APPLICATION NOTE

AN070: Using the MAX14001PMB with TMCM-0960-MotionPy

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This document introduces the usage of MAX14001PMB with the TMCM-0960-MotionPy. The MAX14001 peripheral module provides the hardware to evaluate the MAX14001 isolated ADC to measure two channels of data, line voltage (up to 230V AC or ±325V DC) and load current (up to 5A). The functionality and the implementation in the MicroPython environment are introduced.

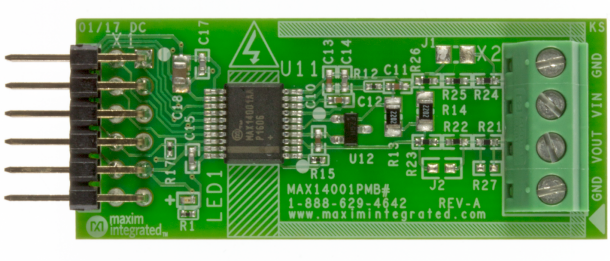

Figure 1: MAX14001PMB

Contents

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1 Introduction

The MAX14001PMB[1] provides the hardware to evaluate the MAX14001[2] isolated ADC. It contains two MAX14001 ICs to measure two channels of data, the line voltage as well as the flowing current (up to 230V AC or ±325V DC and up to 5A). Furthermore, a comparator is implemented in the MAX14001[2] ICs that can be configured by the corresponding registers. For more information please refer to the MAX14001[2] product page. The MAX14001PMB can be evaluated together with the TMCM-0960-MotionPy v2.X[4]. Therefore, some basic functions have been implemented in Python to use this setup in a MicroPython environment. This document will give a brief introduction on how to start up the example and use the basic functions of the module.

2 Requirements

- Set up TMCM-0960-MotionPy[4] as shown in AN061[3]
- Terminal connection to TMCM-0960-MotionPy
- Wire up MAX14001PMB[1]

3 Connecting the PMOD board

There are multiple options to connect the MAX14001PMB[1] to the TMCM-0960-MotionPy[4]. In the default configuration, the MAX14001PMB is connected to the PMOD-0 connector on the TMCM-0960-MotionPy v2.X. This setup is shown in Figure 2. The corresponding pins can be found in Table 2.

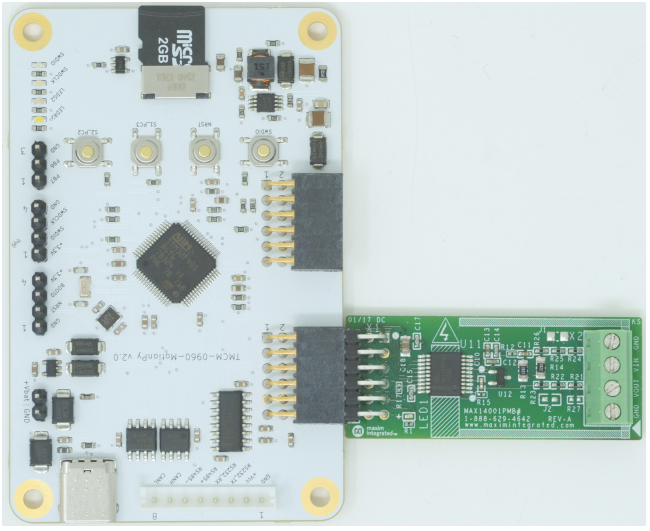

Figure 2: MAX14001PMB connected to TMCM-0960-MotionPy v2.X

MAX14001PMB	Pin	Description
SCLK	SCLK(1)	Serial clock
MISO	MISO/SDI(1)	Serial data in
MOSI	MOSI/SDO(1)	Serial data out
CS1(A)	A4	Chip select (current adc)
CS2(V)	C6	Chip select (volt adc)
COUT1(A)	C13(SWCLK)	Comparator out (current)
COUT2(V)	B0(SWDIO)	Comparator out (voltage)
FAULT	C5	Fault

Table 2: Standard wiring configuration

4 Structure and functions

The communication, as well as some useful functions, have been implemented in the max14001.py[5] script. In max14001.py you will find the classes MAX14001 as well as MAX14001PMB. The class MAX14001 implements the SPI communication with the IC as well as some helping functions. Have a look at the MAX14001 datasheet[7] for further information on behalf of the registers and their functions. For usage of the peripheral module, the class MAX14001PMB exists. On initialization, it will set the appropriate register in the two MAX14001 for using the external reference on the board. The class also has some useful functions specific to the board implemented. With the functions *get_voltage(filtered)* and *get_current(filtered)* the values of the ADCs are read and conversion to real-world units is performed. The functions *get_fault()*, *get_cout_volt()* and *get_cout_curr()* return the value of the assigned pins. To set the comparator thresholds, the functions *set_cout_volt(lower_value,upper_value)* and *set_cout_curr(lower_value,upper_value)* exists. The functions take the real-world unit values and will perform the conversion before writing the registers.

Note: Since the current is inverted the upper and lower_values are switched and the output is inverted in the function *set_cout_curr(lower_value,upper_value)*. This way it behaves the same as the voltage comparator for positive currents.

5 Running the example

To start, you can use the example script max14001pmb.py[6]. Start by connecting the MAX14001PMB to the TMCM-0960-MotionPy. Wire up a power supply and load to the MAX14001PMB terminal. Connect the MotionPy to your PC and start a terminal connection. If you connected the MAX14001PMB to PMOD-0 on TMCM-0960-MotionPy you can simply run the script. Otherwise, open the example script and edit the configuration. You can start the example script with the command:

```
exec(open("PyTrinamicMicro/platforms/motionpy2/examples/modules/max/
    ↪ max14001pmb.py").read())
```

The script should now display the readout in the terminal in the following structure.

```
U: x.xxxV; I: x.xxxA; comp. U: x; comp. I: x;fault: x
```

In the readout, you will find the voltage, current, comparator output for voltage and current as well as the condition on the fault pin. The readout updates regularly. Play around with the MAX14001PMB, feel free to modify the example, and have fun exploring the features.

6 References

[1] MAX14001PMB product page:
www.maximintegrated.com/en/products/interface/isolation/MAX14001PMB.html

[2] MAX14001 product page:
www.maximintegrated.com/en/products/interface/sensor-interface/MAX14001.html

[3] Application Note AN061-TMCM_0960_Module:
www.trinamic.com/products/modules/details/tmcm-0960-motionpy/

[4] TMCM-0960-MotionPy product page:
www.trinamic.com/products/modules/details/tmcm-0960-motionpy/

[5] Path to max14001.py:
PyTrinamicMicro/platforms/motionpy/modules/max/max14001.py

[6] Path to max14001pmb.py:
PyTrinamicMicro/platforms/motionpy/examples/modules/max/max14001pmb.py

[7] MAX14001 datasheet:
datasheets.maximintegrated.com/en/ds/MAX14001-MAX14002.pdf

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8 Revision History

Version	Date	Author	Description
V1.00	18.03.2021	JH	Initial release version

Table 3: Document Revision