Picture: Source: IHP/Maasolf

# IHP 0.25 and 0.13 µm PROTOTYPING AND VOLUME PRODUCTION

**EUROPRACTICE-IC provides access to IHP SiGe:C BiCMOS Technologies for Multi-Project-Wafer Prototyping and Small Volume Production.**

## Why EUROPRACTICE?

- Affordable and easy access to Prototyping and Small Volume Production services for academia and industry.
- MPW (Multi-Project-Wafer) runs for various technologies, including ASICs, Photonics, MEMS and GaN.
- Advanced packaging, system integration solutions and test services.

## Why IHP?

- The world fastest Si-based RF-technologies and monolithic photonic BiCMOS solutions, providing integrated HBTs with cut-off frequencies of up to 500 GHz.
- Very small minimum block size (0.8 mm²) for MPW for all technologies.
- Easy to install PDK and customer-friendly layout rejection test.
- Building a bridge between research and industry.

## Technology Highlights

### 0.13 µm SG13 & 0.25 µm SG25

IHP offers research partners and customers worldwide access to its powerful SiGe:C BiCMOS technologies and special integrated RF modules. IHP technologies are based on 0.13µm / 0.25µm CMOS process. Several generations of high-speed SiGe Heterojunction Bipolar Transistors (HBT), passive components, such as poly resistors and MIM capacitors, have been developed and integrated in 0.25µm and 0.13µm BiCMOS technologies which are available for chip fabrication via IHP's MPW and prototyping service.

The 0.13µm BiCMOS process SG13G2 represents the fastest currently available SiGe HBT technology featuring peak $f_T/f_{max}$ values of 300 GHz/500 GHz. These developments were based on a series of pioneering contributions to the development of SiGe HBTs including the introduction of carbon doping for stabilizing steep base doping profiles and new device constructions with reduced parasitic resistances and capacitance.

These IHP technologies are especially suited for applications in the higher GHz bands, e.g., for telecommunications & broadband (Gigabit WLAN, wireless sensor networks, wireless security solutions, fiber optic circuits), radar, medical imaging applications, aerospace, short-range detection for automotive, image sensor and motion recognition.

**SG13S** is a high-performance 0.13µm BiCMOS with npn-HBTs up to $f_T/f_{max}$ = 250/300 GHz, including CMOS logic.

**SG13G2** is a very high-performance 0.13µm BiCMOS technology with the same device portfolio as SG13S but with a much higher bipolar performance with $f_T/f_{max}$ = 300/500 GHz.

**SG13G2Cu** and **SG13SCu** is a FEOL process SG13S and SG13G2 together with Cu BEOL option from X-FAB containing Copper and Aluminum layer.

**SG25H3** is a 0.25µm technology with a set of npn-HBTs ranging from a higher RF performance ($f_T/f_{max}$ = 110/180 GHz) to higher breakdown voltages up to 7V.

**SGB25V** is a cost-effective technology with a set of npn-HBTs up to a breakdown voltage of 7V.

**TSV (Through Silicon Vias)** is an additional option in SG13S and SG13G2 technology, which offers RF grounding by vias through silicon to improve RF performance.

**LBE (The Localized Backside)** is offered to remove silicon locally to improve passive performance (available in all technologies).

## Electronic Photonic IC Technology - SG25H5EPIC

SG25H5_EPIC is the monolithic integration of photonic devices, such as detectors and modulators, in the frontend of a Si-based integrated circuit technology that allows shortest possible interconnects between photonics and electronics, from which high-speed performance of Electronic-Photonic Integrated Circuits (EPIC) greatly benefit. The PDK features include Luceda IPKISS support for photonic designs (including simulation using Caphe ) and Cadence support for electronic – photonic circuit design (DRC, LVS, QRC). This technology is especially suited for Optical Transceivers for 100G/200G/400GHz applications.

## Technology Details

| 0.13µm SG13S/C | 0.13 µm SG13G2 | 0.13µm SG13S/G2Cu (XFab Cu BEOL) |
|---|---|---|
| Bipolar:<br>High-speed HBT<br>Ft/Fmax/BVceo:<br>250 GHz/330 GHz/1.7V<br>High-voltage HBT<br>Ft/Fmax/BVceo:<br>40 GHz/120 GHz/3.7V<br>CMOS logic:Vdd = 1.2V<br>CMOS I/O: Vdd = 3.3V, 1.2V Core voltage<br>Passives: Poly-Si resistors, MOS varactors, Inductors<br>MIM Cap. 1,5 fF/ µm²<br>Interconnects:<br>Backend offers 7 layers Al incl. 2 & 3 µm layers | Bipolar:<br>High-speed HBT<br>Ft/Fmax/BVceo:<br>300 GHz/500 GHz/1.6V<br>High-voltage HBT<br>Ft/Fmax/BVceo:<br>120 GHz/330 GHz/2.5V<br>CMOS logic:Vdd = 1.2V<br>CMOS I/O:Vdd = 3.3V, 1.2V Core voltage<br>Passives: Poly-Si resistors, MOS varactors, Inductors<br>MIM Cap. 1,5 fF/ µm²<br>Interconnects:<br>Backend offers 7 layers Al incl. 2 & 3 µm layers | IHP SG13S/G2 FEOL device performance and<br>XFab Cu BEOL<br>MIM Cap. 2,1 fF/ µm²<br>Interconnects:<br>Backend offers 8 layers:<br>6 layers Cu: 4 thin, 2 thick plus<br>2 Al top metal layers |

| 0.25µm SGB25V | 0.25µm SG25H3 | 0.25µm SG25H5_EPIC |
|---|---|---|
| npn-HBTs up to Ft/Fmax = 95/75 GHz<br>Vbce0 up to 7V<br>Passives: Poly-Si resistors, MOS varactors, Inductors<br>MIM Cap. 1 fF/ µm²<br>Interconnects: Backend offers 3 thin metal layers,<br>a MIM layer and 2 thick metal layers<br>(TM1: 2 µm TM2: 3 µm) | npn-HBTs up to Ft/Fmax = 110/180 GHz<br>Vbce0 up to 7V<br>Passives: Poly-Si resistors, MOS varactors, Inductors<br>MIM Cap. 1 fF/ µm²<br>Interconnects: Backend offers 3 thin metal layers,<br>a MIM layer and 2 thick metal layers<br>(TM1: 2 µm TM2: 3 µm) | npn-HBTs up to Ft/Fmax = 220/290 GHz<br>Germanium-PhotoDiode, WaveGuide,<br>Full photonic device set for C/O-band<br>Passives: Poly-Si resistors, MOS varactors, Inductors<br>MIM Cap. 1fF/ µm²<br>Interconnects: Backend offers 3 thin metal layers<br>a MIM layer and 2 thick metal layers<br>(TM1: 2 µm TM2: 3 µm) |