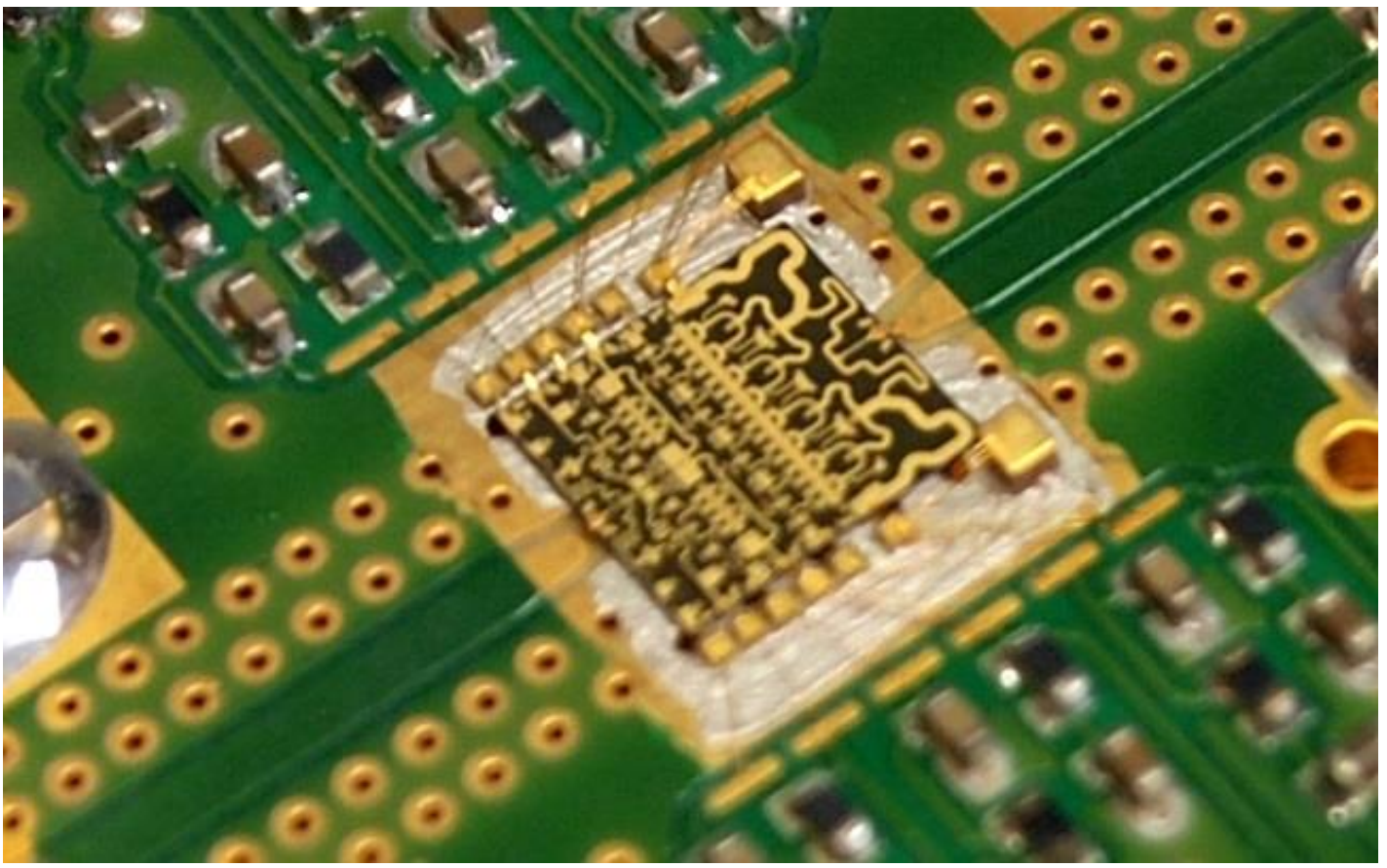

REPRESENTED BY GM SYSTEMS

OMMIC

Short Form Catalog 2015

TOM TERLIZZI
KINGS PARK, N.Y.
516-807-9488 CELL
631-269-3820 OFFICE
terlizzi@gmsystems.com

MMIC products from 500MHz to 160GHz

Advanced GaAs, InP, GaN processes

Epitaxy services

Foundry and FAB+ services

Design Center for state of the art custom MMICs

Space Heritage and Space qualification services

Innovating with III-V's

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GaAs-InP-GaN Solution Leading Supplier

OMMIC in few words

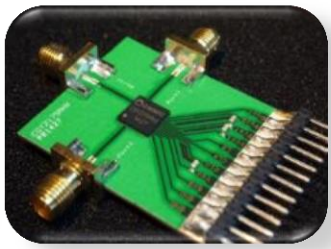
OMMIC, based near Paris in France, is a leading supplier of Epitaxy, Foundry Services and MMICs based around the most advanced III-V processes.

OMMIC is exploiting its more than 40 years background in III-V **Materials**, **Design** and **Processing** to provide innovative solutions enabling its customers to be leaders in a more and more demanding market place.

OMMIC is a supplier of MMIC circuits, Foundry Service and Epitaxial Wafers based on III-V (GaAs, GaN and InP) materials. As a leader in advanced technologies, OMMIC provides its customers with cutting edge performance for Telecommunication, Space and Defense Applications.







OMMIC: Flexible, customer oriented with a strong Quality Policy

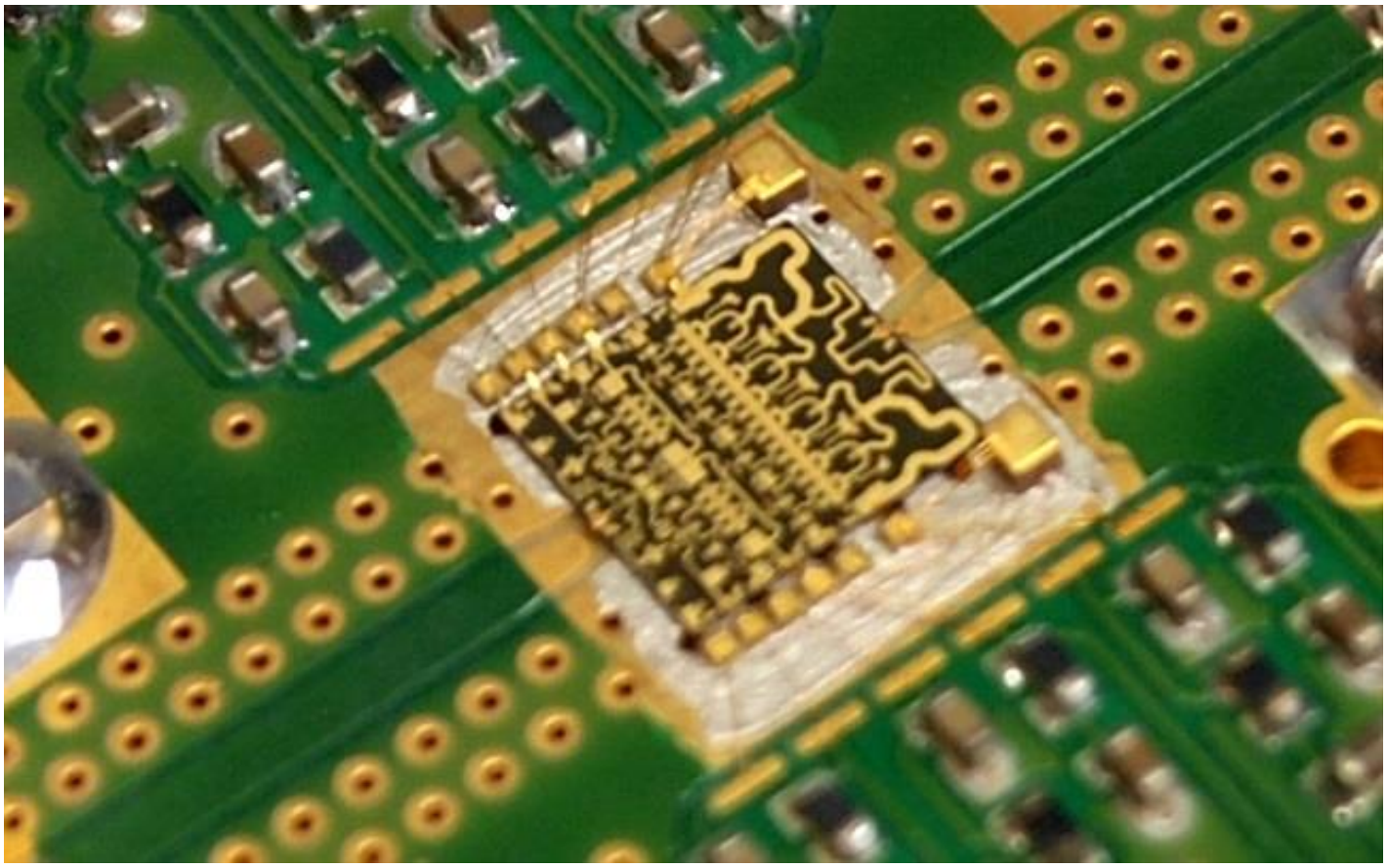
OMMIC operates in a highly competitive global market and must be competitive and responsive.

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 focused on

- Innovation and development through the establishment of partnerships with our customers, agents and suppliers.
- Compliance with the requirements of our customers and with the European regulation.
- Development of staff skills, responsible and motivating human policy.
- Minimize our impact on the environment through preventive action plans.



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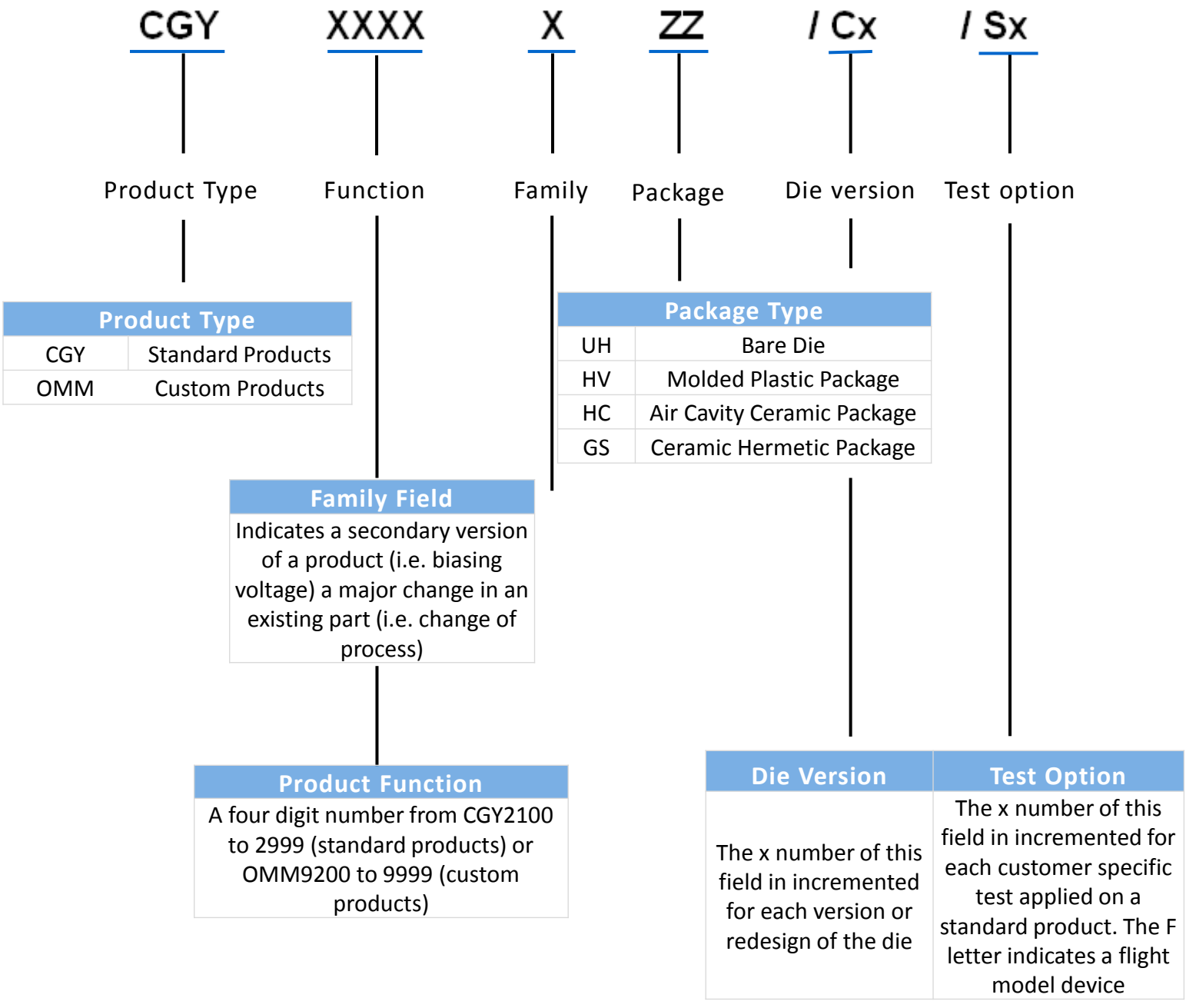
Contents

