

INVERTERS

Inverters

- DC to AC Conversion
- Applications : Adjustable speed ac drive , Induction heating, stand by air craft power supplies , UPS, HVDC Transmission lines etc
- Forced Commutated Inverters , Line commutated Inverters , Load Commutated Inverters , Voltage Source Inverter , Current Source Inverter

Inverters

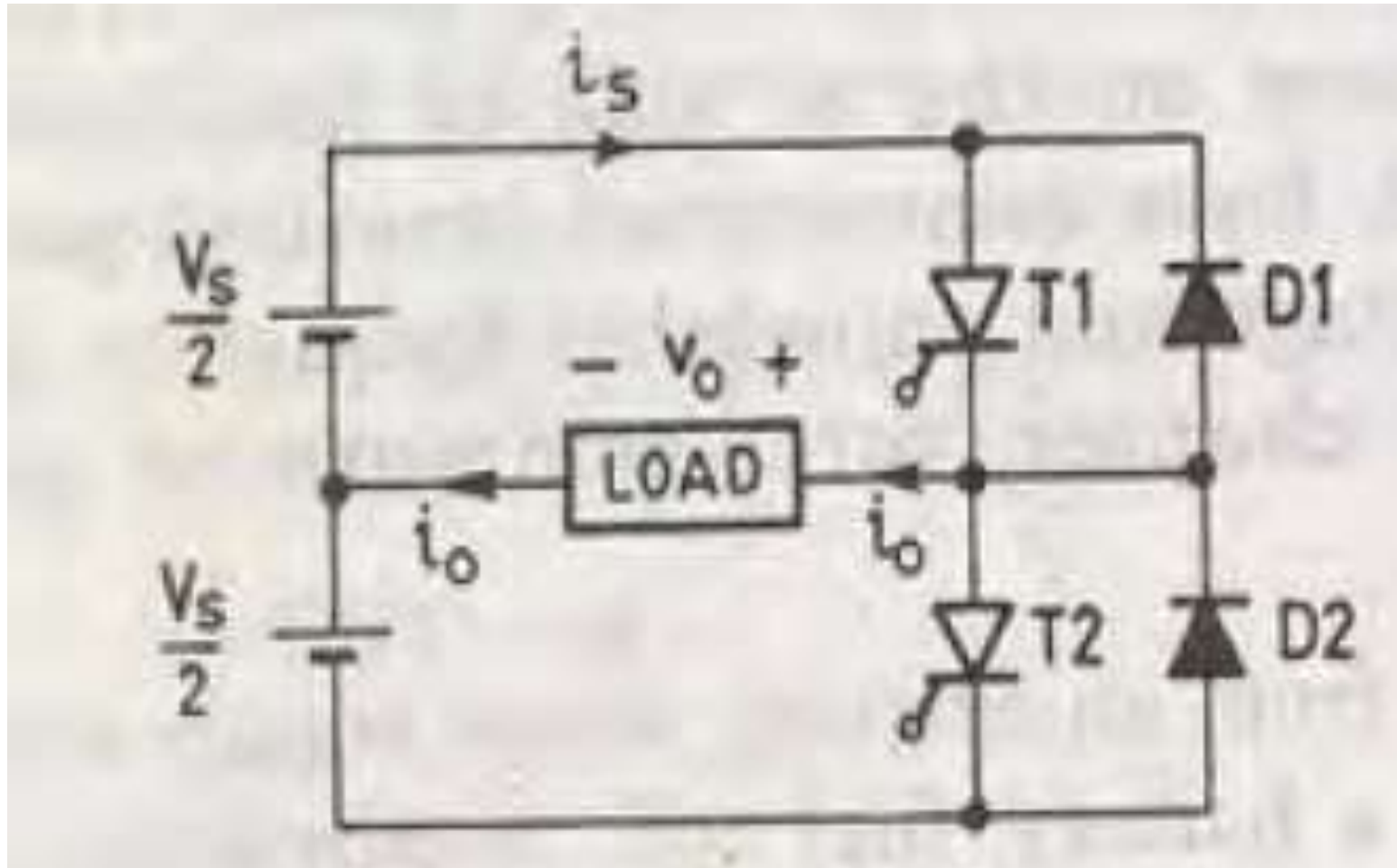
Inverters are also classified depending upon the connection of commutating components with the main circuit.

- Series Inverter
- Parallel Inverter
- Bridge Inverter

Classification

- Broadly categorized into :
 - Voltage Source Inverter (VSI) or Voltage fed Inverters (VFI)
 - Current Source Inverter (CSI) or Current fed Inverters (CFI)
- Impedance of VSI and CSI are as per Voltage Source and Current Source

