现代充电桩技术EVC充电桩

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简短EVC概述发展

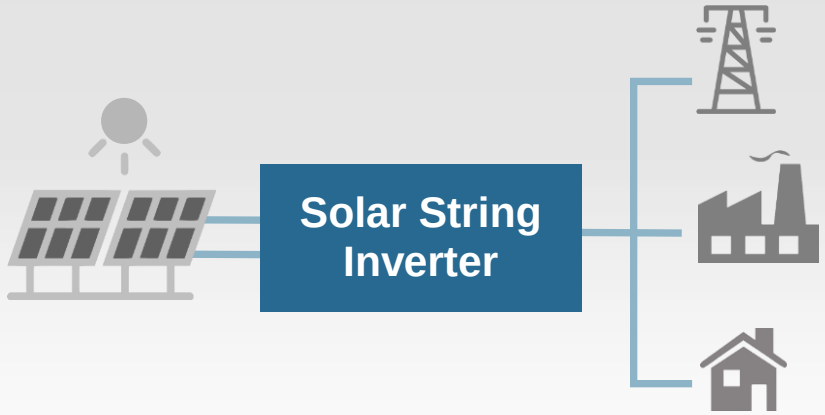
EV Charging Stations, Bad Ragaz, Switzerland

- 电动汽车（Electric Vehicle，EVC）的发展历史可以追溯到19世纪末。
- 最早的电动汽车是由蓄电池驱动的，但由于技术限制和石油燃料的普及，内燃机汽车逐渐占据主导地位。
- 特斯拉的成功推动了电动汽车市场的发展，其他汽车制造商也纷纷推出电动汽车型号。
- 电动汽车已成为可持续交通的重要组成部分，为减少碳排放和改善空气质量做出了重要贡献。
- 电动汽车的发展将继续推动技术创新和可持续交通的实现。

