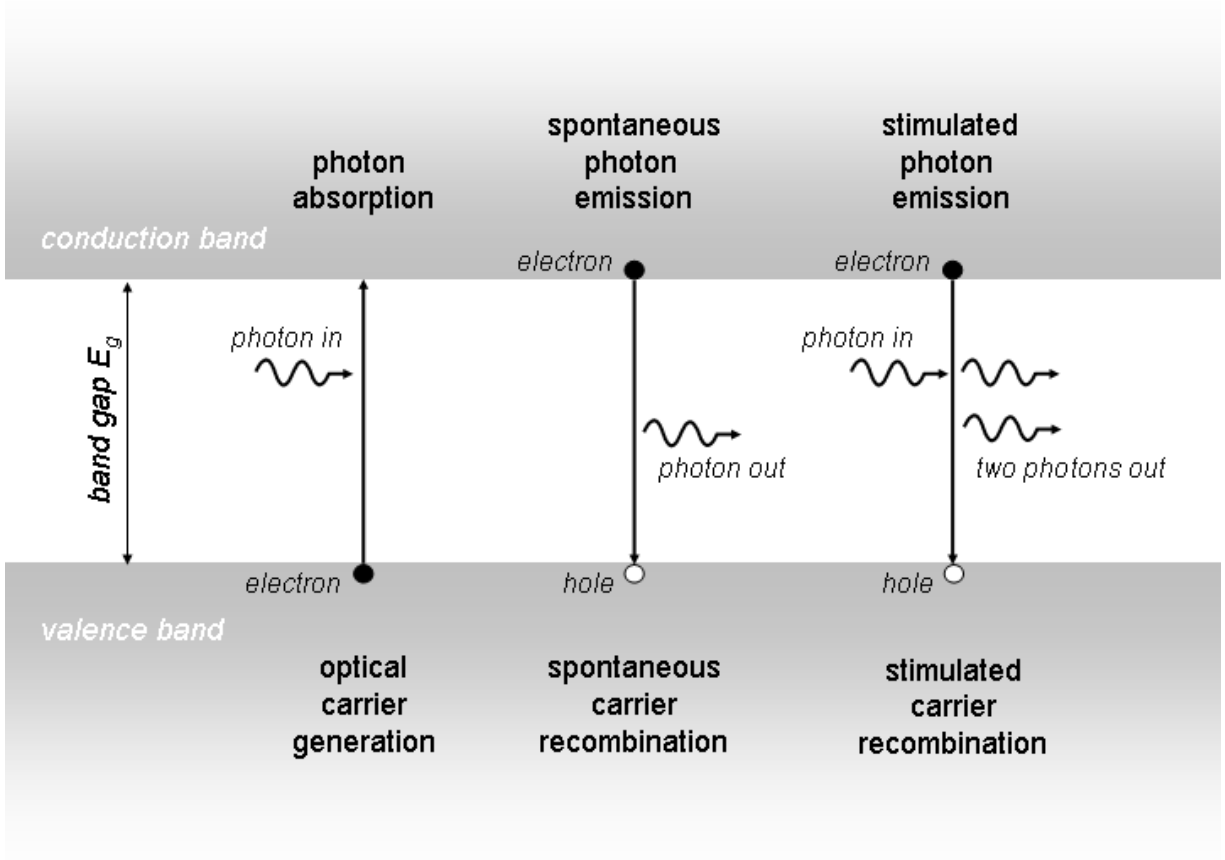

Figure 2.1 Illustration of key processes in optoelectronic devices.

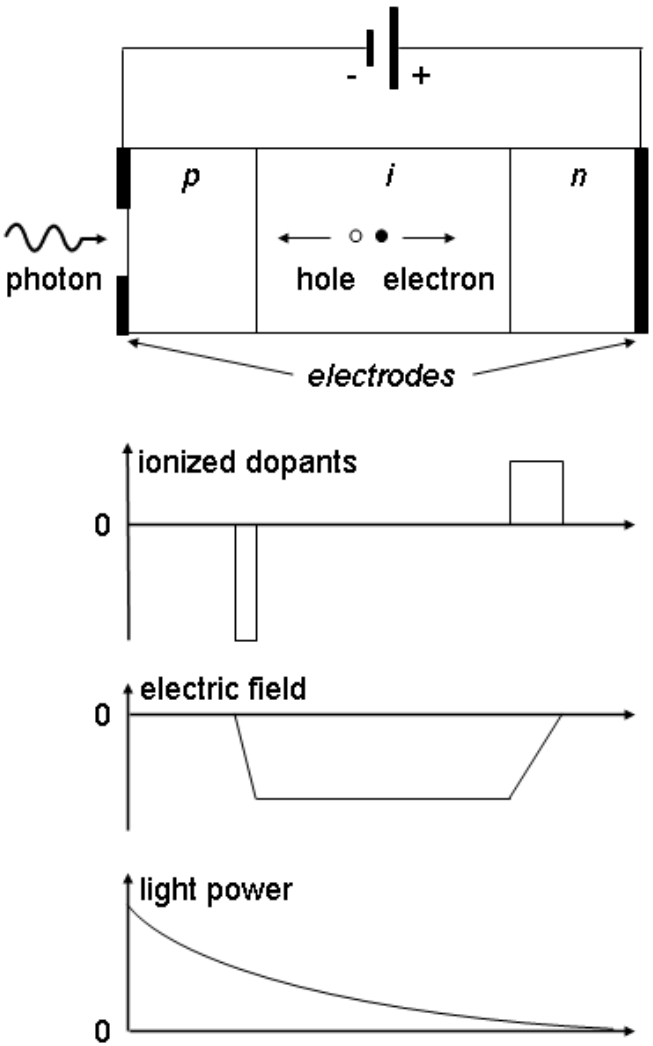

Figure 2.2 Schematic structure and internal physics of *pin* photodiodes.

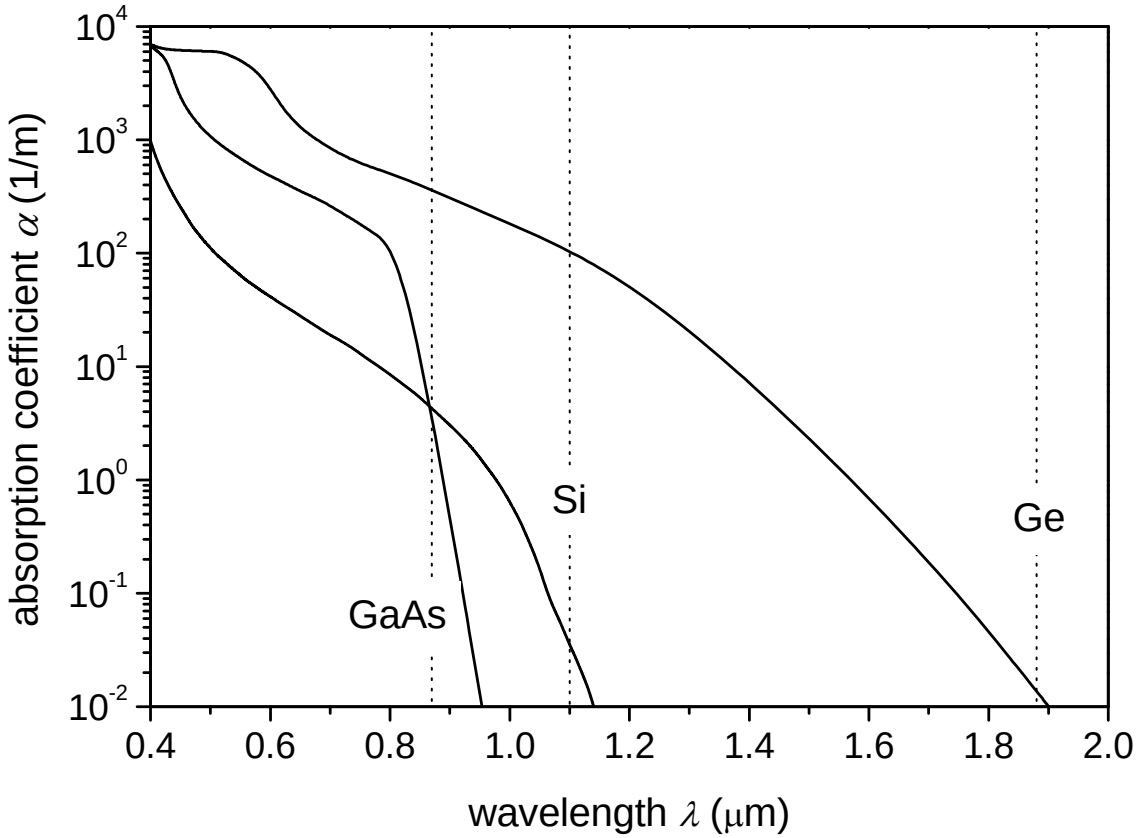

Figure 2.3 Optical absorption constants of GaAs, Si, and Ge as function of light wavelength. The dotted lines indicate the band gap wavelength.

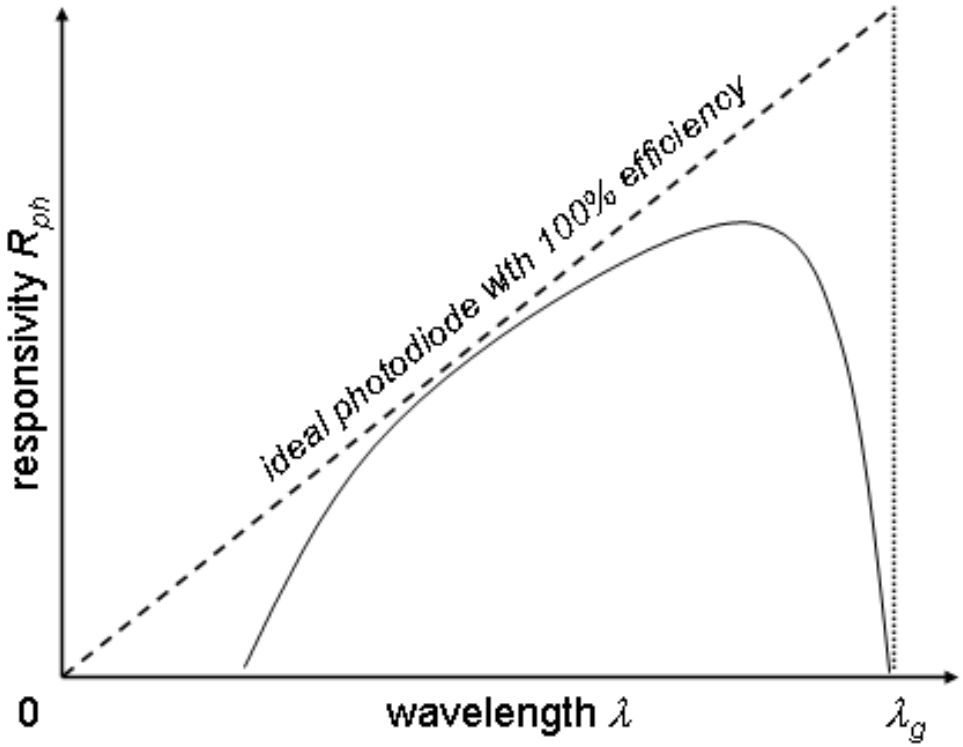

Figure 2.4 Schematic responsivity spectrum of photodiodes.

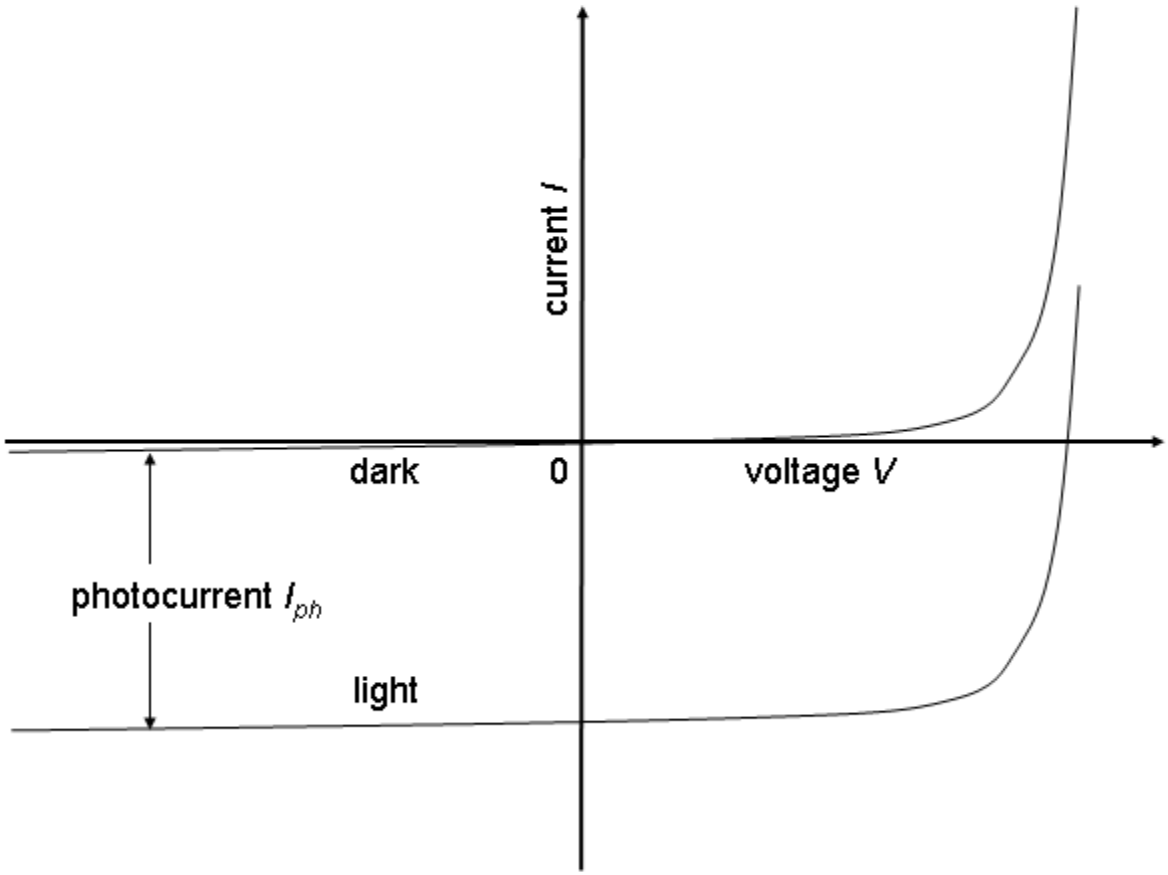

Figure 2.5 Current-voltage characteristic for a photodiode with and without illumination.

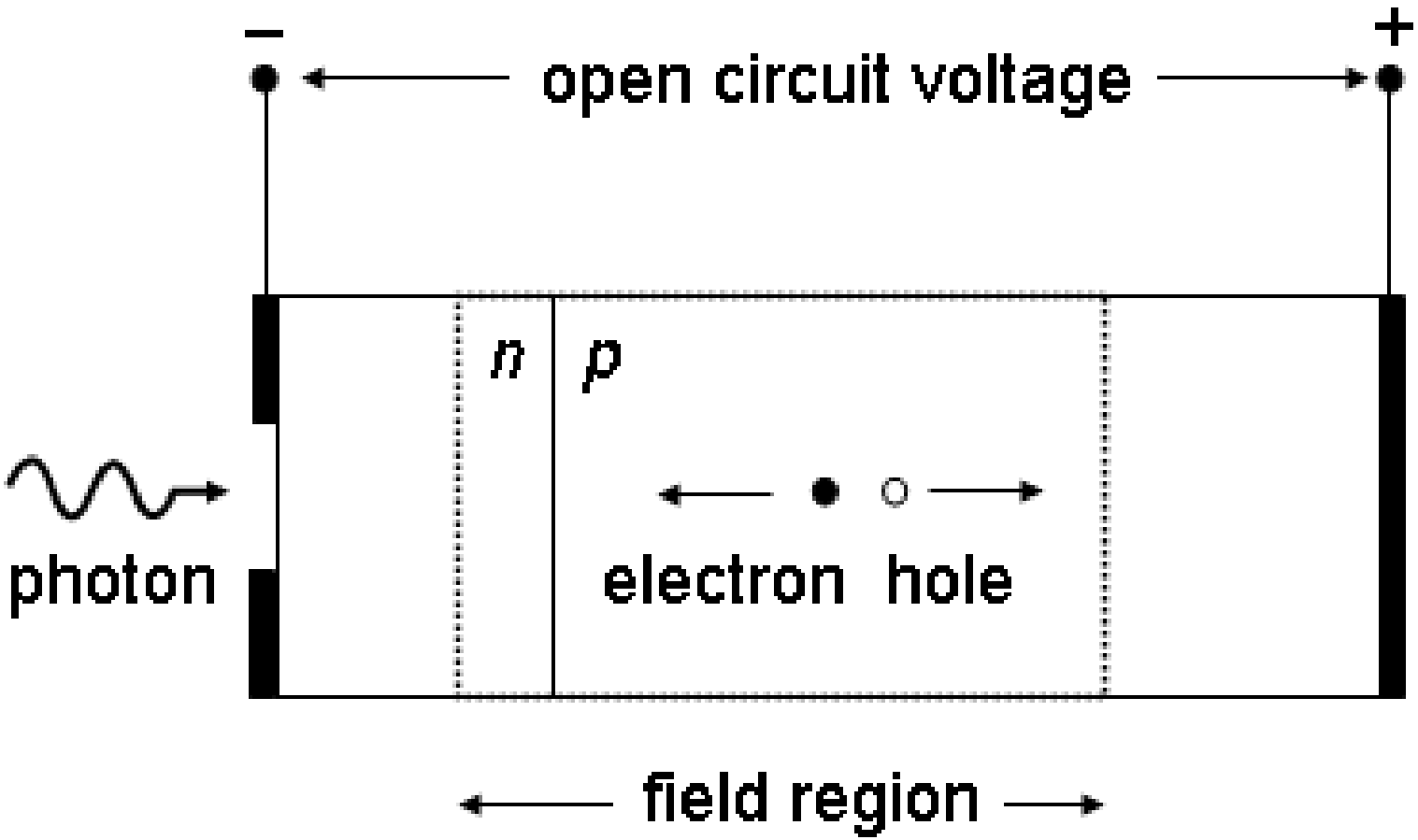

Figure 2.6 Solar cell.

