MTCH1060 Evaluation Kit User's Guide

MTCH1060 Evaluation Kit

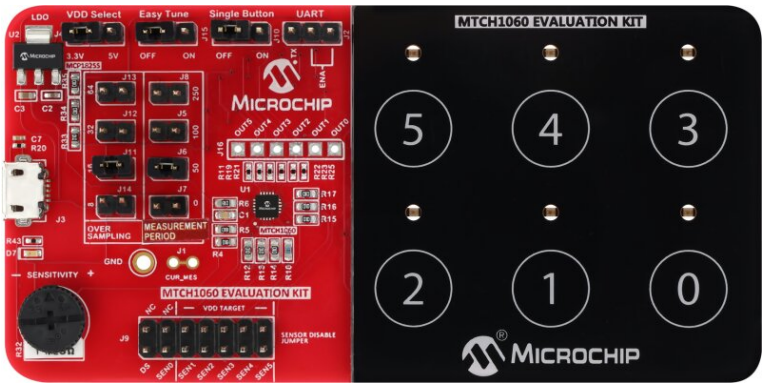
Introduction

The MTCH1060 Evaluation Kit is a self-contained hardware platform designed to evaluate the MTCH1060 Capacitive Touch Controller, the largest of the MTCH10XX turnkey touch controller family. These devices offer robust (water and noise-tolerant) touch implementations while being controlled only by GPIOs. The MTCH10XX family controls up to six capacitive sensors with Driven Shield+ capability, ranging from the MTCH1010 (with one sensor channel) to the MTCH1030 (up to three) to the MTCH1060 (up to six).

The MTCH1060 Evaluation Kit incorporates six touch sensor electrodes with Driven Shield+ to evaluate the MTCH1060's robust noise performance and moisture tolerance. In addition, the MTCH1060 Evaluation Kit offers options to connect external touch electrodes, allowing the user to prototype applications with the MTCH1060 touch controller. Users can also evaluate the performance of their touch control applications in different configurations by enabling and/or changing various parameters, such as:

- Sensitivity
- Response time (Measurement Period)
- Oversampling
- Easy Tune
- Singe Button Mode
- Disabling sensors
- Visual Touch Tuning

Figure 1. MTCH1060 Evaluation Kit



The MTCH1060 Evaluation Kit includes these features:

- Six touch buttons with ring driven shield
- Touch status LEDs for each sensor channel
- Multiple configuration options:
  - Configure oversampling and measurement period
  - Configure sensitivity
  - Disable on-board sensors

- Connect external sensor electrode for evaluation and prototyping
- Enable or disable Single-Button mode
- Enable or disable Easy Tune
- Enable or disable Tune Data
- Stream Touch Tune Data
- Selectable VCC of 3.3V or 5V from USB power input

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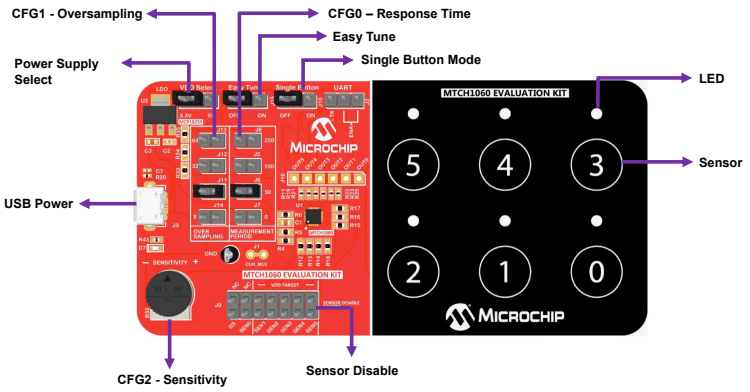
1. Getting Started

MTCH1060 Evaluation Kit is usable as a standalone unit with six buttons with overlay, LED indication for each button, and jumper-selectable configuration options. Touch Tune visualization via MPLAB® Data Visualizer is optionally available.

1.1 Overview

To start exploring the MTCH1060 Evaluation Kit, simply power up the board by connecting it through the USB micro connector to a host computer (or other USB power source) with a USB cable. The board is powered exclusively through the USB connector (J3). The jumper on header J4 on (V_{DD} Select) provides the option to select the desired input voltage (3.3V or 5V) for the MTCH1060 touch controller. Once it is powered up, the Evaluation Kit can be tuned to the required settings.

Figure 1-1. MTCH1060 Evaluation Kit

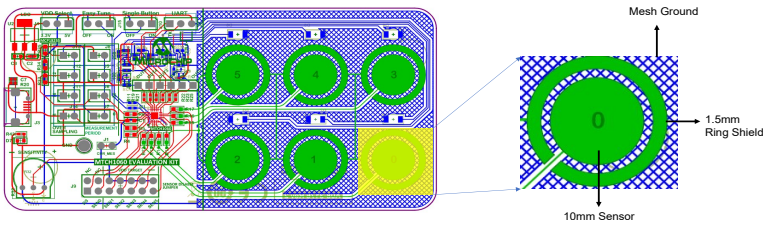


1.2 Electrode Design

The six on-board electrodes are designed as standard touch buttons, with a diameter of 10 mm and a ring shield of 1.5 mm width. The isolation between the sensor and the shield is 1 mm. The electrode overlay is SABIC™ LEXAN™ 8010 polycarbonate film, secured with 3M™ Adhesive Transfer Tape 467 . The schematic and layout for the sensors follow the design rules provided in Microchip Application Note AN2934, *"Capacitive Touch Sensor Design Guide"*(DS0002934).

