Universidad
Politécnica
de Cartagena

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Universidad Politécnica de Cartagena

507102009 Diseño y Simulación Electrónica

Desarrollo de la asignatura 2

Objetivo

Amplificador de audio para casa

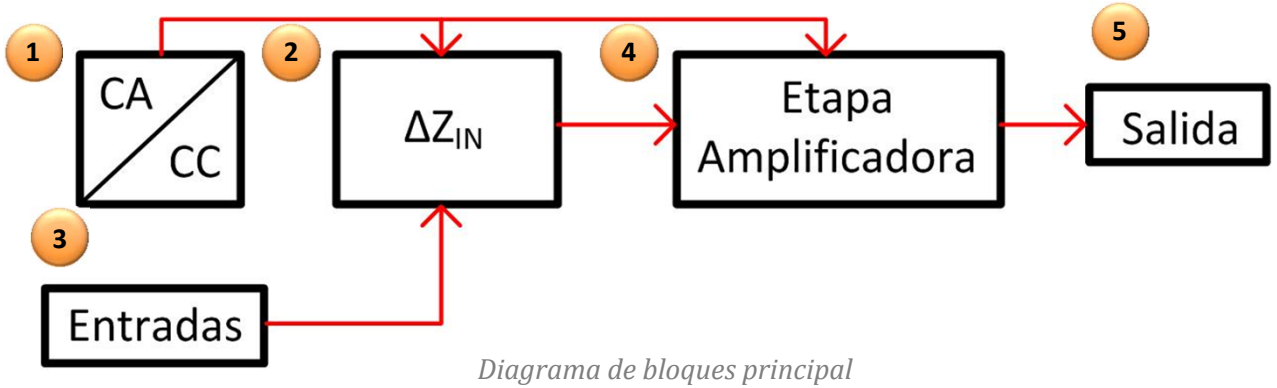


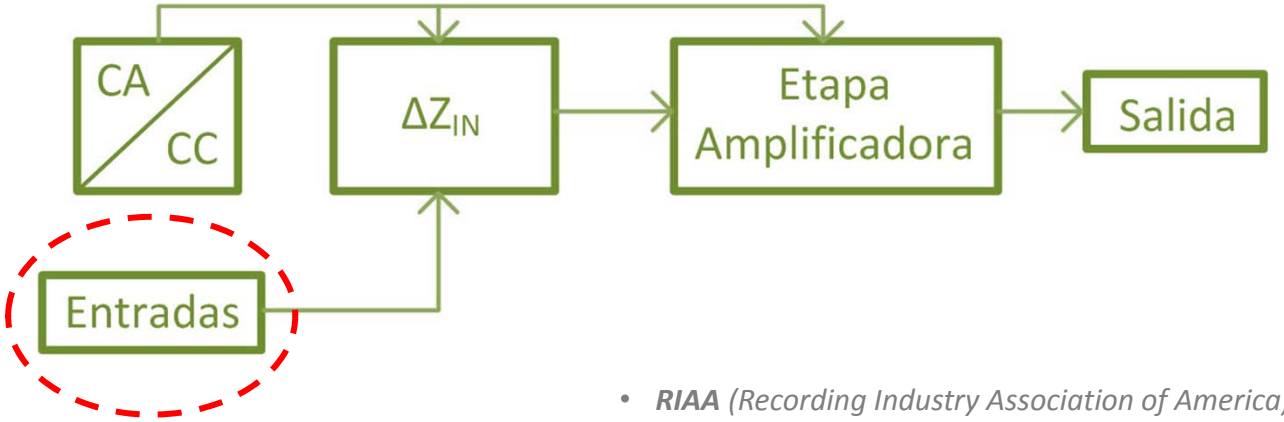
Diagrama de bloques principal

Especificaciones:

- Conexión a la red eléctrica $220V_{ef}$.
- Admita varios tipos de entrada de señal
- Conectable a Baffle (caja acústica) de 3 vías.
- Mejoras, ampliaciones, etc.

3 Entradas de señal al amplificador

a)	MP3	- Auriculares @ 32Ω
b)	Pletina Cassette	- 0.46V @ 1KΩ
c)	Lector de CD	- $0.5V_{RMS}$ @ 600Ω
d)	Ordenador PC	- Altavoces @ 4-8Ω
e)	Teléfono móvil	- Auriculares @ 32Ω
f)	Antiguo giradiscos	- R.I.I.A. 5.6mV @ 50KΩ
g)	Micrófono	- 1-3mV @ 300Ω
h)	Etc…	- Impedancia nominal 600Ω



