Designing a Readout System for Dosepix

University of Glasgow

Sean Alsop
2070580
2070580A@student.gla.ac.uk

Abstract

This poster summarises the results of the creation of a prototype readout system for the Dosepix chip. Custom Firmware and Software has been created to use an FX3 microcontroller, a new adapter board PCB has been constructed and a daughter board schematic was produced. These items can be used together as a readout system for the Dosepix chip. Once the final design issues have been fixed the prototype can be tested.

Dosepix

Dosepix is an active personal Dosimetry device created as a descendant of the chips developed by the Medipix collaboration at CERN. Proprietary readout devices were created, but no access to these devices is available to the public.

Aim

The aim of this project is to create a new readout system for the Dosepix Chip which can be easily reproduced so that the Dosepix can be used over USB 3.0

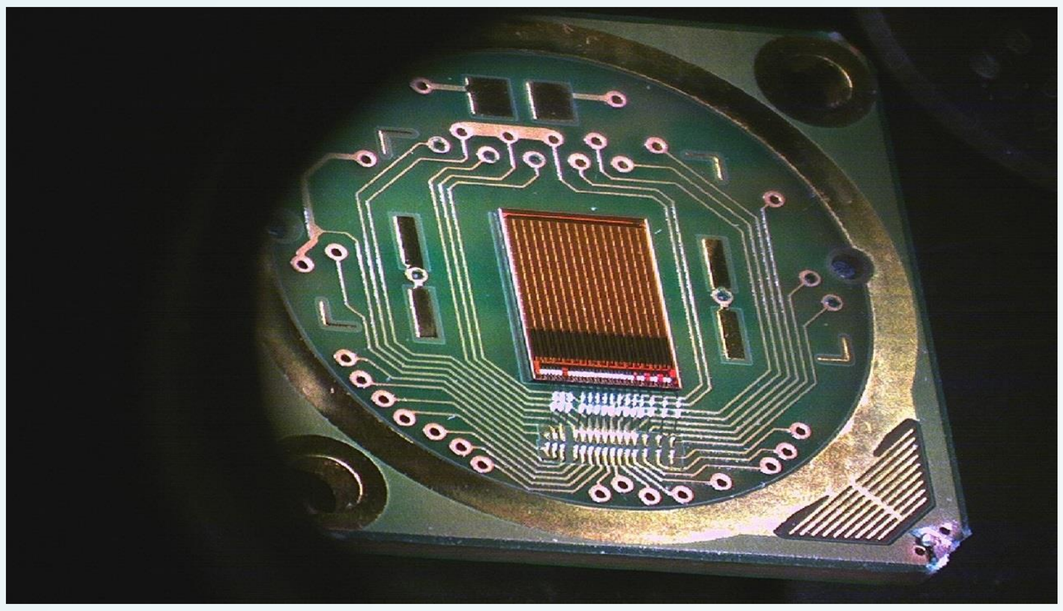

Figure 1: Dosepix chip placed on CERN daughter board. Image taken in University of Glasgow clean room.

Structure of the Readout System

The structure of the readout system is shown in Figure 2. The computer is used to upload firmware to the FX3 device and uses software to pass it commands. The FX3 Microcontroller generates a clock and sends the clock and other data to Dosepix through the adapter board. The adapter board is used to change voltages and to generate a second clock. The daughter board sits on the adapter board and is used to route the lines in and out of Dosepix so that it can send and receive data.

FX3

The FX3 Microcontroller and the development board it sits on are used to change commands sent by the computer over USB to signals that Dosepix can read. It also uses protocols such as SPI (Serial Peripheral Interface) to control other hardware.