Note: Complete CAD files for the MTCH1060 Evaluation Kit board are available at the Microchip web site: https://www.microchip.com/en-us/development-tool/EV54M59A

Figure 1-2. Electrode Design



1.3 Touch Sensor

The sensor electrodes are connected to the BUTTONx pins of the MTCH1060 touch controller via series resistors to reduce electromagnetic interference (EMI) and electromagnetic compatibility (EMC), following the guidelines in the *"Capacitive Touch Sensor Design Guide"* application note. The series resistors used in this evaluation kit are 100 kΩ each, but can vary from 10 kΩ to 200 kΩ, depending on the sensor capacitance and desired level of EMC performance. Refer to the *"Capacitive Touch Sensor Design Guide"* application note for more details.

The MTCH1060 Evaluation Kit has been tested against conducted immunity according to IEC 61000-4-6 and passes the test level 3 (10 V_{RMS} CI noise). The applied settings for the test were:

- CFG0 (Measurement Period) : 50 ms
- CFG1 (Oversampling): 64
- CFG2 (Sensitivity): 64
- Easy Tune : Disabled
- Single-Button mode : Disabled
- Supply voltage level: 5.0V

2. Configuration

The MTCH1060 Evaluation Kit provides convenient options to control all configurations of the MTCH1060:

- Response time
- Sensitivity
- Oversampling
- Easy Tune
- Single Button mode
- Disable sensors
- Tune Data

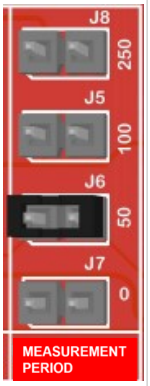
Details on the configuration options can be found in the *"MTCH1060 Data Sheet"*.

2.1 CFG0 (Measurement Period)

CFG0 selects a measurement period between free run (0), 50 ms, 100 ms and 250 ms for the target application.

The array of jumper options allows the user to select the measurement period. One side of the jumpers were connected to the CFG0 pin of MTCH1060 while the other side is connected to a network of resistors. This network acts as a voltage divider and provide user with 0, 1/3 V_{CC}, 2/3 V_{CC} and V_{CC}. By closing a jumper option, corresponding voltage is connected to CFG0 pin of MTCH1060.

Refer to the *"MTCH1060 Data Sheet"* for more details on the measurement period setting and its impact on response time and power consumption.

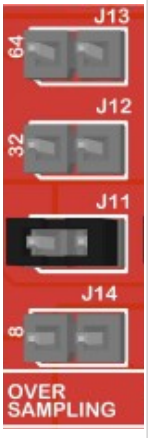


2.2 CFG1 (Oversampling)

CFG1 selects the number of samples to take per scan cycle for the MTCH1060 button. Oversampling values of 8x, 16x, 32x and 64x are available.

The array of jumper option allows the user to select the desired oversampling settings. One side of the jumpers were connected to the CFG1 pin of the MTCH1060 touch controller while the other side is connected to a network of resistors. This network acts as a voltage divider and provides the controller user with 0, 1/3 V_{CC}, 2/3 V_{CC} and V_{CC}. By closing a jumper option, the corresponding voltage is connected to CFG1 pin of MTCH1060

Refer to the *"MTCH1060 Data Sheet"* for more details on oversampling and its impact on noise performance, response time and power consumption.



2.3 CFG2 (Touch Sensitivity)

CFG2 controls the sensitivity of the touch sensor. Various factors like overlay thickness, sensor electrode size, ground loading and so on dictate the sensor's sensitivity; CFG2 is a trim potentiometer that fine-tunes the sensitivity in firmware by adjusting the voltage in the CFG2 pin.

Refer to the *"MTCH1060 Data Sheet"* for more details on the effect of CFG2 on touch sensor sensitivity.

3. Additional Features

3.1 Single-Button Mode

Single-Button mode is enabled or disabled at run-time by setting the jumper on header J10. When enabled, the touch controller enters Single-Button mode if no touches are detected for five seconds on any enabled sensor. When the mode is active, the touch controller only responds to Button0.

To exit Single-Button mode, touch Button0. Changing the J10 jumper will also disable the mode, but requires a power cycle to take effect.

Refer to the *"MTCH1060 Data Sheet"* for more details on single-button operation.

3.2 Easy Tune

The Easy Tune feature automatically adjusts the touch thresholds of the sensors, based on their current noise level. The variation in threshold is adjusted based on both sensor noise and the setting of the CFG2 potentiometer.

Easy Tune feature also automatically overrides CFG1 and CFG2 options in certain conditions. Refer to the *"MTCH1060 Data Sheet"* for more details.

Easy Tune is designed to operate regular size buttons (i.e., 10 x 10 mm) with 1 - 2 mm or 2 - 4 mm overlay thickness without further tuning or configuration of the MTCH1060 required. For a default out-of-the-box experience of Easy Tune, set CFG2 to GND (fully counterclockwise) and CFG1 to GND (jumper removed from all positions)

Easy Tune feature can only be enabled or disabled on power-up. If the setting must be changed, power cycle the kit after changing the jumper.

3.3 Onboard Electrode Selection/External Electrode Connection

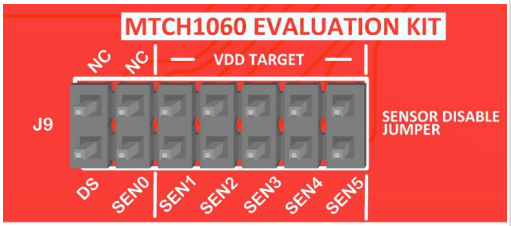
Header J9 is an array of jumpers that serves two purposes: to enable or disable the on-board touch sensors, and to provide a connection point for up to six external sensors.

When used to control the on-board sensors, a jumper placed on this array during power-up *disables* the corresponding sensor. One end of the jumper array is connected to V_{DD} while the other end is connected to the Driven shield and the sensor pins.

This feature can be used to disable up to five buttons. When only three buttons are enabled, the Evaluation Kit emulates the behavior of the MTCH1030 three-channel touch controller.

Disabling the on-board sensors can be enabled or disabled on power-up only. To change the sensor status, the kit must be power cycled after changing the jumper

Header J9 is also used to connect up to six external electrodes. All of the input lines of the touch controller are connected to this header, as well as the on-board sensors. When connecting an external sensor, it is recommended to disconnect the on-board touch sensors by removing their corresponding series resistors.



