# High Precision DAC

Digital-to-Analog Converter

MINDWAVE

FieldLine

## What is Resolution?

More resolution = Greater Detail

1-Bit 4-Bit 8-Bit

**Our product converts high resolution digital numbers into physical (analog) signals, without losing the detail**

This makes it perfect for:

- Medical Imaging Devices
- Quantum Electronics
- Telecommunications
- Advanced Sensors

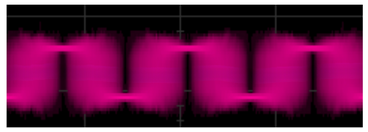
## System Design

**Microcontroller**

Serial Communication

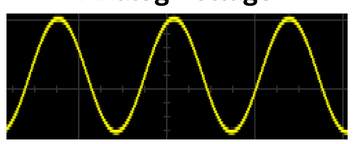
**FPGA**
(Field Programmable Gate Array)

Pulse Density Modulated Signal



**4th-Order Active Low-pass Filter**

Analog Voltage



**Current Driver**

**High-Resolution Analog Sensor**

**Testing System**

### FPGA Breakdown

- **Digital Input**

- **Digital Oversampling**
  - Smooths out transition between digital values
  - Upscales Resolution

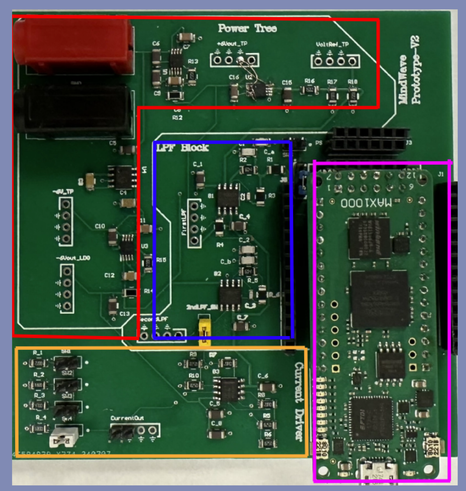
- **Sigma-Delta Modulation**
  - Generates a density of pulses at 8MHz mapped to digital values
  - Heart of the DAC

## Product Accomplishments

- We acheived **16-bit resolution** digital to analog conversion.
- Established proof of concept for **24-bit and beyond** DACs

| Our FPGA DAC $ | Other DACs $$$ |
|---|---|
| • Software Based | • Hardware based |
| • Scales Easily* | • Not Scalable |

## PCB Breakdown




| | |
|---|---|
| **Power** | Provides: -6 V, +6 V, +0.825 V |
| **Low Pass Filter** | Filters out frequency <10 kHz |
| **Current Driver** | Delivers a steady current from +/-4 mA for 220-825 Ohms |
| **FPGA** | Outputs PDM signal to the system |

## System Operation

- **Microcontroller.** Sends data to the FPGA
- **FPGA**. Produces the PDM output
- **Low Pass Filter/ Current Driver** Converts PDM into steady and smooth analog voltage
- **Breakout Board with Testing System.** Mounts the microcontroller, ADC, and testing circuit to verify resolution

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