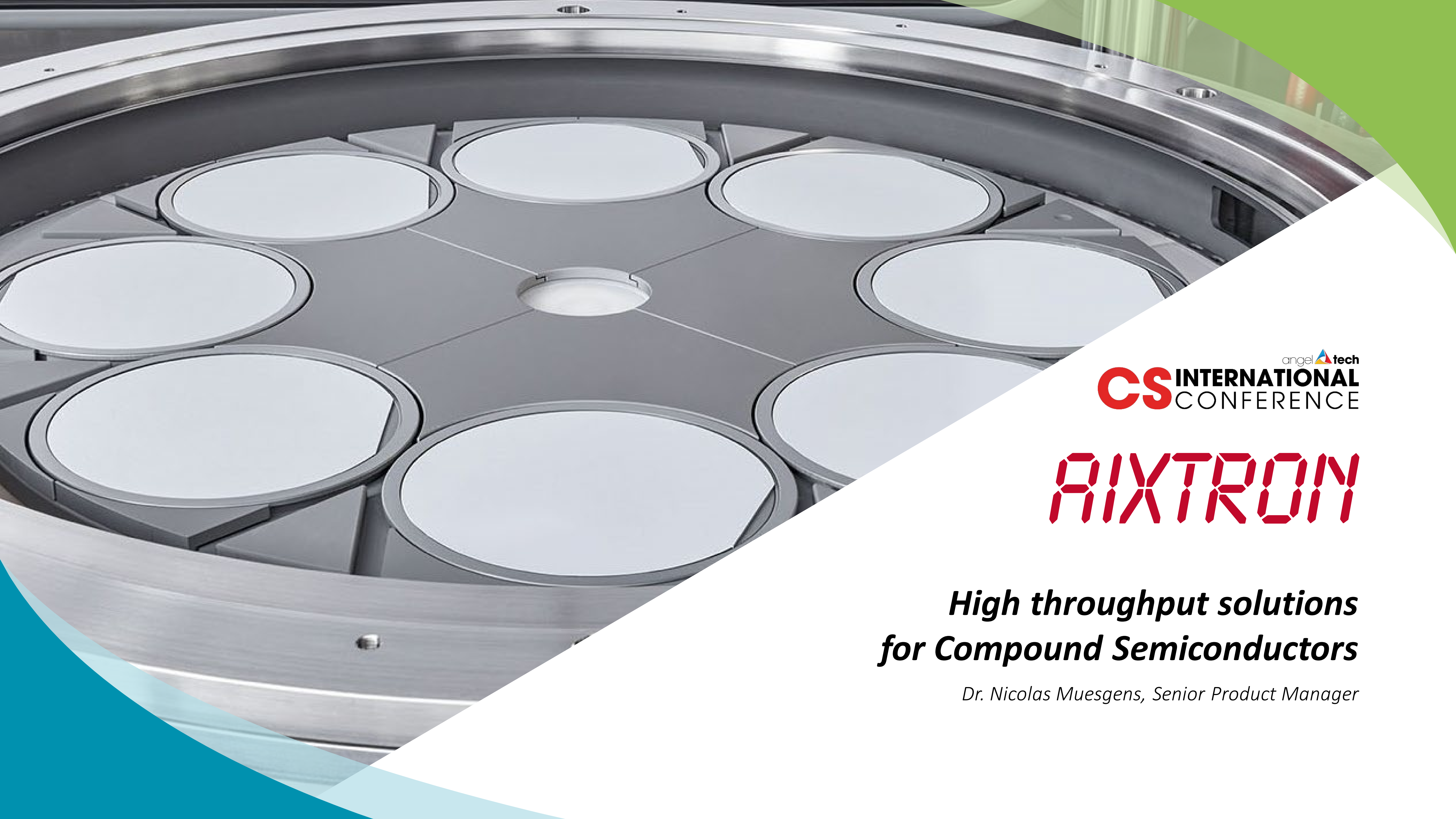


angel tech
CS INTERNATIONAL CONFERENCE

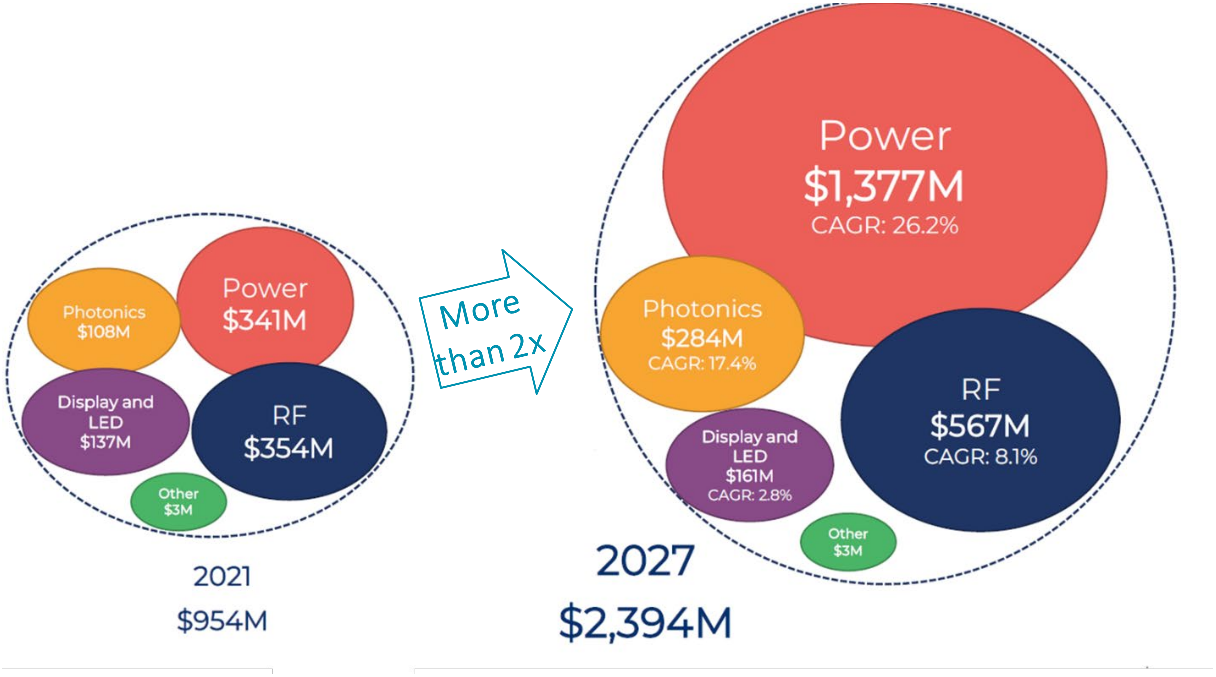
AIXTRON

High throughput solutions for Compound Semiconductors

Dr. Nicolas Muesgens, Senior Product Manager

Compounds semiconductors are unlocking one application after another
Power Electronics leads the pack with 4x growth until 2027

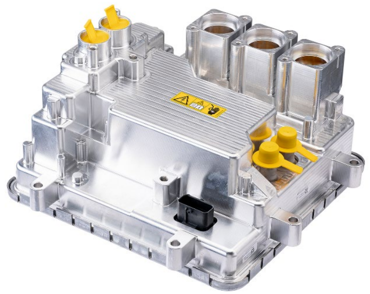
Compound market to double until 2027



Power Electronics have highest growth of all segments

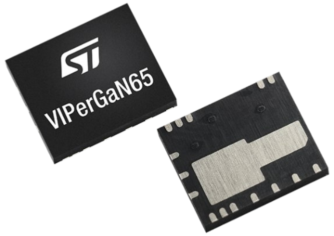
SiC Power devices electrifies most performing EV cars

