

Power Amplifier 80 - 100 GHz

Preliminary - Rev. V2P

Features

- Saturated Output Power: 24 dBm
- Gain: 12 dB
- Input Return Loss: >15 dB
- Output Return Loss: >15 dB
- Reverse Isolation: >30 dB
- Dimension: 1800 x 2000 μm^2
- RoHS* Compliant
- Bare Die

Description

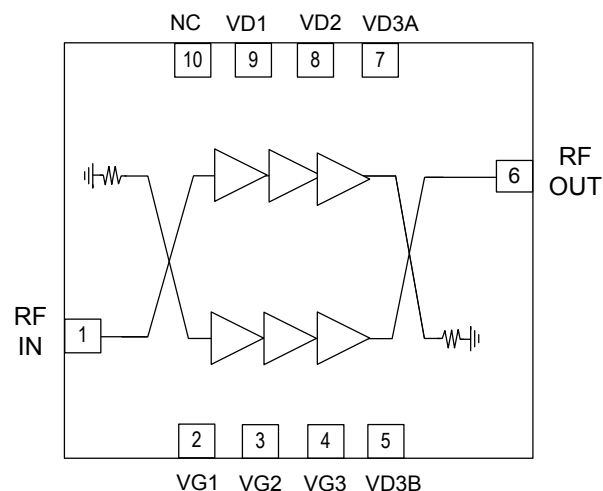
The MAAP-011199 is a balanced 3 stage GaAs pHEMT MMIC power amplifier. The device operates from 80 to 100 GHz and provides typically 24 dBm of output power. The power amplifier's balanced architecture results in excellent input and output match to 50 Ω across the entire 80 - 100 GHz frequency band and the multi-stage design provides high gain of 12 dB.

The device is well suited to communication, sensor, imaging and instrumentation applications

Ordering Information

Part Number	Package
MAAP-011199-DIEPPR	Pre-Production Samples

Functional Schematic



Pin Configuration

Pin No.	Function
1	RF IN
2	VG1
3	VG2
4	VG3
5	VD3B
6	RF OUT
7	VD3A
8	VD2
9	VD1
10	NC

* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

Power Amplifier
80 - 100 GHz

Preliminary - Rev. V2P

Electrical Specifications¹: Freq. = 80 - 100 GHz, $T_A = 25^\circ\text{C}$, $V_D = 4\text{ V}$, $V_G = -0.5\text{ V}$, $Z_0 = 50$

Parameter	Units	Min.	Typ.	Max.
Gain	dB	—	12	—
Input Return Loss	dB	—	15	—
Output Return Loss	dB	—	15	—
Quiescent Drain Current	mA	—	400	—
$P_{1\text{dB}}$	dBm	—	22	—
Saturated Output Power	dBm	—	24	—

1. Quiescent DC Bias: $I_{D1} = 100\text{ mA}$, $I_{D2} = 100\text{ mA}$, $I_{D3} = 200\text{ mA}$. Total DC power = 1.6 W.

Absolute Maximum Ratings^{2,3,4,5}

Parameter	Absolute Maximum
Drain Voltage	+4.3 V
Drain Current	670 mA
Gate Bias Voltage ($V_{G1,2,3}$)	$-1.5\text{ V} < V_G < 0.3\text{ V}$
Input Power	17 dBm
Storage Temperature	-55°C to $+150^\circ\text{C}$
Operating Temperature	-40°C to $+85^\circ\text{C}$
Junction Temperature	150°C
Thermal Resistance	$22.5\text{ }^\circ\text{C/W}$

- Thermal resistance value and maximum drain current limits assume no RF cooling effect.
- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near these survivability limits.
- Operating at nominal conditions with $T_J \leq +150^\circ\text{C}$ will ensure $\text{MTTF} > 1 \times 10^6$ hours.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices. This device is classified as Class 1C for HBM test and Class II for CDM test.

