
UDP C8051F390/F370 MCU CARD USER'S GUIDE

1. Introduction

The Unified Development Platform (UDP) provides a development and demonstration platform for Silicon Laboratories microcontrollers and the Silicon Laboratories software tools, including the Silicon Laboratories Integrated Development Environment (IDE).

Note: The C8051F39x/F37x family has two MCU cards, one for the C8051F39x devices and one for the C8051F37x devices. The information in this document applies to both sets of hardware, and the examples (with the exception of the EEPROM) will run on both.

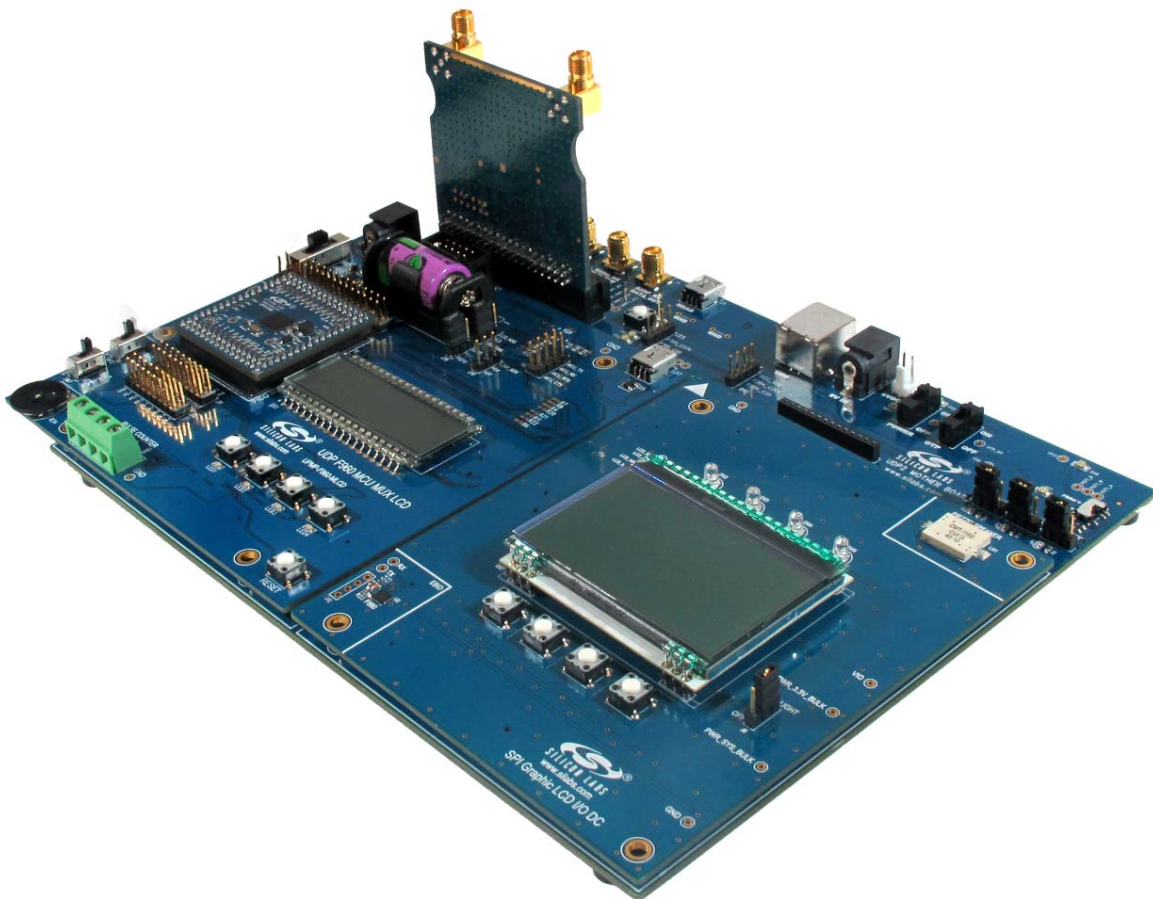


Figure 1. Unified Development Platform

2. Relevant Documents

This document provides a hardware overview for the Unified Development Platform (UDP) system UDP C8051F390/F370 MCU Card. Additional information on the UDP system can be found in the documents listed in this section.

- Motherboard User's Guide: The UDP Motherboard User's Guide contains information on the motherboard features and can be found at www.silabs.com.
- Card User's Guides: The UDP MCU Card and Radio Card User's Guides can be found at www.silabs.com.

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3. Hardware Setup

3.1. Using the MCU Card Alone

Refer to Figure 2 for a diagram of the hardware configuration when using the MCU card without a UDP motherboard.

1. Connect the USB Debug Adapter to the 2x5 debug connector on the MCU card with the 10-pin ribbon cable.
2. Connect one end of the USB cable to the USB connector on the USB Debug Adapter.
3. Connect the other end of the USB cable to a USB Port on the PC.
4. Move the SW1 switch to the VREG position.
5. Connect the 9 V DC adapter to P1.

Notes:

- Use the Reset button in the IDE to reset the target when connected using a USB Debug Adapter.
- Remove power from the MCU card and the USB Debug Adapter before connecting or disconnecting the ribbon cable from the MCU card. Connecting or disconnecting the cable when the devices have power can damage the device and/or the USB Debug Adapter.

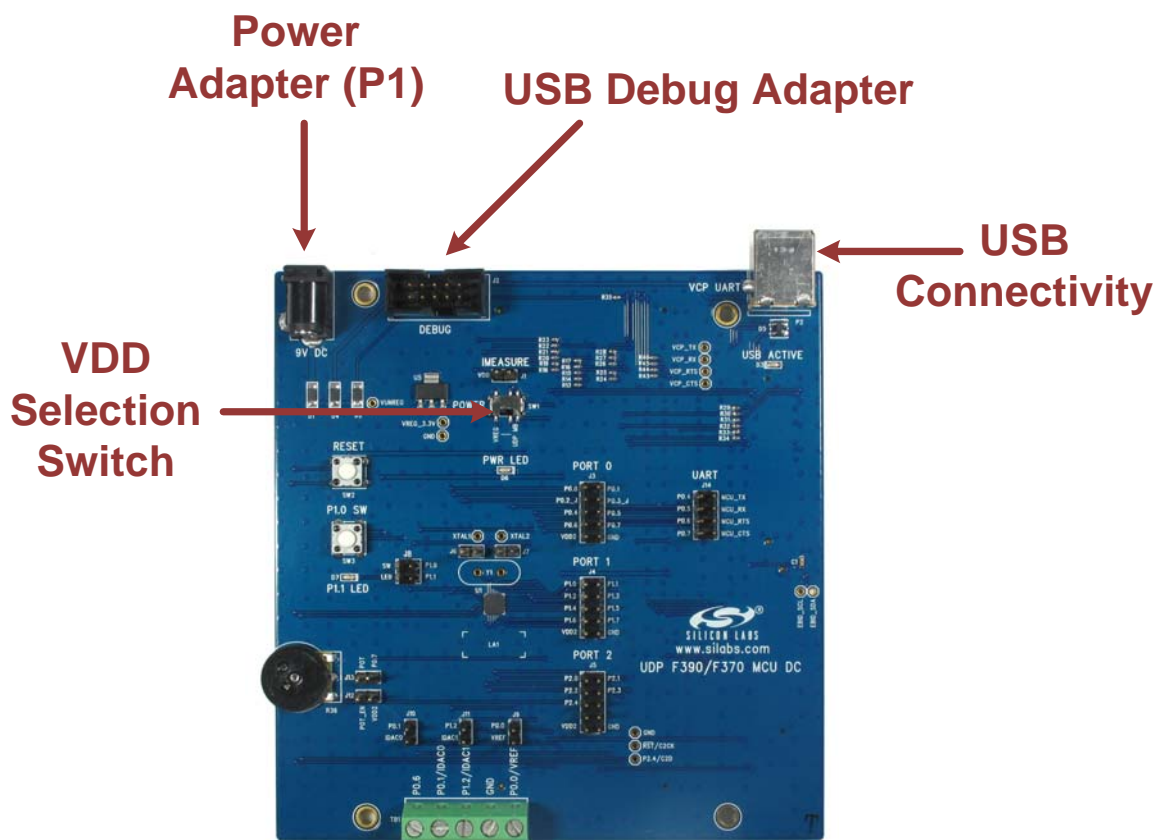


Figure 2. Hardware Setup Using the MCU Card Alone

3.2. Using the MCU Card with the UDP Motherboard

Refer to Figure 3 for a diagram of the hardware configuration when using the MCU card with a UDP motherboard.

1. Connect the MCU card to the UDP motherboard slot.
2. (Optional) Connect the I/O card to the UDP motherboard slot.
3. (Optional) Connect a radio card to the radio card slot in the UDP motherboard.
4. (Optional) Connect an EZLink card to the EZLink card slot in the UDP motherboard.
5. Connect the USB Debug Adapter to the 2x5 debug connector on the MCU card with the 10-pin ribbon cable.
6. Connect one end of the USB cable to the USB connector on the USB Debug Adapter.
7. Connect the other end of the USB cable to a USB Port on the PC.
8. Connect the ac/dc power adapter to power jack J20 on the UDP motherboard. The board can also be powered from the J16 USB or J1 mini USB connectors.
9. Move the SW1 switch on the MCU card to the UDP MB position.
10. Move the S3 power switch on the UDP motherboard to the ON position.

Notes:

- Use the Reset button in the IDE to reset the target when connected using a USB Debug Adapter.
- 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.
- The MCU card can be used alone without the motherboard. However, the motherboard must be powered if an MCU card is connected.

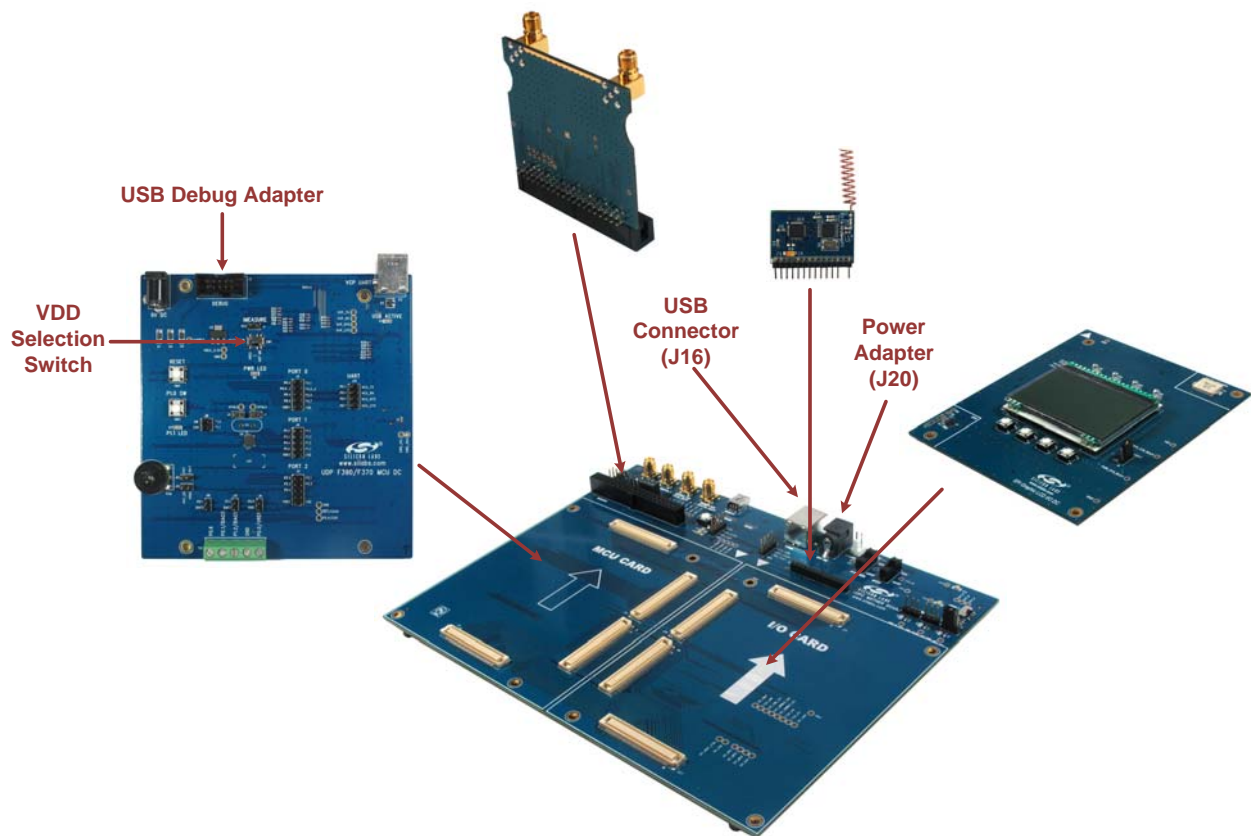


Figure 3. Hardware Setup Using the Unified Development Platform

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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.

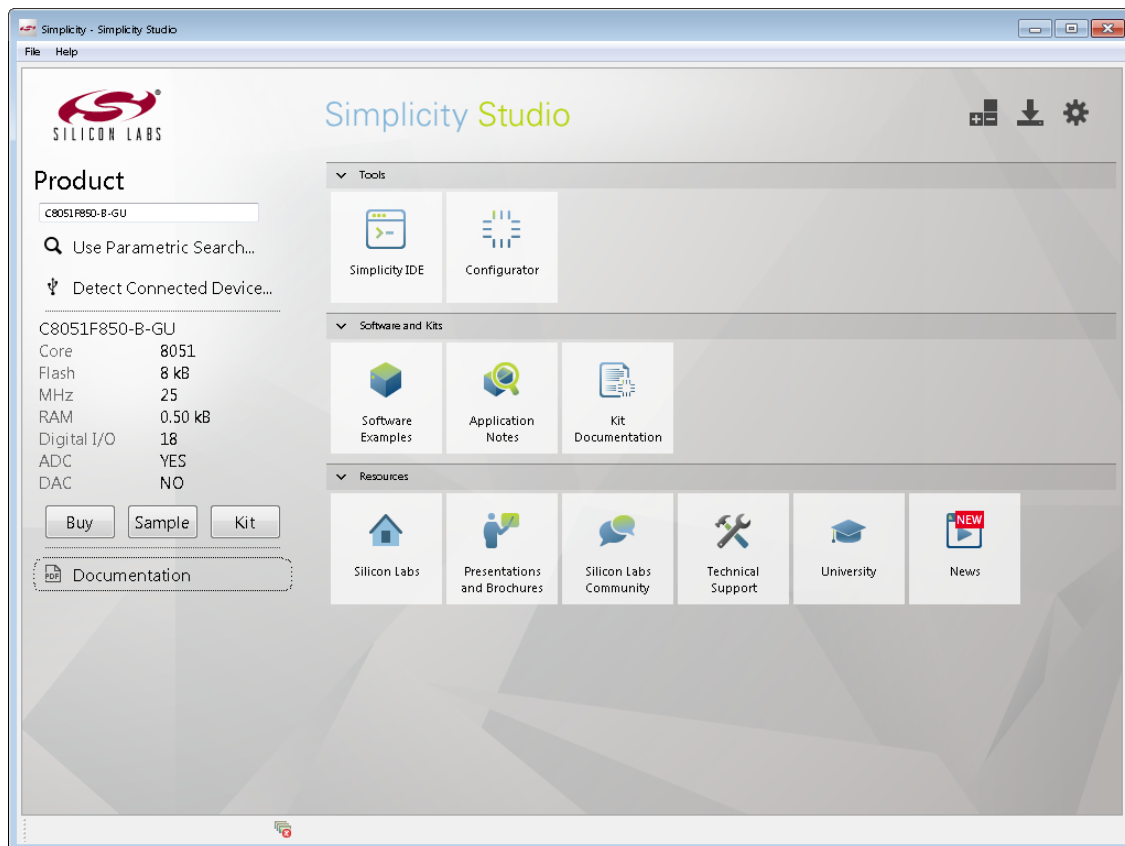


Figure 4. Simplicity Studio

The following Simplicity Studio components are required for the C8051F390 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 use during development. Choosing parts and families in this step affects the displayed or filtered parts in the later device selection menus. Choose the C8051F39x family by checking the **C8051F39x/37x** 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:

1. Click the **Simplicity IDE** tile from the Simplicity Studio home screen.
2. Click the **Create new project** link from the welcome screen or go to **File**→**New**→**Silicon Labs MCU Project**.
3. In the **Kit** drop-down, select **C8051F390 Development Kit**, in the **Part** drop-down, select **C8051F390**, and in the **SDK** drop-down, select the desired SDK. Click **Next**.
4. Select **Example** and click **Next**.
5. Under **C8051F390 Development Kit** in the **Blinky** folder, select **F39x-37x Blinky** and click **Finish**.
6. Click on the project in the **Project Explorer** and click **Build**, the hammer icon in the top bar. Alternatively, go to **Project**→**Build Project**.
7. Click **Debug** to download the project to the hardware and start a debug session.
8. Press the **Resume** button to start the code running. The LED should blink.



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



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



11. 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. Legacy 8-bit IDE

Note: Using the Simplicity Studio tools with the C8051F390 Development Kit is recommended. See section 4. "Software Setup," on page 4 for more information.

Download the 8-bit software from the website (www.silabs.com/8bit-software) or use the provided installer on the CD-ROM to install the software tools for the C8051F39x devices. After installation, examples can be found in ...\\Examples\\C8051F39x_37x in the installation directory. At a minimum, the C8051F390 DK requires:

- **Silicon Labs IDE**—Software enabling initial evaluation, development, and debugging.
- **Configuration Wizard 2**—Initialization code generation software for the C8051F39x devices.
- **Keil C51 Tools**—Keil 8051 Compiler/Assembler/Linker toolchain.
- **CP210x Drivers**—Virtual COM Port (VCP) drivers for the CP210x COM interface. More information on this installation process can be found in Section 4.4.

Other software available includes:

- **Keil μ Vision Driver**—Driver for the Keil μ Vision IDE that enables development and debugging on C8051Fxxx MCUs.
- **Flash Programming Utilities and MCU Production Programmer**—Programming utilities for the production line. More information on the available programming options can be found on the website: <http://www.silabs.com/products/mcu/Pages/ProgrammingOptions.aspx>.
- **ToolStick Development Tools**—Software and examples for the ToolStick development platform. More information on this platform can be found at www.silabs.com/toolstick.

The development kit includes the latest version of the C51 Keil 8051 toolset. This toolset is initially limited to a code size of 2 kB and programs start at code address 0x0800. After registration, the code size limit is removed entirely and programs will start at code address 0x0000.

To register the Keil toolset:

1. Find the **Product Serial Number** printed on the CD-ROM. If you no longer have this serial number, register on the Silicon Labs website (www.silabs.com/8bit-software) to obtain the serial number.
2. Open the Keil μ Vision4 IDE from the installation directory with administrative privileges.
3. Select **File**→**License Management** to open the License Management window.

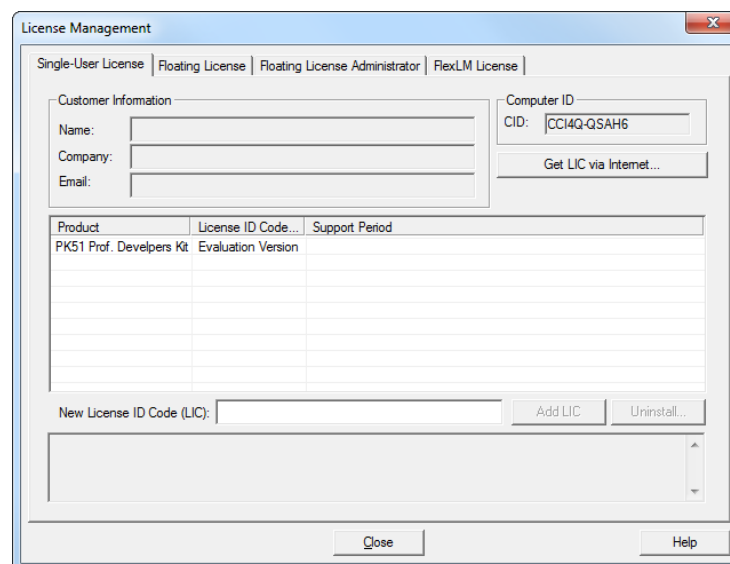


Figure 5. Keil μ Vision4 IDE License Management Window

4. Click on the **Get LIC via Internet...** button to open the Obtaining a License IDE Code (LIC) window.
5. Press **OK** to open a browser window to the Keil website. If the window doesn't open, navigate to

www.keil.com/license/install.htm.

6. Enter the Silicon Labs **Product Serial Number** printed on the CD-ROM, along with any additional required information.
7. Once the form is complete, click the **Submit** button. An email will be sent to the provided email address with the license activation code.
8. Copy the License ID Code (LIC) from the email.
9. Paste the LIC into the **New License ID Code (LIC)** text box at the bottom of the License Management window in μ Vision4.
10. Press the **Add LIC** button. The window should now list the **PK51 Prof. Developers Kit for Silabs** as a licensed product.
11. Click the **Close** button.

4.4. CP210x USB to UART VCP Driver Installation

The MCU Card 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. Use the drivers included CD-ROM or download the latest drivers from the website (www.silabs.com/interface-software).

1. If using the CD-ROM, the **CP210x Drivers** option will launch the appropriate driver installer. If downloading the driver package from the website, unzip the files to a location and run the appropriate installer for the system (x86 or x64).
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 **COM PORT** USB connector (J5) on the MCU Card. Windows will automatically finish the driver installation. Information windows will pop up from the taskbar to show the installation progress.
4. If needed, the driver files can be uninstalled by selecting **Windows Driver Package—Silicon Laboratories...** option in the **Programs and Features** window.

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5. UDP C8051F390/F370 MCU Card Overview

The C8051F39x/F37x MCU cards enable application development on the C8051F390 or C8051F370 MCU. The card connects to the MCU Card expansion slot on the UDP motherboard and provides complete access to the MCU resources. Each expansion board has a unique ID that can be read out of an EEPROM or MCU on the board, which enables software tools to recognize the connected hardware and automatically select the appropriate firmware image. The target MCU card can also be detached from the UDP and used alone as a development or demonstration tool.

Figure 6 shows the C8051F390 MCU card.

