RECTIFIER CIRCUITS

POWER SUPPLY BUILDING BLOCKS

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TOPIC OUTLINE

Half-Wave Rectifier

Full-Wave Center-Tapped Rectifier

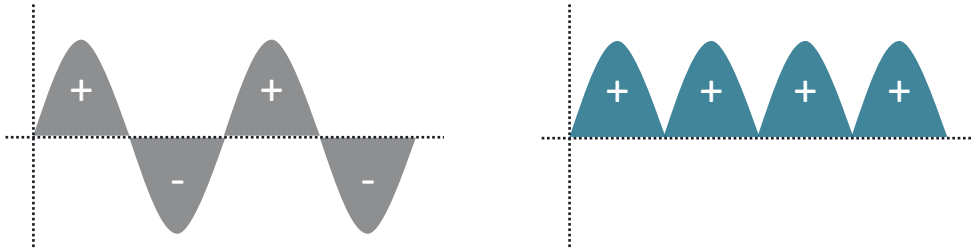
Full-Wave Bridge-Type Rectifier

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



AVERAGE VALUE OF $f(x)$

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

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

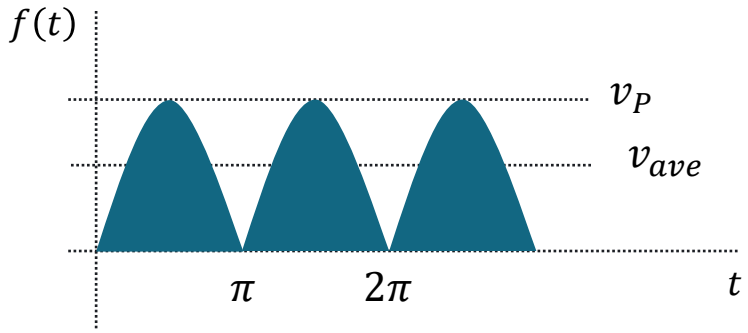
$$v_{ave} = \frac{v_P}{\pi}\left[-\frac{1}{\omega}\cos(\omega t)\right]_0^{\pi} \qquad \text{Let } \omega = 1$$

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

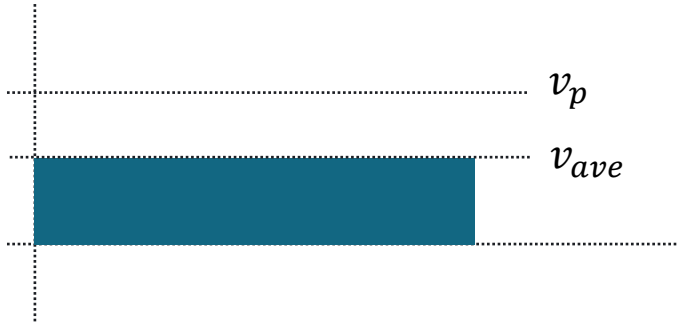
$$v_{ave} = \frac{v_P}{\pi}[-(-1) - (-1)]$$

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

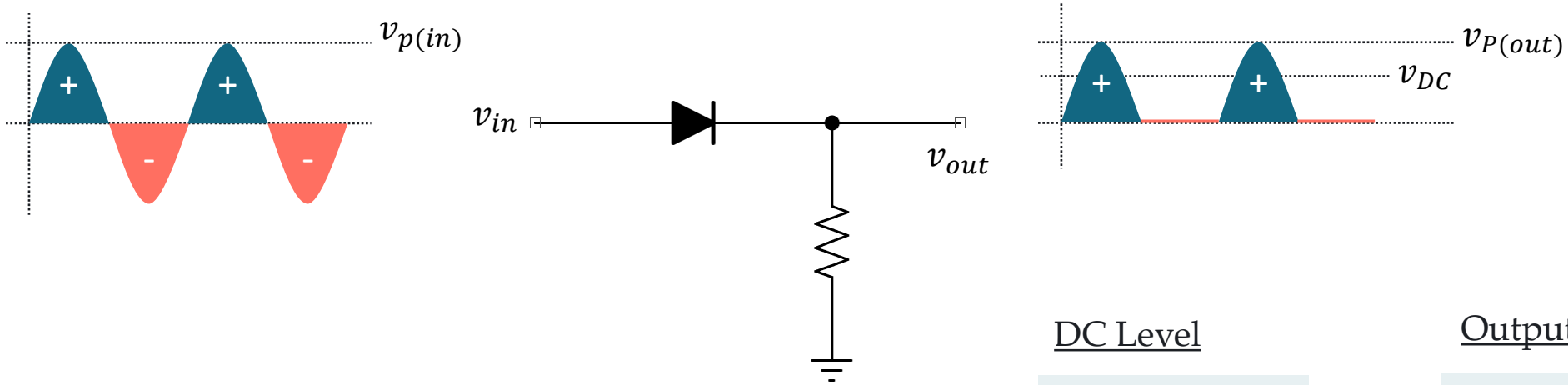
Pulsating DC



DC Level



HALF-WAVE RECTIFIER



DC Level

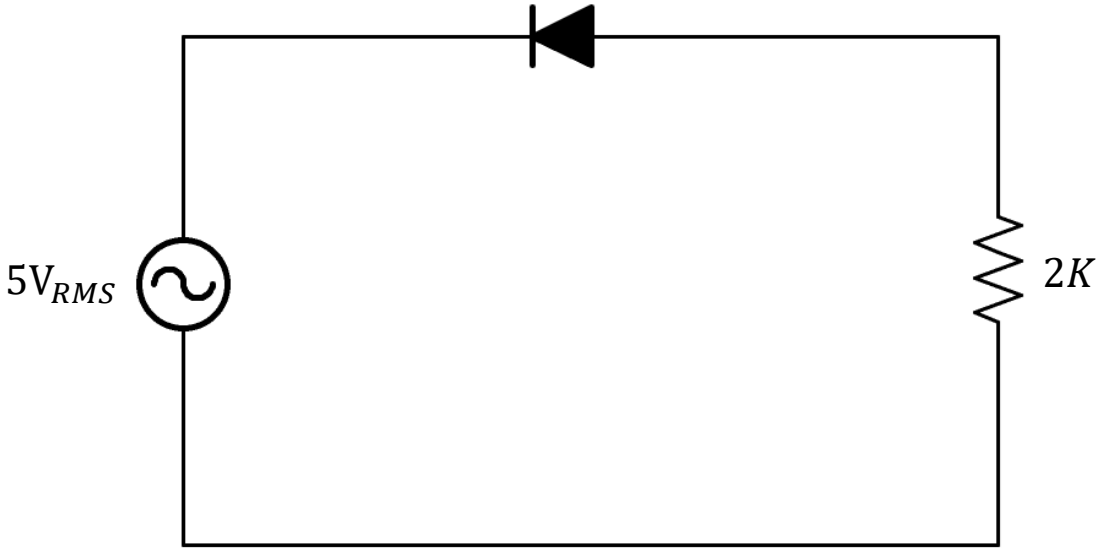
$$v_{DC} = \frac{v_{P(out)}}{\pi}$$

Output Frequency

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

EXERCISE

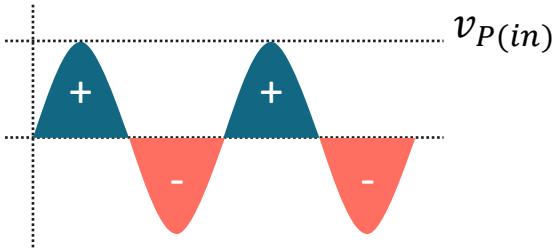
Sketch the waveform and determine the DC level of the output signal for the given circuit.

