C8051F53x/52x

C8051F530A DEVELOPMENT KIT USER'S GUIDE

1. Relevant Devices

The C8051F530 Development Kit is intended as a development platform for microcontrollers in the C8051F53x/52x MCU family. Code developed on the C8051F530 can be easily ported to the other members of this MCU family.

2. Kit Contents

The C8051F530 Development Kit contains the following items:

- C8051F530A Target Board
- C8051Fxxx Development Kit Quick-Start Guide
- AC to DC Power Adapter
- USB Debug Adapter (USB to Debug Interface)
- USB Cable

The development kit target board contains two C8051F530 microcontrollers that can communicate through an LIN network. One of the C8051F530 (U2) can also be connected to a CP2102 USB to UART bridge and directly connected to two analog signals and a Voltage Reference Signal Input.

3. Hardware Setup Using a USB Debug Adapter

The target board is connected to a PC running the Silicon Laboratories IDE via the USB Debug Adapter as shown in Figure 1.

1. Connect the USB Debug Adapter to one of the **DEBUG** connectors on the target board (**HDR1** or **HDR2**) with the 10-pin ribbon cable. The recommended connection is to the **HDR2** (connected to U2) as this microcontroller can be connected to the CP2102 USB to UART bridge.

2. Verify that shorting blocks are installed on J13 and J14 to supply power to the target devices.

3. Connect one end of the USB cable to the USB connector on the USB Debug Adapter.

4. Connect the other end of the USB cable to a USB Port on the PC.

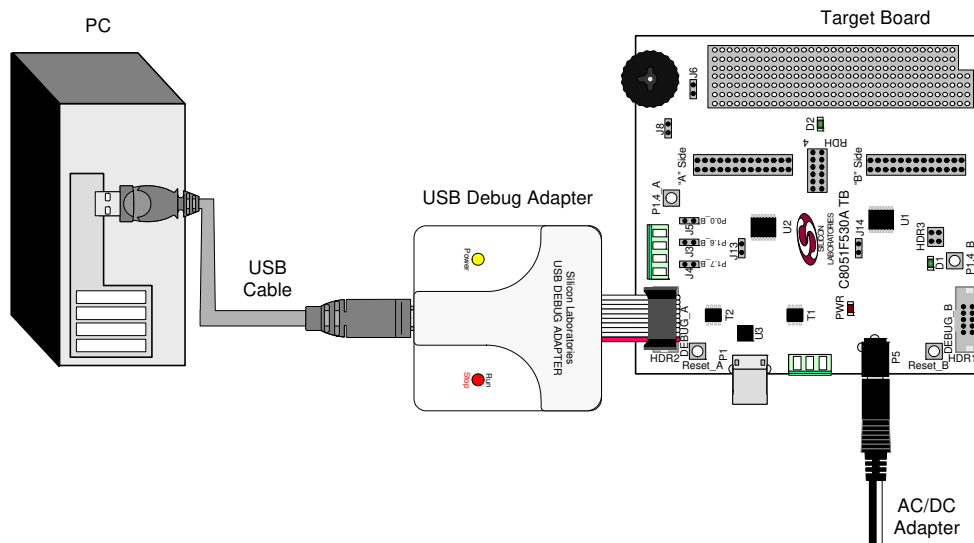5. Connect the ac/dc power adapter to power jack **P5** on the target board.

Figure 1. Hardware Setup using a USB Debug Adapter

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Notes:
1. Use the **Reset** button in the IDE to reset the target when connected using a USB Debug Adapter.
2. Remove power from the target board and the USB Debug Adapter before connecting or disconnecting the ribbon cable from the target board. Connecting or disconnecting the cable when the devices have power can damage the device and/or the USB Debug Adapter.

4. Software Setup

Simplicity Studio greatly reduces development time and complexity with Silicon Labs EFM32 and 8051 MCU products by providing a high-powered IDE, tools for hardware configuration, and links to helpful resources, all in one place.