Calibration Plane

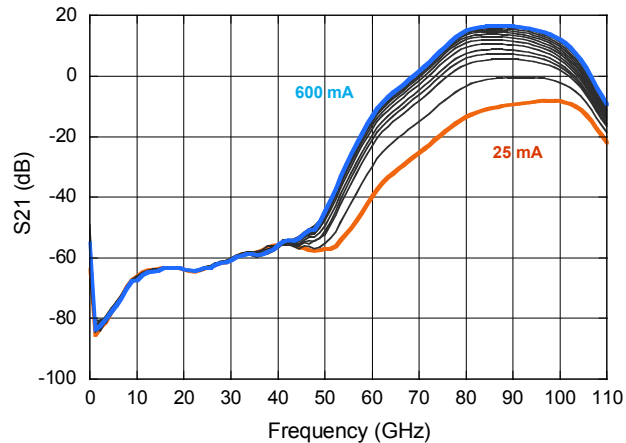
All data was measured with an ISS calibration to the probe tip.

Power Amplifier 80 - 100 GHz

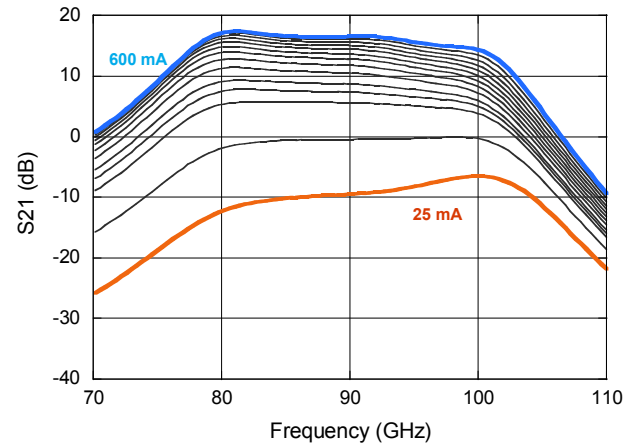
Preliminary - Rev. V2P

Typical Performance Curves @ +25°C

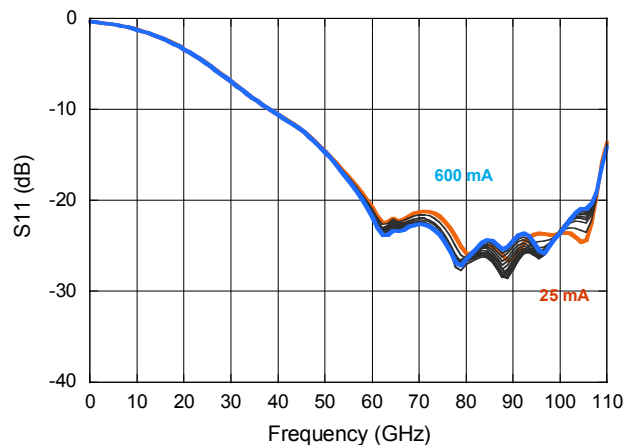
Gain



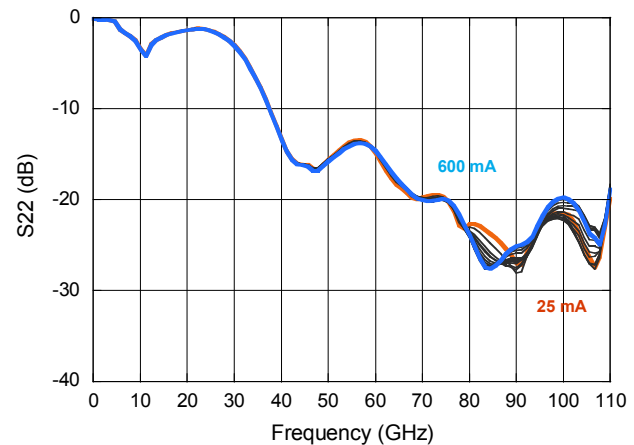
Gain 70 - 110 GHz



