EE16A

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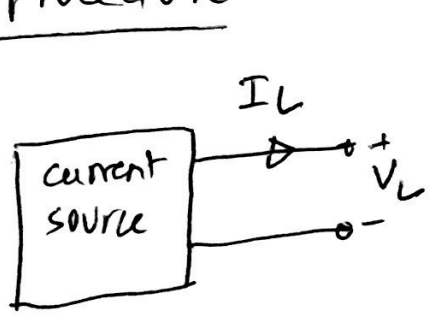
Design Example: Current source

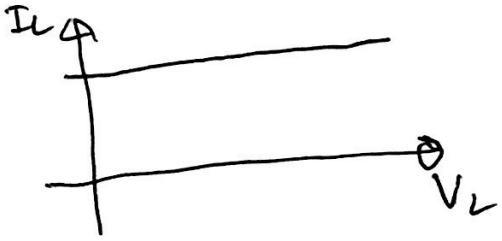
→ Build current source using opamps, resistor, and voltage source

→ for any load voltage o/p current is constant.

Design procedure

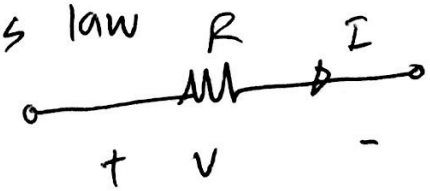
1) Goal





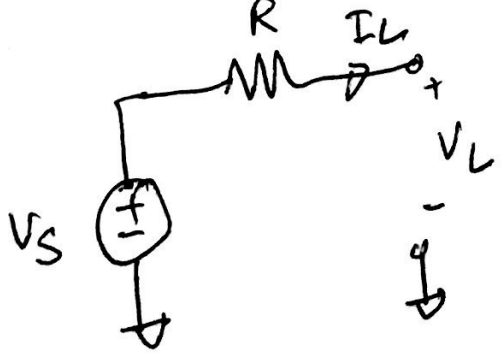
2) Approach

Ohm's law

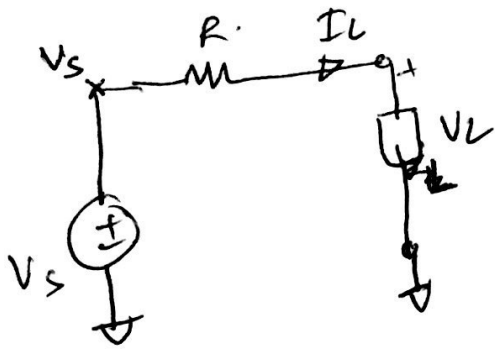


