

Diode Applications

Dr. José Ernesto Rayas Sánchez

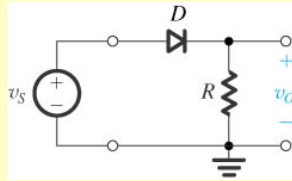
Some figures of this presentation were taken from the instructional resources of the following textbooks:
A. S. Sedra and K. C. Smith, *Microelectronic Circuits*. New York, NY: Oxford University Press, 2003.

1

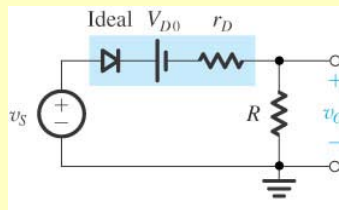
Outline

- Half-wave rectifier
- Precision high-wave rectifier
- Full-wave rectifiers
- Peak detectors
- Voltage limiters or clippers
- DC voltage restorer or clampers
- Voltage multipliers

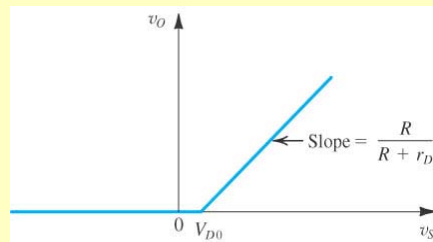
Half-Wave Rectifier



Model



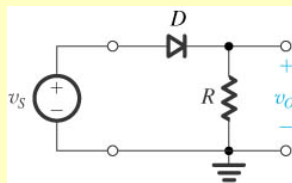
Transfer function



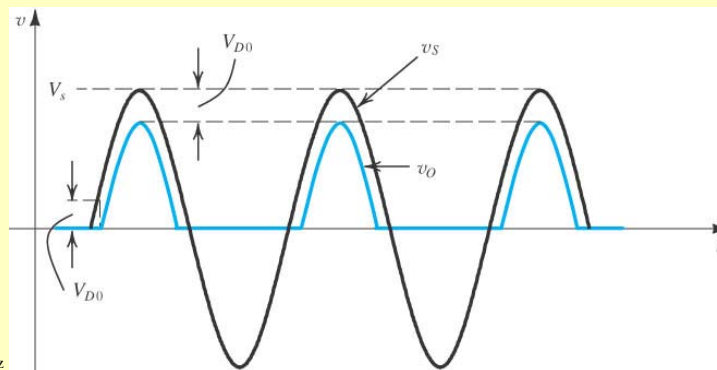
Dr. J. E. Rayas Sánchez

3

Half-Wave Rectifier (cont)



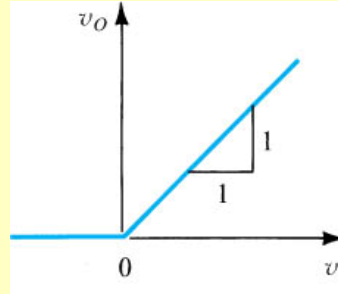
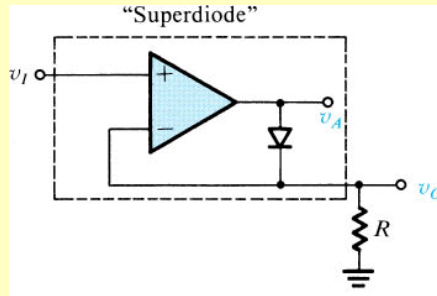
Output for a sinusoidal input



