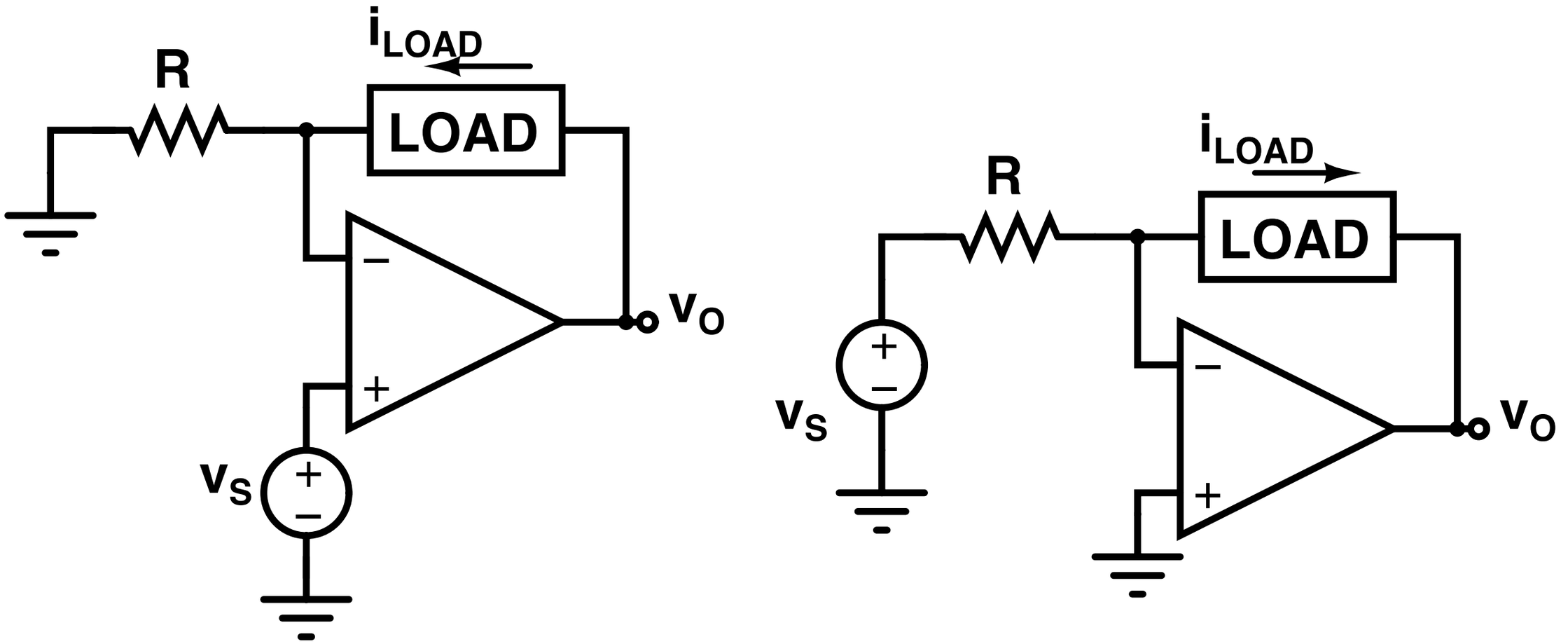
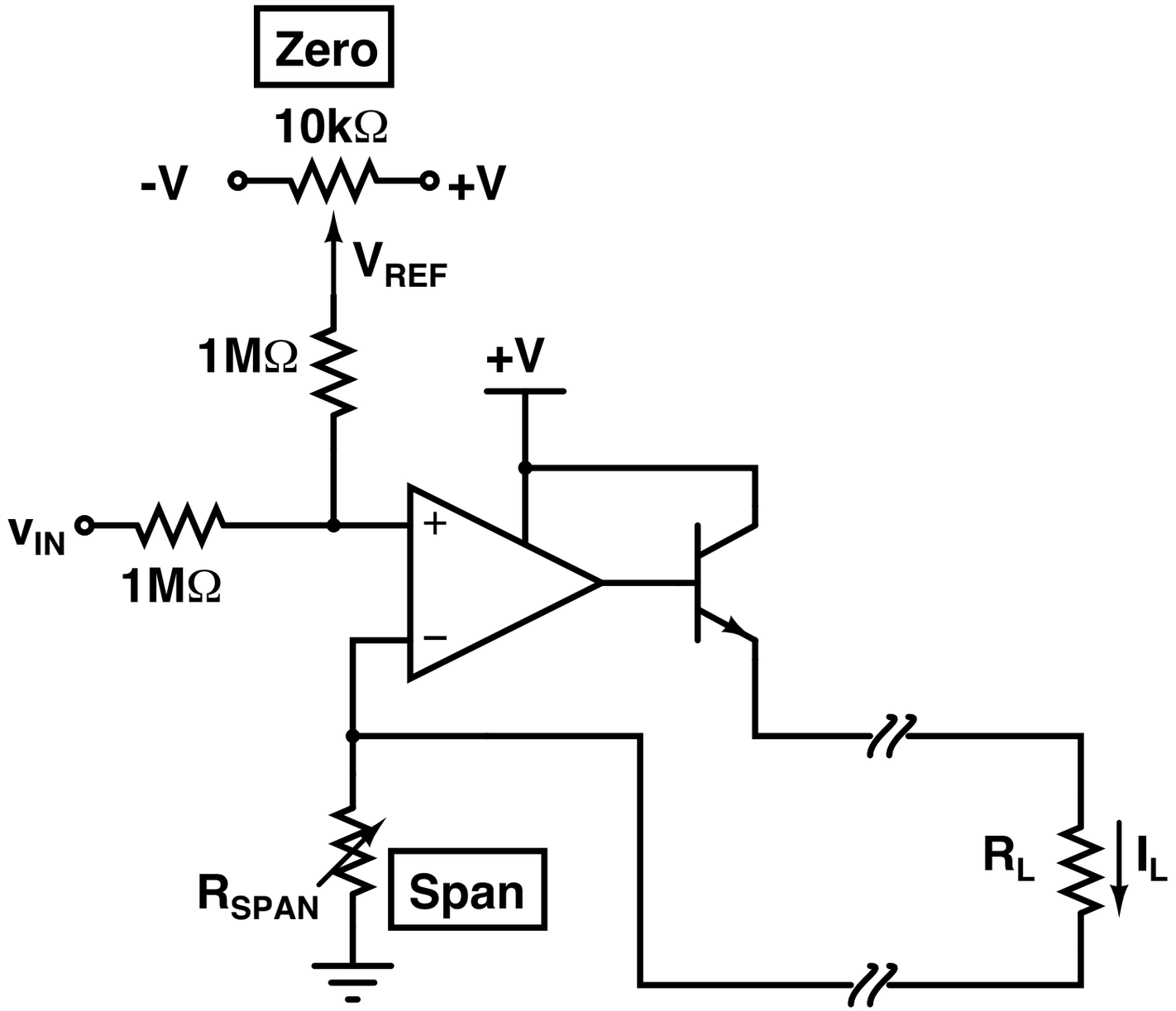
V-I & I-V Converters

