United Monolithic Semiconductors

FOUNDRY SERVICES

2023 - 2024

Express your talent with UMS !

Create your winning RF Products thanks to UMS Foundry Service Expertise

Industrial Technologies qualified for Space

- Broad portfolio of proven and robust GaN / GaAs processes
- Excellent Electrical model accuracy
- On wafer test and Circuit validation
- Industrial low-cost packaging services

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UMS has developed a family of robust and proven GaAs and GaN processes for the production of **state-of-the-art RF performance MMICs.** These processes are extensively used by foundry customers and UMS designers to deliver advanced MMIC solutions for Defense, Automotive, Space, Telecom and ISM markets.

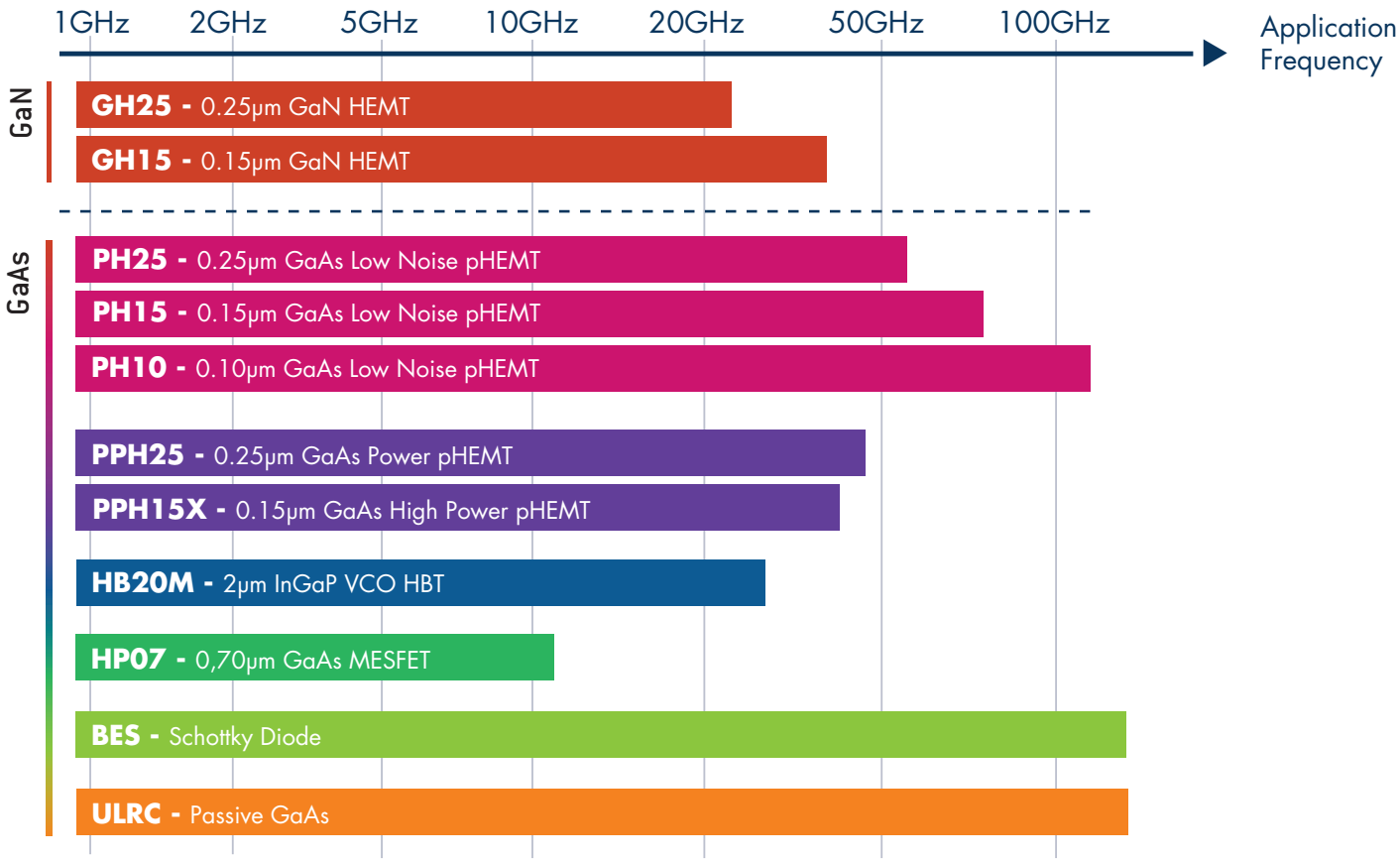
UMS **Design Manuals** and **Design Kits,** developed in-house, help customers create customized circuits. During the design phase, the UMS Foundry team assists customers with a **close and interactive support. UMS electrical models** are renowned for **their accuracy,** which allows customers to succeed in reaching their RF performance targets **right from their first development runs.** All supplied wafers meet UMS **Process Control Monitor (PCM)** acceptance criteria specifications and are visually inspected, which is a guarantee of UMS manufacturing quality.

