Summarize $V_{Lm}(t)$ $I_{Lm}(t)$

$D_1 T_{sw}$ V_g I_{Lm} and increasing $\uparrow V_g/L_m$

L_m — Q_1 on

and decreasing

$D_2 T_{sw}$ L_m D_1 on

$-\frac{V_g}{N_2} \approx \frac{V_{Lm}}{N_1}$

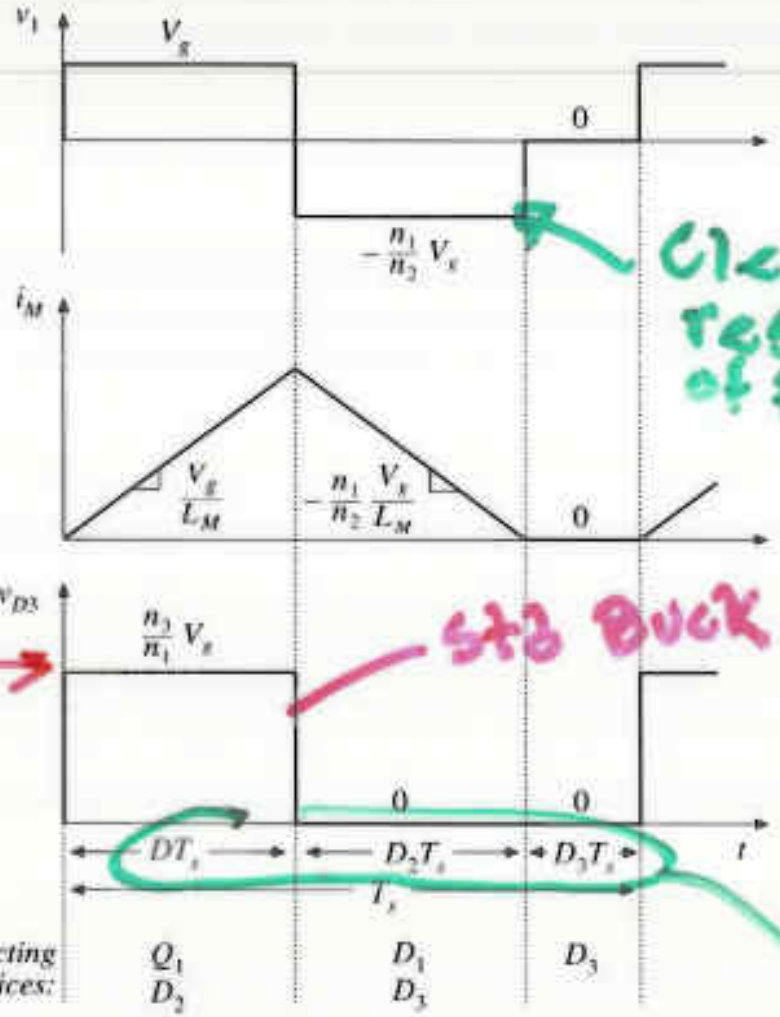
N_2 coil N_1 coil

$-\frac{N_1}{N_2}\frac{V_g}{L_m}$

$\frac{N_1}{N_2} > 1$ forces DCM

Forward converter: waveforms

DCM



- Magnetizing current, in conjunction with diode D_1, operates in discontinuous conduction mode
- Output filter inductor, in conjunction with diode D_3, may operate in either CCM or DCM

Clever reset of the

back bias D_3 forward bias D_2

STB Buck

$V_0 = D \frac{n_3}{n_1} V_g$

Next Details !

Transformer reset

Quantative Conditions for

D_1 choice & $\frac{N_2}{N_1}$ ratio ≥ 1 ? < 1.

From magnetizing current volt-second balance:

$$\langle v_1 \rangle = D\left(V_g\right) + D_2\left(-V_g n_1/n_2\right) + D_3(0) = 0$$

To insure No L_m saturation

Solve for D_2:

$$D_2 = \frac{n_2}{n_1} D$$

D_3 cannot be negative. But $D_3 = 1 - D - D_2$. Hence

$$D_3 = 1 - D - D_2 \geq 0$$

$$D_3 = 1 - D\left(1 + \frac{n_2}{n_1}\right) \geq 0$$

Solve for D

$$D \leq \frac{1}{1 + \frac{n_2}{n_1}}$$

for $n_1 = n_2$: $D \leq \frac{1}{2}$

$\pm V_g$ on V_p

1) Reset for CCM Forward

2) To achieve DCM

limited D_{ON} in Forward

$D_3 T_{sw}$

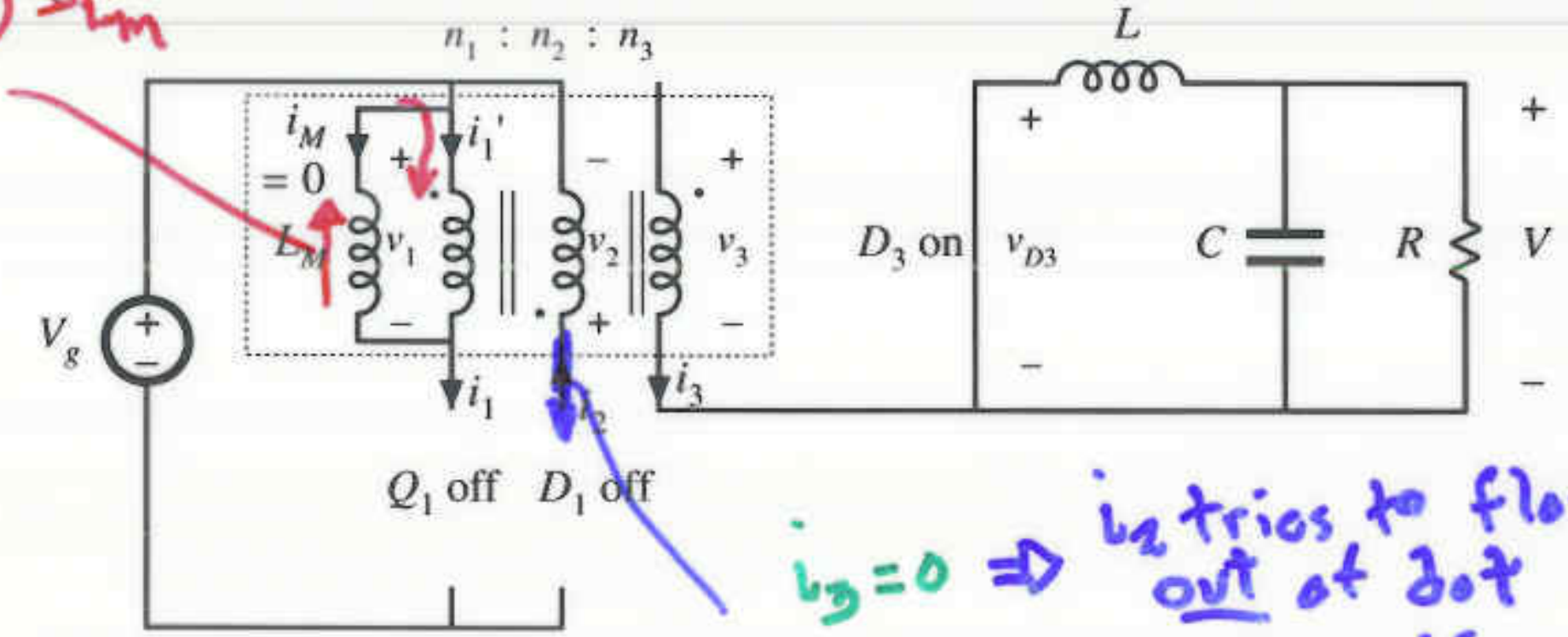
DCM condition

$i_{L_m} \to 0$

if proper conditions

Subinterval 3

$(-) I_{Lm}$



$i_3 = 0 \Rightarrow$ i_2 tries to flow out of dot

D_1 off

interval

If D_1 short enough i_{Lm}(max) is low

Subinterval 3

(2) Interval 3 Caused by i_{Lm} going → 0

All coils i_{coil} = ?

