Short Form Catalog 2018

GM SYSTEMS

"From Old to New"

TOM TERLIZZI
GM SYSTEMS LLC
27 KIM PLACE
KINGS PARK, NEW YORK 11754
EMAIL: t2@gmsystems.com
LAND LINE: 631-269-3820
CELLPHONE: 516-807-9488

OMMIC

innovating with III-V'S

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III – V Leading Supplier

OMMIC at a Glance

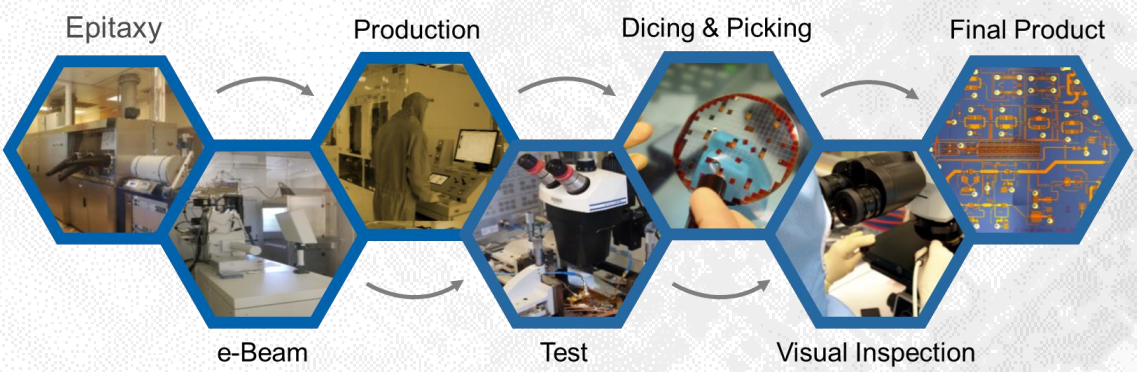
OMMIC, based near Paris in France, is a leading supplier of Epitaxy, Foundry Services and MMICs based around the most advanced III-V processes.

Formerly Phillips Semiconductor, OMMIC is exploiting more than 40 years background in III-V Materials, Design and Processing. Thanks to its innovative solutions, OMMIC enables its customers to be leaders in a more and more demanding market place.

OMMIC operates in a highly competitive global market and must be competitive and responsive.

OMMIC has been ISO 9001 certified since 1994 and ISO 14001 since 2002.

This sustainable commitment is fully supported by its quality management system.



OMMIC is supplying MMIC, Foundry Services and Epitaxial Wafers based on III-V (GaN GaAs and InP) materials. With its advanced technology, OMMIC has proven itself as a leader in its field, providing its customers with cutting edge performance in the Telecommunication, Space and Defense markets.

OMMIC
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Contents

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New Production Line

World's 1st 6" GaN/Si Line in Production

The new 6-inch GaN production line will largely boost OMMIC's production capability by 4 times. Combined with improved production yield and increased work shifts, it is estimated to have 7 times of present production capabilities.

Thanks to improved process automation and 5 work shifts in 2019, lead time will be reduced to 7 weeks

With this new production line, OMMIC has set itself three goals for the comming years :

1

Leader in GaN

OMMIC to become the first and unique foundry in Europe for mmW GaN technology on 6-inch wafers.

2

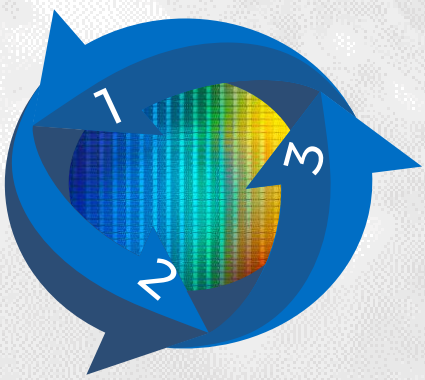
Top 3

OMMIC to become top 3 foundry in the world for GaAs and GaN technology.

3

€ 100 000 000

OMMIC to reach 100 million euros sales in the year of 2020.



Strategy & Roadmap

OMMIC strategy is articulated around GaN technology. With its wide bandgap and high electron mobility, GaN is a perfect candidate for emerging applications.

Our strategy includes

Full Replacement of GaAs Solutions

OMMIC plans to fully replace its GaAs pHEMT solutions by its state-of-the-art GaN/Si technology, offering the best III–V RF solutions, complementary to Silicon RF solutions.

New Cellular Telecom Market

OMMIC aims to enter cellular infrastructure market, especially 5G market with its cutting-edge GaN/Si technology, best suited for the 5G mmWave application.

High-End Space Market

OMMIC continues to serve high-end high value-added space market, by taking advantage of its avant-garde Hi-Reliability process for consumer market.

High-End Defense Market

OMMIC continues to serve high-end high value-added military market, by taking advantage of its high-performance process for consumer market.

D01GH	D01GH GaN/Si process is already available for OMMIC customer through open foundry service
D006GH	D006GH GaN/SiC 60 nm process PDK is already available for download
	f_{max} = 250GHz , f_t : 170 GHz , Gate length: 60nm, I_{max} = 1,1 A/mm, Gm = 700 mS/mm, P_{max} =1 W/mm @ 94 GHz, V_{bdg} > 30V, NF_{min} = 1 dB @ 50 GHz
D004GH	D004GH GaN/SiC 40 nm process is still in development and will be available in 2020
	State-of-the-art and unique 40 nm process for GaN technology

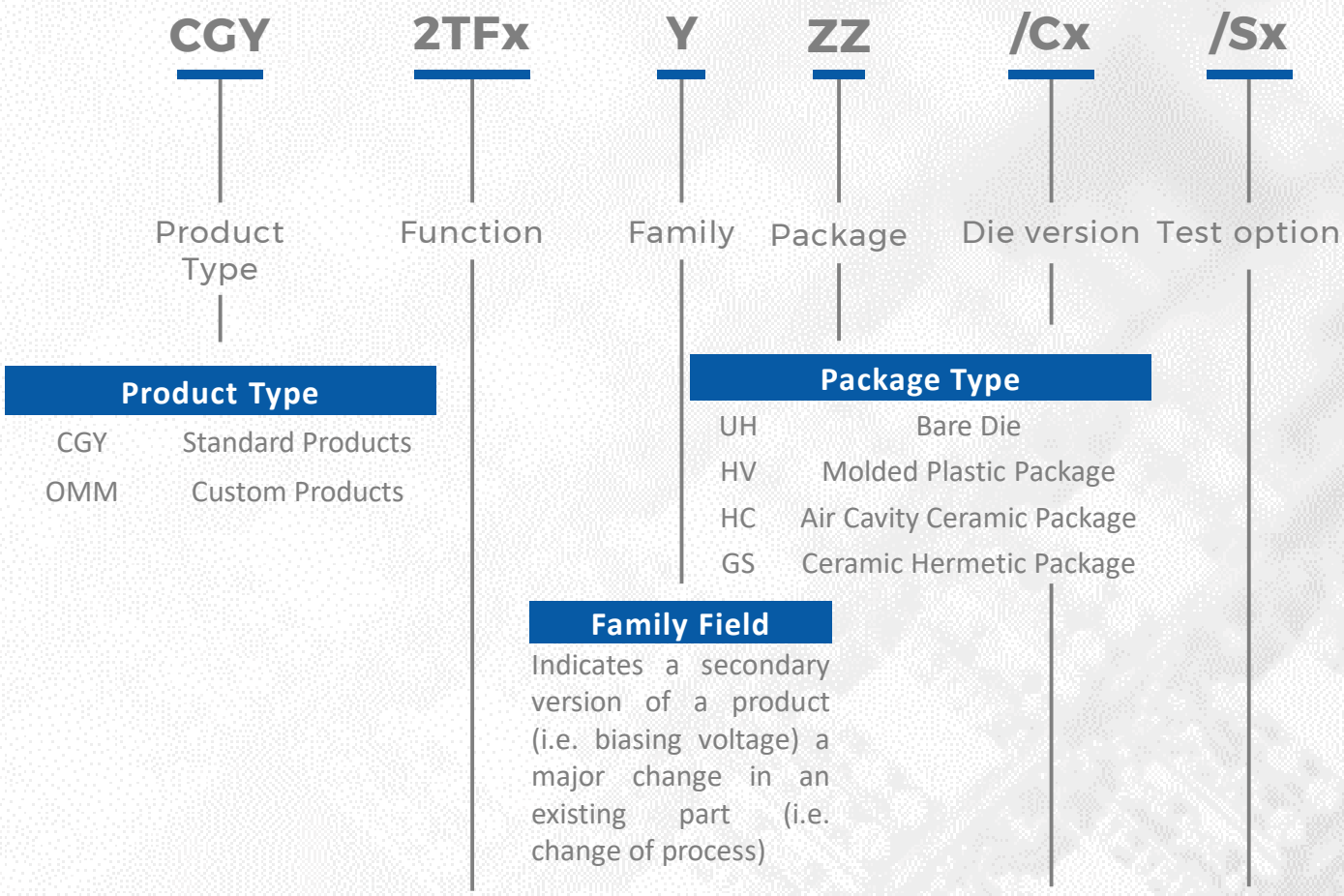
2015 — D01GH (Si)
110 GHz Ft
3,3 W/mm @ 30 GHz

2018 — D006GH (SiC)
150 GHz Ft
2 W/mm @ 94 GHz

2020 — D004GH (SiC)
210 GHz Ft
0,8 W/mm @ 140 GHz

Part Numbering

Part designation at OMMIC are following defined rules; each field is related to the following items



Product Type

CGY	Standard Products
OMM	Custom Products

Package Type

UH	Bare Die
HV	Molded Plastic Package
HC	Air Cavity Ceramic Package
GS	Ceramic Hermetic Package

Family Field

Indicates a secondary version of a product (i.e. biasing voltage) a major change in an existing part (i.e. change of process)

Product Function

A four digit number from CGY2100 to 2999 (standard products) or OMM9200 to 9999 (custom products)

T	Function Digit
0	Not allowed
1	Legacy notation
2	LNA
3	Control Functions
4	Frequency conversion
5	Wide band amplifier
6	PA
7	Amplifier (General)
8	Other functions
9	Special

F	Frequency	Digit
0	0-4	GHz
1	4-8	GHz
2	8-12	GHz
3	12-18	GHz
4	18-26.5	GHz
5	26.5-40	GHz
6	40-75	GHz
7	75-110	GHz
8	110-400	GHz
9	6-18	GHz

Die Version

The x number of this field is incremented for each version or redesign of the die

Test Option

The x number of this field is incremented for each customer specific test applied on a standard product. The F letter indicates a flight model device

Part Number Example

Standard Product — Version A — Design Version 1

CGY 2175 A HV /C1 /S1

Part Number — Plastic QFN — Special Test for Customer 1

MMIC Product Selector Guide

Advanced mmW MMIC Solutions

Innovative GaN Products
(15 – 50 GHz)

Low Noise Amplifiers
(0,5 – 120 GHz)

Power Amplifiers
(0,5 – 46 GHz)

Wideband Amplifiers
(DC – 54 GHz)

Digital Attenuator & Phase Shifters
(5 - 35 GHz)

Corechips & Control Functions
(5 - 35 GHz)

