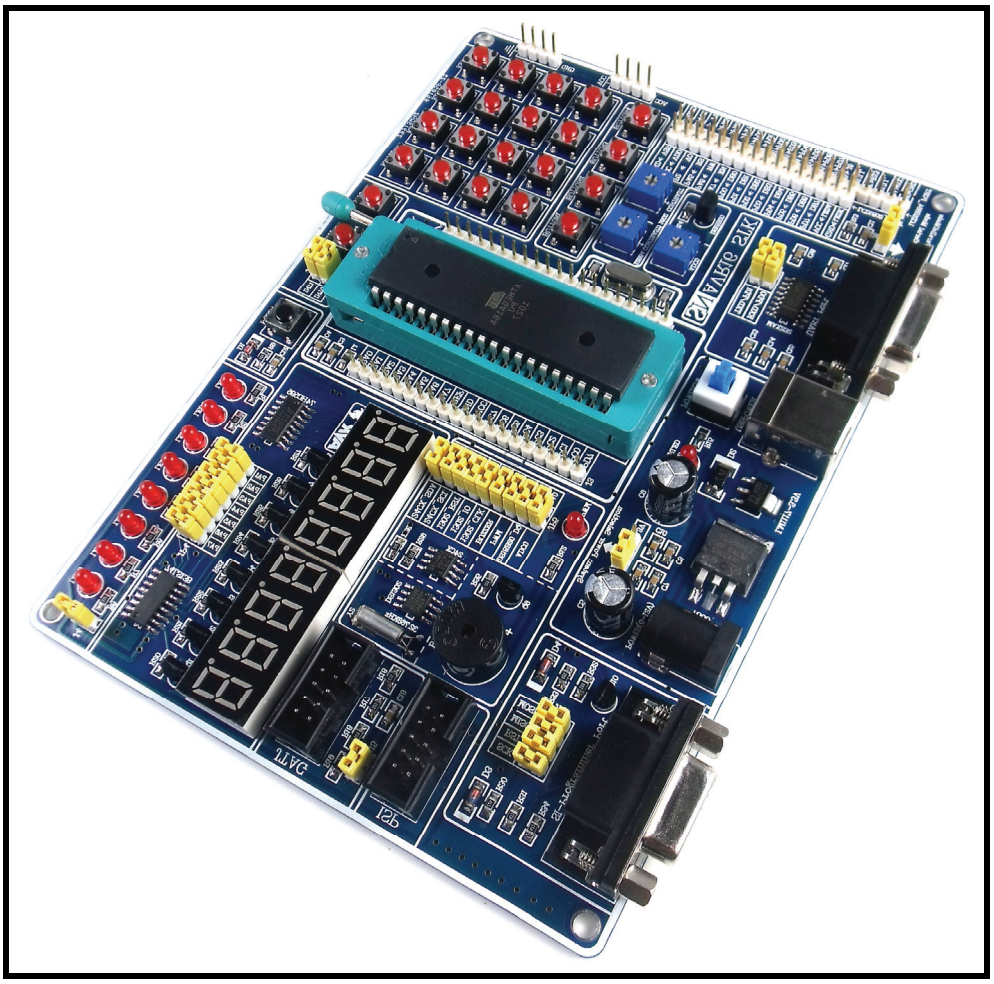
AVR mega16/32 starter development board

Users Manual



Version 1.0

All boards produced by SINTECH STUDIO

Rev.A, Jully 2010

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1. Getting Started

AVR mega16/32 Starter Development Board is an easy-to-use development and testing system for the new ATmega16/32 high-performance microcontroller, and is also a starter kit for learning AVR microcontroller hardware and software design. it has ISP and JTAG port for programming and debugging, RS232 communication, 8 status Leds, 4 user Buttons,4x4 keyboard,DS1302 circuit,DS18B20 circuit, buzzer circuit, EEPROM circuit, ADC input,8bits 7-SEG display control circuit,LCD1602,LCD12864,INT0&INT1 and all of the GPIOs are taken out to make them available for further connections.

2. Devices Supported

AVR mega16/32 Starter Development Board is based on the ATMEL high-performance microcontrollers. Residing on this board is the mega16/32 microcontrollers.

3. Tools Requirement

There is a serial programmer integrated on this board, which allows you to use directly to program the mega16/32 microcontrollers. But it requires a com port on your computer, it will not work with USB-RS232 converters.

Certainly, this board also supports other AVR programmer/debuggers as follows:

⑴AVR ONE ⑵AVR ISP ⑶AVR ISP MKII ⑷AVR JTAGICE
⑸AVR JTAGICE MKII ⑹AVR DREGON ⑺AVR STK200 ⑻AVR STK500
⑼AVR STK600 ⑽AVR USBASP

…

4. Power Requirement

⑴USB power Cables

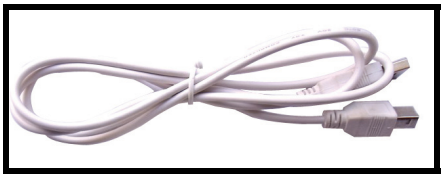


Figure4-1

⑵External 6—12VDC



Figure4-2

You can select one of them to power your board. If your programmer/debugger can power your board, it is no need to use USB power Cables or External 6—12VDC.

5. Software Requirement

⑴. AVR Studio + WinAVR free development IDE, AVRICC or other development IDE.

⑵. Programming software for loading.

6. Board Features

- CPU: mega16/32 microcontroller
■ISP 5x2 pin connector for in-circuit programming with AVR Programmers .
■ JTAG 5x2 pin connector for in-circuit programming and Simulating.
■ 7805,LM1117 and filtering capacitors.Two kinds of power supply: 6V-12V external power supply and 5.0V USB power supply.
■SI-Programmer on Board.
■Quartz crystal oscillator circuit 1-16Mhz.
■Reset circuit.
■Status LED connected to I/O PB port via removable jumper.
■RS232 DB-9 female connector.
■MAX3232 circuit.
■4 User Buttons
■2 External Interrupts: INT0 and INT1
■8bits 7-seg display
■74HC595 8 BIT SHIFT REGISTER for 7-seg display control

■74HC138 3-to-8 line decoder/demultiplexer for 7-seg display control
■I2C eeprom 24CX(X=1,2,4…16)
■Programmable Resolution 1-Wire Digital Thermometer--DS18B20
■Trickle Charge Timekeeping Chip --DS1302
■Buzzer
■ADC0 Input Potentiometer
■LCD1602 interface
■LCD12864 interface
■PCB, 1.6 mm , blue solder mask, white silkscreen component print .
■Dimensions: 114mmx160mm

7. Electrostatic Warning

AVR mega16/32 Starter Development Board is shipped in protective anti-static packaging. The board must not be subject to high electrostatic potentials. General practice for working with static sensitive devices should be applied when working with this board.

8. Mega16/32 Processor Features

For detailed information of mega16/mega32 microcontroller, please refer to the datasheet named "Atmega16.pdf " or "Atmega32.pdf " included in the Product CD Rom.