Dr. J. E. Rayas Sánchez

4

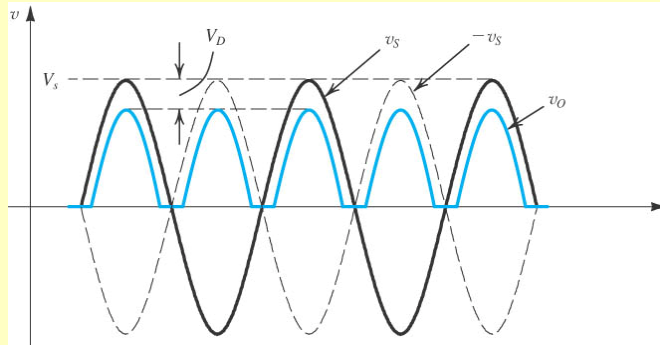
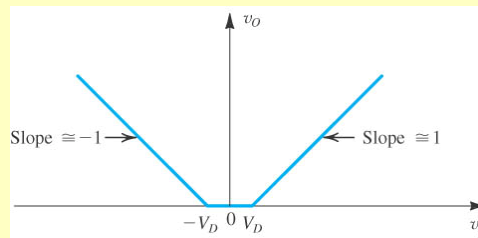
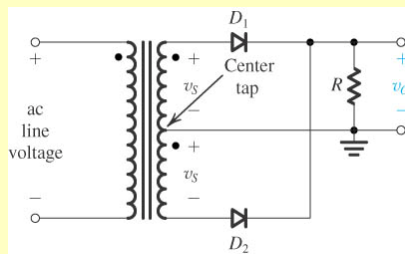
Precision Half-Wave Rectifier



Dr. J. E. Rayas Sánchez

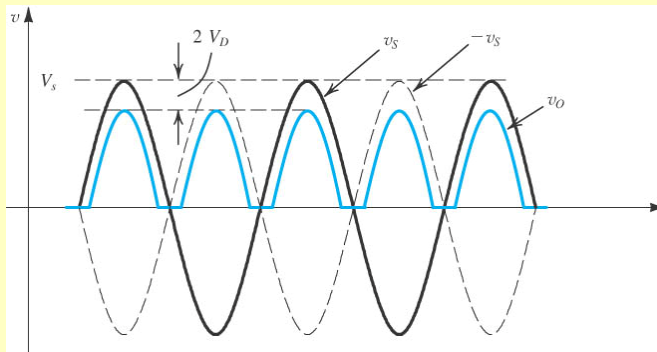
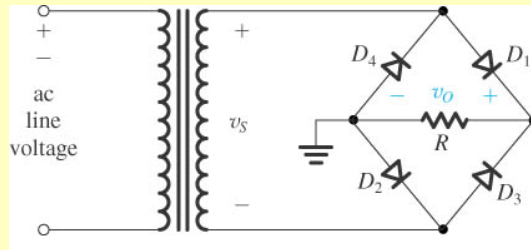
5

Full-Wave Rectifier using Center-Tap Transformor.



Dr. J. E. Rayas Sánchez

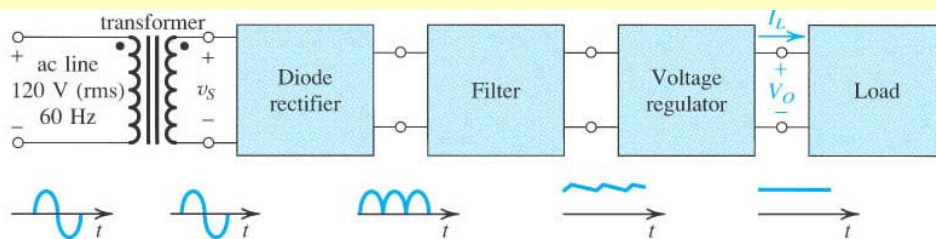
Full-Wave Rectifier (Bridge Rectifier)