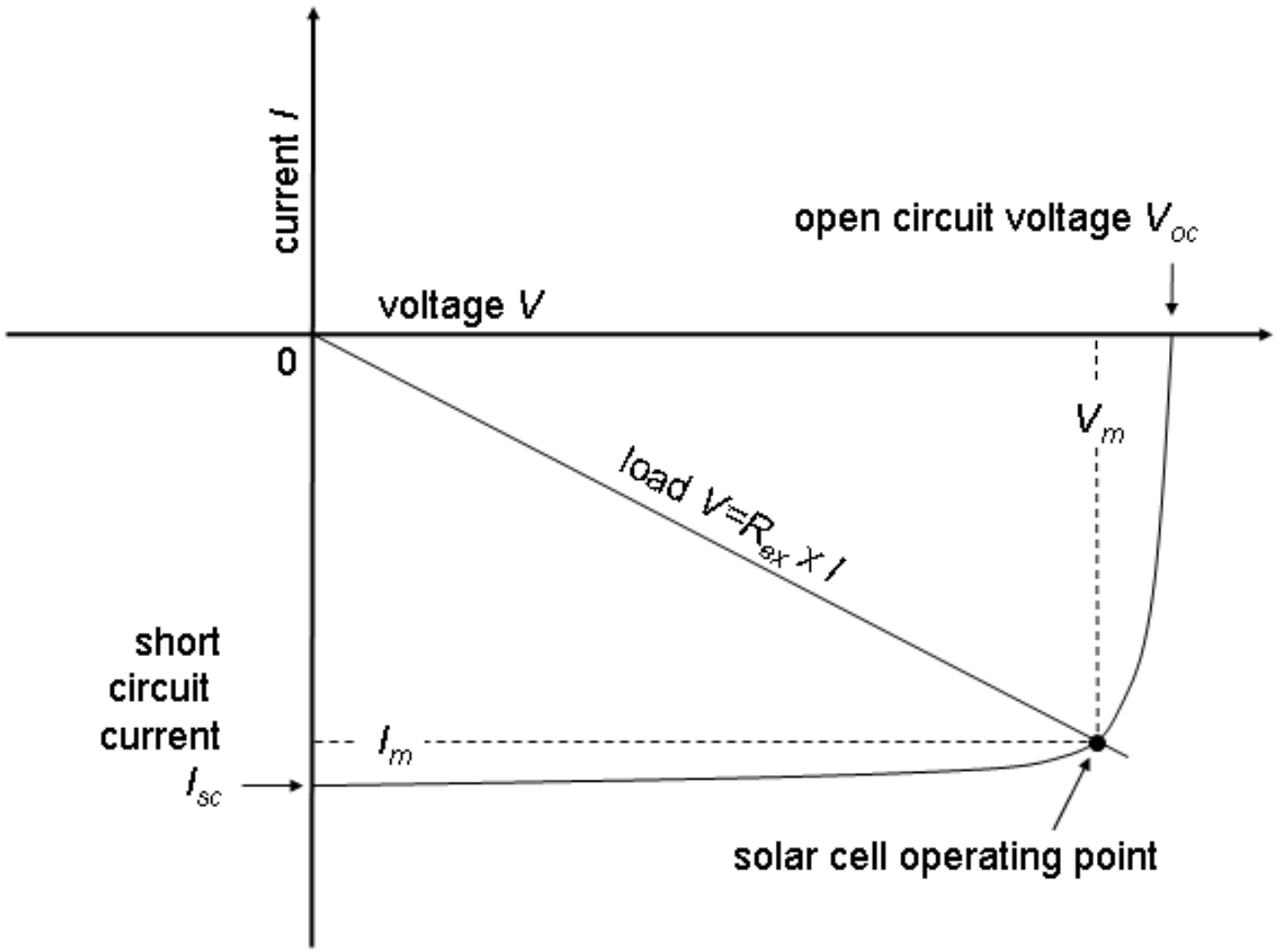

Figure 2.7 Solar cell current-voltage characteristic and parameters.

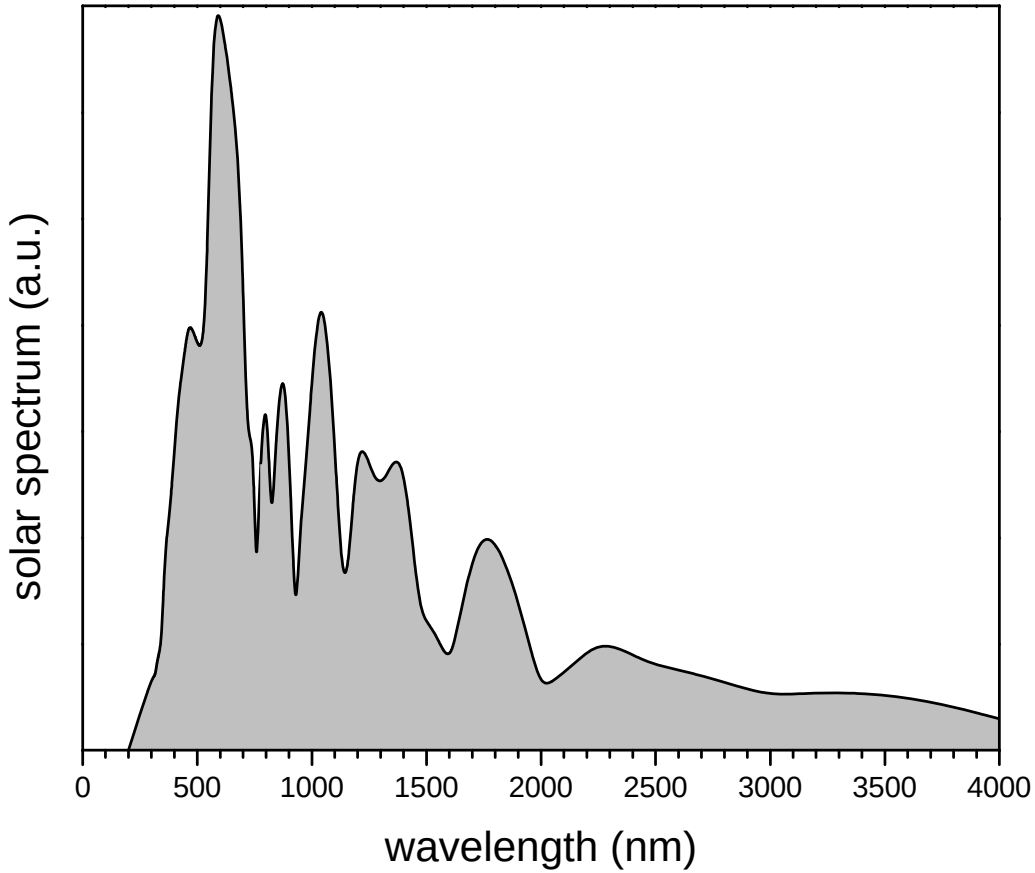

Figure 2.8 Solar spectrum.

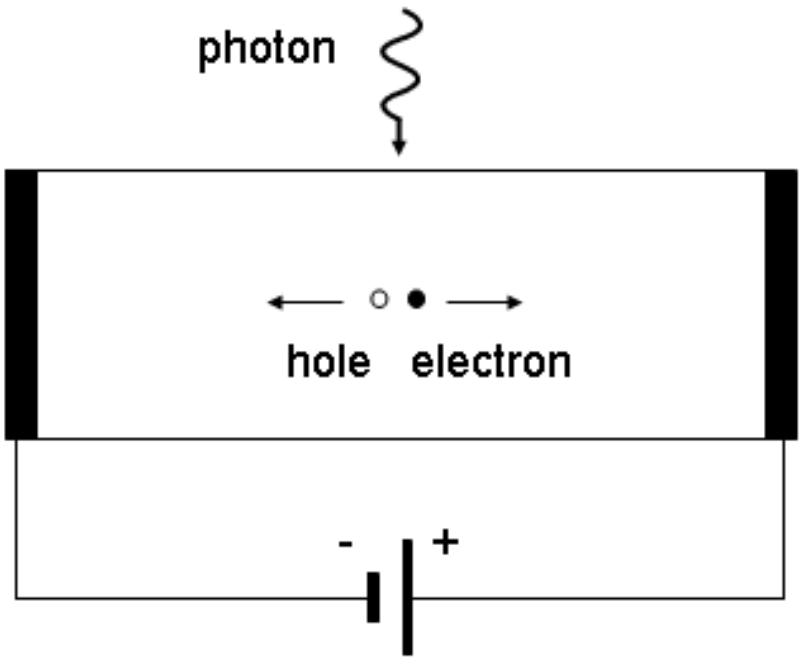

Figure 2.9 Photoconductor.