$$I = V/R$$

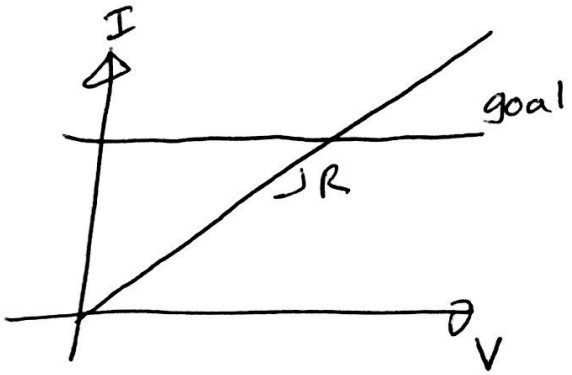
3) Implementation



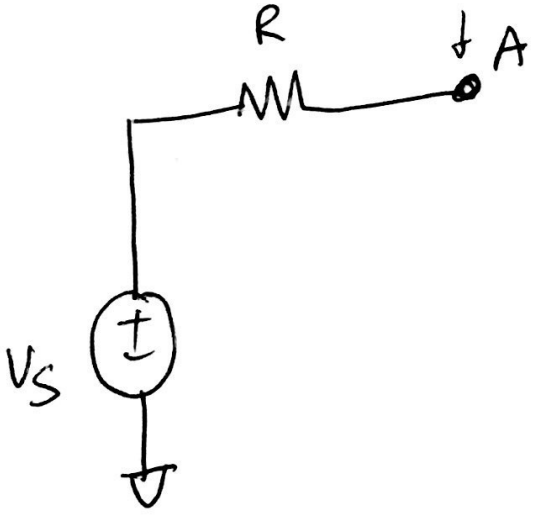
4) Verification / Testing



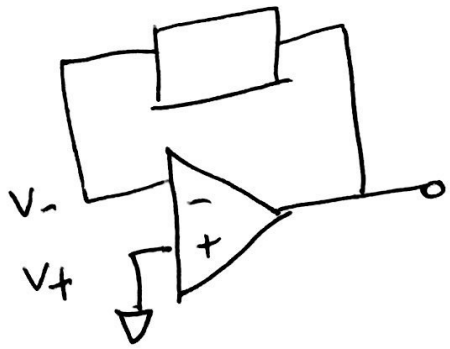
$$\frac{V_S - V_L}{R} = I_L$$



issue: I_L changes with V_L

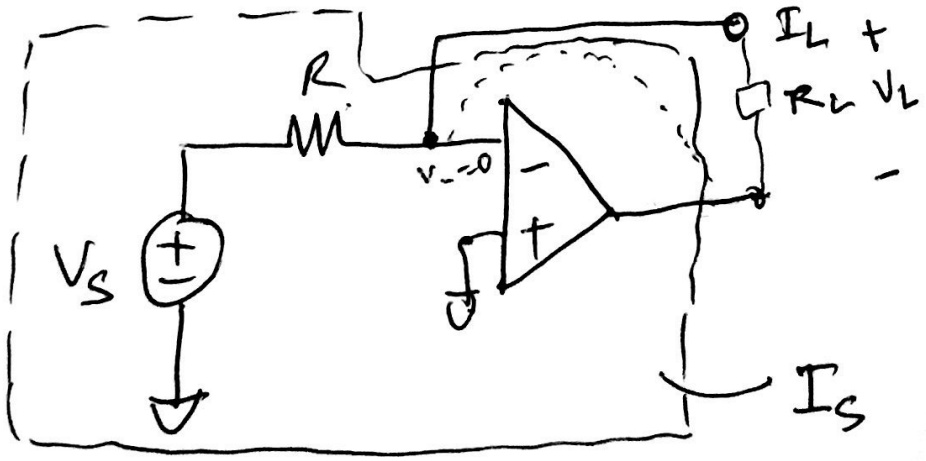


Fix: use an op-amp



NfB exist ✓

GR-2 ⇒ $V_- = V_+$



- $I_L = \frac{V_S}{R}$

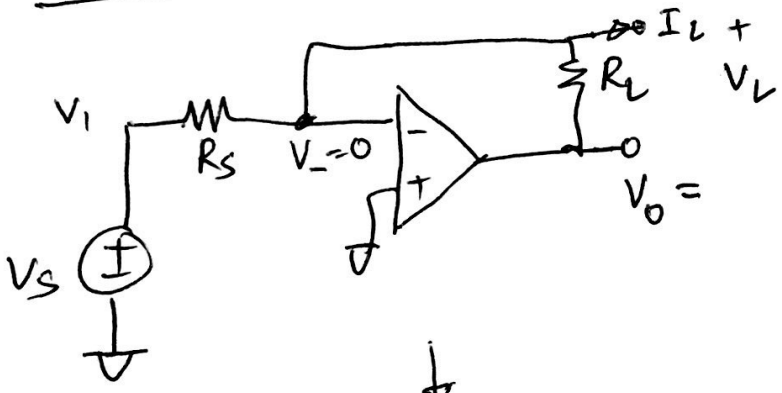
@ $V_+ = V_-$

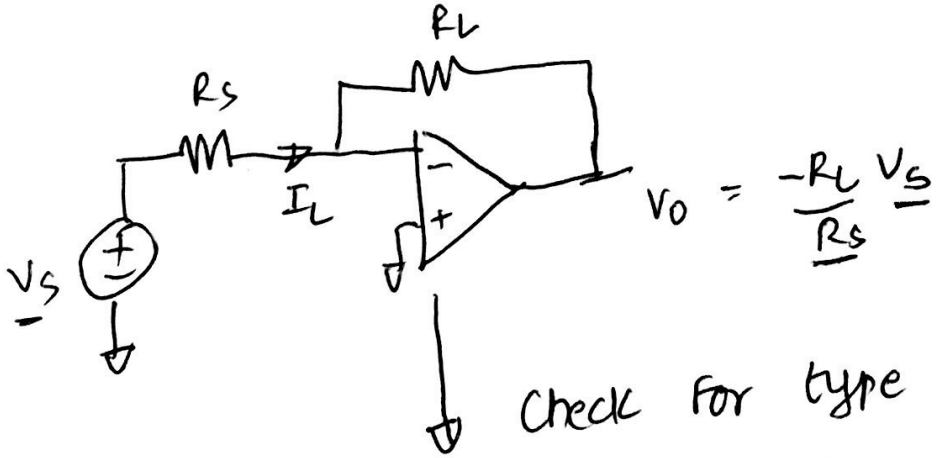
Issues:

[1] ~~Negative~~ -Ve f/B exist

[2] V_L is fixed. for $R_L = 0$ $V_L = 0$

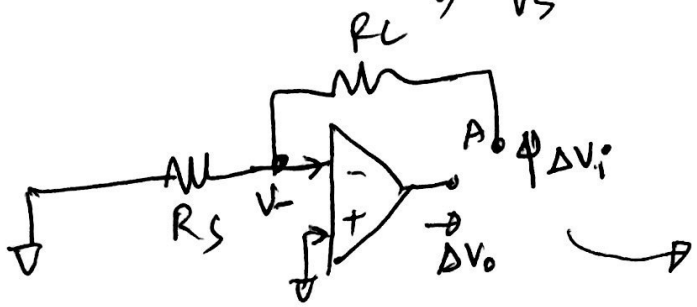
Test for type of f/B



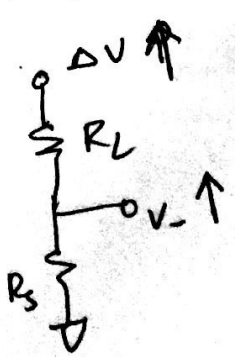


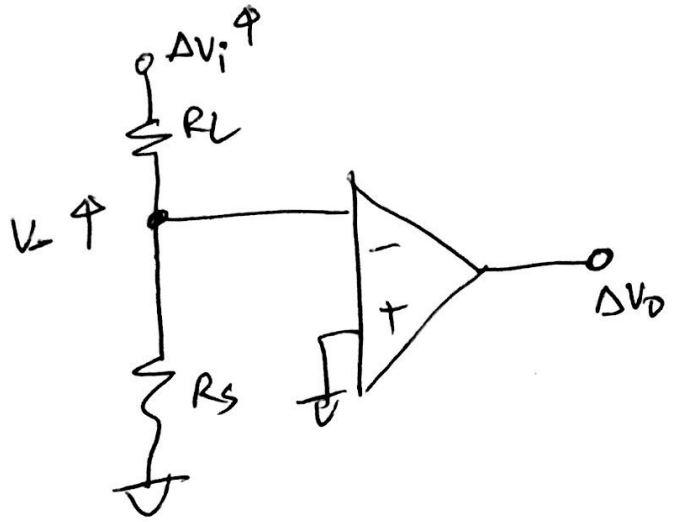