INEL 5205 Instrumentation

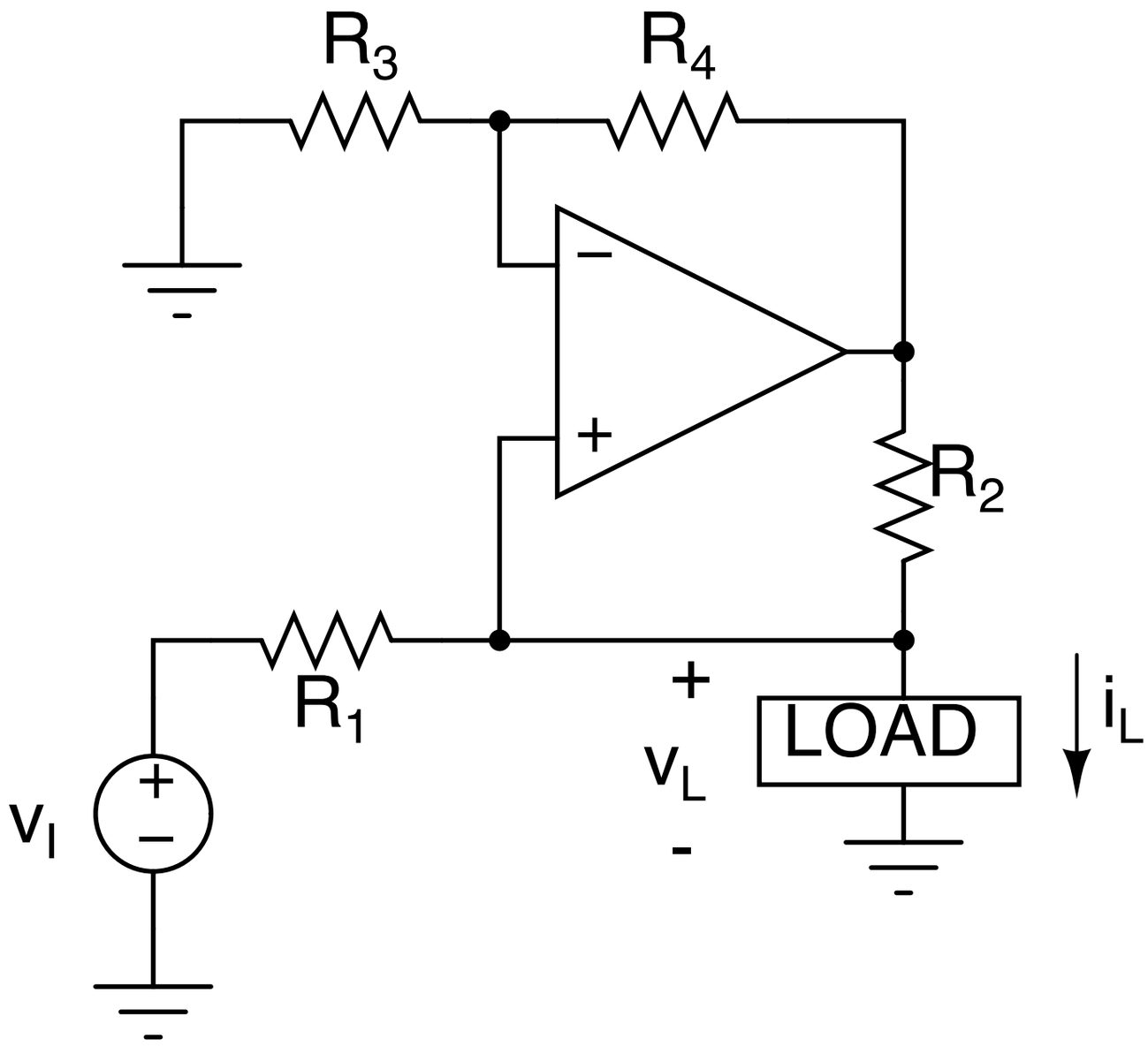


Simple V-to-I Converter

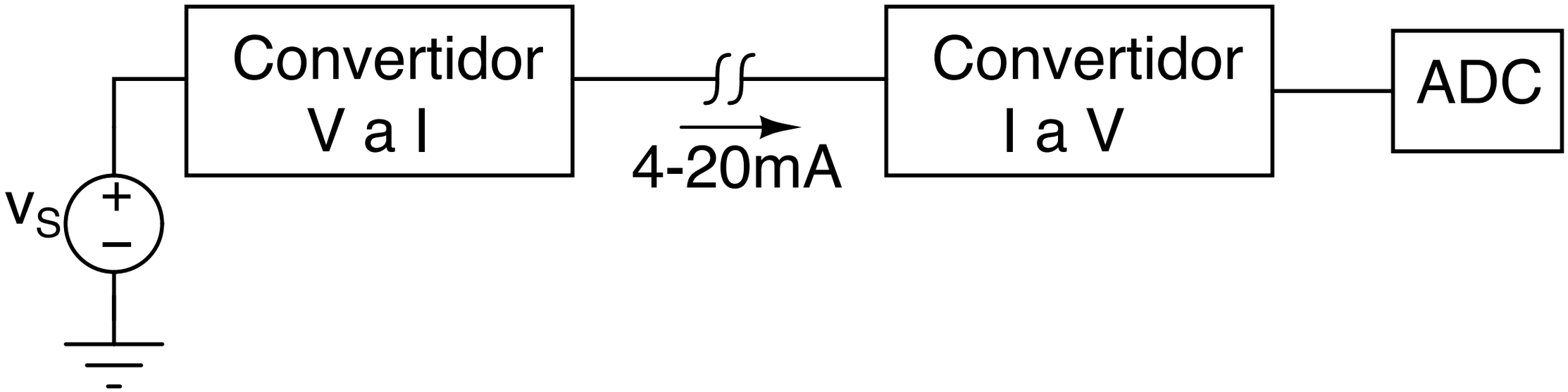


Example: Select R_{SPAN} and V_{REF} so that