Basic Electronics Engineering (Spring 2024)

Resources of PPT:

- www.google.com

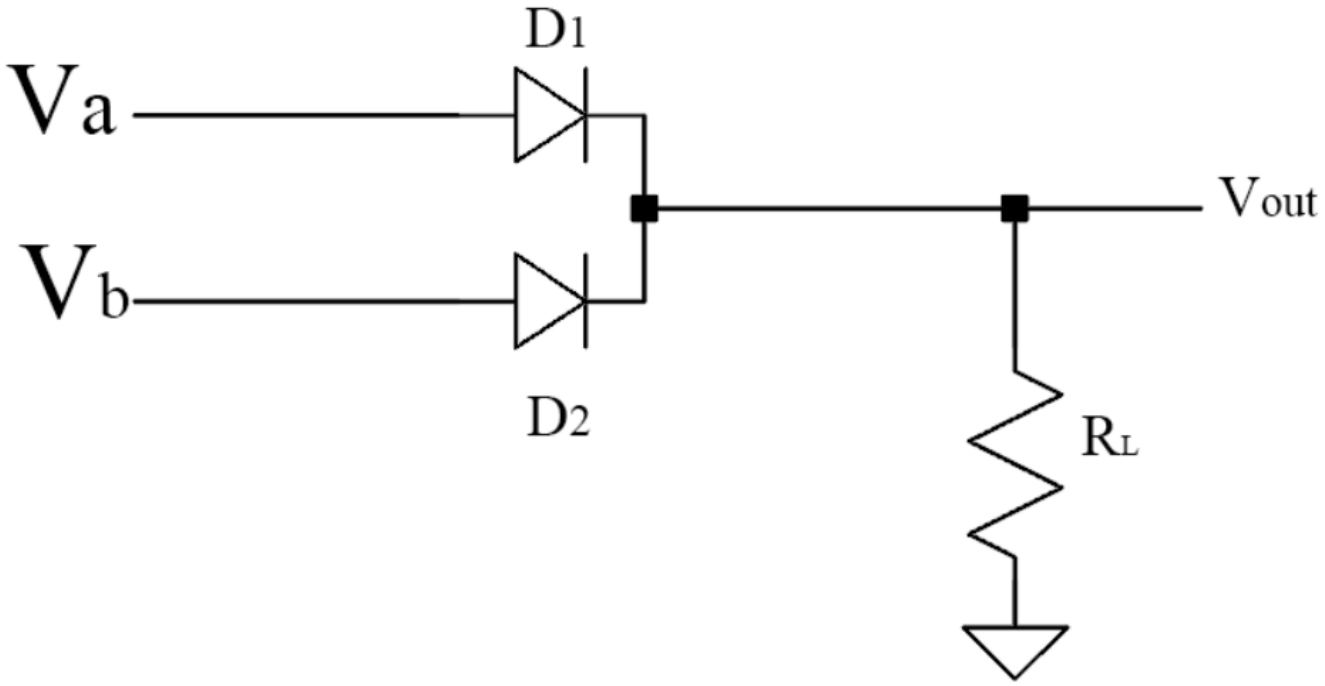
- Digital Design, 4th Edition
  M. Morris Mano and Michael D. Ciletti

Analog Electronics

Reference Book:

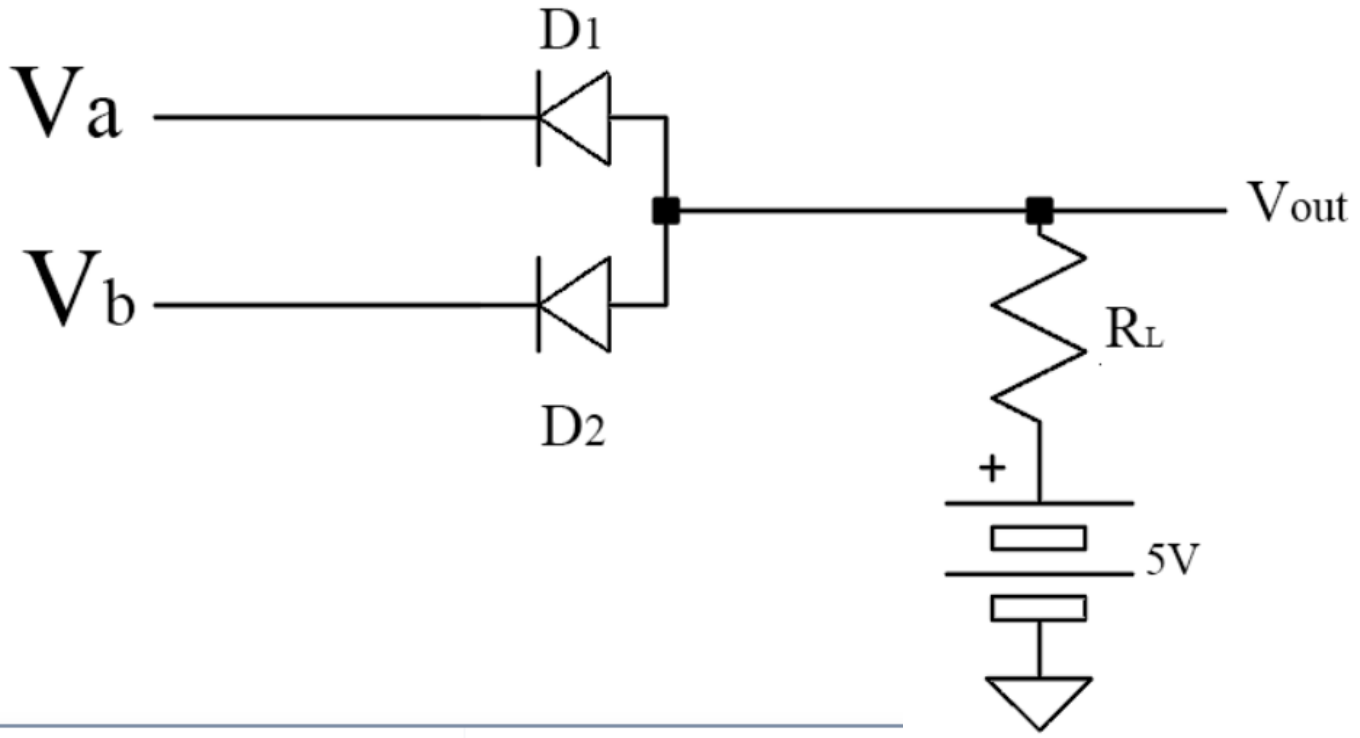
1. **R. BOYLESTAD and L. NASHELSKY, “Electronic Devices And Circuit Theory”, Prentice Hall.**
2. **Sedra and Smith, “Microelectronic Circuits”, Oxford University Press**

AND/OR Gate Using pn-junction diode



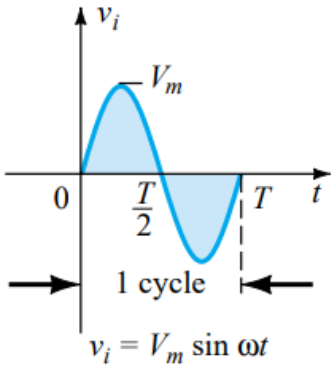
Va	Vb	Vout
LOW	LOW	LOW
LOW	HIGH	HIGH
HIGH	LOW	HIGH
HIGH	HIGH	HIGH

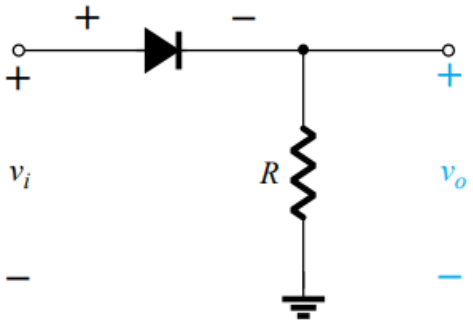
AND/OR Gate Using pn-junction diode



Va	Vb	Vout
LOW	LOW	LOW
LOW	HIGH	LOW
HIGH	LOW	LOW
HIGH	HIGH	HIGH

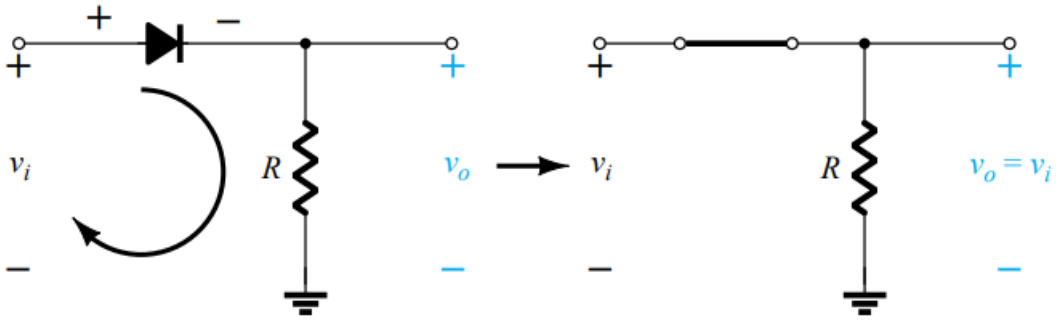
Ideal Half-wave Rectifier

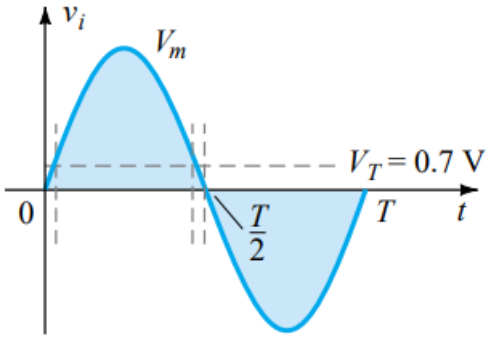




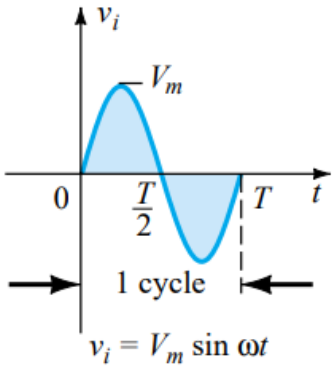
$$v_{dc} = \frac{1}{T}\int_0^T v_o(t)dt$$

