

SERDESUB-913 User's Guide

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Introduction:

National Semiconductor's Automotive SERDES DS90UB913/914Q FPD-Link III evaluation kit contains one (1) DS90UB913Q Serializer board and one (1) DS90UB914Q Deserializer board. The boards are mounted with the Rosenberger connectors for connectivity using the Leoni-Dacar cables (not sent along with the kits). The boards also have the option of being populated with single ended coaxial cables. This mode is for evaluation purposes only.

The DS90UB913Q/914Q chipset supports a variety of automotive mega-pixel camera systems over a two (2) wire serial stream. The single differential pair (FPD-Link III) is well-suited for direct connections between an imager and Host Controller/Electronic Control Unit (ECU)/FPGA. The bidirectional control channel of the DS90UB913Q/914Q provides seamless communication between the ECU/FPGA and the display module.

This kit will demonstrate the functionality and operation of the DS90UB913Q and DS90UB914Q chipset. The chipset enables transmission of a high-speed video data along with a low latency bi-directional control bus over a single twisted pair cable. The integrated control channel transfers data bi-directionally over the same serial video link. The transport delivers 10/12 bits of parallel data, two SYNC bits and PCLK together with a bidirectional control channel that supports an I²C bus. Additionally, there are four unidirectional general purpose (GPI and GPO) signal lines for sending control data. This interface allows transparent full-duplex communication over a single high-speed differential pair, carrying asymmetrical bi-directional control information without the dependency of video blanking intervals. The Serializer and Deserializer chipset is designed to transmit data at PCLK clocks speeds ranging from 10 to 100 MHz and I²C bus rates up to 400 kbps at up to 10 meters cable length over -40 to +105 Deg C.

The user needs to supply only a single 5V supply to the Deserializer boards as these kits have power transfer over coax/ power transfer over differential pair capabilities.

The demo boards can be used for EMI testing.

System Requirements:

In order to demonstrate, the following are required:

- 1) Mega-pixel imager modules such as the Omnivision OV10630 or Aptina MT9M023/24.
- 2) Microcontroller (MCU) or FPGA with I²C interface bus (I²C master)
 - a. slave clock stretching must be supported by the I²C master controller/MCU.
- 3) External peripheral device that supports I²C (slave mode)
- 4) 5V power supply.

Contents of the Demo Evaluation Kit:

- 1) One Serializer board with the DS90UB913Q
- 2) One Deserializer board with the DS90UB914Q

DS90UB913Q/914Q SerDes Typical Application

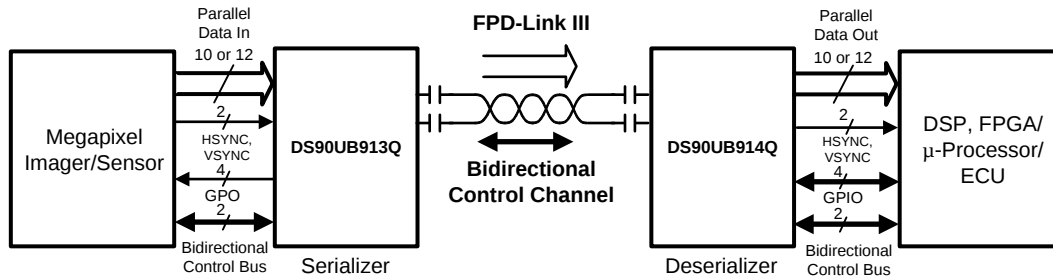


Figure 1. Typical Application of DS90UB913Q/914Q Chipset

The diagram above illustrates a typical application of DS90UB913Q/914Q chipset. The ECU/FPGA can program device registers on the DS90UB913Q, DS90UB914Q, and remote peripheral device, such as a display module.

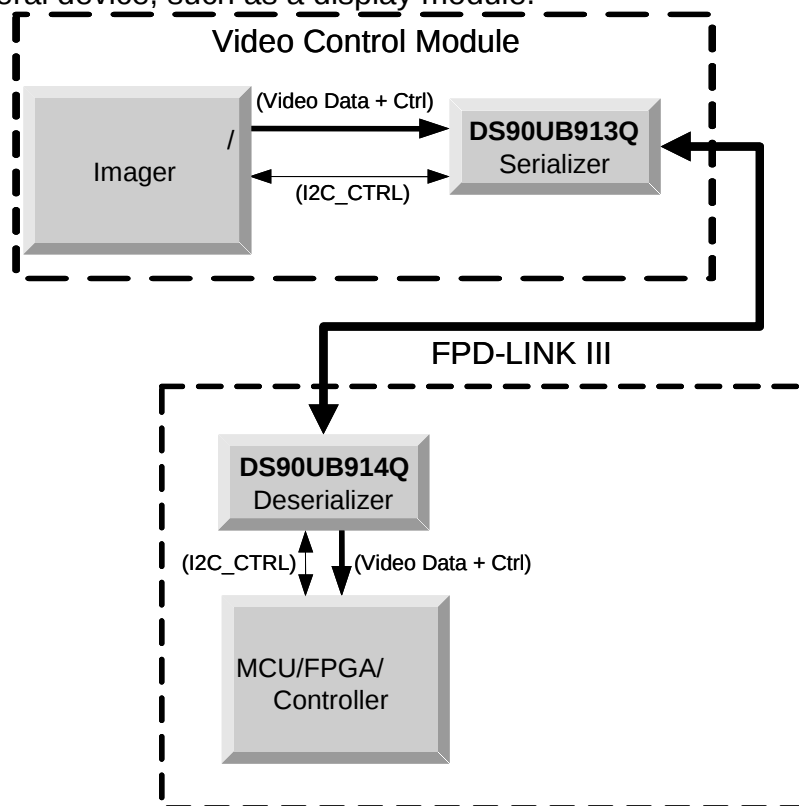


Figure 2. Typical DS90UB913Q/914Q Imager System Diagram

Refer to the proper datasheet information on Chipsets (Serializer/Deserializer) for more detailed information.

How to set up the Demo Evaluation Kit:

The DS90UB913Q/914Q evaluation boards consist of two sections. The first part of the board provides the point-to-point interface for transmitting parallel video data. The second part of the board allows bi-directional control communication of an I²C bus control of using a MCU/FPGA to programming a remote peripheral device via the Serializer.