9. Board layout，jumpers, ports and main modules description.

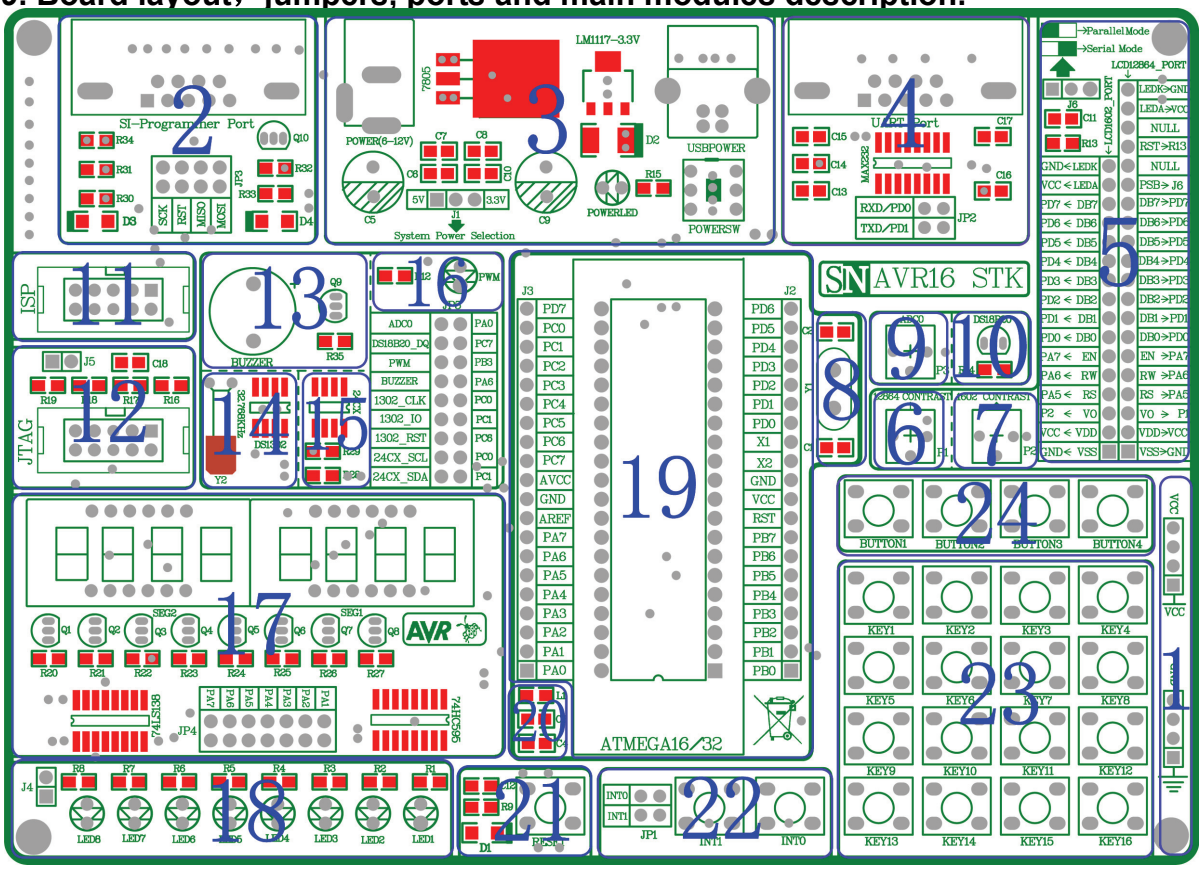


Figure9-1

Table1.

Area	Description	Area	Description
1	Power Input/Output	13	Buzzer Module
2	On-board SI-Programmer Port	14	DS1302 Module
3	System Power Supply	15	Eeprom 24CX Module
4	RS232 Communication Port	16	PWM
5	LCD1602 & LCD12864 Ports	17	8-BITs-7-seg Display Module
6	LCD12864 Contrast Potentiometer	18	8 LEDs
7	LCD1602 Contrast Potentiometer	19	Mega16 core with All Pinouts
8	System Clock (External Clock)	20	ADC Filter
9	ADC0 Potentiometers	21	System Reset Button

10	DS18B20 Module	22	INT0 & INT1 Input Keys
11	ISP Programming Port	23	4*4 Keys
12	JTAG Debugging Port	24	4 User BUTTONS

10. Module Circuits

(1)Power Module

AVR mega16/32 Starter Development Board can be powered by the USB port or external 6-12VDC power supply. It is necessary to note that the external power supply and the USB power can not be connected simultaneously. **Power LED** (red) with name **POWERLED,** and **Power switch** with name **POWERSW**.J1 jumper provides 5V/3.3V system power supply selection.

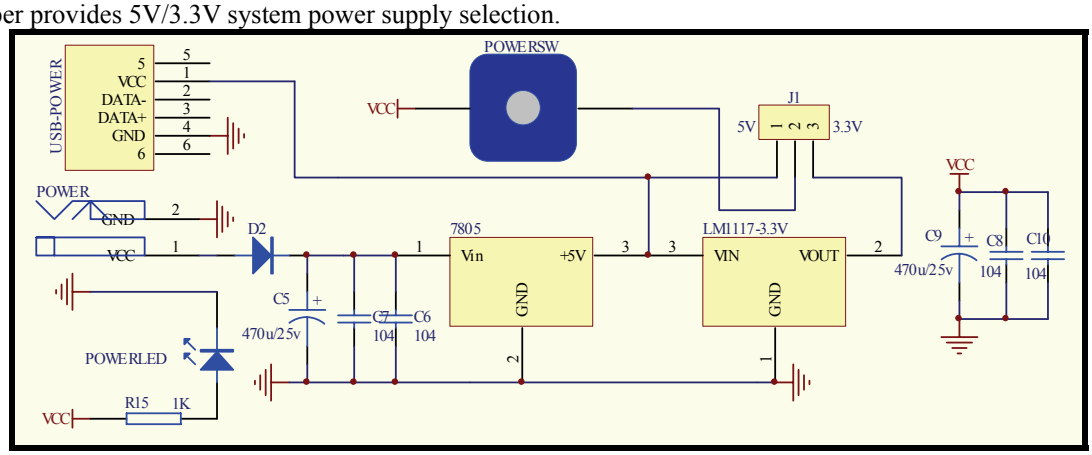


Figure10-1 Power Module

Before using this board please make sure that the J1 jumper is connected properly.

(2)Power Input/Output Port

It allows you to easily power your DIY functional device/ module or to power this board using external 5V/3.3V via this **Power Input/Output Port.**

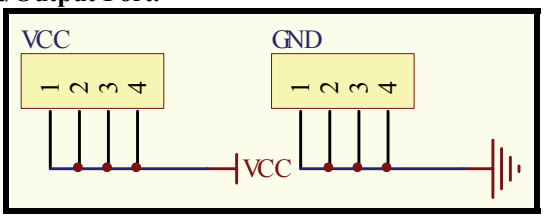


Figure10-2 Power Input/Output Port

(3)Mega16/32 small system with all pinouts

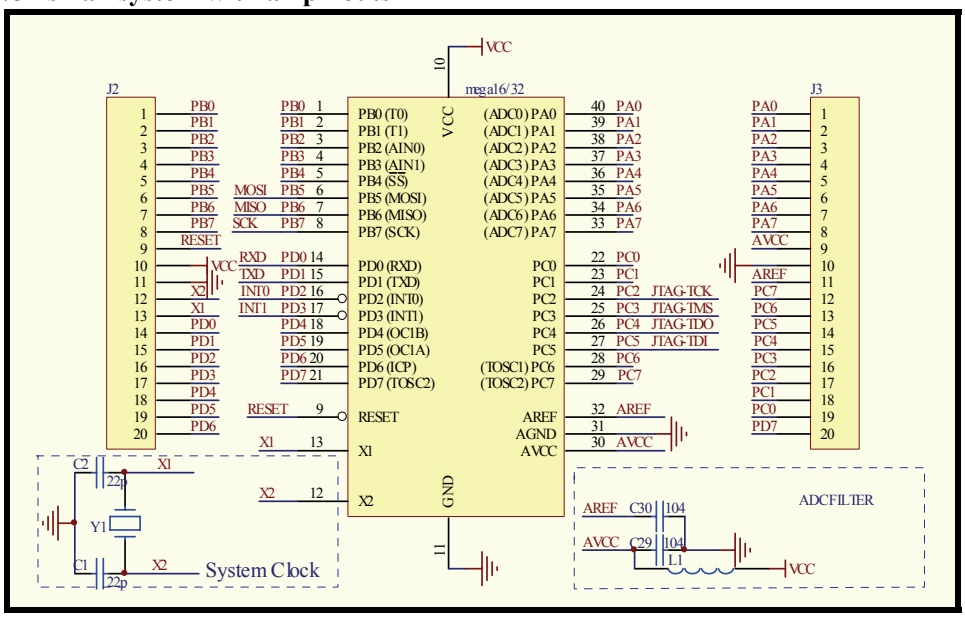


Figure10-3 Mega16/32 small system with all pinouts

(4)4x4 Keyboard Module

In this application, a 4x4 matrix keypad requiring eight Input/Output ports for interfacing is used. Rows are connected to PB4-PB7. Columns are connected to PB0-PB3.

