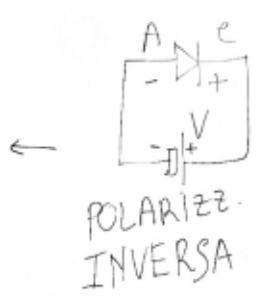
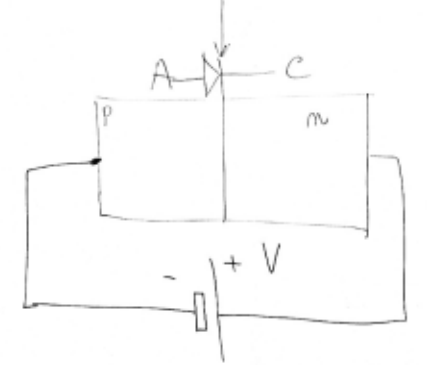
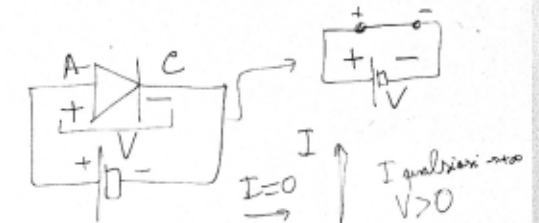


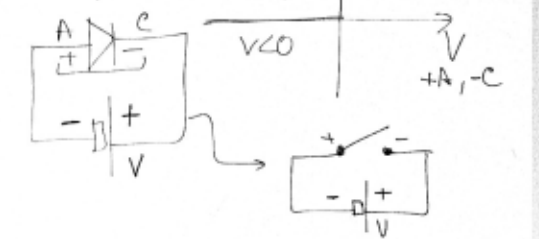
$V_0 \approx 0.5 \div 0.8 V$
 Differenza di
 Potenziale di
 CONTATTO

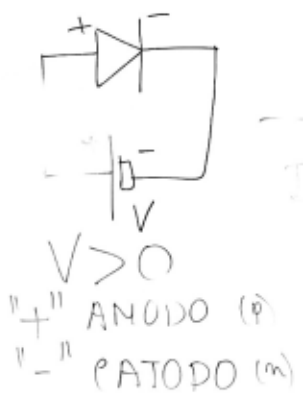
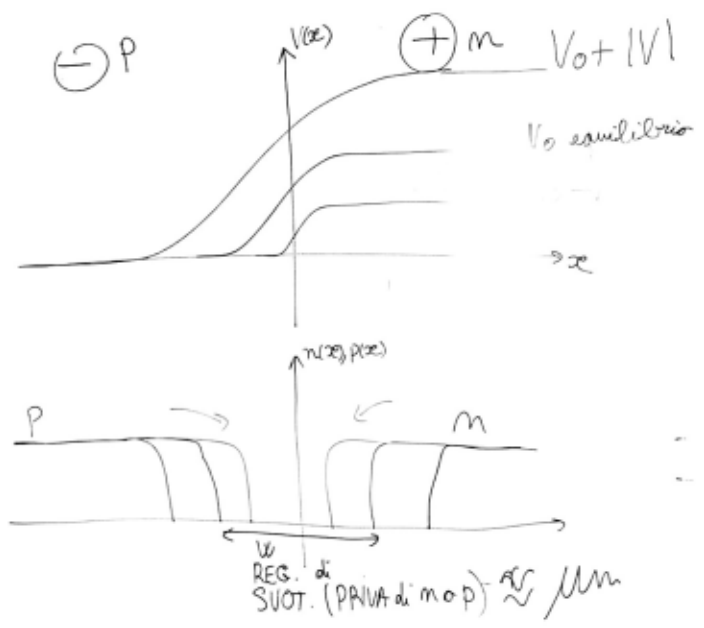


