# ADC resolution

0 - 5 V reference voltage

1 mV sensitivity

resolution?

8 bits

□□□...□

$2^8$

$$\frac{5V}{1mV} = \frac{2^N}{1}$$

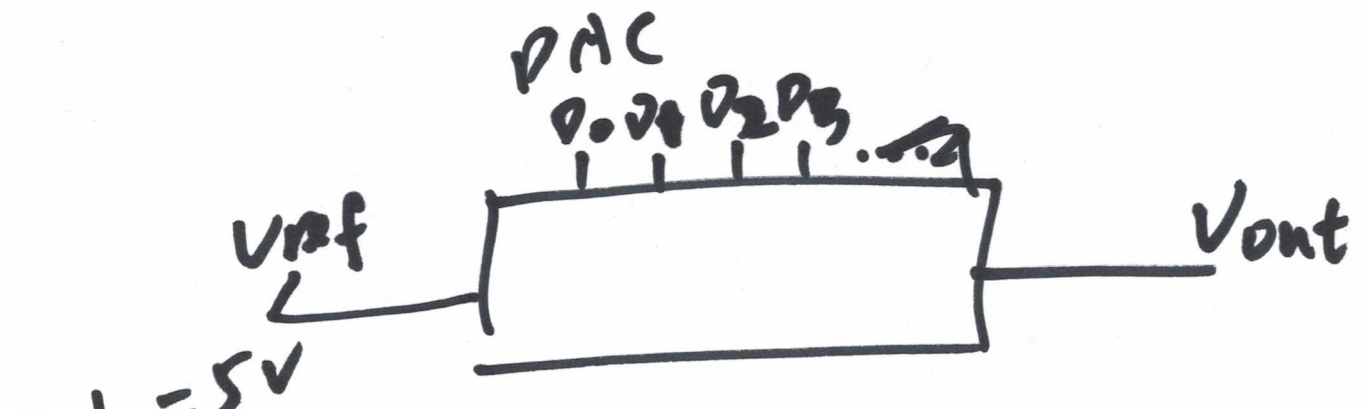
$$2^N = 5000$$

$$\log_2 2^N = \log_2 5000$$

$$N = 12.288$$

$$\approx 13$$

①




$$V_{FS} = V_{DD}\left(\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}\right) = V_{DD}\cdot\frac{15}{16}$$

Full-scale $\quad \frac{8}{16} \quad \frac{4}{16} \quad \frac{2}{16} \quad \frac{1}{16}$

