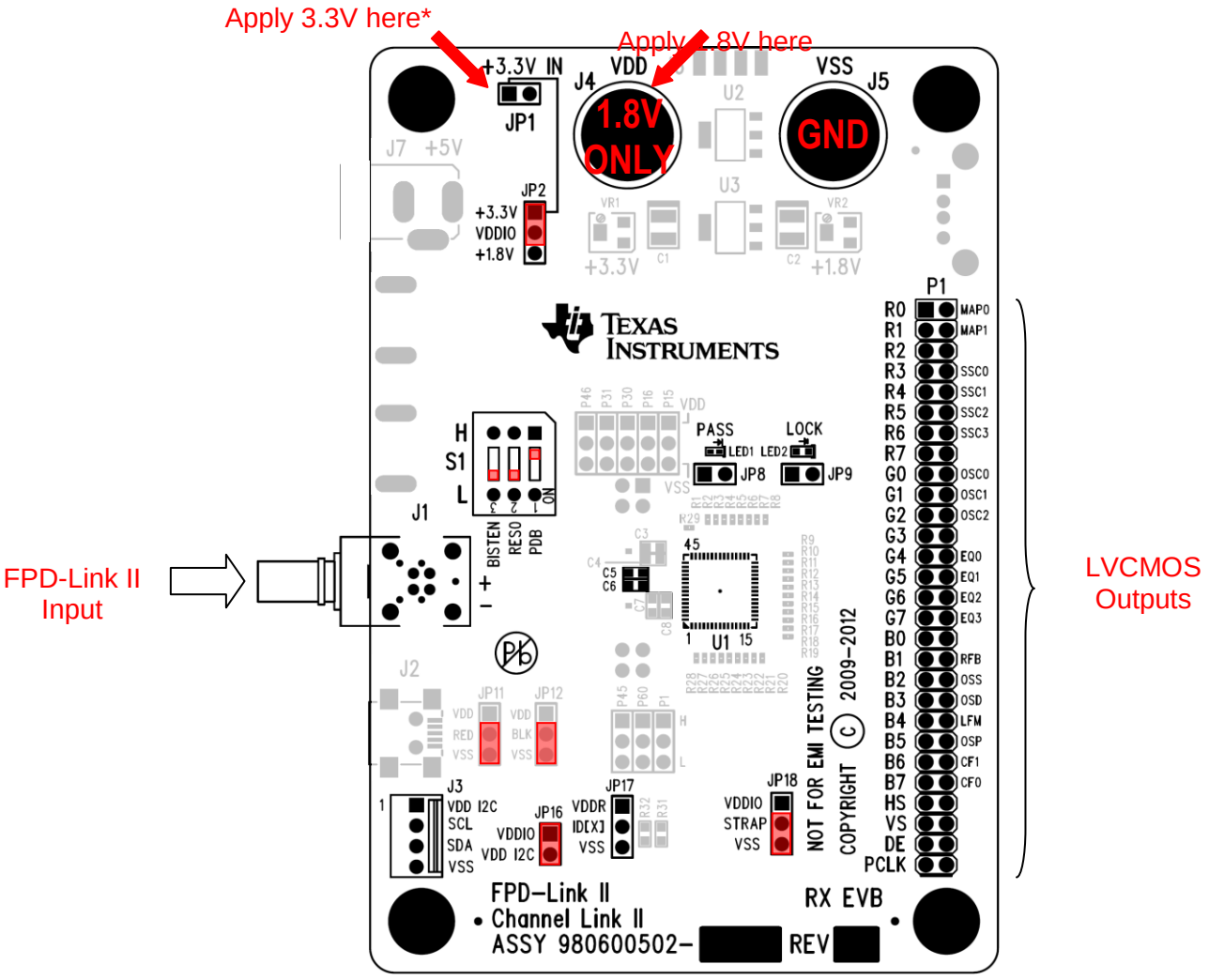


Figure 1: DS90UR916Q EVK

* The default factory configuration is VDDIO = 3.3V that must be applied externally. For VDDIO = 1.8V, move jumper on JP2 to short pins 2 and 3; 1.8V does not have to be applied externally.

1.3. Operation – Quick Setup

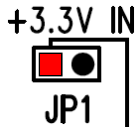
Make sure S1, JP18, JP2, and JP16 are configured as shown in Figure 1.

1) The following applies to the serializer.
   1. The serializer typically would be the DS90UR905Q.
   2. Connect the FPD-LinkII source to J1. See section 2.2. below for pinout.
   3. Apply power to the serializer. Make certain PDB = *HIGH*

2) The following applies to the DS90UR916Q EVK:

   1. Connect GND to J5
   2. Connect **1.8V** core power on J4.

   3. Connect GND to JP1 pin2.
   4. Connect 3.3V VDDIO power on pin 1 of JP1.



   5. Apply power to the deserializer.

3) Look for the green LED2 to light up on the DS90UR916Q EVK. If the green LED is lit and stable, then the DS90UR916Q is **LOCKED** to the FPD-LinkII serial stream. To be absolutely sure the DS90UR916Q is locked, use a scope to monitor off JP9 (pin 1 = LOCK, pin 2 = VSS)

4) CONGRATULATIONS, you are up and running!
   If not continue to the next step…

1.4. Trouble Shooting the DS90UR916Q EVK

1) Check power supply polarity!!! Warning: reverse supply polarity can damage the board.
2) Check to make sure there is sufficient current by checking that the voltage (**1.8V**) is correct at J4.
3) Check polarity of SER to DES cable interface. e.g. SER DOUT+ is going to RIN+ of DES and vice versa.
4) Check to make sure there is a FPD-LinkII signal by probing on **both** C5 AND C6.
5) Go back to figure 1.1 and double check factory settings.

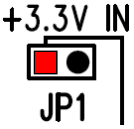
2. Board Setup - Details

This section describes, in detail, the connectors and jumpers on the board as well as how to properly connect, set up, and use the DS90UR916Q EVK.

2.1. Power Connections

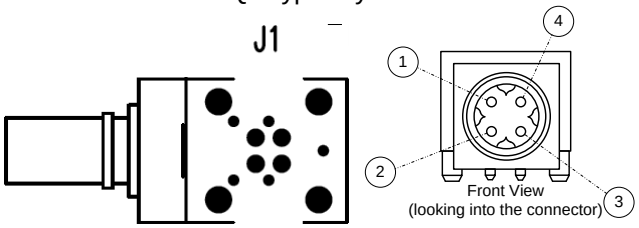
1) Connect ground to J5.
2) Connect an external **1.8V** into J4. This is the core voltage of the DS90UR916Q.

3) Connect ground to pin 2 of JP1.
4) Connect an external 3.3V into pin 1 of JP1. This is VDDIO power.



2.2. FPD-LinkII Connection

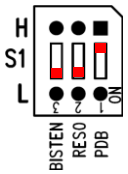
J1 – is the default Rosenberger HSD connector. Apply an FPD-LinkII serial stream into J1. Note: Pin 2 goes to RxIN+, pin 4 goes to RxIN- of the DS90UR916Q. Typically the serializer will be the DS90UR905Q.



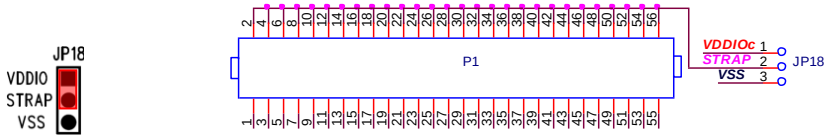
2.3. Factory Set Switch Settings and Jumpers Default Configuration

S1, JP2, JP16, and JP18 are factory configured as shown in Figure 2 for plug and play operation. For each of these 2-pin 3-pin headers, a jumper must be placed as shown.

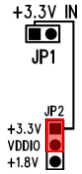
1) The S1 switch is factory set as shown below.
   The PDB switch is set *HIGH* and will turn on the DS90UR916Q upon power up.



2) On JP18, a 2-pin jumper is factory placed as shown below.
   The jumper ties all the even pins of P1 to VSS.



3) On JP2, a 2-pin jumper is factory placed as shown below.
The jumper sets VDDIO to 3.3V. Note 3.3V must then be applied to pin 1 of JP1.



4) On JP16 jumper 2-pin jumper is factory placed as shown below.
The jumper pulls the SCL and SDA pullup to VDDIO (3.3V)

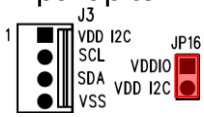
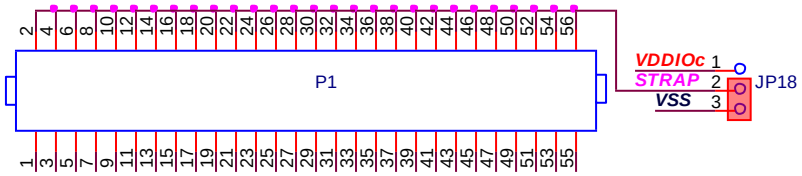


Figure 2: Factory Switch (S1) and Jumper (JP18, JP2, JP16) Configuration

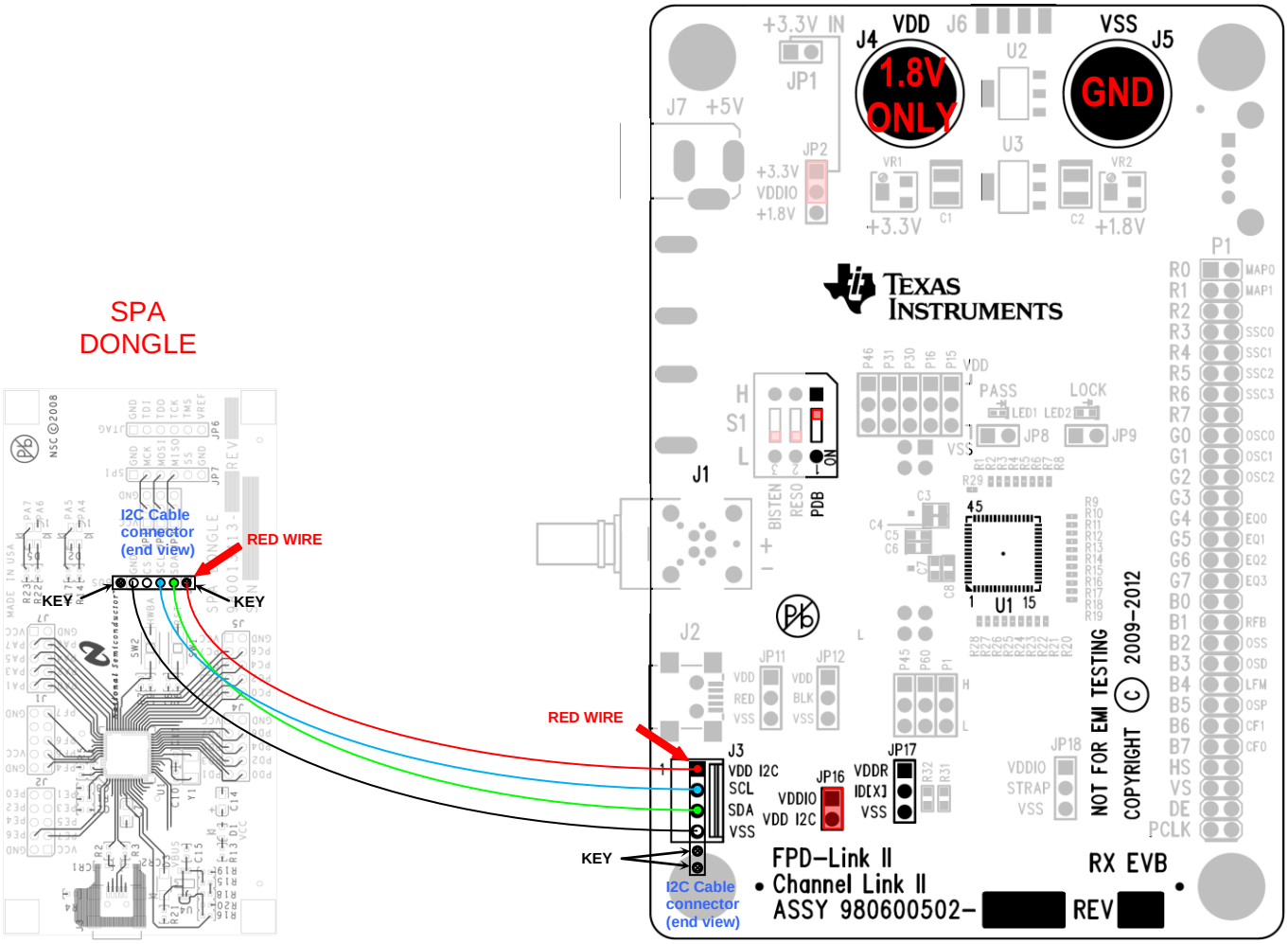
2.4. LVCMOS Output Connector Description

P1 – R[7:0], G[7:0], B[7:0], HS, VS, DE, PCLK is the output connector for the DS90UR916Q data outputs. These are the LVCMOS outputs of the DS90UR916Q. The even numbered pins (right side pins on the board) go to pin 2 (labeled “STRAP”) of JP18. The factory configuration has a jumper between pin 2 (STRAP) and pin 3 (VSS), the even numbered pins are ground referenced.



