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# **Multimedia Expansion Board User's Guide**

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## Preface

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### 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](http://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 “DSXXXXA”, where “XXXX” 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 online help. Select the Help menu, and then Topics to open a list of available online help files.

## INTRODUCTION

This chapter contains general information that will be useful to know before using the starter kit. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

## DOCUMENT LAYOUT

This user's guide describes how to use the Multimedia Expansion Board and consists of the following chapters:

- **Chapter 1. “Introduction”** provides a brief overview of each starter kit, highlighting their features and uses.
- **Chapter 2. “Hardware”** provides the hardware descriptions of each starter kit.
- **Appendix A. “Board Layout and Schematics”** provides a block diagram, board layouts and detailed schematics of each starter kit.

# Multimedia Expansion Board User's Guide

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## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

### DOCUMENTATION CONVENTIONS

Description	Represents	Examples
<b>Arial font:</b>		
Italic characters	Referenced books	<i>MPLAB<sup>®</sup> IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	<u><i>File&gt;Save</i></u>
Bold characters	A dialog button	Click <b>OK</b>
	A tab	Click the <b>Power</b> tab
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
<b>Courier New font:</b>		
Plain Courier New	Sample source code	<code>#define START</code>
	Filenames	<code>autoexec.bat</code>
	File paths	<code>C:\mcc18\h</code>
	Keywords	<code>_asm, _endasm, static</code>
	Command-line options	<code>-Opa+, -Opa-</code>
	Bit values	<code>0, 1</code>
	Constants (in source code)	<code>0xFF, 'A'</code>
<i>Italic Courier New</i>	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets [ ]	Optional arguments	<code>mcc18 [options] file [options]</code>
Curly brackets and pipe character: {   }	Choice of mutually exclusive arguments; an OR selection	<code>errorlevel {0 1}</code>
Ellipses...	Replaces repeated text	<code>var_name [, var_name...]</code>
	Represents code supplied by user	<code>void main (void) { ... }</code>

## RECOMMENDED READING

The following Microchip documents are available and recommended as supplemental reference resources.

### **Release Notes for the Multimedia Expansion Board**

For the latest information, Microchip has a dedicated web page for the Multimedia Expansion Board, which can be accessed at: <http://www.microchip.com/PIC32>

### **PIC32MX3XX/4XX Family Data Sheet (DS61143) and PIC32MX5XX/6XX/7XX Family Data Sheet (DS61156)**

Refer these documents for detailed information on PIC32 32-bit devices. Reference information found in these data sheets includes:

- Device memory maps
- Device pinout and packaging details
- Device electrical specifications
- List of peripherals included on the devices

### **MPLAB<sup>®</sup> C Compiler for PIC32 User's Guide (DS51686)**

This document, formerly the MPLAB C32 C Compiler for PIC32 User's Guide, details the use of Microchip's MPLAB C Compiler for PIC32 to develop an application.

### **MPLAB<sup>®</sup> IDE User's Guide (DS51519)**

Refer this document for more information pertaining to the installation and implementation of the MPLAB IDE software, as well as the MPLAB Editor and MPLAB SIM Simulator software that are included with it.

## THE MICROCHIP WEB SITE

Microchip provides online support through our web site at <http://www.microchip.com>. This web site makes files and information easily available to customers. Accessible by most Internet browsers, 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 listings
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listings of seminars and events; and listings of Microchip sales offices, distributors and factory representatives



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## DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

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To register, access the Microchip web site at <http://www.microchip.com>, click **Customer Change Notification** and follow the registration instructions.

The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers and other language tools. These include the MPLAB C18 and MPLAB C30 C compilers, and MPLAB C Compiler for PIC32; ASM32, MPASM™ and MPLAB ASM30 assemblers; MPLINK™, and MPLAB LINK30, MPLAB LINK32 object linkers; and MPLIB™ and MPLAB LIB30 object librarians.
- **Emulators** – The latest information on Microchip in-circuit emulators. This includes the MPLAB REAL ICE™ and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes the MPLAB ICD 3 and PICKit™ 2.
- **MPLAB IDE** – The latest information on Microchip MPLAB IDE, the Windows® Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include the MPLAB PM3 device programmer and the PICSTART® Plus, PICKit™ 1 and PICKit 2 development programmers.

## CUSTOMER SUPPORT

Several channels are available to assist the users of Microchip products:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

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

Technical support is available through our web site at <http://support.microchip.com>.

## DOCUMENT REVISION HISTORY

### **Revision A (June 2010)**

This is the initial release of the Multimedia Expansion Board User's Guide.

# Multimedia Expansion Board User's Guide

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## **Chapter 1. Introduction**

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Thank you for purchasing Microchip Technology Multimedia Expansion Board. This compact, highly versatile board can be connected to any PIC32MX starter kit for the purpose of developing multimedia applications, such as audio, graphics and touch screen.

This chapter includes the following topics:

- Kit Contents
- Multimedia Features

### **1.1 KIT CONTENTS**

The Multimedia Expansion Board kit contains the following items:

- Multimedia Expansion Board
- Multimedia Expansion Board Information Sheet

### **1.2 MULTIMEDIA FEATURES**

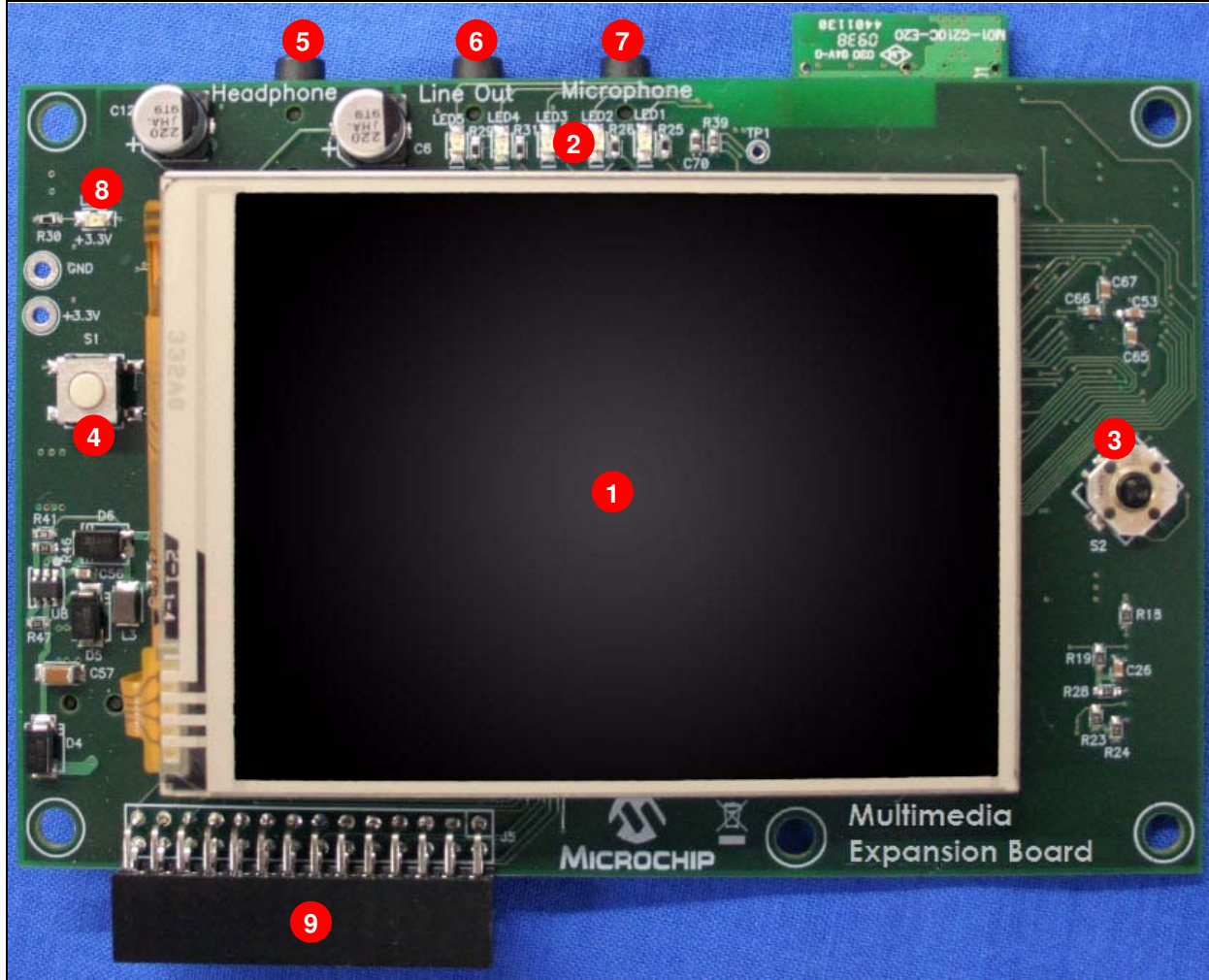
The component layout of the Multimedia Expansion Board is shown in Figure 1-1 (front side) and Figure 1-2 (back side).

The front side of the board includes these key features, as shown in Figure 1-1:

1. 3.2 inch (8.1 cm) QVGA touch screen display with backlight.
2. Five user-controlled LEDs.
3. Four-way joystick (S2).
4. Fire button (S1).
5. Headphone jack.
6. Line output jack.
7. Microphone input jack.
8. Power LED.
9. I/O expansion connector.

# Multimedia Expansion Board User's Guide

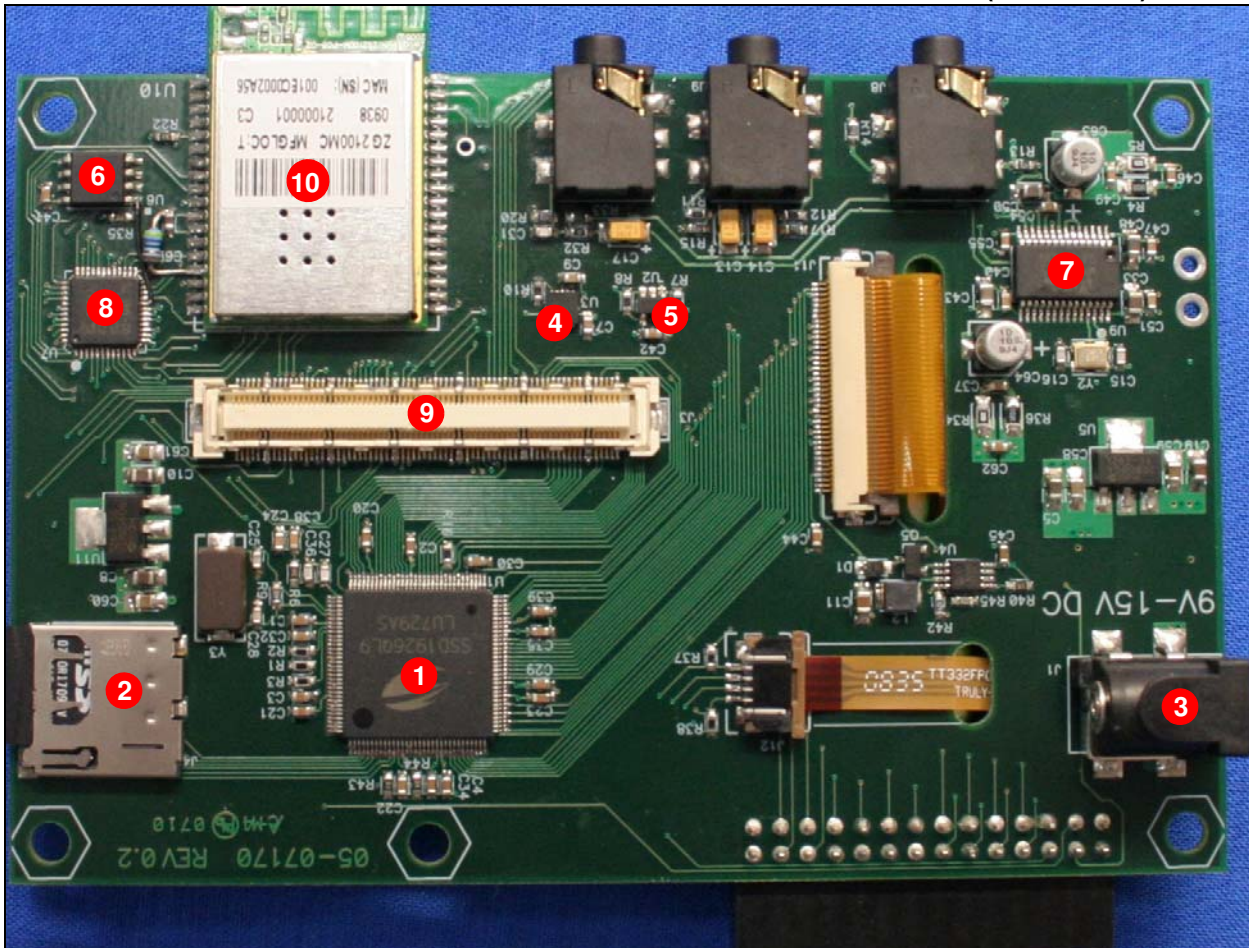
FIGURE 1-1: MULTIMEDIA EXPANSION BOARD COMPONENT LAYOUT (FRONT SIDE)



