Sales: 408-778-9952 | General: 408-778-4200 | Fax: 408-778-4300
Sales & Customer Support: sales@markimicrowave.com
Tech Support: support@markimicrowave.com

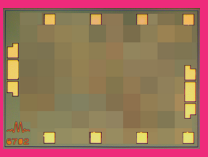
AMM-6702CH

20-55 GHz GaAs LO Driver Amplifier

DEVICE OVERVIEW

General Description

The AMM-6702 is a broadband MMIC LO buffer amplifier that efficiently provides high gain and output power over a 20-55 GHz frequency band. It is designed to provide a strong, flat output power response when driven with an input power at 0 dBm. It has built-in DC blocking capacitors on the input and output.



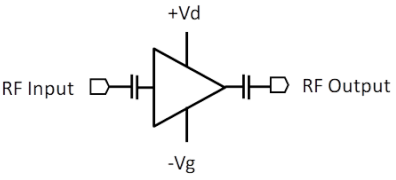
Features

- High 25+ dB gain
- Broadband performance
- +20 dBm output power
- 20%+ PAE
- 5V Single Supply Voltage Module

Applications

- Radar
- 5G transceivers
- Test and Measurement Equipment
- Optimal LO driver amp for Marki S-diode and H-diode mixers and millimeter-wave multipliers

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Connectors	Green Status	Product Lifecycle	Export Classification
AMM-6702UC5	20-55 GHz GaAs LO Driver Amplifier	UC5	Standard	REACH RoHS	Released	EAR99
AMM-6702UC	20-55 GHz GaAs LO Driver Amplifier	UC	Standard	REACH RoHS	Released	EAR99
AMM-6702CH	20-55 GHz GaAs LO Driver Amplifier	CH	-	REACH RoHS	Released	3A001.b.2.d

Table Of Contents

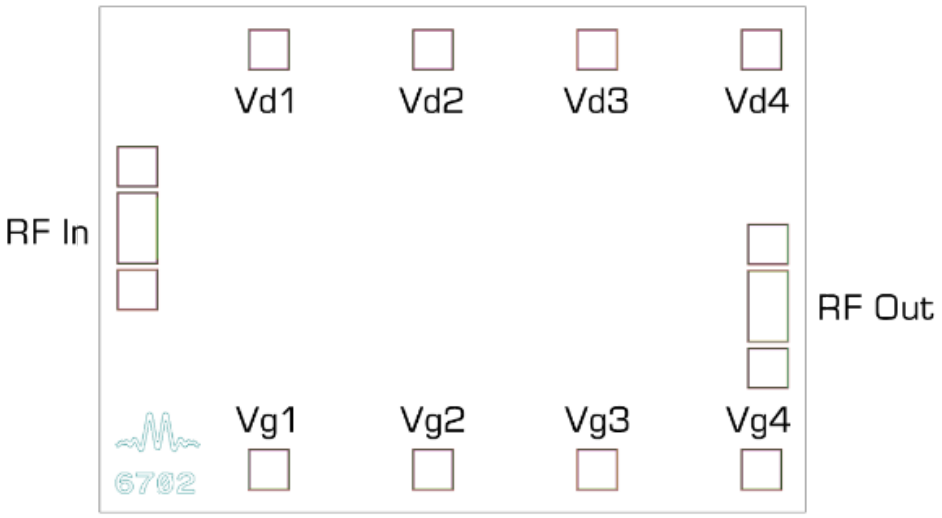
Revision History

Revision Code	Revision Date	Comment
-	2018-10-01	Datasheet Initial Release
A	2019-01-01	AMM-6702UC Release, additional data
B	2019-02-01	Updated Export Classification
C	2019-03-01	Updated Module Production Specs
D	2019-08-01	Updated Module Production Specs
E	2019-09-01	Updated Absolute Maximum Ratings
F	2020-01-01	Added .s2p Files Link
G	2020-02-01	Updated Datasheet Format, Expanded Performance Plots, Expanded Electrical Specs, Added Sequencing Procedure, Added AMM-6702UC5 Package
H	2020-04-01	Updated AMM-6702UC5 Specs and Performance Plots
I	2020-06-01	Corrected AMM-6702UC Outline Drawing to include Ground Screw
J	2020-06-01	Updated Absolute Maximum Ratings
K	2020-07-01	Update AMM-6702UC5 Saturated Output Power Min Spec
L	2020-07-01	Revised Max Operating Temperature
M	2020-09-01	Updated Ground Pin Location on AMM 6702UC5 Module
N	2020-10-01	Updated Thermal Specs, Updated OIP3 Spec
0	2020-11-01	Updated Min Frequency Spec
P	2020-12-01	Updated Electrical Specifications Table
Q	2023-11-02	Updated Continuous Power Dissipation (PDISS) absolute maximum specification to 1W.
R	2023-11-07	Updated thermal resistance and maximum power dissipation, indicating typical use.
S	2024-07-26	Reduced recommended power supply voltage to 3V.
T	2026-02-13	MTTF Table Added.

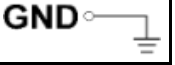
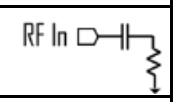
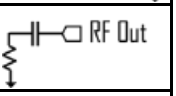
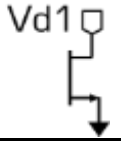
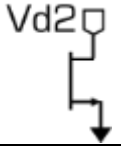
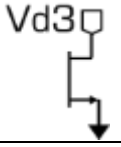
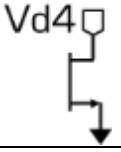
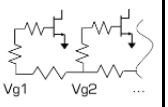
Port Configuration and Functions

Port Diagram

A top-down view of the AMM-6702CH's outline drawing is shown below. The port functions are detailed in section 2.2 of this datasheet.



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 150 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 150 µm pitch.	
Vd1	Drain Supply Port 1	Pad Vd1 supplies drain voltage to the first stage of the 4-stage amplifier IC. Apply gate voltage Vg before applying drain voltage.	
Vd2	Drain Supply Port 2	Pad Vd2 supplies drain voltage to the second stage of the 4-stage amplifier IC. Apply gate voltage Vg before applying drain voltage.	
Vd3	Drain Supply Port 3	Pad Vd3 supplies drain voltage to the third stage of the 4-stage amplifier IC. Apply gate voltage Vg before applying drain voltage.	
Vd4	Drain Supply Port 4	Pad Vd3 supplies drain voltage to the fourth stage of the 4-stage amplifier IC. Apply gate voltage Vg before applying drain voltage.	
Vg1-4	Gate Supply Voltage Pads	The Vg pads are connected resistively on chip. The user should apply between -0.4V and -0.6V to any one of the 4 Vg pads 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 be inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Unit
Continuous Power Dissipation (PDISS)	1.2	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 Current (Pin 4)	10	µA
Positive Bias Current (Pin1) [1]	400	mA
Positive Bias Current (Pin1) [2]	400	mA
Positive Bias Voltage (Pin1)	4.5	V
RF Input Power	22	dBm
Thermal Resistance, θJC	78.5	°C/W

Maximum Continuous Power Dissipation indicates power that will maintain an MTTF > 1E6 hours under typical operating conditions at max operating temperature. Specific use cases may differ, contact support for more detailed information.

[1][2] Maximum current draw is 400 mA when not limited by continuous power dissipation rating

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
ESD	< 250 Volts	HBM Class 0
Dimensions	-	1.72 x 1.23 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 (3.5). 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
Positive DC Voltage	2	3	3	V
Ambient Temperature	-55	25	85	°C
Positive DC Current	100	180	350	mA
Negative DC Voltage	-0.4	-0.5	-0.6	V

Sequencing Requirements

Turn-on Procedure:
1. Apply <-0.4V to Vg (Pin 4)
2. Apply Vd (Pin 1)

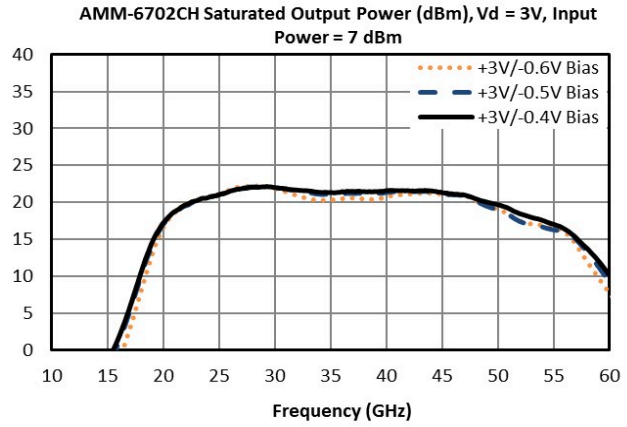
Turn-off Procedure:
1. Turn off Vd (Pin 1)
2. Turn off Vg (Pin 4)

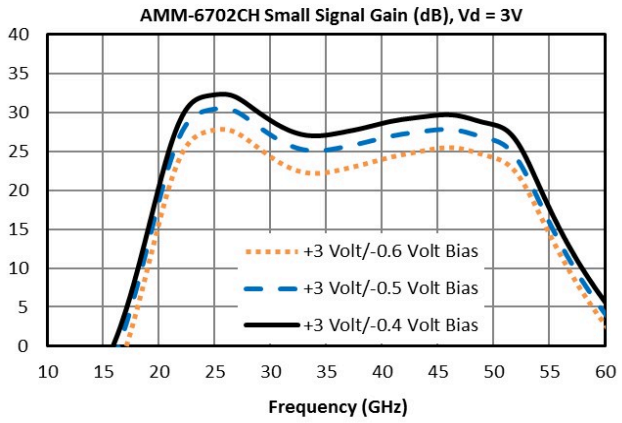
Electrical Specifications

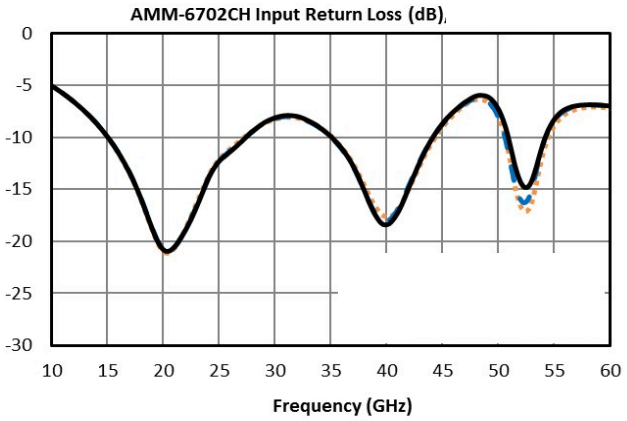
The electrical specifications apply at TA=+25°C in a 50Ω system. Min and Max limits apply only to our connectorized units and are guaranteed at TA=+25°C.

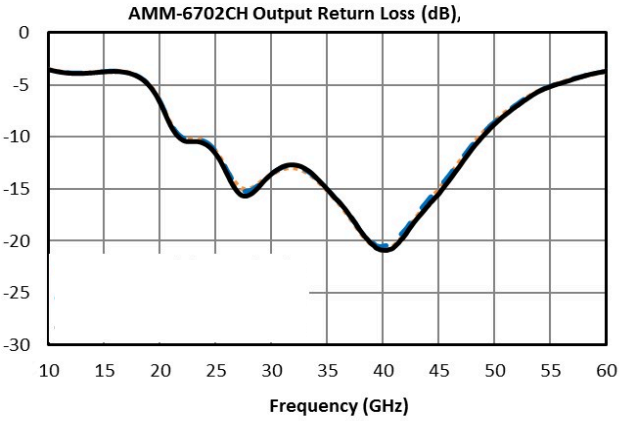
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Noise Figure	3.0V/-0.5V Bias	25	50	-	6.2	-	dB
Output IP3	3.5V/-0.5V Bias	20	55	-	28	-	dBm
Output P1dB	3.5V/-0.5V Bias	20	55	-	19	-	dBm
Saturated Output Power	3.0V/-0.5V Bias	21	55	-	19	-	dBm
Small Signal Gain	3.0V/-0.5V Bias	48	55	-	22	-	dB
Small Signal Gain	3.0V/-0.5V Bias	21	55	-	24	-	dB
Small Signal Gain	3.0V/-0.5V Bias	21	25	-	25	-	dB
Small Signal Gain	3.0V/-0.5V Bias	25	48	20	24	-	dB

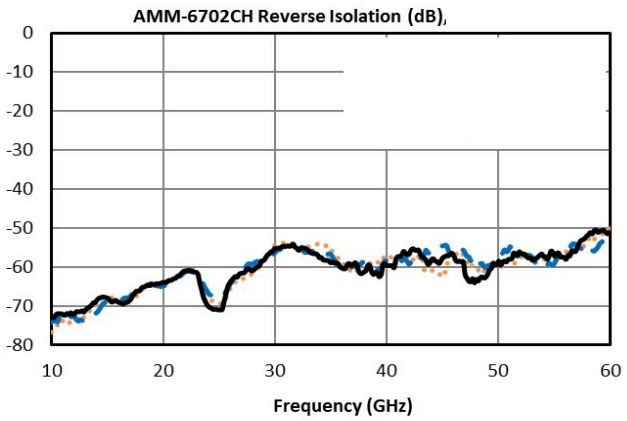
Typical Performance Plots







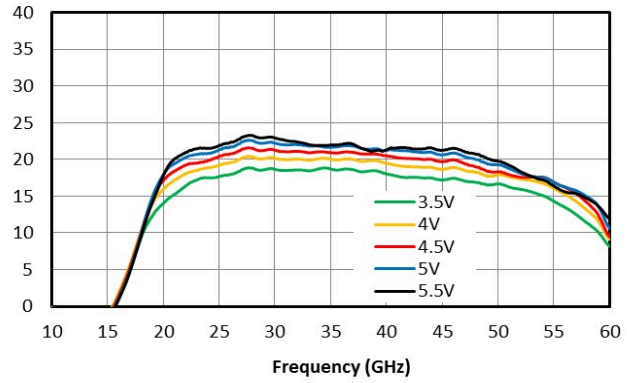




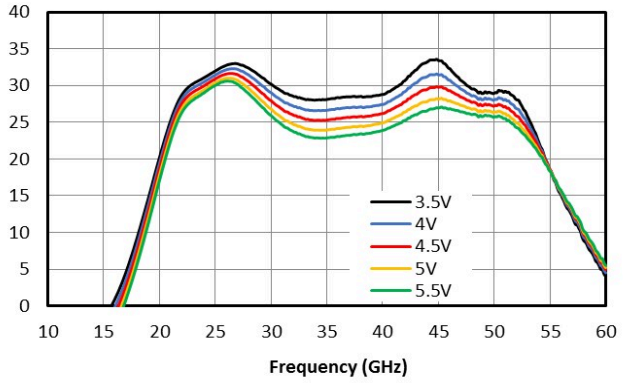
AMM-6702UC5 - Typical Performance Plots

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.

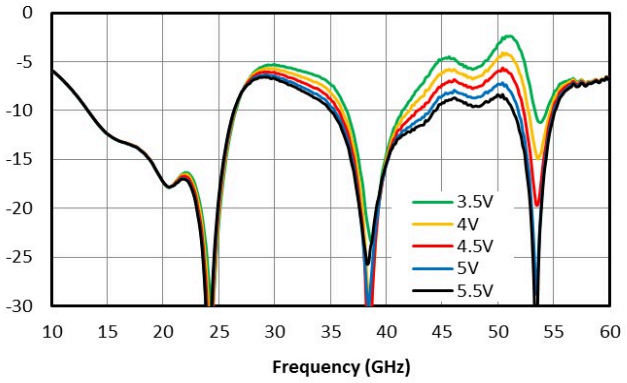
AMM-6702UC5 Psat (dBm) vs. Frequency; Input Power = +5 dBm



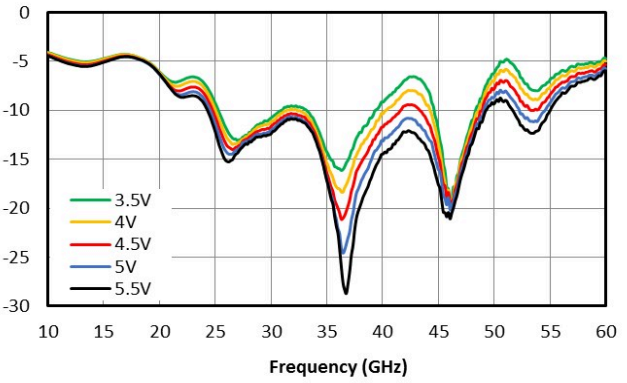
AMM-6702UC5 Small Signal Gain (dB) vs. Frequency



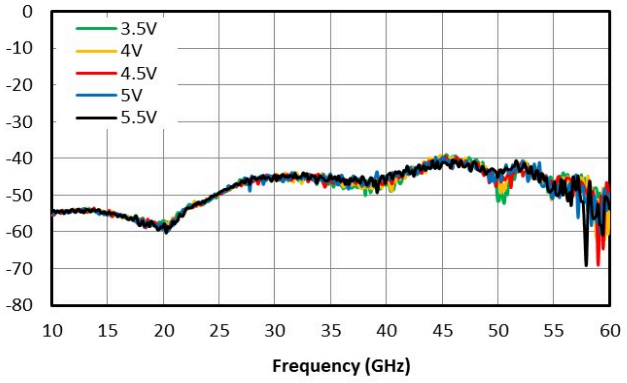
AMM-6702UC5 Input Return Loss (dB) vs. Frequency



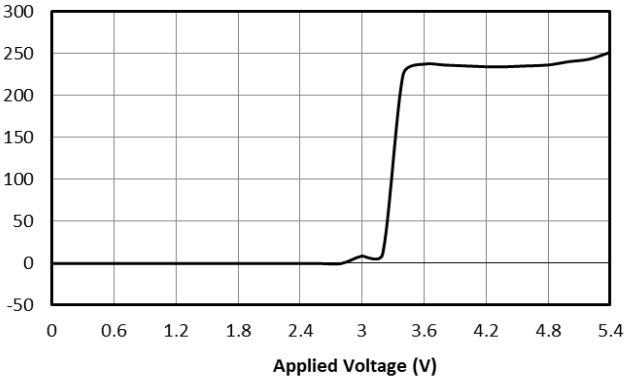
AMM-6702UC5 Output Return Loss (dB) vs. Frequency



AMM-6702UC5 Reverse Isolation (dB) vs. Frequency

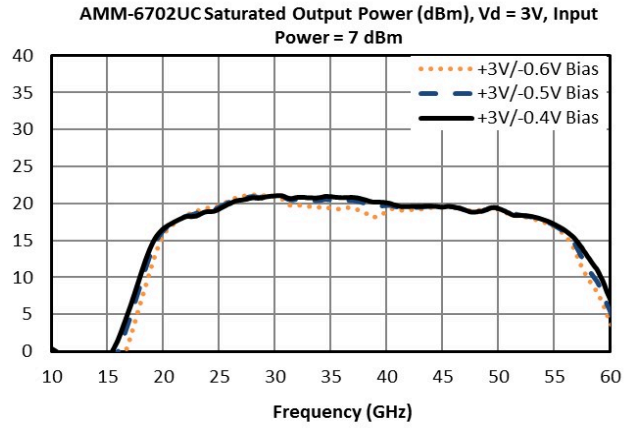


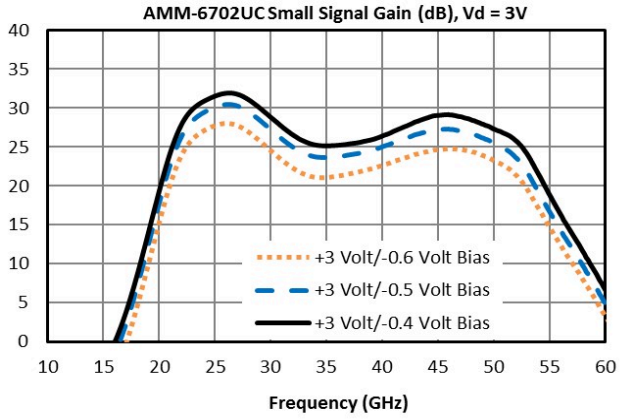
AMM-6702UC5 DC Current (mA) vs. Applied Voltage