能源的基础设施

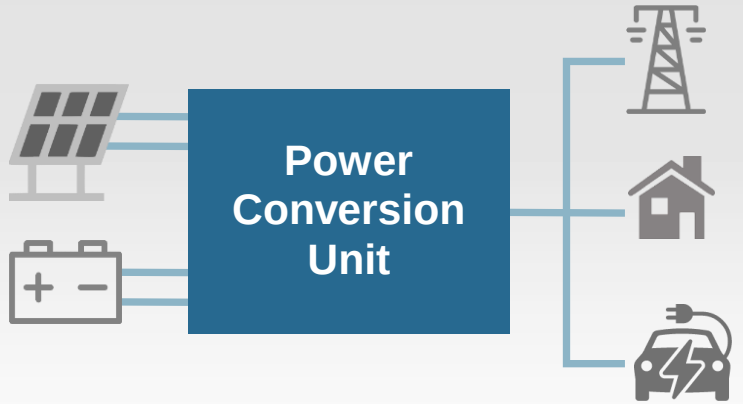
可再生能源和储能系统以减少排放的案例，太阳能、汽车、储能混用

串联式逆变器的增长
13% CAGR



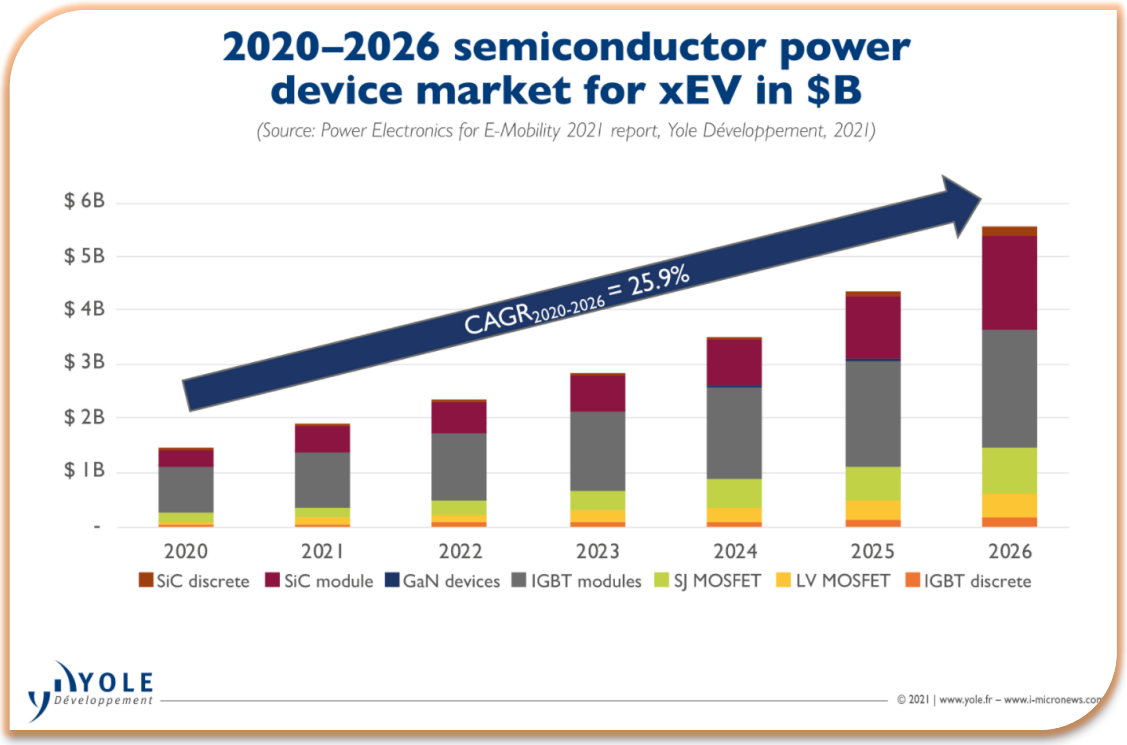
电动汽车充电器的增长
26% CAGR

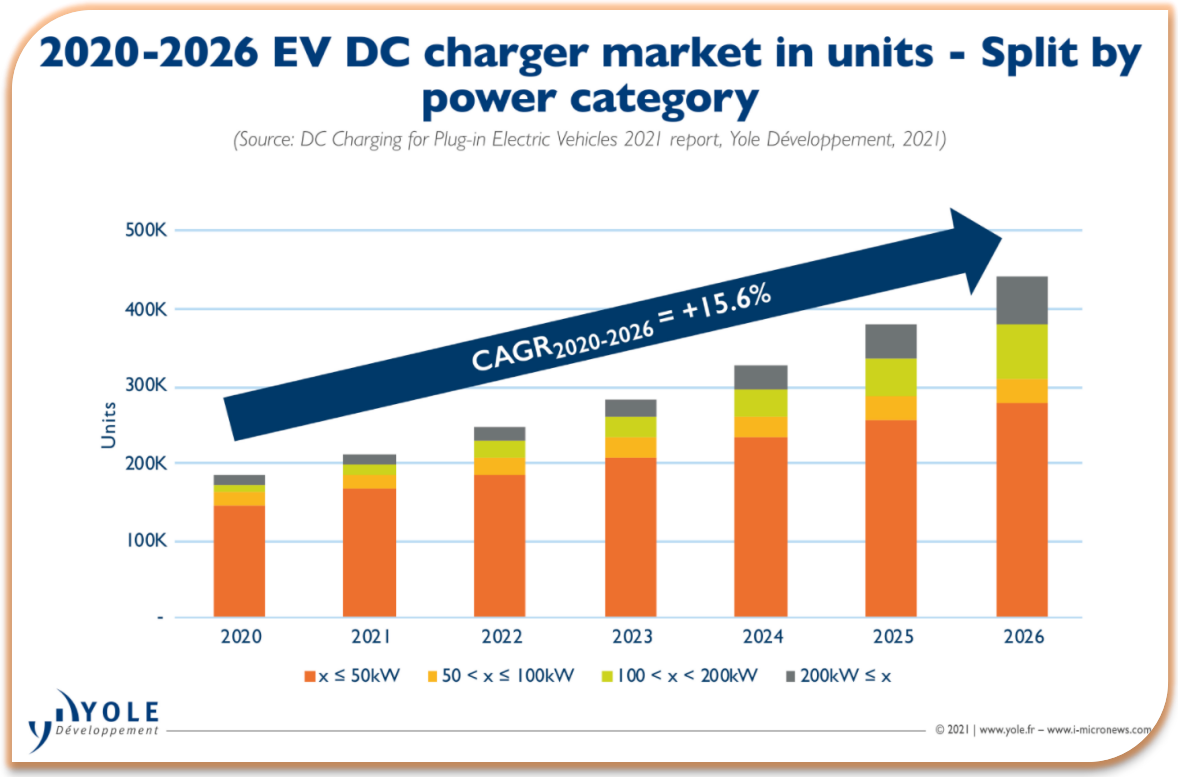
分散式能源储存系统（ESS）的增长
17% CAGR



EVC充电桩的双向性，能够当一个储能设备，完成削峰填谷，和当应急用电，低电价充电高电价卖电

EVC 充电桩的市场分析





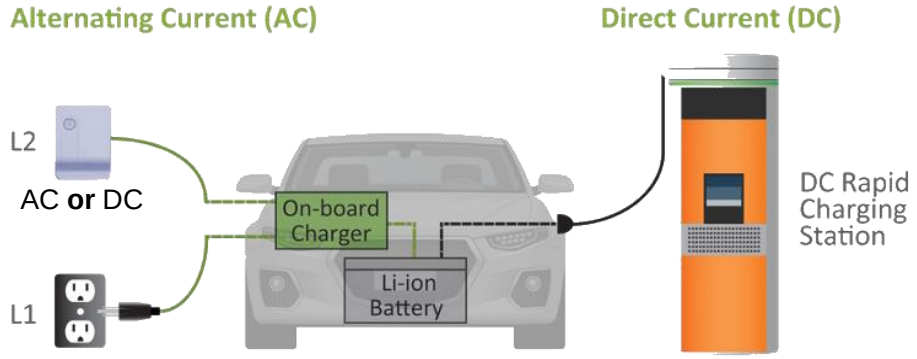
EVC市场的成长，主要占比在于SiC 单管和IGBT

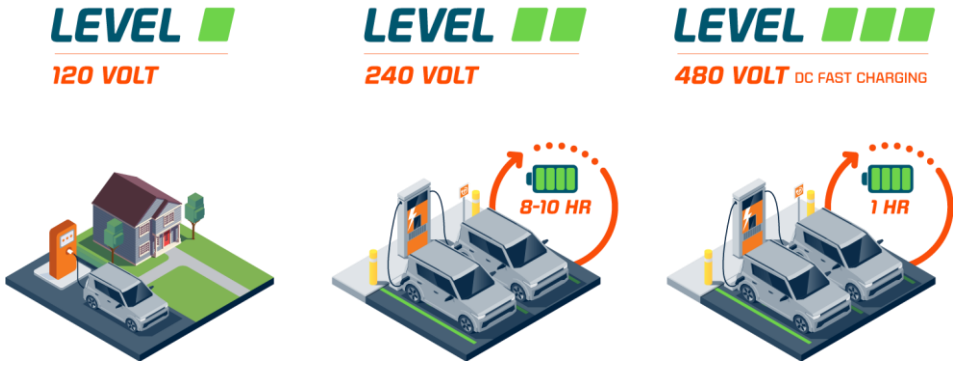
EVC市场的充电功率越来越大，充电时间越来越短

EVC充电的基础知识

充电设备–级别和功能

LEVEL 1		LEVEL 2		DC FAST CHARGING		DC ULTRAFAST CHARGING	
CHARGING	1 h	CHARGING	1 h	CHARGING	20 min	CHARGING	15 min
MILES	2 - 5	MILES	10 - 60	MILES	60 - 80	MILES	100 - 200
1.4 kW maximum		3.3 kW to 19.2 kW		50 kW to 150 kW		400 kW maximum	
120 V		240 V		480 V		480 V +	
Single Phase		Single Phase		Single Phase or Three Phase		Three Phase	



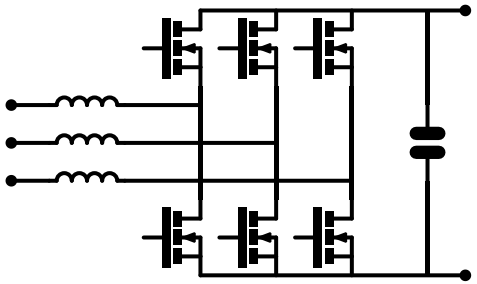


有很多变化，所以考虑这些信息是相对的，而不是绝对的

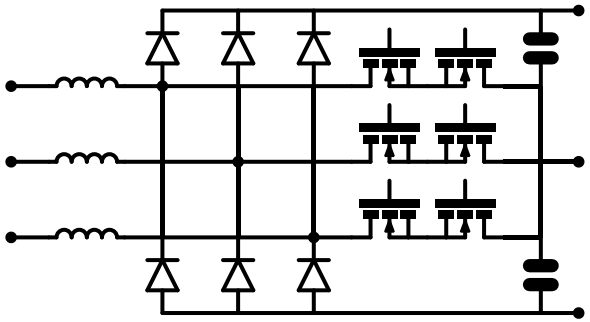
EVC 充电桩PFC和DCDC的常用拓扑结构

3-phase Active Front End of PFC

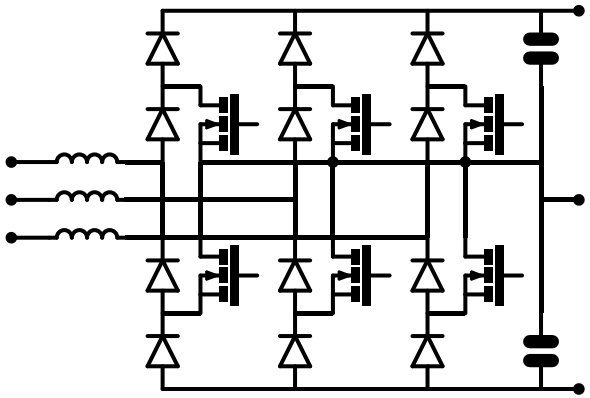
6 Pack Boost



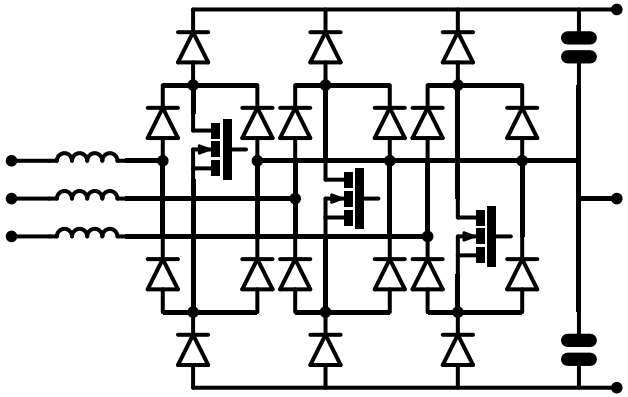
T-NPC Boost



NPC Boost

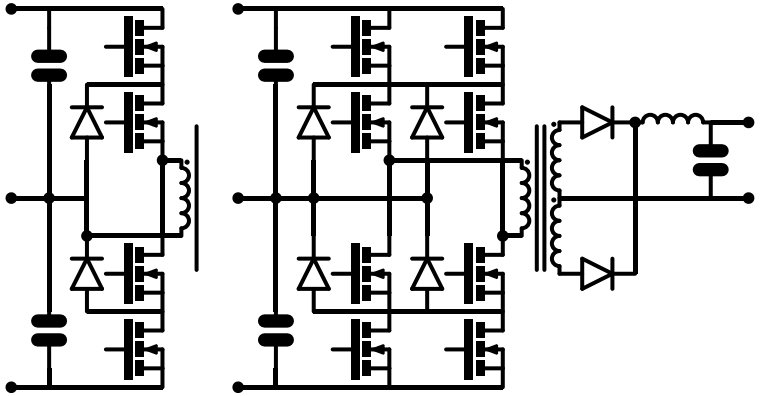


Vienna

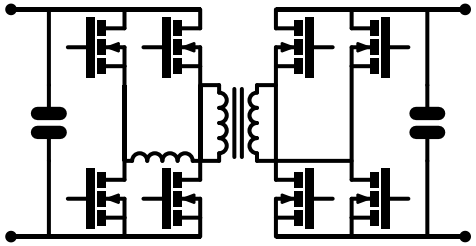


Isolated DC/DC

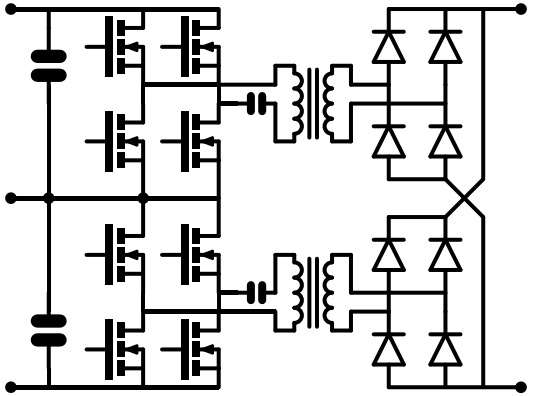
NPC Half-Bridge or Full-Bridge



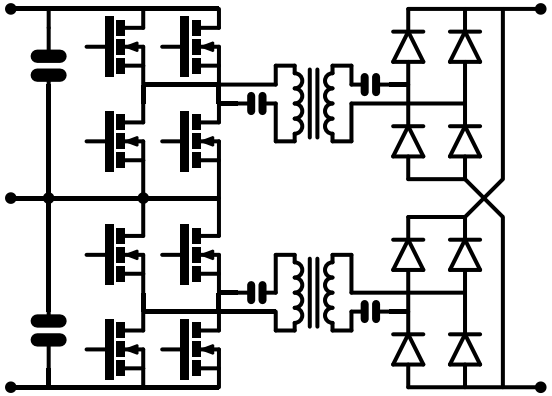
有源双桥 (DAB)



