

PRELIMINARY DATASHEET

CGY2120XUH/C1 Ultra Low Noise C-Band Amplifier

DESCRIPTION

The CGY2120XUH is a high performance GaAs single stage Low Noise Amplifier MMIC designed to operate on the C band.

The CGY2120XUH has an exceptionally low noise figure of 0.5 dB with 13 dB of gain. It can be used in Radar, Telecommunication and Instrumentation applications.

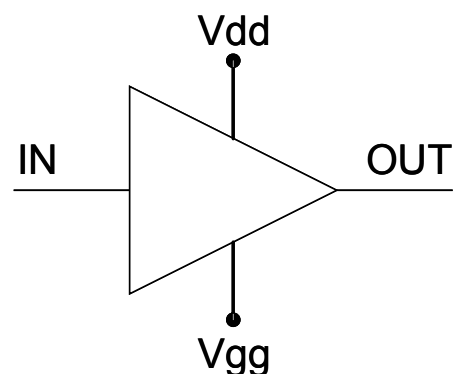
The die is manufactured using OMMIC's Advanced 70 nm gate length high Indium content MHEMT Technology. The MMIC uses gold bonding pads and backside materialization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability.

APPLICATIONS

- ▶ Radar
- ▶ Instrumentation
- ▶ Telecommunications

FEATURES

- ▶ Operating Range 5 GHz to 7 GHz
- ▶ Noise Figure 0.5 dB at 6 GHz
- ▶ Gain 13.2 dB at 6 GHz
- ▶ Input Return Loss 6 dB at 6 GHz
- ▶ Output Return Loss 12 dB at 6 GHz
- ▶ Chip size 1.5 mm x 2.0 mm
- ▶ Tested, Inspected Known Good Die (KGD)
- ▶ Samples Available



*Block Diagram of the CGY2120XUH
Low Noise Amplifier*



LIMITING VALUES

$T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
V_{DD}	Drain voltage		0	1.2	V
I_D	Total Drain current			60	mA
V_{GG}	Gate supply voltage	V_D open-circuited	-2.5	0	V
T_{stg}	Storage temperature		-55	+150	$^{\circ}\text{C}$
T_j	Junction temperature			+150	$^{\circ}\text{C}$
T_{amb}	Ambient temperature		-40	+85	$^{\circ}\text{C}$

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	UNIT
$R_{th(j-a)}$	Thermal resistance from junction to backside ($T_a = 25\text{ }^{\circ}\text{C}$)	TBD	$^{\circ}\text{C/W}$

DC & RF CHARACTERISTICS

$T_{amb} = 25\text{ }^{\circ}\text{C}$, On-wafer measurement results, using $50\text{ }\Omega$ RF probes unless stated otherwise.

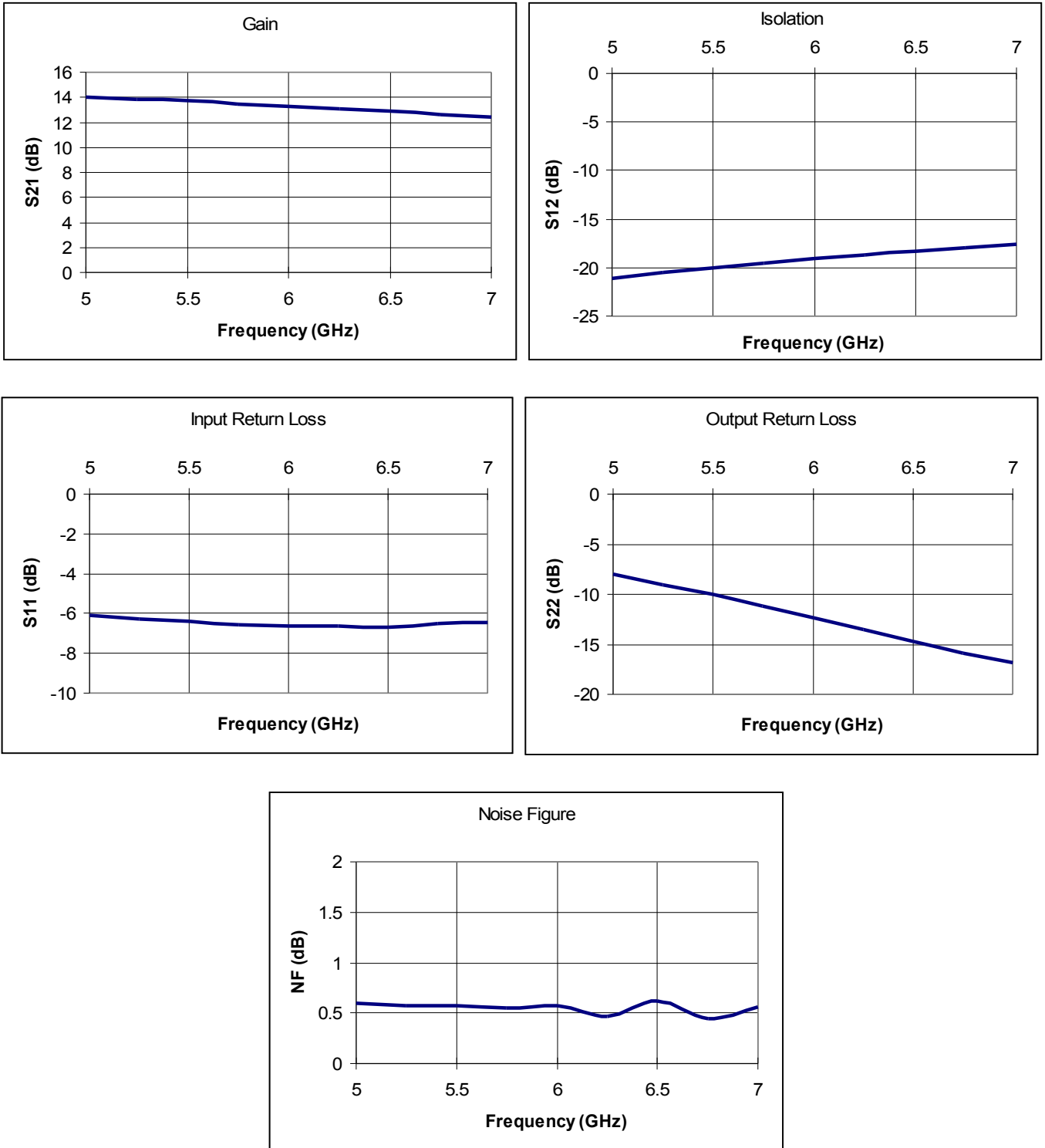
Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
DC characteristics						
V_{DD}	Drain voltage			1	+1.2	V
I_{DD}	Drain current			50		mA
V_{GG}	Gate supply voltage		-2.5	-0.15	0	V
RF characteristics						
BW	Useful bandwidth		5		7	GHz
Gain	Reference Gain	$F = 6\text{ GHz}$		13.2		dB
S11	Input return loss			-6.8	-6	dB
S22	Output return loss			-12	-6	dB
S12	Isolation	$F = 6\text{ GHz}$		-19		dB
NF	Noise Figure	$F = 6\text{ GHz}$		0.5		dB
P1dB	Output P1dB compression point			12		dBm



Caution : This device is a high performance RF component and can be damaged by inappropriate handling. Standard ESD precautions should be followed. OMMIC document "OM-CI-MV/ 001/ PG" contains more information on the precautions to take.

MEASURED PERFORMANCE

$T_{amb} = 25\text{ }^{\circ}\text{C}$, $V_{DD} = 1\text{V}$, $I_{DD} = 50\text{ mA}$. On-wafer measurement results, using $50\text{ }\Omega$ RF probes



NB : This product was originally designed to achieve optimal matching and NF performances with bondwires on both ends of the circuit, whereas the presented results were obtained on wafer, using $50\text{ }\Omega$ RF probes.

CGY2120XUH/C1 TYPICAL SCATTERING PARAMETERS

$T_{amb} = 25\text{ }^{\circ}\text{C}$, $V_{DD} = 1\text{V}$, $I_{DD} = 50\text{ mA}$. On-wafer measurement results, using $50\text{ }\Omega$ RF probes

Frequency (GHz)	S11 (dB)	Ang S11 (°)	S12 (dB)	Ang S12 (°)	S21 (dB)	Ang S21 (°)	S22 (dB)	Ang S22 (°)
4	-4.823	-80.1	-24.05	132.1	14.28	155.9	-4.839	-90.55
4.25	-5.201	-86.35	-23.13	124.5	14.25	147.4	-5.589	-97.05
4.5	-5.529	-91.68	-22.42	117.6	14.2	139.9	-6.326	-103.3
4.75	-5.919	-96.25	-21.65	110.7	14.09	131.9	-7.209	-110.2
5	-6.112	-100.1	-21.07	104.7	14.01	125.2	-8.054	-116.9
5.25	-6.289	-103.2	-20.5	98.56	13.84	118.3	-9.026	-124.2
5.5	-6.398	-106.5	-20	93.02	13.72	112.1	-10.03	-132
5.75	-6.556	-108.1	-19.52	87.41	13.43	105.9	-11.14	-140.3
6	-6.655	-110.7	-19.09	82.05	13.29	99.46	-12.33	-149.7
6.25	-6.648	-112.4	-18.67	77.28	13.07	94.07	-13.5	-160.3
6.5	-6.664	-114.3	-18.32	72.41	12.85	88.19	-14.68	-172
6.75	-6.537	-116.1	-17.96	67.58	12.64	83.06	-15.87	174.1
7	-6.469	-118	-17.63	62.74	12.41	77.66	-16.88	158.4
7.25	-6.312	-120	-17.29	57.95	12.17	72.96	-17.59	140.7
7.5	-6.243	-121.6	-16.97	53.27	11.92	67.77	-17.84	121.9
7.75	-6.087	-123.3	-16.68	49.11	11.68	63.06	-17.5	104.6
8	-5.959	-125.3	-16.49	45.39	11.42	58.21	-16.78	90.01

