ISL71148VMREFEVKIT1Z

Voltage Monitor Reference Design for AMD Versal XQRVE2302

Description

The ISL71148VMREFEVKIT1Z evaluation kit and iRADNavigator software GUI are used to demonstrate the ISL71148M 14-bit SAR ADC in a voltage monitoring application.

The ISL71148VMREFEV1Z voltage monitor reference design board uses the Renesas ISL71148M high precision, 8-channel 14-bit 900ksps SAR ADC paired with the ISL71010B25 precision voltage reference, and the ISL75054M low noise LDO. The primary use of this reference design is to pair with the ISLVERSALDEMO3Z reference design board. Use the ISL71148VMREFEV1Z board with the Vorago VA41620 MCU board and iRADNavigator software.

The ISLVERSALDEMO3Z produces all 11 power supply voltages required to power the AMD Versal™ AI Edge XQRVE2302 Adaptive SOC. An extra voltage is monitored in this application to measure the main +12V supply rail bus. All 12 voltages are digitized by the ISL71148M and read by the iRADNavigator software. Two ISL75054Ms provide the AVCC and DVCC supply rails to the ISL71148M. The ISL71010B25 ultra-low noise, precision voltage reference provides the VREF (2.5V) for the ISL71148M to set the analog input range. There are four power supply voltages that are divided in hardware on the ISL71148VMREFEV1Z board to keep all inputs to the ADC within its input range. The subsequent value read by the iRADNavigator software GUI is multiplied by the same number it was previously divided by to display the correct value. For a block diagram of the reference design circuit, see Figure 1.

This evaluation system supports a text or graphical display of the selected power supply voltage of the ISLVERSALDEMO3Z board in the iRADNavigator software. Any number of voltages from 1 to 12 can be displayed simultaneously.

The included Vorago VA41620 MCU evaluation board must be mated to the ISL71148VMREFEV1Z evaluation board to acquire data and observe any of the 12 required voltages.

Features

This evaluation kit demonstrates an example signal chain used to monitor a large number of power supply voltages in an application while highlighting the accuracy and reconfigurability of all three of the main system components: the LDO, the precision voltage reference, and the SAR ADC.

- Accurate voltage measurement
- Multiple power supply rail observation configurations
- ISL71148M single-ended configuration
- ISL71148M cold sparing application
- ISL71148M/ISL73148SEH dual footprint configuration

Specifications

- +12V power supply input (from a bench top power supply)
- Main system components support -55°C to +125°C operation
- Supporting components support -40°C to +85°C operation

Kit Contents

- ISL71148VMREFEV1Z ADC evaluation board
- Vorago VA41620 MCU Board
- 40-Pin ribbon cable
- USB 2.0 cable Type A to Micro USB
- USB 2.0 cable with UART adapter - DTech DT-6554 or similar

Required Equipment

To properly operate the ISL71148VMREFEV1Z board the following equipment is required:

- Renesas iRADNavigator software
- 12V power supply
- PC running Windows 10 or greater

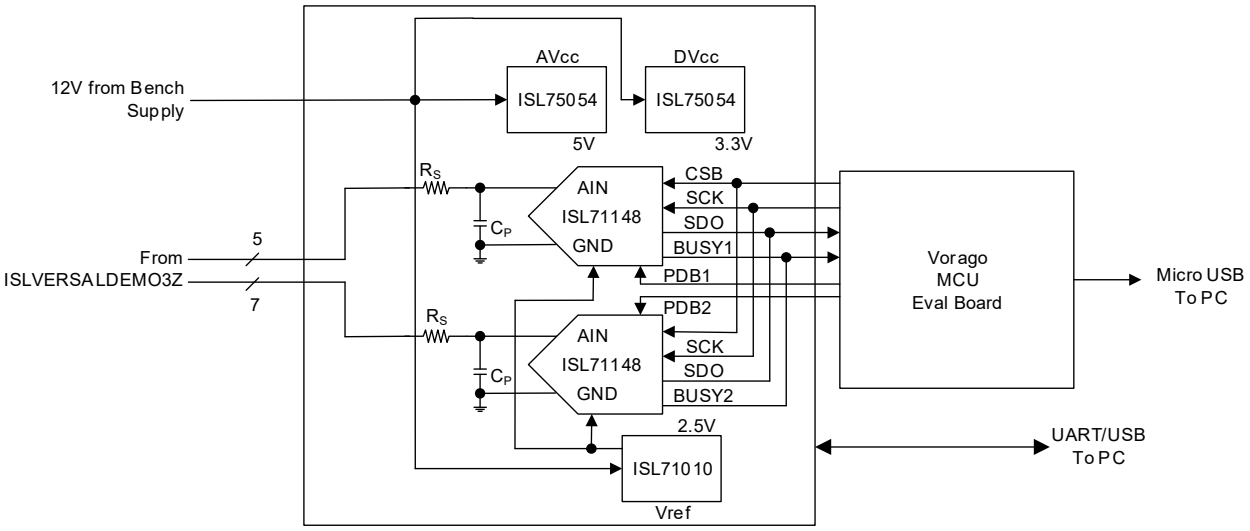

Figure 1. ISL71148VMREFEV1Z Block Diagram

Contents

1. Functional Description

The ISL71148VMREFEV1Z voltage monitor reference design board operates with the ISLVERSALDEMO3Z reference design board. However, it can be mated to other boards with compatible connectors and topologies with voltages to monitor or measure. This user guide discusses the operation of the reference design platform and power supply voltages that are monitored. Table 1 shows the 12 voltages that are monitored.

Table 1. ISL71148VMREFEV1Z Power Supply Rails and Voltages

Voltage Value (V)	Power Supply Rail Name
5.0	ISL73007_5VBUS2
0.0-3.0	ADC_ISENSE
1.8-3.3	ISL73007_VCCO_50X_HDIO
1-1.5	ISL73007_VCCO_XPIO
0.8	ISL73849_VCCINT
1.5	ISL73007_VCCAUX
0.88	ISL75054_MGTY_AVCC
1.5	ISL75054_MGTY_AVCCAUX
1.2	ISL71001_MGTY_AVTT
1.2	ISL70005_DDR_VDD
0.6	ISL70005_DDR_VTT
2.5	ISL73007_DDR_VPP

Figure 2 shows the top side of the ISL71148VMREFEV1Z board. A +12V input must be applied to the VIN and GND banana jacks on both reference design boards to supply power to each board. The Vorago VA41620 board connects to the ISL71148VMREFEV1Z reference design board using connectors J1A and J2A.

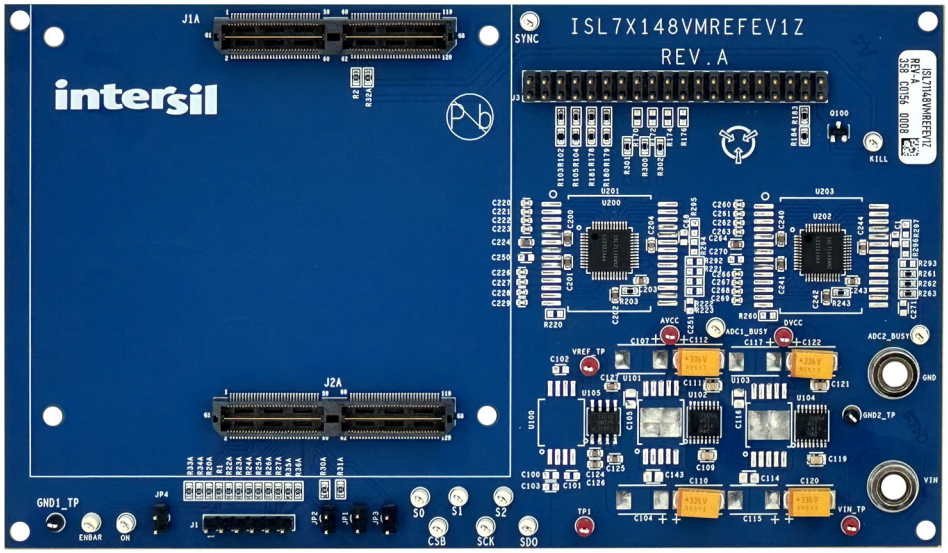

Figure 2. ISL71148VMREFEV1Z Evaluation Board Top

Figure 3 shows the Vorago VA41620 evaluation board connected to the ISL71148VMREFEV1Z voltage monitor reference design board. ***Important***: It is imperative to connect the ribbon cable properly between the ISLVERSALDEMO3Z and the ISL71148VMREFEV1Z reference design boards. On both reference design boards, the ribbon cable should lead away from the connector off of the adjacent edge of the circuit board. All of the main system components of the signal chain are radiation tolerant products. Furthermore, the ISL71148VMREFEV1Z board has dual footprints available to configure its radiation hardened equivalents. The Vorago VA41620 MCU is radiation hardened by design. The remaining components, the surface mount passives, are commercial products that are not radiation hardened and may or may not support extended temperatures used in a typical space application.