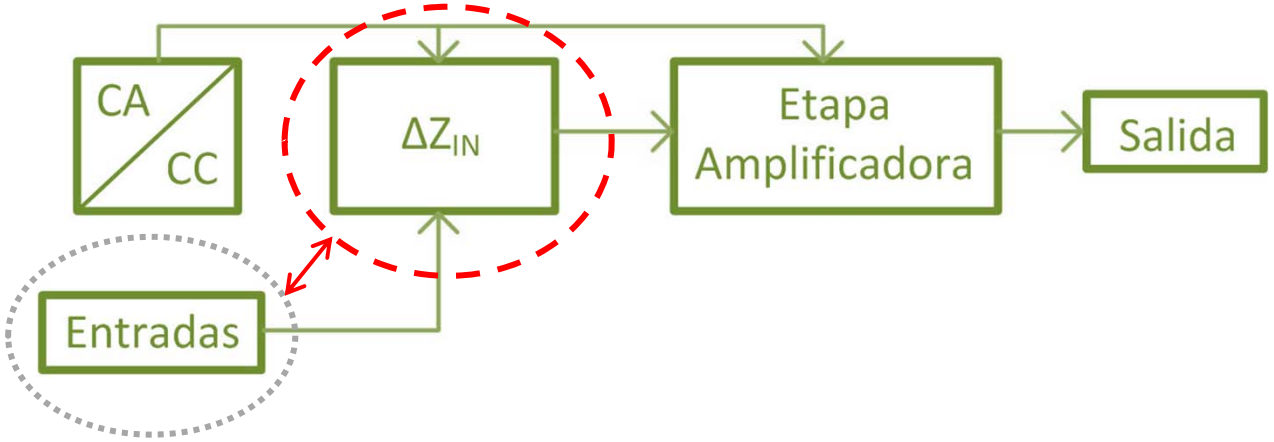
Impedancia de salida
Elementos que ofrecen señal

- ***RIAA*** *(Recording Industry Association of America) standards included the RIAA equalization curve, the format of the stereophonic record groove and the dimensions of 33 1/3 rpm, 45 rpm, and 78 rpm records.*
- ***SGAE*** *(Sociedad General de Autores y Editores).*

2 ΔZ_{IN}: Adaptador de impedancia

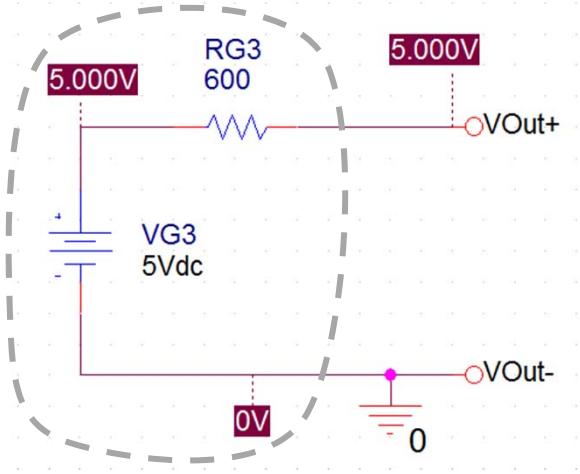
a) MP3
b) Pletina Cassette
c) Lector de CD
d) …

- *Entrada Gral.:* *0.5-1.2V @ 24-47KΩ*
- *Auxiliar:* *125mV @ 47KΩ*
- *Micrófono:* *0.3-15mV @ 1.1KΩ*



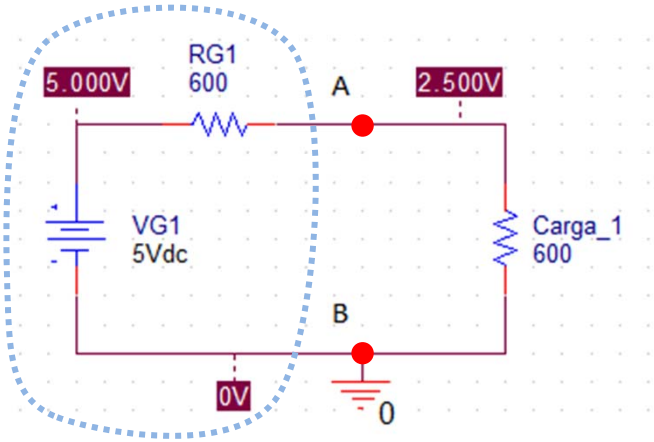
Impedancia de entrada
Amplificador de audio

