

Fig. 3.1 Visualization of carrier drift: (a) motion of carriers within a biased semiconductor bar; (b) drifting hole on a microscopic or atomic scale; (c) carrier drift on a macroscopic scale.

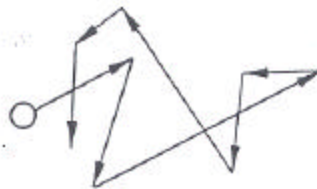


Fig. 3.2 Thermal motion of a carrier.

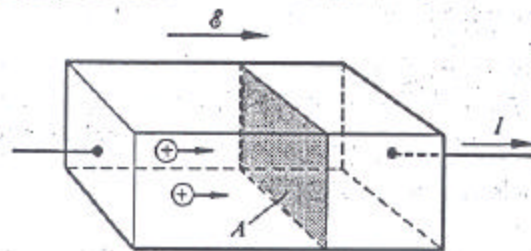


Fig. 3.3 Expanded view of a biased *p*-type semiconductor bar of cross-sectional area *A*.

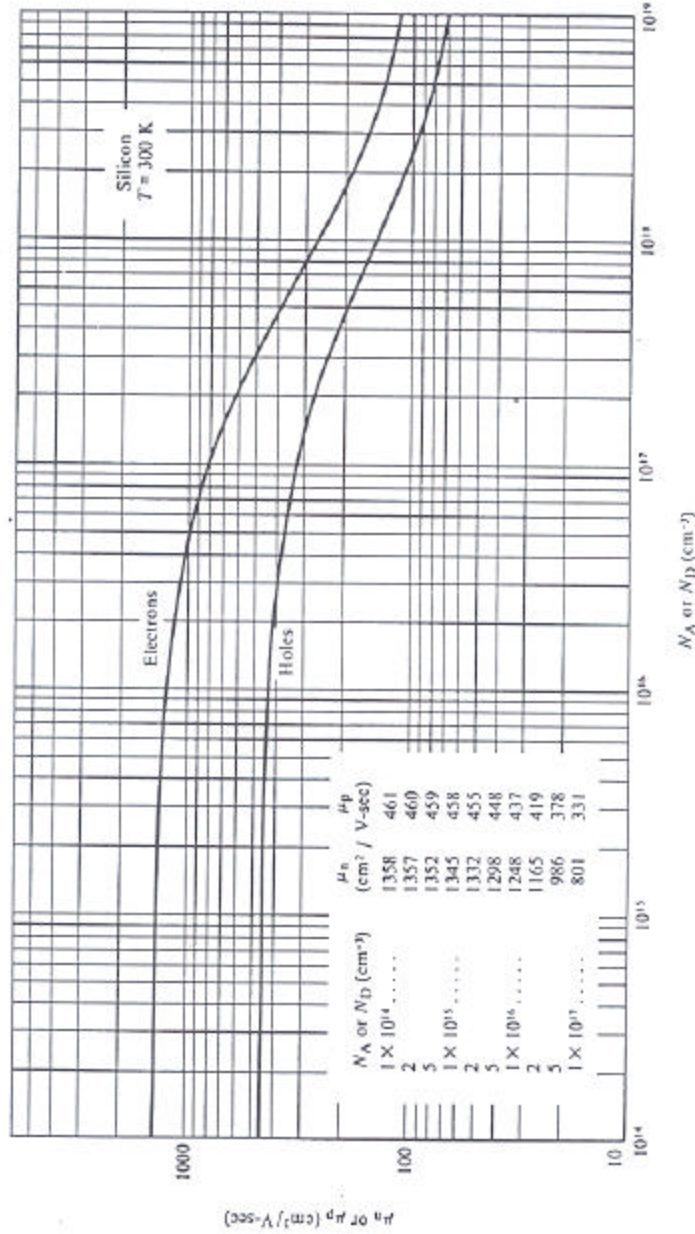


Fig. 3.5 Room-temperature carrier mobilities in silicon as a function of the dopant concentration.  $\mu_n$  is the electron mobility;  $\mu_p$  is the hole mobility.

