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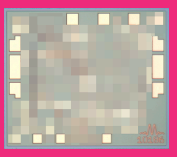
AMM-7199ACH

11 GHz – 38 GHz GaAs Driver Amplifier

DEVICE OVERVIEW

General Description

The AMM-7199 is a general-purpose broadband MMIC driver amplifier that provides +20 dBm output power suitable for driving a Marki H or L diode mixer at 11-38 GHz and S diode mixer from 15-32 GHz. The amplifier has excellent return losses, gain flatness and reduced current consumption. The small die size allows it to be used in a variety of applications and has built in DC-blocking capacitors on the input and output.



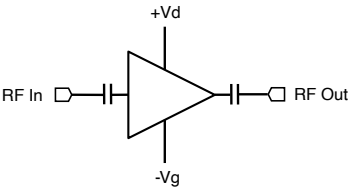
Features

- +20 dBm Output Power
- +20 dB gain
- Gain Flatness
- Excellent Return Losses
- Small Die size

Applications

- 5G transceivers
- Mobile test and measurement equipment
- Radar and satellite communications
- Driver amplifier L,H,S – diode mixers

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
AMM-7199ACH	11 GHz – 38 GHz GaAs Driver Amplifier	CH	REACH RoHS	Released	3A001.b.2.d

Table Of Contents

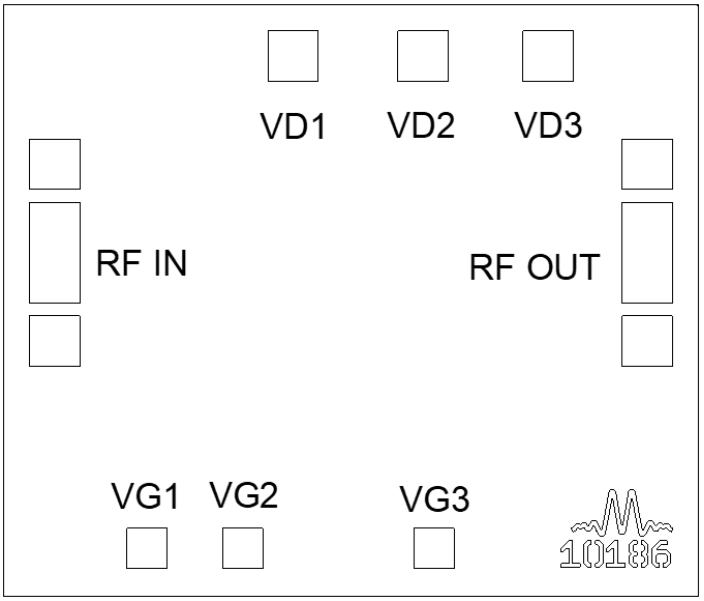
Revision History

Revision Code	Revision Date	Comment
-	2024-09-10	Initial Release
A	2025-04-02	Outline Drawing update

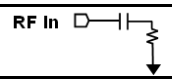
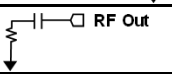
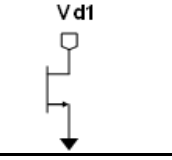
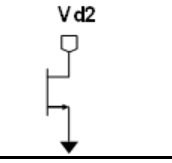
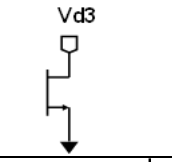
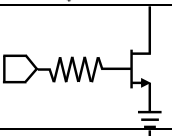
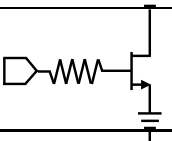
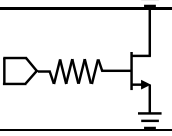
Port Configuration and Functions

Port Diagram

A port diagram of the AMM-7199ACH is shown below.



