# DS90UB913A-CXEVM & DS90UB914A-CXEVM

# User's Guide

![TEXAS INSTRUMENTS]

# *Introduction*

## 1.1 Overview

The Texas Instruments DS90UB913A-CXEVM & DS90UB914A-CXEVM REV A Evaluation Modules (EVM) provides an easy way to evaluate the operation and performance of the DS90UB913AQ / DS90UB914AQ FPD-Link III Serializer/Deserializer.

(A) The DS90UB913A-CXEVM REV A contains the DS90UB913AQ Evaluation board.

(B) The DS90UB914A-CXEVM REV A contains the DS90UB914AQ Evaluation board

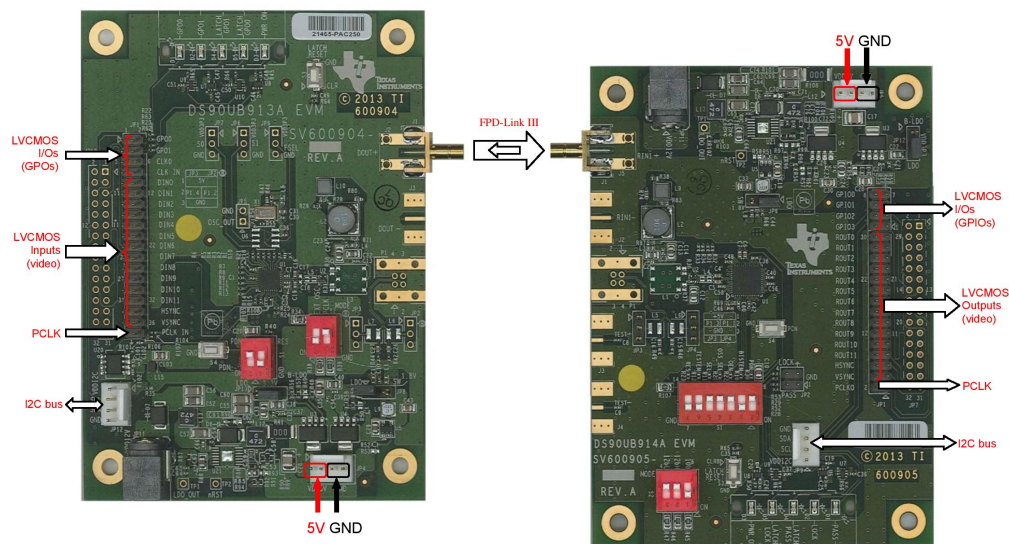Other components required: Power supply (5 V) and 50-Ω coaxial cable. [1] [2]



**Figure 1-1. DS90UB913A-CXEVM & DS90UB914A-CXEVM pair**

**Specification for orderable coax cable:** [3]
Water Blue, FAKRA Jack to FAKRA Jack Cable, 60-inch length, using RG174 Coax cable. EVM boards have SMB connector mounted as shown in Figure 1-1.

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[1]   Coax cable is not provided with the EVM.
[2]   Boards are configured to transmit power over coax cable, hence connect power to Deserializer board only.
[3]   Not a specific recommendation, for evaluation purpose only.
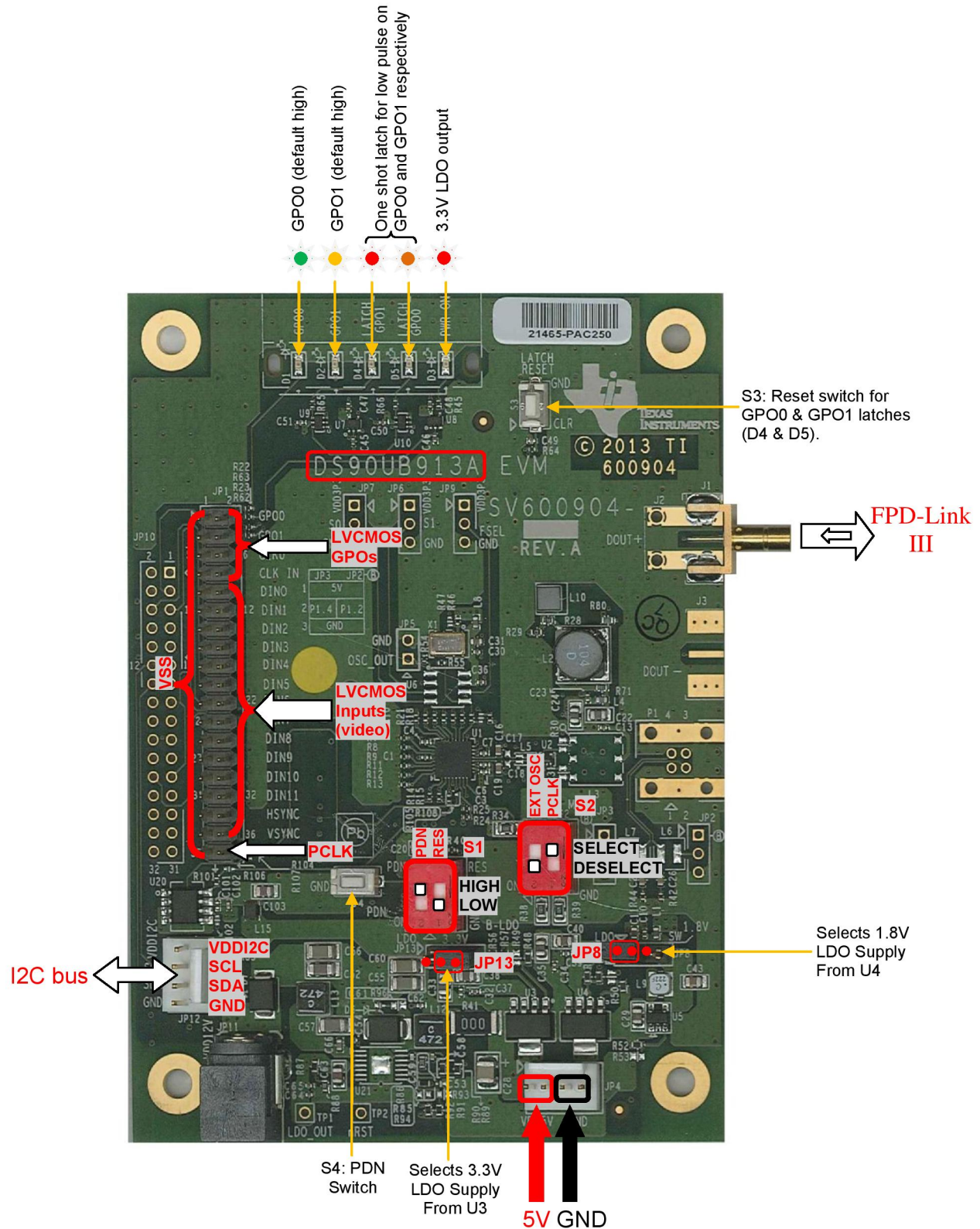
## 1.2 Quick Setup of EVM



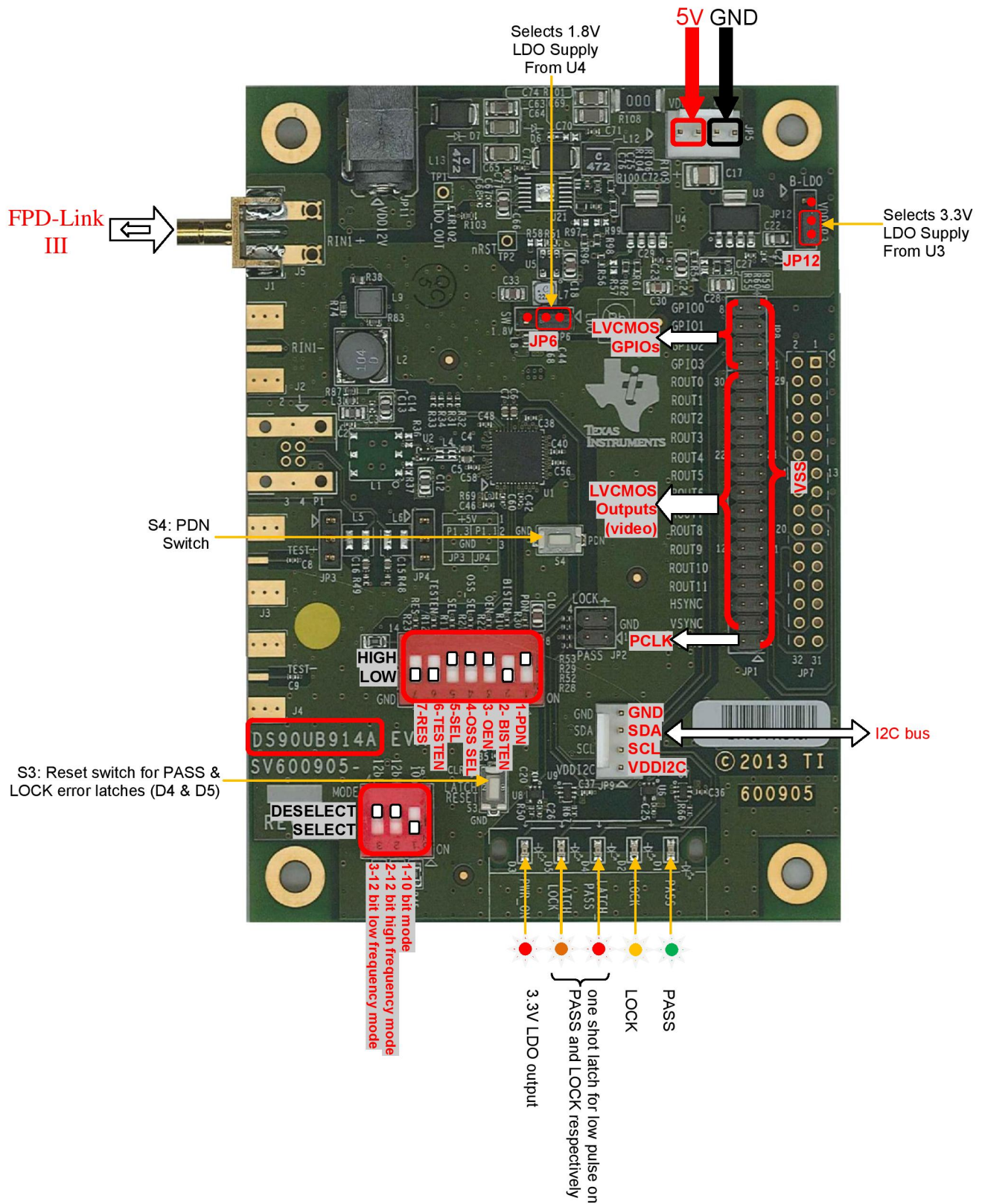**Figure 1-2. DS90UB913A-CXEVM REV A Serializer Board (Default Settings)**

TEXAS
INSTRUMENTS

Selects 1.8V
LDO Supply
From U4

5V GND

FPD-Link
III

Selects 3.3V
LDO Supply
From U3

JP12

JP6

LVCMOS
GPIOs

LVCMOS
Outputs
(video)

S4: PDN
Switch

PCLK

HIGH
LOW

GND
SDA
SCL
VDDI2C

I2C bus

DS90UB914A EV
SV600905-

S3: Reset switch for PASS &
LOCK error latches (D4 & D5)

DESELECT
SELECT

1-10 bit mode
2-12 bit high frequency mode
3-12 bit low frequency mode

3.3V LDO output

one shot latch for low pulse on
PASS and LOCK respectively

LOCK

PASS

**Figure 1-3. DS90UB914A-CXEVM REV A Deserializer Board (Default Settings)**

## 1.3 Operation

Make sure S1, S2, JP8, JP13 of Serializer board and S1, S2, JP6, JP12 of Deserializer board are configured as shown in Figure 1-2 and Figure 1-3.

1. Connect the DS90UB913AQ and DS90UB914AQ Evaluation boards using a coax cable.
2. Connect the 5-V power supply to Deserializer board (recommended current limit is 300 mA) and apply power as shown in Figure 2-1.
3. Look for the LED D2 to light up on the DS90UB914AQ board.
   - If the LED is lit and stable, then the DS90UB914AQ is LOCKED to the FPD-Link III serial stream… CONGRATULATIONS, you are up and running!
   - If not, continue to the next section.

## 1.4 Troubleshooting the EVM setup

1. **Check power supply polarity.**

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# WARNING

**Reverse supply polarity can damage the board.**

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2. Check to make sure there is sufficient current (300 mA) by checking that the voltage (5 V) is correct using DMM.
3. Check to make sure there is a FPD-Link III signal by probing on both C16 AND C19 on SER board and C6 AND C7 on DES board.
4. Monitor the LOCK signal at pin 4 (pin 3 is GND) of connector JP2 using oscilloscope on DES board. Do not rely on visual inspection of D2 (Lock LED) present on deserializer board.
5. With no PCLK input applied on SER board, PCLK output frequency on DES board should be 50MHz for the default settings.

**Table 1-1. PCLK Output (on DES) without Applying PCLK Input (on SER)**

| Mode Selected | PCLK Output Expected |
|---|---|
| 10 bit mode (default mode) | 50 MHz |
| 12 bit low frequency mode | 25 MHz |
| 12 bit high frequency mode | 37.5 MHz |

6. Go back to Figure 1-2 & Figure 1-3 to double check factory settings.

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# Board Setup Details

This section describes the connectors and jumpers on the board as well as how to properly connect, set up and use the DS90UB913A/914A REV A EVM in detail.

## 2.1 Power Connections

1. Connect an external 5 V to pin 1 or 2 of JP5, on Deserializer board. (Refer to Figure 2-1)

2. Connect ground to pin 3 or 4 of JP5, on Deserializer board. (Refer to Figure 2-1)

3. Optionally, these boards can be configured for 12-V supply via Power Jack, JP11 on both the boards separately. However, this would require U21, TPS65320 to be mounted on Deserializer board, as it is not populated on the EVM.

4. Since boards are configured to transmit power over coax cable (PoC), it is not required to connect external power to Serializer, unless PoC is not used.
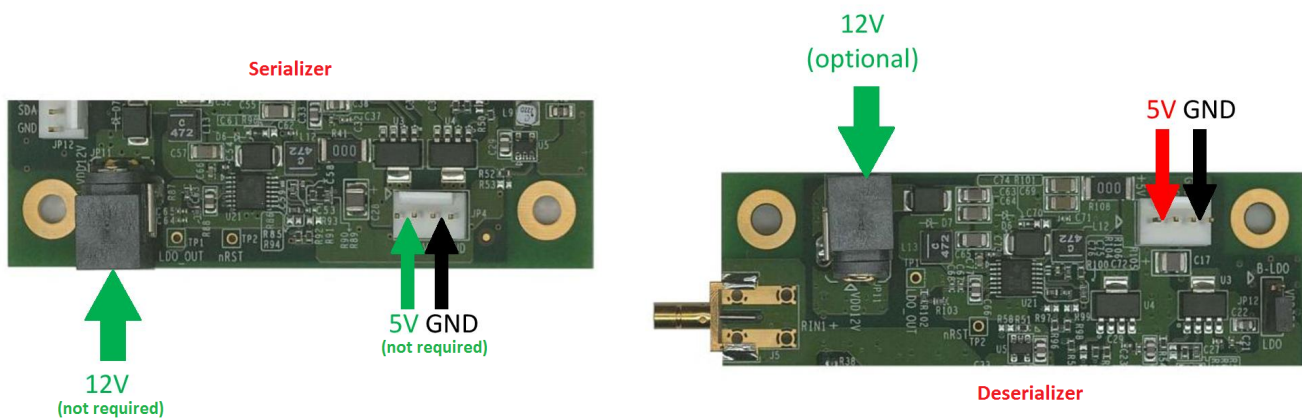


**Figure 2-1. Powering DS90UB913A-CXEVM and DS90UB914A-CXEVM Boards**

## 2.2   FPD-Link III Connection

J1 is the default SMB connector on both the boards. The FPD-Link III serial stream comes out of J1 on Serializer board as a single ended signal. Connect it to J1 on the Deserializer board. DOUT- on serializer and RIN1- on deserializer are terminated to ground through 47-nF capacitor in series with 50Ω resistance.
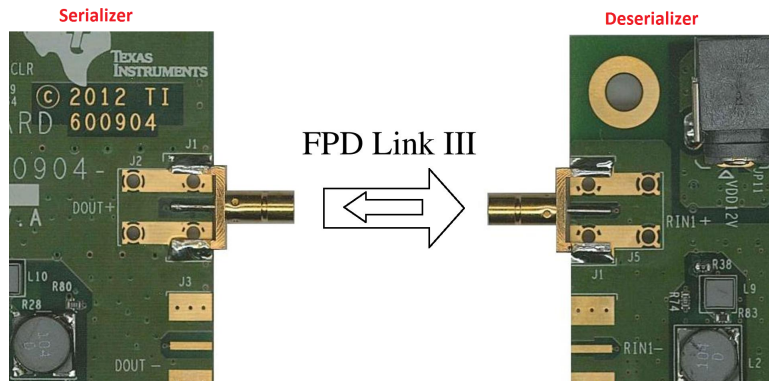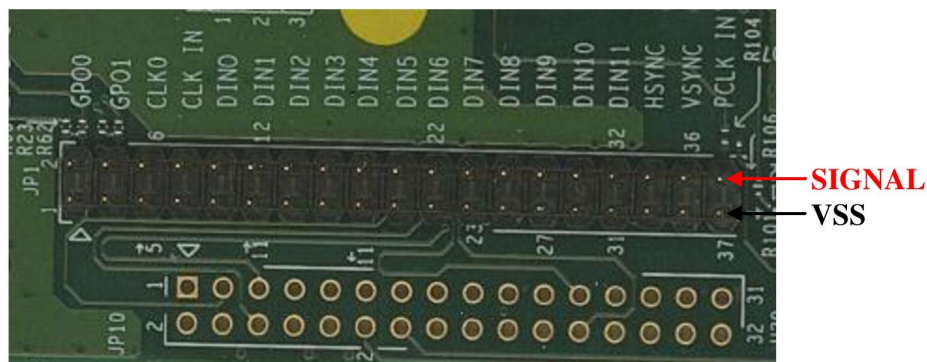


**Figure 2-2. Serial Link Connection Using a Single 50-ω Coaxial Cable**

## 2.3   LVCMOS Input Connector Description (on DS90UB913AQ Board)

JP1 – GPO0, GPO1, CLK OUT, CLK IN, DIN[11:0], HSYNC, VSYNC, PCLK IN are the input pins for the LVCMOS interface on Serializer board. The even numbered pins are the input signals. All the odd numbered pins are connected to VSS. Refer to Figure 2-3 below.
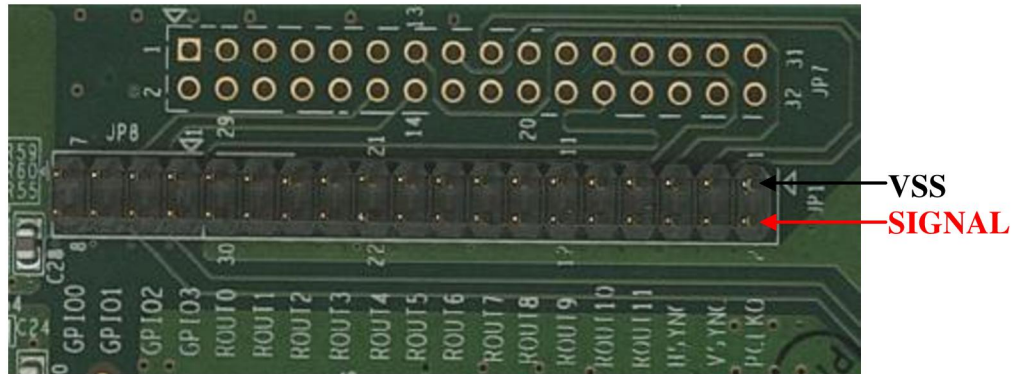


JP10 and JP1 pins are not connected.

**Figure 2-3. Parallel Input Connector on Serializer Board**

## 2.4 LVCMOS Output Connector Description (on DS90UB914AQ Board)

JP1 – ROUT[11:0], HSYNC, VSYNC, PCLKO are the pins of output connector for the LVCMOS interface on Deserializer board. The even numbered pins are the output signals. All the odd numbered pins are connected to VSS.

JP8 – GPIO0, GPIO1, GPIO2, GPIO3 are the access points for DS90UB914AQ GPIO data. Refer to Figure 2-4 below.



JP1 and JP7 pins are not connected.

**Figure 2-4. Parallel Output Connector on Deserializer Board**

## 2.5 Factory Set Switch Settings and Jumpers Default Configuration

### 2.5.1 Serializer Board Default Configuration

S1, S2, JP8 and JP13 of Serializer board are factory configured as shown in Figure 1-2 for plug and play operation.

1. The S1 switch is factory set as shown in Figure 2-5.
   The PDN switch (S1.2) is set HIGH and will turn on the DS90UB913AQ upon power up. This switch is connected to PDB pin of the device.
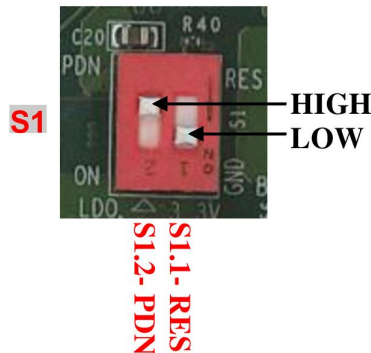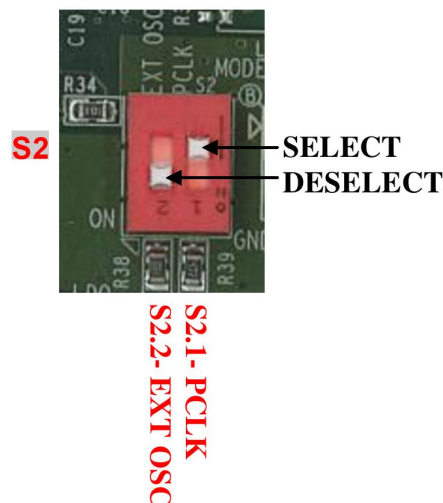   The RES pin (S1.1) is pulled low as recommended by datasheet.



