

EECS192 Lecture 7

Feb. 28, 2017

Notes:

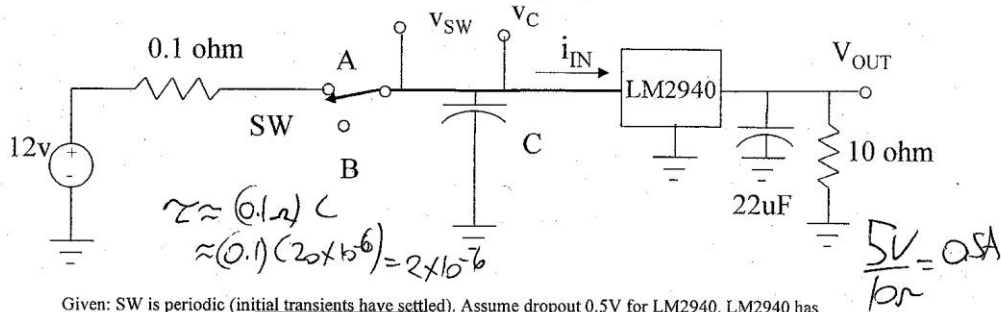
1. Check off-
 - 3/3/2017 : benchtop line tracking (line camera+servo)
+ Lab Clean (individual)
 - 3/10/2017: drop-and-run, velocity control
2. Community Spirit: PCB peer review, Piazza, helping fellow students
3. CalDay Sat. April 22 @ UCB,

Topics

- Quiz 3 review
- Line sensor- processing
 - Automatic Gain Control
 - Edge detection/fitting
 - Sanity check: median/outlier
- Python template and Natcar team1 data (under Resources on Piazza)
- Speed sensing/velocity control

Name Key

EE192 Spring 2017 Quiz 3



Given: SW is periodic (initial transients have settled). Assume dropout 0.5V for LM2940. LM2940 has nominal output of 5.0 V when input voltage is > 5+dropout, or input voltage is > 5.5 V.

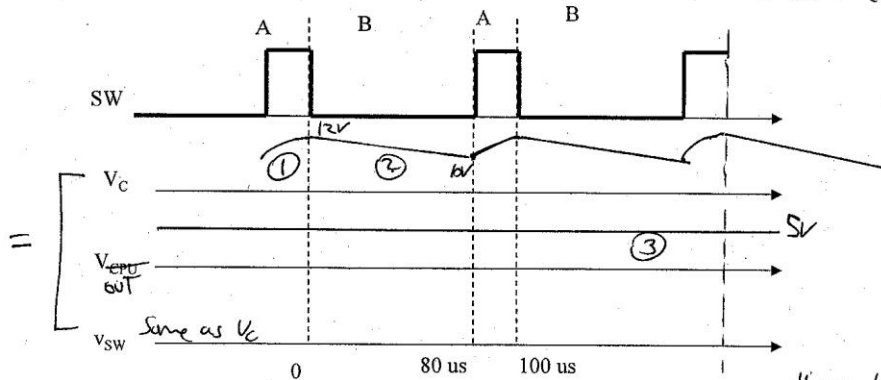
- a) Assuming LM2940 is functioning properly, what is i_{IN} ? $i_{IN} = 0.5A$
- b) The capacitor C can supply current i_{IN} during the interval the switch is in the B position. What is the constitutive relation for capacitor current: $i = C \frac{dv}{dt}$
- c) How large should C be for the change in V_C (from maximum to minimum) to be limited to 2 volts in 80 μs ?
 $C = 20 \mu F$
- d) Sketch below V_C and V_{CPU} for the value of C you found in c)
- e) Why is the 22 μF capacitor required on the output of the LM2940?

for stability.

$$C = \frac{2V}{\frac{0.5A}{80\mu s}} = \frac{(0.5)(80\mu s)}{2V} = 20 \times 10^{-6} F$$

Check $(20 \times 10^{-6} F)$.

