

# ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ Evaluation Board (with Serial Interface) Operation (Rev 5.0)

## Description

The ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ board allows evaluation of the ISL5960x (MegaQ™) or ISL59960 (960MegaQ™) parts, and provides a reference schematic and PCB layout of a MegaQ™/960MegaQ™ implementation on a 4-layer PCB. In addition to the MegaQ™/960MegaQ™ equalization path, the board features a USB interface that allows access to, and control of, the MegaQ™/960MegaQ™ internal configuration registers, enabling several features that are not available when using the stand-alone configuration (see the datasheets for more details). *This application note is for revision 5.0 of the ISL59605-SPI-EVALZ board. For revisions 1.0 to 4.0 of the evaluation board, see [AN1588](#). The board revision number is found in the top right corner on the top side of the board.*

## Initial Set-Up

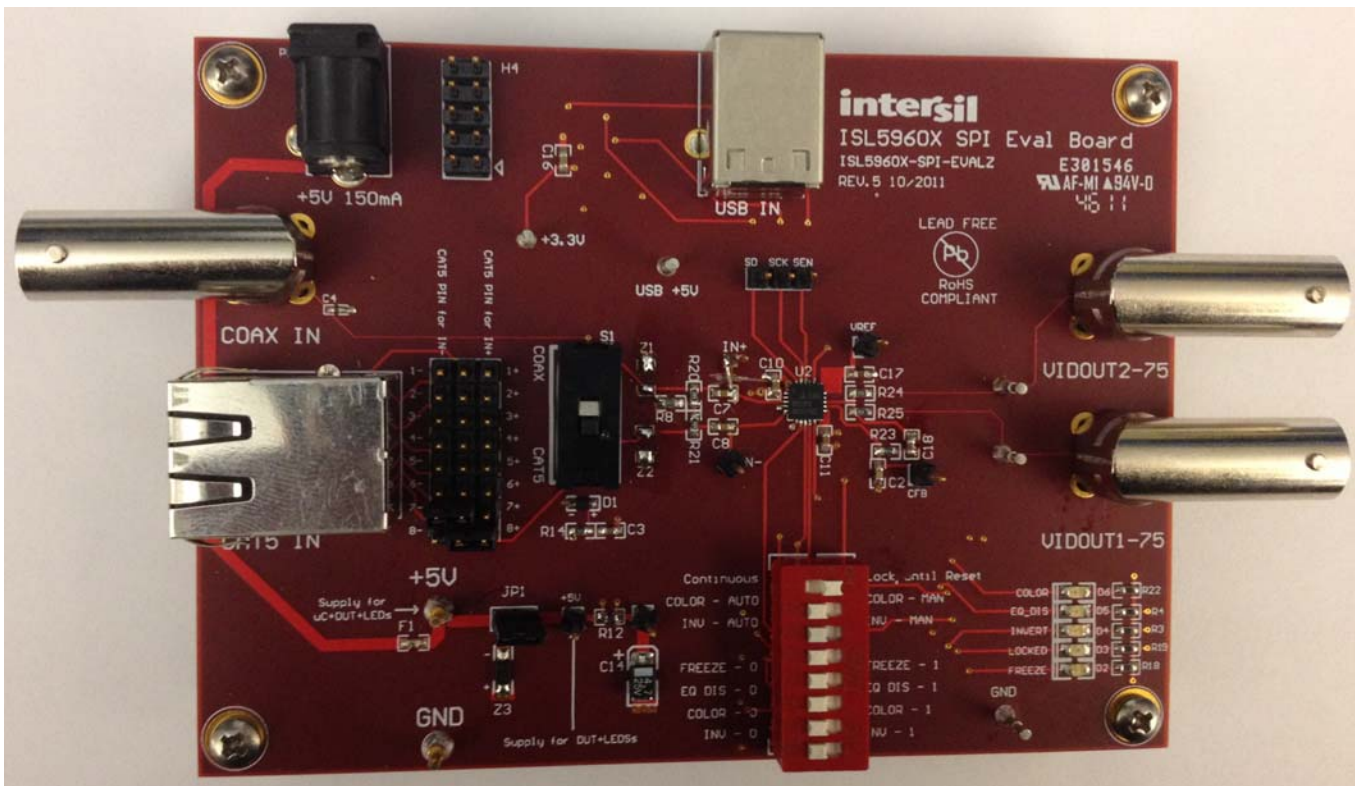
This application note describes how to set-up and use this evaluation board in a stand-alone configuration, then explains how to install the software and use the Windows GUI to read and write to MegaQ™/960MegaQ™'s internal registers.

## Power Connections

The power connection is located at the top left of the evaluation board (see Figure 1). The board requires a +5V DC power supply capable of supplying at least 150mA. Because of the high amount of high-frequency gain required to equalize long cables, excessive noise on the power supply may introduce noise on the output signal or cause difficulty locking at longer distances. Power supplies with linear regulators are preferable to switching regulators, however, switching supplies may work acceptably well if they are adequately filtered.

## Jumpers

JP1 is located on the bottom left side of the evaluation board. It needs to be in place for power to get to MegaQ™/960MegaQ™ and the LEDs. The jumper may be removed and replaced with an ammeter to measure the current consumed by MegaQ™/960MegaQ™ and the LEDs. **JP1 must be shorted (either with a jumper or an ammeter) for the evaluation board to function!**



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The large 3x8 header block is described in the next section.

The JTAG header on the upper left (H4) is used to program the microcontroller during production and is not used when operating the evaluation board. Do not connect anything to the JTAG header.

## Input Connections and Settings for Cat x Cable

Unshielded twisted pair (UTP) signals arrive via the RJ-45 connector on the left. The input signal can be on any arbitrary combination of pins, though it should usually be one of the standard Cat x pairs of 1 and 2, 3 and 6, 4 and 5, or 7 and 8. The 3x8 header block to the right of the RJ-45 jack is used to assign which Cat x pin goes to the positive MegaQ™/960MegaQ™ input (in Figure 1, pin 7), and which goes to the negative input (pin 8). The cable type selection switch (S1) to the right of the jumper block should be switched to “CAT5” (as shown in Figure 1). Do not attach a coax cable while trying to receive a signal over Cat x.

## Input Connections and Settings for Coax Cable

Coax signals are connected through the “COAX IN” BNC connector on the upper left. When using coax signals, set the cable type selector switch (S1) to “COAX” and ensure that no Cat x cables are attached to the RJ45 connector.

The IN+ and IN- test points near U1 can be used to view the input signals at the input to the chip.

## Output Connections

Standard 75Ω composite video is available at the “VIDOUT1-75” and “VIDOUT2-75” BNC connectors on the right, as well as the 2 test pins between R24/R25 and the BNC outputs.

## Switch Settings

The red DIP switch toward the bottom of the board is used to put MegaQ™/960MegaQ™ in its different operational modes (recommended settings are underlined):

- Continuous/Lock until Reset: When set to “Continuous”, MegaQ™/960MegaQ™ will continuously update the EQ settings. When set to “Lock until Reset”, the FREEZE input is connected to the LOCKED output so that device will stop updating once the first optimum solution is reached. “Lock until Reset” is the recommended mode of operation if the SPI interface is not utilized. Set to “Continuous” to allow software control of the locking modes. See the datasheet for more detailed information on the locking modes.
- COLOR-AUTO/COLOR-MAN: Determines whether the COLOR pin is floating (“Auto”) or set by the “COLOR-0/COLOR-1” switch (“Man”). When set to “Auto”, MegaQ™/960MegaQ™ will automatically determine if the incoming signal is color or monochrome. If set to “Man” (manual) the polarity of the COLOR pin is determined by the “COLOR-0/COLOR-1” switch.