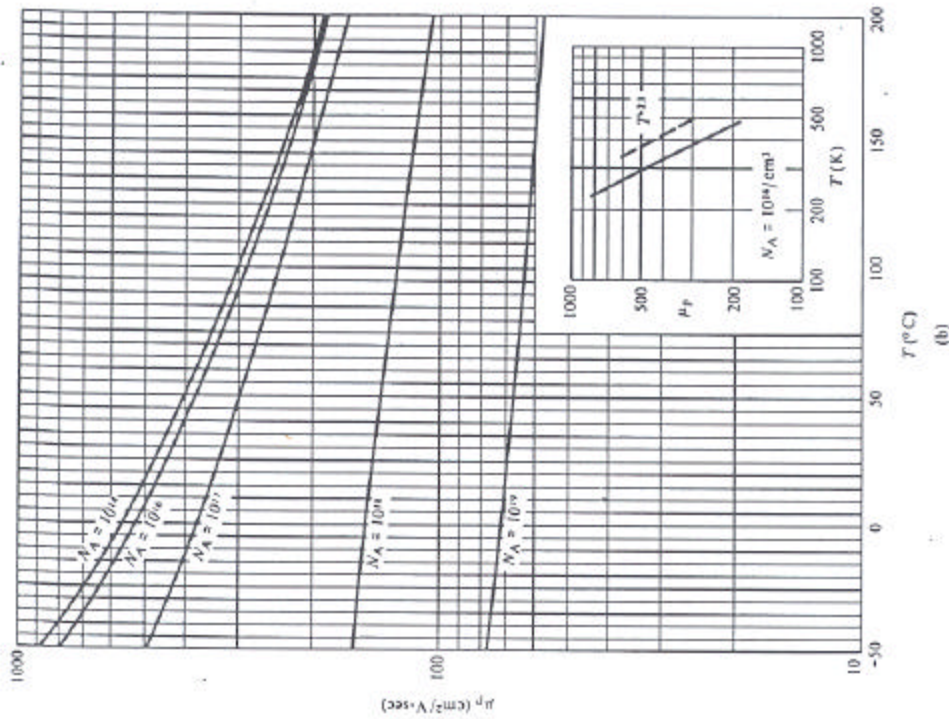
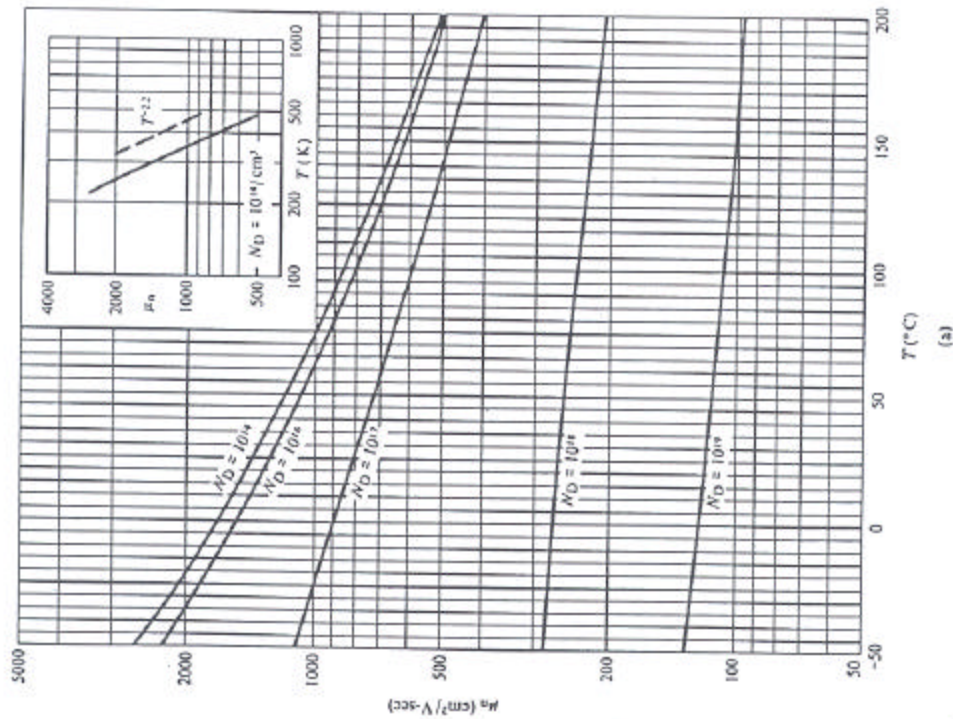


