MINI-MAX/51-D
Single Board Computer
Technical Manual

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BiPOM Electronics

WARRANTY:

BiPOM Electronics warrants MINI-MAX/51-D 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-D. 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-D is a general purpose, low-cost, highly-reliable and highly-expandable micro-controller system that is based on 8051 compatible ATMEL T89C51RB2 micro-controller with

- Four 8-bit I/O ports
- Three 16-bit timer / counters
- 256 Bytes Scratch Pad RAM
- 1024 Bytes Expanded RAM (XRAM)
- 16 K Bytes program / data FLASH.
- Five channel Programmable Counter Array (PCA)
- Full duplex UART with dedicated baud rate generator.

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

- RS232 Serial Port
- In-circuit programming of the micro-controller through the serial port
- Keypad connector
- LCD connector with programmable contrast adjustment for LCD.
- 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-D system.
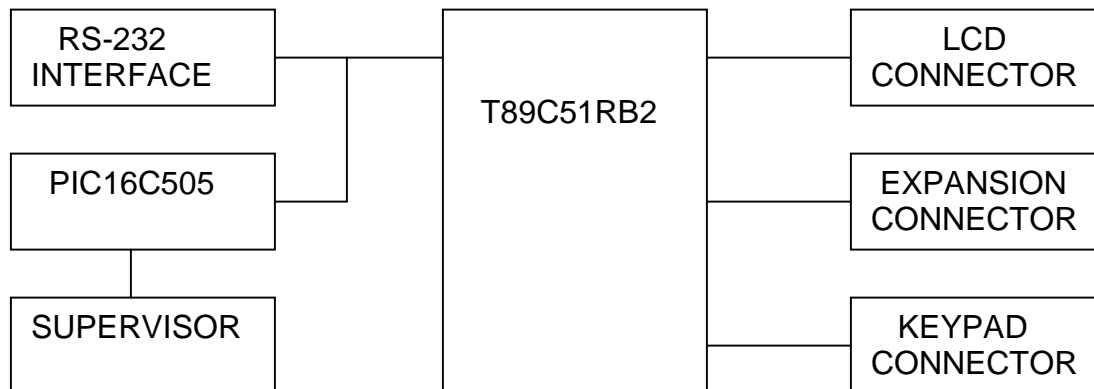
Power Supply

MINI-MAX/51-D board must be powered externally through the screw terminal (X1). External power supply should be regulated +5V DC and must be able to supply minimum 100mA current. The polarity on the supply terminal is indicated with +5V and GND signs.

WARNING: Correct polarity should be observed when applying external DC supply to the power terminal even though MINI-MAX/51-D has a special circuit to prevent damage.

Micro-controller

MINI-MAX/51-D is based on the T89C51RB2 micro-controller from ATMEL.

T89C51RB2 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.

For more detail on the T89C51RB2, please refer to ATMEL web site: www.atmel.com

In-System Programming

T89C51RB2 micro-controller can be re-programmed remotely over the RS-232 interface using a second micro-controller on the board (PIC16C505). 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 and debugging on the MINI-MAX/51-D using the serial port. A Windows-based program WinLoad from BiPOM Electronics is also provided to download programs to the MINI-MAX/51-D board.

Keypad connector(J1)

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.

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(J3)

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 a 8-bit general purpose I/O.

Vee (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.

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

RS232 Serial Port (J2)

One RS232 serial port is available on the MINI-MAX/51-D. U1 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 J2 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-D 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-D in program or run modes. Therefore, user applications must not use the RTS line.

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

Expansion connector(J4)

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-D peripheral boards can be connected either as a piggy-back daughter-board on MINI-MAX/51-D using standoffs or can be placed up away from MINI-MAX/51-D using a 20-wire ribbon cable. Peripherals section lists the available expansion boards. Table 4 shows the pin assignments for the MINI-MAX/51-D Expansion connector.

