Low Drop Out Regulator

Linear Regulators

Rupesh Gupta

Wadhwani Electronics Lab
Indian Institute of Technology, Bombay

Analog Circuits Lab (EE-230)

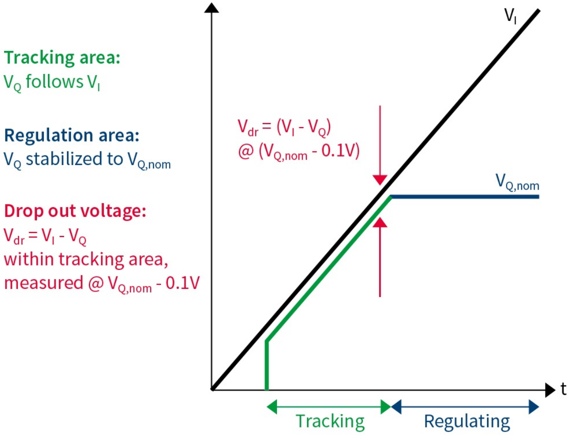
Introduction

DC-DC converters are of two types.
1. Linear Regulators
2. Switched Mode Power Supply

Linear Regulators are used to regulate the voltage. Linear because they use transistors operating in linear region (traditionally). Applications: On table DC supplies, all controllers/processors boards, etc.

Switched mode power supplies uses high frequency switching, and inductors to provide DC voltage. Eg. Buck, Boost, Flyback converters, etc. Applications: CPUs, mobile/laptop chargers,etc.

Linear Regulators



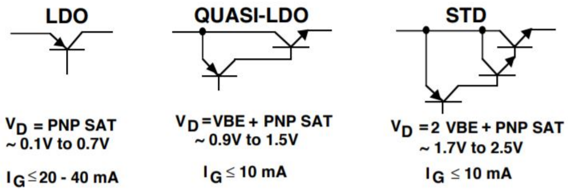
Ref: Infineon Technologies

Linear Regulators

Linear Regulators are generally of 3 types:

- Standard Regulator
- Quasi LDO regulator
- LDO regulator

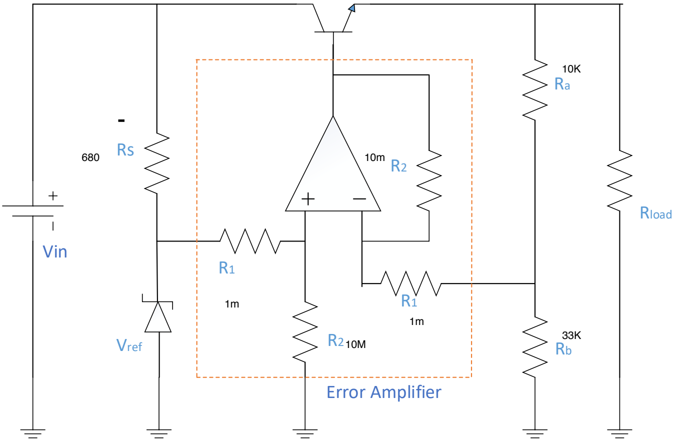
Constructional difference is the use of darlington pair in case of Standard regulator and quasi LDO. This decreases the base current but at the same time increases the voltage drop.



List of components

- Resistances
  R1 = 1 MegΩ
  R2 = 10 MegΩ
  Rs = 680 Ω
  Ra = 10 KΩ
  Rb = 33 KΩ
- Transistor - BC547
- Opamp - LM324
- Zener Diode - 4.7V
- DC voltage supply 0V-15V
- Multimeters

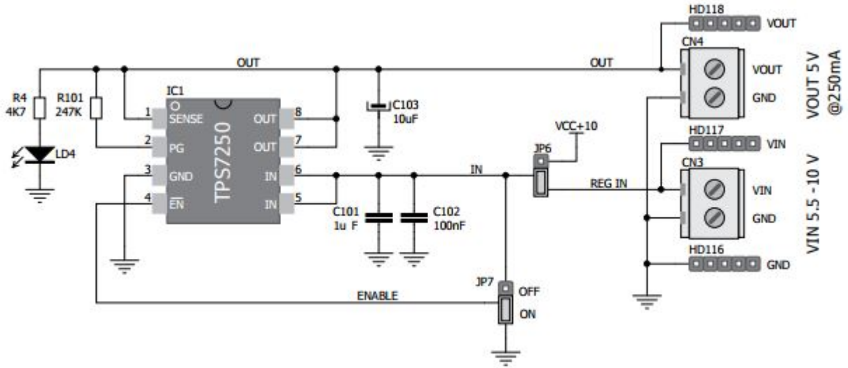
Circuit Diagram



Experimentation

- Assemble the circuit as shown in the circuit diagram.
  Note: The opamp has to be supplied from the same input source.
- Vary the input voltage (0-15V) keeping the load fixed. Observe the output voltage. Plot V_{out} vs V_{in}.
- Vary load resistance ($150\Omega - 10K\Omega$) keeping the input voltage fixed. Observe the output voltage. Plot V_{out} vs R_{load}.

On Board Schematic



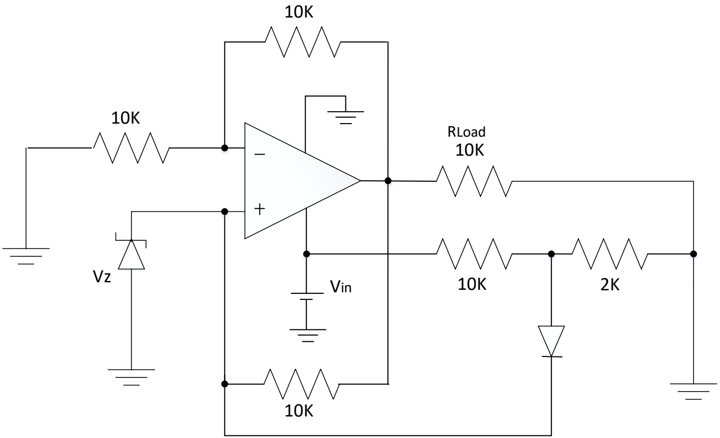
Perform the experiment again using the on board circuit. Replace the supply jumper from 10V to Vin.

Points to remember

- Simple Low Cost Solutions - Easy to use specially for low power applications where thermal stress is not critical.
- Low noise/ripple applications - Linear Regulators have very low output ripple. These could be operated at high bandwidths and with very little EMI issues.
- Fast transient response - Feedback loop is internal and no external compensation is required. They have a wider control loop bandwidth.
- Linear region operation - Causes excessive power loss at high load currents. As the difference between input and output voltage increases efficiency decreases.
- Output voltage has to maintain a certain difference from input voltage in order to perform regulation.
- Linear regulators could perform only step down DC-DC conversion.

Try Out and discuss

Ques. Will this circuit work as a regulator? Explain.



Futher Discussion

- The regulator ICs are available with thermal protection and over current protection.
- In order to obtain variable output voltage ground current is used. And this could be used for stepping up the voltages as well.

For more details:
http://www.ti.com/lit/an/snva558/snva558.pdf