Fig. 3.6 Temperature dependence of (a) electron and (b) hole mobilities in silicon for sample dopings ranging from  $10^{14}/\text{cm}^3$  to  $10^{19}/\text{cm}^3$ . In the lightest-doped sample,  $\mu \propto T(K)^{-2.2}$ . This is clearly evident from the inset plots of  $\log \mu$  versus  $\log T(K)$ .

Fig. 3.6 (continued)

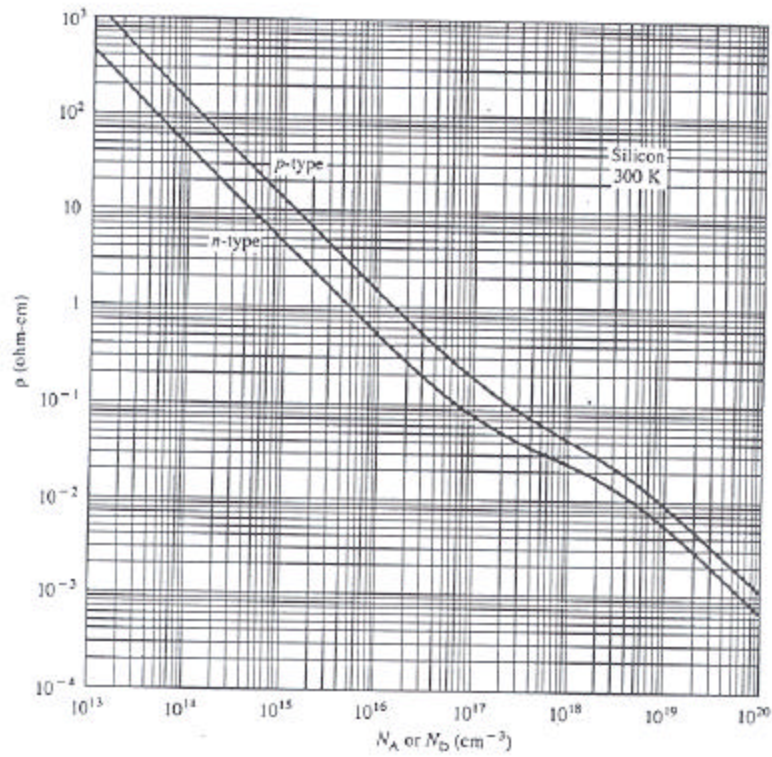


Fig. 3.7 Si resistivity versus impurity concentration at 300 K.

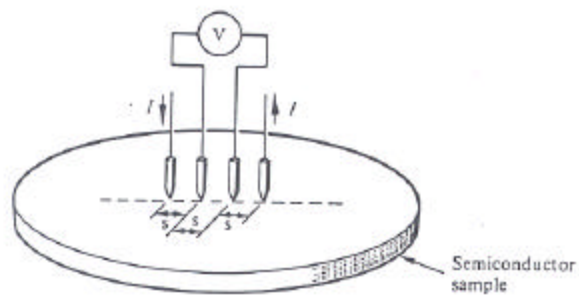


Fig. 3.8 Schematic drawing of the probe arrangement, placement, and biasing in the four-point probe measurement.



