EECS192 Lecture 6
Feb. 21, 2017

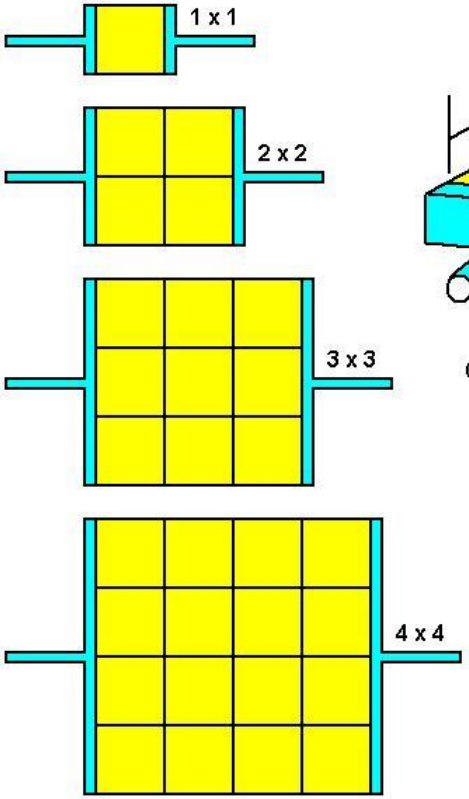
Notes:

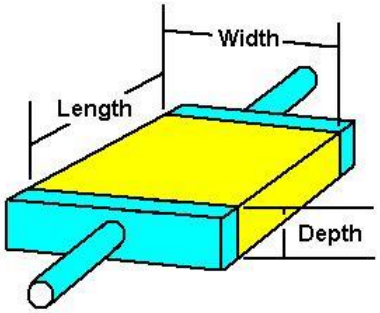
1. Check off-
- PCB design due (Gerbers) Tues 2/21 midnight
- PCB peer review (1 each, should get 2 reviews. 1 pt)
- Peer review here
- Final rework due Thurs 2/23 900 pm
2. 2/21 Quiz 3: switch mode power supply and regulator
3. CalDay Sat. April 22 @ UCB,
4. 3/3 : benchtop line tracking (line camera+servo)

Topics

- PCB tip ohms/square
- Debug
- Analog Interface
- Latchup gotcha
- Line sensor
- iPython notebook (under Resources on Piazza) -later this week

Ohms/square





$$\text{Ohms} = \frac{\text{Resistivity x Length}}{\text{Width x Depth}}$$

For some given depth, resistance is directly in proportion to length and inversely proportional to width.

Therefore, we can rate the resistive material of constant depth in terms of ohms per square.

Cu Weight oz.	Thickness mm(mils)	mΩ/Square 25°C	mΩ/Square 100°C
1/2	.02 (0.7)	1.0	1.3
1	.04 (1.4)	0.5	0.65
2	.07 (2.8)	0.25	0.36
4	.13 (5.3)	0.13	0.18

http://www.edn.com/design/components-and-packaging/4411971/Counting-squares--A-method-to-quickly-estimate-PWB-trace-resistance

Debugging

- See handout: http://inst.eecs.berkeley.edu/~ee192/sp17/docs/debug-checklist.pdf
- Divide and Conquer N → log N
  - Model
  - Measure/observe
  - Hypothesize reason for difference
  - Control and observe