Circuito inicial en vacío

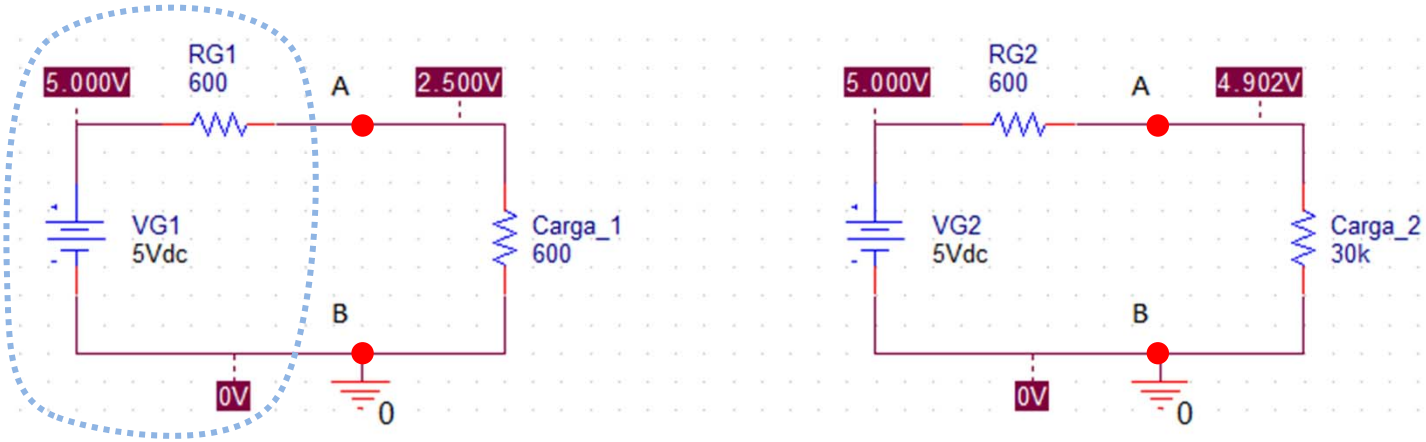


$Z_{Out} = 600\Omega$

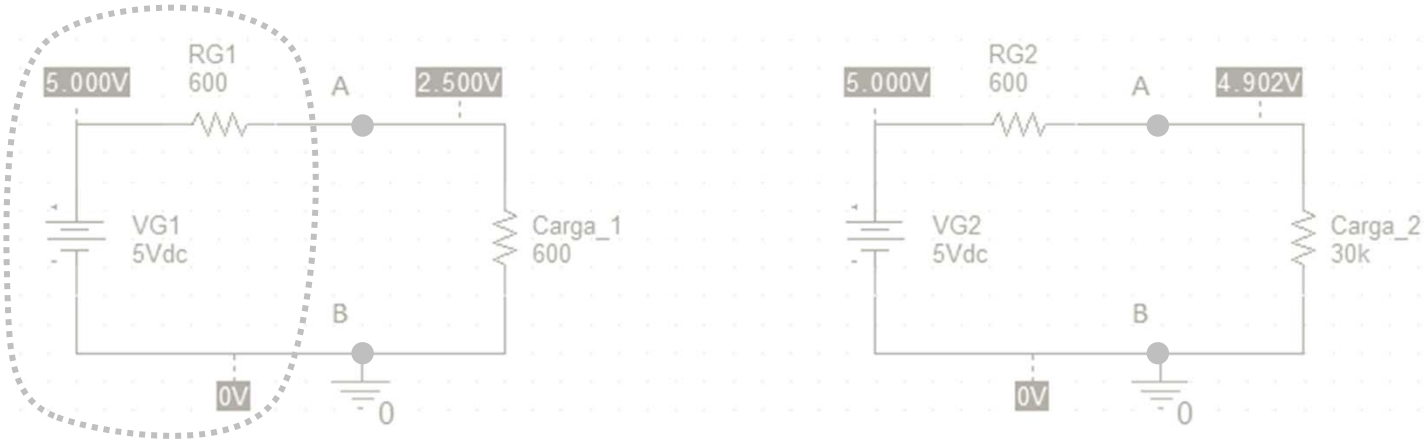
Circuito inicial en carga

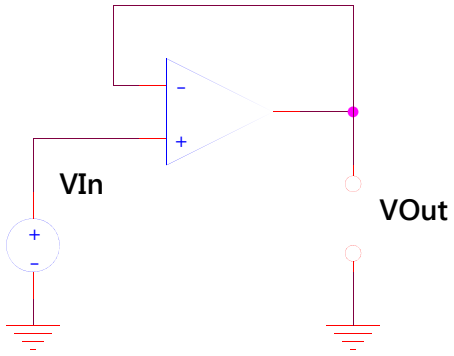


Circuito inicial con diferentes cargas



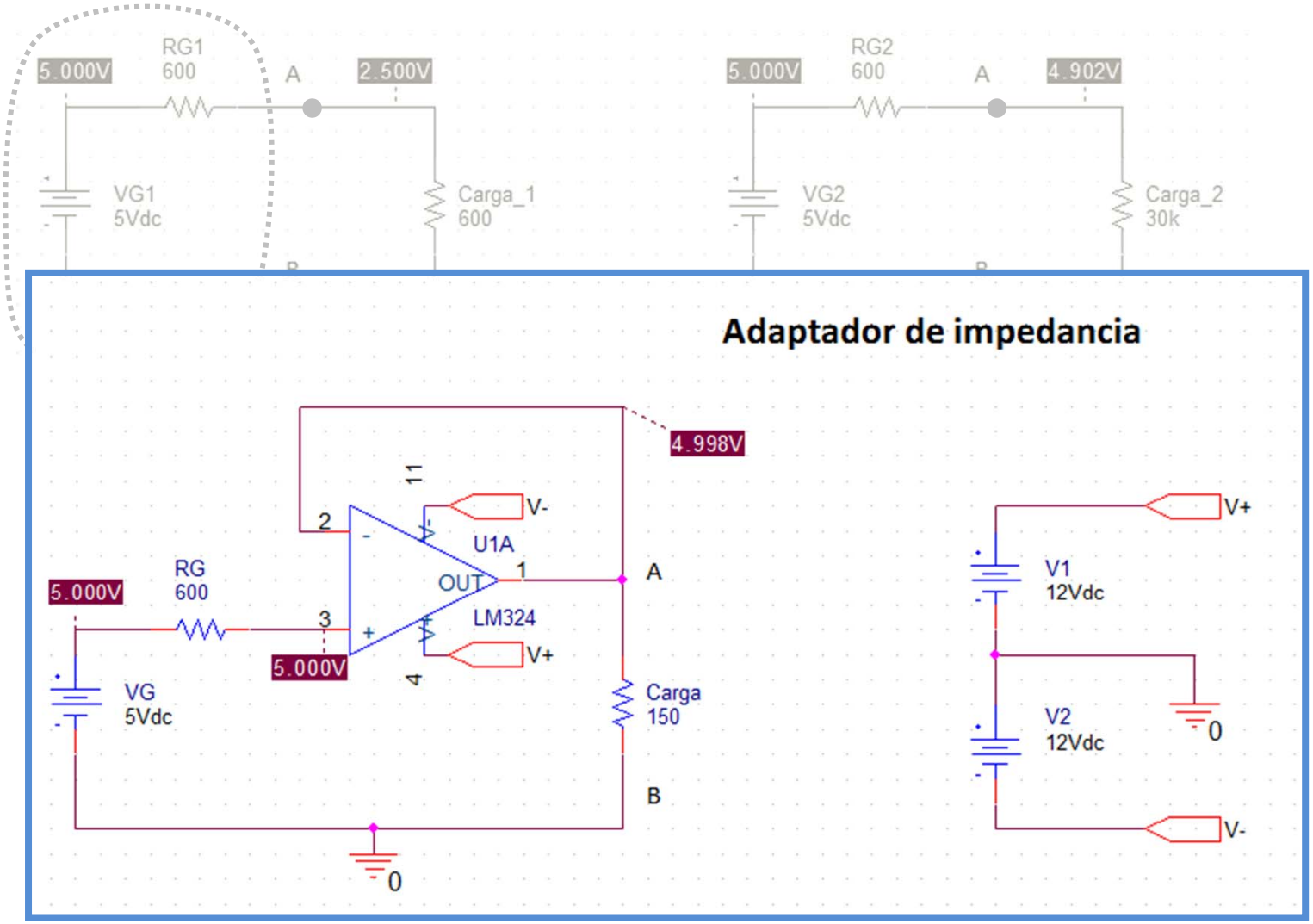
Idea final





Adaptador de impedancias elemental

Idea simulada



Documentación técnica I

LM124/LM224/LM324/LM2902
Low Power Quad Operational Amplifiers

General Description

The LM124 series consists of four independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits which now can be more easily implemented in single power supply systems. For example, the LM124 series can be directly operated off of the standard +5V power supply voltage which is used in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

Unique Characteristics

- In the linear mode the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from only a single power supply voltage
- The unity gain cross frequency is temperature compensated