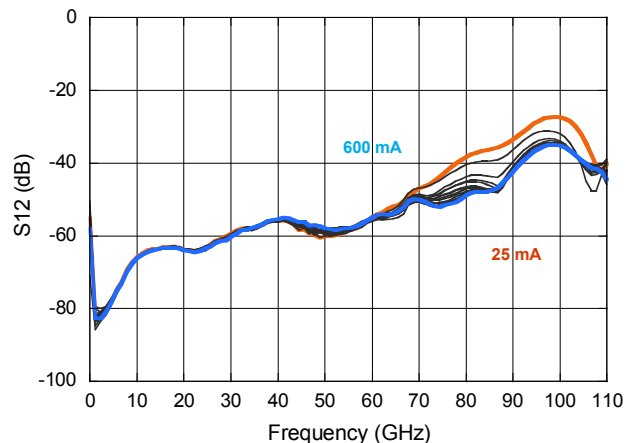
Input Return Loss



Output Return Loss



Reverse Isolation



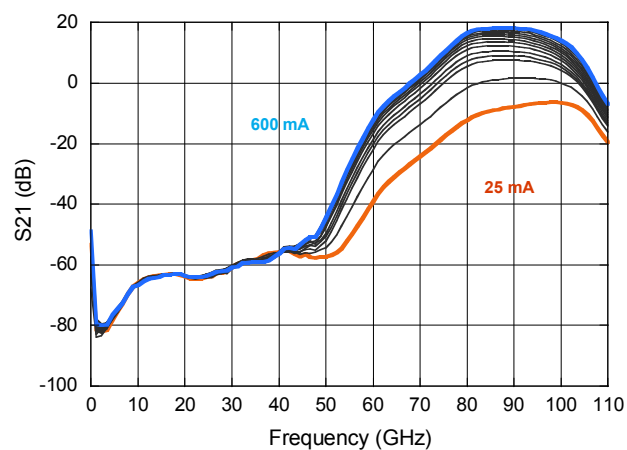
Preliminary Information

Power Amplifier 80 - 100 GHz

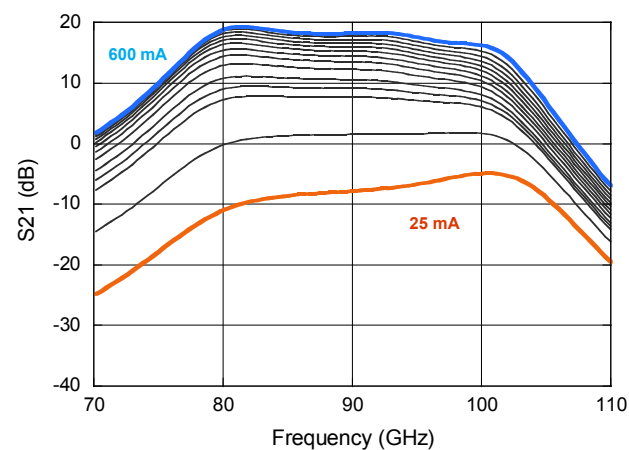
Preliminary - Rev. V2P

Typical Performance Curves @ -40°C

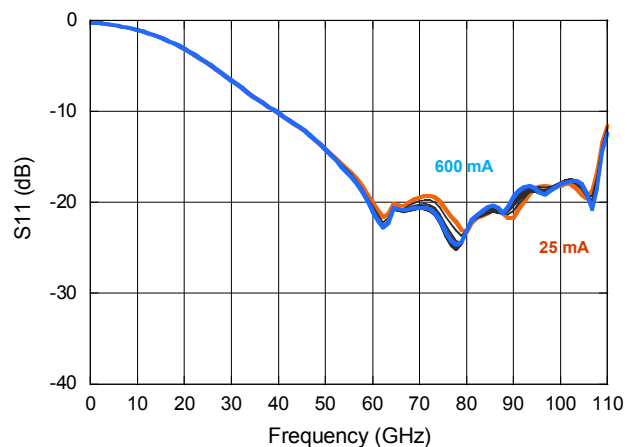
Gain



