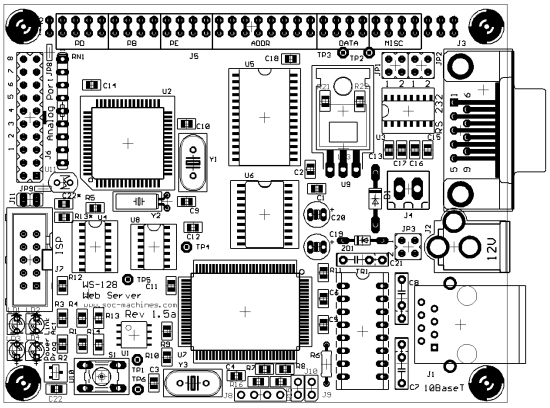
Amber Web Server

WS128 Plus
Hardware Reference Guide
PCB Rev 1.5c



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1925A–08/00/5M

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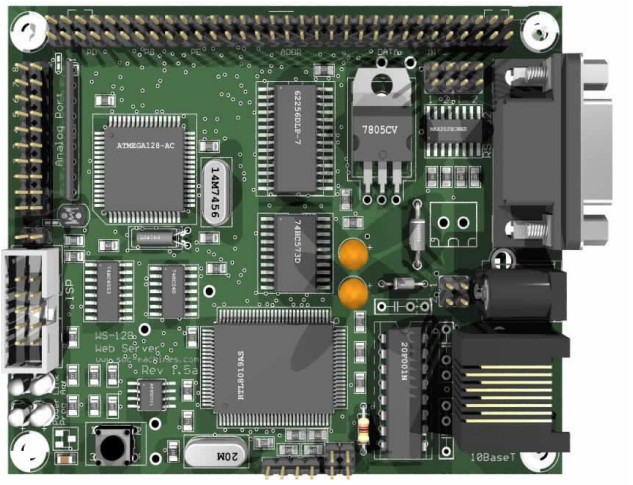
1.0 Introduction

Features:

- Atmel AVR ATmega128 14.756MHz processor
- 128Kbytes Flash
- 512K, 1024K or 2048Kbyte SPI Flash
- 4K SRAM on chip
- 2K EEPROM
- 32Kbytes SRAM
- Temperature and light sensor
- Dual Axis 2G accelerometer
- 10BaseT Ethernet Port
- RS-232 and RS-485 Port
- 8 10 bit A/D
- 32 Bidirectional I/O ports
- ISP Programming Port
- Extensive Source code examples
- Open source TCP/IP stack, web server
- 9-12VDC power input (5VDC board)
- Small form factor (3.85x3.00 in)



Hardware

The WS128 Plus processor is a 14.756MHz AVR Atmega128 8 bit RISC processor with clock crystal real time clock for dynamic power management. The processor has 128K of Sector Programmable Flash, 4K SRAM, 2K EEPROM, 8 10bit A/D channels, 32 multi-function digital IO, two serial ports (an RS-232 compatible with 9pin D sub connector and a RS-485 full duplex to four pin header), 2-Wire port for party line remote processor communication, ISP programming port, SPI communications port. The board has 32K SRAM, 10BaseT Ethernet port with Power Over Ethernet (7-12VDC only) capability, 9 pin D Sub RS-232 connector, 10 pin ISP programming port and a 64 pin AVR Expansion bus for daughter card connection options.

The WS128 is programmed using the ISP10 programming cable connected to the parallel port of a desktop PC. Other third party programming cables are available to program the board. A comprehensive PC based programming utility allows Flash, EEPROM and fuse bits to be set and cleared.

The AVR 2-Wire interface is a shared bus serial communications protocol supported by most of the AVR processor family. 2-Wire supports remote wake-up, node ID identification and high speed communication (>400Kbits/sec). The WS128 can operate as an IP master to a group of up to 128 2-Wire processors allowing extensive and sophisticated data acquisition and control networks to be IP enabled.

Software Tools

A comprehensive set of development tools is available for applications development. A Windows and Linux GNU C compiler provides high level application development. An assembler/simulator is available from Atmel for assembly development and programming. Extensive technical documentation and source code is available including detailed chip operation/management and application programs.

An open source OS, TCP/IP stack and web server code base with broad industry support is available for IP centric application development. Many of the on chip peripherals are supported with drivers and application examples ensuring rapid application development. The sector programmed Flash memory includes a small boot kernel for rapid IP based code download and support in multi-WS128 applications.

2.0 AMBER WEB SERVER Quick Start Guide

2.1 Introduction

Before you begin to use the Amber Web Server Kit you should perform the following procedure, which leads you through the hardware and software setup.

> **WARNING: Do not attach or detach the programming cable while the unit is powered – always remove power from the unit first. It's also advised to remove the programming cable before shutting the PC off or rebooting the PC – leaving the cable attached may result in erasure of Flash memory.**

Revision 1.5a Enhancements

Several significant changes were made in PCB Revision 1.5a over 1.3e – these changes are summarized below:

- SPI 8pin SOIC Serial Flash added – 128Kx8 5V part
- Full duplex RS-485 circuit added to the second serial channel (not populated)
- Dual axis accelerometer added (not populated)
- Light sensor added (not populated)
- Temperature sensor added (not populated)
- Provision for SMD LEDs
- 7805 voltage regulator replaced with LM317 SMD voltage regulator
- DS1811 reset IC removed
- Full wave rectifier bridge removed
- Circuit trace width increased from 0.006 to 0.008 for easier manufacturing
- Minimum hole size increased from 0.012 to 0.0135mil

The WS-128 is now available in two versions: the WS-128 and WS-128 Plus. The Plus version comes with all components installed. The unpopulated version is functionally equivalent to the Rev 1.3e board and can be upgraded by the user to the Plus version by adding the missing components.

2.2 Hardware Setup

The Amber Web Server serial port is pre-strapped for standard PC to WS-128 serial communication. A DC power supply (wall mount adapter), DB9 serial cable (MF) and Ethernet cable are required to verify operation.

1. Remove the Amber WS-128 from the anti-static bag and place on a non-conducting surface. The WS-128 is pre-configured with a sample web server application and the serial port is pre-strapped. Attach an Ethernet and serial cable to the WS-128. For the moment leave the ISP-10 programming adapter unattached. Connect a DC power source between 9-14VDC – polarity is not important – an onboard rectifier bridge ensures the correct polarity – default is center pin positive.
2. The unit should power-up with the RED power led and GREEN led on. Press the reset button once.
3. Start Hyperterminal, select a baud rate in the range 9600 to 57200 with XON/XOFF flow control off. Hold done the space bar. After a few moments the Amber Monitor should start with a sign-on message and test option suite. If no message appears press the reset button again. If still nothing check your serial cable TX/RX lines – they maybe reversed.
4. Press the X key to start the web server. The default Ethernet MAC address programmed into the server is 00-20-78-e1-11-56 – you can change this to another setting by entering the new setting after the prompt. If your Ethernet network supports DHCP or you wish to configure the IP

address using ARP leave the IP address blank – just hit return. The next question asks you to select DHCP or ARP setup. For DHCP setup type Y – hit return to select ARP. Use ARP service if the WS-128 is directly connected the PC.

5. For DHCP setup the web server is provided a dynamic IP address. Enter this address in your browser to access the web server.
6. For ARP setup type **`arp –s 192.168.0.100 00-20-78-e1-11-56`** at the DOS prompt or CMD prompt. Now ping the server using the IP address provided by the Amber Server.
7. Once the Server comes up it requests the current time. Hit return to set the clock to 00:00:00 or enter the current time. You may need to ping again.
8. The server should now be up. Walk through the web pages in the sample application. This particular application consumes slightly less the 50% of system Flash.
9. To re-program the WS-128 remove power from the server, attach the ISP-10 programming adapter (note the 10pin ISP connector is keyed) and reapply power. Start PonyProg2000 and select ATmega128 under the AVR device menu. Next, under the setup menu select Interface setup – select Parallel, AVR ISP I/O on the drop down menu and set LPTX (default is usually LTP1). Now run the calibration test. PonyProg2000 should be ready. To verify programmer operation select Security and Configuration Bits under the Command menu. Press read – if the programmer is communicating with the WS-128 several fields should have check marks. Now try re-programming the web server application by loading `ambermon.hex` located in the **`AmberMon`** directory on the CD. This will replace the Flashed server application with a new copy of the application - the Ethernet MAC is reset to 00-00-00-00-00-00. Restart the WS-128 as before.
10. You are now ready to start application development.

2.3 Software Setup

The Amber Web Server comes pre-loaded with a Web Server demonstration application. To program your own applications the WinAVR development tools included on the CD must be installed. The NutOS development tools are also included.

1. The included CD contains all the necessary software to start developing applications on the Amber Web Server under the Windows environment. If developing under Unix download the appropriate tools. You should check to see if there is a more recent update for each of the tools. The Amber Web Server is designed to run the Ethernut OS an open source development platform.
2. Install the latest Ethernut OS and application software (NutOS 3.9.5) using the supplied Windows installers **– `nut395c.exe`** and **`nut395d.exe`**. Be sure to install `nut395c.exe` first.
3. Install the AVR GNU C compiler using the supplied Windows installer **`WinAVR-20050214-install.exe.`**
4. Make the two modifications described in the section below called "Build Issues".
5. Run the **`NutOS Configurator`** from the Windows start menu**.** It's a good idea to read the Ethernut Software Manual Revision 2.1 April 2005. The Configurator does not run reliably without some data entry – follow the procedure in the manual.
6. Install the PonyProg ISP programming software setup program **`ponyprogV206f.exe`**.
7. Configure each of these utilities for your specific machine.
8. The application examples are compiled using the **`make`** utility. Activate the utility from the target directory in the DOS or CMD window. Update the path variable using the following command:

```
>set path=c:\Ethernut\nut\tools\win32;%PATH%
```

9. Directory **`AmberMon`** contains the sample web server application that is pre-loaded into the WS-128.
10. Check the SOC Robotics web site for additional application examples.

2.4 Build Issues with WinAVR 20050214 and NUTOS 3.9.5

The NutOS 3.9.5 distribution will not build successfully with WinAVR 20050214 unless two modifications are made:

1) Move a copy of **`twi.h`** located in WinAVR directory **`c:\WinAVR\avr\include\compac`** to **`c:\WinAVR\avr\include\avr`**,
2) Add the switch **`–fno-regmove`** after option **`-Os`** in the line starting with **`CPFLAGS`** in file **`Makedefs.avr-gcc`** in directory **`c:\Ethernut\nut`**.

There is a problem with the optimization of the registers in GCC for target AVR that hasn't been fixed in the two distributions - this work around fixes the problem.

2.5 Hardware Differences

The Amber Web Server Revision 1.5a is software compatible with the Ethernut Rev 1.3f board except for a change in the memory/IO expansion bus - the ALE line is routed to pin 1 and the addition of a number of additional features.

3.0 Detailed Description

3.1 Introduction

The WS128 Plus Amber Micro Web Server is a general purpose, small form factor, micro-controller with 128K Flash, 512K, 1M, 2M, 4M or 8Mx8 SPI Flash, 8 10bit A/D channels, 2 serial ports – RS-232 and RS-485, 32 digital IO, 2-Wire port, SPI port, temperature and light sensors, dual axis 2G accelerometer and 10BaseT Ethernet port. The board comes with extensive open source software support including a GNU C compiler, open source OS and an open source TCP/IP stack. The 10BaseT Ethernet interface provides IP interfacing to the desktop for high speed program downloading, communication and general web application development. The WS128 is an excellent platform for industrial control, dedicated web server, hobbyist and robotic control applications.

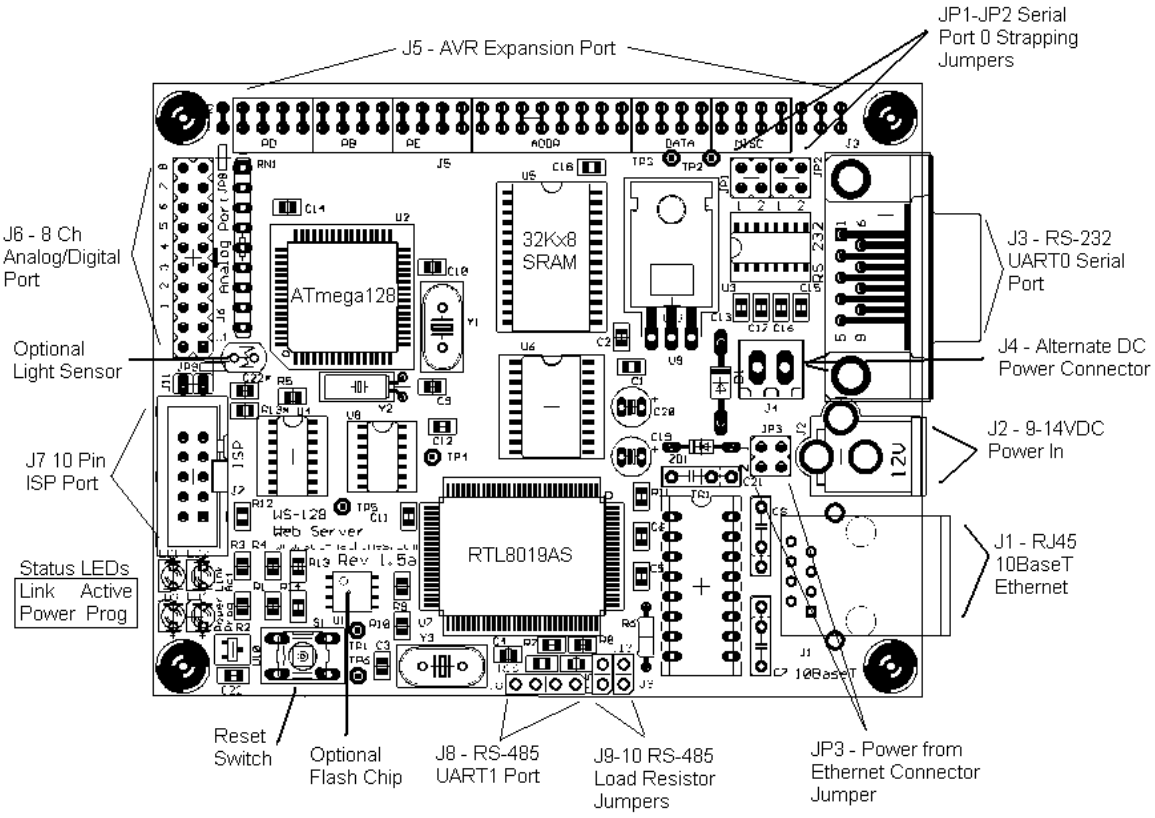


Figure 3.1. **Amber Rev1.5a Micro Web Server Top Side Component Layout**

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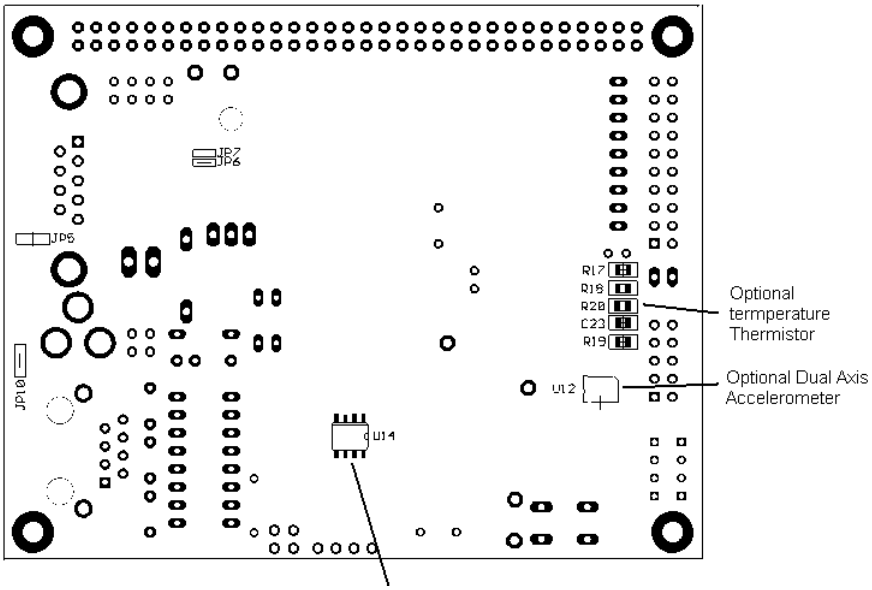

Figure 3-2. **Amber Rev1.5a Micro Web Server Bottom Side Component Layout**

The WS128 is programmed using the ISP10 programming cable connected to the parallel port of a desktop PC. Other third party programming cables are available to program the board. A comprehensive PC based programming utility allows Flash, EEPROM and fuse bits to be set and cleared.

The Ethernet Port provides a comprehensive venue for IP based application development. The open source TCP/IP stack provides tight product control for embedded applications.

The AVR 2-Wire interface (TWI) is a shared bus serial communications protocol supported by most of the AVR processor family. TWI supports remote wake-up, node ID identification and high speed communication (>400Kbits/sec). The WS128 can communicate as a TWI master to a group of up to 128 TWI processors allowing extensive and sophisticated data acquisition and control networks to be IP enabled.

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3.2 AVR Processor

The Amber Web Server is based on the ATmega128, a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega128 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

AVR key features:

- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 133 Powerful Instructions – Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers + Peripheral Control Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16 MHz
  - On-chip 2-cycle Multiplier
- Nonvolatile Program and Data Memories
  - 128K Bytes of In-System Reprogrammable Flash
    Endurance: 10,000 Write/Erase Cycles
  - Optional Boot Code Section with Independent Lock Bits
    In-System Programming by On-chip Boot Program
    True Read-While-Write Operation
  - 4K Bytes EEPROM
    Endurance: 100,000 Write/Erase Cycles
  - 4K Bytes Internal SRAM
  - Up to 64K Bytes Optional External Memory Space
  - Programming Lock for Software Security
  - SPI Interface for In-System Programming
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - Two Expanded 16-bit Timer/Counters with Separate Prescaler, Compare Mode and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Two 8-bit PWM Channels
  - 6 PWM Channels with Programmable Resolution from 2 to 16 Bits
  - Output Compare Modulator
  - 8-channel, 10-bit ADC
    8 Single-ended Channels
    7 Differential Channels
    2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - Byte-oriented Two-wire Serial Interface
  - Dual Programmable Serial USARTs
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby
  - Software Selectable Clock Frequency
  - ATmega103 Compatibility Mode Selected by a Fuse
  - Global Pull-up Disable

The ATmega128 provides the following features: 128K bytes of In-System Programmable Flash with Read-While-Write capabilities, 4K bytes EEPROM, 4K bytes SRAM, 53 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), four flexible Timer/Counters with compare

modes and PWM, 2 USARTs, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain, programmable Watchdog Timer with Internal Oscillator, an SPI serial port, IEEE std. 1149.1 compliant JTAG test interface, also used for accessing the On-chip Debug system and programming and six software selectable power saving modes.

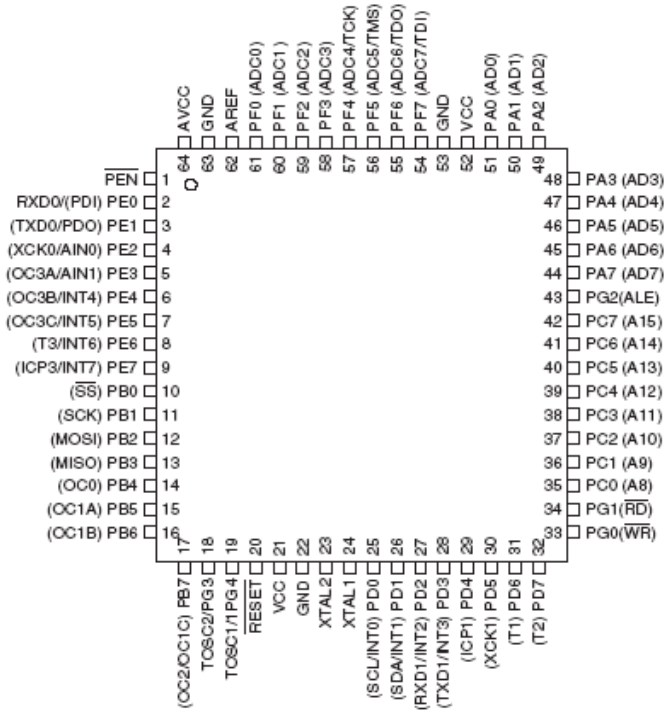


Figure 3-1. Atmega128 pin assignment

The AVR Flash is programmed using an ISP10 Programming Adapter. The ISP10 connects to the PC's parallel port (keyed) and loads programs through pins PE1 andPE0.

Real Time Clock

A 32.768KHz crystal is connected to real time clock inputs PG3, PG4 providing a real time clock option for timed data acquisition applications. The Atmega128 generates the master system clock using an external 14.574MHz crystal.

Serial Peripheral Interface - SPI

The ATmega128 Serial Peripheral Interface (SPI) allows high-speed synchronous data transfer between the ATmega128, the Serial Flash and SPI devices attached to expansion port J5. The SPI is a full-duplex, three-wire (MOSI-PB2, MISO-PB3, SCK-PB1) Synchronous Data Transfer communication channel with Master or Slave operation, LSB first or MSB first data transfer, seven programmable bit rates, End of Transmission interrupt flag, Write Collision flag protection, wake-up from Idle Mode and double speed (CK/2) Master SPI Mode. Maximum SPI clock rate is 3.6Mhz.

TWI Interface – I2C

The Two-wire Serial Interface (TWI) provides the Amber Web Server with an I2C communications capability for off board peripheral communication via connector J5. The TWI protocol allows the systems

designer to interconnect up to 128 different devices using only two bi-directional bus lines, one for clock (SCL-PD0) and one for data (SDA-PD1). The TWI lines must be pulled high for normal use – startup state should be idle. All devices connected to the TWI bus have individual addresses and mechanisms for resolving bus contention are inherent in the TWI protocol. Both Master and Slave operation is supported along with multi-master arbitration support, up to 400 KHz data transfer speed, slew-rate limited output drivers, fully programmable slave address with general call support and address recognition causes wake-up when AVR is in sleep mode

Several TWI modules including audio, compass, accelerometers, color LCD, DC motor control, stepper motor control and general analog/digital IO are available from SOC Robotics to enhance and extend the IO functions already available on the Amber Web Server. See the SOC Robotics web site for more information.

3.3 10BaseT Ethernet Interface

The Amber Web Server has a 10BaseT Ethernet interface with RJ45 connector. The Ethernet chip is the RTL8019AS which provides a buffered interface to the Atmega128.

3.4 RS-232 Serial Port

The Atmega128 has two full duplex USARTs – USART0 and USART1. The ATmega128 USART0 TX0 (PE1) and RX0 (PE0) lines are connected to RS-232 transceiver chip U3 and then to connector J3. The full duplex USART supports various baud rates, stop bit and parity. USART operation is interrupt driven with multiple interrupt sources. USART1 can be strapped for RS-485 operation with the addition of an RS-485 transceiver chip.

3.5 Analog Interface

The ATmega128 features a 10-bit successive approximation ADC. The ADC is connected to an 8-channel Analog Multiplexer that allows 8 single-ended voltage inputs on pins PA0 to PA7. Pins PA0 to PA7 are brought out to analog expansion bus connector J6.

With a 13 - 260 µs conversion time - maximum sample rate is 15Ksps at the maximum resolution. The single-ended voltage inputs refer to 0V (GND). The device also supports 16 differential voltage input combinations. Two of the differential inputs (ADC1, ADC0 and ADC3, ADC2) are equipped with a programmable gain stage, providing amplification steps of 0 dB (1x), 20 dB (10x), or 46 dB (200x) on the differential input voltage before the A/D conversion. Seven differential analog input channels share a common negative terminal (ADC1), while any other ADC input can be selected as the positive input terminal. If 1x or 10x gain is used, 8-bit resolution can be expected. If 200x gain is used, 7-bit resolution can be expected. The ADC contains a Sample and Hold circuit that ensures the input voltage to the ADC is held at a constant level during conversion.

The ADC has a separate analog supply voltage pin, AVCC that is filtered by R13/C22 from the 5.0VDC. Internal reference voltages of nominally 2.56V or AVCC are provided On-chip. The voltage reference may be externally decoupled at the AREF pin by a capacitor for improved noise performance. The Programmer selects either 2.56V or 5.0V for AREF.

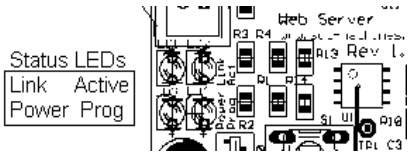
3.6 AVR Memory/IO Expansion

The AVR Expansion port brings AVR functions SPI, TWI, ADC PA0-7, AREF, AVCC, PB0-4, PD2 and PD7 to connectors J5/J8. Analog input pins PA0-7 can also operate as digital I/O ports on an individual

pin basis. Digital port pins PB0 to PB4 are pulled high with 10K resistors. VCCPWR is the unregulated DC input. VDD is 3.3V and AREF is the filtered analog voltage reference. TWI lines SDA and SCL are pulled high.

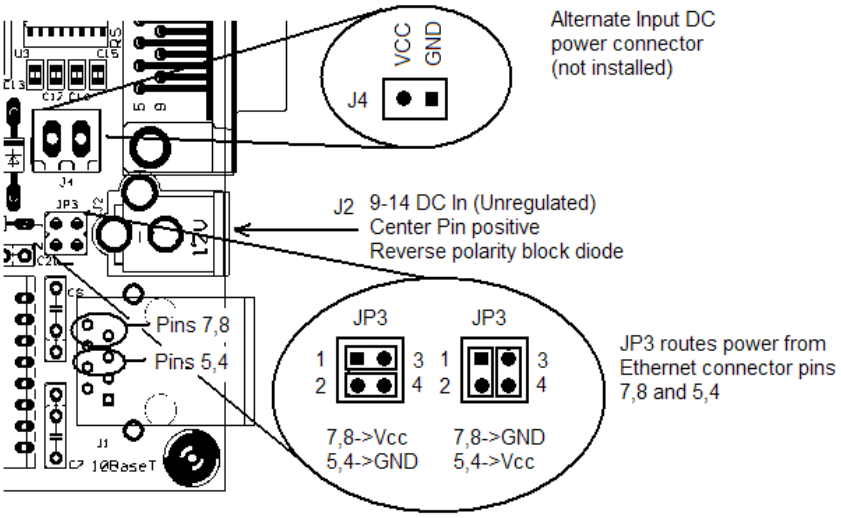
3.7 LEDs, Switches

The Amber Web Server has a reset switch and four LEDs. The LEDs indicate the status of power, programming state, Ethernet link status and reset status (Active).



3.8 Power Strapping Options

The Amber requires an unregulated DC input source between 9 –14V DC. A wall mount DC power adapter is recommended. Power Jack should be center tap positive. A reverse polarity protection diode protects the on board voltage regulator. The board can also be powered using alternate connector J4 or from the Ethernet Cable by installing jumpers on JP3. **Caution: The Amber board does not support Ethernet POE (-48v).** Connection to an Ethernet POE network will damage the Amber. Header pins for J4 and JP3 are installed in the Plus Version.



3.9 Optional Components (Plus Version)

The Amber Web Server is available in a Standard version or Plus version. The Plus version has temperature, light, accelerometer and Serial Flash installed. These components can be installed by the user.

Light and Temperature Sensors

The Amber Web Server has pads for an optional temperature sensor and light sensor. The temperature sensor mounts on the bottom of the PCB. The light sensor mounts on the top of the PCB. Both sensors require a load resistor to set voltage range for proper operation – sensor is connected to ground. See the datasheet for detailed technical information.

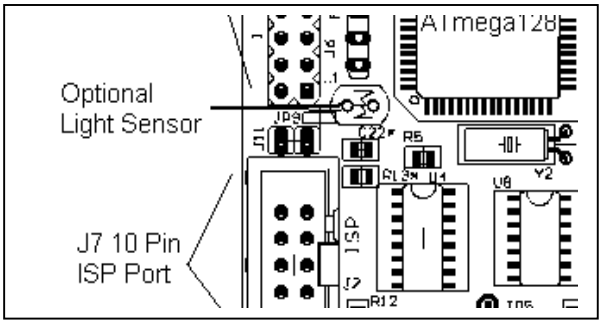


Figure 4-4. Light sensor location.

Light Sensor: PDV-P9005 Photonic Detectors, Inc.
400K@1Lux, 65K@10Lux,15K@100Lux
Response time - 40ms
Other components:
R17 - 50-150K 0805

Temperature Sensor: 2322 615 53103 Vishay
10K@25C, NTC
Other components:
R18 - 5-40K 0805

Accelerometer

The Amber Web Server has a pad for a dual-axis accelerometer. Several possible MEMSIC thermal accelerometers are compatible with the pad pin assignments – MXA2500GL, MXD2004A and MXD2002A. The accelerometer requires the installation of additional components for proper operation. MEMSIC accelerometers output temperature as while as X and Y. Acceleration is output in Analog or Digital PWM format. See the datasheet for detailed technical information.

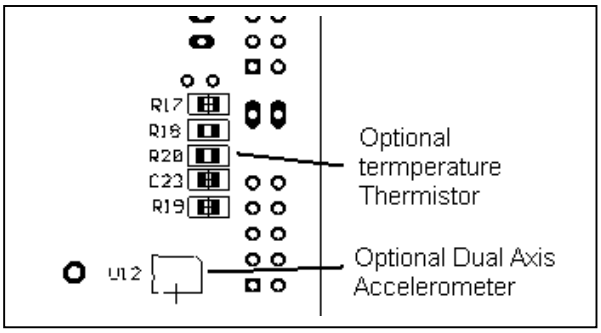
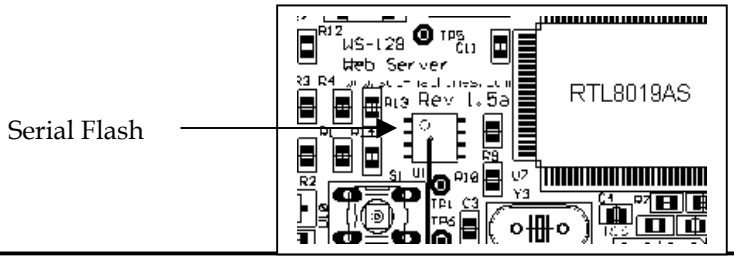


Figure 4-5. Temperature sensor location.

Accelerometer: MXA2500GL +-1.7g Analog
MXD2004A +-5g Digital
MXD2002A +-10g Digital
Other components:
R19 - 100R 0805
C23 - 0.33uF 0805

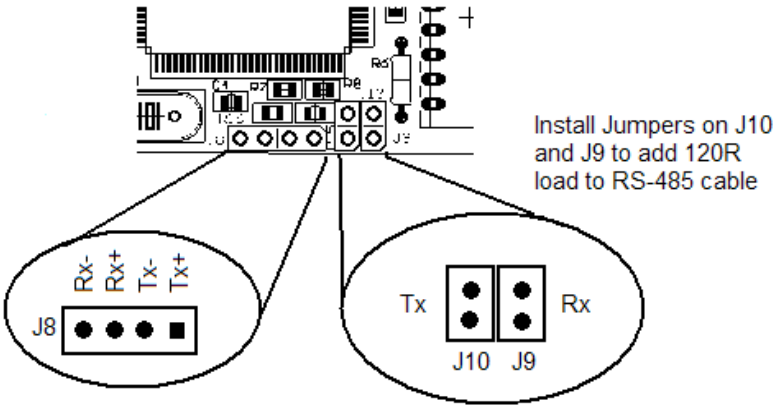
Serial Flash Memory

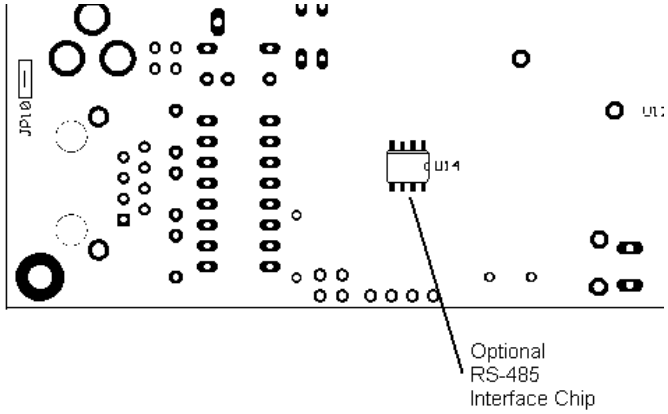
The Amber Web Server has pads for a Serial Flash device (U1) with 128Kx8 capacity. The AVR communicates with the Serial Flash using the SPI communication bus. The Serial Flash is selected by setting PB4 low. The SPI Flash must be 5V compliant with pinouts compatible with the Atmel AT45D011. See the datasheet for detailed technical information.



RS-485 Serial Port

The Amber Web Server supports an RS-485 serial port using USART1 signal lines PD3 (TXD1) and PD2 (RXD1). USART1 supports full duplex operation withvarious baud rates, stop bit and parity. USART1 operation is interrupt driven with multiple interrupt sources. RS-485 transceiver U14 is installed in the Plus version only.





4.0 Amber Software Development Environment

4.1 Introduction

The Amber AVR processor is programmed in C or assembler using open source or commercial software development tools. The AVR GNU C compiler tool chain is a command line development environment for Windows and Linux platforms. The AVR GNU tools must be configured for the Atmega128 before use. A low cost IDE based Windows C development tool chain is available from ImageCraft (as a time limited free trail www.imagecraft.com). Assembler and simulator tools are available for free from Atmel www.atmel.com .

A basic AVR Boot Monitor with integrated TCP/IP stack is under development and should be available in the first quarter of 2006.

An open source OS (Ethernut), web server and TCP/IP stack along with numerous example applications is included with the Amber SDK V1.2 kit. Ethernut is a comprehensive, lean, event passing OS that brings IP functionality to the AVR processor family.

4.2 AVR GNU C Development Tools

The AVR GNU C tool chain is available for Windows and Linux platforms. The GNU C compiler must be configured to generate code for the ATmega128 processor. Once configured a number of sample programs including a Boot Monitor and programming utility are provided to ease application development. The Amber Web Server SDK V1.2 CD includes a recent copy of the AVR GNU software development tools. If the GNU tool chain is selected check to ensure you are using the latest release here http://winavr.sourceforge.net .

4.3 AVR Boot Monitor

The Amber AVR Boot Monitor provides a frame work for accessing most Atmega128 peripheral functions such as SPI, TWI support, interrupt driven serial driver for RS-232 and RS-485, analog multiplexer, TCP/IP stack, digital I/O, optional component interaction and test programs. The TCP/IP stack is based on uIP. The Amber Boot Monitor is written in C using the ImageCraft Windows IDE environment and is provided as a ready to go project – compile and burn. The Boot Monitor is a good starting point for new application development such as new hardware daughter cards or testing interactions with external peripherals on the Serial, TWI or SPI signal lines. Full source to the AVR Boot Monitor code is provided.

The AVR Boot Monitor communicates with a host PC via the DB9 serial connector. Default serial communication settings are 38,700 baud, 8 data bits, 1 stop bit and XON/XOFF flow control.

WinAVR 20050214 is included in the SDK V1.2 CD.

4.4 Ethernut OS Support

The Amber Web Server is fully compatible with the Ethernut OS software environment. The Amber Web Server comes pre-loaded with a version of the Ethernut Operating System demonstrating a typical Web Server application. The Amber Web Server SDK V1.2 CD comes with one of the latest Ethernut software distributions. The Ethernut development environment must be configured to use the AVR GNU tools or ImageCraft tools. Both environments come with extension documentation. The AVR GNU GCC tools are developed by a different group then the Ethernut OS tools so incompatibilities can occur when new releases are introduced. The GNU and Ethernut distributions on the Amber SDK V1.2 CD have been

tested together and instructions concerning fixing any incompatibilities is included in the Quick Start section.

Ethernut Version 3.9.7 is included in the SDK V1.2 CD.

As soon as Ethernut Version 4.0 is released a new distribution will be released along with a more extensive Web Server application.

4.5 Example Programs

Example programs demonstrating several typical TCP/IP applications are included with the Ethernut distribution.

4.6 JTAG Emulation

The Amber Web Server does not have an Atmel compatible JTAG programming port. The JTAG lines are brought out to the Analog Port connector J6. Using pigtails it is possible to attach the necessary JTAG signal lines by using the ISP port and Analog Port. The Amber Web Server is shipped pre-programmed with JTAG fuse lines disabled. The JTAG fuse bits must be enabled before JTAG emulation is possible. JTAG emulation fuse bit can be enabled using the ISP10 programming adapter with PonyProg2000.

4.7 ISP Programming

The ATmega128 is programmed by loading a program into internal 128Kx8 Flash. The internal flash can be programmed using an AVR compatible JTAG or ISP adapter. Several third party ISP programming adapters are available. The ISP10 programming adapter included with the Amber SDK V1.2 development kit is attached between the ISP Port J10 and the parallel port of a PC. The ISP10 is compatible with the standard Atmel 10pin ISP adapters. A programming utility compatible with the ISP10 (**PonyProg.exe**) is included in the SDK V1.2 CD.

CAUTION: Do not attach or detach the ISP10 Programming adapter while the Amber is powered – this can cause accidental erasure of Flash contents or more seriously permanent program the lock bits preventing further Flash programming. Do not restart or re-power the PC as this may also cause erasure of the Amber Web Server.

5.0 Amber Hardware Expansion Port Summary

5.1 Introduction

The Amber supports several IO expansion ports. Different connector options are available to meet specific OEM requirements.

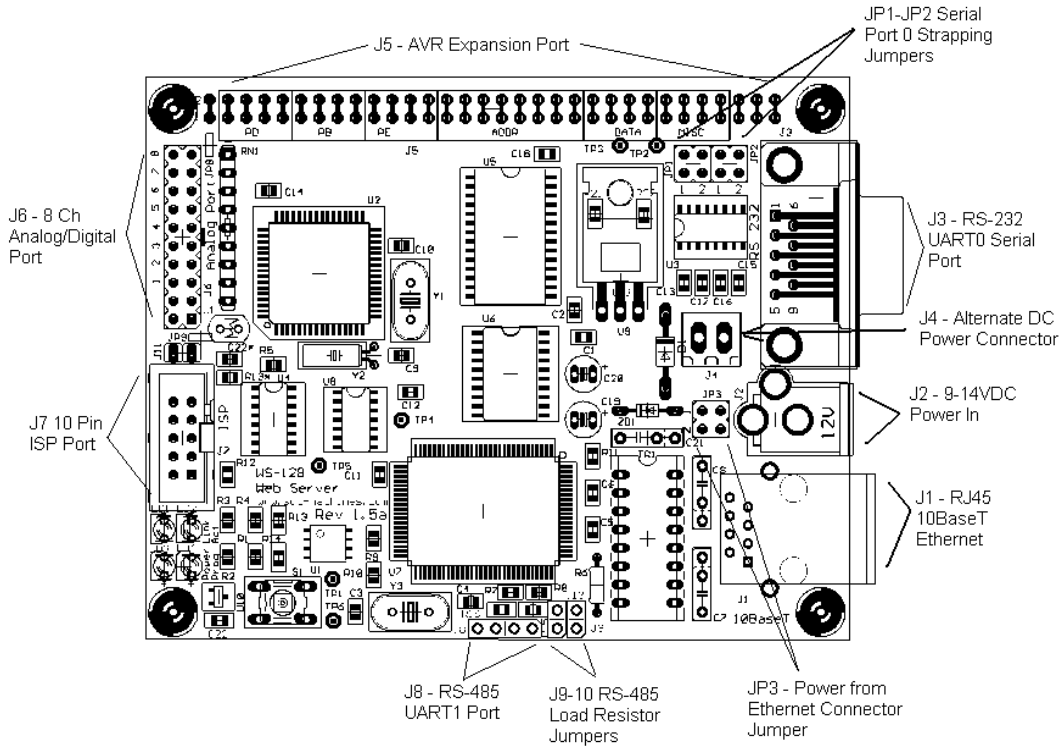


Figure 5-1. **Amber Expansion Connector locations**

5.2 Serial Ports – RS-232 and RS-485

The Amber has two serial channels: an RS-232 full duplex serial port and an RS-485 full duplex serial port. The RS-232 serial port is connected to ATmega128 UART0 – CTS and RTS lines are supported with optional jumpers. The RS-485 serial port is connected to ATmega128 UART1 if the optional RS-485 transceiver chip is installed.

Figure 5-2. **J3 ATmega128 UART0 RS-232 Port**

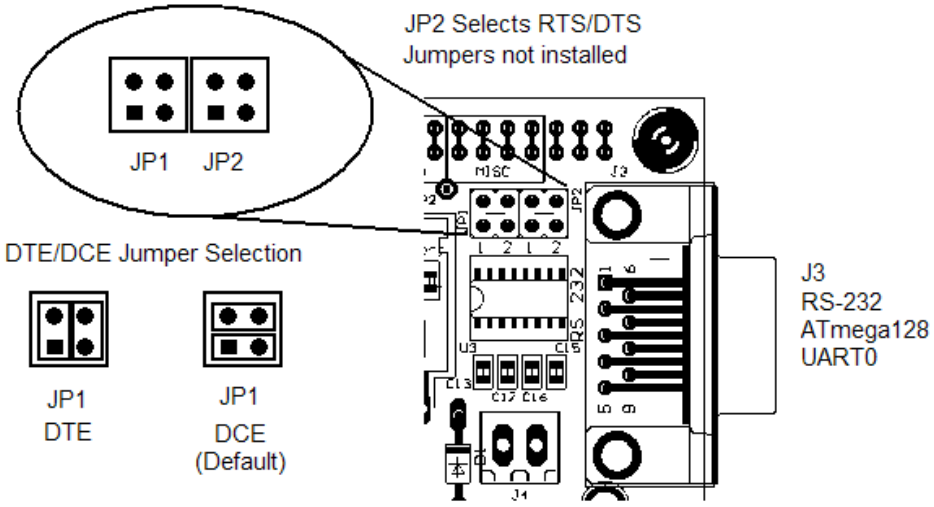
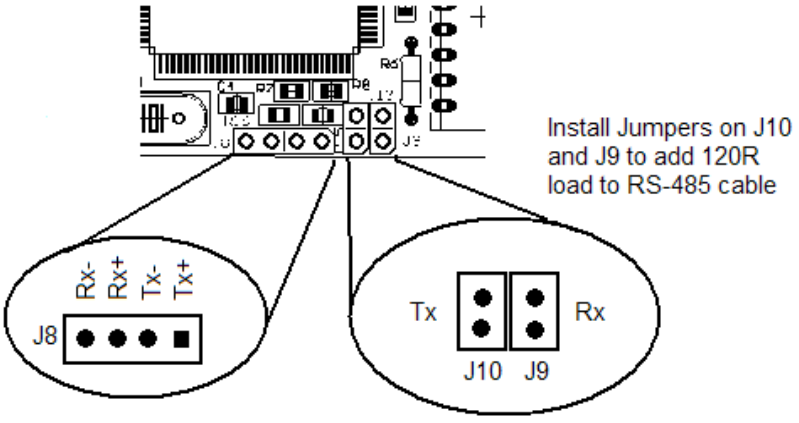


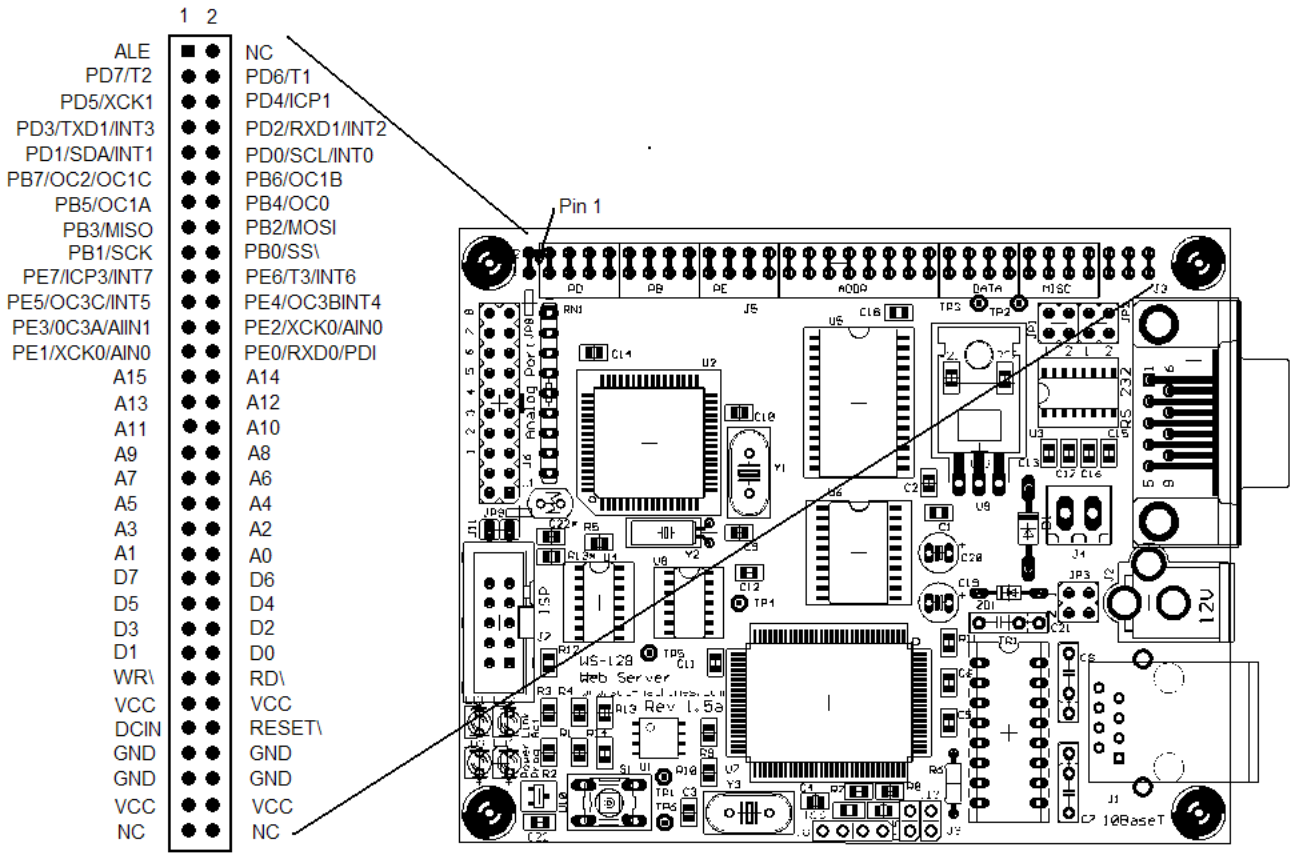
Figure 4-3. **J8 ATmega128 UART1 RS-485 Port**



5.3 Amber AVR Memory/IO Expansion Port

The Amber memory and I/O port pins are brought to bus expansion connector J5.

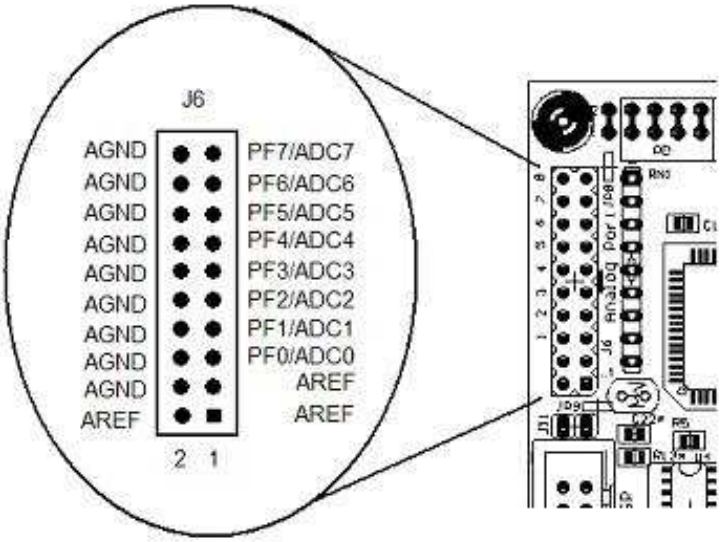
Figure 5.4. **J5 – AVR Bus Expansion Port**



5.4 Amber Analog/Digital Interface Port

The Amber Analog Interface Port supports 8 10bit analog input channels. Each channel can also be configured as a digital input/output port on an individual basis.

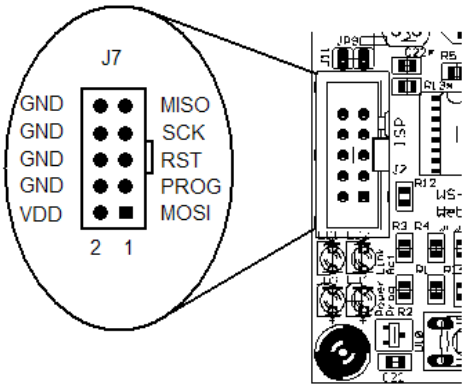
Figure 5-4. **J6 Analog/Digital IO Port**



5.5 ISP Port

The Amber has an AVR compatible 10pin ISP programming port. The orientation key ISP10 programming adapter attaches to J7 and a PC parallel port. Using the appropriate PC software AVR program files in the form of Intel Hex files can be downloaded into the Amber Program Flash.

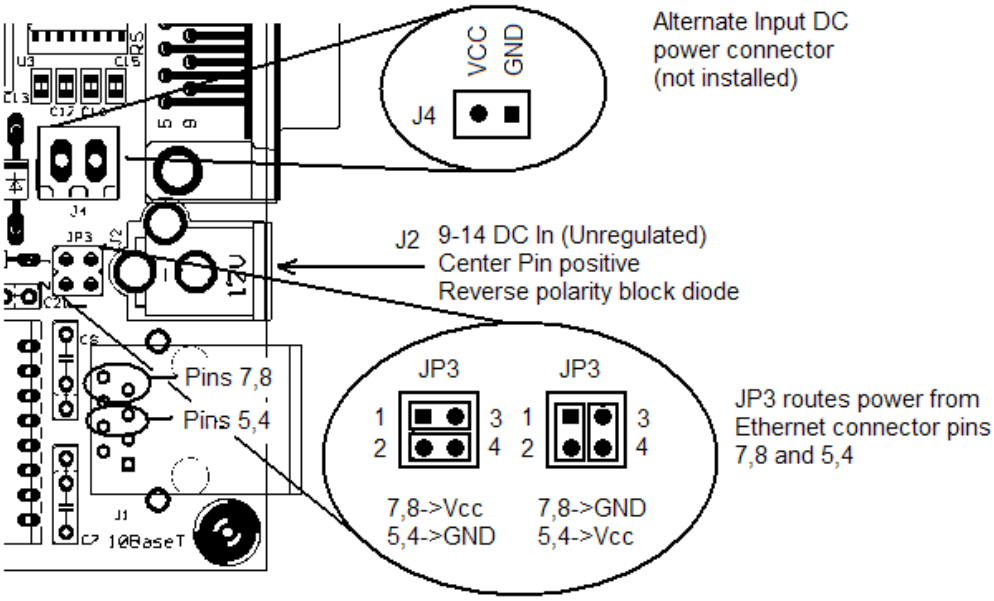
Figure 5-8. **J7 ISP 10 Pin Standard AVR Programming Port**



5.6 Amber Input Power Connector

The Amber requires an unregulated DC input source between 9 –14V DC. A wall mount DC power adapter is recommended. Power Jack should be center tap positive. A reverse polarity protection diode protects the on board voltage regulator. The board can also be powered using alternate connector J4 or from the Ethernet Cable by installing jumpers on JP3. **Caution: The Amber board does not support Ethernet POE (-48v).** Connection to an Ethernet POE network will damage the Amber.

Figure 5-8. **J2 – DC Input power options**



Caution: If power is supplied through the Ethernet Cable do not use –48V. The Amber is not compatible with the Power Over Ethernet (POE) standard.

6.0 Electrical and Mechanical Description

6.1 Component Layout

Figure 6-1. **Amber 1.5a Top Component Layout**

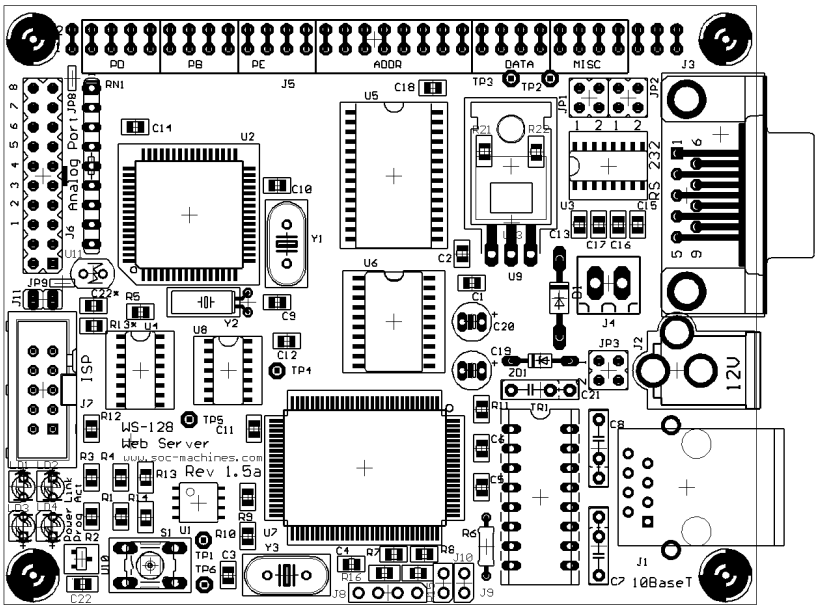
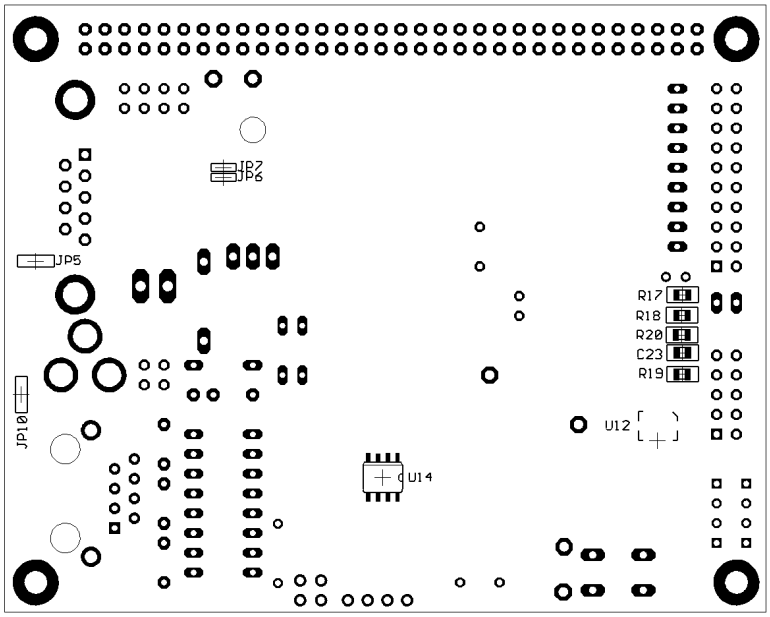


Figure 6-2. **Amber 1.5a Bottom Component Layout**



6.2 Electrical Specifications

Electrical

Input power: 7-12VDC @ 80ma
Board power: 5V DC @ 50ma

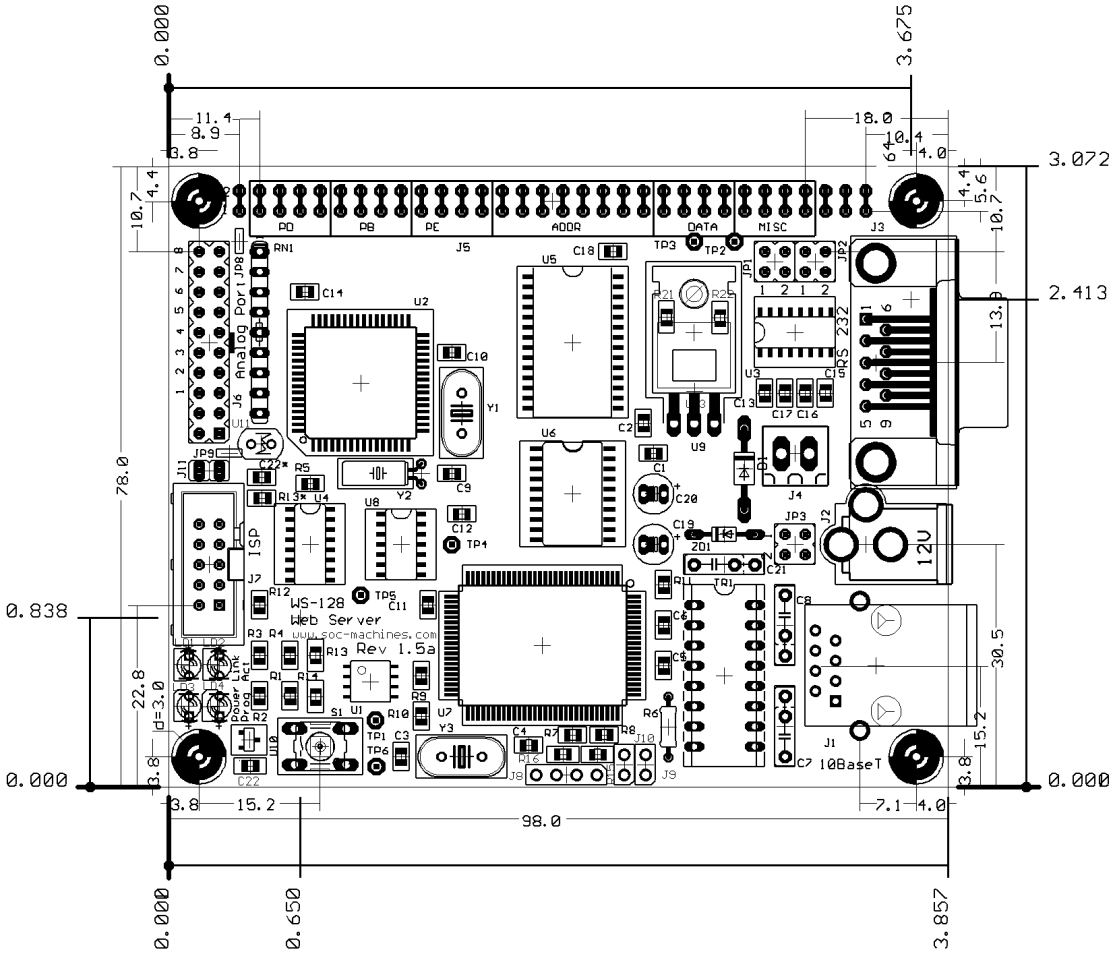
Mechanical

Dimensions: 3.00x3.85 in (four mounting holes)
Weight: 40grams

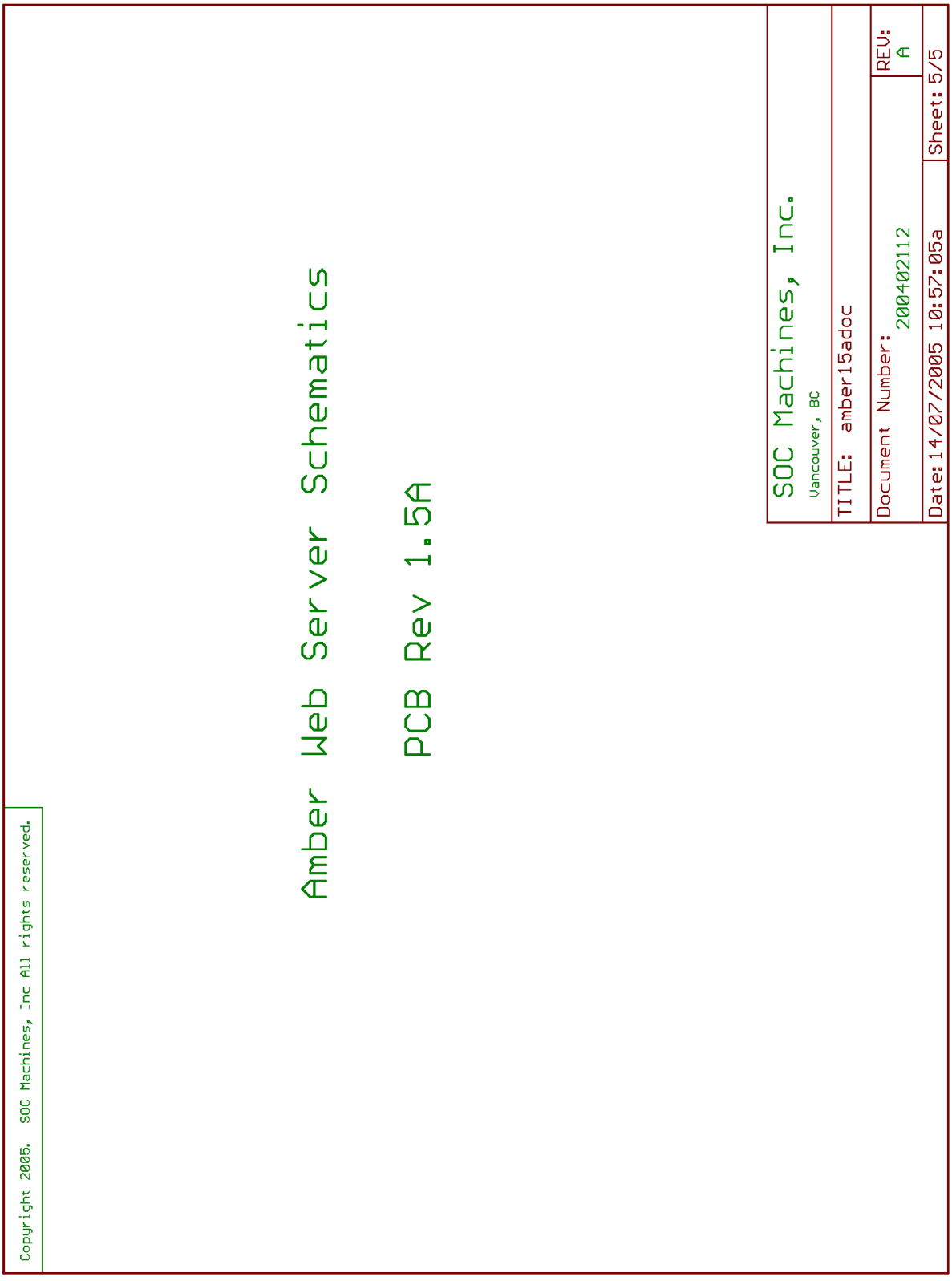
6.3 Mechanical Dimensions

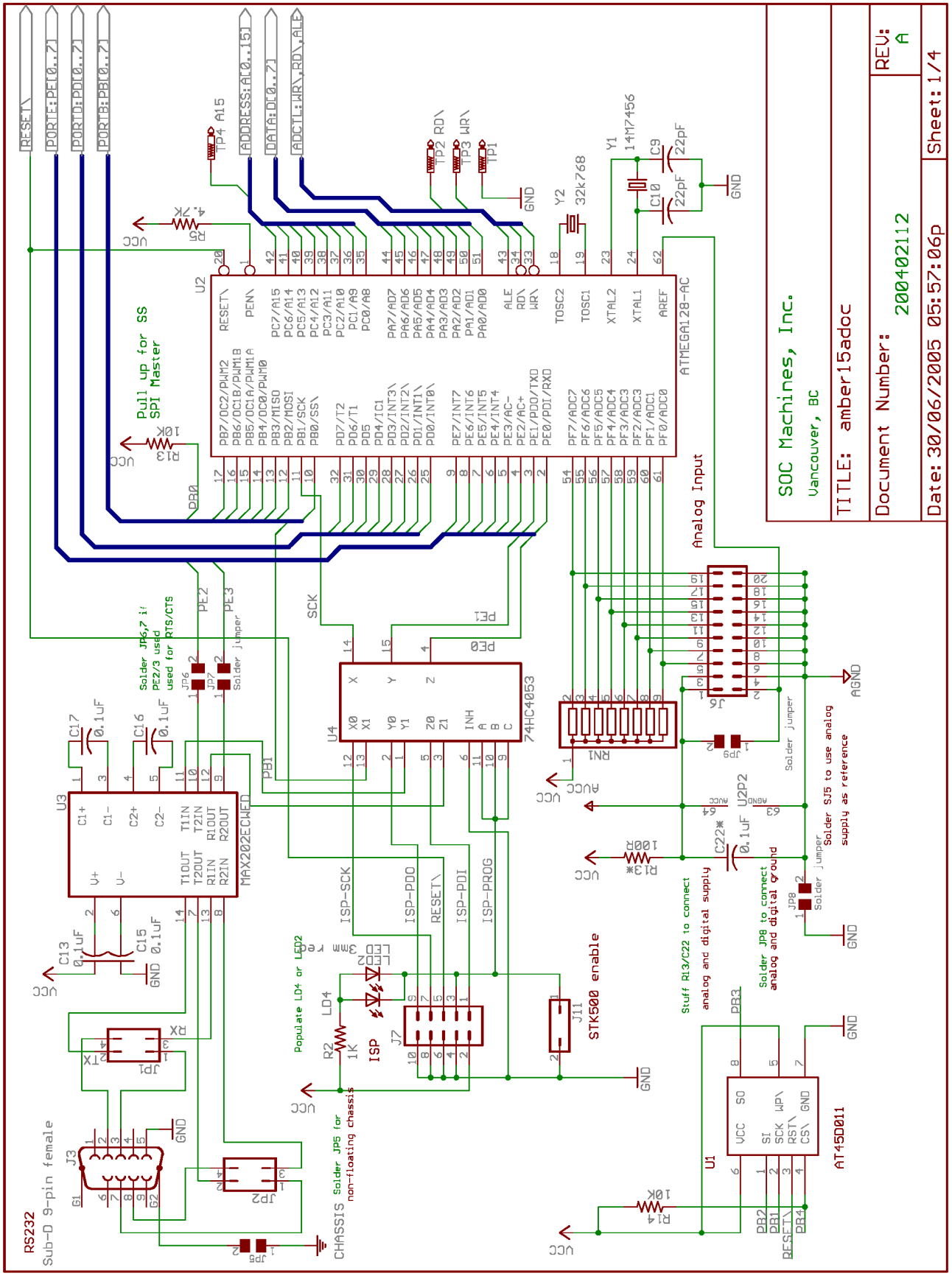
Board dimensions stated in inches and mm. Connector locations with respect to the lower left corner are annotated in the drawing. A sample schematic with connector library and board layout in Eagle CAD format is available at www.soc-Robotics.com/download/amberlayout.htm.

Figure 6-3. **Amber Rev1.5a Mechanical mounting dimensions**



7.0 Amber Rev1.5a Schematics




SOC Machines, Inc.
Vancouver, BC
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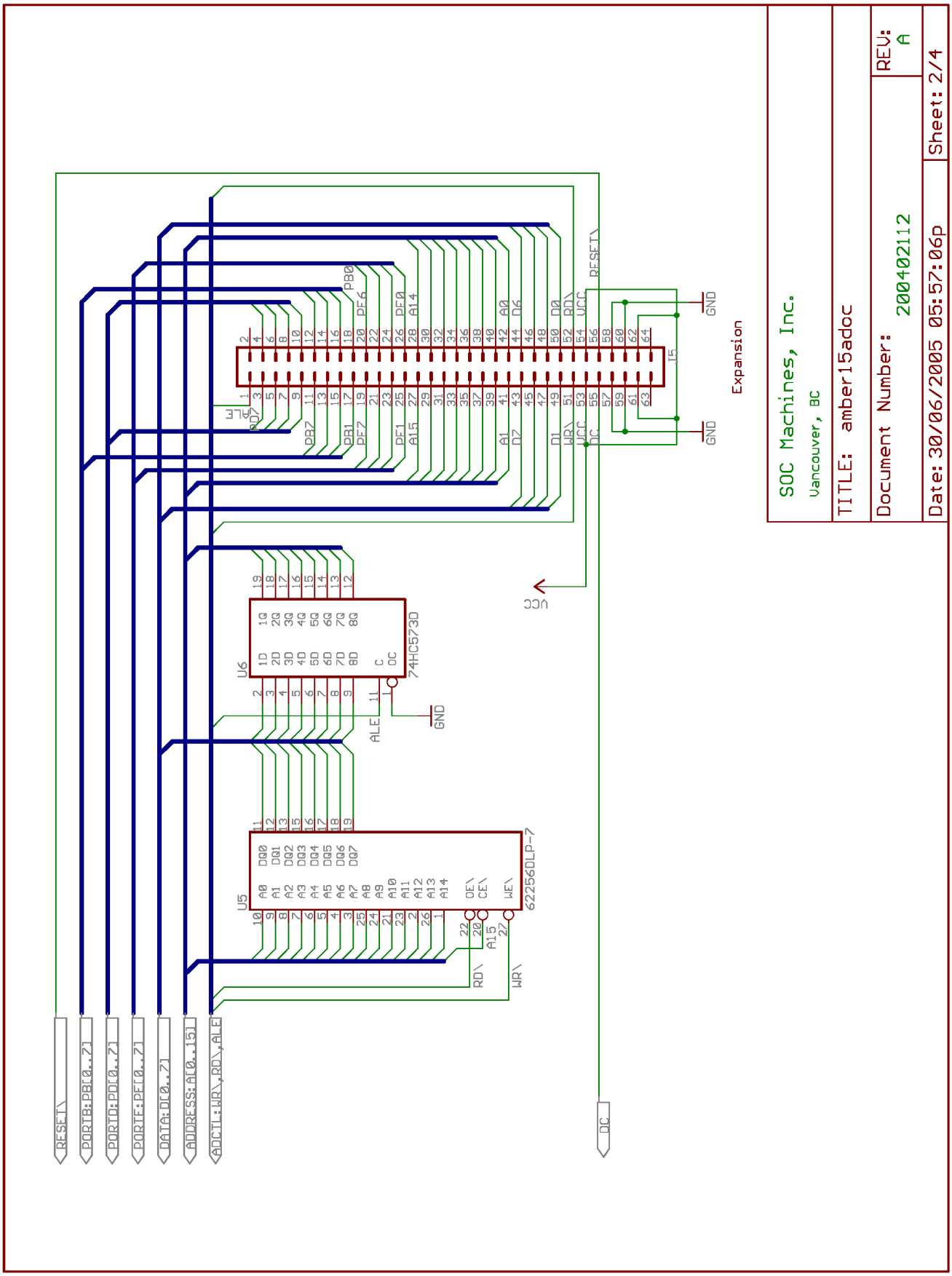
Document Number: 200402112
REV: A
Date: 30/06/2005 05:57:06p
Sheet: 1/4
ATMEGA128-AC
MAX202ECWED
74HC4053
AT45D011
Analog Input
Pull up for SS SPI Master
Solder JP6,7 if PE2/3 used used for RTS/CTS
Solder jumper
Solder SJ5 to use analog supply as reference
Stuff R13/C22 to connect analog and digital supply
Solder JP8 to connect analog and digital ground
Populate LD4 or LED2
STK500 enable
Solder JP5 for non-floating chassis
RS232
Sub-D 9-pin female
CHASSIS
ISP
ISP-SCK
ISP-PDO
RESET\
ISP-PDI
ISP-PROG
SCK
PE2
PE3
PB1
PB0
PB2
PB3
RX
TX
GND
AGND
VCC
AVCC


SOC Machines, Inc.
Vancouver, BC
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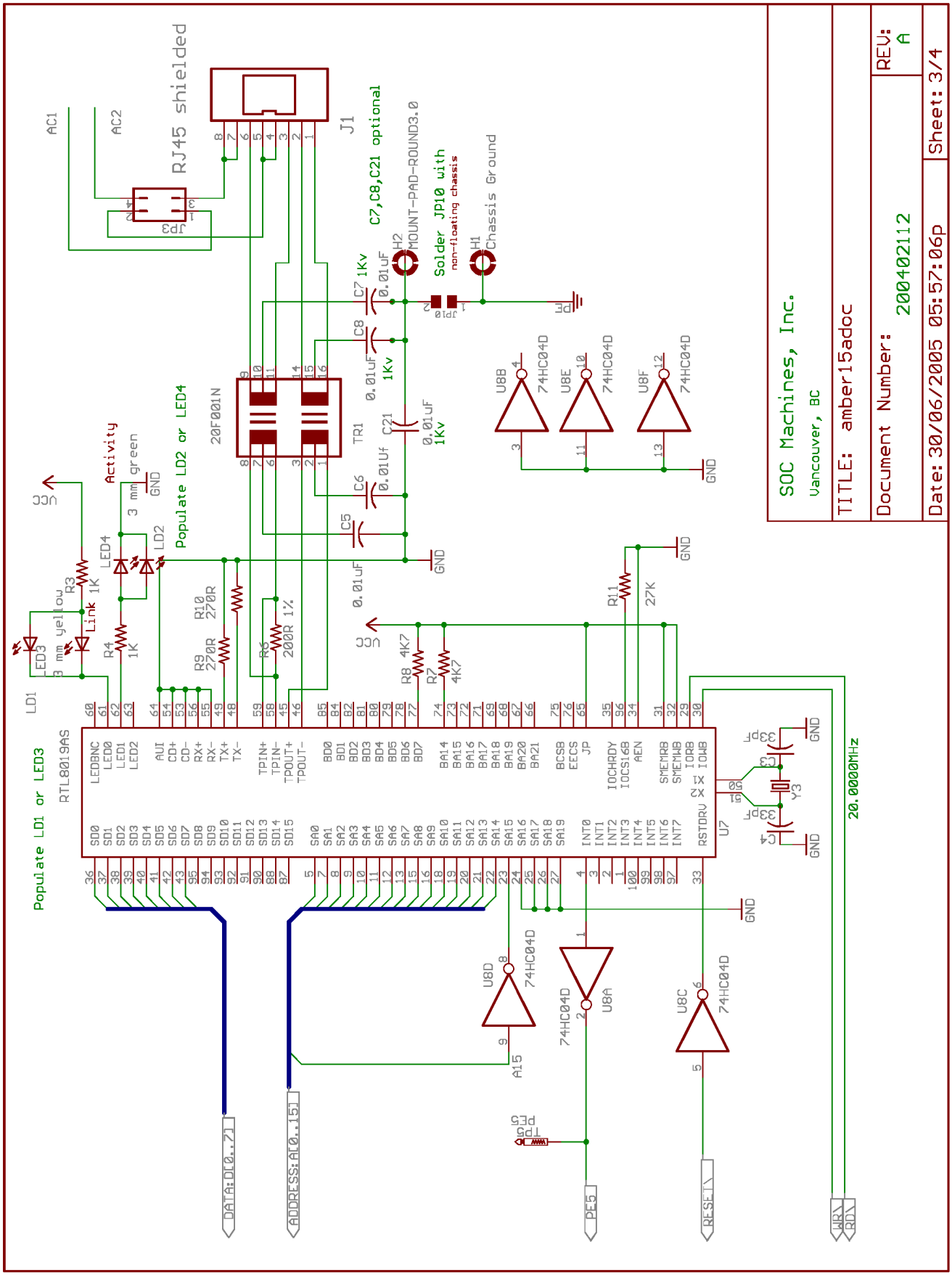
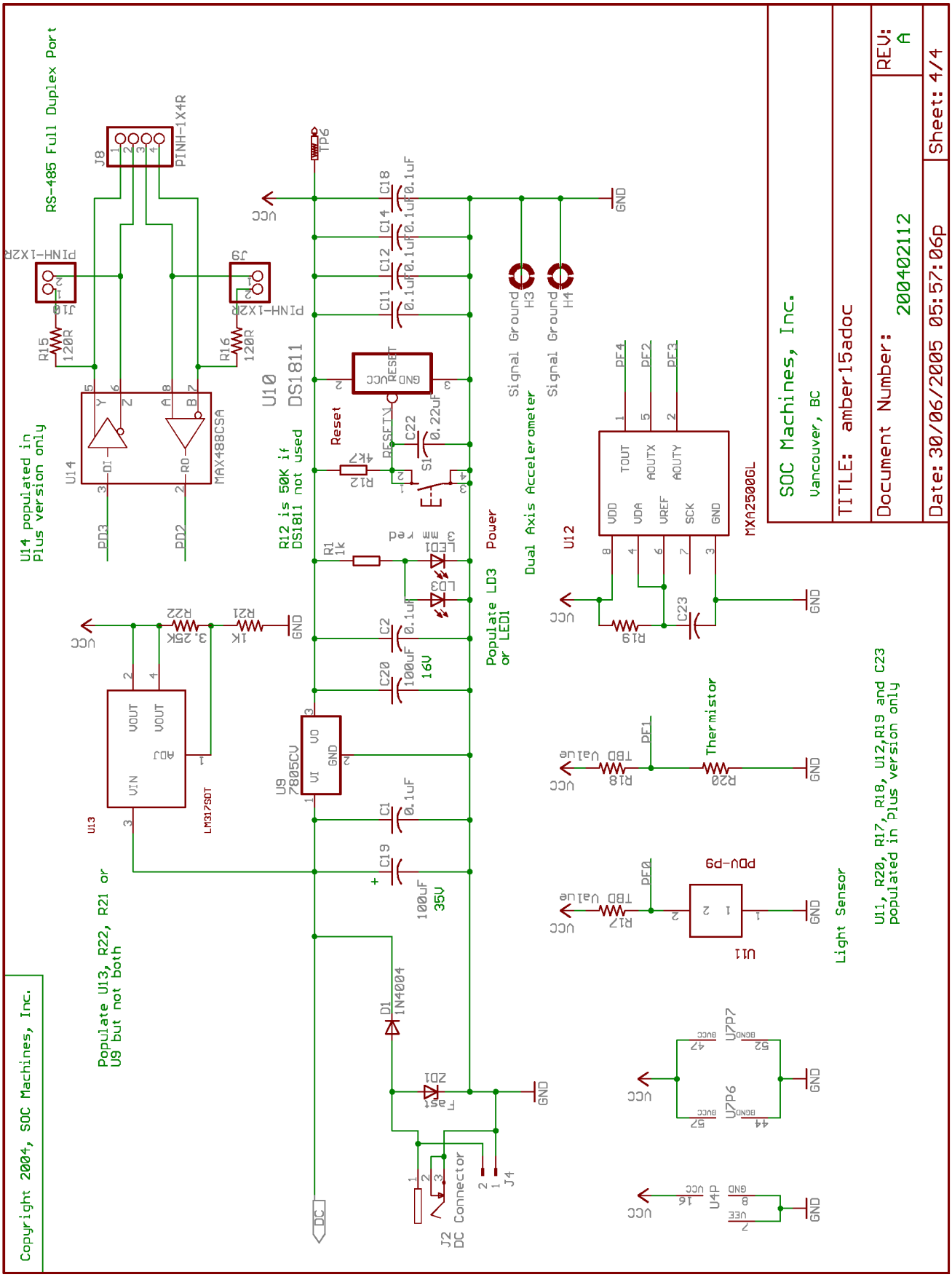
Sheet: 2/4
Expansion
U5
62256DLP-7
U6
74HC573D
J5
GND
VCC
RESET\
ALE
RD\
WR\
DC
PORTB:PB[0..7]
PORTD:PD[0..7]
PORTE:PE[0..7]
DATA:DF[0..7]
ADDRESS:A[0..15]
ADCTL:WR\,RD\,ALE


SOC Machines, Inc.
Vancouver, BC
TITLE: amber15adoc
Document Number: 200402112
REV: A
Date: 30/06/2005 05:57:06p
Sheet: 3/4
RJ45 shielded
J1
C7,C8,C21 optional
Solder JP10 with non-floating chassis
Chassis Ground
Activity
3 mm green
Populate LD2 or LED4
Link
3 mm yellow
Populate LD1 or LED3
RTL8019AS
20F001N
74HC04D
20.0000MHz
DATA:D[0..7]
ADDRESS:A[0..15]
RESET\
PE5
WR\
RD\
GND


RS-485 Full Duplex Port
U14 populated in Plus version only
R12 is 50K if DS1811 not used
Reset
Power
Populate LD3 or LED1
Dual Axis Accelerometer
Signal Ground
Signal Ground
Thermistor
Light Sensor
U1, R20, R17, R18, U12,R19 and C23 populated in plus version only
Populate U13, R22, R21 or U9 but not both
SOC Machines, Inc.
Vancouver, BC
TITLE: amber15adoc
Document Number: 200402112
REV: A
Date: 30/06/2005 05:57:06p
Sheet: 4/4
Copyright 2004, SOC Machines, Inc.

Notes: