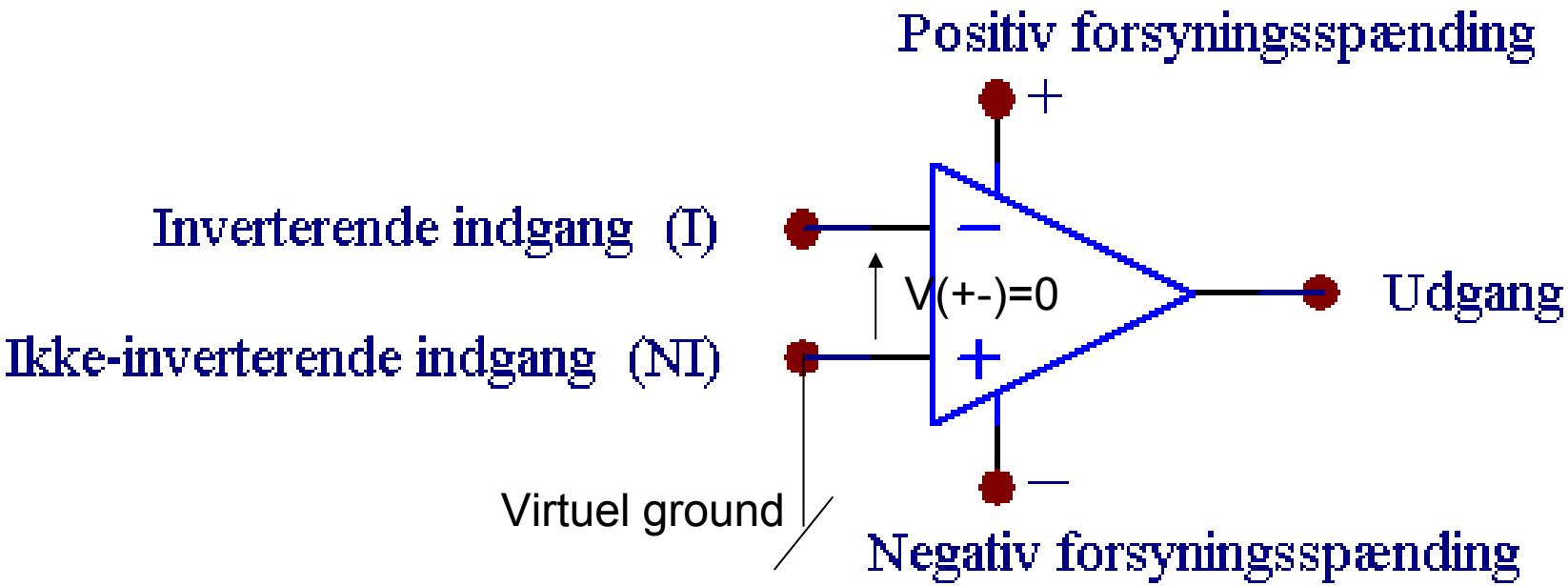
Op-Amp
H1

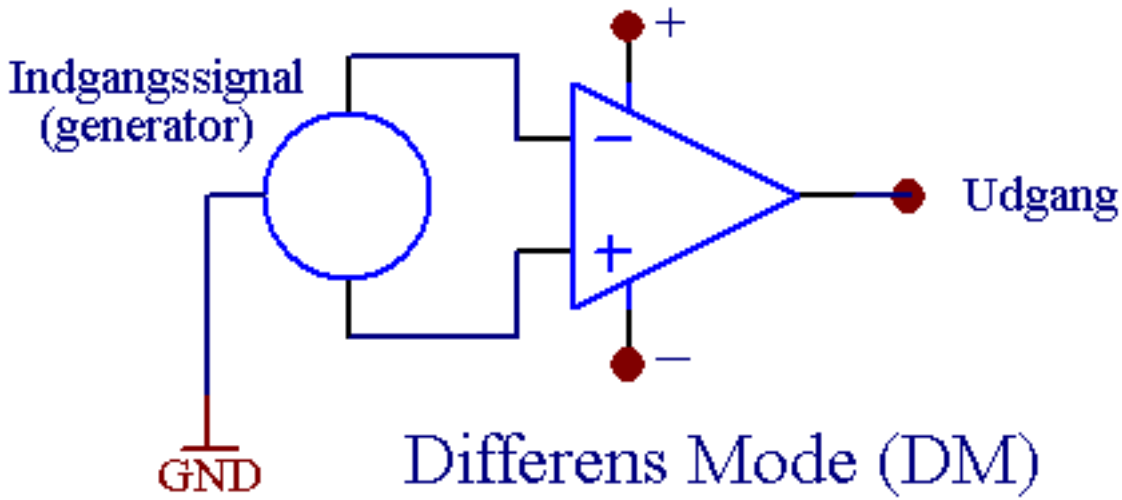
Lkaa

2009

Op-Amp

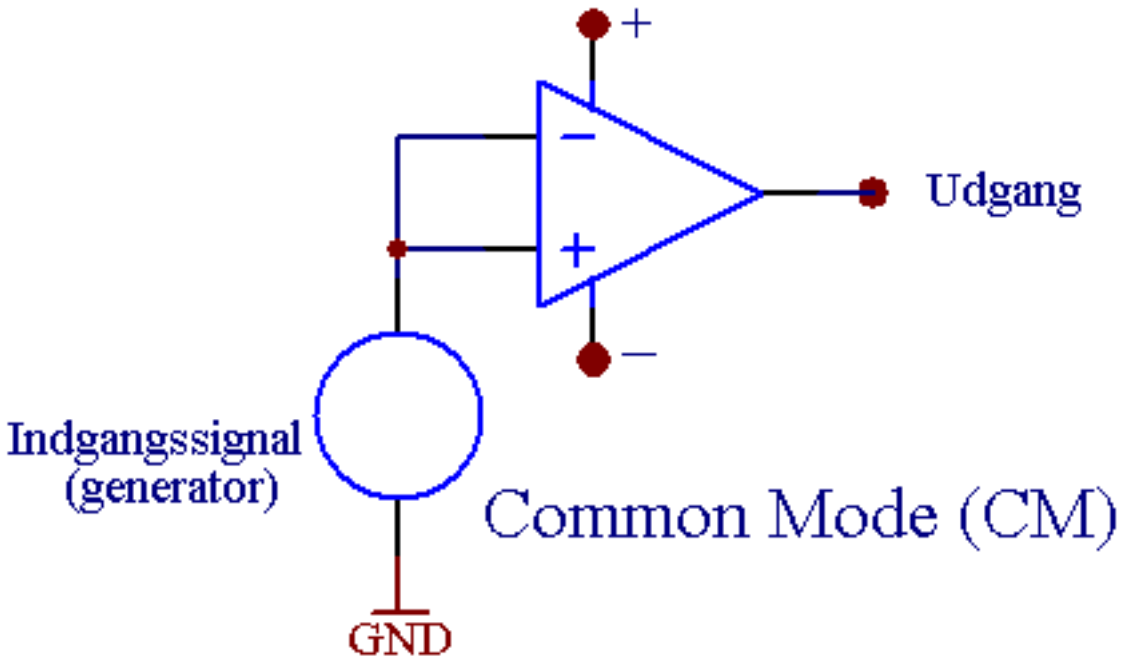

Positiv forsyningsspænding
+
Inverterende indgang (I)
−
V(+-)=0
Udgang
Ikke-inverterende indgang (NI)
+
Virtuel ground
−
Negativ forsyningsspænding

Op-Amp

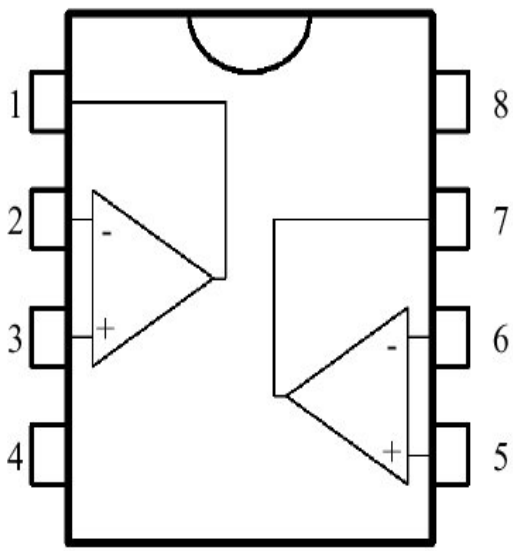


Differens Mode (DM)

