

MINI-MAX/51-F

Single Board Computer

Technical Manual

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MINI-MAX/51-F Single Board Computer Technical Manual. No part of this work may be reproduced in any manner without written permission of BiPOM Electronics.

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WARRANTY:

BiPOM Electronics warrants MINI-MAX/51-F for a period of 1 year. If the board becomes defective during this period, BiPOM will at its option, replace or repair the board. This warranty is voided if the product is subjected to physical abuse or operated outside stated electrical limits. BiPOM Electronics will not be responsible for damage to any external devices connected to MINI-MAX/51-F. BiPOM Electronics disclaims all warranties express or implied warranties of merchantability and fitness for a particular purpose. In no event shall BiPOM Electronics be liable for any indirect, special, incidental or consequential damages in connection with or arising from the use of this product. BiPOM Electronics' liability is limited to the purchase price of this product.

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1. Overview

MINI-MAX/51-F is a general purpose, low-cost, highly-reliable and highly-expandable micro-controller system that is based on Texas Instruments MSC1211Y5 micro-controller with

- 8051 compatible core with 4 clocks per instruction cycle
- 16K bytes of FLASH program / data memory, (endurance 1 million cycles)
- 1280 bytes of static data RAM
- Precision 8 differential or single-ended channels with 24-bit Analog-Digital-Converter (ADC)
- Quad 16-bit monotonic Digital-Analog-Converter (DAC)
- One PGA (Programmable Gain Amplifier), gain from 1 to 128
- Additional 32-bit accumulator
- Master / slave SPI with DMA
- Multi-master I2C
- 16-bit PWM
- 21 Interrupt sources

MINI-MAX/51-F board complements these features by providing

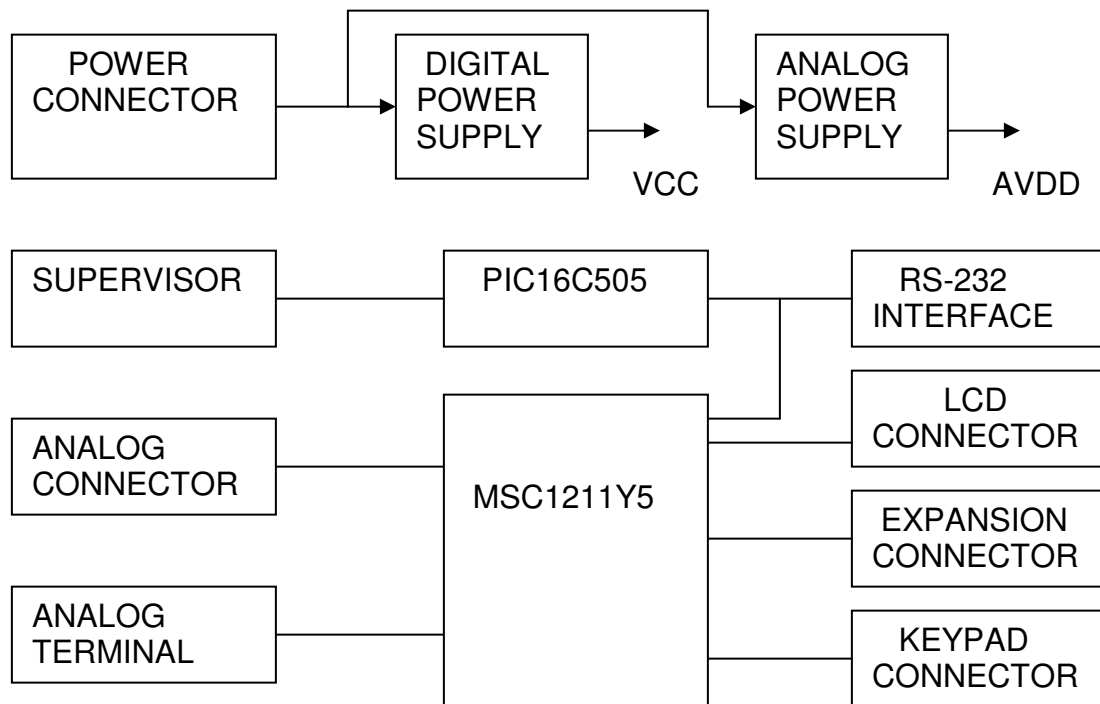
- 512-byte EEPROM (optional up to 128-Kilobyte EEPROM)
- RS232 Serial Port
- In-circuit Programming of the micro-controller through the serial port
- Keypad connector
- LCD connector (programmable contrast adjustment for the LCD)
- Analog connector and screw terminal block for analog circuits
- Expansion bus interface to low-cost peripheral boards