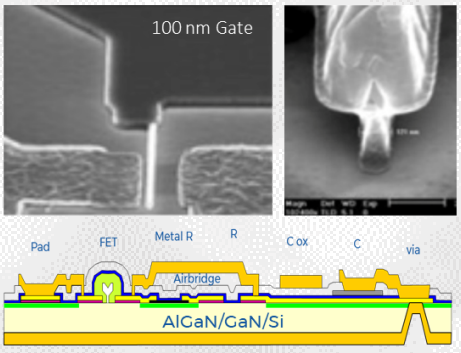
OMMIC
innovating with III-V'S

D01GH GaN/Si

Main Features

D01GH FEATURE

f_{max} : 160 GHz
f_t : 110 GHz
Gate length: 100 nm
V_{bgd} : 40 V



PRELIMINARY ON-WAFER MEASUREMENTS

PW @ 30 GHz : 3,5W/mm
PAE : 48%

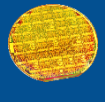
MAIN APPLICATIONS

- High Linearity Mixers
- High frequency PA 15 GHz to 50 GHz
- Instrumentation wide band amplifier DC - 50 GHz
- Robust LNA (< 40 GHz) : up to 35dBm Pin in CW

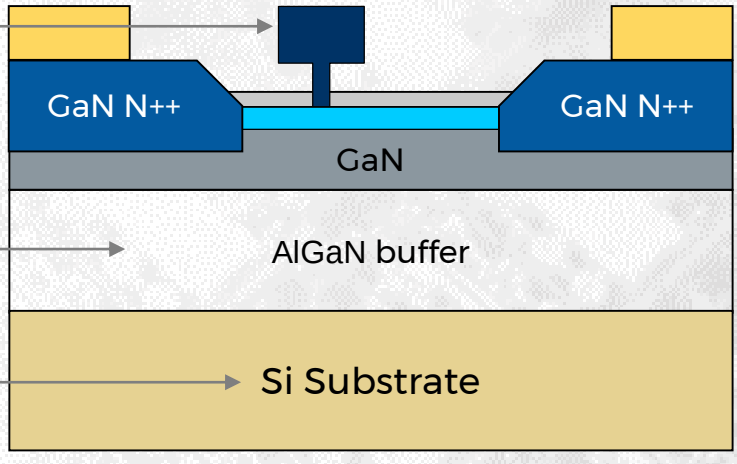
OMMIC's GaN specificities

100 nm gate length and short gate-source distance allow high RF performances

In-house Epitaxy for full process optimization.

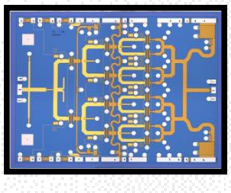


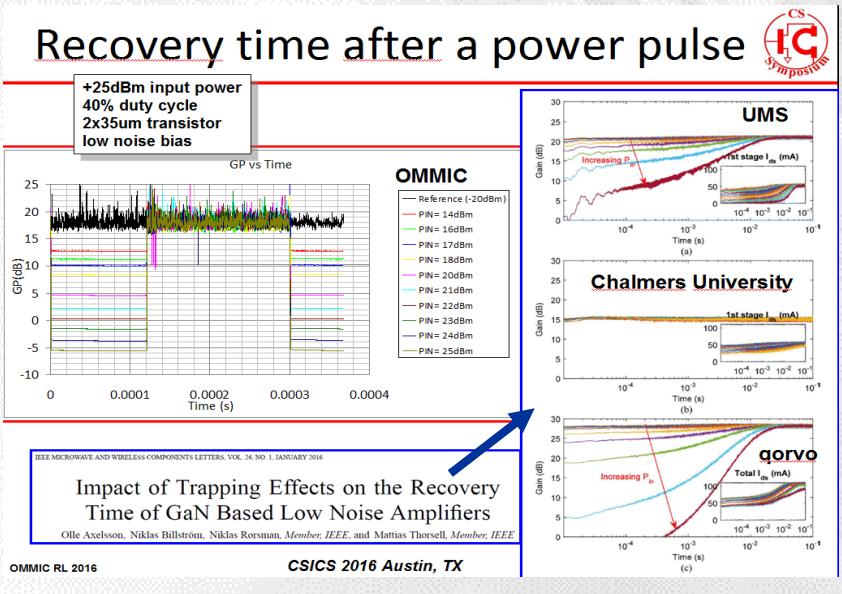
Silicon Substate instead of SiC to **avoid ITAR** regulation and make GaN **affordable**.
Si substrate can deliver reliable MMIC with output power up to dozaines of Watts



The only GaN Process in Production Having no Memory Effect

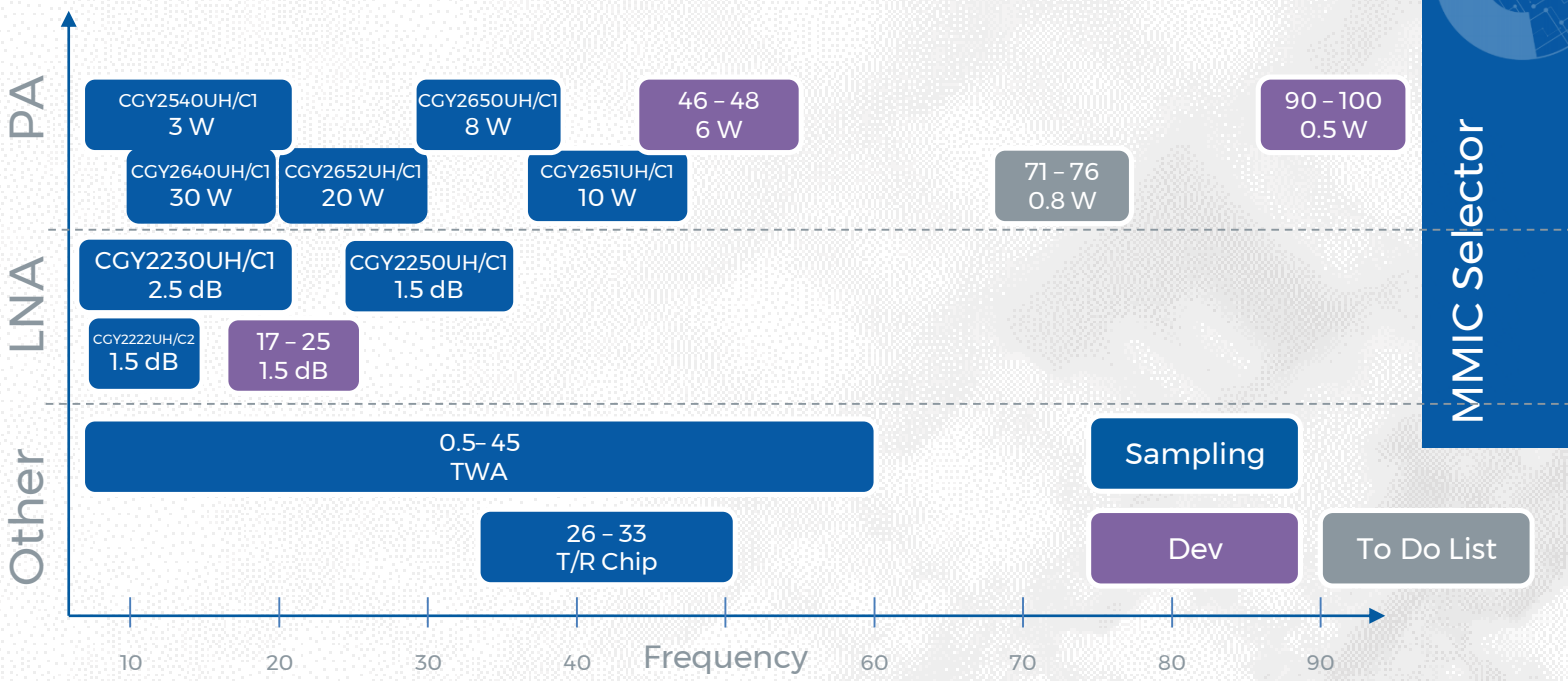
OMMIC's GaN has been engineered to reduce as much as possible traps in its process. This is why, unlike post process in production, OMMIC's D01GH has few-to-no measurable memory effect.
With D01GH, optimized digital pre-distortion technique can be used as much as complex modulation.





Innovative GaN Products Portfolio

GaN products are being actively developed for emmerging applications ; they are processed using D01GH GaN/Si technology which is 100 % european sourced and ITAR regulation free.



GaN LNA have been designed so that maximum input power is higher than 40 dBm. This is handy because, in most settings, no limitor is needed in front of the LNA

LNA

Part number	Frequency (GHz)	Gain (dB)	NF (dB)	OP1dB (dBm)	Bias Voltage (V)	Bias Current (mA)	Package	Status
CGY2230UH/C1	2 – 20	17	2.5	22	8	155	Die	Sampling
CGY2222UH/C2	8 – 12	20	1.5	20	8	155	Die	Sampling
CGY2250UH/C1	26 – 34	20	1.6	27	8.5	90	Die	Sampling

PA

Part number	Frequency (GHz)	Gain (dB)	Saturated Power (dBm)	Compression Point P1dB (dBm)	Bias Voltage (V)	Bias Current (A)	Package	Status
CGY2540UH/C1	0.5 – 20	22	35		12	0.7	Die	Sampling
CGY2640UH/C1	15 – 18	25	45	40	12	1	Die	Sampling
CGY2650UH/C1	30 – 33.5	22	39	28.5	12	0.7	Die	Sampling
CGY2652UH/C1	27 – 31	20	43	41	12	0.46	Die	Sampling
CGY2651UH/C1	37 – 43	18	40	38	12	0.84	Die	Sampling

TWA

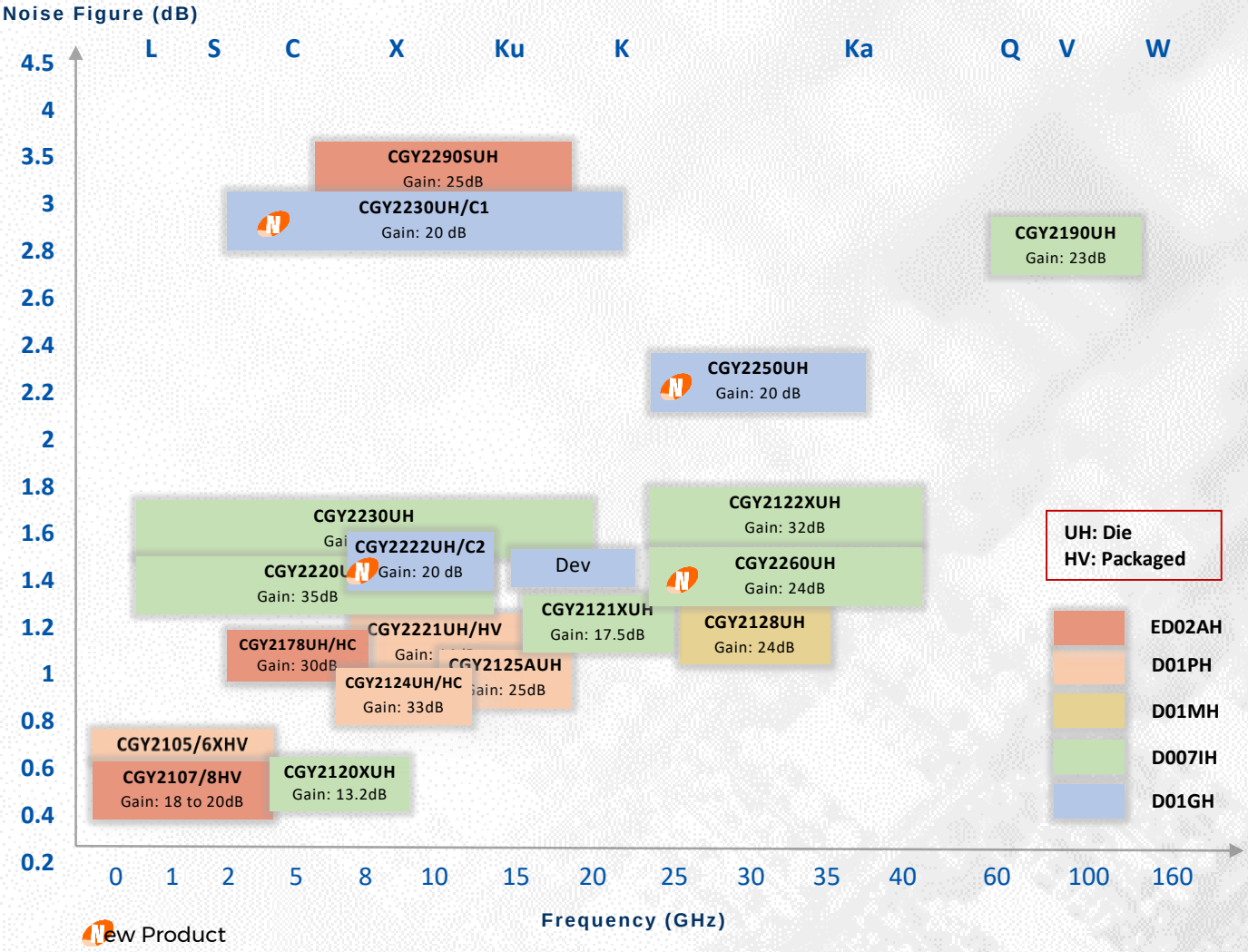
Part number	Frequency (GHz)	Gain (dB)	Saturated Power (W)	Compression Point P1dB (dBm)	Bias Voltage (V)	Bias Current (mA)	Package	Status
CGY2550UH/C1	0.6 – 40	16	2	19	18	91	Die	Production

