



Industrial Power Control Business Update

11 May 2022

Dr. Peter Wawer, Division President Industrial Power Control
Dr. Peter Friedrichs, Vice President Silicon Carbide



We empower a world of unlimited **GREEN** energy!



We are #1 semiconductor supplier for **renewable energies**



We **increase energy efficiency** and reduce electrical losses along the electrical energy chain



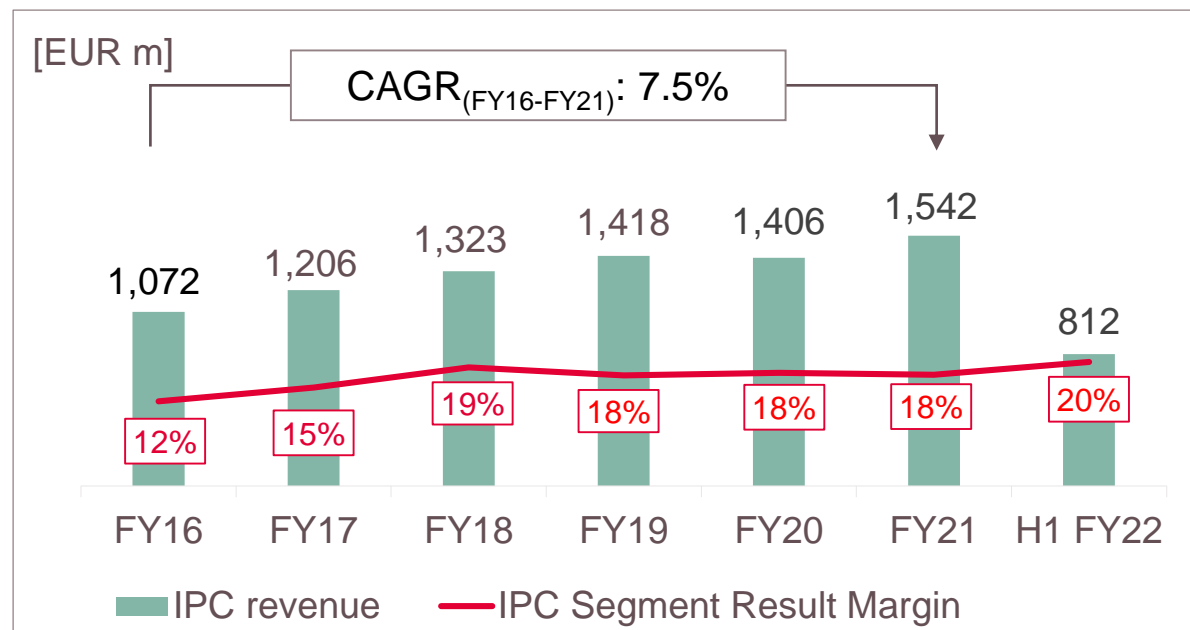
We will become **carbon-neutral by 2030**, reaching 70% CO₂ emissions reduction target in 2025 (Scope 1 and 2 emissions)



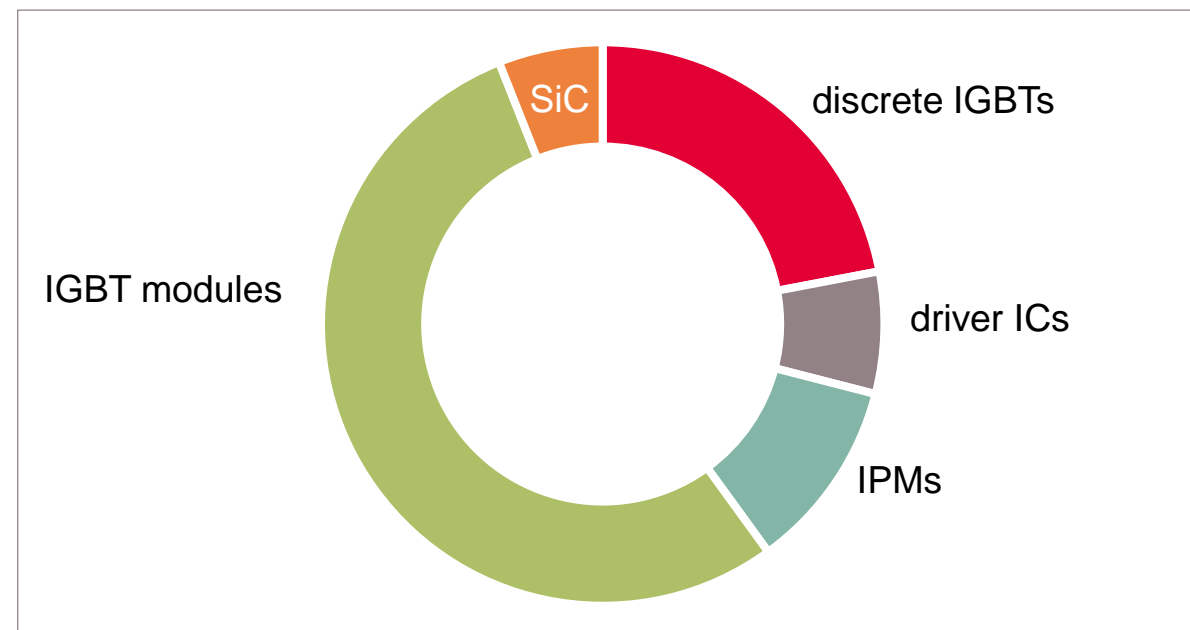
We contribute a **CO₂ reduction** of >54 million tons with our products

IPC at a glance

IPC revenue and Segment Result Margin











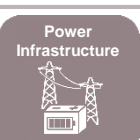



FY21 revenue split by product group (indicative)