2. Specifications

Dimensions are 2.35 X 2.40 inches (5.97 X 6.10 centimeters).
Mounting holes of 0.125 inches (3 millimeters) on four corners.
0° - 70° C operating, -40° - +85° C storage temperature range.

3. Functional Blocks

Figure1. Block diagram of the MINI-MAX/51-F system.



Micro-controller

MINI-MAX/51-F is based on the MSC1211Y5 micro-controller from Texas Instruments. It combines the popular 8051 core with a high-resolution DAC and ADC.

MSC1211Y5 has all the ports that are available on the 8051 family of micro-controllers: Port 0 (P0), Port 1 (P1), Port 2 (P2) and Port 3 (P3).

P0 has open collector outputs that are available on the LCD connector. P1 and P2 are general-purpose bi-directional input/output ports. Port 2 is available on the keypad connector. P1 and P3 are available on the expansion connector. P3 pins can either be used as general-purpose I/O or have special purposes such as asynchronous serial port, SPI, I2C, interrupt inputs and timer inputs.

MSC1211Y5 also has 17 pins related to DAC and ADC. These are DAC outputs, ADC inputs, reference voltage, analog ground and analog power supply. All these lines are present on the analog terminals and most of them are present on the analog connector.

For more detail on the MSC1211Y5, please refer to Texas Instruments web site: www.ti.com

EEPROM

MINI-MAX/51-F uses a 24C04 (IC4) 512-byte Electrically Erasable Programmable Read-Only-Memory (EEPROM). Typically this EEPROM is used for storing calibration values for sensors, customer identification, serial number and other parameters. This EEPROM is on a socket and can easily be replaced with higher capacity EEPROM's (up to 128 Kilobytes).

In-System Programming

MSC1211Y5 micro-controller can be re-programmed remotely over the RS-232 interface. There is a second micro-controller on the board (PIC16C505) for this purpose. The in-circuit programming feature simplifies program development on the board since downloading programs from a host PC takes only few seconds. User programs can also be debugged through the serial port.

Micro-IDE Integrated Development Environment from BiPOM Electronics fully supports In-System Programming on the MINI-MAX/51-F using the serial port.

Keypad connector

Keypad connector can be used to scan various types of keypads, such as 3 by 5 or 4 by 4. Keypad connector contains 5 Volt power and ground lines and the 8 Port 2 lines of the micro-controller. The Port 2 lines can also be used as general-purpose inputs/outputs.

Keypad Connector (J3)

Signal	Pin
P2.0	1
P2.1	2
P2.2	3
P2.3	4
P2.4	5
P2.5	6
P2.6	7
P2.7	8
Ground	9
VCC	10

Table 1

LCD Connector

LCD connector serves to control various types of character and graphic LCD modules. It occupies micro-controller Port 0.

Alternatively LCD port can be used as an 8-bit general purpose I/O.

VCC (Contrast) is a slow analog PWM output to adjust the contrast of the LCD display under software control. Alternatively it can be used as a general purpose analog output.

LCD Connector (J6)

Signal	Pin	Pin	Signal
Ground	1	2	VCC
Contrast	3	4	P0.0
P0.1	5	6	P0.2
P0.3	7	8	N/C
N/C	9	10	N/C
P0.4	11	12	P0.5
P0.6	13	14	P0.7

Table 2

Power Supply Unit

MINI-MAX/51-F board comes with a 6-Volt unregulated DC power supply. Other power supplies can also be used although this invalidates the warranty. External power supply should be able to supply 6 to 12 Volts DC at minimum 100mA current. The inner pin of the supply connector is positive and the outer ring is negative.