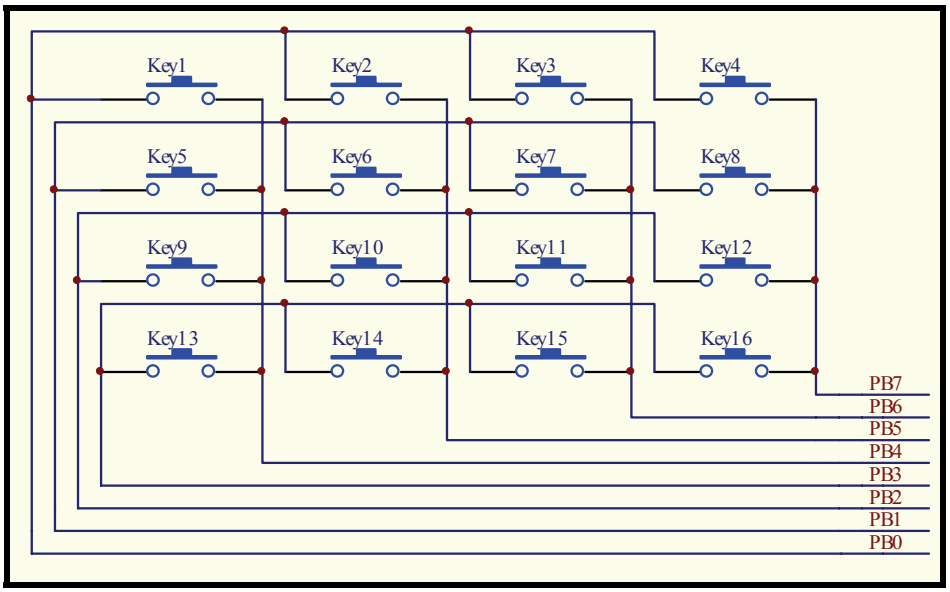


Figure10-4 4x4 Keyboard Module

⑸4x1 User Buttons Module

AVR mega16/32 Starter Development Board has a total of eight user Buttons connected to PB4-PB7 of the Mega16/32 directly.

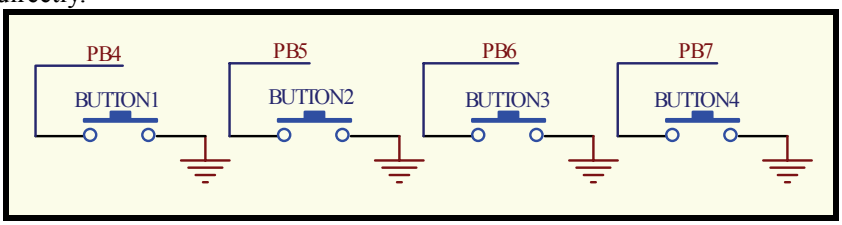


Figure10-5 4x1 User Buttons Module

⑹LEDs Module

AVR mega16/32 Starter Development Board has a total of eight LEDs connected to PB0-PB7 of the Mega16/32 directly. The LEDs can be completely disconnected by using J4 jumper. When the user does not need to use the LEDs, the user should close the LEDs module via disconnecting J4 jumper to reduce the overall power consumption of the board.

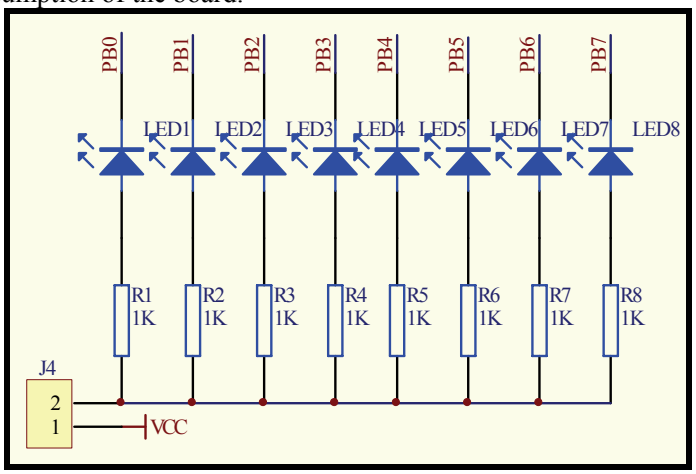


Figure10-6 LEDs Module

When using LEDs please make sure that the relational pin of J4 jumper is connected corectly.

⑺8-BITs-7-SEG Display Module

In this application, 74HC595 and 74HC138 are used to control the 8-BITs-7-SEG display. The 74HC138 provides BIT signals and the 74HC595 provides Code signals.

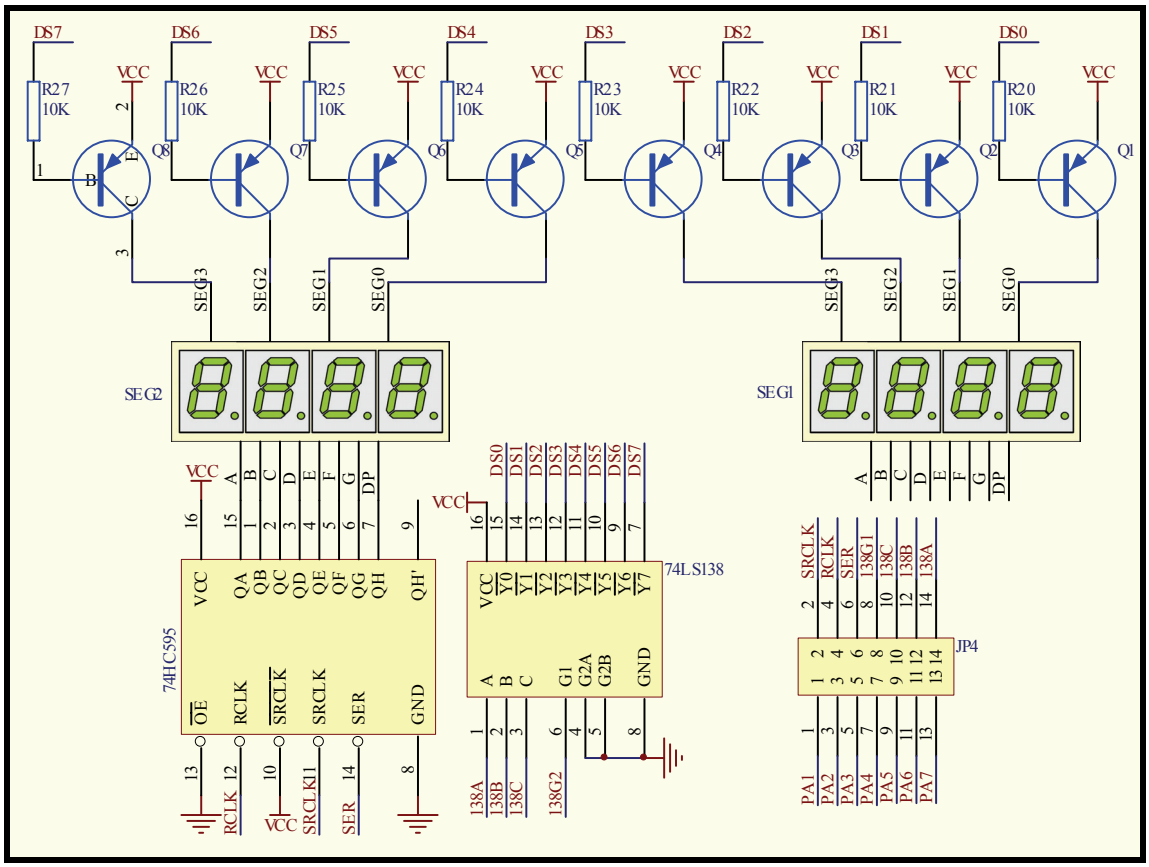


Figure10-7 8-BITs-7-SEG Display Module

When using 8-BITs-7-SEG Display Module please make sure that all the pins of JP4 jumper are connected.

