

FOR ENERGY EFFICIENT INNOVATIONS

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安森美半导体
电动汽车牵引逆变器
及车载充电器
解决方案

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December 2019

Public Information

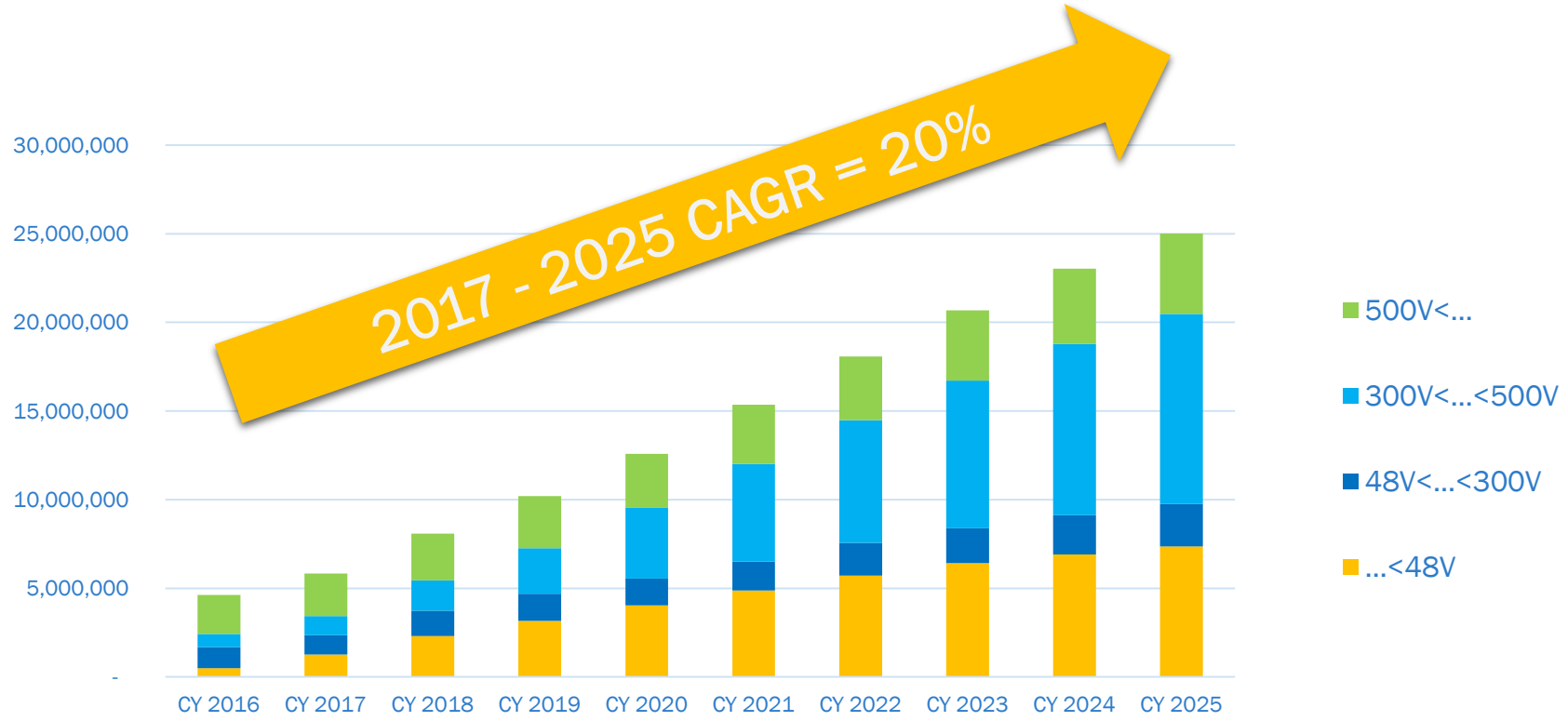
议程

- xEV市场概况及安森美半导体产品总览
- 牵引逆变器方案
  - 牵引逆变器的分立IGBT方案- FS3 650V/120A,160A
  - 安森美半导体VE-TracTM 产品系列
- OBC DCDC 方案
  - 分立车规 IGBT产品
  - 分立车规WBG SiC产品
  - 分立车规SJ MOSFET
  - OBC 模块产品方案
- 车规级高压栅极驱动产品
- 总结

xEV市场概况及安森美半导体产品总览

xEV Market – 安森美半导体视点

Hybrid & Electric Vehicle Production by Battery Voltage Class (millions of units)



Source: Strategy Analytics, IHS, Internal Analysis

- 全球市场来看，安森美半导体预计HEV/EV市场复合年增长率超过20%
- PHEV将拥有强大的市场地位
- 按照目前的增长速度，到2025年，中国将消耗超过65%的纯电动汽车动力系统
- 半导体功率器件等关键部件将给汽车供应链带来压力

Public Information

安森美半导体 - 汽车电气化的先行者

Body Electronics

Doors, Seating,
Keyless entry,
Gateway Modules

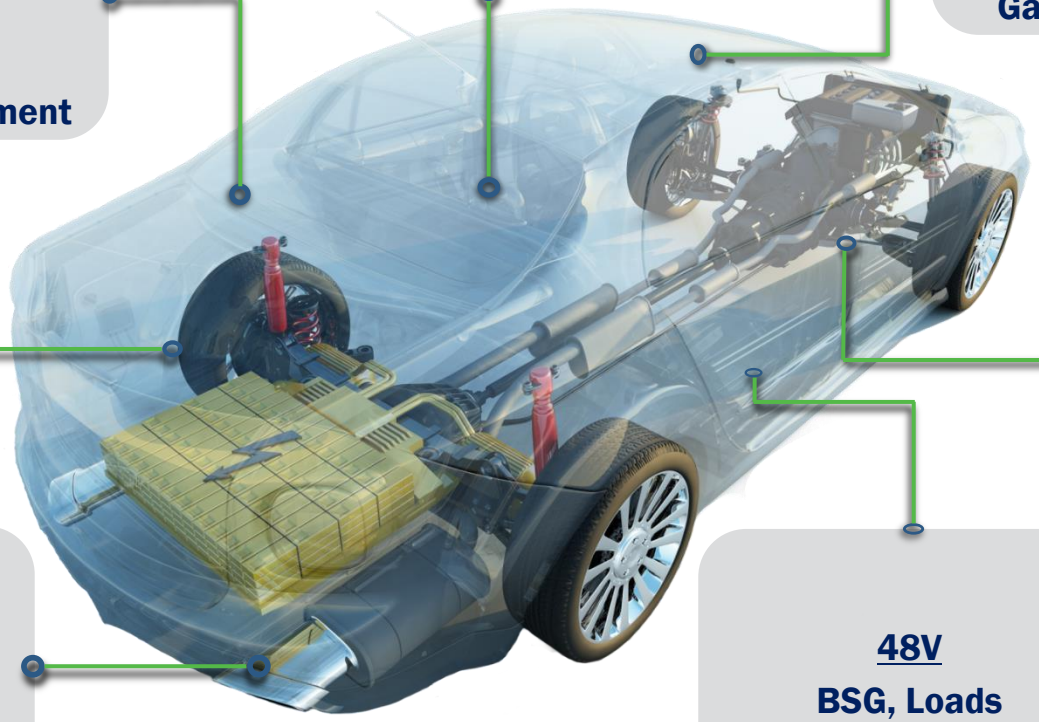
ADAS, Infotainment, HUD

Doors, Seating,
Keyless entry,
Gateway Modules

PHEV, EV

车载充电机(ON Board Chargers),

HV Loads
Battery Management



DC/DC

HV-LV, 48V-12V

Powertrain

混动/电动牵引驱动
(xEV Traction),
ECU, TCU, Safety
(Braking, Parking)

Lighting

Rear, Front, Interior

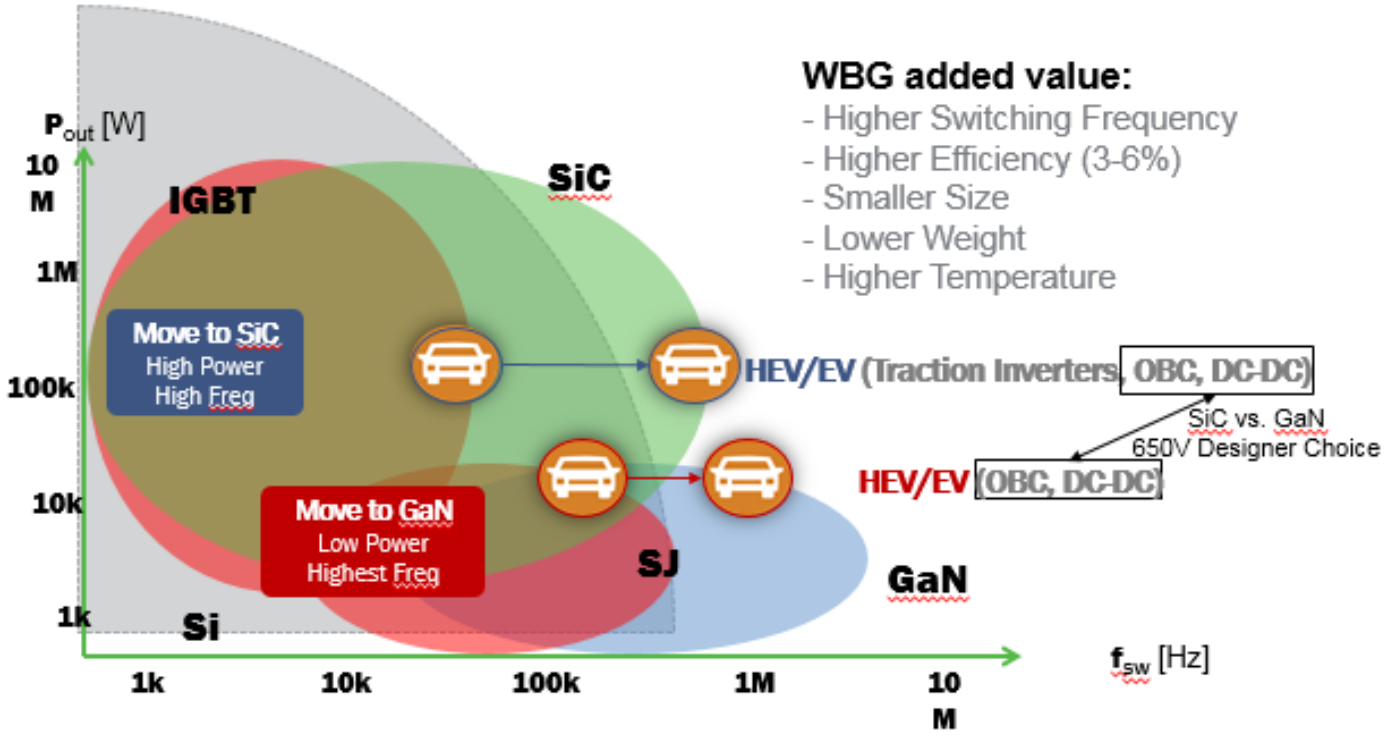
48V

BSG, Loads

Source: ON Semiconductor Corporate Marketing

安森美半导体提供全部功率开关元件的各种封装形式

All Power Switching Technologies into All Packaging Formats



WBG added value:

- Higher Switching Frequency
- Higher Efficiency (3-6%)
- Smaller Size
- Lower Weight
- Higher Temperature

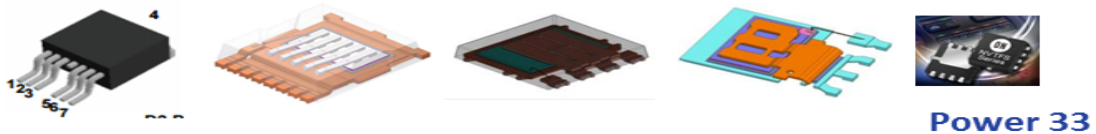
Driving Markets

- EV/HEV
- Alternative Energy
- Cloud Power
- Industrial and Commercial Motors

20 System Engineers

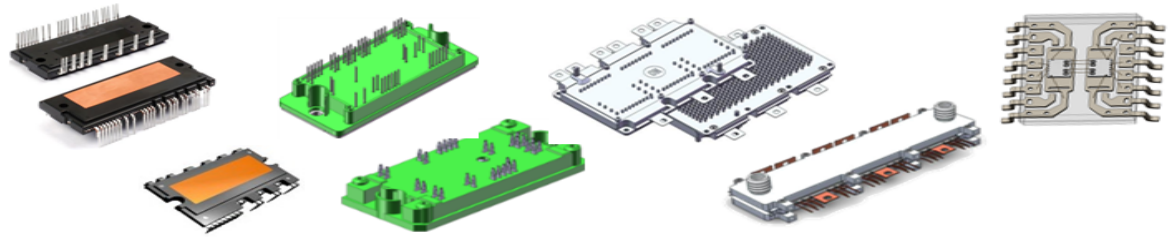
System Architecture

Discrete : Decrease size, increase density



D2PAK-7 | TOLL | Power 88 | Power 56 | Power 33 | Power 22

Modules & GD : System Architecture Driven



牵引逆变器方案

安森美半导体电动牵引方案

安森美半导体提供如下产品:

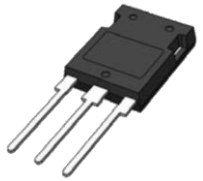
分立的TO-247 Max封装产品(已上市)

提供IGBT 晶圆给客户进行封装(已上市)

带散热片的双面冷却模块(样品)

以及单面直冷的IGBT模块(Q4'2019量产)

分立的IGBTs



TP247

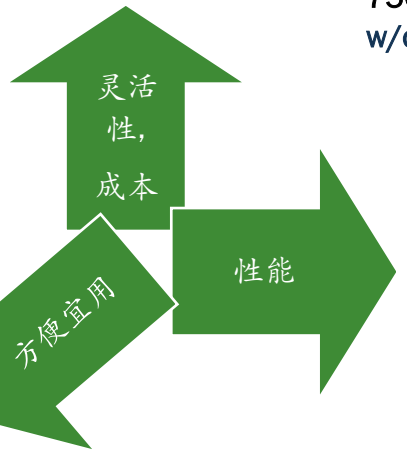


ISO TP247

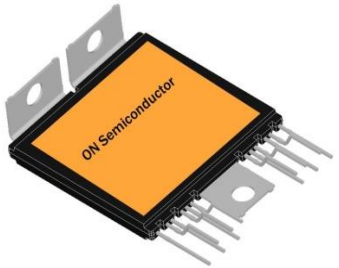
8" IGBT 晶圆

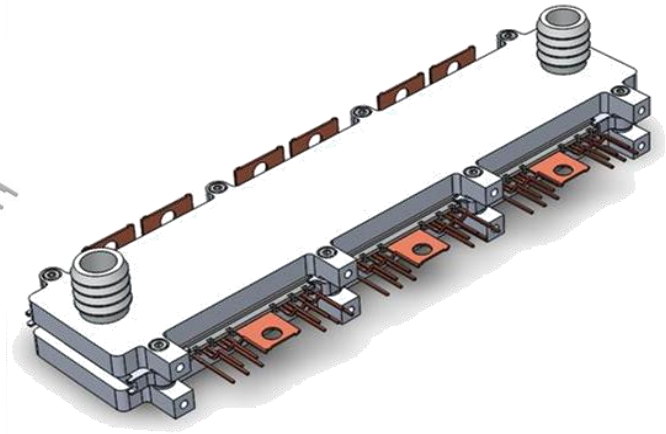


650 V， 160/200/300A
750V，200A
w/o Solderable Front Metal

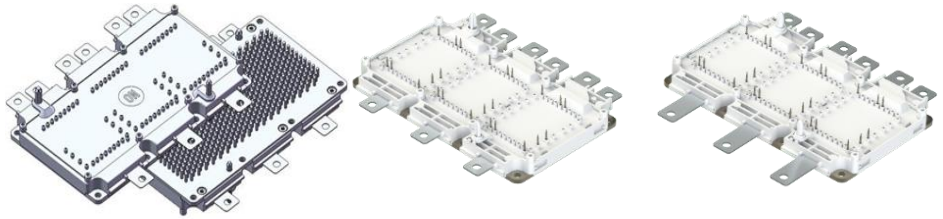


- 双面焊接或烧结用可焊顶层金属片





业界标准封装，采用铝线焊接或烧结



Gel-filled Module

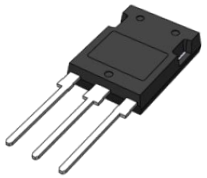
牵引逆变器的分立IGBT方案- FS3 650V/120A,160A

灵活度高,成本较低

主导产品

FGY120T65SPD-F085, 650V, 120A, TP247

FGY160T65SPD-F085, 650V, 160A, TP247



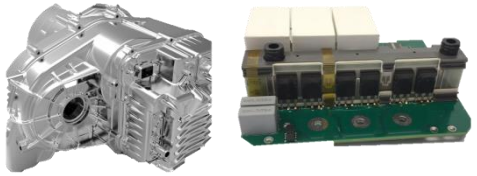
100% 出厂检测:
378A(120A)
500A(160A)
+ >10V/ns dV/dt