Mentally very challenging, rested for best results, with frequent breaks

Analog/Digital Overview

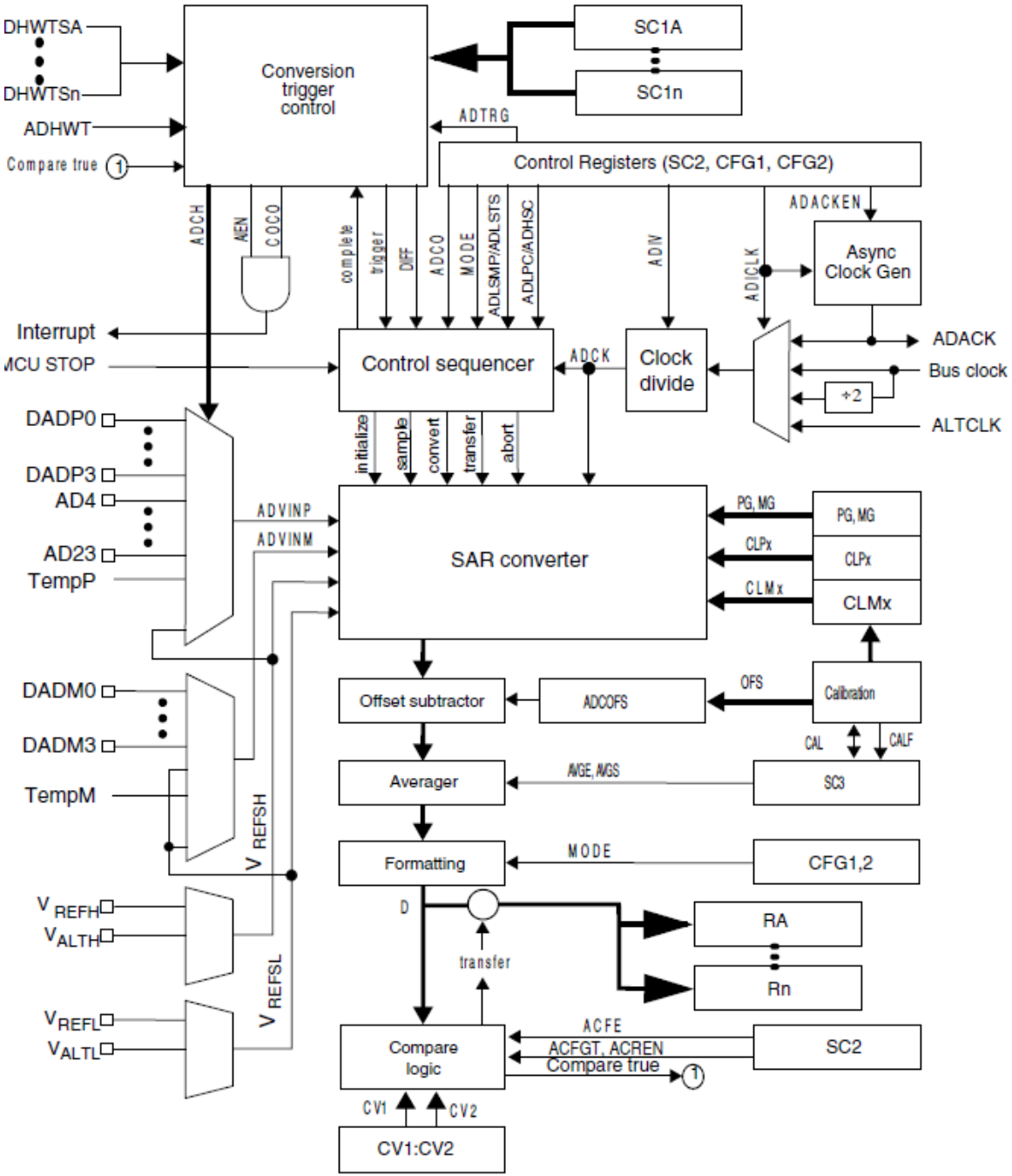


Figure 28-1. ADC block diagram

Analog Input
https://developer.mbed.org/handbook/AnalogIn

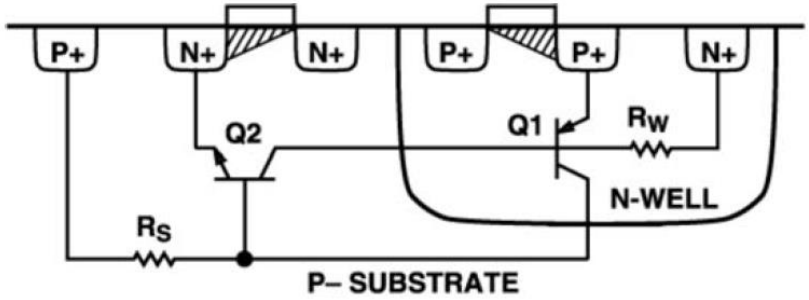
mbed - AnalogIn Class Reference — Import library