Stacked LLC



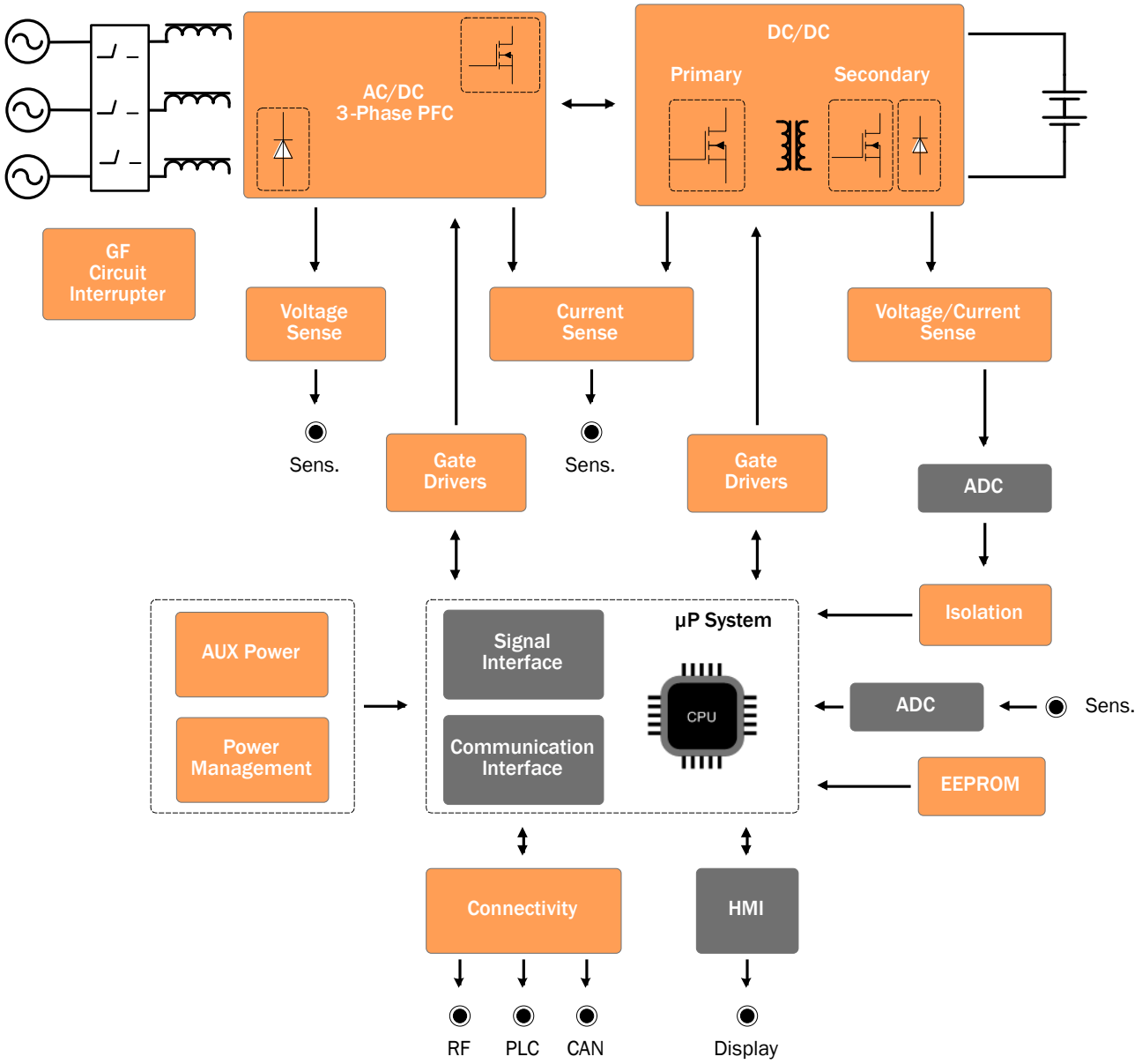
Stacked CLLC



EVC充电模块规格范例(PFC + DC-DC Converter)

AC input	Voltage input rating	Three-phase 400 Vac (EU), 480 Vac (US)
	Max. input current	40 A
	Frequency	50/60 Hz
	Power factor	>0.99
	Efficiency	>96%
DC output	Output voltage	200 V to 1000 V
	Max. output power	25 kW
	Max. output current	50 A
Protections	Output	OVP, OCP, SC
	Input	UVP, OVP, inrush current
	Internal	Desat (gate driver), thermal (NTC on power device)
User Interface	Push buttons	Yes
	GUI	Yes.
Communication buses	Internal	SPI, I^2C
	External	Isolated CAN, USB, UART
Environmental	Operating temperature	0°C to 40°C
	Operating mode	Fully **Bidirectional**
Max. dimensions	PCB	450 x 300 x 280 mm (PFC and dc-dc stacked)
Standards	Regulation	Following guidelines described in EN55011 Class A **Will not be tested**
	EV systems	Following guidelines described in IEC 61851 **Will not be tested**

EVC充电模块– 方框图



- 主动前端（PFC）
- 谐振全桥级
- 输出整流
- 电压感知
- 电流感知
- LEM传感器接口
- AC-DC调节器/控制器
- DC-DC调节器/控制器
- CAN接口
- BLE接口

EliteSiC Application Examples – 25KW 双向直流快速充电器

25kW Bidirectional DC Fast Charger

Applications:

EV Charging:
- DC Fast Charging Level 3
- DC Ultrafast Charging Level 3
- V2G

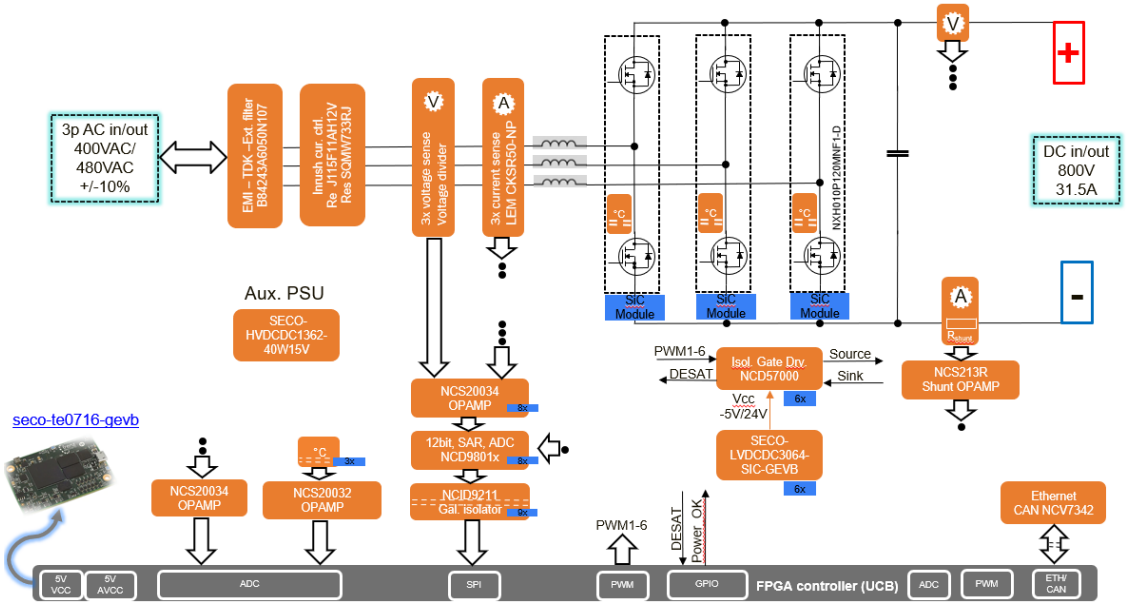
Topologies:

- PFC: 6 Pack Boost
- Dual Active Bridge (DAB)

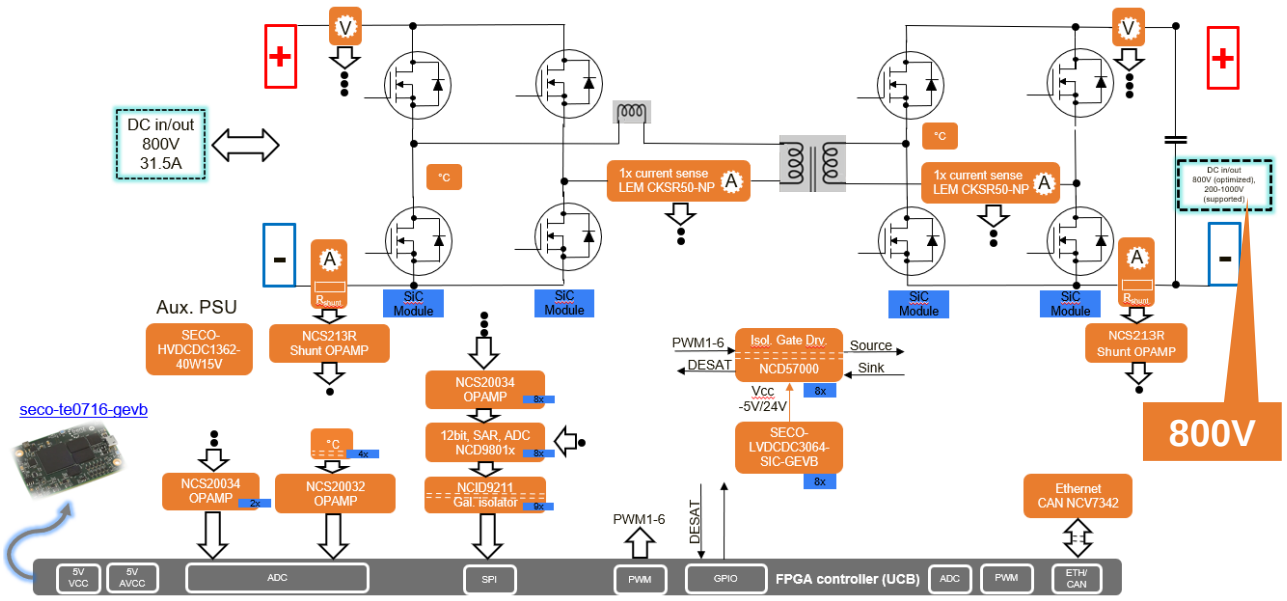
Peak Efficiency:

- 98% at 800V VOUT

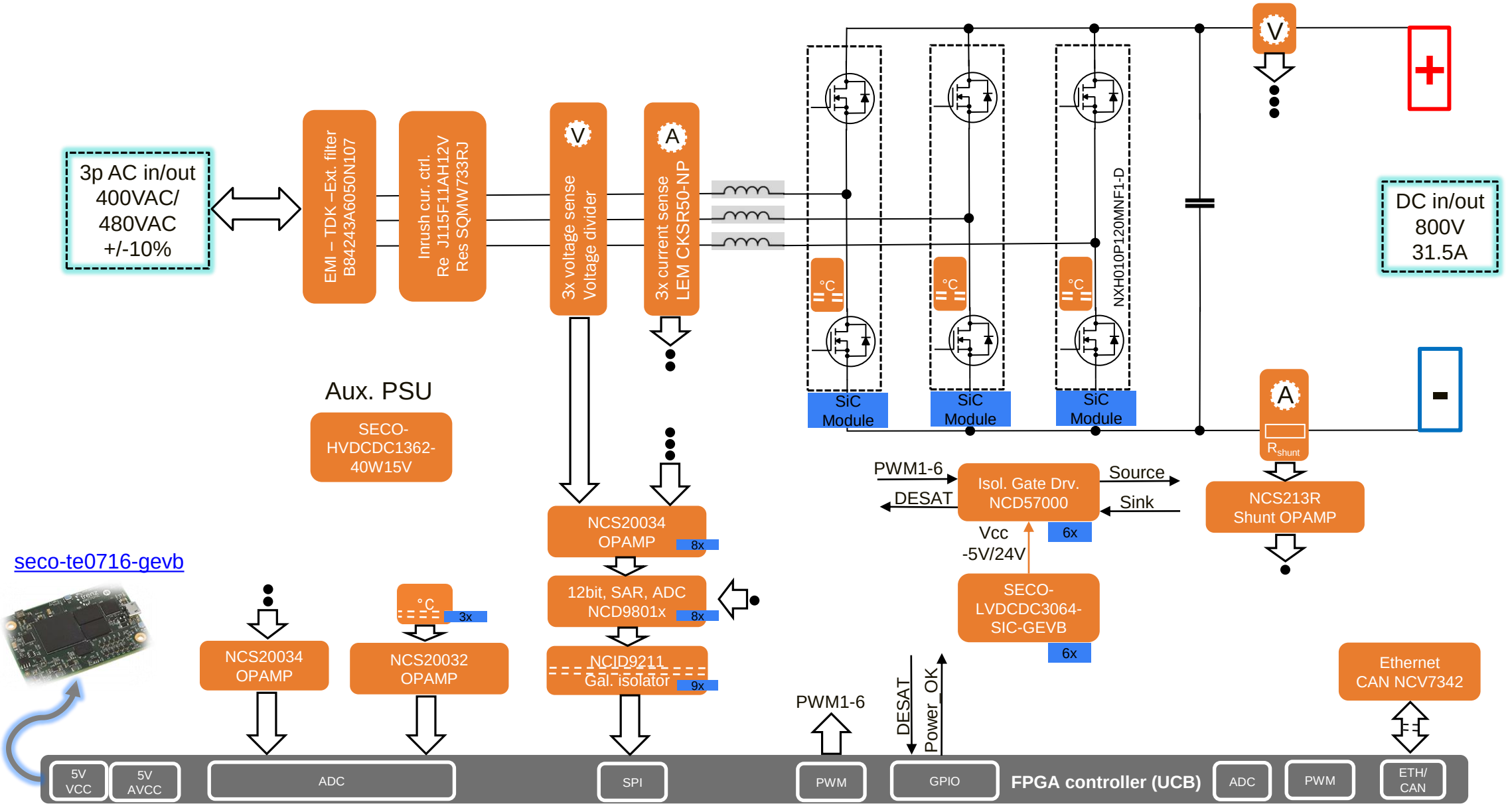
6-Pack Boost Active Front End PFC:



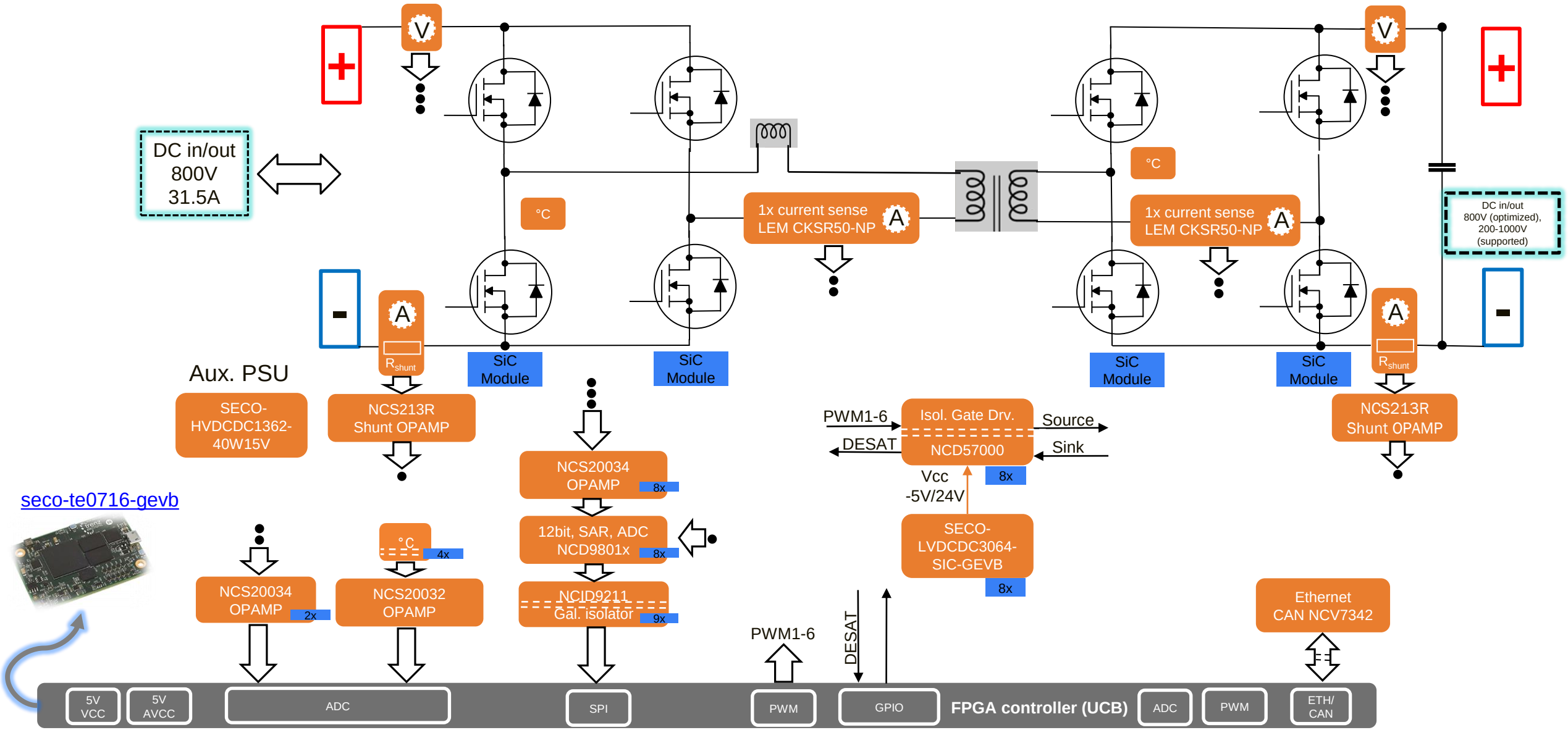
Dual Active Bridge DC - DC:



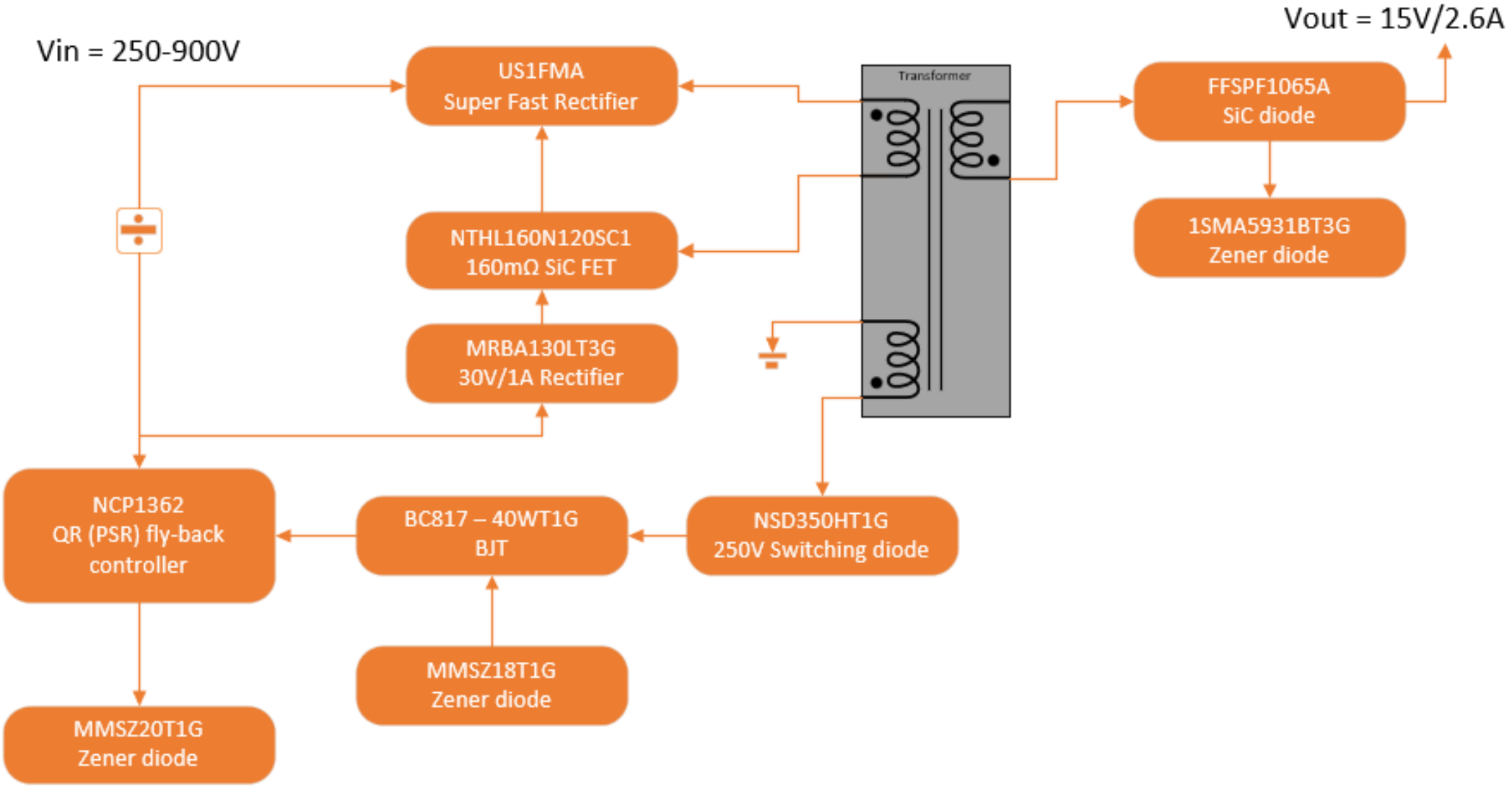
PFC 方框图 :组件选择方案



DC-DC 方框图: 组件选择方案

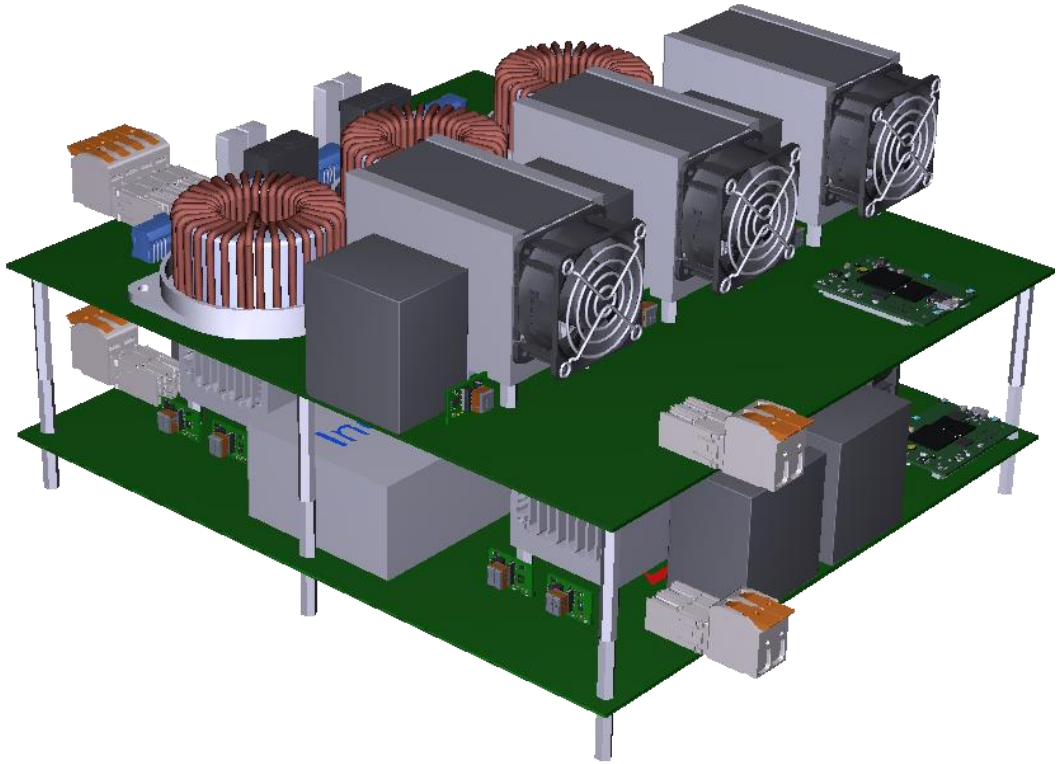


SECO-HVDCDC1362-40W-辅助电源方框图



EVC快速充电桩架构

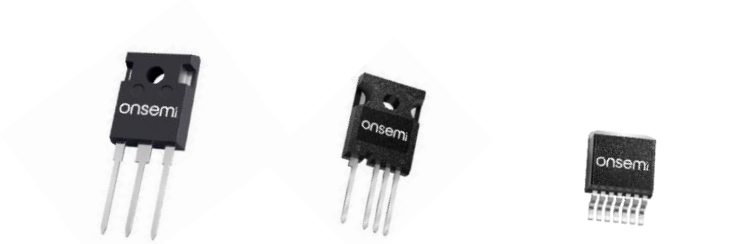
- 用于直流快速电动汽车充电器，
- 可提供300kW以上的功率:
  - 使用并联的方式，从25-75KW之间。。。



25 kW building block	25 kW building block	300kW EV Charging Station
25 kW building block	25 kW building block	
25 kW building block	25 kW building block	
25 kW building block	25 kW building block	
25 kW building block	25 kW building block	
25 kW building block	25 kW building block	