Dr. J. E. Rayas Sánchez

7

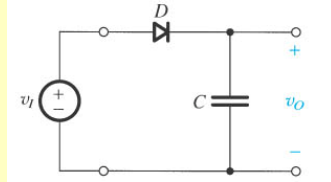
Typical Usage of Full-Wave Rectifiers



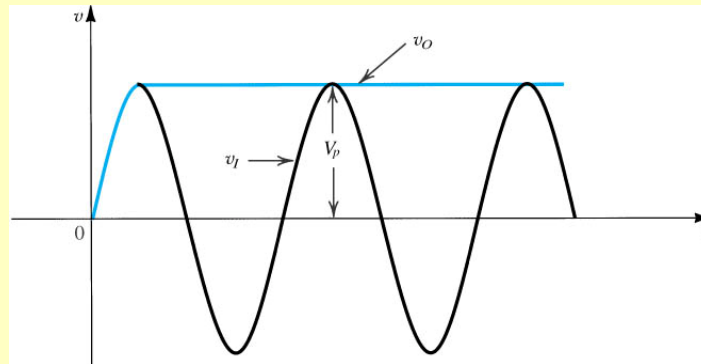
Dr. J. E. Rayas Sánchez

8

Peak Detector



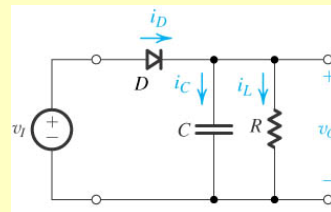
Ideal behavior



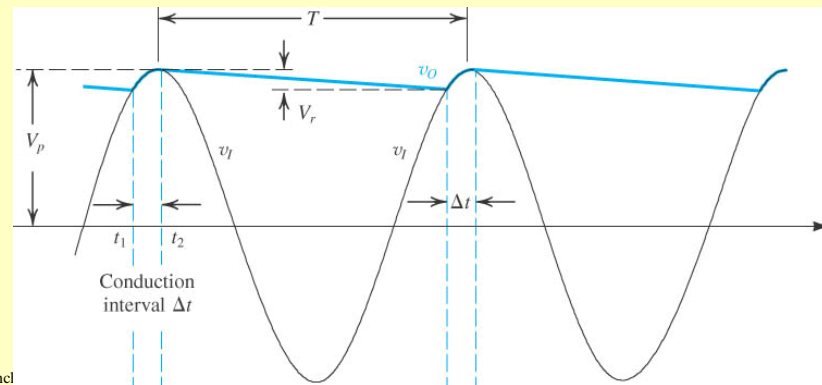
Dr. J. E. Rayas Sánchez

9

Peak Detector (cont)

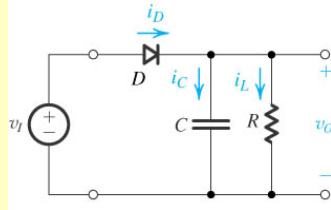


Practical behavior

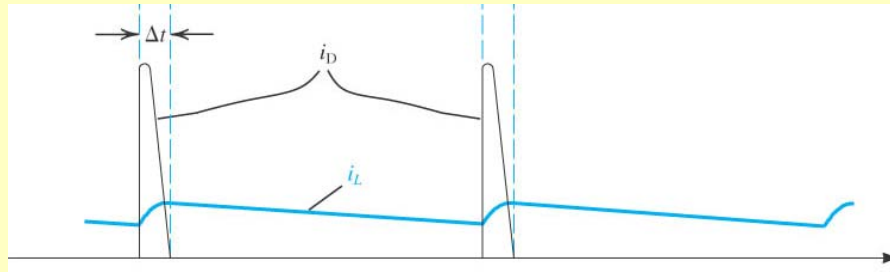


Dr. J. E. Rayas Sánchez

Peak Detector (cont)



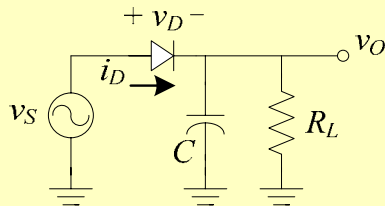
Practical behavior



Dr. J. E. Rayas Sánchez

11

Peak Detector – Transient Response



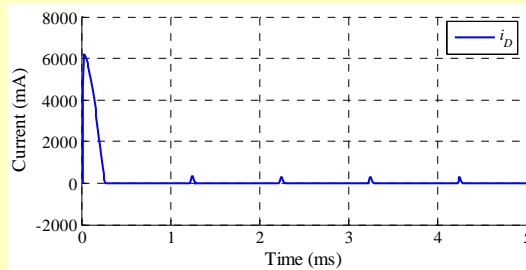
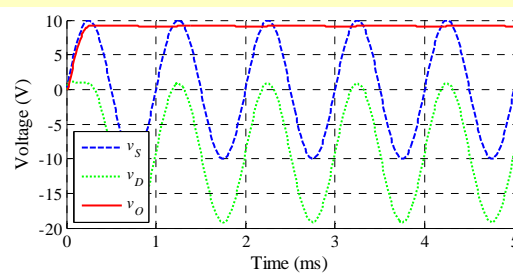
$$v_S = 10V \sin(2\pi ft)$$