I_L= 4mA for V_{IN} = -5V and 20mA for V_{IN}=+10V

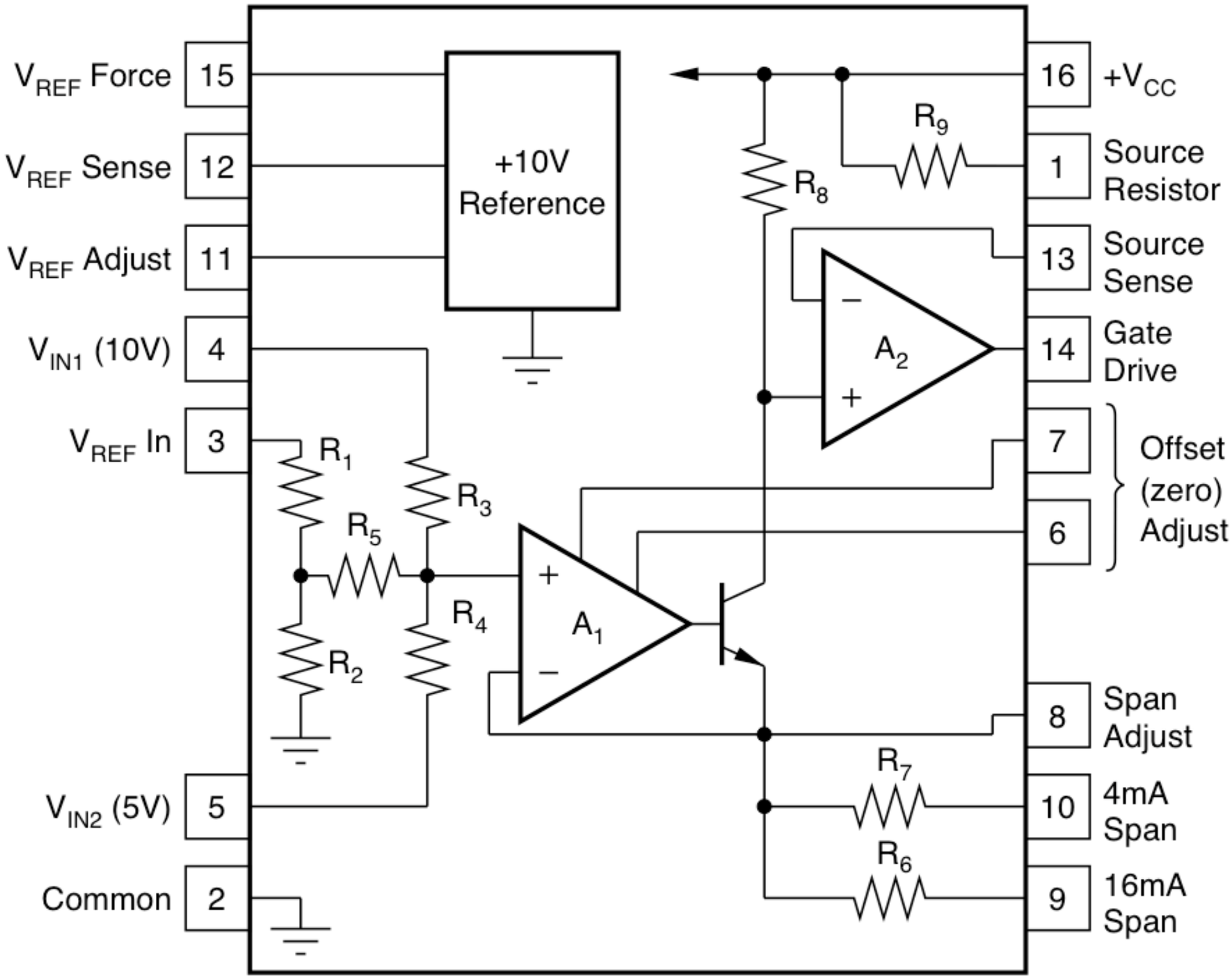
- Keep in mind:
  - Avoid opamp saturation
  - Use current boosting if $i_{LOAD} > i_{SC}$

