

Engineering
and
Architecture
Analog
Electronics
Fundamentals
EEE223

Lec 6

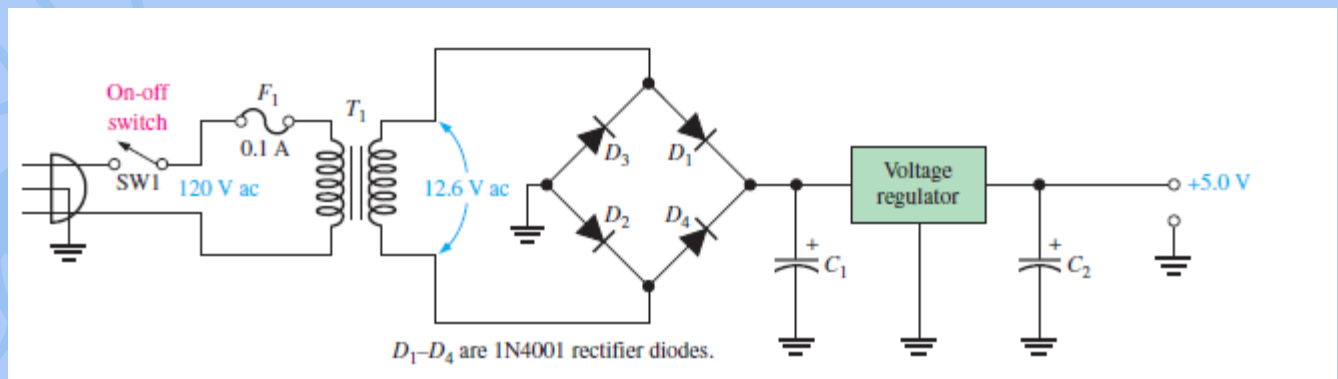
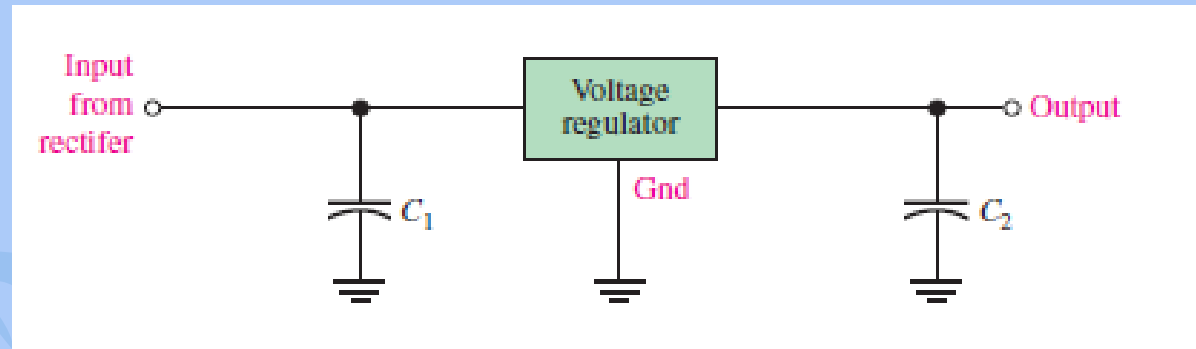
Voltage Regulators

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Power Supply and Voltage Regulators

- A power supply filter ideally eliminates the fluctuations in the output voltage of a halfwave or full-wave rectifier and produces a constant-level dc voltage. Filtering is necessary because electronic circuits require a constant source of dc voltage and current to provide power and biasing for proper operation.
- Voltage regulation in power supplies is usually done with integrated circuit voltage regulators. A voltage regulator prevents changes in the filtered dc voltage due to variations in input voltage or load.

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- A voltage regulator is connected to the output of a filtered rectifier and maintains a constant output voltage (or current) despite changes in the input, the load current, or the temperature.
 - The combination of a large capacitor and a voltage regulator helps produce an excellent power supply.
 - Most regulators are integrated circuits and have three terminals: an input terminal, an output terminal, and a reference (or adjust) terminal. The input to the regulator is first filtered with a capacitor to reduce the ripple to <10%. An output capacitor (typically 0.1 μF to 1 μF) is connected from the output to ground to improve the transient response.



Percent Regulation

- The regulation expressed as a percentage is a figure of merit used to specify the performance of a voltage regulator. It can be in terms of input (line) regulation or load regulation.
- ***Line Regulation*** The **line regulation** is a ratio of a change in output voltage for a corresponding change in the input voltage expressed as a percentage.

$$\text{Line regulation} = \left(\frac{\Delta V_{\text{OUT}}}{\Delta V_{\text{IN}}} \right) 100\%$$

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- ***Load Regulation*** The **load regulation** specifies how much change occurs in the output voltage over a certain range of load current values, usually from minimum current (no load, NL) to maximum current (full load, FL).

$$\text{Load regulation} = \left(\frac{V_{NL} - V_{FL}}{V_{FL}} \right) 100\%$$

- where V_{NL} is the output voltage with no load and V_{FL} is the output voltage with full (maximum) load.

EXAMPLE 2-9

A certain 7805 regulator has a measured no-load output voltage of 5.18 V and a full-load output of 5.15 V. What is the load regulation expressed as a percentage?

Solution Load regulation = $\left(\frac{V_{NL} - V_{FL}}{V_{FL}}\right)100\% = \left(\frac{5.18\text{ V} - 5.15\text{ V}}{5.15\text{ V}}\right)100\% = 0.58\%$

Related Problem If the no-load output voltage of a regulator is 24.8 V and the full-load output is 23.9 V, what is the load regulation expressed as a percentage?



Thank you