Ashaolu Oluwatobiloba

① Difference between N-type and P-type Semi conductors

N-type: this is created by doping silicon with atoms that have extra electrons called donor atoms, this means the n-type semiconductor have extra electrons and the electrons act as the majority charge carriers. It is used when negative charge flow is required. In N-type the electrons carry current.

P-type: this is formed by doping silicon with atoms ~~that~~ lack one electron (acceptor atoms). this creates holes (absence of electrons) that act as positive charge carriers. these missing electrons create holes, P-type contain an excess of holes. Holes are the majority carriers and move to conduct currents.

Both are joined to form a p-n junction, which create a depletion region that acts as a barrier to current.

② A ~~voltage~~ diode operates by applying external voltage accross the p-n junction.

Forward Bias occurs when voltage is applied in the same polarity as the P and n materials, the depletion region narrows allowing electrons and holes to cross the junction, current flows easily and a silicon diode typically conduct above 0.7V. This results in a high current flow (Diode ON)

Reverse Bias: In this case voltage is applied in the opposite polarity to the P-n junction, the depletion region widen blocking charge movement. The result is almost no current flows (except very small leakage) (Diode OFF)

③ An ideal device is a theoretical model ~~that~~ behaves perfectly with no losses or imperfections, for example an ideal diode would conduct perfectly with zero resistance in forward bias and/or block all currents in reverse bias

④ Thermal voltage = 25°C

ⓐ formula $V_T = KT/q$

$K = 1.38 \times 10^{-23}$ J/K

$q = 1.6 \times 10^{-19}$ C

$T_K = T_c + 273$

$= 25 + 273$

$= 298K$

$$V_t = \frac{1.38 \times 10^{-23} \times 298}{1.6 \times 10^{-19}}$$

$V_t = 0.0257V \simeq 26mV$

ⓑ $I_s = 40nA = 40 \times 10^{-9}$

$n = 2$

$V_d = 0.5V$

$V_T = 0.0275V$

$I_D = I_s(e^{V_d/nV_T} - 1)$

$nV_T = 2 \times 0.0257 = 0.0514$

$$\frac{V_d}{nV_T} = \frac{0.5}{0.0514} = 9.73$$

$I_D = 40 \times 10^{-9}(e^{9.73} - 1)$

$I_D = 40 \times 10^{-9} \times 16800$

$I_D = 0.000672A \simeq 0.672 mA$