



ANALOG ELECTRONICS

LECTURE NO. 7

VOLTAGE-MULTIPLIER CIRCUITS

- ▣ Voltage-multiplier circuits are employed to maintain a relatively low transformer peak voltage while stepping up the peak output voltage to two, three, four, or more times the peak rectified voltage.

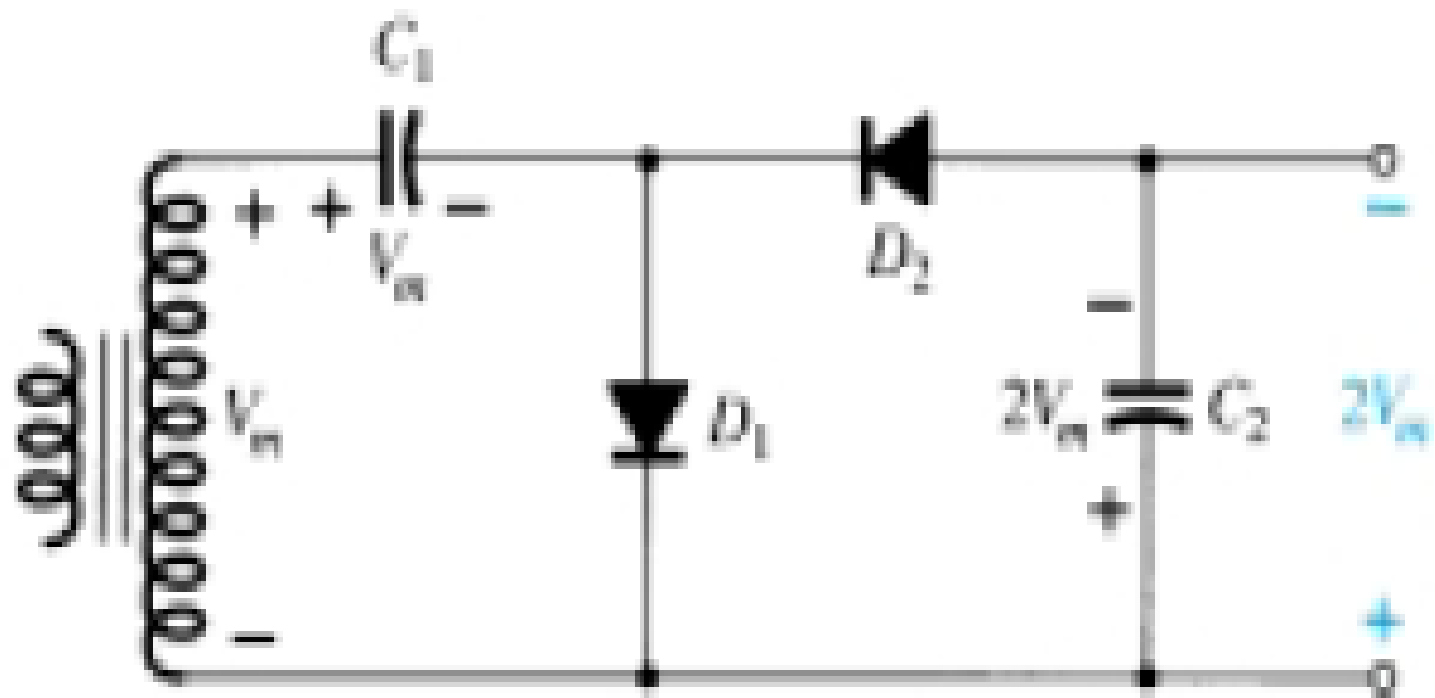
VOLTAGE-MULTIPLIER CIRCUITS

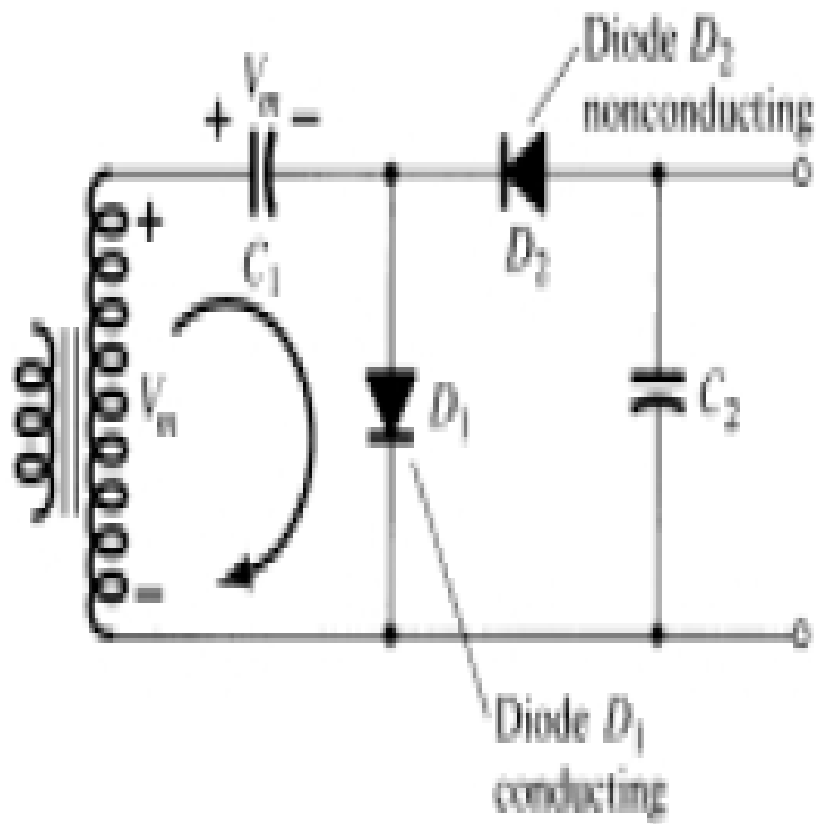
- ▣ Voltage Doubler
- ▣ Voltage Tripler
- ▣ and Quadrupler

VOLTAGE-MULTIPLIER CIRCUITS

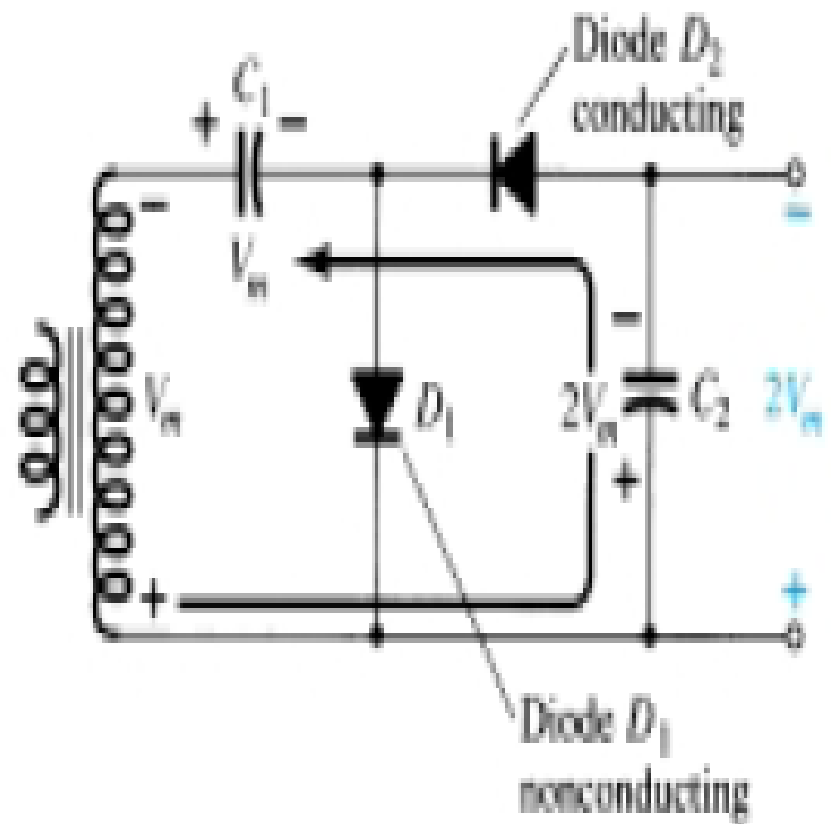
- ▣ Voltage-multiplier circuits are employed to maintain a relatively low transformer peak voltage while stepping up the peak output voltage to two, three, four, or more times the peak rectified voltage.

Half wave Doubler circuit





(a)



(b)

VOLTAGE-MULTIPLIER CIRCUITS

- ▣ During the positive voltage half-cycle across the transformer, secondary diode *D1* conducts (and diode *D2* is cut off), charging capacitor *C1* up to the peak rectified voltage (V_m). Diode *D1* is ideally a short during this half-cycle, and the input voltage charges capacitor *C1* to V_m .