- The input bias current is also temperature compensated

Advantages

- Eliminates need for dual supplies
- Four internally compensated op amps in a single package
- Allows directly sensing near GND and V_{OUT} also goes to GND
- Compatible with all forms of logic
- Power drain suitable for battery operation

Features

- Internally frequency compensated for unity gain
- Large DC voltage gain 100 dB
- Wide bandwidth (unity gain) 1 MHz
  (temperature compensated)
- Wide power supply range:
  Single supply 3V to 32V
  or dual supplies ±1.5V to ±16V
- Very low supply current drain (700 μA)—essentially independent of supply voltage
- Low input biasing current 45 nA
  (temperature compensated)
- Low input offset voltage 2 mV
  and offset current 5 nA
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- Large output voltage swing 0V to V+ − 1.5V

Documentación técnica y II

LM124/LM224/LM324/LM2902
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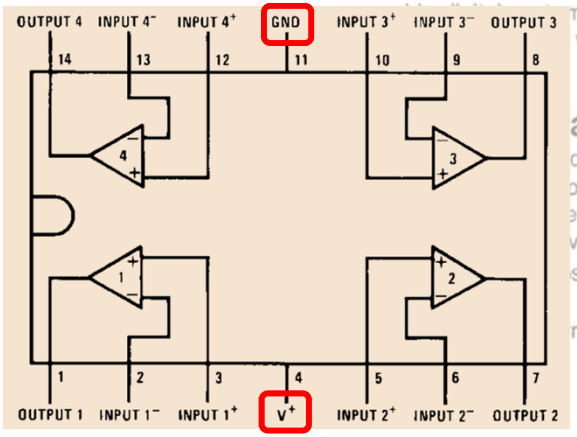