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

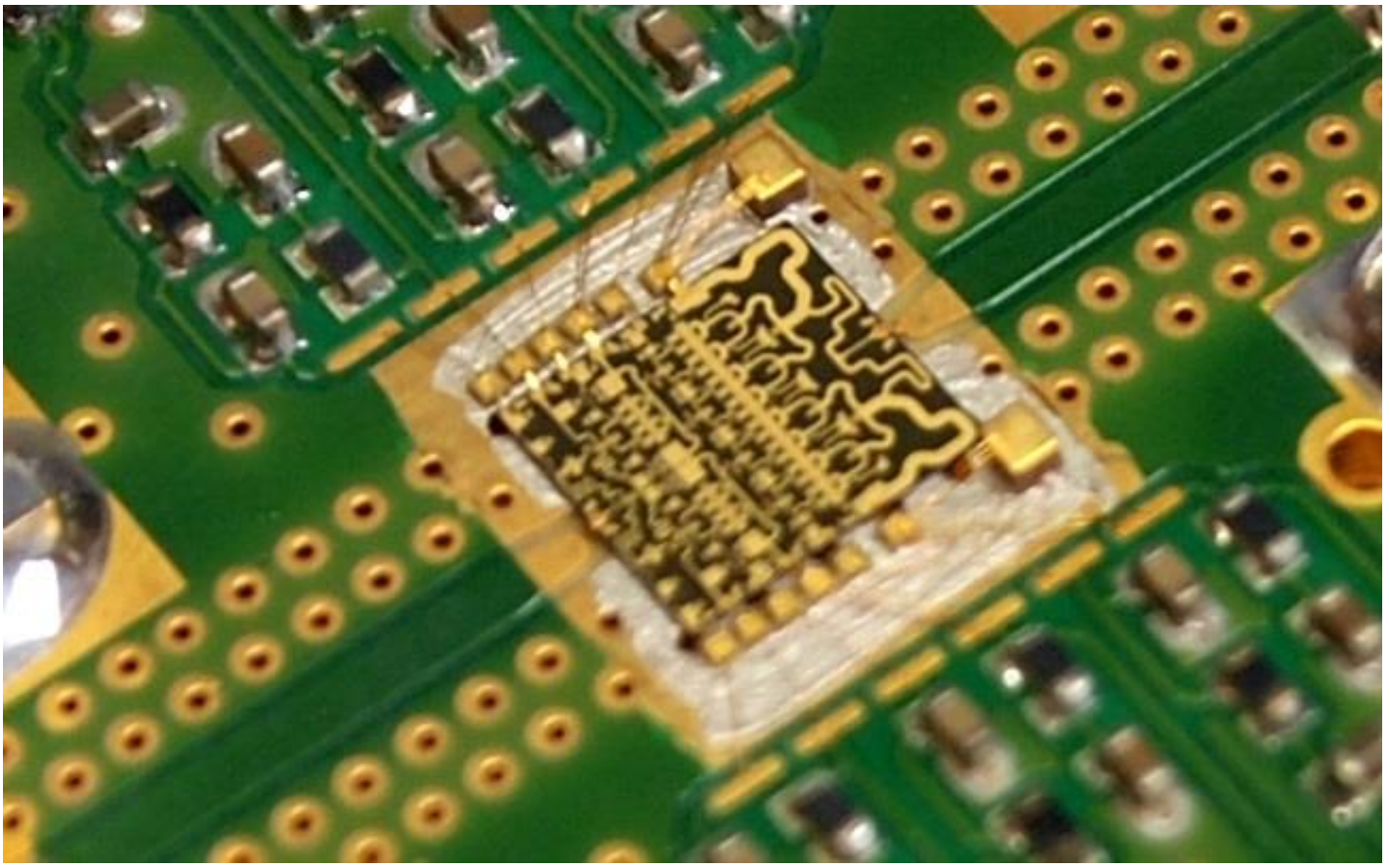
A four digit number from CGY2100 to 2999 (standard products) or OMM9200 to 9999 (custom products)

Die Version	Test Option
The x number of this field in incremented for each version or redesign of the die	The x number of this field in incremented for each customer specific test applied on a standard product. The F letter indicates a flight model device

Example of part number

CGY2175AHV/C1/S1

- CGY: Standard product
- A: Version A
- HV: Plastic QFN
- C1: Design version 1
- S1: Special test for customer 1



OMMIC

MMIC Products Selector Guide

mmW MMIC Solutions

Ultra Low Noise Amplifiers (0.5 - 6GHz)

Low Noise Amplifiers (5 - 160GHz)

mmW GaN Roadmap

Power Amplifiers (8 - 46GHz)

Wideband Amplifiers (DC - 54GHz)

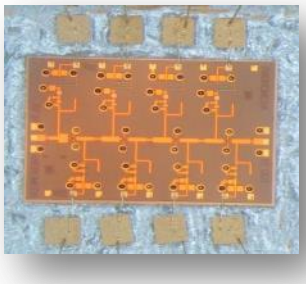
Digital Attenuators and Phase Shifters (5 - 35GHz)

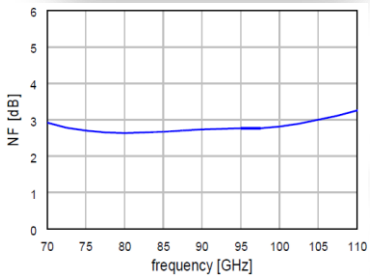
Corechip and Control Functions (5 - 35GHz)

mmW MMIC Solutions

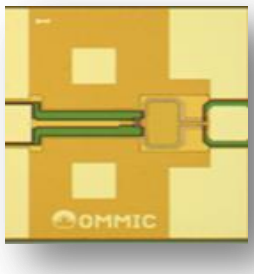
94GHz Passive Imaging Solution

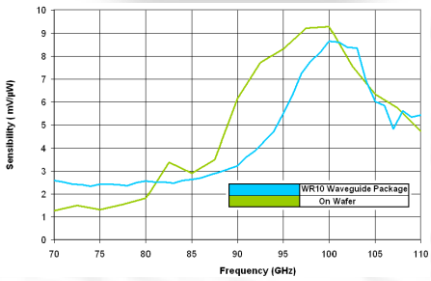
CGY2190UH/C2
LNA 75-110GHz



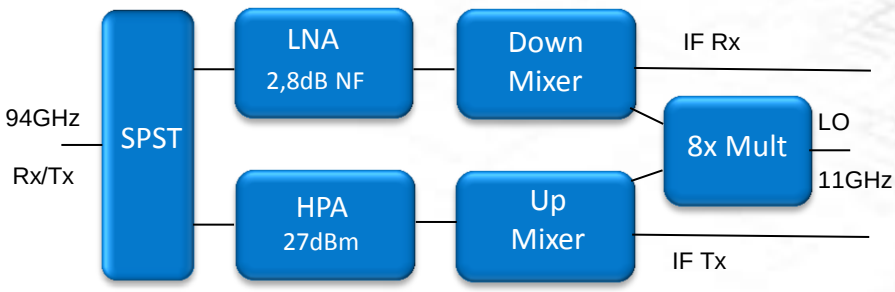


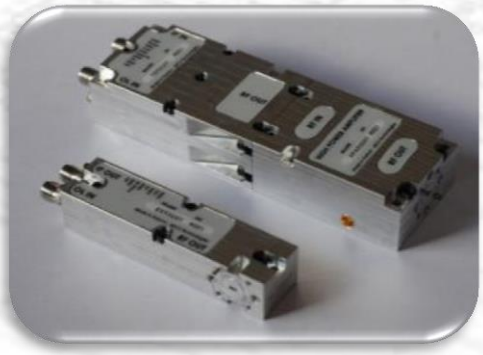
CGY2870UH/C1
RTID Zero bias Detector





94GHz Radar Solution





Point to Point / Point to Multipoint

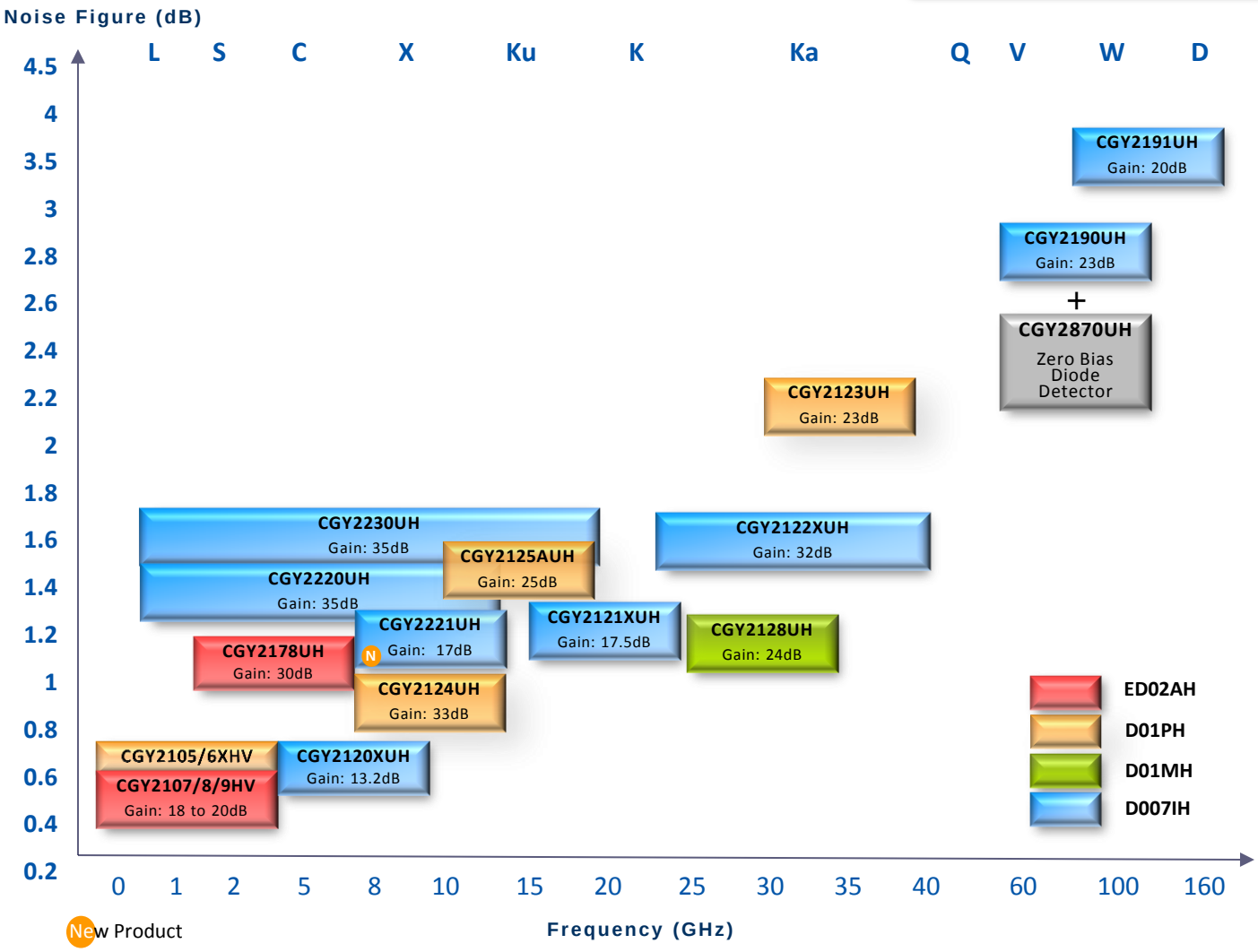
Ka band GaN and GaAs Power Amplifiers

Ka to E band Ultra Low Noise Amplifiers

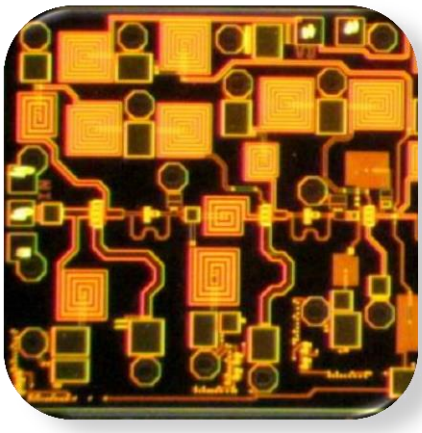
5G MFC LNA + Phase shifters

Low Noise Amplifiers Portfolio

OMMIC LNA Portfolio



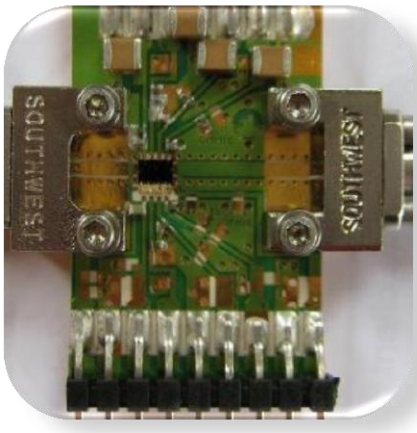
CGY2124UH/C2



8 - 12 GHz NF: 1.1dB

30 dB Gain

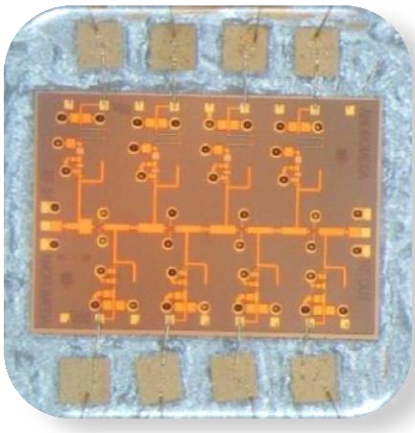
CGY2122XUH/C2



25 - 43GHz NF: 1.5dB

32 dB Gain

CGY2190UH/C2



75 - 110GHz NF: 3dB

23 dB Gain

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Low Noise Amplifiers Portfolio

OMMIC Portfolio of MMICs, includes LNA from 500MHz to 160GHz for civil application such as Telecommunication, Passive imaging, Radars but also for space and military applications.

• LNA are manufactured using OMMIC 180nm E/D PHEMT (ED02AH), 130nm gate length PHEMT (D01PH), 130nm MHEMT (D01MH) and 70nm MHEMT (D007IH) Technologies.

• The MMICs use gold bonding pads, backside metallization and are fully protected with Silicon Nitride passivation to obtain the highest level of reliability.

• **D01PH** technology has been evaluated for Space applications and is on the **(EPPL), E**uropean **P**referred **P**arts List of the **(ESA)** European Space Agency.

Performance Table for Ultra Low Noise Amplifiers

OMMIC Ultra Low Noise Amplifier are dedicated to application such as Base Station Rx architectures thanks to a very low noise and high OIP3 from L to S bands. Standards targeted are GSM, CDMA2000, WCDMA, LTE, LTE-A.

Part number	Frequency (GHz)	Gain (dB)	NF (dB)	OIP3 (dBm)	Bias (V)	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	21,5	0,5	36	5	2 x 50	QFN 4x4	Production
CGY2108GS	0,5 - 6	21	0,6	36	5	2 x 50	Flight Model	Production
CGY2109HV	0,5 - 3	20	0,72	32	5	2 x 50	QFN 4x4	Production

Performance Table for Low Noise Amplifiers MMIC

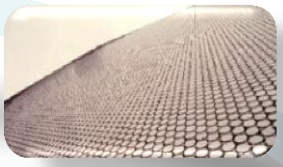
OMMIC LNA MMIC are suitable for nowadays satellite, radar, passive imaging and cryogenic application thanks to very low noise performances

Part number	Frequency (GHz)	Gain (dB)	NF (dB)	OP1dB (dBm)	Bias (V)	Current (mA)	Package	Status
CGY2178UH/C1	5 - 6	30	1	15	3	40	Die	Production
CGY2178HV/C1	5 - 6	30	1	15	3	40	QFN	Sampling
CGY2120XUH/C1	5 - 7	13,2	0,5	12	1	50	Die	Production
CGY2220UH/C1	1 - 12	35	1,3	12	1,5	52	Die	Production
CGY2124UH/C1	8 - 12	33	1,1	11	5	55	Die	Production
CGY2124HV/C1	8 - 12	32	1,35	10	5	55	QFN	Sampling
CGY2221UH/C1	7,5 - 13	17	1,6	17	5	82	Die	Production
CGY2221HV/C1	7,5 - 13	17	1,65	17	5	82	QFN	Sampling
CGY2230UH/C1	1- 18	35	1,45	12	1,5	50	Die	Production
CGY2125UH/C1	13 - 15	25	1,4	8	3,3	20	Die	Production
CGY2121XUH/C1	18 - 26	17,5	1,2	5	0,8	60	Die	Production
CGY2128UH/C1	24 - 34	24	1,3	11	3,5	47	Die	Production
CGY2122XUH/C2	25 - 43	32	1,5	1,2	1,1	30	Die	Production
CGY2123UH/C1	32 - 38	23	2,3	13	5	65	Die	Production
CGY2190UH/C2	75 -110	23	3	1	1	33	Die	Production
CGY2191UH/C2	100 - 160	20	4	3	1,4	42	Die	Production

mmW GaN Roadmap

Pioneering Next MMIC Generation

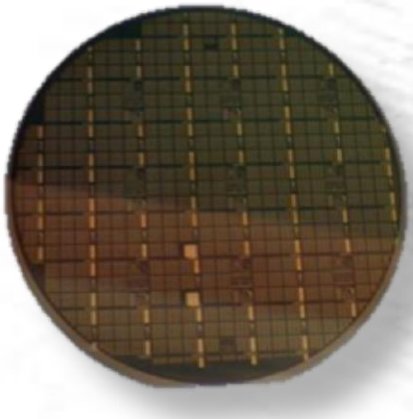
SATCOM PA
12W at 27-31GHz



Robust Radar LNA
>30dBm Pin CW

Backhaul PA
3W at 60GHz

LNA + Phase Shifter
Ka to E band



D01GH (Si)

110GHz Ft
3,3W/mm @ 94GHz

2014

D006GH (SiC)

170GHz Ft
1W/mm @ 94GHz

2016

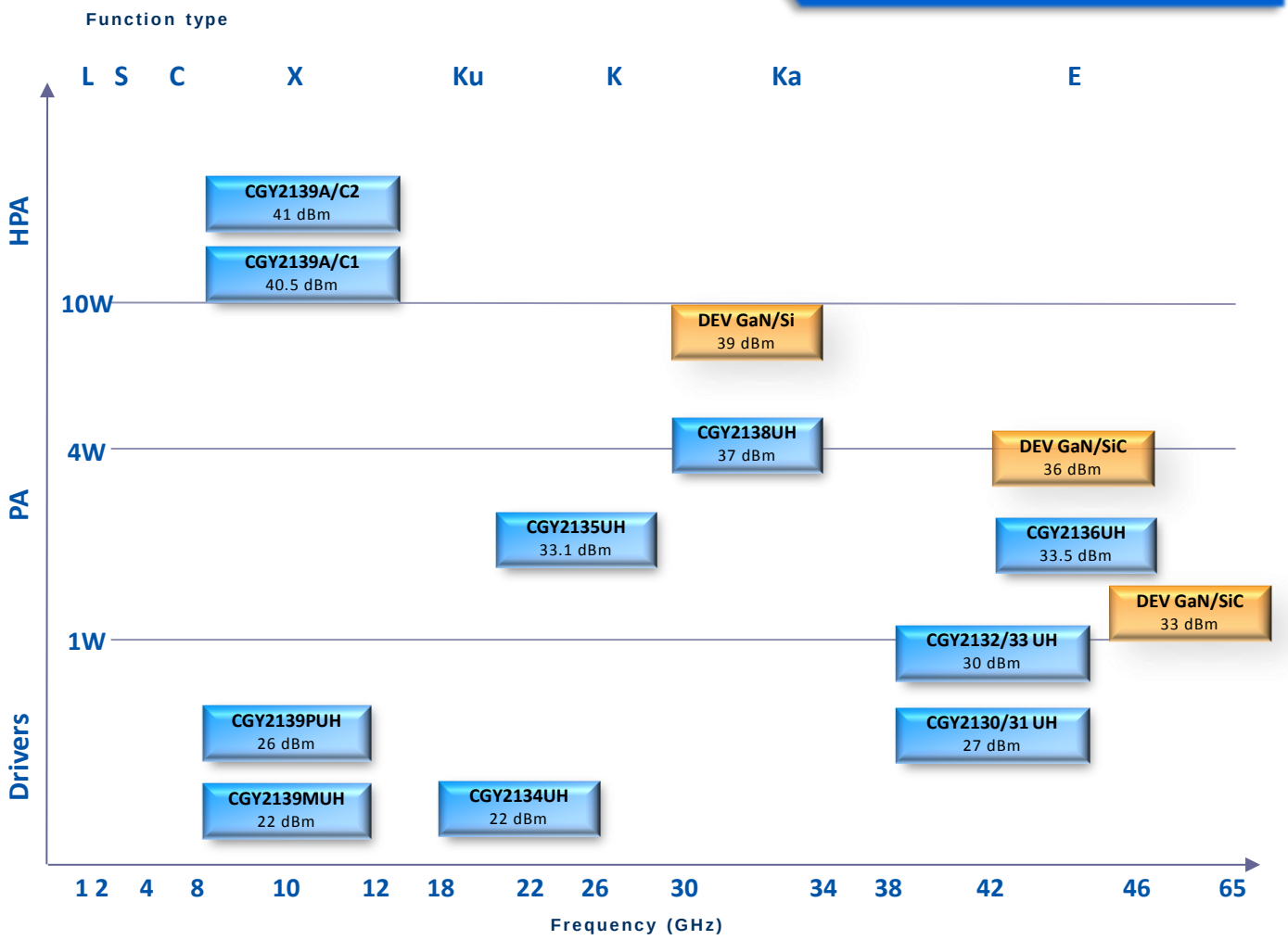
D004GH (SiC)

210GHz Ft
0,8W/mm @ 140GHz

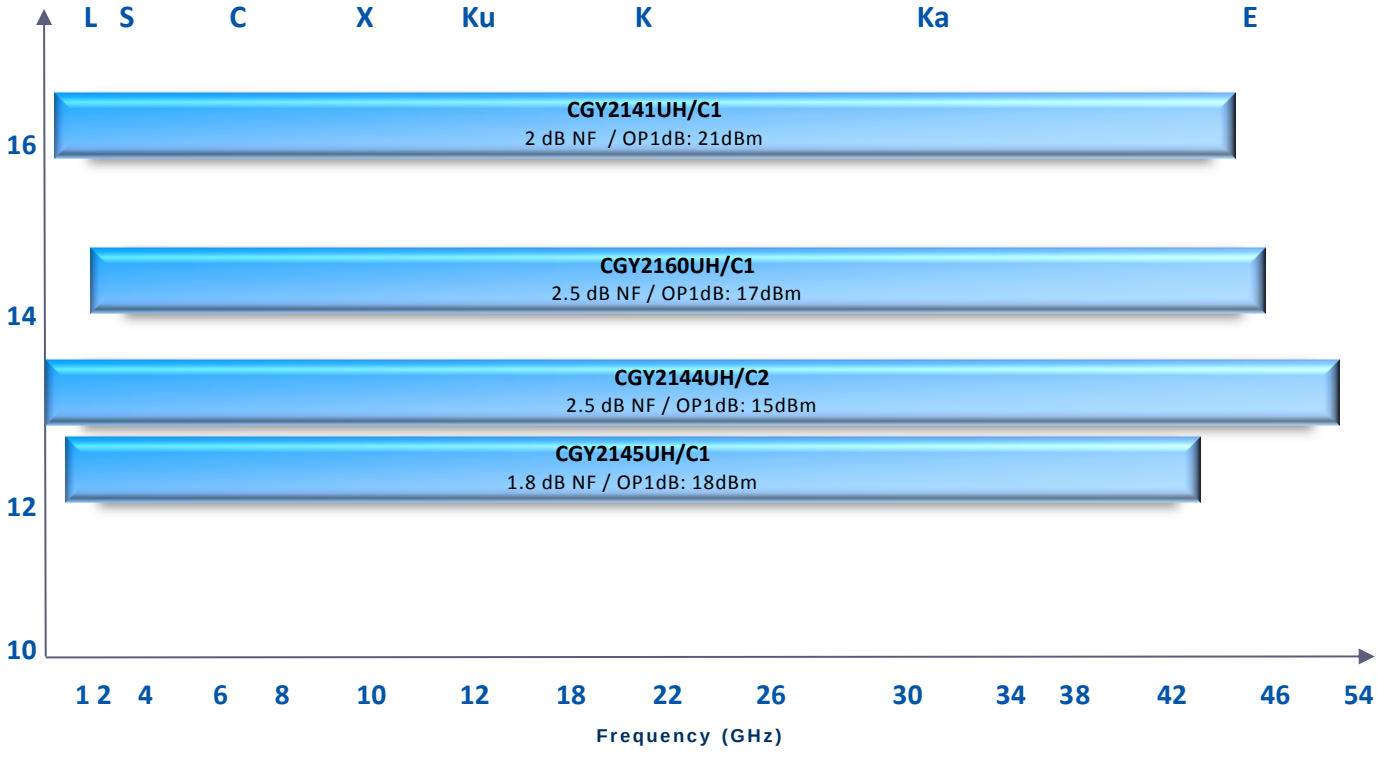
2018

Power Amplifiers & Wideband Amplifiers Portfolio

OMMIC Power Amplifiers



OMMIC Wideband Amplifiers



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Power Amplifiers & Wideband Amplifiers Portfolio

OMMIC Portfolio of MMICs, includes Power Amplifiers from 8 to 46GHz for civil application such as Telecommunication, Instrumentation, Radars but also for Satcom and military applications.

