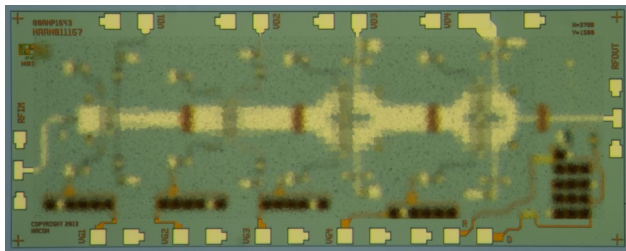


## MAAM-011167 Biasing Recommendations

Rev. V1

MAAM-011167 is a 24 dBm driver amplifier suitable for point to point radios for cellular backhaul applications between 71 - 86 GHz.

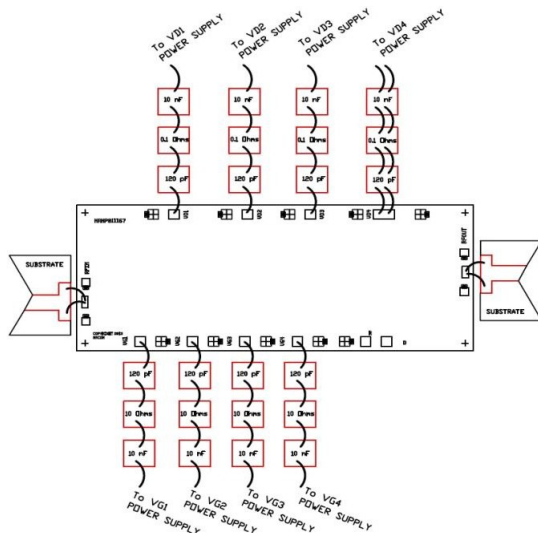
The evaluation board shown below is a configured for general operation providing the end user access to all gates, drains and the on board integrated detector.



MAAM-011167 can consume up to 1.8 W of dissipated power and it is therefore critical to have an effective heatsink for dissipating the heat generated. For more accurate baseplate temperatures a cooling chuck or Peltier may be used to regulate device temperature.

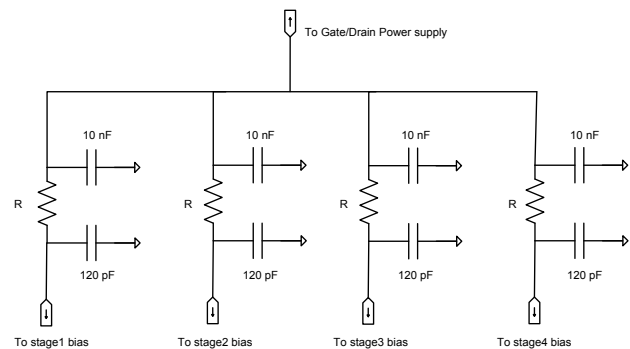
### On Board Bypassing

It is recommended that each drain and gate line has its own bypass capacitors. At a minimum 120 pF and 10 nF capacitors should be used. If additional capacitors are added to the board they should be accompanied by a series resistor to ground to assist in dequing the capacitor to reduce resonances between parallel capacitors.



### Common Gates and Drains

The amplifier can be operated with a single gate or drain source with additional isolation between each stage. The performance may be slightly poorer due to how the power is split to each stage. On the gate side a 10 Ω resistor should be placed in series and tied together in a star to a common supply. The drain side resistance should be reduced to less than 5 Ω to minimise any voltage drop across the resistor. Bypass capacitors are still required for each stage in this arrangement.



### Biasing Sequence

1. Set VG1,2,3,4 to - 1.2 V.
2. Set VD1,2,3,4 to +4 V.
3. Tune VG1 to reach 30 mA. Fix VG1 at corresponding voltage.
4. Tune VG2 to reach 60 mA. Fix VG2 at corresponding voltage.
5. Tune VG3 to reach 120 mA. Fix VG3 at corresponding voltage.
6. Tune VG4 to reach 150 mA. Fix VG4 at corresponding voltage.

Depending on the series resistance between power supply and die further adjustment of drain voltage may be required to set +4 V accurately at the die.

It is recommended if possible to use voltage sense if the setup permits this. At high input power levels this can help adjust voltage levels maximise performance.

Application Note

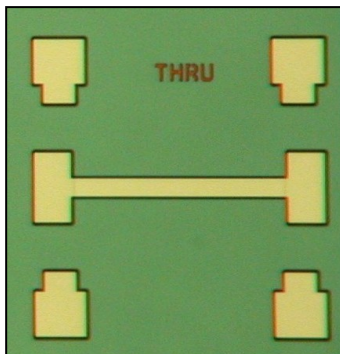
### RF Measurement

The next step is to apply RF power. For S-parameters -25 to -10 dBm should be adequate but check what the maximum input power into the respective VNA is and calibrate out any attenuation that is required.

Before and after the measurement it is recommended to measure the temperature of the device. If completing a suite of measurements it might be possible to notice performance degradation due to the device heating up. Adequate cooling will mitigate the performance changes.

### Calibration Plane

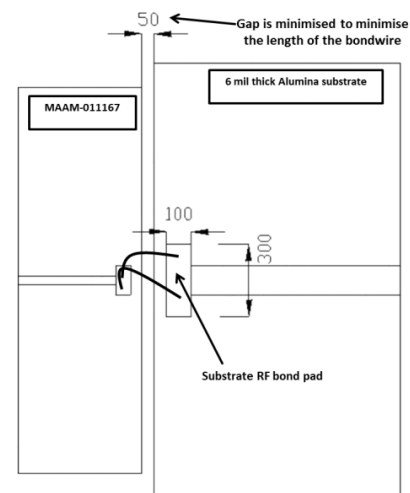
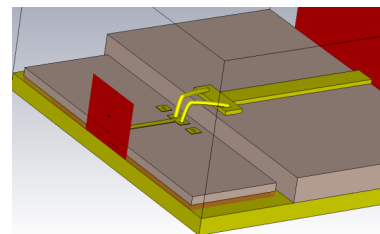
All measurements provided by MACOM have been de-embedded to from the RF pad 178.5  $\mu\text{m}$ . The through used is shown below and was used for both scalar and vector based calibration methods. All measurements utilised 200  $\mu\text{m}$  pitch RF probes directly landing on the die.



### Bond Wire Transition

A number of techniques can be used for transitioning from the GaAs MMIC to the PCB. 3D simulations indicate that low loop heights should be used to minimise the bond wire length. Keeping the bond wire to less than 300  $\mu\text{m}$  will assist in reduction of losses. Employing techniques such as Reverse Ball Stitch On Ball (BSOB) will help in minimising bond wire lengths. Thinner bond wire such as 20  $\mu\text{m}$  (0.8 mil) diameter bond wire will also improve performance.

Using dielectrics that are less than 150  $\mu\text{m}$  thick dielectrics are recommended at these frequencies. Cheaper materials such as Rogers 4350B will work but will have higher track losses compared to materials such as Rogers 3850 or Taconic Talam Plus. Careful consideration of which dielectric and the effective track lengths should be considered when laying out board designs.



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