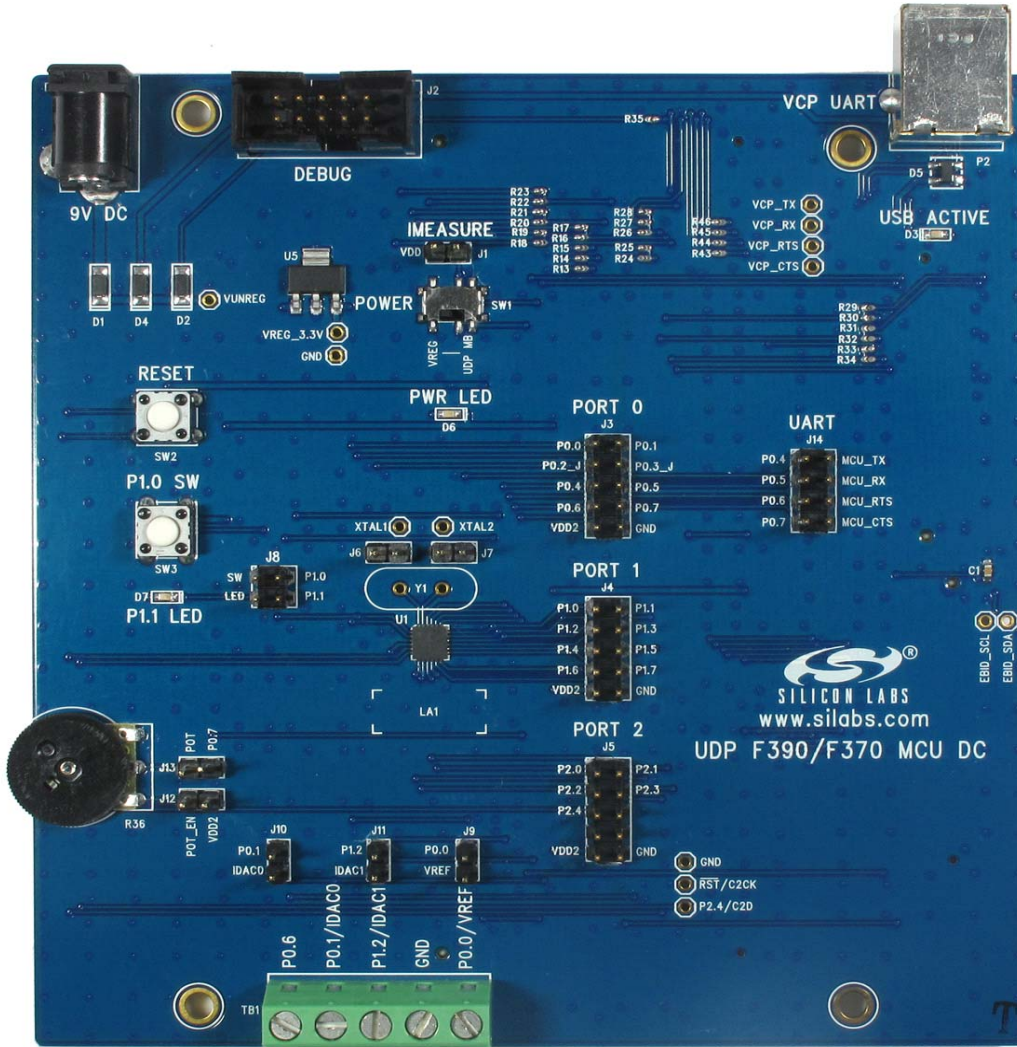


Figure 6. C8051F39x UDP MCU Card

Figure 7 highlights some of the features of the UDP C8051F390/F370 MCU Card.

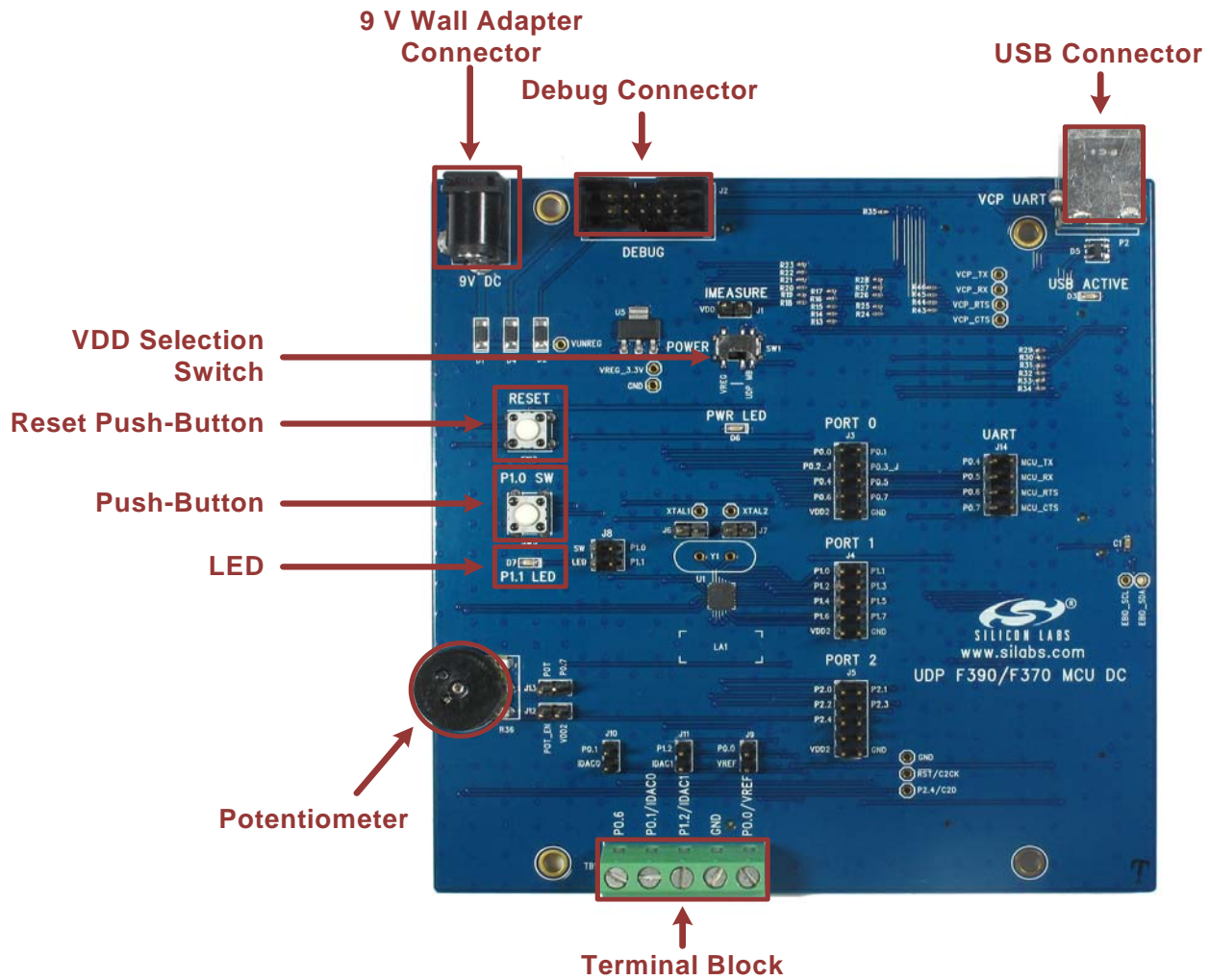


Figure 7. UDP C8051F390/F370 MCU Card

5.1. VDD Selection Switch (SW1)

The UDP C8051F390/F370 MCU Card has two power options. The VDD selector switch (SW1) selects the power source for the C8051F39x/F37x VDD supply pin and the supply for the external peripheral circuits, VDD2.

The left VREG position selects the output of the on-board 3.3 V regulator (U5) for VDD and VDD2. This is the primary supply option for development. The on-board regulator has multiple 5 V and 9 V power sources connected via Schottky diodes to the regulator input. The highest voltage power source will supply power to the regulator.

The power sources for the on-board regulator (U1) are as follows:

- 9 V DC Wall Adapter power receptacle (P1).
- USB receptacle (P2).
- 10-pin Debug connector (J2).

The UDP MB position on the VDD selector selects the UDP motherboard programmable supply (PWR_VDD_OUT) as the power source. Use this position when using the programmable power supply under software control. The UDP motherboard bulk 3.3 V supply (UDP_PWR_3.3V_BULK) supplies VDD2.

The VDD voltage is available on the J1 header. Ground is accessible at various test points on the MCU card, such as header J3, J4, and J5. Use these test points to power the board from an external lab power supply. When using a lab supply, the VDD selector switch should be in the UDP MB position with the MCU card disconnected from the UDP motherboard.

The MCU card facilitates measurement of the MCU supply current by removing the R1 0 Ω resistor and placing a current meter in series with the two terminals of the J1 header.

5.2. Push-Button Switches and LEDs (SW3, D7)

The UDP C8051F390/F370 MCU Card has one push-button switch. Connect to switch to port pin P1.0 by placing a shorting block on J8: SW - P1.0. The switch is normally open and pulls the pin voltage to ground when pressed.

Port pin P1.1 connects to one LED: D7 when a shorting block is placed on J8: LED - P1.1. The LEDs connect to VDD2 through a current limiting resistor.

5.3. Debug Header (J2)

The standard 10-pin debug header supports the Silicon Labs USB Debug Adapter. This connector provides a C2 debug connection to C8051F39x/F37x. The USB Debug Adapter supports two types of debug connections: C2 and JTAG. When using this MCU card with the Silicon Labs IDE, select C2 in the connection options dialog before connecting.

The USB Debug Adapter also provides a 5 V power source that can power the regulator. When powering the MCU from the debug connector, the SW1 switch must be in the VREG position. Additionally, select the Power Target after Disconnect check box in the Silicon Labs IDE connections options dialog to ensure the MCU always has power.

5.4. Reset Button (SW2)

The reset push-button switch is in the lower-right corner. Pushing this button will always reset the MCU. Note that pushing this button while the IDE is connected to the MCU will result in the IDE disconnecting from the target.

5.5. UART VCP Connection Options

The MCU card features a USB virtual COM port (VCP) UART connection via the USB connector (P2). The VCP connection uses the CP2102 USB-to-UART bridge chip.

The UART pins on the target MCU either connect to the CP2102 USB-to-UART bridge chip or to the UDP motherboard. The MCU card has level translators with enable pins that normally route the UART connections to the on-board USB-to-UART bridge chip. However, the UDP motherboard can drive the enable pins to route the UART connections to the UDP motherboard instead of the on-board USB-to-UART bridge chip. There are two enable signals: one with a default pull-down (UART_VCP_EN) and one with a default pull-up (UART_SYS_EN).

When using the UART with either the on-board USB-to-UART bridge or the UDP motherboard, install shorting blocks on header J14 to connect P0.4 to MCU_TX and P0.5 to MCU_RX.

If desired, install shorting blocks for hardware handshaking on P0.6 and P0.7 on the J14 header. Hardware handshaking is not required for most applications. Firmware must implement hardware handshaking on the target MCU using P0.6 and P0.7.

5.6. Potentiometer (R36)

The potentiometer is available on P0.7 when a shorting block is placed on J13. To enable the potentiometer, place a shorting block on J12 to connect the top terminal of the potentiometer to VDD2.

5.7. Screw Terminal (TB1)

The MCU card includes a 5-position screw terminal connection capable of accepting large wires in the field. P0.6, P0.1/IDAC0, P0.2/IDAC1, ground, and P0.0/VREF are available.

Before the VREF output can be observed on TB1, place a shorting block on J9 which connects P0.0/VREF to 4.7 μ F and 0.1 μ F decoupling capacitors.

Before the IDAC0 output can be observed on TB1 with an oscilloscope, place a shorting block on J10 which connects P0.1/IDAC0 to a 1 k Ω resistor to ground.

Before the IDAC1 output can be observed on TB1 with an oscilloscope, place a shorting block on J11 which connects P1.2/IDAC1 to a 1 k Ω resistor to ground.