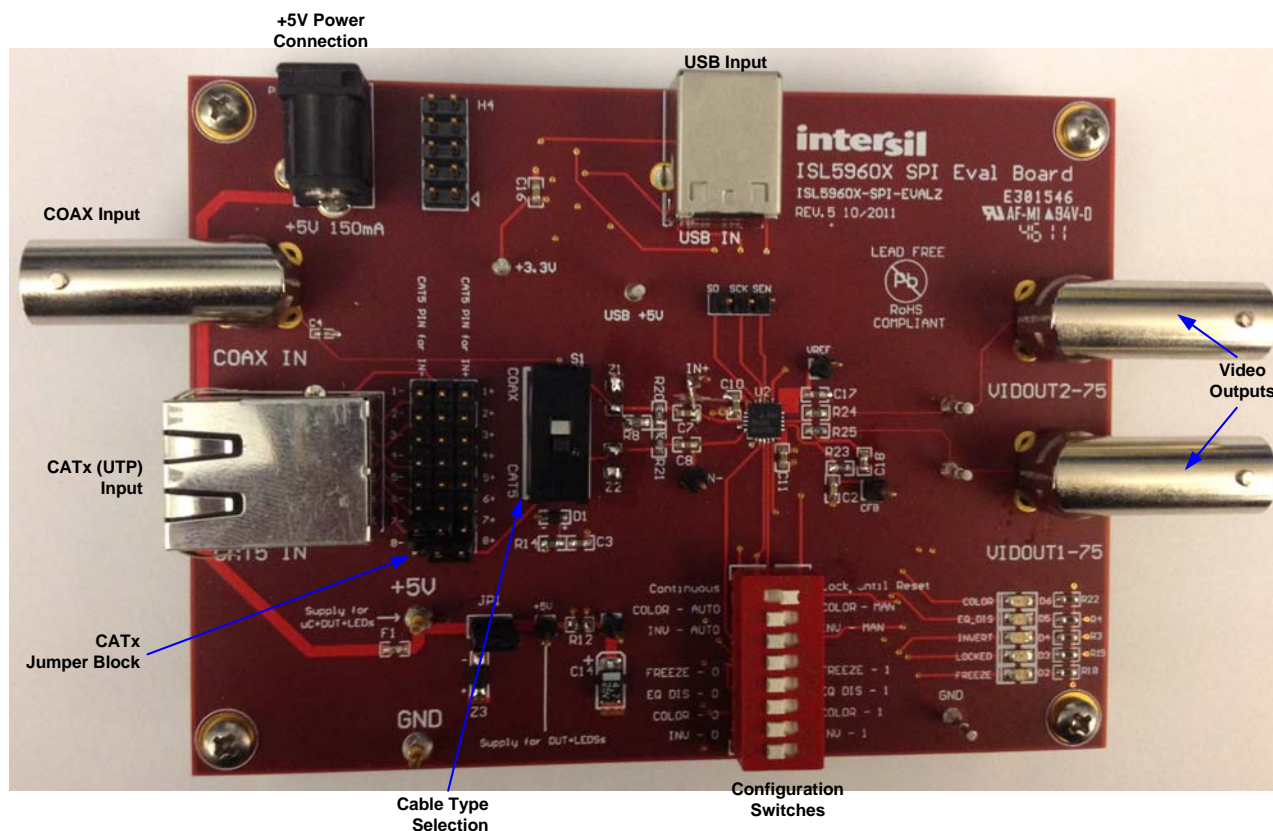


FIGURE 1. EXTERNAL CONNECTIONS AND SWITCHES

- **INV-AUTO/INV-MAN:** Determines whether the INVERT pin is floating (“Auto”) or set by the “INV-0/INV-1” switch (“Man”). When set to “Auto” MegaQ™/960MegaQ™ will automatically determine the polarity of the incoming signal. If set to “Man” (manual) the polarity of the INVERT pin is determined by the “INV-0/INV-1” switch.
- **FREEZE-0/FREEZE-1** Slide the switch left to the “0” position to put the part in “Continuous Update” mode. The “1” position freezes the equalizer in its current state. This switch is ignored when the “Continuous/Lock until Reset” switch is set to “Lock until Reset”. For software control of the locking mode this switch should be set to “0”. See the datasheet for more detailed information on the locking modes.
- **EQ DIS-0/EQ DIS-1:** This can be used to disable the EQ so that an external source can drive a signal over the cable. This switch should be set to the “0” position for normal operation.
- **COLOR-0/COLOR-1:** Slide the switch left to the “0” position to force monochrome (sync tip) equalization mode. Slide the switch right to the “1” position to force color-burst equalization mode. This switch is ignored when the “COLOR-AUTO/COLOR-MAN” switch is set to the “Auto” position.
- **INV-0/INV-1:** Slide the switch left to the “0” position for nominal input signal polarity (positive signal on IN+ and negative signal on IN-). Slide the switch right to “1” position for inverted polarity (positive signal on IN- and negative signal on IN+). This switch is ignored when the “INV-AUTO/INV-MAN” switch is set to the “Auto” position.

### LEDs

There are 5 LEDs at the bottom right of the board that indicate the current state of the EQ\_DIS, COLOR, INVERT, LOCKED, and FREEZE signals. When any LED is illuminated then the corresponding signal is a logic high. When the LEDs are illuminated, they will draw additional supply current from the 5V supply.

## Software Installation

The next section explains how to install the GUI (Graphical User Interface) software, configure the hardware for software control, attach the board to the PC via USB, and use the GUI to control MegaQ™/960MegaQ™.

### Notes

**Some conservative antivirus software may issue an alert during installation. If this occurs, and the software was obtained directly from Intersil then disable the antivirus software for the duration of the installation.**

This software was developed on and will work with 32-bit Windows XP and 32-bit and 64-bit Windows 7 platforms.

The ISL5960x Evaluation Software is designed to work with the entire MegaQ™ family from the ISL59601 through the ISL59605. The ISL59960 Evaluation Software is designed to work with the ISL59960. Some features supported by the software, such as longer equalization lengths and the noise filtering option in register 0x05, are only available on some versions of MegaQ™.

This documentation contains screen captures of the software at the time this manual was written. Subsequent software versions may appear different.

### Software Installation

The ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ software may be installed from a CD-ROM accompanying the hardware or from an installer file downloaded from the Intersil web site. For simplicity the following installation instructions will refer only to the ISL5960x software. The ISL59960 software can be installed and used in exactly the same manner.

Launch the “ISL5960x\_GUI\_Installer\_x\_x.exe” file (x\_x represents version number) and follow the instructions. The default installation will add an “Intersil” directory to the “Start Menu/Programs” tree. That directory will contain a shortcut to the ISL5960x executable and an uninstaller.

The default install option installs the main program files in the C:\Program Files\Intersil\ISL5960x Evaluation Software directory, however the location can be customized if desired.

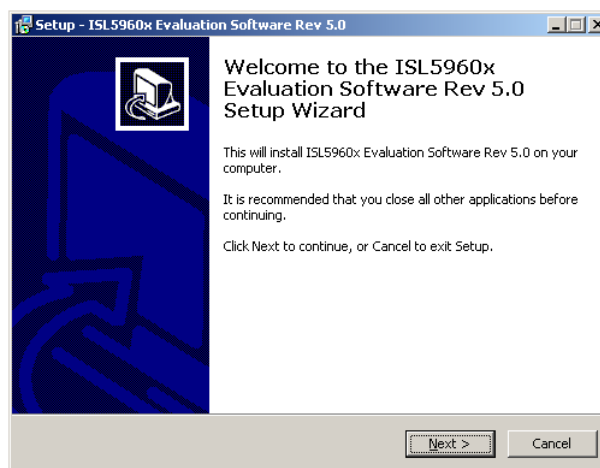


FIGURE 2. INSTALLER WINDOW

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Press **Next** to continue to the license agreement.

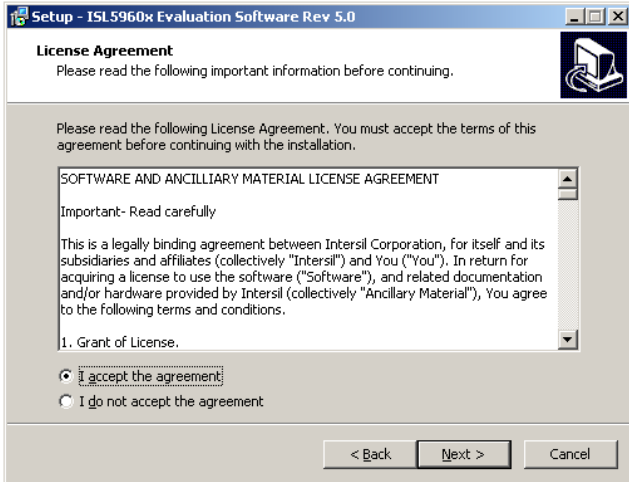


FIGURE 3. LICENSE AGREEMENT

Read the license agreement, choose to accept (or not accept) the license agreement, then click **Next**.

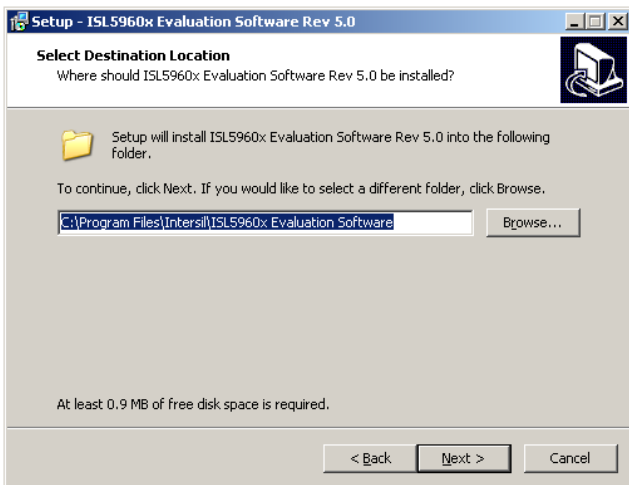


FIGURE 4. INSTALLATION DIRECTORY

By default, the installer will put the evaluation software under **C:\Program Files\Intersil\ISL5960x Evaluation Software** directory. To use a different directory, select the **Browse** button. Press **Next** to continue to the Start Menu Folder screen.

