

PRELIMINARY DATASHEET

CGY2121XUH/C2

Ultra Low Noise 18-26 GHz Amplifier

DESCRIPTION

The CGY2121XUH/C2 is a high performance GaAs Low Noise Amplifier MMIC designed to operate in the K band.

The CGY2121XUH/C2 has an exceptionally low noise figure of 1.2 dB with a very flat 19 dB of gain (+/-0.4dB). The on chip matching provides 12 dB of Input Return Loss and 11 dB of Output Return Loss. Thanks to the DC regulation the gain and noise are very stable wrt temperature change. It can be used in Radar, Telecommunication and Instrumentation applications.

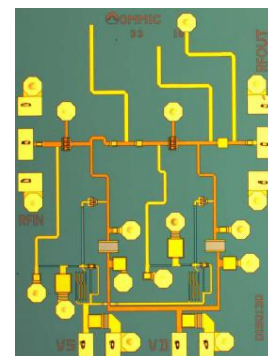
The die is manufactured using OMMIC's Advanced 70 nm gate length high Indium content MHEMT Technology. The MMIC uses gold bonding pads and backside metallization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability.

APPLICATIONS

- Radar
- Telecommunications
- Instrumentation

FEATURES

- Operating frequency range : 18 to 26 GHz
- Flat Gain: 19dB (+/-0.4dB) overall bandwidth
- Noise Figure: < 1.5 dB on overall bandwidth (1.2dB at 22GHz)
- Single positive and negative supply (+ and -1.5V)
- Low consumption : <92mW
- OP1dB : > 5dBm (7dBm@22GHz)
- Robust : Max +19dBm CW Input power
- 50 Ohms input and output matched
- Input Return Loss: > 12 dB at 22GHz
- Output Return Loss: > 11 dB at 22GHz
- Die size = 1.5 x 2.0 mm
- Available
 - Production Tested, Inspected Known Good Die (KGD)
 - Samples
 - Demonstration Boards



CGY2121XUH/C2 picture



MAXIMUM VALUES

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

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
V_s	Gate voltage	V_D Open circuit	- 3.0	0	V
V_D	Drain voltage	V_D Open circuit	0	+ 3	V
I_s / I_D	Current			10/100	mA
P_{IN}	RF Input power	CW		+ 19	dBm
T_{amb}	Ambient temperature		- 40	+ 85	$^{\circ}\text{C}$
T_j	Junction temperature			+ 150	$^{\circ}\text{C}$
T_{stg}	Storage temperature		- 55	+ 150	$^{\circ}\text{C}$

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	$^{\circ}\text{C/W}$

ELECTRICAL CHARACTERISTICS

$T_{amb} = + 25 \text{ }^{\circ}\text{C}$, $V_d = 1.5\text{V}$, $V_s = -1.5\text{V}$ unless otherwise specified.

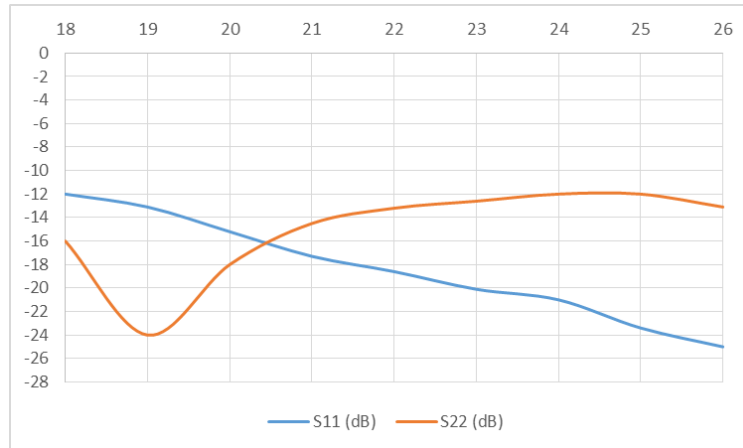
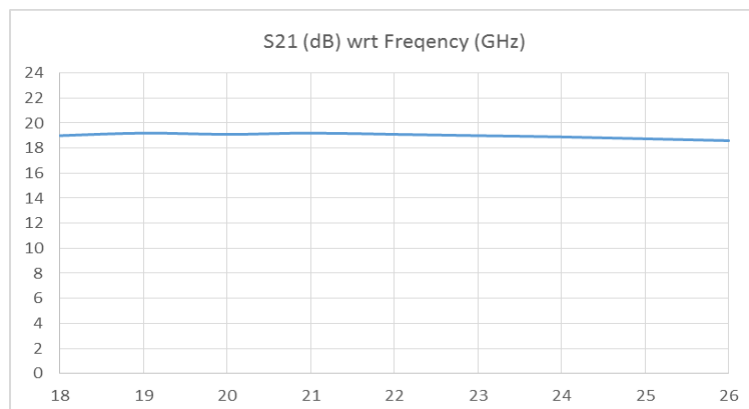
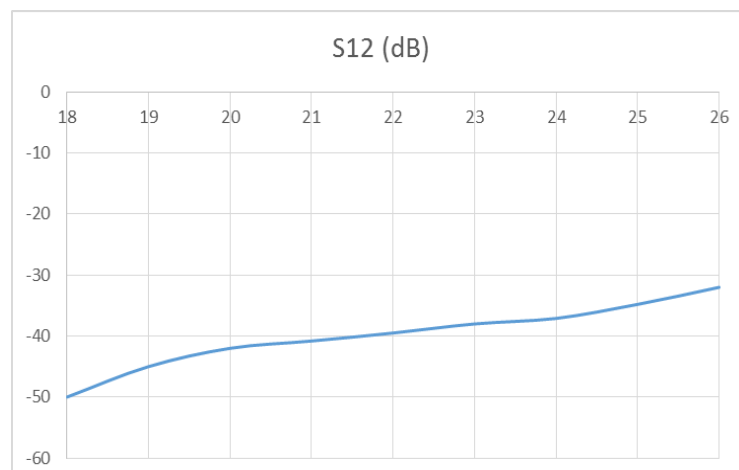
Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
R_{Fin}	Input frequency		18		26	GHz
<i>Performances on Reference Board with 0.25nH bonding parasitic inductor at input and output</i>						
V_D	Drain Supply voltage		+1.3	+ 1.5	+1.7	V
$I_s + I_D$	Drain Supply current	@ $V_d=1.3 / 1.5 / 1.7\text{V}$	44	61	78	mA
G	Gain	@ $V_d=1.3 / 1.5 / 1.7\text{V}$	18.4	19	19.7	dB
NF_{MIN}	Noise Figure		1.2	1.3	1.7	dB
OP1dB	1dB compression point	@ 20/22/24GHz		6/7/8.5		dBm
ISO_{rev}	Reverse Isolation	RF_{OUT}/RF_{IN}	-50		-32	dB
S_{11}	Input reflection coefficient	50 Ohms		-12	-10	dB
S_{22}	Output reflection coefficient	50 Ohms	-10	-12	-10	dB



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.

S-PARAMETERS

 Conditions : $V_d = 1.5V$, $V_s = -1.5V$, $T_{amb} = + 25^\circ C$ (On carrier measurements \rightarrow 0.25nH bonding)

Figure 1 : S11/S22 measurements

Figure 2 : Gain measurements

Figure 3 : Reverse isolation measurement


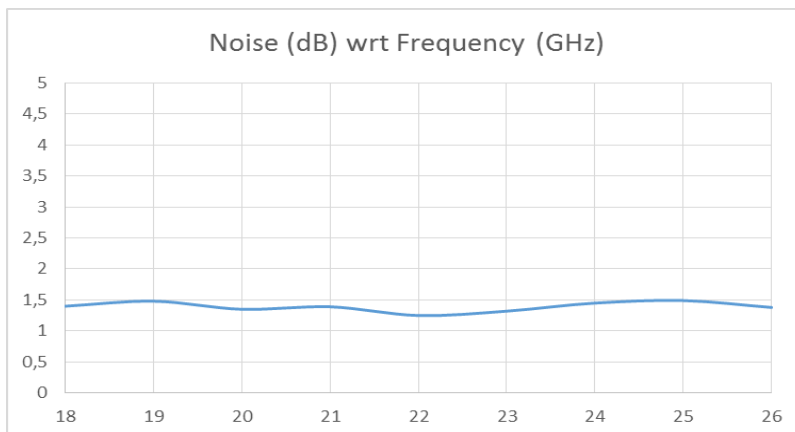
S PARAMETERS

 Conditions : $V_d = 1.5V$, $V_s = -1.5V$, $T_{amb} = + 25^{\circ}C$ (On wafer meas) (available as S2P file upon request)

FREQ	S11M	S11A	S21M	S21A	S12M	S12A	S22M	S22A
0.400000000	9.942001E-01	-2.303	8.343937E-03	-31.330	3.342864E-05	161.621	1.001237E+00	-4.327
1.000000000	9.924753E-01	-7.214	9.508982E-06	-149.012	9.721058E-06	-117.274	1.000159E+00	-11.253
1.400000000	9.946622E-01	-10.868	1.153089E-03	-42.154	2.017038E-05	68.685	1.001888E+00	-15.882
2.000000000	9.917662E-01	-15.762	2.499541E-03	-70.462	2.229215E-05	71.643	9.982312E-01	-23.096
2.400000000	9.919719E-01	-19.387	3.185947E-03	-80.998	2.340182E-05	62.159	9.952984E-01	-27.815
3.000000000	9.929461E-01	-24.611	7.829309E-03	-105.535	5.300073E-05	84.069	9.937590E-01	-35.363
3.400000000	9.923777E-01	-28.288	1.155947E-02	-113.105	5.152580E-05	87.719	9.905831E-01	-40.289
4.000000000	9.908955E-01	-33.789	2.244060E-02	-131.000	1.176936E-04	67.520	9.867871E-01	-48.370
4.400000000	9.888960E-01	-37.493	3.538381E-02	-146.840	1.643916E-04	65.854	9.832571E-01	-53.822
5.000000000	9.795953E-01	-42.994	6.510311E-02	-174.411	3.708514E-04	47.464	9.744985E-01	-62.521
5.400000000	9.752302E-01	-46.219	7.797528E-02	-129.831	5.581270E-04	20.173	9.713427E-01	-68.515
6.000000000	9.809264E-01	-52.082	4.290260E-02	75.552	6.448520E-04	-15.758	9.610796E-01	-78.535
6.400000000	9.825023E-01	-56.276	2.571680E-02	57.919	6.533306E-04	-22.967	9.526942E-01	-85.614
7.000000000	9.764332E-01	-62.388	7.673125E-03	43.073	7.495716E-04	-35.080	9.358364E-01	-97.386
7.400000000	9.725162E-01	-66.718	1.567247E-03	61.686	8.325977E-04	-38.363	9.208030E-01	-106.065
8.000000000	9.652687E-01	-72.942	2.401740E-03	-140.786	1.046271E-03	-47.504	8.915846E-01	-120.673
8.400000000	9.571538E-01	-77.532	3.039377E-03	-73.940	1.406165E-03	-47.929	8.656277E-01	-131.802
9.000000000	9.412722E-01	-85.085	1.617172E-02	-45.737	1.685994E-03	-66.191	8.114859E-01	-150.950
9.400000000	9.301241E-01	-90.007	3.090615E-02	-41.749	2.079519E-03	-76.548	7.656832E-01	-165.722
10.000000000	9.113928E-01	-98.121	7.938534E-02	-36.864	2.646975E-03	-93.452	6.820322E-01	-169.316
10.400000000	8.969244E-01	-103.867	1.475227E-01	-35.308	2.944170E-03	-107.231	6.241365E-01	-150.838
11.000000000	8.597501E-01	-112.626	3.838605E-01	-46.127	3.386306E-03	-129.615	5.412273E-01	-120.453
11.400000000	8.340441E-01	-118.891	6.970857E-01	-57.731	3.657498E-03	-144.776	4.989079E-01	99.734
12.000000000	7.891269E-01	-128.943	1.521298E+00	-84.971	3.642735E-03	-165.477	4.603296E-01	69.040
12.400000000	7.488548E-01	-136.515	2.391504E+00	-105.800	3.610917E-03	179.245	4.476035E-01	49.870
13.000000000	6.845898E-01	-147.587	4.136582E+00	-141.038	3.409295E-03	160.712	4.339788E-01	25.549
13.400000000	6.411882E-01	-156.192	5.452791E+00	-166.813	3.273907E-03	146.107	4.284036E-01	12.273
14.000000000	5.615277E-01	-171.144	7.289099E+00	-155.777	3.119382E-03	126.345	4.195728E-01	-3.668
14.400000000	5.017902E-01	-177.909	8.111471E+00	-131.918	2.924613E-03	111.059	4.187263E-01	-12.067
15.000000000	4.024806E-01	-158.038	8.997981E+00	-100.233	2.721595E-03	85.716	4.232824E-01	-23.089
15.400000000	3.287634E-01	-142.767	9.186123E+00	80.272	2.673045E-03	65.602	4.268728E-01	-30.039
16.000000000	2.417917E-01	-117.488	9.359029E+00	54.216	2.609184E-03	29.445	4.288894E-01	-39.912
16.400000000	1.987725E-01	-97.006	9.238568E+00	38.443	2.549169E-03	14.479	4.273495E-01	-46.600
17.000000000	1.608018E-01	-63.969	9.094944E+00	16.662	2.867546E-03	-11.003	4.164105E-01	-56.238
17.200000000	1.511996E-01	-50.655	9.025776E+00	10.626	2.991047E-03	-20.762	4.111927E-01	-59.440
17.400000000	1.522265E-01	39.722	8.998409E+00	5.013	3.196023E-03	-28.644	4.063007E-01	-62.239
17.600000000	1.574758E-01	28.163	8.954752E+00	-1.800	3.243379E-03	-35.771	3.967197E-01	-65.332
