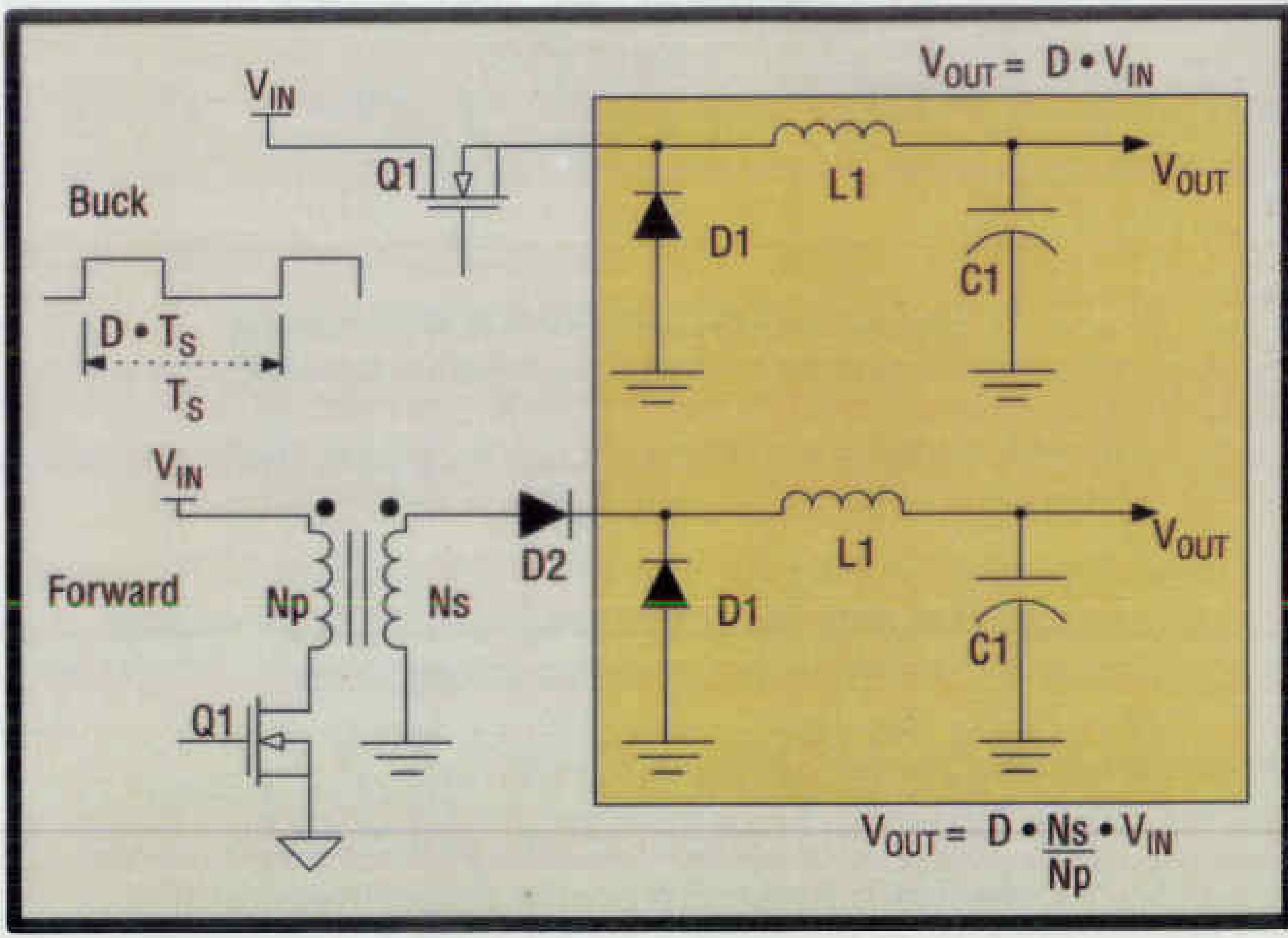


Fig. 1. *Buck and forward topology.*

tive cost, complexity and efficiency tradeoffs. The forward converter is derived from the buck topology family,

