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mTouch™ AR1100
Analog Resistive USB and RS-232
Touch Screen Controller Board
User's Guide

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ISO/TS 16949:2009

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Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE on-line help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains the general information that will be useful to know before using the mTouch™ AR1100 Analog Resistive USB and RS-232 Touch Screen Controller Board. Items discussed in this chapter include:

- Document Layout
- Recommended Reading
- The Microchip Web Site
- Customer Support
- Document Revision History

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mTouch™ AR1100 User's Guide

DOCUMENT LAYOUT

This document describes how to use the mTouch™ AR1100 Analog Resistive USB and RS-232 Touch Screen Controller Board. The manual layout is as follows:

- **Chapter 1. "Product Overview"**
- **Chapter 2. "Connections"**
- **Chapter 3. "Operation"**
- **Chapter 4. "Software Device Drivers"**
- **Chapter 5. "Accessories"**
- **Chapter 6. "Support"**
- **Chapter 7. "Touch Screen Selection"**

RECOMMENDED READING

This user's guide describes how to use the mTouch™ AR1100 Analog Resistive USB and RS-232 Touch Screen Controller Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

Readme for mTouch™ AR1100 Analog Resistive USB and RS-232 Touch Screen Controller Board

For the latest information on using mTouch™ AR1100 Analog Resistive USB and RS-232 Touch Screen Controller Board, read the "`Readme.txt`" file in the main installation directory. The Readme file contains updated information and known issues that may not be included in this user's guide.

Readme Files

For the latest information on using other tools, read the tool-specific Readme files in the Readme subdirectory of the MPLAB IDE installation directory. The Readme files contain update information and known issues that may not be included in this user's guide.

THE MICROCHIP WEB SITE

Microchip provides online support through our web site at www.microchip.com.This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://support.microchip.com

DOCUMENT REVISION HISTORY

Revision A (August 2011)

Initial release of this document.

mTouch™ AR1100 User's Guide

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

The Microchip mTouch[TM] AR1100 Analog Resistive USB and RS-232 Touch Screen Controller Board represents a feature-rich, fully-integrated universal touch screen controller solution. The AR1100 Touch Screen Controller Board automatically selects between USB and RS-232 communication protocols, as well as supports 4, 5 or 8-wire analog resistive touch screens from any of a variety of touch screen manufacturers. The AR1100 Touch Screen Controller Board dynamically adapts to the various touch screen electrical characteristics such as sensitivity, contact resistance, and capacitance to provide optimal performance with minimal design time.

Building on the AR1000 series, the new AR1100 Touch Screen Controller Board offers customers an easy to integrate solution for low-cost, high-performing resistive touch with the advantages of USB plug and play, support for USB mouse or digitizer, advanced touch response and accuracy, field-flash updatability, and free drivers for most operating systems to enable low-risk designs for a wide variety of touch sensing requirements.

The AR1100 Touch Screen Controller Board supports large displays like industrial controls, self-service kiosks, and POS terminals, as well as smaller tablet displays, handheld consumer devices, and medical devices.

Resistive touch provides the advantages of easy integration, low total system cost and acceptance of finger, glove or stylus input, and USB communication is the industry standard for attaching peripherals to a computer. The AR1100 Touch Screen Controller Board is an easy-to-integrate touch screen controller that meets all of these needs in a single-chip solution or production ready-board product. The device comes with free drivers for most major operating systems, making it easy for designers to quickly create low-risk touch interface solutions.

1.2 PRODUCT DESCRIPTION

The mTouch™ AR1100 Touch Screen Controller Board auto-detects communication (RS-232 or USB) and uses a jumper to select between 5-wire and 4/8-wire analog resistive touch screens. The AR1100 Touch Screen Controller Board is ready to go out of the box with little or no configuration.