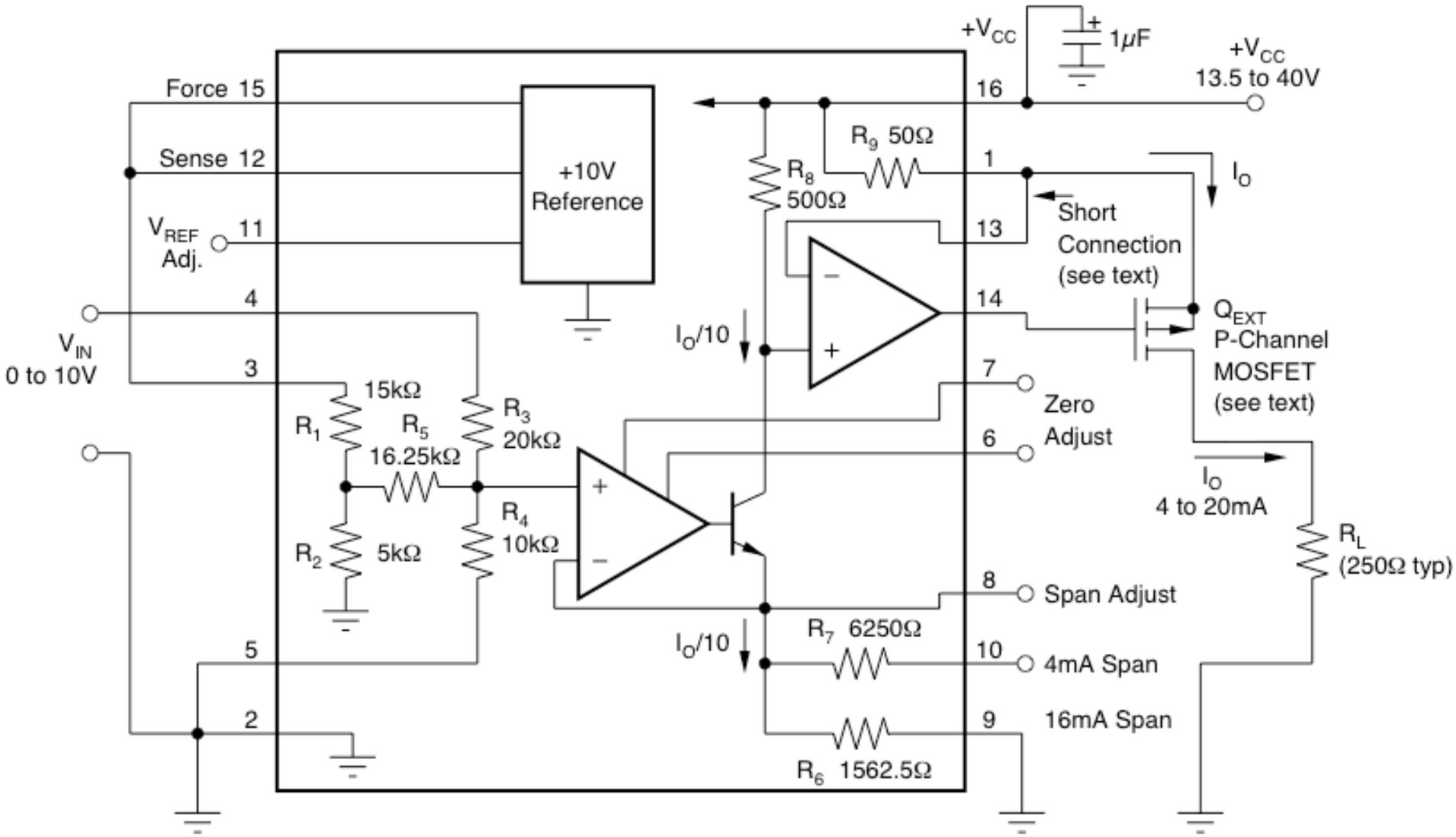


If $\boxed{\frac{R_2}{R_1} = \frac{R_4}{R_3}, i_L = \frac{v_i}{R_1}}$


Convertidor
V a I
4-20mA
Convertidor
I a V
ADC
v_S
+
−

XTR-110 Precision V-to-I Converter





INPUT RANGE (V)	OUTPUT RANGE (mA)	PIN 3	PIN 4	PIN 5	PIN 9	PIN 10
0-10	0-20	Com	Input	Com	Com	Com
2-10	4-20	Com	Input	Com	Com	Com
0-10	4-20	+10V Ref	Input	Com	Com	Open
0-10	5-25	+10V Ref	Input	Com	Com	Com
0-5	0-20	Com	Com	Input	Com	Com
1-5	4-20	Com	Com	Input	Com	Com
0-5	4-20	+10V Ref	Com	Input	Com	Open
0-5	5-25	+10V Ref	Com	Input	Com	Com

$$I_O \simeq 10\frac{V_{REF,in}/16 + V_{IN,1}/4 + V_{IN,2}/2}{R_{span}}$$

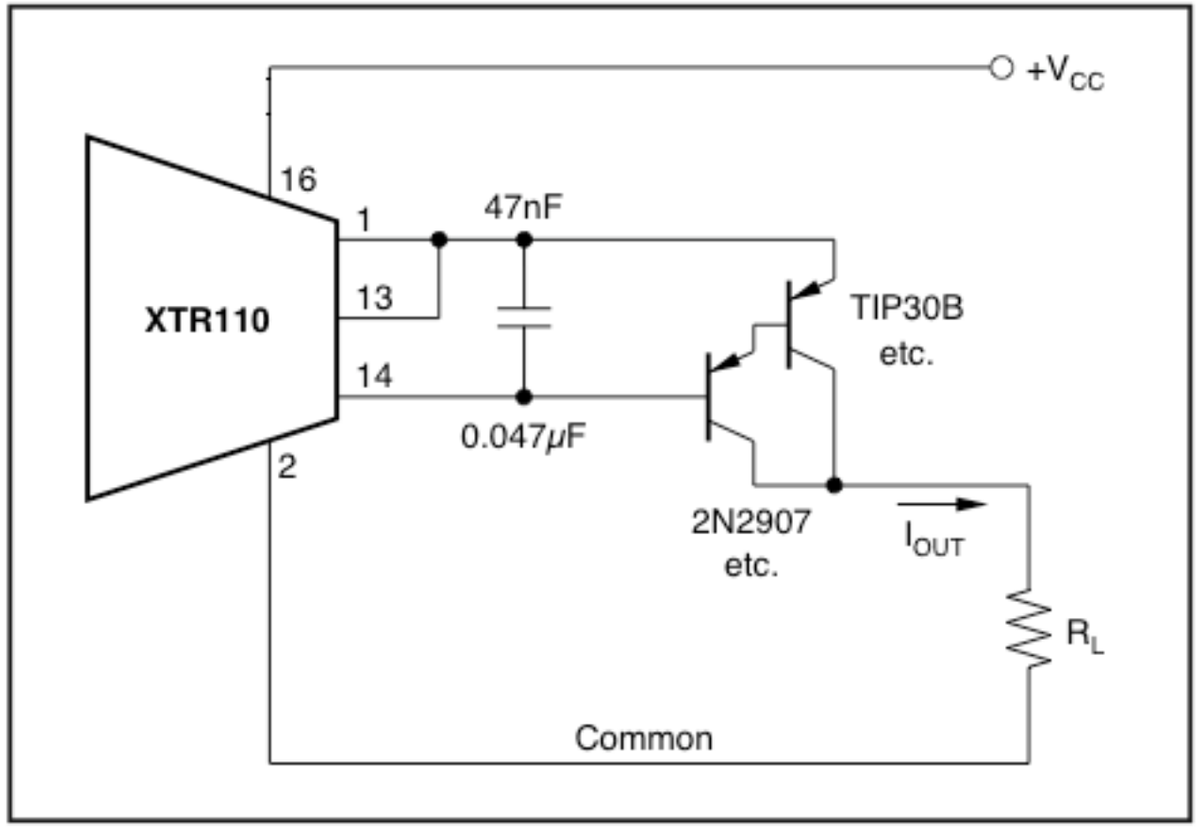


FIGURE 2. Q_{EXT} Using PNP Transistors.

