8-BIT MICROCONTROLLER BOARD HARDWARE REFERENCE GUIDE

Description

This document describes the operation of the Silicon Laboratories 8-bit Microcontroller Board Rev 2.0, which easily interfaces a microcontroller to the Silicon Laboratories line of voice products. The evaluation board for the Si321x, Si322x, Si3232, and Si3050 can be stacked above this board to interface with up to eight voice products.

The microcontroller supplied on this board is the MC68HC908GP32 from Motorola. The board also contains an RS-232 port, an SPI EEPROM, and power and clock circuitry. The schematics for the daughter card can be seen in Figures 2–7.

The layout of the board can be seen in Figures 8–12. Figure 8 shows the component placement, while Figures 9–12 show the four layers of component interconnect.

Features

The board contains an RS-232 port for monitoring and controlling various call features while the software is running. J1 is a db-9 serial port connector for a PC. It is interfaced to the microcontroller through the SCI port via a MAX3221. The baud rate of the RS-232 port is determined by the MCU clock frequency. For information on this chip, consult the data sheet on the Maxim website.

Various debugging elements exist on the board. The LEDs at D7 and D8 are connected to port B of the microcontroller (see microcontroller data book from the Motorola website). The LEDs are software-programmable and can be programmed to flash at any event. Additionally, the IDE header at JP5 contains all the signals on the board for monitoring purposes, including 19 extraneous microcontroller I/O lines. JP4 drives port C pin 2 low and can be used when writing software. Port A, pin 0 and port C, pins 0, 1, and 3, are driven by the onboard PLD and must be inputs to the microcontroller. Port A, pin 7 must be an output. In normal operation, port A, pin 0 is connected to the Invalid signal from the MAX3221, and pin 7 is connected to the test signal from the Silicon Laboratories Evaluation Boards. Port C, pins 1 and 3, can be connected to any device of JP5. All of port C and pins 4–7 of port D are connected to the onboard PLD. Switch 8 on S2 drives port C, pin 4. Port C, pin 0 tells the microcontroller whether 8.192 MHz (high) or 4.9152 MHz (low) is being used. JP3 is a Motorola MONO8 connector used for debugging and programming. See “Programming the Microcontroller” for more information.

The board contains a Microchip 25LC080 SPI EEPROM. The EEPROM shares the SPI bus with the Silicon Laboratories Evaluation Boards but uses separate chip-select lines to differentiate them. For information on how to read and write to the 25LC080, consult the data sheet available on the Microchip website.

A power-on-reset resets the microcontroller and drives the evaluation board’s reset line low on powerup. S1 accomplishes the same purpose after powerup provided there is a jumper across pins 3 and 4 of JP3. Driving the reset line low in code with port A only affects the Reset line of the Evaluation Board and does not affect the microcontroller.

Power and Clock

The board contains its own power and clock circuitry. If an external V_{DD} is not supplied, the board can generate the 3.3 V necessary to power the daughter card. To use the onboard power circuitry, supply 6–25 V at J4. JP6 is used to turn off the onboard V_{DD}.

The required clock signals are MCU-CLK, PCLK, and FSYNC. An external clock source can be used to supply PCLK and MCU-CLK if switches 3 and 5 of the dipswitch at S2 are set appropriately according to Table 1. If an external source is not possible or desired, U11 is a programmable logic device that is capable of providing PCLK, FSYNC, or MCU-CLK. If the PLD is used, the dipswitch at S2 determines the frequency of PCLK and MCU-CLK according to the settings specified in Table 1. Placing a jumper across JP1 stops the oscillator connected to the PLD.

Table 1. Onboard PCLK and Microcontroller Frequency Settings

S2–1,2	S2–3	S2–4	S2–5	S2–6	S2–7
PCLK frequency	PCLK/FSYNC source	Microcontroller Input Frequency	Microcontroller clock source	Programming	DTX/DRX
0,0 = 8.192 MHz 0,1 = 4.096 MHz 1,0 = 2.048 MHz 1,1 = 1.024 MHz	0 = Internal clock 1 = External clock	0 = 8.192 MHz 1 = 4.9152 MHz	0 = Internal clock 1 = External clock	0 = Normal Operation 1 = Monitor Mode	0 = DTX/DRX not connected 1 = DTX/DRX connected
Note: 1 = on; S2–3 and S2–5 tri-states the clock output pins on the PLD. S2–8 is a software configurable switch through Port C pin 4 of the microcontroller.					

Software

Initilization code and drivers are available from Silicon Laboratories for the Microchip EEPROM, SPI port, SCI/RS-232 port, and the on-chip timer. Additionally, demo software is available to demonstrate the operation of Silicon Laboratories' line of voice products. Contact Silicon Laboratories for code on these products. Custom code can be written for the microcontroller on the board to interface with up to eight telephony products including the Silicon Laboratories line of ProSLIC and DAA voice products.

Programming the Microcontroller

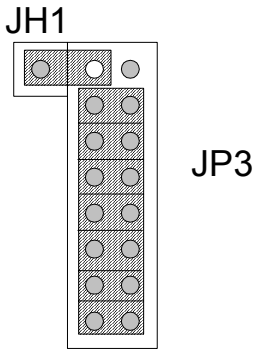
The microcontroller is programmed with the MC68HC908GP32 programming software available from the P&E microsystems website (www.pemicro.com) and the RS-232 port. The software is titled PROG08SZ. To program the microcontroller, place a jumper across JP2. The microcontroller must be in monitor mode before programming. Make sure S2 switch settings are in the correct position according to Table 1 (S2–5 should be off). The PLD automatically supplies the 4.9152 MHz necessary for programming unless S2–5 is in the ON position.

A test voltage between 6–9 V must be applied to the interrupt line of the microcontroller. JP9 selects between an external voltage source and the onboard power to supply the test voltage. Internal circuitry will connect the test voltage to the interrupt line; however, JP10 can be used to supply an external test voltage and clock frequency necessary for programming. (See Figure 5 on page 7.) JP8 can be used to override the internal circuitry and connect the test voltage directly to the $\overline{INT}$ pin of the microcontroller. The microcontroller is then easily programmed using the P&E software.

To program the microcontroller, perform the following steps:

1. Turn S2–6 on and place a jumper across JP2.
2. Ensure S2–5 is off.
3. JP8, JP9, JP10 should be set appropriately to provide a V_{TEST} voltage. Default settings are JP9 in the Int position and No Connection across JP8 and JP10.
4. Connect the board at J1 to the serial port of a PC using a standard db-9 cable.
5. Download, install, and run the PROG08SZ software.
6. When the software starts, set the appropriate COM port, 9600 baud, Class III target hardware type, and FF-FF-FF-FF-FF-FF-FF-FF as the target MCU security bytes.
7. Select the appropriate programming algorithm for the GP32.
8. Click "Erase Module" to remove existing software. (See Figure 1.)
9. Click "Specifiy S-record" and open the *.S19 file that contains the code to be loaded.
10. Click "Program Module".
11. Click "Verify Module". If this completes successfully, programming is complete.