**Figure 2-5. Switch S1: Default Settings on Serializer Board**

2. The Mode Select switch, S2 is factory set as shown below in Figure 2-6 to use Serializer in PCLK from imager mode. To operate in external oscillator mode, move S2.1 to deselect position and S2.2 to select position [1]. Refer device datasheet for more details on these modes.



Only one switch is allowed to be in SELECT mode at a time.

**Figure 2-6. Switch S2: Default Settings on Serializer Board**

3. S3 is a momentary switch, which is present on the top right corner of the SER board. Press this switch to clear the output of one shot latches for low pulse on GPO0 and GPO1.
4. S4 is a momentary switch for Transmitter Power Down.
5. On JP8 and JP13, a 2-pin jumper is factory placed as shown in Figure 1-2. This selects power from U4 for 1.8V VDD and from U3 for 3.3V VDDIO respectively.

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[1] A power down and power up sequence through switch S1.2 is required, for the mode change to be effective.

### 2.5.2 *Deserializer Board Default Configuration*

S1, S2, JP6, JP12 of Deserializer board are factory configured as shown in Figure 1-3 for plug and play operation.

1. The S1 switch is factory set as shown below in Figure 2-7.

    (a) The PDN switch is set high and will turn on the Deserializer upon power up. This switch is connected to PDB pin of the device.

    (b) The OEN and OSS_SEL switch are set HIGH and will enable outputs to toggle upon power up.

    (c) The SEL switch is set high to select RIN1+/- input, which feeds serial stream data to the device from coax cable.
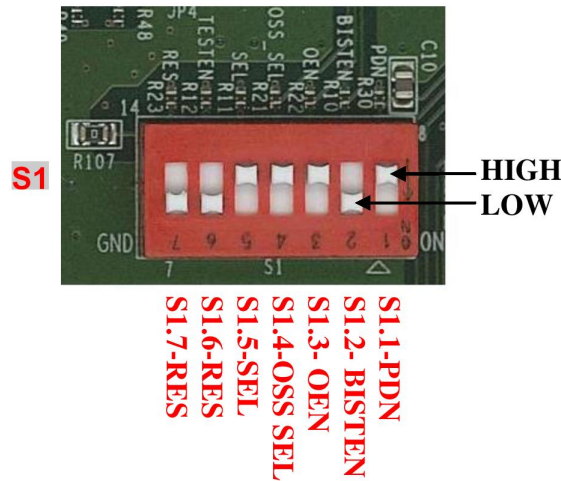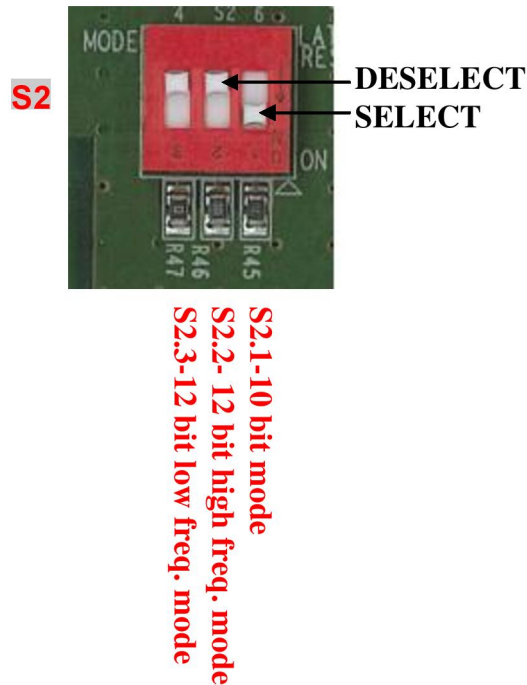
    Refer to Table 2-1 for more details.



**Figure 2-7. Switch S1: Default Settings on Deserializer Board**

**Table 2-1. Switch S1: Deserializer Board**

| Switch reference | Default Setting | Function |
|---|---|---|
| S1.1-PDN | High | High: Deserializer is enabled and is ON.<br>Low: Deserializer is in Sleep (power down mode). In this mode, programmed control register data are NOT retained and reset to default values. |
| S1.2-BISTEN | Low | High: BIST Mode Enabled<br>Low: BIST Mode Disabled |
| S1.3-OEN | High | Refer table on "Output States" in the device datasheet |
| S1.4-OSS SEL | | |
| S1.5-SEL | High | High: RIN1+/- input is selected as the active channel on the Deserializer.<br>Low: RIN0+/- input is selected as the active channel on the Deserializer. |
| S1.6-RES | Low | Reserved and must be set Low always. |
| S1.7-RES | | |

2. The S2 switch is factory set as shown below in Figure 2-8. This will configures the SER/DES link in 10 bit mode.



Only one switch is allowed to be in SELECT mode at a time.

**Figure 2-8. Switch S2: Default Settings on Deserializer Board**

**Table 2-2. Switch S2: Deserializer Board**

| Switch reference | Default Setting | Frequency Range supported | Function |
|---|---|---|---|
| S2.1 - 10 bit mode | Select | 50MHz to 100MHz | When SELECTed, configures device in 10 bit mode and hence LVCMOS input DIN10, DIN11 and LVCMOS output ROUT10, ROUT11 can not be used. |
| S2.2 - 12 bit high frequency mode | Deselect | 37.5MHz to 75MHz | When SELECTed, configures device in 12 bit high frequency mode |
| S2.3 - 12 bit low frequency mode | Deselect | 25MHz to 50MHz | When SELECTed, configures device in 12 bit low frequency mode |

3. S3 is a momentary switch located at the bottom center of the DES board. Press this switch to clear the output of latches for low pulse on LOCK and PASS.

4. S4 is a momentary switch for Receiver Power Down.

5. On JP6 and JP12, a 2-pin jumper is factory placed as shown in Figure 1-3. This selects power from U4 and U3 LDOs for 1.8V VDD and 3.3V VDDIO respectively.

# Using I²C

## 3.1  Default Addresses

The default 7-bit I²C address of DS90UB913AQ is set to 0x58 (101 1000) using suitable resistor divider on ID[x] pin. Also, 7-bit I²C address of DS90UB914AQ is set to 0x60 (110 0000) using suitable resistor dividers on pins IDx[0] and IDx[1]. Change resistor R25 on Serializer board and R32, R33 on Deserializer board to change the address of these devices, refer device datasheet for more information.

## 3.2  USB2ANY [1]

The USB2ANY is required to use interactive GUI over I²C, such as ALP (Analog LaunchPAD).
Download and install ALP from: http://www.ti.com/tool/ALP.
Before using ALP for these devices, it is also required to download DS90UB913-914-ALP-PROFILES from the same web page and copy DS90UB913 and DS90UB914 folders to location: *Program Files\Texas Instruments\Analog LaunchPAD vx.xx.xxxx\Profiles* on your system.
The USB2ANY is shown in Figure 3-1 below. It is powered through the USB port of computer and LED D1 will light up GREEN when the USB2ANY is connected to a computer to indicate that the board is powered.
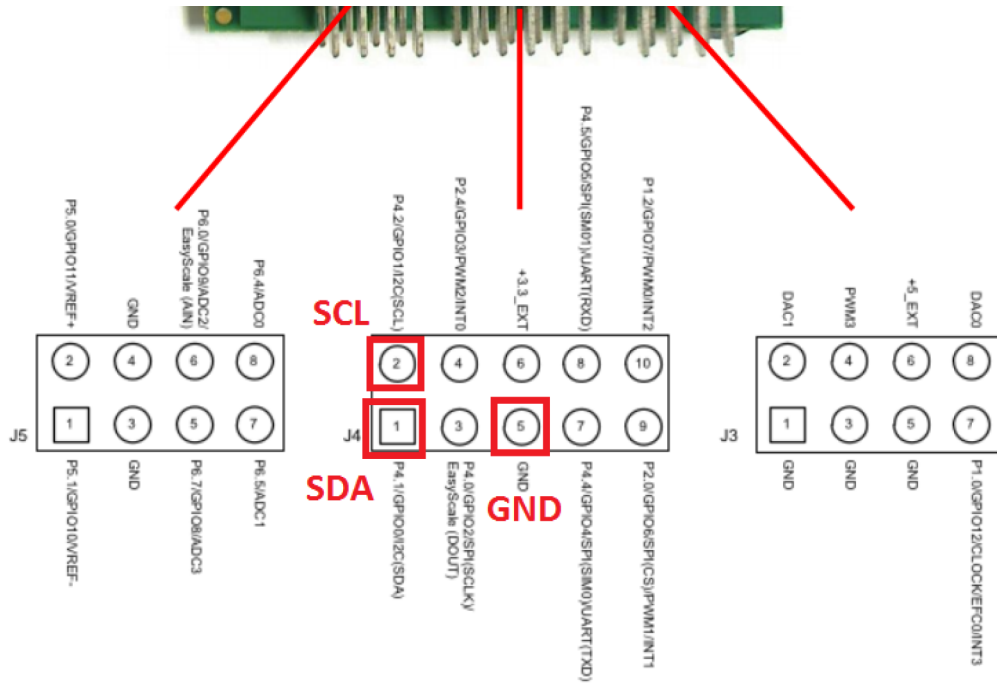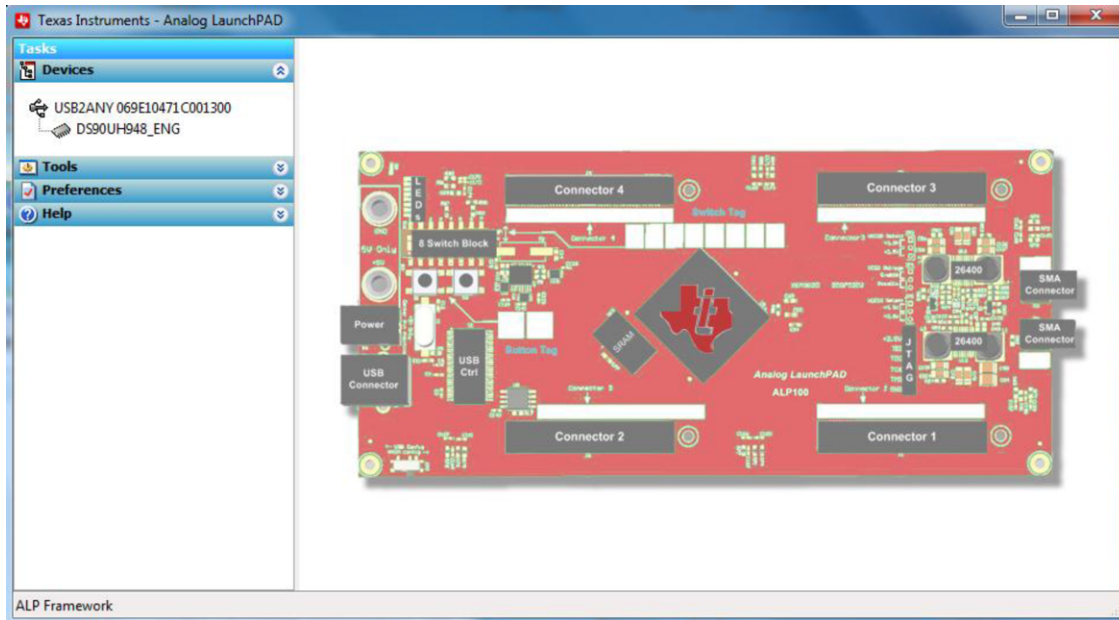


**Figure 3-1. USB2ANY**

Refer to Figure 1-2 and Figure 1-3 for these connections.

[1]   Any I²C controller which support clock stretching can be used.
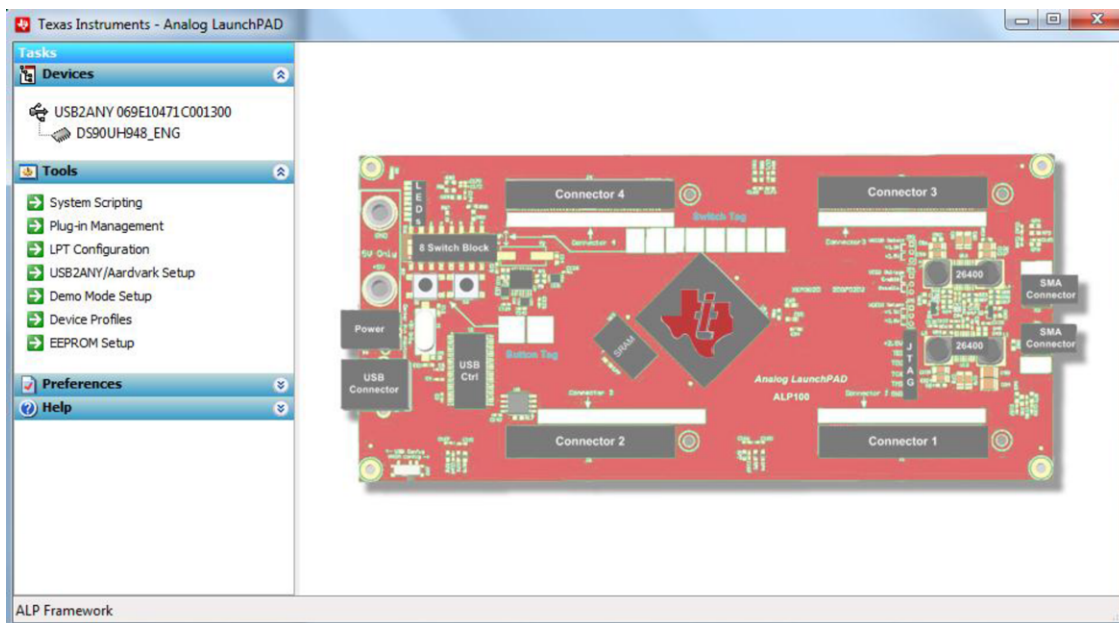
Here is the USB2ANY pinout with the I²C pins highlighted. We typically use jumper wires to connect these to the 913/914 EVMs.
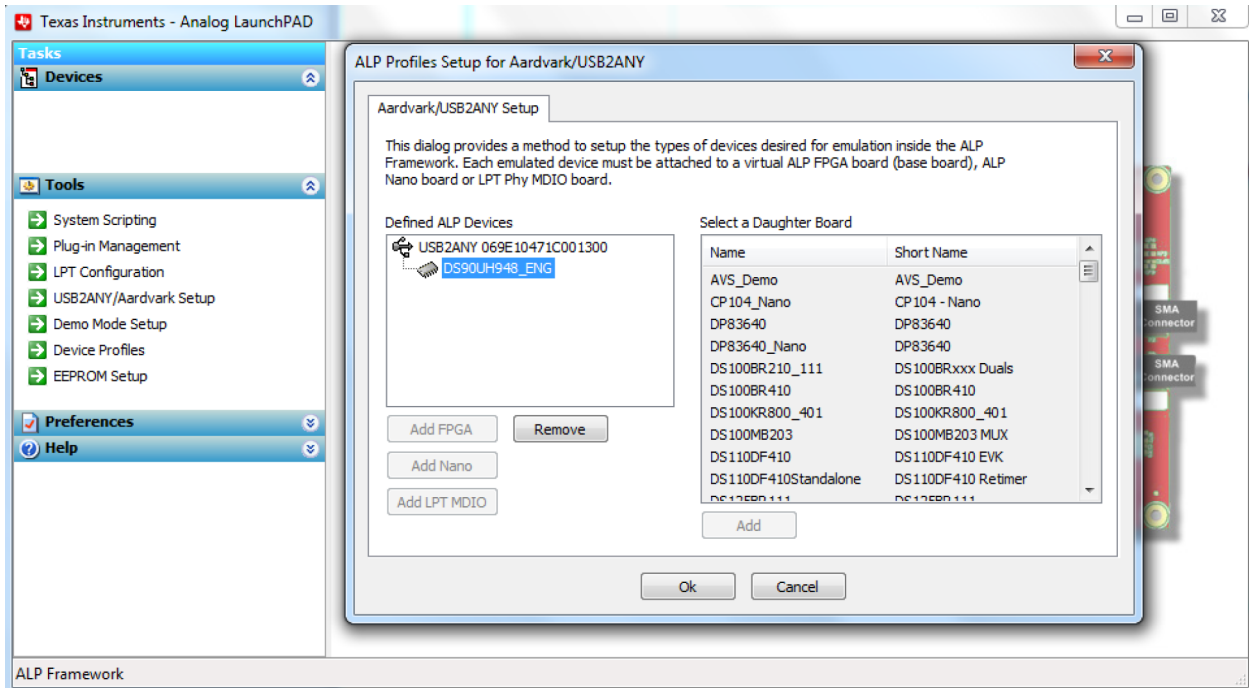
This is what ALP should look like when launched while connected to a USB2ANY. The part number on the left may be different, or there may not be one, but the key is that it will say *USB2ANY…'*under Devices.
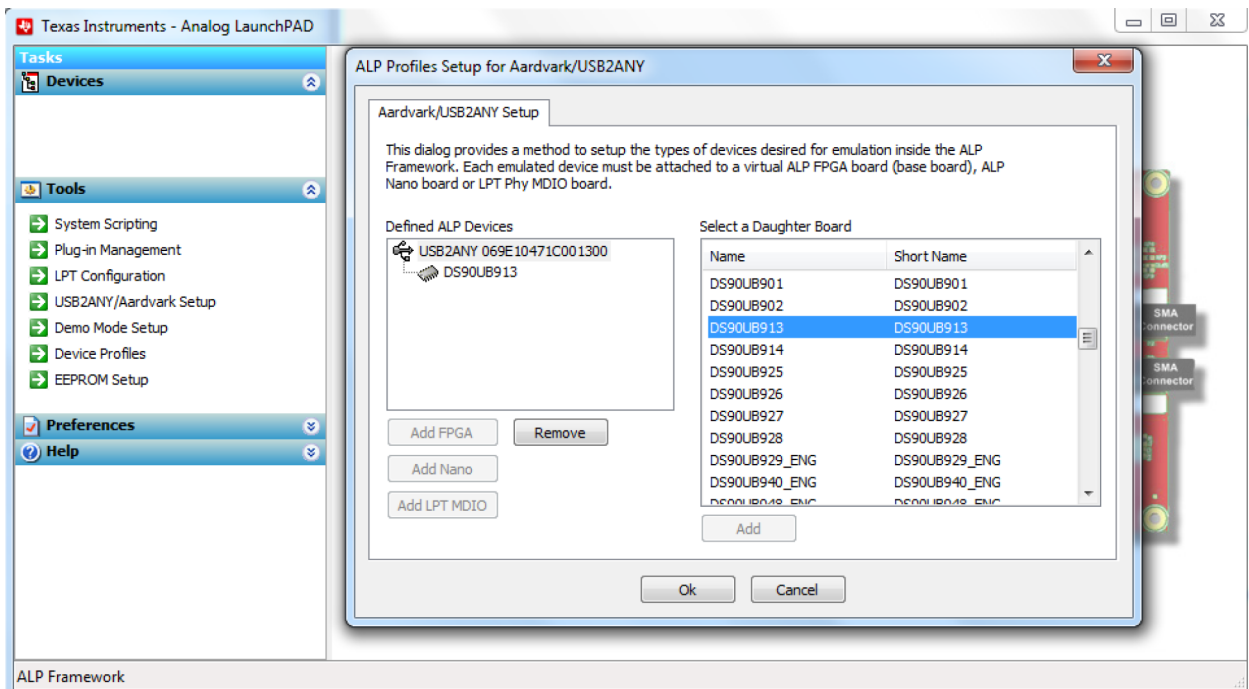


Expand the Tools panel and select USB2ANY/Aardvark Setup.

If there is already a device listed in the menu, then select it and click *Remove.*



Once it has been removed (or if there wasn't one to begin with), select the EVM name from the list on the right and click *Add.*

# Additional Features

## 4.1 Eye Monitor – CMLOUTP/N



**Figure 4-1. Top View of CML Access Points on Deserializer Board**

Connector J3 connects CMLOUTP (or TEST+) and J4 connects to CMLOUTN (or TEST-), which are present on left hand side of DS90UB914A-CXEVM board. CMLOUTP/N must be enabled by register, 0x3F[4] = 0, to be able to monitor the FPD-Link III serial stream.

## 4.2 Differential Operation Over a Pair of Coax Cables

For differential operation,
1. On DS90UB913A-CXEVM board, change C19 to 0.1 µF, remove R80 and mount J3.
2. On DS90UB914A-CXEVM board, change C7 to 0.1 µF, remove R74 and mount J2.

## 4.3 Use of Optional Rosenberger HSD Connector with STP Cable

Following changes are required for using an STP cable with the EVM,

1. On Serializer board, depopulate C16 and C19 capacitors and populate the C17 and C18, 0.1 µF. Also, populate P1 (Rosenberger HSD connector).

2. On Deserializer board, depopulate C6 and C7 capacitors and populate the C4 and C5, 0.1 µF. Also, populate P1 (Rosenberger HSD connector).

