

Application Note 0100C OPEN ARCHITECTURE AMPLIFIER MODULES

Open architecture amplifier modules feature optimum performance in the smallest size with maximum flexibility for customization to a specific application. These important advantages are gained through three key features: (1) separate bias control terminals at each MOSFET gate for good flexibility in gain control, (2) separate power supply terminals for each MOSFET drain for effective amplifier protection, and (3) a low loss output matching network for high efficiency and optimum stability. LCF Enterprises uses these modules as the building blocks for high performance custom amplifier subsystems. LCF Enterprises also offers the modules by themselves for general purpose and OEM applications.

Figure 1 presents a three stage, push-pull amplifier module with an open architecture. Six feedthroughs control the gate bias, and six feedthroughs power the drains. The module features typically 37 dB of compressed gain, 100W compressed power, and 45% efficiency at 225 - 400 MHz for Class AB biasing. Note that this high performance is available in a very small package measuring 4.84" X 2" X 1".

Open architecture modules feature maximum flexibility in biasing, gain control, and performance optimization. Separate gate bias inputs and drain feedthroughs permit either Class A or Class AB biasing. Simple adjustment of the gate bias voltage provides effective gain control for temperature compensation and AGC loops. In addition, for high power MOSFET amplifiers, the gate biasing determines a gain vs. power vs. efficiency vs. distortion trade-off. Therefore, open access to the gate bias terminals gives the user the option of optimizing the amplifier bias to obtain optimum gain, power, intermodulation distortion, and efficiency for a particular application.

The modules by themselves are sufficiently stable and rugged for most amplifier applications. However, the open architecture simplifies development of a custom amplifier subsystem which is protected from abuse. Separate drain feedthroughs permit adding current limiting to protect each MOSFET from current overload which may occur when driving a shorted load. Extra input/output overdrive protection can be added by controlling the gate bias dependent on the output power. Also, gate bias control dependent on a temperature sensor added to the amplifier case provides simple thermal overload protection.

LCF Enterprises uses the open architecture modules in customized amplifier subsystems, and also offers the modules by themselves for general purpose and OEM applications. The bare modules are sufficient for most amplifier applications after the following simple configuration steps.

1. Attach the amplifier to sufficient heat sinking. Forced air cooling may be required.
2. Connect the gate bias terminals to a regulated 15V supply with a 2 mA current capacity per terminal for Class AB biasing.
3. Connect the drain supply terminals to a DC power supply (commonly 28V). Include fast blow fuses for simple, highly effective amplifier protection.

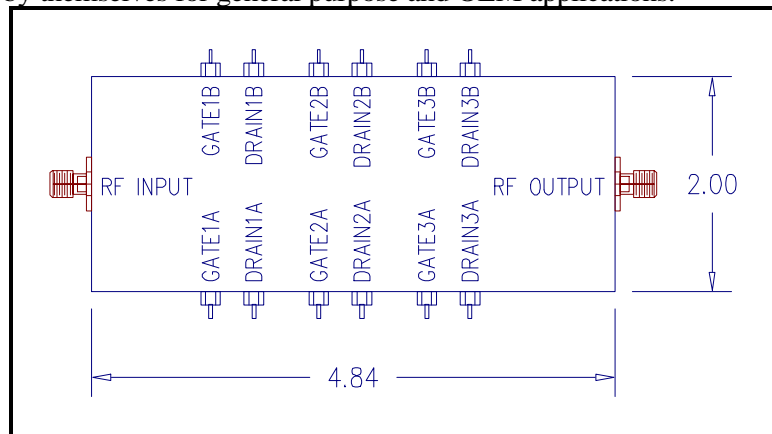


Figure 1. Open Architecture Amplifier Module.

4. Connect the amplifier to the signal source and the load. Apply the 15V gate bias, and slowly increase the drain voltage from zero to full value while monitoring the drain currents. Maintaining the drain currents below the recommended maximum values permits driving bad loads with no damage.

This simple configuration procedure yields a rugged, stable amplifier with high performance and good protection in a small package.

Power Supply and Amplifier Interactions

A Class AB or Class C amplifier designed for CW operation is a very dynamic current load, and the power supply determines the amplifier response to varying RF drive. Power supply surges can result from abrupt changes in CW RF input drive, and an amplifier user should be cautious of how the power supply responds when full CW RF input drive is turned off. Low performance power supplies do not respond well to a current change which can be over 10A in a few microseconds, and a large voltage surge can result. With a power supply of unknown performance, it is best to either adjust RF input drive up and down gradually, or turn off the power supply before abruptly changing the RF drive.

It should be noted that these power supply interactions are important only for CW amplifiers drawing high continuous currents. Pulsed amplifiers which draw low average currents but high peak currents are specifically designed to eliminate dependence of the pulsed response on the power supply. That is, a pulsed amplifier has sufficient energy storage designed into the power supply feedthroughs and matching circuitry to eliminate surges from short, low duty cycle pulses.