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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.

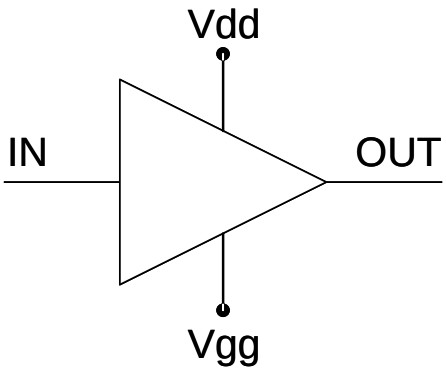
The die is manufactured using OMMIC's Advanced 70 nm gate length high Indium content MHEMT Technology. The MMIC uses gold bonding pads and backside materialization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability.

Application

- Radar
- Telecommunications
- Instrumentation

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

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MAXIMUM VALUES

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	MIN.	MAX.	UNIT
V_{DD}	Drain voltage	0	1.2	V
I_{DQ}	Drain current		60	mA
V_{GG}	Gate supply voltage	-2.5	0	V
T_{amb}	Ambient temperature	-40	+85	° C
T_j	Junction temperature		+150	° C
T_{stg}	Storage temperature	-55	+150	° C

Operation of this device outside the parameter ranges given above may cause permanent damage

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	UNIT
$R_{th\ (j\ -\ amb)}$	Thermal resistance from junction to ambient (DC power at T_{amb} max)	TBD	° C/W

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C, On-wafer measurement results, using 50 Ω RF probes unless stated otherwise.

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
VDD	Drain voltage			1	+1.2	V
IDD	Drain current			50		mA
VGG	Gate supply voltage		-2.5	-0.15	0	V
RFin	Input frequency		5		7	GHz
G	Gain	F = 6 GHz	13.2		13.2	dB
S_{11}	Input reflection coefficient	50 Ohms		-6.8	-6	dB
S_{22}	Output reflection coefficient	50 Ohms		-12	-6	dB
S_{12}	Isolation	F = 6 GHz		-19		
NF	Noise Figure	F = 6 GHz		0.5		dB
OP1dB	Output power 1 dB Compression Point			12		dBm

(*) Measurement reference planes are the INPUT and OUTPUT plans of the OMM9731UH/C1 MMIC.
(*) These characteristics depend of the drain voltage and the mode employed.

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.