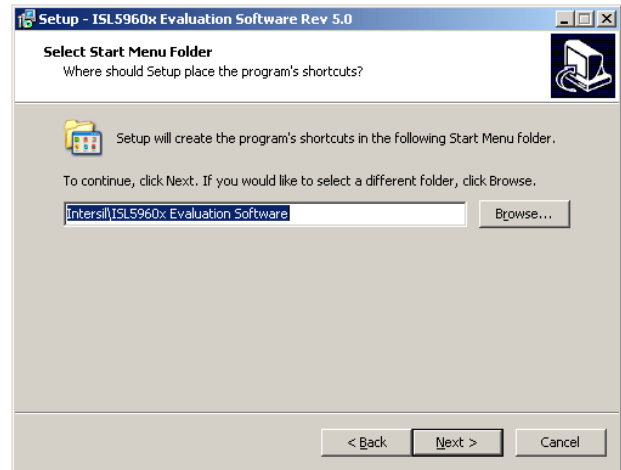


FIGURE 5. START MENU FOLDER

Press **Next** to create the Intersil folder in the Start Menu.

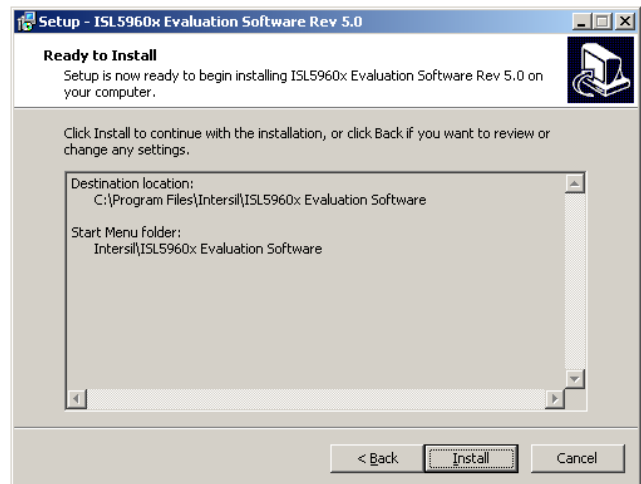


FIGURE 6. BEGIN INSTALLATION

Press **Install** to copy all the necessary files onto the PC.

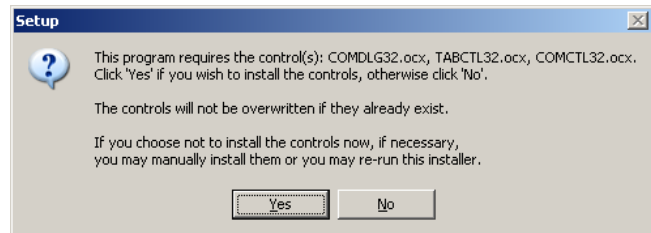


FIGURE 7. OCX FILE INSTALLATION

Click **Yes** to install any required Windows OS files.

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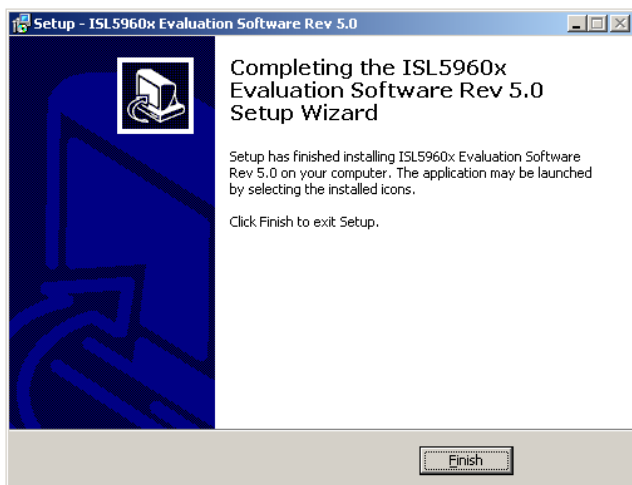


FIGURE 8. COMPLETION SCREEN

Click **Finish** to complete installation. Re-boot the PC if requested.

## Hardware Setup

After the software has been installed, configure and power the evaluation board for connection to the PC.

1. Verify that all the switches are in the correct position as described in “Switch Settings” on page 2. Ensure that the “Continuous/Lock until Reset” switch is set to “Continuous” and that the “FREEZE-0/FREEZE-1” switch is set to “0” to allow the software to set the desired locking mode.
2. Verify that JP1 is shorted (either with a jumper or an ammeter) so power will be applied to the IC.
3. Connect power to the +5V input power jack.
4. Connect the evaluation board to the PC with a USB cable.

Click **Finish** to complete the installation.

On XP systems, a pop-up message may appear displaying the status of the ISL5960X/ISL59960 hardware:

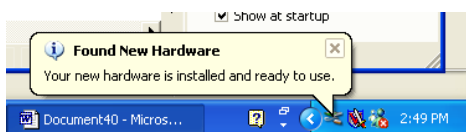


FIGURE 9. HARDWARE INSTALLED NOTIFICATION

## Using the Software

Launch the software (the default location is Start Menu/Programs/Intersil/ISL5960x\_GUI for the MegaQ™ and Start Menu/Programs/Intersil/ISL59960\_GUI for the 960MegaQ™).

After the program has launched, you should see the following screen:

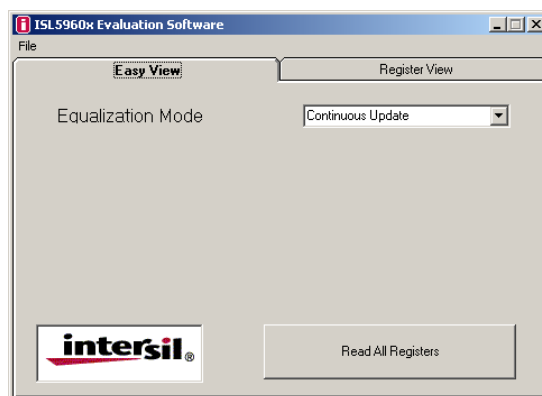


FIGURE 10. BASIC VIEW

## ISL5960x/ISL59960 Basic View

Basic View is a simple interface for controlling the Equalization Mode.

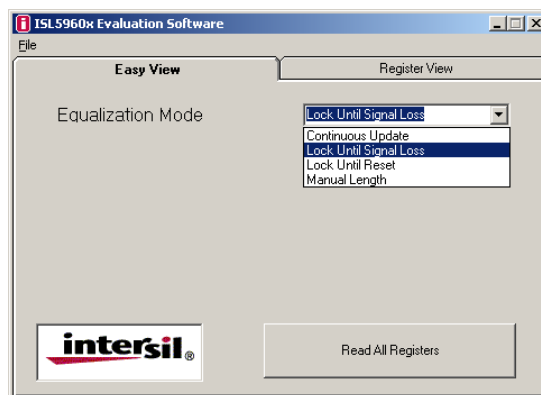


FIGURE 11. EQUALIZATION MODE SELECTION

Using this tab, the user can select between the four equalization modes. The first three modes are various forms of automatic equalization, the last is manual length control (not a particularly useful feature, since the auto EQ almost always equalizes as well as or better than manual, but it may be of some experimental interest):

1. Continuous Update (also available in stand-alone)
2. Lock until Signal Loss
3. Lock until Reset (also available in stand-alone)
4. Manual Length

When the “Manual Length” mode is selected, the slider becomes active and the equalization may be manually adjusted to match the length of cable. In manual mode, the cable type also needs to be selected. The cable type can be set to CAT5/6.

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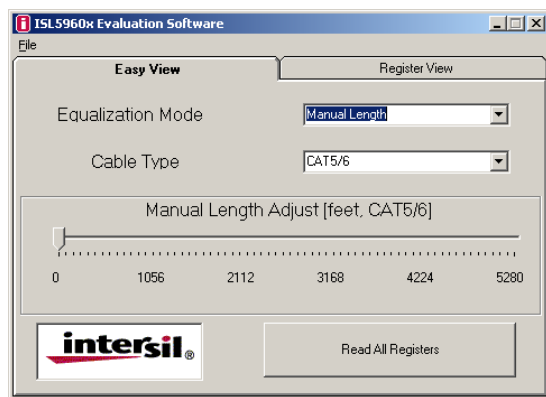


FIGURE 12. MANUAL MODE - CAT5/6

Or the cable type can be set to steel core coax.

