UG286: ClockBuilder® Pro Field Programmer Kit

This user guide describes how to use the ClockBuilder® Field Programmer Kit (CBPROG-DONGLE) with ClockBuilder Pro (CBPro) to support device programming and in-system debug. The ClockBuilder Pro field programmer supports the following use cases and modes of operation:

Use cases:

- Non-volatile firmware/configuration programming
- Volatile firmware/configuration programming
- Real-time status monitoring and device debug

Modes of operation:

1. Wired to target system

   Wiring the field programmer serial interface directly to the system board for “in-system” programming. Users are encouraged to include a standard 10-pin header on their PCB to allow the field programmer to connect directly to the target device SPI/I^2C bus via ribbon cable.

2. Socket-based

   Skyworks offers a range of QFN and LGA socket adapter boards (sold separately) that plug directly into the field programmer. By placing one of the supported Skyworks timing devices into a connected socket board, the field programmer can program the non-volatile memory of this device. The programmed device can then be later assembled/soldered onto the target board.

Table 1. Parts Supported by the CBPro Field Programmer

Part Number	Supports Socketed Programming?	Supports In-System Programming?	Supports Volatile Programming?	Supports NVM Programming?	Supports Flash Programming?
Si5332	Yes	Yes	Yes	Yes	No
Si5338	No	Yes	Yes	No	No
Si535x	No	Some grades	Some grades	No	No
Si534x	Yes	Yes	Yes	Yes	No
Si538x	Yes	Yes	Yes	Yes	No
Si539x	Yes	Yes	Yes	Yes	No
Si5360/1/2/3	Yes	Yes	Yes	Yes	No
Si5401/2/3	Yes	Yes	Yes	Yes	No
Si5508/10	Yes	Yes	Yes	Yes	No
Si5512/18	Yes	Yes	Yes	Yes	No
SKY62101	Yes	Yes	Yes	Some grades[1]	Some grades[1]
SKY63001	Yes	Yes	Yes	Some grades[1]	Some grades[1]
SKY63101/2/3	Yes	Yes	Yes	Some grades[1]	Some grades[1]
SKY63104/5/6	Yes	Yes	Yes	Some grades[1]	Some grades[1]
SKY69001/2	Yes	Yes	Yes	Some grades[1]	Some grades[1]
SKY69003	Yes	Yes	Yes	Some grades[1]	Some grades[1]
SKY69101	Yes	Yes	Yes	Some grades[1]	Some grades[1]
SKY69102	Yes	Yes	Yes	Some grades[1]	Some grades[1]

1. NVM and flash support are mutually exclusive; a part can support one or the other, but not both.

Figure 1 shows how the field programmer kit is intended to bridge between a computer running ClockBuilder Pro software (CBPro) using either the socket adapter boards or customer PCB for in-system firmware and volatile programming.

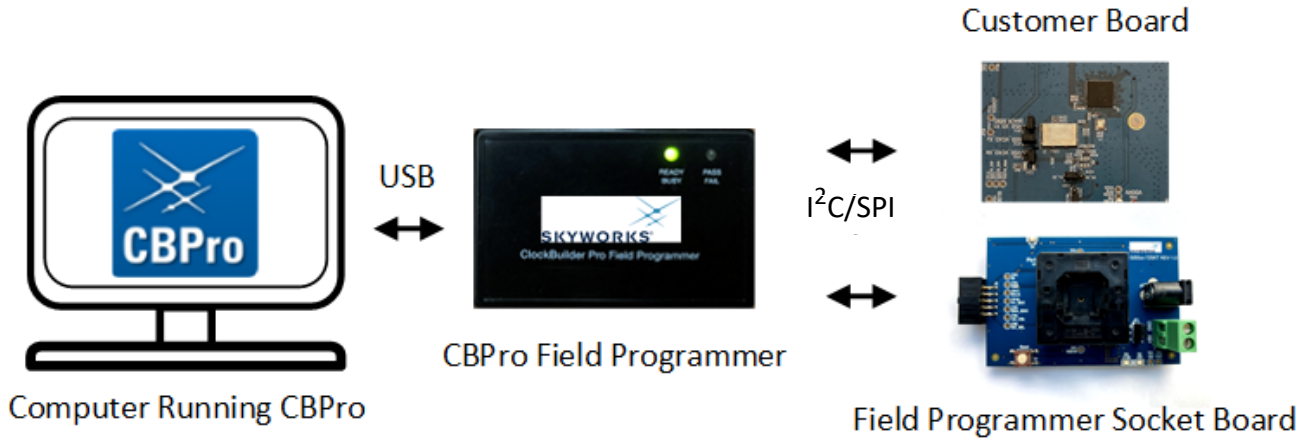

Figure 1. Example Hardware Configuration (Using QFN Socket Board or Customer PCB)

1. Kit Contents

Figure 2 shows the kit contents for the field programmer kit.

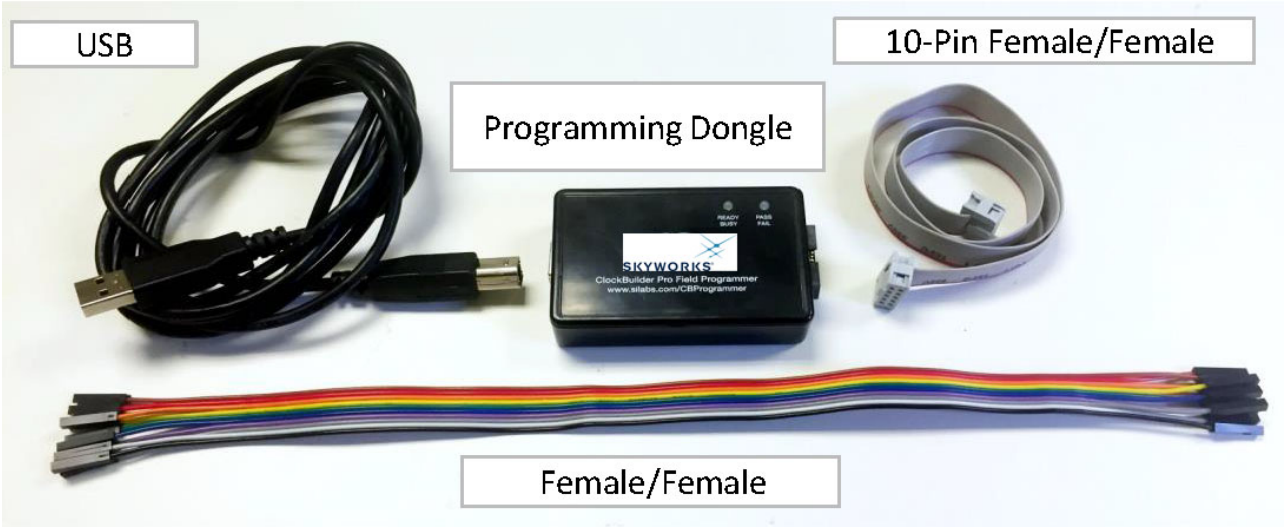

Figure 2. Field Programmer Kit Contents

Table 2 lists available field programmer socket boards which can be ordered separately.

Table 2. Field Programmer Supported Devices

Supported Devices	Socket Part Number	Notes
Si5332	Si5332-32SKT-DK, Si5332-40SKT-DK, Si5332-48SKT-DK	The number of pins in the socket must match the device being programmed. The Si5332E/F/G/H embedded crystal products in 40-pin LGA and 48-pin LGA packages are currently not supported.
Si5338/56	N/A	Socket boards are available as a standalone programmer, P/N Si5338/56-PROG-EVB
Si5350/1	N/A	No sockets are available for this part.
Si534x/8x/9x	Si538x4x-44SKT-DK, Si538x4x-56SKT-DK, Si538x4x-64SKT-DK, Si538x4x-44LGA-DK, and Si538x4x-64LGA-DK	For QFN packages: Si5392/94 44-pin QFN devices require the Si538x4x-44SKT-DK. Si5395 64-pin QFN devices require the Si538x4x-64SKT-DK. For LGA packages: Si5392/94 44-pin LGA devices require the Si538x4x-44LGA-DK. Si5395 64-pin LGA devices require the Si538x4x-64LGA-DK.
Si5360/1/2/3, Si5401/2/3, Si5508/10/12/18	Si55xx-72SKT-DK	The Si55xx-72SKT-DK requires an external 5 V power supply. A wall adapter or external lab supply can be selected using jumper JP1. The development kit comes with a 5 V, 15 W wall adapter though the expected max power draw is less than 1 A (5 W).
SKY63101/02/03, SKY69101/001/002	SATURN-64LGA-SKTDK	The SATURN-64LGA-SKTDK requires an external 5 V power supply. A wall adapter or external lab supply can be selected using jumper JP1. The development kit comes with a 5 V, 15 W wall adapter though the expected max power draw is less than 1 A (5 W).
SKY62101, SKY63001, SKY63104/05/06, SKY69102/003	PLUTO-56QFN-SKT-DK	The PLUTO-56QFN-SKT-DK requires an external 5 V power supply. A wall adapter or external lab supply can be selected using jumper JP1. The development kit comes with a 5 V, 15 W wall adapter though the expected max power draw is less than 1 A (5 W).

The sockets listed in Table 2 are pictured in Figure 3 through Figure 13 and can be ordered separately. More details about the ClockBuilder Pro field programmer, including schematics, layout files, and BOM, can be found on the Skyworks ClockBuilder Pro Field Programmer page.

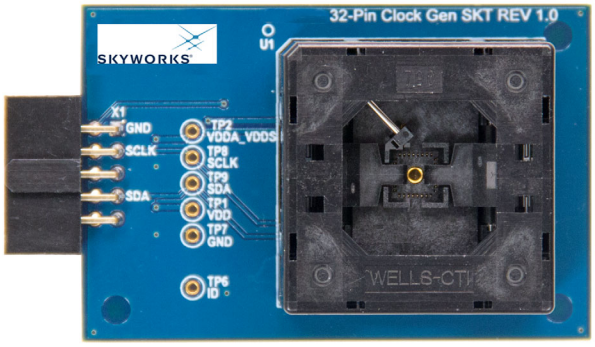

Figure 3. Si533x-32SKT-DK

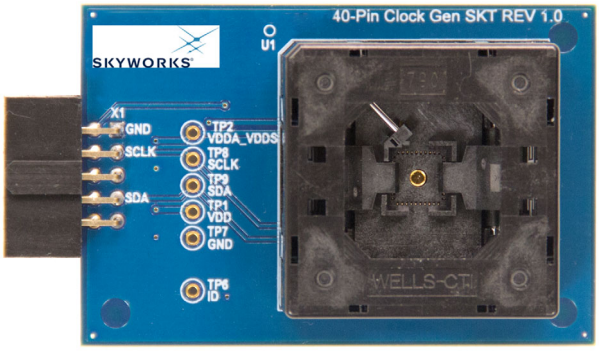

Figure 4. Si5332-40SKT-DK

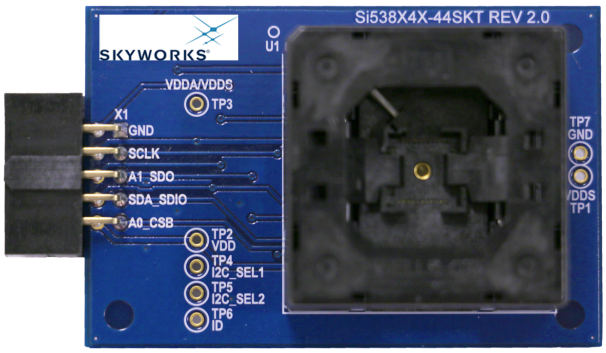

Figure 5. Si538x4x-44SKT-DK

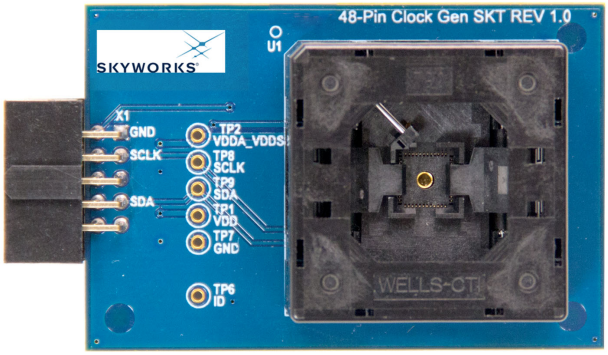

Figure 6. Si5332-48SKT-DK

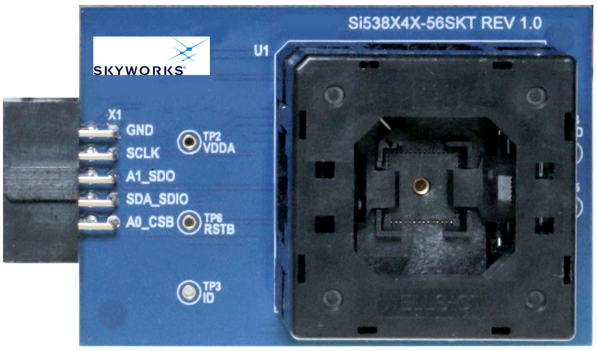

Figure 7. Si538x4x-56SKT-DK

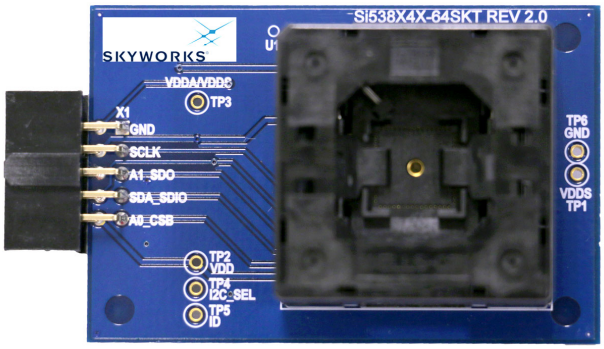

Figure 8. Si538x4x-64SKT-DK

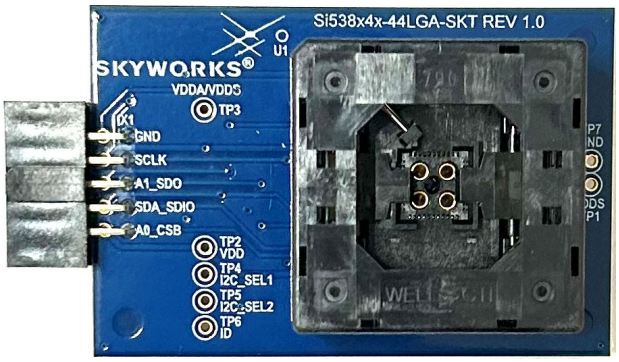

Figure 9. Si538x4x-44LGA-SKT

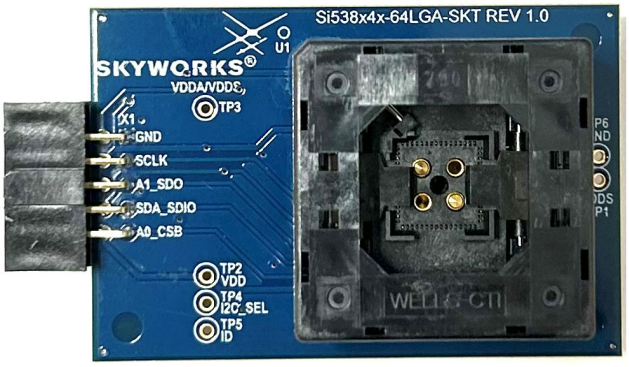

Figure 10. Si538x4x-64LGA-SKT

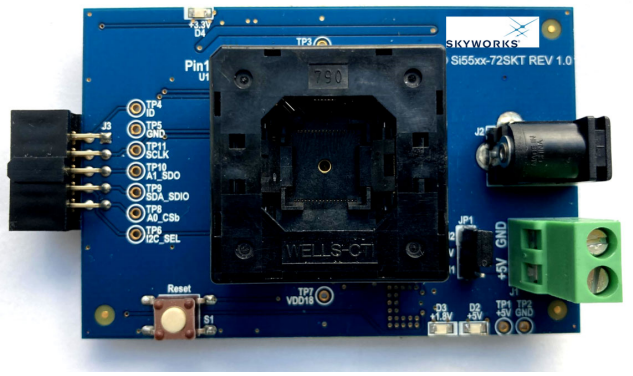

Figure 11. Si55xx-72SKT-DK

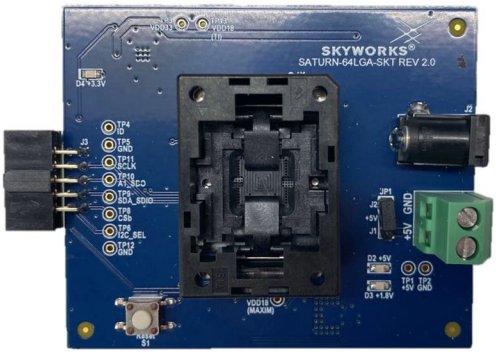

Figure 12. SATURN-64LGA-SKT

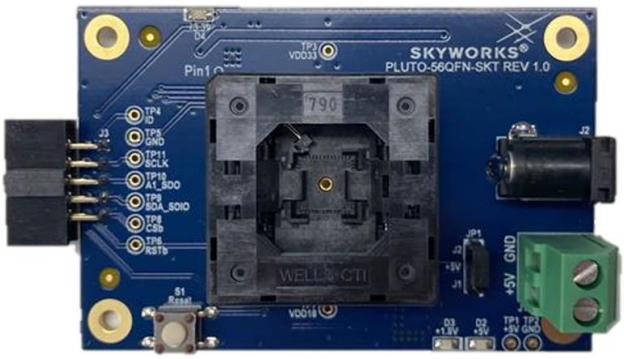

Figure 13. PLUTO-56QFN-SKT

2. Connecting the Field Programmer to a Device Under Test (DUT)

In order to use the field programmer with your device under test (DUT), a physical link between the programmer and the DUT must be established. This can be done in two ways: with a field programmer socket board, or by connecting to the DUT serial lines for in-system programming. Socket boards are well-suited for devices that store their configuration on-chip in a non-volatile manner. Volatile writes are possible through a socket board, though this is not particularly useful since most of the DUT pins are inaccessible on the socket board. In-system connections are useful for troubleshooting DUTs in their final application, as well as reconfiguring them onsite.

2.1. Supported Protocols by Device

Not every device supports every combination of I^2C, 3-wire SPI, and 4-wire SPI at 1.8 V, 2.5 V, and 3.3 V. Even for devices supporting multiple communication protocols, it is important to understand which protocol is in use by default.

For custom OPNs, confirm this using the Skyworks OPN lookup website. A link to this site can be found within the NVM program tool in CBPro, as shown in Figure 14. From this site, search for your OPN and download the data sheet addendum. Search the data sheet addendum for “Host Interface” to confirm the serial protocol(s) the device is set up to support.

In addition to the protocol itself, the data sheet specifies the I/O power supply, which dictates the voltage level at which the serial bus operates. The tables below list the usable serial protocols for different Skyworks devices.

- “VDD (Core)” indicates that the I/O supply for the Si534x/8x/9x I^2C/SPI interface operates from a 1.8 V supply.
- “VDDA (3.3 V)” indicates that the I/O supply for the Si534x/8x/9x I^2C/SPI interface operates from a 3.3 V supply.
- “VDDD” indicates the I/O supply for the Si5332 I^2C interface.
- "VDDIO" indicates the I/O supply for the Si536x, Si540x, Si55xx, SKY62xxx, SKY63xxx, and SKY69xxx devices.

Table 3. Supported Serial Protocols for the Si535x Devices

	1.8 V	2.5 V	3.3 V
4-wire SPI	Not supported		
3-wire SPI	Not supported		
I^2C	Supported	Not supported	Supported

Table 4. Supported Serial Protocols for the Si534x/8x/9x Devices

	1.8 V	2.5 V	3.3 V
4-wire SPI	Supported		
3-wire SPI			
I^2C			

Table 5. Supported Serial Protocols for the Si536x, Si540x, Si55xx, SKY62xxx, SKY63xxx, and SKY69xxx Devices

	1.8 V	2.5 V	3.3V
4-wire SPI	Supported		
3-wire SPI	Not Supported	Not Supported	Supported
I^2C	Supported		

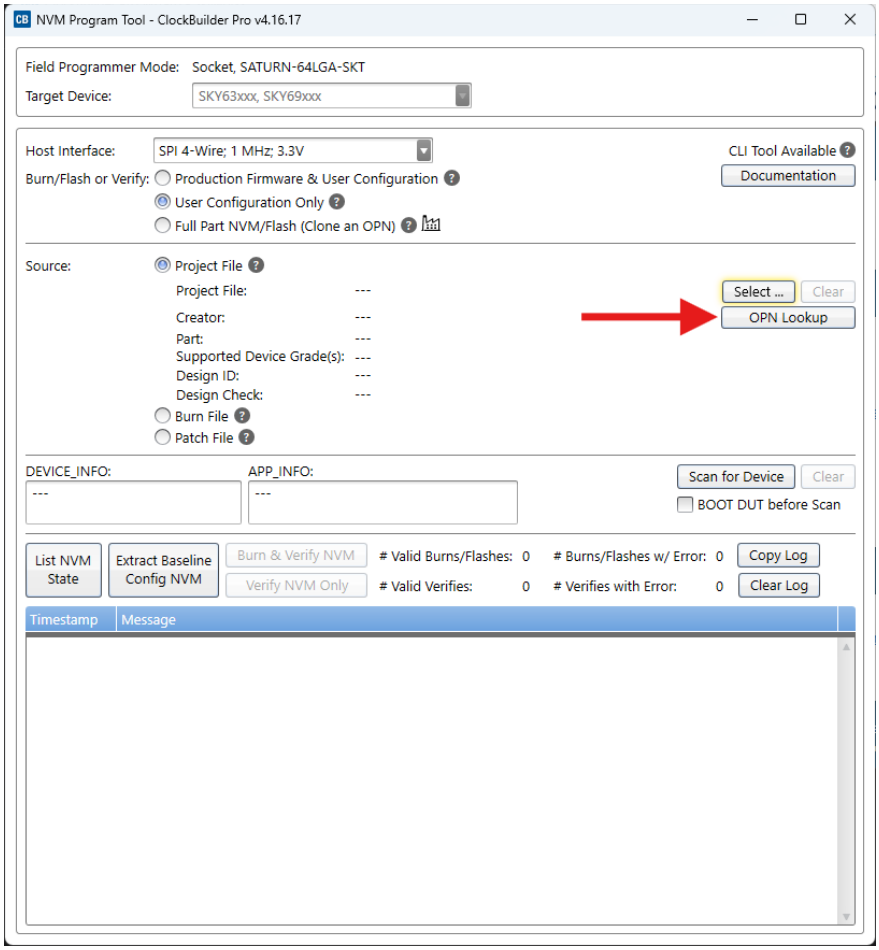

Figure 14. OPN Lookup Button in NVM Program Tool

2.2. Connecting with a Socket Kit

To use a field programmer socket board, use the USB-A to USB-B cable included in the kit to connect the field programmer to a PC with CBPro installed. Install the socket board to the rectangular 10-pin connector on the field programmer, taking note of the keyed edge on the connector to ensure proper orientation.