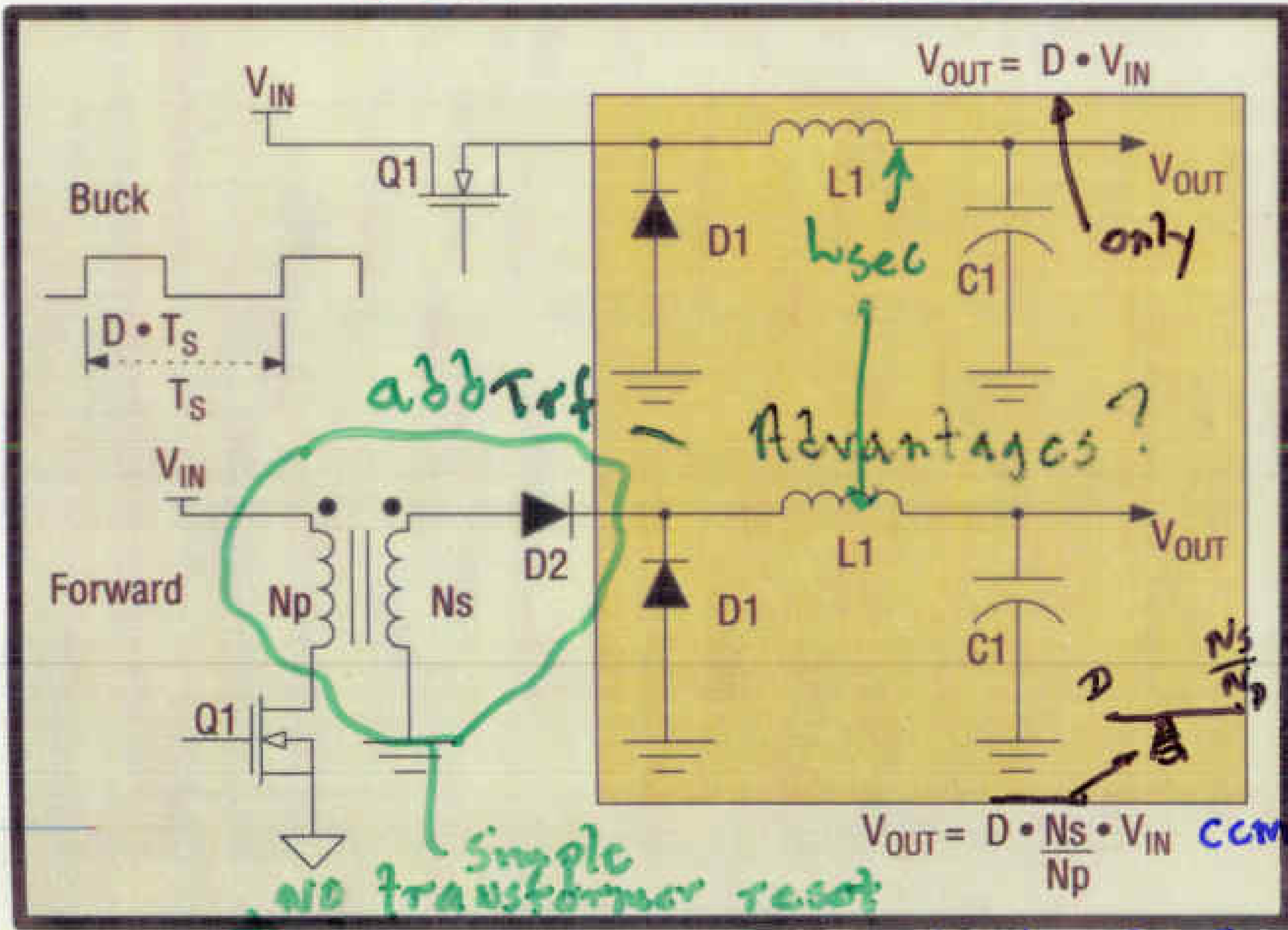


Fig. 1. *Buck and forward topology.*

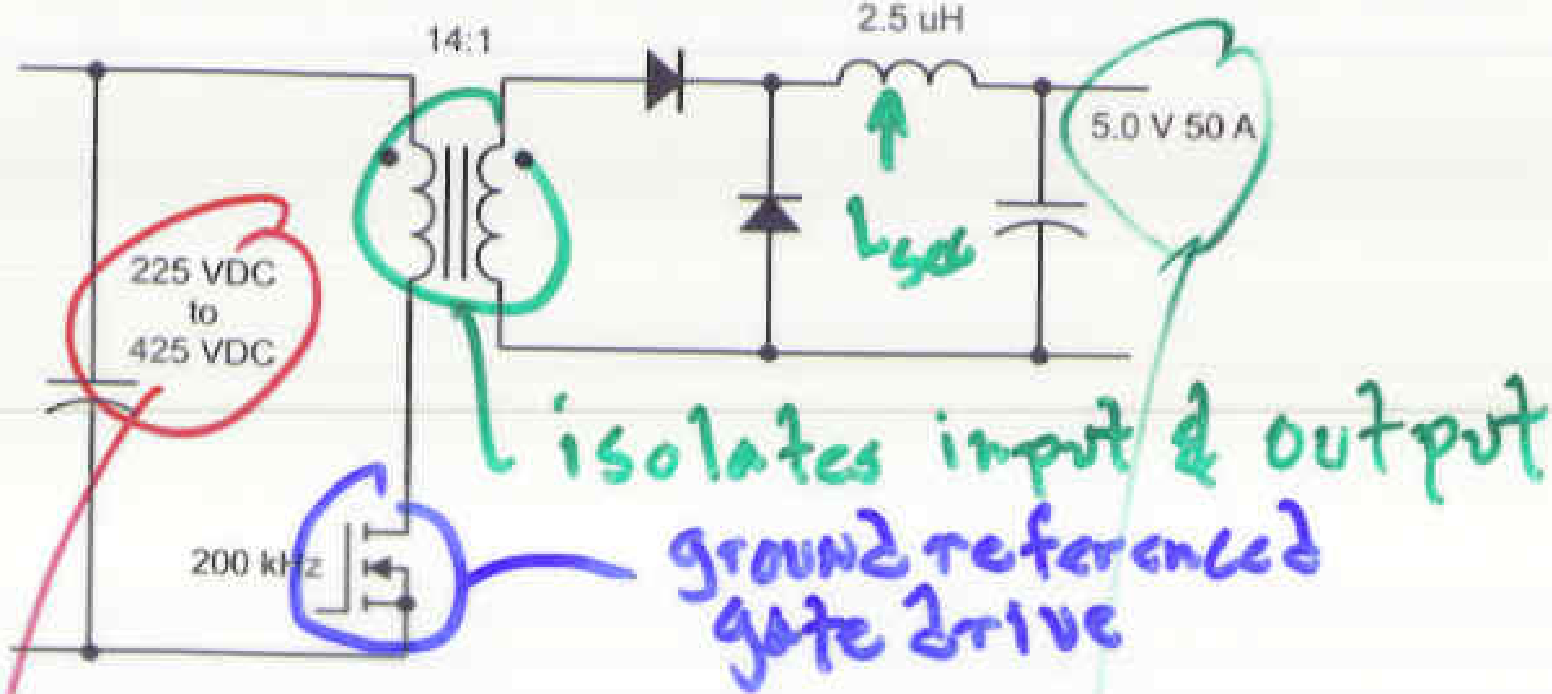


Figure 1 : Forward converter designed for rugged operation.

V_g (rail) very high for ? server with 10^3 μP

V_{out} low eg < 1.0 V