POL. DIRETTA

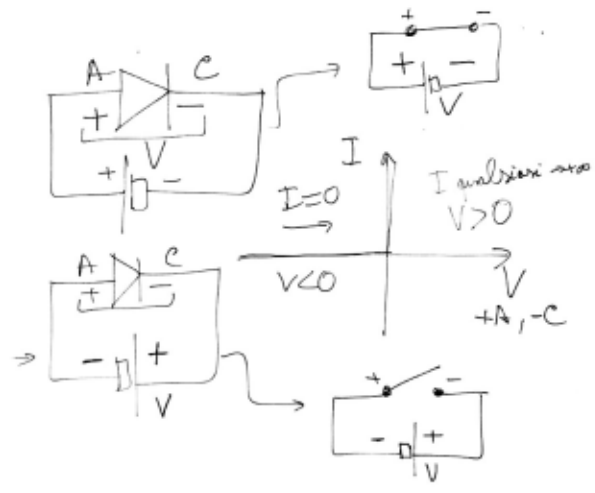


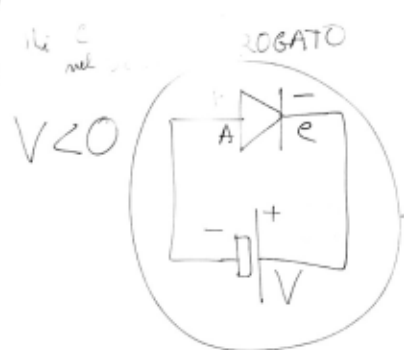
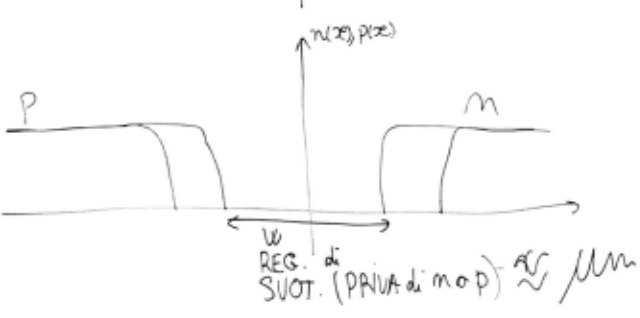
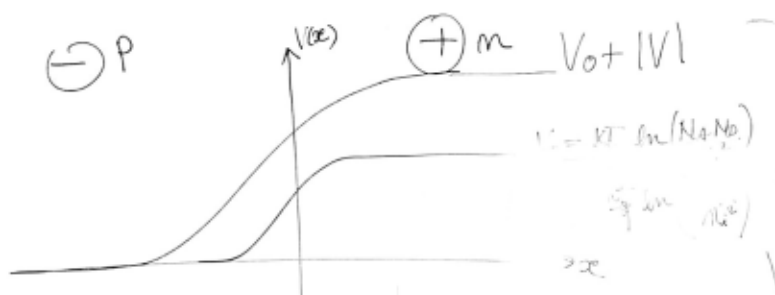
POL. INVERSA



