AVR Butterfly Evaluation Kit

User Guide



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Section 1

Introduction

The AVR Butterfly evaluation kit is designed to demonstrate the benefits and key features of the AVR microcontrollers. It is a stand alone microprocessor module that can be used in numerous applications:

- The AVR architecture in general and the ATmega169 in particular
- Low power design
- The MLF package type
- Peripherals
  - LCD controller
  - Memories
    - Flash, EEPROM, SRAM, external DataFlash
  - Communication interfaces
    - UART, SPI, USI
  - Programming methods
    - Selfprogramming/ Bootloader, SPI, Parallel, JTAG
  - Analog to Digital Converter (ADC)
  - Timers/Counters
    - Real Time Clock (RTC)
    - Pulse Width Modulation (PWM)

It also serve as a development kit for the ATmega169, and can be used as a module in other products.

Figure 1-1. AVR Butterfly



1.1 Resources Available on the AVR Butterfly Kit

The following resources are available on the Butterfly kit.

- ATmega169 (MLF-package)
- LCD-on-glass display with 120 segments, for demonstrating the ATmega169 LCD controller.
- Joystick, 4-directions with centre push, as user input
- Piezo element, to play sounds
- 32kHz Xtal for the RTC
- 4 Mbit DataFlash, for data storage
- RS-232 level-converter, for communicating with off-board units
- Negative Temperature Coefficient (NTC) thermistor, to measure temperature
- Light Dependent Resistor (LDR), to measure light intenisty
- 3V button cell battery (600mAh) to provide operating power
- JTAG emulation, for debugging
- USI-interface, for additional communication interface
- Supported by AVR Studio 4.
- Pre-programmed with a demonstration application, including bootloader
- No external hardware is required to reprogram the AVR Butterfly

The ATmega169 in the kit controls the external peripherals, and can also be used to do voltage readings from 0 to 5 volts. The kit can be reprogrammed a number of different ways including serial programming through the JTAG port. Most users will prefer to use the preloaded bootloader with AVR Studio to download new code.

For more information about the ATmega169, see the datasheet at www.atmel.com.

Section 2

How to Operate the Pre-programmed Application

The AVR Butterfly comes with a preprogrammed application. This section will go through the basics of this application. The firmware can be downloaded from the AVR Butterfly web-site, http://www.atmel.com/products/AVR/butterfly.

2.1 Included Firmware

These modules are preprogrammed with the AVR Butterfly:

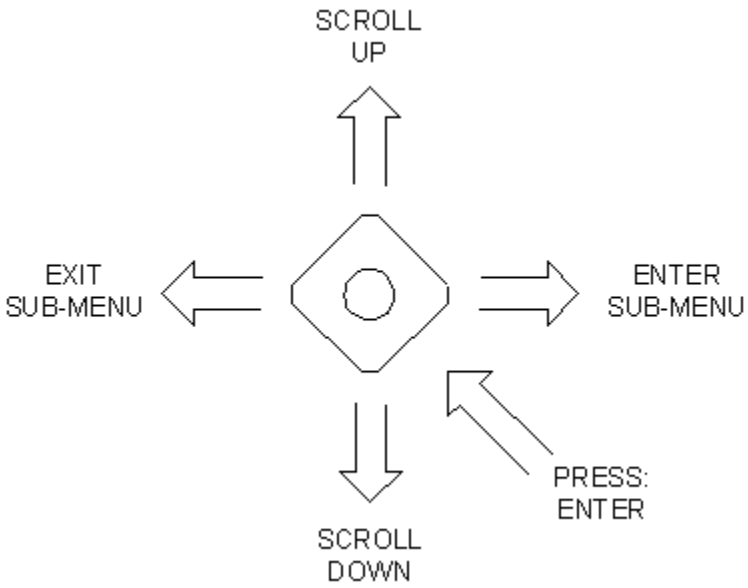
- Bootloader code
- Application code
  - State machine
  - Features included
    - Name-tag
    - Clock (date)
    - Temperature measurements
    - Light measurements
    - Voltage readings
    - Play tunes/melodies
    - Auto power save
    - Adjust LCD contrast
  - More functions can be added later on
    - Calculator
    - Reminder function
    - Alarm (daily alarms, kitchen timers, etc…)
    - Play melodies and displaying the text (Karaoke-function)
    - With the 4Mbit dataflash one can store large amount of data. (Some examples: AVR Info Bank (Basic of all AVR-parts); your local bus-table; melodies, etc.)

Note: The application can be upgraded without any external hardware, due to the integrated level-converter and the Self-programming feature.

2.2 Joystick Input

To operate the AVR Butterfly a joystick is used as user input. It operates in five directions, including center-push, see *Figure 2-1*.

Figure 2-1. Joystick Input



Using the joystick one can move around in the menu shown in *Figure 2-2*, and edit values, entering name, etc. Here are examples on how to enter your name.

2.2.1 Entering Your Name Using the Joystick:

1. Press the joystick up (“SCROLL UP”) to wake the AVR Butterfly. If “AVR BUTTERFLY” is notscrolling over the display, press the joystick to the left (“EXIT SUB-MENU”) until it does.
2. Press the joystick down (“SCROLL DOWN”) three times, so the string “NAME” is displayed.
3. Press the joystick to the right (“ENTER SUB-MENU”). If this is the first time a name is entered, the string “ENTER NAME” will be displayed, otherwise the name already entered will be displayed and you have to press the joystick to the right (“ENTER SUB-MENU”) once more.
4. When “ENTER NAME” is displayed press center push (“ENTER”). If this is the first time you enter a name, the character “A” should be blinking in the right side in the display, otherwise the last character of the already entered name will blink.
5. Press the joystick up (“SCROLL UP”) or down (“SCROLL DOWN”) to get to the wanted character. Press the joystick to the right (“ENTER SUB-MENU”) to add a new character or press the joystick to the left (“EXIT SUB-MENU”) to remove a character.
6. When you have got all the characters, up to maximum 25, press center push (“ENTER”) to save this name. The name will now be displayed in the display. If the name is more than 6 characters long it will scroll over the display, otherwise it will be displayed static.

2.2.2 Entering Your Name Using a Terminal:

1. Connect a serial cable from the PC to the AVR Butterfly as described in Section 3.7 “Connect to PC”, Open a terminal on your PC (e.g. HyperTerminal) and configure the terminal to 19200 Baudrate, 8 Databits, none Parity and one stop bit.
2. Go through point 1, 2 and 3 above.
3. When the “ENTER NAME” is displayed press the joystick down (“SCROLL DOWN”), and “DOWNLOAD NAME” will be displayed
4. Press **center push** (“ENTER”) to activate the UART, and the text “WAITING FOR INPUT ON RS232” will be displayed.
5. Type your name in the terminal window on the PC (up to 25 characters) and save the name by pressing enter on your PC-keyboard. The name you typed should now be displayed in the AVR Butterfly display.

Note: The Auto Power Off feature is default enabled. It will turn off the LCD after default 30 minutes. This timeout can be changed or turned off. To wake the AVR Butterfly from SLEEP, press the joystick in the UP-position.

2.3 Menu System

A menu system is established to be able to shift between the different modules in application in a efficient way.

Figure 2-2. Application Menu

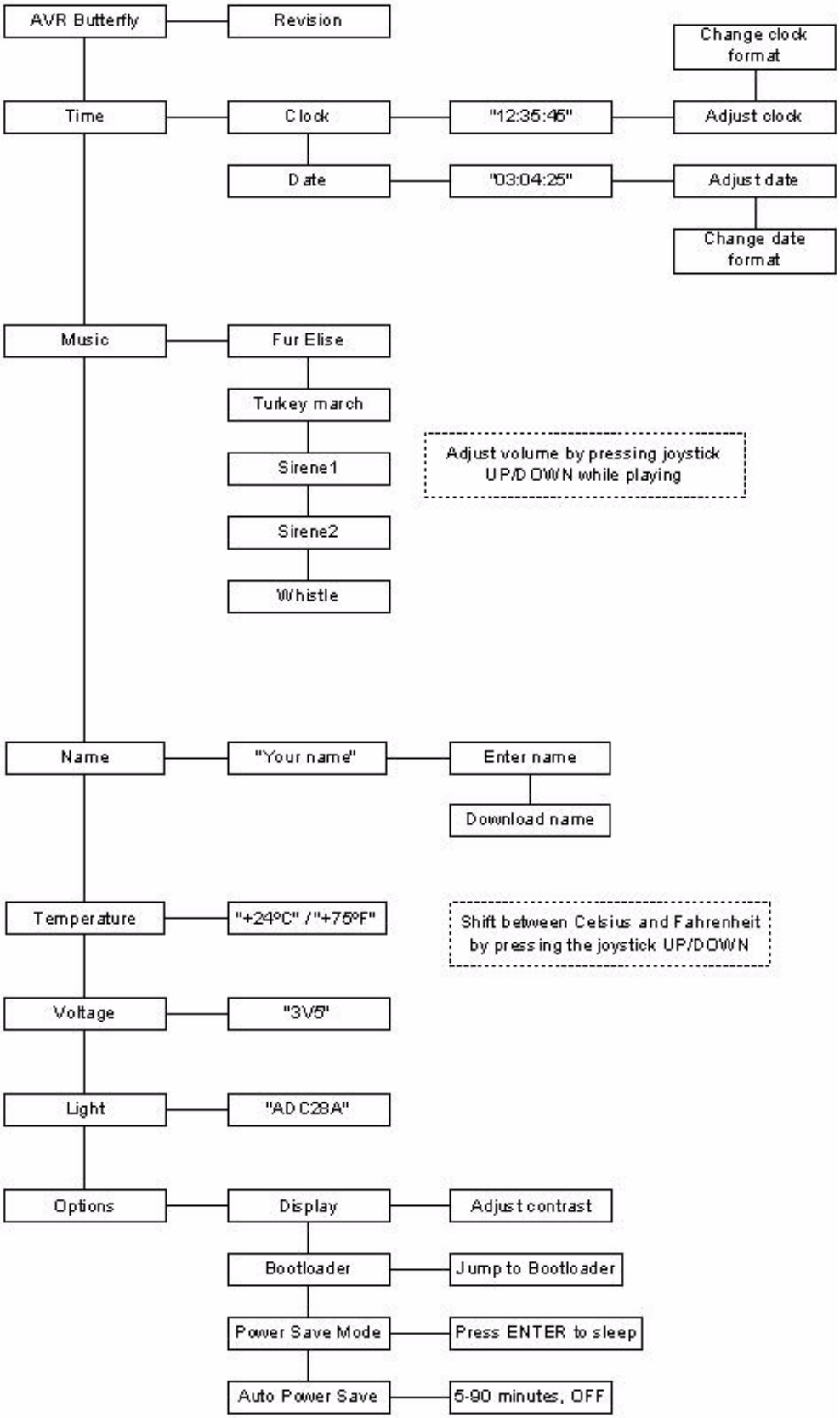
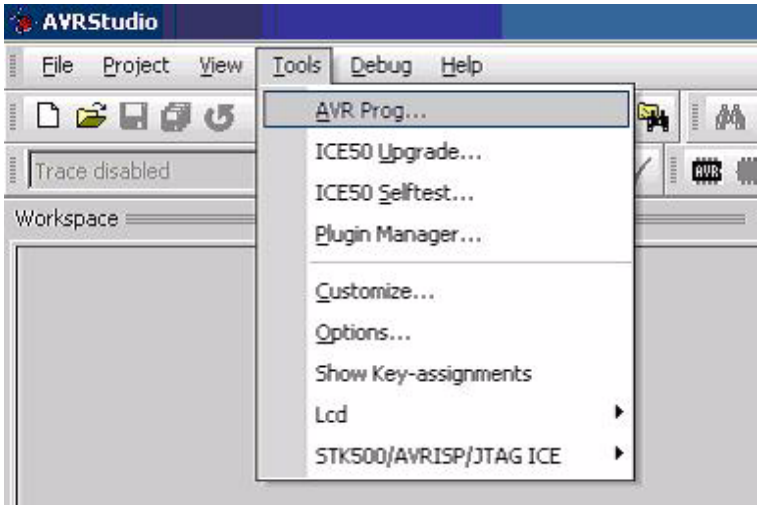


Figure 2-2 shows the menu system of the application that comes with the AVR Butterfly. The column to the left displays the main menu: “AVR Butterfly”, “Time”, “Music” etc… To shift between the alternatives in the menu, press the joystick UP or DOWN. To enter a sub-menu, press the joystick to the RIGHT. To exit a sub-menu, press the joystick to the LEFT. To enter/adjust a value, press ENTER. E.g. when “Adjust clock” appears in the LCD, press ENTER to enter the adjust function.

2.4 Bootloader

The AVR Butterfly comes with a bootloader which uses the self-programming feature in the ATmega169. The bootloader combined with the integrated RS-232 level-converter makes it possible to upgrade the application without any external hardware. It is based on the Application Note AVR109: Self Programming AVR, but uses the new buffer load mode for more efficient data downloading. AVR Prog, which is included in AVR Studio4, is used as PC frontend. The data is transmitted through the RS-232 interface. Connect a serial-cable from the PC to the AVR Butterfly as described in Section 3.7 “Connect to PC”.

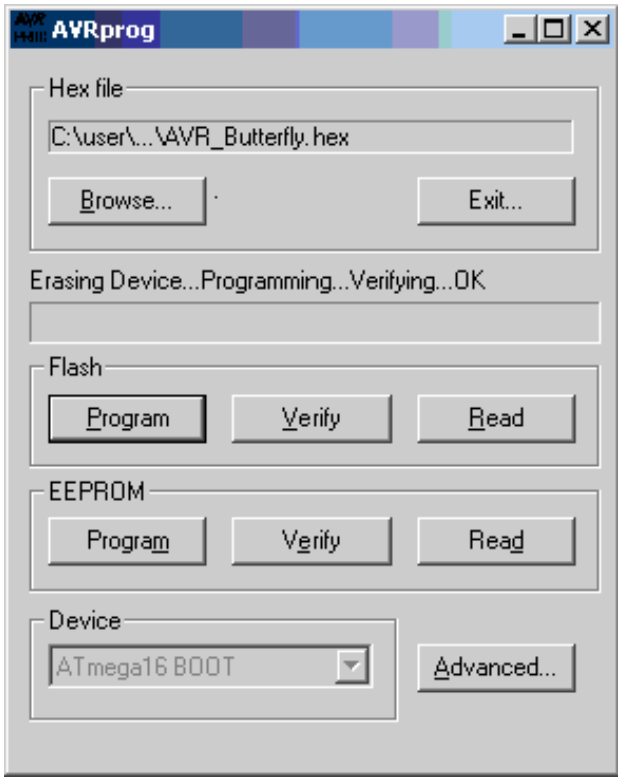
Figure 2-3. AVR Prog in AVRStudio4



2.4.1 Upgrade the ATmega169

A jump to the boot section can be done from the application, “Options>Bootloader>Jump to Bootloader”, see *Figure 2-2*, or just reset the ATmega169 by shortcut pin 5 and 6 on J403 the ISP connector, (after a reset the ATmega169 will start in the boot section). See Figure 3-3 for the pinout of the ISP-connector. Nothing will be displayed on the LCD while in boot section. Press and hold the joystick in the ENTER-modus while starting AVR Prog. When AVR Prog starts, release the joystick. Find the *.hex file you want to program with the “Browse” button, and press “Program”. See that “Erasing Device”, “Programing” and “Verifying” goes “OK”, this is done automatically. After upgrading the application, press the “Exit”-button in AVR Prog in order to leave programming mode in the ATmega169 bootloader.

Figure 2-4. AVR Prog



2.4.2 Jump to the Application Sector

From the Boot Section a jump to the application is done by pressing the joystick in the UP-position.

2.4.3 Fuses and Lock Bits

For the firmware to operate correctly these fuses and lock bits on the ATmega169 are the only ones to be programmed:

Extended Fuse Byte (0xFF)

- None

Fuse High Byte (0x98)

- JTAGEN (JTAG Interface Enabled)
- SPIEN (Serial Programming Enable)
- BOOTSZ1 (1024 words Boot Size)
- BOOTSZ0
- BOOTRST (Boot Reset vector Enabled)

Fuse Low Byte (0xE2)

- SUT0 (65 ms Start-up Time)
- CKSEL3 (Internal RC Oscillator)
- CKSEL2
- CKSEL0

Lock Bit Byte (0xEF)

- BLB11 (SPM is not allowed to write to the Boot Loader section)

Note: For all fuses and lock bits, “1” means unprogrammed and “0” means programmed.Using the AVR Butterfly

Section 3

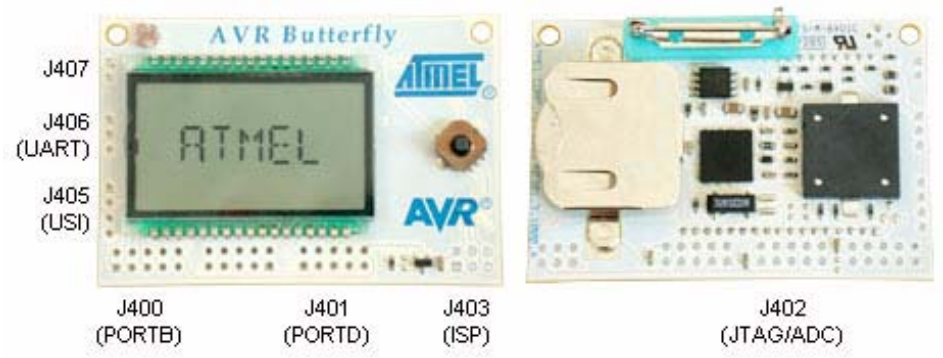
Using the AVR Butterfly

This section describes in detail how to use the AVR Butterfly evaluation kit.

3.1 Connectors

Some of the I/O-pins on the ATmega169 are available on the connectors of the AVR Butterfly. These connectors are for communication, programming and input to the ADC of the ATmega169.

Figure 3-1. Connectors

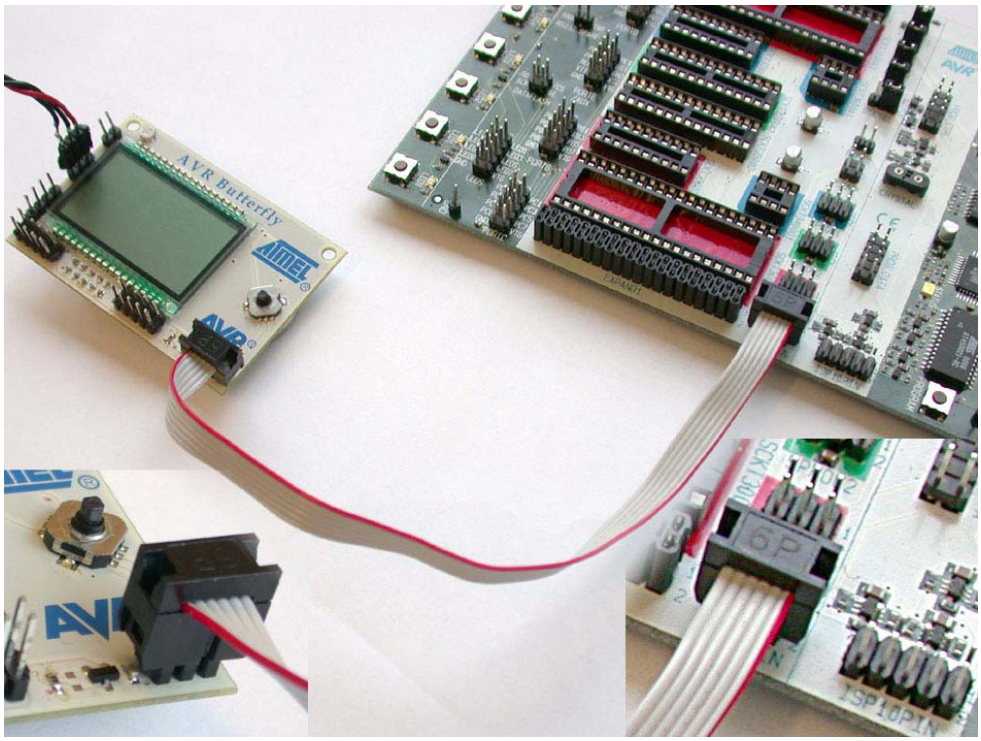


3.2 Programming the AVR Butterfly

In addition to using the pre-programmed bootloader with AVR Studio, the ATmega169 on the AVR Butterfly can be programmed using SPI, High-voltage Parallel Programming and the JTAG interface.

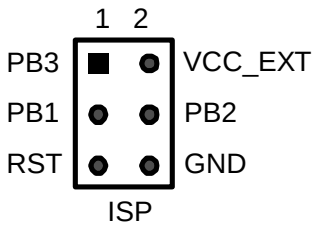
3.2.1 In-System Programming

Figure 3-2. In-System Programming



To program the ATmega169 using ISP Programming mode, connect a 6-wire cable between the ISP6PIN connector on the STK500 board and J403 the ISP connector on the AVR Butterfly as shown in *Figure 3-2*. This device can be programmed using the Serial Programming mode in the AVR Studio4 STK500 software. Instead of soldering in a ISP-header, one can make contact just by pressing the header to the footprint. Make sure that pin 1 on the STK500 match with pin 1 on the AVR Butterfly. See *Figure 3-3* for the pinout of the ISP Connector.

Figure 3-3. ISP Connector, J403



Notes: ***1.*** More information about the STK500 can be found in the STK500 User Guide, which is available at the Atmel web site, www.atmel.com. See STK500 User Guide for information on how to use the STK500 front-end software for ISP Programming.

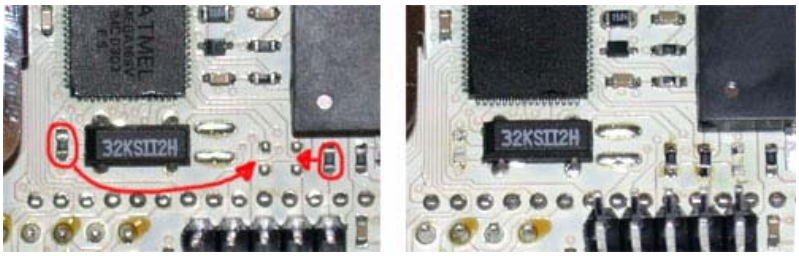
2. Do not use the AVRISP for In-System Programming, unless if the kit is powered from an external power source.

3.2.2 High-voltage Parallel Programming

It is possible to program the ATmega169 through the High-voltage Parallel Programming interface. However this requires to move two resistors on the PCB. High-voltage Parallel Programming is only meant to be used in the worst case scenario, where both SPI and the JTAG interface are disabled.

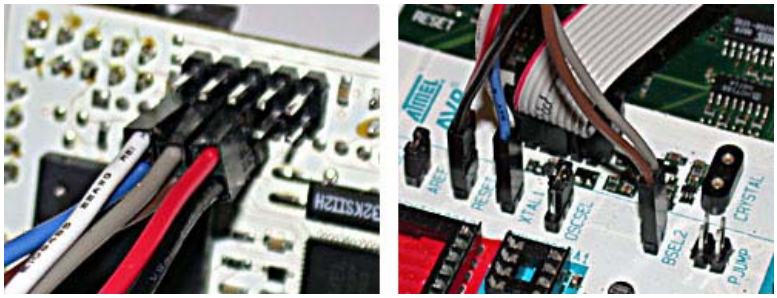
To make the parallel programming work, R203 must be placed where the R204 should be, and R404 must be placed where the R403 should be according to *Figure 3-4.* See the Assembly Drawing in the *7 Complete Schematics*

Figure 3-4. Ohm Resistors



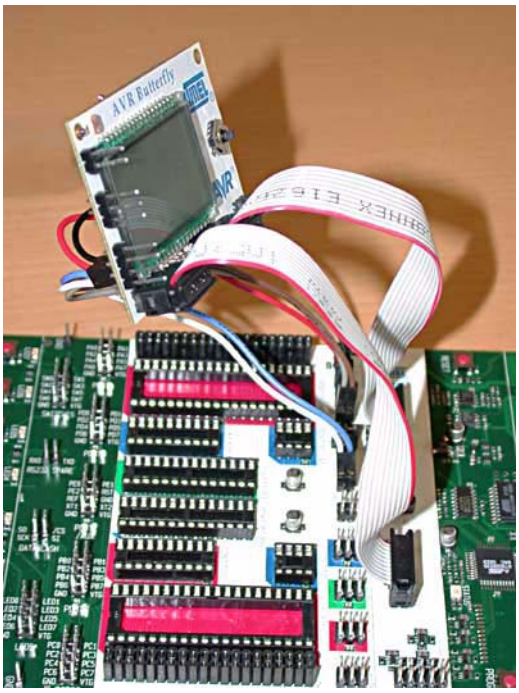
Connect RESET, BSEL2 and XTAL1 from the STK500 to respectively pin 6, pin 8 and pin 10 on the JTAG (J402) connector on the AVR Butterfly. See *Figure 3-5*. The JTAG connector must be mounted on the back side of the AVR Butterfly.

Figure 3-5. Reset, BSEL2 and XTAL1 cables



Connect PROG DATA and PROG CTRL from the STK500 to respectively PORTB and PORTD on the AVR Butterfly. Make sure that pin 1 on the STK500 connects to pin 1 on the AVR Butterfly.

Figure 3-6. PORTB and PORTD



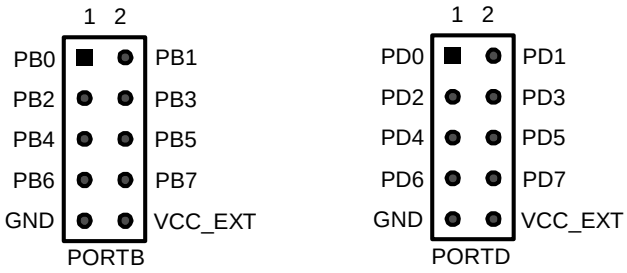
See the Schematic and the Assembly Drawing in the *7 Complete Schematics* for further details.

The device can now be programmed using the High-voltage Programming mode in AVR Studio STK500 software.

During programming there will be some noise from the piezo element, and some flickering on the LCD, this because PORTB and PORTD are connected to theses modules.

Figure 3-7 shows the pinout for the I/O port headers PORT B and PORT D.

Figure 3-7. PORT B and PORT D



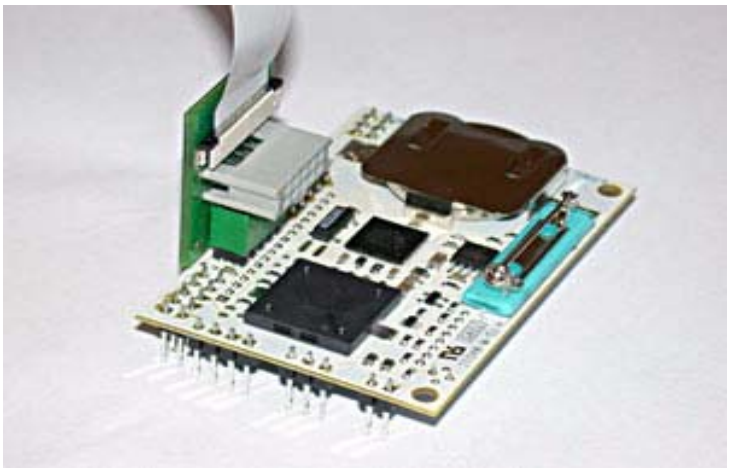
Note: When the AVR Butterfly is configured in High-voltage Parallel Programming mode, the JTAG interface will not work, neither will the external crystal, causing the pre-programmed application that comes with the AVR Butterfly to not operate correctly.

Note: More information about the STK500 can be found in the STK500 User Guide, which is available at the Atmel web site, www.atmel.com. See the STK500 User Guide for information on how to use the STK500 front-end software in High-voltage Programming mode.

3.3 JTAG

Figure 3-8 shows how to connect the JTAG ICE probe to the AVR Butterfly.

Figure 3-8. JTAG connector



Note: The JTAG connector must be mounted on the back-side of the AVR Butterfly.

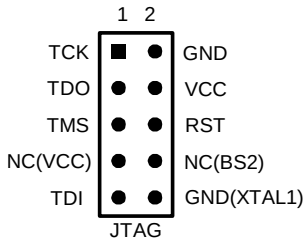
The JTAG connector is used for the ATmega169 built in JTAG interface. The pinout of the connector is shown in *Figure 3-9* and is compliant with the pin out of the JTAG ICE available from Atmel. Connecting a JTAG ICE to this connector allows On-chip Debugging of the ATmega169.

More information about the JTAG ICE and the On-chip Debugging can be found in the AVR JTAG ICE User Guide, which is available at the Atmel web site, www.atmel.com.

Note: Pin 7, NC(VCC) is the Vsupply pin for the JTAG. This pin is not connected because the JTAG would draw power from the battery on the AVR Butterfly.

Pin 8, NC(BS2) and the pin 10, GND(XTAL1) can be modified serve as the BS2 and XTAL1 pin during High-voltage Parallel Programming. For more details see *3.2.2 High-voltage Parallel Programming*.

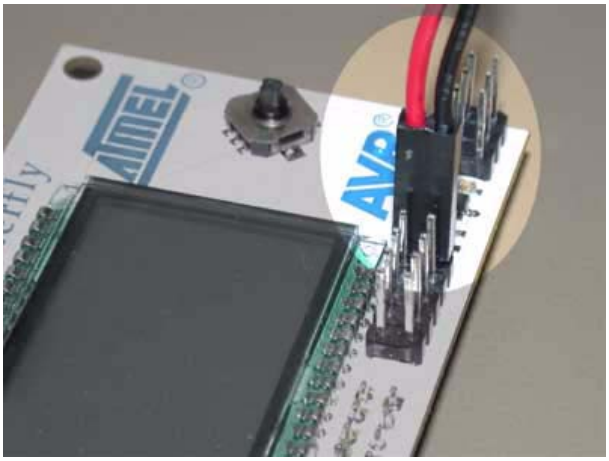
Figure 3-9. JTAG Connector



Note: It is highly recommended to apply external power (3,1 – 4,5V), when using the JTAG to save the battery. See *Figure 3-10* for how to connect external power.

Make sure to disable the OCD-fuse after a debugging session, due to power consumption. The OCD-fuse will be disabled if pressing on the “Stop Debugging” button in AvrStudio4, **before** disconnecting the JTAG ICE probe from the AVR Butterfly.

Figure 3-10. External Power



External power can be applied at pin 9 and 10 at both PORTB and PORTD, see *Figure 3-7* for the pinout.

If the JTAG are not in use, the four JTAG pins can be used as input for the ADC channels ADC[4:7]. See the ATmega169 datasheet for more information, available from www.atmel.com

3.4 LCD Display

The LCD display on the AVR Butterfly is the same as used on the STK502 available from Atmel. The connections between the ATmega169 and the LCD are also the same. See the STK502 User Guide at www.atmel.com for more information about the LCD display, and the LCD bit-mapping.

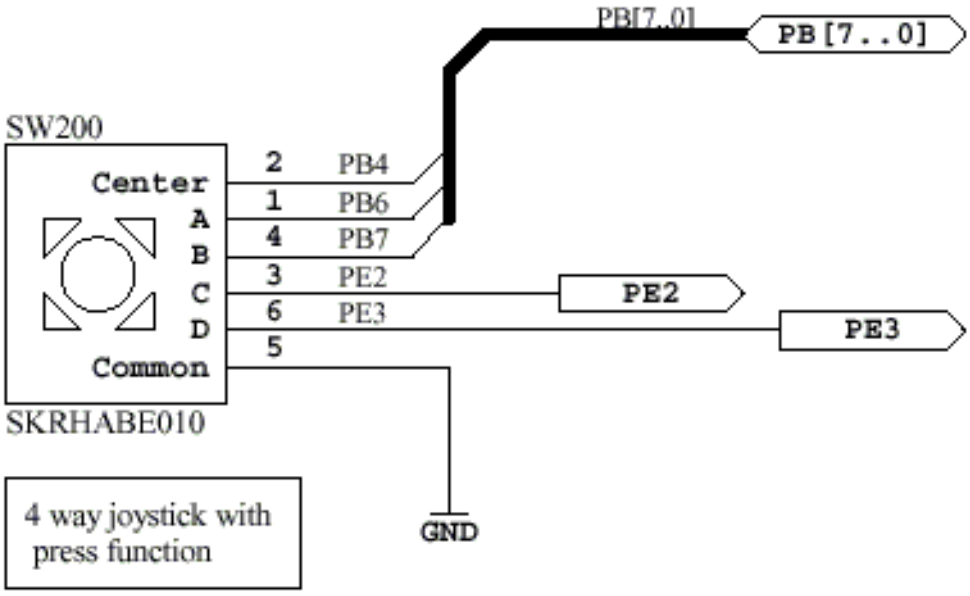
For more information on how to write software for the LCD-display see application note “AVR064: STK502 – A Temperature Monitoring System with LCD Output” and application note “AVR065: LCD Driver for the STK502 LCD”.

Note: Touching the LCD-pins will affect the segments on the LCD.

3.5 Joystick

The AVR Butterfly has a miniature joystick for input from user. It operates in five directions, including centre-push. The common line of all directions is GND. This means that internal pull-up must be enabled on the ATmega169 to detect the input from the joystick.

Figure 3-11. Joystick Schematic



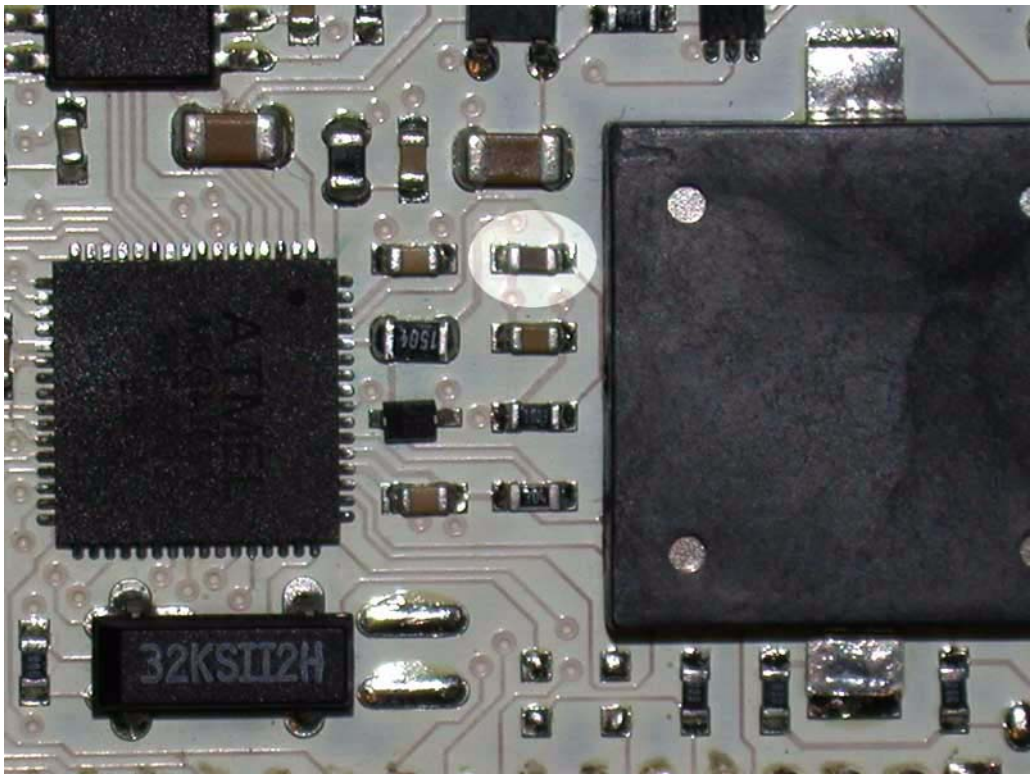
3.6 Sensors

The AVR Butterfly has two on-board sensors which makes it possible to measure both temperature and light. In addition is has a voltage-divider that is used to measure voltages from 0 to 5V.

3.6.1 Temperature Sensor

The temperature sensor can be found at the back side of the AVR Butterfly. See *Figure 3-12*.

Figure 3-12. Temperature Sensor



An NTC (Negative Temperature Coefficient)-thermistor is used to measure the temperature. An NTC-thermistor is characterised by the fact that when the temperature goes down the resistance goes up. Using a voltage divider and reading the voltage over the thermistor through the ADC-channels on the ATmega169, the temperature in can be calculated. Equation for calculating the temperature in Celsius is shown in *Figure 3-13*.

Figure 3-13. Temperature Equation

$$Temperature = \frac{\beta}{\left(\ln\left(\frac{ADC}{(1024 - ADC)}\right) + \frac{\beta}{Tamb}\right)} - Tzero$$

β = 4250

ADC = Value in the ATmega169 ADC Data Register – ADCL and ADCH

T_{zero} = 273°K

T_{amb} = 298°K (273° + 25°)

The temperature in Fahrenheit can be found from *Figure 3-14*

Figure 3-14. Fahrenheit VS Celsius

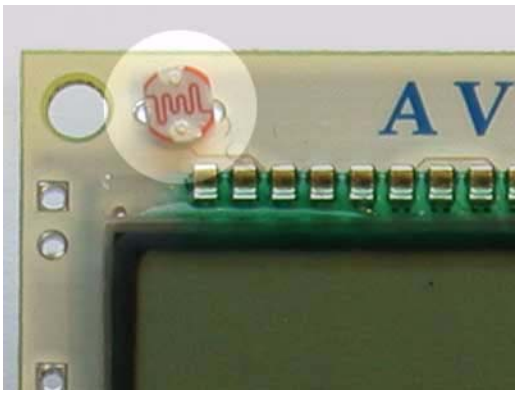
$$\left(\frac{(F - 32)}{1.8}\right) = C$$

The AVR Butterfly is capable of measuring the temperature from –10ºC/+14ºF to +60ºC/140ºC with an accuracy of ±1ºC.

3.6.2 Light Sensor

The light sensor is located at the front of the AVR Butterfly, over the LCD. See *Figure 3-15*.

Figure 3-15. Light Sensor

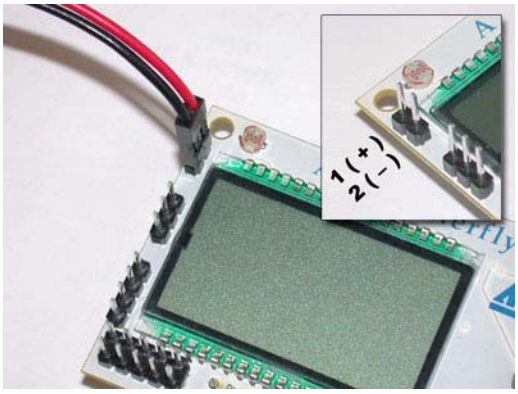


An LDR (Light Dependent Resistor) is used to measure the light. An LDR is characterised by the fact that when the light decreases the resistance goes up. Using a voltage divider and reading the voltage over the LDR through the ADC-channels on the ATmega169, the light can be calculated.

3.6.3 Voltage Reader

The AVR Butterfly is capable of reading voltages from 0V to 5V. The input must be connected to the pins shown in *Figure 3-16*. Using a voltage divider and reading the voltage over the resistors through the ADC-channels on the ATmega169, the applied voltage can be calculated. The accuracy is about 0,1V.

Figure 3-16. Voltage Readings



Note: Do not apply voltages above maximum 10V

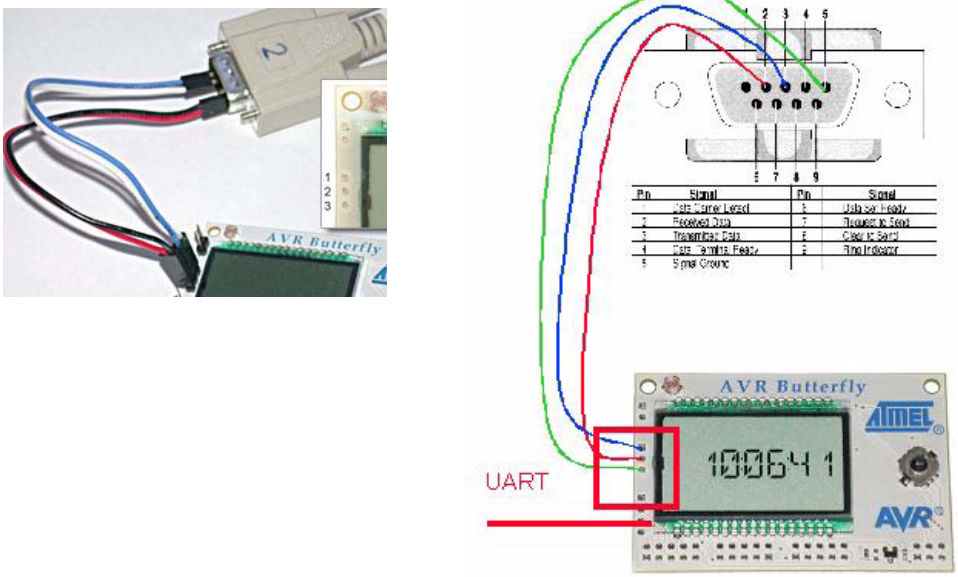
3.7 Connect to PC

The AVR Butterfly has an on-board level-converter for the RS-232 interface. This means that no external hardware is required to reprogram the AVR Butterfly using the self programming feature in the ATmega169. *Figure 3-17* shows how to connect a serial-cable to the AVR Butterfly. The integrated RS232 level converter operates down to 2.0V supply voltage.

Table 3-1. UART

AVR Butterfly UART	COM2
Pin 1 (RXD)	Pin 3
Pin 2 (TXD)	Pin 2
Pin 3 (GND)	Pin 5

Figure 3-17. UART Connector



3.8 USI

The AVR Butterfly has connections for the USI-interface. *Figure 3-18* shows the pin-out for the USI. Through the USI interface other modules can be connected, and the AVR Butterfly can serve as a top-module card.

Figure 3-18. USI Connector

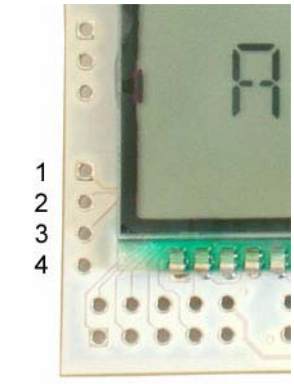


Table 3-2. USI

AVR Butterfly USI
Pin 1 (USCK/SCL)
Pin 2 (DI/SDA)
Pin 3 (DO)
Pin 4 (GND)

3.9 External DataFlash

An external dataflash is provided with the AVR Butterfly. This is the 4-megabit serial DataFlash from Atmel, type AT45DB041B. More information about the DataFlash can be found in the datasheet available at the Atmel web site: http://www.atmel.com/products/DataFlash/

The DataFlash is connected to the SPI interface. This means that in addition to communicate with the ATmega169 on the AVR Butterfly, it can also be accessed externally through the ISP connector.

Note: If the DataFlash is to be accessed externally, the ATmega169 on the AVR Butterfly must be set to disable its own SPI interface to avoid contention on the interface.

Figure 3-19. DataFlash

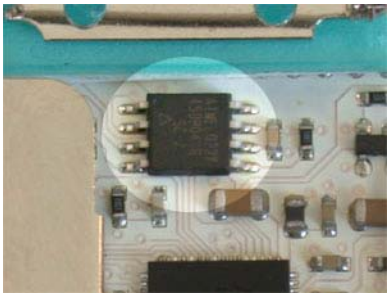
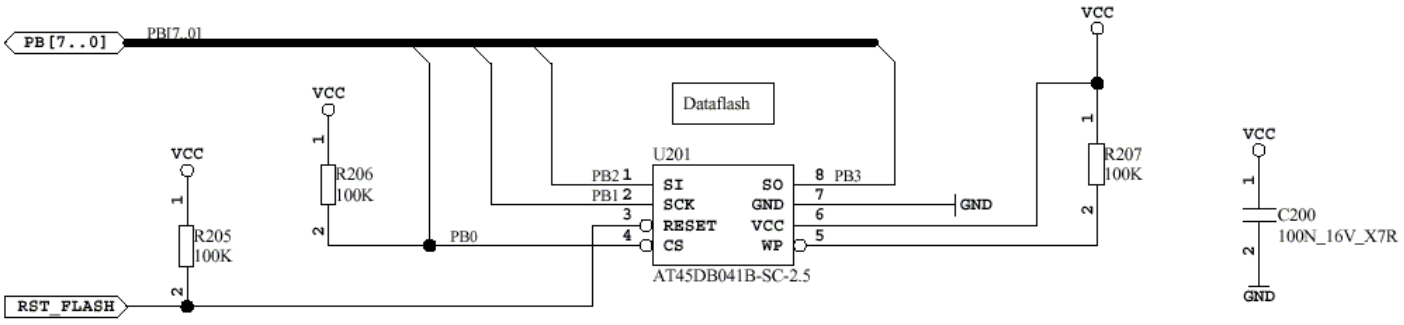


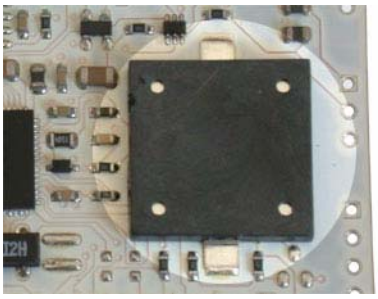
Figure 3-20. DataFlash Schematic



3.10 Piezo element

A piezo element is used to be able to play sounds on the AVR Butterfly. The piezo is connected to PORTB5 on the ATmega169. And using the PWM, one can get the different frequencies required to play tunes.

Figure 3-21. Piezo Element



3.11 Battery

Model: CR2450

Nominal Voltage: 3.0 Volts

Nominal Capacity: 550 mAh (@0.2 mA Discharge Current, +23ºC)

Standard Discharge Current 0.2 mAh

Maximum recommended current under continuous discharge: 3 mA

Maximum recommended current under pulse discharge: 15 mA

Note: DO NOT recharge, short-circuit, disassemble, deform, heat or place the battery near a direct flame. This battery containsflammable materials such as lithium and organic solvent and performing any of the above actions could cause it to ignite explode or become damaged.

The battery is protected by a schottky diode, this will prevent recharging of the battery if external power is applied to PORTB or PORTD on the AVR Butterfly.

Section 4

Troubleshooting Guide

Table 4-1. Troubleshooting Guide

Problem	Reason	Solution
Nothing is displayed on the LCD.	The LCD is not enabled in the AVR device.	Check the LCD initialization. (1)
	The update frequency is not correct.	Verify that the clock prescaling correspond with the clock-source. (1)
Some segments on the LCD seems to disappear	Your fingers are touching the LCD pins or PORTD	Hold the AVR Butterfly on the edge of the PCB, without touching the LCD pins
Serial Programming does not work	ISP cable not connected properly to the ISP-footprint	Connect the ISP cable according to *Figure 3-2*
	STK500 target voltage error.	Please refer to the ATmega169 datasheet for the Serial Programming Voltage limits. Adjust the target voltage on the STK500 board accordingly.
Parallel programming does not work	Cables not connected properly	Please refer to *Section 3.2.2 "High-voltage Parallel Programming"* for correct parallel programming set-up.
	STK500 target voltage error.	Please refer to the ATmega169 datasheet for the Parallel Programming Voltage limits. Adjust the target voltage on the STK500 board accordingly.

Notes: 1. See the Application Note "AVR065 LCD driver for the STK502 LCD" on how to control the LCD-display, or the Application Note "AVR064 STK502 – A temperature monitoring system with LCD output" Or program the application that comes with the AVR Butterfly

Section 5

Technical Specifications

System Unit

Physical Dimension …….....…45 x 67 x 14 mm

Weight..…….....28 g

Operation Conditions

Temperature…….....…...0ºC - 50ºC

If using external power…….....……3,1V - 4,5V

Temperature measurement accuracy…….....…..±1ºC

Voltage reading accuracy…….....….±0,1V

Section 6

Technical Support

For Technical support, please contact avr@atmel.com. When requesting technical support, please include the following information:

- Which target AVR device is used (complete part number)
- Target voltage and speed
- Clock source and fuse setting of the AVR
- Programming method
- Hardware revisions of the AVR tools, found on the PCB
- Version number of AVR Studio (This can be found in the AVR Studio help menu).
- PC operating system and version/build
- PC processor type and speed
- A detailed description of the problem

Section 7

Schematics

On the following pages the complete schematics and assembly drawing of the AVR Butterfly revision A are shown.

Figure 7-1. Schematics, 1 of 4

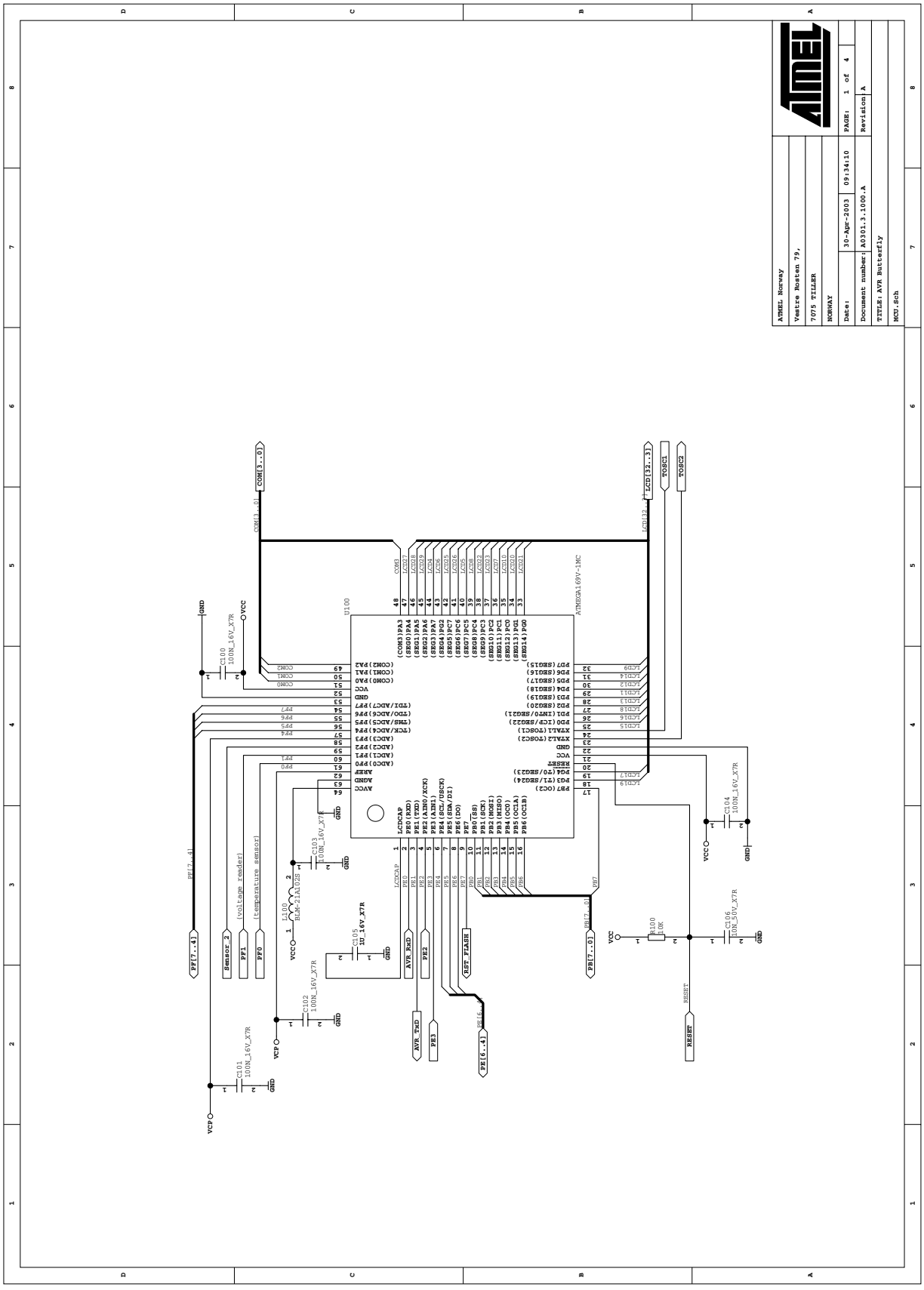


Figure 7-2. Schematics, 2 of 4

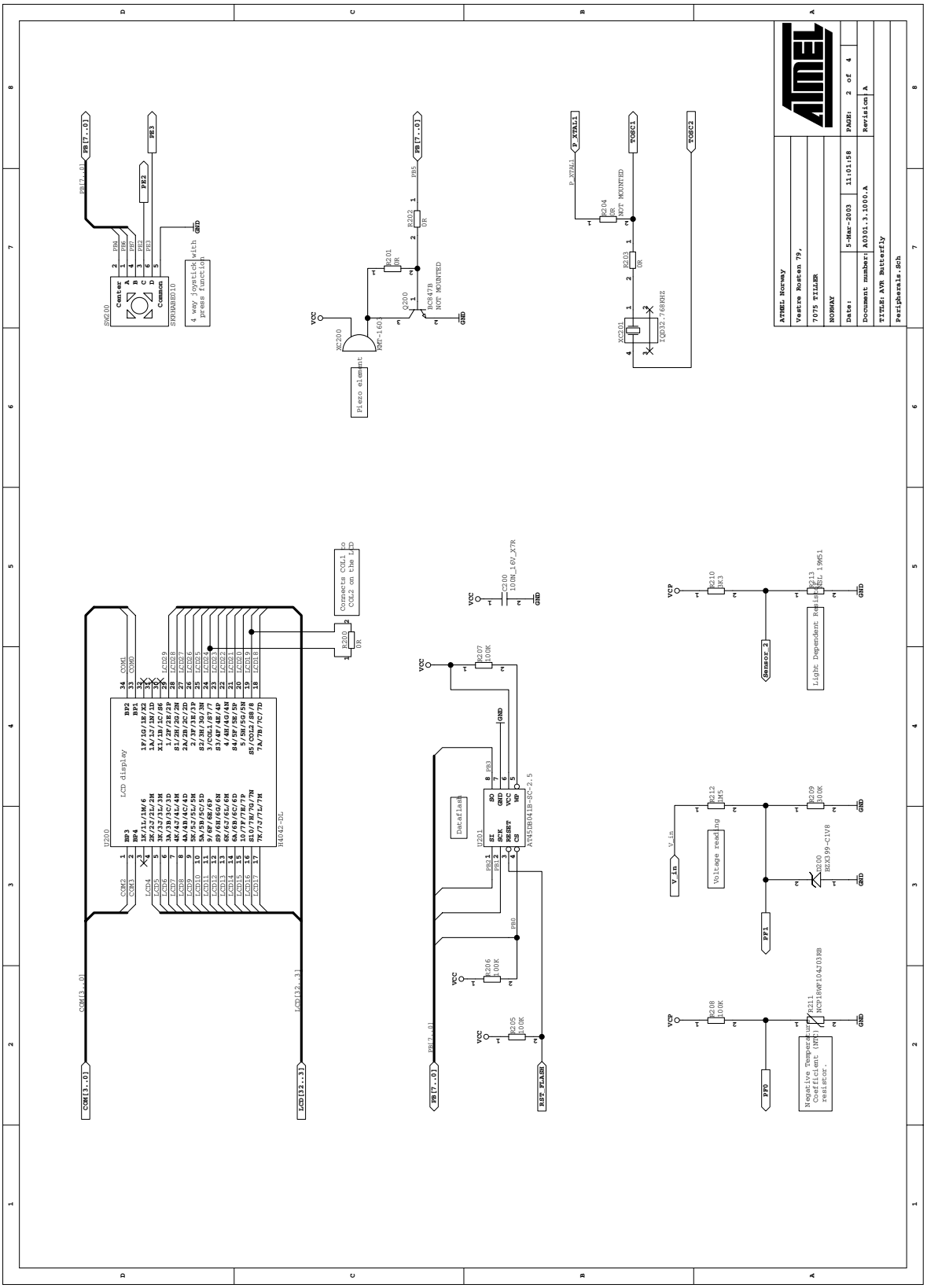


Figure 7-3. Schematics, 3 of 4

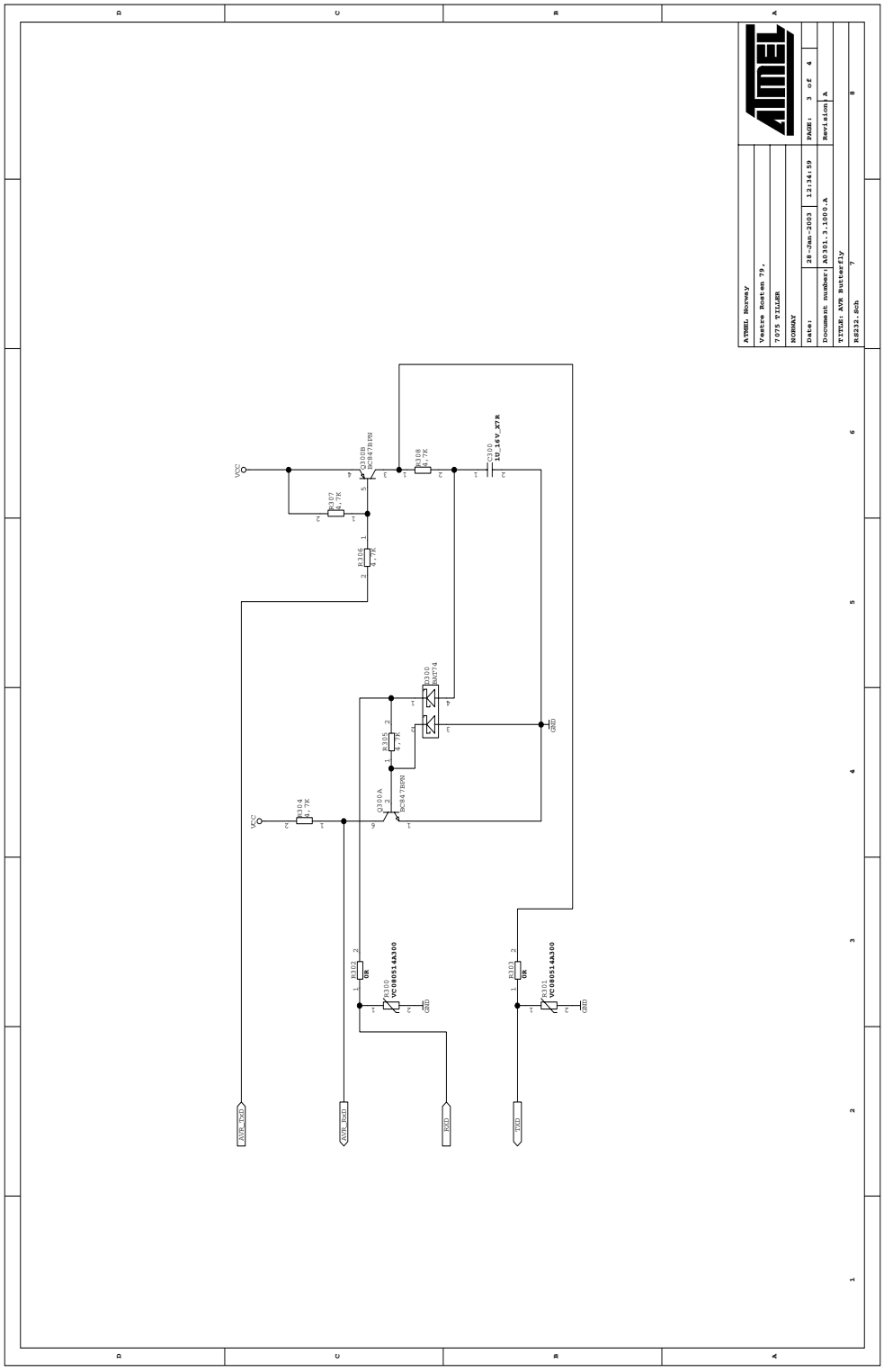


Figure 7-4. Schematics, 4 of 4

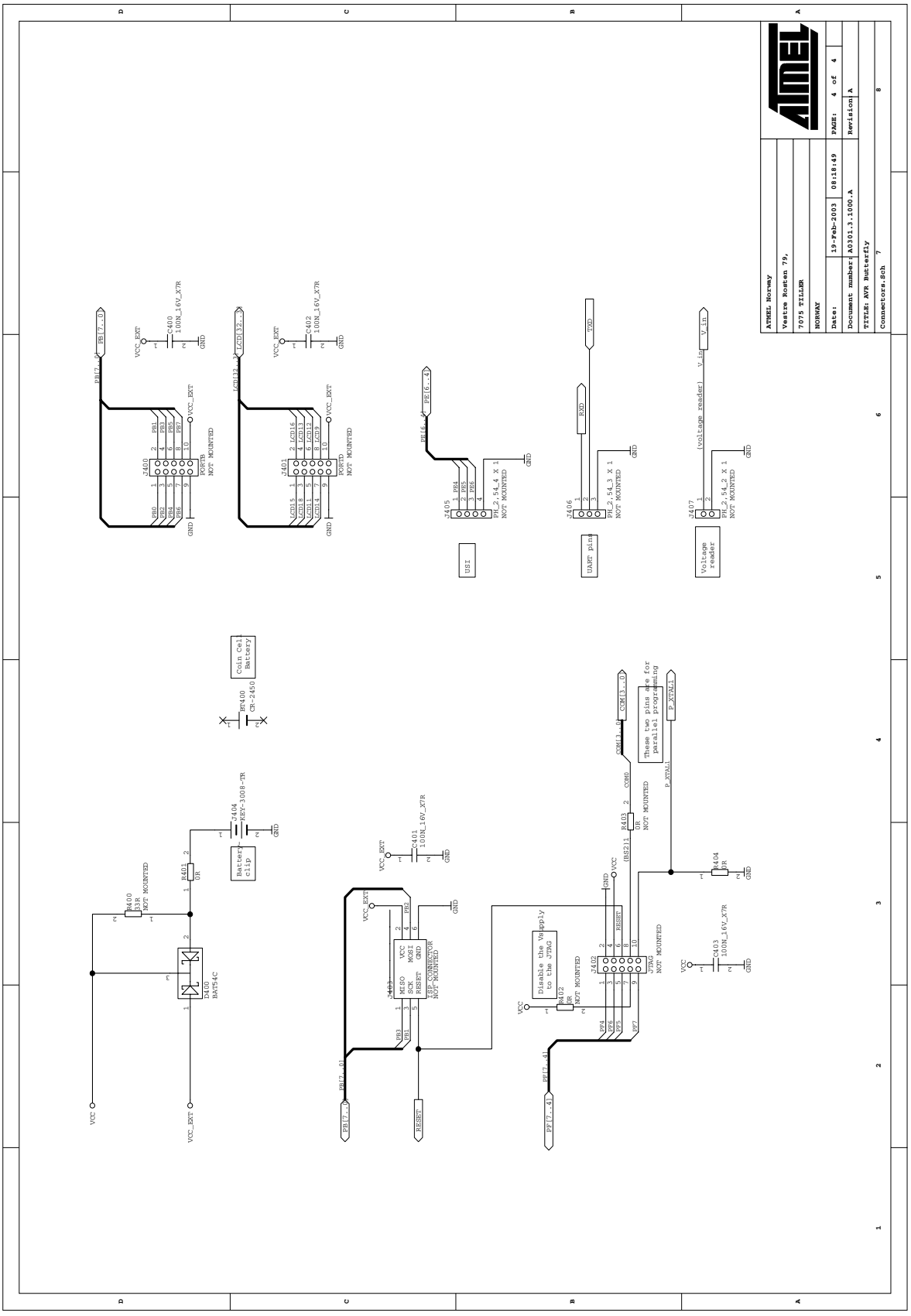


Figure 7-5. Assembly Drawing, Top Side

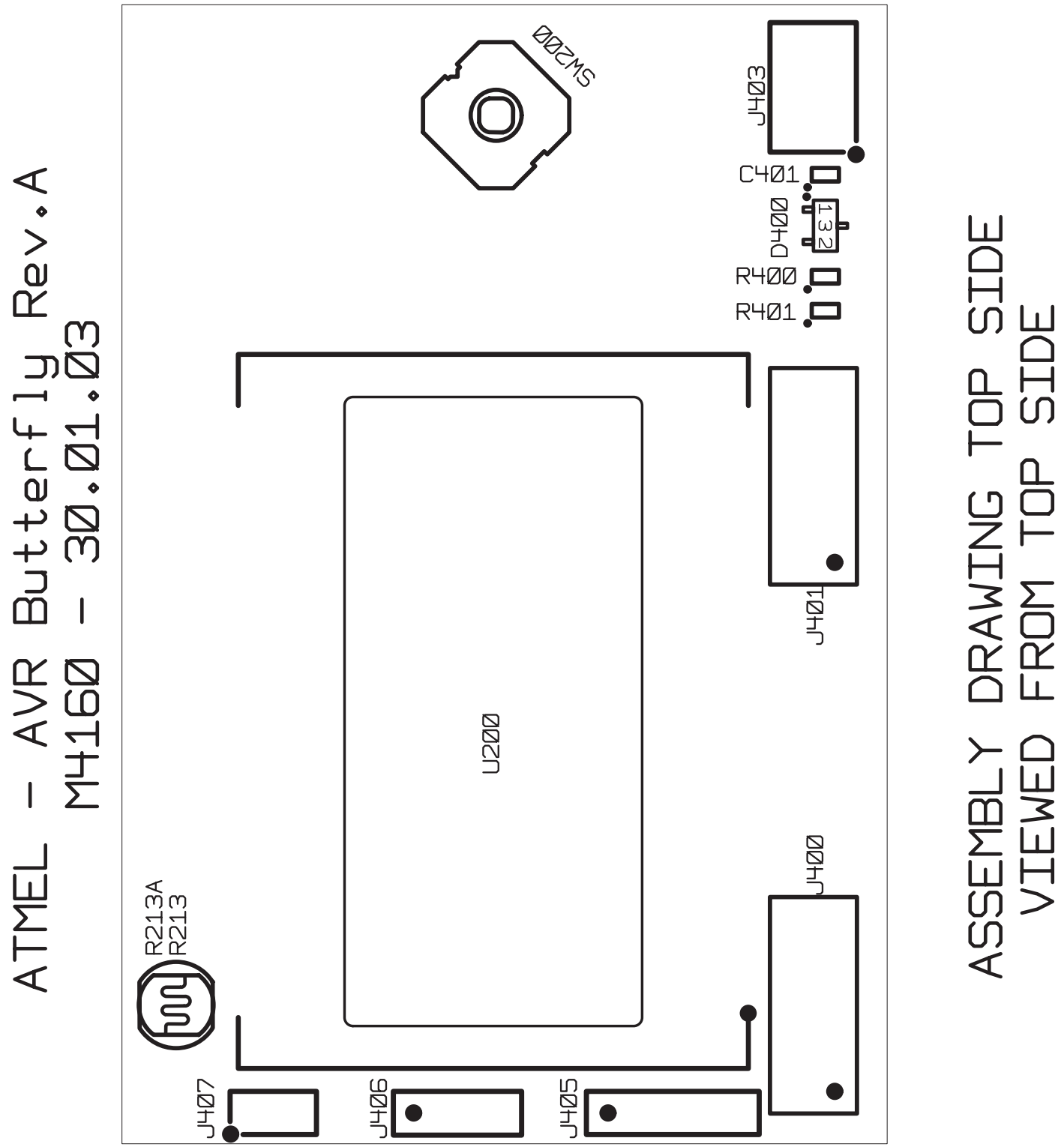
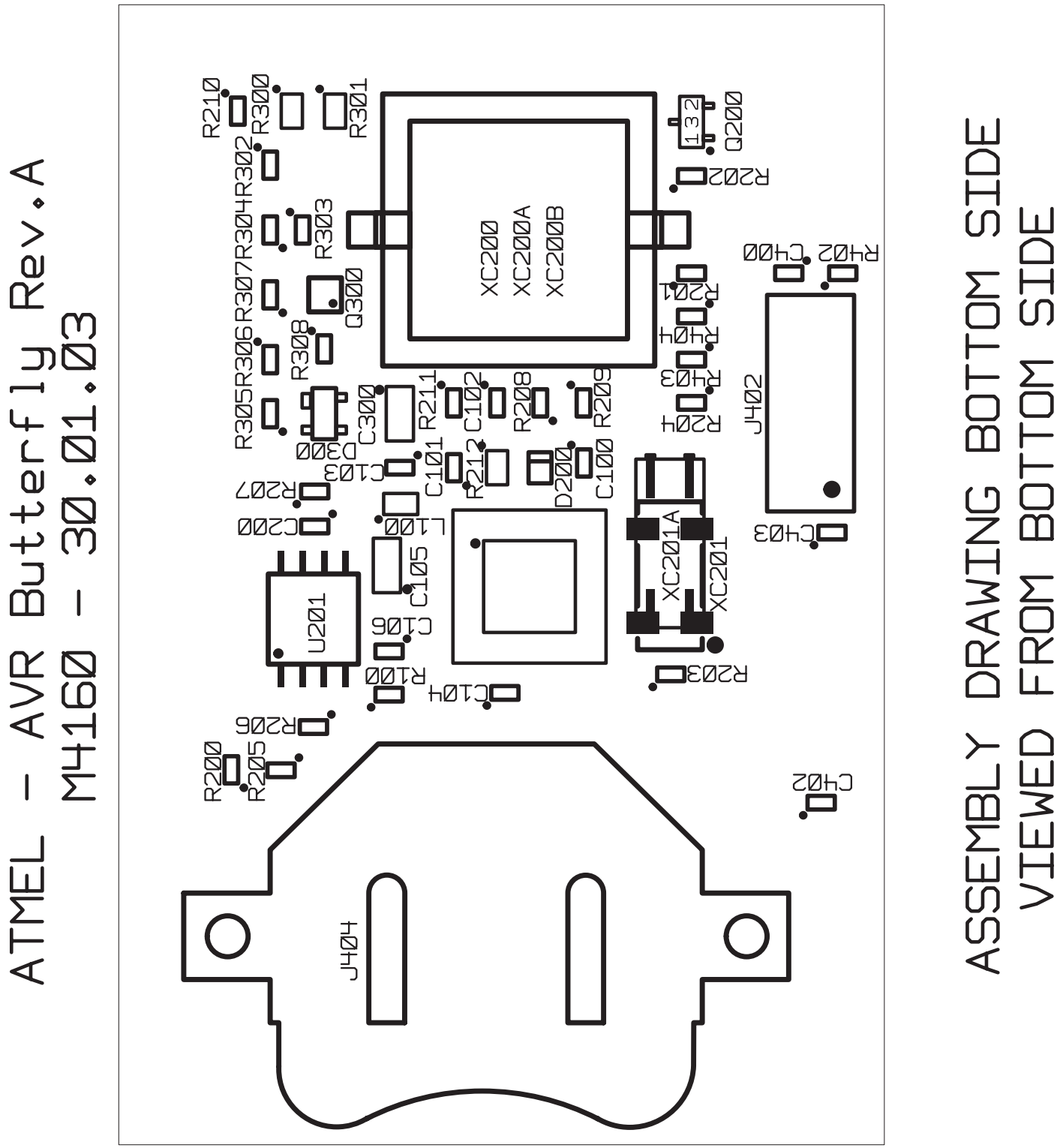


Figure 7-6. Assembly Drawing, Back Side



7.1 Bill of Materials

Table 7-1. Bill Of Material_

Used	Part Type	Designator	Value	Manufacturer	Design specific
8	0R	R200 R201	0R		
		R202 R203			
		R302 R303			
		R401 R404			
3	0R	R204 R402	0R		NOT MOUNTED
		R403			
1	1M5	R212	1M5		*
2	1U_16V_X7R	C105 C300	1u	MURATA	*
1	3K3	R210	3k3		*
5	4,7K	R304 R305	4k7		*
		R306 R307			
		R308			
1	10K	R100	10k		*
1	10N_50V_X7R	C106	10n		*
1	33R	R400	33R		NOT MOUNTED
4	100K	R205 R206	100k		*
		R207 R208			
10	100N_16V_X7R	C100 C101	100n		*
		C102 C103			
		C104 C200			
		C400 C401			
		C402 C403			
1	300K	R209	300K		*
1	AT45DB041B-SC-2.5	U201	4Mb	ATMEL	*
1	ATMEGA169V-1MC	U100		ATMEL	*
1	AVR BUTTERFLY A0301.3.1000.A	PCB500			*
1	BAT54C	D400		PHILIPS	*
1	BAT74	D300		PHILIPS	*
1	BC847B	Q200		PHILIPS	NOT MOUNTED
1	BC847BPN	Q300		PHILIPS	*
1	BLM-21A102S	L100		MUR	*
1	BZX399-C1V8	D200		PHILIPS	*
1	CR-2450	BT400	3V	MAXELL	*
1	H4042-DL	U200			*
1	IQD32.768KHZ	XC201	32,768kHz	IQD Crystals	*
1	ISP_CONNECTOR	J403		SCOTT ELECT.	NOT MOUNTED
1	KEY-3008-TR	J404		KEYSTONE	*

Table 7-1. Bill Of Material_(Continued)

Used	Part Type	Designator	Value	Manufacturer	Design specific
1	NCP18WF104J03RB	R211	100K	MURATA	*
1	NSL 19M51	R213		SILONEX	*
1	PH_2,54_2 X 1	J407		SCOTT ELECT.	NOT MOUNTED
1	PH_2,54_3 X 1	J406		SCOTT ELECT.	NOT MOUNTED
1	PH_2,54_4 X 1	J405		SCOTT ELECT.	NOT MOUNTED
3	PH_2,54_5 X 2	J400 J401		SCOTT ELECT.	NOT MOUNTED
		J402			
1	SKRHABE010	SW200		ALPS	*
1	KMT-1603	XC200		KINGSTATE	*
2	VC080514A300	R300 R301			*
1	U562246	M500			

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