



MICROCHIP

**PICDEM™ LCD 2
Demonstration Kit
User's Guide**

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, PIC³² logo, rfPIC and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.


FilterLab, Hampshire, HI-TECH C, Linear Active Thermistor, MXDEV, MXLAB, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, HI-TIDE, In-Circuit Serial Programming, ICSP, Mindi, MiWi, MPASM, MPLAB Certified logo, MPLIB, MPLINK, mTouch, Omniscient Code Generation, PICC, PICC-18, PICDEM, PICDEM.net, PICKit, PICtail, REAL ICE, rLAB, Select Mode, Total Endurance, TSHARC, UniWinDriver, WiperLock and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2010, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.

ISBN: 978-1-60932-686-9

Microchip received ISO/TS-16949:2002 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC[®] MCUs and dsPIC[®] DSCs, KEELOQ[®] code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

**QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
== ISO/TS 16949:2002 ==**



PICDEM™ LCD 2 DEMONSTRATION KIT USER'S GUIDE

Table of Contents

| | |
|--|-----------|
| Preface | 5 |
| Chapter 1. Introduction | |
| 1.1 Welcome | 11 |
| 1.2 PICDEM LCD 2 Demonstration Board Hardware Features | 12 |
| 1.3 Sample Devices | 13 |
| 1.4 Sample Programs | 13 |
| Chapter 2. Getting Started | |
| 2.1 PICDEM LCD 2 as a Stand-Alone Board – Preprogrammed Device | 15 |
| 2.2 PICDEM LCD 2 Used with an In-Circuit Emulator or In-Circuit Debugger ... | 16 |
| Chapter 3. Using the Demo Software | |
| 3.1 Demo Firmware Operation | 17 |
| Appendix A. Board Technical Information | |
| A.1 Processors | 25 |
| A.2 LCD Display | 26 |
| A.3 LED Display | 46 |
| A.4 Charge Pump and VLCAP | 46 |
| A.5 Resistive Ladder Versus Charge Pump | 46 |
| A.6 Oscillator Options | 47 |
| A.7 RS-232 Serial Port | 47 |
| A.8 Real-Time Clock | 47 |
| A.9 Serial EEPROM | 47 |
| A.10 Analog Input | 47 |
| A.11 Temperature Sensor | 48 |
| A.12 Switches | 48 |
| A.13 ICD Connector | 48 |
| A.14 Power Supply | 49 |
| A.15 Board Layout and Schematics | 52 |
| A.16 PIM Layout and Schematics | 56 |
| Worldwide Sales and Service | 66 |

PICDEM™ LCD 2 Demonstration Kit User's Guide

NOTES:



PICDEM™ LCD 2 DEMONSTRATION KIT USER'S GUIDE

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 “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 on-line help. Select the Help menu, and then Topics to open a list of available online help files.

The VL logo is a registered logo of Varitronix Limited. The illustrations on pages 26, 27, 31, 36, 39 and 45 are copyrighted materials of Varitronix and VL Electronics. Reprinted with permission.

INTRODUCTION

This chapter contains general information that will be useful to know before using the PICDEM™ LCD 2 Demonstration 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 PICDEM LCD 2 as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. “Introduction”** – Describes the hardware of the PICDEM LCD 2 Demonstration Board.
- **Chapter 2. “Getting Started”** – Describes how to use the PICDEM LCD 2 Demonstration Board.
- **Chapter 3. “Using the Demo Software”** – Describes how to use the application in Demo mode and also how it can be customized.
- **Appendix A. “Board Technical Information”** – Shows the schematic and layout diagrams for the PICDEM LCD 2 Demonstration Board.

PICDEM™ LCD 2 Demonstration Kit User's Guide

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

| Description | Represents | Examples |
|--|---|---|
| Arial font: | | |
| Italic characters | Referenced books | <i>MPLAB® 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>Save</i></u> |
| 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 | <i>file.o</i> , where <i>file</i> can be any valid filename |
| Square brackets [] | Optional arguments | mcc18 [options] <i>file</i> [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

For the latest information on using other tools, read the tool-specific Readme files in the Readmes 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 following documents are comprehensive references for Microchip's enhanced microcontrollers with LCD driver:

- "PIC18F85J90 Family Data Sheet" (DS39770)*
- "PIC18F87J90 Family Data Sheet" (DS39933)*
- "PIC18F6390/6490/8390/8490 Data Sheet" (DS39629)*
- "PIC16C9XX Data Sheet" (DS30444)*
- "PIC16C925/926 Data Sheet" (DS39544)*
- "PIC16F917/916/914/913 Data Sheet" (DS41250)*
- "PIC16F/LF1946/47 Data Sheet" (DS41414)*

PICDEM™ LCD 2 Demonstration Kit User's Guide

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
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

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 C (November 2010)

- Added device information for the PIC16F/LF1946/7.

PICDEM™ LCD 2 Demonstration Kit User's Guide

NOTES:



PICDEM™ LCD 2 DEMONSTRATION KIT USER'S GUIDE

Chapter 1. Introduction

1.1 WELCOME

Thank you for purchasing the PICDEM LCD 2 Demonstration Kit from Microchip Technology Incorporated. The PICDEM LCD 2 demonstrates the capabilities of the PIC18FXXJ90, PIC18FXX90, PIC16X9XX, and PIC16X19XX families of devices.

The PICDEM LCD 2 can be used stand-alone with a preprogrammed part, with an in-circuit emulator (e.g., MPLAB® ICE) or with an in-circuit debugger (e.g., MPLAB ICD 2). Sample programs are provided to demonstrate the unique features of the supported devices.

The PICDEM LCD 2 Demonstration Kit comes with the following:

1. PICDEM LCD 2 Demonstration Board (Figure 1-1)
2. Sample Plug-in Module (PIM)
3. CD-ROM which contains:
 - Sample Programs
 - *"PICDEM™ LCD 2 Demonstration Kit User's Guide"*

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

PICDEM™ LCD 2 Demonstration Kit User's Guide

1.2 PICDEM LCD 2 DEMONSTRATION BOARD HARDWARE FEATURES

The PICDEM LCD 2 Demonstration Board has the following hardware features; each feature's number corresponding to the number in Figure 1-1:

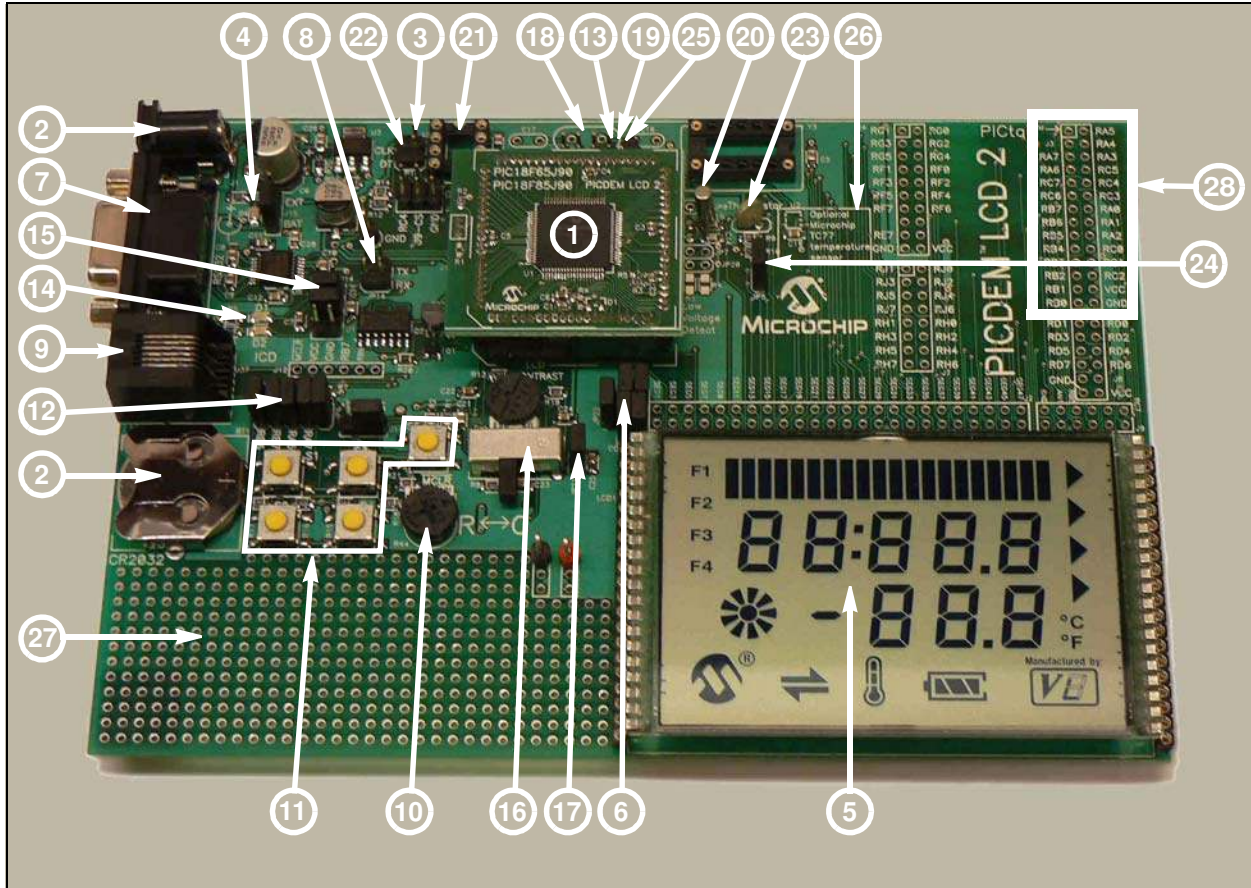
1. The demonstration board provides a daughter board option for the PIC18F85J90, PIC18F87J90, PIC18F8490, PIC16F914/917, PIC16F946, and PIC16F/LF1946/47 families of devices and MPLAB ICE. The board is also supplied with a PIM populated with a PIC18F85J90 device.

Note: Optional PIMs populated with PIC18FXX90, PIC18FXX90, PIC16F9XX, and PIC16X19XX devices are available for purchase from Microchip Direct (www.microchipdirect.com).

The MPLAB ICE can be plugged onto the board without any transition socket for PIC18FXX90 devices. For other devices, a transition socket may be needed.

2. On-board adjustable voltage regulator for direct input from 9V, 100 mA AC/DC wall adapter or 3V button cell battery.
3. Jumper J15 to select different power options.
4. Green power-on indicator LED for direct input from 9V.
5. Varitronix custom segmented LCD display.
6. Jumpers, COM0, COM1, COM2 and COM3, to disconnect COM pins from on-board LCD and allow the usage of any customized LCD glass.
7. RS-232 connection and associated hardware for direct connection to RS-232 interface.
8. Jumpers, JP13 and JP14, to disconnect TX and RX.
9. In-Circuit Debugger (ICD) connector.
10. R44, 10 k Ω , potentiometer for devices with analog inputs.
11. Five push button switches (S1 through S5) for external stimulus and Reset.
12. Jumpers, JP19, JP18, JP1 and JP2, to disconnect switches from RB6, RB7, RA6 and RA7 input pins.
13. Jumper, J11, to select either 10 k Ω (POT R44) or the S1-S4 switches to AN0 (RA0).
14. Two green LEDs connected to RC3 and RC4 (device dependent).
15. Jumpers in J14 to disconnect LEDs from RC3 and RC4.
16. A slide switch (S6) to select either the resistor ladder or the charge pump option for generating the bias values for the LCD pins.
17. Jumper, JP21, to physically tie the resistor ladder to ground.
18. Unpopulated holes provided for crystal connection.
19. Jumpers, JP11 and JP12, to disconnect crystal from OSC1 and OSC2.
20. 32.768 kHz crystal with Timer1 for Real-Time Clock (RTC) operation.
21. A Microwire EEPROM 93AA46C provided on a socket.
22. Jumpers, JP15 and JP16, to disconnect EEPROM from CK and DT. Jumper, J6, to connect CS to GND or to RC4 (device dependent). Jumper, J13, to select either 128 x 8 or 64 x 16 memory organization.
23. Thermistor for sensing temperature.
24. Jumper, JP5, to connect thermistor to AN1 (RA1) (device dependent).
25. Jumper, JP17, to select either Vcc or I/O to power the peripherals.
26. Unpopulated option for TC77 temperature sensor.
27. Prototype area for user hardware.
28. PICtail™ daughter board connection. (The pin names on the board are valid only for the PIC18F8490 device. For other devices, the PICtail daughter board pin connections may be different or not connected.)

FIGURE 1-1: PICDEM™ LCD 2 HARDWARE



1.3 SAMPLE DEVICES

A PIM, populated with the PIC18F85J90, is included.

1.4 SAMPLE PROGRAMS

The PICDEM LCD 2 Demonstration Kit includes a CD-ROM with sample demonstration programs. Depending on the device, these programs may be used with some of the included sample devices with an In-Circuit Emulator (ICE) or with an In-Circuit Debugger (ICD). For each type of device (PIC16F946, PIC16F917, PIC18F8490, PIC18F85J90, PIC18F87J90 and PIC16F/LF1946/47), demo source code, several C and/or .asm files and compiled code (one HEX file) are provided.

PICDEM™ LCD 2 Demonstration Kit User's Guide

NOTES:

Chapter 2. Getting Started

The PICDEM LCD 2 may be used as a stand-alone board with a preprogrammed device, with an In-Circuit Emulator (ICE) or with an In-Circuit Debugger (ICD). For a list of PIC® microcontroller compatible ICEs or ICDs, please refer to the *“Microchip Development Systems Ordering Guide”* (DS30177).

2.1 PICDEM LCD 2 AS A STAND-ALONE BOARD – PREPROGRAMMED DEVICE

The PICDEM LCD 2 may be demonstrated immediately by following the steps listed below:

- Apply power to the PICDEM LCD 2. For information on acceptable power sources, see **Appendix A. “Board Technical Information”**.

Note: In the event that the preprogrammed PICDEM LCD 2 Demonstration Board with the PIC18F85J90 PIM does not operate, check the following conditions:

- The jumper, J15, is configured as per the power supply used. The slide switch, S6, is switched to C.
- JP1, JP2, JP6, JP18 and JP19 are connected.
- The middle two jumpers of J14 are connected.
- JP9 and JP10 are connected.
- J11 connecting POT to AN0 and JP17 connecting Vcc to I/O.

The status of all other jumpers will not affect the preprogrammed demonstration.

Refer to Figure A-1 in **Appendix A. “Board Technical Information”**.

To reprogram the sample device, the following will be necessary:

1. User source code may be programmed to the device or the sample program may be restored from the file on the included CD-ROM.
2. An assembler, such as the MPASM™ Assembler (available with MPLAB IDE), or a compiler, such as MPLAB C18 C Compiler (PIC18XXXX/18XXJXX devices only) must be used.

Source code must be assembled or compiled into a HEX file before it can be programmed into the device. Microchip Technology’s MPASM Assembler or MPLAB C18 C Compiler may be used. Both are compatible with MPLAB IDE; however, other assemblers/compilers may be used.

3. Once the sample program is in the HEX file format, it can be programmed to a Flash device using an MPLAB ICD 2 or PM3 with an ICSP™ module. Microchip Technology’s MPLAB ICD 2 is compatible with MPLAB IDE.

If the code protection bit(s) have not been programmed, the on-chip program memory can be read out for verification purposes.

PICDEM™ LCD 2 Demonstration Kit User's Guide

2.2 PICDEM LCD 2 USED WITH AN IN-CIRCUIT EMULATOR OR IN-CIRCUIT DEBUGGER

To use the PICDEM LCD 2 with an In-Circuit Emulator (ICE) or In-Circuit Debugger (ICD), refer to the tool's user's guide for instructions on how to power-up and configure the ICE/ICD, as well as how to connect to target boards.

Configure the PICDEM LCD 2 for the desired oscillator as described in Table 2-1. Refer to the ICE/ICD user's guide for any oscillator configuration requirements.

TABLE 2-1: OSCILLATOR SELECTION

| Oscillator Selection on PICDEM™ LCD 2 | Modification on PICDEM™ LCD 2 |
|--|---|
| Crystal | JP9 and JP10 not connected. No canned oscillator on board, crystal in Y2, JP11 and JP12 connected, caps in C16 and C17. |
| Canned Oscillator | Put canned oscillator on socket Y3. Y2 empty, JP9, JP11 and JP12 not connected. |
| Device Internal Oscillator | JP11 and JP12 not connected. No canned oscillator on board. |
| Ceramic Resonator – no internal caps | JP9 and JP10 not connected. No canned oscillator on board, resonator in Y2, JP11 and JP12 connected, caps in C16 and C17. |
| Ceramic Resonator – with internal caps | JP9 and JP10 not connected. No canned oscillator on board, resonator in Y2, JP11 and JP12 connected, C16 and C17 empty. |

Note: The MPLAB ICE can be plugged onto the board without any transition socket for PIC18FXX90 devices. For other devices, a transition socket may be needed.

Chapter 3. Using the Demo Software

The demo programs are preprogrammed into the sample devices. Also, this program is included on the CD-ROM program disk for user reference. This demo program uses the functions or macros provided by the firmware LCD driver module to display the required characters, strings or icons on the LCD.

3.1 DEMO FIRMWARE OPERATION

The demo firmware is made up of four components, which are individually displayed on the LCD. The PIC microcontroller's internal RC oscillator is used as the system clock source.

1. **Voltmeter (F1)**

This mode uses the A/D module to measure the voltage of the R44 pot through analog channel AN0, and displays a voltage between 0.00V and 3.30V on the LCD using the LCD module. Voltage is continually updated until the mode is exited by pressing either the S1 or S2 switch.

2. **Thermometer (F2)**

This mode uses the A/D module to measure the voltage of the thermistor R11 through analog channel AN1, and converts to temperature both in Celsius and Fahrenheit and displays the temperature on the LCD using the LCD module. Temperature is continually updated until the mode is exited by pressing either the S1 or S2 switch.

3. **Clock (F3)⁽¹⁾**

This mode uses the Timer1 module and a 32 kHz clock crystal. Once this mode is entered from the main menu, the Real-Time Clock will start counting from 00:00:00. The S3 switch is used to increment minutes and the S4 switch is used to increment hours. To perform the increment operations, press and hold the switches. The clock keeps running continuously until the mode is exited by pressing either the S1 or S2 switch.

4. **Charge Pump and Software Contrast (F4)⁽¹⁾**

This mode is available only for the PIC18F85J90 and PIC18F87J90 families of devices and uses the on-board charge pump and LCD voltage regulator. The LCD module is configured in Charge Pump mode and software contrast is achieved by either pressing S3 to increase the contrast or S4 to decrease the contrast until the mode is exited by pressing either the S1 or S2 switch. By exiting this mode, the Voltmeter mode is entered and retains the contrast level.

Note 1: For low-power battery operation in JP17, remove jumper on Vcc and I/O and connect I/O and RB0.

PICDEM™ LCD 2 Demonstration Kit User's Guide

FIGURE 3-1: DEMO PROGRAM FLOWCHART

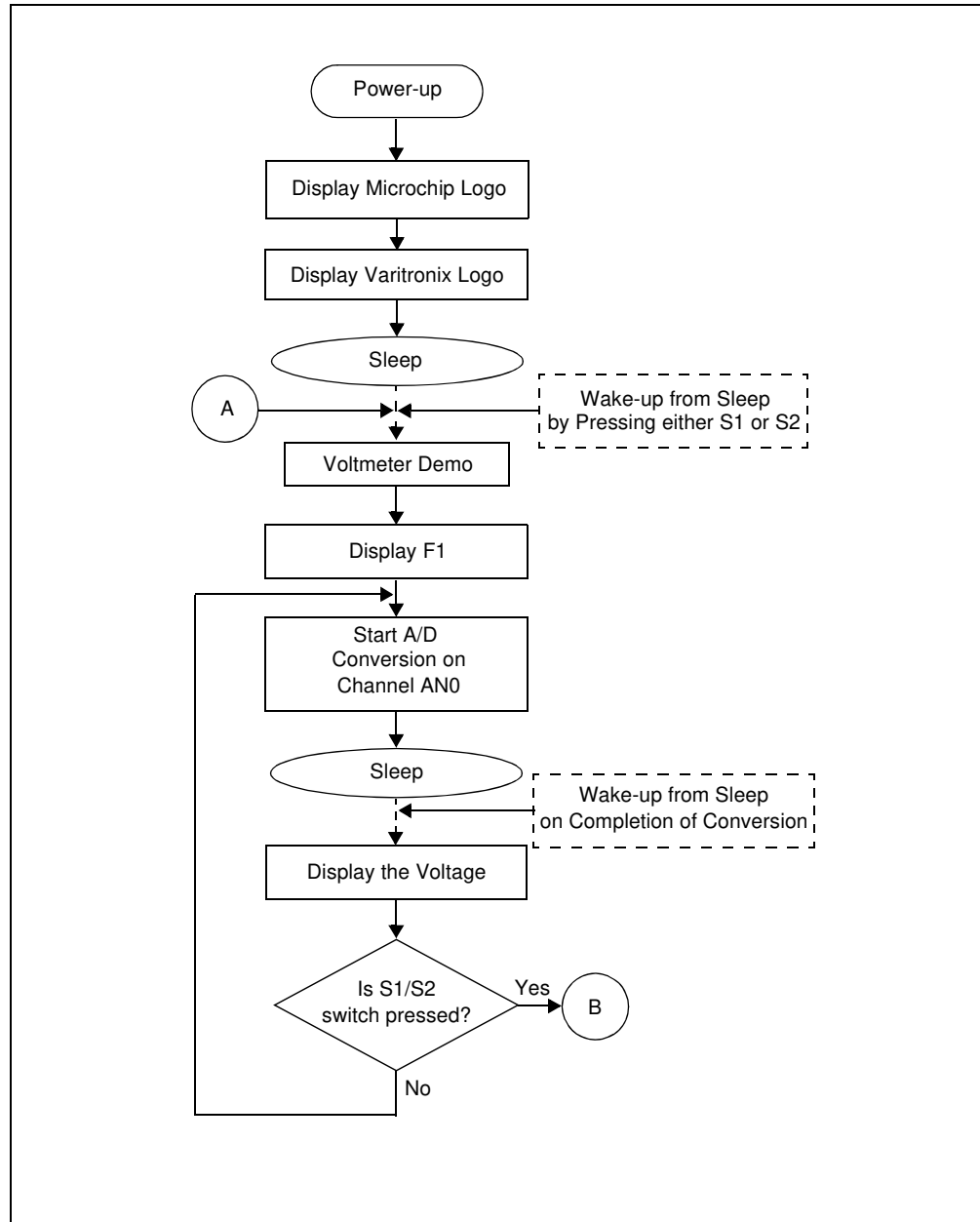


FIGURE 3-2: DEMO PROGRAM FLOWCHART

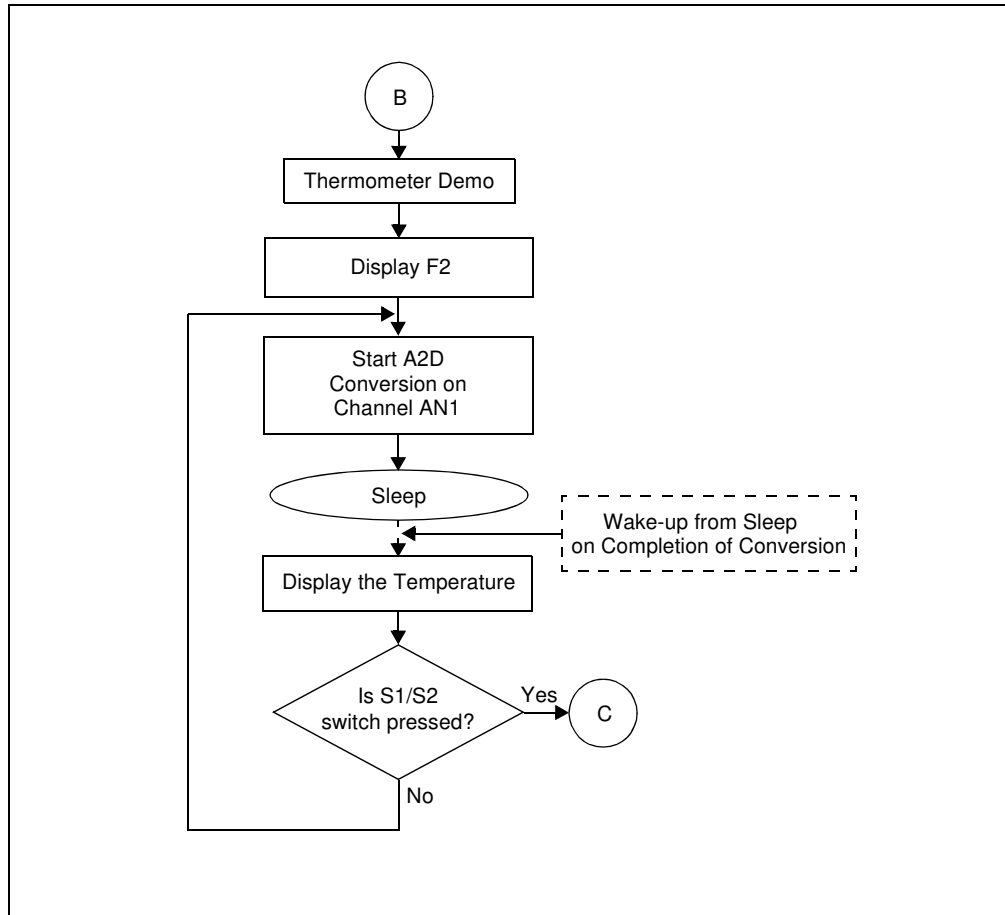


FIGURE 3-3: DEMO PROGRAM FLOWCHART

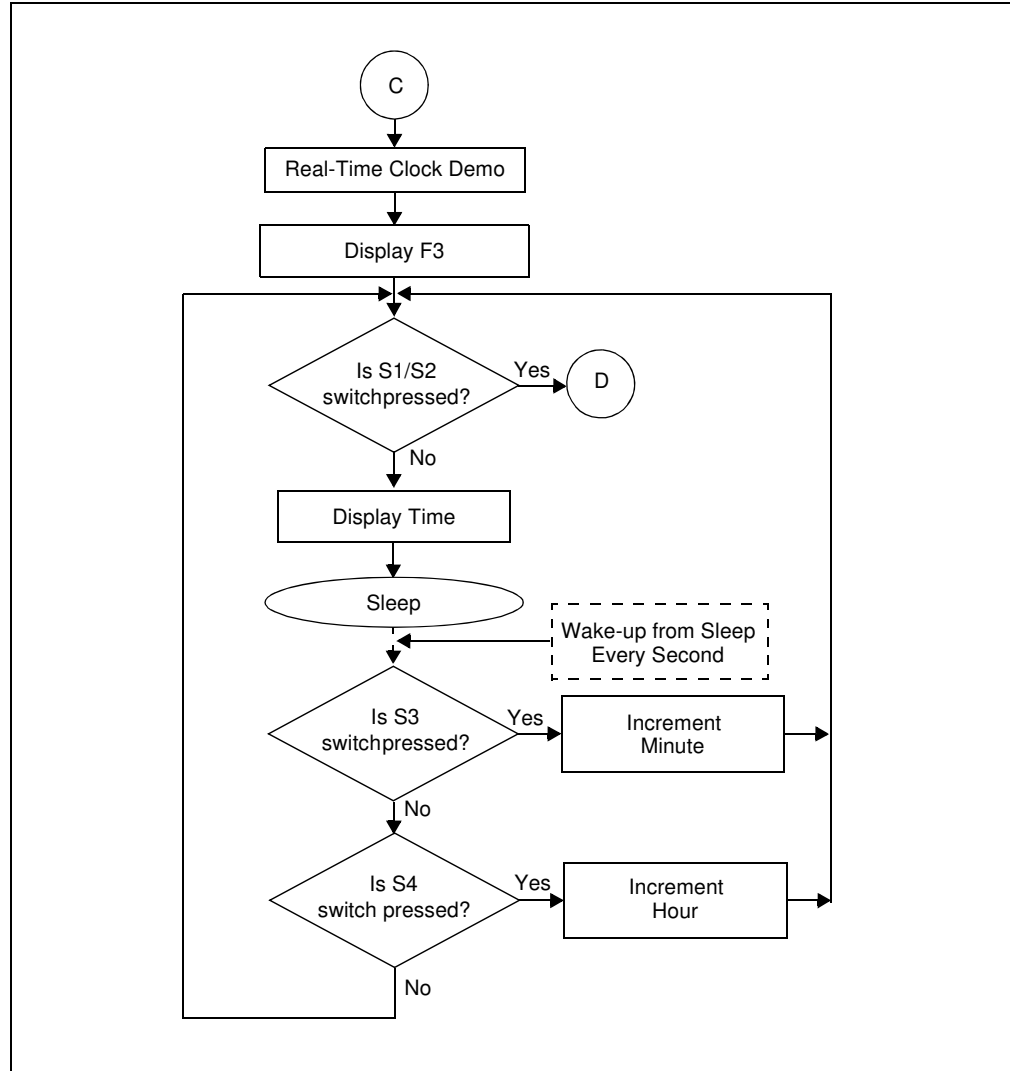


FIGURE 3-4: DEMO PROGRAM FLOWCHART

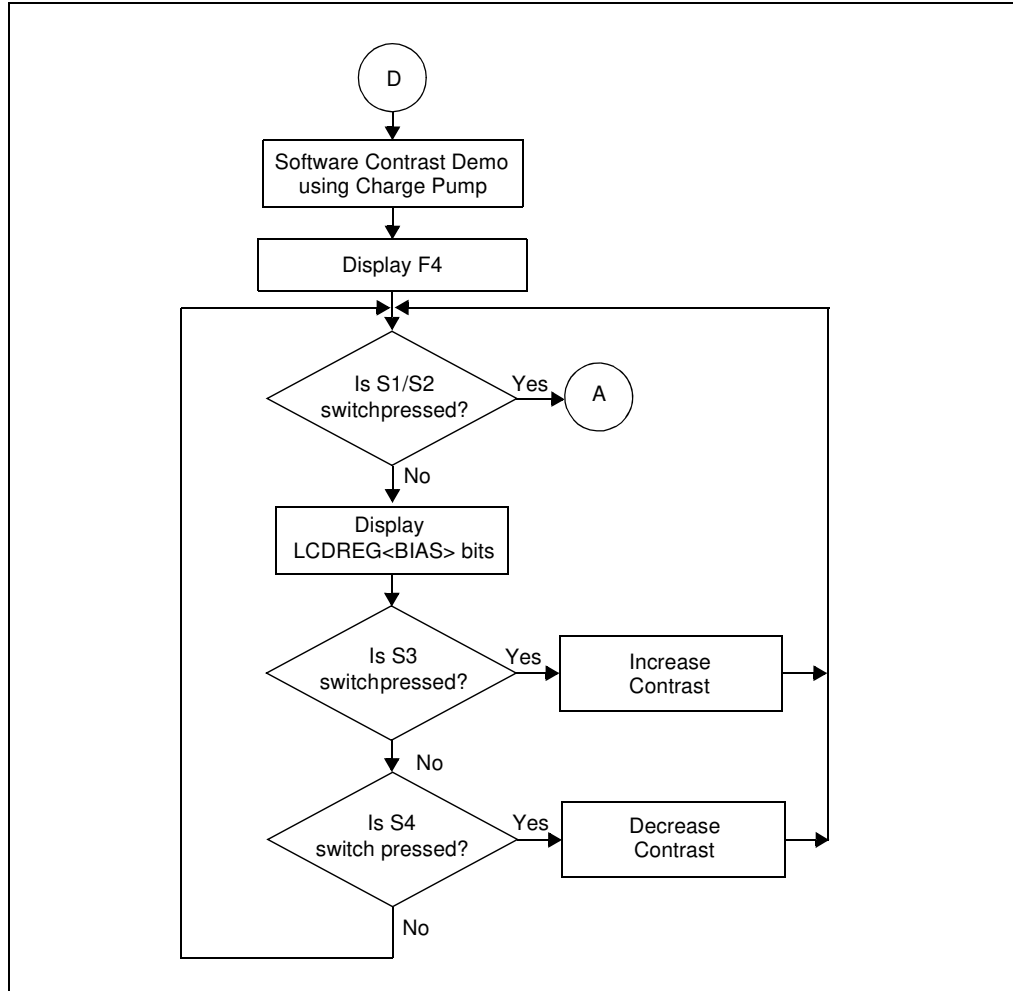
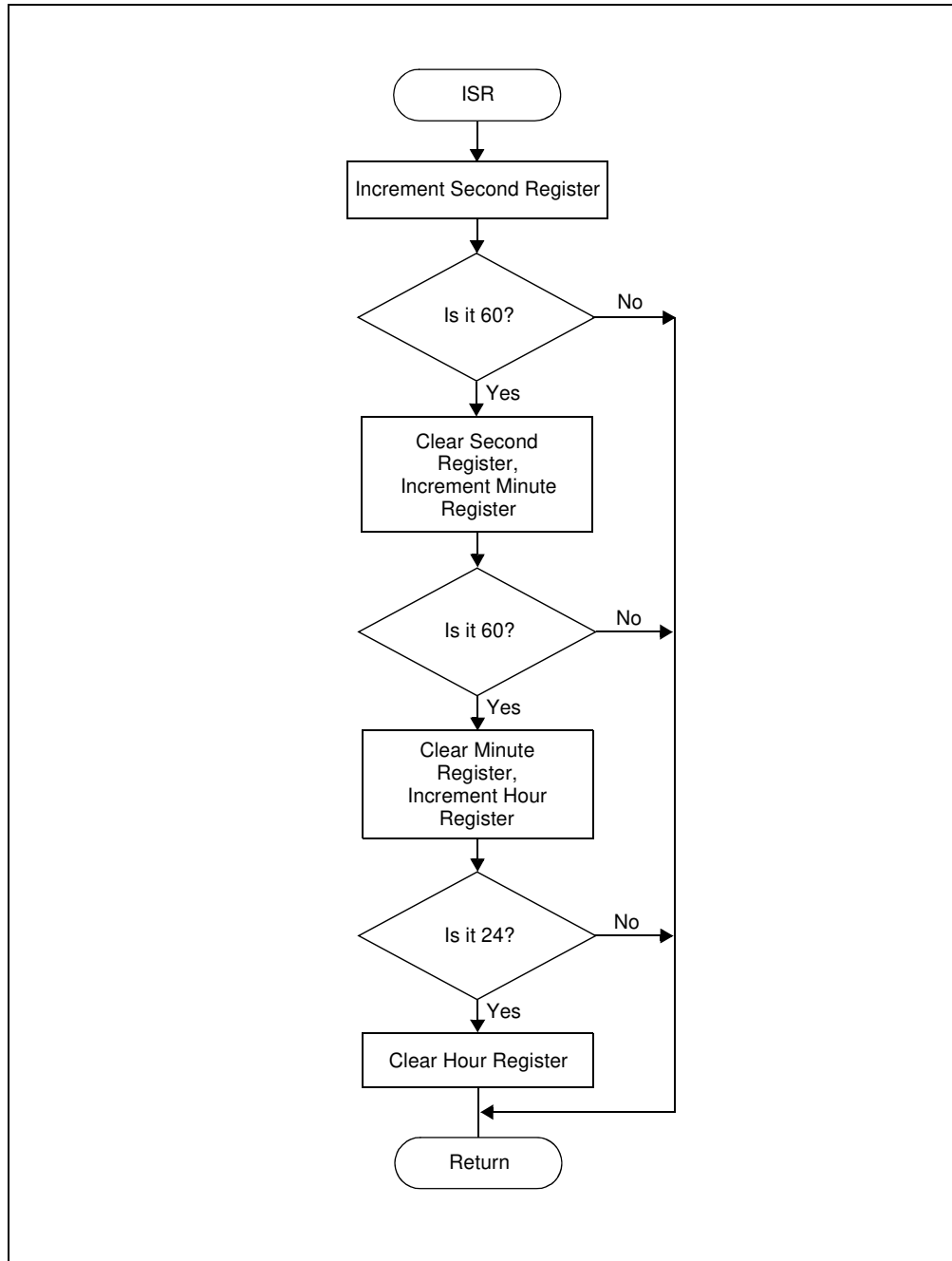


FIGURE 3-5: DEMO PROGRAM FLOWCHART





PICDEM™ LCD 2 DEMONSTRATION KIT USER'S GUIDE

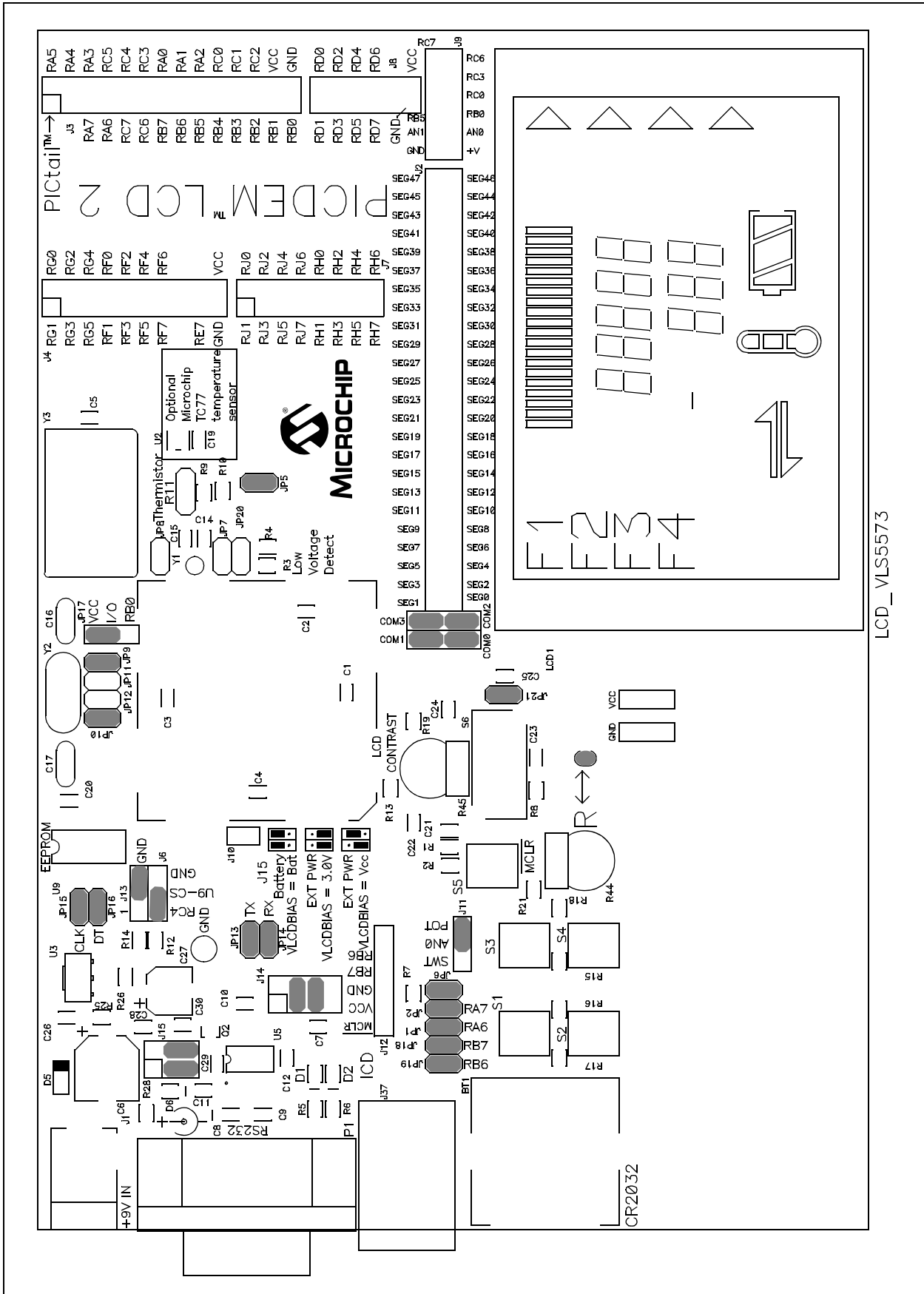
Appendix A. Board Technical Information

The PICDEM™ LCD 2 hardware is not complicated and is intended to illustrate the ease of use of various PIC® microcontrollers. The PICDEM LCD 2 features the following hardware elements.

Note: Many of the following hardware sections will require specific demo board jumper configurations. If a jumper is not listed in a particular section, then that jumper has no effect on the circuitry within the hardware section you are working. Figure A-1 shows a diagram of the PICDEM LCD 2 silkscreen with all necessary jumpers highlighted in gray. Also, refer to the schematic for circuit connections.

PICDEM™ LCD 2 Demonstration Kit User's Guide

FIGURE A-1: PICDEM™ LCD 2 DEFAULT JUMPER LOCATION



LCD_VLS5573

A.1 PROCESSORS

While there is no actual processor populated on the board, a processor is provided with the plug-in module (PIM) that is shipped with the demonstration board. The default processor on the PIM is the PIC18F85J90.

The board also supports the PIC18F87J90, PIC18F8490, PIC16F946, PIC16F917, and PIC16F/LF1946/47 processors, which have been designed for use with the PICDEM LCD 2. These three processors are in the PICDEM LCD 2 PIM Pack which is available for separate purchase.

The part numbers for a replacement PIC18F85J90 and the PIM pack are given in Table A-1.

TABLE A-1: PART NUMBERS(†)

| Item | Part number |
|--|-------------|
| PICDEM LCD 2 PIM Pack <ul style="list-style-type: none">• PIC18F8490 PIM• PIC16F946 PIM• PIC16F917 PIM | MA180019 |
| PIC18F85J90 PIM | MA180022 |
| PIC16F1946/7 PIM | MA160016 |
| PIC16LF1946/7 PIM | MA160015 |

† For the availability and pricing of parts, go to www.microchipdirect.com.

Note: The PIC16LF1946/7 PIM (MA160015) is limited to a maximum of 3.3V operating voltage.

PICDEM™ LCD 2 Demonstration Kit User's Guide

A.2 LCD DISPLAY

A custom-made segmented LCD glass, manufactured by the Varitronix Corporation, is provided as shown in Figure A-2. This LCD has 4 commons and 32 segments. Table A-2 provides a few of the specifics for the display. Refer to the Varitronix specification sheet (VL_5573_V00) for additional details.

FIGURE A-2: PICDEM™ LCD 2 DISPLAY

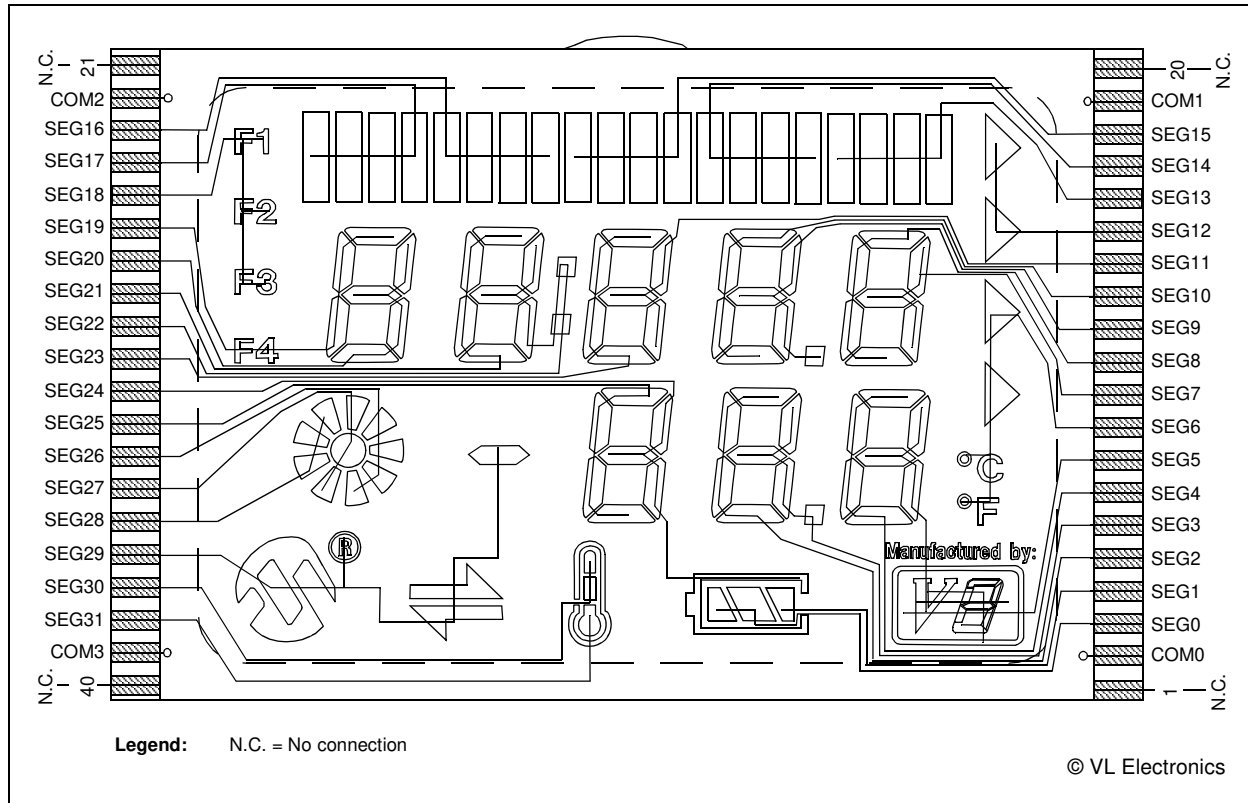


TABLE A-2: LCD GLASS SPECIFICATIONS

| Type | Specification |
|-----------------------|------------------------|
| P.I.D. | VL_5573_V00 |
| Mode/Color/Type | Positive / -- / TN |
| Viewing Direction | 6:00 O'Clock |
| Driving Scheme | 1/4 Duty, 1/3 Bias |
| Drive Voltage (VLCD) | ~3.0 Volt (p-p), +20°C |
| Operating Temperature | 0°C - +50°C |
| Storage Temperature | -10°C - +60°C |
| Polarizer – Front | STD.Transmissive |
| Polarizer – Back | STD.Reflective |

Since the glass used on the PICDEM LCD 2 operates at 3V, there is a voltage protection circuit on the LCDBIAS3 pin, which is enabled in the default configuration. When enabled, even if the VDD is greater than 3V, it regulates the LCDBIAS3 voltage such that it always maintains the value to 3V. This is not necessary for operation of the LCD module, but it is a protection circuit to prevent accidentally applying voltages higher than 3V to the LCD glass present on the board.

FIGURE A-3: DISPLAY DEFINITIONS

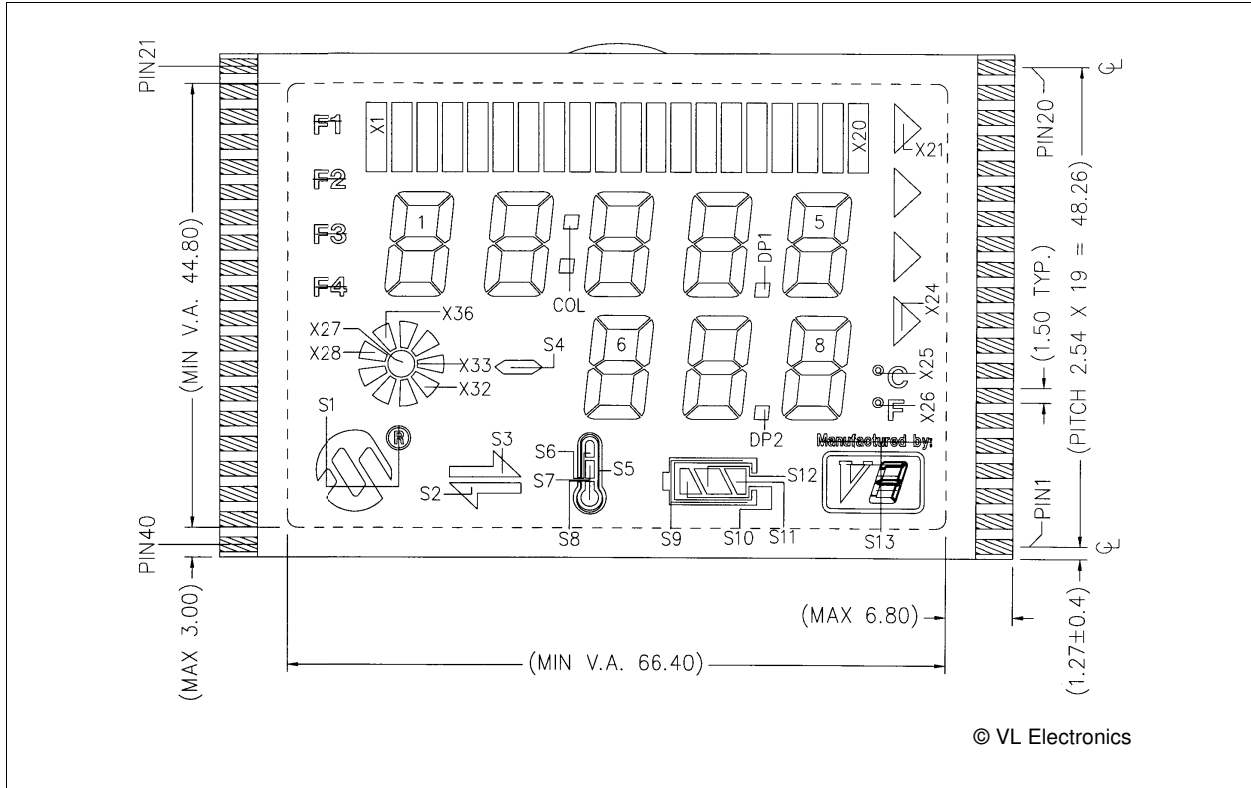
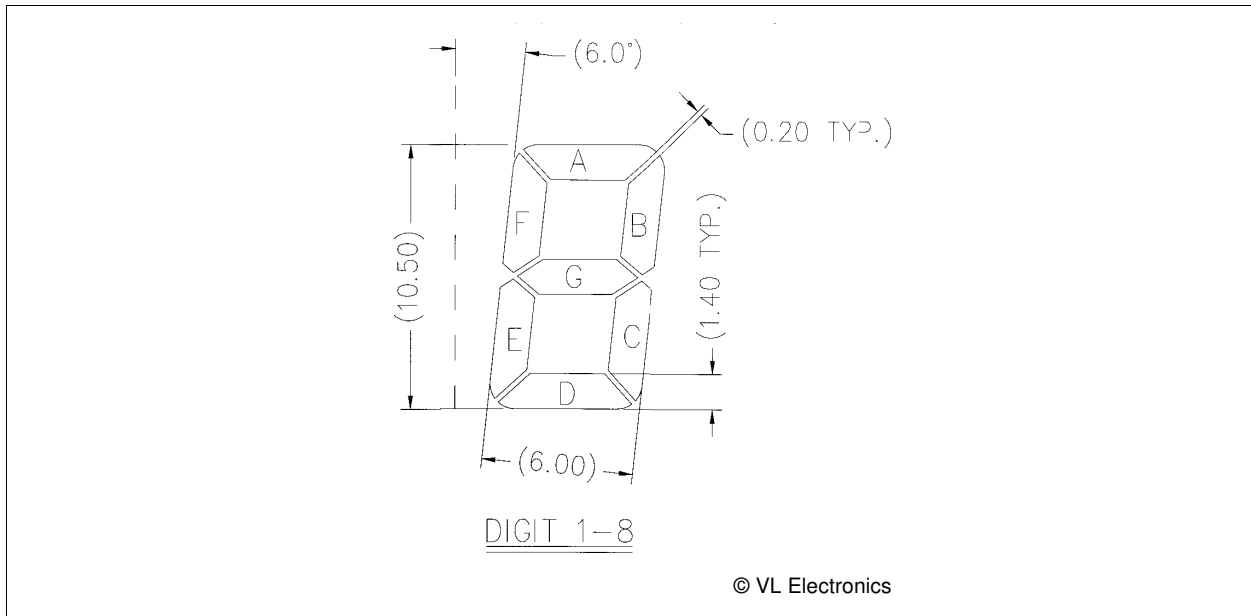


FIGURE A-4: DIGIT DESCRIPTION



PICDEM™ LCD 2 Demonstration Kit User's Guide

TABLE A-3: LCD SEGx AND COMx

| Pin | ICE Pin | COM0 | COM1 | COM2 | COM3 |
|-----|---------|------|------|------|------|
| 1 | | N.C. | N.C. | N.C. | N.C. |
| 2 | | COM0 | — | — | — |
| 3 | SEG0 | S12 | — | — | S10 |
| 4 | SEG1 | S11 | — | — | — |
| 5 | SEG2 | 7D | 7F | 7A | 7E |
| 6 | SEG3 | DP2 | 7G | 7B | 7C |
| 7 | SEG4 | 8D | 8F | 8A | 8E |
| 8 | SEG5 | S13 | 8G | 8B | 8C |
| 9 | SEG6 | X23 | X25 | X26 | X24 |
| 10 | SEG7 | 5B | 5C | — | 5G |
| 11 | SEG8 | 5A | 5E | 5D | 5F |
| 12 | SEG9 | 4B | 4C | DP1 | 4G |
| 13 | SEG10 | 4A | 4E | 4D | 4F |
| 14 | SEG11 | 3B | 3C | — | 3G |
| 15 | SEG12 | — | X22 | X21 | — |
| 16 | SEG13 | X17 | X19 | X20 | X18 |
| 17 | SEG14 | X16 | X14 | X13 | X15 |
| 18 | SEG15 | X9 | X11 | X12 | X10 |
| 19 | | — | COM1 | — | — |
| 20 | | N.C. | N.C. | N.C. | N.C. |
| 21 | | N.C. | N.C. | N.C. | N.C. |
| 22 | | — | — | COM2 | — |
| 23 | SEG16 | X8 | X6 | X5 | X7 |
| 24 | SEG17 | X1 | X3 | X4 | X2 |
| 25 | SEG18 | — | F2 | F1 | F3 |
| 26 | SEG19 | 1A | 1E | F4 | 1F |
| 27 | SEG20 | 1B | 1C | 1D | 1G |
| 28 | SEG21 | 2A | 2E | 2D | 2F |
| 29 | SEG22 | 2B | 2C | COL | 2G |
| 30 | SEG23 | 3A | 3E | 3D | 3F |
| 31 | SEG24 | S9 | 6G | 6B | 6C |
| 32 | SEG25 | 6D | 6F | 6A | 6E |
| 33 | SEG26 | X31 | X33 | X34 | X32 |
| 34 | SEG27 | — | X27 | X35 | X30 |
| 35 | SEG28 | — | X28 | X36 | X29 |
| 36 | SEG29 | S1 | S3 | S4 | S2 |
| 37 | SEG30 | S6 | — | — | S7 |
| 38 | SEG31 | S5 | — | — | S8 |
| 39 | | — | — | — | COM3 |
| 40 | | N.C. | N.C. | N.C. | N.C. |

Legend: N.C. = No connection

Board Technical Information

A.2.1 Device-Specific LCD Segment Configuration

The following figures and tables detail which segments are available for specific PIC® devices.

TABLE A-4: PIC18F85J90 PIM AND ICE PIN/PORT COMPARISON

| PIC18F85J90 PIM Pin No. | PIC18F85J90 Port | PIC18F85J90 Pin | ICE Pin | ICE Port | ICE Pin No. | PIC18F85J90 PIM Pin No. | PIC18F85J90 Port | PIC18F85J90 Pin | ICE Pin | ICE Port | ICE Pin No. |
|-------------------------|------------------|-----------------|------------|------------|-------------|-------------------------|------------------|-----------------|--------------|------------|-------------|
| 1 | RH2 | SEG45 | SEG30 | RG0 | 16 | 41 | RJ6 | SEG37 | SEG37 | RJ6 | 54 |
| 2 | RH3 | SEG44 | SEG29 | RG1 | 17 | 42 | RJ7 | SEG36 | SEG36 | RJ7 | 55 |
| 3 | RE1 | BIAS2 | BIAS2 | RE1 | 14 | 43 | RC2 | SEG13 | SEG13 | RC2 | 56 |
| 4 | RE0 | BIAS1 | BIAS1 | RE0 | 15 | 44 | RC3 | SEG17 | SEG17 | RA3 | 39 |
| 5 | RG0 | BIAS0 | BIAS0 | RB5 | 67 | 45 | RC4 | SEG16 | SEG16 | RA2 | 40 |
| 6 | RG1 | NC | NC | | | 46 | RC5 | SEG12 | SEG12 | RC5 | 59 |
| 7 | RG2 | VLCAP1 | VLCAP1 | RC3 | 57 | 47 | RB7 | RB7 | RB7 | RB7 | 60 |
| 8 | RG3 | VLCAP2 | VLCAP2 | RC4 | 58 | 48 | VDD | ICEVDD | ICEVDD | VDD | 61 |
| 9 | RG5 | MCLR | ICEMCLR | RG5 | 20 | 49 | RA7 | OSC1 | OSC1 | RA7 | 62 |
| 10 | RG4 | SEG26 | SEG26 | RG4 | 21 | 50 | RA6 | OSC2 | OSC2 | RA6 | 63 |
| 11 | VSS | VSS | VSS | VSS | 23 | 51 | VSS | VSS | VSS | VSS | 65 |
| 12 | VDDCORE | VDDCORE | VDD | VDD | 24 | 52 | RB6 | RB6 | RB6 | RB6 | 66 |
| 13 | RF7 | SEG25 | SEG25 | RF7 | 25 | 53 | RB5 | SEG29 | SEG27 | RG3 | 19 |
| 14 | RF6 | SEG24 | SEG24 | RF6 | 26 | 54 | RB4 | SEG11 | SEG11 | RB4 | 68 |
| 15 | RF5 | SEG23 | SEG23 | RF5 | 27 | 55 | RB3 | SEG10 | SEG10 | RB3 | 69 |
| 16 | RF4 | SEG22 | SEG22 | RF4 | 28 | 56 | RB2 | SEG9 | SEG9 | RB2 | 70 |
| 17 | RF3 | SEG21 | SEG21 | RF3 | 29 | 57 | RB1 | SEG8 | SEG8 | RB1 | 71 |
| 18 | RF2 | SEG20 | SEG20 | RF2 | 30 | 58 | RB0 | RB0 | RB0 | RB0 | 72 |
| 19 | RH7 | SEG43 | SEG43 | RH7 | 31 | 59 | RJ3 | SEG35 | SEG35 | RJ3 | 73 |
| 20 | RH6 | SEG42 | SEG42 | RH6 | 32 | 60 | RJ2 | SEG34 | SEG34 | RJ2 | 74 |
| 21 | RH5 | SEG41 | SEG41 | RH5 | 33 | 61 | RJ1 | SEG33 | SEG33 | RJ1 | 75 |
| 22 | RH4 | SEG40 | SEG40 | RH4 | 34 | 62 | RJ0 | NC | NC | | |
| 23 | RF1 | SEG19 | SEG19 | RF1 | 35 | 63 | RD7 | SEG7 | SEG7 | RD7 | 77 |
| 24 | ENVREG | ENVREG | | | | 64 | RD6 | SEG6 | SEG6 | RD6 | 78 |
| 25 | AVDD | AVDD | ICEVDD | AVDD | 37 | 65 | RD5 | SEG5 | SEG5 | RD5 | 79 |
| 26 | AVSS | AVSS | AVSS | AVSS | 38 | 66 | RD4 | SEG4 | SEG4 | RD4 | 80 |
| 27 | RA3 | NC | NC | | | 67 | RD3 | SEG3 | SEG3 | RD3 | 81 |
| 28 | RA2 | AN2 | AN1 | RA1 | 41 | 68 | RD2 | SEG2 | SEG2 | RD2 | 82 |
| 29 | RA1 | SEG18 | SEG18 | RF0 | 36 | 69 | RD1 | SEG1 | SEG1 | RD1 | 83 |
| 30 | RA0 | AN0 | AN0 | RA0 | 42 | 70 | VSS | VSS | VSS | VSS | 84 |
| 31 | VSS | VSS | VSS | VSS | 44 | 71 | VDD | VDD | VDD | VDD | 2 |
| 32 | VDD | ICEVDD | ICEVDD | VDD | 45 | 72 | RD0 | SEG0 | SEG0 | RD0 | 3 |
| 33 | RA5 | SEG15 | SEG15 | RA5 | 46 | 73 | RE7 | SEG31 | SEG28 | RG2 | 18 |
| 34 | RA4 | SEG14 | SEG14 | RA4 | 47 | 74 | RE6 | COM3 | COM3 | RE6 | 5 |
| 35 | RC1 | T1OSCI | T1OSCI | RC1 | 48 | 75 | RE5 | COM2 | COM2 | RE5 | 6 |
| 36 | RC0 | T1OSCO | T1OSCO | RC0 | 49 | 76 | RE4 | COM1 | COM1 | RE4 | 7 |
| 37 | RC6 | TX/CK | TX/CK | RC6 | 50 | 77 | RE3 | COM0 | COM0 | COM0 | 8 |
| 38 | RC7 | RX/DT | RX/DT | RC7 | 51 | 78 | RE2 | BIAS3 | BIAS3 | RE2 | 9 |
| 39 | RJ4 | SEG39 | SEG39 | RJ4 | 52 | 79 | RH0 | SEG47 | SEG32 | RJ0 | 76 |
| 40 | RJ5 | SEG38 | SEG38 | RJ5 | 53 | 80 | RH1 | SEG46 | SEG31 | RE7 | 4 |

Legend: Unshaded cells indicate where a perfect match between PIM and ICE pins and ports exists.
 Shaded cells indicate where differences between PIM and ICE ports and pins exist.
Bold text indicates the PIM pins that are not connected to any ICE pins or ports.

PICDEM™ LCD 2 Demonstration Kit User's Guide

TABLE A-5: PIC18F85J90 LCD CONNECTIONS COMPARISON

| PIC18F85J90 | ICE | Pin # | | | Pin # | ICE | PIC18F85J90 |
|-------------|-------|-------|-----------------|--|-----------------|-----|-------------|
| | NC | 21 | NC | | NC | 20 | NC |
| COM2 | COM2 | 22 | COM3 | | COM2 | 19 | COM1 |
| SEG16 | SEG16 | 23 | X8,X6,X5,X7 | | X9,X11,X12,X10 | 18 | SEG15 |
| SEG17 | SEG17 | 24 | X1,X3,X4,X2 | | X16,X14,X13,X15 | 17 | SEG14 |
| SEG18 | SEG18 | 25 | -,F2,F1,F3 | | X17,X19,X20,X18 | 16 | SEG13 |
| SEG19 | SEG19 | 26 | 1A,1E,F4,1F | | -,X22,X21,- | 15 | SEG12 |
| SEG20 | SEG20 | 27 | 1B,1C,1D,1G | | 3B,3C,-,3G | 14 | SEG11 |
| SEG21 | SEG21 | 28 | 2A,2E,2D,2F | | 4A,4E,4D,4F | 13 | SEG10 |
| SEG22 | SEG22 | 29 | 2B,2C,COL,2G | | 4B,4C,DP1,4G | 12 | SEG9 |
| SEG23 | SEG23 | 30 | 3A,3E,3D,3F | | 5A,5E,5D,5F | 11 | SEG8 |
| SEG24 | SEG24 | 31 | S9,6G,6B,6C | | 5B,5C,-,5G | 10 | SEG7 |
| SEG25 | SEG25 | 32 | 6D,6F,6A,6E | | X23,X25,X26,X24 | 9 | SEG6 |
| SEG26 | SEG26 | 33 | X31,X33,X34,X32 | | S13,8G,8B,8C | 8 | SEG5 |
| SEG29 | SEG27 | 34 | -,X27,X35,X30 | | 8D,8F,8A,8E | 7 | SEG4 |
| SEG31 | SEG28 | 35 | -,X28,X36,X29 | | DP2,7G,7B,7C | 6 | SEG3 |
| SEG44 | SEG29 | 36 | S1,S3,S4,S2 | | 7D,7F,7A,7E | 5 | SEG2 |
| SEG45 | SEG30 | 37 | S6,-,-,S7 | | S11,-,-,- | 4 | SEG1 |
| SEG46 | SEG31 | 38 | S5,-,-S8 | | S12,-,-,S10 | 3 | SEG0 |
| COM3 | COM3 | 39 | COM4 | | COM1 | 2 | COM0 |
| | NC | 40 | NC | | NC | 1 | NC |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
 Shaded cells indicate the pins that are remapped to the corresponding pin on the PIM.

Board Technical Information

FIGURE A-5: SEGMENT CONFIGURATION FOR PIC18F85J90 DEVICES

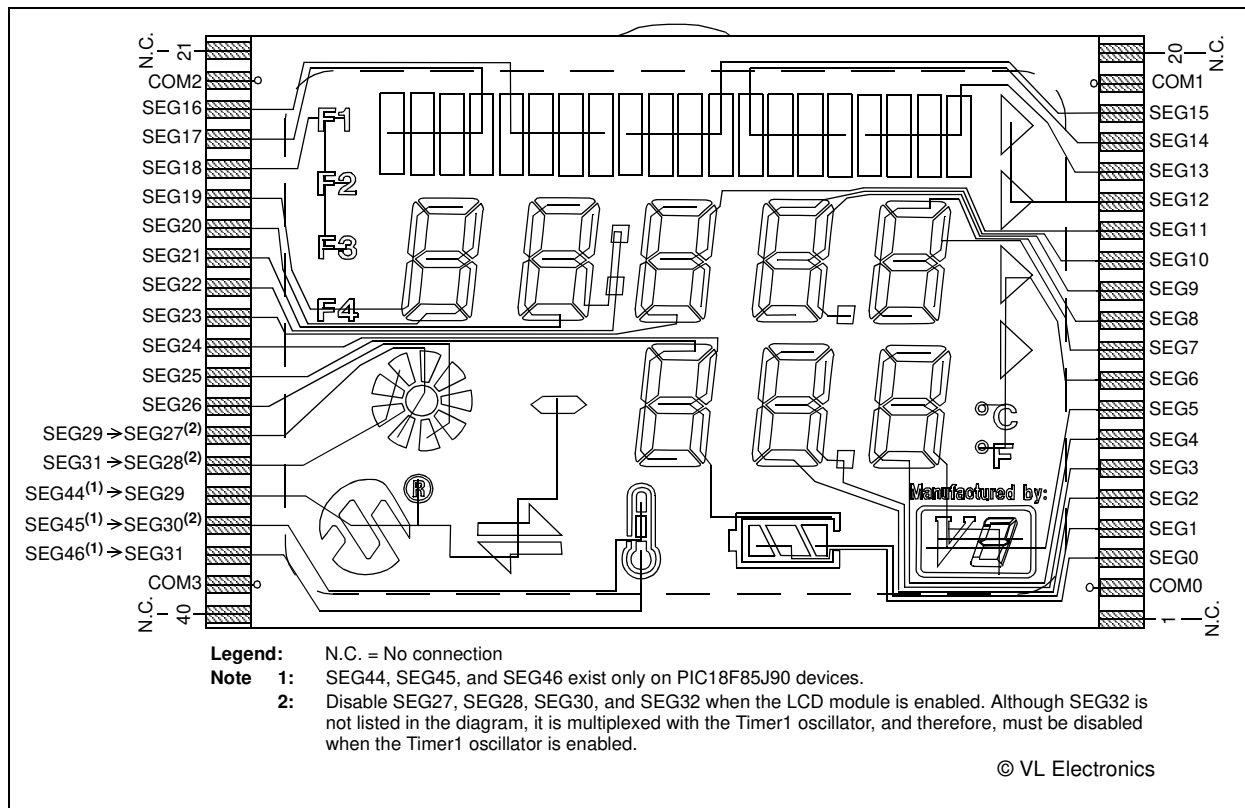


TABLE A-6: PIC18F85J90 PORT AND PIN COMPARISON

| PIC18F85J90 Port | PIC18F85J90 PIN | ICE Pin | ICE Port |
|------------------|-----------------|---------|----------|
| RA0 | AN0 | AN0 | RA0 |
| RA1 | SEG18 | SEG18 | RF0 |
| RA6 | OSC2 | OSC2 | RA6 |
| RA7 | OSC1 | OSC1 | RA7 |
| RB0 | RB0 | RB0 | RB0 |
| RB5 | SEG29 | SEG27 | RG3 |
| RB6 | RB6 | RB6 | RB6 |
| RB7 | RB7 | RB7 | RB7 |
| RC0 | T1OSC1 | T1OSC0 | RC0 |
| RC1 | T1OSC0 | T1OSC1 | RC1 |
| RC3 | SEG17 | SEG17 | RA3 |
| RC4 | SEG16 | SEG16 | RA2 |
| RC6 | TX/CK | TX/CK | RC6 |
| RC7 | RX/DT | RX/DT | RC7 |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
Shaded cells indicate the pins that are remapped to the corresponding pin on the PIM.

PICDEM™ LCD 2 Demonstration Kit User's Guide

TABLE A-7: PIC18F87J90 PIM AND ICE PIN/PORT COMPARISON

| PIC18F87J90 PIM Pin No. | PIC18F87J90 Port | PIC18F87J90 Pin | ICE Pin | ICE Port | ICE Pin No. | PIC18F87J90 PIM Pin No. | PIC18F87J90 Port | PIC18F87J90 Pin | ICE Pin | ICE Port | ICE Pin No. |
|-------------------------|------------------|-----------------|-----------|----------|-------------|-------------------------|------------------|-----------------|-----------|----------|-------------|
| 1 | RH2 | SEG45 | SEG30 | RG0 | 16 | 41 | RJ6 | SEG37 | SEG37 | RJ6 | 54 |
| 2 | RH3 | SEG44 | SEG29 | RG1 | 17 | 42 | RJ7 | SEG36 | SEG36 | RJ7 | 55 |
| 3 | RE1 | BIAS2 | BIAS2 | RE1 | 14 | 43 | RC2 | SEG13 | SEG13 | RC2 | 56 |
| 4 | RE0 | BIAS1 | BIAS1 | RE0 | 15 | 44 | RC3 | SEG17 | SEG17 | RA3 | 39 |
| 5 | RG0 | BIAS0 | BIAS0 | RB5 | 67 | 45 | RC4 | SEG16 | SEG16 | RA2 | 40 |
| 6 | RG1 | NC | NC | | | 46 | RC5 | SEG12 | SEG12 | RC5 | 59 |
| 7 | RG2 | VLCAP1 | VLCAP1 | RC3 | 57 | 47 | RB7 | RB7 | RB7 | RB7 | 60 |
| 8 | RG3 | VLCAP2 | VLCAP2 | RC4 | 58 | 48 | VDD | ICEVDD | ICEVDD | VDD | 61 |
| 9 | RG5 | MCLR | ICEMCLR | RG5 | 20 | 49 | RA7 | OSC1 | OSC1 | RA7 | 62 |
| 10 | RG4 | SEG26 | SEG26 | RG4 | 21 | 50 | RA6 | OSC2 | OSC2 | RA6 | 63 |
| 11 | VSS | VSS | VSS | VSS | 23 | 51 | VSS | VSS | VSS | VSS | 65 |
| 12 | VDDCORE | VDDCORE | VDD | VDD | 24 | 52 | RB6 | RB6 | RB6 | RB6 | 66 |
| 13 | RF7 | SEG25 | SEG25 | RF7 | 25 | 53 | RB5 | SEG29 | SEG27 | RG3 | 19 |
| 14 | RF6 | SEG24 | SEG24 | RF6 | 26 | 54 | RB4 | SEG11 | SEG11 | RB4 | 68 |
| 15 | RF5 | SEG23 | SEG23 | RF5 | 27 | 55 | RB3 | SEG10 | SEG10 | RB3 | 69 |
| 16 | RF4 | SEG22 | SEG22 | RF4 | 28 | 56 | RB2 | SEG9 | SEG9 | RB2 | 70 |
| 17 | RF3 | SEG21 | SEG21 | RF3 | 29 | 57 | RB1 | SEG8 | SEG8 | RB1 | 71 |
| 18 | RF2 | SEG20 | SEG20 | RF2 | 30 | 58 | RB0 | RB0 | RB0 | RB0 | 72 |
| 19 | RH7 | SEG43 | SEG43 | RH7 | 31 | 59 | RJ3 | SEG35 | SEG35 | RJ3 | 73 |
| 20 | RH6 | SEG42 | SEG42 | RH6 | 32 | 60 | RJ2 | SEG34 | SEG34 | RJ2 | 74 |
| 21 | RH5 | SEG41 | SEG41 | RH5 | 33 | 61 | RJ1 | SEG33 | SEG33 | RJ1 | 75 |
| 22 | RH4 | SEG40 | SEG18 | RF0 | 34 | 62 | RJ0 | NC | NC | | |
| 23 | RF1 | SEG19 | SEG19 | RF1 | 35 | 63 | RD7 | SEG7 | SEG7 | RD7 | 77 |
| 24 | ENVREG | ENVREG | | | | 64 | RD6 | SEG6 | SEG6 | RD6 | 78 |
| 25 | AVDD | AVDD | ICEVDD | AVDD | 37 | 65 | RD5 | SEG5 | SEG5 | RD5 | 79 |
| 26 | AVSS | AVSS | AVSS | AVSS | 38 | 66 | RD4 | SEG4 | SEG4 | RD4 | 80 |
| 27 | RA3 | CTMU | NC | | | 67 | RD3 | SEG3 | SEG3 | RD3 | 81 |
| 28 | RA2 | AN2 | AN1 | RA1 | 41 | 68 | RD2 | SEG2 | SEG2 | RD2 | 82 |
| 29 | RA1 | CTMU | NC | | 36 | 69 | RD1 | SEG1 | SEG1 | RD1 | 83 |
| 30 | RA0 | AN0 | AN0 | RA0 | 42 | 70 | VSS | VSS | VSS | VSS | 84 |
| 31 | VSS | VSS | VSS | VSS | 44 | 71 | VDD | VDD | VDD | VDD | 2 |
| 32 | VDD | ICEVDD | ICEVDD | VDD | 45 | 72 | RD0 | SEG0 | SEG0 | RD0 | 3 |
| 33 | RA5 | SEG15 | SEG15 | RA5 | 46 | 73 | RE7 | SEG31 | SEG28 | RG2 | 18 |
| 34 | RA4 | SEG14 | SEG14 | RA4 | 47 | 74 | RE6 | COM3 | COM3 | RE6 | 5 |
| 35 | RC1 | T1OSCI | T1OSCI | RC1 | 48 | 75 | RE5 | COM2 | COM2 | RE5 | 6 |
| 36 | RC0 | T1OSCO | T1OSCO | RC0 | 49 | 76 | RE4 | COM1 | COM1 | RE4 | 7 |
| 37 | RC6 | TX/CK | TX/CK | RC6 | 50 | 77 | RE3 | COM0 | COM0 | COM0 | 8 |
| 38 | RC7 | RX/DT | RX/DT | RC7 | 51 | 78 | RE2 | BIAS3 | BIAS3 | RE2 | 9 |
| 39 | RJ4 | SEG39 | SEG39 | RJ4 | 52 | 79 | RH0 | SEG47 | SEG32 | RJ0 | 76 |
| 40 | RJ5 | SEG38 | SEG38 | RJ5 | 53 | 80 | RH1 | SEG46 | SEG31 | RE7 | 4 |

Legend: Unshaded cells indicate where a perfect match between PIM and ICE pins and ports exists.
 Shaded cells indicate where differences between PIM and ICE ports and pins exist.
Bold text indicates the PIM pins that are not connected to any ICE pins or ports.

Board Technical Information

TABLE A-8: PIC18F87J90 LCD CONNECTIONS COMPARISON

| PIC18F87J90 | ICE | Pin # | | | Pin # | ICE | PIC18F87J90 |
|-------------|-------|-------|-----------------|-----------------|-------|-------|-------------|
| | NC | 21 | NC | NC | 20 | NC | |
| COM2 | COM2 | 22 | COM3 | COM2 | 19 | COM1 | COM1 |
| SEG16 | SEG16 | 23 | X8,X6,X5,X7 | X9,X11,X12,X10 | 18 | SEG15 | SEG15 |
| SEG17 | SEG17 | 24 | X1,X3,X4,X2 | X16,X14,X13,X15 | 17 | SEG14 | SEG14 |
| SEG40 | SEG18 | 25 | -,F2,F1,F3 | X17,X19,X20,X18 | 16 | SEG13 | SEG13 |
| SEG19 | SEG19 | 26 | 1A,1E,F4,1F | -,X22,X21,- | 15 | SEG12 | SEG12 |
| SEG20 | SEG20 | 27 | 1B,1C,1D,1G | 3B,3C,-,3G | 14 | SEG11 | SEG11 |
| SEG21 | SEG21 | 28 | 2A,2E,2D,2F | 4A,4E,4D,4F | 13 | SEG10 | SEG10 |
| SEG22 | SEG22 | 29 | 2B,2C,COL,2G | 4B,4C,DP1,4G | 12 | SEG9 | SEG9 |
| SEG23 | SEG23 | 30 | 3A,3E,3D,3F | 5A,5E,5D,5F | 11 | SEG8 | SEG8 |
| SEG24 | SEG24 | 31 | S9,6G,6B,6C | 5B,5C,-,5G | 10 | SEG7 | SEG7 |
| SEG25 | SEG25 | 32 | 6D,6F,6A,6E | X23,X25,X26,X24 | 9 | SEG6 | SEG6 |
| SEG26 | SEG26 | 33 | X31,X33,X34,X32 | S13,8G,8B,8C | 8 | SEG5 | SEG5 |
| SEG29 | SEG27 | 34 | -,X27,X35,X30 | 8D,8F,8A,8E | 7 | SEG4 | SEG4 |
| SEG31 | SEG28 | 35 | -,X28,X36,X29 | DP2,7G,7B,7C | 6 | SEG3 | SEG3 |
| SEG44 | SEG29 | 36 | S1,S3,S4,S2 | 7D,7F,7A,7E | 5 | SEG2 | SEG2 |
| SEG45 | SEG30 | 37 | S6,-,-,S7 | S11,-,-,- | 4 | SEG1 | SEG1 |
| SEG46 | SEG31 | 38 | S5,-,-,S8 | S12,-,-,S10 | 3 | SEG0 | SEG0 |
| COM3 | COM3 | 39 | COM4 | COM1 | 2 | COM0 | COM0 |
| | NC | 40 | NC | NC | 1 | NC | |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
 Shaded cells indicate the pins that are remapped to the corresponding pin on the PIM.

PICDEM™ LCD 2 Demonstration Kit User's Guide

FIGURE A-6: SEGMENT CONFIGURATION FOR PIC18F87J90 DEVICES

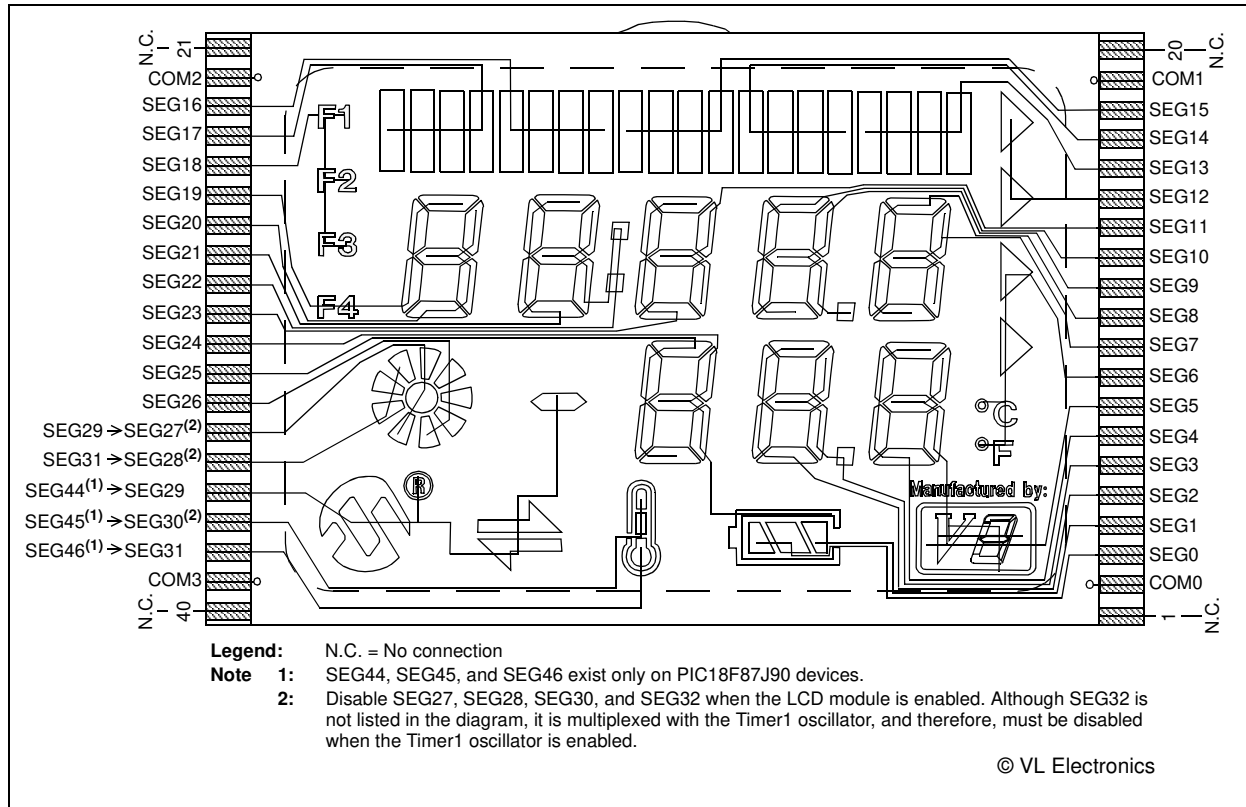


TABLE A-9: PIC18F87J90 PORT AND PIN COMPARISON

| PIC18F87J90 Port | PIC18F87J90 PIN | ICE Pin | ICE Port |
|------------------|-----------------|---------|----------|
| RA0 | AN0 | AN0 | RA0 |
| RA6 | OSC2 | OSC2 | RA6 |
| RA7 | OSC1 | OSC1 | RA7 |
| RB0 | RB0 | RB0 | RB0 |
| RB5 | SEG29 | SEG27 | RG3 |
| RB6 | RB6 | RB6 | RB6 |
| RB7 | RB7 | RB7 | RB7 |
| RC0 | T1OSC1 | T1OSC0 | RC0 |
| RC1 | T1OSC0 | T1OSC1 | RC1 |
| RC3 | SEG17 | SEG17 | RA3 |
| RC4 | SEG16 | SEG16 | RA2 |
| RC6 | TX/CK | TX/CK | RC6 |
| RC7 | RX/DT | RX/DT | RC7 |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
 Shaded cells indicate the pins that are remapped to the corresponding pin on the PIM.

Board Technical Information

TABLE A-10: PIC18F8490 PIM AND ICE PORT/PIN COMPARISON

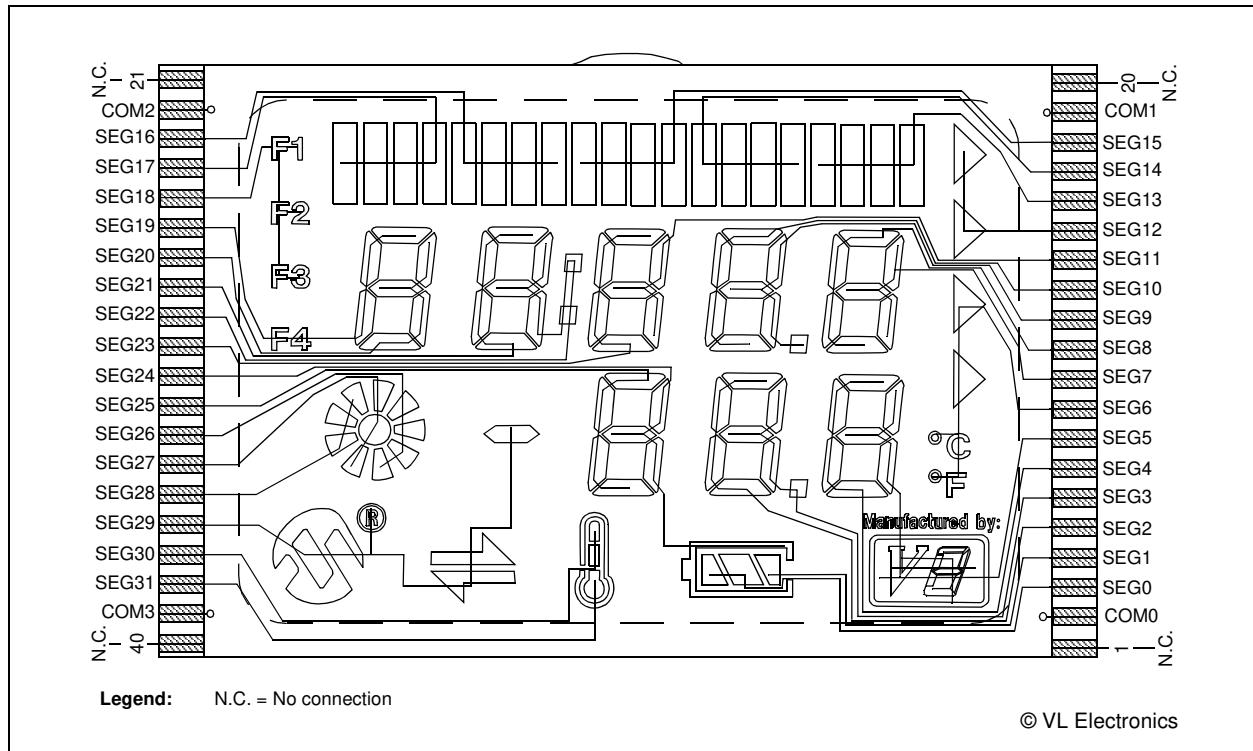
| PIC18F8490 PIM Pin No. | PIC18F8490 Port | PIC18F8490 Pin | ICE Pin | ICE Port | ICE Pin No. | PIC18F8490 PIM Pin No. | PIC18F8490 Port | PIC18F8490 Pin | ICE Pin | ICE Port | ICE Pin No. |
|------------------------|-----------------|----------------|---------|----------|-------------|------------------------|-----------------|----------------|---------|----------|-------------|
| 1 | RH2 | SEG45 | SEG45 | RH2 | 12 | 41 | RJ6 | SEG37 | SEG37 | RJ6 | 54 |
| 2 | RH3 | SEG44 | SEG44 | RH3 | 13 | 42 | RJ7 | SEG36 | SEG36 | RJ7 | 55 |
| 3 | LCDBIAS2 | LCDBIAS2 | BIAS2 | RE1 | 14 | 43 | RC2 | SEG13 | SEG13 | RC2 | 56 |
| 4 | LCDBIAS1 | LCDBIAS1 | BIAS1 | RE0 | 15 | 44 | RC3 | RC3 | RC3 | RC3 | 57 |
| 5 | RG0 | SEG30 | SEG30 | RG0 | 16 | 45 | RC4 | RC4 | RC4 | RC4 | 58 |
| 6 | RG1 | SEG29 | SEG29 | RG1 | 17 | 46 | RC5 | SEG12 | SEG12 | RC5 | 59 |
| 7 | RG2 | SEG28 | SEG28 | RG2 | 18 | 47 | RB7 | RB7 | RB7 | RB7 | 60 |
| 8 | RG3 | SEG27 | SEG27 | RG3 | 19 | 48 | VDD | VDD | ICEVDD | VDD | 61 |
| 9 | RG5 | MCLR | ICEMCLR | RG5 | 20 | 49 | RA7 | OSC1 | OSC1 | RA7 | 62 |
| 10 | RG4 | SEG26 | SEG26 | RG4 | 21 | 50 | RA6 | OSC2 | OSC2 | RA6 | 63 |
| 11 | Vss | Vss | Vss | Vss | 23 | 51 | Vss | Vss | Vss | Vss | 65 |
| 12 | VDD | VDD | ICEVDD | VDD | 24 | 52 | RB6 | RB6 | RB6 | RB6 | 66 |
| 13 | RF7 | SEG25 | SEG25 | RF7 | 25 | 53 | RB5 | RB5 | RB5 | RB5 | 67 |
| 14 | RF6 | SEG24 | SEG24 | RF6 | 26 | 54 | RB4 | SEG11 | SEG11 | RB4 | 68 |
| 15 | RF5 | SEG23 | SEG23 | RF5 | 27 | 55 | RB3 | SEG10 | SEG10 | RB3 | 69 |
| 16 | RF4 | SEG22 | SEG22 | RF4 | 28 | 56 | RB2 | SEG9 | SEG9 | RB2 | 70 |
| 17 | RF3 | SEG21 | SEG21 | RF3 | 29 | 57 | RB1 | SEG8 | SEG8 | RB1 | 71 |
| 18 | RF2 | SEG20 | SEG20 | RF2 | 30 | 58 | RB0 | RB0 | RB0 | RB0 | 72 |
| 19 | RH7 | SEG43 | SEG43 | RH7 | 31 | 59 | RJ3 | SEG35 | SEG35 | RJ3 | 73 |
| 20 | RH6 | SEG42 | SEG42 | RH6 | 32 | 60 | RJ2 | SEG34 | SEG34 | RJ2 | 74 |
| 21 | RH5 | SEG41 | SEG41 | RH5 | 33 | 61 | RJ1 | SEG33 | SEG33 | RJ1 | 75 |
| 22 | RH4 | SEG40 | SEG40 | RH4 | 34 | 62 | RJ0 | SEG32 | SEG32 | RJ0 | 76 |
| 23 | RF1 | SEG19 | SEG19 | RF1 | 35 | 63 | RD7 | SEG7 | SEG7 | RD7 | 77 |
| 24 | RF0 | SEG18 | SEG18 | RF0 | 36 | 64 | RD6 | SEG6 | SEG6 | RD6 | 78 |
| 25 | AVDD | AVDD | ICEVDD | AVDD | 37 | 65 | RD5 | SEG5 | SEG5 | RD5 | 79 |
| 26 | AVss | AVss | AVss | AVss | 38 | 66 | RD4 | SEG4 | SEG4 | RD4 | 80 |
| 27 | RA3 | SEG17 | SEG17 | RA3 | 39 | 67 | RD3 | SEG3 | SEG3 | RD3 | 81 |
| 28 | RA2 | SEG16 | SEG16 | RA2 | 40 | 68 | RD2 | SEG2 | SEG2 | RD2 | 82 |
| 29 | RA1 | AN1 | AN1 | RA1 | 41 | 69 | RD1 | SEG1 | SEG1 | RD1 | 83 |
| 30 | RA0 | AN0 | AN0 | RA0 | 42 | 70 | Vss | Vss | Vss | Vss | 84 |
| 31 | Vss | Vss | Vss | Vss | 44 | 71 | VDD | VDD | VDD | VDD | 2 |
| 32 | VDD | VDD | ICEVDD | VDD | 45 | 72 | RD0 | SEG0 | SEG0 | RD0 | 3 |
| 33 | RA5 | SEG15 | SEG15 | RA5 | 46 | 73 | RE7 | SEG31 | SEG31 | RE7 | 4 |
| 34 | RA4 | SEG14 | SEG14 | RA4 | 47 | 74 | RE6 | COM3 | COM3 | RE6 | 5 |
| 35 | RC1 | TIOSC0 | TIOSC1 | RC1 | 48 | 75 | RE5 | COM2 | COM2 | RE5 | 6 |
| 36 | RC0 | T1OSC1 | T1OSC0 | RC0 | 49 | 76 | RE4 | COM1 | COM1 | RE4 | 7 |
| 37 | RC6 | TX/CK | TX/CK | RC6 | 50 | 77 | COM0 | COM0 | COM0 | RE3 | 8 |
| 38 | RC7 | RX/DT | RX/DT | RC7 | 51 | 78 | LCDBIAS3 | LCDBIAS3 | BIAS3 | RE2 | 9 |
| 39 | RJ4 | SEG39 | SEG39 | RJ4 | 52 | 79 | RH0 | SEG47 | SEG47 | RH0 | 10 |
| 40 | RJ5 | SEG38 | SEG38 | RJ5 | 53 | 80 | RH1 | SEG46 | SEG46 | RH1 | 11 |

PICDEM™ LCD 2 Demonstration Kit User's Guide

TABLE A-11: PIC18F8490 LCD CONNECTIONS COMPARISON

| PIC18F8490 | ICE | Pin # | | | Pin # | ICE | PIC18F8490 |
|------------|-------|-------|-----------------|--|-------|-------|------------|
| | NC | 21 | NC | | 20 | NC | |
| COM2 | COM2 | 22 | COM3 | | 19 | COM1 | COM1 |
| SEG16 | SEG16 | 23 | X8,X6,X5,X7 | | 18 | SEG15 | SEG15 |
| SEG17 | SEG17 | 24 | X1,X3,X4,X2 | | 17 | SEG14 | SEG14 |
| SEG18 | SEG18 | 25 | -,F2,F1,F3 | | 16 | SEG13 | SEG13 |
| SEG19 | SEG19 | 26 | 1A,1E,F4,1F | | 15 | SEG12 | SEG12 |
| SEG20 | SEG20 | 27 | 1B,1C,1D,1G | | 14 | SEG11 | SEG11 |
| SEG21 | SEG21 | 28 | 2A,2E,2D,2F | | 13 | SEG10 | SEG10 |
| SEG22 | SEG22 | 29 | 2B,2C,COL,2G | | 12 | SEG9 | SEG9 |
| SEG23 | SEG23 | 30 | 3A,3E,3D,3F | | 11 | SEG8 | SEG8 |
| SEG24 | SEG24 | 31 | S9,6G,6B,6C | | 10 | SEG7 | SEG7 |
| SEG25 | SEG25 | 32 | 6D,6F,6A,6E | | 9 | SEG6 | SEG6 |
| SEG26 | SEG26 | 33 | X31,X33,X34,X32 | | 8 | SEG5 | SEG5 |
| SEG27 | SEG27 | 34 | -,X27,X35,X30 | | 7 | SEG4 | SEG4 |
| SEG28 | SEG28 | 35 | -,X28,X36,X29 | | 6 | SEG3 | SEG3 |
| SEG29 | SEG29 | 36 | S1,S3,S4,S2 | | 5 | SEG2 | SEG2 |
| SEG30 | SEG30 | 37 | S6,-,-,S7 | | 4 | SEG1 | SEG1 |
| SEG31 | SEG31 | 38 | S5,-,-S8 | | 3 | SEG0 | SEG0 |
| COM3 | COM3 | 39 | COM4 | | 2 | COM0 | COM0 |
| | NC | 40 | NC | | 1 | NC | |

FIGURE A-7: SEGMENT CONFIGURATION FOR PIC18F8490 DEVICES



Board Technical Information

TABLE A-12: PIC18F8490 PIN AND PORT COMPARISON

| PIC18F8490 Port | PIC18F8490 Pin | ICE Pin | ICE Port |
|-----------------|----------------|---------|----------|
| RA0 | AN0 | AN0 | RA0 |
| RA1 | AN1 | AN1 | RA1 |
| RA6 | OSC2 | OSC2 | RA6 |
| RA7 | OSC1 | OSC1 | RA7 |
| RB0 | RB0 | RB0 | RB0 |
| RB5 | RB5 | RB5 | RB5 |
| RB6 | RB6 | RB6 | RB6 |
| RB7 | RB7 | RB7 | RB7 |
| RC0 | T1OSC1 | T1OSC0 | RC0 |
| RC1 | T1OSC0 | T1OSC1 | RC1 |
| RC3 | RC3 | RC3 | RC3 |
| RC4 | RC4 | RC4 | RC4 |
| RC6 | TX/CK | TX/CK | RC6 |
| RC7 | RX/DT | RX/DT | RC7 |

PICDEM™ LCD 2 Demonstration Kit User's Guide

TABLE A-13: PIC16F946 PIM AND ICE PIN/PORT COMPARISON

| PIC16F946 PIM Pin No. | PIC16F946 Port | PIC16F946 Pin | ICE Pin | ICE Port | ICE Pin No. | PIC16F946 PIM Pin No. | PIC16F946 Port | PIC16F946 Pin | ICE Pin | ICE Port | ICE Pin No. |
|-----------------------|----------------|---------------|---------|----------|-------------|-----------------------|----------------|---------------|-----------|----------------|-------------|
| 1 | RD6 | SEG19 | SEG19 | RF1 | 35 | 33 | RE0 | SEG21 | SEG21 | RF3 | 29 |
| 2 | RD7 | SEG20 | SEG20 | RF2 | 30 | 34 | RE1 | SEG22 | SEG22 | RF4 | 28 |
| 3 | RG0 | SEG36 | SEG36 | RB1 | 71 | 35 | RE2 | SEG23 | SEG23 | RF5 | 27 |
| 4 | RG1 | SEG37 | SEG37 | RB2 | 70 | 36 | ICEMCLR | ICEMCLR | ICEMCLR | ICEMCLR | 20 |
| 5 | RG2 | SEG38 | SEG38 | RJ5 | 53 | 37 | RE4 | SEG24 | SEG24 | RF6 | 26 |
| 6 | RG3 | SEG39 | SEG39 | RJ4 | 52 | 38 | ICEVDD | ICEVDD | ICEVDD | ICEVDD | 61 |
| 7 | RG4 | SEG40 | SEG40 | RH4 | 34 | 39 | RA7 | T1OSCI | T1OSCI | RC1 | 48 |
| 8 | RG5 | SEG41 | SEG41 | RH5 | 33 | 40 | RA6 | T1OSCO | T1OSCO | RC0 | 49 |
| 9 | Vss | Vss | Vss | Vss | 23 | 41 | Vss | Vss | Vss | Vss | 65 |
| 10 | VDD | VDD | ICEVDD | ICEVDD | 24 | 42 | RE5 | SEG25 | SEG25 | RF7 | 25 |
| 11 | RF0 | SEG32 | SEG32 | RJ0 | 76 | 43 | RE6 | SEG26 | SEG26 | RG4 | 21 |
| 12 | RF1 | SEG33 | SEG33 | RD0 | 3 | 44 | RE7 | SEG27 | SEG27 | RG3 | 19 |
| 13 | RF2 | SEG34 | SEG34 | RD6 | 78 | 45 | RE4 | SEG28 | SEG28 | RG2 | 18 |
| 14 | RF3 | SEG35 | SEG35 | RD7 | 77 | 46 | RF5 | SEG29 | SEG29 | RG1 | 17 |
| 15 | RB0 | RB0 | RB0 | RB0 | 72 | 47 | RF6 | SEG30 | SEG30 | RG0 | 16 |
| 16 | RB1 | SEG1 | SEG1 | RD1 | 83 | 48 | RF7 | SEG31 | SEG31 | RE7 | 4 |
| 17 | RB2 | SEG2 | SEG2 | RD2 | 82 | 49 | RC0 | VLCD1 | BIAS1 | RE0 | 15 |
| 18 | RB3 | SEG3 | SEG3 | RD3 | 81 | 50 | RC1 | VLCD2 | BIAS2 | RE1 | 14 |
| 19 | VDD | VDD | ICEVDD | ICEVDD | 37 | 51 | RC2 | VLCD3 | BIAS3 | RE2 | 9 |
| 20 | Vss | Vss | Vss | AVss | 38 | 52 | RC3 | RC3 | VLCAP1 | RC3 | 57 |
| 21 | RB4 | COM0 | COM0 | RE3 | 8 | 53 | RD0 | COM3 | COM3 | RE6 | 5 |
| 22 | RB5 | COM1 | COM1 | RE4 | 7 | 54 | RD1 | NC | NC | | |
| 23 | RB6 | RB6 | RB6 | RB6 | 66 | 55 | RD2 | NC | NC | | |
| 24 | RB7 | RB7 | RB7 | RB7 | 60 | 56 | Vss | Vss | Vss | Vss | 1 |
| 25 | AVDD | AVDD | ICEVDD | ICEVDD | 45 | 57 | VDD | VDD | VDD | VDD | 2 |
| 26 | AVss | AVss | AVss | AVss | 44 | 58 | RD3 | SEG16 | SEG16 | RA2 | 40 |
| 27 | RA0 | AN0 | AN0 | RA0 | 42 | 59 | RC4 | RC4 | RC4 | VLCAP1\ RC4 | 58 |
| 28 | RA1 | AN1 | AN1 | RA1 | 41 | 60 | RC5 | SEG10 | SEG10 | RB3 | 69 |
| 29 | RA2 | COM2 | COM2 | RE5 | 6 | 61 | RC6 | TX/CK | TX/CK | TX/CK | 50 |
| 30 | RA3 | SEG15 | SEG15 | RA5 | 46 | 62 | RC7 | RX/DT | RX/DT | RX/DT | 51 |
| 31 | RA4 | SEG4 | SEG4 | RD4 | 80 | 63 | RD4 | SEG17 | SEG17 | RA3 | 39 |
| 32 | RA5 | SEG5 | SEG5 | RD5 | 79 | 64 | RD5 | SEG18 | SEG18 | RF0 | 36 |

Legend: Unshaded cells indicate where a perfect match between PIM and ICE pins and ports exists.
 Shaded cells indicate where differences between PIM and ICE ports and pins exist.
Bold text indicates the PIM pins that are not connected to any ICE pins or ports.

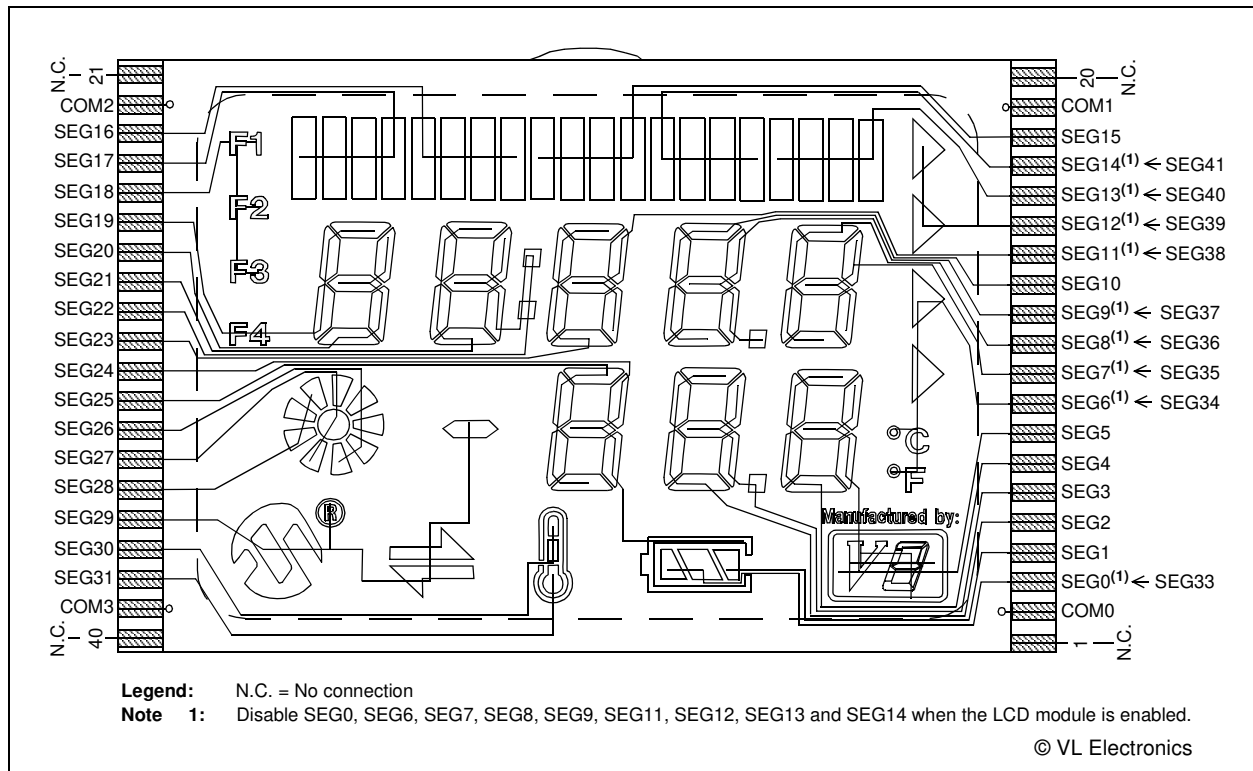
Board Technical Information

TABLE A-14: PIC16F946 LCD CONNECTIONS COMPARISON

| PIC16F946 | ICE | Pin # | | | Pin # | ICE | PIC16F946 |
|-----------|-------|-------|-----------------|--|-------|-------|-----------|
| | NC | 21 | NC | | 20 | NC | |
| COM2 | COM2 | 22 | COM3 | | 19 | COM1 | COM1 |
| SEG16 | SEG16 | 23 | X8,X6,X5,X7 | | 18 | SEG15 | SEG15 |
| SEG17 | SEG17 | 24 | X1,X3,X4,X2 | | 17 | SEG14 | SEG41 |
| SEG18 | SEG18 | 25 | -,F2,F1,F3 | | 16 | SEG13 | SEG40 |
| SEG19 | SEG19 | 26 | 1A,1E,F4,1F | | 15 | SEG12 | SEG39 |
| SEG20 | SEG20 | 27 | 1B,1C,1D,1G | | 14 | SEG11 | SEG38 |
| SEG21 | SEG21 | 28 | 2A,2E,2D,2F | | 13 | SEG10 | SEG10 |
| SEG22 | SEG22 | 29 | 2B,2C,COL,2G | | 12 | SEG9 | SEG37 |
| SEG23 | SEG23 | 30 | 3A,3E,3D,3F | | 11 | SEG8 | SEG36 |
| SEG24 | SEG24 | 31 | S9,6G,6B,6C | | 10 | SEG7 | SEG35 |
| SEG25 | SEG25 | 32 | 6D,6F,6A,6E | | 9 | SEG6 | SEG34 |
| SEG26 | SEG26 | 33 | X31,X33,X34,X32 | | 8 | SEG5 | SEG5 |
| SEG27 | SEG27 | 34 | -,X27,X35,X30 | | 7 | SEG4 | SEG4 |
| SEG28 | SEG28 | 35 | -,X28,X36,X29 | | 6 | SEG3 | SEG3 |
| SEG29 | SEG29 | 36 | S1,S3,S4,S2 | | 5 | SEG2 | SEG2 |
| SEG30 | SEG30 | 37 | S6,-,-,S7 | | 4 | SEG1 | SEG1 |
| SEG31 | SEG31 | 38 | S5,-,-S8 | | 3 | SEG0 | SEG33 |
| COM3 | COM3 | 39 | COM4 | | 2 | COM0 | COM0 |
| | NC | 40 | NC | | 1 | NC | |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
Shaded cells indicate the pins that are remapped to the corresponding pin on the PIM.

FIGURE A-8: SEGMENT CONFIGURATION FOR PIC16F946 DEVICES



PICDEM™ LCD 2 Demonstration Kit User's Guide

TABLE A-15: PIC16F946 PORT AND PIN COMPARISON

| PIC16F946 Port | PIC16F946 Pin | ICE Pin | ICE Port |
|----------------|---------------|---------|----------|
| RA0 | AN0 | AN0 | RA0 |
| RA1 | AN1 | AN1 | RA1 |
| RA6 | T1OSCO | T1OSCO | RC0 |
| RA7 | T1OSCI | T1OSCI | RC1 |
| RB0 | RB0 | RB0 | RB0 |
| RB5 | COM1 | COM1 | RE4 |
| RB6 | RB6 | RB6 | RB6 |
| RB7 | RB7 | RB7 | RB7 |
| RC0 | VLCD1 | BIAS1 | RE0 |
| RC1 | VLCD2 | BIAS2 | RE1 |
| RC3 | RC3 | RC3 | RC3 |
| RC4 | RC4 | RC4 | RC4 |
| RC6 | TX/CK | TX/CK | RC6 |
| RC7 | RX/DT | RX/DT | RC7 |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
Shaded cells indicate the pins that are remapped to the corresponding pin/port on the PIM.

Board Technical Information

TABLE A-16: PIC16F/LF1946/7 PIM AND ICE PIN/PORT COMPARISON

| PIC16/LF1946/7 PIM Pin No. | PIC16F/LF1946/7 Port | PIC16F/LF1946/7 Pin | ICE Pin | ICE Port | ICE Pin No. | PIC16F/LF1946/7PIM Pin No. | PIC16F/LF1946/7 Port | PIC16F/LF1946/7 Pin | ICE Pin | ICE Port | ICE Pin No. |
|----------------------------|----------------------|---------------------|---------|----------|-------------|----------------------------|----------------------|---------------------|-------------|------------|-------------|
| 1 | RE1 | VLCD2 | BIAS2 | E1 | 14 | 33 | C2 | SEG13 | SEG13 | RC2 | 56 |
| 2 | RE0 | VLCD1 | BIAS1 | E0 | 15 | 34 | C3 | RC3 | RC3 | RC3 | 57 |
| 3 | RG0 | SEG42 | SEG42 | RH6 | 32 | 35 | RE2 | RC4 | RC4 | RC4 | 58 |
| 4 | RG1 | SEG43 | SEG43 | RH7 | 31 | 36 | RC5 | SEG12 | SEG12 | RC5 | 59 |
| 5 | RG2 | SEG44 | SEG44 | RJ3 | 13 | 37 | RB7 | RB7 | RB7 | RB7 | 60 |
| 6 | RG3 | SEG45 | SEG45 | RG5 | 20 | 38 | VDD | VDD | ICEVDD | ICEVDD | 61 |
| 7 | RG5 | MCLR | ICEMCLR | RG5 | 20 | 39 | OSC1 | OSC1 | OSC1 | RC1 | 62 |
| 8 | RG4 | SEG26 | SEG26 | RG4 | 21 | 40 | RA6 | OSC2 | OSC2 | RA6 | 63 |
| 9 | VSS | VSS | VSS | VSS | 23 | 41 | VSS | VSS | VSS | VSS | 65 |
| 10 | VDD | VDD | ICEVDD | ICEVDD | 24 | 42 | RB6 | RB6 | RB6 | RB6 | 66 |
| 11 | RF7 | SEG25 | SEG25 | RF7 | 25 | 43 | RB5 | RB5 | RB5 | RB5 | 67 |
| 12 | RF6 | SEG24 | SEG24 | RF6 | 26 | 44 | RB4 | SEG11 | SEG11 | RB4 | 68 |
| 13 | RF5 | SEG23 | SEG23 | RF5 | 27 | 45 | RB3 | SEG10 | SEG10 | RB3 | 69 |
| 14 | RF4 | SEG22 | SEG22 | RF4 | 28 | 46 | RB2 | SEG9 | SEG9 | RB2 | 70 |
| 15 | RF3 | SEG21 | SEG21 | RF3 | 29 | 47 | RB1 | SEG8 | SEG8 | RB1 | 71 |
| 16 | RF2 | SEG20 | SEG20 | RF2 | 30 | 48 | RB0 | RB0 | RB0 | RB0 | 72 |
| 17 | RF1 | SEG19 | SEG19 | RF1 | 35 | 49 | RD7 | SEG7 | SEG7 | RD7 | 77 |
| 18 | RF0 | SEG41 | SEG41 | RH5 | 33 | 50 | RD6 | SEG6 | SEG6 | RD6 | 78 |
| 19 | VDD | VDD | ICEVDD | ICEVDD | 37 | 51 | RD5 | SEG5 | SEG5 | RD5 | 79 |
| 20 | VSS | VSS | VSS | VSS | 38 | 52 | RD4 | SEG4 | SEG4 | RD4 | 80 |
| 21 | RA3 | SEG35 | SEG35 | RJ3 | 73 | 53 | RD3 | SEG3 | SEG3 | RD3 | 81 |
| 22 | RA2 | SEG34 | SEG34 | RJ2 | 74 | 54 | RD2 | SEG2 | SEG2 | RD2 | 82 |
| 23 | RA1 | AN1 | AN1 | RA1 | 41 | 55 | RD1 | SEG1 | SEG1 | RD1 | 83 |
| 24 | RA0 | AN0 | AN0 | RA0 | 42 | 56 | VSS | VSS | VSS | VSS | 84 |
| 25 | VSS | VSS | ICEVSS | ICEVSS | 44 | 57 | VDD | VDD | VDD | VDD | 2 |
| 26 | VDD | VDD | ICDVDD | ICDVDD | 45 | 58 | RD0 | SEG0 | SEG0 | RD0 | 3 |
| 27 | RA5 | SEG15 | SEG15 | RA5 | 46 | 59 | RE7 | SEG31 | SEG31 | RE7 | 4 |
| 28 | RA4 | SEG14 | SEG14 | RA4 | 47 | 60 | RE6 | COM3 | COM3 | RE6 | 5 |
| 29 | RC1 | T1OSC1 | T1OSC1 | RC1 | 48 | 61 | RE5 | COM2 | COM2 | RE5 | 6 |
| 30 | RC0 | T1OSC0 | T1OSC0 | RC0 | 49 | 62 | RE4 | COM1 | COM1 | RE4 | 7 |
| 31 | RC6 | TX/CK | TX/CK | RC6 | 50 | 63 | RE3 | COM0 | COM0 | RE3 | 8 |
| 32 | RC7 | RX/DT | RX/DT | RC7 | 79 | 51 | RE2 | VLCD3 | BIAS3 | RE2 | 9 |

Legend: Unshaded cells indicate where a perfect match between PIM and ICE pins and ports exists.
 Shaded cells indicate where differences between PIM and ICE ports and pins exist.
Bold text indicates the PIM pins that are not connected to any ICE pins or ports.

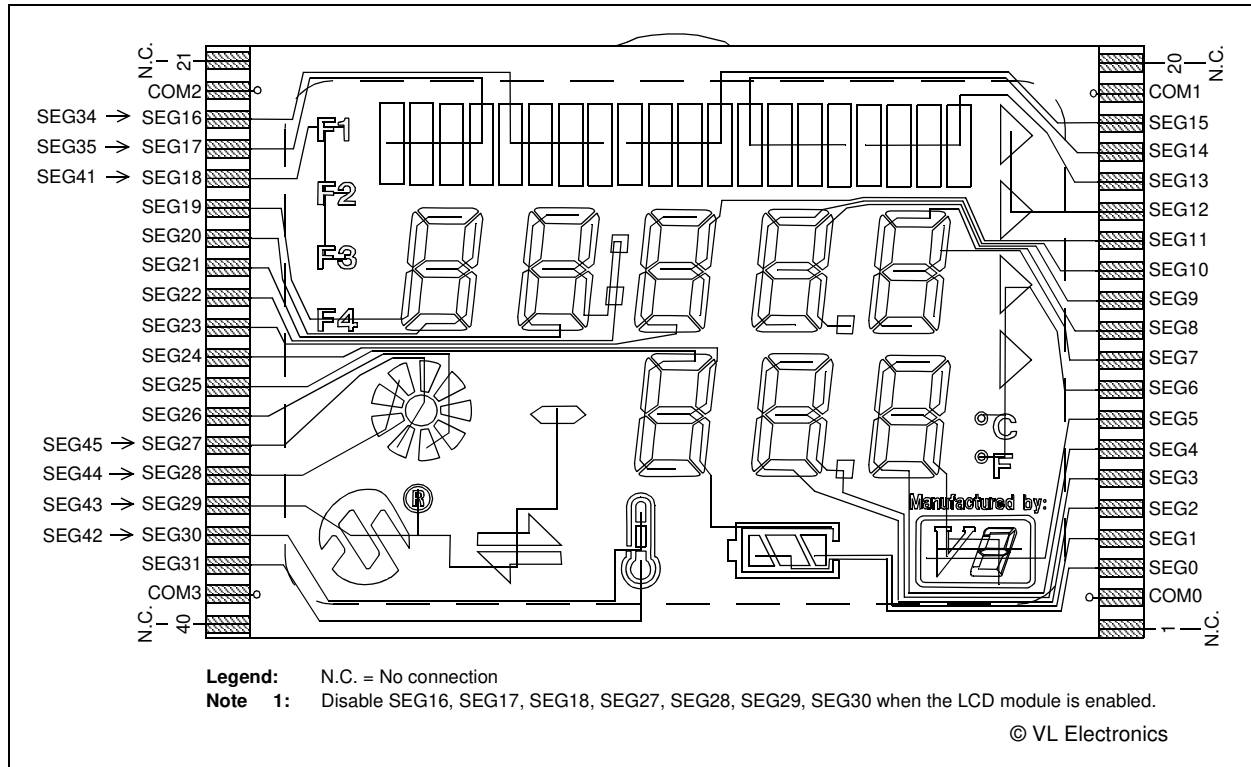
PICDEM™ LCD 2 Demonstration Kit User's Guide

TABLE A-17: PIC16F/LF1946/7 LCD CONNECTIONS COMPARISON

| PIC16F/LF 1946/7 | ICE | LCD Pin # | | | LCD Pin # | ICE | PIC16F/LF1 946/7 |
|------------------|-------|-----------|-----------------|--|-----------------|-----|------------------|
| | NC | 21 | NC | | NC | 20 | NC |
| COM2 | COM2 | 22 | COM3 | | COM2 | 19 | COM1 |
| SEG34 | SEG16 | 23 | X8,X6,X5,X7 | | X9,X11,X12,X10 | 18 | SEG15 |
| SEG35 | SEG17 | 24 | X1,X3,X4,X2 | | X16,X14,X13,X15 | 17 | SEG14 |
| SEG41 | SEG18 | 25 | -,F2,F1,F3 | | X17,X19,X20,X18 | 16 | SEG13 |
| SEG19 | SEG19 | 26 | 1A,1E,F4,1F | | -,X22,X21,- | 15 | SEG12 |
| SEG20 | SEG20 | 27 | 1B,1C,1D,1G | | 3B,3C,-,3G | 14 | SEG11 |
| SEG21 | SEG21 | 28 | 2A,2E,2D,2F | | 4A,4E,4D,4F | 13 | SEG10 |
| SEG22 | SEG22 | 29 | 2B,2C,COL,2G | | 4B,4C,DP1,4G | 12 | SEG9 |
| SEG23 | SEG23 | 30 | 3A,3E,3D,3F | | 5A,5E,5D,5F | 11 | SEG8 |
| SEG24 | SEG24 | 31 | S9,6G,6B,6C | | 5B,5C,-,5G | 10 | SEG7 |
| SEG25 | SEG25 | 32 | 6D,6F,6A,6E | | X23,X25,X26,X24 | 9 | SEG6 |
| SEG26 | SEG26 | 33 | X31,X33,X34,X32 | | S13,8G,8B,8C | 8 | SEG5 |
| SEG45 | SEG27 | 34 | -,X27,X35,X30 | | 8D,8F,8A,8E | 7 | SEG4 |
| SEG44 | SEG28 | 35 | -,X28,X36,X29 | | DP2,7G,7B,7C | 6 | SEG3 |
| SEG43 | SEG29 | 36 | S1,S3,S4,S2 | | 7D,7F,7A,7E | 5 | SEG2 |
| SEG42 | SEG30 | 37 | S6,-,-,S7 | | S11,-,-,- | 4 | SEG1 |
| SEG31 | SEG31 | 38 | S5,-,-S8 | | S12,-,-,S10 | 3 | SEG0 |
| COM3 | COM3 | 39 | COM4 | | COM1 | 2 | COM0 |
| | NC | 40 | NC | | NC | 1 | NC |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
 Shaded cells indicate the pins that are remapped to the corresponding pin on the PIM.

FIGURE A-9: SEGMENT CONFIGURATION FOR PIC16F/LF1946/7 DEVICES



Board Technical Information

TABLE A-18: PIC16F/LF1946/7 PORT AND PIN COMPARISON

| PIC16F/LF1946/7 Port | PIC16F/LF1946/7 Pin | ICE Pin | ICE Port |
|----------------------|---------------------|---------|----------|
| RA0 | AN0 | AN0 | RA0 |
| RA1 | AN1 | AN1 | RA1 |
| RC0 | T1OSCO | T1OSCO | RC0 |
| RC1 | T1OSCI | T1OSCI | RC1 |
| RB0 | RB0 | RB0 | RB0 |
| RE3 | COM0 | COM0 | RE3 |
| RB5 | COM1 | COM1 | RE4 |
| RE5 | COM2 | COM2 | RE5 |
| RE6 | COM3 | COM3 | RE6 |
| RB6 | RB6 | RB6 | RB6 |
| RB7 | RB7 | RB7 | RB7 |
| RE0 | VLCD1 | BIAS1 | RE0 |
| RE1 | VLCD2 | BIAS2 | RE1 |
| RE2 | VLCD3 | BIAS3 | RE2 |
| RC3 | RC3 | RC3 | RC3 |
| RC4 | RC4 | RC4 | RC4 |
| RC6 | TX/CK | TX/CK | RC6 |
| RC7 | RX/DT | RX/DT | RC7 |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
Shaded cells indicate the pins that are remapped to the corresponding pin/port on the PIM.

PICDEM™ LCD 2 Demonstration Kit User's Guide

TABLE A-19: PIC16F917 PIM AND ICE PIN/PORT COMPARISON

| PIC16F917 PIM Pin No. | PIC16F917 Port | PIC16F917 Pin | ICE Pin | ICE Port | ICE Pin No. |
|-----------------------|----------------|---------------|---------|----------|-------------|
| 1 | RC7 | RX/DT | RX/DT | RC7 | 51 |
| 2 | RD4 | SEG17 | SEG17 | RA3 | 17 |
| 3 | RD5 | SEG18 | SEG18 | RF0 | 18 |
| 4 | RD6 | SEG19 | SEG19 | RF1 | 19 |
| 5 | RD7 | SEG20 | SEG20 | RF2 | 20 |
| 6 | Vss | Vss | Vss | Vss | Vss |
| 7 | VDD | ICEVDD | ICEVDD | VDD | 45 |
| 8 | RB0 | RB0 | RB0 | RB0 | 72 |
| 9 | RB1 | SEG1 | SEG6 | RD6 | 78 |
| 10 | RB2 | SEG2 | SEG7 | RD7 | 77 |
| 11 | RB3 | SEG3 | SEG8 | RB1 | 71 |
| 14 | RB4 | COM0 | COM0 | RE3 | 8 |
| 15 | RB5 | COM1 | COM1 | RE4 | 7 |
| 16 | RB6 | RB6 | RB6 | RB6 | 66 |
| 17 | RB7 | RB7 | RB7 | RB7 | 60 |
| 18 | ICEMCLR | ICEMCLR | ICEMCLR | ICEMCLR | 20 |
| 19 | RA0 | AN0 | AN0 | RA0 | 42 |
| 20 | RA1 | AN1 | AN1 | RA1 | 41 |
| 21 | RA2 | COM2 | COM2 | RE5 | 6 |
| 22 | RA3 | SEG15 | SEG15 | RA5 | 15 |
| 23 | RA4 | SEG4 | SEG9 | RB2 | 4 |
| 24 | RA5 | SEG5 | SEG10 | RB3 | 5 |
| 25 | RE0 | SEG21 | SEG21 | RF3 | 21 |
| 26 | RE1 | SEG22 | SEG22 | RF4 | 22 |
| 27 | RE2 | SEG23 | SEG23 | RF5 | 23 |
| 28 | VDD | ICEVDD2 | ICEVDD | VDD | 2 |
| 29 | Vss | Vss | Vss | Vss | Vss |
| 30 | RA7 | T1OSCI | T1OSCI | RC1 | 48 |
| 31 | RA6 | T1OSCO | T1OSCO | RC0 | 49 |
| 32 | RC0 | VLCD1 | BIAS1 | RE0 | 15 |
| 35 | RC1 | VLCD2 | BIAS2 | RE1 | 14 |
| 36 | RC2 | VLCD3 | BIAS3 | RE2 | 9 |
| 37 | RC3 | SEG6 | SEG11 | RB4 | 68 |
| 38 | RD0 | COM3 | COM3 | RE6 | 5 |
| 39 | RD1 | RD1 | RC3 | RC3 | 57 |
| 40 | RD2 | RD2 | RC4 | RC4 | 58 |
| 41 | RD3 | SEG16 | SEG16 | RA2 | 16 |
| 42 | RC4 | SEG11 | SEG14 | RA4 | 47 |
| 43 | RC5 | SEG10 | SEG13 | RC2 | 56 |
| 44 | RC6 | TX/CK | TX/CK | RC6 | 50 |

Legend: Unshaded cells indicate where a perfect match between PIM and ICE pins and ports exists.
 Shaded cells indicate where differences between PIM and ICE ports and pins exist.
Bold text indicates the PIM pins that are not connected to any ICE pins or ports.

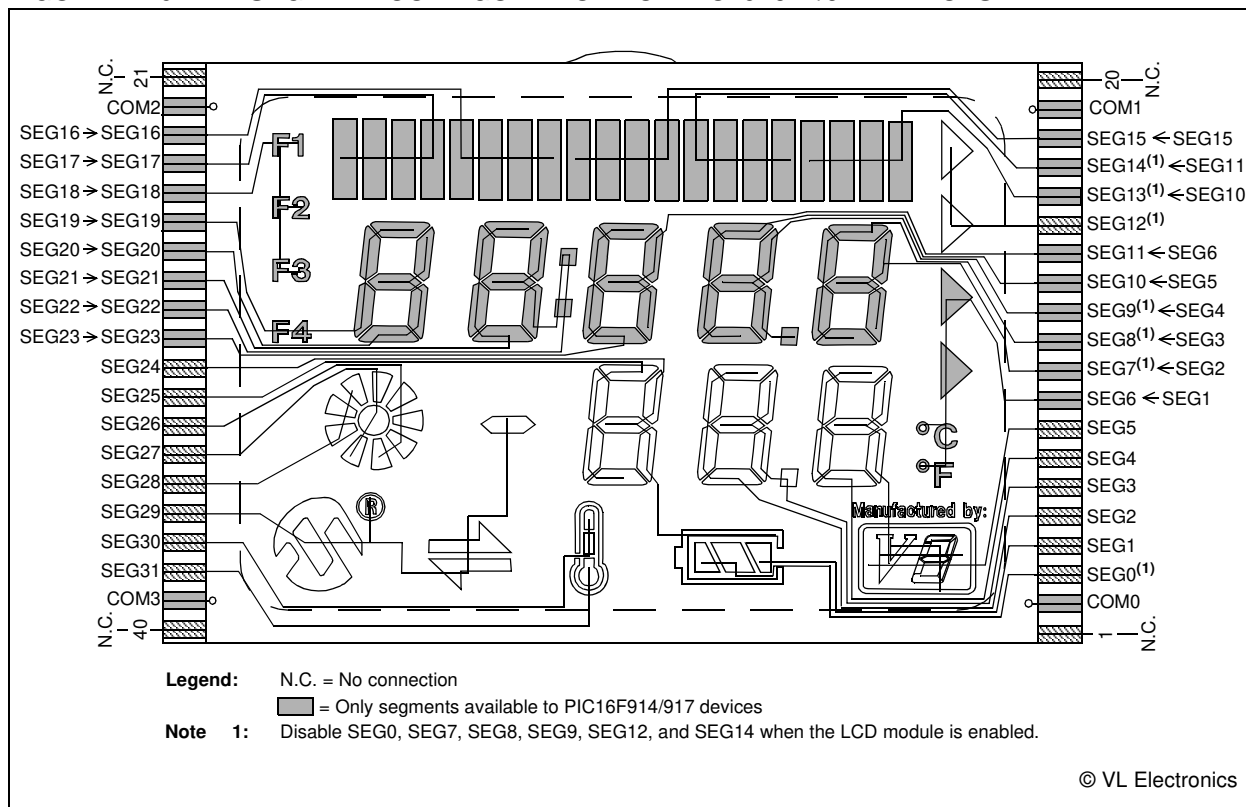
Board Technical Information

TABLE A-20: PIC16F917 LCD CONNECTIONS COMPARISON

| PIC16F917 | ICE | Pin # | | | Pin # | ICE | PIC16F917 |
|-----------|-------|-------|-----------------|--|-----------------|-----|-----------|
| | NC | 21 | NC | | NC | 20 | NC |
| COM2 | COM2 | 22 | COM3 | | COM2 | 19 | COM1 |
| SEG16 | SEG16 | 23 | X8,X6,X5,X7 | | X9,X11,X12,X10 | 18 | SEG15 |
| SEG17 | SEG17 | 24 | X1,X3,X4,X2 | | X16,X14,X13,X15 | 17 | SEG14 |
| SEG18 | SEG18 | 25 | -,F2,F1,F3 | | X17,X19,X20,X18 | 16 | SEG13 |
| SEG19 | SEG19 | 26 | 1A,1E,F4,1F | | -,X22,X21,- | 15 | SEG12 |
| SEG20 | SEG20 | 27 | 1B,1C,1D,1G | | 3B,3C,-,3G | 14 | SEG11 |
| SEG21 | SEG21 | 28 | 2A,2E,2D,2F | | 4A,4E,4D,4F | 13 | SEG10 |
| SEG22 | SEG22 | 29 | 2B,2C,COL,2G | | 4B,4C,DP1,4G | 12 | SEG9 |
| SEG23 | SEG23 | 30 | 3A,3E,3D,3F | | 5A,5E,5D,5F | 11 | SEG8 |
| NC | SEG24 | 31 | S9,6G,6B,6C | | 5B,5C,-,5G | 10 | SEG7 |
| NC | SEG25 | 32 | 6D,6F,6A,6E | | X23,X25,X26,X24 | 9 | SEG6 |
| NC | SEG26 | 33 | X31,X33,X34,X32 | | S13,8G,8B,8C | 8 | SEG5 |
| NC | SEG27 | 34 | -,X27,X35,X30 | | 8D,8F,8A,8E | 7 | SEG4 |
| NC | SEG28 | 35 | -,X28,X36,X29 | | DP2,7G,7B,7C | 6 | SEG3 |
| NC | SEG29 | 36 | S1,S3,S4,S2 | | 7D,7F,7A,7E | 5 | SEG2 |
| NC | SEG30 | 37 | S6,-,-,S7 | | S11,-,-,- | 4 | SEG1 |
| NC | SEG31 | 38 | S5,-,-S8 | | S12,-,-,S10 | 3 | SEG0 |
| COM3 | COM3 | 39 | COM4 | | COM1 | 2 | COM0 |
| | NC | 40 | NC | | NC | 1 | NC |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
 Shaded cells indicate the pins that are remapped to the corresponding pin on the PIM.
Bold text indicates the PIM pins that are not connected.

FIGURE A-10: SEGMENT CONFIGURATION FOR PIC16F914/917 DEVICES



PICDEM™ LCD 2 Demonstration Kit User's Guide

TABLE A-21: PIC16F917 PIN AND PORT COMPARISON

| PIC16F917 Port | PIC16F917 Pin | ICE Pin | ICE Port |
|----------------|---------------|---------|----------|
| RA0 | AN0 | AN0 | RA0 |
| RA1 | AN1 | AN1 | RA1 |
| RA6 | T1OSCO | T1OSCO | RC0 |
| RA7 | T1OSCI | T1OSCI | RC1 |
| RB0 | RB0 | RB0 | RB0 |
| RB5 | COM1 | COM1 | RE4 |
| RB6 | RB6 | RB6 | RB6 |
| RB7 | RB7 | RB7 | RB7 |
| RC0 | VLCD1 | BIAS1 | RE0 |
| RC1 | VLCD2 | BIAS2 | RE1 |
| RC3 | SEG6 | SEG11 | RB4 |
| RC4 | SEG11 | SEG14 | RA4 |
| RC6 | TX/CK | TX/CK | RC6 |
| RC7 | RX/DT | RX/DT | RC7 |

Legend: Unshaded cells indicate a perfect match between the PIM and the glass.
Shaded cells indicate the pins that are remapped to the corresponding pin on the PIM.

A.3 LED DISPLAY

Two green LEDs are connected to RC3 and RC4 of U1A through the J14 pins, 1, 2 and 7, 8 (outer ends), respectively.

One green LED is provided to determine whether there is power to the LCD 2 Demonstration Board (LED on) or not (LED off).

- Note 1:** For the PIC18F85J90 and PIC18F87J90 PIM, the RG2 and RG3 pins are connected to RC3 and RC4 of U1A, respectively.
- 2:** For the PIC16F17 PIM, the RD1 and RD2 pins are connected to RC3 and RC4 of U1A, respectively.
- 3:** For the PIC18F8490 PIM, the RC3 and RD4 pins are connected to RC3 and RC4 of U1A, respectively

A.4 CHARGE PUMP AND VLCAP

For charge pump mode operation in PIC18F85J90 and PIC18F87J90 devices, it is required that RC3 and RC4 of U1A connect to charge pump capacitor C7 through the J14 pins, 3, 4 and 5, 6 (inner pins), respectively.

A.5 RESISTIVE LADDER VERSUS CHARGE PUMP

The switch, S6, allows the connection of either the resistor ladder or the capacitors to the BIAS pins to generate the BIAS voltages for the LCD operation. For the Charge Pump mode operation in PIC18F85J90 and PIC18F87J90 devices, it is required that the S6 switch is flipped towards C and the VLCAP is connected through the inner jumpers of J14. For the resistor ladder, S6 must be flipped towards R. The R45 potentiometer controls the contrast to the LCD in the Resistive Ladder mode.

A.5.1 Jumper JP21

When jumper JP21 is on, the LCDBIAS0 is physically tied to ground. The jumper needs to be on for PIC18F85J90 and PIC18F87J90 devices when the bias voltages are generated through the resistor ladder.

A.6 OSCILLATOR OPTIONS

The on-board firmware uses the internal RC oscillator running at 8 MHz.

- Internal RC oscillator running at 8 MHz can be used.
- Pads provided for user-furnished crystal/resonator (Y2) and two capacitors (C16 and C17).
- Socket provided for a canned oscillator (Y3). This oscillator can be disabled by removing jumpers, JP9, JP11 and JP12.
- 32.768 kHz (watch-type) crystal for Timer1 (Y1) is always connected to RC0 and RC1.

A.7 RS-232 SERIAL PORT

An RS-232 level shifting IC has been provided with all necessary hardware to support connection of an RS-232 host through the DB9 connector (PI). The port is configured as DCE and can be connected to a PC using a serial cable.

A.8 REAL-TIME CLOCK

This circuit allows the user to configure a PIC microcontroller for timekeeping using a 32.768 kHz clock crystal connected to Timer1 module's T1OSO and T1OSI pins.

A.9 SERIAL EEPROM

A socket for a Microwire EEPROM is provided on the board to illustrate usage of the Synchronous mode of operation of the USART module. For its operation:

- Jumpers, JP15 and JP16, should be connected.
- In the jumper, J6, U9-CS should be connected with RB5.
- In the jumper, J13, U9-ORG (pin 6) should be connected to GND.

- | |
|--|
| <p>Note 1: For the PIC18F85J90 and PIC18F87J90 PIM, the RG2 and RG3 pins are connected to RC3 and RC4 of U1A, respectively.</p> <p>2: For the PIC16F917 PIM, the RD1 and RD2 pins are connected to RC3 and RC4 of U1A, respectively.</p> <p>3: For the PIC18F8490, PIC16F946 and PIC16F/LF/1946/7 PIMs, the RC3 and RC4 pins are connected to RC3 and RC4 of U1A, respectively.</p> |
|--|

A.10 ANALOG INPUT

A 10 k Ω potentiometer is connected through a series of 100 Ω resistors to AN0. The potentiometer can be adjusted from VCC to GND. The jumper, J11, should be connecting the potentiometer to AN0.

PICDEM™ LCD 2 Demonstration Kit User's Guide

A.11 TEMPERATURE SENSOR

A 10 k Ω TC thermistor (R11) is provided to sense the temperature. It is connected to AN1 (RA1) through the jumper, JP5. An optional unpopulated TC77-based circuit is provided to read the temperature serially using the USART module. The jumpers, JP15 and JP16, are to be connected and RA1 of U1A should be made digital to be used to enable TC77.

- Note 1:** For the PIC18F85J90 and PIC18F87J90 PIM, the RA2 pin is connected to RA1 of U1A and AN2 is used instead of AN1.
- 2:** For the PIC18F8490, PIC16F/LF/1946/7, PIC16F946, and PIC16F917 PIMs, the RA1 pin is connected to RA1 of U1A.

A.12 SWITCHES

Four switches provide the following functions for digital I/Os:

- S1 – Active-low switch connected to RB6.
- S2 – Active-low switch connected to RB6 and RB7.
- S3 – Active-low switch connected to RB6, RB7 and RA6.
- S4 – Active-low switch connected to RB6, RB7, RA6 and RA7.

For this type of sensing, the jumpers, JP1, JP2, JP6, JP18, JP19, JP9 and JP10, should be connected and the potentiometer should be connected to AN0 through J11. Sensing should be done in the sequence, S1, S2, S3 and S4, only. Individual switch sensing is not allowed.

Additionally, the four switches provide the following functions for analog input (AN0):

- S1 – AN0 will be approximately at $V_{CC}/2$.
- S2 – AN0 will be approximately at $V_{CC}/3$.
- S3 – AN0 will be approximately at $V_{CC}/5.2$.
- S4 – AN0 will be approximately at $V_{CC}/7.7$.

For this type of sensing, the jumpers, JP1, JP2, JP6, JP18 and JP19, should not be connected and the SWT should be connected to AN0 through J11.

A.13 ICD CONNECTOR

By way of the modular connector (J37), the MPLAB ICD 2 can be connected for low-cost debugging. The ICD connector utilizes RB6/PGC and RB7/PGD of the microcontrollers for in-circuit debugging.

A.14 POWER SUPPLY

There are four ways to supply power to the PICDEM LCD 2:

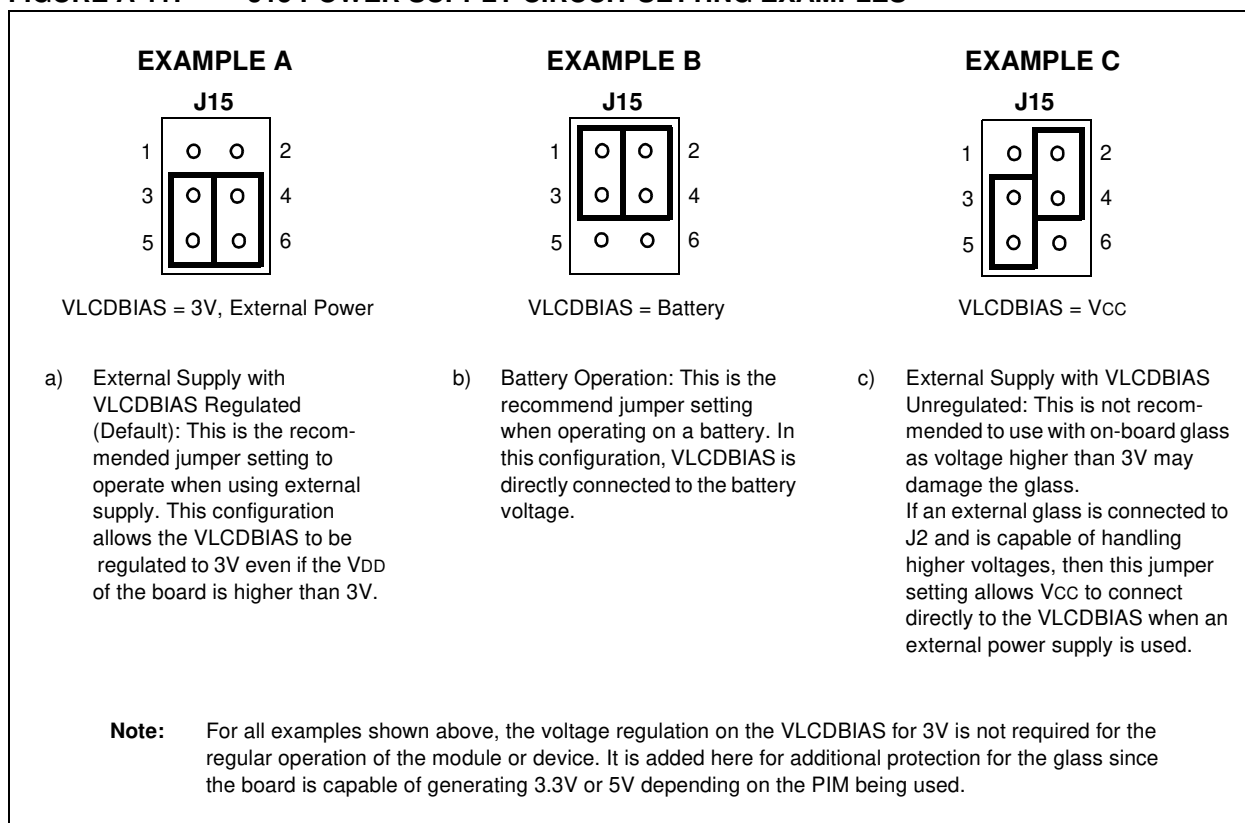
- A 3V button cell (CR2032) can be plugged into BT1.
- A 9V, 100 mA unregulated AC to DC supply can be plugged into J5. A power supply can be purchased through Microchip Technology (Part Number AC162039).
- A 100 mA regulated DC supply of maximum +5V can be connected to the hooks provided.

Note: There is one J15 jumper associated with the power supply circuit. This jumper must be correctly connected to select the required power supply. Refer to Figure A-11 for jumper setting examples.

MPLAB ICD 2 users may use the ICD to power the target board to 5V, up to 200 mA, for the following devices *only*: PIC18F8490, PIC16F/LF/1946/7, PIC16F946 and PIC16F916. The PIC18F85J90 and PIC18F87J90 families of devices do not support this capability.

The default power on the board is 5V. The board voltage can be varied based on resistors populated on the PIM in conjunction with the processor being used.

FIGURE A-11: J15 POWER SUPPLY CIRCUIT SETTING EXAMPLES



A.14.1 Using the Adjustable Voltage Regulator

The PICDEM LCD 2 board features an adjustable voltage regulator, the venerable LM317. It is U3 on the board, and can be recognized by the SO-223 package on the upper left side. Nearby, there is a header, J10, and two resistors, R25 and R26. R25 and R26 are used to set the output voltage of the LM317. By default, R25 = 1K and R26 = 330R, which results in an output voltage of 5.0V.

The reason an adjustable voltage regulator is provided is so that the PICDEM LCD 2 Demonstration Board can be used with a wide range of LCD PIC microcontrollers. The PIC18FXXJ90 family of devices tolerates a maximum V_{DD} of 3.6V, whereas the PIC18FXX90, PIC16F91X and PIC16F946 tolerate a maximum V_{DD} of 5.5V. The adjustable voltage regulator allows a different V_{DD} to be provided for PIC18FJ devices and PIC18F and PIC16F LCD devices.

The switching between 3.6V and 5.5V parts is very convenient. The plug-in module boards are populated with the R101 and R102, appropriately, according to the processor module requirement which mates with the daughter board/emulator header that surrounds the ICE module (U1A). J10 on the PICDEM LCD 2 board is intended to connect with the 3-pin header on the plug-in module. This allows the resistors, R101 and R102, on the plug-in module to be connected in parallel to the resistors, R25 and R26. This way V_{DD} can automatically be adjusted to the voltage appropriate to the part soldered onto the plug-in module.

The plug-in module is prepopulated with the values shown in Table A-22:

TABLE A-22: PIM PREPOPULATED VALUES

| Module | R101 | R102 | V _{DD} |
|---------------|------|-------|-----------------|
| PIC18F87J90 | Open | 1.18K | 3.3V |
| PIC18F85J90 | Open | 1.18K | 3.3V |
| PIC18F8490 | Open | Open | 5.0V |
| PIC16F914/917 | Open | Open | 5.0V |
| PIC16F946 | Open | Open | 5.0V |
| PIC16F1946/7 | Open | Open | 5.0V |
| PIC16LF1946/7 | Open | 1.18K | 3.3V |

For V_{DD} = 3.3 volts, R101 can be left unpopulated and R102 can be 1.18K. (1% resistors are recommended for precise adjustment of V_{DD}.)

Now, let's look at how to determine R101 and R102 if a different V_{DD} is desired. First, it is a good idea to look at the data sheet for the LM317 to understand how the voltage is adjusted. We will not duplicate all the details here. The following equation is taken from an LM317 data sheet:

EQUATION A-1:

$$V_{OUT} = V_{REF} (1 + R2/R1) + I_{ADJ} * R2$$

I_{ADJ} is minimized by the LM317, so it can be assumed to be zero or at least very small. V_{REF} = 1.25V; it is the reference voltage developed by the LM317 between the output and adjustment terminal.

That gives us the following equation:

EQUATION A-2:

$$V_{OUT} = 1.25V(1 + R2/R1)$$

$$R2 = R25 || R102 = (R25 * R102) / (R25 + R102)$$

$$R1 = R26 || R101 = (R26 * R101) / (R26 + R101)$$

As stated previously, $R25 = 1K$ and $R26 = 330$. You can see that without $R102$ and $R101$, $V_{OUT} = 1.25V(1 + 1K/330R) = 5.04V$.

For a desired V_{OUT} , first solve for $R2$, given $R1 = R26 = 330R$. Then, knowing $R2$ and $R25$, solve for $R102$. Determine the nearest available resistor value for $R102$ and recalculate the resulting V_{DD} to make sure it does not exceed the maximum V_{DD} for the part you will be using.

Table A-23 shows values for $R101$ and $R102$ for different V_{DD} values, assuming that $R25$ and $R26$ on the PICDEM LCD 2 Board are left as their default values of $1K$ and $330R$.

TABLE A-23: R101 AND R102 V_{DD} VALUES

| V_{DD} | R101 | R102 |
|----------------------------|-------------|-------------|
| 5V | Open | Open |
| 3.6V | Open | 1.62K |
| 3.3V | Open | 1.18K |
| 3.0V | Open | 866R |

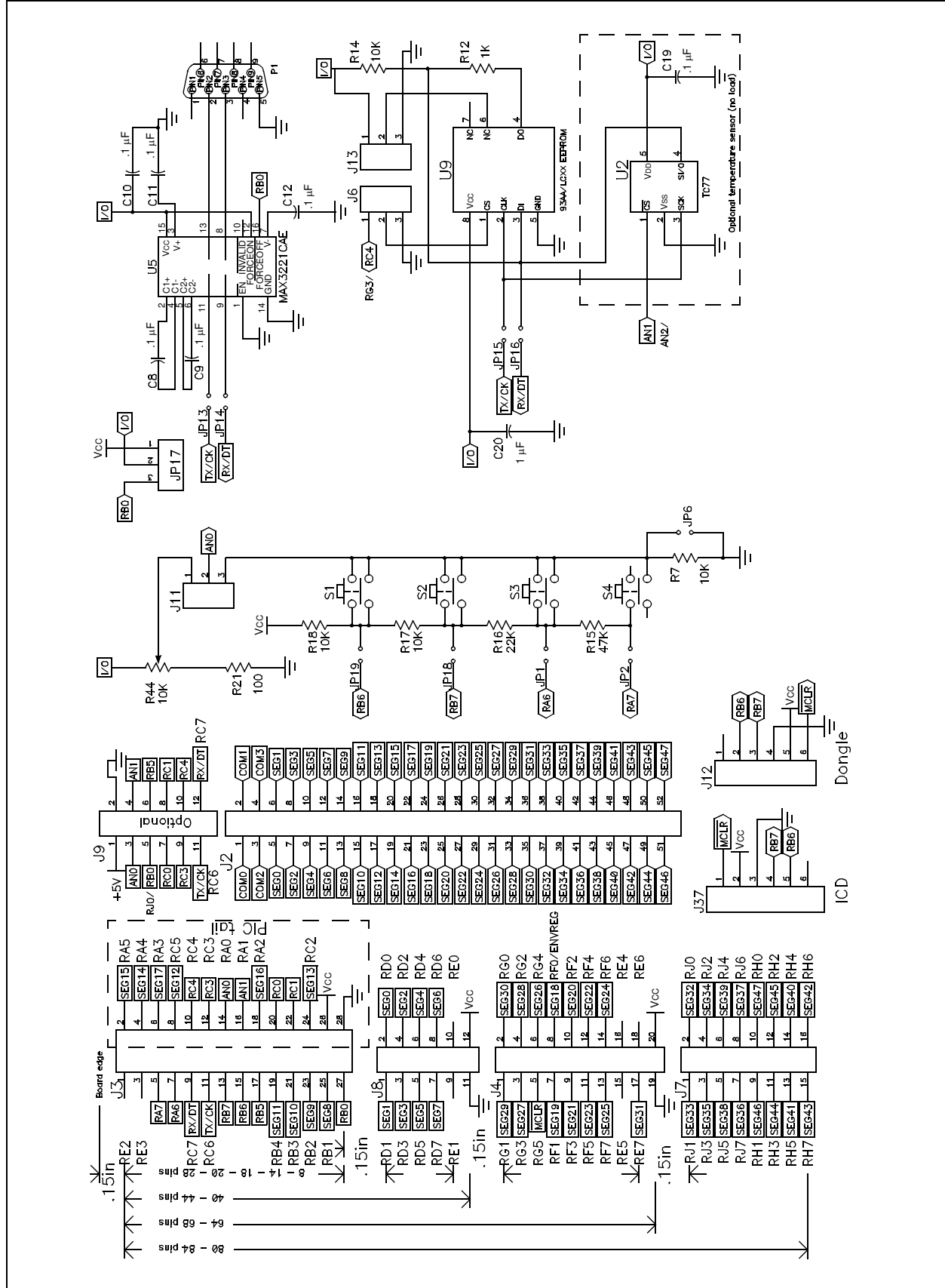
Recommended operating voltages for the various PIMs are:

- PIC18F85J90 and PIC18F87J90 families of devices – 3.3V
- PIC18F8490 family of devices – 5V
- PIC16F917/914 devices – 5V
- PIC16F946 – 5V (when operating on an external 9V DC supply)
- PIC16F1946/7 – 5V
- PIC16LF1946/7 – 3.3V

A.14.2 Slide Switch (S6)

The slide switch allows choosing the BIAS values, either generated by the resistor ladder, or by the capacitive charge pump. When $S6$ is switched to the left, the LCDBIAS pins of the microcontroller are connected to the resistor ladder. When $S6$ is switched to the right, the LCDBIAS pins of the microcontroller are connected to the capacitor network.

FIGURE A-13: PICDEM™ LCD 2 SCHEMATIC SHEET 1 OF 3



PICDEM™ LCD 2 Demonstration Kit User's Guide

FIGURE A-14: PICDEM™ LCD 2 SCHEMATIC SHEET 2 OF 3

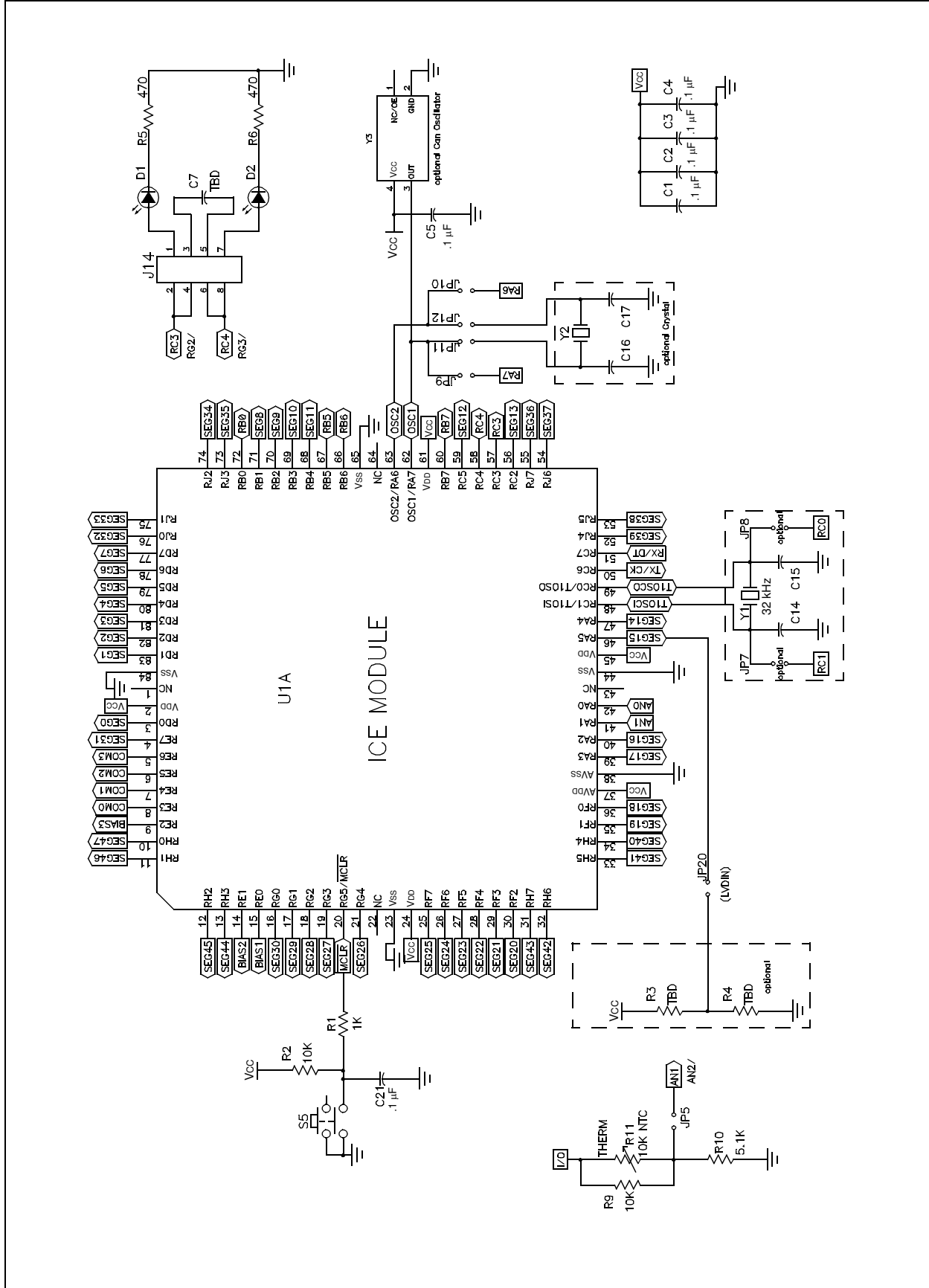
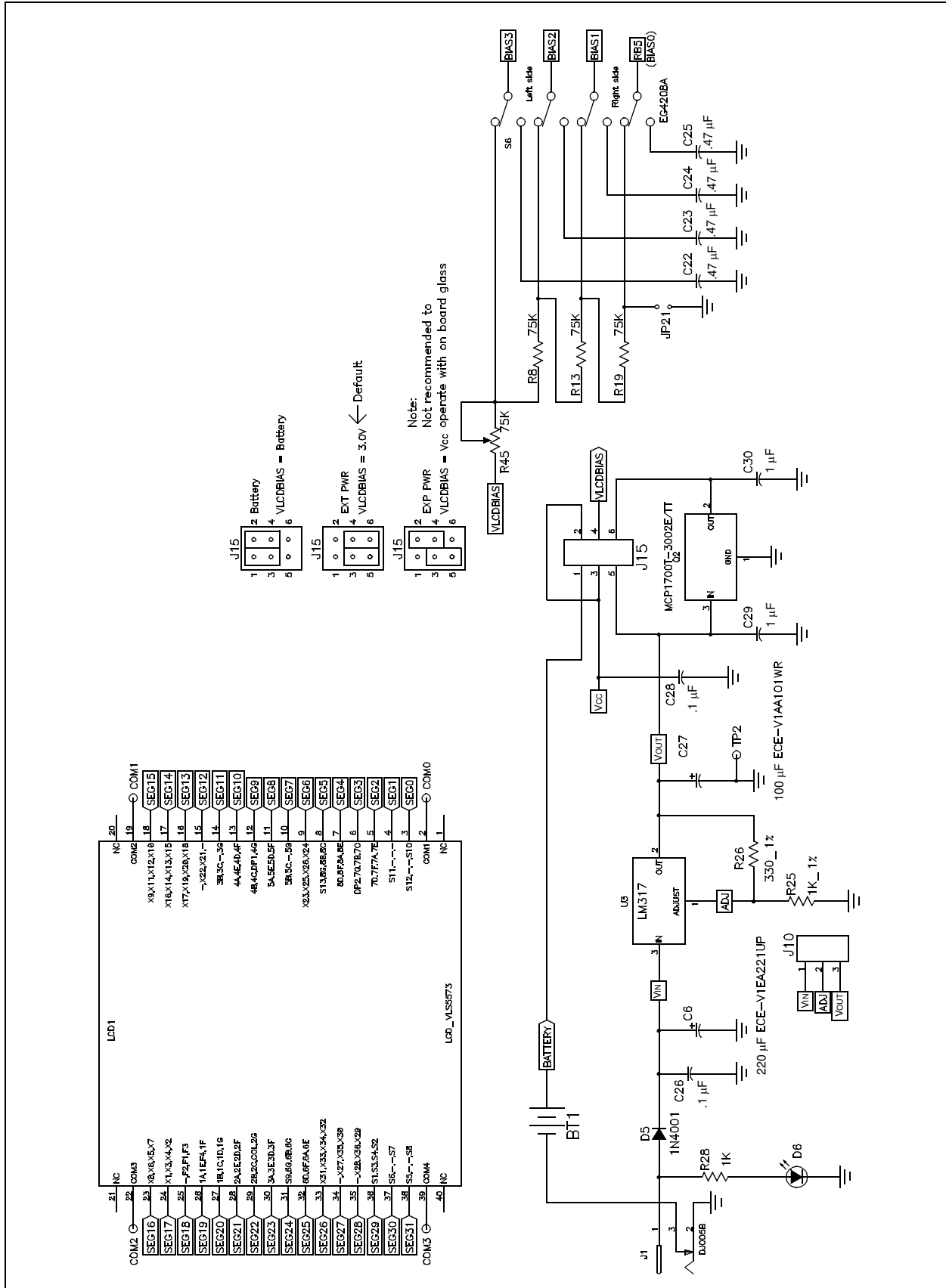


FIGURE A-15: PICDEM™ LCD 2 SCHEMATIC SHEET 3 OF 3



PICDEM™ LCD 2 Demonstration Kit User's Guide

A.16 PIM LAYOUT AND SCHEMATICS

The following figures show the layout (silkscreen) for the individual PIMs.

FIGURE A-16: PIC18F65J90 AND PIC18F85J90 PIM LAYOUT

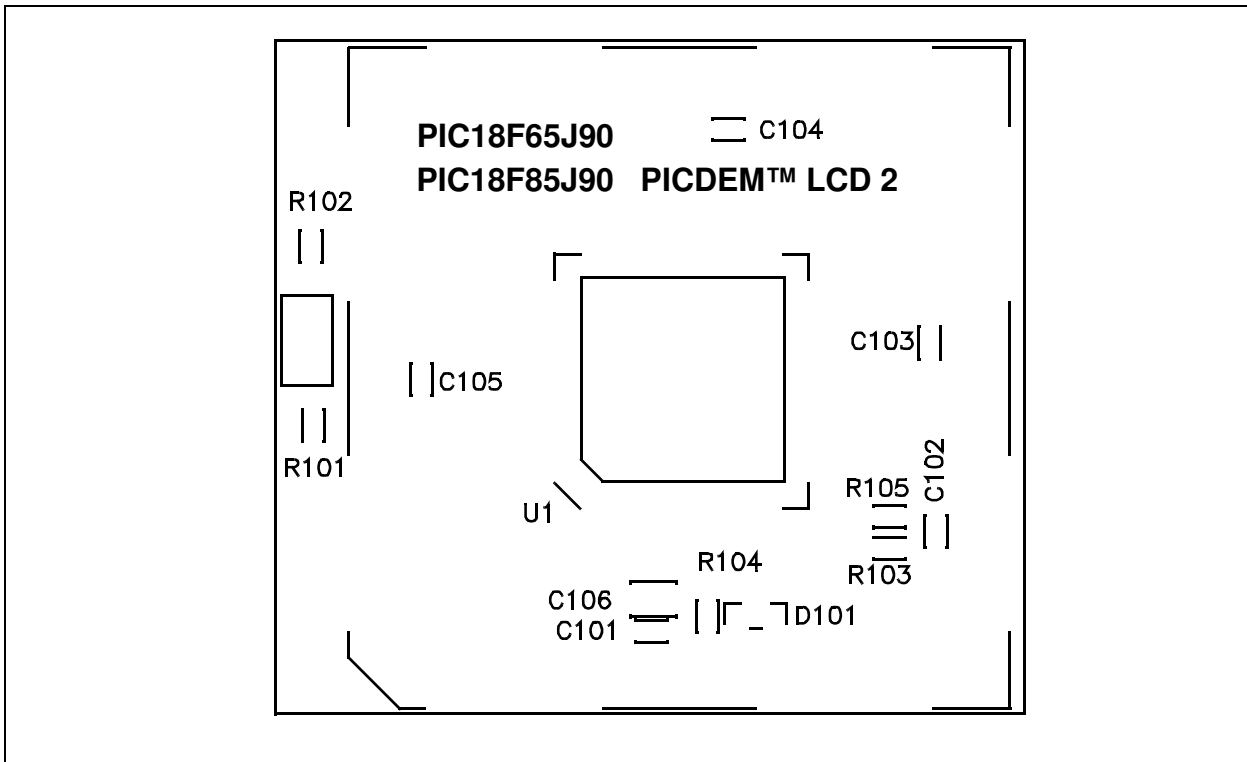


FIGURE A-17: PIC16F914/917 PIM LAYOUT

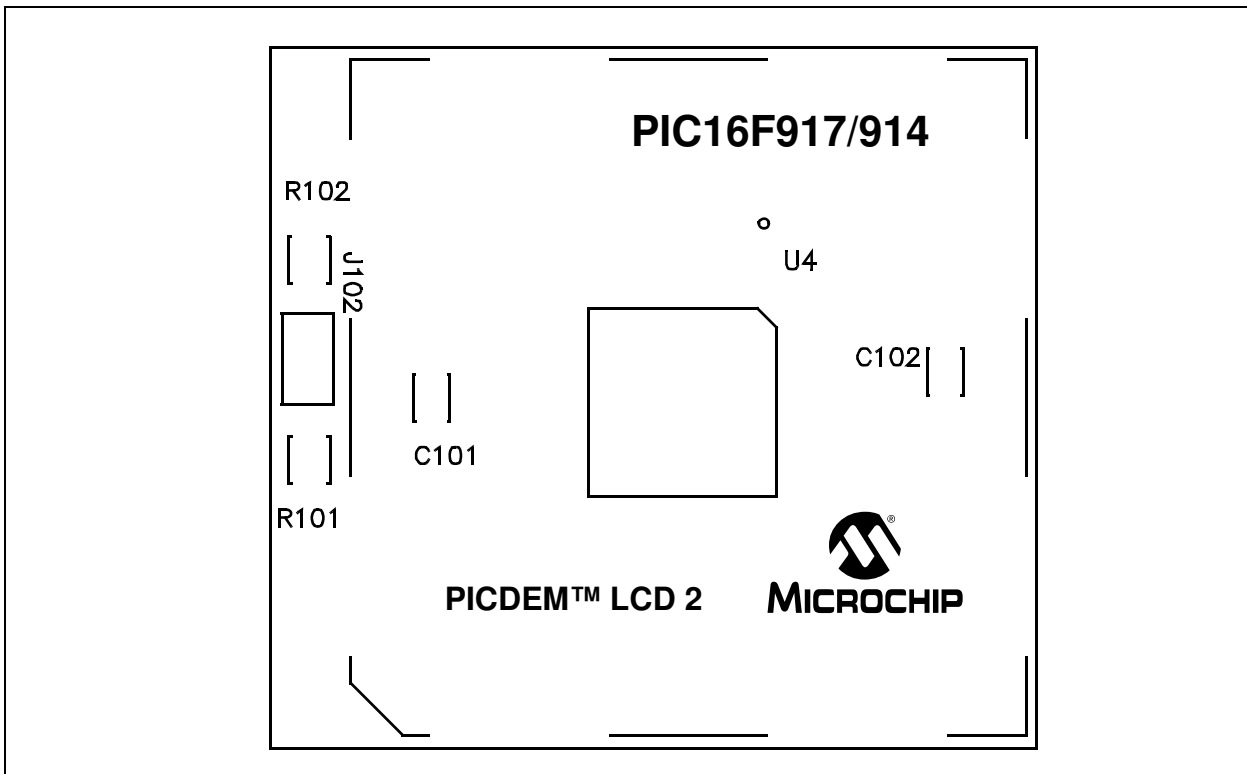


FIGURE A-18: PIC16F946 PIM LAYOUT

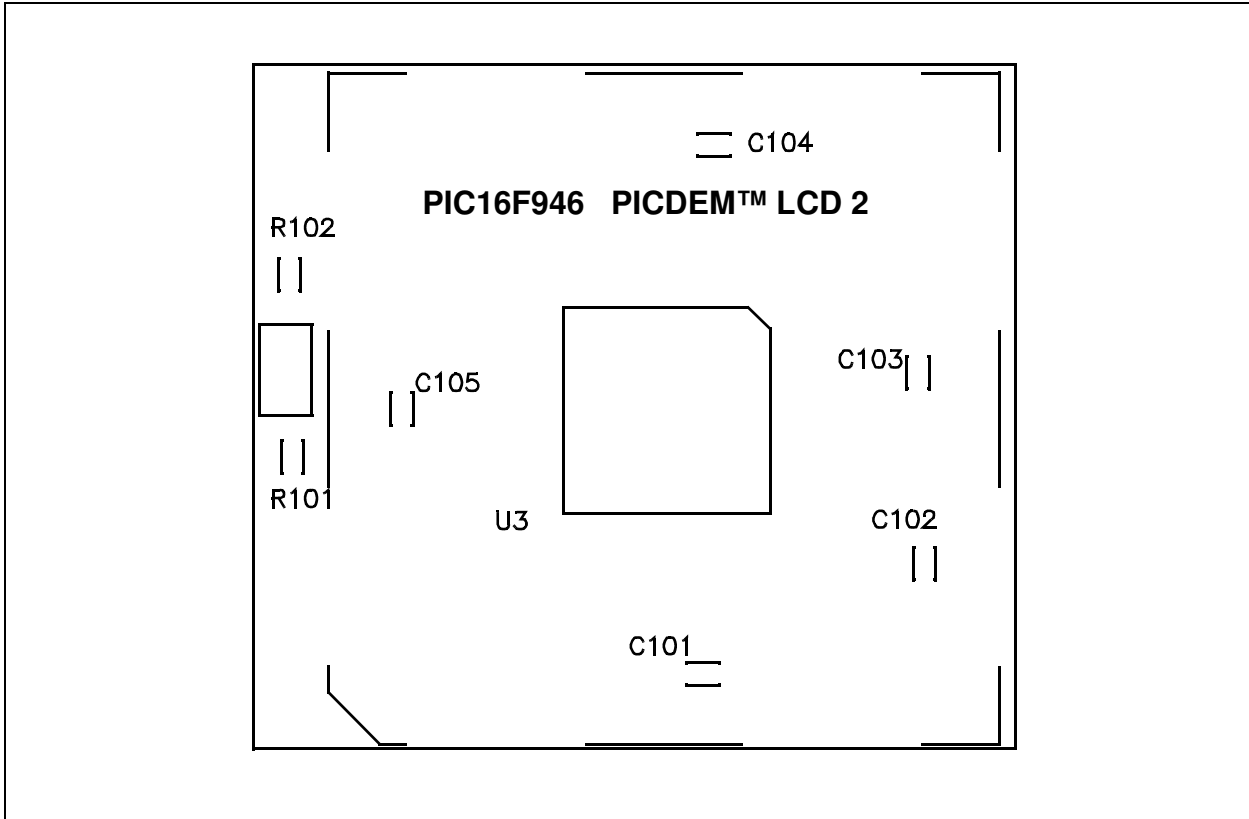
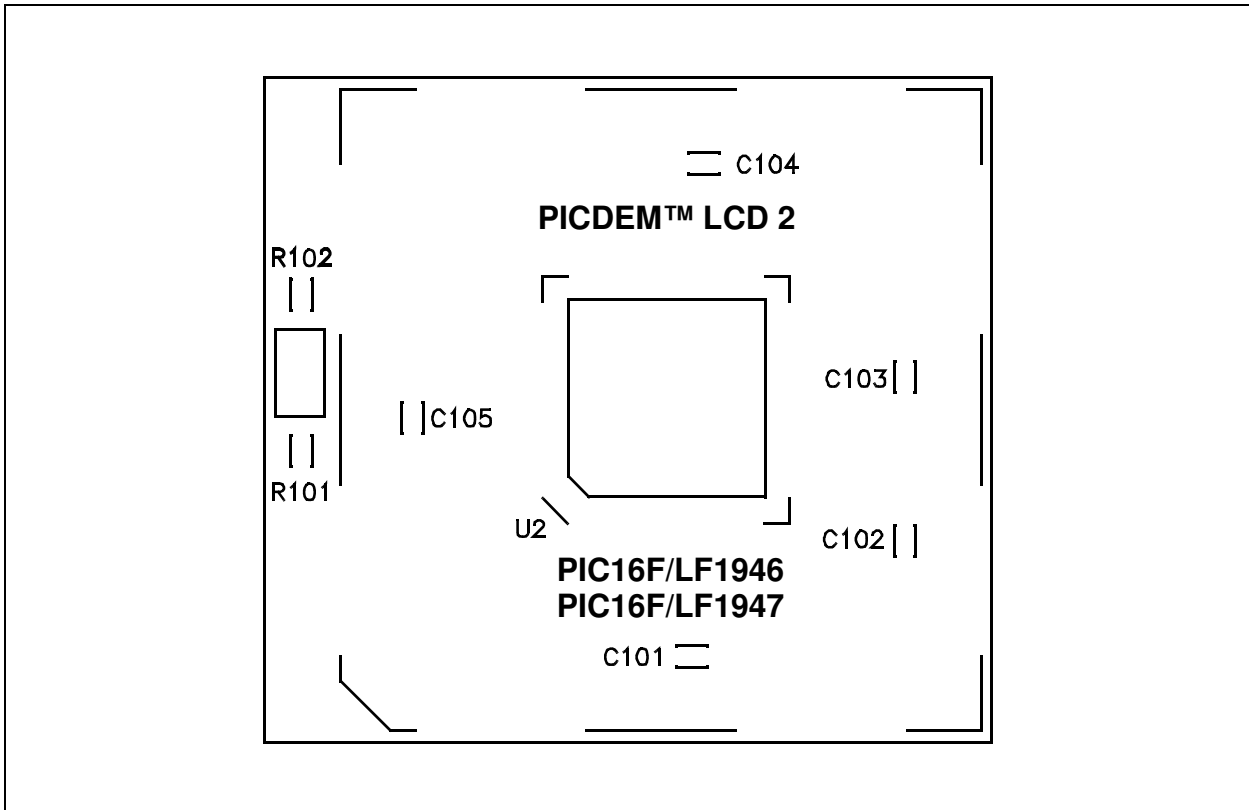