(1) → Buck

No Trf $V_0 = D V_{IN}$

big V_{max} on D_1

(2) → Buck With Trf

vs

Forward

$V_0 = \left(\frac{N_s}{N_p}\right) V_{IN} D$

big step down (on $\frac{N_s}{N_p}$)

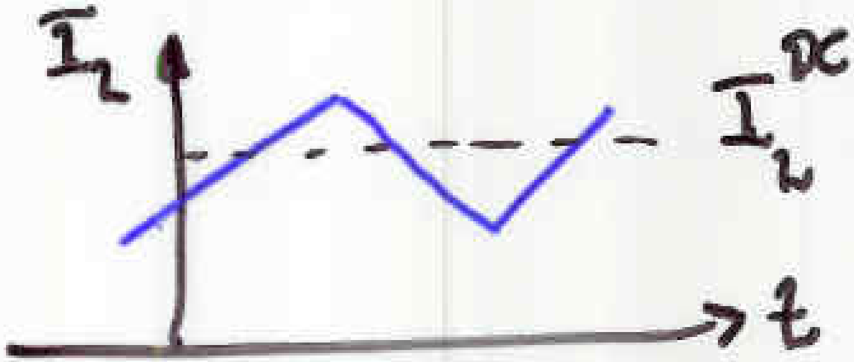
fine tune (on D)

Floating gate drive eliminated

Small V_{max} on D_1 by $\frac{N_s}{N_p}$

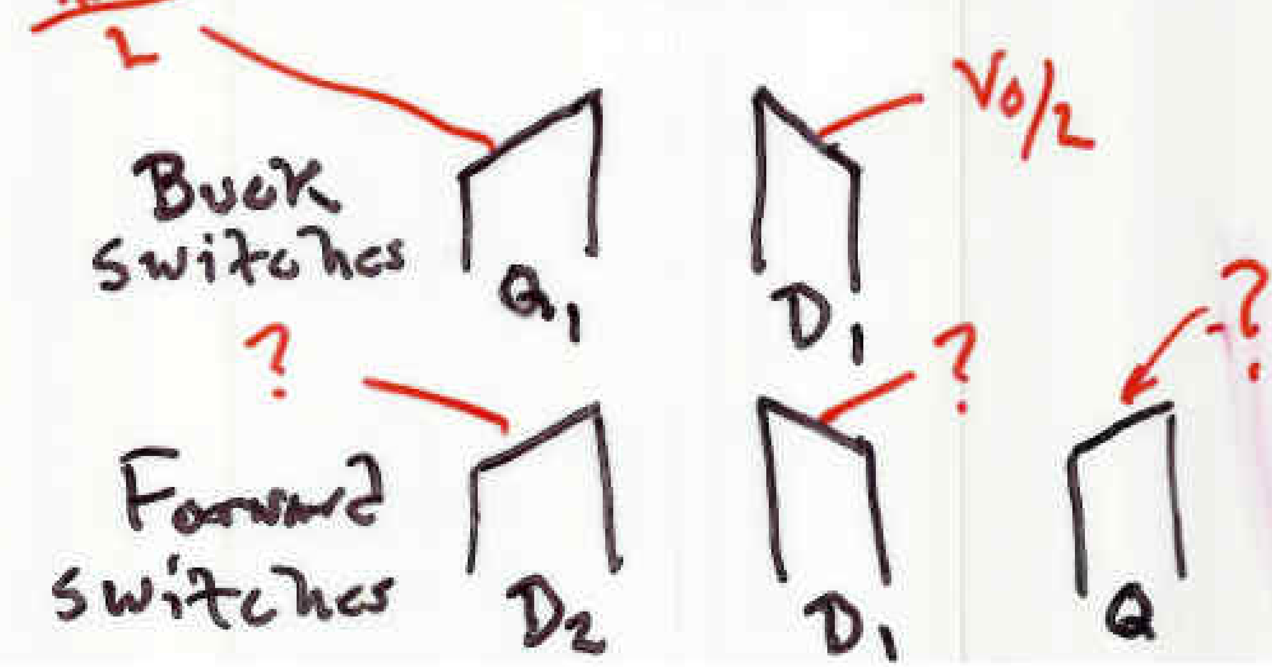
Need extra diode D_2

Both cases



Buck switches

Forward switches



Adv of Trf

① Isolation: seperate grounds V_p & V_{sec} and multiple N_s coils for multiple V_{out}

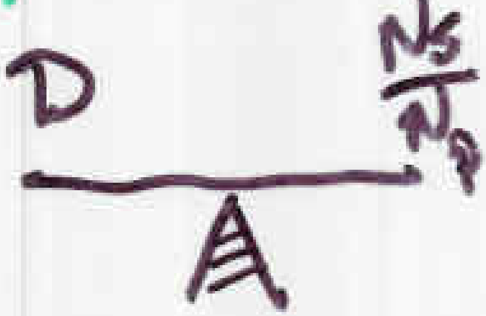
② Q_1 will have lower i_{max} in primary of a step down trf

$\frac{V_s}{V_p}$ step down

V_{GS} w.r.t ground!

③ $$V_o = \underbrace{D V_{IN}}_{\text{Buck}} \underbrace{\left(\frac{N_s}{N_p}\right)}_{\text{Trf}}$$