The PCB routing for the Serializer input pins (DIN) accept incoming parallel video data at 1.8V/3.3V LVCMOS signals from J1 IDC connector. The FPD-Link III interface can use a single twisted pair cable or a single coax cable. The output pins (ROUT) are accessed through a JP1 IDC connector. Please follow these steps to set up the evaluation kit for bench testing and performance measurements:

- 1) Connect the DS90UB913/914Q demo boards using a Leoni/Dacar cable or a coaxial cable(not provided)
- 2) Jumpers and switches have been configured at the factory; they should not require any changes for immediate operation of the chipset. See text on Configuration settings and datasheet for more details. The jumpers and connectors are configured in external oscillator mode with the VDDIOs toggling at 3.3V.
- 3) From the imager, connect a flat cable (not supplied) to the Serializer board and connect another flat cable (not supplied) from the Deserializer board to the ECU/FPGA module.
Note: For 50 ohm signal sources, provide 1.8V/3.3V LVCMOS input signal levels into DIN[12:0], HS, VS and PCLK
- 4) Connect the Deserializer I²C ports to the I²C of the MCU/FPGA (I²C master). Connect the Serializer I²C ports to the I²C bus of the peripheral slave device.
- 5) Power for the Serializer and Deserializer boards must be supplied externally through JP5 on the Deserializer board and JP4 on the Serializer board.

Bi-Directional Control Bus And I²C Modes:

In order to communicate and synchronize with remote devices on the I²C bus through the bi-directional control channel, slave clock stretching must be supported by the I²C master controller/ECU. The chipset utilizes bus clock stretching (holding the SCL line low) during data transmission; where the I²C slave pulls the SCL line low prior to the 9th clock of every I²C data transfer (before the ACK signal).

The bidirectional control bus supports an I²C compatible interface that allows programming of the DS90UB913Q, DS90UB914Q, or an external remote device (such as an imager). Register programming transactions to/from the DS90UB913Q/914Q chipset are employed through the clock (SCL) and data (SDA) lines. These two signals have open drain I/Os and must be pulled-up to VDDIO by external resistors. The boards have an option to use the on-board 10K Ω pull-up resistors tied to VDDIO or connected through external pull-ups at the target Host. The appropriate pull-up resistor values will depend upon the total bus capacitance and operating speed. The DS90UB913Q/914Q I²C bus data rate supports up to 400 kbps according to I²C specification.

Demo Board Power Connections:

Power should be only applied to the DS90UB914Q Deserializer boards. Power is transferred over the link using either the Differential pair.

DS9UB913Q Serializer Board Description:

The 2x15-pin IDC connector JP1 accepts 10/12 bits of 1.8V or 3.3V data, HS, VS and PCLK. VDDIO must be set externally for 1.8V or 3.3V LVCMOS inputs using jumper JP8 and JP6 on the Serializer and Deserializer boards respectively.

The Serializer board can be powered from the Deserializer board. For the Serializer to be operational, the S1-PDB switch on 1 must be set HIGH. S1-RES0 must be set LOW.

The boards can be connected to the Deserializer boards using either Rosenberger connectors.

Configuring the Mode Pin on the Serializer Board

To configure the device in the external oscillator mode, PCLK mode or the AON clock mode, switch S8 has to be configured as shown in Table. 1.

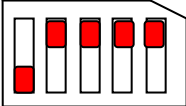
Mode Configuration	Switch S8 Settings
PCLK from imager	
External Oscillator Mode	

Table 1. Mode switch configuration on the Serializer Board

Serializer LVCMOS Pinout by Connector

The following three tables illustrate how the Deserializer connections are mapped to the IDC connector J1 on the Serializer board.

JP1 LVCMOS I/O			
pin no.	name	name	pin no.
1	GND	DIN0	2
3	GND	DIN1	4
5	GND	DIN2	6
7	GND	DIN3	8
9	GND	DIN4	10
11	GND	DIN5	12
13	GND	DIN6	14
15	GND	DIN7	16
17	GND	DIN8	18
19	GND	DIN9	20
21	GND	DIN10	22
23	GND	DIN11	24
25	GND	HS	26
27	GND	VS	28
29	GND	PCLK	30