特点

- ✓ 一流的电气性能, 一流的热性能, 一流的耐用度和一流的可靠性
- ✓ AEC-Q101 Rev. D 认证, 100% BVces HTRB高温反偏测试
- ✓ 良好的制造过程控制，参数一致性好，带来良好的并联性能
- ✓ 100%器件动态测试中具备强固的瞬态可靠性
- ✓ 导通损耗和开关损耗极低, 适用不同应用场合
- ✓ 采用不同的并联器件可方便从20kW扩展到 240kW的功率段

市场地位

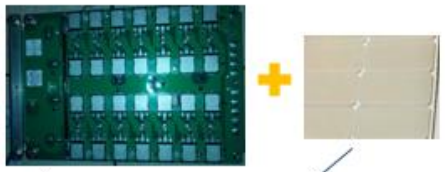
- 已为美国, 中国, 欧洲以及韩国EV/HEV客户所广泛采用
- 应用于电动汽车/混合动力汽车关键的动力传动系统
- 适用范围包括电动乘用车,电动物流车以及轻型电动车等



	unit	FGY120T65SPD	Current Best Seller	Competitor 2
min Bvces	V	**650**	600	600
Ic @Tc=25C	A	240 limited by bond wire	240	160 limited by bond wire
Ic @Tc=100C	A	220	160	120A @ Tc=135C
Icm pulses current	A	378	360	**480**
If @Tc=25C	A	**240 limited by bond wire**	120	160 limited by bond wire
If @Tc=100C	A	**188**	-	120A @ Tc=124C
SCWT	us	6	6	5
Rth_jc IGBT		**0.17**	0.2	0.18
Rth_jc diode		0.32	0.44	**0.3**
Vce_sat, typ/max @25C	V	**1.5/1.85**	1.7/2.05	1.5/2.0
Vce_sat, typ @175C	V	**1.8**	2.2	1.9
Vf @25C, typ/max @25C	V	**1.3/1.6**	1.9/2.2	1.65/2.05
Vf, typ @175C	V	**1.2**	2.0	1.6
Cies	nC	6810	7780	7530
Coes	nC	440	505	446
Cres	nC	50	245	206
Qg, typ	V	**162**	240	772
Eon @175C	mJ	9.8	10	**6.7**
Eoff @175C	mJ	4	3.8	4.1
Err @175C	mJ	3	**2.44**	-

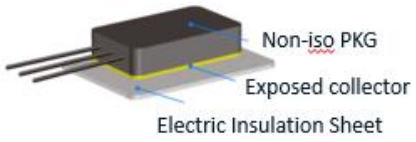
TP247封装的热设计

一般结构
Conventional structure
TP247 + Iso-sheet



较大的控制板面

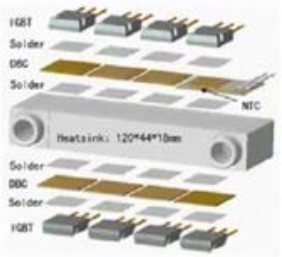
较低的热传导
(~5W/m.K)



• 安装过程困难,品质管理风险
(散热片精确定位)
• 热阻较高

增强热性能结构
Enhanced thermal performance
TP247 + DBC substrate

Unfolding Structure

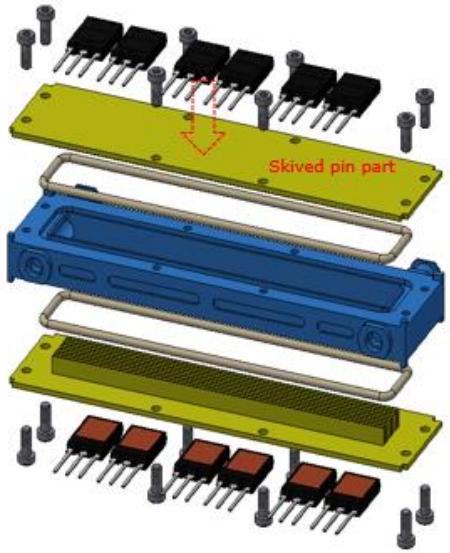


Overall Structure



• 复杂的回流焊流程
(PKG-DBC, DBC-H/S)
• 可靠性风险(PRCL DBC-H/S)
• 安装成本较高

高性能冷却结构
Advanced cooling structure by ON
ISO TP247
(Direct cooling & soldering)

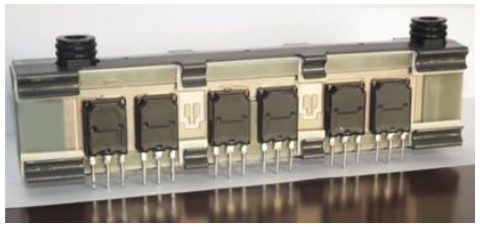




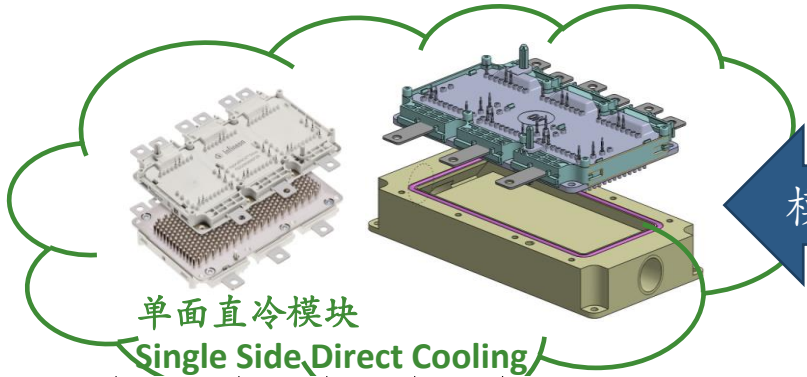


TP247	ISO TP247
Non-direct cooling	Direct Cooling
Non solderable	Solderable(Sinterable)
Non Isolated	Isolated

Target Rthj_f of Direct Cooling
Below 0.3 ℃/W(standard ver.)
~ 0.16 ℃/W(performance ver.)

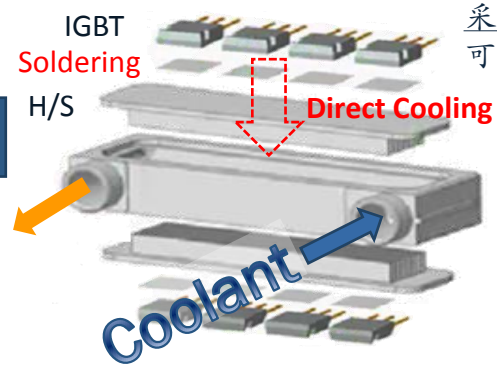


现有的直接散热方案
传统分立的IGBT+ DBC铜基板



R_{thJF}		0.120[2)]	0.140[2)]	K/W

模块方案



采用ISO-TP247直接散热
可直接焊接在散热器上

Public Information

安森美半导体VE-Trac™ 产品系列

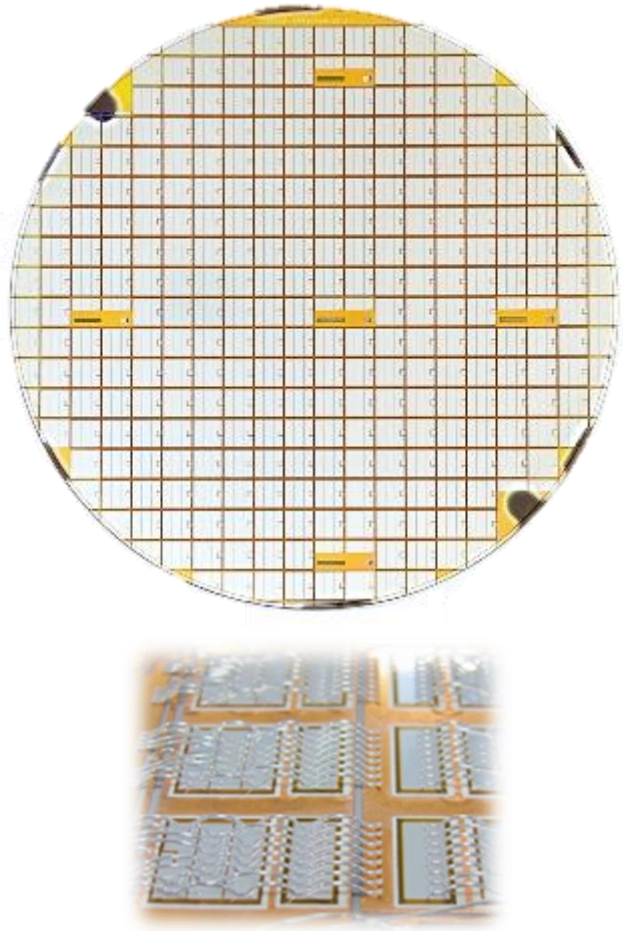
VE-Trac™ Dual



VE-Trac™ Direct



VE-Trac™ Chip



VE-Trac™ 模块核心产品

VE-Trac™ Direct

NVH820S75L4SPA
750V, 820A 6 pack



NVH820S75L4SPB
750V, 820A 6 pack
NVH950S75L4SPB
750V, 950A 6 pack plus

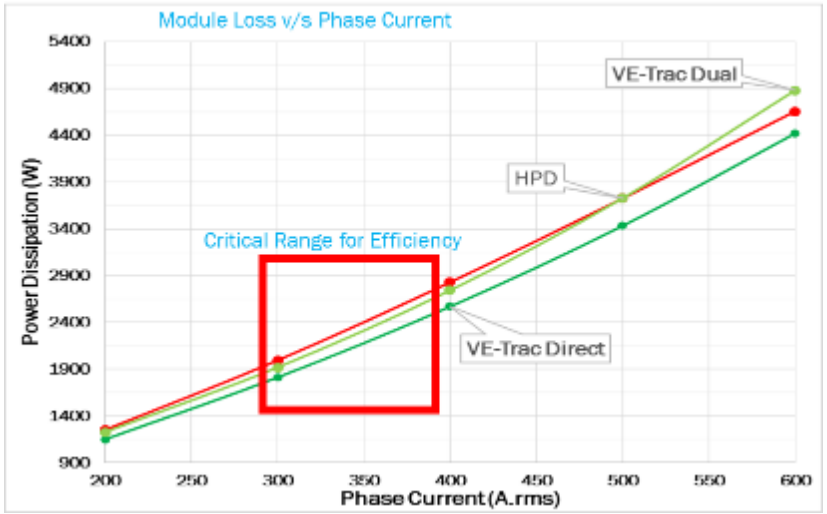


RTM Q4'19

NVH820S75L4SPC
750V, 820A 6 pack



•高集成度,易于安装，标准管脚可直接上板测试
•性能优异，首选二供或新设计。供应有保障

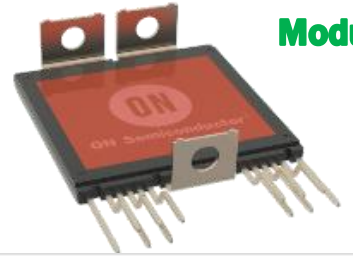


VE-Trac™ Dual

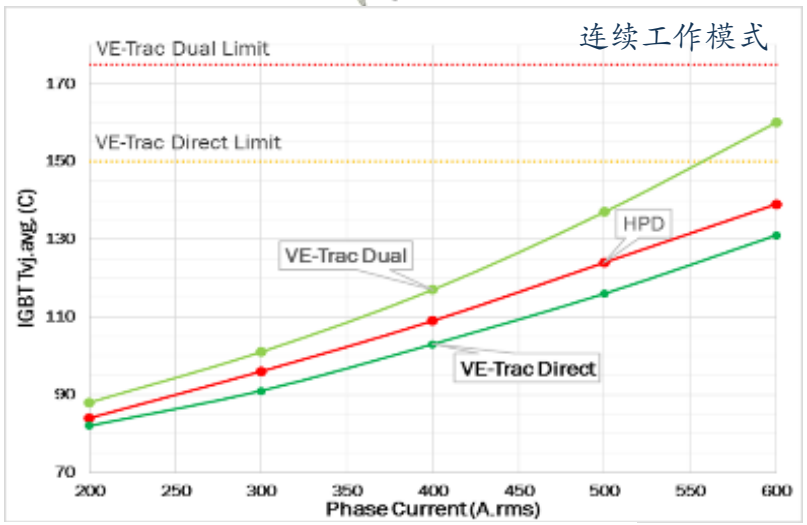
半桥模块：不同管脚可选

双面散热设计实现最优散热性能实现较高功率密度。$/kW成本业界最低的

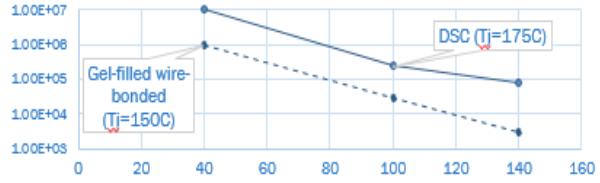
NVG800A75L4DSC: 750V, 800A DSC
NVG400A120L2DSC: 1200V, 400A DSC



Module of choice!



3x power cycling lifetime @ 175°C continuous operations

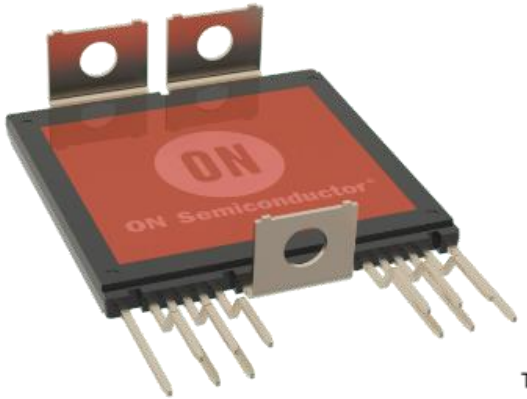


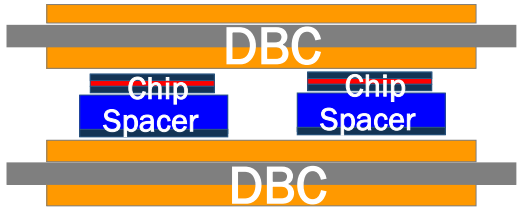
•功率可扩展 (100-300kW)
•无邦定线，超低杂散漏感 <7nH
•10 x PCT, 3x TC

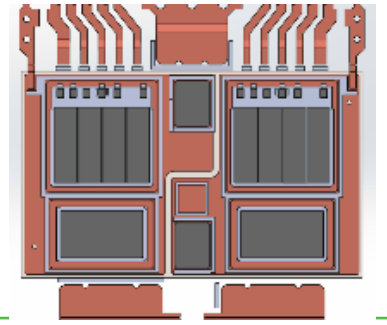
DSC Module 概览

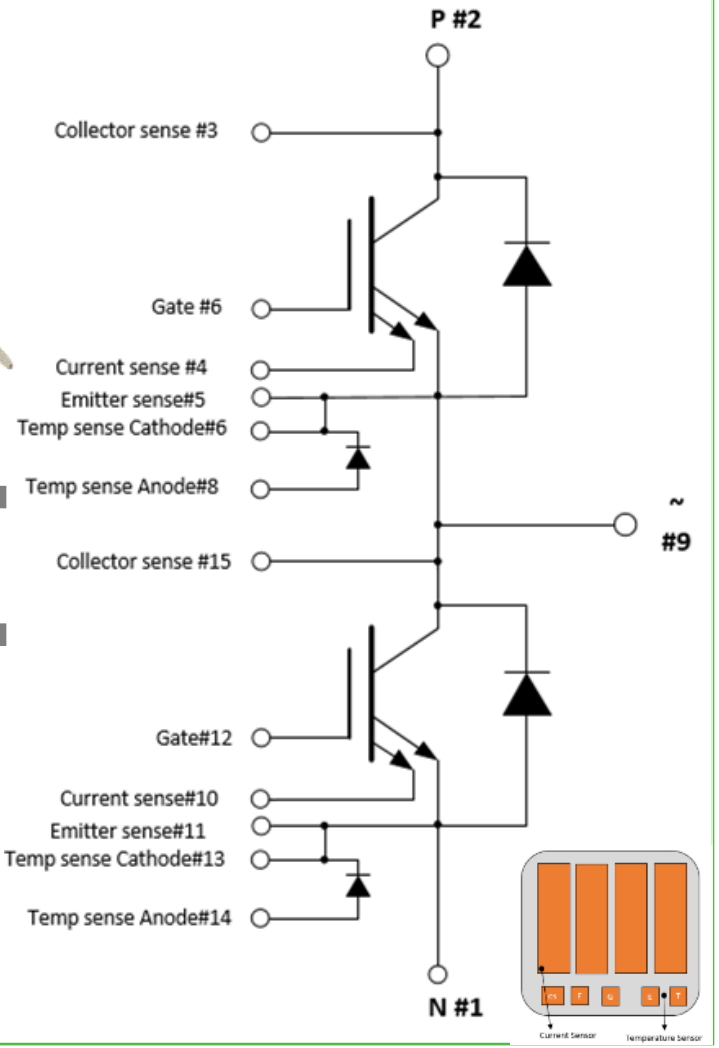
芯片倒装双面冷却Flip Chip Dual Side Cooling

Body Dimension:
55 x 55 x 4.7mm









- 每千瓦成本最低
- 半桥结构便于扩展、支持模块化和紧凑型设计
- 完全无绑定线，性能更好，寿命更久
- **硅上智能集成：** 电流和温度检测，反馈快速
- 业界领先的超低漏感6.5nH
- 顶部和底部双面散热，形成良好的导热特性
  比标准封装的热阻降低40% (RthJ-F)