1.2.1 Part Number

AR1100BRD

1.2.2 AR1100 Core Features:

• RoHS Compliant
• Automatically detects communication type
  - RS-232 (9600 BAUD) and USB (2.0 Compliant)
  - Full-speed USB device HID compliant at 12 Mb/sec.
  - Low-power Suspend mode for USB < 500 uA
  - Low-power Sleep mode for RS-232 <10 uA

- USB plug and play
  - USB mouse (HID-MOUSE) or
  - Single-touch Win7 digitizer (HID-DIGITIZER)
- Jumper-selectable sensor support
  - 5 wire
  - 4/8 wire
- Dynamic rise-time and sampling capability
- Resolution:
  - 10-bit measurement (1024x1024)
  - 12-bit reporting (4096x4096) of processed touch coordinates
  - Report rate: 150 rps (typical)
  - Touch screen resistance – 2k ohm sheet resistance lead to lead.
  - Calibration data stored on local EEPROM
  - User EEPROM available – 96 bytes
  - Flash/Data EEPROM retention: >40 years
  - Industry-leading touch response and accuracy
  - ESD protection – both communication and touch screen connections
- Static Protection: 24 kVA

1.2.3   Mechanical

1.2.3.1   DIMENSIONS

FIGURE 1-1:   PCB – MECHANICAL DRAWING
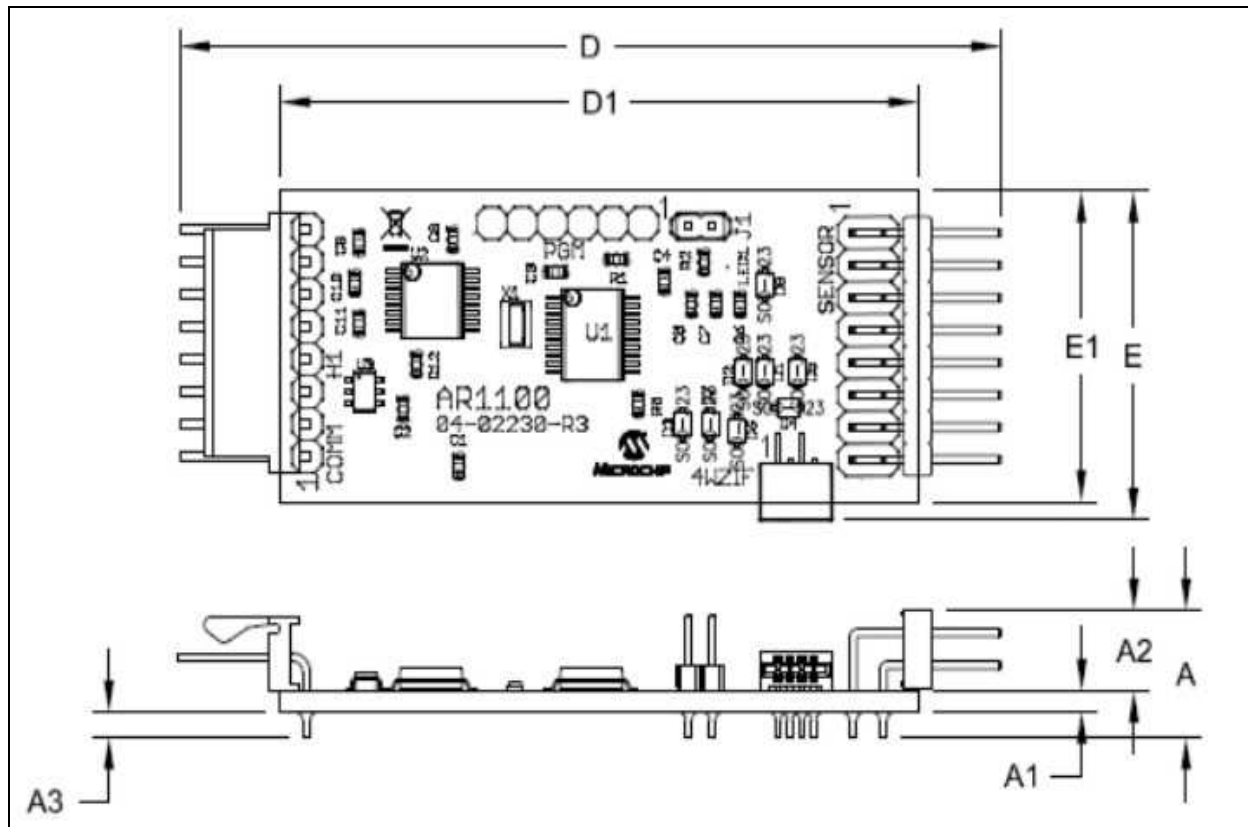
TABLE 1-1:   PCB – MECHANICAL DIMENSIONS

Units:		Millimeters			Inches		
Dimension Limits:		**MIN.**	**NOM.**	**MAX.**	**MIN.**	**NOM.**	**MAX.**
Overall Length	D	67.51	69.02	70.56	2.658	2.718	2.778
Overall Width	E	24.28	25.81	27.33	0.956	1.016	1.076
PCB Length	D1	52.07	53.59	55.12	2.050	2.110	2.17
PCB Width	E1	2.29	24.38	25.91	0.090	0.960	1.02
Overall Height	A	—	—	11.63	—	—	0.458
PCB Thickness	A1	1.42	15.75	1.73	0.056	0.620	0.068
Component Height	A2	—	6.35	7.87	—	0.250	0.310
Through Hole Lead Trim Length	A3	—	—	2.03	—	—	0.080

Note 1:   Passive components omitted from some views for clarity.

2:   Dimensions and tolerances per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

REF: Reference Dimension, usually without tolerance, for information purposes only.

WARNING