$$f = 1\text{KHz}$$

$$R_L = 1\text{K}\Omega$$

$$C = 100\mu\text{F}$$

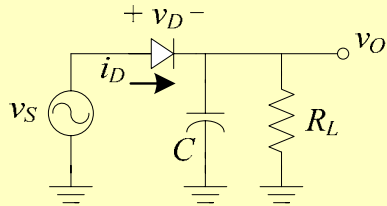
Using diode 1N4004



Dr. J. E. Rayas Sánchez

12

Peak Detector – Transient Response



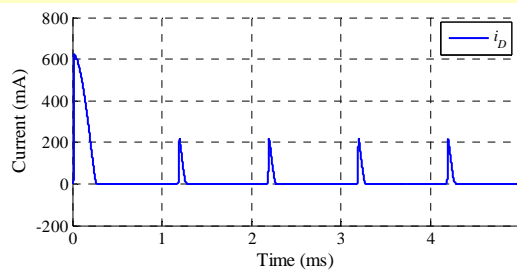
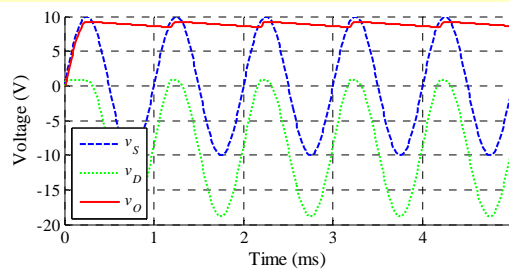
$$v_S = 10V \sin(2\pi ft)$$

$$f = 1\text{KHz}$$

$$R_L = 1\text{K}\Omega$$

$$C = 10\mu\text{F}$$

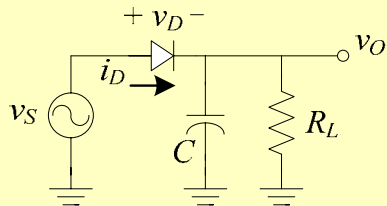
Using diode 1N4004



Dr. J. E. Rayas Sánchez

13

Peak Detector – Transient Response



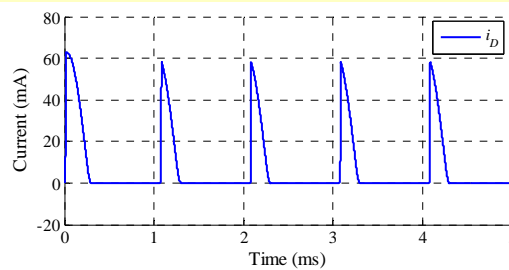
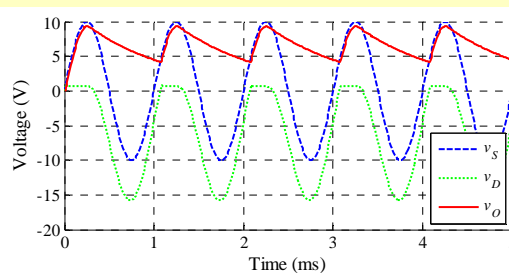
$$v_S = 10V \sin(2\pi ft)$$

$$f = 1\text{KHz}$$

$$R_L = 1\text{K}\Omega$$

$$C = 1\mu\text{F}$$

Using diode 1N4004



Dr. J. E. Rayas Sánchez

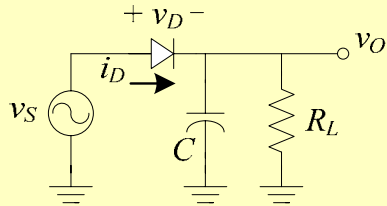
14

Diode Applications

Dr. José Ernesto Rayas Sánchez

January 25, 2007

Peak Detector – Transient Response



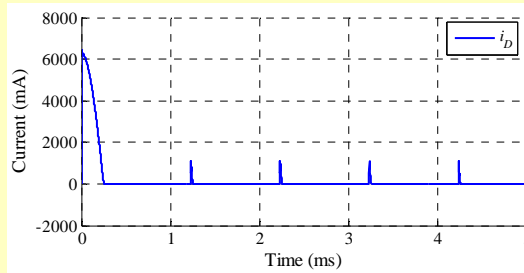
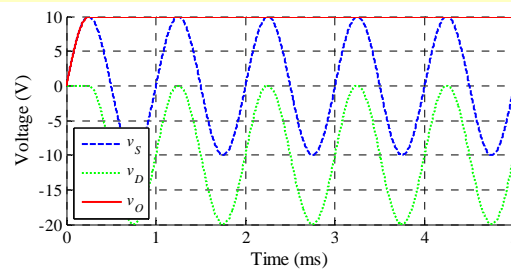
$$v_S = 10V \sin(2\pi ft)$$

