SERIAL ATA II PORT MULTIPLIER
XRS10L120 QFN
Evaluation Board User Manual

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Jan 16, 2008

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1.0 OVERVIEW

BLOCK DIAGRAM OF XRS10L120

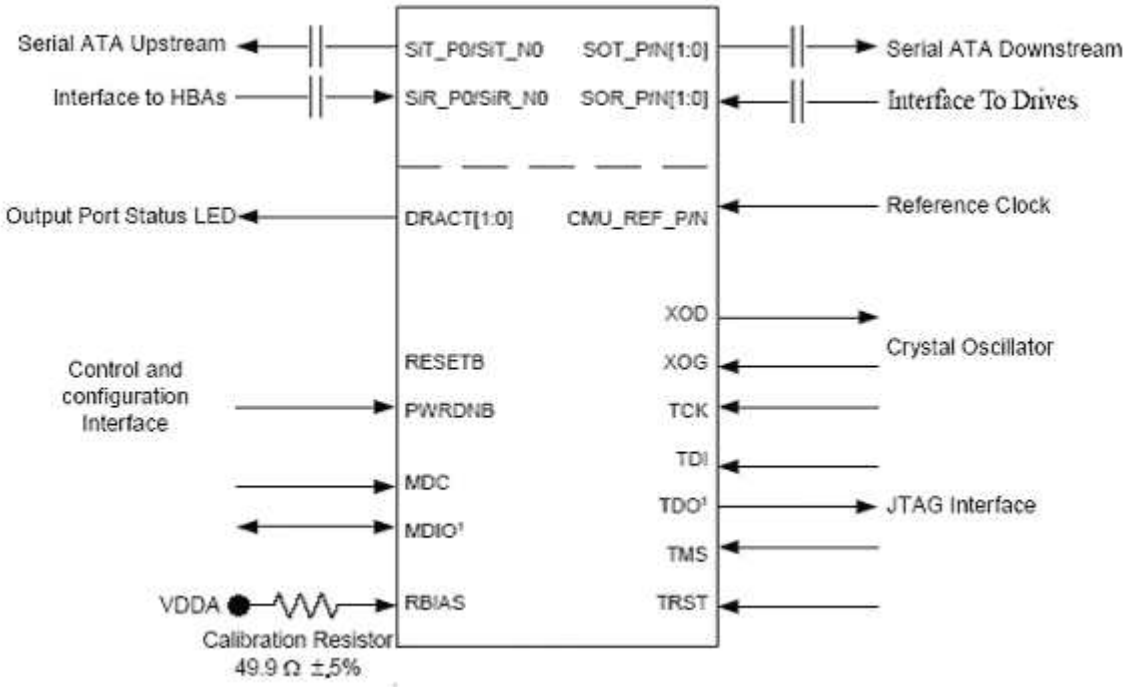


Figure 1.0 XRS10L120 Block Diagram

This is evaluation board manual is intended to help the user become familiarized to operate the XRS10L120 Evaluation Demo Board and run Serial ATA protocol with minimum effort.

Requirements:

1. XRS10L120 Evaluation Demo board
2. 5.0V AC adapter (or PC floppy drive power supply, or Lab power supply)
3. XRS10L120 data sheet
4. One PM-Aware SATA host port (to support multiple drives) or any legacy SATA host port (only drive on device port 0 can be recognized)
5. One or more Serial ATA hard drive(s) with SATA cables

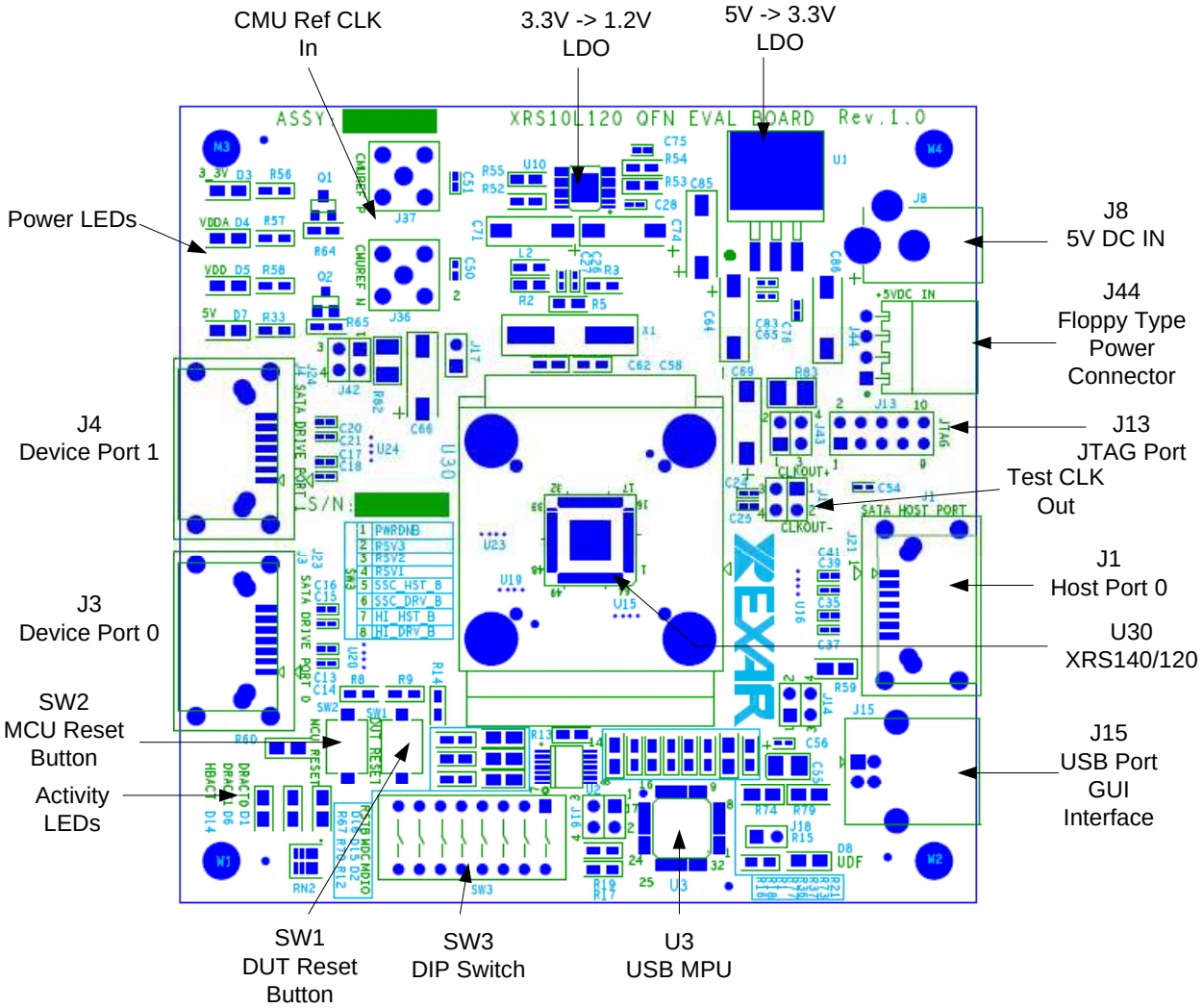
Optional:

1. A Windows-XP/Window-2000 PC with a USB port (needed to change DUT settings from default)
2. XRS10L120 supplied GUI and USB driver to be installed on the PC (using Win98, 2000, or XP)
3. SAS/SATA Protocol Analyzer test equipment with SATA cables

2.0 Evaluation Board Architecture

XRS10L120 Evaluation Board provides a simple and efficient way to quickly evaluation functionality and performance of the XRS10L120 Serial ATA PORT MULTIPLIER.

Figure 2.0 XRS10L120 Evaluation Board Rev 1.0



Evaluation board consists of XRS10L120 device (U30) connected to Five Serial ATA connectors J3,J4, J5,J6, J1 (J1 is a host port connection; J3,J4,J5 and J6 are use for SATA drive)

This evaluation board allows two different kinds of power supply connections:

A) External +5.0 volts power supply with minimum of 1.0 Amperes (AC adapter included in the kit), or
B) A PC floppy drive power supply connector

Figure 2.1 XRS10L120 photo

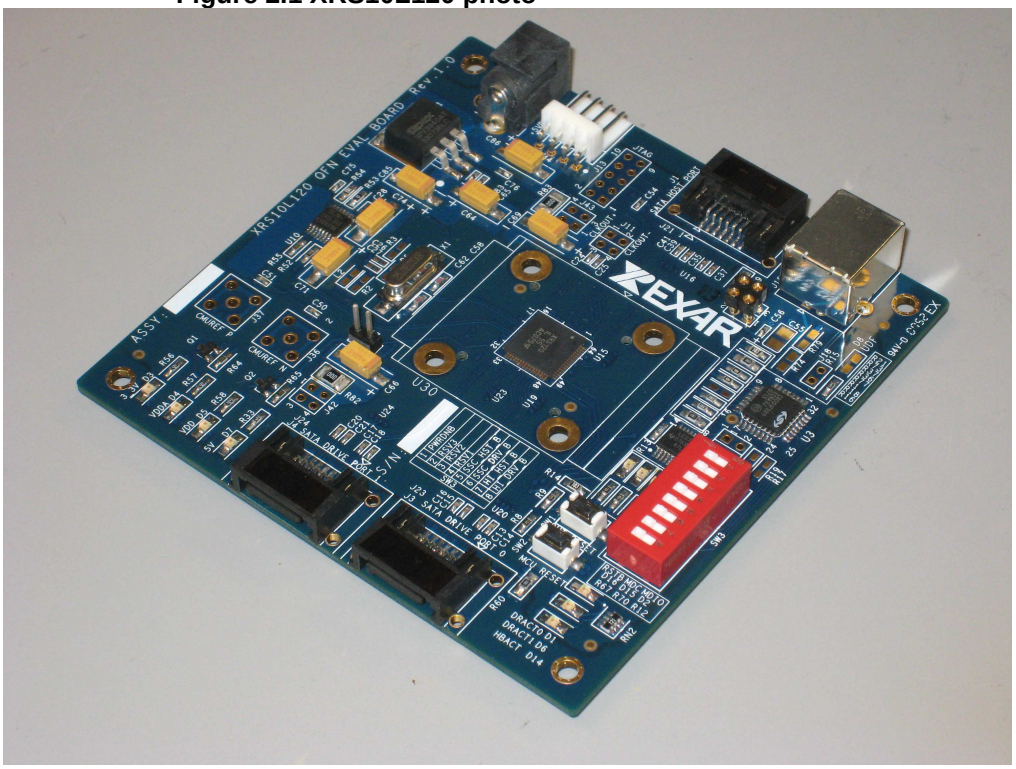


Figure 2.2 XRS10L120 Evaluation Kit

The evaluation board operates with 25Mhz XTAL reference clock. There are two SMA connectors (J36 and J37) for external reference clock input. The header connector (J11) has an output clock of XRS10L120 (it is primarily used for testing purpose). The DIP switch (SW3) has options to turn on transmit SSC (Spread-Spectrum Clocking) for host or/and drive ports, and to increase transmit amplitude for eSATA. These settings are read by on-board USB MPU, and program the chip through MDIO interface. Below is the list of DIP switch options:

Position	Name	OFF (up) meaning	ON (down) meaning	Default
1	PWRDNB	Normal Operation	Shut down the chip	OFF
2	RSV3	Not used now, TBD		OFF
3	RSV2	Not used now, TBD		OFF
4	RSV1	Not used now, TBD		OFF
5	SSC_HST_B	No SSC on host port	Enable SSC on host port Transmit	OFF
6	SSC_DRV_B	No SSC on host port	Enable SSC on drive ports transmit	OFF
7	HI_HST_B	For normal SATA(1i,2i) on host port	For eSATA (1m,2m)	OFF
8	HI_DRV_B	For normal SATA(1i,2i) on drive port	For eSATA (1m,2m)	OFF

The evaluation board has two RESET buttons: 'RESET MPU' (SW1) and 'RESET DUT' (SW2). 'RESET MPU' resets whole board. MPU will take the DIP switch settings and program DUT accordingly. 'RESET DUT' will reset DUT only; MPU will NOT program DUT; DUT will run with power-on default setting.

