

# F5: Switchade nätaggregat (SMPs)

BWW Kap 17



# Sedan tidigare...

- Nedspänningssomvandlare
- Uppspänningssomvandlare
- Saknar galvanisk separation...
- Lösning: transformator



# Om dagens föreläsning!

Switchade nätaggregat är en av de vanligaste kraftelektroniska applikationerna, exempelvis laddare till mobiltelefoner, datorer,

...

Ganska egendomlig framställning i boken där det vi tidigare kallade enkvadrant nedspänningssomvandlare helt plötsligt kallas forward-omvandlare, och helt plötslig börjar Williams räkna approximativt på differentialekvationerna. Vi räknar alltid approximativt! Dvs

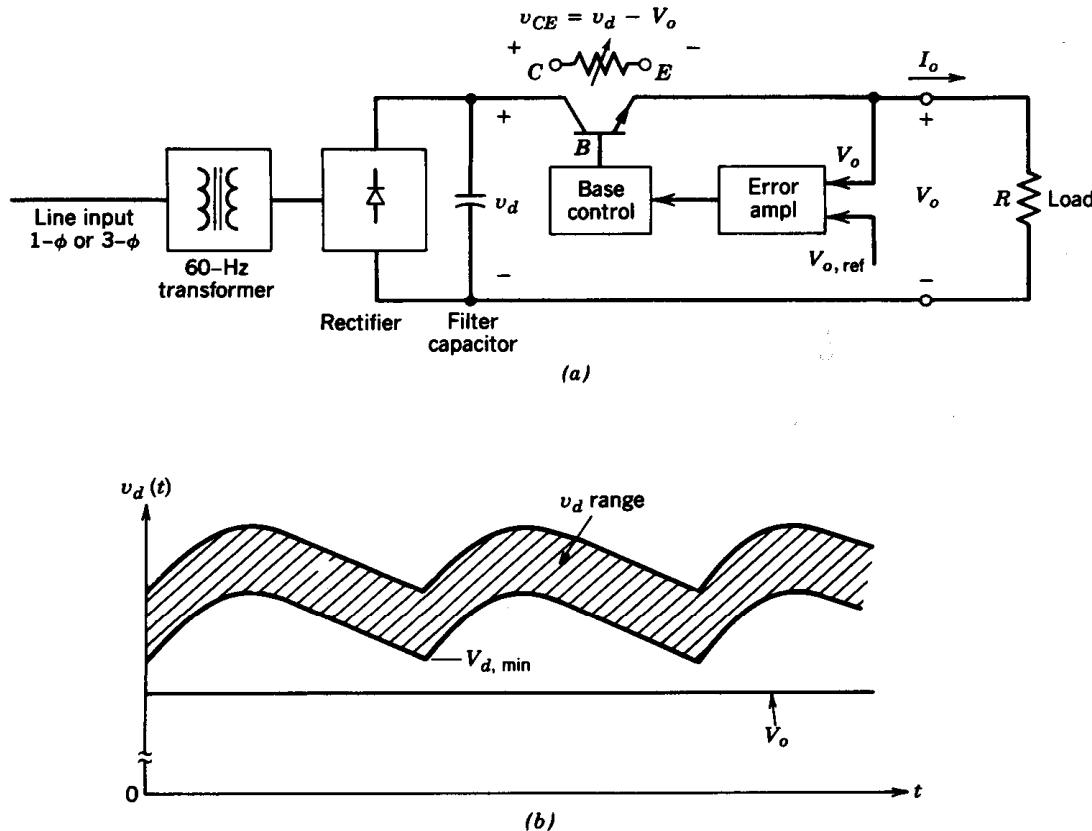
$$\frac{di}{dt} = \frac{\Delta i}{\Delta t}$$

Många olika varianter men två huvudprinciper

- Flyback-omvandlare
- Forward-omvandlare



# Lineärt nätaggregat



**Figure 10-1** Linear power supply: (a) schematic; (b) selection of transformer turns ratio so that  $V_{d,\min} > V_o$  by a small margin.

Källa: Mohan, Undeland, Robbins. *Power Electronics*.