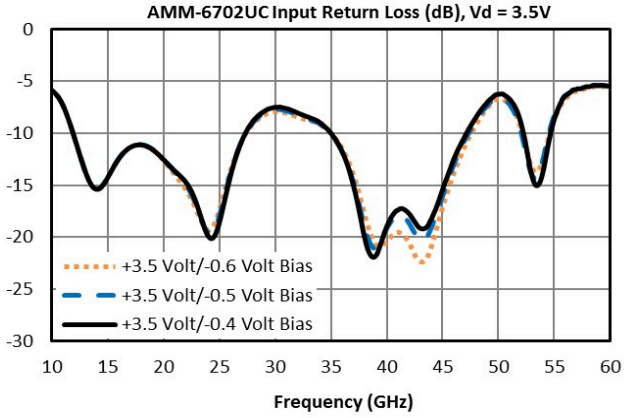


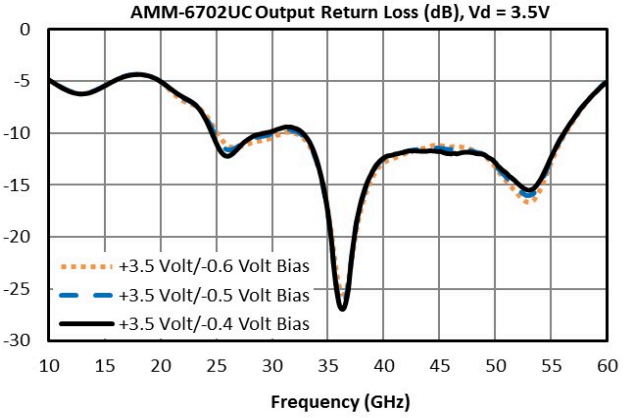
AMM-6702UC - Typical Performance Plots

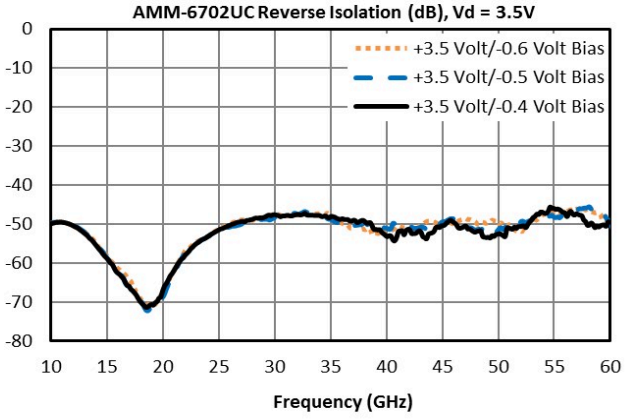
Performance plots for the connectorized module are shown for measurements where directly probed measurements of the die are unavailable. Note that the following measurements include losses from connectors and microstrip traces.