Op-Amp



Op-Amp LM741 eller UA741

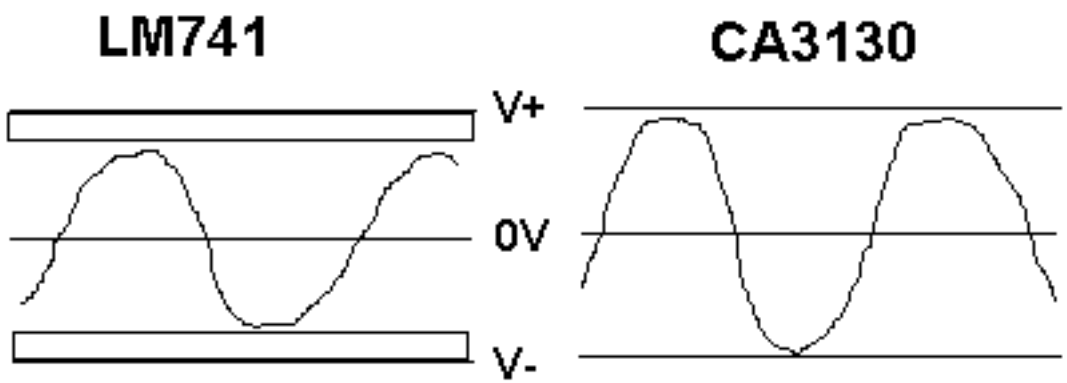


1 - Output 1
2 - Inverting input 1
3 - Non-inverting input 1
4 - V_{CC}^-
5 - Non-inverting input 2
6 - Inverting input 2
7 - Output 2
8 - V_{CC}^+

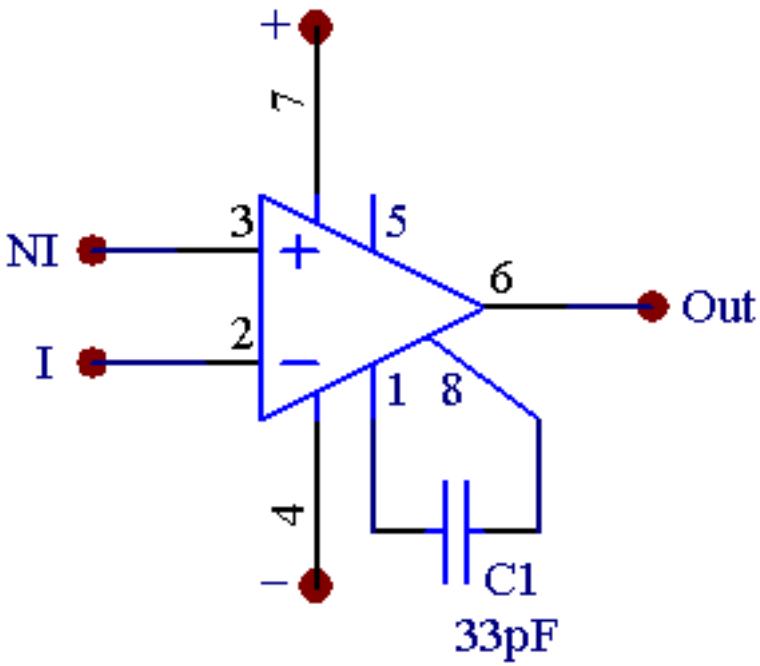
Data

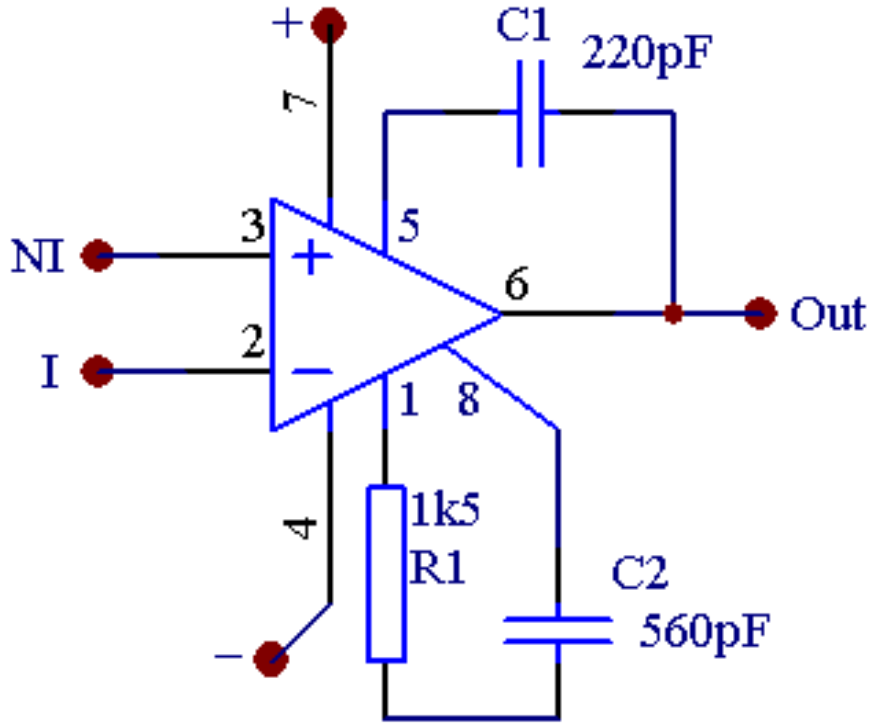
	LM741	**CA3130**
Forsyningsspænding	max ±22V	±2,5V - ±8V
Spændingsforstærkning	200.000	320.000
Ingangsimpedans	2 MΩ	1,5 TΩ
Input offset-spænding	1 mV	8 mV
Input offset-strøm	500 nA	0,5 pA
Slew-rate (spændingsændring)	0,5V/µSek	30V/µSek
Internt kompenseret	ja	nej
Korsslutningssikker udgang	ja	ja
IC-hus (case)	DIP8	DIP8
Teknik	transistor	MOSFET/CMOS