WARNING: Correct polarity should be observed when applying external DC supply to the power jack, otherwise MINI-MAX/51-F will be permanently damaged.

MINI-MAX/51-F has two on-board 5 Volt regulators. IC7 is for digital circuits and IC6 is for analog circuits.

CAUTION: Depending on the current requirements of the any external circuitry such as peripheral boards that are attached to MINI-MAX/51-F and the level of input voltage applied, the power regulator IC7 may dissipate enough heat to cause skin injury upon touch. Contact with this regulator should be avoided at all times, even after the power to circuit has been switched off.

RS232 Serial Port

One RS232 serial port is available on the MINI-MAX/51-F. IC1 converts micro-controller's RXD and TXD pins to/from RS232 levels. IC1 has an internal circuit that generates +/- 10 Volts for RS232 logic levels. The RS232 port has a 9-pin female D connector J4 and can serve a wide range of peripherals using RXD and TXD lines.

Serial port also serves for program and data downloading to the MINI-MAX/51-F board. CTS and RTS Modem control lines are provided on the RS232 port. RTS is used by external host such as a PC to put MINI-MAX/51-F in program or run modes. Therefore, user applications must not use RTS.

Expansion connector

Expansion connector can be used for interfacing to external circuitry, prototyping boards and peripheral boards. Expansion connector has 8 lines of Port 1 and 8 lines of Port 3. MINI-MAX/51-F peripheral boards can be connected either as a piggy-back daughter-board on MINI-MAX/51-F using standoffs or can be placed up away from MINI-MAX/51-F using a 20-wire ribbon cable. Peripherals section lists the available expansion boards. Table 4 shows the pin assignments for the MINI-MAX/51-F Expansion connector.

RS232 Serial Port (J2)

Signal	Pin
Not connected	1
Transmit (TXD)	2
Receive (RXD)	3
Not connected	4
Ground	5
Not connected	6
RTS	7
CTS	8
Not Connected	9

Table 3

MINI-MAX/51-F Expansion (J1)

Signal	Pin	Pin	Signal
P3.0	20	19	P3.1
P3.2	18	17	P3.3
P3.4	16	15	P3.5
P3.6	14	13	P3.7
P1.0	12	11	P1.1
P1.2	10	9	P1.3
P1.4	8	7	P1.5
P1.7	6	5	P1.6
VCC	4	3	GND
VCC	2	1	GND

Table 4

Analog circuits

Analog circuits of MSC1211Y5 are present on the analog connector (J6) and analog terminals (X1, X2, X3). These circuits are ADC inputs, DAC outputs, reference voltage output, analog ground and analog power supply. Analog connector and terminals serve for interfacing to various types of analog devices, such as strain gages, pressure sensors, thermocouples etc. High resolution ADC together with powerful micro-controller core makes it suitable for interesting applications like sound recording.

Analog terminals (X1, X2)

Pin	Signal	Label
X1.1	RDAC0	R0
X1.2	VDAC0	O0
X1.3	AIN0	I0
X1.4	AIN1	I1
X1.5	AGND	⊥
X1.6	AIN2	I2
X1.7	AIN3	I3
X1.8	AGND	⊥
X2.1	AIN4	I4
X2.2	AIN5	I5
X2.3	AIN6	I6
X2.4	AIN7	I7
X2.5	AINCOM	COM
X2.6	REF -	R-
X2.7	AGND	⊥
X2.8	REF+	R+

Analog connector (J5)

Signal	Pin	Pin	Signal
AGND	1	2	AGND
AIN3	3	4	AIN1
AVDD	5	6	AVDD
AGND	7	8	AIN2
AIN4	9	10	AGND
AVDD	11	12	AIN0
AGND	13	14	AVDD
AIN5	15	16	VDAC1
AVDD	17	18	AGND
AGND	19	20	AIN7
AIN6	21	22	AVDD
AVDD	23	24	VDAC0
AGND	25	26	REF+

Table 6

Analog terminals (X3)

