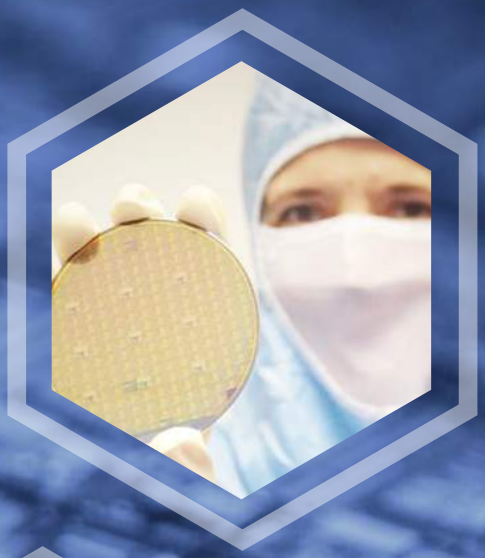
OMMIC

innovating with III-V'S



GM SYSTEMS

"From Old to New"

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CATALOG 2019

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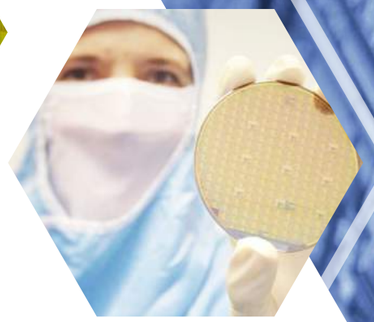
FOREWORD

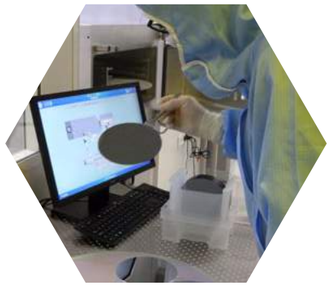
« OMMIC is a pioneer and a leader in the III/V domain, in particular in GaN and GaAs semiconductor technologies.
With the release of its new 6-inch production line, OMMIC has positioned itself as French industrial leader in the development of the European telecommunications. Its current technologies provides solutions for the 5G base station market at 28 and 40 GHz, as much for the backhaul part of the network. Indeed, OMMIC's GaN processes can be used at frequencies above 30 GHz with power output that has never been reached before in the industry. In addition, OMMIC is continuously investing in research and development to help its customers built new technologies.

With this unique line in Europe, OMMIC affirm its ambition to strenghten its leadership in the market with ever-increasing production volumes. »



OMMIC AT A GLANCE

- A LEADING SUPPLIER
- STEPS OF PRODUCTION
- INDUSTRIAL SECTORS



OMMIC AT A GLANCE

A LEADING SUPPLIER

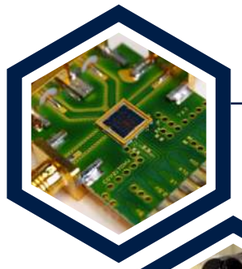
OMMIC, based in France, near Paris, is a leading supplier of **Epitaxy, Foundry Services** and **MMICs** based around the **most advanced III-V processes.**

Formerly Philips 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.

We **have been working in collaboration with ESA** for more than 20 years. ESA has already evaluated 3 OMMIC processes : EDO2AH, D01PH and D01MH. These 3 processes being maintained on ESA EPPL list. Two additional processes (including the D01GH GaN/Si) are being evaluated for insertion in the EPPL.

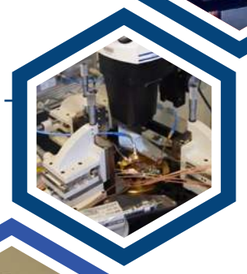
STEPS OF PRODUCTION



Step 7 : FINAL PRODUCT
Designed by OMMIC's team.

Step 6 : VISUAL INSPECTION
OMMIC visual inspect 100% of the dies with commercial and space grade screening.

Step 5 : DICING & PICKING
This step is done within OMMIC in the backend cleanroom.



Step 4 : TEST
OMMIC test 100% of the dies it produces. This includes RF and DC tests.

Step 3 : PRODUCTION
OMMIC produces in France near Paris. The company has a 3-inch and 6-inch Fab line.

Step 2 : E-BEAM
OMMIC uses E-Beam lithography to define gates as small as 40 nm.

Step 1 : EPITAXY
OMMIC has 4 Epitaxy reactors and develops its own epi structure.

INDUSTRIAL SECTORS

OMMIC is supplying **MMIC, Fondry 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 fiels, providing its customers with cutting edge performance in the **Telecommunication, Space** and **Defense** markets.

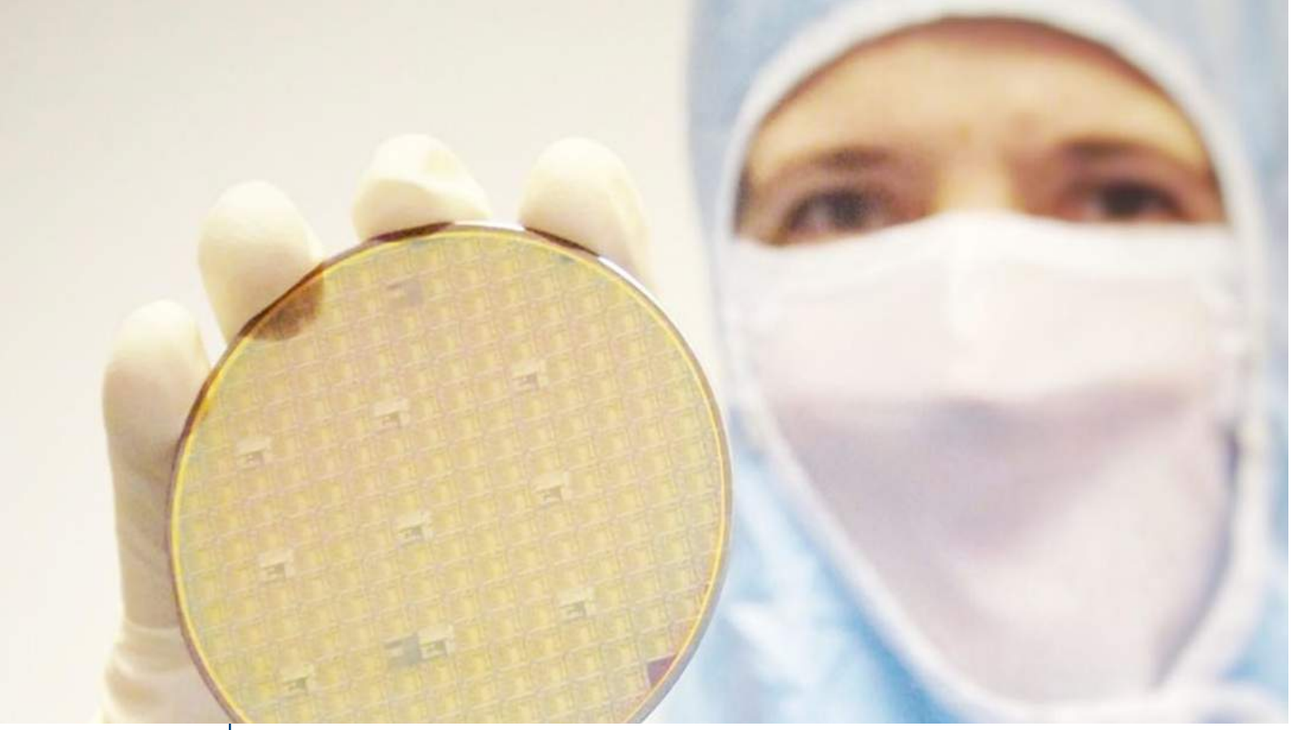
33 %
OF OUR MARKET IS FOR THE
HIGH-END SPACE MARKET

45 %
OF OUR MARKET IS FOR COMMERCIAL APPLICATION INCLUDING THE **NEW CELLULAR TELECOM MARKET**

22 %
OF OUR MARKET IS FOR THE
HIGH-END DEFENSE MARKET

NEW PRODUCTION LINE

- PRODUCTION
- TEST
- INSPECTION
- THE WORLD'S FIRST 6-inch GaN/Si LINE IN PRODUCTION
- STRATEGY & ROADMAP
- THE LATEST NEWS



NEW PRODUCTION LINE

PRODUCTION

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, we are an independant SME.

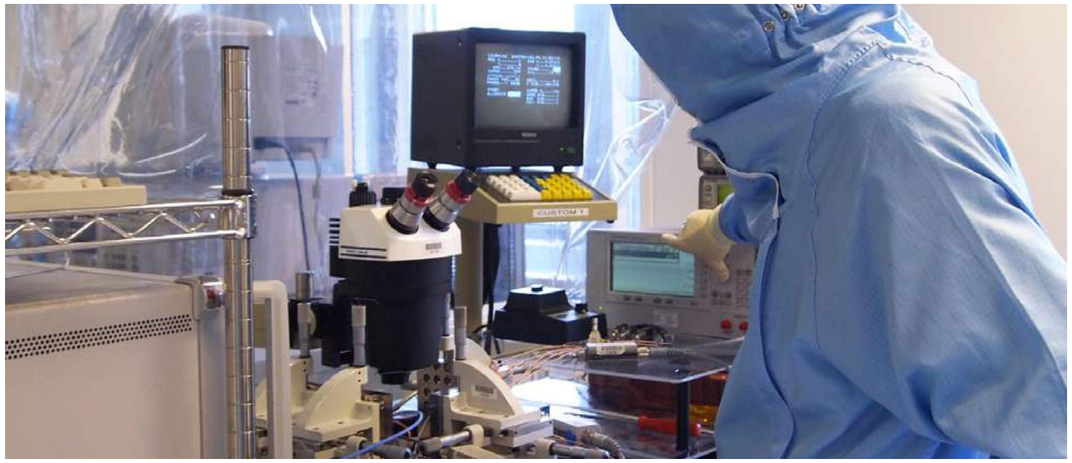
OMMIC consits of 5 main buildings with 1000m² of clean rooms of class 1000 and class 100 which are fully devoted to III-V IC development and fabrication.