VOLTAGE-MULTIPLIER CIRCUITS

- ▣ During the negative half-cycle of the secondary voltage, diode *D1* is cut off and diode *D2* conducts charging capacitor *C2*.
- ▣ Since diode *D2* acts as a short during the negative half-cycle (and diode *D1* is open), we can sum the voltages around the outside loop

- ▣ On the next positive half-cycle, diode $D2$ is non conducting and capacitor $C2$ will discharge through the load. If no load is connected across capacitor $C2$, both capacitors stay charged— $C1$ to V_m and $C2$ to $2V_m$

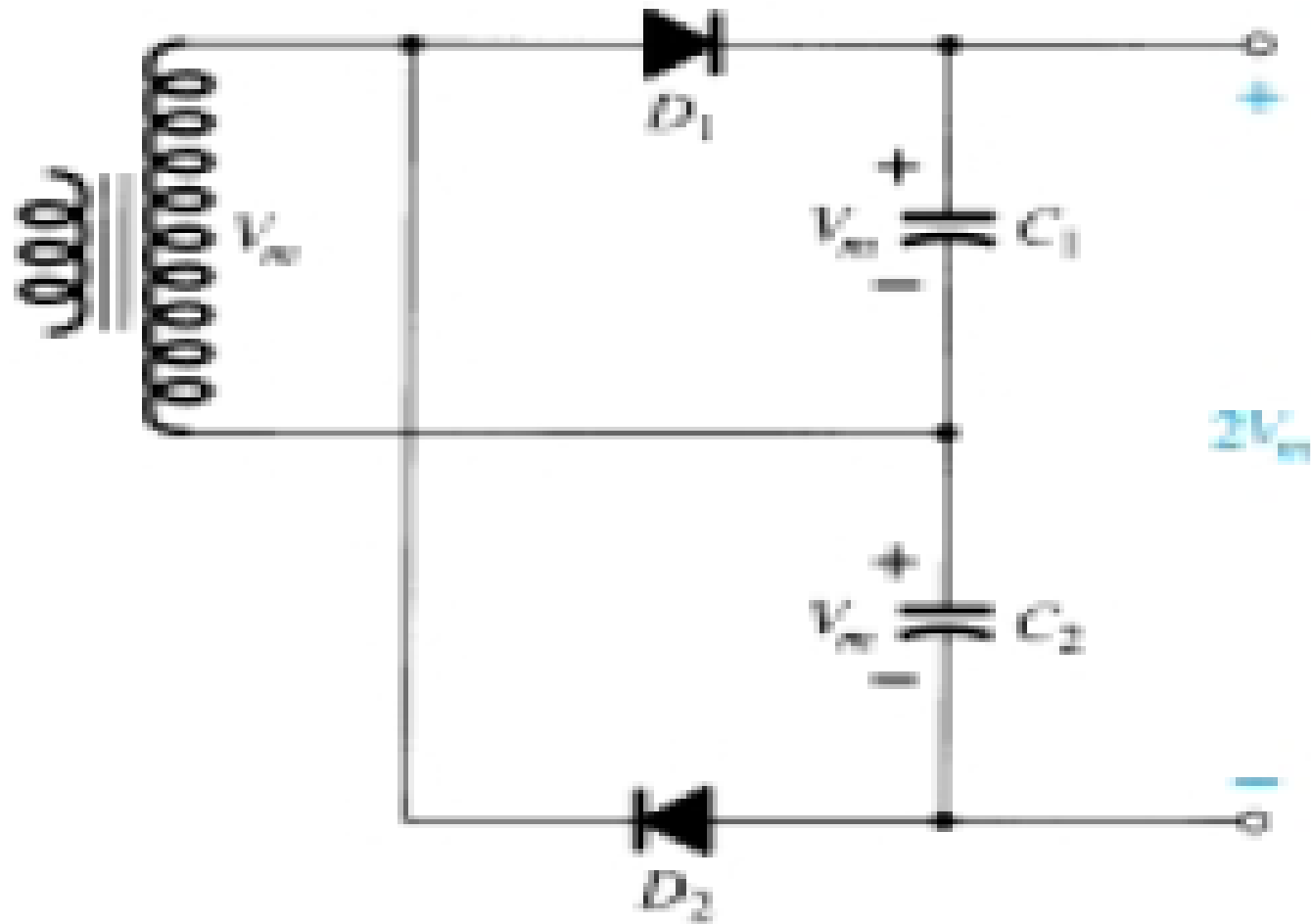
▣ . *If, as would be expected, there is a load connected to the output of the voltage doubler, the voltage across capacitor C_2 drops during the positive half-cycle (at the input) and the capacitor is recharged up to $2V_m$ during the negative half-cycle. The output waveform across capacitor C_2 is that of a half-wave signal filtered by a capacitor filter. The peak inverse voltage across each diode is $2V_m$.*