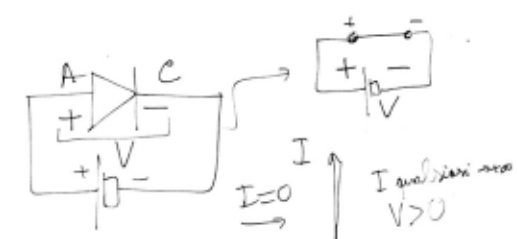


POL. DIRETTA
 DIRETTA
 $V > 0$
 I GRANDE RISPETTO I_0
 POL. INVERSA
 $V < 0$



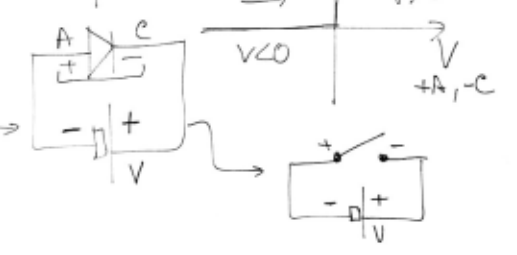


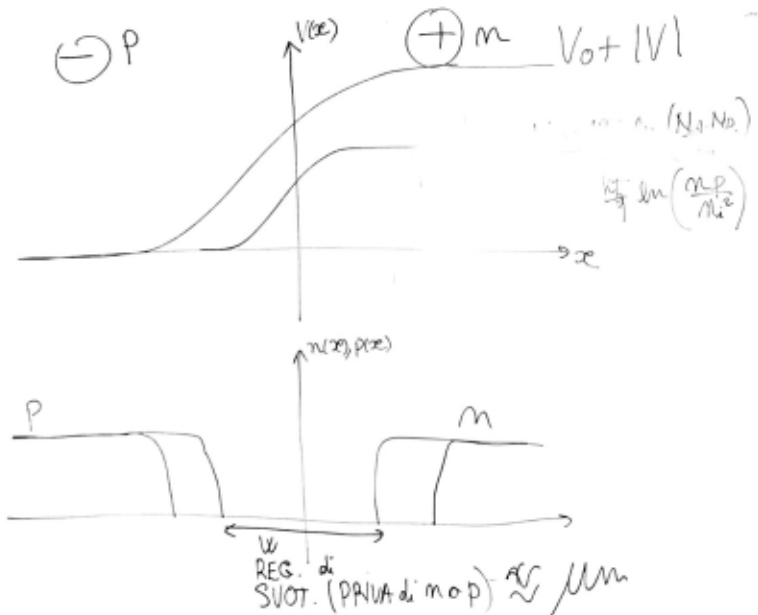
POL. DIRETTA



POL. INVERSA

$I = \emptyset$
 I PICCOLA
 $V < 0$

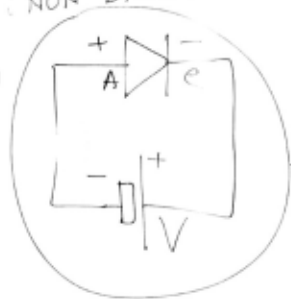




$\ln\left(\frac{N_D N_A}{n_i^2}\right)$

di p e n
NON DROGATO

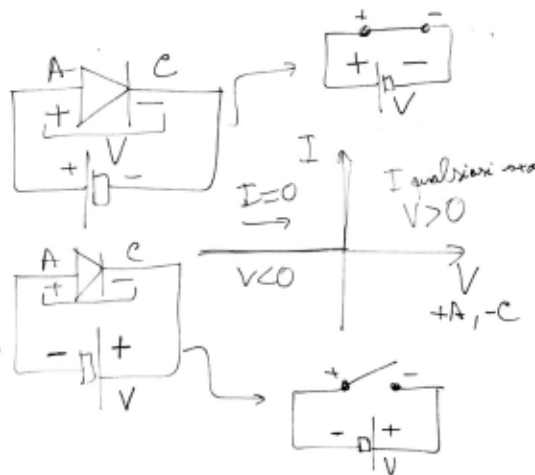
$V < 0$



POL. DIRETTA

POL. INVERSA

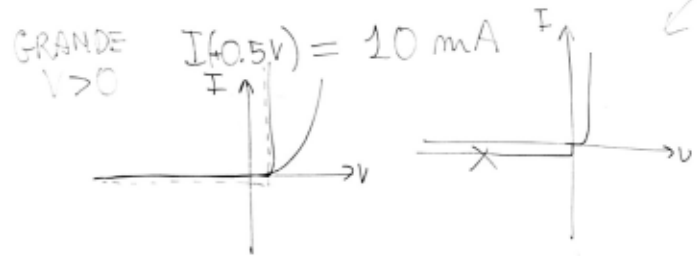
$I = \phi$
 I PICCOLA
 $V < 0$



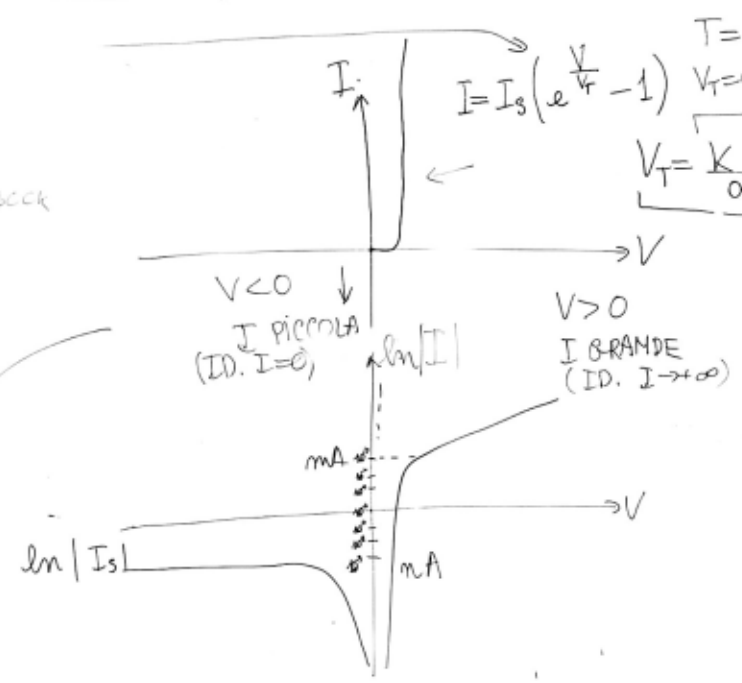
$V > 0 \quad I = I_s e^{\frac{V}{V_T}} \quad (-1 \text{ TRASE.})$

