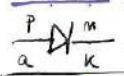
Díode



$V_\gamma = V_p - V_m$

(obert) P.I → $I = 0$

P.D (cable) → $I = \frac{\mathcal{E} - V_\gamma}{R}$; $P_{cons} = V_\gamma \cdot I$

Zèner

P.D → $V_{ACT} < V_z \quad I = 0$

P.I → $V_{ACT} \geq V_z \quad I = \frac{\mathcal{E} - V_z}{R}$

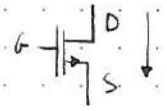
$V_{ACT} = \frac{V_{in} \cdot R_{carr}}{R + R_{carr}}$

Condensador

$Q = \Delta V \cdot C$

$E = \frac{1}{2} \cdot C \cdot \Delta V^2$

NMOS



if ($V_{GS} < V_T$) → TALL [$I_D = 0$]

else if ($V_{DS} \leq V_{GT}$) → ÒHMICA [$I_D = \beta (V_{GT} V_{DS} - \frac{1}{2} V_{DS}^2)$]

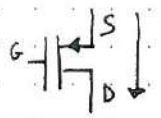
else if ($V_{DS} \geq V_{GT}$) → SATURACIÓ [$I_D = \frac{1}{2} \cdot \beta \cdot V_{GT}^2$]

if ($V_G = 5V$) → ON

else → OFF

NOR → Par. NAND → Se.

PMOS



if ($V_{GS} \geq V_T$) → TALL [$I_D = 0$]

else if ($V_{DS} \leq V_{GT}$) → SATURACIÓ [$I_D = \frac{1}{2} \cdot \beta \cdot V_{GT}^2$]

else if ($V_{DS} \geq V_{GT}$) → ÒHMICA [$I_D = \beta (V_{GT} V_{DS} - \frac{1}{2} V_{DS}^2)$]

if ($V_G = 5V$) → OFF

else → ON

NOR → Se. NAND → Par.

CMOS

if ($V_{in} = 0V$) $V_{GS}^N \leq V_T \Rightarrow$ NMOS TALL

$V_{SG} = V_{SS} \Rightarrow$ PMOS ÒHMICA

→ $V_{out} = V_{SS}$

if ($V_{in} = 5V$) $V_{GS}^N = V_{SS} \Rightarrow$ NMOS ÒHMICA

$V_{SG} = 0 \Rightarrow$ PMOS TALL

→ $V_{out} = 0V$

Temps Propagació

$t_{pHL} = \frac{1'7C}{\beta_n \cdot V_{DD}}$

$t_{pLH} = \frac{1'7C}{\beta_p \cdot V_{DD}}$

$t_p = \frac{t_{pLH} + t_{pHL}}{2}$

Altres

$r_{DS} = \frac{V_{DS}}{I_D}$

Harmòniques

$\Psi(x,t) = A \cdot \sin(\kappa x \pm \omega t + \varphi)$

$\Psi(x,t) = A \cdot \sin\left[2\pi\left(\left(\frac{x}{\lambda}\right) - \left(\frac{t}{T}\right)\right)\right]$

$\Psi(x,t) = A \cdot \sin\left[2\pi \frac{x}{\lambda} - 2\pi \frac{V}{\lambda} t\right]$

$\kappa = \frac{2\pi}{\lambda}$

$vel \cdot T = \lambda$; $\lambda = \frac{vel}{f}$

$f = \frac{1}{T}$

$\omega = 2\pi f = \frac{2\pi}{T}$; $Vel_{max} = A \cdot \omega$

Dist. Mín

$\Delta\varphi = 2\pi \frac{\Delta x}{\lambda}$

$\Delta x = \frac{\Delta\varphi}{\kappa}$

Dif. fase t

$\Delta\varphi = \omega \cdot \Delta t$

$\kappa \downarrow \; f \downarrow \; \lambda \uparrow$; $\lambda \downarrow \; f \uparrow \; \kappa \uparrow$

Electromagnètiques

$\vec{E}(x,t) = E_0 \cdot \sin(\kappa x \pm \omega t + \varphi)$ [V/m]