step down



④ Lm for Forward big ? small. Which and why

⑤ CCM vs DCM goals — reset trf

Effect choice of L (buck) in secondary — in sec

? reset circuits

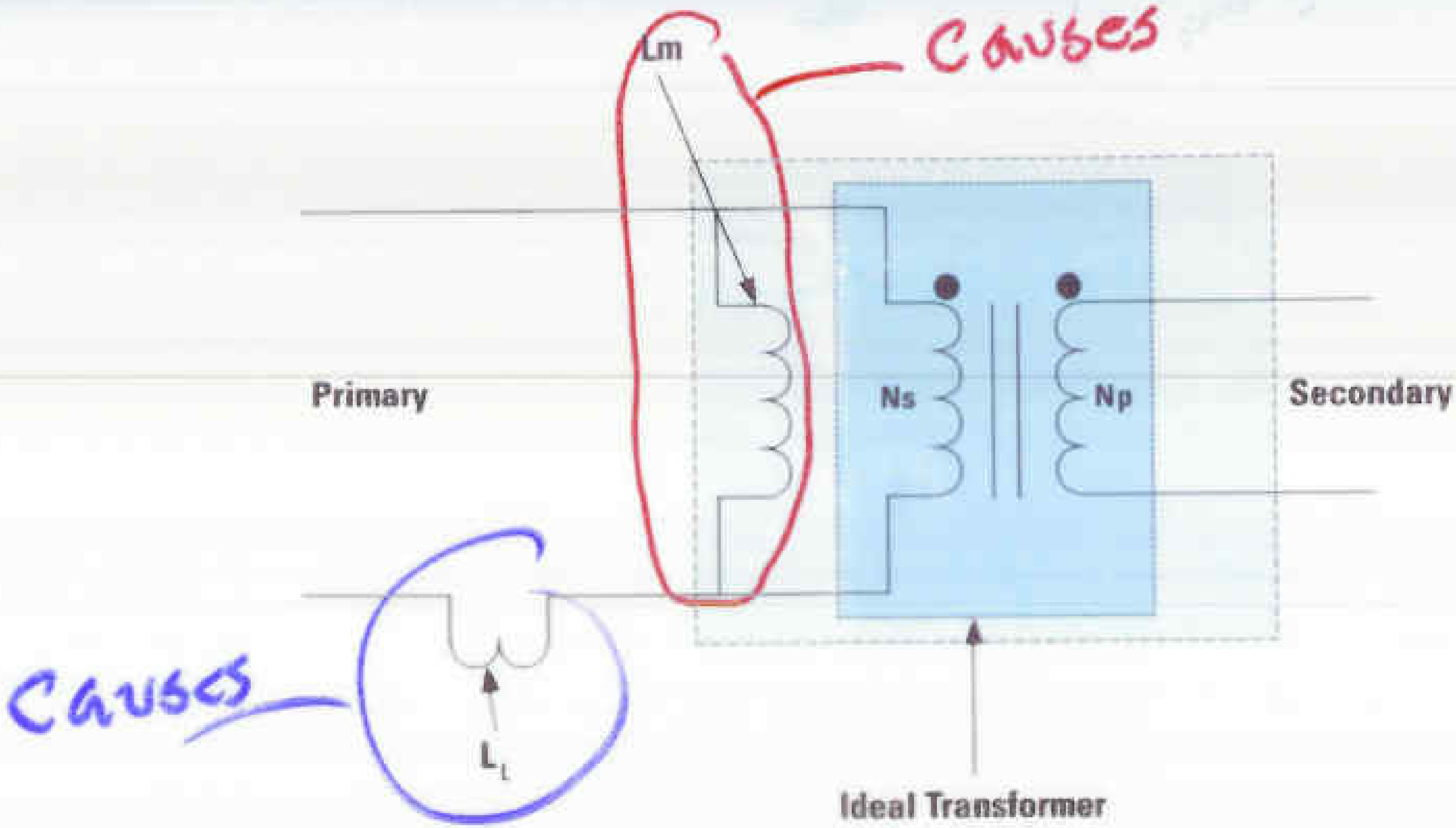
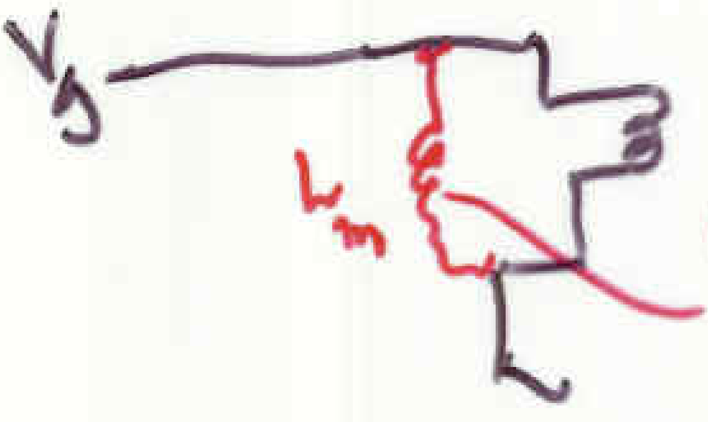