Key customers

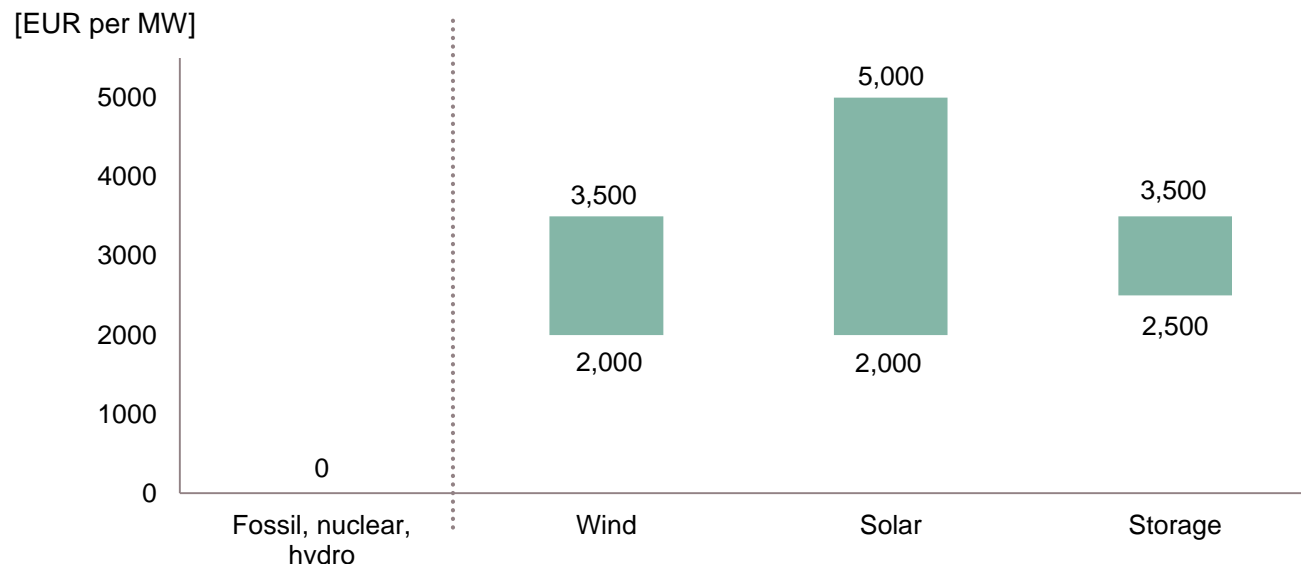


Majority of target applications show continuous positive market outlook; growth rates returning to normal long term patterns

Applications (% of FY21 segment revenue)	Market Outlook for CY22	
 Automation and Drives ~35%		> Growth rates remain above long-term averages after strong recovery in CY21; currently no signs of softening
 Renewable Energy Generation ~26%		> Analyst updates wind installations forecast to show 10% growth compared to CY21 (in GW) > PV installations remain in double-digit growth
 Home appliance ~17%		> After strong growth surge in CY21, demand is softening but still driven by energy efficiency incentives for major appliances
 Transportation ~5%		> Overall expectations dominated and dampened by still delayed recovery for traction in China
 Power Infrastructure ~9%		> Strong growth of xEV driving charging infrastructure; continuous installation of renewable energy generation driving energy storage systems
 Others ~8%		> Long-term positive outlook driven by general trend of electrification in emerging applications (e.g. eMarine)

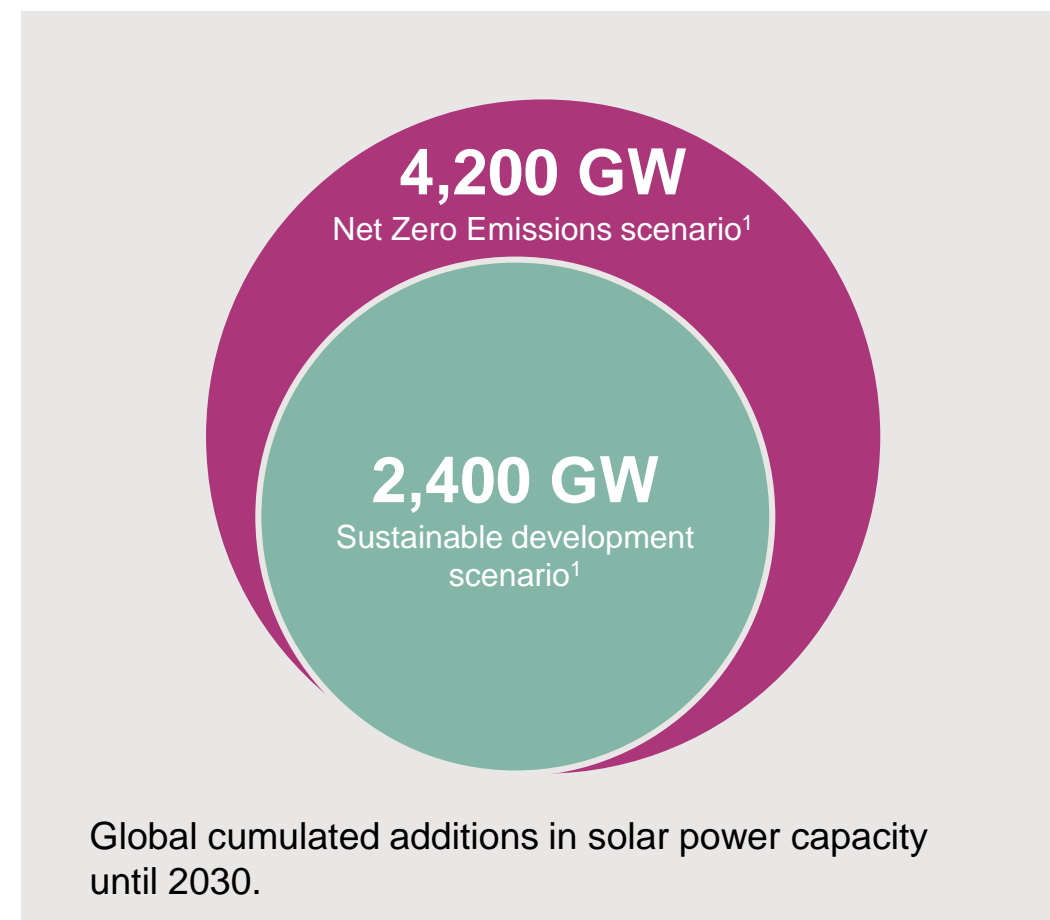
Green energy generation provides large business opportunities