The Exar's supplied **G**raphical **U**ser **I**nterface (GUI) is used to program the XRS10L120 registers using the PC USB port. The USB cable connects from a PC USB port to the evaluation board connector J15. GUI is not necessary if customer just needs to run the DUT under default settings.

Evaluation Board operates with a single +5V power supply. The 5.0 volts power supply is stepped down to 3.3 volts using regulator U1. It is reduced further to 1.2 volts required by the XRS10L120 port multiplier.

2.1 FUNCTIONALITY AND CONTROL

The EXAR XRS10L120 is a Serial ATA II Port Multiplier designed for the next generation disk array systems and DVR systems. The XRS10L120 can support up to 2 device connections and utilizes the full bandwidth of the host connection.

The high-speed serial input features selectable equalization adjustment and the high-speed serial output features selectable pre-emphasis to compensate for line loss and ISI (Inter-Symbol Interference), and to increase maximum cable distances

All XRS10L120 registers read/write access can be programmed using the graphical user interface via the Management Data Input Output (MDIO) bus.

2.2 XRS10L120 REFERENCE CLOCK

All XRS10L120 boards are shipped with a standard 25.0 MHz reference clock crystal. The 25.0 MHz crystal is fed to the XRS10L120's on-chip oscillator pins XOG/XOD.

External reference clock inputs can be applied to the port multiplier via SMA connectors J36, J37.

2.3 MDIO BUS INTERFACE

The Management Data Input Output (MDIO) port is used to configure the XRS10L120 registers. The MDIO interface is a 2-wire serial transaction with 64 MDC clock cycles. Each transaction start with 32 cycles preamble, 2 cycles start of frame, 2 cycles of OPCODE, 5 cycles of port address, 5 cycles of device address, 2 cycles turn around and 16 cycles of address/data. Figure 3 show a representative of a single Management Data Input Output (MDIO) transaction

The Management Data Input Output (MDIO) interface is defined in IEEE 802.3ae (clause 45). MDIO uses an open drain driver with external pull-up resistor to 3.3V. For more detail timing of MDIO Read/Write timing specification, please refer to XRS10L120/240 datasheet.

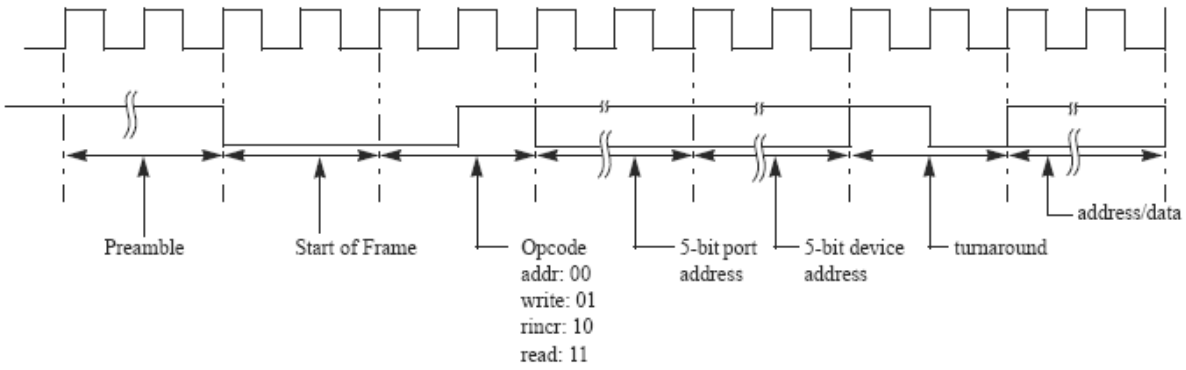


Figure 2.3 MDIO Bus Interface

3.0 SETTING UP THE HARDWARE XRS10L120 EVALUATION BOARD

The XRS10L120 Evaluation Board can be used to test Serial ATA port multiplier functionality and monitor SAS/SATA protocol. The following sections cover the differences in each setup.

3.1 Setting up the XRS10L120 Evaluation Board for Serial ATA port multiplier (With Serial ATA hard disk drives)

3.2 Setting up the XRS10L120 Evaluation Board for SATA protocol testing (Need to have SATA protocol tracer or analyzer, Lecroy's Model SAS-001MA)

3.1 SETTING UP THE XRS10L120 EVALUATION BOARD FOR SERIAL ATA PORT MULTIPLIER TESTING

To successfully perform this test, you must have the following equipment:

- XRS10L120 Evaluation Board
- 5V AC Adapter (included in the evaluation kit)
- Two Serial ATA hard disk Drive
- Three Serial ATA cables
- Serial ATA Host Bus Adaptor

Startup procedure:

1. Connect 5.0V power supply to connector J8.
2. Turn on power and verify power supply on the board by checking Power LED and output of power regulator U1, U10.
3. Turn off power supply to evaluation board
4. Connect the Serial ATA flex-cable from Evaluation Drive ports (J3, J4) to Serial ATA hard disk drives. Verify the power connector of Serial ATA hard-disk drive.
5. Set SSC and amplitude options through DIP switch SW3 or leave them as default.
6. Turn on Power Supply, press 'MCU RESET' button on XRS10L120 Evaluation Board (SW2)
7. Connect the Serial ATA flex-cables from PC Host Bus Adaptor output to Evaluation Board host Port 0 (J1).

Optional steps (8 to 10) to access the MDIO registers:

8. Connect a USB cable from a PC USB port to evaluation board connector J15
9. Install USB driver from the included CD (under CD root directory) if asked by Windows.
10. Install the GUI (if haven't done before) by double-clicking the installer icon "XRS10L140 setup.exe" in the CD.

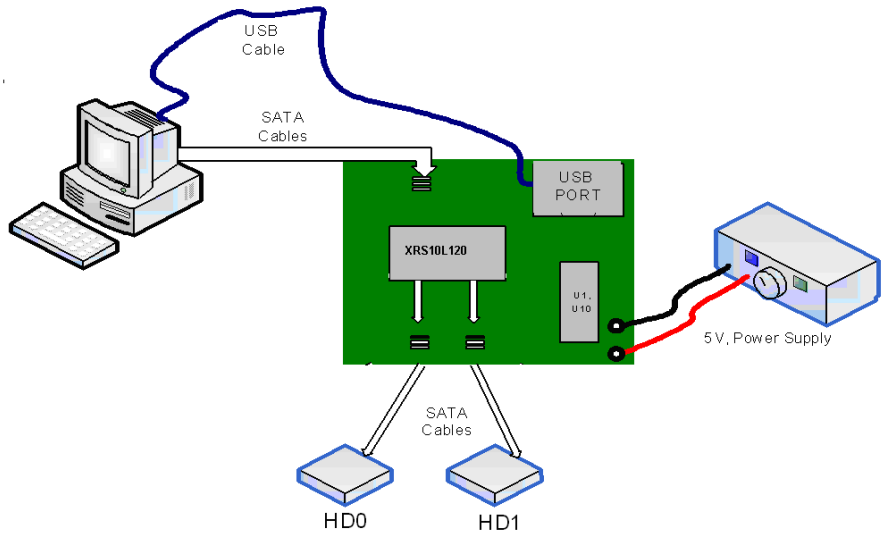


Figure 3.0 Serial ATA Port Multiplier Test Setup with two Hard Disk drives

3.2 SETTING UP THE XRS10L120 EVALUATION BOARD FOR SATA PROTOCOL TESTING

To successfully perform this test, you must have the following equipments:

- XRS10L120 Evaluation Board
- SAS/SATA Protocol Analyzer System (Lecroy's Model SAS 001MA)
- Personal Computer with USB Port and SAS/SATA Analyzer software control via USB

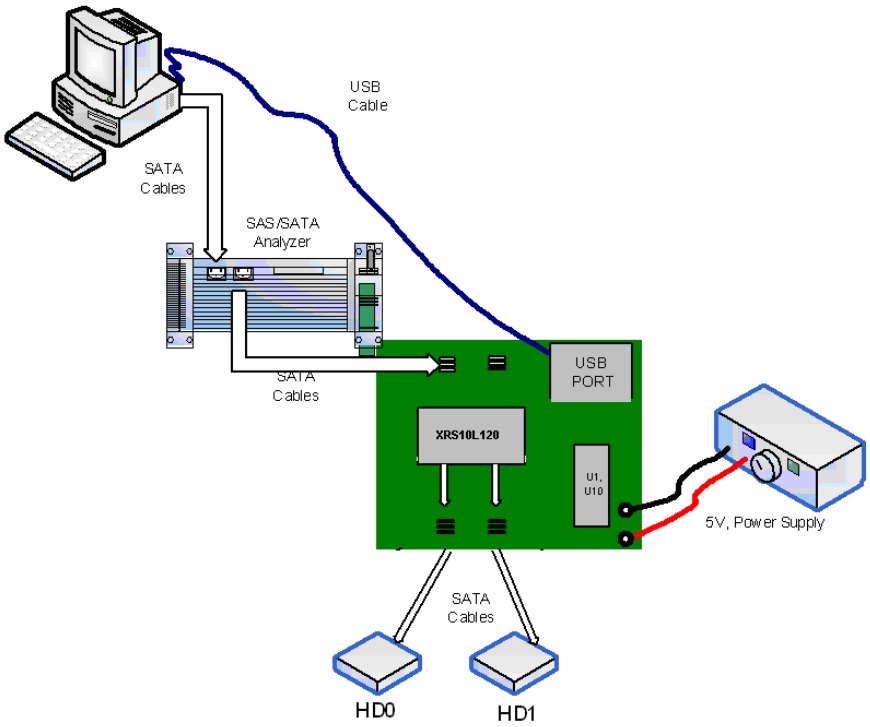


Figure 3.1 Protocol Testing with SAS/SATA Analyzer Test Setup

Startup procedure:

1. Connect 5.0 volts power supply to board connector.
2. Connect the SATA cables from PC host bus adaptor to SAS/SATA Analyzer "Initiator" port
3. Connect the SATA cables from Drive Port outputs to Serial ATA hard disk drive.
4. Set SSC and amplitude options through DIP switch SW3 or leave them as default.
5. Turn on Power Supply, press 'MCU RESET' button on XRS10L120 Evaluation Board (SW2).
6. Connect the SATA cables from SAS/SATA "target" port to Evaluation board Host Port 0 (J1).
7. Press Run button on the SAS/SATA Analyzer
8. Connect a USB cable from a PC USB port to evaluation board connector J15.
9. Install USB driver from the included CD (under CD root directory) if asked by Windows.
10. Install the GUI (if haven't done before) by double-clicking the installer icon "XRS10L140 setup.exe" in the CD.

Note 1. Difference between two RESET buttons: 'RESET MPU' will reset whole board. MPU will take the DIP switch settings and program DUT accordingly. 'RESET DUT' will reset DUT only, MPU will NOT program DUT anyway, DUT will go to power-on default state.

Note 2. Steps 8 to 10 are not necessary if customer just needs to run the DUT under default setting.