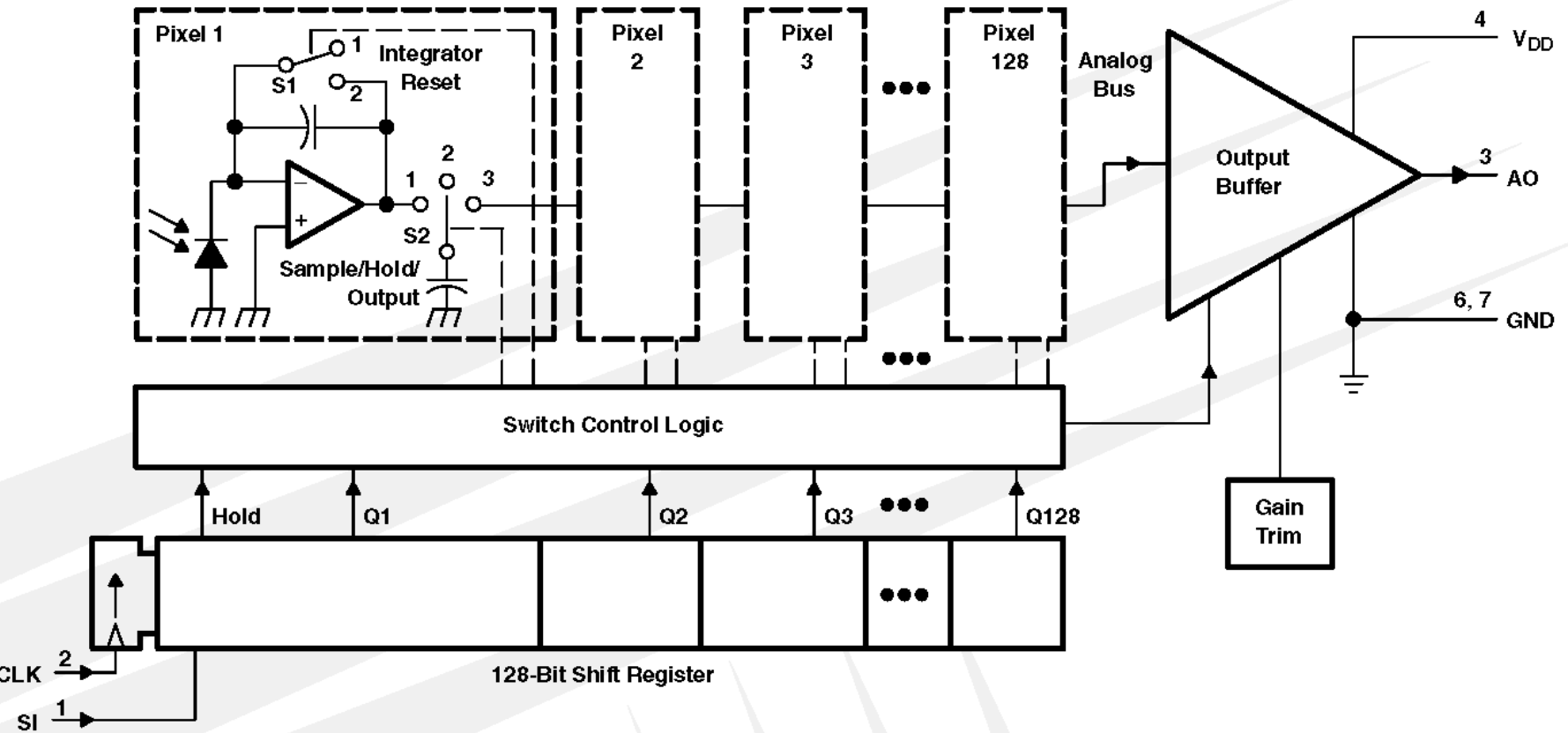
$$\frac{2V}{80\mu s} = \frac{40 \times 10^{-6}}{80 \times 10^{-6}}$$