Power semiconductor content by application



Additions in 2020	[GW]	114	134	5 ²
Ø 2021 – 2030 annual additions Sustainable development scenario ¹		110	240	22 ²
Ø 2021 – 2030 annual additions Net Zero Emissions (NZE) scenario ¹		240	420	33 ³

Upside potential: example solar power



¹ IEA: *World Energy Outlook*. October 2021 | ² Based on or includes content supplied by IHS Markit Climate and Sustainability Group: *Grid Connected Energy Storage Market Tracker H1 2021*. August 2021
³ Extrapolation; conservative assumption of equal ratio renewable generation to storage capacity

Increasing share of renewables require stronger grid

Planned HVDC lines in Germany



Source: TransnetBW GmbH

Infineon's 4.5 kV IGBT modules enable HVDC lines

- › HVDC – High Voltage Direct Current lines are the technology of choice to strengthen the grid
- › Converter stations are equipped with power semiconductors
- › Infineon offers highly robust, low-loss 4.5 kV IGBT solutions
- › 6.5 kV IGBT is in development and will complement offering



4.5 kV IGBT module in IHV-B housing

Converter station



Source: Siemens Energy

State-of-the art charging infrastructure powered by Infineon gives a perfect P2S example



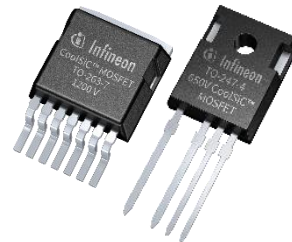
1 **Controller**
AURIX™ microcontroller



2 **EiceDRIVER™ gate driver ICs**
EiceDRIVER™ enhanced



3 **CoolSiC™ switches**
650 V/ 1200 V CoolSiC™ MOSFETs



1200 V in EasyPACK™



System solution enables...



> Fastest charging cycles



> More compact designs with up to **+30% power density**



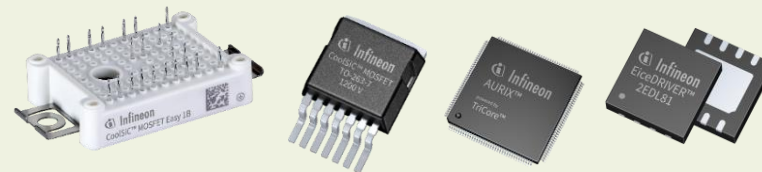
> Highest lifetime and reliability

Enabling the microgrid: 3 in 1 solution with inverter, bi-directional charging and storage using Infineon's CoolSiC™ devices



3in1

- › Solar inverter
- › EV Charging bi-directional
- › Energy storage



The new Developer Community lets us engage closely with our customers

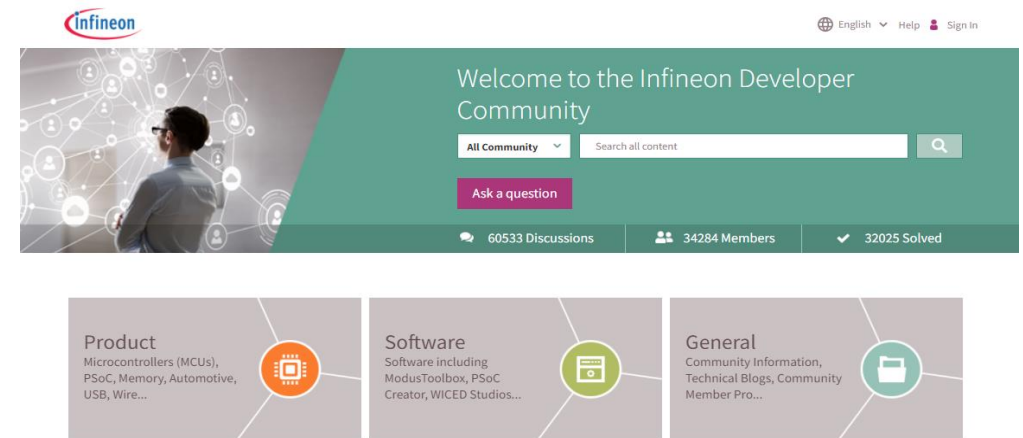
One customer's question...



answered once ...