Dålig verkningsgrad  
Stort och tungt



# Exempel på switchat nätaggregat

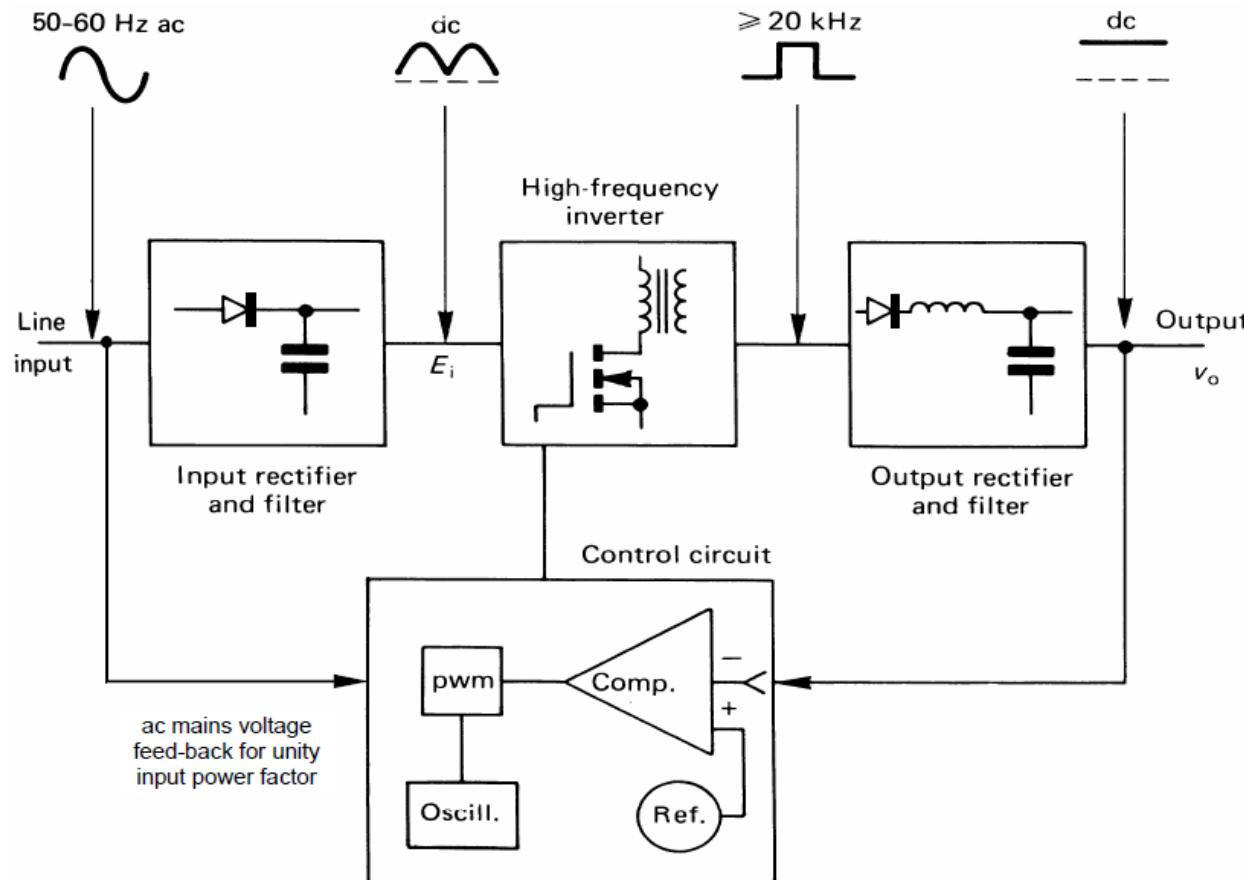
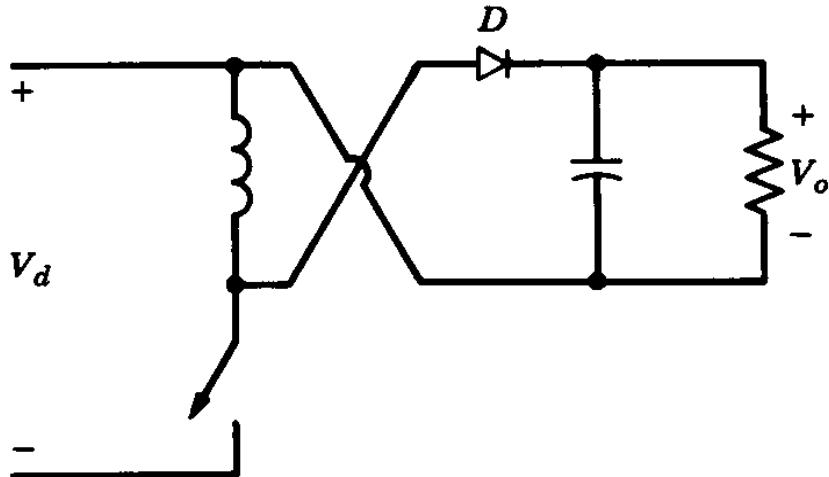


Figure 17.1. Functional block diagram of a switched-mode power supply.



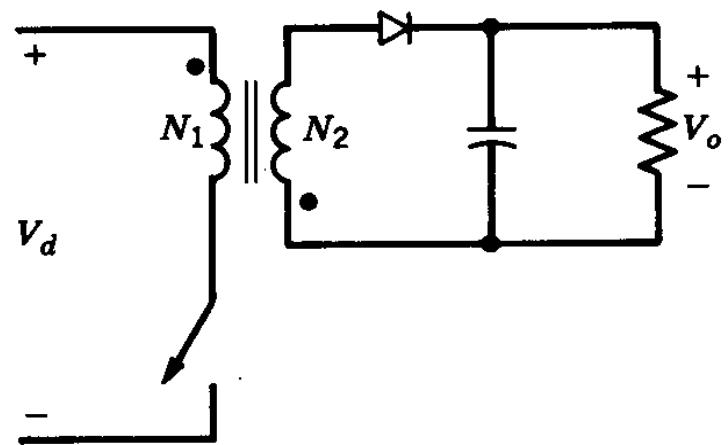
# Flyback-omvandlaren (I)

Utan galvanisk separation



(a)

Med galvanisk separation



(b)

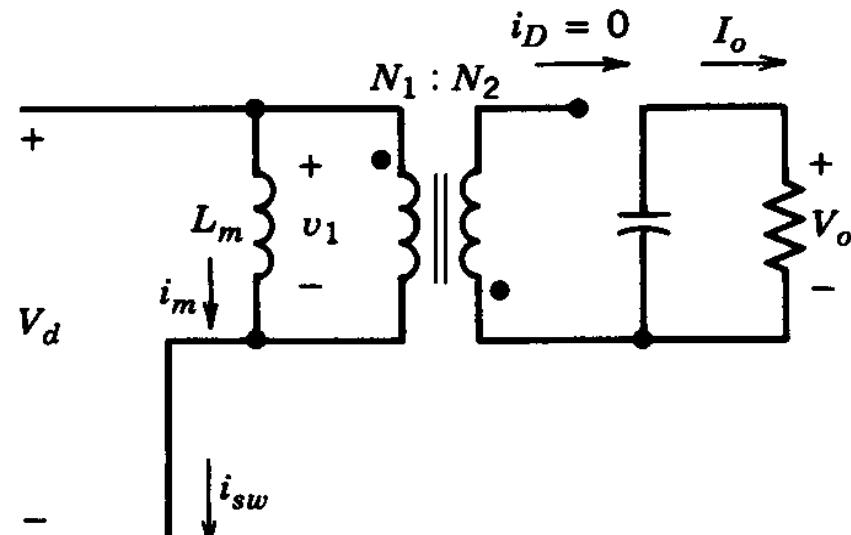
**Figure 10-6 Flyback converter.**

Källa: Mohan, Undeland, Robbins. *Power Electronics*.