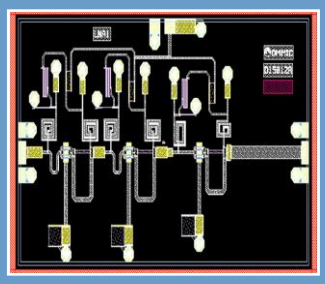
T/R

Part number	Frequency (GHz)	Gain (dB)	Output Power (dBm)	Noise Figure (dB)	Bias Voltage (V)	Bias Current (A)	Package	Status
CGY2750UH/C1	26 – 34	20	35	3	12	0.45	Die	Sampling

Low Noise Amplifiers Portfolio

Performance Figure for Low Noise Amplifiers MMIC





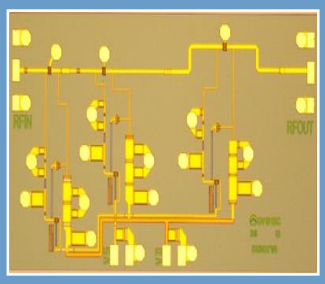
CGY2222UH/C2

Frequency : 8 – 12 GHz

NF : 1.5 dB

Gain : 20 dB

Pin max : 40 dBm

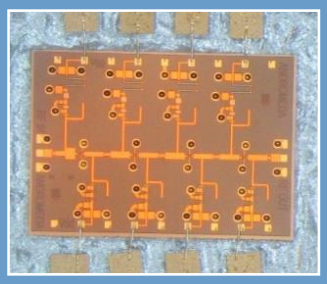


CGY2260UH/C1

Frequency : 25 - 43 GHz

NF : < 1.7 dB

Gain : 25 dB



CGY2190UH/C2

Frequency : 75 – 110 GHz

NF : 3 dB

Gain : 23 dB

Low Noise Amplifiers Portfolio

OMMIC Portfolio of MMICs, includes LNA from 500 MHz to 160 GHz for application such as Telecommunication, Passive imaging, Radars and Space.

LNA are manufactured using GaAs technology (ED02AH, D01PH, D01MH) that have been Space qualified by ESA, or innovating technology : GaAs mHEMT (D007IH) for lower noises & higher frequencies or GaN HEMT (D01GH) for robust LNA.

Performance Table for Low Noise Amplifiers MMIC

LNA written in blue are manufactured using GaN technology. They are therefore very robust an can handle more than 32 dBm input power in CW (>40 dBm in pulse)

Part number	Frequency (GHz)	Gain (dB)	NF (dB)	OP1dB (dBm)	Bias Voltage (V)	Bias Current (mA)	Package	Status
CGY2105XHV	0.5 – 4	19	0.42	35	5	2 x 50	QFN 4x4	Production
CGY2106XHV	0.1 – 3	19	0.45	35	5	2 x 50	QFN 4x4	Production
CGY2108HV	0.5 – 6	22	0.5	36	5	2 x 50	QFN 4x4	Production
CGY2107UH	0.5 – 6	24	0.6	34	5	2 x 50	QFN 4x4	Production
CGY2108GS	0.5 – 6	21	0.6	36	5	2 x 50	Flight Model	Production
CGY2120XUH/C1	5 – 7	13	0.5	12	1	50	Die	Production
CGY2178HV/C1	5 – 6	30	1	15	3	40	QFN	Production
CGY2178UH/C1	5 – 6	30	1	15	3	40	Die	Production
N CGY2222UH/C2	8 – 12	20	1.5	20	8	155	Die	Sampling
CGY2124UH/C1	8 – 12	33	1.1	11	5	55	Die	Production
CGY2220UH/C1	1 – 12	35	1.3	12	1.5	52	Die	Production
CGY2221UH/C1	7.5 – 13	17	1.6	17	5	82	Die	Production
CGY2221HV/C1	7.5 – 13	17	1.7	17	5	82	QFN	Sampling
CGY2125UH/C1	13 – 15	25	1	8	3.3	20	Die	Production
CGY2230UH/C1	1 – 18	35	1.5	12	1.5	50	Die	Production
CGY2290SUH/C1	6 – 18	9	3.3	13	5	30	Die	Production
N CGY2230UH/C1	2 – 20	17	2.5	22	8	155	Die	Sampling
CGY2121XUH/C2	18 – 26	18	1.5	5	0.8	60	Die	Production
N CGY2250UH/C1	26 – 34	20	1.6	27	8.5	90	Die	Sampling
CGY2128UH/C2	24 – 34	24	1.3	11	3.5	47	Die	Production
CGY2122XUH/C2	25 – 43	32	1.5	1	1.1	30	Die	Production
N CGY2260UH/C1	25 – 43	24	1.5	8	1.5	50	Die	Sampling
CGY2190UH/C2	75 – 110	23	3	1	1	33	Die	Production

N New Product

Power & Wideband Amplifiers Portfolio

OMMIC Portfolio of MMICs, includes Amplifiers from DC to 46 GHz for civil application such as Telecommunication, Instrumentation, Radars but also for Satcom and military applications.
LNA are manufactured using GaAs technology (**ED02AH**, **D01PH**, **D01MH**) that have been Space qualified by ESA, or innovating technology : GaAs mHEMT (**D007IH**) for lower noises & higher frequencies or GaN HEMT (**D01GH**) for robust LNA.

Performance Table for (Power) Amplifiers MMIC

OMMIC Power Amplifiers are dedicated to application such as Radar, telecommunication and instrumentation.

New Product

Part number	Frequency (GHz)	Gain (dB)	Saturated Power (dBm)	Compression Point P1dB (dBm)	Bias Voltage (V)	Bias Current (A)	Package	Status
CGY2540UH/C1	0.5 – 20	22	35		12	0.7	Die	Sampling
CGY2620UH/C1	8_ 11	25	42	41	9	3.25	Die	Sampling
CGY2640UH/C1	15 – 18	25	45	40	12	1	Die	Sampling
CGY2134UH/C1	18 – 23	23	23	22	4.5	0.3	Die	Production
CGY2135UH/C1	18 – 23	25	33	32.3	4	1.2	Die	Production
CGY2652UH/C1	27 – 31	20	43	41	12	0.46	Die	Sampling
CGY2651UH/C1	37 – 43	18	40	38	12	0.84	Die	Sampling
CGY2650UH/C1	30 – 33.5	22	39	28.5	12	0.7	Die	Production

The MMICs use gold bonding pads and backside metallization and are fully protected with Silicon Nitride passivation to get the highest level of reliability. **D01PH** technology has been evaluated for Space applications and is on the European Preferred Parts List of the European Space Agency.

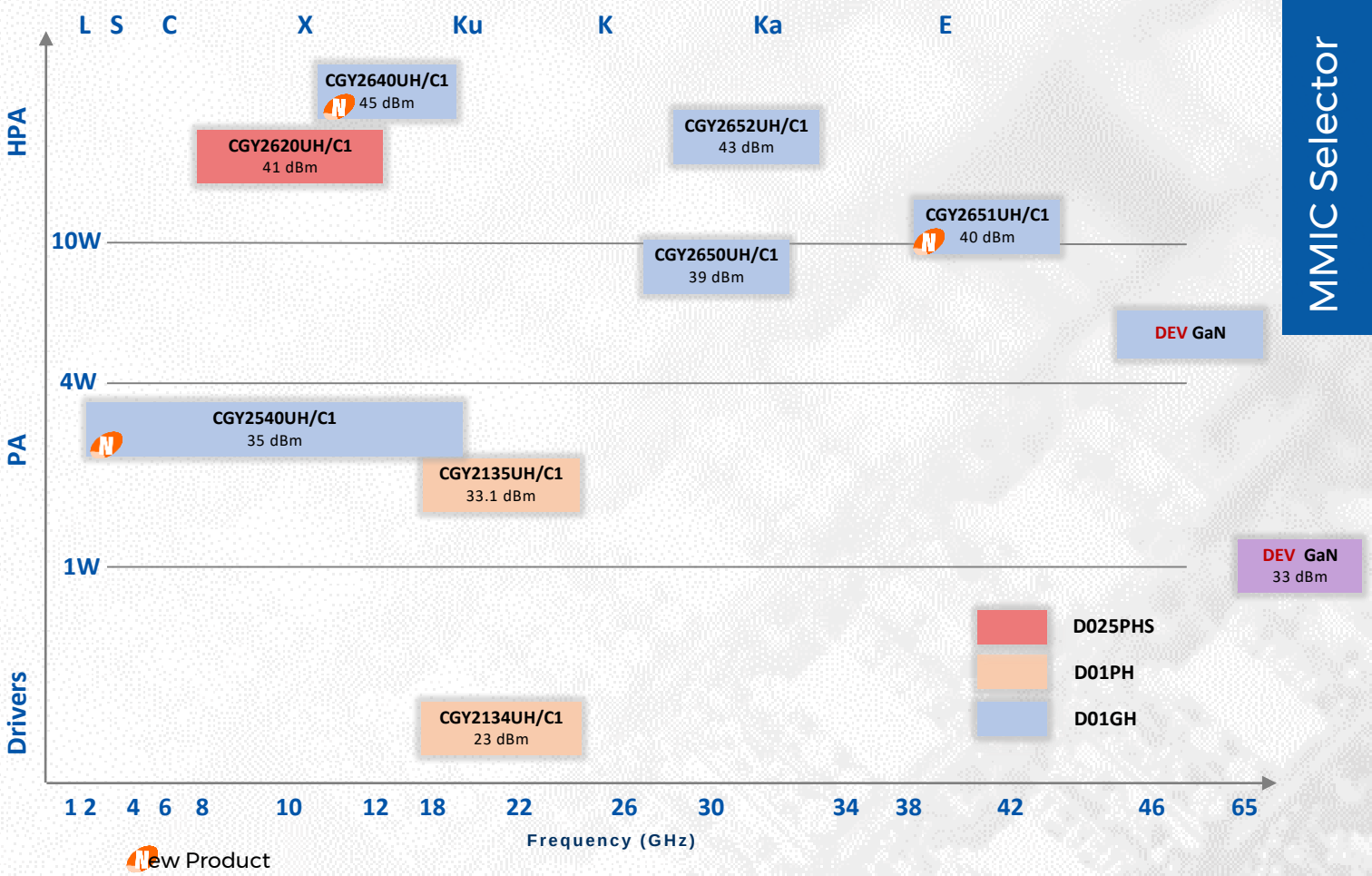
Wideband amplifiers are manufactured using OMMIC 130nm gate length PHEMT Technology **D01PH** or 130nm MHEMT Technology **D01MH.**

