PIC18F4XK22 Development Board User's Guide

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PIC18F4XK22 DEVELOPMENT BOARD USER'S GUIDE

Table of Contents

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 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 PIC18F4XK22 Development Board. Items discussed in this chapter include:

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

DOCUMENT LAYOUT

This document describes how to use the PIC18F4XK22 Development Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. "PIC18F4XK22 Development Board Overview"** – Introduces the PIC18F4XK22 Development Board and provides a brief description of the hardware and the new features.
- **Chapter 2. "Troubleshooting"** – Describes the common problems of the PIC18F4XK22 Development Board and their solutions.
- **Appendix A. "Board Schematics"** – Provides schematic diagrams for the PIC18F4XK22 Development Board.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* 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	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending in the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available at the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use the PIC18F4XK22 Development Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

PIC18LF46K22 Data Sheet (DS41412)

This data sheet summarizes the features of the PIC18LF46K22. It provides essential information needed to develop software for this device.

MCP9700/9700A and MCP9701/9701A Data Sheet (DS21942)

This data sheet summarizes the features of the MCP9700/9700A and MCP9701/9701A. It provides essential information needed to develop software for these devices.

MCP6021/2/3/4 Data Sheet (DS21685)

This data sheet summarizes the features of the MCP6021/2/3/4. It provides essential information needed to develop software for these devices. The data sheet can be found at http://ww1.microchip.com/downloads/en/DeviceDoc/21685d.pdf.

25LC1024 Data Sheet (DS22064)

This data sheet summarizes the features of the 25LC1024. It provides essential information needed to develop software for this device.

THE MICROCHIP WEB SITE

Microchip provides online support via 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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To register, access the Microchip web site at www.microchip.com, click on 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; MPASM™ and MPLAB ASM30 assemblers; MPLINK™ and MPLAB LINK30 object linkers; and MPLIB™ and MPLAB LIB30 object librarians.
- **Emulators** – The latest information on Microchip in-circuit emulators.This includes the MPLAB ICE 2000 and MPLAB ICE 4000.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 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 SIM simulator, MPLAB IDE Project Manager and general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include the MPLAB PM3 and PRO MATE® II device programmers and the PICSTART® Plus and PICkit™ 1 development programmers.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- 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 (December 2011)

- Initial Release of this Document.

Chapter 1. PIC18F4XK22 Development Board Overview

The PIC18F4XK22 Development Board is a demonstration and development tool designed for those getting started with microcontrollers or those looking to migrate to the new PIC18(L)F4XK22/2XK22 family. The board is designed for general purpose applications and includes a variety of hardware to exercise microcontroller peripherals.

1.1 OVERVIEW

The PIC18(L)F4XK22/2XK22 is a new family of microcontrollers that take advantage of Microchip's latest process technology. Among the most notable of the new features are:

- lower power consumption
- high-performance operation and
- low-cost

Several firmware demos that showcase some of the features are included.

The hardware included on the board allows for development as well. The microcontroller that is populated on the board, the PIC18LF46K22, is the superset of the PIC18F4XK22/2XK22 family. Included on the board are various analog and digital circuitry used in microcontroller applications, in addition to a header which breaks out all signal lines for analysis or interfacing to external devices.

1.2 HIGHLIGHTS

This chapter discusses the features of the PIC18F4XK22 Development Board. Topics discussed include:

- PIC18F4XK22 Development Board Contents
- PIC18F4XK22 System Management Layout
- Powering the Demo Board
- Quick Start Guide
- Programming Lessons

1.3 PIC18F4XK22 DEVELOPMENT BOARD CONTENTS

The PIC18F4XK22 Development Board kit includes the following items:

- PIC18F4XK22 Development Board
- PIC18F4XK22 Development Board Quick Start Guide
- On-board PIC18LF46K22 device (pre-loaded with program demonstration)

If you are missing any part of the kit, please contact your nearest Microchip sales office listed on the back of this publication.

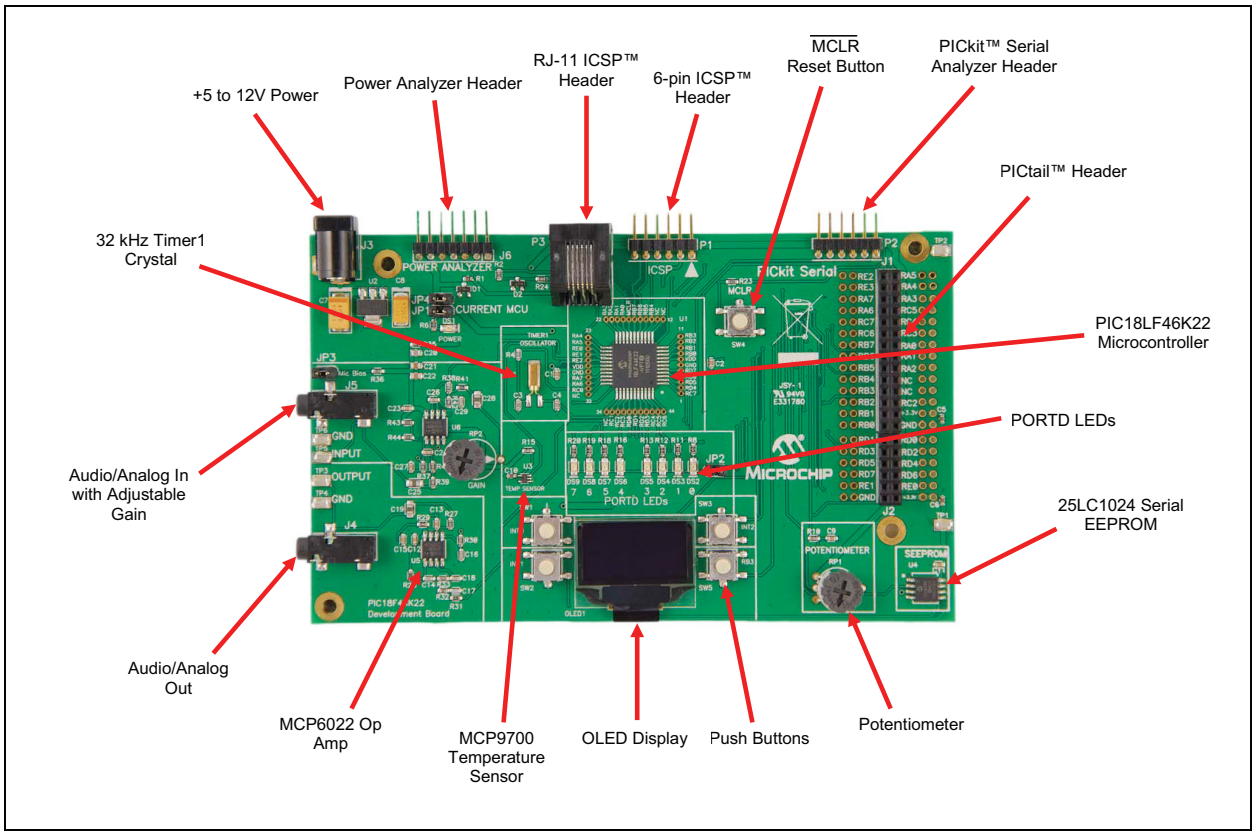
1.4 PIC18F4XK22 DEVELOPMENT BOARD LAYOUT

The PIC18F4XK22 Development Board is populated with a PIC18LF46K22 microcontroller. In addition, the board is also populated with the following features/components:

- 128x64 Organic LED Display (SPI)
- 32.768 kHz External Oscillator (Timer1)

- Analog Input Filtering and Gain Control into RE1 (1.4.1)
- PWM Output Filtering from RC2 (1.4.2)
- 4 Push Buttons for User Interfacing
- 1 $\overline{\text{MCLR}}$ Switch
- 8 LEDs mapped to PORTD
- Potentiometer
- 1024 KB Serial EEPROM
- PICtail™ Daughter Board Header (breaks out all pins)
- 6-Pin ICSP™ Programming Capability Header
- 6-Pin PICkit Serial Analyzer Interface
- Current Measurement Jumper
- RJ-11 ICSP Programming Header
- Power Analyzer Header

FIGURE 1-1: DEVELOPMENT BOARD LAYOUT



1.4.1 Analog Input Filtering Circuit

The analog filtering circuit is designed for use with an electret microphone. Electret microphones typically require biasing, which is provided by MIC bias jumper, JP3. The analog signal generated by a typical electret microphone has a peak-to-peak voltage in the single millivolts range. The analog filtering circuit has a maximum gain of 300, which can be controlled with the potentiometer labeled **GAIN** and is a 2nd order low-pass filter with a cut-off frequency of 5 kHz. Jumper JP3 needs to be removed if the analog input is provided by input test point.

1.4.2 PWM Filtering from RC2

The microcontroller output RC2 provides an active-low pass filter that can be used to generate analog signals. A high-frequency PWM output from RC2 can be pulse-width modulated to vary the amplitude of the output signal.

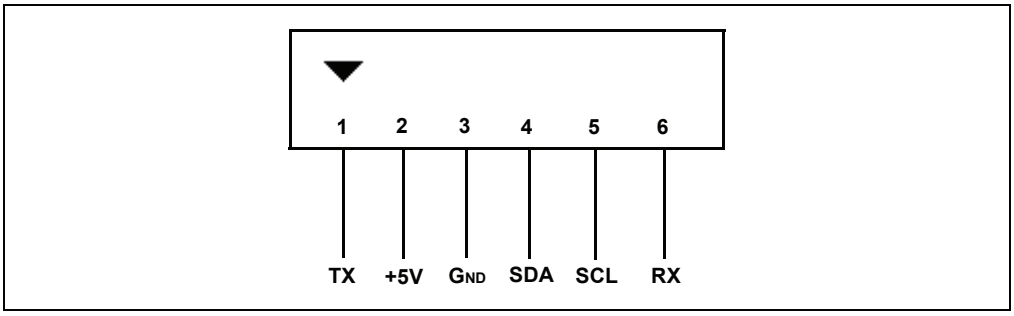
1.4.3 PICtail™ Daughter Board Interface

The PICtail daughter board interface breaks out each pin of the microcontroller in addition to providing +V_{DD} and ground. The header is designed to be compatible with existing PICtail daughter boards. Visit the Microchip web site to find more details on PICtail daughter boards.

1.4.4 PICkit™ Serial Analyzer Connector

The PICkit serial analyzer connector provides pins for serial communication. The serial communications lines are designed to be used with the PICkit serial analyzer, but are also provided for general purpose communications as well. The serial communications pinout is shown below:

FIGURE 1-2: SERIAL COMMUNICATIONS PINOUT



1.4.5 ICSP™ (In-Circuit Serial Programmer™) Connector

A 6-pin ICSP programming capability and RJ-11 connectors are provided for programming the microcontroller. The PIC18LF46K22 can be programmed and debugged through these connectors using Microchip In-Circuit Debuggers/Programmers.

Note:	The programming voltage on the microcontroller V_{PP} pin must be below 9V according to the programming specification. Protection circuitry (8.2V Zener with 820 Ohm series resistor) is in place to ensure that V_{PP} does not exceed programming specifications.

1.4.6 Temperature Sensor

An MCP9700 temperature sensor is located on the board. The MCP9700 is an analog temperature sensor that provides a linear voltage output versus temperature. The voltage output of the temperature sensor is connected to the RE1 pin of the microcontroller.

1.4.7 25LC1024 Serial EEPROM

A Microchip 1024 Kbit serial reprogrammable Flash memory with both Flash and byte-level serial EEPROM functions is provided.

The memory is accessed via a simple Serial Peripheral Interface (SPI) compatible serial bus. The bus signals are a clock input plus separate data in and data out lines. Access to the device is controlled by a Chip Select (CS) input on the microcontroller pin RA6.

1.4.8 32.768 kHz Crystal

The 32.768 kHz tuning fork crystal is interfaced to the RC0/T1OSO and RC1/T1OSI pins for use with the Timer1 peripheral.

1.4.9 128x64 OLED

The display provided on the development board is a 128x64 organic LED display. It interfaces to the microcontroller via Serial Peripheral Interface (SPI). The controller on the OLED is the SSD1306.

1.5 POWERING THE DEMO BOARD

The demonstration board can be powered in the following ways:

1. The board accepts a 2.5mm coaxial power connector in J3. Acceptable voltages range from +5 to 12 VDC.
2. Microchip In-Circuit Debuggers/Programmers can be used to provide power at connector P1 or P3. Do not exceed a voltage of 3.6 VDC or a current of 100 mA on the board if a debugger/programmer is being used to power the board.
3. The PICkit Serial Analyzer can be used to provide power at connector P2. Do not exceed a voltage of 3.6 VDC or a current of 100 mA on the board if the PICkit Serial Analyzer is being used to power the board.

1.6 QUICK START GUIDE

The PIC18F4XK22 Development Board is preloaded with demonstration firmware. The board must be configured as described in this section in order to use the demonstration programs.

Board Setup

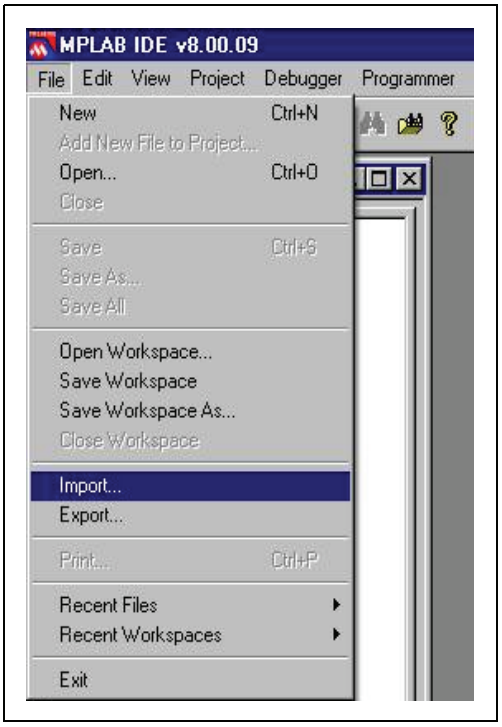
1. Close jumper JP1 labeled **Current MCU**, JP4, JP3 labeled **Mic Bias** and JP2.
2. Connect a +5 to 12V power supply to connector J3 in the upper left portion of the board.

1.6.1 Downloading Demonstration Software

The PIC18F4XK22 Development Board software package can be downloaded from www.microchip.com. It contains demonstration programs and hands-on programming lessons. Using a Microchip In-Circuit Debugger/Programmer, demonstration firmware can be downloaded onto the demo board and the board can be powered.

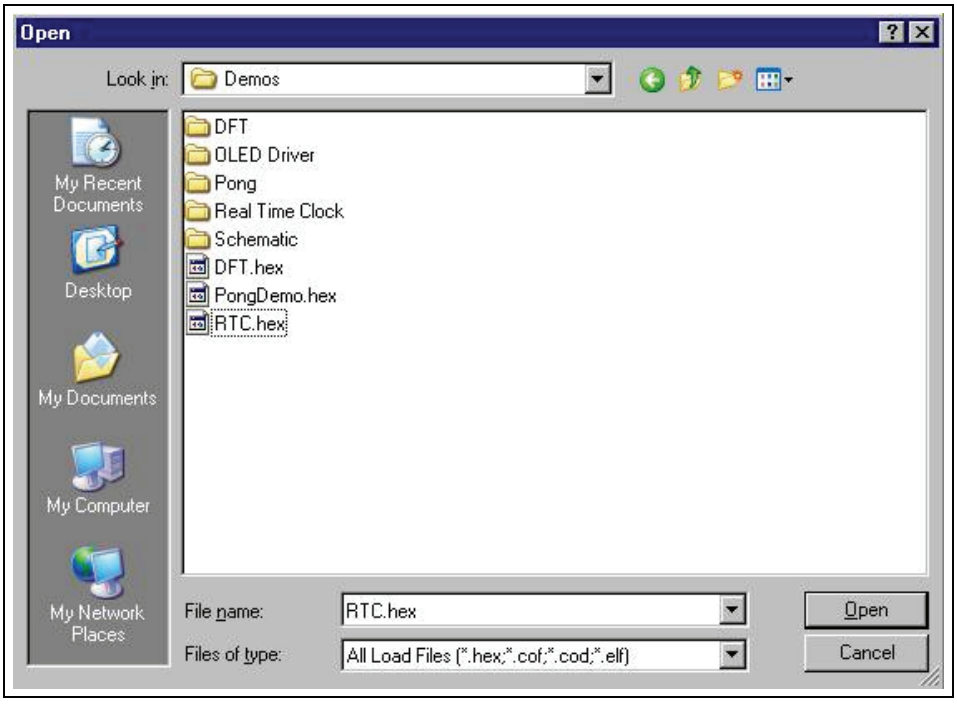
1. Download the PIC18F4XK22 Development Board software package from www.microchip.com/8bit.
2. Unzip the software package.
3. Connect a Microchip In-Circuit Debugger/Programmer to the development board connector P1 or P3.
4. Start the MPLAB IDE software.
5. Click **File** > **Import**.

FIGURE 1-3: IMPORT



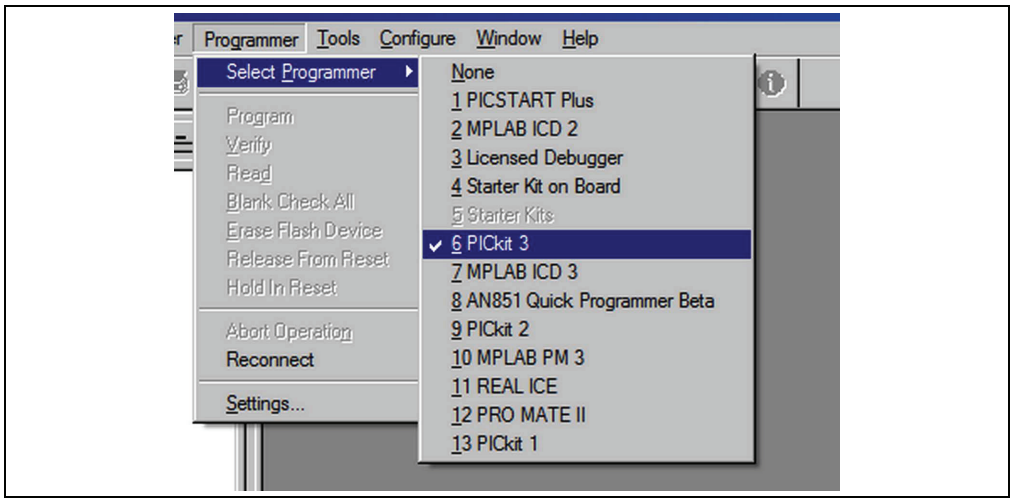
6. Browse to the *Demos* directory.
7. Select one of the several demos available (`readme.txt` in the *Demos* directory will describe each demo) and click **Open**:

FIGURE 1-4: DEMOS AVAILABLE



8. Click **Programmer** > Select **Programmer** and select your programmer:

FIGURE 1-5: SELECTING THE PROGRAMMER



9. To program, click **Programmer** > **Program**.
10. Click **Programmer** > **Release from Reset** to release the $\overline{\text{MCLR}}$ to run the program.

1.7 PROGRAMMING LESSONS

The PIC18F4XK22 software package includes a variety of programming lessons designed for use with the demonstration board. Download the PIC18F4XK22 software package from www.microchip.com/8bit and browse to the *Lessons* directory.

Chapter 2. Troubleshooting

2.1 INTRODUCTION

This chapter describes common problems when using the PIC18F4XK22 Development Board and their solutions.

2.1.1 The board does not power up.

Make sure that the green POWER LED has turned on. If the LED is not on, check to see that the +9V power supply is properly connected.

2.1.2 Microcontroller is not executing code.

First check to make sure that the microcontroller has been programmed with the firmware that is intended to run. If the part is programmed, ensure that the current jumpers JP1 and JP4 are in place.

2.1.3 The microcontroller will not program.

Check to make sure that the programmer/debugger is properly connected to the PC and powered. Make sure that the board is also powered with the +9V power supply. Programming can only occur when the current jumper, JP1, is connected.

NOTES:

Appendix A. Board Schematics

A.1 INTRODUCTION

This appendix contains the PIC18F4XK22 Development Board schematics, broken down into 5 sheets, as follows:

FIGURE A-1: PIC18F4XK22 DEVELOPMENT BOARD SCHEMATIC DIAGRAM (SHEET 1 OF 5)

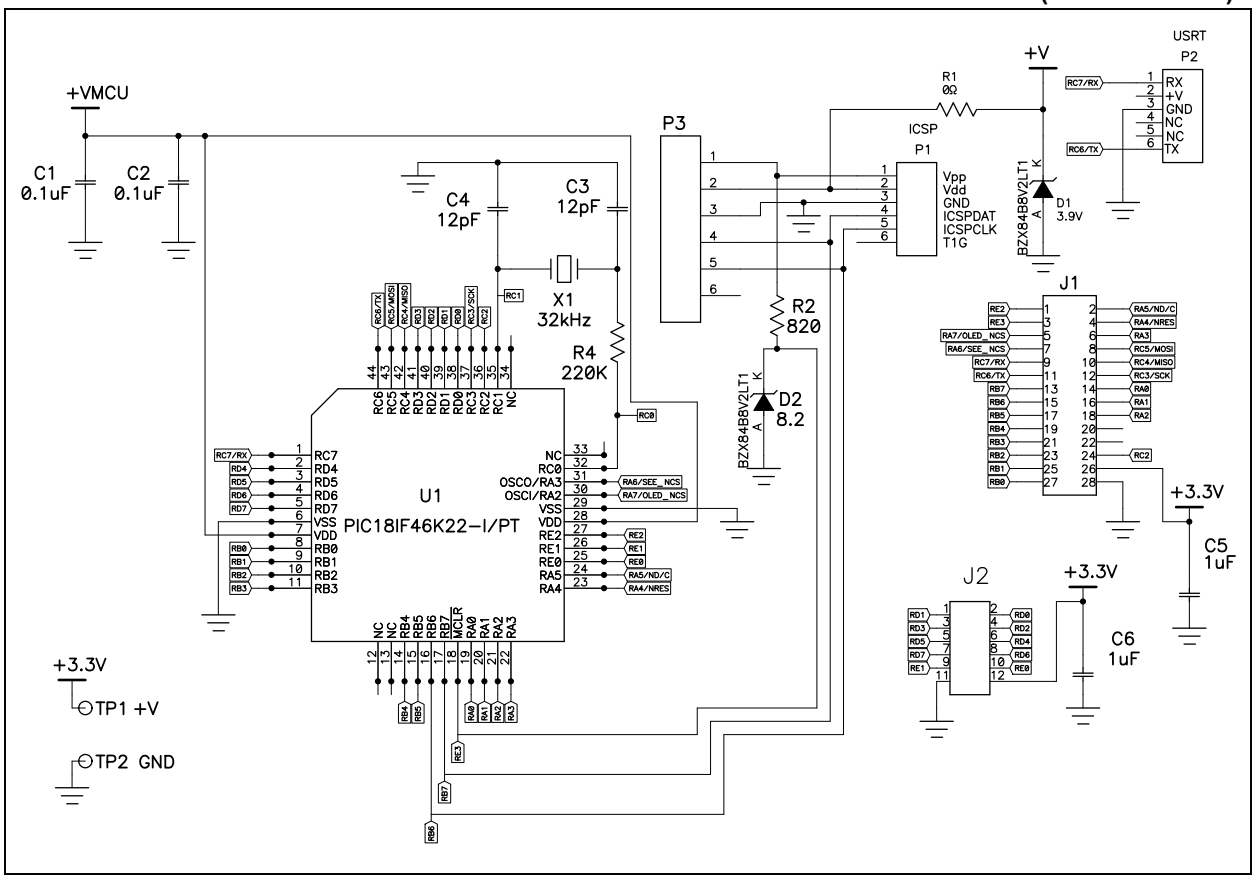


FIGURE A-2: PIC18F4XK22 DEVELOPMENT BOARD SCHEMATIC DIAGRAM (SHEET 2 OF 5)

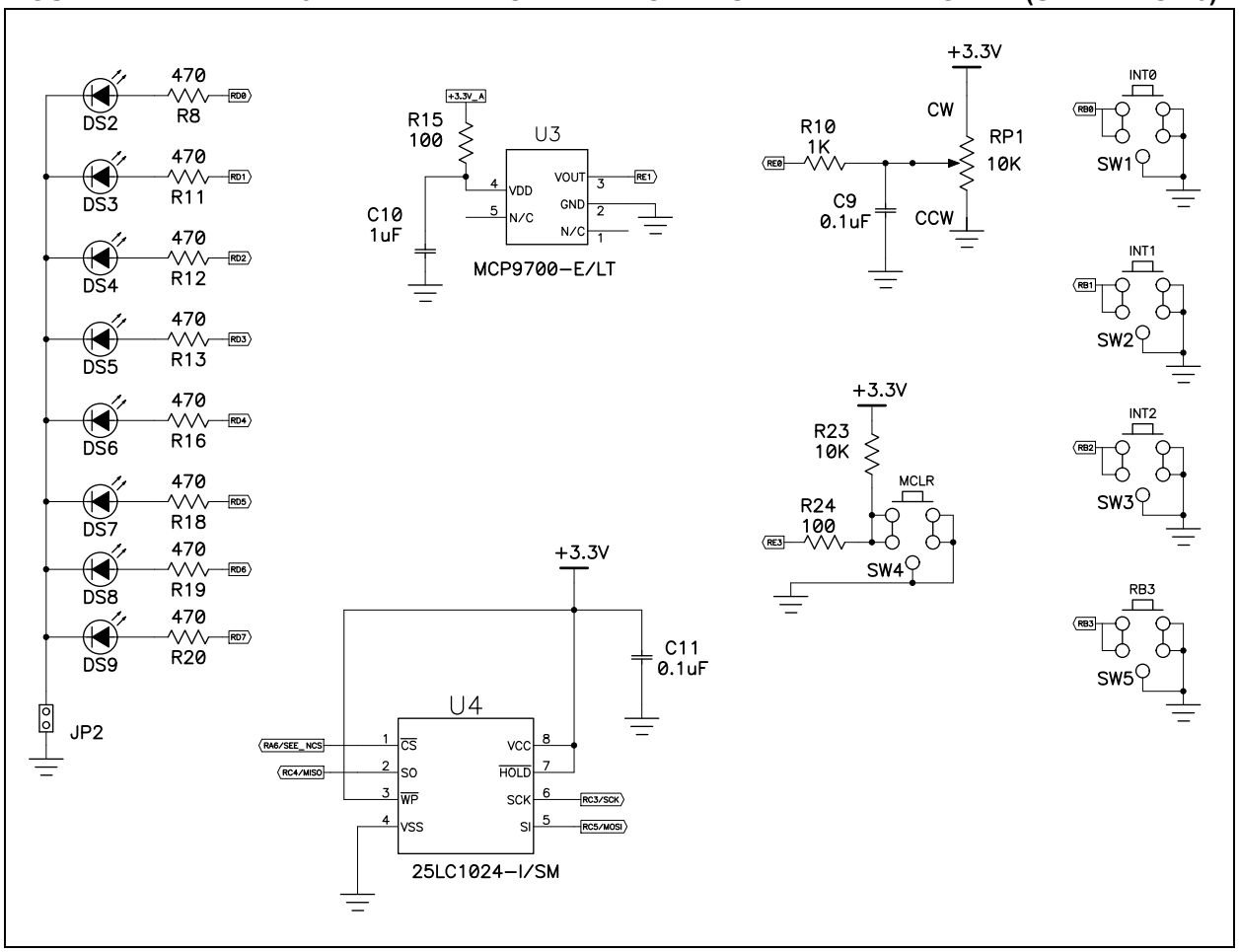


FIGURE A-3: PIC18F4XK22 DEVELOPMENT BOARD SCHEMATIC DIAGRAM (SHEET 3 OF 5)

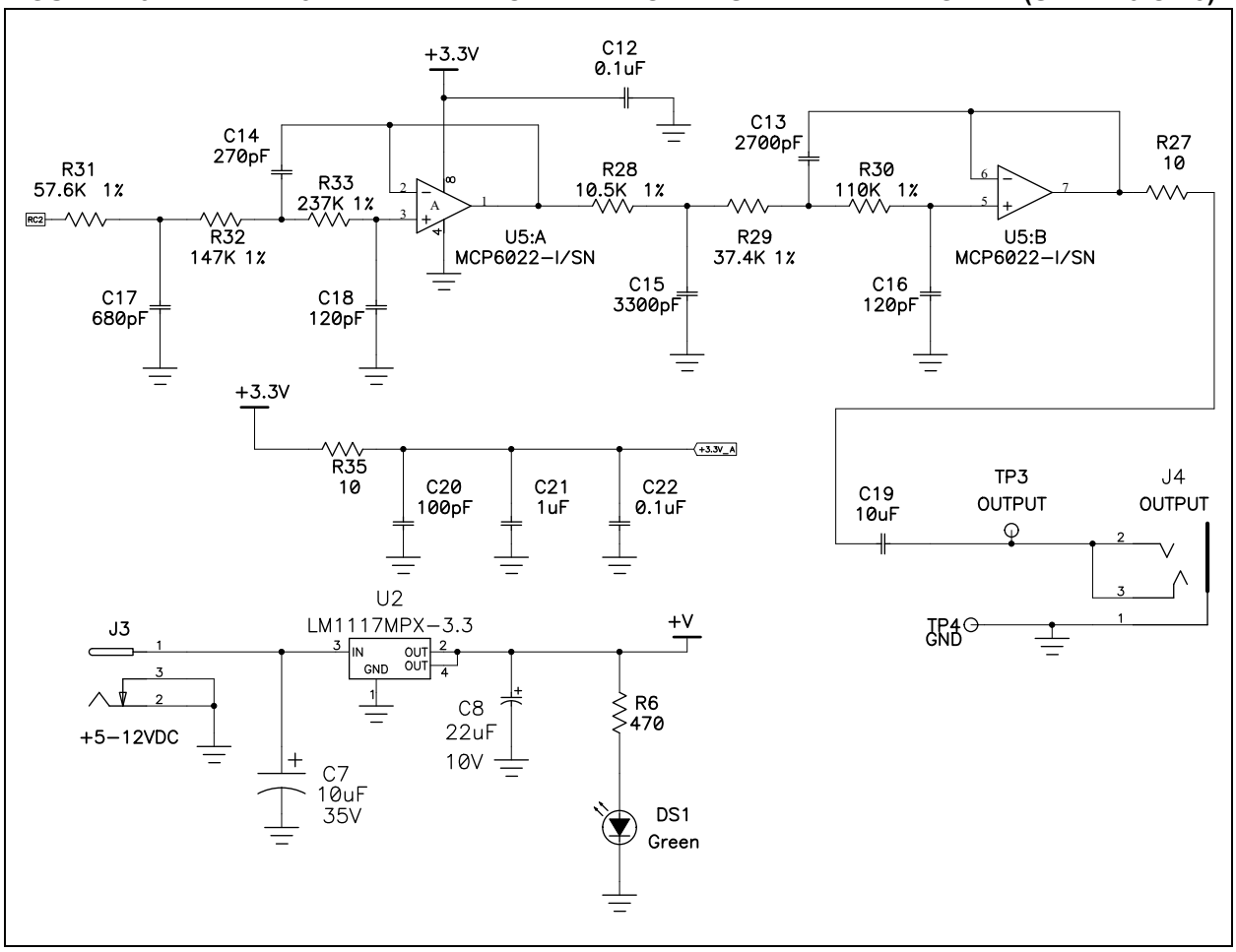


FIGURE A-4: PIC18F4XK22 DEVELOPMENT BOARD SCHEMATIC DIAGRAM (SHEET 4 OF 5)