Our **wafers** are delivered with **electrical properties guaranteed** by the mesurement 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).

TEST

Once the wafers are fabricated, **all dies are measured** with **DC** and **RF** metrics verified. This includes the bias levels, but also S-parameters, Power measurements, noise measurements, etc. This unsure OMMIC delivers only working dies with stunning performances.

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 know 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.



INSPECTION

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 finaly quality of each die before sending them to our customers.

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

Two level of screening are available : Space grade for the highest reliability, and commercial grade for product with less stringent requirements.

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.

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.

New Cellular Telecom Market
OMMIC aims to enter cellular infrastructure market, especially 5G market with its cutting edge GaN/Si technology, bet suited for the 5G mmWave application.

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.

THE LATEST NEWS

D01GH

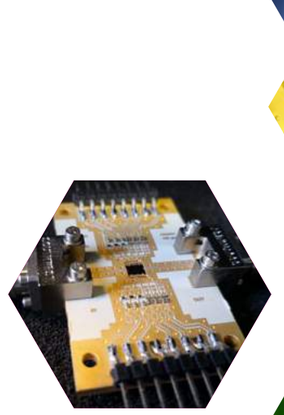
D01GH GaN/Si process is already available for OMMIC customer through open foundry service.

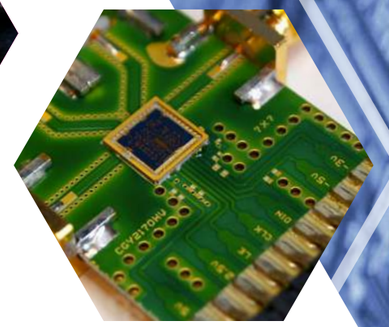
D006GH

D006GH GaN/Si 60 nm process PDK is already available for dowload.

D004IH

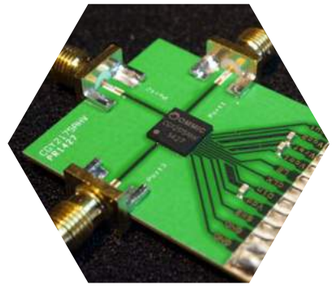
D004IH is being developed, the advancement can be followed by looking at the Ultrawave H2020 public project.

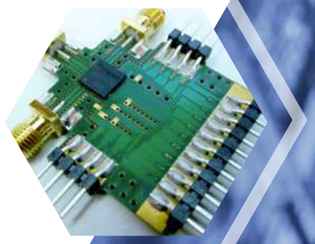


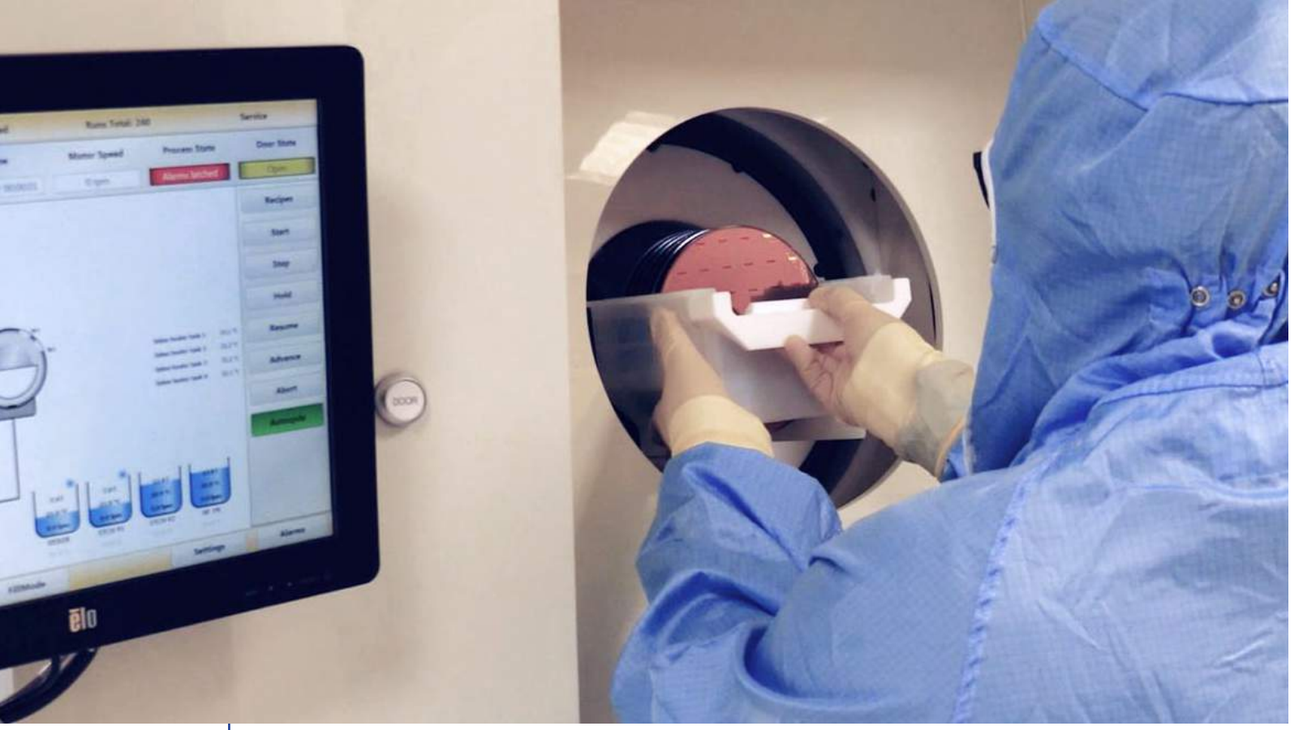


MMIC PRODUCT SELECTOR GUIDE

- D01GH GaN/Si
- INNOVATIVE GaN PRODUCTS
- LOW NOISE AMPLIFIERS
- POWER & WIDEBAND AMPLIFIERS
- CONTROL FUNCTIONS
- MISCELLANEOUS







MMIC PRODUCT SELECTOR GUIDE

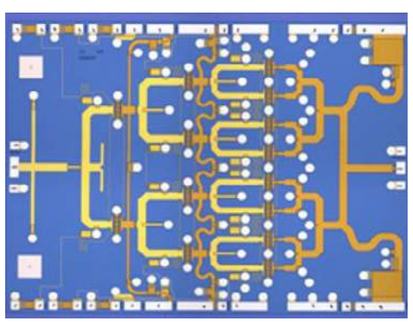
D01GH GaN/Si

D01GH FEATURE :

- Fmax : 160 GHz
- Gate length : 100 nm
- Ft : 110 GHz
- Vbgd : 40 V

Main applications :

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

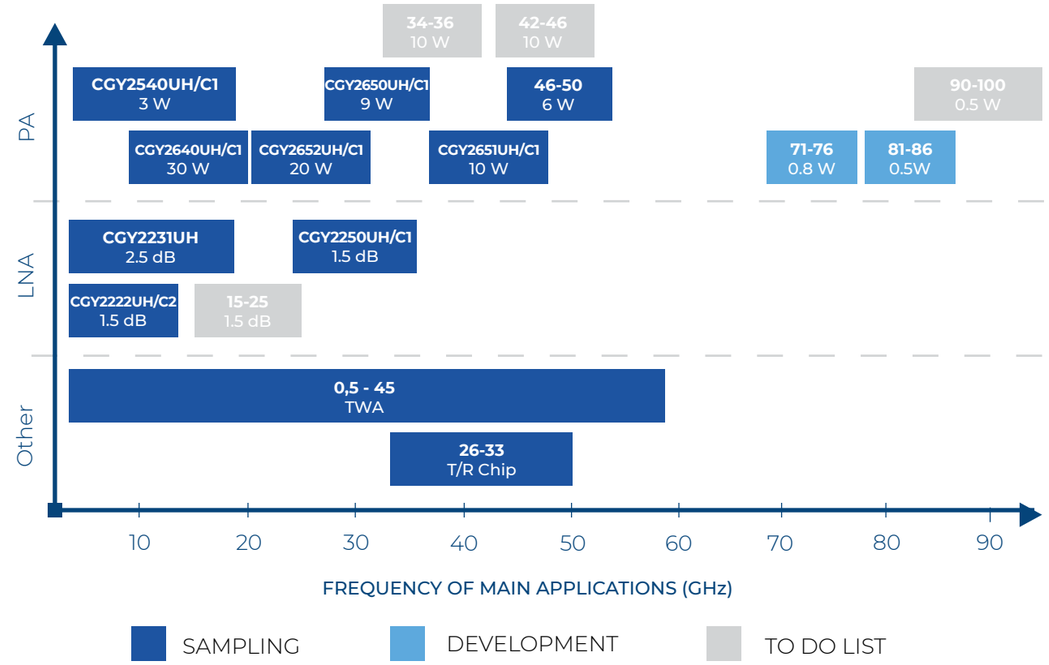


OMMIC's GaN has been engineered to **reduce** as much as possible **traps** in its process. The surface condition of GaN is being strictly monitored which is why , unlike most processes in production, OMMIC's D01GH has **few-to-no measurable memory effect**.