17.800000000	1.626577E-01	22.162	8.932602E+00	-7.202	3.518923E-03	-42.372	3.894868E-01	-68.568
18.000000000	1.629914E-01	11.787	8.736577E+00	-12.995	3.669030E-03	-48.849	3.813673E-01	-71.360
18.400000000	1.823786E-01	0.616	8.838578E+00	-23.320	4.131312E-03	-61.008	3.586772E-01	-77.167
19.000000000	2.086966E-01	-14.248	8.847290E+00	-38.755	4.764491E-03	-75.495	3.157185E-01	-85.881
19.400000000	2.196271E-01	-19.754	8.862725E+00	-49.561	5.372560E-03	-82.437	2.764269E-01	-91.937
20.000000000	2.511549E-01	-24.852	9.013975E+00	-63.699	6.588768E-03	-94.750	2.087331E-01	-97.755
20.400000000	2.642503E-01	-31.280	8.997871E+00	-74.452	7.487141E-03	-105.231	1.611401E-01	-99.737
21.000000000	2.826818E-01	-35.507	9.082990E+00	-89.074	8.430580E-03	-117.653	8.849466E-02	-84.623
21.400000000	3.074922E-01	-39.923	9.076735E+00	-99.739	9.204821E-03	-125.063	7.093664E-02	-44.974
22.000000000	3.272830E-01	-43.729	9.035695E+00	-114.925	1.047820E-02	-137.102	1.373904E-01	-11.134
22.400000000	3.392197E-01	-46.775	8.996519E+00	-124.894	1.146202E-02	-145.115	1.964457E-01	-9.540
23.000000000	3.503259E-01	-51.330	8.744015E+00	-139.593	1.269577E-02	-156.938	2.765385E-01	-15.201
23.400000000	3.597771E-01	-55.276	8.765188E+00	-149.372	1.354192E-02	-164.727	3.239308E-01	-19.938
24.000000000	3.668543E-01	-61.719	8.364953E+00	-163.250	1.425619E-02	-177.672	3.816164E-01	-28.219
24.400000000	3.666879E-01	-64.078	8.223495E+00	-173.235	1.492260E-02	-176.133	4.125409E-01	-33.391
25.000000000	3.646041E-01	-69.266	7.852419E+00	-173.167	1.590927E-02	-165.253	4.422442E-01	-40.555
25.400000000	3.510638E-01	-70.412	7.610055E+00	-162.604	1.664785E-02	-158.544	4.582173E-01	-44.176
26.000000000	3.406391E-01	-70.246	7.253855E+00	-149.196	1.770818E-02	-147.141	4.743732E-01	-48.589
26.400000000	3.304455E-01	-70.691	7.182520E+00	-140.383	1.823243E-02	-138.366	4.868346E-01	-50.430
27.000000000	3.236671E-01	-65.552	6.653464E+00	-126.124	1.897223E-02	-125.240	5.115082E-01	-53.721
27.400000000	3.308552E-01	-65.199	6.377822E+00	-116.868	1.879259E-02	-116.518	5.330622E-01	-55.754
28.000000000	3.405073E-01	-59.443	5.706749E+00	-102.135	1.797113E-02	-101.473	5.690279E-01	-59.486
28.400000000	3.653811E-01	-57.440	5.254837E+00	-93.966	1.712080E-02	-95.197	5.928233E-01	-62.152
29.000000000	4.123963E-01	-55.273	4.765916E+00	-81.185	1.655123E-02	-85.321	6.293497E-01	-65.554
29.400000000	4.69989E-01	-56.460	4.284561E+00	-75.189	1.579951E-02	-78.151	6.613217E-01	-68.484
30.000000000	4.894842E-01	-59.437	3.866301E+00	-62.332	1.489539E-02	-66.464	6.970039E-01	-73.550
30.400000000	5.262553E-01	-61.354	3.652359E+00	-52.936	1.379772E-02	-59.026	7.224963E-01	-77.383
31.000000000	5.731001E-01	-66.800	3.022391E+00	-42.803	1.220451E-02	-48.946	7.546883E-01	-82.731
31.400000000	5.986132E-01	-68.863	2.832551E+00	-32.570	1.125223E-02	-43.514	7.714455E-01	-87.002
32.000000000	6.463342E-01	-73.591	2.282762E+00	-26.981	9.586811E-03	-34.943	7.950746E-01	-91.816
32.400000000	6.631867E-01	-76.397	2.156750E+00	-20.245	9.161716E-03	-31.881	8.059676E-01	-95.768
33.000000000	7.034586E-01	-79.982	2.014783E+00	-11.380	7.599985E-03	-19.768	8.226859E-01	-101.313
33.400000000	7.243452E-01	-83.862	1.900178E+00	5.727	5.976293E-03	-7.324	8.317684E-01	-104.984
34.000000000	7.411534E-01	-87.443	1.517164E+00	-1.444	4.749679E-03	-0.424	8.458482E-01	-110.571
34.400000000	7.655966E-01	-90.660	1.310325E+00	-6.875	3.177053E-03	-3.389	8.515694E-01	-114.196
35.000000000	7.808647E-01	-94.841	1.099885E+00	-12.644	2.504331E-03	-26.617	8.609842E-01	-119.333
35.400000000	7.876277E-01	-98.714	9.394050E-01	-14.707	1.585337E-03	-72.541	8.647118E-01	-122.947
36.000000000	7.977734E-01	-102.608	8.709013E-01	-26.019	1.919116E-03	-145.813	8.676526E-01	-128.816