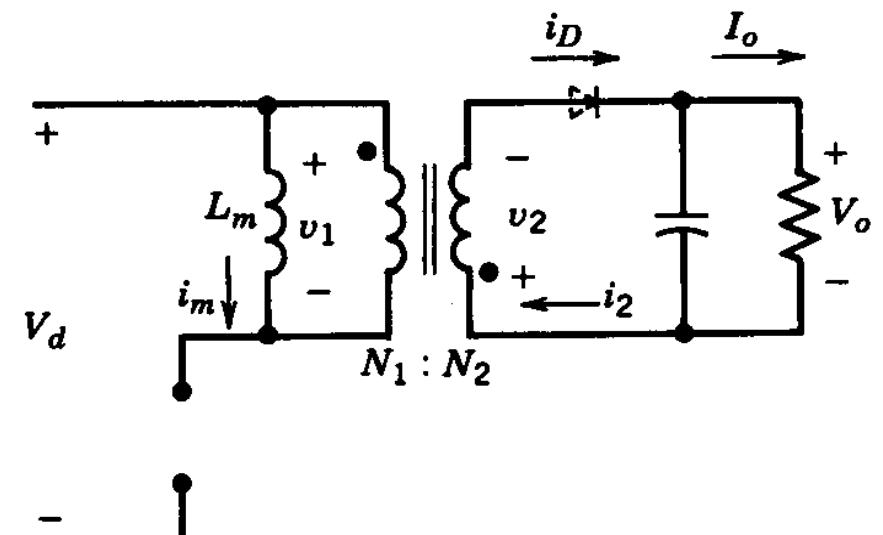
# Flyback-omvandlaren (II)

S="ON"



(a)

S="OFF"



(b)

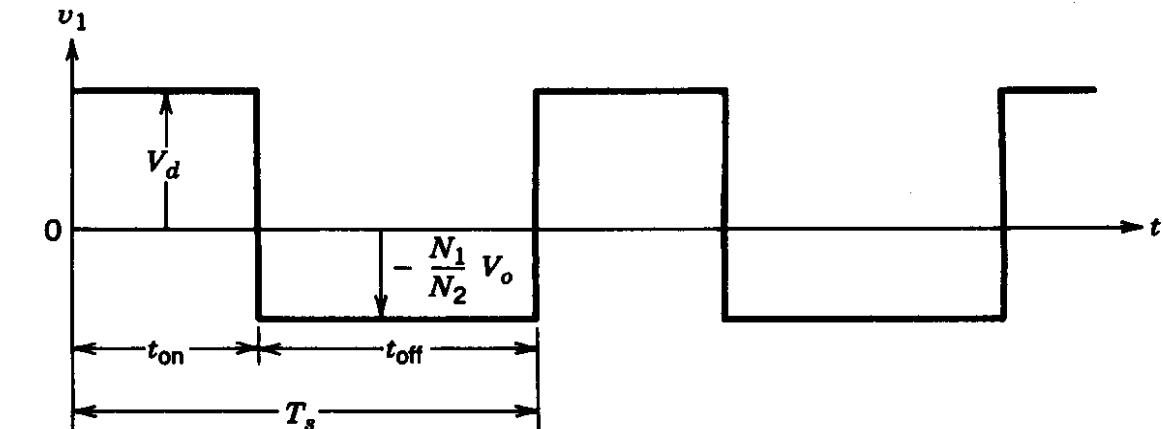
**Figure 10-7** Flyback converter circuit states: (a) switch on; (b) switch off.

Källa: Mohan, Undeland, Robbins. *Power Electronics*.

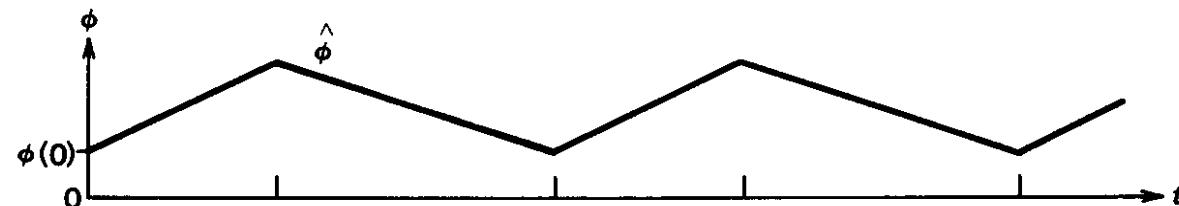


# Flyback-omvandlaren (III)

Spänning över  $L_m$



Höde i transformatorn



Ström på sekundärsidan

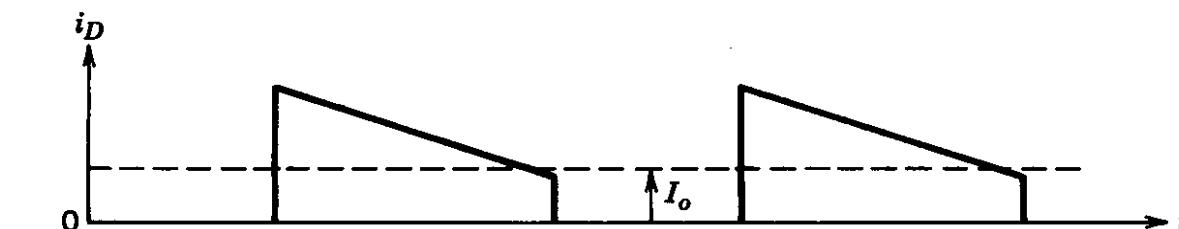
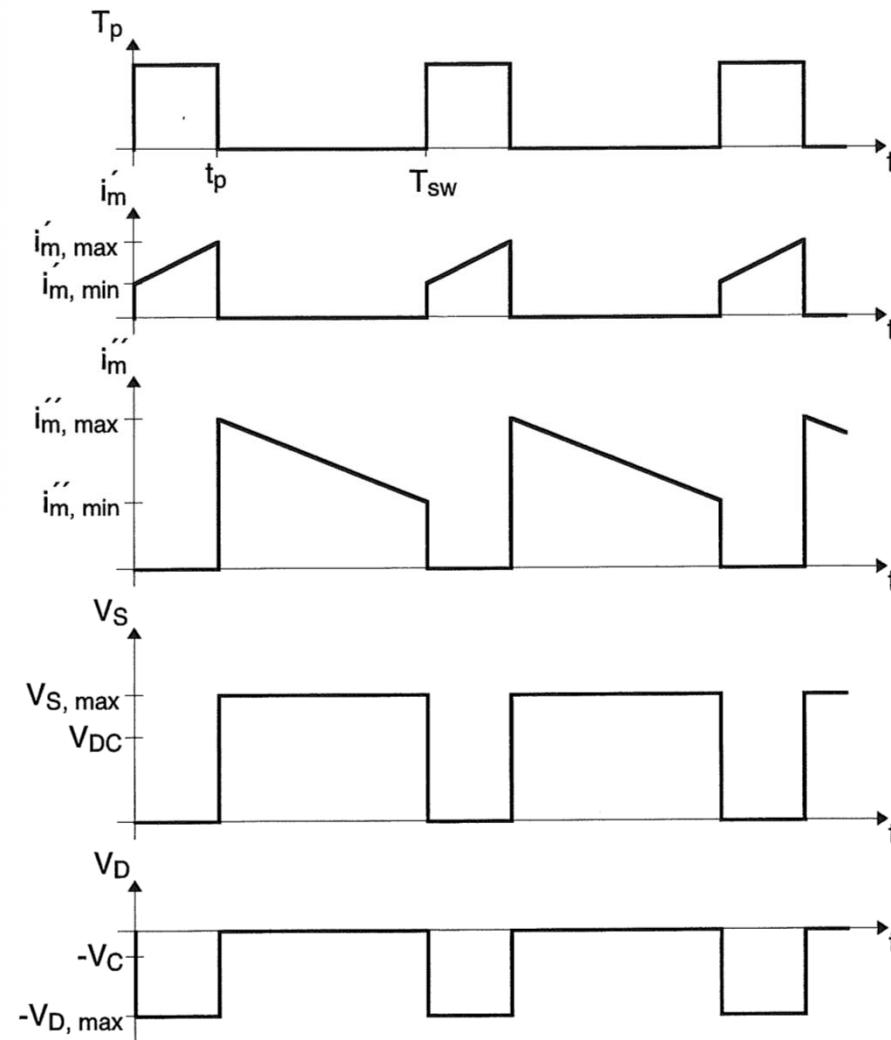