3. Set the pin 5 of switch S1 LOW on DES board, to accept input from RIN0+/-.

This configuration will require Serializer and Deserializer both to be powered separately. To enable power over STP there are two options available as shown in Figure 4-2 and Figure 4-3:

1. To transmit power over the pair carrying data, mount R30 (0Ω), R31 (0Ω), L3 on SER board and R36 (0Ω), R37 (0Ω), L1 on DES board. [5]

2. To transmit power over unused pair of STP cable,
On SER board,

   - Mount L6 (10 µH), L7 (10 µH)

   - Put jumpers across pin 1 and pin 2 of jumpers JP2

   - Put jumpers across pin 2 and pin 3 of jumpers JP3

   On DES board,

   - Mount L5 (2.7 µH), L6 (2.7 µH)

   - Put jumpers on JP3 and JP4 to match the polarity of supply (check on pin2 of each header)

[5] Refer Schematic and BOM section for specification.

**Figure 4-2. Power Over STP: SER Configuration**
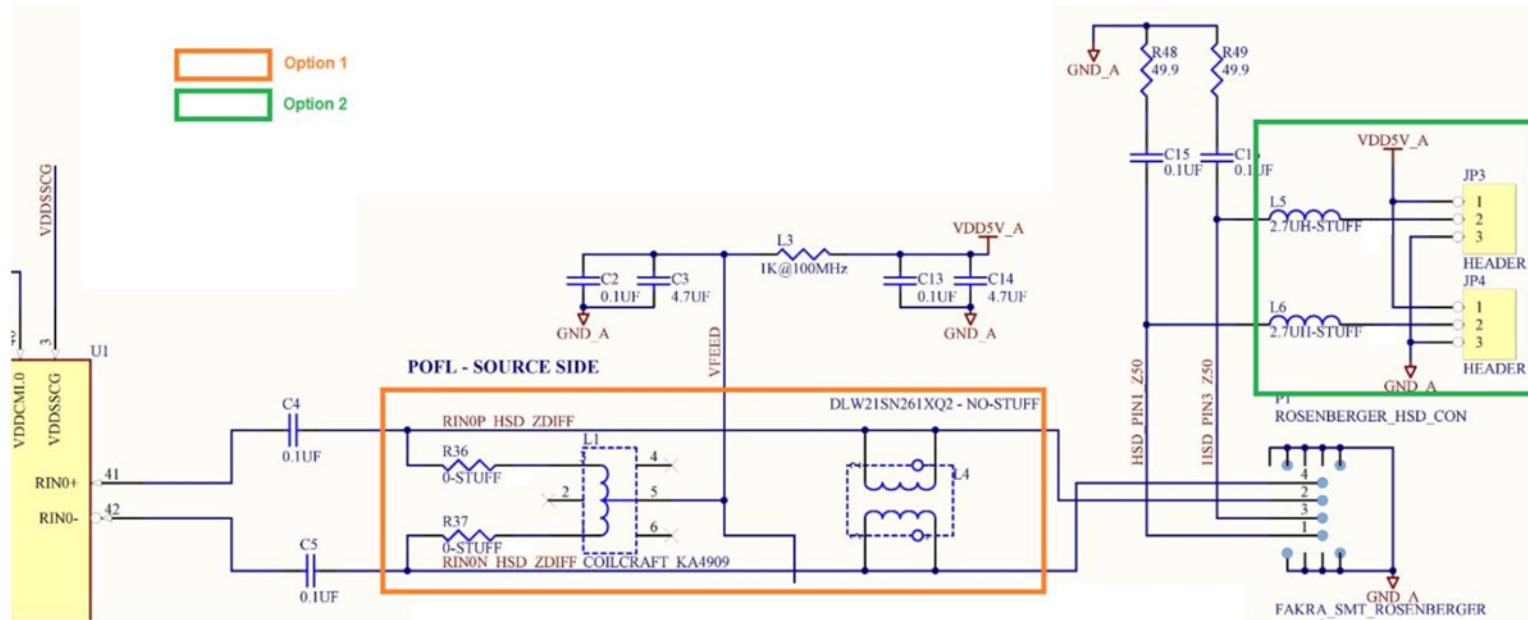
**Figure 4-3. Power Over STP: DES Configuration**

## 4.4 Optional Use of Header Provided for External Imager and Host

This hardware configuration allows connecting an external imager (OV10630) to DS90UB913AQ Serializer and an external host (PIXCI ECB1-34 Base camera link express card/frame grabber) to DS90UB914AQ Deserializer board. To operate in this configuration, the following hardware changes are required:

1. On Serializer board, populate JP10, R67, R68, R69, R70, R72, R73, R75, R76, R77, R78, R79, R81, R82, R83, R84. It is recommended to remove JP1.
2. On Deserializer board, populate JP7, R70, R71, R72, R73, R75, R76, R77, R78, R79, R80, R81, R82, R84, R85, R86. It is recommended to remove JP1.

# *Schematics*

## A.1   DS90UB913A-CXEVM Serializer Board Schematic

1. DS90UB913AQ Serializer



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## 2. Power to Serializer Board



**3.3V ADJ LDO**

External 5V IN
JP4

VDD5V

U3
IN  OUT
EN  ADJ
GND
LP38693MP-ADJ/NOPB

U3_PIN3

C28 22µF
C33 4.7µF
C32 0.1µF
R48 10.0k
R49 DNP
R56 16.5k
R57 10.0k
C37 0.1µF  C38 10µF

GND

**1.8V ADJ LDO**

VDD3P3

R45 330

D3 Red

GND

U4
IN  OUT
EN  ADJ
GND
LP38693MP-ADJ/NOPB

R50 10.0k
R51 DNP
C35 4.7µF  C34 0.1µF
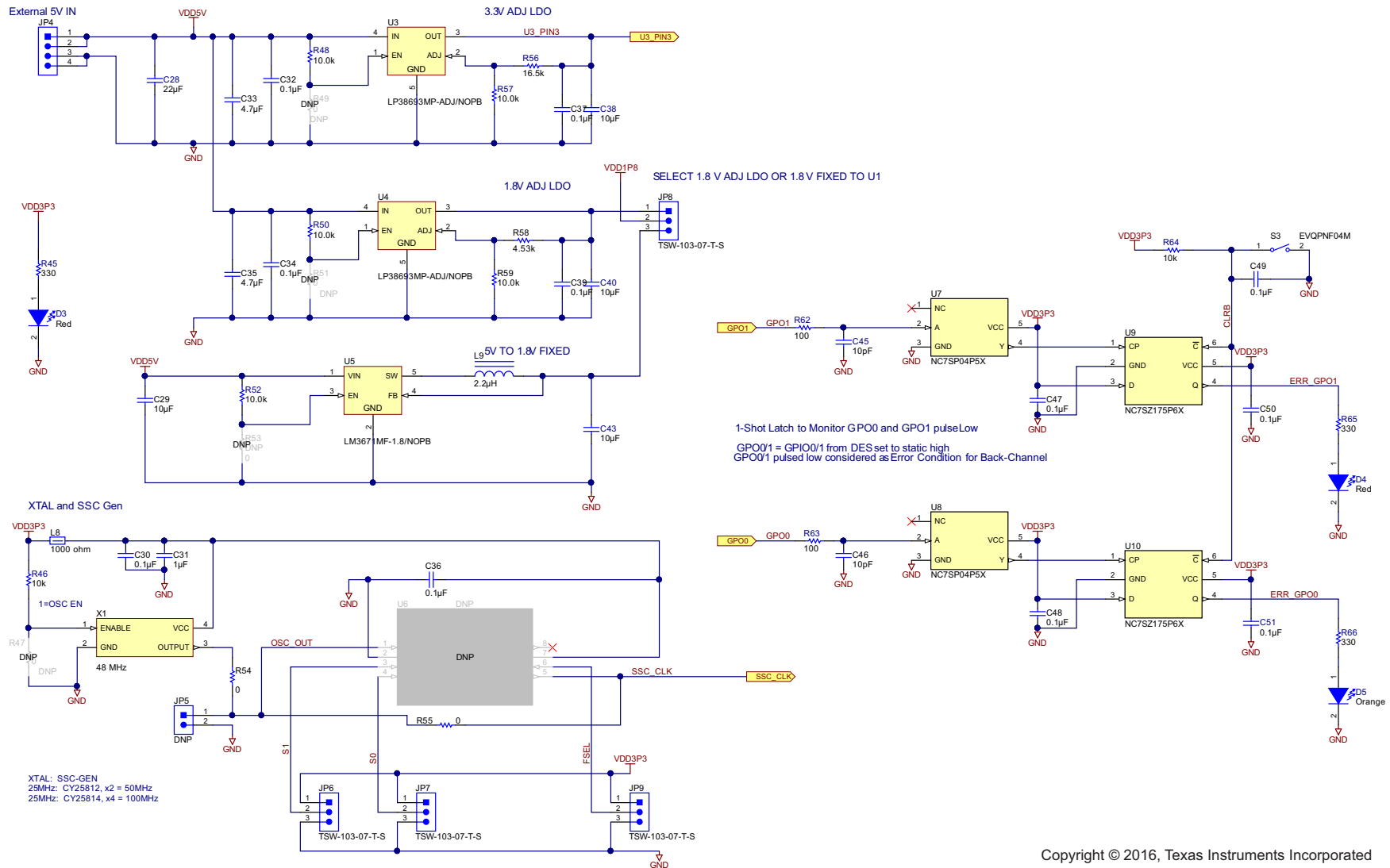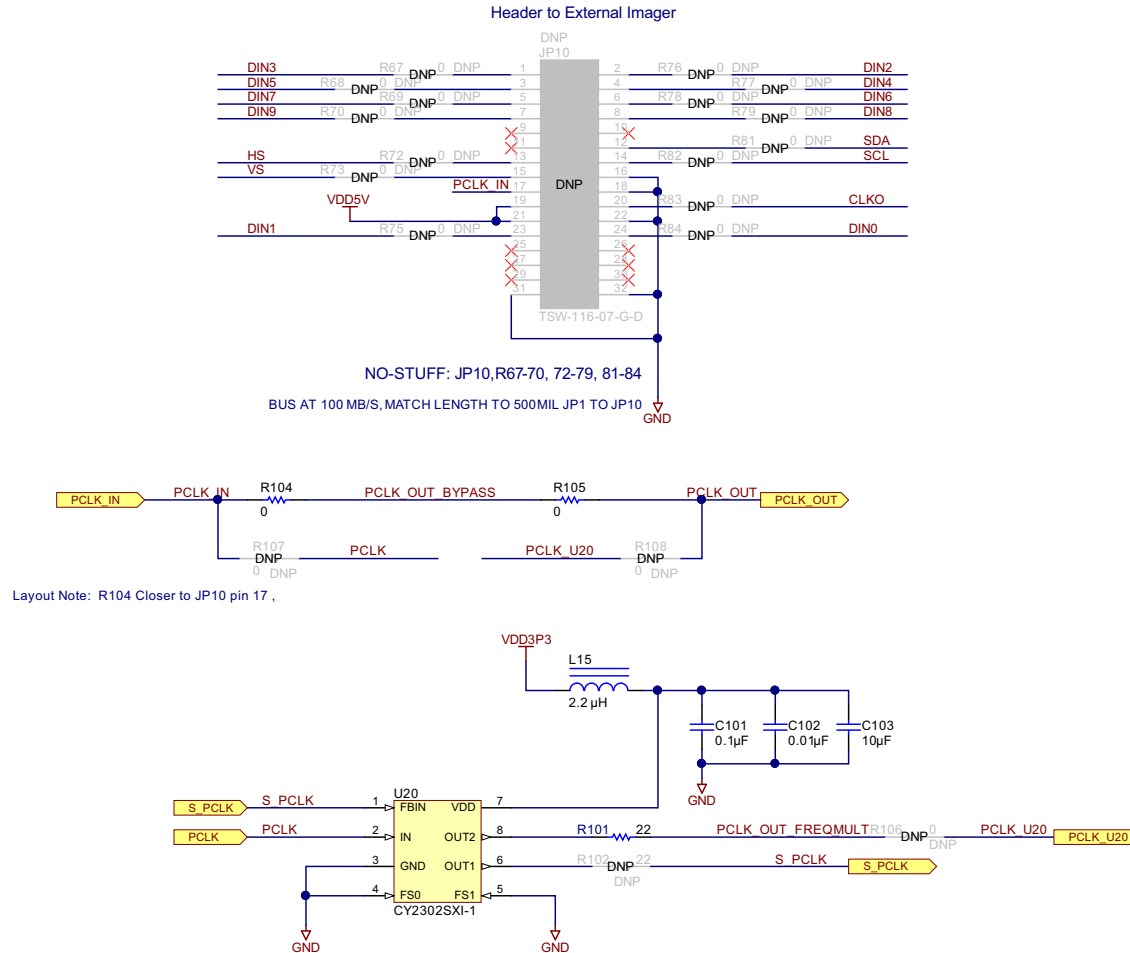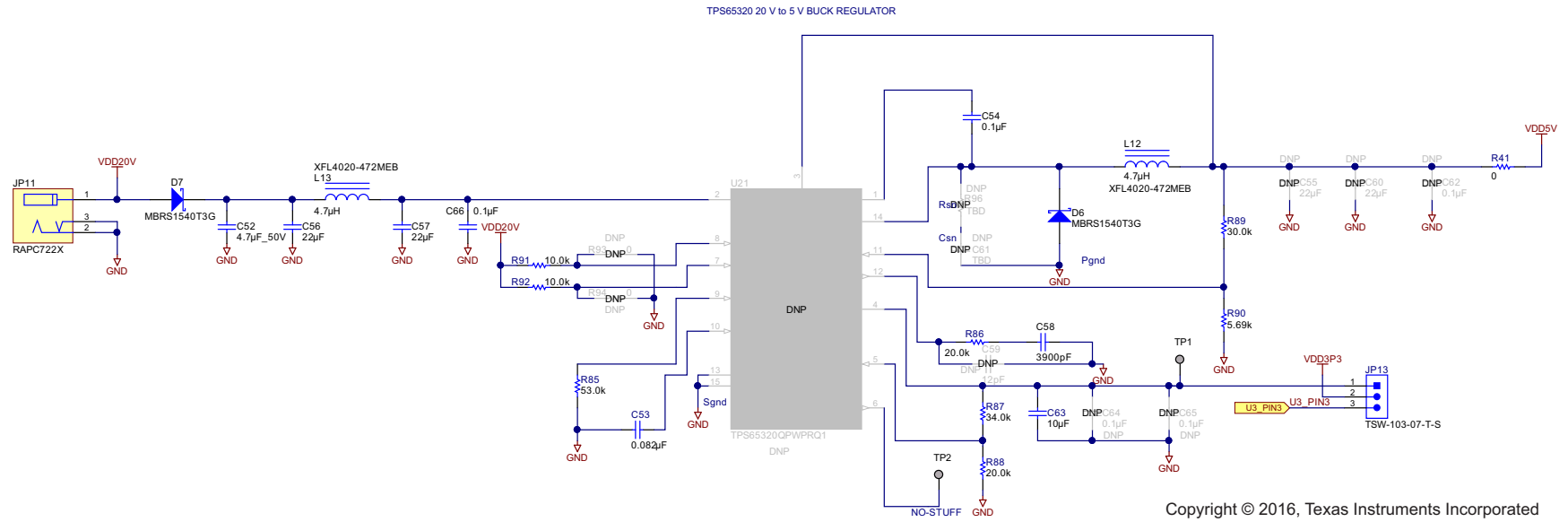R58 4.53k
R59 10.0k
C39 0.1µF  C40 10µF

GND

VDD1P8

SELECT 1.8 V ADJ LDO OR 1.8 V FIXED TO U1

JP8
1
2
3
TSW-103-07-T-S

**5V TO 1.8V FIXED**

VDD5V

U5
VIN  SW
EN  FB
GND
LM3671MF-1.8/NOPB

C29 10µF
R52 10.0k
R53 DNP

L9 2.2µH

C43 10µF

GND

VDD3P3  R64 10k
S3 EVQPNF04M
C49 0.1µF
GND

CLRB

GPO1  R62 100
C45 10pF
GND

U7
NC
A   VCC
GND Y
NC7SP04P5X
VDD3P3
C47 0.1µF
GND

U9
CP  CI̅
GND VCC
D   Q
NC7SZ175P6X
VDD3P3
C50 0.1µF
GND

ERR_GPO1

R65 330

D4 Red

GND

**1-Shot Latch to Monitor GPO0 and GPO1 pulse Low**

GPO0/1 = GPIO0/1 from DES set to static high
GPO0/1 pulsed low considered as Error Condition for Back-Channel

GPO0  R63 100
C46 10pF
GND

U8
NC
A   VCC
GND Y
NC7SP04P5X
VDD3P3

U10
CP  CI̅
GND VCC
D   Q
NC7SZ175P6X
VDD3P3
C51 0.1µF
GND

ERR_GPO0

R66 330

D5 Orange

GND

**XTAL and SSC Gen**

VDD3P3  L8 1000 ohm
C30 0.1µF  C31 1µF
GND

R46 10k
1=OSC EN

R47 DNP

X1
ENABLE  VCC
GND  OUTPUT
48 MHz

GND

C36 0.1µF

GND

U6 DNP
DNP

OSC_OUT

R54 0

JP5
DNP
GND

R55 0

SSC_CLK

S1  S0  FSEL  VDD3P3

**XTAL: SSC-GEN**
25MHz: CY25812, x2 = 50MHz
25MHz: CY25814, x4 = 100MHz

JP6
TSW-103-07-T-S

JP7
TSW-103-07-T-S

JP9
TSW-103-07-T-S

GND

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3. Header Adapter to Imager for Serializer Board



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4. Buck Regulator on Serializer Board



TPS65320 20 V to 5 V BUCK REGULATOR
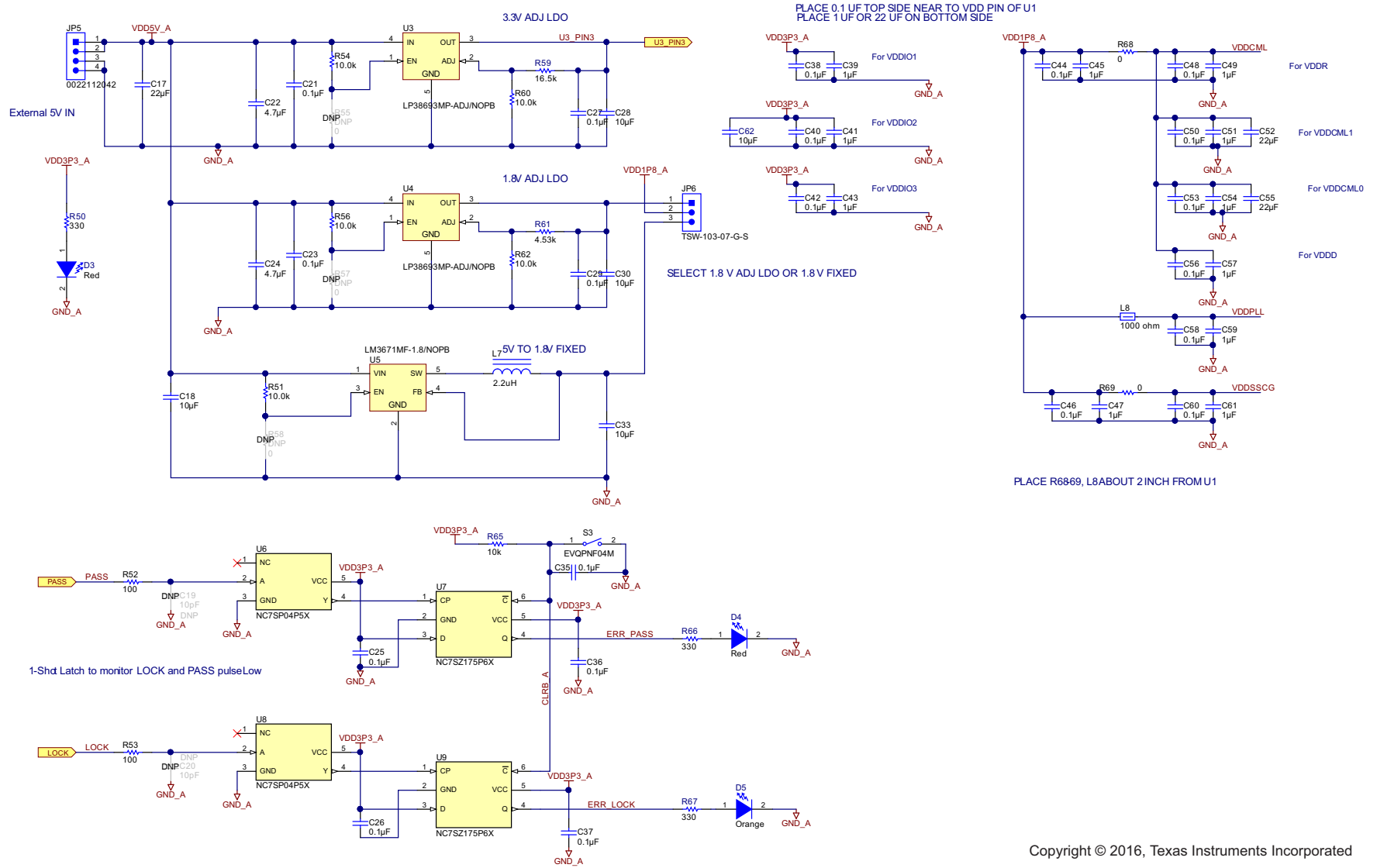
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## A.2 DS90UB914A-CXEVM Deserializer Board Schematic