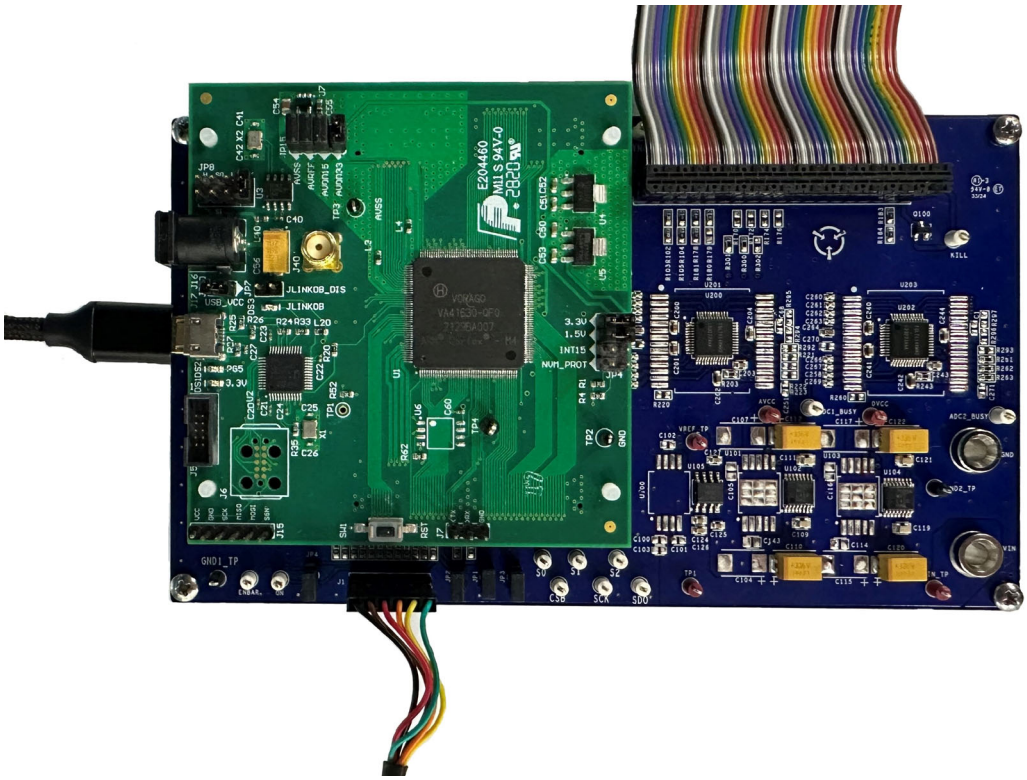

Figure 3. ISL71148VMREFEV1Z Evaluation Board with Vorago VA41620 MCU Evaluation Board

Figure 4 shows the ribbon cable connection on the ISLVERSALDEMO3Z board that connects to the ISL71148VMREFEV1Z board. Similar to the connection on the ISL71148VMREFEV1Z board, the ribbon cable must connect so that the ribbon cable leads away from the connector off the adjacent edge of the circuit board.

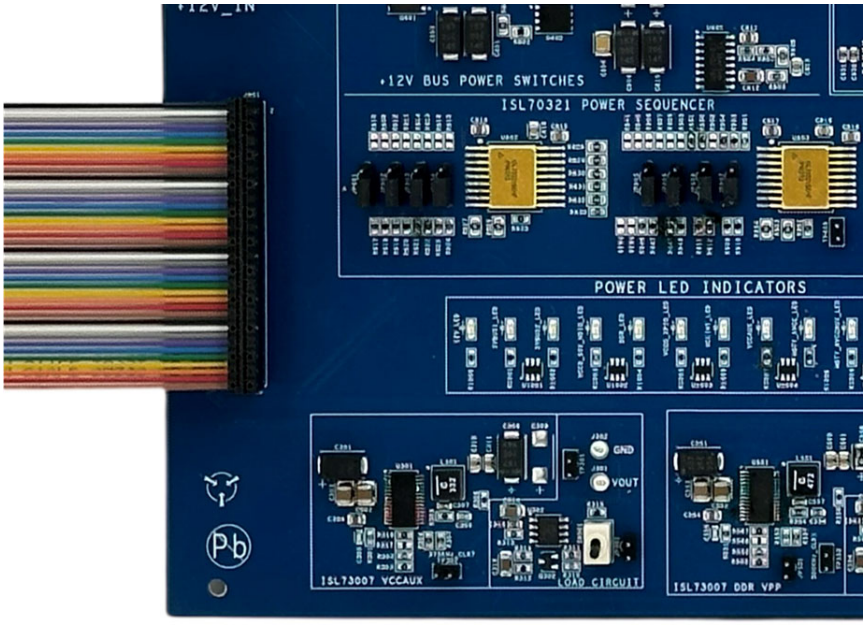

Figure 4. ISLVERSALDEMO3Z Ribbon Cable Connection with the ISL71148VMREFEV1Z Evaluation Board

Power for the ISL71148VMREFEV1Z and the ISLVERSALDEMO3Z reference design boards should be provided by a 12V power supply, which is connected to the VIN and GND connections on the ISL71148VMREFEV1Z board and to the +12V_IN and GND connections on the ISLVERSALDEMO3Z board.

1.1 Evaluation Board Operation

The ISL71148VMREFEV1Z reference design board operates with the ISLVERSALDEMO3Z to show the 12 power supply rails provided. The two boards are connected using a ribbon cable, which supplies the power supply voltages from the ISLVERSALDEMO3Z board to the ISL71148VMREFEV1Z board. The iRADNavigator software GUI drives the voltage selection at a given time to perform a measurement. The ISL71010B25 provides the reference voltage (2.5V) to the ISL71148M, which sets the analog input range of the ISL71148M. Two ISL75054Ms provide the AVCC (5V) and DVCC (2.5V) supply rails to the ISL71148M.

As seen in Table 1, power supply rails ISL73007_5VBUS2, ADC_ISENSE, ISL73007_VCCO_50X_HDIO, and ISL73007_DDR_VPP are equal or larger than 2.5V. Therefore, the voltages are divided by 4, 2, 2, and 2 respectively in hardware on the ISL71148VMREFEV1Z board to keep all ADC inputs in range. To report the correct value, the iRADNavigator software scales this voltage by the same factor each voltage was divided by.

The ISL75054M, ISL71010B25, and ISL71148M devices on the evaluation board support operation from -55°C to +125°C. However, many components (namely the surface mount passive components used on the evaluation board) support a commercial temperature range of -40°C to +85°C. This evaluation board operates under ambient temperature conditions at or near 25°C.

1.2 Connecting the Voltage Monitor, Versal, and MCU Evaluation Boards

Complete the following steps to connect the boards successfully.

1. Connect the supplied Vorago VA41620 MCU evaluation board to the ISL71148VMREFEV1Z board.
2. Connect the ribbon cable from the ISL71148VMREFEV1Z board to the ISLVERSALDEMO3Z board.
3. Connect the supplied USB Type A to Micro USB cable from the PC to the Vorago VA41620 MCU evaluation board.
4. Connect +12V to the ISL71148VMREFEV1Z and the ISLVERSALDEMO3Z boards.
5. Observe LED DS2 on the Vorago VA41620 board to make sure it starts blinking. When the LED blinks, connect the supplied DTech FTDI USB to the UART cable from the PC to the ISL71148VMREFEV1Z board.
6. Press the reset button (SW1) on the Vorago VA41620 MCU evaluation board to load the firmware from the MRAM into the VA41620 MCU.

