



# **RECTIFIER CIRCUITS**

## **POWER SUPPLY BUILDING BLOCKS**

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## **TOPIC OUTLINE**

**Half-Wave Rectifier**

**Full-Wave Center-Tapped Rectifier**

**Full-Wave Bridge-Type Rectifier**



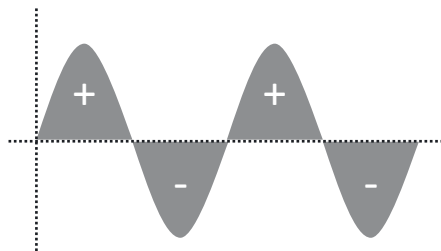
# HALF-WAVE RECTIFIER



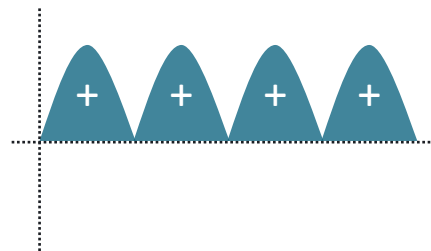
# RECTIFIER

A rectifier is an electronic device or circuit that converts alternating current (AC) to direct current (DC). This process is called rectification.

Power Supply Block Diagram



AC signal



Pulsating DC



# AVERAGE VALUE OF $f(x)$

$$f(x)_{ave} = \frac{1}{b-a} \int_a^b f(x) dx$$

$$v_{ave} = \frac{1}{\pi - 0} \int_0^{\pi} v_P \sin(\omega t) dt$$

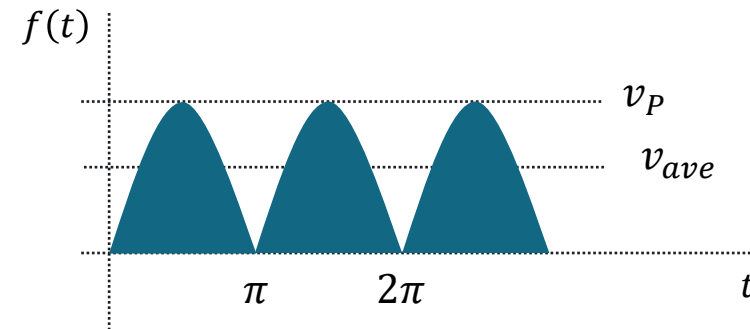
$$v_{ave} = \frac{v_P}{\pi} \left[ -\frac{1}{\omega} \cos(\omega t) \right]_0^{\pi} \quad \text{Let } \omega = 1$$

$$v_{ave} = \frac{v_P}{\pi} [-\cos(\pi) - (-\cos(0))]$$

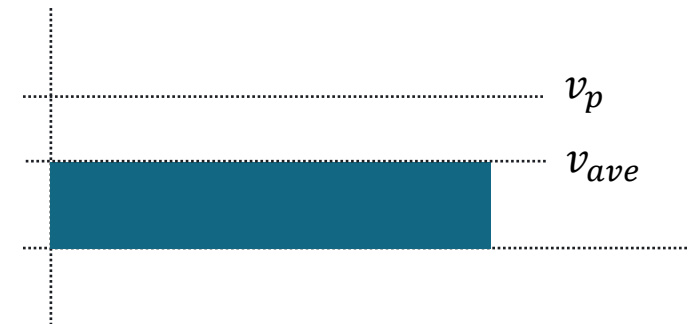
$$v_{ave} = \frac{v_P}{\pi} [-(-1) - (-1)]$$

