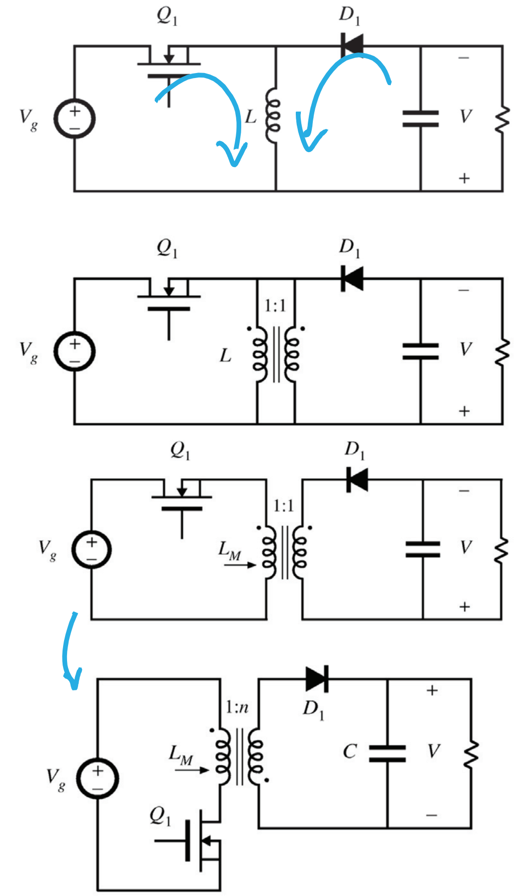
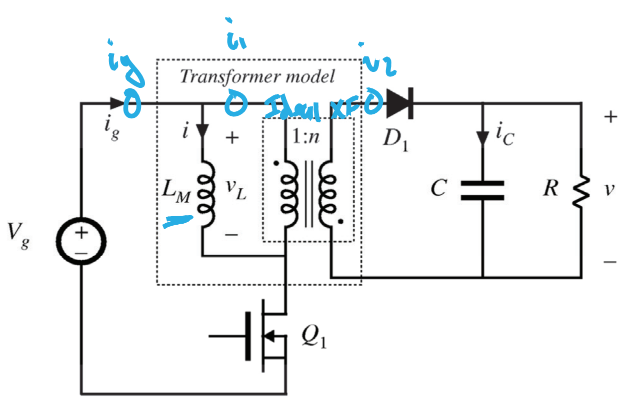
Flyback Converter: Buck-Boost Derived



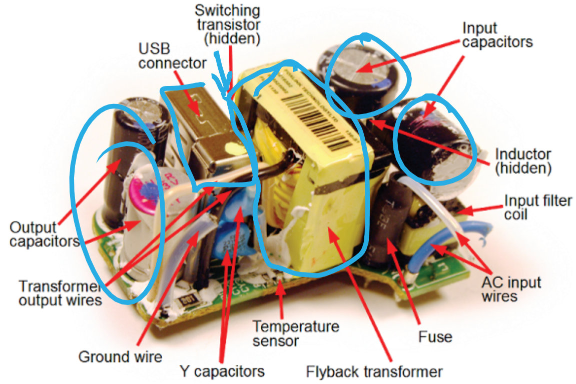
Flyback Transformer

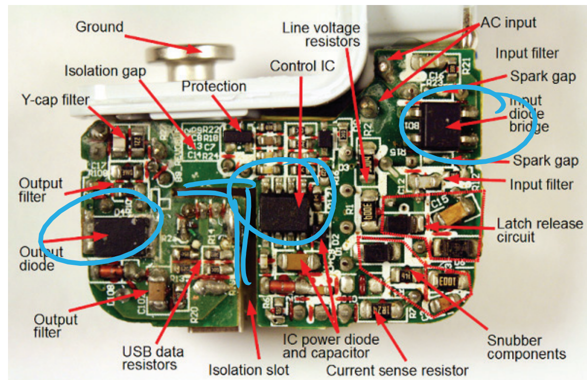


- A two-winding inductor
- Symbol is same as transformer, but function differs significantly from ideal transformer
- Energy is stored in magnetizing inductance
- Magnetizing inductance is relatively small

- Current does not simultaneously flow in primary and secondary windings
- Instantaneous winding voltages follow turns ratio
- Instantaneous (and rms) winding currents do not follow turns ratio
- Model as (small) magnetizing inductance in parallel with ideal transformer

Flyback Application: iPad Charger





http://www.righto.com/2014/05/a-look-inside-ipad-chargers-pricey.html

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Flyback Off-Line Charger Application Circuit