Device Part Number	Current Rating	Voltage Rating	Package
NVG800A75L4DSC	800A	750V	VE-Trac™ Dual
NVG400A120L2DSC	400A	1200V	VE-Trac™ Dual

VE-Trac™ Direct 单面直冷模块优势

管脚兼容、功能匹配Pin & functional compatibility

管脚兼容，可直接上板，外围改动少量匹配即可

NVH820S75L4SPB
750V, 820A



NVH820S75L4SPC
750V, 820A



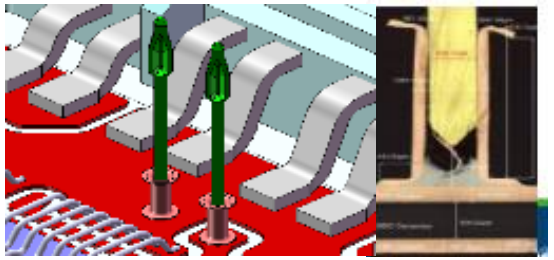
Voltage Rating	750V	1200V
Current Rating	770/660A (Derivative)	400A (Derivative)
	820A (Lead product)	500A (Derivative)
	950A (Lead product)	

- 直接替代或新设计
- 集成6个半桥
- 高集成利于安装
- 超低漏感8nH
- 最新FS4 750V 硅工艺
- 多电源端子配置
- 牢固的压配设计

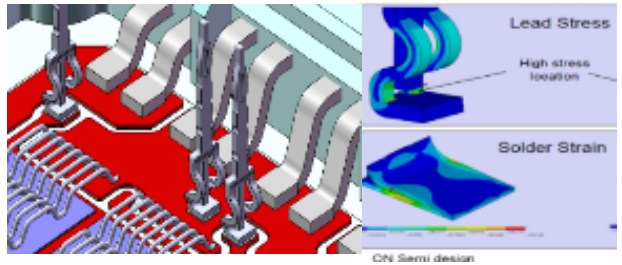
牢靠的压配设计Robust Press-fit design

创新的压配设计，提高定位精度和接触可靠性

Competitor design

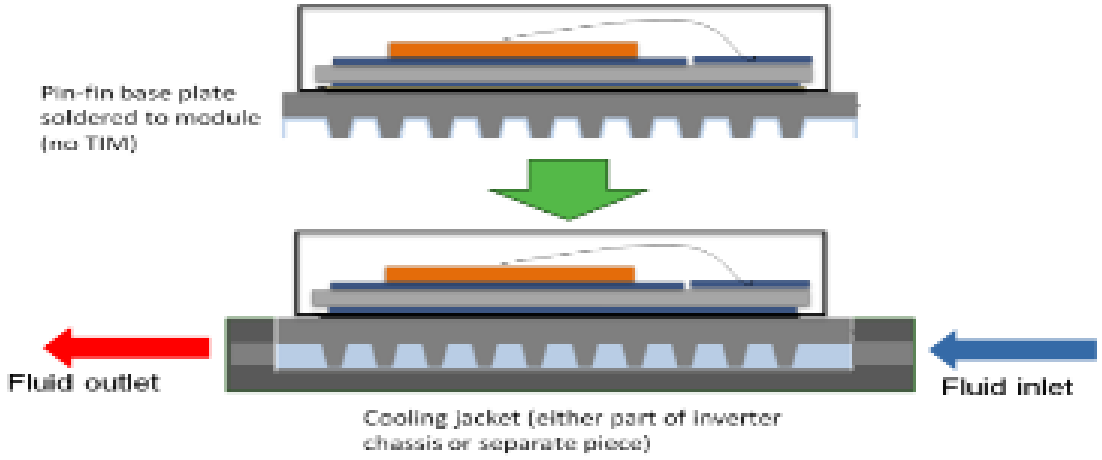


ON's design



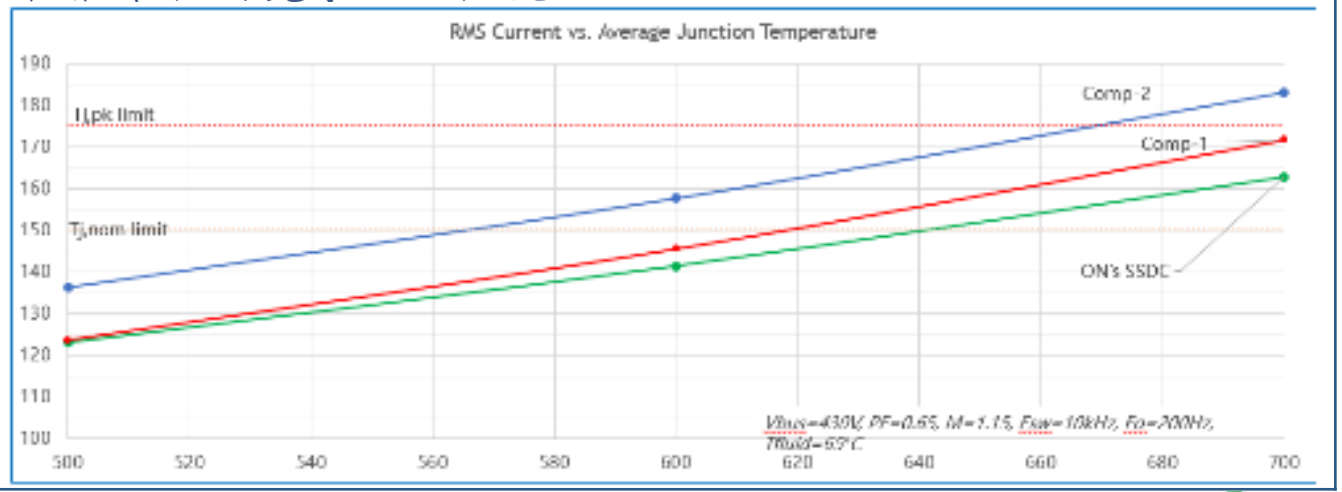
先进直冷设计Advanced direct cooling

新型销翅散热结构，改善Rth.j-f



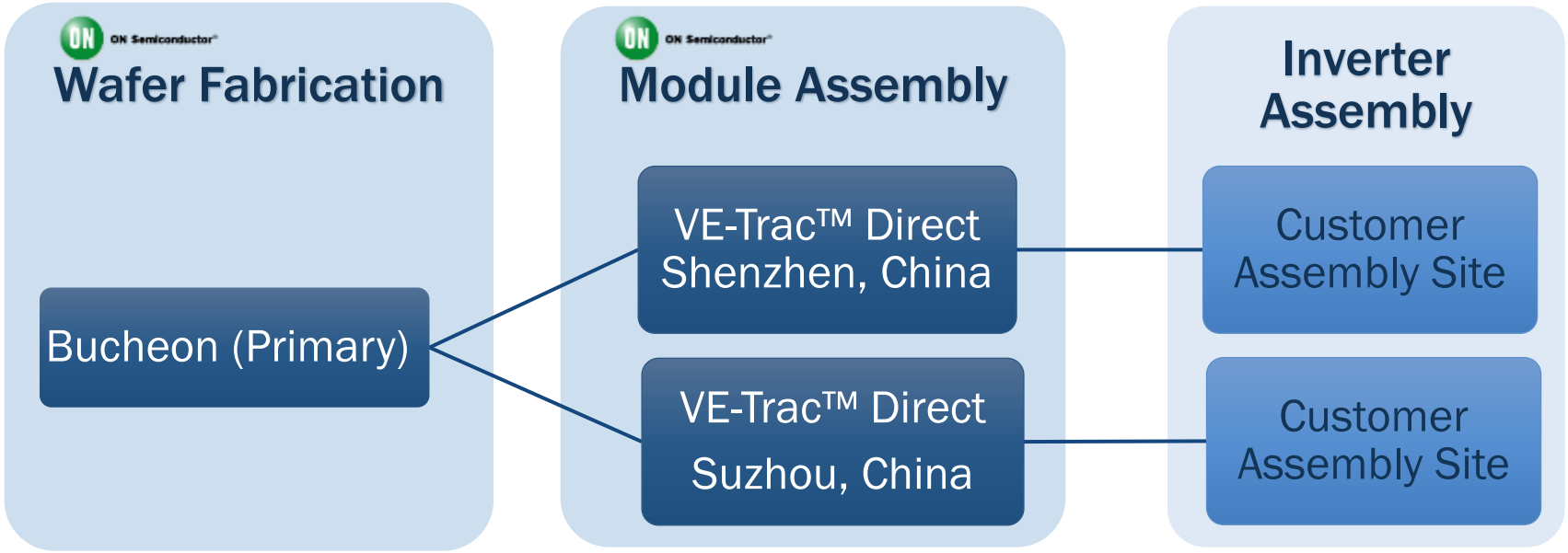
性能优异Excellent Performance

性能最佳的竞争匹配模块



安森美半导体的优势：稳健的内部供应链

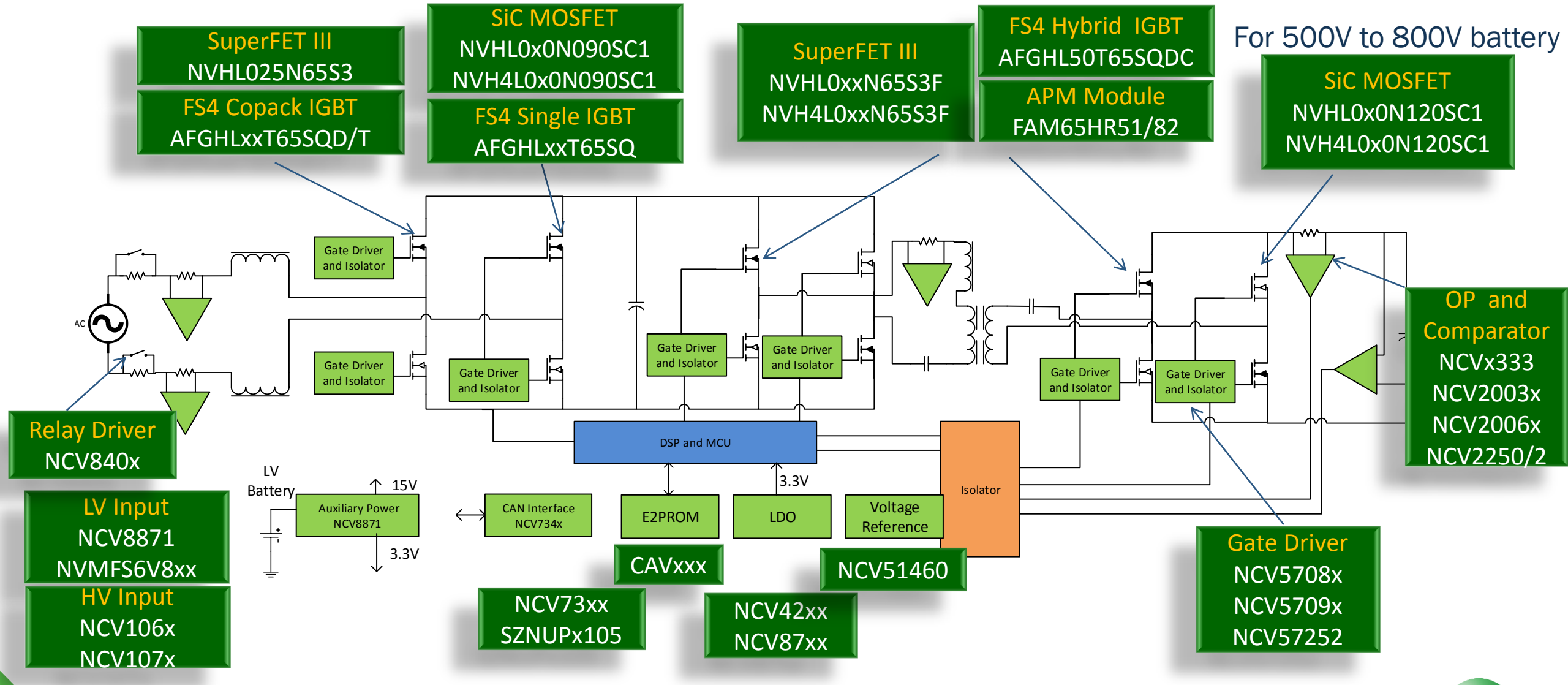
- 晶圆制造和组装在安森美半导体内部工厂进行，实现工艺和质量的最佳控制。晶圆双源保证供应链安全.
- 本地化采购，大批量生产，生产成本最优化。
- 规划IGBT过渡到12”晶圆