Public Member Functions

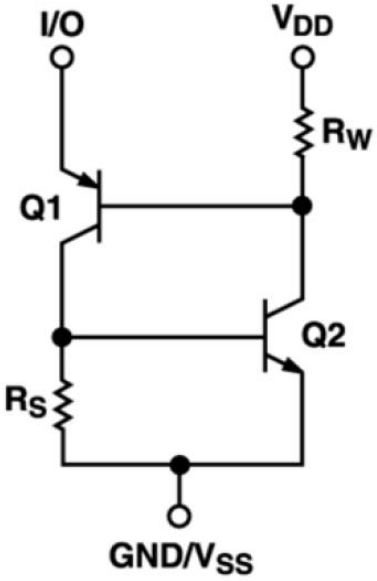
	AnalogIn (PinName pin) Create an **AnalogIn** , connected to the specified pin.
float	**read** () Read the input voltage, represented as a float in the range [0.0, 1.0].
unsigned short	**read_u16** () Read the input voltage, represented as an unsigned short in the range [0x0, 0xFFFF].
	operator float () An operator shorthand for **read()**

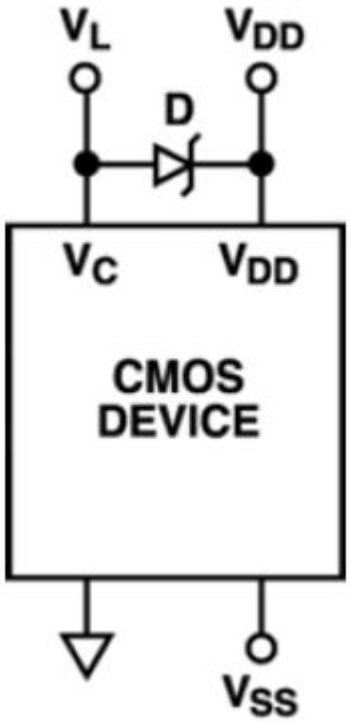
Note: also fast analog in
https://developer.mbed.org/users/Sissors/code/FastAnalogIn/
Class similar to AnalogIn that uses burst mode to run continuous background conversions so when the input is read, the last value can immediately be returned.

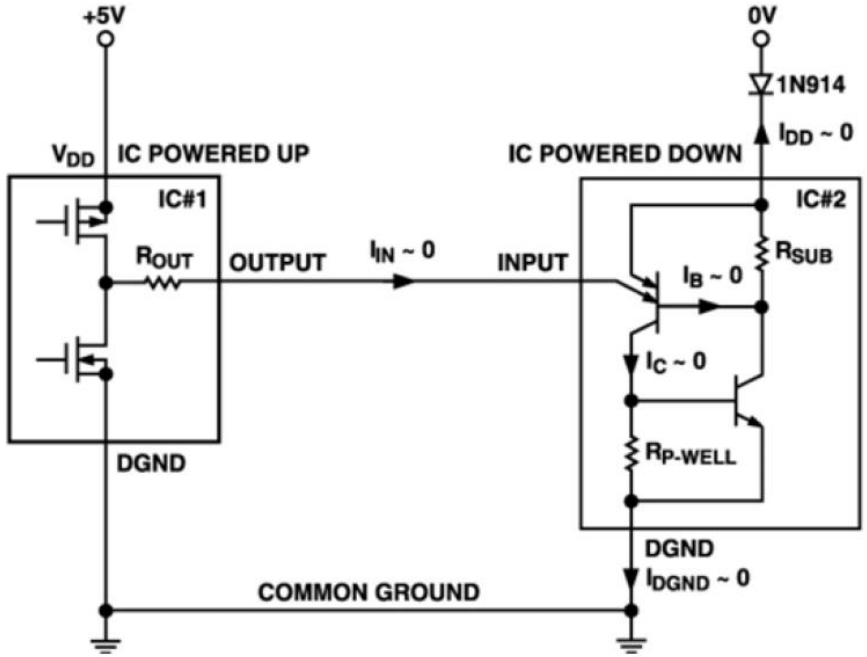
Latchup phenomena



re 2. Cross-section of PMOS and NMOS devices, showing parasitic transistors Q1 and Q2.