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

Performance Table for Power Amplifiers

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

Part number	Operation Frequency (GHz)	Gain (dB)	Saturated Power (dBm)	Compression point P1dB (dBm)	Bias Voltage (V)	Bias Current (A)	Package	Status
CGY2139MUH/C1	8 - 12	22	22	21	8	0,1	DIE	Production
CGY2139PUH/C1	7 - 12	22	26	25	7	0,18	DIE	Production
CGY2139AUH/C1	8 - 12	21	40,5	40	8	4,9	DIE	Production
CGY2139AUH/C2	8 - 12	25	41,2	41	8,5	4,2	DIE	Production
CGY2134UH/C1	18 - 23	28	23	22	4,5	0,3	DIE	Production
CGY2135UH/C1	18 - 23	25,4	32,3	31,2	4,0	1,2	DIE	Production
CGY2138UH/C1	27,5 - 31	19	37	36	4,5	5,6	DIE	Production
CGY2130UH/C1	37 - 41	22	27	26	4,5	0,82	DIE	Production
CGY2132UH/C1	37 - 41	20	30	28,5	4,5	1,45	DIE	Production
CGY2131UH/C1	39 - 44	22	27	26	4,5	0,8	DIE	Production
CGY2133UH/C1	39 - 44	20	30	28	4,5	1,33	DIE	Production
CGY2136UH/C1	40 - 46	20	33,5	33	4,5	2,6	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.**

Performance Table for Wideband Amplifiers

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

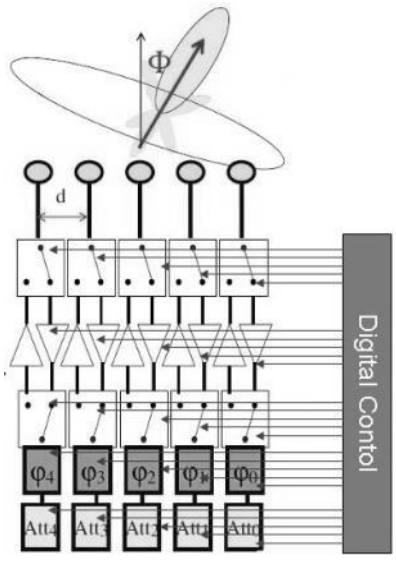
Part number	Operation Frequency (GHz)	Gain (dB)	NF (dB)	Compression point P1dB (dBm)	Bias Voltage (V)	Bias Current (mA)	Package	Status
CGY2141UH/C1	DC - 46	16	2	21	5	195	DIE	Production
CGY2144UH/C2	DC - 54	13	2,5	15	5	100	DIE	Production
CGY2145UH/C1	0,5 - 45	12,7	1,8	18	5	85	DIE	Production
CGY2160UH/C1	1,5 - 47	14,5	2,5	17	5	103	DIE	Production

Control Functions Portfolio

OMMIC Portfolio of MMICs, 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 single digital data serial input using OMMIC's E/D technology (ED02AH), enabling integration of **a Serial to Parallel interface on the die (SIPO).**

OMMIC SIPO stands for Serial Input Parallel Output.



What is the issue without a SIPO integrated on the die ?

If not using a SIPO, you need to control each phase state and attenuation state through a parallel control.

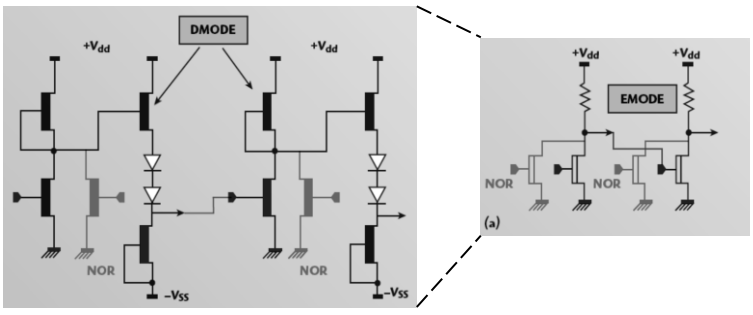
This mean many wires in parallel and very bad integration.

For example for a 12 bit corechip (6 bit phase shifter + 6 bit attenuator) the user will need at least 24 bonding wires to control each states.

To solve serial interface issue some suppliers provide external serial converter dies in CMOS but this doesn't solve integration issue due to large amount of bonding between CMOS die and phase + attenuation die.

What is the advantage of OMMIC ED02AH Process ?

Thanks to its ED02AH process, OMMIC can integrate in the same MMIC , enhanced and depletion transistors. Depletion transistors can be used for analog function such as phase shifters and attenuators.



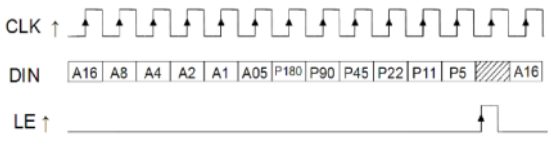
Enhanced transistors help to simplify and better integrate digital functions.

This enable OMMIC to integrate on the MMIC, the SIPO. Then the Corechip or Multifunction chip can be controlled in serial mode with only 3 wire (Data input, Clock and Latch enable).

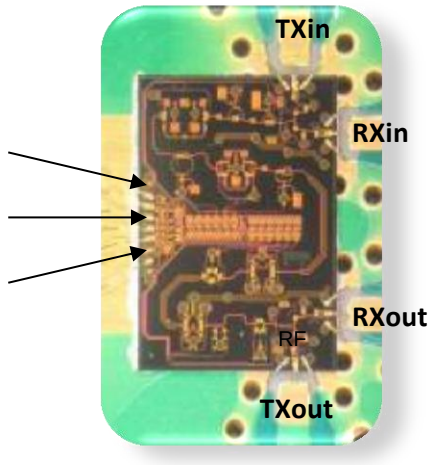
OMMIC solution for highly integrated control functions ?

Each phase and attenuation states are loaded in the shift register at a clock rate up to 250MHz then phase and attenuation configuration is done after latch enable (LE)

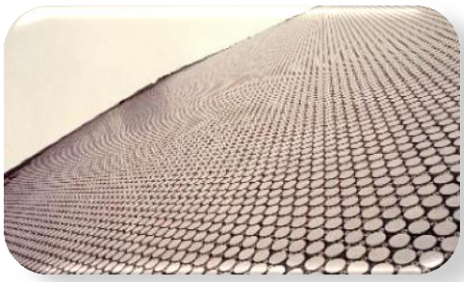
CGY2170XUH (6 bit X band corechip)



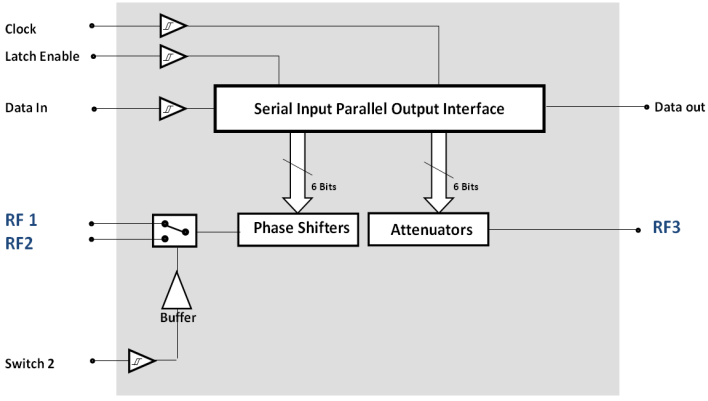
Less than 4x4mm²



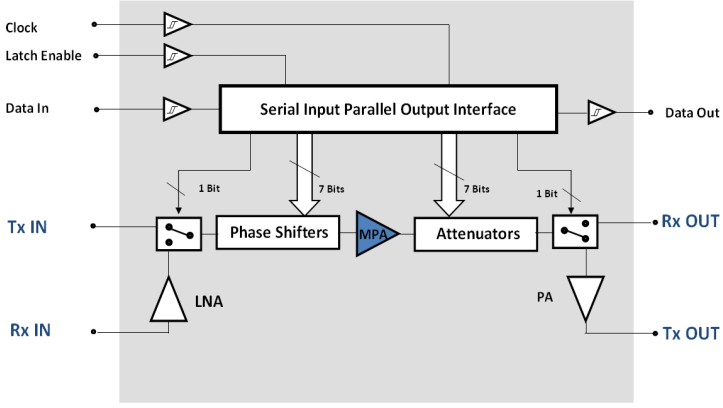
Control Functions Portfolio

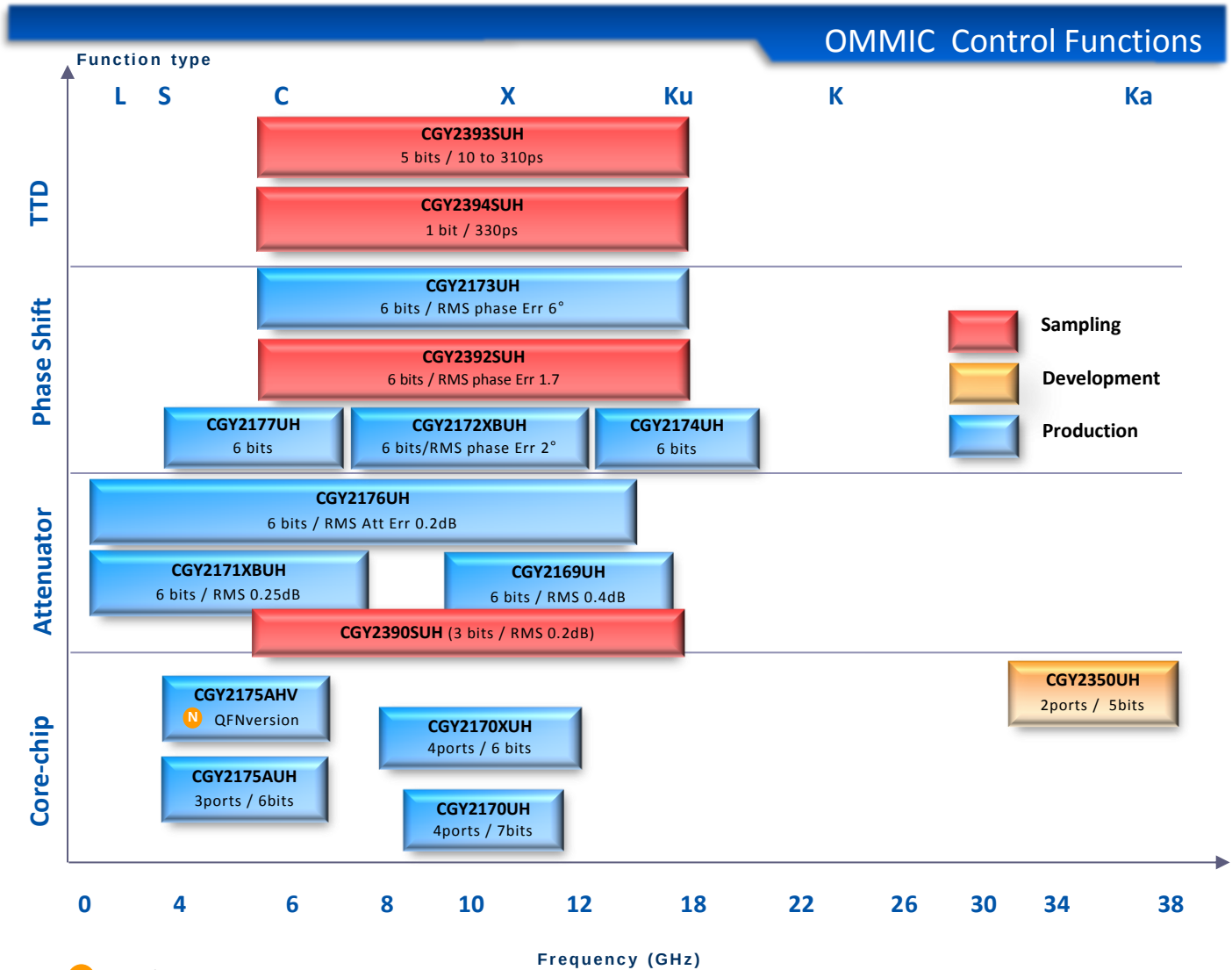


CGY2175AUH/C1 : 3 ports – 6bits
External LNA and PA



CGY2170UH/C2 : 4 ports – 7bits
Internal LNA and PA





New Product

Control Functions Portfolio

Performance Table Integrated Corechip functions

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

Part number	Operation Frequency (GHz)	Resolution (bits)	Topology	Ctrl Ranges (dB / °)	RMS Atten/Phase Error (dB/°)	Ctrl interface (V)	Package	Status
CGY2175AUH/C1 N	4,5 - 6,5	6	3 ports	31,5 / 360	0,2 / 1,3	0 / +5	Die	Production
CGY2175AHV/C1	4,5 - 6,5	6	3 ports	31,5 / 360	0,25 / 1,3	0 / +5	QFN	Production
CGY2175BUH/C1	4,5 - 6,5	6	4 ports	31,5 / 360	0,3 / 1,8	0 / +5	Die	Production
CGY2170UH/C2	8,5 - 11,5	7	4 ports	24,7 / 360	0,25 / 5	0 / +5	Die	Production
CGY2170UH/C2	8,5 - 11,5	7	4 ports	24,7 / 360	0,3 / 5	0 / +5	QFN	Development
CGY2170XUH/C2	8 - 12	6	4 ports	31,5 /360	0,3 / 3	0 / +3	Die	Production
CGY2170XHV/C2	8 - 12	6	4 ports	31,5 / 360	0,35 / 3	0 / +3	QFN	Development
CGY2170YUH/C1 N	8 - 12	6	3 ports	31,5 / 360	0,4 / 3	0 / +3	Die	Production
CGY2170YHV/C1 N	8 - 12	6	3 ports	31,5 / 360	0,4 / 3	0 / +3	QFN	Sampling
CGY2350UH/C1	34 - 36	5	3 ports	31,5 / 360	2 / 8	0 / +3	Die	Sampling