5.8. Port Pin Headers (J3-J5)

All of the MCU port pins are available on the 0.100 inch headers.

Shorting blocks are placed on J6 and J7, connecting pins P0.2 and P0.3 to the P0.2 and P0.3 headers on J3. Pin P0.2 and P0.3 can also connect to an external oscillator circuit. When using an external oscillator driver circuit, remove the shorting block on J6 and J7.

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5.9. C8051F39x Board Default and Optional Connections

The C8051F39x MCU card has many default and optional connections for use with the UDP motherboard. The default connections have shorting jumpers consisting of a 402 resistor footprint with solder connecting the two pads. To disconnect a default connection, remove the solder between the pads. To reconnect, install a 0 Ω 402 resistor or connect the two pads with solder. The optional connections are non-populated (no-pop) resistor footprints. To connect, install a 0 Ω 402 resistor or connect the two pads with solder.

Table 1 shows a summary of the default and optional connections for each pin. Further explanation of the UDP motherboard signals can be found in Section 6.2.

Table 1. MCU Pin Functions

| MCU Pin | MCU Card Function (via shorting blocks) | | UDP Motherboard Signal (via 402 resistor footprint) | |
|------------|--|----------|--|---------------|
| | Default | Optional | Default | Optional |
| P0.0/VREF | VREF | | | |
| P0.1/IDAC0 | IDAC0 | | | |
| P0.2/XTAL1 | | | EXT_INT0 | |
| P0.3/XTAL2 | | | EXT_INT1 | |
| P0.4/TX | TX | | | |
| P0.5/RX | RX | | | |
| P0.6 | | CTS | | |
| P0.7 | Potentiometer | RTS | | |
| P1.0 | | | | |
| P1.1 | | | CLKOUT0/SYSCLK | |
| P1.2/IDAC1 | | IDAC1 | | |
| P1.3 | | | PCA_CEX0, SPI_SL- CK_A | |
| P1.4 | | | SPI_MISO_A, PCA_CEX1 | |
| P1.5 | | | PCA_CEX2, SPI_- MOSI_A | |
| P1.6 | | | SPI_NSS0_A, PCA | |
| P1.7 | | | SMBUS0_SDA, T0 | |
| P2.0 | | | SMBUS0_SCL, T1, ADC_IN0 | |
| P2.1 | | | CP_OUT_A, ADC_IN3 | |
| P2.2 | | | CP_OUT_A_A, ADC_IN2 | |
| P2.3 | | | ADC_IN1 | SMBUS_SDA_EZR |
| P2.4 | | | | SMBUS_SCL_EZR |

5.9.1. P0.2 and P0.3

By default, pins P0.2 and P0.3 connect to the EXT_INT0 and EXT_INT1 signals respectively on the UDP motherboard. To disconnect these signals, remove the solder on the R13 and R14 footprint resistors.

5.9.2. P1.1

By default, pin P1.1 connects to the CLKOUT0/SYSCLK signal on the UDP motherboard. To disconnect this signal, remove the solder on the R15 foot resistor.

5.9.3. P1.7 and 2.0

By default, pins P1.7 and P2.0 connect to the SMBUS0_SDA and SMBUS0_SCL signals respectively on the UDP motherboard. To disconnect these signals, remove the solder on the R24 and R26 footprint resistors.

By default, pins P1.7 and P2.0 also connect to the T0 and T1 signals respectively on the UDP motherboard. To disconnect these signals, remove the solder on the R25 and R27 footprint resistors.

By default, P2.0 also connects to the ADC_IN0 signal on the UDP motherboard. To disconnect this signal, remove the solder on the R28 foot resistor.

5.9.4. P2.1 and R2.2

By default, pins P2.1 and P2.2 connect to the CP_OUT_A and CP_OUT_A_A signals respectively on the UDP motherboard. To disconnect these signals, remove the solder on the R29 and R31 footprint resistors.

By default, pins P2.1 and P2.2 also connect to the ADC_IN3 and ADC_IN2 signals respectively on the UDP motherboard. To disconnect these signals, remove the solder on the R30 and R32 footprint resistors.

5.9.5. P2.3 and R2.4

By default, pins P2.2 and P2.4 do not connect to the SMBUS_SDA_EZR and SMBUS_SCL_EZR signals respectively on the UDP motherboard. To connect these signals, solder the R33 and R35 footprint resistors.

By default, pin P1.0 connects to the ADC_IN1 signal on the UDP motherboard. To disconnect this signal, remove the solder on the R34 foot resistor.

6. Using the C8051F39x with the UDP Motherboard

6.1. VBAT Selector Switch

When used with the UDP motherboard, the motherboard can power the C8051F39x MCU card. With the VBAT selector switch in the VREG position, the motherboard powers the regulator on the card. With the VBAT selector switch in the UDP position, the UDP motherboard powers VBAT directly. This position supports software control of the variable voltage power supply and current measurements.

The S1 switch on the UDP motherboard selects between the fixed or programmable voltage. The variable supply is controlled by the C8051F384 board control MCU through the U1 digital potentiometer. Use the fixed supply when the variable supply is not under software control.

6.2. MCU Card Header Connections

The C8051F39x MCU card has four connectors with 100 pins each. These 400 pins are directly tied to the UDP motherboard and I/O cards. These signals are named and designed to support a wide variety of features and applications, and the UDP C8051F390/F370 MCU Card card implements a subset of these connections.

The MCU cards and I/O cards are designed so that a maximum number of functions are shared between each card. This allows a particular type of I/O card to be shared amongst all MCU cards that connect to the same signals.

The MCU card slot includes the following components:

- J1 MCU card connector H1
- J2 MCU card connector H2
- J3 MCU card connector H3
- J4 MCU card connector H4

The C8051F39x MCU card implements the signals described in Table 3, Table 4, Table 5, and Table 6 in the Appendix.

6.3. Shorting Blocks: Factory Defaults

The UDP C8051F390/F370 MCU Card comes from the factory with pre-installed shorting blocks on several headers. Figure 8 shows the positions of the factory default shorting blocks.

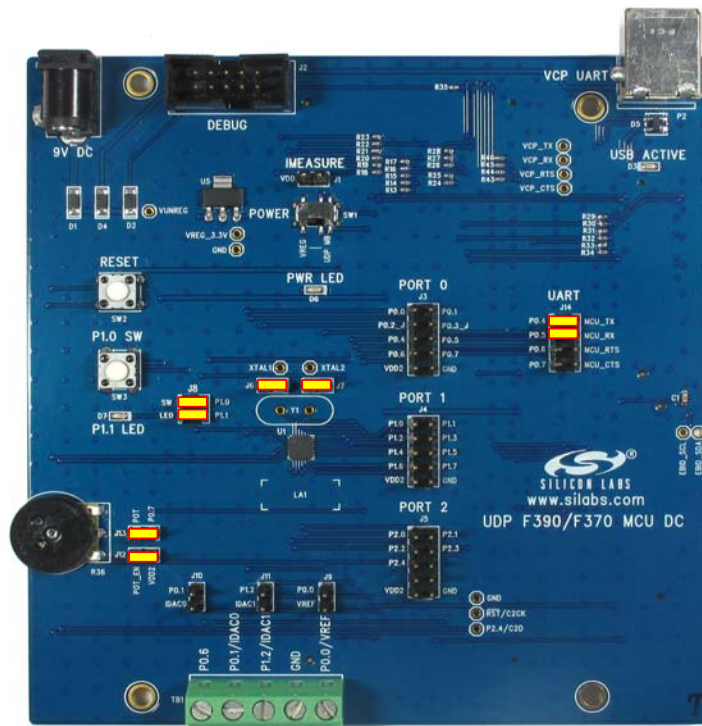


Figure 8. Shorting Blocks: Factory Defaults

Shorting blocks are installed on J14 to connect P0.4 to MCU_TX and P0.5 to MCU_RX.

7. Schematics

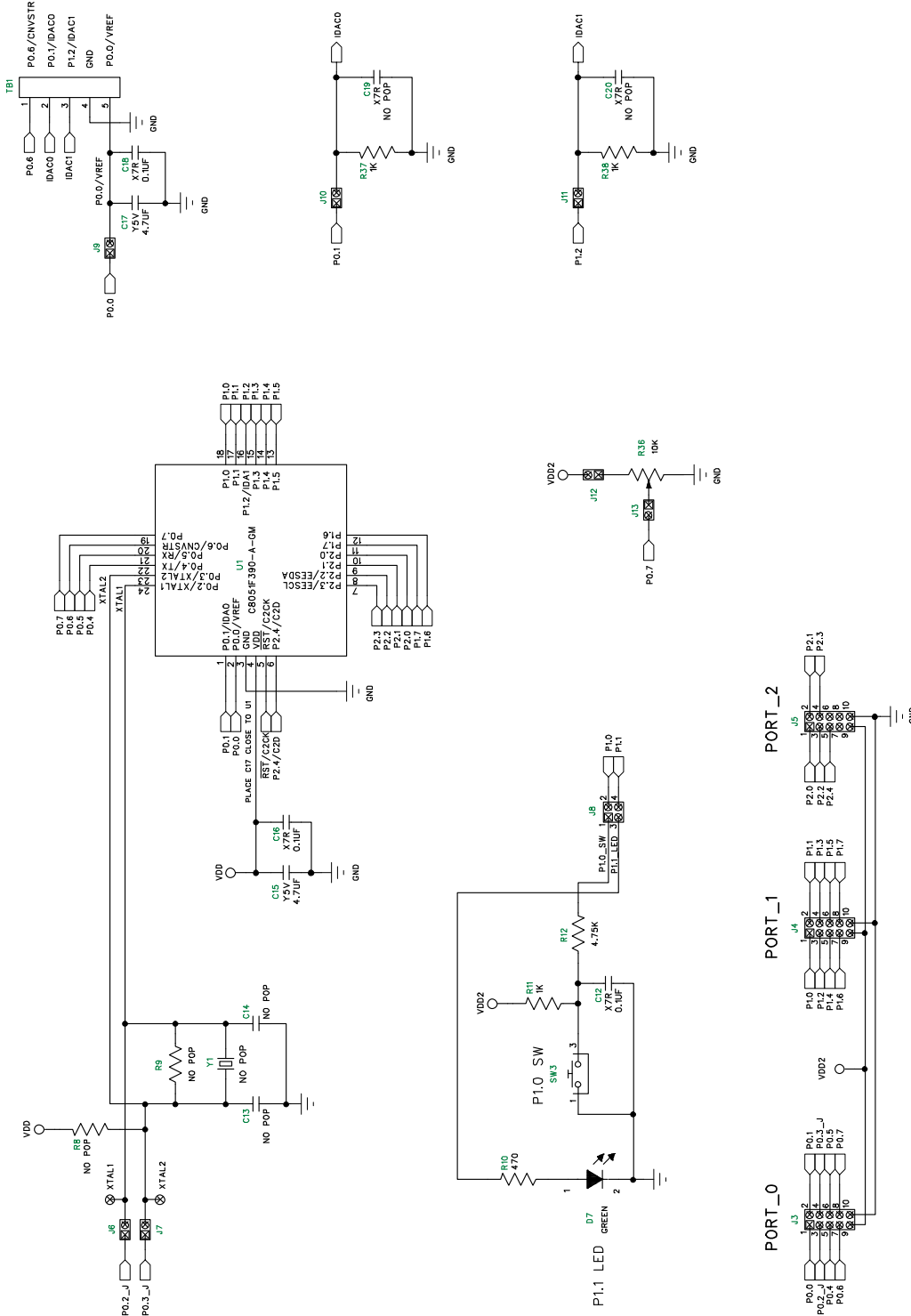


Figure 9. C8051F39x UDP MCU Card Schematic (1 of 6)