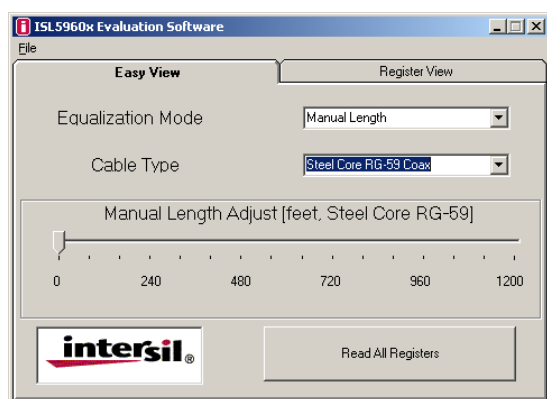


FIGURE 13. MANUAL MODE - STEEL CORE COAX

For CAT5/6, length settings longer than the part is capable of (e.g., 4000 feet with an ISL59601) will have no effect - a part can not equalize farther than the distance it is designed for.

## ISL5960x/ISL59960 Register View

This tab allows user to directly see and modify the contents of the MegaQ™/960MegaQ™ registers. To update the register contents, click **Read All Registers**.

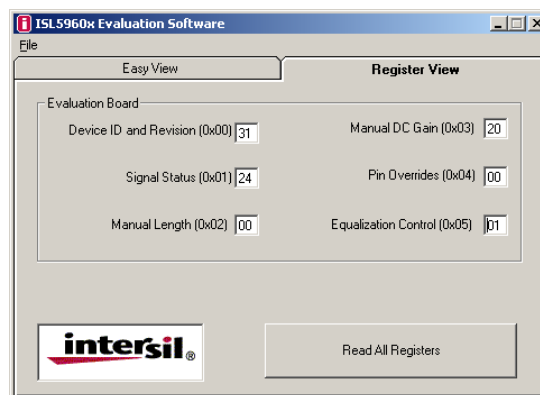


FIGURE 14. REGISTER VIEW

To change a register value, simply type the desired hexadecimal number into the appropriate box. To change both digits of the 2-digit hex number, select both digits with the mouse or by double-clicking inside the text box ( ), then quickly type both digits of the desired value. If you type too slowly (more than ~1 second between the first and second digit), the first digit typed will become the lower nibble, and the higher nibble will be 0. To change one nibble using the keyboard, select the high nibble ( ) or the low nibble ( ) and type the new hexadecimal value. It is not necessary to press the Enter button; the software will automatically send the new value to the ISL59605-SPI-EVALZ Evaluation board.

You can also increment and decrement the register values using the keyboard:

- Up Arrow Key: Increment by 1
- Down Arrow Key: Decrement by 1
- Page Up Key: Increment by 16 (increment high nibble by 1)
- Page Down Key: Decrement by 16 (decrement high nibble by 1)

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## ISL5960x/ISL59960 Detailed Register View

Right-clicking on any register label brings up a detailed bit-level description of each register. If the register has individual bit functions, they will come up as check boxes that can be checked or unchecked.

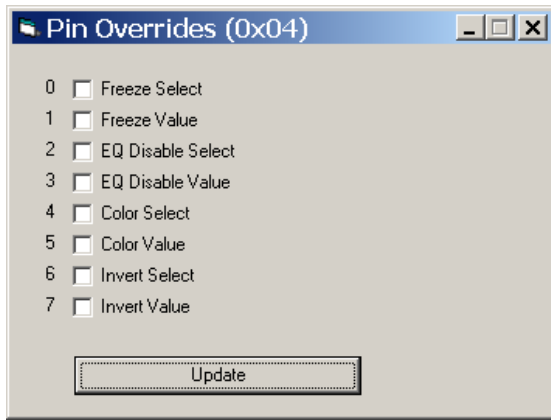


FIGURE 15. PIN OVERRIDE

If the register has grouped bits, they come up as text boxes that can be written to with the desired hex values:

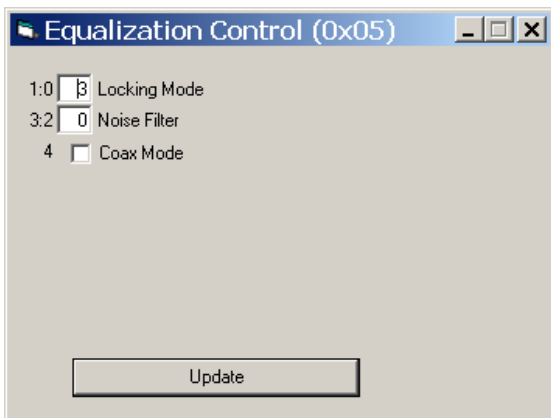


FIGURE 16. EQUALIZATION CONTROL

After the desired data has been entered, click “Update” to send the data to the device. The register view will be automatically updated.

## Saving and Loading Registers

To save all the registers values to a text delimited file, select the “Save Registers” option from the File menu.

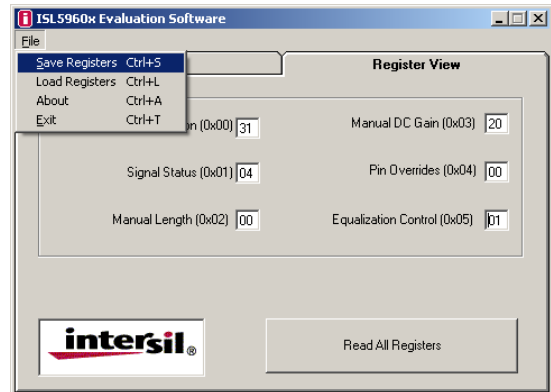


FIGURE 17. SAVING A REGISTER SET

Enter a filename and extension when prompted, and the program will save the file with that extension.

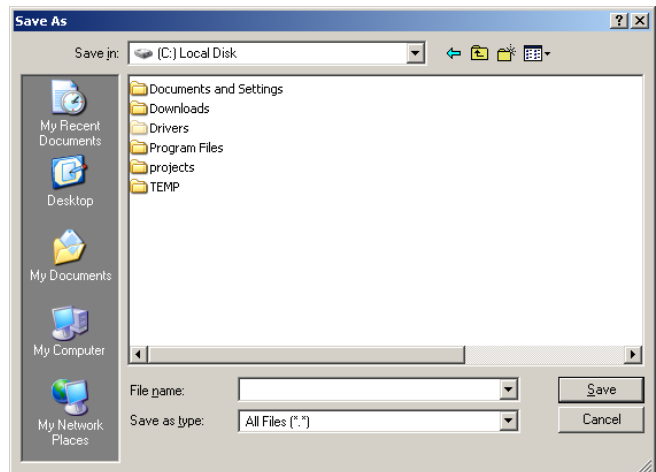


FIGURE 18. REGISTER SAVE DIALOG

Once saved, register files can be loaded using the “Load Registers” function.

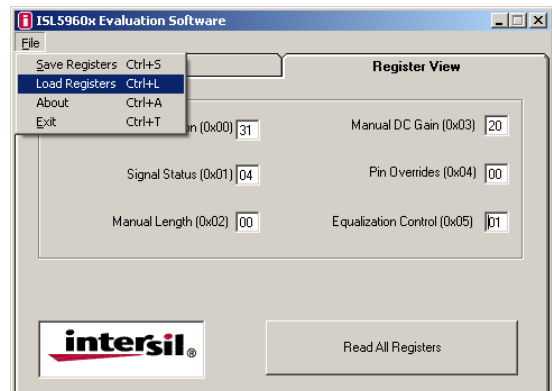


FIGURE 19. LOADING A REGISTER SET

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Please refer to the ISL5960X datasheet for a more detailed description of the registers.

## Related Documents

- ISL5960x Datasheet ([FN6739](#))
- ISL59960 Datasheet ([FN8358](#))
- ISL59605-Catx-EVZ/ISL59960-Catx-EVZ Evaluation Board ([AN1780](#))
- ISL59603-Coax-EVZ/ISL59960-Coax-EVZ Evaluation Board ([AN1776](#))

## Troubleshooting

### Analog (ISL5960x/ISL59960) Troubleshooting

1. Make sure all the switches are in the correct position for the intended operation.
2. Verify that JP1 is shorted (either with a jumper or an ammeter) so that power will be applied to the IC.
3. Verify that there is 5V across the power supply pins, and that the board is drawing at least 80mA of current. If you are seeing less current, JP1 may be open or the “EQ DIS” switch may be set to the wrong position.
4. Probe the IN+ and IN- pins for a video signal. For Cat x inputs, you should see a signal on both inputs (with IN- being the inverse of the signal on IN+). For coax inputs, you should see a signal on IN+ and a DC voltage on IN-. If you do not see the expected signals, inspect your cables, video sources, etc. For Cat x signals, verify that the jumpers in the jumper block are set correctly. If you are not certain which pair of Cat x wires is carrying the signal, you can probe the middle row of 8 pins in the jumper block, where you should see the signal on 2 of them.
5. If you see the correct input signal on IN+ and IN- but are still not seeing a valid output signal, set the “INV Auto/INV Man” switch to the “Man” position and set the “INV-0/INV-1” switch such that a valid signal appears at the output.
6. Verify that the “Continuous/Lock until Reset” switch is in the correct position. “Lock until Reset” for hardware mode and “Continuous” for software control.
7. Probe the VIDEO OUT BNC connector with a scope to see if there is a video signal. If you do not see a composite video signal at the output, and there is a signal present at the input, then the device may be damaged in which case please contact your vendor.

