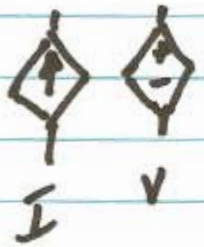
Sources

INDEPENDENT SOURCES

numeric value

$V = 1.5V$

$I = 6A$



DEPENDENT SOURCES

functional relation

$V_1 = 3I_1$

$I_2 = 4I_1$

R RESISTANCE

$$R = \frac{V}{I}$$

positive convention

C CAPACITANCE

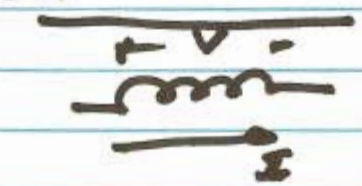
$$i(t) = C\frac{dV}{dt}$$

$$I = j\omega C V$$

$$V = \frac{1}{j\omega C} I$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{sC}\Big|_{s=j\omega}$$

INDUCTANCE

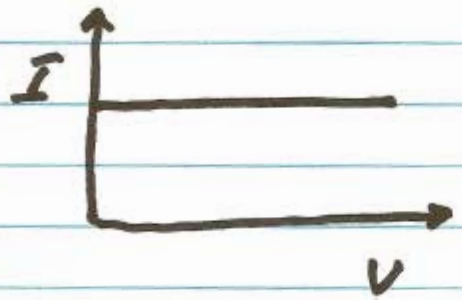


$$v(t) = L\frac{di}{dt}$$

$$V = j\omega L I$$

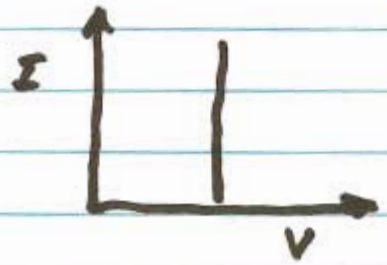
$$Z_L = j\omega L = sL\Big|_{s=j\omega}$$

Current Source



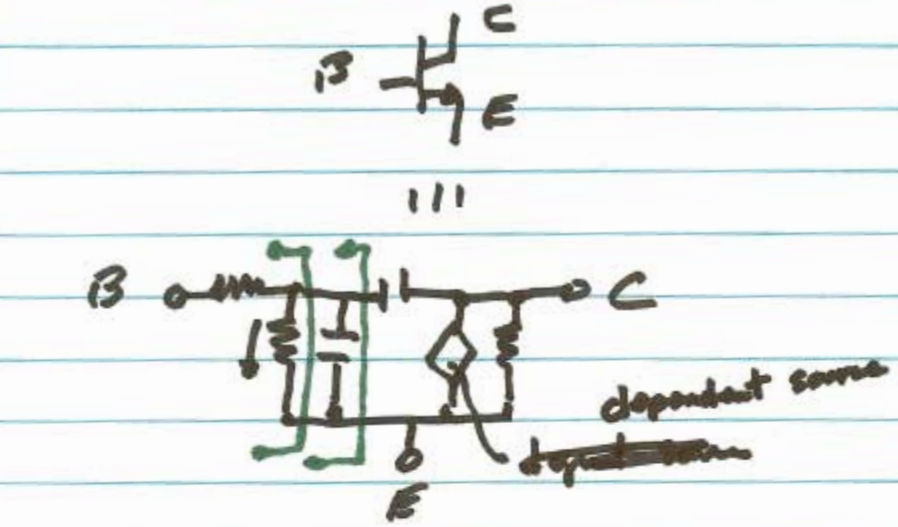
Constant I
Independent of V
∴ infinite impedance

