



VOLTAGE REGULATOR

POWER SUPPLY BUILDING BLOCKS

prepared by:

Gyro A. Madrona
Electronics Engineer

TOPIC OUTLINE

Zener Diode

Linear Voltage Regulator IC



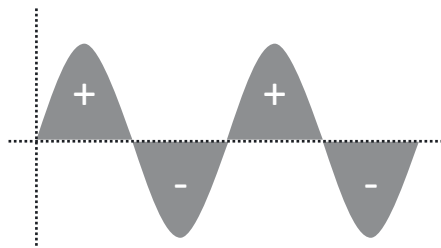
ZENER DIODE



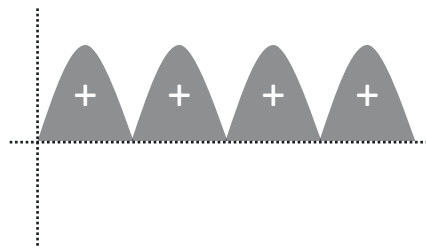
VOLTAGE REGULATOR

Voltage regulator provides a constant DC output voltage by adjusting their internal resistance to compensate for input voltage or load variations.

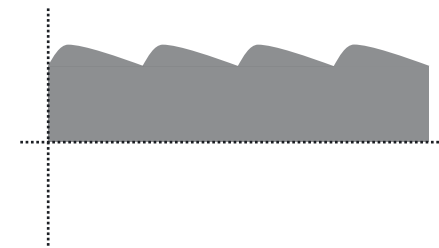
Power Supply Block Diagram



AC signal



Pulsating DC



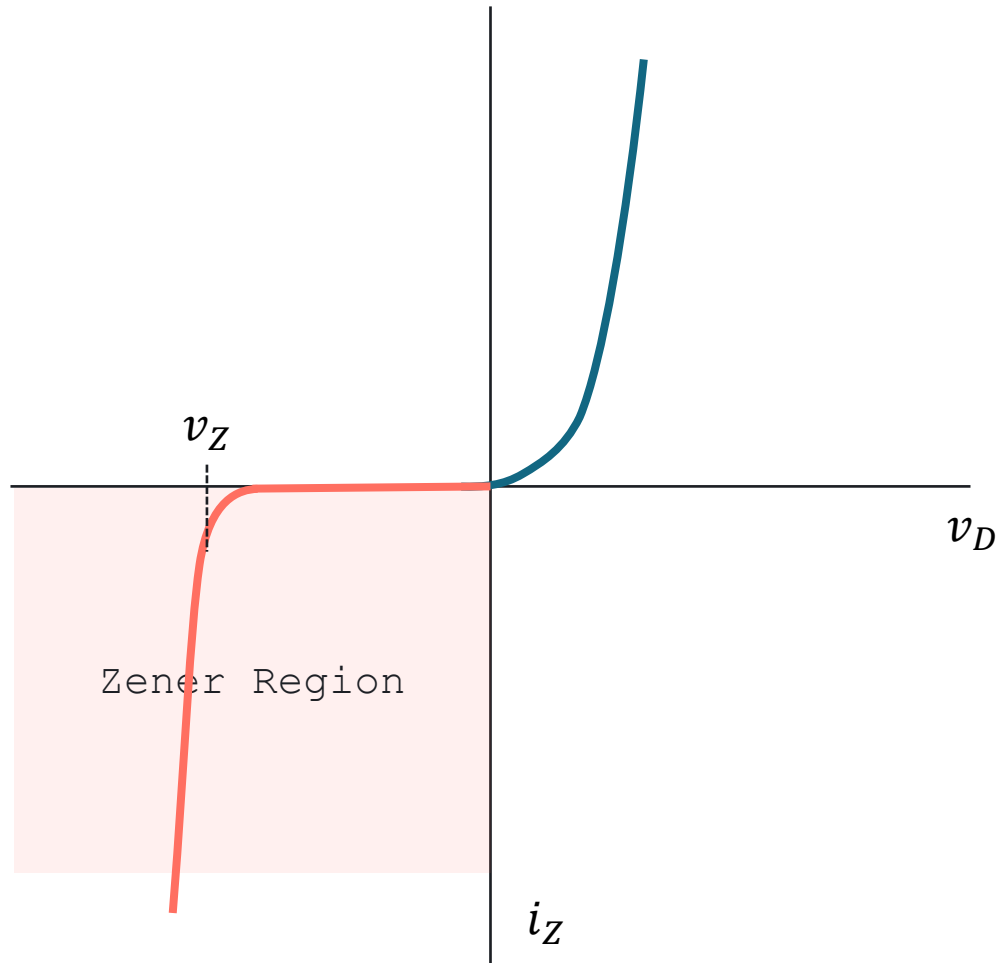
DC
with AC ripple



Pure DC

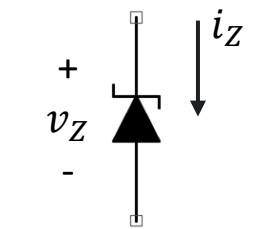
ZENER DIODE

Characteristic Curve

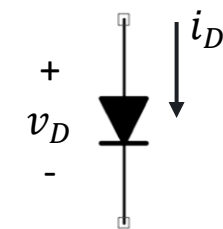


Zener diode operates in the reverse bias region, where it allows current to flow once the reverse voltage reaches a specific value known as the Zener voltage (v_Z).