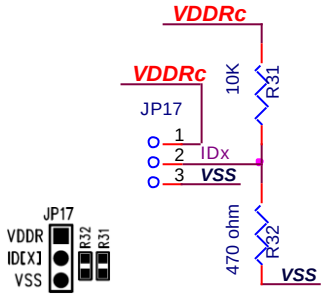
3. Appendix – I2C SPA Dongle Hookup (OPTIONAL)

3.1. I2C SPA Dongle Hookup



3.2. IDx Board Default Address

The IDx address on the EVK has been preloaded with a 0.470Ω resistor.



Resistor RID* kΩ (5% tol)	Address 7'b	Address 8'b 0 appended (WRITE)
0.47	7b' 111 0001 (h'71)	8b' 1110 0010 (h'E2)
2.7	7b' 111 0010 (h'72)	8b' 1110 0100 (h'E4)
8.2	7b' 111 0011 (h'73)	8b' 1110 0110 (h'E6)
Open	7b' 111 0110 (h'76)	8b' 1110 1100 (h'EC)

*Note: RID ≠ 0 ohm, do not connect directly to VSS (GND), this is not a valid address.

3.3. ALP Software Setup

3.3.1. System Requirements

Operating System: Windows XP or Vista
USB: 2.0

3.3.2. CD contents

Extract the "ALPF_*xxxxxxxx_xxx*_xxxx.exe" file to a temporary location that can be deleted later.

Make sure the SPA dongle is connected to the PC and the DS90UR916 EVB board is connected to the SPA dongle and power is applied to the DS90UR916 EVB

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

3.3.3. Installation of the ALP software

Execute the ALP Setup Wizard program called "ALPF_monthdayyear_major version_minor version.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 and Quick Launch 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.

Connect J3 of the DS90UR916Q EVB board to JP8 of the SPA dongle via the 6-pin parallel cable. Power the DS90UR916Q EVB board with a 1.8 VDC power supply. Connect the SPA dongle to the PC with the USB cable supplied with the evaluation board. The "Found New Hardware Wizard" will open on the PC. Proceed to the next section to install the USB driver.

3.3.4. Installation of the USB driver

There are 6 steps to install the USB driver:

1. Select “No, not at this time” then select the “Next” button.
2. Select “Install from a list or specific location” then select the “Next” button.
3. Select “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. Select “Continue Anyway”.
6. Select the “Finish” button.

The software installation is complete. The ALP software may now be launched, as described in the next section.

3.3.5. DS90UR916 - Profile Installation (for ALP v1.28.1027a and earlier, otherwise skip this step)

There is only one step to copy the DS90UR916 profiles into the profiles folder:

1. Copy the contents of DS90UR916.zip on the CD to the Install Directory which is typically located at C:\Program Files\National Semiconductor Corp\Analog LaunchPAD vx.x.x\Profiles.

3.3.6. 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” 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 in the figure below. If it does not, see “Trouble Shooting” at the end of this document. Under the Devices tab click on “DS90UR916” to select the device and open up the device profile and its associated tabs.

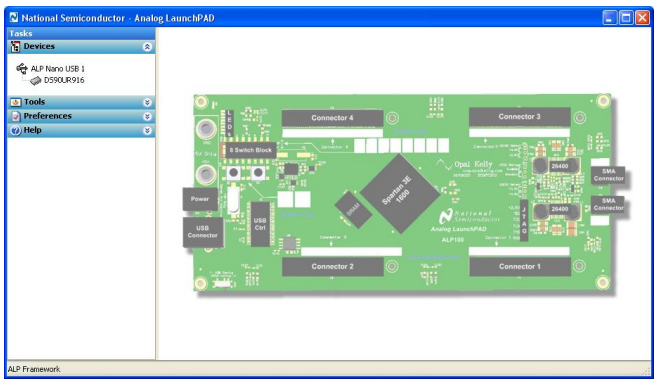
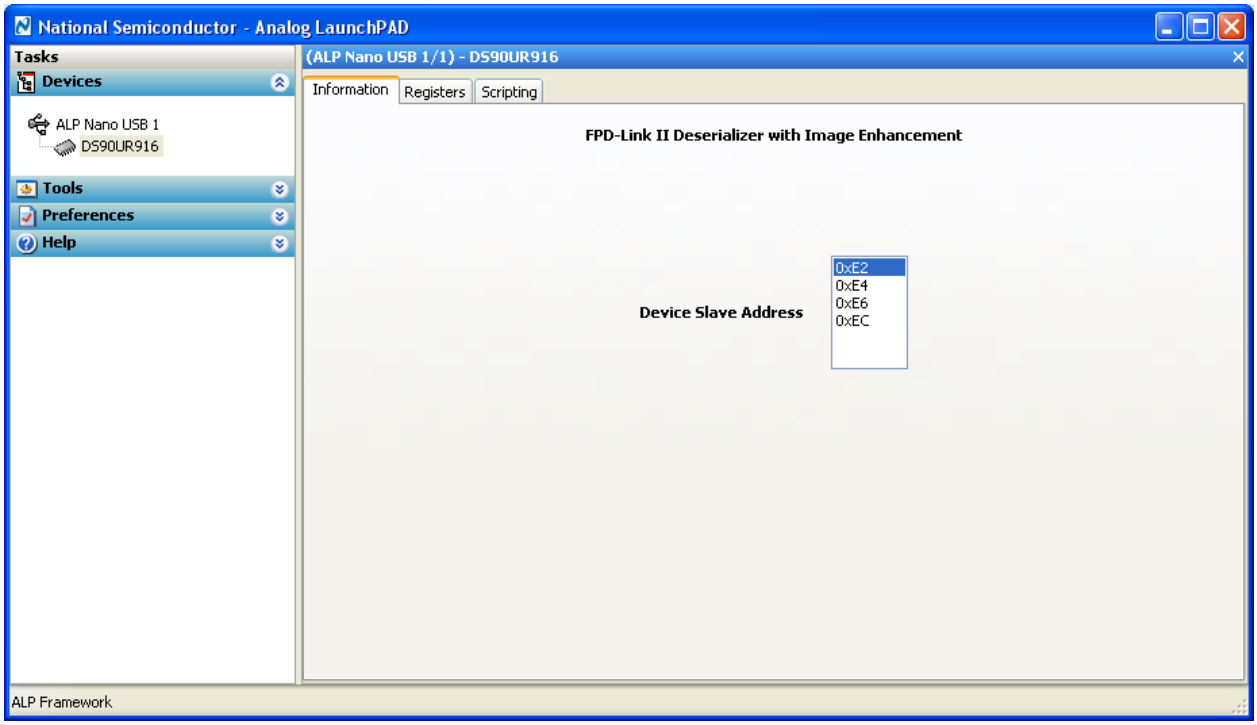
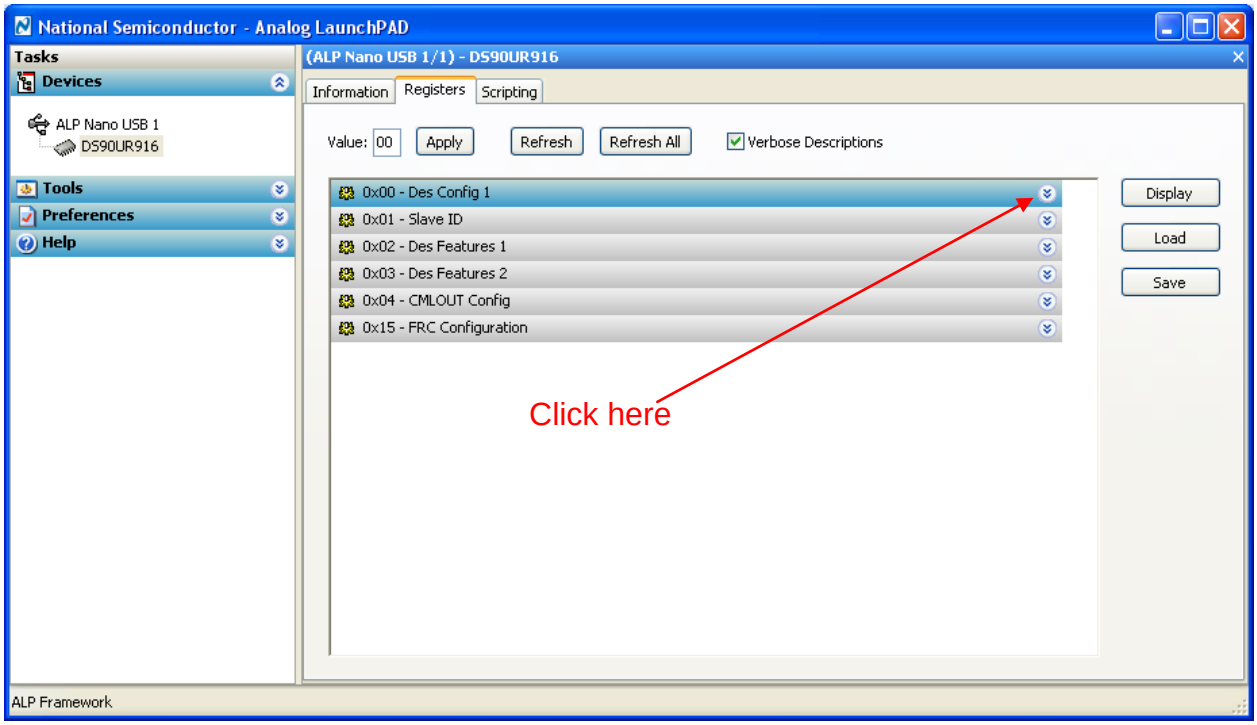


Figure 3: Initial ALP Screen

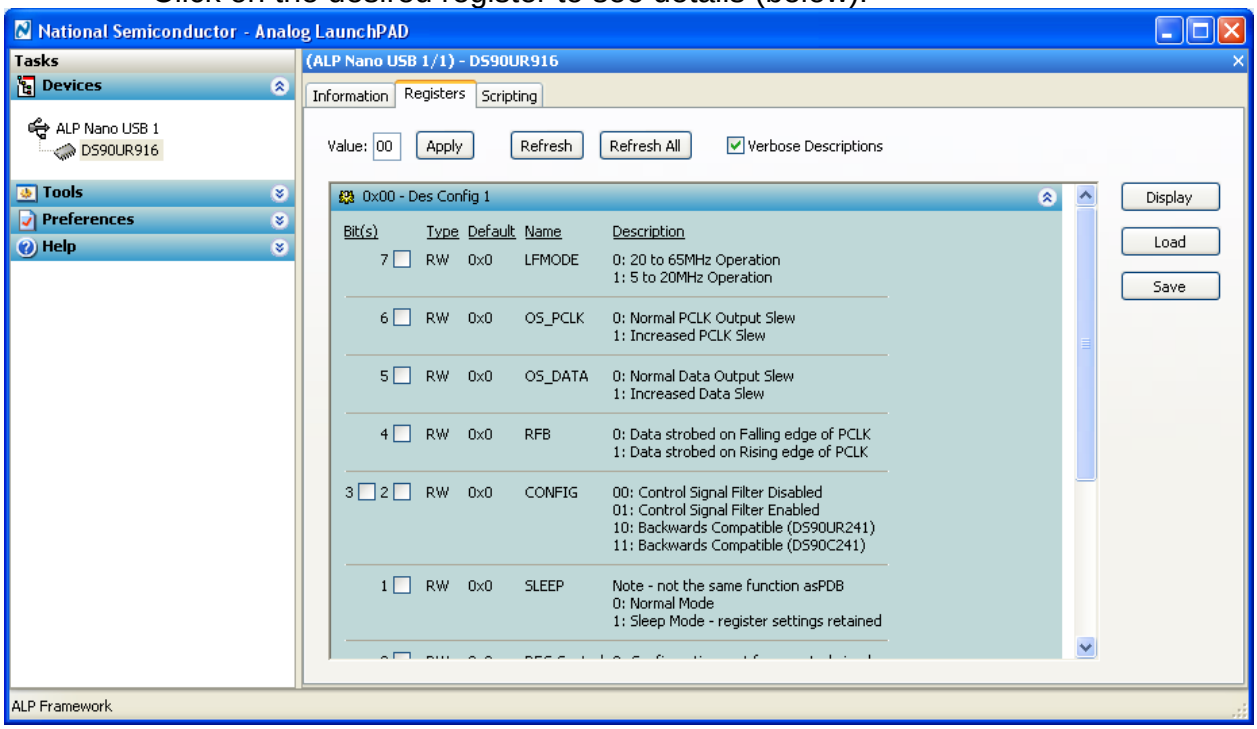
After selecting the DS90UR916Q, the following screen should appear. In this step, select the assigned I2C address (default is 0xE2).



