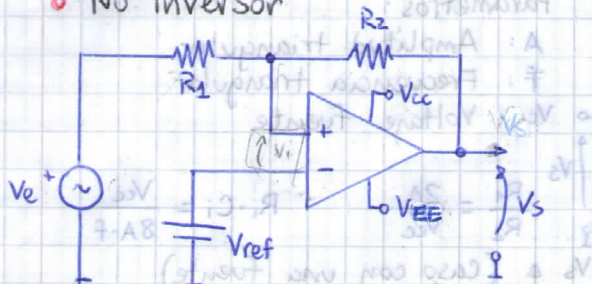


\* Apéndice: Bloques útiles. (Negro: Análisis, Azul: Diseño)

\* Schmitt Trigger:

o No inverting



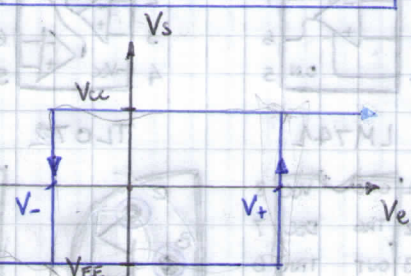
$$R = \frac{R_1}{R_2}$$

$$V_+ = V_{ref} \cdot (1+R) - V_{EE} \cdot R$$

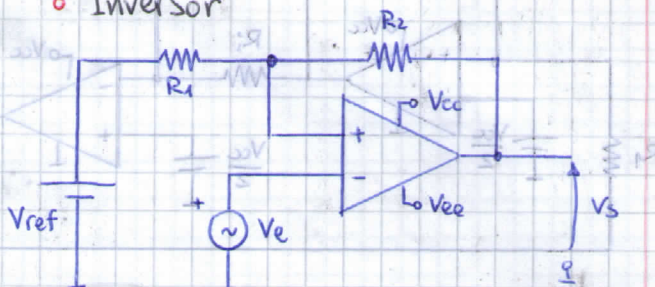
$$V_- = V_{ref} \cdot (1+R) - V_{CC} \cdot R$$

$$R = \frac{R_1}{R_2} = \frac{V_+ - V_-}{V_{CC} - V_{EE}}$$

$$V_{ref} = \frac{V_+ + V_{EE} \cdot R}{1+R} = \frac{V_- + V_{CC} \cdot R}{1+R}$$



o Inverting



$$V_+ = V_{ref} (1-k) + k \cdot V_{CC}$$

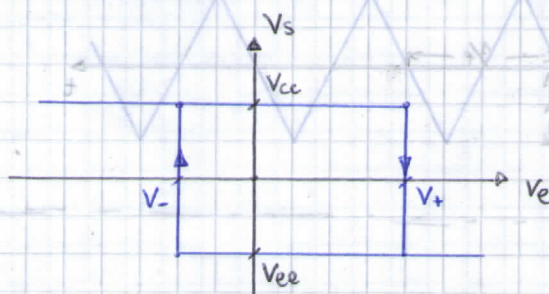
$$k = \frac{R_1}{R_1 + R_2}$$

$$V_- = V_{ref} (1-k) + k \cdot V_{EE}$$

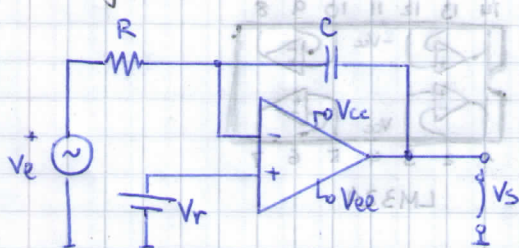
$$\frac{1}{R} = \frac{R_2}{R_1} = \frac{V_{CC} - V_{EE}}{V_+ - V_-} - 1$$