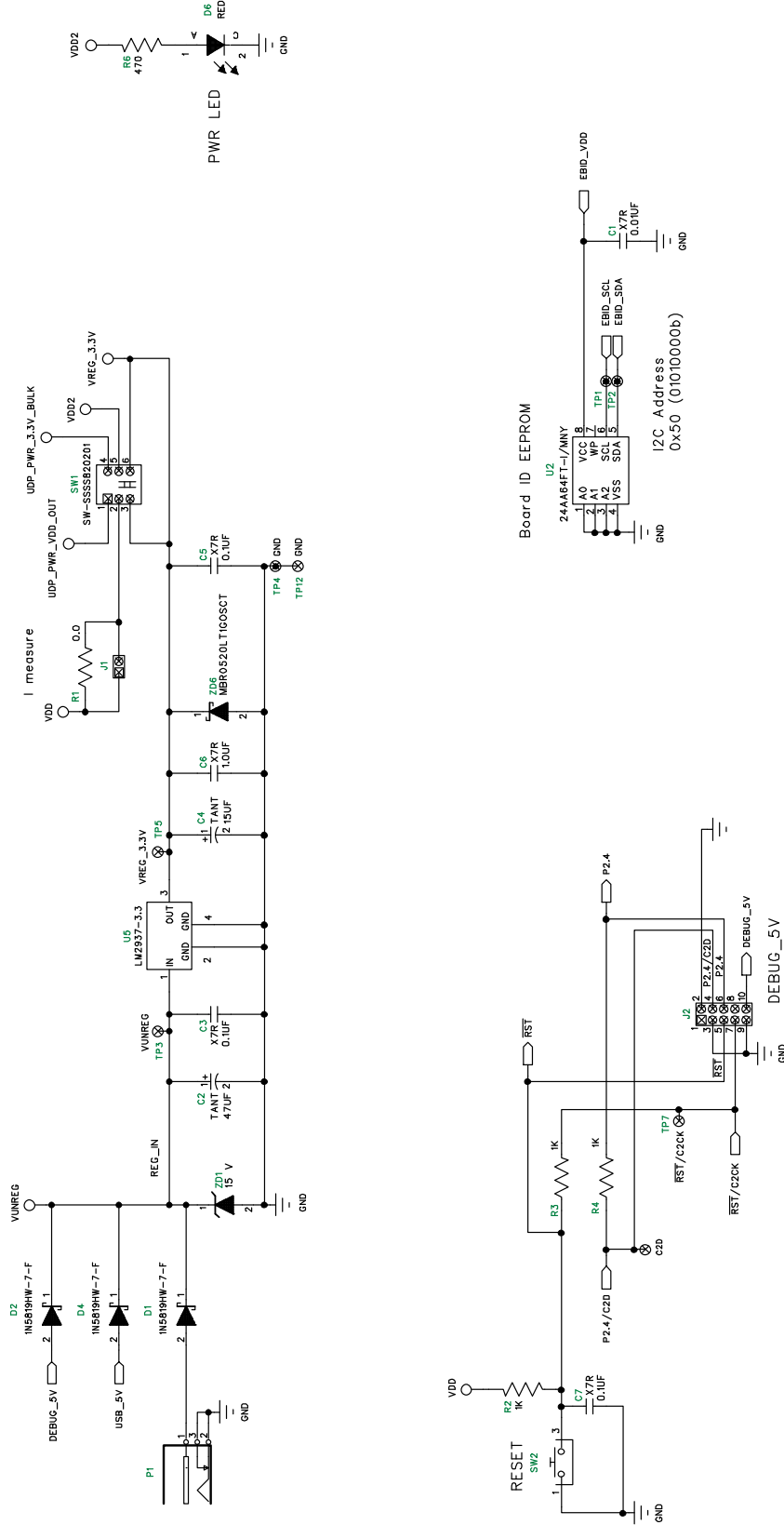
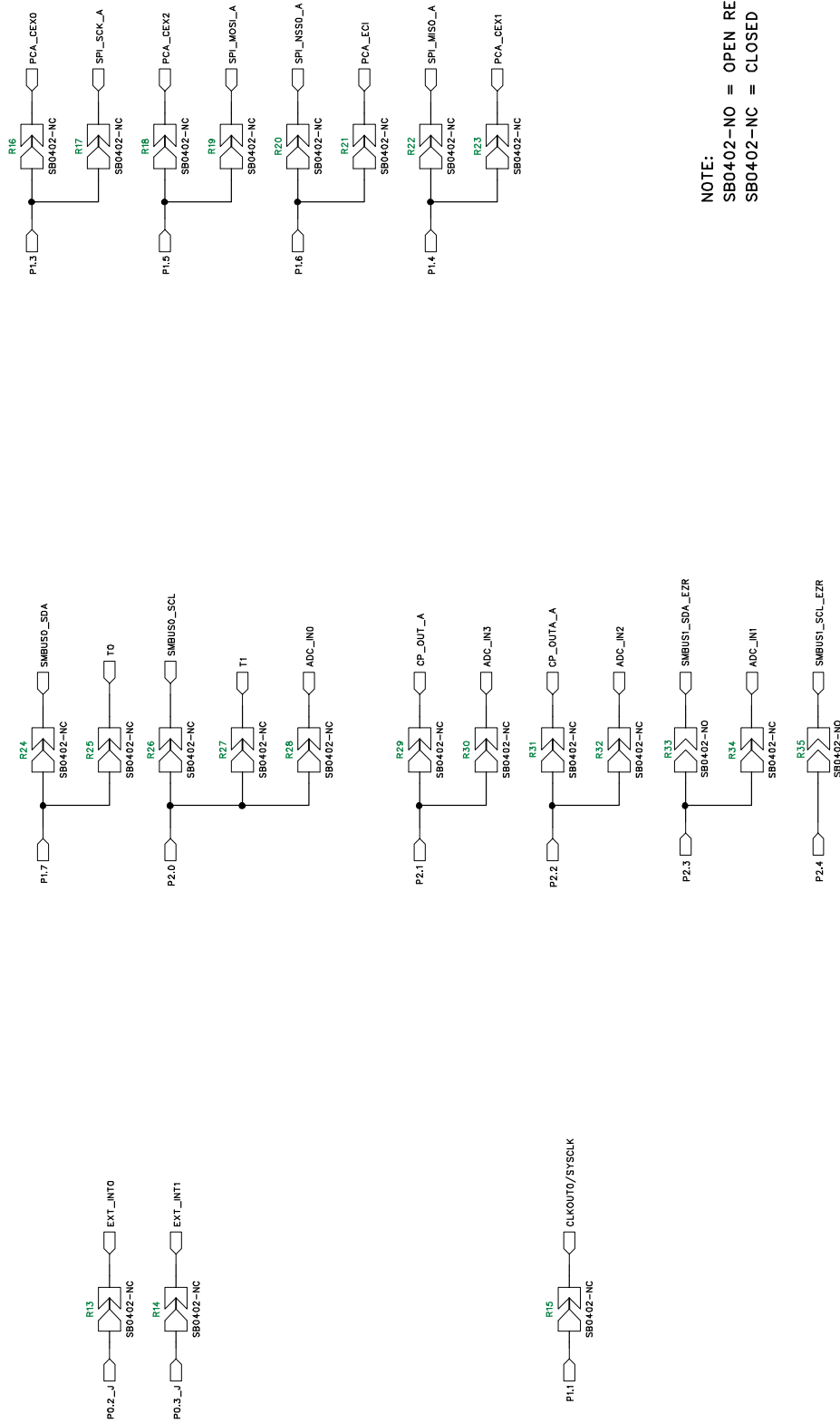
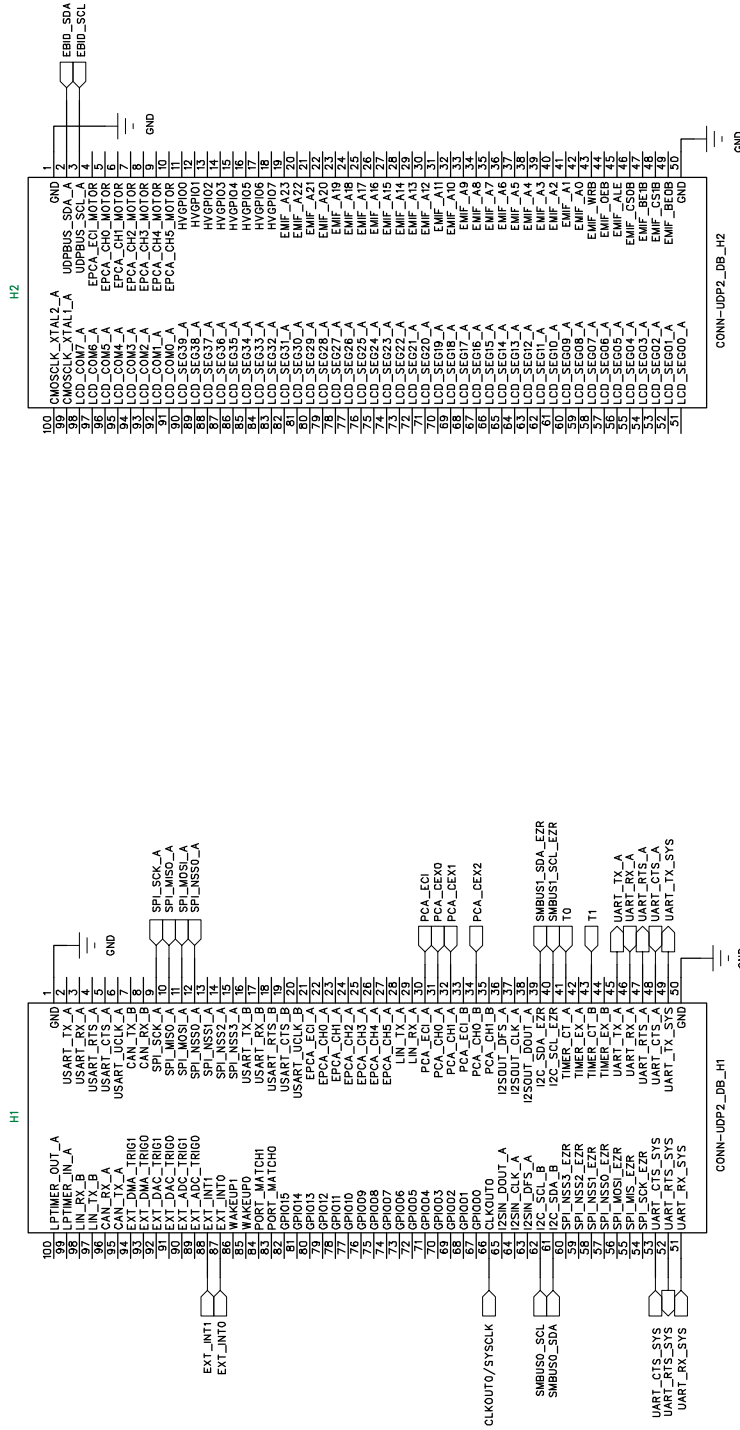


Figure 10. C8051F39x UDP MCU Card Schematic (2 of 6)



NOTE:
 SB0402-NO = OPEN RESISTOR.
 SB0402-NC = CLOSED RESISTOR.