With D01GH, optimized **digital predistortion** technique can be used as much as **complex modulation**.

INNOVATIVE GaN PRODUCTS PORTFOLIO

GaN products are being actively developped for emmerging applications : they are processed using D01GH **GaN/Si** technology which is 100% **european source.**



GaN LNA have been designed so that maximum input power is higher than 35 dBm. This is handy because, in most settings, no limitor is needed in front of the LNA.

LOW NOISE AMPLIFIER

	PART NUMBER	FRQNCY (GHz)	GAIN (dB)	NF (dB)	OP1dB (dBm)	VOLTAGE BIAS (V)	CURRENT BIAS (mA)	PACKAGE & STATUS
	CGY**2222**UH/C2	8 - 12	20	1.5	20	8	155	Die / Production
N	CGY**2231**UH	2 - 20	17	2.5	22	8	-	Die / Sampling
N	CGY**2250**UH/C1	26 - 34	20	1.6	27	8.5	90	Die / Production

POWER AMPLIFIER

	PART NUMBER	FRQNCY (GHz)	GAIN (dB)	Psat (dBm)	PAE (%)	VOLTAGE BIAS (V)	CURRENT BIAS @ Psat (A)	PACKAGE & STATUS
	CGY**2540**UH	0.5 - 20	22	35	-	12	-	Die / Sampling
N	CGY**2631**UH	6 - 18	20	40	35	12	2	Die / Sampling
N	CGY**2632**UH	13 - 17	30	40	30	12	-	Die / Sampling
	CGY**2650**UH/C1	30 - 33.5	22	39	31	12	1.2	Die / Production
N	CGY**2651**UH/C1	37 - 43	18	40	31	12	3.1	Die / Production
N	CGY**2652**UH	27 - 31	20	43	38	12	4	Die / Sampling
	CGY**2660**UH	46 - 50	18	38	20	12	2.7	Die / Sampling

TWA

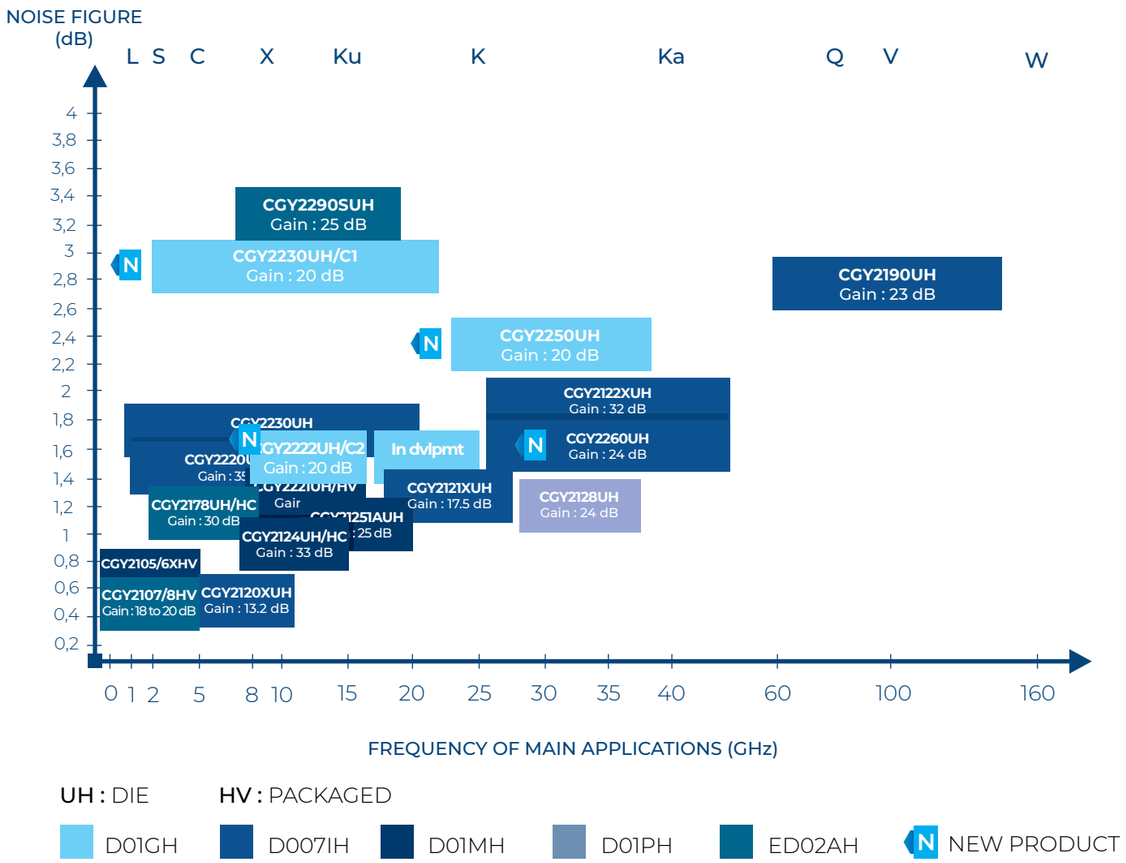
PART NUMBER	FRQNCY (GHz)	GAIN (dB)	Psat (W)	COMPRESSION POINT P1dB (dBm)	VOLTAGE BIAS (V)	CURRENT BIAS (A)	PACKAGE & STATUS
CGY**2550**UH/C1	0.6 - 40	16	2	19	18	91	Die / Production

T/R

PART NUMBER	FRQNCY (GHz)	GAIN (dB)	Output POWER (dBm)	NF (dB)	VOLTAGE BIAS (V)	CURRENT BIAS (A)	PACKAGE & STATUS
CGY**2750**UH	26 - 34	20	35	3	12	0.45	Die / Sampling

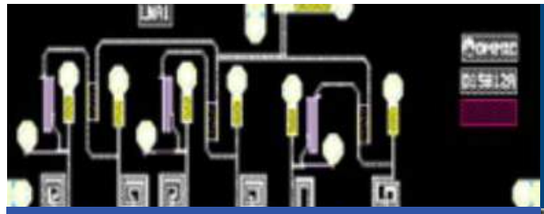
LOW NOISE AMPLIFIERS PORTFOLIO

PERFORMANCE FIGURE FOR LOW NOISE AMPLIFIERS MMIC



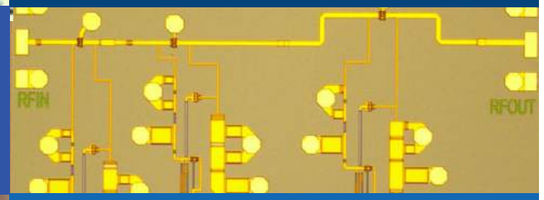
UH : DIE **HV :** PACKAGED

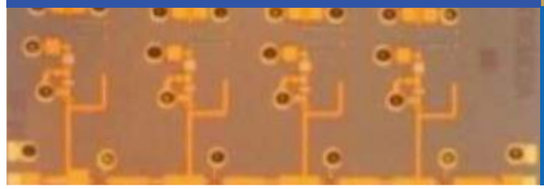
D01GH D007IH D01MH D01PH ED02AH N NEW PRODUCT



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

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 for lower noises & higher frequencies of GaN HEMT (D01GH) for **robust LNA**.

PERFORMANCE TABLE FOR LOW NOISE AMPLIFIERS MMIC

PART NUMBER	FRQNCY (GHz)	GAIN (dB)	NF (dB)	OP1dB (dBm)	VOLTAGE BIAS (V)	CURRENT BIAS (mA)	PACKAGE & STATUS
CGY**2120**XUH/C1	5 - 7	13	0.5	12	1.0	50	Die / Production
CGY**2121**XUH/C1	18 - 26	18	1.5	5	0.8	60	Die / Production
CGY**2122**XUH/C2	25 - 43	32	1.5	1	1.1	30	Die / Production
CGY**2124**UH/C1	8 - 12	33	1.1	11	5.0	55	Die / Production
CGY**2125**AUH/C1	13 - 15	25	1.0	8	3.3	20	Die / Production
CGY**2128**UH/C2	24 - 34	24	1.3	11	3.5	47	Die / Production
CGY**2178**UH/C1	5 - 6	30	1.0	15	3.0	40	Die / Production
CGY**2190**UH/C2	75 - 110	23	3.0	1	1.0	33	Die / Production
CGY**2220**UH/C1	1 - 12	35	1.3	12	1.5	52	Die / Production
CGY**2221**HV/C1	7.5 - 13	17	1.7	17	5.0	82	QFN / Sampling
CGY**2221**UH/C1	7.5 - 13	17	1.6	17	5.0	82	Die / Production
CGY**2222**UH/C2	8 - 12	20	1.5	20	8.0	-	Die / Production
CGY**2230**UH/C1	1 - 18	35	1.5	12	1.5	50	Die / Production
N CGY**2231**UH	2 - 20	17	2.5	22	8.0	-	Die / Sampling
CGY**2232**UH/C1	12 - 15	27	1.3	0	3.0	50	Die / Production
N CGY**2250**UH/C1	26 - 34	20	1.6	27	8.0	90	Die / Production
CGY**2260**UH/C1	25 - 43	24	1.5	8	1.5	50	Die / Production
N CGY**2272**UH	45 - 70	22	2.0	5	1.5	60	Die / Developement
CGY**2290**SUH/C1	6 - 18	9	3.3	13	5.0	30	Die / Production

