

Digital scope implemented on DE1-SoC

Electrical and Computer Engineering
MEng Program Design project

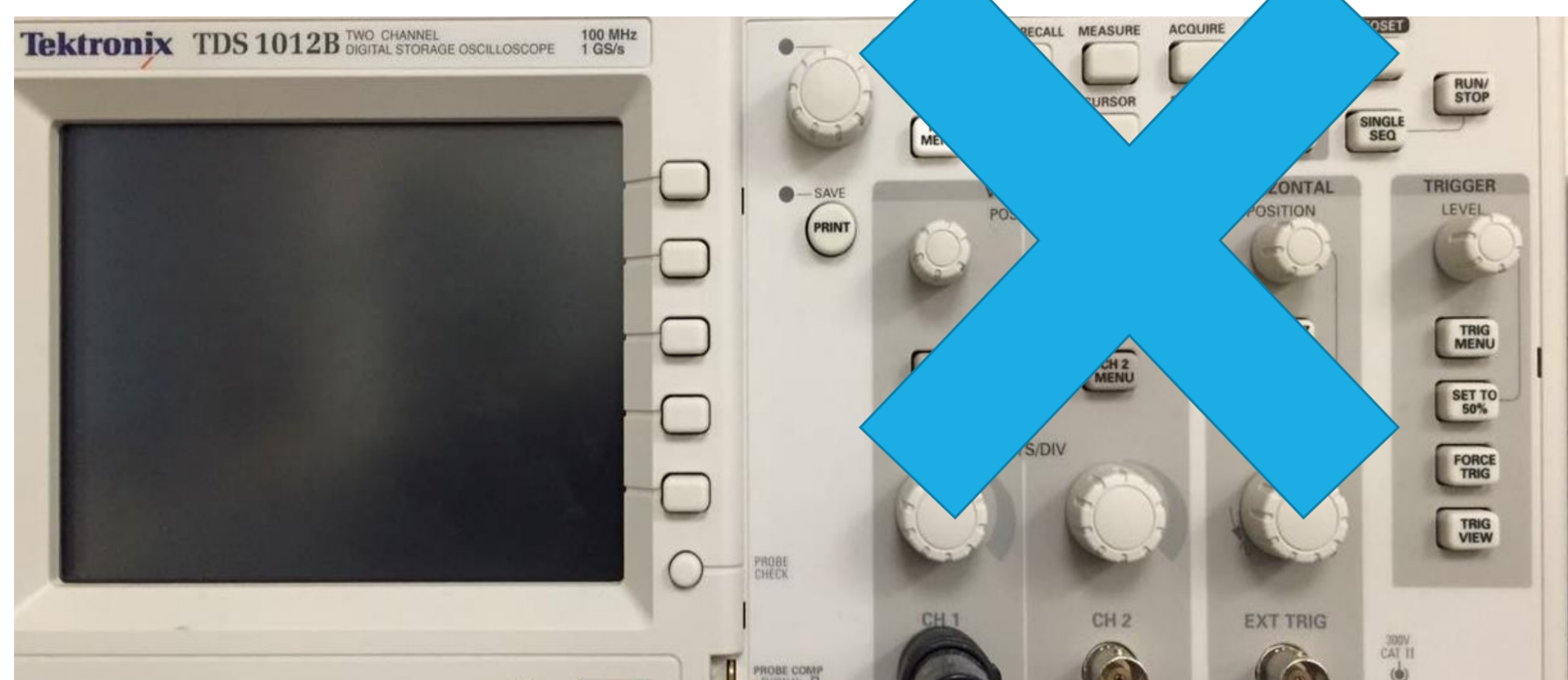
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Motivation

- Digital designs at home/dormitory
- Wrong output happens, but ...

Oscilloscope is unavailable!



Too Expensive to buy...

- We are engineers. So~

Just Design One!