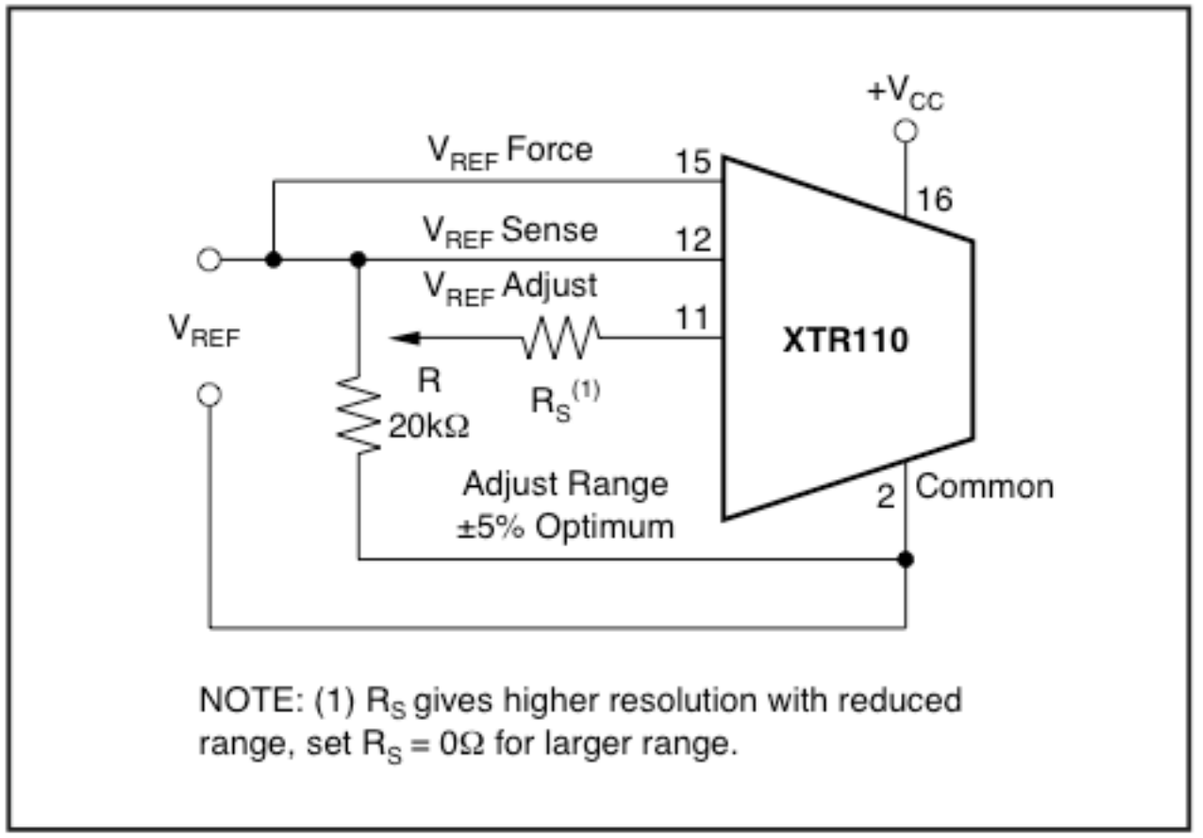


FIGURE 3. Optional Adjustment of Reference Voltage.

$$V_{A1} = \frac{(V_{REF\ IN})}{16} + \frac{(V_{IN1})}{4} + \frac{(V_{IN2})}{2}$$