PERFORMANCE TABLE FOR ULTRA LOW NOISE AMPLIFIERS MMIC

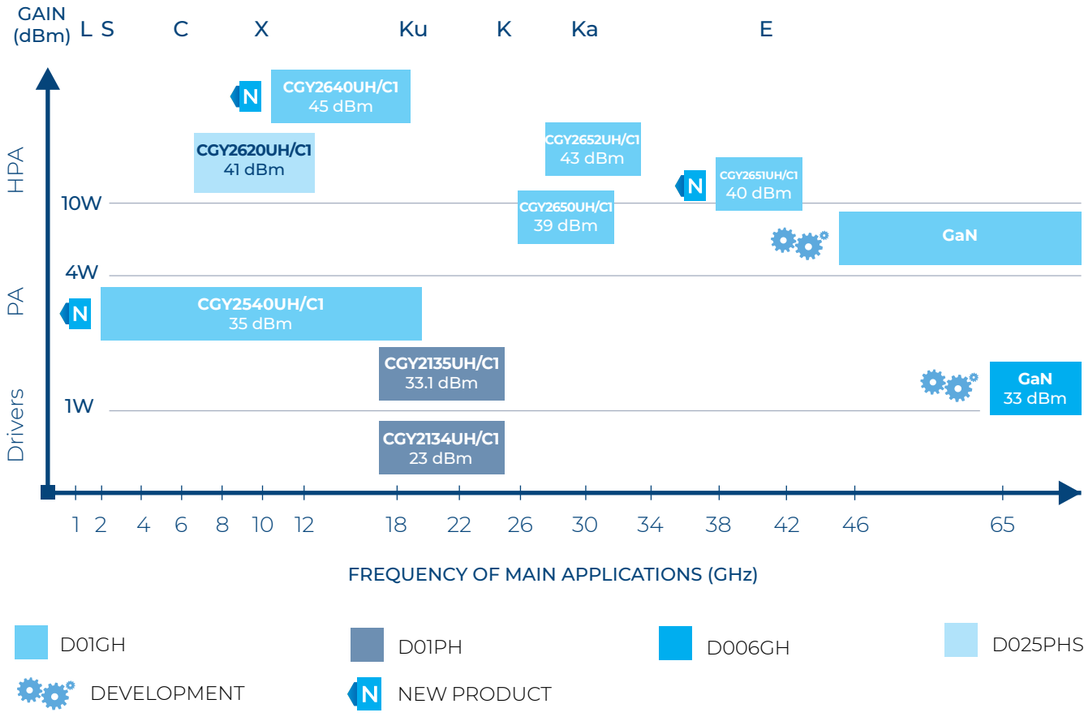
PART NUMBER	FRQNCY (GHz)	GAIN (dB)	NF (dB)	OP1dB (dBm)	VOLTAGE BIAS (V)	CURRENT BIAS (mA)	PACKAGE & STATUS
CGY**2105**XHV	0.5 - 4	19	0.42	21	5	2 x 50	QFN 4 x 4 / Production
CGY**2106**XHV	0.1 - 3	19	0.45	19	5	2 x 50	QFN 4 x 4 / Production
CGY**2107**UH	0.5 - 6	24	0.60	22	5	2 x 50	QFN 4 x 4 / Production
CGY**2108**GS	0.5 - 6	21	0.60	22	5	2 x 50	Flight Model / Production
CGY**2108**HV	0.5 - 6	22	0.50	22	5	2 x 50	QFN 4 x 4 / Production

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

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 applicatons. PA were manufactured using GaAs technology (**ED02AH**, D01PH, D025PHS), that have been **space qualified by ESA**. New amplifiers are designed in GaN HEMT (D01GH) for outsanding **performances**.

PERFORMANCE FIGURE FOR POWER AMPLIFIERS MMIC



PERFORMANCE TABLE FOR POWER AMPLIFIERS MMIC

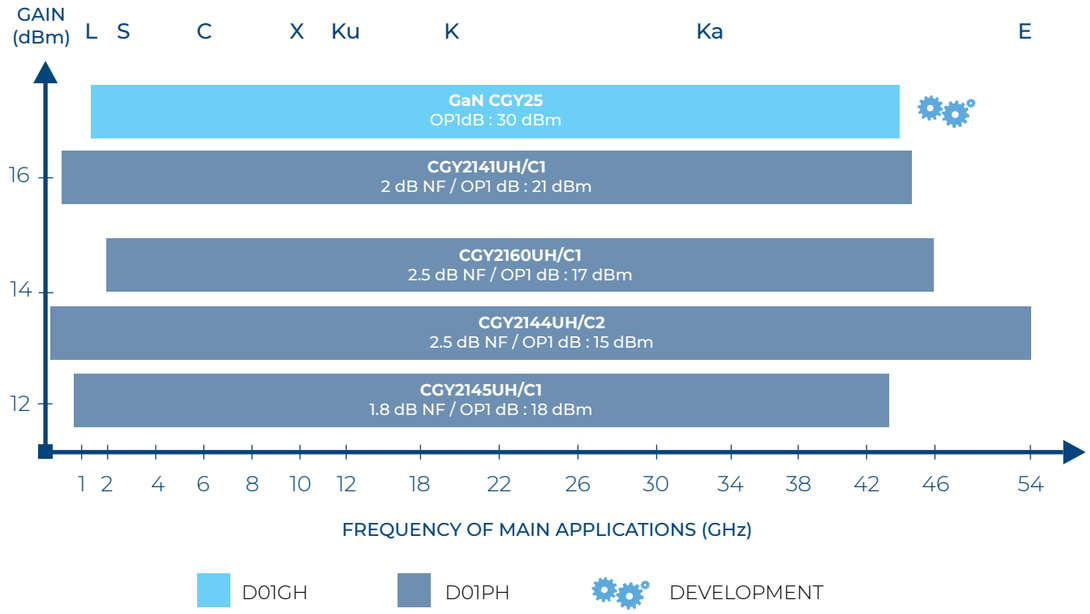
PART NUMBER	FREQUENCY (GHz)	GAIN (dB)	Psat (dBm)	PAE @ Psat (%)	VOLTAGE BIAS (V)	CURRENT BIAS (A)	PACKAGE & STATUS
CGY**2134**UH/C1	18 - 23	23	23	-	4.5	0.40	Die / Production
CGY**2135**UH/C1	18 - 23	25	22	-	4.0	1.20	Die / Production
CGY**2540**UH	0.5 - 20	22	35	-	12	-	Die / Sampling
CGY**2620**UH/C1	8 - 11	25	42	-	9.0	3.25	Die / Production
N CGY**2631**UH	6 - 18	20	40	35	12.0	2.0	Die / Sampling
N CGY**2632**UH	13 - 17	30	40	30	12.0	-	Die / Sampling
CGY**2650**UH/C1	29.5 - 33.5	22	39	30	12.0	1.20	Die / Production
CGY**2651**UH/C1	40 - 46	20	34	35	12.0	3.20	Die / Production
N CGY**2652**UH	27.5 - 31	-	-	30	12.0	-	Die / Sampling
N CGY**2660**UH	46 - 50	18	38	20	12.0	2.70	Die / Sampling

OMMIC Power Amplifiers are dedicated to application such as **radars**, **telecommunication** and **instrumentation**. MMIC labeled in **blue** are using **GaN** technology.

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 130 nm gate length pHEMT Technology D01PH or 100 nm HEMT Technology D01GH.

PERFORMANCE FIGURE FOR WIDEBAND AMPLIFIERS MMIC

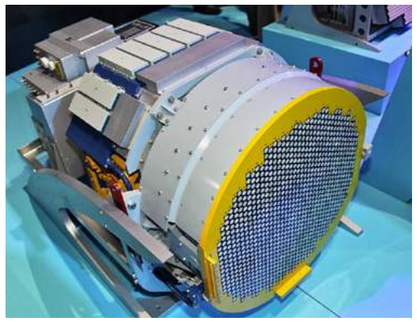


PERFORMANCE TABLE FOR WIDEBAND AMPLIFIERS MMIC

PART NUMBER	FRQNCY (GHz)	GAIN (dB)	Psat (W)	COMPRESSION POINT P1dB (dBm)	VOLTAGE BIAS (V)	CURRENT BIAS (A)	PACKAGE & STATUS
CGY**2141**UH/C1	DC - 46	16	0.20	21.0	5	195	Die / Production
CGY**2144**UH/C2	DC - 54	13	0.05	15.0	5	100	Die / Production
CGY**2145**UH/C1	0.5 - 45	13	0.10	18.0	5	85	Die / Production
CGY**2160**UH/C1	1.5 - 47	15	0.08	19.0	5	103	Die / Production
N CGY**2550**UH	0.6 - 40	16	1.00	17.0	18	91	Die / Sampling

MMIC labeled in **blue** are usign **GaN** technology. OMMIC Wideband Amplifiers are dedicated to application such as instrumentation, electronic warfare, 43 Gb/s OC-768 EAM Driver.

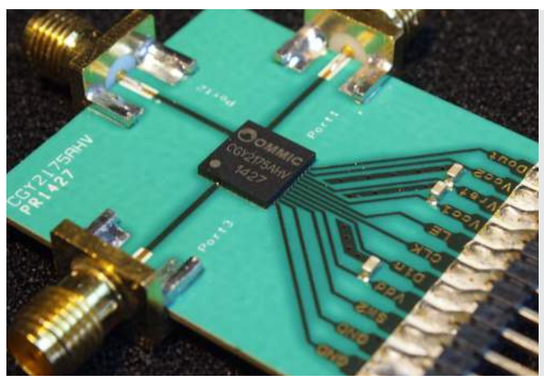
CONTROL FUNCTIONS ADVANTAGES & PORTFOLIO



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 attenuations 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.



Exemple : **CGY215AHV/C1**
(6-bit package C-band corechip)

Each phase and attenuation states are loaded in the shift register (at a clock (CLK) rate up to 100 MHz), then phase and attenuation configuration are changed after latch enable (LE) signal.

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

PERFORMANCE TABLE FOR CORECHIP (PS + ATT)

PART NUMBER	FRQNCY (GHz)	CTRL BITS	TOPOLOGY	CTRL RANGE (dB/°)	RMS ATTEN./PHASE ERROR (dB/°)	CTRL INTERFACE (V)	PACKAGE & STATUS
CGY**2170**YHV/C1	8 - 12	6	3 ports	31.5 / 360	0.40 / 3.0	0 / +3	QFN / Production
CGY**2170**YUH/C1	8 - 12	6	3 ports	31.5 / 360	0.40 / 3.0	0 / +3	Die / Production
CGY**2170**XHV/C2	8 - 12	6	4 ports	31.5 / 360	0.35 / 3.0	0 / +3	QFN / Production
CGY**2170**XUH/C2	8 - 12	6	4 ports	31.5 / 360	0.30 / 3.0	0 / +3	Die / Production
CGY**2175**AHV/C1	4.5 - 6.5	6	3 ports	31.5 / 360	0.25 / 1.3	0 / +5	Die / Production
CGY**2175**AUH/C1	4.5 - 6.5	6	3 ports	31.5 / 360	0.20 / 1.3	0 / +5	Die / Production
N CGY**2330**UH/C1	12 - 15	6	2 ports	31.5 / 360	0.40 / 3.0	- 3 / 3	Die / Production
CGY**2350**UH/C1	34 - 36	5	3 ports	31.5 / 360	0.35 / 4.0	0 / +3	Die / Production
CGY**2351**UH/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	FRQNCY (GHz)	CTRL BITS	TOPOLOGY	GAIN / NOISE (dB)	RMS PHASE ERROR (°)	CTRL INTERFACE (V)	PACKAGE & STATUS
CGY**2179**HV	10.7 - 12.75	4	2 ports	12 / 2	7.00	0 / +5	QFN / Production
CGY**2179**UH	10.7 - 12.5	4	2 ports	12 / 2	7.00	0 / +5	Die / Production

PERFORMANCE TABLE TRUE-TIME DELAY FUNCTIONS

PART NUMBER	FRQNCY (GHz)	CTRL BITS	MIN DELAY (ps)	FULL DELAY (ps)	INSERTION LOSS (dB)	CTRL INTERFACE (V)	PACKAGE & STATUS
CGY**2393**SUH/C1	6 - 18	5	10	310	6	0 / +4	Die / Production
CGY**2394**SUH/C1	6 - 18	1	330	310	6	0 / +4	Die / Production

PERFORMANCE TABLE FOR DIGITAL PHASE-SHIFTER FUNCTIONS

PART NUMBER	FRQNCY (GHz)	CTRL BITS	INSERTION LOSS (dB)	PHASE RANGE (°)	RMS PHASE ERROR (°)	CTRL INTERFACE (V)	PACKAGE & STATUS
CGY**2172**XAUH/C1	8 - 12	6	8.00	360	2.00	0 / -3	Die / Production
CGY**2172**XBUH/C1	8 - 12	6	8.00	360	2.00	0 / +5	Die / Production
CGY**2173**UH/C2	6 - 18	6	13.00	360	4.00	0 / -3	Die / Production
CGY**2174**UH/C1	13 - 16	6	8.00	360	6.00	0 / -3	Die / Production
CGY**2177**AUH/C1	4.8 - 6.8	6	5.00	360	2.00	0 / +5	Die / Production
CGY**2392**SHV/C1	6 - 18	6	10.80	360	1.90	0 / +5	QFN / Production
CGY**2392**SUH/C1	6 - 18	6	10.80	360	1.70	0 / +5	Die / Production

PERFORMANCE TABLE FOR DIGITAL ATTENUATORS FUNCTIONS

PART NUMBER	FRQNCY (GHz)	CTRL BITS	INSERTION LOSS (dB)	ATTEN. RANGE (dB)	RMS ATTEN. ERROR (dB)	CTRL INTERFACE (V)	PACKAGE & STATUS
CGY**2169**UH/C1	8 - 12	6	4.00	24	0.40	0 / -3	Die / Production
CGY**2171**XBUH/C1	1 - 12	6	5.00	32	0.25	0 / +3	Die / Production
CGY**2176**UH/C1	4.8 - 6.8	6	5.60	32	0.20	0 / +5	Die / Production
CGY**2191**SUH/C1	6 -18	6	4.00	32	0.20	0 / +5	Die / Production
CGY**2390**SUH/C1	8 - 12	6	4.00	35	0.20	0 / +5	Die / Production

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

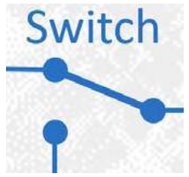
PERFORMANCE TABLE FOR MIXERS

PART NUMBER	FRQNCY (GHz)	LO FRQNCY (GHz)	IF FRQNCY (GHz)	PinLO (dBm)	CVRSN GAIN (dB)	ISO LO-RF (dB)	ISO LO-IF (dB)	IP1dB (dBM)	PACKAGE & STATUS
CGY**2180**UH/C1	0.7 - 3.7	0.7 - 4	DC - 2	15	-7	35	35	12	Die/Production
CGY**2181**UH/C1	1 - 4.5	1 - 5	DC - 2	15	-7	45	32	13	Die/Production
CGY**2182**UH/C1	3 - 10	3 - 10	DC - 3	15	-7	60	45	12	Die/Production
CGY**2183**UH/C1	0.1 - 6	0.1 - 6	DC - 3	-5	12	35	40	-5	Die/Production
CGY**2184**UH/C1	0.1 - 6	0.1 - 6	DC - 3	0	18	40	40	3	Die/Production
CGY**2460**UH/C1	40,5 - 43,5	8.8 - 10	5.0 - 6	9	33			0	Die/Production
CGY**2470**UH/C1	92 - 96	86 - 90	5.1 - 6	7	-3	4	3	2	Die/Production
CGY**2471**UH/C1	92 - 96	86 - 90	5.2 - 6	7	-10		> 10	5	Die/Production

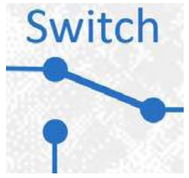
MISCELLANEOUS PORTFOLIO

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

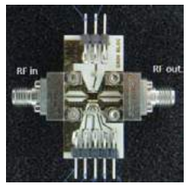
OTHER PRODUCTS



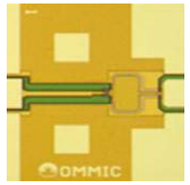
SPDT Switch :
CGY**2890**SUH/C1
6-18 GHz
Isolation : > 50 dB
Insertion loss : 1,5 dB



SPDT Switch :
CGY**2370**UH/C1
92-96 GHz
Isolation : 20 dB
Switching speed : 10 ns



Gain Block Taverny :
CGY**2731**UH/C1
12-15 GHz
Gain : 19 dB
NF : 4 dB
P3 dB : 10 dBm

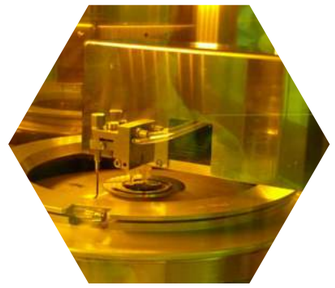


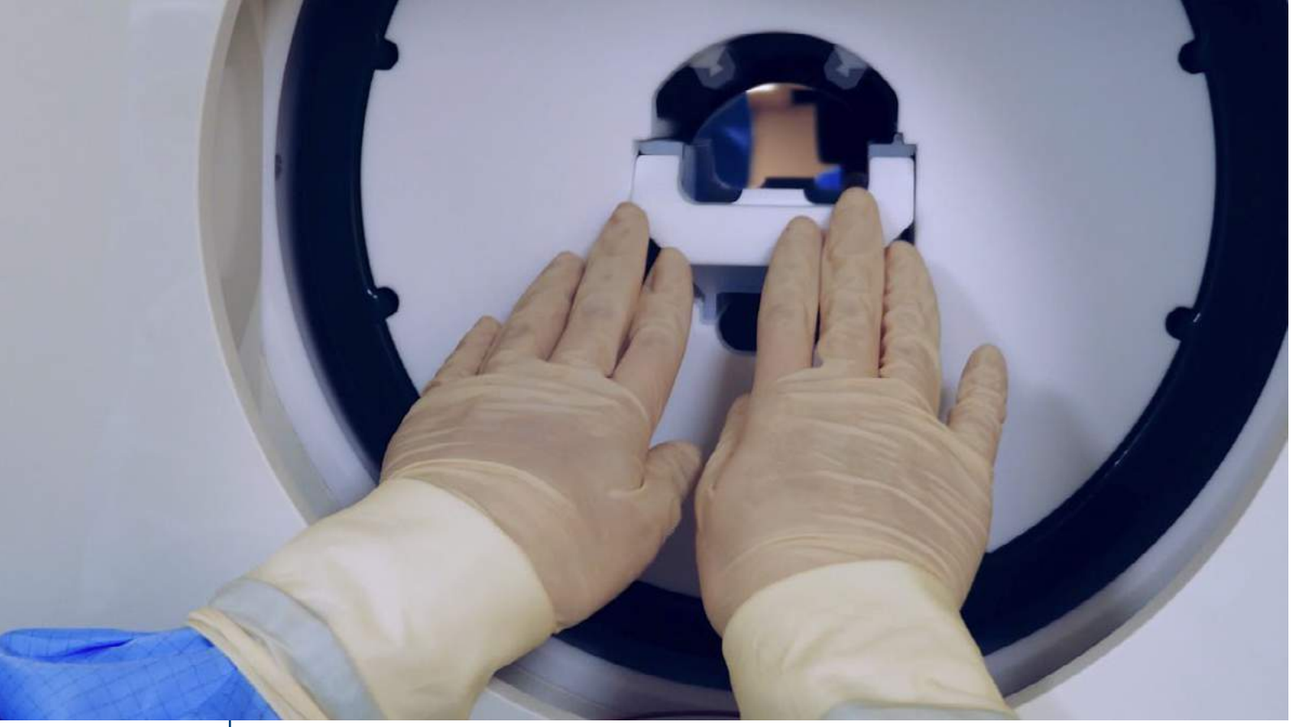
Detector diode :
CGY**2870**AUH/C1
80-110 GHz
Zero biais
Input power : < 0 dBm
Input matching : -15 dB