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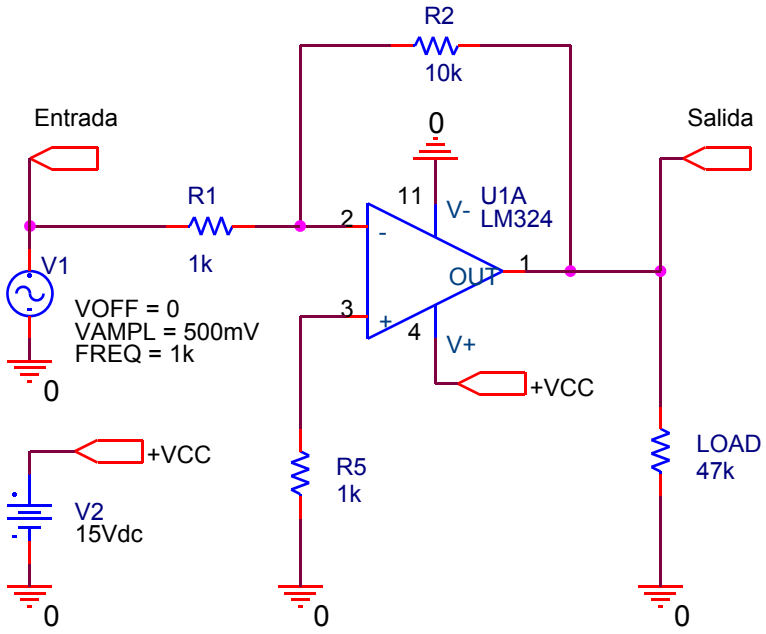
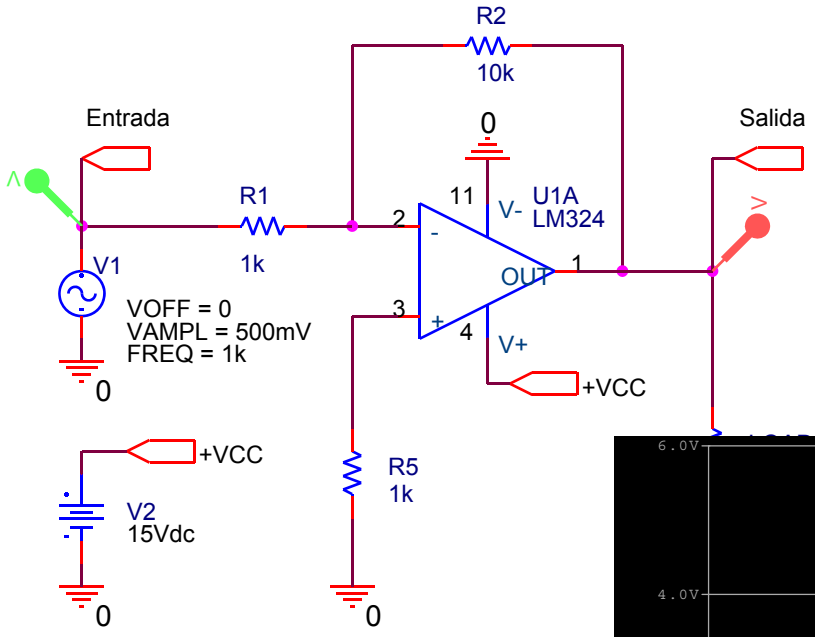
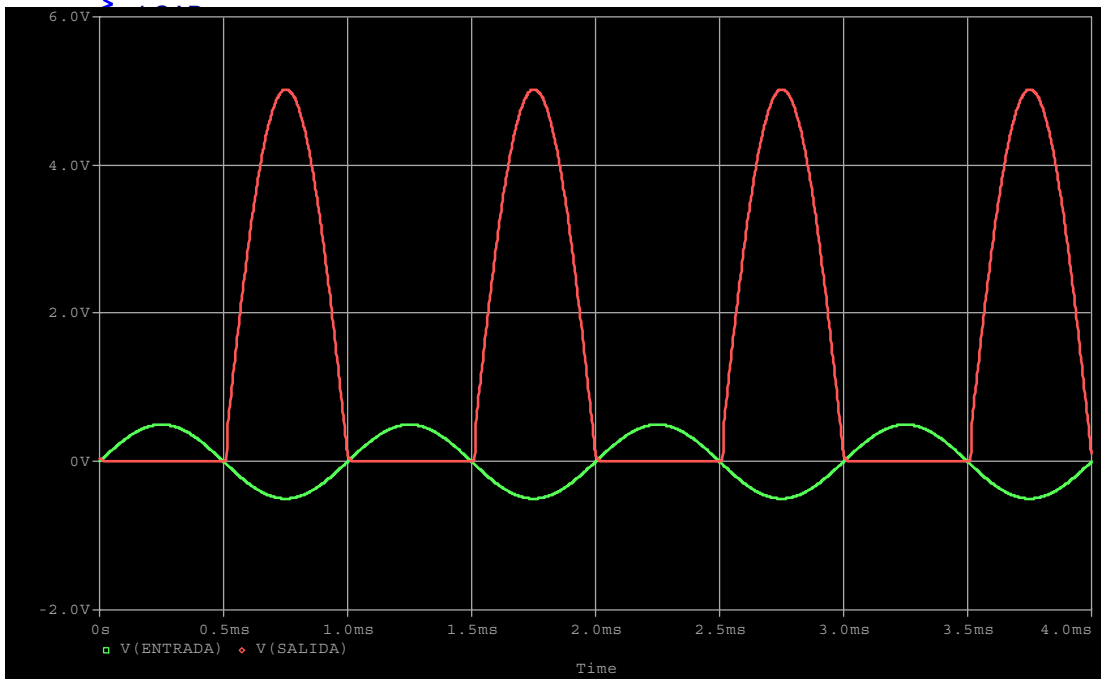
Amplificador inversor *(Fuente simple)*



Amplificador inversor simulado *(Fuente simple)*

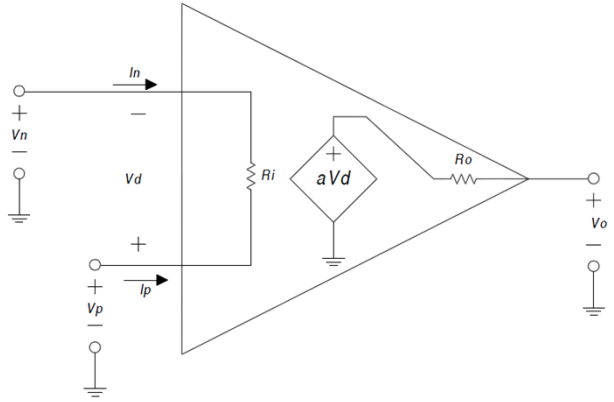


$$V_{Out} = -\frac{R_2}{R_1} = -10$$



Amplificador Operacional ideal

Un A.O. es un amplificador de entrada diferencial y salida simple. Este dispositivo amplifica la diferencia de tensión del puerto de entrada ($V_d = V_p - V_n$) y produce una tensión en el puerto de salida, referida a masa (V_o).