Furthermore, UMS offers several optional services including **foundry training, on-wafer tests** (DC, RF, noise, power, mixer), **wafer dicing, die sorting, visual inspection, MMIC picking and packaging or delivery of Known Good Dies (KGD) as well as Space Wafer Acceptance and Lot Acceptance services**

This wide range of services completes UMS foundry offer, enabling our customers to succeed with their development and production, **from small to very large volumes.**

GaN and GaAs processes for RF & mm-wave applications

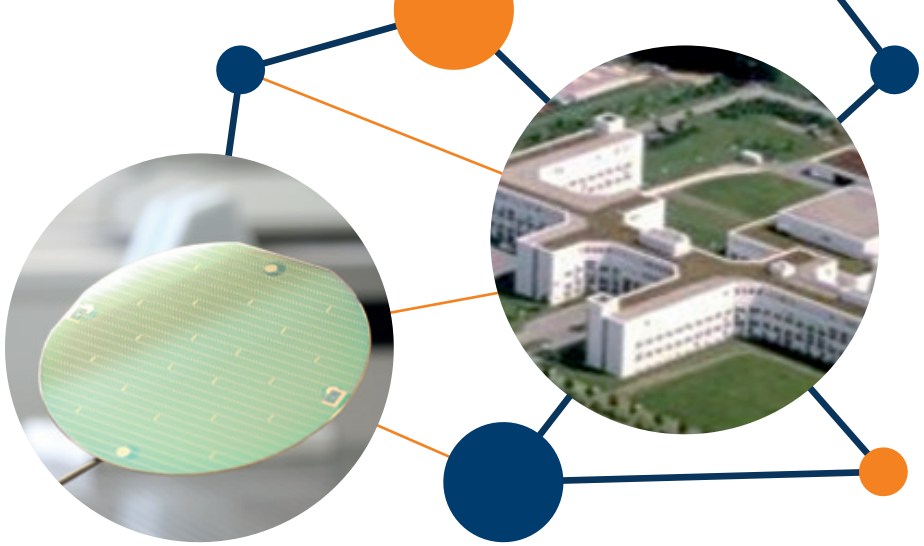
UMS offers a broad portfolio of high-performance and **high-reliability** GaAs and GaN-on-SiC processes for MMIC design.



Open processes / Wafer fabrication

Our processes include:

- Air bridges
- MIM capacitors
- TaN and TiWSi resistors
- Via-holes
- Coating for packaging



Process	GH15 GaN	GH25 GaN	PH25 Low Noise	PH15 Low Noise	PH10 Low Noise	PPH25 Power	PPH15X High Power	HB20M VCO	HP07	BES
Active device	HEMT	HEMT	pHEMT	pHEMT	pHEMT	pHEMT	pHEMT	HBT	MESFET	Schottky
Power Density	4.2W/mm	4.5W/mm	250mW/mm	300mW/mm	250mW/mm	700mW/mm	800mW/mm	2W/mm	400mW/mm	-
Gate Length	0.15µm	0.25µm	0.25µm	0.15µm	0.1µm	0.25µm	0.15µm	2µm Emitter width	0.7µm	1µm
Ids (gm max) Idss Ids sat/Ic	- 1200 mA/mm 1450 mA/mm	- 880mA/mm 1000mA/mm	200mA/mm - 500mA/mm	220mA/mm - 550mA/mm	280mA/mm - -	200mA/mm - 500mA/mm	350mA/mm - 575mA/mm	- - 0.3mA/µm²	300mA/mm - 450mA/mm	- - -
V_{BDS} / V_{BCE}	>70V	>100V	> 6V	> 4.5V	> 5V	> 12V	> 12V	> 14V	> 14V	< -5V (Anode/ Cathode
Cut off freq.	> 35 GHz	30GHz	90GHz	110GHz	130GHz	50GHz	70GHz	30GHz	15GHz	3THz
Vpinch	-3.2V	-3.4V	- 0.8V	- 0.7V	-0.45V	- 0.9V	- 0.95V	-	- 4.0V	-
Gm max / β	405mS/mm	290mS/mm	560mS/mm	640mS/mm	750mS/mm	450mS/mm	480mS/mm	60	110mS/mm	-
Wafer Thickness	70µm	100µm	100µm	100µm	70µm	100µm	70µm	100µm	100µm	100µm
Noise / Gain	1.5dB / 11dB @15GHz	1.8dB / 11dB @15GHz	0.6dB / 13dB @10GHz 2dB / 8dB @40GHz	0.5dB / 14dB @10GHz 1.9dB / 6dB @60GHz	2.3dB / 4.5dB @70GHz	0.6dB / 12dB @10GHz	1.8dB / 6dB @40GHz	-	-	-

