

PICDEM™ LCD Demonstration Kit User's Guide

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PICDEM™ LCD DEMONSTRATION KIT USER'S GUIDE

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PICDEM™ LCD 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 "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

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

INTRODUCTION

This chapter contains general information that will be useful to know before using the PICDEM™ LCD Demonstration Kit User's Guide. Items discussed in this chapter include:

- About this Guide
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support

ABOUT THIS GUIDE

Document Layout

This document describes how to use the PICDEM LCD 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 Demonstration Board.
- **Chapter 2. Getting Started** – Describes how to use the PICDEM LCD 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 Demonstration Board.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*PICDEM LCD 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
'b*nnnn*	A binary number where *n* is a digit	'b00100, 'b10
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier font:		
Plain Courier	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`
Italic Courier	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
`0x`*`nnnn`*	A hexadecimal number where *`n`* is a hexadecimal digit	`0xFFFF`, `0x007A`
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) { ... }`

RECOMMENDED READING

This user's guide describes how to use the PICDEM LCD Demonstration Kit. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

Readme for PICDEM LCD

For the latest information on using the PICDEM LCD Demonstration Kit, read the `Readme for PICDEM LCD.txt` file (an ASCII text file) in the Readmes subdirectory of the MPLAB® IDE installation directory. The Readme file contains update information and known issues that may not be included in this user's guide.

Readme Files

For the latest information on using other tools, read the tool-specific Readme files in the 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:

"PIC18F6390/6490/8390/8490 Data Sheet" (DS39629)
"PIC16C9XX Data Sheet" (DS30444)
"PIC16C925/926 Data Sheet" (DS39544)
"PIC16F91X Data Sheet" (DS41250)

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

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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 C17, 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 and MPLAB SIM30 simulators, 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 development programmer.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

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

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

In addition, there is a Development Systems Information Line which lists the latest versions of Microchip's development systems software products. This line also provides information on how customers can receive currently available upgrade kits.

The Development Systems Information Line numbers are:

1-800-755-2345 – United States and most of Canada

1-480-792-7302 – Other International Locations

Chapter 1. Introduction

1.1 WELCOME

Thank you for purchasing the PICDEM LCD Demonstration Kit from Microchip Technology Incorporated. The PICDEM LCD demonstrates the capabilities of the PIC18FXX90 and PIC16X9XX family devices.

The PICDEM LCD 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 Demonstration Kit comes with the following:

1. PICDEM LCD Demonstration Board (Figure 1-1)
2. Sample Devices
3. CD-ROM, which contains:
   a) Sample Programs
   b) "PICDEM™ LCD 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.

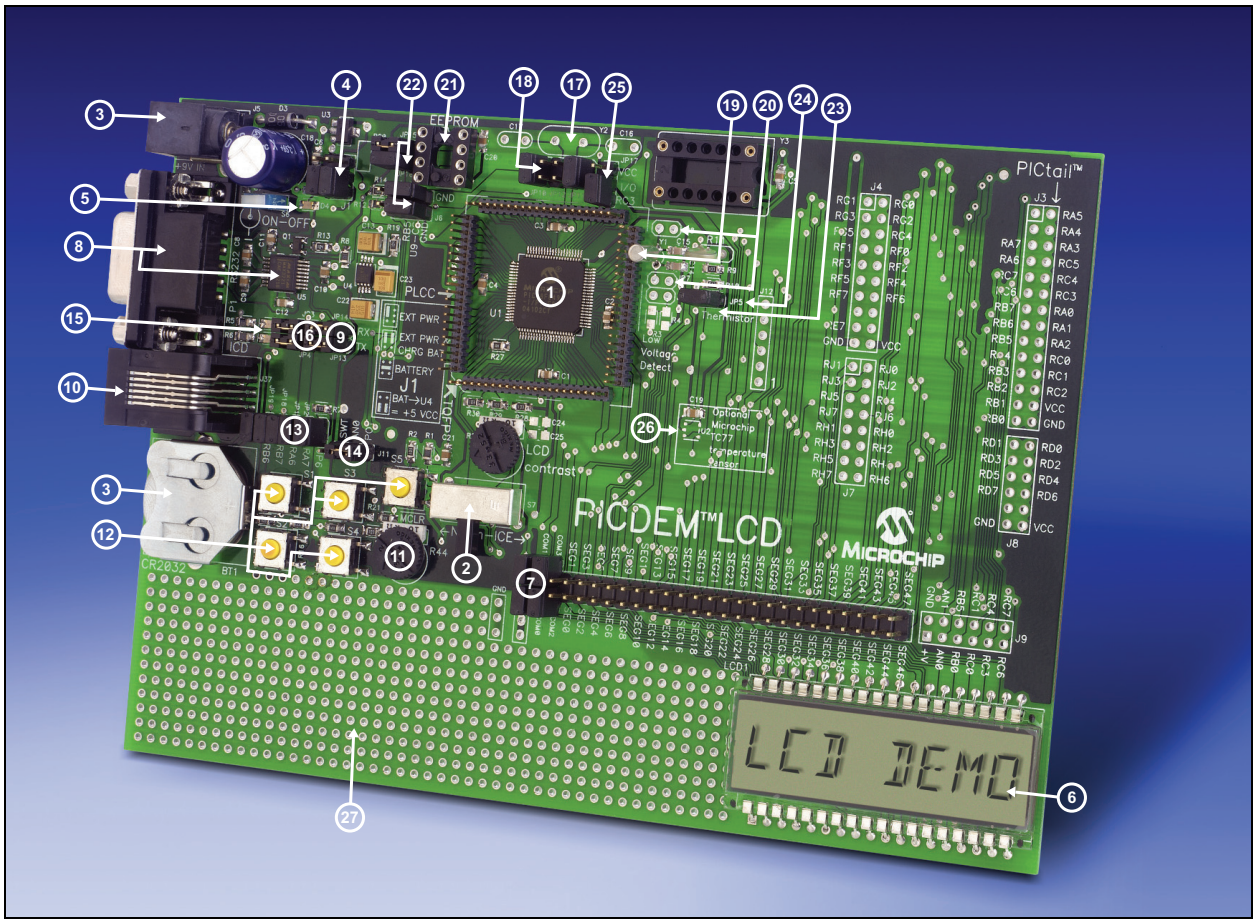
1.2 PICDEM LCD DEMONSTRATION BOARD HARDWARE FEATURES

The PICDEM LCD Demonstration Board has the following hardware features:

1. On-board PIC18F8490 provided with the daughter board option for other PIC18FXX90 and PIC16X9XX devices, Microchip's future LCD parts and MPLAB ICE.

   The MPLAB ICE can be plugged on to the board without any transition socket.
2. A slide switch (S7) to select either the on-board device (PIC18F8490) or the device on the daughter board.
3. On-board +5V regulator for direct input from 9V, 100 mA AC/DC wall adapter or test loops for a maximum of +5V, 100 mA regulated DC supply, 3V button cell battery or on-board 3V to 5V DC-DC converter option.
4. Jumper J1 to select different power options.
5. Green power-on indicator LED.
6. 8-digit starburst LCD display.
7. Jumpers COM0, COM1, COM2 and COM3 to disconnect COM pins from on-board LCD and allow the usage of any customized LCD glass.
8. RS-232 connection and associated hardware for direct connection to RS-232 interface.
9. Jumpers JP13 and JP14 to disconnect TX and RX.
10. In-Circuit Debugger (ICD) connector.
11. A 10 kΩ potentiometer for devices with analog inputs.
12. Five push button switches for external stimulus and Reset.
13. Jumpers JP19, JP18, JP1 and JP2 to disconnect switches from RB6, RB7, RA6 and RA7 input pins.
14. Jumper J11 to select either 10 kΩ (POT R44) or the S1-S4 switches to AN0 (RA0).
15. Two green LEDs connected to RB0 and RB5.
16. Jumpers JP3 and JP4 to disconnect LEDs from RB0 and RB5.
17. Unpopulated holes provided for crystal connection.
18. Jumpers JP11 and JP12 to disconnect crystal from OSC1 and OSC2.
19. 32.768 kHz crystal with Timer1 for Real-Time Clock (RTC) operation.
20. Jumpers JP7 and JP8 to have I/O function on RC0 and RC1.
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 RB5. Jumper J13 to select either 128x8 or 64x16 memory organization.
23. Thermistor for sensing temperature.
24. Jumper JP5 to connect thermistor to AN1 (RA1).
25. Jumper JP17 to select either V_{CC} or I/O to power the peripherals.
26. Unpopulated option for TC77 temperature sensor.
27. Prototype area for user hardware.

FIGURE 1-1: PICDEM™ LCD HARDWARE



1.3 SAMPLE DEVICES

The on-board device, PIC18F8490, is included.

1.4 SAMPLE PROGRAMS

The PICDEM LCD Demonstration Kit includes a CD-ROM with sample demonstration programs. These programs may be used with the included sample devices, with an In-Circuit Emulator (ICE) or with an In-Circuit Debugger (ICD). For each type of device (PIC16XXXX or PIC18XXXX), demo source code (several ASM files) and compiled code (one HEX file) are provided.

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NOTES:

Chapter 2. Getting Started

The PICDEM LCD 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 PICmicro® microcontroller compatible ICEs or ICDs, please refer to the "*Development Systems Ordering Guide"* (DS30177).

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

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

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

> **Note:** In the event that the preprogrammed PICDEM LCD Demonstration Board does not operate, check the following conditions:
>
> - The jumper J1 is configured as per the power supply used. The slide switch S7 is switched to select Normal mode (Norm).
> - JP1 to JP6, JP9, JP10, JP18 and JP19 are connected.
> - J11 connecting POT to AN0 and JP17 connecting RC2 to V0.
>
> 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 used to program the device or, if this has previously been done, then 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 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 HEX file format, MPLAB ICD 2 may be used to program a Flash device. 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.

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

To use the PICDEM LCD 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 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	Modification on PICDEM™ LCD
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.

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 or strings on the LCD. These functions and macros can be used to display any character at any position or to display the whole string. This firmware LCD driver module uses the Synchronous mode of the USART module to communicate with a Microwire EEPROM.

The demo program uses the PIC® microcontroller's internal RC oscillator (at 8 MHz) as the system clock source.

3.1 FIRMWARE LCD DRIVER MODULE ROUTINES

To use the LCD module of the device easily, some of the functions and macros are defined and explained below. Before using these functions and macros, the `LCD.Def` file needs to be edited as per your requirement.

TABLE 3-1: LCD MODULE FUNCTIONS OR MACROS

Functions or Macros	Description
`LCDInit`	This function initializes the LCD module as per the entries in the `LCD.Def` file.
`LCDClear`	This function clears the LCD glass.
`mLCDEnable`	This macro enables the LCD module.
`mLCDDisable`	This macro disables the LCD module.
`mLCDDisplayChar Digitx, Char` (For example, `mLCDDisplayChar Digit1, 'A'`)	This macro displays the given character at the specified position on the LCD glass.
`mLCDDisplayVar Digitx, Var_Name` (For example, `mLCDDisplayVar Digit1, WREG`)	This macro displays the number stored in the given variable at the specified position on the LCD glass.
`mLCDDisplayASCIIMessageROM Str_Adrs`	This macro displays the string stored in the program area on the LCD glass.
`mLCDDisplayASCIIMessageRAM Str_Adrs`	This macro displays the string stored in the buffer on the LCD glass.
`mLCDIsActive`	This macro checks whether the LCD module is active or not. If the LCD module is active, then it returns a '0' in WREG.
`mLCDIsWriteAllowed`	This macro checks whether the LCD data can be written or not. If LCD data can be written, then it returns a '0' in WREG.
`mLCDIsWriteError`	This macro checks whether a write error has occurred or not. If a write error has not occurred, then it returns a '0' in WREG.
`mLCDClearWriteError`	This macro clears the write error flag.

3.2 FIRMWARE ROUTINES FOR COMMUNICATING WITH MICROWIRE EEPROM USING SYNCHRONOUS MODE OF USART MODULE

The PICDEM LCD board also helps you to use the Synchronous mode of the USART module to communicate with a Microwire EEPROM device. Before using these functions, the `MWMEE.Def` and `USRTPol.Def` files need to be edited as per your requirement.

TABLE 3-2: USART MODULE FUNCTIONS

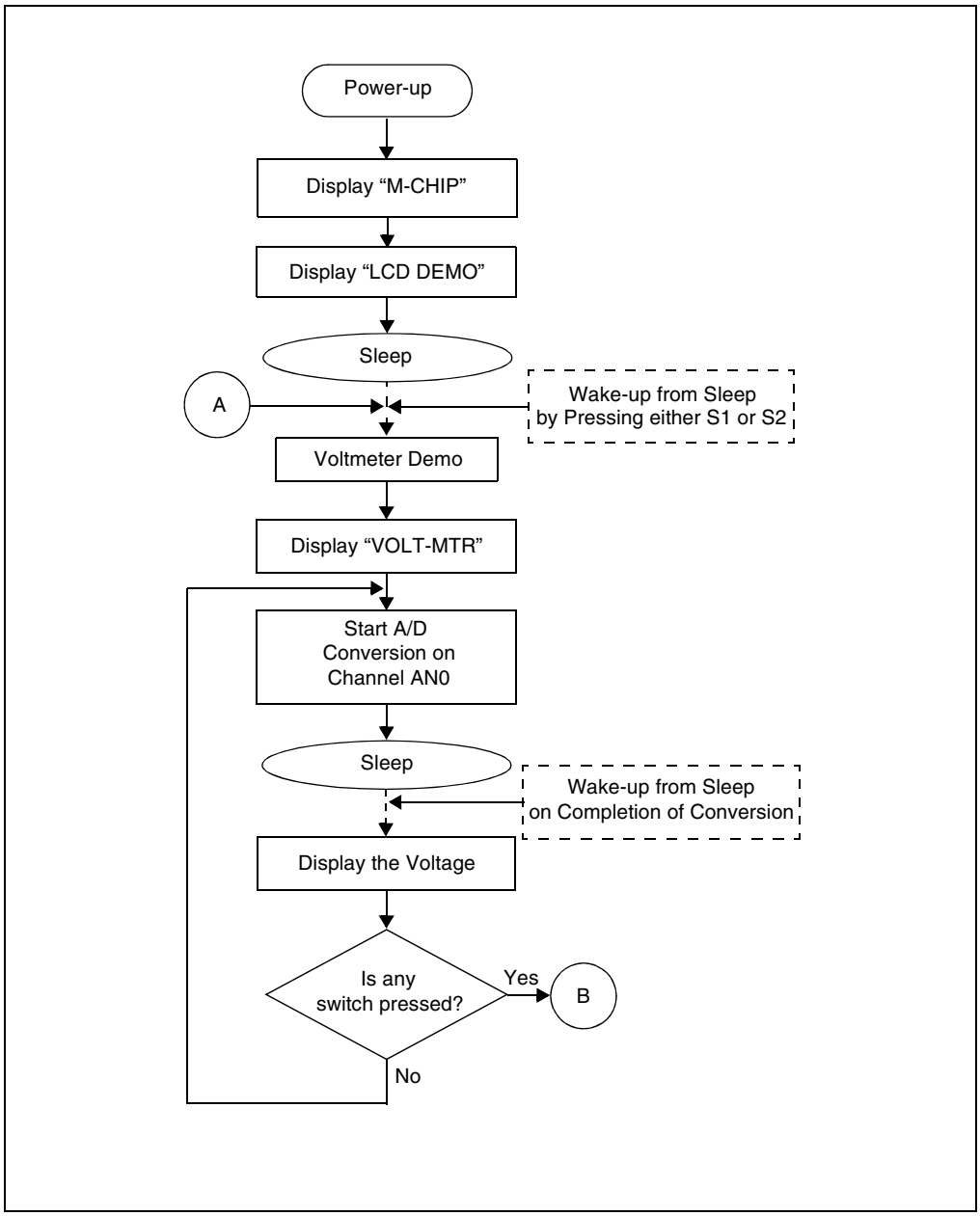
Functions	Description
`MWMEEUSARTPolErase`	This function erases a location in the EEPROM. The location should be specified in AdrsReg.
`MWMEEUSARTPolWrite`	This function writes the data specified in DataReg into a location in the EEPROM. The location should be specified in AdrsReg.
`MWMEEUSARTPolRead`	This function reads a location in the EEPROM. The location should be specified in AdrsReg. The data is available in WREG.
`MWMEEUSARTPolWrEnable`	This function enables the write to EEPROM.
`MWMEEUSARTPolWrDisable`	This function disables the write to EEPROM.
`MWMEEUSARTPolEraseAll`	This function erases the entire EEPROM.
`MWMEEUSARTPolWriteAll`	This function writes the data specified in DataReg into a location in the EEPROM.

3.3 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**
   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 5.10V on the LCD using the LCD module. Voltage is continually updated until the mode is exited by pressing either the S1, S2, S3 or S4 switch.
2. **Thermometer**
   This mode uses the A/D module to measure the voltage of the thermistor R11 through analog channel AN1 and converts to temperature in Celsius 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, S2, S3 or S4 switch.
3. **Battery Voltage Indicator**
   This mode uses the HLVD module on the PIC18F8490 device to find the battery voltage range and displays the voltage (4.5 V+, 4.25 V+....2.0 V+) on the LCD using the LCD module. Battery voltage is continually updated until the mode is exited by pressing either the S1, S2 or S4 switch.
4. **Clock**
   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.The clock keeps running continuously until the mode is exited by pressing either the S1 or S2 switch. By exiting the Clock mode, the Voltmeter mode is entered.

FIGURE 3-1: DEMO PROGRAM FLOWCHART



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FIGURE 3-2: DEMO PROGRAM FLOWCHART