Part number	Operation Frequency (GHz)	Resolution (bits)	Topology	Gain/Noise (dB)	RMS Phase Error (°)	Ctrl interface (V)	Package	Status

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

CGY2179UH	10,7 - 12,75	4	2 ports	12 / 1,9	7	0 / +5	Die	Production
CGY2179HV	10,7 - 12,75	4	2 ports	12 / 1,9	7	0 / +5	QFN	Production

Performance Table for True Time Delay functions

Part number	Operation Frequency (GHz)	Resolution (bits)	Min Delay (ps)	Full Delay (ps)	Insertion Loss (dB)	Ctrl interface (V)	Package	Status
CGY2393SUH/C1 N	6 -18	5	10	310	6	0 / +4	Die	Production
CGY2394SUH/C1 N	6 -18	1	330	330	6	0 / +4	Die	Production

Performance Table for Digital Phase Shifters functions

Part number	Operation 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	360	2	0 / +5	Die	Production
CGY2173UH/C2	6 - 18	6	13	360	4	0 / -3	Die	Production
CGY2172XAUH/C1	8 - 12	6	8	360	2	0 / -3	Die	Production
CGY2172XBUH/C1	8 - 12	6	8	360	2	0 / +5	Die	Production
CGY2392SUH/C1	6 - 18	6	10,8	360	1,7	0 / +5	Die	Production
CGY2174UH/C1	13 - 16	6	8	360	6	0 / -3,3	Die	Production

Performance Table for Digital Attenuators functions

Part number	Operation Frequency (GHz)	Resolution (bits)	Insertion Loss (dB)	Atten Range (dB)	RMS Atten Error (dB)	Ctrl interface (V)	Package	Status
CGY2176AUH/C1	1 - 8	6	5,6	31,5	0,2	0 / +5	Die	Production
CGY2171XAUH/C1	1 - 15	6	5	31,5	0,25	0 / -3	Die	Production
CGY2171XBUH/C1	1 - 15	6	5	31,5	0,25	0 / +3	Die	Production
CGY2390SUH/C1	6 - 18	6	4	35	0,2	0 / +5	Die	Production
CGY2169UH/C1	10 - 18	6	4	23,5	0,4	0 / -3,3	Die	Production

N New Products

OMMIC

Foundry Services & III-V Processes

On Site Epitaxy and Custom Wafers Processing

ED02AH 0.18um E/D GaAs pHEMT

D01PH 0.13um GaAs pHEMT

D01MH 0.13um GaAs mHEMT

D007IH 70nm GaAs mHEMT

D004IH 40nm GaAs mHEMT

DH15IB 1.5um InP/HBT

D01GH 100nm GaN/Si

Epitaxy & III-V Processes

OMMIC is a supplier of InP, GaN and GaAs based MMIC circuits and services to the Professional the Telecom, Space and Defense markets and MOCVD based Epitaxial Wafers to the Merchant Market. Our on site epitaxy serves High performance low cost PHEMT, MHEMT & HBT epitaxial wafer supply to large volume GaAs fab.

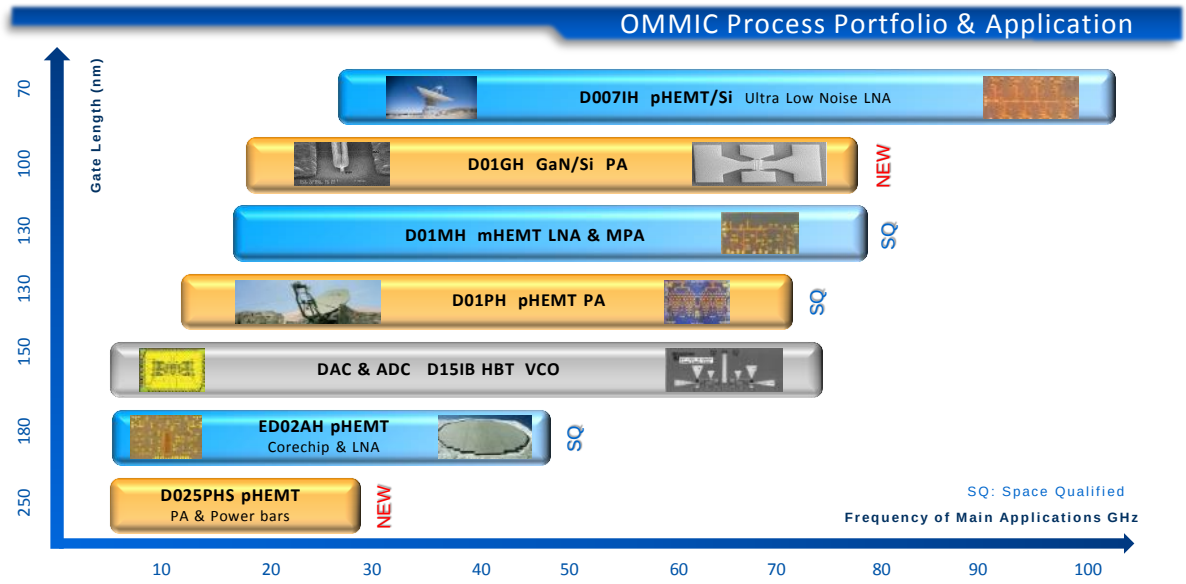
Processes and Technology:

OMMIC has three principal HEMT processes in full production and we have been introducing other processes including mHEMT and HBT. These services enable cut-off frequencies as high as 400 GHz via the mHEMT technology. The latest processes include GaN-on-silicon 100nm. Another newly released process is D025PHS which is a 250nm pHEMT D mode, enabling high power from C to X band (12W at 10GHz).

Process	ED02AH	D01PH	D01MH	D007IH	D004IH	D01GH	D006GH
Technology	GaAs p-Hemt	GaAs p-Hemt	GaAs m-Hemt	GaAs m-Hemt	GaAs m-Hemt	GaN / Si	GaN / SiC
Status	Production	Production	Production	Production	Developement	Released	Developement
Space Grade	Space Qualified	Space Qualified	In 2015	In 2017	—	—	—
Gate Length (um)	0,18	0,13	0,13	0,07	0,04	0,1	0,06
Wafer size (inches)	3	3	3	3	3	3	3
Thickness (um)	100	100	100	100/70	100/70	100	100
Gate write	E-beam	E-beam	E-beam	E-beam	E-beam	E-beam	E-beam
Ft (GHz)	60	100	150	300	400	110	170
Fmax (GHz)	110	180	250	450	600	160	250
Vbgd (V)	8	12	8	4	4	30	25
Vds max(V)	7	10	6	3	3	25	20
Idss(mA/mm)	250(on)/140(off)	500	300	200	200	700	800
Idss max(mA/mm)	400(on)/180(off)	700	500	400	400	1100	1200
MiM Capacitors (pF/mm²)	49 and 400	400	400	400	400	400	400
NF (dB)	0,8 (18GHz)	1,1 (30GHz)	0,8 (30GHz)	0,5 (30GHz)	0,4 (30GHz)	1,5 (40GHz)	1 (50GHz)
Power density (mW/mm)	330	640	300	NA	NA	3300	1000
gm (mS/mm)	450	650	700	1600	2000	650	700

OMMIC's InGaAs mHEMT process contains up to 80% indium in the InGaAs layer. Ommic uses this process to target low-noise and power devices fabricated on GaAs and InP substrates. The High Indium content in the InGaAs channel on a GaAs substrate yields performance equivalent to pHEMT on an InP substrate, with lower cost.

OMMIC's RF device catalog includes E/D-mode pHEMT, power pHEMT, general-purpose mHEMT, low noise MHEMT, E-Mode MHEMT and InP DHBT processes. Gate Lengths from 180nm to 70nm with Ft's from 60 GHz to 300 GHz. The pHEMT and mHEMT devices are processed on GaAs substrate and the HBT devices on InP substrates.



Epitaxy:

In addition to a product offering, OMMIC also supplies epi wafers to the merchant market in 3-, 4- and 6-inch formats using production MOVPE.

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.

Roadmap:

OMMIC has an aggressive roadmap to develop and introduce to the market advanced technologies based on III-V compounds.

This means moving to shorter gate lengths and optimizing the Channel Indium content for the PHEMT and MHEMT processes and smaller emitters and the use of antimonides for the InP DHBT.

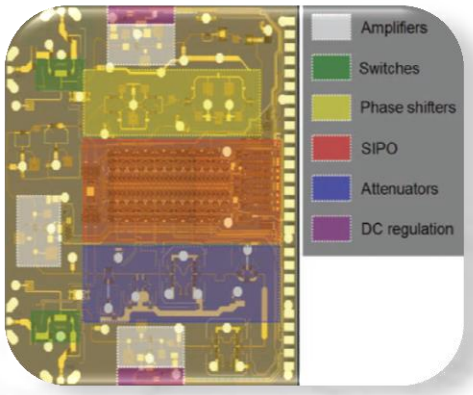
The use of the MHEMT technology allows OMMIC to release processes that are truly optimized for high In content fully compatible with 6 inch wafers.

The short gate length technologies include 70 nm 70 % In MHEMTs, and soon 40nm with D004IH process. With 100nm GaN/Si, 60nm GaN/SiC and D025PHS process OMMIC is targeting power applications from X to E band. The roadmap will lead us to develop sub-50nm GaN/SiC in the future to target higher power at up to W band.

OMMIC's RF device and wafer fab process catalog includes E/D-mode pHEMT, power pHEMT, general-purpose mHEMT, low noise MHEMT, GaN/Si and InP DHBT processes.

ED02AH Process

0.18 µm PHEMT - Fully available in Production since 1995
Optimized for Low Noise and Mixed Signal thanks to Enhanced and Depletion transistors.



Well suited for Corechip in phased array antenna application (integration of a serial interface on chip) .

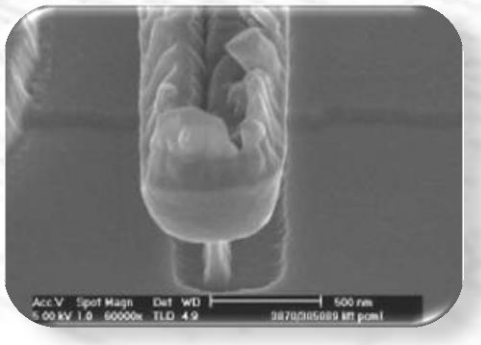
RF and DC Characteristics:

- Two Threshold Voltages (Vt's) :
  - *Enhancement Mode (225 mV)*
  - *Depletion Mode (- 900 mV)*
- Vbgd 8 V (typical)
- Ft's of 60 GHz
- Full set of passives :

Epitaxied Resistors, NiCr Resistors MIM capacitors (400 pf/mm2 **and** 49 pf/mm2), Spirals, Air Bridges, Via holes, Microbumps, Fully passivated Chips with 150nm SiN passivation layer or optional 300nm for packaged devices.

This process is Space evaluated and EPPL listed by ESA.

D01PH Process



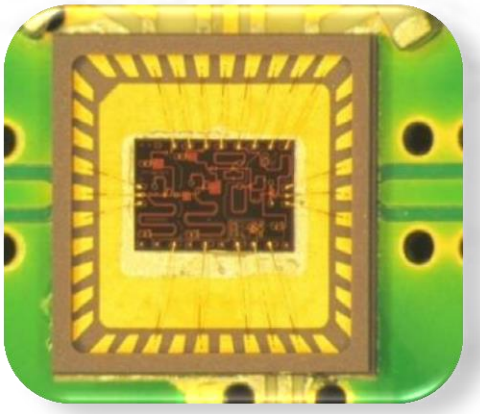
135 nm PHEMT D mode - Fully available in Production since 1999
Optimized for Ultra Low Noise and medium power application from 1GHz to 50GHz.

Well suited for NF <0.6dB at 2GHz, NF < 1.5dB at 10GHz

RF and DC Characteristics:

- Vbgd 12 V (typical)
- Vt of -0.9V
- Ft of 100 GHz
- Fmax of 180 GHz
- NFmin at 30GHz of 1.1dB
- P1dB/mm (40GHz): 640mW/mm
- Full set of passives:

Epitaxied Resistors, NiCr Resistors MIM capacitors, Spirals, Air Bridges, Via holes, Microbumps, Fully passivated Chips with 150nm SiN passivation layer or optional 300nm for packaged devices.
Thickness of 100um with possibility of 70um if special request
Thick metal option available for optimized noise performances.



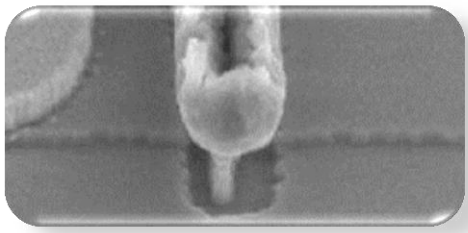
CGY2124HC : X band LNA NF=1.1dB

This process is Space evaluated and EPPL listed by ESA.