V_{A1} shouldn't be below -0.5V

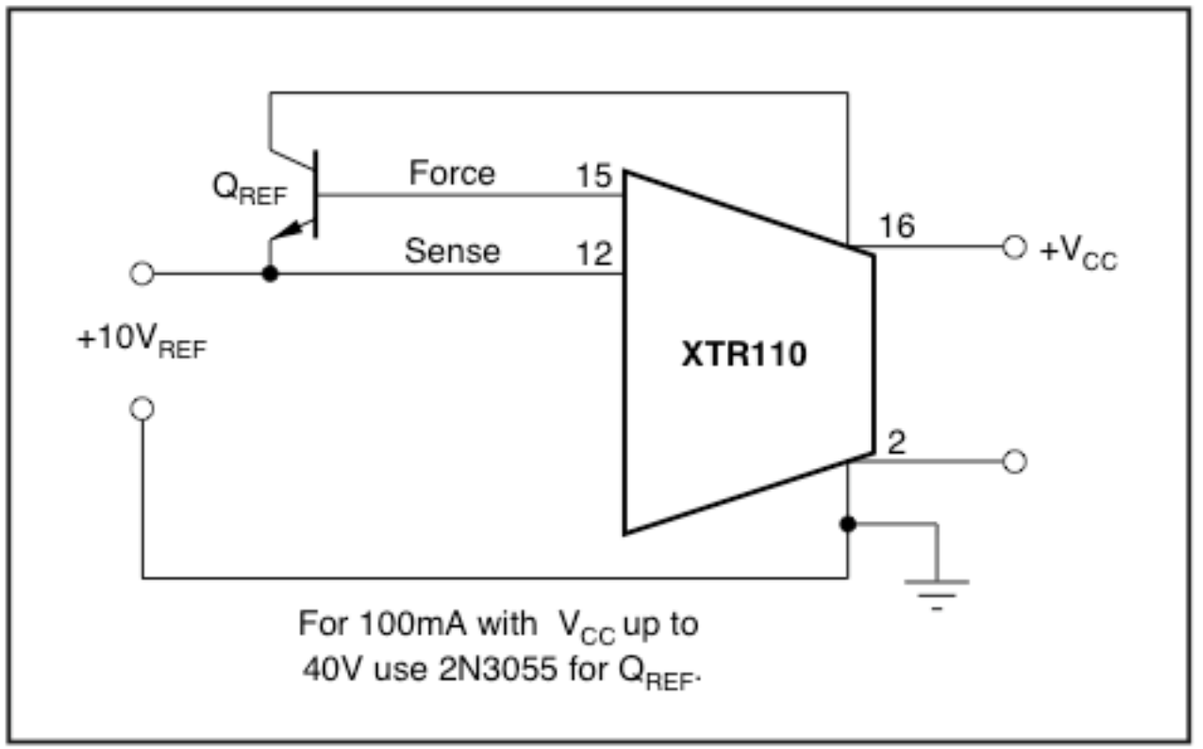
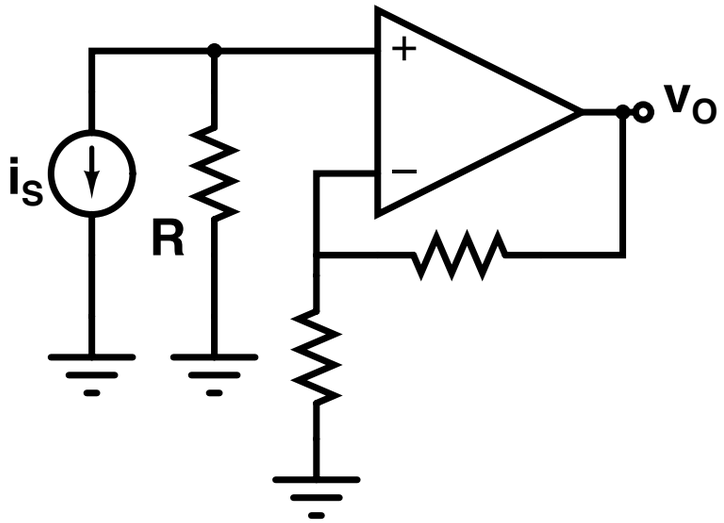
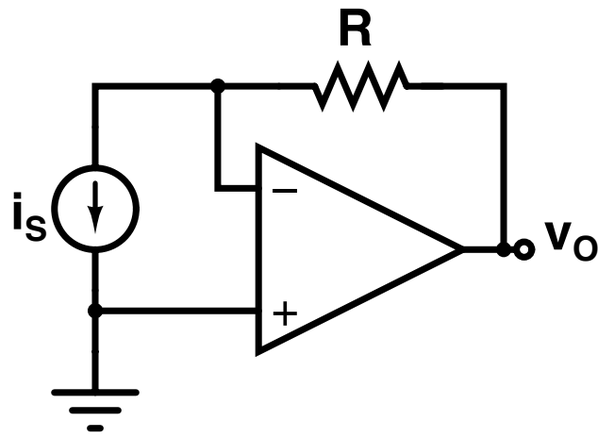