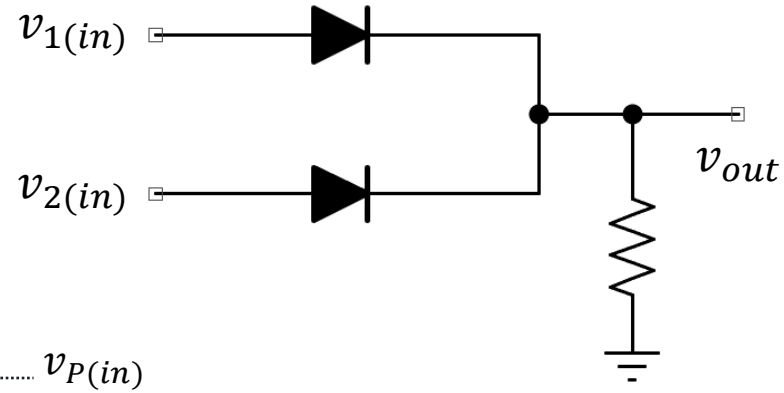


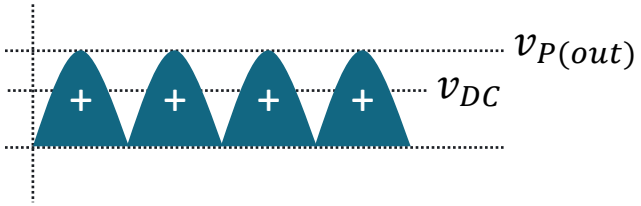
Solution

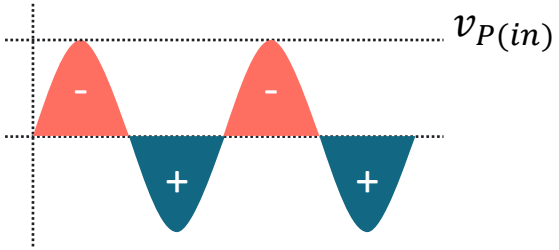
FULL-WAVE CENTER-TAPPED RECTIFIER

FULL-WAVE CENTER-TAPPED RECTIFIER









DC Level

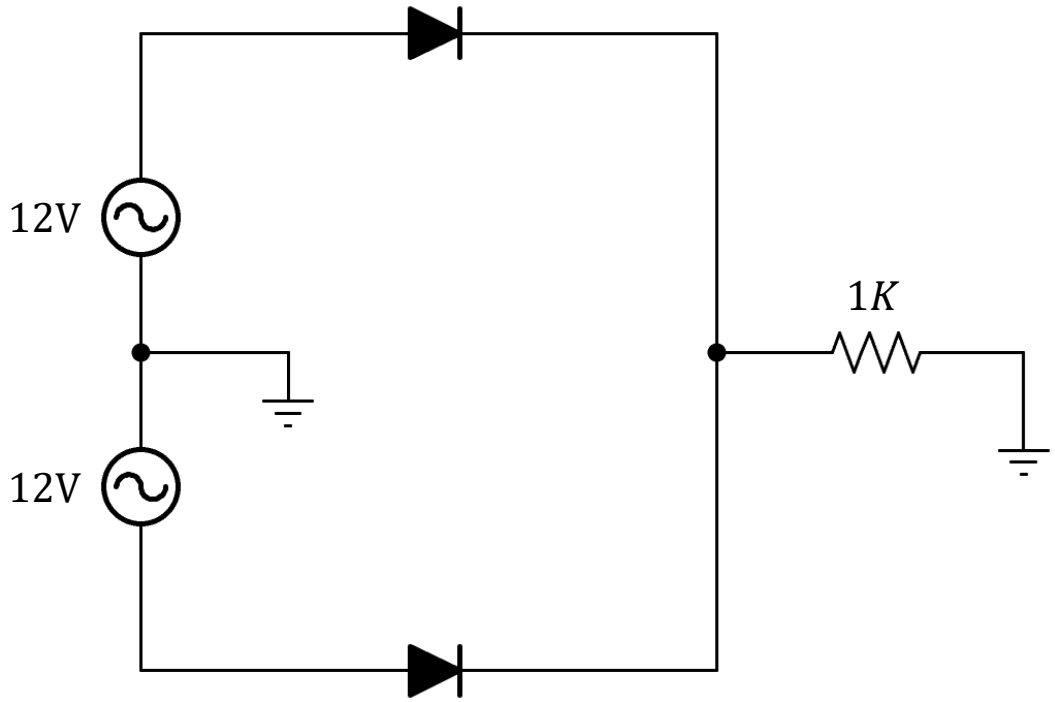
$$v_{DC} = \frac{2v_{P(out)}}{\pi}$$

Output Frequency

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

EXERCISE

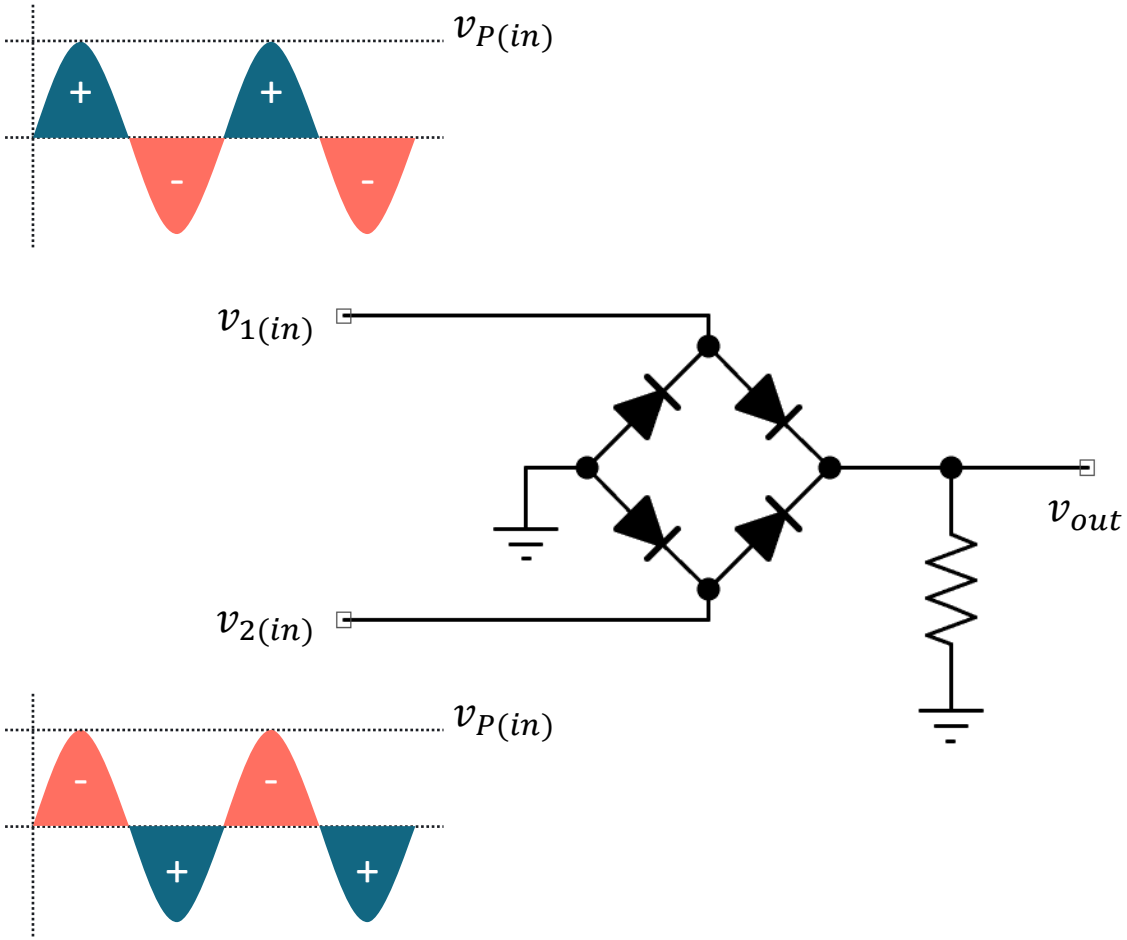
Sketch the waveform and determine the DC level of the output signal for the given circuit.