$$f = 1\text{KHz}$$

$$R_L = 1\text{K}\Omega$$

$$C = 100\mu\text{F}$$

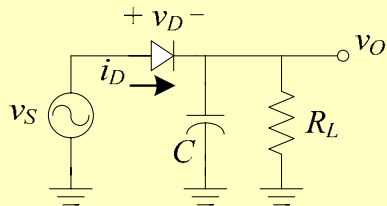
Using ideal diode



Dr. J. E. Rayas Sánchez

15

Peak Detector – Transient Response



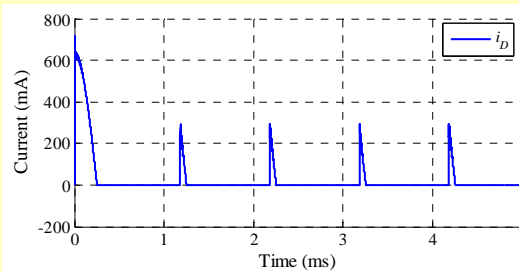
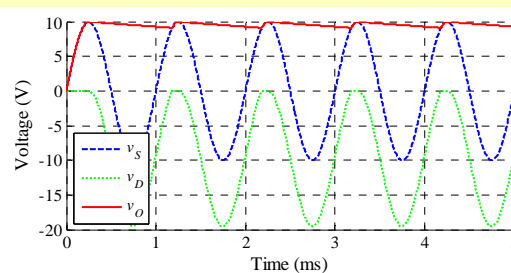
$$v_S = 10V \sin(2\pi ft)$$

$$f = 1\text{KHz}$$

$$R_L = 1\text{K}\Omega$$

$$C = 10\mu\text{F}$$

Using ideal diode



Dr. J. E. Rayas Sánchez

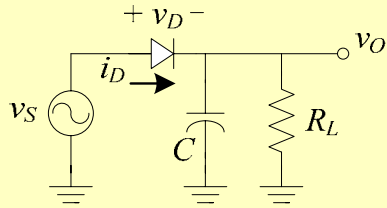
16

Diode Applications

Dr. José Ernesto Rayas Sánchez

January 25, 2007

Peak Detector – Transient Response



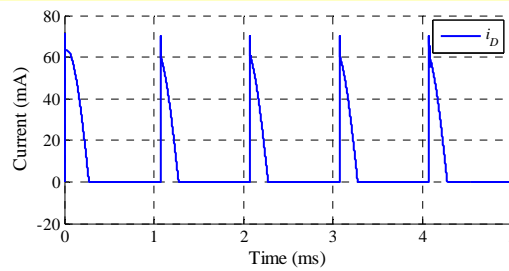
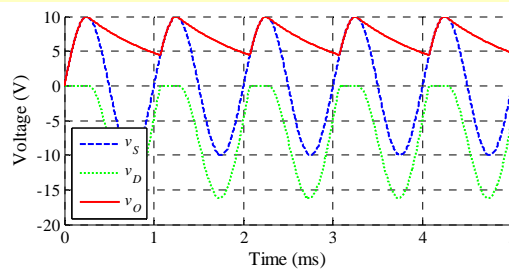
$$v_S = 10V \sin(2\pi ft)$$

$$f = 1\text{KHz}$$

$$R_L = 1\text{K}\Omega$$

$$C = 1\mu\text{F}$$

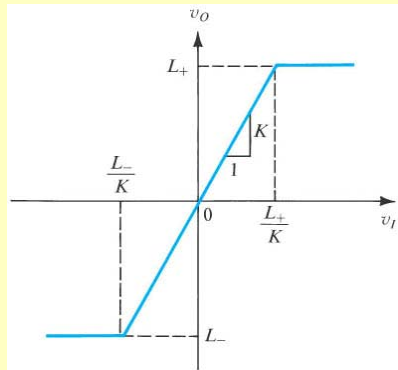
Using ideal diode



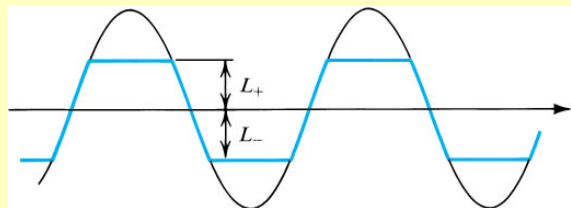
Dr. J. E. Rayas Sánchez

17

General Voltage Limiters (Clippers)



