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Sales & Customer Support: sales@markimicrowave.com
Tech Support: support@markimicrowave.com

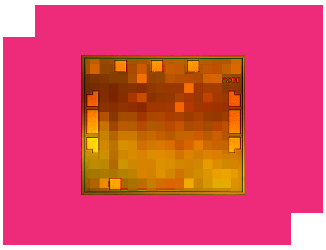
AMM-7200CH

12 GHz – 46 GHz GaAs Driver Amplifier

DEVICE OVERVIEW

General Description

The AMM-7200 is a general-purpose broadband MMIC driver amplifier that provides +21 dBm output power suitable for driving a Marki H or L diode mixer at 12-46 GHz and S diode mixer from 14 40 GHz. The amplifier also has excellent return losses and a small die size which allows it to be used in a variety of applications. It has built in DC-blocking capacitors on the input and output.



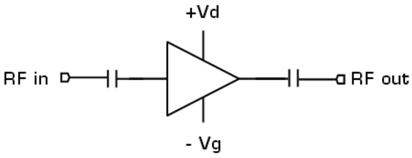
Features

- +21 dBm Output Power
- 18 dB gain
- Excellent Return Losses
- Small Die size

Applications

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

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Connectors	Green Status	Product Lifecycle	Export Classification	Recommended Replacement
AMM-7200UC-K	12 GHz – 40 GHz GaAs Driver Amplifier	UC	-	RoHS RoHS	Released	EAR99	-
AMM-7200UC	12 GHz – 46 GHz GaAs Driver Amplifier	UC	Standard	REACH RoHS	Released	EAR99	-
AMM-7200CH	12 GHz – 46 GHz GaAs Driver Amplifier	CH	-	REACH RoHS	Not Recommended for New Design	3A001.b.2.d	-

Table Of Contents

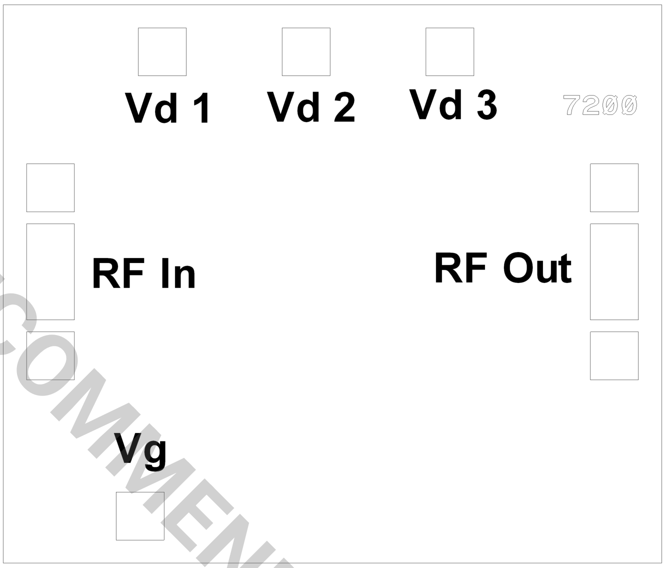
Revision History

Revision Code	Revision Date	Comment
-	2021-05-01	Datasheet Initial Release
A	2025-04-02	Outline Drawing updated
B	2026-02-13	MTTF Table Added.

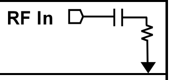
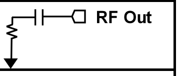
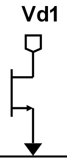
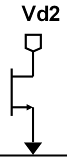
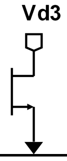
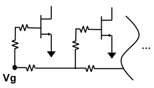
Port Configuration and Functions

Port Diagram

A port diagram of the AMM-7200CH is shown below.



Port Functions

Port	Function	Description	DC Equivalent Circuit
GND	Ground	Bottom side must be connected to a DC/RF ground potential 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 Port 1	Pad Vd 1 supplies drain voltage to the first stage of the 3-stage amplifier IC. Apply gate voltage Vg before applying drain voltage.	
Vd2	Drain Supply Port 2	Pad Vd 2 supplies drain voltage to the second stage of the 3-stage amplifier IC. Apply gate voltage Vg before applying drain voltage.	
Vd3	Drain Supply Port 3	Pad Vd 3 supplies drain voltage to the third stage of the 3-stage amplifier IC. Apply gate voltage Vg before applying drain voltage.	
Vg	Gate Bias Voltage Pad	The Vg pad is connected resistively on chip. The user should apply between 0.4V and -0.6V to Vg pad before applying positive DC voltage to any Vd port. Lower (more negative) voltages on a Vg pad will result in lower drain current and lower small signal gain.	

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]	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	ºC/W

[1] Derates by 11 mW/ ˚C above 85 ˚C case temperature.

FIT and MTTF Table

T (°C)	λ (TIF)	MTTF (hr)	MTTF (yr)
105	2,441.45	4.10E+05	47
85	310.48	3.22E+06	368
55	8.79	1.14E+08	12,992
25	0.12	8.24E+09	941,063

Package Information

Parameter	Details	Rating
Dimensions	-	1.37 x 1.16 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. Power Supply DC current should be modified by changing bias voltage Vg to maintain junction temperature within MTTF target for given operating conditions.

Parameter	Min	Nominal	Max	Unit
Ambient Temperature	-40	25	85	˚C
Power Supply DC Voltage (Vd)	2.5	3	4	V
Power Supply DC Current (Id) (No RF Input)	115	180	300	mA
Negative Bias Voltage (Vg)	-0.6	-0.5	-0.4	V
Input Power for Saturation	6	9	12	dBm

Sequencing Requirements

Turn-on Procedure:
1. Apply negative bias to Vg
2. Apply Vd

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

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

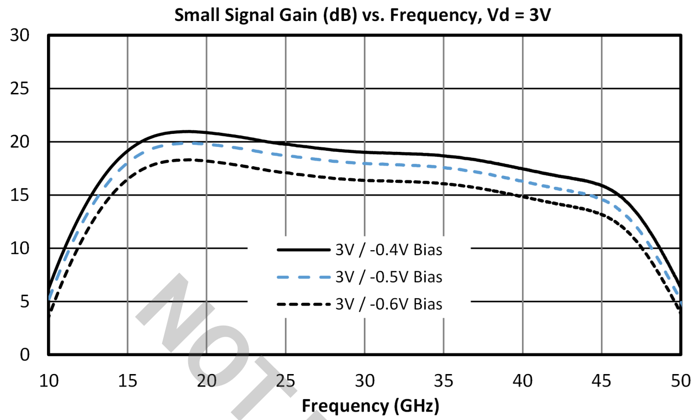
Electrical Specifications

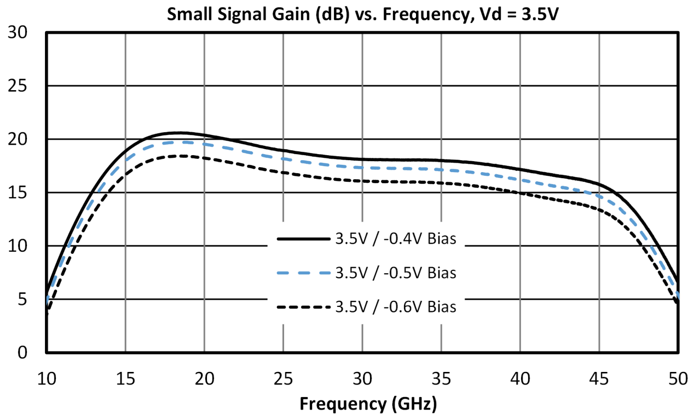
The electrical specifications apply at TA=+25°C in a 50Ω system. Min and Max limits apply only to our connectorized units and are guaranteed at TA=+25°C. Die are 100% DC tested and RF tested on a per lot basis