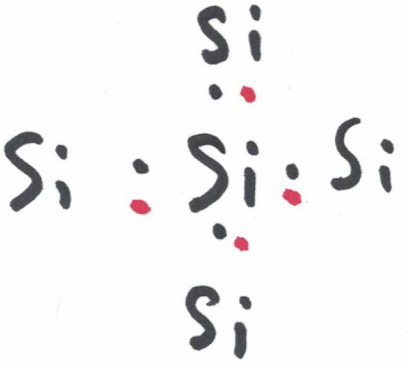
$\frac{1\cdot V_{DD}}{16}$ = LSB

$$\frac{V_{DD}}{2^N}\cdot\left(\frac{2^N-1}{2^N}\right)$$

$$\boxed{V_{FS} = \frac{V_{DD}}{2^N}\cdot\left(2^N-1\right)}$$

# phosphorus

Dope

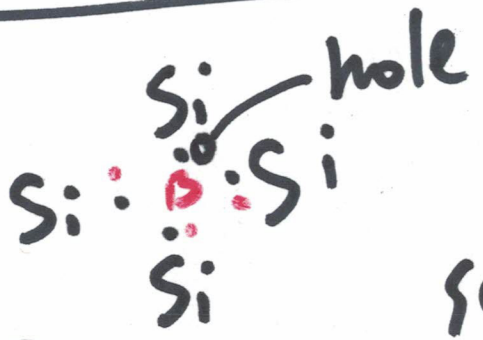



P: 5 free electrons

covalent Bond

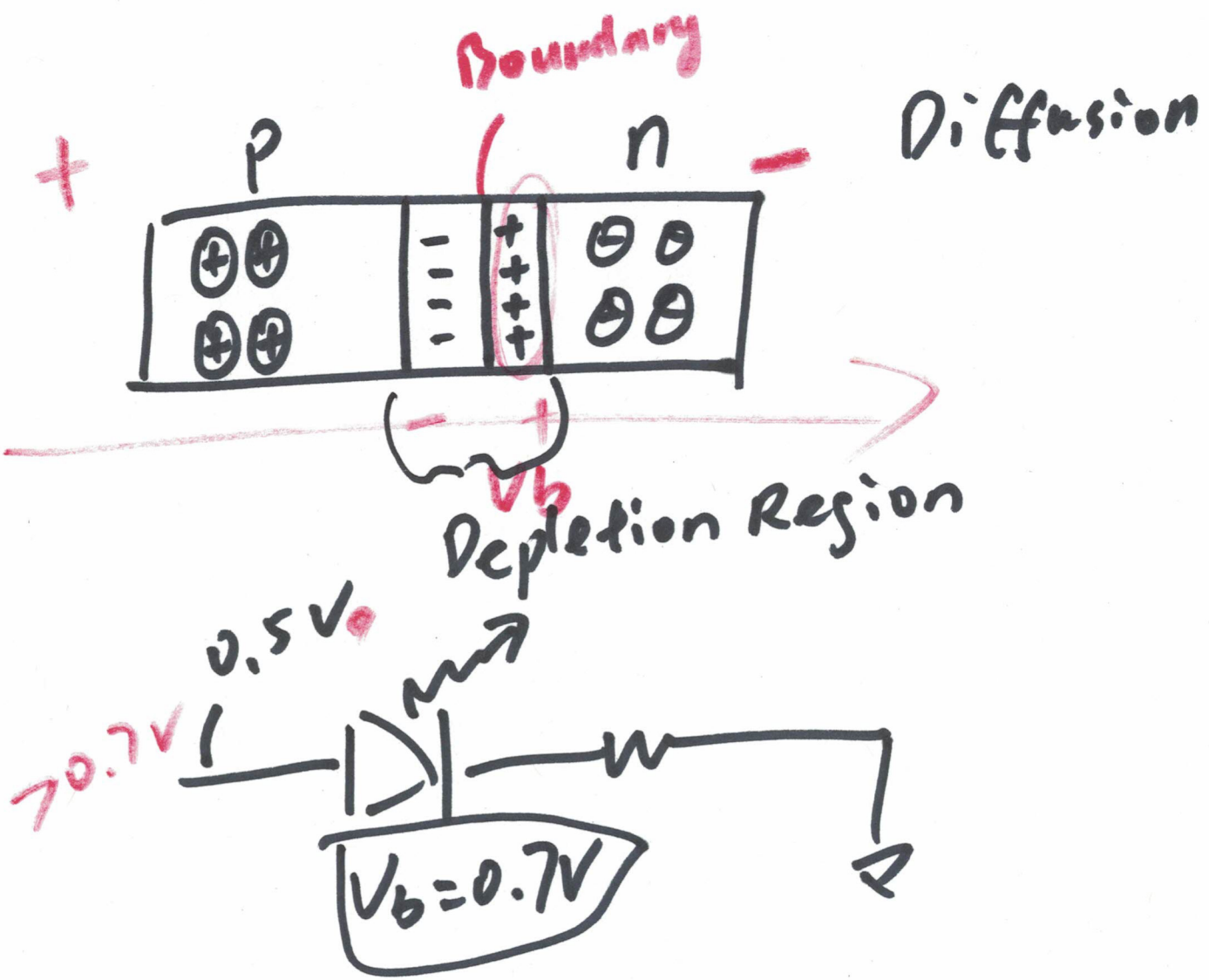
n-type semiconductor

# Boron

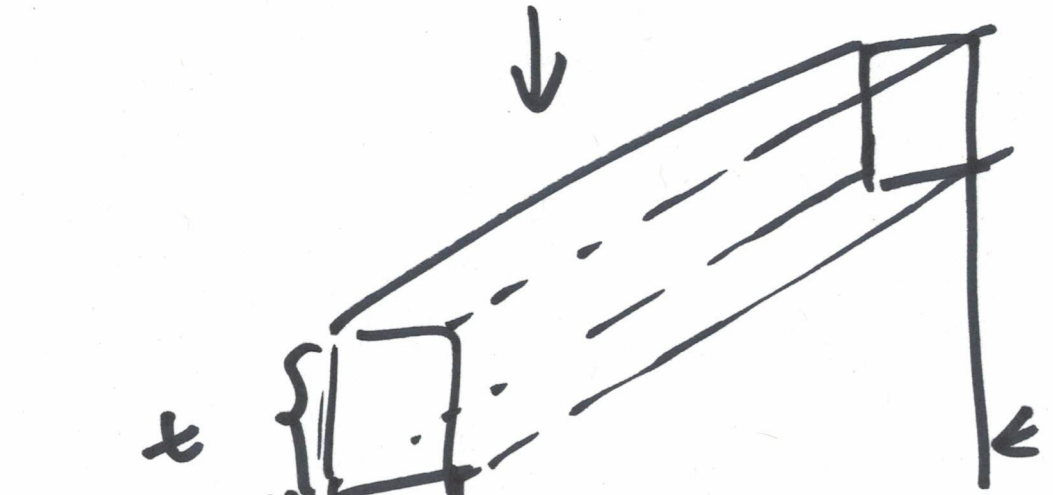



p-type semiconductor

B : 3 free electrons




sheet resistance




How many squares.