4.0 INSTALLING THE XRS10L120/ XRS10L140 EVALUATION GUI

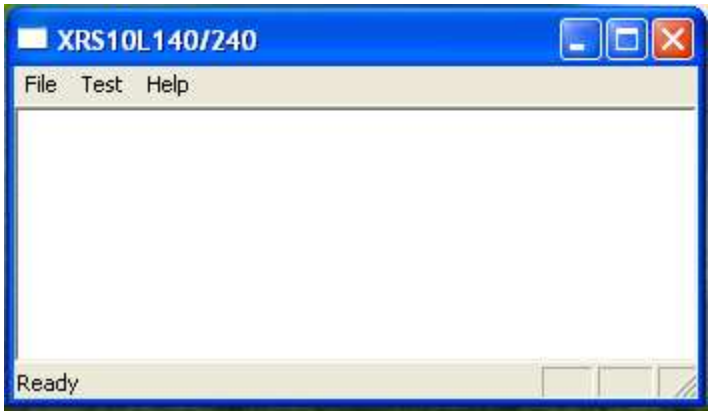
To install the XRS10L120 GUI, double click on the installation file enclosed in the CD, as part of the evaluation package. It will place the relevant GUI files in an EXAR created folder. The installation program by default will copy all the files onto c:\Program File\Exar\XRS10L140 Evaluation directory.

4.1 STARTING THE EVALUATION SOFTWARE

The evaluation software allows the user to do the following:

- Configure the XRS10L120 for proper operation using the script file
- Programming MDIO individual registers value.

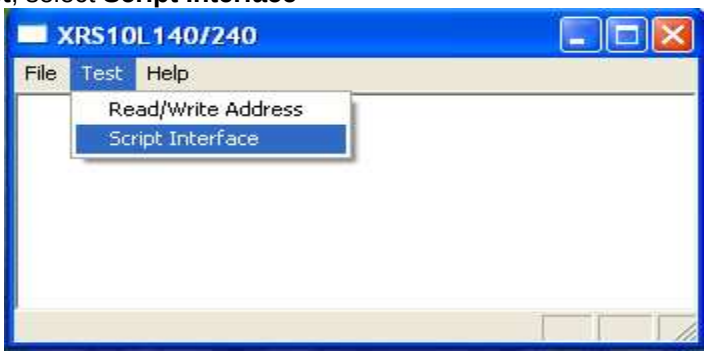
Once the XRS10L120 GUI is installed, it can be found through the **Start Menu->Exar->XRS10L140 Evaluation**. Once selected, it will open up the application.



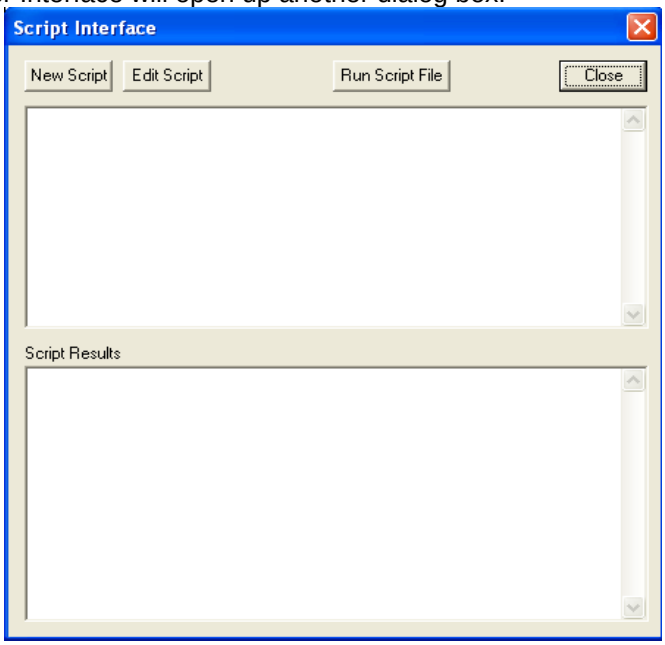
Steps to Configure the XRS10L120 Evaluation board through GUI.

1. Connect the power supply to the board (all power is derived from the 5.0 volts supply).
2. Connect from USB Port to the evaluation board J15 connector.
3. Connect Serial ATA cables from J3, and J4 to SATA drives.
4. Power up the system and press the RESET MCU button.
5. The Evaluation Board is ready for script download.

Under Menu **Test**, select **Script Interface**

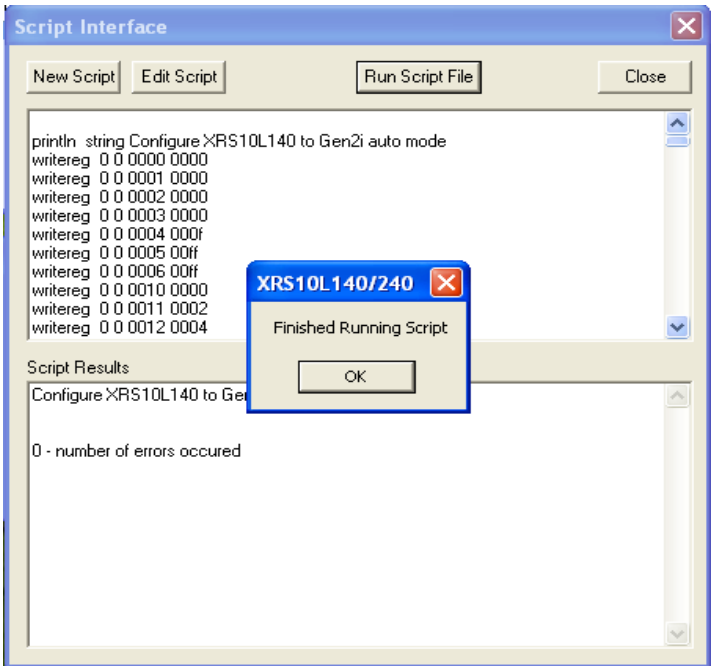


The Graphical User Interface will open up another dialog box.



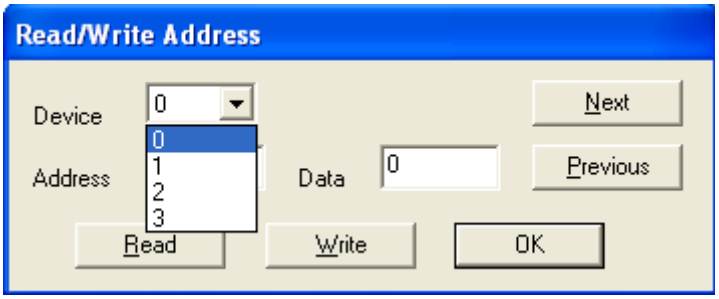
Select “Run Script File”. Under directory XRS10L140 Evaluation\Scripts, select one of the script files as needed. Such as “RevC_SSC_HST.txt” will enable SSC on host port.

Please wait about 1 sec for the GUI to load the registers setting. After successfully program registers, the following dialog is display



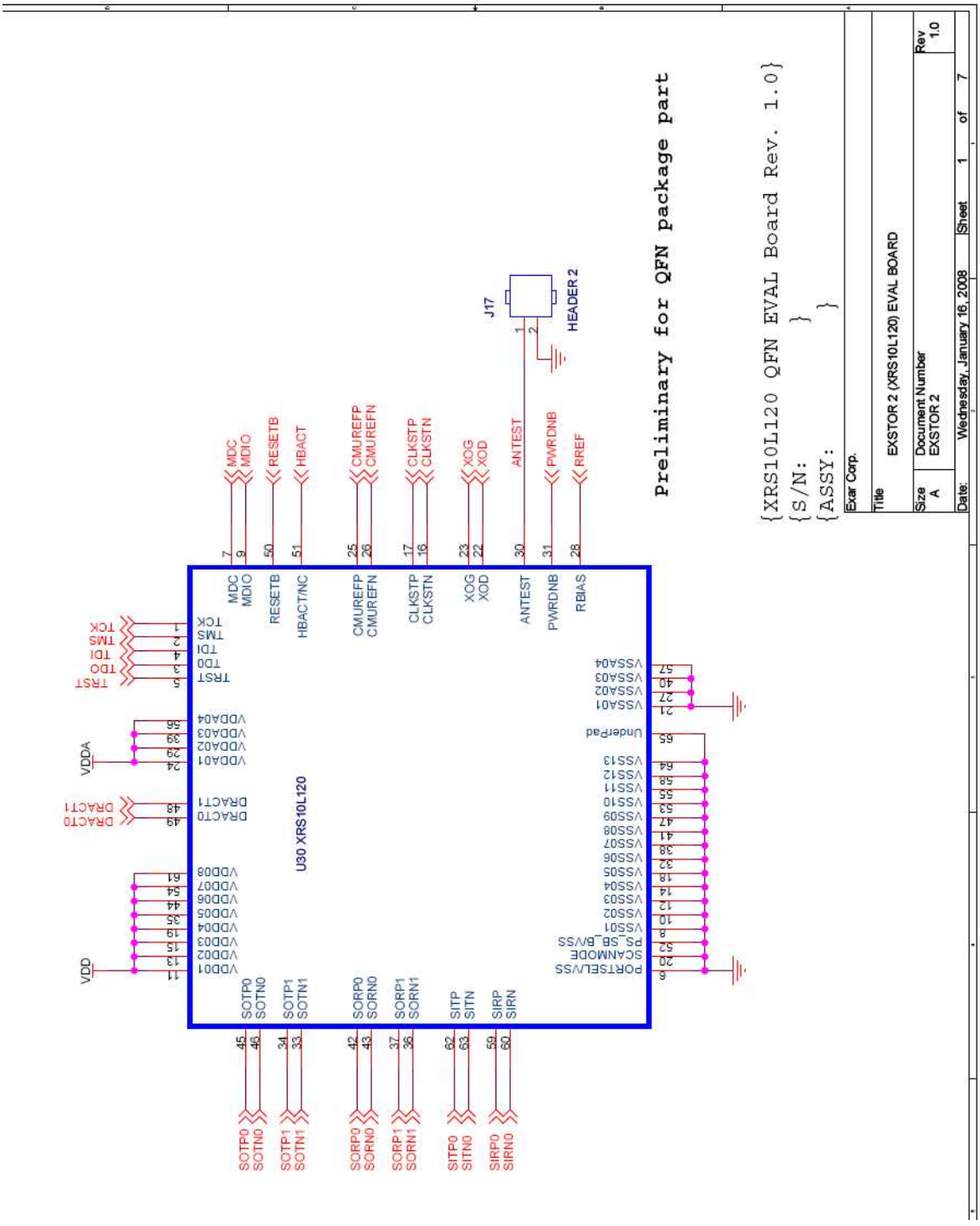
Select the OK button, and then connect the Serial ATA cable from your PC SATA Host adaptor to Evaluation Board Host Port 0 (J1 connector).
In order to verify the status of your attached hard-drive, right click your mouse on “My Computer”, then choose manage option. Click the Disk Management utility. The following screen is displaying the four Serial ATA hard disk drives
(Disk1, and Disk2 are for Port0 and Port1 of XRS10L120 evaluation board).