Ex: 800V Vitesco SiC inverter to be used in E-MGP platform for Hyundai Electric cars



GaN Power devices leads the revolution for Mobile device charging and Data Centers power efficacy

Ex: ST Micro ViperGaN product family fully dedicated to 65-100W Rapid chargers



Source: Yole, Compound Semiconductors Report 2022

Compounds semiconductors are unlocking one application after another Power Electronics leads the pack with 4x growth until 2027

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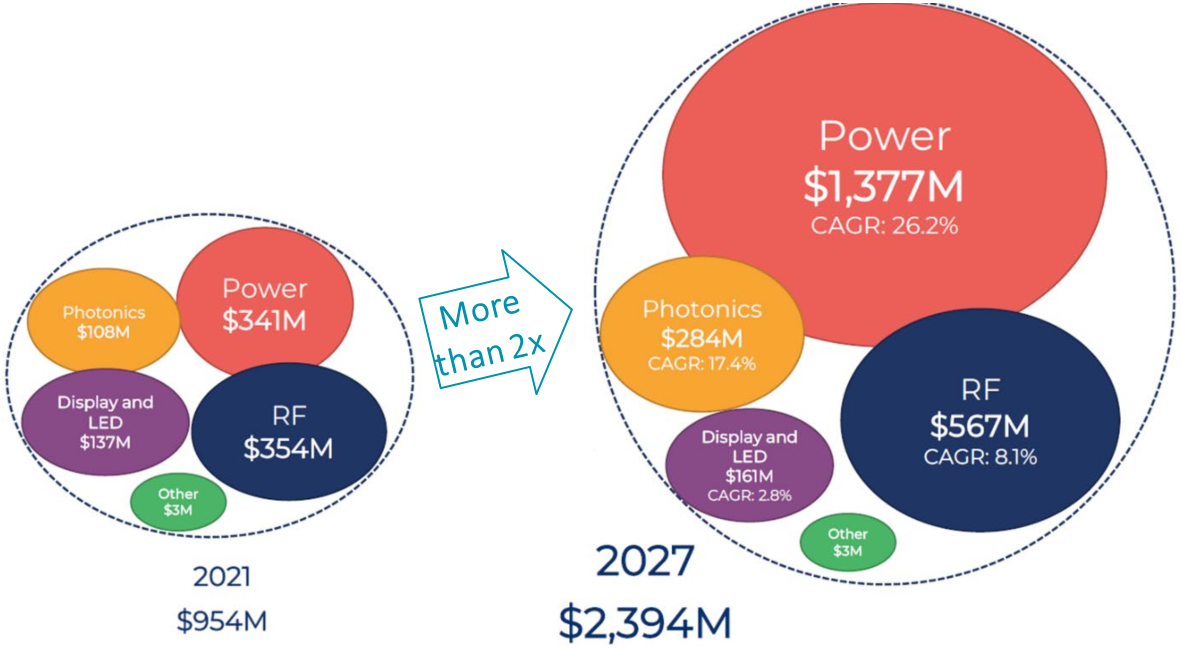


