Maple Candy Quick Start Guide

30th June 2019 Rev 8.0

Contents

"What is the Maple Candy? "

1 Introduction

Maple Candy!! The best demo kit to get engineers attention and start the discussion on the RL78 and how a supplier like Renesas can be part of your complete solution. Why maple Candy? Because the RL78 is so low power that you will need a sugar boost, or the RL78 is "sweet" to work with.

Future Electronics' Design Center created this new multiple applications platform featuring Renesas RL78/L1A as well as their analog and power devices. The main purpose is to demonstrate the analog capability of the RL78 while showing the connectivity using the Renesas BLE solution. The kit will be preloaded with demo programs, and Android and iOS apps will be available to communicate with the Maple Candy. The demo includes 3.3V DAC and ADC, 10V DAC and ADC, a Metal detector circuitry and a 4-20mA input, and to complete the kit, we also designed a moisture sensor which is part of each demo kit.

The Maple Candy will introduce the RL78 with its development tool suite. With all the available peripherals and standard expansion headers like MikroBUS and Pmod the Maple Candy can be transformed in a development platform. This offers engineers the capability of developing other applications in a very short time.

2 Key Component List

Supplier	Position	Part Number	Description
RENESAS	MOD1	RY7011A0000DZ00#002	RF BLE4.2 Module SM 2.7-3.6Vop 2.4GHz
RENESAS	U1	ISL28408FBZ	Analog Amplifier OpAmp Quad SOIC14 SM 3-20Vop 1.2MHz
RENESAS	U4	R5F11MMFAFB#30	MCU 16bit RL78 Core LPQFP-80 SM 2.7-3.6Vop 1-20MHz
RENESAS	U5	ISL28108FBZ	Analog Amplifier OpAmp R-to-Rail SOIC8 SM 3-40V 120dBcmrr
RENESAS	U6	ISL97656IRTZ-TK	PMIC Boost Regulator TDFN10 SM 2.2-6.0Vin 1.1*Vin-24Vout
RENESAS	U7	ISL80102IRAJZ	PMIC Linear Regulator LDO DFN10 SM 2.2-6Vop 2A AdjVout
RENESAS	U8	ISL9113AIRAZ-T	PMIC Boost Converter TDFN8 SM 0.8-4.7Vin 3.0-5.2Vout
KEYSTONE	BH1	2468	Battery Holder 2 AAA PCB Mount 53X24.6mm TH
PANASONIC	BT1, BT2	LR03XWA/B	Batterie AAA Alka-Zinc/Mang Dioxide 1.5V

*Sullins Connector Solutions, C&K Switches and NIC Components have generously supported this project with Connector and Passive components respectively.

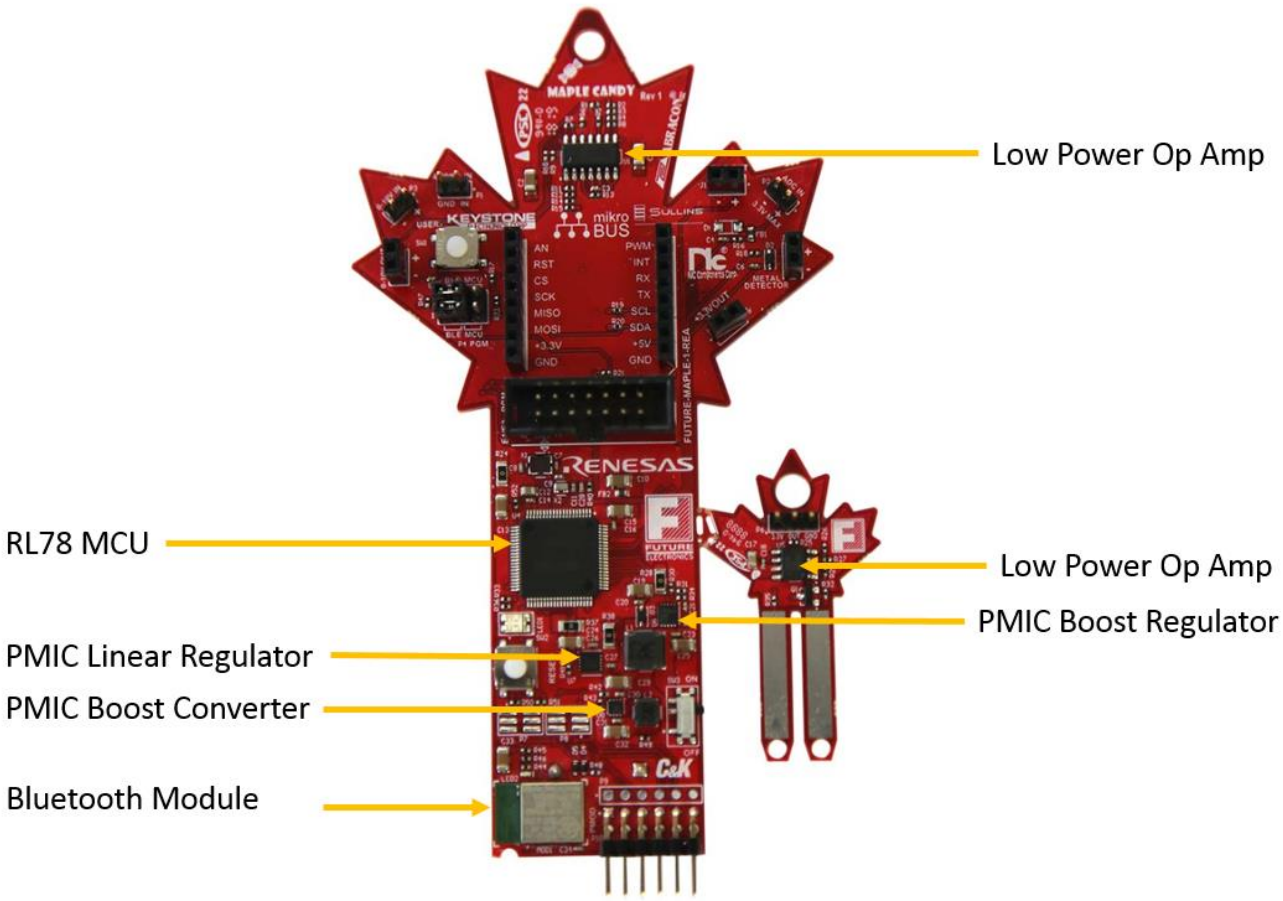
3 Kit Content

The box contains the following items:

a. Maple Candy
b. Little Maple Candy
c. Jumper wires of various colors
d. 2 AAA Batteries

4 Key Components on Board

Introducing Big Maple Candy with the side-kick Little Maple Candy



5 Out of the box demo

There are four out of the box demonstrations.

a. DAC to ADC Loop-back (App based)
b. Metal Detector
c. Moisture Sensor (App based)
d. 4-20 mA Simulator (App based)

The Maple Candy comes with both an Android and iOS App from the Play/App Store. Search and download for "Maple Candy".

5.1 DAC and ADC Loop-back Demo

Description:

The RL78/1A features

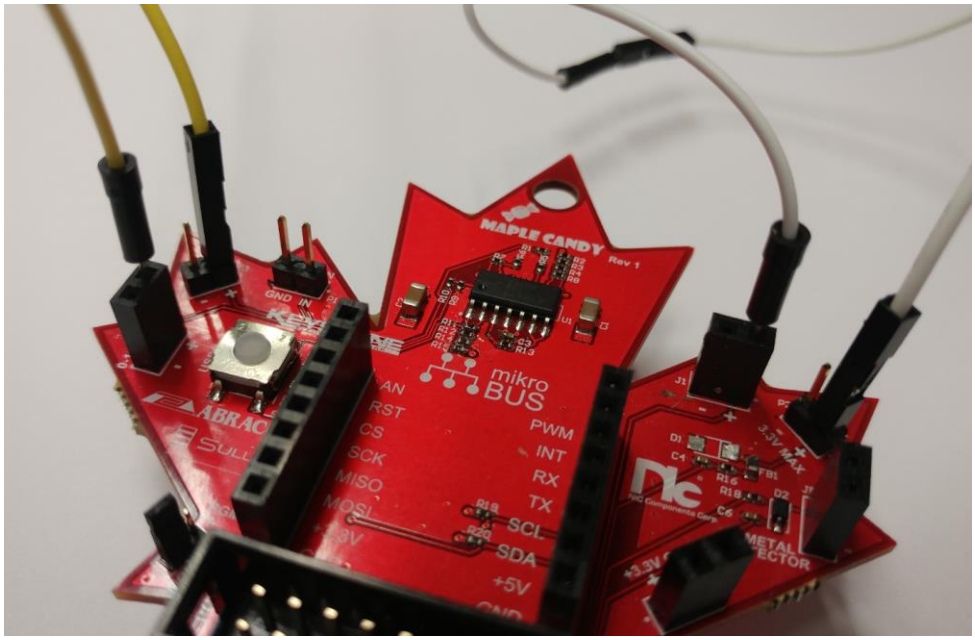
A/D converter
- 12-bit resolution A/D converter (1.8 V ≤ AVDD ≤ VDD ≤ 3.6 V)
- Analog input: 10 to 14 channels
- Internal reference voltage (TYP. 1.45 V) and temperature sensor Note 2

D/A converter
- 12-bit resolution D/A converter (1.8 V ≤ AVDD ≤ VDD ≤ 3.6 V)
- Analog output: 2 channels
- Output voltage: 0.35 V to AVDD – 0.47 V

Using the DAC, you will control an output voltage which will be read by the ADC.

Setup:

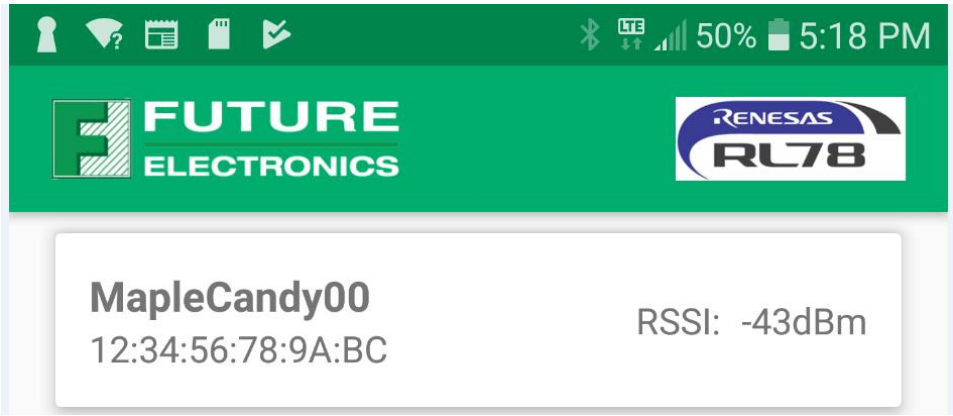
1. Plug two jumper wires as show in picture below to loop back
   i) 0-10V OUT: J4-1(+) to 0-10V IN: P3-1(+) in yellow
   ii) DAC OUT : J1-1(+) to ADC IN : P2-1(+) in white



The Demo:

1. Ensure that you have downloaded the Maple Candy app from the Play Store or App Store

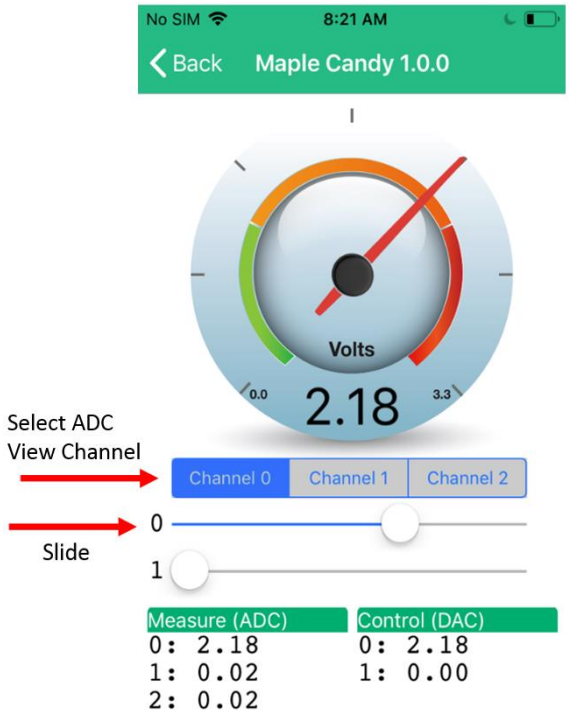
2. Connect through Bluetooth



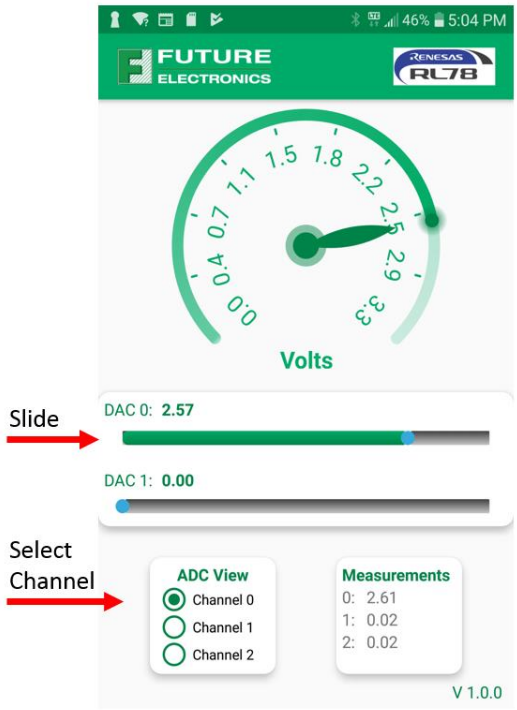
3. LED1 will turn solid when Bluetooth is connected.
4. Select ADC View Channel 0,
5. then go ahead slide DAC 0 bar (0 -3.3 V)
6. Select ADC View Channel 1
7. then go ahead slide DAC 1 bar (0 - 10 V)

Example:

iOS



Android



Tip: If you are trying to set 10V on DAC1 but measurements keeps are coming up short, this could mean your batteries are getting weak. If so, please replace batteries.

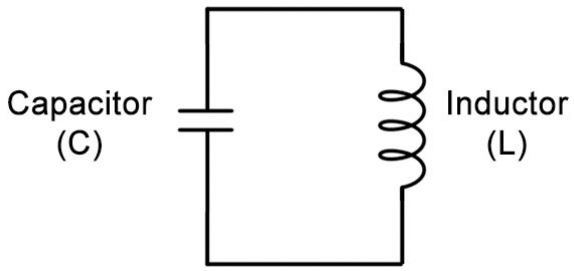
5.2 Metal Detector

Description:

The Maple Candy has a Metal Detection mode. All you need is a homemade coil.

Here is a quick primer on how it works. You start with a tank circuit consisting of a capacitor and an inductor. When energy transfers from one component to the other, we have an oscillation of a specific frequency depending on the capacitance and inductance. When you change the inductance, for example, the oscillation frequency of the tank will change.

The circuit will pulse/charge the Capacitor, then it will use the ADC on the RL78 to read the Capacitor voltage value over two hundred times per cycle. The change of the inductance will affect the charge-discharge rate/oscillation; thus, ADC reading will change. This circuit detects metals when there is change of inductance due to the presence a metal in the middle or near the inductor coil. While ferrous metal will increase the inductance, non-ferrous metal will decrease the inductance.



What you need:

To make a Coil you need

1. Wire
2. Something to coil the wire like a duct tape roll

Inductor calculator:
http://onlinecalculators.brainmeasures.com/Electric/AirCoreCoil.aspx

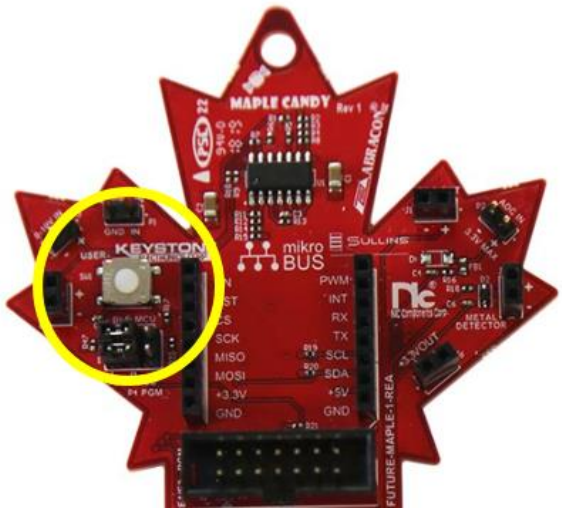
- Recommended to have 200uH or more
- Choose a non-metallic and non-magnetic cylindrical object. For example,
-
    - Small diameter: Toilet paper roll or sponge towel roll (3-4cm (1.18-1.57in) diameter)
    - Larger diameter: duct tape roll or equivalent (7.5cm (3in))

- Calculate the number of turns required for the cylindrical object chosen – use online calculator
- Wind wire around the chosen cylindrical object for number of turns calculated