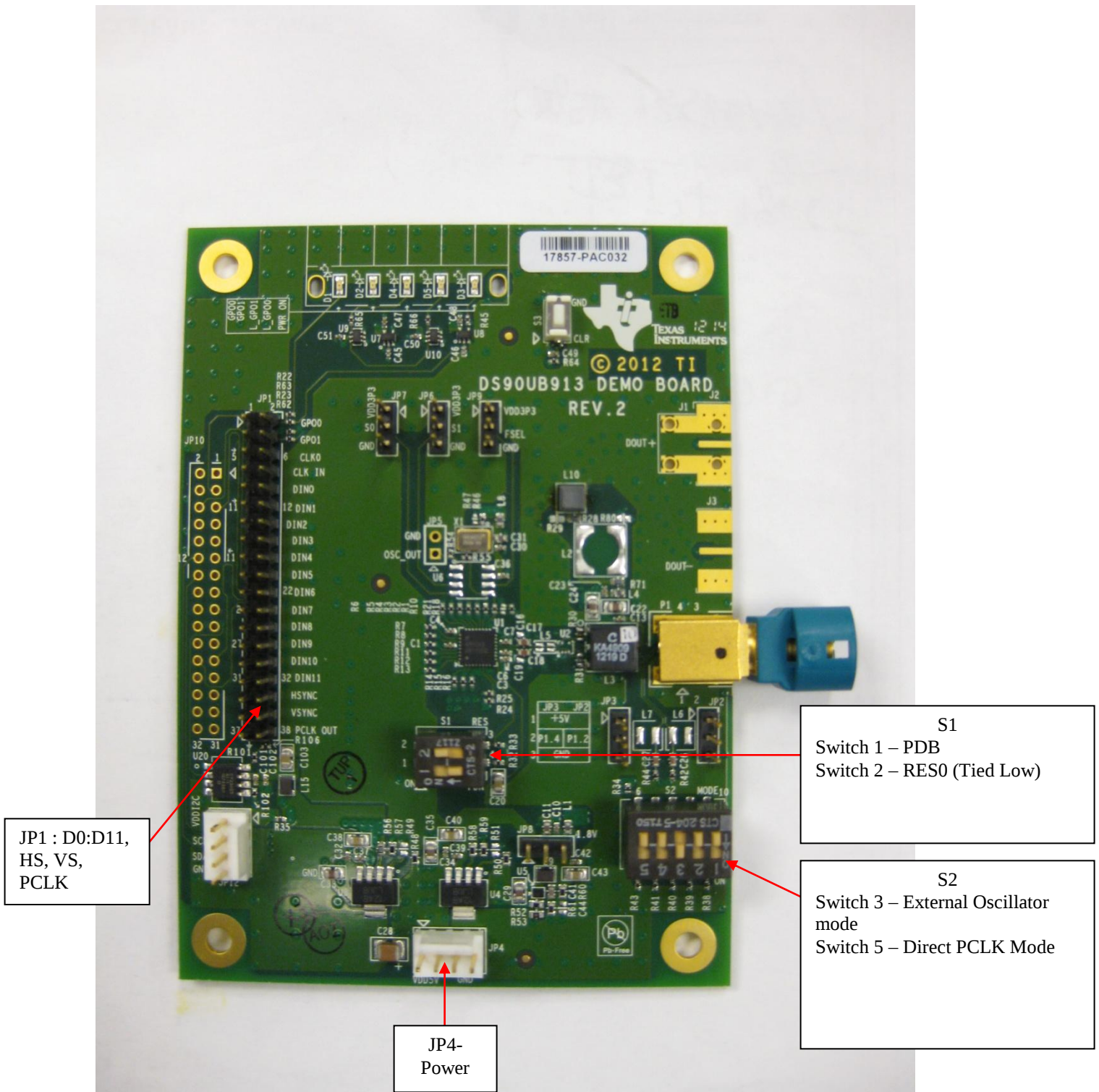


Figure 3. DS90UB913Q Boards with HSD Connector

DS9UB914Q Deserializer Board Description:

The Deserializer board can be powered using header JP5. For the Deserializer to be operational, follow the dip switch configuration for S1 and S2 shown in Table 2 and Table 3. The 2x15 pin IDC Connector JP1 provides access to the 1.8V or 3.3V LVCMOS data, HS, VS and PCLK outputs.

The Deserializer board is by default configured to operate in the 100MHz mode with 3.3V I/O. The default device address of the DS90UB914Q on the Board is C0.

Dip Switch S2 Configuration on the Deserializer Board

To configure the DS90UB914Q device on the Deserializer board, please follow Table.2.

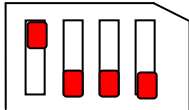
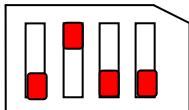
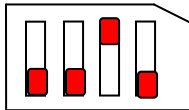
Mode Configuration	Switch S6 Settings
12-bit Low Frequency Mode	
12-bit High Frequency Mode	
10-bit Mode	

Table 2. Mode Switch Configuration on the Deserializer Board

Dip Switch S1 Configuration on the Deserializer Board

To configure the DS90UB914Q device on the Deserializer board, please follow Table.2.

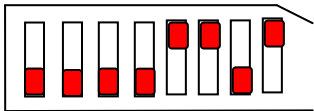
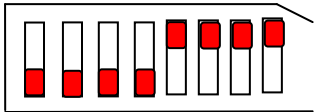
Mode Configuration	Switch S6 Settings
Normal Mode configuration	
BIST Mode configuration	

Table 3. Mode Switch Configuration on the Deserializer Board

Deserializer LVCMOS Pinout by Connector

The following table illustrates how the Deserializer connections are mapped to the IDC connector J1 on the Serializer board.

J1 LVCMOS I/O			
pin no.	name	name	pin no.
1	ROUT0	GND	2
3	ROUT1	GND	4
5	ROUT2	GND	6
7	ROUT3	GND	8
9	ROUT4	GND	10
11	ROUT5	GND	12
13	ROUT6	GND	14
15	ROUT7	GND	16
17	ROUT8	GND	18
19	ROUT9	GND	20
21	ROUT10	GND	22
23	ROUT11	GND	24
25	HS	GND	26
27	VS	GND	28
29	PCLK	GND	30

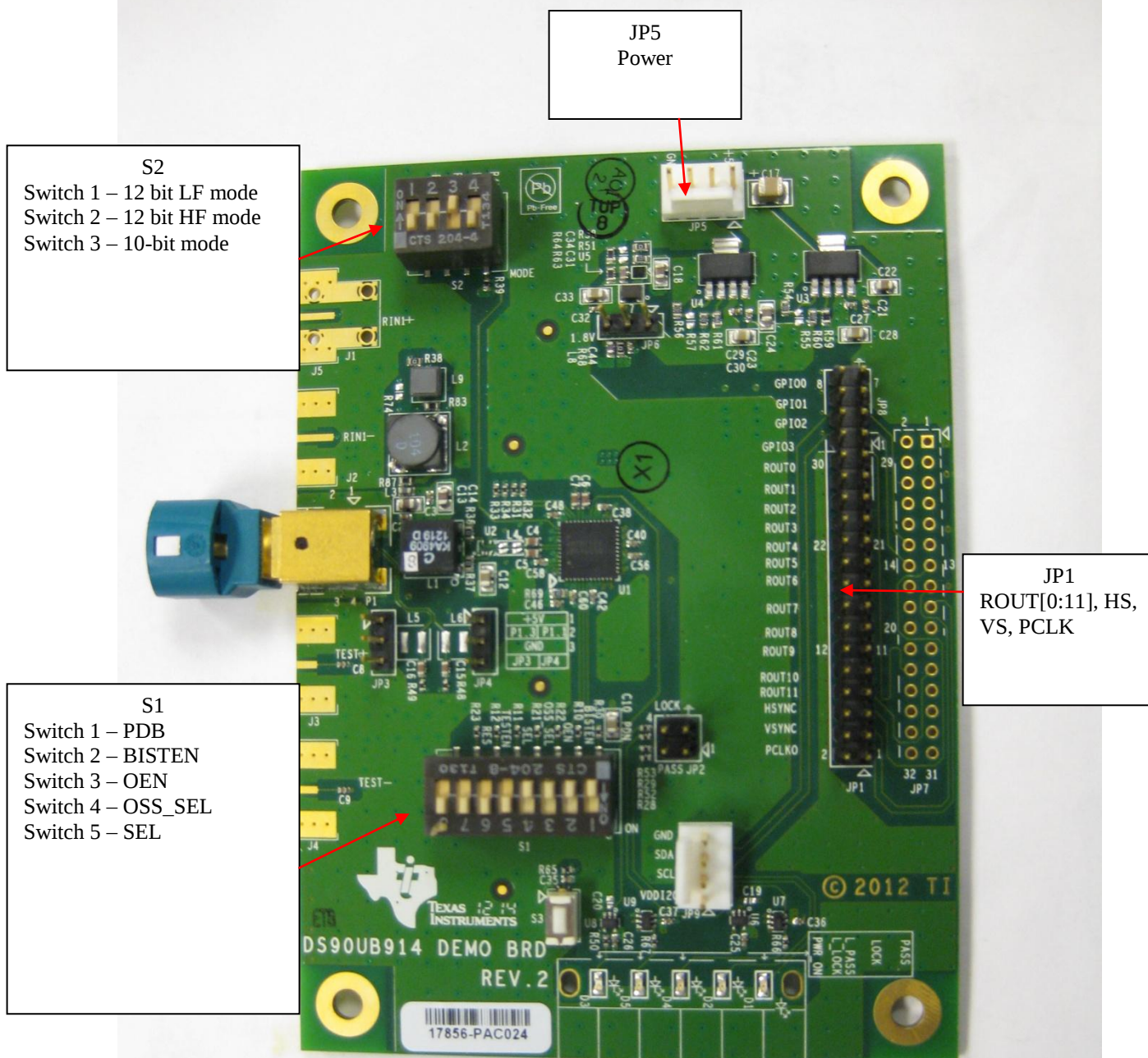


Figure 4. DS90UB914Q Deserializer boards with HSD Connectors

Typical Connection and Test Equipment

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

- 1) Image Sensor such as the OV10630 or MT9M024
- 2) Any other signal generator / video source that generates the correct input levels.