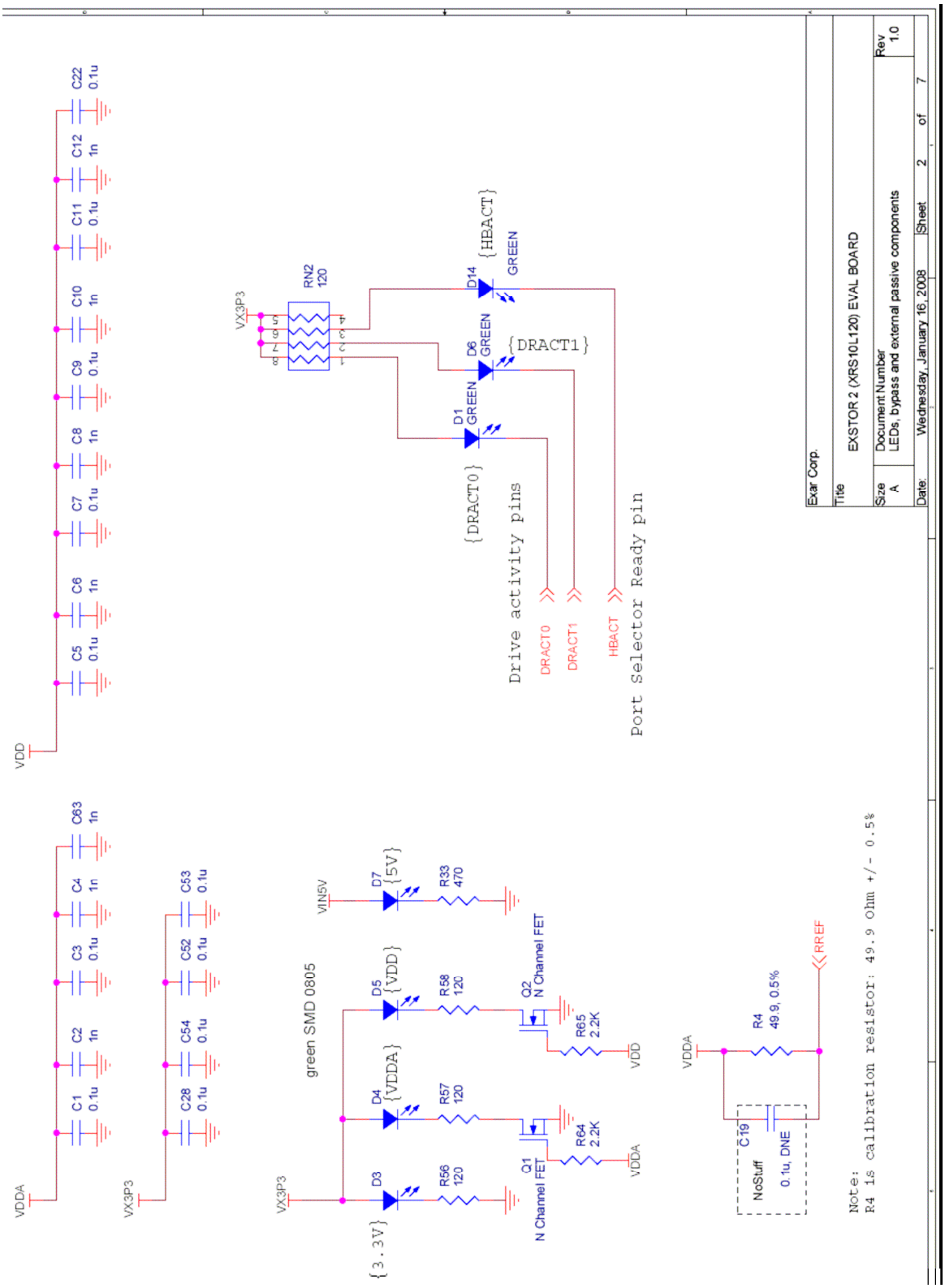
XRS10L120 individual register can be programmed using the Read/Write Address option under Test menu. Under the **Test** menu, select the **Read/Write Address** sub-menu. The following dialog box allow user to perform the Read/Write access to all MDIO device registers.

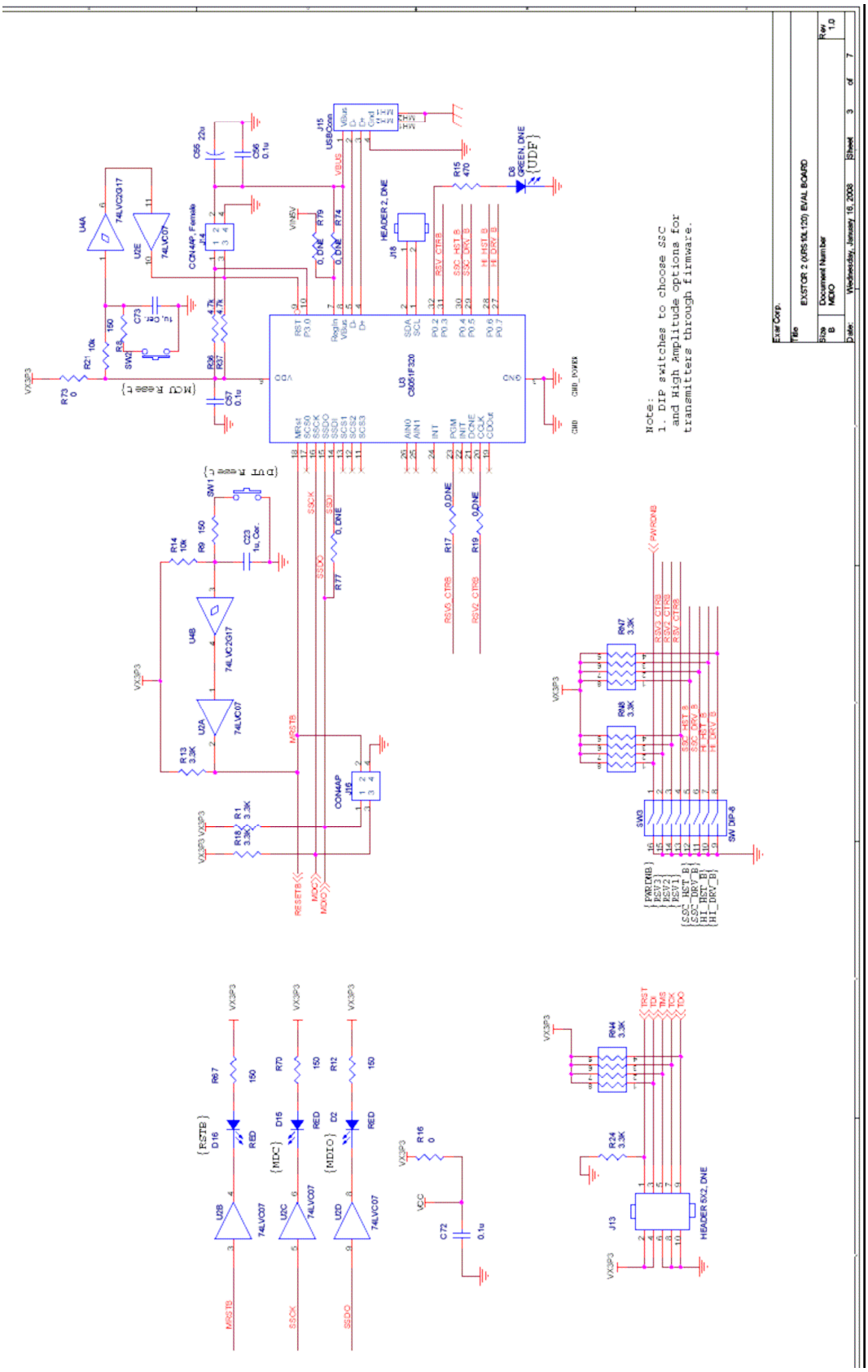


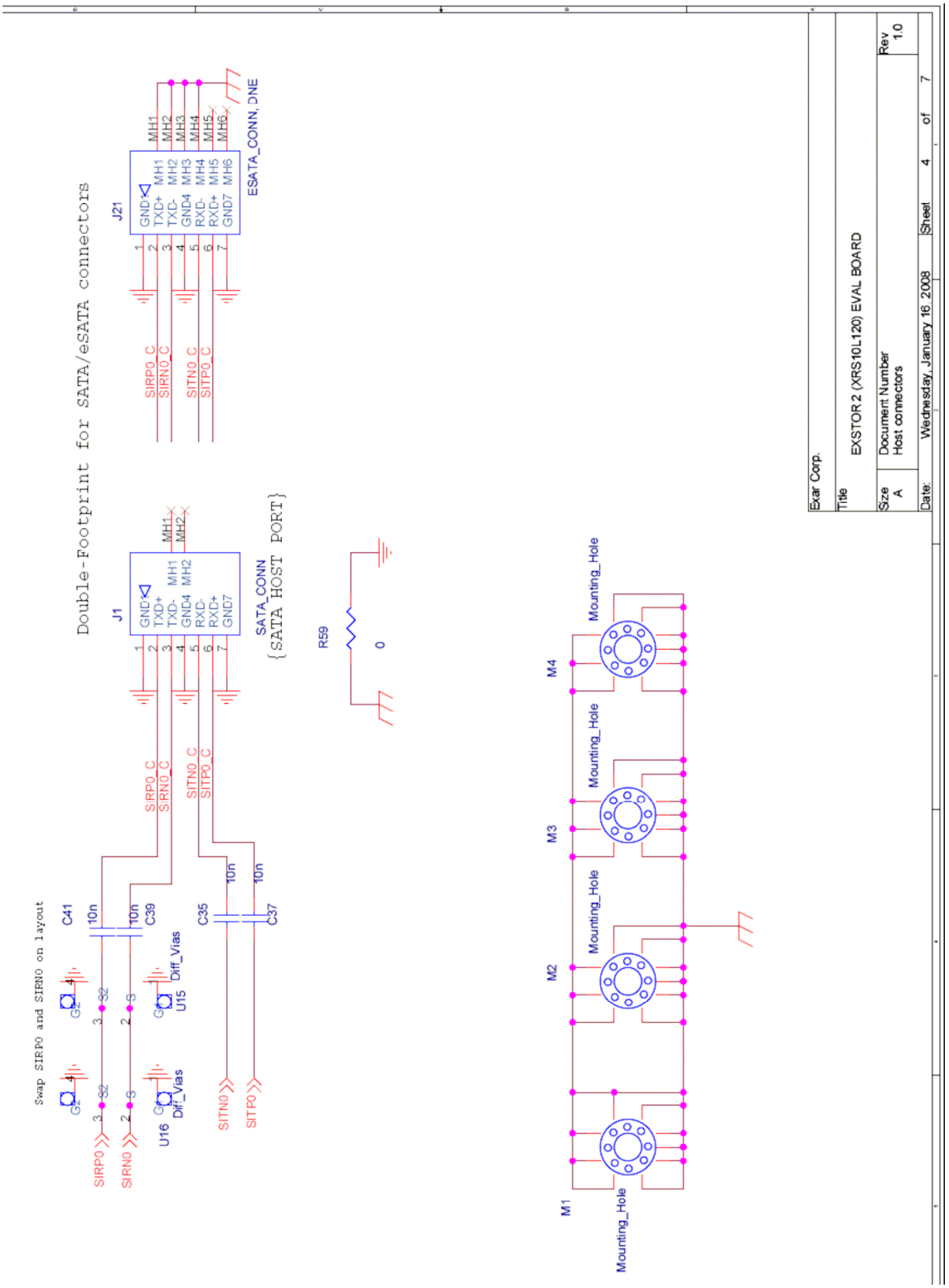
MDIO Device 0,1,2, and 3 can be selected under Device Drop-down box.
Press ***Next*** to increase the register address by one location.
Press ***Previous*** to decrease the register address by one location
Press ***Read*** to read-back register content
Press ***Write*** to program data value to XRS10L120 register
Press ***OK*** to close the Read/Write Address dialog box.