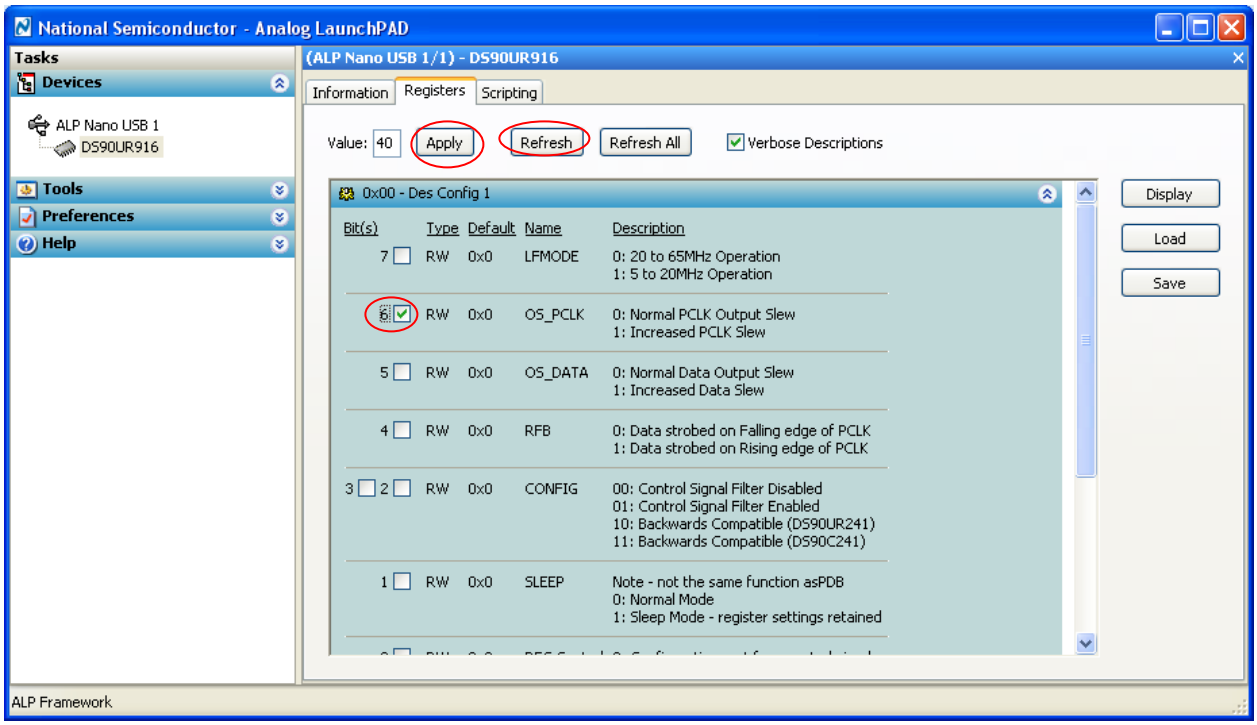
Next, click on the “Registers” tab for a complete listing of programmable registers.



Click on the desired register to see details (below).



Click the check box to set a register bit to"1". Click the "Apply" button to write the register, and "refresh" to see the new value of the selected (highlighted) register.



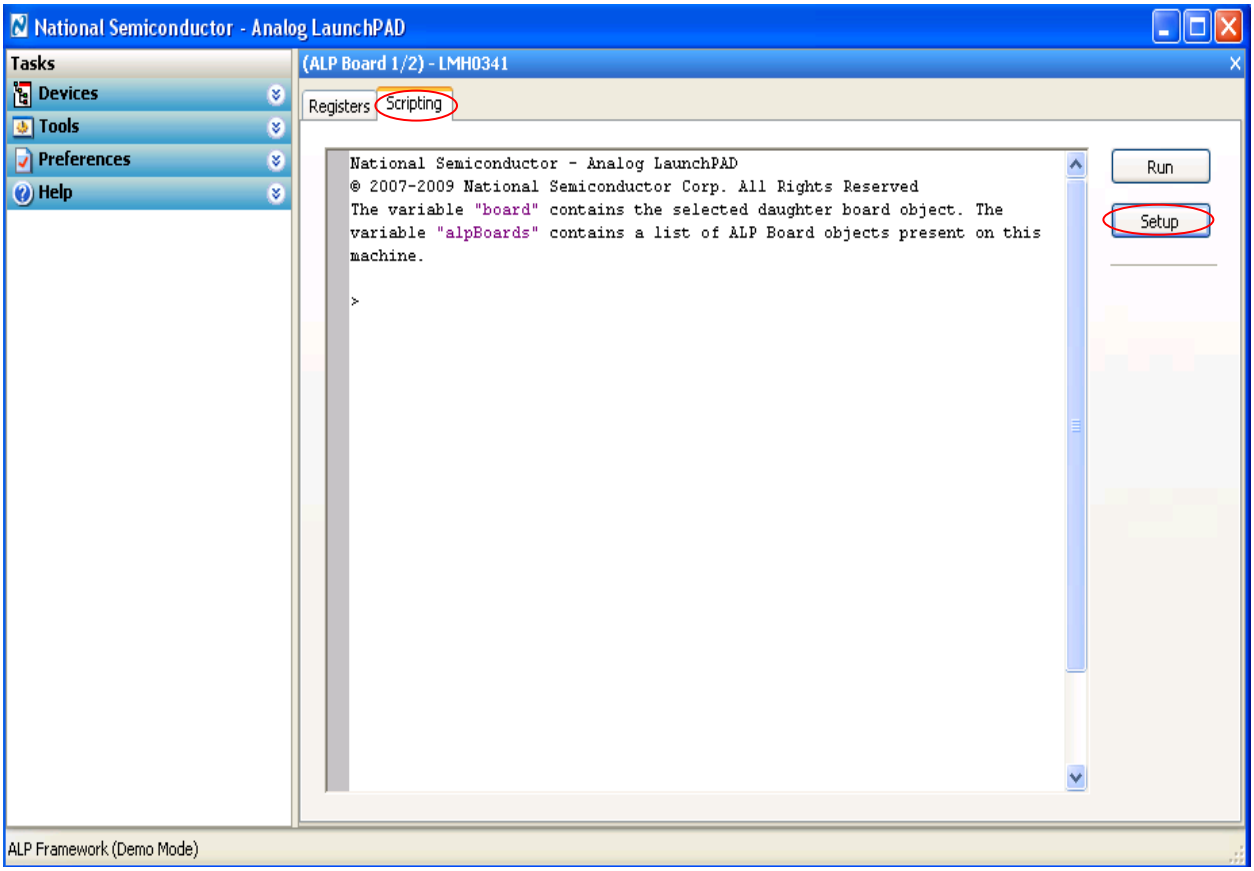
3.3.7. User note to Install and Run White Balancing Scripts Using Analog LaunchPAD

This user note documents the steps required to install and run the White Balancing scripts to demonstrate the image enhancement capabilities of the DS90UR916Q device. The user should unzip and save the white balancing scripts to a local machine running National Semiconductor's Analog Launch Pad program.

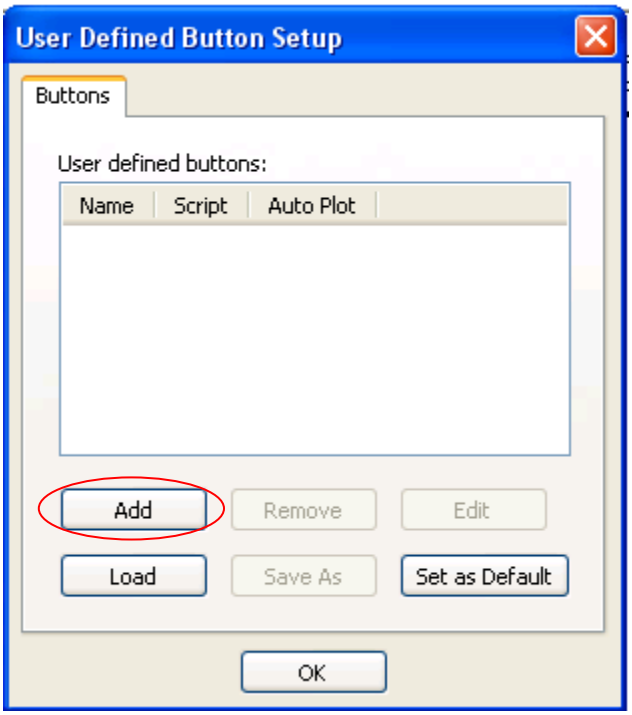
3.3.8. Installing and Running Scripts

The following steps need to be followed in order to install and run the White Balancing scripts supplied to the user.

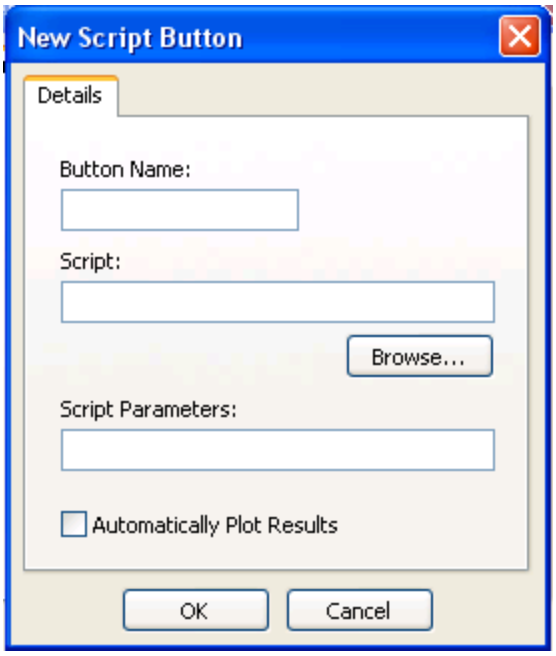
1. On the DS90UR916Q Profile, open the scripts tab from the National Semiconductor – Analog Launch Pad window as shown below.



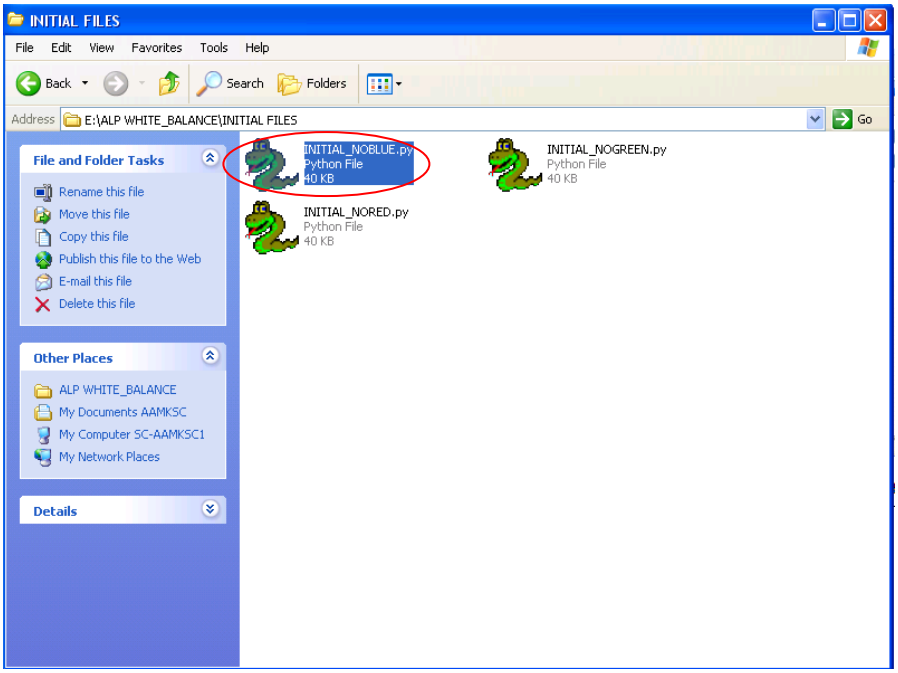
2. Click the 'Setup' button on the scripting tab. The following screen will be displayed on your screen.