$i_{Lm} \to 0$, D_1 off

Fig 6.25c
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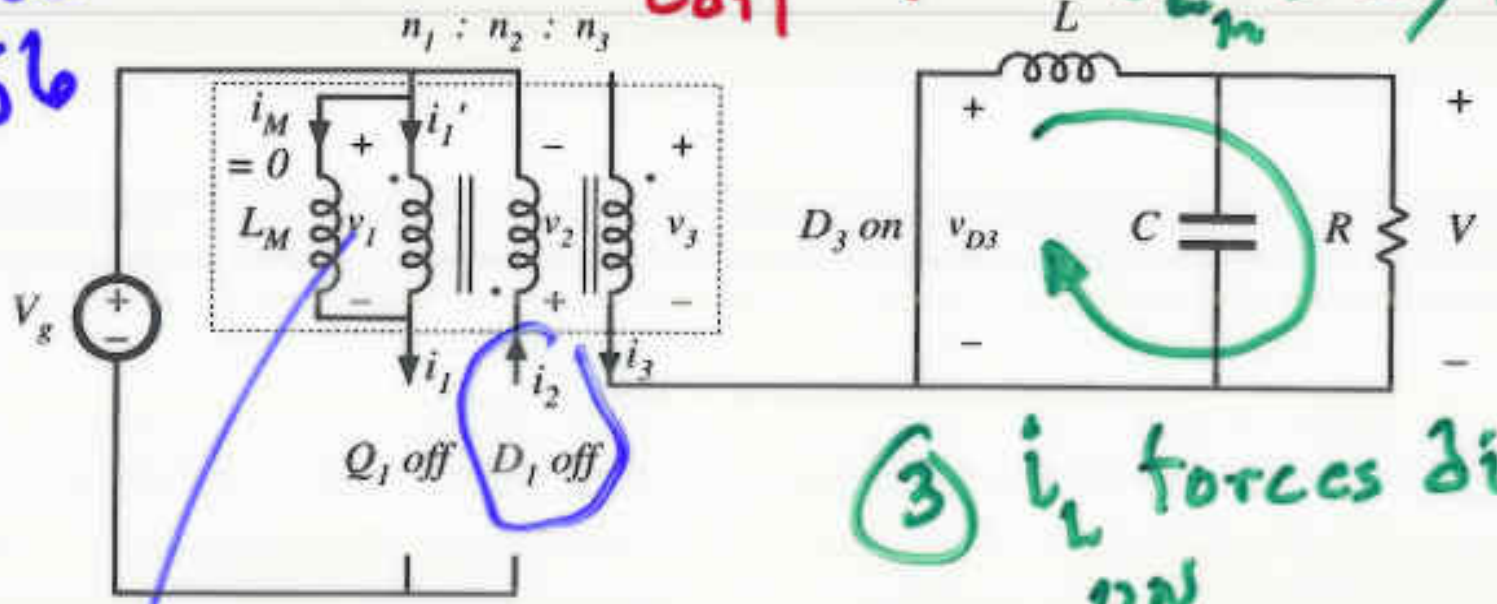
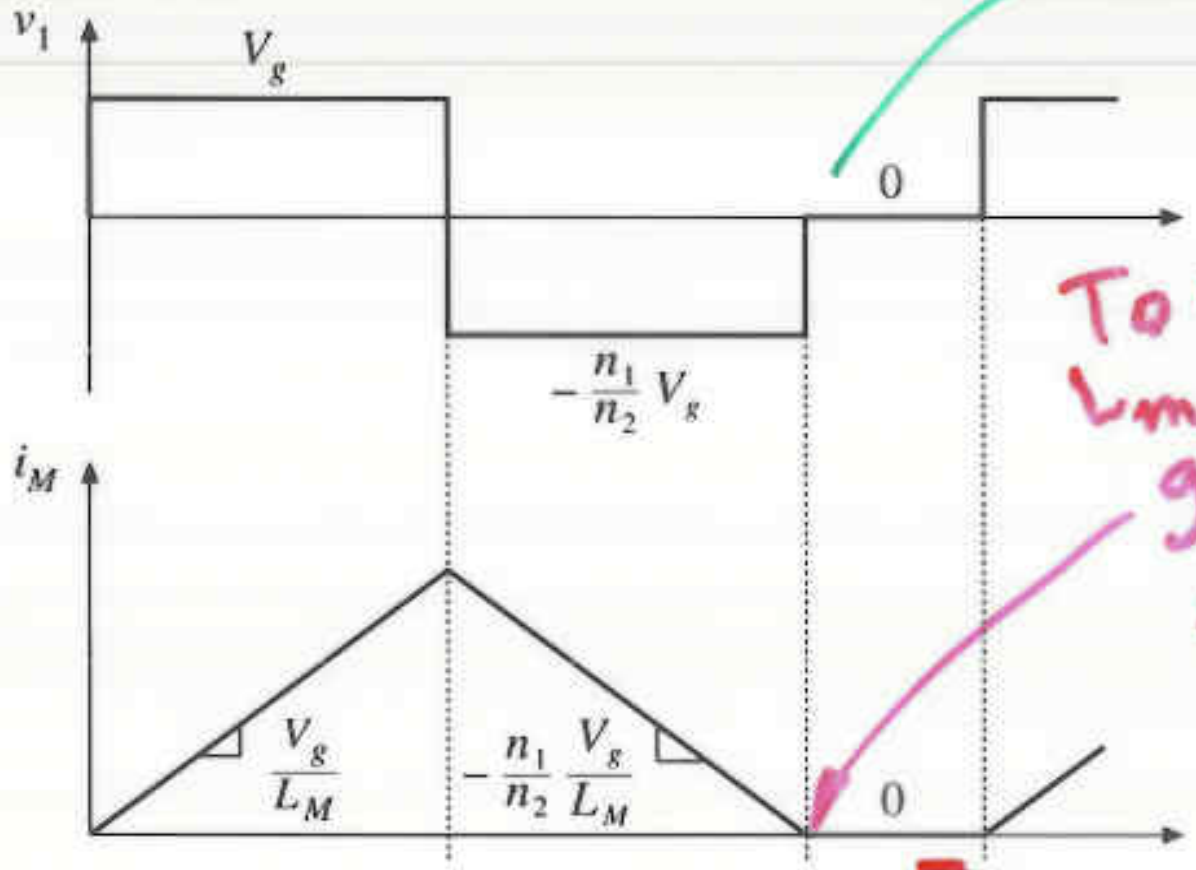