1. DS90UB914AQ Deserializer

PULL-UP PLACED NEAR HEADER

Power & bypass
DS90UB914-PG2.SchDoc

Host Adaptor Header
DS90UB914-PG3.SchDoc

ESD placed closed to P1

POFL - SOURCE SIDE

R74 IS A DUMMY PAD

BUS AT 100 MB/S, MATCH LENGTH TO 100MIL

JP1, JP8 SEPARATE BY 0.1 INCH

J1 and J2 625mil center-to-center
J1 and J3 share the same footprint

JP9 >0.3 INCH ON EAST SIDE OF JP8

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## 2. Power to Deserializer Board



PLACE 0.1 UF TOP SIDE NEAR TO VDD PIN OF U1
PLACE 1 UF OR 22 UF ON BOTTOM SIDE

3.3V ADJ LDO

1.8V ADJ LDO

SELECT 1.8 V ADJ LDO OR 1.8 V FIXED

5V TO 1.8V FIXED

PLACE R6869, L8 ABOUT 2 INCH FROM U1

1-Shot Latch to monitor LOCK and PASS pulse Low

External 5V IN

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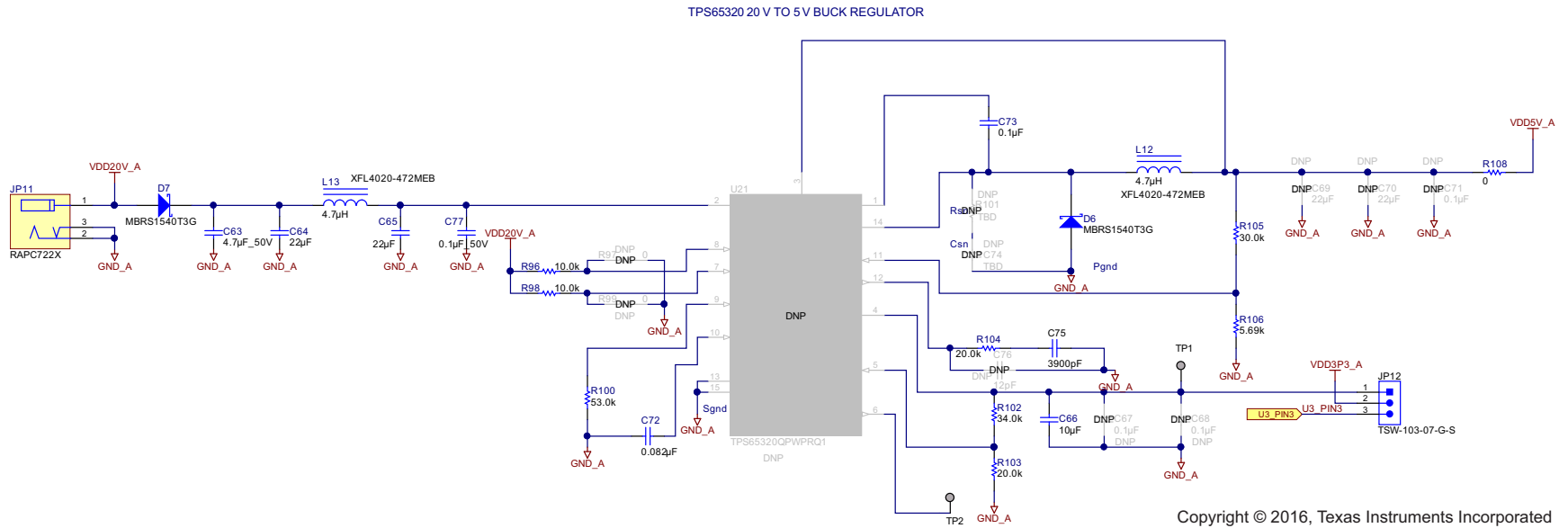
3.  Header Adapter for Deserializer Board

Header to External Host



NO-STUFF: JP7, R70-73, R75-82, R84-86

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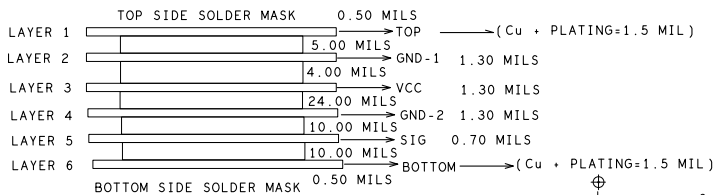
4. Buck Regulator on Deserializer Board

TPS65320 20 V TO 5 V BUCK REGULATOR



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# PCB Layout

## B.1 DS90UB913A-CXEVM Serializer Board Layout

### 1. DS90UB913A-CXEVM Stackup & FAB Notes

```
        LAYER STACK-UP
   THIS IS A 6 LAYER BOARD
```



```
         TOP SIDE SOLDER MASK     0.50 MILS
LAYER 1 ┌──────────────────────────┐ TOP ─────→(Cu + PLATING=1.5 MIL)
                                5.00 MILS
LAYER 2 ┌──────────────────────────┐ GND-1  1.30 MILS
                                4.00 MILS
LAYER 3 ┌──────────────────────────┐ VCC    1.30 MILS
                               24.00 MILS
LAYER 4 ┌──────────────────────────┐ GND-2  1.30 MILS
                               10.00 MILS
LAYER 5 ┌──────────────────────────┐ SIG    0.70 MILS
                               10.00 MILS
LAYER 6 ┌──────────────────────────┐ BOTTOM ─────→(Cu + PLATING=1.5 MIL)
         BOTTOM SIDE SOLDER MASK  0.50 MILS
```
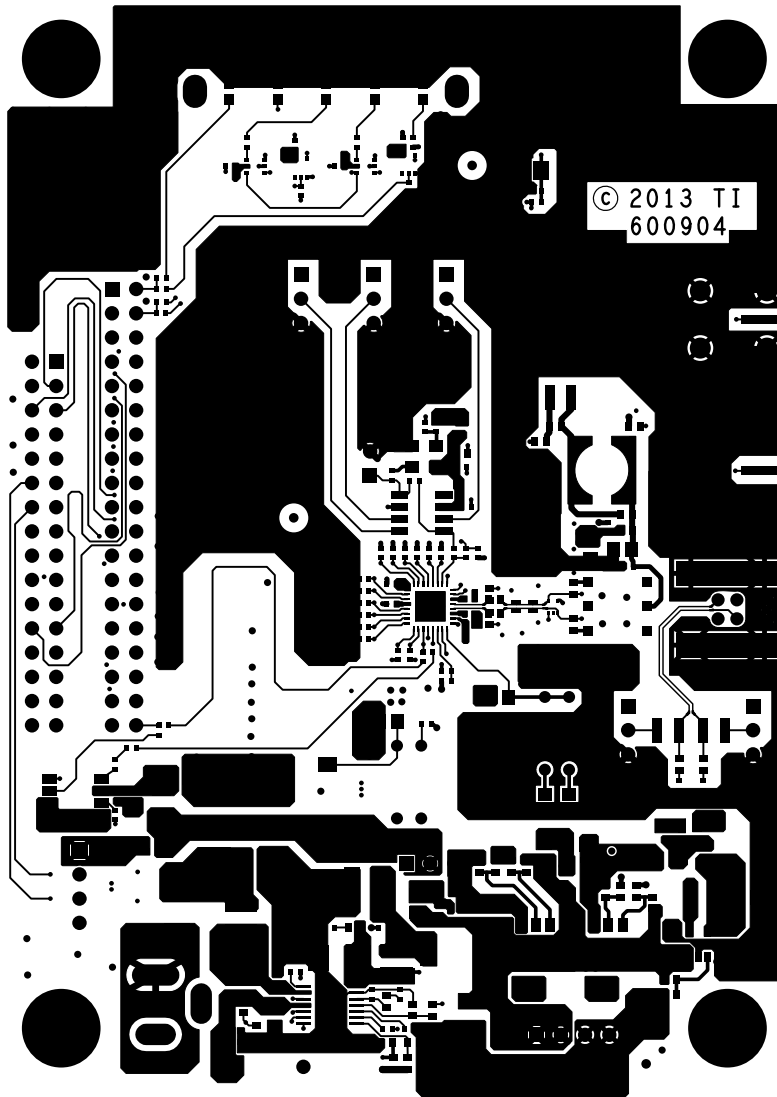
NOTES (UNLESS OTHERWISE SPECIFIED):
1. BOARD THICKNESS : 62 +/- 4 MILS
2. DIELECTRIC : FR4
3. NUMBER OF LAYERS: 6.
4. SOLDERMASK : LPI GREEN.
5. SILKSCREEN : WHITE EPOXY INK.
6. NO VENDOR LOGO OR NAME ON THE BOARD.
7. REMOVE THE NON-FUNCTIONAL PADS ON ALL INNER LAYERS.
8. PLATING : SOFT IMMERSION GOLD.
9. MAXIMUM WARP AND TWIST SHALL NOT EXCEED .005 PER INCH.
10. ANY CHANGES MADE BY THE PCB FABRICATOR TO THE FILM OR
    THE GERBER FILES MUST BE APPROVED BY TEXAS.
11. DEBURR ALL SHARP EDGES.
12. BOARD DIMENSIONS ARE IN INCHES.
13. 8 MIL TRACES REQUIRES 50 OHM +/-5 OHM SINGLE ENDED IMPEDANCE ON TOP LAYER AND SIGNAL LAYER.
6/9/6  TRACES REQUIRE 100 OHM +/-5 OHM DIFFERENTIAL IMPEDANCE ON TOP LAYER.
6/7/6  TRACES REQUIRE 100 OHM +/-5 OHM DIFFERENTIAL IMPEDANCE ON SIGNAL LAYER(LAYER 5).
14. THIS BOARD SHOULD BE LEAD FREE.

| DRILL CHART: TOP to BOTTOM | | | | |
|---|---|---|---|---|
| ALL UNITS ARE IN MILS | | | | |
| FIGURE | SIZE | TOLERANCE | PLATED | QTY |
| • | 8.0 | +3.0/-3.0 | PLATED | 9 |
| • | 10.0 | +3.0/-3.0 | PLATED | 226 |
| • | 15.0 | +3.0/-3.0 | PLATED | 293 |
| ▲ | 16.0 | +3.0/-3.0 | PLATED | 5 |
| • | 30.0 | +3.0/-3.0 | PLATED | 8 |
| ▲ | 35.0 | +3.0/-3.0 | PLATED | 4 |
| ● | 40.0 | +3.0/-3.0 | PLATED | 95 |
| • | 40.0 | +3.0/-3.0 | PLATED | 1 |
| • | 40.0 | +3.0/-3.0 | PLATED | 3 |
| • | 40.0 | +3.0/-3.0 | PLATED | 1 |
| • | 40.0 | +3.0/-3.0 | PLATED | 3 |
| • | 62.99 | +3.0/-3.0 | PLATED | 4 |
| • | 65.0 | +3.0/-3.0 | PLATED | 4 |
| • | 156.0 | +3.0/-3.0 | PLATED | 4 |
| ▮ | 123.11x44.37 | +3.0/-3.0 | PLATED | 1 |
| ▬ | 123.11x44.37 | +3.0/-3.0 | PLATED | 1 |
| ▬ | 142.8x44.37 | +3.0/-3.0 | PLATED | 1 |
| ● | 118.0x79.0 | +2.0/-2.0 | NON-PLATED | 2 |

```
          ├──── 3.25 ────┤
4.57
```
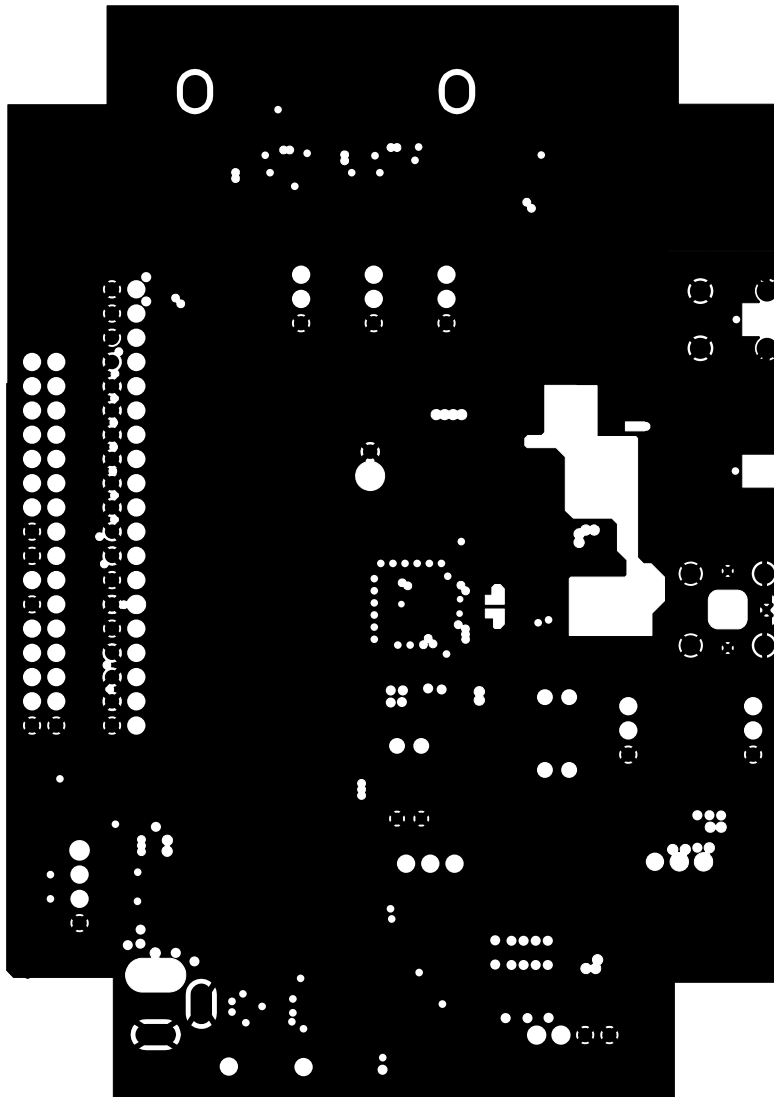
TEXAS INSTRUMENTS
NAME: DS90UB913 DEMO BOARD
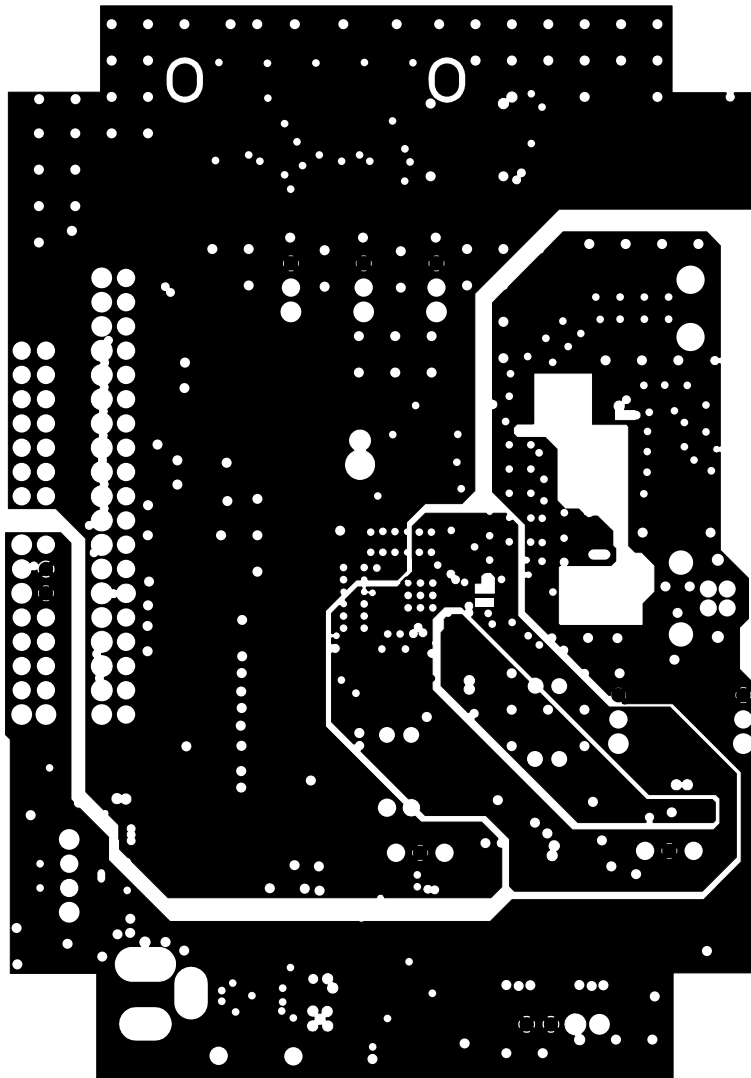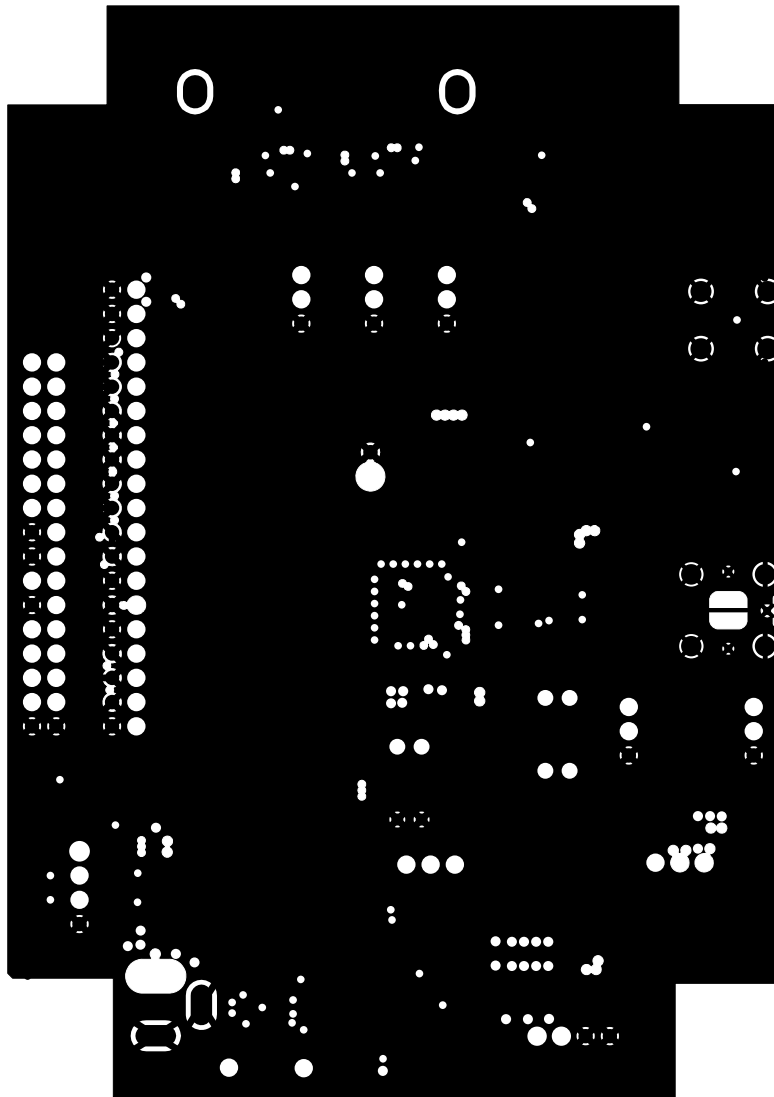DATE: MAR 2013 | DOC NO: SV600904 | Rev.3
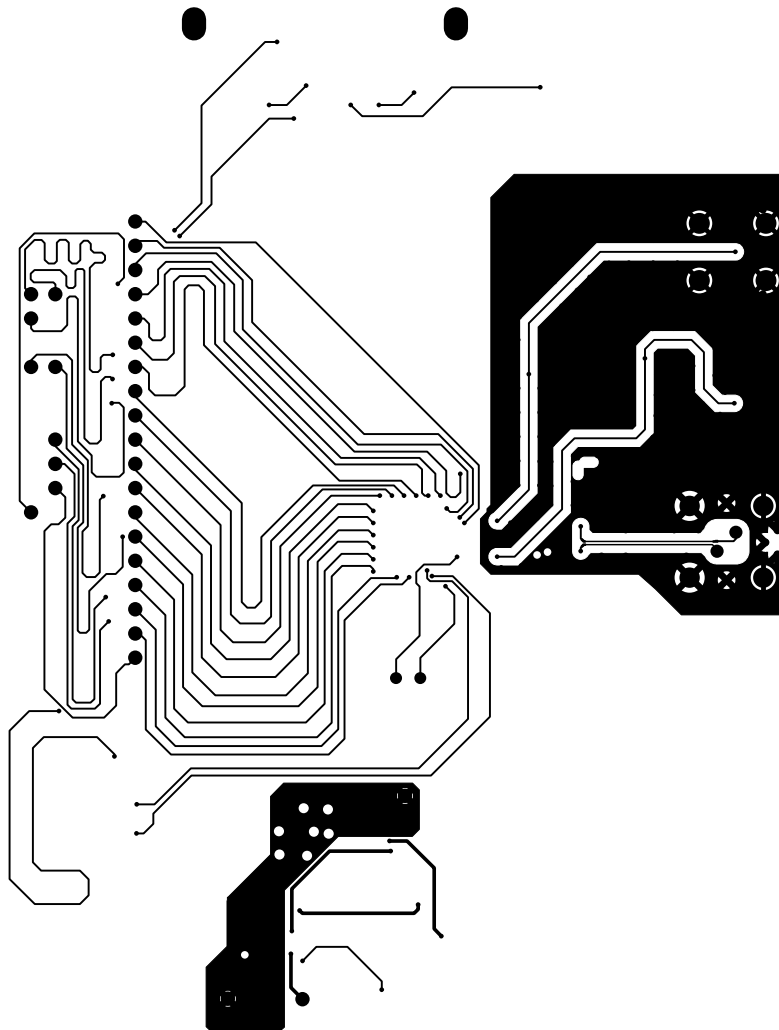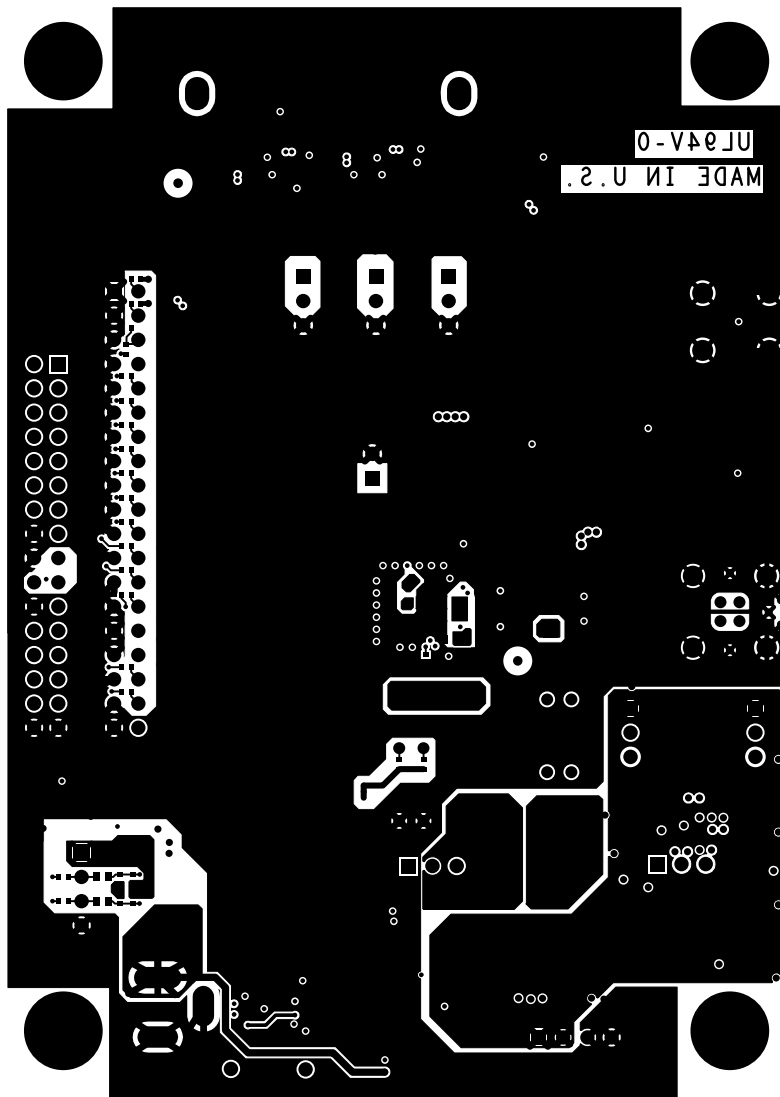LAYER: FAB