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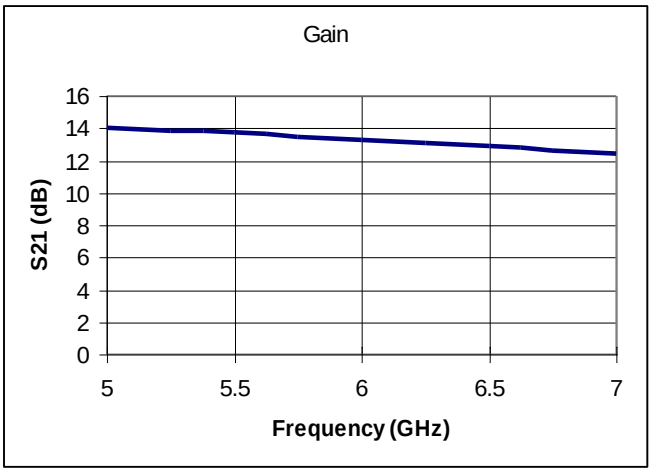
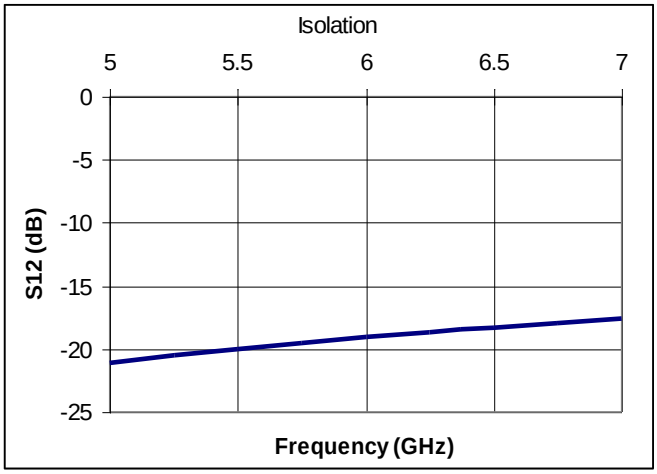
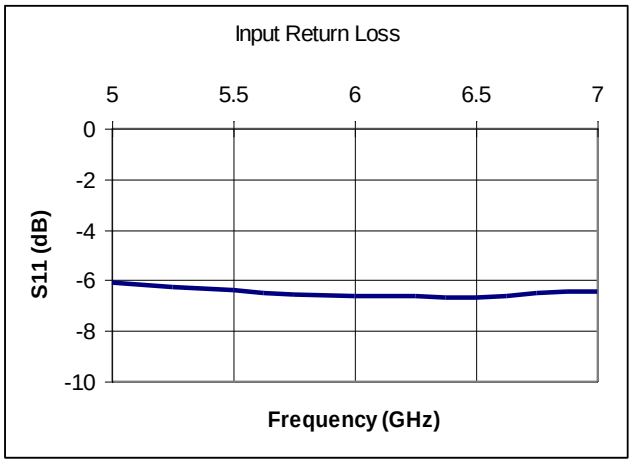
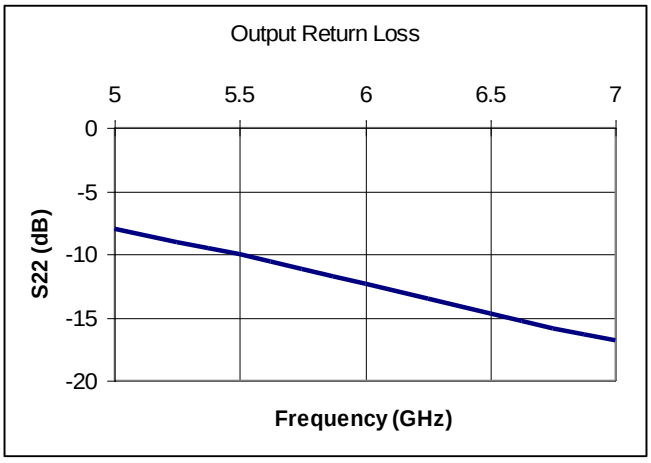
ON WAFER MEASUREMENTS

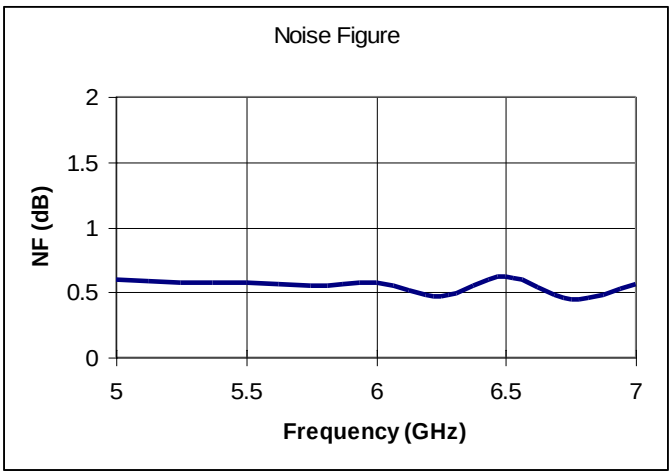
T_{amb} = 25 °C, V_{DD} =1V, I_{DD} = 50 mA. On-wafer measurement results, using 50 Ω RF probes











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 Ω RF probes.