Voltage Source

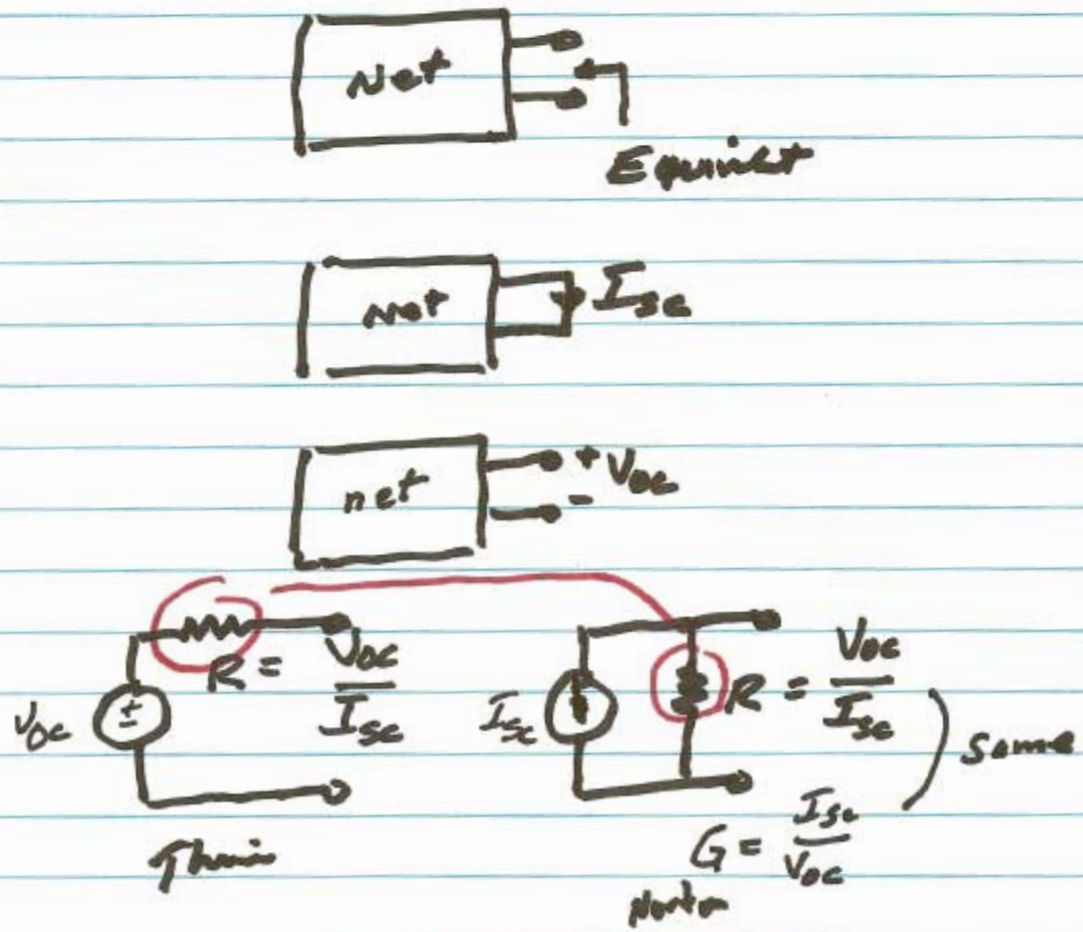


Constant voltage
Independent of I
∴ zero impedance

Bipolar Transistor (BJT)



THEVENIN/NORTON EQUIVALENT



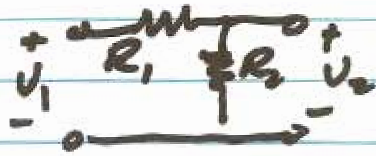
$Z_c = \frac{1}{j\omega c} = X_c$ capacitive reactance

$Z_L = j\omega L = X_L$ inductive reactance

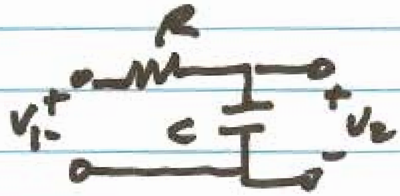
L & C ≡ reactive elements
store energy

Z's are function of ω.

Contrast:



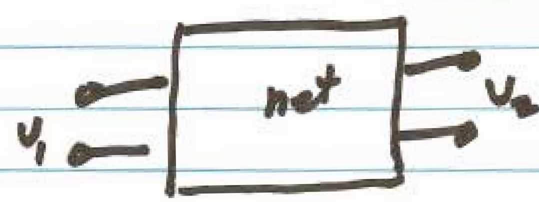
$V_2 = \left(\frac{R_2}{R_1+R_2}\right)V_1$
no freq dependence

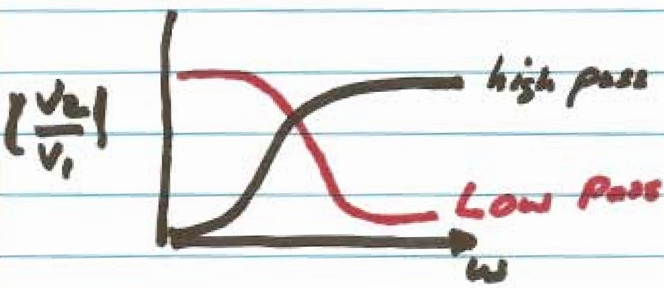


$V_2 = \left(\frac{X_C}{R+X_C}\right)V_1$

$X_C(\omega) \rightarrow$ freq dependent

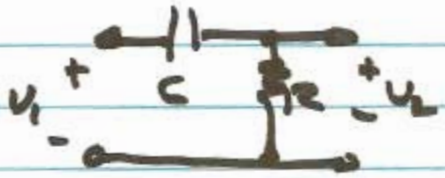
• frequency response



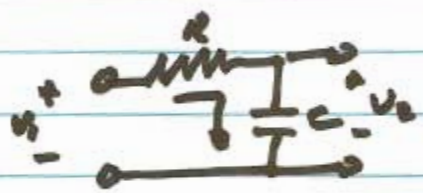


text:
STC response

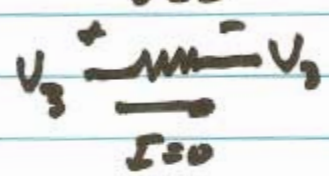
High Pass



Low Pass



V=0



Appendix Test

STC Appendix D-1