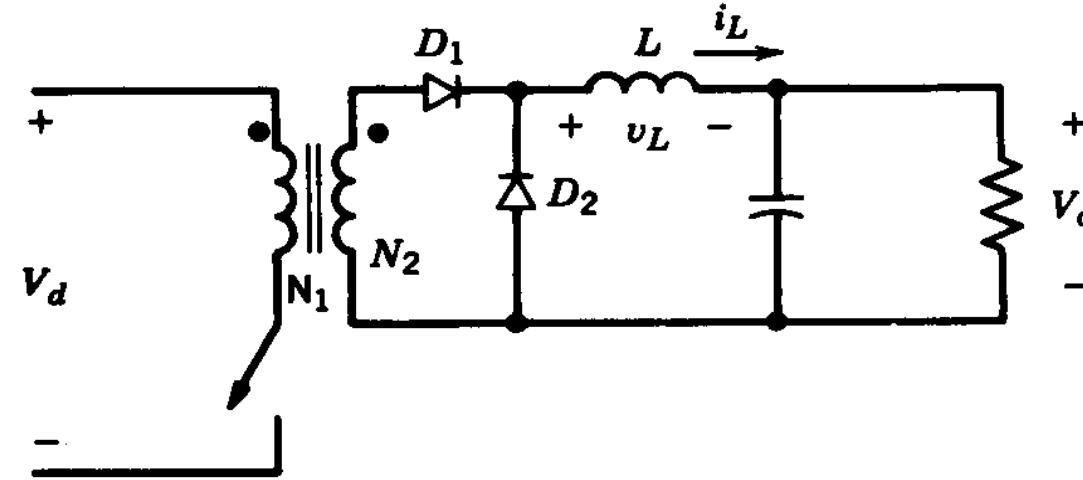
Figure 10-8 Flyback converter waveforms. Källa: Mohan, Undeland, Robbins. Power Electronics.



# Flyback-omvandlaren (IV)



# Forward-omvandlaren (I)



**Figure 10-10** Idealized forward converter.

Källa: Mohan, Undeland, Robbins. *Power Electronics*.