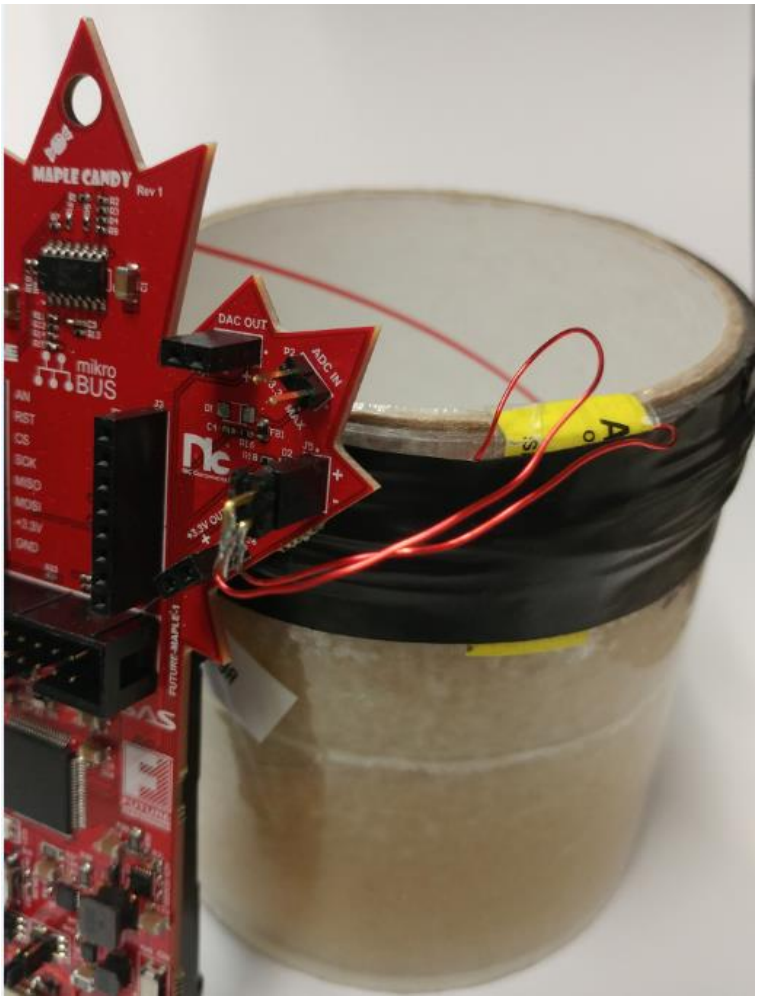
Here is a Coil we made:

Setup:

1. Plug in your Coil assembly in to Metal Detector: J5 header
2. Depress USER button for 3-4 seconds as shown below
3. LED will blink red 3 times



You are now ready to go metal hunting.



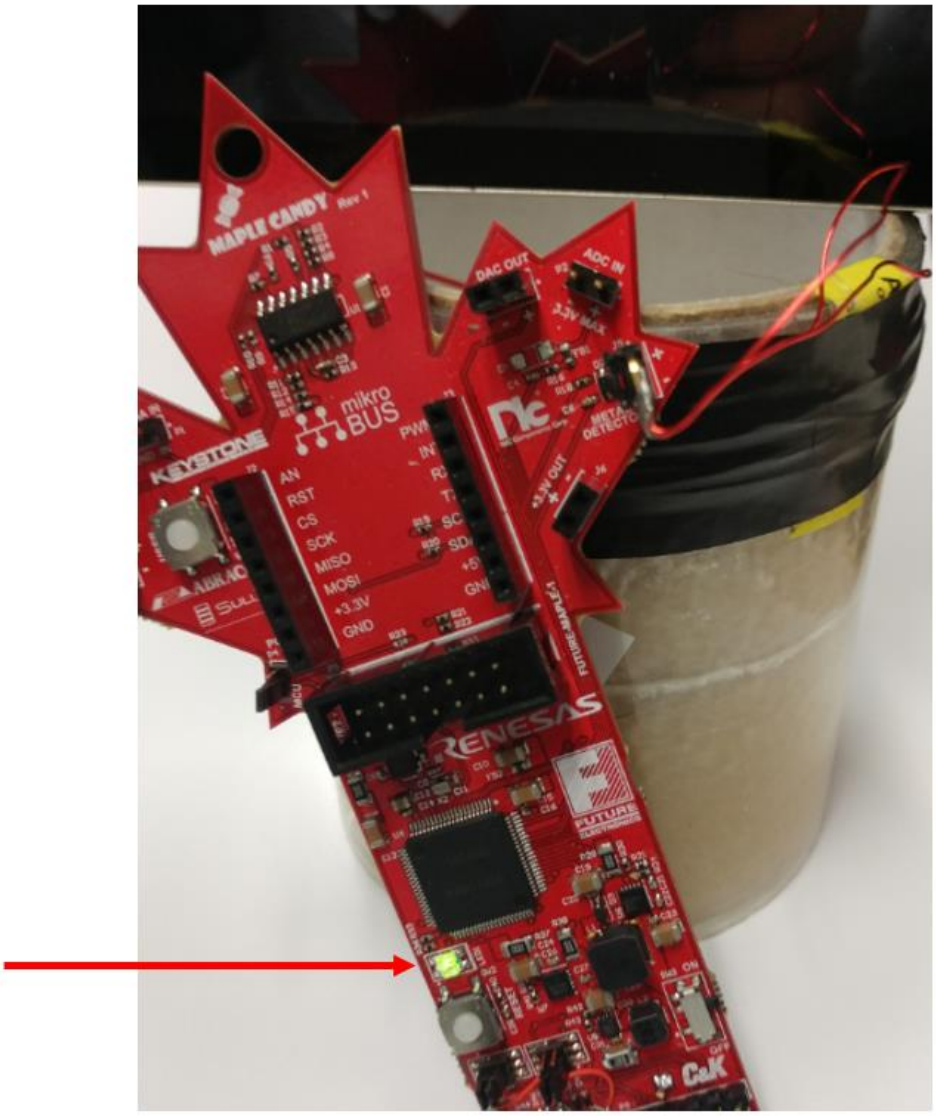
The Demo:

When a piece of metal is introduced through the coils, we are changing the inductance of the Coil. The Circuit will detect the change and indicate the magnitude of the change through LED1.

LED1 Status	**Coil Inductance**	**Detection**
Shut off	No change in inductance	No object detected
Blinking	Transition state to stabilize	
Solid LED –	Big change in inductance	metal object introduced/removed

Example:

When you bring big metal object through the Coil, the LED will turn solid green for about 3 seconds. After that, it will shut off. The circuit now has a stabilized with a new Induction value due to the metal object. When you remove the object, the LED will also turn solid for about 3 seconds because you have changed the Inductance value once again. It might blink for a while before it settles down.



