

Application Note 0102C

OPEN ARCHITECTURE AMPLIFIER MODULES WITH TEST FIXTURE

1. OPEN ARCHITECTURE 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.

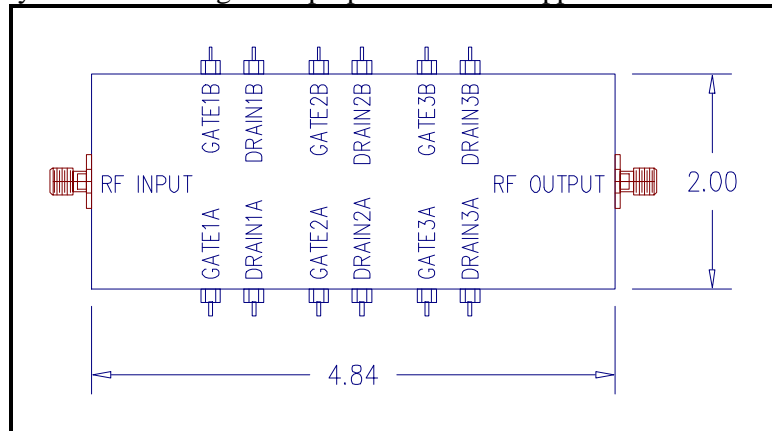


Figure 1. Open Architecture Amplifier Module.

2. TEST FIXTURE:

LCF offers the amplifier modules mounted on a test fixture for fast and problem free setup. The additional features provided by the test fixture include the following,

1. Amplifier is attached to a heat sink for cooling. A biscuit fan is provided for forced air cooling.

2. Bias board is provided to deliver the voltage to the gate bias terminals on the amplifier module from a regulated 18V supply with a 2 mA current capacity per terminal for Class A or AB biasing.
3. Power and Bias Distribution Boards on each side of the amplifier connect the drain supply terminals of the amplifier to a DC power supply (commonly 28V). Fast blow fuses are included for simple, highly effective amplifier protection.
4. A thermal shutdown switch is attached to the heat sink. When the temperature rises above 50°C, this switch disconnects the 15V bias, thereby disabling the amplifier and protecting it from over heating.

Operating Procedure.

The steps for powering on the amplifier with the test fixture are fast and easy.

1. First turn on the biscuit fan. Make sure air flow is directed along the length of the heat sink fins.
2. Connect input signal to the input connector on amplifier module. A signal analyzer with tracking generator or a network analyzer can be used to provide the input signal for set up and test of small signal gain performance.
3. Connect output connector on amplifier to a load. Caution: Power amplifier should drive a 50 ohm high power attenuator to prevent any damage to test equipment.
4. Apply 18-24 volt power supply to bias board (Yellow/Black wires are ground and power supply .
5. Verify with voltmeter that the bias pins on the amplifier module have 15 volts nominal applied.
6. Connect variable main power supply (28 volts) to the Distribution boards through the red/black wires.
7. Increase main power supply slowly from zero to full value while monitoring output signal on the analyzer and current on a meter.

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.