Conduction direction



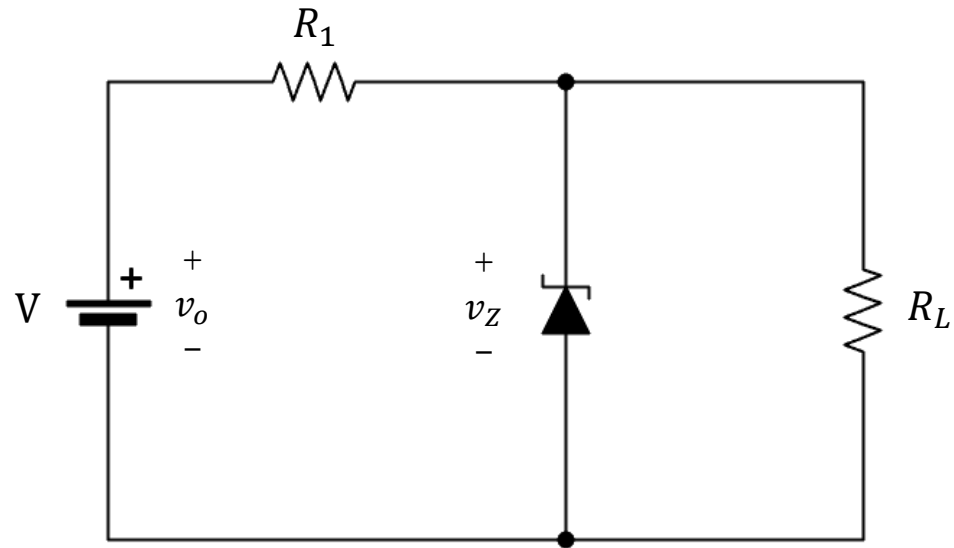
Zener diode



Rectifier diode

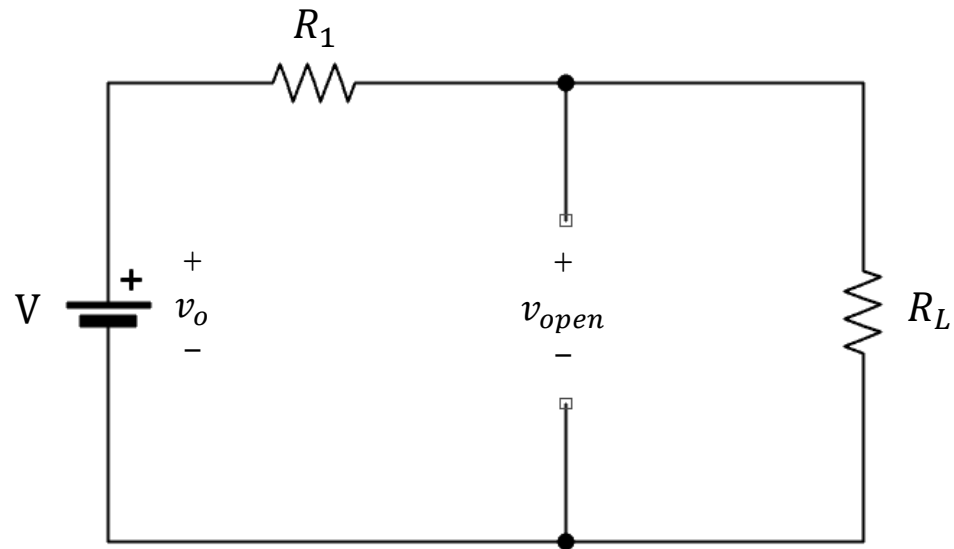
STATE OF ZENER DIODE

Determine the state of Zener diode by removing it from the network and calculating the voltage across the resulting open circuit.



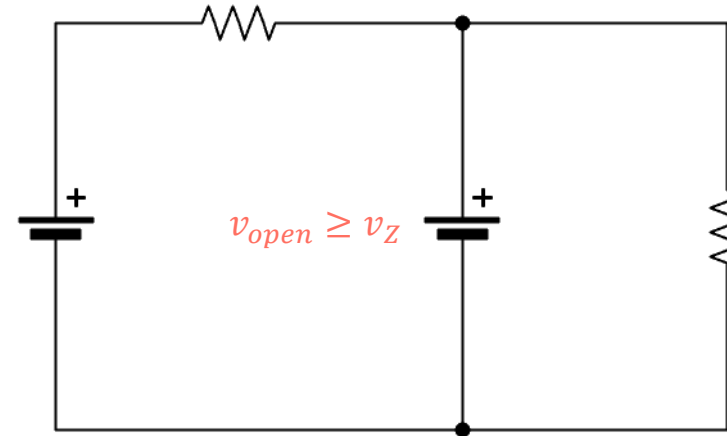
STATE OF ZENER DIODE

Determine the state of Zener diode by **removing** it from the network and calculating the voltage across the resulting open circuit.