x8 Multiplier :
CGY**2770**UH/C2
11-11,5 to 88-92 GHz
Isolation : 20 dB
Output power : 5 dBm

FOUNDRY SERVICES & III-V PROCESSES

- EPITAXY
- PROCESSES
- III-V PROCESSES FOR FOUNDRY SERVICES
- GaN PROCESSES
- GaAs m-HEMT PROCESSES
- GaAs p-HEMT PROCESSES





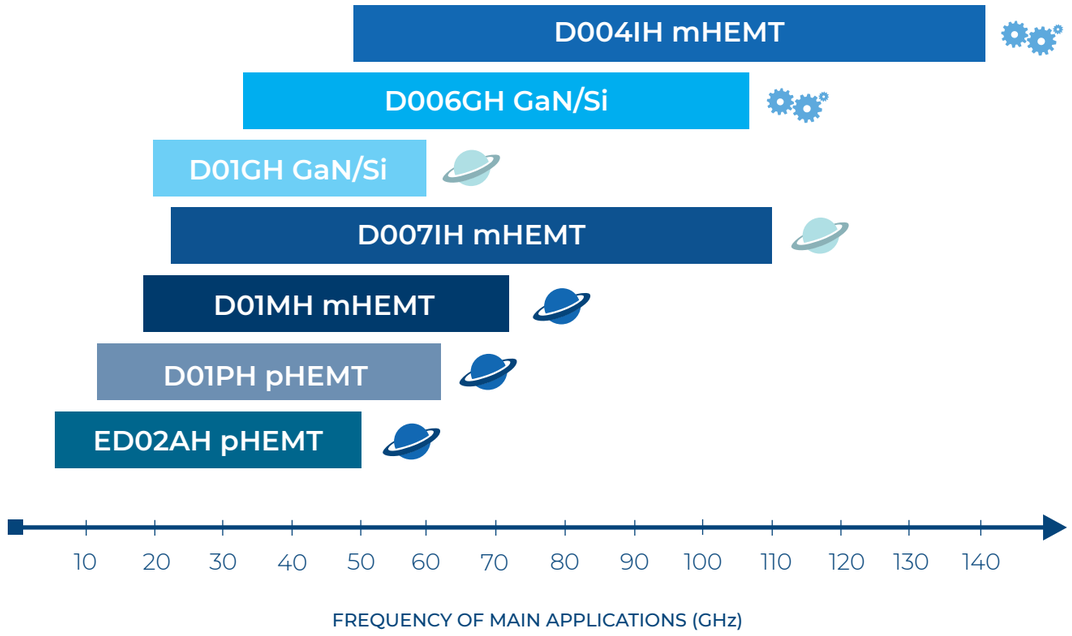
FOUNDRY SERVICES III-V PROCESSES

EPITAXY

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

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

PROCESSES



SPACE QUALIFIED ONGOING SPACE QUALIFICATION DEVELOPMENT

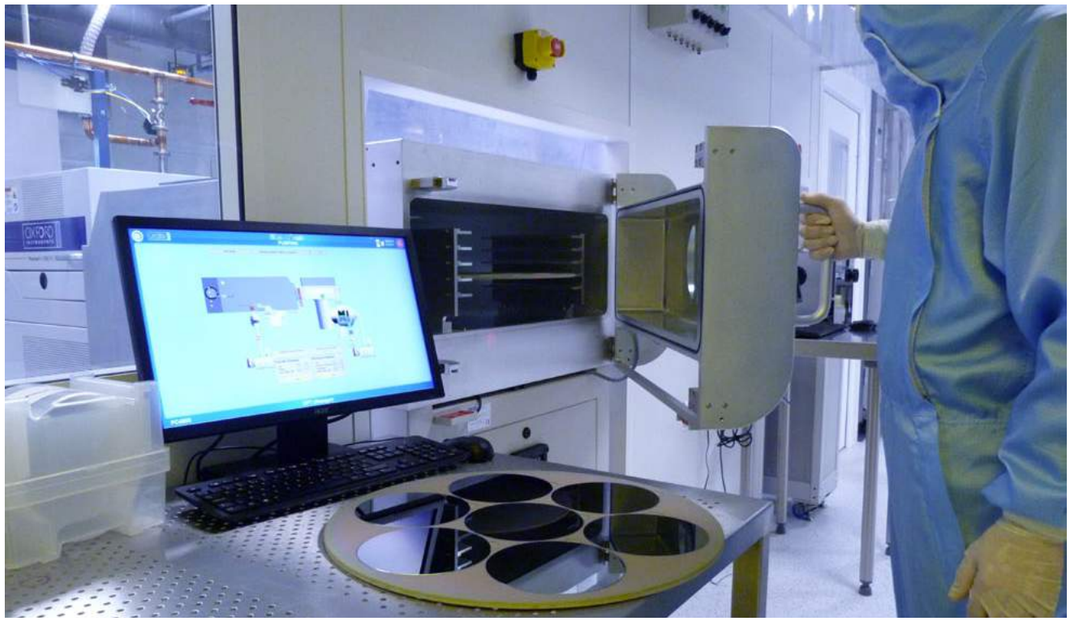
III-V PROCESSES FOR FOUNDRY SERVICES

You have not found any corresponding design in our standart product porfolio ? 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. Our process portolio 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 ou GaN processes (D01GH, D006GH). OMMIC's GaN technology features high output power (up to W-band), but also high linearity, low noise and no noiticeable memory effect.

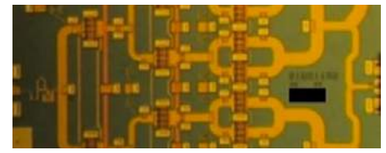
Control Function :
With our ED02AH process, it is possible to have enhanced (E) and depletion (D) transistors on the same die. Having E- and D- type transistors allows one to design control functions with a serial interface that simplifies the interaction with the device.

GaN PROCESSES

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

D01GH
Process

Technology	GaN on Si
Status	Market Introduction
Space Grade	in 2020
Gate Length	0.1 µm
Wafer Size	3 inch / 6 inch
Thinkness	100 µm
Gate Write	E-beam
Ft	110 GHz
Fmax	160 GHz
Vbgd	36 V
Vds q	12 V
Idss	1200 mA/mm
Idss max	1700 mA/mm
MIM Capacitors	400 pF/mm^2
NF	1,5 dB (40 GHz)
Power Density	3300 mW/mm CW 5,9 Pulse
gm	800 mS/mm



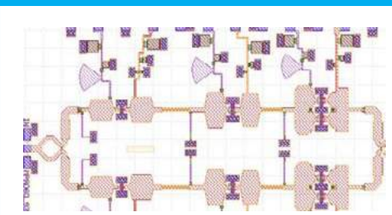
HPA ✓ ROBUST LNA ✓ T/R Chip ✓

Well suited for application from 15 to 50 GHz.
Representative Device :
CGY**2651**UH

Operating range : 37 GHz to 43 GHz
Gain : 18 db
Pout : 40 dBm @40 GHz
PAE : 30%
Power Consumption :
Vd = 12 V
IQtot = 0,84 V

D006GH
Process

Technology	GaN on Si
Status	Market Introduction
Space Grade	-
Gate Length	0,06 µm
Wafer Size	3 inch / 6 inch
Thinkness	100 µm
Gate Write	E-beam
Ft	150 GHz
Fmax	190 GHz
Vbgd	36 V
Vds q	12 V
Idss	1200 mA/mm
Idss max	1700 mA/mm
MIM Capacitors	400 pF/mm^2
NF	1 dB (40 GHz)
Power Density	3300 mW/mm CW 5,9 Pulse
gm	900 mS/mm



HPA ✓ ROBUST LNA ✓ SWITCH ✓

Well suited for application from 50 to 100 GHz.
Development Device :
Dev-WAVERIN

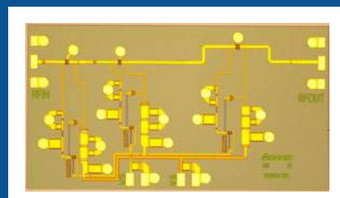
Operating range : 75 GHz to 89 GHz, CW
Gain : 14 db
Pout : 27 dBm @88 GHz
PAE : 10%