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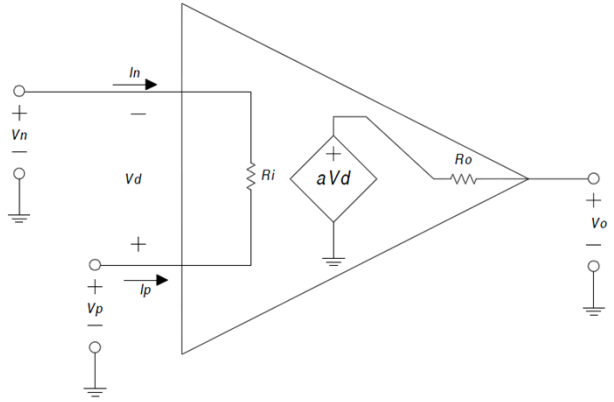

Se realizan tres simplificaciones

- Resistencia de entrada infinita $R_i = \infty$
- Resistencia de salida nula $R_o = 0$
- Ganancia infinita $a = \infty$

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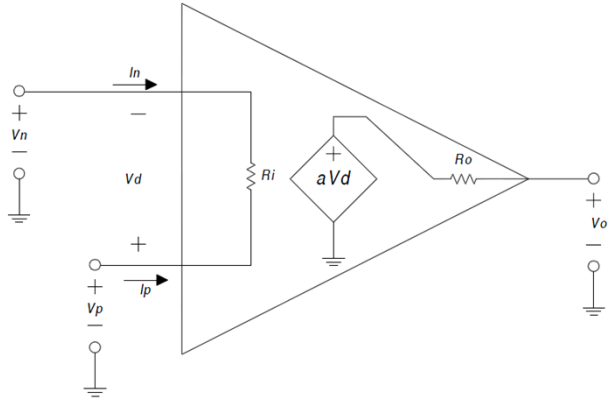

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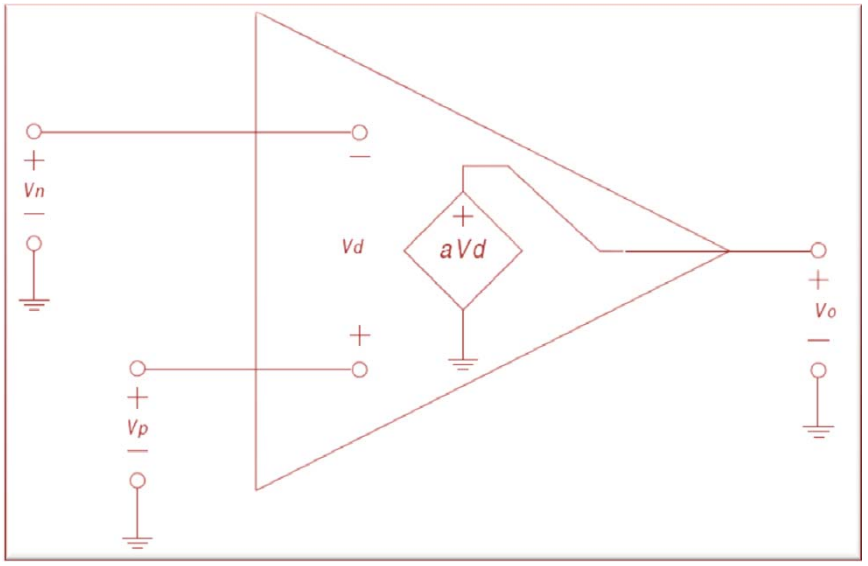

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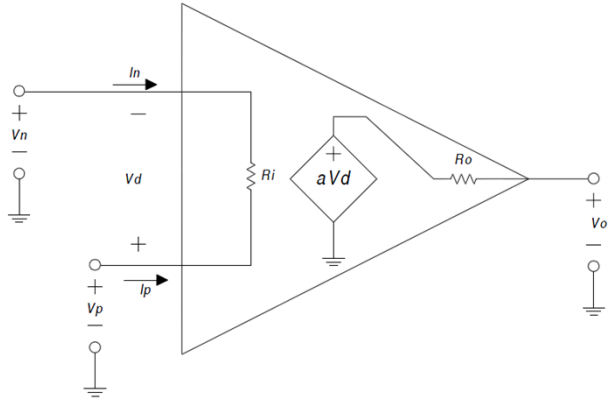

Estas simplificaciones implican:

- Si $R_i = \infty$ → Las entradas no consumen corriente

$$\mathbf{I_n = I_p = 0}$$

→ No hay efecto de carga sobre la entrada

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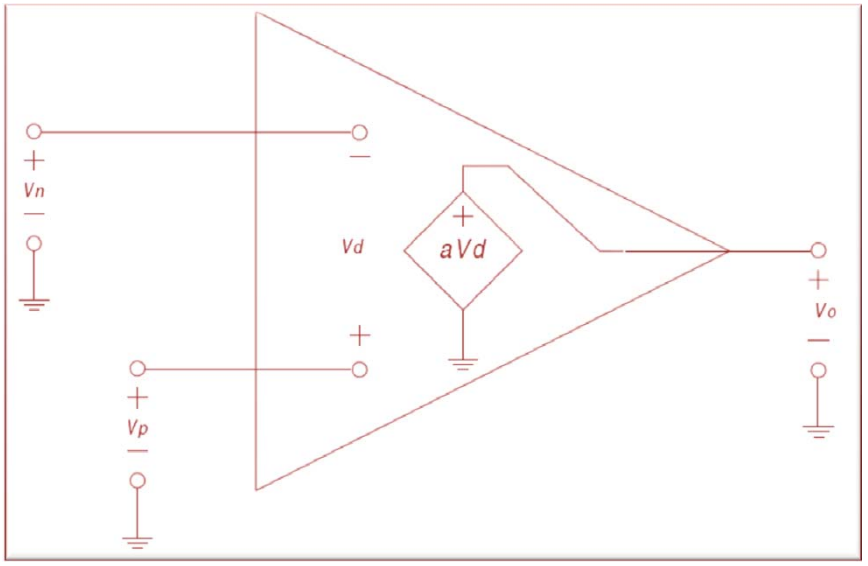

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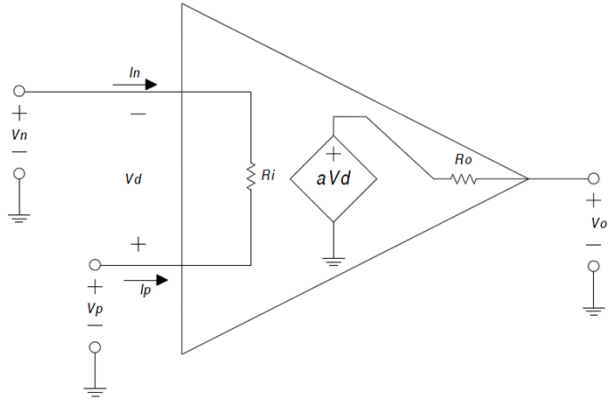

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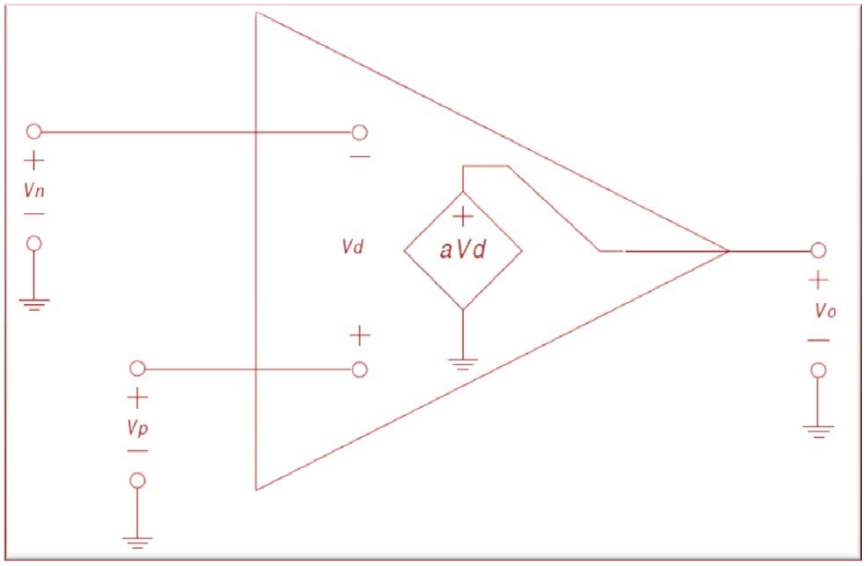

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- Si $R_o = 0$ → No hay efecto de carga sobre la salida

  $V_o = V_d \cdot a \Rightarrow V_d = V_o/a \ \{Si\ a = \infty\} \Rightarrow V_d = 0$

  → La tensión de salida sólo depende de V_d

  → Si $V_d = 0 = V_p - V_n \rightarrow \mathbf{V_p = V_n}$

  → ***Cortocircuito virtual***

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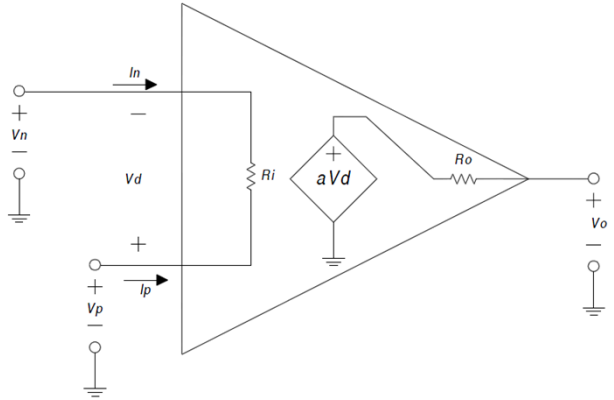