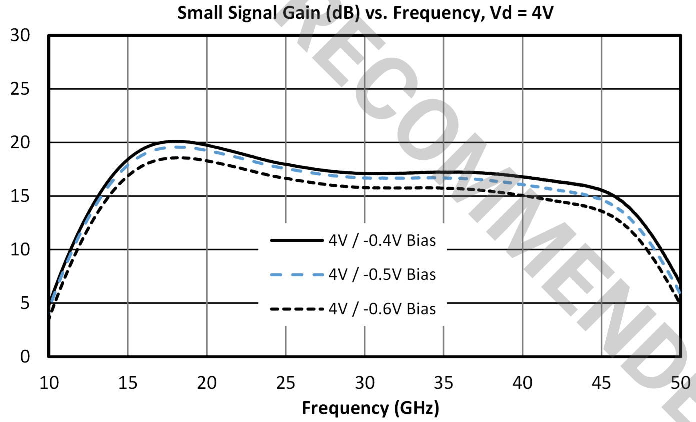
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Current Consumption [1]	3V/-0.4V	-	-	-	230	-	mA
Current Consumption [2]	3V/-0.5V	-	-	-	180	-	mA
Current Consumption [3]	3V/-0.6V	-	-	-	130	-	mA
Input IP3	3V/-0.5V, -20 dBm Input Power	12	46	-	12	-	dBm
Input Power for Saturation	3V/-0.5V bias	12	46	-	9	-	dBm
Input Return Loss	3V/-0.5V Bias	12	46	-	19	-	dB
Noise Figure	3V/-0.5V bias	12	46	-	6.3	-	dB
Output IP3	3V/-0.5V, -20 dBm Input Power	12	46	-	29	-	dBm
Output P1dB	3V/-0.5V bias	12	46	-	19	-	dBm
Output Return Loss	3V/-0.5V Bias	12	46	-	18	-	dB
Reverse Isolation	3V/-0.5V Bias	12	46	-	52	-	dB
Saturated Output Power [4]	3V/-0.5V bias	35	46	-	19.5	-	dBm
Saturated Output Power [5]	3V/-0.5V bias	18	35	17	21.5	-	dBm
Saturated Output Power [6]	3V/-0.5V bias	12	18	-	19	-	dBm
Small Signal Gain	3V/-0.5V bias	35	46	-	15	-	dB
Small Signal Gain	3V/-0.5V bias	18	35	14	18	-	dB
Small Signal Gain	3V/-0.5V bias	12	18	-	17	-	dB

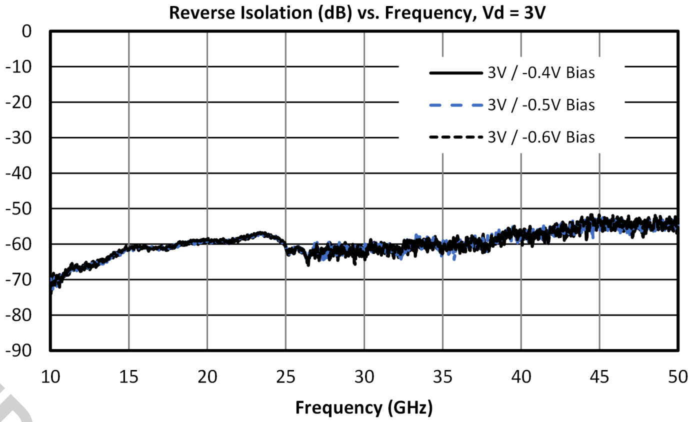
[1][2][3] Bias conditions tested with no RF input power. Bias conditions presented as Vd/Vg.
[4][5][6] Saturated Output Power specification defined using the AMM-7200UC P5dB compression curve shown in section.