$V < 0 \quad I = -I_s$

PICCOLA $V < 0$
 $I_s = 10 \text{ mA}$
 ↳ DROGGAGGIO P, n, T, Area

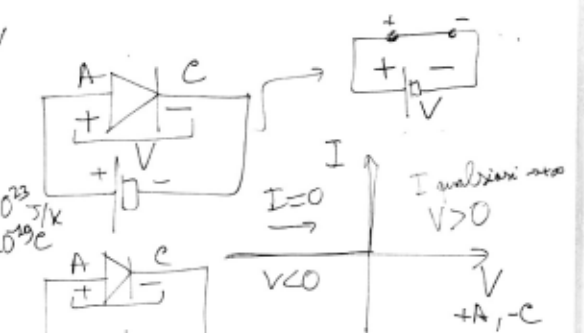


$I = -I_s$
 ... 300K
 ... 0.1V



$I = I_s (e^{\frac{V}{V_T}} - 1)$
 $T = 300 \text{ K}$
 $V_T = 0.02585 \text{ V}$
 $V_T = \frac{kT}{q}$

$k = 1.38 \times 10^{-23} \text{ J/K}$
 $q = 1.602 \times 10^{-19} \text{ C}$



IDEALE $\begin{cases} V > 0, I \rightarrow +\infty \\ V < 0, I = 0 \end{cases}$

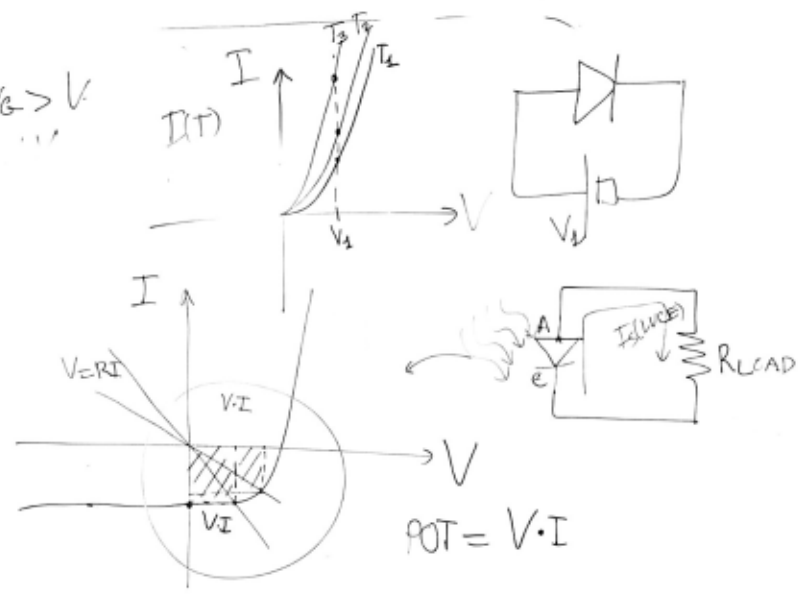
REALE $\begin{cases} V > 0 \rightarrow I = I_s e^{\frac{V}{V_T}} \quad (-1 \text{ TRASE.}) \\ V < 0 \rightarrow I = -I_s \quad (e^{-\frac{|V|}{V_T}} \ll 1) \\ I \approx I_s (0 - 1) \end{cases}$

I_s PICCOLA

$$I = I_s \left(e^{\frac{V}{V_T}} - 1 \right)$$

$I_s (n, p, S, T)$
 $I_s \propto L \rightarrow$ LUCE
 $I_s \propto e^{-\frac{V_g}{V_T}}$ $V_g > V$
 $I_s \propto S$
 $I_s \propto T^3$