Port Functions

Port	Function	Description	Equivalent Circuit for Package
GND	Ground	Ground is provided through the backside of the die. The backside of the die must be connected to a DC/RF ground with high thermal and electrical conductivity.	
RF In	RF Input	This is the RF Input port of the amplifier die. It is internally DC blocked and RF matched to 50 Ω. RF input pad is GSG with 175 µm pitch.	
RF Out	RF Output	This is the RF Output port of the amplifier die. It is internally DC blocked and RF matched to 50 Ω. RF output pad is GSG with 175 µm pitch.	
VD1	Drain Supply Voltage	Pad VD1 supplies the drain voltage to the first stage of the 3-stage amplifier IC. Apply gate voltage to VG pins before applying drain voltage.	
VD2	Drain Supply Voltage	Pad VD2 supplies the drain voltage to the first stage of the 3-stage amplifier IC. Apply gate voltage to VG pins before applying drain voltage.	
VD3	Drain Supply Voltage	Pad VD3 supplies the drain voltage to the first stage of the 3-stage amplifier IC. Apply gate voltage to VG pins before applying drain voltage.	
VG1	Gate Bias Voltage	VG1 provides the gate bias to the first stage of the 3-stage amplifier. The user should apply between -0.4 and -0.6V to VG1 pad before applying any VD drain supply.	
VG2	Gate Bias Voltage	VG2 provides the gate bias to the first stage of the 3-stage amplifier. The user should apply between -0.4 and -0.6V to VG2 pad before applying any VD drain supply.	
VG3	Gate Bias Voltage	VG3 provides the gate bias to the first stage of the 3-stage amplifier. The user should apply between -0.4 and -0.6V to VG3 pad before applying any VD drain supply.	

Specifications

Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may become inoperable or have a reduced lifetime. This amplifier is designed and characterized in a 50Ω system, and operation in a reflective environment can cause performance degradation.

Parameter	Maximum Rating	Unit
Continuous Power Dissipation (PDISS) (at 85 ˚C case temp.)	1	W
Maximum Operating Temperature	85	°C
Maximum Storage Temperature	150	°C
Max Junction Temperature for MTTF > 1E6 Hours	175	°C
Minimum Operating Temperature	-40	°C
Minimum Storage Temperature	-65	°C
Negative Bias Voltage (Vg)	-2	V
Positive Drain Supply Current (Id) (with RF Input)	450	mA
Positive Drain Supply Voltage (Vd)	4.5	V
RF Input Power	20	dBm
Thermal Resistance, θJC	90	°C/W

Package Information

Parameter	Details	Rating
Dimensions	-	1.38x1.25 mm

Recommended Operating Conditions

The Recommended Operating Conditions indicate the limits, inside which the device should be operated, to guarantee the performance given in Electrical Specifications Operating outside these limits may not necessarily cause damage to the device, but the performance may degrade outside the limits of the electrical specifications. For limits, above which damage may occur, see Absolute Maximum Ratings.

Parameter	Min	Nominal	Max	Unit
Negative Bias Voltage (Vg)	-0.6	-0.5	-0.4	V
Power Supply DC Current (Id) (No RF Input)	100	130	180	mA
Ambient Temperature	-40	25	85	°C
Input Power for Saturation	3	6	8	dBm
Power Supply DC Voltage (Vd)	2.5	3	3	V

Sequencing Requirements

Turn-on Procedure:
1. Apply negative bias voltage to Vg pads
2. Apply positive supply voltage to Vd pads

Turn-off Procedure:
1. Turn off Vd supply
2. Turn off Vg bias

Note: RF input power can be injected at any moment in the bias sequencing procedure.

Electrical Specifications

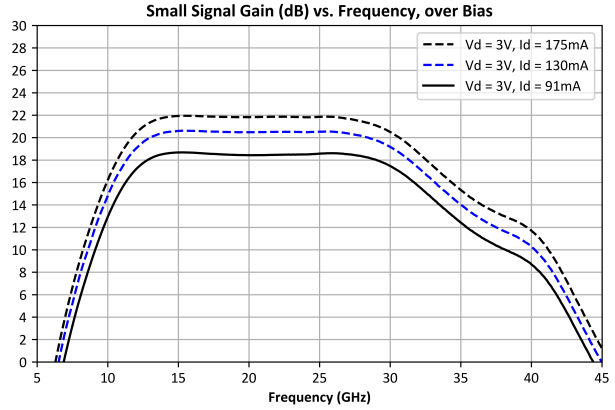
The electrical specifications apply at TA=+25°C in a 50Ω system. Min and Max limits apply only to our connectorized units and are guaranteed at TA=+25°C. Die are 100% DC tested and RF tested on a per lot basis.

Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Bias Requirements [1]	3V/-0.4V	-	-	-	180	-	mA
Bias Requirements [2]	3V/-0.5V	-	-	-	130	-	mA
Bias Requirements [3]	3V/-0.6V	-	-	-	100	-	mA
Input Power for Saturation	3V/-0.5V bias	11	38	-	6	-	dBm
Input Return Loss	3V/-0.5V Bias	11	38	-	18	-	dB
Noise Figure	3V/-0.5V bias	11	38	-	5.5	-	dB
Output IP3	3V/-0.5V, -20 dBm Input Power	11	38	-	31	-	dBm
Output P1dB	3V/-0.5V bias	11	38	-	18	-	dBm
Output Power [4]	3V/-0.5V bias	11	15	-	18	-	dBm
Output Power [5]	3V/-0.5V bias	30	38	-	16	-	dBm
Output Power [6]	3V/-0.5V bias	15	30	17	20	-	dBm
Output Return Loss	3V/-0.5V Bias	11	38	-	12	-	dB
Reverse Isolation	3V/-0.5V Bias	11	38	-	60	-	dB
Small Signal Gain	3V/-0.5V bias	15	30	17	20	-	dB
Small Signal Gain	3V/-0.5V bias	11	15	-	18	-	dB
Small Signal Gain	3V/-0.5V bias	30	38	-	14	-	dB

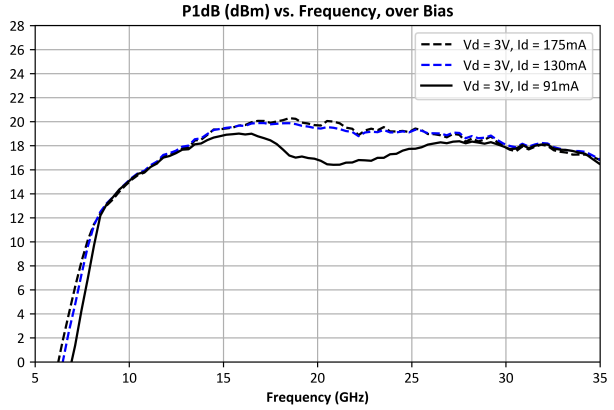
[1][2][3] Bias conditions tested with no RF input power. Bias conditions presented as Vd/Vg.
[4][5][6] Saturated Output Power specification defined using the AMM-7199UC.

Typical Performance Plots

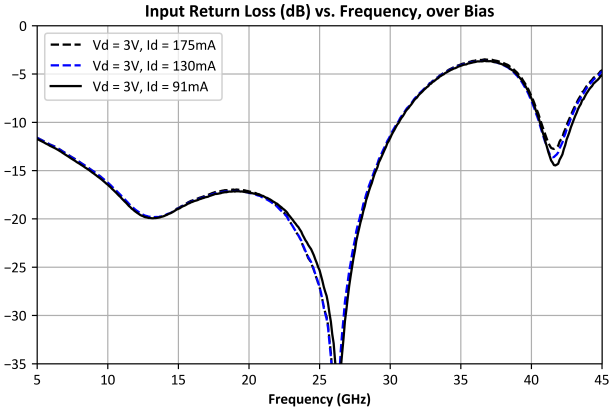
Small Signal Gain (dB) vs. Frequency, over Bias