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CGY2120XUH/C1 TYPICAL SCATTERING PARAMETERS

T_{amb} = 25 °C, V_{DD} =1V, I_{DD} = 50 mA. On-wafer measurement results, using 50 Ω 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

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APPLICATION INFORMATION

Typical application scheme

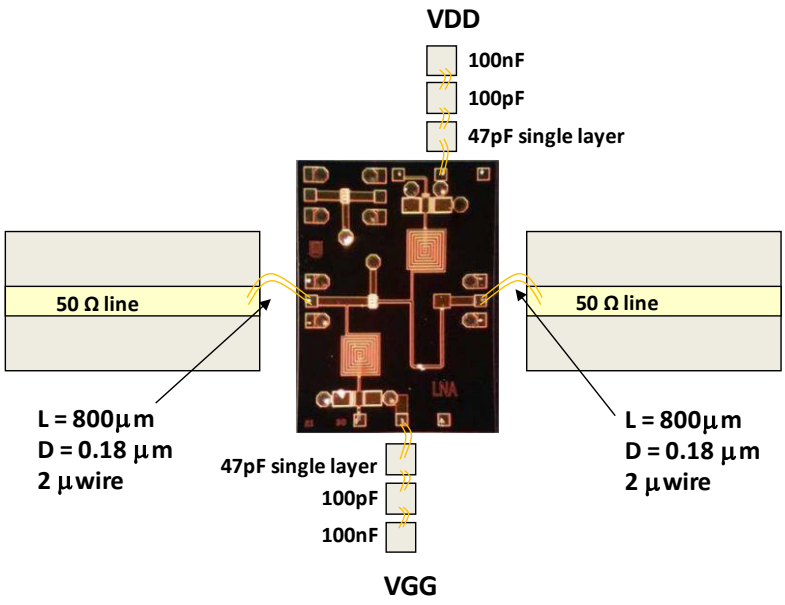
A reference module layout is shown below, where RF input and output microstrip transmission lines are used. However, coplanar transmission lines with similar performance may also be used. All path lengths and physical sizes of the components should be minimized.

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

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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

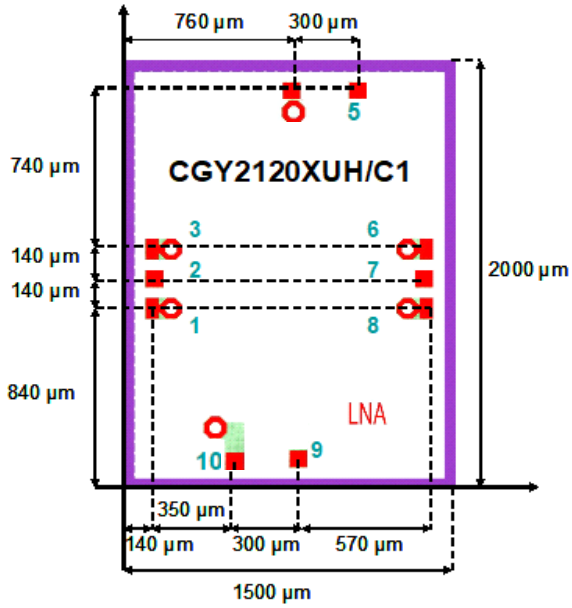
The following power supply sequence is recommended.

- Make sure the transient peaks from DC supply voltages do not exceed the limiting values.
- Pinch off the device by setting $V_{GG\ to}$ -2V.
- Increase V_{DD} to +1V
- Increase the gate voltages V_{GG} from -2V until the drain current reaches 50 mA.
- 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



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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
GND	4	760	1860	Connected to ground with on-chip via hole
VDD	5	1060	1860	Drain supply voltage, must be decoupled to ground using external capacitor(s)
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
VGG	9	790	140	Gate supply voltage, must be decoupled to ground using external capacitor(s)
GND	10	490	140	Connected to ground with on-chip via hole

MECHANICAL INFORMATION

PARAMETER		VALUE
Size		1500 x 2000 µm
Thickness		100 µm
Backside material		TiAu
Passivation		PECVD deposited Si3N4
Bonding pad dimensions	GND RF	80 x 100 µm
	IN, OUT, VDD, VGG, 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 (± 5 µm). A misalignment of the sawline with the middle of the dicing street (± 20 µm on all sides) may also result in a variation of ± 20 µm of the actual positions of the pads on the diced chip and an additional tolerance of ± 40 µm on the die size.

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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
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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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