OMMIC Wideband Amplifiers are dedicated to application such as Instrumentation, Electronic warfare, 43 Gb/s OC-768 EAM Driver

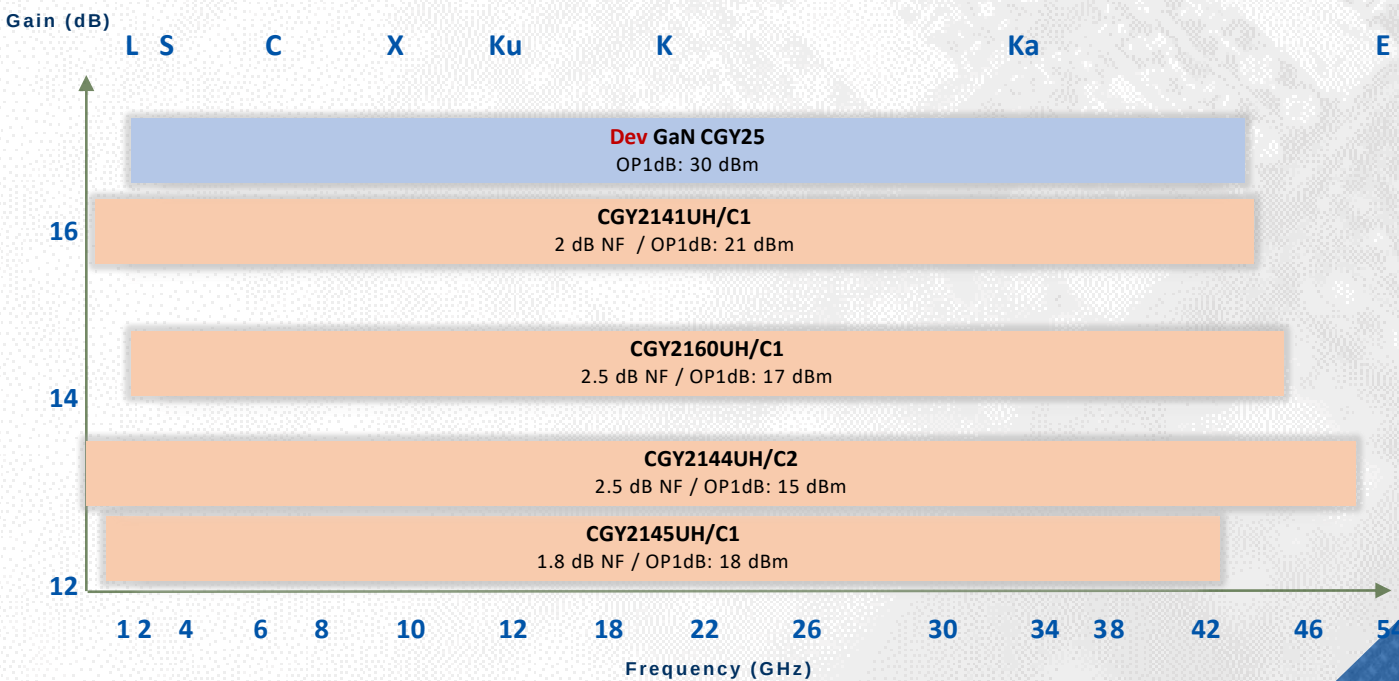
Part number	Frequency (GHz)	Gain (dB)	Saturated Power (W)	Compression Point P1dB (dBm)	Bias Voltage (V)	Bias Current (mA)	Package	Status
CGY2141UH/C1	DC – 46	16	0.2	21	5	195	Die	Production
CGY2144UH/C2	DC – 54	13	0.05	15	5	100	Die	Production
CGY2145UH/C1	0.5 – 45	13	0.1	18	5	85	Die	Production
CGY2550UH/C1	0.6 – 40	16	1	19	18	91	Die	Sampling
CGY2160UH/C1	1.5 – 47	15	0.08	17	5	103	Die	Production

Power & Wideband Amplifiers Portfolio

Performance Figure for Power Amplifiers MMIC



Performance Figure for Wideband Amplifiers MMIC



Control Function Advantages

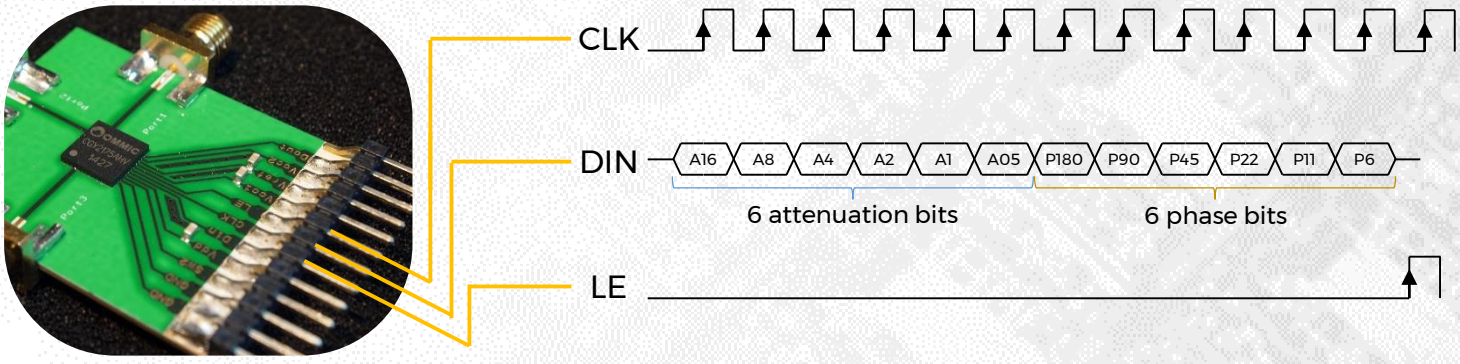
OMMIC Portfolio includes Corechip and control functions.

Corechips are based on the **integration in a single die of Digital Phase Shifters, Digital Attenuators, LNA, MPA and Switches** for **phased array antenna** applications. Phases and attenuation states are controlled through a **Serial to Parallel interface on the die (SIPO)** built with OMMIC's E/D technology,

OMMIC SIPO stands for Serial Input Parallel Output.

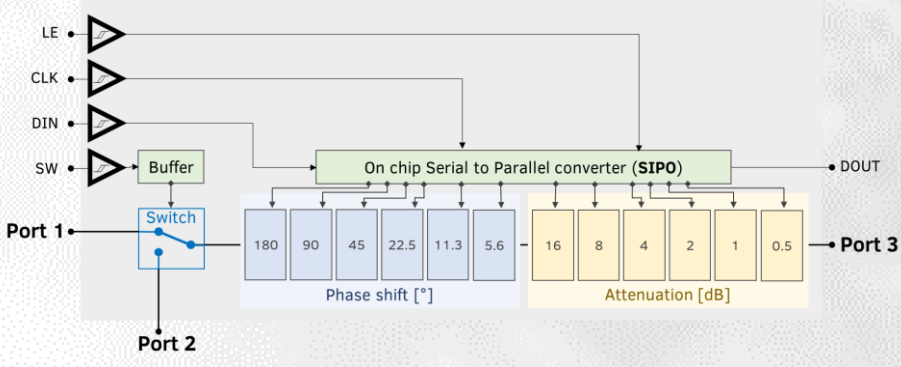
With the SIPO, the number of bonding is greatly reduced and only three of them are needed to control a corechip.

Example : CGY2175AHV/C1 (6-bit packaged C-band corechip)



Each phase and attenuation states are loaded in the shift register (at a clock (CLK) rate up to 250 MHz), then phase and attenuation configuration are changed after latch enable (LE) signal.

CGY2175AHV/C1 Block Diagram



Control Functions Portfolio

Performance Table for Digital Phase-Shifter Functions

Phase shifter, Attenuators, LNA and MPA integrated into a single chip controlled through Serial CMOS TTL compatible access

Part number	Frequency (GHz)	Resolution (bits)	Topology	Ctrl Range (dB/°)	RMS Atten/Phase Error (dB/°)	Ctrl Interface (V)	Package	Status
CGY2175AUH/C1	4.5 – 6.5	6	3 ports	31.5 / 360	0.20 / 1.3	0 / +5	Die	Production
CGY2175AHV/C1	4.5 – 6.5	6	3 ports	31.5 / 360	0.25 / 1.3	0 / +5	Die	Production
CGY2170YUH/C1	8 – 12	6	3 ports	31.5 / 360	0.40 / 3.0	0 / +3	Die	Production
CGY2170YHV/C1	8 – 12	6	3 ports	31.5 / 360	0.40 / 3.0	0 / +3	QFN	Production
CGY2170XUH/C2	8 – 12	6	4 ports	31.5 / 360	0.30 / 3.0	0 / +3	Die	Production
CGY2170XHV/C2	8 – 12	6	4 ports	31.5 / 360	0.35 / 3.0	0 / +3	QFN	Production
CGY2350UH/C1	34 – 36	5	3 ports	31.5 / 360	0.35 / 3.0	0 / +3	Die	Production
CGY2351UH/C1	26.5 – 30.5	6	2 ports	31.5 / 360	0.50 / 4.0	0 / +5	Die	Production

Phase shifter + LNA integrated in one die for internet over satellites Rx phased array antenna application

Part number	Frequency (GHz)	Resolution (bits)	Topology	Gain / Noise (dB)	RMS Phase Error (°)	Ctrl Interface (V)	Package	Status
CGY2179UH	10.7 – 12.5	4	2 ports	12 / 2	7.00	0 / +5	Die	Production
CGY2179HV	10.7 – 12.8	4	2 ports	12 / 2	7.00	0 / +5	QFN	Production

Performance Table True-Time Delay Functions

Part number	Frequency (GHz)	Resolution (bits)	Min Delay (ps)	Full Delay (ps)	Insertion Loss (dB)	Ctrl Interface (V)	Package	Status
CGY2393SUH/C1	6 – 18	5	10.00	310	6.00	0 / +4	Die	Production
CGY2394SUH/C1	6 – 18	1	330.00	310	6.00	0 / +4	Die	Production

Performance Table for Digital Phase-Shifter Functions

Part number	Frequency (GHz)	Resolution (bits)	Insertion Loss (dB)	Phase Range (°)	RMS Phase Error (°)	Ctrl Interface (V)	Package	Status
CGY2177AUH/C1	4.8 – 6.8	6	5.00	360	2.00	0 / +5	Die	Production
CGY2173UH/C2	6 – 18	6	13.00	360	4.00	0 / -3	Die	Production
CGY2172XAUH/C1	8 – 12	6	8.00	360	2.00	0 / -3	Die	Production
CGY2172XBUH/C1	8 – 12	6	8.00	360	2.00	0 / +5	Die	Production
CGY2392SUH/C1	6 – 18	6	10.80	360	1.70	0 / +5	Die	Production
CGY2392SHV/C1	6 – 18	6	10.80	360	1.90	0 / +5	QFN	Production
CGY2174UH/C1	13 – 16	6	8.00	360	6.00	0 / -3	Die	Production

Performance Table for Digital Attenuators Functions

Part number	Frequency (GHz)	Resolution (bits)	Insertion Loss (dB)	Atten Range (dB)	RMS Atten Error (dB)	Ctrl Interface (V)	Package	Status
CGY2176UH/C1	4.8 – 6.8	6	5.60	32	0.20	0 / +5	Die	Production
CGY2171XBUH/C1	1 – 12	6	5.00	32	0.25	0 / +3	Die	Production
CGY2390SUH/C1	8 – 12	6	4.00	35	0.20	0 / +5	Die	Production
CGY2169UH/C1	8 – 12	6	4.00	24	0.40	0 / -3	Die	Production
CGY2191SUH/C1	6 – 18	6	4.00	32	0.20	0 / +5	Die	Production

Miscellaneous Portfolio

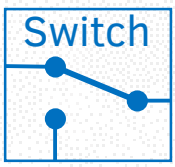
OMMIC Portfolio of MMICs, includes up and down, passive and active converters, SPDT switches and diodes.