3.4 Touch Tune Data

The Touch Tune Data feature enables the user to visualize key touch data from MTCH1060 touch controller and helps the user to adjust the CFGx settings, which assists in the development and validation process.

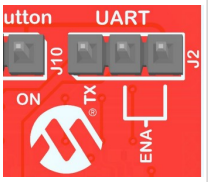
To enable the feature, place the jumper on the ENA pins of header J2. When Tune Data is enabled, tune data is sent on the TX pin. The data is read and interpreted by appropriate software, such as MPLAB® Data Visualizer. Refer to the **"Procedure to Visualize Touch Tune Data"**section (in the Appendix) on how to use MPLAB DV with the Evaluation Kit.

When Tune Data is enabled, the Button2 LED is lit, and the Button3 LED flashes to show the UART flow of data.

Enabling Touch Tune disables the touch status reporting on all OUTx pins.

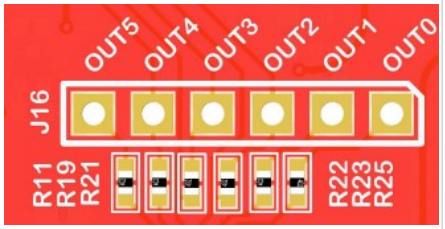
The Touch Tune Data feature is enabled or disabled on power-up only. To change the Tune Data configuration, the Evaluation Kit must be power cycled after changing the jumper.

Note: For best operation, use the configuration files for MPLAB Data Visualizer that are provided on the MTCH1060 Evaluation Kit web page.



3.5 Host MCU Connection

The output pins of the MTCH1060 touch controller may be connected to an external host microcontroller through the pins at header J16. When using the OUTx pins for external connections, keep in mind that they are also permanently connected to LEDs D1 through D6.



3.6 Current Measurement

J1 can be used to perform power measurements on the Evaluation Kit.

By default, the terminals of J1 are shorted. To enable current measurement, cut the trace between the terminals and install a jumper across J1. Leave the jumper in place for normal operation without current measurement.

4. Documentation and Relevant Links

Microchip Technology offers a range of application development tools that allows users to implement their software solutions:

- MPLAB® X Integrated Development Environment (IDE) is a software program that runs on a PC (Microsoft® Windows®, Mac OS®, or Linux® operating systems) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment because it provides a single integrated “environment” to develop code for embedded microcontrollers.
- MPLAB Code Configurator (MCC) is a free, graphical programming environment that generates seamless, easy-to-understand C code to be inserted into the project. Using an intuitive interface, it enables and configures a rich set of peripherals and functions specific to the application.
- MPLAB Harmony v3 is a fully integrated, embedded software development framework. It provides flexible and interoperable software modules that allow the user to dedicate their resources to creating applications for 32-bit MicrochipPIC® and SAM devices, rather than dealing with device details, complex protocols, and library integration challenges. MPLAB Harmony works seamlessly with MPLAB X IDE and the MPLAB XC32 Compiler to enable a smooth transition and maximum code reuse between PIC32 MCUs and SAM MCUs and MPUs.

  MPLAB Harmony v3 also has drivers, demo code, and the MPLAB Data Visualizer that supports data streaming and advanced debugging.
- Microchip Studio is a free IDE for the development of C/C++ and assembler code for microcontrollers.

In addition to the MTCH1060 Evaluation Kit product page, the following resources are also available for users:

- Design Documentation is the archive package containing CAD source files, schematics, BOM, assembly drawings, 3D and layer plots, etc.
- Hardware User’s Guide is the PDF version of this document.
- MTCH1060 Data Sheet is the data sheet for the touch controller at the heart of this Evaluation Kit.

For additional information on the MTCH1060 Touch Controller, refer to the product page on the Microchip website

5. Revision History

Revision	Date	Comments
A	5/2023	Initial document release

5.1 Hardware Revision History and Known Issues

5.1.1 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:

Table 5-1.