Once Simplicity Studio is installed, the application itself can be used to install additional software and documentation components to aid in the development and evaluation process.
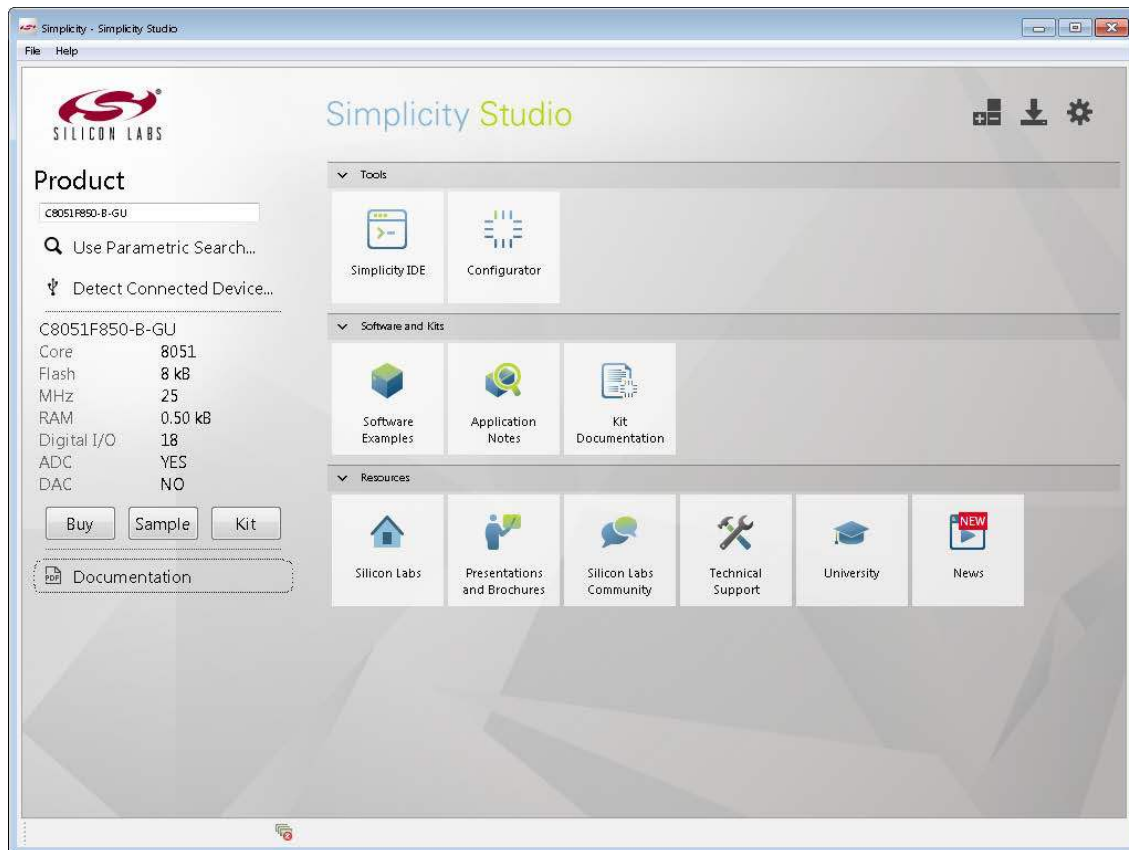

Figure 2. Simplicity Studio

The following Simplicity Studio components are required for the C8051F530 Development Kit:

- 8051 Products Part Support
- Simplicity Developer Platform

Download and install Simplicity Studio from www.silabs.com/8bit-software or www.silabs.com/simplicity-studio. Once installed, run Simplicity Studio by selecting **Start**→**Silicon Labs**→**Simplicity Studio**→**Simplicity Studio** from the start menu or clicking the **Simplicity Studio** shortcut on the desktop. Follow the instructions to install the software and click **Simplicity IDE** to launch the IDE.

The first time the project creation wizard runs, the **Setup Environment** wizard will guide the user through the process of configuring the build tools and SDK selection.

In the **Part Selection** step of the wizard, select from the list of installed parts only the parts to be used during development. Choosing parts and families in this step affects the displayed or filtered parts in the later device selection menus. Choose the C8051F53x/52x family by checking the **C8051F53x/52x** check box. Modify the part selection at any time by accessing the **Part Management** dialog from the **Window**→**Preferences**→**Simplicity Studio**→**Part Management** menu item.

Simplicity Studio can detect if certain toolchains are not activated. If the **Licensing Helper** is displayed after completing the **Setup Environment** wizard, follow the instructions to activate the toolchain.

4.1. Running Blinky

Each project has its own source files, target configuration, SDK configuration, and build configurations such as the **Debug** and **Release** build configurations. The IDE can be used to manage multiple projects in a collection called a workspace. Workspace settings are applied globally to all projects within the workspace. This can include settings, such as key bindings, window preferences, and code style and formatting options. Project actions, such as build and debug, are context-sensitive. For example, the user must select a project in the **Project Explorer** view in order to build that project.

To create a project based on the Blinky example, perform the following steps:

1. Click the **Software Examples** tile from the Simplicity Studio home screen.
2. In the **Kit** drop-down, select **C8051F530A Development Kit**; in the **Part** drop-down, select **C8051F530**, and in the **SDK** drop-down, select the desired SDK. Click **Next**.
3. Select **Example**, and click **Next**.
4. Under **C8051F530A Development Kit**, select **F52x-53x Blinky**; click **Next**, and click **Finish**.
5. Click on the project in the **Project Explorer**, and click **Build** (the hammer icon in the top bar). Alternatively, go to **Project**→**Build Project**.
6. Click **Debug** to download the project to the hardware and start a debug session.
7. Press the **Resume** button to start the code running. The LED should blink.

8. Press the **Suspend** button to stop the code.

9. Press the **Reset the device** button to reset the target MCU.

10. Press the **Disconnect** button to return to the development perspective.

4.2. Simplicity Studio Help

Simplicity Studio includes detailed help information and device documentation within the tool. The help contains descriptions for each dialog window. To view the documentation for a dialog, click the question mark icon in the window:

This will open a pane specific to the dialog with additional details.

The documentation within the tool can also be viewed by going to **Help**→**Help Contents** or **Help**→**Search**.