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

4. Peripherals

MINI-MAX/51-D 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-D using stand-offs or connected in a chain configuration using flat ribbon cable. Figure 2 shows how MINI-MAX/51-D can be connected to a peripheral board in a stacked fashion. Figure 3 shows chain connection.
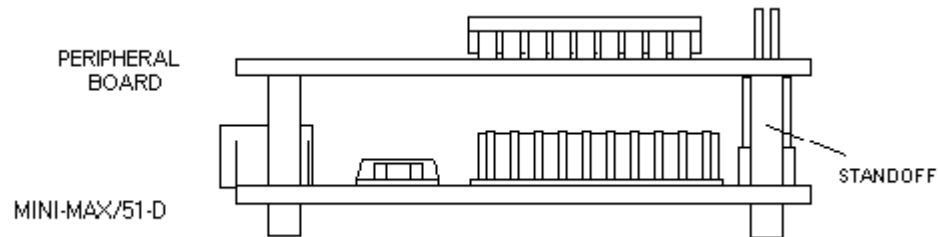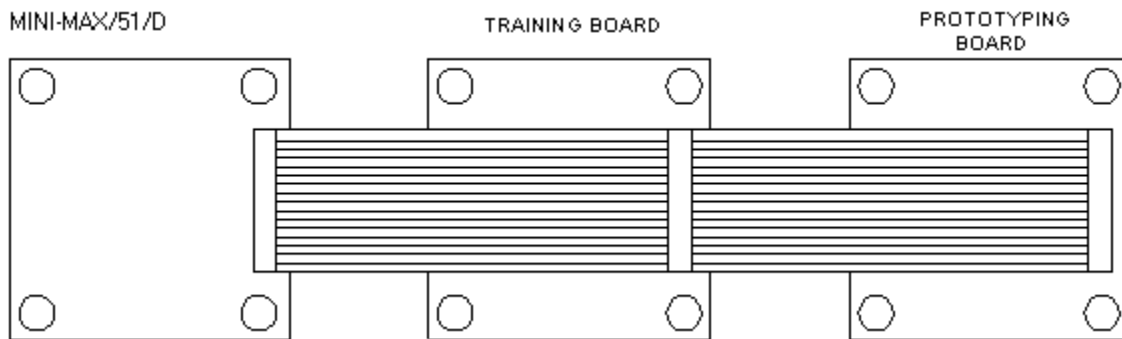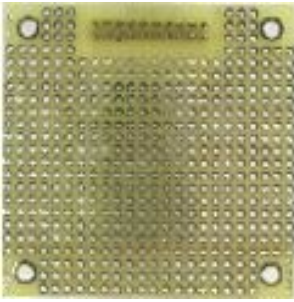

Figure 2

Figure 3

PROTO-1 Board

PROTO-1 provides prototyping area to add custom circuitry to MINI-MAX/51-D. PROTO-1 can either be stacked with MINI-MAX/51-D, using standoffs or connected to MINI-MAX/51-D as a separate board using ribbon cable (EXPCABLE-6 or EXPCABLE-18). The latter method is useful for mounting behind the panel of an instrument enclosure, for example, as a detachable display board.

LED-1 Board

A peripheral board with four 7-segment LED displays with decimal point. The displays are placed on sockets and can be easily replaced. 4-digit LED-driver with I2C-Bus interface is installed to this board. The segment outputs of LED-driver are controllable current-sink sources. They are switched on by the corresponding data bits and their current is adjusted by control bits. LED-driver on the board is controlled via an I2C-compatible 2-wire serial bus.
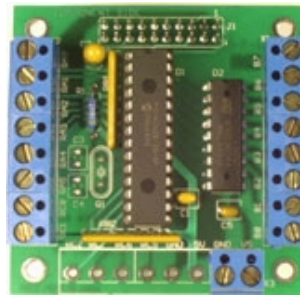
TB-1 Training Board

TB-1 Training Board allows performing various experiments with the MINI-MAX/51-D board. TB-1 has programmable traffic lights, 4-channel, 8-bit analog inputs, buzzer, switch inputs, and counter/timer inputs to test the interrupts.