- ① short time constant $2\mu s$, so V_C will reach $12V - (0.5A)(0.1\Omega) \approx 12V$
- ② constant current from load of $0.5A$
- ③ $V_C > 5.5V$, so output of LM2940 = 5V

TSL 1401 line sensor

Functional Block Diagram



TSL 1401 line sensor

PARAMETER MEASUREMENT INFORMATION

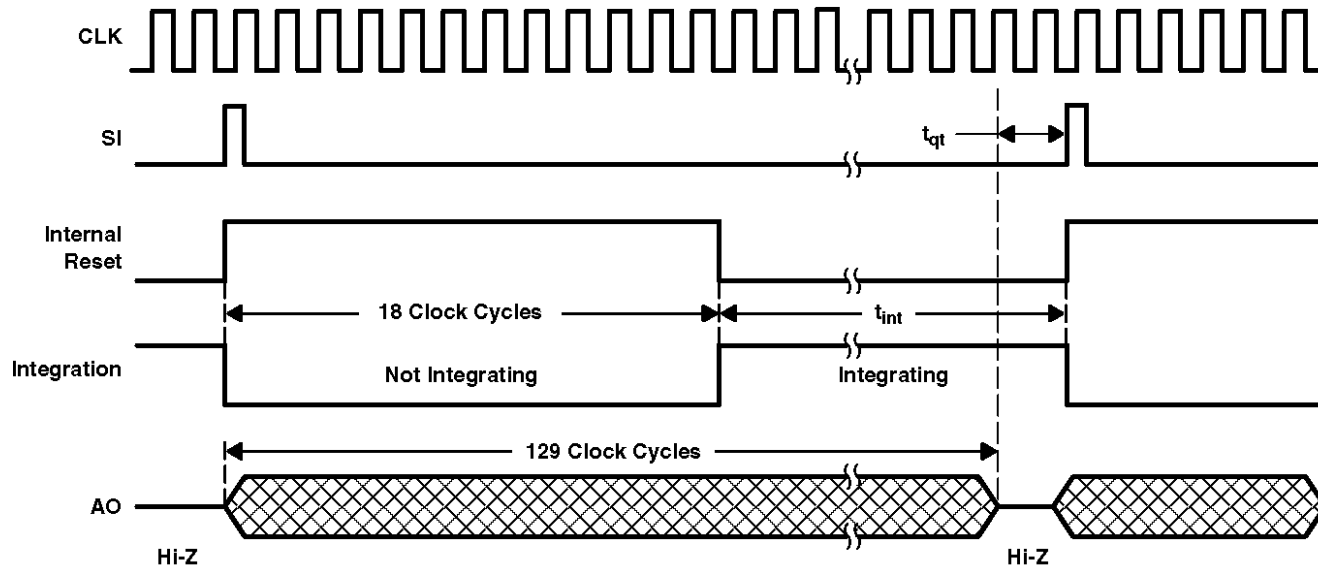


Figure 1. Timing Waveforms

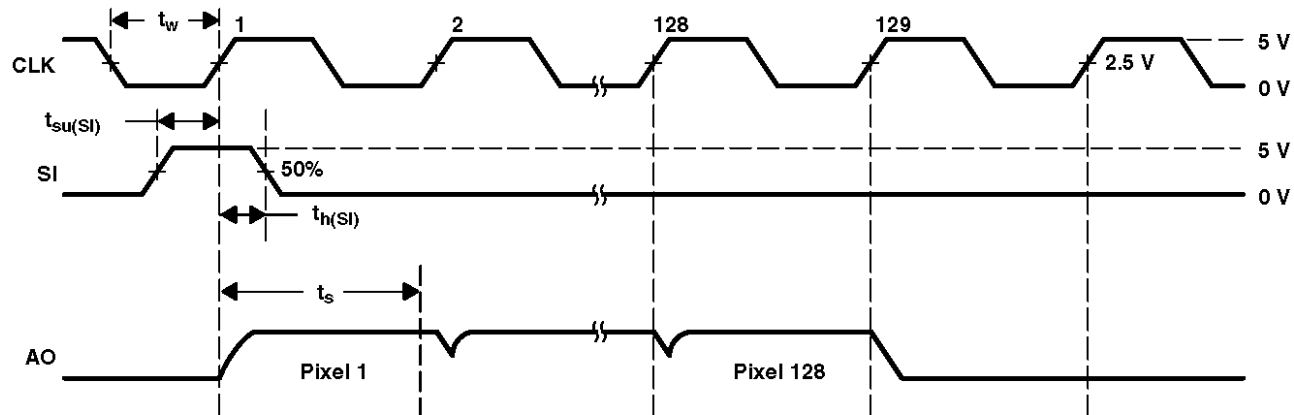
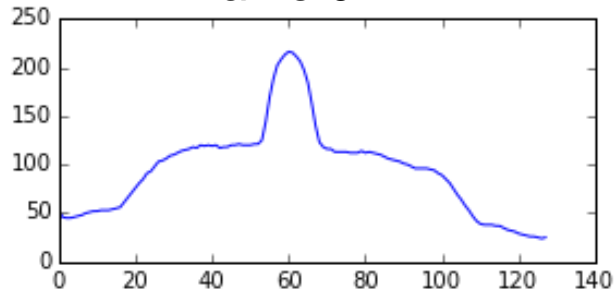