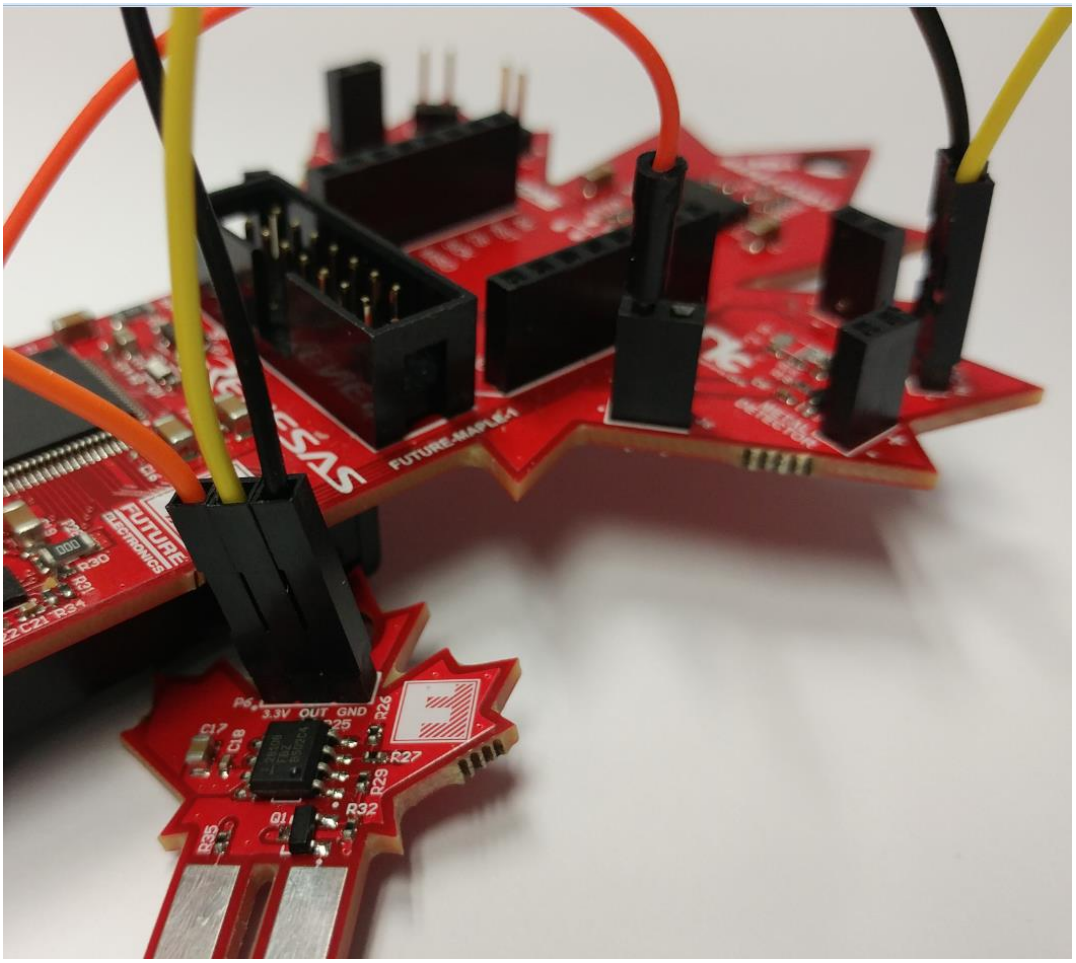
5.3 Moisture Sensor

You can detect moisture levels using the Maple Candy side-kick board a.k.a. Little Maple Candy.

Setup:

Connect the boards the following way:

Big Maple Candy	**Little Maple Candy**	**Wire Color**
3.3V OUT: J6-1 (+3.3V)	P6-1 (3.3V)	Orange
ADC IN : P2-1 (ADC +)	P6-2 (Out)	Yellow
ADC IN : P2-1 (ADC -)	P6-3 (Ground)	Black

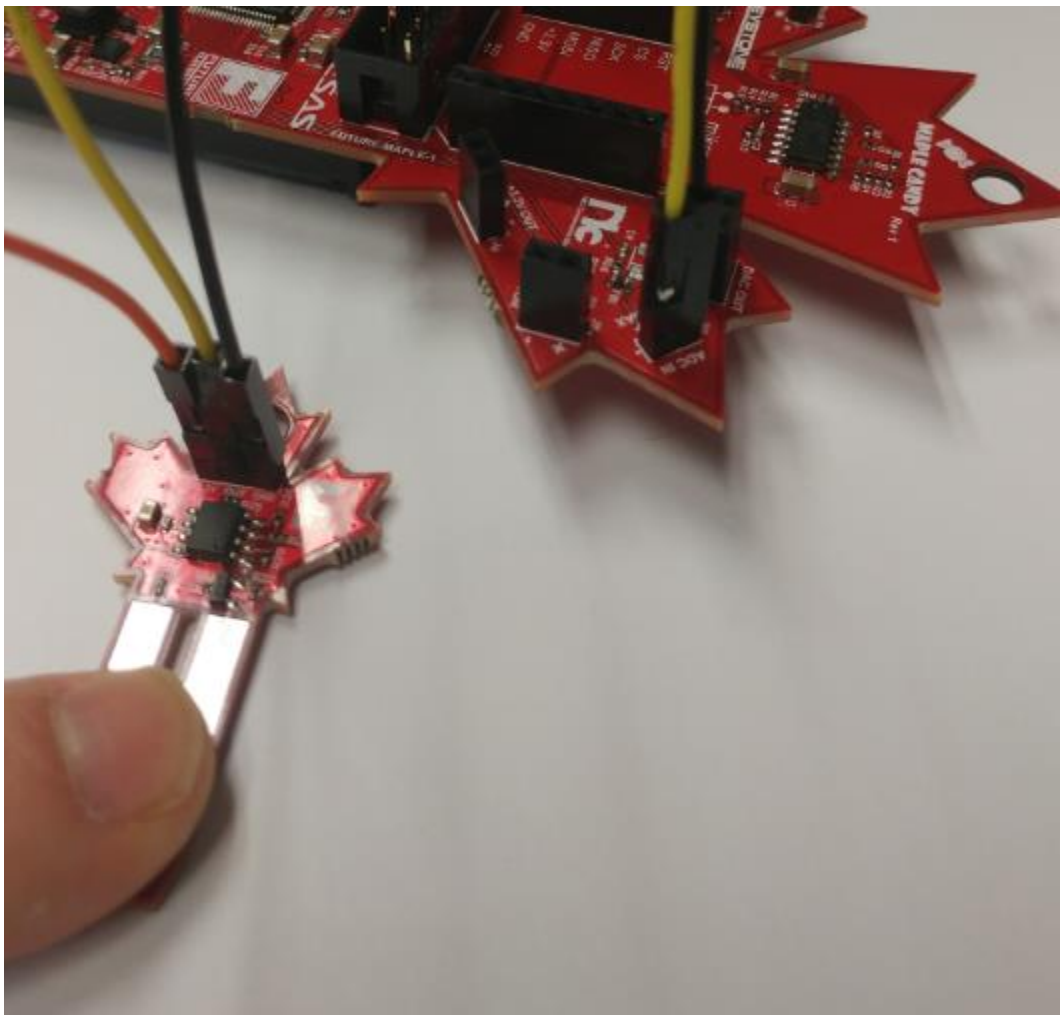


The Demo:

First, connect board to the Maple Candy App.