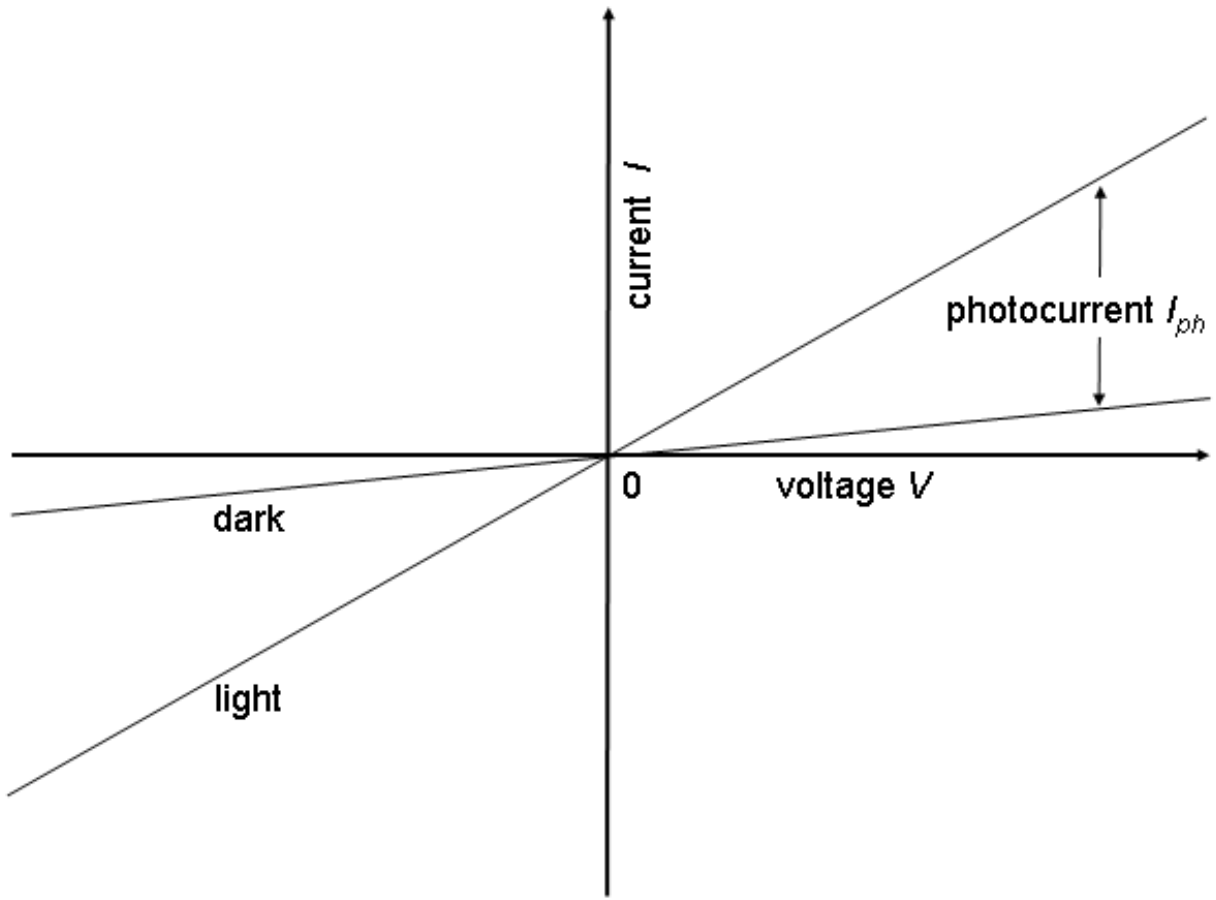

Figure 2.10 Current-voltage characteristic for a photoconductor with and without illumination.

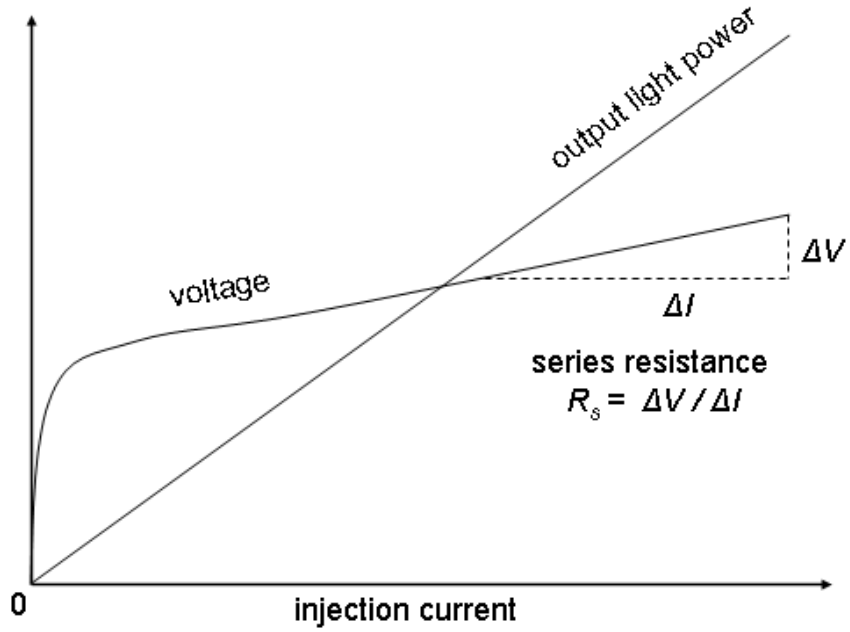

Figure 2.11 Typical LED characteristics: light vs. current (*LI*) and voltage vs. current (*IV*).

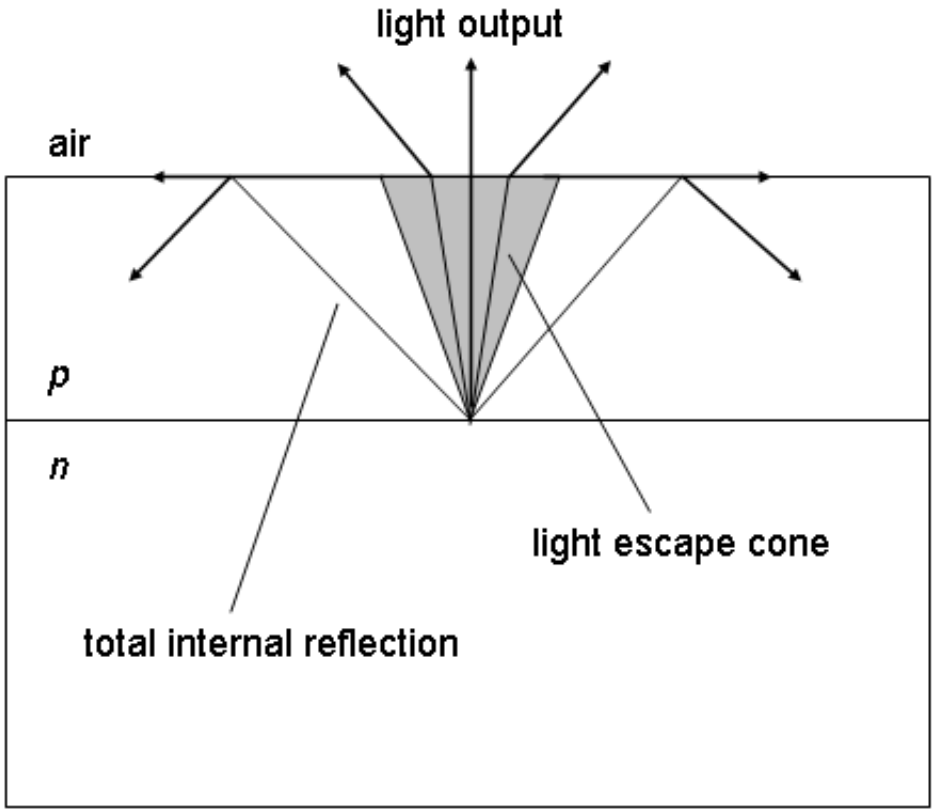

Figure 2.12 Illustration of light propagation in a simple LED structure.