3. Clicking the ‘Add’ button on the screen will open the following window

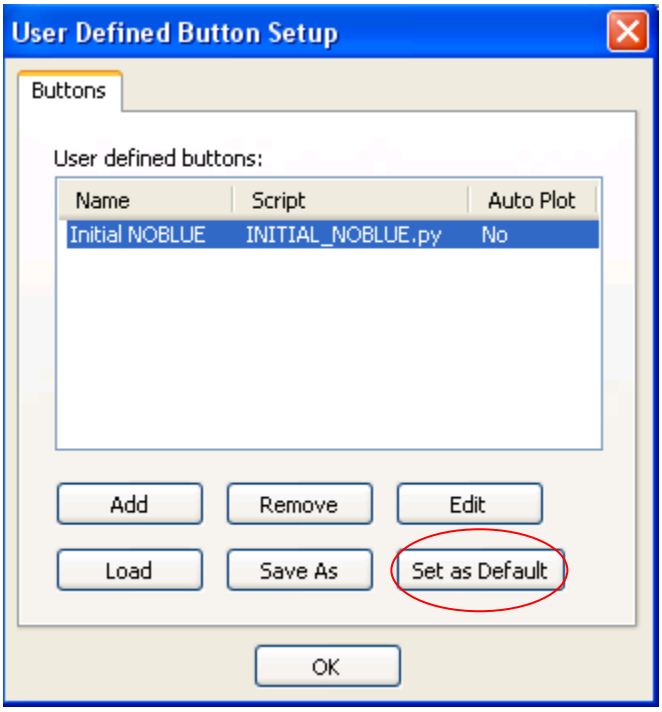


Under ‘Button Name’, type the name of the button that demonstrates the respective White Balancing feature. For example, to install the ‘INITIAL_NOBLUE’ script, type in ‘Initial NOBLUE’ in the button name. Next click on the Browse button on the screen and point it to the respective script file that demonstrates the feature. In this case, the INITIAL_NOBLUE script as shown below.



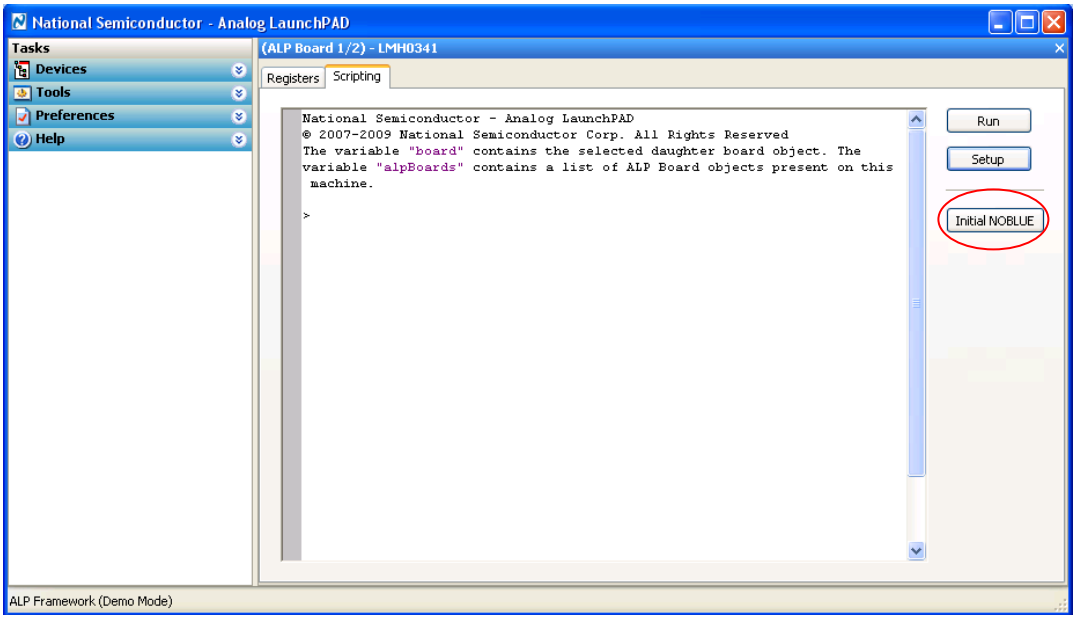
Then click OK on the New Script Button window.

4. Clicking ‘OK’ on the new script window will get you back to the ‘User Defined Button Setup’ window. Click on the newly added user defined button as shown.



Next, click on ‘Set as Default’ so that the newly added script always shows up whenever National Semiconductor – Analog Launch Pad is started.

5. The scripting tab under the DS90UR916Q profile should now show the button that was just added.



6. Repeat steps 1 to 5 to create buttons for various different scripts that demonstrate the White Balancing features for the DS90UR916Q device. Please refer to the Appendix section for description of each of the White Balancing scripts.

Example Files:

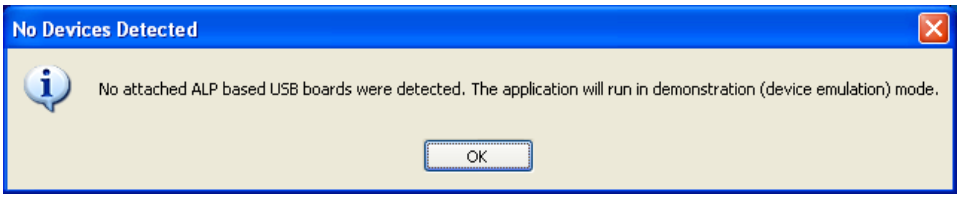
There are four different folders in the ALP_White_Balance_916.zip file to demonstrate the various White Balancing features.

1. Initial Files: This folder contains three scripts; Initial NOBLUE, Initial NOGREEN and Initial NORED. Once the device is Powered ON or RESET, any of these scripts can be run to demonstrate the removal or RED, GREEN or BLUE from the screen. *It should be noted that only one of the script should be run after initial POWER ON or RESET. These scripts will have no effect once one of the scripts has been run after POWER UP or RESET.*
2. Reload ALL COLORS : This folder contains four scripts that reload all the colors on the screen or selectively load the RED, GREEN or BLUE on the screen. These scripts can be run ONLY after any of the initial file scripts have been run.
3. Reload NO COLORS: This folder contains six scripts and the name of the script is self defining. These files can be used to remove any of the three colors from the screen while reloading the other colors or remove any of the colors while not reloading the earlier color removed.
4. Subtle Changes: This folder contains scripts which demonstrate the mostly likely use of the White Balancing feature. Rather than removing the colors completely, these scripts make subtle color changes on the screen. Individual

colors may be subtly changed or all the three colors can be changed simultaneously to make the picture look brighter.

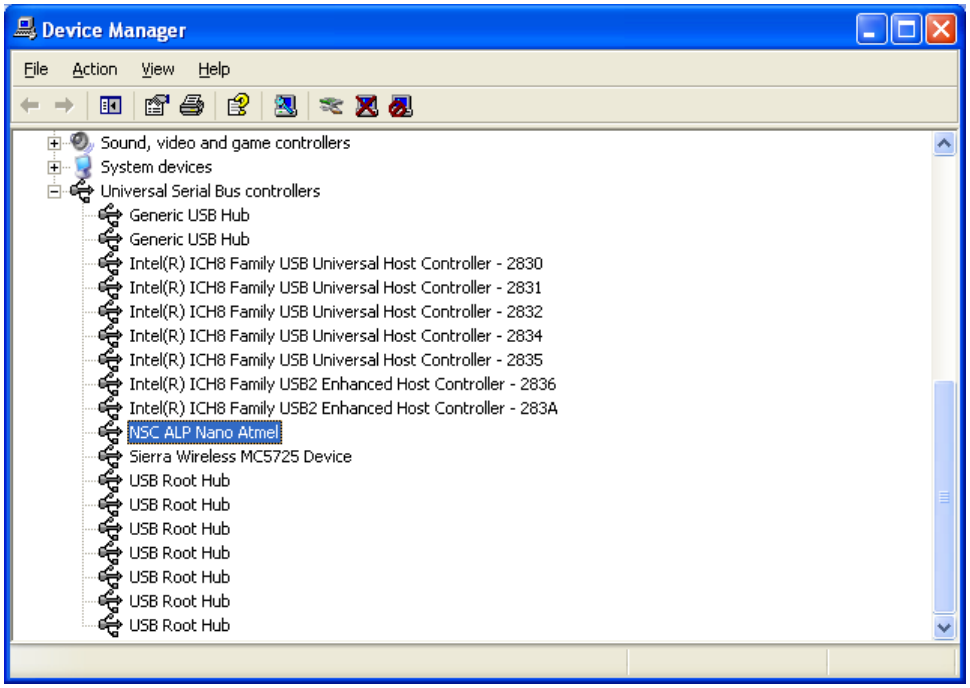
3.3.9. Trouble Shooting ALP Software

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



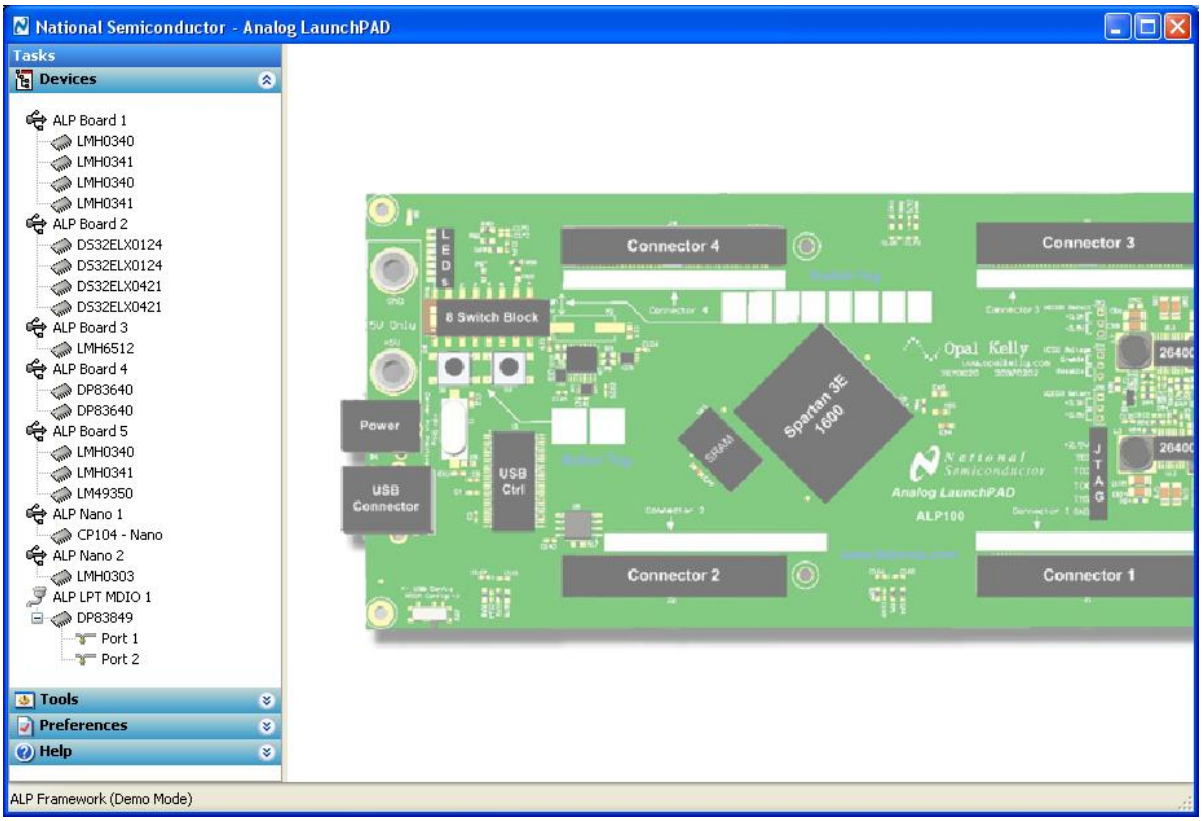
Analog LaunchPAD No Devices Error

It may also be that the USB driver is not installed. Check the device manager. There should be an “NSC ALP Nano Atmel” device under the “Universal Serial Bus Controllers” as shown below.



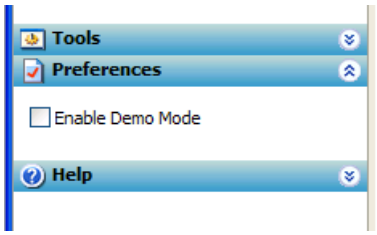
Windows XP, Analog LaunchPAD USB Driver

The software should start with only “DS90UR916Q” 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.



Analog LaunchPAD in Demo Mode

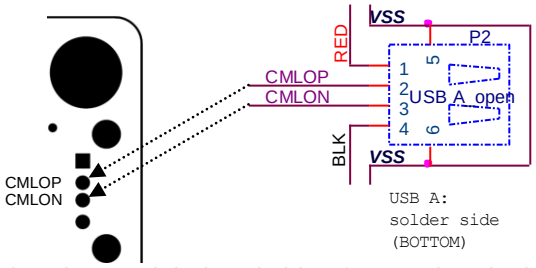
Disable the demo mode by selecting the “Preferences” pull down menu and un-checking “Enable Demo Mode”.



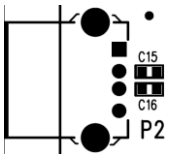
Analog LaunchPAD Preferences Menu

After demo mode is disabled, the ALP software will poll the ALP hardware. The ALP software will update and have only “DS90UR916Q” under the “Devices” pull down menu.