Hardware

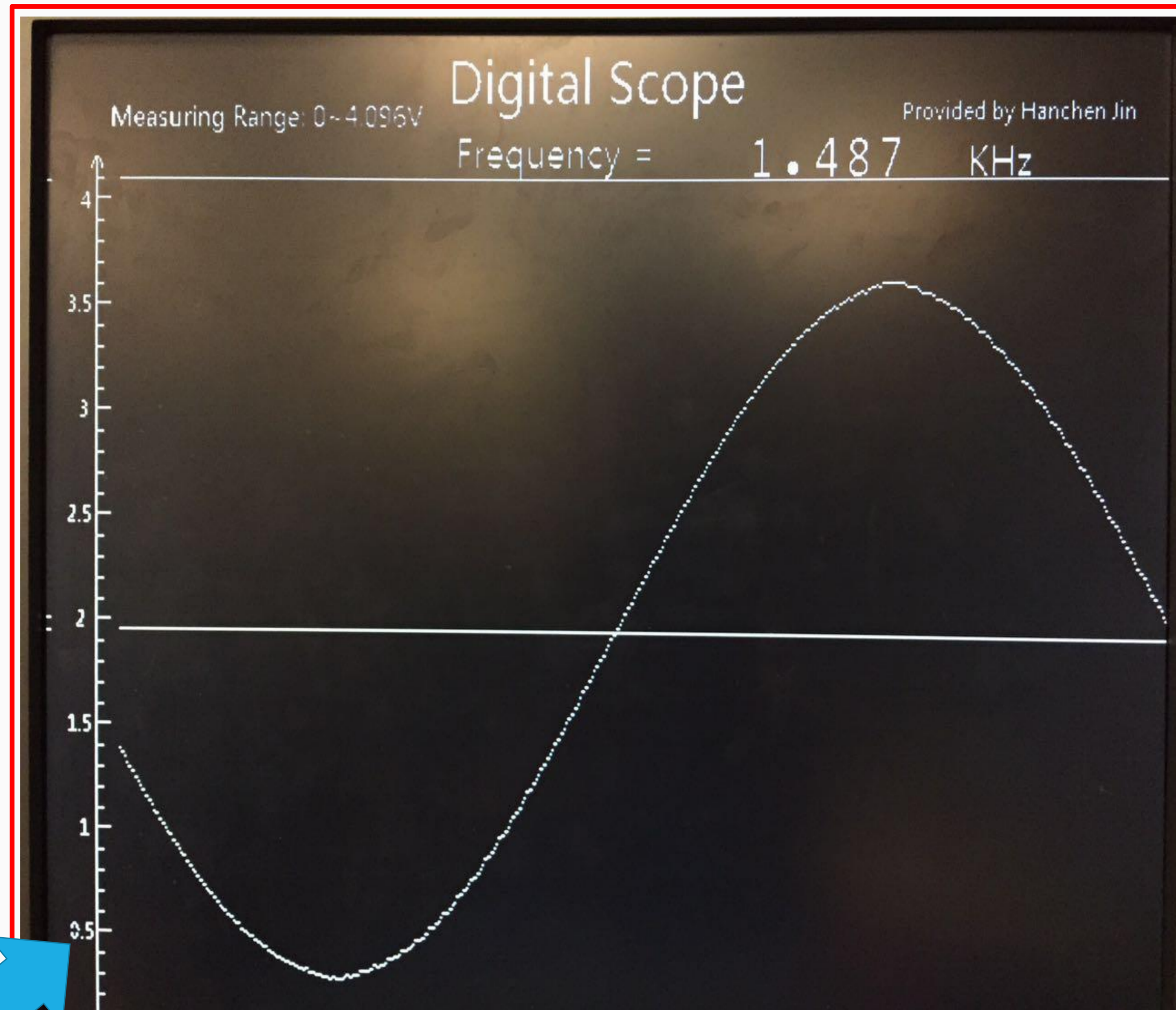


\$175

For Academic

- 12-bit 500Ksps 8-channel ADC converter
- 85K programmable logic elements
- 4,450 Kbits embedded memory
- VGA DAC (8-bit high-speed triple DACs) with VGA-out connector
- 10 slide switches
- 4 push buttons