$$R = \frac{R_1}{R_2}$$

$$V_{ref} = V_+ (R+1) - R \cdot V_{CC} = V_- (R+1) - R \cdot V_{EE}$$

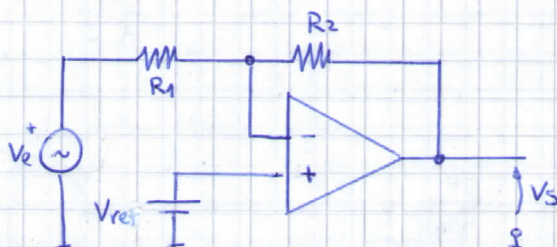


\* Integrador



$$V_s = V_r - \frac{1}{RC} \int_0^t (V_e - V_r) dt$$

\* Amplificador inverting



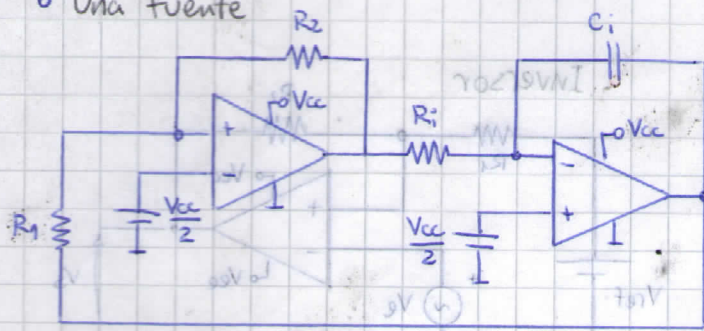
$$V_s = \left( \frac{R_2}{R_1} + 1 \right) V_r - \frac{R_2}{R_1} V_e$$

$$A = \frac{R_2}{R_1}$$



# \* Oscilador triangular

## Una Fuente



## Parámetros:

A: Amplitud triangular

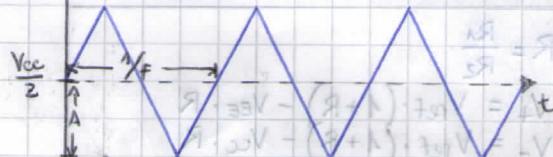
f: Frecuencia triangular

Vcc: Voltaje fuente

$$\frac{R_1}{R_2} = \frac{2A}{V_{cc}}$$

$$R_i \cdot C_i = \frac{V_{cc}}{8A \cdot f}$$

Vs (caso con una fuente)

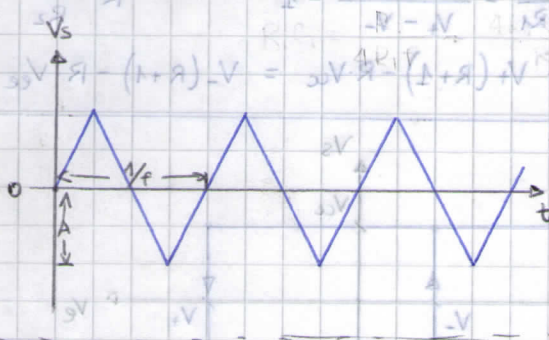


## Fuente simétrica

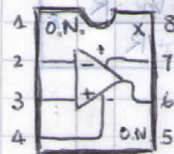
Se reemplazan las fuentes de  $\frac{V_{cc}}{2}$  por conexiones a tierra.

$$\frac{R_1}{R_2} = \frac{A}{V_{cc}}$$

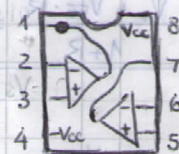
$$R_i \cdot C_i = \frac{V_{cc}}{4A \cdot f}$$



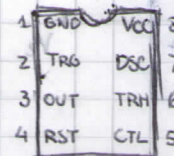
## \* Componentes:



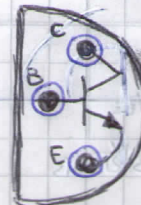
LM741



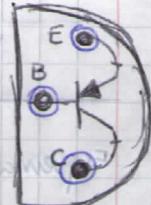
TL072



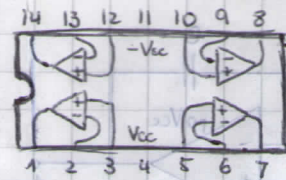
NE555



2N2222



2N3906



LM324

$$\frac{V_{cc}}{2} = A$$

$$V_{cc} \cdot \frac{R_1}{R_2} = 2V \left( 1 + \frac{R_1}{R_2} \right) = 2V$$

(1/2)