Note: For detailed information of 74HC595 and 74HC138, please refer to the datasheet named "74HC595.pdf " and "74HC138.pdf " included in the Product CD Rom.

(8)INT0 and INT1

In this application, two external interrupt push buttons, INT0 and INT1, are connected to the PD0 to PD1 of Mega16/32 via JP1 jumper. Please make sure that the relational pins of JP4 jumper are connected correctly when using INT0 or INT1 external interrupt sources.

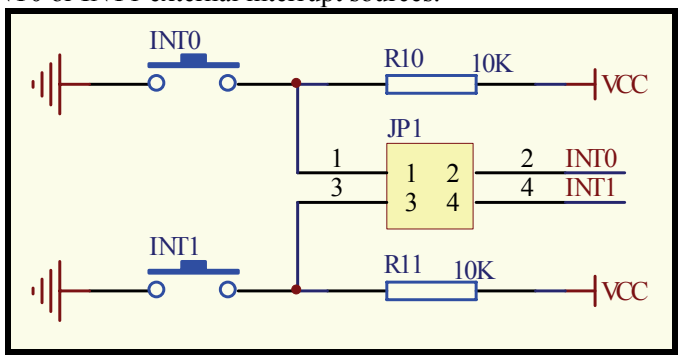


Figure10-8 INT0 and INT1

(9)System Reset Circuit

The RESET pin on the AVR is active LOW, and setting the pin LOW externally will thus result in a reset of the AVR. The RESET has two purposes:

1. To release all lines by tri-stating all pins (except XTAL pins), initialize all I/O registers and set program counter to zero.

2. To enter programming mode (for some parts also the PEN line is used to enter programming mode). Furthermore it is possible to enter high-voltage/parallel programming mode by drawing the RESET pin "very" high, where very high means 11.5 – 12.5V.

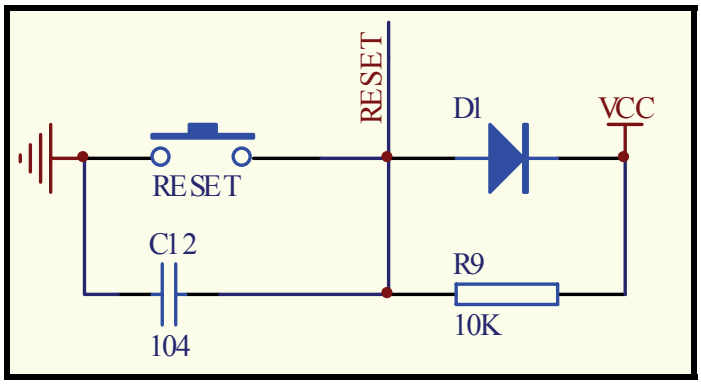


Figure10-9 System Reset Circuit

⑩ADC0 Input

In this application,ADC0 Input Potentiometer is connected to the PA0 Mega16/32 via JP5 jumper. Please make sure that the related pins of JP5 jumper is connected correctly when using ADC0 Input.

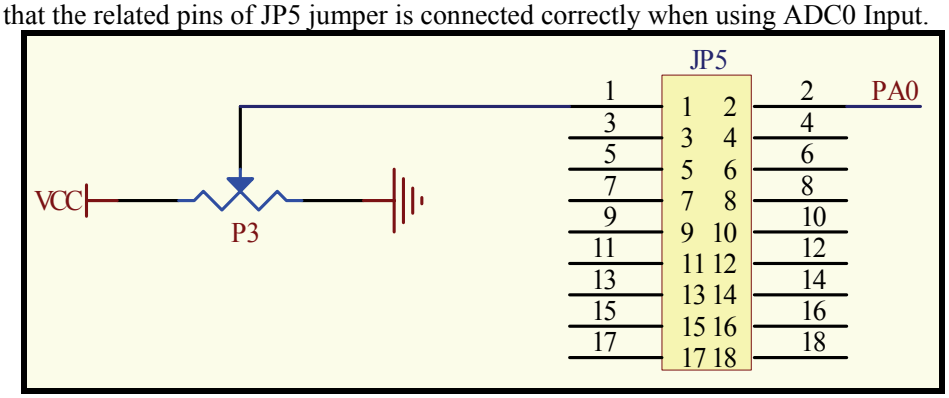


Figure10-10 ADC0 Input

⑪Buzzer Module

In this application, buzzer drive circuit is connected to PA6 via JP5. Please make sure that the related pins of JP5 jumper are connected correctly when using Buzzer.

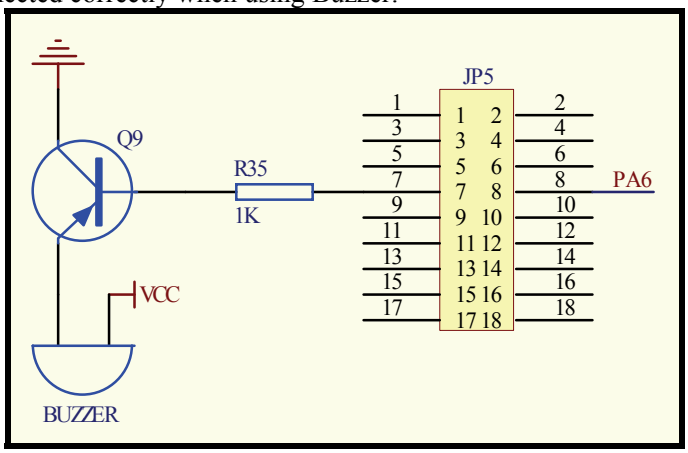


Figure10-11 Buzzer Module

⑫DS1302 Module

The DS1302 Trickle Charge Timekeeping Chip contains a real time clock/calendar and 31 bytes of static RAM. It communicates with a microprocessor via a simple serial interface. The real time clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with less than 31 days, including corrections for leap year. The clock operates in either the 24–hour or 12–hour format with an AM/PM indicator. Interfacing the DS1302 with a microprocessor is simplified by using synchronous serial communication. Only three wires are required to communicate with the clock/RAM: (1) RST (Reset), (2) I/O (Data line), and (3) SCLK (Serial clock). Data can be transferred to and from the clock/RAM 1 byte at a time or in a burst of up to 31 bytes. The DS1302 is designed to operate on very low power and retain data and clock information on less than 1 microwatt.

The DS1302 is the successor to the DS1202. In addition to the basic timekeeping functions of the DS1202, the DS1302 has the additional features of dual power pins for primary and back–up power supplies, programmable trickle charger for VCC1, and seven additional bytes of scratchpad memory.

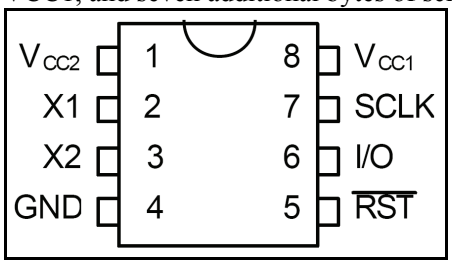


Figure10-12. DS1302 pin assignment

Table2.DS1302 pin description

Number	Name	Function
1	VCC2	Power Supply Pins
2	X1,	32.768 kHz Crystal Pins
3	X2	32.768 kHz Crystal Pins
4	GND	Ground
5	RST	Reset
6	I/O	Data Input/Output
7	SCLK	Serial Clock
8	VCC1	Power Supply Pins

In this application, the signal pin SCLK,IO,RST of DS1302 are separately connected to PC0,PC1,PC6 of mega16/32 via JP5,showed in Figure10-13.