OBC DCDC 方案

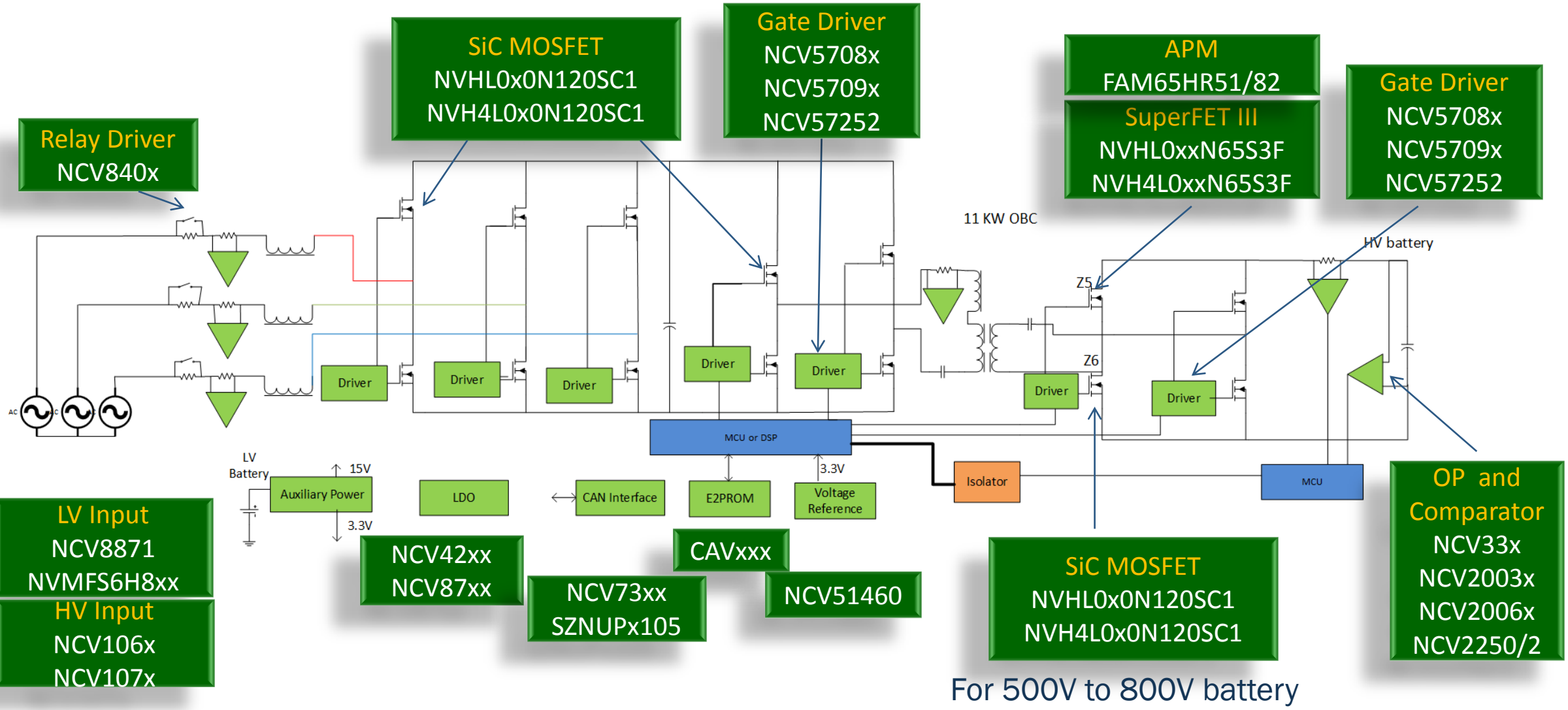
Public Information

6.6KW 双向OBC 框图



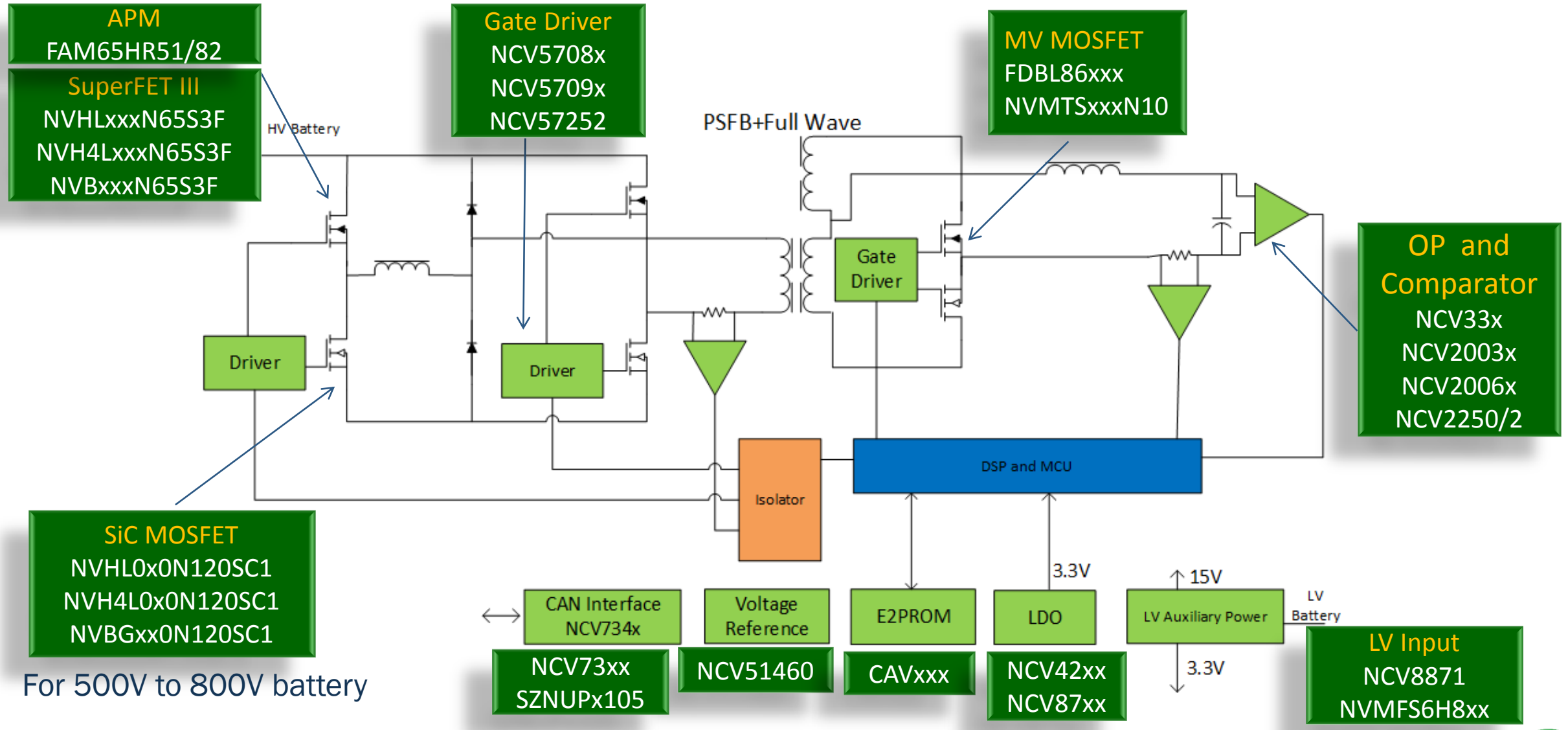
Public Information

11KW 双向OBC 框图



For 500V to 800V battery

1.8KW ~ 3KW DCDC变换器框图



Public Information

分立车规 IGBT产品

OBC-车规级的分立IGBT路线图

Released | Development | Plan | Concept

2017 | 2018 | 2019 | 2020 | 2021 | 2022

1200V SCR


Iso-TP247


TO-247


HV-D²PAK

- UFS 1200V 14.5x14.5 tech. qual, SFM ver. Bare die
- FS7 1200V SCR Large bare die
- STM ver.
- UFS 1200V *40A TO247
- 25A, 75A TO247,TP247
- FS7 1200V 25, *40A *TO247-3L, HV-D2PAK
- UFS 1200V 100A Iso-TP247
- FS7 1200V 120A ISO-TP247

1200V HS


TP-247


TO-247


TO-247-4L

- FS7 HS 1200V 40A TO247
- 25A, *40A TO247-3L/*4L
- FS7 1200V 80A TP247

750V SCR


Iso-TP247


TO-247

- FS4 750V 10x10 tech. qual, non-SFM ver. Bare die
- SFM die
- FS7 750V SCR Large bare die 10*10
- Large Die w. SFM
- FS4 750V 40A, *50A TO247
- FS4 750V *160A Iso-TP247
- FS7 1200V 120A Iso-TP247

650V SCR


Iso-TP247

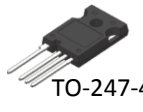

TO-247


HV-D²PAK

- FS3 650V 200A, 300A w. STM Bare die
- FS3 650V 40A for e-Comp TO247-LL
- FS4 650V 200A *Iso-TP247 qual vehicle
- FS4 650V 30 A, 40, 50A for e-Comp , PTC TO247, D2Pak
- FS7 650V SCR 200A Iso-TP247
- FS7 650V 30, 40, 50, 75A TO247-3L, HV-D2PAK

650V HS


TO-247

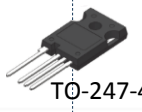

TO-247-4L


HV-D²PAK

- FS4 650V *40A, 30A HS for OBC D2PAK
- FS4 650V 40,50,*75A HS TO247
- FS7 650V HS 75A TO247
- FS7 650V HS 30, 40, 50, 75A TO247-3L/-4L, HV-D2PAK

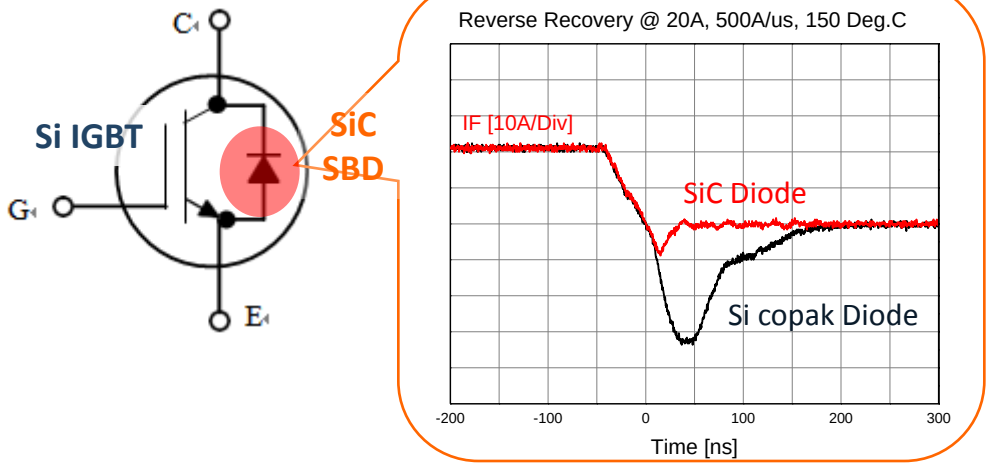
Hybrid IGBT (IGBT + SiC diode)


TO-247

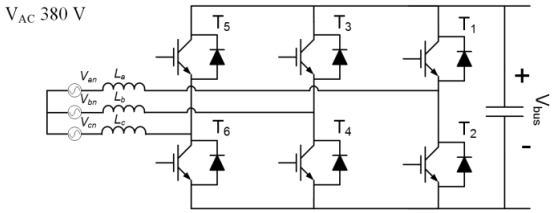

TO-247-4L

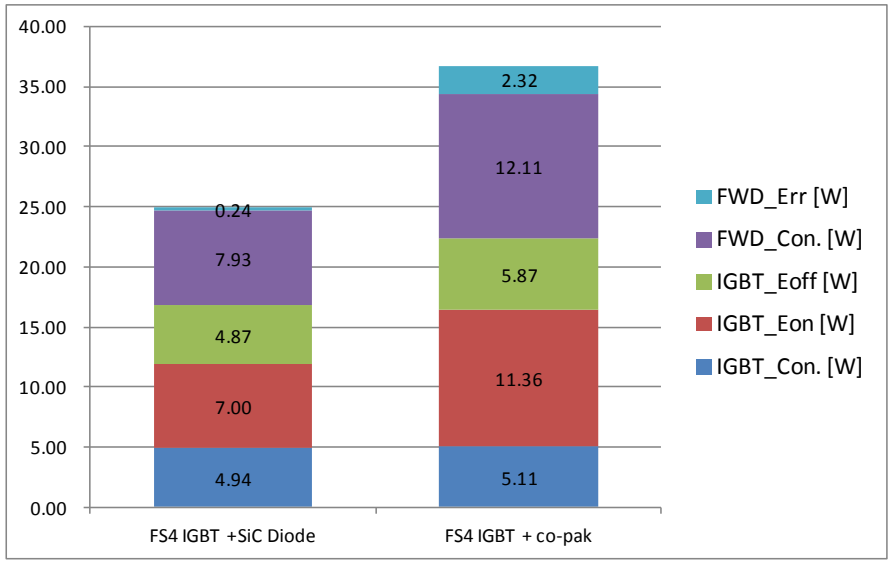
- FS4 650V Hybrid *50A for OBC TO247
- 75A
- FS7 Hybrid 650V, 1200V 40A TO247-4L

OBC -Hybrid IGBT的应用优势

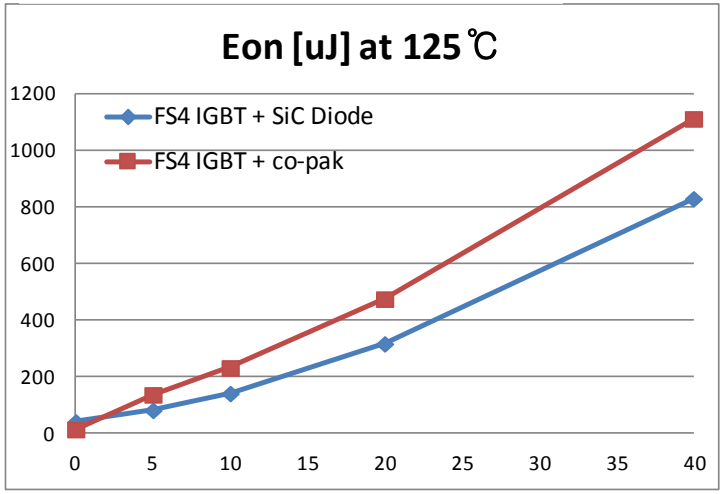


- **Loss Simulation Result for Totem-pole PFC**

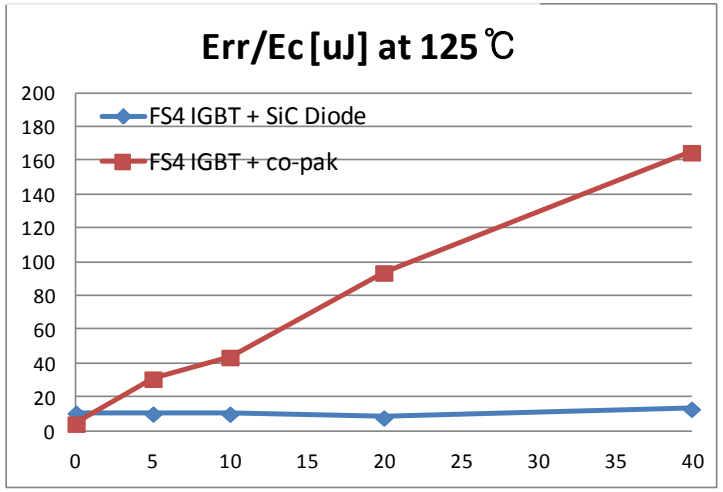




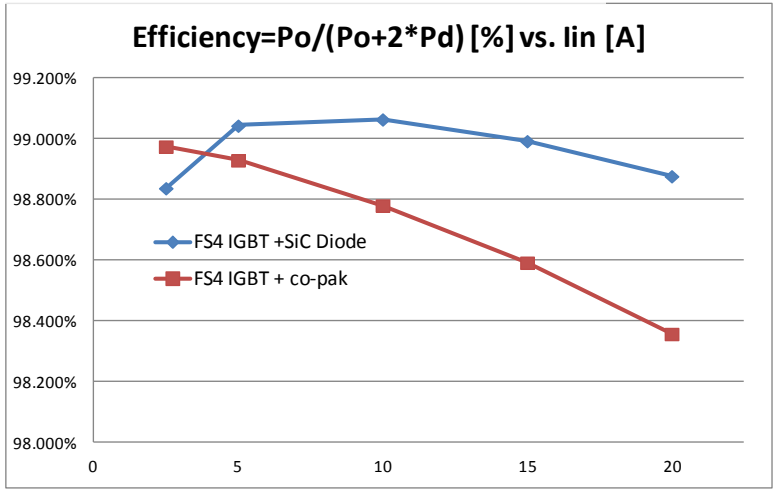
➢ **25% lower Eon loss**



➢ **Almost zero diode loss**



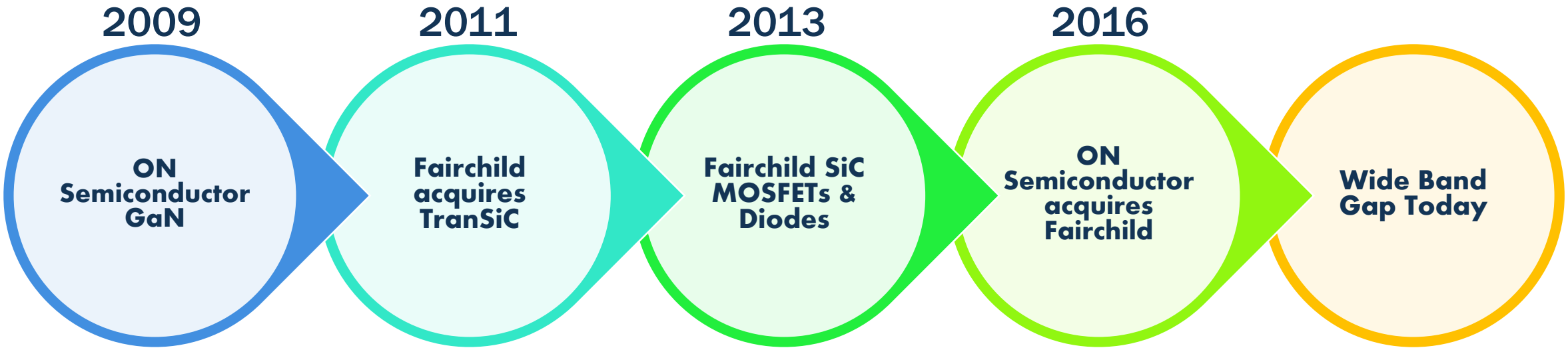
➢ **+0.55% efficiency improvement**



Public Information

分立车规WBG SiC产品

OBC -安森美半导体WBG的10年历程



- Started with Cascode GaN

- Startup from Sweden, developed SiC BJT
- Fab in Kista (Sweden) used for R&D

- Epitaxy line in Mountaintop (PA)
- Manufacturing line in 6” FAB in Bucheon (Korea)

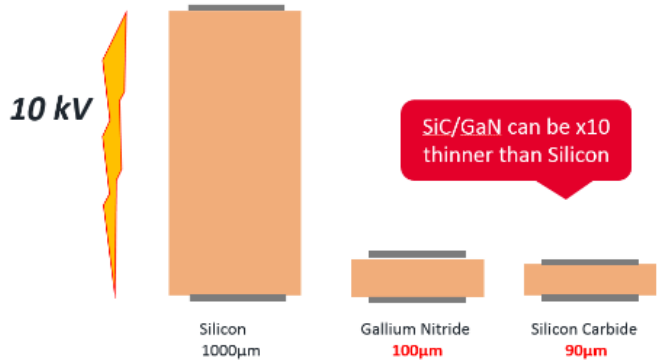
- ON Semiconductor creates Wide Band Gap Business Unit (previously managed by R&D teams)

- Maintain dedicated SiC and GaN R&D teams driven by the BU
- Full internal supply chain
- SiC Diodes and MOSFETs in production
- GaN Sampling