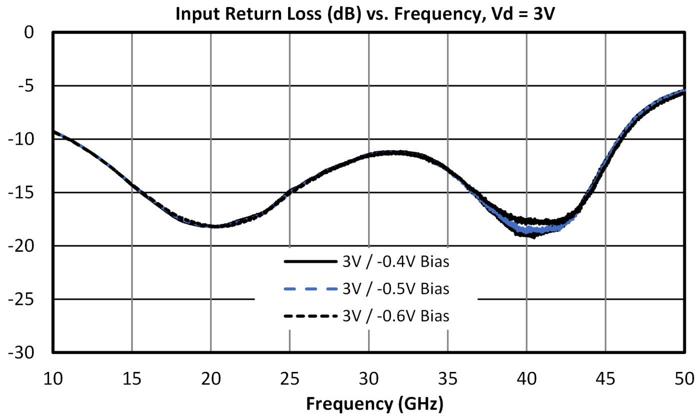
Typical Performance Plots

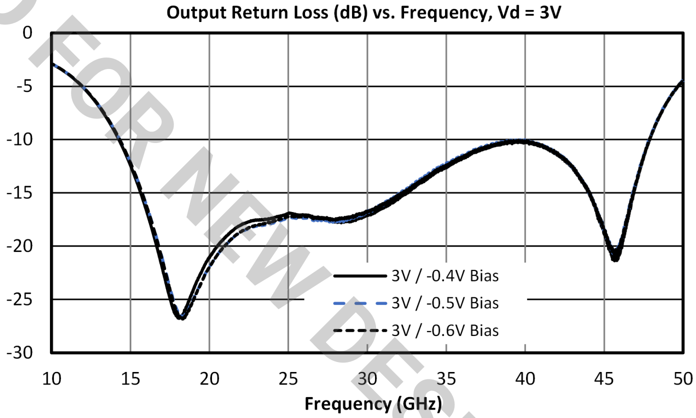

Small Signal Gain (dB) vs. Frequency, Vd = 3V


Small Signal Gain (dB) vs. Frequency, Vd = 3.5V


Small Signal Gain (dB) vs. Frequency, Vd = 4V

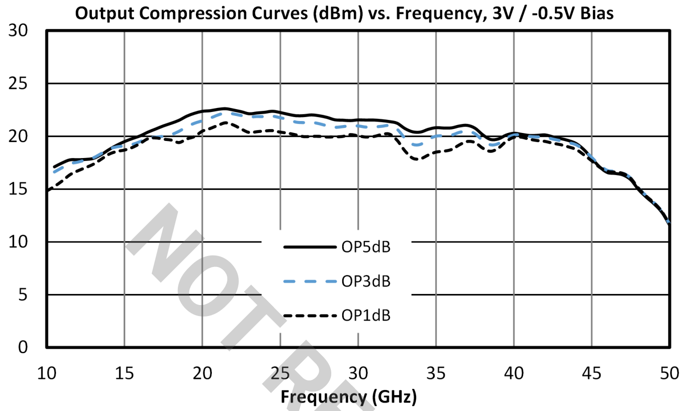

Reverse Isolation (dB) vs. Frequency, Vd = 3V

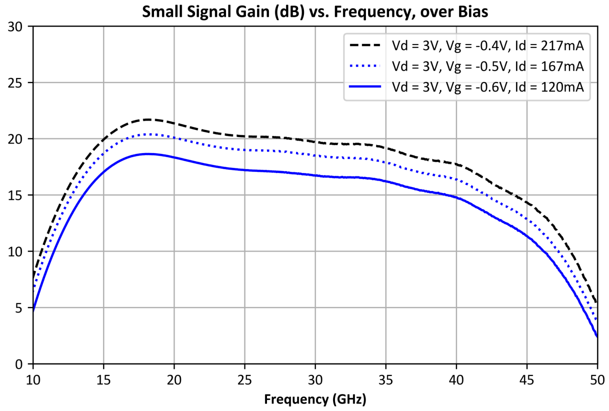

Input Return Loss (dB) vs. Frequency, Vd = 3V

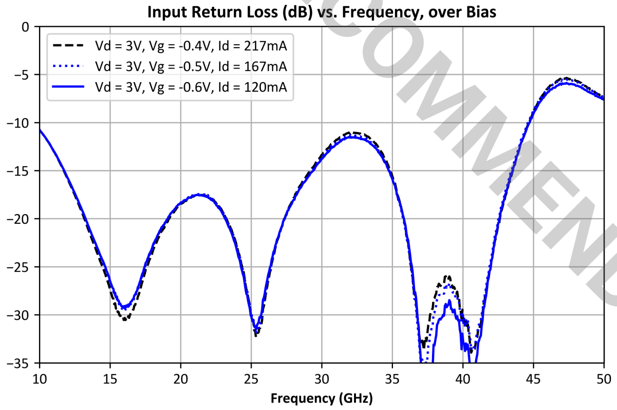

Output Return Loss (dB) vs. Frequency, Vd = 3V

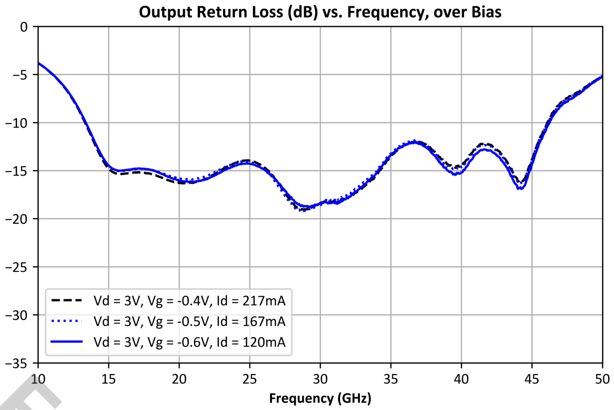
AMM-7200UC-K - AMM-7200UC Typical Performance Plots

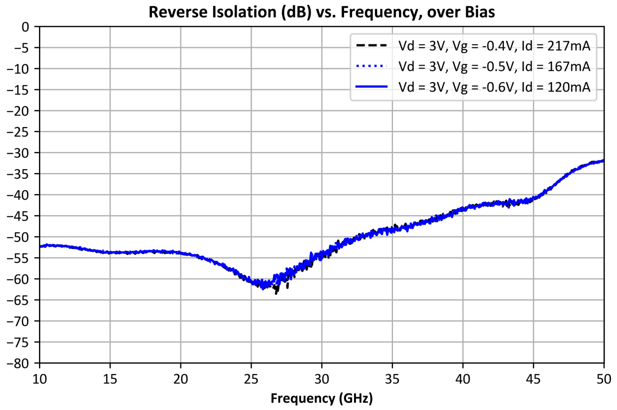
Performance plots for the connectorized module are shown for measurements where directly probed measurements of the die are unavailable. Note that the following measurements include losses from connectors and microstrip traces.

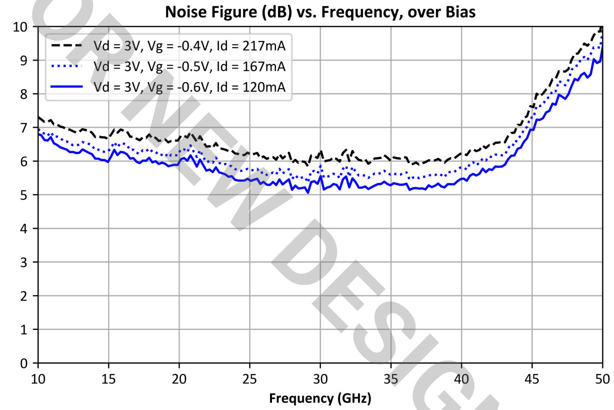


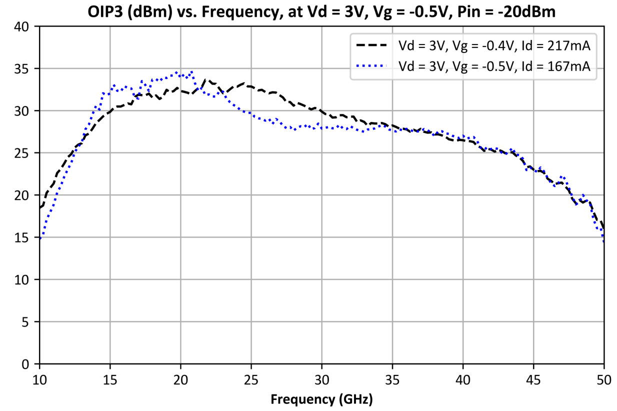


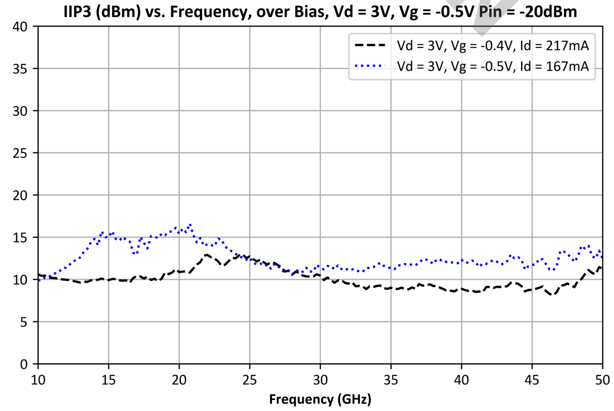


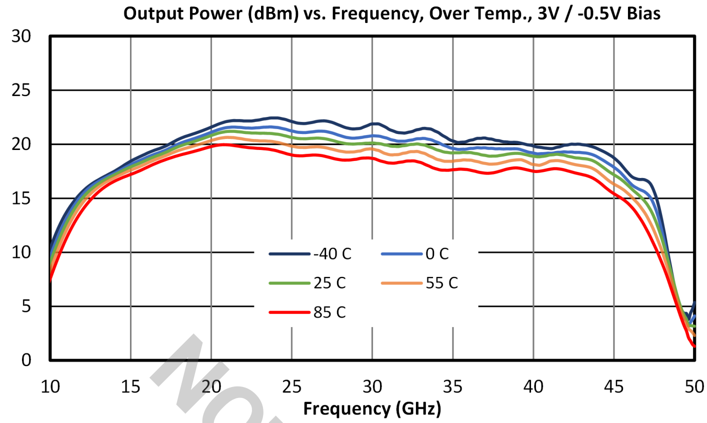


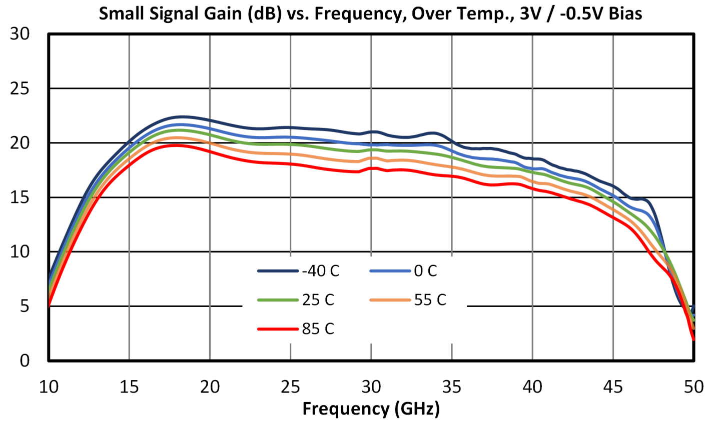


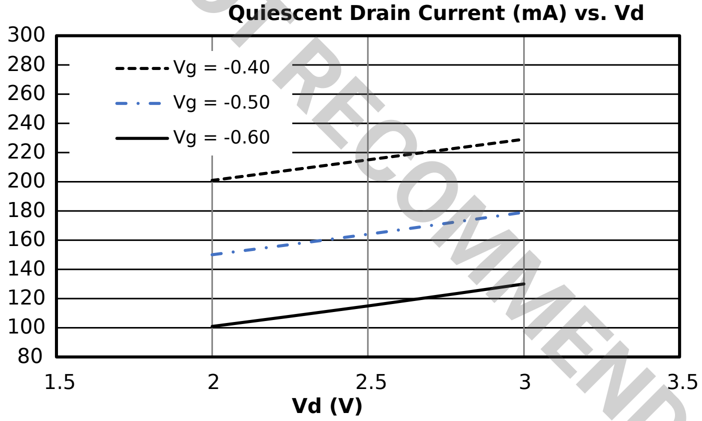


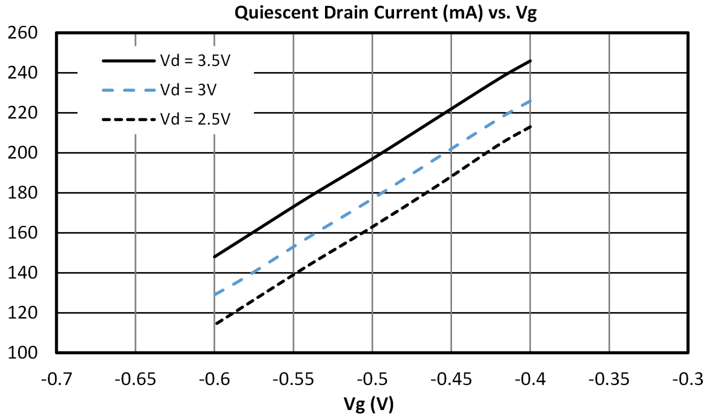


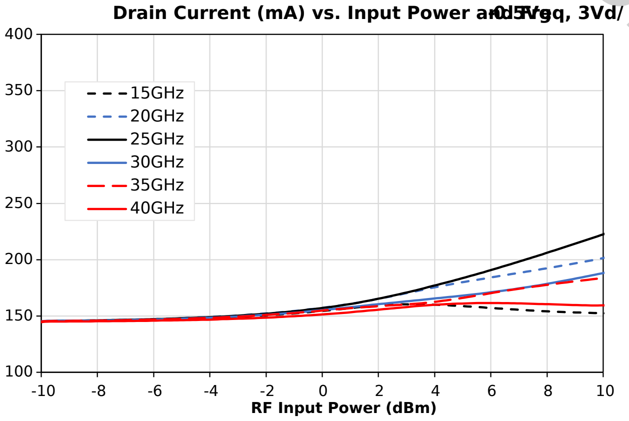



Output Power (dBm) vs. Frequency, Over Temp., 3V / -0.5V Bias
30
25
20
15
10
5
0
10
15
20
25
30
35
40
45
50
Frequency (GHz)
-40 C
0 C
25 C
55 C
85 C


Small Signal Gain (dB) vs. Frequency, Over Temp., 3V / -0.5V Bias
30
25
20
15
10
5
0
10
15
20
25
30
35
40
45
50
Frequency (GHz)
-40 C
0 C
25 C
55 C
85 C


Quiescent Drain Current (mA) vs. Vd
300
280
260
240
220
200
180
160
140
120
100
80
1.5
2
2.5
3
3.5
Vd (V)
Vg = -0.40
Vg = -0.50
Vg = -0.60

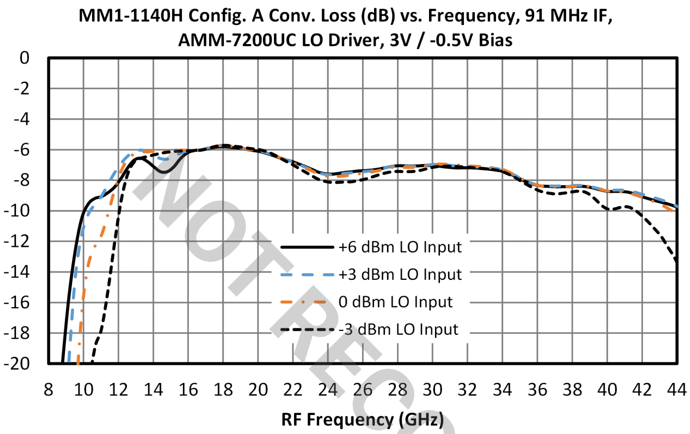

Quiescent Drain Current (mA) vs. Vg
260
240
220
200
180
160
140
120
100
-0.7
-0.65
-0.6
-0.55
-0.5
-0.45
-0.4
-0.35
-0.3
Vg (V)
Vd = 3.5V
Vd = 3V
Vd = 2.5V

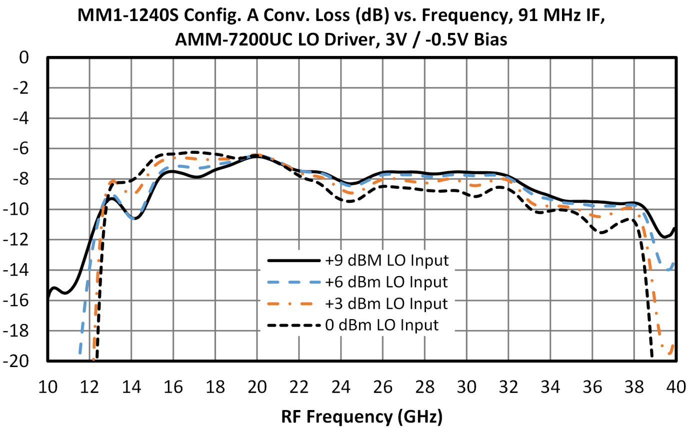

Drain Current (mA) vs. Input Power and Freq, 3Vd/-0.5Vg
400
350
300
250
200
150
100
-10
-8
-6
-4
-2
0
2
4
6
8
10
RF Input Power (dBm)
15GHz
20GHz
25GHz
30GHz
35GHz
40GHz

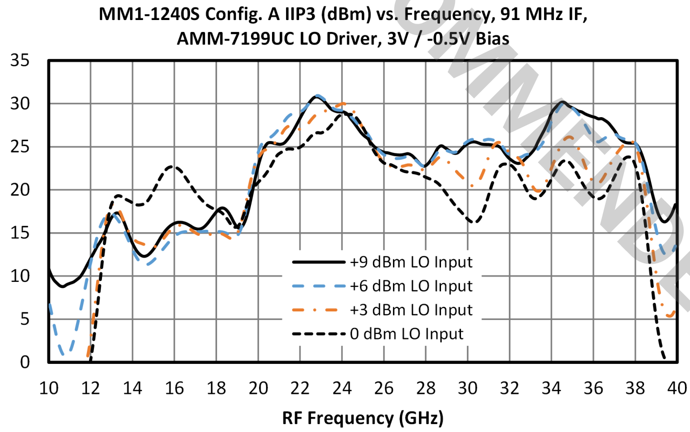
AMM-7200UC-K - Typical Marki Mixer Performance Plots with AMM-7200UC LO Driver

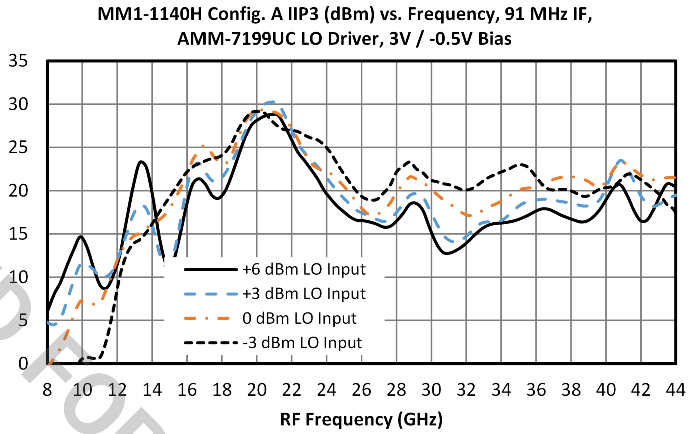
LO Input Powers specified as the input power into the AMM-7200UC LO driver

Performance plots for the connectorized module are shown for measurements where directly probed measurements of the die are unavailable. Note that the following measurements include losses from connectors and microstrip traces.