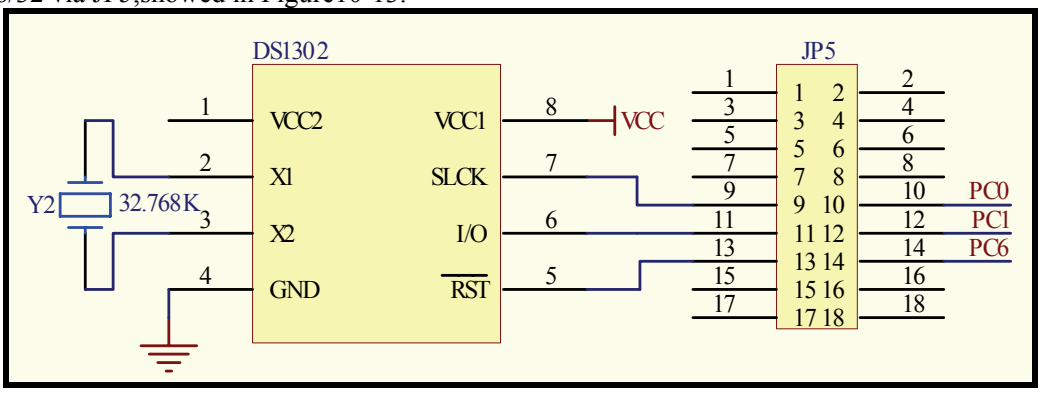


Figure10-13 DS1302 Module

Please make sure that the related pins of JP5 jumper are connected correctly when using DS1302.
Note: For detailed information of DS1302's use, please refer to the datasheet named "DS1302.pdf" included in the Product CD Rom.

⑬DS18B20 Module

The DS18B20 Digital Thermometer provides 9 to 12-bit (configurable) temperature readings which indicate the temperature of the device. Information is sent to/from the DS18B20 over a 1-Wire interface, so that only one wire (and ground) needs to be connected from a central microprocessor to a DS18B20. Power for reading, writing, and performing temperature conversions can be derived from the data line itself with no need for an external power source.
Because each DS18B20 contains a unique silicon serial number, multiple DS18B20s can exist on the same 1-Wire bus. This allows for placing temperature sensors in many different places. Applications where this feature is useful include HVAC environmental controls, sensing temperatures inside buildings, equipment or machinery, and process monitoring and control.

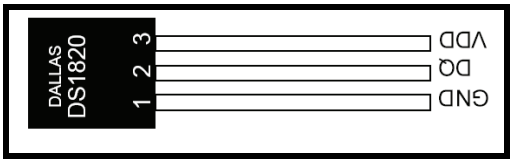


Figure10-14. DS18B20 pin assignment

Table3. DS18B20 pin description

Number	Name	Function
1	GND	Ground
2	DQ	Data In/Out
3	VDD	Power Supply Voltage

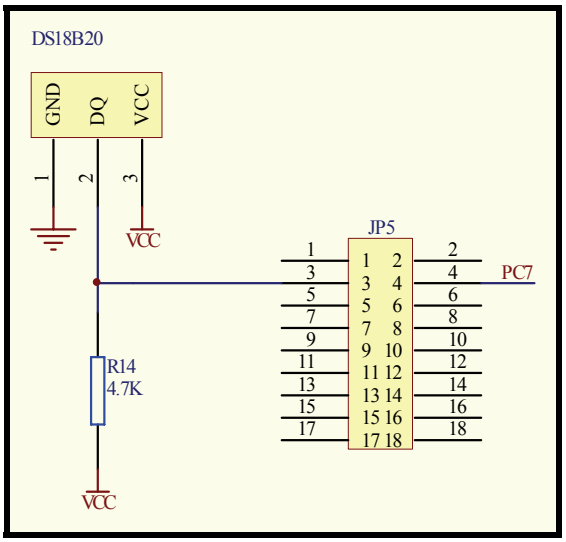


Figure10-15 DS18B20 Module

In this application, the signal pin DQ of DS18b20 is connected to PC7 of mega16/32 via JP5, showed in Figure10-15.Please make sure that the related pin of JP5 jumper is connected correctly when using DS18b20.

Note: For detailed information of DS18B20's use, please refer to the datasheet named "DS18B20.pdf " included in the Product CD Rom.

⑭LED Controlled by PWM Signal

In this application, LED circuit is connected to PB3 of mega16/32 via JP5, showed in Figure10-16. Please make sure that the related pin of JP5 jumper is connected correctly when using LED Controlled by PWM Signal.

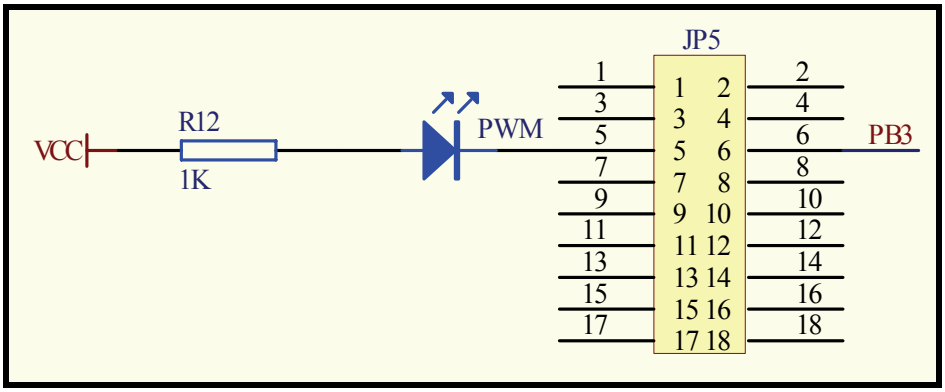


Figure10-16

⑮RS232 Communication Module

The MAX3232 transceivers has a proprietary low-dropout transmitter output stage enabling true RS-232 performance from a 3.0V to 5.5V supply with a dual charge pump. The device requires only four small 0.1µF external chargepump capacitors. The MAX3232 is guaranteed to run at data rates of 120kbps while maintaining RS-232 output levels. The MAX3232 has 2 receivers and 2 drivers. The MAX3232 is pin, package, and functionally compatible with the industry-standard MAX242 and MAX232, respectively. The device feature a shutdown mode in which all receivers can remain active while using only 1µA supply current. The MAX3232 can be connected to MCU with RS232 communication port.

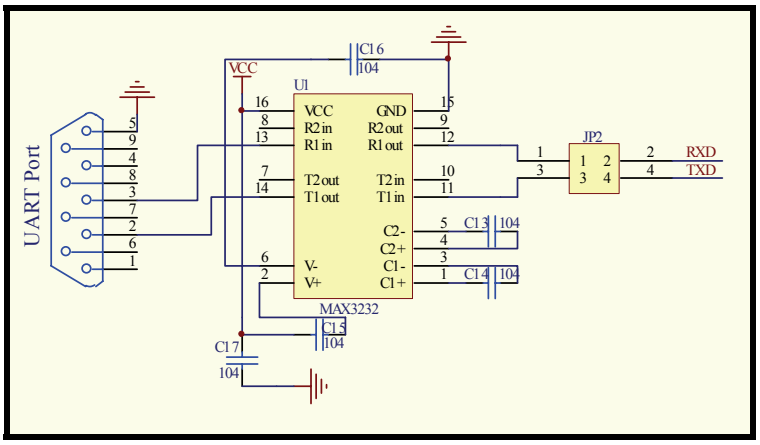


Figure10-17 RS232 Communication Module

In this application, the signal pin R1OUT, T1IN of max3232 are separately connected to RXD(PD0),TXD(PD1) of mega16/32 via JP2, showed in Figure10-17. Please make sure that the JP2 jumper is connected correctly when using RS232 Communication Module.