Port A, pins 0 and 7, and port C, pins 0, 1, and 3, are used during programming, so no devices should interfere with those lines. Code on the microcontroller can be debugged and single-stepped using the MONO8 connection at JP3. The MONO8 connection can be used in conjunction with a variety of development tools available from Motorola and P&E microsystems. When the board is in normal operation or being programmed with onboard circuitry and the MONO8 connection is not being used, jumpers should be placed along JP3 and JH1 as follows:



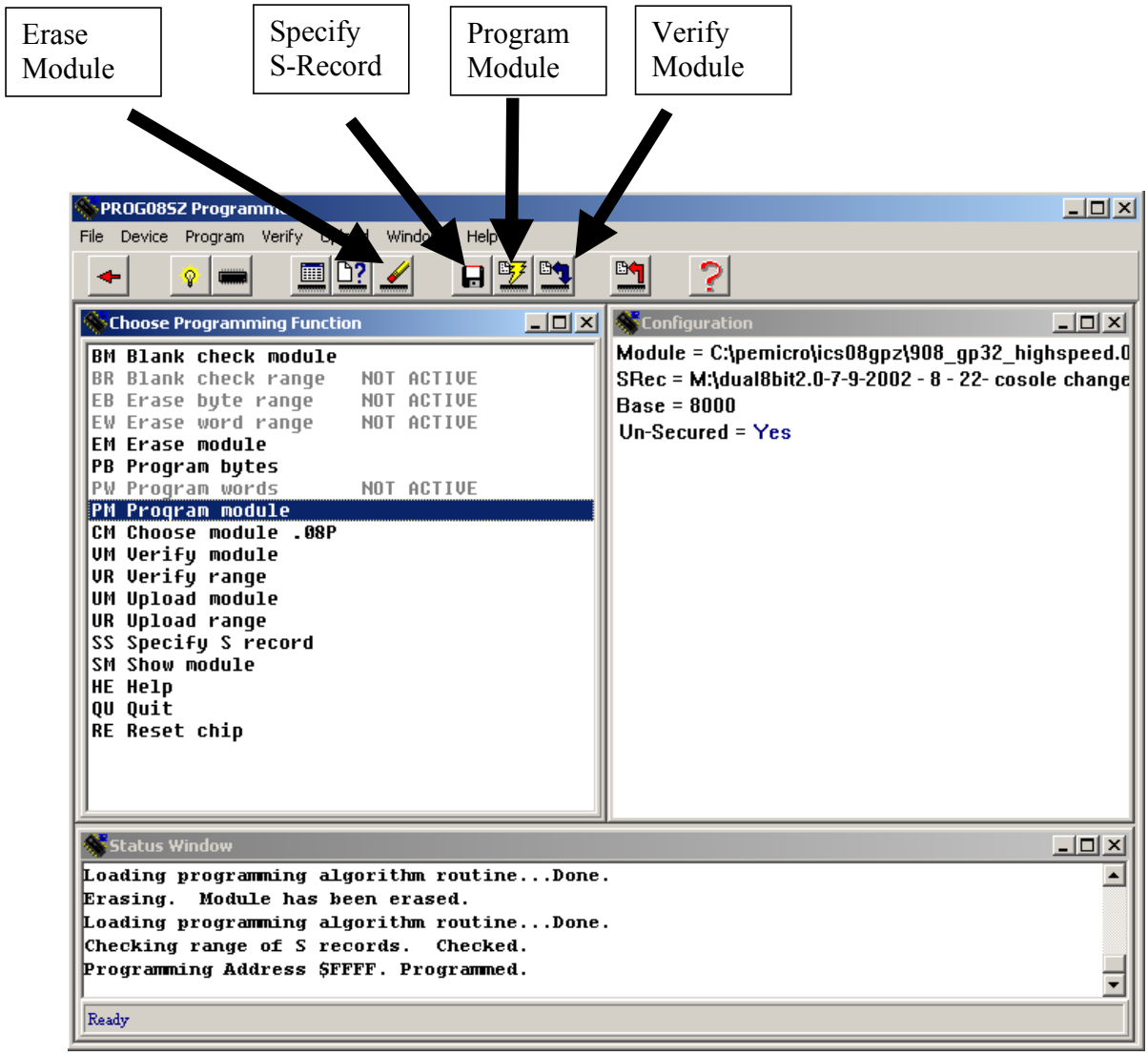


Figure 1. Programming Software

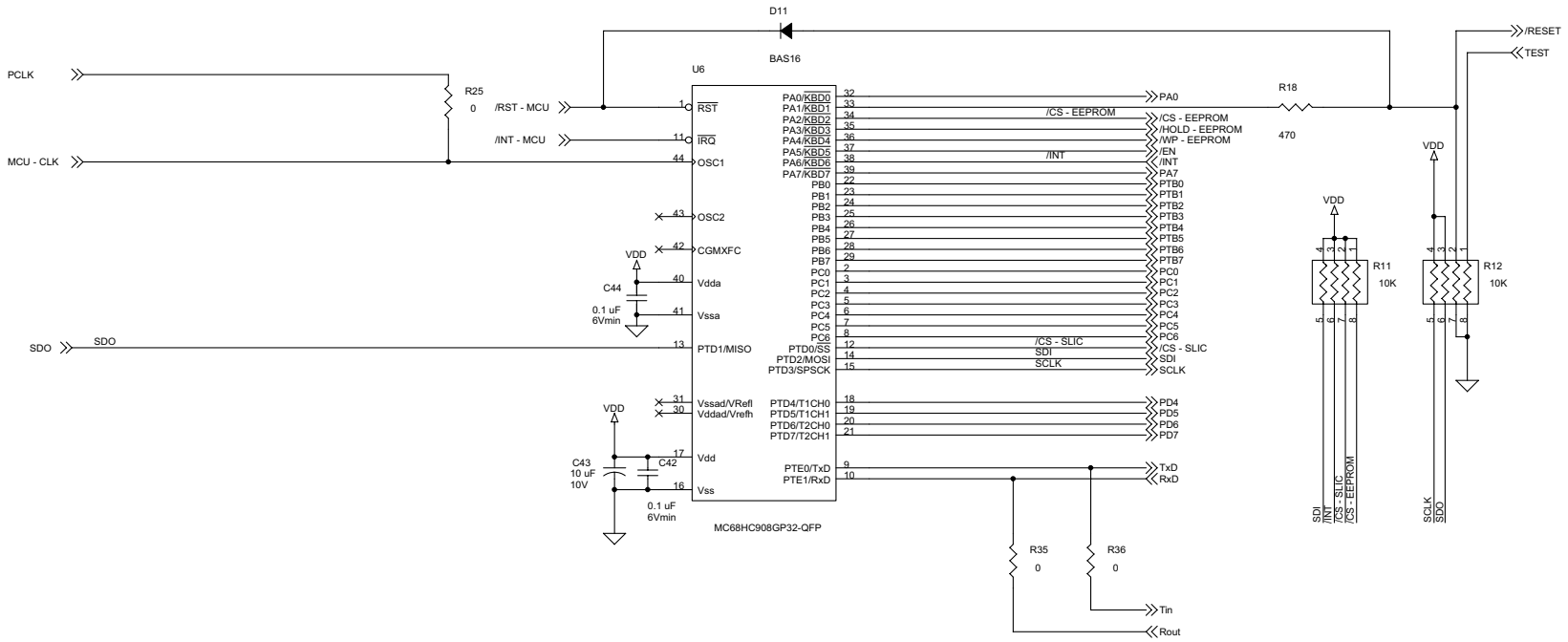


Figure 2. 68HC908GP32