MM1-1140H Config. A Conv. Loss (dB) vs. Frequency, 91 MHz IF, AMM-7200UC LO Driver, 3V / -0.5V Bias

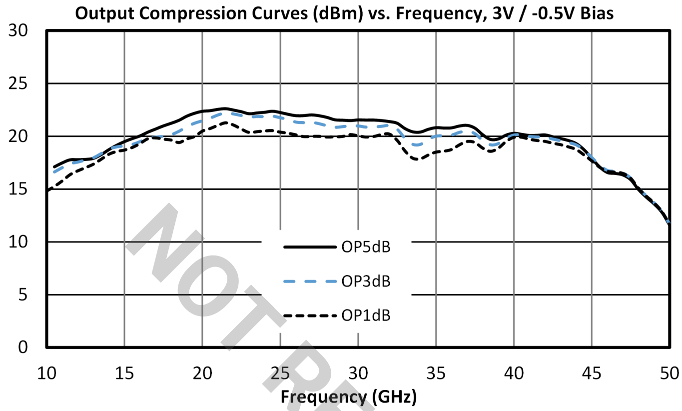

MM1-1240S Config. A Conv. Loss (dB) vs. Frequency, 91 MHz IF, AMM-7200UC LO Driver, 3V / -0.5V Bias

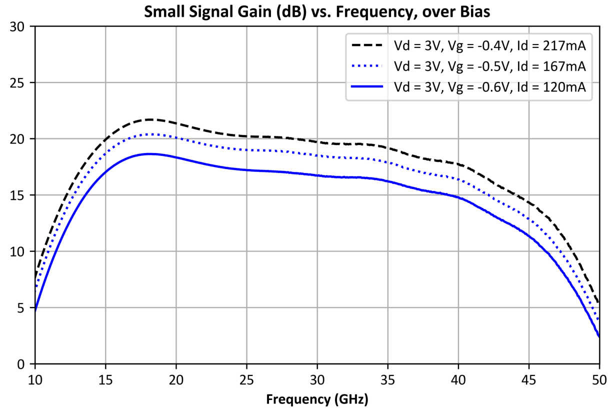

MM1-1240S Config. A IIP3 (dBm) vs. Frequency, 91 MHz IF, AMM-7199UC LO Driver, 3V / -0.5V Bias

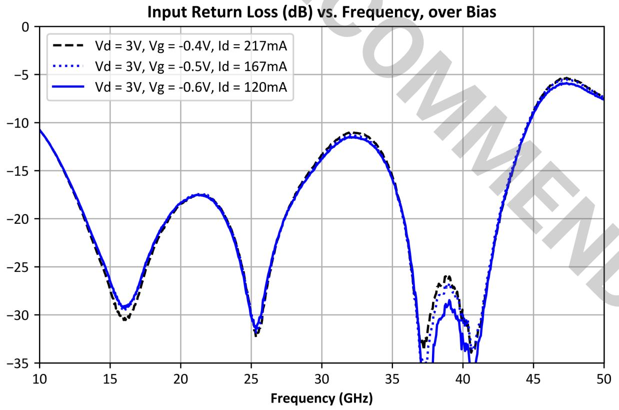

MM1-1140H Config. A IIP3 (dBm) vs. Frequency, 91 MHz IF, AMM-7199UC LO Driver, 3V / -0.5V Bias

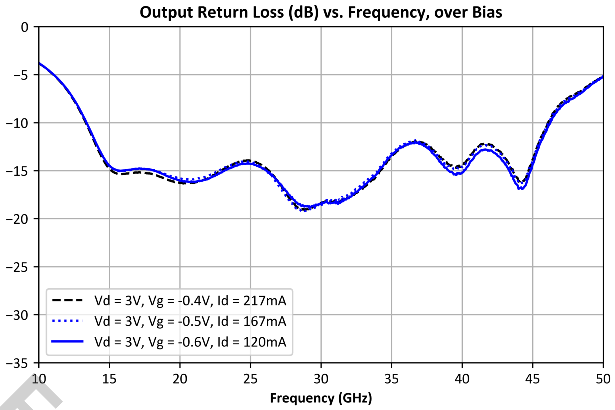
AMM-7200UC - AMM-7200UC Typical Performance Plots

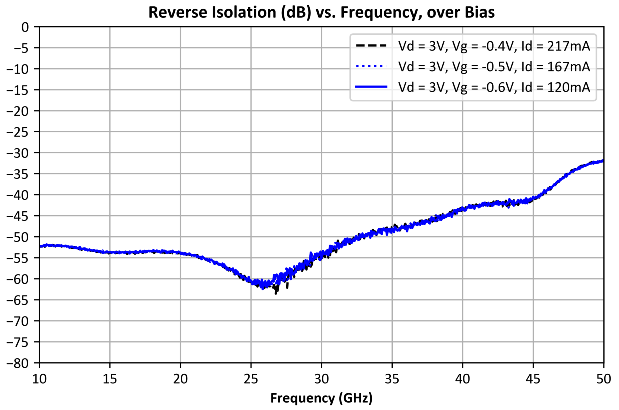
Performance plots for the connectorized module are shown for measurements where directly probed measurements of the die are unavailable. Note that the following measurements include losses from connectors and microstrip traces.