4. Eye Monitor – CMLOP/N



Top view of CML access points (upper right hand side of EVK when looking at the front side of the EVK). Connector P2 pin 2 connects CMLOP and pin 3 connects to CMLON.

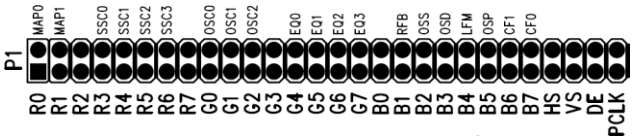


Bottom view of CML access points (upper left hand side of the EVK when looking at the back side of the EVK).
CMLOP/N must be enabled by register, 0x04[7] = 1, to be able to monitor the FPD-LinkII serial stream.

PAGE	ADD (dec)	ADD (hex)	Register Name	Bit(s)	R/W	Default (bin)	Function	Description
0	4	4	CMLOUT Config	7	R/W	0	Repeater Enable	0: Output CMLOUTP/N = disabled 1: Output CMLOUTP/N = enabled
				6:0	R/W	0000000	***Reserved***	***Reserved***

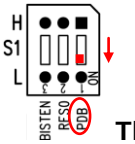
5. Appendix – STRAP

5.1. Configuration using the STRAP pins on P1



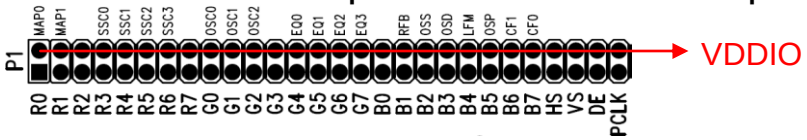
There are two options for setting strap(s):

1) On-the-fly strap selection on the demo board is a six (6) step process:



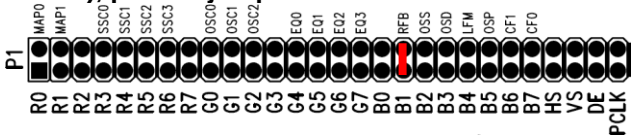
Step 1: Set PDB to LOW on SW1. This will place the part in power down mode.

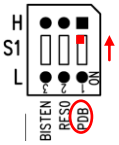
Step 2: Place jumper between pin 1 and 2 of JP18.
This ties the even numbered pins on P1 to VDDIO which will provide the pull-up for the strap option.



Step 3: Place jumper(s) on strap pins option(s) desired.

E.g. if you wanted to change RFB from default RFB=L (falling edge strobe) to RFB=H (rising edge strobe), place a jumper on RFB of P1.

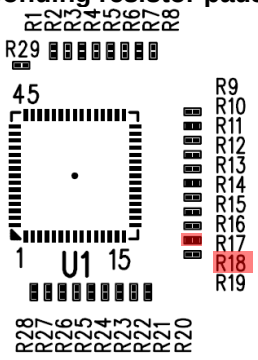




Step 4: Switch PDB on SW1 from LOW to HIGH.
This configures the device based on strap pin values and overrides the default register(s).
Step 5: Remove ALL jumper(s) on strap pin placed in Step 3.
Step 6: Remove jumper between pin 1 and 2 of JP18 and place the jumper between pin 2 and 3 of JP18.

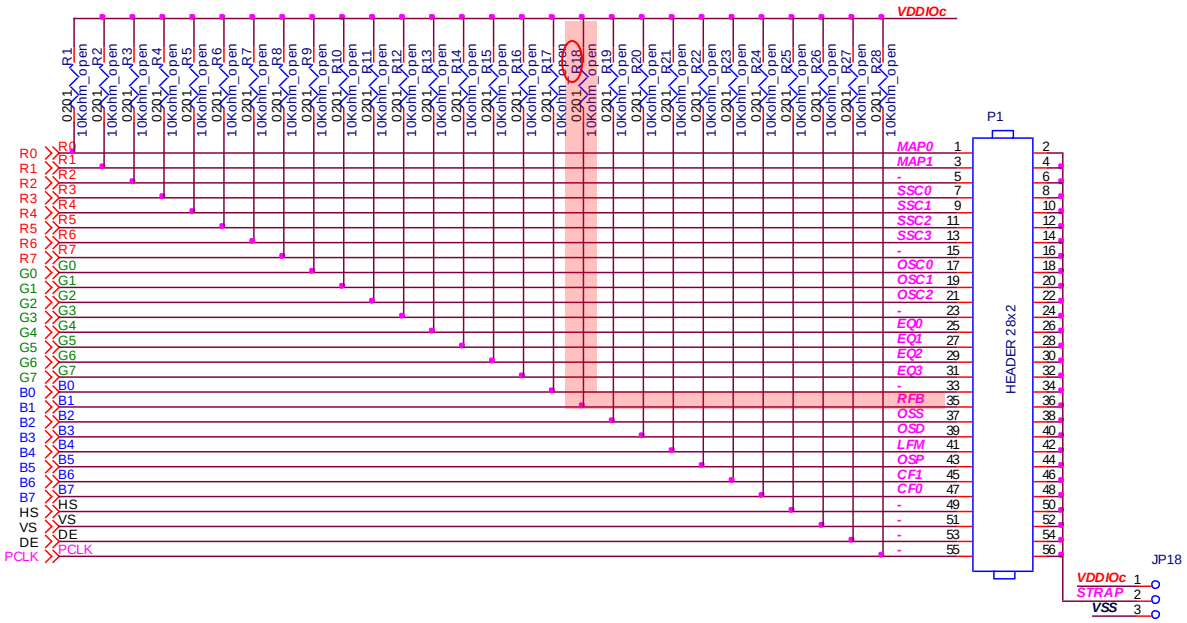
This ties the even numbered pins on P1 to VSS and is used as the ground reference for R[7:0], G[7:0], B[7:0], HS, VS, DE, PCLK. The board is now configured for normal operation.

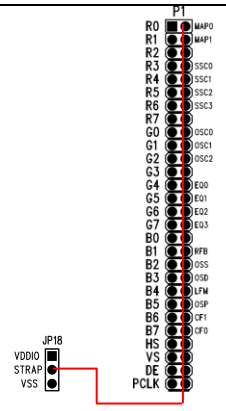
For straps options to be loaded permanently without using the on-the-fly option:
Place a 10K ohm 0201 size resistor on corresponding resistor pads.

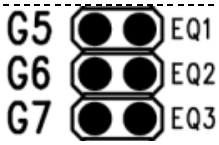
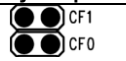
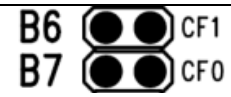


E.g.

Note: This is the same configuration setting as previous example using 10K ohm resistor instead of jumpers

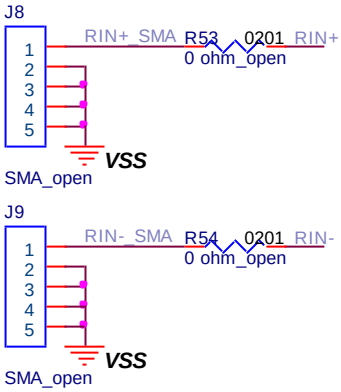


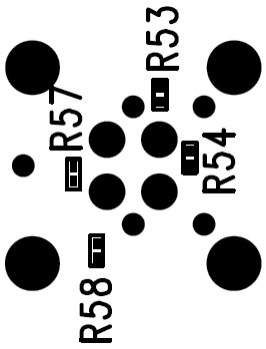
		Normal operation	For strap pullup	
	Ties all even pins on P1 to VDDIO or VSS.	JP18 VDDIO STRAP VSS **All strap inputs = L**	JP18 VDDIO STRAP VSS **Strap pullup to VDDIO**	
Reference	**Description**	**Input = L**	**Input = H**	**P1**
MAPSEL[1:0]	**MAP SEL**ect See datasheet for settings	R0 MAP0 R1 MAP1 **(Default)** No jumper(s)	R0 MAP0 R1 MAP1	R0 MAP0 R1 MAP1
SSC[3:0]	**S**pread **S**pectrum **C**lock Generation control See datasheet for settings	Disabled **(Default)** R3 SSC0 R4 SSC1 R5 SSC2 R6 SSC3 No jumper(s)	R3 SSC0 R4 SSC1 R5 SSC2 R6 SSC3 ⋮ R3 SSC0 R4 SSC1 R5 SSC2 R6 SSC3 *(15 settings)*	R3 SSC0 R4 SSC1 R5 SSC2 R6 SSC3
OSC[2:0]	**OSC**illator Frequency select See datasheet for settings	Disabled G0 OSC0 G1 OSC1 G2 OSC2 **(Default)** No jumper(s)	G0 OSC0 G1 OSC1 G2 OSC2 ⋮ G0 OSC0 G1 OSC1 G2 OSC2 *(7 settings)*	G0 OSC0 G1 OSC1 G2 OSC2

Reference	Description	Input = L	Input = H	P1
EQ[0]	**EQ**ualizer Disable/Enable See datasheet for settings	Disabled  **(Default)** No jumper	Enabled 	
EQ[3:1]	**EQ**ualizer control See datasheet for settings	 **(Default)** No jumper(s)	 	
RFB	Latch output data on **R**ising or **F**alling Data Strobe of RCLK	Falling  **(Default)** No jumper	Rising **Must also set JP18**	
OSS SEL	**O**utput **S**elect **S**leep **SEL**ect See datasheet for explaination	Disabled  **(Default)** No jumper	Enabled 	
OSD	**O**utput **S**lew - **D**ata	Normal  **(Default)** No jumper	Increased data outputs slew 	
LF_MODE	**L**ow **F**requency **MODE** Used only when SSCG is enabled otherwise this pin is a don't care	PCLK≥20MHz  **(Default)** No jumper	PCLK≤20MHz 	
OSP	**O**utput **S**lew - **P**CLK	Normal  **(Default)** No jumper	Increased PCLK slew 	
CONFIG[1:0]	**CONFIG**uration control See datasheet for settings	 **(Default)** No jumper(s)	 	

6. Appendix – Use of optional SMA connector (J8 and J9)

Populate R53 and R54 with 0201 sized 0Ω resistor (suggest Panasonic ERJ-1GE0R00C or equivalent). R53 and R54 pads are on the back side of the EVM. This will connect J8 and J9 (SMAs). Ideally, J1 (Rosenberger HSD connector) should be removed to eliminate the stub. Warning: R57 and R58 should not be populated when using J2.

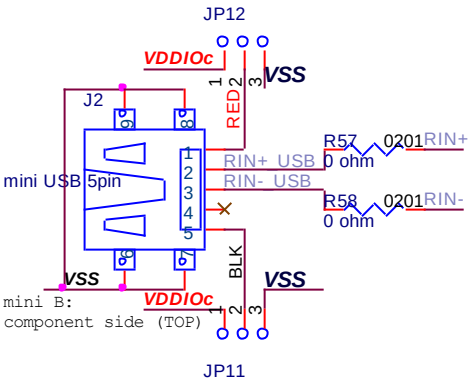


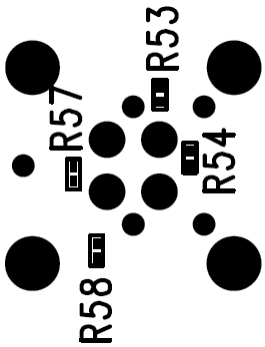


7. Appendix – Use of optional mini-B USB connector (J2)

Use this option when connecting to standard DS90UR905Q EVK.

Populate R57 and R58 with 0201 sized 0Ω resistor (suggest Panasonic ERJ-1GE0R00C or equivalent). R57 and R58 pads are on the back side of the EVM. This will connect J2. Ideally, J1 (Rosenberger HSD connector) should be removed to eliminate the stub. Warning: R53 and R54 should not be populated when using J2.





Add a two pin jumper on JP12 and JP11; this will ground the unused wires in the USB cable.

8. Appendix - Board Layout

Figure 5, Figure 6, Figure 7, and Figure 8 show the board layout for the DS90UR916Q EVB.

The DS90UR916Q is a 4-layer board (TOP / GND / PWR / BOTTOM). The 50Ω microstrip trace on the top layer of the board is referenced to GND, and the 100Ω differential traces are referenced to GND.