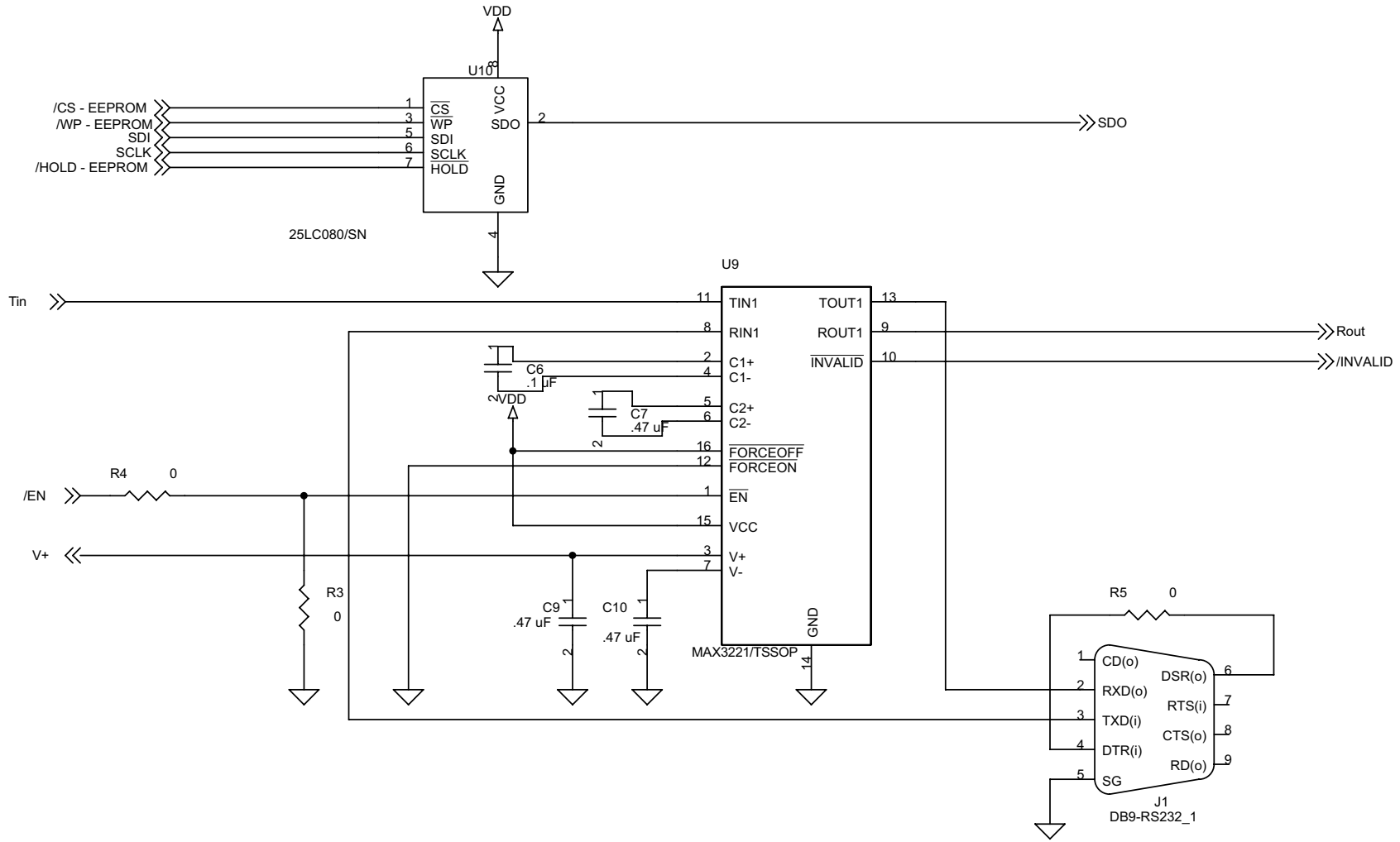


Figure 3. Board Devices

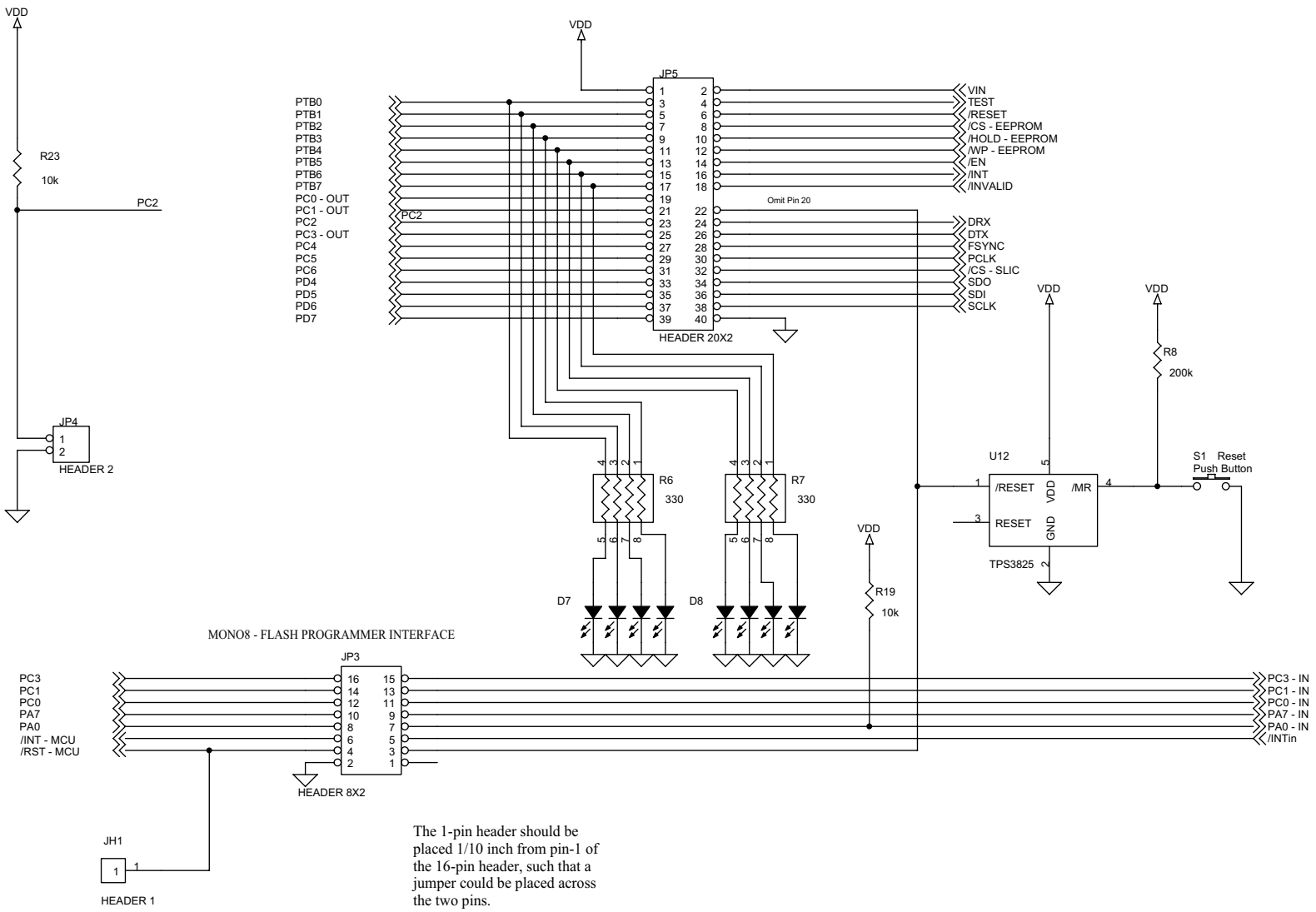


Figure 4. Debugging Devices

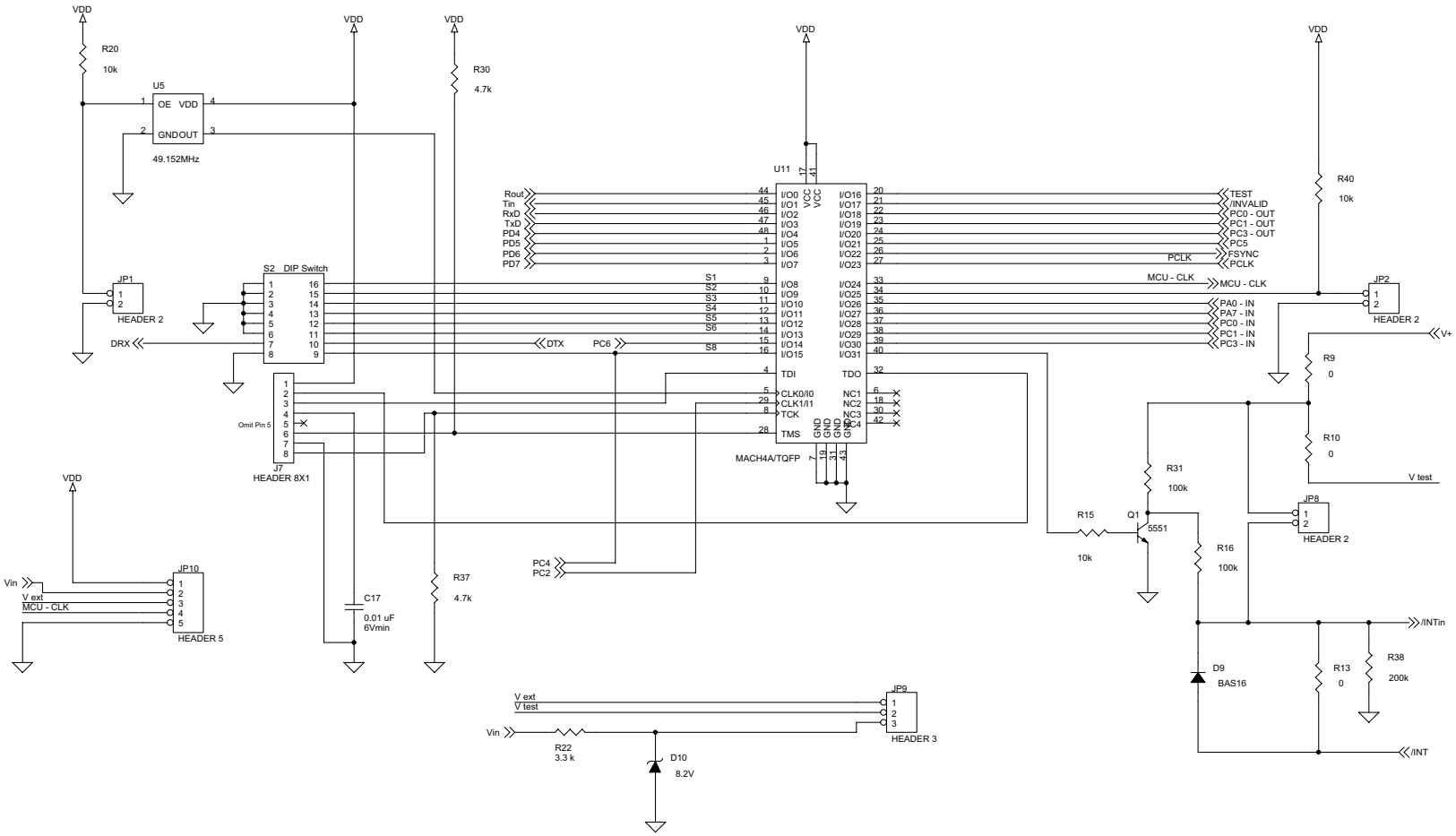


Figure 5. Clock Devices

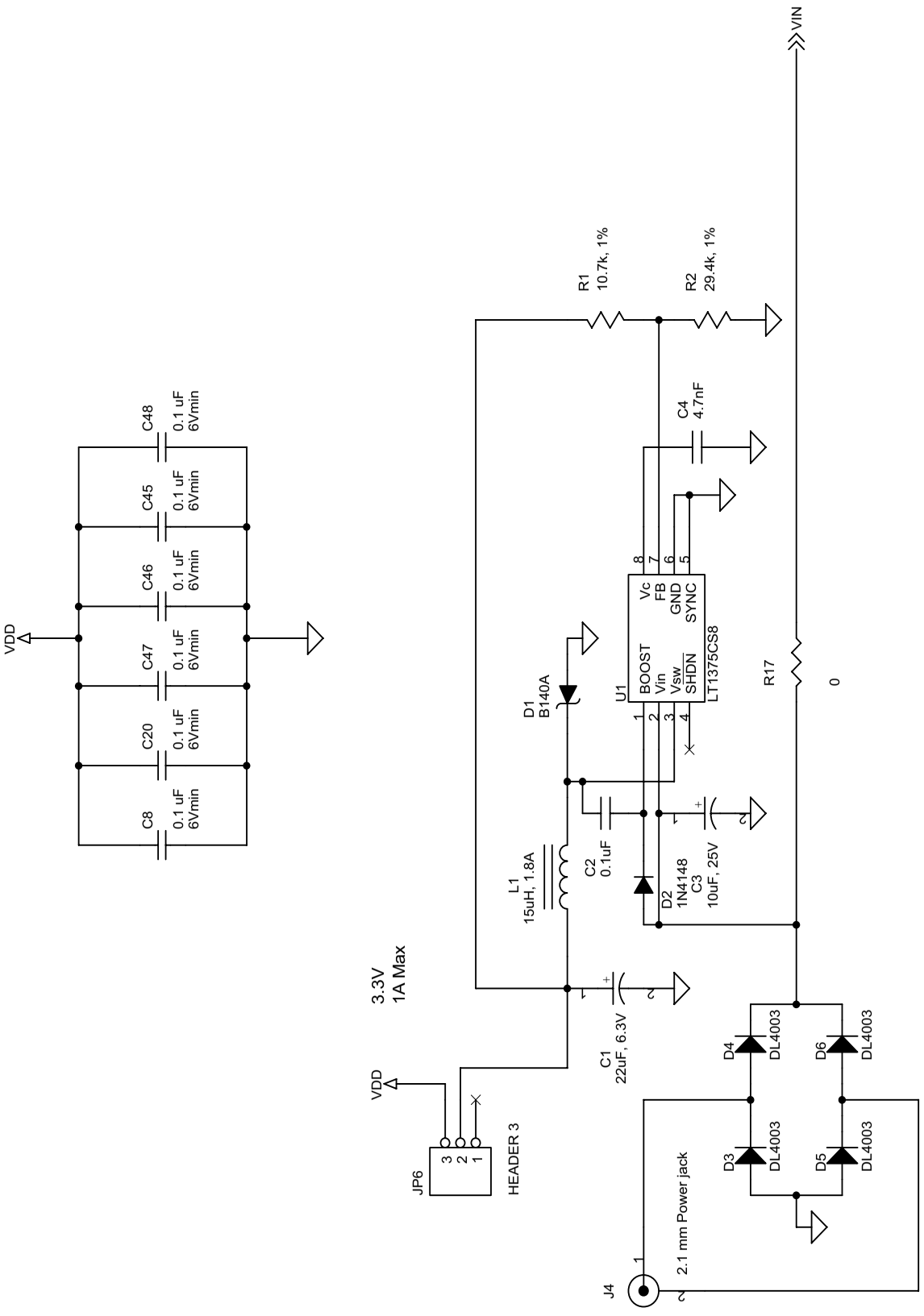