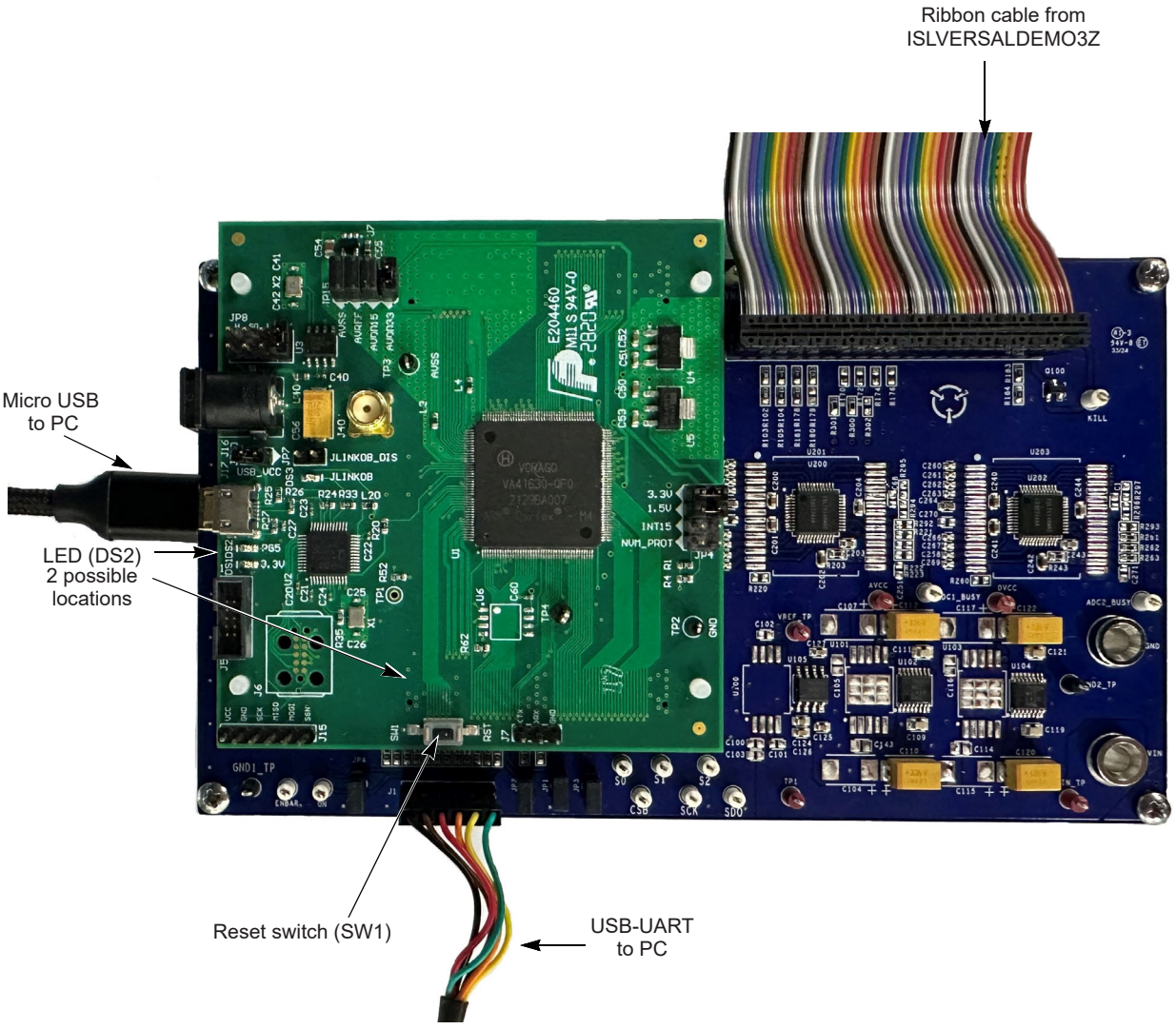

Figure 5. ISL71148VMREFEV1Z/VA41620/ISLVERSALDEMO3Z Connection Diagram

1.2.1 iRADNavigator Board Selection

Double-click on the **iRADNavigator** icon from the desktop on the PC to open the **iRADNavigator** software. In the Available Hardware box, click to expand the list of ADC Reference designs. Select ISL71148_Versal3_Monitor from the list and then click the **Select** button.

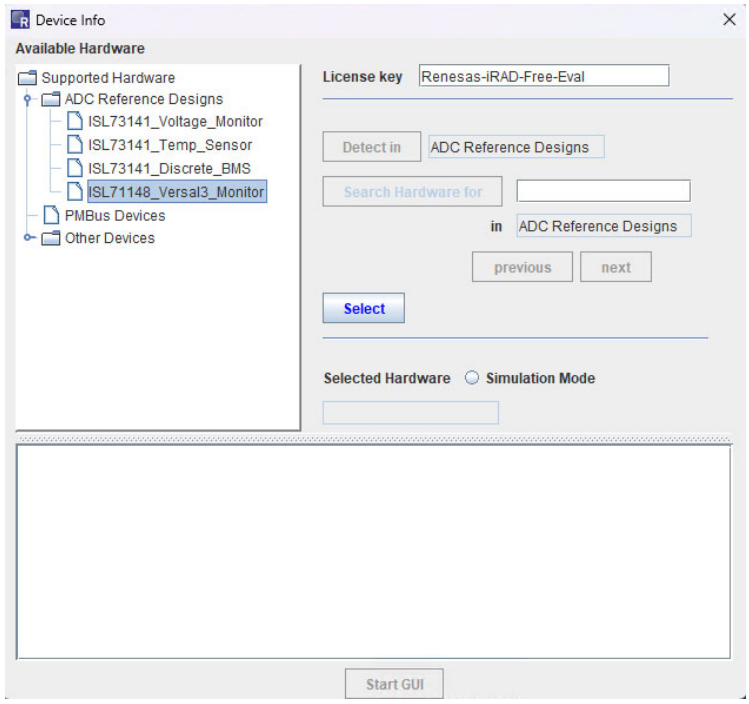

Figure 6. iRADNavigator Board Selection

After clicking **Select**, the GUI loads the screen shown in Figure 7, which shows the board selected and its communication options. Click **Connect** to connect the GUI to the board.

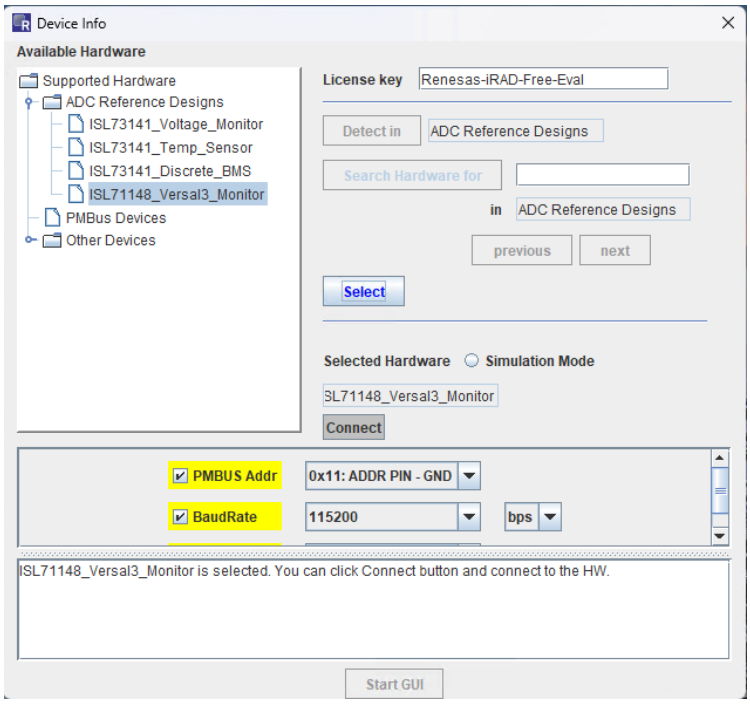

Figure 7. iRADNavigator Board Selection and Communication Options

After clicking the **Connect** button, iRADNavigator communicates with the Vorago MCU board to ensure the latest firmware is loaded into the Vorago MCU. If not, a pop-up window opens prompting the update of the firmware. If the Vorago MCU firmware is up to date, this pop-up window does not open.

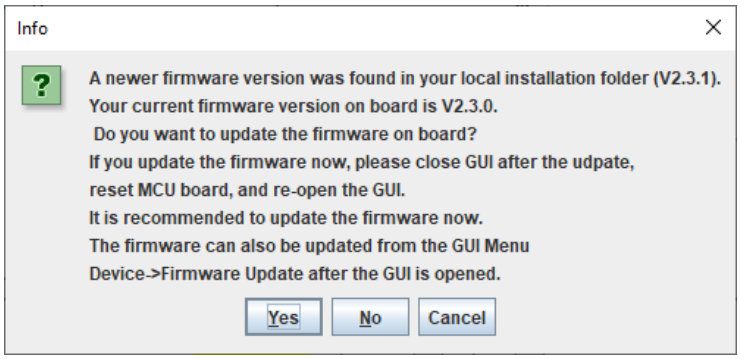

Figure 8. iRADNavigator Firmware Update Prompt

When the firmware update is complete, another pop-up window opens to state that the Vorago MCU firmware has been updated. Click **OK** to acknowledge the firmware update.

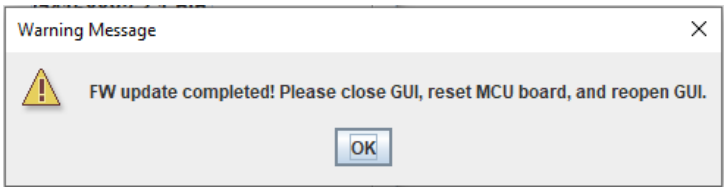

Figure 9. iRADNavigator Firmware Update Complete

After clicking **OK**, close iRADNavigator, press the reset button on the Vorago MCU board, and reopen the GUI. Select the ISL71148_Versal3_Monitor from the selection tree and click **Connect**.

The **Start GUI** button is enabled when communication is established to the ISL71148_Versal3_Monitor board. Click the **Start GUI** button to proceed.