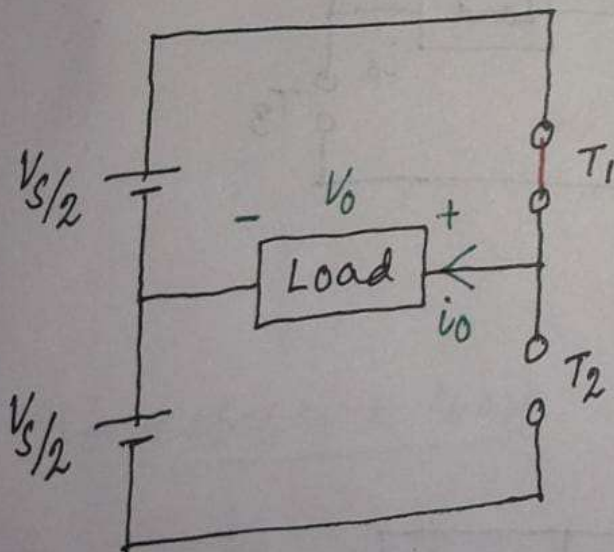
Single Phase Voltage Source Inverter



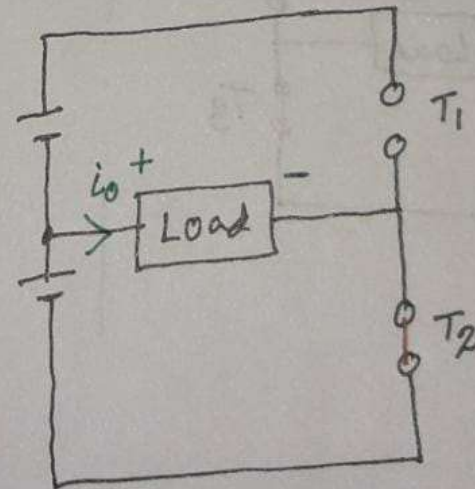
Single Phase VSI

Voltage Source Inverter

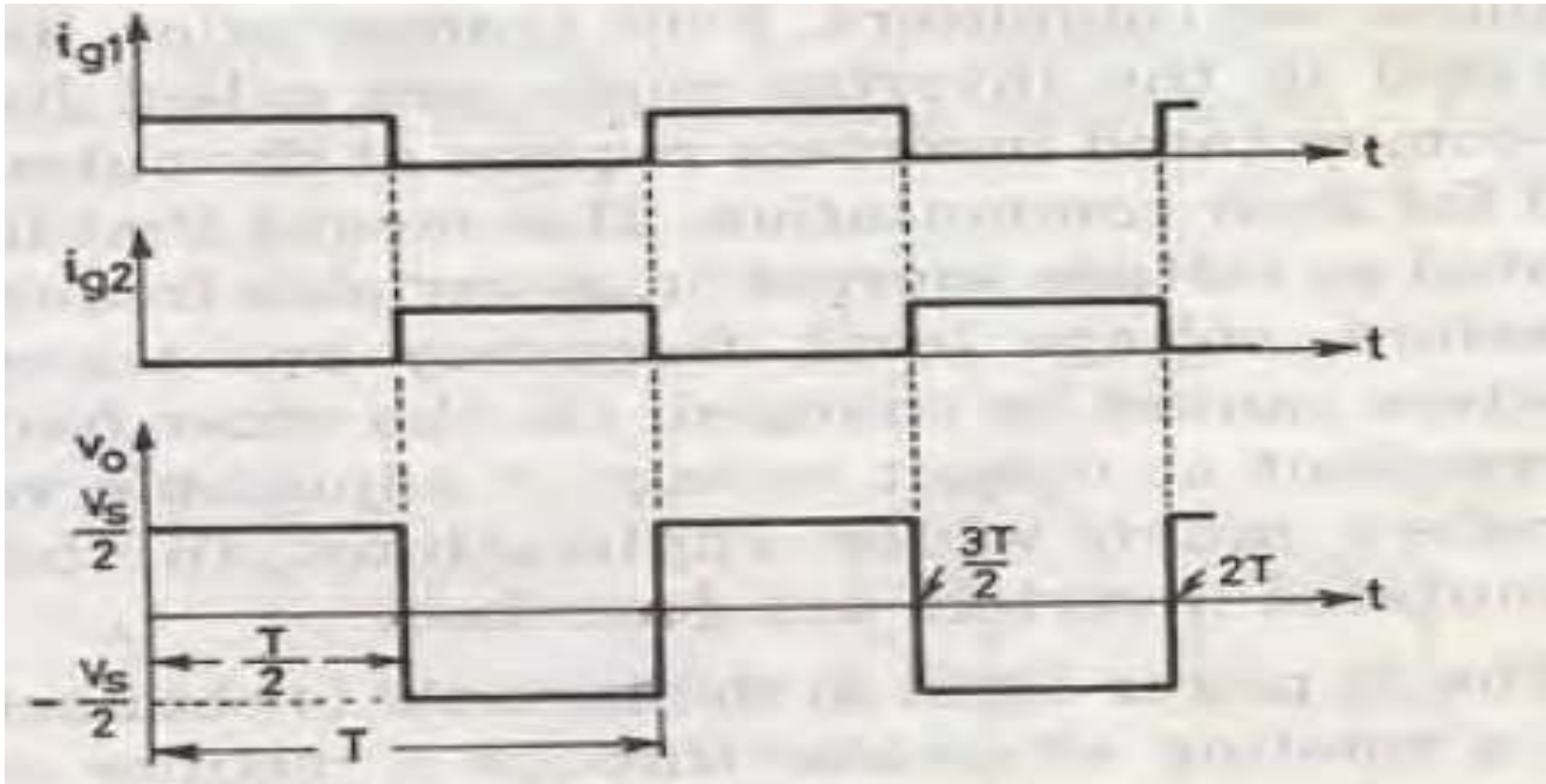
Mode I



Mode II



Single Phase Voltage Source Inverter



Half Bridge Configuration

Half Bridge VSI

For resistive load

$$V_o = \frac{V_s}{2} \quad \dots \text{for } 0 \leq t \leq T_0/2$$

$$V_o = -\frac{V_s}{2} \quad \dots \text{for } T_0/2 \leq t \leq T_0$$

$$I_o = \frac{V_o}{R} = \frac{V_s}{2R} \quad \dots \text{for } 0 \leq t \leq T_0/2$$

$$I_o = \frac{V_o}{R} = -\frac{V_s}{2R} \quad \dots \text{for } T_0/2 \leq t \leq T_0$$

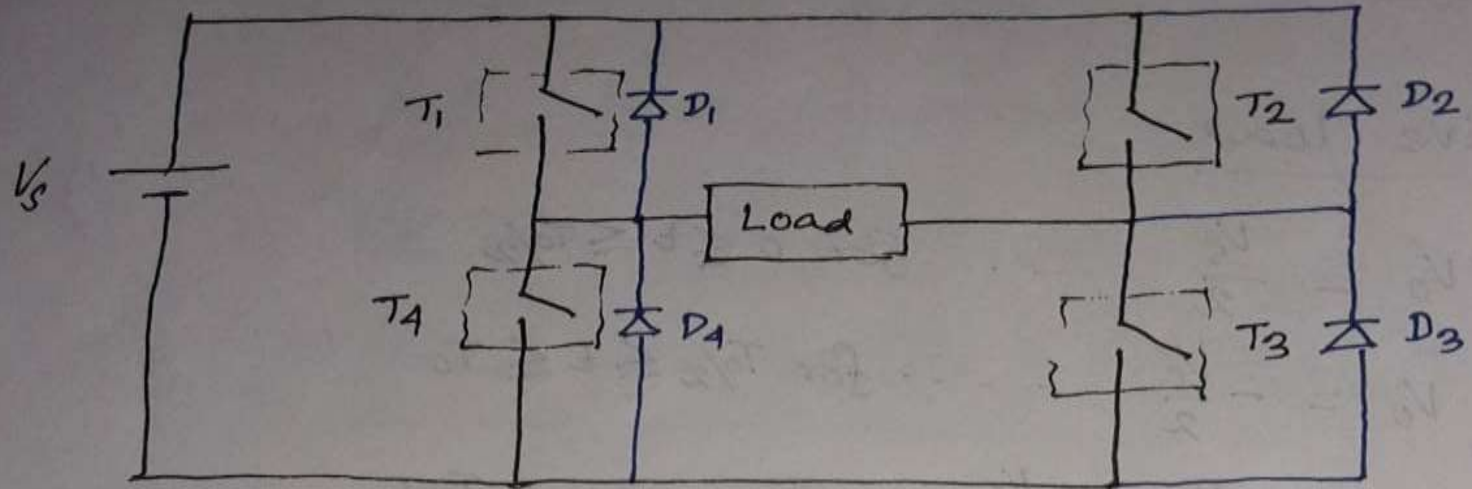
$$V_{\text{RMS}} = \left[\frac{1}{T_0/2} \int_0^{T_0/2} \left(\frac{V_s}{2} \right)^2 dt \right]^{1/2}$$
$$= \frac{V_s}{2}$$

$$I_{\text{RMS}} = \frac{V_s}{2R}$$

Limitations

- Requirement of 3 terminal DC Power Supply
- Output voltage is using half of the total voltage
- Full Bridge configuration eliminates the limitations
- Output nature is square wave.

