MAAM-011167 Biasing Recommendations

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 genera 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 dequeing 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.
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 µm. The through used is shown below and was used for both scalar and vector based calibration methods. All measurements utilised 200 µm 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 µm 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 µm (0.8 mil) diameter bond wire will also improve performance.

Using dielectrics that are less than 150 µm 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 Taclam Plus. Careful consideration of which dielectric and the effective track lengths which should be considered when laying out board designs.
MACOM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with MACOM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppels or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.