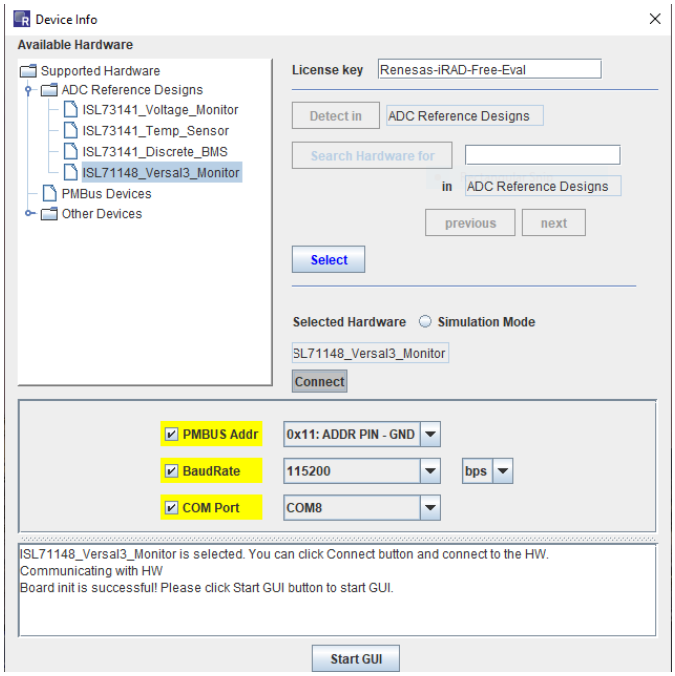

Figure 10. iRADNavigator Start GUI

1.2.2 iRADNavigator Voltage Monitor Selection and Measurements

After selecting the **Start GUI** button, the GUI window changes to allow selecting the voltages to be monitored with the ISL71148VMREFEV1Z board. The **Versal Monitor** window is selected by default. All of the available voltages are displayed on this main screen. From this screen, check the box beside any required voltage and click the **Read** button to obtain a single measurement.

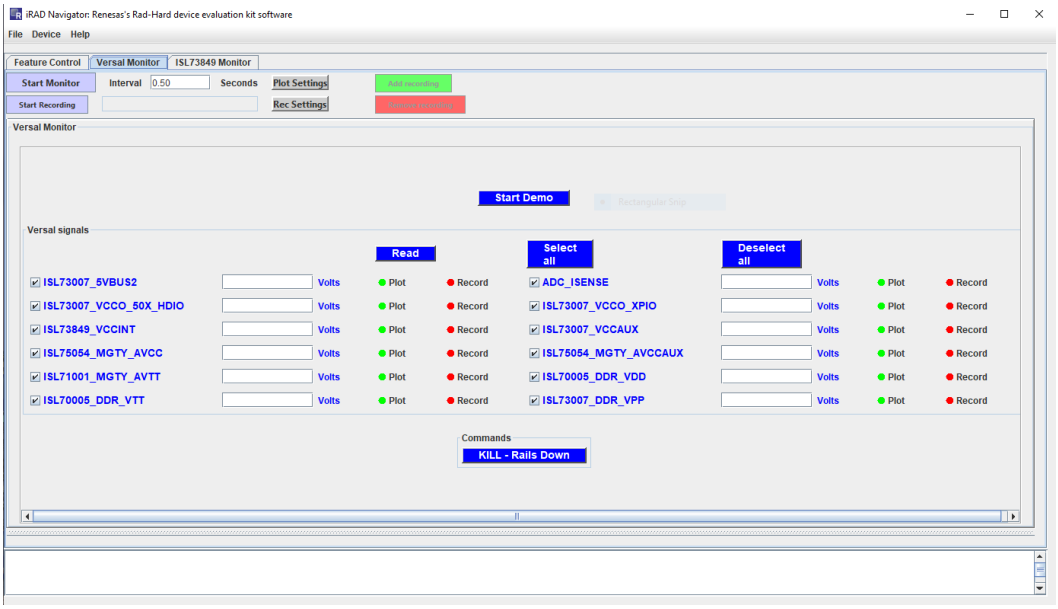

Figure 11. iRADNavigator Versal Monitor Main Screen

Each time the **Read** button is pressed, it updates the values in the boxes. The values should look similar to those shown in Figure 12.

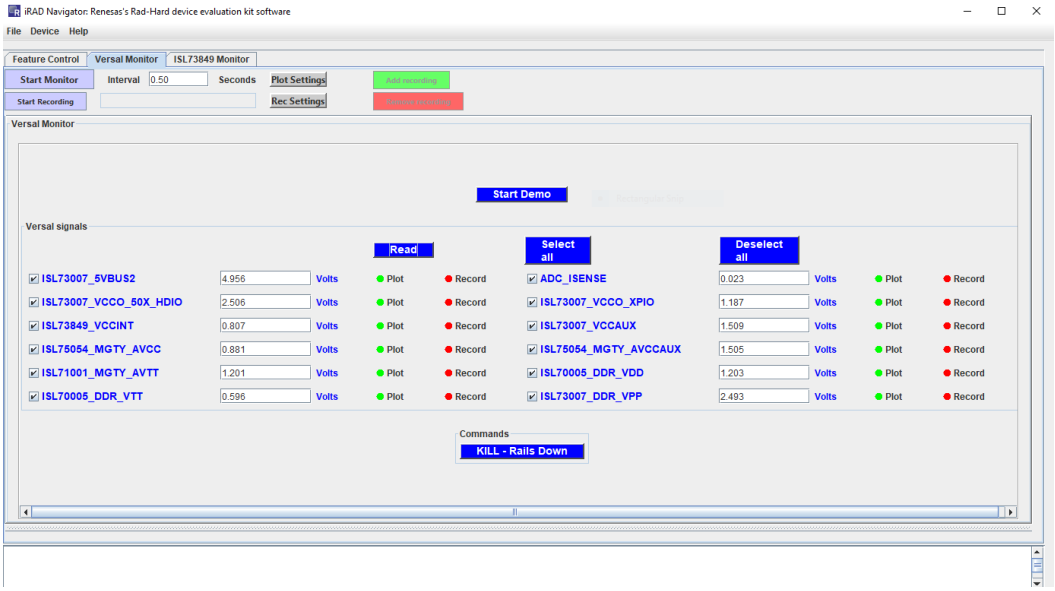

Figure 12. iRADNavigator Voltage Values

When the required voltages are selected, the measurements can plotted in the Monitor Panel by clicking on the **Start Monitor** button.The Monitor Panel can support plotting all twelve channels at the same time.

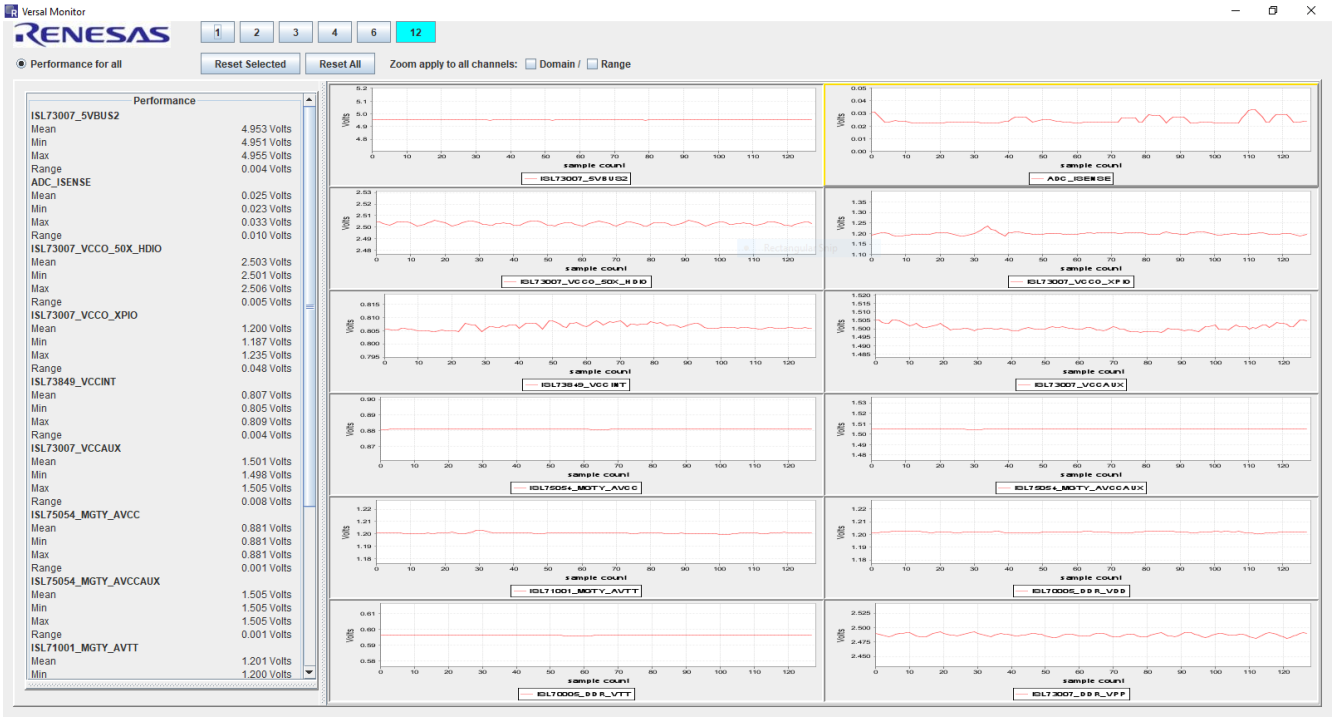

Figure 13. iRADNavigator Twelve Voltages Selected to be Monitored

The Versal Monitor screen has a button **Start Demo** that makes the voltages available easy to read and plot. All twelve voltages are selected by default. In Figure 13, all twelve voltages are plotted. The user has the availability of selecting 1, 2, 3, 4, 6, and 12 plots to be monitored at the same time. For instance, if Box 1 is selected, a window is displayed (as shown in Figure 14), enabling the user to choose the voltage to be monitored.