Full Bridge VSI

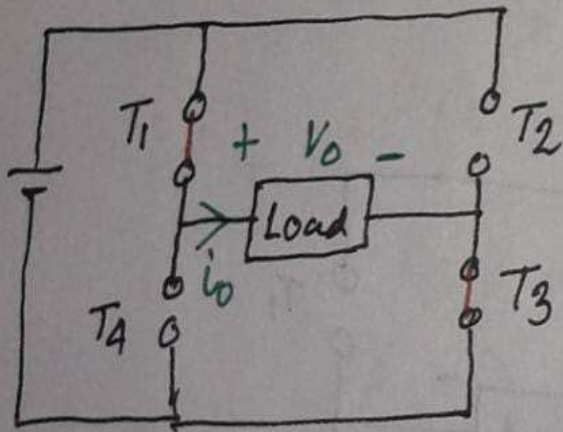


$T_1, T_3 \Rightarrow +ve$ group

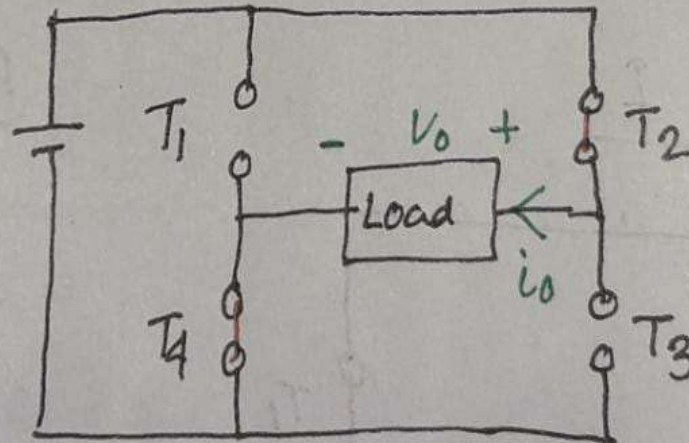
$T_2, T_4 \Rightarrow -ve$ group

Full Bridge VSI

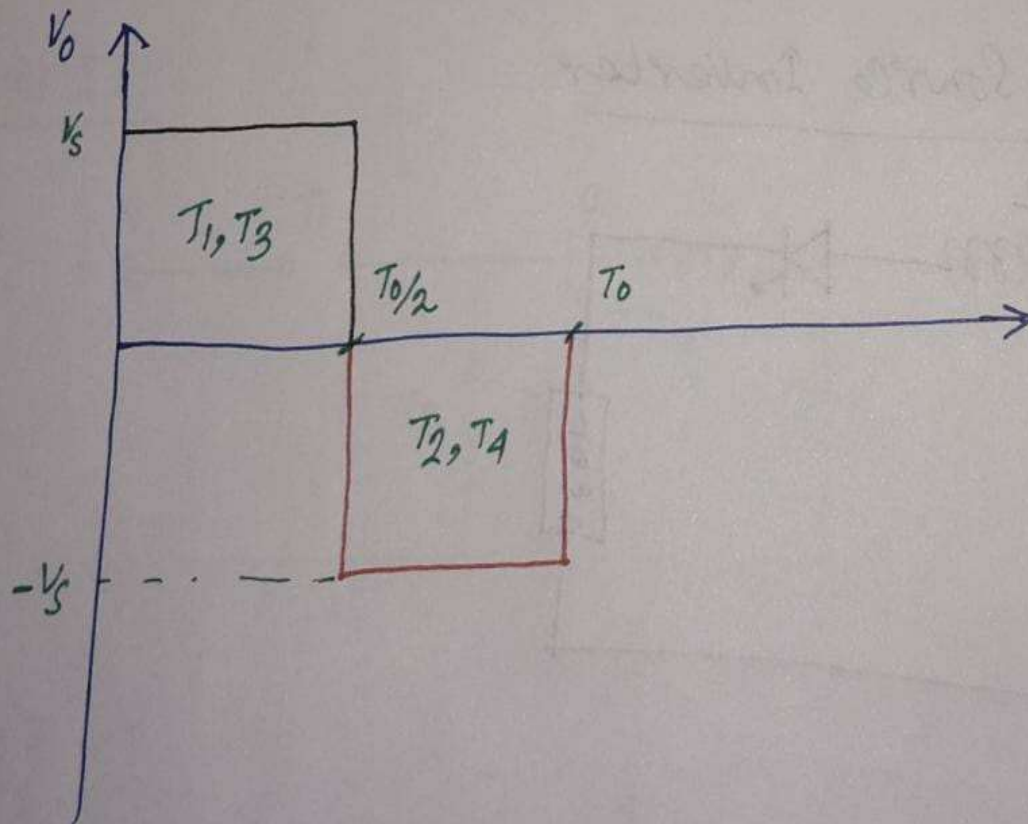
Mode I



Mode II



Full Bridge VSI



Full Bridge VSI