---

2. Layer 1 - TOP
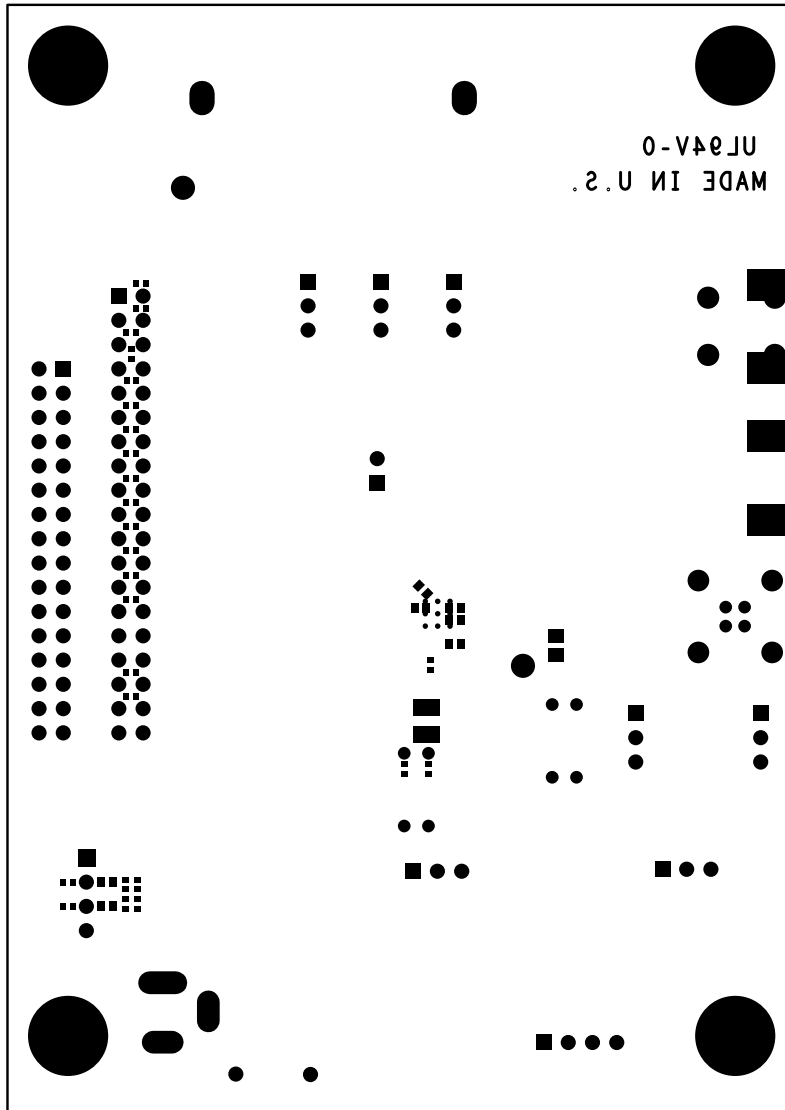
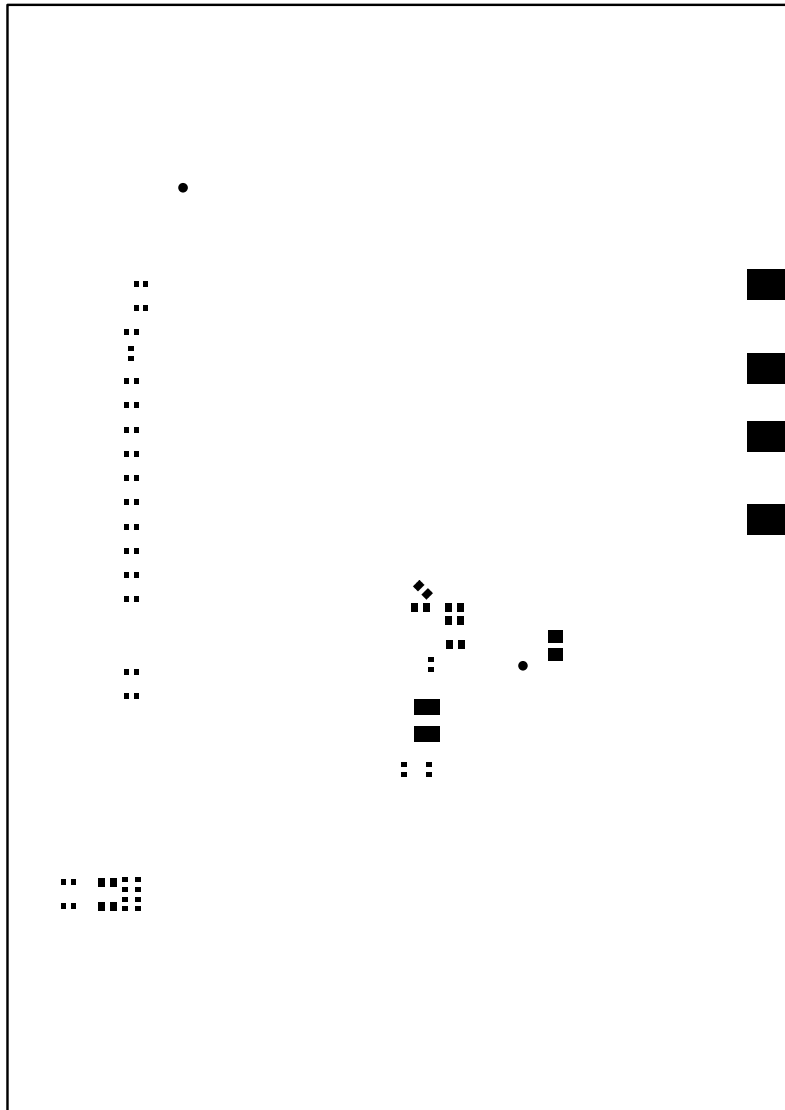3. Layer 2 - GND-1

4. Layer 3 - VCC

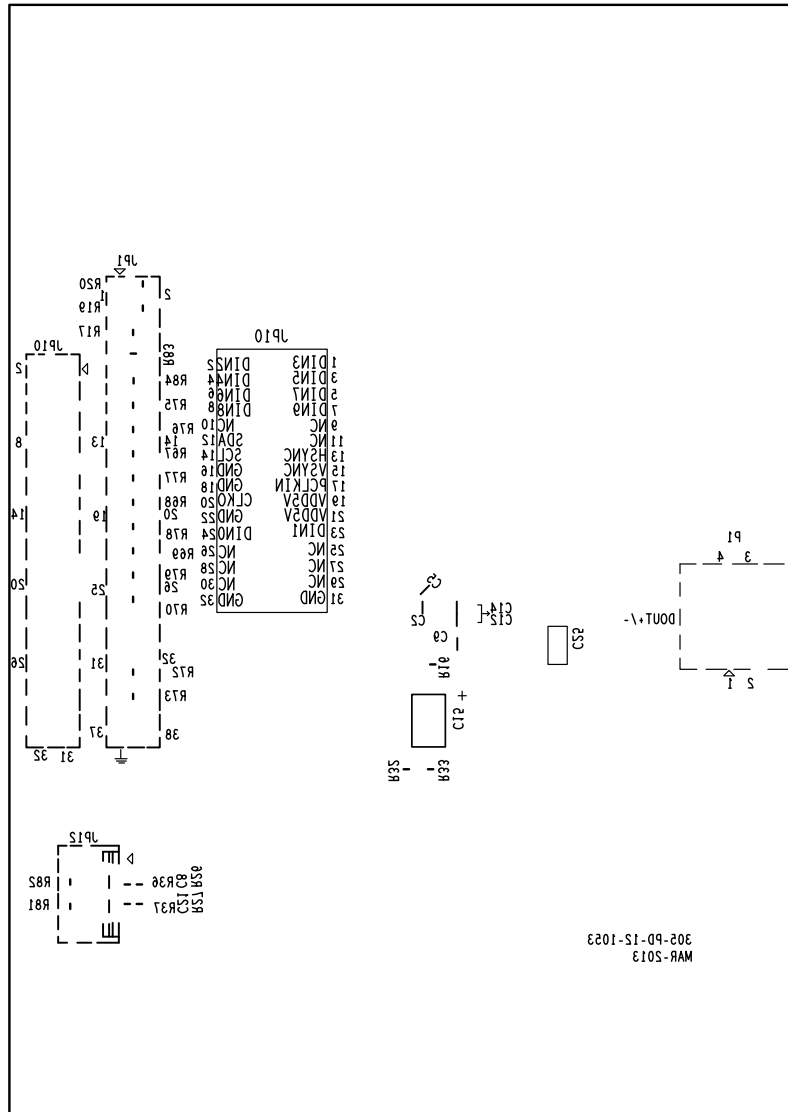5.   Layer 4 - GND-2

6. Layer 5 - SIGNAL

7.   Layer 6 - BOTTOM

## 8. BOTTOM MASK

9.　BOTTOM PASTE

## 10. BOTTOM SILK

11. TOP MASK

12. TOP PASTE

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## 13. TOP SILK

## B.2 DS90UB914A-CXEVM Deserializer Board Layout

1.  DS90UB914A-CXEVM Stackup & FAB Notes

LAYER STACK-UP

THIS IS A 6 LAYER BOARD

```
                TOP SIDE SOLDER MASK   0.50 MILS
                                              ┌──→ TOP ─────→ (Cu + PLATING=1.5 MIL)
LAYER 1  ────────────────────────────────────┘
                                    5.00 MILS
                                              ┌──→ GND-1  1.3 MILS
LAYER 2  ────────────────────────────────────┘
                                    4.00 MILS
                                              ┌──→ VCC     1.3 MILS
LAYER 3  ────────────────────────────────────┘
                                   24.00 MILS
                                              ┌──→ GND-2  1.3 MILS
LAYER 4  ────────────────────────────────────┘
                                   10.00 MILS
                                              ┌──→ SIG     0.7 MILS
LAYER 5  ────────────────────────────────────┘
                                   10.00 MILS
                                              ┌──→ BOTTOM ─────→ (Cu + PLATING=1.5 MILS)
LAYER 6  ────────────────────────────────────┘
                BOTTOM SIDE SOLDER MASK  0.50 MILS
```

| | DRILL CHART: TOP to BOTTOM | | | |
|---|---|---|---|---|
| | ALL UNITS ARE IN MILS | | | |
| FIGURE | SIZE | TOLERANCE | PLATED | QTY |
| • | 10.0 | +3.0/-3.0 | PLATED | 9 |
| • | 10.0 | +3.0/-3.0 | PLATED | 338 |
| + | 16.0 | +3.0/-3.0 | PLATED | 316 |
| ▲ | 16.0 | +3.0/-3.0 | PLATED | 5 |
| • | 30.0 | +3.0/-3.0 | PLATED | 20 |
| ▲ | 35.0 | +3.0/-3.0 | PLATED | 4 |
| ● | 40.0 | +3.0/-3.0 | PLATED | 88 |
| • | 40.0 | +3.0/-3.0 | PLATED | 2 |
| • | 40.0 | +3.0/-3.0 | PLATED | 6 |
| • | 62.99 | +3.0/-3.0 | PLATED | 4 |
| • | 65.0 | +3.0/-3.0 | PLATED | 4 |
| ● | 156.0 | +2.0/-2.0 | NON-PLATED | 4 |
| ▬ | 123.11x44.37 | +3.0/-3.0 | PLATED | 1 |
| ▮ | 123.11x44.37 | +3.0/-3.0 | PLATED | 1 |
| ▬ | 142.8x44.37 | +3.0/-3.0 | PLATED | 1 |
| ● | 118.0x79.0 | +2.0/-2.0 | NON-PLATED | 2 |

3.25

4.50

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 INCH.
10. ANY CHANGES MADE BY THE PCB FABRICATOR TO THE FILM OR
    THE GERBER FILES MUST BE APPROVED BY TEXAS.
11. DEBURR ALL SHARP EDGES.
12. BOARD DIMENSIONS ARE IN INCHES.
13. 8 MIL TRACES REQUIRES 50 OHM +/-5 OHM SINGLE ENDED IMPEDANCE ON TOP LAYER AND SIGNAL LAYER.
6/9/6  TRACES REQUIRE 100 OHM +/-5 OHM DIFFERENTIAL IMPEDANCE ON TOP LAYER.
6/7/6  TRACES REQUIRE 100 OHM +/-5 OHM DIFFERENTIAL IMPEDANCE ON SIGNAL LAYER(ON LAYER 5).
14. THIS BOARD SHOULD BE LEAD FREE.

| TEXAS INSTRUMENTS | | |
|---|---|---|
| NAME:DS90UB914 DEMO BRD | | |
| DATE:MAR 2013 | DOC NO:SV600905 | Rev.3 |
| LAYER: FAB | | |