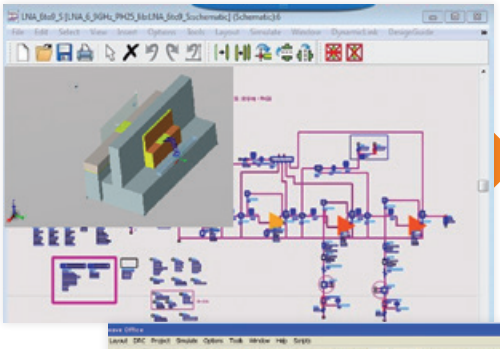
- ULRC allows filters and matching circuits compatible with GaN
- More details on process datasheets on the website

Process Design Kits

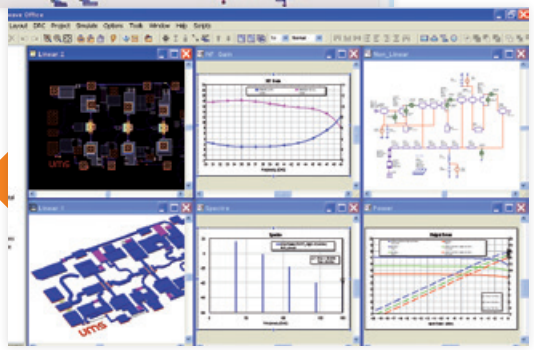
UMS modeling and CAD experts have built complete and highly accurate Process Design Kits (PDK). These PDKs include active (small and large signal) and passive scalable models that are directly linked to auto-layout and library options, compatible with your CAD tools.

UMS PDKs include schematic capture, layout generation, layout verification (DRC) and 3D view generation for EM simulation. They are fully compatible with:

- **Pathwave ADS from Keysight (2017 to 2021 versions) for all processes.**
- **Microwave Office from Cadence for GaAs and GaN HEMT, HBT and Schottky diodes.**
- **Cadence Virtuoso (Layout and DRC).**
- **eDRC and Tape Out via our web portal.**



Pathwave ADS (Keysight)



Microwave Office (Cadence)

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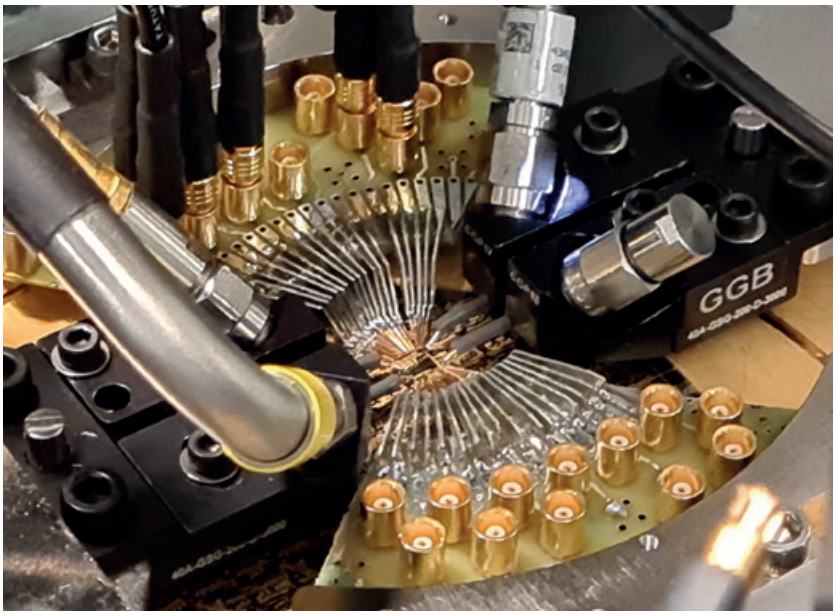
UMS foundry services

UMS mainstream foundry service offer comes with the delivery of Design Kits and Design Manuals, the engineering support needed to get started, the construction of the reticle, the fabrication of the mask, and the manufacturing of GaN or GaAs wafers. In addition, UMS extensive Back-End services help customers address a broad range of requirements"