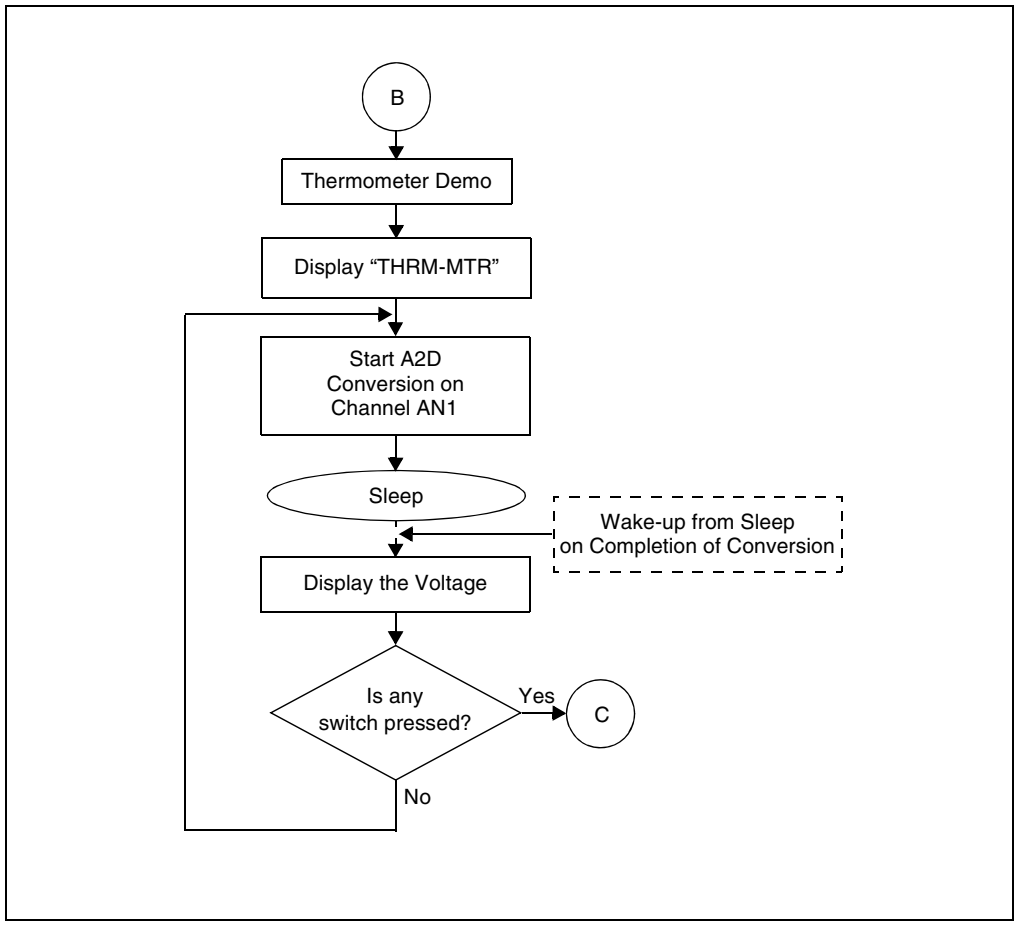
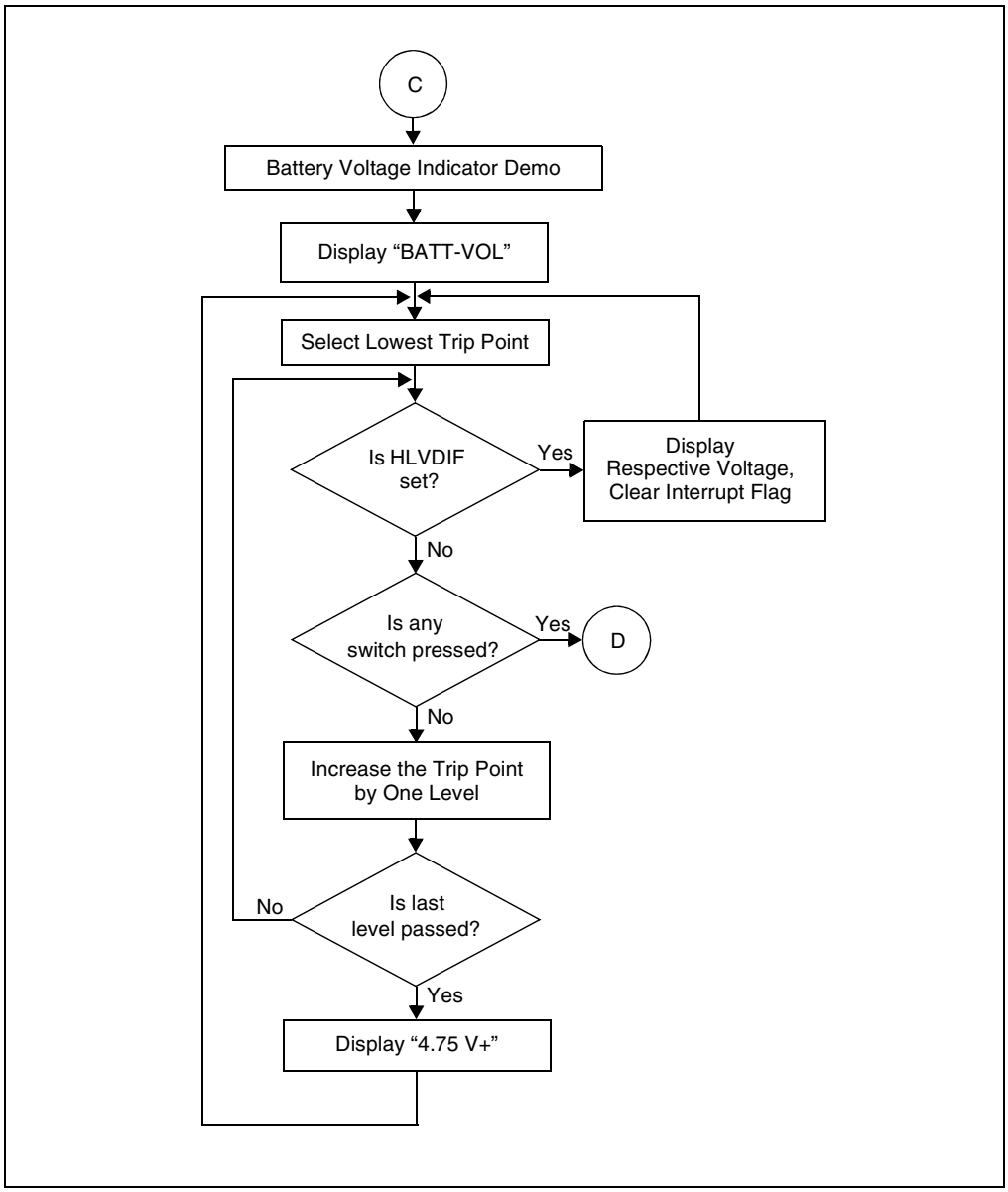


FIGURE 3-3: DEMO PROGRAM FLOWCHART



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FIGURE 3-4: DEMO PROGRAM FLOWCHART

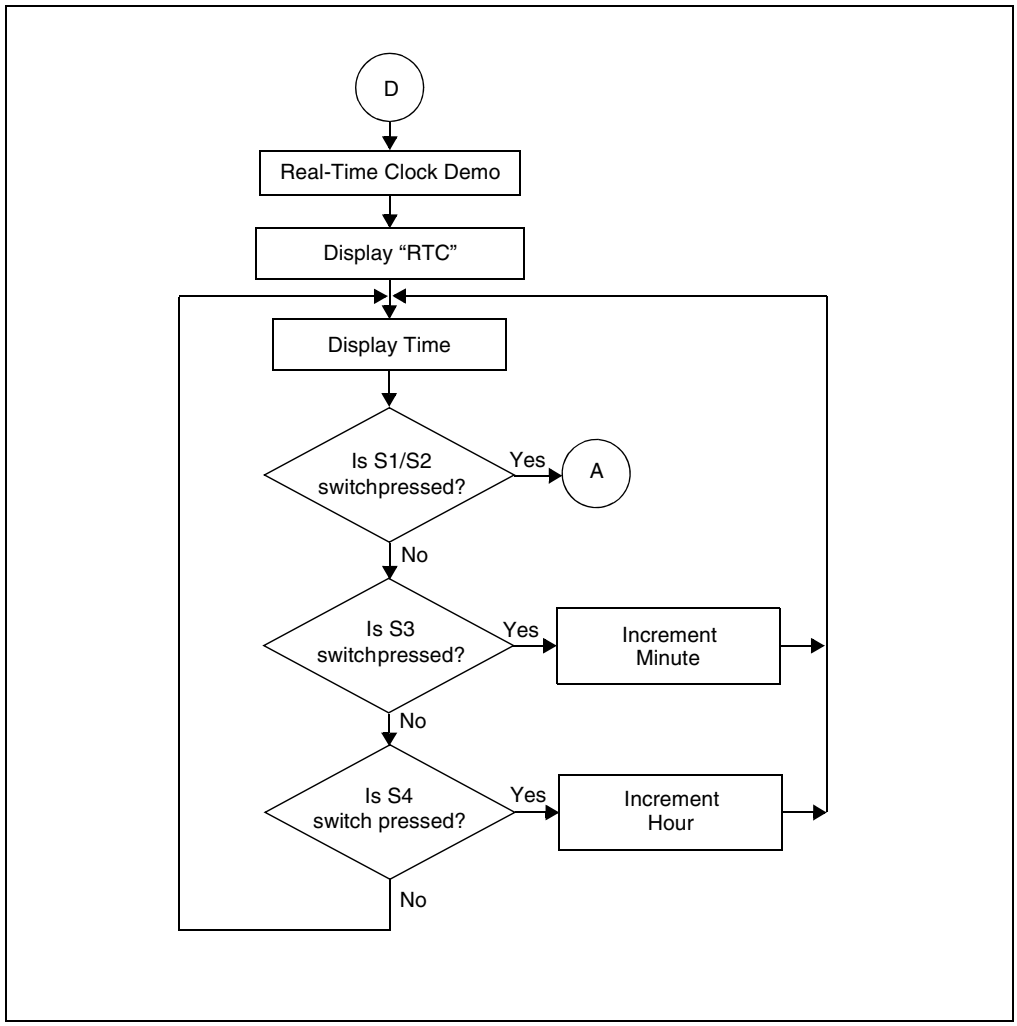
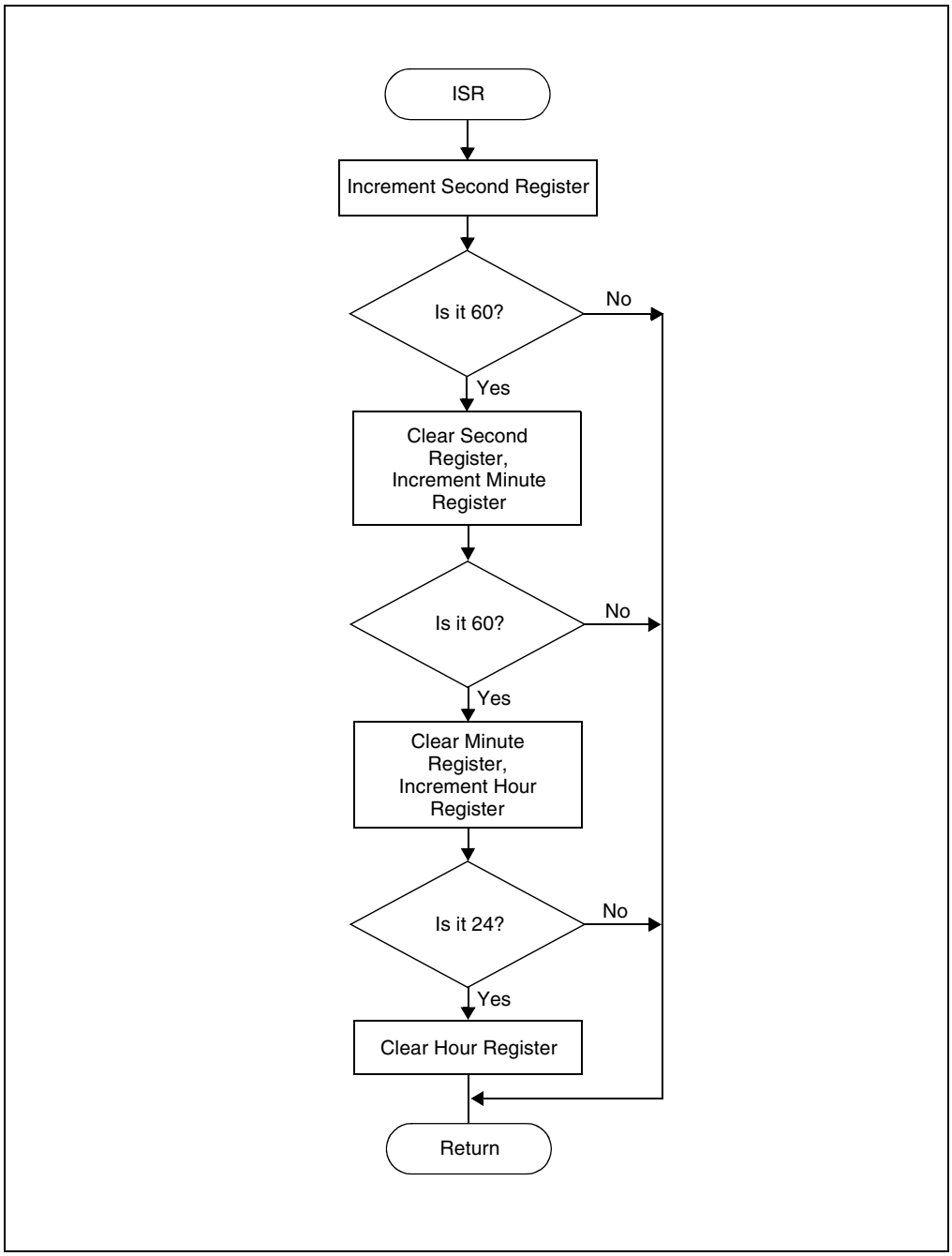


FIGURE 3-5: DEMO PROGRAM FLOWCHART



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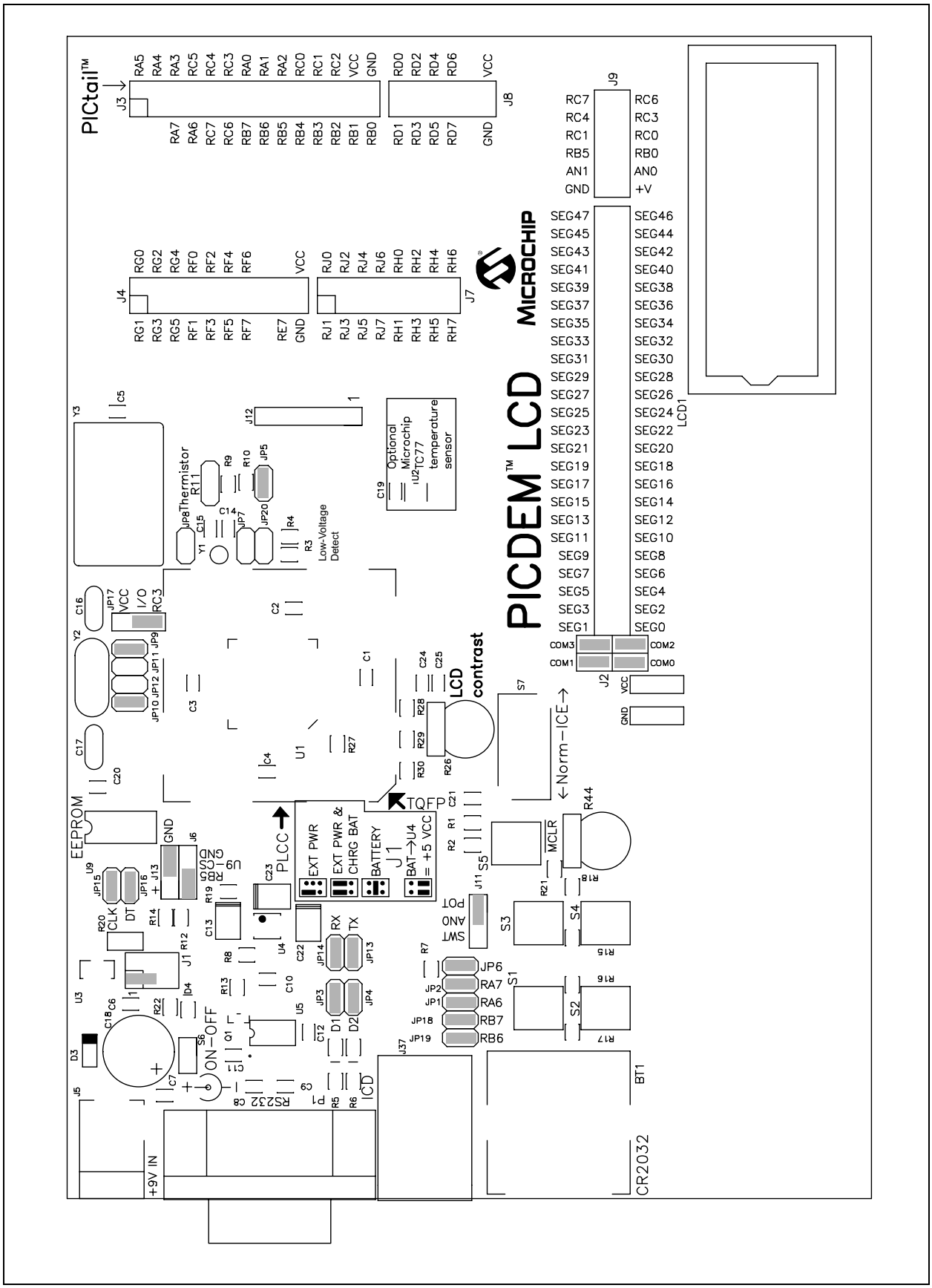
NOTES:

Appendix A. Board Technical Information

The PICDEM LCD hardware is not complicated and is intended to illustrate the ease of use of various PICmicro® MCUs. The PICDEM LCD 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 silkscreen with all necessary jumpers highlighted. Also, refer to the schematic for circuit connections.

FIGURE A-1: PICDEM™ LCD DEFAULT JUMPER LOCATION



A.1 PROCESSORS

On-board PIC18F8490 (U1) is provided with the daughter board option (U1A) for other PIC18FXX90 and PIC16C92X devices, Microchip's future LCD parts and ICE. A slide switch (S7) is provided to select either the on-board device or the device on the daughter board.

A.2 LCD DISPLAY

An 8-digit starburst LCD display with 14 segments each is provided. This LCD has 4 commons and 32 segments.

In PICDEM LCD, the user can use any LCD glass by:

- Removing jumpers COM0, COM1, COM2 and COM3.
- Connecting the LCD glass on J2.

A.3 LED DISPLAY

Two green LEDs are connected to RB0 and RB5 of U1 and U1A. These LEDs may be disconnected from RB0 and RB5 by removing jumpers JP3 and JP4.

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

A.4 OSCILLATOR

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). This oscillator can be disabled by removing jumpers JP7 and JP8.

A.5 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.6 REAL-TIME CLOCK

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

A.7 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 should be connected to GND.

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A.8 ANALOG INPUT

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

A.9 TEMPERATURE SENSOR

A 10 kΩ 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 should be made digital to be used to enable TC77.

A.10 SWITCHES

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

- S1 – Active-low switch connected to RB6, RB7, RA6 and RA7.
- S2 – Active-low switch connected to RB7, RA7and RA7. Active-high switch connected to RB6.
- S3 – Active-low switch connected to RA6 and RA7. Active-high switch connected to RB6 and RB7.
- S4 – Active-low switch connected to RA7. Active-high switch connected to RB6, RB7 and RA6.

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.

Four switches provide the following functions for analog input (AN0):

- S1 – AN0 will be approximately at VCC/2.
- S2 – AN0 will be approximately at VCC/3.
- S3 – AN0 will be approximately at VCC/5.2.
- S4 – AN0 will be approximately at VCC/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.11 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.12 POWER SUPPLY

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

- 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 (Part Number AC162039).
- A 100 mA regulated DC supply of maximum +5V can be connected to the hooks provided.
- In addition to the 3V button cell on BT1, the voltage can be boosted to 5V using on-board MCP1253 by connecting pin 3, pin 5, pin 4 and pin 6 of the J1 jumper.

Note 1:	There is one J1 jumper associated with the power supply circuit. This jumper must be correctly connected to select the required power supply.
2:	The PICDEM LCD Demonstration Kit does not include a power supply.

MPLAB ICE 2000/ICE 4000 users have a regulated +5V power supply available in the logic probe connector and can easily connect to the hooks on the PICDEM LCD (Red probe to +5V and Black probe to GND).

MPLAB ICD 2 users may use the ICD to power the target board to 5V, up to 200 mA.

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A.13 BOARD LAYOUT AND SCHEMATICS

The following figures show the parts layout (silkscreen) and schematics for the PICDEM LCD board.

FIGURE A-2: PICDEM™ LCD DEMONSTRATION BOARD PARTS LAYOUT (SILKSCREEN)

