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Tech Support: support@markimicrowave.com

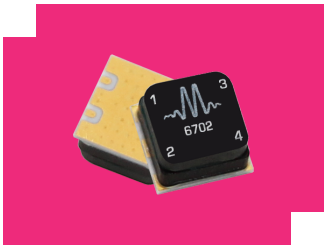
AMM-6702SM

20-50 GHz GaAs Surface Mount LO Driver Amplifier

DEVICE OVERVIEW

General Description

The AMM-6702SM is a surface-mount LO driver amplifier that is designed to provide sufficient LO drive for an H or S diode mixer such as the MM1-1850HSM or MM1-1850SSM across temperature with input power from 0-10 dBm. This ferritic package offers improved resilience to radiative feedback and oscillatory behavior over the bare-die package option, providing the customer with a compact, high gain, wideband LO driver amplifier.



Download s-parameters here

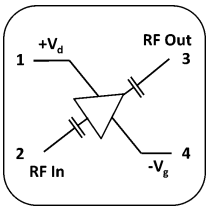
Features

- High gain
- Broadband performance
- +19 dBm output power
- Compact package

Applications

- SATCOM
- Radar
- Mobile test and measurement equipment
- 5G transceivers
- Optimal LO driver amp for Marki S-diode mixers

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification	Recommended Replacement
AMM-6702SM	20-50 GHz GaAs Surface Mount LO Driver Amplifier	KFN	REACH RoHS	Not Recommended for New Design	3A001.b.2.d	AMM-10202PSM
EVAL-AMM-6702SM	Evaluation Board, 20-50 GHz GaAs Surface Mount LO Driver Amplifier	EVAL	REACH RoHS	Not Recommended for New Design	EAR99	EVB-AMM-10202P

AMM-6702SM

20-50 GHz GaAs Surface Mount LO Driver Amplifier

Table Of Contents

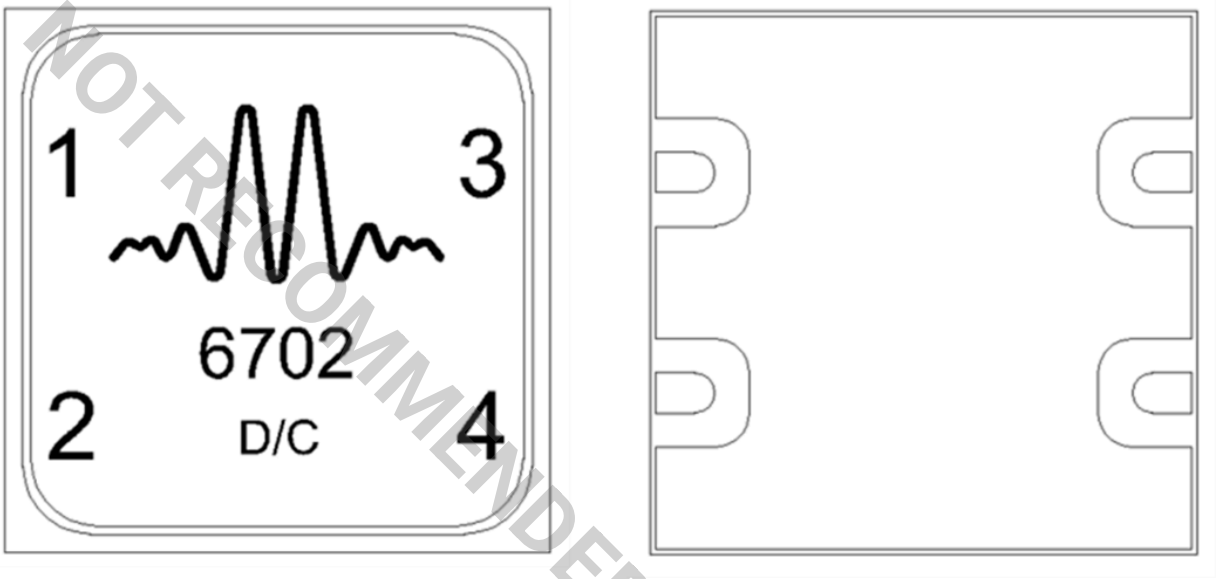
Revision History

Revision Code	Revision Date	Comment
-	2019-10-01	Datasheet Initial Release
A	2019-10-01	Updated Performance Plots
B	2019-11-01	Mixer Performance Plots & Application Circuits
C	2019-11-01	Production fixture minimum gain spec modified
D	2020-01-01	Gain and Power Output Performance Plots Updated
E	2020-02-01	Added content
F	2020-06-01	Updated Maximum Ratings
G	2020-08-01	Updated Landing Pattern
H	2020-11-01	Updated Thermal Specs and IP3 specs, added link to landing pattern
I	2020-11-01	Updated Min Frequency Spec
J	2023-11-07	Updated thermal resistance and maximum power dissipation, indicating typical operation.
K	2024-07-26	Reduced Recommended Supply Voltage to 3V
L	2026-02-13	MTTF Table Added.

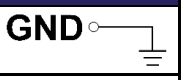
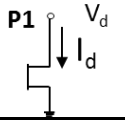
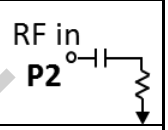
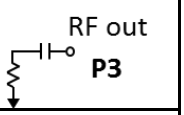
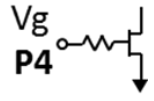
Port Configuration and Functions

Port Diagram

A top-down (left) and bottom-up (right) view of the AMM-6702SM's KFN package outline drawing is shown below. The pin functions are detailed in 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.	
Pin 1	Positive DC Supply Vd	Pin 1 provides +2V to +4V DC voltage and drain current to the amplifier. Negative voltage must be supplied to Pin 4 before turning on the positive supply voltage.	
Pin 2	RF Input	Pin 2 is the RF input of the amplifier. It is internally DC blocked.	
Pin 3	RF Output	Pin 3 is the RF output of the amplifier. It is internally DC blocked.	
Pin 4	Negative DC Supply Vg	Pin 4 provides -0.4V to -0.6V of DC voltage. This must be turned on before turning on the positive supply voltage to Pin 1.	

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
Negative Bias Voltage (Pin4)	-2	V
Positive Bias Current (Pin1) [1]	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] 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	-	4 x 4 mm
Moisture Sensitivity Level	-	MSL 1

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
Ambient Temperature	-55	25	85	°C
Positive DC Current	100	180	350	mA
Negative DC Voltage	-0.4	-0.5	-0.6	V
Positive DC Voltage	2	3	3	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)

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. Minimum test specifications are verified up to 44 GHz within an EVAL fixture due to the high insertion loss of the fixture above 45 GHz.

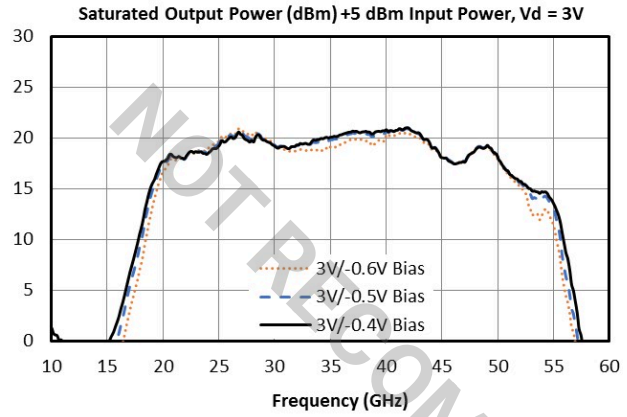
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Current Consumption [1]	3V/-0.4V	21	50	-	230	-	mA
Current Consumption [2]	3V/-0.5V	21	50	-	180	-	mA
Current Consumption [3]	3V/-0.6V	21	50	-	130	-	mA
Input IP3	3V/-0.5V bias, -25 dBm Input Power	21	50	-	3	-	dBm
Input Return Loss	3V/-0.5V bias, -25 dBm Input Power	21	50	-	8	-	dB
Noise Figure	3V/-0.5V bias, -25 dBm Input Power	21	50	-	6.5	-	dB
Output IP3	3V/-0.5V bias, -25 dBm Input Power	21	50	-	27	-	dBm
Output P1dB	3V/-0.5V bias	21	50	-	14.8	-	dBm
Output Return Loss	3V/-0.5V bias, -25 dBm Input Power	21	50	-	9	-	dB
Reverse Isolation	3V/-0.5V bias, -25 dBm Input Power	21	50	-	45	-	dB
Saturated Output Power	3V/-0.5V bias, +5 dBm Input Power	21	50	-	19	-	dBm
Small Signal Gain	3V/-0.5V bias, -25 dBm Input Power	21	50	-	24	-	dB

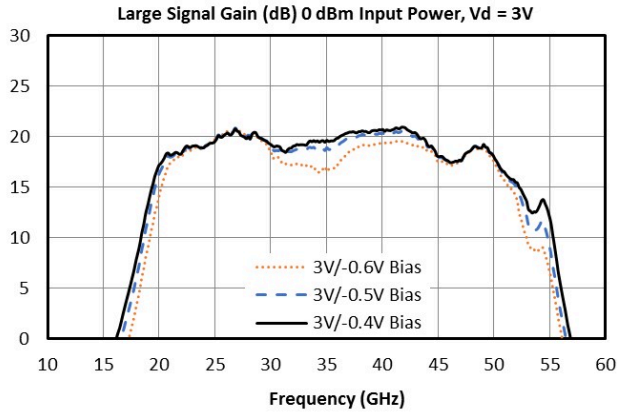
[1][2][3] Bias conditions tested with no RF input power. See Typical Performance Plots for DC current vs. RF power

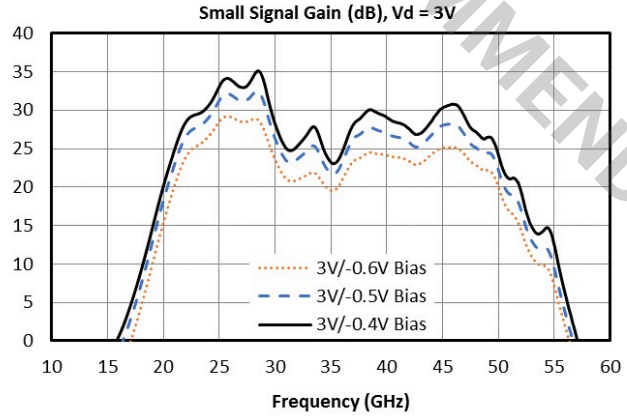
Typical Performance Plots

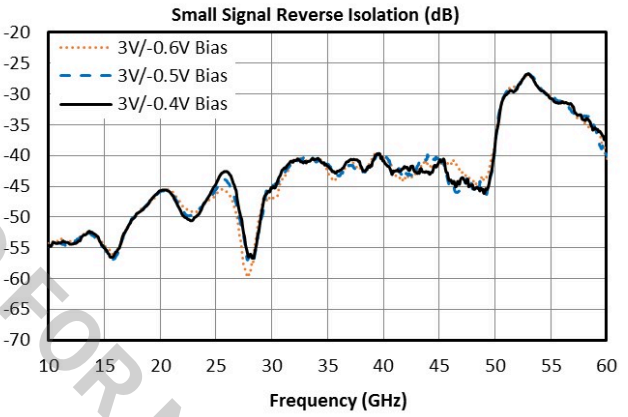
Measurement data extracted from within the EVAL-AMM-6702SM module. Insertion loss of the EVAL board has been extracted from the small signal gain and output power measurements.

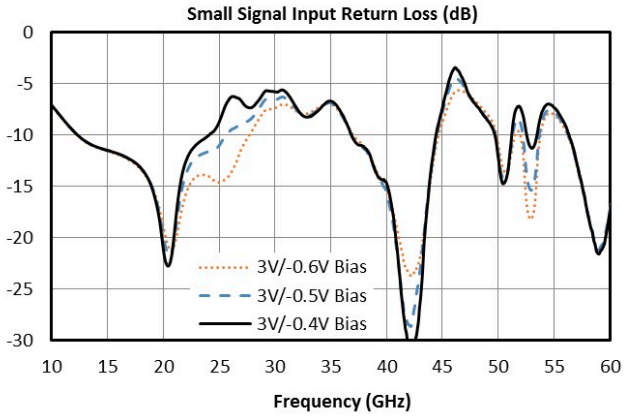
[6] Temperature-controlled output power measurements were performed in the EVAL-AMM-6702SM test fixture with 3V/-0.5V bias and +10 dBm RF input power

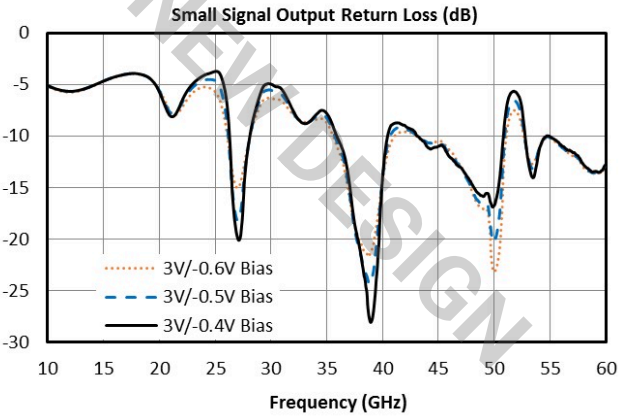








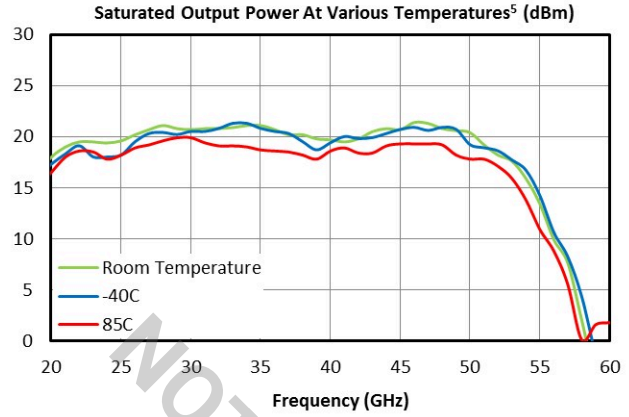




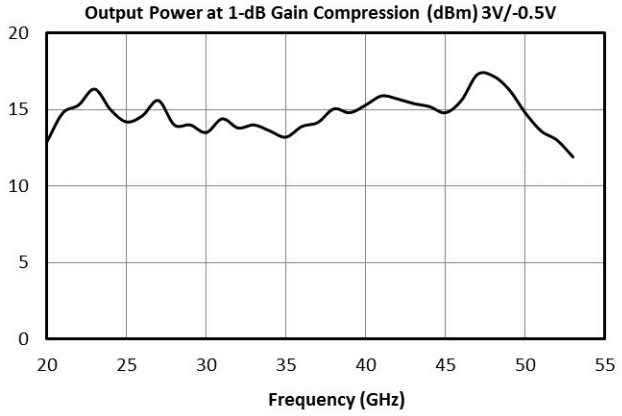
AMM-6702SM

20-50 GHz GaAs Surface Mount LO Driver Amplifier

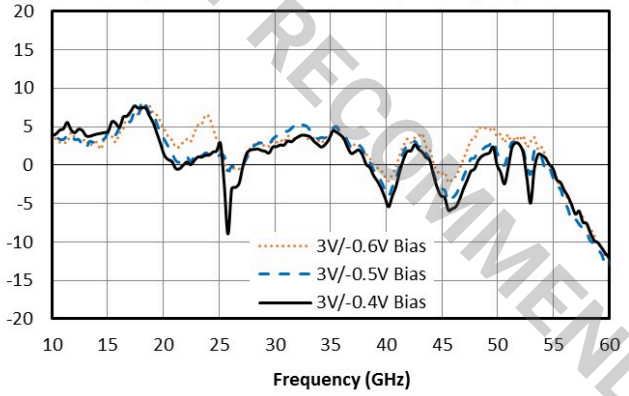
Saturated Output Power At Various Temperatures[5] (dBm)



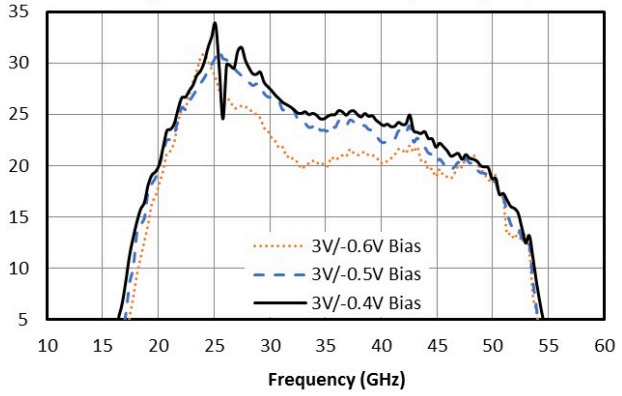
Output Power at 1-dB Gain Compression (dBm) 3V/-0.5V



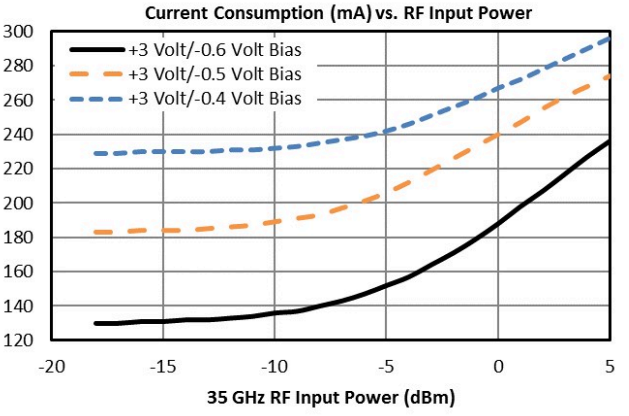
Input-Referred 3rd Order Intercept Point (dBm)



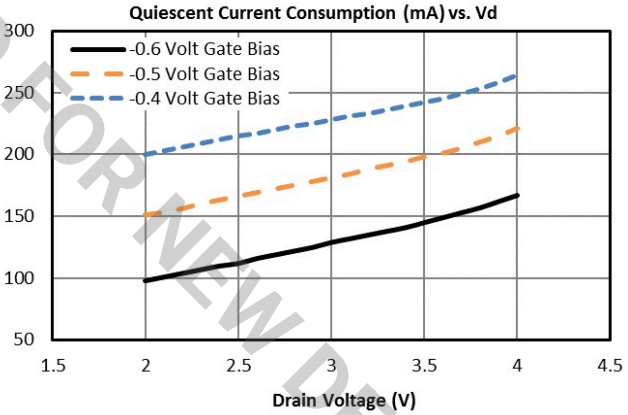
Output-Referred 3rd Order Intercept Point (dBm)



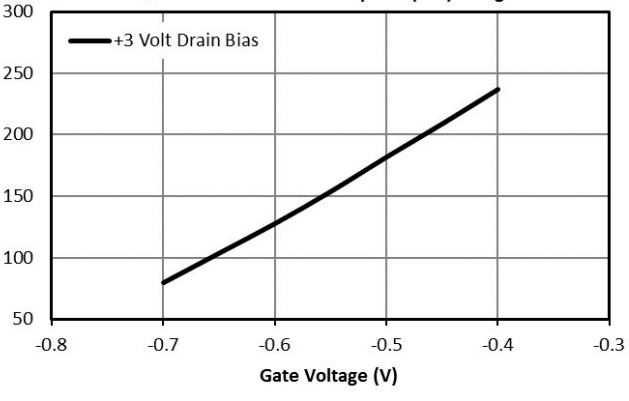
Current Consumption (mA) vs. RF Input Power



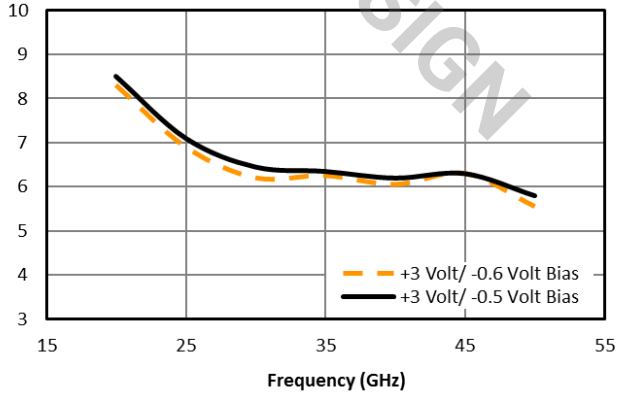
Quiescent Current Consumption (mA) vs. Vd