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4.3. CP210x USB to UART VCP Driver Installation

The Target Board includes a Silicon Labs CP210x USB-to-UART Bridge Controller. Device drivers for the CP210x need to be installed before the PC software can communicate with the MCU through the UART interface.

1. After opening Simplicity Studio for the first time, a dialog will prompt to install the CP210x drivers. Click **Yes**. The drivers can also be installed at any time by going to **Help→Install Drivers→CP210x VCP USB Drivers**.

2. Accept the license agreement and follow the steps to install the driver on the system. The installer will let you know when your system is up to date. The driver files included in this installation have been certified by Microsoft.

3. To complete the installation process, connect the included USB cable between the host computer and the USB connector (P4) on the Target Board. Windows will automatically finish the driver installation. Information windows will pop up from the taskbar to show the installation progress.

4. If necessary, the driver files can be uninstalled by selecting **Windows Driver Package—Silicon Laboratories...** option in the **Programs and Features** window.

4.4. Configuration Wizard 2

The Configuration Wizard 2 is a code generation tool for all of the Silicon Laboratories devices. Code is generated through the use of dialog boxes for each of the device's peripherals.
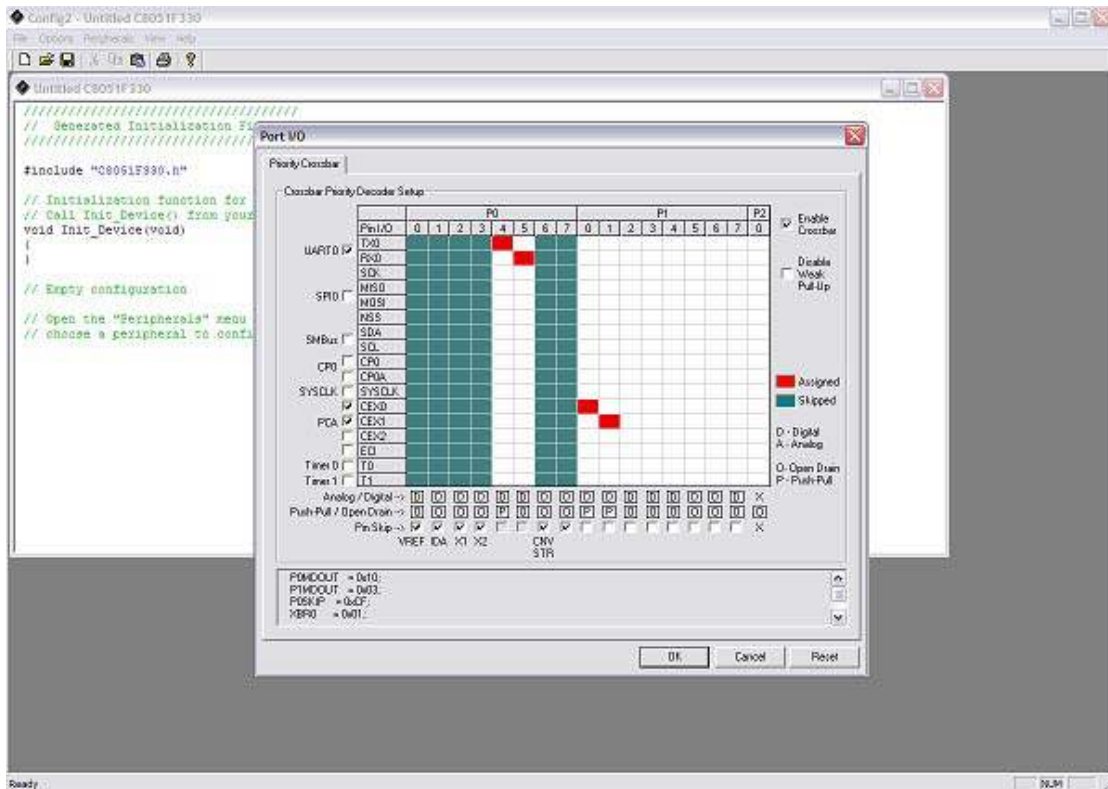

Figure 3. Configuration Wizard 2 Utility

The Configuration Wizard 2 utility helps accelerate development by automatically generating initialization source code to configure and enable the on-chip resources needed by most design projects. In just a few steps, the wizard creates complete startup code for a specific Silicon Laboratories MCU. The program is configurable to provide the output in C or assembly language. For more information, refer to the Configuration Wizard documentation. Documentation and software is available on the kit CD and from the downloads web page: www.silabs.com/mcudownloads.

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5. Target Board

The C8051F52xA-53xA Development Kit includes a target board with two C8051F530A devices preinstalled for evaluation and preliminary software development. Numerous input/output (I/O) connections are provided to facilitate prototyping using the target board. Refer to Figure 4 for the locations of the various I/O connectors.

