# Ant6

# 6 Channel H Bridge 3-Axis Bipolar Stepper Motor Controller

## Technical Reference Manual

PCB Rev 1.0

www.soc-robotics.com

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1935A–08/00/5M

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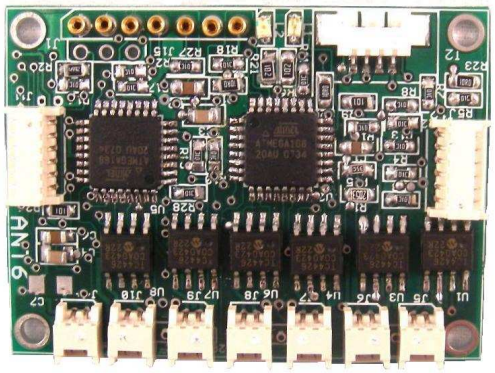
# 1.0 Introduction

## Features:



- 2 8bit RISC AVR Processors (Atmega168)
- 20MHz External crystal oscillator
- 6 1.5A 18V H-Bridges or 3 bipolar stepper motor ports
- 8ch 10 bit A/D
- 15 Digital IO
- SPI Port
- TWI I2C Port
- 16K Internal Program Flash
- 512bytes Internal EEPROM
- 1K Internal SRAM
- ISP Programming Port
- Machine pins on J1, J2, J3 to enable stacking
- GNU C Compiler, Third Party Commercial C Compiler
- Example application included for rapid application development
- Extremely Small form factor (1.4x1.9 in)
- 3.0-5.0VDC @ 12ma Power input
- Optional Components:
    - 10MHz Crystal
    - Three 4 pin Molex connectors

### Hardware

The **Ant6** is a six channel H-Bridge or 3-Axis bipolar stepper motor controller. With two ATmega168 processors the Ant6 is capable for variable speed motor control and small bipolar stepper motor control with PWM regulation of current. Each processor has 16K Flash, 1K SRAM and 512bytes EEPROM. The board is shipped with an H-Bridge control application. Commands are sent to the board via an I2C interface. The processor is programmed via a DISP port that is compatible with the Atmel ISP programming protocol. The **Ant6** is available as an H-Bridge controller or a bipolar stepper motor controller.

The Ant6 consumes about 12ma in active state and about 0.6ma in standby. By changing the internal clock and reducing power to certain peripherals it is possible for the Ant6 to operate with very low power consumption. The Ant6 is programming using an ISP Programming Adapter such as the ISP10.

The Rev 1.0 PCB has connectors J1, J2 and J3 on 0.1" pin spacing so prototype daughter cards can easily be attached to the top or bottom of the board making custom circuit design possible without the need for a custom PCB. Included on the CD is an Eagle CAD layout template of the connectors to facilitate the development of custom circuits.

### Software

The **Ant6** is programmed in C using either a GNU C Compiler, AVR Studio V4.13 or higher with GNU C integrated with the IDE or a third party IDE such as ICCAVR from ImageCraft. Check the SOC Robotics web site www.soc-robotics.com for program examples and ICCAVR project files. ICCAVR project files are on the included CD. Example code is provided to communicate on the I2C port, control the H-Bridge, read/write EEPROM and how to use the UART.

The example Project files that come with the Ant6 were written using the ImageCraft ICCAVR Windows IDE. With the release of AVR Studio V4.13 the open source AVR GNU C Tool chain is now integrated with the AVR Studio V4 Windows IDE and is recommended for cost sensitive development projects. The ImageCraft IDE is a low cost commercial C development environment and includes support for 64bit floating point operation in the PRO version.

## Configurations

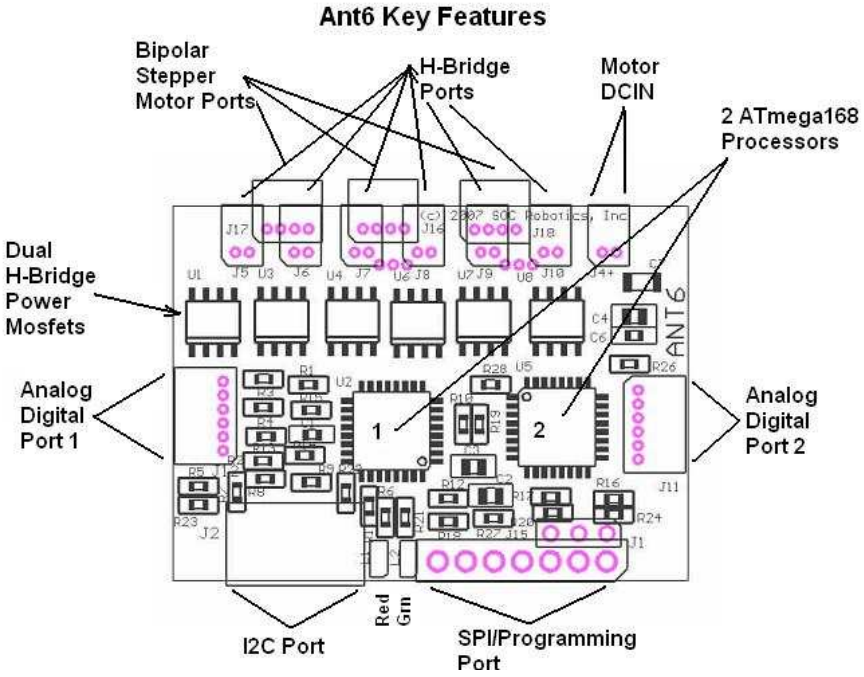
The **Ant6** is available with two different connector options – six two pin Molex connectors or three four pin Molex connectors. The default configuration is six two pin Molex connectors.

The default crystal is 20MHz – this requires that the board be supplied with 5VDC power. An optional 10MHz oscillator can be installed for 3.3V operation or the internal clock can be selected by setting the appropriate fuse bits.

# 2.0 Ant6 Detailed Description

## 2.1 Introduction

The Ant6 is an extremely compact embedded processor for mobile variable speed motor control and small bipolar stepper motor control. Programmed in C and powered by a standalone battery the Ant6 is an excellent embedded processor platform for small mobile applications that require six dual H-Bridge drive.




## 2.2 Processors

The Ant6 has two 8bit RISC AVR Atmega168 processors with 16K Flash, 512bytes EEPROM and 1K SRAM. Each processor has a UART, SPI port, TWI I2C, 8 Channel 10 bit A/D, digital IO ports, interrupts and timer/counter pins. A detailed device datasheet is available from the Atmel web site providing very detailed information on the internal peripherals.

The Ant6 has a pad for an external crystal – the default crystal is 20MHz although an optional 10MHz crystal is available. Note that the Atmega168 requires 5VDC to run at 20MHz.

Nominal power consumption of the board is 12ma. If internal peripherals are turned off and the processor placed in a sleep state power drops below 1ma.

## 2.3 TWI I2C Port

The Ant6 has one TWI I2C port for communicating with smart peripherals or other I2C peripherals. The TWI port uses a 4 pin Molex picoBlade connector with power and ground so the Ant6 can power other peripherals or be powered itself via this connector.

## 2.4 Expansion Ports

The Ant6 has three expansion ports - Processor 1 and 2 analog/digital IO port and SPI/Programming Port. In addition the Ant6 has an I2C port connected to both processors, a serial port and six motor drive port. The Ant6 is supplied with small machine pins that allow mounting on both sides. These can be removed or replaced with 0.1" pin headers.

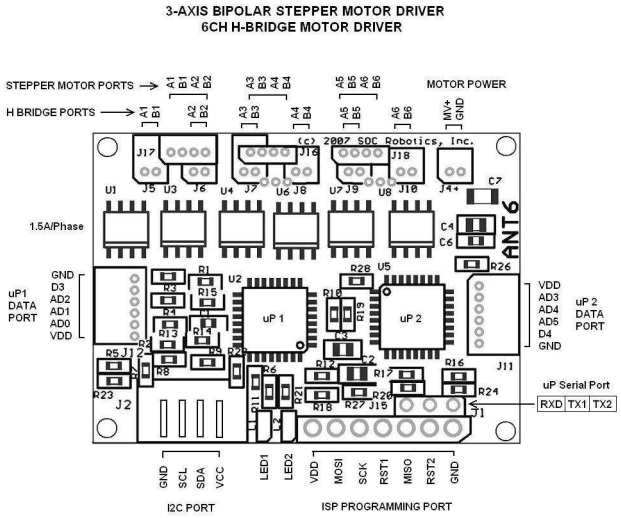



*Figure 2-2.* **Ant6 Expansion port pin assignments.**

## 2.5 ISP Programming Port

The Ant6 is programmed using an ISP10 Parallel Port programming adapter or any 10pin Atmel ISP compatible programming adapter. The Ant6 is supplied with a CISP adapter that converts the Ant6 programming pins on J2 to an Atmel compatible 10pin adapter. The CISP attaches to connector J2 located on the top edge of the board – attach as shown in the picture below. The Ant6 can also be programmed using a USB10 USB 2.0 peripheral.

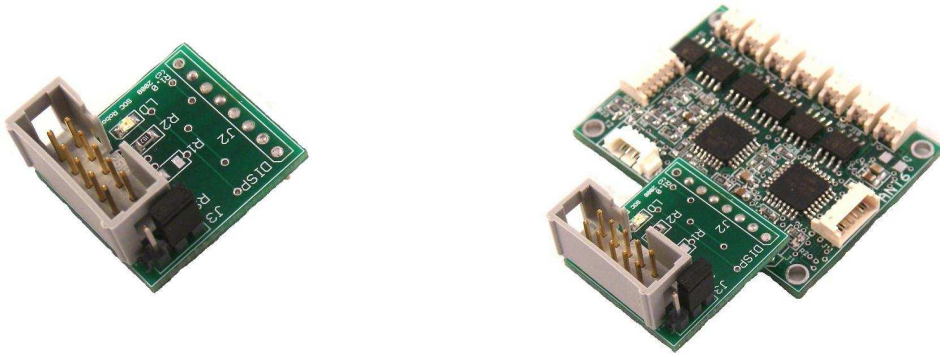


*Figure 2-3.* **DISP ISP attached to the Ant6.**

## 2.6 Molex Connectors

The **Ant6** uses two small Molex picoBlade 4 pin and 5 pin male connectors with 1.25mm pin spacing (4 pin Molex Part No. 53048-0410 - Digikey Part No. WM1744-ND - 5 pin Molex Part No. 51021-0500 – Digikey part no. WM1745-ND). These connectors mate with female Molex 4 and 5 pin housing connectors (4 pin housing Molex Part No. 51021-0400 - Digikey Part No. WM1722-ND – 5 pin housing Molex Part No. 51021-0500 - Digikey Part No. WM1723-ND).

The housing connectors has two different crimp terminal types: 26-28AWG (Molex Part No. 50079-8000 - Digikey Part No. WM1722-ND – Crimp tool 63811-0300 ) and 28-32AWG (Molex Part No. 50058-8000 - Digikey Part No. WM1775-ND - Crimp tool 63811-0200).

## 2.7 Serial Port

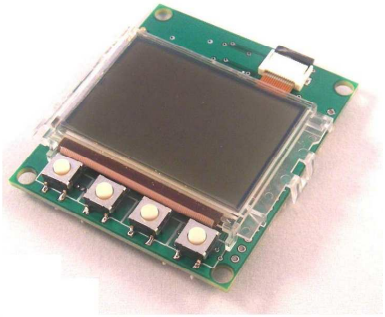
The **Ant6** has a three pin serial port that connects a common RX line to both processors and a separate TX line for each processors. By connecting one of the TX lines to the RX line it become possible for one of the processors to send commands to the other processor using the on chip UART.

## 2.8 H-Bridge/Bipolar Stepper Motor Port

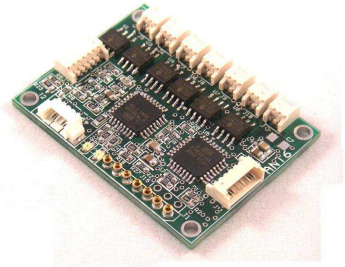
The **Ant6** has six 1.5A 4.5-18VDC Dual H-Bridge drivers that can be configured in software to control a three bipolar stepper motor.

## 2.9 Related Peripherals

The **Ant6** attaches to or can communicate with other SOC Robotics Embedded Processor devices such as the **SmartLCD**, **USB10**, **Cricket, LED8** and other peripherals.



. SmartLCD display that communicates via I2C.



Ant6 6 Channel H-Bridge Controller

## 2.10 Applications

The **Ant6** is a small, battery powered, low power, embedded processor with up to 8Mbytes of serial flash for storage of data measurement data, 8 10 bit analog input channels and up to 14 digital IO channels. The two H-Bridge drivers allow the Ant6 to control two small DC motors or a single Bipolar Stepper Motor.

The USB10 provides a simple high speed communications interface with a PC for rapid transfer of data to the host PC. The USB10 also allows the PC to program the Ant6 without the need for an ISP10 CISP combination.

Ant6s can be stacked to increase processing horsepower and drive more H-Bridges. For example ten stacked Ant6s operating at 5V would have a combined processing speed of 200MIPs, or a combined storage capacity of 80mbytes at 3.3V. The picture below shows two stacked Ant6s. By stacking Ant6s processing power can be increased in increments ensuring that a Ant6 solution can address a wide range of embedded processing applications.

# 3.0 Ant6 Hardware Expansion Port Summary

## 3.1 Introduction

The Ant6 has three I/O expansion ports, power port, I2C and H-Bridge/stepper port as shown in the connector layout diagram below.

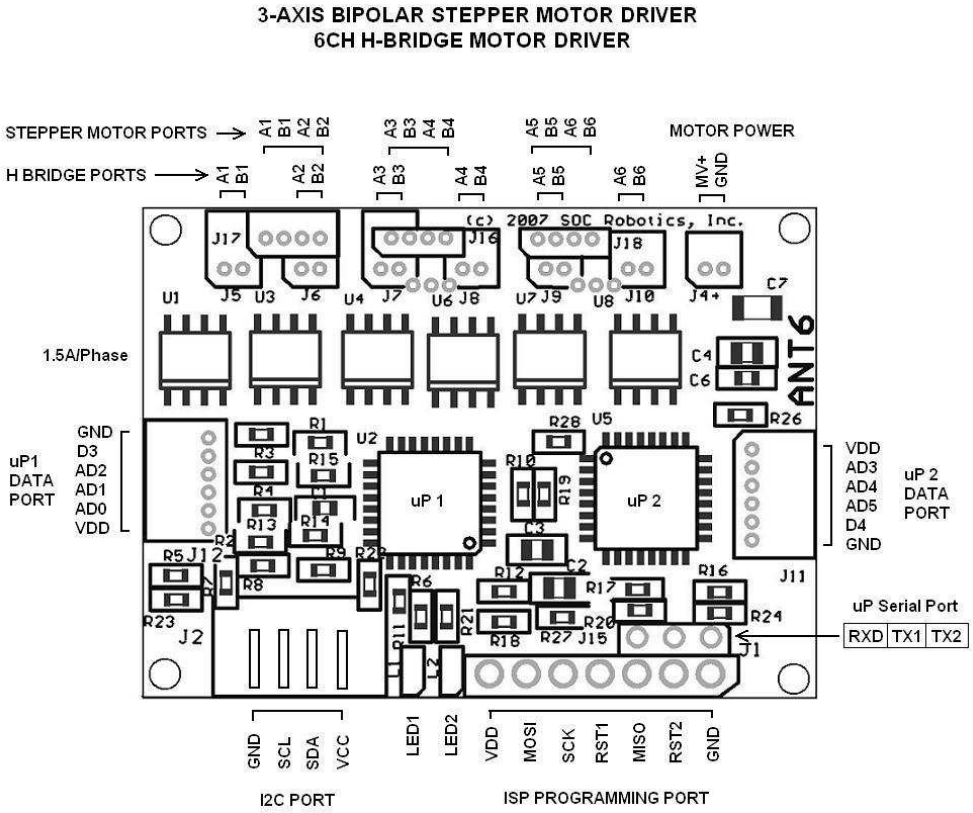



*Figure 3-1.* **Ant6 port pin assignments.**

## 3.2 SPI/Programming Port

The AVR SPI port is routed to connector J1. The two Atmega168 processors are programming using this port. The port is also a high speed SPI communications port. The MOSI, MISO and SCK lines are connected in parallel on both processors. The port, under software control, can also be used as a general purpose digital IO and can be configured on an individual pin basis to be either an digital input or output.


*Figure 3-2.* **SPI/Programming Port J1 and ISP10 Programming Adapter.**

## 3.3 Processor 1 IO Expansion Port

Processor 1's IO port is routed to connector J12. Most of the inputs are analog although they can be converted to digital IO under software control. Processor 1's port J12 can be used to monitor external sensors, limit switches or other peripheral devices controlled by processor 1's motor drivers.

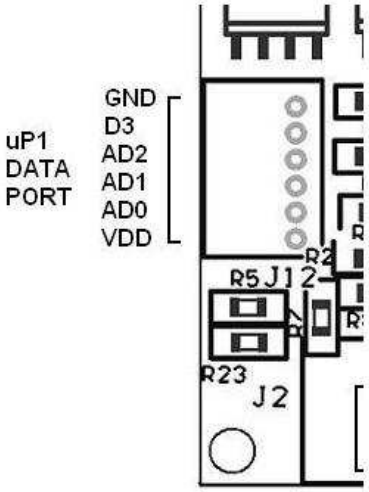



*Figure 3-3.* **Processor 1 Analog/Digital IO Port on J12.**

## 3.4 Processor 2 IO Expansion Port

Processor 2's IO port is routed to connector J11. Most of the inputs are analog although they can be converted to digital IO under software control. Processor 2's port J11 can be used to monitor external sensors, limit switches or other peripheral devices controlled by processor 1's motor drivers.

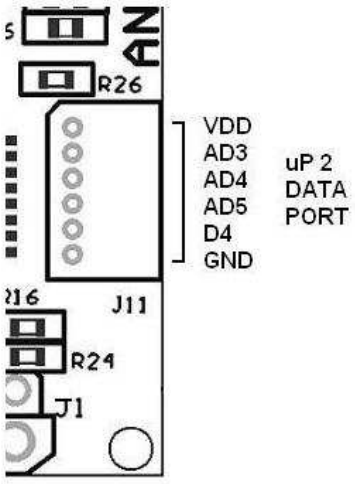



*Figure 3-3.* **Processor 2 Analog/Digital IO Port on J11.**

## 3.5 TWI I2C Expansion Port

The TWI I2C lines are routed to a 4 pin Molex connector J10 (4 pin Molex picoBlade connector). J10 is compatible with the SOC Robotics Smart Peripheral family of motor controllers, LCD displays and data acquisition modules.

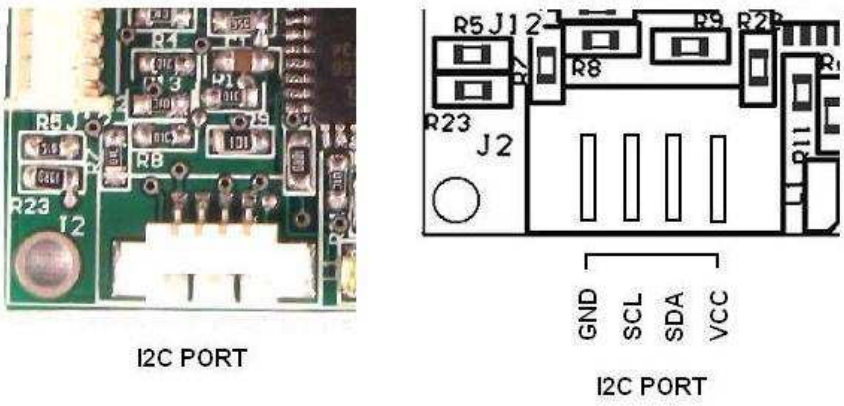



*Figure 3-4.* **TWI I2C Port with 4 Pin Molex picoBlade Connector.**

## 3.6 Board Power

Ant6 does not have a separate power connector but power can be supplied to the board via the I2C connector, processor 1 and 2 IO Expansion connectors or the SPI/Programming connector. Note that power should be within the range 3.0-5VDC and be regulated.

## 3.7 H-Bridge/Bipolar Stepper Motor Port

The Ant6 has six dual H-Bridge driver circuits that can be configured in software to be a three bipolar stepper motor drivers or six dual H-Bridge circuits. Each H-Bridge (TC4426) is capable of 1.5A at 4.5-18VDC (with suitable forced air cooling). The default connector is a two pin Molex picoblade connector. Optional four pin Molex picoblade connectors can be installed if the Ant6 is used to control stepper motors only.

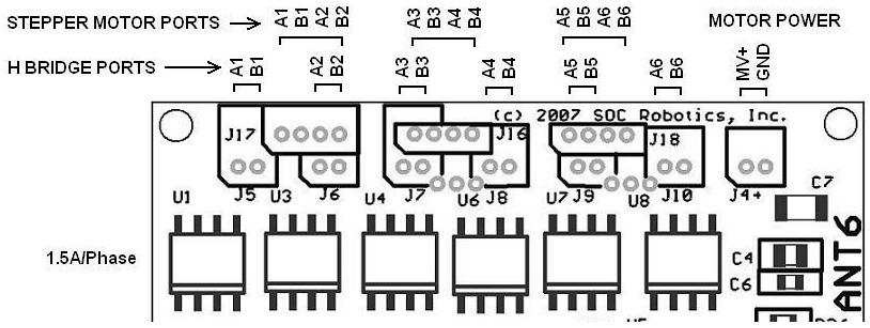



*Figure 3-7.* **Ant6 H-Bridge/Bipolar Stepper Control Port.**

## 3.8 Serial Port

The Ant6 has a serial UART port. The RX line on each processor is common while a separate pin for each TX line is provided. By connection TX1 or TX2 to RXD it become possible for one of the processors to send commands to the other processor using the on chip UART.

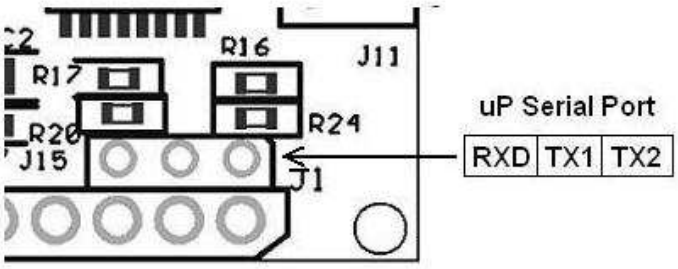
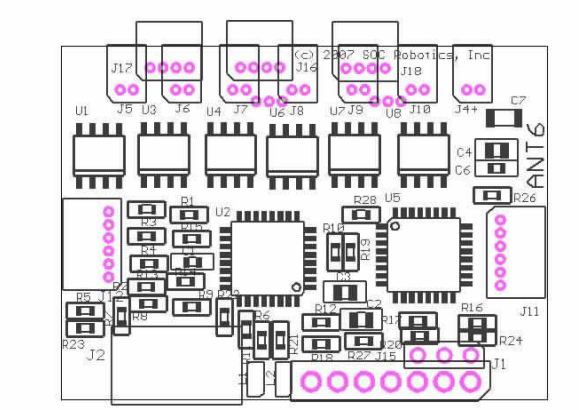



*Figure 3-8.* **Ant6 Serial Uart Port.**

# 4.0 Electrical and Mechanical Description

## 4.1 Component Layout

Components are mounted on both sides of the board. Not all components may be mounted. See the section on optional components for more information.




## 4.2 Electrical Specifications

### Electrical

Input power: 5VDC @ 12ma (not including DC motor drive current)
Sleep Mode: 0.7ma

### Mechanical

Dimensions: 1.82x1.33 in (four mounting holes)
Weight: 19 grams

## 4.3 Mechanical Dimensions

Board dimensions are stated in inches.

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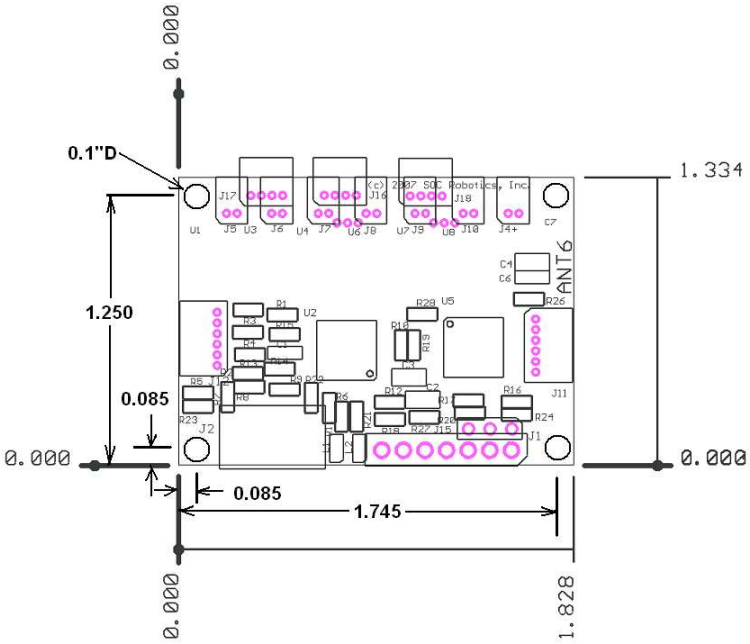
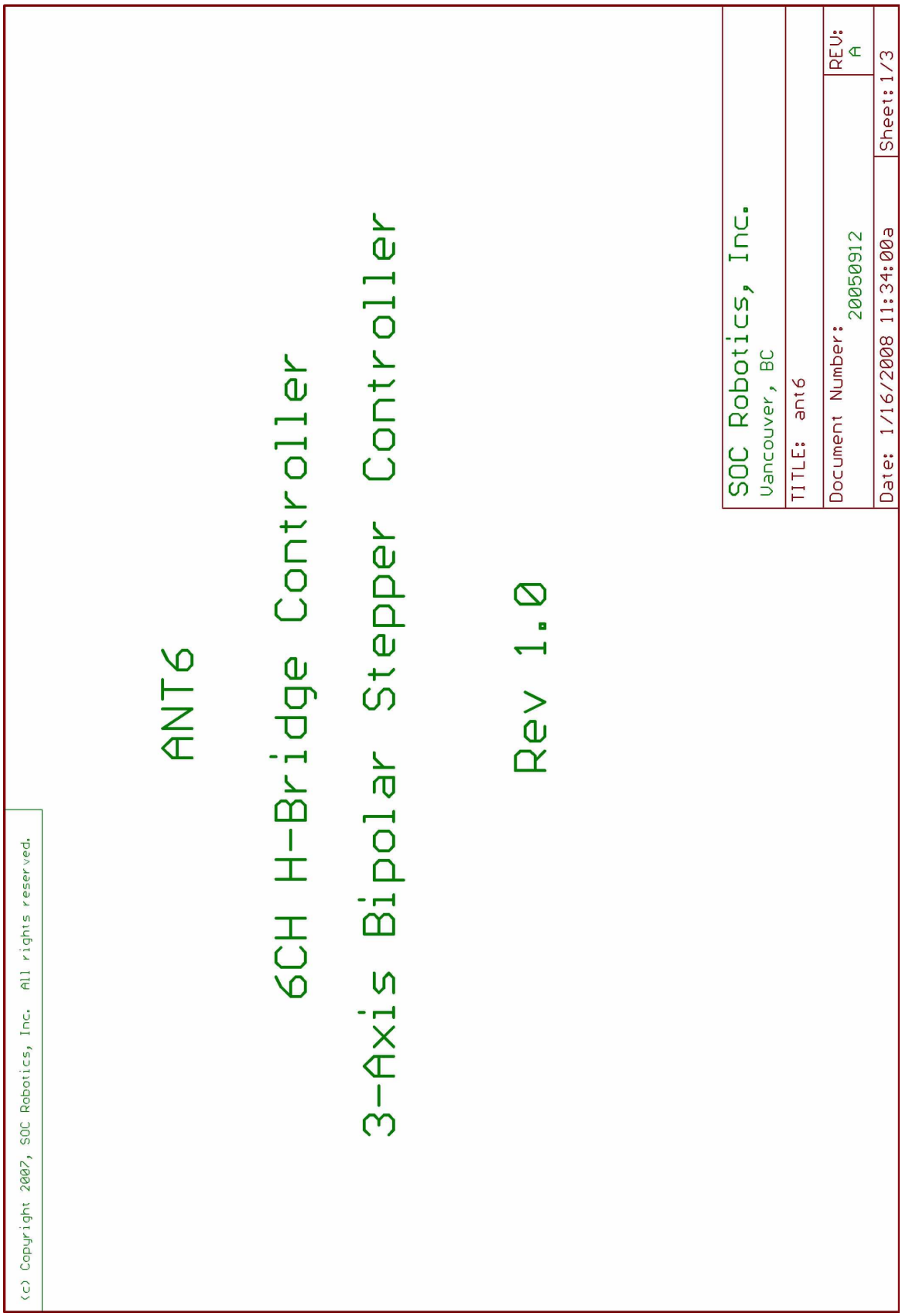
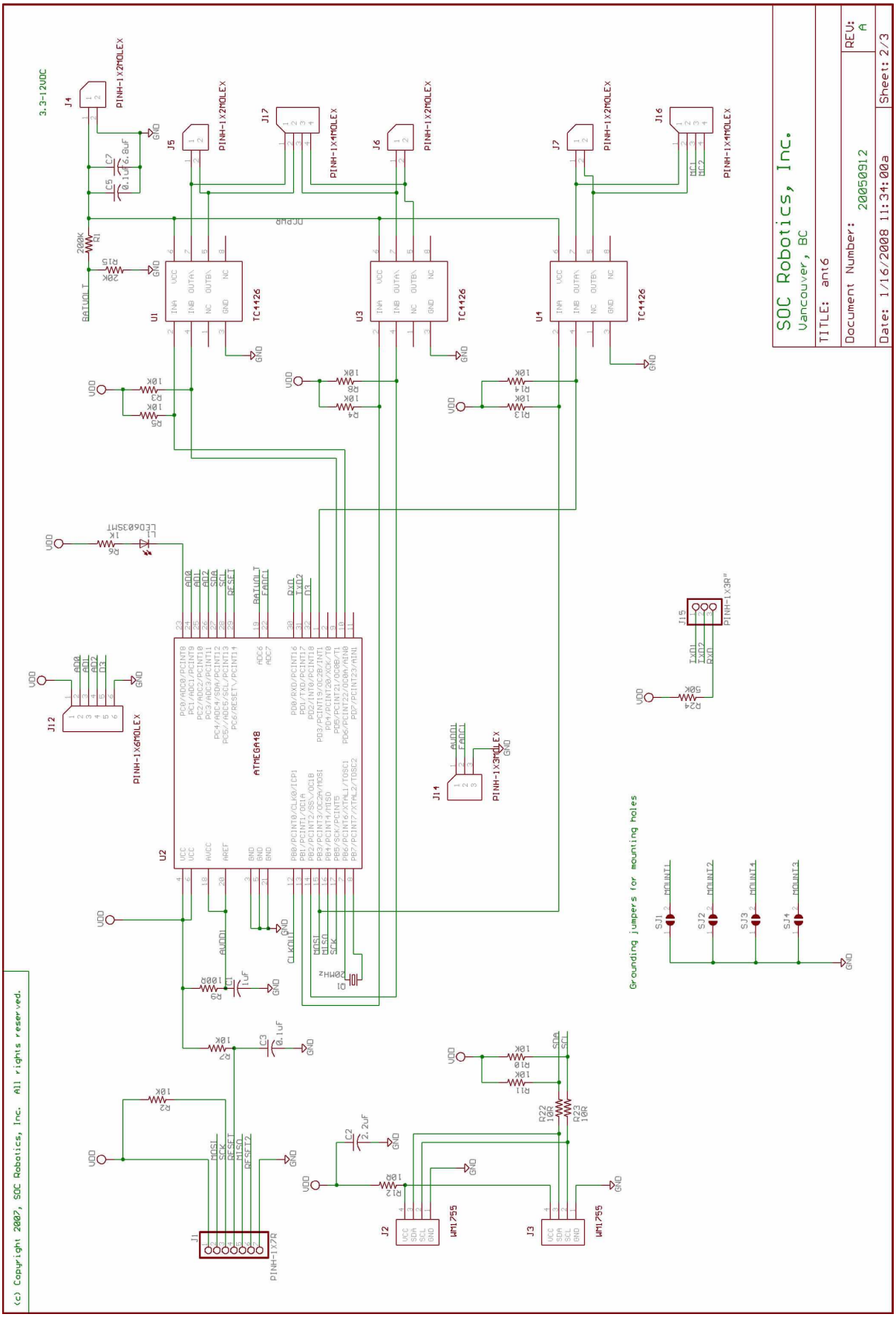


## Ant6 Circuit Schematics

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Vancouver, BC
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Document Number: 20050912
REV: A
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Sheet: 2/3
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TC4426
PINH-1X2MOLEX
PINH-1X4MOLEX
PINH-1X6MOLEX
PINH-1X3MOLEX
PINH-1X3R"
PINH-1X7R
WM1755
Grounding jumpers for mounting holes
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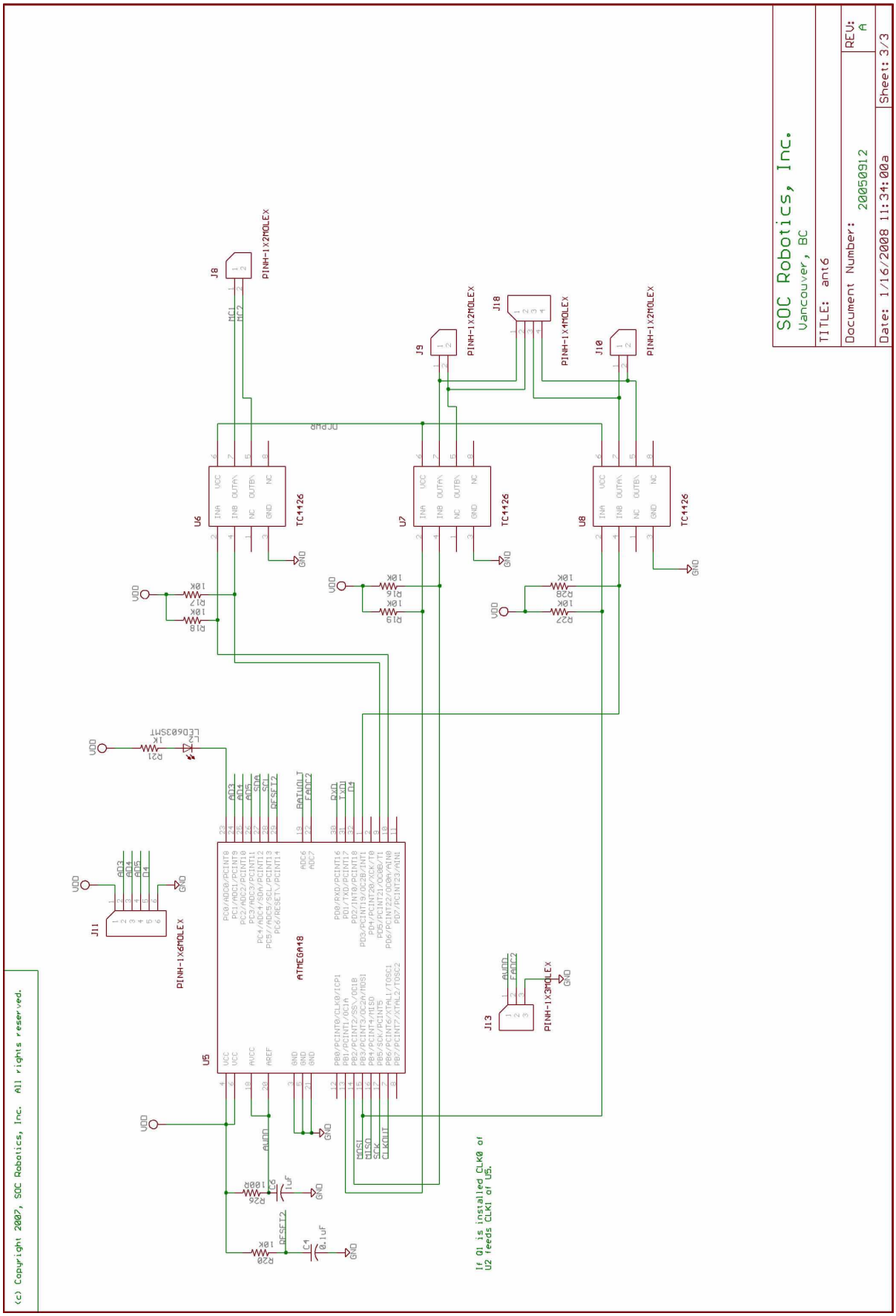
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Vancouver, BC
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Date: 1/16/2008 11:34:00a
Sheet: 3/3
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If Q1 is installed CLK0 of U2 feeds CLK1 of U5.
ATMEGA48
TC4426
PINH-1X2MOLEX
PINH-1X3MOLEX
PINH-1X4MOLEX
PINH-1X6MOLEX
LED0603SMT
VDD
GND
AVDD
RSFET2
RatioLJ
FanC2
RxD
TxD
SDA
SCL
MOSI
MISO
SCK
CLKOUT

## Notes: