



Water Tolerant 2D Touch Surface Kit PIC[®] MCU Edition

Water Tolerant 2D Touch Surface Kit PIC[®] MCU Edition User's Guide

Preface



Important: 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 website (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 “XXXXX” is the document number and “A” is the revision level of the document.

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

Introduction

This document describes how to use the device as a development tool to emulate and debug firmware on a target board, as well as how to program devices.

Recommended Reading

For the latest information on using the device, read the “`Readme for Device #.htm`” file (an HTML file) in the Readmes subdirectory of the MPLAB IDE installation directory. The release notes (Readme) contain update information and known issues that may not be included in this user’s guide.

Water Tolerant 2D Touch Surface kit – PIC[®] MCU edition

The Water Tolerant 2D Touch Surface kit – PIC MCU edition lets you experience Microchip’s robust touch pad solution. The touch pad is controlled by an MCU (PIC16F18456) running the 2D Touch Library. Besides single finger position tracking the kit offers dual finger gesture sensing (taps, swipes, rotation, pinch-zoom). The PIC MCU edition is a sister board to the DM164149 featuring the ATtiny1617 as the MCU running the same 2D Touch Library. The kit shows the moisture performance of capacitive touch using the Driven Shield Plus feature. The kit has two water tolerant self-cap touch buttons and a 5x6 surface sensor (track pad). The 14 LEDs indicate touch position, detected gestures and board information.

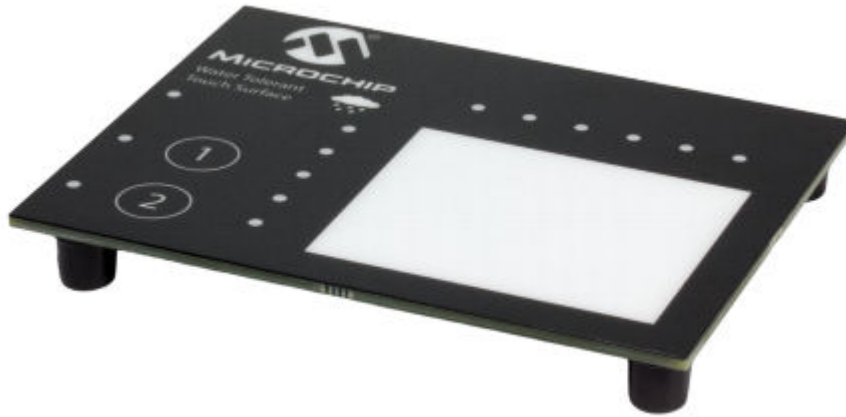


Table of Contents

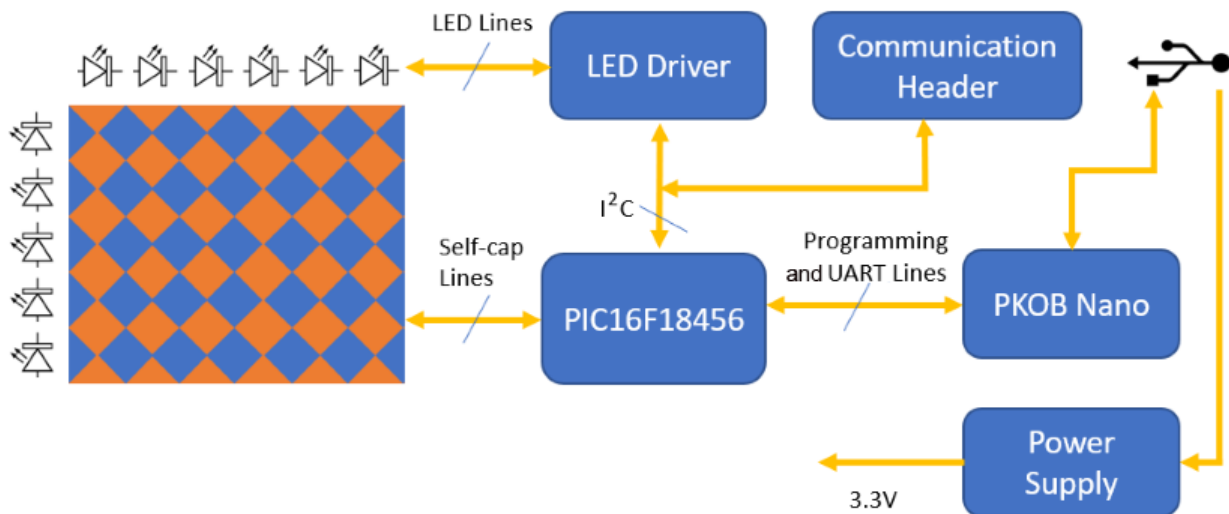
Preface.....	1
1. Introduction.....	4
1.1. Features and Overview.....	4
2. Getting Started.....	5
2.1. Quick Start.....	5
2.2. Surface Sensor Design.....	6
2.3. Touch Buttons.....	7
2.4. LEDs.....	8
3. User Guide.....	9
3.1. Powering The Board.....	9
3.2. Modes of Operation.....	9
3.3. Application Flow.....	12
4. Documentation and Relevant Links.....	14
5. Hardware Revision History and Known Issues	15
5.1. Identifying Product ID and Revision	15
5.2. Revision 3.....	15
5.3. Document Revision History.....	15
The Microchip Web Site.....	16
Customer Change Notification Service.....	16
Customer Support.....	16
Microchip Devices Code Protection Feature.....	16
Legal Notice.....	17
Trademarks.....	17
Quality Management System Certified by DNV.....	18
Worldwide Sales and Service.....	19

1. Introduction

1.1 Features and Overview

- Surface Sensor (touch pad): 5x6 surface Diamond Pattern
- Two Self-Capacitance Touch Buttons
- Processor: PIC16F18456 8-bit PIC Microcontroller - 32 MHz, 28 KB Flash, 2 KB RAM, 256 Bytes of EEPROM, ADC² with Touch
- Debugging and Programming: PICKIT™ on Board Nano with CDC UART
- LEDs: LEDs to Indicate Position, Gestures and Mode
- LED Driver: MCP23017
- Drag-and-Drop Programming

Figure 1-1. Functional Block Diagram

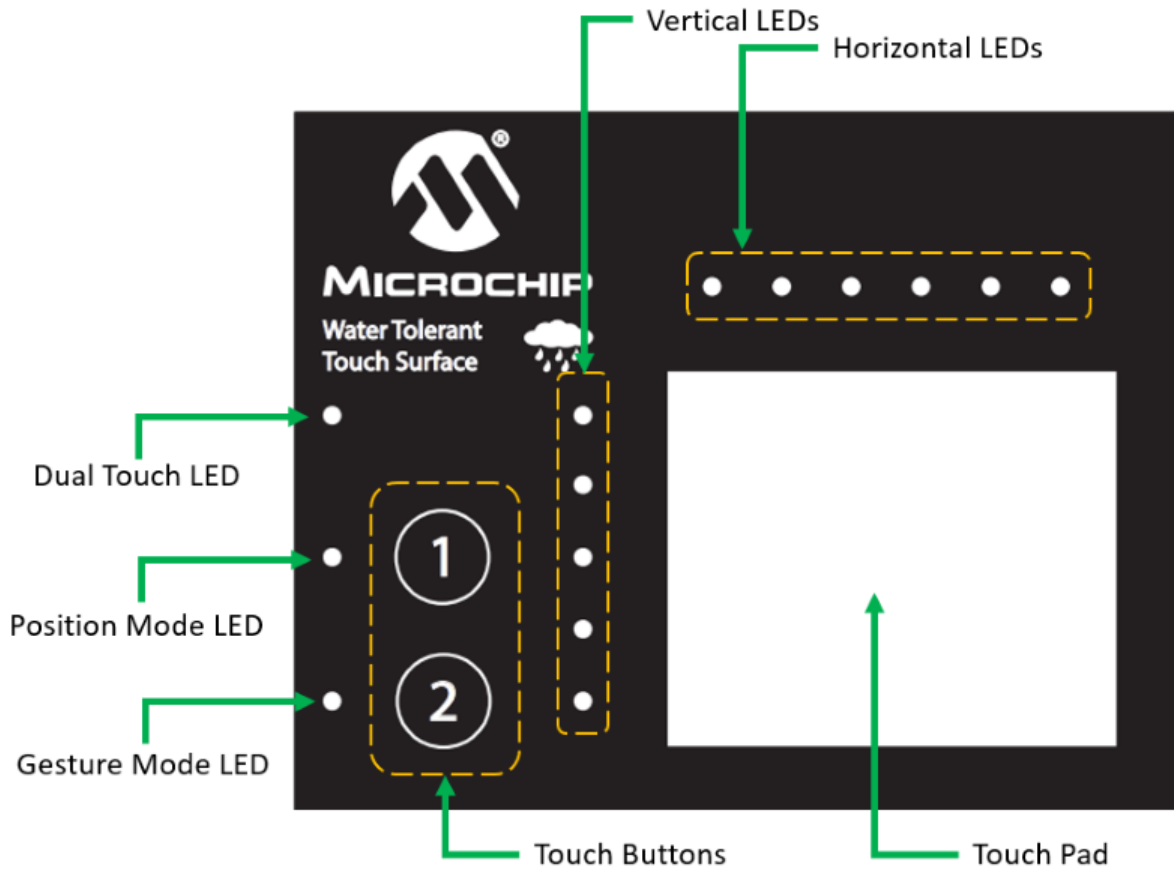


2. Getting Started

2.1 Quick Start

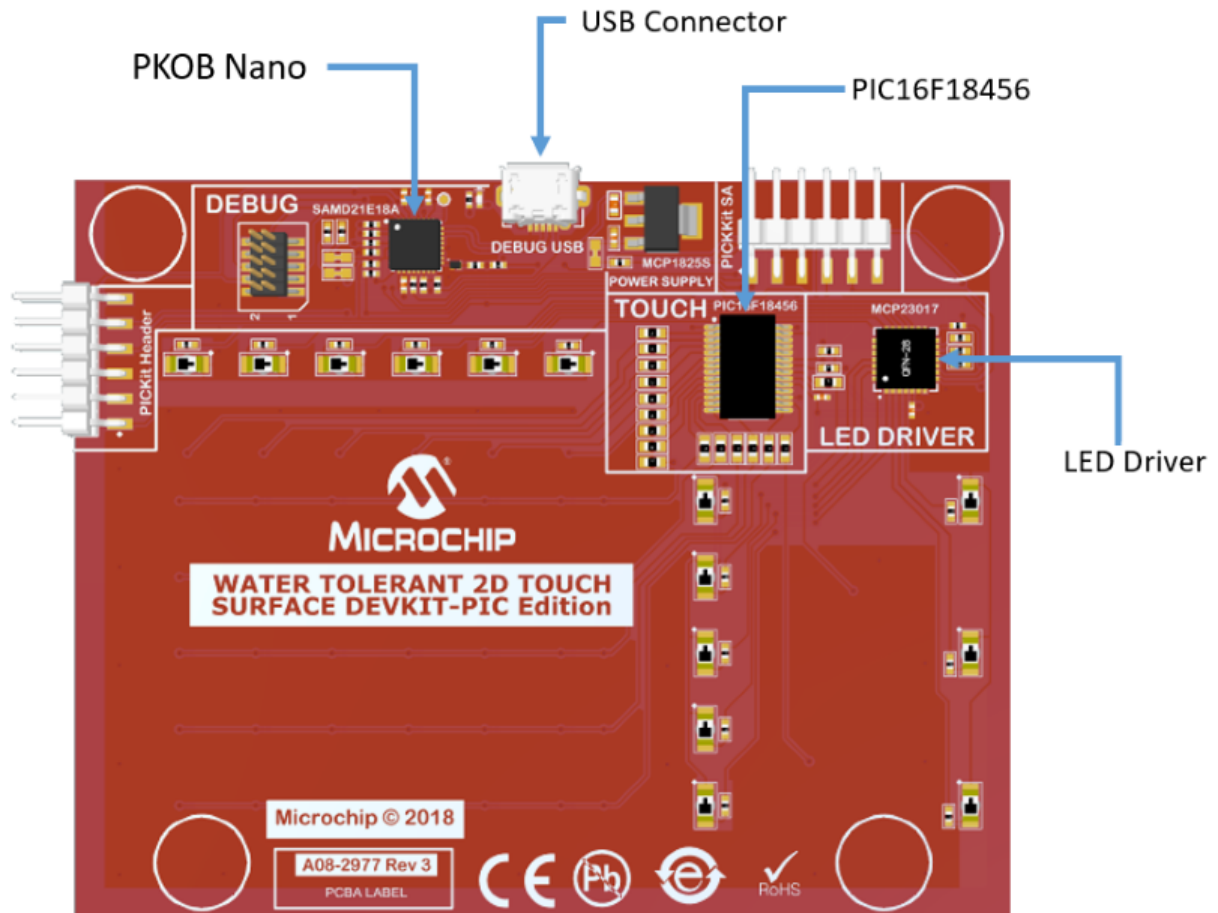
Figure 2-1 explains the front panel LED's position and touch pad area.

Figure 2-1. Kit - Front Panel



On the bottom side of the kit, Figure 2-2 represents the position of Debug USB, Touch MCU and LED driver.

Figure 2-2. Kit - Bottom Side



2.2 Surface Sensor Design

[Figure 2-3](#) represents the diamond pattern used for surface sensor and [Figure 2-4](#) represents the driven shield.

Figure 2-3. Surface Sensor

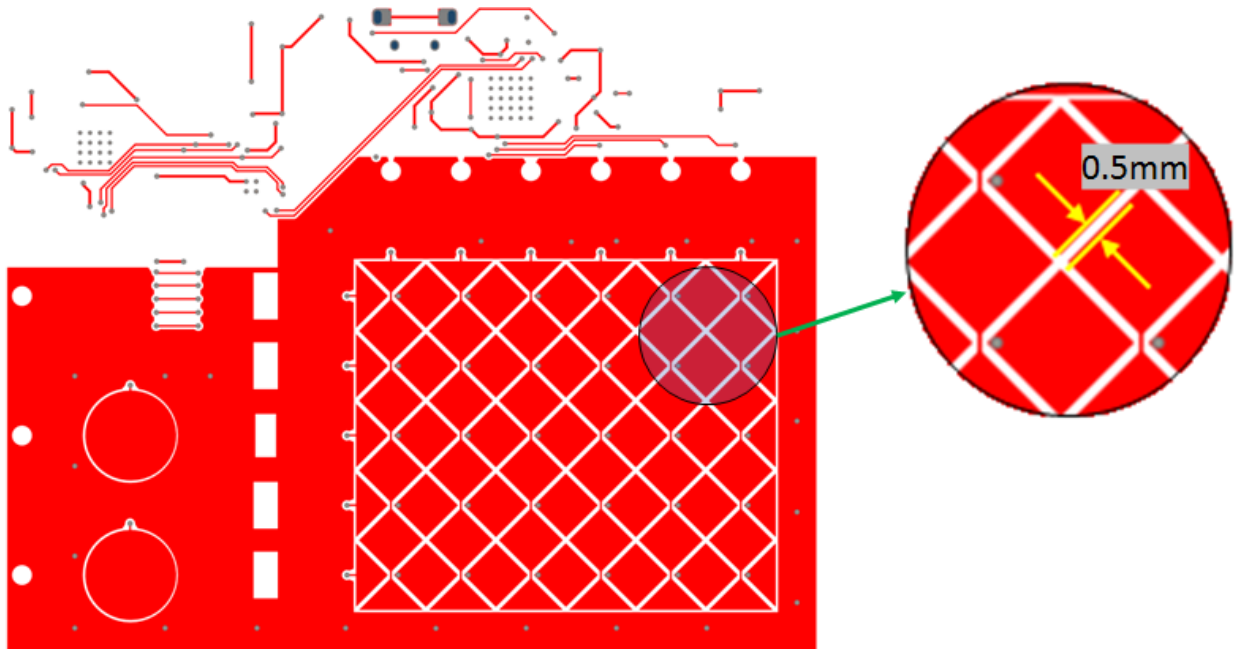
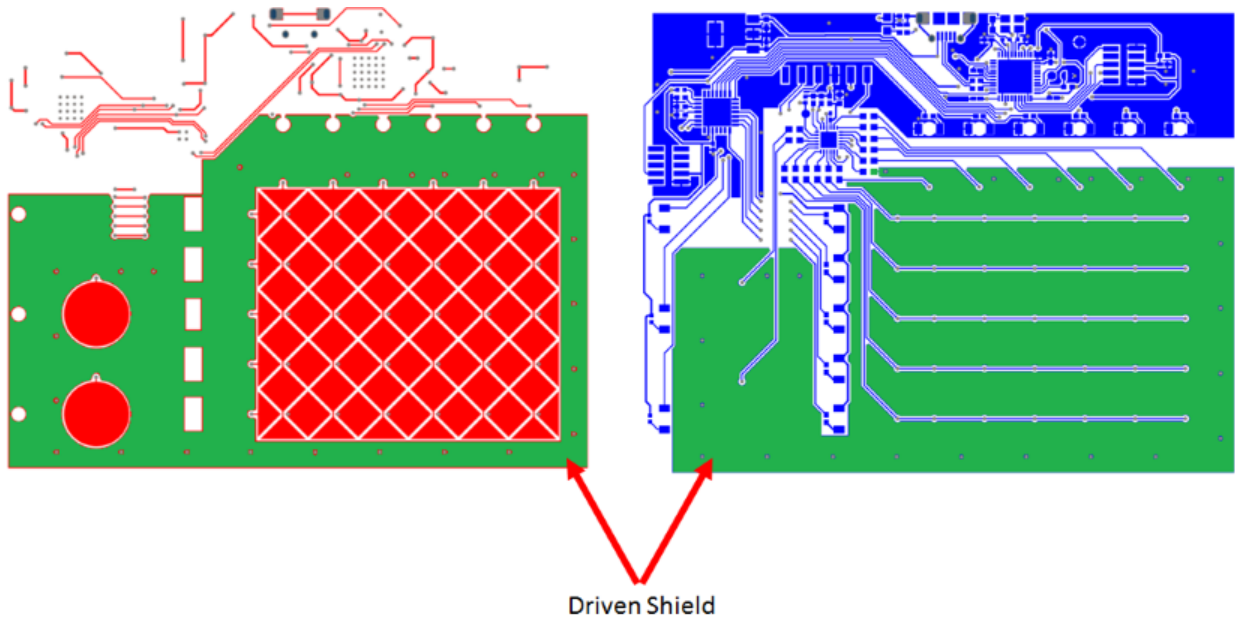


Figure 2-4. Driven Shield



2.3 Touch Buttons

- Button 1:** When touched, the Kit mode is changed to Position mode.
- Button 2:** When touched, the Kit mode is changed to Gesture mode.

2.4 LEDs

There are three Status LEDs used in this kit refer (see [Figure 2-1](#)) that light up depending on which mode is active:

- Dual Touch LED:** This LED glows when two fingers touch the Touch Surface Area.
- Position Mode LED:** This LED glows to indicate that the kit is currently in Position mode.
- Gesture Mode LED:** This LED glows to indicate that the kit is currently in Gesture mode.

3. User Guide

3.1 Powering The Board

The kit takes power through a micro-USB cable. The kit can be powered by connecting the micro-USB cable to the USB connector on the board and to the computer.

3.2 Modes of Operation

The kit operates in two different modes: Position mode and Gesture mode.

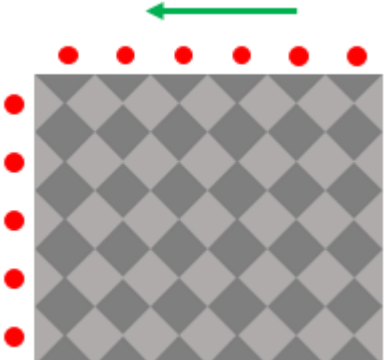
Position Mode:

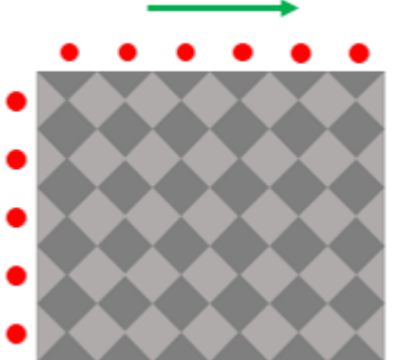
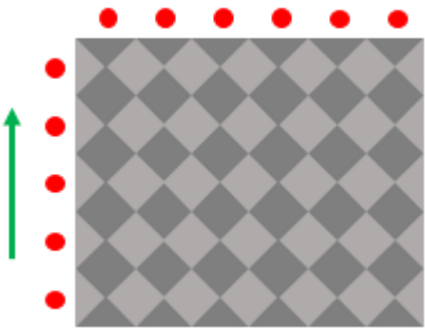
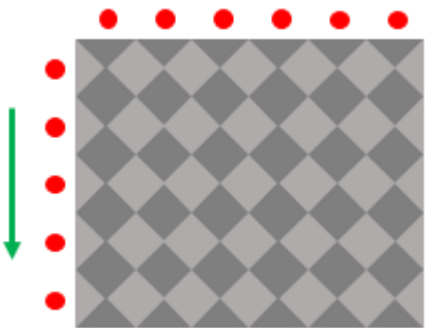
In Position mode, the user touch position is decoded and based on the position the vertical and horizontal LEDs glow. After power-up, the kit works in this mode.

Note: In this kit, two-touch is supported only for gestures. No two individual positions can be decoded correctly due to self-capacitance sensor arrangement. If the user tries to do two-touch, then the decoding stops and the two-touch LED starts glowing.

Gesture Mode

In Gesture mode, depending on the performed gesture, the LEDs glow to indicate the gesture. The tap is indicated by a blink, and swipes are indicated by LED chasing. The following table provides information on how LEDs glow when a gesture is performed.

Gesture	LED
Tap	All vertical and horizontal LEDs blink ONCE.
Double-tap	All vertical and horizontal LEDs blink TWICE.
Left swipe	Moving illumination: 

.....continued	
Gesture	LED
Right swipe	<p>Moving illumination:</p> 
Up swipe	<p>Moving illumination:</p> 
Down swipe	<p>Moving illumination:</p> 

.....continued	
Gesture	LED
Clockwise wheel gesture	<p>Moving illumination:</p>
Counter clockwise wheel gesture	<p>Moving illumination:</p>
Pinch-Zoom	<p>Zoom: The horizontal and vertical LEDs start to glow from one end. Pinch: The horizontal and vertical LEDs start to diminish from one end.</p>

Connecting to GUI

The application streams data to the GUI (Microchip 2D Touch Surface Utility). The touch position and detected gestures are communicated.



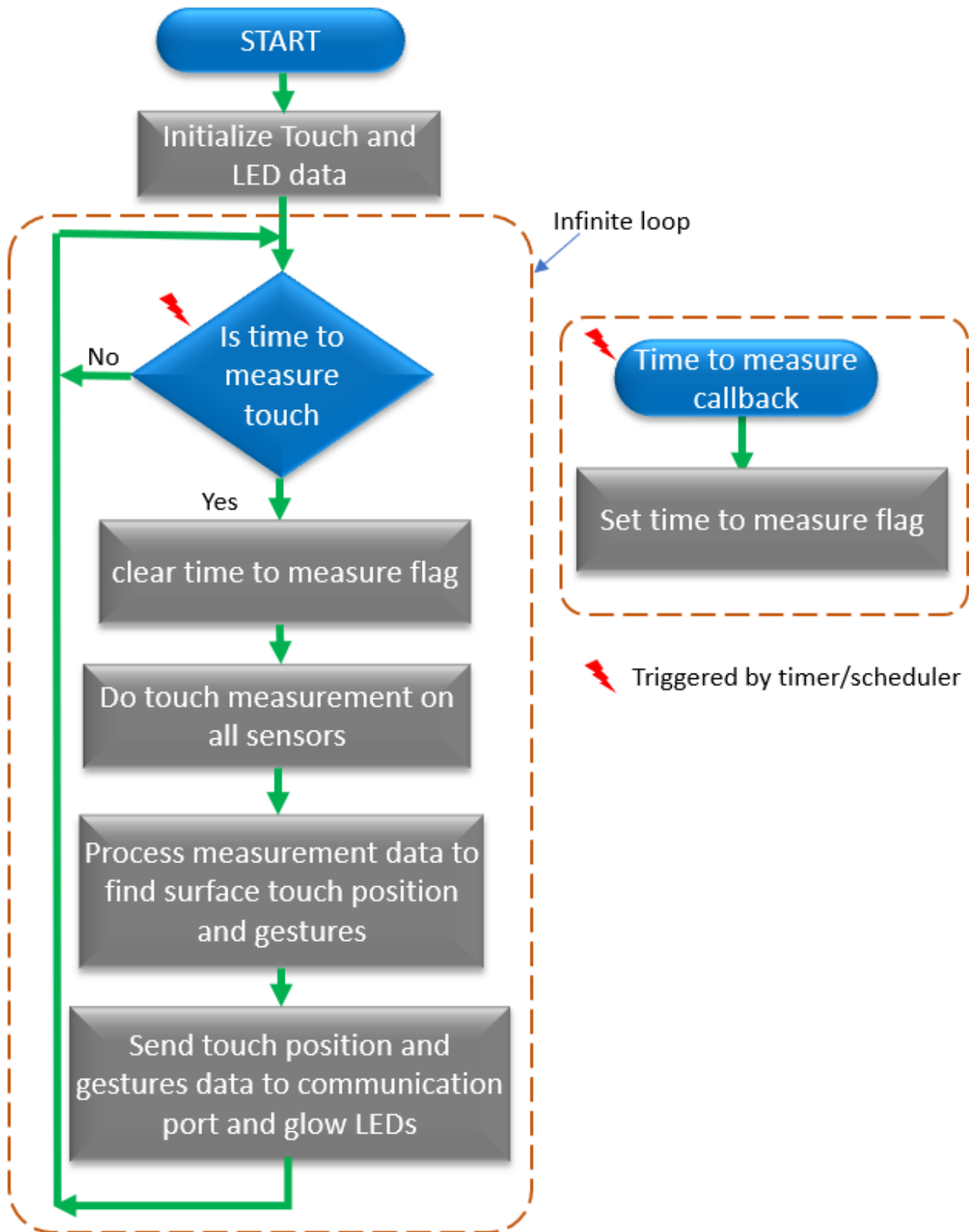
Fastpath: [link](#) for 2D Touch Surface GUI

Comport Settings: Baud rate is 115200, parity none, stop bit 1 and flow control none.

3.3 Application Flow

The following diagram shows the application flow. Touch measurement are performed at regular intervals. At the end of each measurement, the data is processed to find surface touch positions and gestures. Depending on the position, or gesture information, the LEDs are updated.

Figure 3-1. Application Flow Diagram



4. Documentation and Relevant Links

Software / IDE

- Microchip Touch design center:
<http://www.microchip.com/design-centers/capacitive-touch-sensing>
- Microchip MPLAB + MCC
<http://www.microchip.com/mplab/mplab-x-ide>
<http://www.microchip.com/MCC>
- Atmel Studio + Start:
<http://www.microchip.com/mplab/avr-support/atmel-studio-7>
<http://www.microchip.com/START>
- Data Visualizer:
[Atmel Data Visualizer Installer - Standalone](#)

Turnkey Touch Devkits:

- Turnkey evaluation kits:
 - CAP1188 Evaluation Kit :
<http://www.microchip.com/DevelopmentTools/ProductDetails/PartNo/dm160222>
 - CAP1298 Evaluation Kit :
<https://www.microchip.com/DevelopmentTools/ProductDetails/DM160223>
 - MTCH108 Evaluation Board:
<http://www.microchip.com/DevelopmentTools/ProductDetails/PartNo/dm160229>
- **Design Documentation:** Package containing CAD source, schematics, BOM, assembly drawings, 3D plots, layer plots, etc.
- **Hardware User's Guide:** PDF version of this user's guide
- **Water tolerant touch surface kit on Microchip Page:** Microchip website link.
- **Water tolerant touch surface kit Example Project:** PIC16F18456-2Button-2FingerGesture-LEDandGUI zip file

5. Hardware Revision History and Known Issues

5.1 Identifying Product ID and Revision

When an evaluation board is connected to a computer with MPLAB running, an information window with the serial number is shown. The first six digits of the serial number contain the product identifier and revision. Information about connected evaluation boards is also shown in the window.

The same information can be found on the sticker on the bottom side of the PCB. Most kits have stickers that have the identifier and revision printed in plain text as A09-nnnn/rr, where nnnn is the identifier and rr is the revision. Boards with limited space have a sticker with only a data matrix code, which contains a serial number string.

The serial number string has the following format:

```
“nnnnrrssssssss”
```

n = product identifier r = revision

r = revision

s = serial number

The product identifier for the Water Tolerant Touch Surface kit is A09-3240.

5.2 Revision 3

Revision 3 of Water Tolerant Touch Surface Kit (A09-3240/03) is the initial released version. There are no known issues.

5.3 Document Revision History

Doc.rev.	Date	Comment
A	03/2019	Initial document release.

The Microchip Web Site

Microchip provides online support via our web site at <http://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 (FAQ), 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

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 <http://www.microchip.com/>. Under "Support", click on "Customer Change Notification" and follow the registration instructions.

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://www.microchip.com/support>

Microchip Devices Code Protection Feature

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.

Legal Notice

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 unless otherwise stated.

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, AVR, AVR logo, AVR Freaks, BitCloud, chipKIT, chipKIT logo, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Heldo, JukeBlox, KeeLoq, Klear, LANCheck, LINK MD, maXStylus, maXTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, EtherSynch, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and Quiet-Wire are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, INICnet, Inter-Chip Connectivity, JitterBlocker, KlearNet, KlearNet logo, memBrain, Mindi, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICKit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, 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.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

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

© 2019, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-4263-9

Quality Management System Certified by DNV

ISO/TS 16949

Microchip received ISO/TS-16949:2009 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.

