DESIGN NOTES

The LT1166: Power Output Stage Automatic Bias System Control IC – Design Note 126

Dale Eagar

Class AB amplifiers are popular because of their "near Class A" performance and their ability to operate on considerably less quiescent power than Class A. Class AB amplifiers are easy to construct, rugged and reliable. However, there is an aspect of these amplifiers that can cause perplexity, consternation and finally hair loss—their bias scheme. The problem is that the very parameter that makes Class AB so good, namely, low quiescent current, is poorly controlled. The LT®1166 offers control over the quiescent current directly, removing the necessity of temperature tracking, matching transistors or trim pots. In addition, it removes all excess crossover distortion caused by improperly set quiescent current, and significantly reduces the distortion caused by the effects of nonlinear transconductance in the output transistors.

Functional Description

The LT1166 (Figure 1), combined with external transistors, implements a unity-gain buffer. The circuit controls the Class AB output stage by incorporating two control loops, the current-control loop and the voltage-control loop. The current-control loop (Figure 2) operates independently of the voltage loop while keeping the product of V1 and V2 constant. The voltage loop maintains the output voltage at the input voltage level by driving both gates up or down. The two loops, although mutually independent, act in harmony to provide a component insensitive, temperature insensitive, simple Class AB bias network.

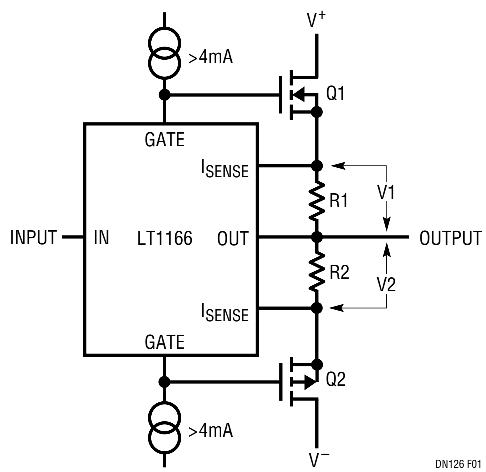


Figure 1. Basic LT1166 Circuit Configuration

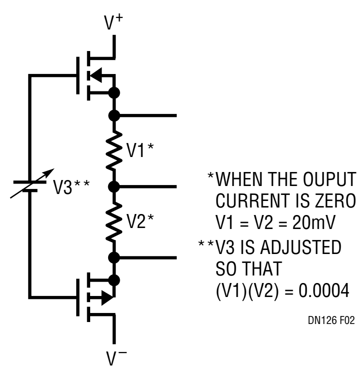


Figure 2. LT1166 Current-Control Loop

Parallel Operation

Parallel operation is an effective way to get more output power by connecting multiple power drivers. All that is required is a small ballast resistor to ensure current sharing between the drivers and an inductor to isolate the drivers at high frequencies. In Figure 3 one power slice can deliver ±6A at $100V_{PK}$ or $300W_{RMS}$ into 16Ω. Adding another slice boosts the power output to $600W_{RMS}$ into 8Ω and adding two or more drivers theoretically raises the power output to $1200W_{RMS}$ into 4Ω. Due to IR losses across the sense resistors, the FET R_{ON} resistance at 10A and some sagging of the power supply, the circuit of Figure 3 actually delivers $350W_{RMS}$ into 8Ω. Performance photos are shown in Figures 4 and 5. Frequency compensation is provided by the 2k input resistor, 180μH inductor and the 1nF compensation capacitors. The common node in the auxiliary power supplies is connected to the amplifier output to generate the floating ±15V supplies.