APPLICATION INFORMATION

Typical application scheme

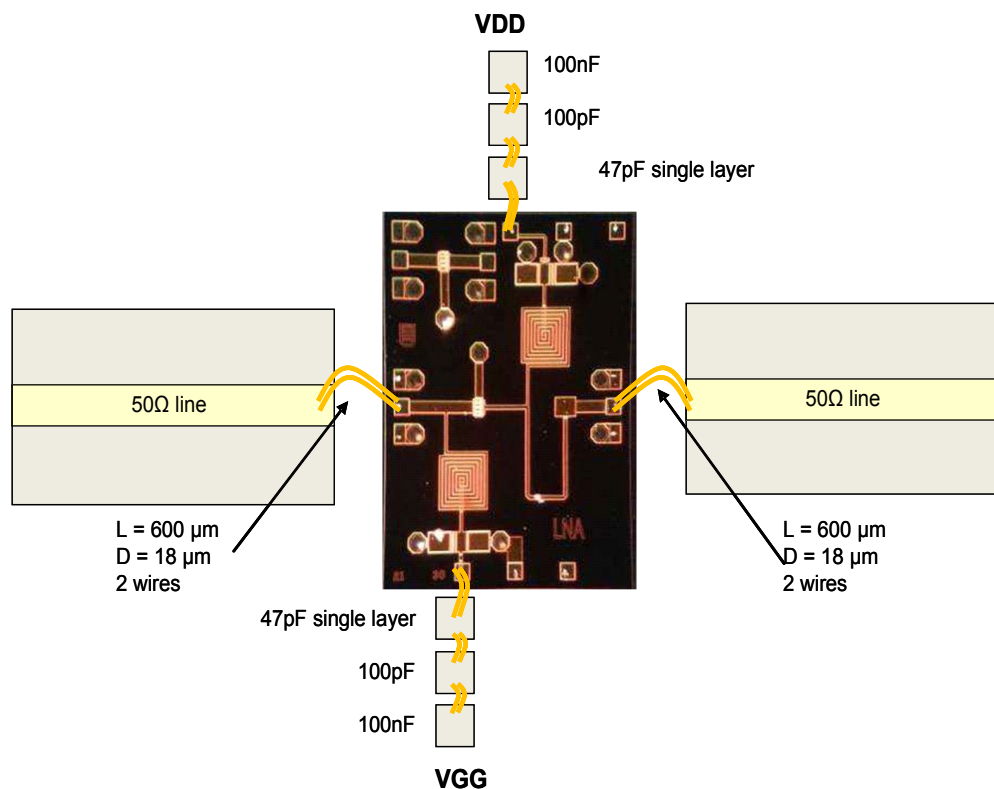
A reference module layout is shown below, where RF input and output microstrip transmission lines are used. However, coplanar transmission lines with similar performance may also be used. All path lengths and physical sizes of the components should be minimized.

All RF input and output bonding inductances should be minimized to give the best performance. Overall wire length should be kept as small as possible to reduce parasitic inductance. Higher RF input / output inductance may result in a degradation of gain and match. Ribbon bonding technique can also be used.

All others bondings (pads V_{DD} and V_{GG}) should be kept as short as possible.

Decoupling 47 pF and 100 pF chip capacitors (close to the chip) and 100 nF chip or SMD* capacitors (positioned at around 4mm from the chip) are used to improve the power supply rejection.

The chip itself has via holes connecting the front side to the back side of the chip. A good RF grounding connection should be maintained between the backside of the chip and system ground. It is extremely important to use an uninterrupted ground plane. AuSn or silver conductive epoxy material can be used for die attachment.



CGY2120XUH/C1 application layout : Microstrip assembly

*Surface Mount Devices

OPERATING AND HANDLING INSTRUCTIONS

The CGY2120XUH/C1 is a very high performance MHEMT device and as such, care must be taken at all times to avoid damage due to inappropriate handling, mounting and biasing conditions.