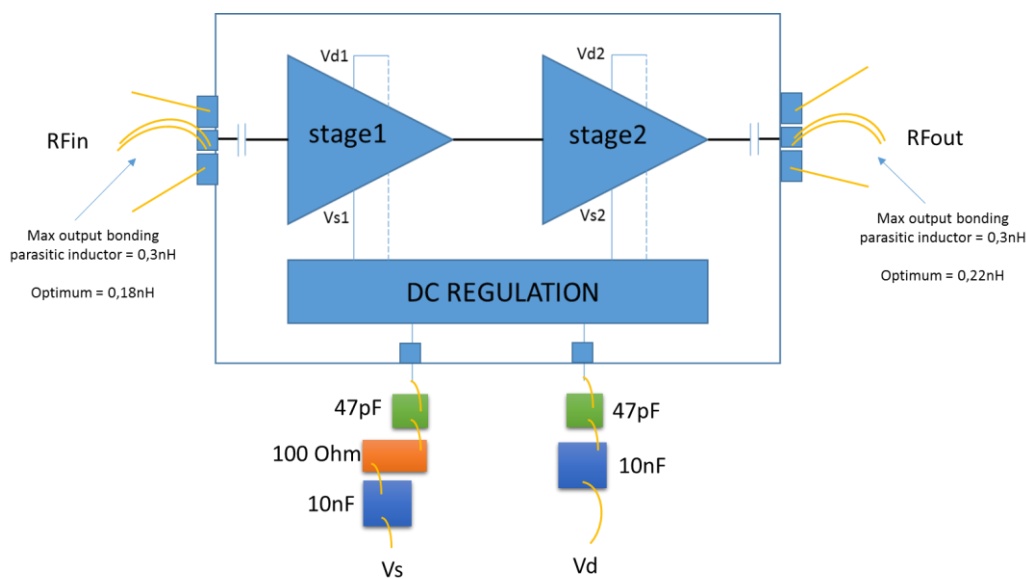
NOISE FIGURE

Conditions : $V_d = 1.5V$, $V_s = -1.5V$, $T_{amb} = + 25^{\circ}C$ (On carrier measurements \rightarrow 0.25nH bonding)