Table 1. Target Board Part Summary

Part	Description
P5	Power connector (Accepts input from 7 to 15 VDC unregulated power adapter.)
PWR	Red Power-on LED (D3)
TB1	LIN connector
U5	5 V Voltage Regulator
A Side	
J2	28-pin Expansion I/O connector for U2
HDR2	Debug connector for Debug Adapter Interface
P1.3_A	Green LED (D2)
Reset_A	Reset button
P1.4_A	Push button
R32	Potentiometer for P1.2_A
J6, J8	Connects R32 (potentiometer) to U2 and +5 V
J13	Connects power to U2
J11, J12	Connects external crystal to U2 pins P0.7_A and P1.0_A
J3	Connects analog channel 1 to U2 P1.6_A
J4	Connects analog channel 2 to U2 P1.7_A
J5	Connects VREFIN to U2 P0.0_A
TB2	Analog input connector
HDR4	Connector block for serial port connection, Green LED, and push-button
U3	Silicon Laboratories CP2102 USB-to-UART Bridge
P1	USB connector to serial interface (CP2102)
USB ACTIVE	Red USB Active LED (D4) (CP2102)
T2	LIN transceiver
U2	C8051F530A "A" Side

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Table 1. Target Board Part Summary

Part	Description
B Side	
J1	26-pin Expansion I/O connector for U1
HDR1	Debug connector for Debug Adapter Interface
P1.3_B	Green LED (D1)
Reset_B	Reset button
P1.4_B	Push button
J14	Connects power to U1
J9, J10	Connects external crystal to U1 pins P0.7_B and P1.0_B
HDR3	Green LED and push-button connector block
T1	LIN transceiver
U1	C8051F530A "B" Side

5.1. Target Board Shorting Blocks: Factory Defaults

The C8051F530A target board comes from the factory with preinstalled shorting blocks on many headers. Figure 4 shows the positions of the factory default shorting blocks.
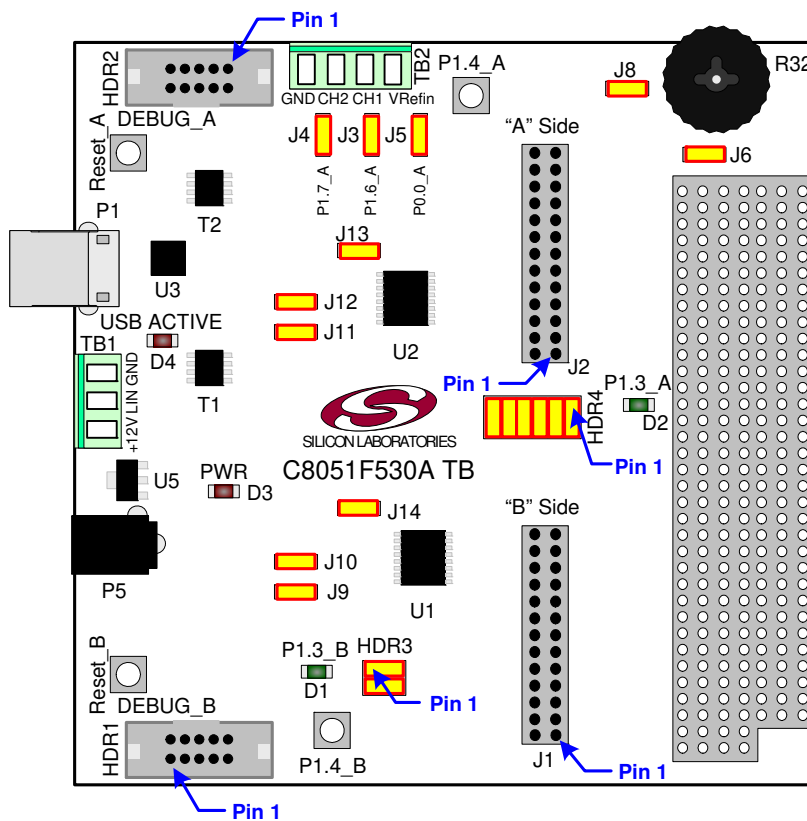

Figure 4. C8051F530A Target Board

5.2. System Clock Sources

The C8051F530A device installed on the target board features a calibrated programmable internal oscillator that is enabled as the system clock source on reset. After reset, the internal oscillator operates at a frequency of 191.4 kHz (±0.5%) by default but may be configured by software to operate at other frequencies. Therefore, in many applications, an external oscillator is not required. However, if you wish to operate the C8051F530A device at a frequency not available with the internal oscillator, an external crystal may be used. Refer to the C8051F52x/52xA/53x/53xA data sheet for more information on configuring the system clock source.

The target board is designed to facilitate the installation of external crystals. Install the crystals at the pads marked Y1 or Y2. Install a 10 MΩ resistor at R17 or R22, and install capacitors at C29 and C30 or C34 and C35 using values appropriate for the crystals selected. Headers J9, J10, J11, and J12 connect the external crystal pins to the general purpose I/O headers (J1 and J2). If the external crystal is in use, these headers should not be populated. Refer to the C8051F52x/52xA/53x/53xA data sheet for more information on the use of external oscillators.

5.3. Switches and LEDs

Four switches are provided on the target board.

Switch RESET_A is connected to the RESET pin of the C8051F530A A-Side (U2).

Switch RESET_B is connected to the RESET pin of the C8051F530A B-Side (U1).

Pressing RESET_A or RESET_B puts the attached device into its hardware-reset state.