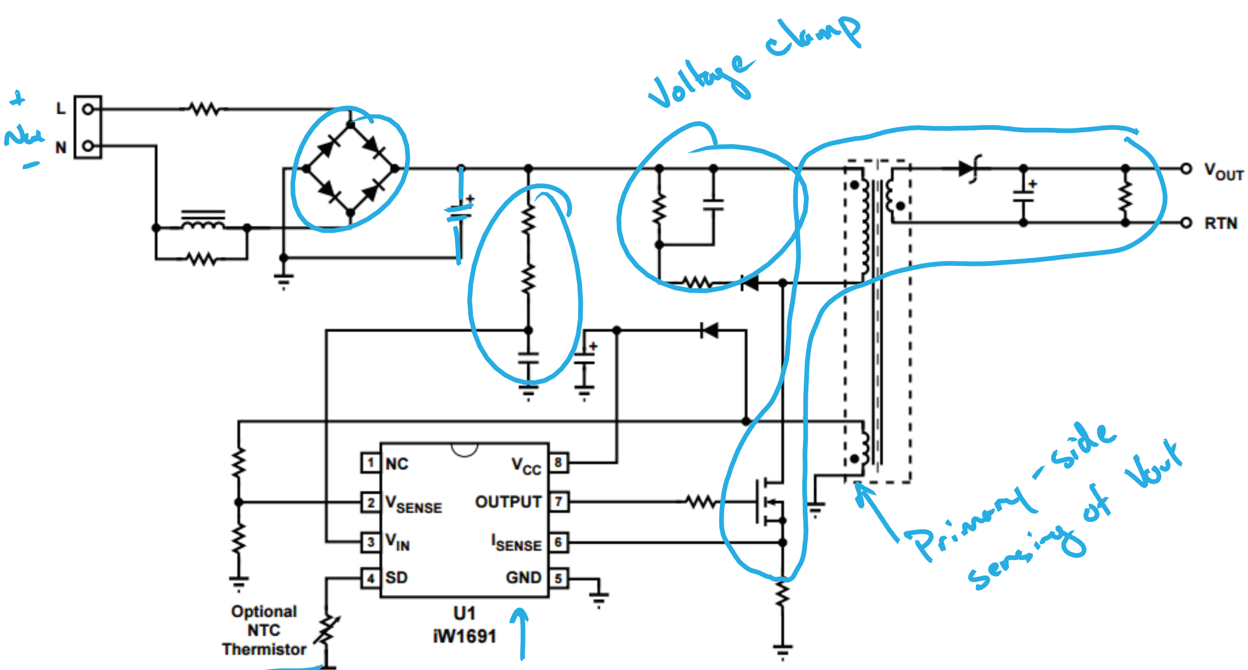

Figure 3.1 : Typical Application Circuit

http://www.dialog-semiconductor.com/sites/default/files/iw1691-datasheet.pdf

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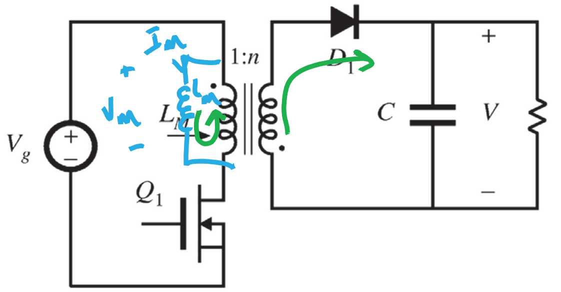
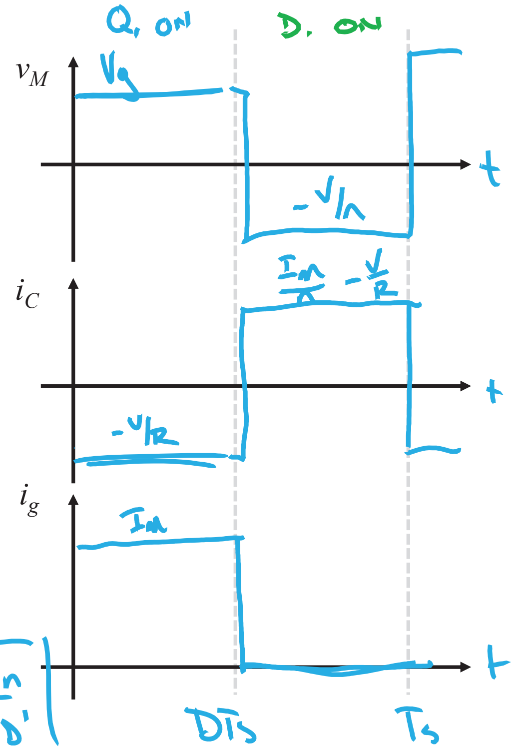
Flyback Waveforms





CCM operation $i_m(t) \simeq I_m$ (SRA on L_m)

$\langle v_m \rangle = 0 = D V_g - D' \frac{V}{n}$

$M(D) = \frac{V}{V_g} = n \frac{D}{D'}$

$\langle i_c \rangle = -\frac{V}{R} + D' \frac{I_m}{n} \rightarrow I_m = \frac{Vn}{RD'}$