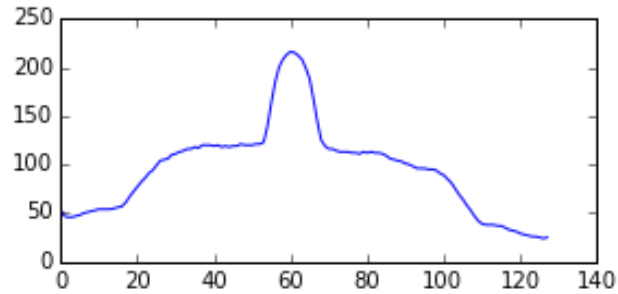
Figure 2. Operational Waveforms

TSL 1401 line sensor NATCAR 8 bit

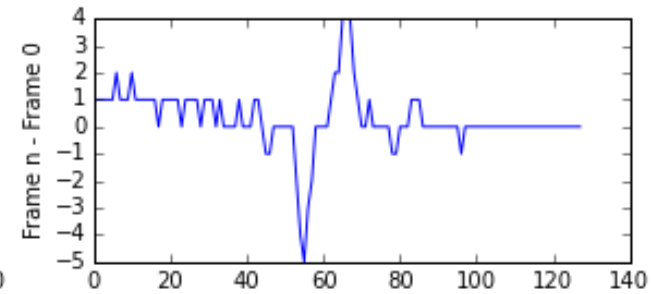
Frame 0



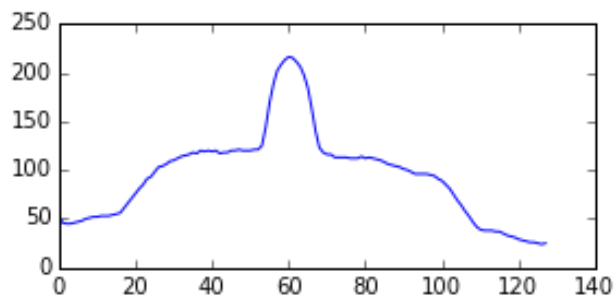
Frame 1



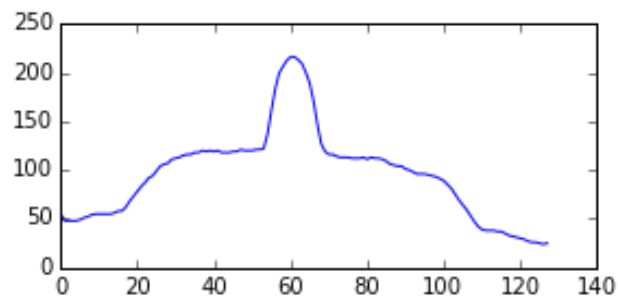
Frame 1-Frame 0