1- Power Supply Sequence

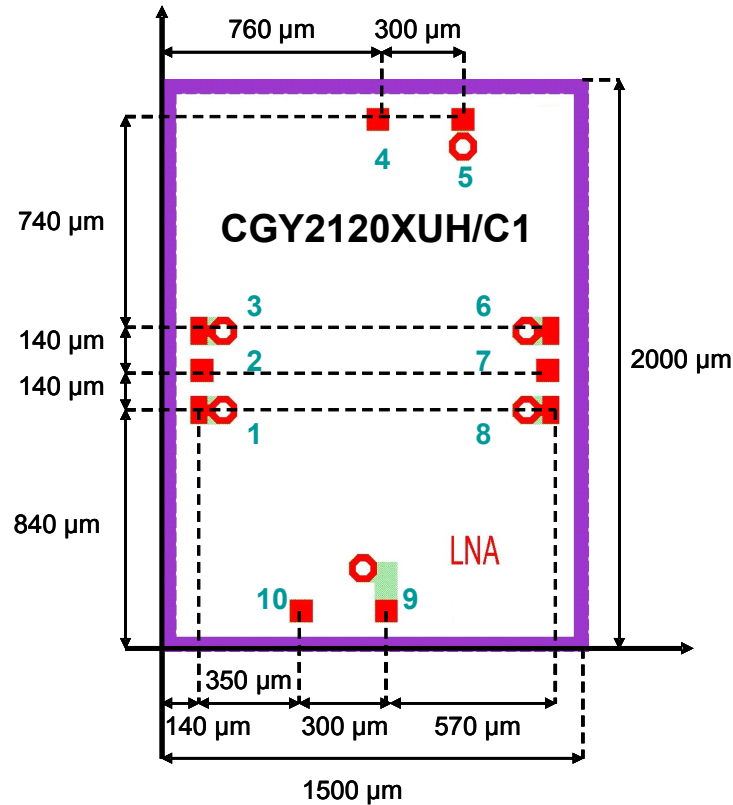
The following power supply sequence is recommended.

- a) Make sure the transient peaks from DC supply voltages do not exceed the limiting values.
- b) Pinch off the device by setting V_{GG} to -2V.
- c) Increase V_{DD} to +1V
- d) Increase the gate voltages V_{GG} from -2V until the drain current reaches 50 mA.
- e) Apply the RF input signal.

2- Mounting and ESD handling precautions

For high performance Integrated Circuits, such as the CGY2120XUH/C1, care must be taken when mounting GaAs MMICs so as to correctly mount, bond and hence obtain the most reliable long-term operation. The temperature, duration and material compatible with GaAs MMICs and the precautions to be taken are described in OMMIC's document "OM-CI-MV/001/PG", entitled, "Precautions for use III-V products".

PAD CONFIGURATION



PAD POSITION

SYMBOL	PAD	COORDINATES		DESCRIPTION
		X	Y	
GND	1	140	840	Connected to ground with on-chip via hole
IN	2	140	980	RF input
GND	3	140	1120	Connected to ground with on-chip via hole
V _{DD}	4	760	1860	Drain supply voltage, must be decoupled to ground using external capacitor(s)
GND	5	1060	1860	Connected to ground with on-chip via hole
GND	6	1360	1120	Connected to ground with on-chip via hole
OUT	7	1360	980	RF Output
GND	8	1360	840	Connected to ground with on-chip via hole
GND	9	790	140	Connected to ground with on-chip via hole
V _{GG}	10	490	140	Gate supply voltage, must be decoupled to ground using external capacitor(s)

MECHANICAL INFORMATION

PARAMETER	VALUE
Size	1500 x 2000 μm

Thickness		100 μm
Backside material		TiAu
Passivation		PECVD deposited Si_3N_4
Bonding pad dimensions	GND RF	80 x 100 μm
	IN, OUT, V_{DD} , V_{GG} , GND DC	80 x 80 μm

NOTE

The die size and all pad positions refer to the mask layout, with (X=0, Y=0) at the bottom left corner of the layout. For each pad, the (X,Y) coordinates refer to the center of the pad. Wafers are diced by sawing, with a sawline width of 35 μm ($\pm 5 \mu\text{m}$). A misalignment of the sawline with the middle of the dicing street ($\pm 20 \mu\text{m}$ on all sides) may also result in a variation of $\pm 20 \mu\text{m}$ of the actual positions of the pads on the diced chip and an additional tolerance of $\pm 40 \mu\text{m}$ on the die size.

DEFINITIONS

Limiting values definition

Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information

Applications that are described herein for any of these products are for illustrative purposes only. OMMIC makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

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Life support applications

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ORDERING INFORMATION

Generic type	Package type	Version	Description
CGY2120XUH	Bare Die	C1	Ultra Low Noise C-Band Amplifier



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