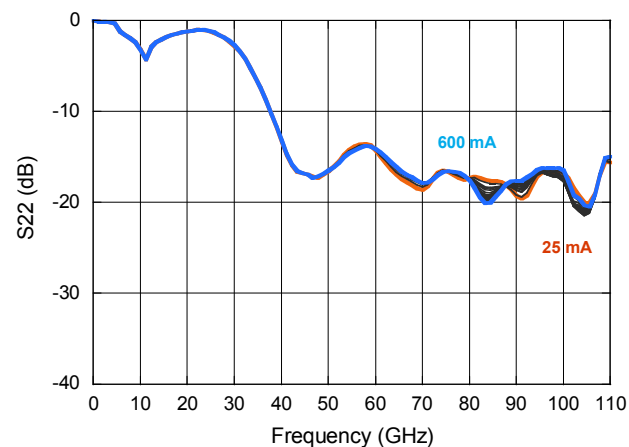
Gain 70 - 110 GHz



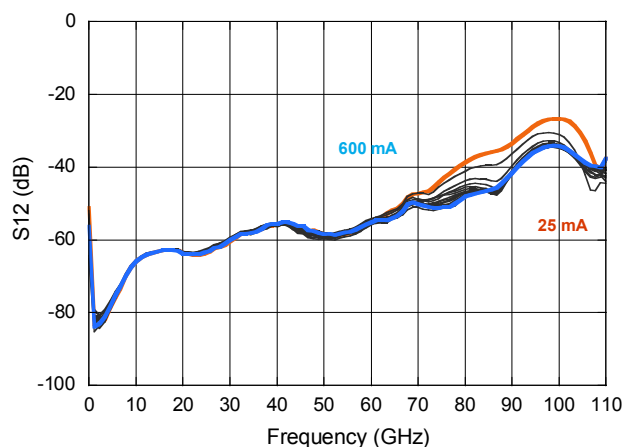
Input Return Loss



Output Return Loss



Reverse Isolation



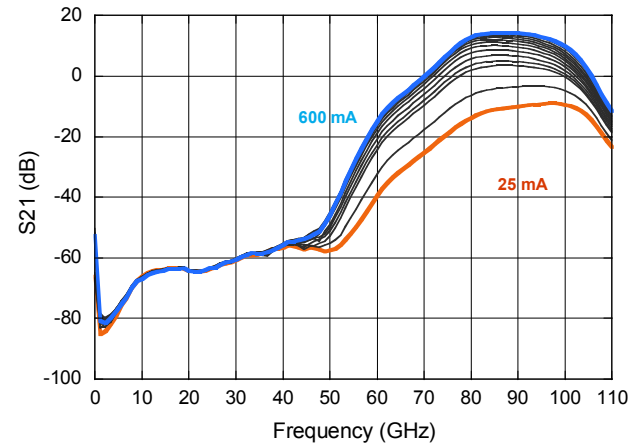
Preliminary Information

Power Amplifier 80 - 100 GHz

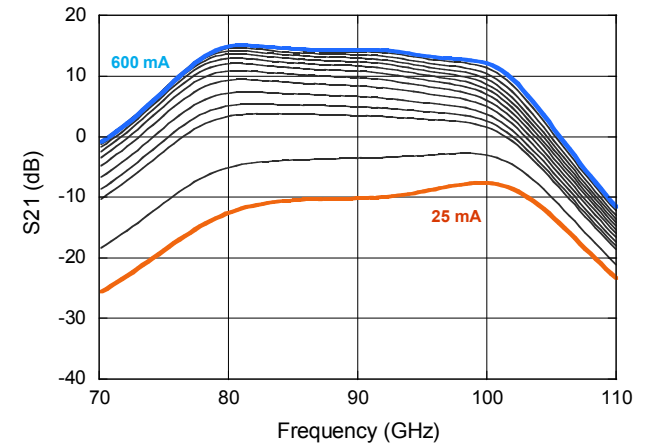
Preliminary - Rev. V2P

Typical Performance Curves @ +85°C