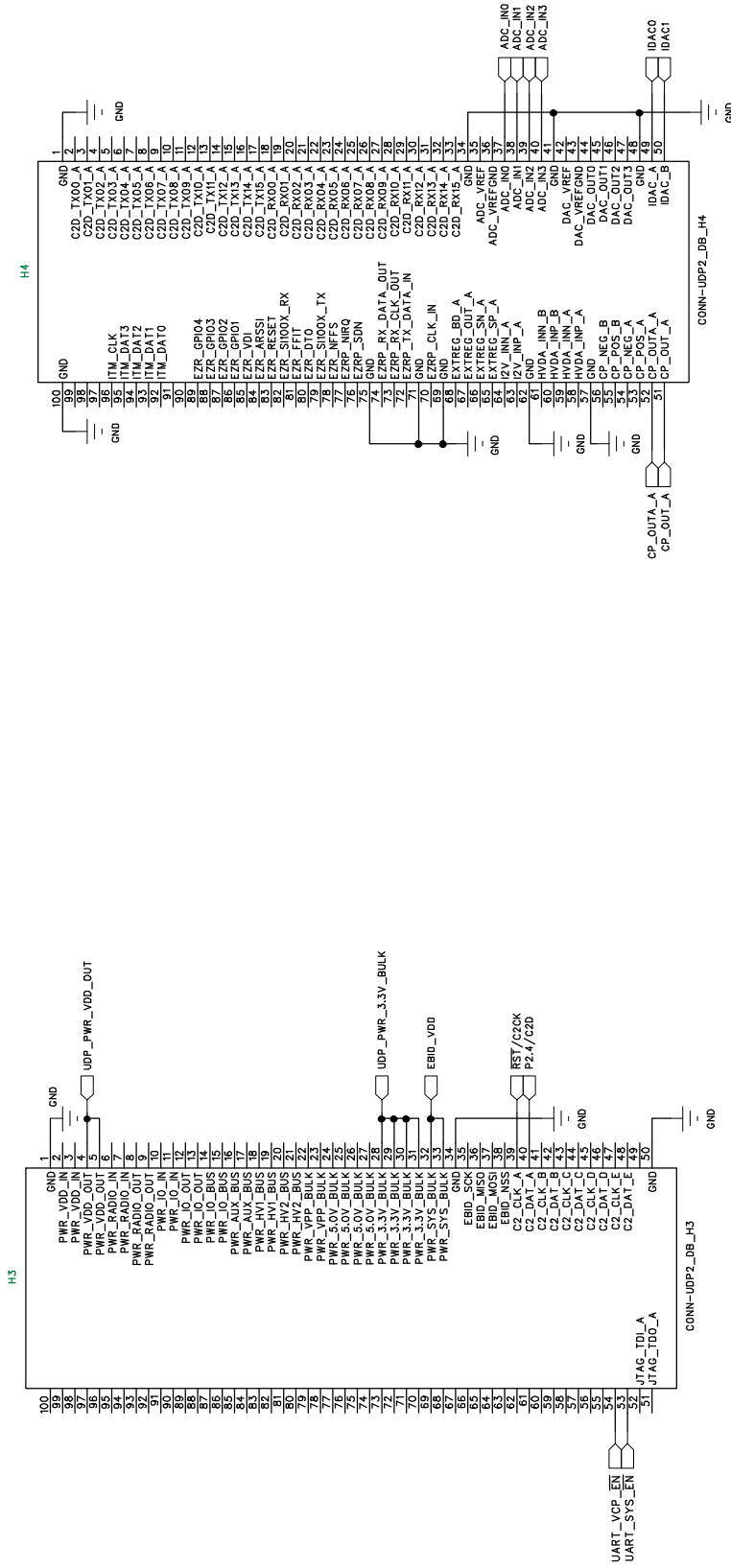
Figure 11. C8051F39x UDP MCU Card Schematic (3 of 6)



UDP Header 1 (Top View)

UDP Header 2 (Top View)

Figure 12. C8051F39x UDP MCU Card Schematic (4 of 6)



UDP Header 3 (Top View)

UDP Header 4 (Top View)

Figure 13. C8051F39x UDP MCU Card Schematic (5 of 6)

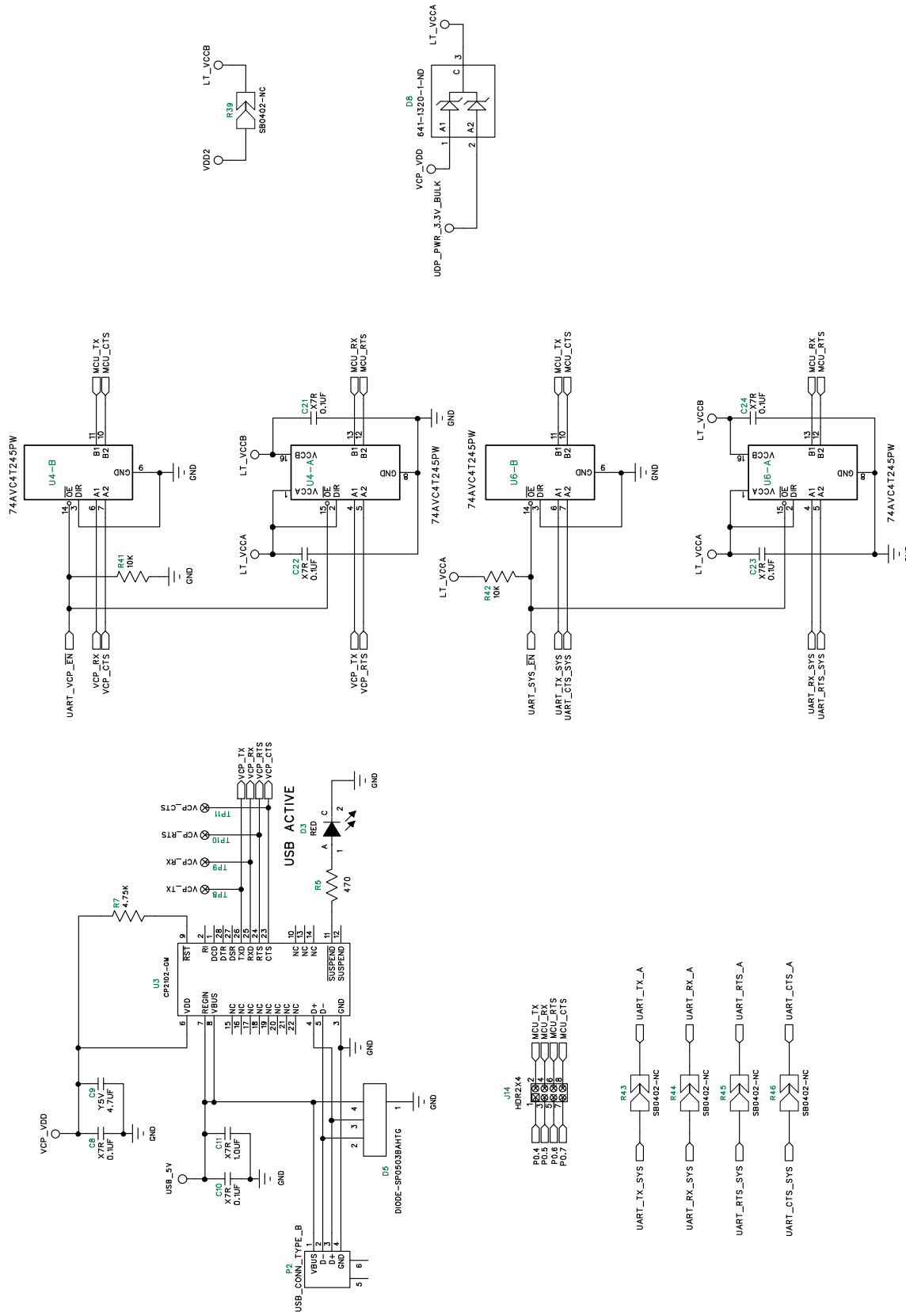


Figure 14. C8051F39x UDP MCU Card Schematic (6 of 6)

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8. Bill of Materials

Table 2. UPMU-F390-A/UPMU-F370-A Bill of Materials

| Reference | Part Number | Source | Description |
|---|-------------------------------------|-----------------------------|---|
| U1 | C8051F390-A-GM or C8501F370-A-GM | Silicon Labs | Mixed-Signal MCU, 50 MIPS 16 kB Flash, 512B EEPROM, RoHS. |
| U3 | CP2102-GM | Silicon Labs | SINGLE-CHIP USB TO UART BRIDGE, QFN28, RoHS. |
| U2 | 24AA64FT-I/MNY | Microchip | 64KBIT I ² C SERIAL FLASH, 400 KHZ, 8- TDFN, RoHS. |
| U4 U6 | SN74AVC4T245PWR | Texas Instruments | Quad Dual-Supply Level Shifter, TSSOP |
| C1 | 06035C103KAT2A | AVX Corporation | CAP, 0.01 μ F (10000PF), X7R, CERAMIC, 0603, 50 V, \pm 10%, OR EQ, RoHS. |
| C3 C5 C7-8 C10 C12 C16 C18 C21-24 | C0603C104J3RACTU | Kemet | CAP, 0.1 μ F, X7R, CERAMIC, 0603, 25 V, \pm 5%, OR EQ, RoHS. |
| C6 C11 | GRM188R71A105KA61D | Murata | CAP CERAMIC, 1.0 μ F, X5R, 0603, 10 V, \pm 10%, RoHS. |
| C4 | TCA1A156M8R | Rohm | CAP TANT, 15 μ F, A-CASE, 10 V, \pm 20%, OR EQ, RoHS. |
| C9 C15 C17 | GRM188F51A475ZE20D | Murata | CAP, 4.7 μ F, Y5V, CERAMIC, 0603, 10 V, -20%, +80%, OR EQ, RoHS. |
| C2 | TAJ476K016RNJ | AVX Corporation | CAP, 47 μ F, TANT, 6032-28, 16 V, \pm 10%, OR EQ, RoHS. |
| C13-14 C19- 20 | NO POP | NO POP | CAP, NO POP, 0603, OR EQ, RoHS. |
| P1 | RAPC722X | Switchcraft Inc. | CONN, POWERJACK MINI.08" RA PC MNT, RoHS. |
| H1 H2 H3 H4 | FX8-100P-SV1(91) | Hirose Electronic Co Ltd | CONN, HDR, 100POS, .6 mm, GOLD, SMD, RoHS |
| D1-2 D4 | 1N5819HW-7-F | Diodes Inc | DIODE SCHOTTKY, 40 V, 1A, SOD123, RoHS. |
| D8 | BAT54C-G | Comchip Technology | DIODE, Schottkey DUAL CC, 200 mA, 30 V, SOT23,RoHS. |
| ZD6 | MBR0520LT1G | ON Semiconductor | DIODE SCHOTTKY 0.5A 20 V, SOD123, RoHS. |
| ZD1 | MMSZ5245B-7-F | Diodes Inc | DIODE, ZENER, 15 V, 500MW, SMT, SOD123, RoHS. |