DIO-1 Board

DIO-1 is an expander board with 8 open/collector outputs (each capable of 400mA) and 12 TTL/CMOS inputs/outputs. A PIC16C62 micro-controller on this board acts as an I2C 2-wire slave device to control inputs and outputs. DIO-1 can also be used as a standalone PIC micro-controller board

RTC board

Real Time Clock board with DS1307 Real-Time Clock from Dallas Semiconductor. The DS1307 is a battery-backed, low power, full-BCD clock/calendar with 56 bytes of nonvolatile static RAM. Address and data are transferred serially via I2C 2-wire bus. The clock/calendar provides seconds, minutes, hours, day, date, month and year information. RTC board has a 3Volt standard lithium battery which allows clock/calendar to operate in the absence of external power.

MMC/RTC board

MMC/RTC board is a storage flash device which is designed specifically for storage/data logger applications. MMC/RTC board has built-in Multi Media Card (MMC) socket. A Multi Media Card with high capacities such as 128 Megabytes can be installed on this board. MMC/RTC board also includes a DS1307 Real-Time Clock (RTC) from Dallas Semiconductor. The DS1307 has a battery-backed, low power full-BCD clock/calendar with 56 bytes of nonvolatile static RAM.
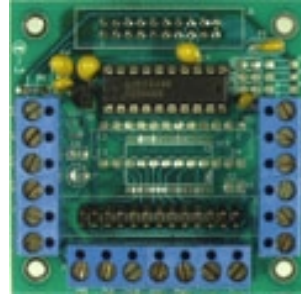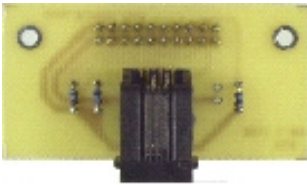
Terminal-1
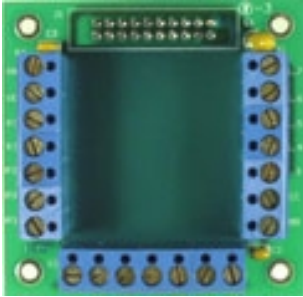
Brings out ports 1 and 3 on the MINI-MAX/51-D to terminal blocks for easier access.
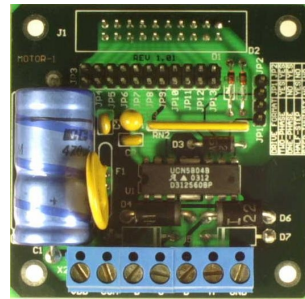
DAQ-2543 Board

DAQ-2543 is Analog-To-Digital / Digital-To-Analog peripheral board with TLC2543, 11-channel, 12-bit Analog-To-Digital Converter from Texas Instruments. All the channels are available on terminal blocks
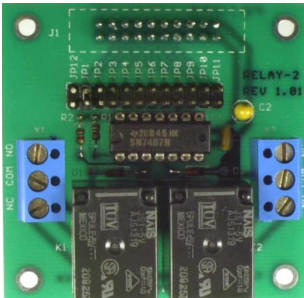
X10-1

Connects MINI-MAX/51-D to standard X10 devices through the TW523 Power line interface
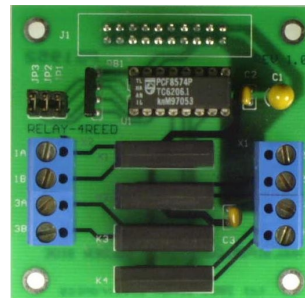
MOTOR-1

Peripheral board to drive unipolar stepper motors. Provides up to 1.5A, 35V outputs. HALF-STEP and ONE-PHASE jumpers will determine the drive format (one-phase, two-phase or half-step).

RELAY-1 and RELAY-2

Relay peripheral board with 1 or 2 power relay respectively. Normally Open and Normally Closed Contacts

RELAY-4REED

Relay peripheral board with 4 reed relays. Normally Open Contacts.

RS232 Devices

Various keypads and terminals may be connected to the RS232 port of MINI-MAX/51-D through connector J1. MINI-MAX/51-D can be connected to a host PC through the RS232 port. For example, MINI-MAX/51-D 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 straight through cable. MINI-MAX/51-D end of this cable should be a 9-pin Female D connector for connection to J1 on the MINI-MAX/51-D 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.