For resistive load

$$V_o = V_s \quad \text{--- for } 0 \leq t \leq T_o/2$$

$$V_o = -V_s \quad \text{--- for } T_o/2 \leq t \leq T_o$$

$$I_o = \frac{V_s}{R} \quad \text{--- for } 0 \leq t \leq T_o/2$$

$$I_o = -\frac{V_s}{R} \quad \text{--- for } T_o/2 \leq t < T_o$$

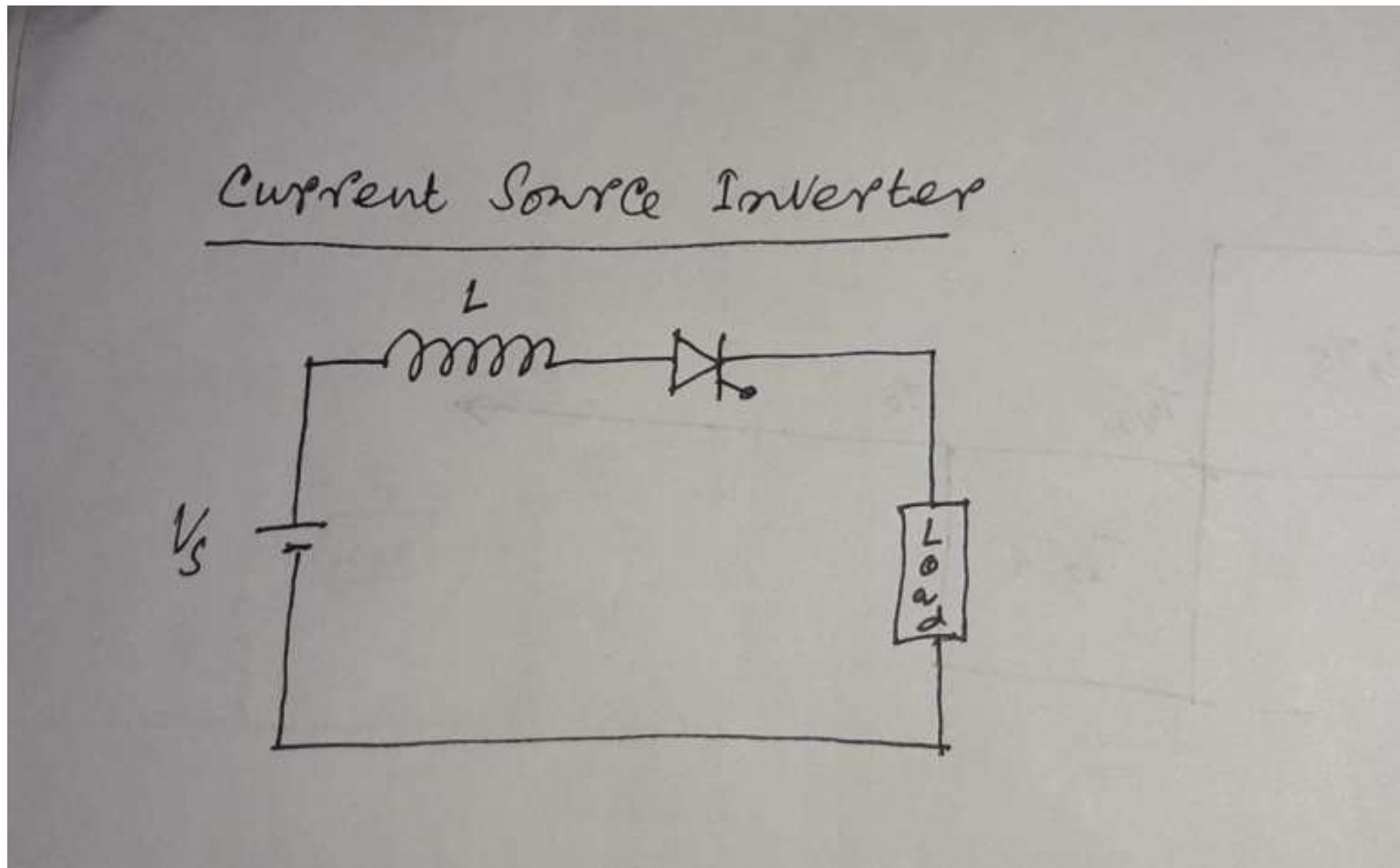
RMS o/p voltage

$$V_{ORMS} = \left[\frac{1}{T_o/2} \int_0^{T_o/2} V_s^2 dt \right]^{1/2}$$

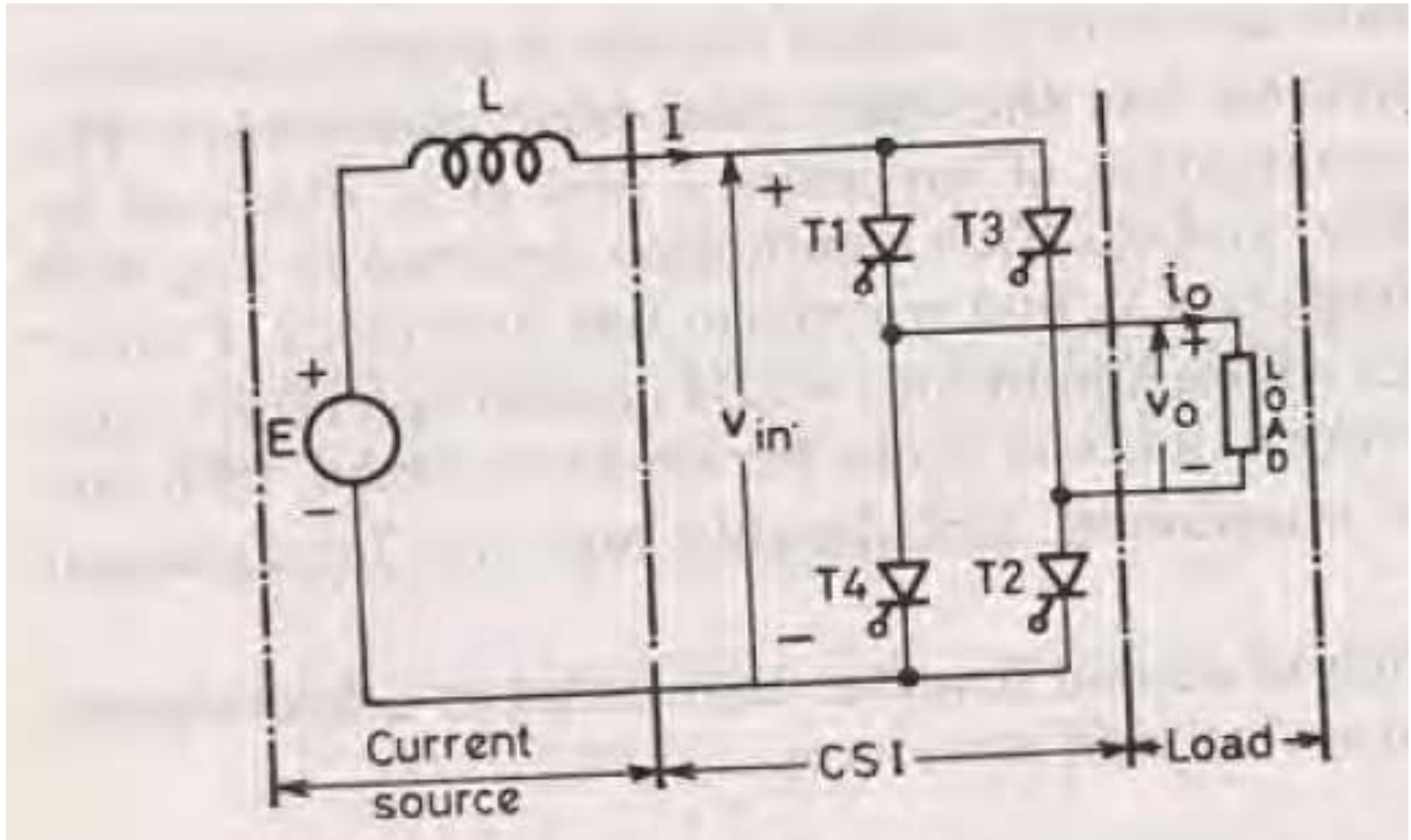
$$= V_s$$

$$I_{ORMS} = \frac{V_s}{R}$$

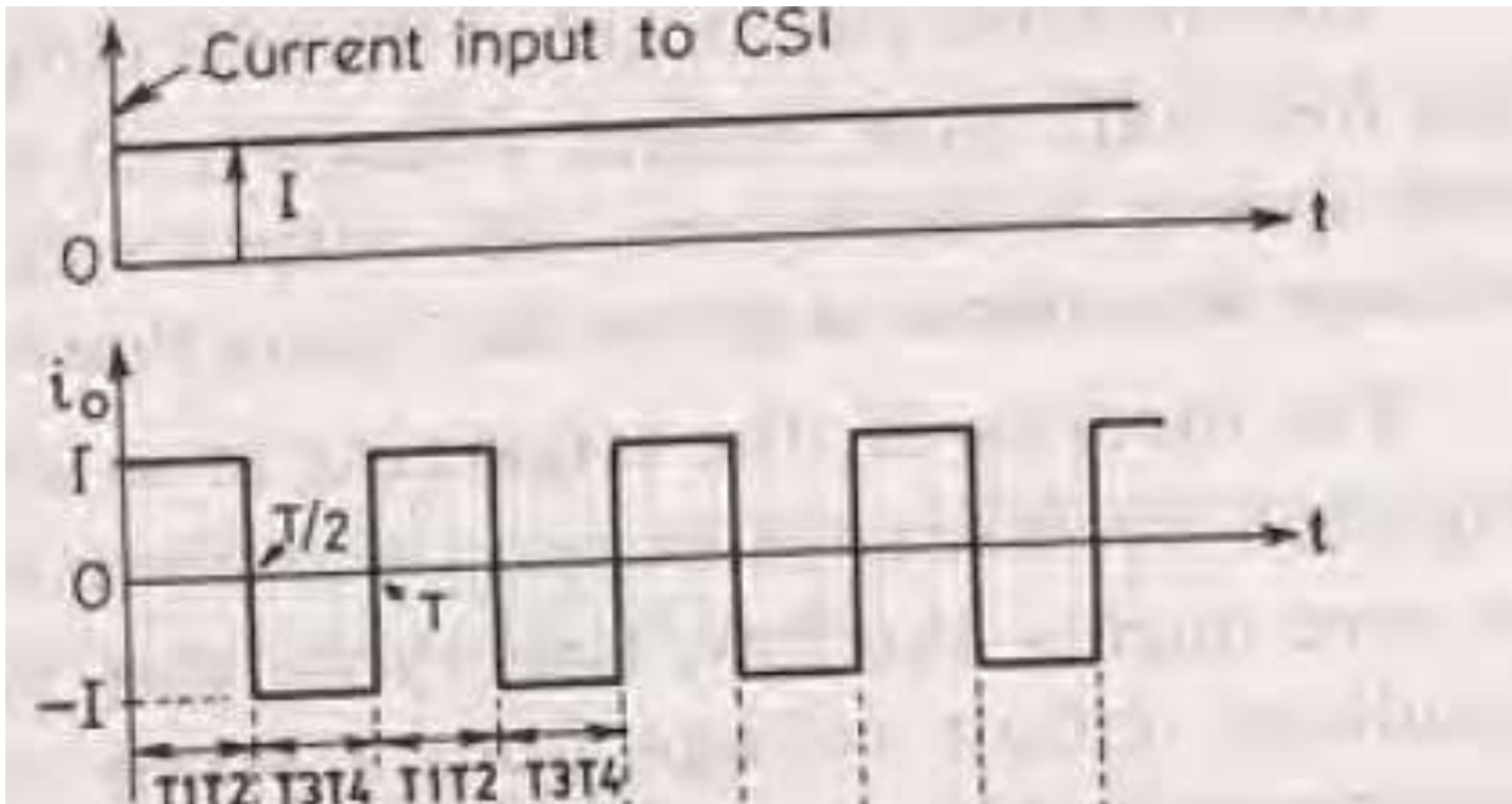
Current Source Inverter (CSI)