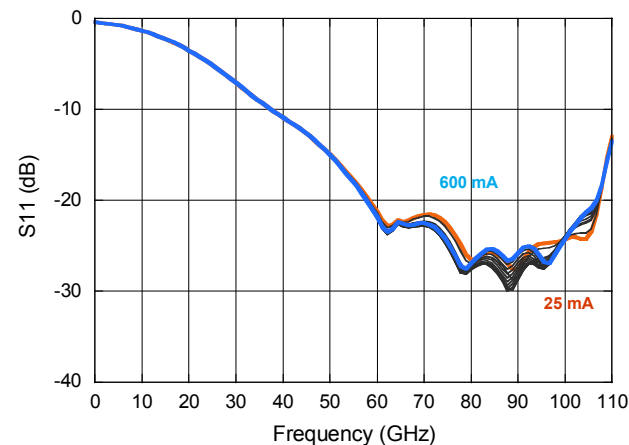
Gain



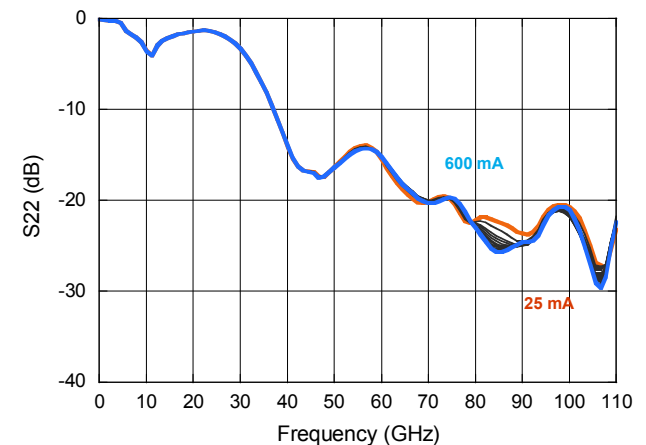
Gain 70 - 110 GHz



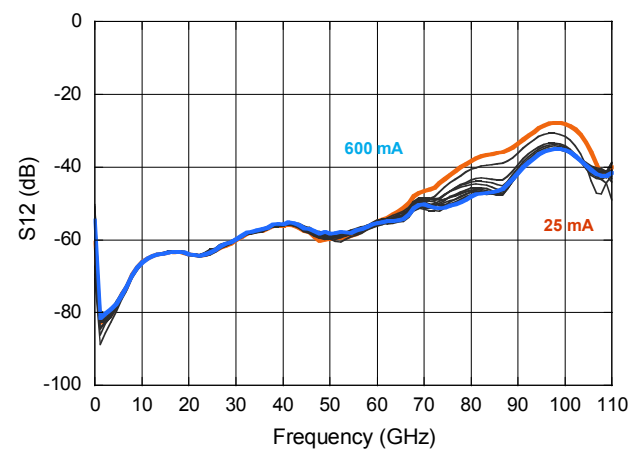
Input Return Loss



Output Return Loss



Reverse Isolation



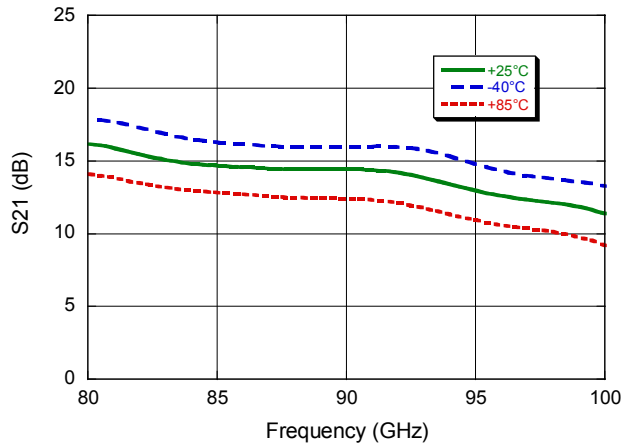
Preliminary Information

Power Amplifier 80 - 100 GHz

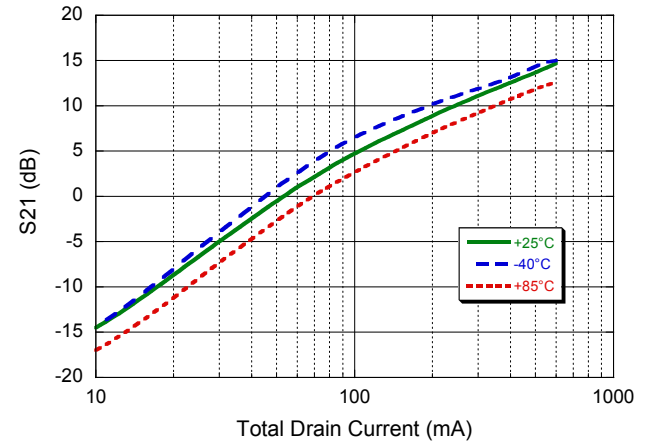