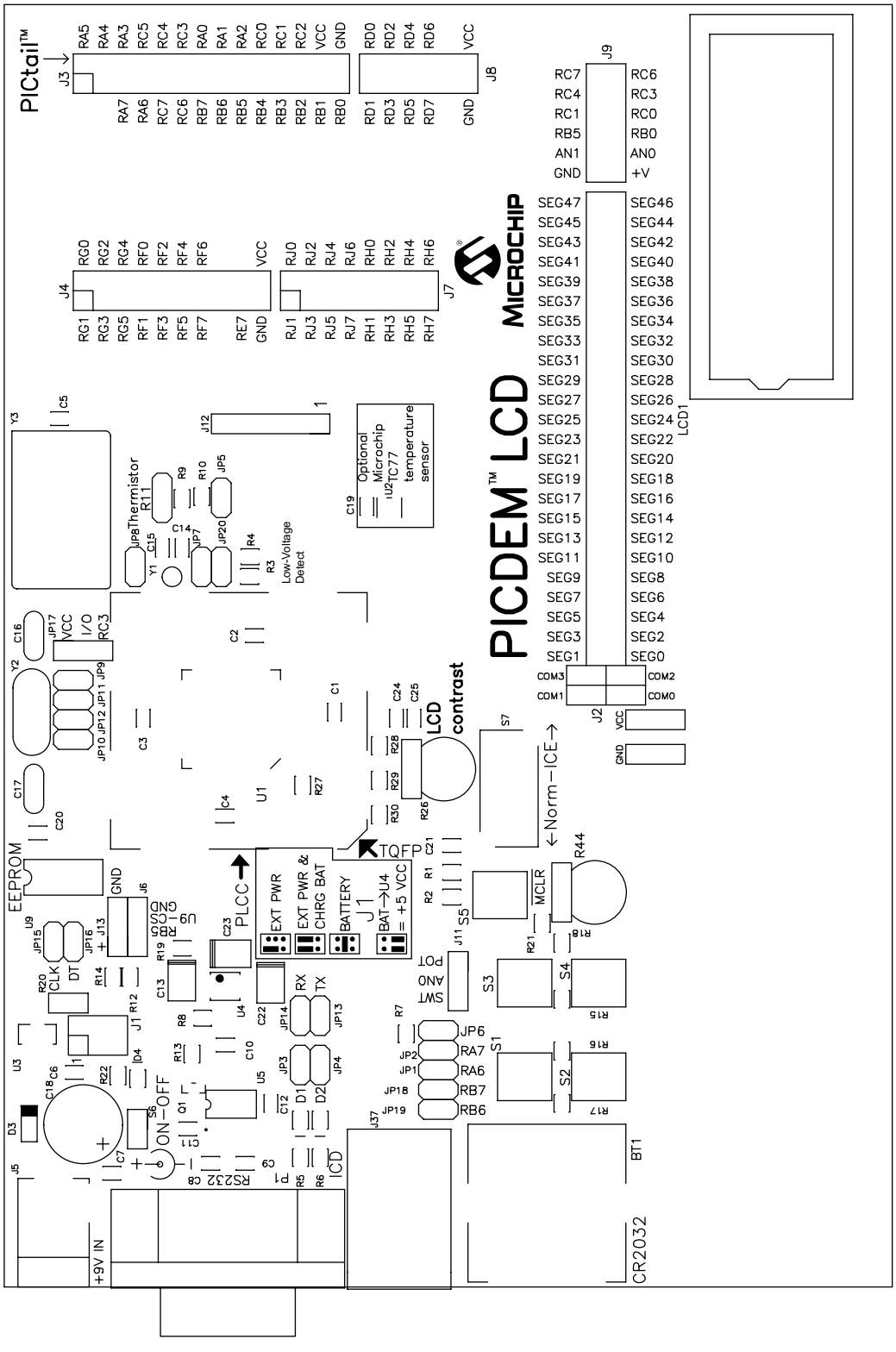
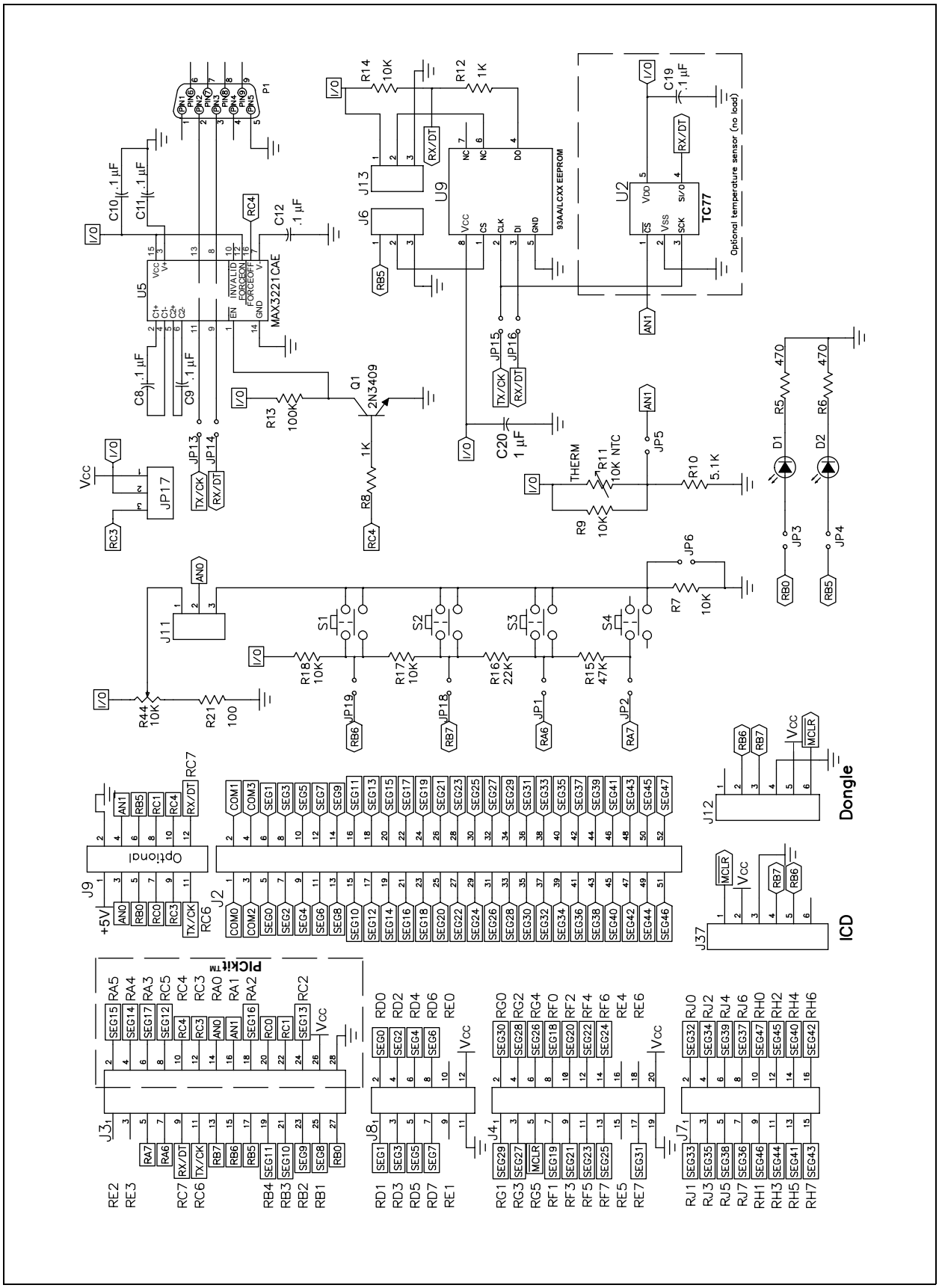


FIGURE A-3: PICDEM™ LCD SCHEMATIC SHEET 1



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FIGURE A-4: PICDEM™ LCD SCHEMATIC SHEET 2