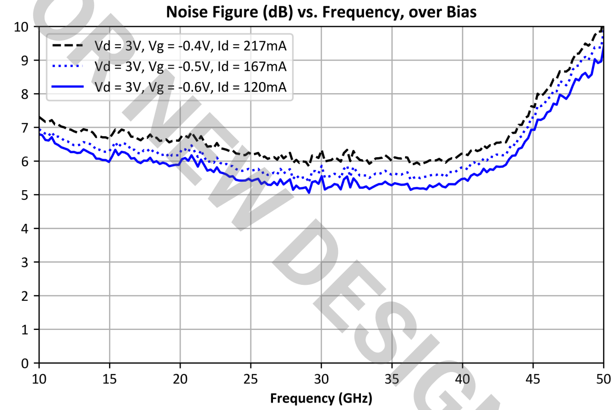

Output Compression Curves (dBm) vs. Frequency, 3V / -0.5V Bias

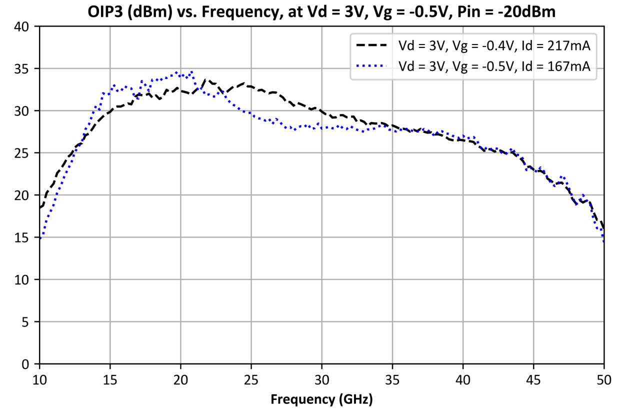

Small Signal Gain (dB) vs. Frequency, over Bias

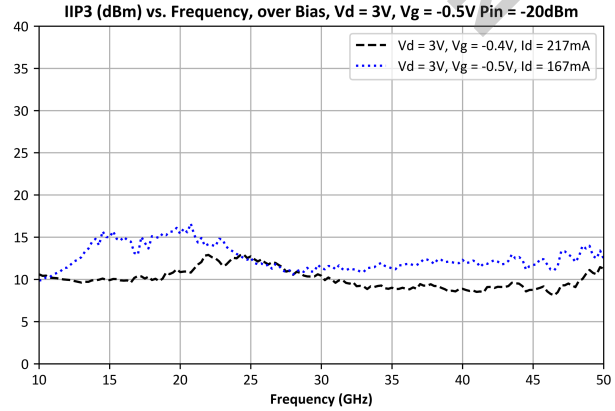

Input Return Loss (dB) vs. Frequency, over Bias

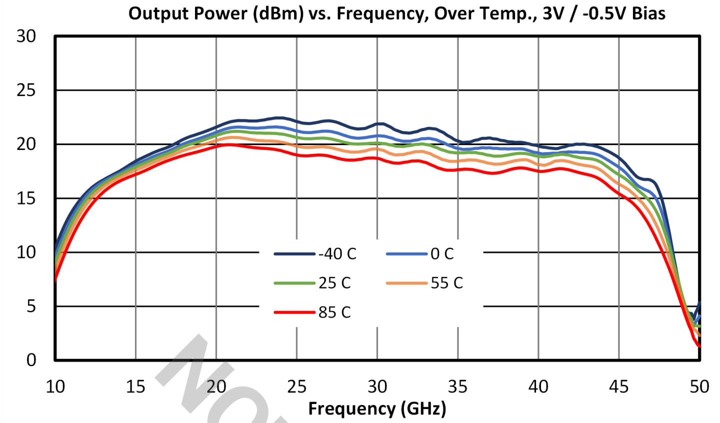

Output Return Loss (dB) vs. Frequency, over Bias

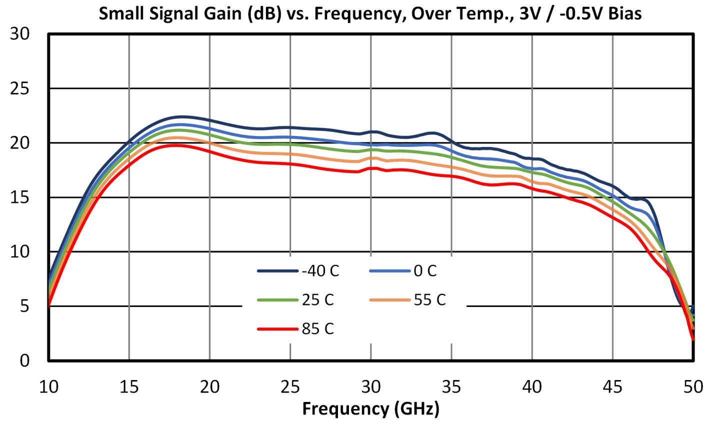

Reverse Isolation (dB) vs. Frequency, over Bias

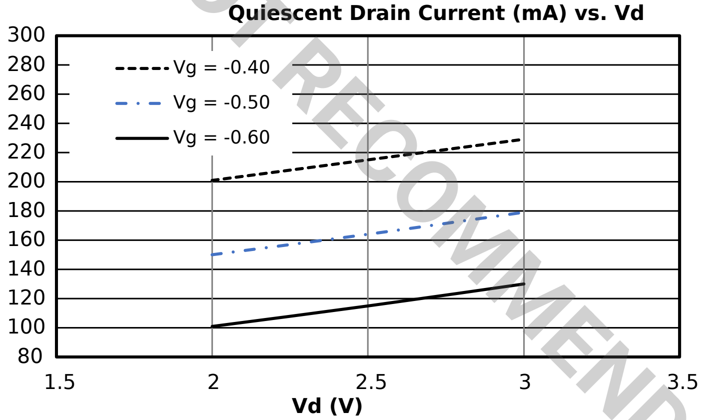

Noise Figure (dB) vs. Frequency, over Bias

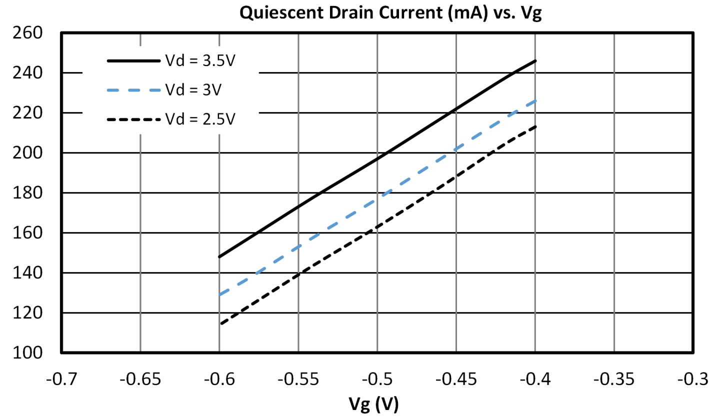

OIP3 (dBm) vs. Frequency, at Vd = 3V, Vg = -0.5V, Pin = -20dBm

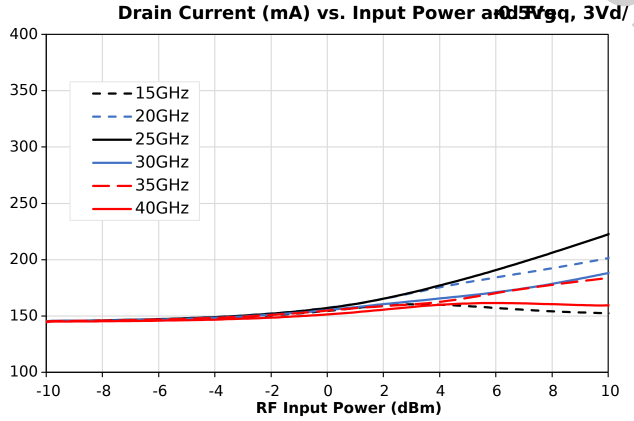

IIP3 (dBm) vs. Frequency, over Bias, Vd = 3V, Vg = -0.5V Pin = -20dBm


Output Power (dBm) vs. Frequency, Over Temp., 3V / -0.5V Bias


Small Signal Gain (dB) vs. Frequency, Over Temp., 3V / -0.5V Bias


Quiescent Drain Current (mA) vs. Vd

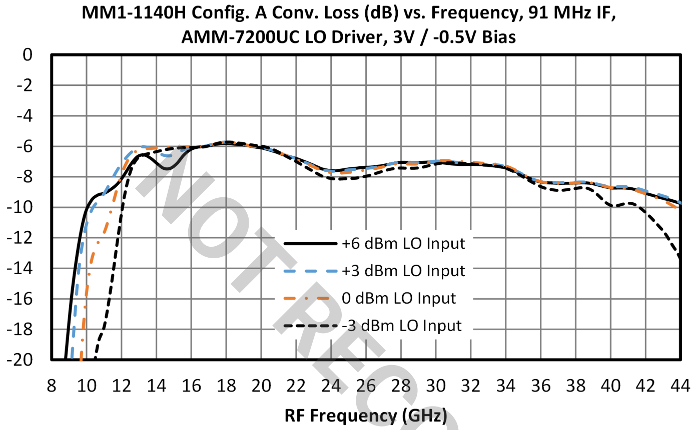

Quiescent Drain Current (mA) vs. Vg

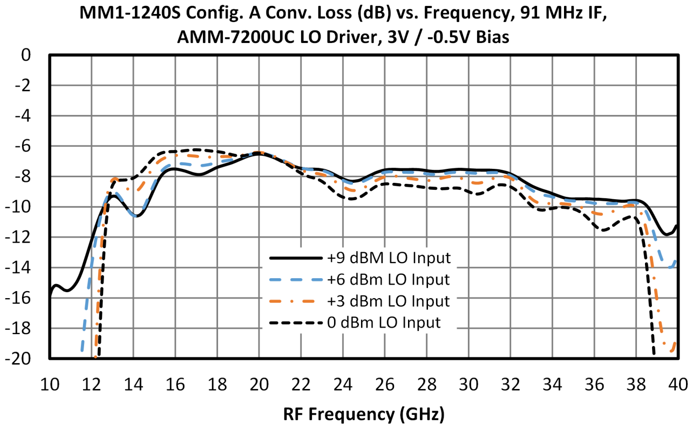

Drain Current (mA) vs. Input Power and Freq, 3Vd/-0.5Vg

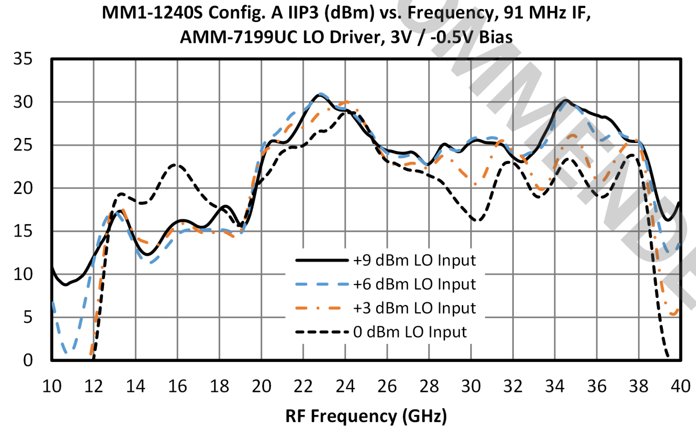
AMM-7200UC - Typical Marki Mixer Performance Plots with AMM-7200UC LO Driver