Rail- rail

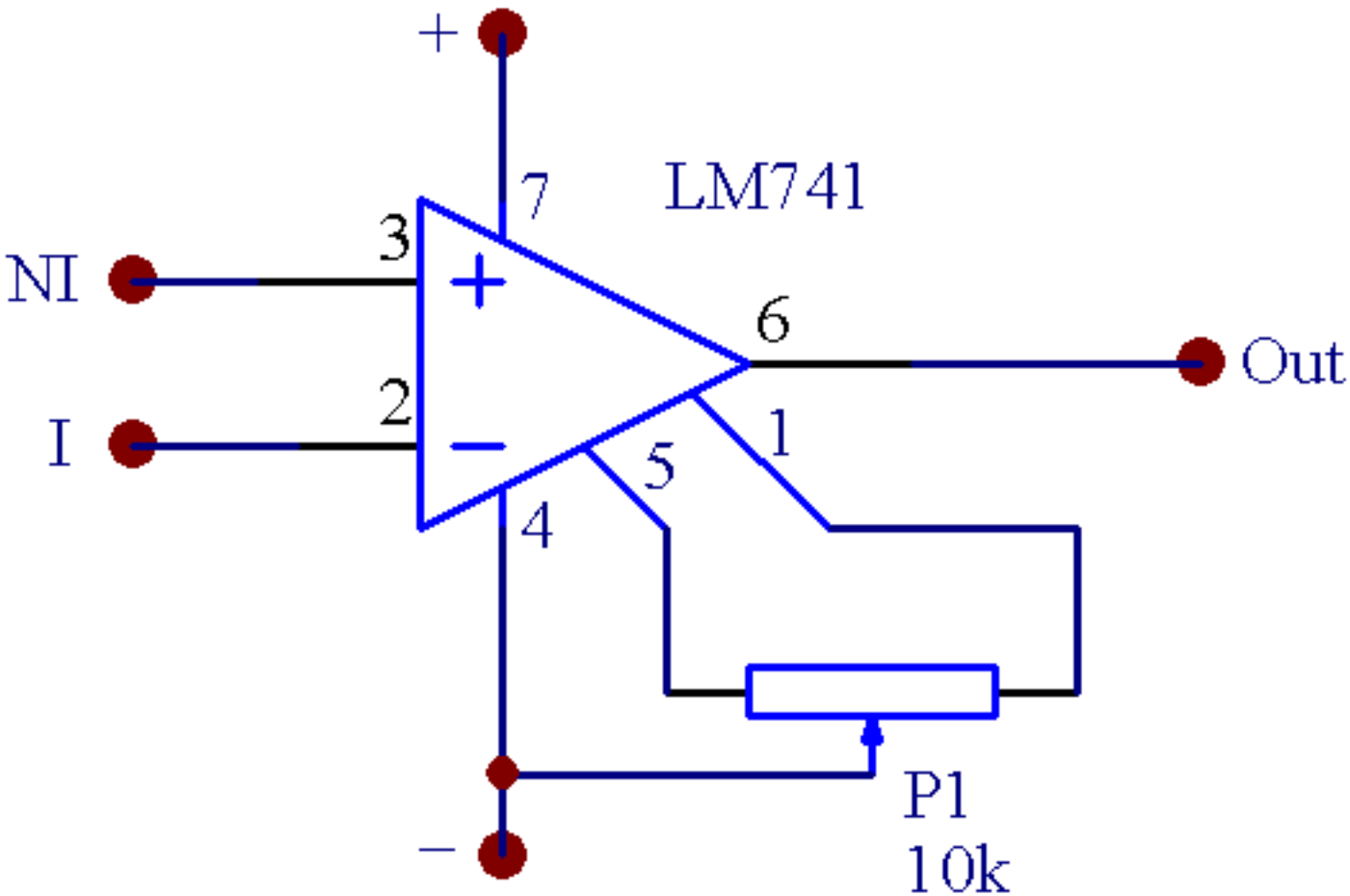


Kompensationskredløb ”selvsving”

