Unit-4

Lecture -3

APD, Structure, Equivalent Circuit

Avalanche Photodiodes (APDs)

- High resistivity p-doped layer increases electric field across absorbing region
- High-energy electron-hole pairs ionize other sites to multiply the current
- Leads to greater sensitivity

APD Detectors

Signal Current $i_s = M\left(\frac{\eta q}{h\nu}\right)P$

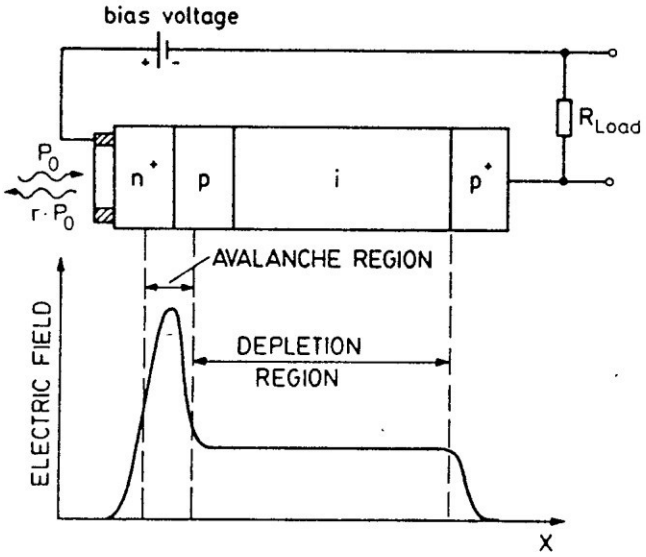
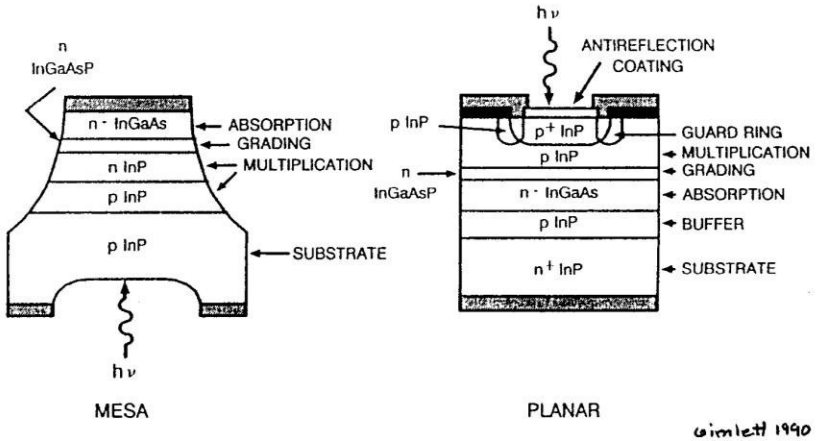
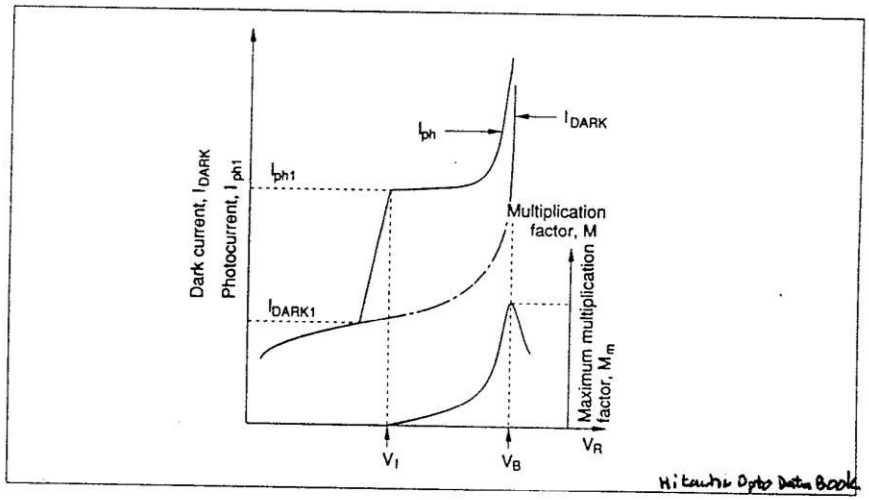


FIGURE 4. Structure of an APD and the electric field distribution in the avalanche and depletion region.





APD Structure and field distribution (Albrecht 1986)