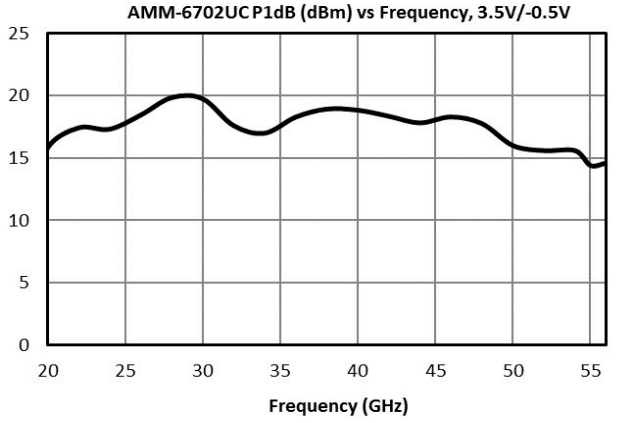


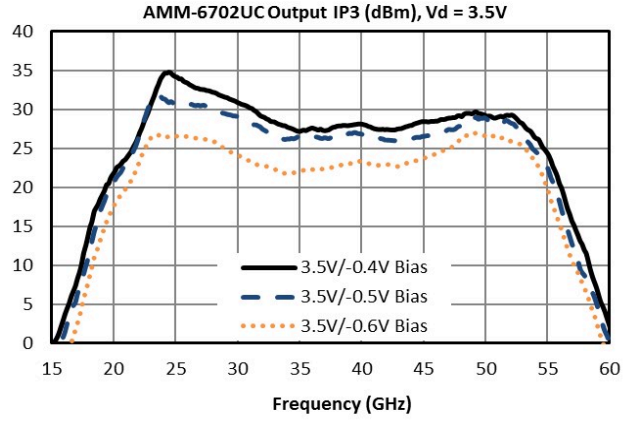


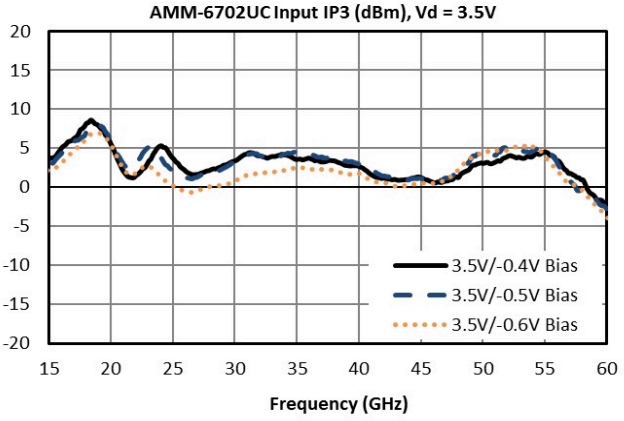


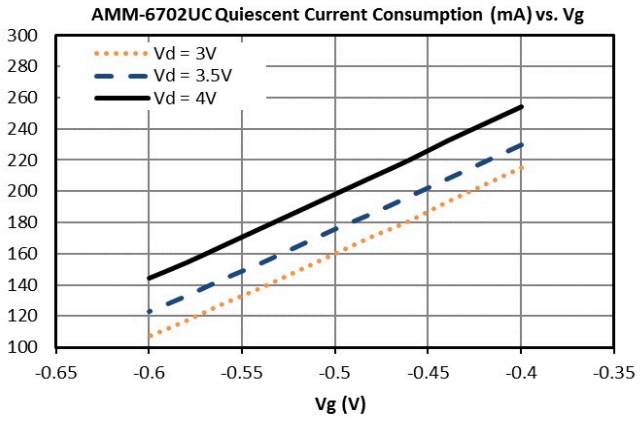


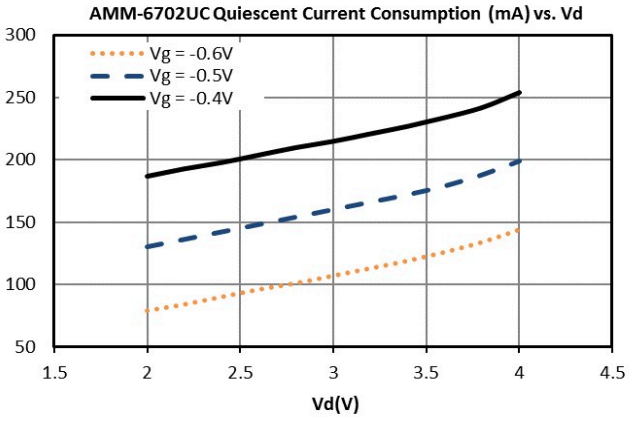


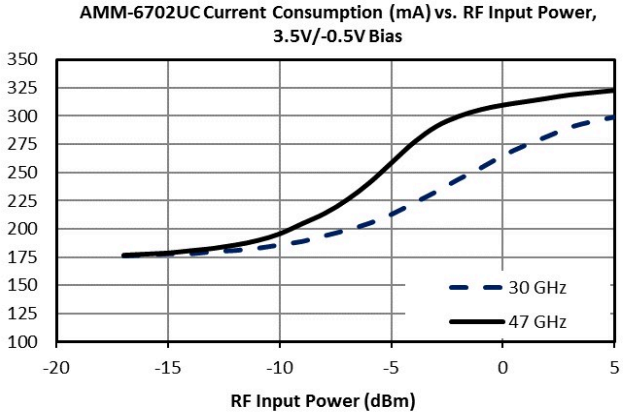


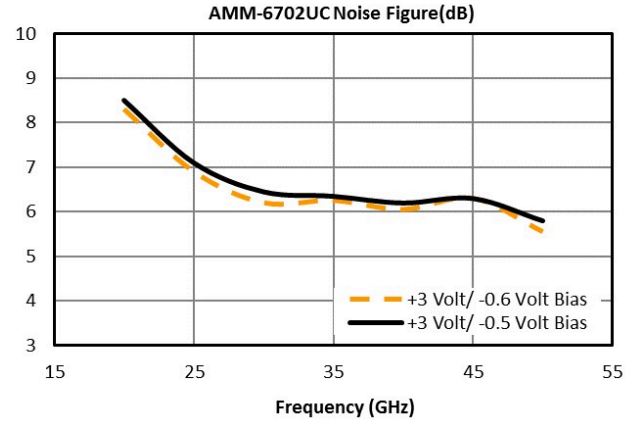






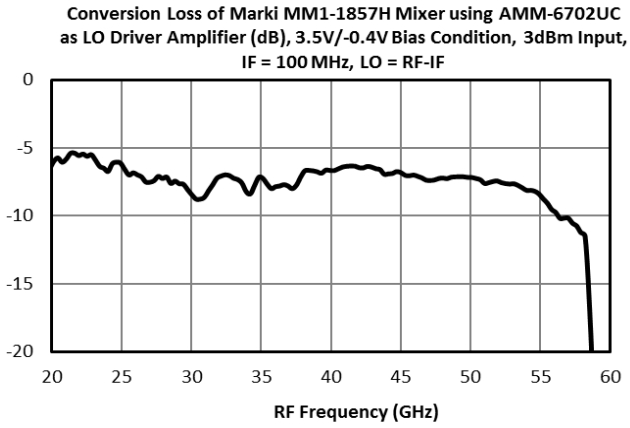


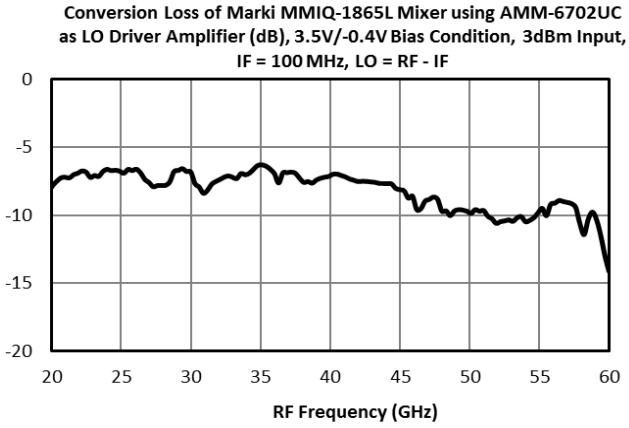


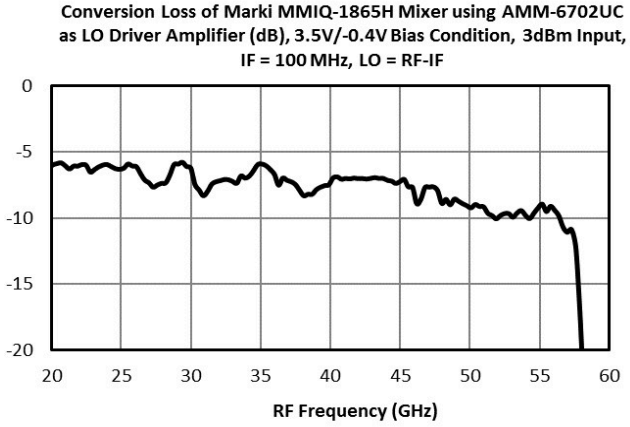


AMM-6702UC - Conversion Loss of Marki Mixers Using AMM-6702UC as LO Driver

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.