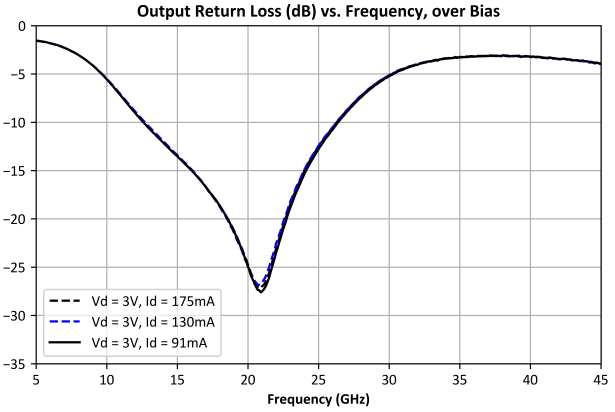
P1dB (dBm) vs. Frequency, over Bias



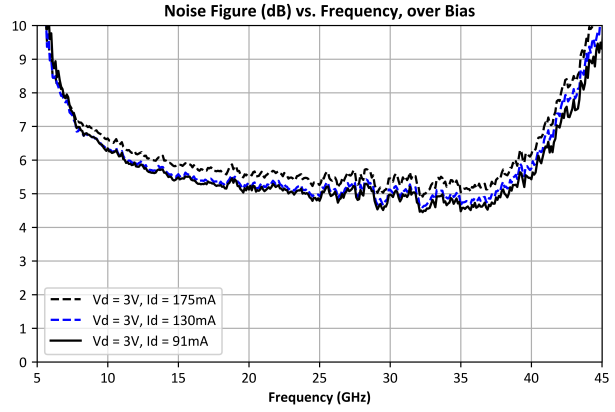
Input Return Loss (dB) vs. Frequency, over Bias



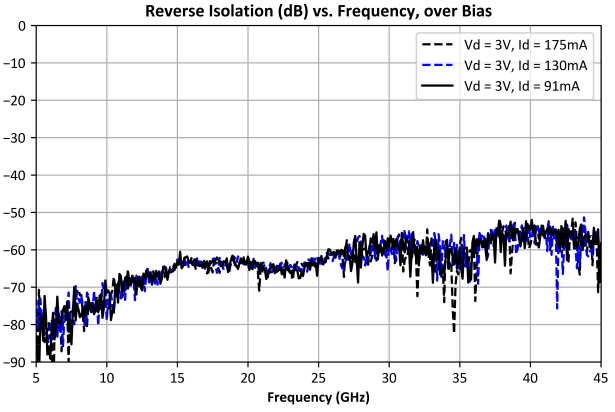
Output Return Loss (dB) vs. Frequency, over Bias



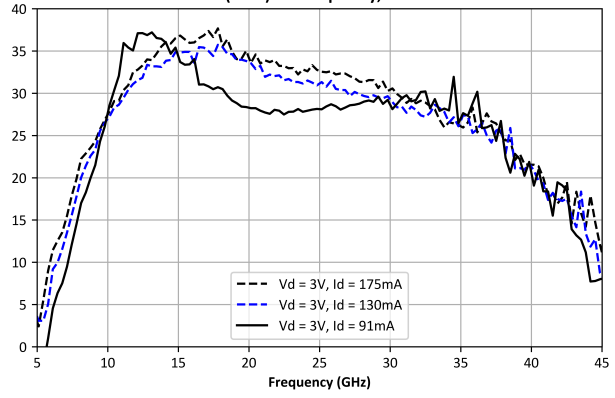
Noise Figure (dB) vs. Frequency, over Bias



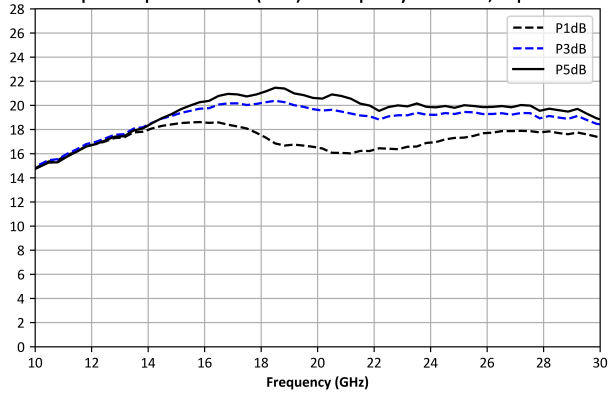
Reverse Isolation (dB) vs. Frequency, over Bias