Worldwide Sales and Service

AMERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
<p>Corporate Office 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Fax: 480-792-7277 Technical Support: http://www.microchip.com/support Web Address: www.microchip.com</p> <p>Atlanta Duluth, GA Tel: 678-957-9614 Fax: 678-957-1455</p> <p>Austin, TX Tel: 512-257-3370</p> <p>Boston Westborough, MA Tel: 774-760-0087 Fax: 774-760-0088</p> <p>Chicago Itasca, IL Tel: 630-285-0071 Fax: 630-285-0075</p> <p>Dallas Addison, TX Tel: 972-818-7423 Fax: 972-818-2924</p> <p>Detroit Novi, MI Tel: 248-848-4000</p> <p>Houston, TX Tel: 281-894-5983</p> <p>Indianapolis Noblesville, IN Tel: 317-773-8323 Fax: 317-773-5453 Tel: 317-536-2380</p> <p>Los Angeles Mission Viejo, CA Tel: 949-462-9523 Fax: 949-462-9608 Tel: 951-273-7800</p> <p>Raleigh, NC Tel: 919-844-7510</p> <p>New York, NY Tel: 631-435-6000</p> <p>San Jose, CA Tel: 408-735-9110 Tel: 408-436-4270</p> <p>Canada - Toronto Tel: 905-695-1980 Fax: 905-695-2078</p>	<p>Australia - Sydney Tel: 61-2-9868-6733</p> <p>China - Beijing Tel: 86-10-8569-7000</p> <p>China - Chengdu Tel: 86-28-8665-5511</p> <p>China - Chongqing Tel: 86-23-8980-9588</p> <p>China - Dongguan Tel: 86-769-8702-9880</p> <p>China - Guangzhou Tel: 86-20-8755-8029</p> <p>China - Hangzhou Tel: 86-571-8792-8115</p> <p>China - Hong Kong SAR Tel: 852-2943-5100</p> <p>China - Nanjing Tel: 86-25-8473-2460</p> <p>China - Qingdao Tel: 86-532-8502-7355</p> <p>China - Shanghai Tel: 86-21-3326-8000</p> <p>China - Shenyang Tel: 86-24-2334-2829</p> <p>China - Shenzhen Tel: 86-755-8864-2200</p> <p>China - Suzhou Tel: 86-186-6233-1526</p> <p>China - Wuhan Tel: 86-27-5980-5300</p> <p>China - Xian Tel: 86-29-8833-7252</p> <p>China - Xiamen Tel: 86-592-2388138</p> <p>China - Zhuhai Tel: 86-756-3210040</p>	<p>India - Bangalore Tel: 91-80-3090-4444</p> <p>India - New Delhi Tel: 91-11-4160-8631</p> <p>India - Pune Tel: 91-20-4121-0141</p> <p>Japan - Osaka Tel: 81-6-6152-7160</p> <p>Japan - Tokyo Tel: 81-3-6880-3770</p> <p>Korea - Daegu Tel: 82-53-744-4301</p> <p>Korea - Seoul Tel: 82-2-554-7200</p> <p>Malaysia - Kuala Lumpur Tel: 60-3-7651-7906</p> <p>Malaysia - Penang Tel: 60-4-227-8870</p> <p>Philippines - Manila Tel: 63-2-634-9065</p> <p>Singapore Tel: 65-6334-8870</p> <p>Taiwan - Hsin Chu Tel: 886-3-577-8366</p> <p>Taiwan - Kaohsiung Tel: 886-7-213-7830</p> <p>Taiwan - Taipei Tel: 886-2-2508-8600</p> <p>Thailand - Bangkok Tel: 66-2-694-1351</p> <p>Vietnam - Ho Chi Minh Tel: 84-28-5448-2100</p>	<p>Austria - Wels Tel: 43-7242-2244-39 Fax: 43-7242-2244-393</p> <p>Denmark - Copenhagen Tel: 45-4450-2828 Fax: 45-4485-2829</p> <p>Finland - Espoo Tel: 358-9-4520-820</p> <p>France - Paris Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79</p> <p>Germany - Garching Tel: 49-8931-9700</p> <p>Germany - Haan Tel: 49-2129-3766400</p> <p>Germany - Heilbronn Tel: 49-7131-67-3636</p> <p>Germany - Karlsruhe Tel: 49-721-625370</p> <p>Germany - Munich Tel: 49-89-627-144-0 Fax: 49-89-627-144-44</p> <p>Germany - Rosenheim Tel: 49-8031-354-560</p> <p>Israel - Ra'anana Tel: 972-9-744-7705</p> <p>Italy - Milan Tel: 39-0331-742611 Fax: 39-0331-466781</p> <p>Italy - Padova Tel: 39-049-7625286</p> <p>Netherlands - Drunen Tel: 31-416-690399 Fax: 31-416-690340</p> <p>Norway - Trondheim Tel: 47-72884388</p> <p>Poland - Warsaw Tel: 48-22-3325737</p> <p>Romania - Bucharest Tel: 40-21-407-87-50</p> <p>Spain - Madrid Tel: 34-91-708-08-90 Fax: 34-91-708-08-91</p> <p>Sweden - Gothenberg Tel: 46-31-704-60-40</p> <p>Sweden - Stockholm Tel: 46-8-5090-4654</p> <p>UK - Wokingham Tel: 44-118-921-5800 Fax: 44-118-921-5820</p>