$\langle i_g \rangle = D I_m$

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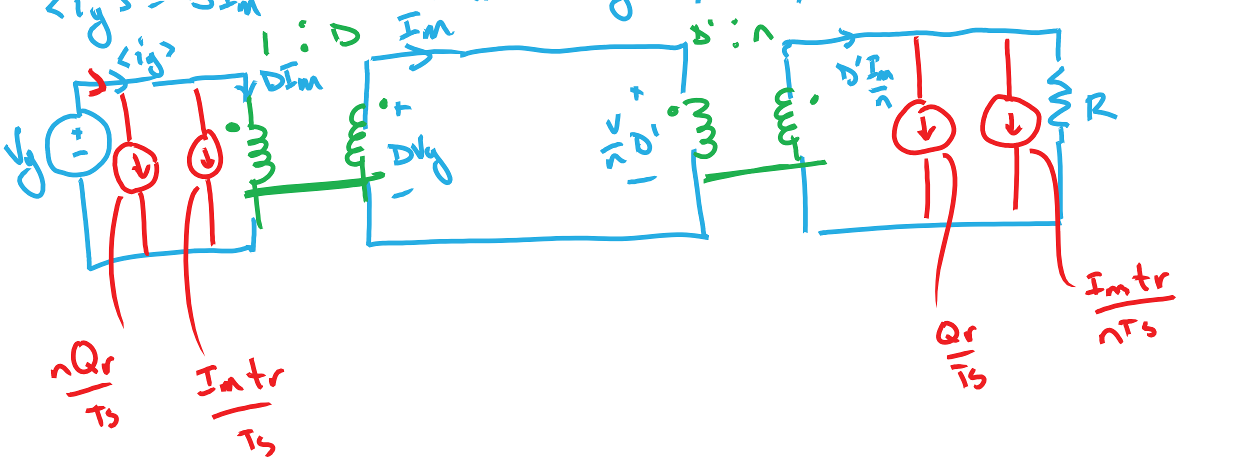
Flyback Equivalent Circuit Model

$\langle i_g \rangle = D I_m$ $\quad \langle v_m \rangle = D V_g - \frac{V}{n} D' = 0$ $\quad \langle i_c \rangle = -\frac{V}{R} + D' \frac{I_m}{n}$



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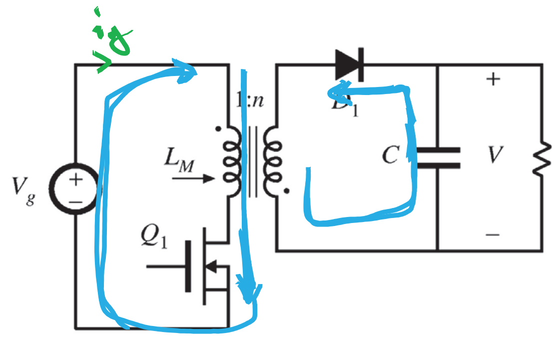
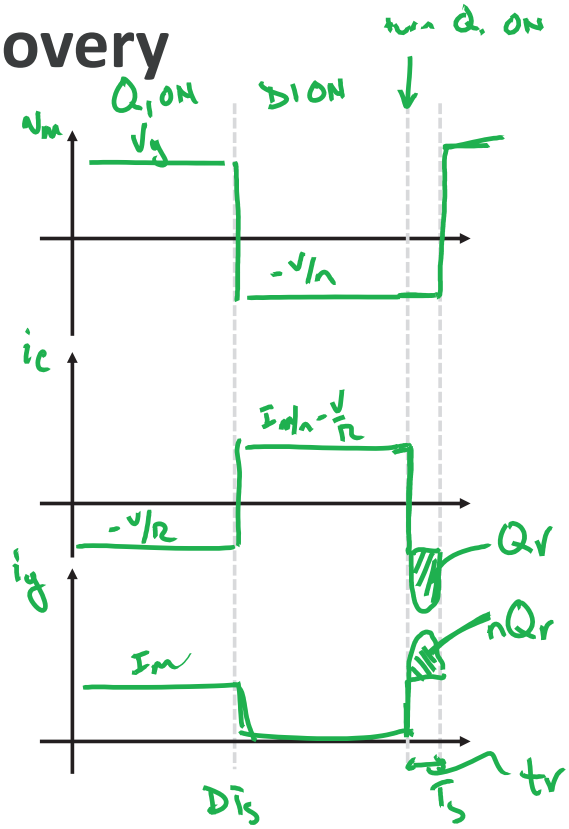
Flyback Reverse Recovery





D_1 has Q_r, t_r

$\langle v_m \rangle = $ (the same)

$$\langle i_c \rangle = -\frac{V}{R} + D' \frac{I_m}{n} - \frac{Q_r}{T_s} - \frac{t_{rr} I_m}{n T_s}$$

$$\langle i_g \rangle = D I_m + \frac{t_r I_m}{T_s} + \frac{n Q_r}{T_s}$$