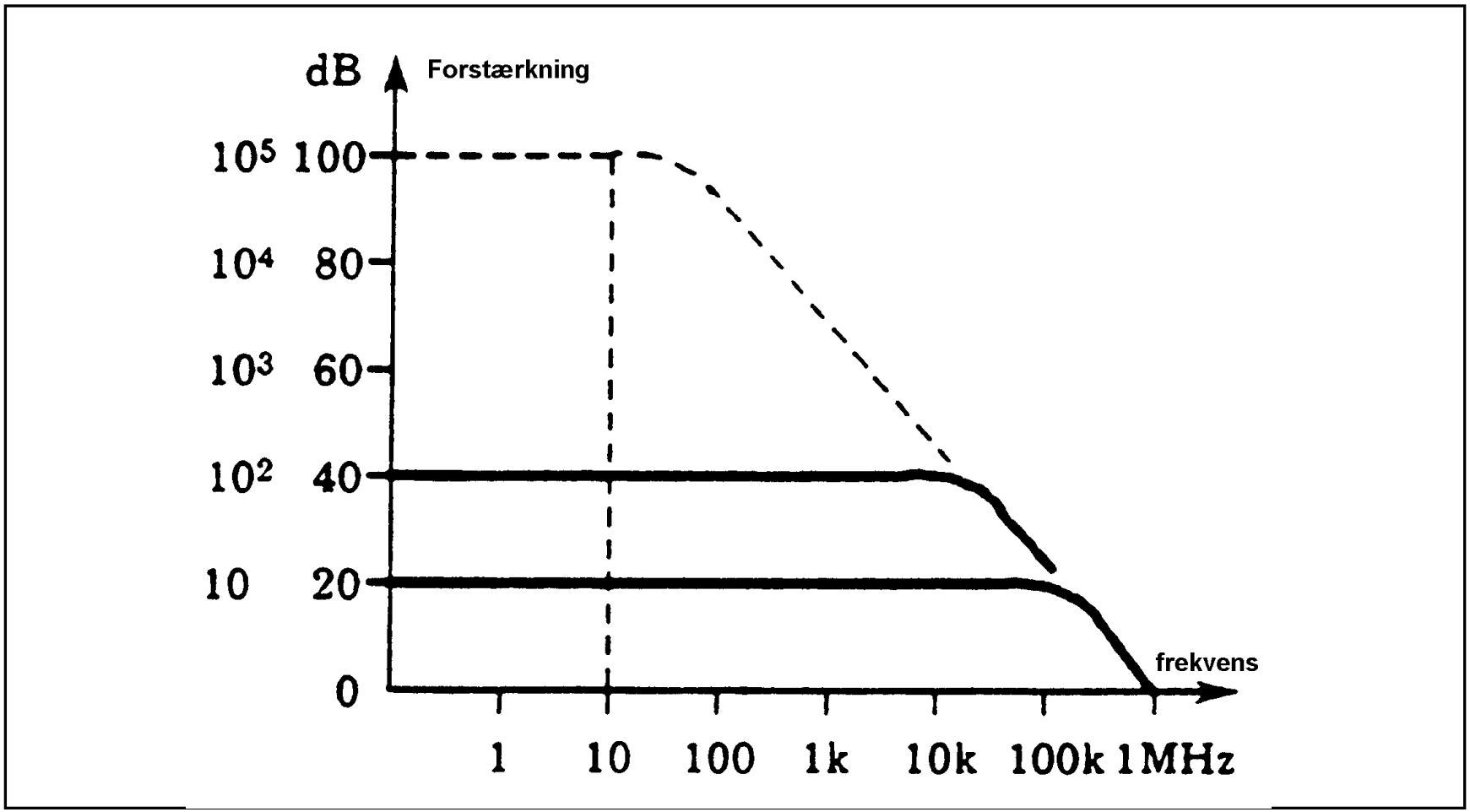




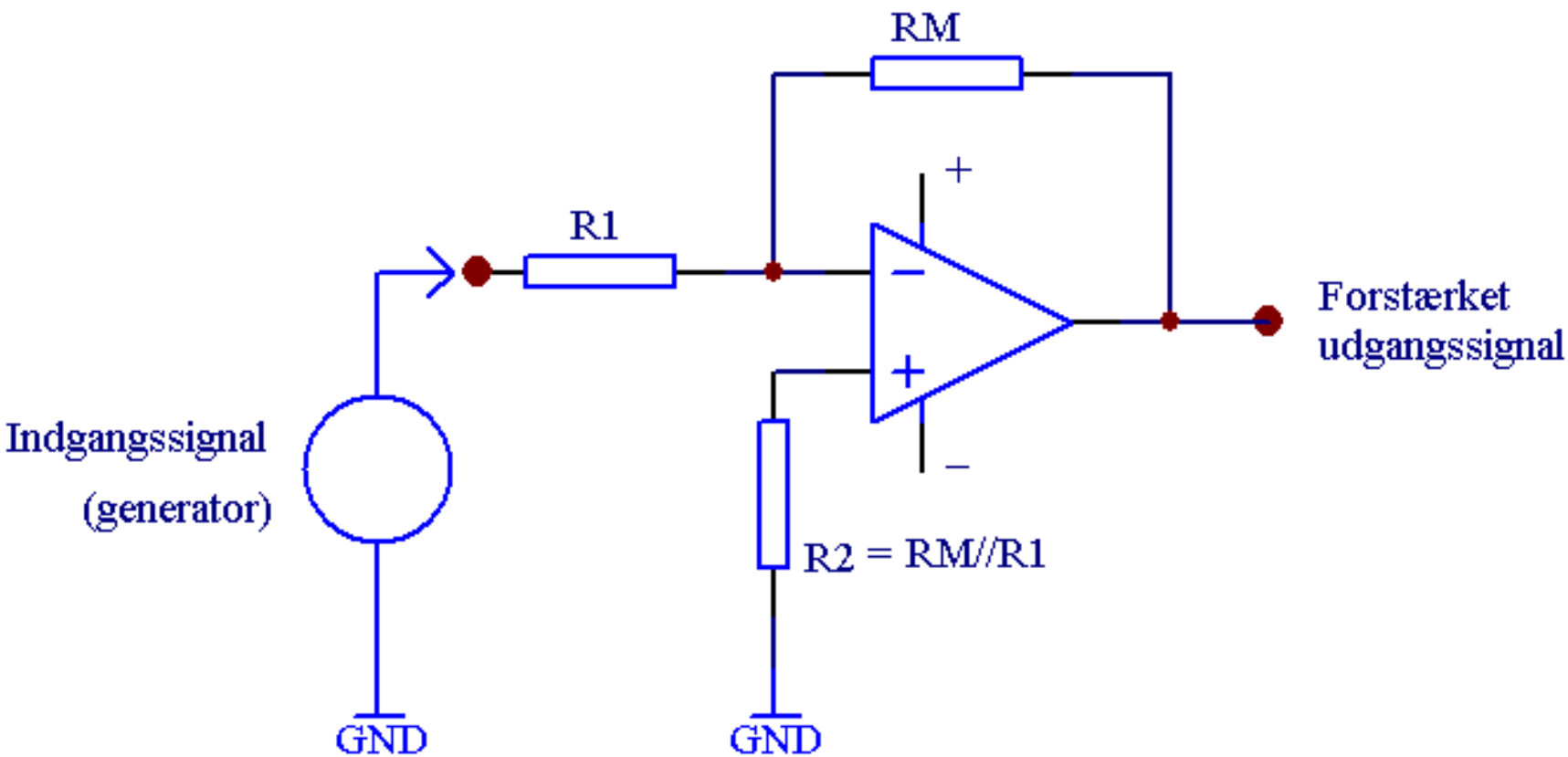
Off-set



Slew-rate & rå forstærkning



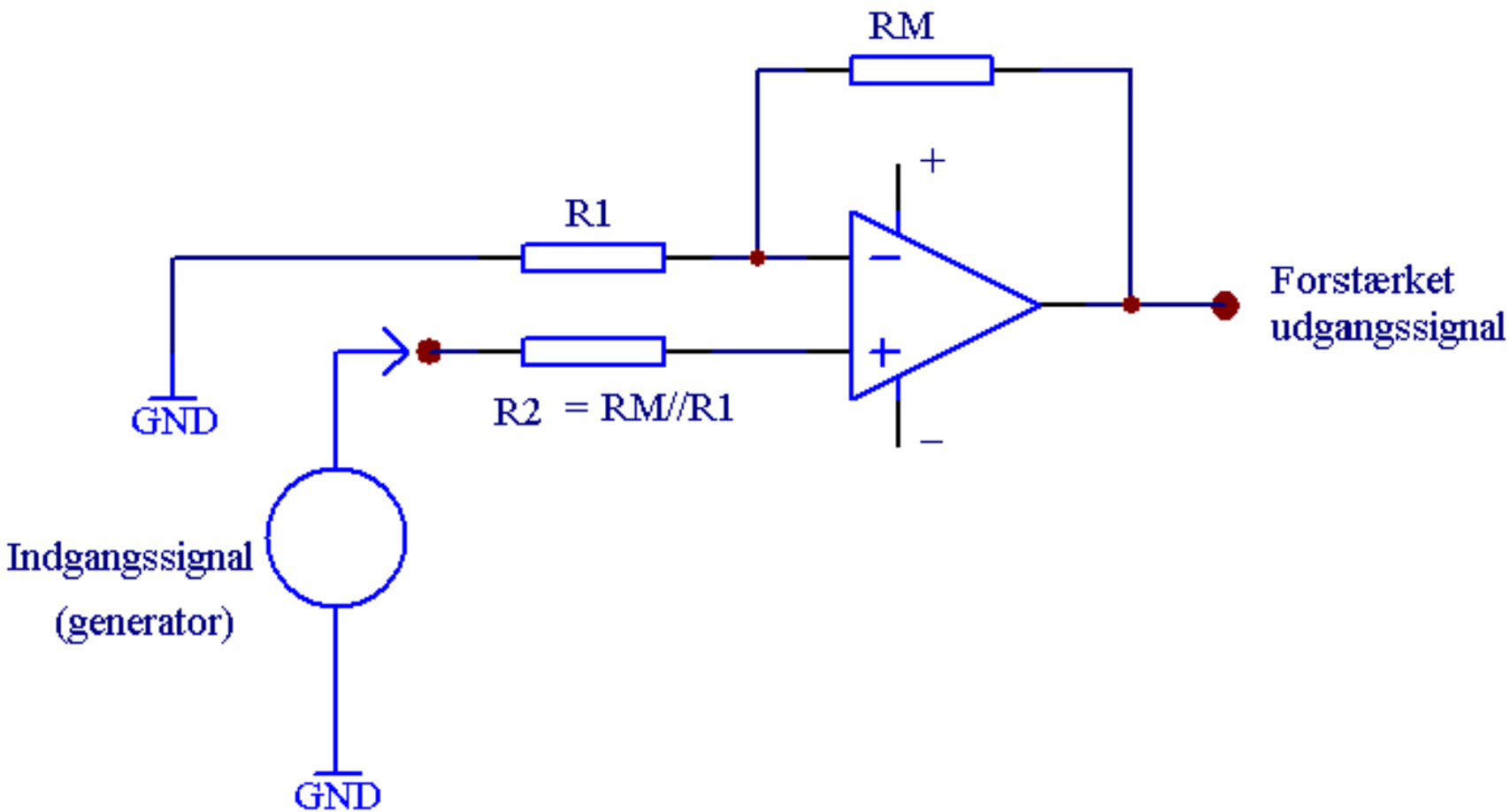
Invertende forst.



Beregning

- $Z_{in} = R_1$
- $A_u = -R_M/R_1$
- Z_{out}-> 0 Ohm

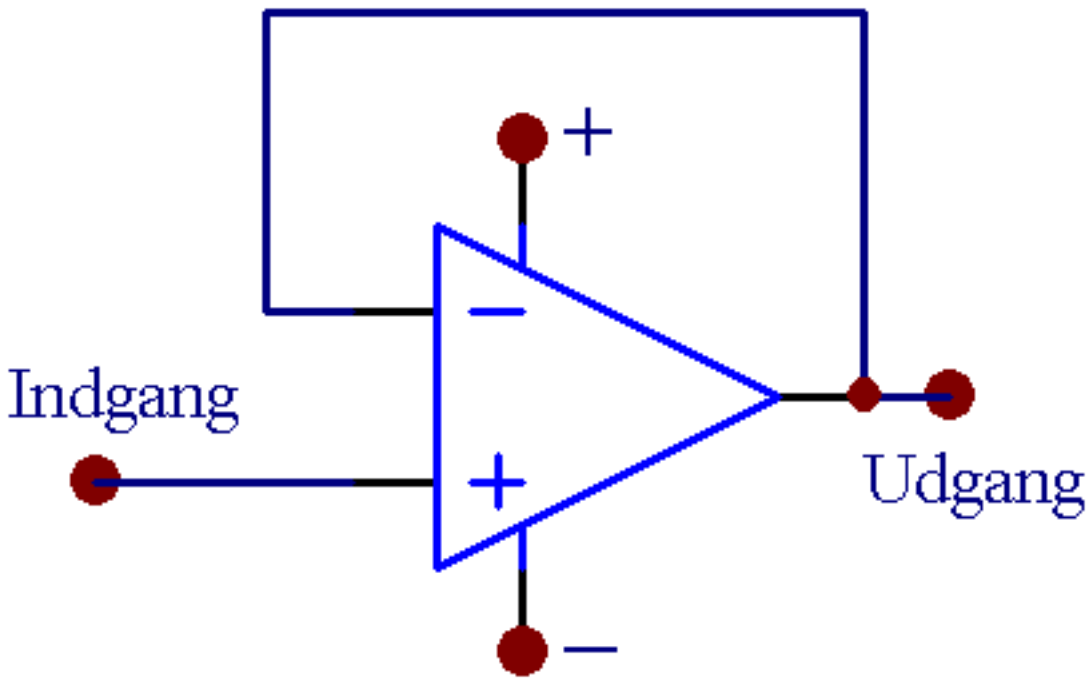
Ikke-invertende forst.



