# Tellegen's Theorem

For any valid circuit (KVL & KCL apply)

$$\sum_{i \in \text{elements}} V_i I_i = \phi$$

$V_i \rightarrow$ Voltage across $i$

$I_i \rightarrow$ current through $i$

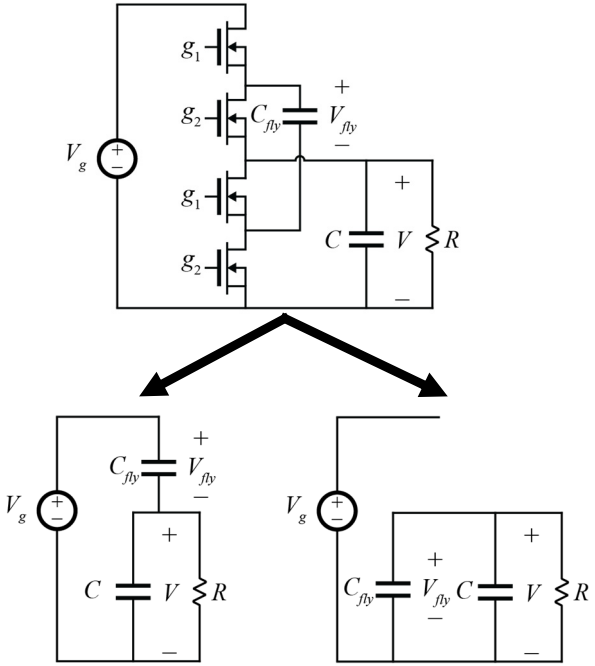
Passive sign convention held on all elements

For our 2-interval SC converter

$$\bar{a}^{I}\bar{v}^{I} + \bar{a}^{II}\bar{a}^{II} = \phi \quad \& \quad \bar{a}^{I}\bar{v}^{I} = \bar{a}^{II}\bar{v}^{II} = \phi$$

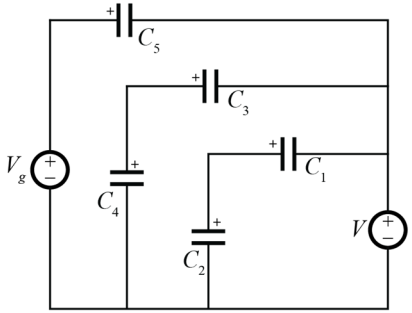
# SSL Output Resistance

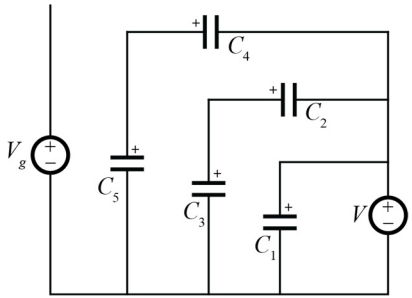
# Output Resistance




$$\bar{a}^{\mathrm{I}} = \left[-\frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{2}\right] \qquad \bar{a}^{\mathrm{II}} = \left[0 \quad -\frac{1}{2} \quad \frac{1}{2}\right]$$

