

# DESIGN NOTES

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

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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<sup>®</sup>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.

### 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  $\pm 6A$  at  $100V_{PK}$  or  $300W_{RMS}$  into  $16\Omega$ . Adding another slice boosts the power output to  $600W_{RMS}$  into  $8\Omega$  and adding two or more drivers theoretically raises the power output to  $1200W_{RMS}$  into  $4\Omega$ . Due to IR losses across the sense resistors, the FET  $R_{ON}$  resistance at 10A and some sagging

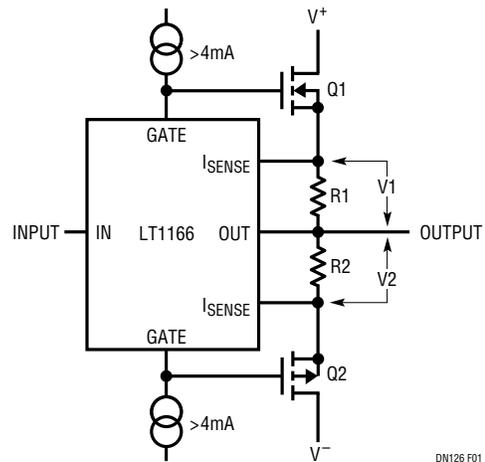


Figure 1. Basic LT1166 Circuit Configuration

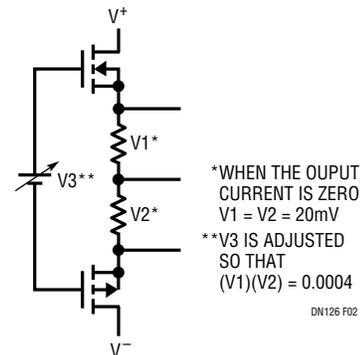


Figure 2. LT1166 Current-Control Loop

of the power supply, the circuit of Figure 3 actually delivers  $350W_{RMS}$  into  $8\Omega$ . Performance photos are shown in Figures 4 and 5. Frequency compensation is provided by the 2k input resistor,  $180\mu H$  inductor and the 1nF compensation capacitors. The common node in the auxiliary power supplies is connected to the amplifier output to generate the floating  $\pm 15V$  supplies.

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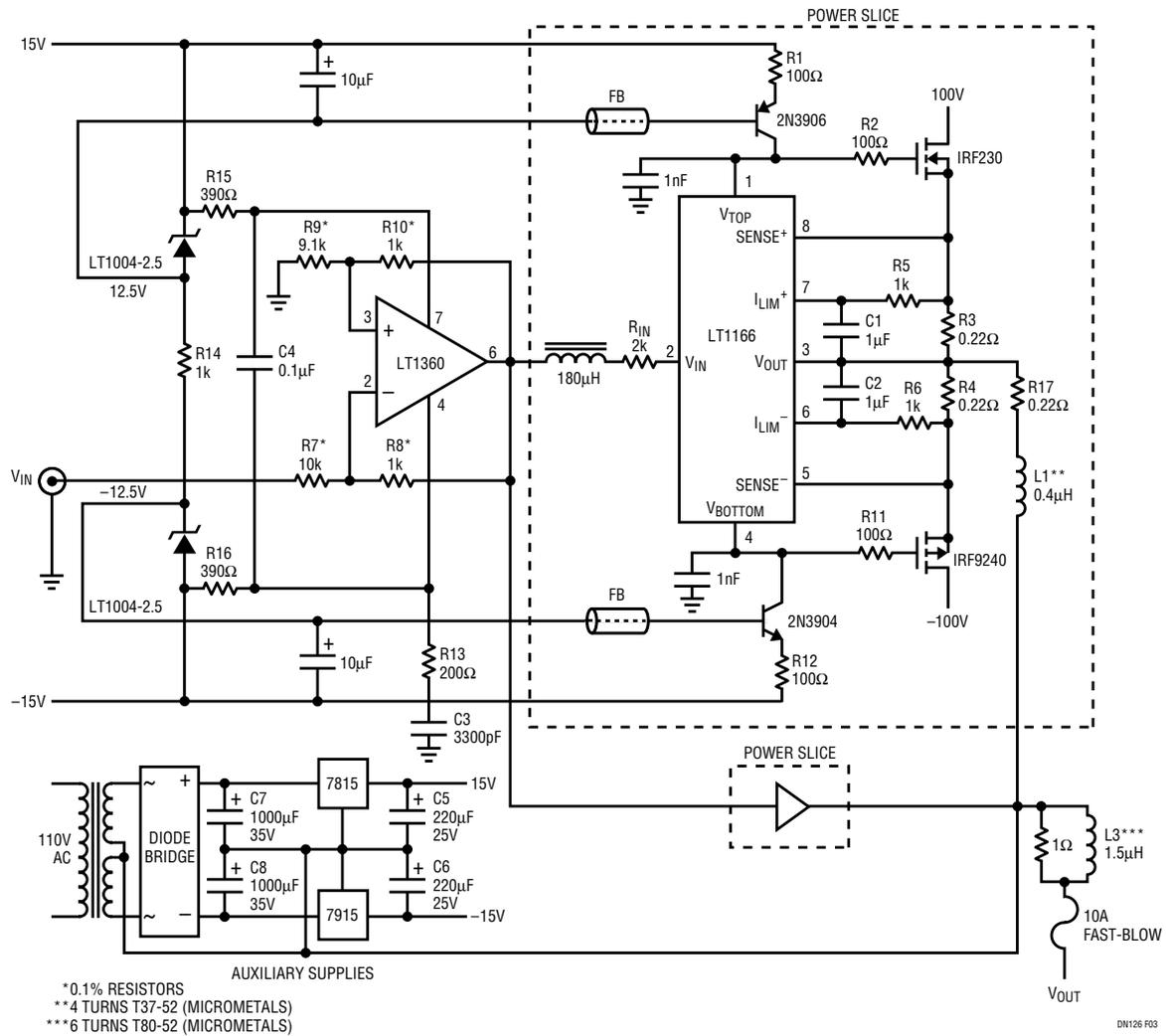
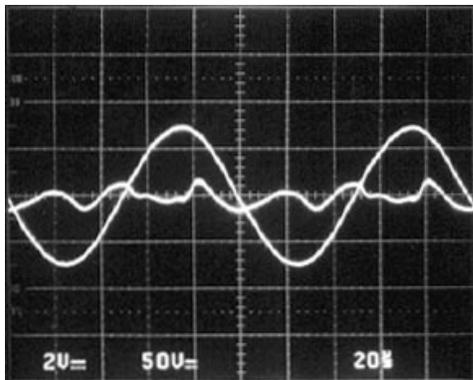


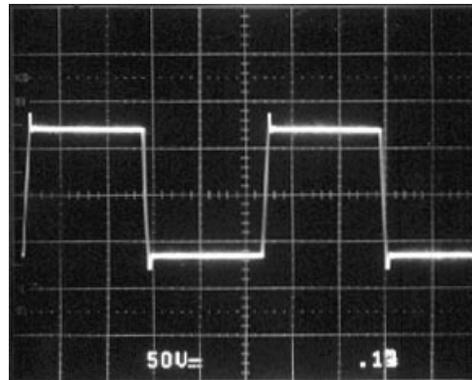
Figure 3. 350W Power Amplifier



P<sub>0</sub> = 350W, R<sub>L</sub> = 8Ω

DN126 F04

Figure 4. 0.3% THD at 10kHz



C<sub>L</sub> = 1µF

DN126 F05

Figure 5. 2kHz Square Wave

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 call (408) 432-1900, Ext. 456