ADC View Channel 0 will read 3.3V by default since you are supplying the ADC with 3.3V from the mikroBUS.

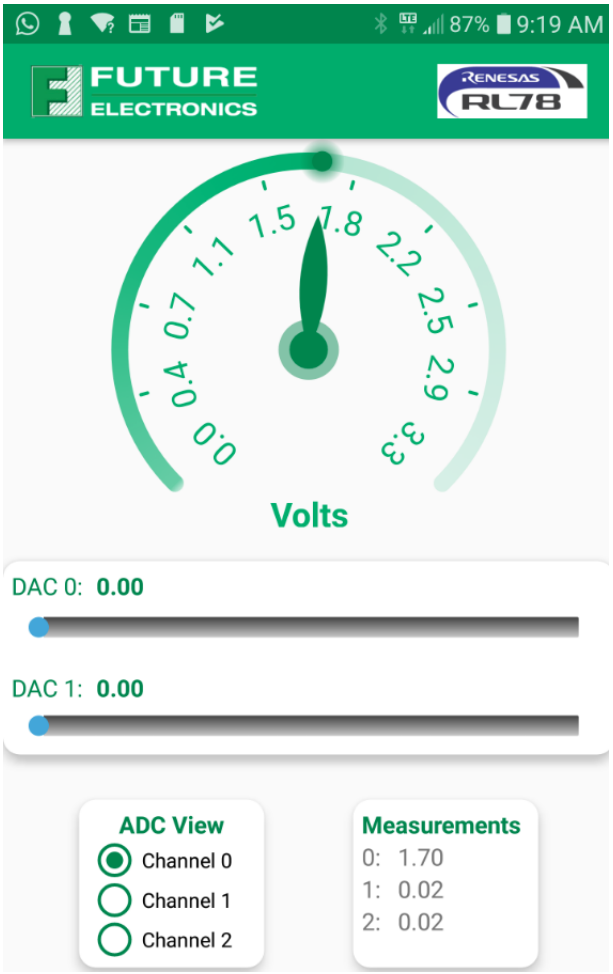
Go head, touch the two pads on Little Maple Candy. Moisture on your finger will allow current to conduct between the two pads. The gauge will drop according to the conductance.



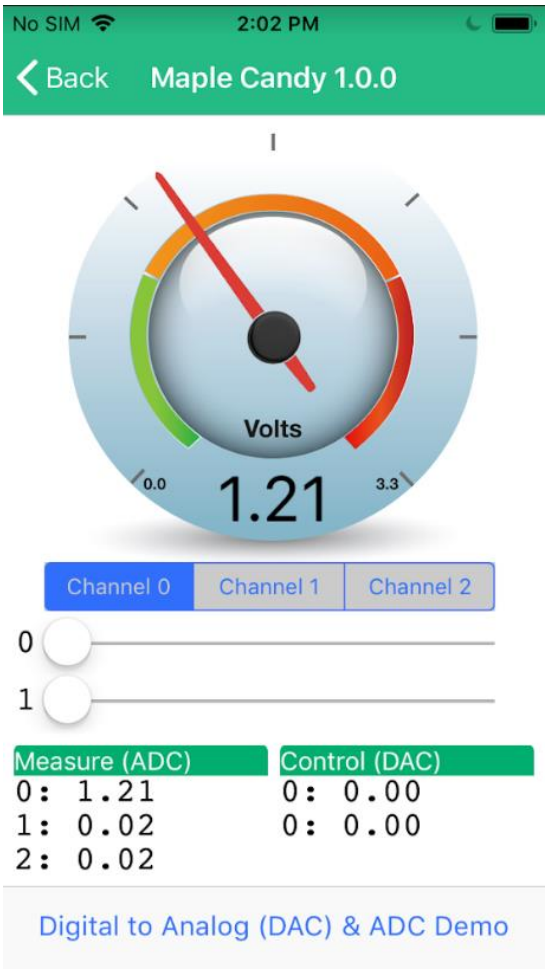
Example:

Using ADC View Channel 0, we read 1.7V (Android) or 1.21(iOs) in this example. This means it has detect moisture.