Note: For detailed information of MAX3232's use , please refer to the datasheet named "MAX3232.pdf " included in the Product CD Rom.

⑯AT24CX(X=1,2….16) Eeprom Module

The AT24C01A/02/04/08A/16A provides 1024/2048/4096/8192/16384 bits of serial electrically erasable and programmable read-only memory (EEPROM) organized as 128/256/512/1024/2048 words of 8 bits each. The device is optimized for use in many industrial and commercial applications where low-power and low-voltage operation are essential. The AT24C01A/02/04/08A/16A is available in space-saving 8-lead PDIP, 8-lead JEDEC SOIC, 8-lead MAP, 5-lead SOT23 (AT24C01A/AT24C02/AT24C04), 8-lead TSSOP, and 8-ball dBGA2 packages and is accessed via a Two-wire serial interface. In addition, the entire family is available in 2.7V (2.7V to 5.5V) and 1.8V (1.8V to 5.5V) versions.

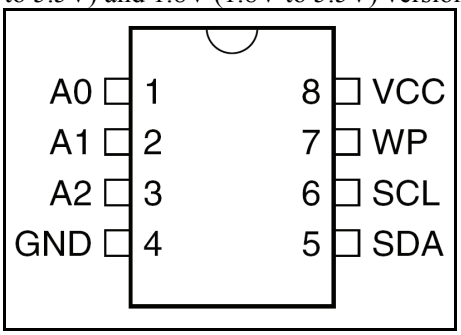


Figure10-18. AT24CX(X=1,2….16) pin assignment

Table3. AT24CX(X=1,2….16) pin description

Number	Name	Function
1-3	A0-A2	Address Inputs
4	GND	Ground
5	SDA	Serial Data
6	SCL	Serial Clock Input
7	WP	Write Protect
8	VCC	Power Supply

In this application, the signal pin SCL, SDA of AT24CX are separately connected to PC0, PC1 of mega16/32 via JP5, showed in Figure10-19. Please make sure that the related pin of JP5 jumper are connected correctly when using AT24CX(X=1,2….16) Module.

Note: For detailed information of 24CX's use, please refer to the datasheet named "24C04.pdf " included in the Product CD Rom.

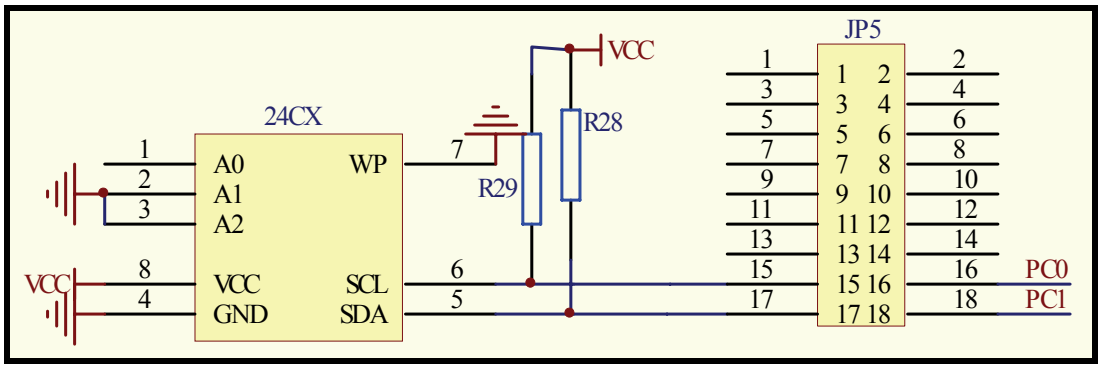


Figure10-19 Eeprom Module

⑰LCD1602 Display Port

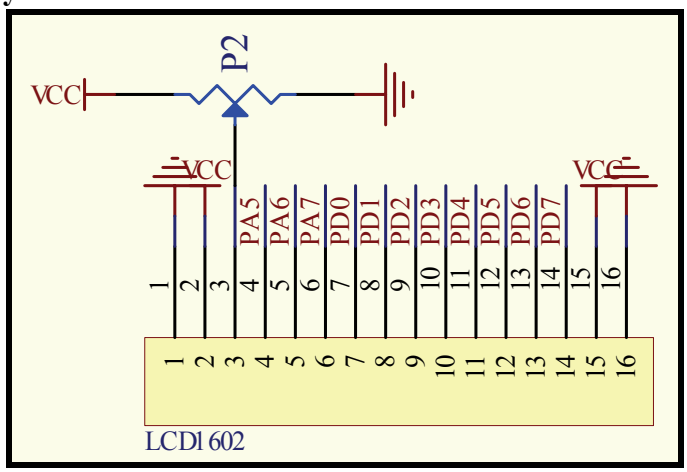


Figure10-20 LCD1602 Display Port

Note: For detailed information of LCD1602's use, please refer to the datasheet named "LCD1602.pdf " which is included in the Product CD Rom.

⑱LCD12864 Display Port

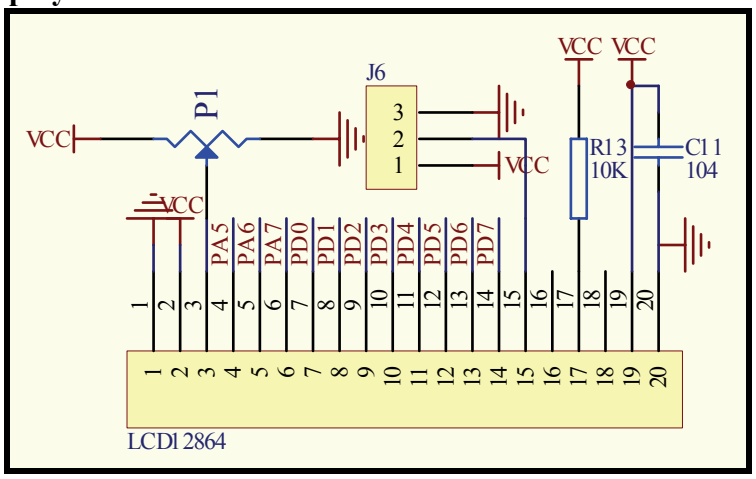


Figure10-21 LCD12864 Display Port

Note: For detailed information of LCD12864's use, please refer to the datasheet named "LCD12864.pdf " which is included in the Product CD Rom.

⑲ISP Programming Port

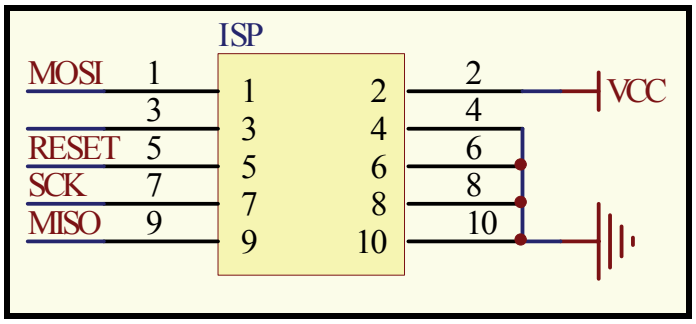


Figure10-22 ISP Programming Port

⑳JTAG Debugging Port

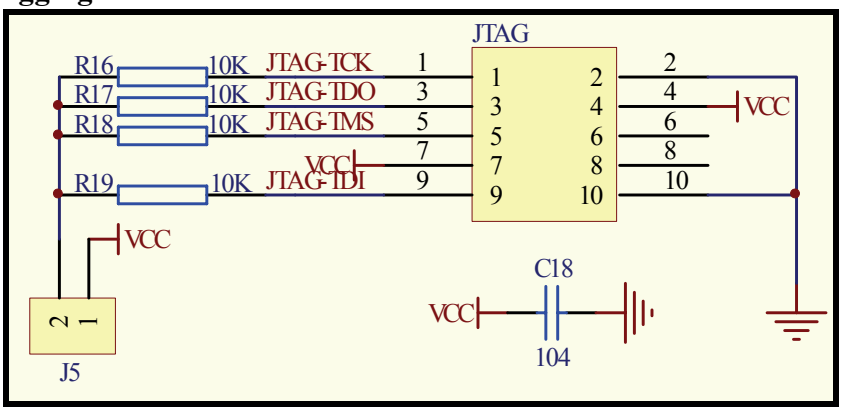


Figure10-23 JTAG Debugging Port

(21)SI-Programmer Integrated on Board

SI-Programmer is an easy-to-use programmer integrated on this development board. It works with the AVRICC included in the Product CD Rom. It also supports the great free AVR programming software made by Claudio Lanconelli - the Pony Prog.