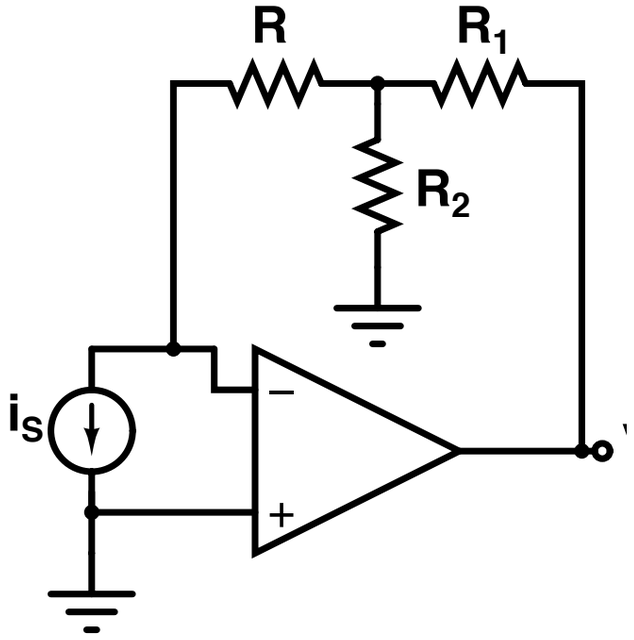


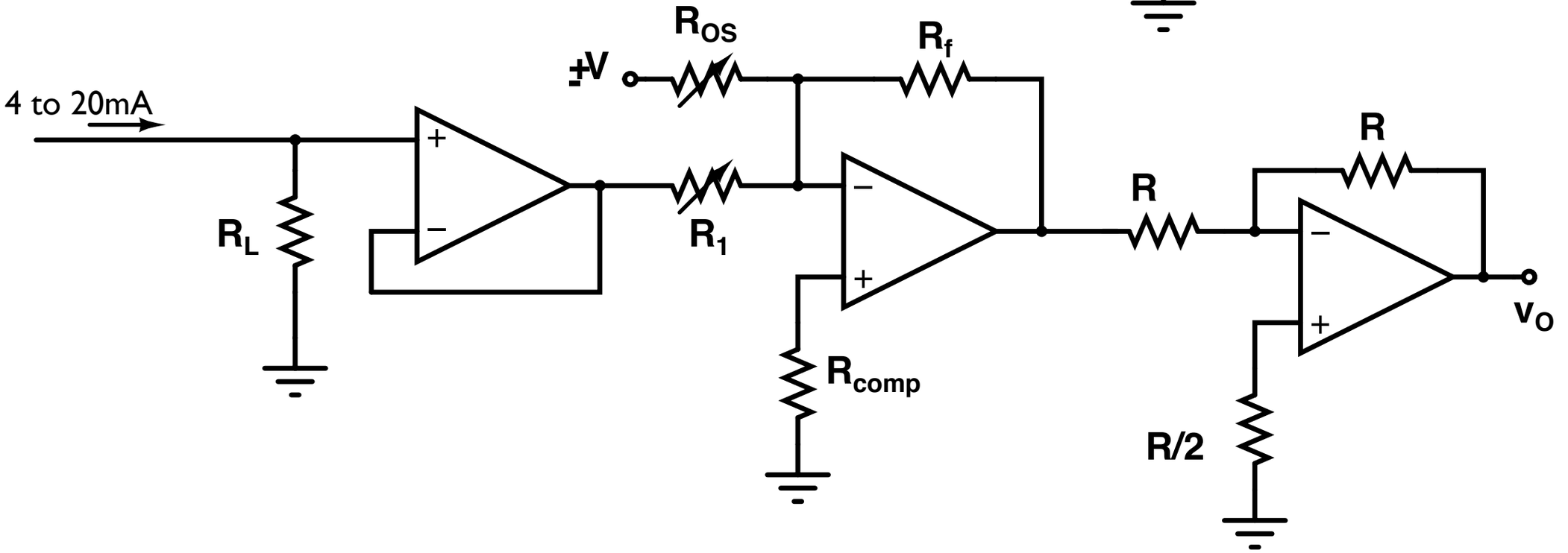
FIGURE 4. Increasing Reference Current Drive.