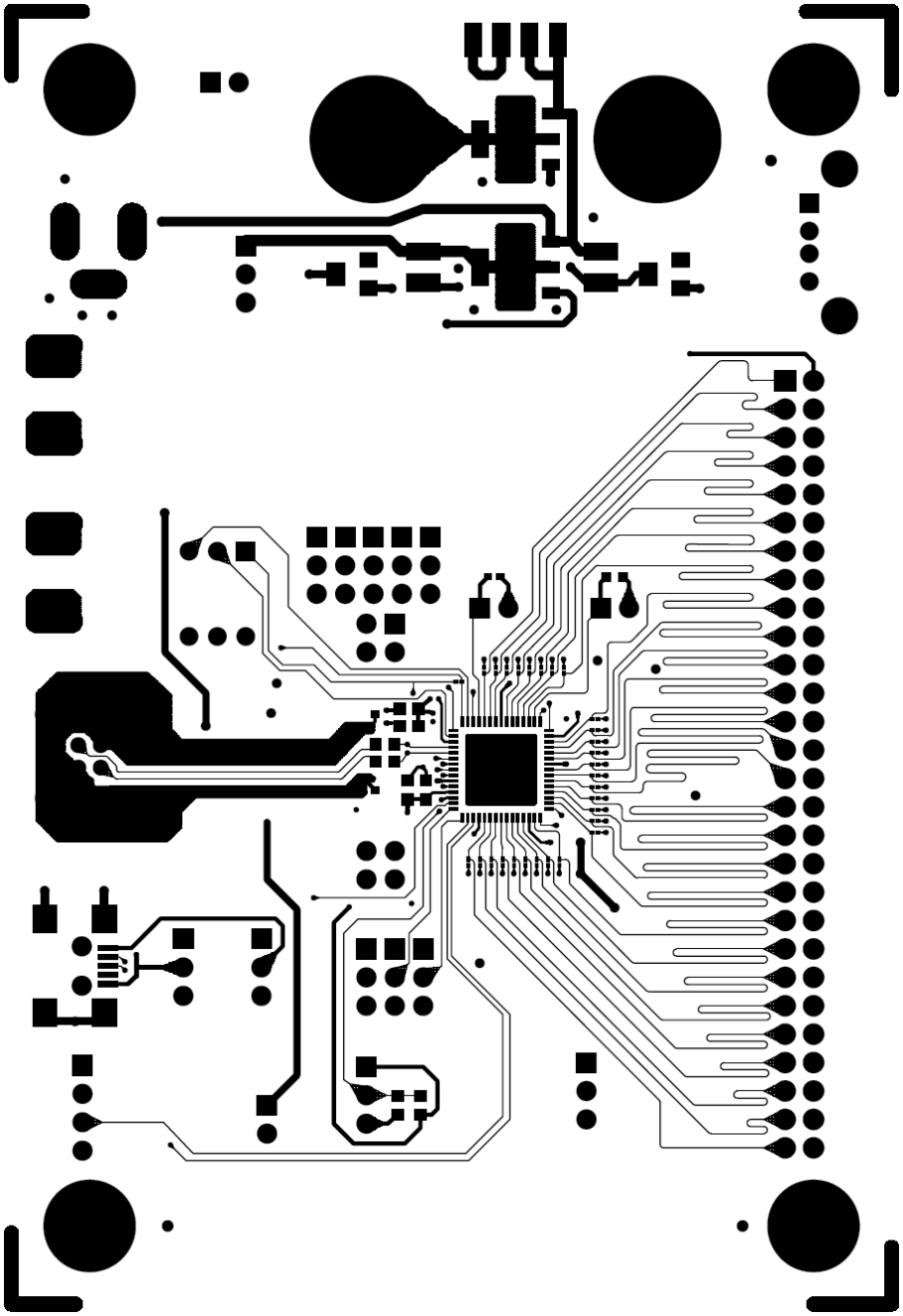


Figure 4: TOP Layer

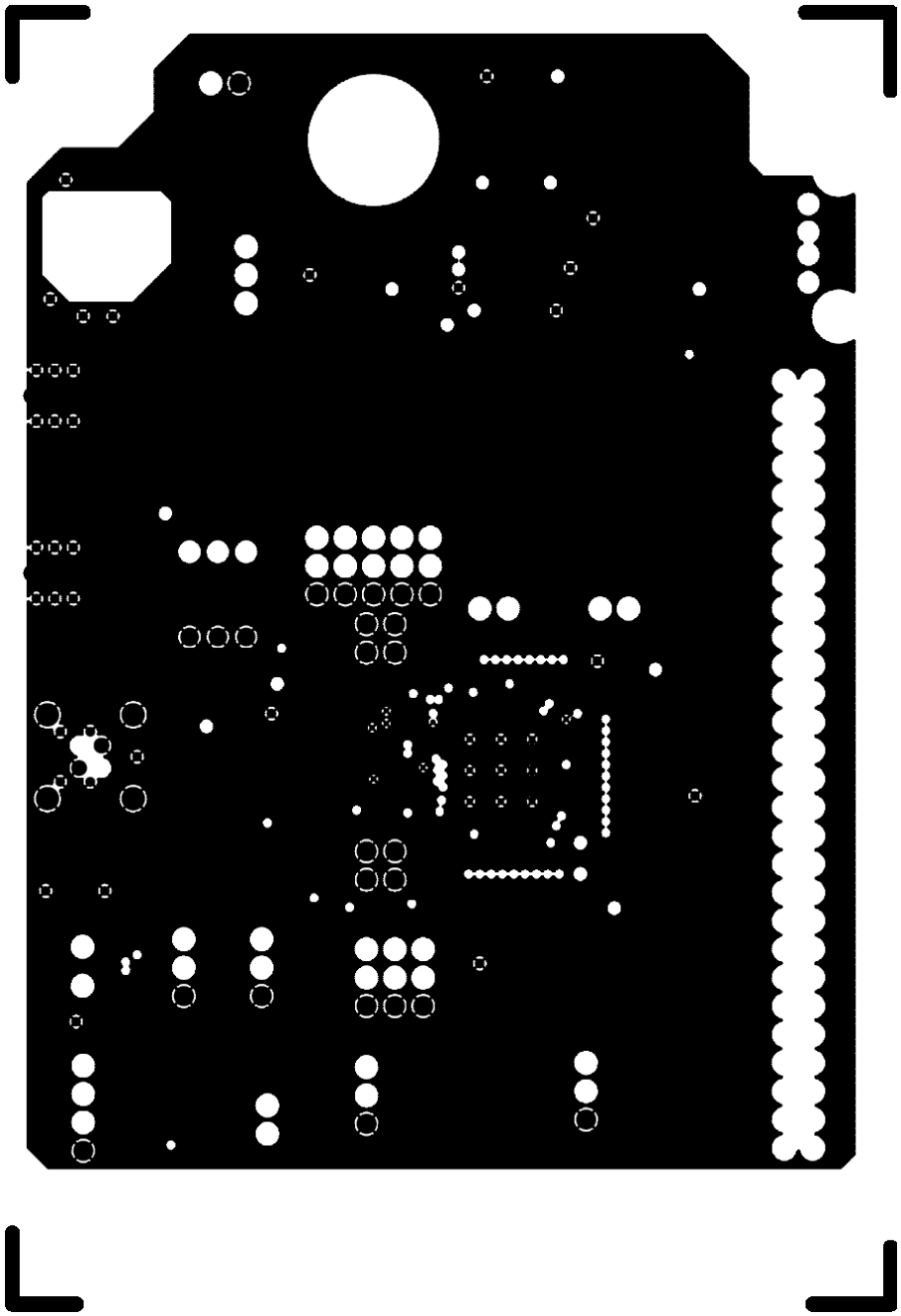


Figure 5: GND Layer

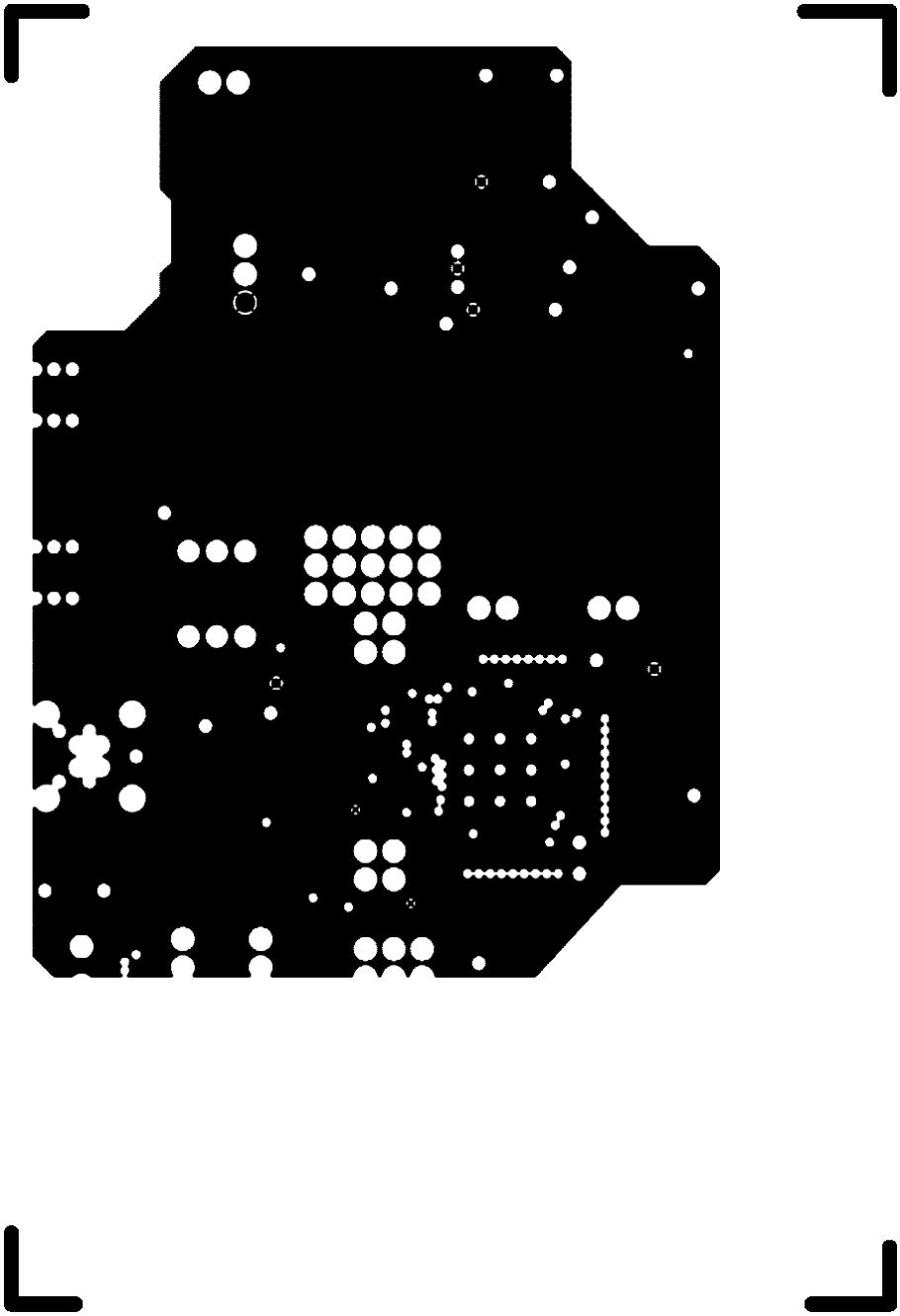