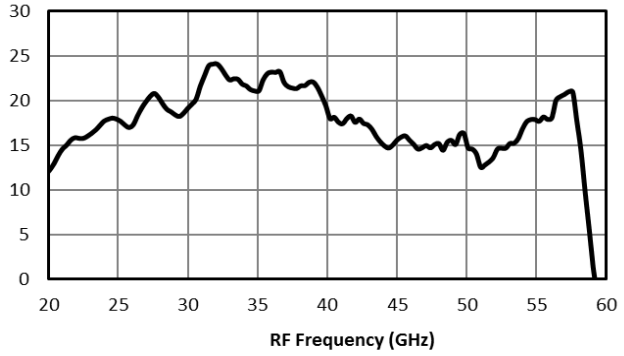




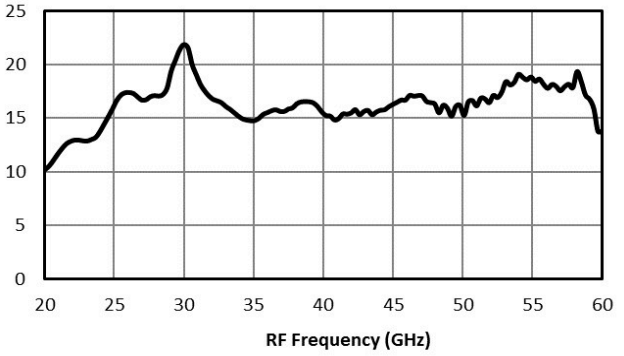
AMM-6702UC - Input-Referred IP3 of Marki Mixers Using AMM-6702UC as LO Driver

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.

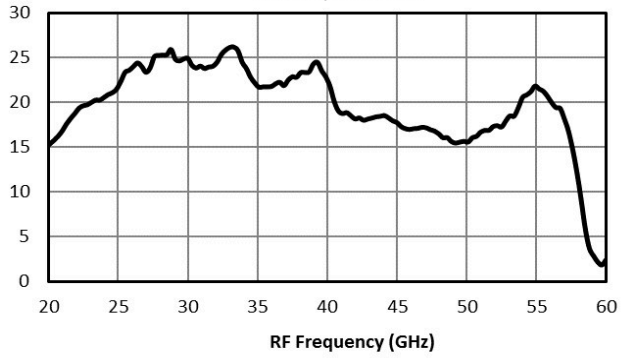
Input IP3 of Marki MM1-1857H Mixer using AMM-6702UC as LO Driver Amplifier (dBm), 3.5V/-0.4V Bias Condition, 3dBm Input, IF = 100 MHz, LO = RF - IF



Input IP3 of Marki MMIQ-1865L Mixer using AMM-6702UC as LO Driver Amplifier (dBm), 3.5V/-0.4V Bias Condition, 3dBm Input, IF = 100 MHz, LO = RF - IF



Input IP3 of Marki MMIQ-1865H Mixer using AMM-6702UC as LO Driver Amplifier (dBm), 3.5V/-0.4V Bias Condition, 3dBm Input, IF = 100 MHz, LO = RF - IF



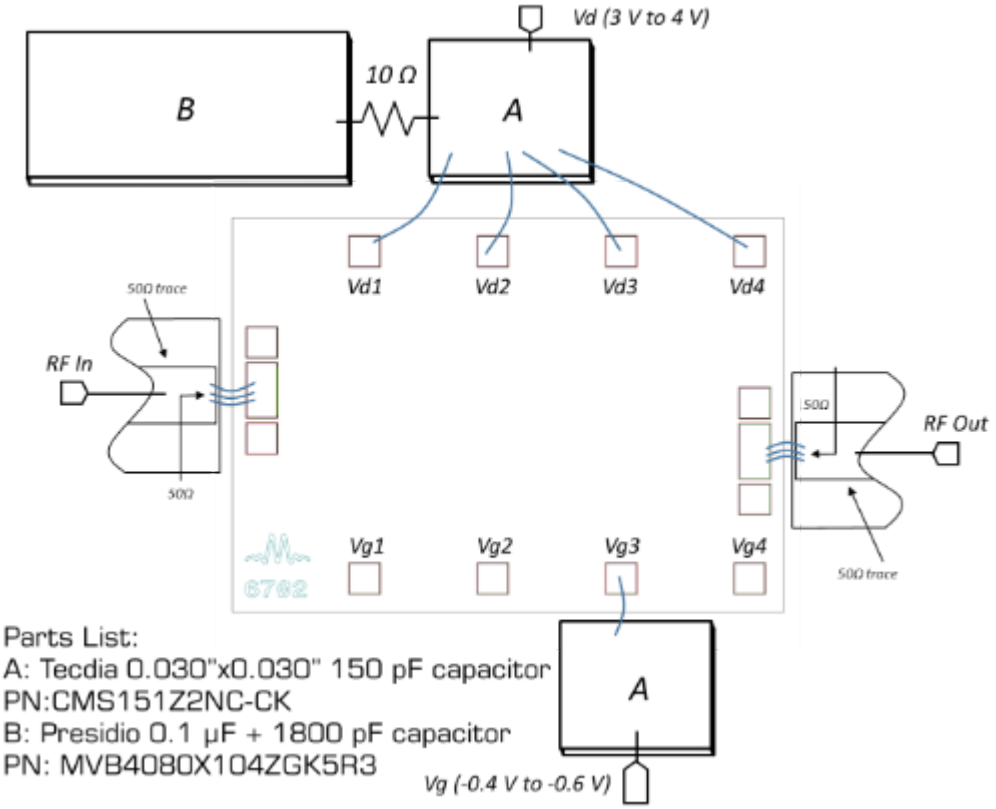
Application Information

Example AMM-6702CH Application Circuit

Below is an example application circuit for the AMM-6702CH. It is particularly important to use sufficient external capacitance on the Vd pads to prevent potential feedback oscillations from occurring. We have found that adding some small (10 Ω) shunt resistance as shown in the application circuit diagram creates very reliable operation.