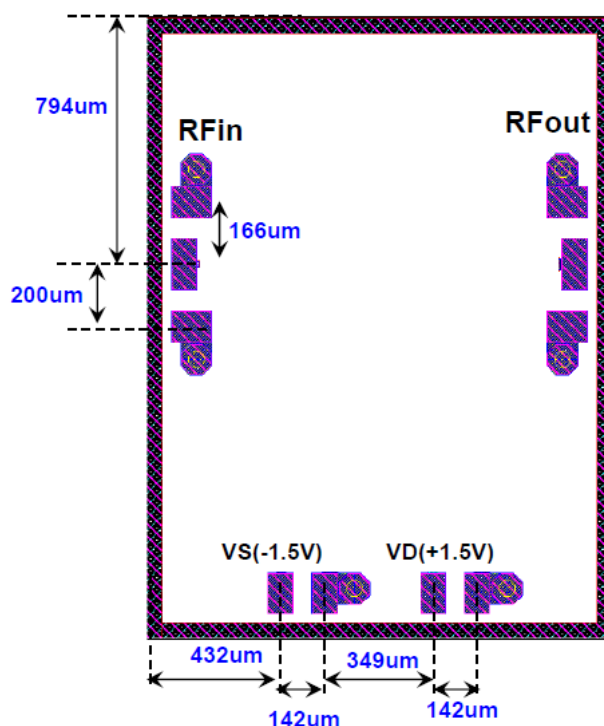
APPLICATION SCHEMATIC

To prevent instability of the customer design it is highly recommended to place small chip capacitors as near as possible to the CGY2121XUH/C2 die and to connect them with bondings as short as possible. Additionally, a 10nF capacitor can be added on a drain connection. In the gate circuitry, a 500 Ω resistor may be added in serie to improve gate isolation and prevent unwanted oscillations. The resistors are introducing some low pass filtering in case of fast power switching using gate control architecture..



Component NAME	Value	Type	Comment
All 47pF capacitors	47pF	Chip Capacitor	Chip capacitor PRESIDIO COMPONENTS P/N SA151BX470M2HX5#013B soldered close to the die with bonding as short as possible
All 100 Ω resistors	100 Ω	Chip Resistor	Chip resistor US MICROWAVES RG1421-100-1% soldered close to the 47pF chip capacitor with bonding as short as possible
All 10nF capacitors	10nF	Chip Capacitor	MURATA GMA085R71C103MD01T GM260 X7R 103M 16M100 PM520

DIE LAYOUT AND PIN CONFIGURATION



Pad layout

PINOUT

Symbol	Pad	Description
RFOUT	OUT	RF output
RFIN	IN	RF input
Vd	VD1	Positive supply voltage
Vs	VD2	Negative supply voltage
GND	BACKSIDE	Ground

Note :

In order to ensure good RF performances and stability It is key to connected to the ground the pad available on the backside of the die.

BONDINGS PAD COORDINATES

Symbol	Pad X coordinate	Pad Y coordinate
GND	100	1406
RFIN	100	1206
GND	100	1006
VS	432	100
GND	574	100
VD	923	100
GND	1065	100
GND	1400	1006
RFOUT	1400	1206
GND	1400	1406

Figure 4 : pad coordinates (in um)

PACKAGE

Type	Description	Terminals	Pitch (mm)	Package size (mm)
DIE	100% RF and DC on-wafer tested	23	-	1.5 x 2 x 0.1

SOLDERING

To avoid permanent damages or impact on reliability during soldering process, die temperature should never exceed 330°C.

Temperature in excess of 300°C should not be applied to the die longer than 1mn

Toxic fumes will be generated at temperatures higher than 400°C

ORDERING INFORMATION

Generic type	Package type	Version	Sort Type	Description
CGY2121X	UH	C2	-	On-Wafer measured Die



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.

DISCLAIMERS

Life support applications

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. OMMIC's customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify OMMIC for any damages resulting from such application.

Right to make changes

OMMIC reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. OMMIC assumes no responsibility or liability for the use of any of these products, conveys no licence or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.