Beregning

- $A_u = R_M / R_1 + 1$
- Z_{out} -> 0 Ohm

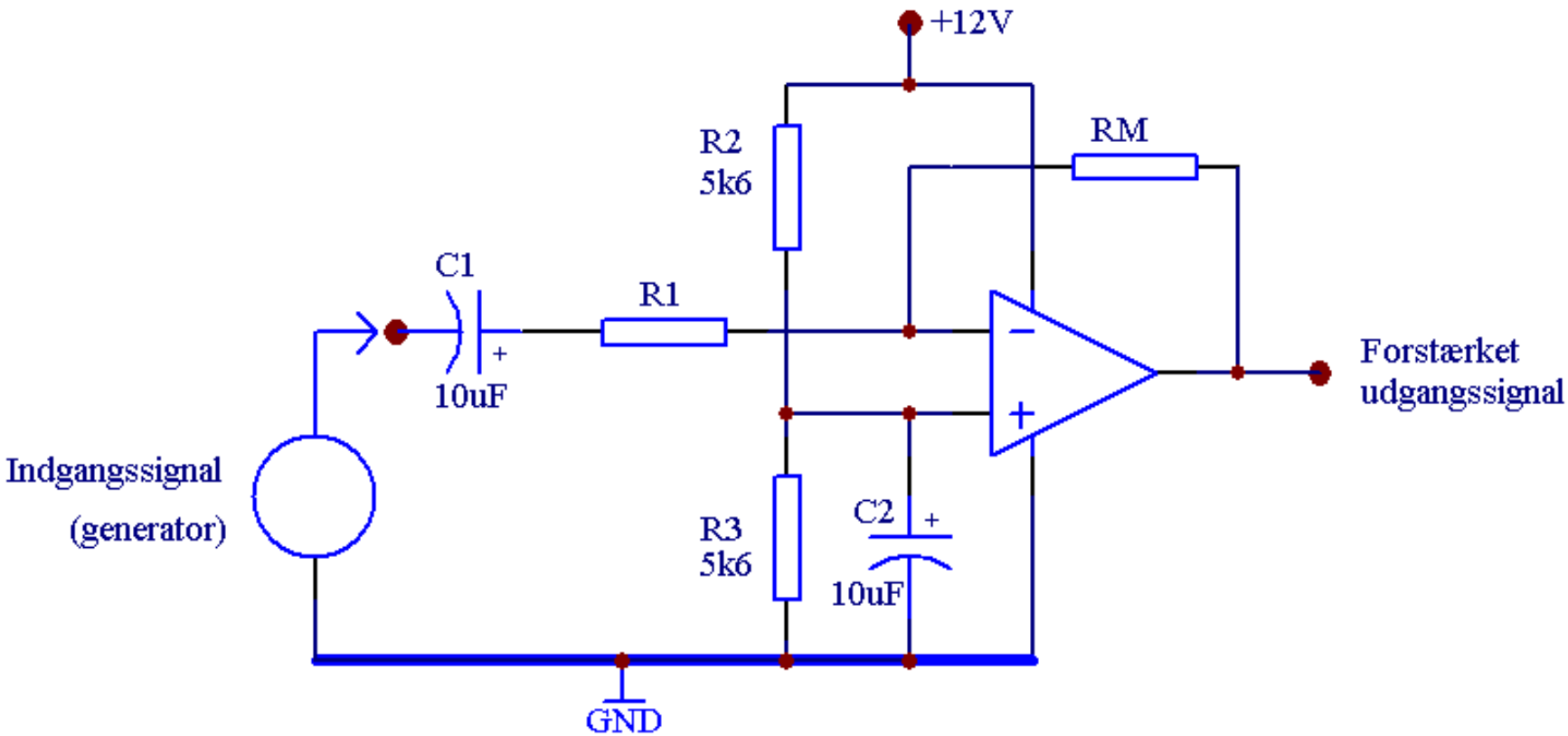
Unity- gain forst. (buffer)



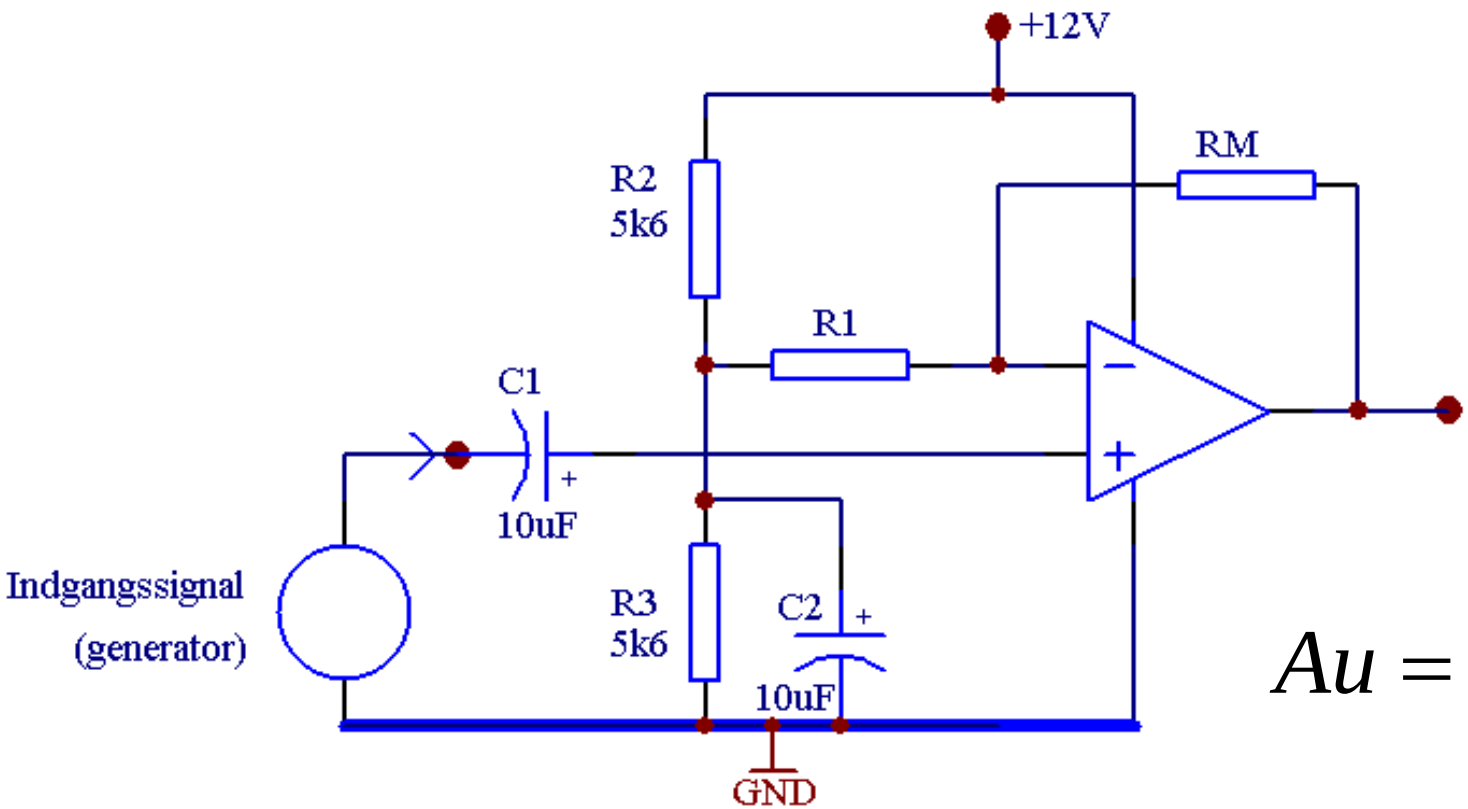
Data

- Forstærkning: $Au = \frac{0\Omega}{\infty\Omega} + 1 = 1$ ganges forst.
- Fordele: Høj indgangsimpedans, ZIN → ∞Ω
- Lav udgangsimpedans, ZOUT → 0Ω
- Op-amp= diff. I indgangen og effekt forstærker i udgangen