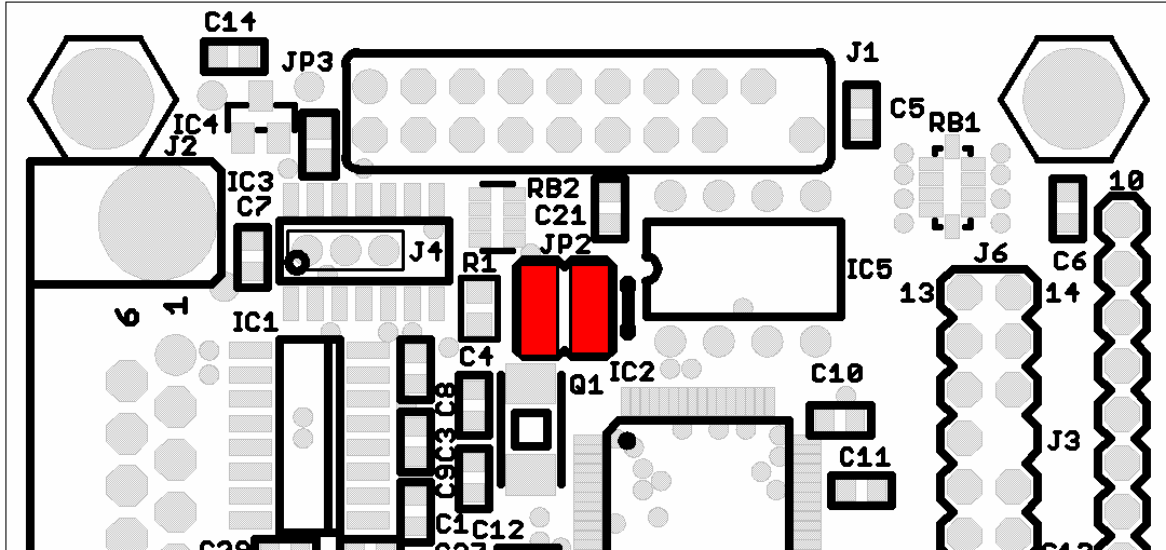
Pin	Signal	Label
X3.1	VDAC1	O1
X3.2	RDAC1	R1
X3.3	AGND	⊥
X3.4	AVDD	AV