Switches P1.4_A and P1.4_B are connected to the C8051F530A parts (U1 and U2) general purpose I/O (GPIO) pins through headers. Pressing P1.4_A or P1.4_B generates a logic low signal on the port pin of the respective microcontroller.

Remove the shorting block from the header to disconnect P1.4_A or P1.4_B from the port pins. The port pin signals are also routed to pins on the J1 and J2 I/O connectors. See Table 2 for the port pins and headers corresponding to each switch.

Four LEDs are also provided on the target board. The red LED labeled PWR is used to indicate a power connection to the target board. The green LEDs labeled D1 and D2 are connected to the C8051F530A's GPIO pins through headers. Remove the shorting blocks from the headers to disconnect the LEDs from the port pins. The port pin signals are also routed to pins on the J1 and J2 I/O connectors. The red LED labeled USB ACTIVE is used to indicate that the CP2102 USB-to-UART bridge is properly connected to a PC and is ready for communication. See Table 2 for the port pins and headers corresponding to each LED.

A potentiometer (R32) is provided on the target board. Header J8 connects the potentiometer to +5 V, and header J6 connects the potentiometer to the P1.2_A pin of the U2 A-Side C8051F530A microcontroller.

Table 2. Target Board I/O Descriptions

Description	I/O	Header
Reset_A	U2-Reset	none
Reset_B	U1-Reset	none
P1.4_A	U2-P1.4	HDR4[3–4]
P1.4_B	U1-P1.4	HDR3[3–4]
Green LED D2	U2-P1.3	HDR4[1–2]
Green LED D1	U1-P1.3	HDR3[1–2]
Red LED D3	PWR	none
Red LED D4	USB ACTIVE	none
Potentiometer R32	U2-P1.2	J6, J8

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5.4. Expansion I/O Connectors (J1, J2)

The two Expansion I/O connectors J1 (26 pins) and J2 (28 pins) provide access to all signal pins of the C8051F530A devices. Pins for V_{DD}, GND, 5 V, Reset, Vbat, LIN, 3.3 V, and VREFIN are also available. A small through-hole prototyping area is also provided.

All I/O signals routed to connectors J1 and J2 are also routed to through-hole connection points between J1 and J2 and the prototyping area (see Figure 4). Each connection point is labeled indicating the signal available at the connection point. Table 3 lists the pin descriptions for J1 and J2.

Table 3. Pin Descriptions for J1 and J2

J1				J2			
Pin #	Description	Pin #	Description	Pin #	Description	Pin #	Description
1	P0.0_B	14	P1.5_B	1	P0.0_A	15	P1.6_A
2	P0.1_B	15	P1.6_B	2	P0.1_A	16	P1.7_A
3	P0.2_B	16	P1.7_B	3	P0.2_A	17	+5V
4	P0.3_B	17	+5V	4	P0.3_A	18	RST/C2CLK_A
5	P0.4_B	18	RST/C2CLK_B	5	P0.4_A	19	VBAT
6	P0.5_B	19	VBAT	6	P0.5_A	20	LIN
7	P0.6_B	20	LIN	7	P0.6_A	21	VREFIN
8	P0.7_B	21	NC	8	P0.7_A	22	VREGOUT_A
9	P1.0_B	22	VREGOUT_B	9	P1.0_A	23	+3.3V
10	P1.1_B	23	NC	10	P1.1_A	24	NC
11	P1.2_B	24	NC	11	P1.2_A	25	NC
12	P1.3_B	25	GND	12	P1.3_A	26	NC
13	P1.4_B	26	GND	13	P1.4_A	27	GND
				14	P1.5_A	28	GND

5.5. Target Board DEBUG Interface (HDR1, HDR2)

The DEBUG connectors (HDR1 and HDR2) provide access to the DEBUG (C2) pins of the C8051F530A parts. They are used to connect the USB Debug Adapter to the target board for in-circuit debugging and Flash programming. Table 4 shows the DEBUG pin definitions.

Table 4. DEBUG Connector Pin Descriptions

Pin #	Description
1	+3 VD (+3.3 VDC)
2, 3, 9	GND (Ground)
4	C2D
5	$\overline{\text{RST}}$ (Reset)
6	P0.6
7	C2CK
8	Not Connected
10	USB Power

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5.6. USB to Serial Connector (P1, HDR4)

A USB-to-Serial bridge interface is provided. A B-type USB connector (P1), a CP2102, and related circuits are provided to facilitate the serial connection between a PC and the U2 A-Side C8051F530A microcontroller on the target board. The RX, TX, CTS, and RTS signals of the UART side of the Bridge (CP2102) may be connected to the microcontroller by installing shorting blocks on HDR4 as shown in Table 5.

Table 5. UART Connections

HDR3	
Connection	**Signals**
5–6	P0.4_A to TX_A
7–8	P0.5_A to RX_A
9–10	P1.1_A to RTS_A
11–12	P1.2_A to CTS_A

The BUS-Powered CP2102 uses the 5 V provided by the USB interface.

5.7. Analog I/O (TB2, J3, J4, J5)

The Analog connector block (TB2) and headers J3, J4, and J5 provide Analog inputs to the C8051F530A (U2) as shown in Table 6. Headers J3, J4, and J5 connect the inputs from the Analog connector to the microcontroller pins.

