SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade (III Cycle)
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

23ECB202 – LINEAR INTEGRATED CIRCUITS

II YEAR/ IV SEMESTER

UNIT 3 – **WAVEFORM GENERATORS AND VOLTAGE REGULATORS**

TOPIC 8 – **Low Drop – Out(LDO) Regulators**

Outline

- Introduction to Voltage Regulators
- low-dropout (LDO) regulator
- Basic Blocks of LDO Regulator
- Working Principle of LDO Regulator
- Advantages & Disadvantages of LDO Regulators
- Applications of LDO Regulators
- Comparison of LDO vs Standard Linear Regulators
- Summary

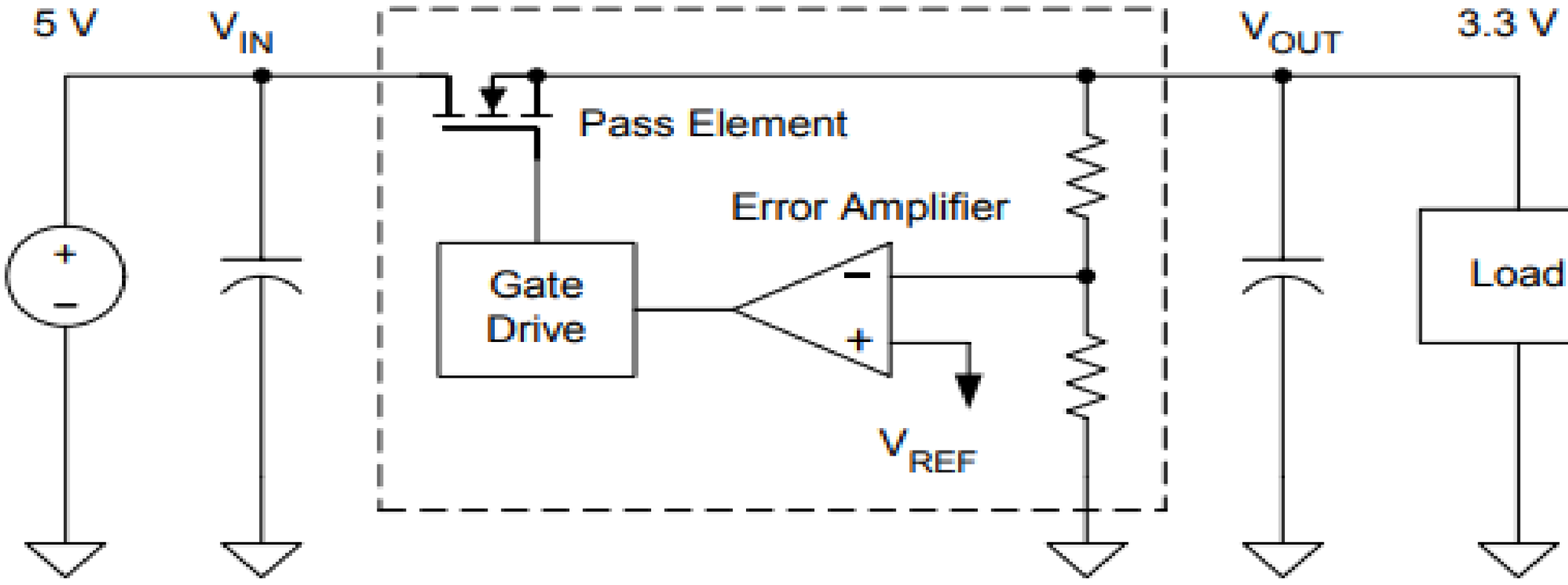
Introduction to Voltage Regulators

- A voltage regulator provides a constant output voltage despite variations in input voltage or load conditions.
- Types:
  - Linear Regulators
  - Switching Regulators
  - LDOs are a special type of linear regulators designed to **work with a low dropout voltage**.

low-dropout (LDO) regulator

- A low-dropout (LDO) regulator is a DC voltage regulator that can operate with a small difference between the input and output voltage.
- **Key Feature:** It requires a very small dropout voltage (difference between input and output).
- Traditional regulators (e.g., 7805) require a high dropout voltage (~2V-3V).
- LDO regulators work efficiently even when the input voltage is very close to the output.

Basic Block Diagram of LDO Regulator



Components:

Pass Transistor (PMOS/NPN/PNP): Controls the current flow.

Error Amplifier: Compares output voltage with reference voltage.

Reference Voltage (Vref): Provides a stable reference for regulation.

Feedback Network: Helps maintain a stable output.

Activity

In class activity

Working Principle of LDO Regulator

- Reference Voltage (Vref) is generated internally.
- Error Amplifier compares the feedback voltage with Vref.
- If the output voltage drops, the pass transistor allows more current to maintain the set voltage.
- If the output voltage increases, the pass transistor reduces the current flow.
- **As a result**, the output remains constant.

Dropout Voltage in LDO Regulators

- Dropout Voltage (VDO): Minimum voltage difference required between input and output to maintain regulation.
- Traditional Regulators: Require ~2V or more.
- LDO Regulators: Work with < 0.5V, sometimes as low as 100mV.

Advantages and Disadvantages of LDO Regulators

Advantages of LDO Regulators:

- Works with low input voltage
- High efficiency for small voltage differences
- Less power dissipation
- Compact and simple design
- Ideal for battery-powered devices

Disadvantages of LDO Regulators:

- Lower current-handling capability
- Limited efficiency for high current applications
- Requires careful stability design (capacitor selection is important)

Applications of LDO Regulators

- 📱 Mobile phones & Tablets – Power management for microprocessors
- 🔋 Battery-operated devices – Reducing power consumption
- 🔧 Embedded Systems – Supplying stable voltage to low-power circuits
- 📡 RF & Communication Systems – Noise-sensitive applications

Comparison of LDO vs Standard Linear Regulators

Feature	Standard Linear Regulator	LDO Regulator
Dropout Voltage	2V - 3V	<0.5V
Efficiency	Lower	Higher
Heat Dissipation	More	Less
Output Stability	Moderate	High
Applications	General Power Supply	Battery-Powered Devices

Conclusion

- LDO regulators maintain output voltage with minimal input-output difference.
- Suitable for battery-powered and low-power applications.
- More efficient and compact compared to standard linear regulators.
- Selection of capacitors and thermal management is crucial for performance.

Assessment

1. Why LDO Regulators?

Traditional regulators (e.g., 7805) require a high dropout voltage (~2V-3V). LDO regulators work efficiently even when the input voltage is very close to the output.

2. In the Working of LDO Regulator, If the output voltage drops, the pass transistor allows more current to maintain the set voltage.

THANK YOU