# Forward-omvandlaren (II)

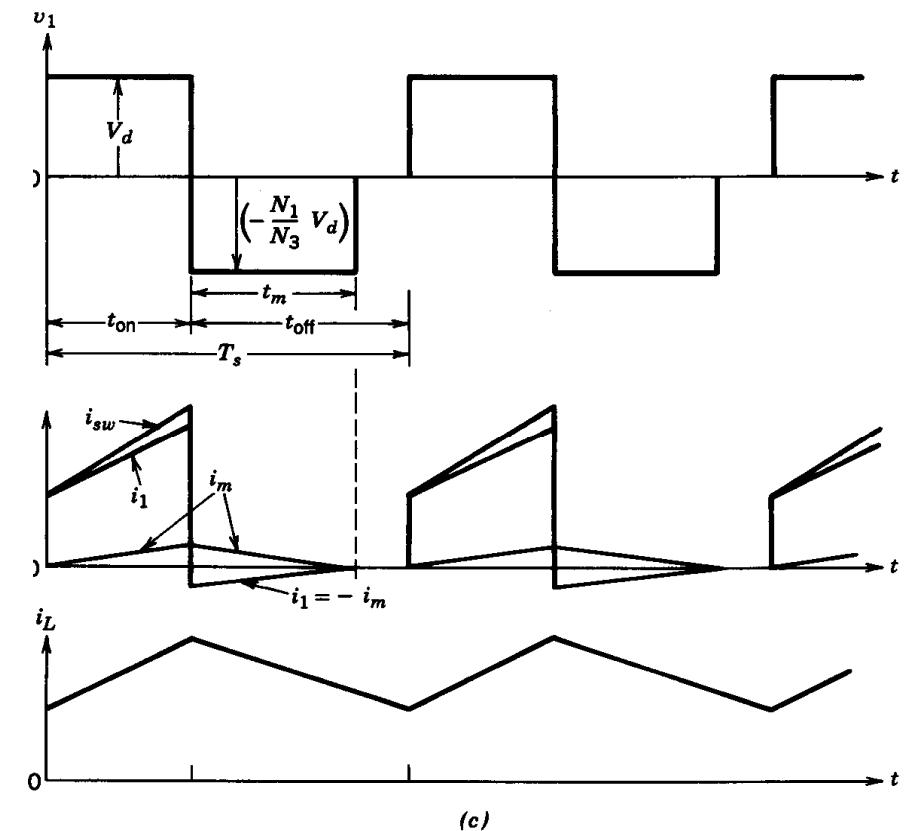
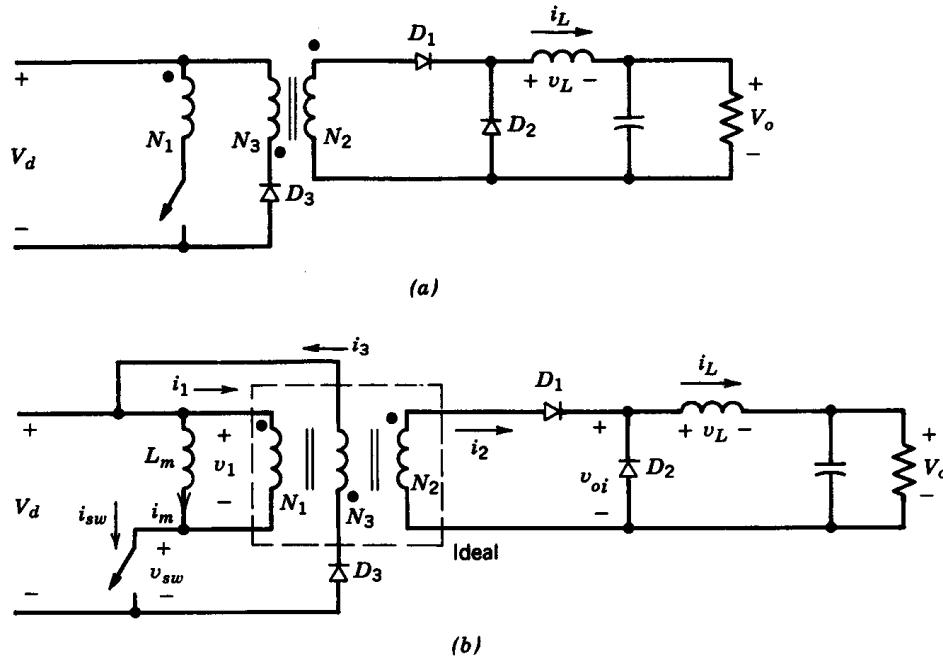
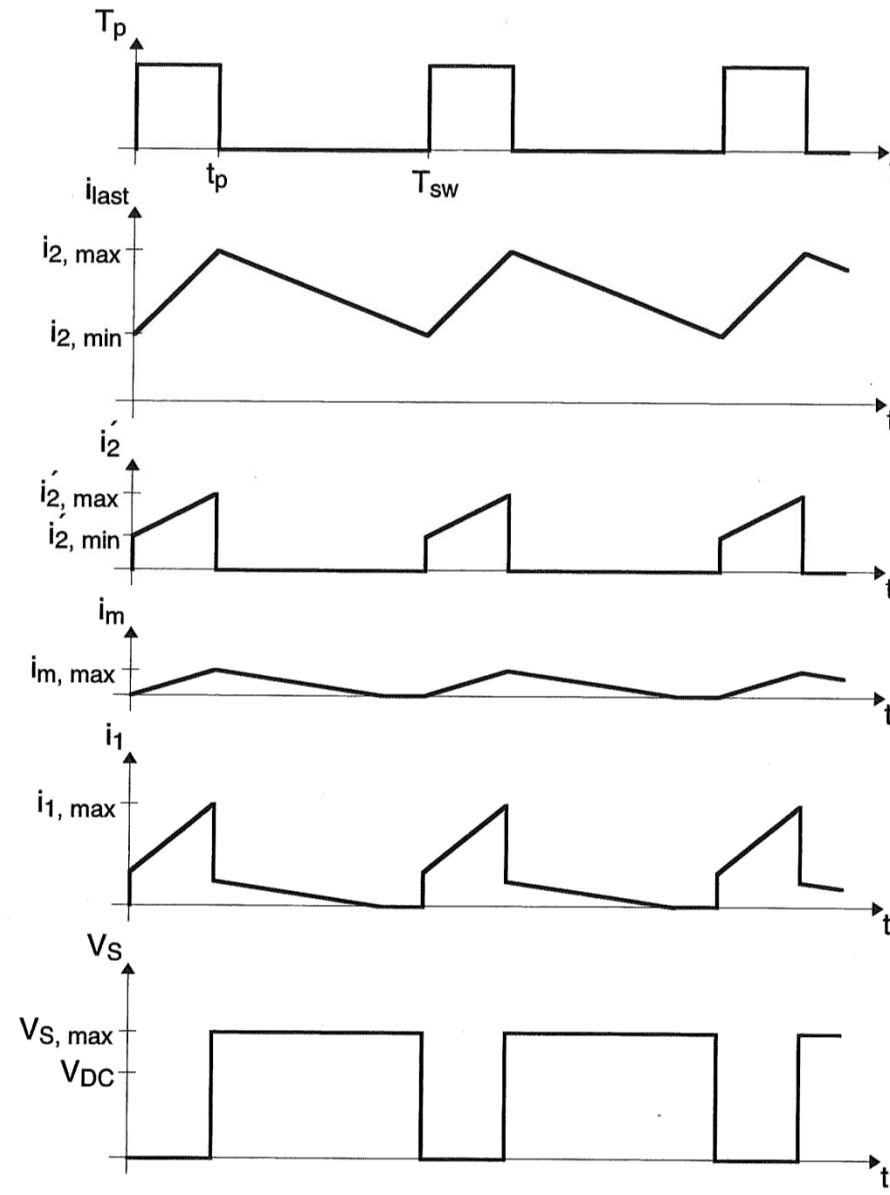


Figure 10-11 Practical forward converter.