Socket boards are recognized by the field programmer when installed, whether or not a DUT is present in the socket. This can be verified by checking the field programmer EVB GUI in CBPro, as shown in Figure 15.
See "3.1. Communicating via EVB GUI" on page 12 for more information.

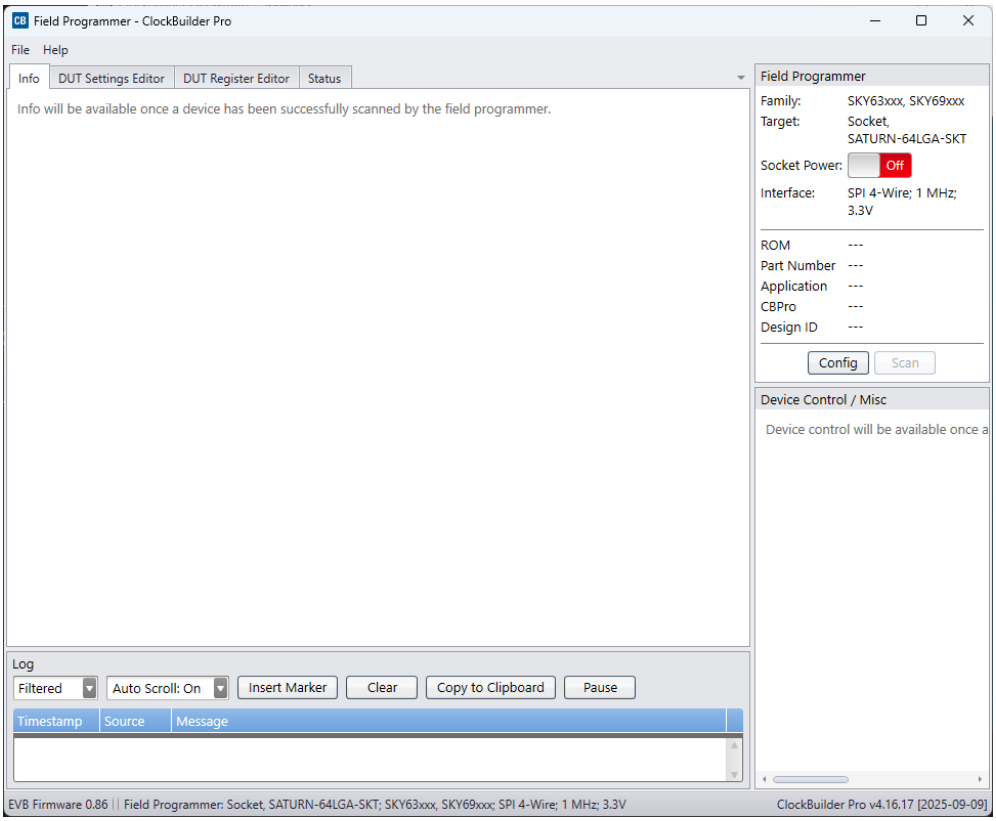

Figure 15. SATURN-64LGA-SKT Recognized in EVB GUI

By default, the socket board does not apply power to the DUT VDD pins. Power is only applied to the DUT when the user directs the field programmer to do so, such as by initiating a scan or writing to the device. It is therefore safe to install a DUT to the socket itself as long as the socket board is not powering the VDD pins.

It is important that the device is correctly oriented before powering up the board. However, if there is no device in the socket or if the device is not correctly oriented, the software auto-detects the fault and does not connect to the part. The part will not be damaged if oriented incorrectly. The device has two circles on the part. The smaller circle is the pin 1 indicator. Pin 1 on the socket is lined up with the U1 and dot symbol on the socket board silk screen. 64-QFN and 44-QFN orientations are shown in Figure 16. The same idea applies to all DSPLL socket boards—align the dot on the IC to the dot on the PCB.

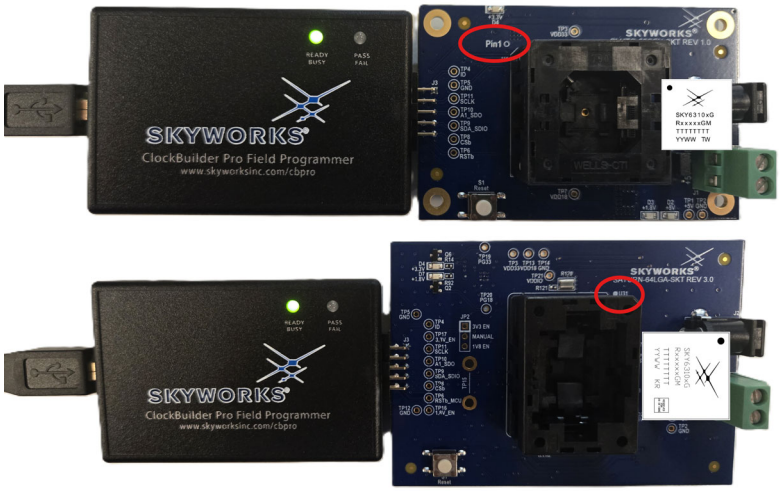

Figure 16. Pin 1 Dot Indicating Device Orientation

2.3. Connecting to a DUT In-System

To communicate with a DUT mounted onto an end-equipment PCB, you must properly connect the pins of the field programmer to the host board. If the board was designed with a 10-pin header compatible with the field programmer using the pin arrangement shown in Figure 17, this could be as simple as connecting a ribbon cable. Refer to Table 6 or the following sections for a description of the field programmer pins and how to wire them to the PCB.

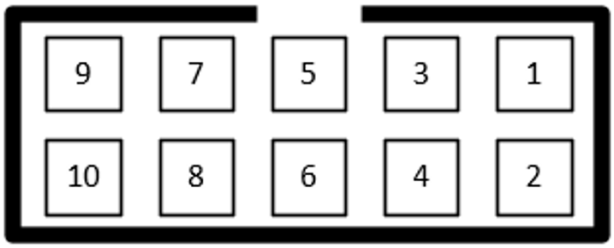

Figure 17. Header Pin Numbering

Table 6. Interface Pin Connections from the Field Programmer

Pin #	Description	Wire to Your PCB?	I^2C	4-wire SPI	3-wire SPI
1	GND	Always	GND		
2	ID	Never	Select programming field programmer socket boards provide a voltage on this pin to identify the board. For in-system programming, this pin should be grounded or not connected to any signal.		
3	SCLK	Always	Serial clock signal for I^2C transactions.	Serial clock signal for SPI transactions.	
4	VDDA_VDDS	Never	Supplies the VDDA and VDDS voltages to the device when using a programming field programmer socket board. Do not use this pin for in-system programming.		
5	A1_SDO	4-wire SPI only	For Si534x/8x/9x devices, this pin can be used to set I^2C address bit A1 high or low. Routed to A1 device pin on the programming field programmer socket boards.	Serial data from device for 4-wire SPI transactions (MISO).	Not used
6	I2C_SEL2	Never	Used to set I2C_SEL signal high to set the device for I^2C communication (refer to specific part pinout and the programming field programmer socket board to determine whether to use I2C_SEL1 or I2C_SEL2)	Used to put I2C_SEL signal low for SPI communication (refer to the specific part pinout and the programming field programmer socket board to determine whether to use I2C_SEL1 or I2C_SEL2)	
7	SDA_SDIO	Always	Serial data signal for I^2C transactions.	Serial data out to device for 4-wire SPI transactions (MOSI).	Bidirectional Serial data for 3-wire SPI transactions (SDIO).
8	I2C_SEL1	Never	Used to set I2C_SEL signal high to set the device for I^2C communication (refer to the specific part pinout and the programming field programmer socket board to determine whether to use I2C_SEL1 or I2C_SEL2)	Used to put I2C_SEL signal low for SPI communication (refer to the specific part pinout and the programming field programmer socket board to determine whether to use I2C_SEL1 or I2C_SEL2)	
9	A0_CSB	3- or 4-wire SPI	Can be used to set the I^2C address bit A0 high or low. Routed to A0 device pin on the programming field programmer socket boards.	Drives the chip select signal during SPI transactions	
10	VDD	Never	Supplies the core VDD voltage to the device when using a programming field programmer Socket Board. Do not use this pin for in-system programming.		

2.3.1. I^2C Hardware Configuration

For I^2C communication to an external device board, the following pins should be used from the field programmer:

- Pin 1: Ground GND
- Pin 3: Serial Clock SCLK
- Pin 7: Serial Data SDA

If communicating with an Si534x/8x/9x device, you should also connect the following pins on the DUT:

- A0/CS: Drive this pin high or low to set the I^2C address
- A1/SDO: Drive this pin high or low to set the I^2C address
- I2C_SEL: Drive this pin high to select I^2C communication

If communicating with an Si536x/540x/55xx, or SKY62xxx/63xxx/69xxx device, the DUT must be explicitly configured for I^2C communication from the Host Interface page of ClockBuilder Pro. You should also connect the A0/CSb pin, which can be driven high or low to set the I^2C address.

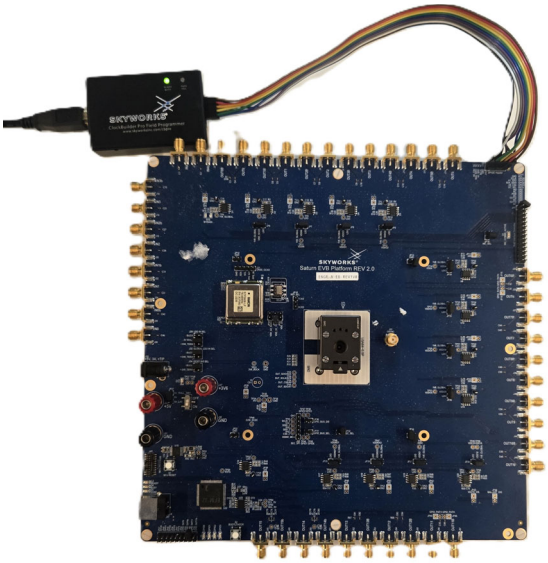

Figure 18. Example I^2C Connection to External Target Board using Jumper Wires (Si5346-EVB)

2.3.2. 3-Wire SPI Hardware Configuration

For 3-wire SPI communication, the following field programmer pins should be used when connecting to an external device board:

- Pin 1: Ground GND
- Pin 3: Serial Clock SCLK
- Pin 7: Serial Data In/Out SDIO
- Pin 9: AO_CSb for Chip Select

If communicating with an Si534x/8x/9x device, you should also drive I2C_SEL low to select SPI communication.

If communicating with an Si536x/540x/55xx, or SKY62xxx/63xxx/69xxx device, the device must be explicitly configured for 3-wire SPI from the Host Interface page of ClockBuilder Pro. The field programmer only supports 3.3 V communications with these devices.

2.3.3. 4-Wire SPI Hardware Configuration

For 3-wire SPI communication, the following field programmer pins should be used when connecting to an external device board:

- Pin 1: Ground GND
- Pin 3: Serial Clock SCLK
- Pin 5: A1_SDO Serial Data Out (MISO)
- Pin 7: Serial Data SDIO (MOSI)
- Pin 9: AO_CSb for Chip Select

If communicating with an Si534x/8x/9x device, drive I2C_SEL low to select SPI communication.

If communicating with an Si536x/540x/55xx or SKY62xxx/63xxx/69xxx device, the device must be explicitly configured for 3-wire SPI from the Host Interface page of ClockBuilder Pro. The field programmer supports 1.8 V, 2.5 V, and 3.3 V communications with these devices.

3. Communicating with the DUT

With the connection to the DUT established, there are three ways to communicate with it. The EVB GUI can be used to check basic functionality like the ability of the DUT to communicate over its SPI/I^2C interface, or self-report its status. It can also be used to interact with the device API or write a pre-generated bootfile or flash image to the device. The ClockBuilder Pro Design Dashboard can be used to write to the volatile memory of a DUT or to flash storage (for devices supporting flash). The NVM burn tool is used to write non-volatile configurations or patches to NVM-supported devices.

Because these tools all support a wide range of devices, the exact features may differ from part to part, as well as the appearance of the part within the tool. For detailed information about a specific part, see the device reference manual.

3.1. Communicating via EVB GUI

The CBPro EVB GUI is included in any installation of CBPro, and can be found from the Windows Start menu, or a desktop shortcut if the option is checked during installation. This GUI provides easy access to a DUT API and status registers, as well as an interface for loading a frequency plan onto a device. The EVB GUI can also be launched from the CBPro home screen or Design Dashboard by clicking the **EVB GUI** button next to the field programmer, as shown in Figure 20.

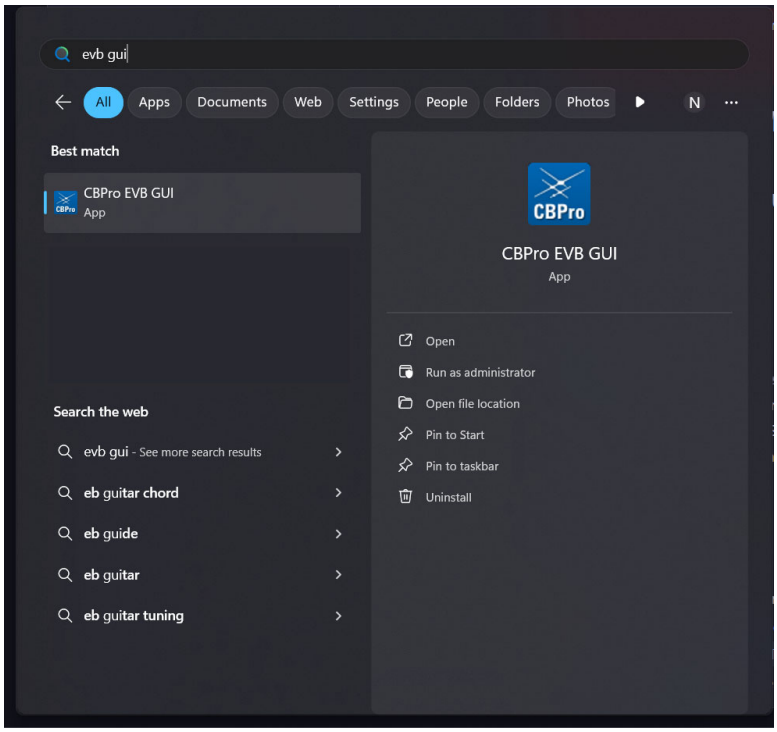

Figure 19. EVB GUI in Windows Start Menu

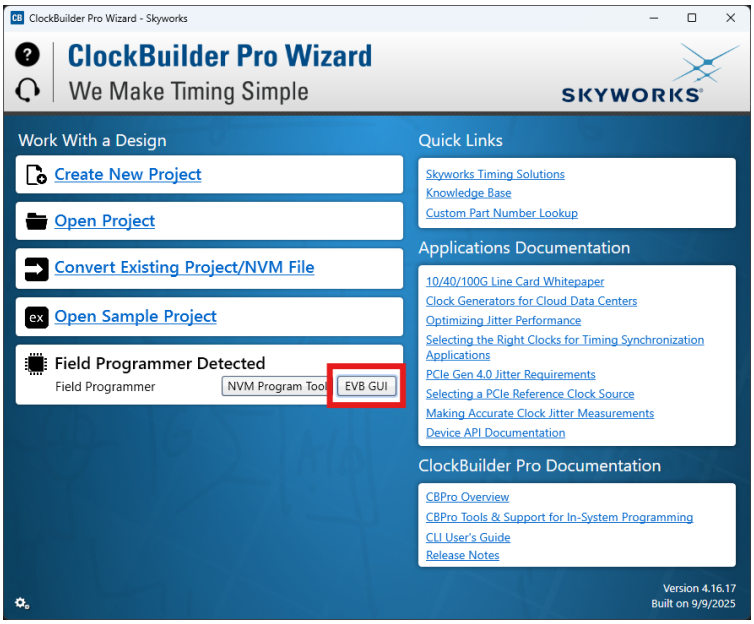

Figure 20. EVB GUI from CBPro Home Page

If using a field programmer socket board, the EVB GUI recognizes the board as shown in Figure 15, and the field programmer automatically configures its settings for communication with the board. You must still select the appropriate communication protocol by clicking the **Config** button and choosing either I^2C, 3-wire SPI, or 4-wire SPI. The socket does not provide power to the DUT until the "Socket Power" switch in the GUI is enabled or a scan is initiated.

When communicating with a device in-system, there is no socket to manage power to the DUT, so the EVB GUI only offers to configure the field programmer or scan for a device. In addition to the serial protocol used, you must specify which device family you are communicating with. The field programmer assumes the host board is applying power to the DUT, so initiating a scan immediately sends data over the SPI/I^2C bus without waiting for any power sequence.

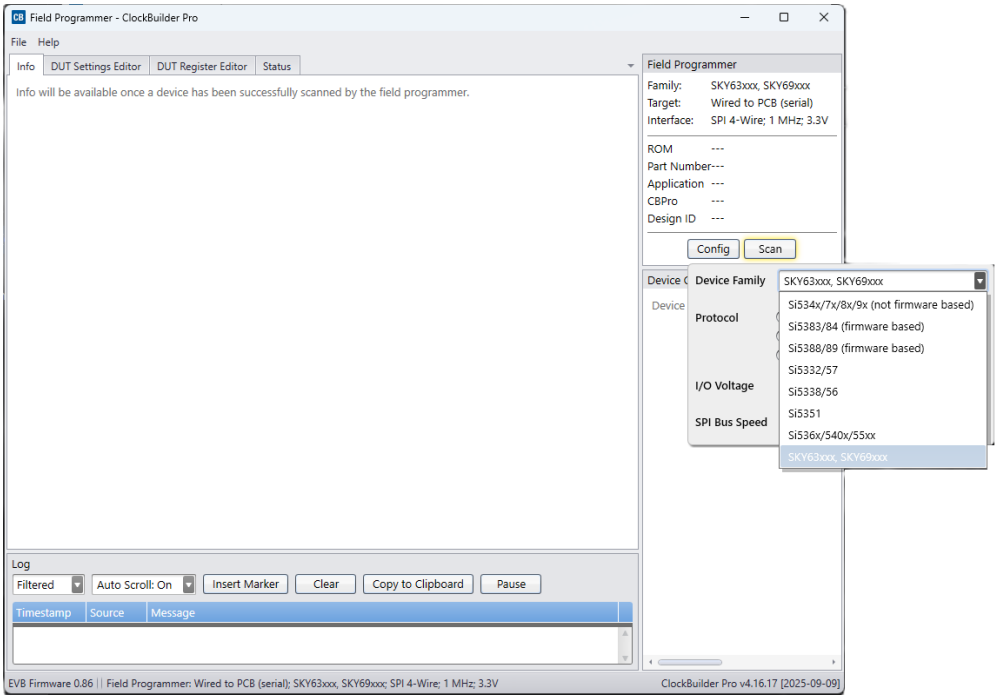

Figure 21. Configuring the Field Programmer for In-System Configuration in EVB GUI

Once a DUT is detected, the exact features available vary by device family. Common features include access to the Device API and Status Registers. You can also write a frequency plan to the device as shown in Figure 22. Note that some generations of devices may have slightly different options here, such as “Write Register File to Device.” In general, these options require creation of a file in CBPro that is used to write to the DUT. For detailed information about device features in the EVB GUI, consult its reference manual.

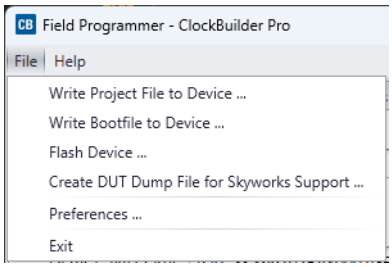

Figure 22. Writing a Plan to Your Device in EVB GUI

3.2. Communicating Using the CBPro Design Dashboard

If the field programmer is connected to a computer while CBPro is opened, it appears as a potential target for writing a project to a device. If a socket board is in use, an additional check is performed to confirm if the socket supports the device in use by the CBPro project. Figure 23 shows an attempt to use a SATURN-64LGA-SKT board with an Si5518 project, however, CBPro has disabled the **Write Design to DUT** button due to incompatibility. For in-system devices, no such check is made in the CBPro design dashboard, but a check is made at the beginning of the write process. If the DUT is incompatible with the project, the write is aborted.