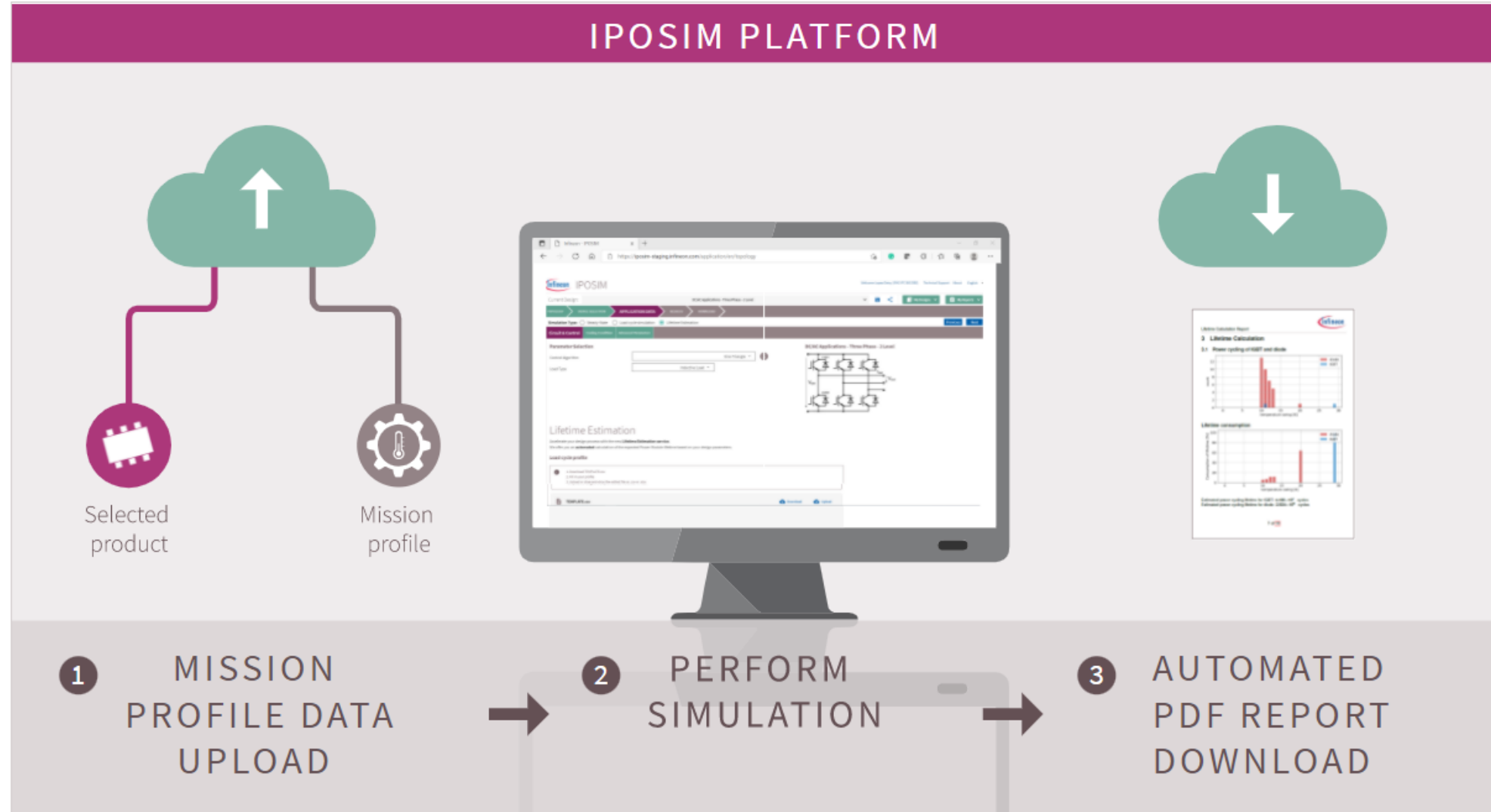
- 1 Developer Forum
- 2 Knowledge Base Articles
- 3 Technical Blog Articles

could serve thousands more - 24/7!



Infineon Developer Community

34K users
60K discussions
>300K monthly page views





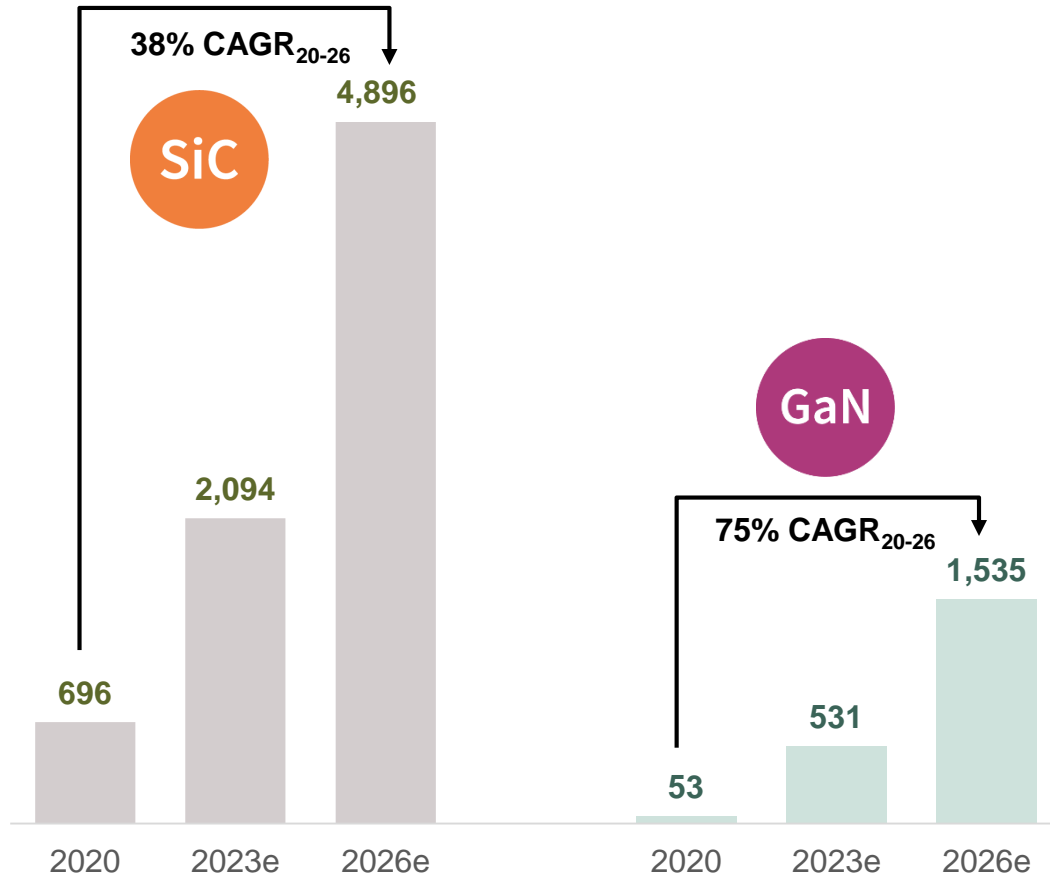
The game changers – a recipe for WBG success



Infiniteon is excellently positioned to leverage its wide bandgap - WBG portfolio to provide additional value for its customers