GaAs m-HEMT PROCESSES

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

D007IH
Process

Technology	GaAs m-Hemt
Status	Production Space
Space Grade	Qualified
Gate Length	0,07 µm
Wafer Size	3 inch
Thinkness	70 - 100 µm
Gate Write	E-beam
Ft	300 GHz
Fmax	450 GHz
Vbgd	4 V
Vds q	3 V
Idss	200 mA/mm
Idss max	400 mA/mm
MIM Capacitors	400 pF/mm^2
NF	0,5 dB (30 GHz)
Power Density	NA
gm	1600 mS/mm



LNA ✓ MIXER ✓

Well suited for application from 20 to 150 GHz.
Representative Device :

CGY**2260**UH/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 :
Vd = 1,5 V
Id = 0,52 A

D004IH
Process

Technology	GaAs m-Hemt
Status	Development
Space Grade	-
Gate Length	0,04 µm
Wafer Size	3 inch
Thinkness	100 µm
Gate Write	E-beam
Ft	400 GHz
Fmax	600 GHz
Vbgd	4 V
Vds q	3 V
Idss	200 mA/mm
Idss max	400 mA/mm
MIM Capacitors	400 pF/mm^2
NF	0,4 dB (30 GHz)
Power Density	NA
gm	2000 mS/mm

LNA ✓ MIXER ✓

Well suited for application from 60 to 250 GHz.

D01MH
Process

Technology	GaAs m-Hemt
Status	Production Space
Space Grade	Qualified
Gate Length	0,07 µm
Wafer Size	3 inch
Thinkness	70-100 µm
Gate Write	E-beam
Ft	150 GHz
Fmax	250 GHz
Vbgd	8 V
Vds q	6 V
Idss	300 mA/mm
Idss max	500 mA/mm
MIM Capacitors	400 pF/mm^2
NF	0,8 dB (30 GHz)
Power Density	30 mW/mm
gm	700 mS/mm

LNA ✓ MIXER ✓

Well suited for application from ? to ? GHz.
Representative Device :

CGY**2128**UH/C2

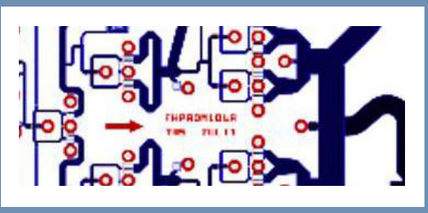
Operating range : 24 to 34 GHz
Gain : 24 dB
NF : 1.3 dB
OP1dB : 11 dBm
Power Consumption :
Vd =
Id =

GaAs p-HEMT PROCESSES

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

D01PH
Process

Technology	GaAs p-Hemt
Status	Production
Space Grade	Space Qualified
Gate Length	0,135 µm
Wafer Size	3 inch
Thinkness	70 - 100 µm
Gate Write	E-beam
Ft	100 GHz
Fmax	180 GHz
Vbgd	12 V
Vds q	10 V
Idss	500 mA/mm
Idss max	700 mA/mm
MIM Capacitors	400 pF/mm^2
NF	1,1 dB (30 GHz)
Power Density	640 mW/mm
gm	650 mS/mm



PA ✓ LNA ✓ MIXER ✓ TWA ✓

Well suited for application from 5 to 45 GHz and Space application.
Representative Device :

CGY**2135**UH/C1

Operating range : 18 GHz to 23 GHz
Gain : 25 dB
OP1dB : 31 dBm
Power Consumption :
Vd = 4 V
Id = 1,2 A

ED02AH
Process

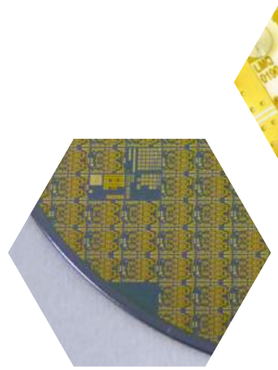
Technology	GaAs p-Hemt
Status	Production
Space Grade	Space Qualified
Gate Length	0,18 µm
Wafer Size	3 inch / 6 inch
Thinkness	100 µm
Gate Write	E-beam
Ft	60 GHz
Fmax	110 GHz
Vbgd	8 V
Vds q	7 V
Idss	250 (on) / 140 (off) mA/mm
Idss max	400 (on) / 180 (off) mA/mm
MIM Capacitors	49 & 400 pF/mm²
NF	0,8 dB (18 GHz)
Power Density	330 mW/mm
gm	450 mS/mm

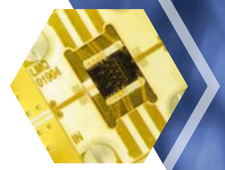
LNA ✓ CONTROL FUNCTION ✓
CORECHIPS ✓ MIXER ✓

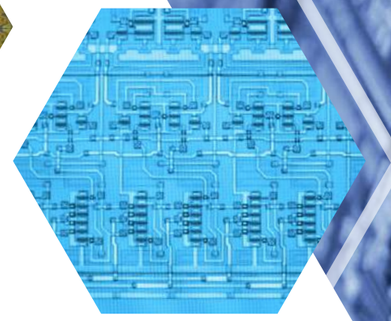
Well suited for application from 1 to 40 GHz.
Representative Device :
CGY**2170**UH/C1

Operating range : 8 GHz to 12 GHz
Gain : 5 db
RMS_phase : 4°
RMS_atten : 0,5 dB

They are designing using OMMIC's PDK :

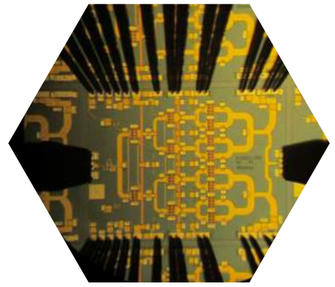


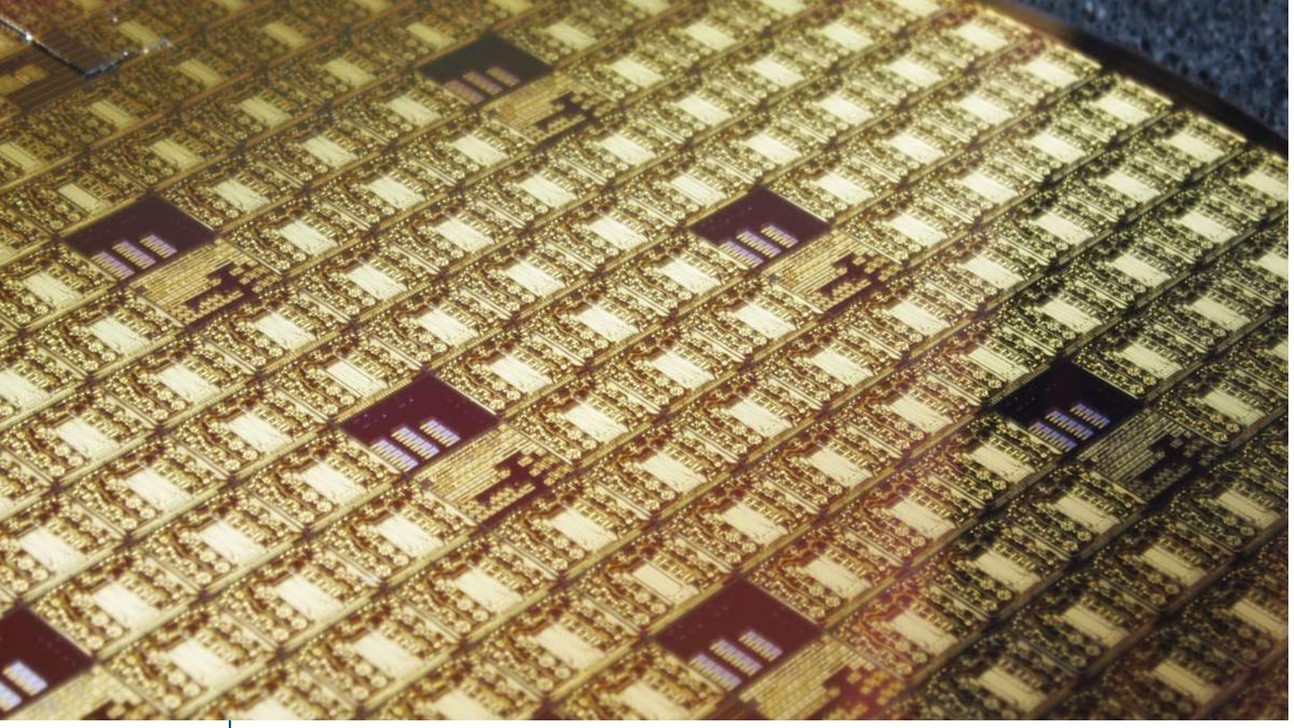




DESIGN CENTER & FAB + SERVICES

- DESIGN KITS
- FOUNDRY SERVICE
- CUSTOM DESIGN
- MPW SCHEDULE





DESIGN CENTER & FAB + SERVICES

DESIGN KITS

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

Foundry Service

OMMIC provides its Process Design Kit (PDK) under ADS (Keysight) 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 OMMIC'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**.