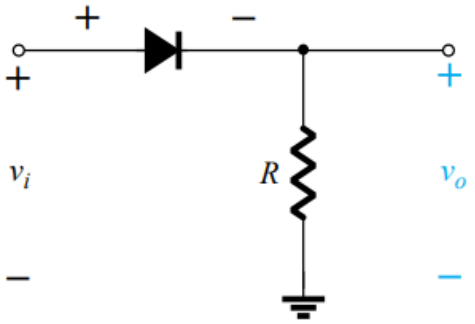
$$V_{dc} = 0.318V_m$$ half-wave



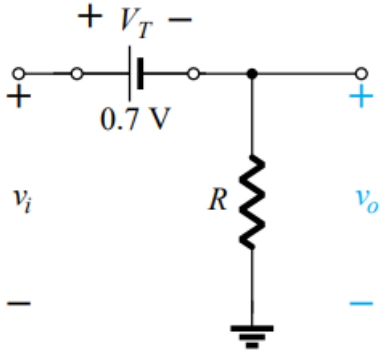


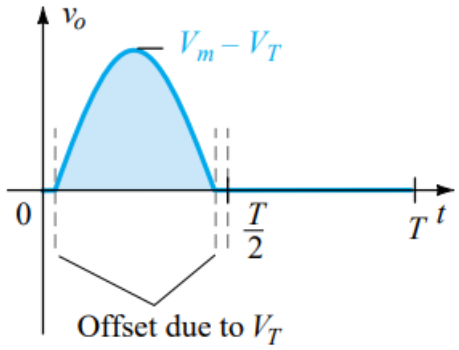
Non-ideal Half-wave Rectifier





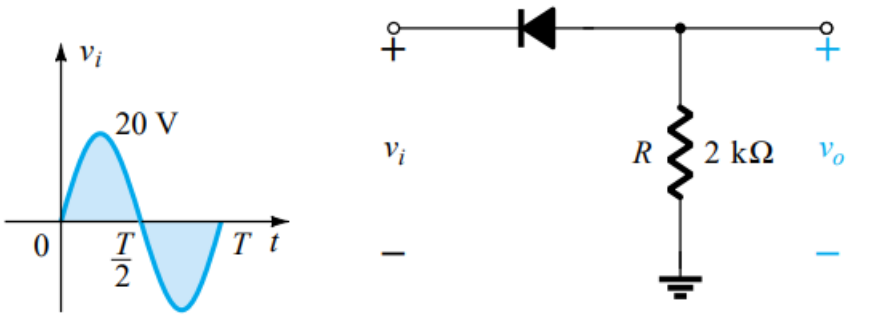
$$v_{dc} = \frac{1}{T}\int_0^T v_o(t)dt$$





$$V_{dc} \cong 0.318(V_m - V_T)$$

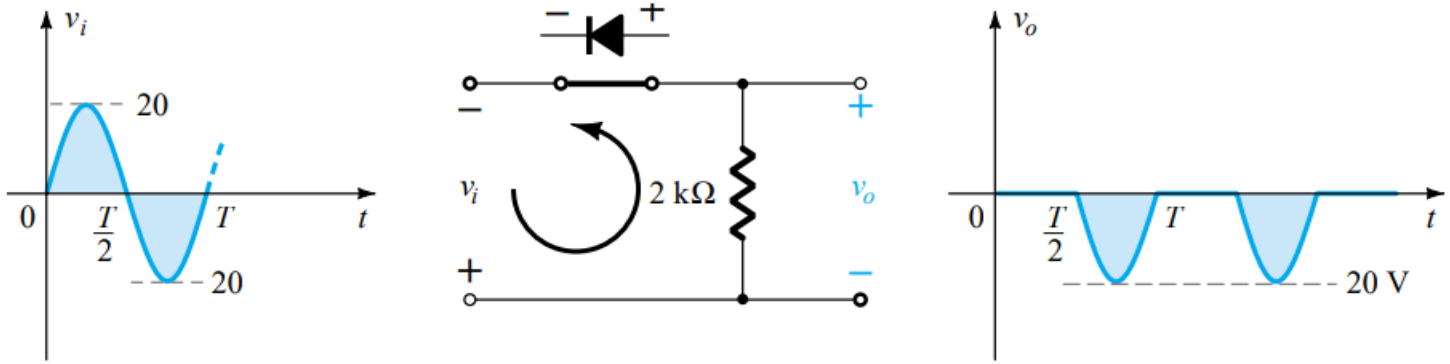
pn-junction diode rectifier



(a) Sketch the output v_o and determine the dc level of the output for the network.

(b) Repeat part (a) if the ideal diode is replaced by a silicon diode.

