ISIG | Executive Summit
USA 2026

Nano-Mechanical Devices

The next revolution in semiconductor and silicon photonics design

nanusens
CREATIVE NANODEVICES

PROBLEM:
No manufacturing standard for MEMS

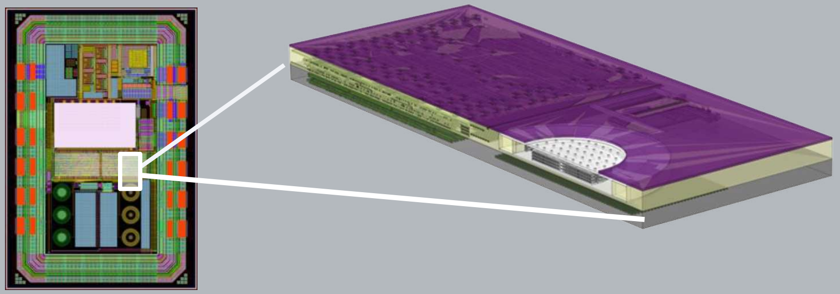
- Limited economy of scale
- Stand alone Integrated Circuit
- Cannot meet the cost, performance, size & volume production requirements the market is demanding

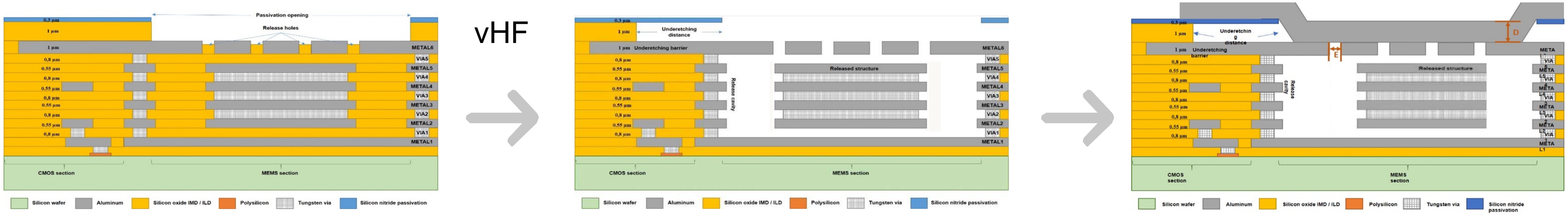
SOLUTION:
Use solid state manufacturing (CMOS & Si photonics)

- Large economy of scale
- Embedded MEMS (e-MEMS)
- Unique levels of low cost, high performance, miniaturization and virtualy unlimited volume production capability

SECRET SAUCE: ONE POST-PROCESSING STEP + UNIQUE DESIGNS

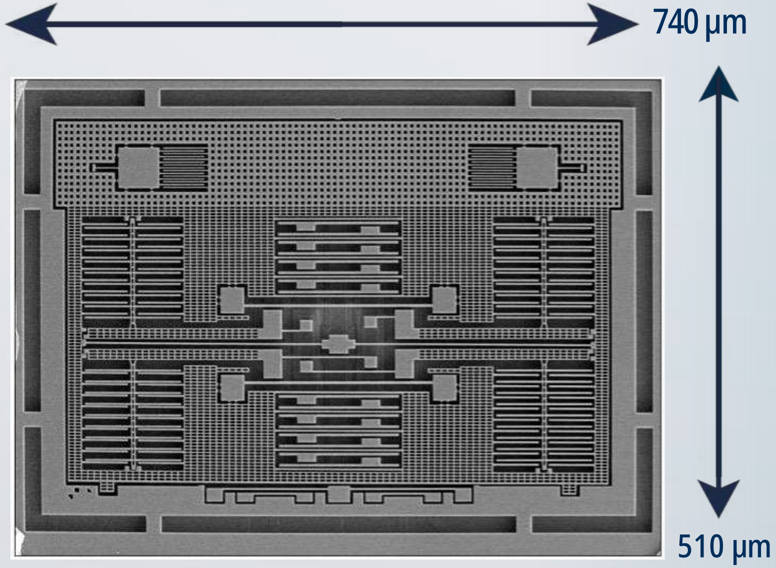
- We use the metal layers existing into the CMOS die to implement the MEMS devices.
- We use vHF (Hydrofluoric Acid in vapour stage) to etch away some silicon oxide, creating a MEMS cavity.
- It is a maskless and short process, using standard equipment.
- Optionaly we seal with Al sputtering or standard WLCSP repassivation.





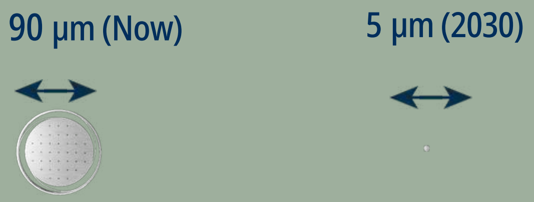
NANUSENS BREAKS THE SIZE AND PERFORMANCE BARRIER

Competitor’s micro-mechanical device



Next generation devices need smaller, faster, lower energy and higher sensitivity chips. Current manufacturing technology cannot meet these demands.

Nanusens technology: up to 10,000x smaller



Single-chip solution

Create 3D mechanical devices on the microchip itself.
No need for complex multi-die packages

Nano-mechanical devices built using standard manufacturing process

No need of low-volume proprietary manufacturing processes

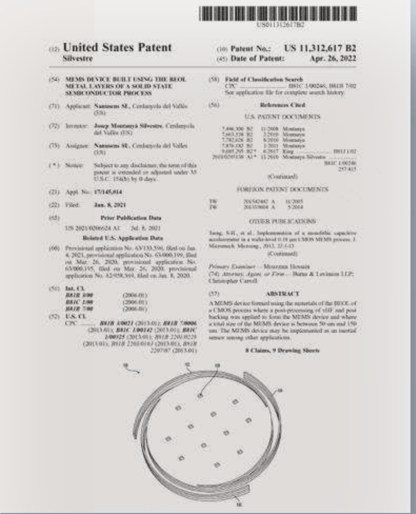
Leveraging the latest advances in semiconductor manufacturing

100nm feature sizes and beyond
+10x smaller than what is possible today

PATENT PORTFOLIO

Blocking all useful MEMS built in CMOS BEOL

- More than 100 inventions packed in multiple patents
- 10 patents granted, first one in Q2 2022
- 53 patents filed, grouped in 12 patent families and more coming
- Boston Galway (Boston) as patent attorneys
- Useful MEMS = performance, yield, Q&R, standard packaging



US011312617B2

(12) **United States Patent**
Silvestre

(10) **Patent No.:** **US 11,312,617 B2**
(45) **Date of Patent:** **Apr. 26, 2022**

(54) **MEMS DEVICE BUILT USING THE BEOL METAL LAYERS OF A SOLID STATE SEMICONDUCTOR PROCESS**

(71) Applicant: **Nanusens SL**, Cerdanyola del Vallès (ES)

(72) Inventor: **Josep Montanyà Silvestre**, Cerdanyola del Vallès (ES)

(73) Assignee: **Nanusens SL**, Cerdanyola del Vallès (ES)

(21) Appl. No.: **17/145,014**

(22) Filed: **Jan. 8, 2021**

(65) **Prior Publication Data**

Related U.S. Application Data

(51) **Int. Cl.**

(52) **U.S. Cl.**

(58) **Field of Classification Search**

(56) **References Cited**

U.S. PATENT DOCUMENTS

(Continued)

FOREIGN PATENT DOCUMENTS

OTHER PUBLICATIONS

(Continued)

(57) **ABSTRACT**

A MEMS device formed using the materials of the BEOL of a CMOS process where a post-processing of vHF and post backing was applied to form the MEMS device and where a total size of the MEMS device is between 50 um and 150 um. The MEMS device may be implemented as an inertial sensor among other applications.

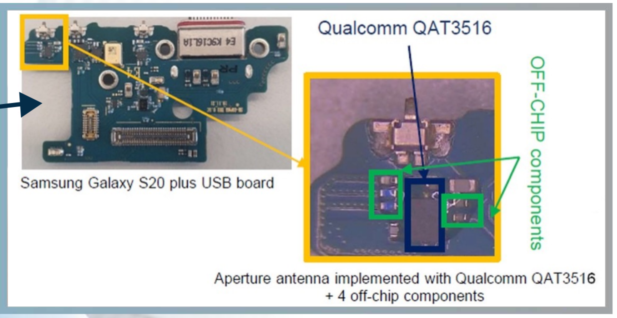
8 Claims, 9 Drawing Sheets

Nanusens first patent Granted Q2-2

PRODUCTS

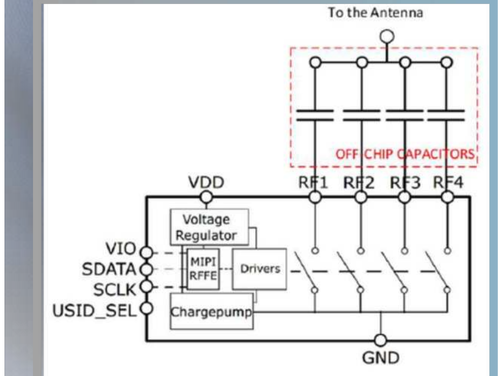
RF DTC (Digitally Tunable Capacitor)

- Initially targeting smartphone antenna tuning.
- Higher antenna efficiency in 5G & reduced PCB area. We are the only company providing a solution for 6G.
- Only company to satisfy all requirements: performance, cost, size, reliability & volume production capability.

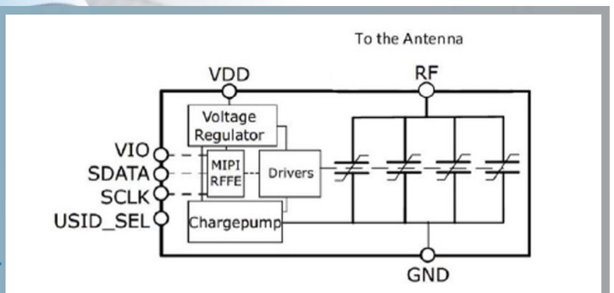


Samsung Galaxy S20 plus USB board

Aperture antenna implemented with Qualcomm QAT3516 + 4 off-chip components

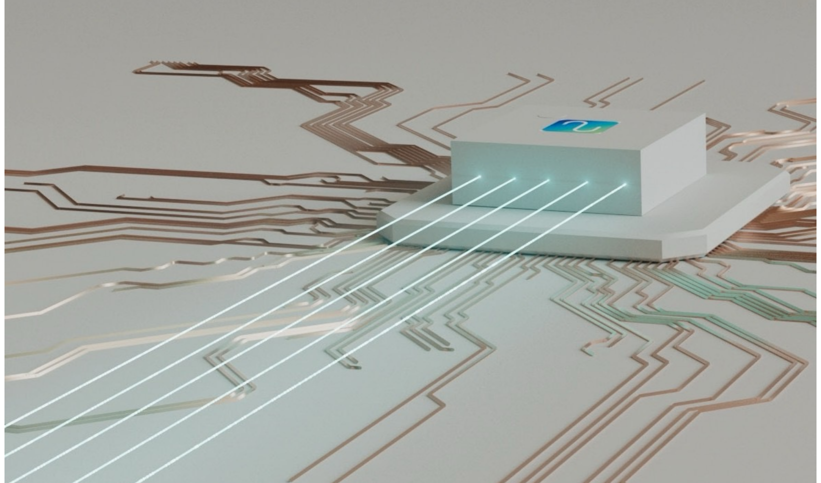


4Bit Digital Tunable Capacitor for aperture antenna implement with SOI 4SPST part



4Bit Digital Tunable Capacitor for aperture antenna implement with Nanusens RF-MEMS DTC

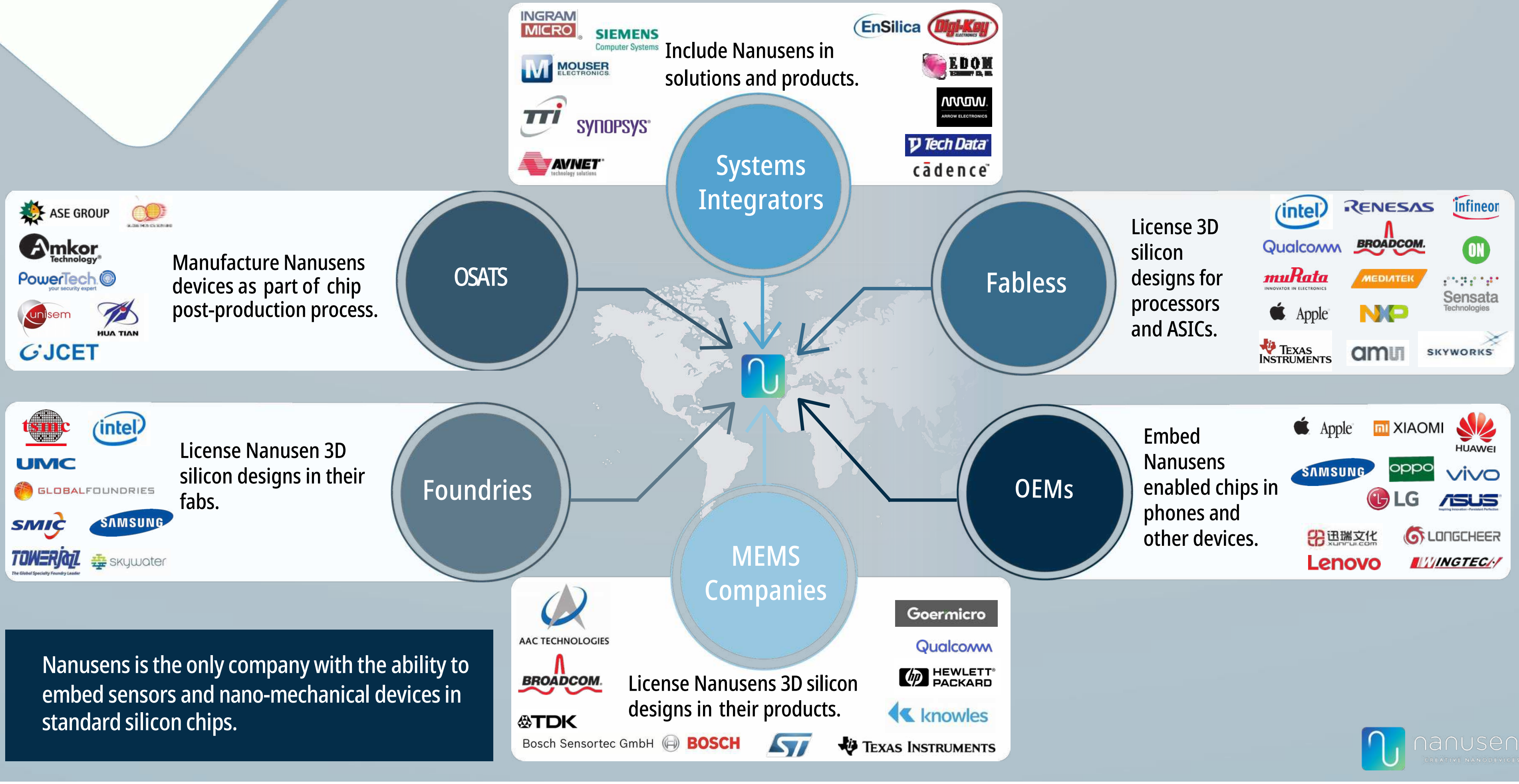
AI Optical Interconnects



- e-MEMS to solve the two main challenges in AI optical interconnects: MRR/MRM detuning and optical fiber alignment.
- Only company not requiring to modify the silicon photonics process. Only the vHF etching step.

NANUSENS AT THE HEART OF THE SEMICONDUCTOR INDUSTRY

Strong IP protection will lead to global partnerships, licensing and royalty agreements



Systems Integrators

Include Nanusens in solutions and products.

OSATS

Manufacture Nanusens devices as part of chip post-production process.

Fabless

License 3D silicon designs for processors and ASICs.

Foundries

License Nanusen 3D silicon designs in their fabs.

OEMs

Embed Nanusens enabled chips in phones and other devices.

MEMS Companies

License Nanusens 3D silicon designs in their products.

Nanusens is the only company with the ability to embed sensors and nano-mechanical devices in standard silicon chips.

TEAM

Executive Team

Dr. Josep Montanyà
Chief Executive Officer – UK/ Spain

Co-founder leading the company, with +23 years of experience in MEMS, patents and the semiconductor industry. Founded Baolab Microsystems prior to Nanusens.

Núria Martí
Chief Financial Officer - UK

+15 years leading finance and operations, driving growth through strategic financial leadership. Economist specialised in tech companies and the arts sector. Former CFO at Linke (now Syntax).

Dr. Marc Llamas
Chief Technology Officer - Spain

Co-founder with +18 years in MEMS technology. Previously at Baolab Microsystems and DelfMems.

Dr. Tom Hanley
VP MEMS - UK

+12 years of experience in MEMS. Previously at Sofant Technologies and Cirrus Logic in senior MEMS engineering roles.

Board and Advisors

Ramon Borrell
Chairman - UK

+30 years in technical and business leadership positions in the field of MEMS inkjet printheads and applications. Previously at HP, Xaar, Quantica and as independent consultant.

Matthew Crowley
Board Director - USA

+22 years in MEMS, semiconductor, market and patents. Previously at Sand 9, Vesper and Qualcomm. Currently CEO at SCINTIL Photonics.

Filippos Kodellas
Board Director - UK

Tech VC founder and investor.
+15 years in the Special Situations community. Previously at Bain & Company, Houlihan Lokey, Sankaty Advisors, KKR, Tennor.

Richard Ord
Advisor - UK

+40 years in semiconductor industry: VLSI: $300m revenue, CSR sold to Qualcomm.

Yu-Ming Wang
Sr. Director, Engineering & Operations - Taiwan

+26 years focus on semiconductor manufacturing technology enablement and stable volume production. Previously in TSMC, KLA, specialty chemical / material companies, UMC, Allegro Microsystems, IGBT Startup, Nexperia and Vesper.

Dr. Graham Hine
Advisor - Commercial - UK

+30 years experience in semiconductor technology and business. Serial CEO, Chairman of deep tech start-ups. Previously at Philips, Hitachi, Capteur, P2i, Hardide, SGX.

Sandhiprakash Bhide
Board Advisor -USA

+20 years with Intel Steering committee, Edison Awards Multiple patents.

Jeff Hilbert
Board Advisor -USA

+50 years in technology companies with annual budgets between $50M and $150M. 2 exits. WiSpry, an RF-MEMS company. Raised over $150M in startup funding.

INVEST IN THE NEXT REVOLUTION IN SEMICONDUCTOR & SILICON PHOTONICS DESIGN

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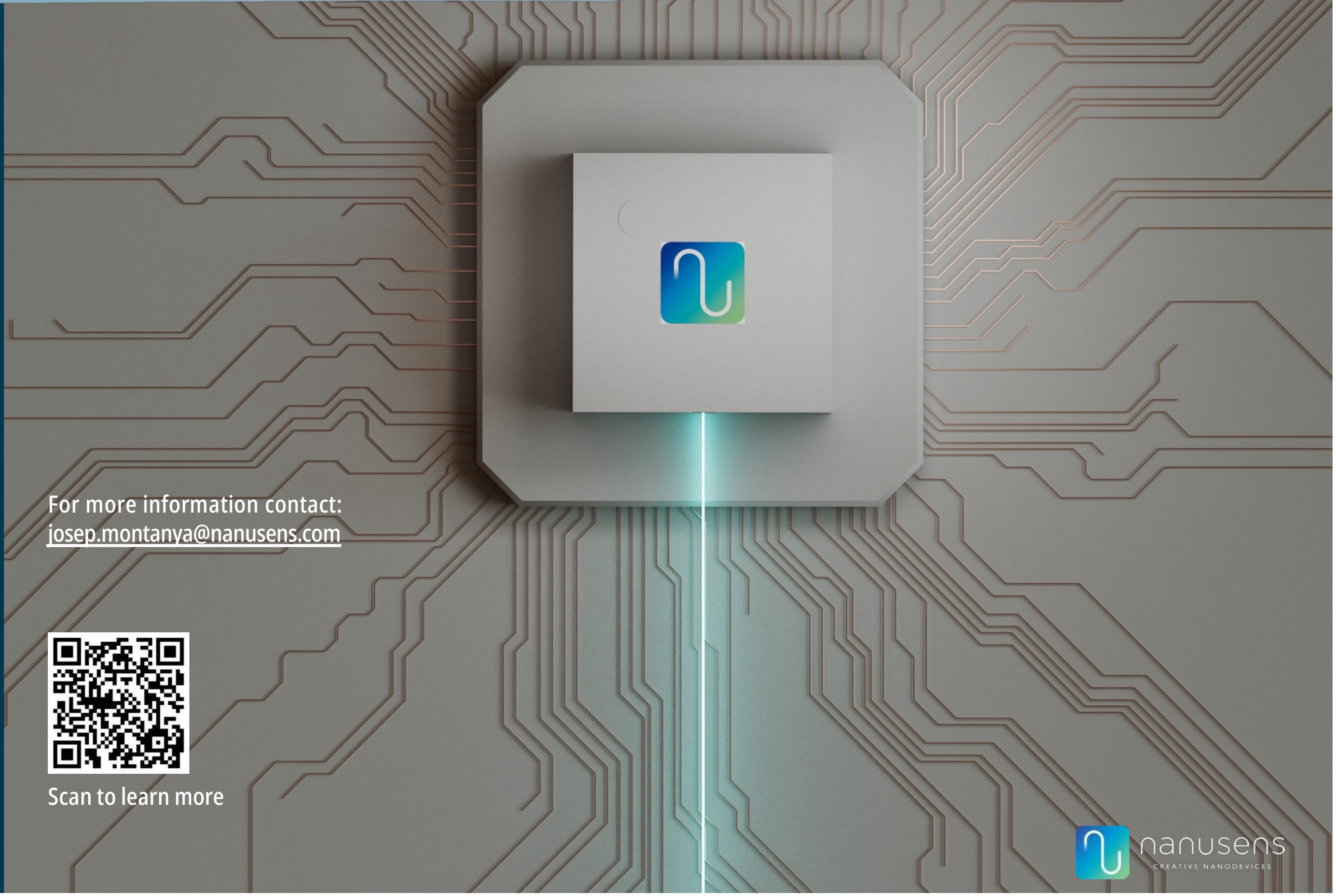
- $8m (£6m) in exchange of 20% Equity
  - Finalize first product
  - Design win
  - Series A
- Proven Technology
- Blocking patent portfolio
- Finishing first product & clear route to market
- Discussing formal engagement with major RF corporation
- Approaching main AI chip vendors and suppliers to provide our silicon photonics IP
- Excellent Team, Board of Directors and Advisors Network
- Exit: trade sale or IPO



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