OP-amp med enkelt strømforsyning, Inverterende



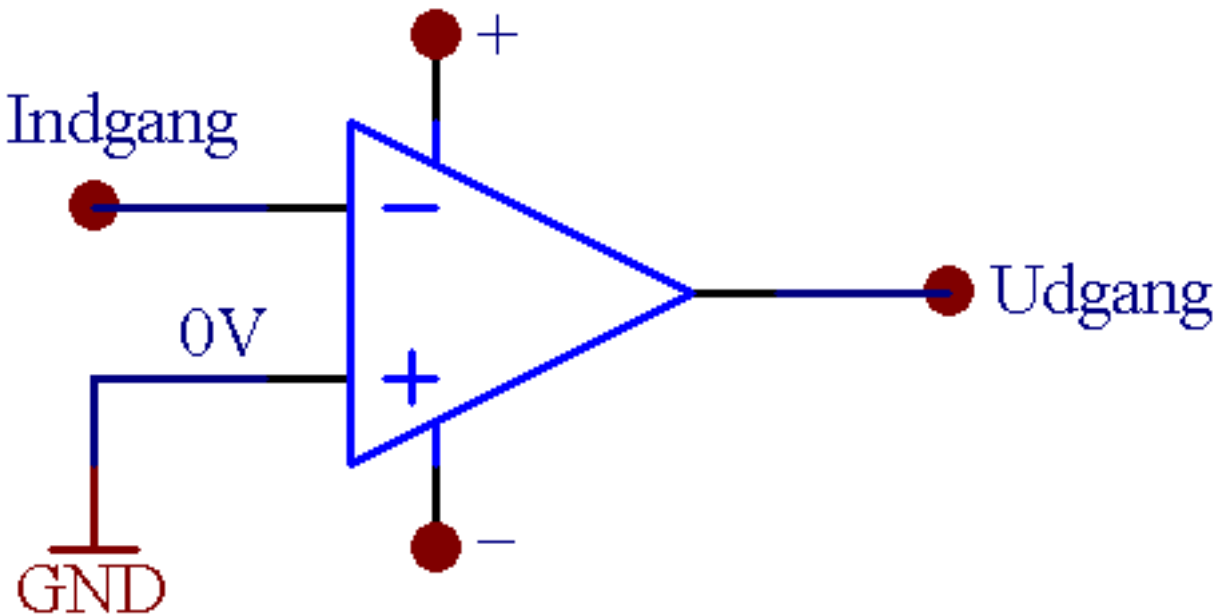
Enkelt strømforsyning, Ikke-Inverterende



$$Au = \frac{R_M}{R_1} + 1$$

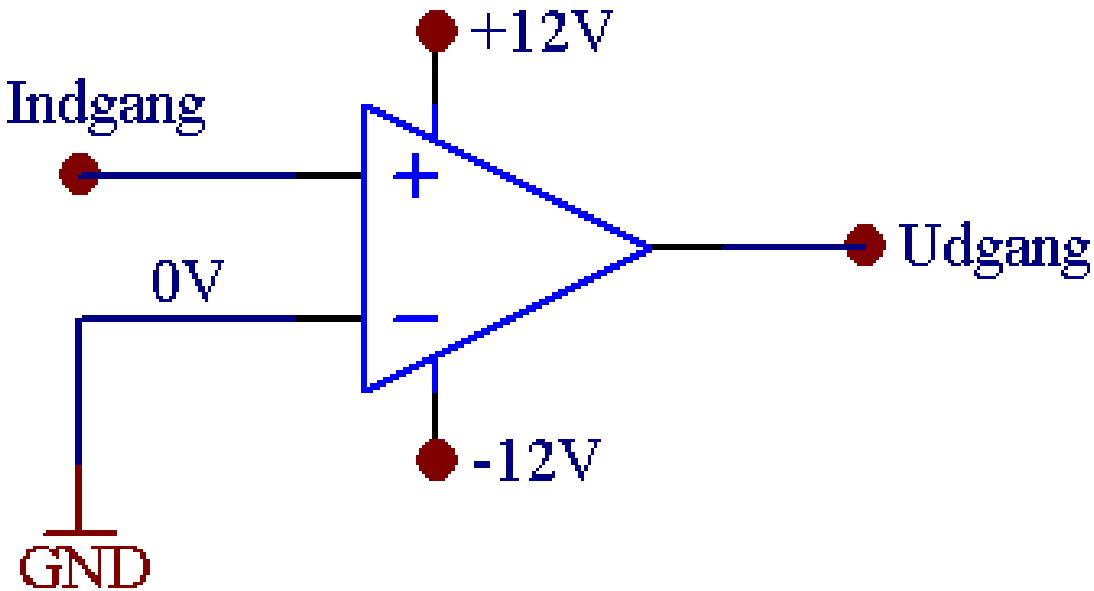
OP-amp som Komparator

Er indgangssignalet >0V går udgangen → -12V
Er indgangssignalet <0Vgår udgangen → +12V

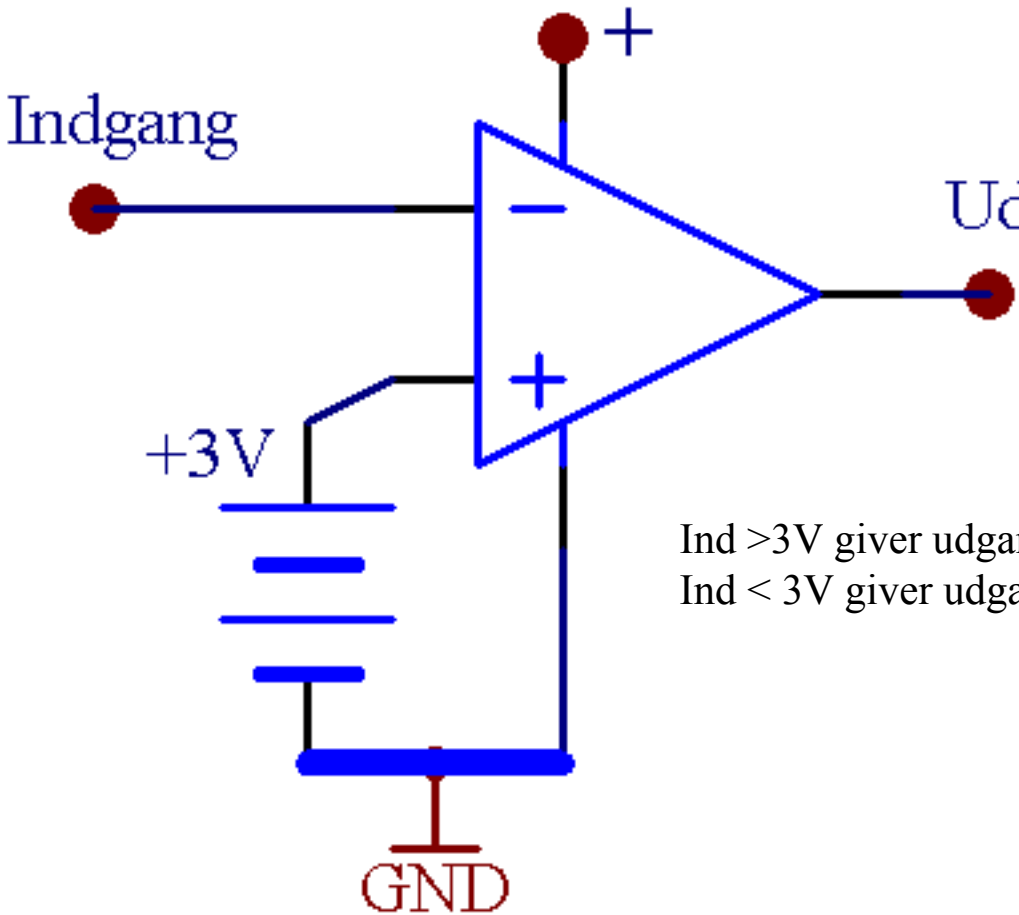


OP-amp som Komparator

Er indgangssignalet >0Vgår udgangen → +12V
Er indgangssignalet <0Vgår udgangen → -12V