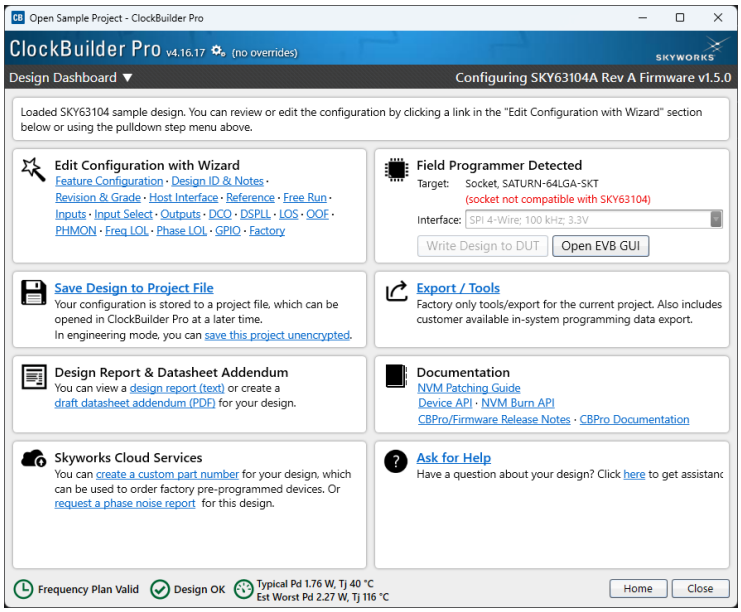

Figure 23. Socket Incompatible with CBPro Project

Devices with support for flash storage have two write options as shown in Figure 24: **Write DUT Volatilely** and **Flash DUT**. The former writes a frequency plan to the device RAM, which persists as long as the device remains powered on but is lost upon power loss or restart. Flashing a DUT ensures that the frequency plan can be reloaded immediately upon device boot. Note that CBPro only checks the device family when showing the flash option. Some products using the SATURN-64LGA-SKT board support flash, so the option is there even if the DUT itself is of a grade with no flash support.

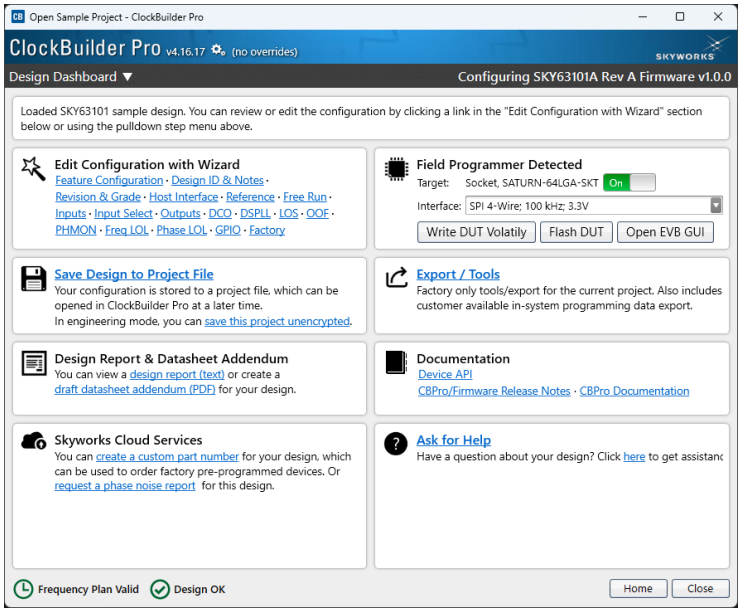

Figure 24. Two Options to Write a 63101 Frequency Plan

3.3. Communicating Using the NVM Program Tool

The NVM program tool is included by the CBPro installer, and can be launched either through the Windows Start menu or from the home page of CBPro when a field programmer is installed, as shown in Figure 25.

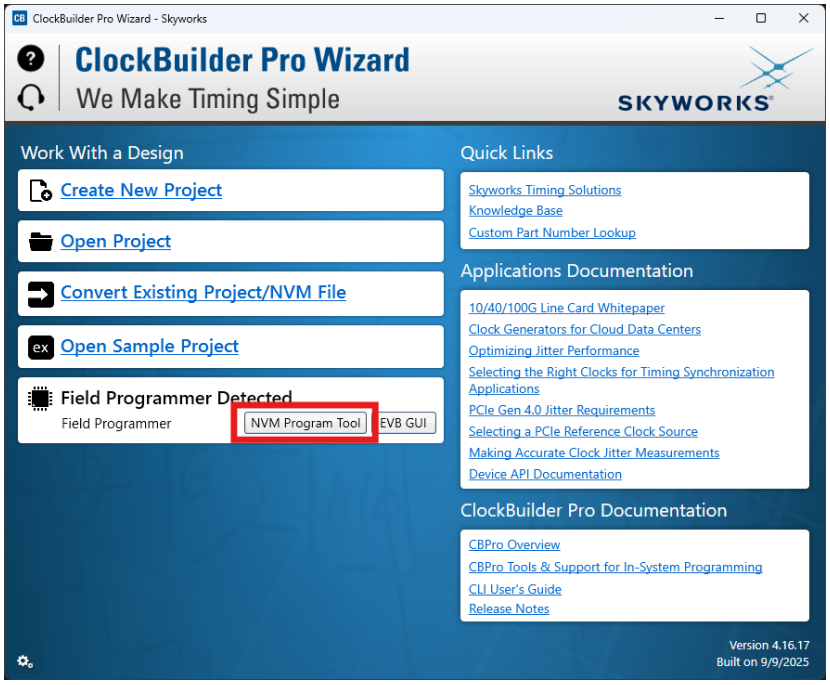

Figure 25. Starting the NVM Program Tool from the CBPro Home Page

If this is the first time you are launching the NVM program tool and no socket board has been detected, the tool prompts you to select the device family you are targeting, as shown in Figure 26. If a socket is installed, it is automatically detected and the appropriate device family selected, as shown in Figure 27.

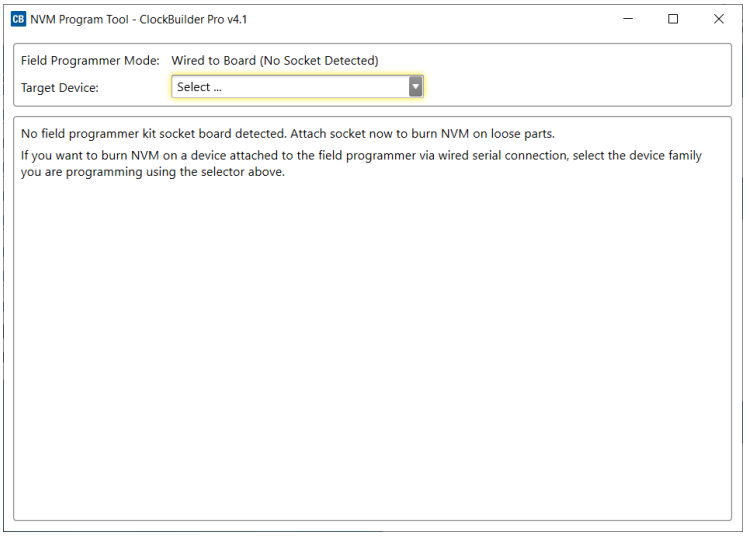

Figure 26. Select Device Family Prompt

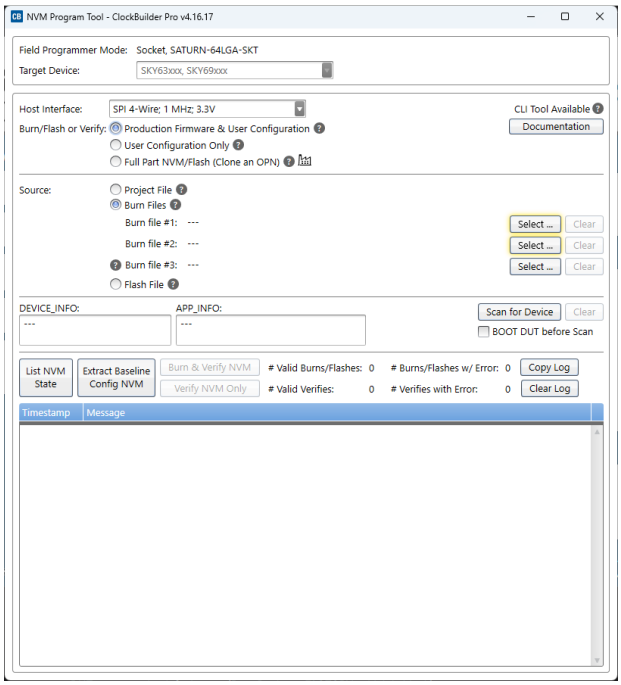

Figure 27. Programming Panel, Socket Detected

Once the device family is selected, select the appropriate programming interface for the device and the project/burn/patch files to be written to your device. Because NVM can only be written to once per register (as the name indicates), it is important to only write finished frequency plans to NVM. The NVM program tool supports patches to the installed frequency plan, but only if there is enough space remaining in the NVM storage of the device. AN1360: Serial Communications and API Programming Guide has detailed information about writing to NVM on Si536x/540x/55xx and SKY 62xxx/63xxx/69xxx devices. For other parts, refer to the product reference manual.

4. Field Programmer Firmware Update

Firmware update of the field programmer is now automatically performed if CBPro detects an old firmware version on a connected field programmer. To manually update the firmware at the direction of Skyworks Support, follow the instructions below. The firmware of the field programmer must be updated to v0.86 to be used with Si536x, Si540x, Si55xx, SKY62xxx, SKY63xxx, and SKY69xxx devices.

1. Plug in the field programmer to a PC with the latest version of ClockBuilder Pro installed.
2. Search for and open the EVB, Field Programmer Flash Utility. This utility is bundled with the regular ClockBuilder Pro installation.

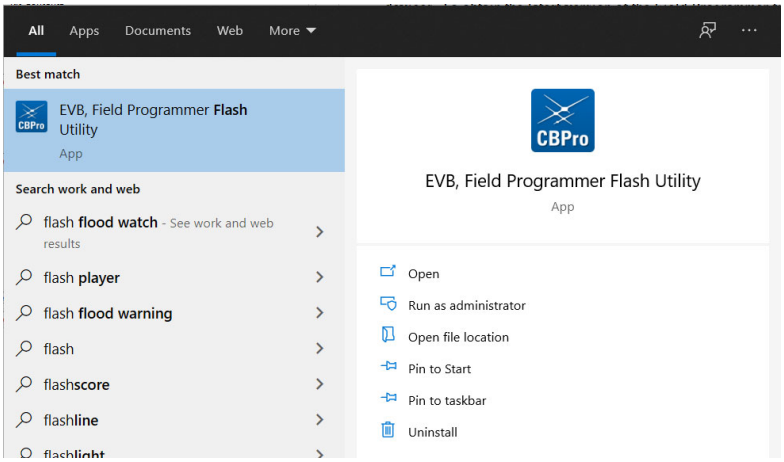

Figure 28. Searching for the Flash Utility

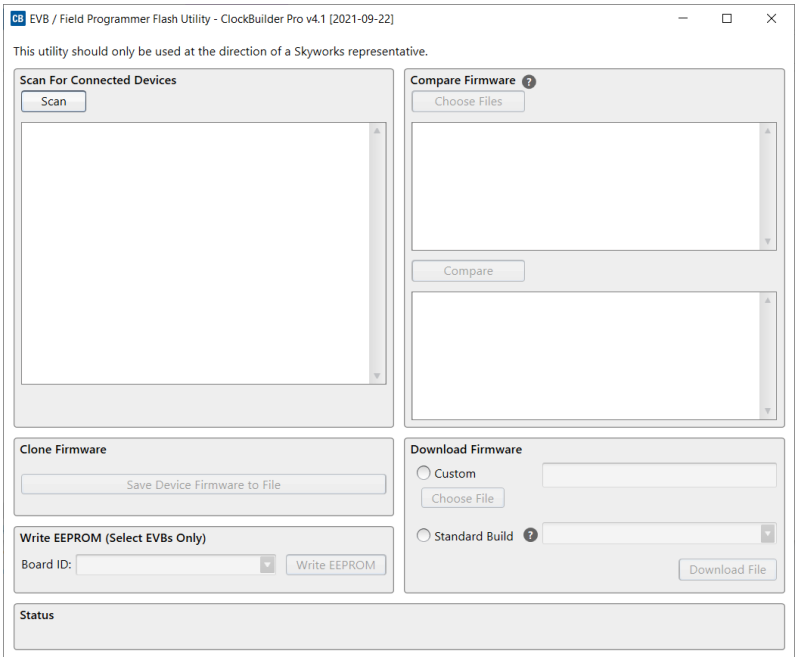

Figure 29. Flash Utility

3. With the field programmer plugged in and the flash utility open, click **Scan**. The connected field programmer appears. If the scan did not detect a field programmer, ensure that all other open CBPro windows are closed, disconnect and reconnect the field programmer USB connection, then try scanning again.

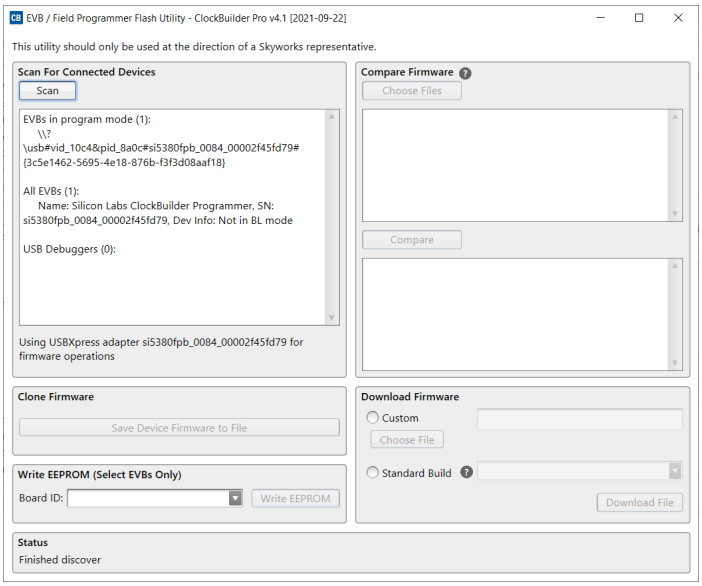

Figure 30. Field Programmer Successful Scan

4. Click **Standard Build**, then find the latest firmware image to flash to the field programmer. Select the latest “cbpro_fp_v#.##.hex”, where “v#.##” is the version number. In this example, the version number is v0.85.

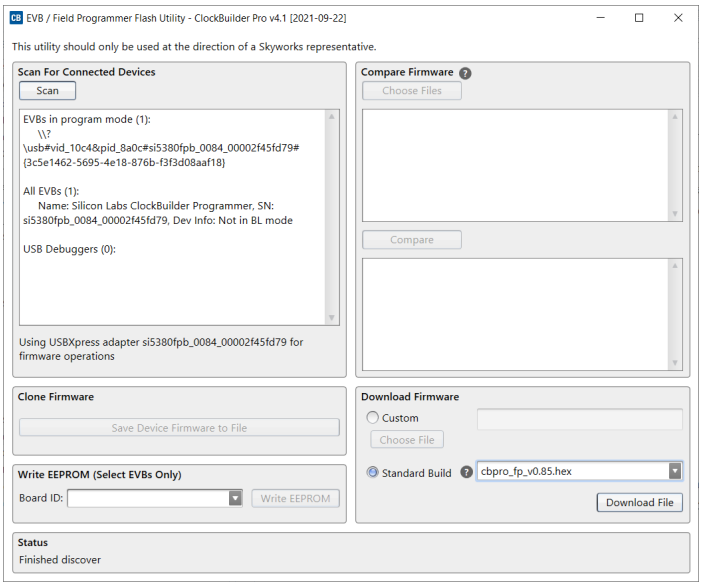

Figure 31. Select the Latest Field Programmer Firmware Image

5. Click **Download File** and wait for the operation to complete.

5. Troubleshooting Communication Issues

5.1. Obtaining a Debug Log for Skyworks Support

If Skyworks Support requests a debug log of a device, follow these steps to obtain the log. The log contains a snapshot of the device volatile and non-volatile states.

5.1.1. Procedure for Updating the Debug Log through the Field Programmer

1. Follow the steps in "3.1. Communicating via EVB GUI" on page 12 to connect to the DUT.
2. After a successful scan, click **File**, then click **Create DUT Dump for Skyworks Support** and wait for the log collection to complete.
3. Save the resulting file on your system, then send it to Skyworks Support.

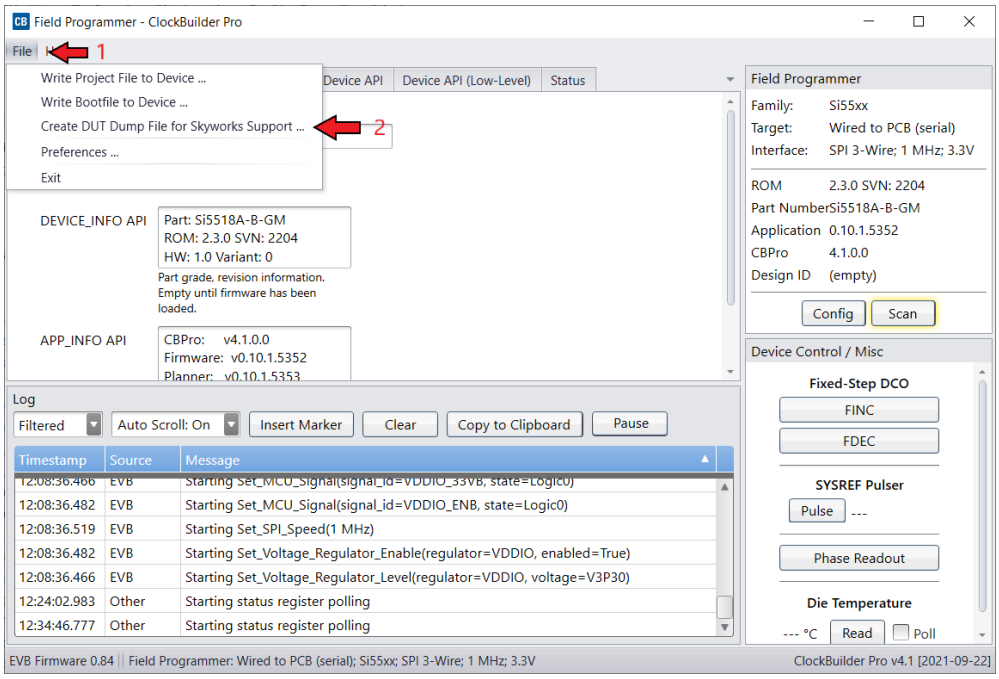

Figure 32. Accessing the DUT Dump Tool

5.2. Inability to Communicate with the DUT on My Hardware Using the Field Programmer

There are multiple windows in the CBPro software that use or provide communication to the device connected to the CBPro field programmer. The examples below show the windows and type of errors you may encounter. All of these situations can be resolved using the following steps.

5.2.1. General Steps for Resolving Communication Issues

1. Verify which communication protocol your hardware is using; SPI or I^2C. If using SPI, check whether it is 3-wire or 4-wire SPI.
2. **For Si534x/8x/9x devices:** if using I^2C, use a multimeter and measure the voltage on the I2C_SEL control pin on the DUT. The voltage should be logic low (0 V) if your communication protocol is SPI. This level should be logic high (1.8 V or 3.3 V—refer to step 3 below) if your communication protocol is I^2C. I2C_SEL is not a pin on the Si536x/Si540x/Si55xx devices, so this point can be ignored for those devices.
3. **For Si534x/8x/9x devices:** verify the value of the IO_VDD_SEL bit (Register 0x0943[0]) for the DUT. If IO_VDD_SEL is 0, the I/O voltage setting should be 1.8 V. If IO_VDD_SEL is 1, the I/O voltage setting should be 3.3 V. If you this value is unknown, try both voltages to determine which voltage level works successfully.
4. **For Si536x/Si540x/Si55xx devices:** check that the communication protocol selected under the HOST INTERFACE page in CBPro matches the protocol the host device is using.
5. **For Si534x/8x/9x devices:** if the communication protocol is I^2C, verify the I^2C address setting (register 0x000B) for the device. You may also need to verify the voltage level on the A0/CSb and A1/SDO pins if they are not connected to the field programmer. The level on these pins set bit 1 and bit 0 in the I^2C address. If these are connected to the CBPro field programmer, they are both driven low.
6. **For Si536x/Si540x/Si55xx devices:** make sure the regulators used to power the device can supply enough current. On the evaluation boards, make sure the external 5 V dc adapter is plugged in.

5.2.2. Communication Error Using the Design Dashboard Window

If the design dashboard experiences an error communicating with the device, the following error window appears. Errors communicating to the device can be due to the device not being powered on, or the selected communication protocol does not match what is expected by the device.

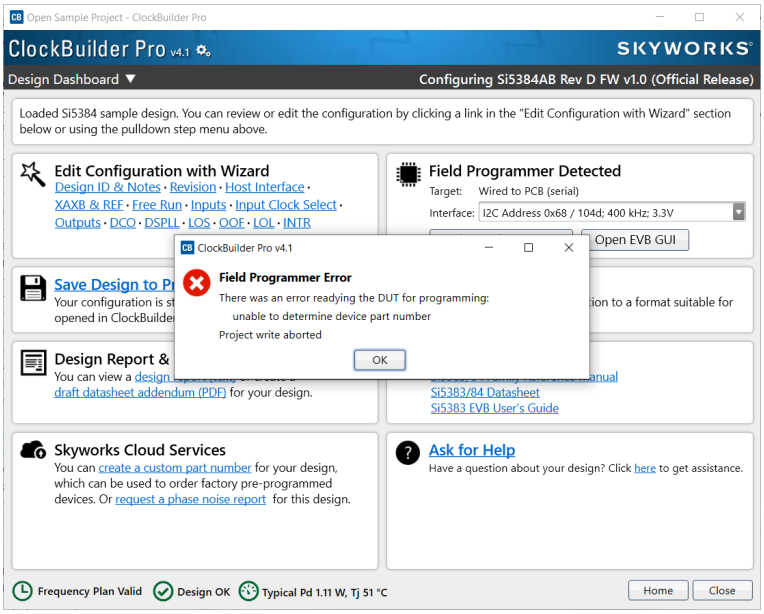

Figure 33. Communication Error Using Design Dashboard

Figure 34 shows how to adjust the communication settings of the dashboard to resolve communication errors.