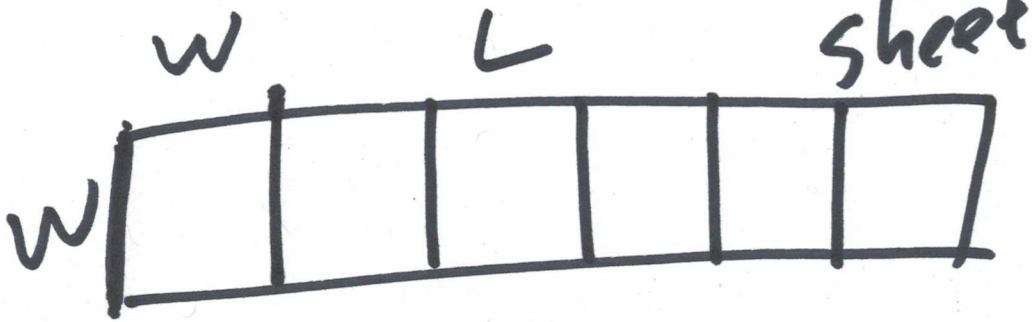
$$R = \rho \frac{L}{t \cdot w} = \frac{\rho}{t} \cdot \frac{L}{w}$$

$\frac{L}{w}$ = 1 square(s)

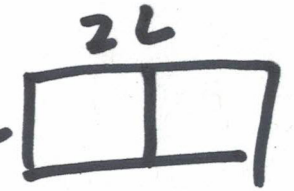
$\frac{\rho}{t}$ = sheet resistance

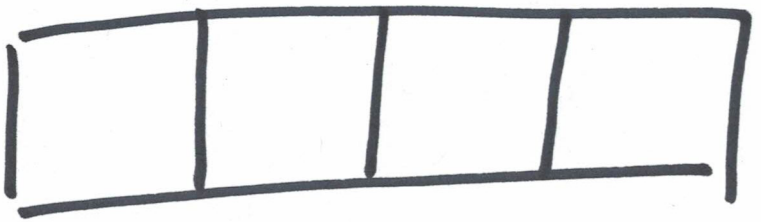
$\frac{\rho}{t}$ = 800 Ω/□

$\frac{L}{w}$ = 1.6 KΩ

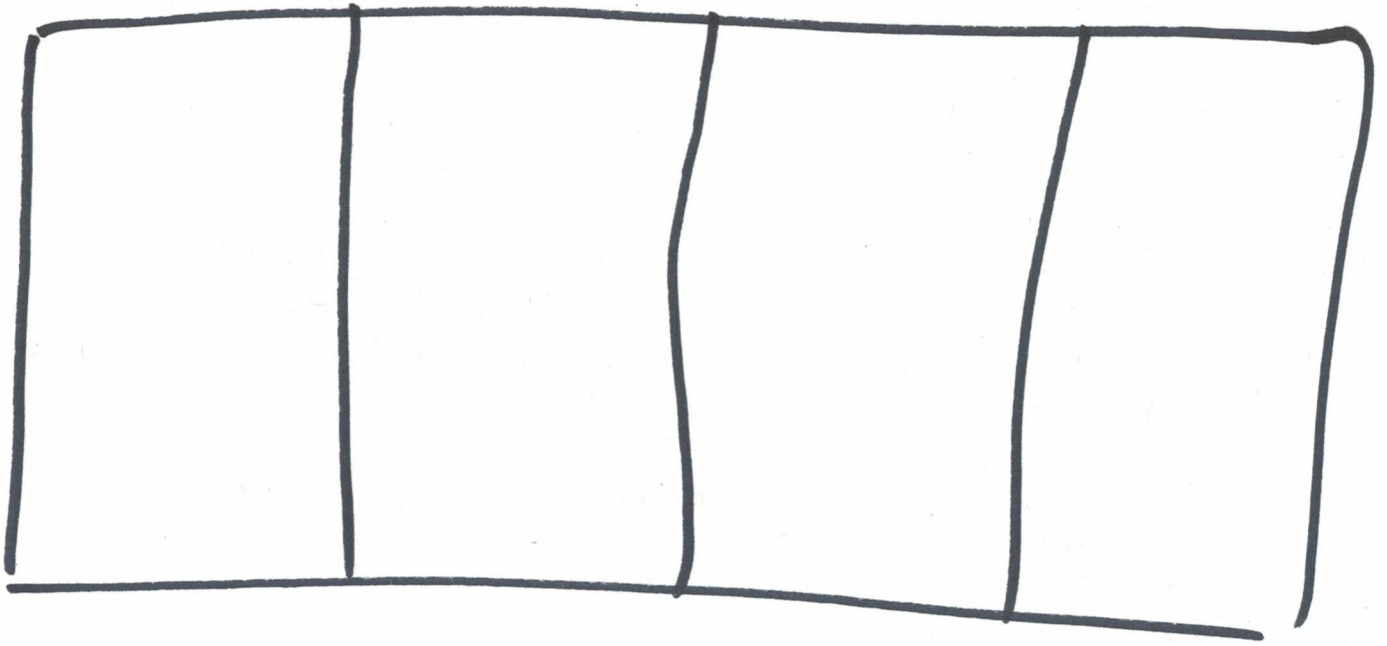



Top view





$R_1$?



$R_2$?

800Ω/□ × 4 = 3.2KΩ