Source: Yole, Compound Semiconductors Report 2022

Our Solutions for SiC & GaN Power devices

SiC Power devices

G10-SiC

GaN Power devices

AIX G5+ C

The new G10-SiC packs unmatched productivity and epi performance for both 150 & 200mm wafer sizes

The new G10-SiC solution

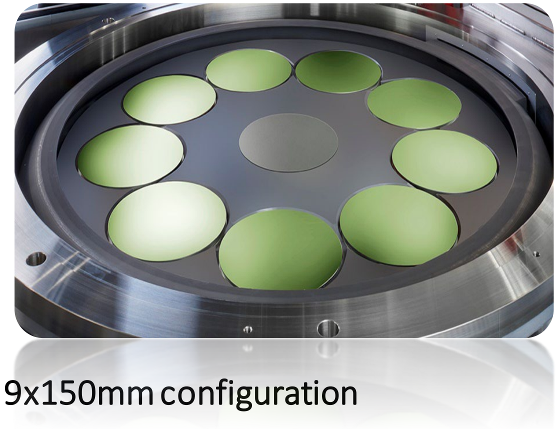
Designed to support most aggressive Production Ramp up on 150 and 200mm

1. 150 & 200 mm – dual wafer size capable – safeguard investment into the future
2. Highest epilayer uniformity enabled by new quad injection technology
3. Unmatched process stability/control
4. Ease of operations and maintenance (Automation & Advanced operation models)
5. Highest wafer throughput at lowest cost per wafer in the market

1 The G10-SiC is optimized for both 150 and 200mm Wafer size

One chamber – two configurations

6x200 mm configuration

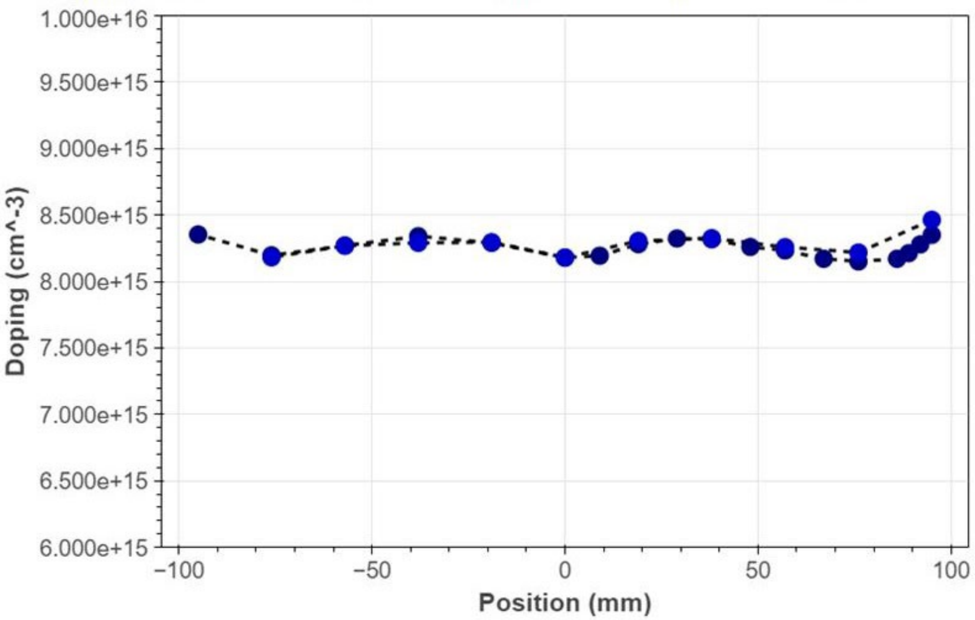


9x150mm configuration

- Enlarged reaction chamber compared to G5 WW C to host 6x200 mm configuration
- Reaction chamber, RF coil and gas injector with improved cooling capacity for higher reactor temperature (T_{max} = 1700°C) – safeguarding tomorrow Process requirements
- Change between 6x200 mm & 9x150 mm configuration by simple exchange of susceptor (routine maintenance)

2 Highest epilayer uniformity enabled by new quad injection technology

Doping uniformity on 200 mm

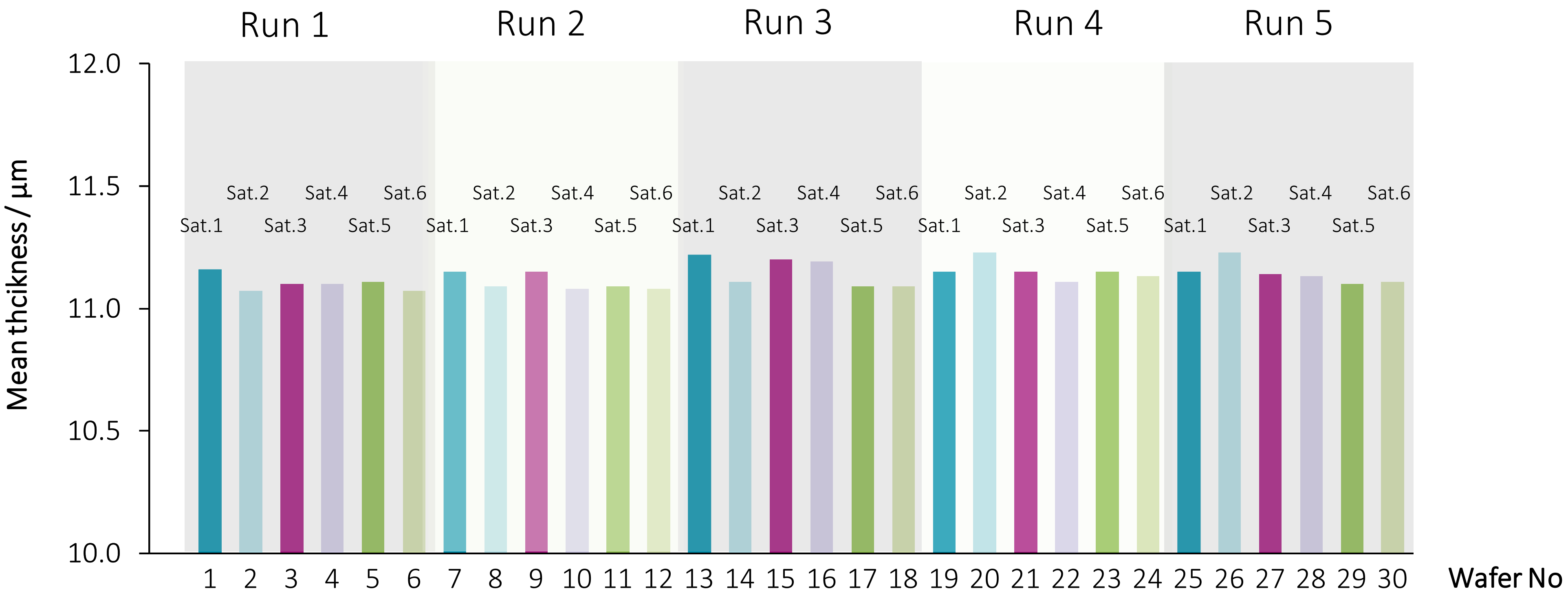


Sigma/mean < 0.9% (200 mm on-wafer)
(Max-Min)/mean < ± 1.9% (all wafer, all points)

- Gas injection via new quad injection technology featuring additional 4th dopant gas channel
  - Flattest doping profiles to date on 200mm substrates *"best in class"*
  - No edge effect
  - Applicable to 6x200 & 9x150 mm configuration

③ Unmatched process stability/control

Mean Thickness Uniformity over 30 wafers (5 consecutive runs)

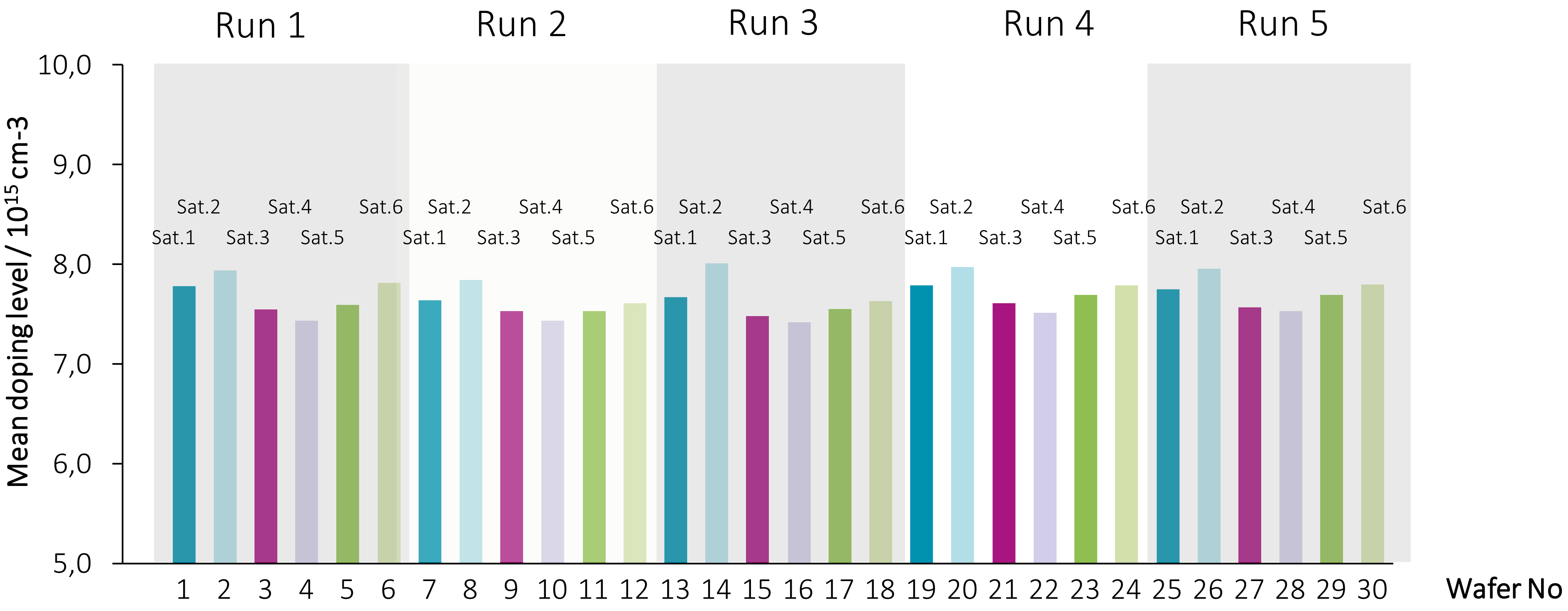


No epi recipe parameter change over 5 runs

Mean Thickness uniformity (30 wafer, 5 runs)	sigma[mean1-30]/mean	<= 1%

No process tuning run to run

3 Unmatched process stability/control
Mean Doping Uniformity over 30 wafers (5 consecutive runs)



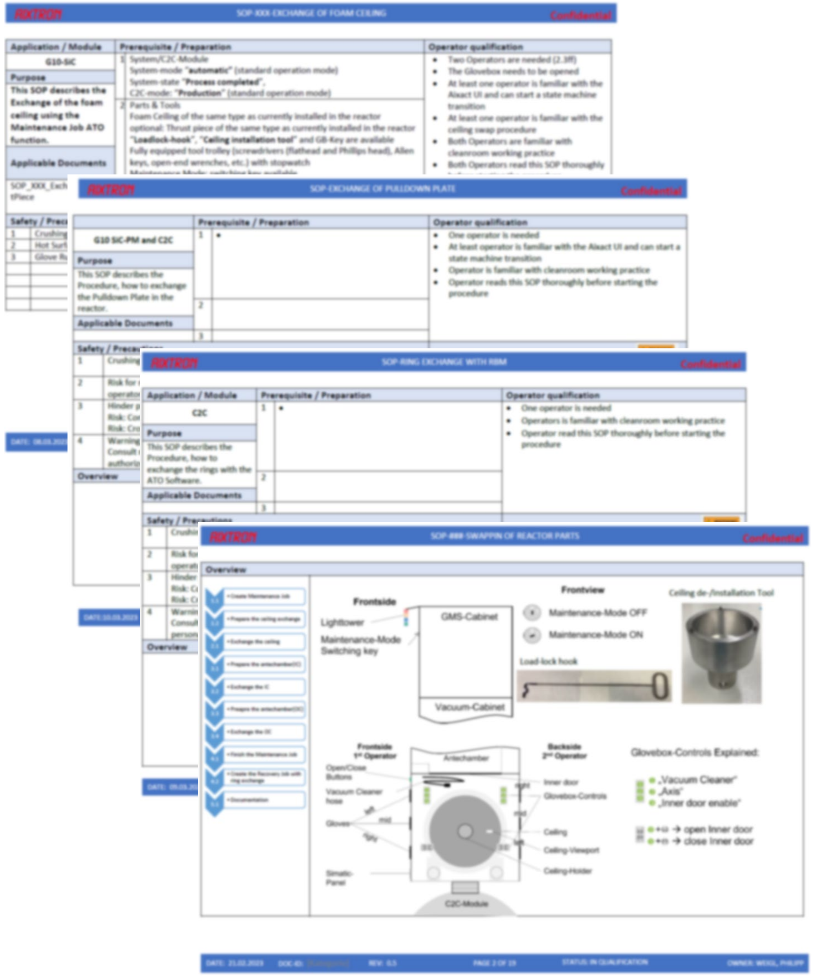
No epi recipe parameter change over 5 runs

Mean Doping uniformity (30 wafer, 5 runs)	sigma[mean1-30]/mean	<= 2.5%

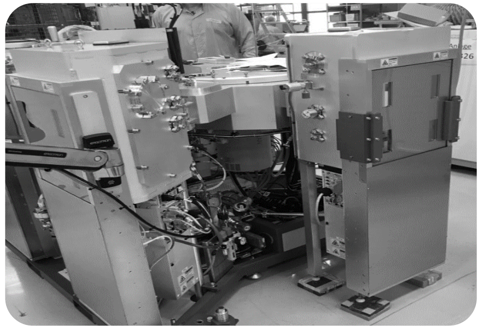
No process tuning run to run

4 Ease of operation & maintenance

New operation and support model



- Standard Operation Procedure (SOP) for all relevant maintenance steps to ensure fast and flawless execution of routine maintenances
- Fast system recovery with standardized recovery recipes provide by AIXTRON
- Ring buffer module on C2C handler for hot swap of components and “zero downtime”



Ring Buffer Module (RBM)
on automation module

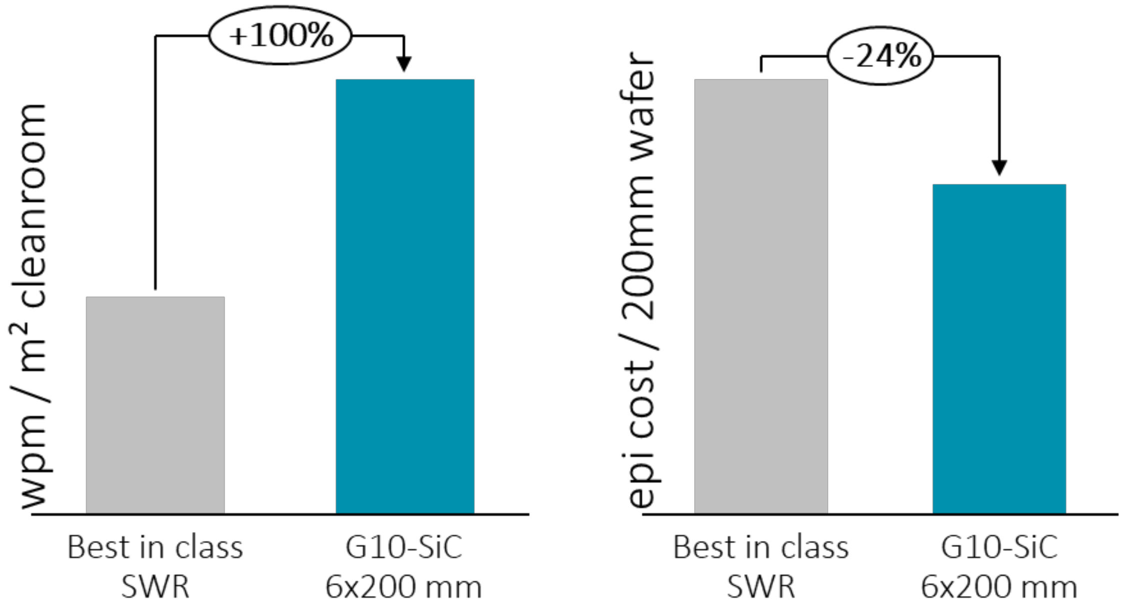
5 G10-SiC enables highest throughput per area at lowest cost/wafer

SiC application

SiC 1200V MOSFT epi on 200mm SiC

highest wafer output
per m² cleanroom area

lowest cost/wafer



AIXTRON can provide double output and revenue per fab compared to competition, at higher margin rates

AIX G5+ C addresses existing GaN power market demands

650V application

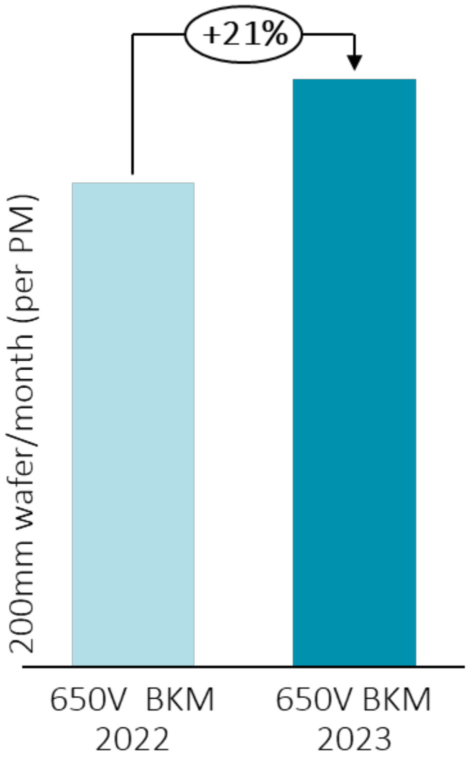
Source: https://www.digitalcameraworld.com/buying-guides/best-gan-charger

Fast charger

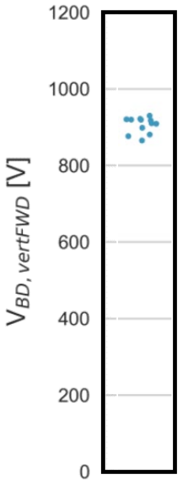
Source: https://www.datacenterknowledge.com

Data Center

AIXTRON improved 650V BKM



Vertical buffer breakdown voltage
(1µA/mm² @ 25°C)



In collaboration with imec

~5 µm epi structure (on 950µm Si substrates)

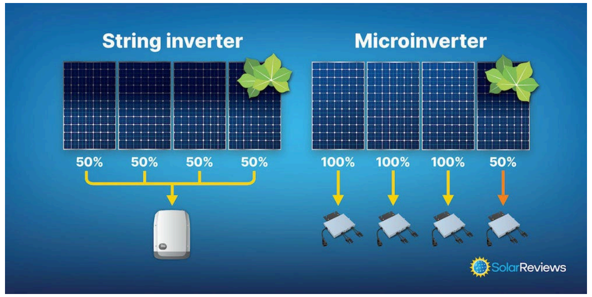
Dedicated throughput improvement program (e.g. shorter cleaning, faster transfer…)

AIX G5+ C addresses existing GaN power market demands

Low voltage application

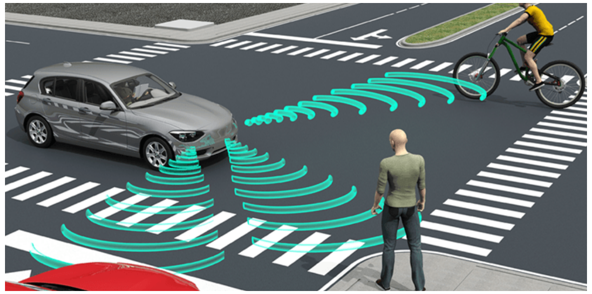
Source: https://www.technics.com/

Class-D Audio



Source: https://www.solarreviews.com

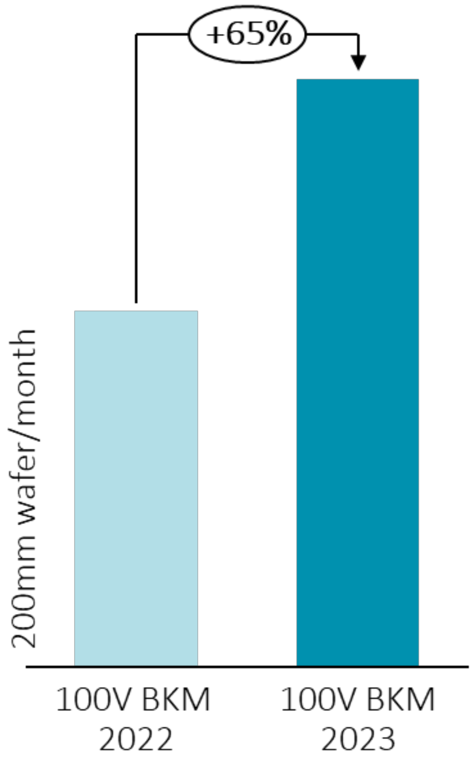
**Solar
Micro Inverter**



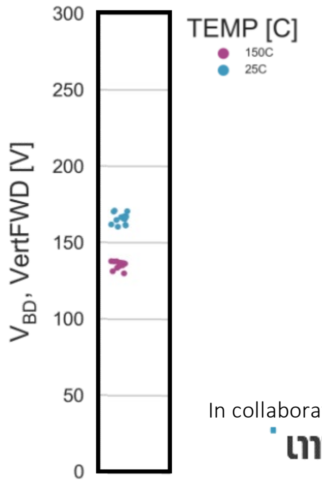
Source: https://epc-co.com/

Lidar

AIXTRON new 100V BKM



Vertical buffer breakdown voltage
(1μA/mm²)



In collaboration with imec

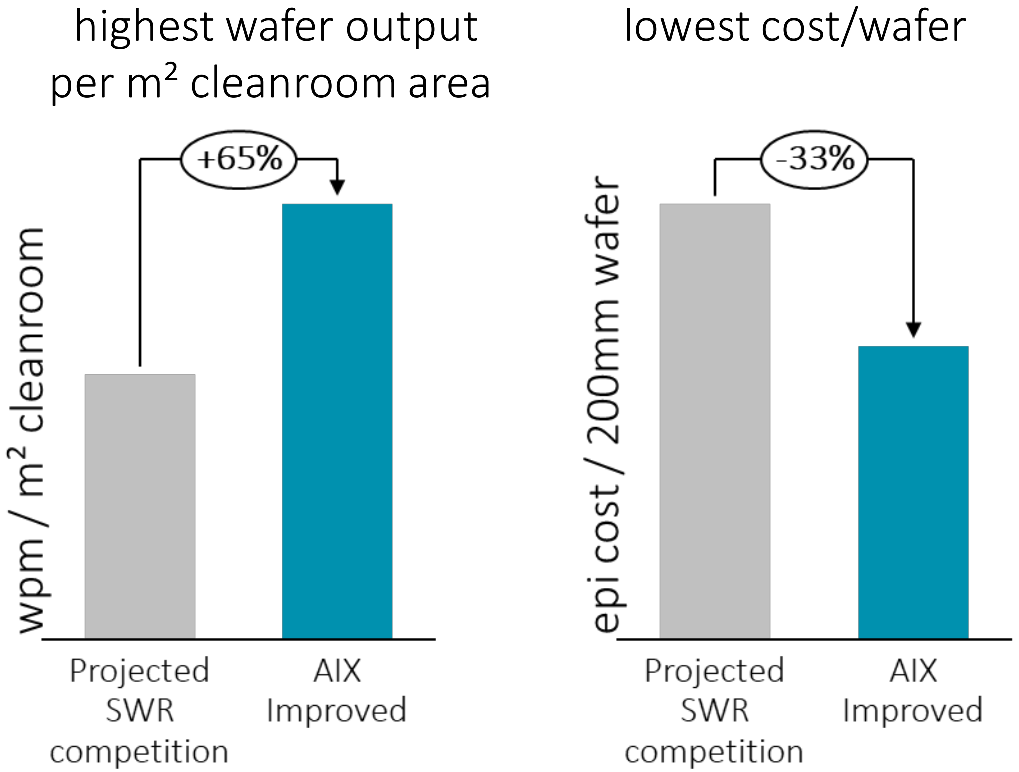
*~1.3 μm epi structure
(on 725μm Si substrates)*

**Dedicated throughput optimized 100V stack
(e.g. new epi stack, shorter cleaning…)**

AIX G5+ C leads the market with highest throughput per area at lowest cost/wafer

GaN application

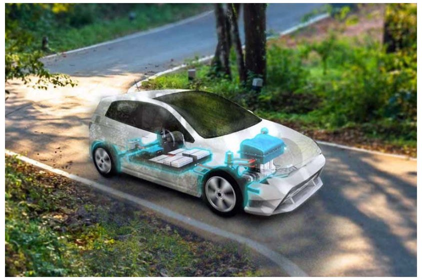
650V GaN HEMT epi on 200mm Si



Planetary reactor technology benefits from YoY Cost reduction programs !
Secures highest throughput and revenue for your fab, at highest margin rates

AIX G5+ C addresses existing GaN power market demands… …as well as tomorrow's growth market

>650V application



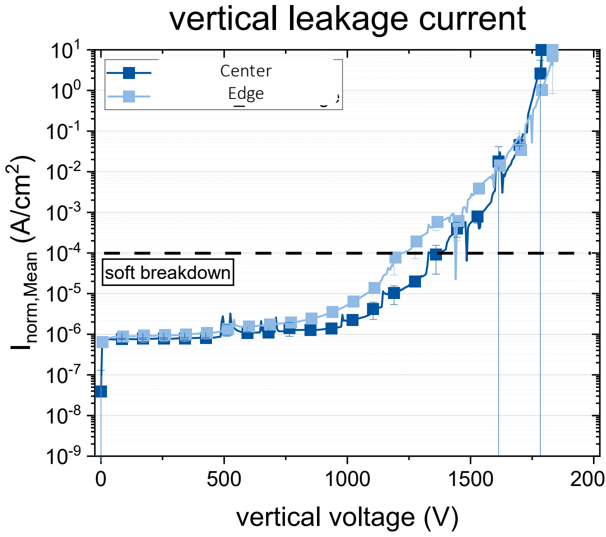
Automotive

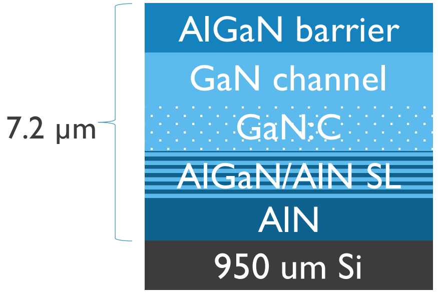
Source: https://components101.com/

Source: https://gansystems.com/newsroom/gan-based-800v-on-board-charger/

AIXTRON new 1200V BKM

> 1200 V soft breakdown @ 10^{-4} A/cm^2





AIXTRON addresses existing GaN power market demands…
…as well as tomorrow's growth market

GaN on 300mm wafer size

AIXTRON's new 300mm GaN product based on long-proven CCS performance on 300mm

System design based on proven 300mm CRIUS R (launched back in 2009)

- Proven track record at Customer
- Product focus: high yield
    - excellent uniformity
    - low particles

AIXTRON CRIUS R

- 1st tool shipped to cea leti

AIXTRON to roll out new series 300mm reactors

Advantage of AIXTRON CCS Technology for 300mm epitaxy

"Real" showerhead reactor technology

- Uniform gas flow distribution over the wafer
- Full on-wafer temperature control at all times
- Low rotation speed = lower stress on wafers

Wide process window

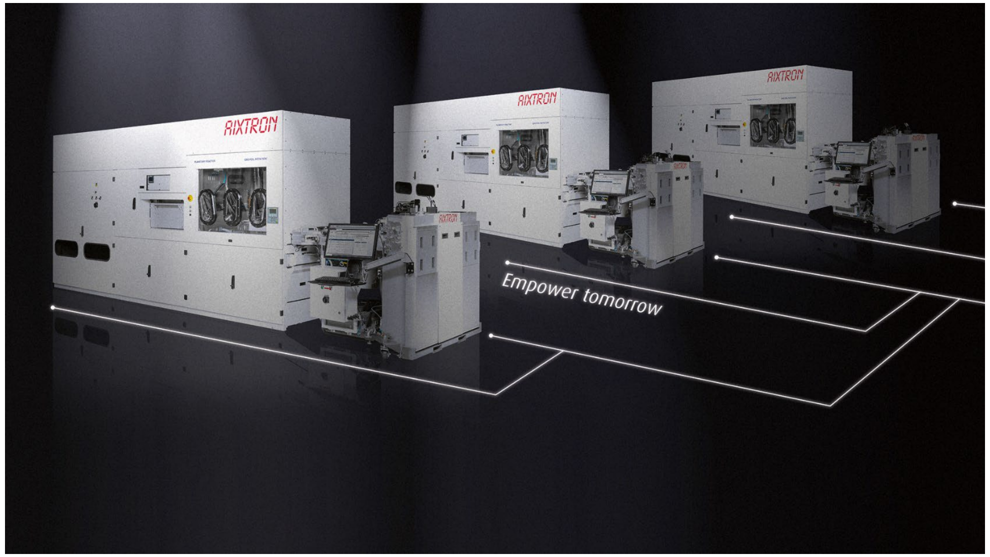
- Ideal laminar flow concept
  access to low- and high-pressure epi capability
- High MO efficiency

Fully automated MOCVD Technology

- Cassette-to-cassette loading with FOUP front-end
- *In-situ* cleaning technology
  no part exchange for long campaigns (>100+ runs)
  no part air exposure between runs, no contamination

AIXTRON develops highest productivity platforms to warrant you will always capture new opportunities

- **Strong market push for very productive tools per area** of cleanroom – with highest pressure for GaN and SiC Power devices market
- **AIXTRON Planetary batch reactor technology** enables highest wafer output / cleanroom area at **lowest cost/wafer** for both, SiC and GaN application
- Revitalized **AIXTRON GaN 300mm platform** based available to serve early 300mm epi demands



AIXTRON

Our technology. Your future.

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