WBG market development¹

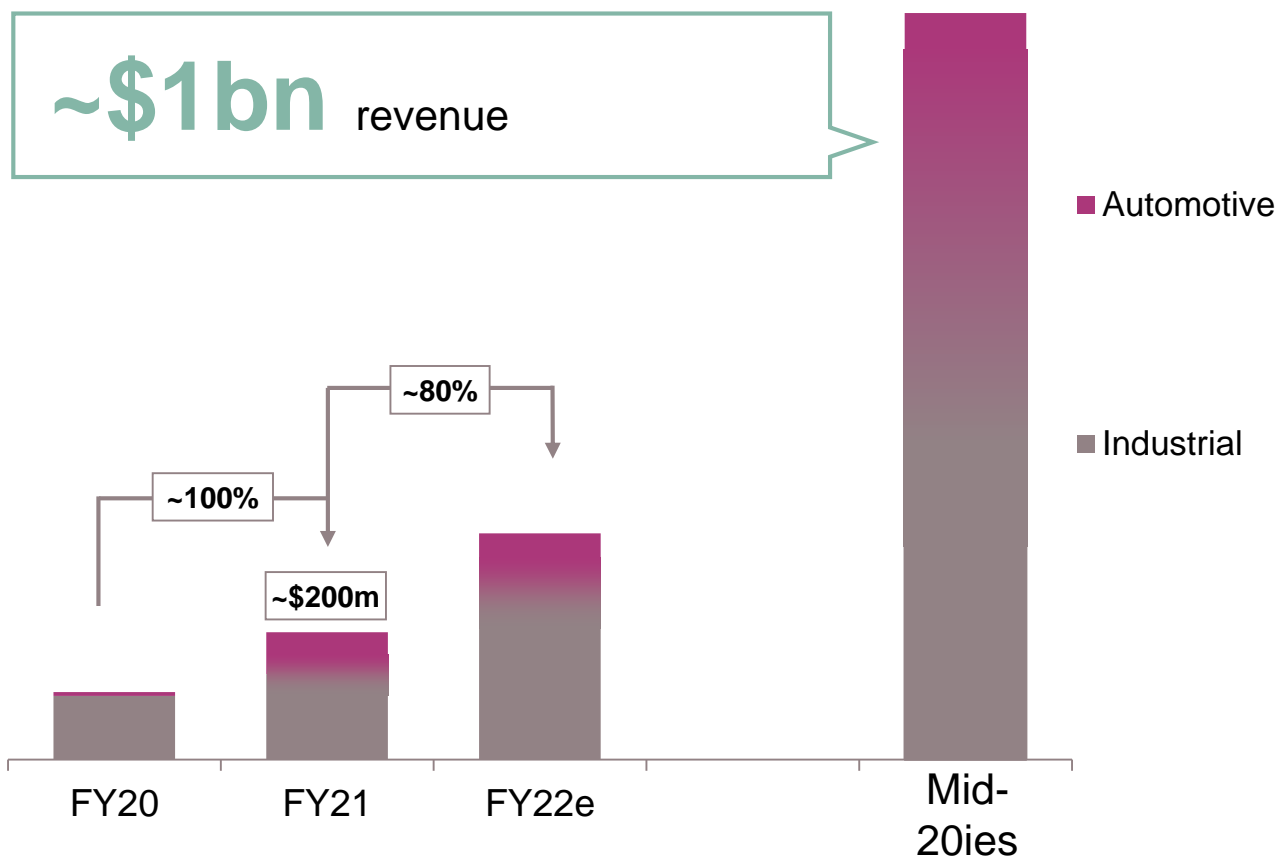
Total market [in million USD]



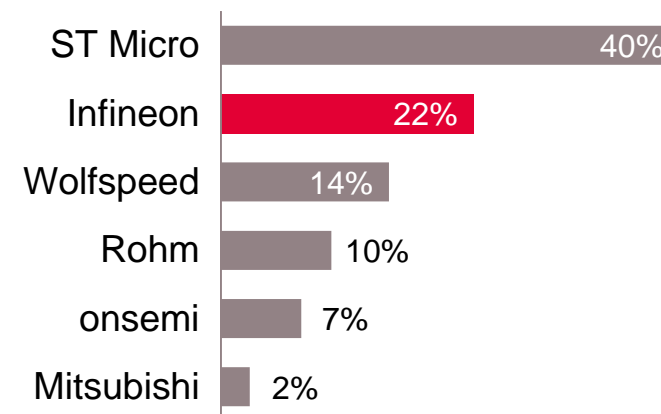
¹ Yole Développement: *Compound Semiconductor Quarterly Market Monitor*. Q1 2022