"nnnnrrssssssssss" n = product identifier r = revision s = serial number

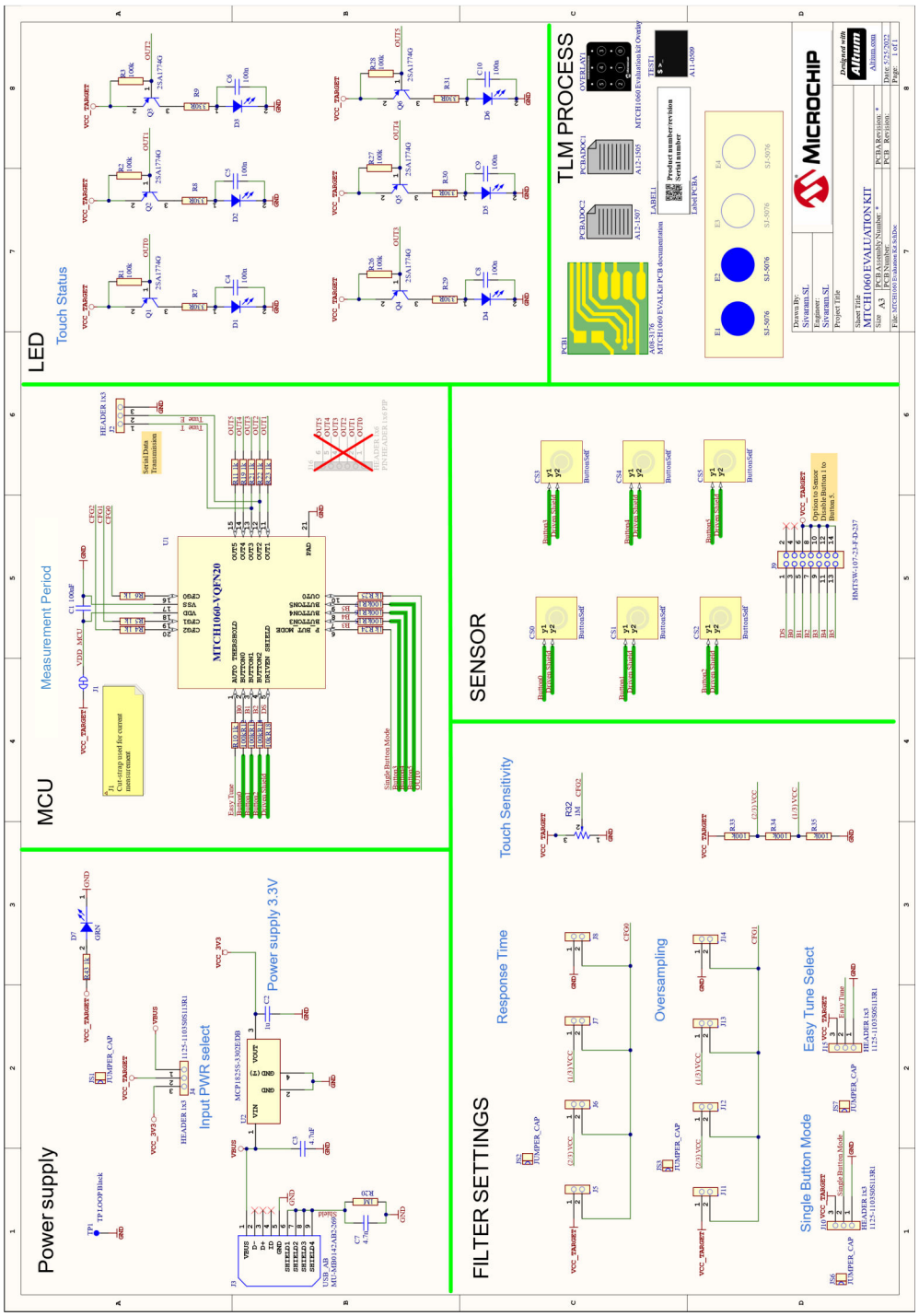
The product identifier for the MTCH1060 Evaluation Kit is A08-3176.

5.1.2 Revision One Evaluation Kit

Revision one of the MTCH1060 Evaluation Kit (A08-3176/02) is the initial released version. There are no known issues.

6. Appendix

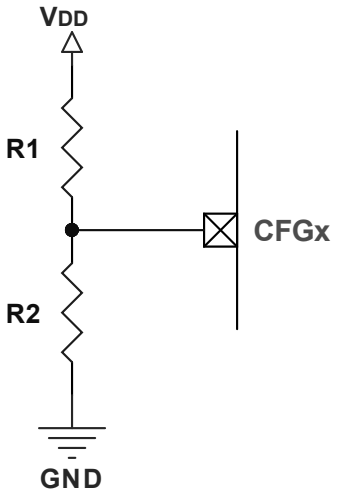
6.1 Schematics



6.2 Static Input Voltages

These methods will configure the MTCH1060 and provide a fixed behavior at power-up and run-time.

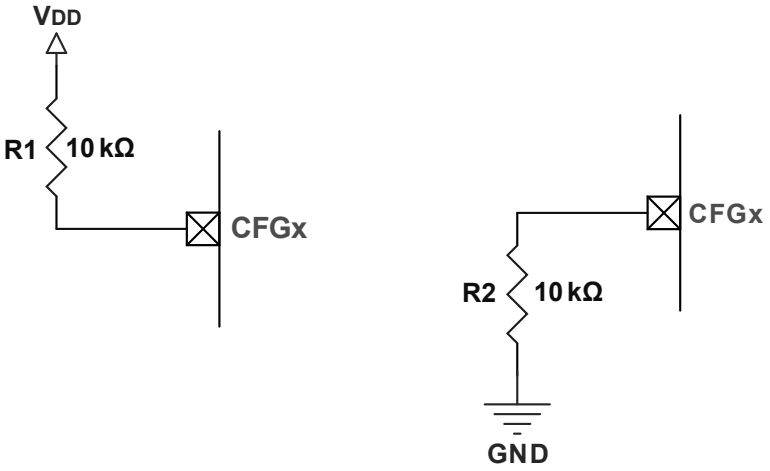
6.2.1 Resistor Ladder



Note: It is recommended that R1 and R2 be greater than 100 kΩ for lower power consumption.

6.2.2 Direct Connect to V_{DD} or GND

Use a series resistor if a setting is set by connecting a CFGx pin to V_{DD} or GND.



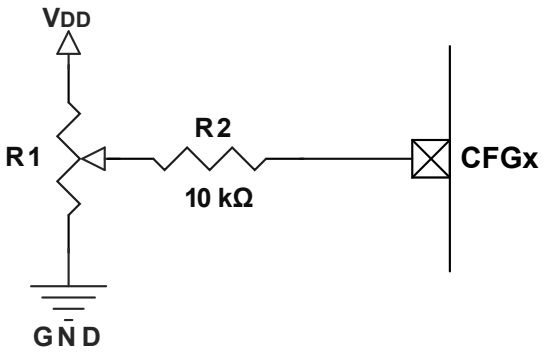
The pull-up/pull-down resistor is a pre-cautionary recommendation, as MTCH1060 will pull the CFGx neither to the V_{DD} nor to the GND during the operation.

6.3 Dynamic Input Voltages

These methods enable flexible settings during run-time or development. They are controlled by the human developer or the host IC.

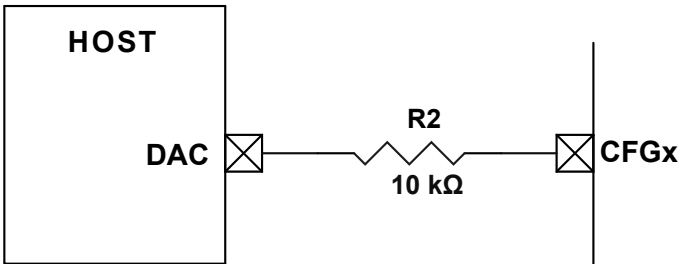
6.3.1 Potentiometer

A useable method during development. This method is also used on the MTCH1060 DevKit.