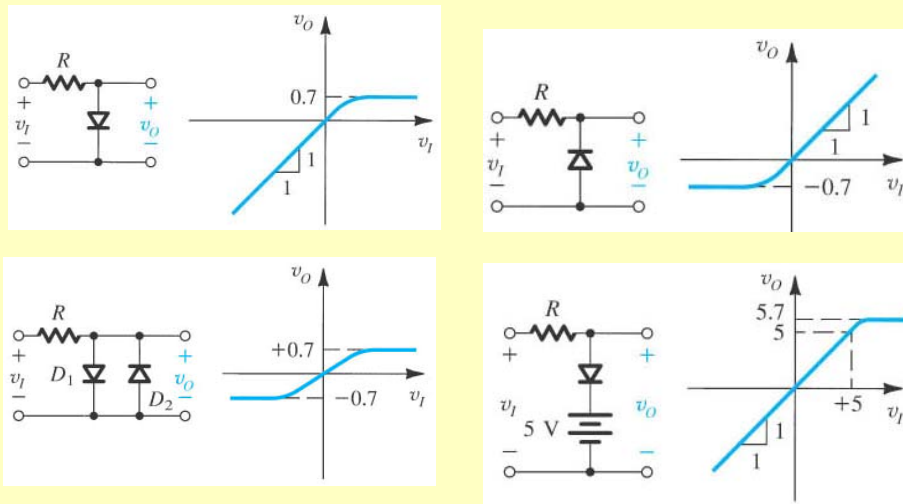
Passive voltage limiters have $K \leq 1$



Dr. J. E. Rayas Sánchez

18

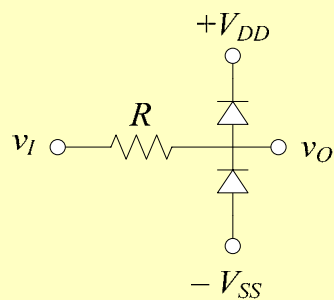
Diode Voltage Limiters (Diode Clippers)



Dr. J. E. Rayas Sánchez

19

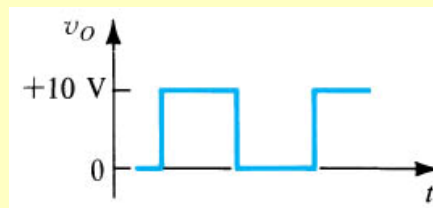
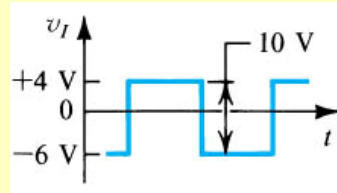
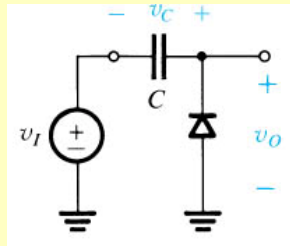
Typical Diode Voltage Limiter



Dr. J. E. Rayas Sánchez

20

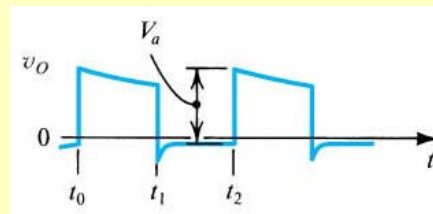
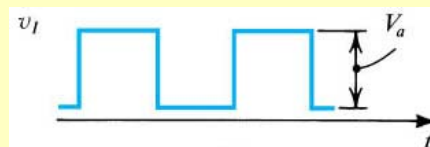
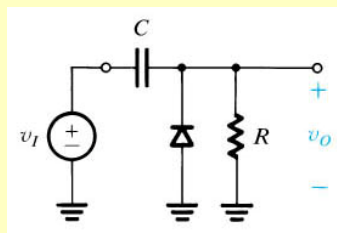
DC Voltage Restorer or Clampers



Dr. J. E. Rayas Sánchez

21

DC Voltage Restorer or Clampers (cont)



Dr. J. E. Rayas Sánchez

22

Half-Wave Voltage Doubler