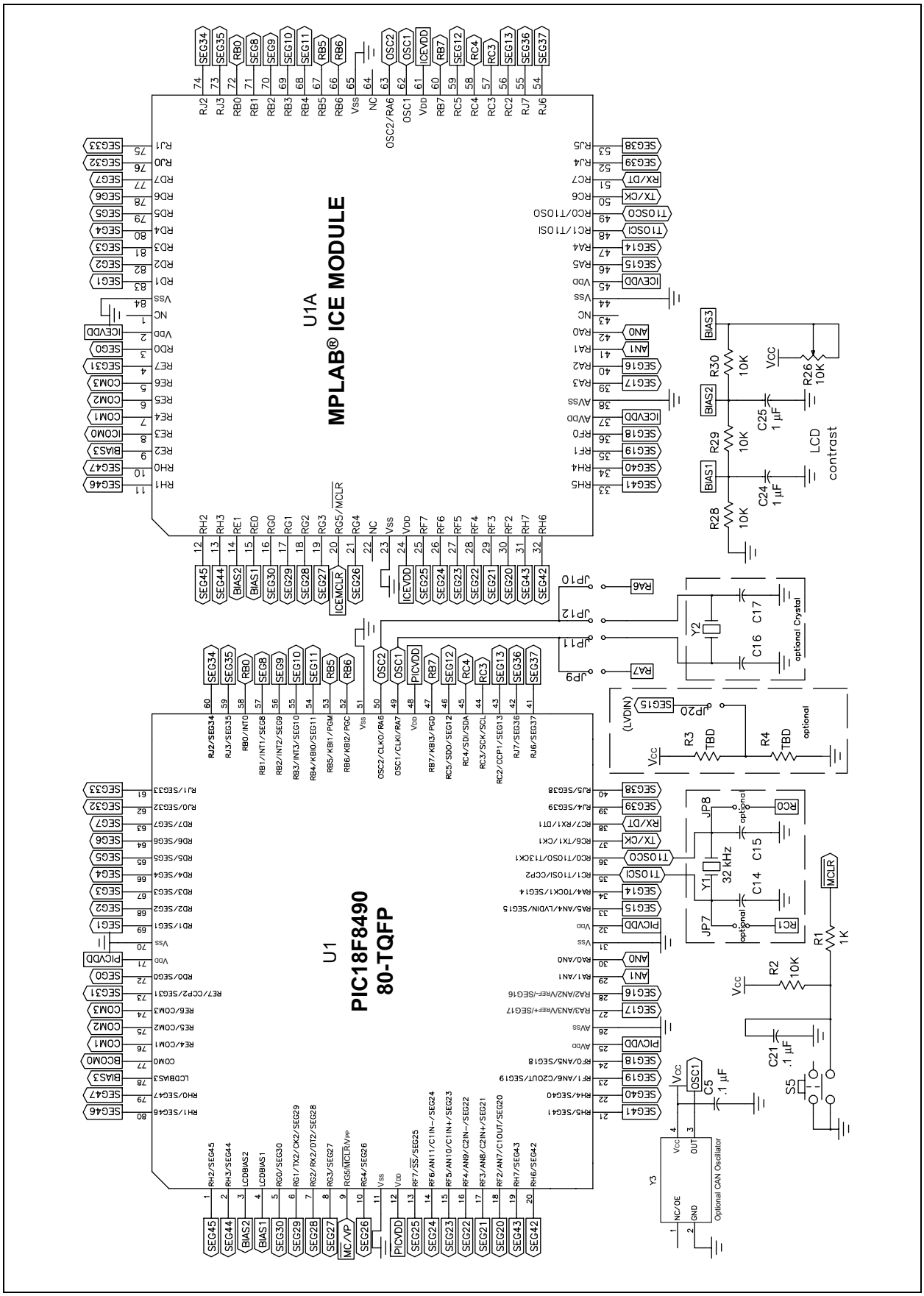
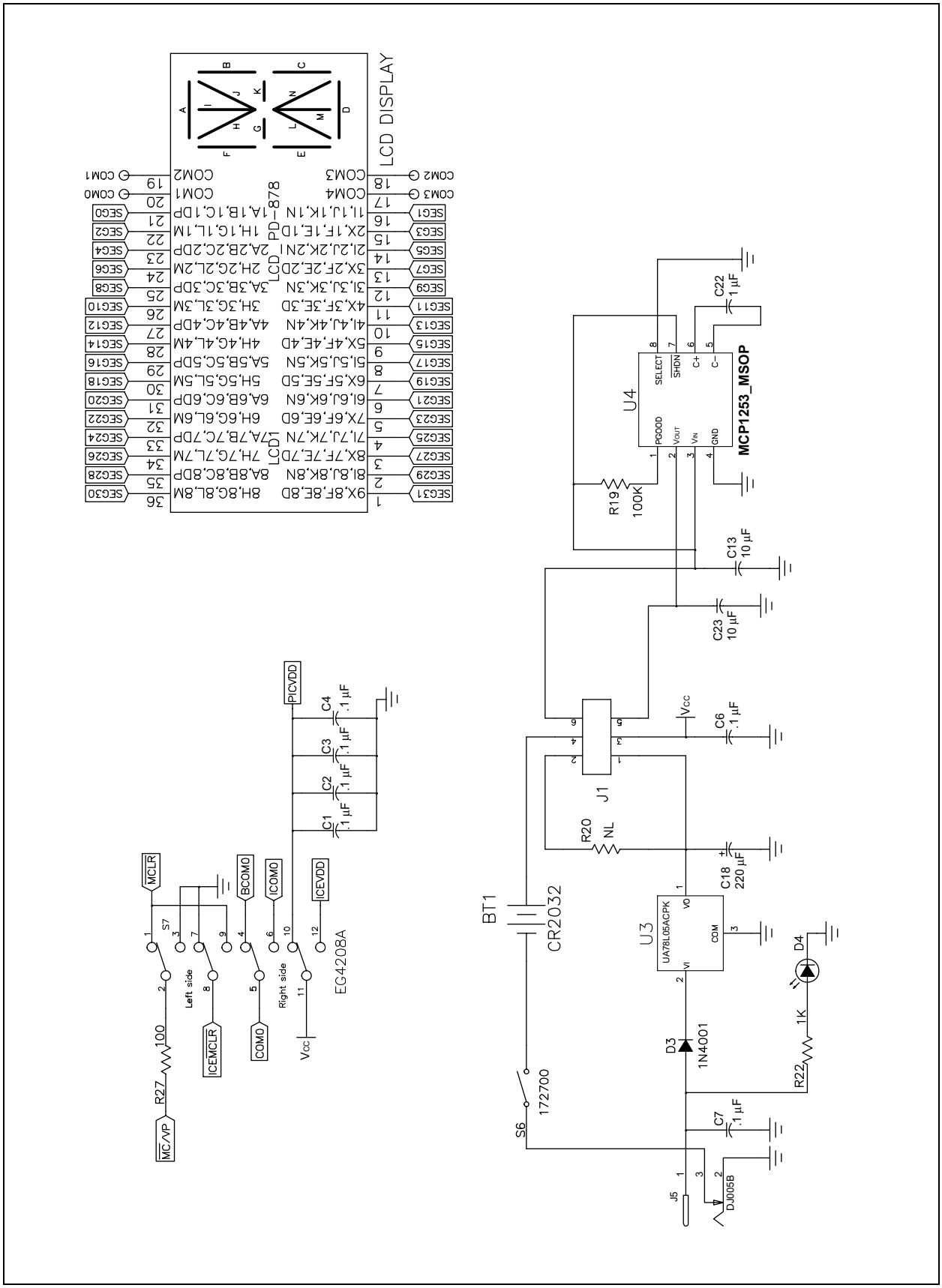


FIGURE A-5: PICDEM™ LCD SCHEMATIC SHEET 3



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