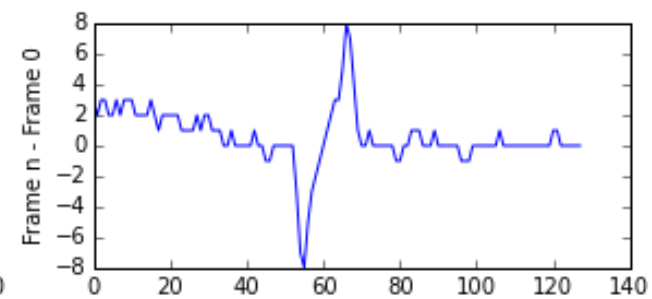
Frame 0



Frame 2



Frame 2-Frame 0



Python Template

track_center_list - A length n array of integers from 0 to 127.

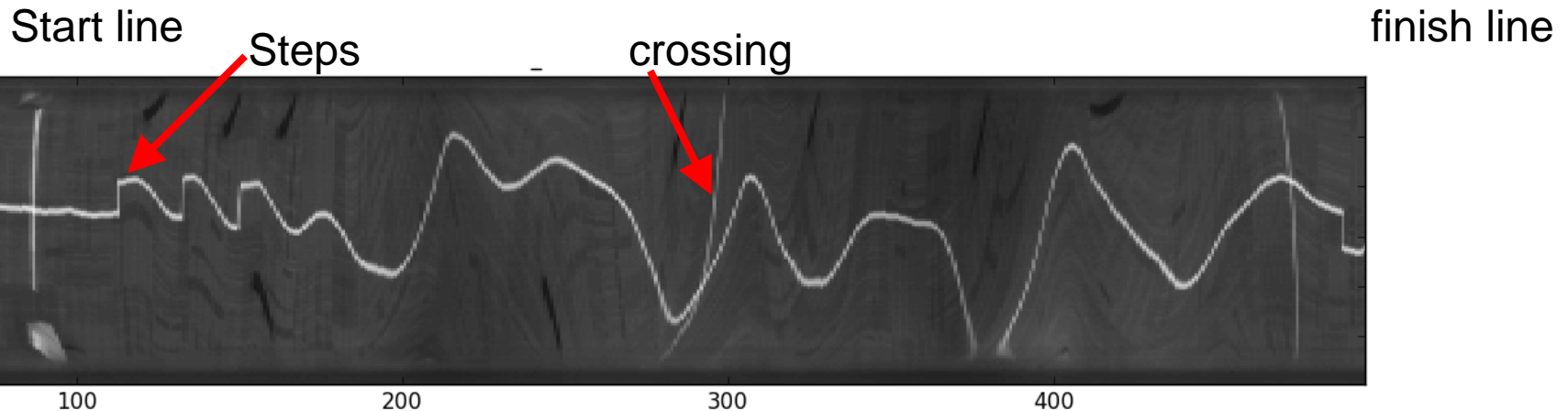
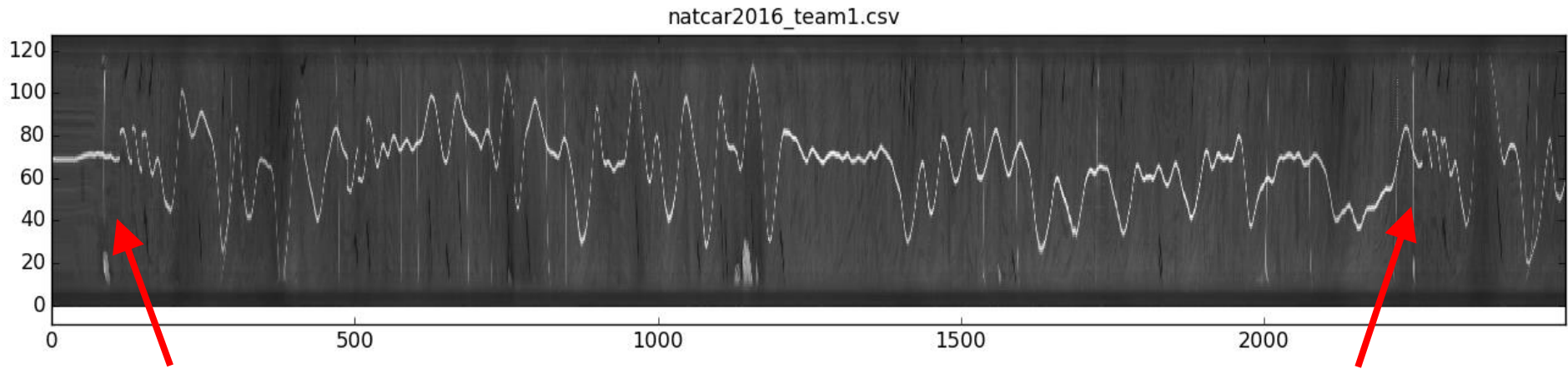
Represents the predicted center of the line in each frame.