12 x 25kW building blocks
used in 300kW EV Charging Station

SiC MOSFETs



TO247-3LD　　TO247-4LD　　D2PAK-7LD

更快的开关速度 更紧凑的最终产品

与行业领先竞争对手相比，
1200V M3S SiC MOSFET
在硬开关应用中可实现高达
20%的功率损耗降低

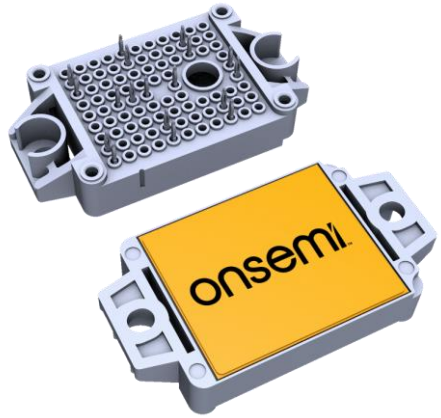
onsemi公司的广泛功率元件系列
使您能够选择最适合您设计
的尺寸、成本和效率限制的
功率拓扑结构。

SiC Diodes

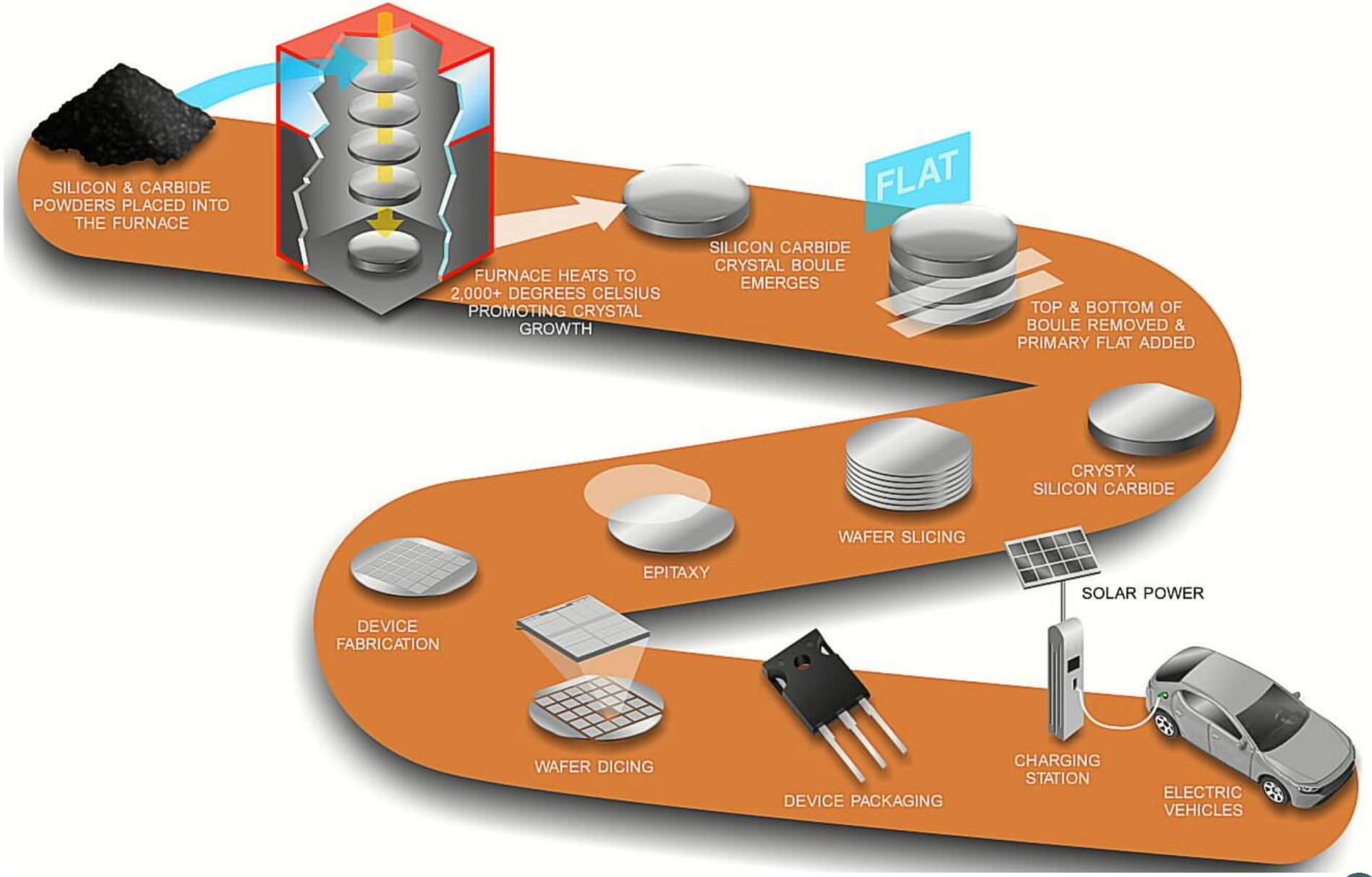
新的D3 1200V SiC 二极管系列通过
最小化导通和开关损耗，
提高了高端应用的效率

Full SiC & Hybrid SiC Modules

- 针对卓越性能进行优化
- 比离散器件具有更低的热阻易于安装的封装，
- 适合行业标准引脚布局

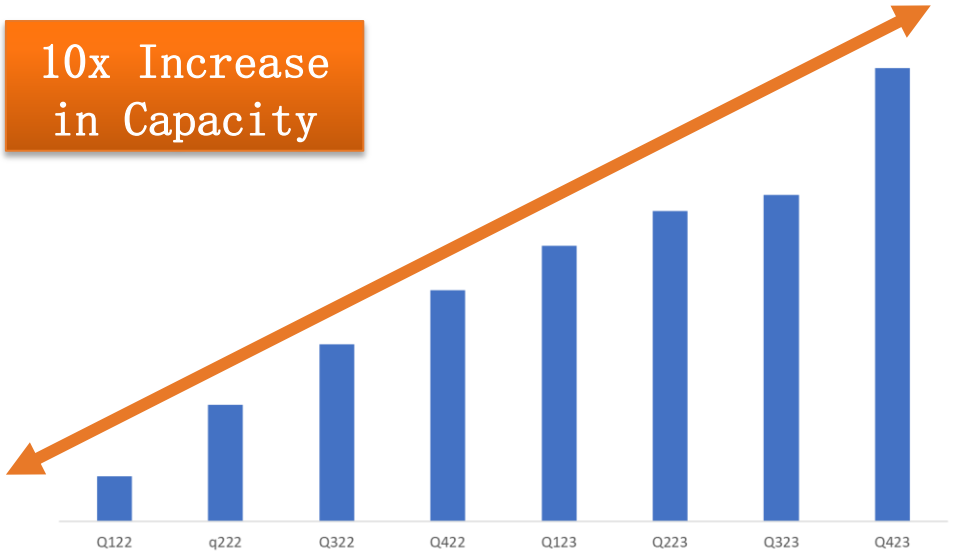


onsemi 的 EliteSiC垂直整合-行业独特之处



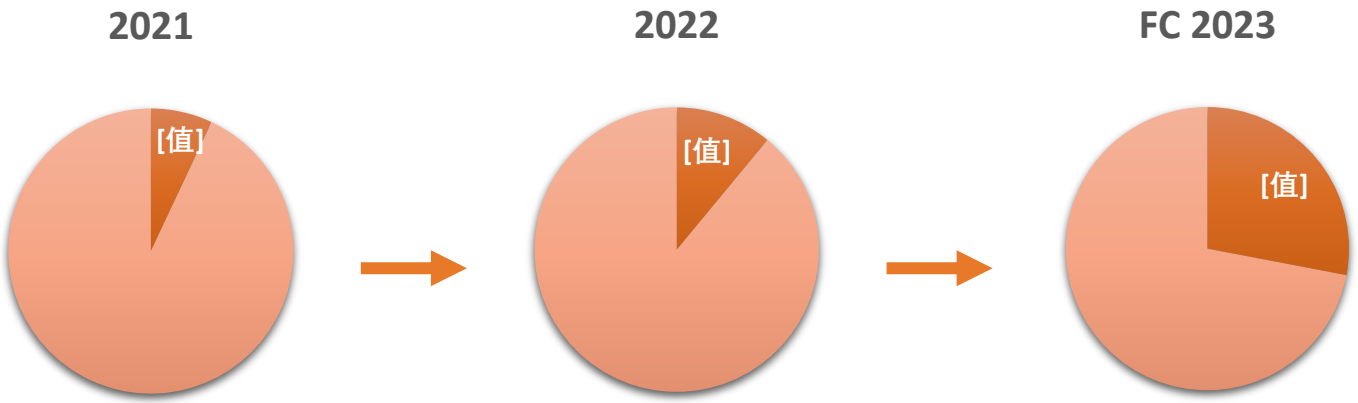
onsemi EliteSiC Capacity Expansions and Market Share

onsemi SiC Capacity Increase



New Bucheon Fab Addition:
Building Near Completion
Adding Equipment

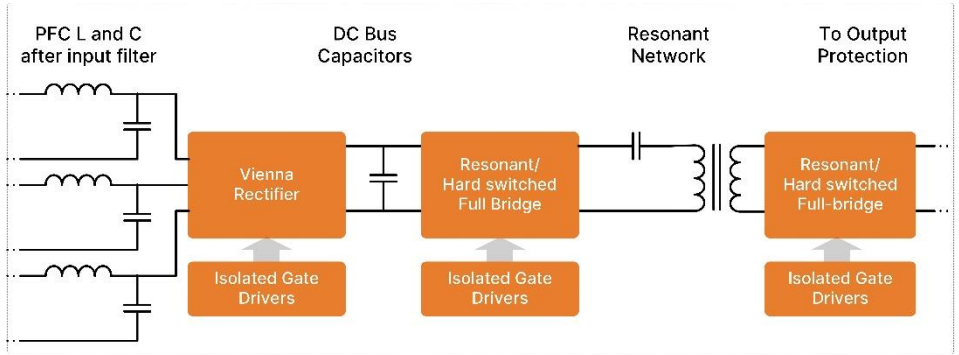
onsemi SiC Market Share 2021 to 2023 Projected