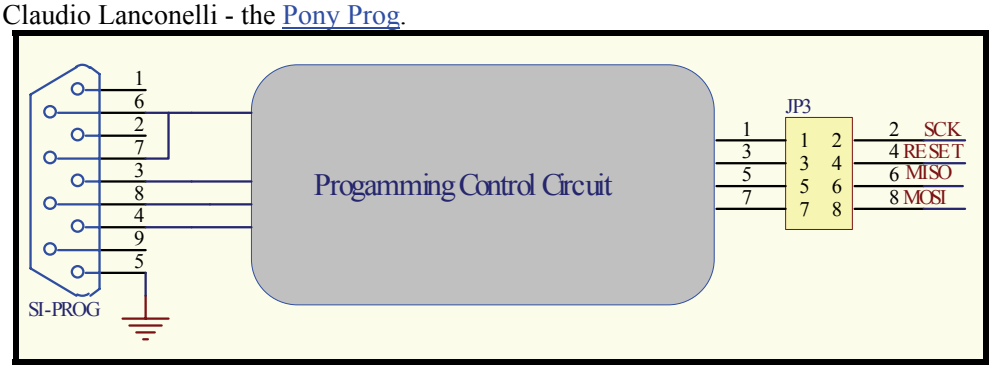


Figure10-24

How to install and use(works with the AVRICC software):

Step1.connects to PC via RS232 port (note it will not work with USB-RS232 converters!),the JP3 jumper keeps connecting.

Step2.Power on the board via USB cable or external 6-12V power supply.

Step3.Start AVRICC software, enter“In System Programmer”.

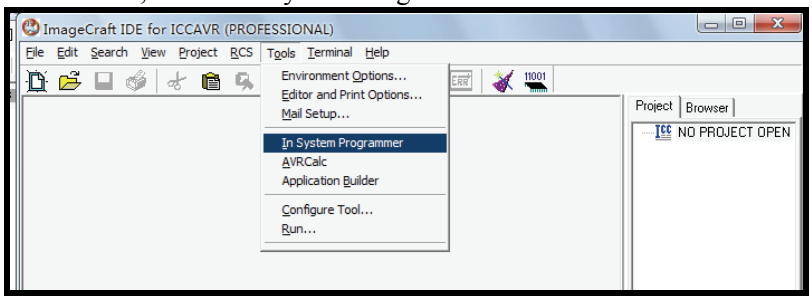


Figure10-25

Step4.Programmer Type and Com Port Settings.

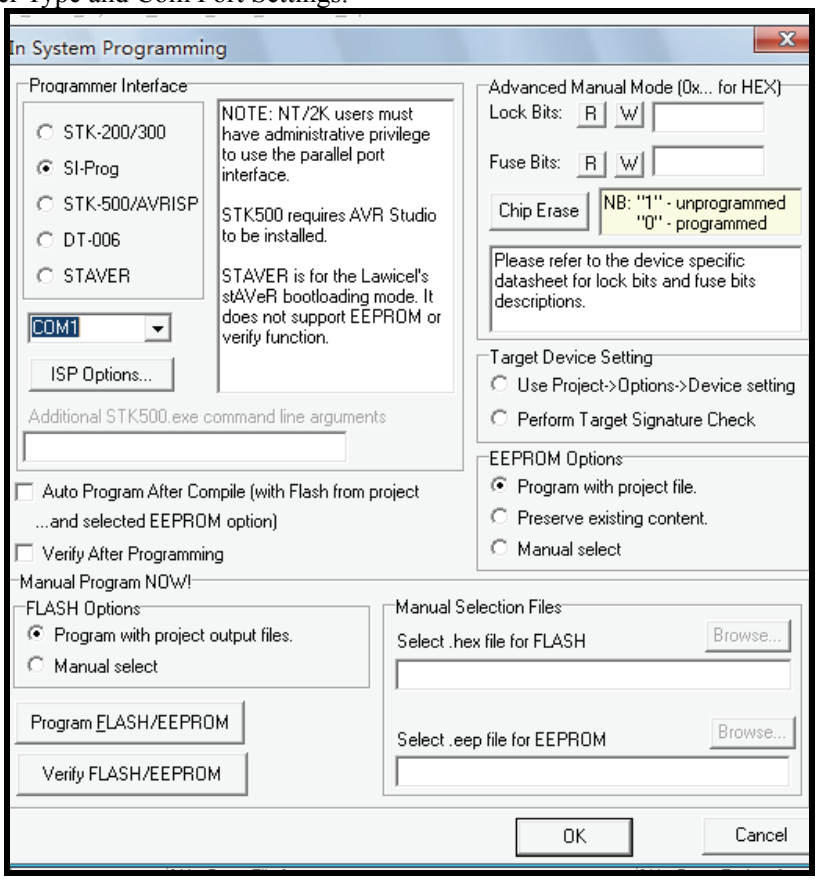


Figure10-26

Step5. Select “Manual select”



Figure10-27

Step6. Load “.hex”file.

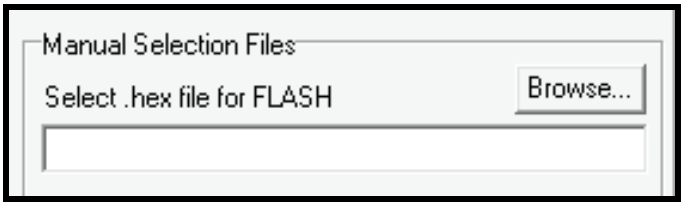


Figure10-28

Step7.Click “Program FLASH/EEPROM” to Download “.hex”file to mega16/32 microcontroller.



Figure10-29

11. Frequently Asked Questions

1).I tries to power the board, but the board does not power up, what’s wrong?

Make sure that the POWER LED has turned on. If the LED is not on, check to see that the external power supply(DC6-12V) or the USB power is properly connected, check to see that the J1 is properly connected .It is necessary to note that the external power supply(DC6-12V) and the USB power can not be connected simultaneously.

2) How is power supplied to the experimenter's board?

Three supply options exist: USB power Cables, external 6—12VDC and programmer/debugger power supplies are supported. You are only allowed to choose one of them.

3) What devices can be programmed with the experimenter's board?

AVR mega16/32 Starter Development Board is designed to develop applications using the Mega16/32. The device can be replaced by Mega16L/32L/16A/16A/ 8535 device derivatives, respectively.

4) The Mega16/32 is no longer accessible via programmer/debugger, is something wrong with the device?

- Verify that the target device is powered properly.
- If the target is powered locally, verify your programmer/debugger is connected properly.
- If the programmer/debugger is connected properly, the Mega16/32 is possibly "dead". Well, it's not really dead, it's just that it can't be reprogrammed until the Mega16/32 is unlocked (for detailed method of unlocking an AVR device, please search for solution on the internet).

5) I have loaded the Mega16/32 sample code, but It doesn't seem to be working, what's wrong?

-Try to disconnect the **SI-Programmer** cable or JP3， in case of some IOs occupied.
- Make sure the relational jumper is correctly connected.
- If the relational jumper is correctly connected, pls check whether the **FUSE BITS** had been changed.

Note: For detailed information of **FUSE BITS** settings, please refer to the datasheet named "mega16.pdf " or "mega32.pdf " which is included in the Product CD Rom.

6) I have loaded the Mega16/32 sample code, but It seem to be working very slowly, what's wrong?

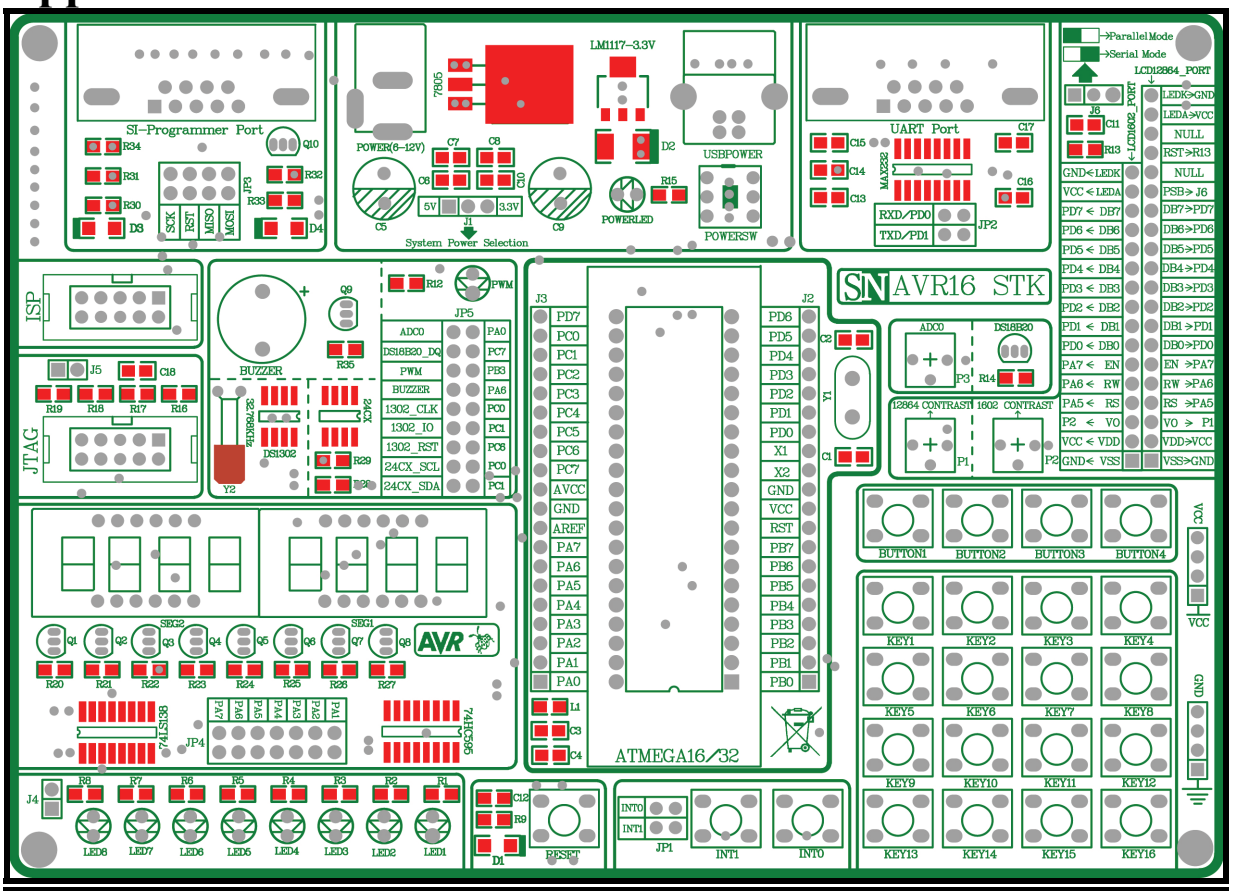
Make sure the system clock had been changed .The **AVR mega16/32 Starter Development Board** has a default system--internal RC 8MHz system clock, and the sample codes in product CD-ROM is based on this default system clock. If the system clock had been changed to lower one like 1MHz, the board will work slowly.

Appendix A. Packing List

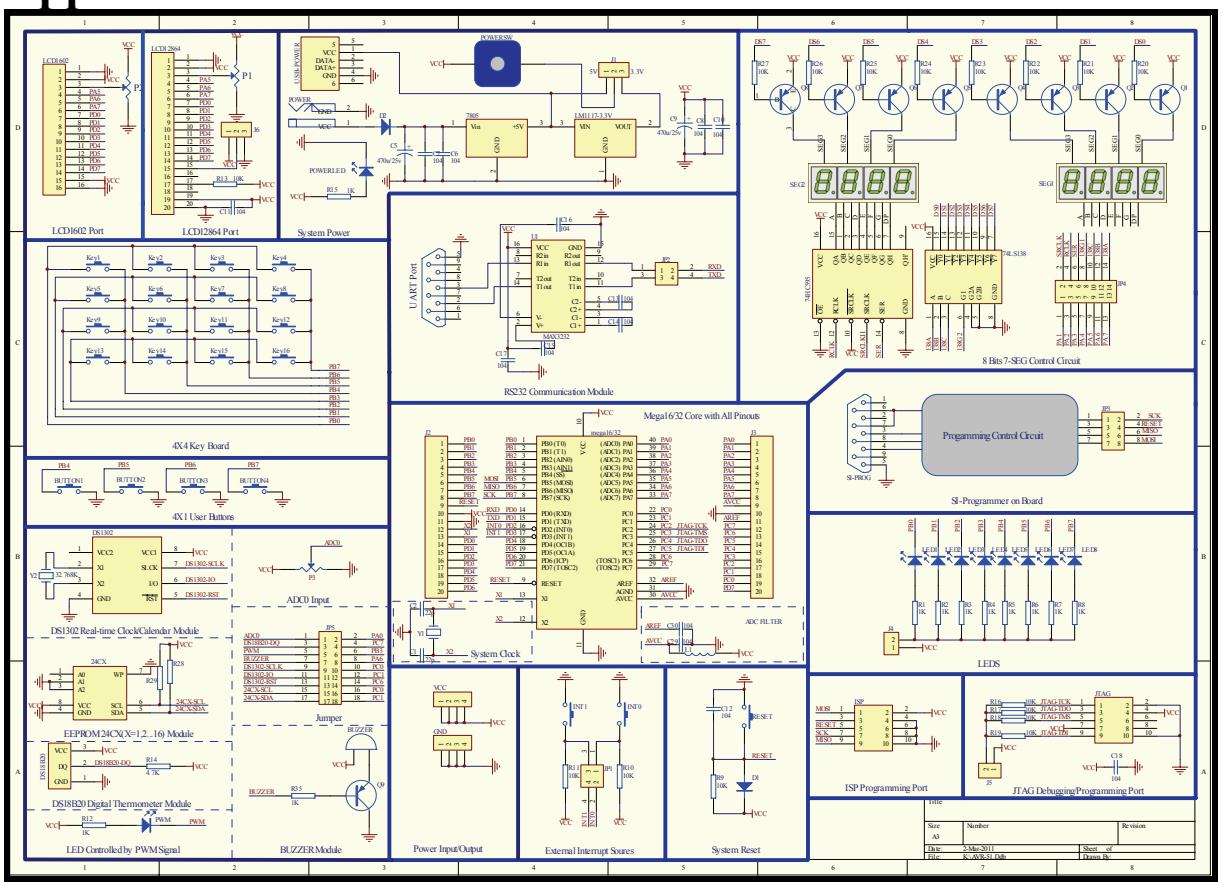
When you receive the products, please check the box to see if all accessories are complete. This product should include the following components:

- AVR mega16/32 Starter Development Board, 1 pcs;
- USB power supply cable, 1 pcs;
- CD-ROM or DVD-ROM, 1 pcs;

Appendix B. Board PCB



Appendix C. Board Schematic



Appendix D. Contact Us

e-mail:wxl07297662156@163.com
QQ: 634503119