4.3.4. Efficiency vs. switching frequency

Add up all of the energies lost during the switching transitions of one switching period:

$$W_{tot} = W_{on} + W_{off} + W_D + W_C + W_L + \ldots$$

Average switching power loss is

$$P_{sw} = W_{tot}\ f_{sw}$$

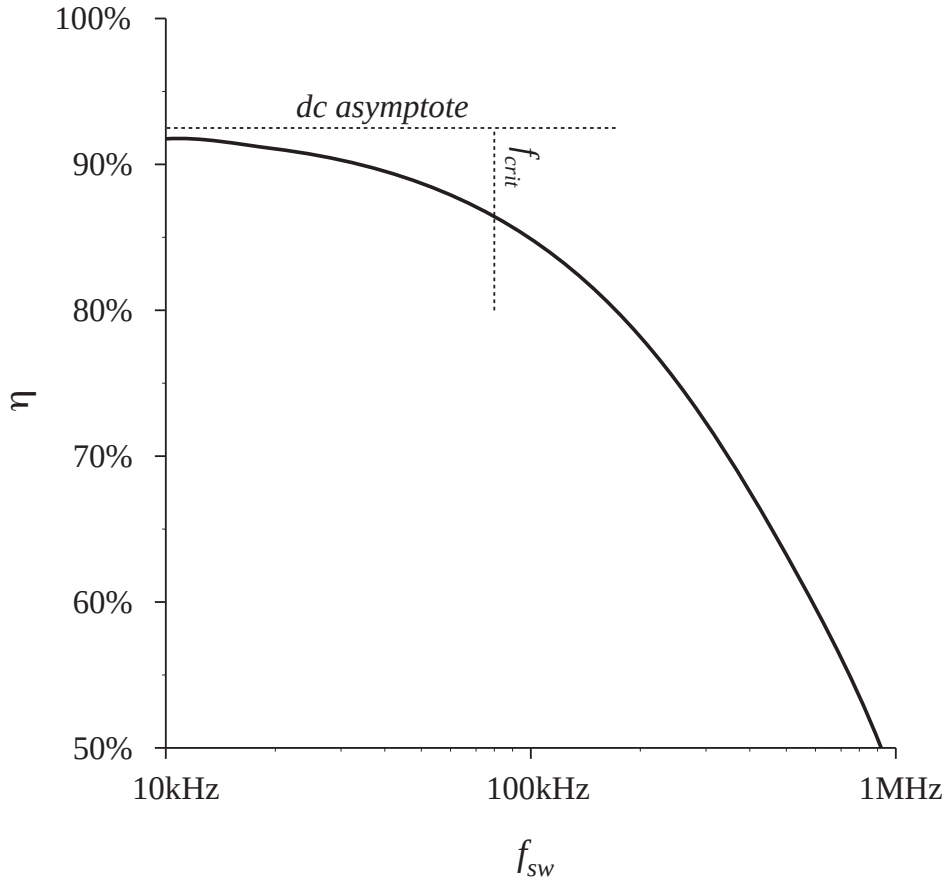
Total converter loss can be expressed as

$$P_{loss} = P_{cond} + P_{fixed} + W_{tot}\ f_{sw}$$

where P_{fixed} = fixed losses (independent of load and f_{sw})
P_{cond} = conduction losses

Efficiency vs. switching frequency

$$P_{loss} = P_{cond} + P_{fixed} + W_{tot}\ f_{sw}$$



Switching losses are equal to the other converter losses at the critical frequency

$$f_{crit} = \frac{P_{cond} + P_{fixed}}{W_{tot}}$$

This can be taken as a rough upper limit on the switching frequency of a practical converter. For $f_{sw} > f_{crit}$, the efficiency decreases rapidly with frequency.