I_s AUMENTA con LUCE

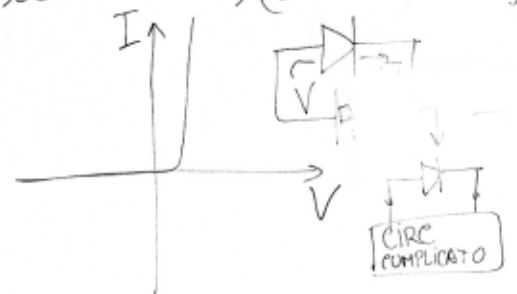


$k = 1.38 \times 10^{-23} \text{ J/K}$
 $q = 1.601 \times 10^{-19} \text{ C}$

IDEALE $\begin{cases} V > 0, I \rightarrow +\infty \\ V < 0, I = 0 \end{cases}$
REALE $\begin{cases} V > 0 \rightarrow I = I_s e^{\frac{V}{V_T}} - 1 \text{ (TRASE?)} \\ V < 0 \rightarrow I = -I_s \left(e^{-\frac{V}{V_T}} - 1 \right) \end{cases}$
 I_s PICCOLA

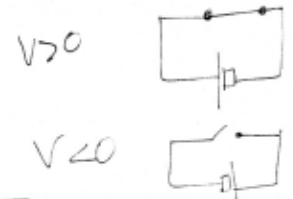
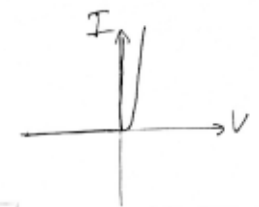
$T = 300K$

$I = I_s (e^{\frac{V}{V_T}} - 1)$

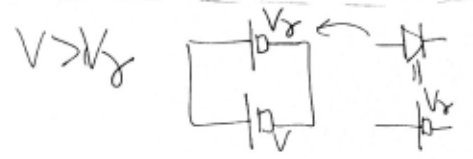
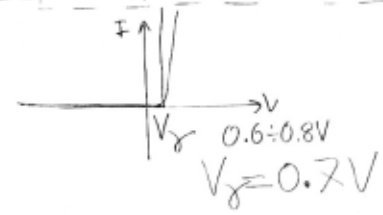


MODELLI - CIRCUITALI
PER GRANDI SEGNALI

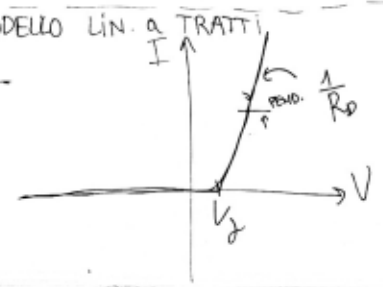
MODELLI IDEALE



MODELLO V_T

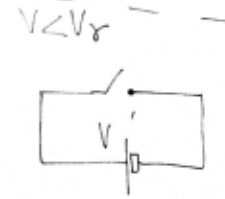
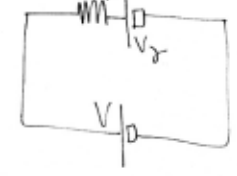


MODELLO LIN. a TRATTI



$R_D \approx 1-10\Omega$

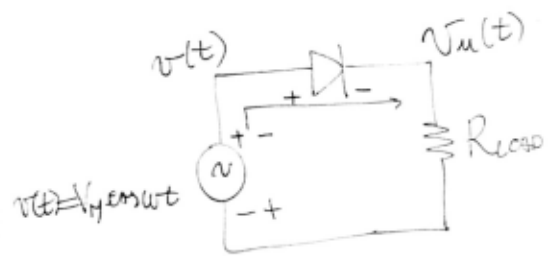
$V > V_T$



$V = RI$

$V = L \frac{dI}{dt}$
 \downarrow
 $V = L j\omega I$

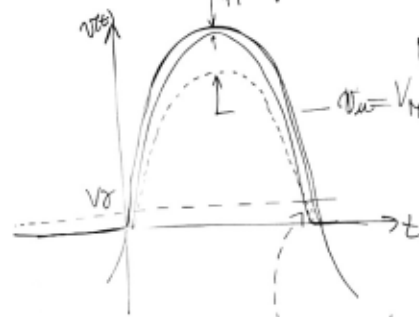
$V = \frac{1}{C} \int i(t) dt$
 \downarrow
 $V = \frac{1}{j\omega C} I$



→ SPICE
 μ-SPICE, CADENCE
 LT SPICE



MODELLO IDEALE



MODELLO V_D

MODELLO V_D, R_D

VARIA con $I(t)$