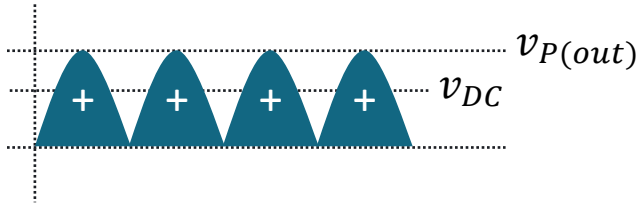


Solution

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

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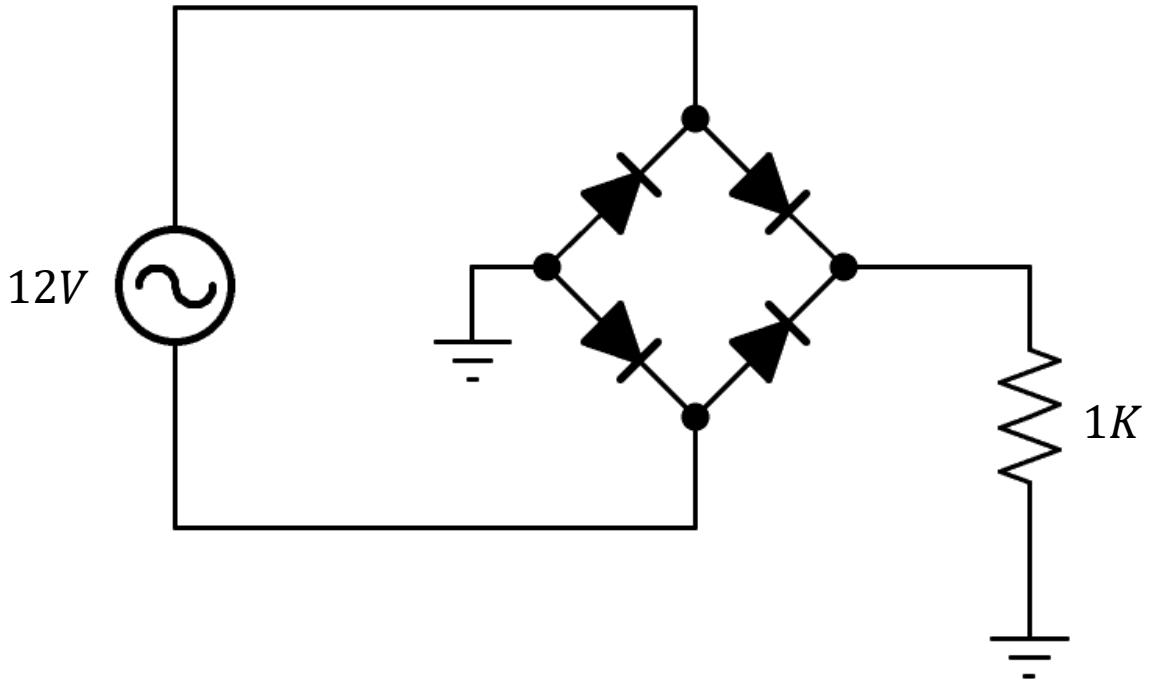

Solution

LABORATORY