Table 2. UPMU-F390-A/UPMU-F370-A Bill of Materials (Continued)

| Reference | Part Number | Source | Description |
|-----------------------|--------------------------|---------------------------------|--|
| D5 | SP0503BAHTG | Littelfuse Inc | TVS AVAL DIODE ARRAY, 3 CH, SOT143, RoHS. |
| J1 J6-7 J9-13 | PBC02SAAN | Sullens Connector Solutions | STAKE HEADER, 1X2, 0.1"CTR, GOLD, OR EQ, RoHS. |
| J8 | PBC02DAAN | Sullens Connector Solutions | STAKE HEADER, 2x2, 0.1"CTR, GOLD, OR EQ, RoHS. |
| J14 | PBC04DAAN | Sullens Connector Solutions | STAKE HEADER, 2x4, 0.1"CTR, OR EQ, RoHS. |
| J3-5 | PBC05DAAN | Sullens Connector Solutions | STAKE HEADER, 2x5, 0.1"CTR, GOLD, OR EQ, RoHS. |
| J2 | N2510-6002-RB | 3M | HEADER, SHROUDED, 2x5, OR EQ, RoHS. |
| D7 | SML-LX0603GW-TR | Lumex Opto/Components Inc | LED, 565NM, GREEN DIFF, SMT0603, OR EQ, RoHS. |
| D3 D6 | SML-LX0603IW-TR | Lumex Opto/Components Inc | LED, RED DIFF, 635NM, SMT0603, OR EQ, RoHS. |
| U5 | LM2937IMP-3.3/NOPB | National Semiconductor | VOLTAGE REG, 3.3 V, LDO, 500MA, SOT223, RoHS. |
| R36 | RV100F-30-4K1B-B10K-B301 | Alpha (Taiwan) | POT, 10K, THUMBWHEEL LINEAR, 0.03W, ±20%, OR EQ, RoHS. |
| R1 | RC0603JR-070RL | Yageo | RES, 0.0, SMT, 0603, 1/10W, ±5%, OR EQ, RoHS. |
| R41-42 | ERJ-3EKF1002V | Panasonic Electronic Components | RES, EQ. 10.0 kΩ, SMT, 0603, 1/10W, ±1%, OR EQ, RoHS. |
| R2-4 R11 R37-38 | ERJ-3EKF1001V | Panasonic Electronic Components | RES, 1 kΩ, SMT, 0603, 1/10W, ±1%, OR EQ, RoHS. |
| R7 R12 | ERJ-3EKF4751V | Panasonic Electronic Components | RES, 4.75 kΩ, SMT, 0603, 1/10W, ±1%, OR EQ, RoHS. |
| R5-6 R10 | MCR03EZPJ471 | Rohm Semiconductor | RES, 470 Ω, SMT, 0603, 1/10W, ±5%, OR EQ, RoHS. |
| R8-9 | NO POP | NO POP | RES, NO POP, SMT, 0603, OR EQ, RoHS. |
| R13-32 R34 R39 R43-46 | N/A | N/A | SOLDER BUMP RESISTOR, CLOSED, 0402, RoHS. |
| R33 R35 | N/A | N/A | SOLDER BUMP RESISTOR, OPEN, 0402, RoHS. |
| SJ1-6 | SPC02SYAN | Sullins Connector Solutions | CONN, JUMPER SHORTING, TIN, OR EQ, RoHS. |

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Table 2. UPMU-F390-A/UPMU-F370-A Bill of Materials (Continued)

| Reference | Part Number | Source | Description |
|-------------------|---------------|---------------------------------|--|
| SW2-3 | EVQ-PAD04M | Panasonic Electronic Components | SWITCH, LIGHT TOUCH, 130GF, 6 mm SQ, RoHS. |
| SW1 | SSSS820201 | Alps | SWITCH SLIDE, SMT, RoHS. |
| TP1-12 TP42-43 | NO POP | NO POP | TEST POINT, PC COMPACT, NO POP, OR EQ, RoHS. |
| TB1 | 1729157 | Phoenix Contact | TERM. BLOCK, 5.08 mm CTRS, 5 POS, RoHS. |
| P2 | 61729-0010BLF | FCI | CONN, USB RECEIPT, TYPE B, RoHS. |
| Y1 | NO POP | NO POP | CRYSTAL, NO POP, OR EQ, RoHS. |

APPENDIX—MCU CARD HEADER PIN DESCRIPTIONS

Table 3. UDP C8051F390/F370 MCU Card H1 Pin Descriptions

| MCU Card Pin | Signal Name | Usage |
|--------------|--------------|---------------------------|
| 1 | GND | |
| 2 | USART_TX_A | |
| 3 | USART_RX_A | |
| 4 | USART_RTS_A | |
| 5 | USART_CTS_A | |
| 6 | USART_UCLK_A | |
| 7 | CAN_TX_B | |
| 8 | CAN_RX_B | |
| 9 | SPI_SCK_A | SPI0 clock |
| 10 | SPI_MISO_A | SPI0 master-in, slave-out |
| 11 | SPI_MOSI_A | SPI0 master-out, slave-in |
| 12 | SPI_NSS0_A | SPI0 slave select |
| 13 | SPI_NSS1_A | |
| 14 | SPI_NSS2_A | |
| 15 | SPI_NSS3_A | |
| 16 | USART_TX_B | |
| 17 | USART_RX_B | |
| 18 | USART_RTS_B | |
| 19 | USART_CTS_B | |
| 20 | USART_UCLK_B | |
| 21 | EPCA_ECI_A | |
| 22 | EPCA_CH0_A | |
| 23 | EPCA_CH1_A | |
| 24 | EPCA_CH2_A | |
| 25 | EPCA_CH3_A | |
| 26 | EPCA_CH4_A | |
| 27 | EPCA_CH5_A | |
| 28 | LIN_TX_A | |
| 29 | LIN_RX_A | |
| 30 | PCA_ECI_A | PCA0 external clock input |
| 31 | PCA_CH0_A | PCA0 channel 0 |
| 32 | PCA_CH1_A | PCA0 channel 1 |
| 33 | PCA_ECI_B | |
| 34 | PCA_CH0_B | PCA0 channel 2 |
| 35 | PCA_CH1_B | |
| 36 | I2SOUT_DFS_A | |

Table 3. UDP C8051F390/F370 MCU Card H1 Pin Descriptions (Continued)

| MCU Card Pin | Signal Name | Usage |
|--------------|---------------|-----------------------------------|
| 37 | I2SOUT_CLK_A | |
| 38 | I2SOUT_DOUT_A | |
| 39 | I2C_SDA_EZR | EZRadioPro I ² C data |
| 40 | I2C_SCL_EZR | EZRadioPro I ² C clock |
| 41 | TIMER_CT_A | Timer0 input |
| 42 | TIMER_EX_A | |
| 43 | TIMER_CT_B | Timer1 input |
| 44 | TIMER_EX_B | |
| 45 | UART_TX_A | UART A transmit |
| 46 | UART_RX_A | UART A receive |
| 47 | UART_RTS_A | UART A hardware handshaking |
| 48 | UART_CTS_A | UART A hardware handshaking |
| 49 | UART_TX_SYS | System UART transmit |
| 50 | GND | |
| 51 | UART_RX_SYS | System UART receive |
| 52 | UART_RTS_SYS | System UART hardware handshaking |
| 53 | UART_CTS_SYS | System UART hardware handshaking |
| 54 | SPI_SCK_EZR | |
| 55 | SPI_MISO_EZR | |
| 56 | SPI_MOSI_EZR | |
| 57 | SPI_NSS0_EZR | |
| 58 | SPI_NSS1_EZR | |
| 59 | SPI_NSS2_EZR | |
| 60 | SPI_NSS3_EZR | |
| 61 | I2C_SDA_B | SMBUS0 data |
| 62 | I2C_SCL_B | SMBUS0 clock |
| 63 | I2SIN_DFS_A | |
| 64 | I2SIN_CLK_A | |
| 65 | I2SIN_DOUT_A | |
| 66 | CLKOUT0 | MCU system clock |
| 67 | GPIO00 | |
| 68 | GPIO01 | |
| 69 | GPIO02 | |
| 70 | GPIO03 | |
| 71 | GPIO04 | |
| 72 | GPIO05 | |
| 73 | GPIO06 | |

Table 3. UDP C8051F390/F370 MCU Card H1 Pin Descriptions (Continued)

| MCU Card Pin | Signal Name | Usage |
|--------------|---------------|----------------------|
| 74 | GPIO07 | |
| 75 | GPIO08 | |
| 76 | GPIO09 | |
| 77 | GPIO10 | |
| 78 | GPIO11 | |
| 79 | GPIO12 | |
| 80 | GPIO13 | |
| 81 | GPIO14 | |
| 82 | GPIO15 | |
| 83 | PORT_MATCH0 | |
| 84 | PORT_MATCH1 | |
| 85 | WAKEUP0 | |
| 86 | WAKEUP1 | |
| 87 | EXT_INT0 | External interrupt 0 |
| 88 | EXT_INT1 | External interrupt 1 |
| 89 | EXT_ADC_TRIG0 | |
| 90 | EXT_ADC_TRIG1 | |
| 91 | EXT_DAC_TRIG0 | |
| 92 | EXT_DAC_TRIG1 | |
| 93 | EXT_DMA_TRIG0 | |
| 94 | EXT_DMA_TRIG1 | |
| 95 | CAN_TX_A | |
| 96 | CAN_RX_A | |
| 97 | LIN_TX_B | |
| 98 | LIN_RX_B | |
| 99 | LPTIMER_IN_A | |
| 100 | LPTIMER_OUT_A | |

Table 4. UDP C8051F390/F370 MCU Card H2 Pin Descriptions

| MCU Card Pin | Signal Name | Description |
|--------------|----------------|---|
| 1 | GND | |
| 2 | UDPBUS_SDA_A | Electronic Board ID I ² C data |
| 3 | UDPBUS_SCL_A | Electronic Board ID I2C clock |
| 4 | EPCA_ECI_MOTOR | |
| 5 | EPCA_CH0_MOTOR | |
| 6 | EPCA_CH1_MOTOR | |
| 7 | EPCA_CH2_MOTOR | |
| 8 | EPCA_CH3_MOTOR | |
| 9 | EPCA_CH4_MOTOR | |
| 10 | EPCA_CH5_MOTOR | |
| 11 | HVGPI00 | |
| 12 | HVGPI01 | |
| 13 | HVGPI02 | |
| 14 | HVGPI03 | |
| 15 | HVGPI04 | |
| 16 | HVGPI05 | |
| 17 | HVGPI06 | |
| 18 | HVGPI07 | |
| 19 | EMIF_A23 | |
| 20 | EMIF_A22 | |
| 21 | EMIF_A21 | |
| 22 | EMIF_A20 | |
| 23 | EMIF_A19 | |
| 24 | EMIF_A18 | |
| 25 | EMIF_A17 | |
| 26 | EMIF_A16 | |
| 27 | EMIF_A15 | |
| 28 | EMIF_A14 | |
| 29 | EMIF_A13 | |
| 30 | EMIF_A12 | |
| 31 | EMIF_A11 | |
| 32 | EMIF_A10 | |
| 33 | EMIF_A9 | |
| 34 | EMIF_A8 | |
| 35 | EMIF_A7 | |
| 36 | EMIF_A6 | |
| 37 | EMIF_A5 | |