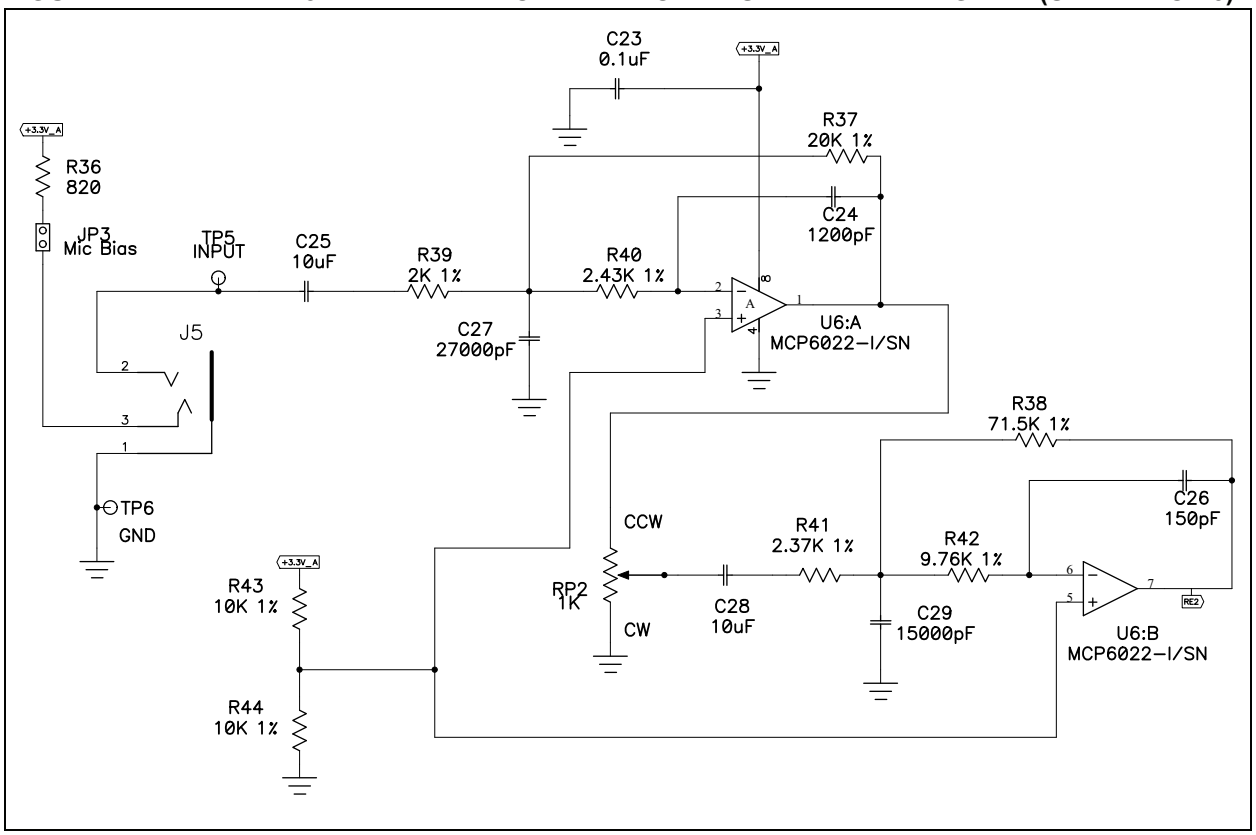
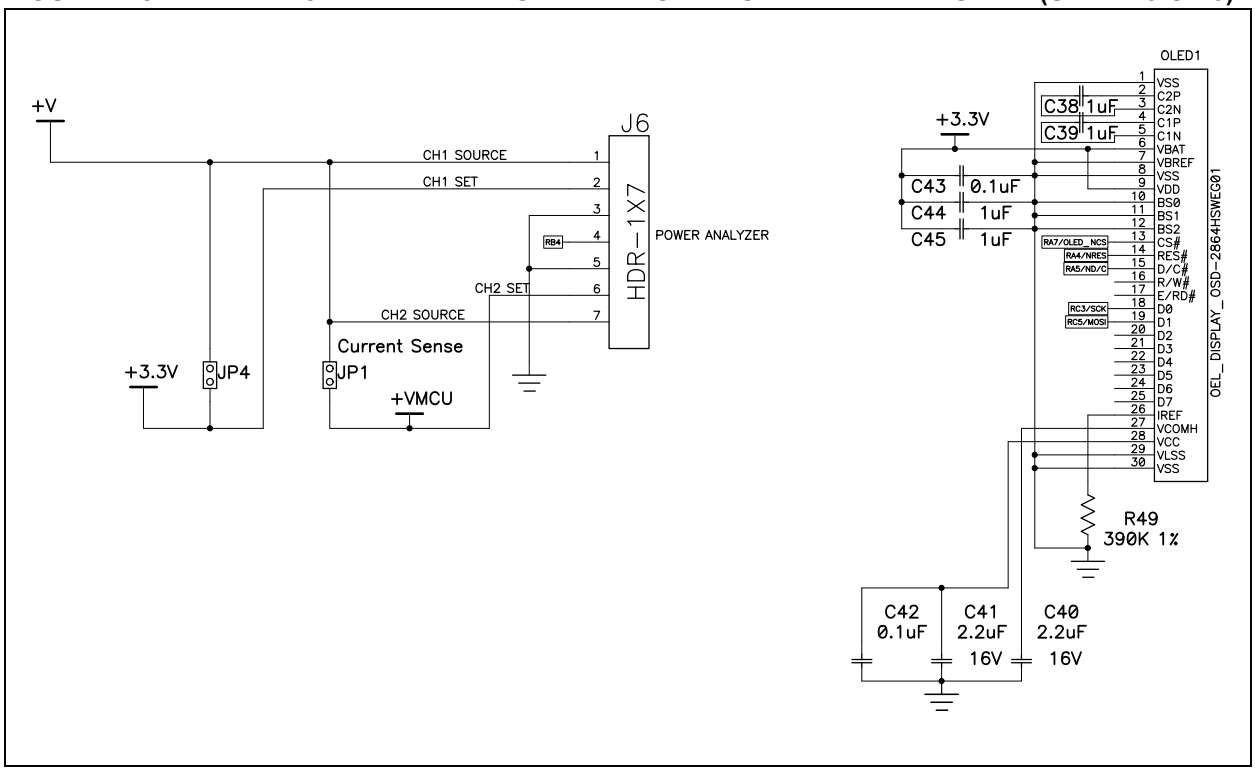


FIGURE A-5: PIC18F4XK22 DEVELOPMENT BOARD SCHEMATIC DIAGRAM (SHEET 5 OF 5)



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