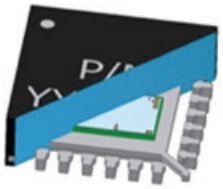
Back-end services:

- **Automated on-wafer testing solutions** for circuit characterization over 1 to 110GHz and MMIC sorting according to your product specifications: 100% functional on-wafer tests can thus be performed with various purposes such as DC tests, S-parameters measurement, noise measurement and CW-mode or pulsed-mode power measurement.
- **Laser wafer dicing:** This dicing technology allows high dicing yields.
- **Visual inspection:** with commercial or space screening grades.
- **Picking in accordance** with your sorting criteria: Individual die numbering allows chip identification. Known Good Dies may be delivered in Gel-Pak® or on UV-film.



Standard & custom Probe cards

QFN packaging



UMS also propose low-cost **QFN packaging service:** BCB passivated circuits can be encapsulated in plastic molded packages.

Standard QFN packages are offered with various dimensions. Electrical models are available in the associated Design Kit for packaged MMIC designs.

Foundry course

UMS 2-day Foundry Courses bring information about the III-V technologies, processes, design methods, standards and spirit of UMS foundry service. This 2-day training is organized on a regular basis. It can also be arranged on request.

The foundry course is delivered by UMS experienced product line designers and engineers. The course covers the following topics:

- **GaN/GaAs technologies and design rules**
- **LNA, PA, mixer, VCO design examples and design tricks**
- **CAD tools and electrical models demo with Cadence and Keysight CAD support engineers**

Back-end services:

- **Measurement & Packaging capabilities for production**
- **Thermal methodology and simulation**
- **Reliability**
- **Foundry flow and DRC**

In addition, UMS foundry users have the possibility to access additional e-training.

Foundry Service Modes

Full Wafer mode

- ■ Full mask
- ■ Technical support
- ■ Full wafer / Known Good Dies
- ■ Standard process time
- □ Full Back-End offering
- □ Space screening
- □ QFN packaging

Multi Project Wafer (MPW)

- ■ Shared mask
- ■ Limited UMS support
- ■ Low budget opportunity
- ■ Fixed project launch date
- ■ Fixed MMIC dimensions
- ■ 16-20 chips per MMIC version
- ■ No On-Wafer Test

■ Standard □ Optional

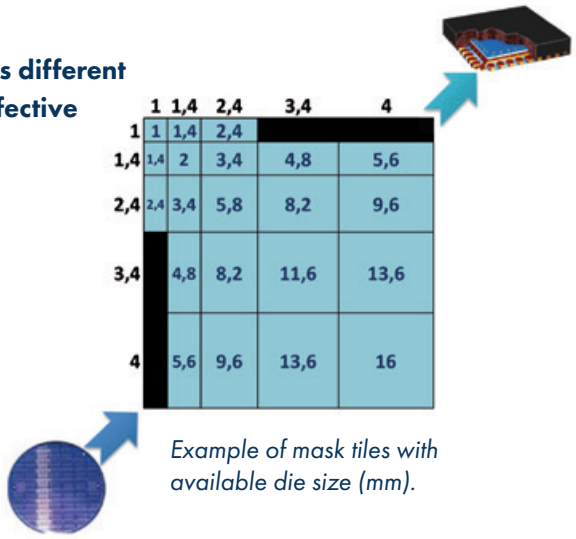
Multi Project Wafer (MPW)

MPW runs combine circuits of multiple projects. This foundry offer allows different customer projects to be manufactured on a single wafer. This is a cost effective foundry approach suited to institutes,... and universities.

Participants have free access to Design Kits and receive 16-20 untested devices of each MMICs version on the MPW tile in Gel-Pak® box. The possible MMIC length and width, including dicing streets and with a maximum 1:3 aspect ratio, are:

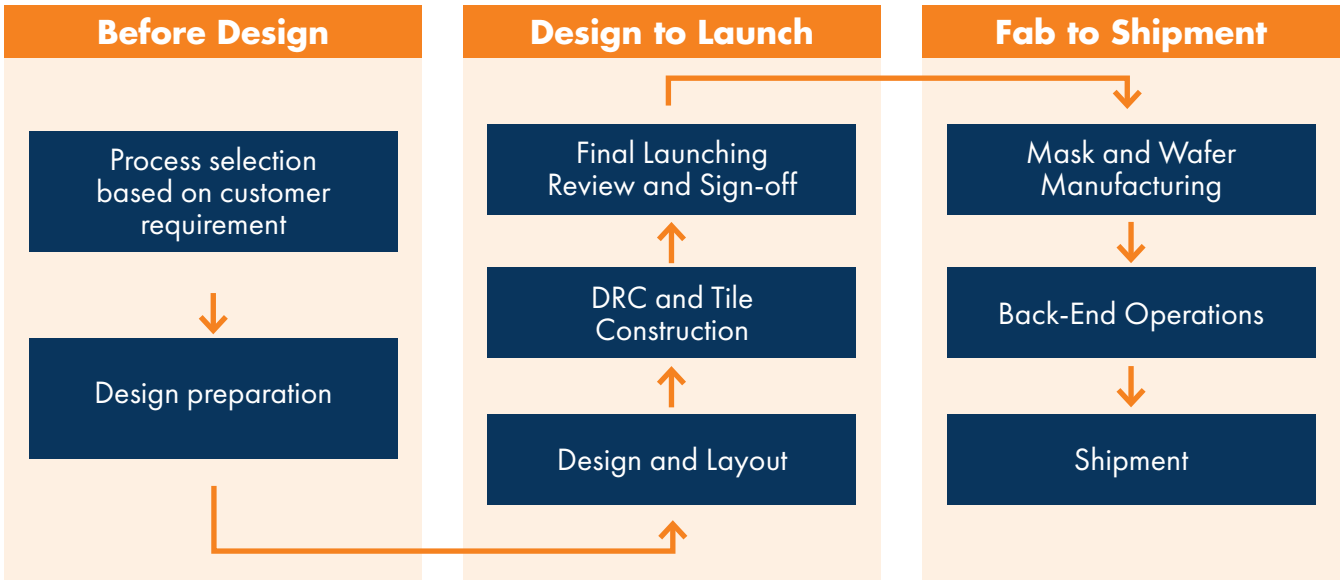
- 1mm, 2mm, 3mm and 4mm for **GaN** processes **(GH25, GH15)**
- 1.4mm, 2mm, 2.4mm, 3.4mm, 4mm and 4.4mm for **high power GaAs** processes **(PPH25X, PPH15X)**
- 1mm, 1.4mm, 2.4mm, 3.4mm and 4mm for **low-to-medium power GaAs** processes **(PH25, PH15, PH10, PPH25, HB20M, HP07, BES)**
- 1.4mm, 2mm, 2.4mm and 3.4mm for UMS **passive GaAs** process **(ULRC)**

Prices per square millimeter vary according to the selected process. They can be found, along with additional details and MPW launch planning, at https://www.ums-rf.com/foundry/



Example of mask tiles with available die size (mm).

High Level Foundry Service Flow



UMS is committed to offer full space evaluated processes. UMS is certified ISO 9001, ISO 14001 and ISO TS16949.

Preferred Design Center

For customers lacking in-house design resources or with limited MMIC design expertise, but willing to benefit from UMS advanced processes and foundry services, UMS recommends the design services of Viper RF and MEC who are well-established design houses with a strong experience of using UMS foundry services.

Both design houses have highly skilled engineers with extensive experience in using UMS design tools and processes, as well as a proven track record of successfully delivering high-frequency, high-performance UMS-based MMICs. Outsourcing MMIC design to those UMS preferred design centers is a highly recommended option for companies seeking design expertise and cost-effectiveness, and willing to be on target immediately through the first MMIC prototyping run.

Since its inception in 2004, MEC has been dedicated to developing high-performance MMICs on UMS advanced IIIV processes. Over the years, more than 200 MMICs have been designed with UMS, mainly for space, military and telecom applications. Notably, MEC and UMS have successfully cooperated on many European strategic programs.

MEC's strengths are its ability to design very challenging high-power GaAs and GaN MMICs up to millimeter bands, its in-house thermal modeling expertise and its on-field applicative support.

VIPER RF is a microwave and millimetre-wave product company with headquarters in the United Kingdom. The company was established in 2008 and is now a globally recognized MMIC supplier and design center.

VIPER RF custom designs GaAs & GaN MMICs for applications from 1-150GHz and has supplied MMICs into some of the most demanding commercial, defence and space markets.

Contact UMS

For more information about UMS foundry services:
foundry@ums-rf.com

In addition to Foundry services, UMS also offers a complete catalogue of RF and mmwave solutions.

For more information about UMS catalogue RF and mmwave solutions:

mktsales@ums-rf.com

Visit our website:
www.ums-rf.com

and

www.linkedin.com/company/ums-united-monolithic-semiconductors/
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