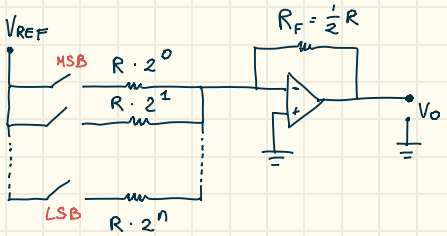
# DAC A RESISTORI PESATI




$$V_o = \sum_{i=0}^{n} V_{Ref} \cdot \left(-\frac{R_F}{R_i}\right)$$

$$R_i \triangleq R \cdot 2^i$$

$$V_o = -\frac{R_F}{R \cdot 2^0} \cdot V_{Ref} \cdot d_0 - \frac{R_F}{R \cdot 2^1} V_{Ref} \cdot d_1 - \dots - \frac{R_F}{R \cdot 2^{N-2}} V_{Ref} \cdot d_{N-2} - \frac{R_F}{R \cdot 2^{N-1}} V_{Ref} \cdot d_{N-1}$$

$$= -\frac{\frac{R}{2}}{R \cdot 2^i} = -\frac{1}{2 \cdot 2^i} = -\frac{1}{2^{i+1}}$$

$$= -\frac{d_1}{2^1} V_{Ref} - \frac{d_2}{2^2} V_{Ref} - \dots - \frac{d_N}{2^N} V_{Ref} = V_{Ref} \cdot \sum_{i=1}^{N} -\frac{d_i}{2^i} = V_{Ref} \cdot \text{ValoreDigitale}$$

# OPAM DIFFERENZIALE

Esempio ho 4 bit 1000 ⇝ 8 V.N.

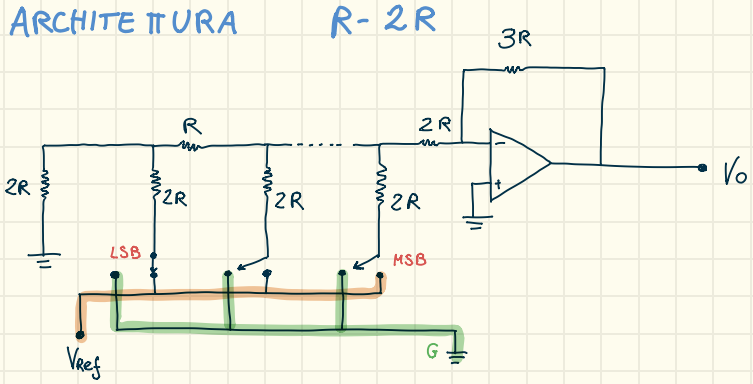
$$V_o = V_{Ref} \cdot \sum_{i=1}^{N} \frac{d_0}{2^i} = V_{Ref} \cdot \frac{1}{2^1} = \frac{V_{Ref}}{2}$$

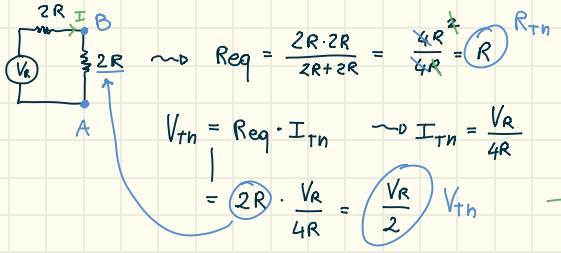
Il primo bit vale la metà del fondoscala

ho 0001 ⇝ $V_o = V_{Ref} \cdot \frac{1}{2^4} = \frac{V_{Ref}}{16}$

ho 0100 ⇝ $V_o = V_{Ref} \cdot \frac{1}{2^2} = \frac{V_{Ref}}{4}$

# ARCHITETTURA R-2R



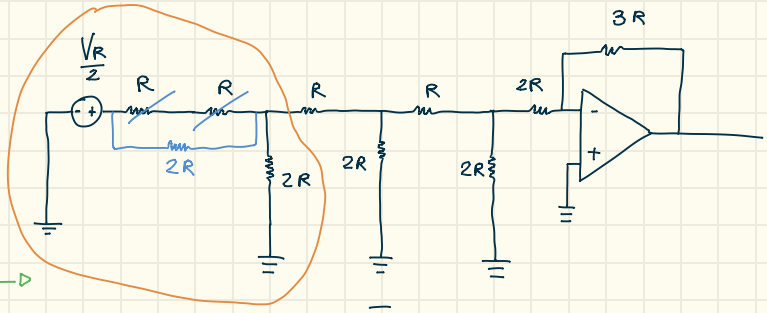

$$R_{eq} = \frac{2R \cdot 2R}{2R + 2R} = \frac{4R^2}{4R} = R \quad \Rightarrow R_{Th}$$

$$V_{Th} = R_{eq} \cdot I_{Th} \quad \rightsquigarrow I_{Th} = \frac{V_R}{4R}$$

$$= 2R \cdot \frac{V_R}{4R} = \frac{V_R}{2} \quad \Rightarrow V_{Th}$$

Supponiamo in input di MSB 0001 LSB

⇝ Ci aspettiamo un out di $\frac{V_{Ref}}{16}$




$$\Rightarrow V''_{Th} = \frac{V}{2}, \quad R''_{Th} = R$$

$$\Rightarrow V''_{Th} = \frac{V_{Ref}}{2 \cdot 2} = \frac{V_{Ref}}{4}, \quad R''_{th} = R$$

$$\rightsquigarrow V'''_{Th} = \frac{V_{Ref}}{4 \cdot 2} = \frac{V_{Ref}}{8}, \quad R'''_{Th} = R$$

$$\rightsquigarrow V''''_{Th} = \frac{V_{Ref}}{8 \cdot 2} = \frac{V_{Ref}}{16}, \quad R''''_{Th} = R$$

0001 QED