18 Channel Oscilloscope

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Power supplies are getting more complex
Typical oscilloscopes only have 4 channels
Cannot monitor an entire system with one scope.
Our Project

● Create an 18 Channel Oscilloscope
  o Hardware
    ▪ Main Board
    ▪ Signal conditioning board
  o Software
    ▪ Graphical User Interface (GUI)
Block Diagram

PC

GUI

USB

FT2232

FPGA

DDR RAM

ADC's

Signal Conditioning
Graphical User Interface

- Developed in C#
- IDE: Microsoft Visual Studio Express 2013
  - "Drag and Drop" auto-generates front-end code.
  - Auto-generates event driven functions upon request.
  - Objects in front-end provides very useful functions.
GUI Design Goals

- Minimalistic Design
GUI Design Goals

- Minimalistic Design
- Intuitive Feel
GUI Design Goals

- Minimalistic Design
- Intuitive Feel
- Large Buttons
GUI Design Goals

- Minimalistic Design
- Intuitive Feel
- Large Buttons
- Large Graph, High Resolution
Block Diagram

PC

GUI

USB

FT2232

FPGA

DDR RAM

ADC's

Signal Conditioning
Main Board Hardware

- 3 - LTC2351
  - 1.5Msps
  - 6 - sample and holds
- Cyclone V GX starter kit
  - 512 MB DDR2 RAM
  - Example projects available
- USB interface
  - FT2232
  - SPI and high speed data transfer
EAGLE PCB Layout

- Incorporates Hard Metric Connector
ADC Interface
ADC Interface

Synchronizing The Conversion Signals
Formatting The Data

Data Packing Format

<table>
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<th>CH0</th>
<th>CH2</th>
<th>CH4</th>
<th>CH6</th>
<th>CH8</th>
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12C Data/Token  Reserved for Future Use  32 Bits Long

16 Words
How to Record Before A Trigger Event?

Answer: Ring Buffer
Signal Conditioning Boards

- Interchangeable boards
- Stuffable options for different voltage ranges
EAGLE PCB Layout
Signal Conditioning

- **LT1761** - Low Noise LDO
- Regulates output voltage
Enclosure
Demo Video
Conclusion

● Project enables better system debugging
● It is expandable
● Future Improvements:
  ○ Add Network Connectivity