(c) Repeat parts (a) and (b) if v_m is increased to 200 V



$$V_{dc} = -0.318V_m = -0.318(20\text{ V}) = \mathbf{-6.36\text{ V}}$$

pn-junction diode rectifier

(b) Using a silicon diode, the output has the appearance of Fig. 2.50 and

$$V_{dc} \cong -0.318(V_m - 0.7\text{ V}) = -0.318(19.3\text{ V}) \cong \mathbf{-6.14\text{ V}}$$

The resulting drop in dc level is 0.22 V or about 3.5%.

(c) Eq. (2.7): $V_{dc} = -0.318V_m = -0.318(200\text{ V}) = \mathbf{-63.6\text{ V}}$

Eq. (2.8): $V_{dc} = -0.318(V_m - V_T) = -0.318(200\text{ V} - 0.7\text{ V})$

$= -(0.318)(199.3\text{ V}) = \mathbf{-63.38\text{ V}}$

which is a difference that can certainly be ignored for most applications. For part c the offset and drop in amplitude due to V_T would not be discernible on a typical oscilloscope if the full pattern is displayed.

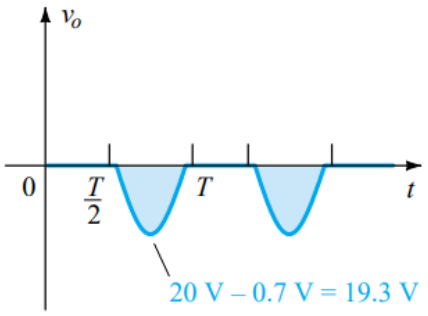
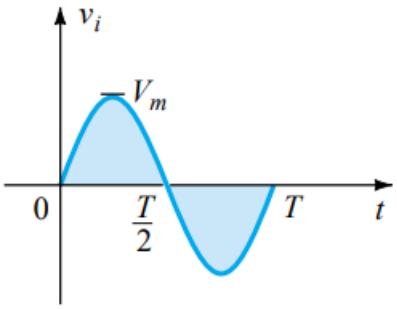
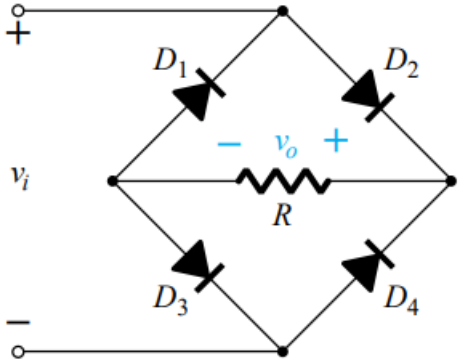
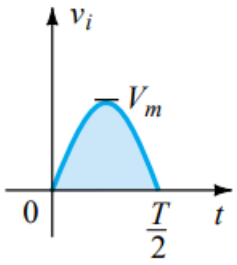


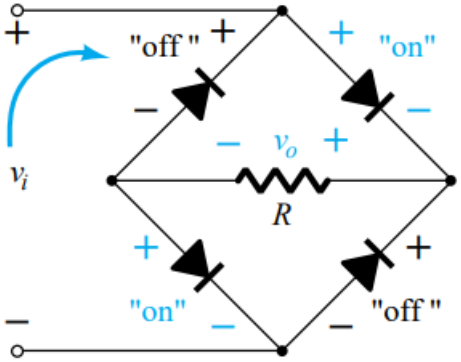
Figure 2.50 Effect of V_T on output of Fig. 2.49.