SiC – US\$ 1 billion revenue in sight

SiC revenue development



SiC power devices¹ 2021 total market: \$1,137m

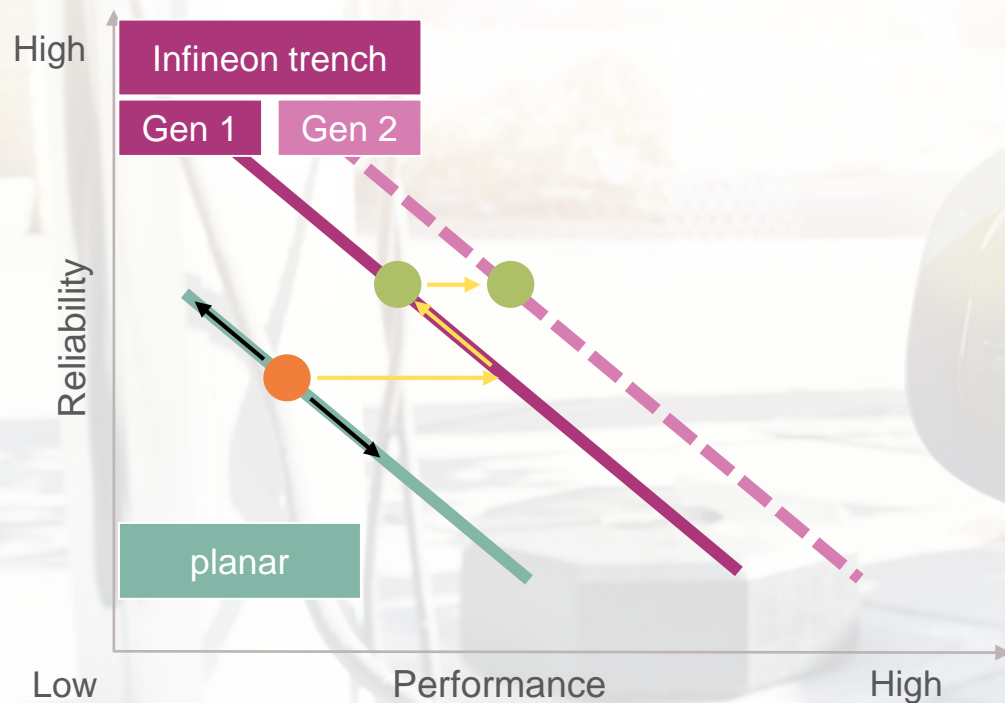


- › Solid #2 position in SiC device market
- › Highest yoy growth of all peers
- › Broadest portfolio fits customers' individual needs
- › First product qualified on Cold Split technology

¹ Yole Développement: *Compound Semiconductor Quarterly Market Monitor*. Q1 2022

CoolSiC™ trench design optimized performance and reliability

Infineon's trench technology moves the boundaries



Instead of exploiting full potential of performance, Infineon turns part of this budget into much higher reliability



Infineon offers the most comprehensive WBG-portfolio

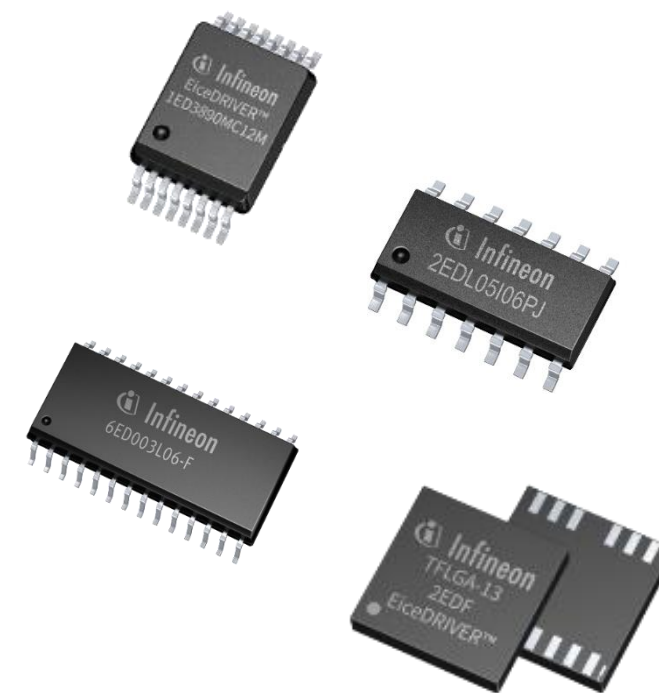
CoolSiC™

Package options Voltage class	Diode		Hybrid		MOSFET				
	Discrete	Bare die	Discrete	Modules	Discrete	IPM	LP module	HP module	Bare die
650 V									
1200 V									
1700 V									
2000 V									
High voltage									