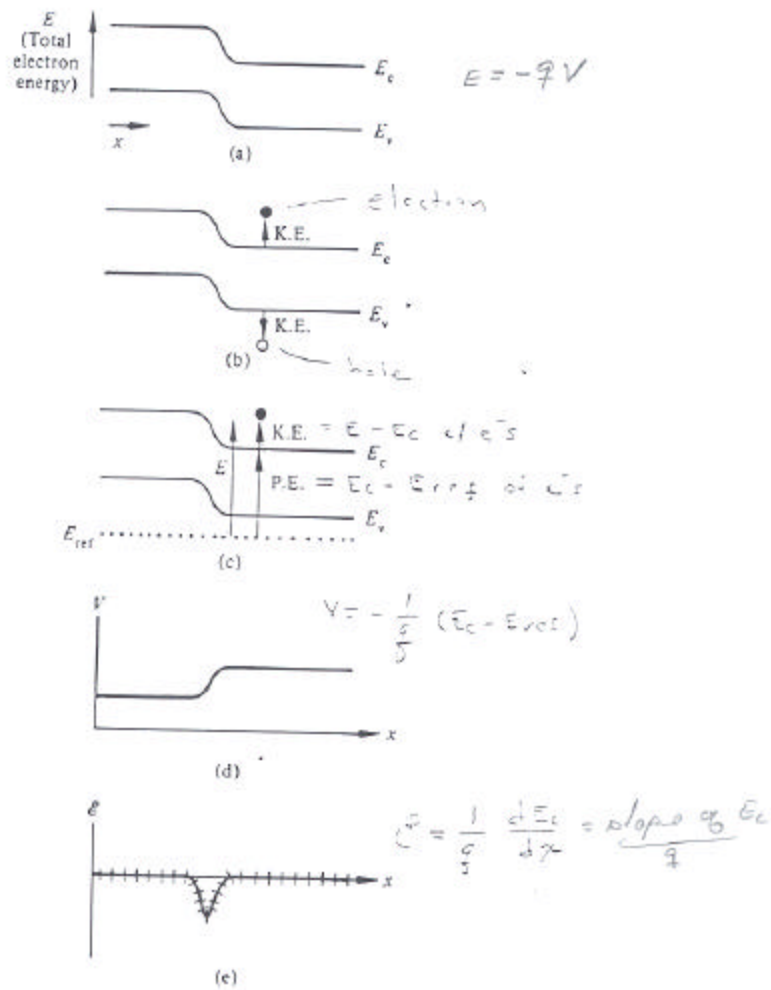


Fig. 3.9 Relationship between band bending and the electrostatic variables inside a semiconductor: (a) sample energy band diagram exhibiting band bending; (b) identification of the carrier kinetic energies; (c) specification of the electron potential energy; (d) electrostatic potential and (e) electric field versus position dependence deduced from and associated with the part (a) energy band diagram.