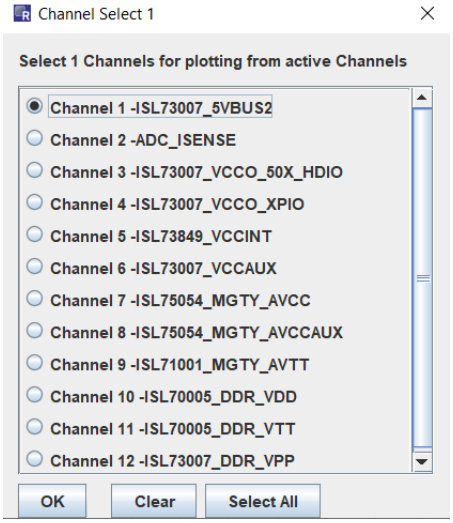

Figure 14. iRADNavigator Voltage Selection to Plot

The **ISL73849 Monitor** window is available to read and plot all eleven voltages related to the ISL73849 PWM controller on the ISLVERSALDEMO3Z board. From this screen, check the box next to any voltage and click the **Read** button to obtain a single measurement. Each time the **Read** button is pressed, it updates the selected values. The values should look similar to those shown in Figure 15.

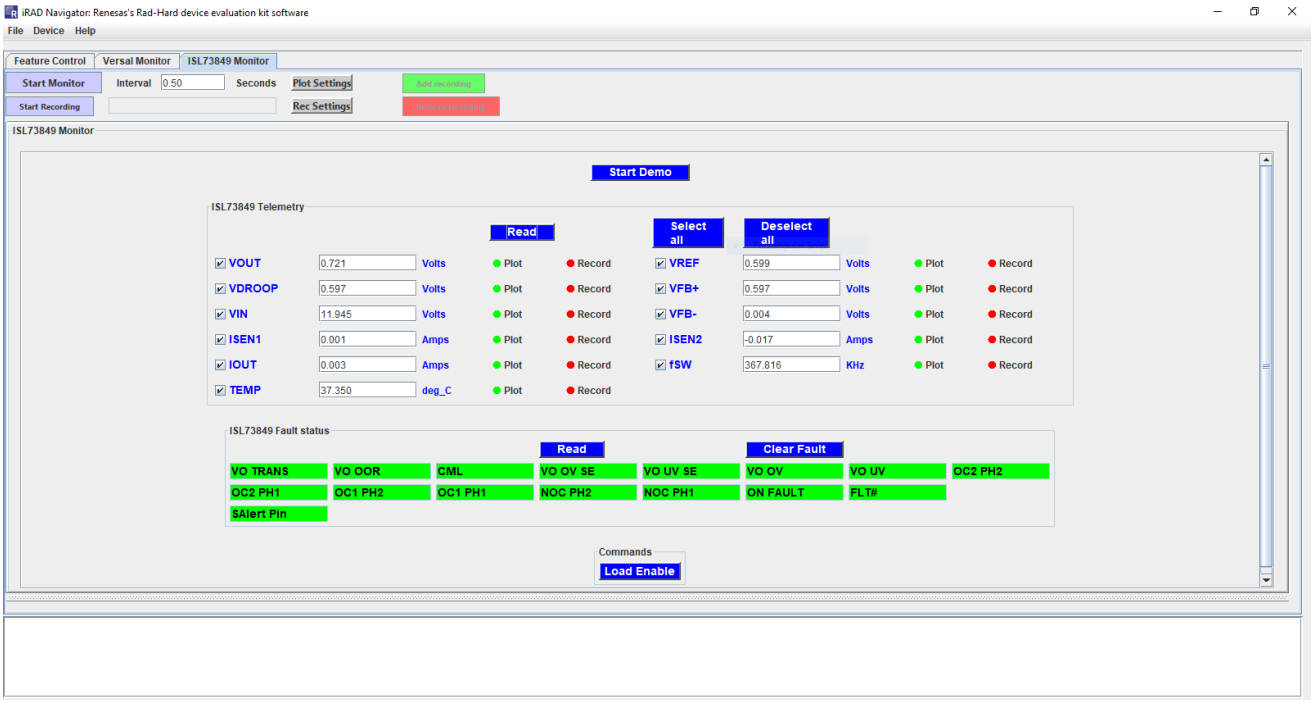

Figure 15. iRADNavigator Voltage Values

When the required voltages are selected, the measurements can be continuously monitored and plotted by pressing the **Start Demo** button. The GUI can support plotting all eleven channels at the same time, as seen in Figure 16.

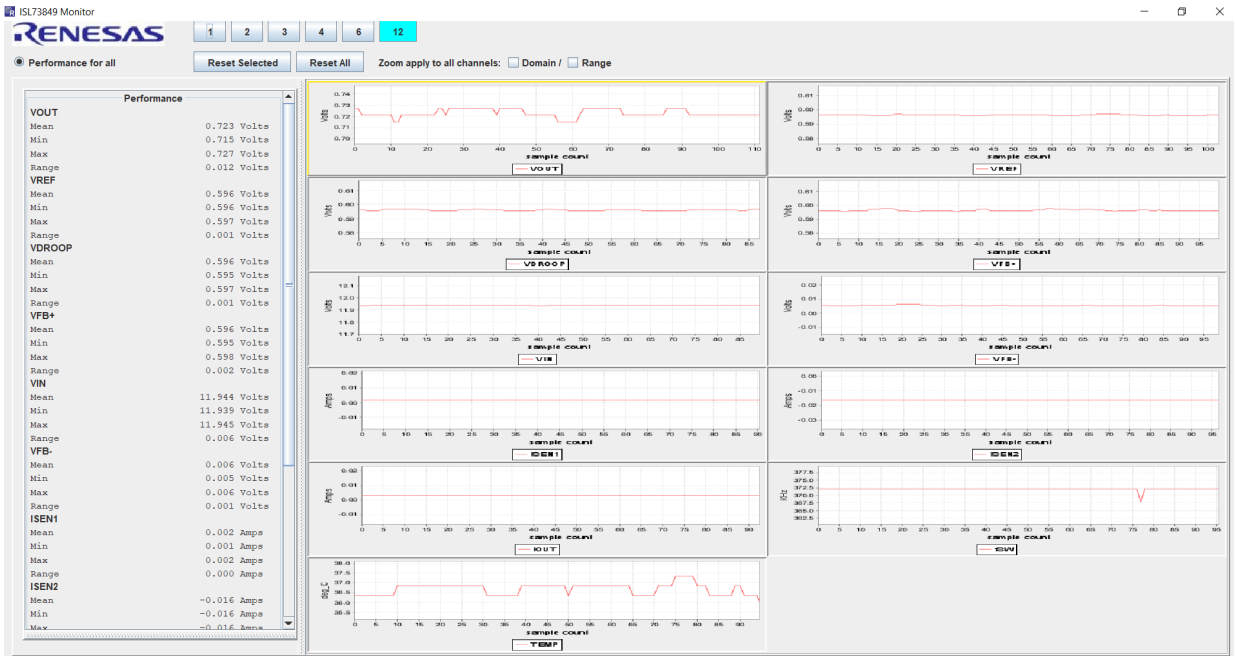

Figure 16. iRADNavigator Eleven Voltages Selected to be Monitored

The button **Start Demo** makes the voltages available easy to read and plot. All eleven voltages are selected by default and are continuously monitored and plotted.

1.2.3 iRADNavigator Feature Control

The **Feature Control** window shows a block diagram with all the available voltages, as seen in Figure 17. The voltages that are being monitored will be continuously updated on this diagram as they are read and processed by the GUI.