Quiescent Current Consumption (mA) vs. Vg

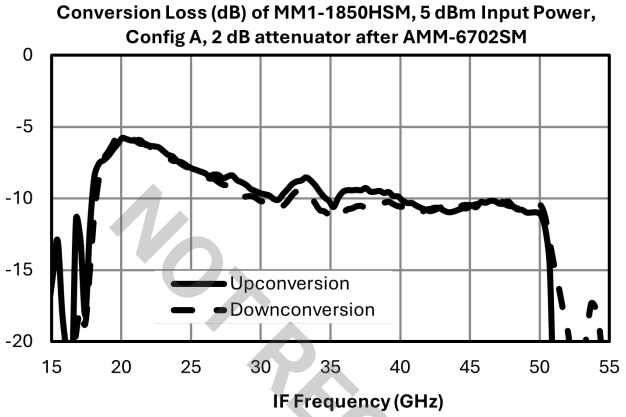


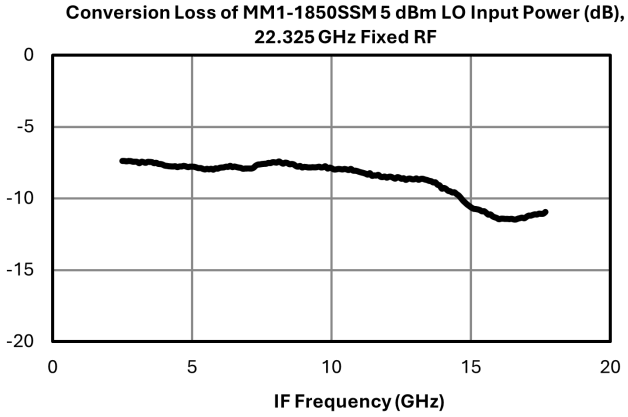
Noise Figure(dB)[6]



Conversion Loss of Marki Surface Mount Mixers Using AMM-6702SM as LO Driver

Conversion loss plots taken using custom AMM-6702SM/MM1-1850SM connectorized EVAL board. RF path insertion loss is ~1.5 dB at 50 GHz.





Application Information

Preventing oscillatory behavior

The AMM-6702SM contains a multi-stage MMIC amplifier with very high small signal gain. This MMIC can be susceptible to oscillatory behavior if it is mounted in an environment which allows for output power from the AMM-6702SM to radiate back to the DC drain voltage supply line. We have created a special ferritic KFN package to greatly reduce the susceptibility to this behavior, but oscillations are still possible if the environment is conducive to radiative feedback or cavity resonances.

The AMM-6702SM is designed to be driven in saturation/gain compression as an LO driver amplifier, and will be more susceptible to oscillations when driven in small signal operation. In the case that the amplifier oscillates in your application circuit, packing additional ferrite and absorber around the KFN is an effective tool to combat it. We advise our customers to experiment with the AMM-6702SM in their planned application circuit and to contact support@markimicrowave.com if they have any questions or need advice for avoiding oscillations.

The AMM-6702 has a potential low frequency oscillation mode in very specific operating conditions when the power supply voltage is above 3V.