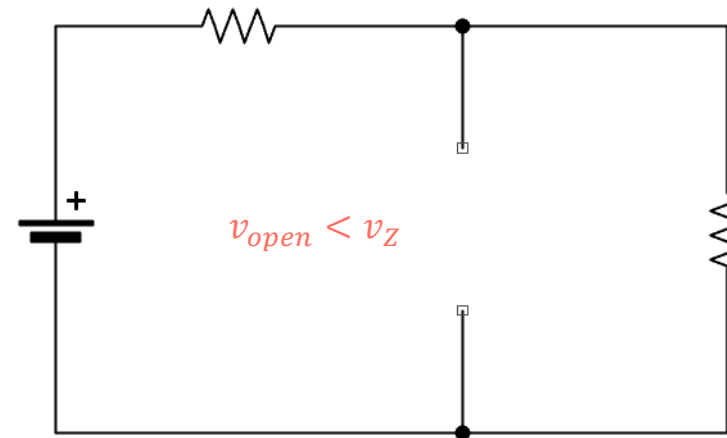


$$v_{open} = v_o \frac{R_L}{R_1 + R_L}$$

“ON” state equivalent circuit



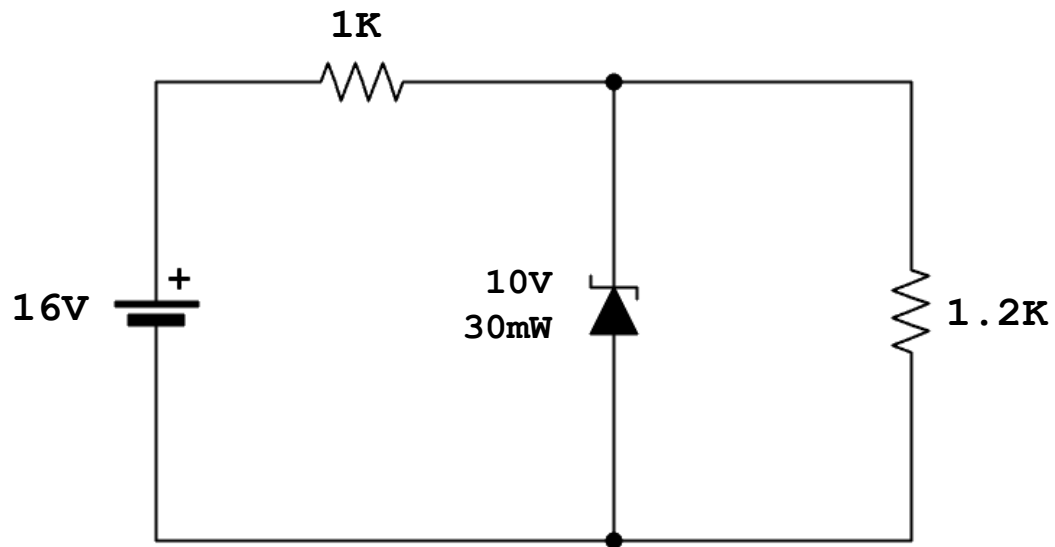
“OFF” state equivalent circuit



EXERCISE

For the given circuit, determine the voltage across the load, the voltage across $1K\Omega$ resistor, the current flowing through the Zener diode, and the power dissipated by the Zener diode.

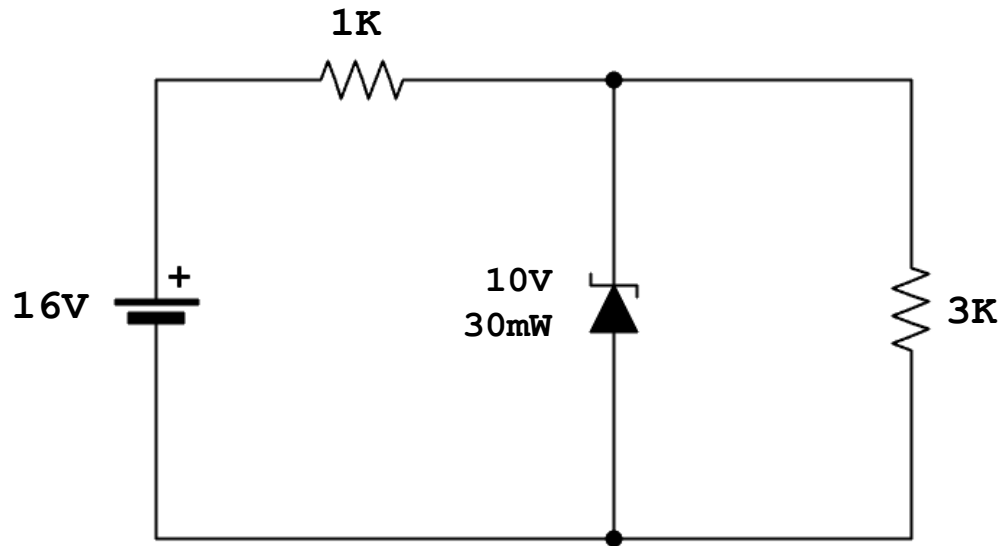
Solution



EXERCISE

In reference to the previous problem, assume the load resistance is changed to $3K\Omega$.

