



mtec



mtec

EMBRACING A BETTER LIFE

IMEC IS THE PRIME SEMICONDUCTOR LAB OF THE WORLD



skilled
people



world-class
infrastructure



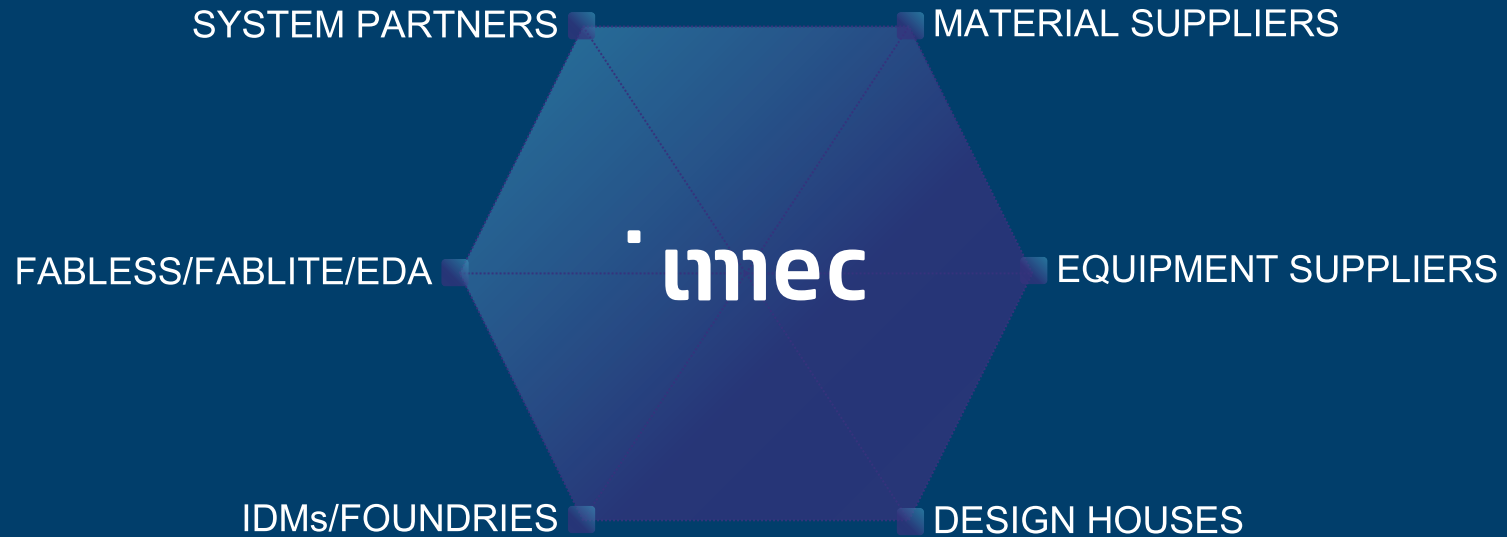
global
ecosystem

Senja • Anai • Jakub • Seifallah • Eleftheria • Yusuke • Nayoung • Yu-Chun • Nils • Selika • Sarina • Han • Many • Many • Amrapali • Jonathan • Seongbin • Haki • Jonathan • Douglas Charles • Deanna • Dylan • Bas • Arian • Weijiang • Kartik • Asma • Tessa •
Mahtab • Tom • Andre • Wout • Vera • Muhammad Raed • Stijn • Valerie • Javad • Alessandro • Yusuf • Neha • Peter • Jan • Henrique • Jun • Shruthi • Jeroen • Sam • Danica • Soheila • Annie • Mohamed El Kordy • Emre • Jonas • Thomas • Franjo • Rishab •
Marwan • Hong Hai • Christian • Genis • Noemie • Laura • Sarah • Patricia • Guy • Giulia • Lea • Caro • Virginie • Karol • Morena • Valentine • Amber • Francesca • Nathan • Sien • Nele • Francesco • Sofie • Gaëlle • Thomas • Jana • Wouter • Lennerd • Halil •
Beatriz • Luca • Yannick • Robert • Marie • Lize • Damon • Domenico • Alaa • Rick • Shu-Ngua • Yosuke • Nicole • Hikaru • Michiel • Anna • James • Fernando • Natan • Julian • Yashovardhan • Jonas • Jasper • Vitaly • Irene • Arno • Bram • Sarah • Konstantin •
Wafae • Gianpiero • Julian • Sang Cheol • Laila • Abdaoui • Preston • Wout • Thais • Onur • Woo Jin • Michiel • Ali • Peter • Maarten • Hasanth • Willi • Mehmet Kutay • Behzat Utku • Rostislav • Kurt • Evelien • Stijn • Roman • Brent • Seger • Seger • E •
Tom • Marleen • Koen • Filip • Yoann • Thomas • Erik • Kristoffel • Mireille • Liesbeth • Ursula • Lammert • Nicholas • Yiming • Kishan • Vincent • Frederik • Dirk • Kevin • Veerle • Alex • Pieter • Aida • Cheng • Fabian • Jesu Kiran • Karen • Sathisha • Nick •
Erik • Filip • Chidharth • Haijin • Jesse • Francesco • Wenqi • Willy • Sander • Stephanie • Kulakshna • Victor • Jonas • Hua • Xiaolong • Sandeep • Chenming • Benjamin • Makoto • Giulia • Celine • Daniel • Arthur • Giordano • Carlo • Nathalie • Jannes • Charlo •
Frederic • Michel • Liesbeth • Maxim • Bryan • James • Stephanie • Robbe • Wei2 • Kenny • Annelies • Kushagra Singh • Nishant • Jason • Arno • Akshit • Ananya • Yiwei • Katrien • Bas • Thomas • Laura • Alexander • David • Varun • Jasper • Bra •
Jack • Anh Minh • Almudena • Shahriar • Jelle • Jerome • Luis Alberto • Jalal • Wei-Yu • Marion • Salma • Jonne • Charlotte • Michiel • Stuart • César • Saja • Carmen • Tanmoy • Vincent • Andrey • Reza • Charis • Hisashi • Kazutaka • Ian • Stefan • Hicham •
Ju Hyuck • Hana • Theo • Ioannis • Nico • Marcel • Takashi • Aurore • Yann • Felipe Kenji • Igor • Rossa • Jack • Lisa • Hsiao-Lun • Jun-noh • Chen • Samson • Marco • Catalina • Meryem • Daria • Fatma • Amine • Maria Jose • Ikhtas • Omid • Milica • Sin Fu • Ja •
afal • Mathijs • Laura • Milad • Stephen • Javad Arian • Thanos • Chelsey • Ege • Safae • Marko • Hojjat • Sander • Sahar • Ahmed • Kanta • Shinya • Christoph • Nancy • Laetitia • Jonathan • Mohammadsadeh • Matthieu • Youngwook • Fawaz • Aladdin • Fran •
rm • Ann • Flora • Marion • Bruno • Sander • Delphine • Anthony • Joachim • Ricardo • Boris • Joonyoung • Stephanie • Karan • Lene • Benjamin • Zhengtao • Christoforos • Apostolia • Lucan • Vinod • Gerson • Yuchao • Emre • Asuncion • Santhosh • Naza •
Natasja • Matthias • Sylvia • Thomas • Olivier • Michiel • Bas • Ralf • Maarten • Hannes • Annelies • Ine • Sanne • Daniel • Isaac • Matthias • Kenzo • Laura • Jasper • Tom • Wanda • Ruben • Kyle • Dieter • Lien • Annie • Emiel • Thomas • Ruben • Miel • Pieter •
Yan • Daniel • Mike • Yao • Ruben • Karien • Wim • Hubert • Yoann • Geert • Peter • Reginald • Jan • Dieter • Davinia • Martin • Christophe • Joni • Pascal • Kim • Stefaan • Pieter • Joël • Jan • Veerle • Werner • Jan • Anthony • Tom • Mario • Marilize • Gert •
en • David • Nathalie • Arnaud • Stephanie • Ben • Mohit • Bart • Alan • Bjorn • Rik • Jesse • Yannick • Piet • Kaushik • Niek • Wouter • Ine • Bart • Frank • Rik • Max • Yannick • Peter • Nik • Hemant Kumar • Willemien • Ali • Joshua • Werner • Christophe • Fran •
• Arnaud • Dongyang • Shirotori • Lukas • Hanna • Frederik • Geoffrey • Eric • David • Laura • Laura • Bart • Cedric • Xuelong • Gianluca • Ruben • Emmerik • Jens • Bram • Jeroen • Els • Eric • Wim • Patrick • Gijssbert • Marijn • Ellen • Simon • Alessandra • T •
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hadur • Georgios • Elisabeth • Vladimir • Francesca • Andriy • Vincent • Rene • Douglas • Ziad • Michael • Gosia • Kathleen • Ken • Gavin • Paulius • Ainhua • Amir-Hossein • Jonas • Sebastian • Pierre • Lucien • Karen • Pishko • Aftab • Jose Ignacio • Andrew • H •
Gabriel • Matteo • Abdalrhman • Ugo • Guillermo • Edward • Julian • Catherine • Nadia • Jafar • Anwar • Delany • Chao • Ching • Christian • Jessica • Sam • Andrea • Ivan • Rakesh • Yixi • Roushou • Ba • Chao • Tazda • David • Tom • Norma • Javad • H •

WE ARE A GLOBAL TEAM OF OVER 6,000 TALENTED EMPLOYEES FROM MORE THAN 100 NATIONALITIES.

tebing • Kevin • Yuan • Paul • Jochem • Shenqi • Marnix • Jerrald • Roy • Lei • Swathi • Cina • Mathijs • Murat • Alexandra • Ivo • Igor • Gabriela • Lucy • Leendert • Wenzhe • Saptarshi • Yannick • Roberto • Paul • Simone • Justin • Ulzhan • Daisuke • Sébas •
ardies • Raj • Karolina • Rajendra Kumar • Maaike • Mehmet Bilgehan • Cornelia • Daniel • Valdy • Yunqi • Julien • Dogukan • Bas • Abhishek • Ward • Achintya • Istvan • Tamara • Yunfan • Jelle • Yang • Jan • Prafulla • Cassie • Linda • Bevita • Shuchi • Tobias •
llo • Kim • Erwin • Martine • Pieter • Utku • Jef • Jacob • Seunghak • Il Gyo • Karina • Hyukyun • Anoop • Warre • Julian • Shiqi • Hans • Jeroen • Swapnil • Tzu-Hstng • Fengben • Maxime • Jarich • Gijis • Robert • Peter • Esma • Anurag • Hamed • Ashish • Pedr •
nis • Florian • Catherine • Steven • Arantxa • Shashikant • Chris • Rob • Antonietta • Tekin • David • Karen • Lorenza • Saransh • Bo • Neam • Mariachiara • Nick • Robbe • Wei-Hua • Benedikt • Muhammad Usama • Anadi • Soulyman • Mahsa • Jin San • Marc •
ate • Junren • Junren • Baris • Lukas • Harish • Sriram • Birta Woon • Aislan • Wouter • Kazuki • Kaiwen • Jesper • Chia-Wei • Jiseok • Ivania • Andrew • Li • Hyun-Cheol • Jakob • Jordi • Bibi Zhara • Nicolas • Bas • Joost • Ali • Maarten • Hans • Jiwon • Anmol • Joh •
ashika • Lauren • Neha • Martin • Brecht • Toon • Kier • Eveline • Thomas • Paola • Eduardo • Marika • Ching • Carlos • Thomas • Jacob • Ali • Andreas • Tjian • Rufi • Esmee • Andri • Jori • Ewelina • Akane • Patricia • Pieter • Steven • Dora • Daigo • Saeed • Il •
Raju • Ulysse • Carina • Hannah • Douae • Maurice • Zeno • Felitsa • Eleni • Carla • Leala • Laxman kumar • Pieter-Jan • Giselle • Abhinay • Priya • Yilun • Barzi • Erfan • Yaren • Liam • Andrew • Greenshma • Jeroen • Ye • Sung Woo • Parkaj • Arantxa • Muham •
Raj • Isaak • Aasiya Bano Abdul Rauf • Godfred • Aruzhan • Frederik • Hans • Jacobus • Arne • Lorin • Peter • Ying-Chun • Binghua • Tien Dat • Evangelos • Diego • Sacid • Gabriel • Gabriel • Blake • Matthias • Yusuf • Gaurav • Sahan • Serkan • Liwang • Meh •
Tijs • Ward • Hareen • Gargya • Stijn • Julie • Krishna • Chunzhuo • Jonathan • Chao • Zhongtao • Tibo • Lotte • Morgane • Marco • Gianpiero • Ernest • Meng • Jorik • Xiangyu • Yuqing • Siyuan • Anuj • Zhanwei • Martijn • Ilaria • Oreste • Gaoyuan • Jan •
Xinrui • Marieke • Aditya • Hui • Aslihan • Samer • Anupam • Kamal • Chen • Ansar • Aarti • Martin • Vivek • Deepanjan • Tom • Shanxing • Mathijs • Tomas • Simone • Marco • Fabio • Viraj • Emad • Robbe • Gautam • Raphael • Federico • Arturo • Vic •
Simon • Elise • Veronique • Johan • Karlén • Philippe • Maarten • Elise • Tim • Gerald • Kristof • Dieter • Thomas • Wendy • Ann • Bram • Wim • Simon • Marc • Ruben • Peter • Stefanie • Wouter • Ruben • Chris • Pieter • Dorien • Hadewijch • Steven • Mat •
lason • Tom • Ben • Lars • Devesh • Aleksandra • Joseph Daniel • Lars • Andreia • Claire • Jay • David • Kwanyong • Tom • Mustafa • Merve • Hironori • Rreze • Rene • Kanksha • Ivan • Adnan • Eslam • Sara • Carlos • Cagatay • Afzaal • Luis • Brendan • Yuta • Fur •
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zhan • Hussein • Filip • Constantin • Mike • Armand • Arash • Veronica Juliana • Mauricio • Ahmed • Ahmed • Sofia • Sara • Guido • Esmeralda • Thiago • Joomeeok • Seunghwan • Pelin • Ludwika • Mihaela • Sonja • Pieter • Robert • Michael • Quentin • An •
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istiane • Jef • Daniël • Lieven • Danielle • Rik • Vincent • Piet • Goedele • Serge • Bart • Erwin • Kristof • Albert • Marc • André • Ingrid • Luc • Nausikaa • Geert • Hilde • Hendrik • Eric • Greet • Steven • Dirk • Erwin • Wim • Johan • Wim • Tom • Philip • Mat •
Sabine • Bart • Martine • Steven • Johan • Guy • Filip • Jan • Johnny • Dries • Luc • Geert • Johan • Joost • Liesbet • Sigrid • Kristof • Gunther • Rudy • Ilse • Hans • Patrick • Monique • Benny • Paul • Dominique • Wendy • Hans • Luc • Koen • Bart • Nadine •
Rita • Ann • Tom • Marc • Andre • Anne • Sara • Ann • Beatrijs • Christa • Eli • Paul • Jan • Piet • Franciska • Myriam • Nadine • Annouck • Peter • Geert • Ingrid • Dirk • Jan • Luc • Philip • Erik • Gregor • Joost • Hans • Paul • Nadia • Veronique • Johan • Nanc •

