Sohag University
Faculty Of Engineering
Electrical Engineering Department

POWER ELECTRONICS

Sheet (1)

Ch3 Half Wave Rectifier

Uncontrolled Half-Wave Rectifier

1. The half-wave rectifier circuit of Fig. 3-1*a* has $Vs(t) = 170 \sin(377t)$ V and a load resistance $R = 15\ \Omega$ .Determine (*a*) the average load current, (*b*) the rms load current, (*c*) the power absorbed by the load, (*d*) the apparent power supplied by the source, and (*e*) the power factor of the circuit.

2. A half-wave rectifier has a source of 120 V rms at 60 Hz and an *RL* load with $R = 10\ \Omega$ and $L = 15$ mH. Determine (*a*) an expression for load current, (*b*) the average current, (*c*) the power absorbed by the resistor, and (*d*) the power factor.

3. A half-wave rectifier of Fig. 3-5*a* has a 240 V rms, 60 Hz ac source. The load is a series inductance, resistance, and dc source, with $L = 75$ mH, $R = 10\ \Omega$, and $V_{dc} = 100$ V. Determine (*a*) an expression for load current, (*b*) the power absorbed by the dc voltage source, (*c*) the power absorbed by the resistance, and (*d*) power supplied by the source and the power factor.

4. A half-wave rectifier of Fig. 3-6 has a 120 V rms, 60 Hz ac source. The load is a series inductance and dc voltage with $L = 100$ mH and $V_{dc} = 48$ V. Determine (*a*) an expression for load current, (*b*) Determine the power absorbed by the dc voltage source. (*c*) the power factor.

5. The half-wave rectifier with a freewheeling diode (Fig. 3-7*a*) has $R = 2\ \Omega$ and $L = 25$ mH, Vm is 100 V, and the frequency is 60 Hz. (*a*) Determine the average load voltage and current, and (*b*) the power absorbed by the resistor.

6. For the half-wave rectifier with a freewheeling diode and RL load as shown in Fig. 3-7a, the source is 240 V rms at 60 Hz and $R = 8\ \Omega$. (a) Assume L is infinitely large. Determine the power absorbed by the load and the power factor as seen by the source. Sketch Vo, iD1 , and iD2 . (b) Determine the average current in each diode. (c) For a finite inductance, determine L such that the peak-to-peak current is no more than 10 percent of the average current.

7. The half-wave rectifier of Fig. 3-11a has a 120 V rms source at 60 Hz, $R = 500\ \Omega$, and $C = 100\mu F$. Determine (a) an expression for output voltage, (b) the peak-to-peak voltage variation on the output, (c) an expression for capacitor current, (d) the peak diode current, and (e) the value of C such that ΔVo is 1 percent of Vm.

Controlled Half-Wave Rectifier

8. Show that the controlled half-wave rectifier with a resistive load in Fig. 3-13*a* has a power factor of $\sqrt{\frac{1}{2} - \frac{\alpha}{2\pi} + \frac{\sin(2\alpha)}{4\pi}}$

9. A controlled half-wave rectifier has an AC source of 240 V rms at 60 Hz. The load is a 30 Ω resistor. (*a*) Determine the delay angle such that the average load current is 2.5 A. (*b*) Determine the power absorbed by the load. (*c*) Determine the power factor.

10. A controlled half-wave rectifier has a 120 V rms 60 Hz ac source. The series *RL* load has $R = 40\ \Omega$ and $L = 75$ mH. The delay angle is 60°. Determine (*a*) an expression for load current, (*b*) the average load current, and (*c*) the power absorbed by the load, (*d*) the power factor.

11. A controlled half-wave rectifier has a 120 V, 60 Hz ac source. The load is a series inductance, resistance, and dc source, with $L = 100$ mH, $R = 12\ \Omega$, and Vdc _ 48 V. The delay angle is 50. Determine (*a*) the power absorbed by the dc voltage source, (*b*) the power absorbed by the resistance, and (*c*) the power factor.