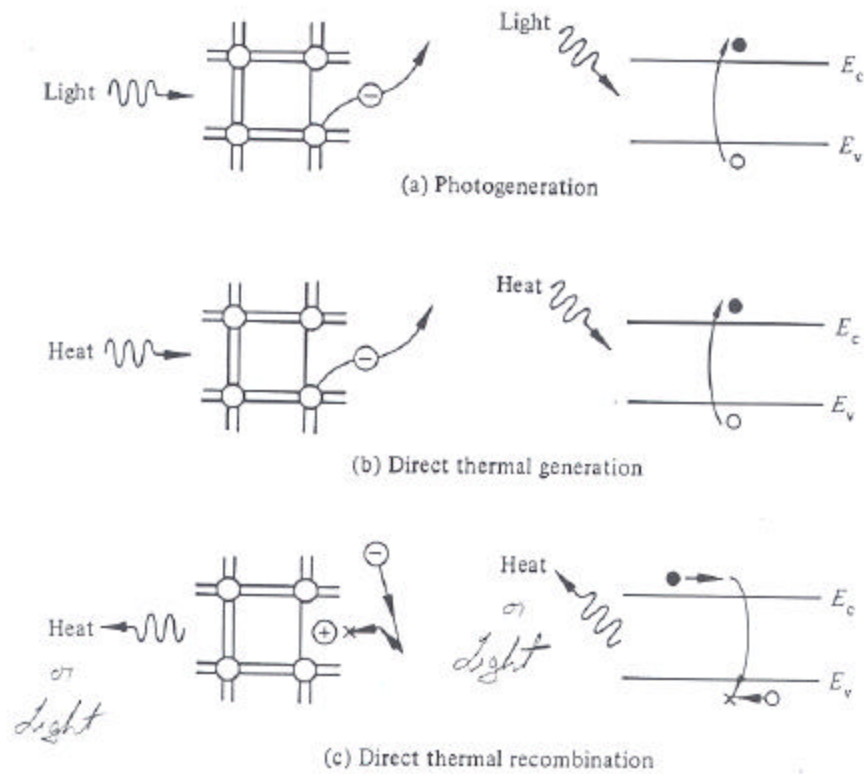


Fig. 3.14 Band-to-band recombination-generation processes. Bonding model (left-hand side) and equivalent energy band model (right-hand side) visualizations of (a) photogeneration, (b) direct thermal generation, and (c) direct thermal recombination.

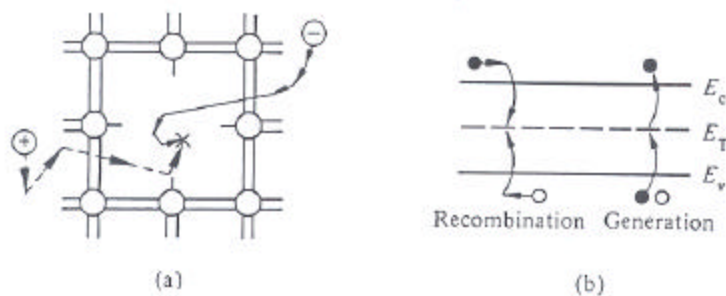


Fig. 3.15 R-G center (indirect thermal) recombination-generation. (a) Bonding model visualization of recombination at a missing atom R-G center. (b) Energy band model description of the R-G center assisted recombination and generation of carriers. R-G centers introduce the  $E_T$  levels pictured near the center of the band gap.

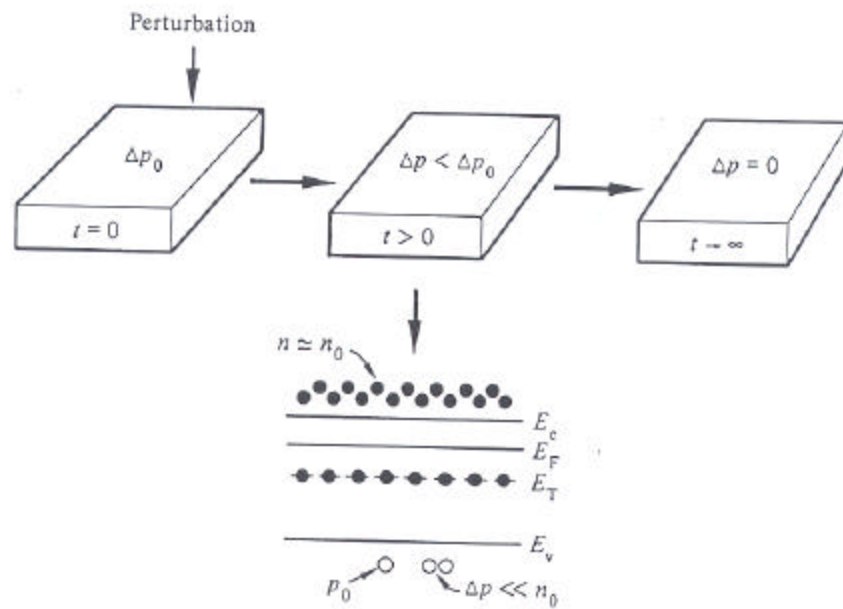


Fig. 3.16 Situation inside an n-type semiconductor after a perturbation causing the low level injection of excess holes.