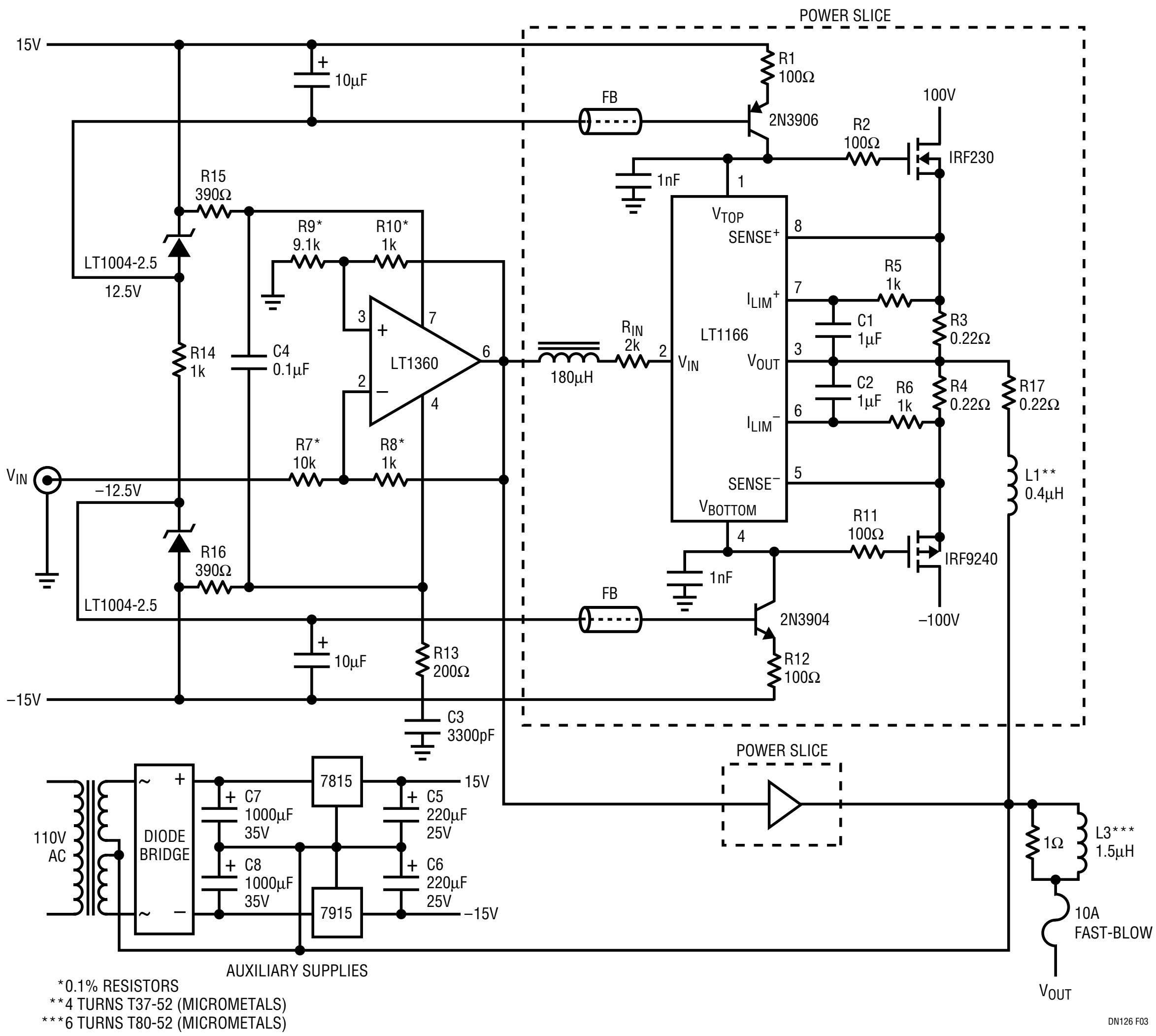
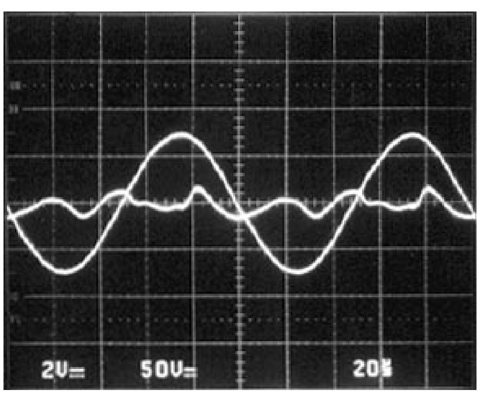


Figure 3. 350W Power Amplifier



P_O = 350W, R_L = 8Ω

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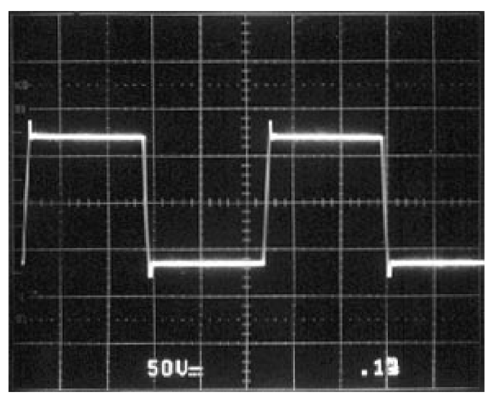
Figure 4. 0.3% THD at 10kHz



C_L = 1µF

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Figure 5. 2kHz Square Wave

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