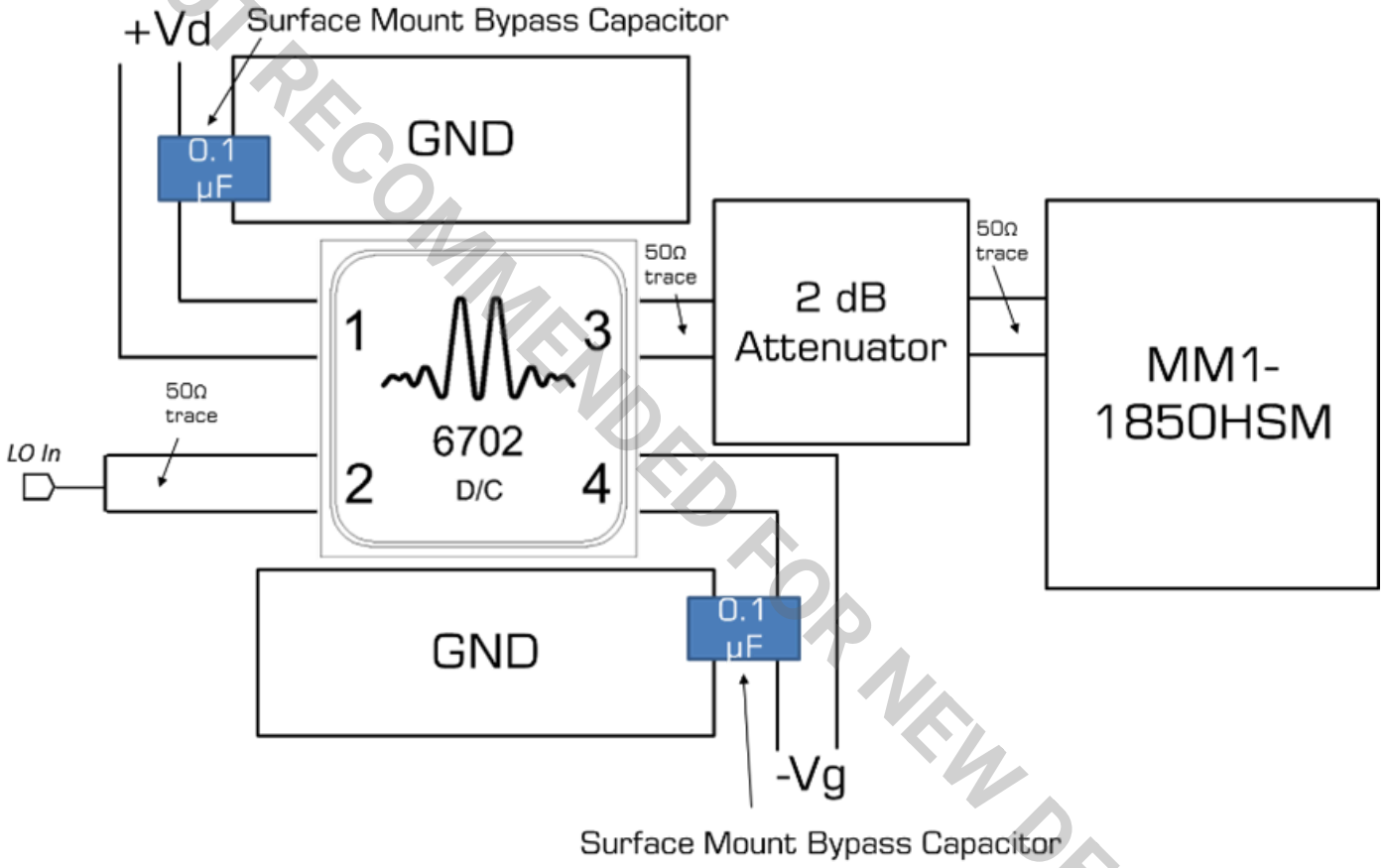
Bypass Capacitance

It is recommended that customers use sufficient shunt capacitance to ground distributed along the gate and drain supply rails to prevent uncontrolled reactive loading from being presented to the DC supply ports of the AMM-6702SM. Customers observing oscillatory behavior in the amplifier may benefit from placing a small resistor in series with a large capacitor along the drain supply line close to the KFN.

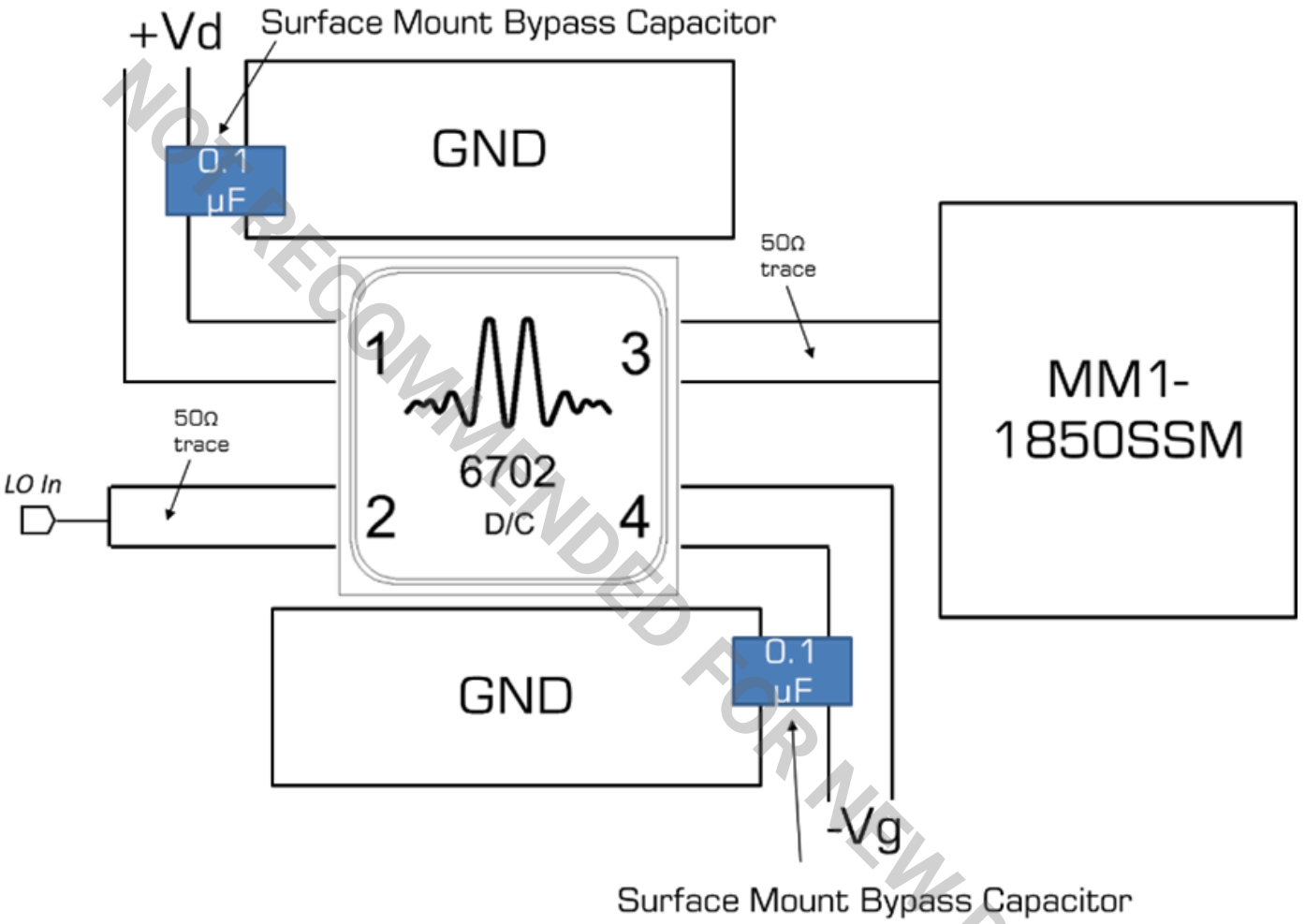
Application Circuit Description

Example Application Circuits

Below is an example of an application circuit using the AMM-6702SM to drive the LO port of an MM1-1850HSM. It is recommended that the customer use a small amount attenuation between the amplifier and the mixer to prevent a standing wave pattern from forming when using an MM1-1850HSM, which has a reflective LO port. There are bypass capacitors connected internally in the SM package, but we also recommend using additional surface mount capacitors on the drain and gate supply lines to ensure predictable performance.