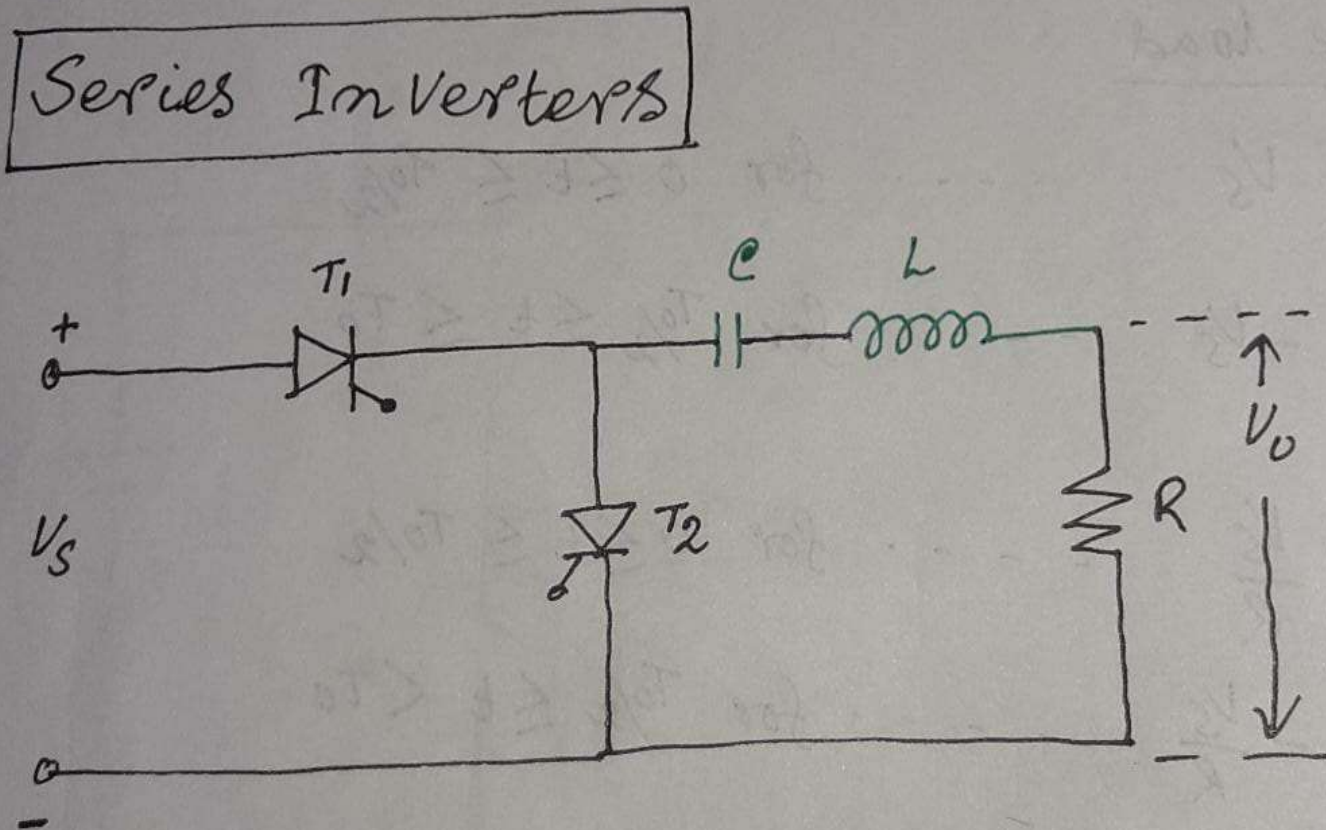
Current Source Inverter



Current Source Inverter

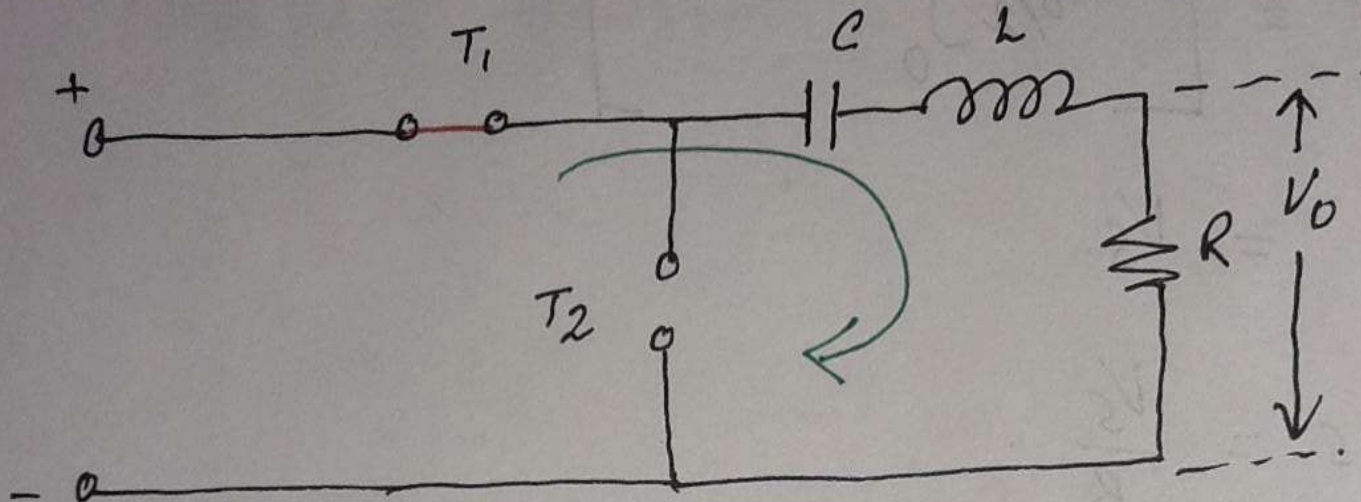


Series Inverter



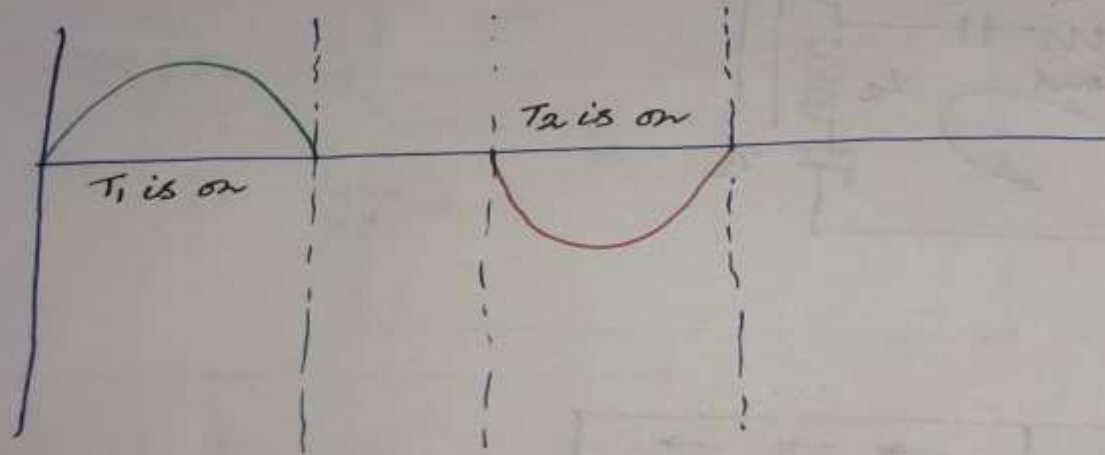
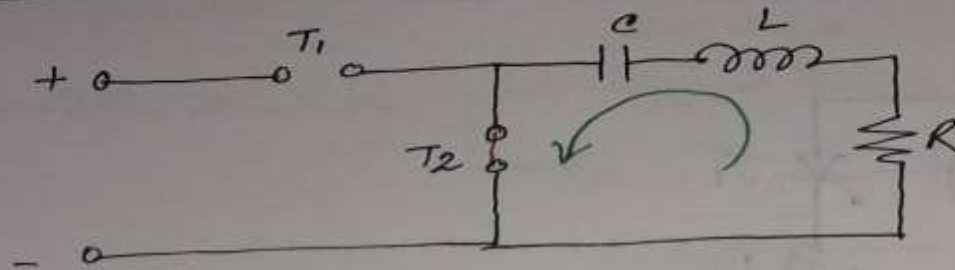
Series Inverter