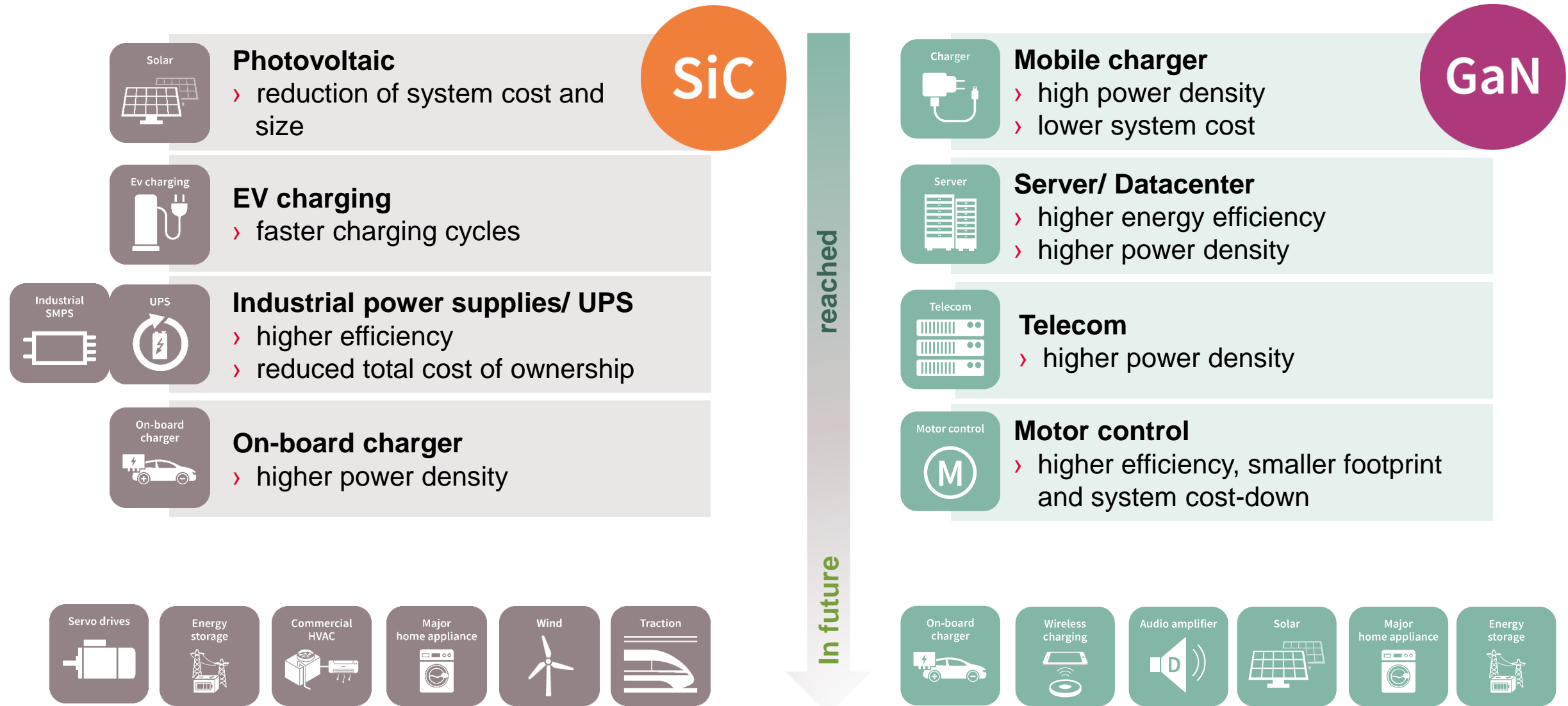
CoolGaN™

Package options Voltage class	Gate injection transistor HEMTs discrete						Schottky gate HEMTs discrete			IPS Half-bridge		IPS1 channel
	TOLL	TOLT	DFN		DSO		QFN			QFN		QFN
	H5OF-8-3	HDSOP-16-3	DFN 8x8 mm	ThinPack 5x6 mm	TSC	BSC	PQFN3x5 ED/OM	PQFN3x3 ED/OM	Laminate 5x6 Center / corner gate	6x8 mm	8x8 mm	8x8 mm
100V												
400 V												
600 / 650 V												

Complementing vast portfolio of CoolSiC™ and CoolGaN™:
The right-fit EiceDRIVER™ gate driver ICs

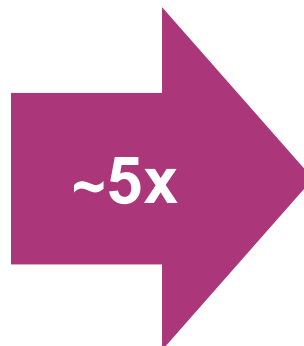
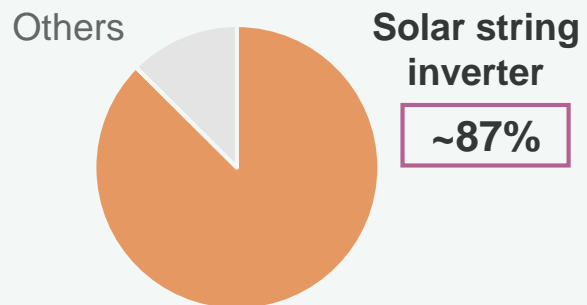


WBG addresses high growth markets – various applications have reached their tipping points and more to follow

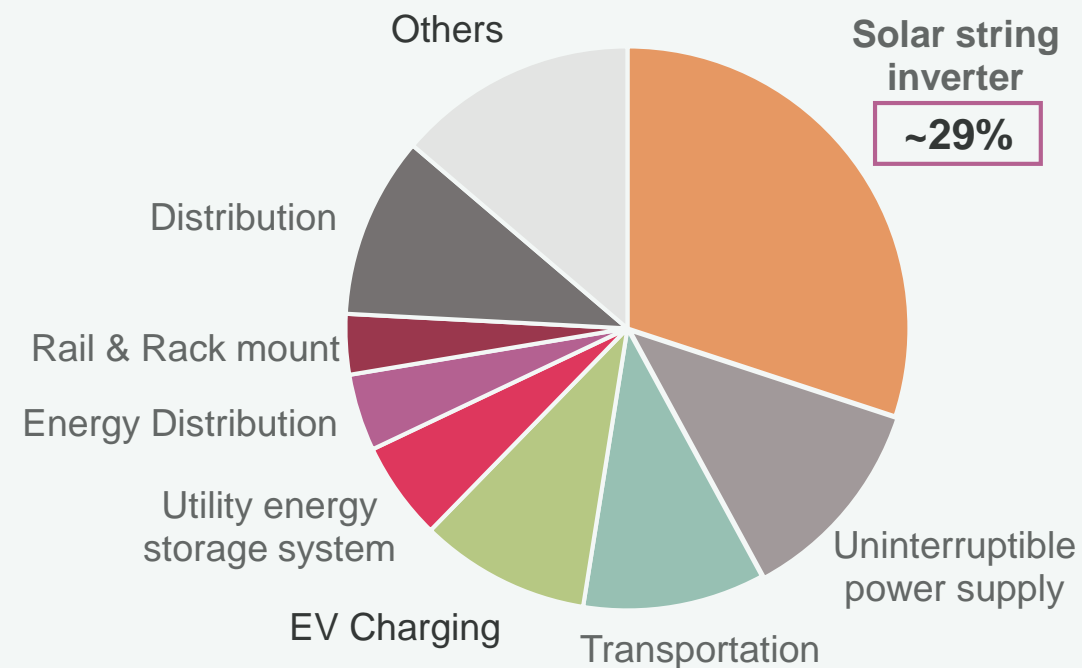


IPC quintupled the SiC design wins

IPC SiC design wins FY17



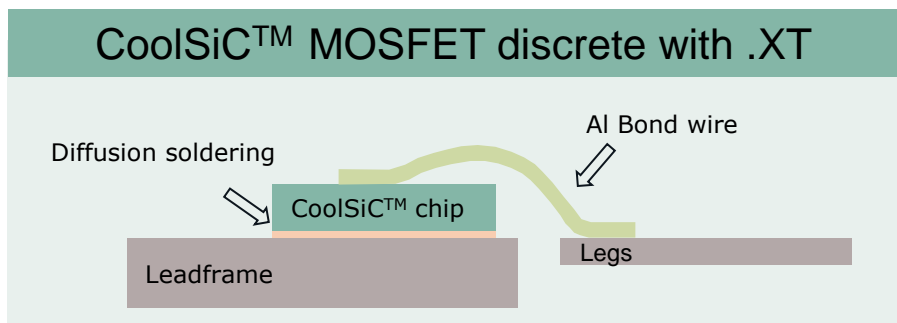
IPC SiC design wins FY21



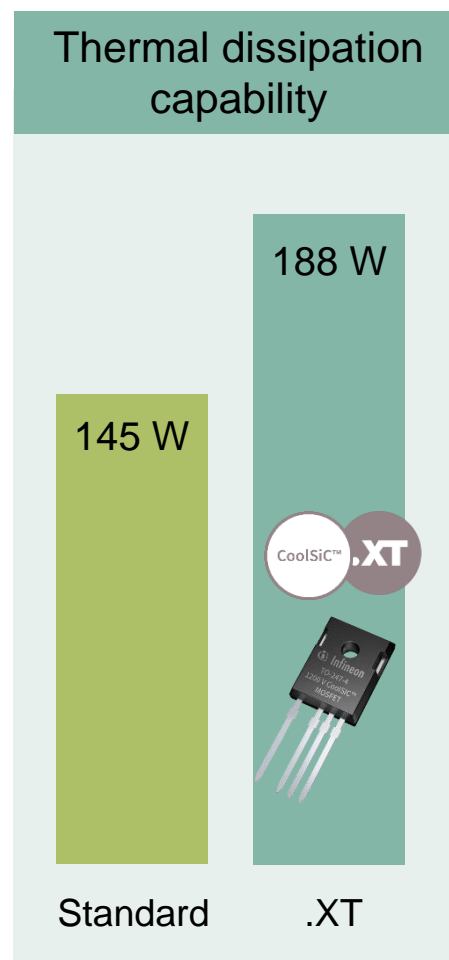
Starting as a key success factor in solar, SiC becomes designed-in into more and more applications

Diffusion solder in our .XT technology enables higher power density

.XT technology



- › New die attach process enables a significant improvement of the thermal impedance
- › Compensates for the drawback of small die due to low area specific resistance if nominally identical devices are compared
- › Simplification of assembly process due to lack of solder layer



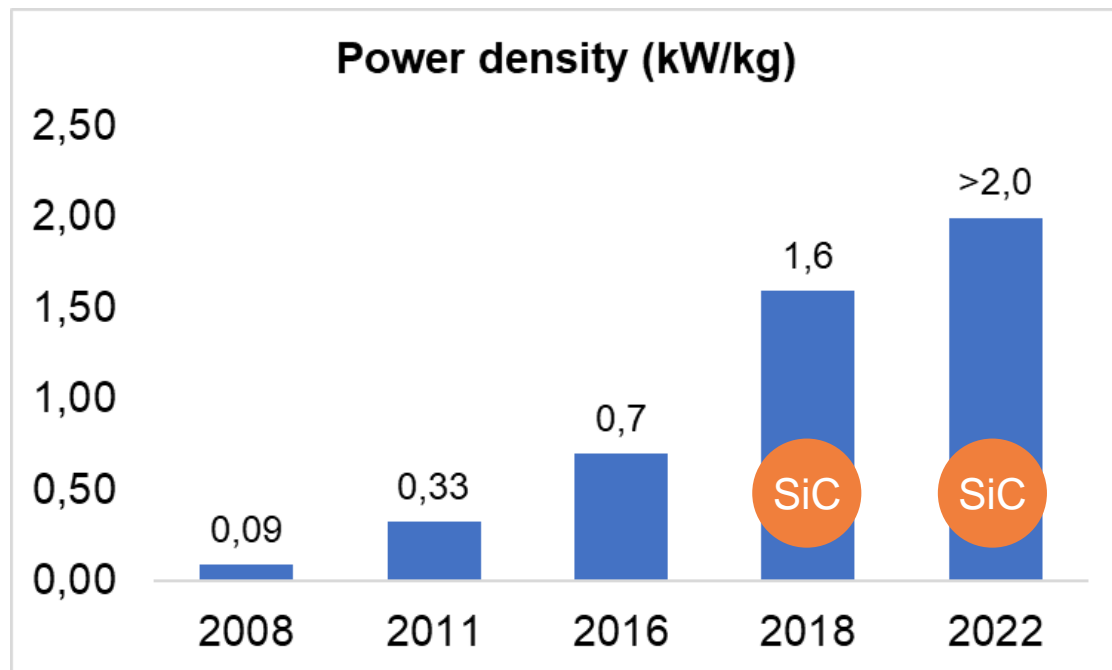
Award presentation ceremony



› Foto: Marc-Steffen Unger

Infineon establishes a new voltage class with SiC 2 kV MOSFET

SiC 2 kV MOSFET



Saving weight



Energy storage



Future charging



Solid-state transformer



Photovoltaic

Field test of XHP™ 2 module with SiC MOSFET successfully concluded

Product

XHP™ 2
SiC MOSFET



Application



SIEMENS Avenio Streetcar

Outcome

- › One year in operation transporting passengers
- › 65,000 kilometers
- › **10% energy savings**
- › **Reduction of motor noise**

Voice of Customer



“The project [...] shows that we can not only optimize the noise levels of our vehicles but also improve our energy efficiency. **We would be very interested in this solution if these improvements could be commercially mass-produced.**” Ingo Wortmann, Head of Mobility at Stadtwerke München

Expansion of SiC and GaN capacity follows our long-term strategy

> €2bn investment to build a 3rd module at our site in Kulim



Rationale

- › Seize structural growth opportunities linked to electrification
- › Prepare manufacturing cluster for acceleration of WBG
- › Create higher resilience of WBG supply by further expanding capacities with Kulim 3 and in Villach
- › Leverage economies of scale

Total frontend investment	> €2bn	
Revenue potential	~ €2bn per year	
Groundbreaking	January 2022	
Start of construction	June 2022	
Ready for equipment	Summer 2024	
First volumes out	Second half of calendar year 2024	

Megatrends provide sustainable market growth – Differentiation on all levels to ensure our position as market leader



IPC **outperformed the market** over the past five years and was particularly resilient during the COVID pandemic

IPC is on a **sustainable profitable growth path** driven by the megatrend **decarbonization**

IPC with its profitable **SiC portfolio** is actively driving and shaping the transformation towards wide bandgap **as leader in industrial applications**

Our P2S approach will be strengthened by **application focus** with a system offering including more and more **reference designs, software** and **digital services**



Part of your life. Part of tomorrow.

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Disclaimer

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