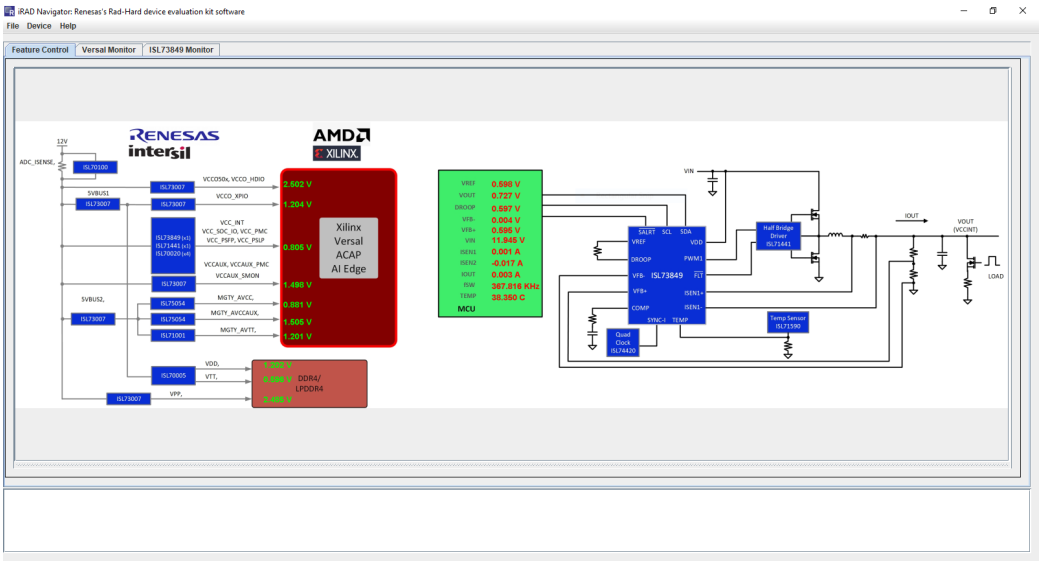

Figure 17. iRADNavigator Voltages Ready for Display in Block Diagram

2. Board Design

2.1 ISL71148VMREFEV1Z Evaluation Board

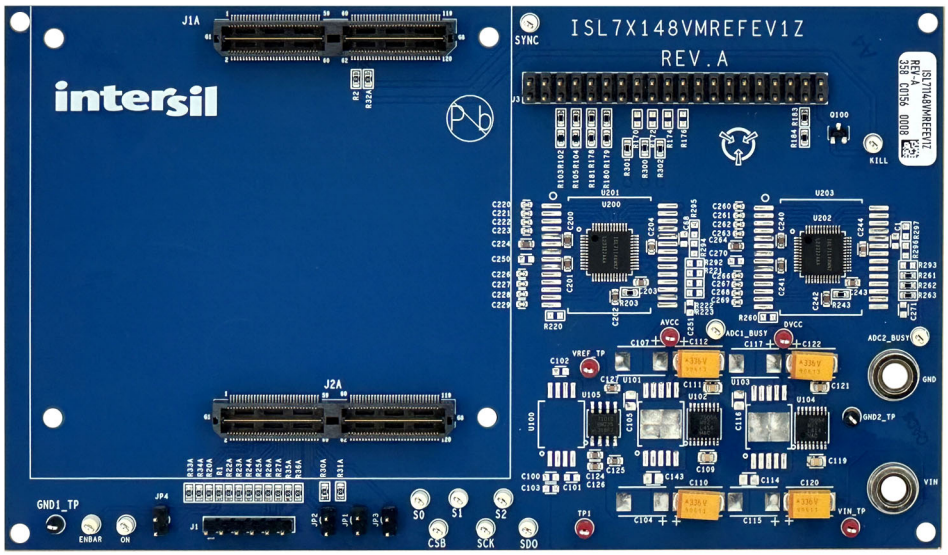

Figure 18. ISL71148VMREFEV1Z Evaluation Board (Top)

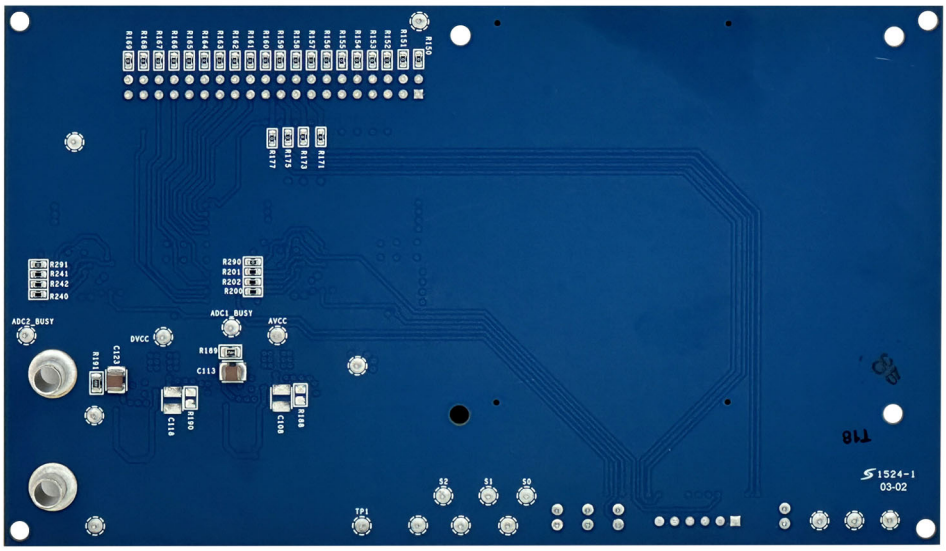

Figure 19. ISL71148VMREFEV1Z Evaluation Board (Bottom)