Although Microchip Technology Inc. has taken steps to protect your touch screen controller from transient voltage, it is important to make all grounding, communication and touch screen connections to the controller and touch screen. This must be done before powering on your computer, video monitor or touch screen controller. Failure to follow this procedure may result in damage to your controller and/or communication port**.** If you believe that your application will require additional static protection, it is up to you to determine the appropriate static protection needed to protect your electronics from transient voltage.

Failure to take the necessary precautions may result in damage to your controller. Microchip does not warranty the Microchip controller board against transient static discharge damage.

1.2.4 Electrical

TABLE 1-2: PCB – ELECTRICAL SPECIFICATIONS

	Conditions	Min.	Typical	Max.	Units
Supply Voltage		3.3		5.0	V
Supply Current	RS-232 (idle)		16		mA
	RS-232 (touch)		18		
	USB (idle)		17		
	USB (touch)		25		
Suspend Current	RS232			10	µA
	USB			330	
Operating temperature	Chip	-40		125	°C
	Board	-25		85	°C
Resolution	V$_{CC}$: +5V, V$_{DD}$: Gnd		1024 x 1024		Pixels
Response Time	Normal		8		ms
	Waking		10		
Detect Voltage Threshold			1.65		V
Touch Screen Resistance				2000	Ω
Touch Capacitance		0		0.5	µF

Note 1: Additional literature is available from Microchip Technology Inc. – definitions, specifications, and other general touch screen information.

Chapter 2. Connections

FIGURE 2-1: **CONNECTIONS – OVERVIEW**
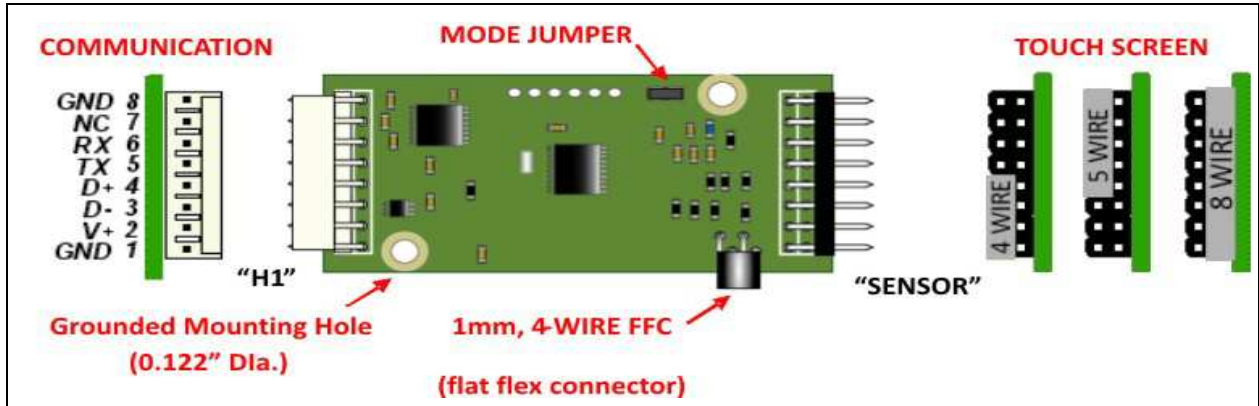
2.1 MOUNTING

Two static ground mounting holes (0.122" diameter) are provided. Take special care to insulate the controller from system and from EMI and RFI generating components of the display. Use conductive 4-40 stand-offs or ground-lead wires terminated to the grounded system enclosure or PC board to insure proper static protection and grounding. *STANDOFFS MUST NOT TOUCH ANY PORTION OF THE CIRCUIT.*

Position the controller in a location that minimizes bending or creasing of the touch screen overlay connection tail. Wear to the tail, printed traces, or tail header will negatively impact touch screen performance.

2.2 POWER

Power to the AR1100 Touch Screen Controller Board is provided by the H1 communication connector as seen in Figure 2-2. In USB Communication mode, power can be derived from the USB bus. In RS-232 mode – regulated power (3.3V – 5.0V) is provided from an external source. Check connections before applying power to the controller as **reversing polarity WILL damage the board.**

FIGURE 2-2: **POWER**

mTouch™ AR1100 User's Guide
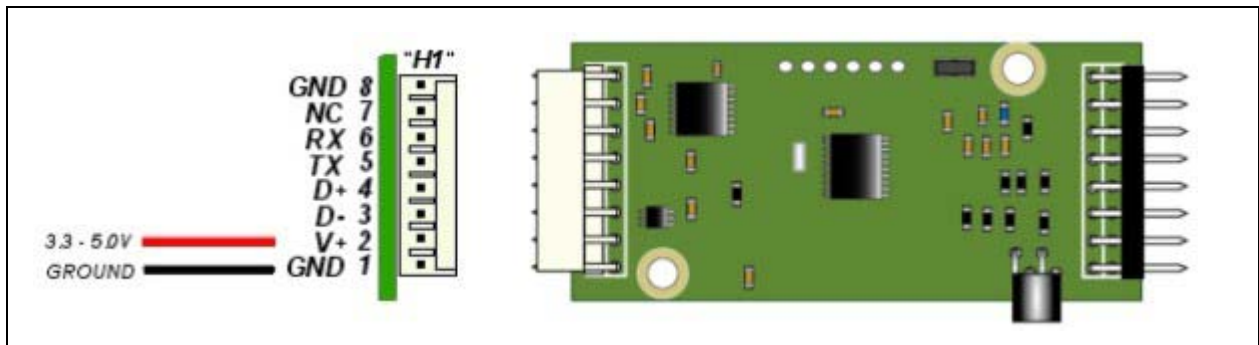
WARNING
SUPPLYING POWER FROM TWO DIFFERENT POWER SOURCES WILL PERMANENTLY DESTROY YOUR CONTROLLER, YOUR COMPUTER, OR YOUR MONITOR.

If the Microchip AR1100 Touch Screen Controller Board is installed into a monitor application where the end user will decide to use USB communication or RS-232 communication, the board must be powered internally. Because the board cannot be supplied with power from USB and internal 5V, it is recommended that the power (pin 1) contact be removed from the USB socket to insure that multiple power source connections are not permitted.

2.3   COMMUNICATION

The AR1100 Touch Screen Controller Board will automatically detect and configure itself for the active communication protocol – RS-232 or USB HID. The controller will default to RS-232 communication until USB activity is detected. Once the active communication mode is determined, the inactive mode is decommissioned to minimize power consumption. The active communication will remain in effect until power is removed from the controller.

2.3.1   RS-232

Microchip cable harness p/n: C72-080S1F-09XDXF is a standard 6' long, round shielded cable terminated by a DB-9 female connector and an 8-position single-row socket. This cable has a ground termination wire running the length of the cable which may be utilized to ground the controller board through the DB-9 connector. In any case, for best performance, a jacketed, shielded cable is recommended.

FIGURE 2-3:   RS-232 CONNECTIONS
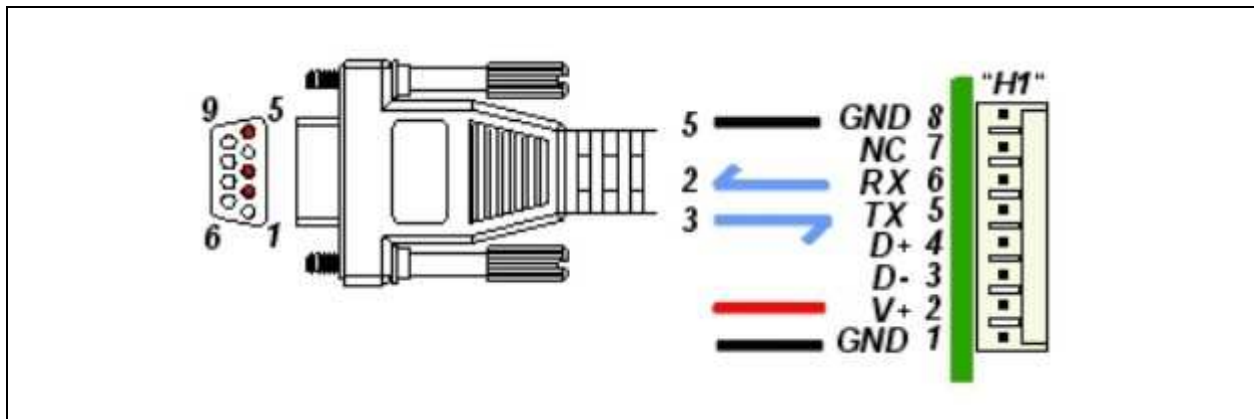
2.3.2 USB

Microchip cable harness p/n: C72-080S1F-04XAXM-D is a 6' long, jacketed shielded cable terminated by a Type "A" USB plug and an 8-position, single-row socket. *DO NOT SUPPLY POWER FROM BOTH RS-232 AND USB.*

FIGURE 2-4: **USB**
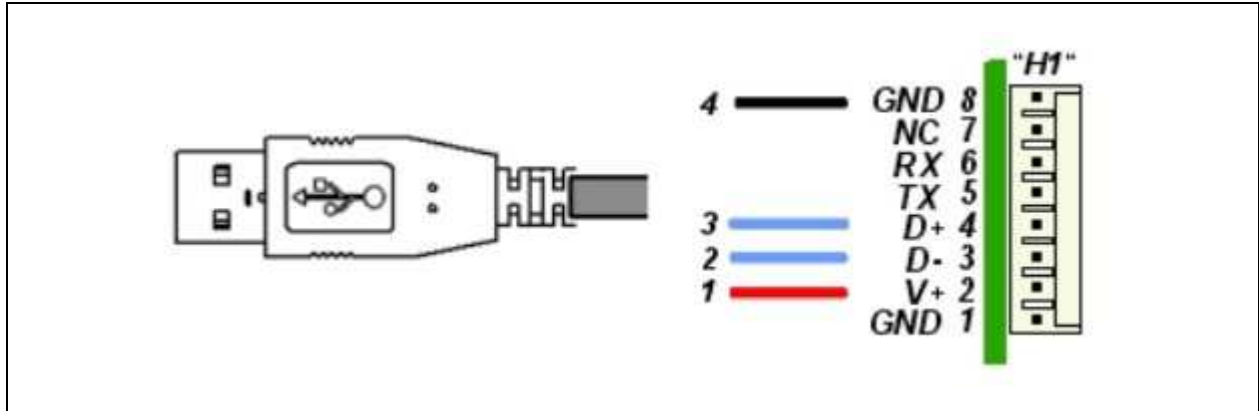
WARNING
SUPPLYING POWER FROM TWO DIFFERENT POWER SOURCES COULD PERMANENTLY DAMAGE YOUR CONTROLLER, YOUR COMPUTER, AND/OR YOUR MONITOR.

If the Microchip AR1100 Touch Screen Controller Board is installed into a monitor application where the end user will decide to use USB communication or RS-232 communication, the board must be powered internally. Because the board cannot be supplied with power from USB and internal 5V, it is recommended that the power (pin 1) contact be removed from the USB socket to insure that multiple power source connections are not permitted.

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2.4 SENSOR

The AR1100 Touch Screen Controller Board supports 4, 5 and 8-wire sensors. A 2x8 pin header ("SENSOR") seen in the mechanical diagram is the connection point for all 3 sensor types. Additionally, a 4-conductor flat flex connector can be used with 4-wire sensors. An illustration of sensor wiring/construction is given below for reference (see Figure 2-5).

FIGURE 2-5: **SENSOR CONNECTIONS**
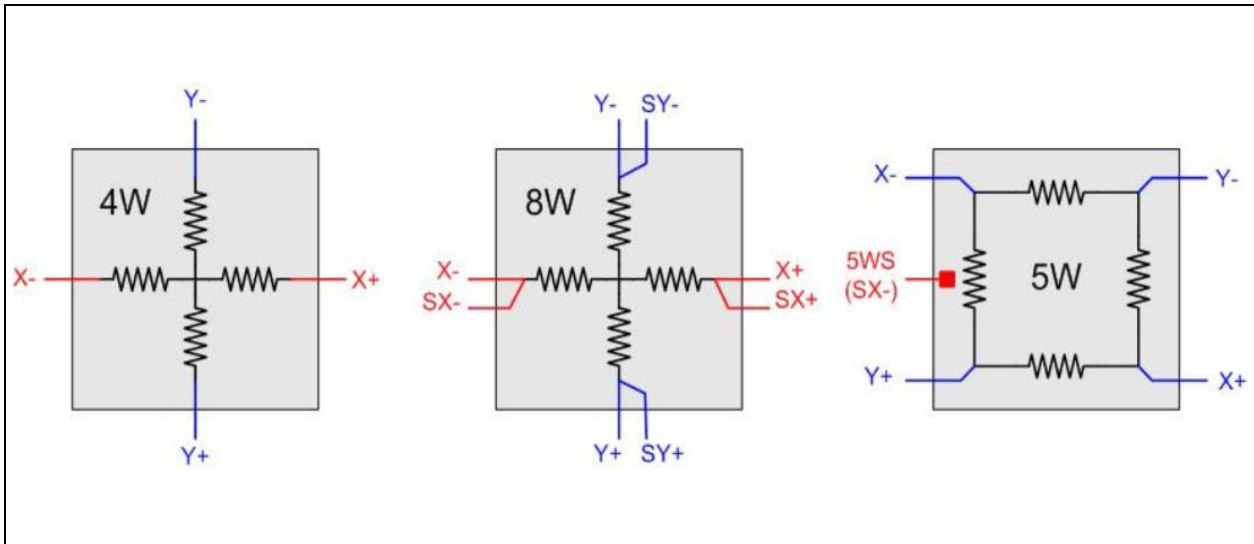
2.4.1 Connector: "4WZIF" – 4-Conductor FFC (flat flex)

JST part number: JST-04FM-1.st (LF)(SN) (4-position low insertion force flat flex connector)

TABLE 2-1: **4WZIF PIN ASSIGNMENTS**

PIN#	FUNCTION
1	Y-
2	X-
3	Y+
4	X+

2.4.2 Connector: 'SENSOR' – 2x8 Header

Sullins part number: PTC08DBAN. 2 x 8, 0.100" spacing, .024" sq.post, .230" mating length.

TABLE 2-2: SENSOR PIN ASSIGNMENTS

Function	Pin#		Function
Y+	1	2	Y-
X+	3	4	SY-
5WSX-	5	6	SY+
X-	7	8	Y+
Y-	9	10	X-
X-	11	12	5WSX-
Y+	13	14	SX+
X+	15	16	X+

FIGURE 2-6: SENSOR CONNECTIONS
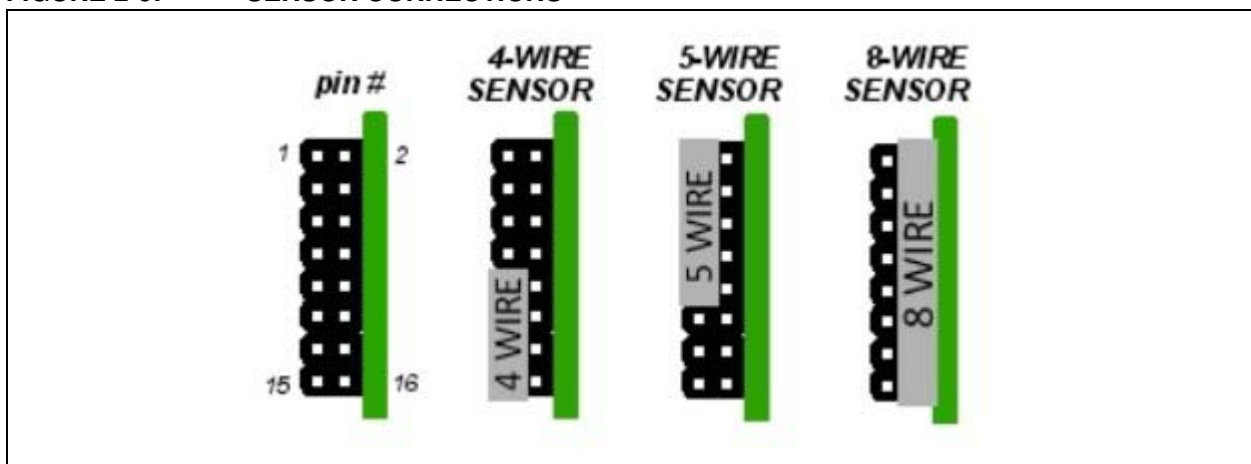
NOTES:

Chapter 3. Operation

3.1 CONFIGURATION

The AR1100 Touch Screen Controller Board is operational out of the box. Communication protocol is detected automatically (as described below) and the Mechanical mode jumper selects between 5-wire (jumper on) and 4/8-wire (jumper off). If a USB cable is connected, the AR1100 Touch Screen Controller Board will default to Mouse mode (HID-MOUSE). Additional configuration is possible (but generally, not necessary) using commands described in the AR1100 IC data sheet. The Microchip AR Configuration Utility Software can be used with the AR1100 Touch Screen Controller Board to modify (fine tune) operational parameters, change the 'default' USB device or actually update the control firmware. Any change made to the factory defaults is saved to internal, nonvolatile memory.

3.2 COMMUNICATION

The AR1100 Touch Screen Controller Board supports both RS-232 and USB. The controller will automatically detect and select between the two at power-up. The USB support is further defined to be one of three devices – HID-GENERIC, HID-MOUSE or HID-DIGITIZER – the controller can be configured to power-up as any of the three devices but the factory default is HID-MOUSE.

3.3 DATA FORMAT

The touch report data format for each communication protocol is defined below. The HID-MOUSE and HID-DIGITIZER are compatible with intrinsic drivers of Windows® XP and Windows 7, respectively. The HID-GENERIC and RS-232 protocols require custom handling.

3.3.1 Mode: HID-GENERIC, RS-232

TABLE 3-1: TOUCH REPORT FORMAT – GENERIC

BYTE	BIT							
	7	6	5	4	3	2	1	0
1	1	R	R	R	R	R	R	P
2	0	X6	X5	X4	X3	X2	X1	X0
3	0	0	X11	X10	X9	X8	X7	X6
4	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0
5	0	0	Y11	Y10	Y9	Y8	Y7	Y6

Note 1: P   Pen state 1: Pen down; 0: Pen up

         R   (Reserved)

         X   X ordinate of touch location (12 bits)

         Y   Y ordinate of touch location (12 bits)

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3.3.2   Mode: HID-MOUSE

The USB 'report' format is given below:

TABLE 3-2:   TOUCH REPORT FORMAT – MOUSE

BYTE	BIT							
	7	6	5	4	3	2	1	0
1	0	0	0	0	0	B3	B2	B1
2	X7	X6	X5	X4	X3	X2	X1	X0
3	0	0	0	0	X11	X10	X9	X8
4	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
5	0	0	0	0	Y11	Y10	Y9	Y8

Note 1: B1   Button 1 depressed (configurable, reacts to touch event/state (see the description below)

B2   Button 2 depressed (<u>always 0</u>)

B3   Button 3 depressed (<u>always 0</u>)

X   X ordinate of touch location (12 bits)

Y   Y ordinate of touch location (12 bits)

As seen in Table 3-2 above, the AR1100 Touch Screen Controller Board provides flexibility to the 'Button 1' field in the HID-MOUSE touch report. The value of 'Button 1' and the touch reports issued in reaction to touch events is dictated by the operational parameter, TouchMode, (described in the AR1100 Resistive USB and RS-232 Touch Screen Controller data sheet, DS41606). In the summary below, touch report field "P" (pen) corresponds to 'Button 1'.

3.3.2.1   SUMMARY OF PARAMETER: *TouchMode*

In reaction to each touch state/event, the AR1100 issues 0,1,2 or 3 touch reports with pen state "P" (a 1-bit field) set as described below.