Check for type of f/B

i) V_S → GND



$\Delta V_i \uparrow$ $V_- \uparrow$

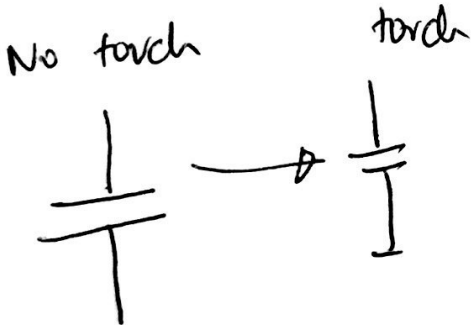




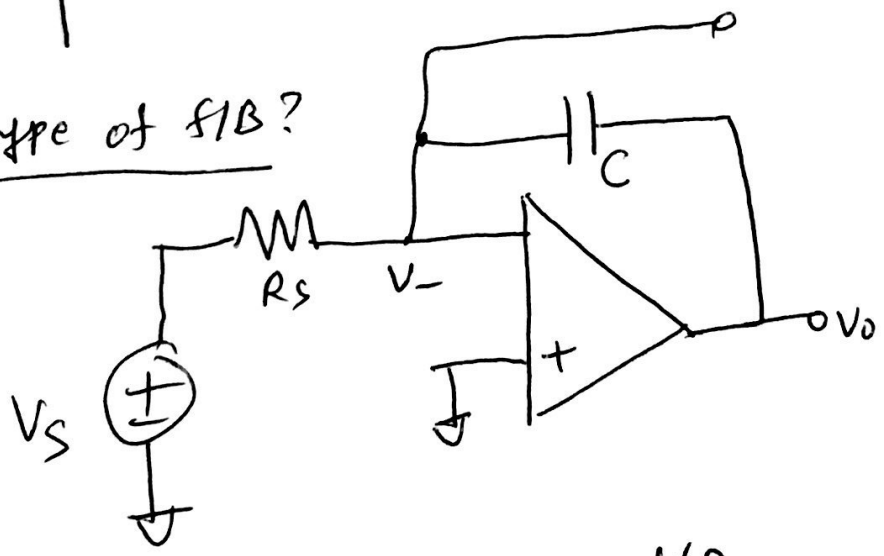
ΔVi ↑

V_ ↑

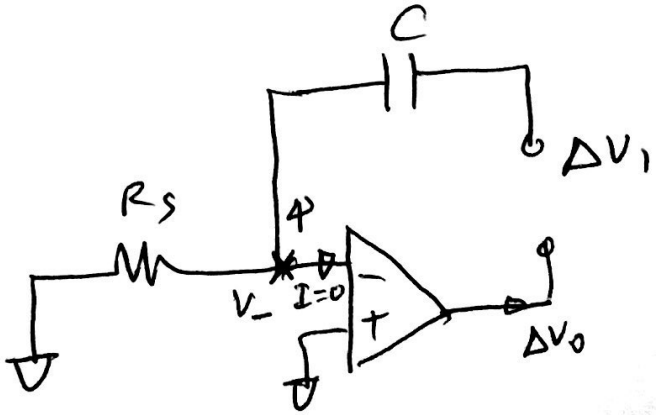
ΔVo ↓



What type of f/B?