The following is a list of typical test equipment that may be used to monitor the output signals from the Deserializer:

- 1) Microcontroller or FPGA with an I²C interface
- 2) Optional – Logic Analyzer or Oscilloscope
- 3) Any SCOPE with a bandwidth of at least 50MHz for 1.8V/3.3V LVCMOS and/or 1.5GHz for observing differential signals.

Troubleshooting Demo Setup

If the demo boards are not performing properly, use the following as a guide for quick solutions to potential problems. If the problem persists, please contact the local Sales Representative for assistance.

QUICK CHECKS:

1. Check that Powers and Grounds are connected to both Serializer and Deserializer boards.
2. Verify input clock and input data signals meet requirements (VIL, VIH, tset, thold), Also verify that data is strobed on the selected rising/falling (RFB register) edge of the clock.
3. Check that the Jumpers and Switches are set correctly.
4. Check that the cable is properly connected.

TROUBLESHOOTING CHART

Problem...	Solution...
There is only the output clock.	Make sure the data is applied to the correct input pin.
There is no output data.	Make sure data is valid at the input.
No output data and clock.	Make sure Power is on. Input data and clock are active and connected correctly.
Power, ground, input data and input clock are connected correctly, but no outputs.	Check the Power Down pins of both Serializer and Deserializer boards to make sure that the devices are enabled (PDB=Vdd) for operation.
The devices are pulling more than 1A of current.	Check for shorts in the cables connecting the Serializer and Deserializer boards.
After powering up the demo boards, the power supply reads less than 1.8V when it is set to 1.8V.	Use a larger power supply that will provide enough current for the demo boards, a 500mA minimum power supply is recommended.

Note: Please note that the following references are supplied only as a courtesy to our valued customers. It is not intended to be an endorsement of any particular equipment or supplier.

Cable References

For optimal performance, we recommend Shielded Twisted Pair (STP) 100ohm differential impedance and 24 AWG (or larger diameter) cable for high-speed data applications.

Leoni Dacar 535 series cable:

www.leoni-automotive-cables.com

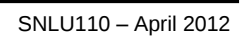
Rosenberger HSD connector:

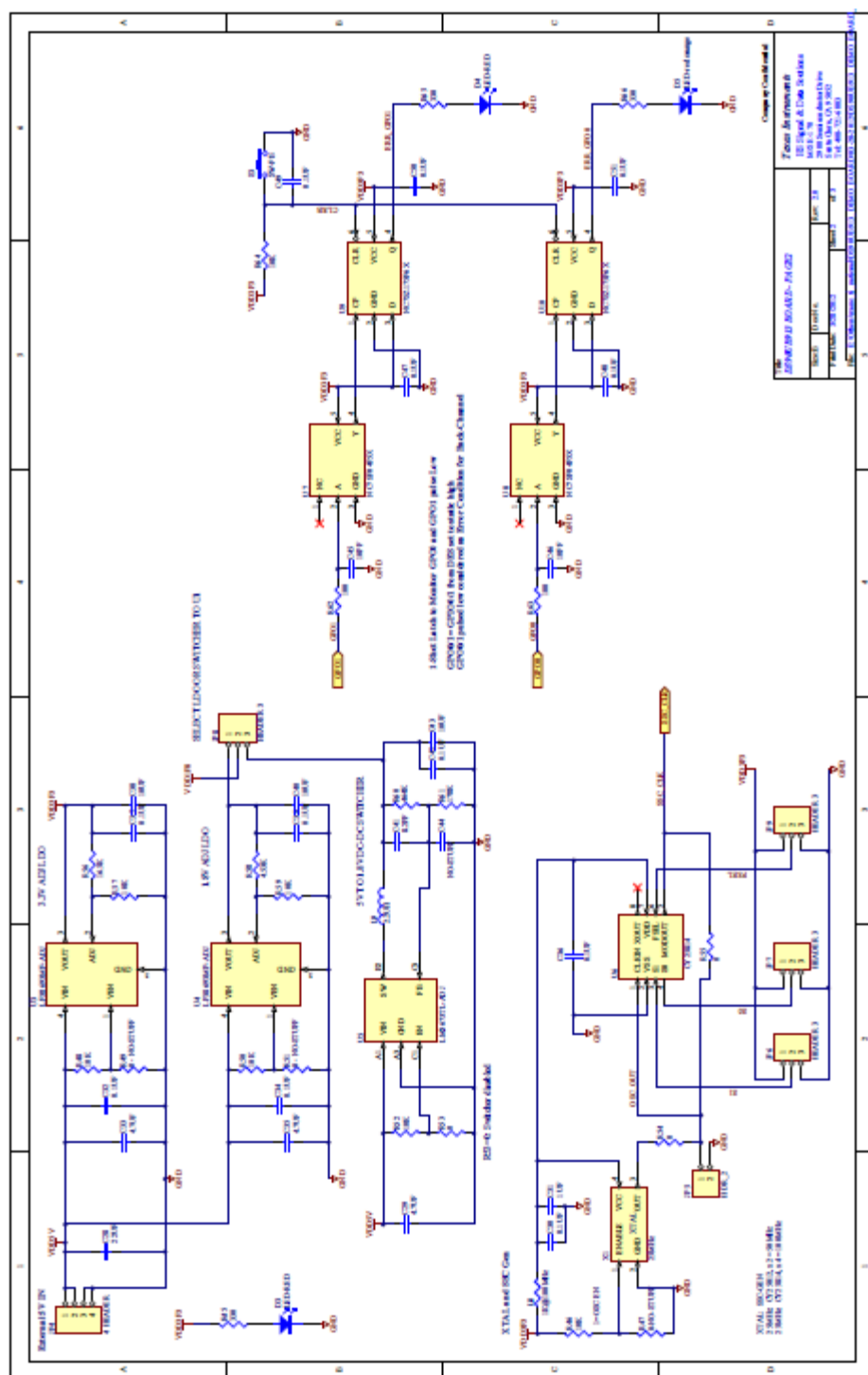
www.rosenberger.de/en/Products/35_Automotive_HSD.php