The back side of the board includes these key features, as indicated in Figure 1-2:

1. Solomon Systech Graphics Controller (SSD1926).
2. microSD card slot.
3. Regulated 3.3V and 1.8V power supply for powering the board via a starter kit or 9-14V power supply.
4. Accelerometer and temperature sensor (BMA150).
5. 24LC08 EEPROM.
6. 2 MB SPI Flash (SST25VF016).
7. 24-bit stereo audio codec (WM8731).
8. CPLD for SPI and Chip Select configuration.
9. PIC32 starter kit connector.
10. Integrated 802.11 wireless connectivity.

**FIGURE 1-2: MULTIMEDIA EXPANSION BOARD COMPONENT LAYOUT (BACK SIDE)**



# Multimedia Expansion Board User's Guide

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## Chapter 2. Hardware

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This chapter describes the hardware used in the Multimedia Expansion Board. Topics covered include:

- Power Supply
- Starter Kit Connector
- Display
- microSD Card Slot
- Joystick and Fire Button
- User-Controlled LEDs
- Accelerometer and Temperature Sensor
- External Memory
- 24-bit Audio Codec
- 802.11 Wireless Connectivity
- I/O Expansion Connector
- CPLD

**Note:** Refer to **Appendix B. “Bill of Materials (BOM)”** for the manufacturer and part number information of the hardware components used in the Multimedia Expansion Board.

### 2.1 POWER SUPPLY

Power can be supplied to the Multimedia Expansion Board through the DC connector located on the Multimedia Expansion Board (Figure 2-1). By connecting a 9-14V power supply to the DC connector, the Multimedia Expansion Board and starter kit will receive the proper voltages. The user can also supply power via the starter kit. However, if the application uses multiple features of the Multimedia Expansion Board, it is recommended to use 9-14V power supply.

**FIGURE 2-1: DC POWER SUPPLY**



#### **CAUTION**

**When connecting the Multimedia Expansion Board or starter kit, do not have power applied when connecting the DC power supply. Failure to heed this caution could result in hardware damage.**



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## 2.2 STARTER KIT CONNECTOR

Any PIC32 starter kit can be used in conjunction with the Multimedia Expansion Board through the PIC32 expansion connector, as shown in Figure 2-2. After connecting a PIC32 starter kit, applications can be developed and run using the rich features of the Multimedia Expansion Board. Table 2-1 provides information on starter kit pins and the corresponding Multimedia Expansion Board device.

**TABLE 2-1: STARTER KIT PIN DESCRIPTION**

Starter Kit Connector (J3)			Multimedia Expansion Board	
Pin	Description	Pin Type	Device	Description
25	PMP Data <7:0>	I/O	Graphics Controller (SSD1926)	8-bit or 16-bit Data Bus
23		I/O		
21		I/O		
19		I/O		
17		I/O		
15		I/O		
13		I/O		
9		I/O		
7		I/O		
10	PMP Data <15:8>	I/O		
14		I/O		
16		I/O		
18		I/O		
20		I/O		
22		I/O		
24		I/O		
26		I/O		
8	RG13	O		Chip Select
101	RB10	O		Register Select
39	RC3	I		Wait Line
115	RA10	O		Reset
103	RB11	I/O	Touch Screen	X+
105	RB12	O		Y-
107	RB13	O		X-
127	RB14	I/O		Y+
72	RB0/CN2	I	Joystick	Left
70	RB1/CN3	I		Up
66	RB3/CN5	I		Down
64	RB4/CN6	I		Right
36	RB15/CN12	I		Fire
44	RD1	O	LEDs	LED1
42	RD2	O		LED2
40	RD3	O		LED3
35	RC1	O		LED4
37	RC2	O		LED5