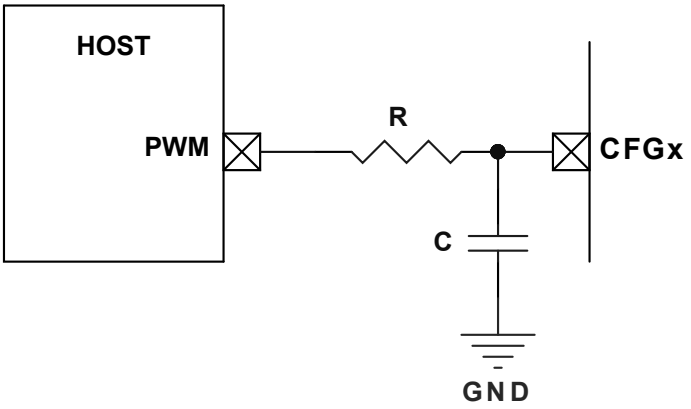
6.3.2 DAC Controlled by Host

This method is recommended if settings will dynamically change during run-time.



6.3.3 PWM Controlled by Host

This method is recommended if settings will dynamically change during run-time.



Note: Refer to Microchip Application Note TB3250, *"Using PWM to Generate Analog Output"* (DS90003250), for details on choosing the appropriate values of R and C.

6.4 Procedure to Visualize Touch Tune Data

Prerequisites to Enable Touch Tune Data:

1. MPLAB Data Visualizer or MPLAB DV plug-in (if MPLABX IDE is already present) must be installed in the host system.
2. A UART-to-USB converter is required to stream the UART data from the MTCH1060 at a baud rate of 38400 to the host system. One of the following converter boards is recommended:

- Microchip Touch Bridge (Microchip Part Number EV96R35A)
- MCP2221A Breakout Module (Microchip Part Number ADM00559)

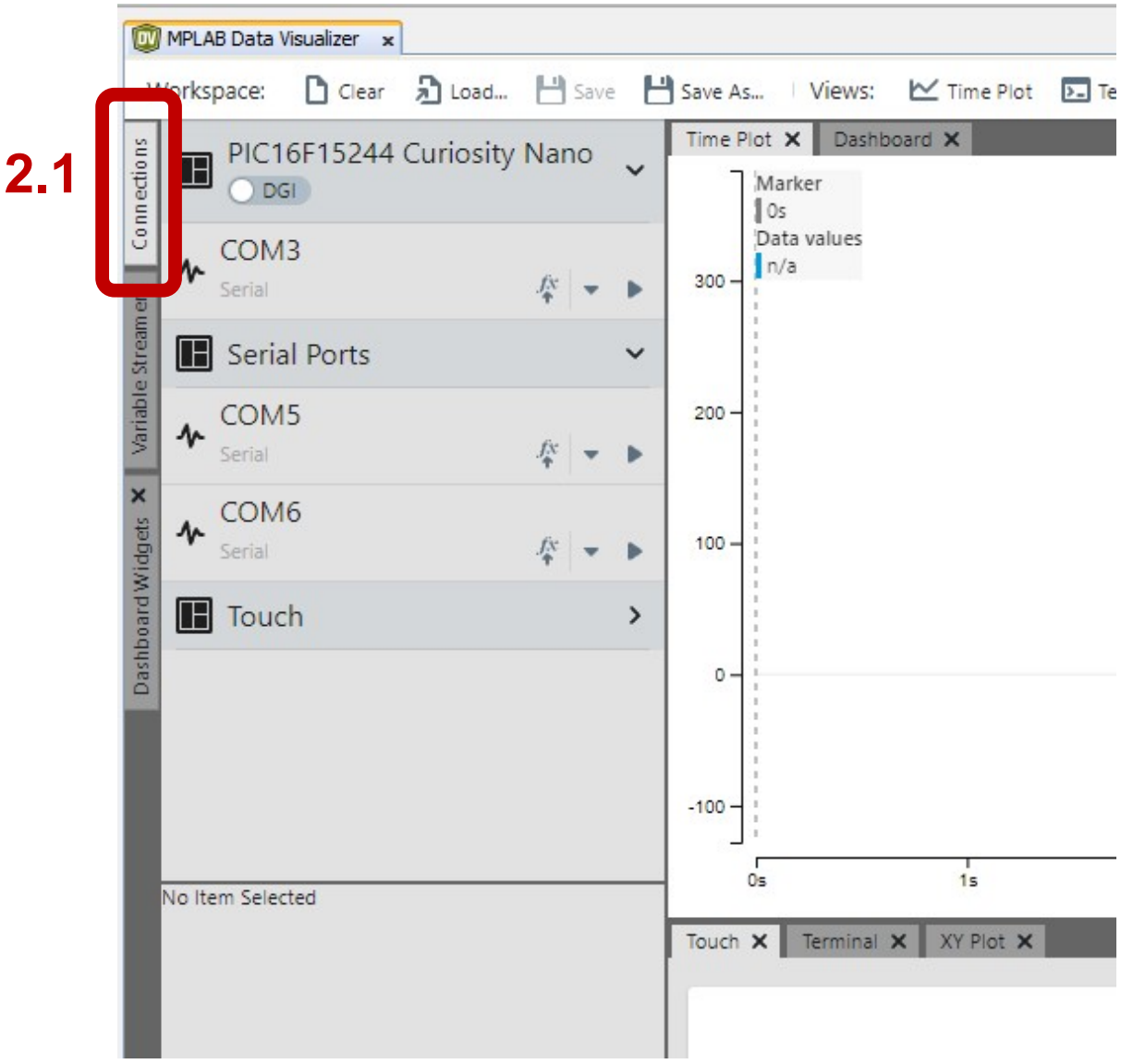
3. The configuration files required to connect to MPLAB DV can be downloaded from the MTCH1060 product page.