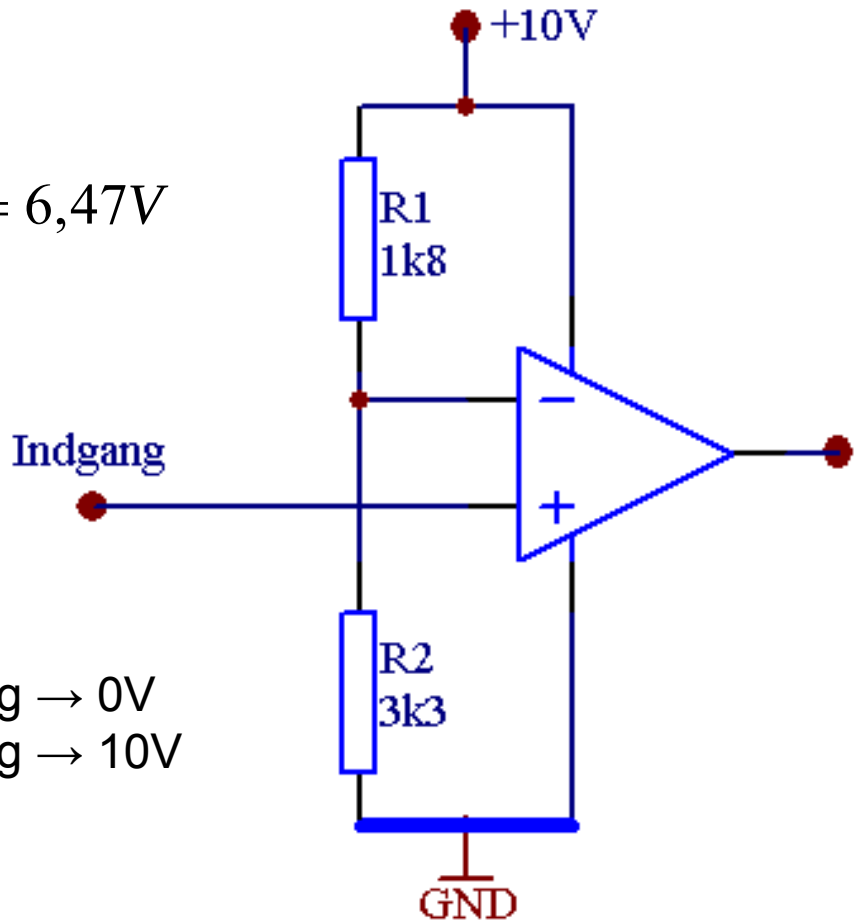
OP-amp som Komparator



Ind >3V giver udgangsspænding → 0V
Ind < 3V giver udgangsspænding → +5V

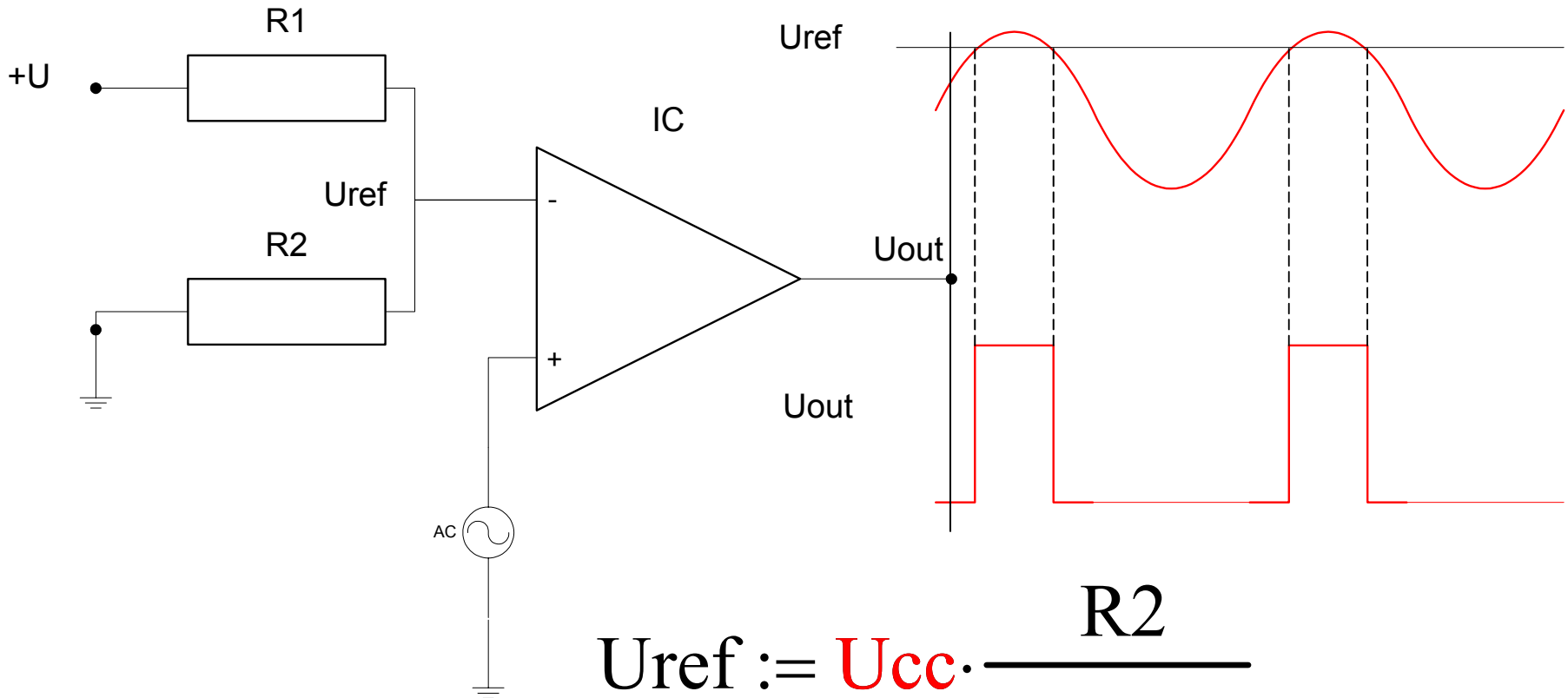
OP-amp som Komparator

$$U_{REF} = U_{R2} = 10V \cdot \frac{3{,}3k}{3{,}3k + 1{,}8k} = 6{,}47V$$



Ind <6,47V giver udgangsspænding → 0V
Ind >6,47V giver udgangsspænding → 10V

Inverterende komparator