宽禁带技术的优势

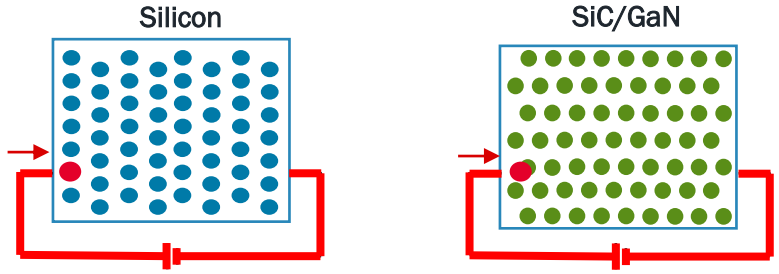
10倍高的介电击穿场强

- SiC/GaN 厚度减少，降低电阻和热阻，降低功率损耗



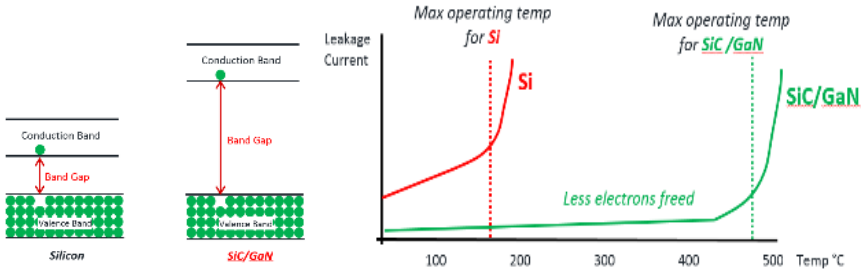
2倍高的电子饱和速度

- 更快的开关速度
- 电子饱和快，获得最大的电子速度



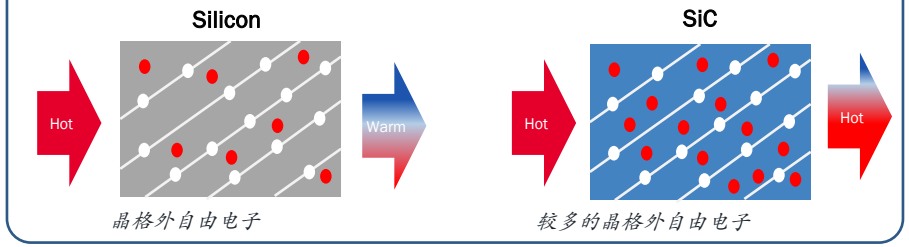
3倍高的能带间隙

- 大温度范围内提供稳定和低的漏电流
- 需要更高能量以释放电子



3倍高的热传导性

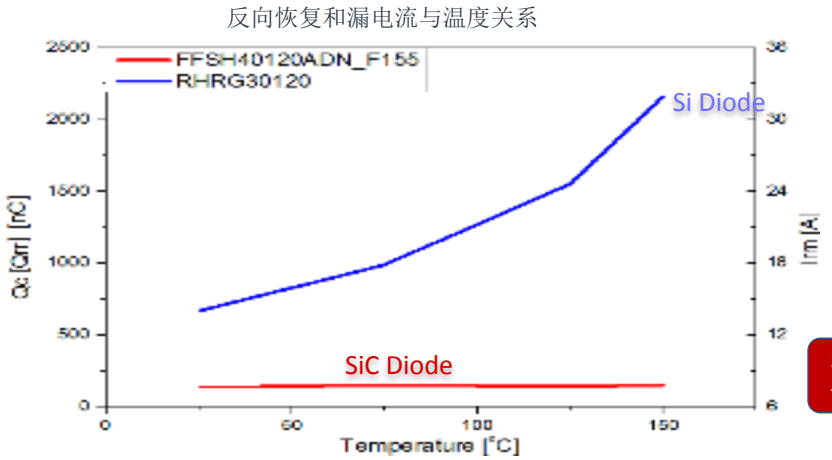
- 碳化硅的高散热能力可以降低工作时的温度和热应力
- SiC的激发电子能更快地转移，有助于散热



Source: Yole 2016, IHS

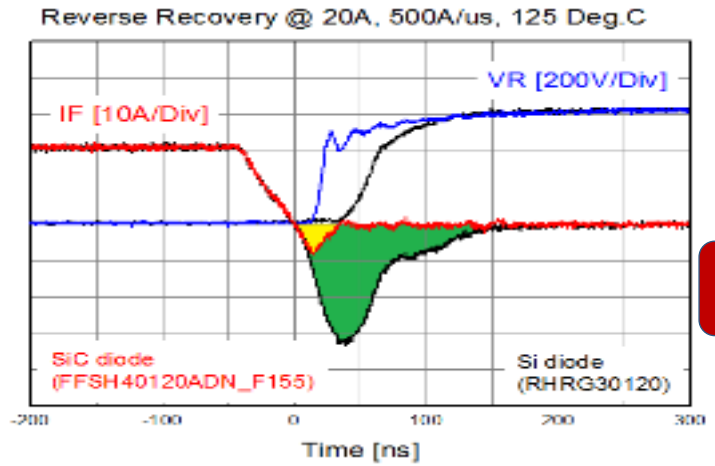
Public Information

SiC 有助于提升效率水平



SiC remains independent of temperature

- 稳定的温度特性可以在高温情况下不致增加开关损耗



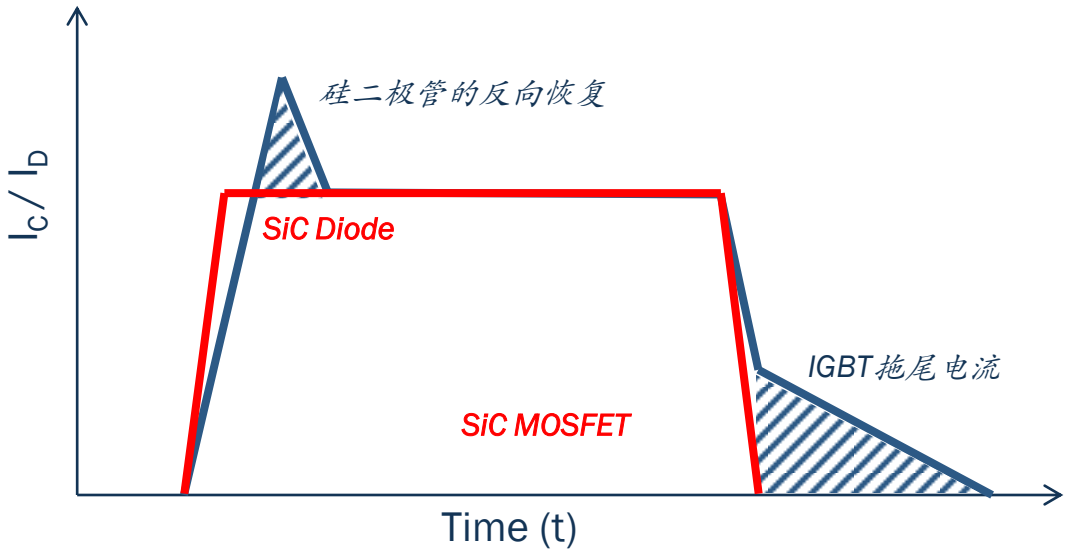
90% reduction in Qrr compared to Si diode

- 最小化的反向恢复电荷Qrr可以降低开关损耗并提高开关速度

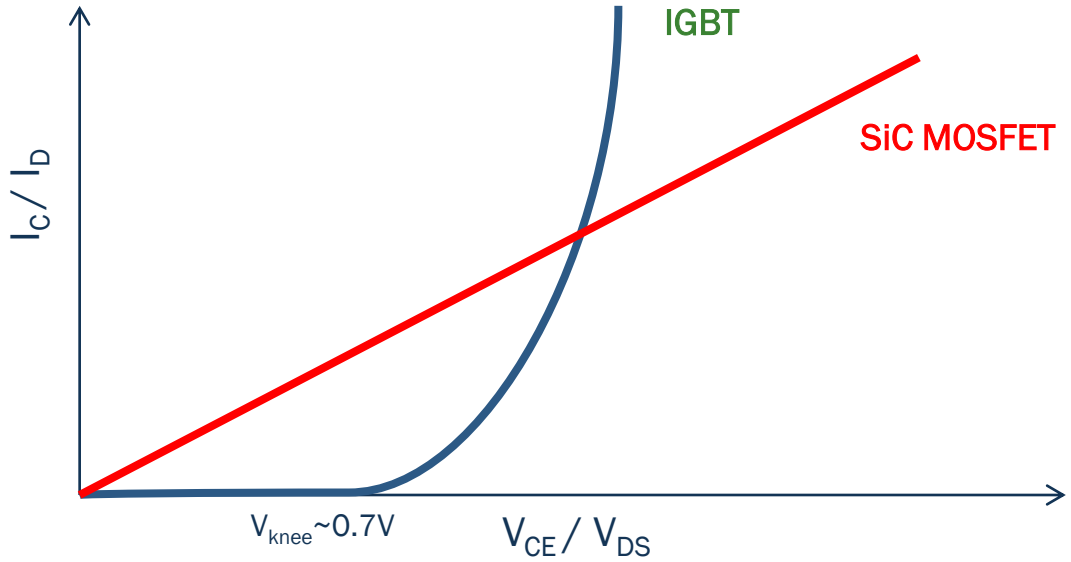
- SiC-SBDs 是多载流子器件，无少载流子
- 没有少载流子存储
- SiC SBDs的反向恢复电流仅是结电容的放电电流

Silicon IGBT & Diode vs SiC MOSFET

- 较低的开关损耗
  - 反向恢复时间短
  - 单极性电荷可使关断快速
  - 低栅极电荷和短恢复时间可以快速开通

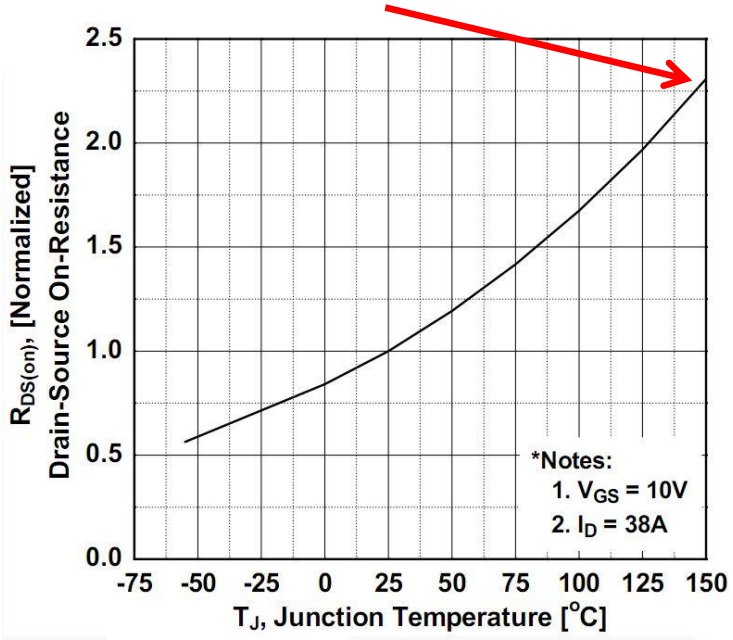


- 较低导通损耗
  - 无拐点电压
  - 低温度系数

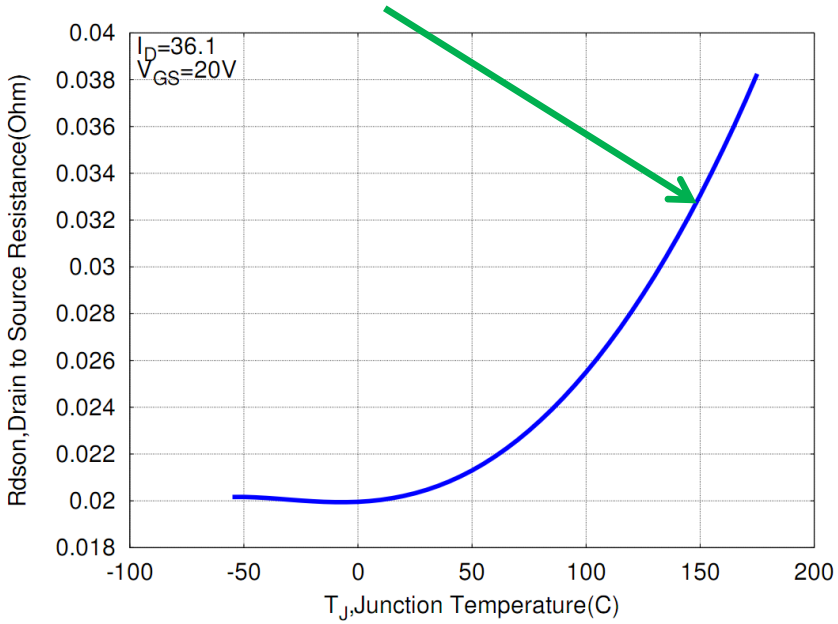


SiC 与 Si SJ MOSFET 参数对比

SJ MOSFET的Ron在150° C时是25°C 时的2.3倍



SiC MOSFET的Ron在150° C时 是25° C 时的1.6倍

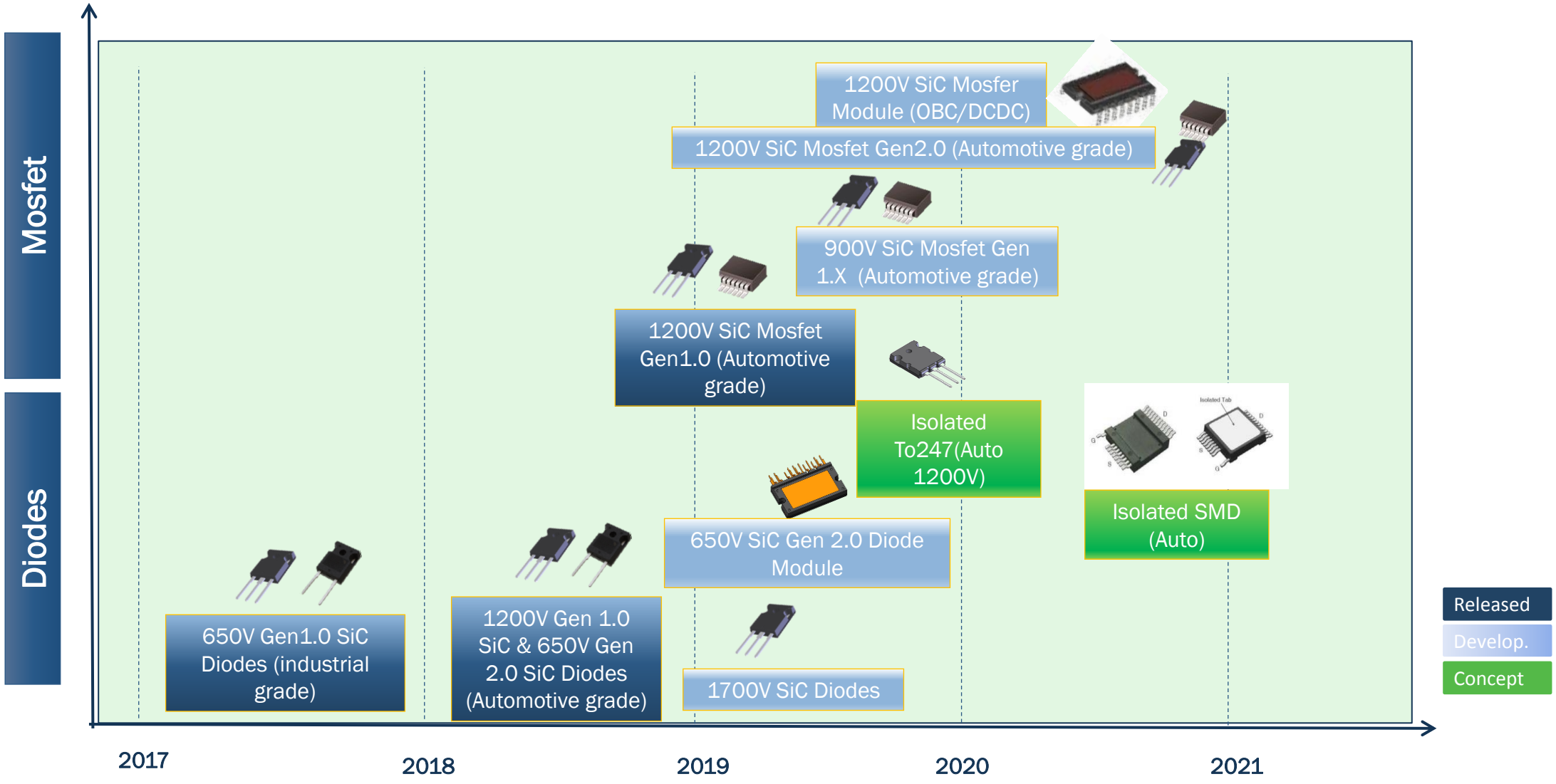


- SJ MOSFET的Ron在150° C时是25° C 时的2.3倍, 而SiC MOSFET的Ron在150° C时 是25° C 时的1.6倍。
- 一个 80mOhms 的SiC MOSFET 性能可以与65mOhms 的SJ MOSFET媲美。

针对相同系统效率需要对比两者的高温下的 R_{ON}

Note: Above diagram compares relative RON changes vs. absolute change.