2. Layer 1 - TOP

3. Layer 2 - GND-1

4.   Layer 3 - VCC

5. Layer 4 - GND-2
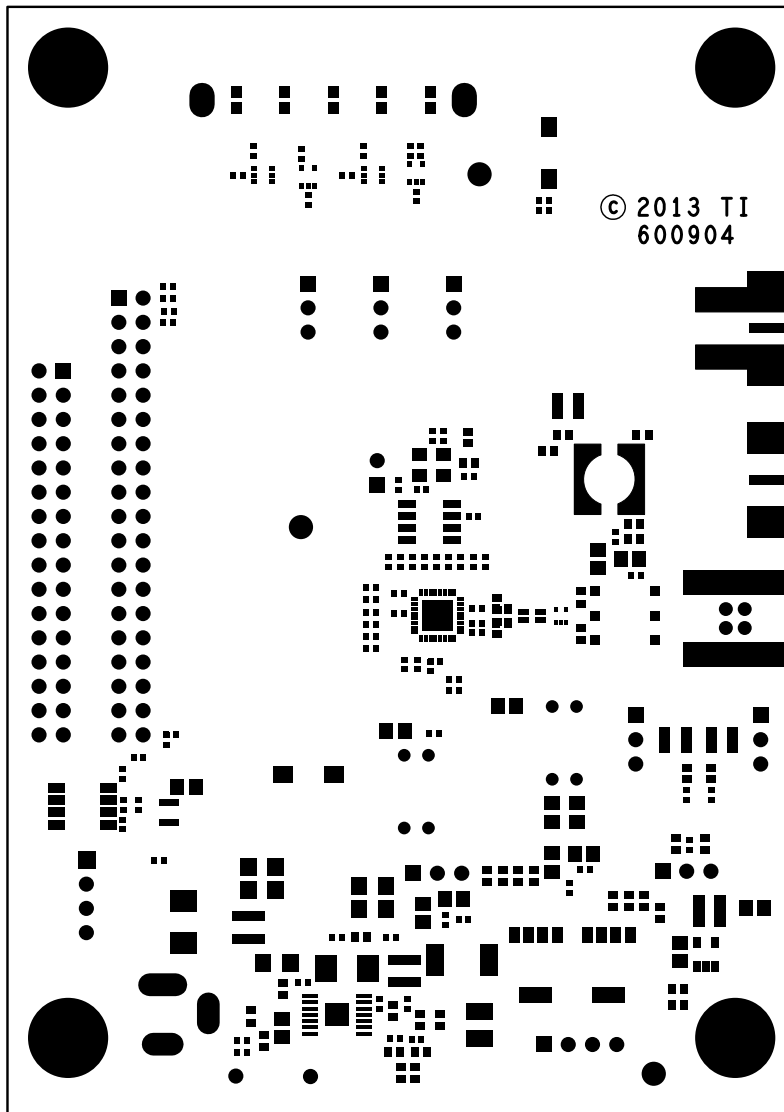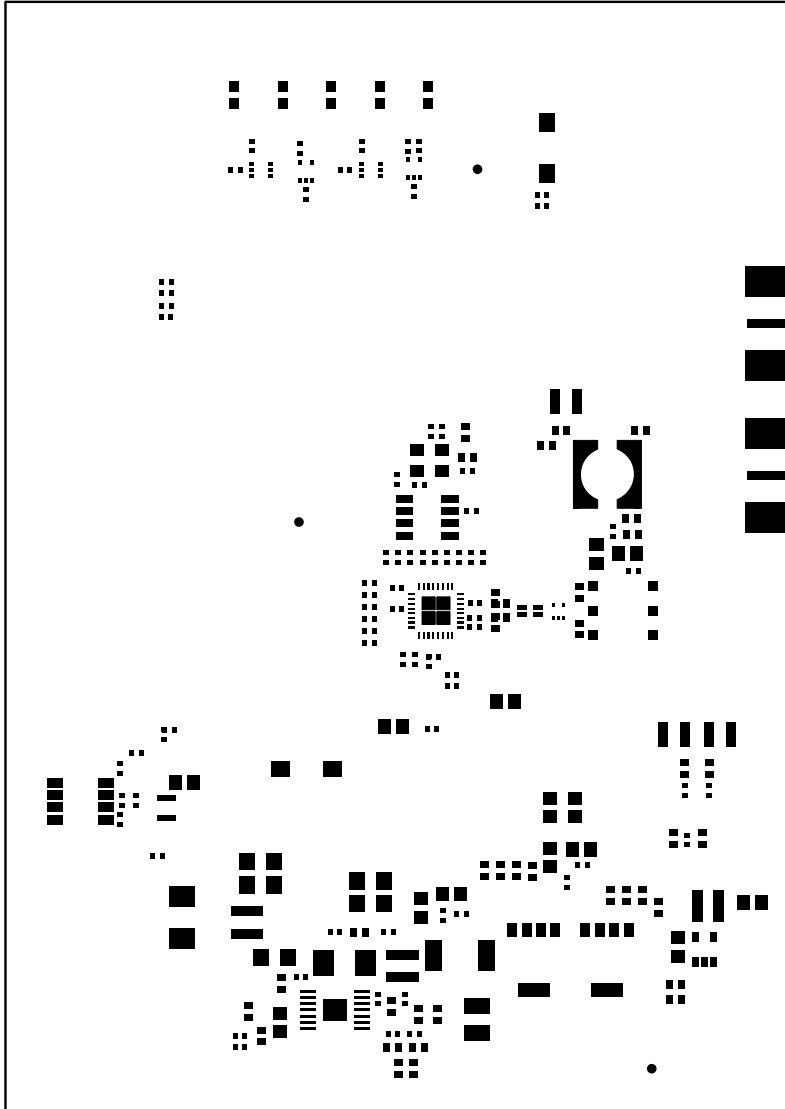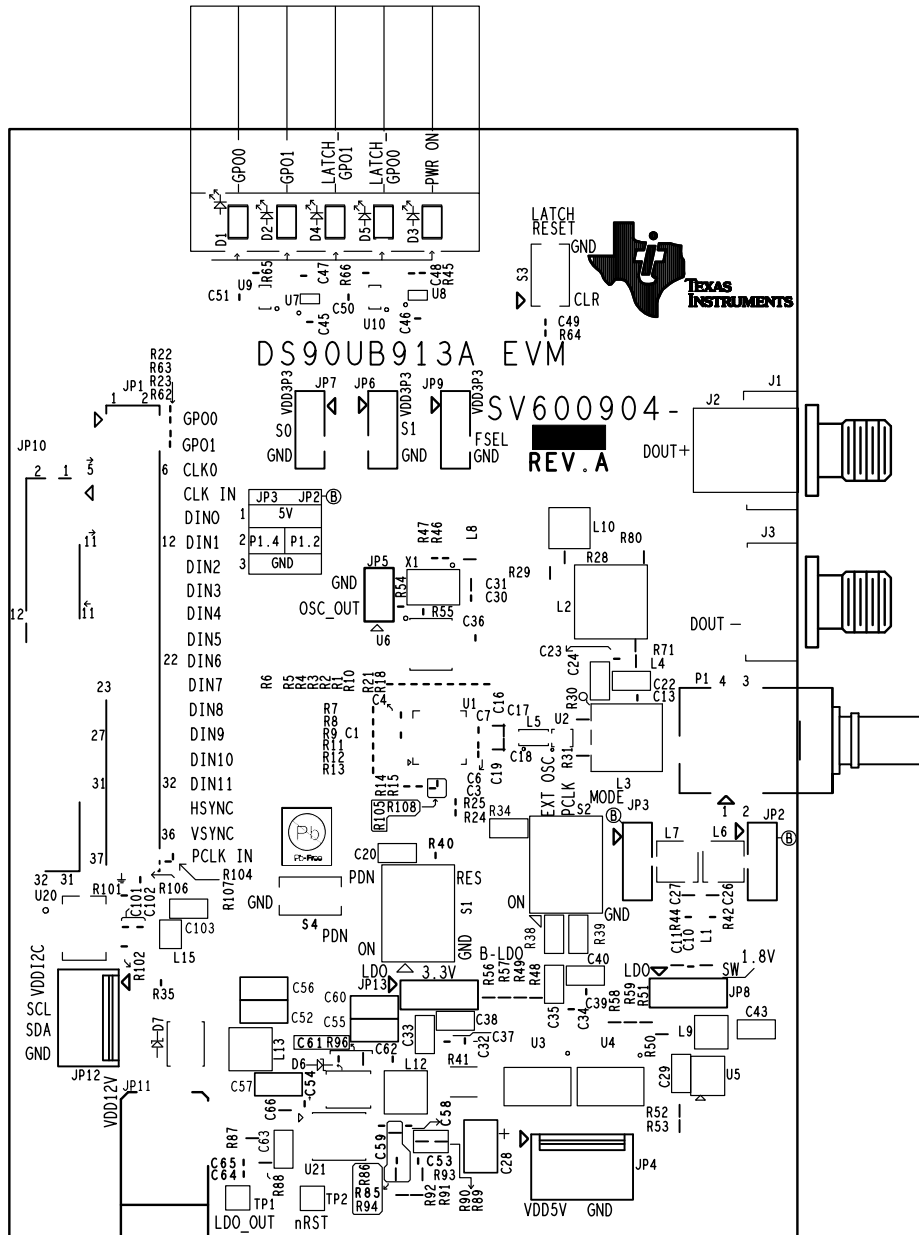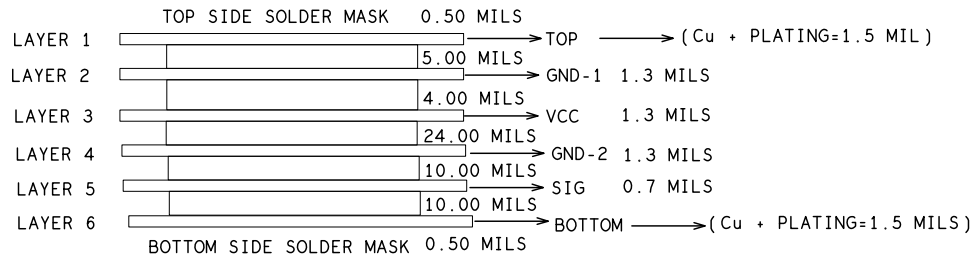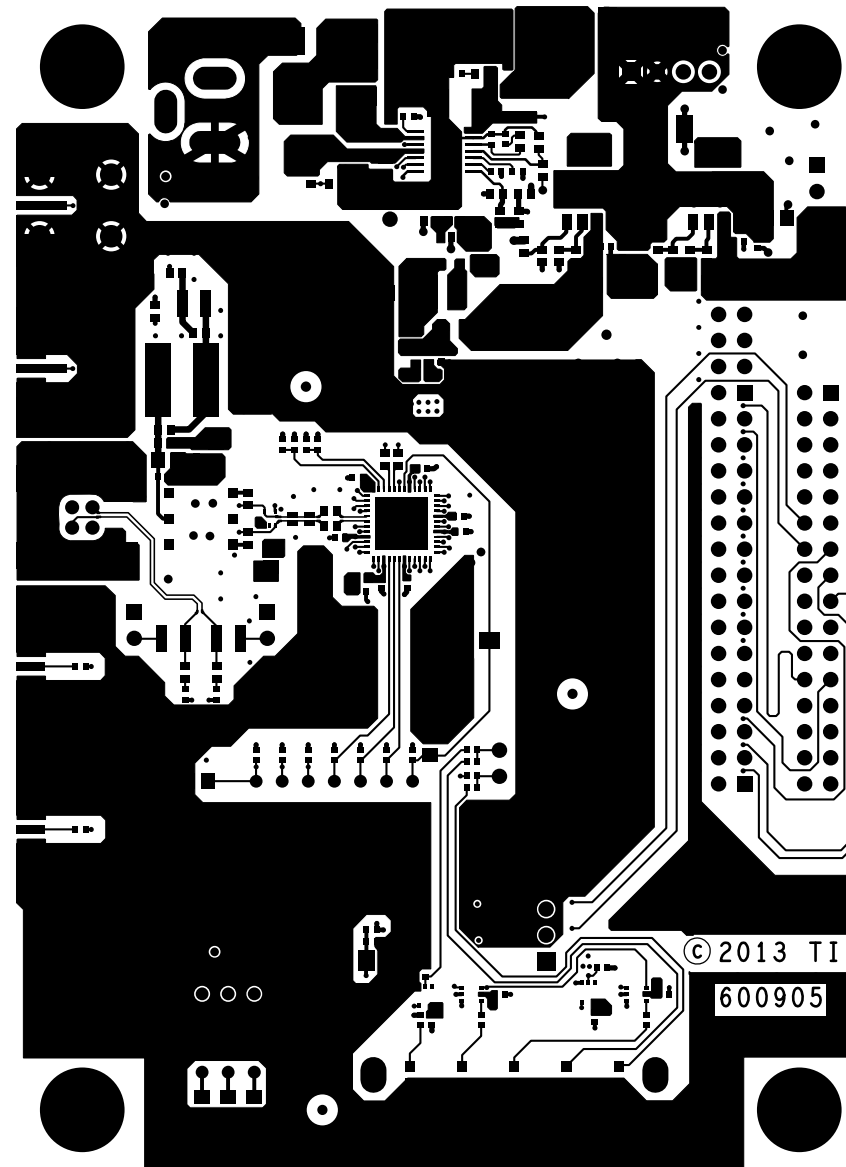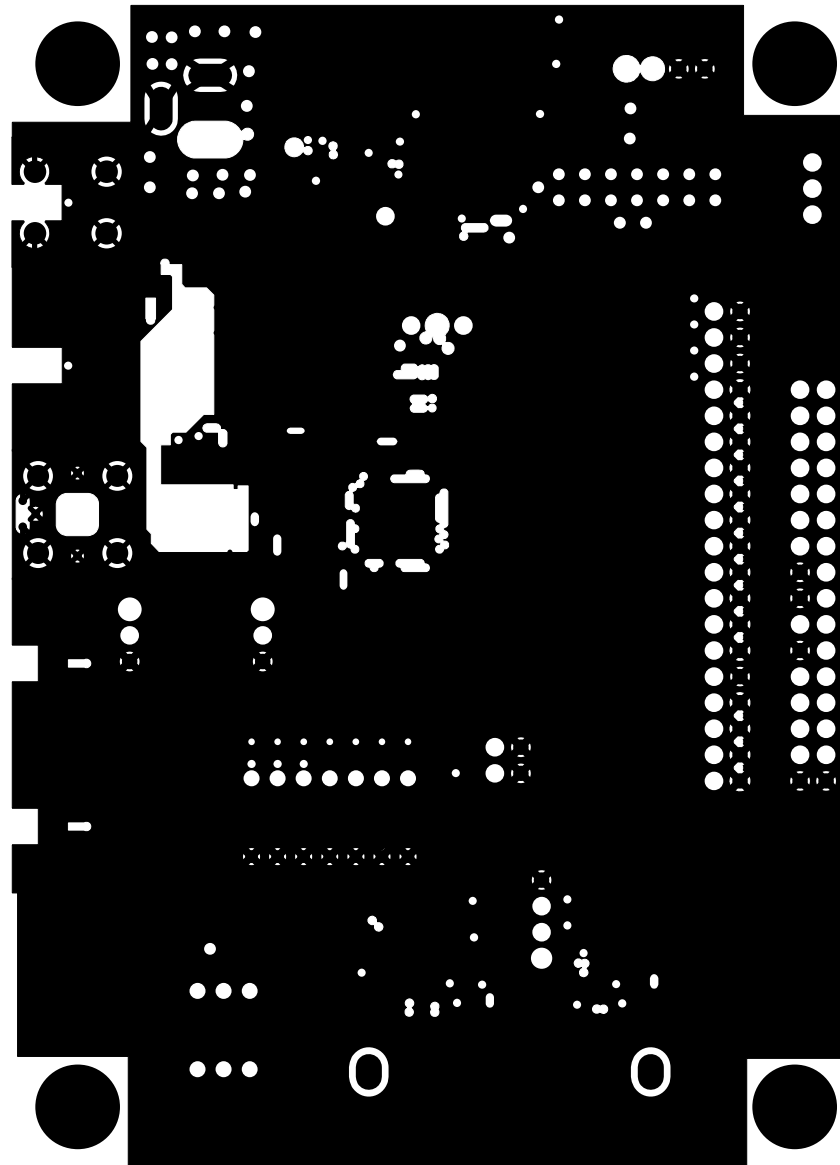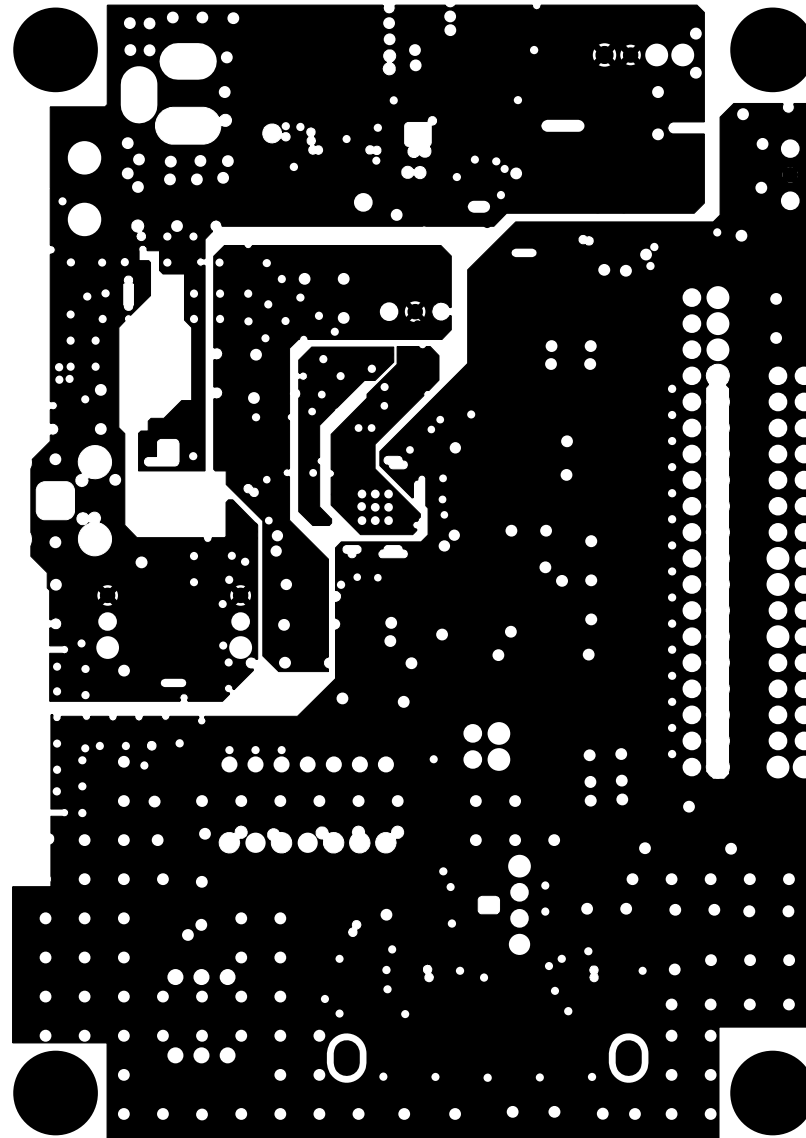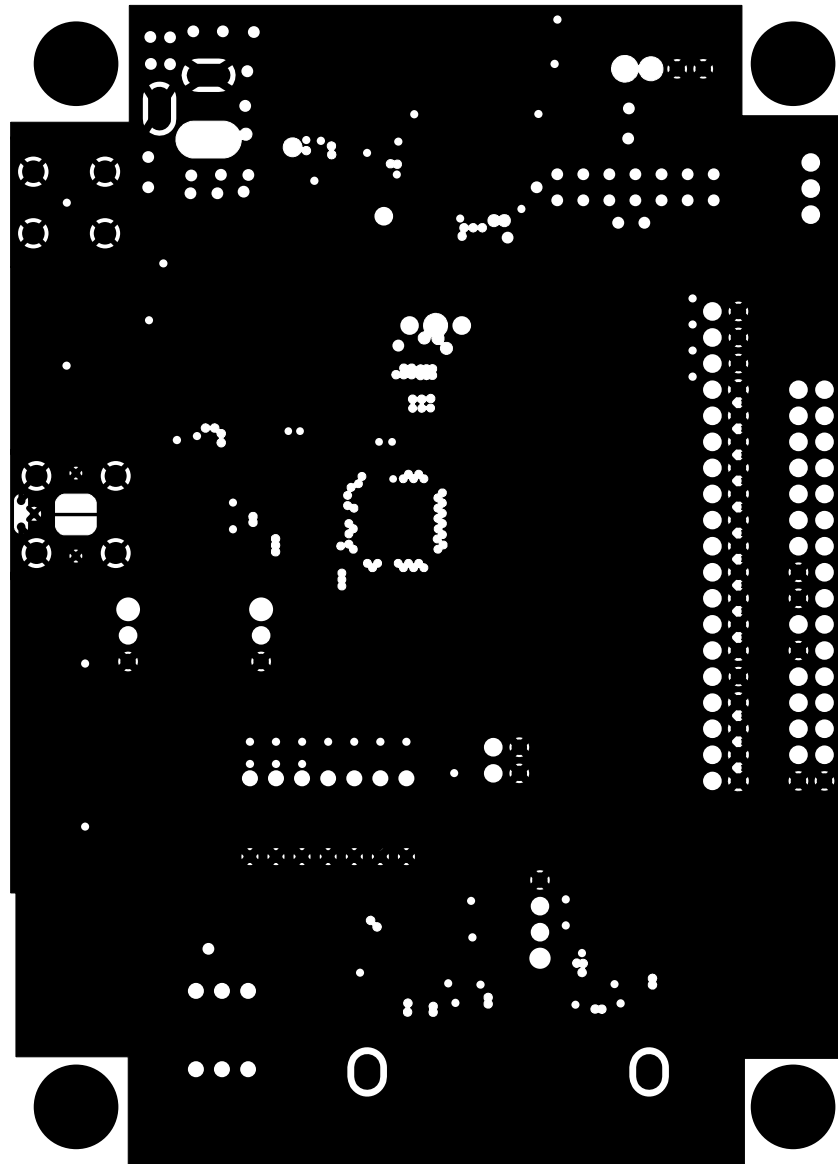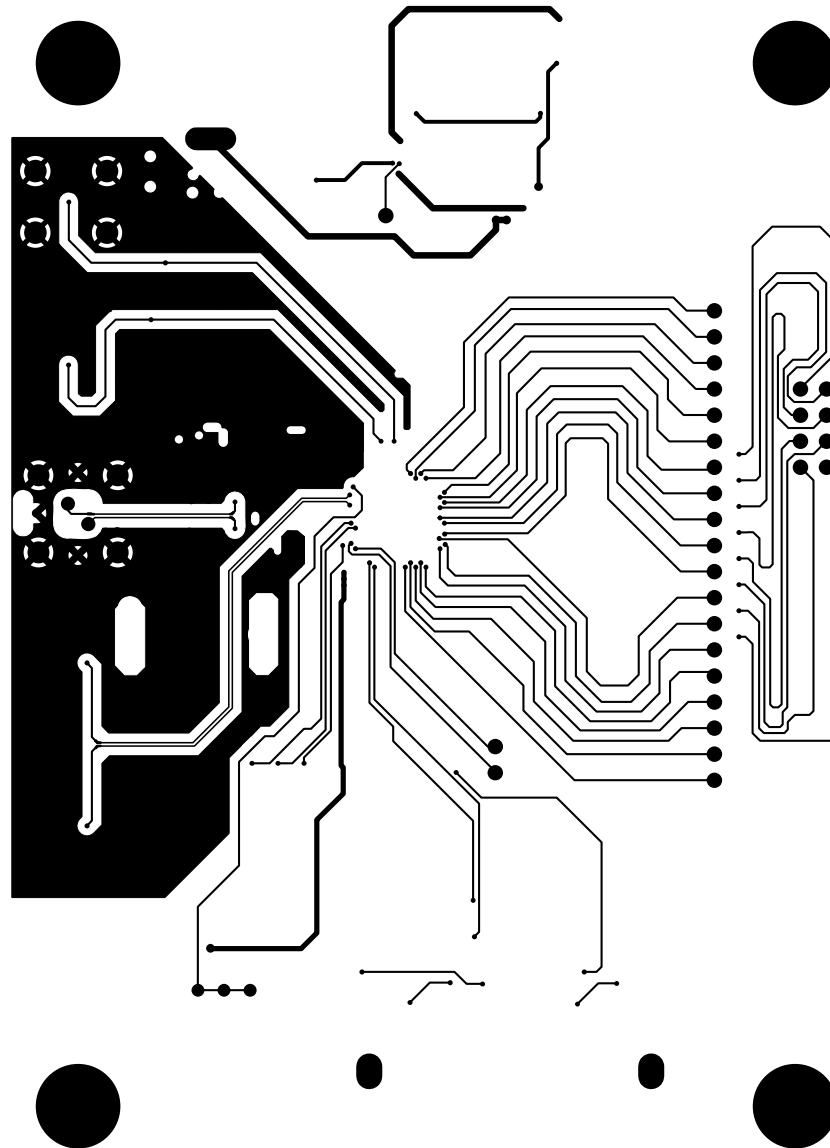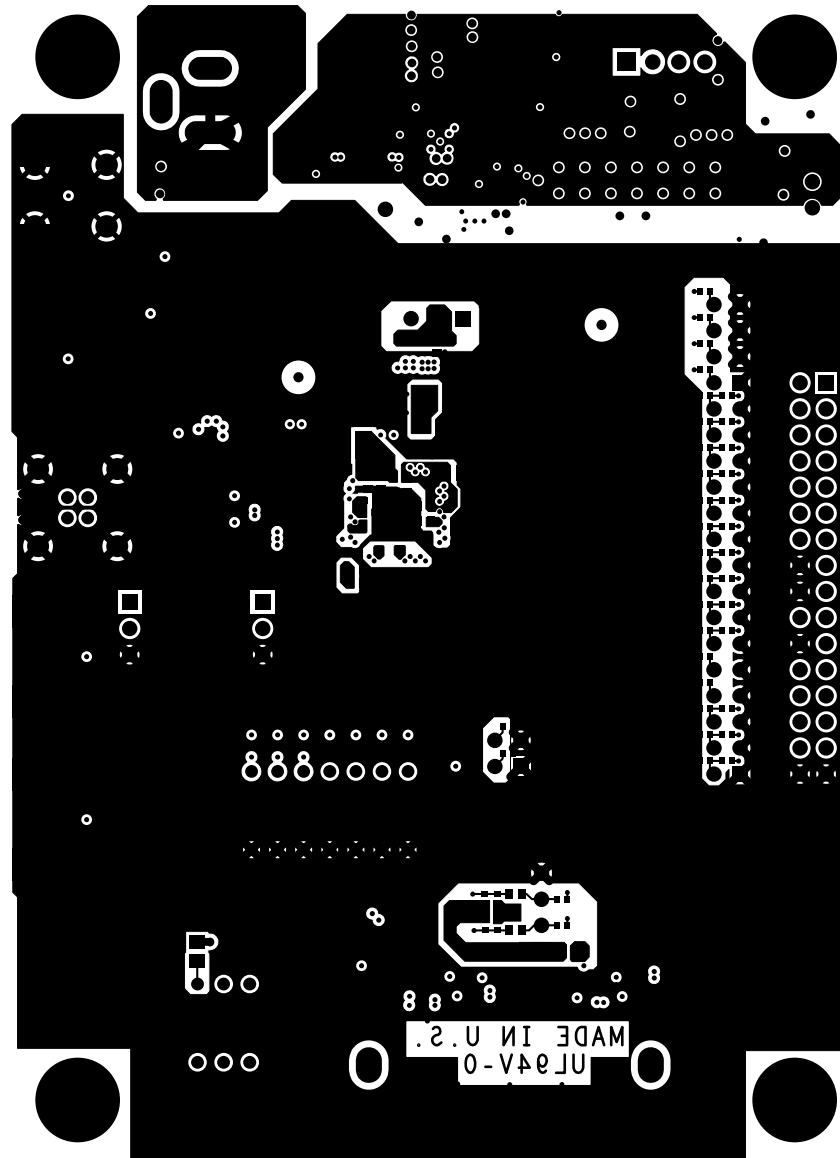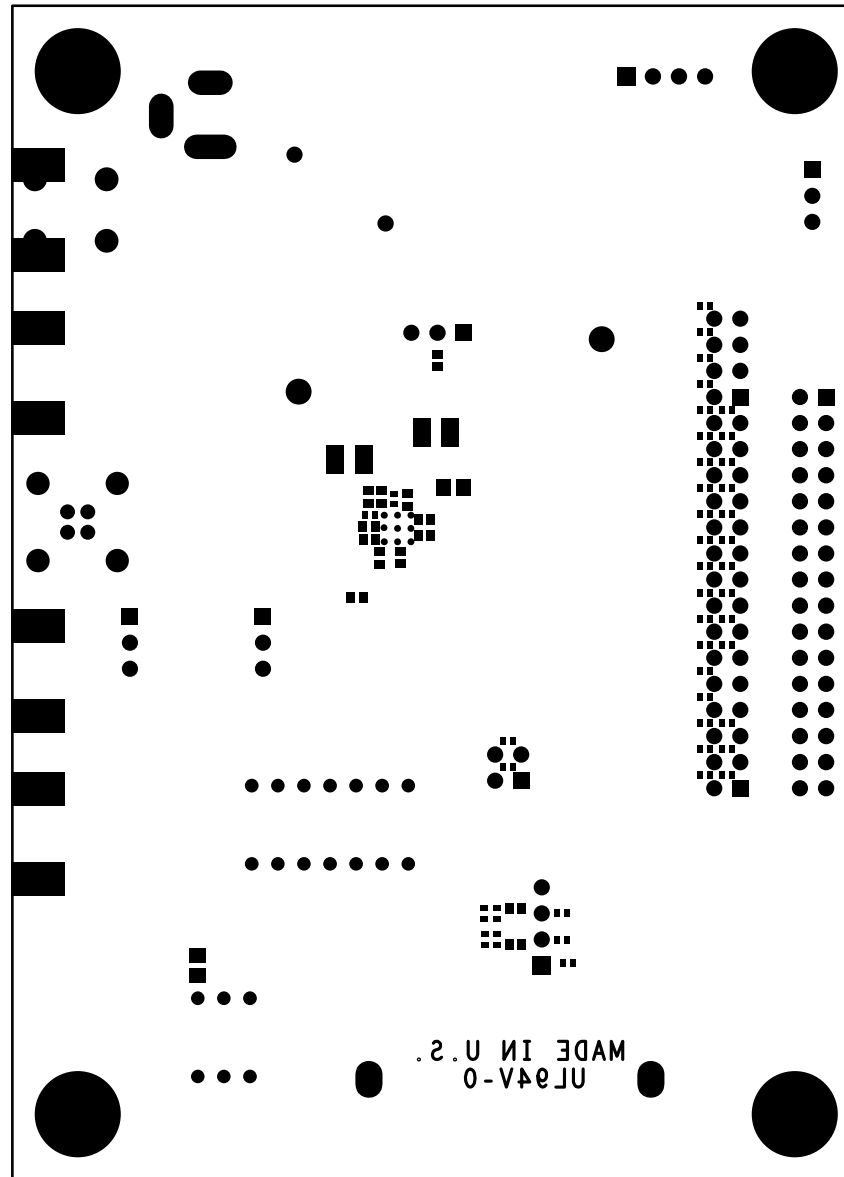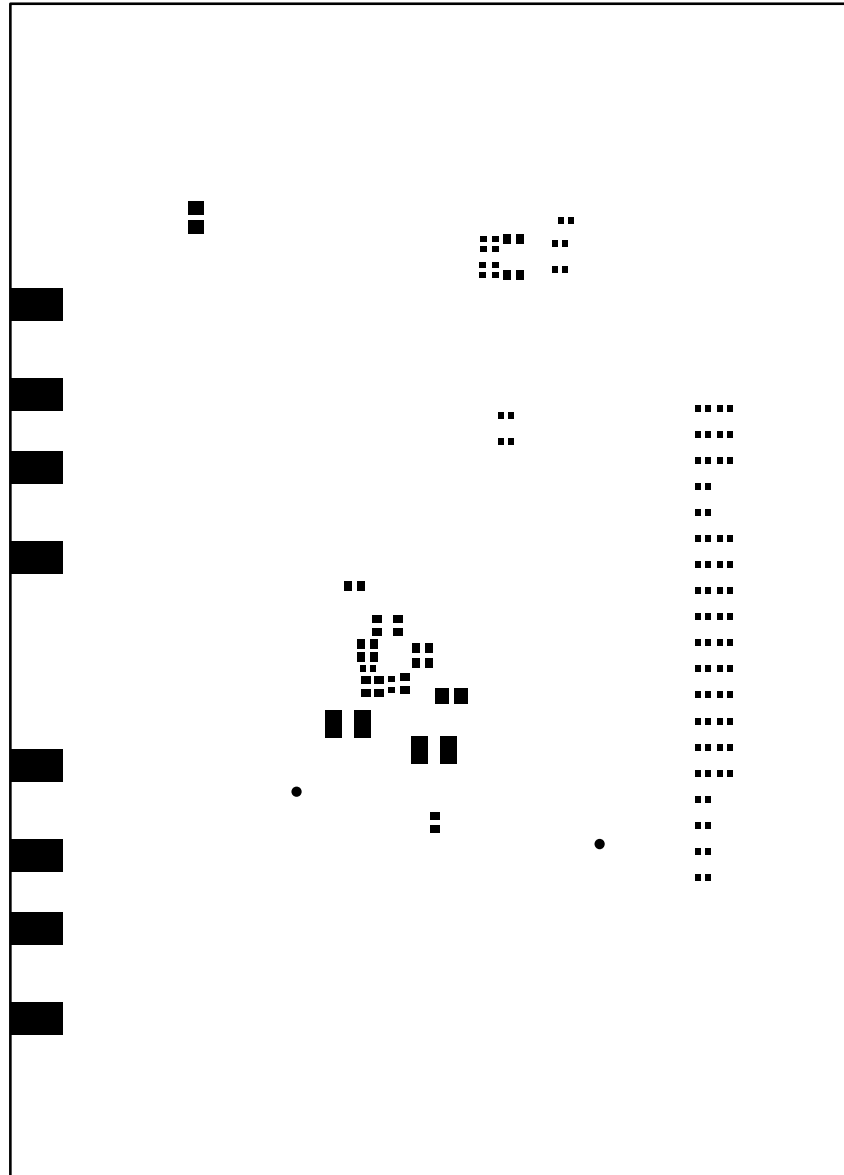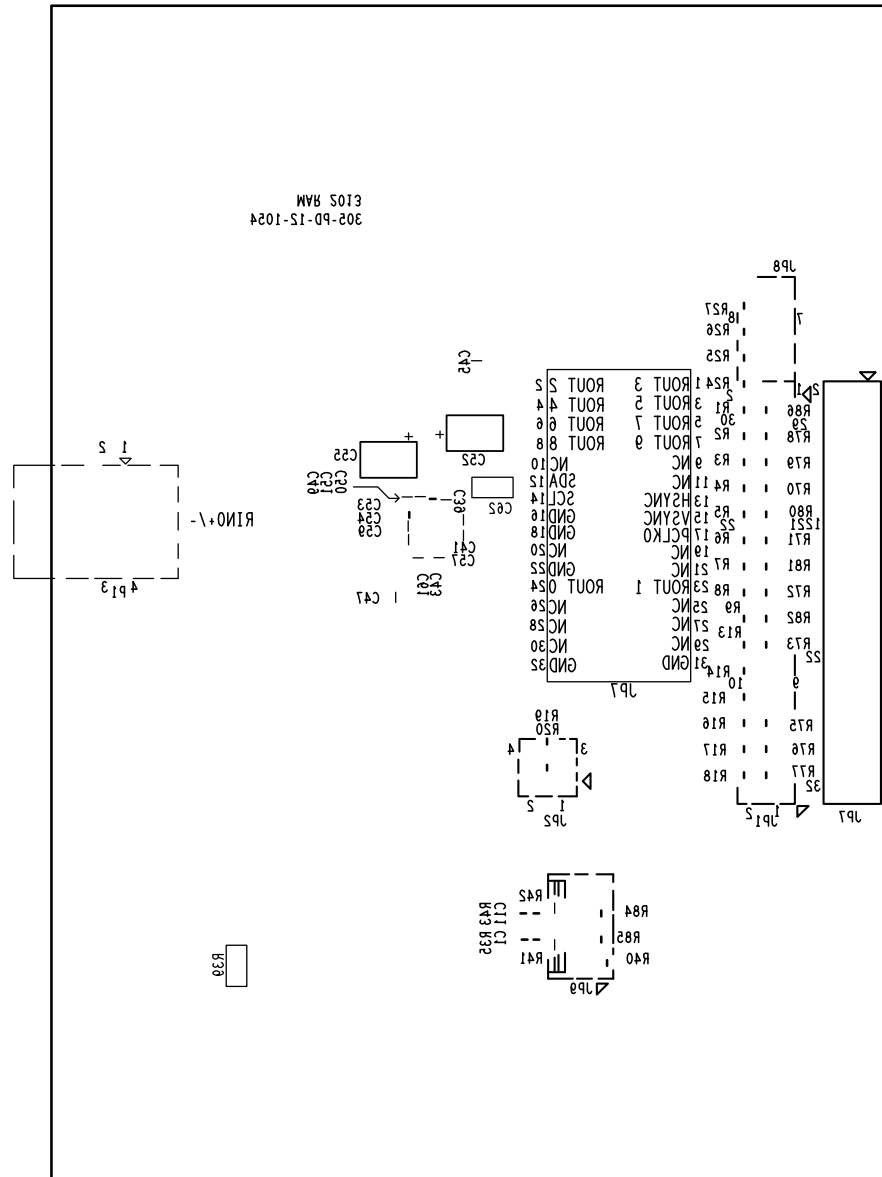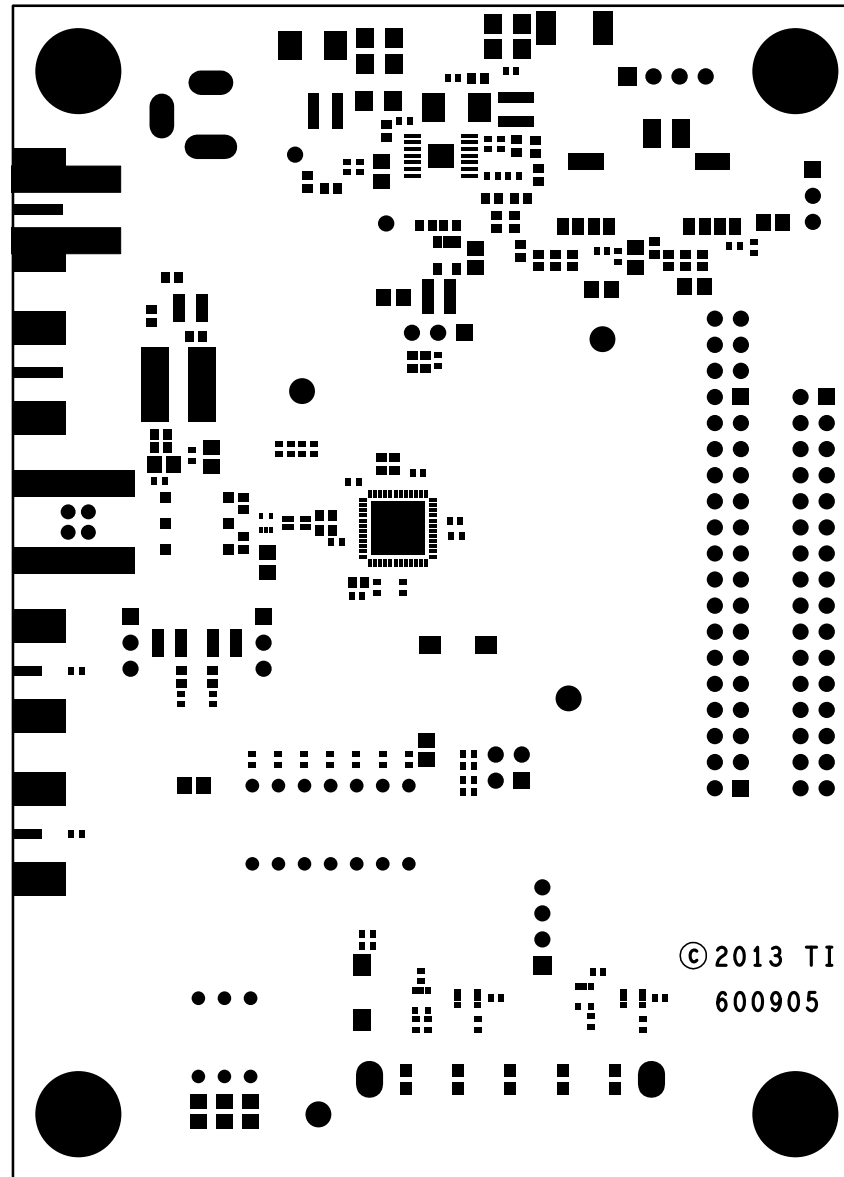
6.   Layer 5 - SIGNAL