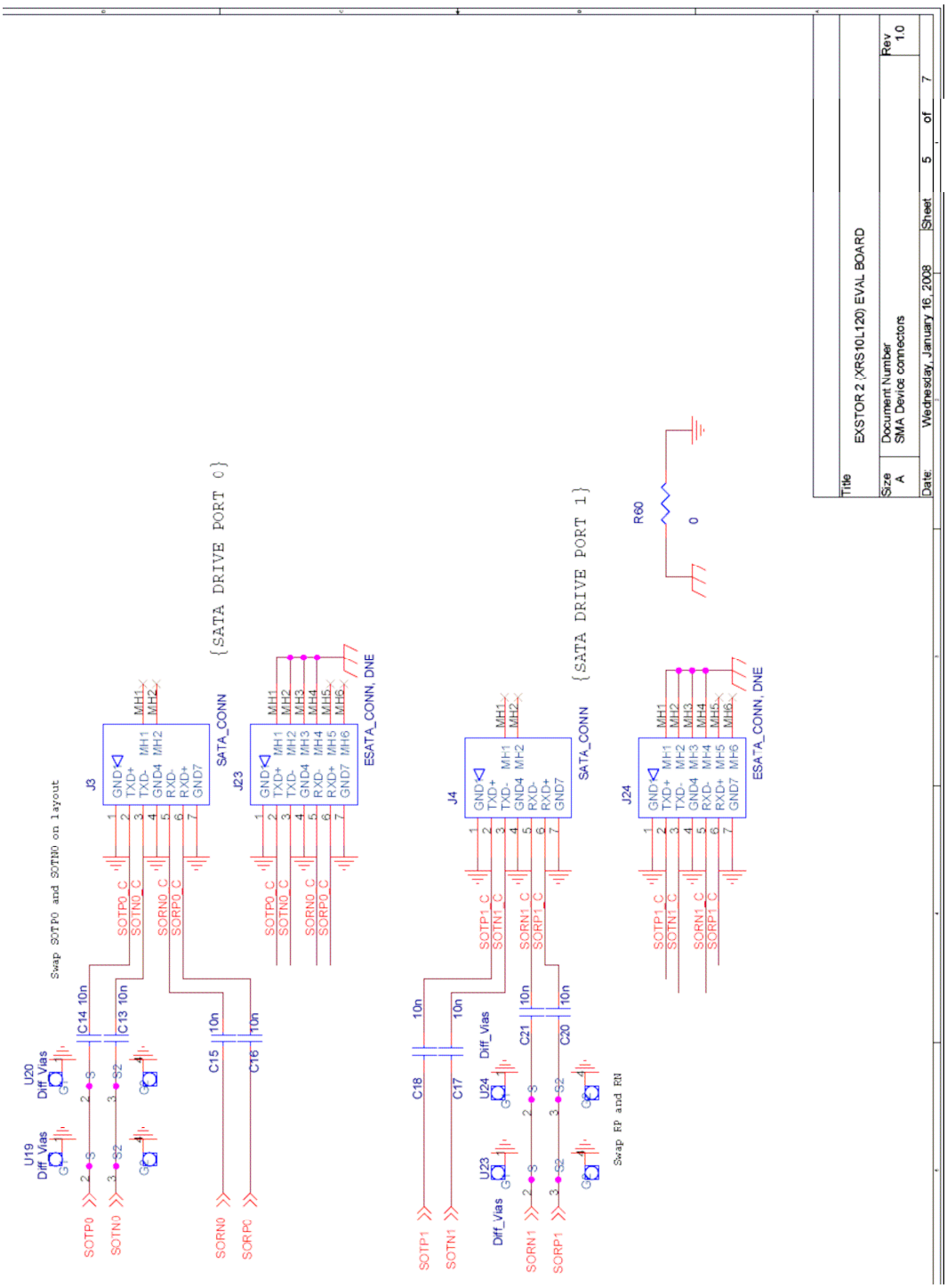
APPENDIX A. XRS10L120 QFN EVALUATION BOARD SCHEMATICS

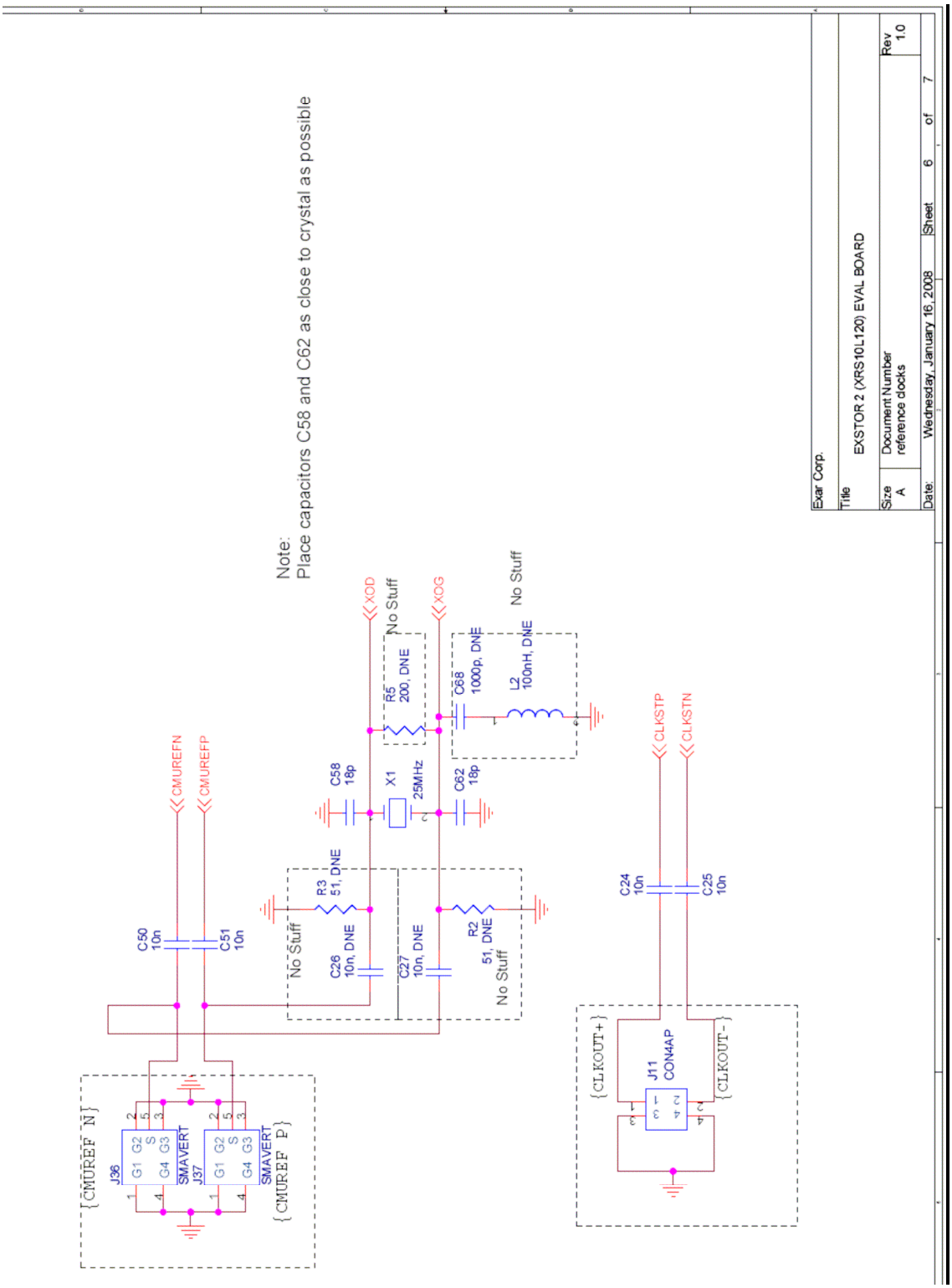


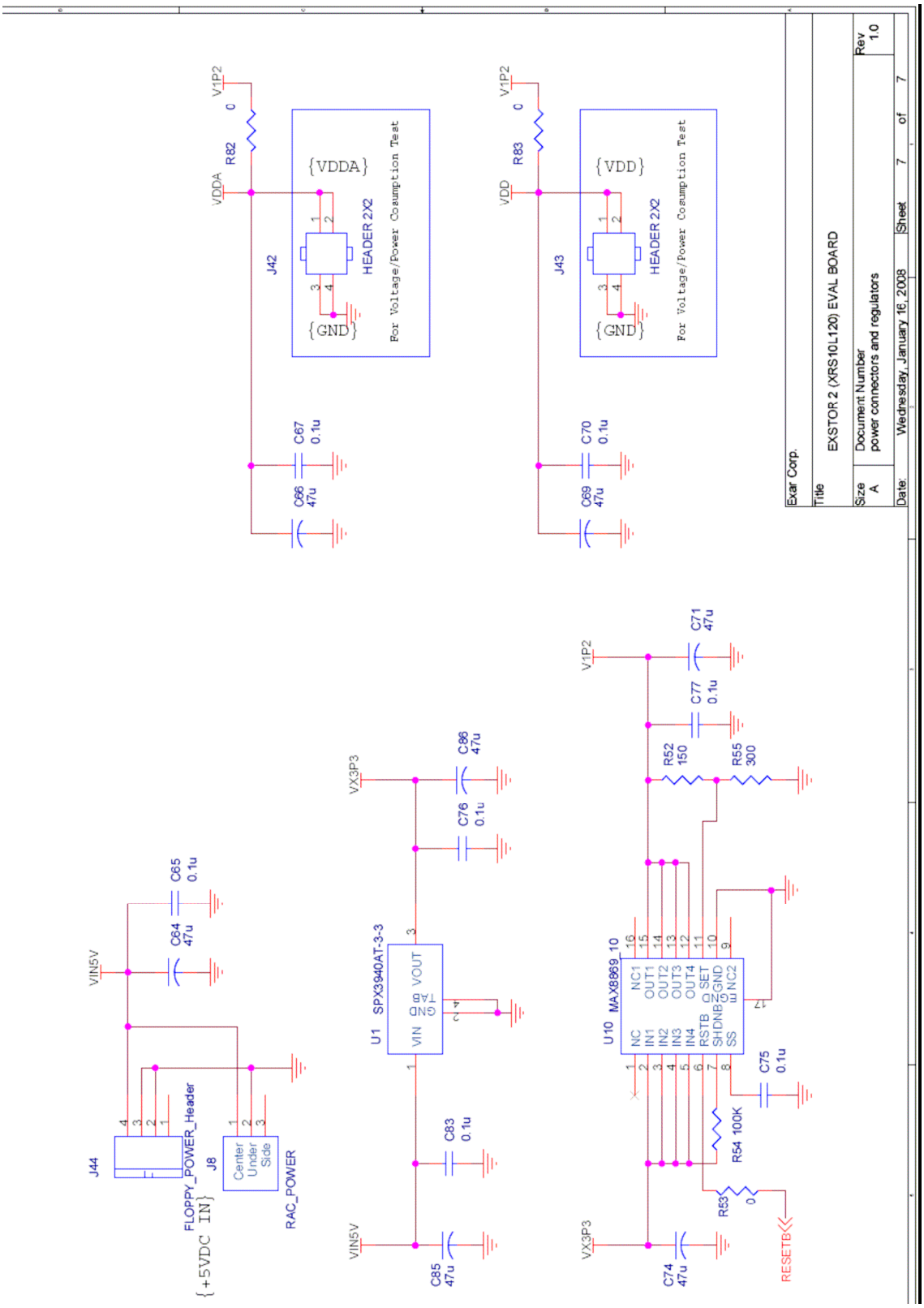

Exar Corp.
Title
EXSTOR 2 (XRS10L120) EVAL BOARD
Size A
Document Number
LEDs, bypass and external passive components
Rev 1.0
Date: Wednesday, January 16, 2008
Sheet 2 of 7
Drive activity pins
Port Selector Ready pin
{DRACT0}
{DRACT1}
{HBACT}
DRACT0
DRACT1
HBACT
VDD
VDDA
VX3P3
VIN5V
RN2 120
D14 GREEN
D6 GREEN
D1 GREEN
D7 {5V}
D5 {VDD}
D4 {VDDA}
D3 {3.3V}
green SMD 0805
R33 470
R58 120
R57 120
R56 120
Q2 N Channel FET
Q1 N Channel FET
R65 2.2K
R64 2.2K
R4 49.9, 0.5%
RREF
C19 NoStuff 0.1u, DNE
Note:
R4 is calibration resistor: 49.9 Ohm +/- 0.5%