1) -ve 2) +ve 3) No f/B



test

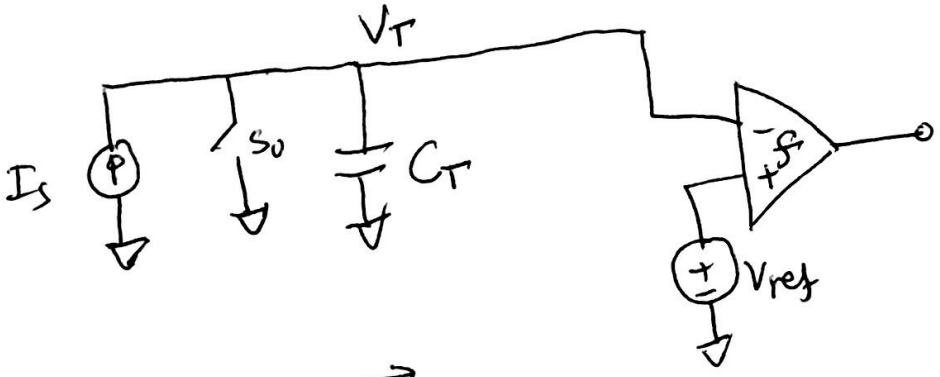
ΔVi ↑

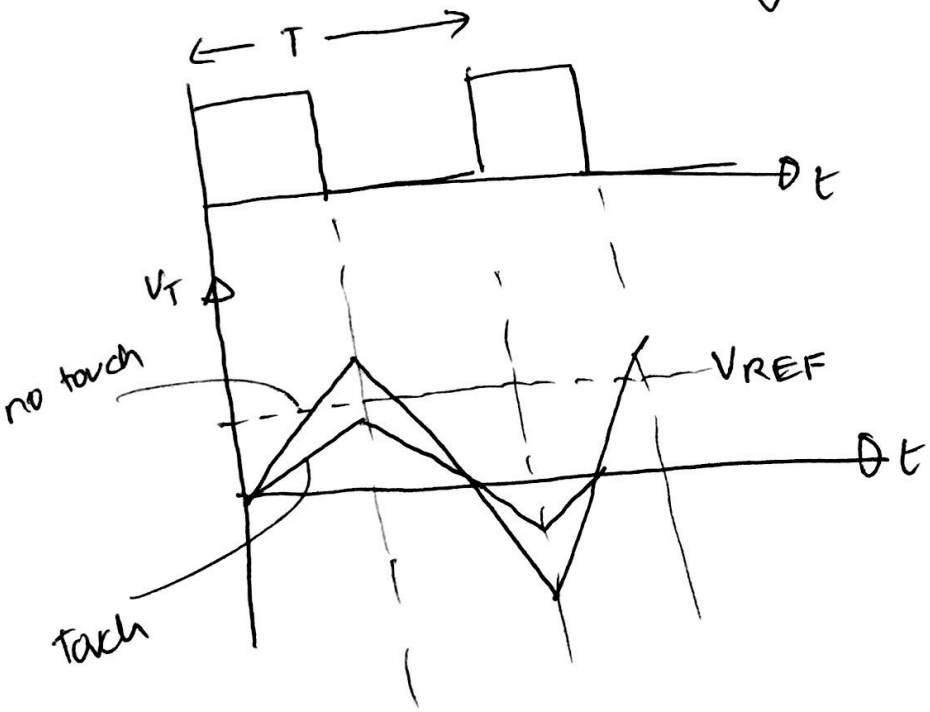
V_ ↑

ΔVo ↓ ← f/B we receive

NFB

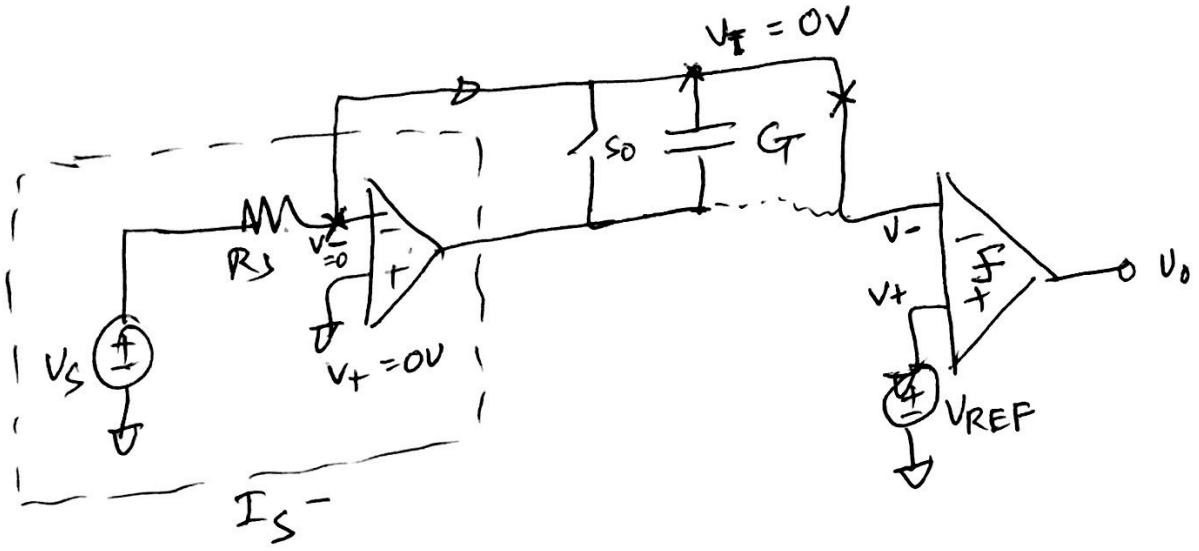
Circuit of touch-screen sensor



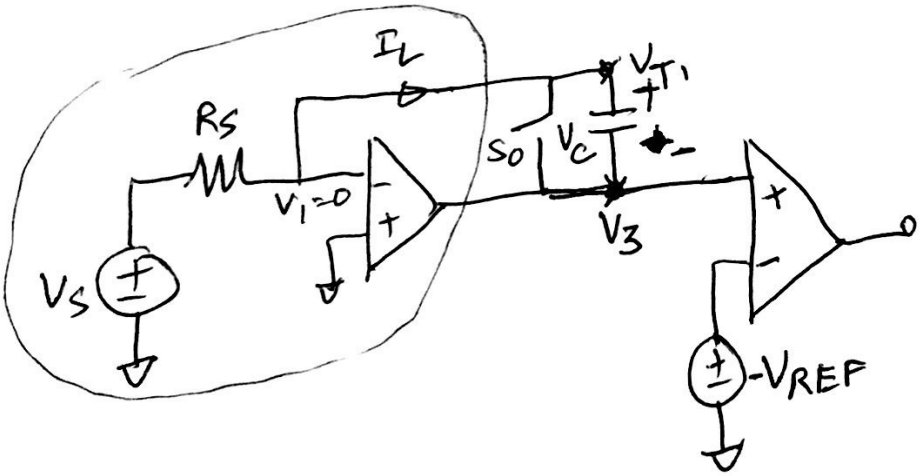


No-touch
$C_T = C_{T1}$