Expansion will *Double* onsemi's SiC Fab Capacity in 2024/2025

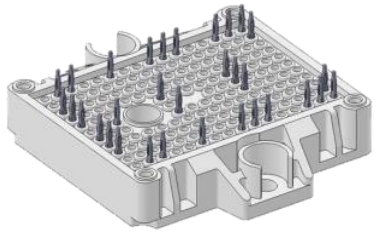
EV Charging 电动车充电站-主动整流阶段（或PFC）

Vienna Rectifier Version



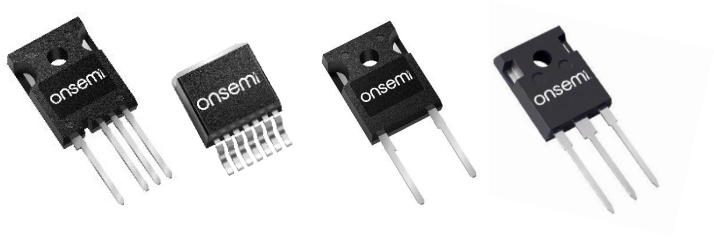
Module

F2 Vienna Rectifier



Discrete

SiC Diodes + SiC MOSFETs



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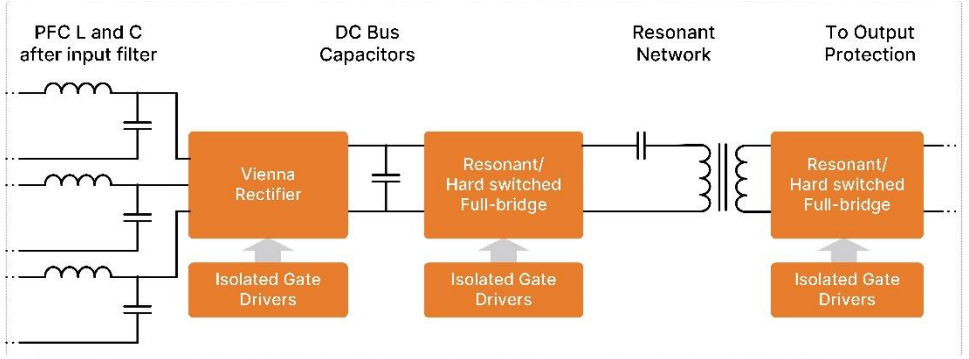
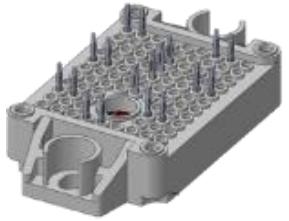
High Efficiency

Six Switch Converter Version



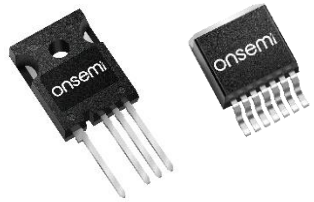
Module

F1 2-PACK Module



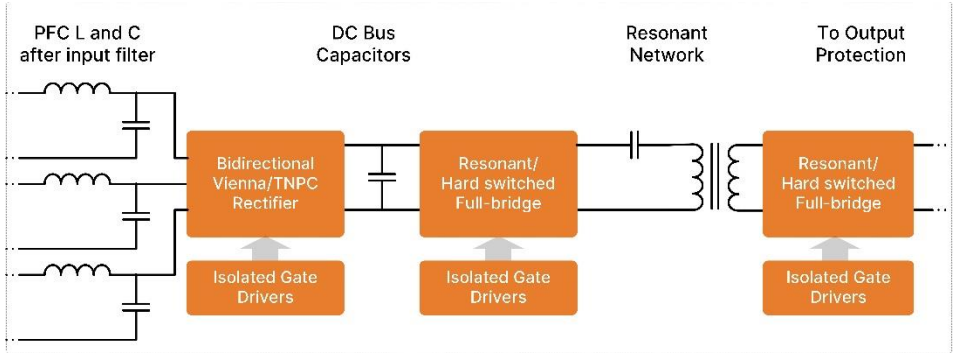
Discrete

SiC MOSFETs



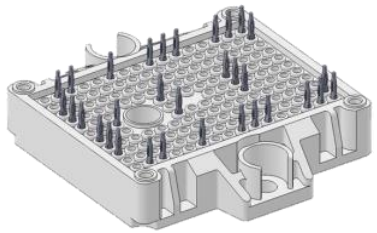
EVC 主动PFC模块和单管应用

双向维也纳/调制谐振NPC（Vienna/TNPC）



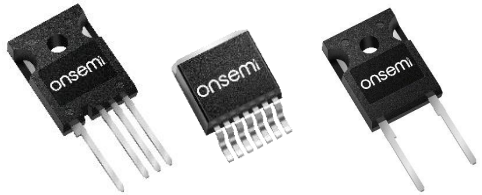
Module

F2 (Concept)



Discrete

SiC Diodes + SiC MOSFETs



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Avalanche Rated
High Efficiency

关于双向转换的评论：

维也纳： 不具备双向转换功能。

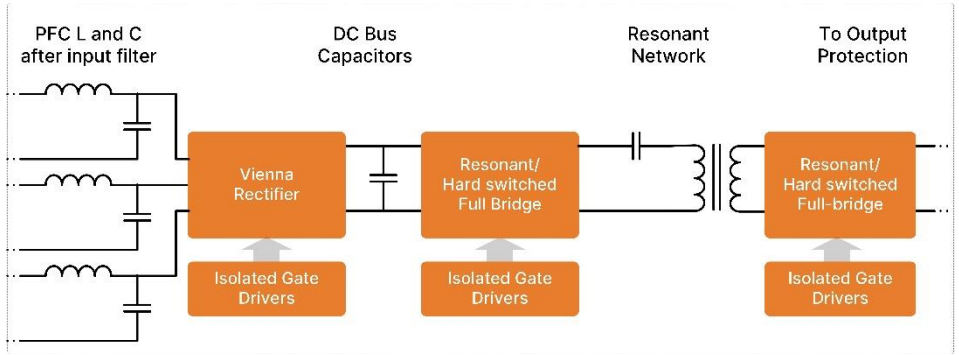
- 双向维也纳/调制谐振NPC：
- 六开关转换器： 具备双向转换功能。

双向转换的应用场景：

- 为电网提供无功功率支持。
- 允许从电动车电池向电网输送能量。
- 双向转换器可以实现能量的双向流动，
- 在电动车和电网之间进行能量交换的场景。
- 允许将电动车电池中的能量输送到电网中。

