

Understanding Dual Rail Power Supplies and Their Applications

Introduction: Why Negative Voltages?

- **Power Supplies & Batteries:** Typically, power supplies provide a single positive DC voltage.
 - **Exception:** Devices like waveform generators require dual rail power supplies, which provide both positive and negative voltage rails.
 - **Importance:** Dual rail power supplies are crucial in applications like audio amplifiers, sensors, operational amplifiers (Op-Amps), ADCs/DACs, LCDs, etc.
 - **Objective:** The video demonstrates various methods to generate dual rail power supplies and their uses.
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Charge Pump Design

- **Simple Commercial Solution:**
 - Dual rail voltage can be created by using a commercial board that provides +12V (V+) and -12V (V-), powered by a 5V DC input.
- **DIY Solution with Boost Converter:**
 - A normal boost converter circuit can be modified to generate dual rail voltages.
 - **Reverse Engineering:**
 - The commercial dual rail board uses a boost converter to generate positive voltage.
 - An additional inverting charge pump is used to generate the negative voltage.
 - **Working of Inverting Charge Pump:**
 - Capacitors and diodes work together to invert the voltage, creating the negative rail.
 - **Limitations:**
 - Current output is typically limited (e.g., 30-50mA).
 - Noise is a major problem, especially in sensitive applications.

- **DIY Performance:** Even with modifications, DIY charge pumps may perform poorly if the boost converter is inadequate.
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Transformer Design for Dual Rail Power Supply

- **Center-Tapped Transformer:**
 - Provides two symmetrical outputs (positive and negative) around a central ground.
 - A 30V RMS center-tapped transformer is used to generate dual rail voltages.
 - **Rectification and Filtering:**
 - Full bridge rectification converts AC to DC.
 - Capacitors smooth out the waveform, and a linear voltage regulator stabilizes the output to create stable 12V positive and negative rails.
 - **Advantages:**
 - Higher current output (500mA).
 - Low noise, making it suitable for precision applications.
 - **Disadvantages:**
 - Requires AC mains voltage input.
 - Less efficient than charge pumps.
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Simpler Rail Splitter Designs

- **Voltage Divider Approach:**
 - Two resistors and capacitors split a single supply voltage to create a virtual ground and dual rail voltages.
 - **Drawbacks:**
 - Unstable voltage when current is drawn, due to resistive differences.
 - Performance degrades when current is drawn unevenly from the positive or negative rail.

- **Op-Amp Buffer:**
 - Adding an operational amplifier (Op-Amp) between the voltage divider and the virtual ground stabilizes the voltage and allows for higher current draw.
 - The Op-Amp keeps the voltage at both its inputs equal, stabilizing the virtual ground.
 - **Limitations:**
 - The current output is limited by the Op-Amp's capabilities.
 - A BUF634 buffer IC can be added to increase the current output.
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Other Voltage Rail Splitter Approaches

- **TLE2426 IC and Discrete Transistor Solutions:**
 - These are alternative methods for creating dual rail voltages, each with their pros and cons.
 - Further resources can be found through the video's links for more details on these methods.
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Conclusion

- **Overview:** Various techniques for generating dual rail power supplies were discussed, including charge pumps, transformer-based solutions, and simpler rail splitting designs.
 - **Applications:** Understanding when and how to use dual rail power supplies is crucial for designing circuits involving audio, sensors, and precision electronics.
 - **Call to Action:** Support through Patreon, and stay creative for further learning.
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This summary encapsulates the main points covered in the video, focusing on methods for creating dual rail power supplies and their respective use cases.