Task: Design class D amplifier

Detailed Explanation of Class D Amplifier Components

A Class D amplifier operates by converting the input analog signal into a series of high-frequency pulses using Pulse Width Modulation (PWM). These pulses are then filtered back into an amplified analog signal. Each component in the circuit plays a key role in achieving efficient switching, amplification, and signal fidelity.

Power Supplies (V1 and V2)

- Provide the necessary dual DC voltages (e.g., +14V and -14V).
- Powers the operational amplifier and other active devices.
- Essential for enabling proper biasing and full output swing in audio circuits.

Operational Amplifier (U1 - LM324)

- Likely used as a comparator or to generate PWM.
- Compares the input signal with a triangular or sawtooth waveform to produce a PWM signal.
- Central to signal modulation in Class D amplifiers.

Resistors (R1, R2)

- Form a voltage divider or set gain/reference levels.
- Control the behavior of the Op-Amp by setting its input voltage or feedback ratio.
- Impacts amplification accuracy and stability.

MOSFETs (Q1 2N6849, Q2 - 2N7000)

- Act as switching devices.
- Rapidly switch on/off to control power delivery to the load.
- Core switching elements in Class D topology—enable high efficiency.

Gate Resistors (R3, R4)

- Connected to MOSFET gates.
- Limit inrush current and suppress ringing/oscillations during switching.
- Improve reliability and reduce electromagnetic interference (EMI).

Output Filter Capacitor (C1)

- Smooths out the PWM signal.
- Part of a low-pass filter to recover the analog audio signal.
- Ensures output is audible and free of high-frequency switching noise.

Output Filter Inductor (L1)

- Complements the capacitor in forming a low-pass LC filter.
- Blocks high-frequency components while passing audio signals.
- Critical for clean signal reconstruction.

Oscilloscope (OSC)

- Observes waveform behavior.
- Monitors input vs. output to verify modulation and signal integrity.
- Aids in debugging and performance evaluation.

Voltmeter (VM1)

- Measures voltage at circuit nodes.
- Tracks DC levels or output amplitude.
- Useful for calibration and monitoring output conditions.