## Software and USB Driver

The software should be able to communicate with the evaluation board as soon as it is launched. If there is a communication problem, the following dialog box may be displayed:

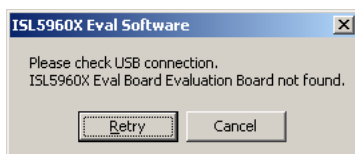


FIGURE 20. DEVICE NOT CONNECTED

After rebooting the PC, please verify that the following files are in the following locations:

- For MegaQ™: ISL5960x Eval.exe in  
C:\Program Files\Intersil\ISL5960X Evaluation Software
- For 960MegaQ™: ISL59960 Eval.exe in  
C:\Program Files\Intersil\ISL59960 Evaluation Software
- COMDLG32.ocx, TABCTL32.ocx, COMCTL32.ocx in  
C:\Windows\System32

If you see the dialog, open the Windows Control Panel. Double-click on the “System” icon, select the “Hardware” tab, then click on Device Manager:

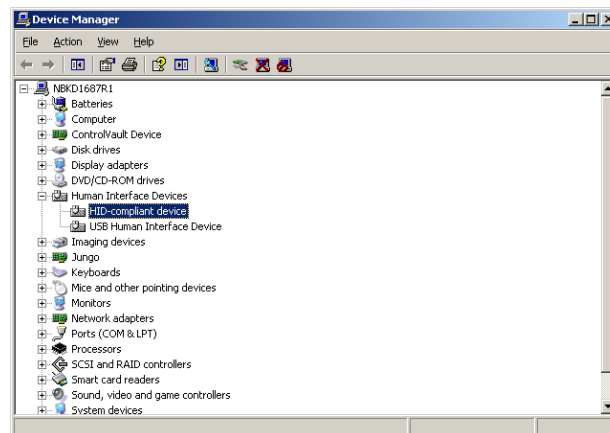


FIGURE 21. DEVICE MANAGER

There should be a “Human Interfaces Devices” entry, with a “HID-compliant device” sub category. Right click on the entry and select “Properties”. In the “Properties” window select the “Details” tab and select “Device Instance Id” from the drop down menu. You should see the following screen:

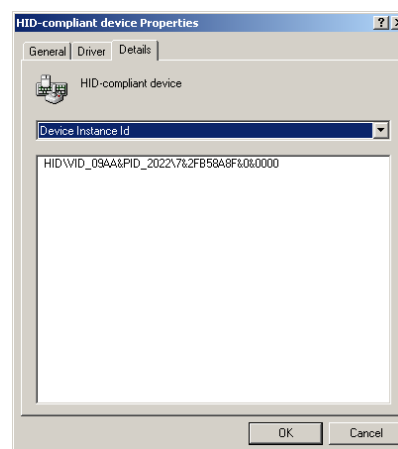


FIGURE 22. DEVICE INSTANCE ID

The window should display the Vendor and Product ID numbers (VID and PID) as VID\_xxxx and PID\_xxxx where “xxxx” represents the number. The ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ has a Vendor ID (VID) of 0x09AA and a Product ID (PID) of 0x2022. If these numbers are present then this indicates that the driver is properly installed and is communicating with the evaluation board.



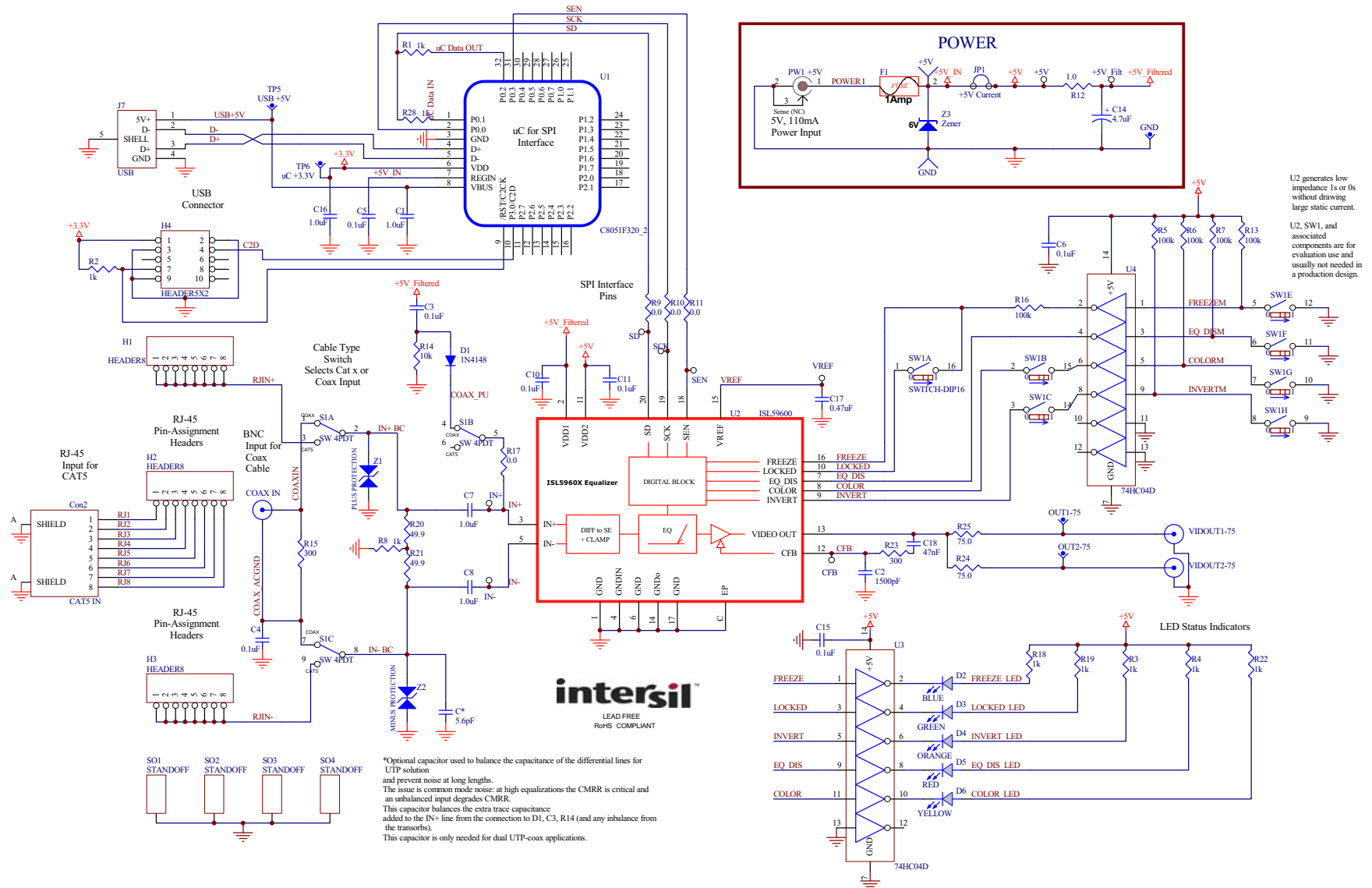
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If the device is not visible in Device Manager, or there are any error messages, try the following:

- Verify that the evaluation board has power and the USB cable is connected to the evaluation board and the PC.
- Disconnect then reconnect the USB cable. You may hear 2 tones from the PC's speakers when the USB device is enumerated.
- Cycle power to the board.
- Close all instances of the ISL5960x application and restart the software. Restart the PC if necessary.
- If none of this works, try installing the software on a different PC isolate the cause to either the PC or the evaluation board.

# ISL59605-SPI-EVALZ/ISL5960-SPI-EVALZ Evaluation Board Schematic



U2 generates low impedance 1s or 0s without drawing large static current. U2, SW1, and associated components are for evaluation use and usually not needed in a production design.

\*Optional capacitor used to balance the capacitance of the differential lines for UTP solution and prevent noise at long lengths. The issue is common mode noise; at high equalizations the CMRR is critical and an unbalanced input degrades CMRR. This capacitor balances the extra trace capacitance added to the IN+ line from the connection to D1, C3, R14 (and any imbalance from the transorbs). This capacitor is only needed for dual UTP-coax applications.



# ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ Board Layout

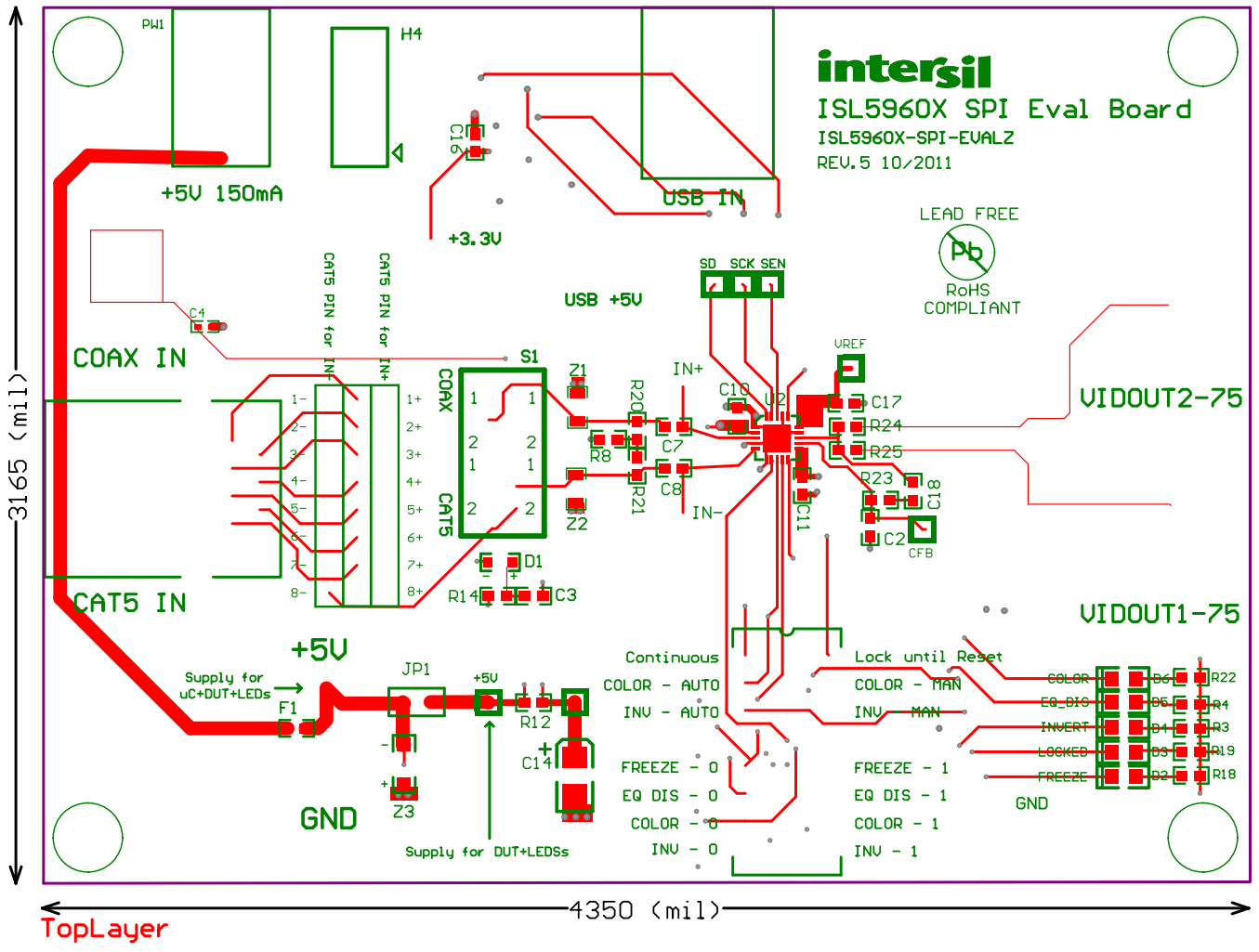


FIGURE 23. PCB TOP LAYER WITH SILKSCREEN

**ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ Board Layout** (Continued)

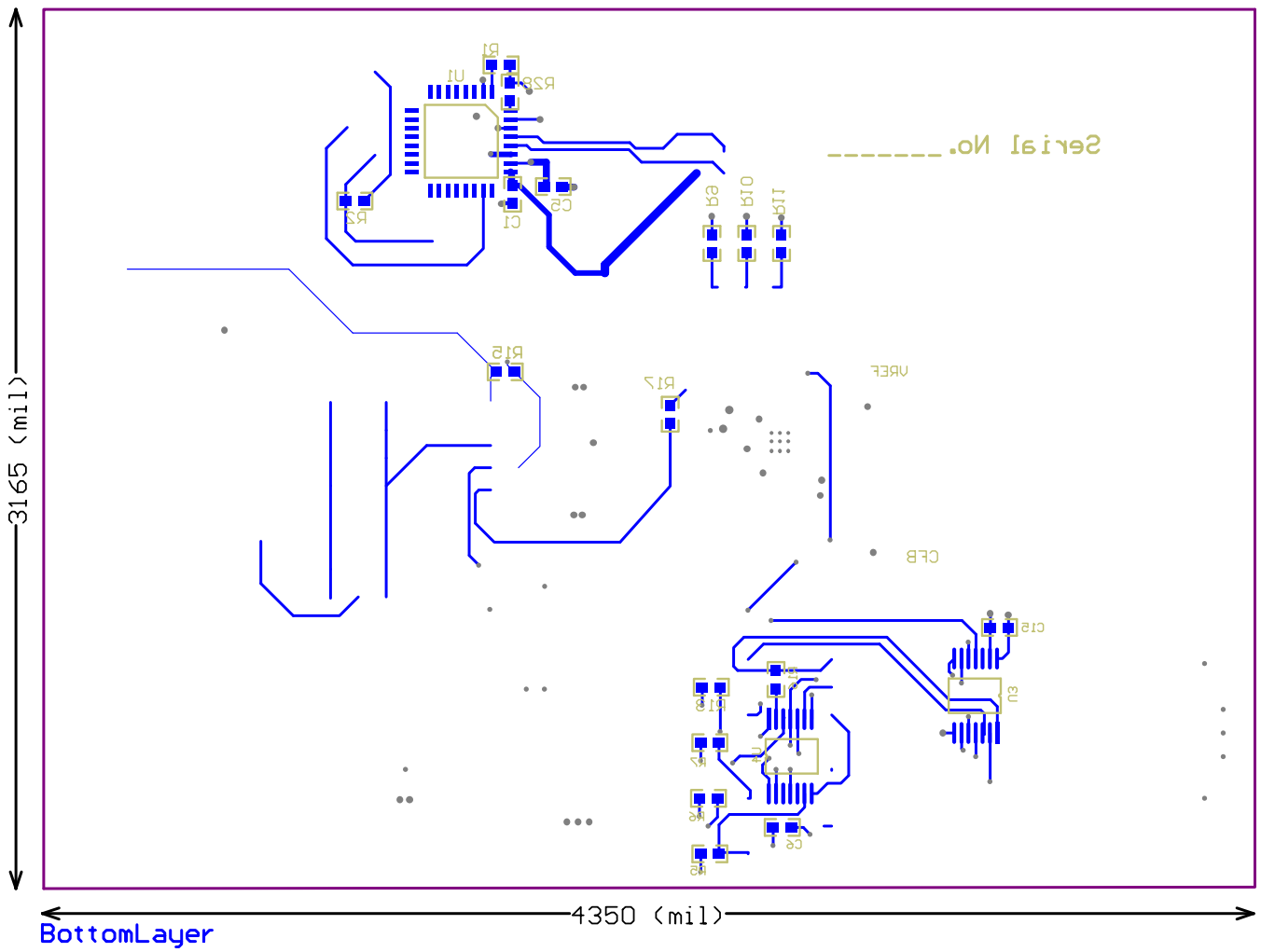


FIGURE 24. PCB BOTTOM LAYER WITH SILKSCREEN

ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ Board Layout (Continued)