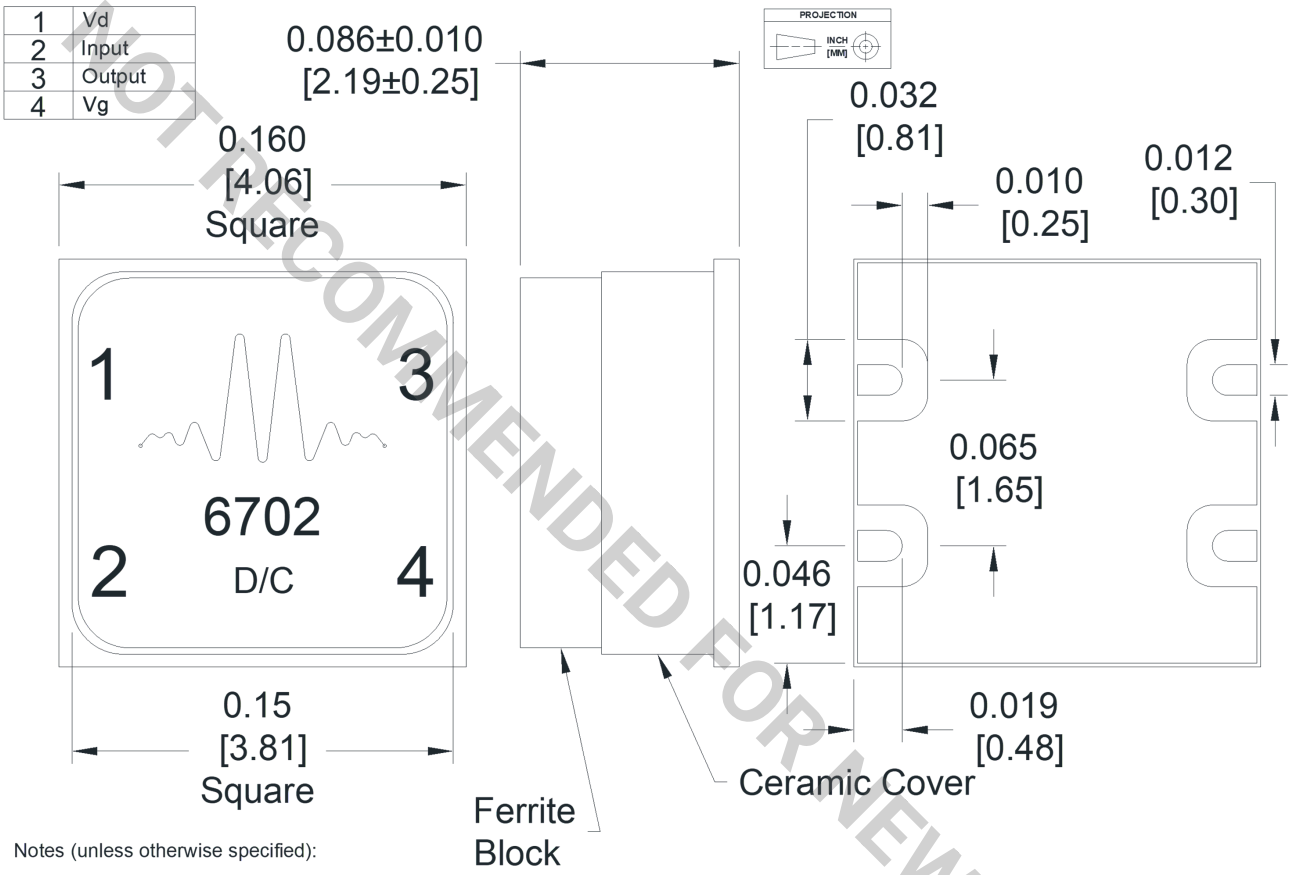
Below is an example of an application circuit using the AMM-6702SM to drive the LO port of an MM1-1850SSM. Note that in this case, the LO port of the mixer is not reflective, and the LO drive requirement is higher. Therefore, it is recommended that the amplifier output be fed directly into the LO port of the mixer rather than through an attenuator to ensure that sufficient LO drive reaches the mixer throughout the band.