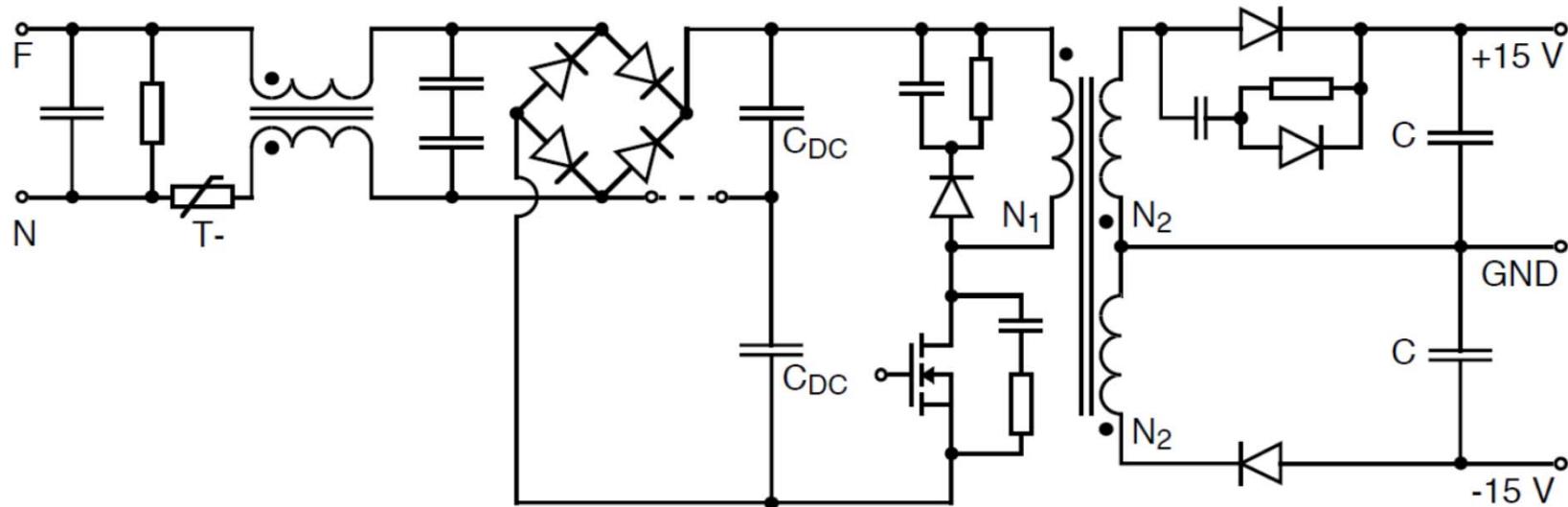
Källa: Mohan, Undeland, Robbins. *Power Electronics*.



# Forward-omvandlaren (III)

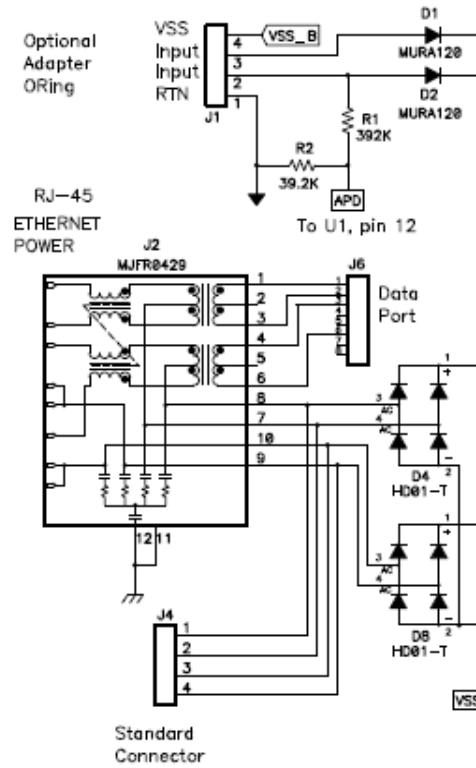


# Typisk flyback-omvandlare



# Laboration 1

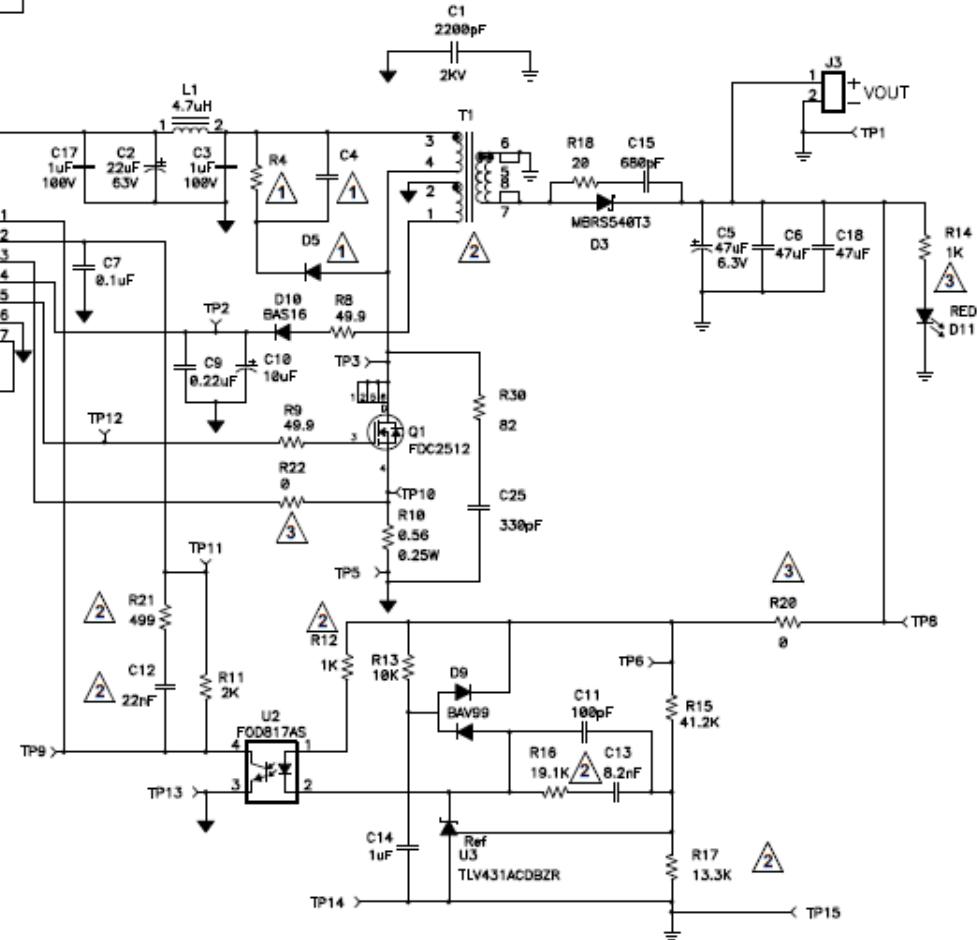
## Flyback-omvandlaren



Type: Flyback  
 Output Power: 7W (24/48V Input), 4W (12V input)  
 External Adaptor: 24V/48V  
 Output