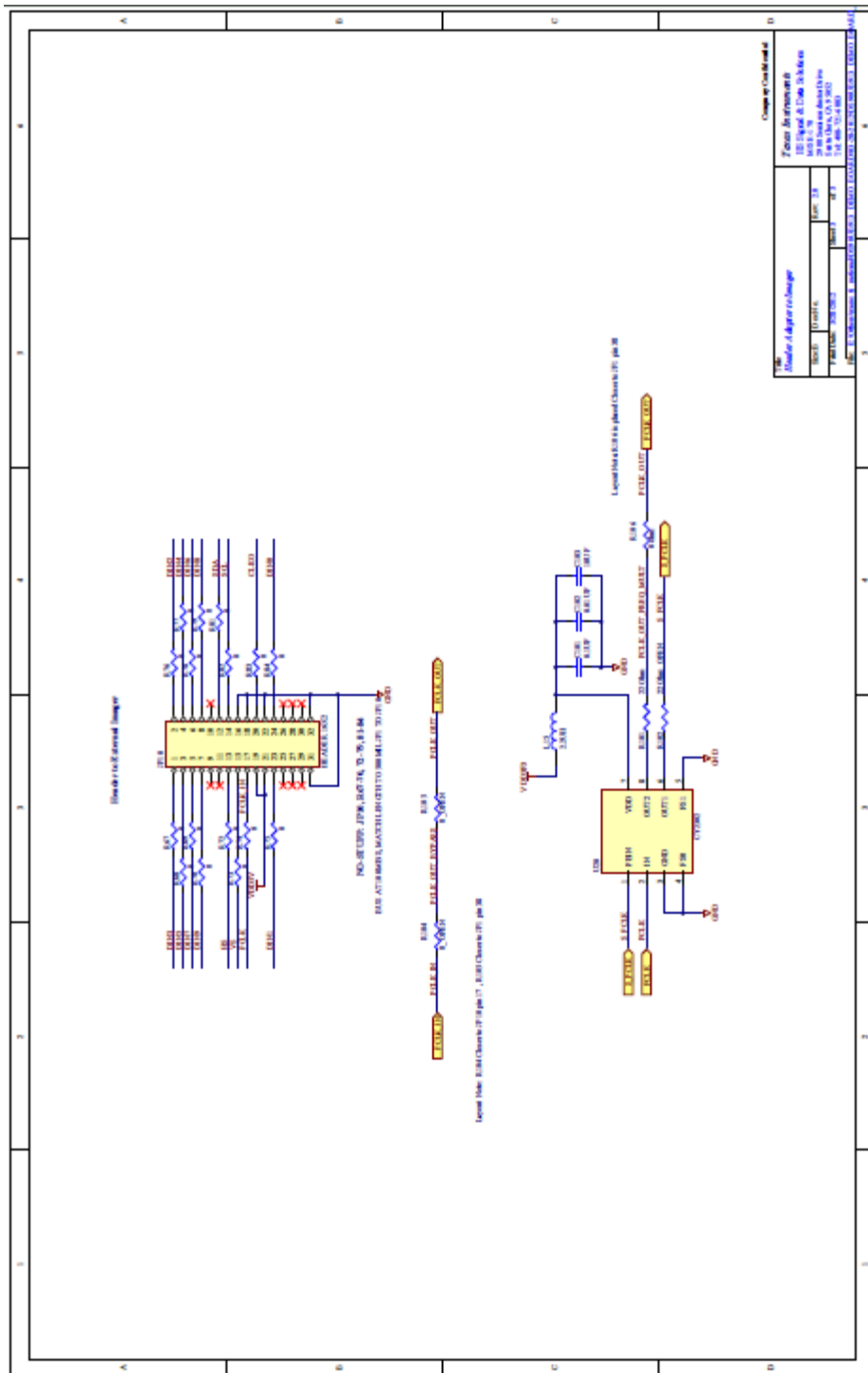
Equipment References

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

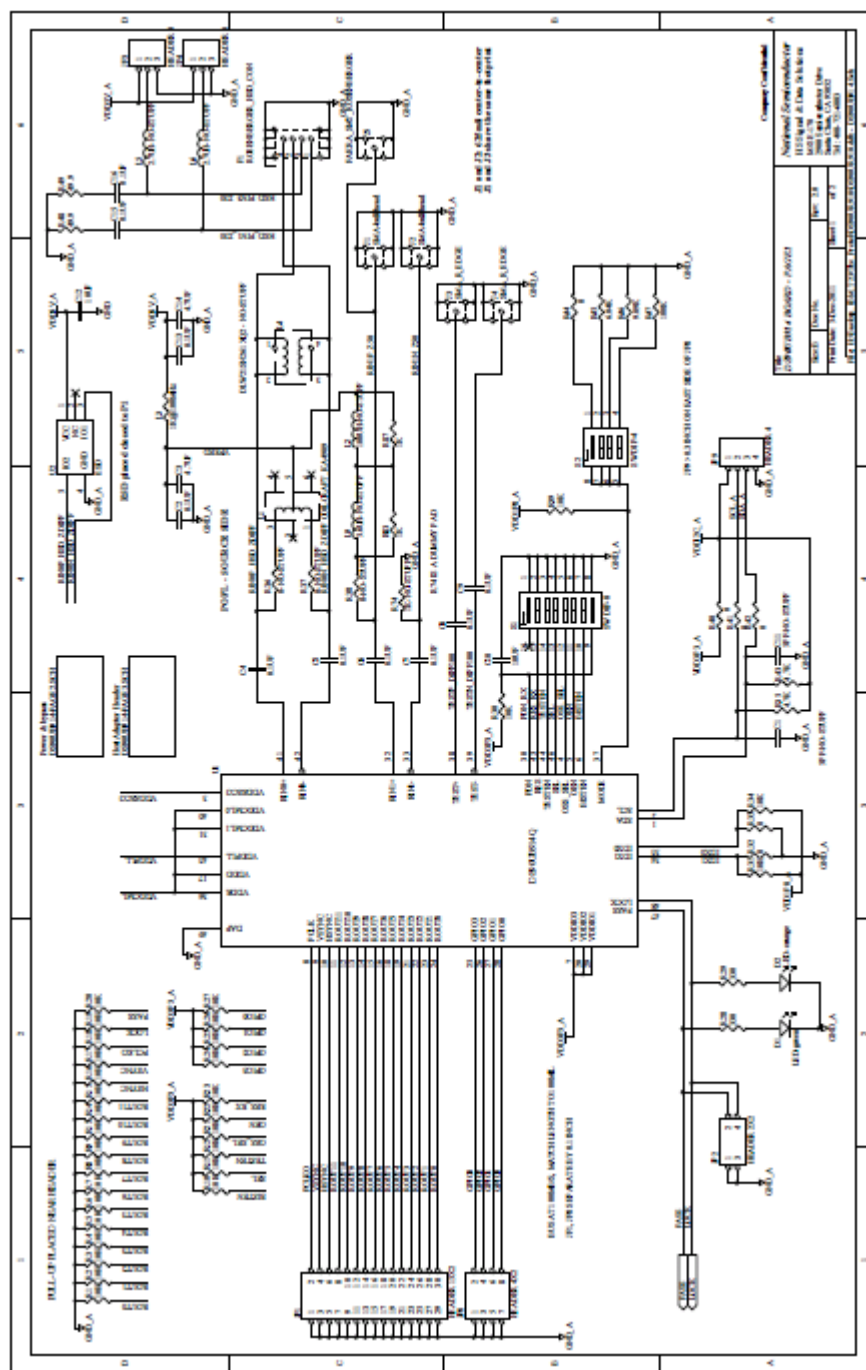
www.corelis.com/products/I2C-Analyzer.htm