APDs Continued

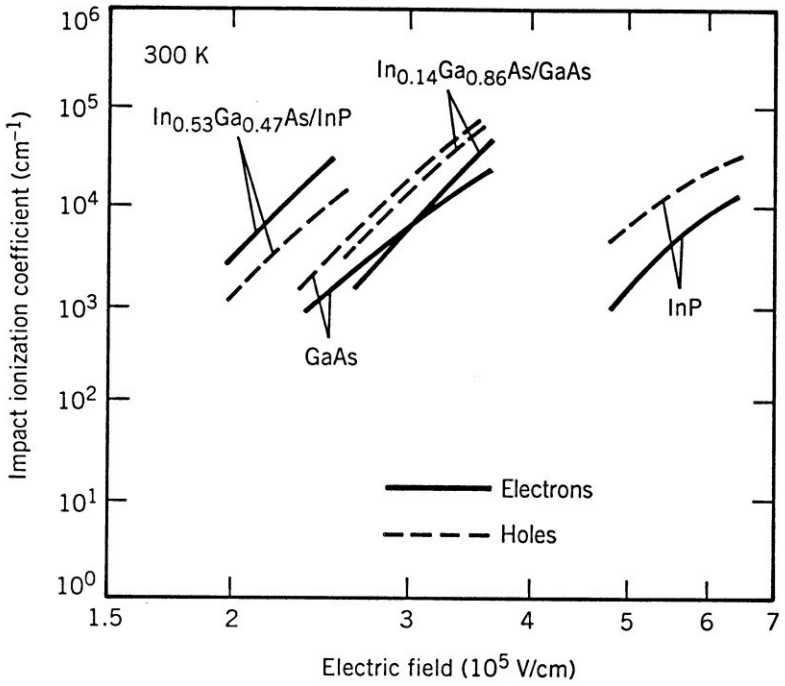


Figure 4.7 Variation of impact-ionization coefficient as a function of the electric field for electrons (solid line) and holes (dashed line) for several semiconductors. (After Ref. [23]. ©1977 Elsevier. Reprinted with permission.)

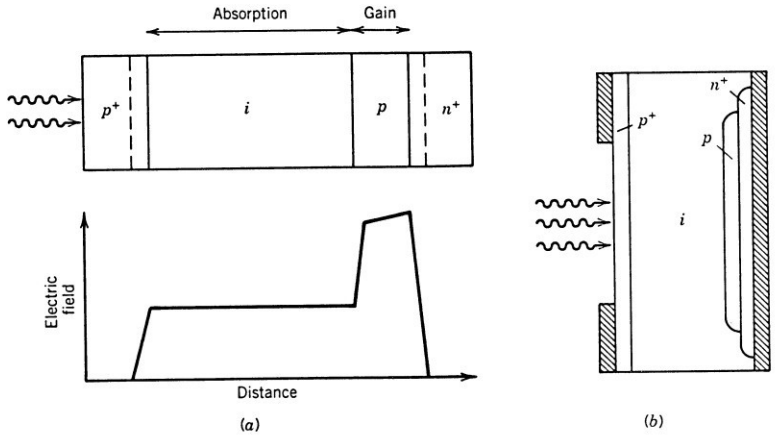
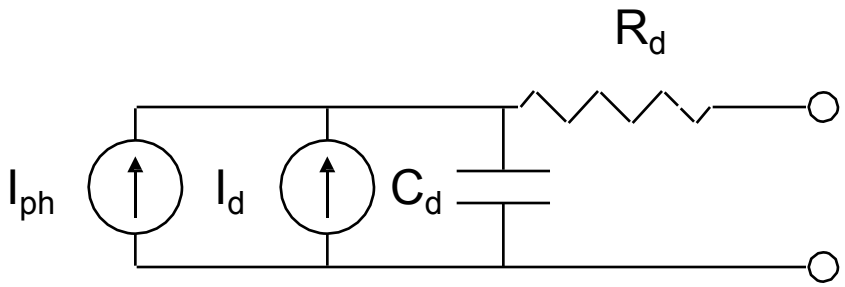
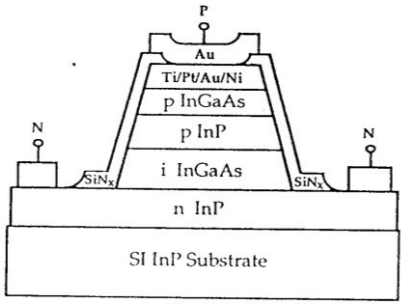


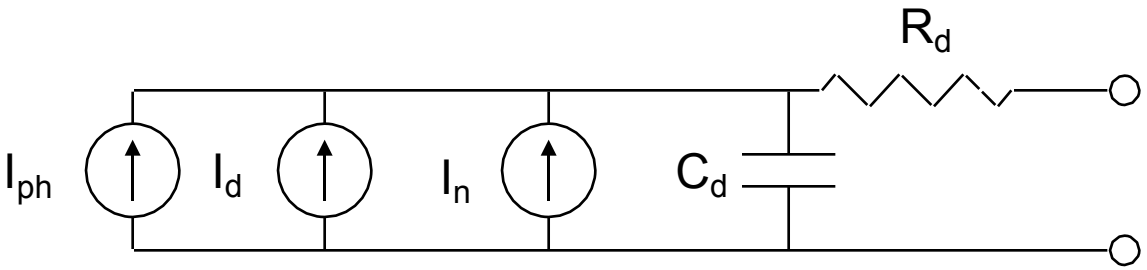
Figure 4.8 (a) An APD together with the electric-field distribution inside various layers under reverse bias; (b) design of a silicon reach-through APD.

Detector Equivalent Circuits

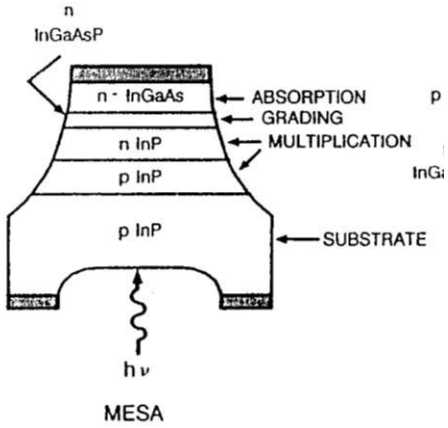


PIN





APD



I_{ph}=Photocurrent generated by detector
C_d=Detector Capacitance
I_d=Dark Current
I_n=Multiplied noise current in APD
R_d=Bulk and contact resistance