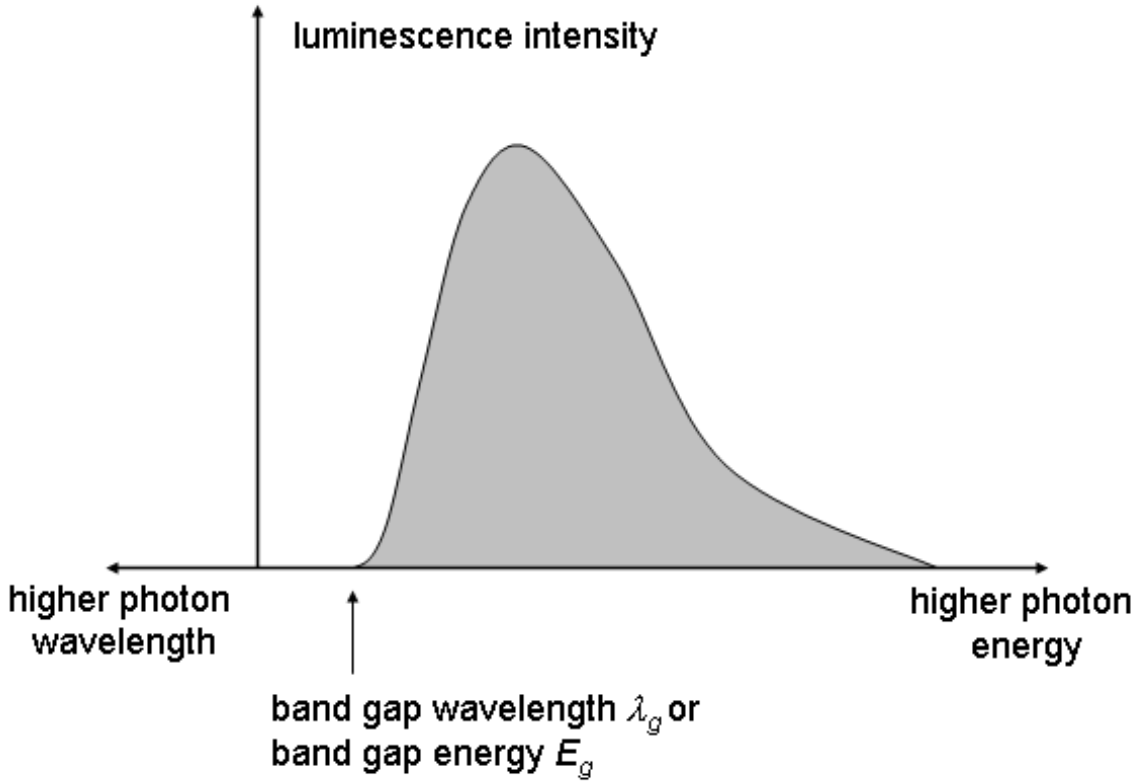

Figure 2.13 Schematic LED emission spectrum.

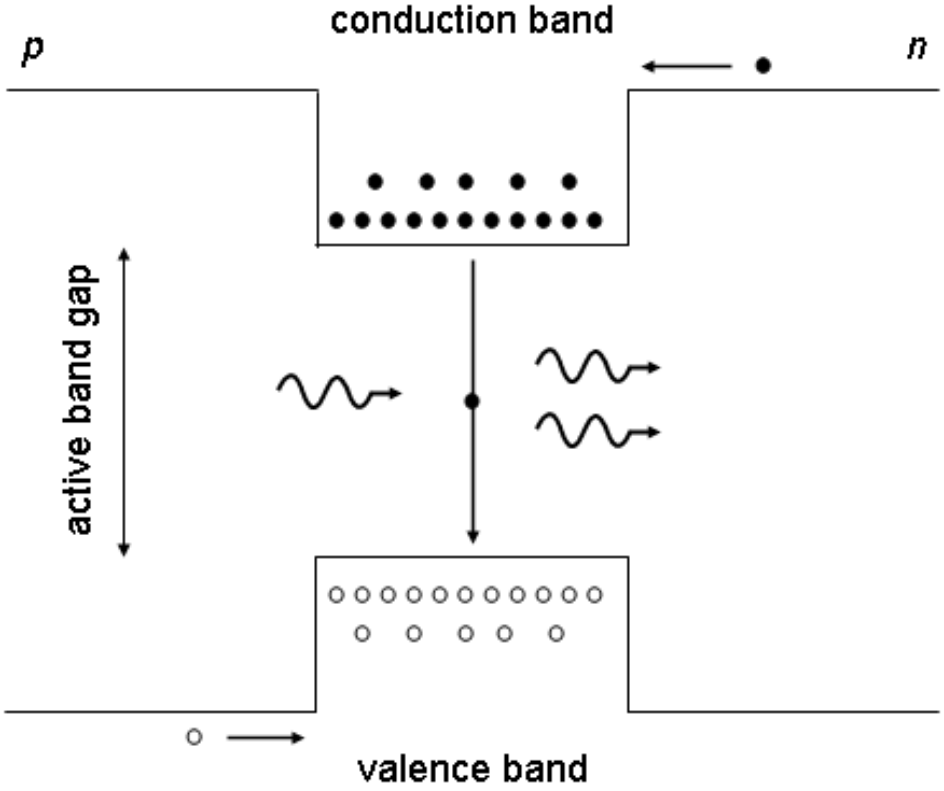

Figure 2.14 Energy band diagram of a *pin*-heterojunction illustrating stimulated photon emission at forward bias.

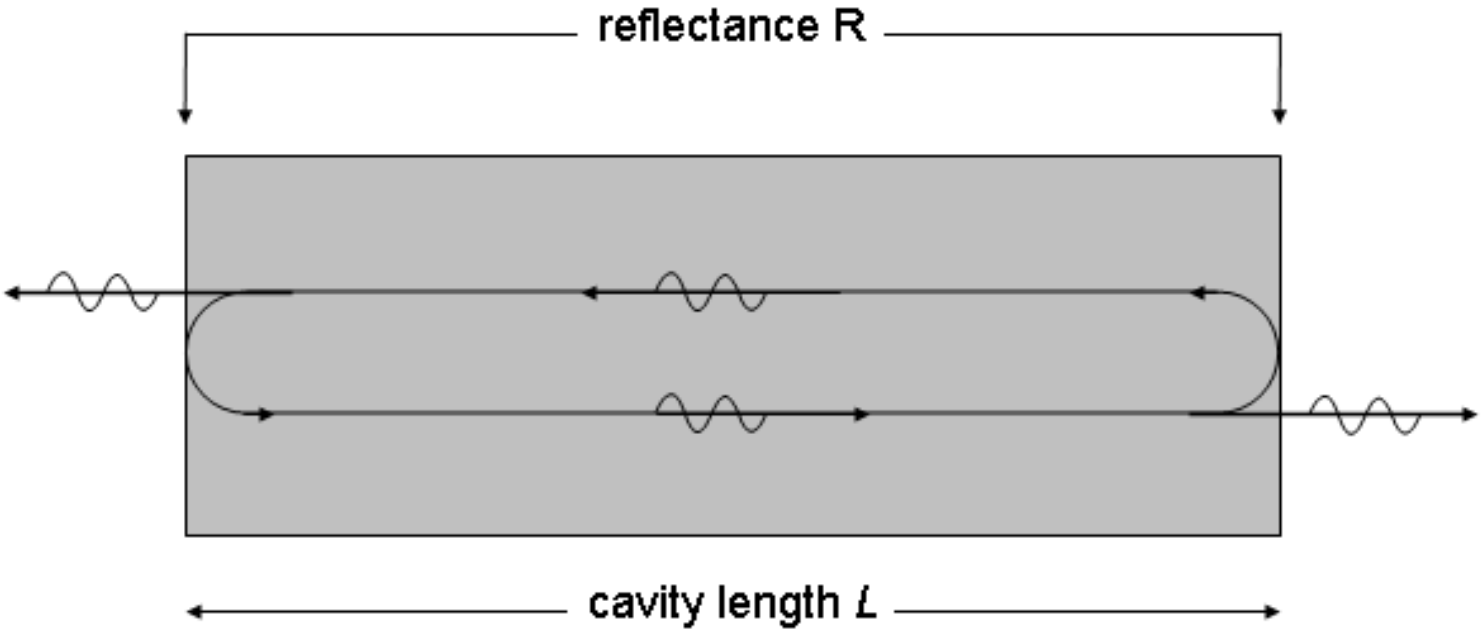

Figure 2.15 Optical feedback in a Fabry-Perot laser.

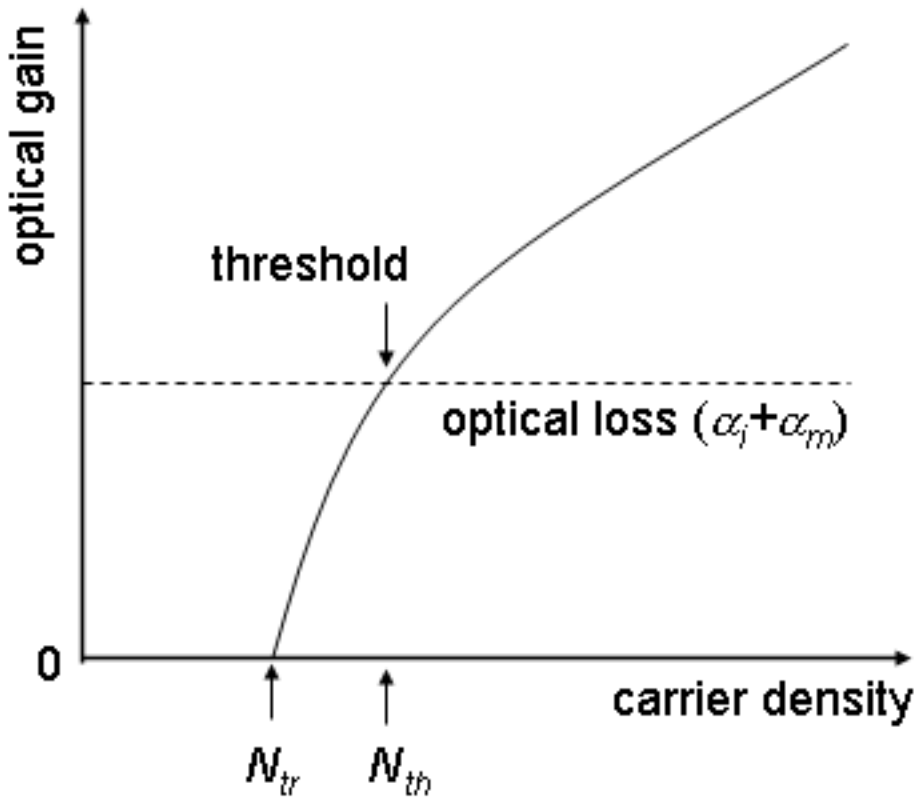

Figure 2.16 Gain versus carrier density *g(N)* with transparency density *Ntr* and threshold density *Nth.*