(3) i_L forces diode 3 ON

Is $v_{D3} = 0$ for both D_2 & D_3 intervals ?

(1) $i_{Lm} = 0$ by ⇒ $v_1 = 0$

Magnetizing inductance volt-second balance



$$\langle v_1 \rangle = D(V_g) + D_2(-V_g n_1/n_2) + D_3(0) = 0$$

$i_L = 0$ & flat
$\Rightarrow V_{L_m} = 0$

To insure NO L_m saturation goal $i_{L_m} = 0$ each SW cycle

Force a D_3 interval

Quantifying Trk. Reset Condition

Magnetizing inductance volt-second balance

ON Coil #1 (L_m)

Fig 6.24
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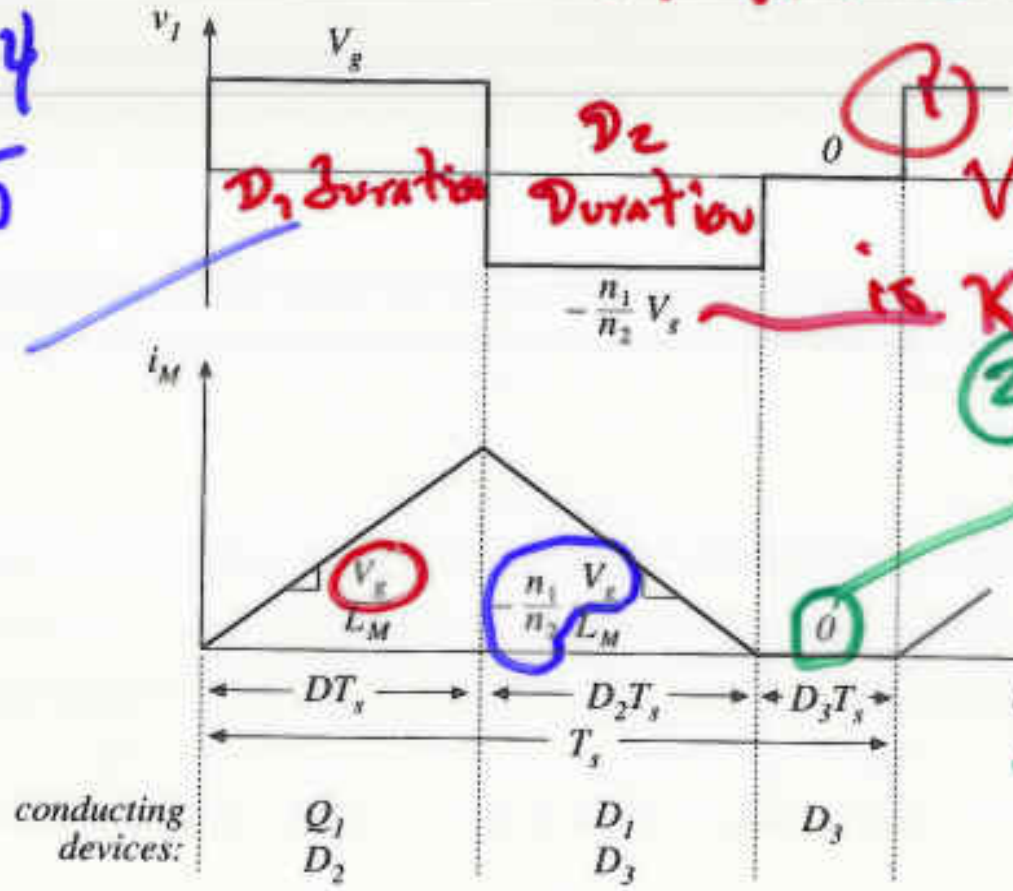

(1) ON coil #1 V-sec balance is Key! D_1 is time!

(2) L_m is a Must for reset of L_m hence why DCM best for doing so

(2) Solve for D_2 as D_1 is set by Q control

(3) Times: D_1, D_2, D_3:

$$\langle v_1 \rangle = D(V_g) + D_2(-V_g n_1 / n_2) + D_3(0) = 0$$