Android

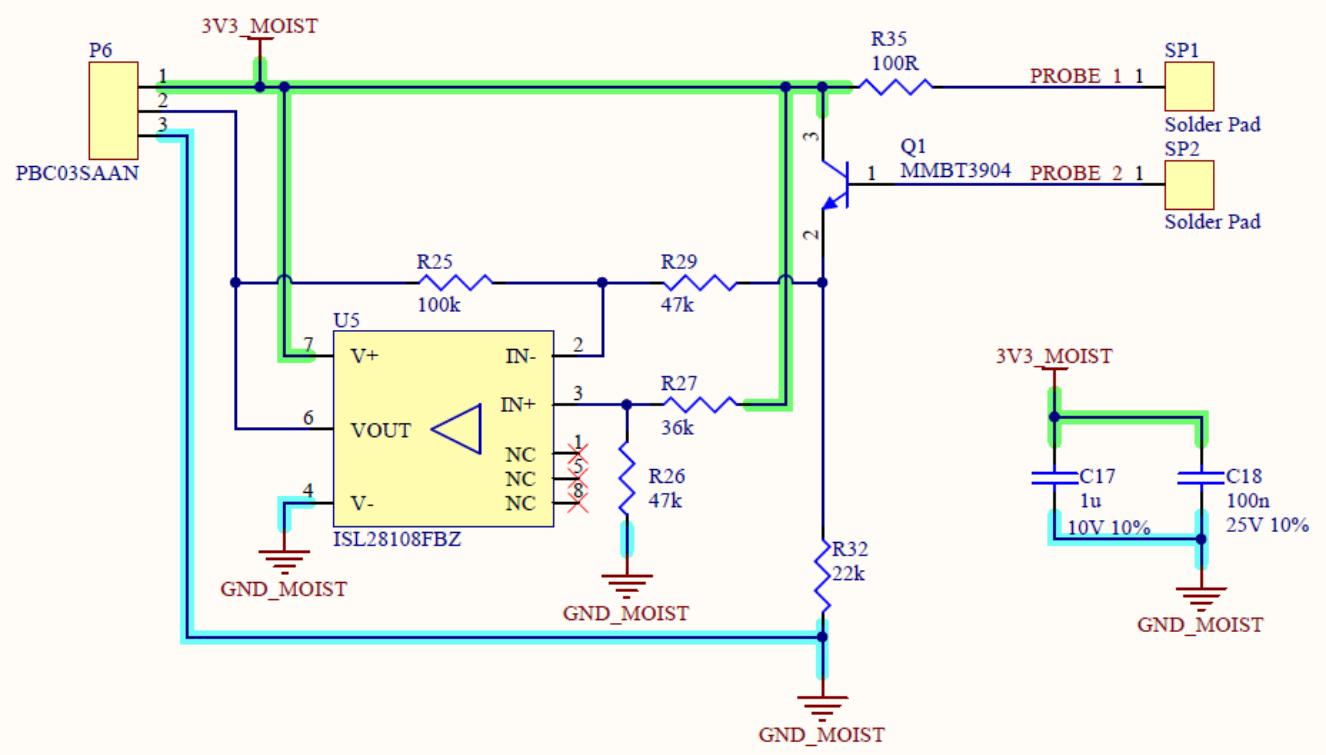


iOS



Moisture Sensing Circuit:

Here is the moisture sensing circuit for your reference.



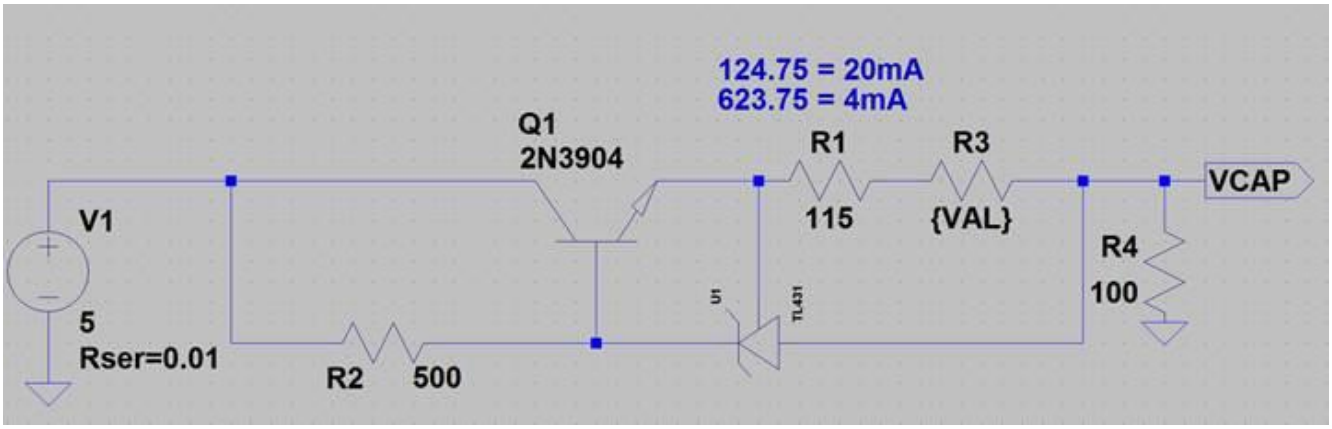
5.4 4-20 mA Simulator

A major application of current loops is the industry de facto standard 4–20 mA current loop for process control applications, where they are extensively used to carry signals from process instrumentation to PID controllers, SCADA systems, and programmable logic controllers (PLCs).*Wiki

You can also use the Maple Candy to measure 4-20mA.

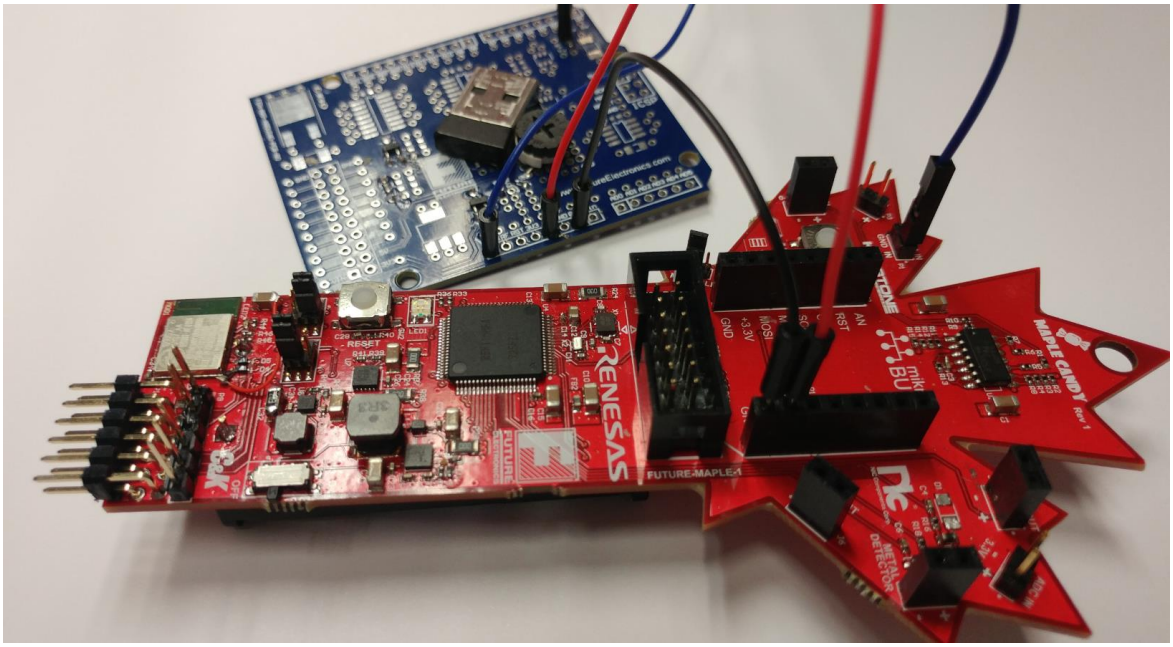
What you need:

First you need to build a little 4-20 mA Simulator Circuit like the one below or you can purchase a signal generator from Amazon.