OMMIC's RF device and wafer fab process catalog includes E/D-mode pHEMT, power pHEMT, General Purpose mHEMT, low noise MHEMT, GaN/Si and InP DHBT processes

D01MH Process

125 nm MHEMT - Fully available in Production since 2010
Optimized for Ultra low noise application up to 90GHz

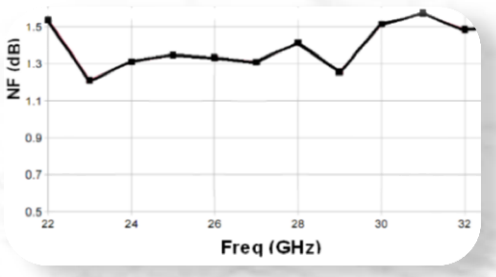


Well suited very low noise application from Ku to E band such as Satcom application or Ka Band guidance systems.

RF and DC Characteristics:

- Vbgd 8V (typical)
- Vt of -0.9V
- Ft of 150 GHz
- Fmax of 250 GHz
- NFmin at 30GHz of 0.80dB
- Associated Gain at 30GHz of 11.5dB
- Full set of passives:

Epitaxied Resistors, NiCr Resistors MIM capacitors, Spirals, Air Bridges, Via holes, Microbumps, Fully passivated Chips with 150nm SiN.
Thickness of 100um with possibility of 70um upon request
Thick metal option available for optimized noise performances.



CGY218UH Noise Performances

This process is under space evaluation by ESA (to be completed by Q3 2015).

D007IH Process

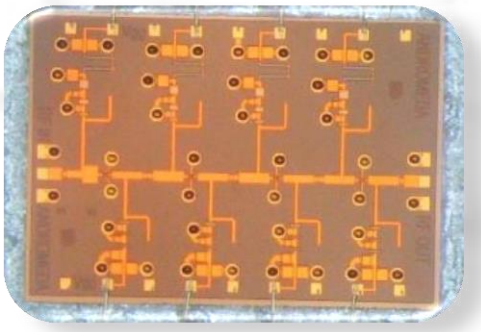
70 nm MHEMT - Fully available in Production since 2011
Optimized for Ultra Low Noise from 20GHz to 160GHz.

Well suited for telecommunication, Satcom, Passive Imaging
Typical 2.8dB noise around 90GHz.

RF and DC Characteristics:

- Advanced 70 nm double - mushroom gate
- High In Channel (70 %)
- Outstanding ft: 300 GHz
- Very Low Noise: 0.5 dB Minimum Noise Figure at 30 GHz
- Associated Gain: 12.5dB at 30GHz
- Fmax of 450 GHz
- Full set of passives based on D01PH:

Epitaxied Resistors, NiCr Resistors MIM capacitors, Spirals, Air Bridges, Via holes, Microbumps, Fully passivated Chips with 150nm SiN passivation layer or optional 300nm for packaged devices.
Thickness of 100um with possibility of 70um upon request.
Thick metal option available for optimized noise performances.



CGY2190UH/C2 : W band LNA NF=2.8dB

OMMIC's RF device and wafer fab process catalog includes E/D-mode pHEMT, power pHEMT, General Purpose mHEMT, low noise MHEMT, GaN/Si and InP DHBT processes

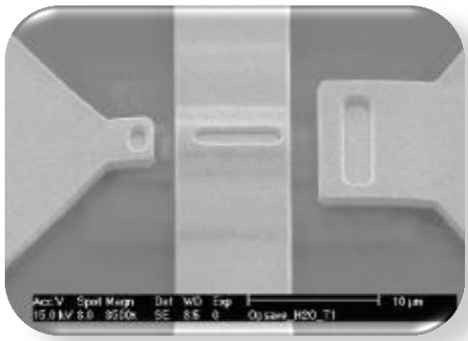
DH15IB InP HBT

1.5 µm Emitter length D-mode - Available as Pre-production, prototyping and shared wafer services
Optimized for VCO and mixers from C to V band

Well suited for High data rate interfaces , TIA, Drivers , very low phase noise oscillators, mixers.

RF and DC Caracteristics:

- Vce 6 V
- Ft of 180 GHz
- Fmax of 220 GHz



D01GH GaN/Si Power Process NEW

100 nm GaN/Si - Available upon request for design and prototyping
Design Kit available. Shared wafer services available Q2 2015.

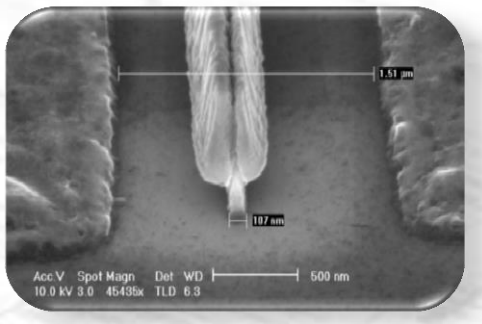
Optimized for power application from 20GHz to 94GHz but also for robust Low noise amplifier from 10 to 30GHz.

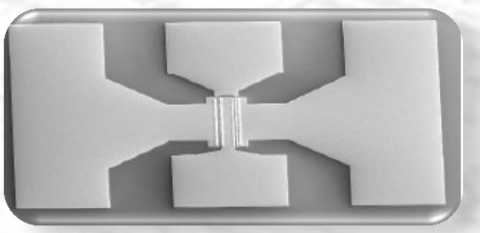
Well suited for power amplifier design for Ka band Sat application, V band and E band point to point radio or Backhaul, future 5G LNAs

RF and DC Characteristics :

- Vbgd 30 V
- Ft of 110GHz
- Fmax of 160GHz
- Power: 3.3W/mm of gate at 30GHz
- PAE: 45%
- Mushroom Gate (100nm - 60nm)
- In situ Passivated (for low lag effect <10%)
- Regrown ohmic contact (for high Gm)
- Full set of passives like D01PH

This process is based on 100% European raw material sourcing.





D025PHS Power Process NEW

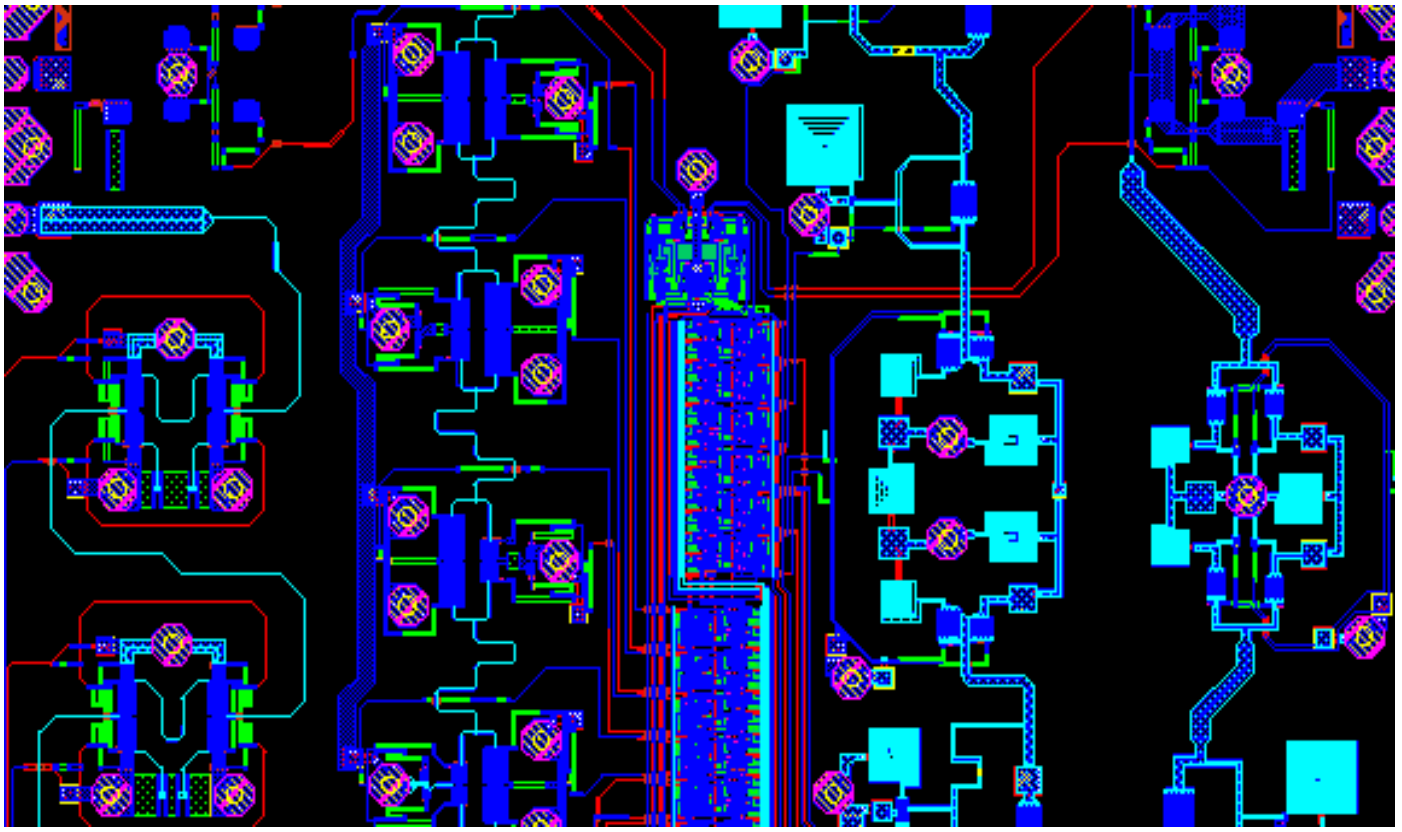
250 nm PHEMT - Prototyping
Optimized for power application from 5GHz to 20GHz

Well suited for telecommunication, Civil or Military Radar application or Satcom.

RF and DC Characteristics:

- Vbgd of 16V
- Vt of - 0.9V
- ft: 37 GHz
- fmax: 95GHz
- Power: 1.7W/mm of gate at 10GHz

Xband radar (source US Navy)



OMMIC

Design Center & Fab +

Custom Designs Team

Challenging Designs from 5 to 160GHz

ADS SPICE and AWR Design Kits

Multi Chip Projects Shared Wafers Service

Simulation and Extractions for Customers

System Models

Design Center & FAB+ Services

OMMIC provides services to Customers requiring specific MMICs:

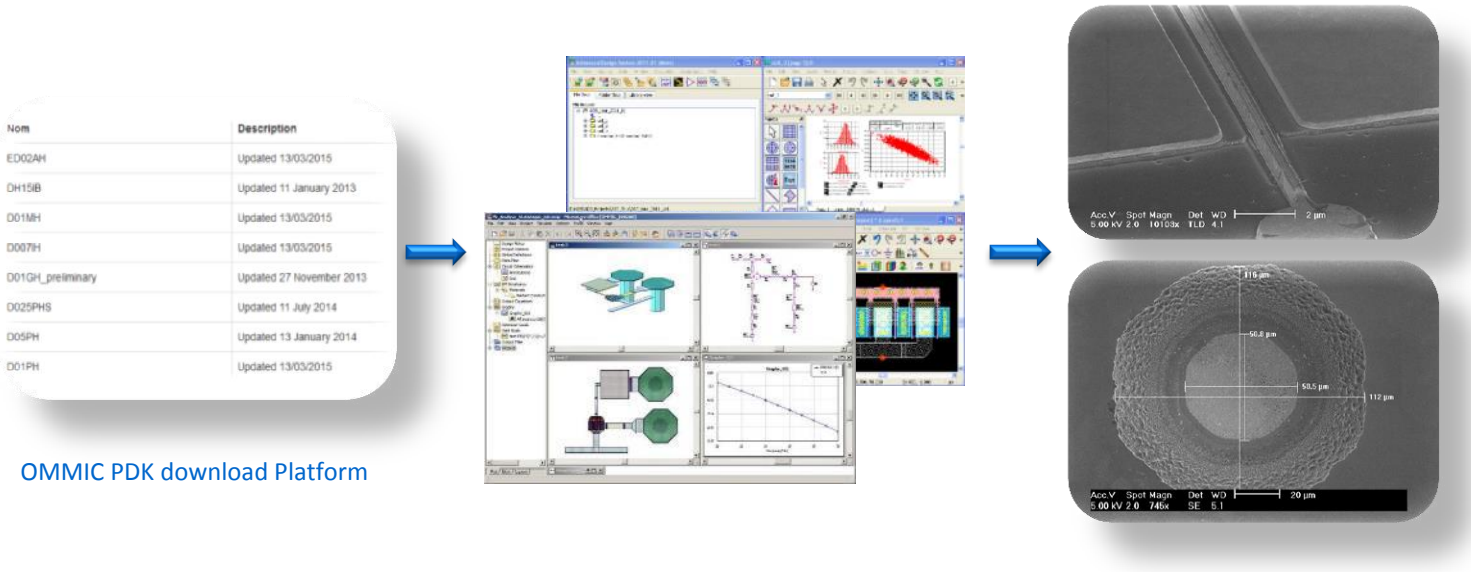
- Open Foundry Service, allowing customers to design their own circuit, with help, training and support from OMMIC
- Custom Design Service: OMMIC designs circuits based on customer specifications

OMMIC has a long history of fully open Foundry Service. All OMMIC processes are available for Foundry Service.