$$-V_m - V_{C_1} + V_{C_2} = 0$$

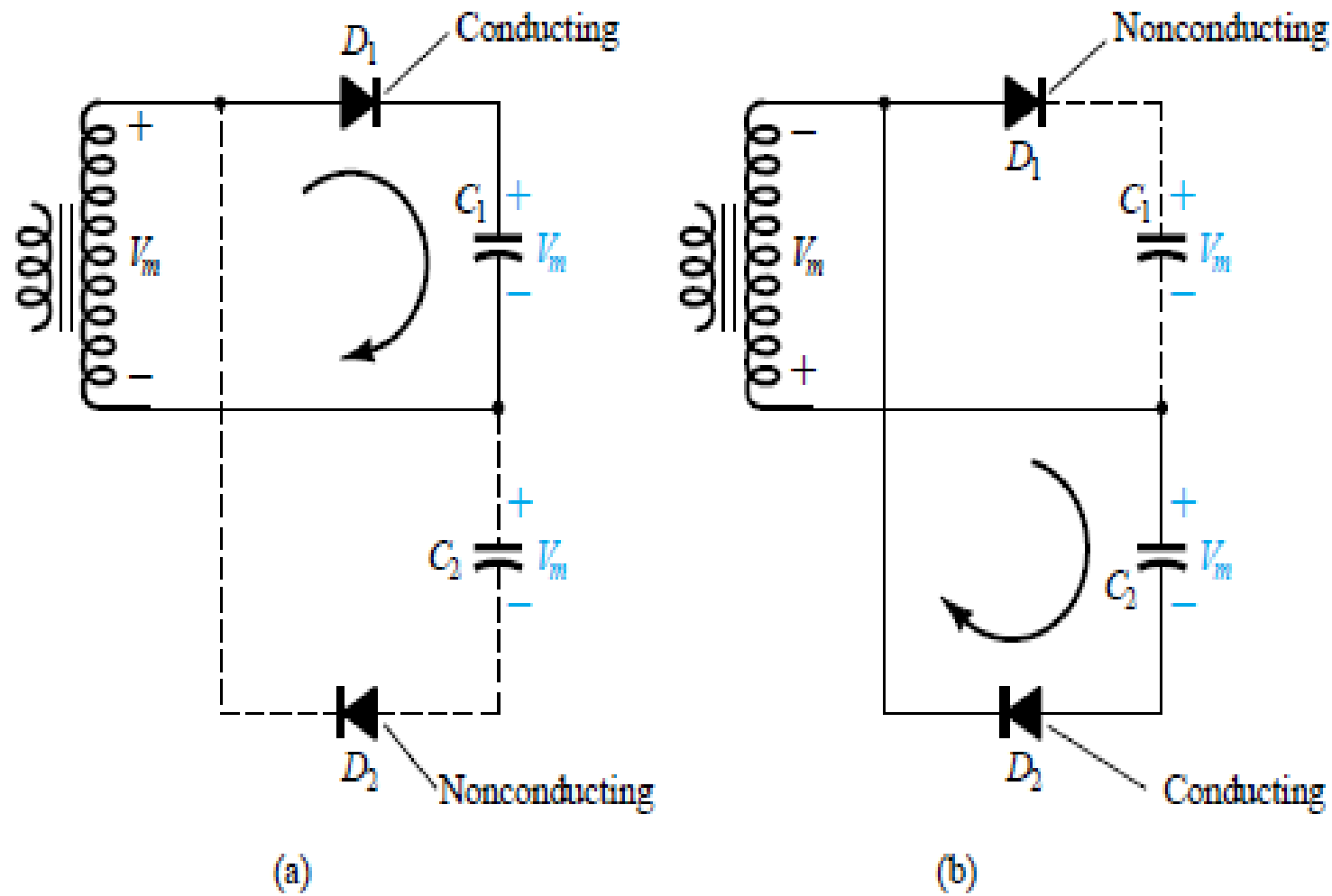
$$-V_m - V_m + V_{C_2} = 0$$

$$V_{C_2} = 2V_m$$

Full wave Doubler



Full wave Doubler



Voltage Tripler and Quadrupler