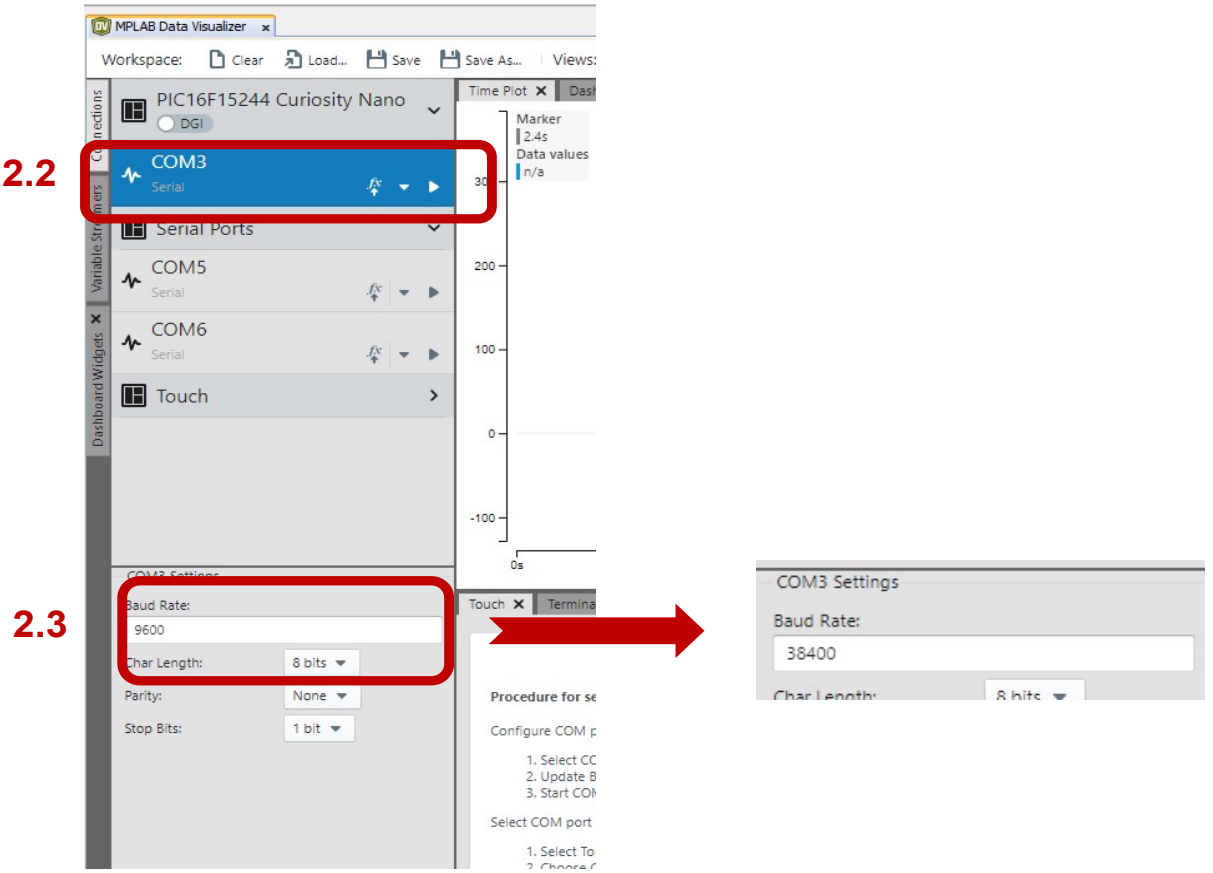
To connect the hardware:

1. Connect the TX pin (header J2) of the MTCH1060 Evaluation Kit to the RX pin of the Touch Bridge or Breakout Module.
2. Connect the GND pins of the MTCH1060 Evaluation Kit and the Touch Bridge or Breakout Module.
3. Connect the Touch Bridge or Breakout Module to the host system's USB port with an appropriate USB mini or USB micro cable.