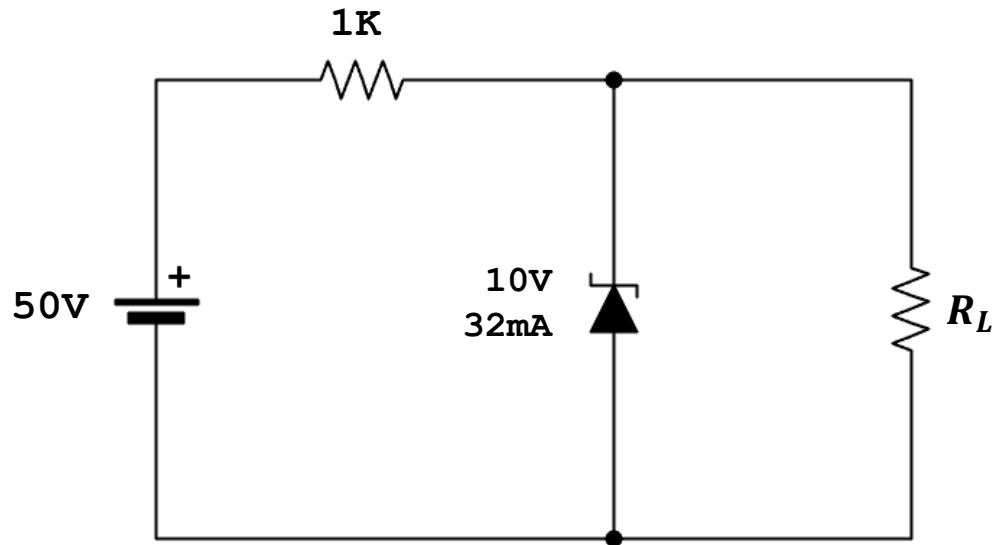
Solution



EXERCISE

For the given circuit, determine the range of load resistance and load current that will ensure the load voltage remains regulated at 10V.

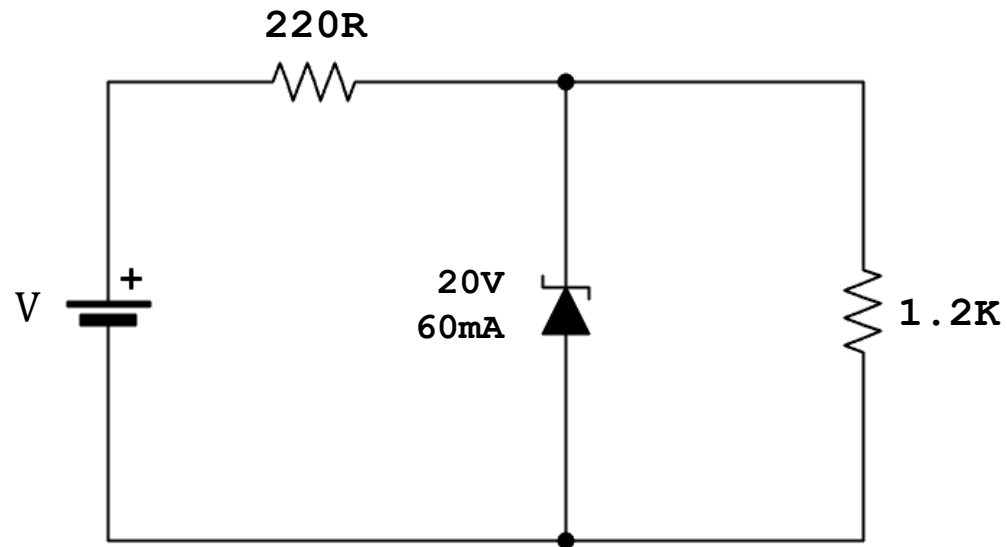
Solution



EXERCISE

Determine the range of input (source) voltage for which the Zener diode remains in its conducting state in the given circuit.

Solution



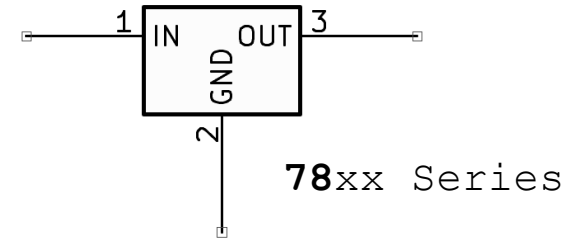
LINEAR VOLTAGE REGULATOR IC



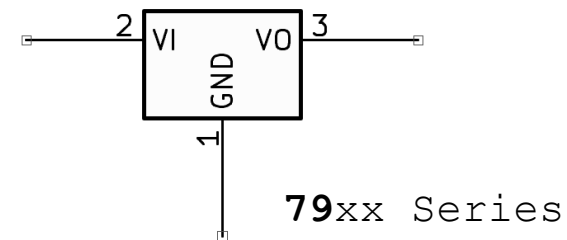
LINEAR VOLTAGE REGULATOR

A linear voltage regulator compares the output to a reference voltage and adjusts a pass transistor (BJT or MOSFET) to maintain a steady output.