Figure 2. Transformer Model

Disadvantage of Trf

Worst case

1. Saturation of L_m by V-sec from big V_{IN}
   ⇒ (1) desire large L_m value to avoid saturation
   ⇒ (2) Will need active trf reset as well - how achieved?
2. No residual V_{DC} on input to Trf allowed



$$V_p^{DC} \equiv 0$$

Comes from trf design
Separate from L sec
Trf Core

3. Extra losses < R windings

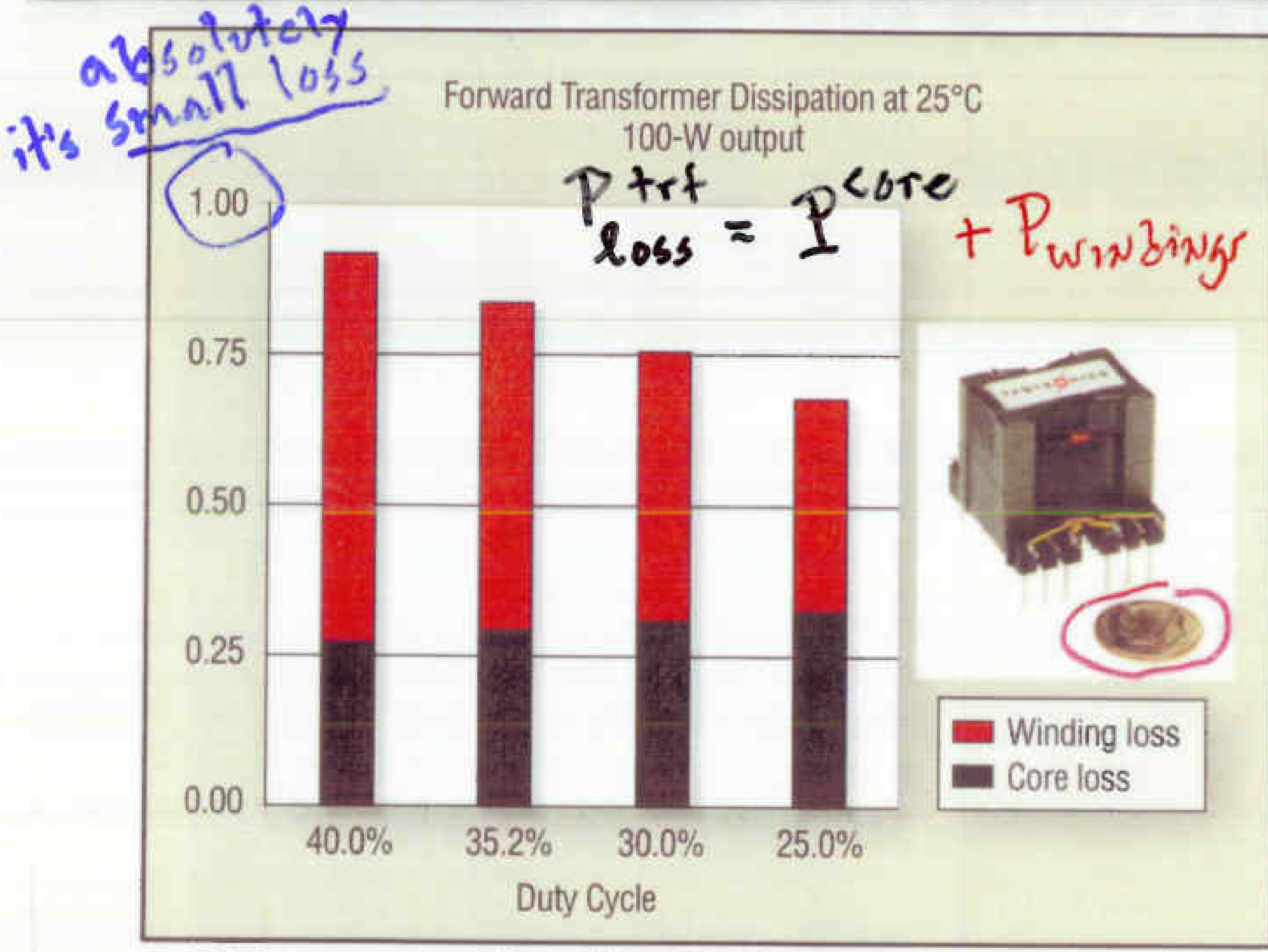


Fig. 11. *Measured total loss of 100-kHz forward transformer providing 20 V at 5 A.*

Ways to insure L_m does not saturate

① Make sure i_{L_m} always returns to "0" over a switch cycle — Operate DCM only

⇒ Small L (sec) will cause Buck $\Delta i > I_{DC}$

② Insure equal & opposite V-sec on L_m over a CCM switch cycle — add a third winding and a clamp diode