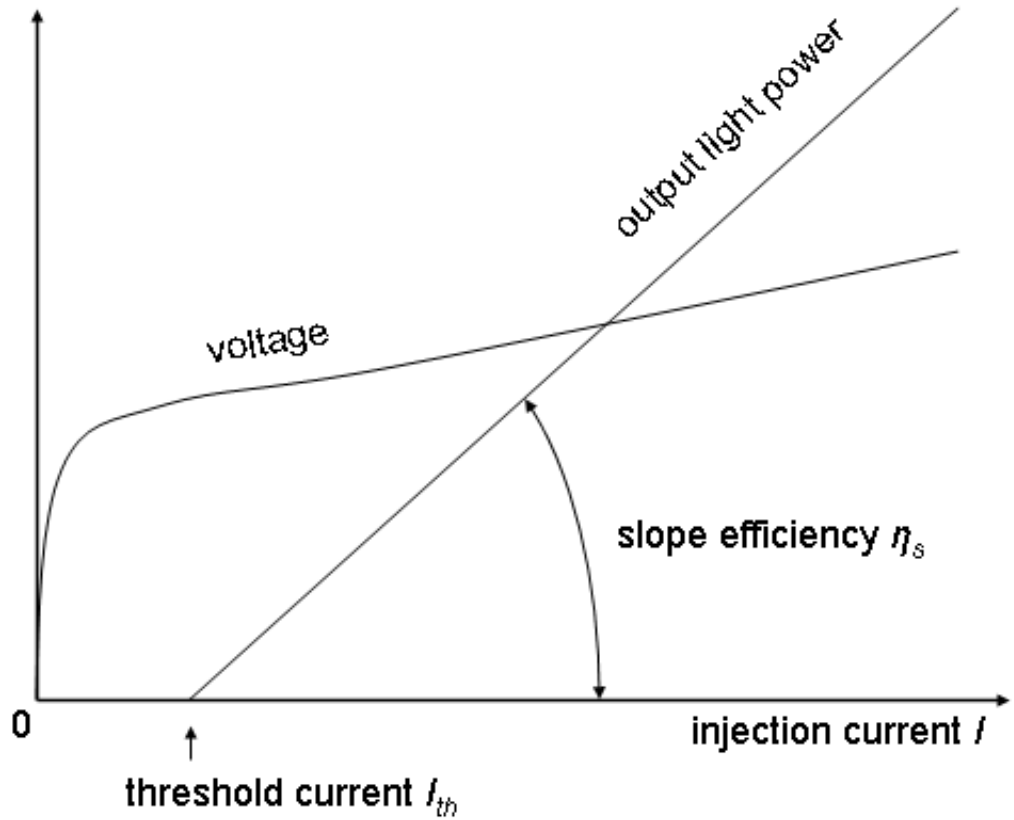

Figure 2.17 Laser characteristics: light power vs. current (*LI*) and voltage vs. current (*IV*).

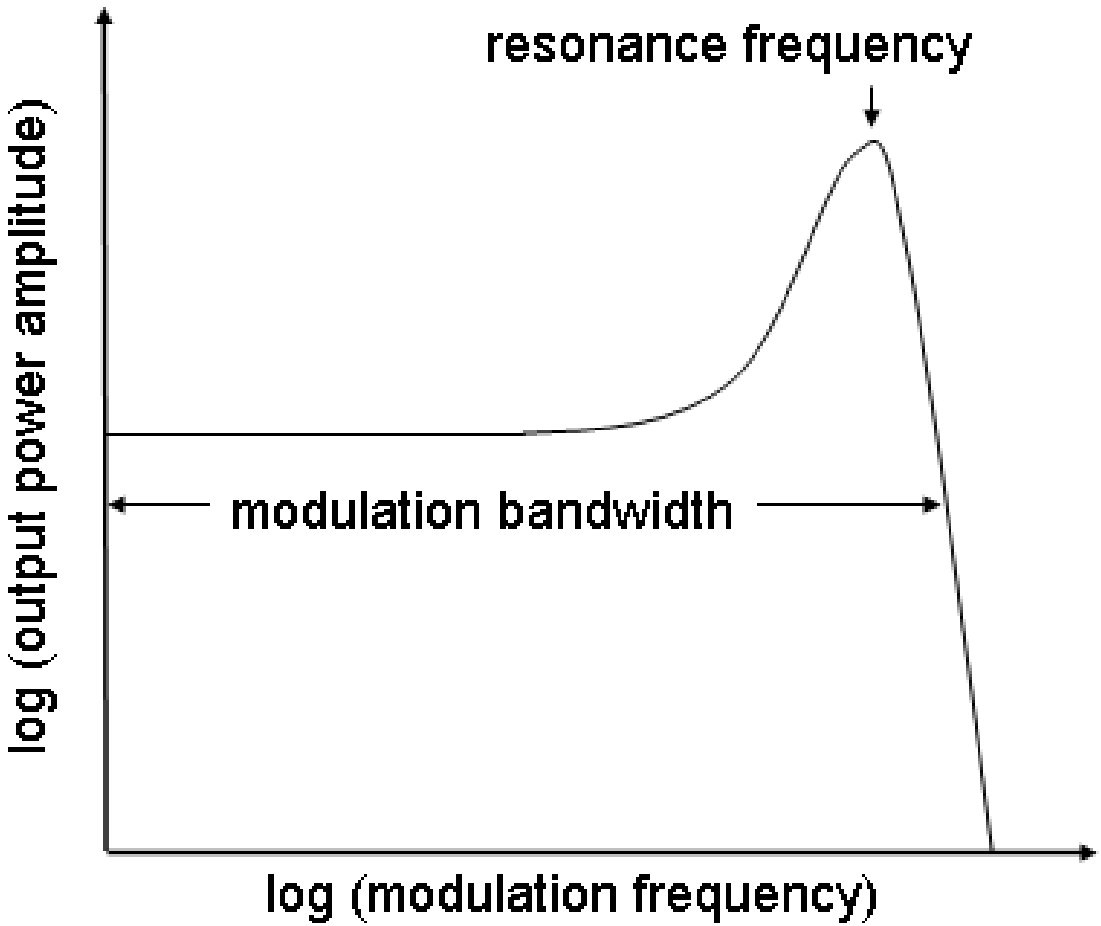

Figure 2.18 Analog modulation characteristic of a laser.

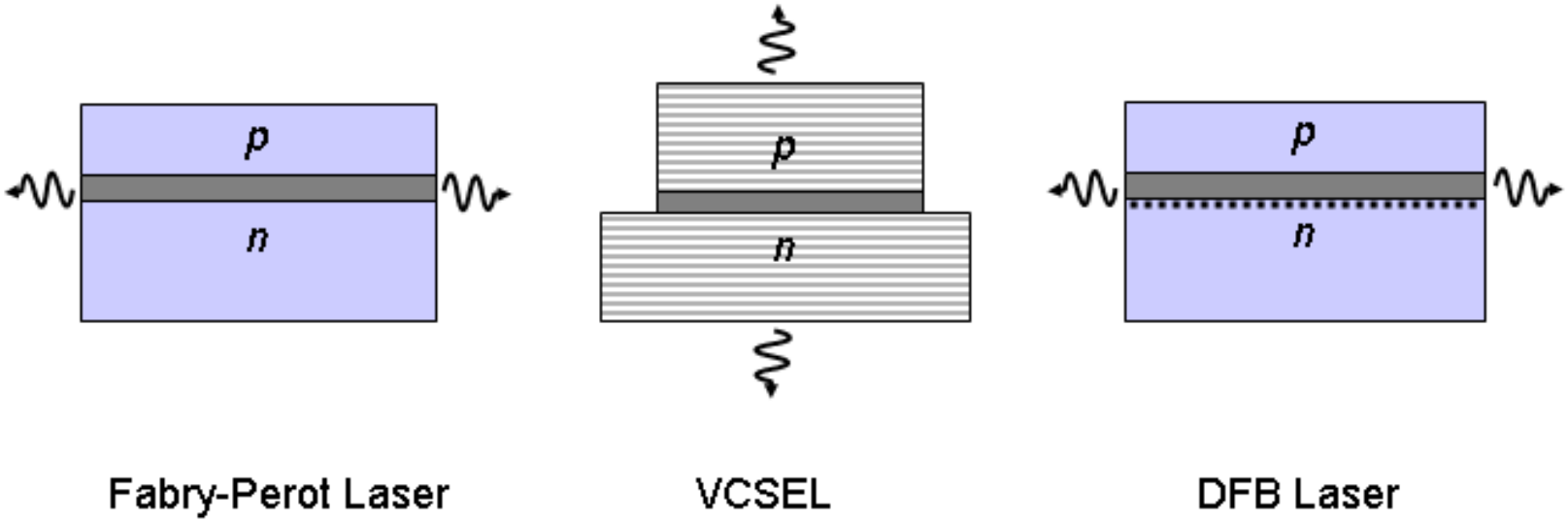

Figure 2.19 Optical resonator designs for semiconductor lasers.