FIGURE A-19: PIC16F/LF1946/7 PIM LAYOUT



PICDEM™ LCD 2 Demonstration Kit User's Guide

FIGURE A-20: PIC18F6490/8490 PIM LAYOUT

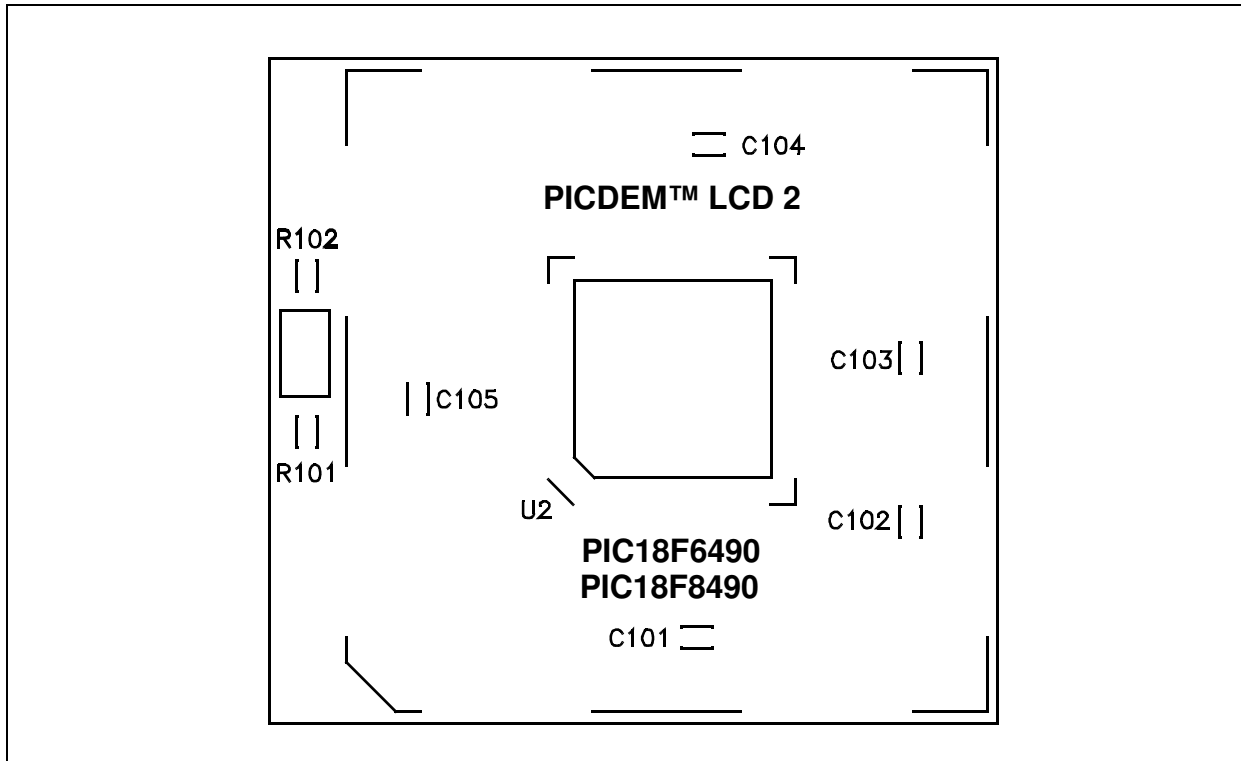


FIGURE A-21: PIC18F87J90 PIM LAYOUT

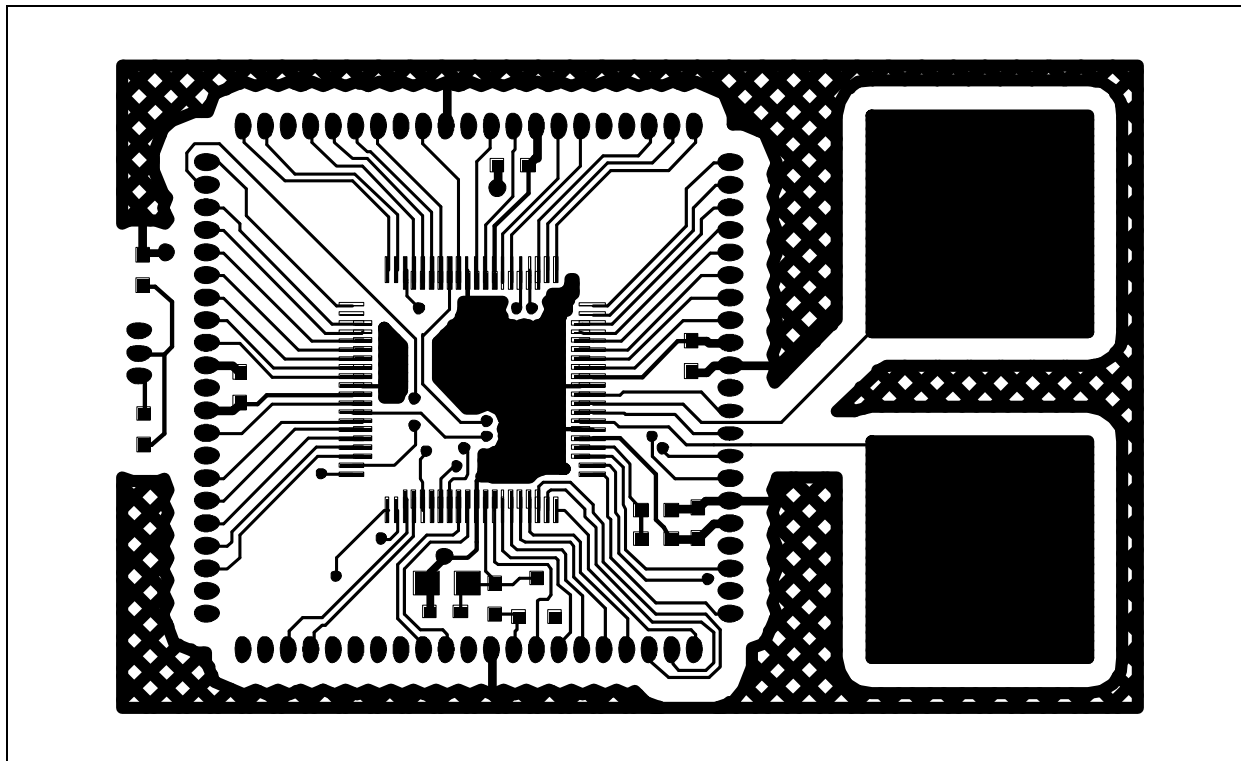


FIGURE A-22: PICDEM™ LCD 2 PIC16F914/917 PIM SCHEMATIC

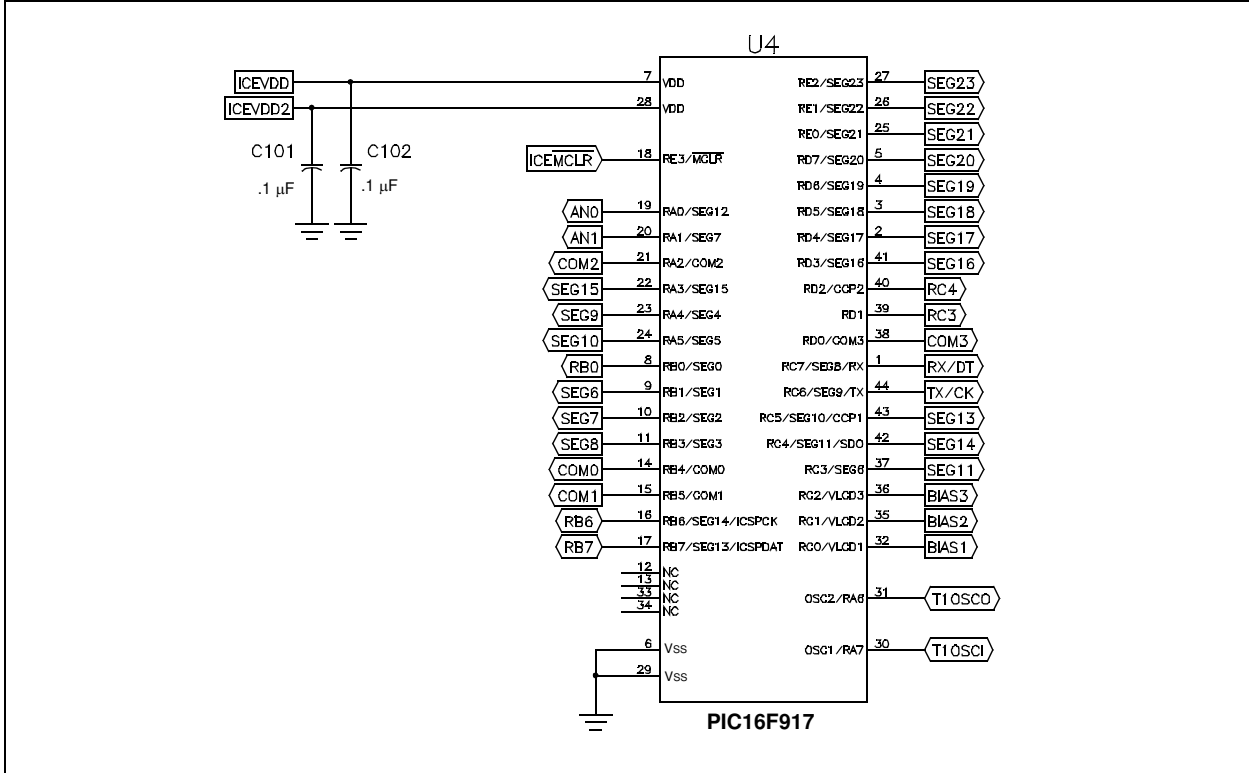
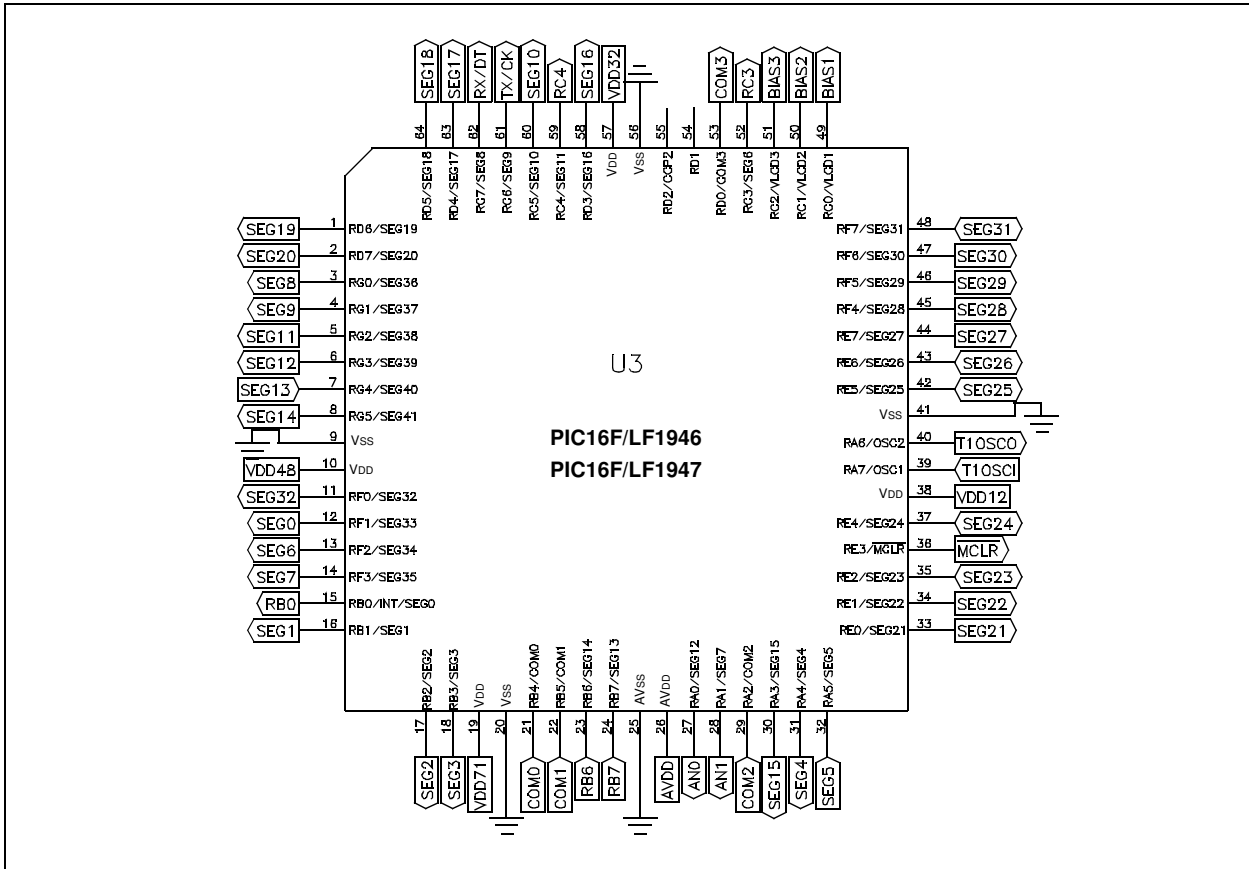


FIGURE A-23: PICDEM LCD 2 PIC16F/LF1946/7 64-PIN PIM SCHEMATIC



Board Technical Information

FIGURE A-26: PICDEM™ LCD 2 PIC18F8490 80-PIN PIM SCHEMATIC

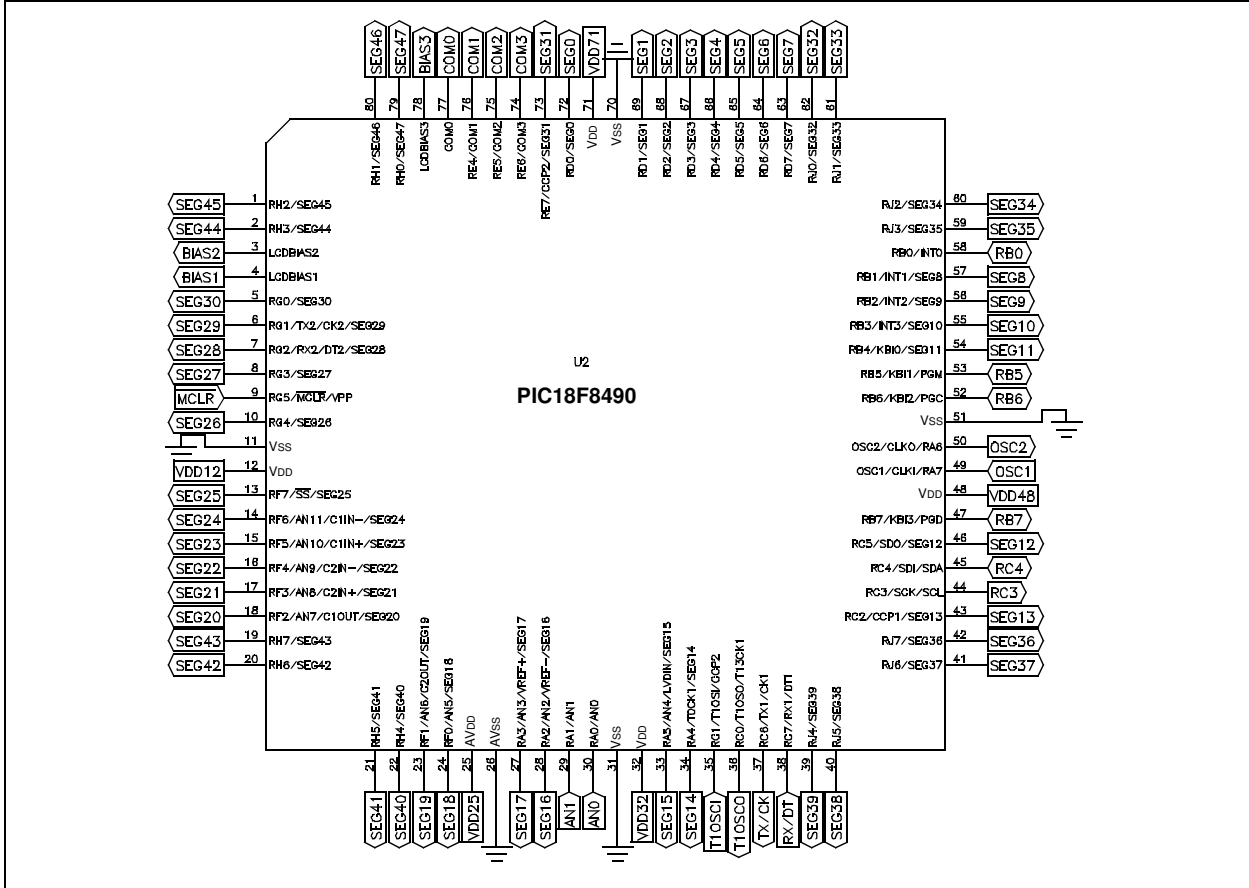
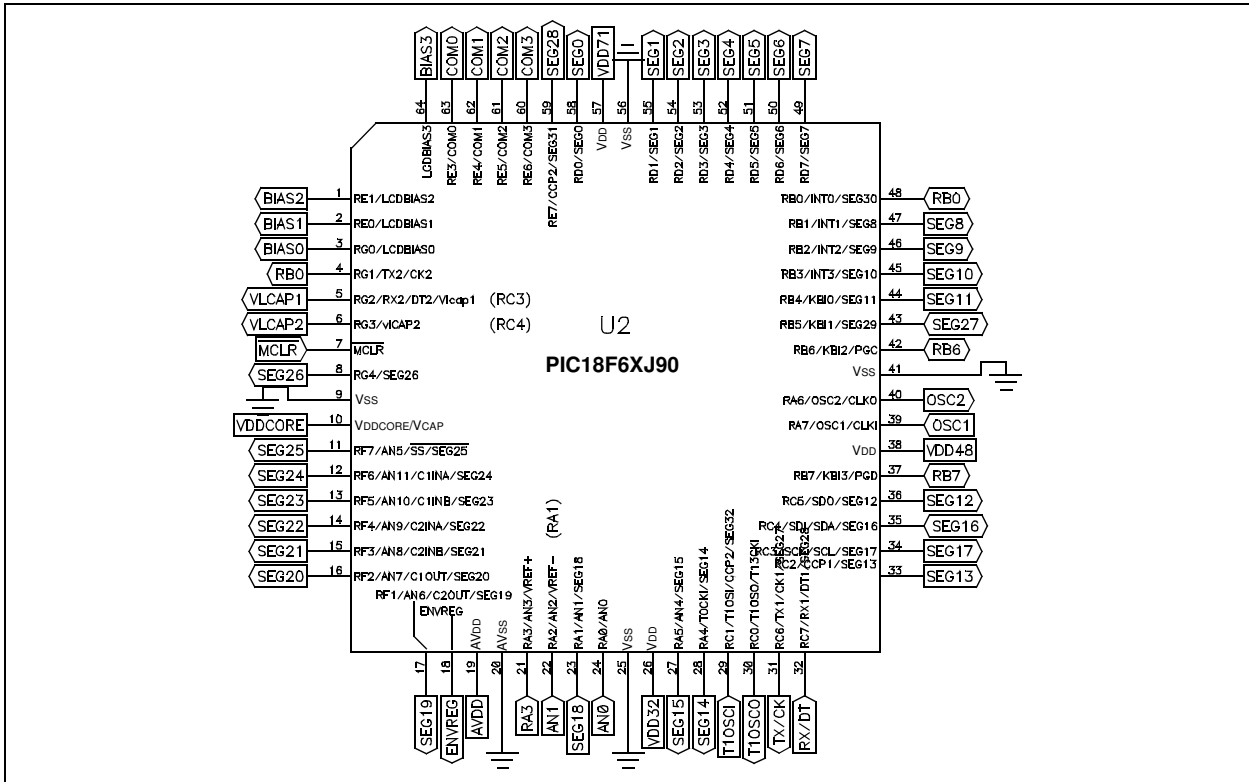
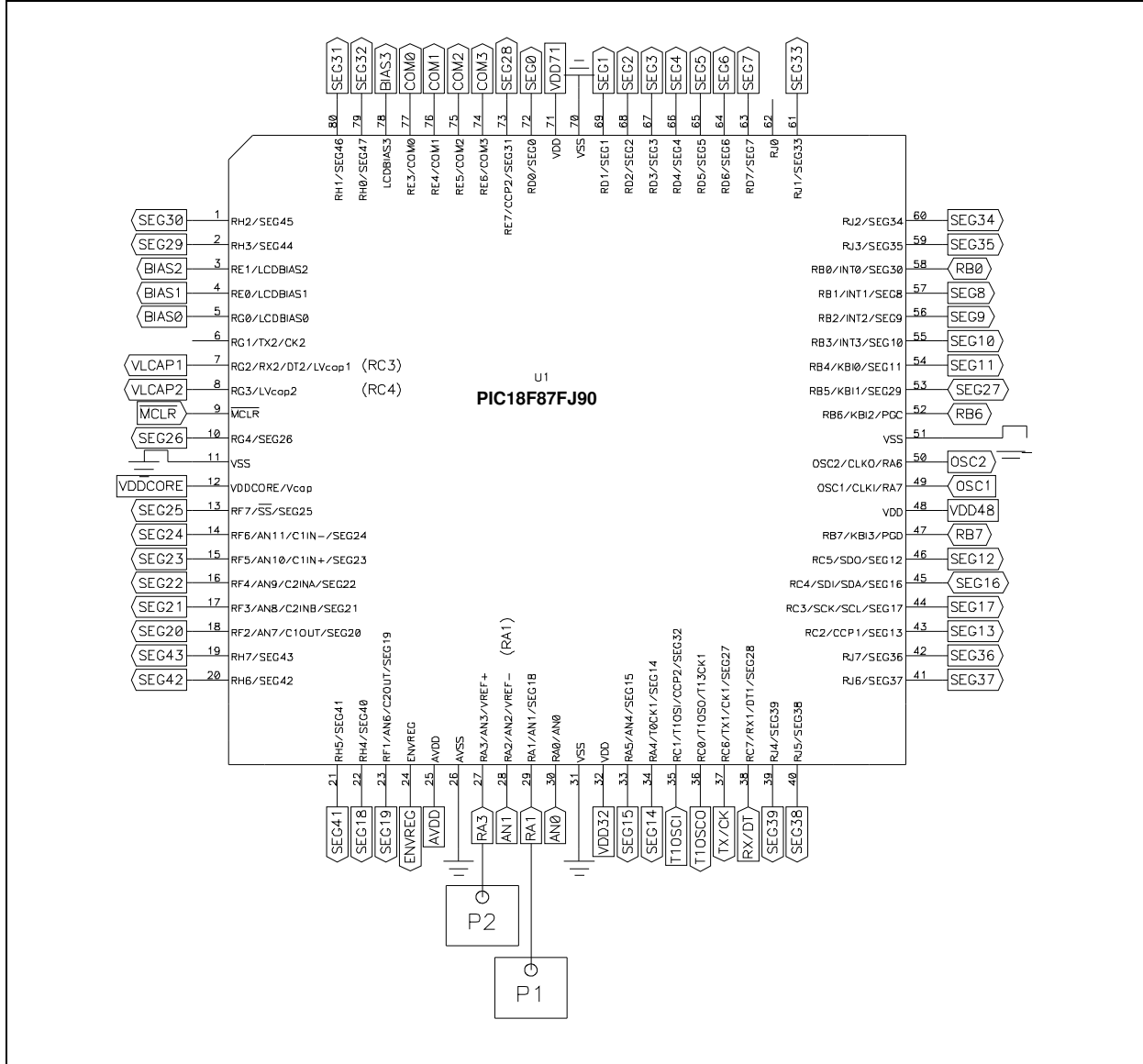


FIGURE A-27: PICDEM™ LCD 2 PIC18F6XJ90 64-PIN PIM SCHEMATIC



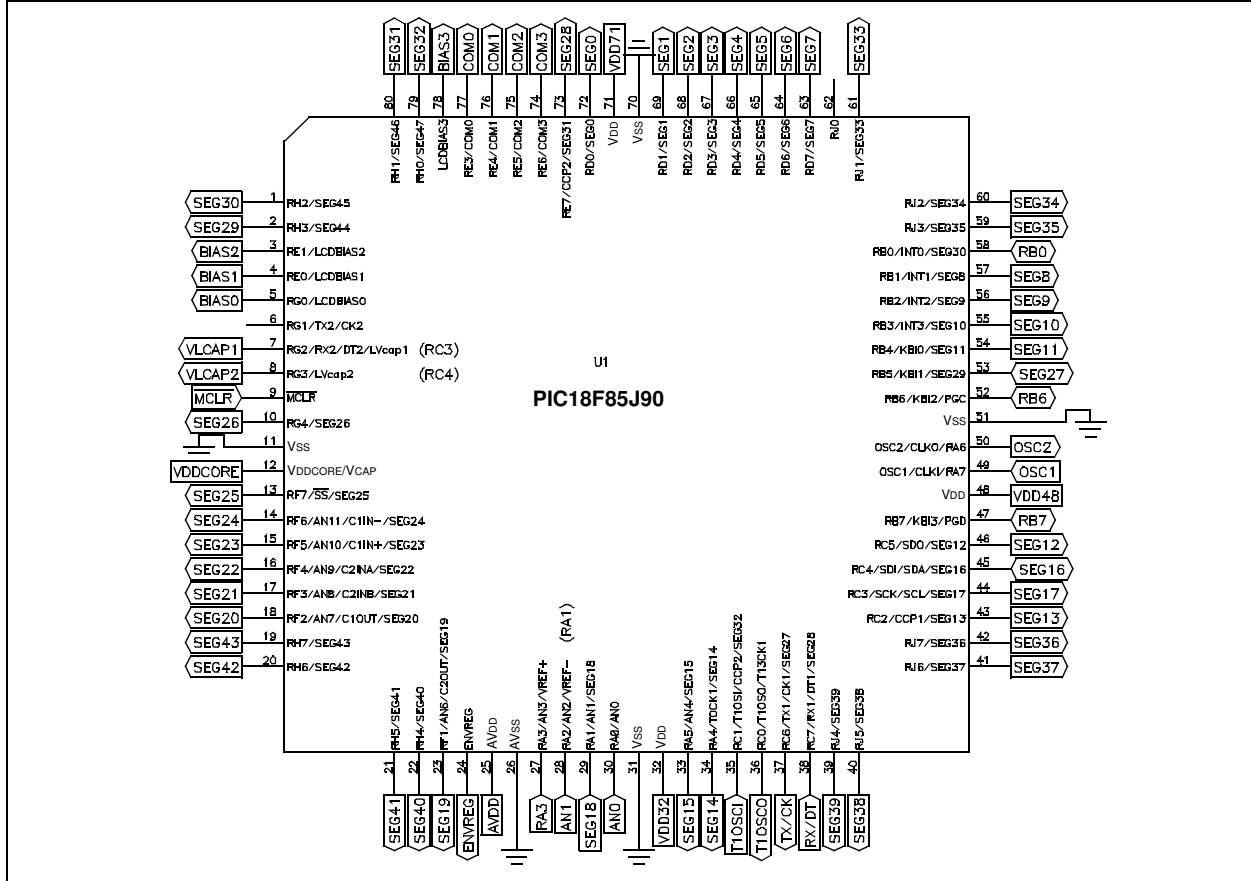
PICDEM™ LCD 2 Demonstration Kit User's Guide

FIGURE A-28: PICDEM™ LCD 2 PIC18F87J90 80-PIN PIM SCHEMATIC



Board Technical Information

FIGURE A-29: PICDEM™ LCD 2 PIC18F85J90 80-PIN PIM SCHEMATIC



PICDEM™ LCD 2 Demonstration Kit User's Guide

NOTES:



PICDEM™ LCD 2 DEMONSTRATION KIT USER'S GUIDE

Index

| | | |
|---|------------|----|
| A | | |
| Analog Input..... | 47 | |
| B | | |
| Board | 11 | |
| C | | |
| Charge Pump and Software Contrast | 17 | |
| Clock..... | 17 | |
| Customer Notification Service..... | 8 | |
| Customer Support..... | 9 | |
| D | | |
| Demonstration Board. <i>See</i> Board | | |
| Demonstration Programs. <i>See</i> Sample Programs. | | |
| Documentation | | |
| Conventions..... | 6 | |
| Layout..... | 5 | |
| H | | |
| Hardware Features | 12 | |
| I | | |
| Internet Address..... | 8 | |
| K | | |
| Kit Components | 11 | |
| L | | |
| LCD | | |
| Digit Description..... | 27 | |
| Display Definition | 27 | |
| SEGx and COMx | 28 | |
| LCD Display | 26 | |
| LEDs | | |
| Green Display | 46 | |
| Green Power..... | 46 | |
| M | | |
| Microchip Internet Web Site..... | 8 | |
| MPASM Assembler..... | 15 | |
| MPLAB C18 C Compiler | 15 | |
| MPLAB ICD 2..... | 11, 16, 48 | |
| MPLAB ICE..... | 11, 16 | |
| MPLAB IDE | 15 | |
| O | | |
| Oscillator Options..... | 47 | |
| Oscillator Selection | 16 | |
| P | | |
| Part Numbers..... | 25 | |
| PIC16XXXX | | |
| Demo | 17 | |
| PIC18XXXX | | |
| Demo Program..... | 17 | |
| PICDEM LCD 2 Board | | |
| Hardware | 23 | |
| PICDEM LCD 2 Board. <i>See</i> Board | | |
| PICDEM LCD 2 Demo Board..... | | 12 |
| PICDEM LCD 2 Hardware (Graphic) | | 13 |
| PICDEM LCD 2 Kit. <i>See</i> Kit Components. | | |
| PICDEM LCD 2 Stand-Alone Board..... | | 15 |
| Power Supply | 15 | |
| PICDEM LCD2 Board | | |
| Power Supply | 49 | |
| Processors | 25 | |
| Push Buttons. <i>See</i> Switches. | | |
| R | | |
| Reading, Recommended | 7 | |
| Real-Time Clock..... | 47 | |
| RS-232 | 12, 47 | |
| S | | |
| Sample Devices | 13 | |
| Sample PIM..... | 11 | |
| Sample Programs | 11, 13 | |
| Serial EEPROM | 47 | |
| Switches..... | 12 | |
| Analog Input..... | 48 | |
| Digital I/O | 48 | |
| T | | |
| Temperature Sensor | 48 | |
| Thermometer..... | 17 | |
| U | | |
| Using the Demo Software | 17 | |
| V | | |
| Voltmeter..... | 17 | |
| W | | |
| Warranty Registration | 7 | |
| WWW Address..... | 8 | |



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://support.microchip.com>
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Cleveland
Independence, OH
Tel: 216-447-0464
Fax: 216-447-0643

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Farmington Hills, MI
Tel: 248-538-2250
Fax: 248-538-2260

Kokomo
Kokomo, IN
Tel: 765-864-8360
Fax: 765-864-8387

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608

Santa Clara
Santa Clara, CA
Tel: 408-961-6444
Fax: 408-961-6445

Toronto
Mississauga, Ontario,
Canada
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon
Hong Kong
Tel: 852-2401-1200
Fax: 852-2401-3431

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8528-2100
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing
Tel: 86-23-8980-9588
Fax: 86-23-8980-9500

China - Hong Kong SAR
Tel: 852-2401-1200
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8203-2660
Fax: 86-755-8203-1760

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian
Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

China - Xiamen
Tel: 86-592-2388138
Fax: 86-592-2388130

China - Zhuhai
Tel: 86-756-3210040
Fax: 86-756-3210049

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444
Fax: 91-80-3090-4123

India - New Delhi
Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune
Tel: 91-20-2566-1512
Fax: 91-20-2566-1513

Japan - Yokohama
Tel: 81-45-471- 6166
Fax: 81-45-471-6122

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-6578-300
Fax: 886-3-6578-370

Taiwan - Kaohsiung
Tel: 886-7-213-7830
Fax: 886-7-330-9305

Taiwan - Taipei
Tel: 886-2-2500-6610
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

UK - Wokingham
Tel: 44-118-921-5869
Fax: 44-118-921-5820

08/04/10