Preliminary - Rev. V2P

Typical Performance Curves

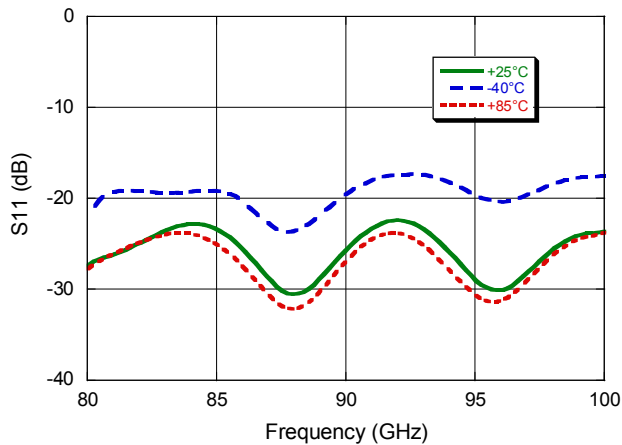
Gain vs. Frequency @ 400 mA



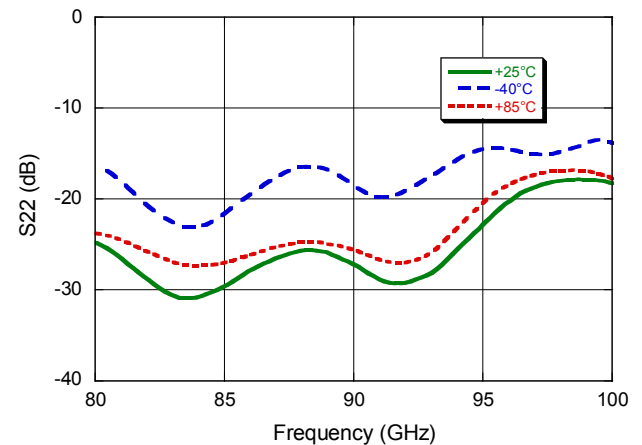
Gain vs. Drain Current @ 94 GHz



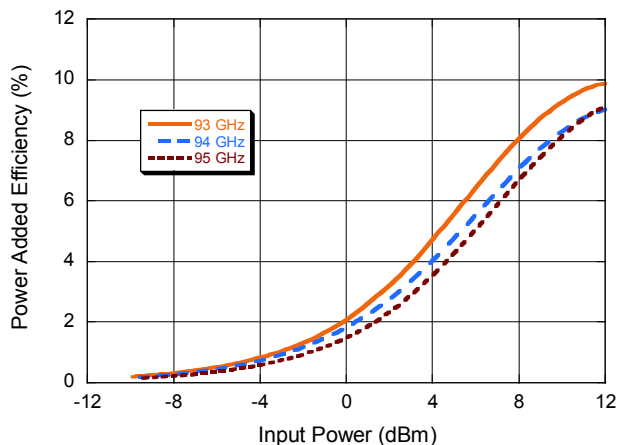
Input Return Loss vs. Frequency @ 400 mA



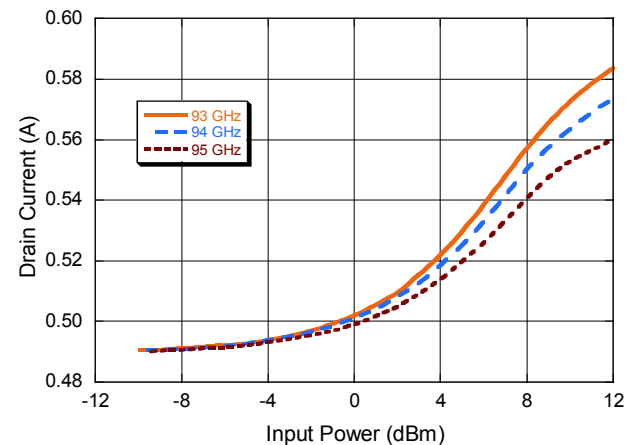
Output Return Loss vs. Frequency @ 400 mA