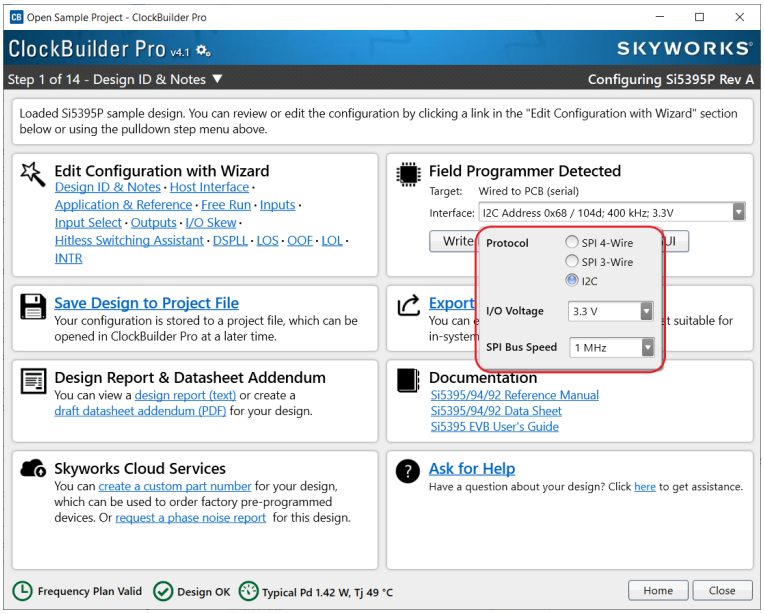

Figure 34. Design Dashboard Communication Error Solution

5.2.3. USB Communication Error

You may encounter a USB-related error. To solve this, close out all CBPro instances, unplug the USB cable, reopen CBPro, and plug in the USB cable after CBPro loads.

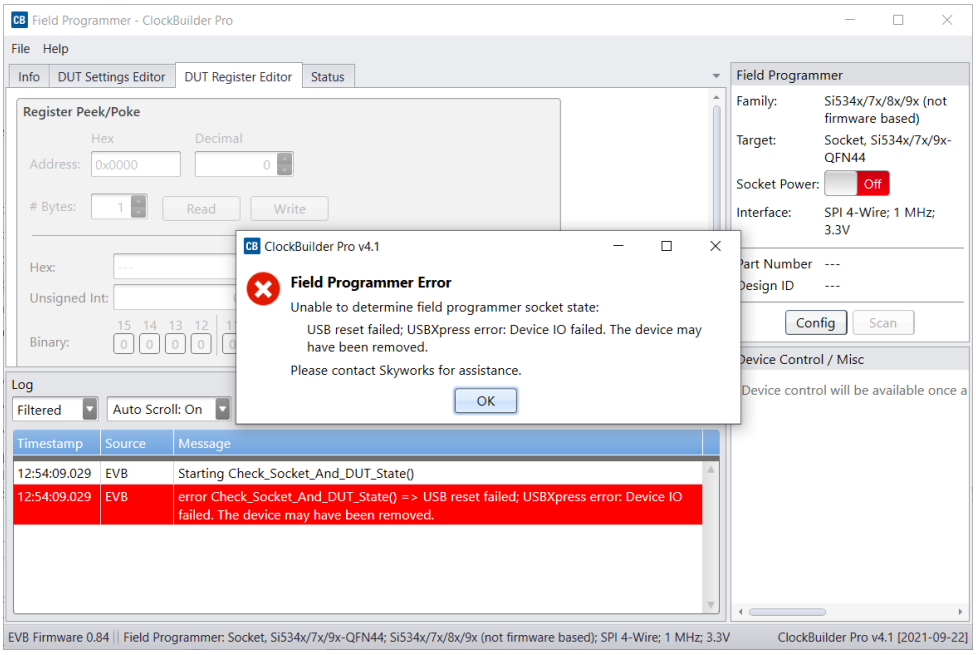

Figure 35. USB Error Message

5.2.4. Communication Error Using the Burn NVM Window

The following window shows a communication error in the NVM Burn window. This error can appear after the **Scan for Device** button is pressed if the incorrect communication protocol was selected.

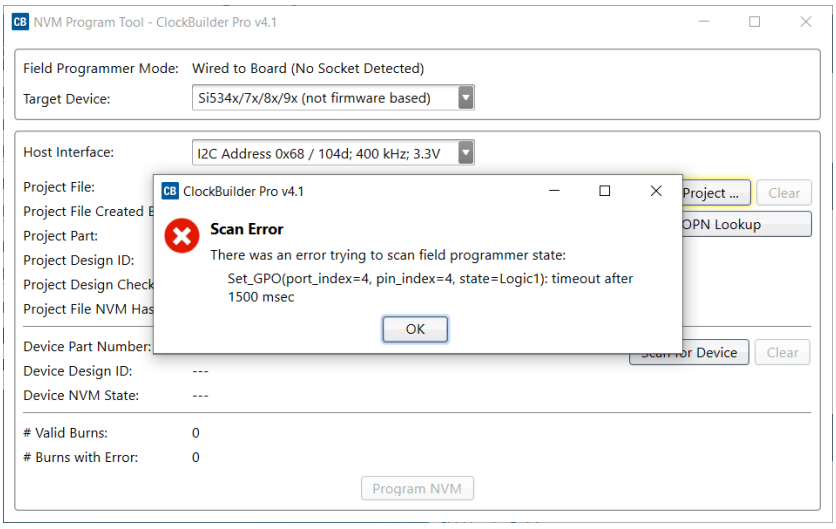

Figure 36. Burn NVM Error Message

To address the error, select the correct communication protocol the device is configured for. If I^2C is used, check all the addresses between 0x68 and 0x71 (the allowable range of addresses set via hardware pin). It is also possible that the I^2C address was programmed to a number outside the normal range using the I^2C address burn tool. The following window shows the dropdown used to adjust the communication settings to resolve the communication error.

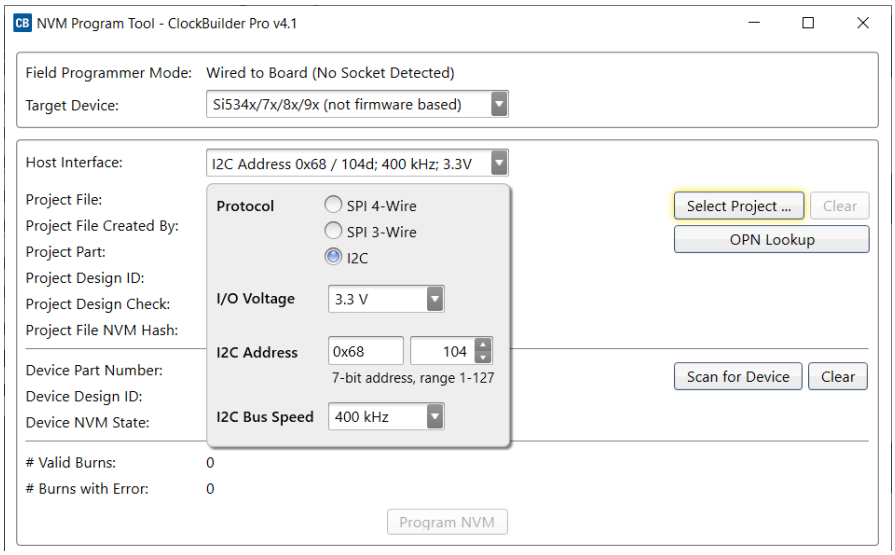

Figure 37. Burn NVM Error Message Solution

5.2.5. Communication Error Using the EVB GUI

Figure 38 shows an example of the error produced when the EVB GUI experiences an SPI error. An error in communicating through SPI can occur due to many things, including:

- Incorrect connection of SPI wires.
- SPI host is communicating at a voltage level not expected by the clock device.
- I^2C pullup resistors being present on a custom board.
- Long traces or heavy capacitive loads on a custom board leading to errors in high-frequency SPI communications.
- If the field programmer is being used with an evaluation board, double check the schematic for any missing (or extra) 0 Ω resistors in the path. On some newer devices, it is possible for a SPI pin to double as a GPIO pin.

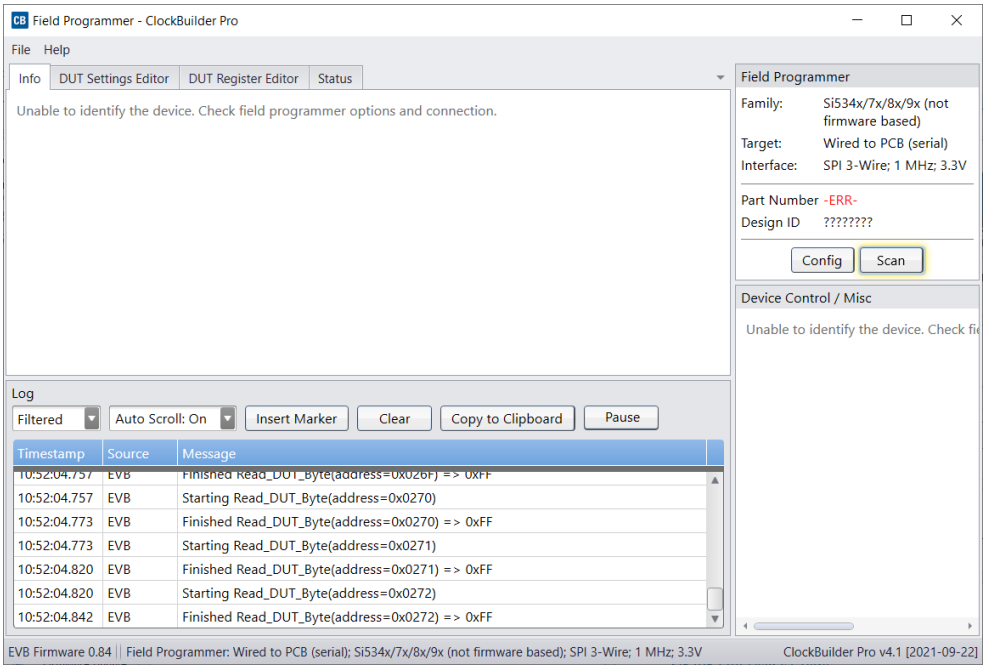

Figure 38. EVB GUI SPI Error

Figure 39 shows how to change the communication settings using the EVB GUI window. Selecting the correct communication protocol, and double-checking the signal at the SPI pins with an oscilloscope should resolve the -ERR- message.

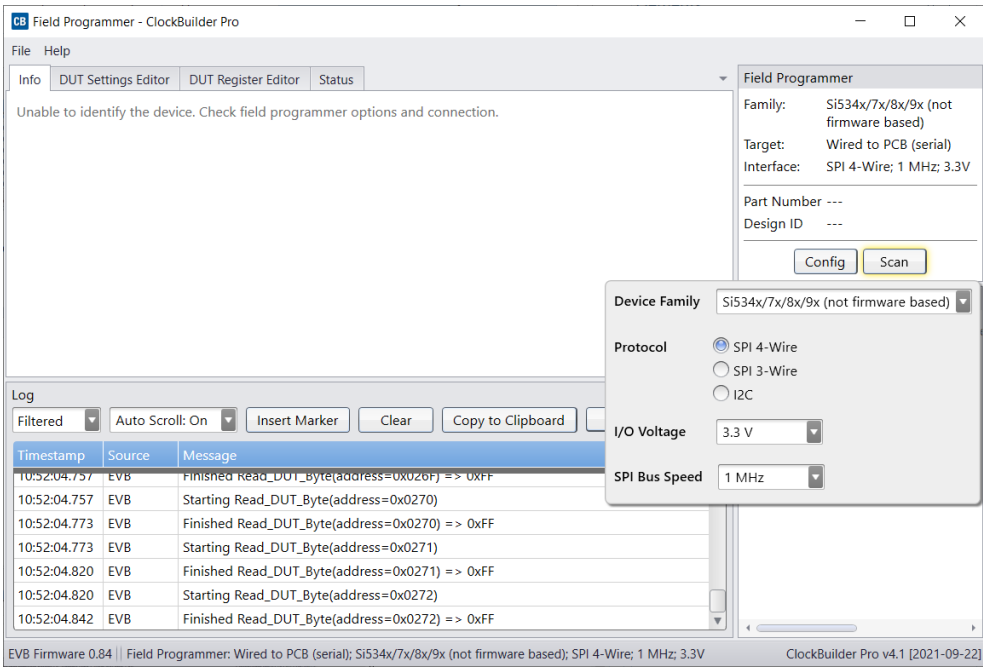

Figure 39. EVB GUI Solution

5.3. Troubleshooting Errors When Writing to Si534x/8x/9x Devices

5.3.1. Description of the IO_VDD_SEL Bit (Register 0x0943[0])

In order for the field programmer to communicate with the device correctly, the field programmer I/O voltage needs to match the IO_VDD_SEL bit in the device. CBPro may force this bit when writing a new plan to a device. If the plan changes this bit during the writing process, communication can fail. To determine if the new plan is changing this bit, perform the following steps:

Read the current IO_VDD_SEL value in the device by using the **DUT Register Editor** tab in the EVB GUI window as shown in Figure 40. Check if IO_VDD_SEL read above is different from the settings in the **Host Interface** tab in the Design Dashboard of the new project, as shown in Figure 40.

- If VDD (Core) is selected in the project and 0x943 reads 0, no change is needed
- If VDD (Core) is selected in the project and 0x943 reads 1, refer to section "5.3.2. Changing the IO_VDD_SEL Bit" on page 27.
- If VDDA (3.3V) is selected in the project and 0x943 reads 0, refer to section "5.3.2. Changing the IO_VDD_SEL Bit" on page 27.
- If VDDA (3.3V) is selected in the project and 0x943 reads 1, no change is needed.

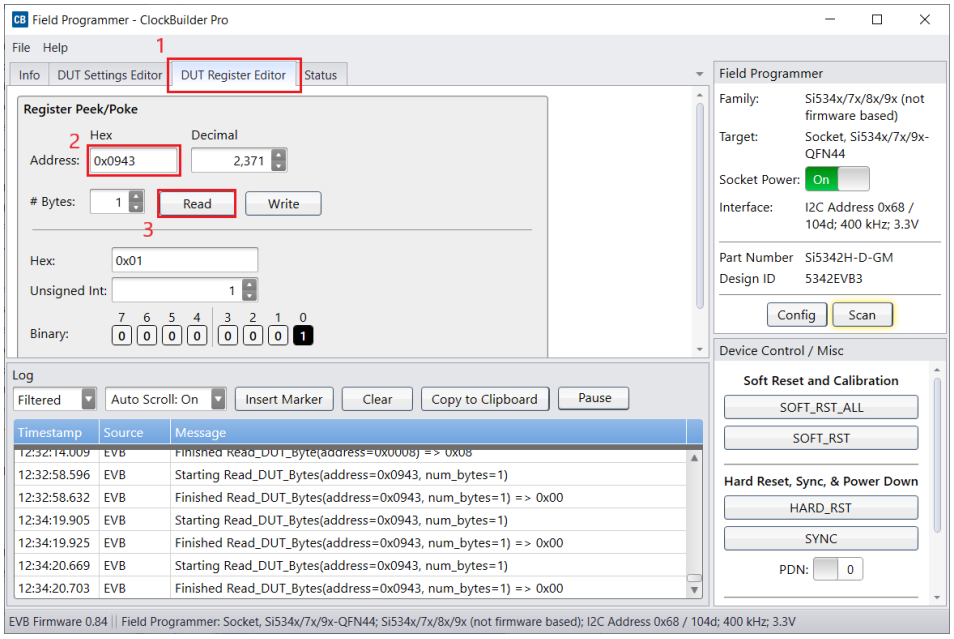

Figure 40. Read IO_VDD_SEL Bit from Device

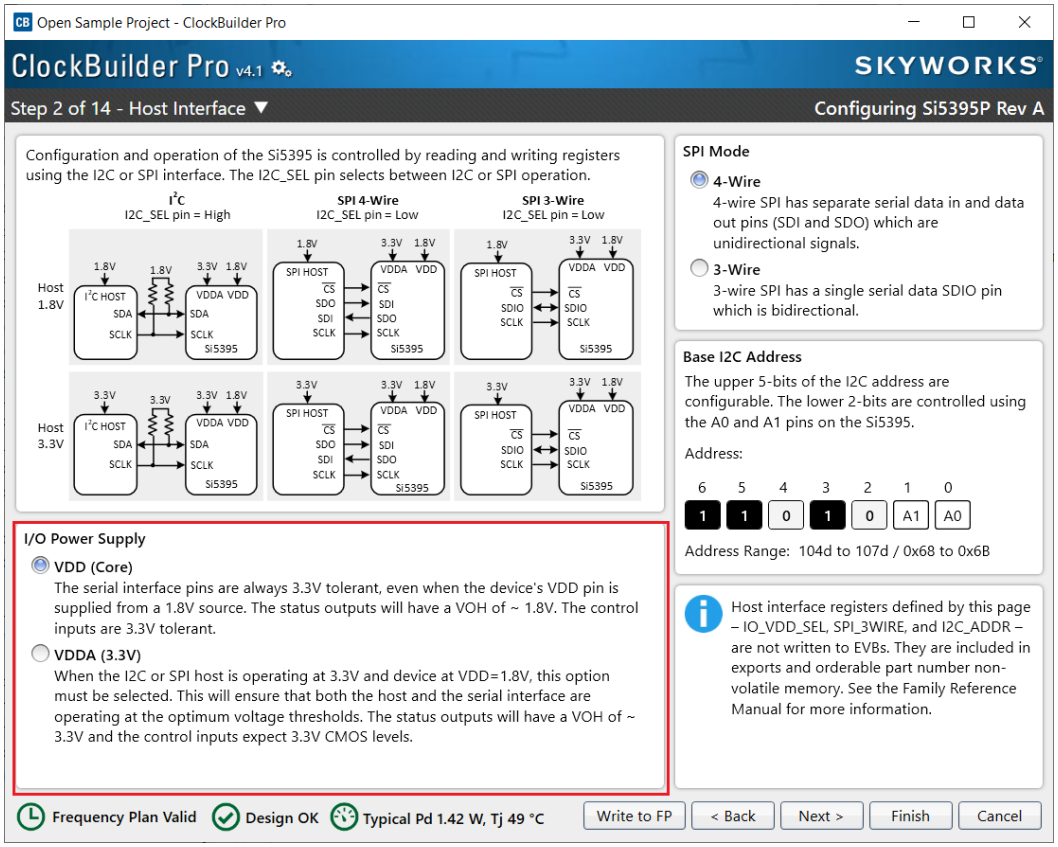

Figure 41. Determine the I/O Power Supply in a CBPro Project

5.3.2. Changing the IO_VDD_SEL Bit

If it is suspected that IO_VDD_SEL has changed after writing a new plan to the device, you cannot communicate with the device. However, the device still responds to a register write request to change the IO_VDD_SEL bit even when communicating with the incorrect IO_VDD. To do this, follow the steps below:

1. Power down and power on the clock device to ensure that the next write operation is the first bus transaction.
2. Write a 9 (0x9) to the page address register (address = 0x1)
3. Write a value of 0x00 to register 67 (0x43). Steps 2 and 3 combined write a 0 value to register address = 0x0943.
4. Read back some registers to check if communications are now restored. A suggestion is to read registers 0x02 and 0x03. These registers should be non-zero and correspond to the device part number.

This sets the serial interface to use VDD as the I/O voltage level. Even if VDD is 1.8 V, the serial inputs remain 3.3 V tolerant, so this should allow the device to communicate with the field programmer at any voltage level.

5.3.3. How to Change I/O the IO_VDD_SEL Bit with a Project File

In order for the field programmer to communicate with the device correctly, the field programmer I/O voltage needs to match the IO_VDD_SEL bit in the device and use the correct serial communication protocol to match the I2C_SEL pin on the device. This is not automatically detected by the GUI or the CLI command.

If the new project changes the IO_VDD_SEL bit, the following steps must be performed. The flow chart and figures that follow provide the details for each of these steps. There are detailed steps using the CBPro Graphical User Interface (GUI) or the CBPro Command Line interface. A summary of the general steps is listed below, and shown in Figure 42.

1. Establish communication with the device to be programmed and determine the current value of the IO_VDD_SEL (0x0943[0]) bit.
2. Does the current value of the IO_VDD_SEL bit match the value of the new plan to be written to the device?
   a. Yes: Proceed to step 3.
   b. No: Change the IO_VDD_SEL bit to match the value in the new plan. Re-establish communication with the device after changing the IO_VDD_SEL value (change the field programmer I/O voltage to match new value for IO_VDD_SEL).
3. Write the new plan to the device.