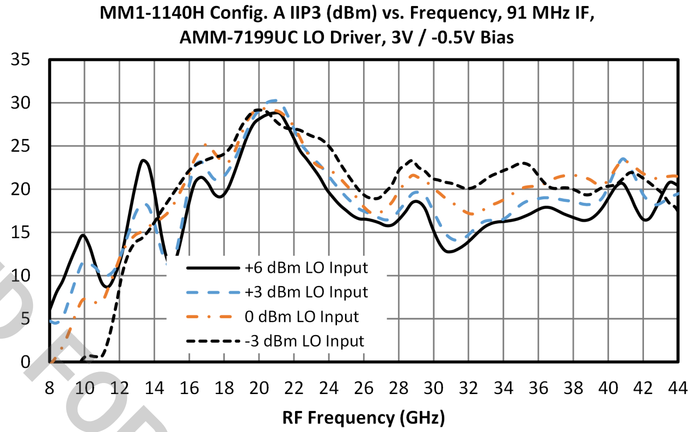
LO Input Powers specified as the input power into the AMM-7200UC LO driver

Performance plots for the connectorized module are shown for measurements where directly probed measurements of the die are unavailable. Note that the following measurements include losses from connectors and microstrip traces.


MM1-1140H Config. A Conv. Loss (dB) vs. Frequency, 91 MHz IF, AMM-7200UC LO Driver, 3V / -0.5V Bias


MM1-1240S Config. A Conv. Loss (dB) vs. Frequency, 91 MHz IF, AMM-7200UC LO Driver, 3V / -0.5V Bias

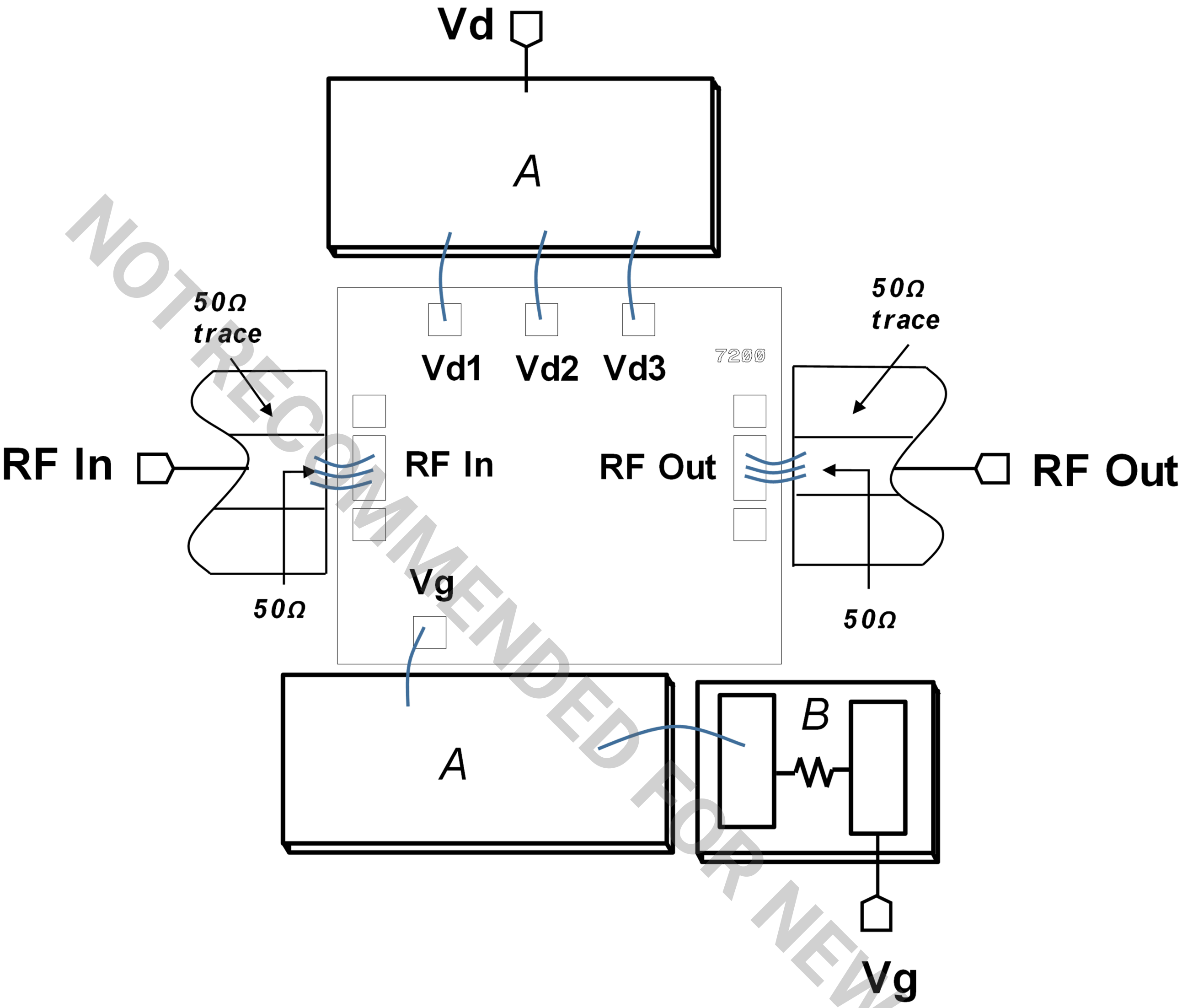

MM1-1240S Config. A IIP3 (dBm) vs. Frequency, 91 MHz IF, AMM-7199UC LO Driver, 3V / -0.5V Bias


MM1-1140H Config. A IIP3 (dBm) vs. Frequency, 91 MHz IF, AMM-7199UC LO Driver, 3V / -0.5V Bias