PAE vs. Input Power



Drain Current vs. Input Power

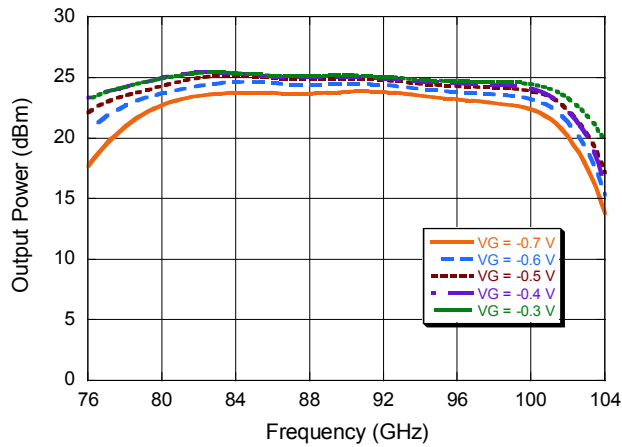


Power Amplifier 80 - 100 GHz

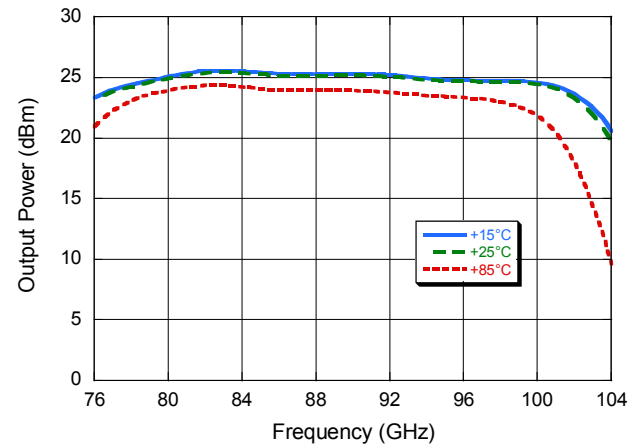
Preliminary - Rev. V2P

Typical Performance Curves

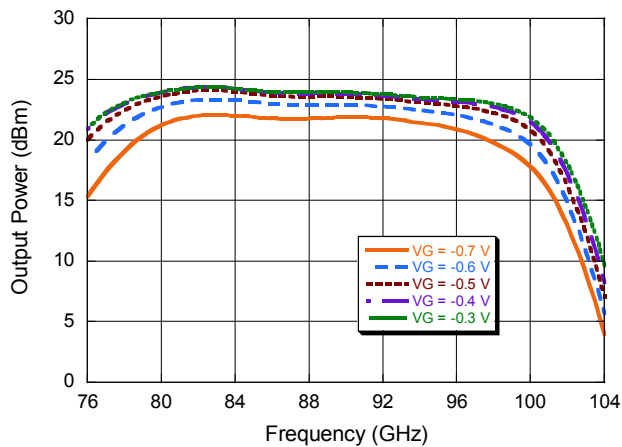
P_{SAT} vs. Frequency over Gate Voltage @ +25°C



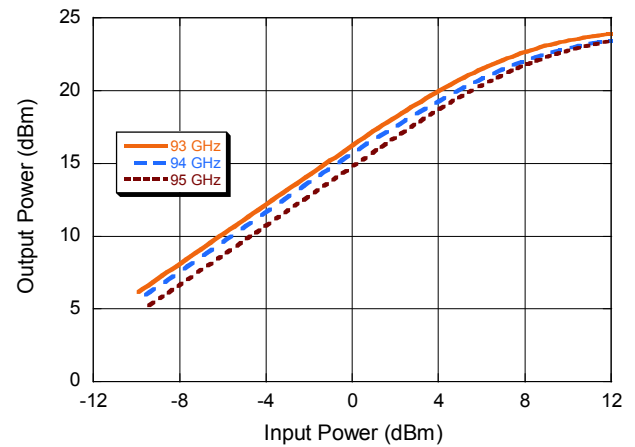
P_{SAT} vs. Frequency over Backside Temp. @ $V_g = -0.3$ V



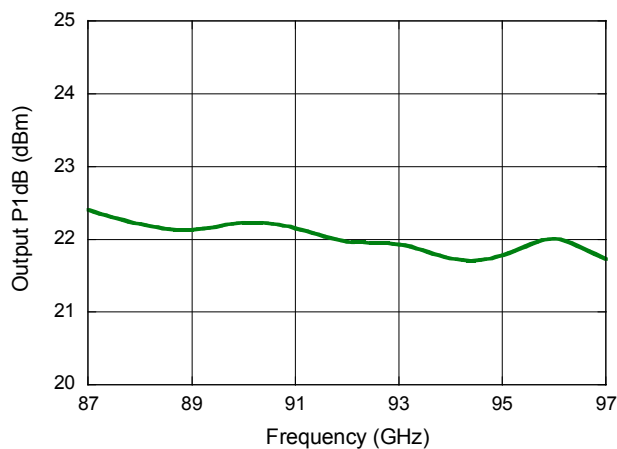
P_{SAT} vs. Frequency over Gate Voltage @ +85°C