Performance Table for Mixers

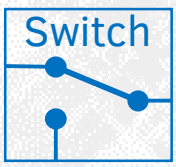
Mixers are manufactured using OMMIC's GaAs 180 nm E/D PHEMT (ED02AH) and 70 nm MHEMT (D007IH) technologies. They generally feature high isolation and can be used for application such as radar, telecommunication, instrumentation and GPS system.

Part number	RF frequency (GHz)	LO frequency (GHz)	IF frequency (GHz)	PinLO (dBm)	Conversion Gain (dB)	ISO LO-RF (dB)	ISO LO-IF (dB)	IP1dB (dBm)	Type	Status
CGY2180UH/C1	0.7–3.7	0.7–4	DC–2	15	-7	35	35	12	Die	Production
CGY2181UH/C1	1–4.5	1–5	DC–2	15	-7	45	32	13	Die	Production
CGY2182UH/C1	3–10	3–10	DC–3	15	-7	60	45	12	Die	Production
CGY2184UH/C1	0.1–6	0.1–6	DC–3	0	18	40	40	3	Die	Production
CGY2183UH/C1	0.1–6	0.1–6	DC–3	-5	12	35	40	-5	Die	Production
CGY2460UH/C1	40.5–43.5	8.8–10	5.0–6	9	33			0	Die	Production
CGY2470UH/C1	92–96	86–90	5.1–6	7	-3	4	3	2	Die	Production
CGY2471UH/C1	92–96	86–90	5.2–6	7	-10		>10	5	Die	Production

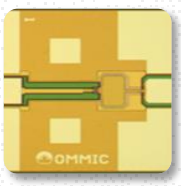
Other products



SPDT Switch :
CGY2370UH/C1
92 - 96 GHz
Isolation : 20 dB
Switching speed : 10 ns

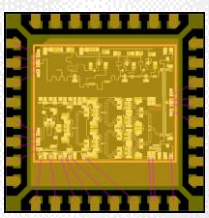


SPDT Switch :
CGY2890SUH/C1
6 - 18 GHz
Isolation : > 50 dB
Insertion Loss : 1.5 dB



Detector diode :
CGY2870AUH/C1
80 - 110 GHz
Zero bias
Input power : < 0 dBm
Input matching : -15 dB

x8 Multiplier:
CGY2770UH/C2
11 - 11.5 to 88 - 92 GHz
Isolation : 20 dB
Output power : 5 dBm



T/R Chip (PA + LNA + SPDT)
GY2750H/C1
26 - 34 GHz
Gain (Rx & Tx): 20 dB
Pout (Tx) : 35 dBm
NF (Rx) : 3 dB

Foundry Services
III - V Processes

Epitaxy & Custom Wafers Processing

D025PHS 250 nm	GaAs pHEMT
ED02AH 180 nm	E/D GaAs pHEMT
D01PH 135 nm	GaAs pHEMT
D01MH 125 nm	GaAs mHEMT
D007IH 70 nm	GaAs mHEMT
DH15IB 1.5 µm	InP HBT
D01GH 100 nm GaN/Si (or Sic)	HEMT
D006GH 60 nm GaN/Si (or Sic)	HEMT

Epitaxy

OMMIC has a powerful R&D department developing its own processes starting from epitaxial structure. OMMIC has a number of MOCVD reactors and supply epi wafers in 3-, 4- and 6-inche

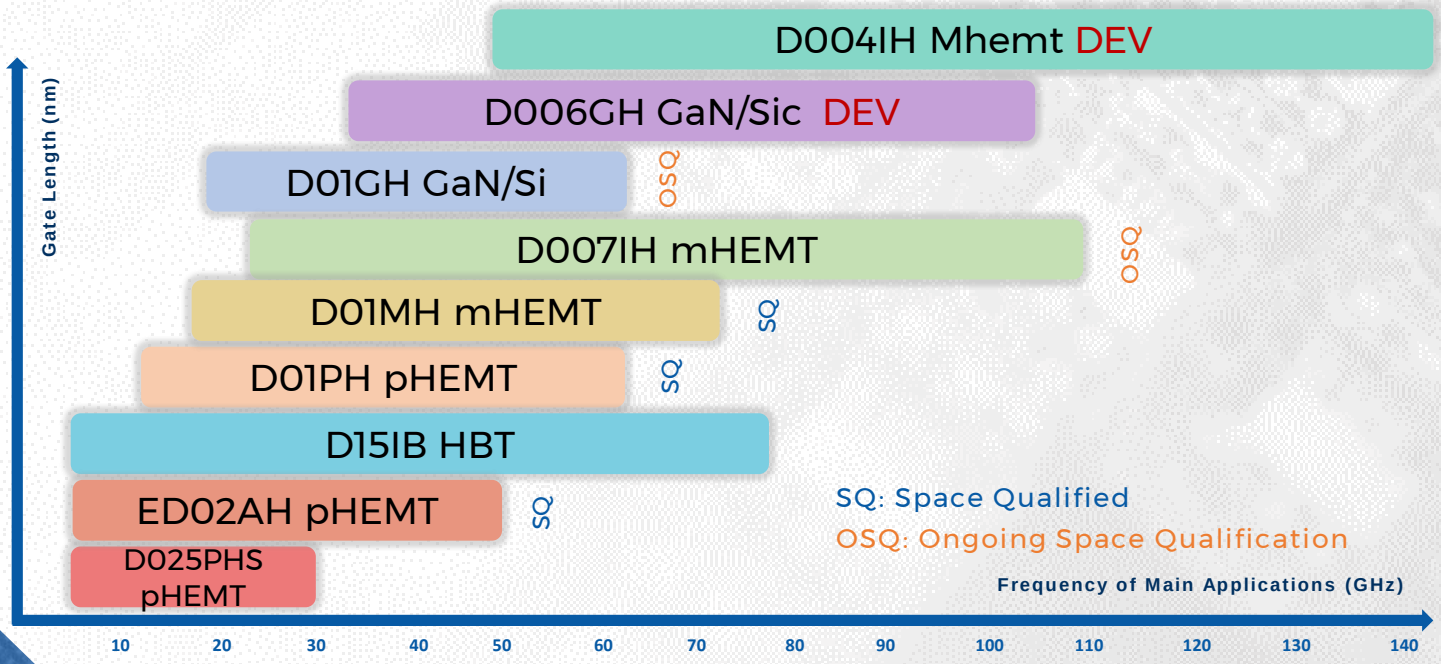
This activity includes pHEMT containing up to 25% indium in the GaInAs layer, as opposed to 40% that they use internally, as well as HBT structures.

Existing epi processes include :

- GaAs MESFET and HFET
- GaAs and InP based PHEMT
- GaAs/GaInP HBT
- InP/GaAsSb HBT

pHEMT materials are provided with inline capless wafer data.
HBT materials are provided with inline wide area HBT test data.

Processes



III-V Processes For Foundry Services

You have not found any corresponding design in our standard product portfolio ?

OMMIC as a fully open foundry policy, providing the most innovating processes to the rest of the world; use it to design the device that is best suited for you !

Processes & Technology

OMMIC is focused on III-V material for the performance it can offers. OMMIC process portfolio includes GaAs pHEMT & mHEMT technology, InP HBT technology and GaN HEMT technology. These services enable cut-off frequencies as high as 400 GHz enabling new application at always higher frequencies.

OMMIC processes are built for high reliability and space application. This is why all our processes in production are either spaced qualified by the European Space Agency, or in the process of being qualified.

Low Noise Application

All of OMMIC processes are designed to minimize the noise figure of the transistors.
Metamorphic technology (e.g D007IH, D004IH) is especially good for providing low noise at high frequencies.
Need for robust LNA (Pin > 40 dBm) ? The large Breakdown voltage combined with the low noise of our GaN (D01GH, D006GH) technologies makes it perfect for such feature.

Power Application

The well-trusted reliability of GaAs pHEMT (D01PH) technology can be used for mid-power application in space. For other environment, take advantage of the high power density of our GaN processes (D01GH, D006GH). OMMIC's GaN technology features high output power (up to W-band), but also high linearity, low noise and no noticeable memory effect.

Control Function

With our ED02AH process, it is possible to have enhanced (E) and depletion (D) transistors on the same die. Having E- and D-type transistors allows one to design control functions with a serial interface that simplifies the interaction with the device.

They are designing using OMMIC's PDK

SKYware TECHNOLOGIES

MC2 technologies

IMST

Plextek

VIPER DESIGN

GaN Processes

OMMIC has released its first GaN process in 2015. All of the supply chain is located in Europe

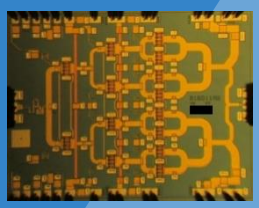
D01GH

Process	D01GH
Technology	GaN on Si
Status	Pre-production
Space Grade	**In 2020**
Gate Length (µm)	0.1
Wafer Size (")	3
Thinkness (µm)	100
Gate Write	E-beam
Ft (GHz)	**110**
Fmax (GHz)	160
Vbgd (V)	**36**
Vds max (V)	12
Idss (mA/mm)	1200
Idss max (mA/mm)	1700
MIM Capacitors (pF/mm²)	400
NF (dB)	**1.5 (40 GHz)**
Power Density (mW/mm)	3300
gm (mS/mm)	800

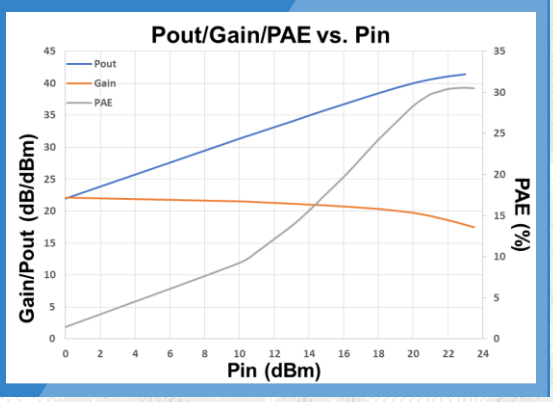
✓ HPA ✓ Robust LNA ✓ Switch

Well suited for application from **15** to **50 GHz**

Representative Device : **CGY2651UH**



- ✓ Operating Range: 37 GHz to 43 GHz
- ✓ Gain: 18 dB
- ✓ Pout: 40 dBm @40 GHz
- ✓ PAE: 30 %
- ✓ Power Consumption:
  - ✓ V_D = 12 V
  - ✓ I_{Qtot} = 0.84 A



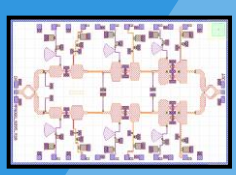
D006GH

Process	D006GH
Technology	GaN on Si
Status	Development
Space Grade	**-**
Gate Length (µm)	0.06
Wafer Size (")	3
Thinkness (µm)	100
Gate Write	E-beam
Ft (GHz)	**150**
Fmax (GHz)	190
Vbgd (V)	**36**
Vds max (V)	12
Idss (mA/mm)	1200
Idss max (mA/mm)	1700
MIM Capacitors (pF/mm²)	400
NF (dB)	**1 (40 GHz)**
Power Density (mW/mm)	3300
gm (mS/mm)	900

✓ HPA ✓ Robust LNA ✓ Switch

Well suited for application from **50** to **100 GHz**

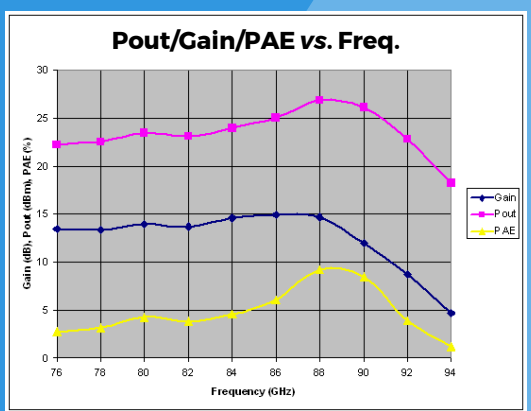
Development Device : **Dev-WAVERIN**



- ✓ Operating Range: **75** to **89 GHz, CW**
- ✓ Gain: 14 dB
- ✓ Pout: 27 dBm @88 GHz
- ✓ PAE: 10 %

The process is currently **being modified** to **increase** the **Ft**

Pre-release at the end of the Year



GaAs m-HEMT Processes

OMMIC has released metamorphic processes with up to 70 % of indium in the channel.