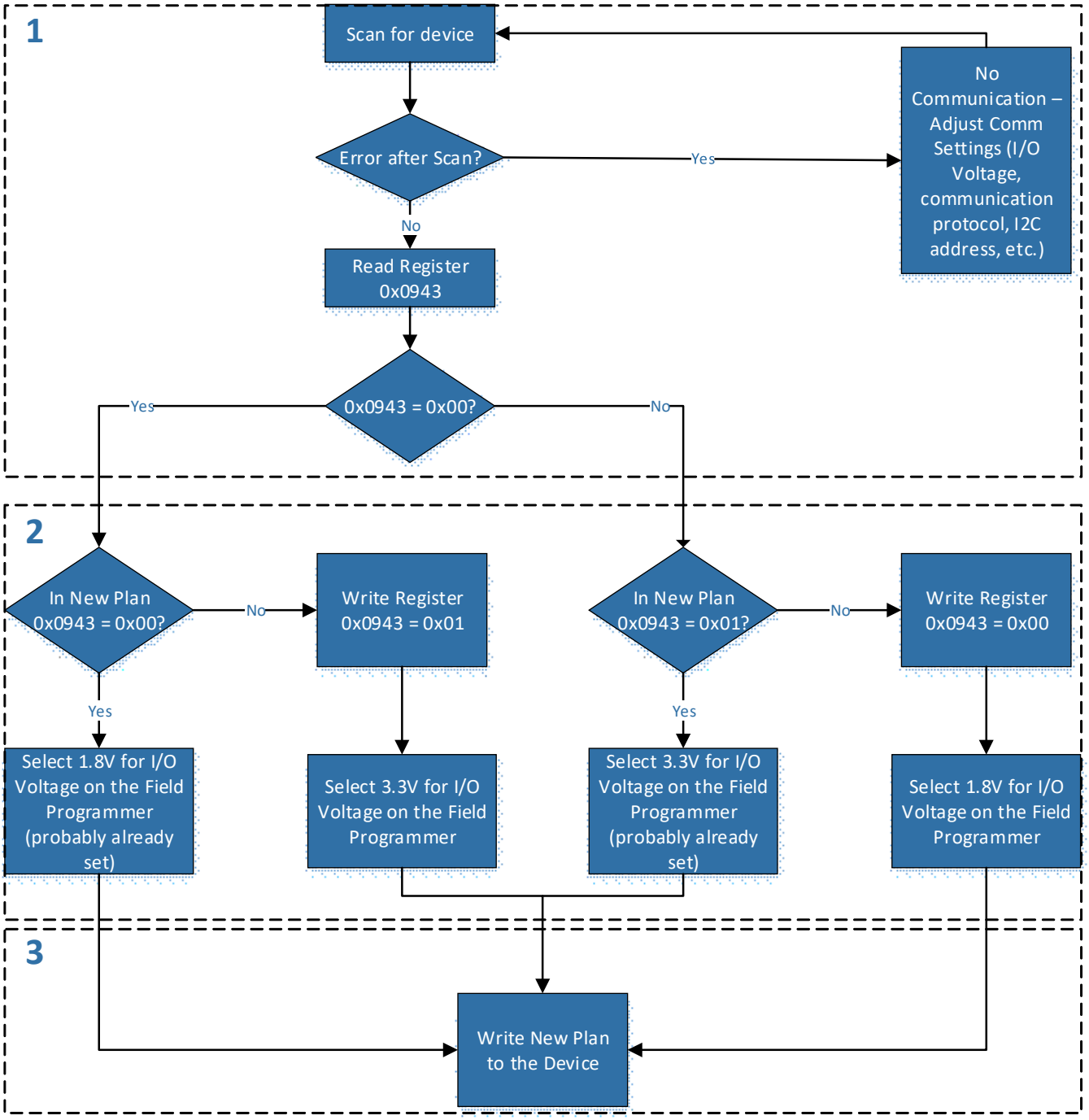

Figure 42. General Steps to Change I/O Power Supply Setting with a Project File

5.3.4. Steps Using CBPro Graphical User Interface

1. Click the **EVB GUI** button on the CBPro home screen.
   a. Click the **DUT Register Editor** tab.
   b. Determine the correct device communication protocol and set up CBPro accordingly as shown. For an in-socket device, click the Socket Power slider to power up the device. For in-system devices, click the **Device Family** pulldown and select the appropriate device family.
   c. Click the **Scan** button to verify communication with the device.
   d. If communication is successful, the device part number and design ID are updated. If communication is not successful, the part number field displays -ERR- and the DUT register tab is disabled. Communication settings configuration is shown in Figure 43.

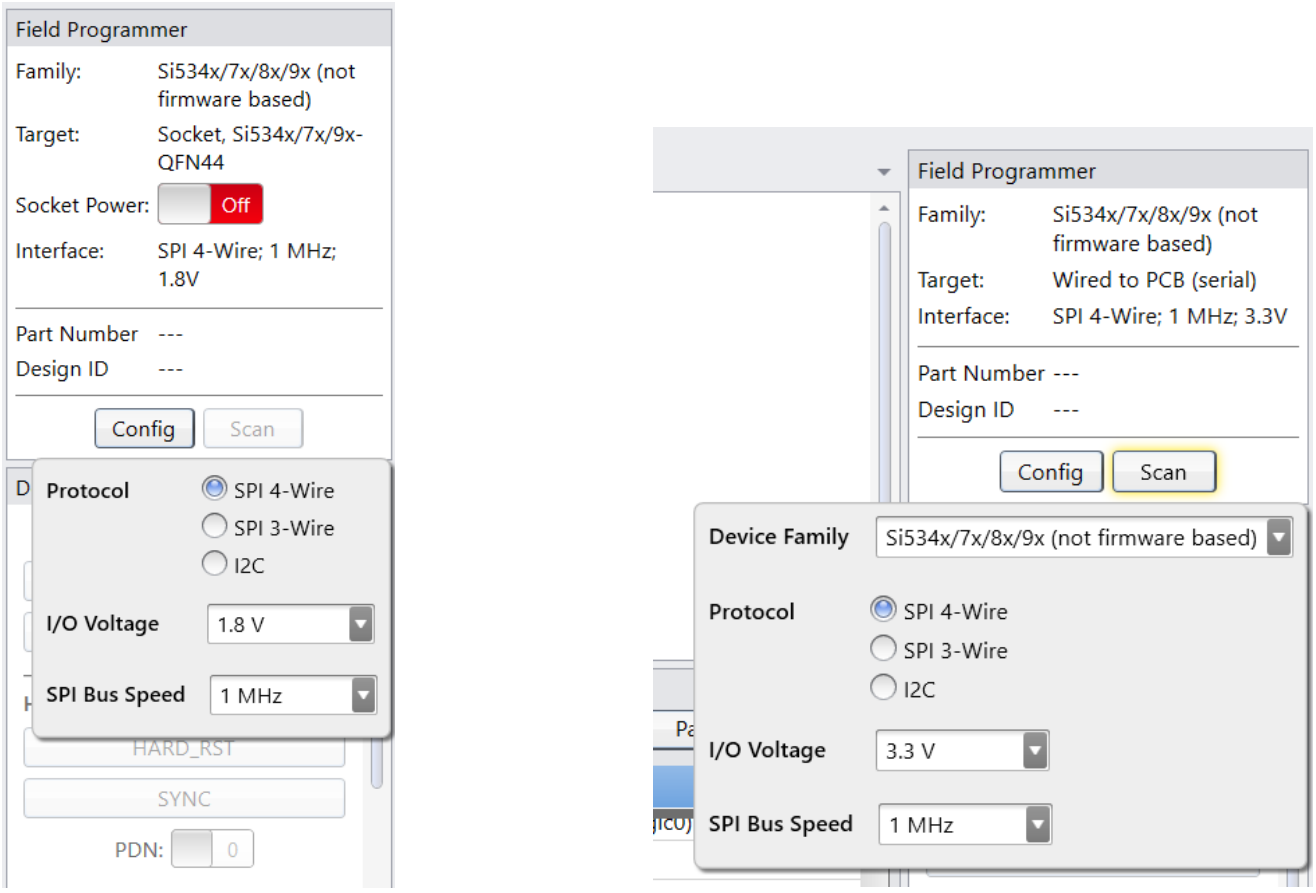

Figure 43. Configuring Communication Settings

2. Match the IO_VDD_SEL bit to the value in the plan to be written to the device.
   a. If the IO_VDD_SEL bit already matches the value in the plan to be written, skip to Step 3.
   b. If the IO_VDD_SEL bit is not correct, change the value and write the new value to the device (see Figure 44).
   c. Reconfigure the communication settings of the field programmer to reestablish communication to the device.
3. Write the new plan to the device.

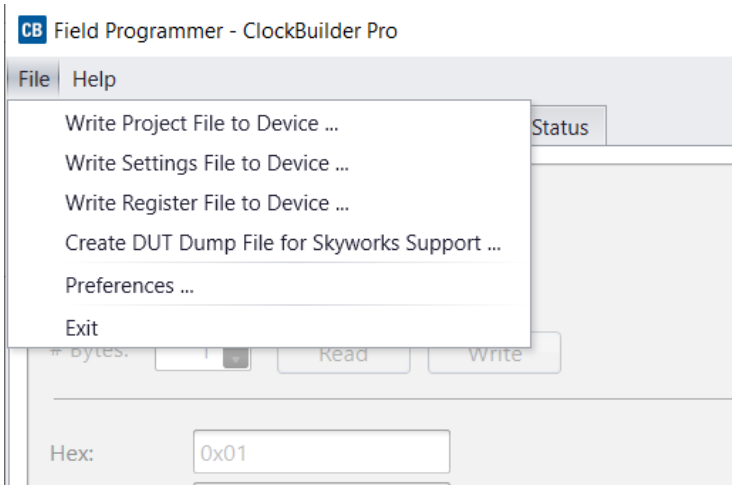

Figure 44. Write New Plan to Device (EVB GUI)

5.3.5. How to Change the IO_VDD_SEL Bit Using the Command Line Interface

Note: *All commands in this section are examples. Refer to the documentation and help for the CBPro CLI for your specific configuration.*

1. Attempt to communicate with the Si534x/8x/9x device and determine the current value of the IO_VDD_SEL bit.
   a. SPI example:

```
CBProDeviceRead.exe --io-voltage 1.8 --mode spi4wire --speed 1M --family si538x4x --registers 0x0943
CBProDeviceRead.exe --io-voltage 3.3 --mode spi4wire --speed 1M --family si538x4x --registers 0x0943
```

   b. I^2C communication example:

```
CBProDeviceRead.exe --io-voltage 1.8 --mode i2c --speed 100k --i2c-address 0x68 --family si538x4x --
registers 0x0943

CBProDeviceRead.exe --io-voltage 3.3 --mode i2c --speed 100k --i2c-address 0x68 --family si538x4x --
registers 0x0943
```

2. Match the IO_VDD_SEL bit to the value in the plan that will be written to the device.
   a. A simple text file must be created that writes register 0x943 to 0x00 or 0x01.
      To write 0x01 to 0x0943, the text file should contain a single line:

```
0x0943,0x01
```

   To write 0x00 to 0x0943, the text file should contain the following single line of text:

```
0x0943,0x00
```

b. SPI example:

```
CBProDeviceWrite.exe --mode spi4wire --speed 4M --io-voltage 3.3 --family si538x4x --registers
simple_text_file.txt
```

c. I²C example:

```
CBProDeviceWrite.exe --mode i2c -i2c-address 0x68 --speed 400K --io-voltage 3.3 --family si538x4x --
registers simple_text_file.txt
```

3. Write the new plan to the part.
   a. SPI example:

```
CBProDeviceWrite.exe --mode spi4wire --speed 4M --io-voltage 3.3 --family si538x4x --project
your_plan_name.slabtimeproj
```

   b. I²C example:

```
CBProDeviceWrite.exe --mode i2c -i2c-address 0x68 --speed 400K --io-voltage 3.3 --family si538x4x --
project your_plan_name.slabtimeproj
```

5.4. I Burned a Project File to my Device with a New Base I²C Address, but the Base Address in the Device was Not Changed after the Burn Process Completed

The I²C address is not changed during the burn process. Changes to the base I²C address in the CBPro Configuration Wizard are included in exports and the project file used to create orderable part numbers. However, this change is not burned to the device using the NVM burn tool. See the note highlighted in Figure 45.

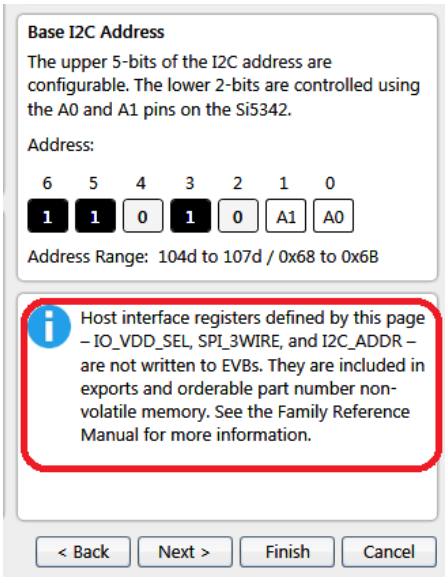

Figure 45. Base I²C Address

To permanently change the I²C base address on a 534x/538x device, use the I²C address burn tool. See Figure 46.