7. Layer 6 - BOTTOM

8. BOTTOM MASK

## 9. BOTTOM PASTE

Submit Documentation Feedback

## 10. BOTTOM SILK

### 11. TOP MASK

12. TOP PASTE

## 13. TOP SILK

![Texas Instruments logo]

# Bill of Materials

## C.1 DS90UB913A-CXEVM Serializer Board BOM

**Table C-1. DS90UB913A-CXEVM BOM**

| Qty. | Reference | Part | PCB Footprint | MFR and Part# |
|------|-----------|------|---------------|---------------|
| 23 | C1, C3, C4, C6, C7, C10, C13, C23, C26, C27, C30, C32, C34, C36, C37, C39, C47, C48, C49, C50, C51, C54, C101 | 0.1µF | 0402 | MuRata GRM155R71C104KA88D CAP, CERM, 0.1 µF, 16 V, +/- 10%, X7R |
| 7 | C2, C5, C9, C11, C12, C14, C31 | 1µF | 0603 | MuRata GRM188R71E105KA12D CAP, CERM, 1 µF, 25 V, +/- 10%, X7R |
| 2 | C15, C28 | 22µF | 1210 | MuRata GCM32ER71C226KE19L CAP, CERM, 22 µF, 16 V, +/- 10%, X7R |
| 2 | C16, C66 | 0.1µF | 0603 | MuRata GRM188R72A104KA35D CAP, CERM, 0.1 µF, 100 V, +/- 10%, X7R |
| 1 | C19 | 0.047µF | 0603 | MuRata GRM188R71H473KA61D CAP, CERM, 0.047 µF, 50 V, +/- 10%, X7R |
| 6 | C20, C25, C29, C38, C40, C43 | 10µF | 0805 | MuRata GRM21BR61C106KE15L CAP, CERM, 10 µF, 16 V, +/- 10%, X5R |
| 4 | C22, C24, C33, C35 | 4.7µF | 0805 | MuRata GRM21BR71C475KA73L CAP, CERM, 4.7 µF, 16 V, +/- 10%, X7R |
| 2 | C45, C46 | 10pF | 0402 | MuRata GRM1555C1H100JA01D CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0 |
| 1 | C52 | 4.7µF | 1206_190 | TDK C3216X7R1H475M160AC CAP, CERM, 4.7 µF, 50 V, +/- 20%, X7R |
| 1 | C53 | 0.082µF | 0402 | Kemet C0402C823K4RACTU CAP, CERM, 0.082 µF, 10 V, +/- 10%, X7R |
| 2 | C56, C57 | 22µF | 1206_190 | TDK C3216X5R1E226M160AB CAP, CERM, 22 µF, 25 V, +/- 20%, X5R, 1206 |
| 1 | C58 | 3900pF | 0402 | Kemet C0402C392K4RACTU CAP, CERM, 3900 pF, 16 V, +/- 10%, X7R |
| 1 | C63 | 10µF | 0805 | TDK C2012X7R1A106K125AC CAP, CERM, 10 µF, 10 V, +/- 10%, X7R |
| 1 | C102 | 0.01µF | 0402 | MuRata GRM155R71C103KA01D CAP, CERM, 0.01 µF, 16 V, +/- 10%, X7R |
| 1 | C103 | 10µF | 0805 | MuRata GRM21BR71A106KE51L CAP, CERM, 10 µF, 10 V, +/- 10%, X7R |
| 1 | D1 | LED | SMD | Lite-On LTST-C191TGKT LED, Green, SMD |
| 2 | D2, D5 | LED | SMD | Lite-On LTST-C191KFKT LED, Orange, SMD |
| 2 | D3, D4 | LED | SMD | Lite-On LTST-C191KRKT LED, Red, SMD |
| 2 | D6, D7 | Schottky | SMB | ON Semiconductor MBRS1540T3G Diode, Schottky, 40 V, 1.5 A, SMB |
| 1 | J2 | RF 50 Ohm | | Rosenberger 59S2AQ-40MT5-Z Connector. RF 50 Ohm R/A, TH |
| 1 | JP1 | Header | | Samtec TSW-119-07-T-D Header, 2.54mm, 19x2, Tin, TH |
| 7 | JP2, JP3, JP6, JP7, JP8, JP9, JP13 | Header | | Samtec TSW-103-07-T-S Header, 2.54 mm, 3x1, Tin, TH |

## Table C-1. DS90UB913A-CXEVM BOM (continued)

| Qty. | Reference | Part | PCB Footprint | MFR and Part# |
|---|---|---|---|---|
| 1 | JP4 | Header | | Molex 0022112042 Header (friction lock), 100mil, 4x1, Gold, TH |
| 1 | JP5 | Header | | Samtec TSW-102-07-T-S Header, 2.54 mm, 2x1, Tin, TH |
| 1 | JP11 | Power Jack | | Switchcraft RAPC722X Power Jack, mini, 2.1mm OD, R/A, TH |
| 1 | JP12 | Header | | Samtec TSW-104-07-G-S Header, 100mil, 4x1, Gold, TH |
| 4 | L1, L4, L8, R29/L16 | 1000Ω @ 100 MHz | 0603 | MuRata BLM18AG102SN1D Ferrite Bead, 1000 ohm @ 100 MHz, 0.4 A |
| 1 | L2 | 100µH | SMD | Coilcraft MSS7341T-104MLB Inductor, Shielded Drum Core, Ferrite, 100 µH, 0.7 A, 0.28 ohm, SMD |
| 1 | L9 | 2.2µH | SMD | Coilcraft LPS3015-222MLB Inductor, Shielded Drum Core, Ferrite, 2.2 µH, 1.4 A, 0.11 ohm, SMD |
| 1 | L10 | 4.7µH | SMD | Coilcraft 1008PS-472KLB Inductor, Shielded, Ferrite, 4.7 µH, 0.7 A, 0.35 ohm, SMD |
| 2 | L12, L13 | 4.7µH | SMD | Coilcraft XFL4020-472MEB Inductor, Shielded, Composite, 4.7 µH, 2.7 A, 0.05 ohm, SMD |
| 1 | L15 | 2.2µH | SMD | Taiyo Yuden BRL2518T2R2M Inductor, Wirewound, 2.2 µH, 0.85 A, 0.135 ohm, SMD |
| 25 | R1, R2, R3, R4, R5, R6, R7, R8, R9, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R24, R32, R33, R34, R46, R64 | 10kΩ | 0402 | Panasonic ERJ-2GEJ103X RES, 10 k, 5%, 0.1 W |
| 8 | R10, R25, R35, R40, R54, R55, R104, R105 | 0Ω | 0402 | Panasonic ERJ-2GE0R00X RES, 0, 5%, 0.063 W |
| 5 | R22, R23, R45, R65, R66 | 330Ω | 0402 | Panasonic ERJ-2RKF3300X RES, 330, 1%, 0.1 W |
| 2 | R26, R27 | 4.7kΩ | 0402 | Panasonic ERJ-2RKF4701X RES, 4.70 k, 1%, 0.1 W |
| 2 | R28, R71 | 1kΩ | 0603 | Panasonic ERJ-3EKF1001V RES, 1.00 k, 1%, 0.1 W |
| 2 | R36, R37 | 0Ω | 0603 | Panasonic ERJ-3GEY0R00V RES, 0, 5%, 0.1 W |
| 1 | R38 | 100kΩ | 0805 | Panasonic ERJ-6ENF1003V RES, 100 k, 1%, 0.125 W |
| 1 | R39 | 4.7kΩ | 0805 | Panasonic ERJ-6GEYJ472V RES, 4.7 k, 5%, 0.125 W |
| 1 | R41 | 0Ω | 2512 | Vishay-Dale CRCW25120000Z0EGHP RES, 0, 5%, 1.5 W, AEC-Q200 Grade 0 |
| 2 | R42, R44 | 49.9Ω | 0402 | Panasonic ERJ-2RKF49R9X RES, 49.9, 1%, 0.1 W |
| 7 | R48, R50, R52, R57, R59, R91, R92 | 10kΩ | 0603 | Panasonic ERJ-3EKF1002V RES, 10.0 k, 1%, 0.1 W |
| 1 | R56 | 16.5kΩ | 0603 | Panasonic ERJ-3EKF1652V RES, 16.5 k, 1%, 0.1 W |
| 1 | R58 | 4.53kΩ | 0603 | Panasonic ERJ-3EKF4531V RES, 4.53 k, 1%, 0.1 W |
| 2 | R62, R63 | 100Ω | 0402 | Panasonic ERJ-2RKF1000X RES, 100, 1%, 0.1 W |
| 1 | R80 | 49.9Ω | 0603 | Panasonic ERJ-3EKF49R9V RES, 49.9, 1%, 0.1 W |
| 1 | R85 | 53kΩ | 0603 | Vishay-Dale PAT0603E5302BST1 RES, 53.0 k, 0.1%, 0.15 W |
| 2 | R86, R88 | 20kΩ | 0603 | Panasonic ERJ-3EKF2002V RES, 20.0 k, 1%, 0.1 W |
| 1 | R87 | 34kΩ | 0603 | Panasonic ERJ-3EKF3402V RES, 34.0 k, 1%, 0.1 W |
| 1 | R89 | 30kΩ | 0603 | Panasonic ERJ-3EKF3002V RES, 30.0 k, 1%, 0.1 W |
| 1 | R90 | 5.69kΩ | 0603 | Vishay-Dale PAT0603E5691BST1 RES, 5.69 k, 0.1%, 0.15 W |
| 1 | R101 | 22Ω | 0402 | Panasonic ERJ-2GEJ220X RES, 22, 5%, 0.1 W |
| 2 | S1, S2 | Switch | | Grayhill 78B02ST Switch, 2 SPST, 0.15 A, 30 V, TH |
| 2 | S3, S4 | Switch | SMD | Panasonic EVQPNF04M Switch, Tactile, SPST-NO, 0.05A, 12V, SMD |
| 1 | U1 | IC | RTV0032A | Texas Instruments DS90UB913ATRTVTQ1 DS90UB913A-Q1/DS90UB914A-Q1 25 to 100 MHz 10/20-Bit FPD-Link III Serializer and Deserializer |