Table 7

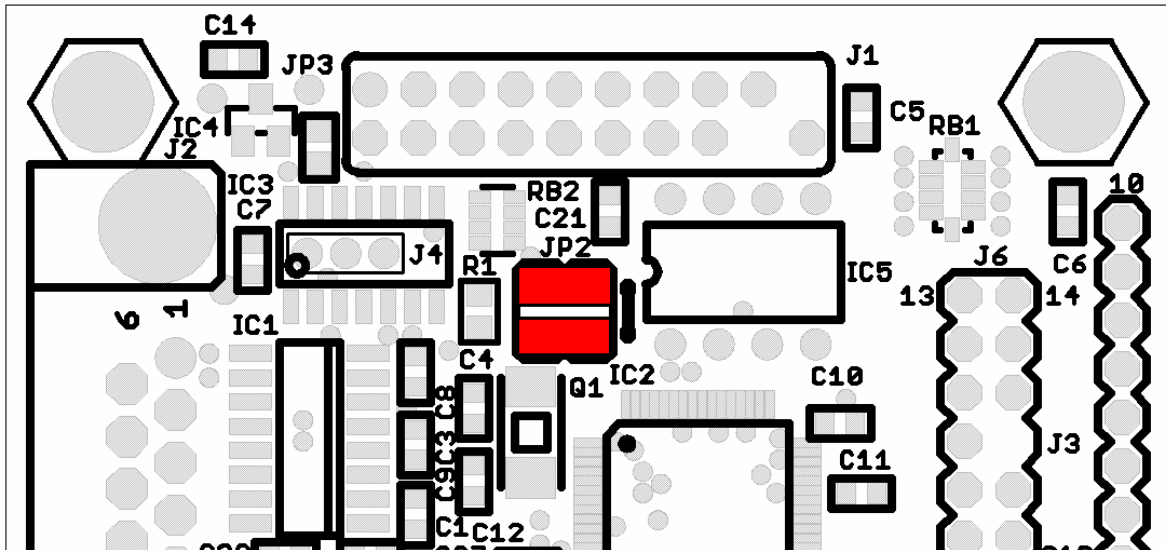
Jumpers JP2 and JP4 configurations

JP2 – I2C Pin Select

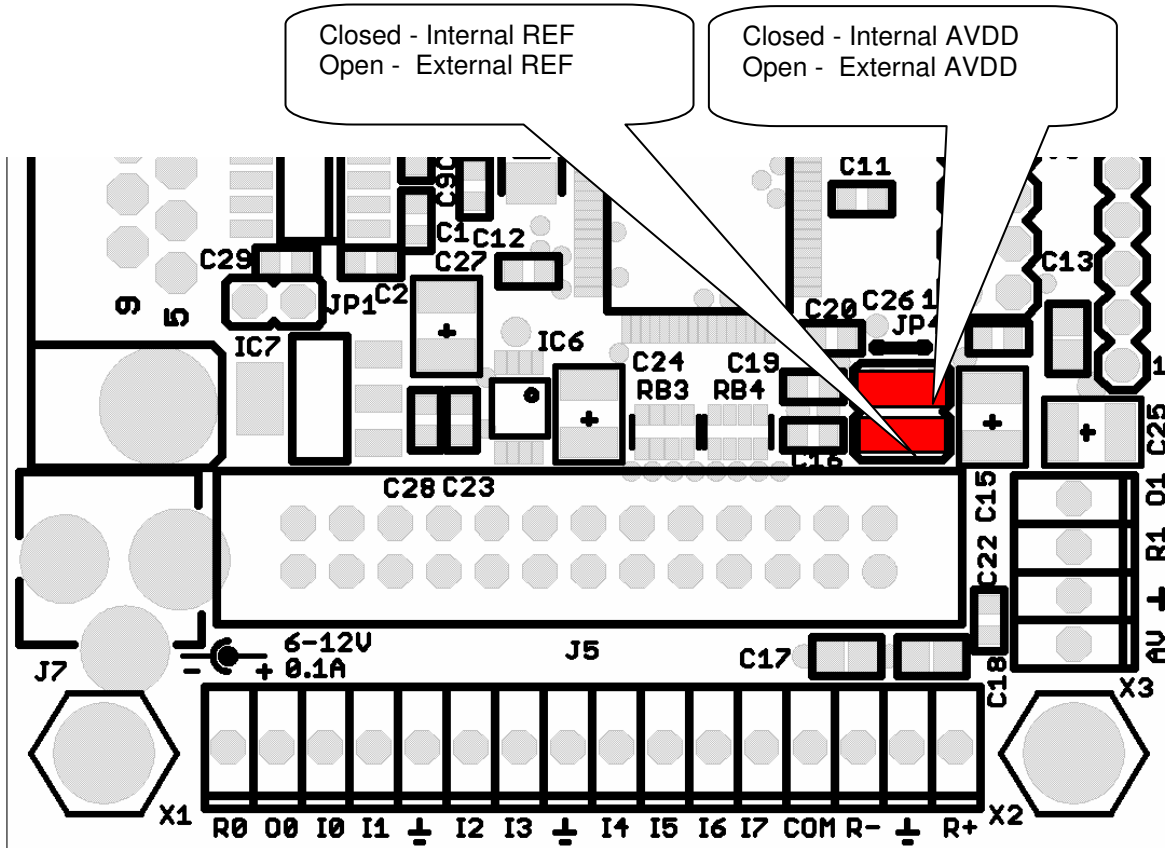
I2C Master (software implementation)



I2C Master (hardware implementation)



JP4 – Reference Select



4. Peripherals

MINI-MAX/51-F can be connected to a wide variety of low-cost peripheral boards to enhance its functionality. Some possibilities are:

- Prototyping board (PROTO-1)
- Training Board (TB-1)
- 4-digit 7-segment LED display board (LED-1)
- 12-bit Analog-To-Digital Converter Board (DAQ-2543)
- Digital Input/Output Expander Board (DIO-1)
- Real time clock + 128 MB flash card board (MMC-RTC-1)
- Terminal board (TERMINAL-1)
- Reed relay board with 4 relays (RELAY-4REED)
- Power relay board with 1 or 2 relays (RELAY-1 or RELAY-2)
- Stepper motor driver board (MOTOR-1)

Peripheral boards can either be stacked on top of MINI-MAX/51-F using stand-offs or connected in a chain configuration using flat ribbon cable. Figure 2 shows how MINI-MAX/51-F can be connected to a peripheral board in a stacked fashion. Figure 3 shows chain connection.

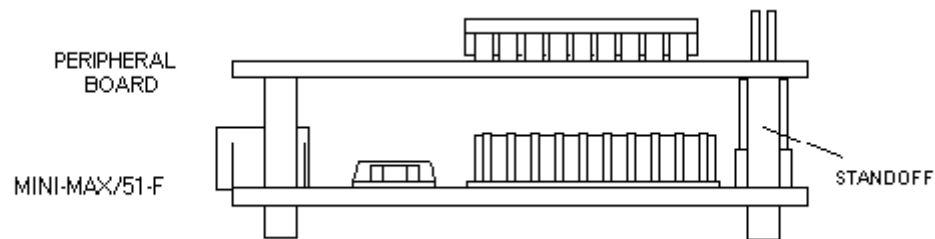


Figure 2

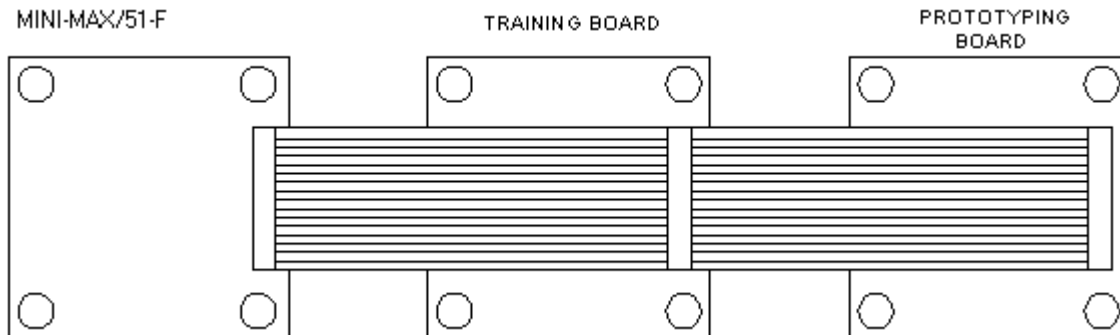


Figure 3

More details on BiPOM Peripheral boards are available from

http://www.bipom.com/periph_cat/us/44/0.html

RS232 Devices

Various keypads and terminals may be connected to the RS232 port of MINI-MAX/51-F through connector J2. MINI-MAX/51-F can be connected to a host PC through the RS232 port. For example, MINI-MAX/51-F can be used as a remote data acquisition or control unit serving a host PC in a client-server configuration.

Connection to a host PC is accomplished by using a NULL-Modem cable. MINI-MAX/51-F end of this cable should be a 9-pin Female D connector for connection to J2 on the MINI-MAX/51-F board. Host PC end of this cable can be either 9-pin Female or 25-pin Female D Connector depending on available serial (COM) ports on the host PC.

A NULL modem cable can be obtained from BiPOM Electronics (Part#: CNM1-9F9F-6) or it can be prepared according to the wiring diagram below:

MINI-MAX/51 9-pin Female			Host PC 9-pin Female
RECEIVE DATA (RXD)	2	3	TRANSMIT DATA (TXD)
TRANSMIT DATA (TXD)	3	2	RECEIVE DATA (RXD)
GROUND	5	5	GROUND
RTS	7	8	CTS
CTS	8	7	RTS