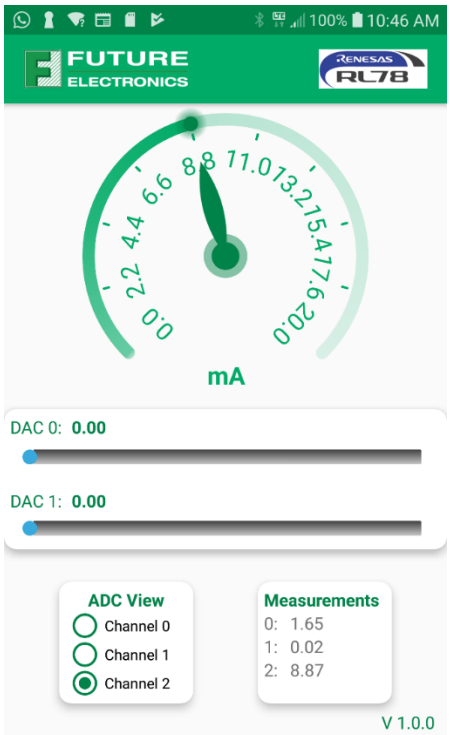
Setup:

We powered of signal general board from the 5V mikroBUS connector. The output goes into the "4-20 mA IN" P1-1: IN pin.



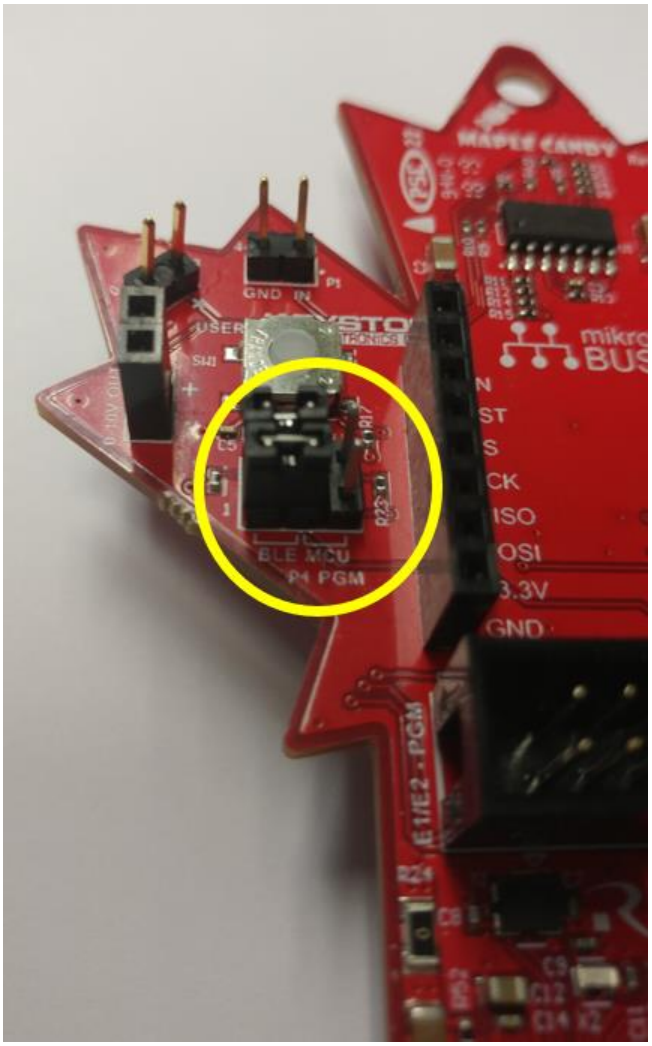
Example:

Connect to the Maple Candy App. Then using ADC View Channel 2, we read 8.8 mA in the example.



6 Appendix

To program the RL78 MCU, make sure that the jumpers are in the position as show in the picture below on P4 PGM header. The silkscreen "BLE" should read "MCU, and the "MCU" should read "BLE". Thus, the default position is set for programming the MCU.



Disclaimer of Warranty
All materials, information and services are provided “as-is” and “as-available” for your use. Future Electronics disclaims all warranties of any kind, either express or implied, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose, title, or non-infringement. You acknowledge and agree that the reference designs and other such design materials included herein are provided as an example only and that you will exercise your own independent analysis and judgment in your use of these materials. Future Electronics assumes no liability for your use of these materials for your product designs.

Indemnification
You agree to indemnify, defend and hold Future Electronics and all of its agents, directors, employees, information providers, licensors and licensees, and affiliated companies (collectively, “Indemnified Parties”), harmless from and against any and all liability and costs (including, without limitation, attorneys’ fees and costs), incurred by the Indemnified Parties in connection with any claim arising out of any breach by You of these Terms and Conditions of Use or any representations or warranties made by You herein. You will cooperate as fully as reasonably required in Future Electronics’ defense of any claim. Future Electronics reserves the right, at its own expense, to assume the exclusive defense and control of any matter otherwise subject to indemnification by You and You shall not in any event settle any matter without the written consent of Future Electronics.

Limitation of Liability
Under no circumstances shall Future Electronics, nor its agents, directors, employees, information providers, licensors and licensee, and affiliated companies be liable for any damages, including without limitation, direct, indirect, incidental, special, punitive, consequential, or other damages (including without limitation lost profits, lost revenues, or similar economic loss), whether in contract, tort, or otherwise, arising out of the use or inability to use the materials provided as a reference design, even if we are advised of the possibility thereof, nor for any claim by a third party.