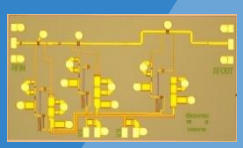
D007IH

Process	D007IH
Technology	GaAs m-Hemt
Status	Production
Space Grade	**In 2020**
Gate Length (µm)	0.07
Wafer Size (")	3
Thinkness (µm)	70 || 100
Gate Write	E-beam
Ft (GHz)	**300**
Fmax (GHz)	450
Vbgd (V)	**4**
Vds max (V)	3
Idss (mA/mm)	200
Idss max (mA/mm)	400
MIM Capacitors (pF/mm²)	400
NF (dB)	**0.5 (30 GHz)**
Power Density (mW/mm)	NA
gm (mS/mm)	1600

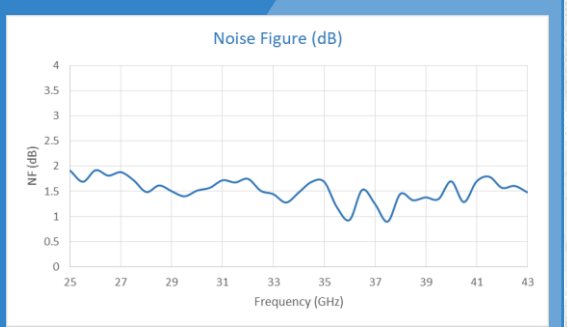
✓ LNA ✓ Mixer

Well suited for application from **20** to **150 GHz**

Representative Device : **CGY2260UH/C1**



- ✓ Operating Range: 25 GHz to 43 GHz
- ✓ Gain: 25 dB (±0.4 dB on bandwidth)
- ✓ NF 1.0 dB @36 GHz
- ✓ OP1dB: 8 dBm
- ✓ Power Consumption:
  - ✓ V_D = 1,5 V
  - ✓ I_D = 0.52 A



D004IH

Process	D004IH
Technology	GaAs m-Hemt
Status	Development
Space Grade	**-**
Gate Length (µm)	0.04
Wafer Size (")	3
Thinkness (µm)	100
Gate Write	E-beam
Ft (GHz)	**400**
Fmax (GHz)	600
Vbgd (V)	**4**
Vds max (V)	3
Idss (mA/mm)	200
Idss max (mA/mm)	400
MIM Capacitors (pF/mm²)	400
NF (dB)	**0.4 (30GHz)**
Power Density (mW/mm)	NA
gm (mS/mm)	2000

✓ LNA ✓ Mixer

Well suited for application from **60** to **250 GHz**

The process is currently **being modified** to **increase** the **Ft**

Pre-release at the end of the Year

GaAs p-HEMT Processes

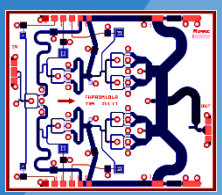
GaAs p-HEMT have been manufactured since the late nineties, whith a strong space heritage

D01PH

Process	D01PH
Technology	GaAs p-Hemt
Status	Production
Space Grade	**Space Qualified**
Gate Length (µm)	0.135
Wafer Size (")	3
Thinkness (µm)	70 || 100
Gate Write	E-beam
Ft (GHz)	**100**
Fmax (GHz)	180
Vbgd (V)	**12**
Vds max (V)	10
Idss (mA/mm)	500
Idss max (mA/mm)	700
MIM Capacitors (pF/mm²)	400
NF (dB)	**1.1 (GHz)**
Power Density (mW/mm)	640
gm (mS/mm)	650

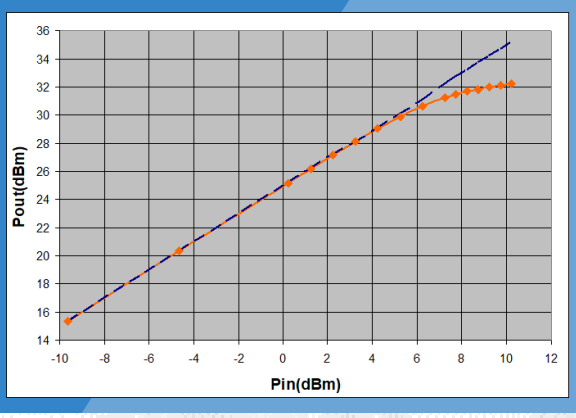
✓ PA ✓ LNA ✓ Mixer ✓ TWA

Well suited for application from **5** to **45 GHz** and Space application



Representative Device : **CGY2135UH/C1**

- ✓ Operating Range: 18 GHz to 23 GHz
- ✓ Gain: 25 dB
- ✓ OP1dB: 31 dBm
- ✓ Power Consumption:
  - ✓ V_D = 4 V
  - ✓ I_D = 1.2 A



ED02AH

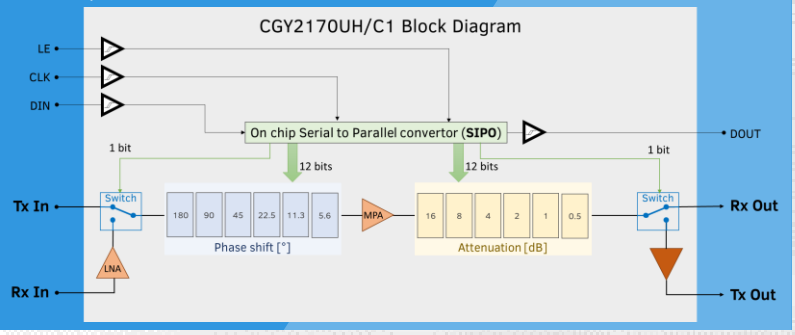
Process	ED02AH
Technology	GaAs p-Hemt
Status	Production
Space Grade	Space Qualified
Gate Length (µm)	0.18
Wafer Size (")	3
Thinkness (µm)	100
Gate Write	E-beam
Ft (GHz)	60
Fmax (GHz)	110
Vbgd (V)	8
Vds max (V)	7
Idss (mA/mm)	250(on)/140(off)
Idss max (mA/mm)	400(on)/180(off)
MIM Capacitors (pF/mm²)	49 & 400
NF (dB)	0.8 (18 GHz)
Power Density (mW/mm)	330
gm (mS/mm)	450

✓ Corechips ✓ LNA

Well suited for application from **1** to **40 GHz**
The E-&D-type transistors enables the implementation of digital functions

Representative Device : **CGY2170UH/C1**

- ✓ Operating Range: 8 GHz to 12GHz
- ✓ Gain: 5 dB
- ✓ RMS_phase: 4 °
- ✓ RMS_atten: 0,5 dB



OMMIC
innovating with III-V'S

Design Center & Fab +

Custom Design Services

Challenging Design from 5 to 200 GHz

ADS SPICE and AWR Design Kits

Multi Chip Projects Shared Wafer Service

Simulation & Extractions for Customers

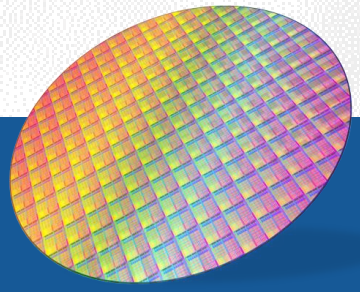
System Modeling

Design Center & FAB+ Services

Having trouble finding a product with exotic specification on the market ?
Check-out our other options :

Foundry Service

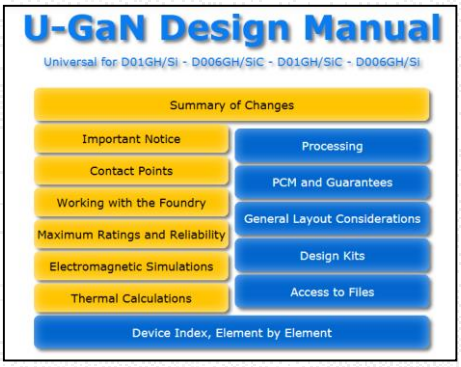
OMMIC provides its Process Design Kit (PDK) under ADS (preferred) or Microwave Office (AWR) for customers to design their own product.

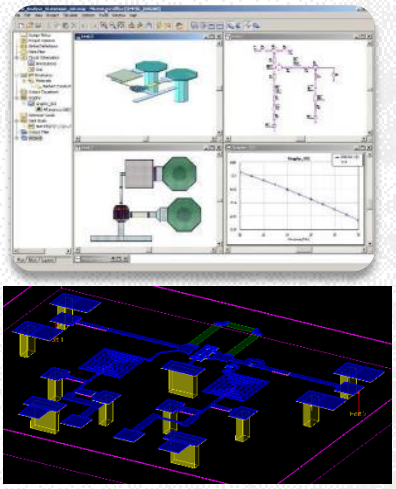


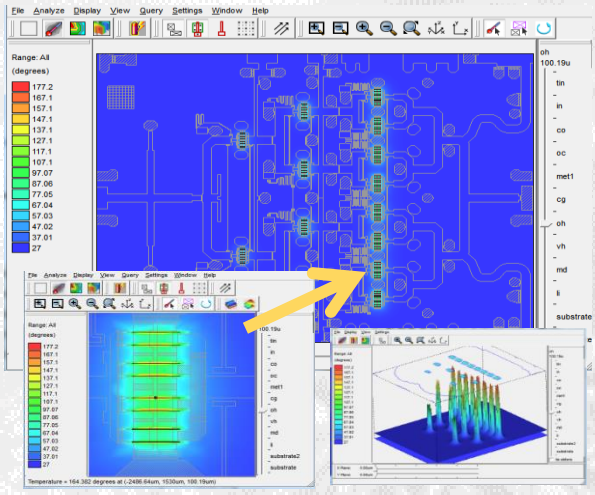
Custom Design

OMMIC provides custom design MMIC services based on customer's specifications, from DC to W-band.

Most of OMMIS's processes have completed or are running a Space evaluation (ESA-EPPL).
The OMMIC design Manuals and design tools are extremely comprehensive and allow any type of design. This includes mixed signal to low noise and high power, from DC to millimeter wave.