Table 6. Analog I/O Connections

TB2			
Signal	**Connection**	**I/O**	**Shorting Block**
Vrefin	External Reference Input <u>or</u> Internal Reference Output	P0.0_A	J5
CH1	Analog Input 1	P1.6_A_MC	J3
CH2	Analog Input 1	P1.7_A_MC	J4
GND	Ground	GND	—

5.8. Power Supply Options (P5, TB1, J13, J14)

The target board provides two options of power supply. The first option is to use the provided 9 V power supply attached to the P5 connector. The second option is to use an external 12 V (7.5 V minimum) connected to the TB1 terminal block (pins 1 and 3).

Headers J13 and J14 connect the +5 V power supply to the VREGIN pins on U1 and U2. These headers can be populated to supply power directly or depopulated to measure the operating current drawn by the corresponding C8051F530A device.

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5.9. LIN Connectivity (TB1)

The C8051F530A Target Board has two C8051F530A devices (U1 and U2) and two LIN transceivers (T1 and T2) to provide LIN connectivity on the target board. These devices can also be interfaced to another LIN bus using the TB1 terminal block.

Table 7. LIN Connections

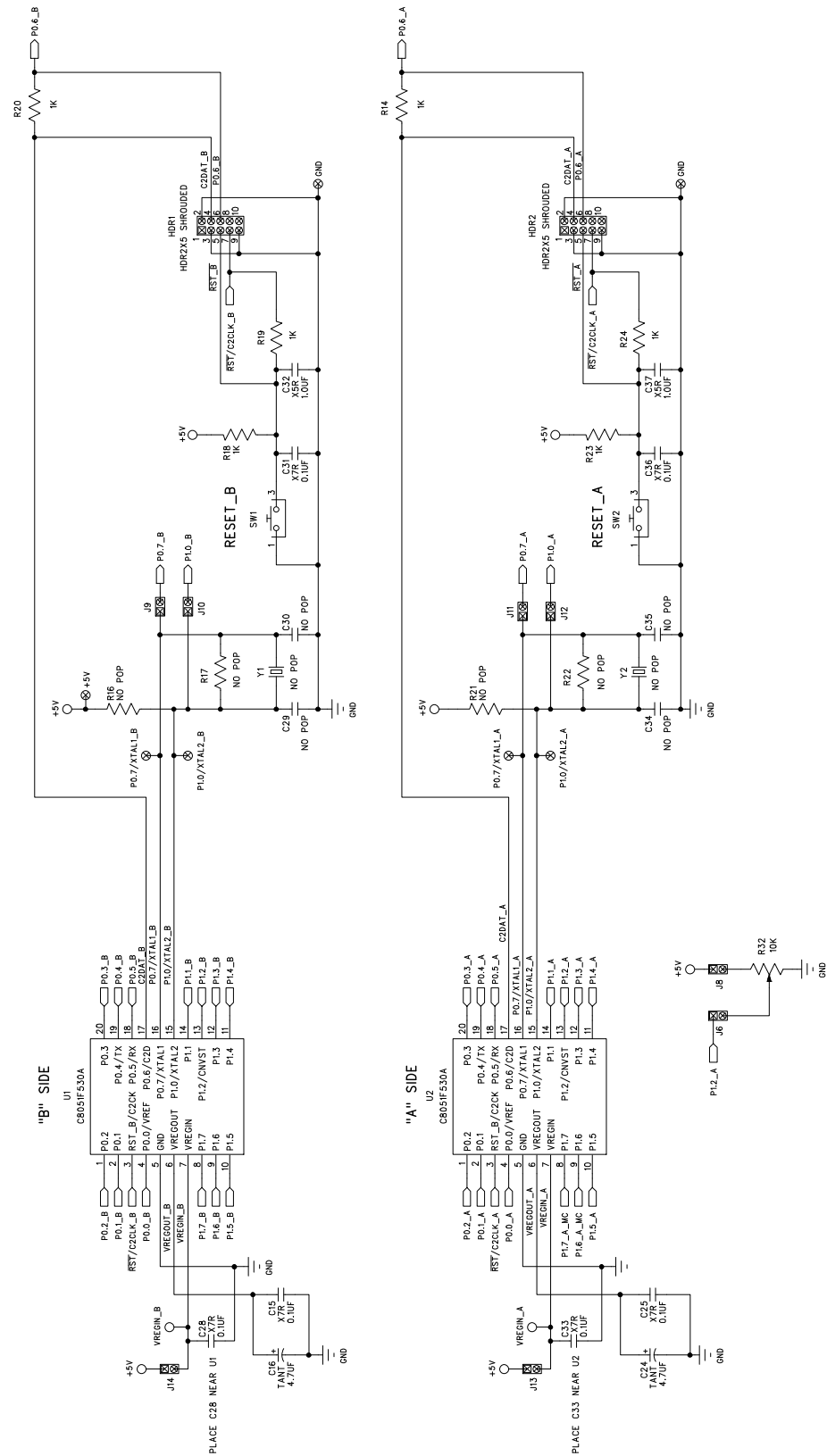| TB1	
Signal	**Connection**
+12V	Supplies 12 V (7.5 V minimum) to the target board. This can be connected to the power supply of another LIN bus or any external supply.
LIN	Connects the 12 V LIN bus signal to the T1 and T2 LIN transceivers.
GND	Ground