track_found_list - A length n array of booleans.

Represents whether or not each frame contains a detected line.

cross_found_list - A length n array of booleans.

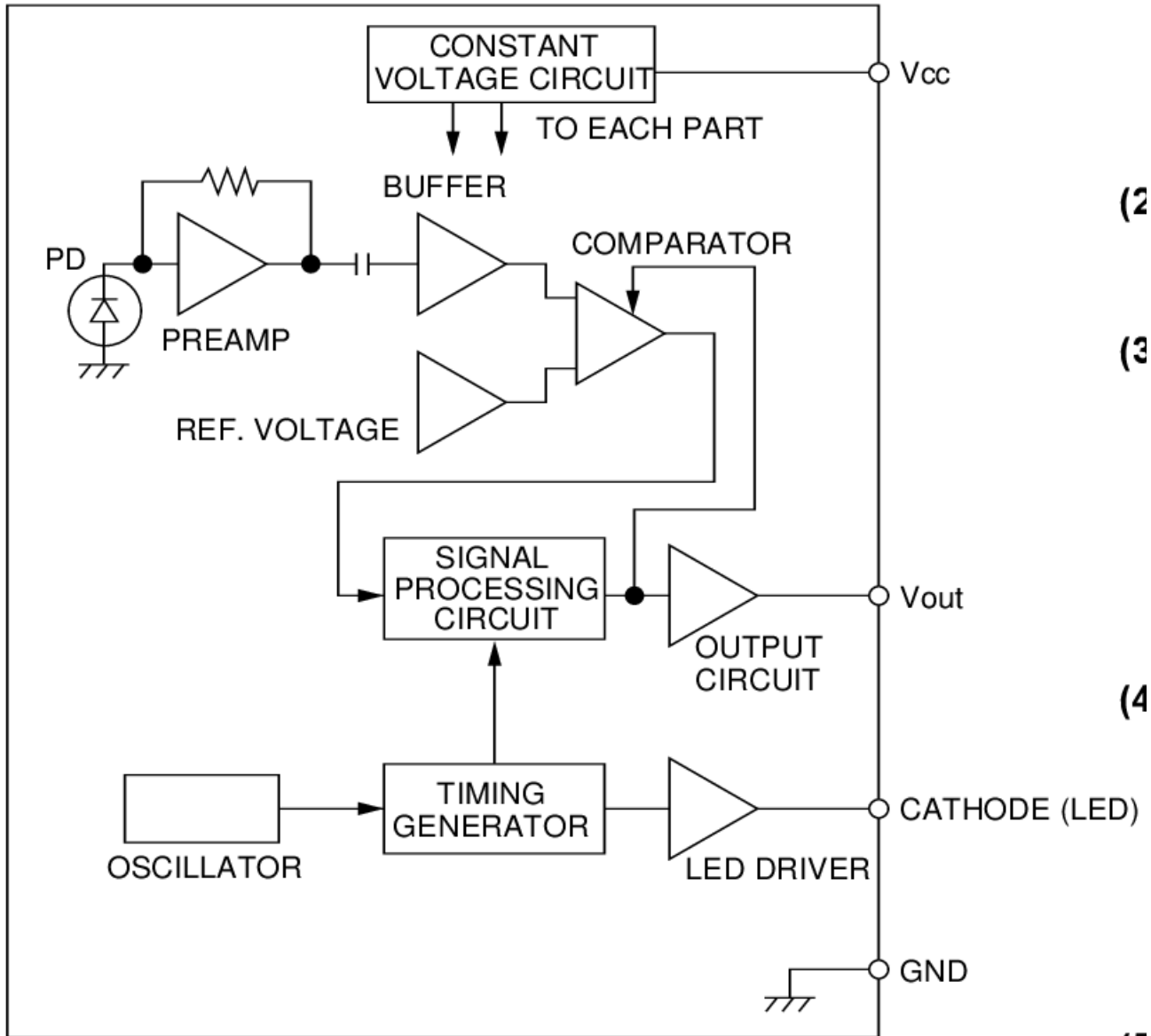
Represents whether or not each frame contains a crossing.



