Why $L_m$ small in Flyback?

$E(\text{trf from primary})$ each sw to secondary

$E = \frac{1}{2} L_m i_m^2 = \frac{1}{2} \frac{1}{L_m} \left( \frac{V_D}{L_m} \right)^2$

$L_m \uparrow \ E(\text{trf}) \uparrow$ each sw cycle

$L_m = \frac{N^2}{\bar{Q}_c}$

$Q = \frac{l_c}{\mu c \bar{A}_c}$

$Q \text{ small}$

$L_m \text{ big}$

$Q \text{ big}$

$L_m \text{ small}$

- air gap
- $\log \mu_d$
- $\log \frac{\mu_o}{\mu_0 \text{ Ag}}$
- dominates
Fig. 3: An idealized B/H characteristic for the continuous mode flyback transformer.

- Secondary current (Reflected to primary)
- Current for larger gap
- Primary current
- Larger air-gap
- Core B/H Loop (idealized)
- Core saturation
- Larger saturation
- Key

Ungapped
Allows Lm
Carry
High I
DC
Saturation
$L_m \downarrow$ causes $\Delta i_{L_m} \uparrow$

What if $\Delta i_{L_m} > I_{L_m}^{DC}$?

$R_L \uparrow$ $I_{L_m}^{DC}$

Get third circuit

Both $Q$ and $D$ off

1st state: $Q$ on $D$ off

2nd state: $Q$ off $D$ on

3rd state: Both $Q$ and $D$ off

DCM Could occur

When $i_L = 0$
Fig. 2. Current waveforms for (a) Continuous mode and (b) Discontinuous mode.