6. Schematics
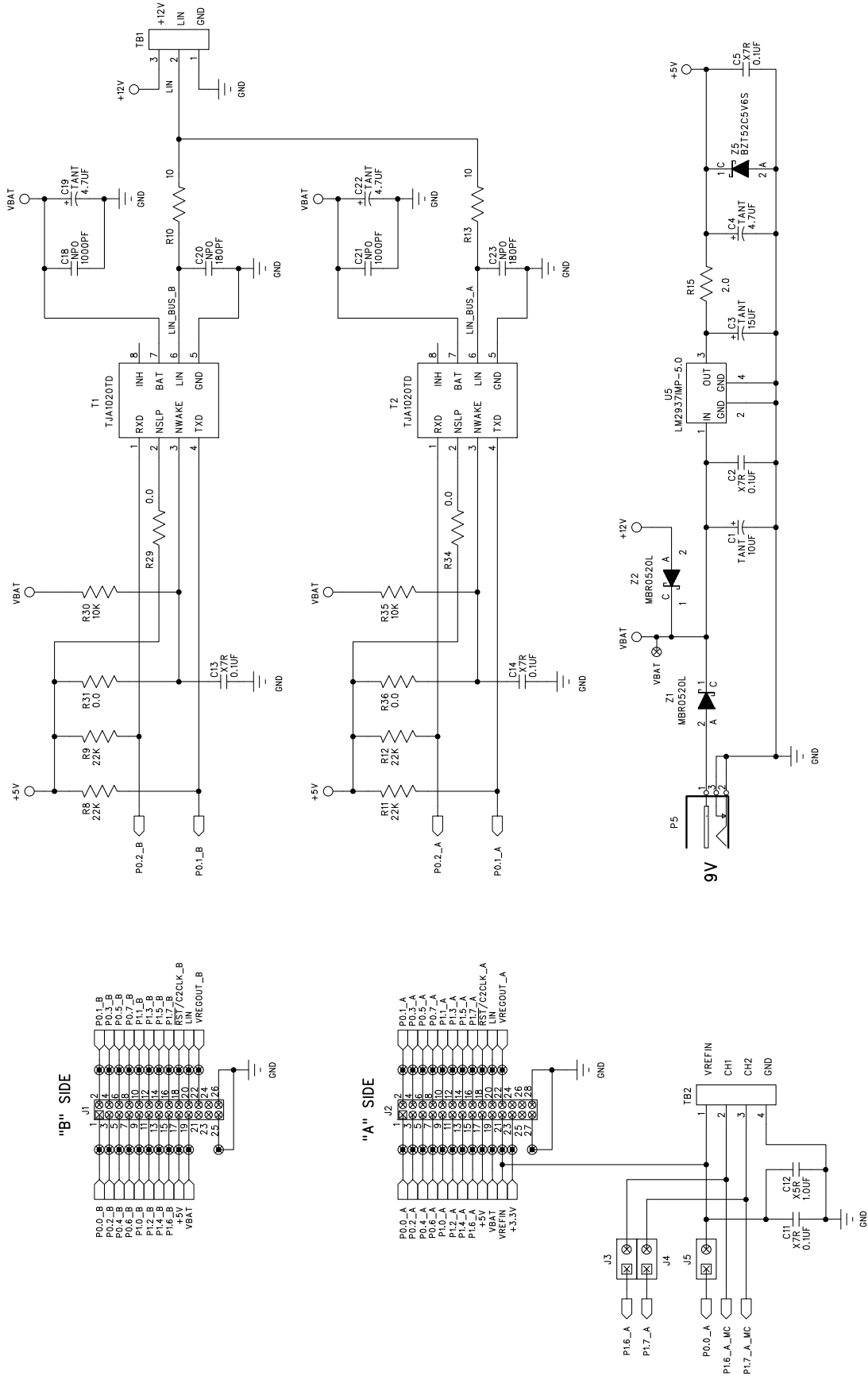
Figure 5. C8051F530A Target Board Schematic (1 of 3)

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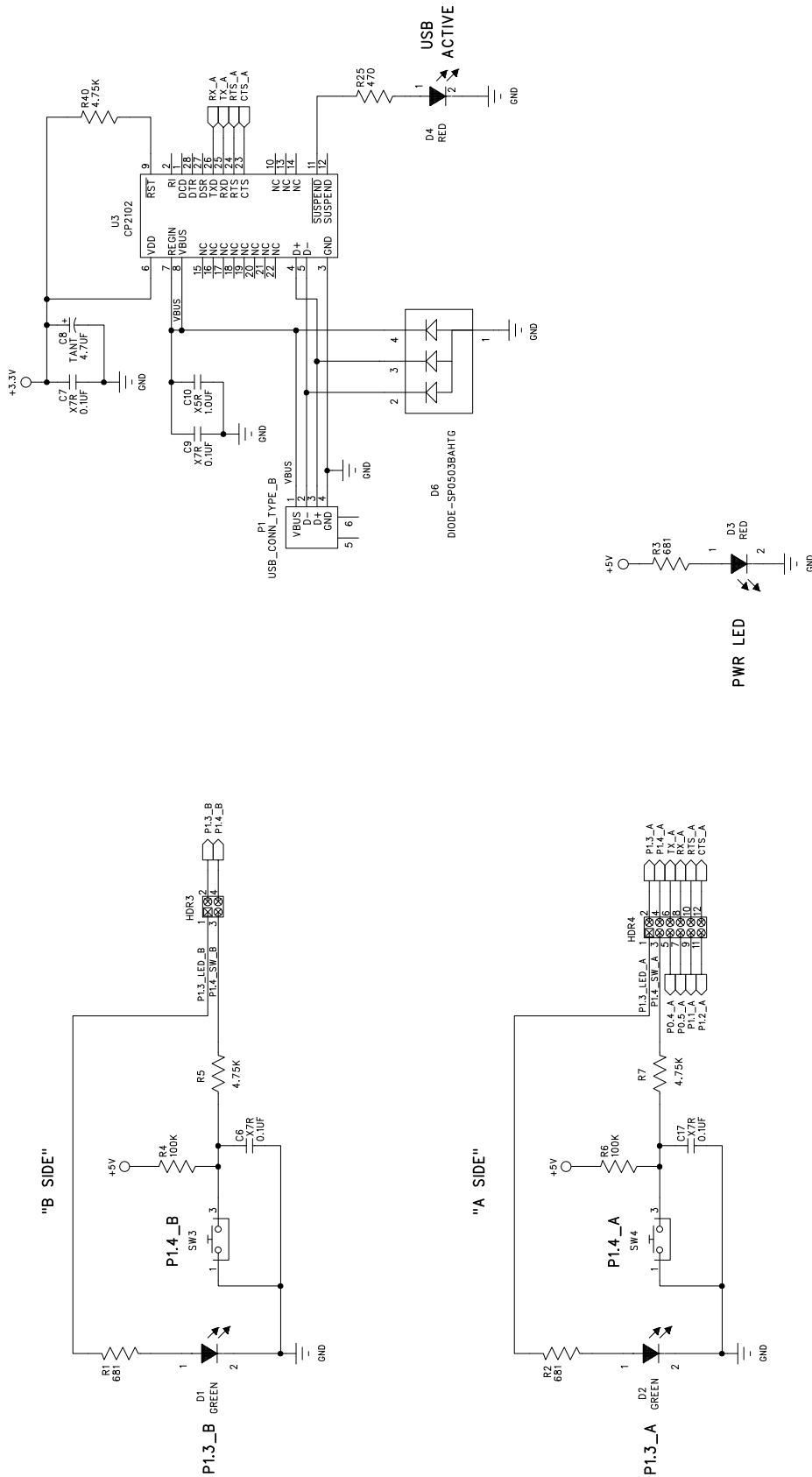Figure 6. C8051F530A Target Board Schematic (2 of 3)

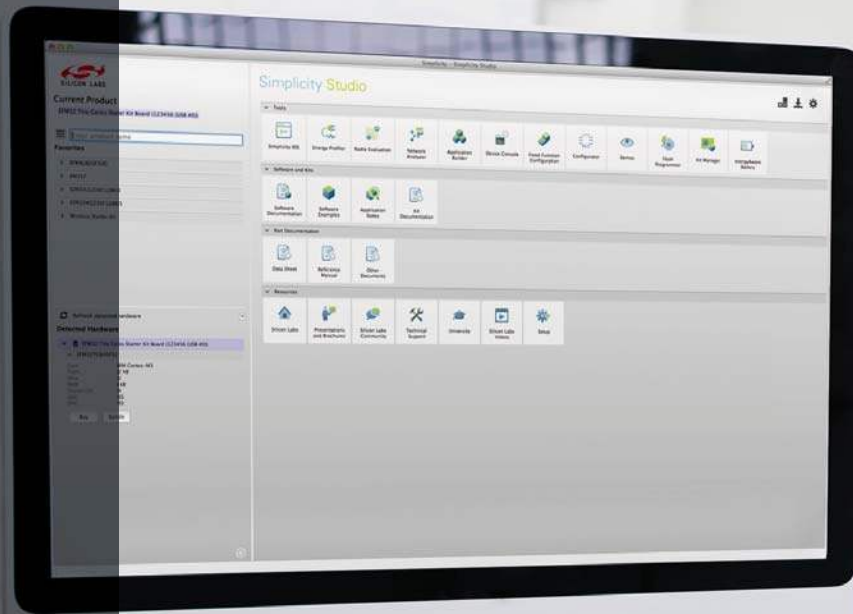**Figure 7. C8051F530A Target Board Schematic (3 of 3)**

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DOCUMENT CHANGE LIST

Revision 0.2 to Revision 0.3

■ Updated for C8051F530A TB.
■ Added "LIN Connectivity (TB1)," on page 10.

Revision 0.3 to Revision 0.4

■ Updated "Software Setup," on page 2.

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