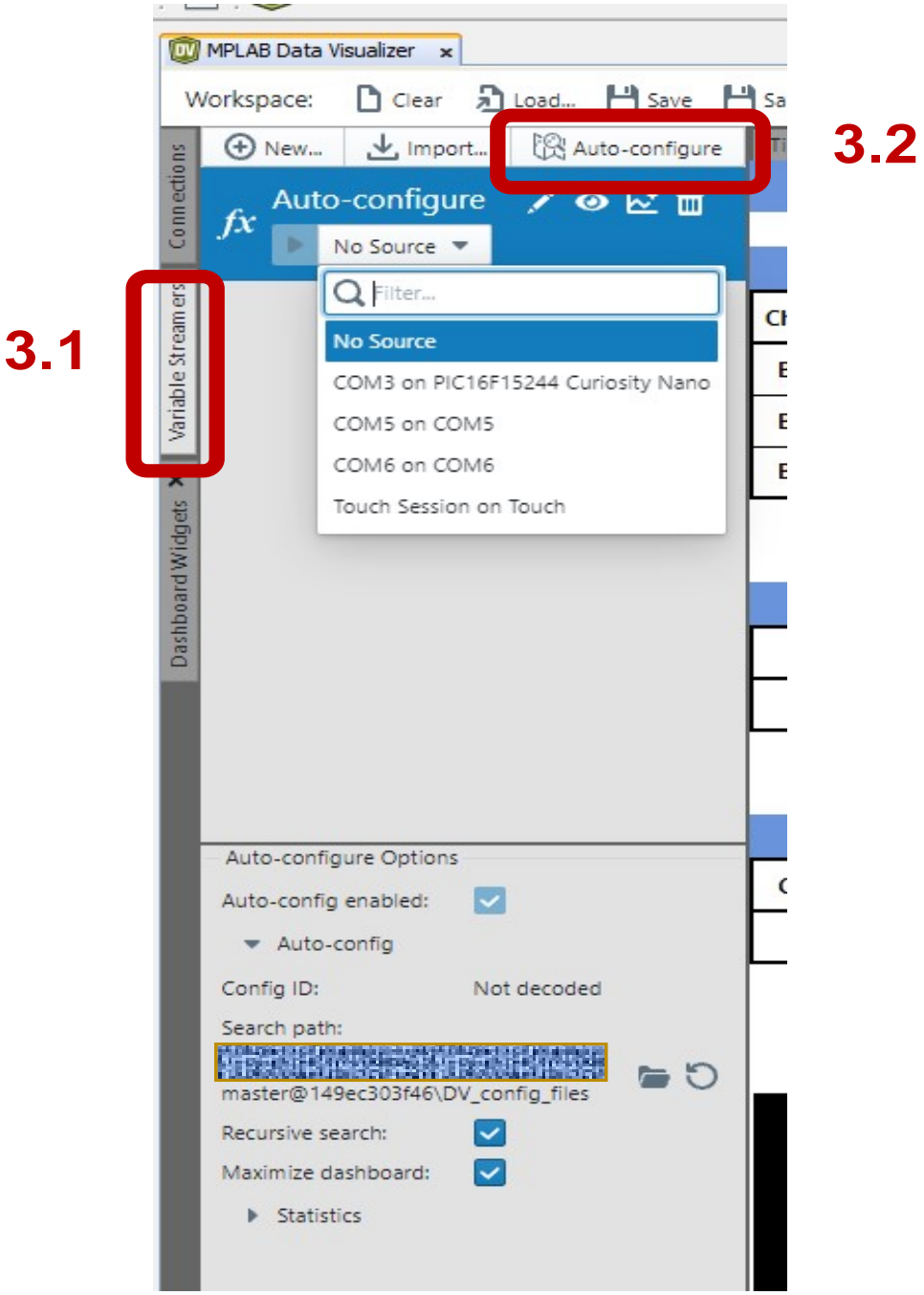
To connect MPLAB DV and the Evaluation Kit:

1. Open MPLAB Data Visualizer.
2. Click on **Connections**, and click the correct **COM port**. Enter the **Baud rate** in the **COM settings** as shown in the following images.