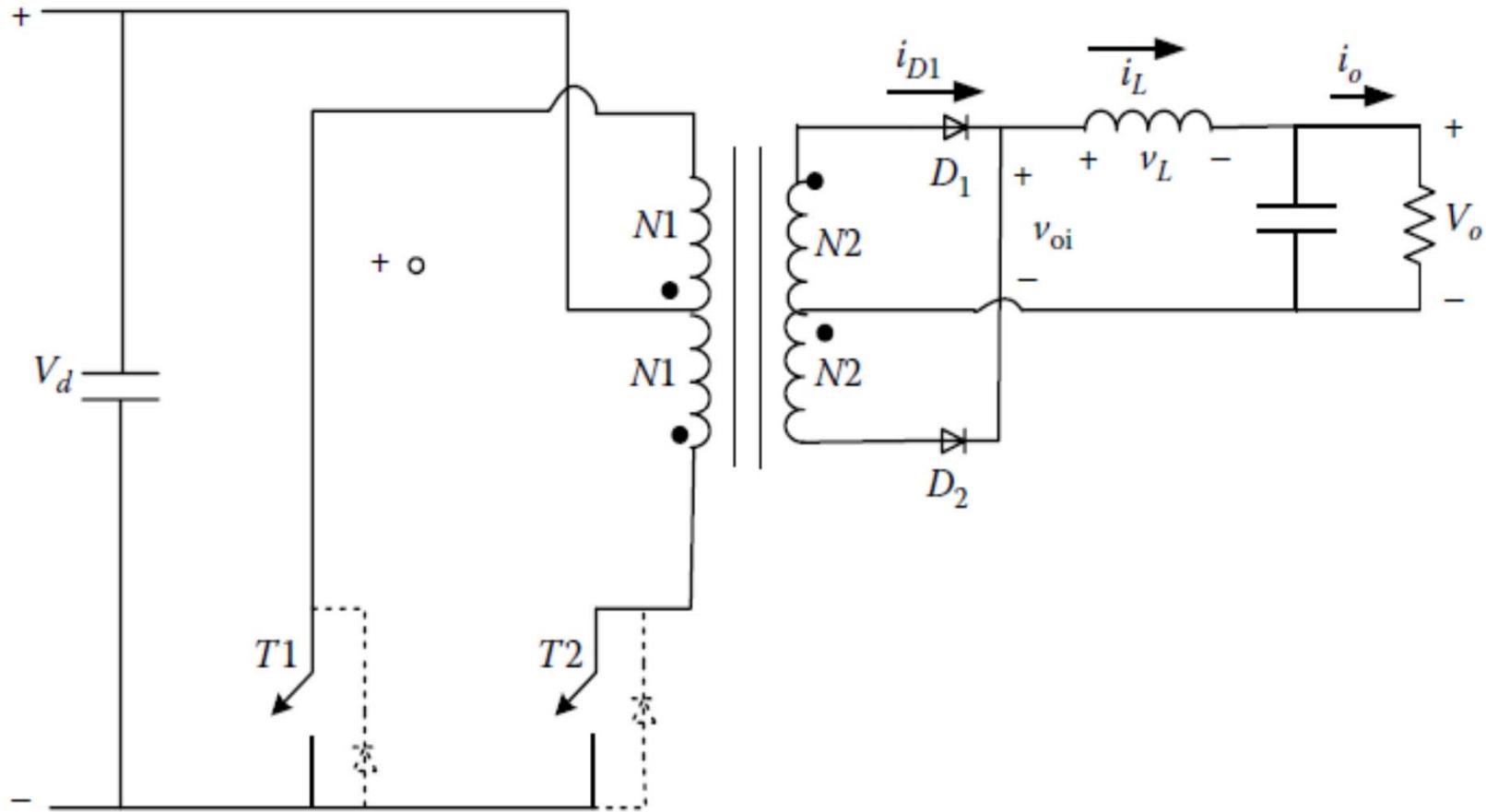
### NOTES

- △ NOT USED
- △ COMPONENT VALUES REQUIRED FOR 5V OUTPUT  
SEE BOM FOR 3.3V OUTPUT VALUES.
- △ EVM "EASE OF USE" COMPONENTS
  - A. POWER ON LED: R14/D11
  - B. LOOP INJECTION: R20
  - C. ADDITIONAL SLOPE COMPENSATION: R22