OMMIC Design Kits include:

- ✓Fully scalable models for all devices
- ✓Linear, non linear and noise models for transistors (and diodes)
- ✓Process statistical variations of all active and passive devices, allowing representative yield analysis
- ✓Temperature effects for all passive and active devices
- ✓Complete auto layout for all devices, including all types of interconnections
- ✓E.M. information allowing advanced analysis
- ✓Electro-thermal simulator
- ✓Design Rules Checking

Design kits are regularly updated, on our website in close collaboration with software suppliers. OMMIC provides hot line support, dedicated training, and powerful verification tools.

Design Center & FAB+ Services

Custom Design

OMMIC design team is able to design MMICs from Customer specifications and Statement of Work.

- LNA
- Power Amplifiers
- Multifunction chips including digital parts
- Multipliers
- Down-convertors or Trans Impedance Amplifiers from DC to W-band

The design flow includes several reviews where close discussions with the customer ensure that the final MMIC will really enhances the final system.

This design flow is based on space standards such as ECSS-Q60-12A and have been approved for flight model designs.
The Fabrication Line, Test Center, Reliability Center and Modeling Team are on the same site. This proximity allows OMMIC Design Center to obtain the best performances from all the OMMIC processes, while maintaining yield and reliability.

Foundry service

All of OMMIS's processes are available for full wafer foundry services. This service comes with on-wafer test (following customer specification) and visual inspection (MIL-STD-883). Before manufacturing, all projects are checked by OMMIC using the OMMIC design rule checker (DRC). DRCs are performed at no extra cost.

A MultiProject Wafer (MPW) is a cost effective way to experience a new design topology or a new technology through a limited number of samples. OMMIC has been offering this service for a long time on his proprietary technologies.

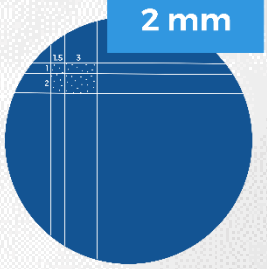
Conditions of use

- The size of the circuit must correspond to one of the fixed patterns for a MCP project.
- The Layout must be supplied according to a predefined time table available on the web site, by default 4 dates per year.
- MCP order should be placed at least 4 weeks before the announced MCP start date.
- The order needs to complain with minimum order value when it is applicable.

University Partnership:

OMMIC is committed to give access to its technologies for Educational Purposes to Universities and Educational Establishments. Please contact us for more details.

Sizes	1.5 mm	3 mm
1 mm	A = 1.5 mm² N = 25 Dies	A = 3 mm² N = 20 Dies
2 mm	A = 3 mm² N = 20 Dies	A = 6 mm² N = 15 Dies



A : Area of the reticule
N: Number of dies delivered

Other Die size can sometime be used, please contact OMMIC for special demands

MPW Schedule

Space quafified :

ED02AH	D01PH	D01MH
✓ 21 / 04 / 2018 ✓ 13 / 09 / 2018	✓ 31 / 07 / 2018 ✓ 15 / 11 / 2018	✓ 31 / 07 / 2018 ✓ 15 / 11 / 2018

High Indium content m-HEMT:

D007IH	D004IH
✓ 26 / 03 / 2018 ✓ 05/ 07 / 2018 ✓ 15 / 10 / 2018	MPW dates not available yet

GaN:

D01GH	D006GH
✓ 12 / 06 / 2018 ✓ 01 / 10 / 2018	✓ 12 / 06 / 2018 ✓ 01 / 10 / 2018

HBT:

D15IB
✓ 11 / 12 / 2018

For any other information or special request contact
information@OMMIC.com

Visit our website *http://www.ommic.com/site/mpw-4*
for up-to-date information

Production Line & Back-end

More than 40 years in III – V industry

Produce on 3- and 6-inch wafers

Class 10,000 production clean room

Certified ISO9001 ISO14001&RoHs compliant
Standard & Space grade visual inspection

On wafer test capabilities for microwave
& mm-wave products

Competitive lead time & maximum flexibility

OMMIC
innovating with III-V'S

Production Line & Back-end

OMMIC was founded on January 1, 2000 by Philips, based on a track record of 40 years of cutting -edge research and development in the fields of III-V epitaxy and integrated circuits technologies. Today, OMMIC is an independent SME.

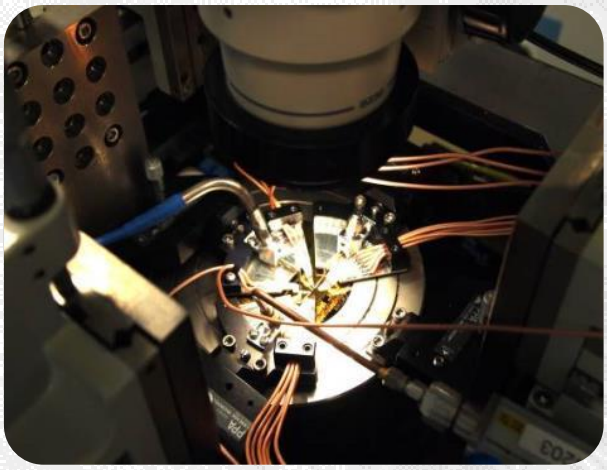
OMMIC consists of 5 main buildings with 1 000 m² of clean rooms of class 1000 and class 100 which are fully devoted to III-V IC development and fabrication.

Our wafers are delivered with electrical properties guaranteed by the measurement of specific test modules added during the fabrication called PCM (Process Control Monitor).

Our processes and our equipments are also followed with SPC (statistical process control).

Our on-wafer test center disposes of a wide variety of high performance tools and experienced people. It allows us to routinely measure the usual microwave characteristics like Sij, spectrum anal., Scalar meas., Noise figure, DC pulsed meas...
All wafers are monitored by DC parametric and RF measurements during the Front End process.

Our experience in microwaves and mm-Waves tests and probe card's design, leads us to design complex tests procedures allowing testing the main performances and functionalities of our MMIC products in order to guarantee the delivery of known good dies.
We open to our customers our RF-test capabilities and knowledge to design and conduct tests on their own prototypes, in order to help them to validate and improve their products.



The visual inspection process plays an essential role in our manufacturing steps to ensure anomaly detection. We can therefore implement prompt corrective or preventive responses and verify the final quality of each die before sending them to our customers.

In order to do so, we perform preliminary visual inspections at each critical step in the production line with sampling and a final visual inspection.

All our products are inspected according to international standards (MIL-STD-883) by a trained and qualified inspection staff. Moreover, for products with less stringent requirements, a commercial grade die inspection is available.

Space Heritage & Flight Models

Services & Tools

Custom Design Services

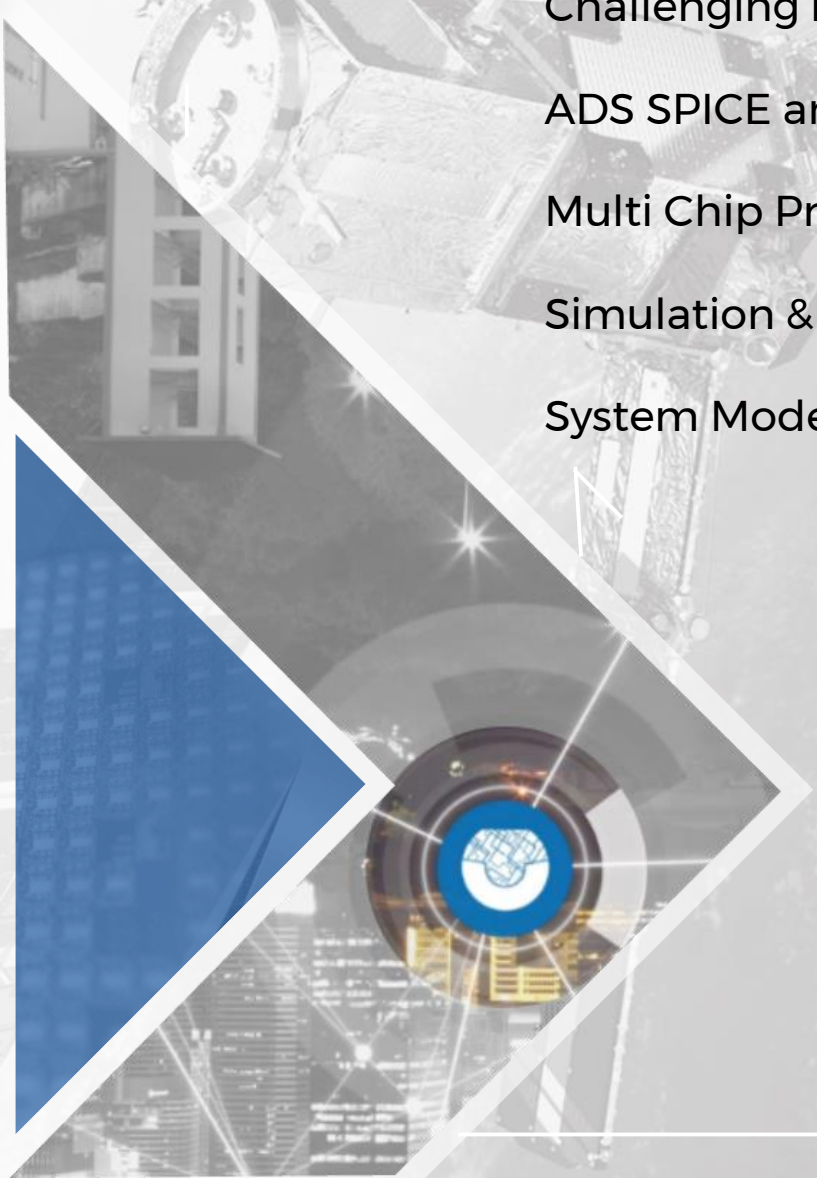
Challenging Design from 5 to 200 GHz

ADS SPICE and AWR Design Kits

Multi Chip Projects Shared Wafer Service

Simulation & Extractions for Customers

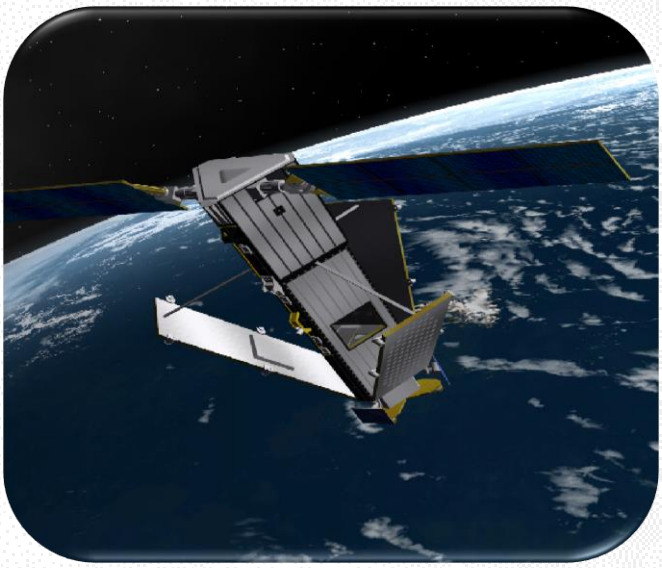
System Modeling



OMMIC
innovating with III-V'S

Space Heritage

More than 30 000 MMICs have been supplied for Flight Models. OMMIC has more than 100 000 years of accumulated Flight Life time around earth in several space mission and satellite equipment.



Components from OMMIC have been used in Flight Models for satellites from Europe, USA, India, Russia and other countries.