Figure 6: PWR Layer

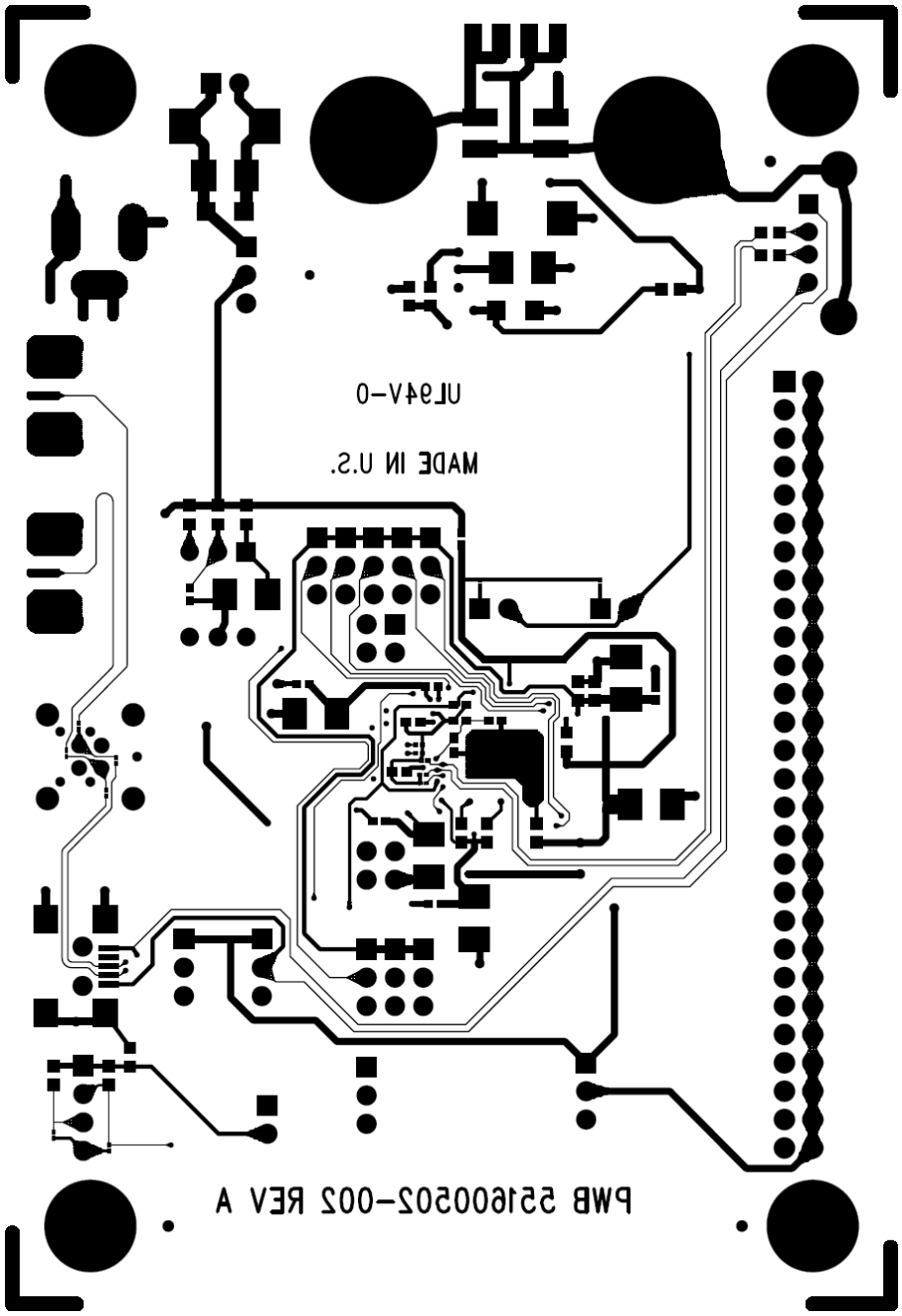
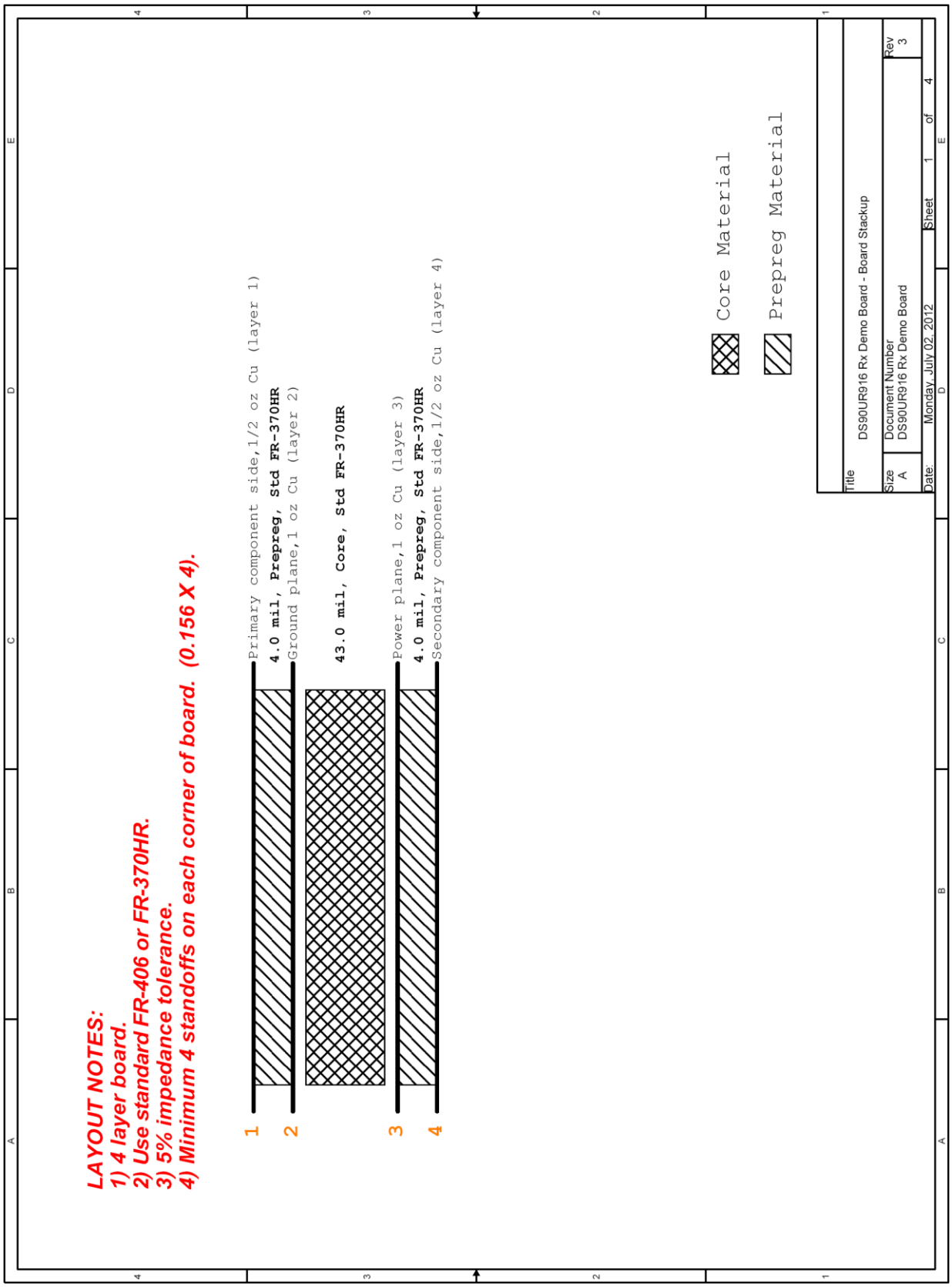
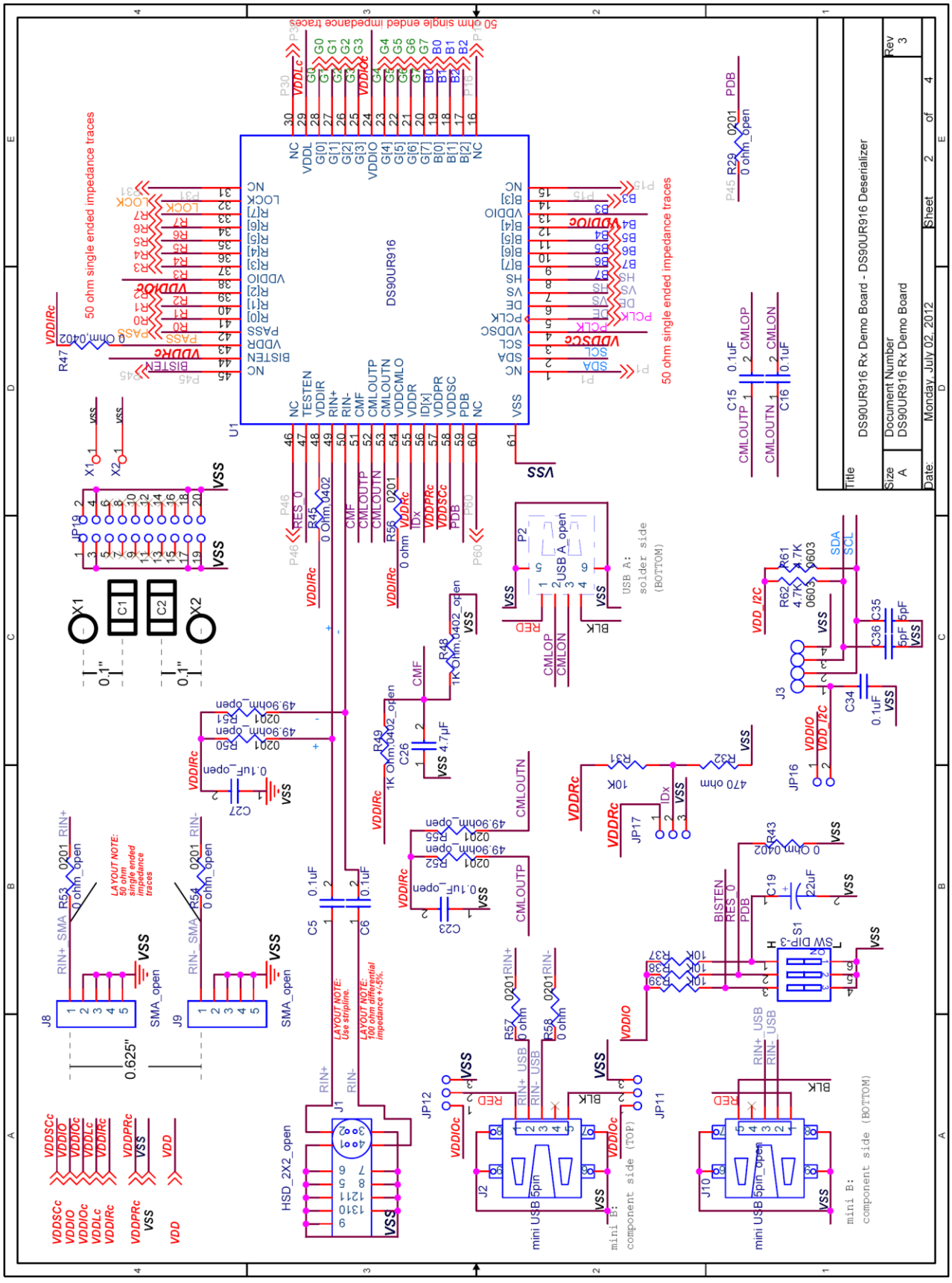
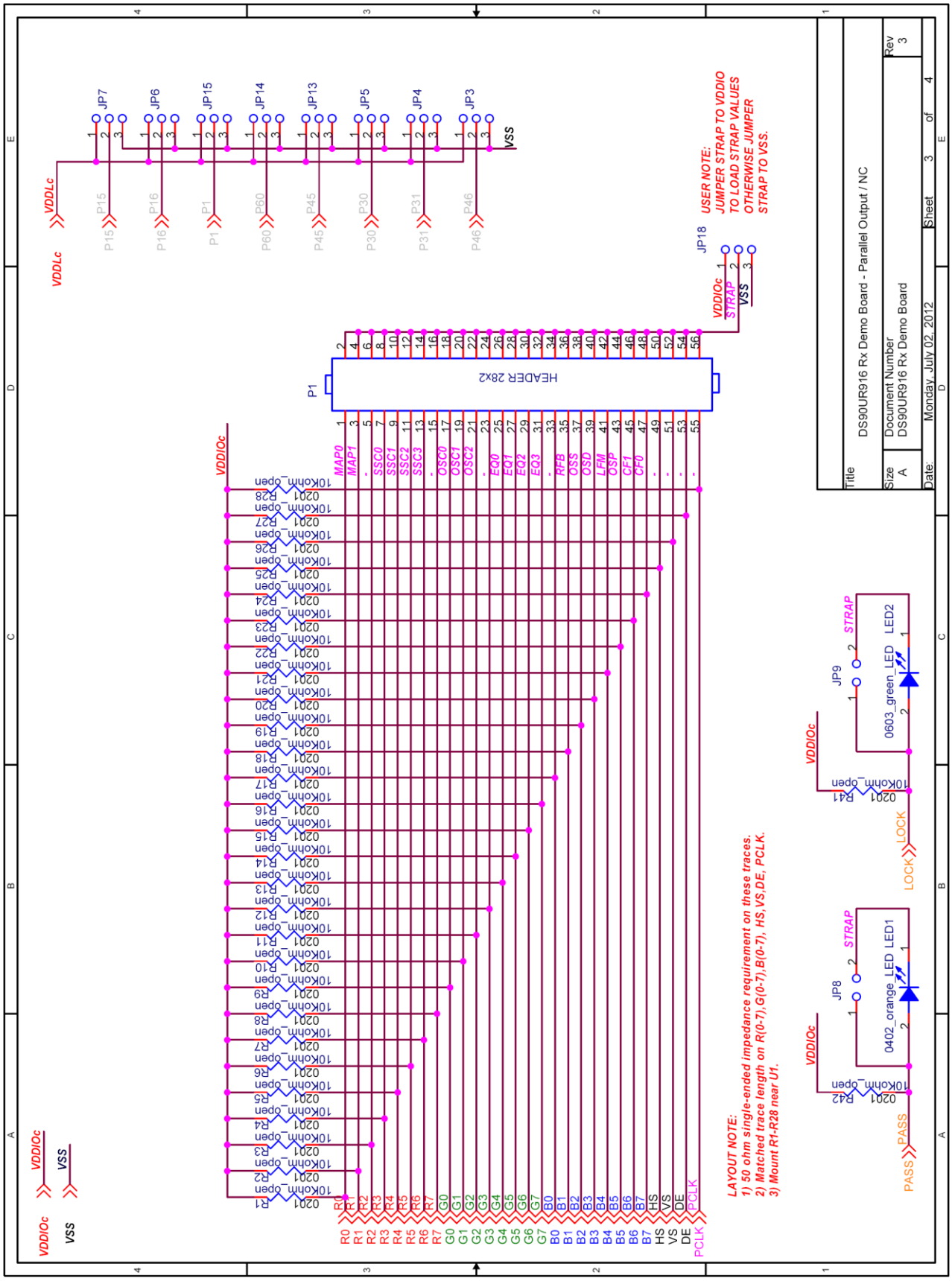