Mode I



Series Inverter

Mode II

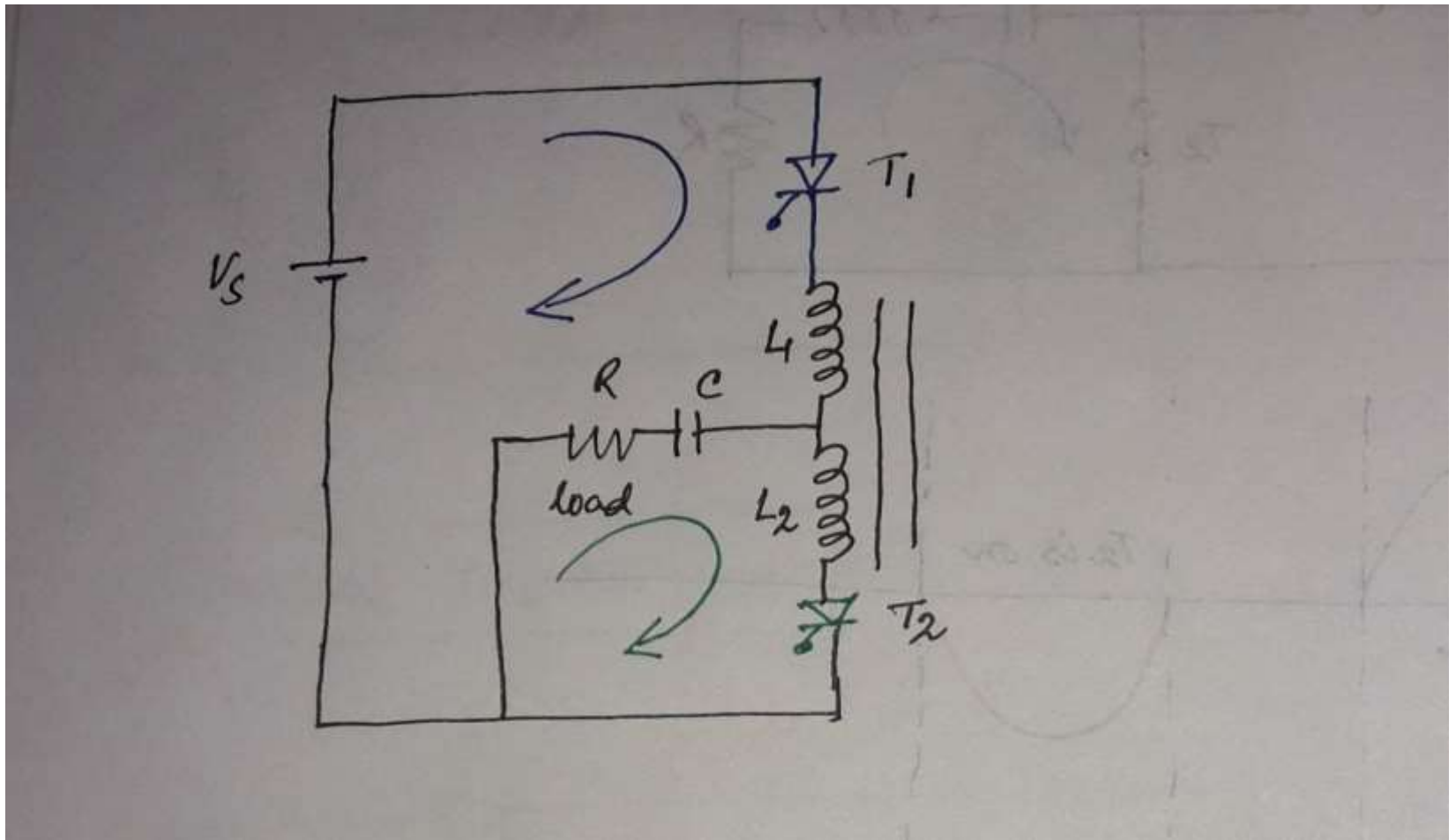


Series Inverter

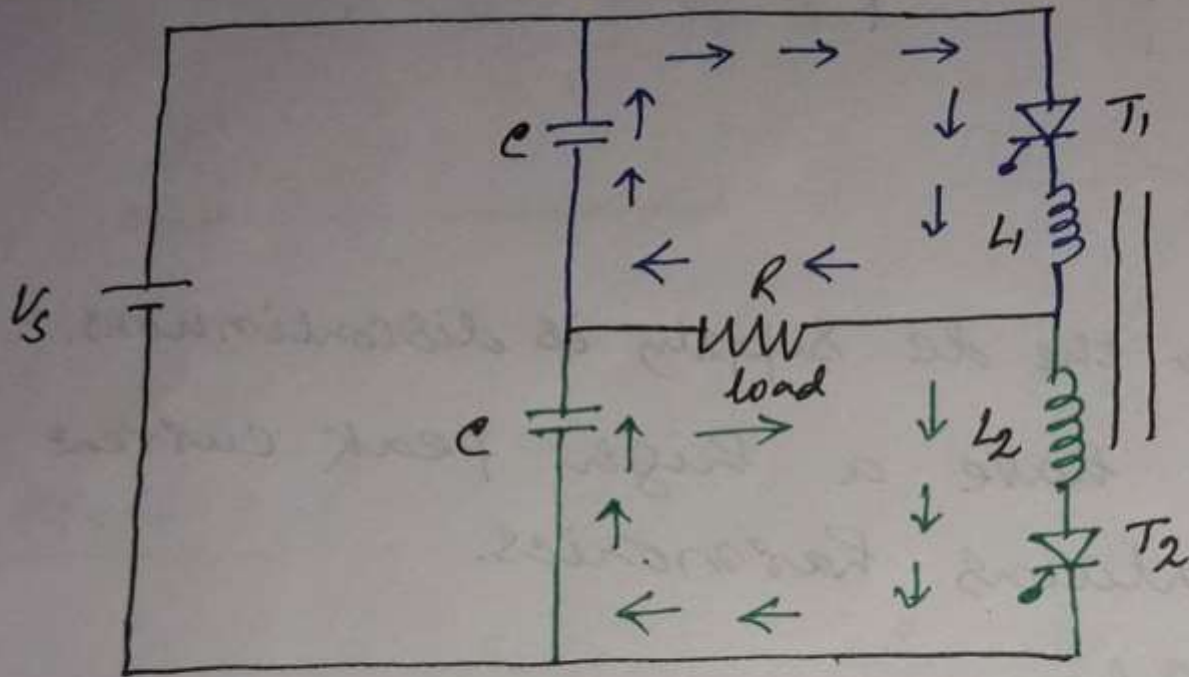
Drawbacks

1. Power flow from the dc supply is discontinuous.
2. DC supply will have a high peak current and hence contains harmonics.
3. Proper Time delay.
4. Discontinuous current, thus ripples
5. Poor o/p regulation
6. Rating of the commutation components are high.