SiC产品 分立元件和模块



Public Information

Automotive 1200V/650V SiC Diodes: Line up

Power Diode	Package	BVDSS(V)	Current (A)	Samples	Release to Market
FFSH40120ADN-F085	TO247-3L	1200	40	Available	Released
FFSH20120A-F085	TO247-2L	1200	20	Available	Released
FFSH20120ADN-F085	TO247-3L	1200	20	Available	Released
FFSH10120A-F085	TO247-2L	1200	10	Available	Released
FFSB20120A-F085	D2pak	1200	20	Available	Released
FFSB10120A-F085	D2pak	1200	10	Available	Released

650V	50A	2*20A (dual Die)	30A	20A	2*10A (dual Die)	2*6A (dual Die)	10A	8A	6A
TO247-2L	FFSH5065B-F085		FFSH3065B-F085	FFSH2065B-F085			FFSH1065B-F085		
TO247-3L		FFSH4065BDN-F085			FFSH2065BDN-F085	FFSH1265BDN-F085			
TO220-2L			FFSP3065B-F085	FFSP2065B-F085			FFSP1065B-F085		
TO220-3L		FFSP4065BDN-F085			FFSP2065BDN-F085				
DPAK							FFSD1065B-F085	FFSD0865B-F085	FFSD0665B-F085
D2PAK-2L			FFSB3065B-F085	FFSB2065B-F085			FFSB1065B-F085	FFSB0865B-F085	FFSB0665B-F085
D2PAK-3L					FFSB2065BDN-F085				

Automotive 1200V/900V SiC MOSFET's: Line up

SiC MOSFET	Package	BVDSS	Gate Drive	RDS(on) (mΩ)	Samples	RTM
		(V)	Level	max @ 20V		
NVHL020N120SC1	TO247-3L	1200V	+20/-5V	20	Available	Q4,2019
NVHL040N120SC1	TO247-3L	1200V	+20/-5V	40	Available	Q4,2019
NVHL080N120SC1	TO247-3L	1200V	+20/-5V	80	Available	Available
NVHL160N120SC1	TO247-3L	1200V	+20/-5V	160	Available	Q4,2019
NVH4L020N120SC1	TO247-4L	1200V	+20/-5V	20	Available	Q4,2019
NVH4L040N120SC1	TO247-4L	1200V	+20/-5V	40	Available	Q4,2019
NVH4L080N120SC1	TO247-4L	1200V	+20/-5V	80	Available	Q4,2019
NVH4L160N120SC1	TO247-4L	1200V	+20/-5V	160	Q4,2019	Q4,2019
NVBG020N120SC1	D2pak7L	1200V	+20/-5V	20	Available	Available
NVBG040N120SC1	D2pak7L	1200V	+20/-5V	40	Available	Q4,2019
NVBG080N120SC1	D2pak7L	1200V	+20/-5V	80	Available	Q4,2019
NVHL020N090SC1	TO247-3L	900V	+15/-5V	20	Available	Q4,2019
NVHL060N090SC1	TO247-3L	900V	+15/-5V	60	Available	Q4,2019
NVBG020N090SC1	D2pak7L	900V	+15/-5V	20	Available	Q4,2019
NVBG060N090SC1	D2pak7L	900V	+15/-5V	60	Available	Q4,2019
NVC020N090SC1	Bare Die	900V	+15/-5V	20	Available	Q4,2019
NVC060N090SC1	Bare Die	900V	+15/-5V	60	Available	Q4,2019

分立车规SJ MOSFET

安森美半导体车规超级结MOSFETs 技术演进

SJ MOSFET 世代

SuperFET I (2004)
- First Gen. SJ MOSFET
- Best-in-class body diode dv/dt
- 190mΩ in TO-220, **70mΩ in TO-247**

SupreMOS (2009)
- 50% lower Qg than SF1
- World 1st Trench Type
- 90mΩ in TO-220, **36mΩ in TO-247**

SuperFET II Reg. & Fast (2011)
- Direct replace to SupreMOS®
- For high efficiency

SuperFET II (2012) – Easy Drive
- Direct replace to SF1
- Easy to design by a internal Rg
- 104mΩ in TO-220, **41mΩ in TO-247**

SuperFET II (2012) – FRFET
- Smaller Qrr and robust body diode
- For soft switching topologies

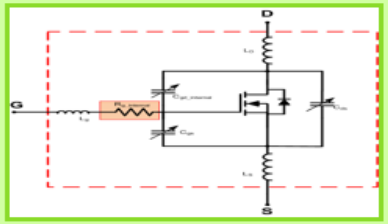
SuperFET III (2015) – Easy Drive
- 41% lower Rsp than SF2
- Direct replace to SF2 Easy Drive
- 67mΩ in TO-220/F, **23mΩ in TO-247**

SuperFET III (2017) – FRFET
25mΩ in TO-247

SuperFET III (2018) – Fast
19mΩ in TO-247

2004 2009 2011 2012 2015 2017 2018

易驱动版Easy Drive Version
- Hard/Soft Switching Topologies
- Easy to drive
- Low EMI and Voltage spikes
- Internal Rg and optimized Cap



快恢复版FRFET Version
- Soft switching topologies
- Better system reliability
- Small Qrr and Trr
- Robust diode ruggedness



10年车规超级结MOS的发展.

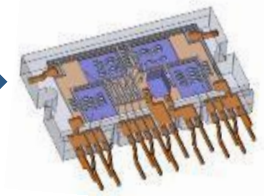
引领业界高效的第三代技术.

现有分立产品组合, 以及确好的die裸片.

持续投资研发超级结第五代、第六代技术.

- ❑ Applications
  - ❑ OBC and DC-DC
- ❑ Product Variations
  - ❑ H Bridge
  - ❑ Input/Output Rectifiers
  - ❑ PFC Bridge

SJ Module



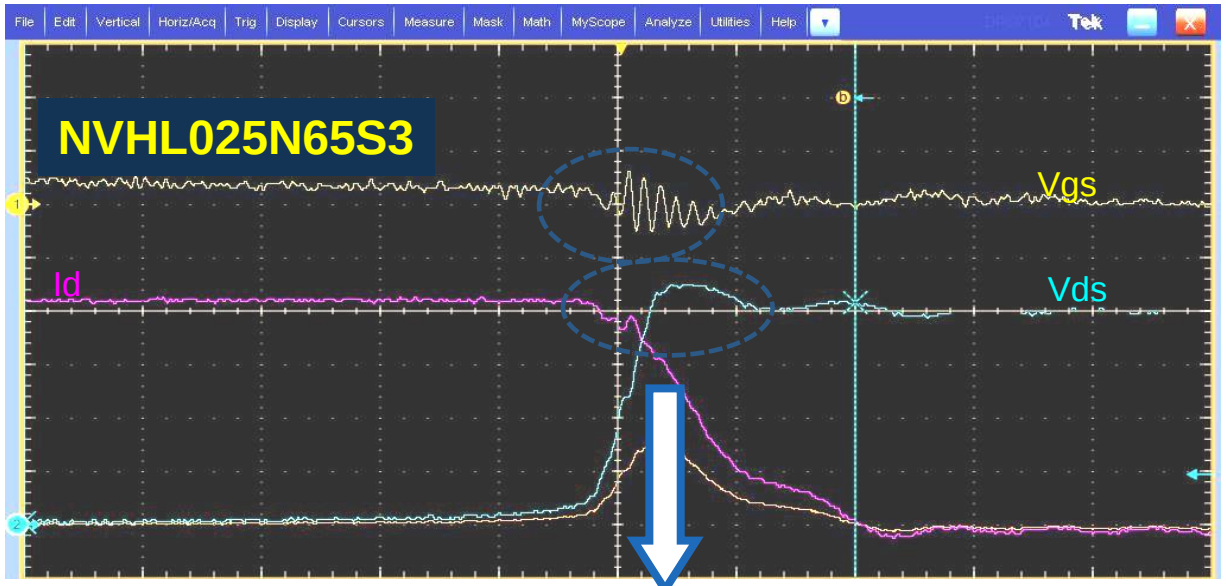
- 1 个封装 (APM16)包含12不同的半导体元件
- 适用于3.3kW to 22kW OBC 和DC-DC不同的电路段.
- 耐压650V 到 1200V.
- 降低系统成本.
- 减少元件数量
  - 1xAPM16 replaces 4xTO-247
- 经得起未来考验的设计
  - Super FET II → SuperFET III
  - Super FET III → WBG

2018年中推出业界首款车规级模块.

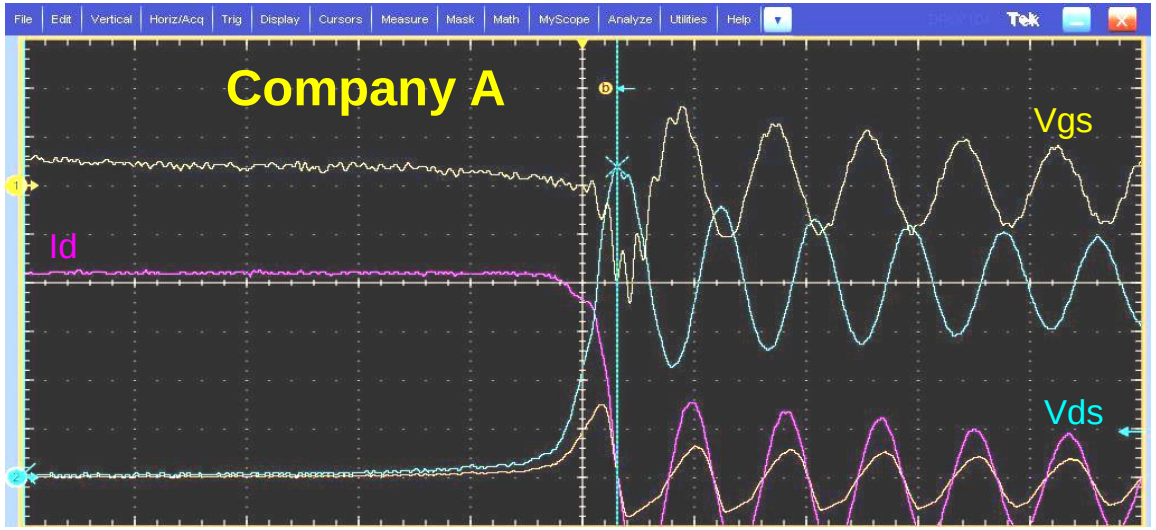
Public Information

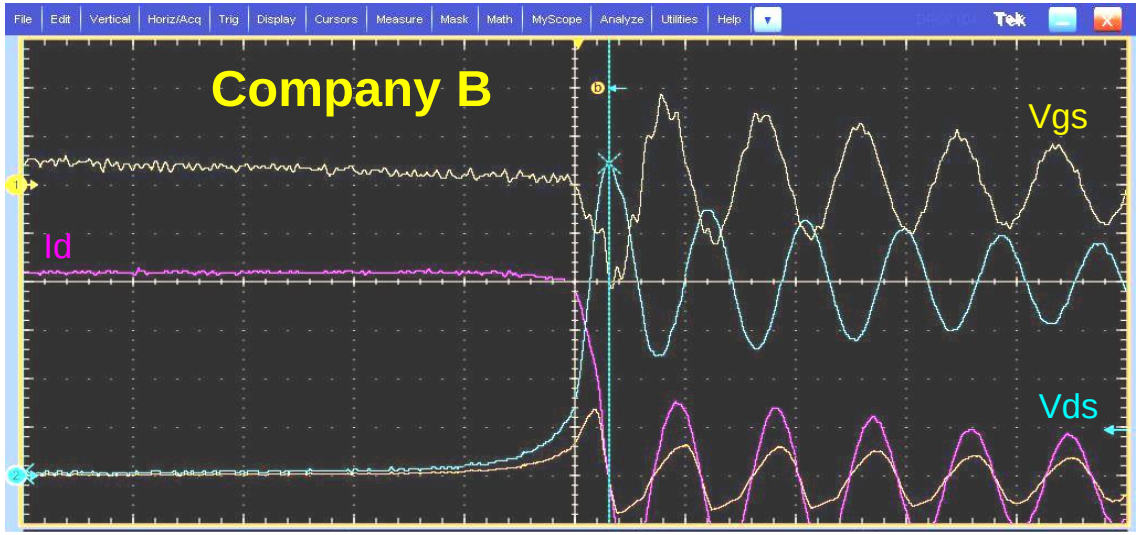
SuperFET® III Easy Drive MOSFETE Features, Benefits

特点	益处
• 优化的开关特性 • 相同封装下较低导通阻抗$R_{DS(ON)}$ • 较低的 FOM($R_{DS(ON)\ max.}$ X $Q_{g\ typ}$) • Lower Eoss • 强健的体二极管 • 650V	• 易用 • 提高功率密度 • 减少并联MOSFETs • 提高系统效率 • 改善轻载效率 • 提高系统可靠性 • 提高安全裕量



•降低栅极电压的震荡
• 漏极电压尖峰降低

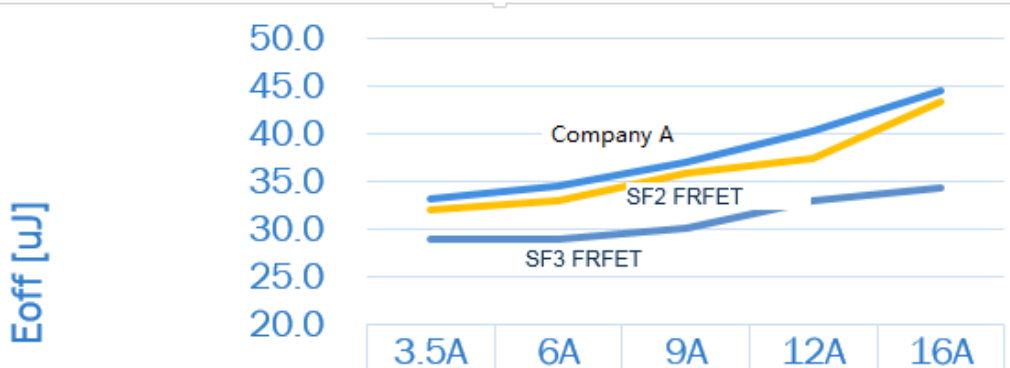




SuperFET® III FRFET MOSFET Features and Benefits

SF 3 FRFET为了提高软开关拓扑的可靠性和高效率而设计的

特点	益处
• 优异的体二极管 • 低开关噪音 • 相同封装下较低导通阻抗$R_{DS(ON)}$ • 较低的 FOM($R_{DS(ON)\ max.}$ X $Q_{g\ typ}$) • 650V	• 提高系统可靠性 • 易于快速设计 • 提高功率密度 • 减少并联MOSFETs • 提高系统效率 • 提高安全裕量



	3.5A	6A	9A	12A	16A
NTH040N65S3F	28.9	28.8	30.1	32.9	34.3
FCH041N60F	31.9	32.9	35.8	37.3	43.4
Company A	33.2	34.5	37.0	40.2	44.5

	Reverse Recovery Characteristics		
	Qrr[uC]	Trr[ns]	Irrm[A]
	V_{DD}=400V, I_{SD}=35A, di/dt=200A/us, Tj=25C		
NVHL040N65S3F	**1.2**	**114**	**18.9**
FCH041N60F	**2.6**	**164**	**28.0**
IPW65R041CFD	**1.8**	**141**	**22.9**