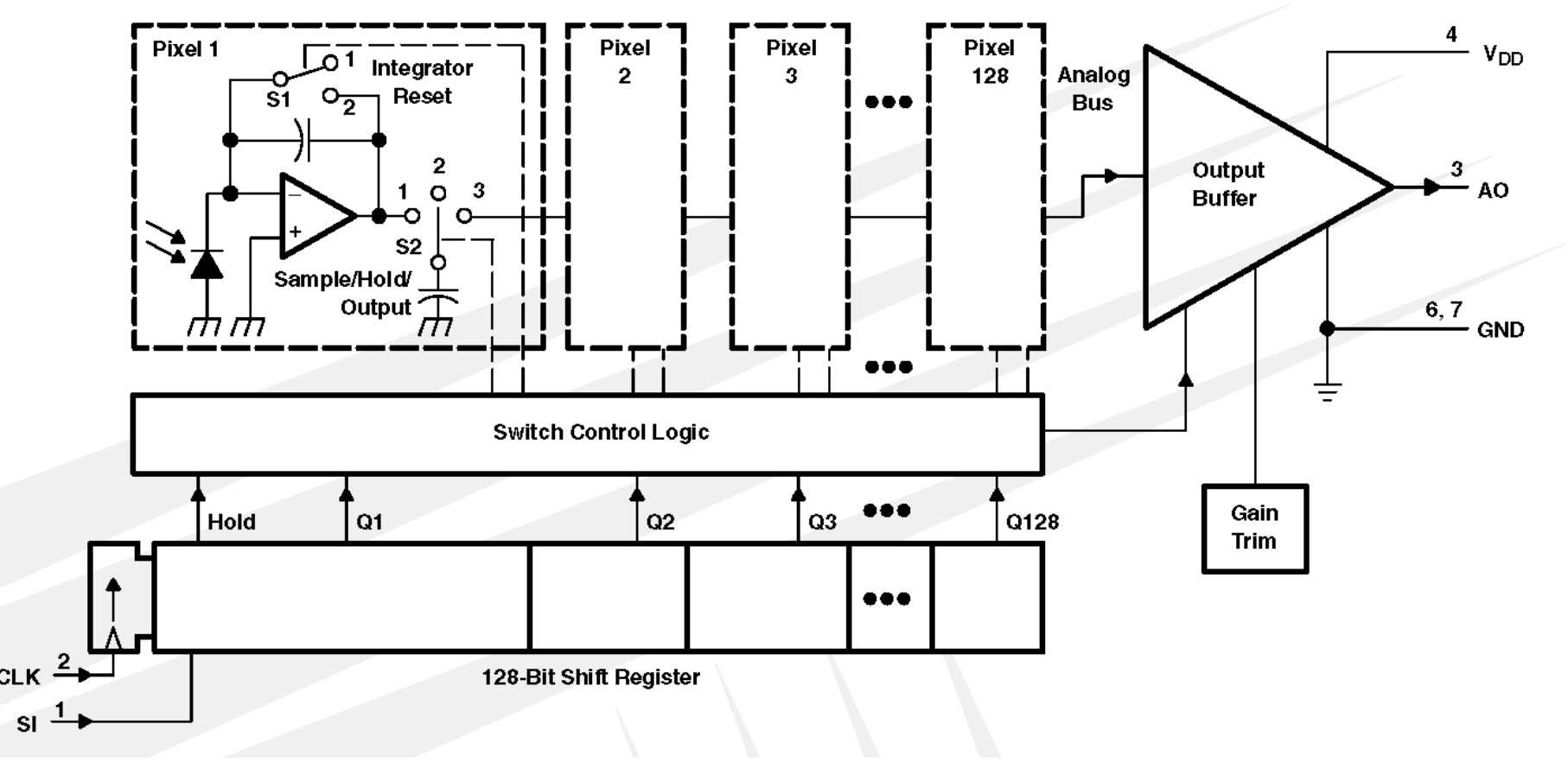




Protection circuit

TSL 1401 line sensor

Functional Block Diagram



TSL 1401 line sensor