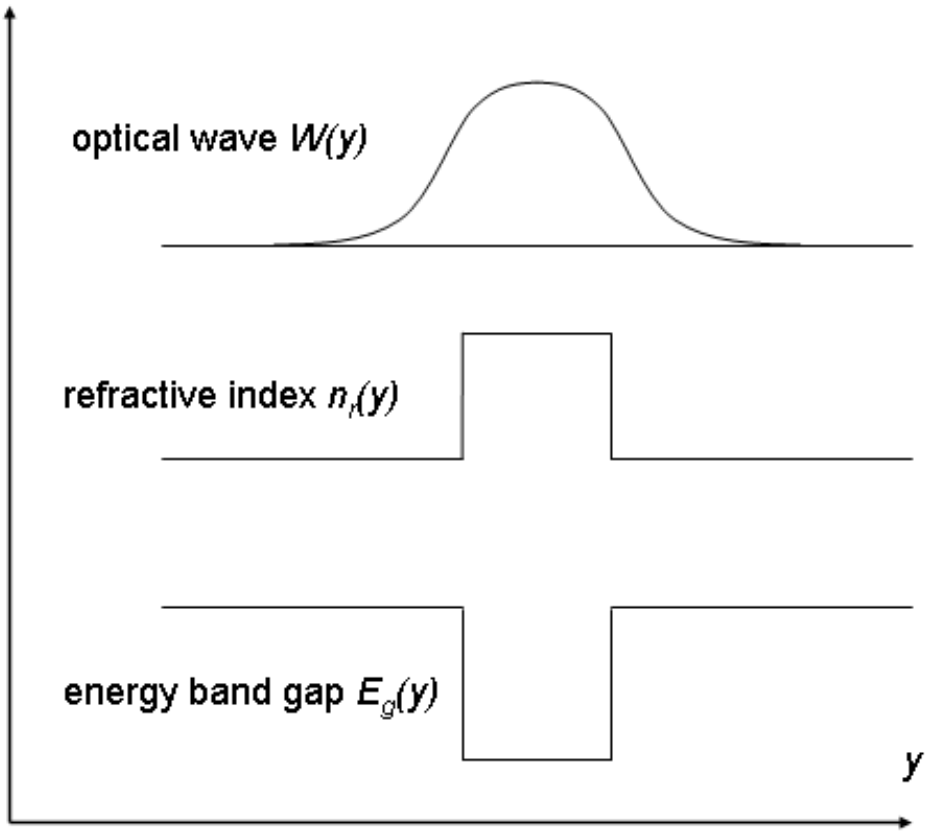

Figure 2.20 Vertical profile of band gap, refractive index, and optical wave within a planar symmetric heterostructure.

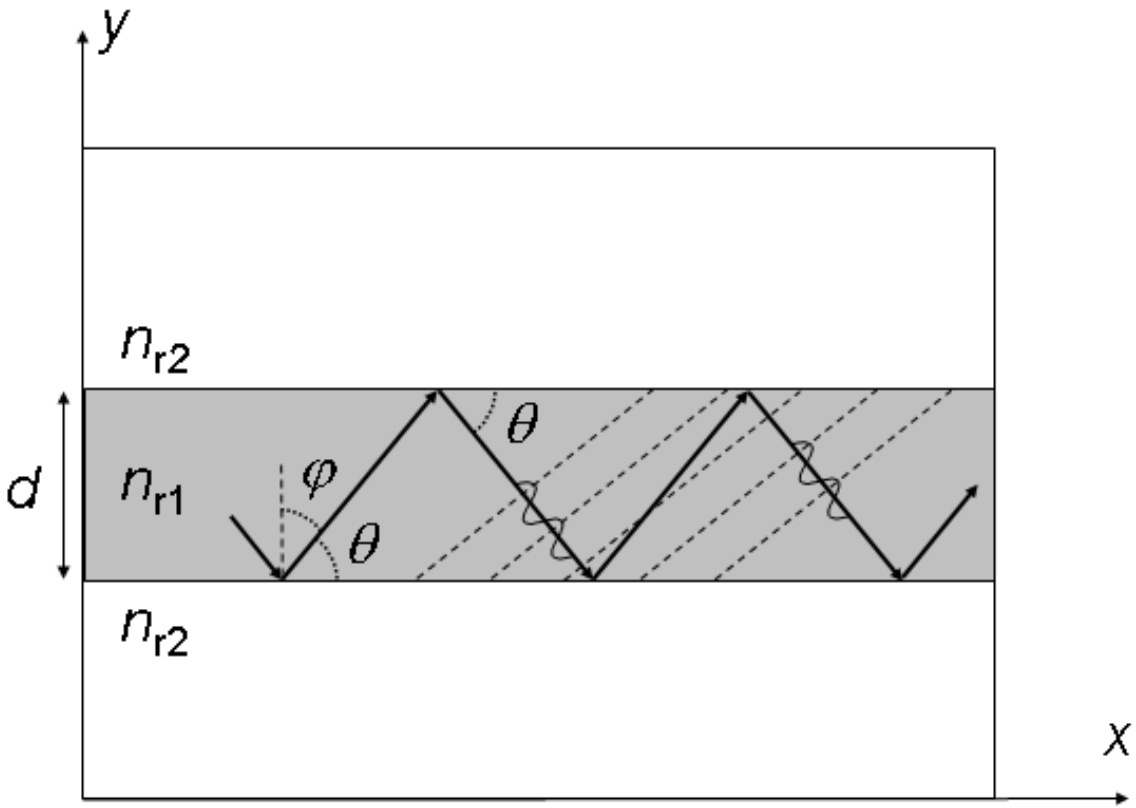

Figure 2.21 Light propagation in a planar waveguide. The dashed lines indicate constructive interference of reflected waves.

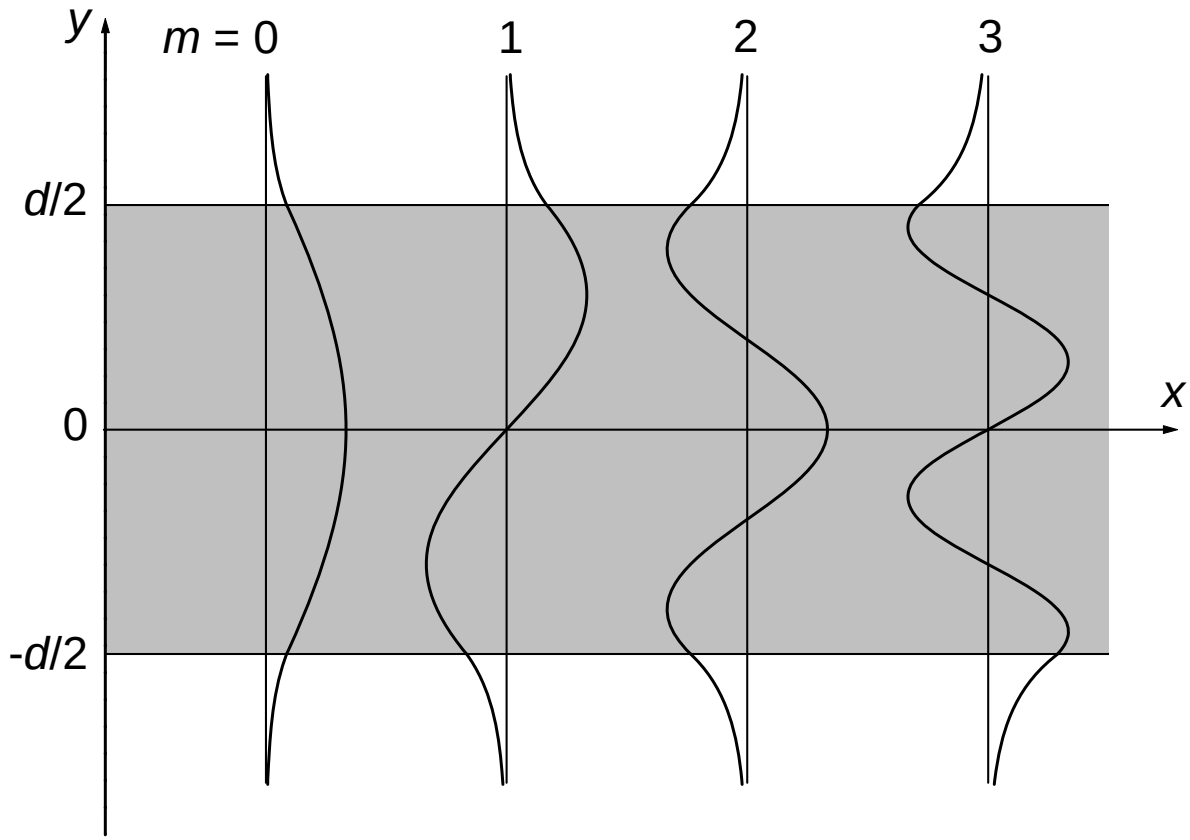

Figure 2.22 Transverse optical field profiles *Wm(y)* for waveguide mode number *m*.