- **最优的体二极管特性 !!**

Comparison of waveforms @ I_{SD}=35A, di/dt=500A/us

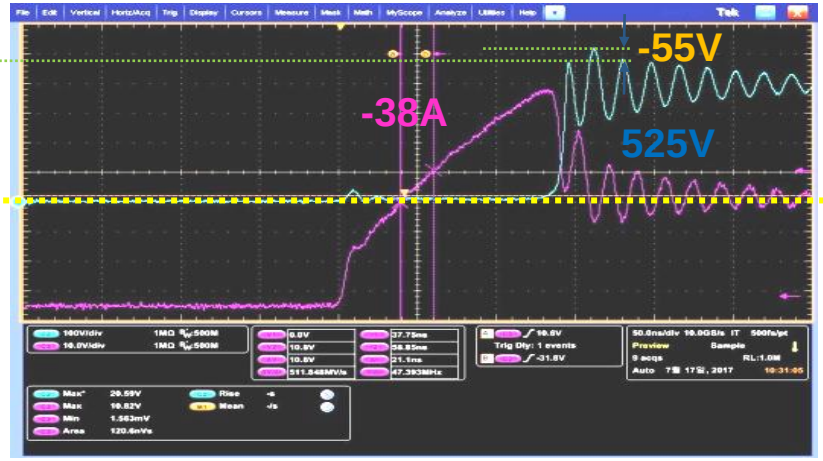
NVHL040N65S3F



FCH041N60F

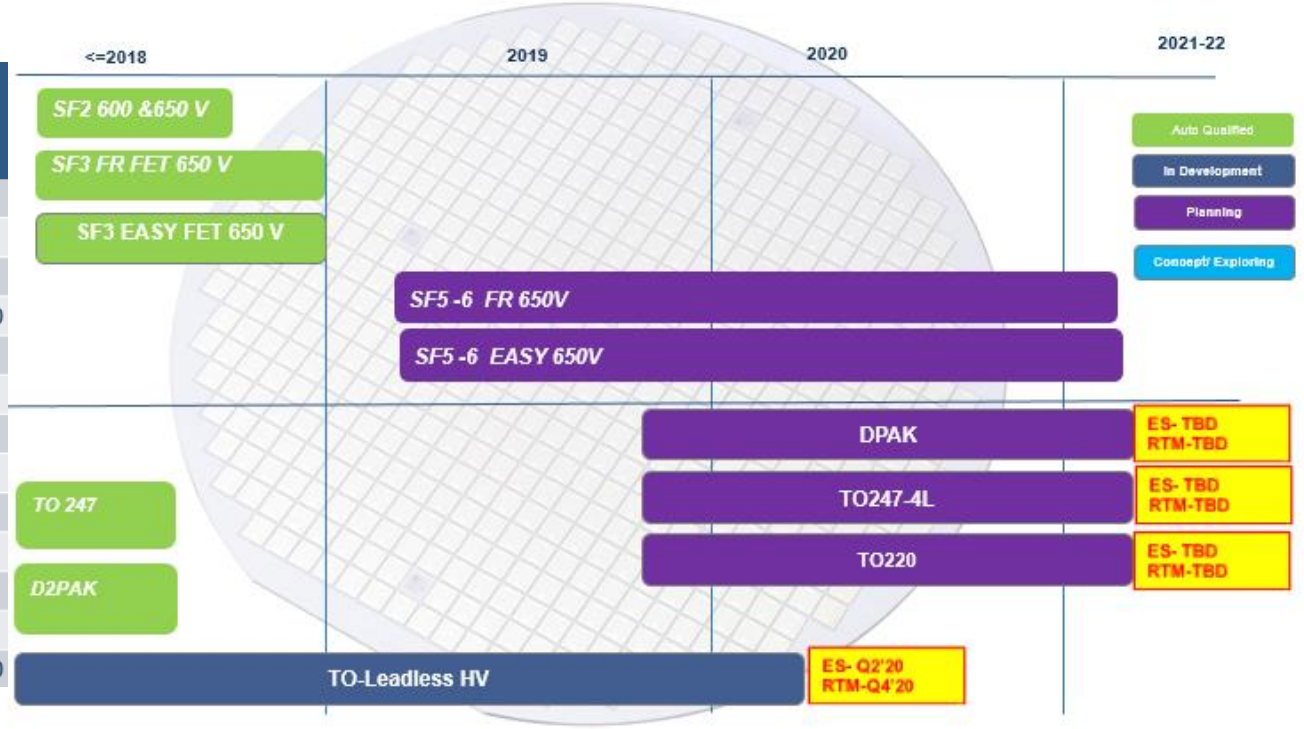


Company A



安森美半导体车规高压MOSFETs

Power MOSFET	Technology Family	Package	BVDSS (V)	Gate Level (V)	RDS(on) max @ 10V (mΩ)	Samples	RTM
NVHL025N65S3	Easy Drive	TO247-3L	650	10	25	Available	Now
NVHL072N65S3	Easy Drive	TO247-3L	650	10	72	Available	Now
NVB072N65S3	Easy Drive	D2pak	650	10	72	Available	Now
NVBL*****S3	Easy Drive	TOLL HV	650	10	70	Q4,2019	Q2,2020
NVHL027N65S3F	Fast Rec Diode	TO247-3L	650	10	28	Available	Now
NVHL040N65S3F	Fast Rec Diode	TO247-3L	650	10	40	Available	Now
NVHL082N65S3F	Fast Rec Diode	TO247-3L	650	10	82	Available	Now
NVHL110N65S3F	Fast Rec Diode	TO247-3L	650	10	110	Available	Now
NVB082N65S3F	Fast Rec Diode	D2PAK	650	10	82	Available	Now
NVB110N65S3F	Fast Rec Diode	D2PAK	650	10	110	Available	Now
NVB150N65S3F	Fast Rec Diode	D2PAK	650	10	150	Available	Now
NVBL*****S3F	Fast Rec Diode	D2PAK	650	10	150	Available	Now
NVBL082N65S3F	Fast Rec Diode	TOLL HV	650	10	82	Q4,2019	Q2,2020



Public Information

HV TOLL 封装源极Kelvin引脚

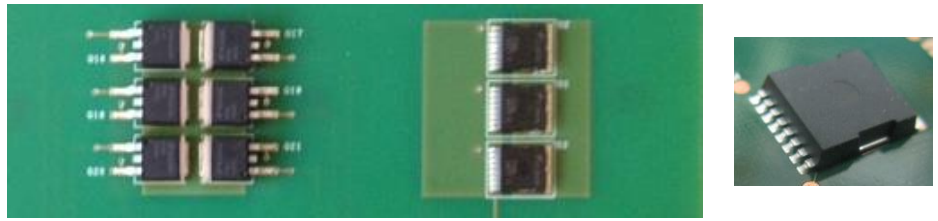
优势所在

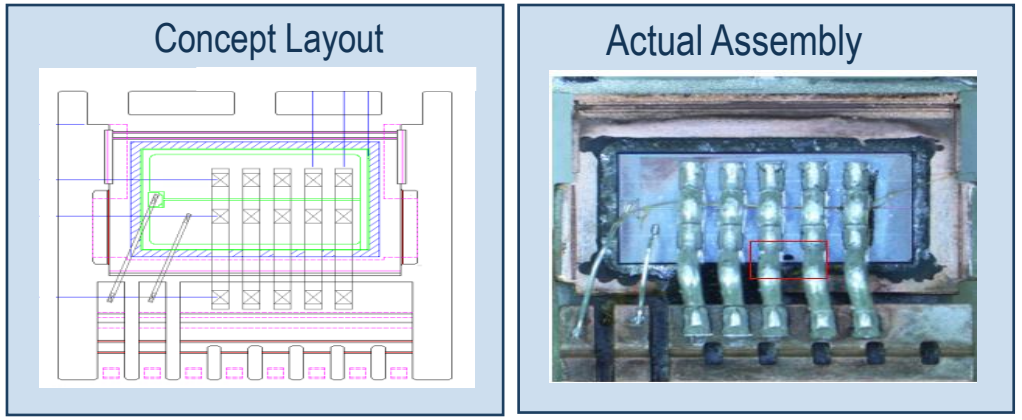
- TOLL 较 D2PAK 节约30%的占板面积和 60% 的空间
- 超强的热性能
- 封装比Power88更强健
- 与标准的无Kelvin的封装相比可使开通损耗降低50%
- 潮敏等级 MSL 1

40-150V低压 Mosfet 从2014开始量产）

Device	TOLL-Kelvin	TOLL	D2PAK
Eon-loss	201uJ	316uJ	353uJ
Eoff-loss	189uJ	196uJ	241uJ

- 更小的板面空间(11x16 mm vs 10x12 mm)





OBC 模块产品方案

Public Information

安森美半导体OBC 模块产品

功率等级

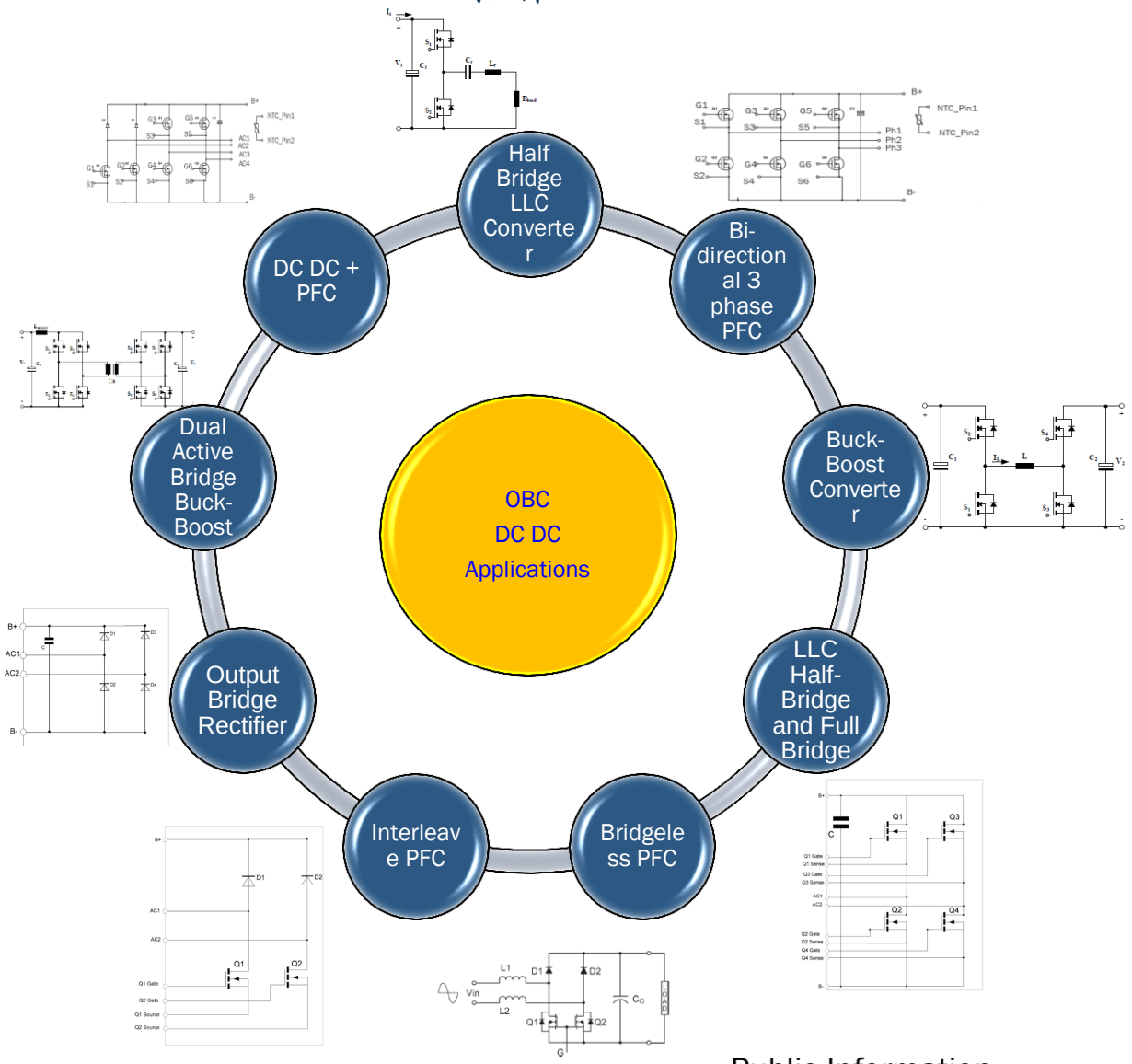
3.6kw

7.2kw

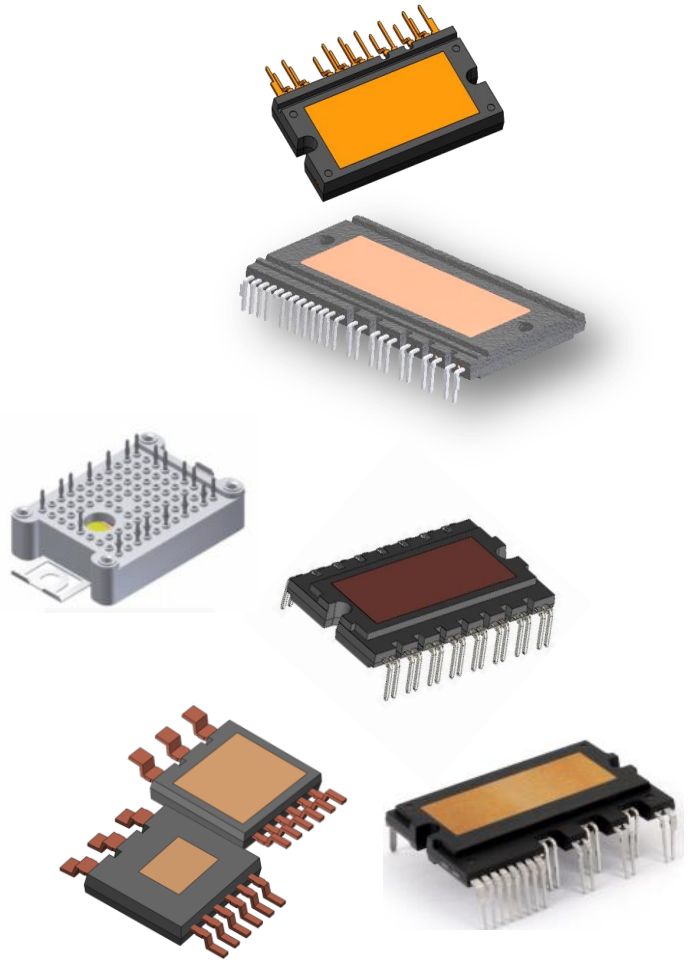
11 kw

22 kw

拓扑



APM方案



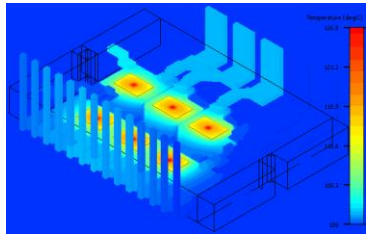
Public Information

安森美半导体APM的优势

大功率应用

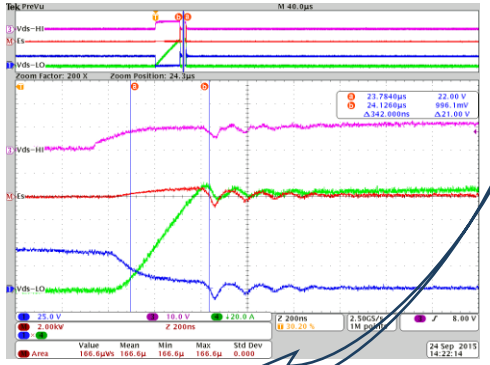
特性

低热阻



电气特性：

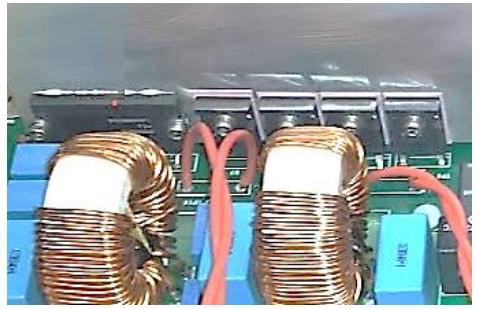
- 大电流能力
- 低电感
- 低阻抗
- EMI 特性好（by snubber）
- 内部高压隔离



低损耗 & 低结温

功率密度提升↑

小尺寸，轻量化



总成本降低↓

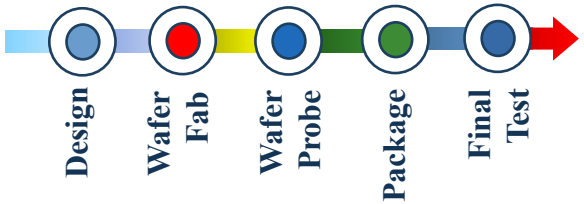
节约总体的制造成本和质量成本

品质

可靠性经过实际验证



晶圆及封装



所有步骤全部在安森美半导体内部完成

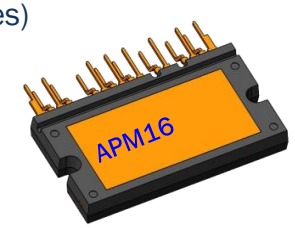
APM16平台产品

Description

- 应用于EV-PHEV OBC的PFC部分，DCDC变换, 桥堆部分
- 爬电和安全间距符合IEC60664-1, IEC60950-1
- 热阻低
- 高度集成设计
- 适宜集成硅/碳化硅/半桥/全桥电路拓扑
- 5kV/1秒电隔离基板，易于组装
- 符合车规模块认证– AQG324

APM16: 耐压650V, (PFC or DC/DC or Bridge diodes)

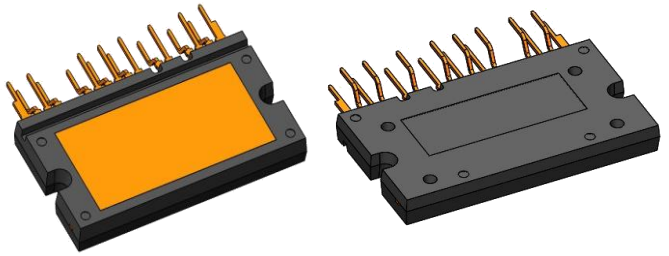
发布
DCDC-FAM65HR51DS2
PFC-FAM65CR51DZ2认证标准AQG324.
更多产品即将发布



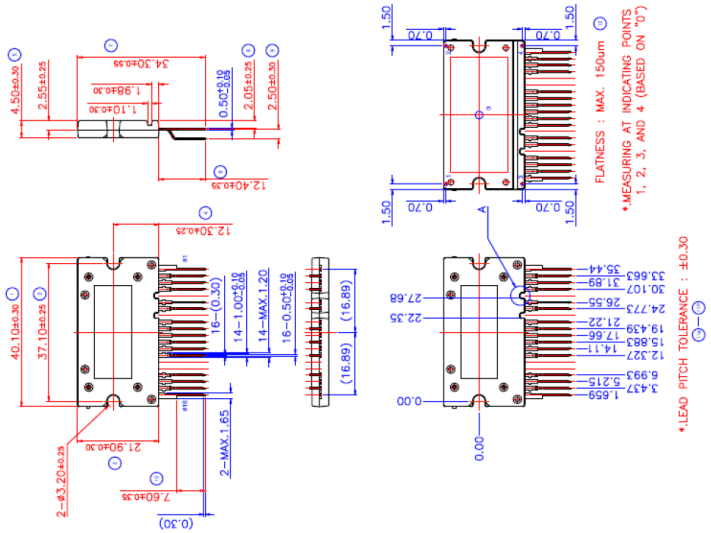
Application

3,3KW	6,6KW	3,3KW	6,6KW
DCDC APM16 Al2O3 Substrate	**DCDC APM16** AlN Substrate	**PFC APM16** Al2O3 Substrate	**PFC APM16** AlN Substrate