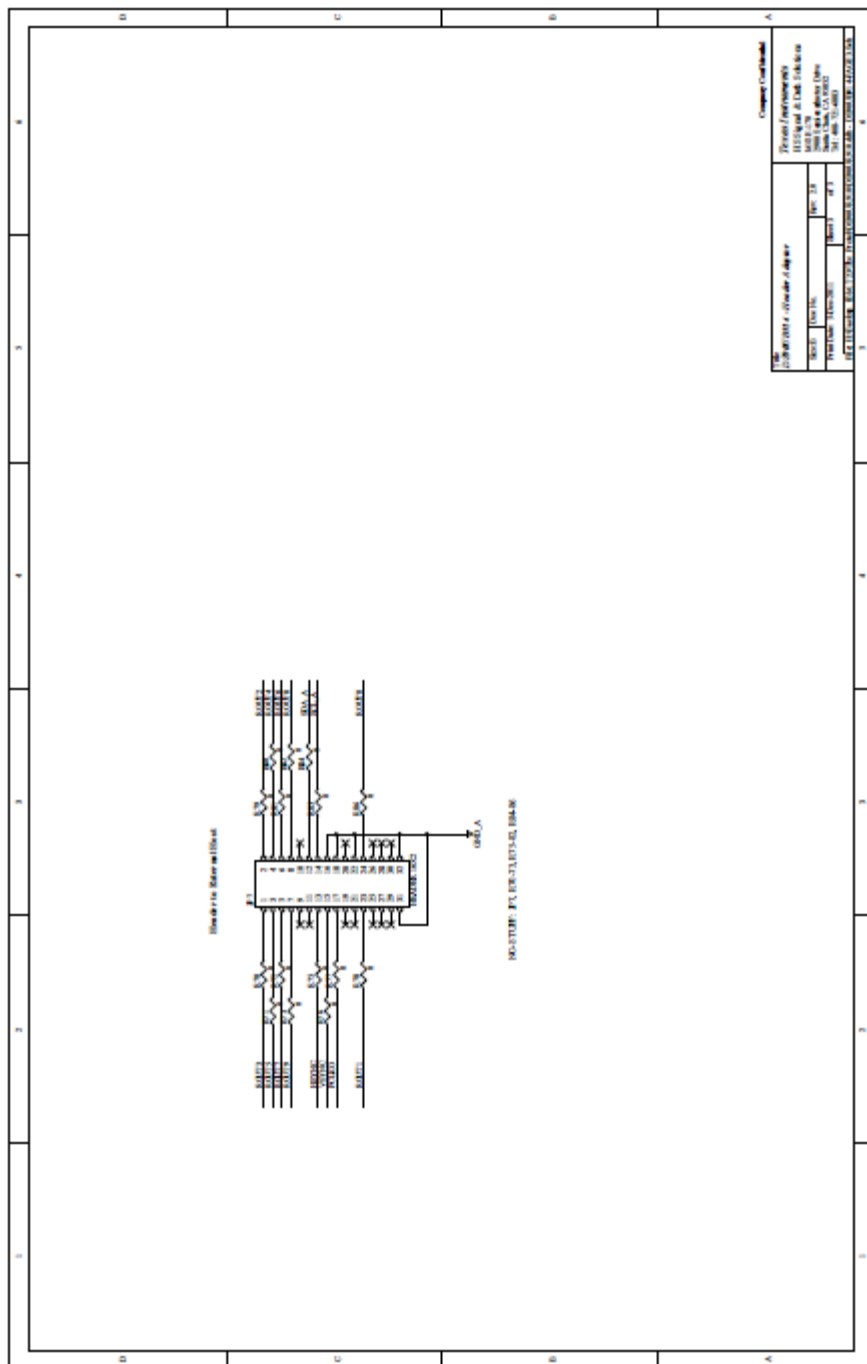






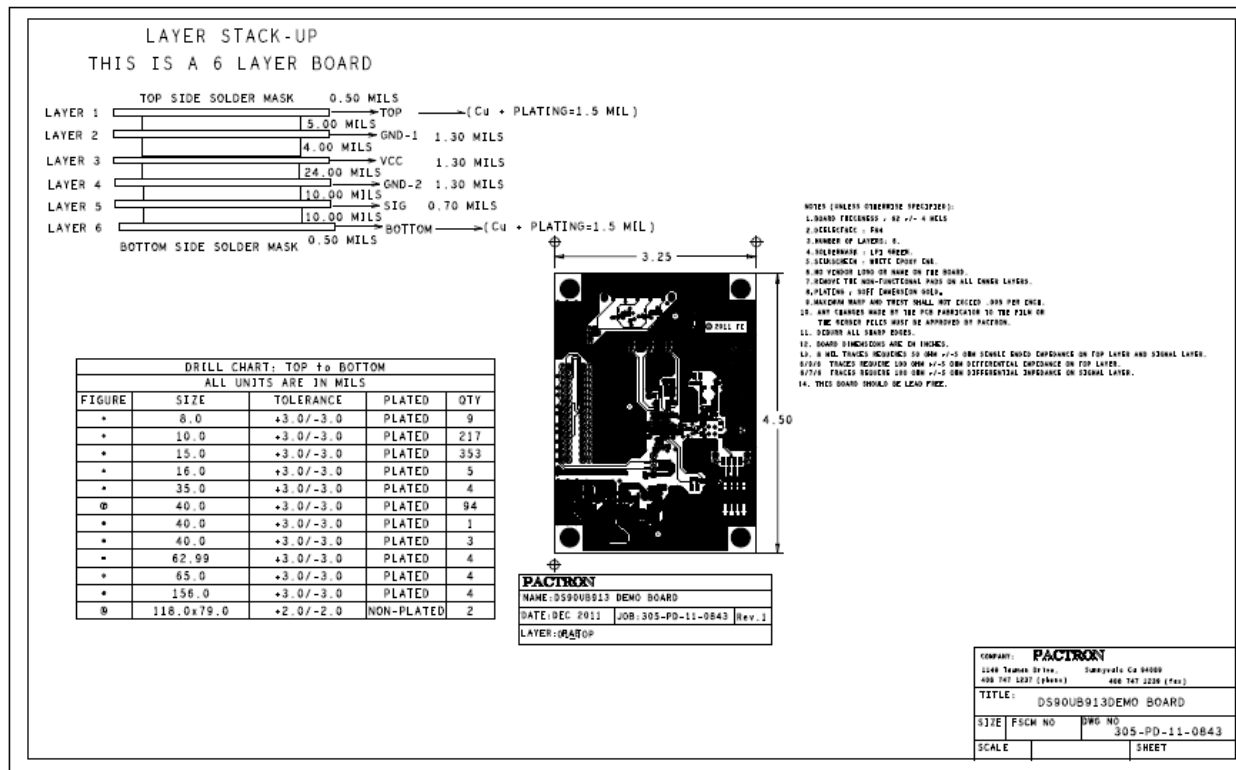
DS90UB914Q EVK Schematic

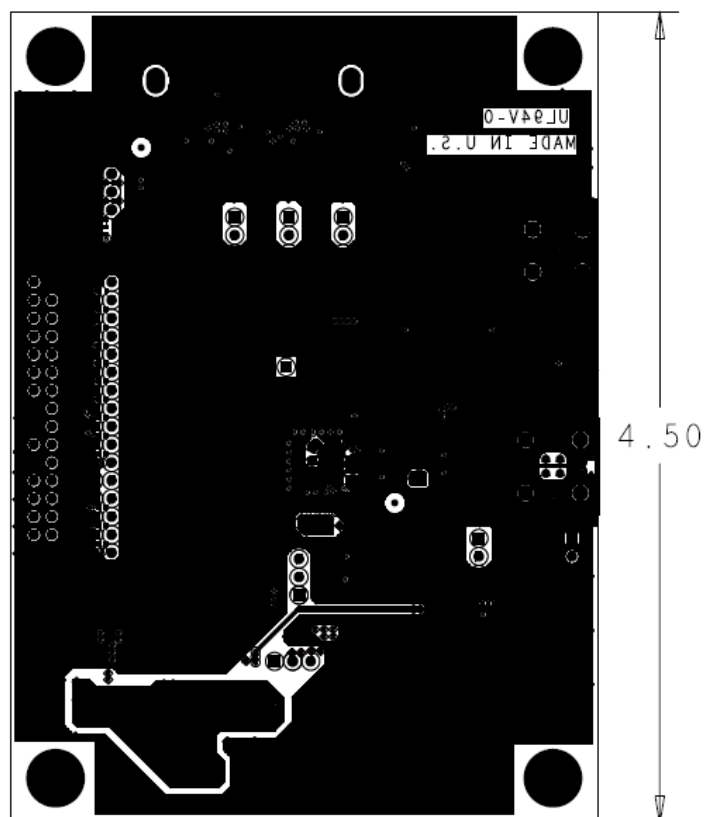
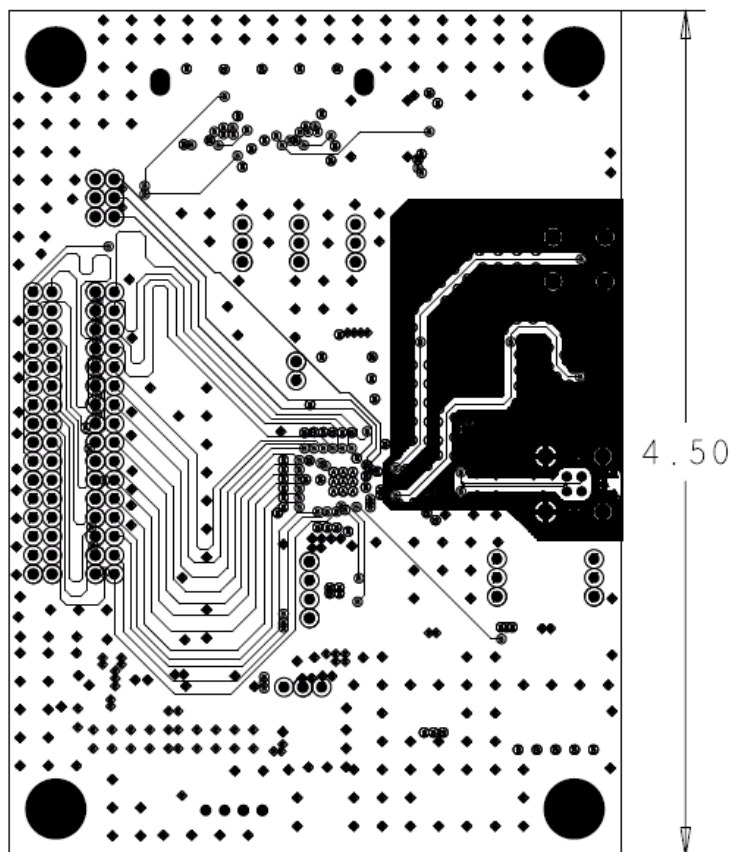




Component Information Part Number: SERDESUB-16USB Revision: 1.0 Date: 11/11/2011 Author: [Name] Designer: [Name] Checked: [Name] Approved: [Name]	
Project Information Project Name: SERDESUB-16USB Project Number: 11111111 Project Manager: [Name] Project Engineer: [Name]	Customer Information Customer Name: [Name] Customer Address: [Address] Customer Phone: [Phone] Customer Email: [Email]

DS90UB913Q PCB Layout



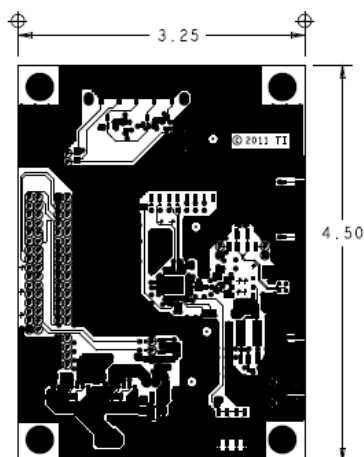


DS90UB914Q EVK Layout

4.00 MILS	VCC	1.3 MILS
24.00 MILS	GND-2	1.3 MILS
10.00 MILS	SIG	0.7 MILS
10.00 MILS	BOTTOM	(Cu + PLATING=1.5 MILS)
4 SIDE SOLDER MASK	0.50 MILS	