Mechanical Data

Outline Drawing

Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP

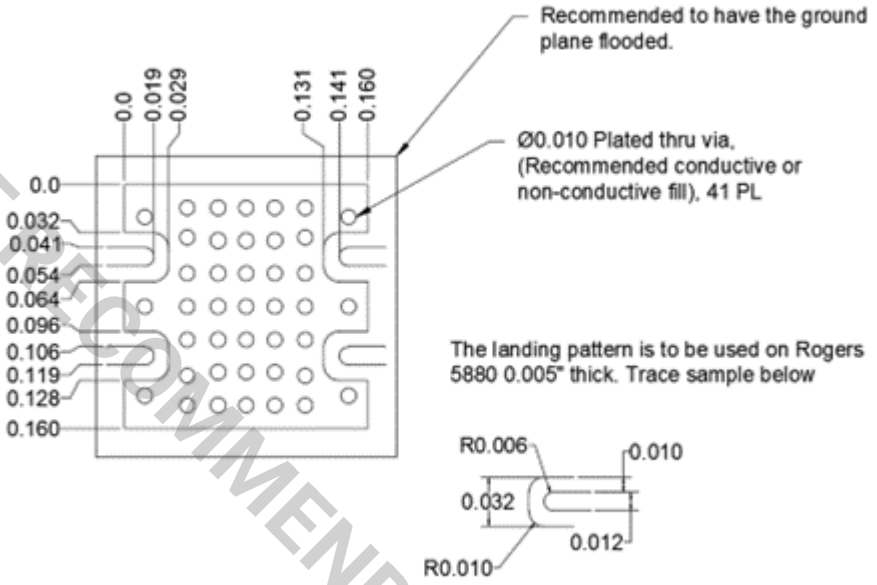


Notes (unless otherwise specified):

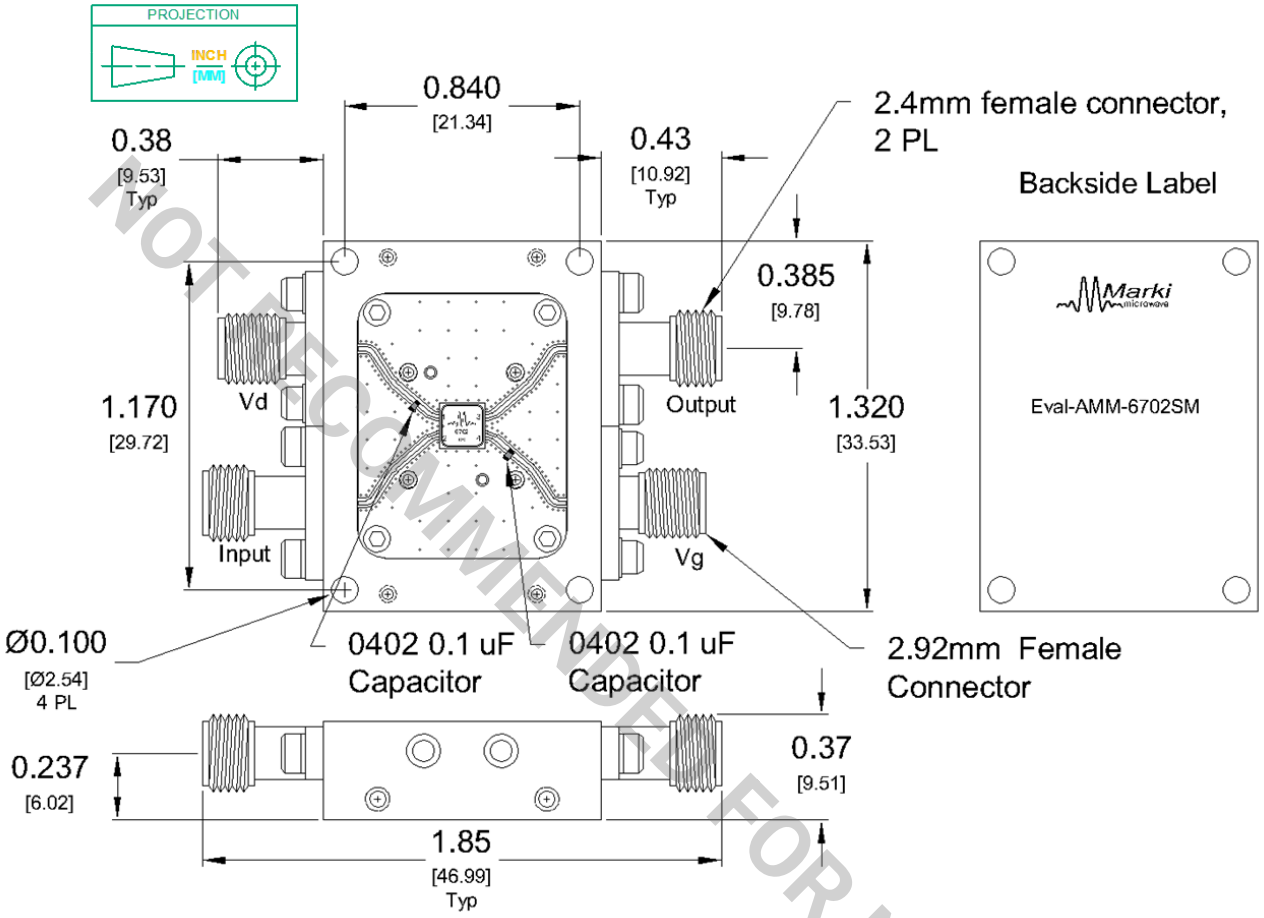
1. Substrate and lid material is Ceramic.
2. I/O Leads and Ground Paddle plating is 2 uin Au max over 40-80 uin Ni over 433 uin of Ag.
3. Ferrite is Eccosorb MF-124.

Footprint Image

Download : Footprint Drawing



Evaluation Board - Outline Drawing



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