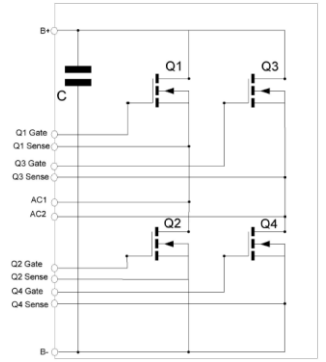
Package : 40.1 mm × 21.9 mm × 4.5 mm



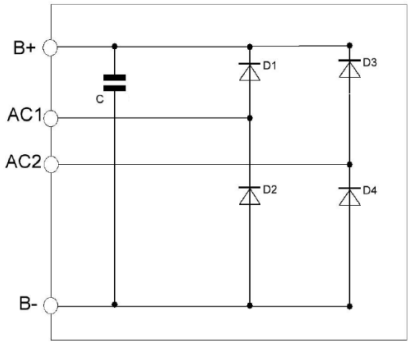
Package Details



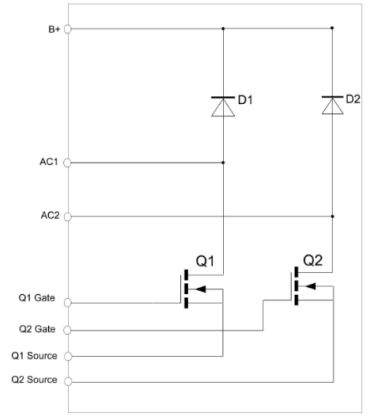
DC DC



Bridge Rectifier



PFC



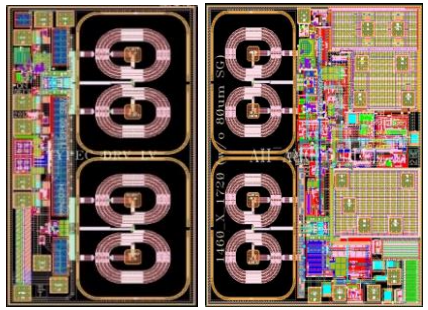
Public Information

车规级高压栅极驱动产品

Public Information

栅极隔离驱动技术

A. 5kV UL Recognized Isolation (Robustness)



Features	Inductive
UL 5kV Isolation	√
Reliability /Aging	√
Temp Range	√
EMI	√

隔离技术优势:

A. 安全、可靠、经过合格认证

B. 大驱动电流改善系统效率

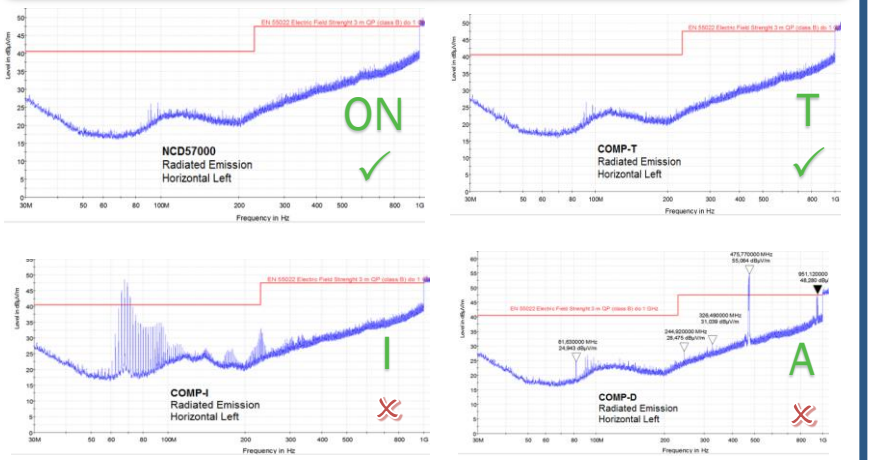
C. 不产生电磁干扰，也不易受系统电磁干扰

D. 对高压大功率开关电压瞬变引起的瞬态共模抗扰能力强

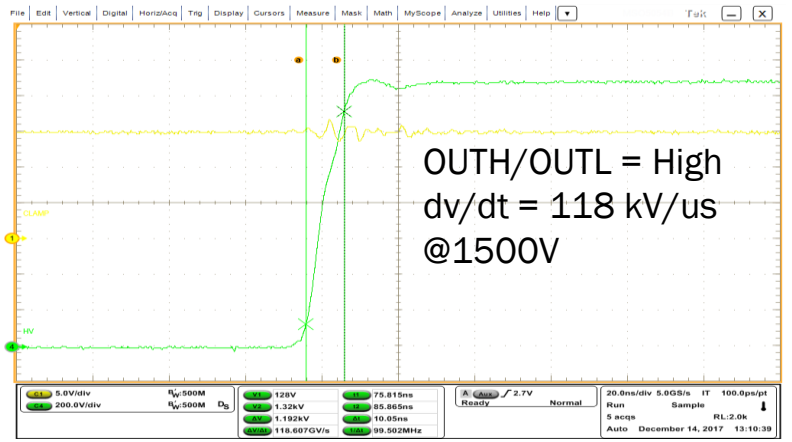
B. Highest Drive Current (improved Efficiency)

	ON	A	I	T
I-source Peak	8A	4.6A	4A	2.5A
I-Sink Peak	8A	4.6A	3A	5A
I-Source Miller Plateau	4A	3A	1.1A	2A
I-Sink Miller Plateau	6A	4A	2.9A	4A

C. Best-in-Class EMI (Higher Noise Robustness)



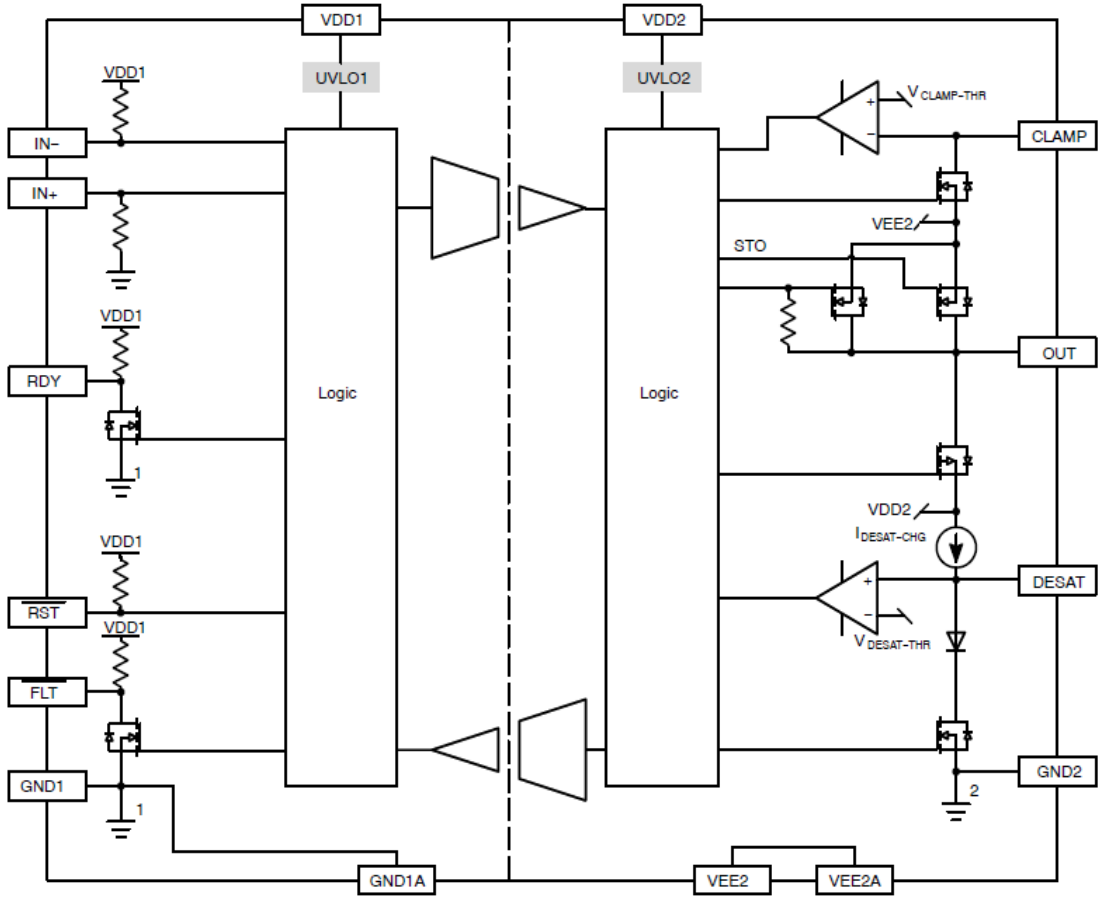
D. Best-in-Class CMTI (Higher Noise Robustness)



NCD(V)57000/01 隔离驱动

Features

- 米勒平台电压维持大电流输出High current (4.0 A/6 A src/snk)
- 绝缘隔离电压大于5 kV,工作电压高达1400 V
- 共模抑制比CMTI > 100kV/us @ 1500V
- Typical 66ns 延迟
- 软关断
- 去饱和检测延时可编程
- IGBT 短路时栅极钳位
- 精密的UVLO检测保证IGBT 安全



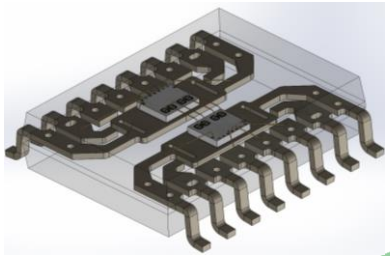
Market & Applications

光伏逆变器, 电机驱动器, 电动车充电器, 汽车动力总成等

Packages/Options

SOIC-16 宽体封装



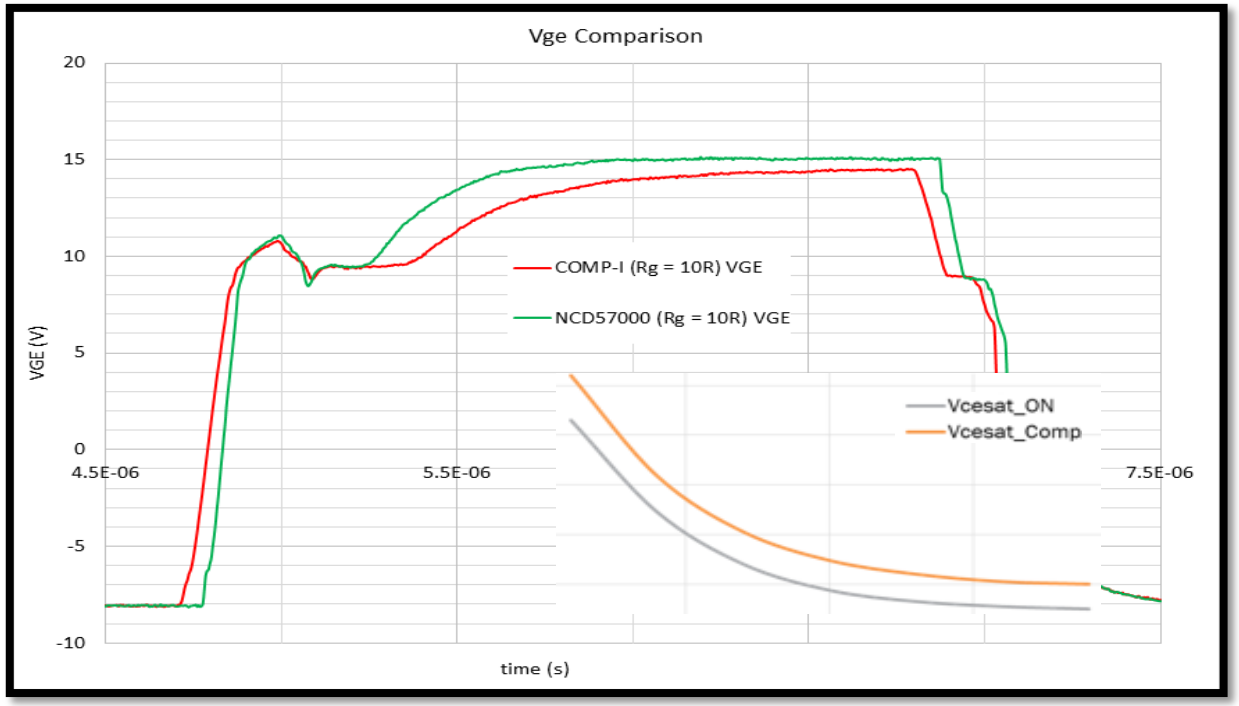


Public Information

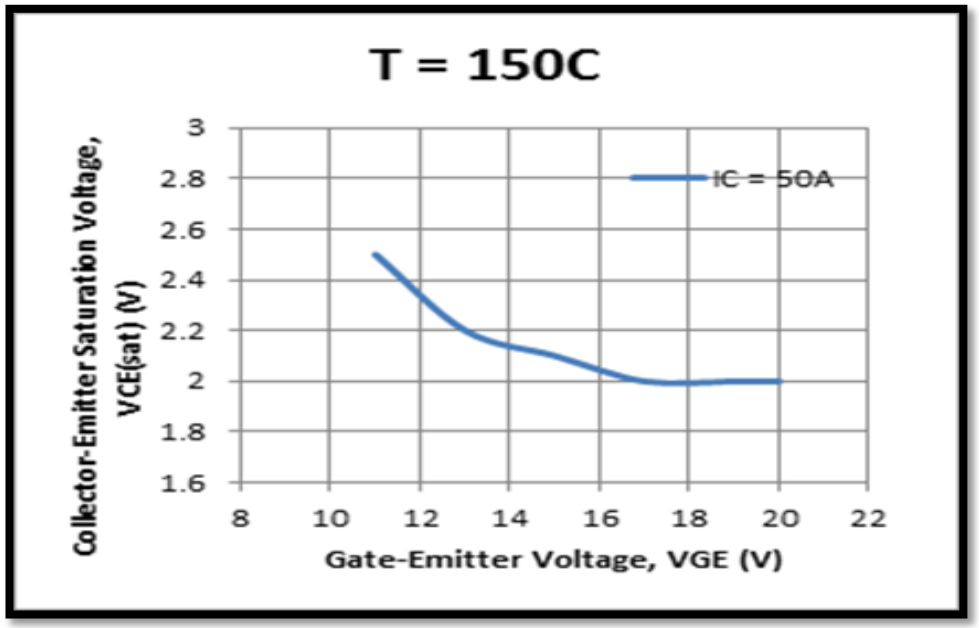
NCD5700x 改善导通损耗和开关状态测试

导通损耗的改善

NCD5700x提供极低的VOH和VOL轨对轨电压，而有些驱动(或缓冲)会在VOH产生1V 到3V的压降.



IGBT Vcesat 与Vge电压有关



- **开关测试，条件: 40A, 600V switching, 1x IGBTs (40A, 1200V)**

NCD5700x 开关延时低，脉宽畸变小

Part	Turn ON [ns]	Turn OFF [ns]	Pulse width distortion [ns]
NCD57000	70	70	10ns max
Competition - I	170	165	60ns max

IGBT开通损耗低

Driver	Rg [Ohm]	di/dt [A/us]	Eon [mJ]	Eon1 [mJ]	Eon2 [mJ]	Eon3[mJ]
NCD57000	10	479	3.7	0.9	2.4	0.4
Competition - I	10	389	4.5	1.2	2.6	0.7

Public Information

总结

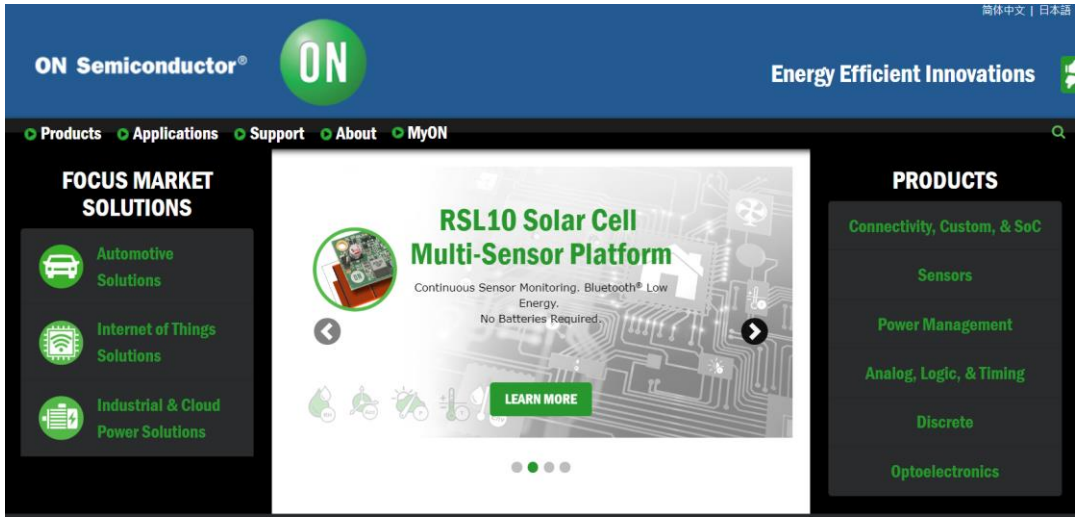
- 安森美半导体作为汽车电气化的领先企业，拥有xEV必要的技术和完整供应链体系
- 持续的研发投入，提供全面的产品组合，以及解决方案
- 重大投资项目，以支持稳定可靠的供应链
- 优秀的代理合作伙伴

更多信息请访问

- 安森美半导体网站
  www.onsemi.cn

- 产品手册
  汽车解决方案手册

- 安森美半导体官方微信号
  最新资讯及产品信息





安森美半导体

Thank You!

Raymond Yang

Raymond.yang@wtmec.com