$$Uref := Ucc \cdot \frac{R2}{R1 + R2}$$

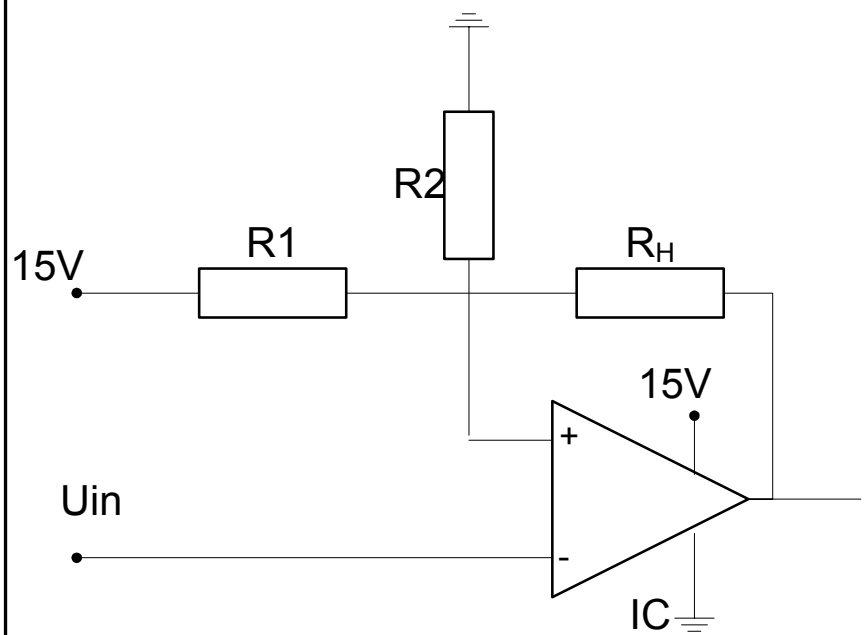
Hysterese

- Lower level trigger

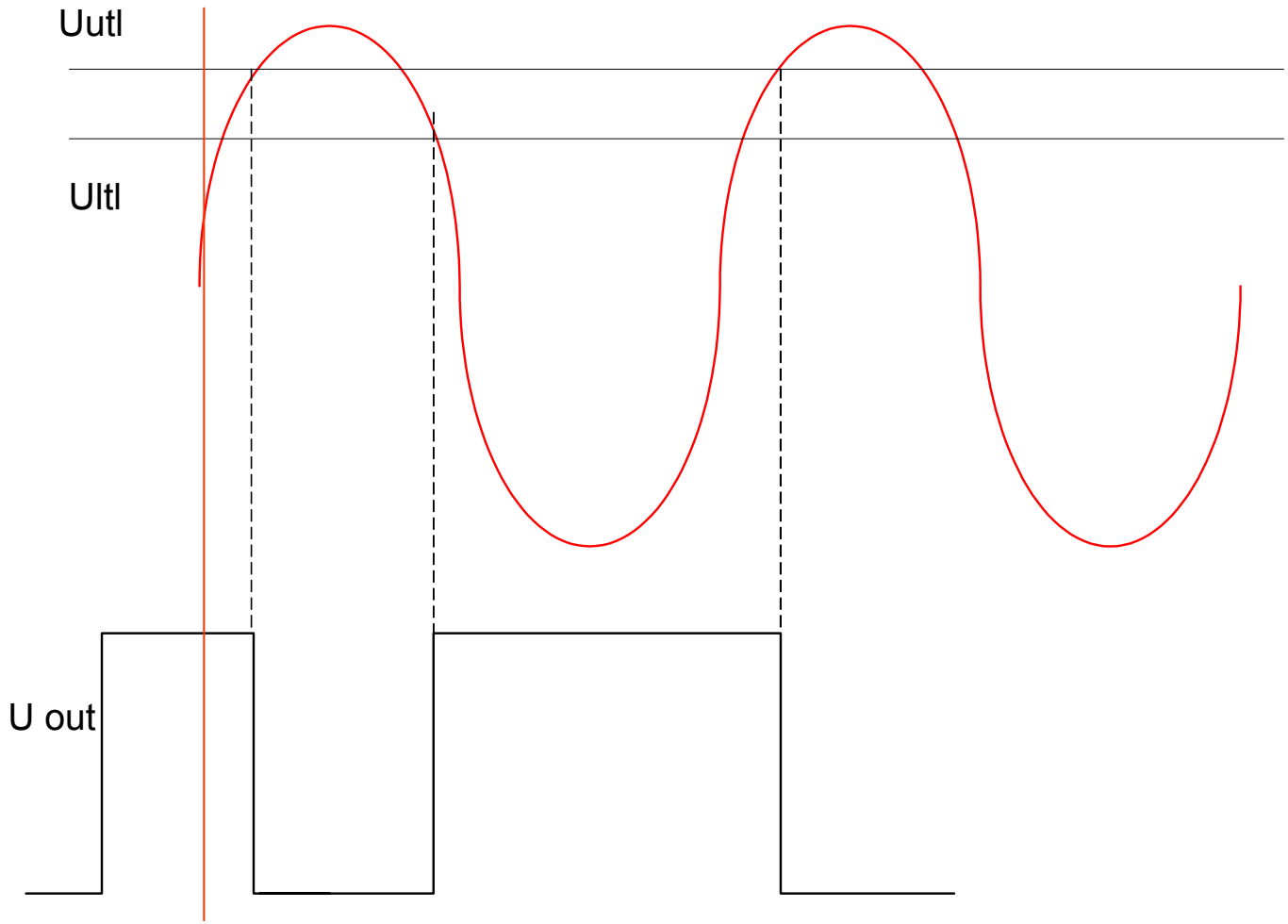
$$U_{tlt} = U_{cc} * \frac{R_2 // R_H}{(R_2 // R_H) + R_1}$$

- Upper level trigger

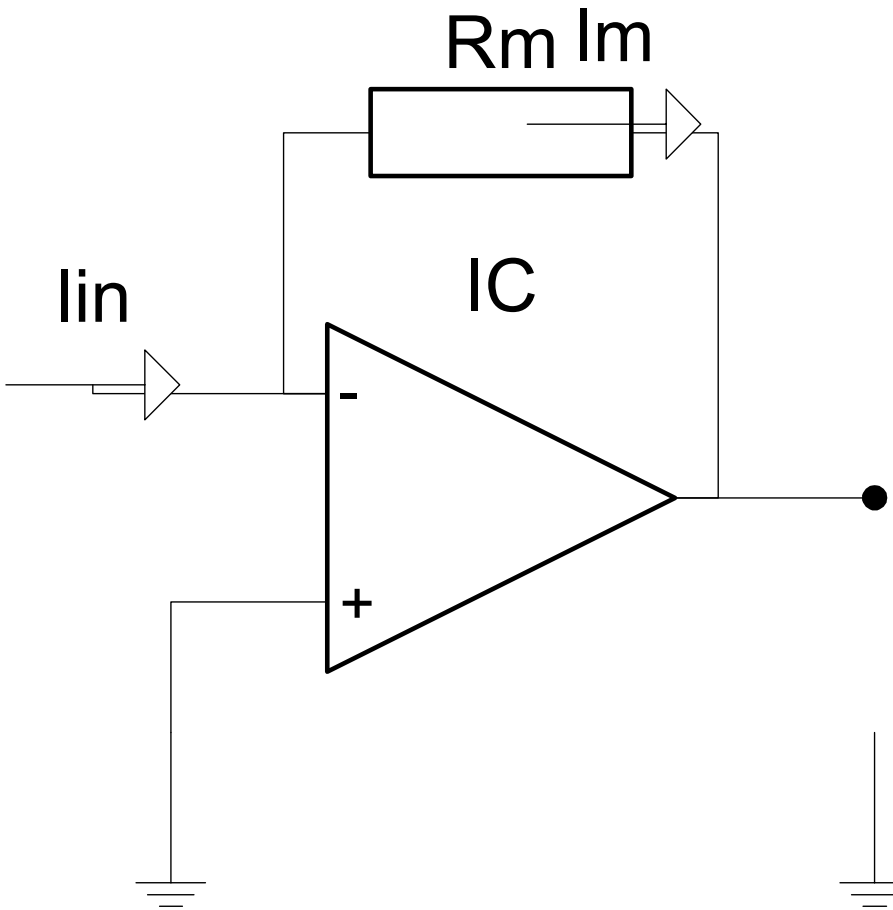
$$U_{ult} = U_{cc} \frac{R_2 // R_H}{(R_1 // R_H) + R_2}$$



Trigger level



Strøm til Spænding



Uout=-Iin*Rm