Figure 6. Power

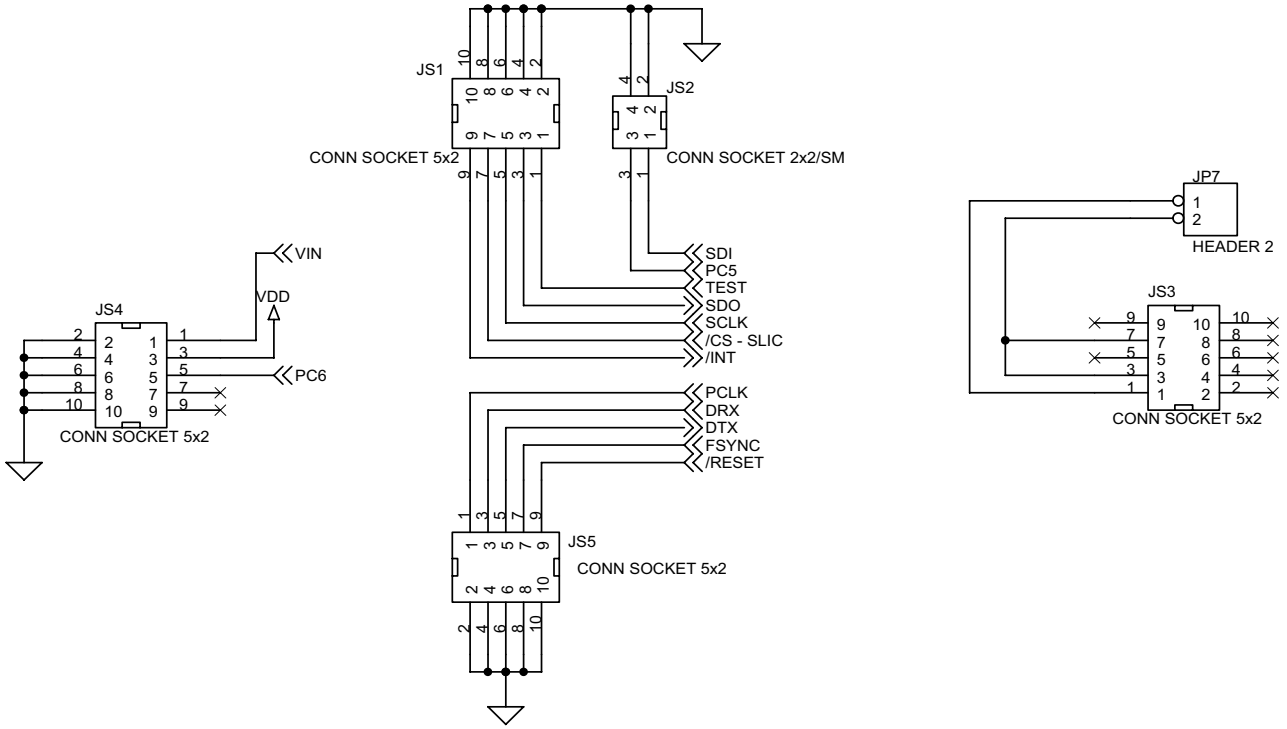


Figure 7. Board Interconnect

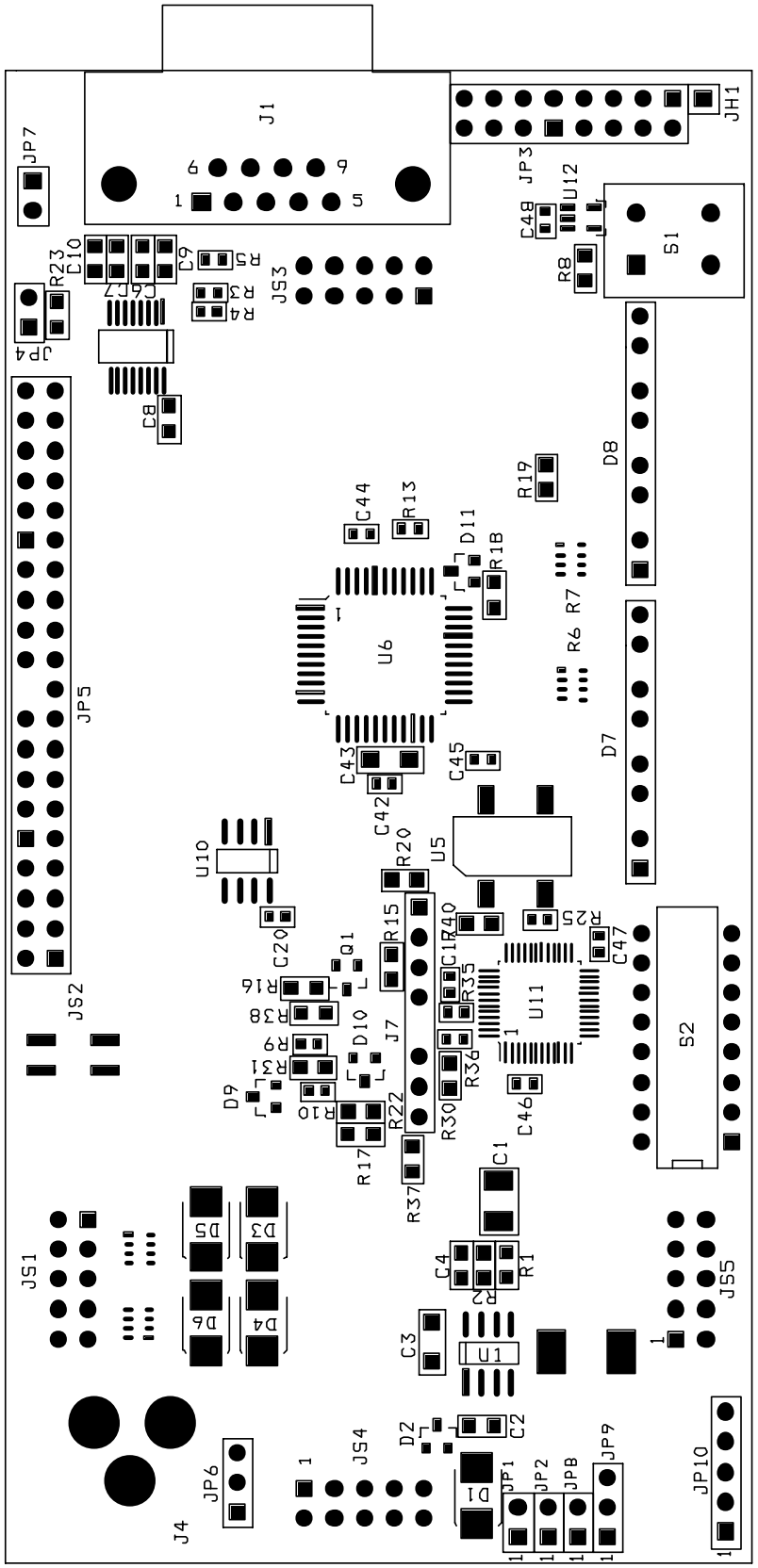


Figure 8. Controller Board Silkscreen

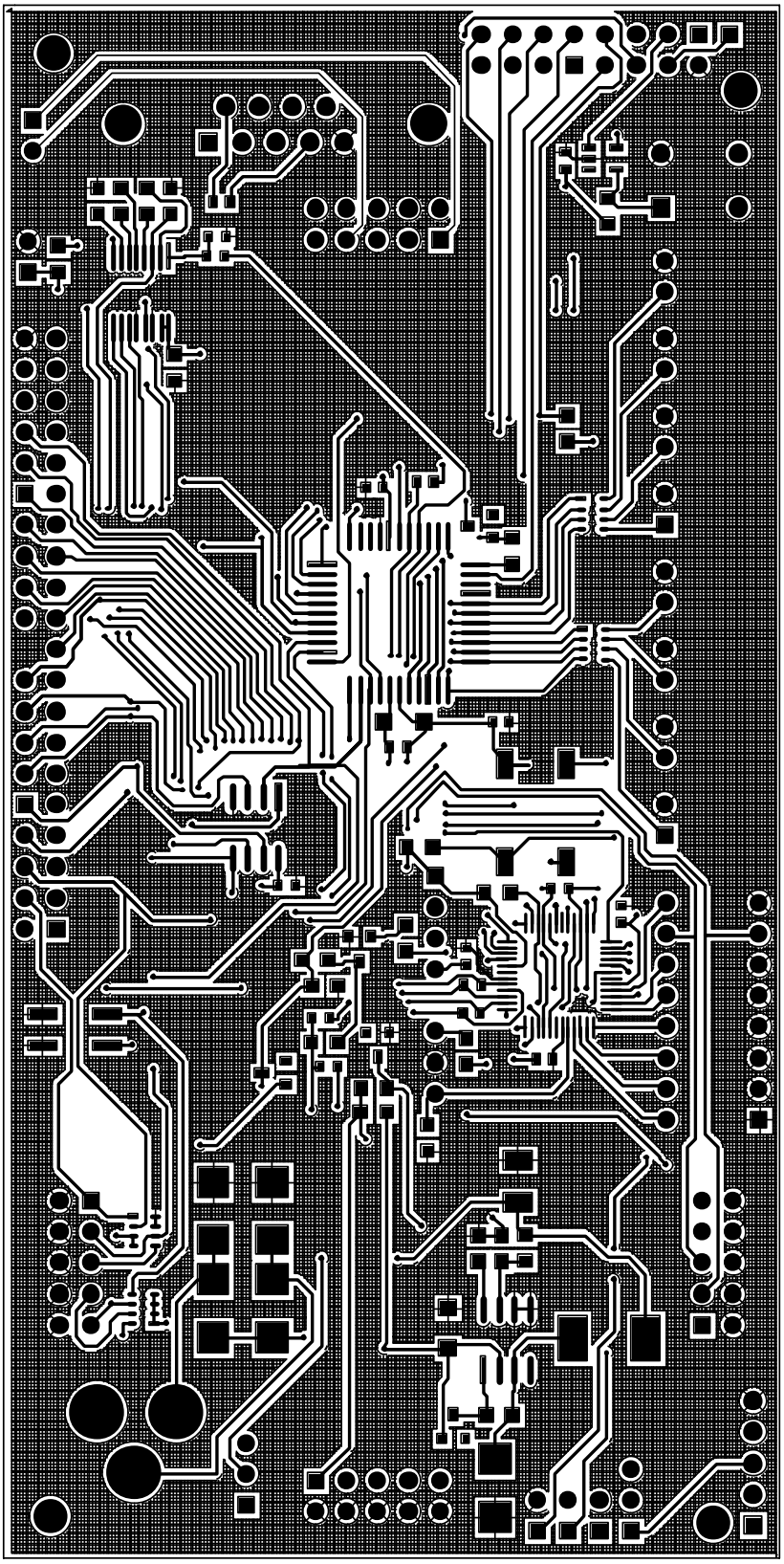