TouchMode[7:5] = PD[2:0] Response to event PD (PEN/TOUCH DOWN)

b000   No touch report issued in response to the event

b001   Touch report w/ P=0

b010   Touch report w/ P=1

b011   Touch report w/ P=1, then Touch report w/ P=0

b100   Touch report w/ P=0, then Touch report w/ P=1, then Touch report w/ P=0

b101   Touch report w/ P=0, then Touch report w/ P=1

TouchMode[4:3] = PM[1:0] Response to event PM (PEN/TOUCH MOVEMENT)

b000   No touch report issued in response to the event

b001   Touch report w/ P=0

b010   Touch report w/ P=1

TouchMode[2:0] = PU[2:0] Response to event PU (PEN/TOUCH UP)

b000   No touch report issued in response to the event

b001   Touch report w/ P=0

b010   Touch report w/ P=1

b011   Touch report w/ P=1, then Touch report w/ P=0

b100   Touch report w/ P=0, then Touch report w/ P=1, then Touch report w/ P=0

b101   Touch report w/ P=0, then Touch report w/ P=1

3.3.3   Mode: HID-DIGITIZER

The USB 'report' format is given below:

TABLE 3-3:   TOUCH REPORT FORMAT – DIGITIZER

BYTE	BIT							
	7	6	5	4	3	2	1	0
1	0	0	0	0	0	0	P	T
2	0	0	0	0	0	0	0	0
3	X7	X6	X5	X4	X3	X2	X1	X0
4	0	0	0	0	X11	X10	X9	X8
5	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
6	0	0	0	0	Y11	Y10	Y9	Y8

Note 1: T1   Tip switch

P   Proximity (in range) – always 1

X   X ordinate of touch location (12 bits)

Y   Y ordinate of touch location (12 bits)

For flexibility, the value and behavior of the 'tip switch' data entity ("T") reflects the pen up/down state (similar to the 'Button 1' description in HID-MOUSE mode.

3.4   LED INDICATOR

The Microchip AR1100 Touch Screen Controller Board is equipped with a LED indicator to display controller status as follows:

TABLE 3-4:   LED INDICATOR

Behavior	Status
LED blinks slowly (once per second)	Controller is powered, awake and no touch is detected.
LED blinks rapidly (5 times per second)	Controller detects a touch.
LED is off	Controller has no power or is asleep (suspended).

NOTES:

Chapter 4. Software Device Drivers

Microchip Technology has device driver software available for all AR1100 touch screen controller chip and board solutions.

The software drivers may be downloaded at no additional charge at: www.micro-chip.com/mtouch

The Microchip device driver software enables you to configure the touch screen operation to meet your needs. The following is a list of features available with Microchip's software:

1. Touch screen calibration/linearization/alignment (4, 9, 25-point)
2. Adjustable calibration inset
3. Touch modes:
   -Normal mouse emulation
   -Touch-Up mode
   -Touch-Down mode
4. Other special features are also included. Please see the complete driver manuals available at the www.microchip.com web site for further details.

> **Note:** Microchip device drivers vary between operating systems and operating system varieties and versions.

NOTES:

Chapter 5. Accessories

5.1   COMMUNICATION CABLES

TABLE 5-1:   COMMUNICATION CABLES

Part Number	Description
C72-080S1F-09XDXF	6' RS-232 cable. Female DB9 to 8-position SIP socket Direct connect to **H1** header
C72-080S1F-04XAXM-D	6' USB cable. Male type A USB to 8-postion SIP socket Direct connect to **H1** header

5.2   TOUCH SCREEN CABLES

TABLE 5-2:   TOUCH SCREEN CABLES

Part Number	Description
C18-040S1F-040G1M	4-Wire – 18", 4-position, 0.100" SIP header to SIP socket. Direct connect to SENSOR header
C18-050S1F-050G1M	5-Wire – 18", 5-position, 0.100" SIP header to SIP socket Direct connect to SENSOR header
C18-080S1F-080G1M	8-Wire – 18", 8-position, 0.100" SIP header to SIP socket Direct connect to SENSOR header
C12-040S1F-041Z1F	4-Wire – 12", 4-position, 0.100" socket to 1 mm flat flex conector. Direct connect to flat flex connector
10022-100	6" 4-wire touch screen 'crossover' cable, 4-position SIP socket to SIP header Direct connect to SENSOR header
10023-100	6" 5-wire touch screen 'crossover' cable, 5-position SIP socket to SIP header Direct connect to SENSOR header
10024-100	6" 8-wire touch screen 'crossover' cable, 8-position SIP socket to SIP header Direct connect to SENSOR header