PARAMETER MEASUREMENT INFORMATION

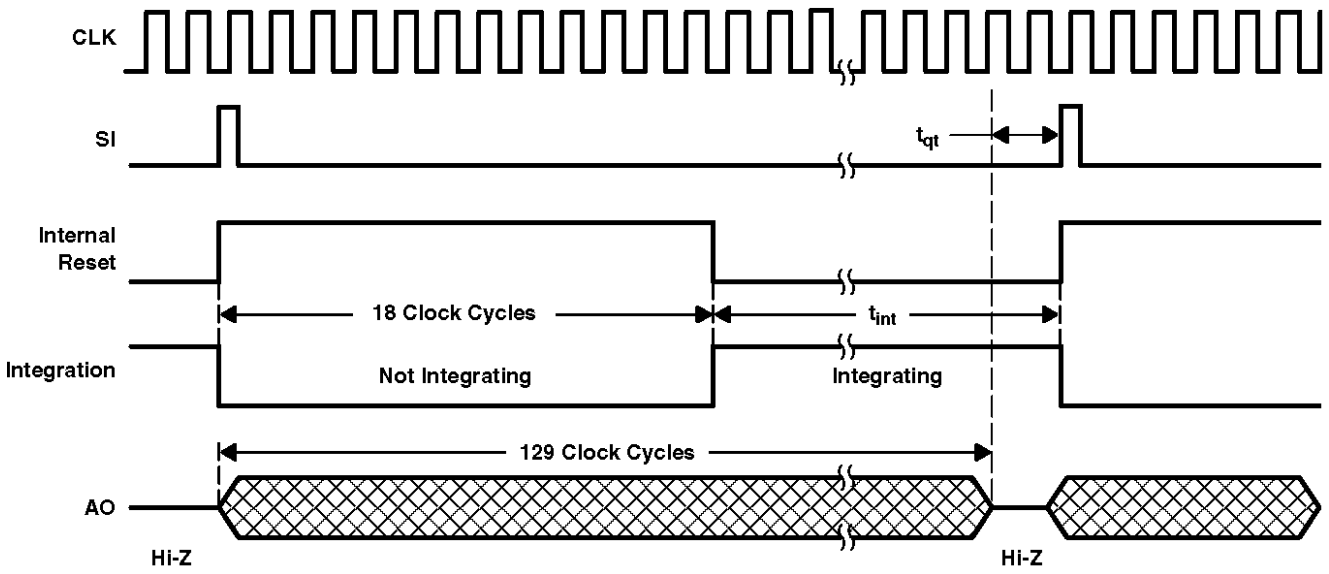


Figure 1. Timing Waveforms

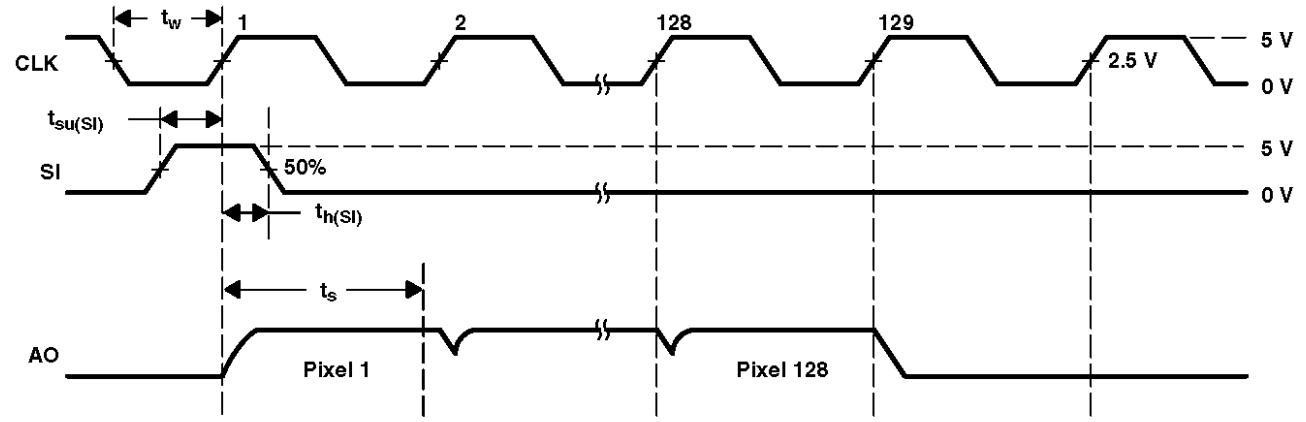