Grounded I to V converters

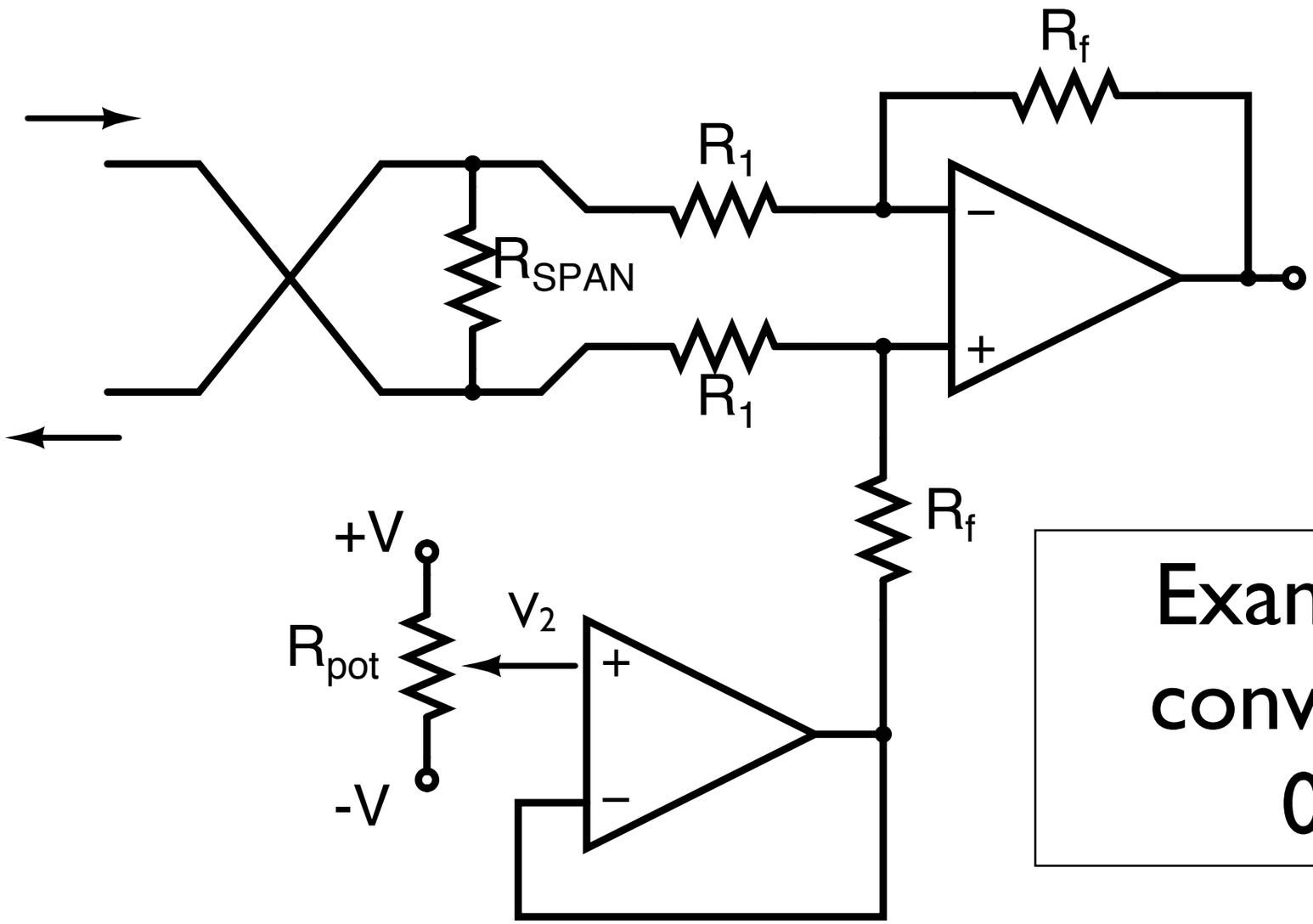








Floating I to V converter



Example: Design to convert 4-20mA to 0-10V signal

$$v_{out} = \frac{R_f}{R_1} I R_{span} + V_2$$

$$R_{span} << R_1$$