This includes ED02AH PHEMT 60 GHz E/D process for Analog/Digital designs, D01PH PHEMT 100 GHz process for power up to millimeter wave, D01MH and D007IH 150 and 300 GHz MHEMT processes for mid power or extremely low noise designs up to 150 GHz or more, DH15IB 175 GHz D-HBT process for high bit rate functions or low phase noise devices.

Most of these processes have completed or are running a Space evaluation (ESA-EPPL).

Foundry is available for full wafer runs or MCP ("pizza-masks").



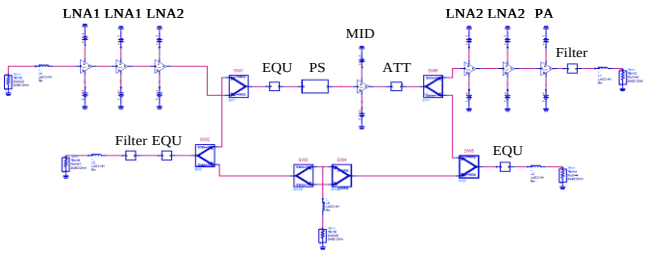
OMMIC PDK download Platform

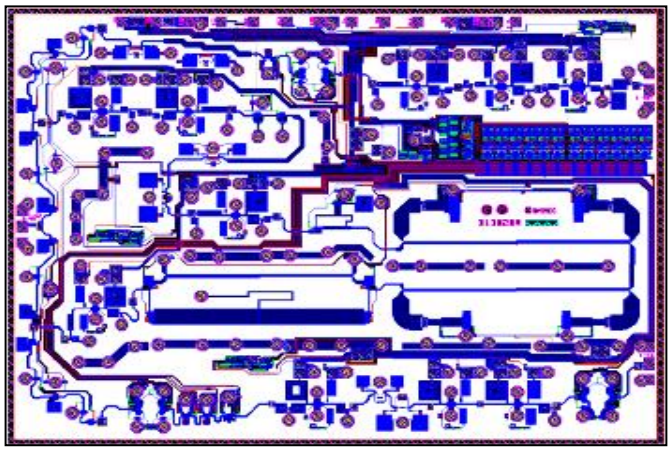
The OMMIC design Manuals and design tools are extremely comprehensive and allow any type of design, from mixed signal to low noise and high power, from DC to sub-millimeter wave.

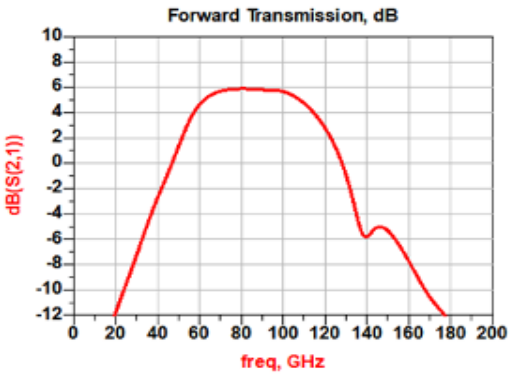
OMMIC Design Kits include:

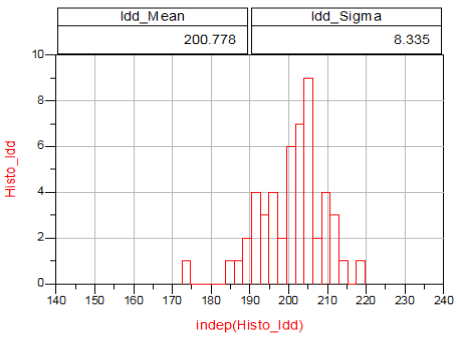
- Fully scalable models for all devices
- Linear, non linear and noise models for transistors (and diodes)
- Process statistical variations of all active and passive devices, allowing representative yield analysis
- Temperature effects for all passive and active devices
- Complete auto layout for all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

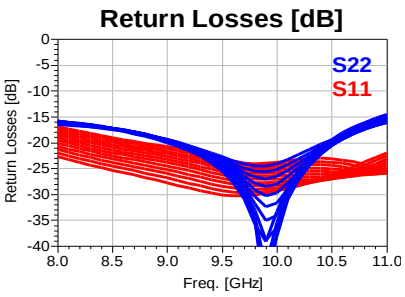
Design kits are regularly updated, in close collaboration with Software suppliers. OMMIC provides hot line, support, dedicated training and powerful verification tools.











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 enhance the final system.

This design flow is based on space standards such as ECSS-Q60-12A and have been approved for flight model designs.

Thanks to proximity of Fabrication Line, Test Center, Reliability Center and Modeling Team on the same site, OMMIC Design Center is able to obtain the best from all the OMMIC processes, while maintaining yield and reliability.

Foundry Services: Multi Chip Project

A MultiChip Project (MCP) is a cost effective way to experience a new design topology or a new technology through a limited number of samples. OMMIC offered this service for a long time for his mature proprietary technologies.

Technologies:

The following list of OMMIC technologies can be used following the MCP projects :

- **D01PH**: Depletion mode PHEMT process with a gate length of 0.13 µm for both power and high frequency designs.
- **ED02AH**: Enhancement and Depletion mode PHEMT process with a gate length of 0.18 µm for analog and mixed analog/digital designs;
- **D01MH**: Depletion mode MHEMT process with a gate length of 0.13 µm for low noise, power and high frequency designs.
- **D007IH**: Depletion mode MHEMT process with a gate length of 0.07 µm for low noise and very high frequency designs.
- **DH15IB**: Double Heterojunction HBT process with a emitter of 1.5 µm for very high speed digital and high frequency RF designs.

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 need to complain with minimum order value when it is applicable.

Support:

Users of OMMIC's normal MCP projects have full access to the MCP Customer Support Hotline during 1 year and get access to the technology design kit though OMMIC website.

Before manufacturing, all projects are checked by OMMIC using the OMMIC design rule checker. DRC's are perfomed at no extra cost.

Start Dates:

Multichip runs are programmed at regular intervals. Please contact us or check website to have the dates of the next run starts.
Please see: ***http://www.ommic.com/site/mpw-4***

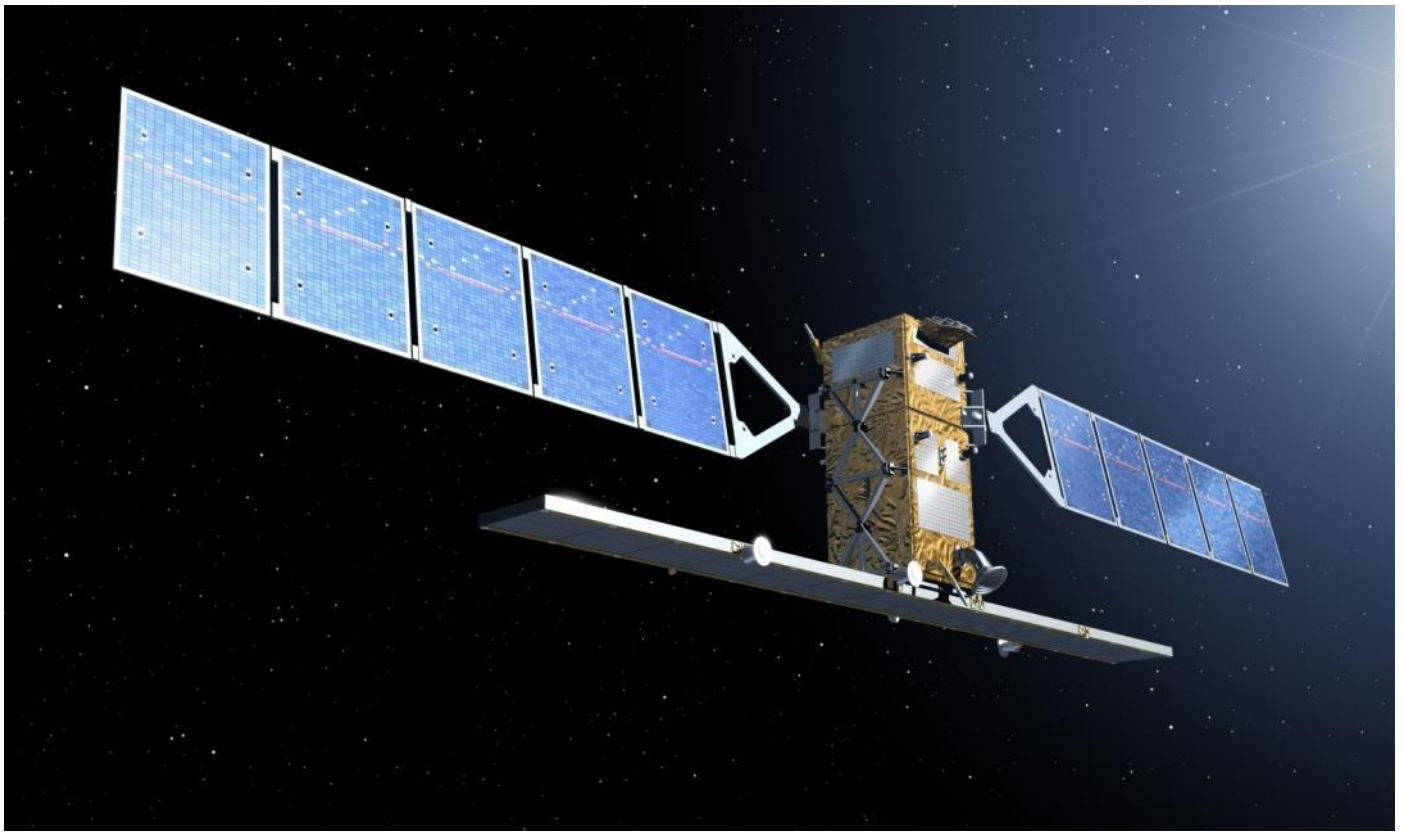
University Partnership:

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

Available die sizes:

	1.5mm	3mm
1mm	A = 1.5 mm^2 N = 25 dies	A = 3 mm^2 N = 20 dies
2mm	A = 3 mm^2 N = 20 dies	A = 6 mm^2 N = 15 dies

X, Y dimension of the die
A : Surface of the reticule N : Number of dies delivered
Other Die size can be used, please contact OMMIC for special demands



OMMIC

Space Heritage & Flight Models

State of the art processes for space application

Space qualified processes

Wafer and Lot qualification capabilities

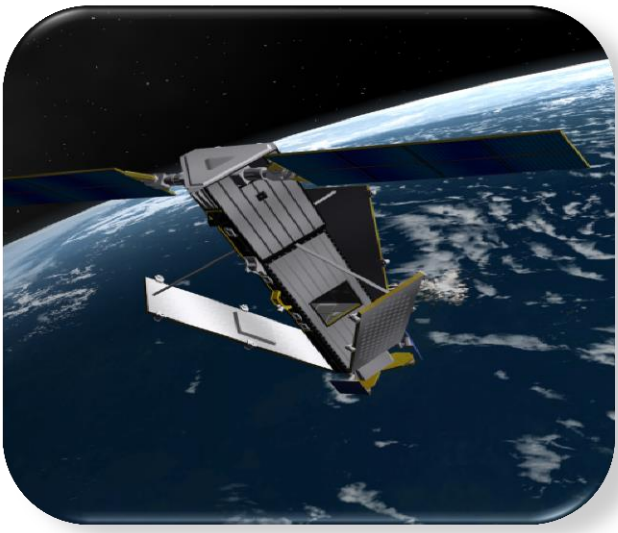
Reliability team dedicated to qualify flight models

Products in ESA preferred part list

More than 30.000 flight models delivered

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 satellites equipments.



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

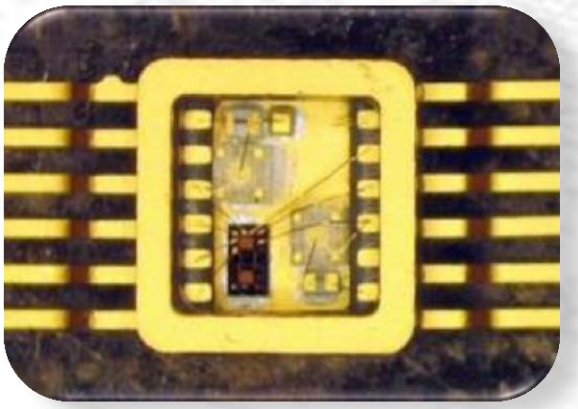
Functions include :

- 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 2 OMMIC processes ED02AH and D01PH, this 2 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 the OMMIC's design team of OMMIC.