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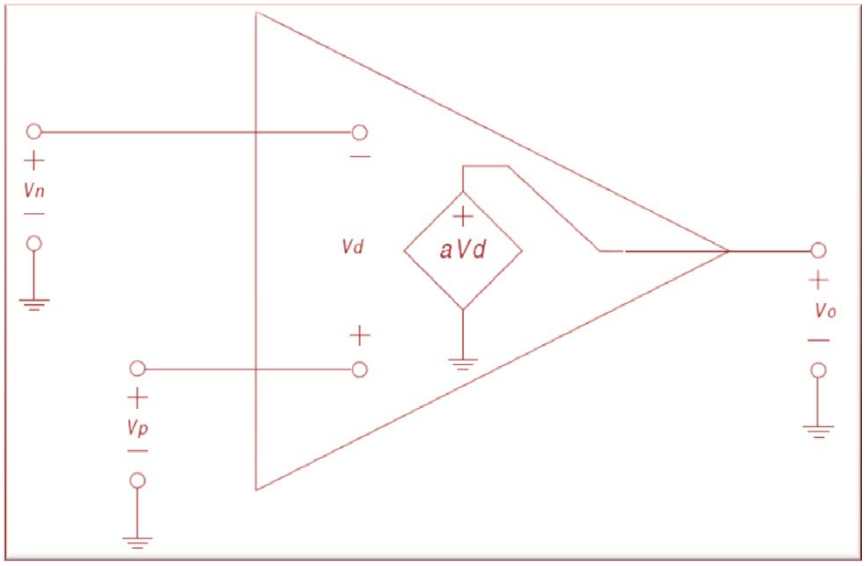

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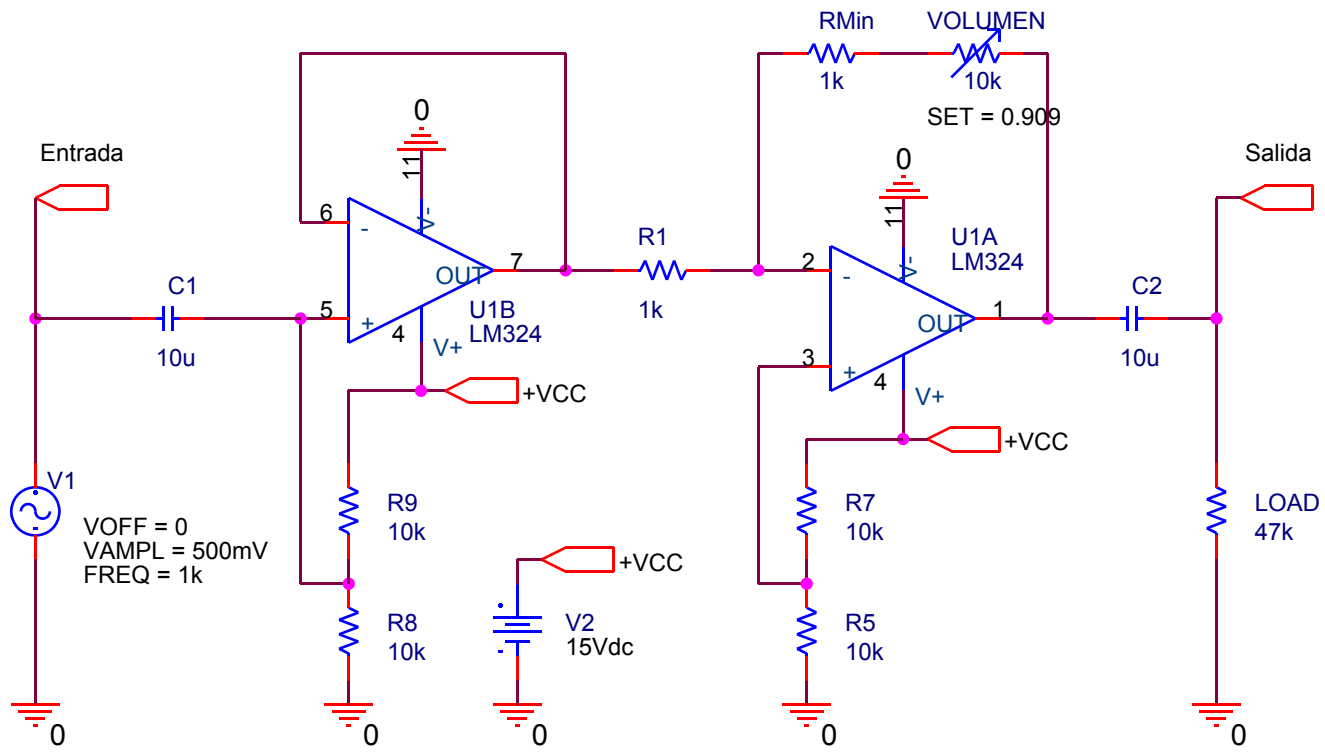
  → La tensión de salida sólo depende de V_d
  → Si $V_d = 0 = V_p - V_n \rightarrow \mathbf{V_p = V_n}$
  → ***Cortocircuito virtual***
- Ganancia en modo común = 0. *V_o sólo depende de V_d*
- El ancho de banda es infinito ($BW = \infty$)
- El Slew Rate es infinito ($SR = \infty$)

Circuito final (Fuente simple)



Adaptador de impedancia

Amplificador regulable

Circuito simulado final