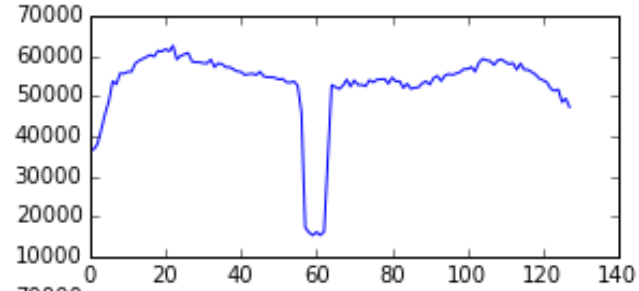
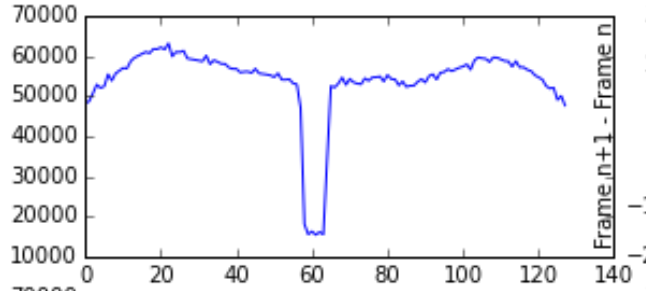
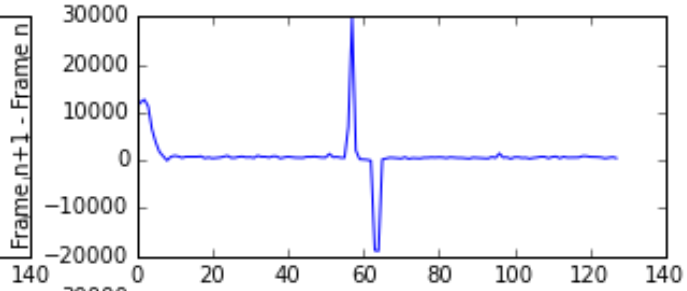