# Dickson Charge Vector Analysis

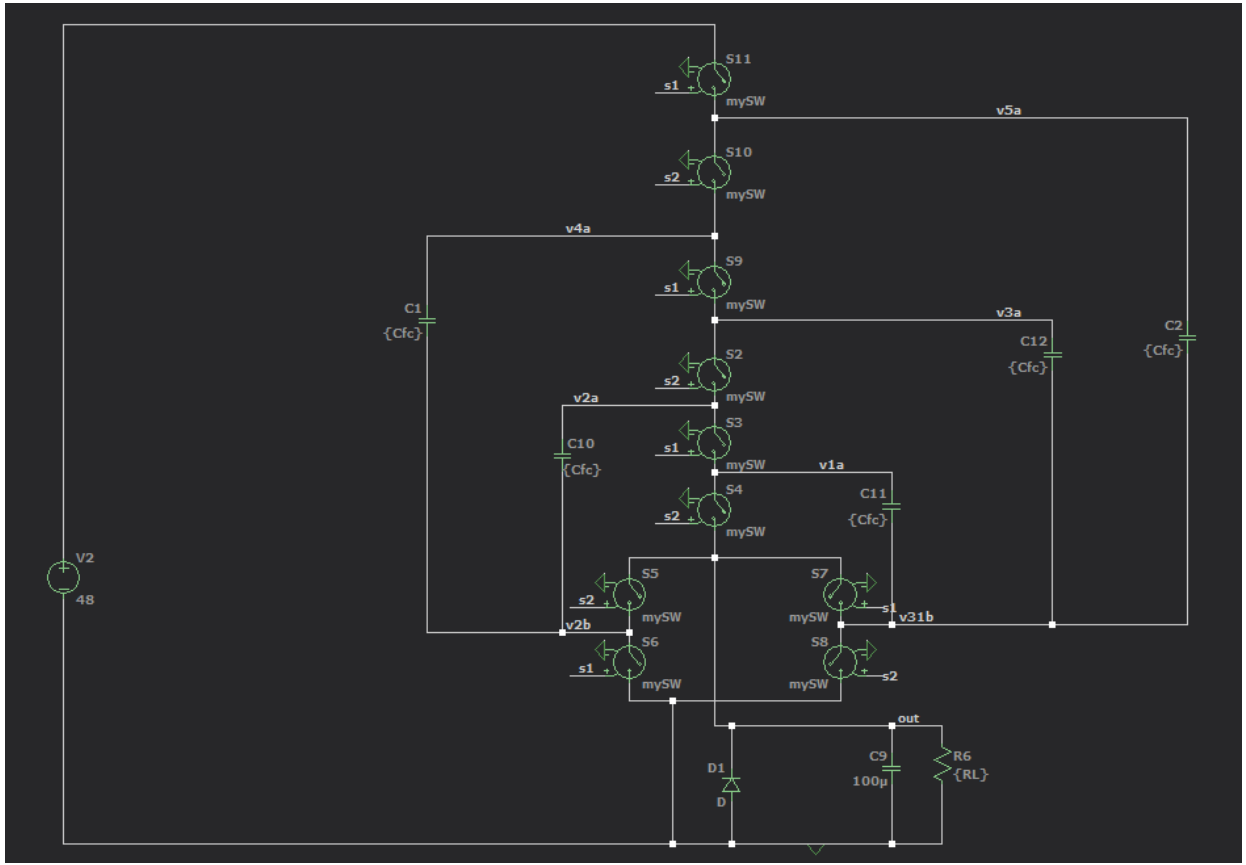


# Dickson Output Resistance

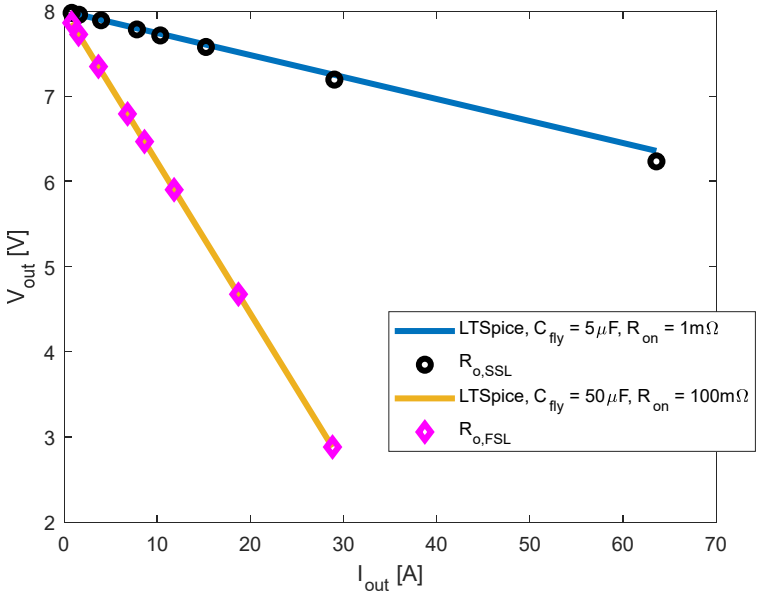
# Charge Vector Analysis in FSL

# 6:1 Dickson Converter Simulation



# Simulation Comparison to Model

fixed $f_s$= 1MHZ



# $R_o$ vs Switching Frequency

fixed $R_{on}$= 10mΩ, $C_{fly}$ = 5µF