Since the amplifier IC has very high gain, it is possible for positive radiative feedback to occur between the wire bonds on the RF traces and the power supply network. We have observed that the most effective ways to protect against radiative feedback oscillations is to epoxy ferritic absorber material near the input and output traces and to avoid mounting the chip inside of an extremely small cavity. Email support@markimicrowave.com for any additional questions and assistance in avoiding oscillations in the AMM-6702CH in your specific application.

Application Circuit



Parts List:
A: Tecdia 0.030"x0.030" 150 pF capacitor
PN:CMS151Z2NC-CK
B: Presidio 0.1 µF + 1800 pF capacitor
PN: MVB4080X104ZGK5R3

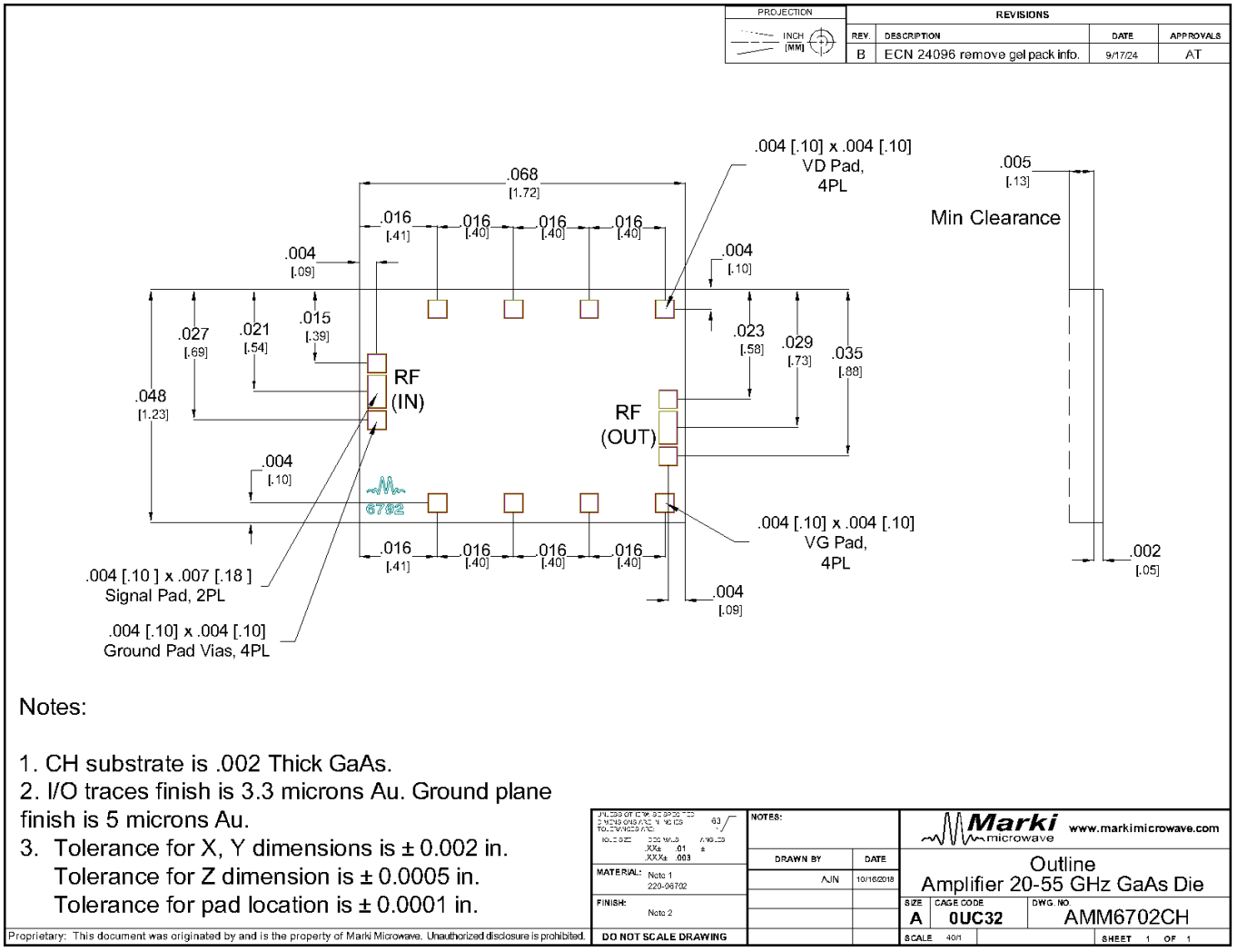
Application Circuit Description

The AMM-6702 has a potential low frequency oscillation mode under specific input conditions for power supply voltages above 3V. It is recommended to operate below a 3V power supply voltage.

Mechanical Data

Outline Drawing

Download : Outline 2D Drawing



DISCLAIMER

MARKI MICROWAVE, LLC., (“MARKI”) PROVIDES TECHNICAL SPECIFICATIONS AND DATA (INCLUDING DATASHEETS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, AND OTHER INFORMATION AND RESOURCES “AS IS” AND WITH ALL FAULTS. MARKI DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT.

These resources are intended for developers skilled in the art designing with Marki products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards and other requirements. Marki makes no guarantee regarding the suitability of its products for any particular purpose, nor does Marki assume any liability whatsoever arising out of your use or application of any Marki product.

Marki grants you permission to use these resources only for development of an application that uses Marki products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Marki intellectual property or to any third-party intellectual property. Marki reserves the right to make changes to the product(s) or information contained herein without notice.

MARKI MICROWAVE and T3 MIXER are trademarks or registered trademarks of Marki Microwave, LLC. All other trademarks used are the property of their respective owners.