

McLean ゼミ

Section8 exercise 4&10

小島裕樹

4. What are the main sources of “noise” in a buried-channel CCD with a standard floating diffusion output?

There are several potential sources of unwanted electronic noise, and 5 of them are introduced in the text.

- background charge associated with fat-zero offsets
- transfer loss fluctuations ←“This effect can be of order 70 electrons for surface-channel CCDs, but is typically ten times smaller or better for buried-channel CCDs.”
- reset or kTC noise
- MOSFET noise ←“Other noise sources associated with the output MOSFET ... can generally be made quite small by good manufacture, typically a few electrons.”
- fast interface state noise ←“This effect is very serious for surface-channel CCDs but is normally quite small (of order 5 electrons or less) for good buried-channel devices.”

4. What are the main sources of “noise” in a buried-channel CCD with a standard floating diffusion output?

So the main noise sources here are probably these two.

- background charge associated with fat-zero offsets

When a pre-flash is used to introduce a fat-zero charge to aid transfer efficiency or eliminate charge skimming, the consequence is a noise equal to the square root of the total number of charges in a pixel.

- reset or kTC noise

To measure the voltage of each charge packet we need a “reference” voltage. This “reference” can be obtained by recharging the output capacitor to a fixed voltage by briefly pulsing the gate of another transistor. Due to random thermal motion of electrons, there is “noise” on the mean value and so the final voltage can fluctuate.

4. What are the main sources of “noise” in a buried-channel CCD with a standard floating diffusion output?

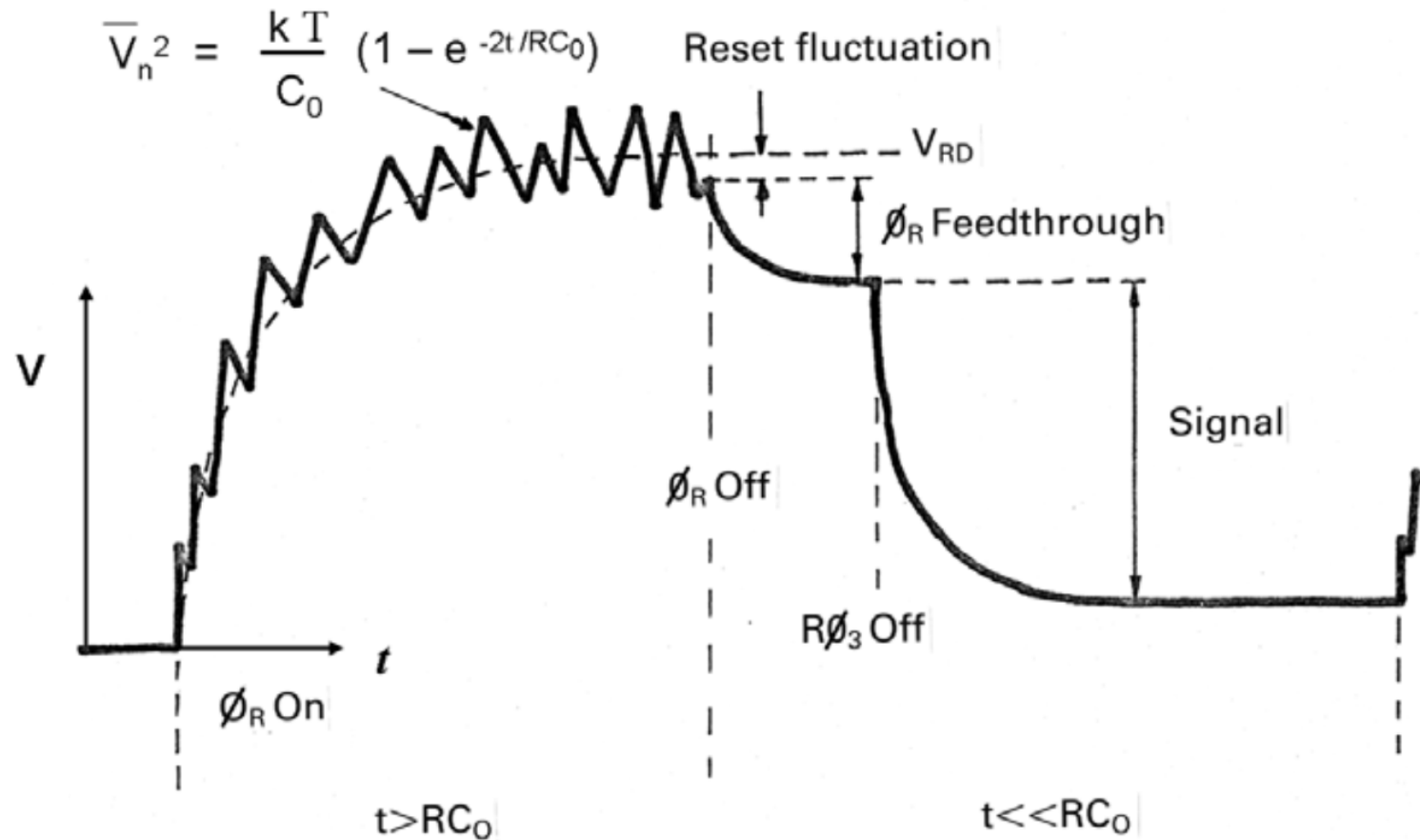
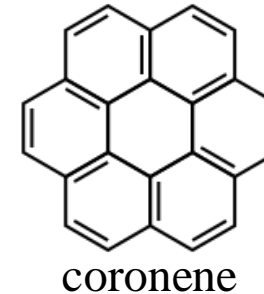


Figure 8.13. The charging profile of the output of a CCD when reset. The curve is “noisy” but when the reset pulse disappears the last value of the signal becomes frozen.

10. What is meant by the term “down-converter”? Name two such materials and explain how they are used?

Down-converter

- Chemical materials deposited on CCDs to act as ultraviolet-to-optical converters.
- Lumogen and coronene are such materials.
- Ex): coronene



Incoming ultraviolet photons cause the coronene to glow in visible light, where the CCD is sensitive, and the coronene produces a certain degree of effective efficiency to blue and ultraviolet light.