FOUNDRY SERVICE

All of OMMIC'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 :

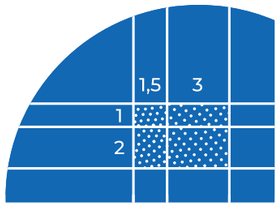
- The size of the circuit must correspond to one of the fixed patterns for a MCP project.
- The layout must be suplied according to a predefined time table available on the web site, by default 4 dates per year.
- MCP order should be placed at least 4 weeks before the annonced MCP start date.
- T he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

University Partnership :
OMMIC is commited to give access to ts 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.



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 whre close discussions with the customer ensure that the final MMIC will really enhances the final system.

This **design flow** 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.

MPW SCHEDULE

Important date for available process for Multi Project Wafer (MPW).

SPACE QUALIFIED	**ED02AH** 03/09/2019	**D01PH** 23/04/2019 10/09/2019	**D01MH** 16/04/2019 03/09/2019
HIGH INDIUM CONTENT m-HEMT	**D007IH** 28/06/2019 31/10/2019	**D004IH** MPW dates not available yet	
GaN	**D01GH** 30/04/2019 13/08/2019 29/11/2019	**D006GH** 30/04/2019 13/08/2019 29/11/2019	

For any other information or special request contact information@ommic.com
Visit our website www.**ommic**.com for **up-to-date information**.

SPACE HERITAGE & FLIGHTS MODELS

- SPACE HERITAGE
- SPACE QUALIFICATION & RELIABILITY CENTER

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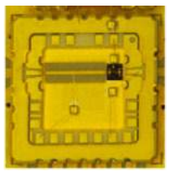
SPACE HERITAGE

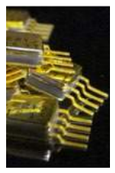
More than 50 000 MMICs have been supplied for **Flight Models**. OMMIC has more than 1 000 000 years of accumulated Flight Life time around earth in several space mission and satellite equipment.

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 such as Medium Power Amplifiers
- Non Linear Components such as Frequencies Multipliers
- Negative Resistor for Oscillators
- Multi-functions components composed by several function
- Numerical Components as Phase or Frequency Detector





ESA has already evaluated 3 OMMIC processes : EDO2AH, D01PH and D01MH.These 3 processes being maintained on **ESA EPPL list**. Two 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 Iniative) programs. We can be a custom design center for space qualified components, many of them have already been designed by OMMIC's design team.

SPACE QUALIFICATION & RELIABILITY CENTER

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

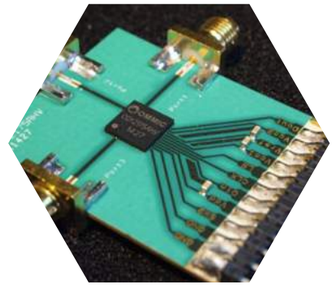
TEST PERFORMED FOR SPACE EVALUATION

All tests below are **assembly test** for flight models and are performed at OMMIC or specialised external laboratories.

They have already trusted OMMIC :

SALES SUPPORT FIELD

- MMIC PACKAGING
- SALES REPRESENTATIVE NETWORK
- THEY TRUSTING US

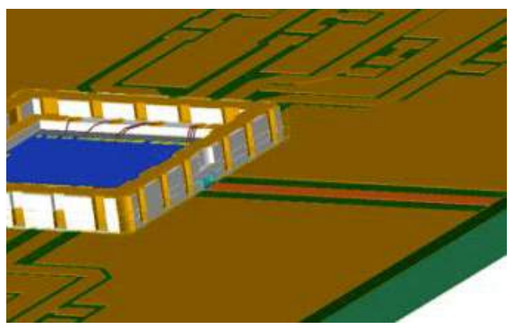


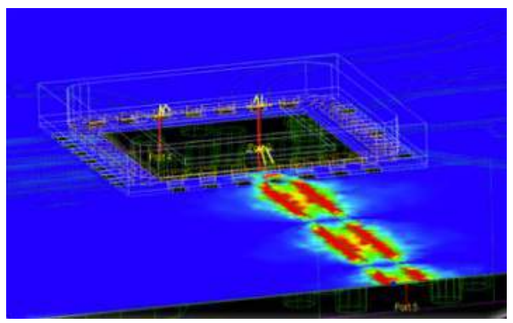
SALES SUPPORT FIELD

MMIC PACKAGING

We are moving towards a word 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 white ensuring optimal performances.

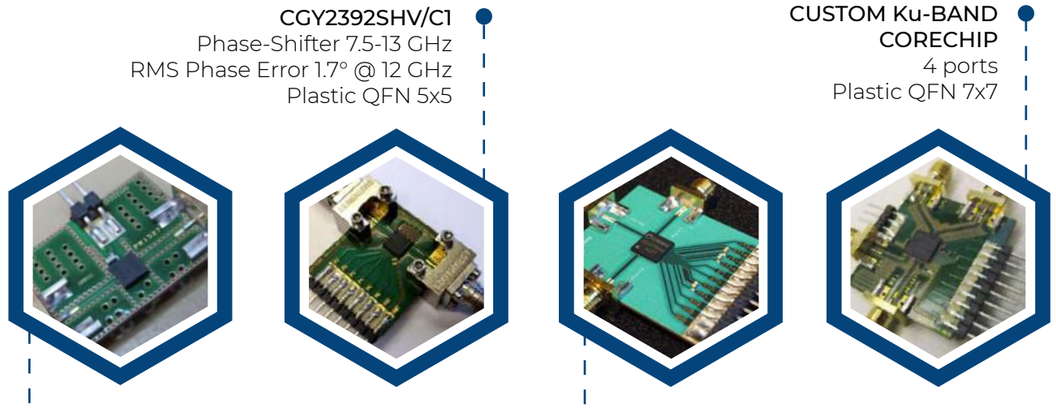
Exemple of modeling with EM simulation :





Today, our solutions cover L-, to Ka-band. This includes GaN products for power application, robust LNA and T/R chip front ends.

Exemple of LNA and Corechip packaged solution :



SALES REPRESENTATIVE NETWORK

A **sales and field application team** at OMMIC is **dedicated to customer** sales and **technical resquest** 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 **meets us** at international RF event such as IMS or EuMW !

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.

Wherever you are, contact us !

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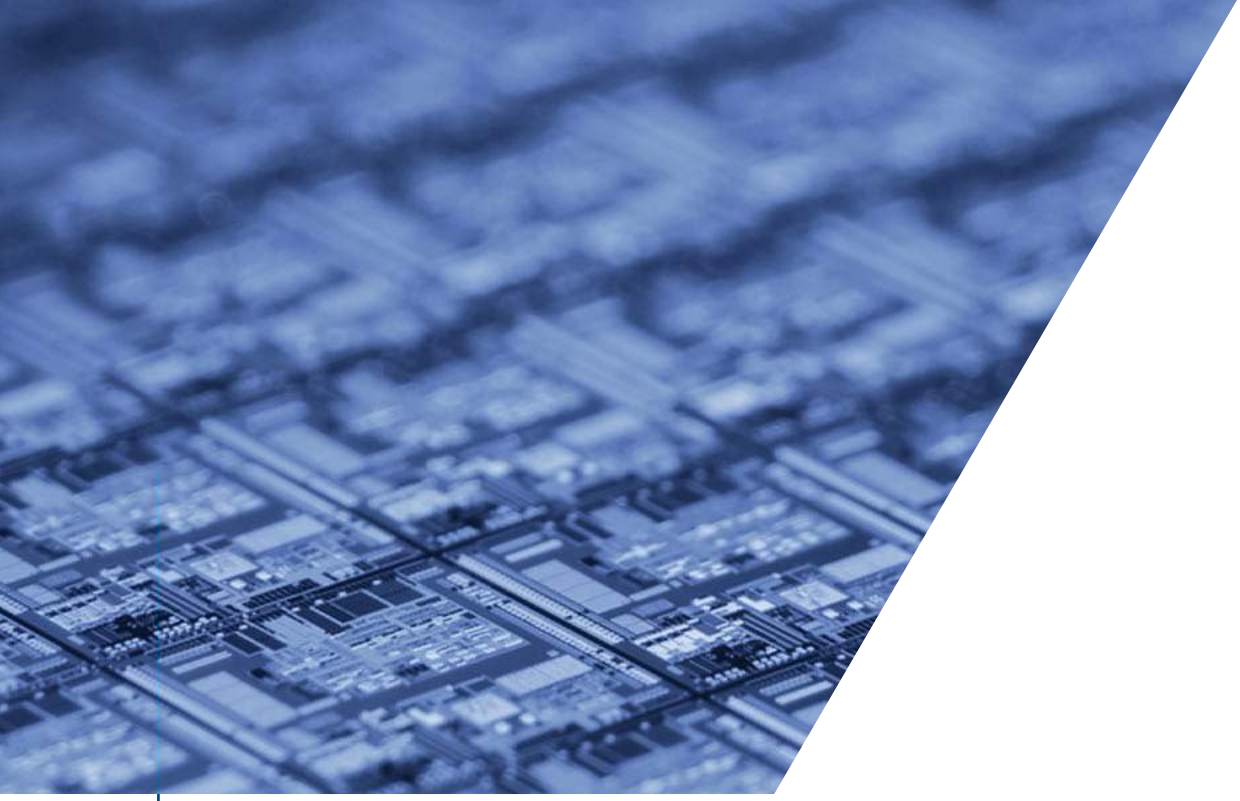
For all other region, please contact information@ommic.com

THEY TRUST US

More than 160 partners have already trusted OMMIC. Why not you ?

& more ...



OMMIC
innovating with III-V'S

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