Figure 9. Controller Board Component Side

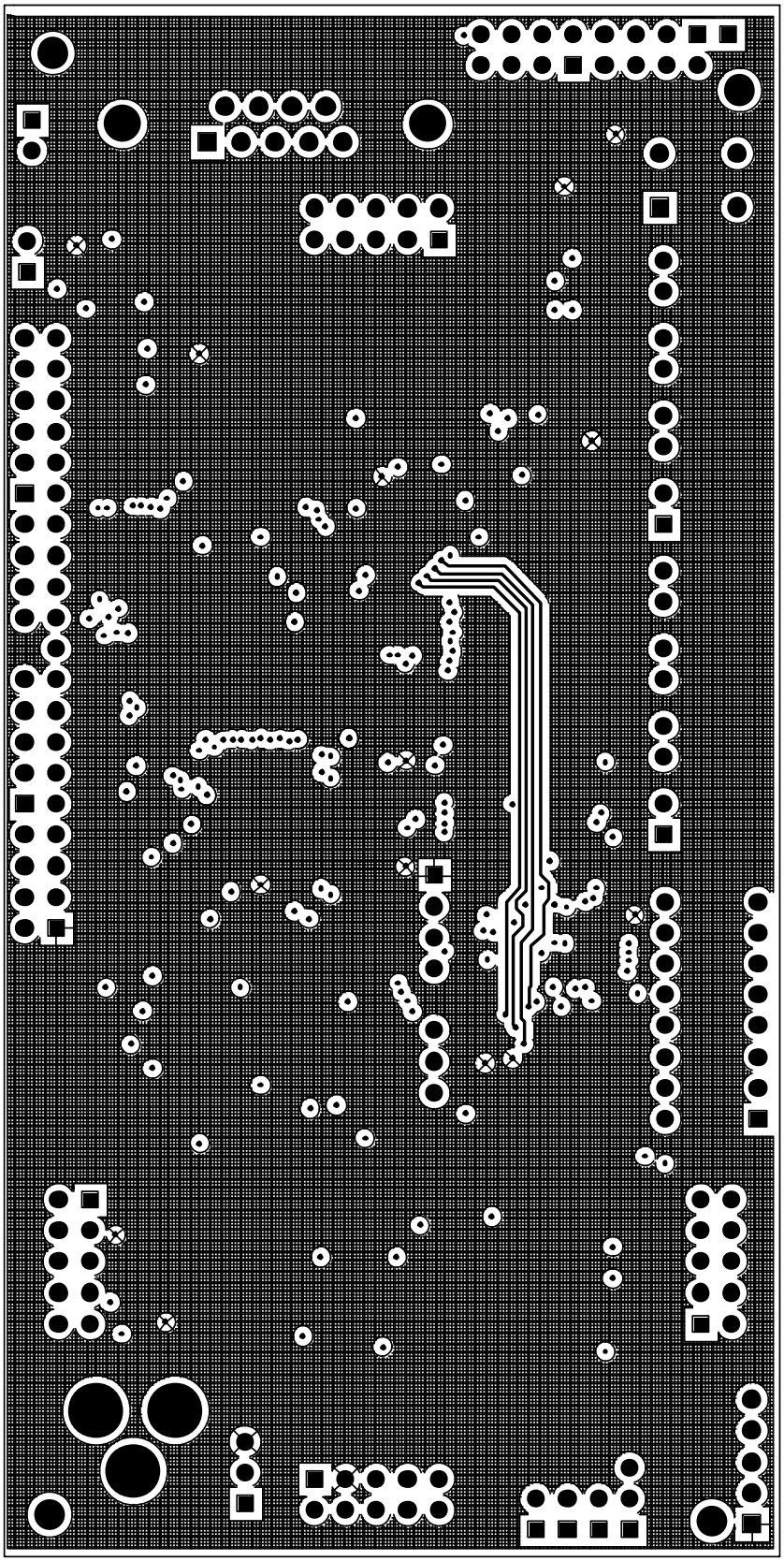


Figure 10. Controller Board VDD Layer

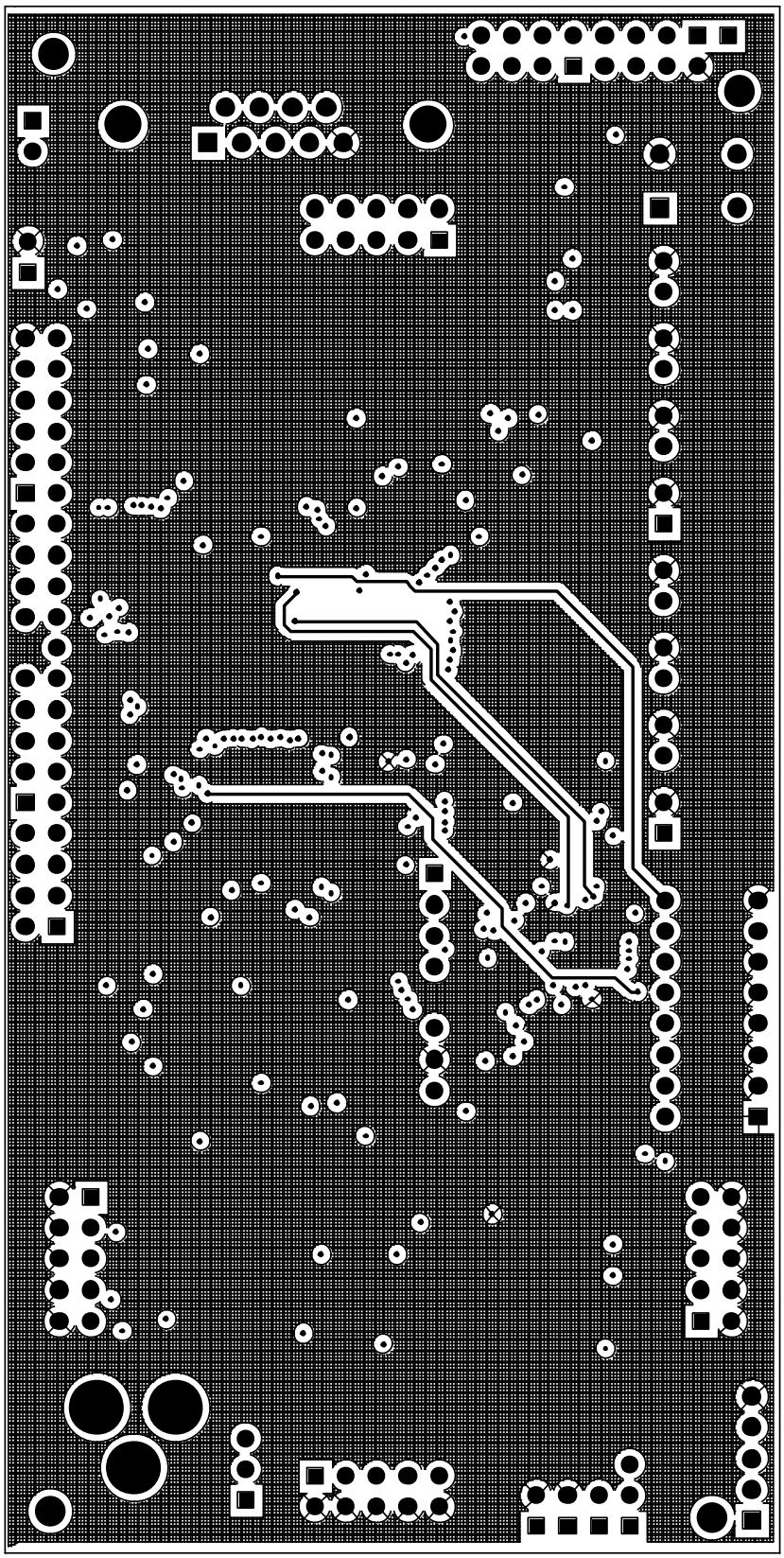


Figure 11. Controller Board Ground Layer

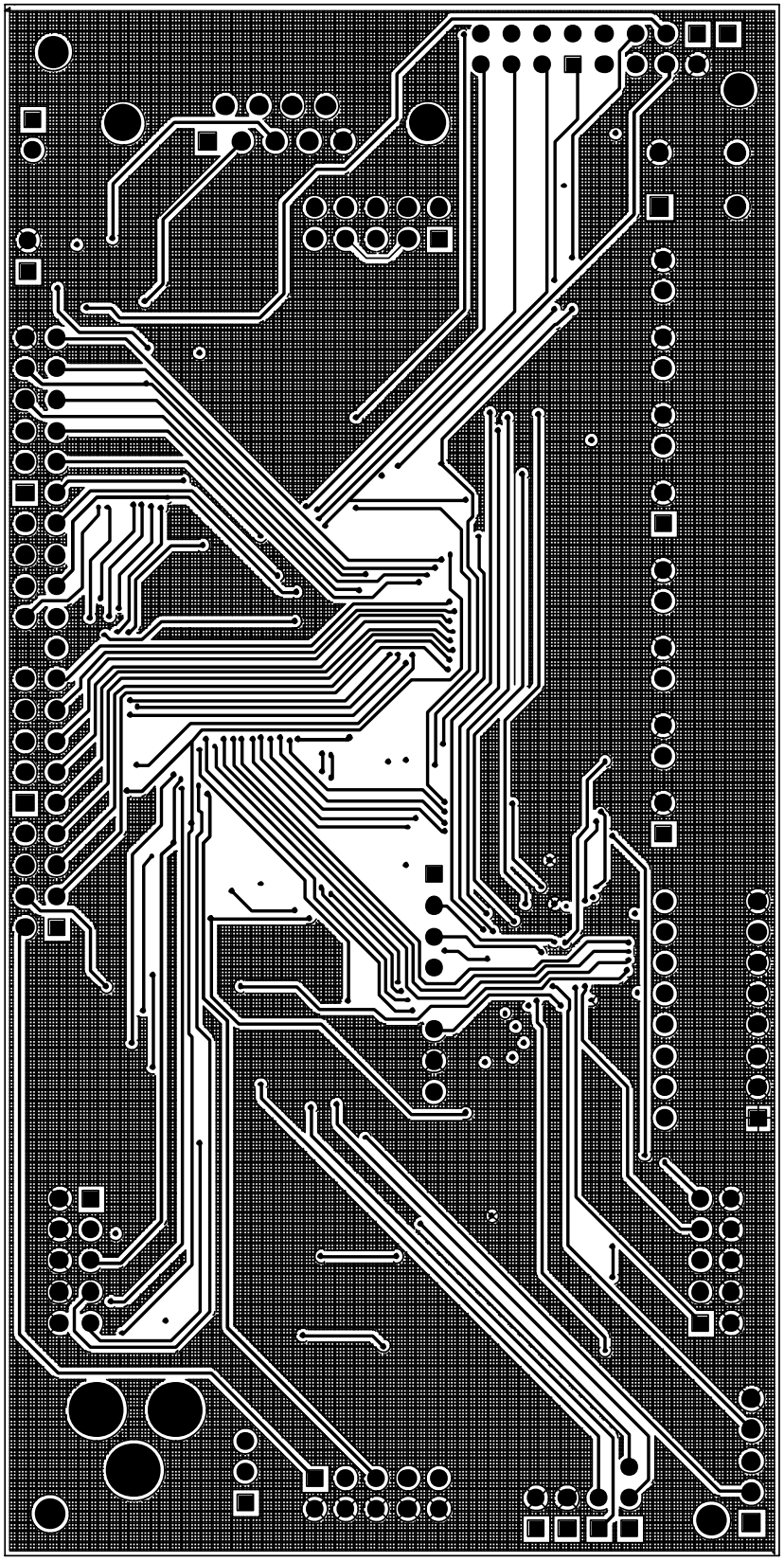


Figure 12. Controller Board Solder Side

Document Change List

Revision 0.1 to Revision 0.2

- Updated programming procedure.
- Corrected direction of IO lines.

Contact Information

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