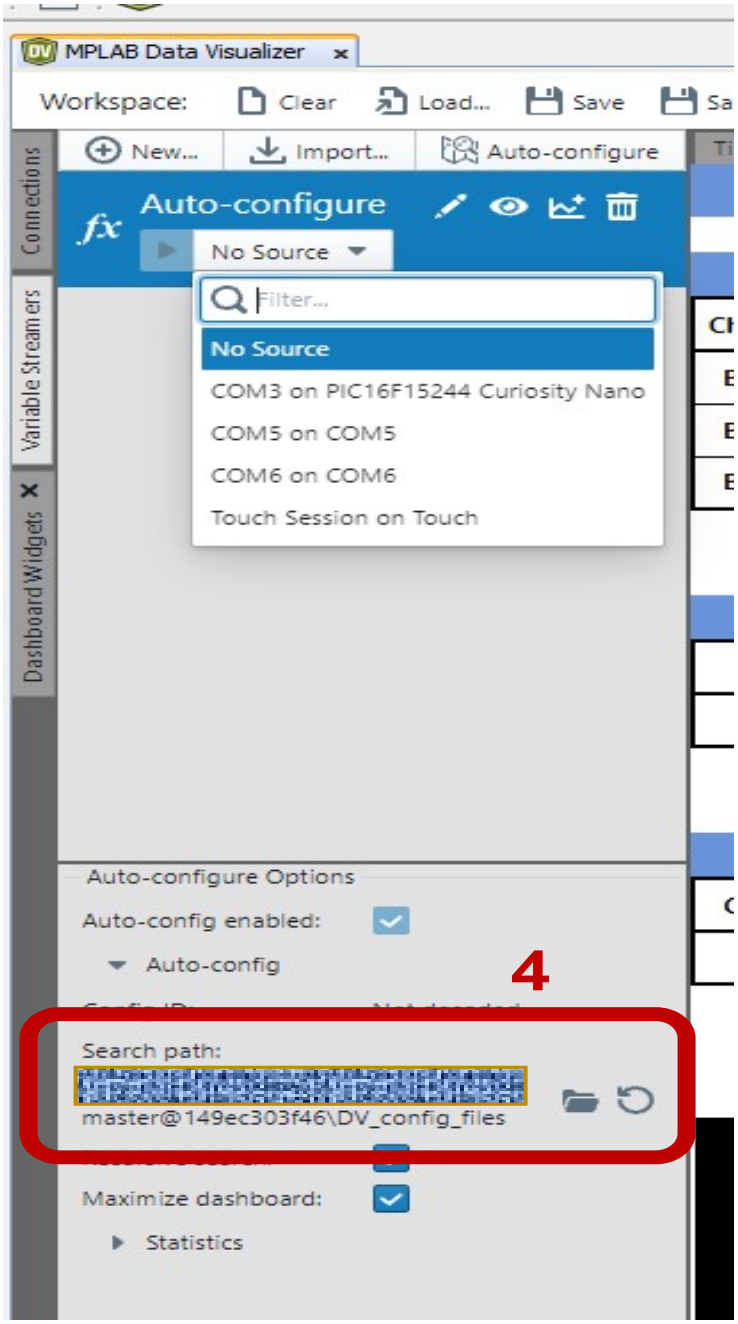




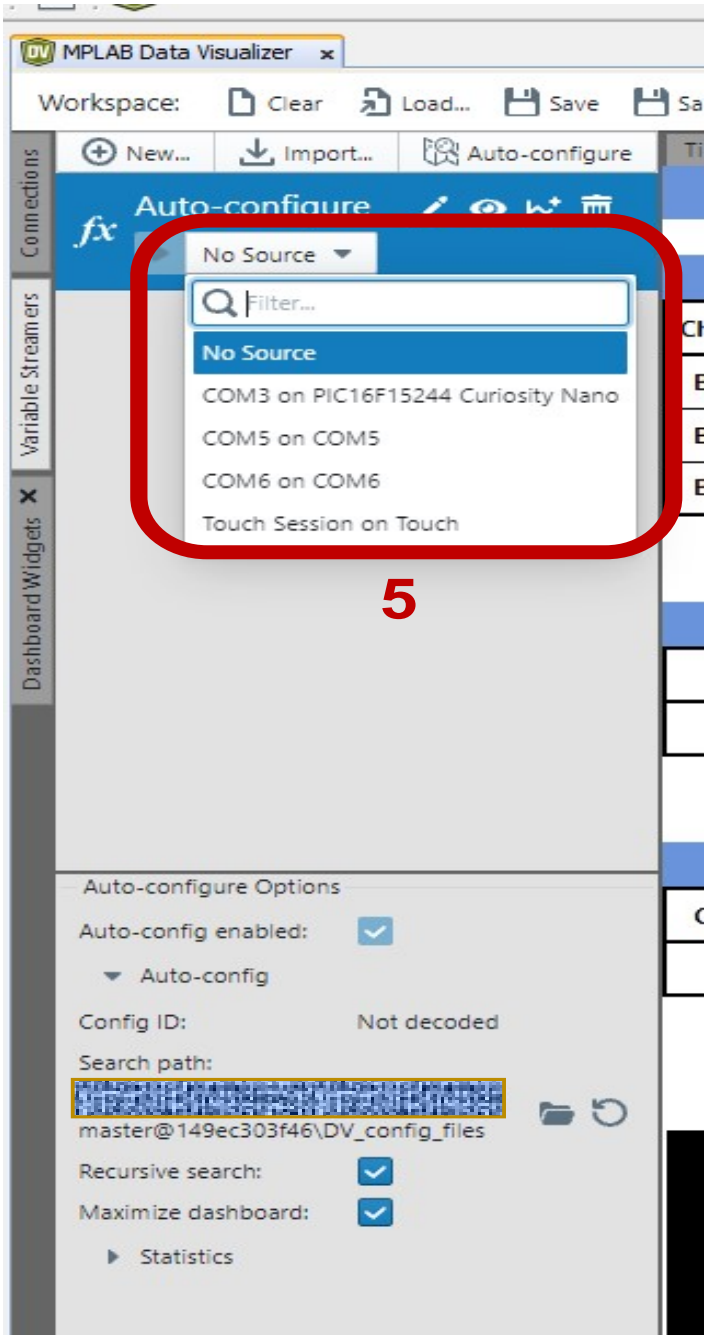
3. Select the **Variable Streamer** tab and select the **Auto-Configure** option.



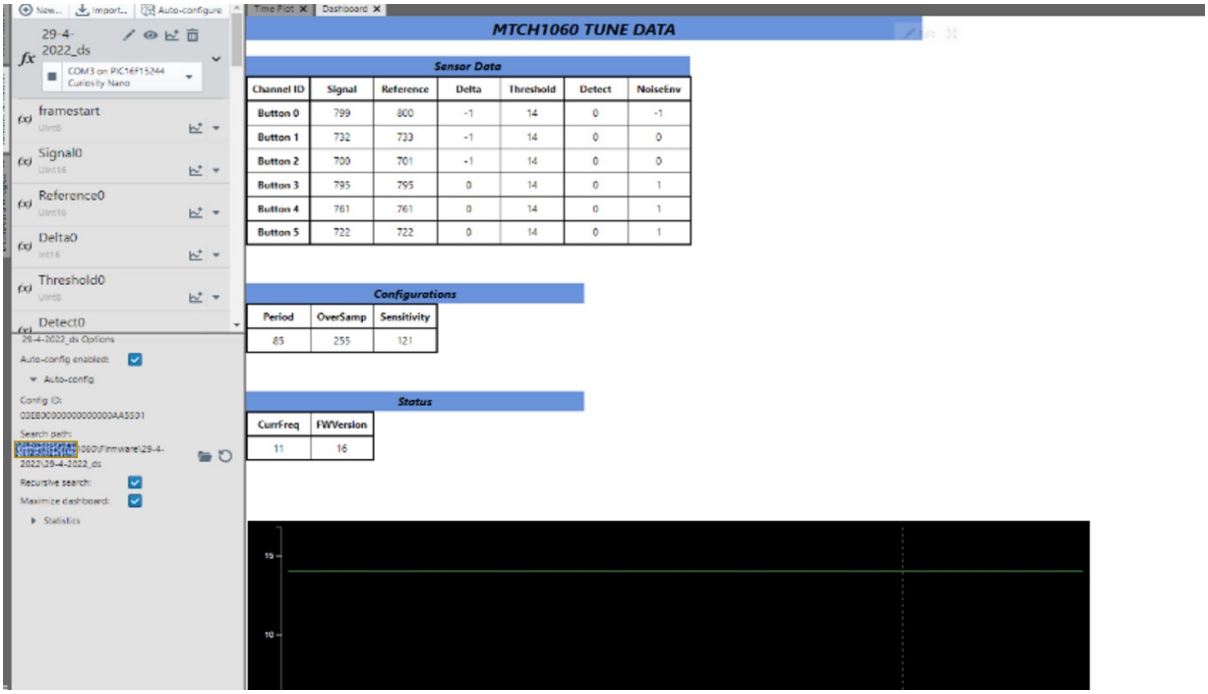
4. In the **Auto-Configure** options, select the correct folder path where the .ds files are available.



5. From the **Auto-Configure** drop-down, select the correct **COM port** to visualize the output.



6. The MPLAB DV shows Tune Data from the MTCH1060 as shown in the following image.



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