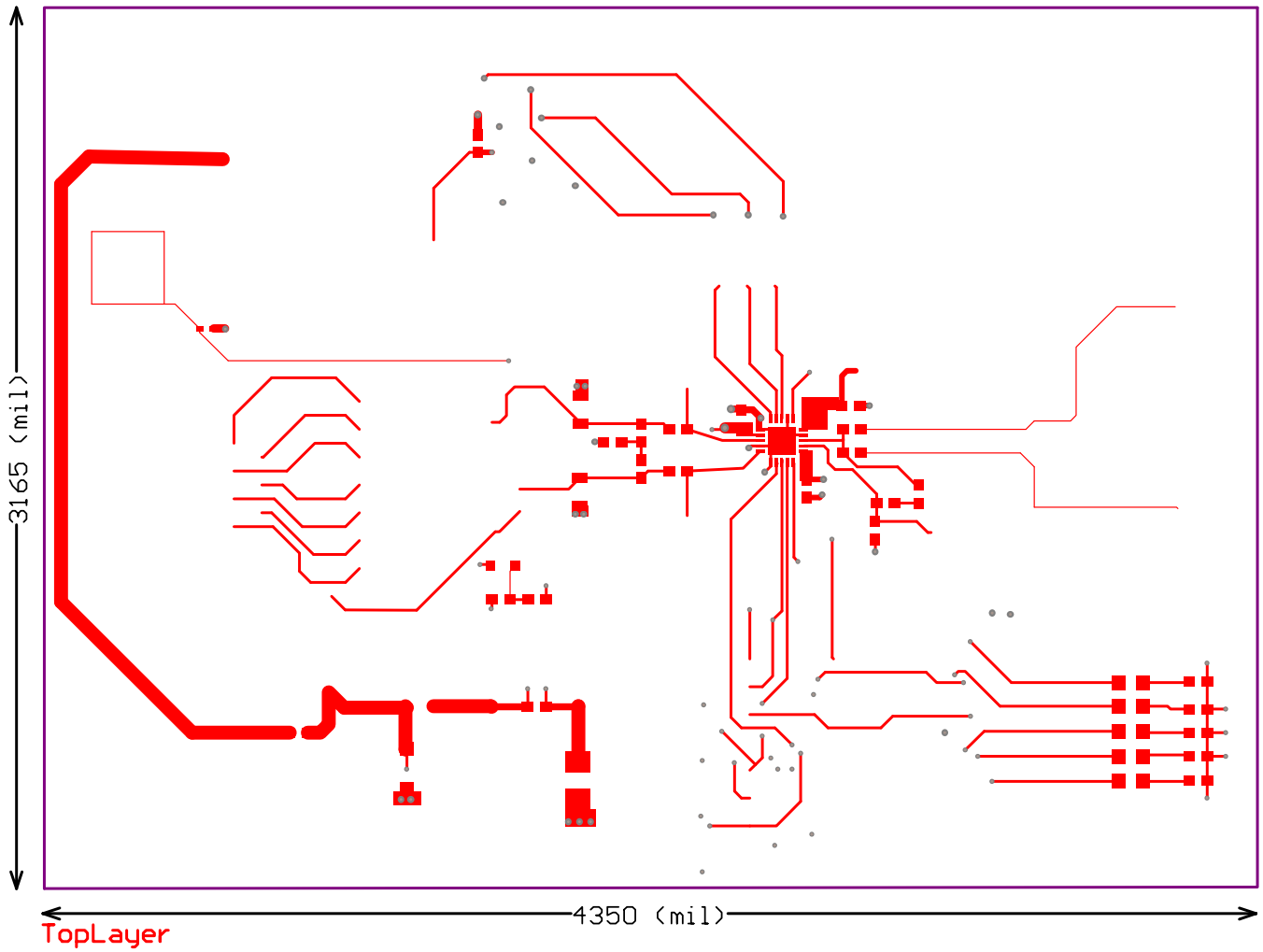


FIGURE 25. PCB TOP LAYER

**ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ Board Layout** (Continued)

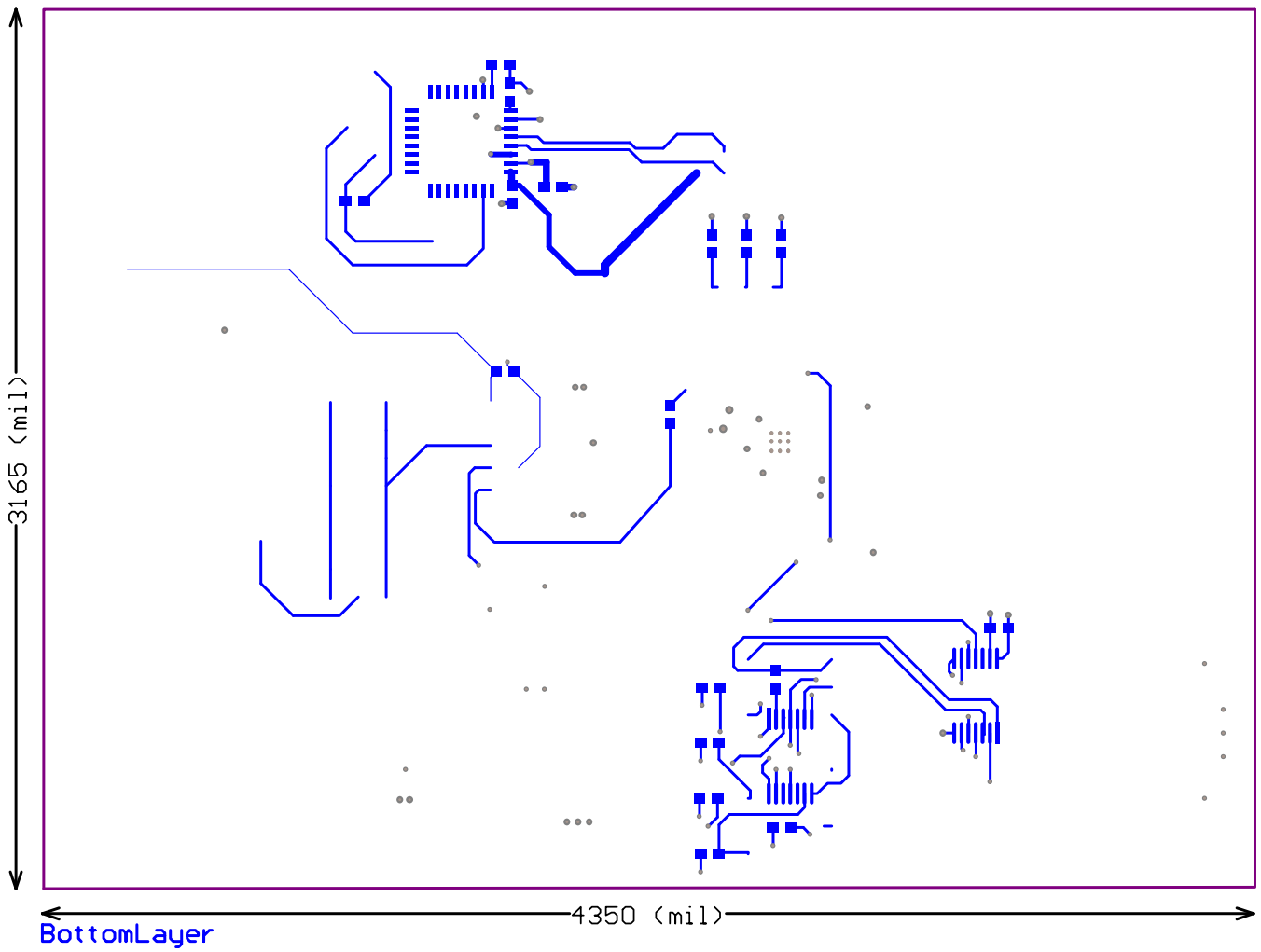


FIGURE 26. PCB BOTTOM LAYER

ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ Board Layout (Continued)