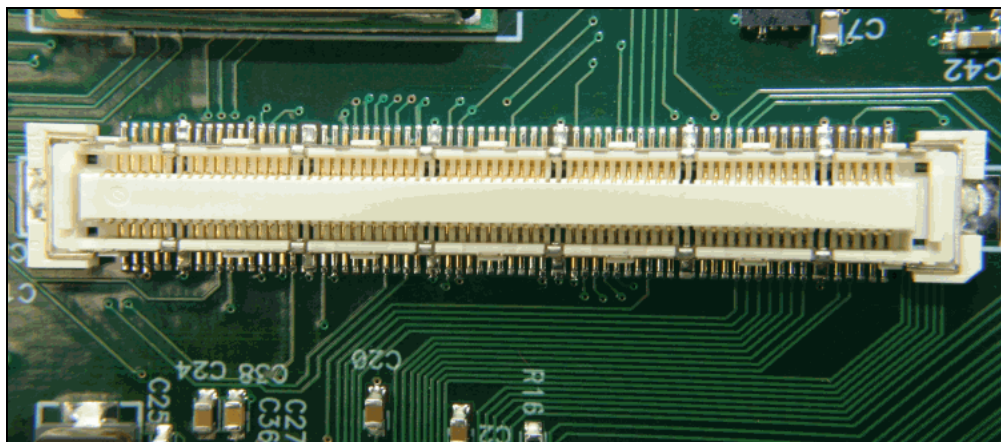
**TABLE 2-1: STARTER KIT PIN DESCRIPTION (CONTINUED)**

Starter Kit Connector (J3)			Multimedia Expansion Board	
Pin	Description	Pin Type	Device	Description
74	SDA2	I	i <sup>2</sup> C bus for BMA150, MCHP24LC08 and WM8731	i <sup>2</sup> C Bus
76	SCL2	O		
91	SCK1	O		
93	SDI1	I	SPI Bus for WM8731	SPI Bus
95	SDO1	O		
4	RA6	O		
6	RA7	O	CPLD	Control Pins
5	RG12	O		
3	RG14	O		
45	SCK2	O		
47	SDI2	I		
49	SDO2	O		SPI Bus
51	RG9	O		
106	SCK3A	O		
110	SDI3A	I		SPI Bus
112	SDO3A	O		
108	RF12	O		
97	SS1	O		Chip Select
54	RD9	O		
81	INT3	I		
115	RA10	O		MRF24WBOMA
71	RB8	O		
76	SCL2	I/O		
74	SDA2	I/O	PICtail J5	Pin 3
47	SDI2	I/O		Pin 5
49	SDO2	I/O		Pin 7
45	SCK2	I/O		Pin 9
51	RG9	I/O		Pin 11
88	U1RX	I/O		Pin 13
90	U1TX	I/O		Pin 15
92	U1RTS	I/O		Pin 17
94	U1CTS	I/O		Pin 19
73	RB9	I/O		Pin 21
115	RA10	O		Pin 23
85	INT1	I/O		Pin 25
84	SCL1	I/O		Pin 27
86	SDA1	I/O		Pin 4
97	SS1	I/O		Pin 6
110	U2RX	I/O		Pin 8
112	U2TX	I/O		Pin 16
106	U2RTS	I/O		Pin 18
108	U2CTS	I/O		Pin 20

# Multimedia Expansion Board User's Guide

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FIGURE 2-2: EXPANSION CONNECTOR FOR EASY INTERFACE TO PIC32 STARTER KITS



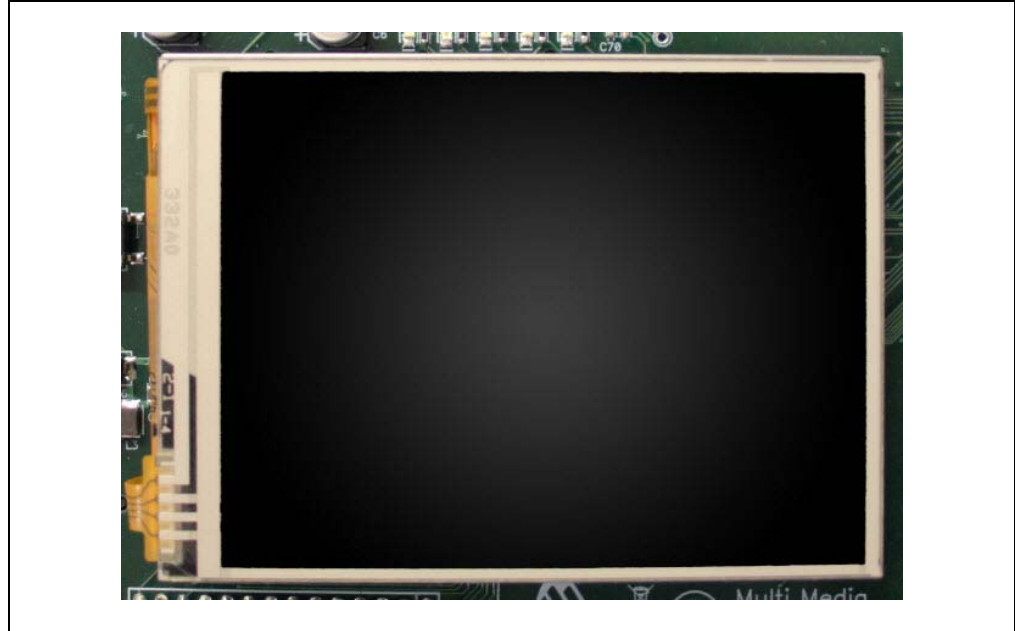
## CAUTION

When connecting the Multimedia Expansion Board to a starter kit, do not have power applied to either the starter kit or the DC power supply. Failure to heed this caution could result in hardware damage.

## 2.3 DISPLAY

The Multimedia Expansion Board has a 3.2 inch (8.1 cm) QVGA TFT touchscreen, as shown in Figure 2-3. The display is controlled by a Solomon Systech SSD1926 LCD controller, which is shown in Figure 2-4. The display controller may be configured to use an 8-bit or 16-bit interface (see **Section 2.12 “CPLD”** for configuration data). The display also has a resistive touch screen and backlight controls, as shown in Figure 2-5.

**FIGURE 2-3: 3.2 INCH (8.1 CM) QVGA TFT TOUCH SCREEN**

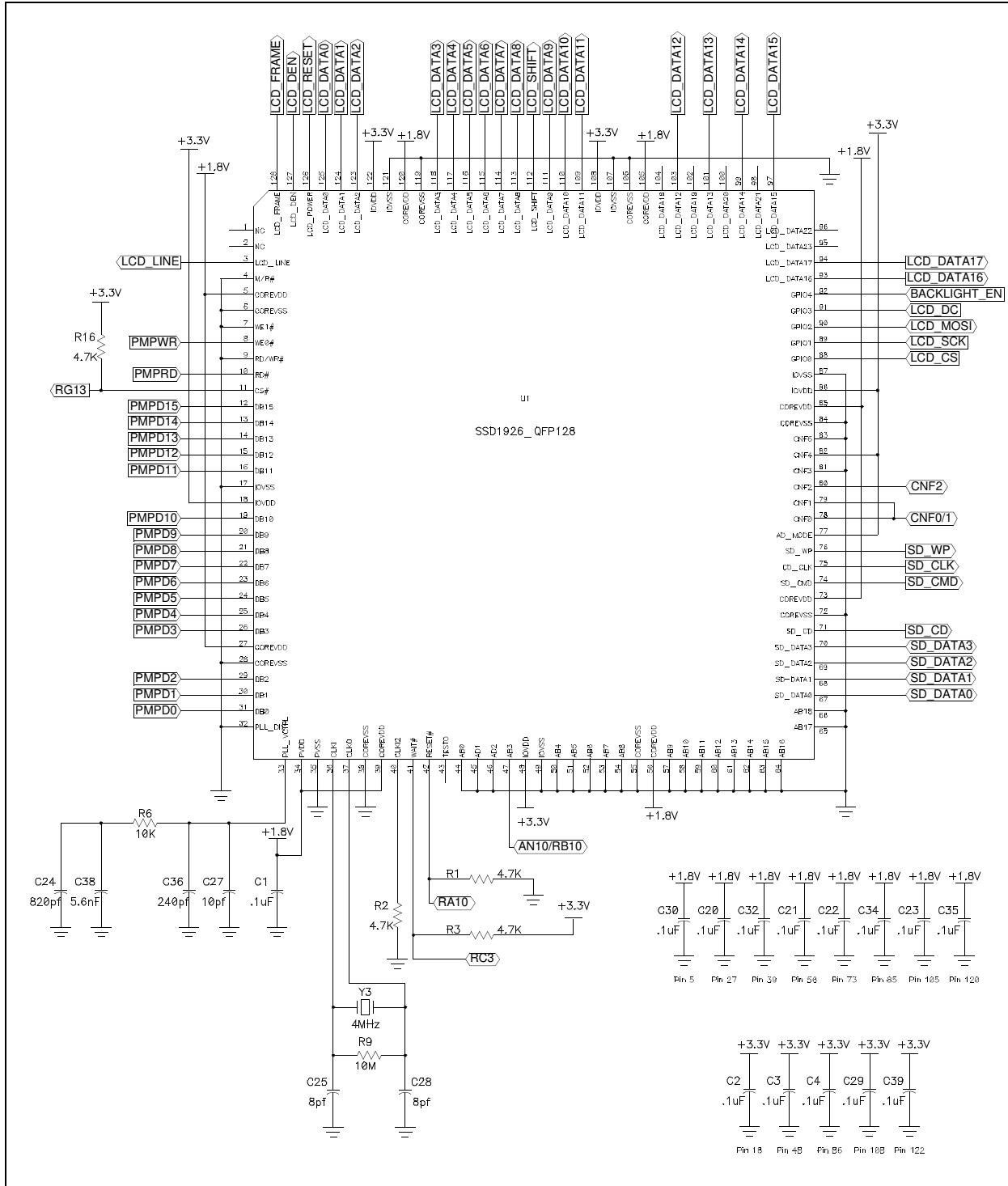


**FIGURE 2-4: SOLOMON SYSTECH SSD1926 LCD CONTROLLER**

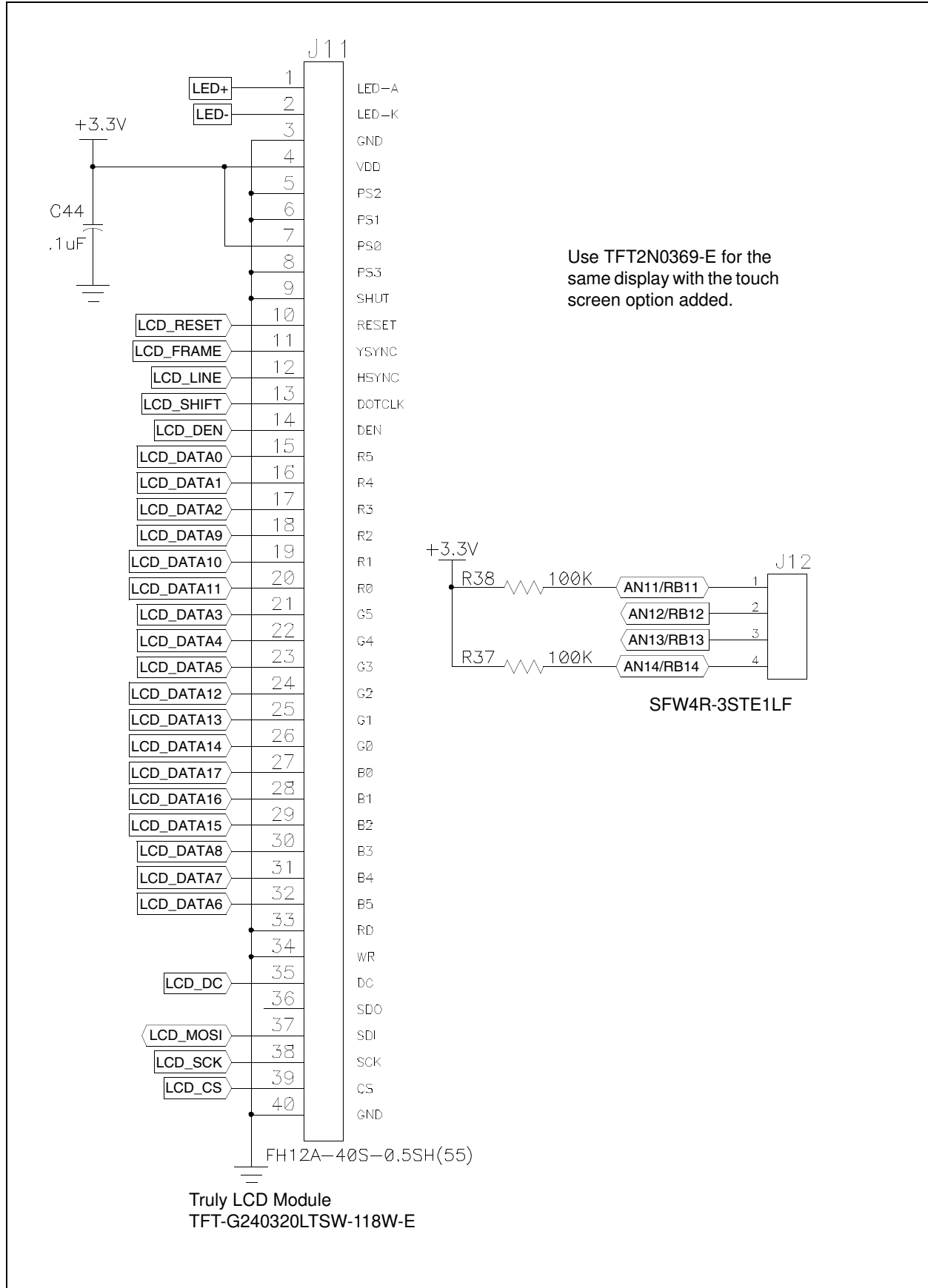


# Multimedia Expansion Board User's Guide

FIGURE 2-5: SOLOMON SYSTECH SSD1926 LCD CONTROLLER SCHEMATIC



**FIGURE 2-6: TOUCHSCREEN CONNECTOR**



# Multimedia Expansion Board User's Guide

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**TABLE 2-2: SOLOMON SYSTECH SSD1926 LCD CONTROLLER I/O CONNECTIONS**

SSD1926 Pin Description	Expansion Connector Pin
Chip Select	RG13
Chip Reset <sup>(1)</sup>	RA10
Chip Register Select	RB10
Chip Wait	RC3

**Note 1:** This pin is shared with 802.11 and PICtail daughter boards.

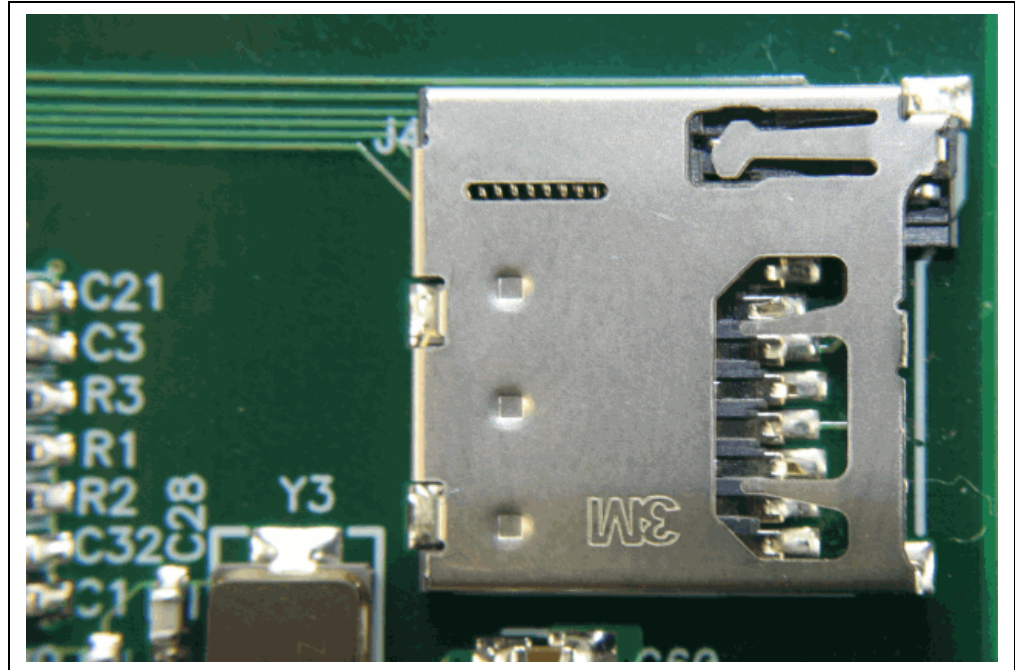
**TABLE 2-3: DISPLAY TOUCH SCREEN I/O CONNECTIONS**

Touch Screen Pin	Expansion Connector Pin
X+	AN11/RB11
X-	RB13
Y+	AN14/RB14
Y-	RB12

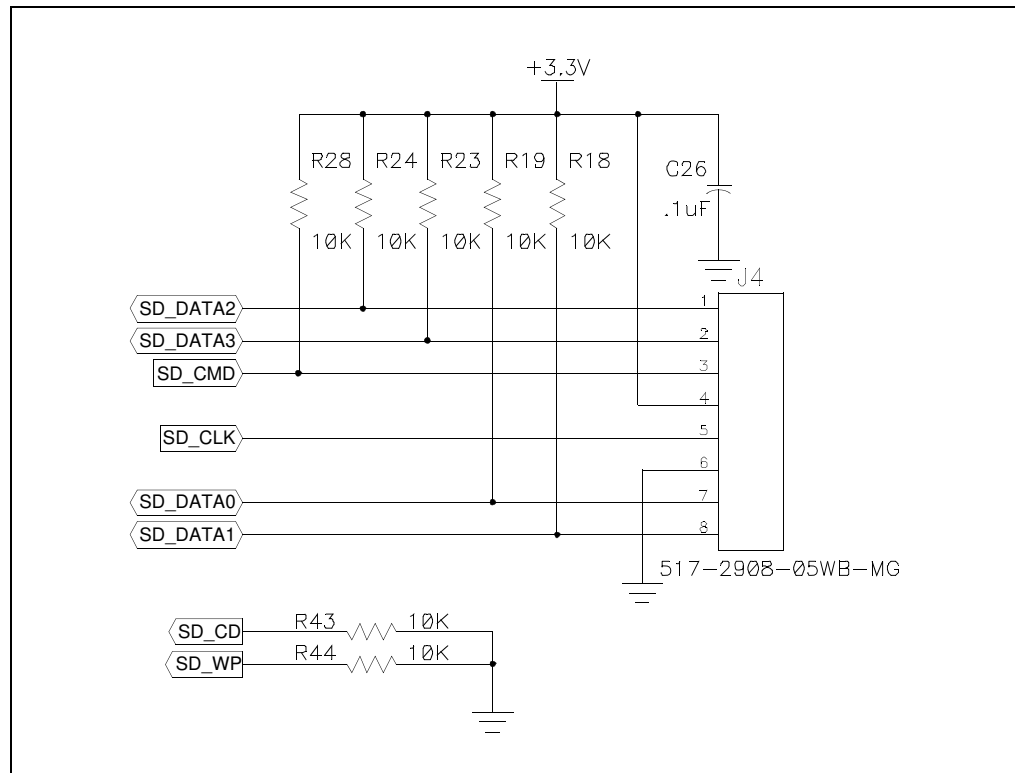
## 2.4 microSD CARD SLOT

The Solomon Systech SSD1926 Graphics Controller provides a four-wire SD card interface, as shown in Figure 2-7. The Multimedia Expansion Board takes advantage of this interface by providing a microSD card slot, as shown in Figure 2-8.

**FIGURE 2-7: microSD CARD SLOT**



**FIGURE 2-8: SOLOMON SYSTECH SSD1926 LCD CONTROLLER AND microSD CARD CONNECTION SCHEMATIC**



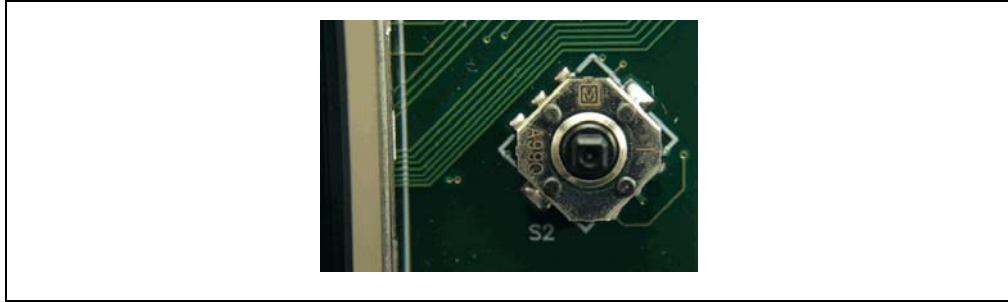


# Multimedia Expansion Board User's Guide

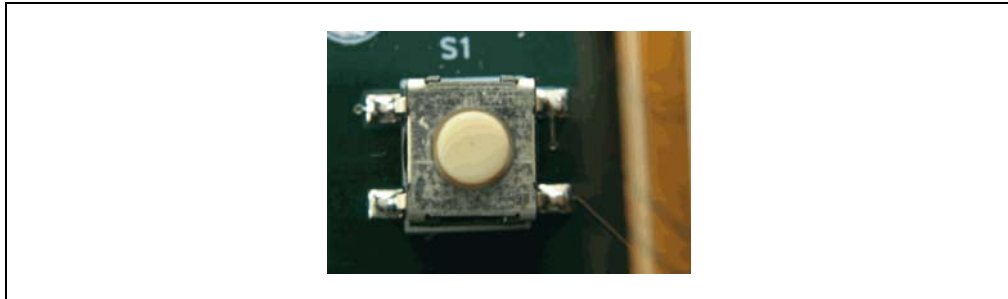
## 2.5 JOYSTICK AND FIRE BUTTON

The Multimedia Expansion Board provides a four direction joystick with a fire button (Figure 2-9). The directional joystick and fire button can be used to interact with and provide feedback to an application. The joystick (S2) is also connected to the fire button (S1), as shown in Figure 2-10, which allows the user to press either the fire button or the joystick to register a fire command.