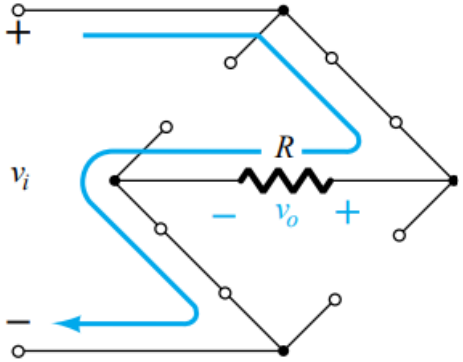
Full-wave Bridge rectifier

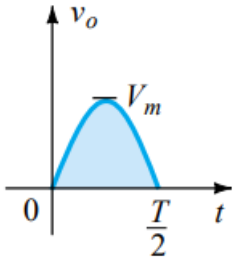




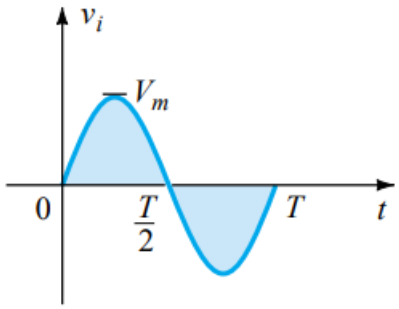


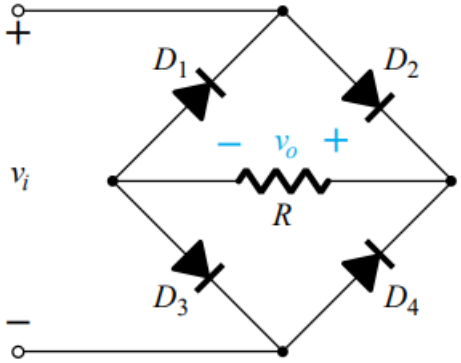


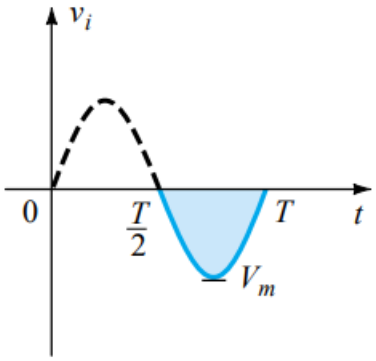


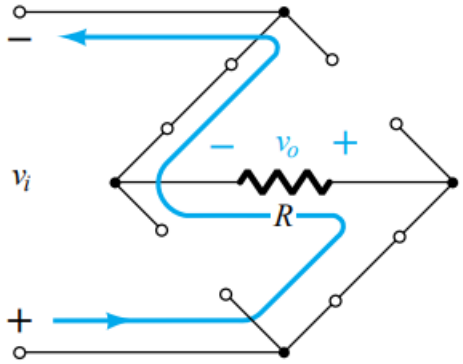


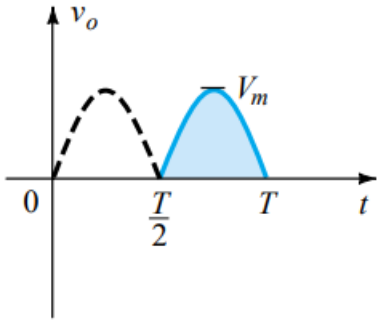
Full-wave Bridge rectifier



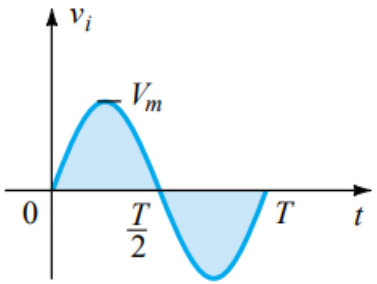


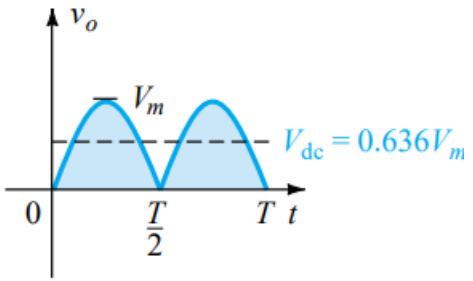




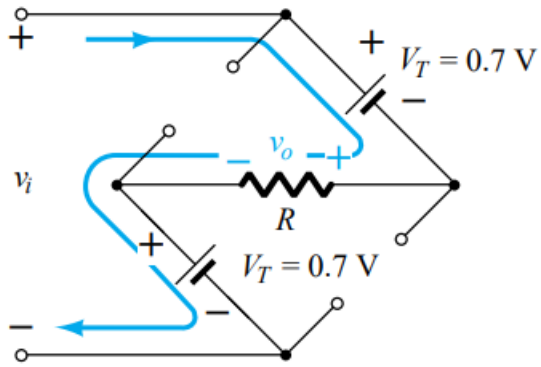


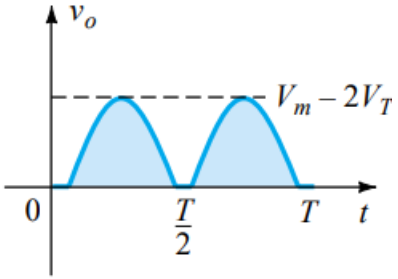
Full-wave Bridge rectifier





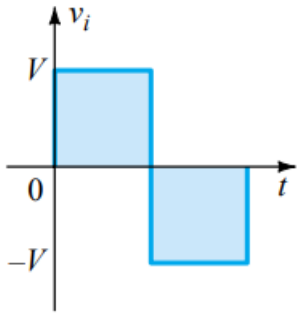
$$V_{dc} = 0.636V_m$$ full-wave

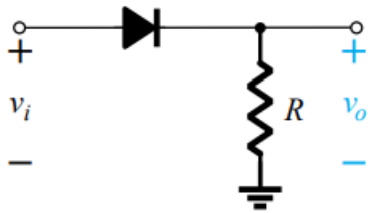


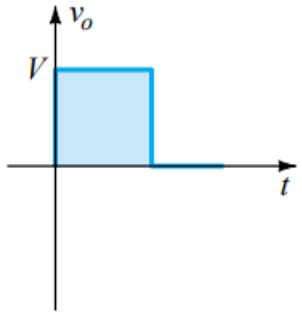