Table 4. UDP C8051F390/F370 MCU Card H2 Pin Descriptions (Continued)

| MCU Card Pin | Signal Name | Description |
|--------------|-------------|-------------|
| 38 | EMIF_A4 | |
| 39 | EMIF_A3 | |
| 40 | EMIF_A2 | |
| 41 | EMIF_A1 | |
| 42 | EMIF_A0 | |
| 43 | EMIF_WRB | |
| 44 | EMIF_OEB | |
| 45 | EMIF_ALE | |
| 46 | EMIF_CS0B | |
| 47 | EMIF_BE1B | |
| 48 | EMIF_CS1B | |
| 49 | EMIF_BE0B | |
| 50 | GND | |
| 51 | LCD_SEG00_A | |
| 52 | LCD_SEG01_A | |
| 53 | LCD_SEG02_A | |
| 54 | LCD_SEG03_A | |
| 55 | LCD_SEG04_A | |
| 56 | LCD_SEG05_A | |
| 57 | LCD_SEG06_A | |
| 58 | LCD_SEG07_A | |
| 59 | LCD_SEG08_A | |
| 60 | LCD_SEG09_A | |
| 61 | LCD_SEG10_A | |
| 62 | LCD_SEG11_A | |
| 63 | LCD_SEG12_A | |
| 64 | LCD_SEG13_A | |
| 65 | LCD_SEG14_A | |
| 66 | LCD_SEG15_A | |
| 67 | LCD_SEG16_A | |
| 68 | LCD_SEG17_A | |
| 69 | LCD_SEG18_A | |
| 70 | LCD_SEG19_A | |
| 71 | LCD_SEG20_A | |
| 72 | LCD_SEG21_A | |
| 73 | LCD_SEG22_A | |
| 74 | LCD_SEG23_A | |

Table 4. UDP C8051F390/F370 MCU Card H2 Pin Descriptions (Continued)

| MCU Card Pin | Signal Name | Description |
|--------------|-----------------|-------------|
| 75 | LCD_SEG24_A | |
| 76 | LCD_SEG25_A | |
| 77 | LCD_SEG26_A | |
| 78 | LCD_SEG27_A | |
| 79 | LCD_SEG28_A | |
| 80 | LCD_SEG29_A | |
| 81 | LCD_SEG30_A | |
| 82 | LCD_SEG31_A | |
| 83 | LCD_SEG32_A | |
| 84 | LCD_SEG33_A | |
| 85 | LCD_SEG34_A | |
| 86 | LCD_SEG35_A | |
| 87 | LCD_SEG36_A | |
| 88 | LCD_SEG37_A | |
| 89 | LCD_SEG38_A | |
| 90 | LCD_SEG39_A | |
| 91 | LCD_COM0_A | |
| 92 | LCD_COM1_A | |
| 93 | LCD_COM2_A | |
| 94 | LCD_COM3_A | |
| 95 | LCD_COM4_A | |
| 96 | LCD_COM5_A | |
| 97 | LCD_COM6_A | |
| 98 | LCD_COM7_A | |
| 99 | CMOSCLK_XTAL1_A | |
| 100 | CMOSCLK_XTAL2_A | |

Table 5. UDP C8051F390/F370 MCU Card H3 Pin Descriptions

| MCU Card Pin | Description | Description |
|--------------|---------------|---|
| 1 | GND | |
| 2 | PWR_VDD_IN | |
| 3 | PWR_VDD_IN | |
| 4 | PWR_VDD_OUT | Programmable Supply from UDP to VDD (when VDD select switch is set to UDP) |
| 5 | PWR_VDD_OUT | |
| 6 | PWR_RADIO_IN | |
| 7 | PWR_RADIO_IN | |
| 8 | PWR_RADIO_OUT | |
| 9 | PWR_RADIO_OUT | |
| 10 | PWR_IO_IN | |
| 11 | PWR_IO_IN | |
| 12 | PWR_IO_OUT | |
| 13 | PWR_IO_OUT | |
| 14 | PWR_IO_BUS | |
| 15 | PWR_IO_BUS | |
| 16 | PWR_AUX_BUS | |
| 17 | PWR_AUX_BUS | |
| 18 | PWR_HV1_BUS | |
| 19 | PWR_HV1_BUS | |
| 20 | PWR_HV2_BUS | |
| 21 | PWR_HV2_BUS | |
| 22 | PWR_VPP_BULK | |
| 23 | PWR_VPP_BULK | |
| 24 | PWR_5.0_BULK | |
| 25 | PWR_5.0_BULK | |
| 26 | PWR_5.0_BULK | |
| 27 | PWR_5.0_BULK | |
| 28 | PWR_3.3_BULK | 3.3 V power from the UDP mother (Powers VDD2 when VDD select switch is set to UDP) |
| 29 | PWR_3.3_BULK | |
| 30 | PWR_3.3_BULK | |
| 31 | PWR_3.3_BULK | |
| 32 | PWR_SYS_BULK | 3.3 V power supply for EBID EEPROM |
| 33 | PWR_SYS_BULK | |
| 34 | GND | |
| 35 | EBID_SCK | |
| 36 | EBID_MOSI | |
| 37 | EBID_MISO | |

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Table 5. UDP C8051F390/F370 MCU Card H3 Pin Descriptions (Continued)

| MCU Card Pin | Description | Description |
|--------------|-------------|---|
| 38 | EBID_NSS | |
| 39 | C2_CLK_A | Reset/C2 interface clock |
| 40 | C2_DAT_A | P2.4/C2 interface data |
| 41 | C2_CLK_B | |
| 42 | C2_DAT_B | |
| 43 | C2_CLK_C | |
| 44 | C2_DAT_C | |
| 45 | C2_CLK_D | |
| 46 | C2_DAT_D | |
| 47 | C2_CLK_E | |
| 48 | C2_DAT_E | |
| 49 | nc | |
| 50 | GND | |
| 51 | JTAG_TDO_A | |
| 52 | JTAG_TDI_A | |
| 53 | VCP_EN | Active-low enable for MCU Card VCP Bridge (default) |
| 54 | UART_SYS_EN | Active-low enable for MCU to UDP UART path |
| 55 | H3_55 | |
| 56 | H3_56 | |
| 57 | H3_57 | |
| 58 | H3_58 | |
| 59 | H3_59 | |
| 60 | H3_60 | |
| 61 | H3_61 | |
| 62 | H3_62 | |
| 63 | H3_63 | |
| 64 | H3_64 | |
| 65 | H3_65 | |
| 66 | H3_66 | |
| 67 | H3_67 | |
| 68 | H3_68 | |
| 69 | H3_69 | |
| 70 | H3_70 | |
| 71 | H3_71 | |
| 72 | H3_72 | |
| 73 | H3_73 | |
| 74 | H3_74 | |

Table 5. UDP C8051F390/F370 MCU Card H3 Pin Descriptions (Continued)

| MCU Card Pin | Description | Description |
|---------------------|--------------------|--------------------|
| 75 | H3_75 | |
| 76 | H3_76 | |
| 77 | H3_77 | |
| 78 | H3_78 | |
| 79 | H3_79 | |
| 80 | H3_80 | |
| 81 | H3_81 | |
| 82 | H3_82 | |
| 83 | H3_83 | |
| 84 | H3_84 | |
| 85 | H3_85 | |
| 86 | H3_86 | |
| 87 | H3_87 | |
| 88 | H3_88 | |
| 89 | H3_89 | |
| 90 | H3_90 | |
| 91 | H3_91 | |
| 92 | H3_92 | |
| 93 | H3_93 | |
| 94 | H3_94 | |
| 95 | H3_95 | |
| 96 | H3_96 | |
| 97 | H3_97 | |
| 98 | H3_98 | |
| 99 | H3_99 | |
| 100 | H3_100 | |

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Table 6. UDP C8051F390/F370 MCU Card H4 Pin Descriptions

| MCU Card Pin | Description | Description |
|--------------|-------------|--------------|
| 1 | GND | |
| 2 | C2D_TX00_A | |
| 3 | C2D_TX01_A | |
| 4 | C2D_TX02_A | |
| 5 | C2D_TX03_A | |
| 6 | C2D_TX04_A | |
| 7 | C2D_TX05_A | |
| 8 | C2D_TX06_A | |
| 9 | C2D_TX07_A | |
| 10 | C2D_TX08_A | |
| 11 | C2D_TX09_A | |
| 12 | C2D_TX10_A | |
| 13 | C2D_TX11_A | |
| 14 | C2D_TX12_A | |
| 15 | C2D_TX13_A | |
| 16 | C2D_TX14_A | |
| 17 | C2D_TX15_A | |
| 18 | C2D_RX00_A | |
| 19 | C2D_RX01_A | |
| 20 | C2D_RX02_A | |
| 21 | C2D_RX03_A | |
| 22 | C2D_RX04_A | |
| 23 | C2D_RX05_A | |
| 24 | C2D_RX06_A | |
| 25 | C2D_RX07_A | |
| 26 | C2D_RX08_A | |
| 27 | C2D_RX09_A | |
| 28 | C2D_RX10_A | |
| 29 | C2D_RX11_A | |
| 30 | C2D_RX12_A | |
| 31 | C2D_RX13_A | |
| 32 | C2D_RX14_A | |
| 33 | C2D_RX15_A | |
| 34 | GND | |
| 35 | ADC_VREF | |
| 36 | ADC_VREFGND | |
| 37 | ADC_IN0 | ADC0 input 0 |

Table 6. UDP C8051F390/F370 MCU Card H4 Pin Descriptions (Continued)

| MCU Card Pin | Description | Description |
|--------------|------------------|---------------------------------|
| 38 | ADC_IN1 | ADC0 input 1 |
| 39 | ADC_IN2 | ADC0 input 2 |
| 40 | ADC_IN3 | ADC0 input 3 |
| 41 | GND | |
| 42 | DAC_VREF | |
| 43 | DAC_VREFGND | |
| 44 | DAC_OUT0 | |
| 45 | DAC_OUT1 | |
| 46 | DAC_OUT2 | |
| 47 | DAC_OUT3 | |
| 48 | GND | |
| 49 | IDAC_A | IDAC0 output |
| 50 | IDAC_B | IDAC1 output |
| 51 | CP_OUT_A | Comparator0 synchronous output |
| 52 | CP_OUTA_A | Comparator0 asynchronous output |
| 53 | CP_POS_A | |
| 54 | CP_NEG_A | |
| 55 | CP_POS_B | |
| 56 | CP_NEG_B | |
| 57 | GND | |
| 58 | HVDA_INP_A | |
| 59 | HVDA_INN_A | |
| 60 | HVDA_INP_B | |
| 61 | HVDA_INN_B | |
| 62 | GND | |
| 63 | I2V_INP_A | |
| 64 | I2V_INN_A | |
| 65 | EXTREG_SP_A | |
| 66 | EXTREG_SN_A | |
| 67 | EXTREG_OUT_A | |
| 68 | EXTREG_BD_A | |
| 69 | GND | |
| 70 | EZRP_CLK_IN | |
| 71 | GND | |
| 72 | EZRP_TX_DATA_IN | |
| 73 | EZRO_RX_CLK_OUT | |
| 74 | EZRP_RX_DATA_OUT | |

Table 6. UDP C8051F390/F370 MCU Card H4 Pin Descriptions (Continued)

| MCU Card Pin | Description | Description |
|--------------|---------------|-------------|
| 75 | GND | |
| 76 | EZRP_SDN | |
| 77 | EZRP_NIRQ | |
| 78 | EZR_NFFS | |
| 79 | EZR_SI100X_TX | |
| 80 | EZR.DTO | |
| 81 | EZR_FFIT | |
| 82 | EZR_SI100X_RX | |
| 83 | EZR_RESET | |
| 84 | EZR_ARSSI | |
| 85 | EZR_VDI | |
| 86 | EZR_GPIO0 | |
| 87 | EZR_GPIO1 | |
| 88 | EZR_GPIO2 | |
| 89 | EZR_GPIO3 | |
| 90 | EZR_GPIO4 | |
| 91 | H4_91 | |
| 92 | ITM_DAT0 | |
| 93 | ITM_DAT1 | |
| 94 | ITM_DAT2 | |
| 95 | ITM_DAT3 | |
| 96 | ITM_CLK | |
| 97 | H4_97 | |
| 98 | H4_98 | |
| 99 | H4_99 | |
| 100 | GND | |

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