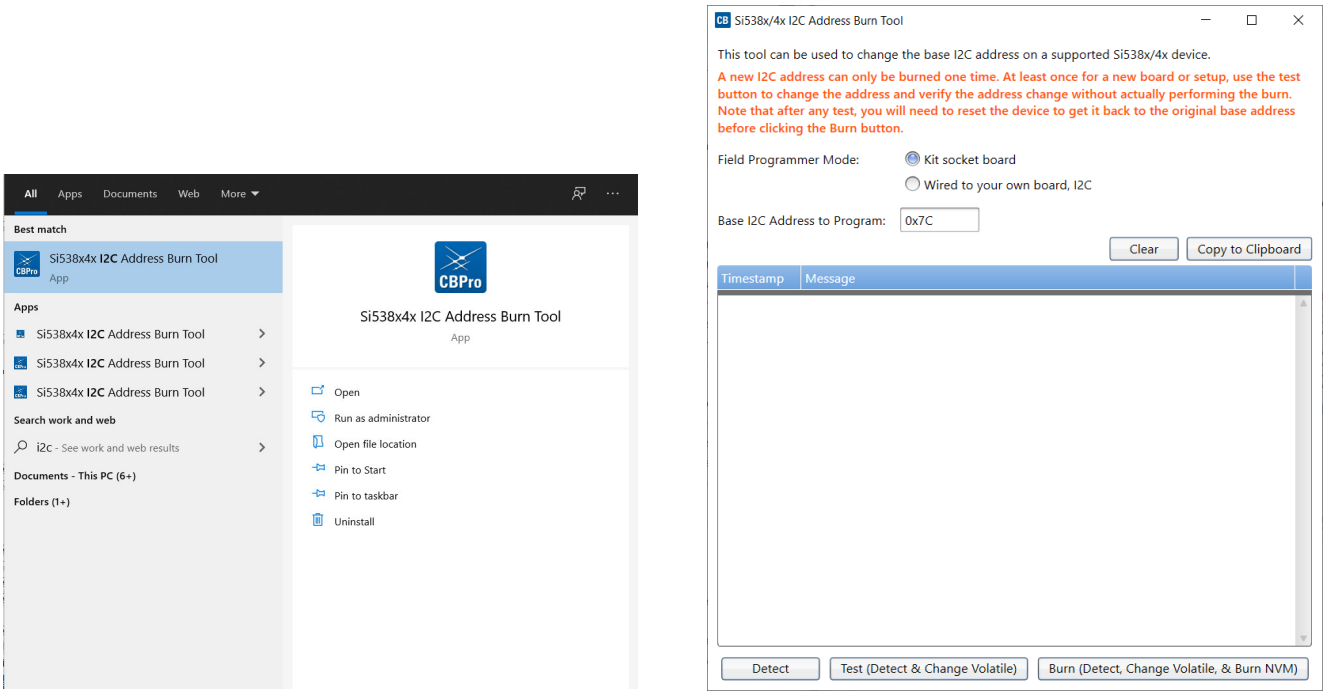

Figure 46. I²C Address Burn Tool

6. Field Programmer Schematic

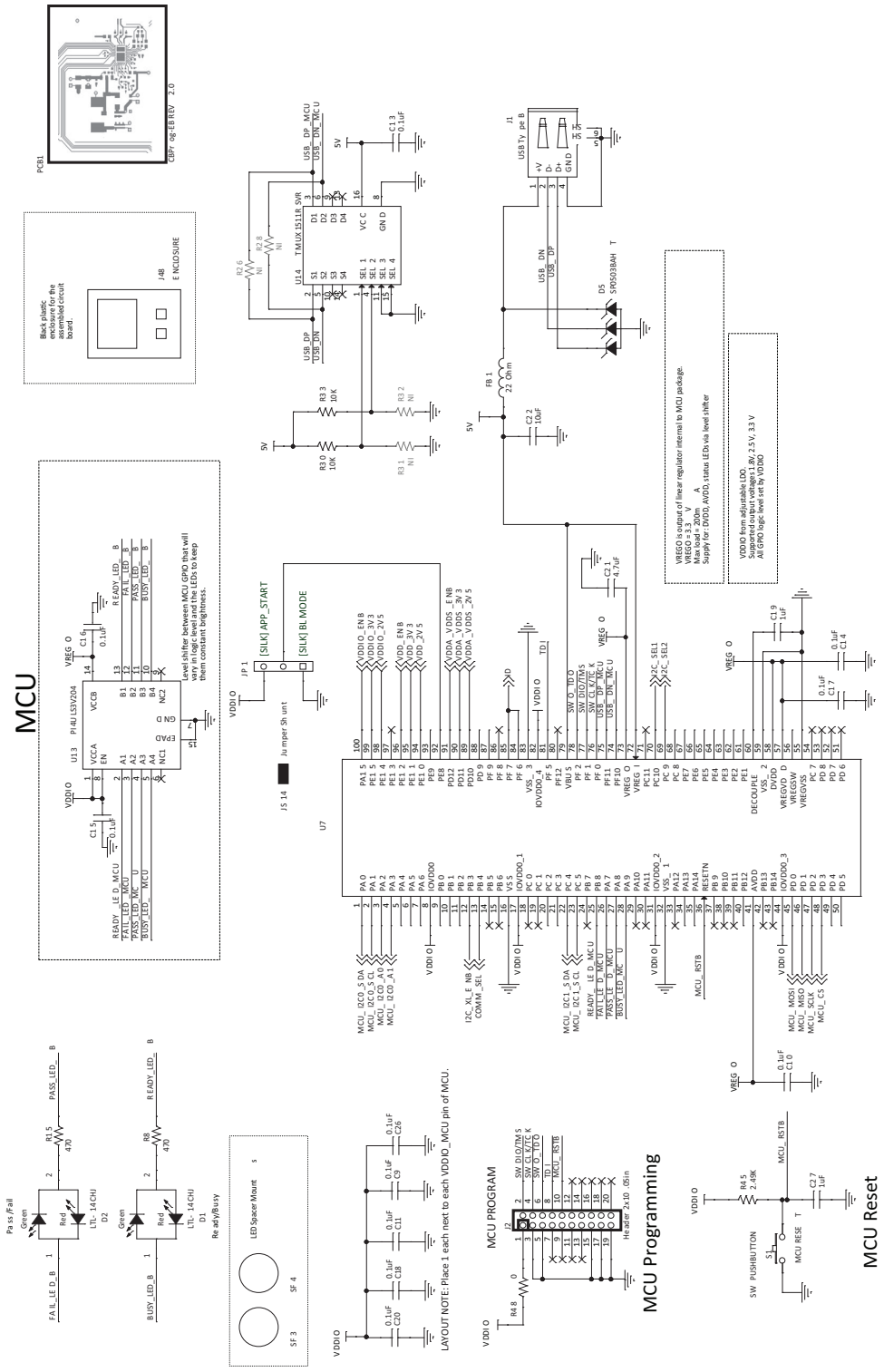

Figure 47. CBPROG-DONGLE MCU Schematic

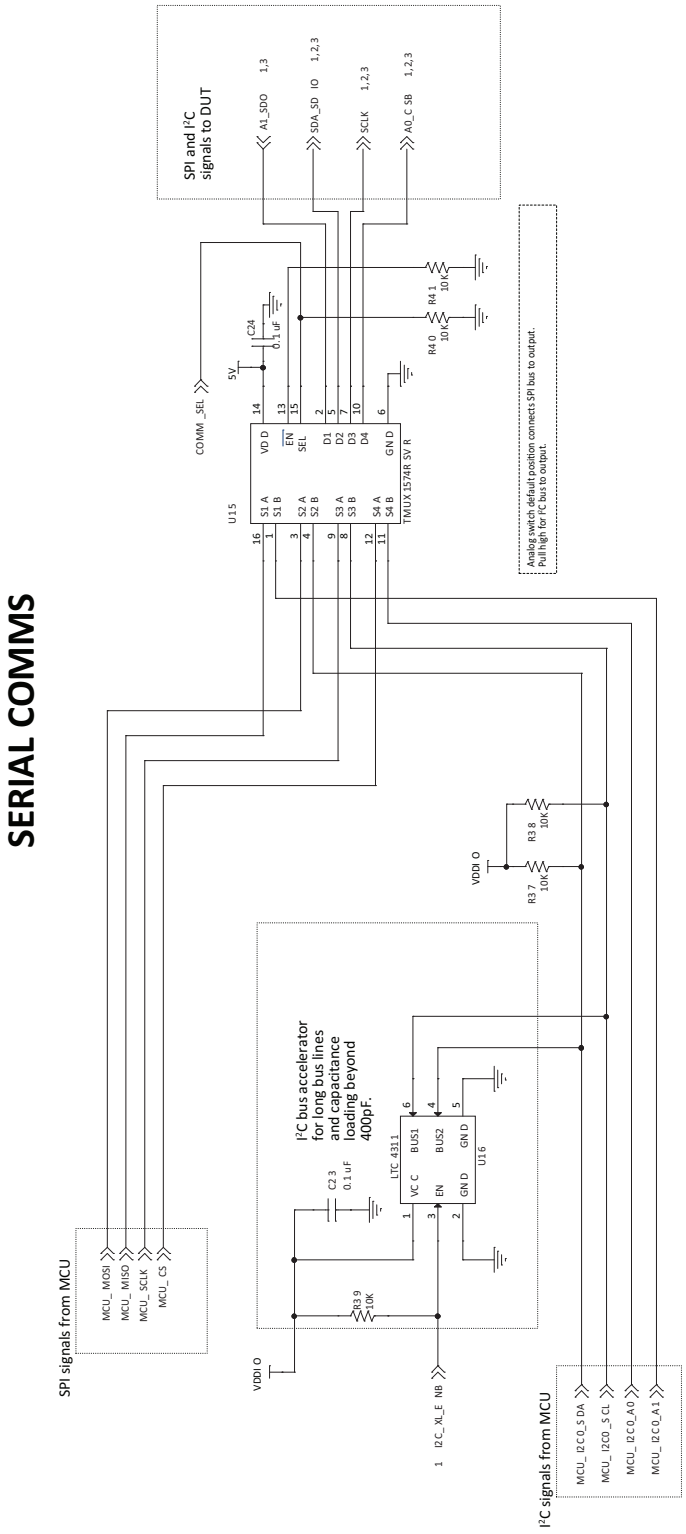

Figure 48. CBPROG-DONGLE Serial Comms Schematic

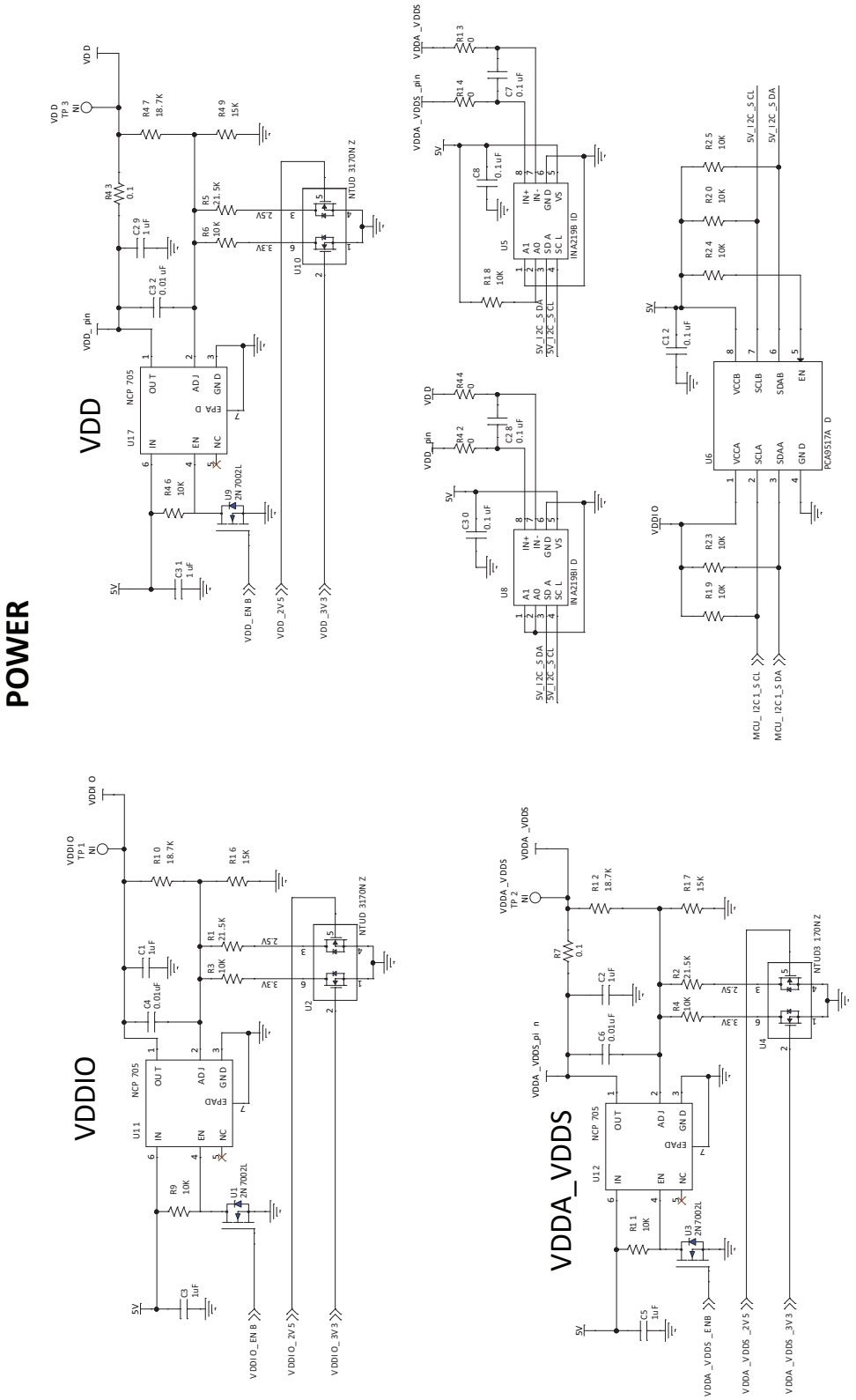

Figure 49. CBPROG-DONGLE Power Schematic

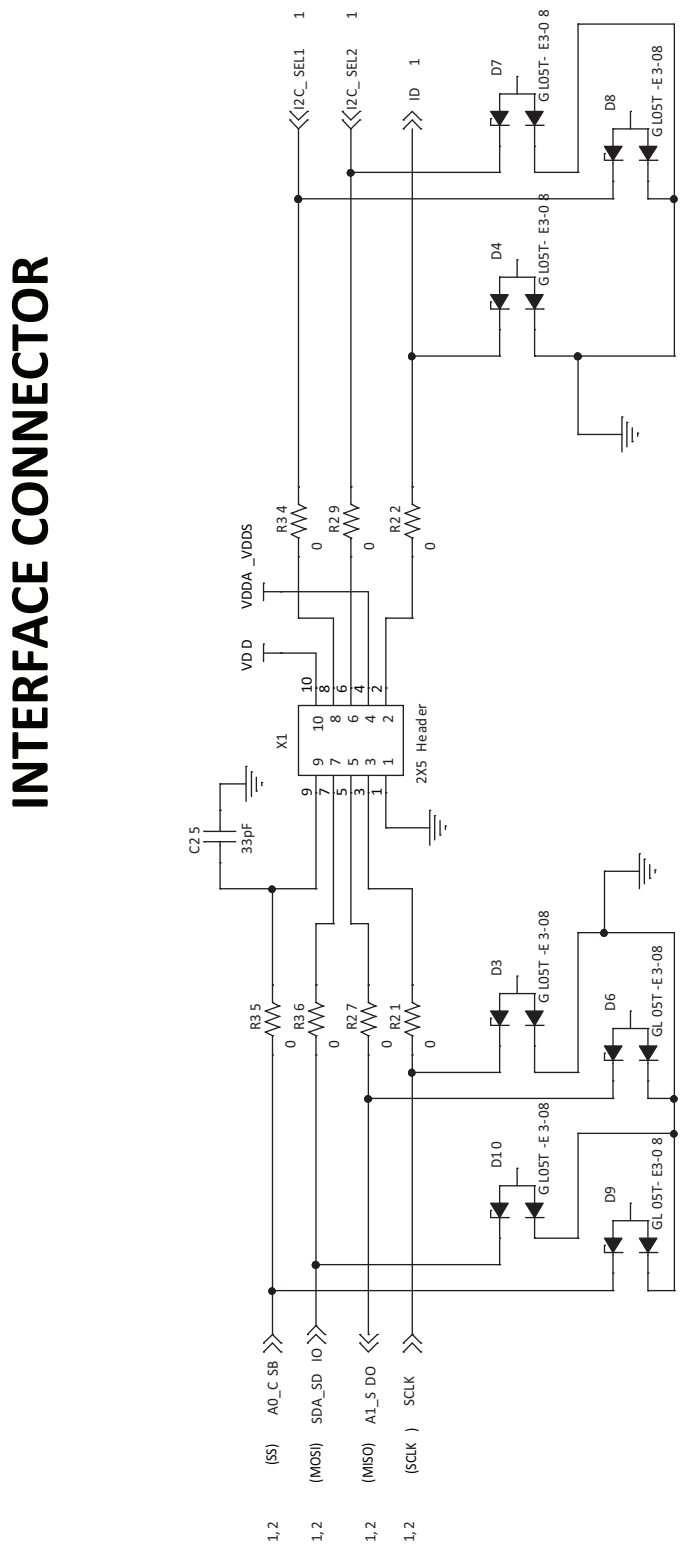

Figure 50. CBPROG-DONGLE Interface Connector Schematic

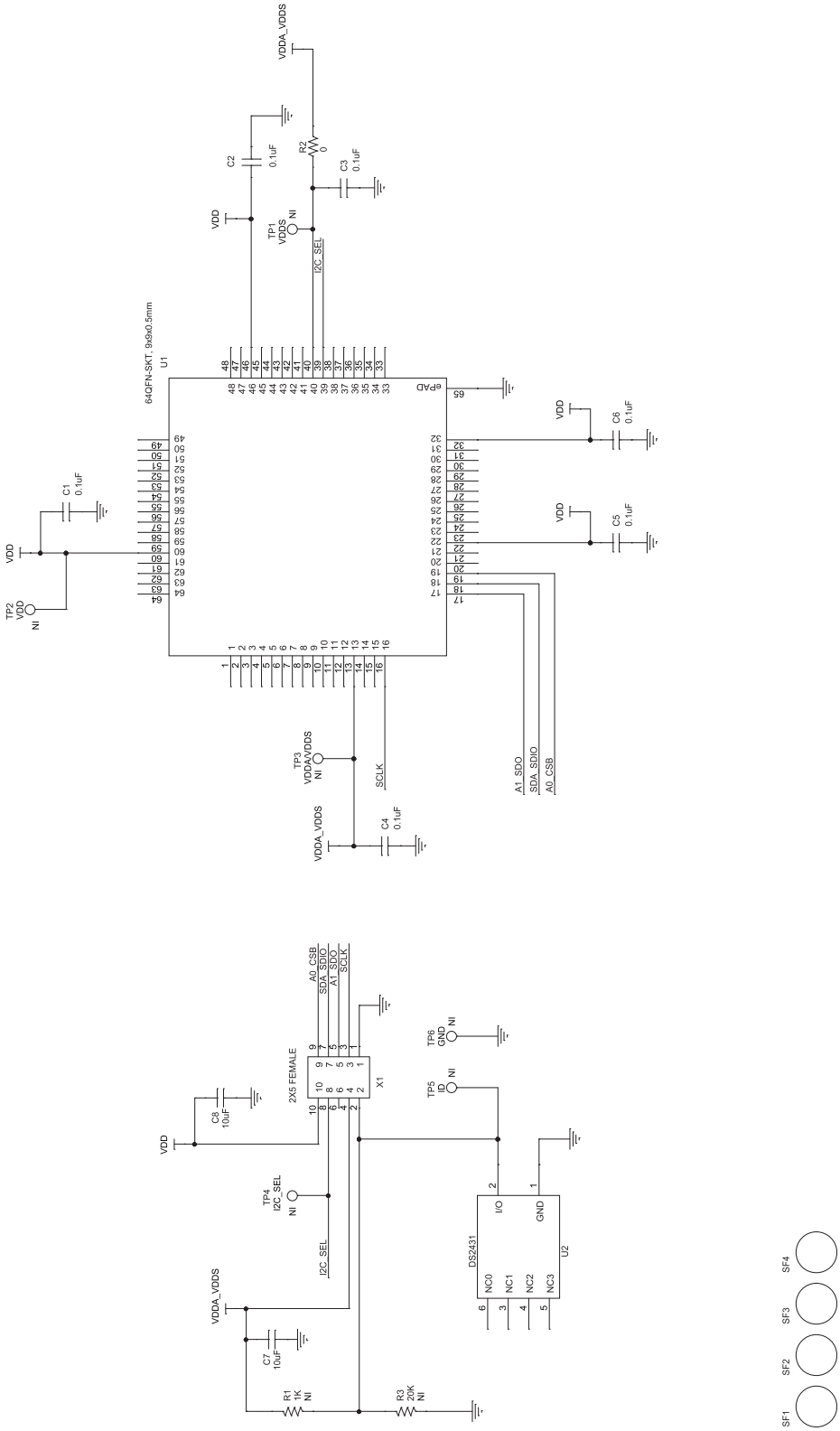

Figure 51. 64-Pin Socket Board Schematic

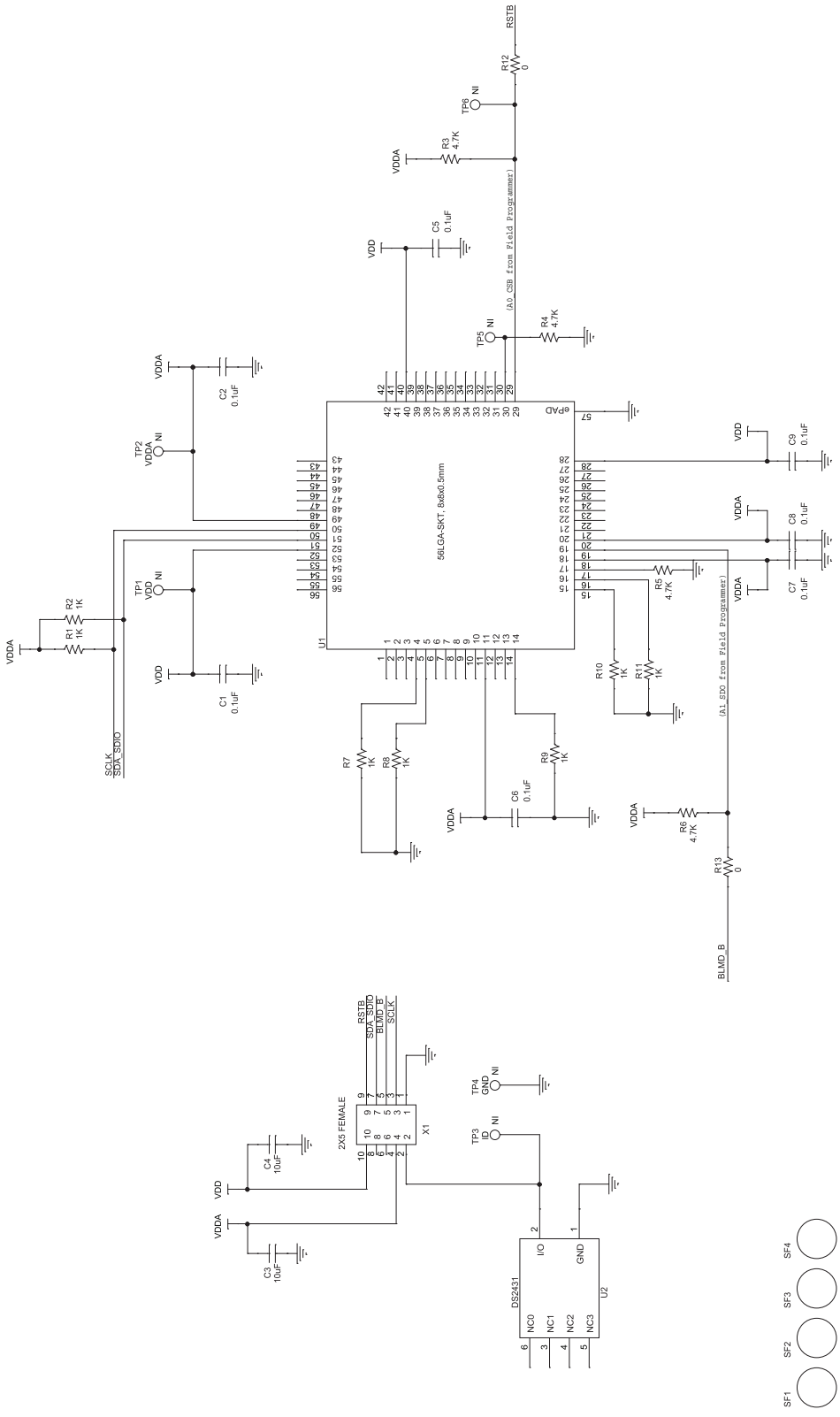

Figure 52. 56-Pin Socket Board Schematic

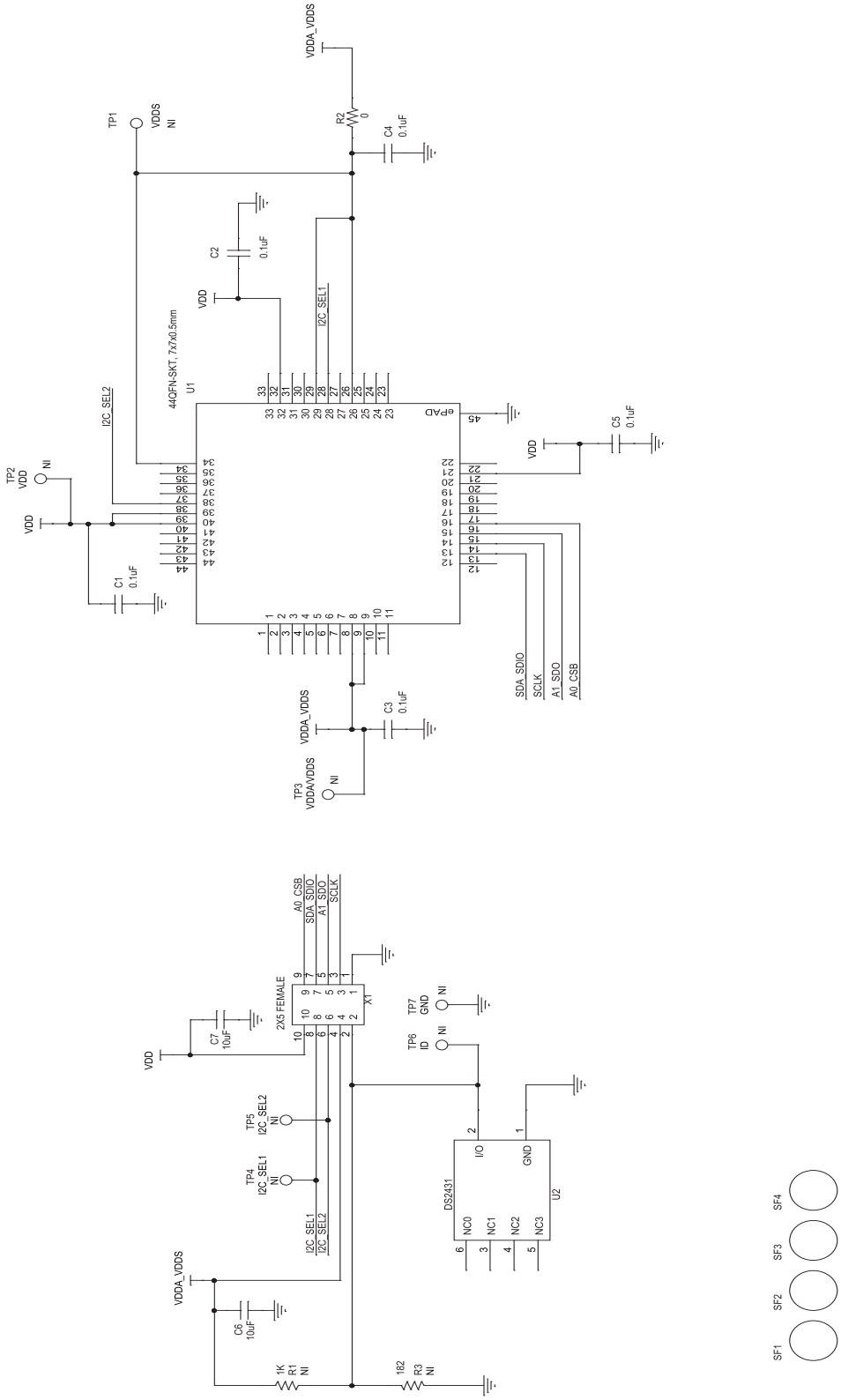

Figure 53. 44-Pin Socket Board Schematic

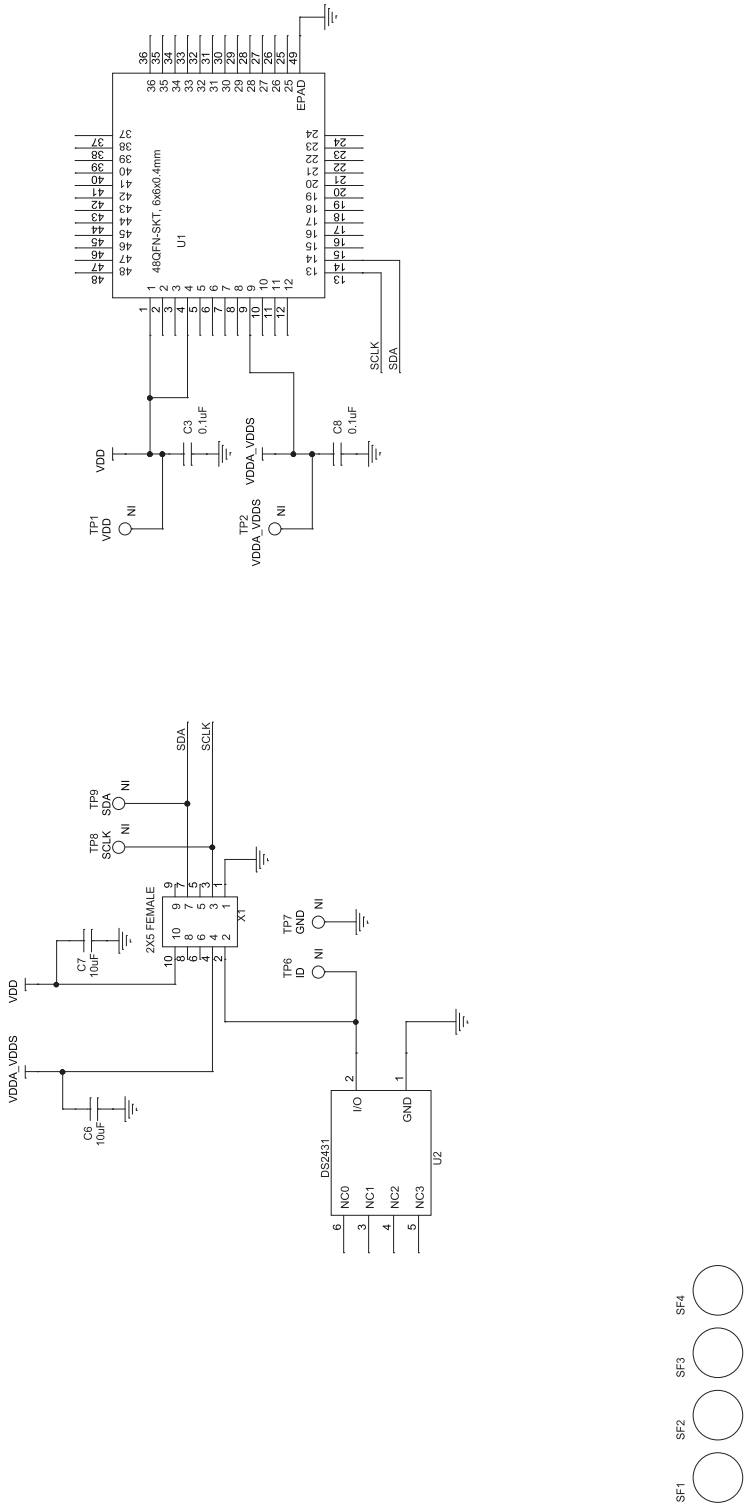

Figure 54. Si5332 48-Pin Socket Board Schematic

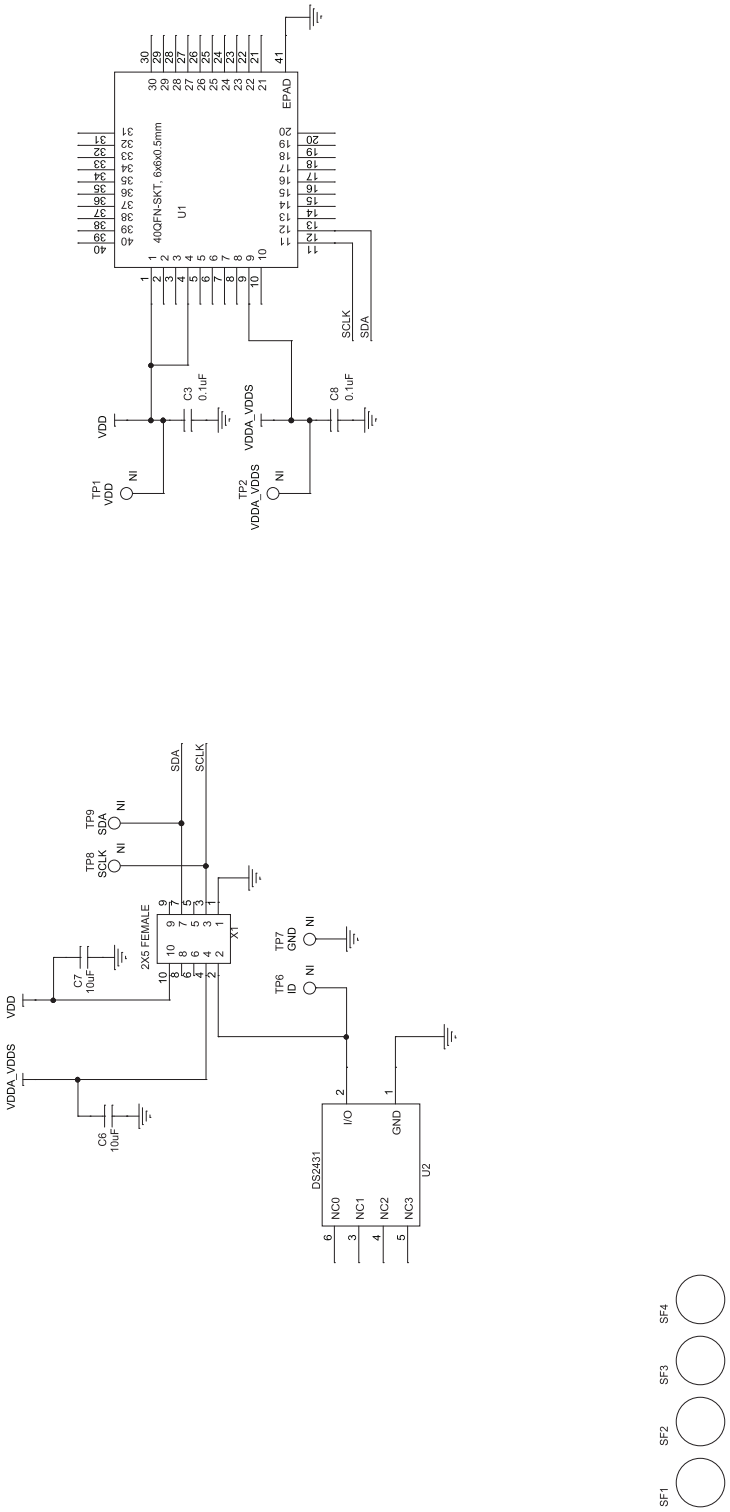

Figure 55. Si5332 40-Pin Socket Board Schematic

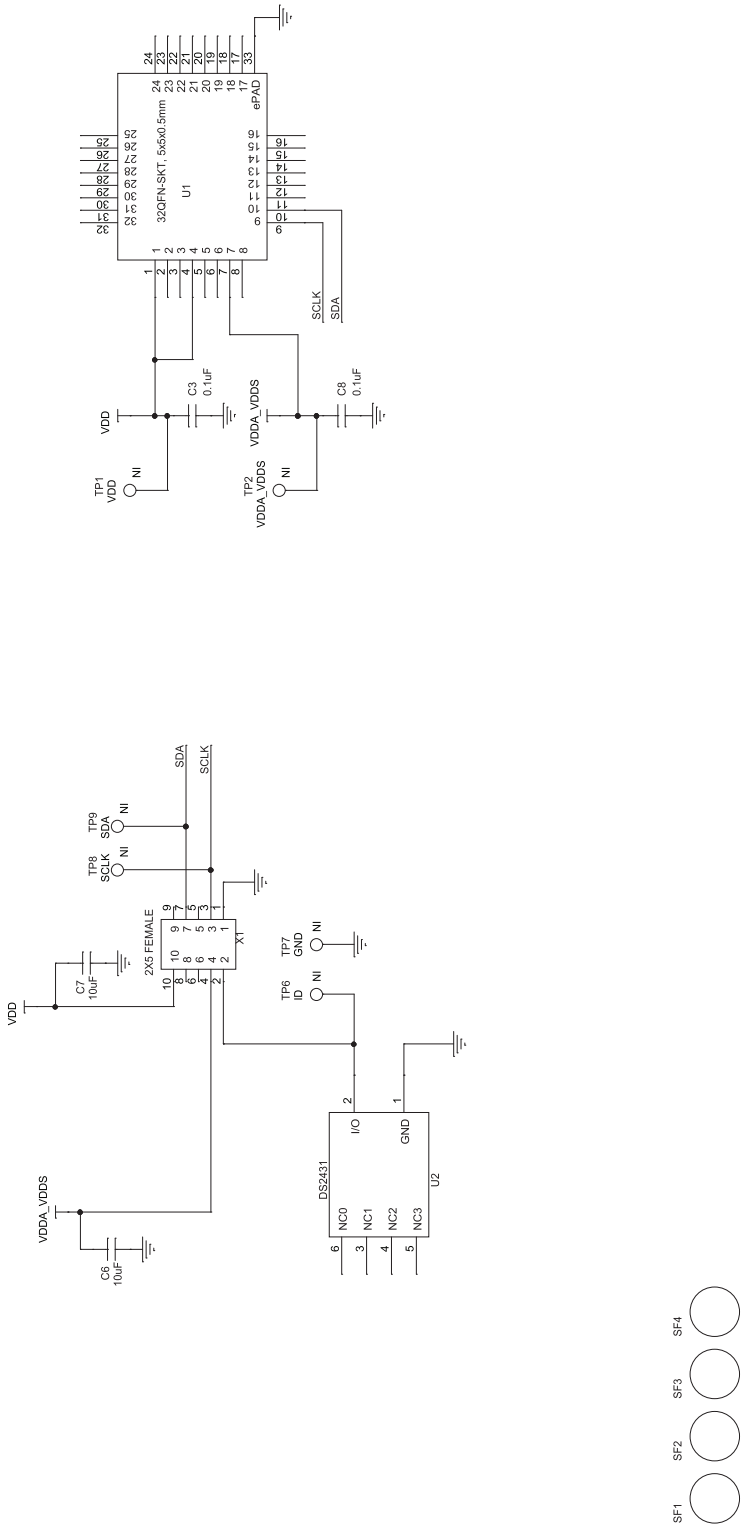

Figure 56. Si5332 32-Pin Socket Board Schematic

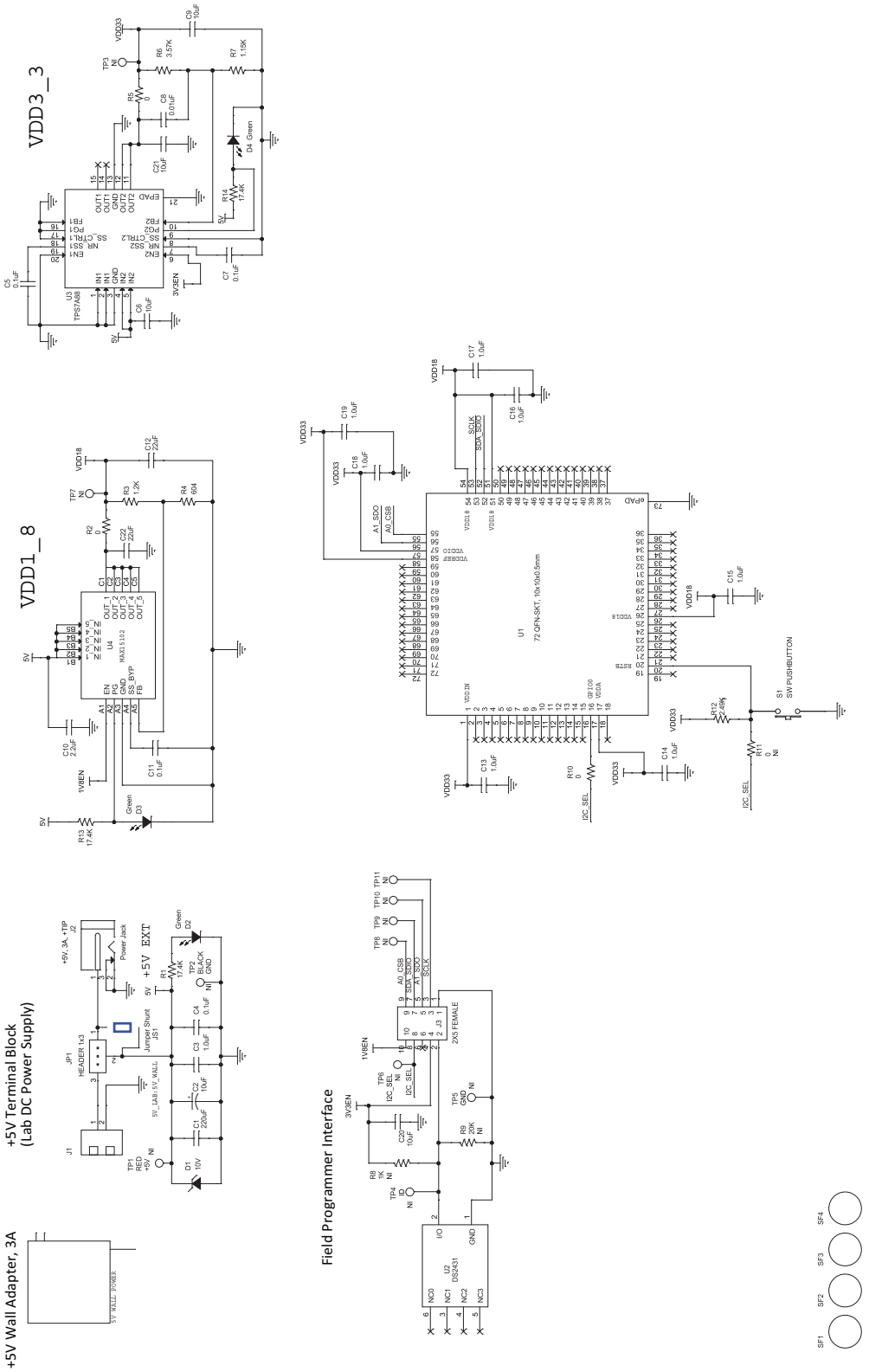

Figure 57. Si55xx 72-Pin Socket Board Schematic

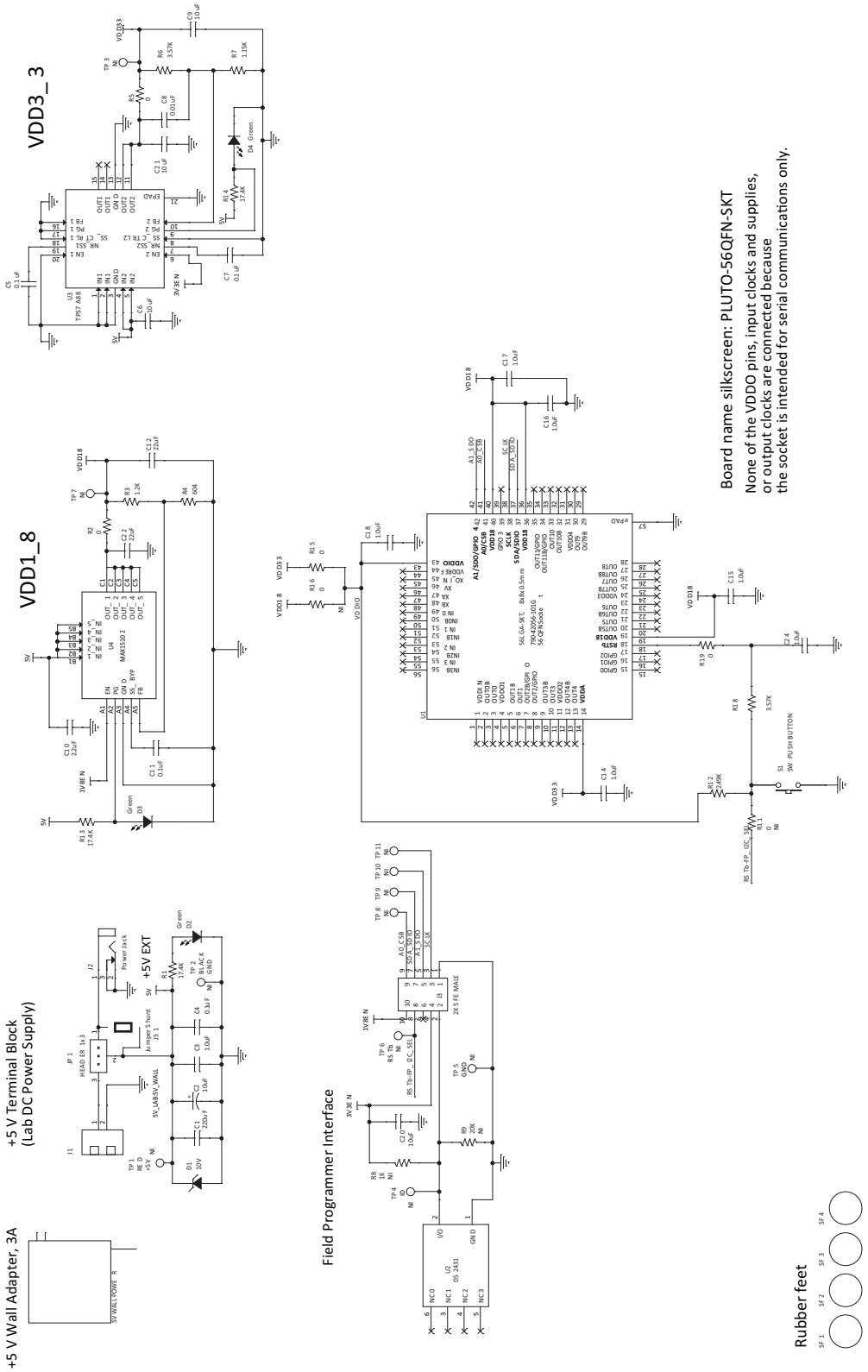

Figure 58. PLUTO-56QFN-SKT Schematic

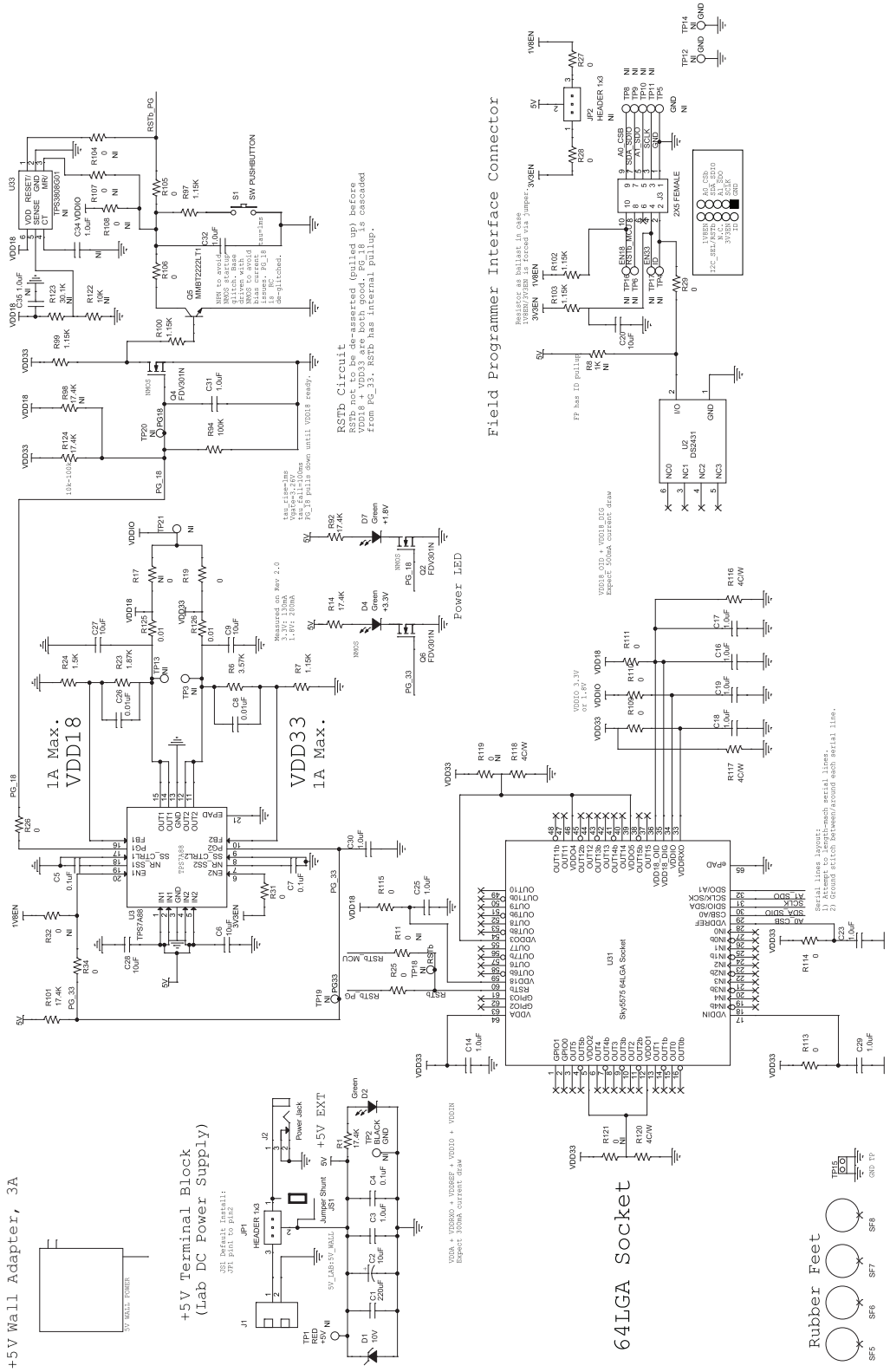

Figure 59. SATURN-64LGA-SKT Schematic

7. Appendix C. Bill of Materials

7.1. Field Programmer Bill of Materials

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	9	C2 C3 C8 C11 C26 C28 C30 C31 C32	1uF		16V	±10%	X7R	C0603	C0603X7R160-105K	Venkel
	3	C24 C27 C29	0.01uF		16V	±20%	X7R	C0603	C0603X7R160-103M	Venkel
	1	C39	33pF		25V	±10%	C0G	C0402	C0402C0G250-330K	Venkel
	9	C4 C6 C12 C13 C14 C35 C36 C37 C38	0.1uF		10V	±10%	X7R	C0402|C0402L	C0402X7R100-104K	Venkel
	2	C5 C25	4.7uF		10V	±20%	X7R	C1206	C1206X7R100-475M	Venkel
	1	C9	10uF		10V	±20%	X7R	C1206	C1206X7R100-106M	Venkel
	2	D14 D15	LTL-14CHJ	20mA				LED-T1-KK	LTL-14CHJ	LITE-ON TECHNOLOGY CORP
	1	D5	SP0503BAHT	300mW	20V		TVS	SOT143-AKKK|SOT143	SP0503BAHTG	Littlefuse
	7	D6 D7 D8 D9 D10 D11 D12	GL05T-E3-08	5A	11V		Dual Common Anode	SOT23-123	GL05T-E3-08	Vishay
	1	FB1	22 Ohm	6000mA			SMT	L0805	BLM21PG220SN1	MuRata
	1	J2	USB Type B				USB	CONN-USB-B	61729-0010BLF	FCI
	1	J3	ENCLOSURE					N/A	Emulator7045	Shanghai Zhongxingda Electronics