$$v_{ave} = \frac{2v_P}{\pi}$$

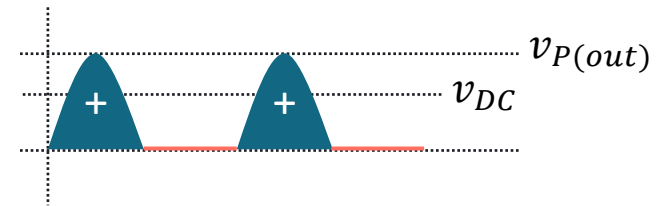
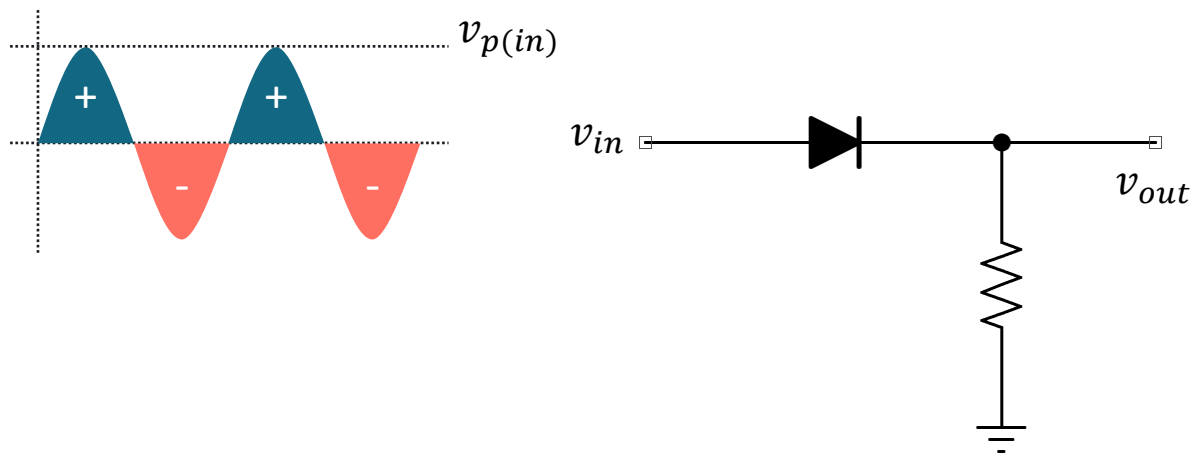
## Pulsating DC



## DC Level



# HALF-WAVE RECTIFIER



DC Level

$$v_{DC} = \frac{v_{P(out)}}{\pi}$$

Output Frequency

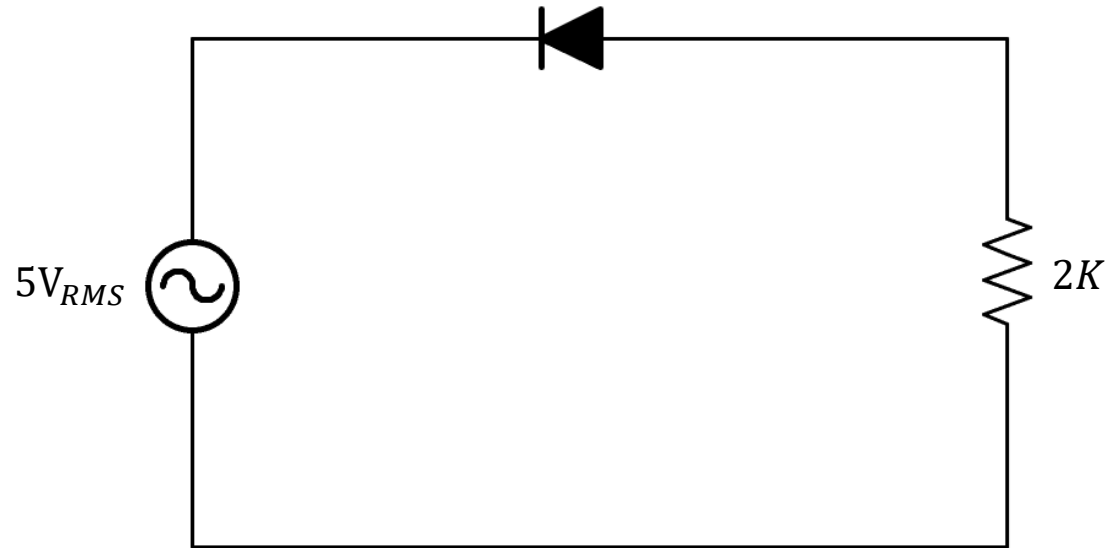
$$f_{out} = f_{in}$$

## EXERCISE

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Sketch the waveform and determine the DC level of the output signal for the given circuit.