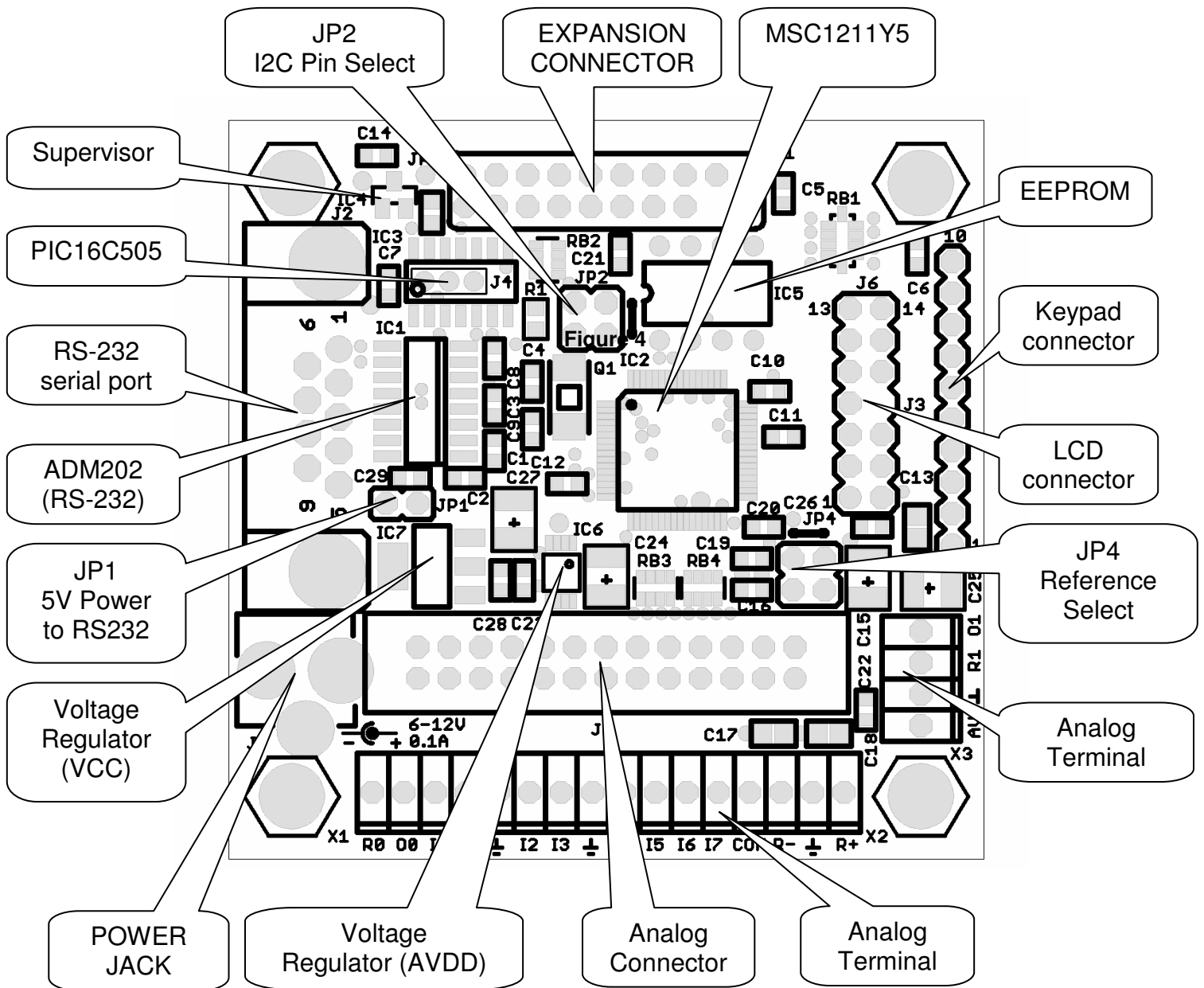
MINI-MAX/51 9-pin Female			Host PC 25-pin Female
RECEIVE DATA (RXD)	2	2	TRANSMIT DATA (TXD)
TRANSMIT DATA (TXD)	3	3	RECEIVE DATA (RXD)
GROUND	5	7	GROUND
RTS	7	5	CTS
CTS	8	4	RTS