2.2 Board Schematics

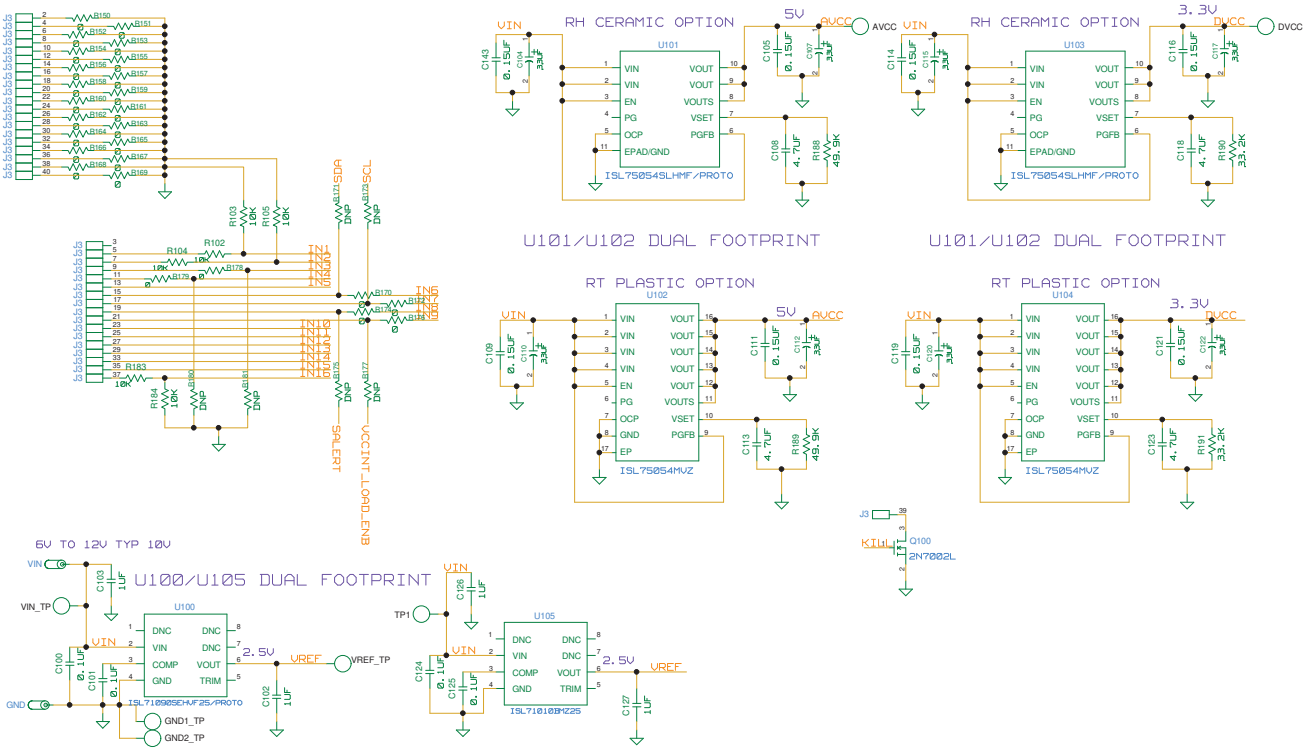

Figure 20. Voltage References and LDOs

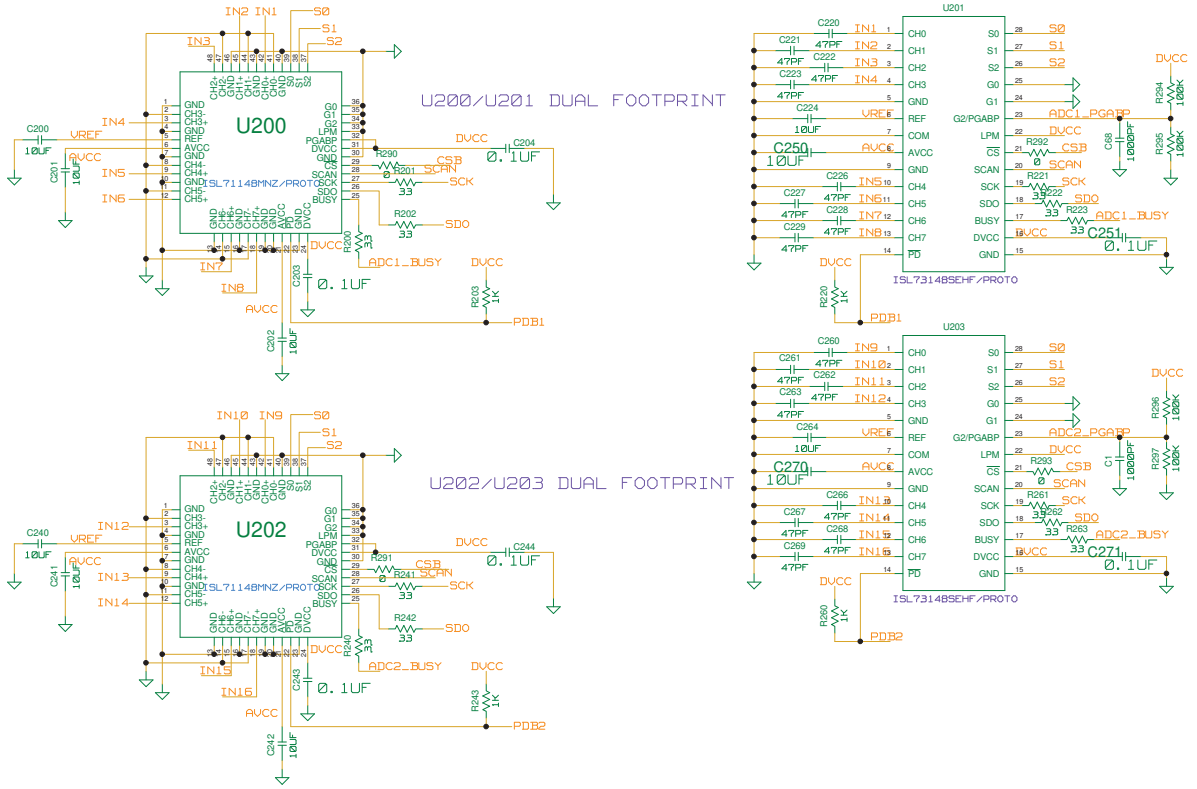

Figure 21. ADCs

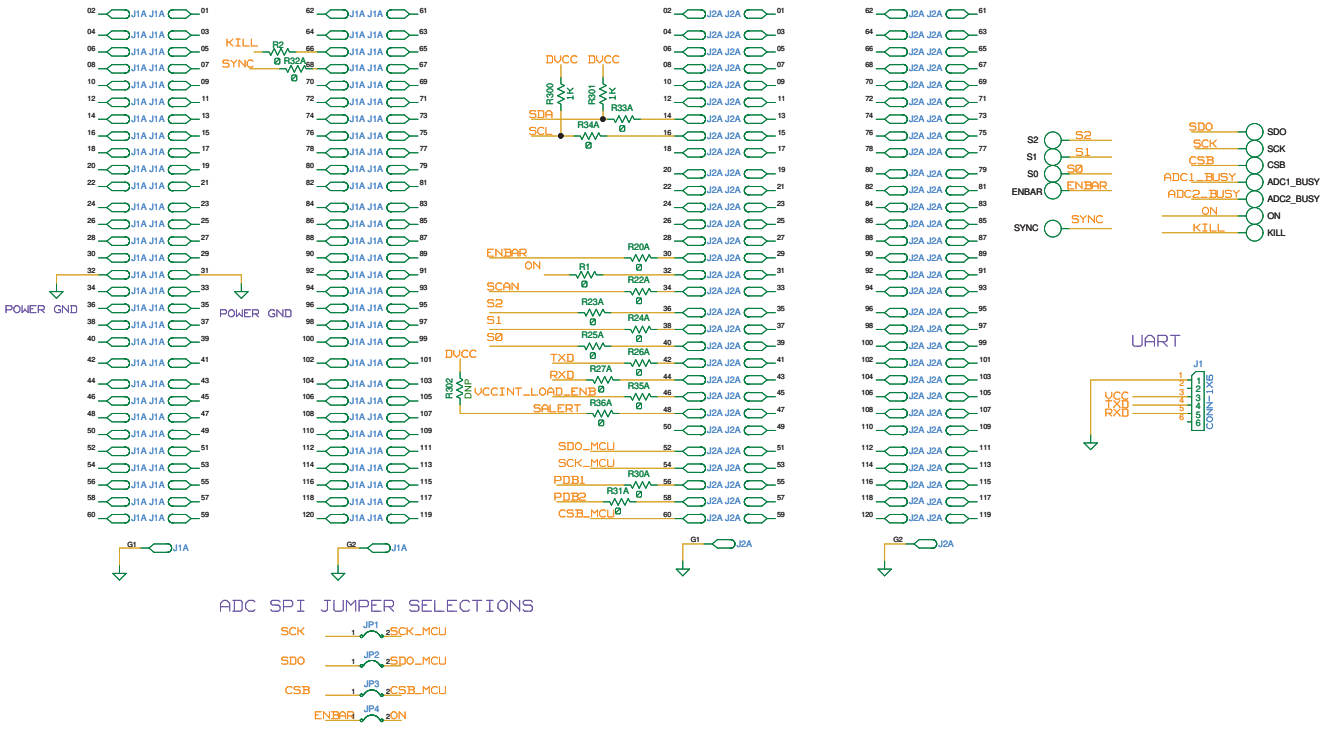

Figure 22. Board Connector Circuitry

2.3 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1	-	PWB-PCB, ISL7X148VMREFEV1Z, REVB, ROHS	Imagineering Inc	ISL7X148VMREFEV1ZREVBPCB
1	Q100	N-Channel 60V 115mA MOSFET	ON Semi	2N7002L
5	AVCC, DVCC, TP1, VIN_TP, VREF_TP	Miniature Red Test Point 0.100 Pad 0.040 Thole	Keystone	5000
2	GND1_TP, GND2_TP	Miniature Black Test Point 0.100 Pad 0.040 Thole	Keystone	5001
12	ADC1_BUSY, ADC2_BUSY, CSB, ENBAR, KILL, ON, S0, S1, S2, SCK, SDO, SYNC	Miniature White Test Point 0.100 Pad 0.040 Thole	Keystone	5002
2	GND, VIN	L = 0.350in Solder Mount Banana Plug	Keystone	575-8
1	J3	Dual Row Vertical PCB Male Connector	Molex	70280-0769
6	C124, C125, C203, C204, C243, C244	Multilayer Cap	TDK	C1608X7R1H104K080AA
1	J1	Male Inline 6 pins X 0.1 inch Connector Strip	BERG/FCI	68000-106HLF
6	C200, C201, C202, C240, C241, C242	Ceramic Chip Cap	Murata	GRM188R61C106MA73D
2	C126, C127	Ceramic Chip Cap	Murata	GCJ188R71E105KA01D
2	C224, C264	Multilayer Cap	Murata	GRM188Z71A106MA73D
16	C220, C221, C222, C223, C226, C227, C228, C229, C260, C261, C262, C263, C266, C267, C268, C269	Multilayer Cap	AVX	C0402C470K5RACAUTO
4	C109, C111, C119, C121	Multilayer Cap	AVX	KGM21ER71H154KU
2	C113, C123	Ceramic Chip Cap	AVX	KGM32LR71H475KU
9	R200, R201, R202, R240, R241, R242, R261, R262, R263	Thick Film Chip Resistor	Panasonic	ERJ-3EKF33R0V