Positive voltage regulator



Negative voltage regulator



DROPOUT VOLTAGE

The dropout voltage, typically 2V, is the minimum amount of voltage across input–output terminals that must be maintained if the IC is to operate as regulator.

Positive voltage regulator

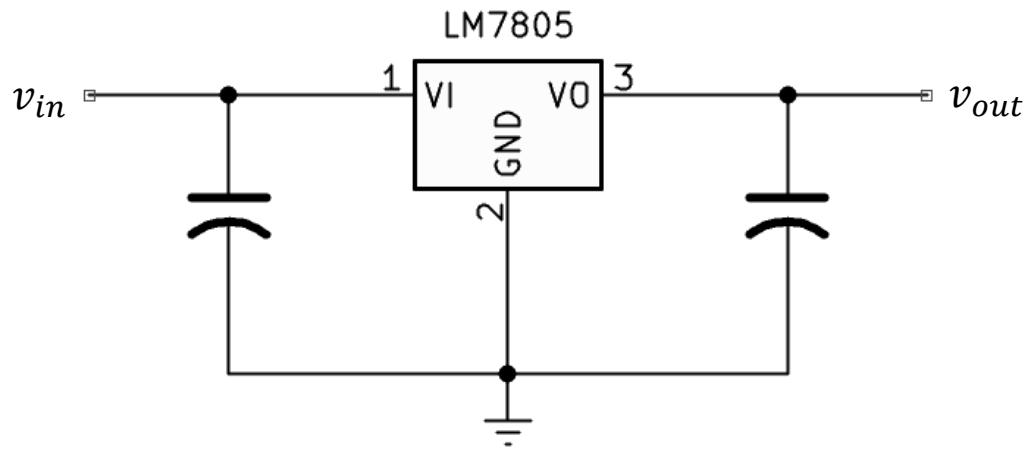
IC	Output Voltage (V)	Minimum Input Voltage (V)
7805	+5	7.3
7810	+10	12.5
7812	+12	14.6

Negative voltage regulator

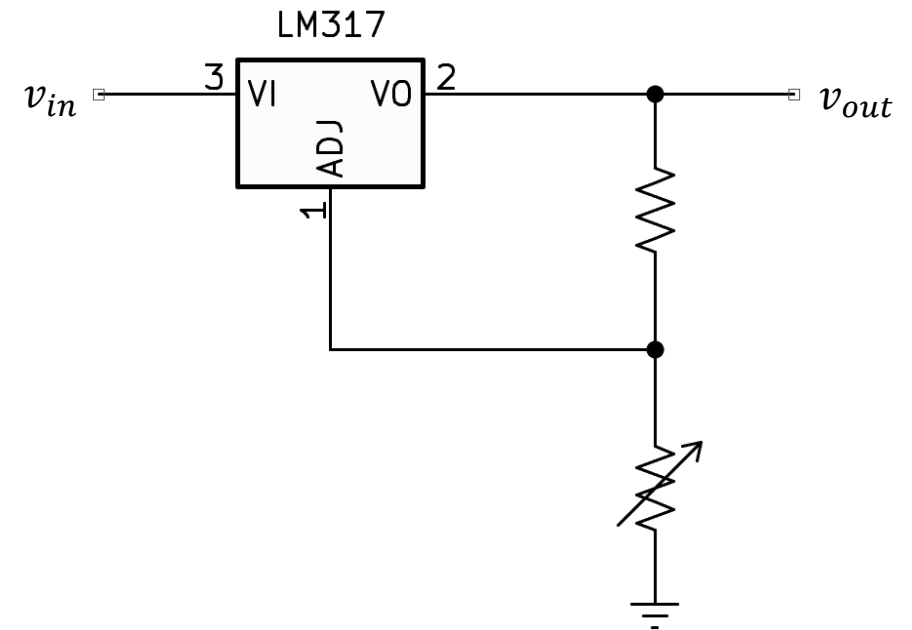
IC	Output Voltage (V)	Minimum Input Voltage (V)
7906	−6	−8.4
7909	−9	−11.5
7915	−15	−17.7

VOLTAGE REGULATOR CONNECTION

Fixed Voltage Regulator



Adjustable Voltage Regulator



LABORATORY