Table 6

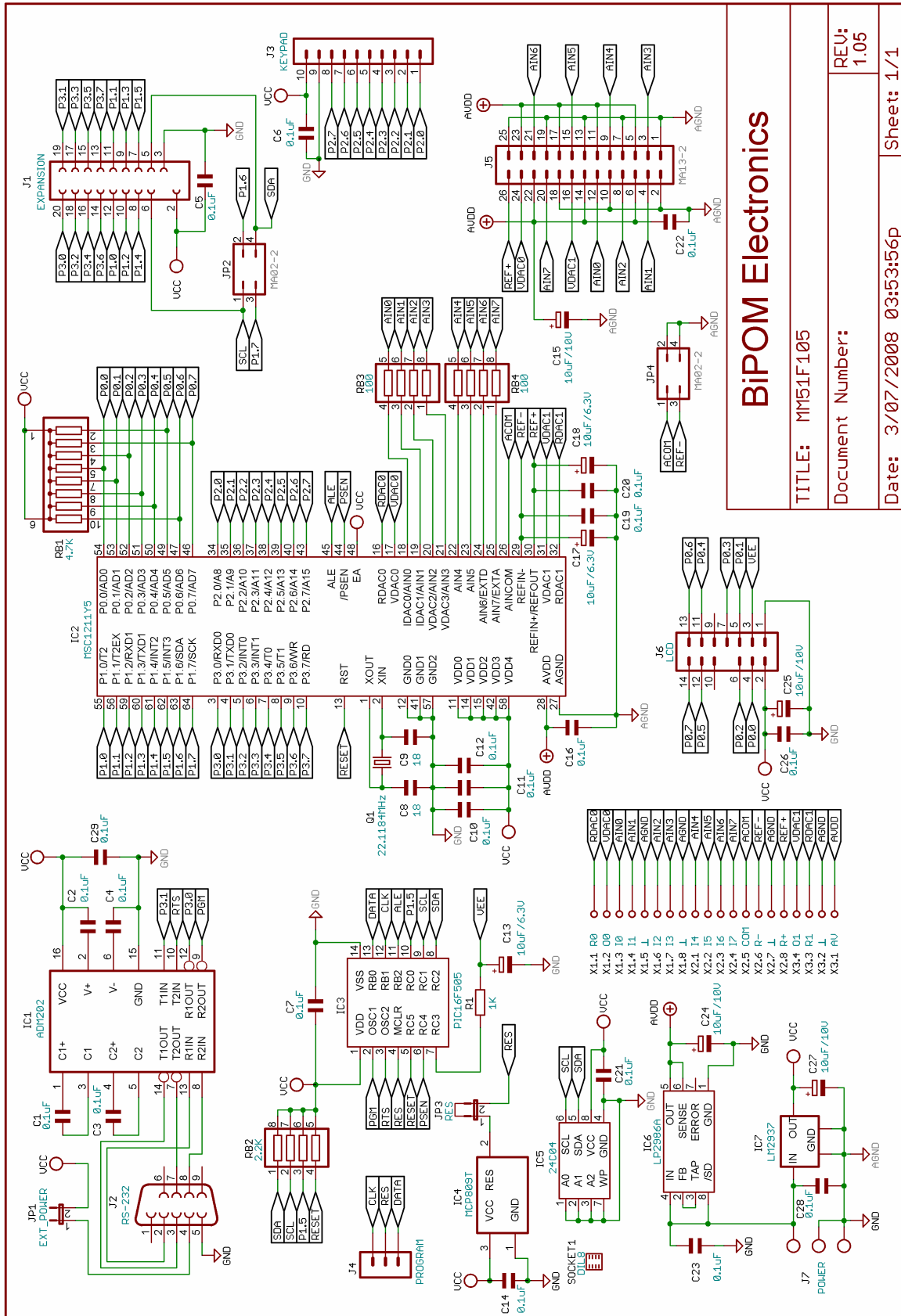
5. Software

All required software can be downloaded from http://www.bipom.com/web_softwares/318527.html

6. Board Layout



7.Schematics



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