## Table C-1. DS90UB913A-CXEVM BOM (continued)

| Qty. | Reference | Part | PCB Footprint | MFR and Part# |
|---|---|---|---|---|
| 2 | U3, U4 | LDO | SOT-223 | Texas Instruments LP38693MP-ADJ/NOPB 500mA Low Dropout CMOS Linear Regulators with Adjustable Output Stable with Ceramic Output Capacitors, Pb-Free |
| 1 | U5 | Switcher | SOT-23 | Texas Instruments LM3671MF-1.8/NOPB 2MHz, 600mA Step-Down DC-DC Converter, Pb-Free |
| 2 | U7, U8 | Inverter | SOT-353 | Fairchild Semiconductor NC7SP04P5X TinyLogic ULP Inverter |
| 2 | U9, U10 | Flip-Flop | SOT-363 | Fairchild Semiconductor NC7SZ175P6X TinyLogic UHS D-Type Flip-Flop with Asynchronous Clear |
| 1 | U20 | Freq. Multiplier | SOIC-8 | Cypress Semiconductor CY2302SXI-1 Frequency Multiplier and Zero Delay Buffer |
| 1 | X1 | 48MHz | SMD | ECS Inc. ECS-3963-480-BN-TR OSC, 48 MHz, 3.3 V, SMD |
| 0 | C8, C21 | 5pF | 0402 | MuRata GRM1555C1H5R0CA01D CAP, CERM, 5 pF, 50 V, +/- 5%, C0G/NP0 |
| 0 | C17, C18 | 0.1µF | 0603 | MuRata GRM188R72A104KA35D CAP, CERM, 0.1 µF, 100 V, +/- 10%, X7R |
| 0 | C55, C60 | 22µF | 1206_190 | TDK C3216X5R1E226M160AB CAP, CERM, 22 µF, 25 V, +/- 20%, X5R |
| 0 | C59 | 12pF | 0402 | Kemet C0402C120J3GACAUTO CAP, CERM, 12 pF, 25 V, +/- 5%, C0G/NP0, AEC-Q200 Grade 1 |
| 0 | C61, C62, C64, C65 | 0.1µF | 0402 | MuRata GRM155R71C104KA88D CAP, CERM, 0.1 µF, 16 V, +/- 10%, X7R |
| 0 | J1, J3 | RF 50 Ohm | | Emerson Network Power 142-0701-871 RF 50 Ohm Gold Connectors / Coaxial Connectors PC END |
| 0 | JP10 | Header | | Samtec TSW-116-07-G-D Header, 100mil, 16x2, Gold, TH |
| 0 | L3 | 165µH | SMD | Coilcraft KA4909-AL Inductor, Wirewound, Ferrite, 165 µH, 0.65 A, 0.46 ohm, SMD |
| 0 | L5 | Common-Mode Choke | SMD | MuRata DLW21SN261XQ2L Coupled inductor, 0.22 A, 0.59 ohm, SMD |
| 0 | L6, L7 | 10µH | SMD | Coilcraft 1008PS-103KLB Inductor, Shielded, Ferrite, 10 µH, 0.4 A, 0.92 ohm, SMD |
| 0 | P1 | RF 50 Ohm | | Rosenberger D4S20L-40MA5-Z Right Angle Plug for PCB, TH |
| 0 | R21, R47, R67, R68, R69, R70, R72, R73, R75, R76, R77, R78, R79, R81, R82, R83, R84, R106, R107, R108 | 0Ω | 0402 | Panasonic ERJ-2GE0R00X RES, 0, 5%, 0.063 W |
| 0 | R30, R31, R49, R51, R53, R93, R94 | 0Ω | 0603 | Panasonic ERJ-3GEY0R00V RES, 0, 5%, 0.1 W |
| 0 | R96 | 1kΩ | 0603 | Vishay-Dale CRCW06031K00FKEA RES, 1.00 k, 1%, 0.1 W |
| 0 | R102 | 22Ω | 0402 | Panasonic ERJ-2GEJ220X RES, 22, 5%, 0.1 W |
| 0 | U2 | ESD | SOT (DRL) | Texas Instruments TPD2E001DRLR Low-Capacitance + / - 15 kV ESD-Protection Array for High-Speed Data Interfaces, 2 Channels, -40 to +85 degC, Green (RoHS & no Sb/Br) |
| 0 | U6 | SSCG | SOIC-8 | ON Semiconductor P3P25814AG-08SR Spread Spectrum Clock Generator |
| 0 | U21 | Switcher | PWP0014E | Texas Instruments TPS65320QPWPRQ1 40-V Step-Down Converter With Eco-mode and LDO Regulator |

## C.2 DS90UB914A-CXEVM Deserializer Board BOM

**Table C-2. DS90UB914A-CXEVM BOM**

| Qty. | Reference | Part | PCB Footprint | MFR and Part# |
|------|-----------|------|---------------|---------------|
| 25 | C2, C8, C9, C13, C21, C23, C25, C26, C27, C29, C35, C36, C37, C38, C40, C42, C44, C46, C48, C50, C53, C56, C58, C60, C73 | 0.1µF | 0402 | MuRata GRM155R71C104KA88D CAP, CERM, 0.1 µF, 16 V, +/- 10%, X7R |
| 4 | C3, C14, C22, C24 | 4.7µF | 0805 | MuRata GRM21BR71C475KA73L CAP, CERM, 4.7 µF, 16 V, +/- 10%, X7R |
| 3 | C6, C15, C16 | 0.1µF | 0603 | MuRata GRM188R72A104KA35D CAP, CERM, 0.1 µF, 100 V, +/- 10%, X7R |
| 1 | C7 | 0.047µF | 0603 | MuRata GRM188R71H473KA61D CAP, CERM, 0.047 µF, 50 V, +/- 10%, X7R |
| 6 | C10, C18, C28, C30, C33, C62 | 10µF | 0805 | MuRata GRM21BR71A106KE51L CAP, CERM, 10 µF, 10 V, +/- 10%, X7R |
| 1 | C12 | 10µF | 0805 | MuRata GRM21BR61C106KE15L CAP, CERM, 10 µF, 16 V, +/- 10%, X5R |
| 3 | C17, C52, C55 | 22µF | 1210 | MuRata GCM32ER71C226KE19L CAP, CERM, 22 µF, 16 V, +/- 10%, X7R |
| 11 | C39, C41, C43, C45, C47, C49, C51, C54, C57, C59, C61 | 1µF | 0603 | MuRata GRM188R71E105KA12D CAP, CERM, 1 µF, 25 V, +/- 10%, X7R |
| 1 | C63 | 4.7µF | 1206_190 | TDK C3216X7R1H475M160AC CAP, CERM, 4.7 µF, 50 V, +/- 20%, X7R |
| 2 | C64, C65 | 22µF | 1206_190 | TDK C3216X5R1E226M160AB CAP, CERM, 22 µF, 25 V, +/- 20%, X5R |
| 1 | C66 | 10µF | 0805 | TDK C2012X7R1A106K125AC CAP, CERM, 10 µF, 10 V, +/- 10%, X7R |
| 1 | C72 | .082µF | 0402 | Kemet C0402C823K4RACTU CAP, CERM, 0.082 µF, 10 V, +/- 10%, X7R |
| 1 | C75 | 3900pF | 0402 | Kemet C0402C392K4RACTU CAP, CERM, 3900 pF, 16 V, +/- 10%, X7R |
| 1 | C77 | 0.1µF | 0603 | TDK C1608X7R1H104K080AA CAP, CERM, 0.1 µF, 50 V, +/- 10%, X7R |
| 1 | D1 | LED | SMD | Lite-On LTST-C191TGKT LED, Green, SMD |
| 2 | D2, D5 | LED | SMD | Lite-On LTST-C191KFKT LED, Orange, SMD |
| 2 | D3, D4 | LED | SMD | Lite-On LTST-C191KRKT LED, Red, SMD |
| 2 | D6, D7 | Schottky | SMB | ON Semiconductor MBRS1540T3G Diode, Schottky, 40 V, 1.5 A, SMB |
| 1 | J5 | RF 50 Ohm | | Rosenberger 59S2AQ-40MT5-Z Connector. RF 50 Ohm R/A, TH |
| 1 | JP1 | Header | | Samtec TSW-115-08-L-D Header, 100mil, 15x2, Gold, TH |
| 1 | JP2 | Header | | Samtec TSW-102-07-G-D Header, 100mil, 2x2, Gold, TH |
| 4 | JP3, JP4, JP6, JP12 | Header | | Samtec TSW-103-07-G-S Header, 100mil, 3x1, Gold, TH |
| 2 | JP5, JP9 | Header | | Molex 0022112042 Header (friction lock), 100mil, 4x1, Gold, TH |
| 1 | JP8 | Header | | Samtec TSW-104-07-G-D Header, 100mil, 4x2, Gold, TH |
| 1 | JP11 | Power Jack | | Switchcraft RAPC722X Power Jack, mini, 2.1mm OD, R/A, TH |
| 1 | L2 | 100µH | SMD | Coilcraft MSS7341T-104MLB Inductor, Shielded Drum Core, Ferrite, 100 µH, 0.7 A, 0.28 ohm, SMD |
| 3 | L3, L8, R38/L14 | 1000Ω @ 100 MHz | 0603 | MuRata BLM18AG102SN1D Ferrite Bead, 1000 ohm @ 100 MHz, 0.4 A |
| 1 | L7 | 2.2µH | SMD | Coilcraft LPS3015-222MLB Inductor, Shielded Drum Core, Ferrite, 2.2 µH, 1.4 A, 0.11 ohm, SMD |

**Table C-2. DS90UB914A-CXEVM BOM (continued)**

| Qty. | Reference | Part | PCB Footprint | MFR and Part# |
|---|---|---|---|---|
| 1 | L9 | 4.7µH | SMD | Coilcraft 1008PS-472KLB Inductor, Shielded, Ferrite, 4.7 µH, 0.7 A, 0.35 ohm, SMD |
| 2 | L12, L13 | 4.7µH | SMD | Coilcraft XFL4020-472MEB Inductor, Shielded, Composite, 4.7 µH, 2.7 A, 0.05 ohm, SMD |
| 31 | R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R30, R31, R34, R65 | 10kΩ | 0402 | Panasonic ERJ-2GEJ103X RES, 10 k, 5%, 0.1 W |
| 5 | R28, R29, R50, R66, R67 | 330Ω | 0402 | Panasonic ERJ-2RKF3300X RES, 330, 1%, 0.1 W |
| 3 | R32, R33, R40 | 0Ω | 0402 | Panasonic ERJ-2GE0R00X RES, 0, 5%, 0.063 W |
| 2 | R35, R43 | 4.7kΩ | 0402 | Panasonic ERJ-2RKF4701X RES, 4.70 k, 1%, 0.1 W |
| 1 | R39 | 10kΩ | 0805 | Panasonic ERJ-6GEYJ103V RES, 10 k, 5%, 0.125 W |
| 4 | R41, R42, R68, R69 | 0Ω | 0603 | Panasonic ERJ-3GEY0R00V RES, 0, 5%, 0.1 W |
| 1 | R45 | 11kΩ | 0805 | Panasonic ERJ-6ENF1102V RES, 11.0 k, 1%, 0.125 W |
| 1 | R46 | 3kΩ | 0805 | Panasonic ERJ-6ENF3001V RES, 3.00 k, 1%, 0.125 W, AEC-Q200 Grade 0 |
| 2 | R47, R107 | 0Ω | 0805 | Panasonic ERJ-6GEY0R00V RES, 0, 5%, 0.125 W |
| 2 | R48, R49 | 49.9Ω | 0402 | Panasonic ERJ-2RKF49R9X RES, 49.9, 1%, 0.1 W |
| 7 | R51, R54, R56, R60, R62, R96, R98 | 10kΩ | 0603 | Panasonic ERJ-3EKF1002V RES, 10.0 k, 1%, 0.1 W |
| 2 | R52, R53 | 100Ω | 0402 | Panasonic ERJ-2RKF1000X RES, 100, 1%, 0.1 W |
| 1 | R59 | 16.5kΩ | 0603 | Panasonic ERJ-3EKF1652V RES, 16.5 k, 1%, 0.1 W |
| 1 | R61 | 4.53kΩ | 0603 | Panasonic ERJ-3EKF4531V RES, 4.53 k, 1%, 0.1 W |
| 1 | R74 | 49.9Ω | 0603 | Panasonic ERJ-3EKF49R9V RES, 49.9, 1%, 0.1 W |
| 2 | R83, R87 | 1kΩ | 0603 | Panasonic ERJ-3EKF1001V RES, 1.00 k, 1%, 0.1 W |
| 1 | R100 | 53kΩ | 0603 | Vishay-Dale PAT0603E5302BST1 RES, 53.0 k, 0.1%, 0.15 W |
| 1 | R102 | 34kΩ | 0603 | Panasonic ERJ-3EKF3402V RES, 34.0 k, 1%, 0.1 W |
| 2 | R103, R104 | 20kΩ | 0603 | Panasonic ERJ-3EKF2002V RES, 20.0 k, 1%, 0.1 W |
| 1 | R105 | 30kΩ | 0603 | Panasonic ERJ-3EKF3002V RES, 30.0 k, 1%, 0.1 W |
| 1 | R106 | 5.69kΩ | 0603 | Vishay-Dale PAT0603E5691BST1 RES, 5.69 k, 0.1%, 0.15 W |
| 1 | R108 | 0kΩ | 2512 | Vishay-Dale CRCW25120000Z0EGHP RES, 0, 5%, 1.5 W, AEC-Q200 Grade 0 |
| 1 | S1 | Switch | | Grayhill 78B07ST Switch, 7 SPST, 0.15 A, 30 V, TH |
| 1 | S2 | Switch | | Grayhill 78B03ST Switch, 3 SPST, 0.15 A, 30 V, TH |
| 2 | S3, S4 | Switch | SMD | Panasonic EVQPNF04M Switch, Tactile, SPST-NO, 0.05A, 12V, SMD |
| 1 | U1 | IC | RHS0048A | Texas Instruments DS90UB914ATRHSTQ1 FPD-Link III Serializer and Deserializer |
| 2 | U3, U4 | LDO | SOT-223 | Texas Instruments LP38693MP-ADJ/NOPB 500mA Low Dropout CMOS Linear Regulators with Adjustable Output Stable with Ceramic Output Capacitors, Pb-Free |
| 1 | U5 | Switcher | SOT-23 | Texas Instruments LM3671MF-1.8/NOPB 2MHz, 600mA Step-Down DC-DC Converter, Pb-Free |
| 2 | U6, U8 | Inverter | SOT-353 | Fairchild Semiconductor NC7SP04P5X TinyLogic ULP Inverter |
| 2 | U7, U9 | Flip-Flop | SOT-363 | Fairchild Semiconductor NC7SZ175P6X TinyLogic UHS D-Type Flip-Flop with Asynchronous Clear |
| 0 | C1, C11 | 5pF | 0402 | MuRata GRM1555C1H5R0CA01D CAP, CERM, 5 pF, 50 V, +/- 5%, C0G/NP0 |
| 0 | C4, C5 | 0.1µF | 0603 | MuRata GRM188R72A104KA35D CAP, CERM, 0.1 µF, 100 V, +/- 10%, X7R |

## Table C-2. DS90UB914A-CXEVM BOM (continued)

| Qty. | Reference | Part | PCB Footprint | MFR and Part# |
|------|-----------|------|---------------|---------------|
| 0 | C19, C20 | 10pF | 0402 | MuRata GRM1555C1H100JA01D CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0 |
| 0 | C67, C68, C71, C74 | 0.1µF | 0402 | MuRata GRM155R71C104KA88D CAP, CERM, 0.1 µF, 16 V, +/- 10%, X7R |
| 0 | C69, C70 | 22µF | 1206_190 | TDK C3216X5R1E226M160AB CAP, CERM, 22 µF, 25 V, +/- 20%, X5R |
| 0 | C76 | 12pF | 0402 | Kemet C0402C120J3GACAUTO CAP, CERM, 12 pF, 25 V, +/- 5%, C0G/NP0, AEC-Q200 Grade 1 |
| 0 | J1, J2, J3, J4 | RF 50 Ohm | | Emerson Network Power 142-0701-871 RF 50 Ohm Gold Connectors / Coaxial Connectors PC END |
| 0 | JP7 | Header | | Samtec TSW-116-07-G-D Header, 100mil, 16x2, Gold, TH |
| 0 | L1 | 165µH | SMD | Coilcraft KA4909-AL Inductor, Wirewound, Ferrite, 165 µH, 0.65 A, 0.46 ohm, SMD |
| 0 | L4 | Common-Mode Choke | SMD | MuRata DLW21SN261XQ2L Coupled inductor, 0.22 A, 0.59 ohm, SMD |
| 0 | L5, L6 | 10µH | SMD | Coilcraft 1008PS-103KLB Inductor, Shielded, Ferrite, 10 µH, 0.4 A, 0.92 ohm, SMD |
| 0 | P1 | RF 50 Ohm | | Rosenberger D4S20L-40MA5-Z Right Angle Plug for PCB, TH |
| 0 | R36, R37, R55, R57, R58, R97, R99 | 0Ω | 0603 | Panasonic ERJ-3GEY0R00V RES, 0, 5%, 0.1 W |
| 0 | R70, R71, R72, R73, R75, R76, R77, R78, R79, R80, R81, R82, R84, R85, R86 | 0Ω | 0402 | Panasonic ERJ-2GE0R00X RES, 0, 5%, 0.063 W |
| 0 | R101 | 1kΩ | 0603 | Vishay-Dale CRCW06031K00FKEA RES, 1.00 k, 1%, 0.1 W |
| 0 | U2 | ESD | SOT (DRL) | Texas Instruments TPD2E001DRLR Low-Capacitance + / - 15 kV ESD-Protection Array for High-Speed Data Interfaces, 2 Channels, -40 to +85 degC, Green (RoHS & no Sb/Br) |
| 0 | U21 | Switcher | PWP0014E | Texas Instruments TPS65320QPWPRQ1 40-V Step-Down Converter With Eco-mode and LDO Regulator |

# Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

*Submit Documentation Feedback*

# STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1.  *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

    1.1  EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software

    1.2  EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2  *Limited Warranty and Related Remedies/Disclaimers*:

    2.1  These terms and conditions do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

    2.2  TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

    2.3  If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3  *Regulatory Notices:*

    3.1  *United States*

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

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

        3.1.2  *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

        **CAUTION**

        This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

        **FCC Interference Statement for Class A EVM devices**

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

**FCC Interference Statement for Class B EVM devices**

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

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

3.2  *Canada*

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

**Concerning EVMs Including Radio Transmitters:**

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

**Concernant les EVMs avec appareils radio:**

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

**Concerning EVMs Including Detachable Antennas:**

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

**Concernant les EVMs avec antennes détachables**

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3  *Japan*

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

  3.3.2   *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

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

1.  Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,

2.  Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or

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

【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】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもの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。

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page
電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

4   *EVM Use Restrictions and Warnings:*

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

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

4.3  *Safety-Related Warnings and Restrictions:*

4.3.1  User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, 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 also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2  EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4  User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

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