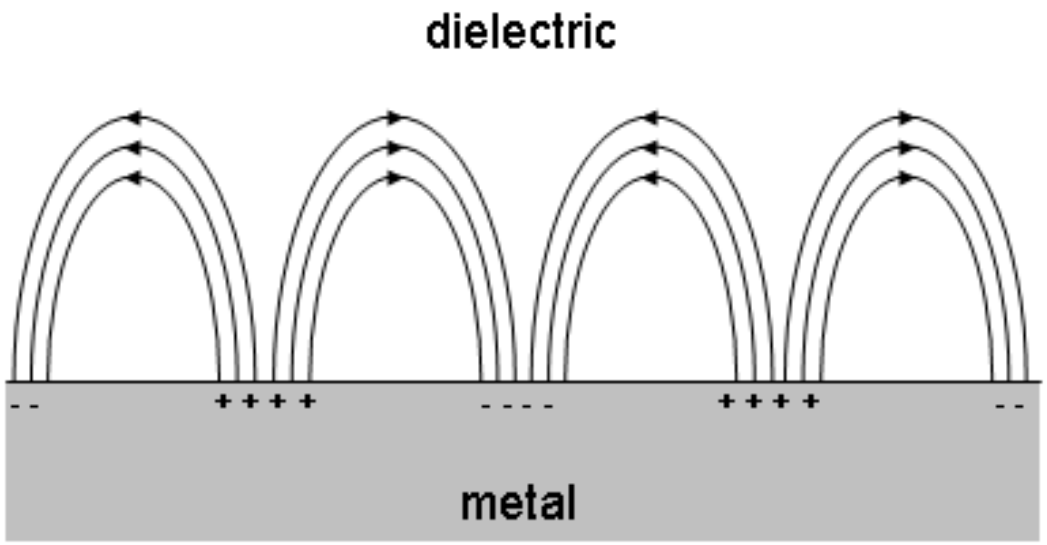

Figure 2.23 Surface plasmons: interaction of electrons and optical waves at a metal / dielectric interface.

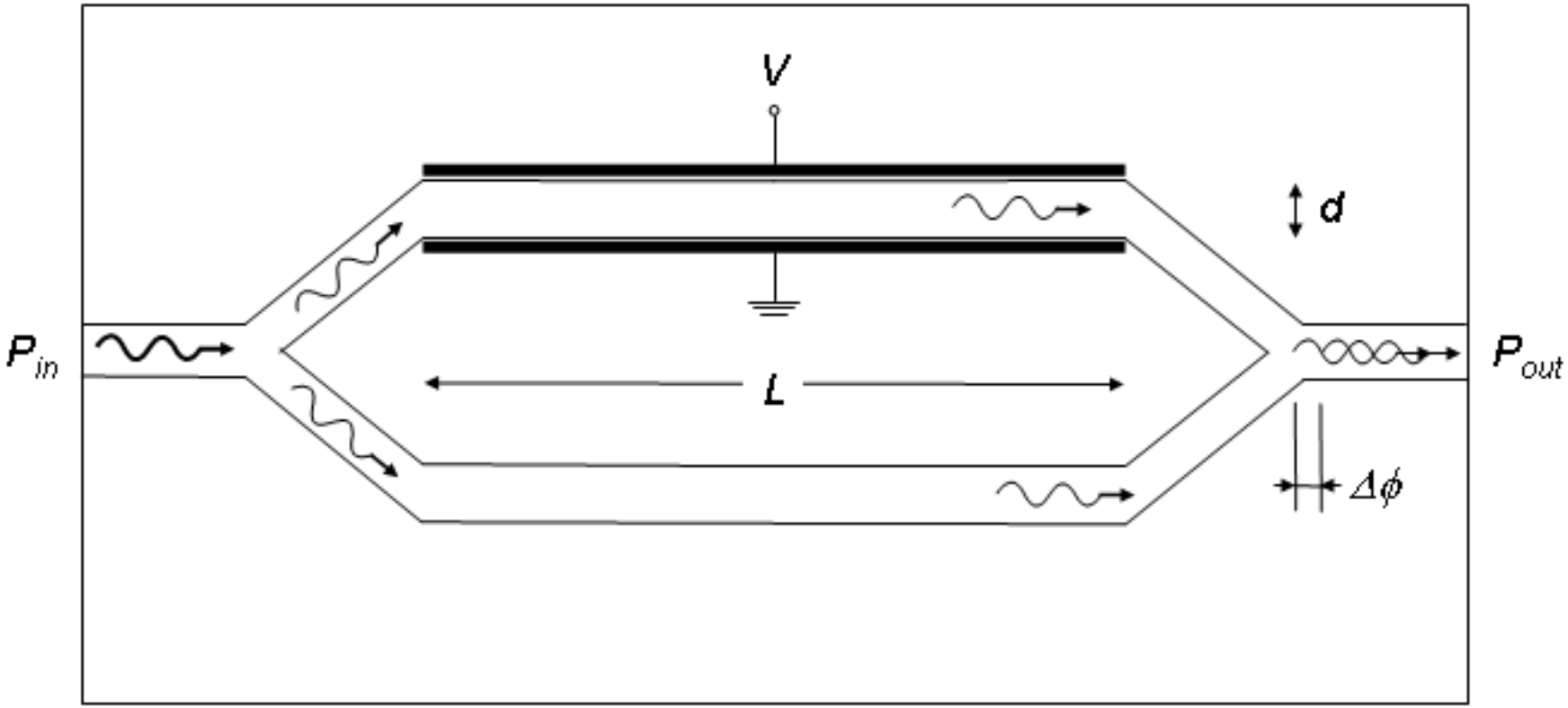

Figure 2.24 Mach-Zehnder Modulator.

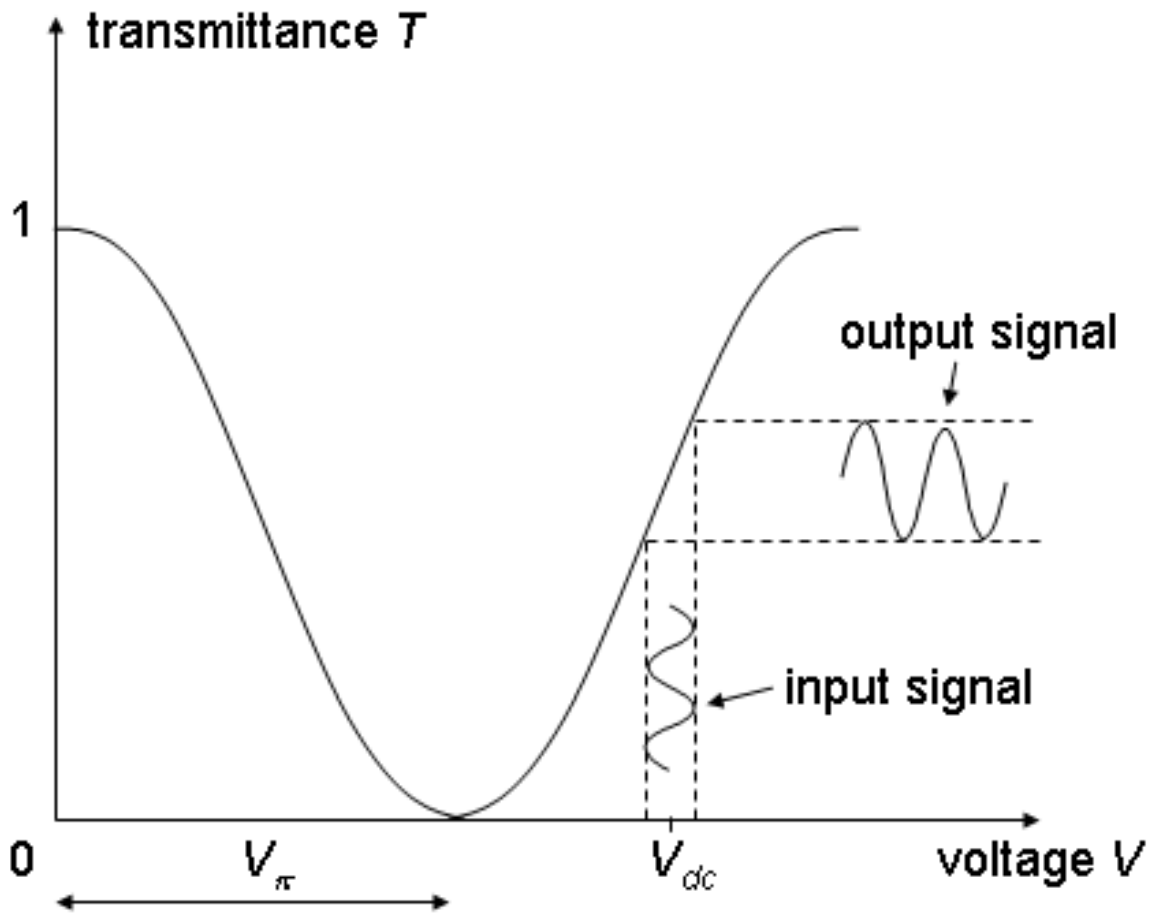

Figure 2.25 Modulator transmittance function *T(V).*