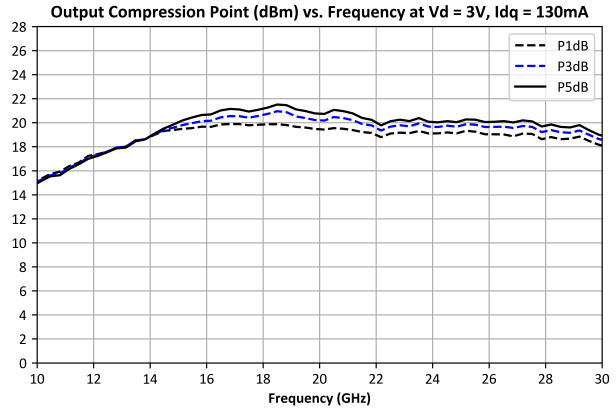


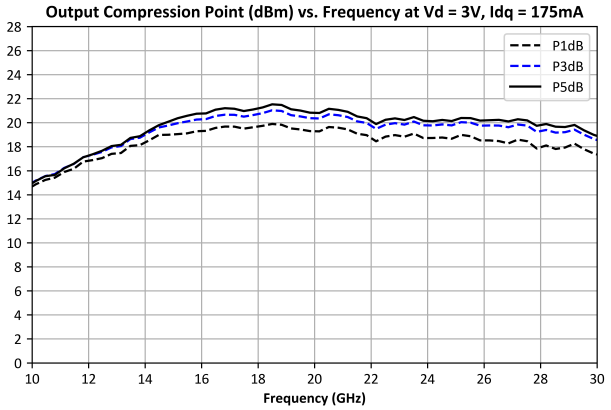
OIP3 (dBm) vs. Frequency, over Bias

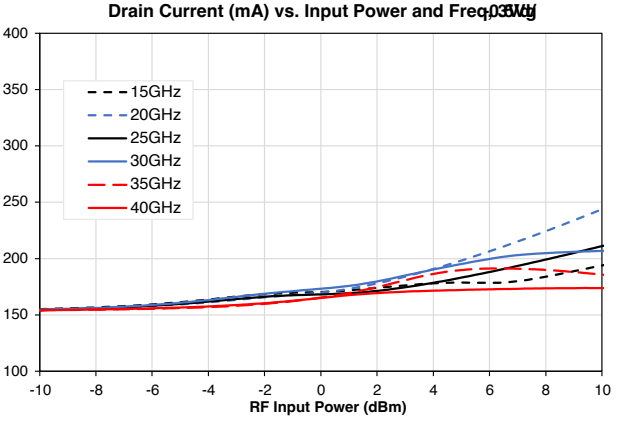


Output Compression Point (dBm) vs. Frequency at Vd = 3V, Idq = 91mA





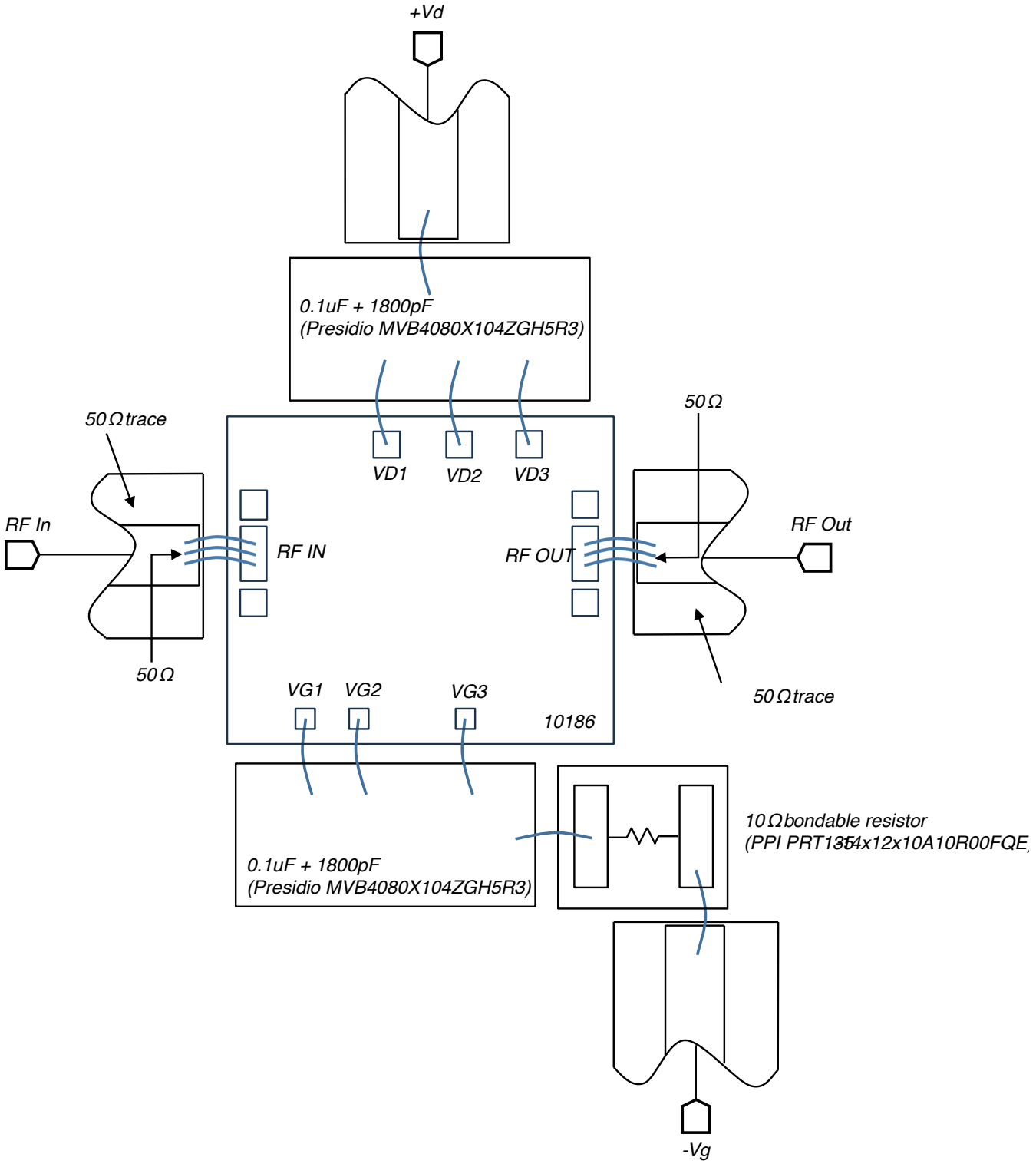




Application Information

Below is the recommended application circuit for the AMM-7199ACH. This application circuit is used for the performance plots shown in this datasheet. However, each PCB layout and environment are different which may require minor modifications of the biasing network. Please contact support@markimicrowave.com for more information.