	4	R1 R11 R12 R65	1K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1001F	Venkel
	10	R13 R16 R26 R27 R40 R41 R42 R43 R59 R67	10K	1/16W		±1%	ThickFilm	R0402|R0402L	CR0402-16W-1002F	Venkel
	4	R14 R15 R24 R25	2.49K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-2491F	Venkel
	1	R28	1.0	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1R00F	Venkel
	8	R29 R30 R31 R32 R35 R37 R38 R68	0	1A			ThickFilm	R0402|R0402L	CR0402-16W-000	Venkel
	1	R3	100	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1000F	Venkel
	1	R33	4.42K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-4421F	Venkel
	1	R34	9.53K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-9531F	Venkel
	1	R36	5.9K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-5901F	Venkel
	2	R39 R66	1.0	3/4W		±1%	ThickFilm	R1210	CRCW12101R00FKEAHP	Vishay Dale
	2	R44 R47	8.06K	1/16W		±0.1%	±25PPM	R0402	TFCR0402-16W-E-8061B	Venkel
	2	R45 R48	17.4K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1742F	Venkel
	2	R46 R49	21.5K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-2152F	Venkel
	2	R50 R51	20K	1/10W		±1%	ThickFilm	R0603	CR0603-10W-2002F	Venkel
	4	R55 R56 R57 R58	402	1/16W		±1%	ThickFilm	R0402	CR0402-16W-4020F	Venkel
	1	R62	499	1/16W		±1%	ThickFilm	R0402|R0402L	CR0402-16W-4990F	Venkel
	2	R63 R64	470	1/16W		±5%	ThickFilm	R0402	CR0402-16W-471J	Venkel
	2	R9 R10	10.0K	1/10W		±0.1%	±25PPM	R0603	ERA-3AEB103V	Panasonic
	2	SF1 SF2	BUMPER					RUBBER_FOOT_0.250"	SJ5382	3M
	2	SF3 SF4	SPACER					N/A	7363	Keystone Electronics
	1	U1	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	U12	TPS76201	100mA			LDO	SOT5N2.8P0.95	TPS76201DBV	TI
	2	U13 U14	TPS79501	500mA			LDO	DFN8N3.0P0.65E2.4X1.65	TPS79501DRBT	TI
	1	U16	ADG719					SOT6N2.8P0.95	ADG719BRTZ	Analog Devices
	1	U17	NLSV1T244		.9-4.5V		Buffer	UDFN6N1P0.4	NLSV1T244MUTBG	On Semi
	1	U2	C8051F380				MCU	QFP48N9X9P0.5	CF380P1104AGQ	SiLabs
	2	U3 U8	ADG712					TSSOP16N6.4P0.65	ADG712BRU	Analog Devices
	1	U5	LTC4311		5.5V			SC70-6N2.1P0.65	LTC4311CSC6#TRMPBF	Linear Technology
	1	U6	PCA9517D				I2C	SO8N6.0P1.27	PCA9517D	NXP
	1	X1	2X5 Header				Shrouded	CONN2X5-RA-SBH11	SBH11-PBPC-D05-RA-BK	Sullins Connector Solutions