Digital Scope Display

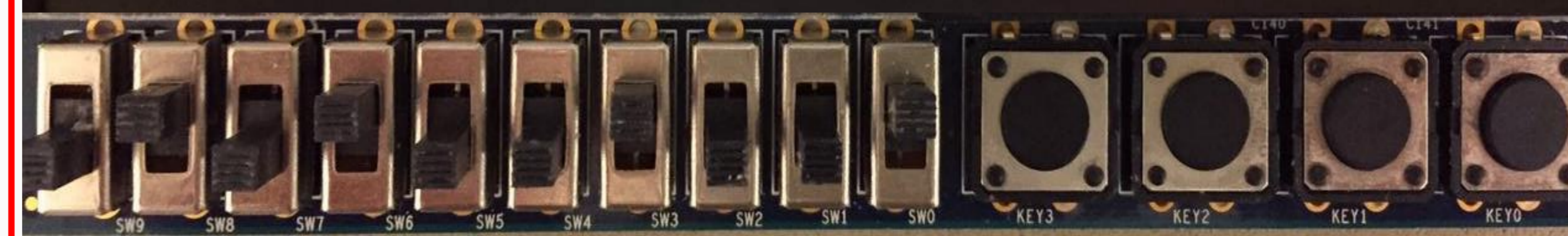


Digital Scope Functions

Digital Scope User Guide

- (1) SW9: mode selection--'1' AC mode; '0' DC mode
- (2) SW8: run_stop function--'1' stop; '0' run
- (3) SW7: peak voltage cursor, available under AC mode--'1' on; '0' off
- (4) SW6: enable trigger adjustment, also display the trigger voltage--'1' on; '0' off
KEY2: increase the trigger value; KEY3: decrease the trigger value
- (5) SW5: horizontal position adjustment for lower SEC/DIV--'1' on; '0' off
- (6) SW4: horizontal position adjustment for higher SEC/DIV--'1' on; '0' off
KEY0: increase the degree of regulation; KEY1: decrease the degree of regulation
- (7) SW3: reset--'1' display waveform; '0' reset whole system
- (8) SW2~0: ADC convertor channel selection
default: [SW2,SW1,SW0] = 000--channel 0
ADC channel available on DE1 SoC: channel 0 to 7 selected by SW2~0