FILL CHART: TOP to BOTTOM
ALL UNITS ARE IN MILS

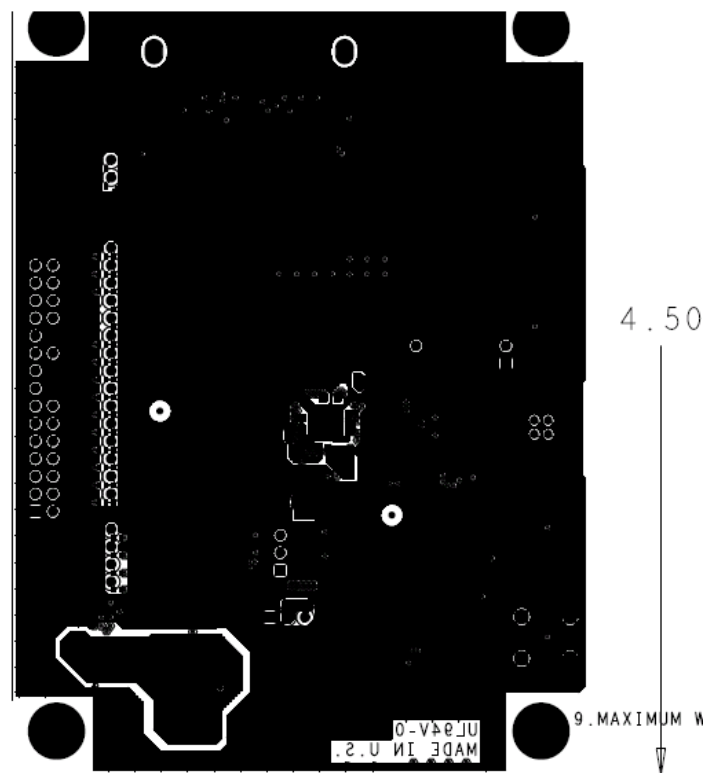
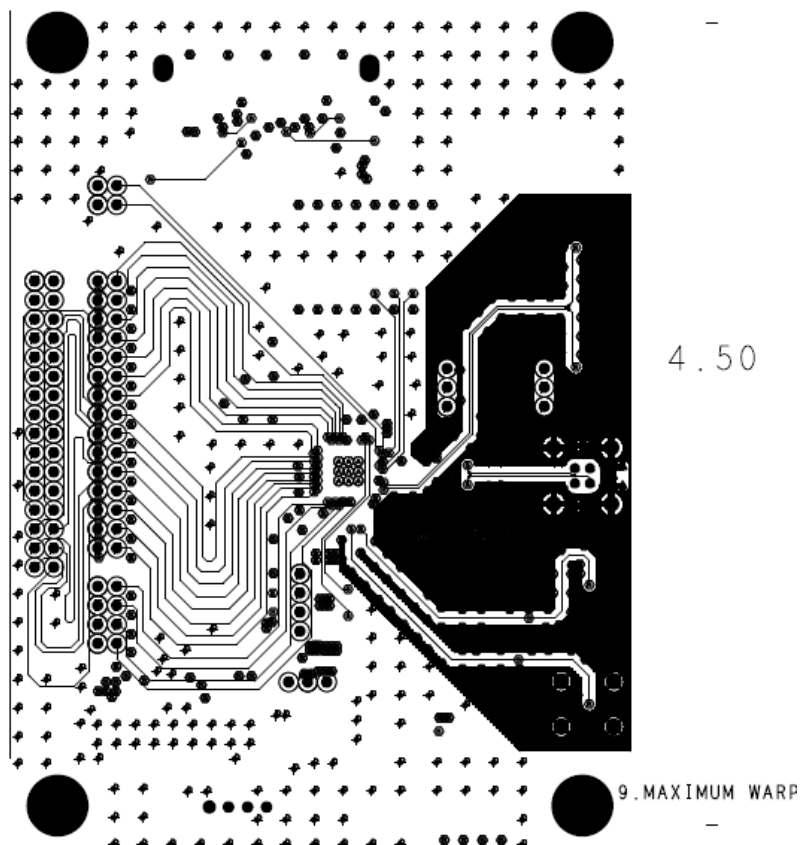
E	TOLERANCE	PLATED	QTY
0	+3.0/-3.0	PLATED	9
0	+3.0/-3.0	PLATED	335
0	+3.0/-3.0	PLATED	312
0	+3.0/-3.0	PLATED	5
0	+3.0/-3.0	PLATED	4
0	+3.0/-3.0	PLATED	87
0	+3.0/-3.0	PLATED	3
0	+3.0/-3.0	PLATED	1
99	+3.0/-3.0	PLATED	4
0	+3.0/-3.0	PLATED	4
0	+2.0/-2.0	NON-PLATED	4
79.0	+2.0/-2.0	NON-PLATED	2



- NOTES (UNLESS OTHERWISE SPECIFIED):
1. BOARD THICKNESS : 62 +/- 4 MILS
 2. DIELECTRIC : FR4
 3. NUMBER OF LAYERS: 6.
 4. SOLDERMASK : LPI GREEN.
 5. SILKSCREEN : WHITE EPOXY INK.
 6. NO VENDOR LOGO OR NAME ON THE BOARD.
 7. REMOVE THE NON-FUNCTIONAL PADS ON ALL INNER LAYERS.
 8. PLATING : SOFT IMMERSION GOLD.
 9. MAXIMUM WARP AND TWIST SHALL NOT EXCEED .005 PER IN
 10. ANY CHANGES MADE BY THE PCB FABRICATOR TO THE FILED GERBER FILES MUST BE APPROVED BY PACTRON.
 11. DEBURR ALL SHARP EDGES.
 12. BOARD DIMENSIONS ARE IN INCHES.
 13. 8 MIL TRACES REQUIRE 50 OHM +/-5 OHM SINGLE ENDED
 14. 6/9/8 TRACES REQUIRE 100 OHM +/-5 OHM DIFFERENTIAL IMP
 15. 6/7/6 TRACES REQUIRE 100 OHM +/-5 OHM DIFFERENTIAL IMP
 16. THIS BOARD SHOULD BE LEAD FREE.

PACTRON			
NAME: DS90UB914 DEMO BRD			
DATE: DEC 2011	JOB: 305-PD-11-0844	Rev. 1	
LAYER: 01EXP			

COMPANY: .



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Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. 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 85° C. The EVM is designed to operate properly with certain components above 60° C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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NOTES

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Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
Low Power	www.ti.com/lpw
Wireless	

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless