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Embedded Computer Systems

Bitsy

User's Manual

ADS document # 110111-1003A

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Revision History

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REV	DESCRIPTION	DATE	BY
1	Initial release	06/20/01	HW
A	Correct Header Information 1.2: Clearify Features 1.3: Update Block Diagram J7: Add Illustration for pin locations J1: Add note Correct Pin 28 description J3: Modify Descriptions for Pin 1, 2, 16 and 18 J6: Modify Pin 1 description to 5-12V Added 4.1.3 Using Compact Flash Interface Added 4.1.4 Using USB Interface 4.3.1: Modified Maximum voltage 10 12V 4.3.2: Modified to maximum 12V 4.3.7: Added notes 4.4: Removed VDDI (1.75V) and +30V for J3 and Panel VEE for J1 from table 4.5: Corrected mA reference for fully populated board Removed footnote 1 4.7: Added Protection 4.8: Added information to 4.8.1 Analog Inputs Added SA1111 information 5.1.2: Corrected Rev B description to 12V	07/03/01	PD

About the Cover Photo

The cover photo shows a fully populated Rev B Bitsy with 16MB of onboard flash.

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1 Introduction

1.1 Overview

The Bitsy is a full-featured single board computer using the SA-1110 StrongARM RISC microprocessor. The Bitsy is designed to meet the needs of embedded and graphical systems developers.

1.2 Features

1.2.1 Processor

- SA-1110 32-bit StrongARM
- SA-1111 Companion Chip
- Clock rates up to 206 MHz

1.2.2 Power Supply

- 5-12V Input Range
- DC/Battery Switching
- Battery Charger

1.2.3 Memory

- 16, 32 or 64 MB synchronous DRAM (Runs 1/2 of CPU clock rate)
- 8, 16 or 32 MB Flash
- 3.3 and 5V PCMCIA

1.2.4 Communications

- Ethernet, RJ45 (with optional connector board)
- CompactFlash interface (with optional connector board)
- USB Master and Slave connections, Support for 12Mb/s
- Three Serial Ports
  - Serial 1: RS-232, TTL
  - Serial 2: TTL, RS-232 (IrDA with optional connector board)
  - Serial 3: RS-232, TTL

1.2.5 User Interface and Display

- Flat panel interface
- Onboard VEE generator with software contrast control
- Analog touch panel interface

1.2.6 I/O

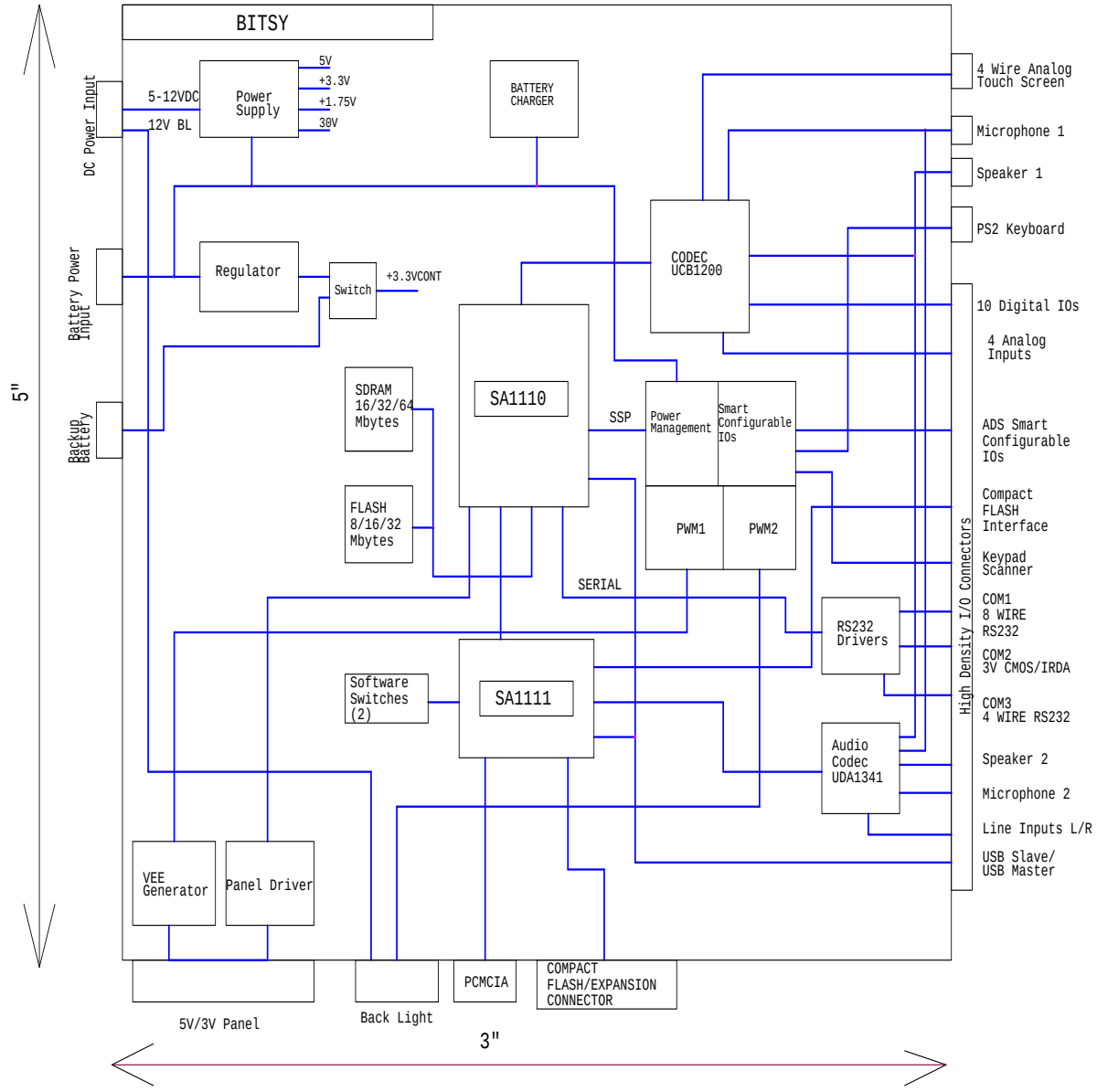
- ADSmartIO™ configurable for digital I/O, PWM and A/D inputs
- Up to eight analog inputs
- Up to 25 Digital I/O
- Backlight control signals for intensity and on/off
- Passive LCD contrast control
- External temperature probe support

1.2.7 Audio Interface

- Input mono microphone to UCB1200 codec
- Output mono speaker from UCB1200 codec
- Input stereo microphone to UDA1341 stereo codec
- Output stereo speaker from UDA1341 stereo codec

1.3 Block Diagram

The following diagram illustrates the system organization of the Bitsy.



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2 Getting Started

2.1 Evaluation Systems

Bitsy boards are shipped as evaluation systems designed to get the developer up and running quickly.

To use the system, simply plug power supply into the mini DIN-8 receptacle on the system.

If the screen does not display anything after five to ten seconds, check the *Frequently Asked Questions*, below. Most operating systems cold boot within twenty seconds.

An evaluation system consists of the following:

- Bitsy single-board computer
- Bitsy Compact Flash Connector Board
- Flat panel display and cable
- Backlight inverter and cable
- Touch screen and cable
- 120VAC power supply
- Plexiglas mounting
- Developer's Cable Kit including
  - Serial Port DB9 adapter (ADS cable #610111-80001)
  - DB9F/F null modem cable
- Operating system of your choice
- User's Guide (this document and operating system guide)
- Information about how to access ADS technical resources for the operating system you have chosen.

Make sure you have received ***all*** the components before you begin your development.

2.2 Frequently Asked Questions

The following are some of the most commonly asked questions for evaluation systems:

Q: When I turn on power, my screen is white and nothing comes up on it.

A: Check the connector seating. The flat panel connector may have come loose in shipping. Press it firmly into the panel and reapply power to your system.

Q: Do I have to turn off the system before I insert a PCMCIA or compact flash card?

A: No. The Bitsy supports hot-swapping of PCMCIA and compact flash cards. Consult the operating system documentation for details.

Q: Do I need to observe any ESD precautions when working with the system?

A: Yes. If possible, work on a grounded anti-static mat. At a minimum, touch an electrically grounded object before handling the board or touching any components on the board.

Q: What do I need to start developing my application for the system?

A: You will need a flash ATA card (8MB or larger) and the cables supplied with your system to interface your development station to the system. For further direction, consult the ADS guide for the installed operating system.

Q: Who can I call if I need help developing my application?

A: ADS provides technical support to get your development system running. For customers who establish a business relationship with ADS, we provide support to develop applications and drivers.

Q: Is there online support?

A: Yes. Information about the Bitsy hardware (such as this manual) is available on the ADS product page. ADS has operating-system-specific sites to support its customers. You should have received information about ADS's developers' web site for the operating system you have selected.

Q: Can I upgrade the version of the operating system?

A: Yes. ADS provides regular operating system updates on its developers' web site. For operating systems not maintained by ADS, contact the operating system vendor.

Q: I would like to interface to a different display panel. How can I do this?

A: ADS may have already interfaced to the panel you are interested in. Consult ADS for availability. ADS can interface to just about any panel you provide.

2.3 Organization of this Manual

The manual organizes information in three key sections:

Introduction	Provides an overview of the functionality and organization of the Bitsy.
Hardware Reference	Describes the configuration settings and connector pinouts for all systems of the Bitsy.
System Integration	Provides key information about power management, tips for system integration and electrical and mechanical interface specifications.

To locate the information you need, try the following:

1. Browse the *Table of Contents.* Section titles include connector designators and their function.
2. Follow cross-references between sections.
3. View and search this manual in PDF format

2.4 For Further Information...

ADS maintains a web site exclusively for its developers. The site includes downloads, troubleshooting guides, operating system updates and the "ADS Knowledge Base", a comprehensive document with dozens of questions answered about developing applications for ADS products. Instructions on how to access the site are shipped with every evaluation system.

3 Hardware Reference

This section gives an overview of the hardware features of the Bitsy. This overview includes a description of the switches, jumper settings, connectors and connector pinouts.

3.1 Locating "Pin 1"

Many connectors and headers have a visible number on the board that indicates pin 1. If that pin is not clearly marked, there are two other ways to locate pin 1:

1. The easiest method is to look at the underside of the board. The square pad is pin 1.

2. You can determine pin 1 from the mechanical drawing provided in section 4.2.

3.2 Switches

3.2.1 S1: DIP Switch

S1 is a four-position DIP switch. It connects to the system/interrupt controller. The settings of some individual switches can be read from the SA1111 I/O, others are available for off board use. Some operating systems on the Bitsy reserve these switches for their use. Consult the operating system manual for details.

3.3 ADSmartIO™

ADSmartIO™ is a second RISC microcontroller on the Bitsy. This device provides additional I/O functionality for specialized tasks. Your application software can configure the standard ADSmartIO™ firmware for a variety of functions, including digital I/O, PWM, A/D, keypad and PS/2 keyboard operation.

3.4 Onboard LEDs

The Bitsy has one onboard LED mapped as follows:

Signal	GPIO line	Part Designator	Color
LED0	*20*	*D3*	*Green*

3.5 Jumper Settings

Jumpers on the Bitsy select a variety of operational options. All use 2mm shorting blocks (shunts) to select settings. Make sure power is turned off to the Bitsy when changing the position of a shunt.

3.5.1 JP1, JP2: VEE Contrast Voltage Control

Type: 2-post header, 2mm

These jumpers are used when configuring the VEE voltage between a positive output and a negative output.

JP1,2 Jumper setting	Voltage Selected
1-2	*Negative VEE*
2-3	*Positive VEE*

3.5.2 JP3: Flat Panel Voltage Select

This jumper selects the supply voltage for the flat panel.

Jumper setting	Voltage Selected
1-2	*3.3 V*
2-3	*5.0 V*

WARNING! Make sure you have selected the correct voltage before connecting the panel. Flat panels are notoriously sensitive to--and are often irreparably damaged by--incorrect voltages.

3.5.3 JP4: Flat Panel Data Voltage Select

Type: 3-post header, 2mm

This jumper selects the voltage of the data signals for the flat panel display.

Important: These jumpers are set at the factory and cannot be changed by the user. Damage to the panel drivers may occur if this jumper setting is changed.

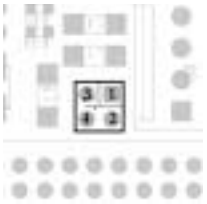
Hint: Some 5V panels will run correctly with 3.3V data.

Jumper setting	Voltage Selected
1-2	*3.3 V*
2-3	*5.0 V*

3.5.4 J7: Flat Panel VEE Select

Type: 4-post header, 2mm

This jumper selects the VEE voltage for the flat panel. Note that VEE is installed only as an option and is not installed on all Bitsy boards.



Jumper setting	Voltage Selected
none	*none*
1-3, 2-4	*Positive VEE*
1-2, 3-4	*Negative VEE*

WARNING! Make sure you have selected the correct voltage before connecting the panel. Flat panels are sensitive to--and are often irreparably damaged by--incorrect voltages.

3.6 Connector Pinouts

The following tables describe connector pinouts and the type of connector. At least one pin of every connector is labeled on the Bitsy. Double-row headers on the board are all numbered as shown in the figure to the right.

```
2 4 6 8...
1 3 5 7...
```

For information about the location of the connectors on the Bitsy, refer to section 4.2, *Mechanical Specifications*:

Legend:

n/c	Not connected
GND	Bitsy ground plane

3.6.1 J1: LCD Panel Interface Connector

Board Connector: Samtec #STMM-117-02-T-D-SM

Recommended Mating Cable: Samtec TCSD Series

Pin	Signal name	Description	SA-1110 Pin Name
1	*PNL_VEE*	*V_{EE} (contrast); see JP1, J2*	
2	*PNL_GND*	*Ground*	
3	*PNL_PIXCLK*	*Pixel Clock*	*L-PCLK*
4	*PNL_HSYNC*	*Horizontal Sync.*	*L-LCLK*
5	*PNL_VSYNC*	*Vertical Sync.*	*L-FCLK*
6	*PNL_GND*	*Ground*	
7	*PNL_RED0*	*Red Bit 0 (same as RED5)*	*GPIO9*
8	*PNL_RED1*	*Red Bit 1*	*GPIO5*
9	*PNL_RED2*	*Red Bit 2*	*GPIO6*
10	*PNL_RED3*	*Red Bit 3*	*GPIO7*
11	*PNL_RED4*	*Red Bit 4*	*GPIO8*
12	*PNL_RED5*	*Red Bit 5*	*GPIO9*
13	*PNL_GND*	*Ground*	
14	*PNL_GREEN0*	*Green Bit 0*	*LDD5*
15	*PNL_GREEN1*	*Green Bit 1*	*LDD6*
16	*PNL_GREEN2*	*Green Bit 2*	*LDD7*
17	*PNL_GREEN3*	*Green Bit 3*	*GPIO2*
18	*PNL_GREEN4*	*Green Bit 4*	*GPIO3*
19	*PNL_GREEN5*	*Green Bit 5*	*GPIO4*
20	*PNL_GND*	*Ground*	
21	*PNL_BLUE0*	*Blue Bit 0 (same as BLUE5)*	*LDD4*
22	*PNL_BLUE1*	*Blue Bit 1*	*LDD0*
23	*PNL_BLUE2*	*Blue Bit 2*	*LDD1*
24	*PNL_BLUE3*	*Blue Bit 3*	*LDD2*
25	*PNL_BLUE4*	*Blue Bit 4*	*LDD3*
26	*PNL_BLUE5*	*Blue Bit 5*	*LDD4*
27	*PNL_GND*	*Ground*	
28	*PNL_LBIAS*	*Data_Enable*	*L-BIAS*
29	*PNL_PWR*	*Vcc(5V) or 3.3 V, depending on JP1 position*	
30			
31	*PNL_RL*	*Horizontal Mode Select (set by R22, R87)*	
32	*PNL_UD*	*Vertical Mode Select (set by R79, R17)*	
33	*PNL_ENA*	*Panel enable signal*	*GPIO24*
34		*Not Connected*	

Be aware that the SA1110 LCD interface utilizes these pins differently depending on factors such as palette size and LCD technology. Consult the SA1110 User's Manual for more information.

3.6.2 J2: PCMCIA

Production option: Mating ejector Amp #146019-1

The 68-pin PCMCIA socket conforms to the PCMCIA standard for 3.3V and 5V Type II cards. It will supply up to 500 mA of 5V current. The socket is normally de-energized; the operating system is responsible for turning on the socket when a card is inserted and turning it off when the card is removed.

Ejector hardware is available for applications that require regular insertion and removal of PCMCIA cards.

3.6.3 J3: High Density IO connector

Board Connector : Samtec #STMM-125-02-T-D-SM

Recommended Mating Connector: Samtec # TCSD Series

Pin Number	Name	Description
1	*UCB_IO9*	*Digital IO from UCB1200 (3.3V)*
2	*UCB_IO8*	*Digital IO from UCB1200 (3.3V)*
3	*UCB_IO7*	*Digital IO from UCB1200 (3.3V)*
4	*AGCSTAT*	*Stereo CODEC Status Indicator*
5	*TEMP_SENSOR_MINUS*	*External Temperature Probe Connection*
6	*CODEC_OFL*	*Stereo CODEC Status Indicator*
7	*TEMP_SENSOR_PLUS*	*External Temperature Probe Connection*
8	*AMP_SDWN*	*Stereo Amplifier Shutdown Input (3.3V)*
9	*/IRDAON*	*External IRDA Control Output (0V = ON)*
10	*QMUTE*	*Stereo CODEC Mute Input*
11	*TSPX*	*Touchscreen Right Side Input*
12	*UCB_IO5*	*Digital IO from UCB1200 (3.3V)*
13	*TSMY*	*Touchscreen Top Input*
14	*UCB_IO6*	*Digital IO from UCB1200 (3.3V)*
15	*TSMX*	*Touchscreen Left Side Input*
16	*BACKLIGHT PWM*	*Backlight Intensity Adjustment Voltage (0-3.3V)*
17	*TSPY*	*Touchscreen Bottom Side Input*
18	*/BACKLIGHTON*	*Backlight On/Off Control Output (0-Backlight Voltage)*
19	*RXD2T*	*COM2 TTL Rx Input*
20	*TXD2T*	*COM2 TTL Tx Input*
21	*SPK+*	*External Mono Speaker Output +*
22	*SPK-*	*External Mono Speaker Output -*
23	*MICGND*	*External Mono Microphone Ground*
24	*MICSIG*	*External Mono Microphone Signal*
25	*CTS3*	*COM3 RS232 CTS Signal*
26	*TXD3*	*COM3 RS232 Tx Signal*
27	*RTS3*	*COM3 RS232 RTS Signal*
28	*RXD3*	*COM3 RS232 Rx Signal*
29	*SLAVE_USB+*	*USB Bus Slave Positive*
30	*SLAVE_USB-*	*USB Bus Slave Negative*
31	*SW2*	*On Board DIP Switch Connection*
32	*+30V*	*Connection to +30V Plane*
33	*SW3*	*On Board DIP Switch Connection*

Pin Number	Name	Description
34	*+30V_GND*	*Connection to 30V Ground*
35	*SMTIO2*	*Smart IO Digital I/O Bit 2 (Port C6)*
36		*Not Connected*
37	*SMTIO3*	*Smart IO Digital I/O Bit 2 (Port C7)*
38	*VBATT_POS*	*External Battery Positive Input*
39		*Not Connected*
40	*VBATT_NEG*	*External Battery Negative Input*
41	*POWERENABLE*	*Power Supply Control Output*
42	*VDDI*	*Connection to On-Board 1.75V Plane*
43		*Not Connected*
44	*DCIN_POS*	*External Power Positive Input*
45	*/RQONOFF*	*On/Off Switch Input*
46	*DCIN_NEG*	*External Power Negative Input*
47	*GPIO27_CLK*	*3.6864MHz Clock Output*
48	*12V_IN*	*12V Power Input for Backlight Support*
49	*Ground*	*Ground Input*
50	*BAT_POS*	*Backup Battery Voltage Input (3.0V)*

3.6.4 J4: Manufacturing Test Connector:

Type: 2x3 header, 0.100-inch spacing

For manufacturing use.

3.6.5 J5: Manufacturing JTAG Test Connector:

Type: 1x6 header, 0.100-inch spacing

For manufacturing use.

3.6.6 J6: Line Input Power Connector:

Board Connector: Molex #22-23-2021

Recommended mating connector: Molex 22-01-3027

Pin Number	Name	Description
1	*DCIN_POS*	*5-12V DC Power Input*
2	*DCIN_NEG*	*Ground*

3.6.7 J8: Touch Screen Connector:

Board Connector: Molex #22-23-2041

Recommended mating connector: Molex 22-01-3047

Pin Number	Name	Description
1	*TSMX*	*Touchscreen Left Hand Side*
2	*TSPX*	*Touchscreen Right Hand Side*
3	*TSPY*	*Touchscreen Bottom*
4	*TSMY*	*Touchscreen Top*

3.6.8 J9: High Density External Compact Flash Signal Connector:

Board Connector : Samtec #STMM-125-02-T-D-SM

Recommended Mating Connector: Samtec # TCSD Series

Pin Number	Name	Description
1	*Ground*	*Ground Connection*
2	*/CARDBDET2*	*External Compact Flash Card Detect 2*
3	*PCBD10*	*External Compact Flash Data*
4	*/CARDB16*	*External Compact Flash 16 Bit Access*
5	*PCBD9*	*External Compact Flash Data*
6	*PCBD2*	*External Compact Flash Data)*
7	*PCBD8*	*External Compact Flash Data*
8	*PCBD1*	*External Compact Flash Data*
9	*CARDBSTSCHG*	*External Compact Flash Status Change*
10	*PCBD0*	*External Compact Flash Data*
11	*CARDBSPK*	*External Compact Flash Speaker Input*
12	*PCBA0*	*External Compact Flash Address*
13	*/CARDBREG*	*External Compact Flash Register Access*
14	*PCBA1*	*External Compact Flash Address*
15	*VCC*	*Connection to 5V*
16	*PCBA2*	*External Compact Flash Address*
17	*/CARDBWAIT*	*External Compact Flash Wait*
18	*PCBA3*	*External Compact Flash Address*
19	*CARDBRES*	*External Compact Flash Reset*
20	*PCBA4*	*External Compact Flash Address*
21	*/CARDBVS2*	*External Compact Flash Voltage Sense 2 Input*
22	*PCBA5*	*External Compact Flash Address*
23	*+3.3V*	*Connection to +3.3V*
24	*PCBA6*	*External Compact Flash Address*
25	*/CARDBON*	*External Compact Flash 5V Power Control*
26	*CARDBVCC*	*External Switched CardB Power Input*
27	*CARDBIRQ*	*External Compact Flash Interrupt Signal*
28	*PCBA7*	*External Compact Flash Address*
29	*/CARDBMWR*	*External Compact Flash Memory Write*
30	*PCBA8*	*External Compact Flash Address*
31	*/CARDBIOWR*	*External Compact Flash IO Write*
32	*PCBA9*	*External Compact Flash Address*
33	*/CARDBIORD*	*External Compact Flash IO Read*
34	*/CARDBMRD*	*External Compact Flash Memory Read*
35	*/CARDB_VS1*	*External Compact Flash Voltage Sense 1 Input*
36	*PCBA10*	*External Compact Flash Address*
37	*/CARDBCE2*	*External Compact Flash Low Byte Chip Select*
38	*/CARDBCE1*	*External Compact Flash High Byte Chip Select*
39	*PCBD15*	*External Compact Flash Data*
40	*PCBD7*	*External Compact Flash Data*
41	*PCBD14*	*External Compact Flash Data*
42	*PCBD6*	*External Compact Flash Data*
43	*PCBD13*	*External Compact Flash Data*
44	*PCBD5*	*External Compact Flash Data*
45	*PCBD12*	*External Compact Flash Data*
46	*PCBD4*	*External Compact Flash Data*
47	*PCBD11*	*External Compact Flash Data*

Pin Number	Name	Description
48	*PCBD3*	*External Compact Flash Data*
49	*/CARDBDET1*	*External Compact Flash Card Detect 1*
50	*/CARDBON_3P3V*	*External Compact Flash 3.3V Power Control*

3.6.9 J10: High Density IO connector:

Board Connector : Samtec #STMM-125-02-T-D-SM

Recommended Mating Connector: Samtec # TCSD Series

Pin Number	Name	Description
1	*/EXT_IRQ1*	*External Interrupt 1 Input*
2	*UCB_IO3*	*Digital IO from UCB1200 (3.3V)*
3	*/EXT_IRQ2*	*External Interrupt 2 Input*
4	*UCB_IO2*	*Digital IO from UCB1200 (3.3V)*
5	*UCB_IO4*	*Digital IO from UCB1200 (3.3V)*
6	*UCB_IO1*	*Digital IO from UCB1200 (3.3V)*
7	*SIGPS2*	*Data Input from external PS/2 Connector*
8	*UCB_IO0*	*Digital IO from UCB1200 (3.3V)*
9	*CLKPS2*	*Clock Input from external PS/2 Connector*
10	*USB_PWR_SENSE*	*Sense Input from external USB power switch*
11		*Not Connected*
12	*USB_PWR_CTRL*	*Discrete output to control external USB power switch*
13	*SMTIO1*	*Smart IO Digital I/O Bit 1*
14	*USB_UDC-*	*USB Bus Master Negative*
15	*SMTIO0*	*Smart IO Digital I/O Bit 0*
16	*UCB_UDC+*	*USB Bus Master Positive*
17	*ROW0*	*Smart IO Keyscan Row Connection*
18	*SPKR2-*	*Stereo Speaker 2 Negative Output*
19	*ROW1*	*Smart IO Keyscan Row Connection*
20	*SPKR2+*	*Stereo Speaker 2 Positive Output*
21	*ROW2*	*Smart IO Keyscan Row Connection*
22	*SPKR1-*	*Stereo Speaker 1 Negative Output*
23	*ROW3*	*Smart IO Keyscan Row Connection*
24	*SPKR1+*	*Stereo Speaker 1 Positive Output*
25	*ROW4*	*Smart IO Keyscan Row Connection*
26	*RIB1*	*COM1 RIB*
27	*COL0*	*Smart IO Keyscan Column Connection*
28	*DCD1*	*COM1 DCD Control Input (RS232)*
29	*COL1*	*Smart IO Keyscan Column Connection*
30	*DSR1*	*COM1 DSR Control Input (RS232)*
31	*COL2*	*Smart IO Keyscan Column Connection*
32	*DTR1*	*COM1 DTR Control Output (RS232)*
33	*COL3*	*Smart IO Keyscan Column Connection*
34	*RXD1*	*COM1 Rx Data*
35	*ANIN0*	*Analog Input to UCB1200*
36	*TXD1*	*COM! Data Output (RS232)*
37	*ANIN1*	*Analog Input to UCB1200*
38	*CTS1*	*COM1 CTS Control Input (RS232)*
39	*ANIN2*	*Analog Input to UCB1200*

Pin Number	Name	Description
40	*RTS1*	*COM1 RTS Control Output (RS232)*
41	*ANIN3*	*Analog Input to UCB1200*
42	*MIC1_IN*	*Stereo Microphone Input*
43	*VREF*	*Analog Input to UCB1200Reference Voltage*
44	*MIC2_IN*	*Stereo Microphone Input*
45	*/RESET_IN*	*External Reset Input*
46	*/SHDN_RS232*	*External RS232 Buffer Disable Input*
47	*+3.3V*	*Connection to 3.3V Plane*
48	*VCC*	*Connection to 5v Plane*
49		*Not Connected*
50	*Ground*	*Ground Connection*

3.6.10 Functions of SA1110 GPIOs:

Pin Name	Signal Name	Direction	Description
GPIO0	*SA1111_IRQ*	*Input*	*SA-1111 Interrupt input*
GPIO1	*WAKE_UP*	*Input*	*SMART IO signal to wake processor up during sleep mode*
GPIO2	*GREEN3*	*Output*	*LCD Green bit 3 in 16 bit color mode*
GPIO3	*GREEN4*	*Output*	*LCD Green bit 4 in 16 bit color mode*
GPIO4	*GREEN5*	*Output*	*LCD Green bit 5 in 16 bit color mode*
GPIO5	*RED0*	*Output*	*LCD Red bit 0 in 16 bit color mode*
GPIO6	*RED1*	*Output*	*LCD Red bit 1 in 16 bit color mode*
GPIO7	*RED2*	*Output*	*LCD Red bit 2 in 16 bit color mode*
GPIO8	*RED3*	*Output*	*LCD Red bit 3 in 16 bit color mode*
GPIO9	*RED4*	*Output*	*LCD Red bit 4 in 16 bit color mode*
GPIO10	*SSP_TXD*	*Output*	*SSP Port transmit for Smart IO microcontroller*
GPIO11	*SSP_RXD*	*Input*	*SSP Port Receive for Smart IO microcontroller*
GPIO12	*SSP_SCLK*	*Output*	*SSP Port Clock for Smart IO microcontroller*
GPIO13	*SSP_SFRM*	*Output*	*SSP Port Frame for Smart IO microcontroller*
GPIO14	*CTS1*	*Input*	*CTS signal for Serial port 1*
GPIO15	*RTS1*	*Output*	*RTS signal for Serial port 1*
GPIO16	*RIB1*	*Input*	*RIB signal for Serial port 1*
GPIO17	*DCD1*	*Input*	*DCD signal for Serial port 1*
GPIO18	*CTS3*	*Input*	*CTS signal for Serial port 3*
GPIO19	*RTS3*	*Output*	*RTS signal for Serial port 3*
GPIO20	*LED0/DTR1*	*Output*	*SMD LED Green on board (D3)/DTR Signal for Serial Port 1*
GPIO21	*GPIO21_MBGNT*	*Output*	*SA-1111 Memory Request Bus Grant*
GPIO22	*GPIO22_MBREQ*	*Input*	*SA-1111 Memory Bus Request*
GPIO23	*IRDA ON*	*Output*	*0-> IRDA On 1 -> IRDA Off*
GPIO24	*DSR1*	*Input*	*DSR signal for Serial Port 1*
GPIO25	*/RESET_AVR*	*Output*	*Reset control to SMART IO Device*
GPIO26	*/SA1111_RESET*	*Output*	*Reset control to SA-1111 Device*
GPIO27	*GPIO27_CLK*	*Output*	*External GPIO on J7 pin 32/Clock Source for SA-1111*

4 System Integration

4.1 Tips for System Integration

4.1.1 Strategies for Backup Power

There are several ways to provide backup power to the Bitsy. Each has advantages that favor particular applications.

1. No Battery Backup. Applications that are entirely non-volatile (no critical data is stored in RAM), or that can recover from unexpected power failures, are good candidates for doing without a backup battery.

2. 3.0V to 3.6V Battery on J3.50 and J3.49. The backup battery supplies power to the system if the main battery or the DC main power source fails. Operating systems with power management will put the system to sleep if they detect that the system is operating from this supply.

4.1.2 Electrical Tips

Keep the following issues in mind when designing a system using the Bitsy.

- Make sure that the DC Input and Battery input (if used) are stable, clean and robust (will be able to provide enough current for the system). Since the Bitsy board directly provides power for the LCD display, make sure to take it into account when dimensioning the power supply that will run the bitsy board.
- Route the touch panel cabling away from the backlight inverter and other noisy systems. The touch panel driver algorithms can be adjusted to filter out large amounts of noise; however, the touch panel may then be less responsive.
- The backlight frequency can resonate with some flat panels. If beats appear, change the backlight frequency or panel refresh rate. Please contact ADS for assistance.

4.1.3 Utilizing the Compact Flash Interface

The Compact Flash Interface is offered to provide an extension of the SA1110 address and memory bus that can be used for as variety of purposes. When designing plug in modules to take advantage of this feature, it is recommended that these boards have robust power and ground planes. The logic on the Bitsy board will support 3.3/5V external devices. A limited amount of Bitsy board power is available to this connector on the VCC and +3.3V pins. For further information on these and other design requirements, please contact ADS.

4.1.4 Using the USB Interface

Separate connections are available on the Bitsy to support USB Slave and Master. When utilizing these interfaces on a custom designed daughter board, the designer must be aware of certain components that are required in order that the interface meets the requirements set out in USB Specification 2.0. Please contact ADS for more information. .

4.1.5 Bitsy Power Supply

The Bitsy has an on-board switching power supply which regulates from input voltage ranges between 5-12V. The input to this supply can come from Bitsy pins DC_IN or VBATT to support dual supply inputs. Should the unit be required to operate from a single supply, it is recommended to utilize the VBATT input. This circumvents the voltage drop associated with the blocking diode on the DC_IN input. System ground should be connected to DC_GND in this case.

The Bitsy supply outputs 5V, +3.3V, 30V (LCD VEE), and 1.75V (CPU Core). It is possible to regulate these voltages externally, and supply them through connector pins. See section 4.3 for more information.

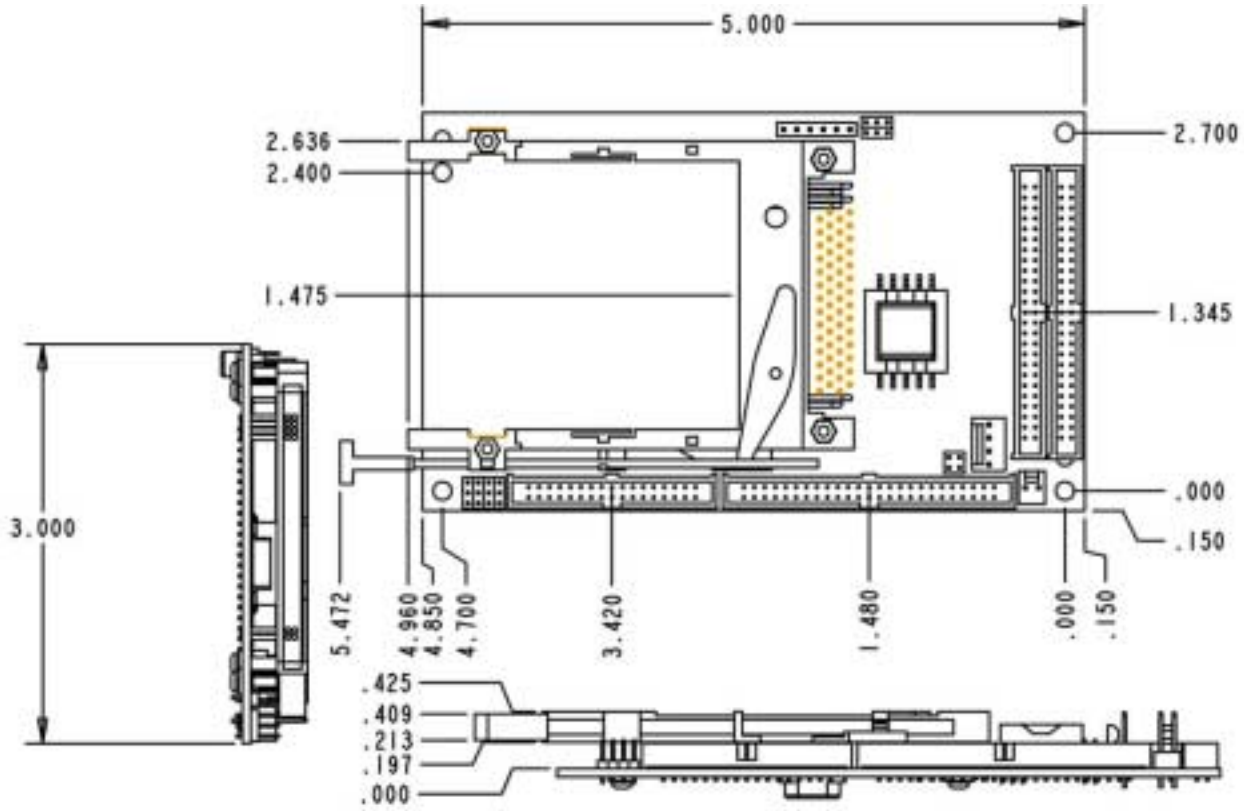
4.2 Mechanical Specifications

The Bitsy is 3 by 5 inches in size. This section describes the component dimensions and mounting of the board. Detailed drawings are available from ADS in PDF format for customers who are going into production.

4.2.1 Mechanical Drawing

The following mechanical drawing of the Bitsy specifies the dimensions of the Bitsy, as well as locations of key components on the board. The origin for measurements is the center of the mounting hole on the lower right corner of the board.

PCMCIA ejectors are available. These are the same height as the rest of the PCMCIA socket and extend beyond the forward edge of the board. The footprint is shown as crosshatching in the drawing.



4.2.2 Mounting Holes

Four holes are provided, one on each corner, for mounting; the diameter of the holes is 0.138-in. Mounting holes are plated through and connected to the Bitsy ground plane.

For reliable ground connections, use locking washers (star or split) when securing a Bitsy in an enclosure. Make sure that washers do not extend beyond the limits of the pads provided.

4.2.3 Clearances

The Bitsy has a low profile. It can fit in an enclosure as thin as 0.744-in I.D. Key clearances are as follows:

- Highest component: 0.425 inches
- Minimum clearance under board: 0.207 inches
- Board Thickness: 0.062 inches
- Clearance over top/Bottom: 0.05 inches

Note: Selection of connectors and wiring harnesses will determine height of final assembly.

4.3 Input Power Requirements

Power is supplied to the Bitsy through connector J6. A second source battery, with optimized power efficiency, can be connected on J3.38, J3.40 pins. A backup battery may also be connected to J3.50. Finally, it is possible to provide all the voltages the board needs in order to bypassing the on-board power supply. Be aware that this is a special situation that requires the removal of some components. The following are the power inputs to the Bitsy.

4.3.1 DC power input

The Bitsy requires a high-quality DC input of at least 5.0 VDC to operate normally, up to a maximum voltage of 12V. This voltage is used to generate additional on-board voltages though a switching power supply. The 5V supply enters the board on pin 1 of J6, while the Ground must be connected to J6.2. Please contact ADS to discuss higher input voltage options.

4.3.2 Main battery input

A battery of 5V to 12V may be connected to the board through pins J3.38 and J3.40. The board also provides a charging circuitry, specially suited for Lead-Acid batteries. In this way, the Bitsy board can become part of a portable unit.

4.3.3 3V Backup battery input

A 3V (to 3.6V) backup battery can be connected to the board to supply power when the main battery or the DC inputs are disconnected. This allows the board to retain its information and also allows the board to resume normal operations when power is reapplied. The connection of the battery can be performed through pins J3.50 (Positive connection) and J3.49 (ground connection).

4.3.4 Switching Supply Outputs

The onboard switching supply generates the following voltages: VCC(+5V), +3.3V, +1.75V, +30V. This supply can be configured to regulated from the +5V output, +3.3V output, or both. Please contact ADS is if you have special power requirements. The 1.75V is a high quality output required to power the StrongARM processor core logic. The +30V is generated in order to support required by some passive LCD panels with high voltage input requirements.

4.3.5 Backlight Power

The Bitsy provides software control of Backlight Intensity and On/Off. Power for the Backlight is not generated by the Bitsy, instead this power is routed through the board from the input power connector. This provides the user greater choice when selecting Backlight Inverters.

4.3.6 EMI/RFI and Transient Suppression

It is the responsibility of the user to provide surge protection on the input power lines. This is especially important if the power supply wires will be subject to EMI/RFI or ESD.

4.4 Externally Available Voltages

The Bitsy board generates voltages for the processor and other on-board logic. Some of these power sources can be used to power external circuitry. The amount of current that is available for external use depends on many factors, including LCD selection, board part stuffing, and input voltage. Please discuss these applications with ADS. The externally available voltages are listed as follows:

Voltage	Maximum Output Current	Connector
VCC (+5V)	TBD	J9, pin 15
+3.3V	TBD	J9, pin 23 and J10, pin 47

4.5 Power Consumption

The Bitsy has been designed to use a minimum of power. When not active, the SA-1110 can be put into Idle or Sleep modes, further reducing power consumption.

The following measurements were made using production boards running Windows CE and driving an Active TFT display.

Mode	Fully populated, board only	Fully populated, driving Sharp LQ64D343 panel (mA)
206 MHz	0.27A @ 9.0V	TBD
Sleep (VBATT)	~2.7mA	TBD

Note that actual power consumption will vary according to input voltage, temperature, panel selection and processor and peripheral activity.

4.6 Power Management

The SA1110 supports three operational modes: RUN, IDLE, and SLEEP. RUN mode offers the greatest performance at the highest cost in power consumption. IDLE mode defines operation with reduced power consumption from RUN mode while offering a shorted transition time to RUN then from SLEEP. In IDLE mode, the StrongARM continues to run, while unused peripherals are disabled. SLEEP mode offers the greatest reduction of operating current. When the Bitsy is in SLEEP mode the switching regulator is disabled, and the system data will be maintained by a low current draw on the DC_IN or VBATT_POS pins. When power is not present on either of those two pins, the system contents will not be maintained unless power is present on the BATPOS input. Supply voltage must be restored to either DC_IN or VBATT_POS before the system will return to RUN mode. Switching from SLEEP mode to RUN mode can be triggered by a variety of methods, and is set by the OS prior to entry into SLEEP mode. These methods include external signal transition, internal timers, or DC power application..

If Main Power (DC_IN or VBATT_POS) fails, the Bitsy automatically goes in a sleep state and switches to Backup Power BATPOS. The transition from RUN mode to SLEEP mode is a function of the Operating System. In general, the Operating System should shut down operations, prepare for a wakeup condition (external interrupt, system timer wakeup, etc) and then put the system to sleep. Consult the reference manual for your Operating System to better understand this function.

4.7 EMI/RFI and ESD Protection

The Bitsy board incorporates a number of industry-leading features that protect it from electrostatic discharge (ESD) and suppress electromagnetic and radio-frequency interference (EMI/RFI). Transient voltage suppressors, EMI fences, filters on I/O lines and termination of high-frequency signals are included standard on all systems.

Many products using ADS single-board computers have successfully completed FCC emissions testing as a part of their design cycle. Because ADS supplies only the single-board computer and not fully integrated systems, ADS cannot provide meaningful system-level emissions test results.

4.8 Electrical Specifications for I/O Ports

4.8.1 ADSmartIO™ Controller

As Digital Outputs:

Push-pull 3.3V CMOS
Sink up to 20 mA and source up to 12mA

As Digital Inputs:

CMOS, V_{DD}=3.3V (3.8V max)
Logical low @ <0.3 V_{DD}, logical high @ > 0.6V_{DD}
Software-selectable MOS pull-ups, 35-120kΩ

As Analog Inputs (Port A/Columns):

10-bit, 0~2.0V
Input impedance: 100MΩ, with overvoltage protection
V_{max}=V_{ref}=2.5V

Additional information:

Row and column I/Os have 1kΩ series resistance and overvoltage protection to ground. SMTIO0-3 I/Os are directly connected to I/O controller without external protection. Control pullup resistors by writing to bits of IO port when the port is configured as a digital input (bit mask 1=enable, 0=disable).

4.8.2 UCB 1200

As Digital Outputs:

Push-pull 3.3V CMOS
Maximum output current: 4 mA

As Digital Inputs:

CMOS, V_{DDD}=3.3V (3.8V max)
Logical low @ <0.3 V_{DDD}, logical high @ > 0.7V_{DDD}

Analog Inputs:

10-bit, 0~9.9V (11.0V max)
Input impedance: 1.3kΩ (0.76 voltage divider)
Range of maximum reading (0x3ff): 9.2-10.5V.

Additional information:

Digital I/Os have 1kΩ series resistance with overvoltage protection.

4.8.3 LCD Panel

LCD display panels have a wide range of voltage and data requirements. The Bitsy has a number of adjustable voltages to support these requirements.

PNL_PWR:

Voltage is 3.3 or 5V, depending on setting of JP3.
Must be set to match panel specifications.

VEE:

Bias voltage used for many passive panels.
Can be positive, negative or fixed at "26V" (from JP1 and JP2). Selected with J7.
Voltage and current range can be changed at the factory for specific panels or needs and can be modified by the user through control of the PWM settings of the AVR microcontroller.

4.8.4 SA1111

Compact Flash Port

Outputs:

Push-Pull CMOS (0-CARDBVcc)
Maximum output current: 4 mA

Inputs:

CARDBVcc = 3.3V:

Logical Low < .325 CARDBVcc
Logical High >.475 CARDBVcc

CARDBVcc = 5V

Logical Low = < .8V
Logical High = >.2.4V

Digital I/O:

As Digital Outputs:

Push-pull 3.3V CMOS
Maximum output current: 2 mA

As Digital Inputs:

CMOS, V_{DDX}=3.3V (3.6V max)
Logical low @ <0.2 V_{DDX}, logical high @ > 0.8V_{DDX}

4.8.5 SA-1110

As Digital Outputs:

Push-pull 3.3V CMOS
Maximum output current: 2 mA

As Digital Inputs:

CMOS, V_{DDX}=3.3V (3.6V max)
Logical low @ <0.2 V_{DDX}, logical high @ > 0.8V_{DDX}

5 Board Revision History

5.1.1 Identifying the board revision

The product revision number of the Bitsy is etched on the underside of the printed circuit board. That number is 170111-1000x, where "x" is the board revision.

5.1.2 Revision History

The following are the most significant changes that have occurred.

Rev. A:

Initial release

Rev. B:

Change of Input power capacitor to provide for wider input range up to 12V.

Modified the VEE switching and optimizerd the VEE setting circuitry.

Provided possibility to bypass TTL to RS-232 conversion on COM1 and COM2 signals without need for rework.

Added Slave USB signals on J3 connector

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