WITH AN ECOSYSTEM OF OVER 600 PARTNERS,
THAT WORK TOGETHER IN AN OPEN INNOVATION MODEL



WITH THE MOST ADVANCED SEMICONDUCTOR R&D INFRASTRUCTURE



€3,5B investment



~12,000m² cleanroom



over 250 tools

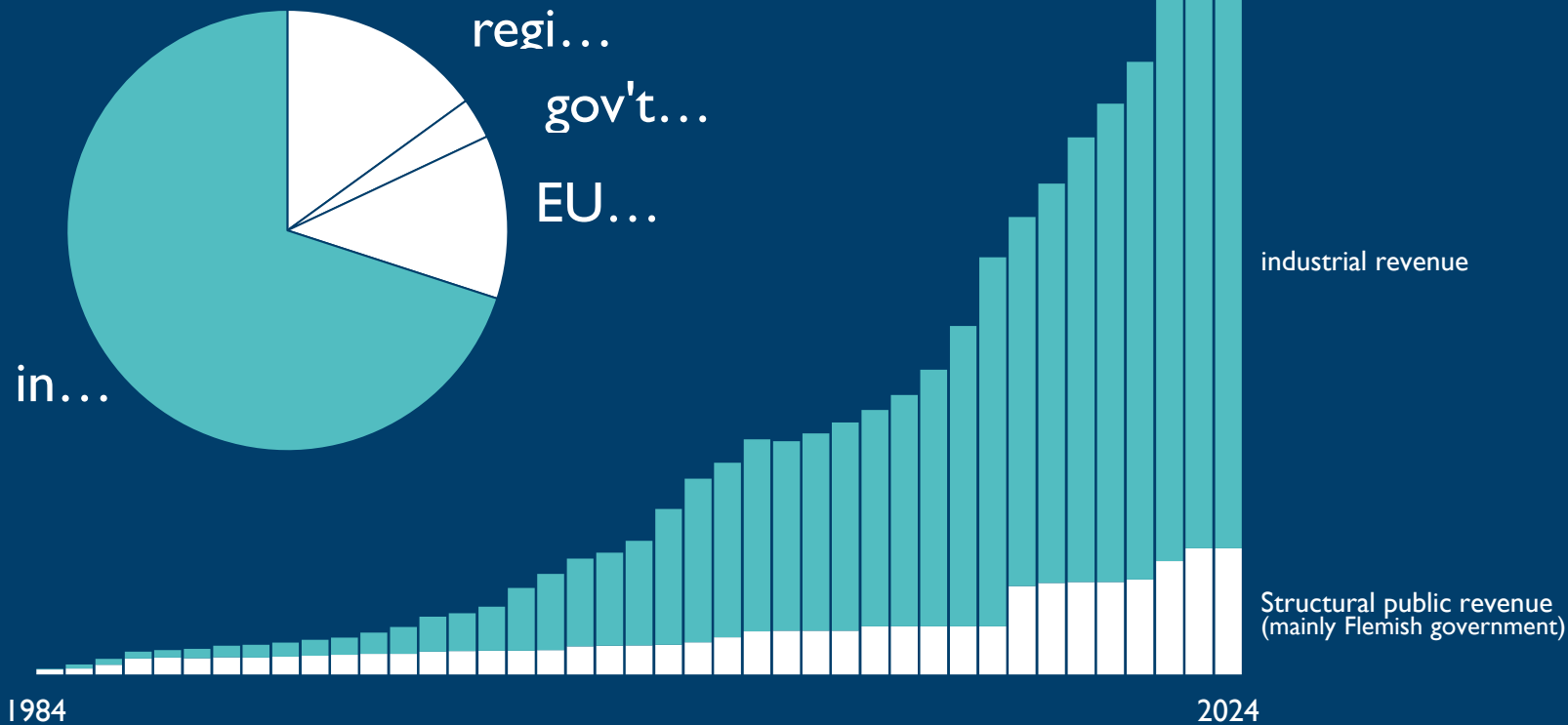


24/7 operation



6,000m² cleanroom expansion
€2,5B investment

imec



To be constructed

New opened

Fab 2+Fab 3
300mm

FAB4 300mm

FAB3 expansion
2000m² opened 2023

FAB1 200mm

FAB4 construction
4000m² – ready in 2027



Office
building

imec Leuven Campus:
World leading semiconductor R&D



● R&D

● Representative office

OUR STRONG CONNECTION WITH THE ACADEMIC WORLD NURTURES OUR INNOVATIVE EXCELLENCE.



Global collaboration
with >200
universities
700 PhD students



Long-term research
pipeline and
fundamental insights

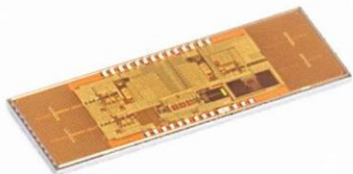


Turning academic
insights into industrial
innovations

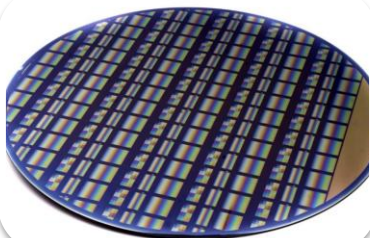


Together, we develop new concepts and leading-edge technology

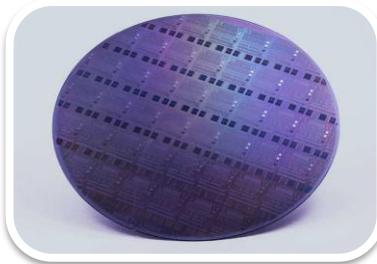
IMEC SEMICONDUCTOR PLATFORMS



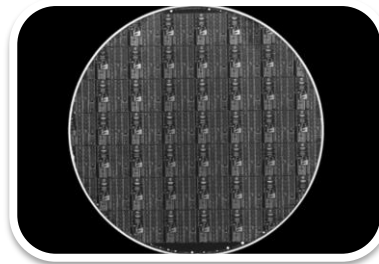
Radar



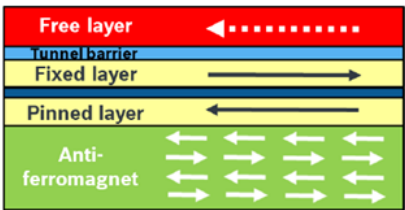
Scaled
imagers



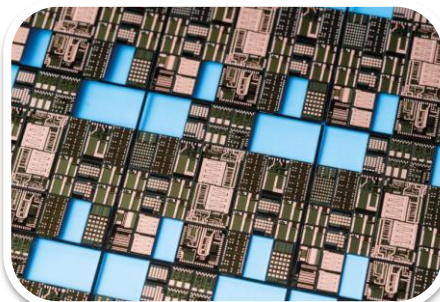
Photonics & flat
optics



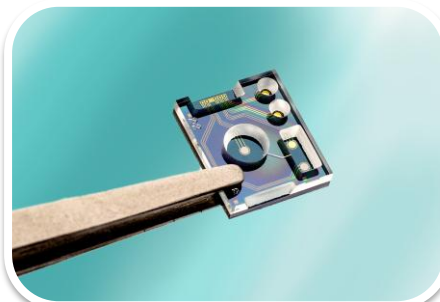
MEMS &
Ultrasound



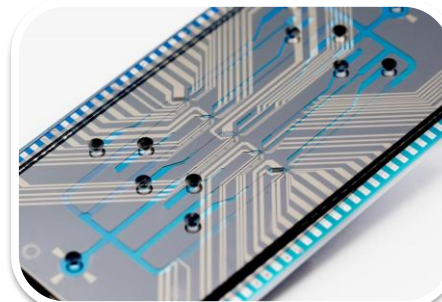
TMR



High-voltage
GaN



Electrochemical



Micro-fluidics

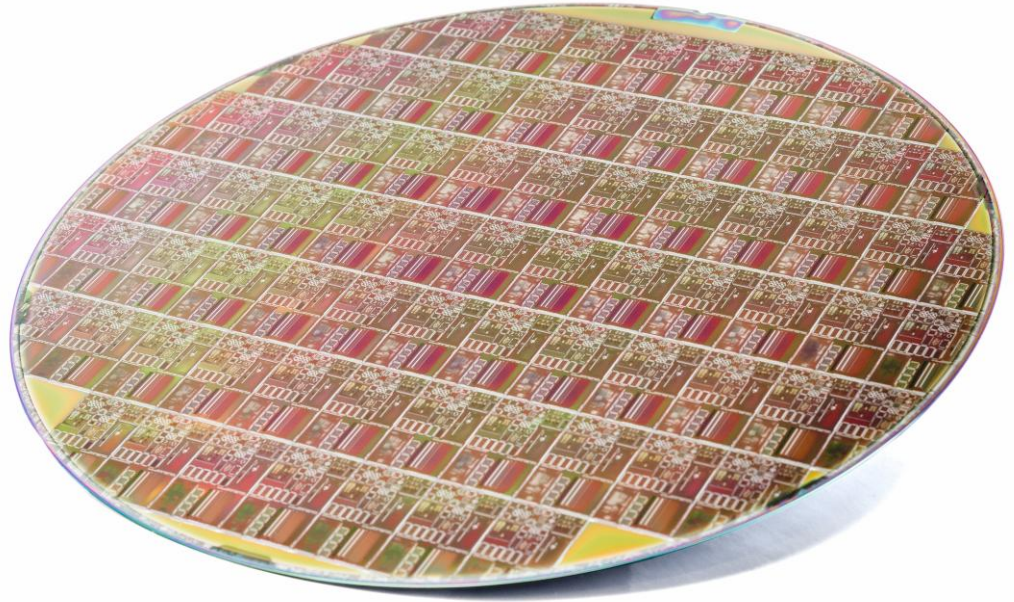
Non-Terrestrial Networks (NTN)



Cost-Effective High-Efficiency GaN-on-Silicon Technology

Benefits for NTN Power Amplifiers (PA) and Front-Ends Modules (FEM)

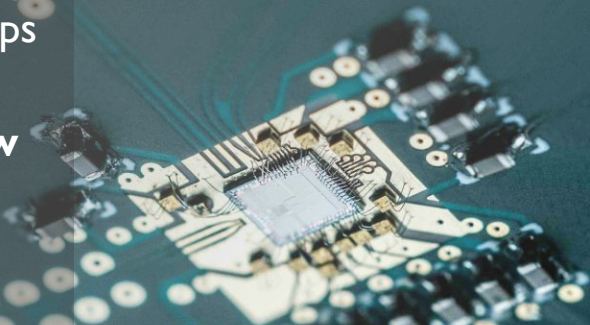
- **High-performance** front-end modules for NTN
- **>60% device efficiency** (PAE)
- **>2x more cost-effective** (vs SiC), reaching CMOS price point
- **>30% smaller FEM** footprint (vs GaAs)
- Tech **benchmarking** vs **GaAs, CMOS, GaN-on-SiC** a.o.



Innovative High-Efficiency Circuits (ADC, PLL, PA)

Benefits for NTN Components and Circuits

- Circuits & components
 - **High-speed**, best-in-class **ADCs**: Low power >2Gbps up to high performance >175Gbps
 - **Wideband PLLs**, including All-Digital PLLs, for **ultra-low jitter** (ps-fs)
 - High-efficiency, **high-power PAs** ~30dBm
- Covering process **nodes** >22nm down to <3nm



Innovative High Efficiency Systems & Architectures

Benefits for NTN Systems & Architectures

- Sub-10GHz up to 140GHz **transceivers**
- Analog/RF, Digital and Hybrid **beamforming**
- **Low-power** digital architectures, e.g., digital transmitter (DTX)
- High reliability **deterministic** network protocols / physical layer
- Advanced **antennas and packaging**
- **Tape out & silicon** validation



ASIC services

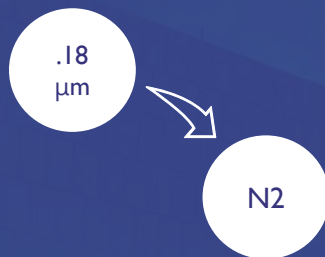
IC-Link, customized solutions for innovative chip manufacturing

End-to-end ASIC services

Scaling ASICs without limits



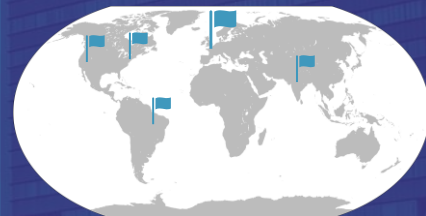
Wide technology range



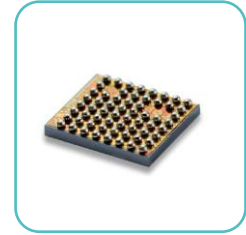
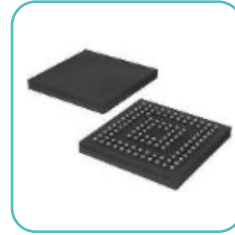
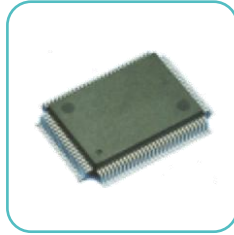
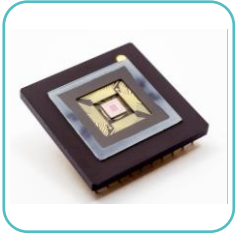
Full turnkey or flexible services



Teams worldwide



Custom ASIC is a business differentiator



UNIT COST

FORM FACTOR

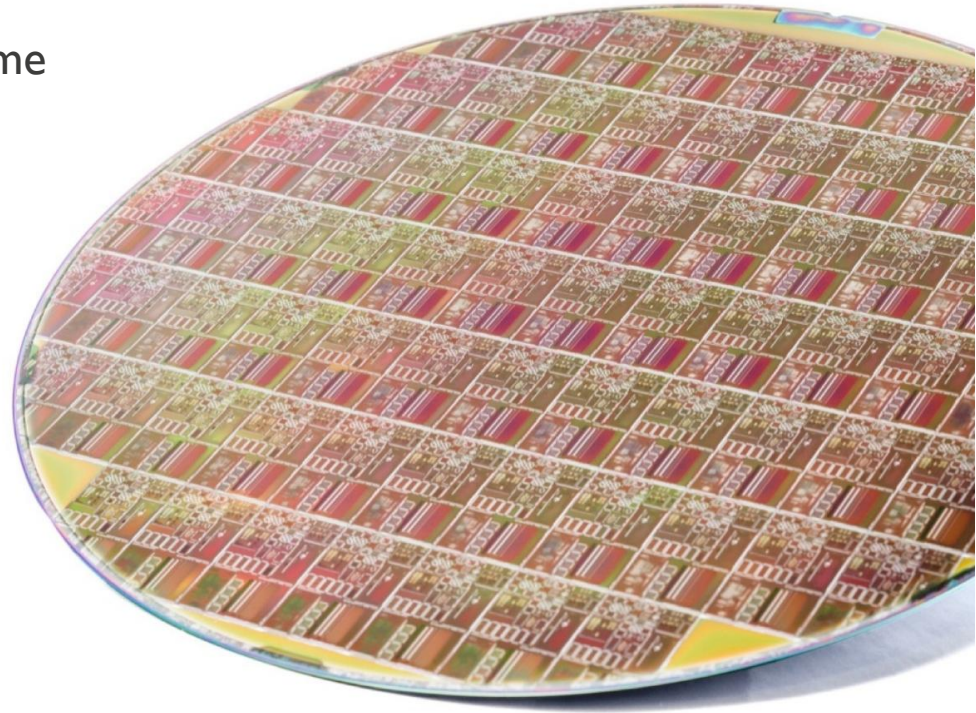
PERFORMANCE

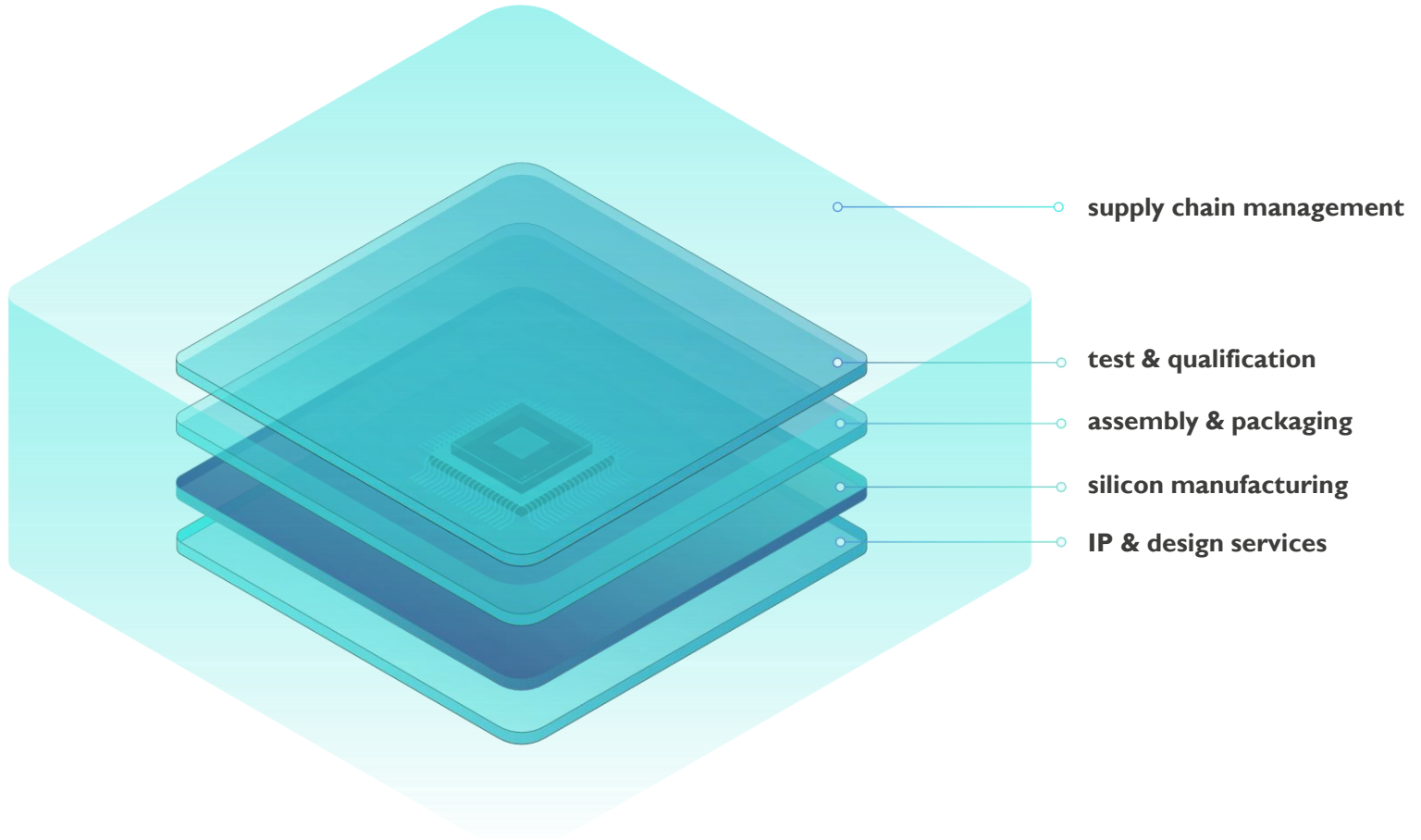
IP PROTECTION

MARKET
DIFFERENTIATION

IC-Link for space

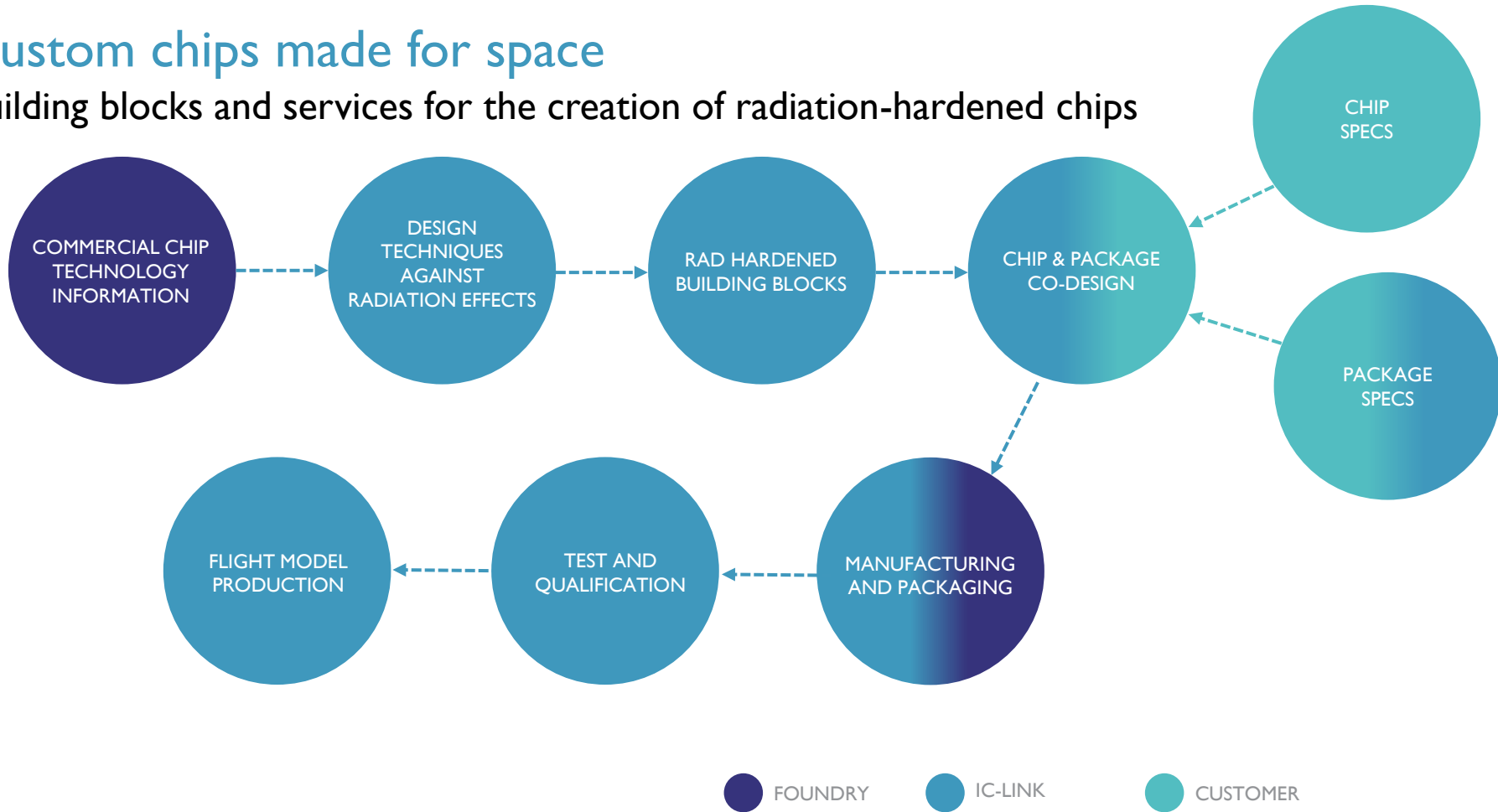
Providing a fast route from prototype to volume





Custom chips made for space

Building blocks and services for the creation of radiation-hardened chips



Rad-hard IP & design services

Design Against Radiation Effects (DARE)

DARE Platforms

- Rad-hard solution using standard commercial technology
- Digital and analog design flows
- Supported by ESA and EC
- Various foundry technologies TSMC, XFAB, UMC, GF
- Solutions from 180nm down to 22nm, developing 7nm
- Flexible towards application needs for GEO, MEO, LEO and other fields like HEP

DARE Mitigation Approach

- Guard rings to kill latch-up
- Single-event-upset hardened flip-flops
- Single-event-transient hardened clock tree cells
- Single-event-upset & transient hardened memories
- Enhanced rad-hard aware physical implementation flow
- Single-event-transient analog simulation flow
- Enclosed-layout-transistor for high total-ionizing-dose applications

Rad-hard IP & design platforms

Design Against Radiation Effects (DARE)

DARE180U

- UMC 180nm Mixed-Mode RF 1.8V / 3.3V
- SEL LET_{th} > 60 MeV.cm²/mg
- SEU FF (HIT/DICE)
- TID tolerance > 1 Mrad
- -55°C ~ 125°C
- Gate density = 25 kgates/mm²
- Single & dual port memory compilers

DARE65T

- TSMC 65nm Low-Power Mixed-Mode RF 1.2V / 2.5V
- SEL LET_{th} > 70 MeV.cm²/mg
- SEU FF (DICE)
- TID tolerance > 100 krad
- -40°C ~ 125°C
- Gate density = 250 kgates/mm²
- Single port memory compiler / 5 dual port memories

DARE180X

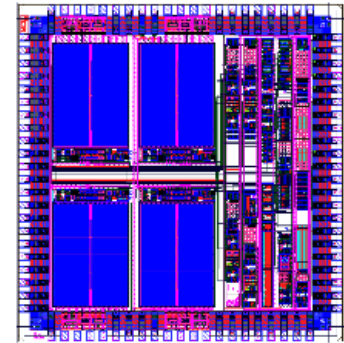
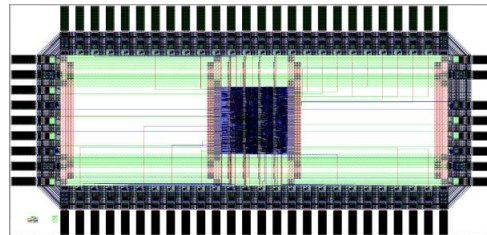
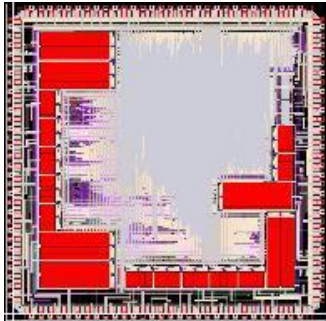
- XFAB 180nm 1.8V / 3.3V
- SEL LET_{th} > 60 MeV.cm²/mg
- SEU FF (DICE)
- TID tolerance > 100 krad
- -40°C ~ 125°C
- Gate density = 50 kgates/mm²
- 5 dual port memories

DARE22G

- GF 22nm FDSOI 0.8V / 1.8V
- SEL LET_{th} > 70 MeV.cm²/mg
- SEU FF (DICE)
- TID tolerance > 100 krad
- -40°C ~ 125°C
- Gate density = 2.5 Mgates/mm²


HISPASAT 36W-1

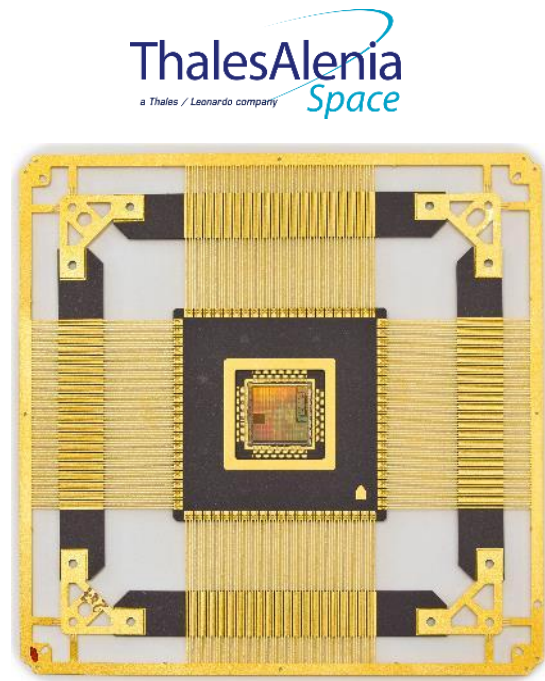
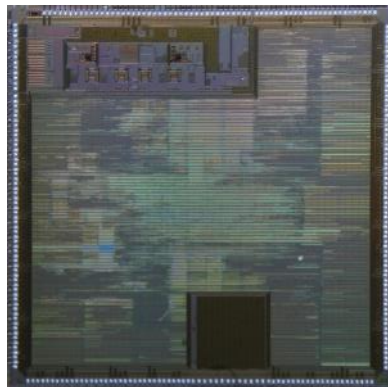
- Launched on January 27, 2017 - GEO orbit
- Innovative regenerative payload
- First use of SmallGeo platform
- 645 chips delivered by imec
 - 543 DARE chips in UMC 180nm
 - 102 DARE chips in Onsemi I3T80



TRL9 DARE 180nm ASIC

Digital Programmable Controller (DPC)

- Defined by Thales Alenia Space (Belgium)
 - Digital library enhancements: imec
 - Digital design: Thales Alenia Space + P&R by imec
 - Analog design: ICsense  **ICsense**
THE IC DESIGN COMPANY
- Manufactured in DARE 180nm UMC
- Delivery: Qualified Flight hardware
- Currently flying in several missions



Pictures: TAS-B

www.imeciclink.com/dare





embracing a better life