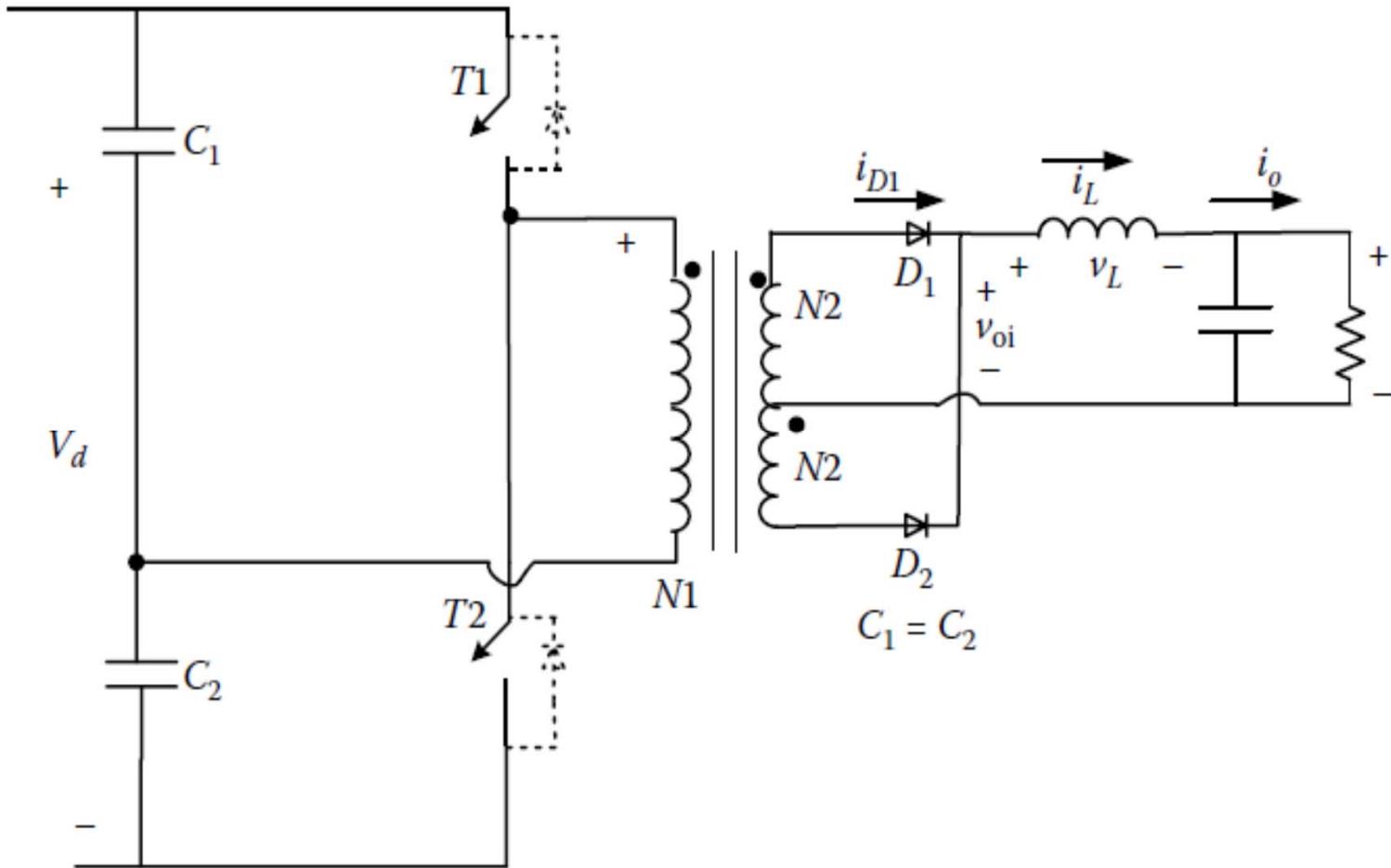
# Några fler SMPS

## Push-Pull



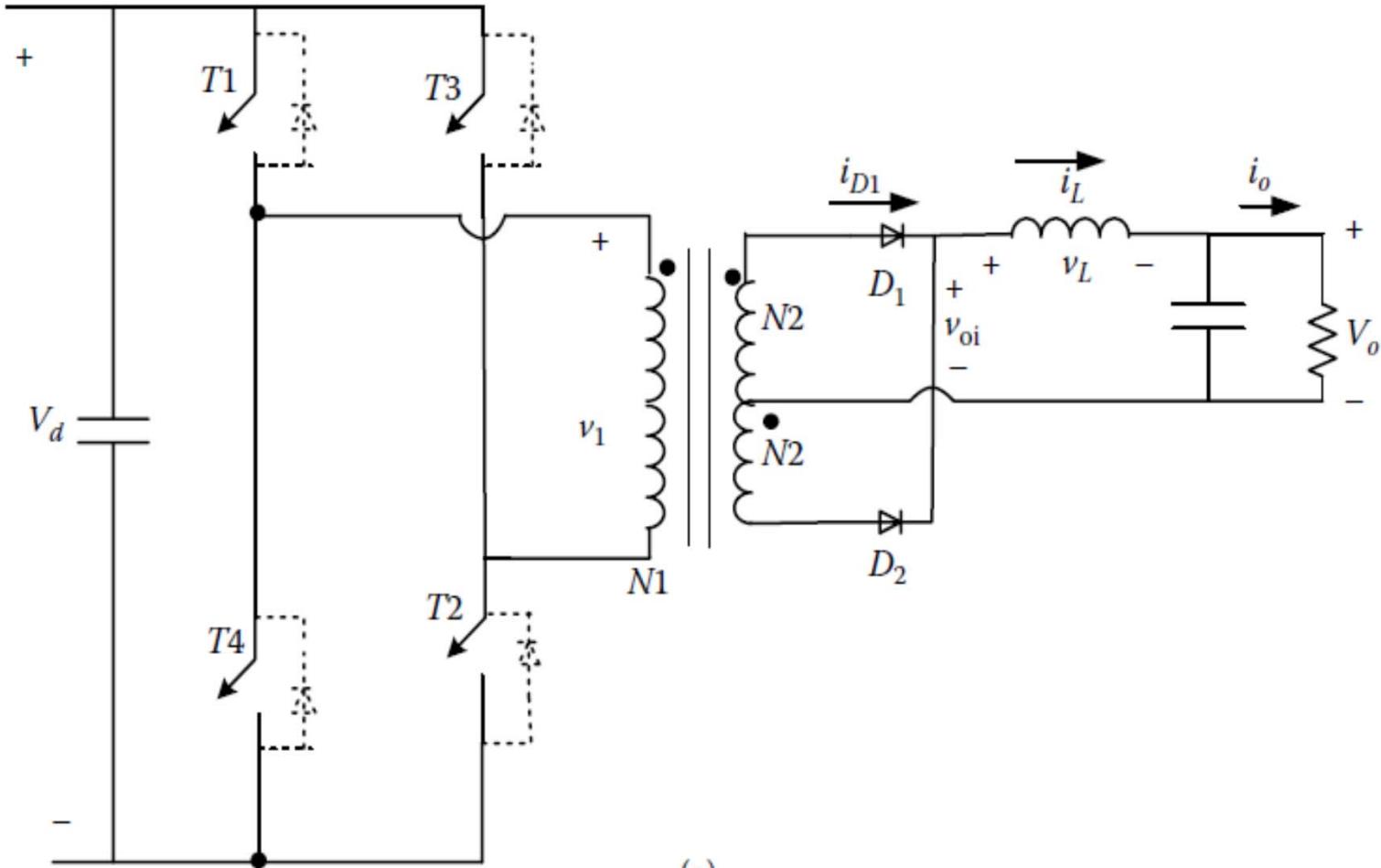
# Några fler SMPS

## Halvbrygga



# Några fler SMPS

## Fullbrygga



# Förluster i SMPS

- \*1. Start-up current can be significant in a low-power charger/adapter (especially if not disabled after start-up).
- \*2. If constant current control is used.