Output Power vs. Input Power



Output P1dB vs. Frequency

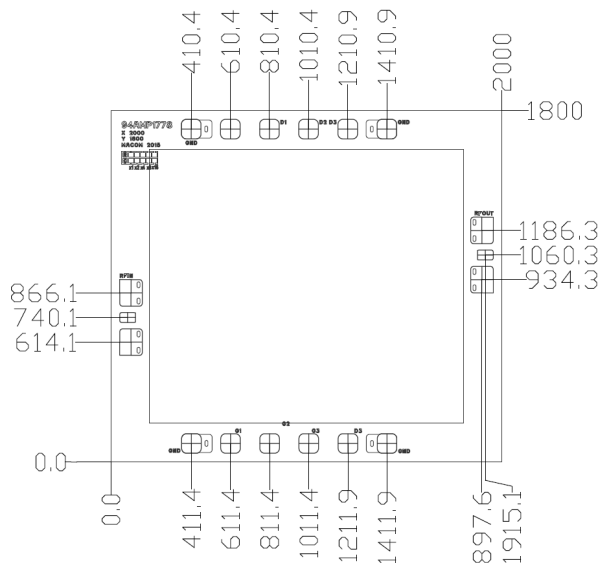


Preliminary Information

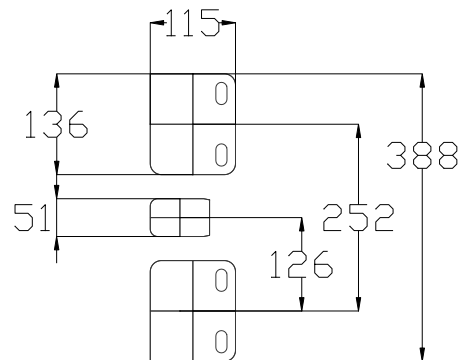
Power Amplifier 80 - 100 GHz

Preliminary - Rev. V2P

MMIC Bare Die



RF Probe



App Note [1] Biasing -

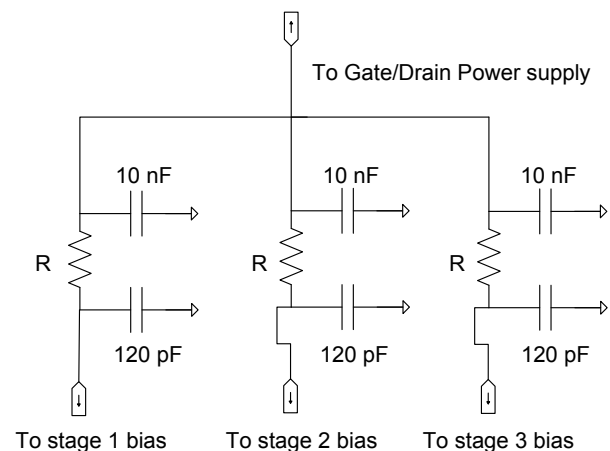
All gates should be pinched-off ($V_G < -1$ V) before applying drain voltage ($V_D = 4$ V). Then the gate voltages can be increased until the desired quiescent drain current is reached in each stage. The recommended quiescent bias is $V_D = 4$ V, $I_{D1} = 100$ mA, $I_{D2} = 100$ mA, and $I_{D3} = 200$ mA. The performance in this datasheet has been measured with fixed gate voltage and no drain current regulation under large signal operation. It is also possible to regulate the drain current dynamically, to limit the DC power dissipation under RF drive. To turn off the device, the turn on bias sequence should be followed in reverse.

App Note [2] Bias Arrangement -

Each DC pin (V_{D1} , V_{D2} , V_{D3A} , V_{D3B} , and V_{G1} , V_{G2} , V_{G3}) needs to have bypass capacitance (120 pF and 10 nF) mounted as close to the MMIC as possible.

App Note [3] Common Gates and Drains -

When biasing the device with only a single gate or drain source additional isolation is required. 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 minimize any voltage drop across the resistor. Suitable bias pass capacitance should still be applied to each stage as per App Note [2].



M/A-COM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with M/A-COM 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 estoppel 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.