Application Information

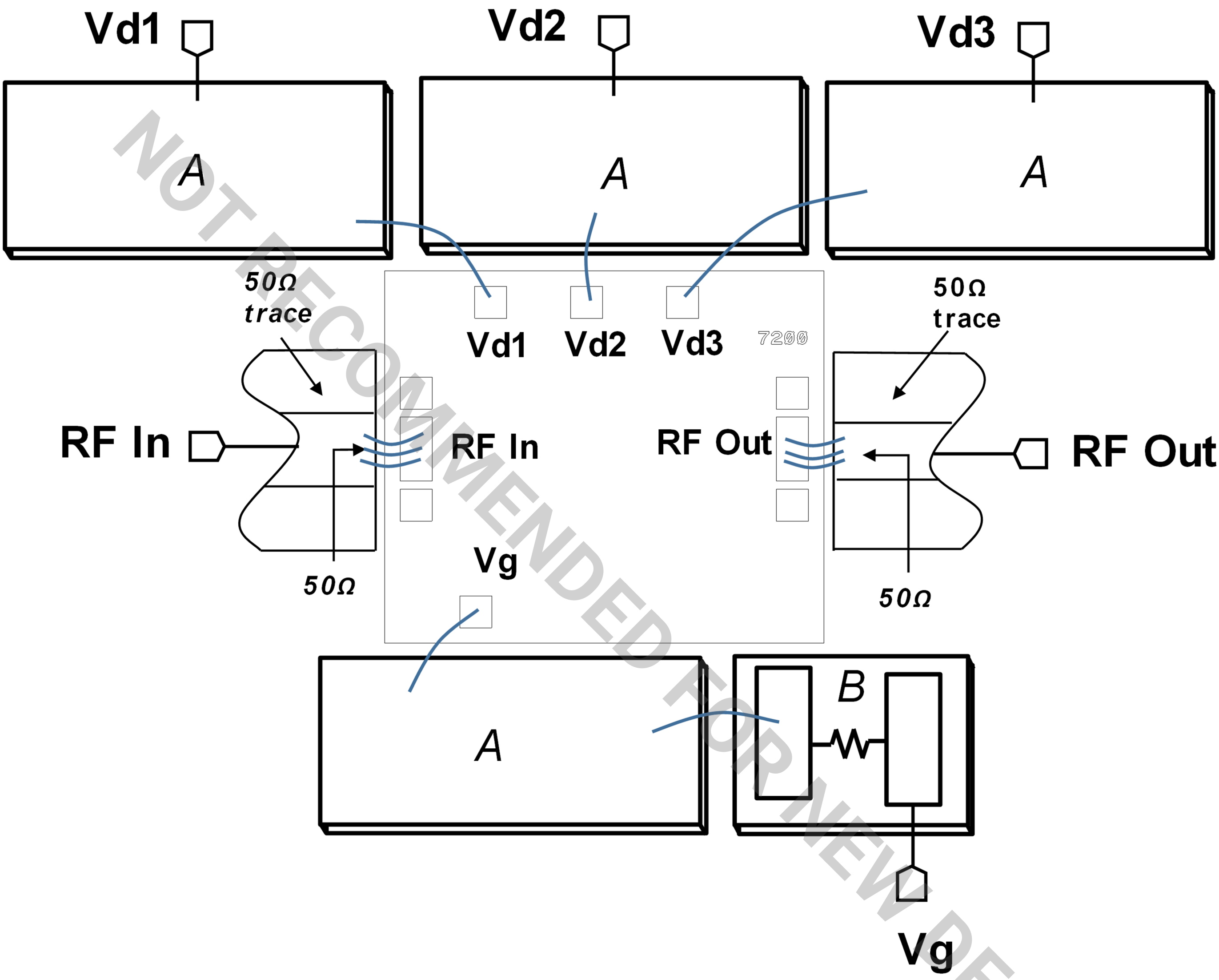
Below are the recommended application circuits for the AMM-7200CH. This application circuit is used for the performance plots shown in this datasheet. However, each PCB layout and environment are different which may require minor modifications of the biasing network.

Application Circuit



Application Circuit Description

One can also choose to break out Vd1, Vd2, and Vd3 to separate power supply lines to increase gain control and further strengthen amplifier stability.



Designator	Description	Sample Part Number
A	Presidio 0.1 µF + 1800 pF Capacitor	MVB4080X104ZGH5R3
B	PPI 10Ω Wire-bondable series resistor	PRT135-14x12x10A10R00FQE

Constant Drain Current vs. Constant Gate Voltage Operation

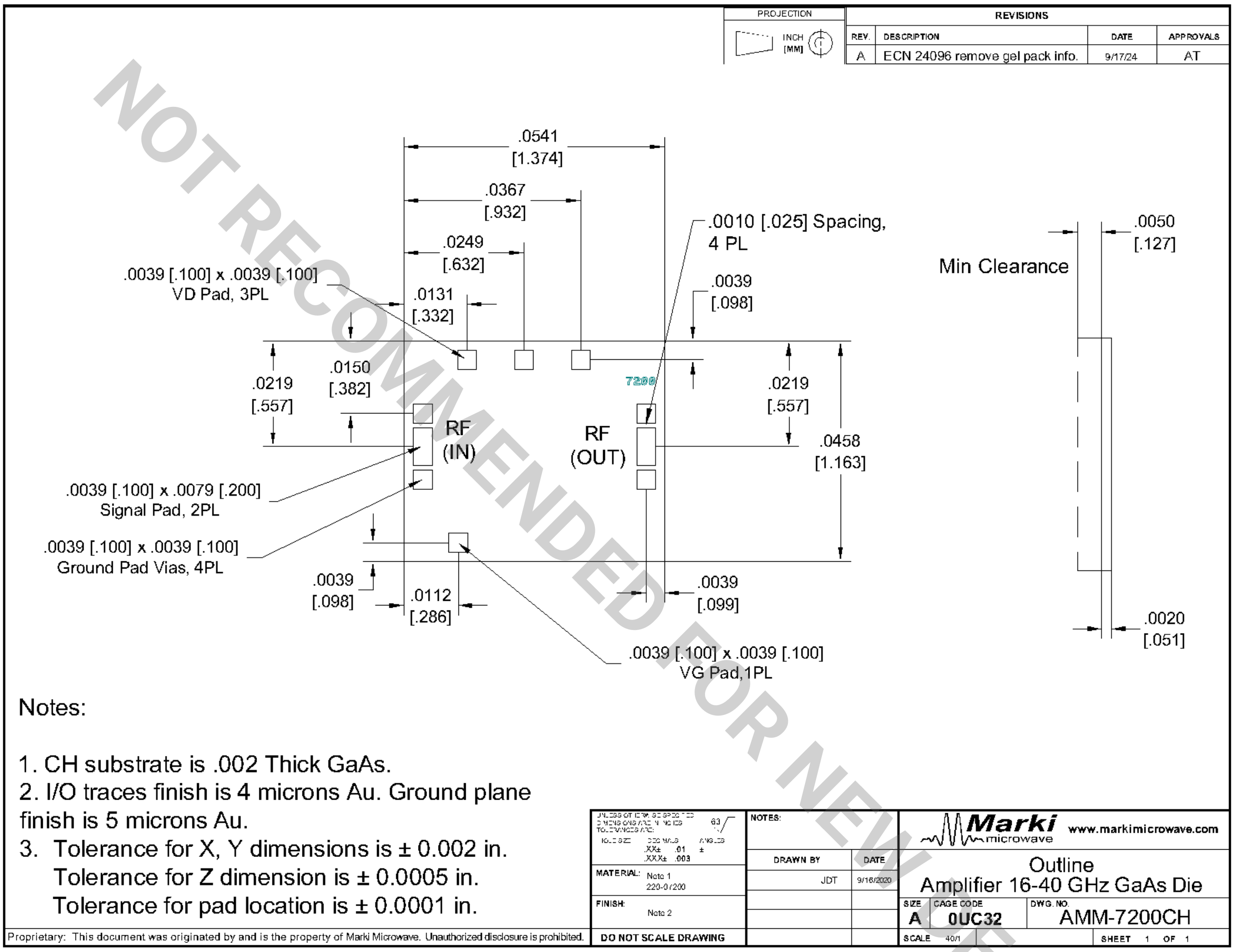
The AMM-7200 pHEMT amplifier can be biased with a constant gate and drain voltage, or with a constant drain current by regulating the gate voltage. Using a constant gate and drain voltage reduces circuit complexity, but has variable current consumption during operation. However, regulating the gate voltage 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



REVISIONS			
REV.	DESCRIPTION	DATE	APPROVALS
A	ECN 24096 remove gel pack info.	9/17/24	AT

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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UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
HOLE SIZE DECIMALS ANGLES
.XX± .01 ±
.XXX± .003
63

MATERIAL: Note 1
220-0/200

FINISH: Note 2

DO NOT SCALE DRAWING

NOTES:

DRAWN BY	DATE
JDT	9/16/2020

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Outline
Amplifier 16-40 GHz GaAs Die

SIZE A
CAGE CODE 0UC32
DWG. NO. AMM-7200CH
SCALE 40/1
SHEET 1 OF 1

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