Not Installed Components

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	2	C10 C40	1uF		16V	±10%	X7R	C0603	C0603X7R160-105K	Venkel
NI	1	C7	0.1uF		10V	±10%	X7R	C0402|C0402L	C0402X7R100-104K	Venkel
NI	1	JP1	HEADER 4X1				Header	CONN-1X4	TSW-104-07-T-S	Samtec
NI	2	R60 R61	0	1A			ThickFilm	R0603	CR0603-16W-000	Venkel
NI	5	TP1 TP2 TP3 TP9 TP10	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	1	TP7	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn
NI	1	TP8	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn
NI	1	U4	AD8628		5V		OPAMP	SOT23-5N	AD8628AUJ-R2	Analog Devices

7.2. Si538x4x-64SKT-DK Socket Board BOM

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	6	C1 C2 C3 C4 C5 C6	0.1uF		10V	±10%	X7R	C0402|C0402L	C0402X7R100-104K	Venkel
	2	C7 C8	10uF		10V	±20%	X7R	C1206	C1206X7R100-106M	Venkel
	1	R2	0	1A			ThickFilm	R0402|R0402L	CR0402-16W-000	Venkel
	4	SF1 SF2 SF3 SF4	BUMPER					RUBBER_FOOT_SMALL	SJ61A6	3M
	1	U1	64QFN-SKT, 9x9x0.5mm				QFN	QFN64N9X9P0.5-SKT-WELLS-CTI	790-42064-101G	Sensata
	1	U2	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	X1	2X5 FEMALE				CONN	CONN2X5-FRA-SFH11	SFH11-PBPC-D05-RA-BK	Sullins Connector Solutions
Not Installed Components										
NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	1	R1	1K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1001F	Venkel
NI	1	R3	20K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-2002F	Venkel
NI	3	TP1 TP2 TP3	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	2	TP4 TP5	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn
NI	1	TP6	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn

7.3. Si538x4x-56SKT-DK Socket Board Bill of Materials

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	7	C1 C2 C5 C6 C7 C8 C9	0.1uF		10V	±10%	X7R	C0402|C0402L	C0402X7R100-104K	Venkel
	2	C3 C4	10uF		10V	±20%	X7R	C1206	C1206X7R100-106M	Venkel
	7	R1 R2 R7 R8 R9 R10 R11	1K	1/16W		±1%	ThickFilm	R0603	CR0603-16W-1001F	Venkel
	2	R12 R13	0	1A			ThickFilm	R0603|R0603L	CR0603-16W-000	Venkel
	4	R3 R4 R5 R6	4.7K	1/10W		±1%	ThickFilm	R0603	CR0603-10W-4701F	Venkel
	4	SF1 SF2 SF3 SF4	BUMPER					RUBBER_FOOT_SMALL	SJ61A6	3M
	1	U1	56LGA-SKT, 8x8x0.5mm				LGA	QFN56N8X8P0.5-SKT-WELLS-CTI	790-42056-101G	Sensata
	1	U2	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	X1	2X5 FEMALE				CONN	CONN2X5-FRA-SFH11	SFH11-PBPC-D05-RA-BK	Sullins Connector Solutions
Not Installed Components										
NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	2	TP1 TP2	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	3	TP3 TP5 TP6	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn
NI	1	TP4	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn

7.4. Si538x4x-44SKT-DK Socket Board Bill of Materials

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	5	C1 C2 C3 C4 C5	0.1uF		10V	±10%	X7R	C0402|C0402L	C0402X7R100-104K	Venkel
	2	C6 C7	10uF		10V	±20%	X7R	C1206	C1206X7R100-106M	Venkel
	1	R2	0	1A			ThickFilm	R0402|R0402L	CR0402-16W-000	Venkel
	4	SF1 SF2 SF3 SF4	BUMPER					RUBBER_FOOT_SMALL	SJ61A6	3M
	1	U1	44QFN-SKT, 7x7x0.5mm				QFN	QFN44N7X7P0.5-SKT-WELLS-CTI	790-41044-101G	Sensata
	1	U2	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	X2	2X5 FEMALE				CONN	CONN2X5-FRA-SFH11	SFH11-PBPC-D05-RA-BK	Sullins Connector Solutions
Not Installed Components										
NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	1	R1	1K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1001F	Venkel
NI	1	R3	182	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1820F	Venkel
NI	3	TP1 TP2 TP3	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	3	TP4 TP5 TP6	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn
NI	1	TP7	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn

7.5. Si5332-48SKT-DK Socket Board Bill of Materials

Eval Board Name	SI5332-48SKT
Revision	1.0

CreationDate	Proto Rev	Released
5/18/2017	1.00	0

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	2	C3 C8	0.1uF		10V	±10%	X7R	C0402|C0402L	C0402X7R100-104K	Venkel
	2	C6 C7	10uF		10V	±20%	X7R	C1206	C1206X7R100-106M	Venkel
	4	SF1 SF2 SF3 SF4	BUMPER					RUBBER_FOOT_SMALL	SJ61A6	3M
	1	U1	48QFN-SKT, 6x6x0.4mm				QFN		790-62048-101G	Sensata
	1	U2	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	X1	2X5 FEMALE				CONN	CONN2X5-FRA-SFH11	SFH11-PBPC-D05-RA-BK	Sullins Connector Solutions
Not Installed Components										
NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	4	TP1 TP2 TP8 TP9	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	1	TP6	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn
NI	1	TP7	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn

7.6. Si5332-40SKT-DK Socket Board Bill of Materials

Eval Board Name	SI5332-40SKT
Revision	1.0

CreationDate	Proto Rev	Released
5/18/2017	1.00	0

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	2	C3 C8	0.1uF		10V	±10%	X7R	C0402|C0402L	C0402X7R100-104K	Venkel
	2	C6 C7	10uF		10V	±20%	X7R	C1206	C1206X7R100-106M	Venkel
	4	SF1 SF2 SF3 SF4	BUMPER					RUBBER_FOOT_SMALL	SJ61A6	3M
	1	U1	40QFN-SKT, 6x6x0.5mm				QFN		790-42040-101G	Sensata
	1	U2	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	X1	2X5 FEMALE				CONN	CONN2X5-FRA-SFH11	SFH11-PBPC-D05-RA-BK	Sullins Connector Solutions
Not Installed Components										
NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	4	TP1 TP2 TP8 TP9	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	1	TP6	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn
NI	1	TP7	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn

7.7. Si5332-32SKT-DK Socket Board Bill of Materials

Eval Board Name	SI5332-32SKT
Revision	1.0

CreationDate	Proto Rev	Released
5/18/2017	1.00	0

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	2	C3 C8	0.1uF		10V	±10%	X7R	C0402|C0402L	C0402X7R100-104K	Venkel
	2	C6 C7	10uF		10V	±20%	X7R	C1206	C1206X7R100-106M	Venkel
	4	SF1 SF2 SF3 SF4	BUMPER					RUBBER_FOOT_SMALL	SJ61A6	3M
	1	U1	32QFN-SKT, 5x5x0.5mm				QFN		790-42032-101G	Sensata
	1	U2	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	X1	2X5 FEMALE				CONN	CONN2X5-FRA-SFH11	SFH11-PBPC-D05-RA-BK	Sullins Connector Solutions
Not Installed Components										
NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	4	TP1 TP2 TP8 TP9	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	1	TP6	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn
NI	1	TP7	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn

7.8. Si55xx-72SKT-DK Socket Board Bill of Materials

Eval Board Name	SI55XX-72SKT
Revision	1.0

CreationDate	Proto Rev	Released
8/20/2020	12.00	0

End product must be RoHS compliant

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	1	C1	220uF		6.3V	±20%	X5R	C1210	C1210X5R6R3-227MNE	Venkel
	1	C10	2.2uF		10V	±10%	X7R	C0603	C0603X7R100-225K	Venkel
	2	C12 C22	22uF		6.3V	±20%	X5R	C0603	C1608X5R0J226M080AC	TDK
	1	C2	10uF		25V	±20%	TANT	C6032	T491C106M025ZT	Kemet
	8	C3 C13 C14 C15 C16 C17 C18 C19	1.0uF		6.3V	±10%	X5R	C0402|C0402L	C0402X5R6R3-105K	Venkel
	4	C4 C5 C7 C11	0.1uF		16V	±10%	X7R	C0402	C0402X7R160-104K	Venkel
	4	C6 C9 C20 C21	10uF		6.3V	±20%	X5R	C0603|C0603L	C0603X5R6R3-106M	Venkel
	1	C8	0.01uF		25V	±10%	X7R	C0402	C0402X7R250-103K	Venkel
	1	D1	10V	500mW	10V	5%	Zener	SOD-123	MMSZ4697T1G	On Semi
	3	D2 D3 D4	Green	20mA	3.4V		SMT, ChipLED	LED-HSMX-C170	HSMQ-C170	Avago Technologies
	1	J1	CONN TRBLK 2	24A			TERM BLK	CONN-TB-1711026	1711026	PHOENIX CONTACT
	1	J2	Power Jack	2.5A			BARREL	CONN-3-PWR|PJ-002A	PJ-002A	CUI
	1	J3	2X5 FEMALE				CONN	CONN2X5-FRA-SFH11	SFH11-PBPC-D05-RA-BK	Sullins Connector Solutions
	1	JP1	HEADER 1x3				Header	CONN-1X3	TSW-103-07-T-S	Samtec
	1	JS1	Jumper Shunt				Shunt	N/A|SHUNT	SNT-100-BK-T	Samtec
	3	R1 R13 R14	17.4K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1742F	Venkel
	1	R10	0	1A			ThickFilm	R0603|R0603L	CR0603-16W-000	Venkel
	1	R12	2.49K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-2491F	Venkel
	2	R2 R5	0	1W			ThickFilm	R2512	RMCF2512ZT0R00	Stackpole Electronics Inc.
	1	R3	1.2K	1/16W		±5%	ThickFilm	R0402	CR0402-16W-122J	Venkel
	1	R4	604	1/16W		±1%	ThickFilm	R0402	CR0402-16W-6040F	Venkel
	1	R6	3.57K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-3571FT	Venkel
	1	R7	1.15K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1151FT	Venkel
	1	S1	SW PUSHBUTTON	50mA	12Vdc		Tactile	SW4N10P4.5	2-1437565-8	Tyco Electronics
	4	SF1 SF2 SF3 SF4	BUMPER				FOOT	RUBBER_FOOT_SMALL	SJ61A6	3M
	1	U1	72 QFN-SKT, 10x10x0.5mm				QFN	QFN72N10X10P0.5-SKT-WELLS-CTI	790-42072-101G	Sensata
	1	U2	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	U3	TPS7A88	1A			LDO	QFN20N4X4P0.5E2.7	TPS7A88	TI
	1	U30	WSU050-3000	15W	5V		MISC		WSU050-3000	TRIAD
	1	U4	MAX15102EWL+	2A			LDO	WLBGA15N1.6X2.7P0.5	MAX15102EWL+	Maxim

Not Installed Components

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	1	R11	0	1A			ThickFilm	R0402|R0402L	CR0402-16W-000	Venkel
NI	1	R8	1K	1/16W		±1%	ThickFilm	R0402|R0402L	CR0402-16W-1001F	Venkel
NI	1	R9	20K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-2002F	Venkel
NI	7	TP1 TP3 TP7 TP8 TP9 TP10 TP11	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	2	TP2 TP5	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn
NI	2	TP4 TP6	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn

7.9. PLUTO-56QFN-SKY Bill of Materials

Eval Board Name	PLUTO-56QFN-SKT
Revision	1.0

CreationDate	Proto Rev	Released
2/28/2024	2.00	0

End product must be RoHS compliant

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	1	C1	220uF		6.3V	±20%	X5R	C1210	C1210X5R6R3-227MNE	Venkel
	1	C10	2.2uF		10V	±10%	X7R	C0603	C0603X7R100-225K	Venkel
	2	C12 C22	22uF		6.3V	±20%	X5R	C0603	C1608X5R0J226M080AC	TDK
	1	C2	10uF		25V	±20%	TANT	C6032	T491C106M025ZT	Kemet
	7	C3 C14 C15 C16 C17 C18 C24	1.0uF		6.3V	±10%	X5R	C0402|C0402L	C0402X5R6R3-105K	Venkel
	4	C4 C5 C7 C11	0.1uF		16V	±10%	X7R	C0402	C0402X7R160-104K	Venkel
	4	C6 C9 C20 C21	10uF		6.3V	±20%	X5R	C0603|C0603L	C0603X5R6R3-106M	Venkel
	1	C8	0.01uF		25V	±10%	X7R	C0402	C0402X7R250-103K	Venkel
	1	D1	10V	500mW	10V	5%	Zener	SOD-123	MMSZ4697T1G	On Semi
	3	D2 D3 D4	Green	20mA	3.4V		SMT, ChipLED	LED-HSMX-C170	HSMQ-C170	Avago Technologies
	1	J1	CONN TRBLK 2	24A			TERM BLK	CONN-TB-1711026	1711026	PHOENIX CONTACT
	1	J2	Power Jack	2.5A			BARREL	CONN-3-PWR|PJ-002A	PJ-002A	CUI
	1	J3	2X5 FEMALE				CONN	CONN2X5-FRA-SFH11	SFH11-PBPC-D05-RA-BK	Sullins Connector Solutions
	1	JP1	HEADER 1x3				Header	CONN-1X3	TSW-103-07-T-S	Samtec
	1	JS1	Jumper Shunt				Shunt	SHUNT	SNT-100-BK-T	Samtec
	3	R1 R13 R14	17.4K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1742F	Venkel
	1	R12	2.49K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-2491F	Venkel
	2	R15 R19	0	1A			ThickFilm	R0402|R0402L	CR0402-16W-000	Venkel
	2	R2 R5	0	1W			ThickFilm	R2512	RMCF2512ZT0R00	Stackpole Electronics Inc.
	1	R3	1.2K	1/16W		±5%	ThickFilm	R0402	CR0402-16W-122J	Venkel
	1	R4	604	1/16W		±1%	ThickFilm	R0402	CR0402-16W-6040F	Venkel
	2	R6 R18	3.57K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-3571FT	Venkel
	1	R7	1.15K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1151FT	Venkel
	1	S1	SW PUSHBUTTON	50mA	12Vdc		Tactile	SW4N10P4.5	2-1437565-8	Tyco Electronics
	4	SF1 SF2 SF3 SF4	BUMPER				FOOT	RUBBER_FOOT_SMALL	SJ61A6	3M
	1	U1	56LGA-SKT, 8x8x0.5mm				LGA	QFN56N8X8P0.5-SKT-WELLS-CTI	790-42056-101G	Sensata
	1	U2	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	U3	TPS7A88	1A			LDO	QFN20N4X4P0.5E2.7	TPS7A88	TI
	1	U30	WSU050-3000	15W	5V		MISC		WSU050-3000	TRIAD
	1	U4	MAX15102EWL+	2A			LDO	WLBGA15N1.6X2.7P0.5	MAX15102EWL+	Maxim

Not Installed Components

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	2	R11 R16	0	1A			ThickFilm	R0402|R0402L	CR0402-16W-000	Venkel
NI	1	R8	1K	1/16W		±1%	ThickFilm	R0402|R0402L	CR0402-16W-1001F	Venkel
NI	1	R9	20K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-2002F	Venkel
NI	7	TP1 TP3 TP7 TP8 TP9 TP10 TP11	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	2	TP2 TP5	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn
NI	2	TP4 TP6	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn

7.10. SATURN-64LGA-SKY Bill of Materials

Eval Board Name	SATURN 64LGA SKT
Revision	3.1

CreationDate	Proto Rev	Released
6/27/2025	1.00	0

End product must be RoHS compliant

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
	1	C1	220uF		6.3V	±20%	X5R	C1210	C1210X5R6R3-227MNE	Venkel
	1	C2	10uF		25V	±20%	TANT	C6032	T491C106M025ZT	Kemet
	12	C3 C14 C16 C17 C18 C19 C23 C25 C29 C30 C31 C32	1.0uF		6.3V	±10%	X5R	C0402|C0402L	C0402X5R6R3-105K	Venkel
	3	C4 C5 C7	0.1uF		16V	±10%	X7R	C0402	C0402X7R160-104K	Venkel
	5	C6 C9 C20 C27 C28	10uF		6.3V	±20%	X5R	C0603|C0603L	C0603X5R6R3-106M	Venkel
	2	C8 C26	0.01uF		25V	±10%	X7R	C0402	C0402X7R250-103K	Venkel
	1	D1	10V	500mW	10V	5%	Zener	SOD-123	MMSZ4697T1G	On Semi
	3	D2 D4 D7	Green	20mA	3.4V		SMT, ChipLED	LED-HSMX-C170	HSMQ-C170	Avago Technologies
	1	J1	CONN TRBLK 2	24A			TERM BLK	CONN-TB-1711026	1711026	PHOENIX CONTACT
	1	J2	Power Jack	2.5A			BARREL	CONN-3-PWR|PJ-002A	PJ-002A	CUI
	1	J3	2X5 FEMALE				CONN	CONN2X5-FRA-SFH11	SFH11-PBPC-D05-RA-BK	Sullins Connector Solutions
	1	JP1	HEADER 1x3				Header	CONN-1X3	TSW-103-07-T-S	Samtec
	1	JS1	Jumper Shunt				Shunt	SHUNT	SNT-100-BK-T	Samtec
	3	Q2 Q4 Q6	FDV301N	220mA	25V		N-CHNL	SOT23-GSD	FDV301N	Fairchild
	1	Q5	MMBT2222LT1	600mA	30V		NPN	SOT23-BEC	MMBT2222LT1	On Semi
	5	R1 R14 R92 R101 R124	17.4K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1742F	Venkel
	4	R116 R117 R118 R120	4C/W				THERMAL JUMPER	R0612	THJP0612AST1	Vishay Dale
	2	R125 R126	0.01	1W		±1%	ThickFilm	R2512	LCR2512-R010F	Venkel
	16	R19 R25 R26 R27 R28 R29 R31 R34 R105 R106 R109 R110 R111 R113 R114 R115	0	1A			ThickFilm	R0402|R0402L	CR0402-16W-000	Venkel
	1	R23	1.87K	1/10W		±1%	ThickFilm	R0603	CR0603-10W-1871F	Venkel
	1	R24	1.5K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1501F	Venkel
	1	R6	3.57K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-3571FT	Venkel
	6	R7 R97 R99 R100 R102 R103	1.15K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1151FT	Venkel
	1	R94	100K	1/16W		±5%	ThickFilm	R0402	CR0402-16W-104J	Venkel
	1	S1	SW PUSHBUTTON	50mA	12Vdc		Tactile	SW4N10P4.5	2-1437565-8	Tyco Electronics
	4	SF5 SF6 SF7 SF8	BUMPER				FOOT	RUBBER_FOOT-0.65"	BS11BL04X08RP	Bumper Specialties Inc.
	1	U2	DS2431					SOJ6N4.45P1.27	DS2431P+	Maxim
	1	U3	TPS7A88	1A			LDO	QFN20N4X4P0.5E2.7	TPS7A88	TI
	1	U30	WSU050-3000	15W	5V		MISC		WSU050-3000	TRIAD
	1	U31	Sky5575 64LGA Socket				POGO	LGA64N9X9P0.5E7.25-BOYD	716PSH06409-500-B0	Boyd Shin-Yokohama

Not Installed Components

NI	Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	PCB_Footprint	ManufacturerPN	Manufacturer
NI	2	C34 C35	1.0uF		6.3V	±10%	X5R	C0402|C0402L	C0402X5R6R3-105K	Venkel
NI	1	JP2	HEADER 1x3				Header	CONN-1X3	TSW-103-07-T-S	Samtec
NI	8	R11 R17 R32 R104 R107 R108 R119 R121	0	1A			ThickFilm	R0402|R0402L	CR0402-16W-000	Venkel
NI	1	R122	10K	1/16W		±5%	ThickFilm	R0402	CR0402-16W-103J	Venkel
NI	1	R123	30.1K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-3012FT	Venkel
NI	1	R8	1K	1/16W		±1%	ThickFilm	R0402|R0402L	CR0402-16W-1001F	Venkel
NI	1	R98	17.4K	1/16W		±1%	ThickFilm	R0402	CR0402-16W-1742F	Venkel
NI	8	TP1 TP3 TP8 TP9 TP10 TP11 TP13 TP21	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
NI	7	TP2 TP5 TP12 TP14 TP18 TP19 TP20	BLACK				Loop	TESTPOINT	151-203-RC	Kobiconn
NI	4	TP4 TP6 TP16 TP17	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn
NI	1	U33	TPS3808G01				RESET	SOT6N2.8P0.95	TPS3808G01DBV	TI

8. Revision History

Revision	Date	Description
B	October, 2025	Added support for SKY62xxx/63xxx/69xxx
A	November, 2023	Initial release