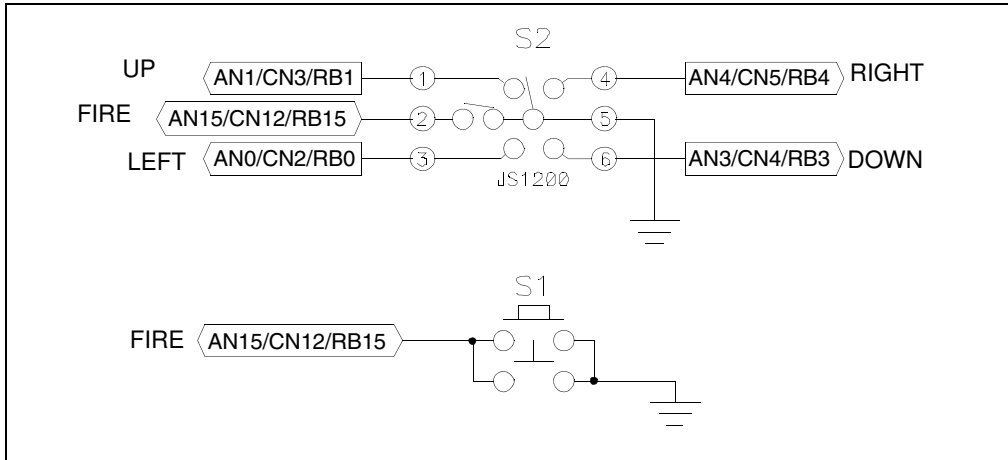
**FIGURE 2-9: JOYSTICK (S2 SWITCH)**



**FIGURE 2-10: FIRE BUTTON (S1 SWITCH)**



**FIGURE 2-11: JOYSTICK AND FIRE BUTTON CONNECTION SCHEMATIC**



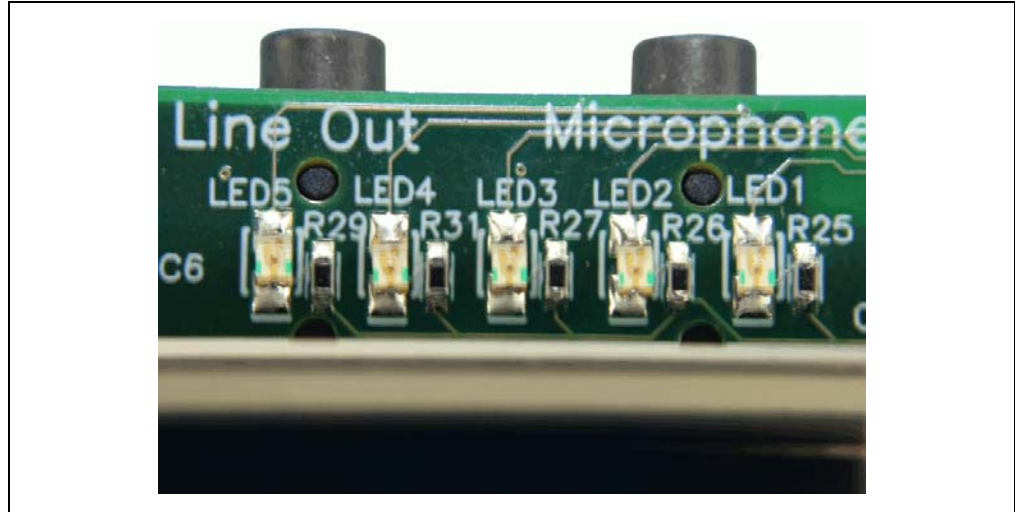
**TABLE 2-4: JOYSTICK AND FIRE BUTTON CONNECTIONS**

Joystick and Fire Button Pin Description	Expansion Connector Pin
Up	RB1/CN3
Down	RB3/CN5
Left	RB0/CN2
Right	RB4/CN6
Fire	RB15/CN12

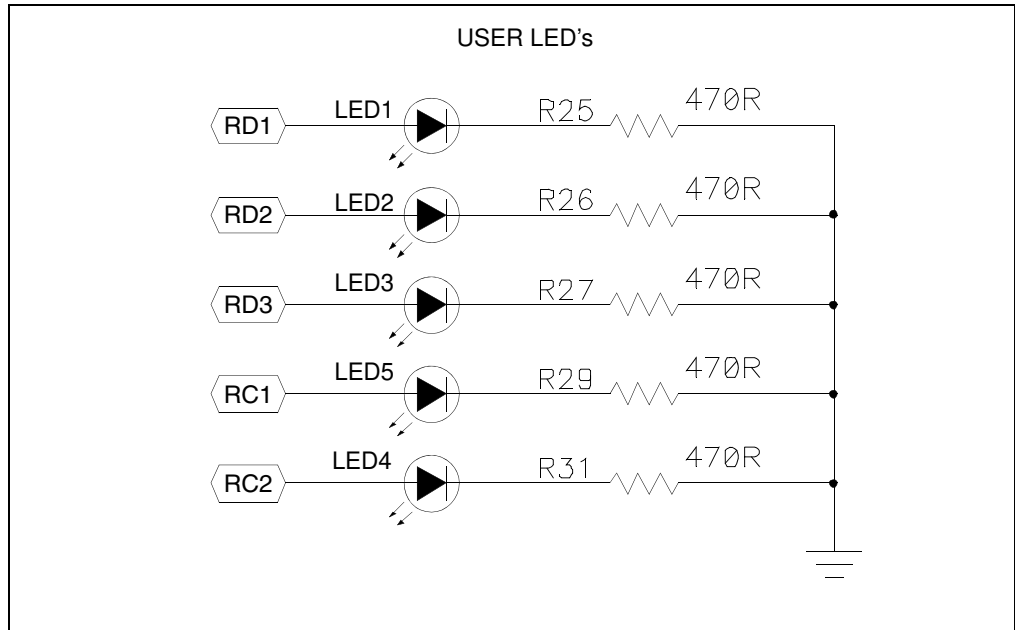
## 2.6 USER-CONTROLLED LEDS

The Multimedia Expansion Board provides five user-controlled LEDs, as shown in Figure 2-12.

**FIGURE 2-12: LEDS**



**FIGURE 2-13: LED CONNECTION SCHEMATIC**



**TABLE 2-5: LED CONNECTIONS**

LED Description	Expansion Connector Pin
LED 1	RD1
LED 2	RD2
LED 3	RD3
LED 4	RC1
LED 5	RC2