英飞凌光伏微型逆变器及优化器解决方案

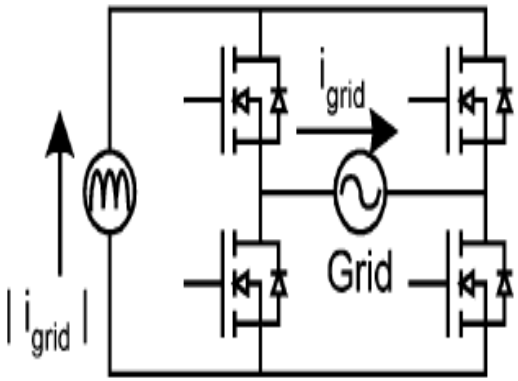
主要内容

- 英飞凌200W光伏微型逆变器解决方案
- 英飞凌300W光伏优化器解决方案
- 英飞凌最新一代产品OptiMOS™5产品及性能介绍

几种常见太阳能微型逆变器方案的比较

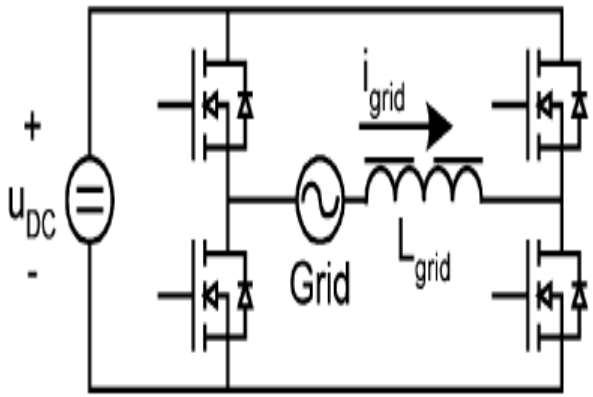
电流源型逆变器

+ 逆变器工作在低频开关状态
+ 效率高
- MPPT端有100 Hz 的纹波，需电解电容，限制使用寿命
- 输出侧需要额外的保护电路
- 没有处理无功功率的能力



电压源型逆变器

- 逆变器工作在高频开关状态
- 效率相对较低
+ MPPT端没有100 Hz 的纹波，不需要大容量的电容，所以可以无需电解电容，使用寿命长
+ 输出侧不需要额外的保护电路
+ 可以处理一定的无功功率



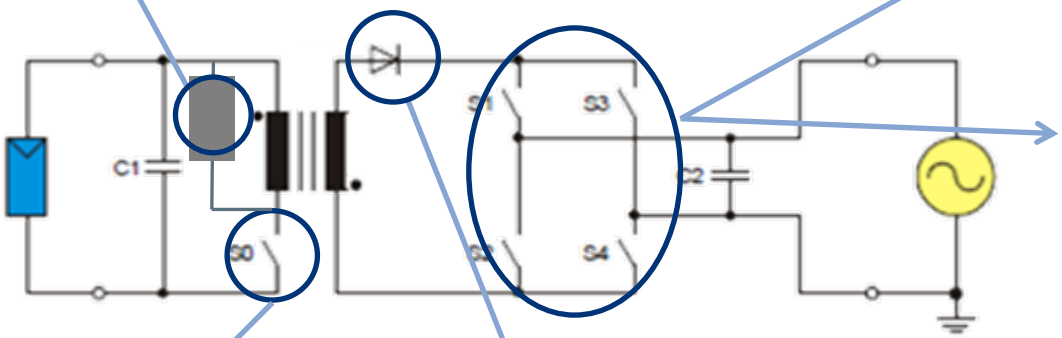
基于反激变换器的太阳能微型逆变器

交错式反激变换器

有源嵌位电路

OptiMOS™

800V-900V CoolMOS™



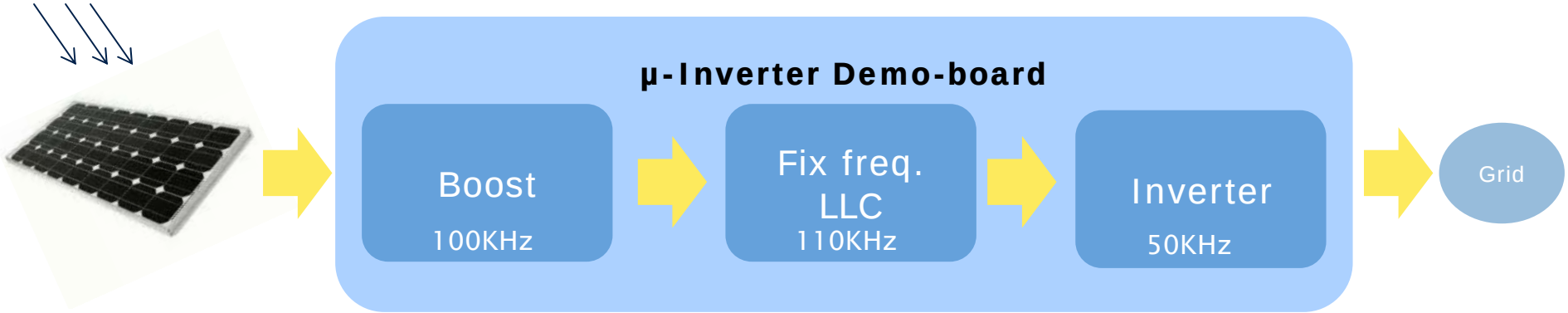
电流源型逆变器

150V OPTIMOS™

1200V SiC diode thinQ!™

Source: Prof. Burger, „Modulintegrierte Elektronik – eine Übersicht“, Bad Staffelstein 2010

英飞凌200W微型逆变器参考设计

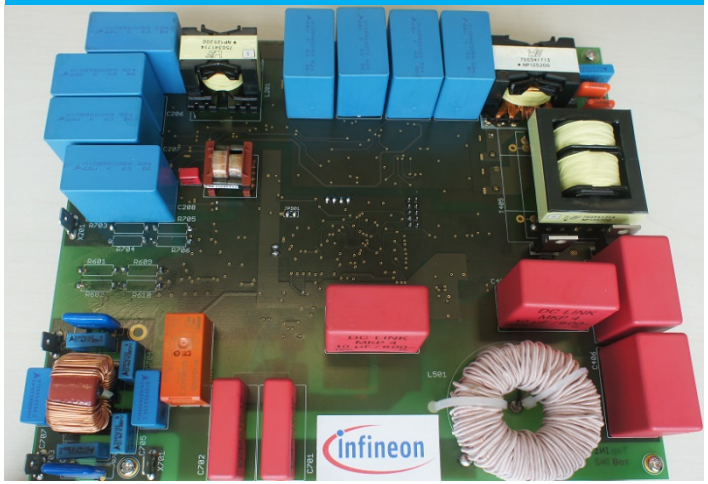


基本规格

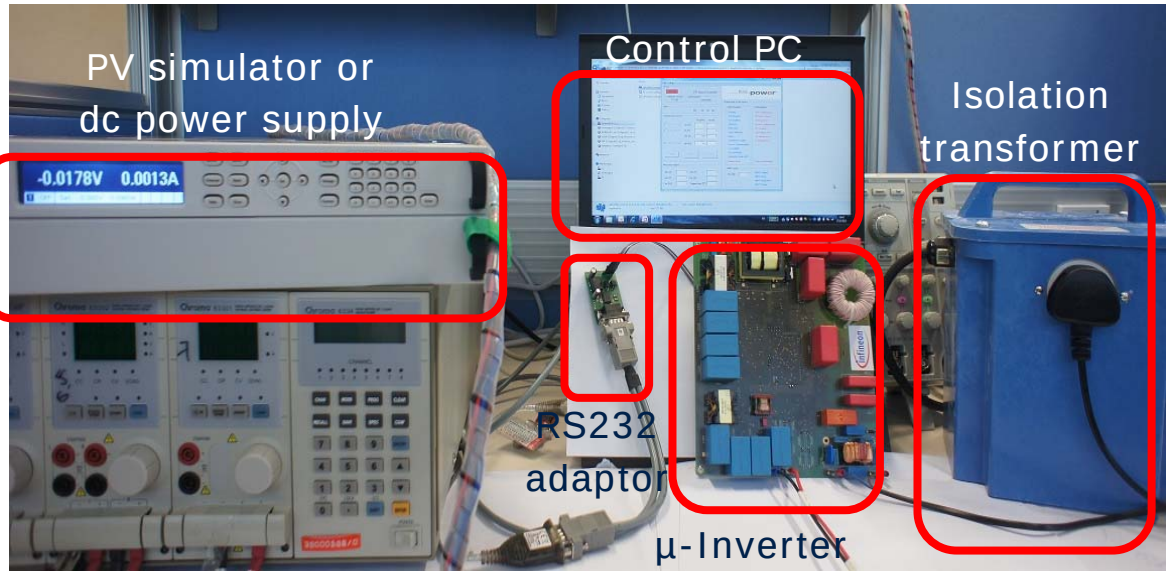
Input Voltage	Operation voltage range: 22Vdc ~ 45Vdc MPPT voltage range: 25V ~ 36V Solar panel open circuit voltage: 55V
Nominal output voltage	230Vac/ 211Vac ~ 264Vac
Nominal frequency range	49.5Hz ~ 50.5Hz
Nominal output power	200W
Dimension	250mm * 175mm * 30mm
Cooling	Natural convection, no fan

英飞凌200W 微型逆变器主要特点

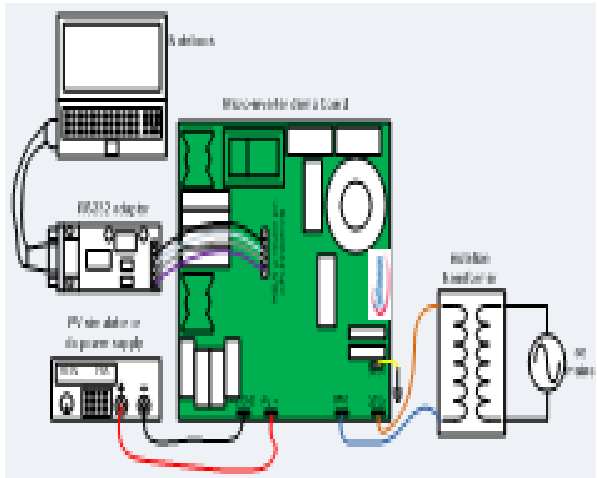
200W 微型逆变器参考设计



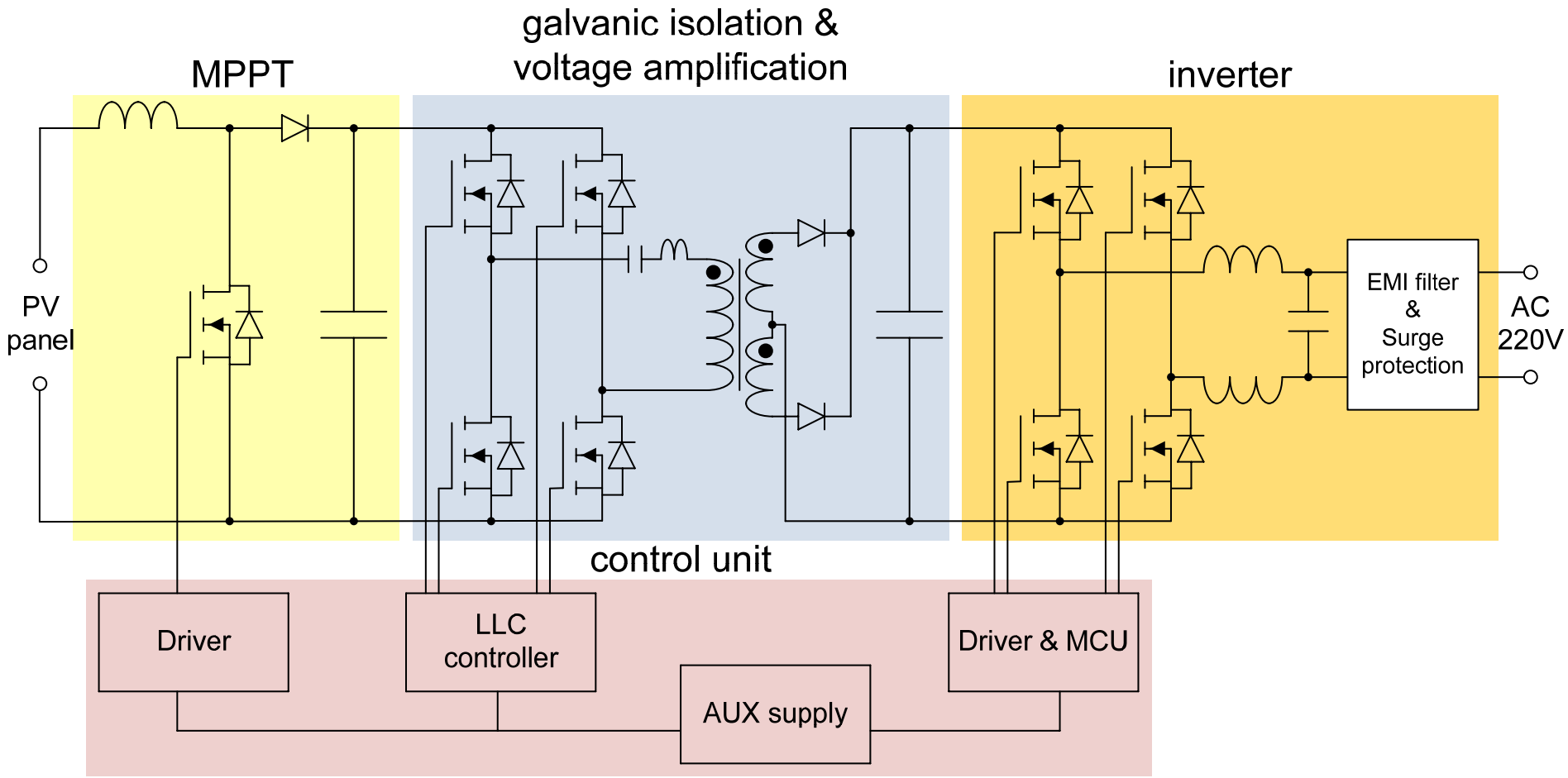
- 无功功率的能力
- 电解电容



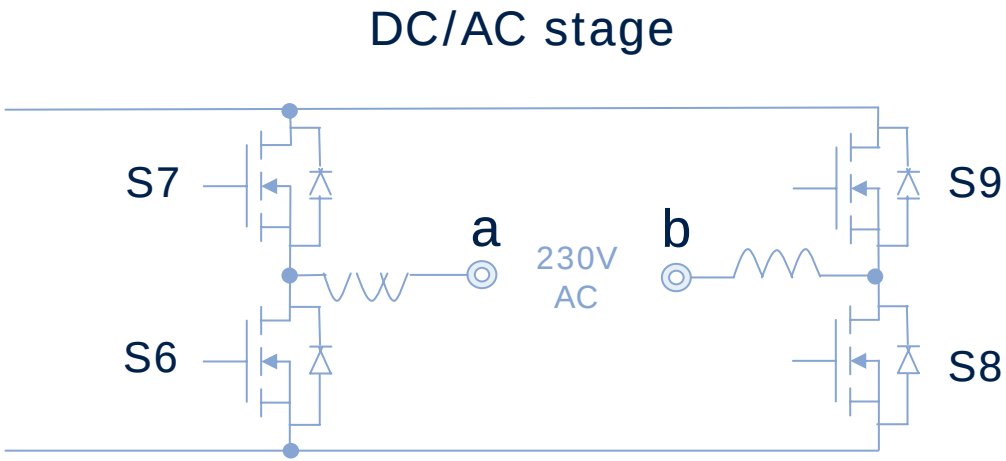
Operation Manual



微型逆变器基本结构图

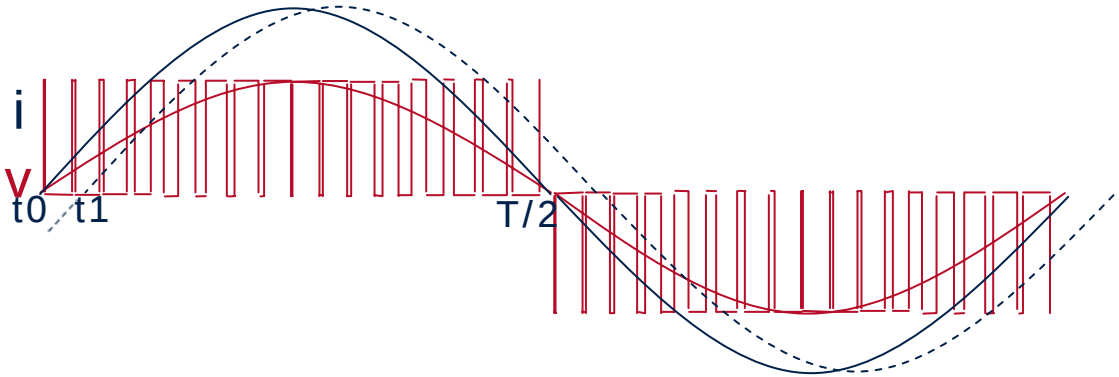


电压源型逆变器:
处理无功功率时的工作模式分析



- S6，S7工作在高频开关状态，寄生二极管可能工作在硬换流模式，建议选用CFD2
- S8，S9 工作在工频开关状态，建议选用低导通电阻的开关器件

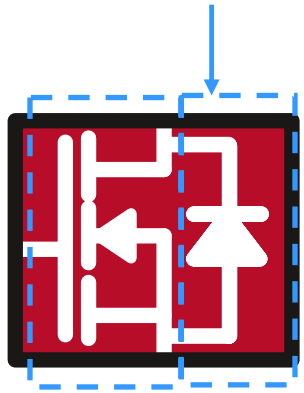
- 对于电压源型逆变器来说，在处理无功功率时，对开关器件有什么特殊的要求?
- 电压和电流不同向，电流双向流动；对开关器件来说，需要带快恢复二极管（低Qrr）的MOSFET

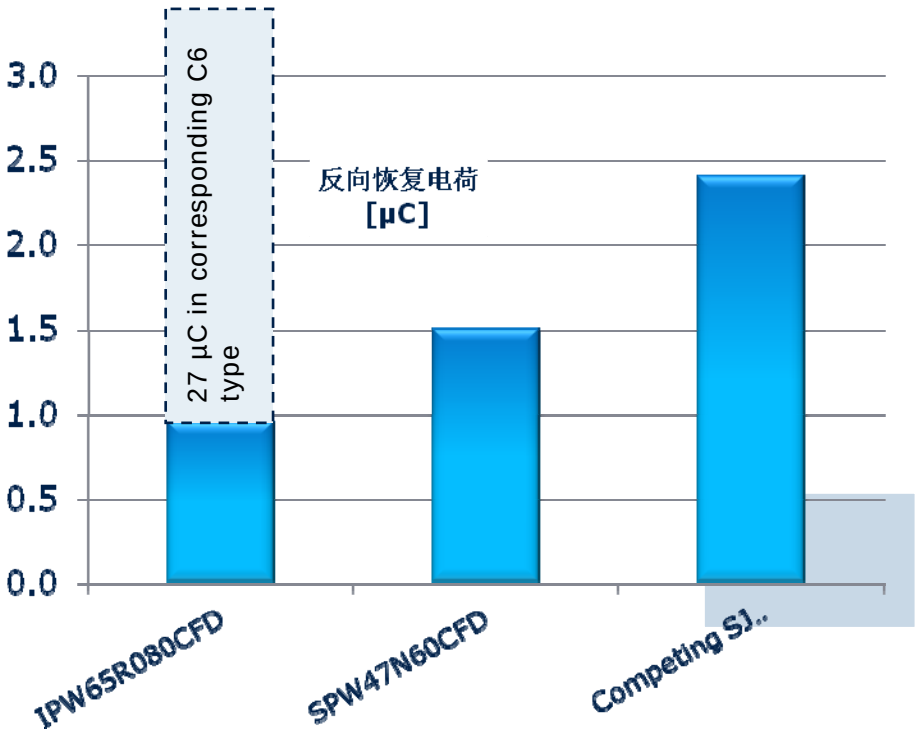


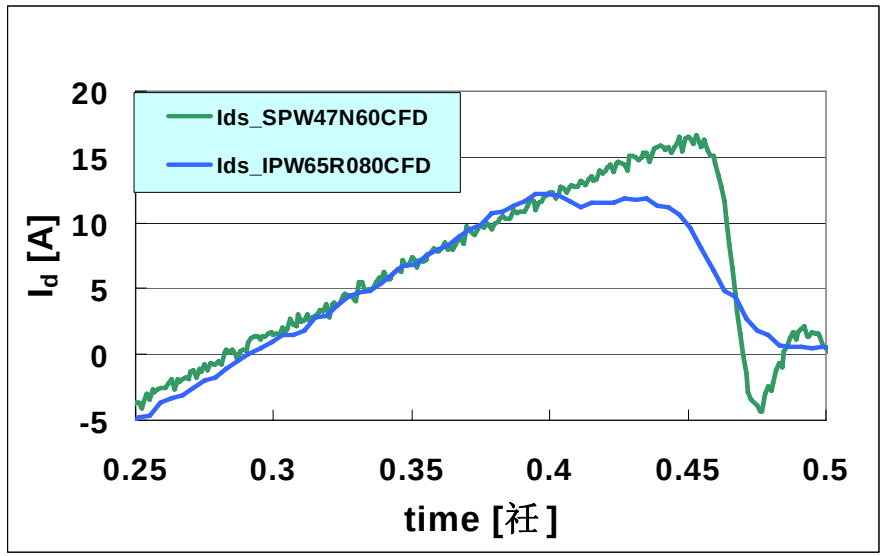
CFD/CFD2的比较

- CFD系列产品的电压等级是600V，CFD2则是650V
  - 适应更高输入电压的应用，更大的设计裕量
  - 更好的性价比
  - 更好的轻载效率
  - 更好的EMI性能

带快恢复体内二极管的CoolMOS™系列产品

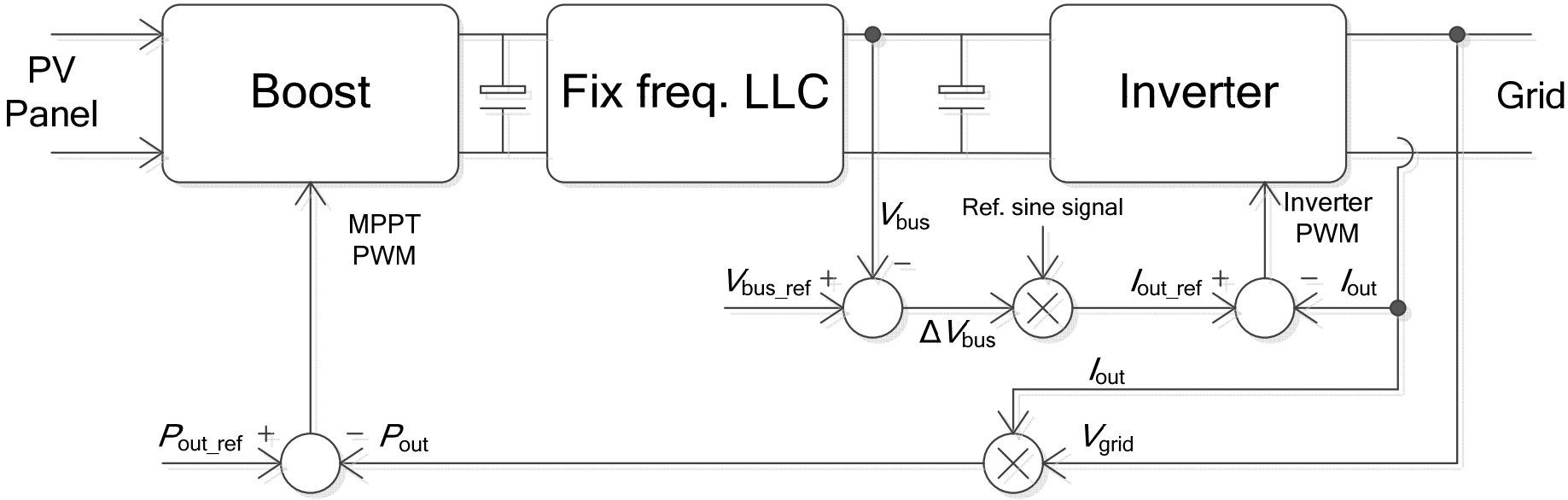


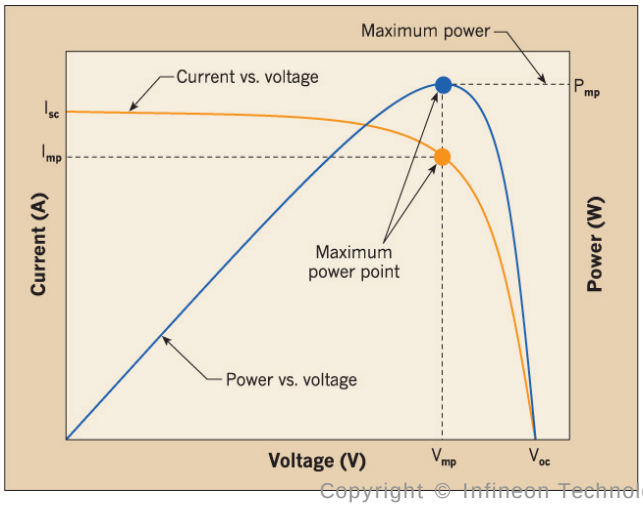


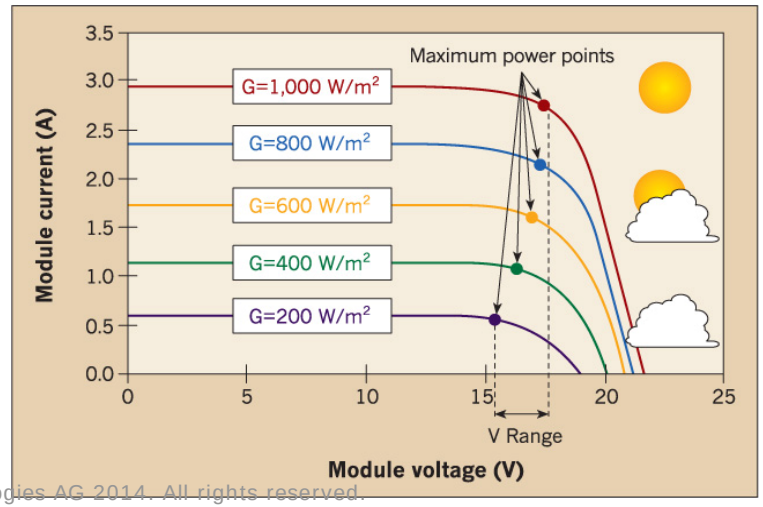


控制策略

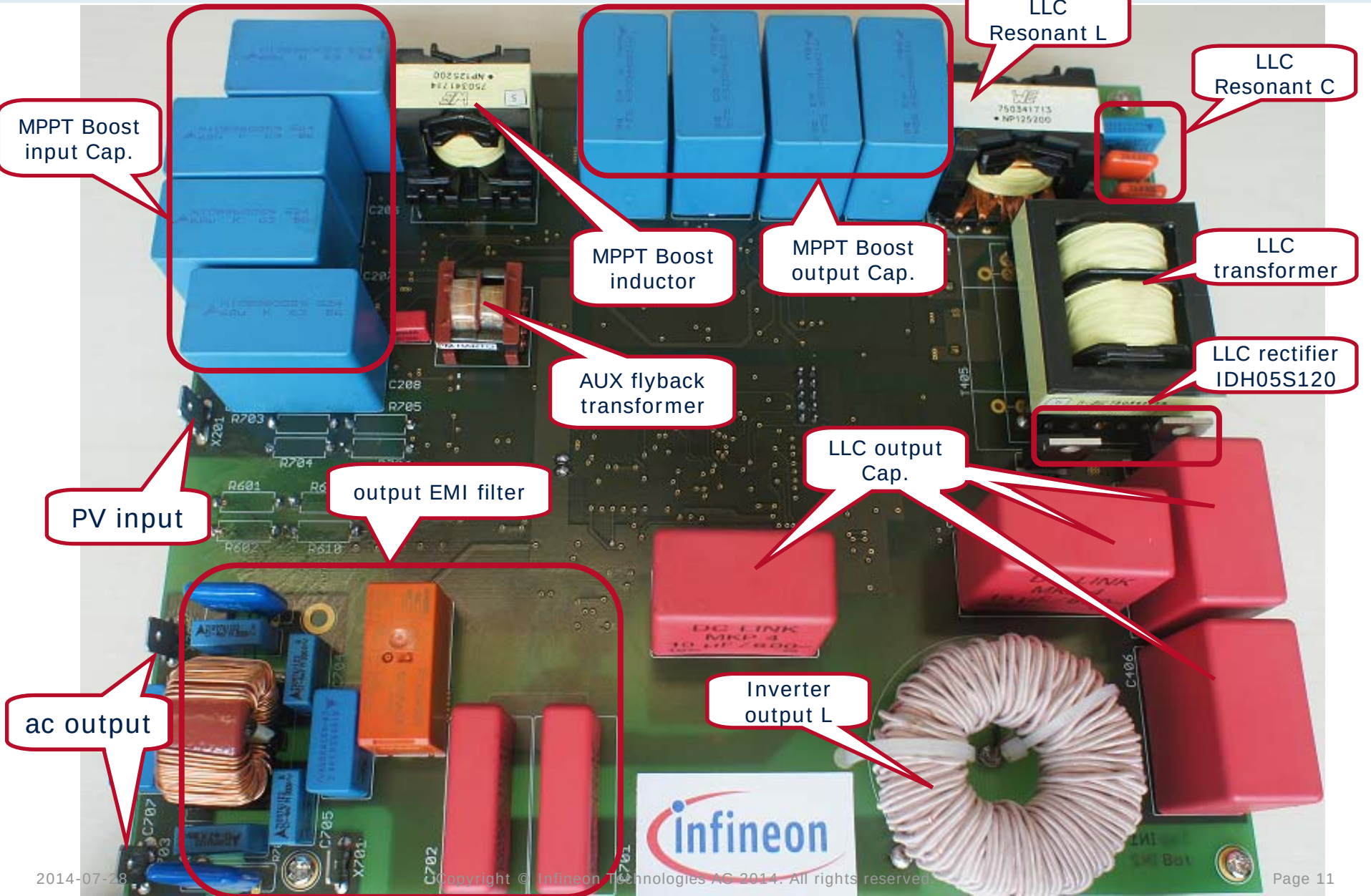
系统控制策略



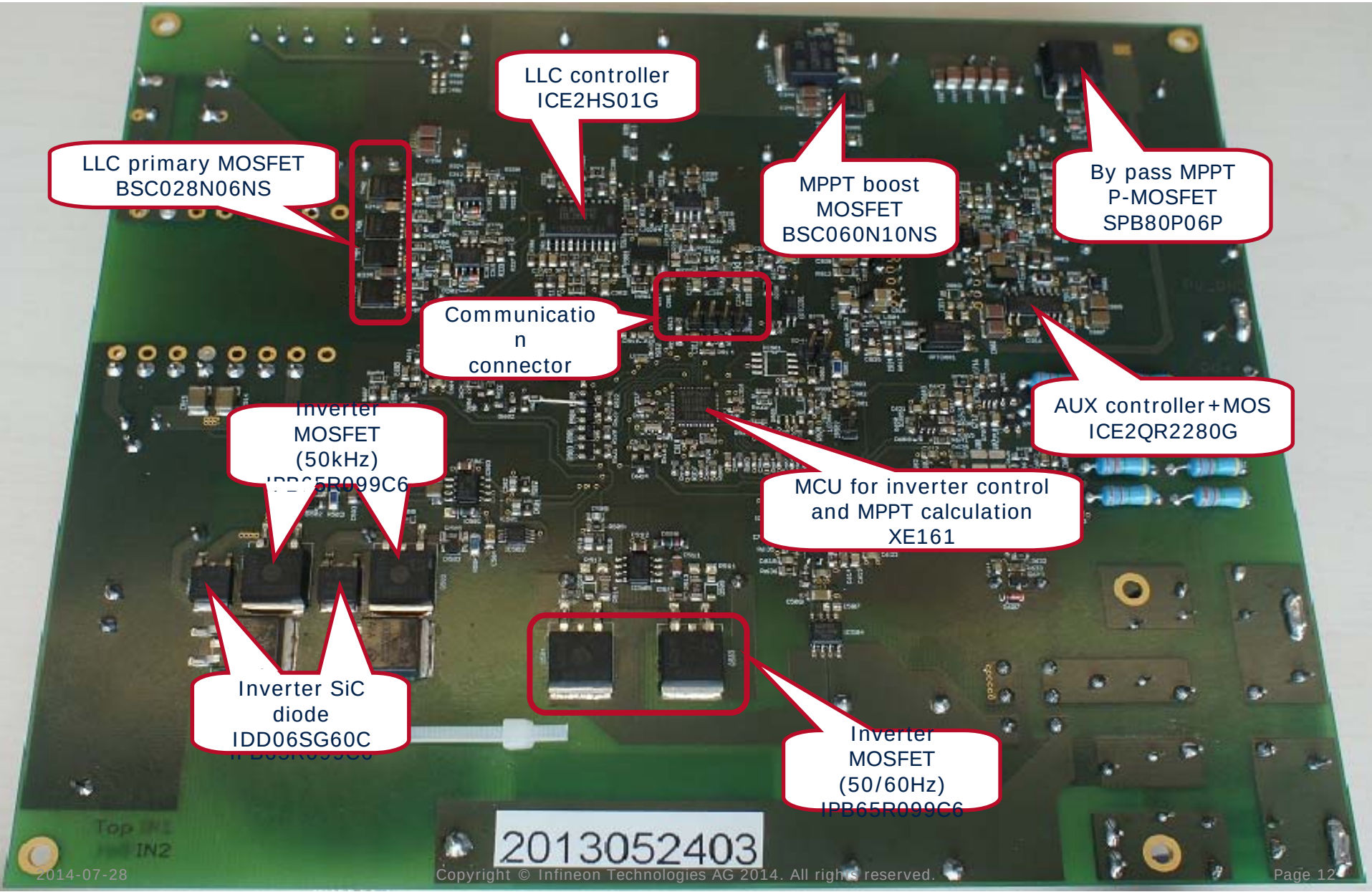




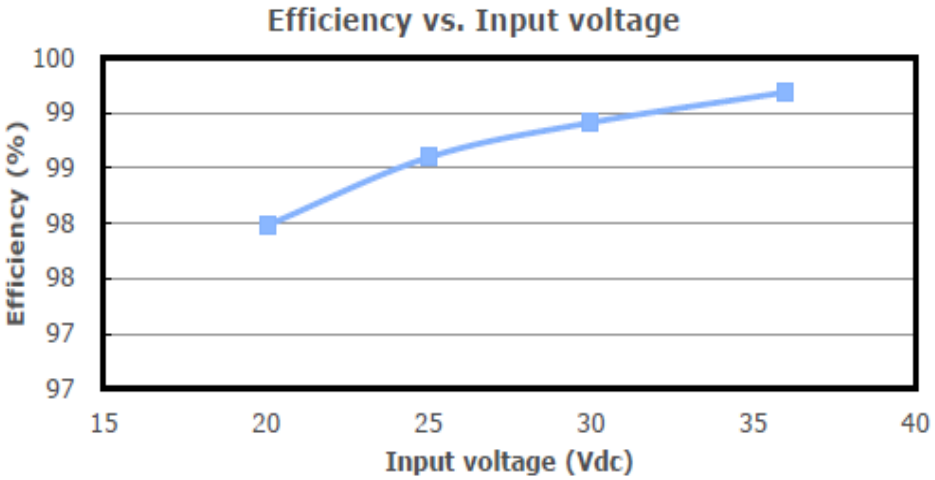
英飞凌200W 微型逆变器：顶视图

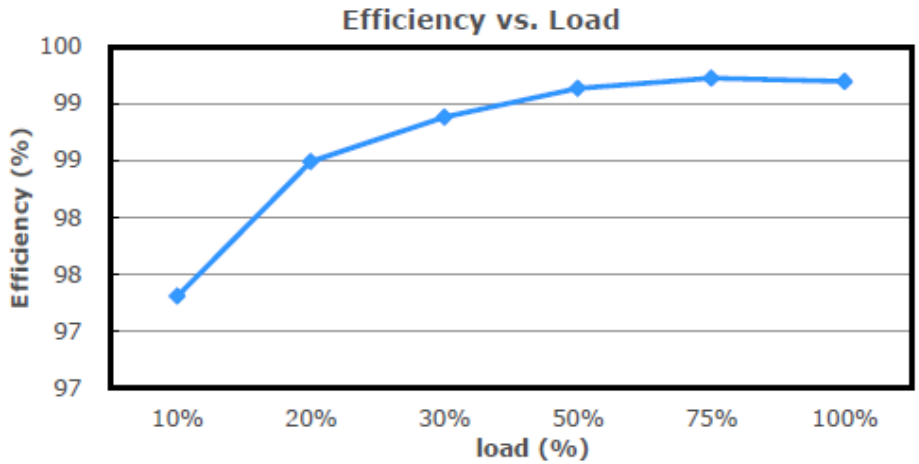


英飞凌200W 微型逆变器：底视图



20~36Vin/45Vout MPPT Boost
效率测试结果

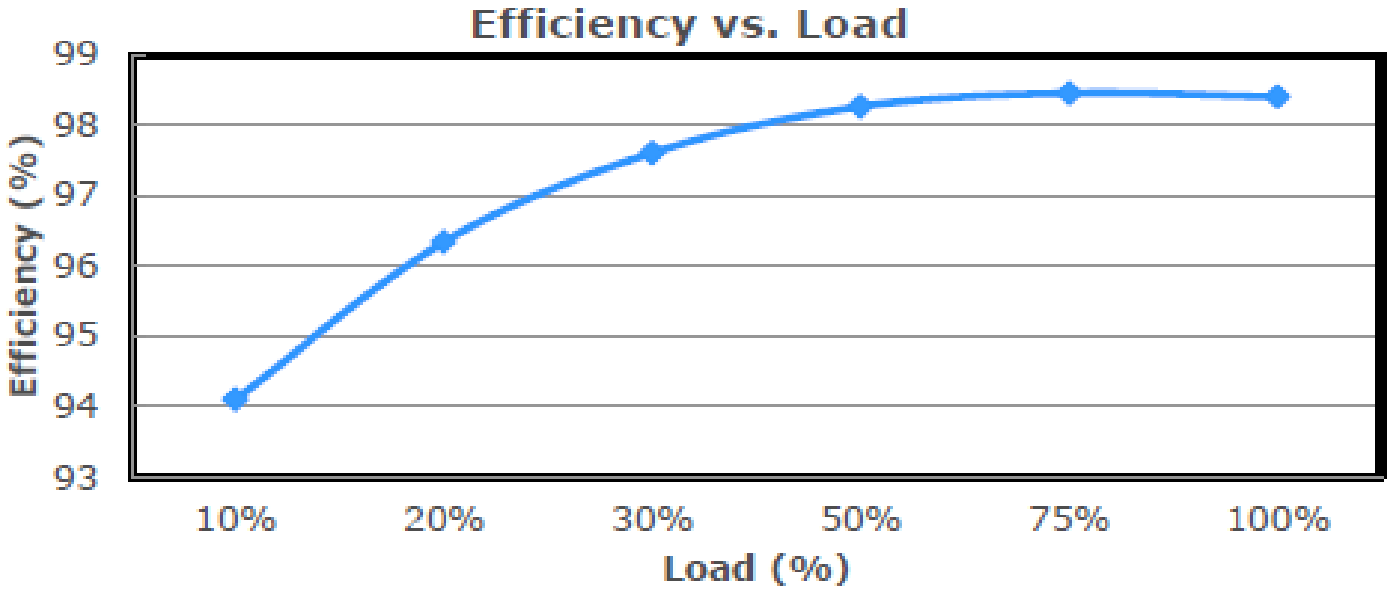




BSC070N10NS3	Vout(V)	Iout(A)	Vin(V)	Iin(A)	Eff(%)
	45.242	4.600	20.066	10.5849	97.98
	45.194	4.600	25.030	8.4239	98.60
	45.089	4.600	30.003	6.9891	98.91
	45.202	4.600	36.000	5.8233	99.18

BSC070N10NS3	Vout(V)	Iout(A)	Vin(V)	Iin(A)	Eff(%)	Load (%)
	45.165	0.460	36.005	0.5930	97.31	10%
	45.113	0.920	35.996	1.1707	98.49	20%
	45.079	1.380	35.998	1.7477	98.88	30%
	45.178	2.300	36.008	2.9110	99.13	50%
	45.223	3.450	36.003	4.3675	99.22	75%
	45.154	4.600	36.001	5.8164	99.19	100%

45Vin/360Vout Full-bridge LLC dc-dc Stage
效率测试结果

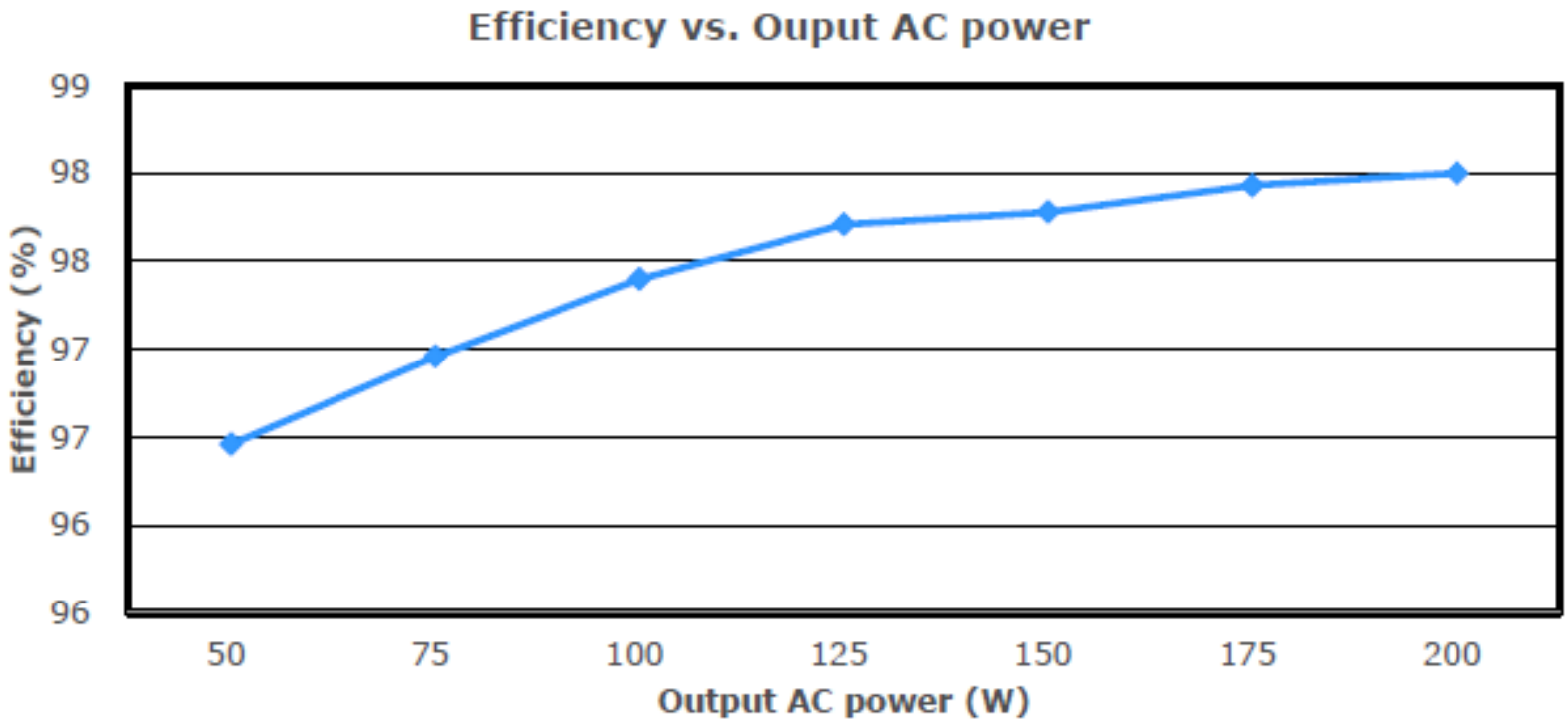


Vout(V)	Iout(mA)	Vin(V)	Iin(A)	Eff(%)
360.27	55.582	40.015	0.5318	94.100
360.82	111.500	44.238	0.9440	96.338
359.73	167.290	44.354	1.3901	97.604
359.76	280.600	44.706	2.2980	98.262
359.79	419.320	44.886	3.4140	98.451
359.82	558.840	45.022	4.5390	98.398

- LLC input voltage is fixed by MPPT stage and this is 45V

Inverter Stage
效率测试结果

Pout(W)	50	75	100	125	150	175	200
Eff(%)	96.46	96.96	97.40	97.71	97.78	97.93	98.00



- The total efficiency of the demo is around 93.7%

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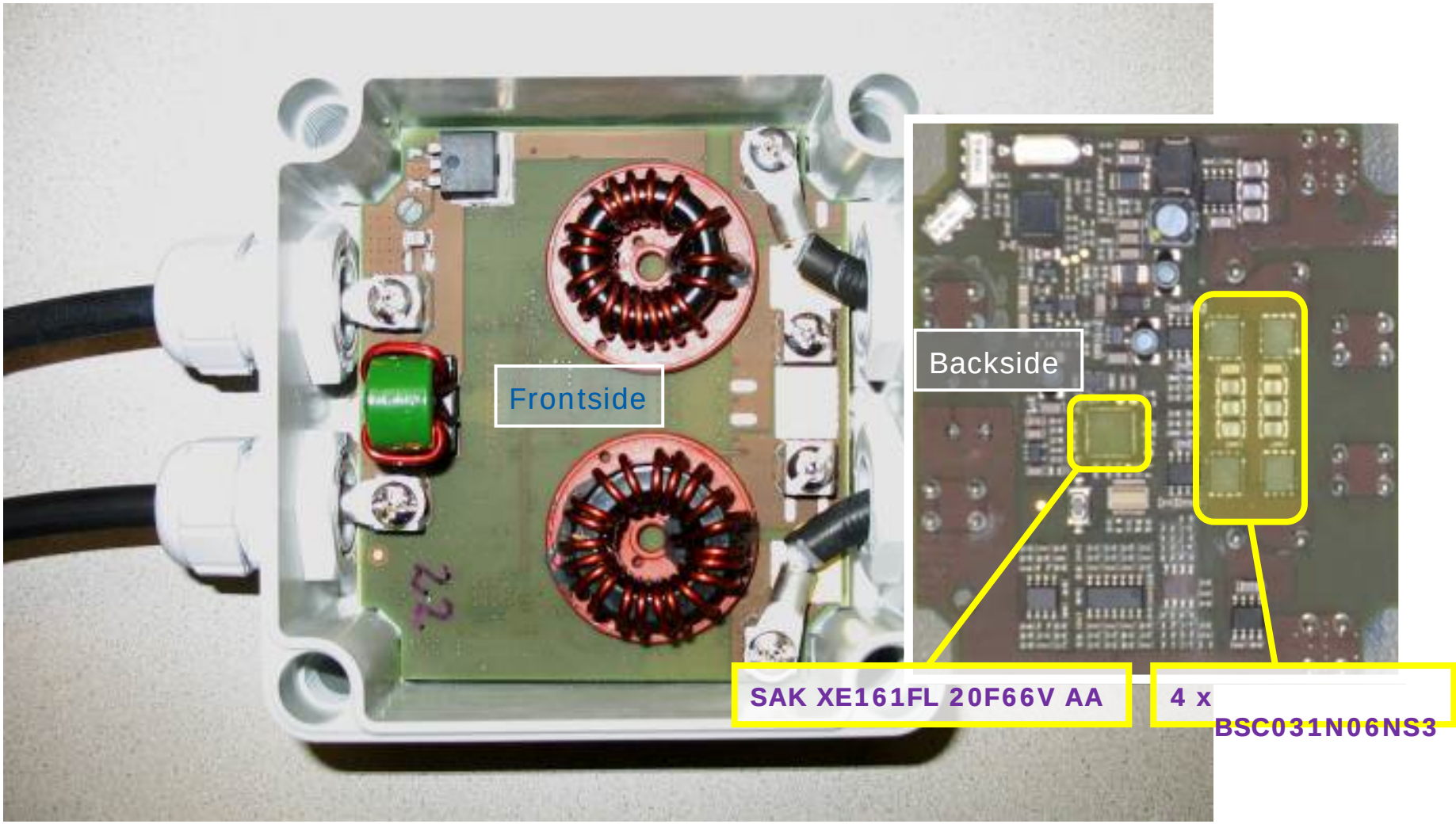
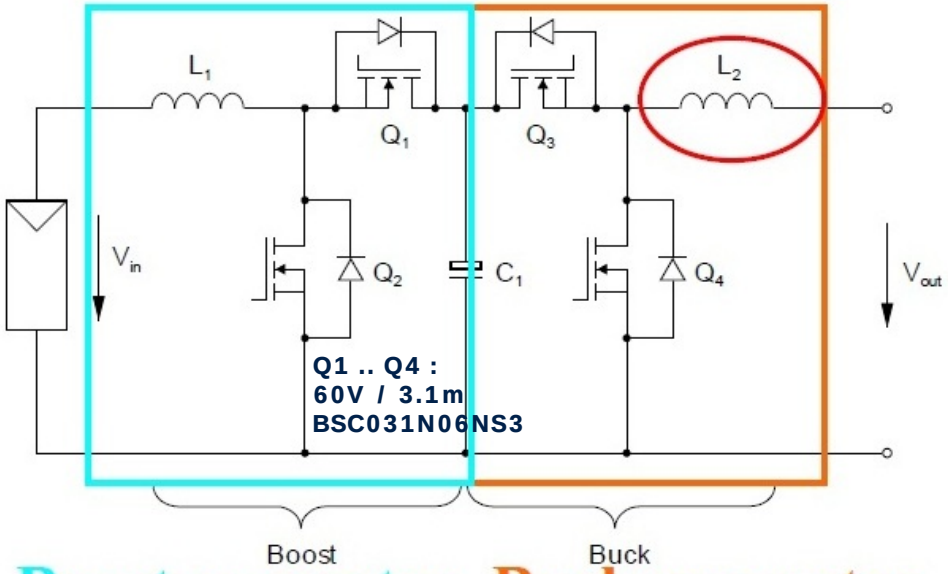
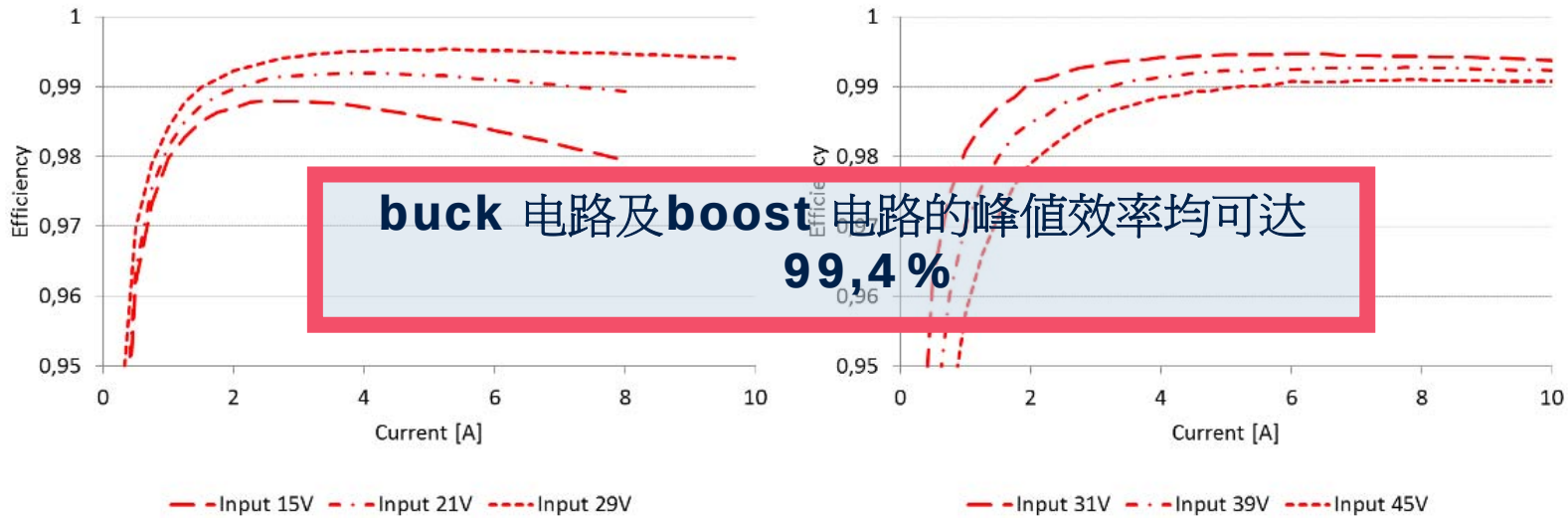
- 英飞凌最新一代产品OptiMOS™5产品及性能介绍

英飞凌300W太阳能优化器参考设计



300W太阳能优化器:
OPTIMOS3™ 60V/3.1m, 开关频率 130kHz





buck 电路及boost电路的峰值效率均可达 99,4%

不同光照条件下，太阳能优化器测试结果对比

在三种不同光照条件下，分别测试三种不同太阳能优化器方案下的输出功率：

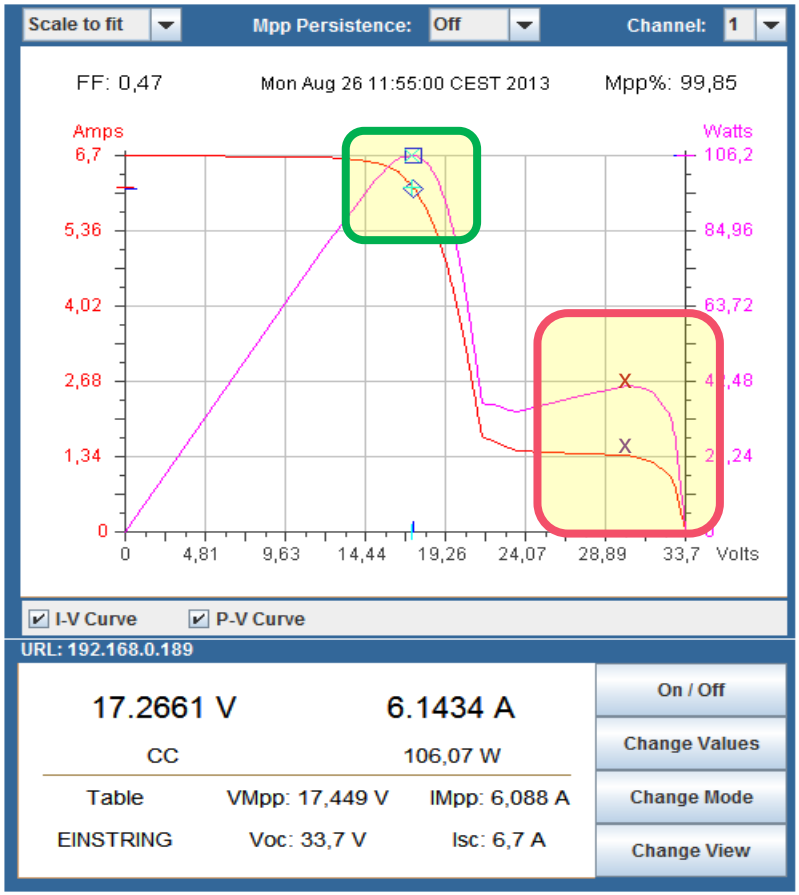
	Detection of the global MPP					
	After 1 min			After 15 min		
MPP tracker	shading of 1 string	shading of 2 strings	diagonal shadow	shading of 1 string	shading of 2 strings	diagonal shadow
Infineon	✓ 99,9 %	✓ 99,9 %	✓ 99,9 %	✓ 99,8 %	✓ 99,9 %	✓ 99,8 %
Tracker A	X 38,6 %	X 80,8 %	✓ 99,8 %	X 38,4 %	X 82,9 %	✓ 99,6 %
Tracker B	X 33,2 %	X 14,7 %	✓ 94,3 %	✓ 99,7 %	X 82,2 %	✓ 99,9%

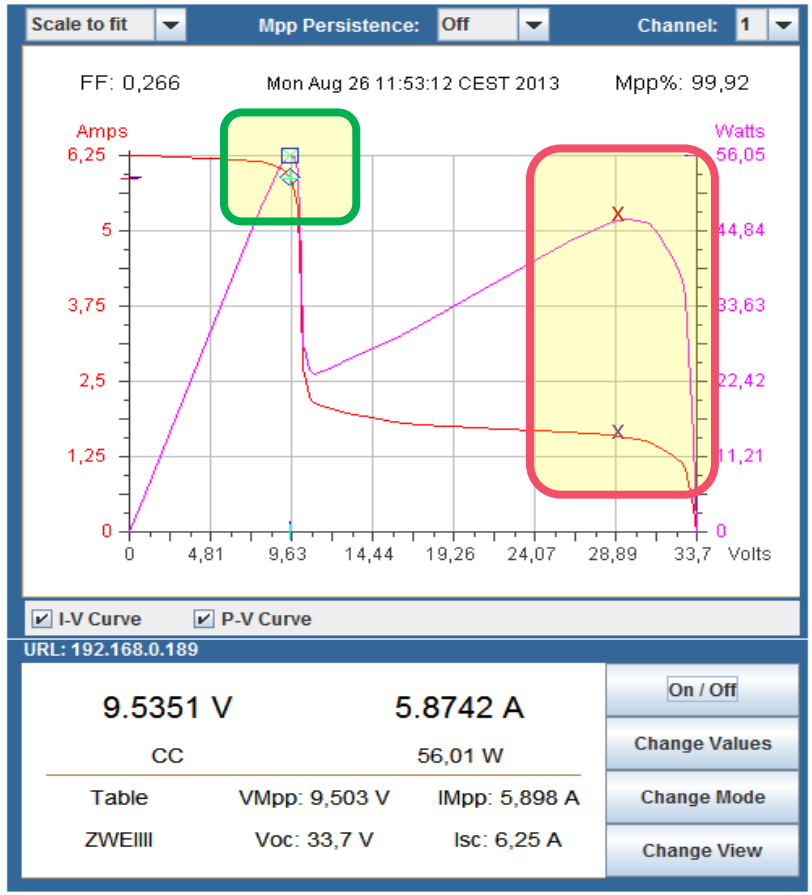
X .. off global mpp

X .. off global mpp

测试结果：英飞凌300W太阳能优化器方案在三种光照条件下均能以实际最大功率输出，而Track A/B在某一种/几种光照条件无法输出太阳能电池板实际能提供的最大功率

太阳能电池板在有阴影遮挡的光照条件下会产生两个波峰（输出功率）





英飞凌300W太阳能优化器方案能使太阳能电池板工作在上图中绿色区域，确保其能以实际最大功率输出

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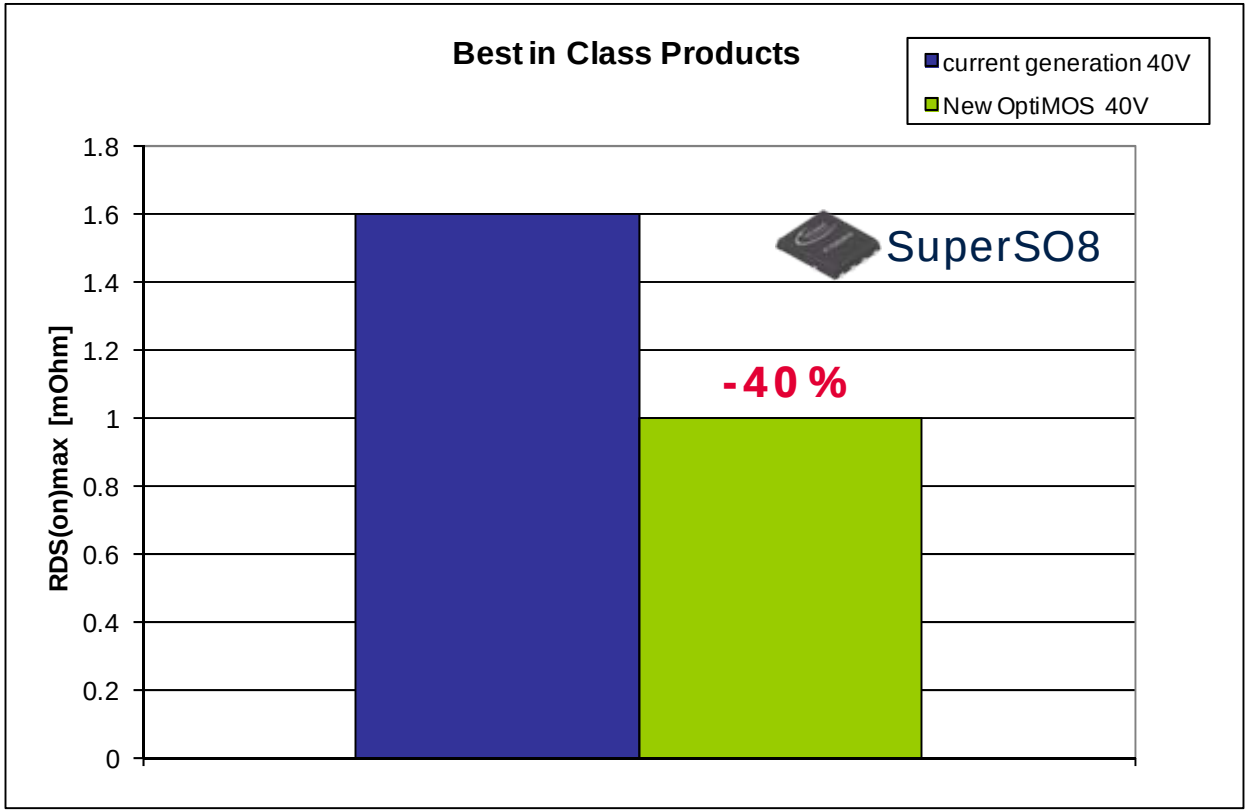
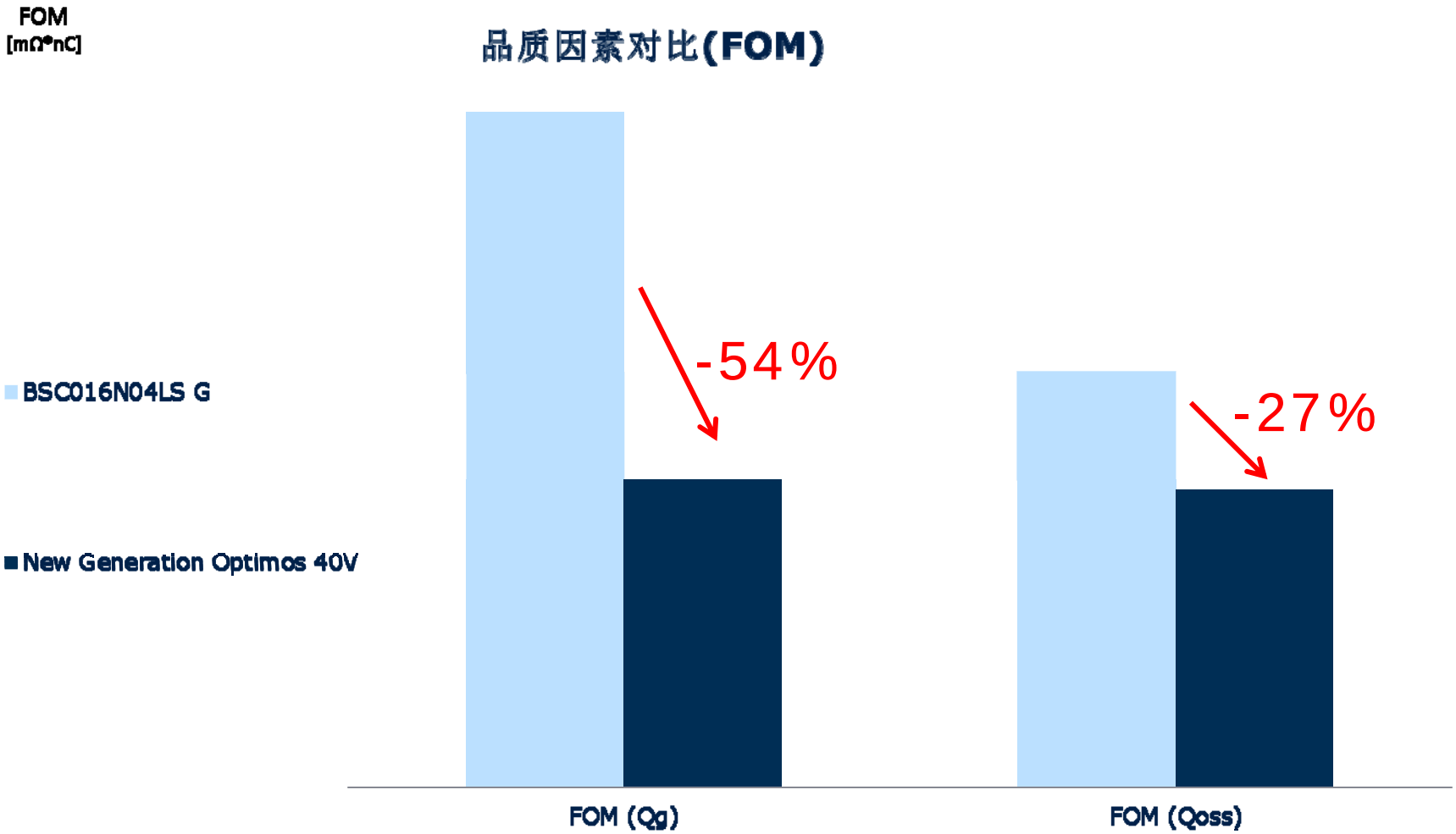
OptiMOS™5-40V
性能比较

New generation of OptiMOS™ 40V – 业内最低导通电阻 $R_{DS(on)}$

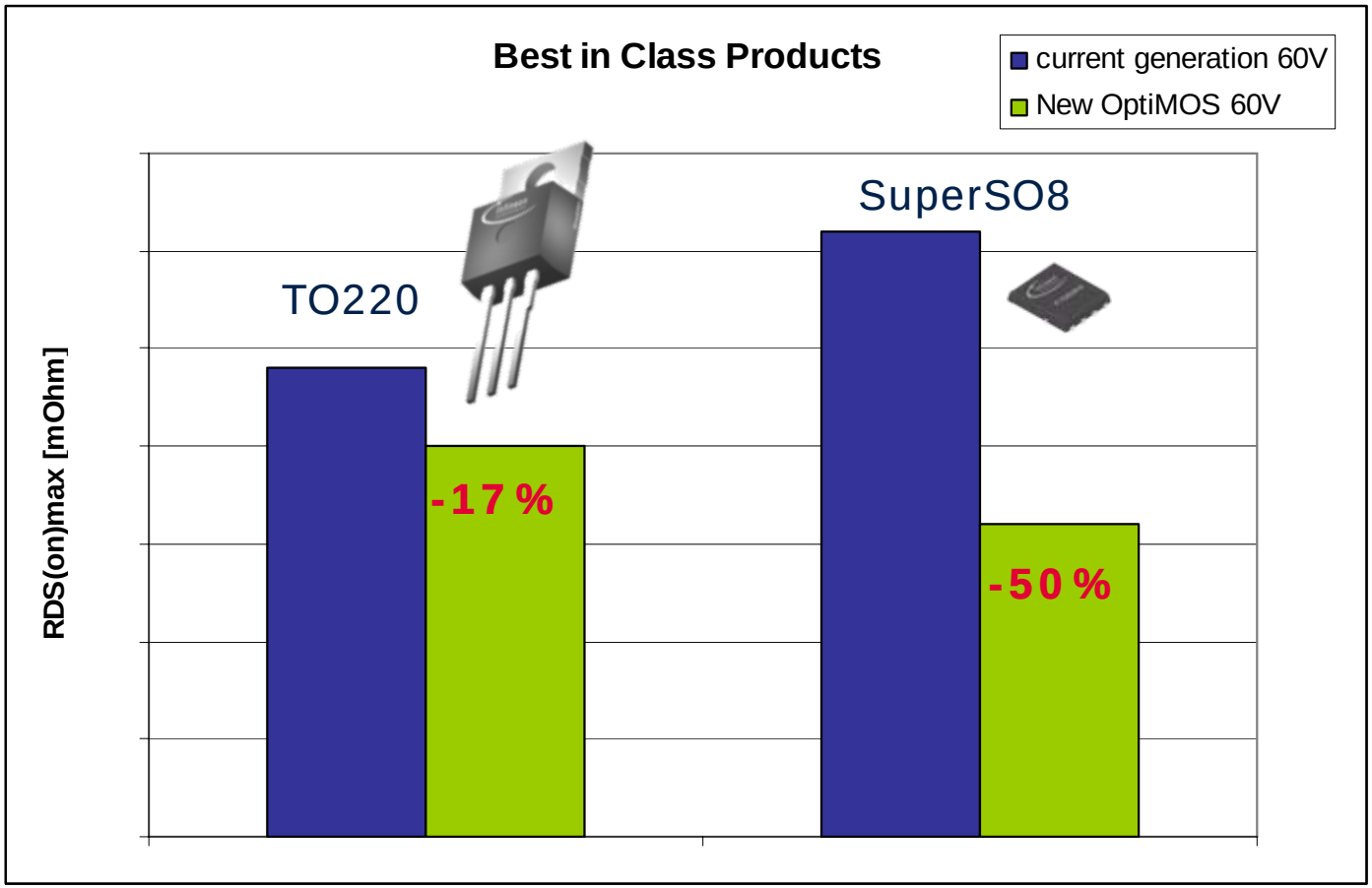


OptiMOS™5-40V
性能比较



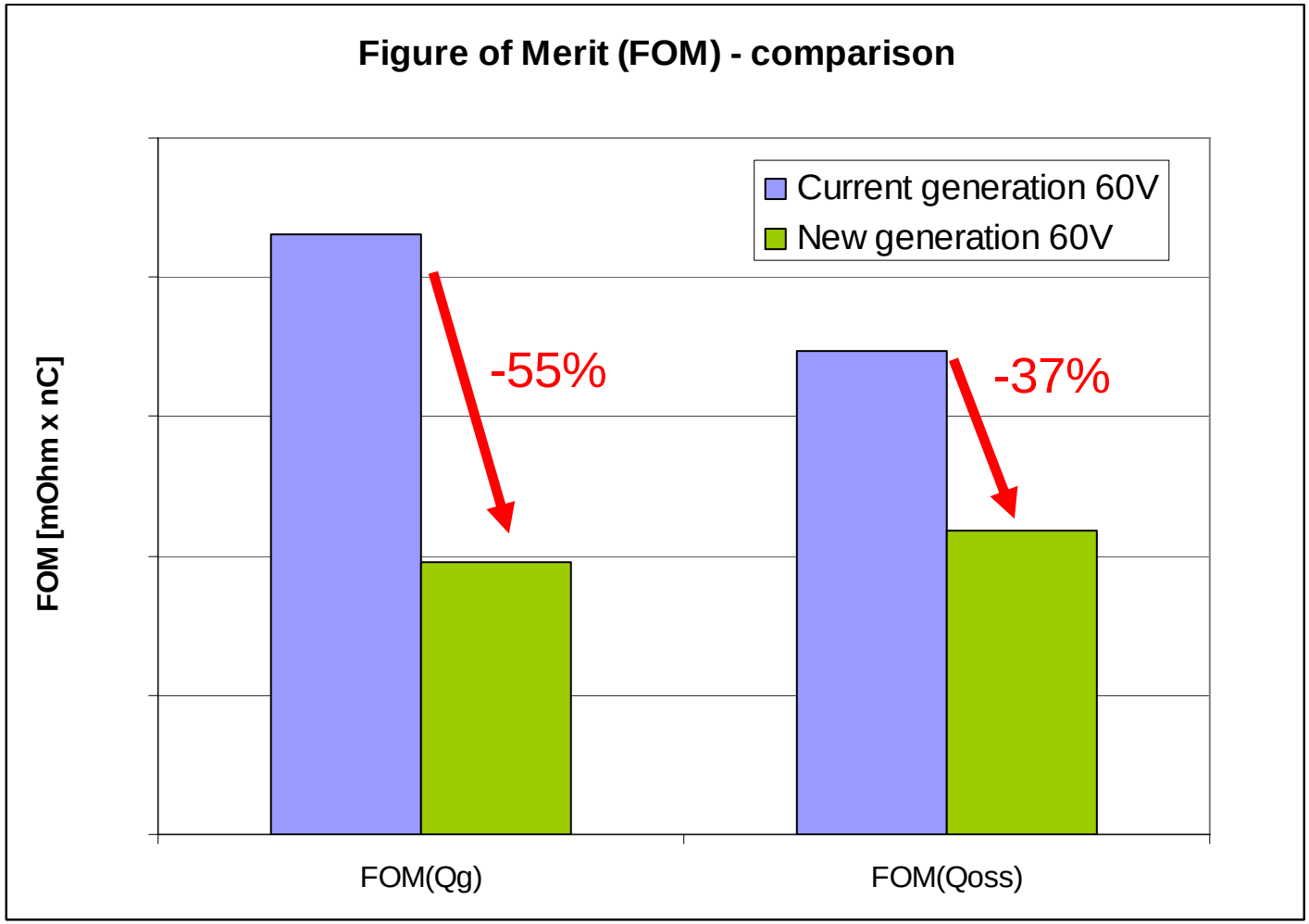
OptiMOS™5-60V
性能比较

New generation of OptiMOS™ 60V – 业内最低导通电阻

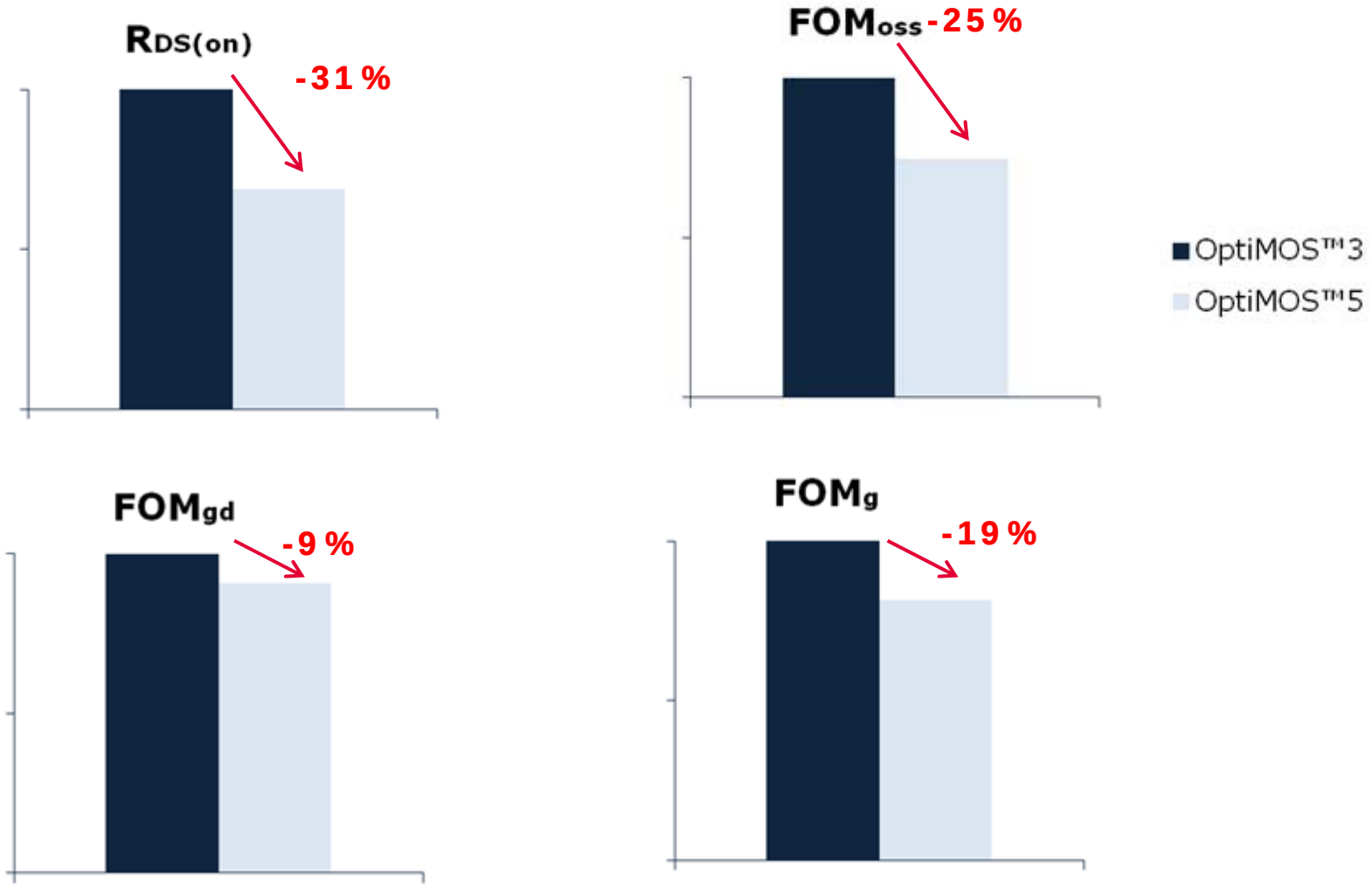


OptiMOS™5-60V
性能比较

New generation of OptiMOS™ 60V – 品质因素对比



OptiMOS™5-80V
性能比较



OptiMOS™5-80V
产品列表及计划

Package	Product	$R_{DS(on)}$	Application	Engineering samples		Release date mass production	
				Best case	Customer commitment	Best case	Customer commitment
SuperS08	BSC026N08NS5	2.6	Telecom, DC/DC Solar	available		Dec 2014	May 2015
	BSC030N08NS5	3.0	Server, SR	available		**Released**	
	BSC040N08NS5	4.0	Server, SR	available		Dec 2014	May 2015
	BSC037N08NS5	3.7	Telecom, Server	available		**Released**	
	BSC052N08NS5	5.2	Telecom, Server	available		Dec 2014	May 2015
	BSC061N08NS5	6.1	Telecom, Server	available		Dec 2014	May 2015
	BSC072N08NS5	7.2	Telecom, Server	available		Dec 2014	May 2015
	BSC117N08NS5	11.7	Telecom, Server	available		**Released**	
S308	BSZ075N08NS5	7.5	Telecom, DC/DC Solar	available		**Released**	
	BSZ110N08NS5	11.0	Telecom, DC/DC Solar	available		**Released**	
	BSZ084N08NS5	8.4	Telecom, Server	available		**Released**	

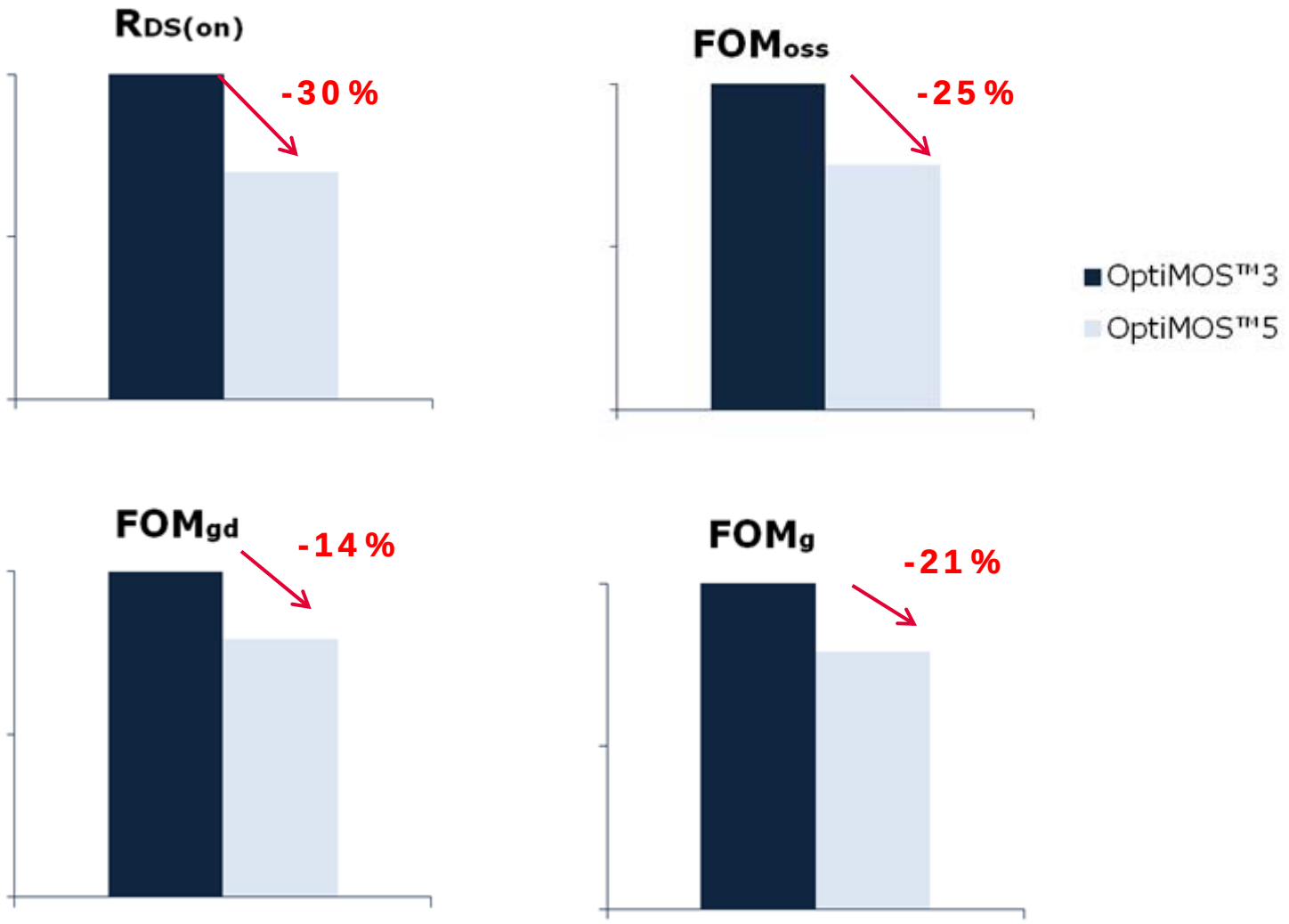
OptiMOS™5-80V
产品列表及计划

Package	Product	$R_{DS(on)}$	Application	Engineering samples		Release date mass production	
				Best case	Customer commitment	Best case	Customer commitment
TO-220	IPP020N08N5	2.0	Telecom, AC/DC, LV drives	available		**Released**	
	IPP023N08N5	2.3	Server SR, Telecom, LV drives	available		**Released**	
	IPP027N08N5	2.7	Server SR, Telecom	available		**Released**	
	IPP034N08N5	3.4	Server SR, Telecom	available		**Released**	
	IPP052N08N5	5.2	Server SR, Telecom	available		**Released**	
TO-Leadless	IPT012N08N5	1.2	LV drives, Battery protection, Power distribution	available		**Released**	

OptiMOS™5-80V
产品列表及计划

Package	Product	$R_{DS(on)}$	Application	Engineering samples		Release date mass production	
				Best case	Customer commitment	Best case	Customer commitment
D²PAK	IPB017N08N5	1.7	Telecom, AC/DC, LV drives	available		**Released**	
	IPB020N08N5	2.0	Server SR, Telecom, LV drives	available		**Released**	
	IPB024N08N5	2.4	Server SR, Telecom	available		**Released**	
	IPB031N08N5	3.1	Server SR, Telecom	available		**Released**	
	IPB049N08N5	4.9	Server SR, Telecom	available		**Released**	
D²PAK 7-pin	IPB015N08N5	1.5	LV drives, Battery protection, Power distribution	available		**Released**	

OptiMOS™5-100V
性能比较



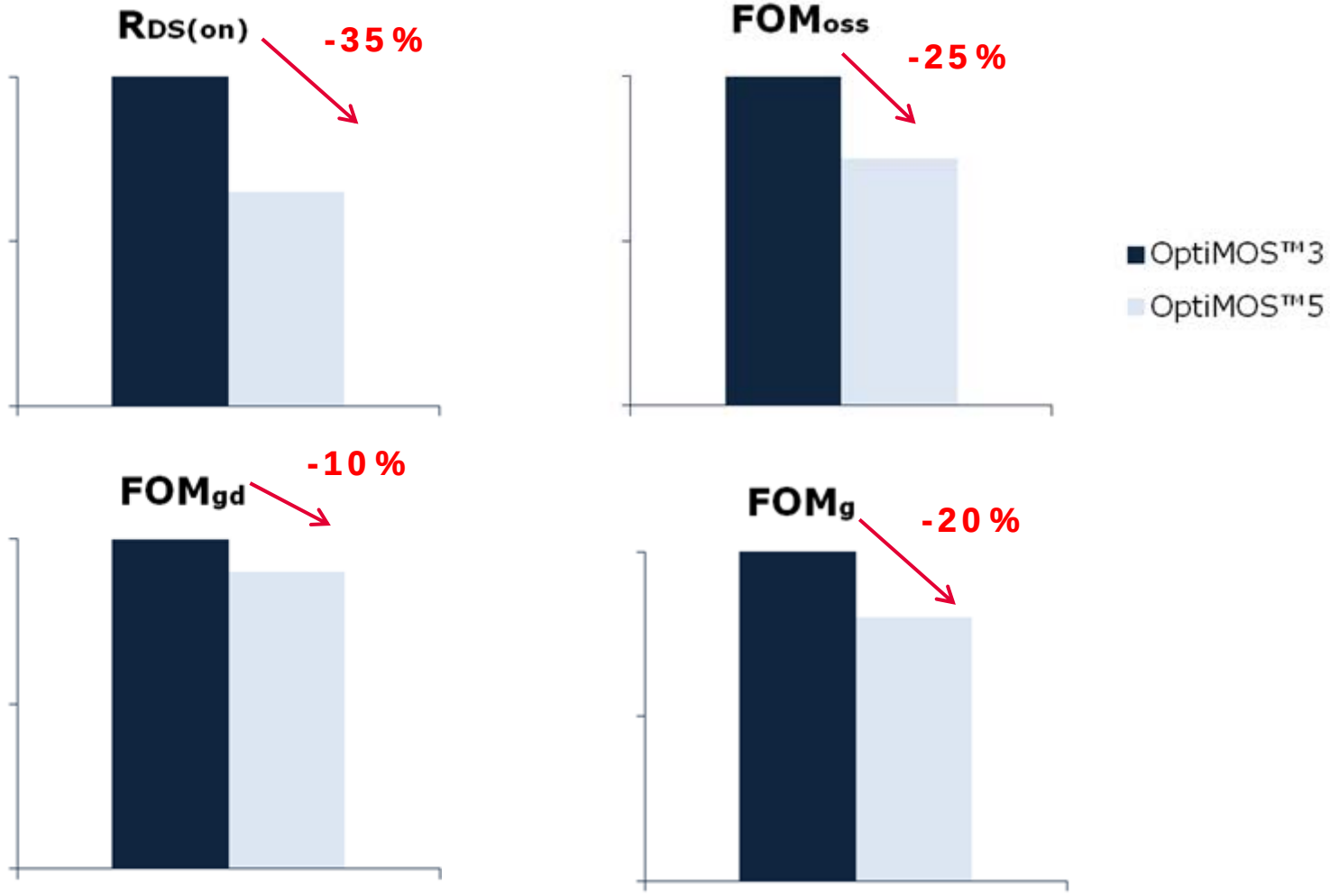
OptiMOS™5-100V
产品列表及计划

Package	Product	$R_{DS(on)}$	Application	Engineering samples		Release date mass production	
				Best case	Customer commitment	Best case	Customer commitment
SuperSO8	BSC035N10NS5	3.5	Telecom	available		Released	
	BSC040N10NS5	4.0	Telecom, Adapter	available		Released	
	BSC070N10NS5	7.0	Telecom, Adapter	available		Released	
	BSC098N10NS5	9.8	Telecom, Adapter	available		Released	
S3O8	BSZ097N10NS5	9.7	Telecom	available		Released	
TO-220	IPP023N10N5	2.3	Telecom, LV drives	available		Released	
	IPP030N10N5	3.0	Adapter	available		Released	
	IPP083N10N5	8.3	Telecom, Adapter	available		Released	
TO-220 FullPAK	IPA083N10N5	8.3	Adapter	available		Released	
TO-Leadless	IPT015N10N5	1.5	LV Drives	available		Released	

OptiMOS™5-100V
产品列表及计划

Package	Product	$R_{DS(on)}$	Application	Engineering samples		Release date mass production	
				Best case	Customer commitment	Best case	Customer commitment
D²PAK	IPB020N10N5	2.0	Telecom, LV drives	available		**Released**	
	IPB027N10N5	2.7	Telecom, Adapter, LV Drives	available		**Released**	
D²PAK 7-pin	IPB017N10N5	~1.7	LV drives, Battery protection	available		**Released**	

OptiMOS™5-150V
性能比较



OptiMOS™5-150V
产品列表及计划

Package	Product	$R_{DS(on)}$ max [mΩ]	Application	Engineering samples		Release date mass production	
				Best case	Customer commitment	Best case	Customer commitment
SuperSO8	BSC09XN15NS5	~9.3	Telecom	Oct 2014	Q4 2014	Q2 2015	Q4 2015
	BSC12XN15NS5	~12.0	Telecom	Oct 2014	Q4 2014	Q2 2015	Q4 2015
	BSC18XN15NS5	~18.0	Telecom/ Solar	Oct 2014	Q4 2014	Q2 2015	Q4 2015
S3O8	BSZ30XN15NS5	~30	Telecom	Oct 2014	Q4 2014	Q4 2014	Q4 2015
TO-220	IPP046N15N5	~4.6	Telecom	Oct 2014	Q4 2014	Q4 2014	Q4 2015
	IPP06XN15N5	~6.8	Telecom	Oct 2014	Q4 2014	Q4 2014	Q4 2015
TO-Leadless	IPT03XN15N5	~3.9	LV Drives	Oct 2014	Q4 2014	Q2 2015	Q4 2015
D²PAK	IPB04XN15N5	~4.3	Telecom	Oct 2014	Q4 2014	Q4 2014	Q4 2015
	IPB06XN15N5	~6.5	Telecom	Oct 2014	Q4 2014	Q4 2014	Q4 2015
D²PAK 7pin	IPB040N15N5	~4.0	LV drives	Oct 2014	Q4 2014	Q2 2015	Q4 2015
I²PAK	IPI04XN15N5	~4.6	Telecom	Oct 2014	Q4 2014	Q4 2014	Q4 2015
	IPI07XN15N5	~6.9	Telecom	Oct 2014	Q4 2014	Q4 2014	Q4 2015

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英飞凌电源管理与射频技术生态圈

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英飞凌电源管理与射频技术生态圈架起方案提供商与系统厂商沟通、合作的桥梁。方案提供商通过生态圈平台发布方案，使方案得到迅速推广，并加快方案的产业化进程；系统厂商的项目需求也可通过生态圈寻找合适的方案提供商，缩短项目开发周期，降低开发成本。

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系统厂商：

1、提出方案需求➔2、需求评审 ➔ 3、推荐相应的方案商➔ 4、与方案商达成合作

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