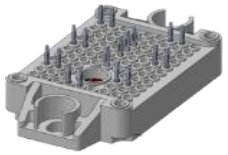
EVC 充电桩 – DC-DC部分模块和单管应用

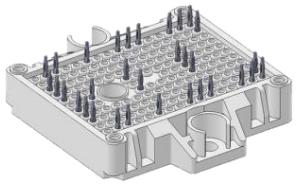
Dual Active Bridge, DC-DC, LLC, …



Module

F1 2-PACK Module
F1 4-PACK Module
F2 2-PACK Module

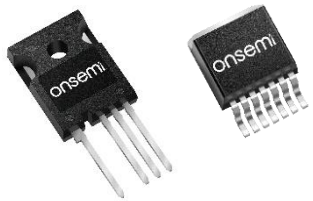




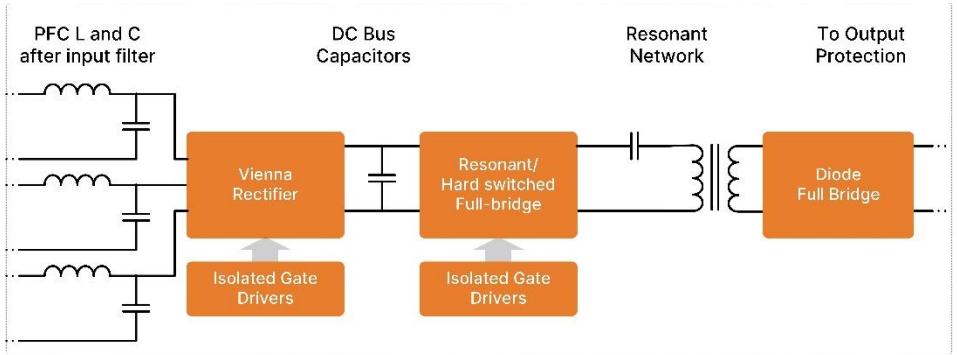
Robust
Avalanche Rated
High Efficiency

Discrete

SiC Diodes + SiC MOSFETs

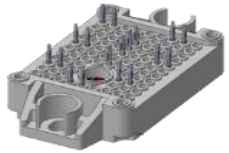


Diode Output Bridge



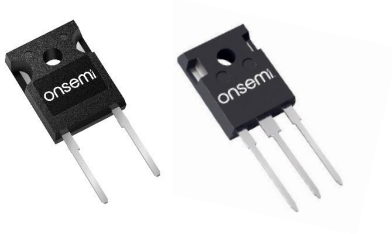
Module

F1 4-PACK Module



Discrete

SiC Diodes
Single
Dual



1200V SiC MOSFETs – M3 Family

Released
In Development
(Sample / Release Date)

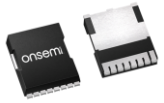
Automotive grade uses “NV” Industrial grade uses “NT”

$R_{DS(ON)}$ (mΩ) Typical @Vgs:18V	TO-247-3L	TO-247-4L	D2PAK-7L	BPAK (Top Cool SMD PKG)	Die
					
13		NTH4L013N120M3S (Available / Sep ’23)			NTCR013N120M3S (Sep ’23 / Sep ’23)
14		NTH4L014N120M3P	NTBG014N120M3P		
22	NTHL022N120M3S	NVH4L022N120M3S NTH4L022N120M3S	NVBG022N120M3S NTBG022N120M3S	NVTC022N120M3S NTTC022N120M3S (Available / Q4 ’24)	
29	NTHL030N120M3S	NVH4L030N120M3S NTH4L030N120M3S	NVBG030N120M3S NTBG030N120M3S	NVTC030N120M3S NTTC030N120M3S (Available / Q4 ’24)	
40	NTHL040N120M3S	NVH4L040N120M3S NTH4L040N120M3S	NVBG040N120M3S NTBG040N120M3S	NVTC040N120M3S NTTC040N120M3S (Available / Q4 ’24)	
65	NTHL070N120M3S	NVH4L070N120M3S NTH4L070N120M3S	NVBG070N120M3S NTBG070N120M3S	NVTC070N120M3S NTTC070N120M3S (Available / Q4 ’24)	

650V SiC MOSFETs – M2 Family

Released
In Development
(Sample / Release Date)

Automotive grade uses “NV” Industrial grade uses “NT”

$R_{DS(ON)}$ (mΩ) Typical @Vgs:15V	$R_{DS(ON)}$ (mΩ) Typical @Vgs:18V	TO-247-3L	TO-247-4L	D2PAK-7L	TOLL	PQFN88
						
15	12	NVHL015N065SC1 NTHL015N065SC1	NVH4L015N065SC1 NTH4L015N065SC1	NVBG015N065SC1 NTBG015N065SC1		
25	19	NVHL025N065SC1 NTHL025N065SC1	NVH4L025N065SC1 NTH4L025N065SC1	NVBG025N065SC1 NTBG025N065SC1		
45	33	NVHL045N065SC1 NTHL045N065SC1	NVH4L045N065SC1 NTH4L045N065SC1	NVBG045N065SC1 NTBG045N065SC1	NTBL045N065SC1	NTMT045N065SC1
60	44	NVHL060N065SC1 NTHL060N065SC1	NVH4L060N065SC1 NTH4L060N065SC1	NVBG060N065SC1 NTBG060N065SC1	NTBL060N065SC1 (Nov ‘23 Sample)	
75	57	NVHL075N065SC1 NTHL075N065SC1	NVH4L075N065SC1 NTH4L075N065SC1	NVBG075N065SC1	NTBL075N065SC1 (Dec ‘23 Sample)	
95	78		NVH4L095N065SC1	NVBG095N065SC1		

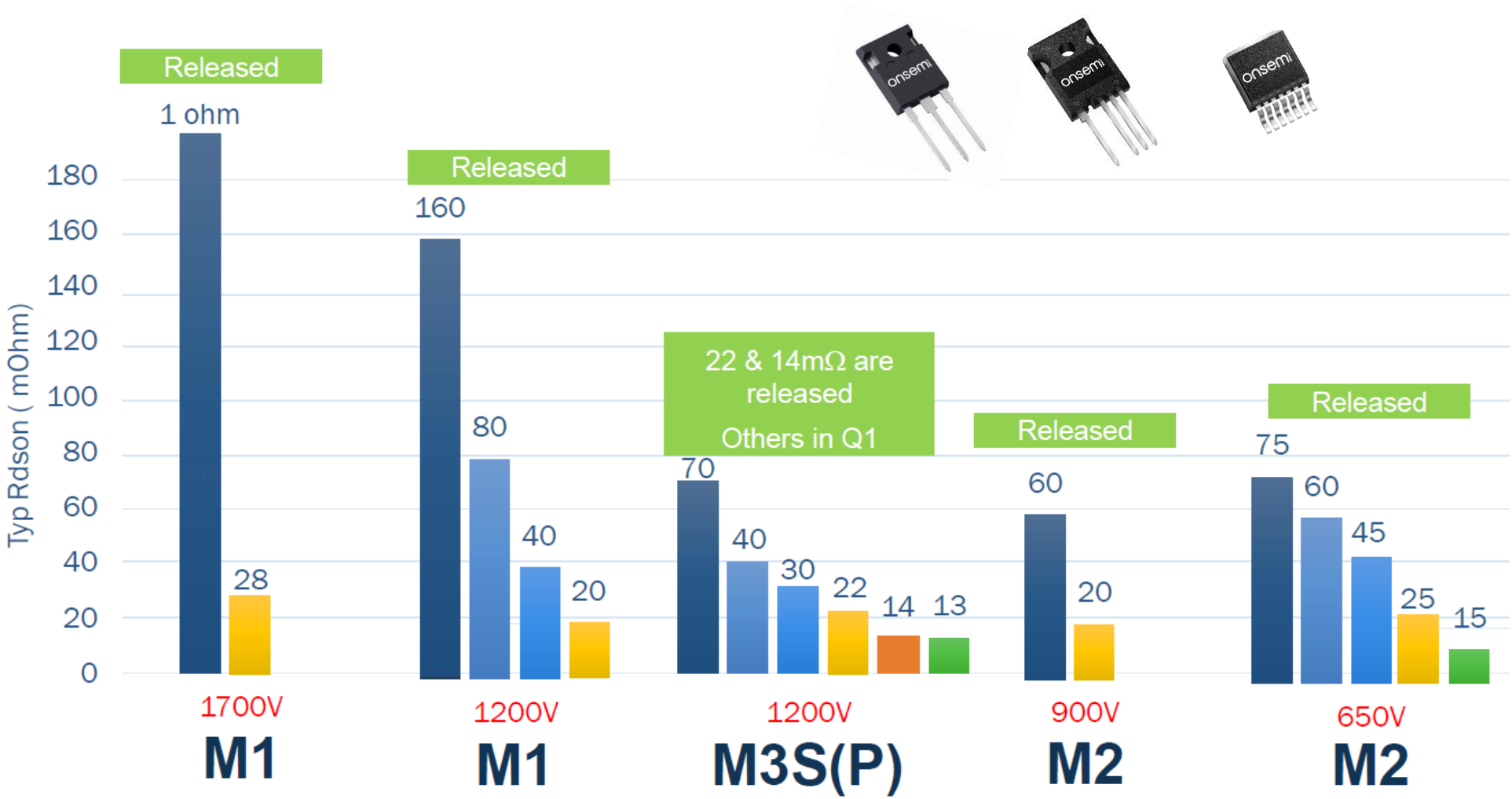
650V SiC MOSFETs – M3 Family

In Plan

Prototype samples in Q3 ‘23

$R_{DS(ON)}$ (mΩ) Typical @Vgs:18V	TO-247-3L	TO-247-4L	D2PAK-7L
			
8	NTHL008N065M3S	NTH4L008N065M3S	NTBG008N065M3S
12	NTHL012N065M3S	NTH4L012N065M3S	NTBG012N065M3S
24	NTHL024N065M3S	NTH4L024N065M3S	NTBG024N065M3S
38	NTHL038N065M3S	NTH4L038N065M3S	NTBG038N065M3S

Comparison of onsemi SiC MOSFET Families



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