Touch
$C_T = C_{T2}$



GR-2 $V_- = V_+$ ⇓



~~V_C~~ ~~I_C~~

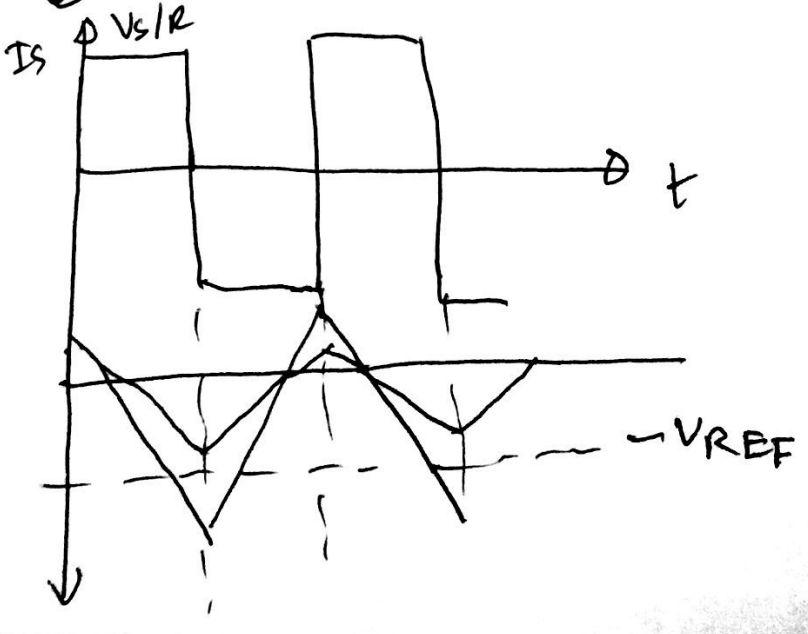
$$I_C = I_L = C_T \frac{dV_C}{dt}$$

$$I_L = \frac{C_T V_C}{T}$$

$$V_C = \frac{I_L T}{C_T}$$

$$I_L = \frac{V_S}{R}$$

$V_3 = -V_C$



No. torch $C_T = C_{T1}$

torch $C_T = C_{T2}$