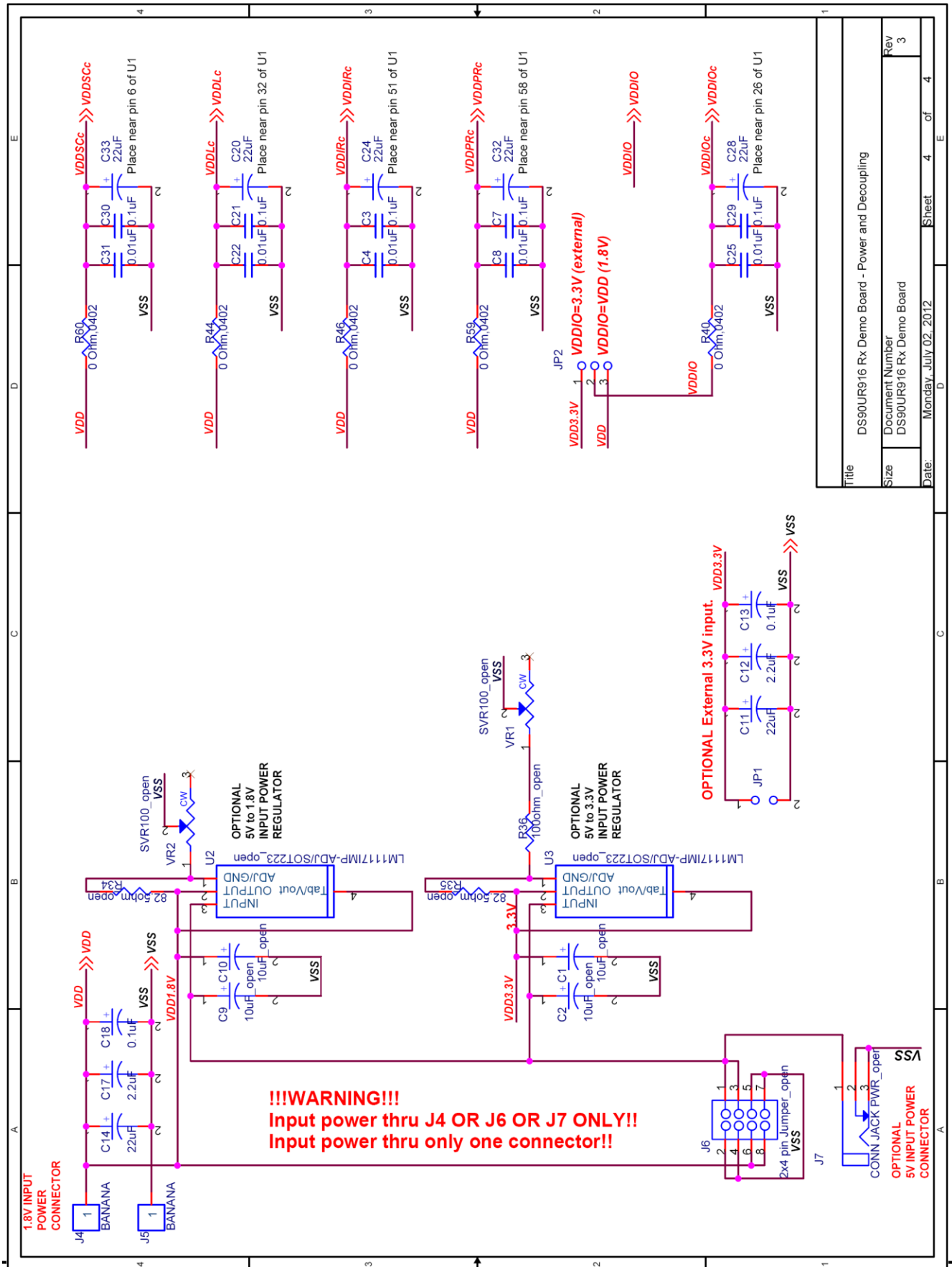
Figure 7: BOTTOM Layer

9. Schematic


LAYOUT NOTES:
1) 4 layer board.
2) Use standard FR-406 or FR-370HR.
3) 5% impedance tolerance.
4) Minimum 4 standoffs on each corner of board. (0.156 X 4).
1
Primary component side,1/2 oz Cu (layer 1)
4.0 mil, Prepreg, Std FR-370HR
2
Ground plane,1 oz Cu (layer 2)
43.0 mil, Core, Std FR-370HR
3
Power plane,1 oz Cu (layer 3)
4.0 mil, Prepreg, Std FR-370HR
4
Secondary component side,1/2 oz Cu (layer 4)
Core Material
Prepreg Material
Title
DS90UR916 Rx Demo Board - Board Stackup
Size
A
Document Number
DS90UR916 Rx Demo Board
Rev
3
Date:
Monday, July 02, 2012
Sheet
1
of
4


DS90UR916 Rx Demo Board - DS90UR916 Deserializer
DS90UR916 Rx Demo Board
Monday, July 02, 2012
DS90UR916
50 ohm single ended impedance traces
50 ohm single ended impedance traces
50 ohm single ended impedance traces
LAYOUT NOTE: 50 ohm single ended impedance traces
LAYOUT NOTE: Use stripline.
LAYOUT NOTE: 100 ohm differential impedance +/-5%
mini B: component side (TOP)
mini B: component side (BOTTOM)
USB A: solder side (BOTTOM)
HSD_2X2_open
SMA_open
0.625"
mini USB 5pin
5pin_open
SW DIP-3


Title
DS90UR916 Rx Demo Board - Parallel Output / NC
Size
A
Document Number
DS90UR916 Rx Demo Board
Rev
3
Date:
Monday, July 02, 2012
Sheet
3
of
4
HEADER 28x2
P1
JP3
JP4
JP5
JP6
JP7
JP13
JP14
JP15
JP18
VDDIOc
VSS
VDDLc
STRAP
USER NOTE:
JUMPER STRAP TO VDDIO
TO LOAD STRAP VALUES
OTHERWISE JUMPER
STRAP TO VSS.
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 R1-R28 near U1.
JP8
JP9
0402_orange_LED
0603_green_LED
LED1
LED2
LOCK
PASS
10Kohm_open
0201
MAP0
MAP1
SSC0
SSC1
SSC2
SSC3
OSC0
OSC1
OSC2
EQ0
EQ1
EQ2
EQ3
RFB
OSS
OSD
LFM
OSP
CF1
CF0
R0
R1
R2
R3
R4
R5
R6
R7
G0
G1
G2
G3
G4
G5
G6
G7
B0
B1
B2
B3
B4
B5
B6
B7
HS
VS
DE
PCLK


Title
DS90UR916 Rx Demo Board - Power and Decoupling
Size
Document Number
DS90UR916 Rx Demo Board
Rev
3
Date:
Monday, July 02, 2012
Sheet
4
of
4
VDDSCc
VDDLc
VDDIRc
VDDPRc
VDDIOc
VDDIO
VDD
VSS
VDD3.3V
VDD1.8V
3.3V
VDDIO=3.3V (external)
VDDIO=VDD (1.8V)
Place near pin 6 of U1
Place near pin 32 of U1
Place near pin 51 of U1
Place near pin 58 of U1
Place near pin 26 of U1
OPTIONAL External 3.3V input.
OPTIONAL
5V to 1.8V
INPUT POWER
REGULATOR
OPTIONAL
5V to 3.3V
INPUT POWER
REGULATOR
LM1117IMP-ADJ/SOT223_open
!!!WARNING!!!
Input power thru J4 OR J6 OR J7 ONLY!!
Input power thru only one connector!!
1.8V INPUT
POWER
CONNECTOR
OPTIONAL
5V INPUT POWER
CONNECTOR
BANANA
2x4 pin Jumper_open
CONN JACK PWR_open
SVR100_open
100ohm_open
82.5ohm_open
0 Ohm,0402
0.01uF
0.1uF
10uF_open
2.2uF
22uF

10. Bill of Materials

Table 1: Bill of Materials

DS90UR916 Rx Demo Board - Board Stackup Revised: Friday, September 18, 2009							
DS90UR916 Rx Demo Board Revision: 2							
Bill Of Materials September 18,2009 18:25:53							
Item	**Qty**	**Reference**	**Part**	**PCB Footprint**	**Comments**	**MFR**	**MFR Part#**
2	6	C3,C7,C21,C29,C30,C34	0.1uF	CAP/HDC-0603	CAP .1UF ±10% 25V CERAMIC X7R 0603	Panasonic	ECJ-1VB1E104K
3	5	C4,C8,C22,C25,C31	0.01uF	CAP/HDC-0603	CAP CERAMIC .01UF 100V X7R 0603	KEMET	C0603C103K1RACTU
4	4	C5,C6,C15,C16	0.1uF	CAP/HDC-0603	CAP CERAMIC .1UF 50V X7R 0603	Panasonic	ECJ-1VB1H104K
5	2	C11,C14	22uF	CAP/N	CAP TANTALUM 22UF 25V 20% SMD	nichicon	F931E226MNC
6	2	C12,C17	2.2uF	3528-21_EIA	CAPACITOR TANT 2.2UF 20V 10% SMD	KEMET	T491B225K020AT
7	2	C18,C13	0.1uF	CAP/HDC-1206	CAP .10UF 50V CERAMIC X7R 1206	KEMET	C1206C104K5RACTU
8	6	C19,C20,C24,C28,C32,C33	22uF	CAP/EIA-B 3528-21	CAPACITOR TANT 22UF 16V 20% SMD	Kemet	T494B226M016AT
10	1	C26	4.7µF	CAP/HDC-0402	CAP CERAMIC 4.7UF 6.3V X5R 0402	Panasonic	ECJ-0EB0J475M
11	2	C35,C36	5pF	CAP/HDC-0201	CAP CERAMIC 5.0PF 25V NP0 0201	Panasonic	ECJ-ZEC1E050C
12	2	JP1,JP16	2-Pin Header	Header/2P	CONN HEADER VERT .100 2POS 30AU	AMP/Tyco	87220-2
13	3	JP2,JP17,JP18	3-Pin Header	Header/3P	CONN HEADER VERT .100 3POS 15AU	AMP/Tyco	87224-3
16	2	JP11,JP12	3-Pin Header	Header/3P	CONN HEADER VERT .100 3POS 15AU.	AMP/Tyco	87224-3
18	1	J1	HSD_2X2	CON/HSD-4P	Automotive HSD Connector - Right Angle Plug for PCB	Rosenberger	D4S20B-40ML5-Y
19	1	J2	mini USB 5pin	mini_B_USB_surface_mount	CONN RECEPT MINI USB2.0 5POS.	Hirose	UX60-MB-5ST
20	1	J3	IDC1X4	IDC-1x4	CONN HEADER 4POS .100 VERT GOLD	Molex/Waldom Electronics Corp	22-11-2042
21	2	J4,J5	BANANA	CON/BANANA-S	BANANA-female (non-insulated)	Johnson	108-0740-001
26	1	LED1	0402_orange_LED	0402 SMT	LED ORN/CLEAR 610NM 0402 SMD	Lumex Opto/Components Inc	SML-LX0402SOC-TR
27	1	LED2	0603_green_LED	0603 (Super Thin)	LED GREEN CLEAR THIN 0603 SMD	LITE-ON INC	LTST-C191KGKT
28	1	P1	HEADER 28x2	2x28 0.1"	CONN HEADER VERT 56POS .100 30AU. Cut 60 POS or use AMP part #2-87215-9.	AMP/TYCO	3-87215-0
32	4	R31,R37,R38,R39	10K	RES/HDC-0603	RES 10.0K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF1002V
33	1	R32	470 Ohm	RES/HDC-0603	RES 470 OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF4700V
37	8	R40,R43,R44,R45,R46,R47, R59,R60	0 Ohm,0402	RES/HDC-0402	RES ZERO OHM 1/16W 5% 0402 SMD	Panasonic	ERJ-2GEJ0R00X
40	1	R56	0 ohm	RES/HDC-0201	RES 0.0 OHM 1/20W 5% 0201 SMD.	Panasonic	ERJ-1GE0R00C
41	2	R62,R61	4.7K	RES/HDC-0603	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ472V
42	1	S1	SW DIP-3	DIP-6	SWITCH DIP EXTENDED SEALED 3POS	Grayhill	78B03ST
43	1	U1	DS90UR916	60ld LLP	DO NOT PURCHASE, National will supply.	National	DS90UR916

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Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment 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: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. 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 Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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
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.

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.

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.

【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM)
WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 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 the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its 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 use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI 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 you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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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.

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