E3: Getting started with voltage regulators
Introduction

TTL logic chips would need precisely DC 5V. With the given battery supply of 9V, need to step down the voltage from 9V to 5V.
This can be achieve by using voltage regulators.
One example is the LM78XX series. Guess what the LM7805 will do?
Step down from a range of voltages to 5V. Find out the range of the voltages from the data sheet at the appendix.

Absolute Maximum Ratings

Absolute maximum ratings are those values beyond which damage to the device may occur. The datasheet specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside datasheet specifications.

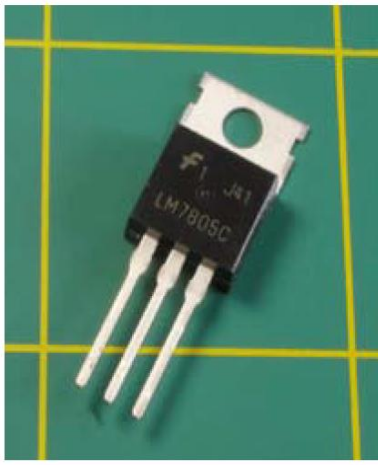

Figure 4-8. *Many integrated circuit chips require a controlled power supply of 5 volts, which can be delivered by this regulator when you apply 7.5 to 9 volts to it. The lefthand pin is for positive input, the center pin is a common ground, and the righthand pin is the 5V output. For currents exceeding 250mA, you should bolt the regulator to a metal heat sink using the hole at the top.*

FUNDAMENTALS

Voltage regulators

The simplest versions of these little semiconductors accept a higher DC voltage on one pin and deliver a lower DC voltage on another pin, with a third pin (usually in the middle) serving as a common negative, or ground. You should also attach a couple of capacitors to smooth the current,

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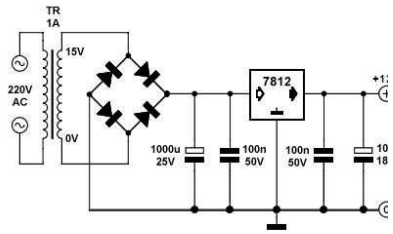

Create a **short presentation** to identify the components used in the schematic above and explain the objective of this schematic.

- Voltage regulators maintain a constant dc output voltage as long as the input voltage or load varies within limits.
- Voltage regulator is one of the components in the DC power supply.
- Three terminal linear IC regulators are available to provide either fixed-value or variable value output voltages of positive or negative polarities.
- The 78XX and 79XX series regulators provide fixed-value positive and negative output voltages respectively.
- Two basic categories of voltage regulation are
  - Line regulation
  - Load regulation

Basic DC power supply components

1. Transformer - steps down the ac voltage at the primary
2. Rectifiers - convert ac voltage into dc voltage
3. Filter – eliminates the fluctuations in the rectified voltage and produces a relatively smooth dc voltage
4. Voltage regulator - maintains a constant dc voltage for variations in the input line voltage or in the load
5. Load – a circuit for which the power supply is producing the dc voltage and load current

E3.1 Wiring up a voltage regulator
Parts required: 9V battery, LM7805,
0.33uF (electrolyte) and 0.1uF capacitors

Introduction:
You are required to **conduct** an experiment
to discover the behaviour of the LM7805, using the
schematic given on the R.H.S.

Deliverables:
A demonstration of this working circuit on the breadboard.
A stand up poster that describes the potential application of this type of circuit.

Procedure:

1. Determine the tests that are necessary prior to the start of this experiment.
2. Assess the necessary risk factor and possible mitigation associated with this experiment.
3. Establish the hypothesis associated with this experiment and the desired outcome.
4. Design the testing methodology for this experiment.
5. Collect the data, such as observation during experiments, readings recorded on DMM, and more.

E3.2 Design a custom voltage regulator circuit
Introduction:
You are required to **design** a circuit that is able to step down 9V DC to 5V, and then to 3.3V. In other words, your circuit will need to take in 9V DC to supply both 5V and 3.3V. Assume that the current to be supplied is at the minimum.

Procedure:

1. Draw the new schematic based on the schematic given in Act 1.8.
2. Modify the circuit use in Act 1.8 to satisfy the requirements. Justify for the type of devices chosen for the modifications.
3. Measure the voltage and current for the circuit in step2. Record your observations.
4. Using the measured value of the voltage and value of current across the 5V terminal. Assuming a LED is needed to be place here, calculate the necessary resistor value based on the readings recorded at step3.
5. Repeat step4, at the 3.3 terminal.
6. Assess the necessity for heat management.
7. Evaluate the situation where this circuit will come in handy.