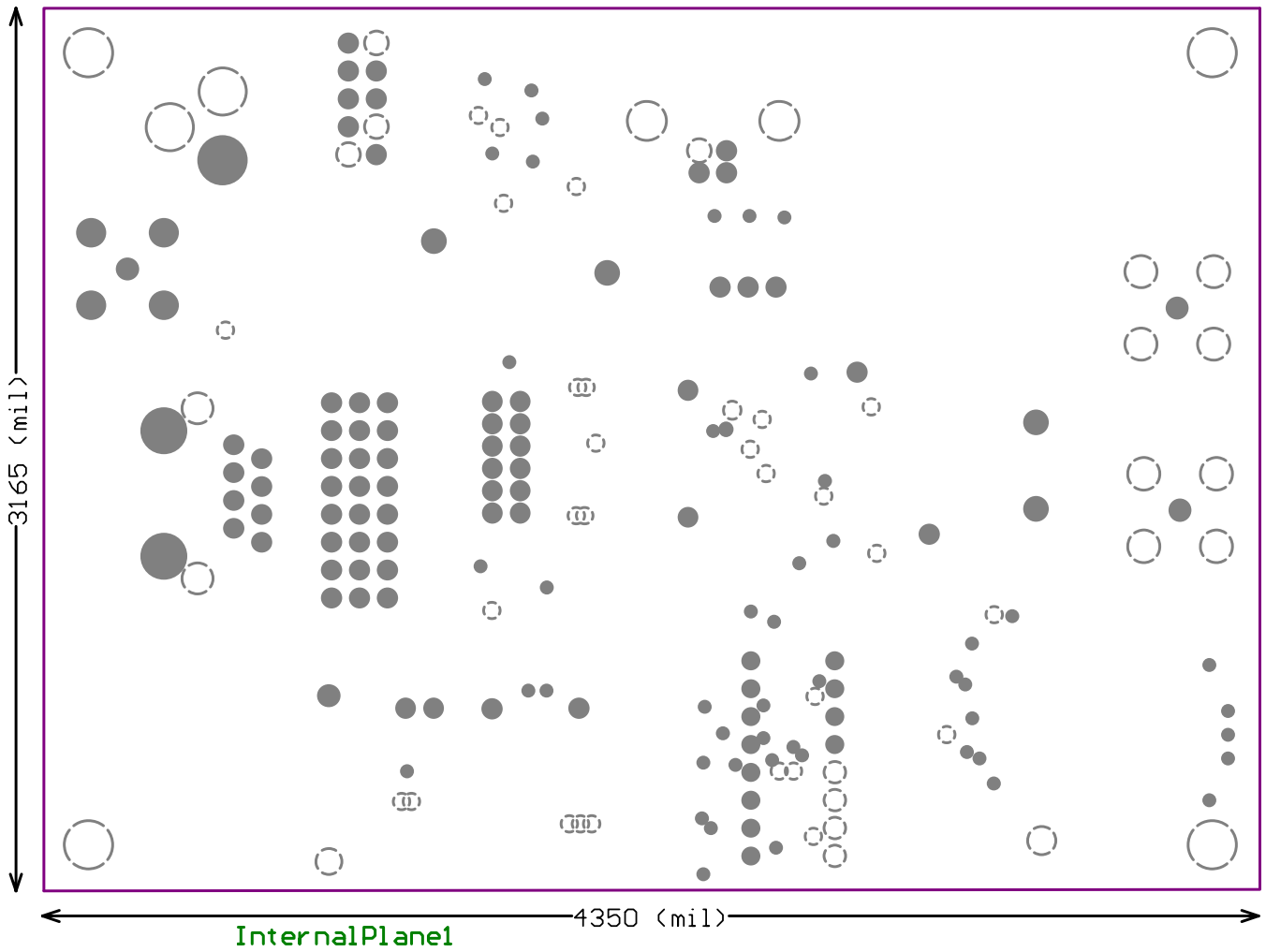


FIGURE 27. PCB INTERNAL PLANE 1 (GROUND)

ISL59605-SPI-EVALZ/ISL59960-SPI-EVALZ Board Layout (Continued)

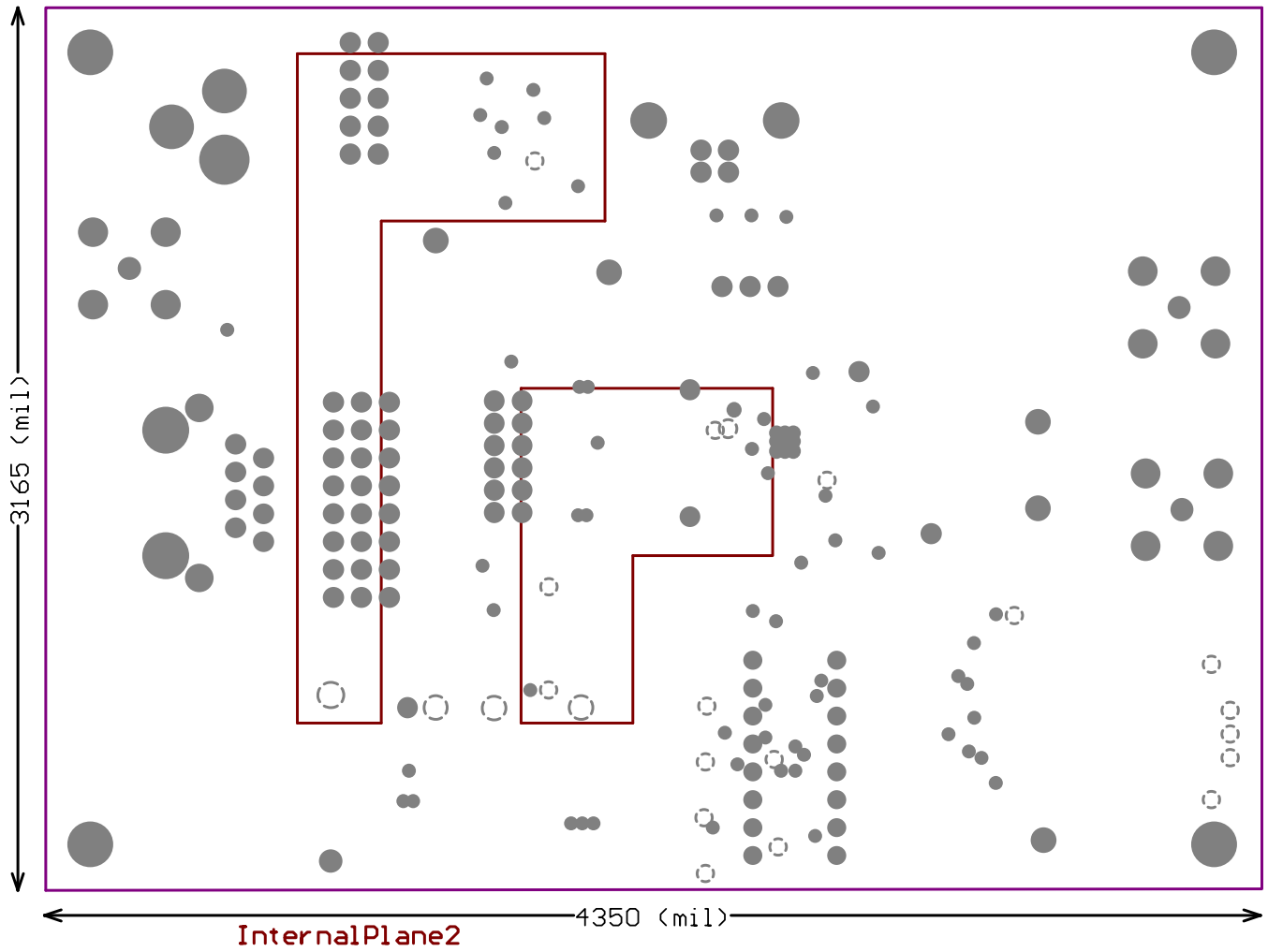


FIGURE 28. PCB INTERNAL PLANE 2 (POWER)



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### Bill of Materials

| QUANTITY | COMPONENT NAME                         | VALUE        | FOOTPRINT               |
|----------|--|--------------|-------------------------|
| 8        | J1, J4, J8, J5, J6, J12, J13, J15, J16 |              | HEADER-1 PIN            |
| 1        | PW1                                    | +5V          | POWER CONN              |
| 2        | J2, J3                                 |              | POWERPOST               |
| 1        | JP1                                    | +5V Current  | JUMPER-2 PIN            |
| 5        | TP2, TP5, TP6, TP14, TP15              |              | TESTPOINT               |
| 1        | H4                                     | HEADER5X2    | HEADER-10P              |
| 3        | H1, H2, H3                             | HEADER8      | HDR8                    |
| 1        | C4                                     | 0.1 $\mu$ F  | 0402                    |
| 4        | R9, R10, R11, R17                      | 0.0          | 0603                    |
| 5        | C5, C6, C10, C11, C15                  | 0.1 $\mu$ F  | 0603                    |
| 1        | C3                                     | 0.33 $\mu$ F | 0603                    |
| 1        | C17                                    | 0.47 $\mu$ F | 0603                    |
| 1        | R12                                    | 1.0          | 0603                    |
| 4        | C1, C7, C8, C16                        | 1.0 $\mu$ F  | 0603                    |
| 5        | R5, R6, R7, R13, R16                   | 100k         | 0603                    |
| 1        | R14                                    | 10k          | 0603                    |
| 1        | C2                                     | 1500pF       | 0603                    |
| 9        | R1, R2, R3, R4, R8, R18, R19, R22, R28 | 1k           | 0603                    |
| 2        | R24, R25                               | 75.0         | 0603                    |
| 2        | R15, R23                               | 300          | 0603                    |
| 1        | C18                                    | 47nF         | 0603                    |
| 2        | R20, R21                               | 49.9         | 0603                    |
| 1        | F1                                     | Fuse         | 0603                    |
| 1        | C14                                    | 4.7 $\mu$ F  | 3528                    |
| 2        | Z1, Z2                                 | CPDFR5V0     | 1005                    |
| 1        | D1                                     | 1N4148       | SOD-323F                |
| 1        | Z3                                     | Zener        | SOD-123                 |
| 1        | U2                                     | ISL59600     | QFN20 4MM               |
| 2        | U3, U4                                 | 74HC04D      | TSSOP-14                |
| 1        | U1                                     | C8051F320    | LQFP32                  |
| 1        | D2                                     | BLUE         | LED-0805                |
| 1        | D6                                     | YELLOW       | LED-0805                |
| 1        | D4                                     | ORANGE       | LED-0805                |
| 1        | D3                                     | GREEN        | LED-0805                |
| 1        | D5                                     | RED          | LED-0805                |
| 1        | J7                                     | USB          | USB TYPEB               |
| 1        | Con2                                   | CAT5 IN      | Modular-8S              |
| 1        | P2                                     | COAX IN      | BNC-EDGE                |
| 2        | P1, J14                                | VIDOUT1-75   | BNC-EDGE                |
| 4        | S01, S02, S03, S04                     | STANDOFF     | STANDOFF                |
| 1        | S1                                     | SW 4PDT      | SWITCH 4PDT SLIDE MMS42 |
| 1        | SW1                                    | SWITCH-DIP16 | SWITCH-DIP8X2           |

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