Solution

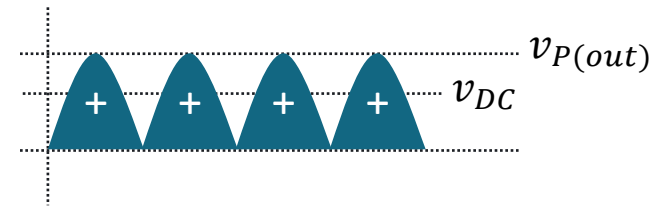
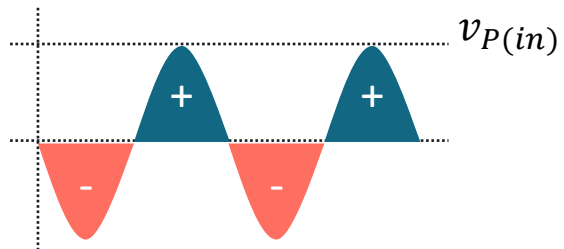
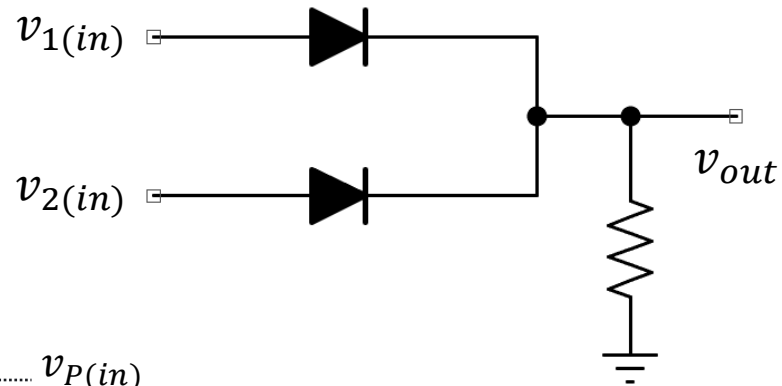
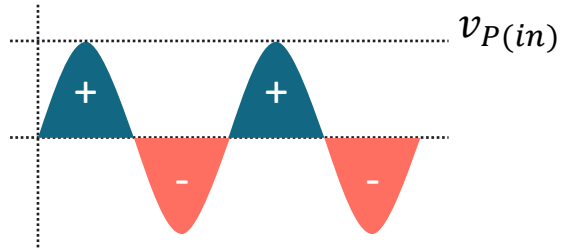