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

Table 5

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

Table 6

5. Software

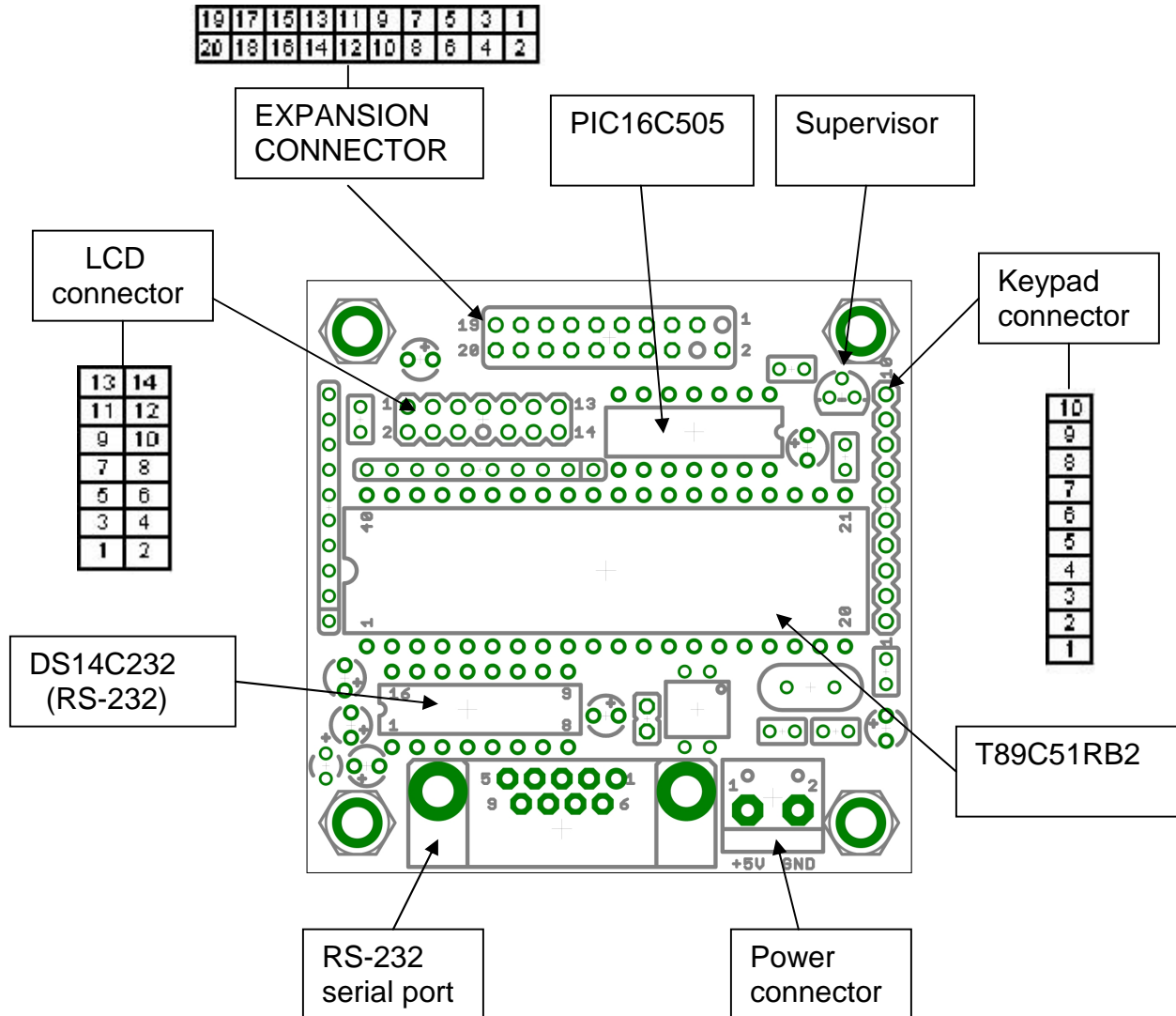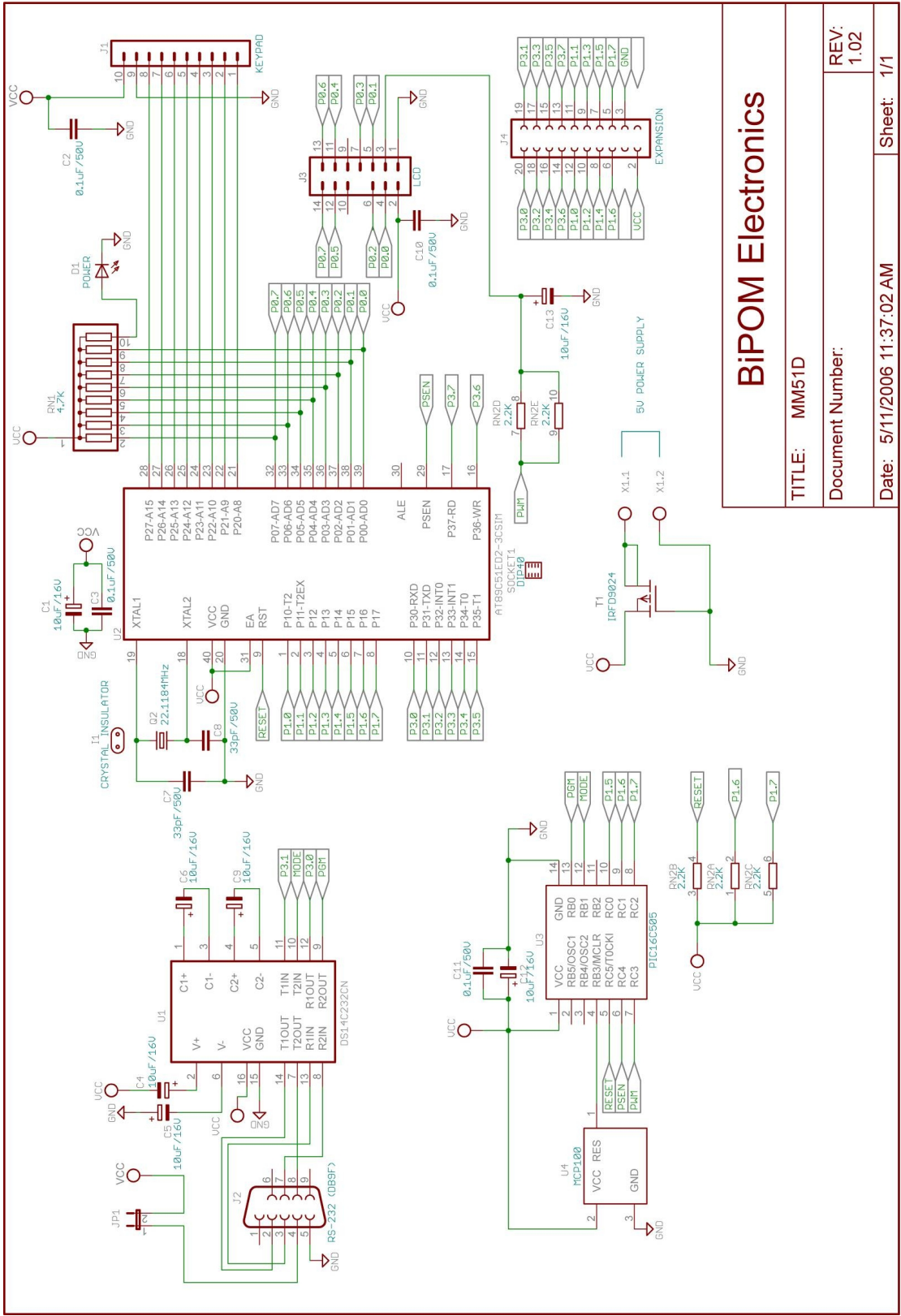 All required software can be downloaded from www.bipom.com/minimax51d.htm

6. Board Layout

Figure 4.

7.Schematics

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