$\vec{B}(x,t) = B_0 \cdot \sin(\kappa x \pm \omega t + \varphi)$ [T]

$E_f = \frac{E_0}{\sqrt{2}}$; $B_f = \frac{B_0}{\sqrt{2}}$

$E_0 = \sqrt{\frac{2\mu_0 \cdot c \cdot P_c}{4\pi \cdot r^2}}$

$E_0 = B_0 \cdot c$

Relacions

$I_2 = I_1 \cdot \left(\frac{r_1}{r_2}\right)^2$

$E_2 = E_1 \left(\frac{r_1}{r_2}\right)$

Geometria

Sup. Esf. $= 4\pi r^2$

Sp. Cercle $= \pi \cdot r^2$

Long. Cercle $= 2\pi r$

$\sin(\alpha) = \frac{O_p}{H}$

$\cos(\alpha) = \frac{Ad}{H}$

$tg(\alpha) = \frac{O_p}{Ad}$

$\sin(\alpha) = \cos\left(\alpha - \frac{\pi}{2}\right)$

$\cos(\alpha) = \sin\left(\alpha + \frac{\pi}{2}\right)$

Esfèriques

$$I = \frac{P}{4\pi \cdot r^2}$$

$$I = \frac{1}{2} \cdot \varepsilon_0 \cdot E_0^2 \cdot c$$

$$I = \frac{B_0^2 \cdot c}{2\mu_0}$$

$$P = I \cdot S_{\perp}$$

$$P = \frac{E}{t}$$

$$dist = c \cdot \Delta t = r$$

Polaritzador

$$I_0 = \frac{I_{NAT}}{2}$$

$$I_N = I_0 \cdot \cos^{2N}\left(\frac{90}{N}\right)$$

$$I_1 = I_0 \cdot \cos^2(\theta)$$

Làser

$$E_{foto} = h \cdot f = \frac{h \cdot c}{\lambda}$$

$$E_{tot} = N \cdot E_{foto} = \frac{N \cdot hc}{\lambda}$$

$$N = num \cdot temps$$

$$\Delta t = \frac{Long}{c}$$

$$num = \frac{P}{E}$$

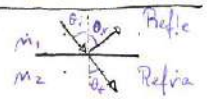
Reflexió

$$n = \frac{c}{vel}$$

$$\lambda = \frac{c}{f} = \frac{\lambda_0}{n}$$

$$n_1 \cdot \sin(\theta_i) = n_2 \cdot \sin(\theta_t)$$

$$\theta_i = \theta_r$$



$$\theta_{crit} = \arcsin\left(\frac{n_2}{n_1}\right)$$

$$n_1 \cdot \sin(\theta_{crit}) = n_2$$

Interferències

$$\vec{E}(x,t) = 2E_0 \cdot \cos\left[\frac{k(x_2 - x_1) + (\varphi_2 - \varphi_1)}{2}\right]$$

$$\Delta\phi = k(x_2 - x_1) + (\varphi_2 - \varphi_1)$$

$$\Delta\phi = \frac{2\pi \Delta x}{\lambda} + \varphi = \frac{2\pi m \cdot \Delta x}{\lambda_0} + \Delta\varphi$$

$$I = 2I_0(1 + \cos(\Delta\phi))$$

Const → $\Delta x = m\lambda$ ↑↑

Dest → $\Delta x = (m + \frac{1}{2})\lambda$ ↑↓

DVD

$$d = \frac{\lambda}{4}$$

Exp. Pfund

$$\sin(\theta_c) = \frac{r}{\sqrt{r^2 + q^2}}$$

Exp. Young

$$d = \frac{1}{n^o lin}$$

$$d = \frac{\lambda \cdot \sqrt{\Delta x^2 + D^2}}{\Delta x}$$

$$y = \frac{m\lambda \cdot D}{d}$$ (dist. entre max)

$$x = \frac{\lambda \cdot D}{d}$$ Esp. max.

$$\sin(\phi) = \frac{y}{D}$$

$$d \cdot \sin(\phi) = m\lambda$$