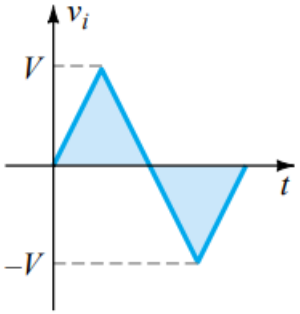
$$V_{dc} \cong 0.636(V_m - 2V_T)$$

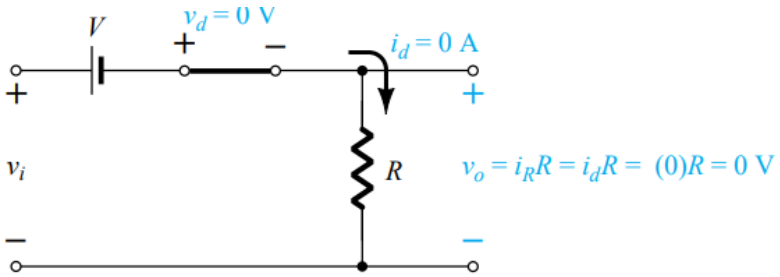
Clipper

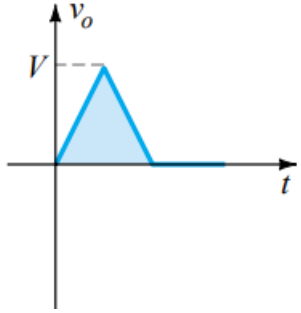

v_i
V
0
$-V$
t

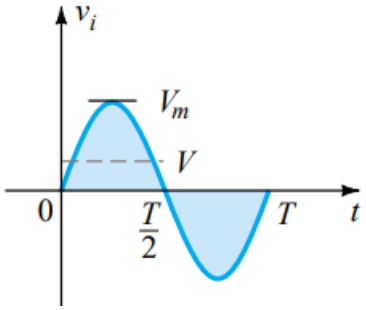

+
v_i
−
R
+
v_o
−

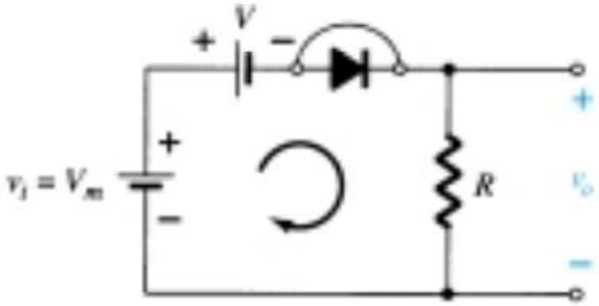

v_o
V
t

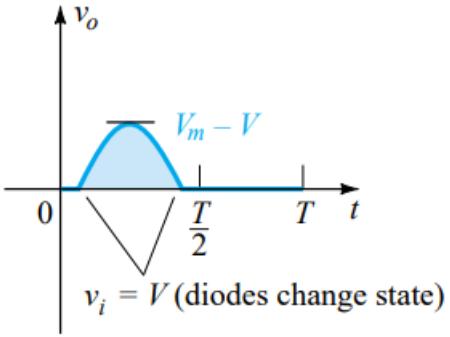

v_i
V
t
$-V$


V
$v_d = 0$ V
+
−
$i_d = 0$ A
+
v_i
R
$v_o = i_R R = i_d R = (0)R = 0$ V
−
+
−

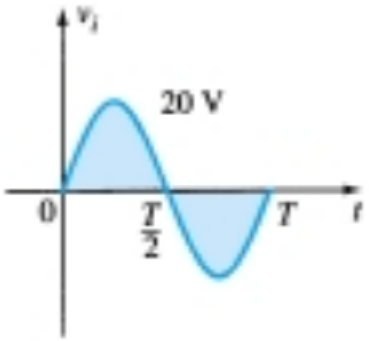

v_o
V
t

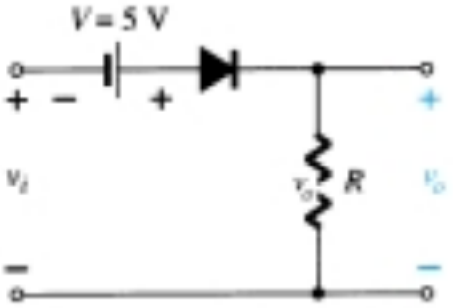

v_i
V_m
V
0
$\frac{T}{2}$
T
t

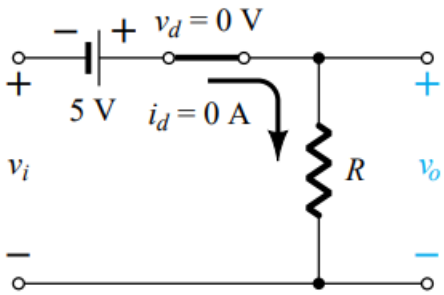

V
+
−
+
$v_i = V_m$
−
R
+
v_o
−


v_o
$V_m - V$
0
$\frac{T}{2}$
T
t
$v_i = V$ (diodes change state)