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
43	R1, R2, R20A, R22A, R23A, R24A, R25A, R26A, R27A, R30A, R31A, R32A, R33A, R34A, R35A, R36A, R150, R151, R152, R153, R154, R155, R156, R157, R158, R159, R160, R161, R162, R163, R164, R165, R166, R167, R168, R169, R171, R173, R175, R177, R179, R290, R291	Thick Film Chip Resistor	Panasonic	ERJ-3GEY0R00V
5	R203, R243, R300, R301, R302	Thick Film Chip Resistor	Panasonic	ERJ-3EKF1001V
6	R104, R105, R178, R181, R183, R184	Thick Film Chip Resistor	Vishay Dale	CRCW060310K0FKEA
1	R191	Thick Film Chip Resistor	Panasonic	ERJ-6ENF3322V
1	R189	Thick Film Chip Resistor	Panasonic	ERJ-6ENF4992V
1	U105	2.5V Rad-Hard Ultra Low Noise Precision Voltage Reference	Renesas Electronics America	ISL71010BMZ25
2	U200, U202	Radiation Tolerant 8-Channel 14-Bit 900/480ksps ADC	Renesas Electronics America	ISL71148MNZ
2	U102, U104	RT Ultra Low Noise LDO	Renesas Electronics America	ISL75054M
4	C110, C112, C120, C122	ESR 65m ohms 2006ma Commercial Multi-anode High Power Tantalum Capacitor	AVX	TPME336K035R0065
1	R102	Thick Film Chip Resistor	Vishay Dale	ERJ-3EKF1502V
1	R103	Thick Film Chip Resistor	Vishay Dale	ERJ-PA3F4991V
4	JP1, JP2, JP3, JP4	CONN-HEADER, 1×2, RETENTIVE, 2.54mm, 0.230×0.120, ROHS	BERG/FCI	69190-202HLF
2	J1A, J2A	120 pin QTH Series Connector	Samtec	QTH-060-01-F-D-A
1	-	40-Pin Ribbon Cable, Socket to Socket, 0.100” Pitch	Samtec	IDSD-20-D-24.00
4	JP1, JP2, JP3, JP4	CONN-Jumper, Shunt, 2P, 2.54mm Pitch, BLK, 6mm, OPEN, ROHS	Sullins	SPC02SYAN

2.4 Evaluation Board Layout

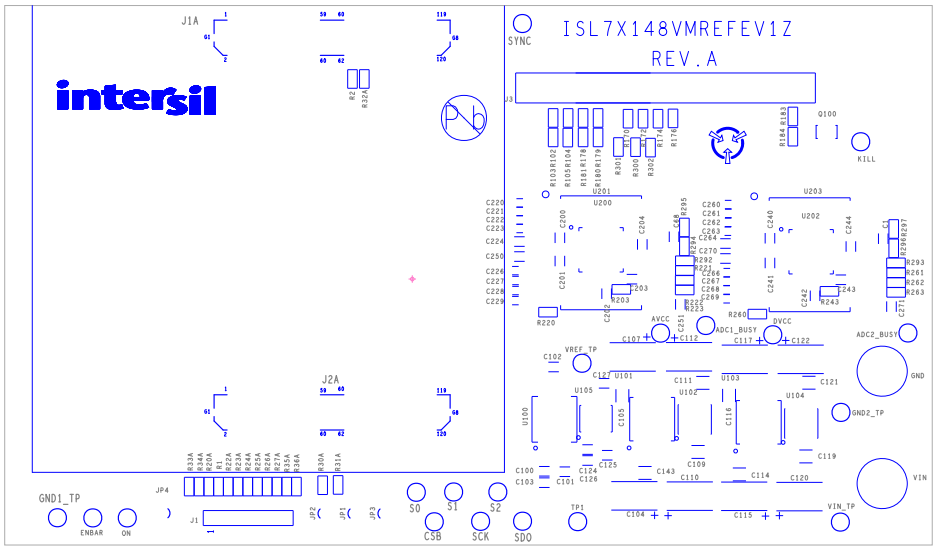

Figure 23. Top Silkscreen

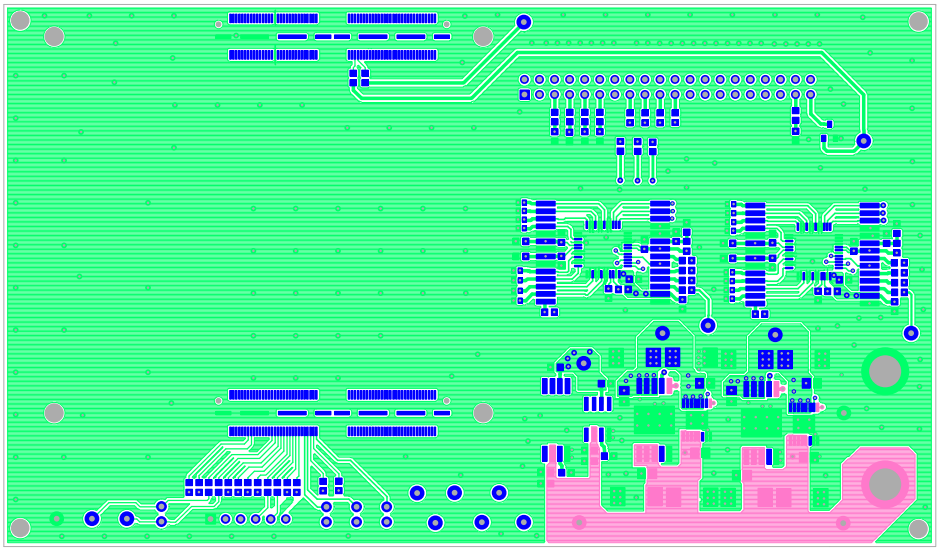

Figure 24. Top Layer

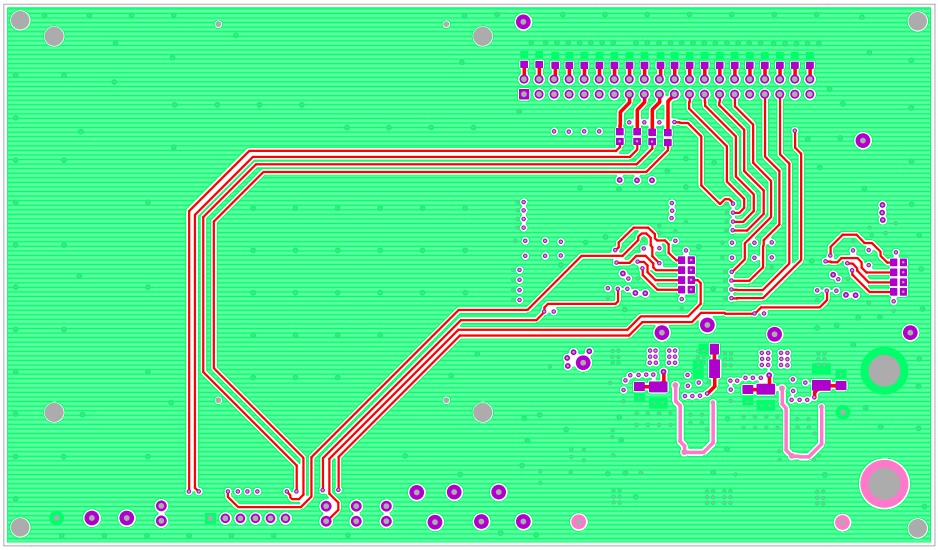

Figure 25. Bottom Layer

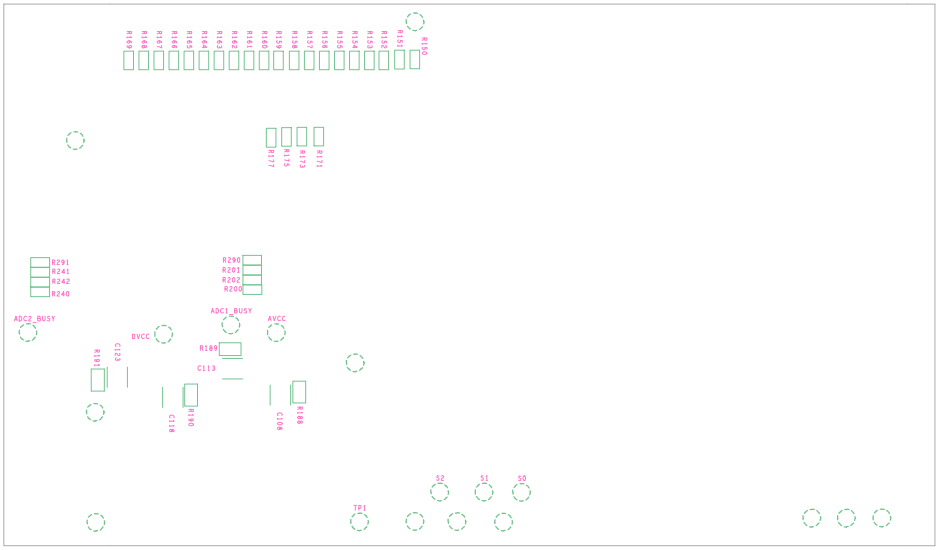

Figure 26. Silkscreen Bottom

3. Ordering Information

Part Number	Description
ISL71148VMREFEVKIT1Z	ISL71148M ADC Voltage Monitor Reference Design Kit
ISL71148VMREFEV1Z	ISL71148M ADC Voltage Monitor Reference Board

4. Revision History

Revision	Date	Description
1.00	July 23, 2025	Initial release

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