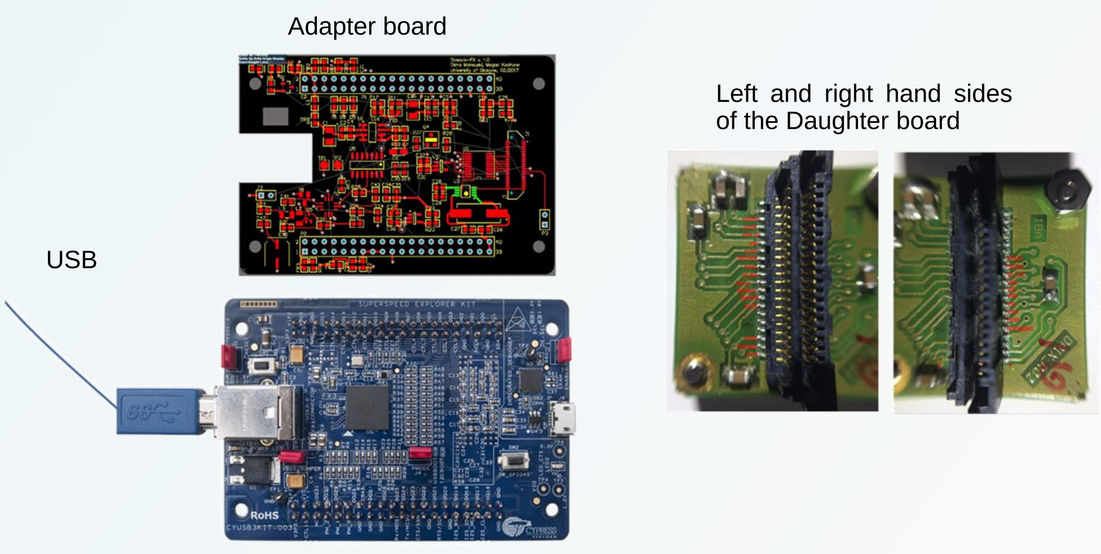

Figure 2: Theoretical final setup for the readout system.

PCB Design Considerations

The adapter board for Dosepix was created with the knowledge that the FX3 must supply power to Dosepix. The FX3 device outputs 3.3V and Dosepix requires 1.8V. To solve this problem a new component was sourced called a latch. Another issue solved was that Dosepix requires two clocks, one used for input and one used for output. For this reason clock generator components were added to the PCB design.

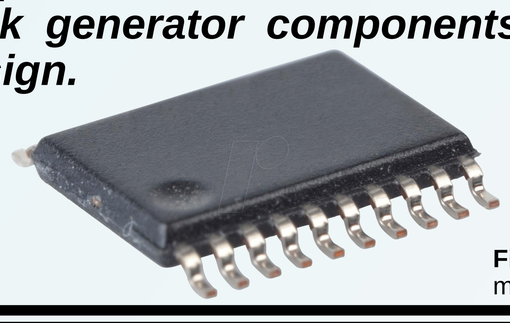

Figure 3: Surface mountable Latch

Software and Firmware

Custom software and firmware was created for the FX3 microcontroller. The firmware is the code upon which the FX3 device runs and contains all the functions the FX3 needs to be able to use the correct protocols. For example, the firmware created contains functions for the FX3 to be able to send data, and use SPI (Serial Peripheral Interface). The software runs on the PC sends commands to the FX3 over USB.

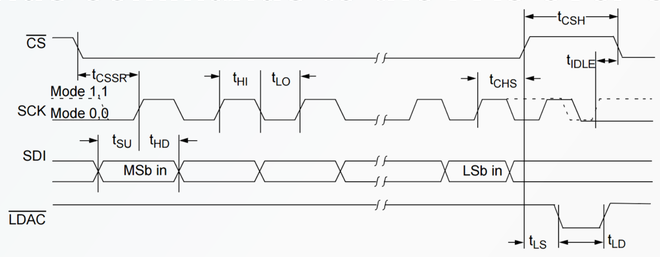

Figure 4: SPI timing for surface mountable DAC. Image provided by Microchip Technology.

Conclusions

Much progress has been made towards the creation of a prototype readout device. Firmware and Software have been created for use with the FX3 microcontroller and a new adapter board PCB has been designed. The adapter board PCB needs to be printed by a manufacturer and some small changes need to be made to firmware in order for data to be received over the FX3. Once this is complete, the first prototype edition will be ready for testing.