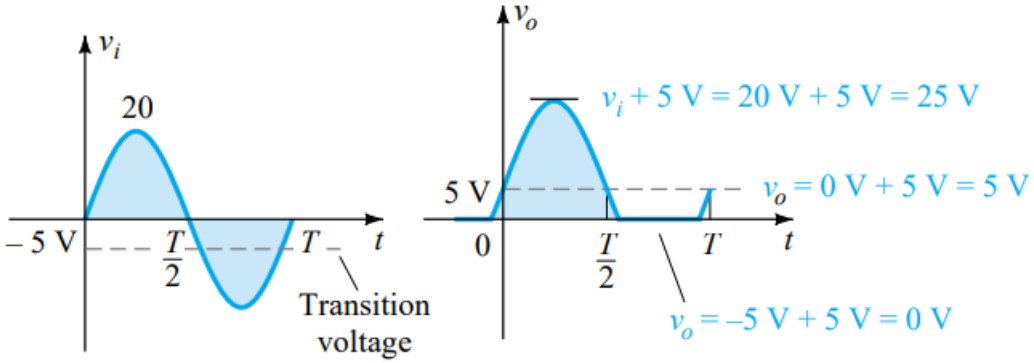
Clipper



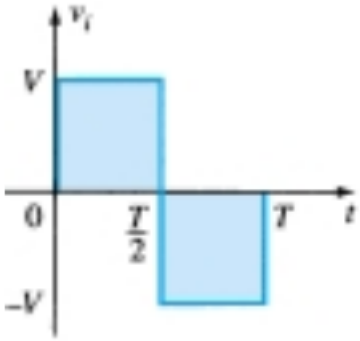


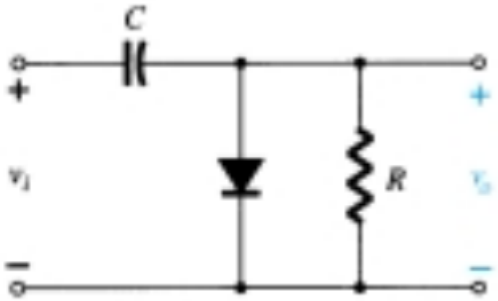


$v_o = v_R = i_R R = i_d R = (0)\,R = 0$ V



Clamper





Positive Cycle:

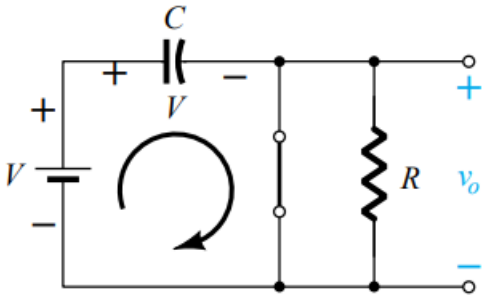
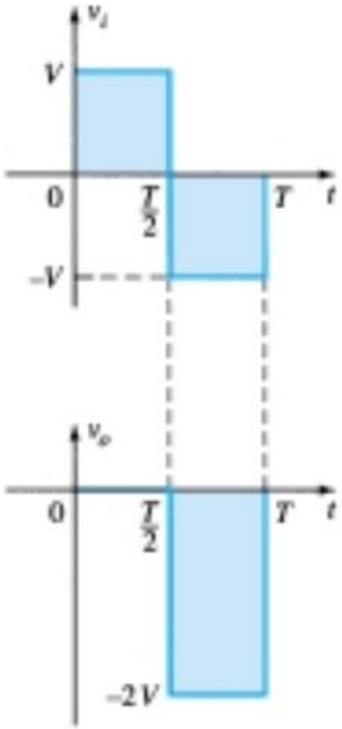
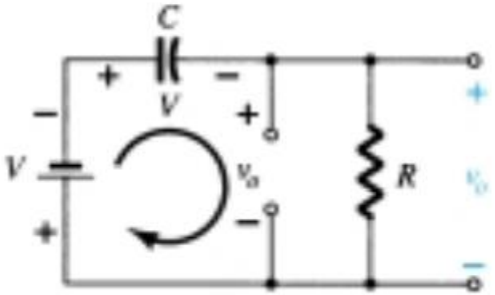


Figure 2.93 Diode "on" and the capacitor charging to V volts.



Negative Cycle:



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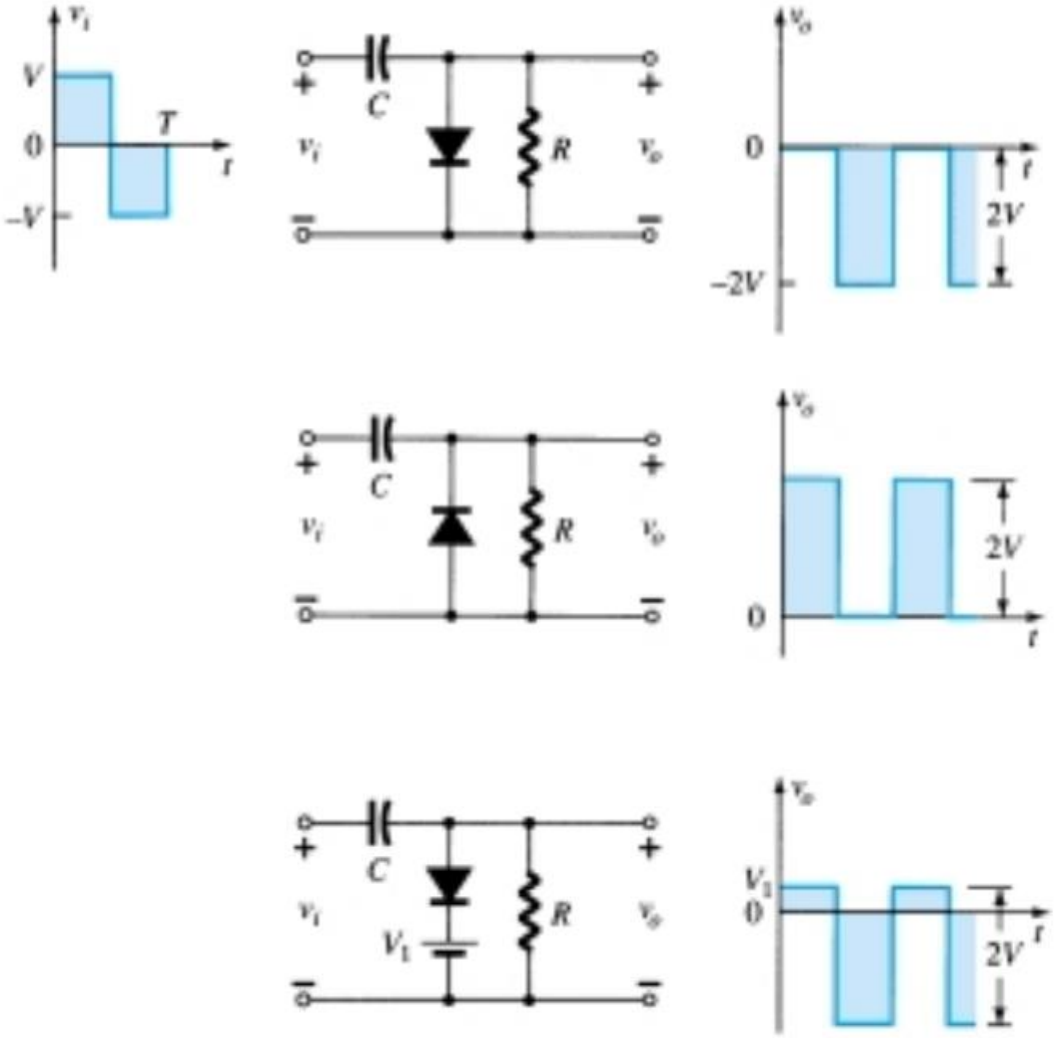

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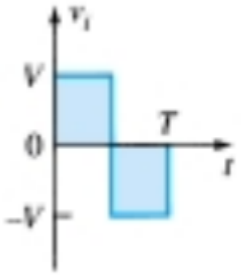
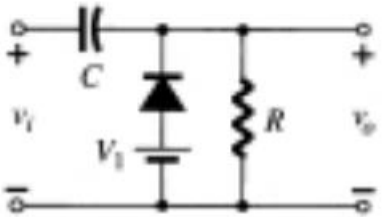
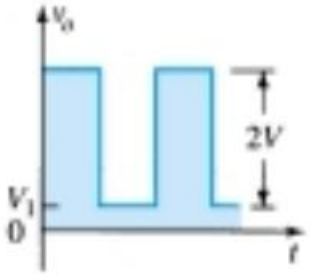
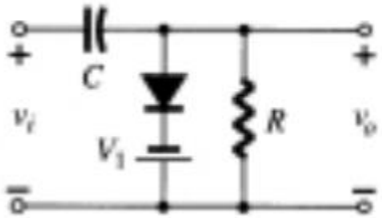
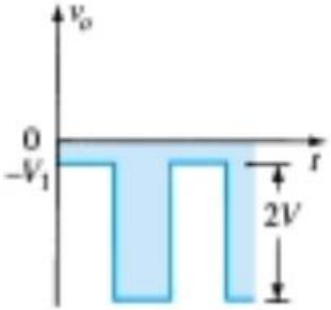
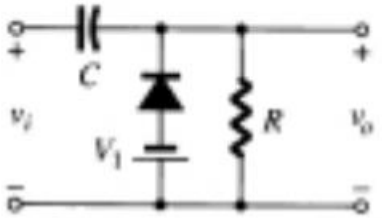

v_i
V
0
T
t
$-V$

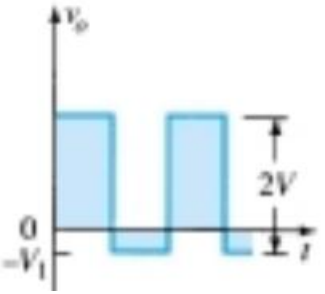

C
v_i
V_1
R
v_o


v_o
$2V$
V_1
0
t


C
v_i
V_1
R
v_o


v_o
0
$-V_1$
t
$2V$


C
v_i
V_1
R
v_o


v_o
$2V$
0
$-V_1$
t