Application Circuit



Application Circuit Description

Constant Drain Current vs. Constant Gate Voltage Operation

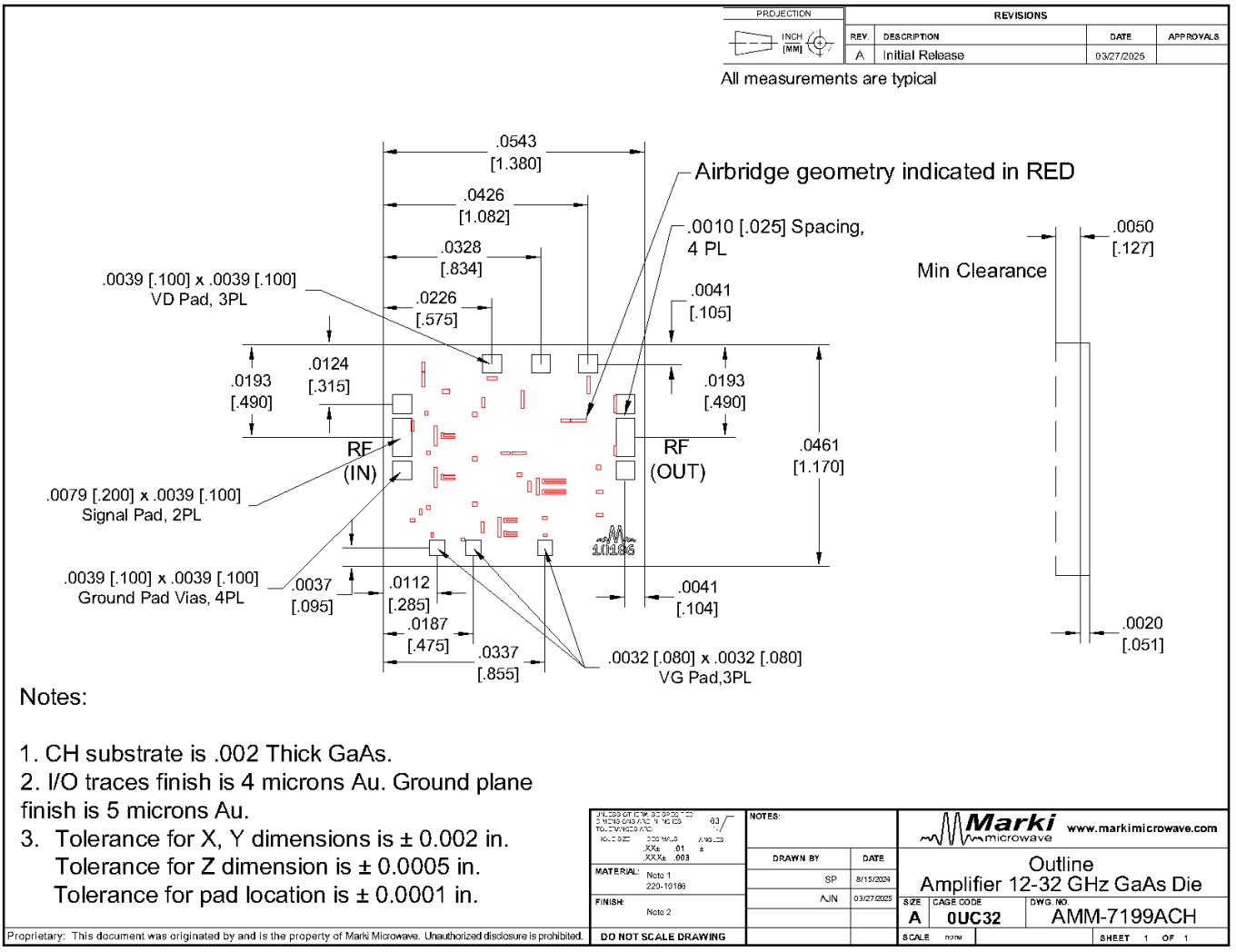
The AMM-7199 pHEMT amplifier can be biased with a constant gate and drain voltage, or with a constant drain current by regulating the gate voltage. Using a constant gate and drain voltage reduces circuit complexity but has variable current consumption during operation. However, regulating the gate voltage using feedback circuitry which controls the drain current to a constant value minimizes unit-to-unit variation in gain, output power, and compression points.

Under small signal excitation at a fixed temperature, these two approaches are equivalent because the current draw versus frequency is relatively constant in small signal. However, they will diverge in large signal conditions, where the drain current is affected the input signal's frequency and power. The output power in saturation is relatively unchanged, as it is more strongly dependent on the drain voltage. However, output referred 1dB compression point will decrease by 2-3dB when operated with a constant drain current.

Mechanical Data

Outline Drawing

Download : Outline 2D Drawing



Notes:

1. CH substrate is .002 Thick GaAs.
2. I/O traces finish is 4 microns Au. Ground plane finish is 5 microns Au.
3. Tolerance for X, Y dimensions is ± 0.002 in.
Tolerance for Z dimension is ± 0.0005 in.
Tolerance for pad location is ± 0.0001 in.

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