They have already trusted OMMIC

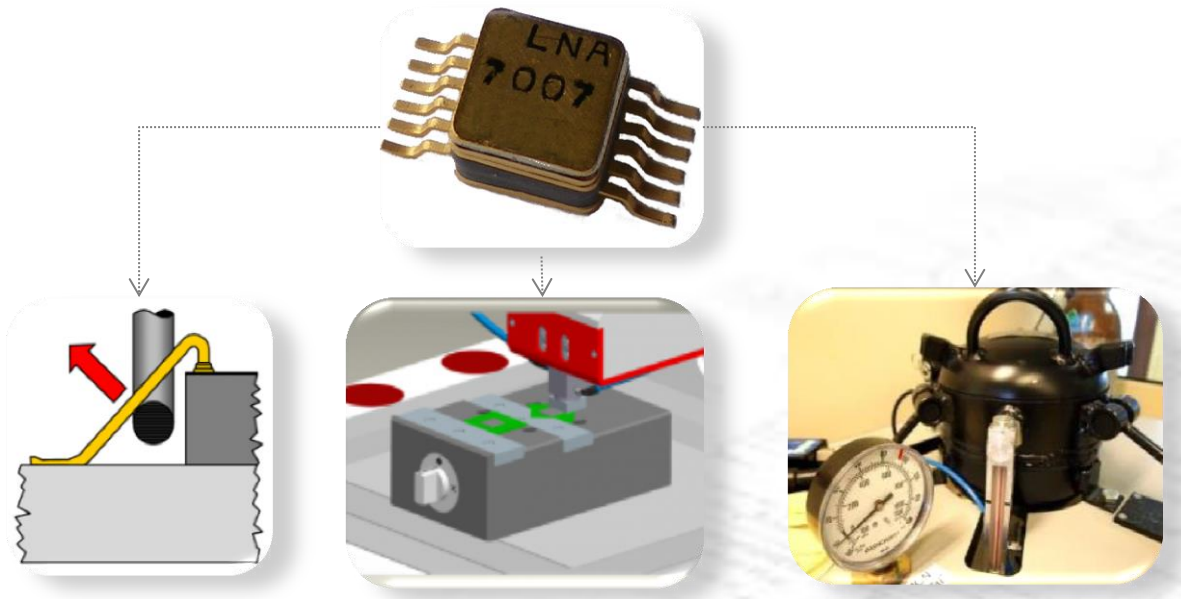
ASTRIUM AN EADS COMPANY
Together ahead. RUAG
esa
CASC 中国航天
CASSIDIAN AN EADS COMPANY
ThalesAlenia Space
cnes
इसरो isro

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

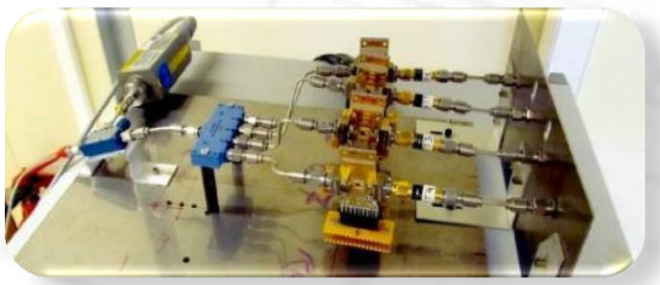
All tests below are **Assembly test** for flight models and are performed at OMMIC in our reliability laboratory



Bond-pull test | **Die-Shear test** | **Hermeticity test**

We also perform Aging and life cycle tests when requested like in MIL-STD-83 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

OMMIC
Production Line & Back-end

More than 40 years in III-V industry

Class 10.000 production clean room

Certified ISO9001 ISO14001 and RoHs compliant

Standard and Space grade visual inspection

On wafer test capabilities for microwave & mmW products

Competitive lead time and maximum flexibility

Production Line & Back-end

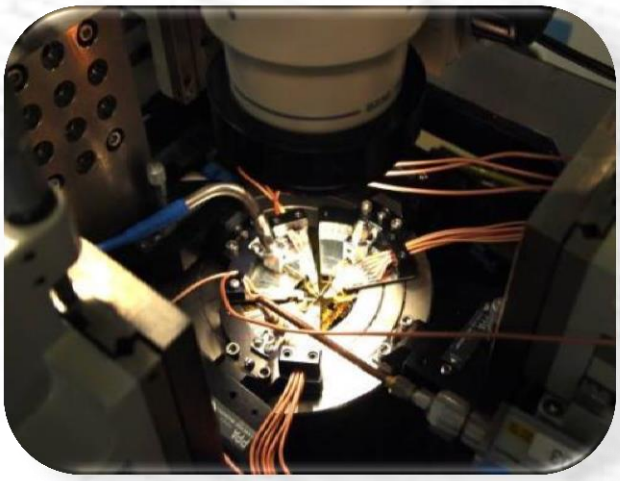
OMMIC was founded on January 1, 2000 by Philips, based on a track record of 40 years of cutting - edge research and development in the fields of III-V epitaxy and integrated circuits technologies. Today, OMMIC is an independent SME.

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 followed too 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.

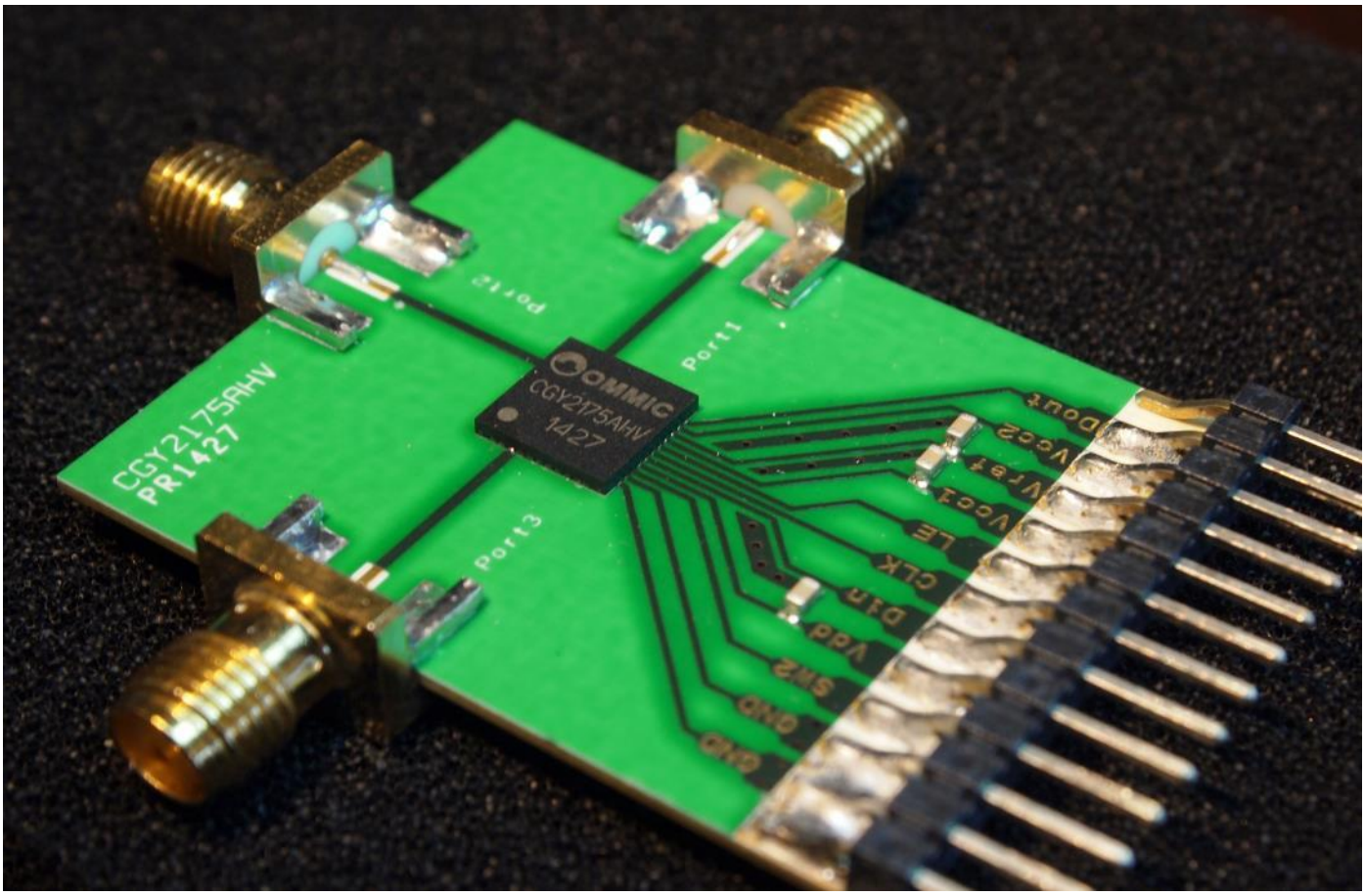


Our experience in microwaves and mm-Waves tests and probe card's design, leads us to design complex tests procedures allowing testing the main performances and functionalities of our MMIC products in order to guarantee the delivery of known good dies.
We open to our customers our RF-test capabilities 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 to allow us to implement prompt corrective or preventive response and to verify the final quality of each die before sending to our customers.

For this, we performed 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.



OMMIC
Sales Support & Application

Global and dedicated customer support

System studies support

On field demonstration upon request

Mounting support

Packaging support

Custom modules design studies

MMIC Packaging

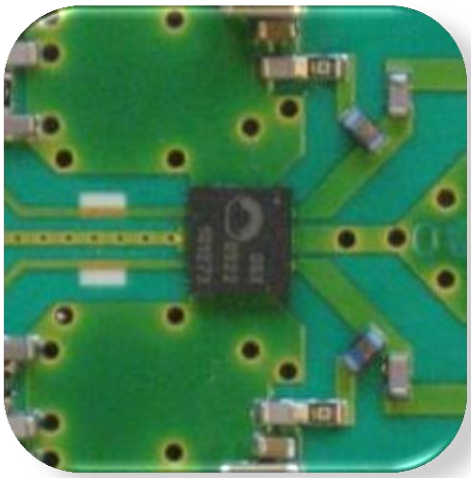
We are moving towards a world where integration and ease of use are central to the definition of complex electronic Subsystems.

OMMIC invests every day to make easier to use products for our customers by developing packaged solutions while ensuring optimal performances.

For now our solutions cover L, S, C and X band while our efforts are moving toward the challenging packaging of our Ka band Corechip solution;

Below are some examples of LNA packaged solution:

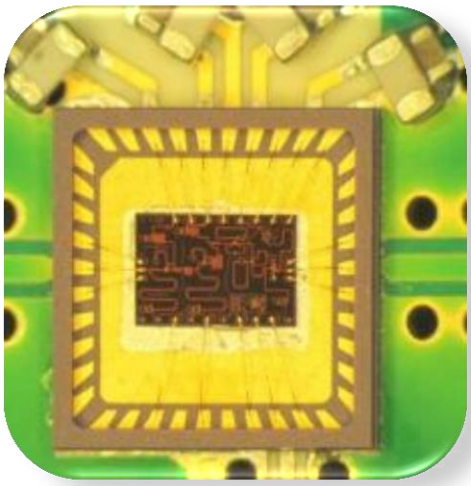
CGY2105XHV /06XHV /07HV /09HV



LNA 500MHz - 6GHz 0.5dB NF

Plastic QFN 4x4 16pin

CGY2124HC

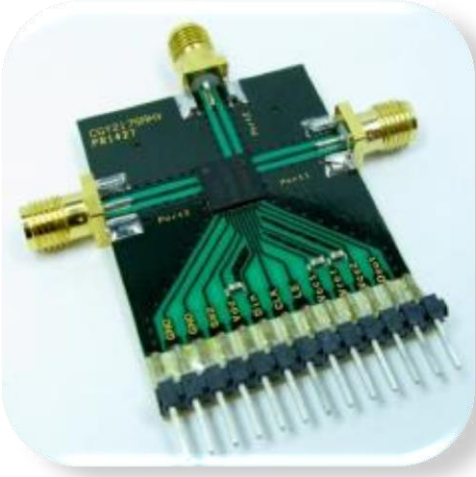


LNA 8 - 12GHz 1.4dB NF

HTCC QFN 5x5 32pin

Example of Corechip packaged solution:

CGY2175AHV



6 bit C-band Corechip

Plastic QFN 7x7 44pin

OMMIC also has the capability to integrate custom designed MMIC in custom package up to Ku band to optimize RF performances.

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.

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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 during events such as IMS or EuMW.

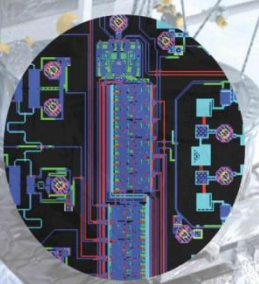
OMMIC
Innovating with III-V's

GaAs - InP - GaN

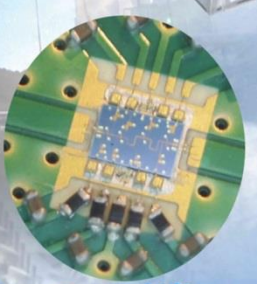
Innovating with III-V from 0.5 to 400 GHz

Tailoring your MMIC Needs

Your Independent European Foundry providing MMIC solutions from catalogue products to custom designs



Custom designs



Low Noise Amplifiers

Power Amplifiers

T/R Modules & Corechips

www.ommic.com Tel: 00 33 (1) 45 10 67 31 email: information@ommic.com

Rev 1.15

OMMIC

Short Form Catalog 2015

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