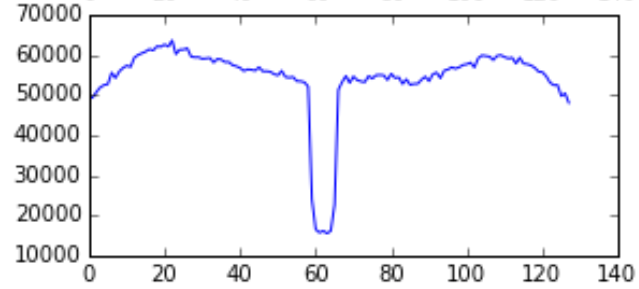
Figure 2. Operational Waveforms

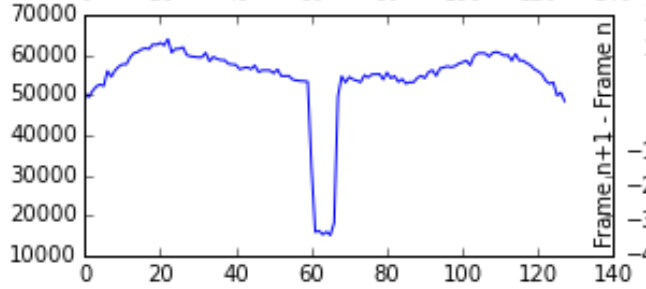
TSL 1401 line sensor

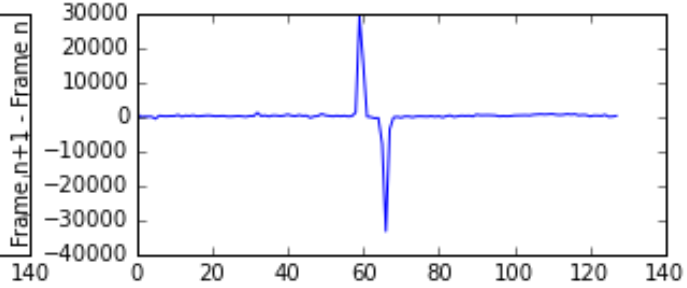


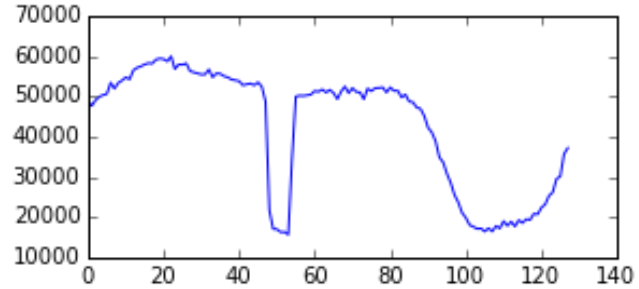


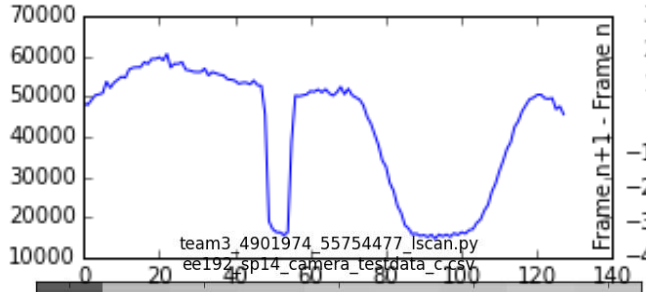


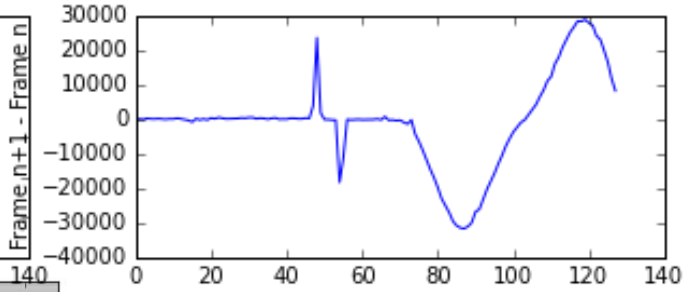


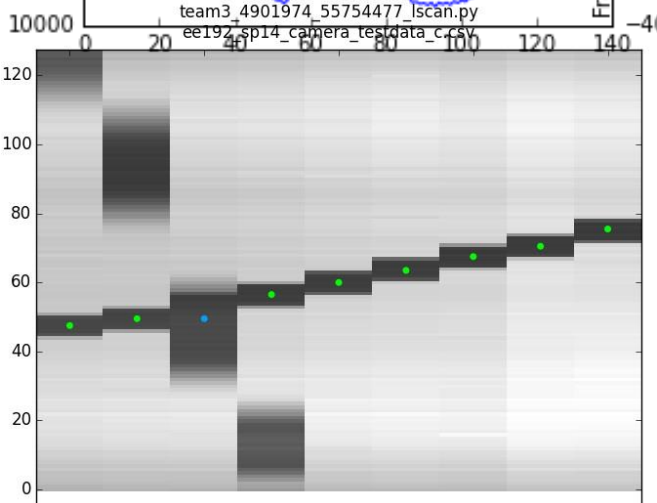












TSL 1401 line sensor