Tips: SW9 '0' + SW6 '1' = Display this User Guide

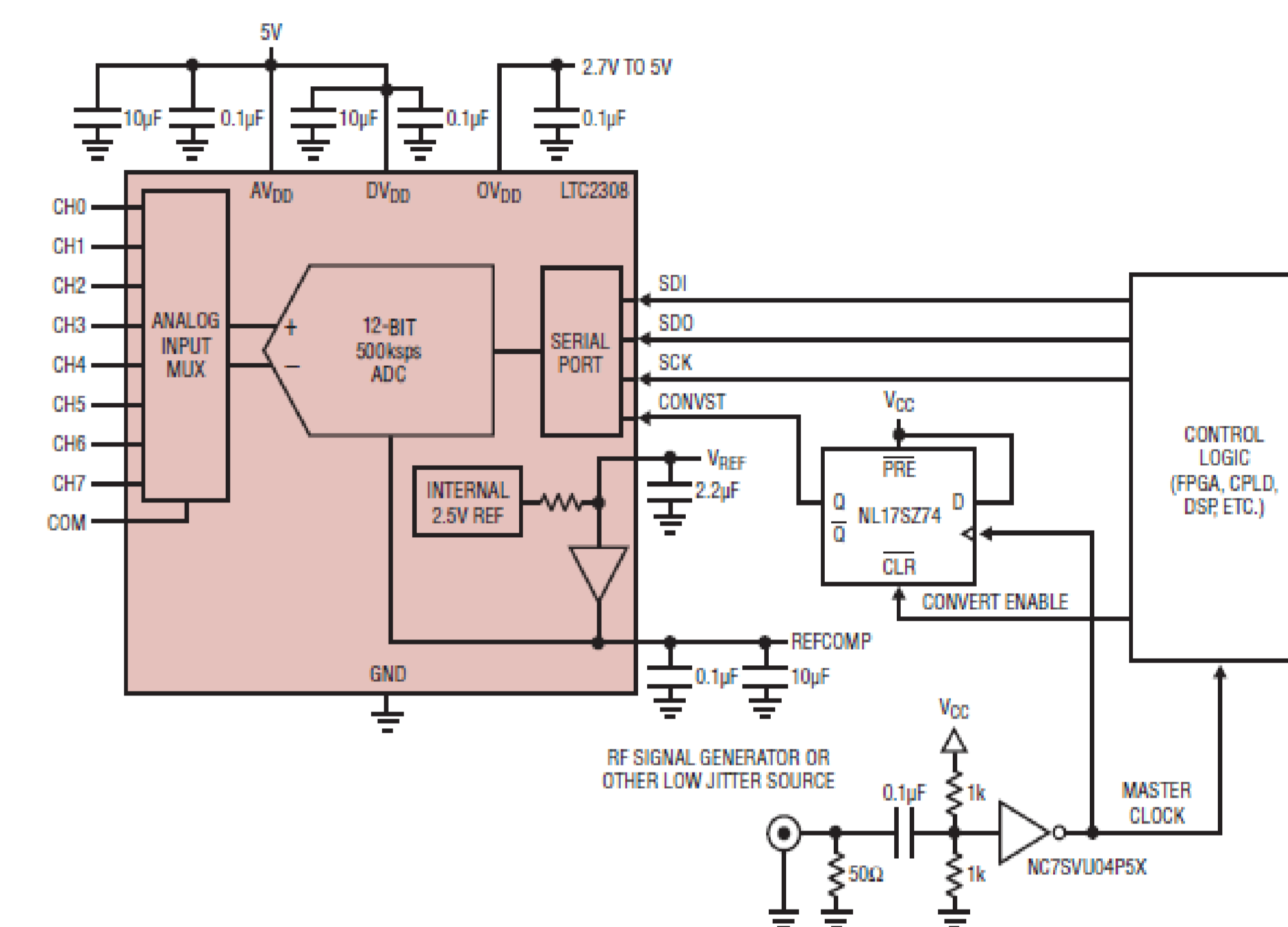


Implementation

1. Input signals desired to measured



2. ADC converter: LTC2308



3. FPGA logic: Paralleled Floating Operation

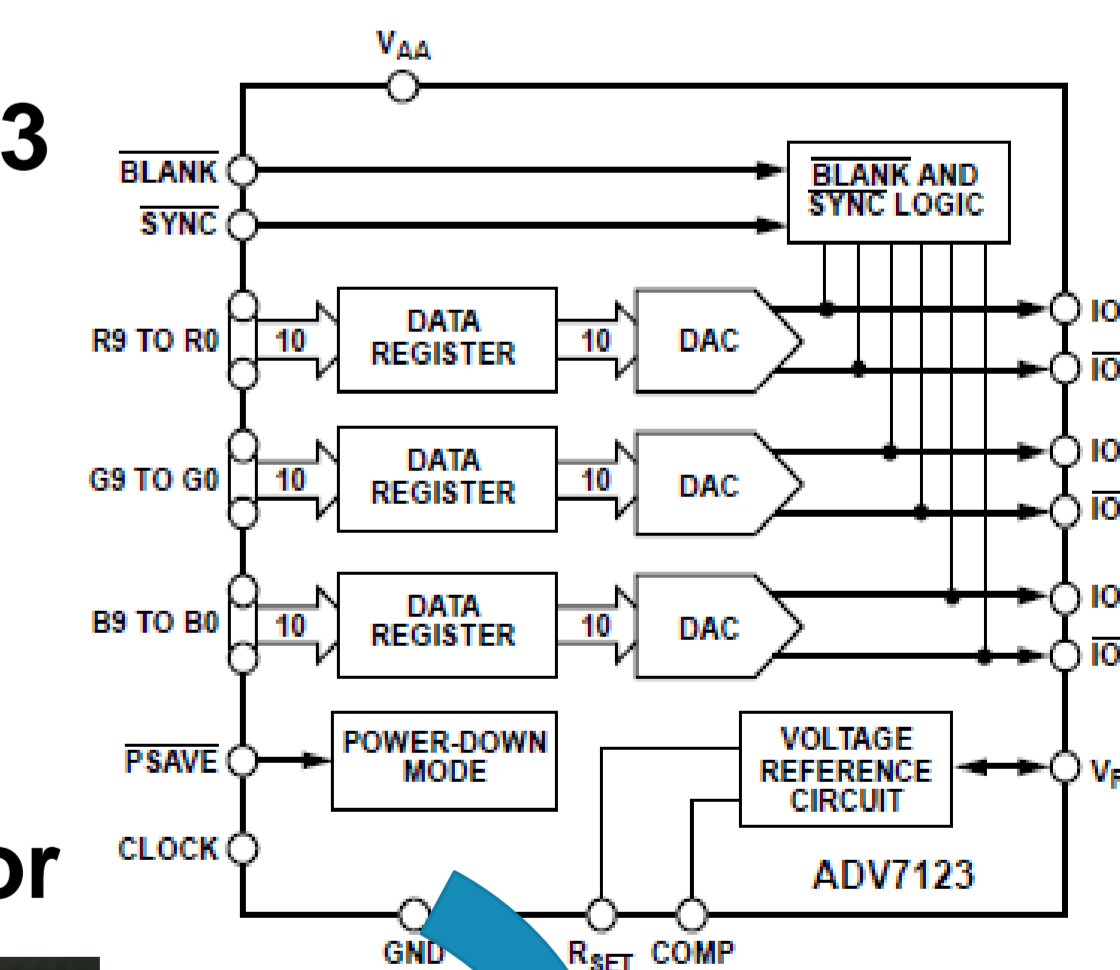
- Frequency calculation

4. VGA output : VGA(60Hz) 640x480@25MHz

- Static notes
- Dynamic waveform
- Font library for
 - Dynamic notes
 - Dynamic numbers

5. Video DAC: ADV7123

- Three high speed 10-bit video DAC



6. VGA output - monitor



Acknowledgements

- MEng advisor: Bruce Land
I really appreciate his help during this design
- Cornell ECE Department