Hamamatsu Optical Detector

■ BLOCK DIAGRAM AND FUNCTIONS

(1)

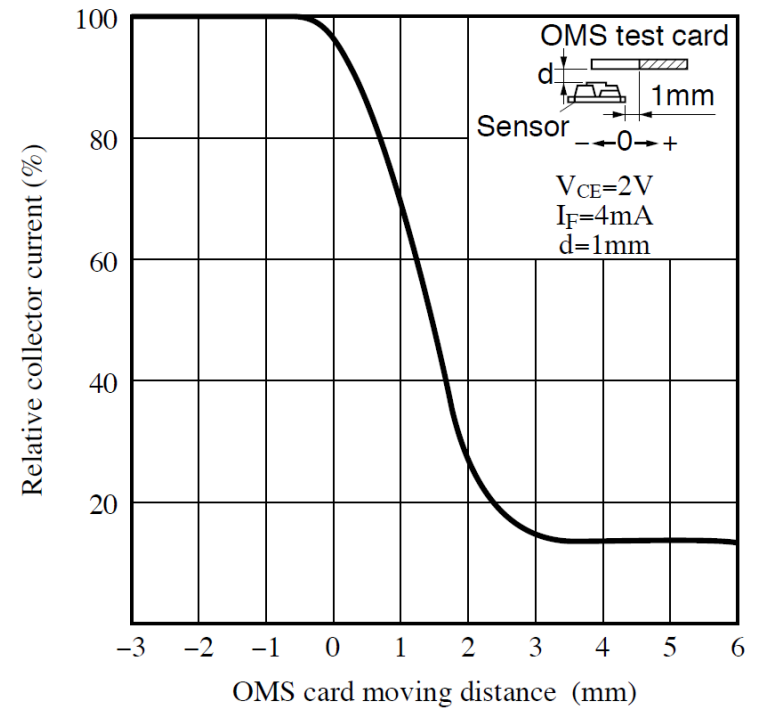
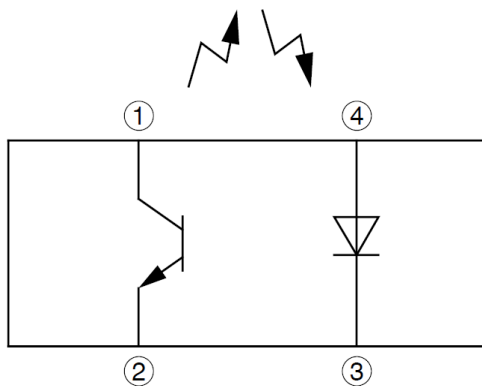


Sharp GPS260

100 us response time



Top view



Velocity Sensing

- On board: estimating $\Delta x/\Delta T$