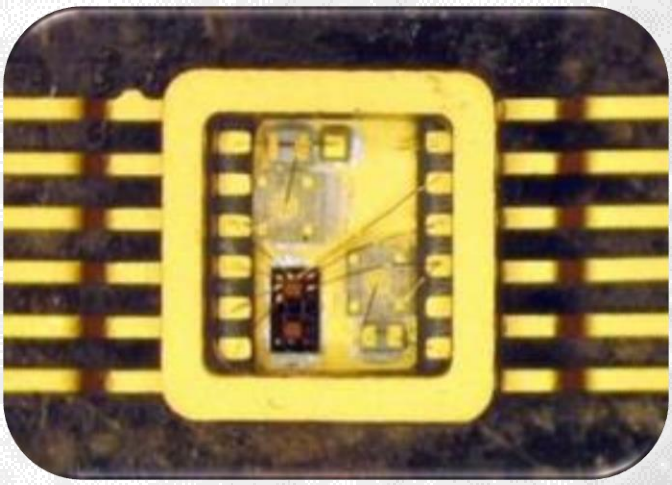
Functions include :

- Frequency Converters components as mixers and modulators
- Linear Components as Low Level Amplifiers, LNAs.
- Control Components as Phase Shifters, Attenuators.
- Power Components such as Medium Power Amplifiers.
- Non Linear Components such as Frequencies Multipliers.
- Negative Resistor for Oscillators.
- Multi-functions components composed by several functions.
- Numerical Components as Phase or Frequency Detector.

ESA has already evaluated 3 OMMIC processes ED02AH, D01PH and D01MH, these 3 processes being maintained on ESA EPPL list.
2 additional processes are considered to be inserted in the EPPL list after ESA monitored evaluation procedures.

OMMIC has already delivered many standard parts designed during the ECI (European Component Initiative) programs.

OMMIC can be a custom design center for space qualified components, many of them have already been designed by OMMIC's design team.



They have already trusted OMMIC

ASTRIUM AN EADS COMPANY

Together ahead. RUAG

esa

CASSIDIAN AN EADS COMPANY

ThalesAlenia Space

cnes

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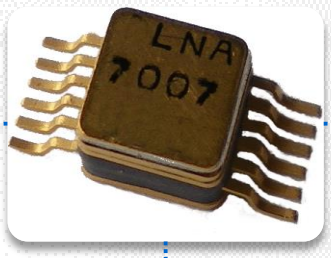
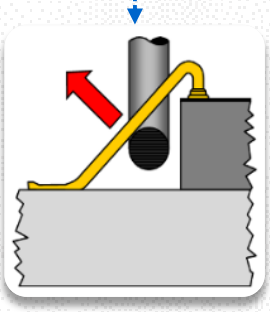
Space Qualification & Reliability Center

OMMIC has a dedicated team for space qualification of flight models but also for reliability of all our components.

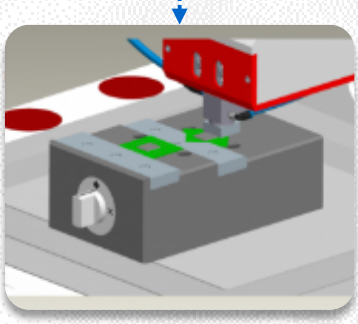
Test performed for SPACE EVALUATION FLOW of Flight Model MMICs

All tests below are **Assembly test** for flight models and are performed at OMMIC in our reliability laboratory





Bond-pull test

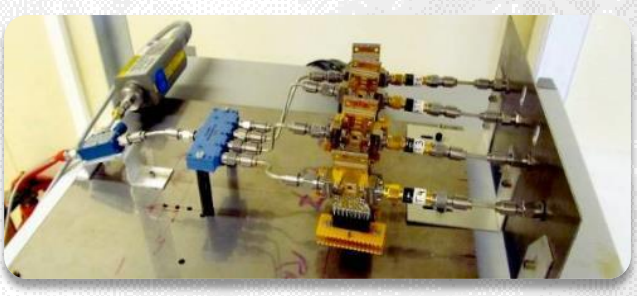


Die-Shear test

Hermeticity test

We also perform Aging and life cycle tests when requested like in MIL-STD-883 standard

High temperature DC life test



Room temperature RF stress test

Space Qualification & Reliability Center

OMMIC has a dedicated team for space qualification of flight models, but also for reliability of all our components.

QUALIFICATION FLOW

Packaged Chips

- **Die-shear (MIL-STD-883G,method 2011.7) –** *2 samples/ batch*
- **Bond-pull (MIL-STD-883G,method 2019.7 z) –** *2 samples/ batch*
- **Pre-cap inspection (SCC 20400)**
- **Hermeticity test**

Initial electrical measurements

- **OMMIC specification**
- **12 chips by wafer all kinds of considered MMIC**
- **100% of MMIC**

Burn-in test

- **MIL STD 883 method 1015**
- **160h @ 125°C (oven temperature)**

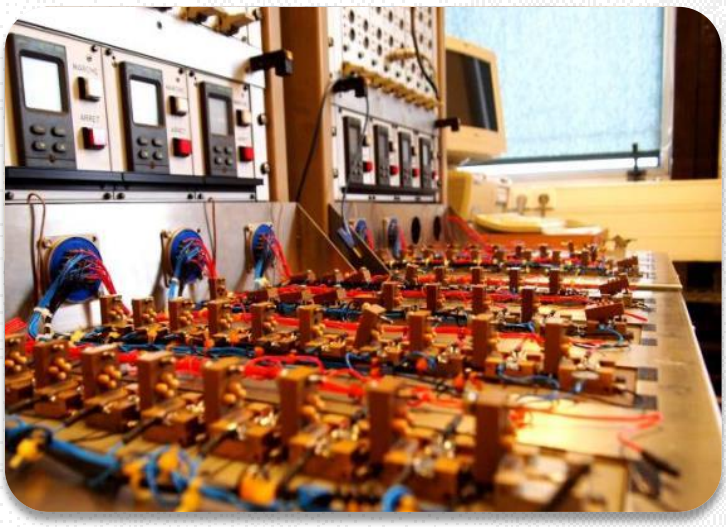
Final electrical measurements & External visual inspection

- **OMMIC specification**
- **Hermeticity test**

Delivered

LAT

- **Temperature cycling (**MIL-STD-883G / 1010 cond. C**)**
- **Constant Acceleration (**MIL-STD-883G / 2001 cond. E, Y1 axis only**)**
- **Electrical measurements (-20°C, room temperature, +80°C)**



Aging biasing test bench

Burn-in Tests ovens

Sales Support & Application

Global & dedicated customer support

System studies support

On field demonstration upon request

Mounting support

Packaging support

Custom modules design studies

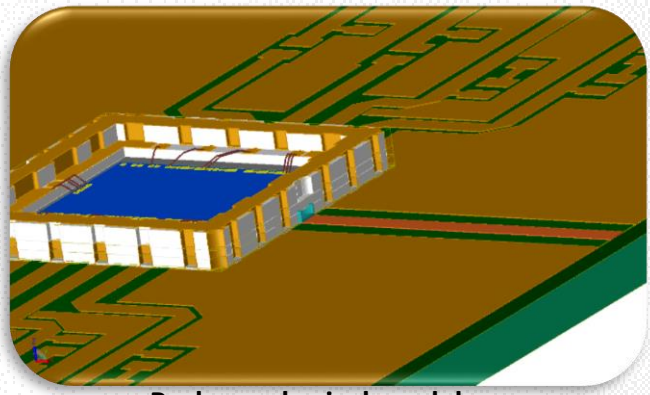
OMMIC
innovating with III-V'S

MMIC Packaging

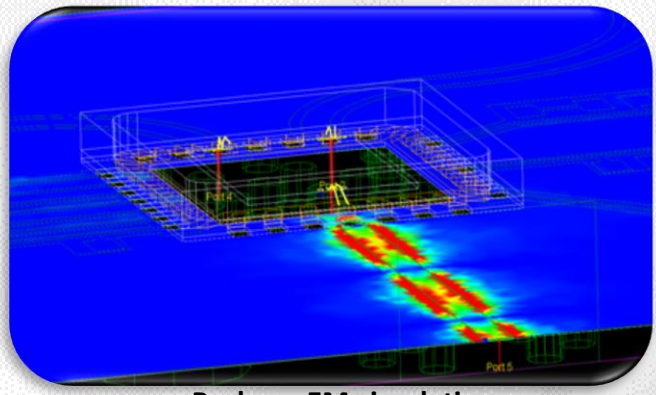
We are moving towards a world where integration and ease of use are central to the definition of complex electronic subsystems.

OMMIC invests every day to simplify the use of its products for its customers by developing packaged solutions while ensuring optimal performances.

Exemple of modeling with EM simulation:



Package physical model

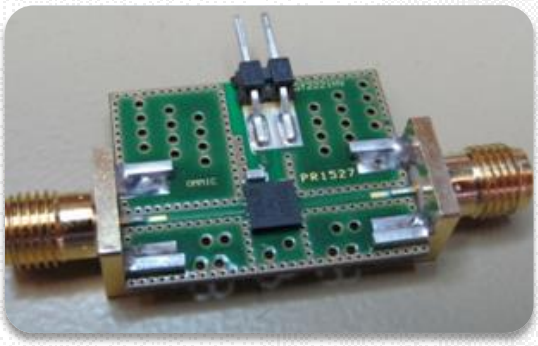


Package EM simulation

Today, our solutions cover L-, S-, C- and X-band. Following our customers request, we are now focusing on packaging our Ka-band corechips solutions.

Exemple of LNA and Corechip packaged solution :

CGY2221HV/C1



LNA 7.5 - 13 GHz NF: 1.6 dB

Plastic QFN 4x4

CGY2392SHV/C1

Phase-Shifter 7.5 - 13 GHz
RMS Phase Error 1.7 ° @ 12 GHz

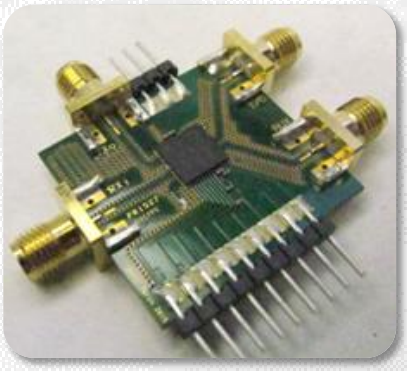
Plastic QFN 5x5

CGY2175AHV

6 bit C-band Corechip

Plastic QFN 7x7

Custom Ku-band Corechip



4 ports

Plastic QFN 7x7

Sales Support & Application

Based in France, in Paris area, OMMIC occupies a central position in Europe, but also in the world, to deliver the right product in the right time to customers. Thanks to its powerful supply chain and reactive regional reps network, OMMIC can support any project in the entire world.

Sales Representative Network

Eastern U.S.A
GM Systems LLC
terlizzi@gmsystems.com

Western U.S.A
Rankin Components Sales
trankin@rankincomponents.com

ISRAEL
American Aviation
yoav@amav.co.il

For all other region
Direct contact
information@ommic.com

NORDIC
Stowira AB
jens.malmgren@stowira.com

ITALY
Celte S.r.l
m.sidoti@celte-srl.co

RUSSIA
OESSP
p.grishanovich@oessp.ru

RUSSIA
NPK Fotonika
alexey.s@npk-photonica.com

CHINA
ERA Spread Ltd
sales@eraspread.com

INDIA
IHE
harkesh@iheindia.com

SOUTH KOREA
TELCOM
shkim@telcom.kr

JAPAN
Noah Technology
fkato@noah-techno.com
M-RF
sales@mrf.co.jp

A sales and field application team at OMMIC is dedicated to customer sales and technical request to provide the best support in the shortest time.

Due to its world class status and human size, OMMIC is a very flexible company able to follow you in your most challenging projects.
You can contact our support team whenever you need at *information@ommic.com*
Or meet us at international RF events such as IMS or EuMW.

Rev 1.18

OMMIC

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Address
2 rue du Moulin, 94453
Limeil-Brévannes, France

Visit us
www.ommic.com

Contact us
information@ommic.com

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