Note:
1. DIP switches to choose SSC
and High Amplitude options for
transmitters through firmware.
EXAR Corp.
Title
EXSTOR 2 (XRS10L120) EVAL BOARD
Size
B
Document Number
MDIO
Rev
1.0
Date:
Wednesday, January 16, 2008
Sheet
3
of
7

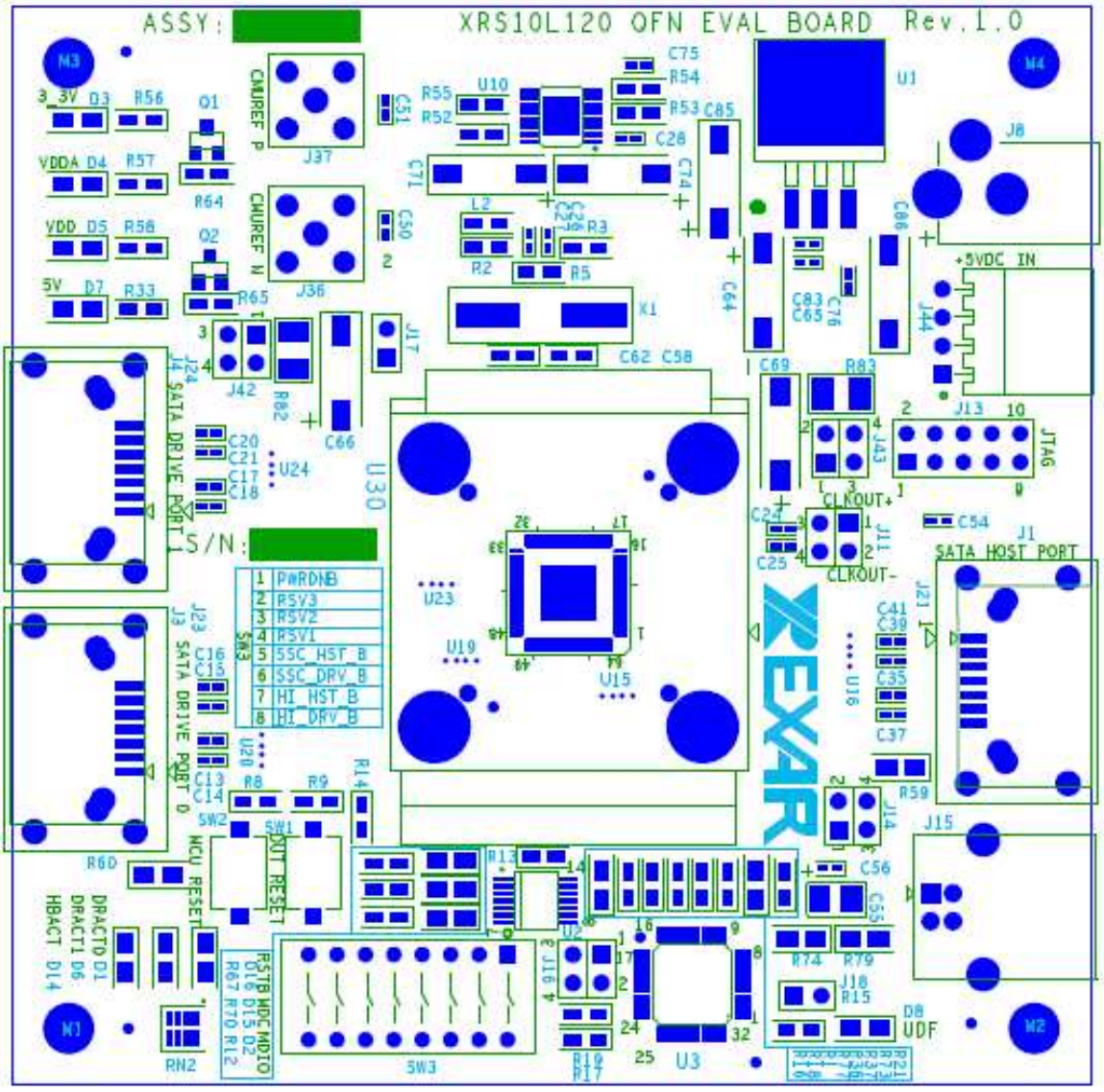

Double-Footprint for SATA/eSATA connectors
J21
ESATA_CONN, DNE
J1
SATA_CONN
{SATA HOST PORT}
R59
0
SIRP0_C
SIRN0_C
SITN0_C
SITP0_C
C41
C39
C35
C37
10n
Diff_Vias
U15
U16
SIRP0
SIRN0
SITN0
SITP0
Swap SIRP0 and SIRN0 on layout
M1
M2
M3
M4
Mounting_Hole
Exar Corp.
Title
EXSTOR 2 (XRS10L120) EVAL BOARD
Size
A
Document Number
Host connectors
Rev
1.0
Date:
Wednesday, January 16, 2008
Sheet
4
of
7


{SATA DRIVE PORT 0}
{SATA DRIVE PORT 1}
SATA_CONN
ESATA_CONN, DNE
J3
J23
J4
J24
R60
0
C13 10n
C14 10n
C15 10n
C16 10n
C17 10n
C18 10n
C20 10n
C21 10n
U19 Diff_Vias
U20 Diff_Vias
U23 Diff_Vias
U24 Diff_Vias
SOTP0
SOTN0
SORN0
SORP0
SOTP1
SOTN1
SORN1
SORP1
Swap SOTP0 and SOTN0 on layout
Swap RP and RN
Title
EXSTOR 2 (XRS10L120) EVAL BOARD
Size
A
Document Number
SMA Device connectors
Rev
1.0
Date:
Wednesday, January 16, 2008
Sheet
5
of
7

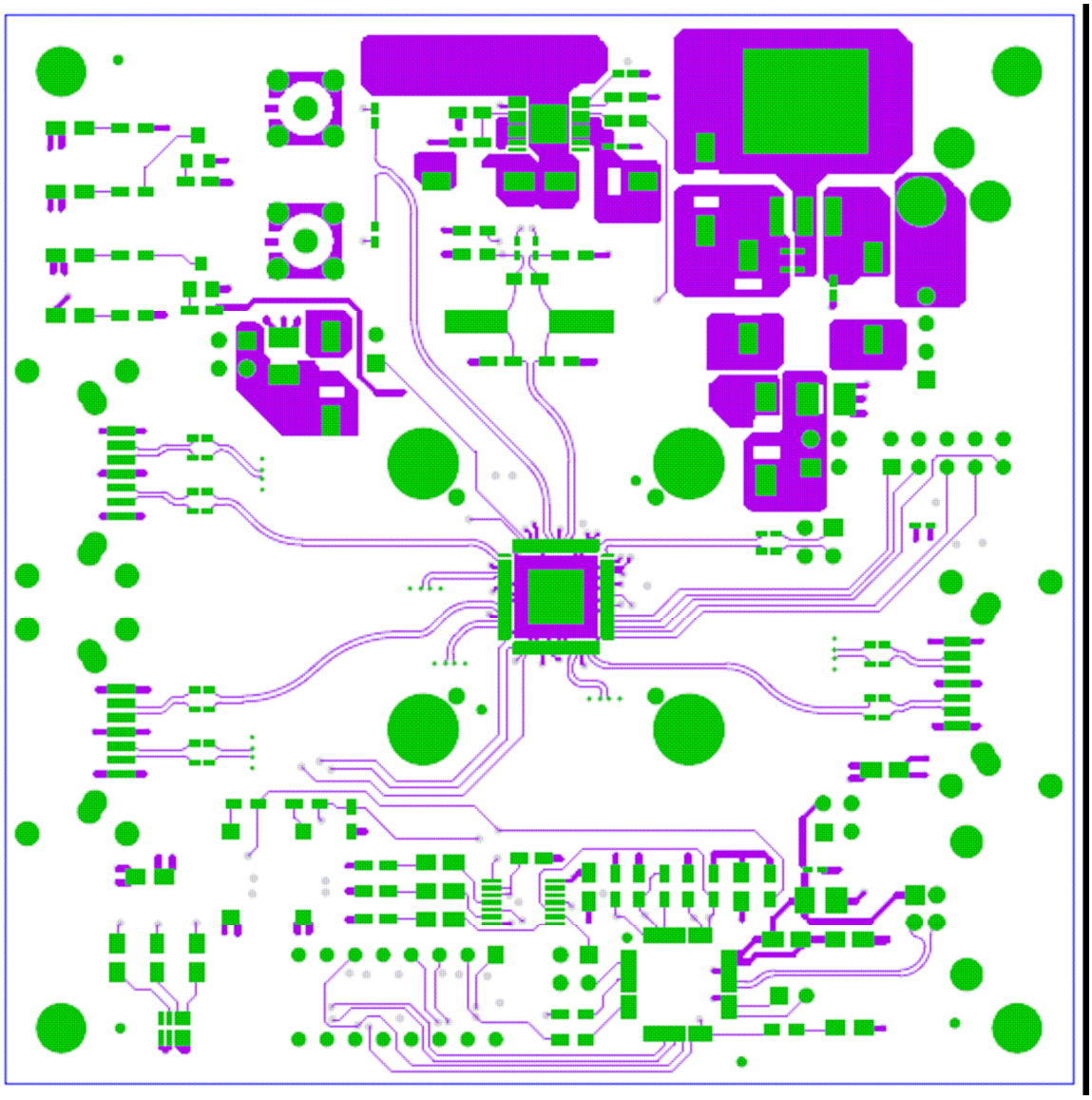

Note:
Place capacitors C58 and C62 as close to crystal as possible
Exar Corp.
Title
EXSTOR 2 (XRS10L120) EVAL BOARD
Size
A
Document Number
reference clocks
Rev
1.0
Date:
Wednesday, January 16, 2008
Sheet
6
of
7
XOD
XOG
No Stuff
R5
200, DNE
C68
1000p, DNE
L2
100nH, DNE
C58
18p
X1
25MHz
C62
18p
CMUREFN
CMUREFP
R3
51, DNE
C26
10n, DNE
C27
10n, DNE
R2
51, DNE
C50
10n
C51
10n
CLKSTP
CLKSTN
C24
10n
C25
10n
{CMUREF N}
J36
SMAVERT
J37
SMAVERT
{CMUREF P}
{CLKOUT+}
J11
CON4AP
{CLKOUT-}


V1P2
R82
0
VDDA
{VDDA}
J42
HEADER 2X2
{GND}
For Voltage/Power Consumption Test
R83
VDD
{VDD}
J43
C67
0.1u
C66
47u
C70
C69
Exar Corp.
Title
EXSTOR 2 (XRS10L120) EVAL BOARD
Size
A
Document Number
power connectors and regulators
Rev
1.0
Date:
Wednesday, January 16, 2008
Sheet
7
of
7
C71
47u
C77
0.1u
R52
150
R55
300
VX3P3
C86
47u
C76
0.1u
C65
0.1u
C64
47u
VIN5V
U1
SPX3940AT-3-3
VIN
GND
TAB
VOUT
U10
MAX8869_10
NC
IN1
IN2
IN3
IN4
RSTB
SHDNB
SS
SET
GND
NC2
OUT1
OUT2
OUT3
OUT4
C75
0.1u
R54
100K
R53
0
RESETB
C83
0.1u
C85
47u
C74
47u
J44
FLOPPY_POWER_Header
{+5VDC IN}
J8
Center
Under
Side
RAC_POWER