# FULL-WAVE CENTER-TAPPED RECTIFIER





# FULL-WAVE CENTER-TAPPED RECTIFIER



DC Level

$$v_{DC} = \frac{2v_{P(out)}}{\pi}$$

Output Frequency

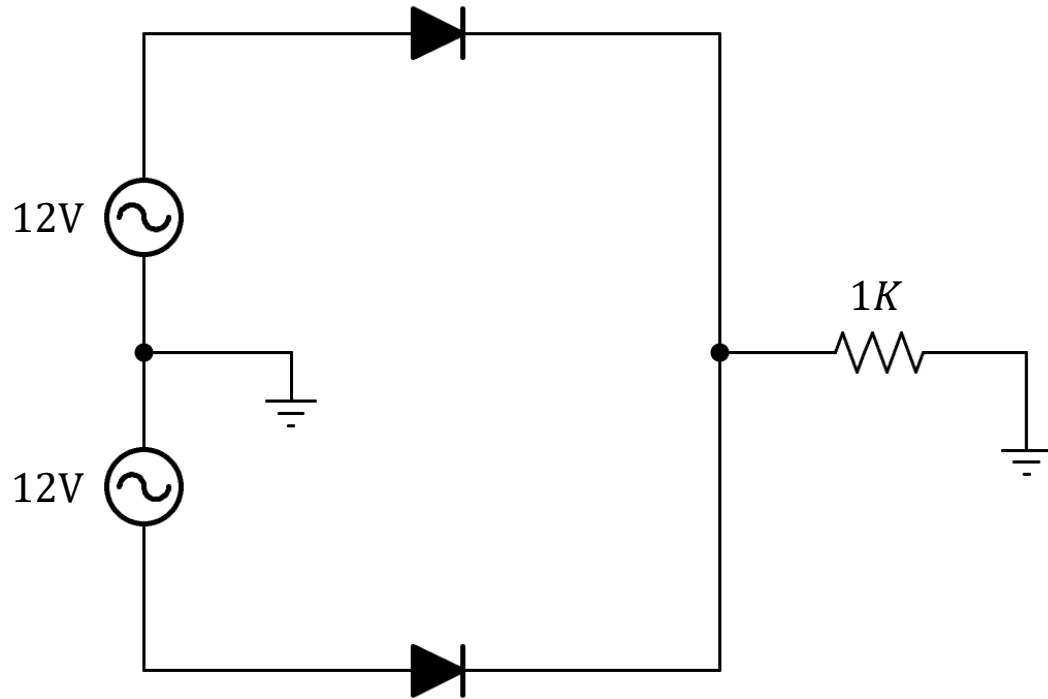
$$f_{out} = 2f_{in}$$



## EXERCISE

Sketch the waveform and determine the DC level of the output signal for the given circuit.

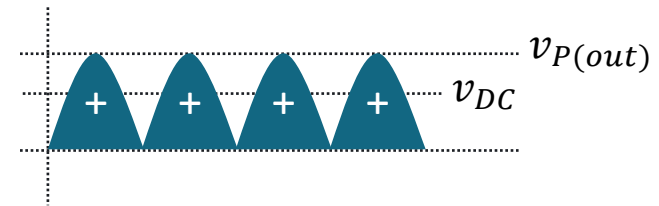
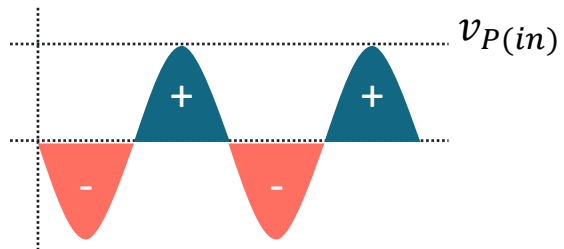
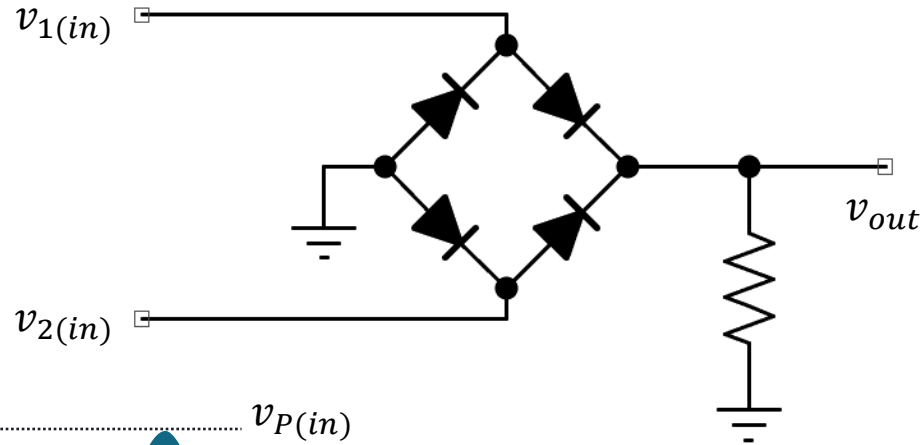
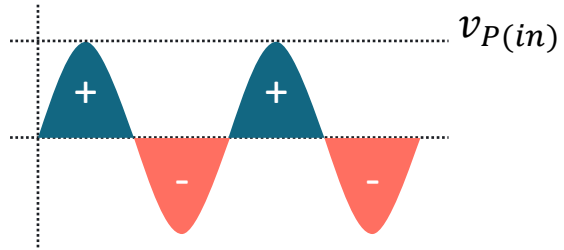
Solution