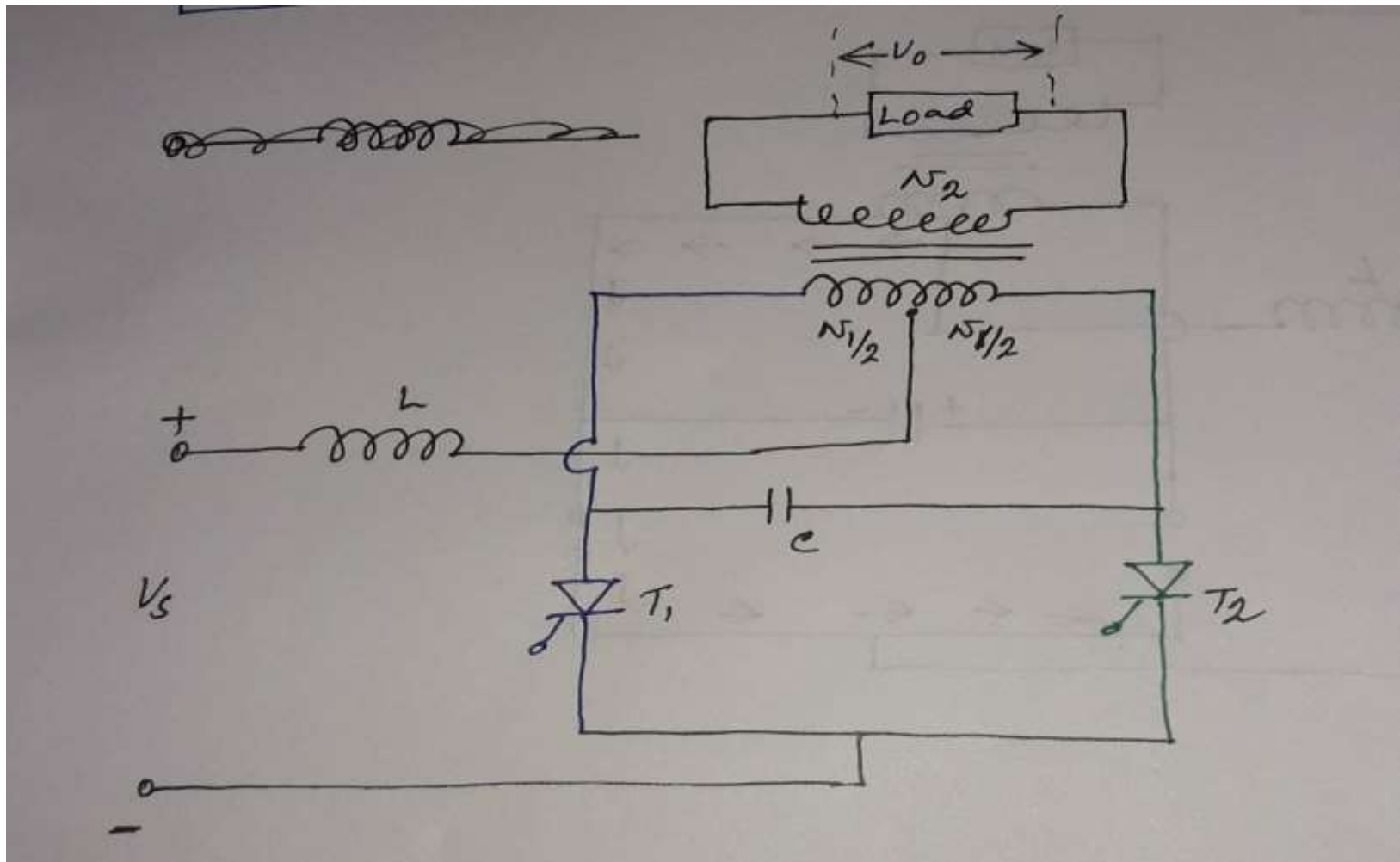
Modified Series Inverter



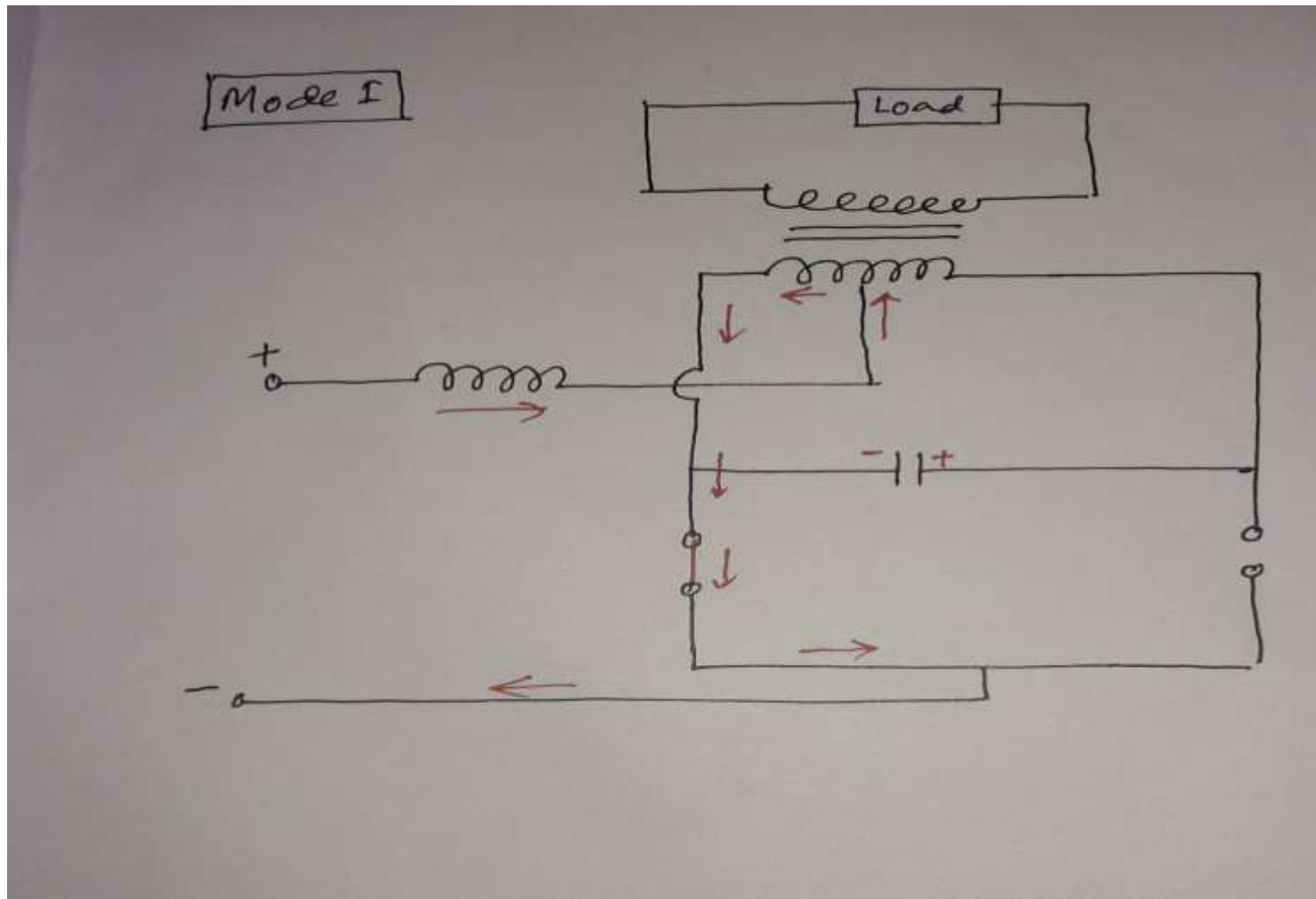
Modified Series Inverter



Parallel Inverter



Parallel Inverter



Parallel Inverter