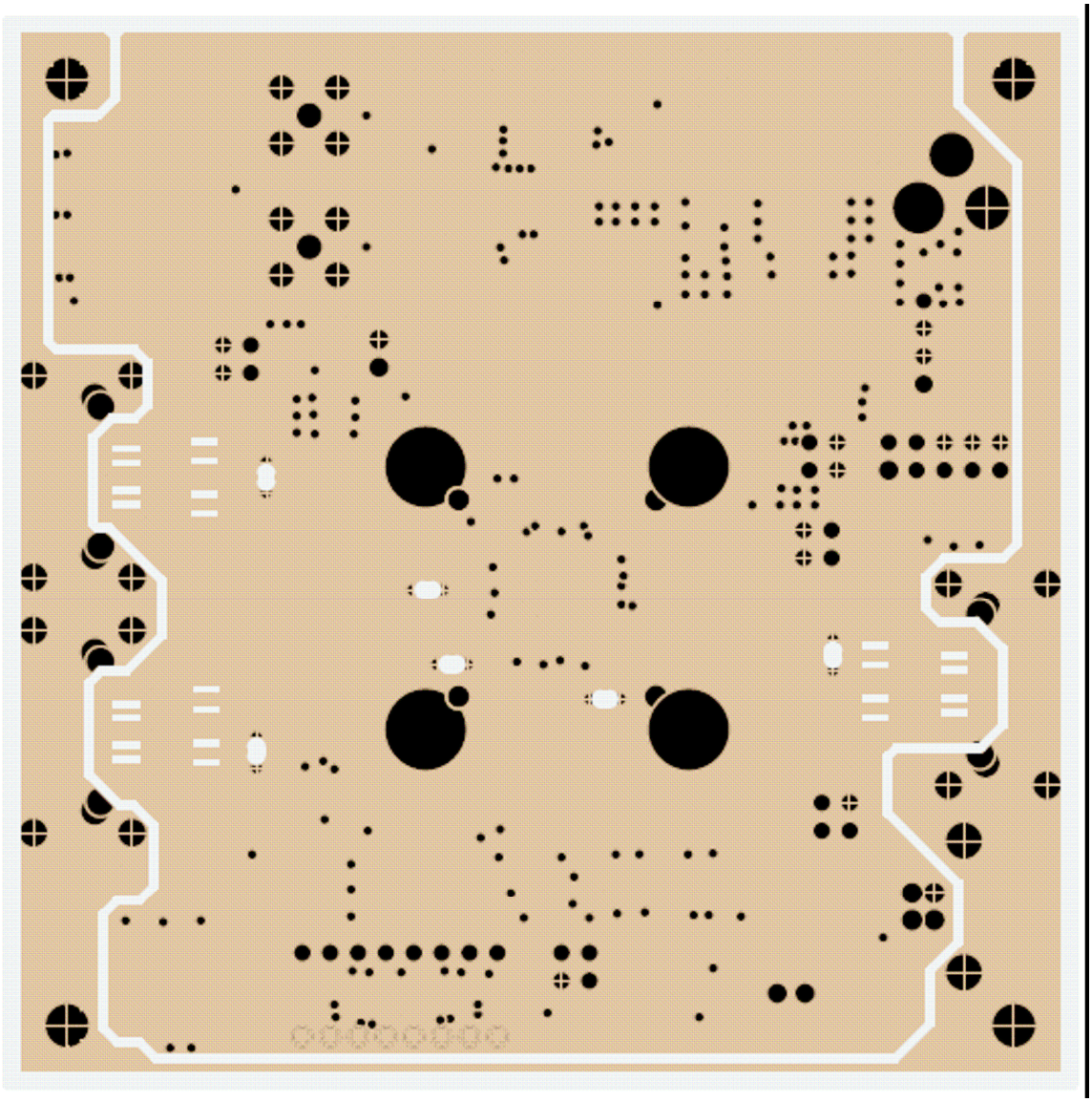
APPENDIX B. XRS10L120 QFN EVAL BOARD LAYOUT FOR ALL LAYERS



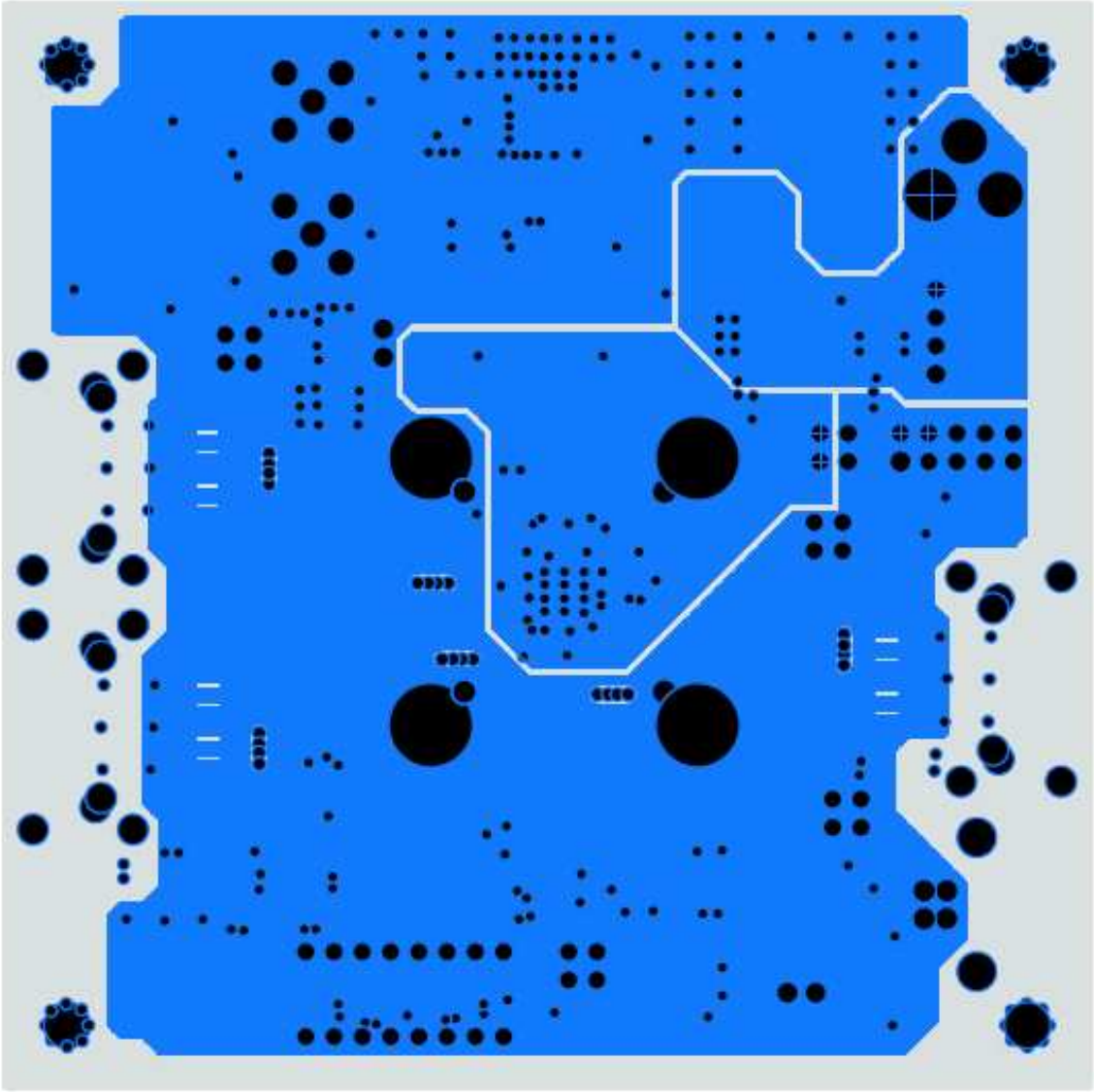
TOP Assembly



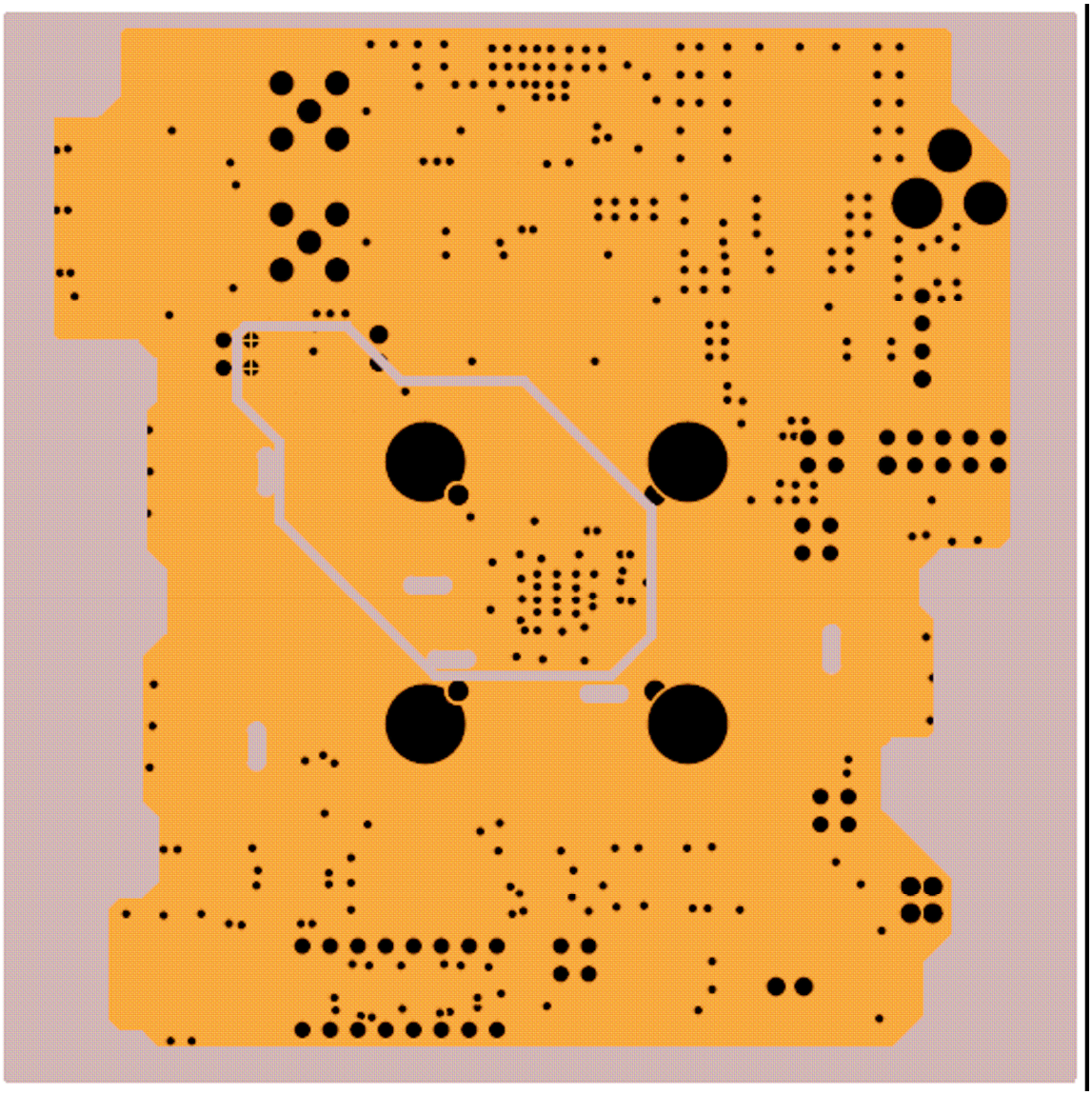
Layer 1