# FULL-WAVE BRIDGE-TYPE RECTIFIER



# FULL-WAVE BRIDGE-TYPE RECTIFIER



DC Level

$$v_{DC} = \frac{2v_{P(out)}}{\pi}$$

Output Frequency

$$f_{out} = 2f_{in}$$

note

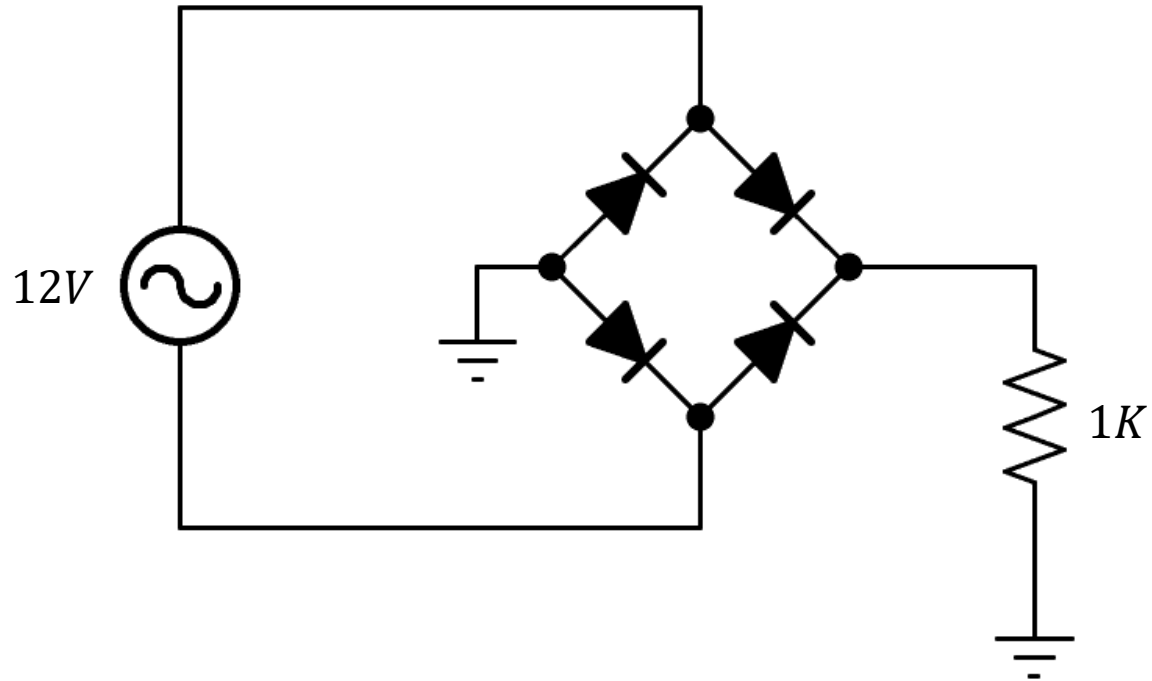
Two diodes are ON every half-cycle.



## EXERCISE

Sketch the waveform and determine the DC level of the output signal for the given circuit.

Solution



# LABORATORY