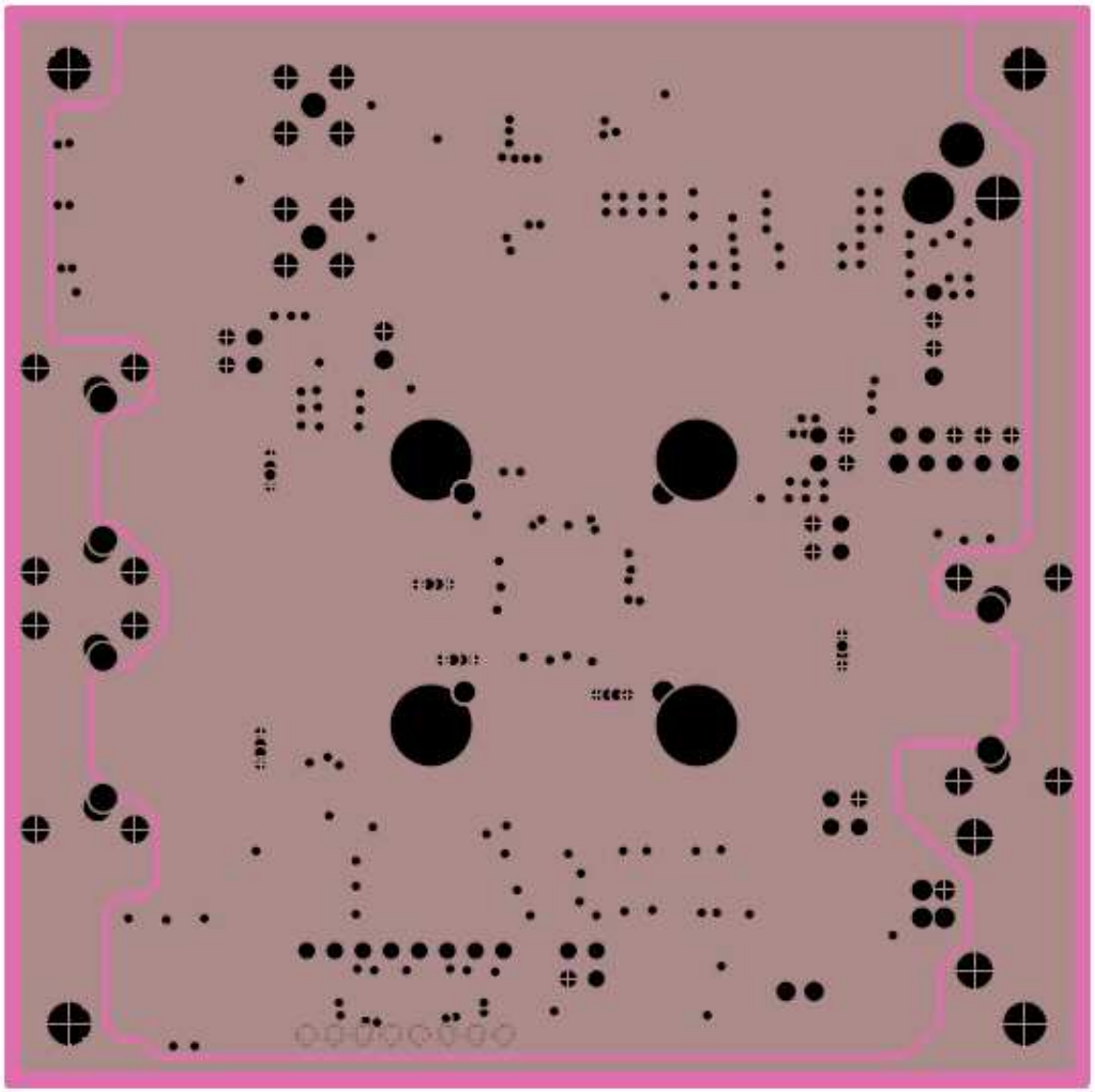
Layer 2: GND



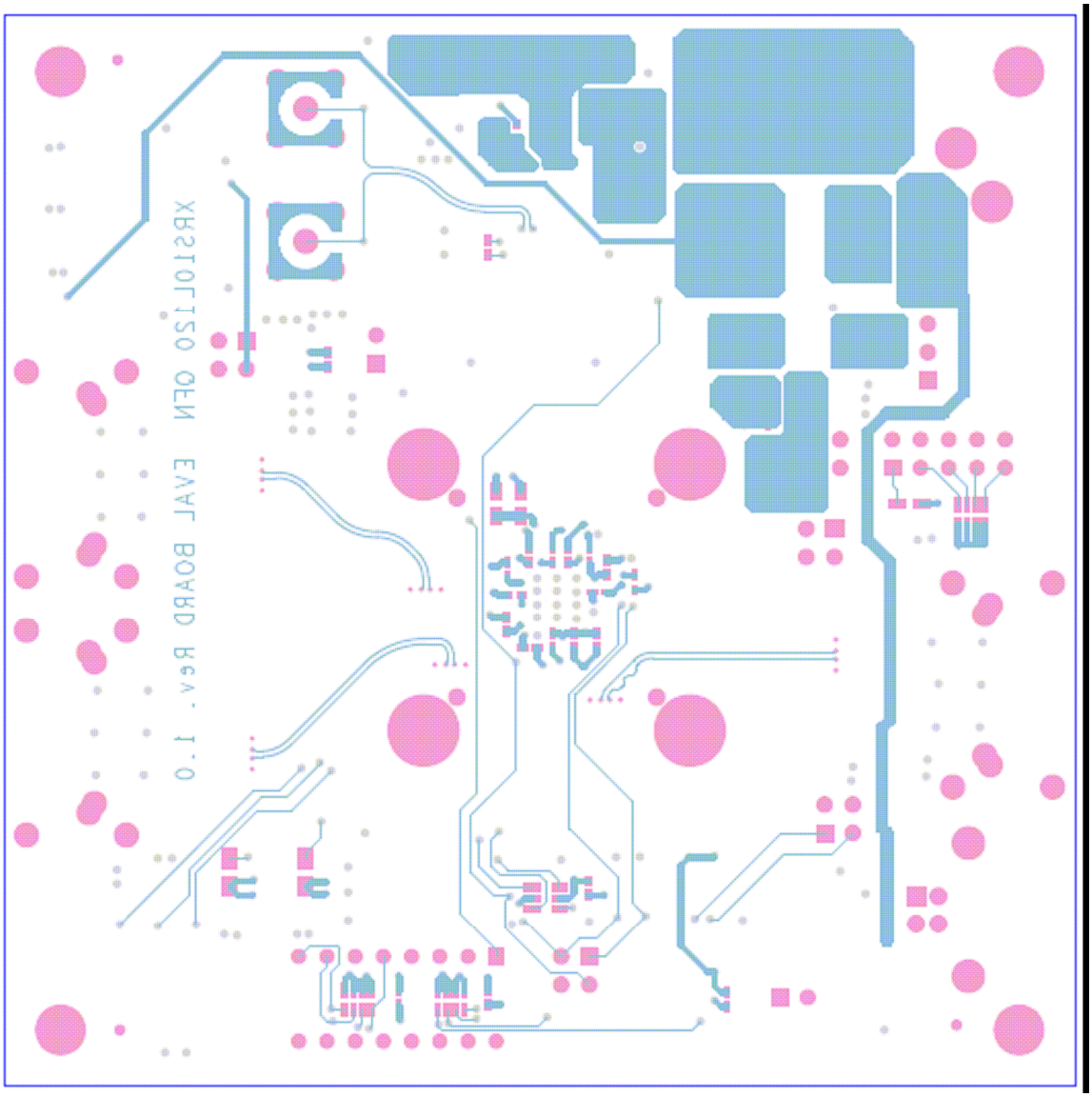
Layer 3: PWR 1



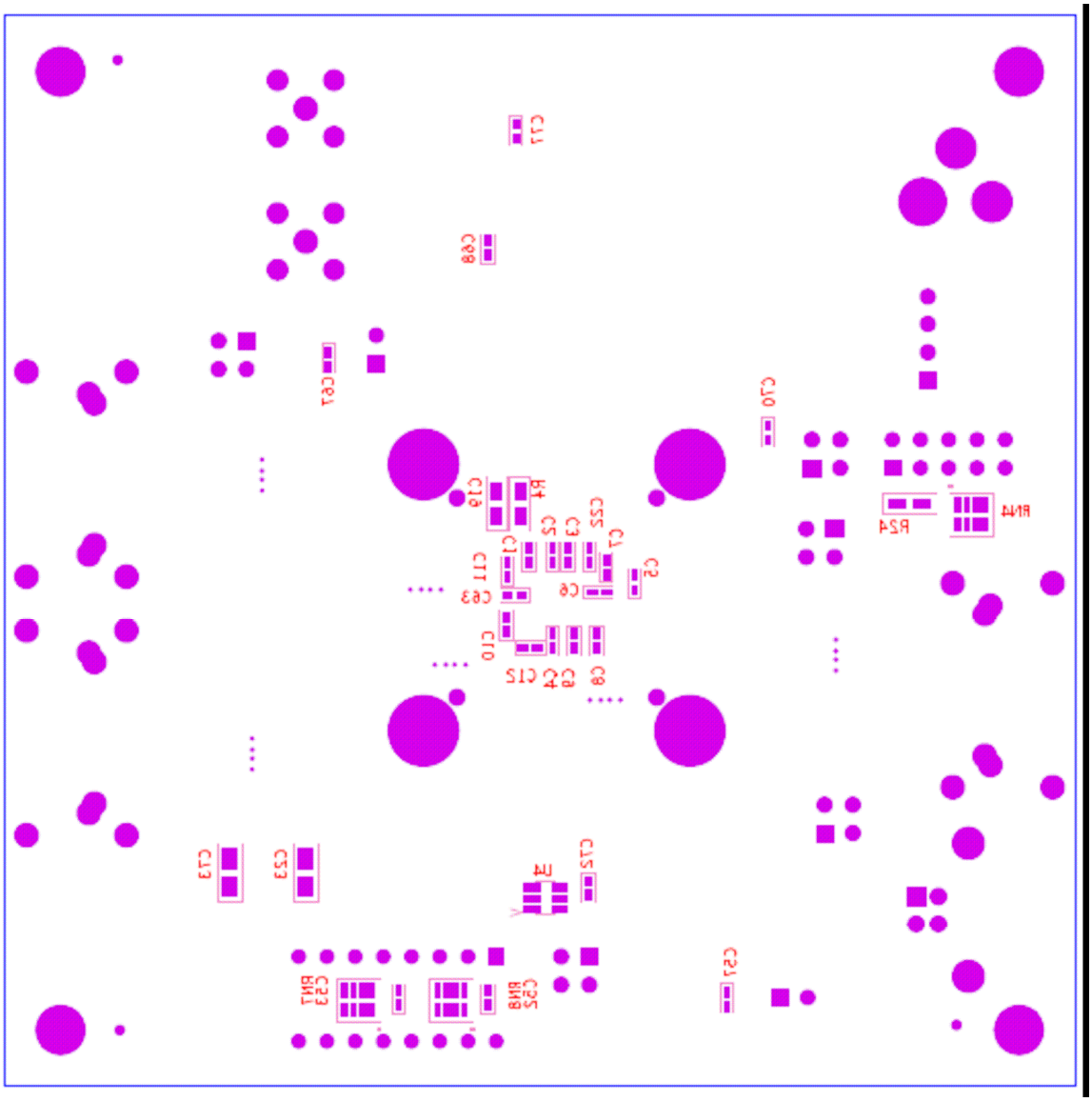
Layer 4: PWR 2



Layer 5: GND



Layer 6: Bottom



Bottom Assembly