第四代氮化鎵（eGaN®）技術

宜普電源轉換公司

IIC China 9.2014

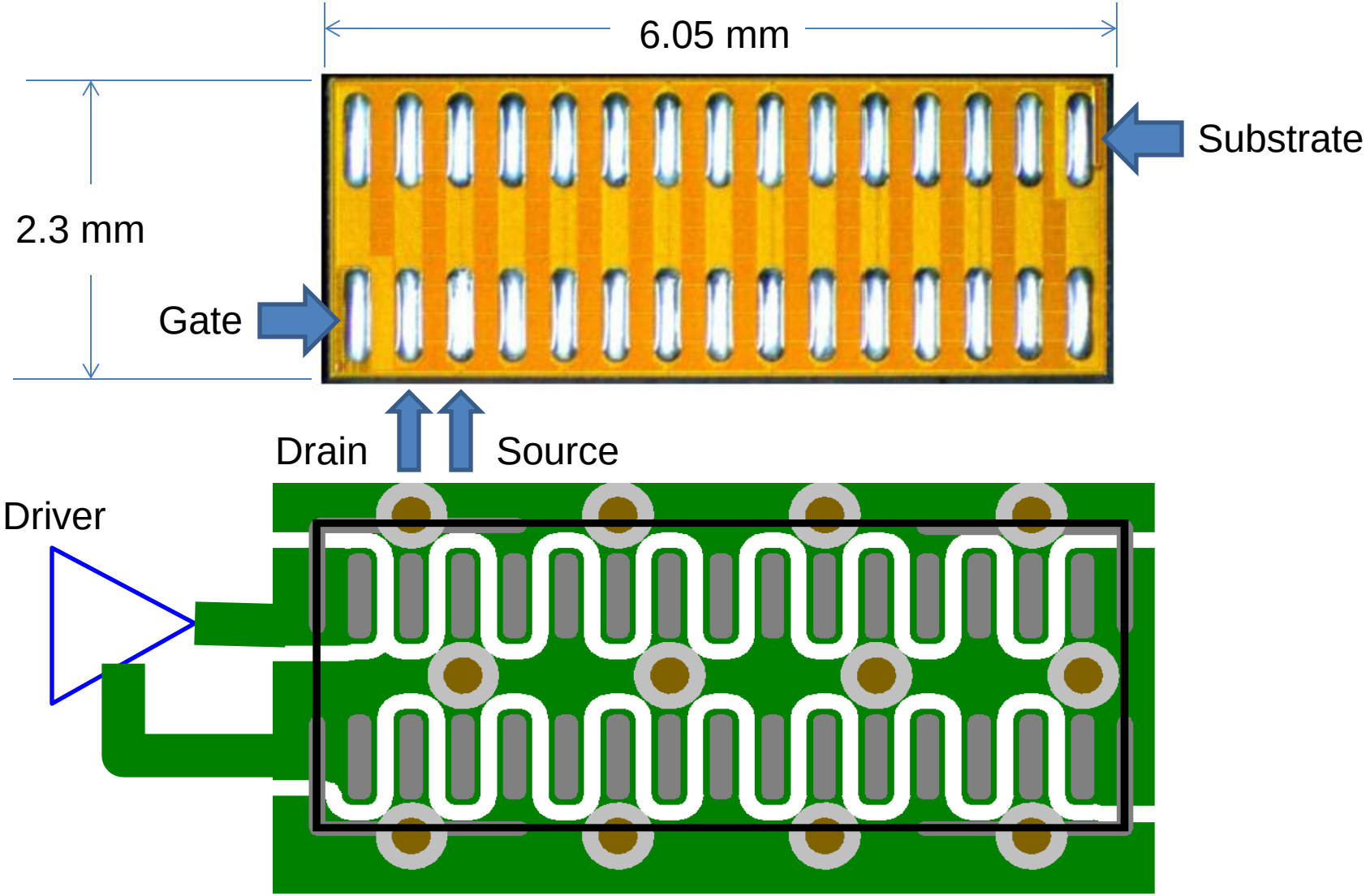
議題

- 第四代氮化鎵場效應電晶體(eGaN®FET)簡介
- 進一步降低導通電阻（$R_{DS(ON)}$）
- 改善品質因數（FOM）
- 改善米勒比
- 增加直流-直流轉換器的效率
- 總結

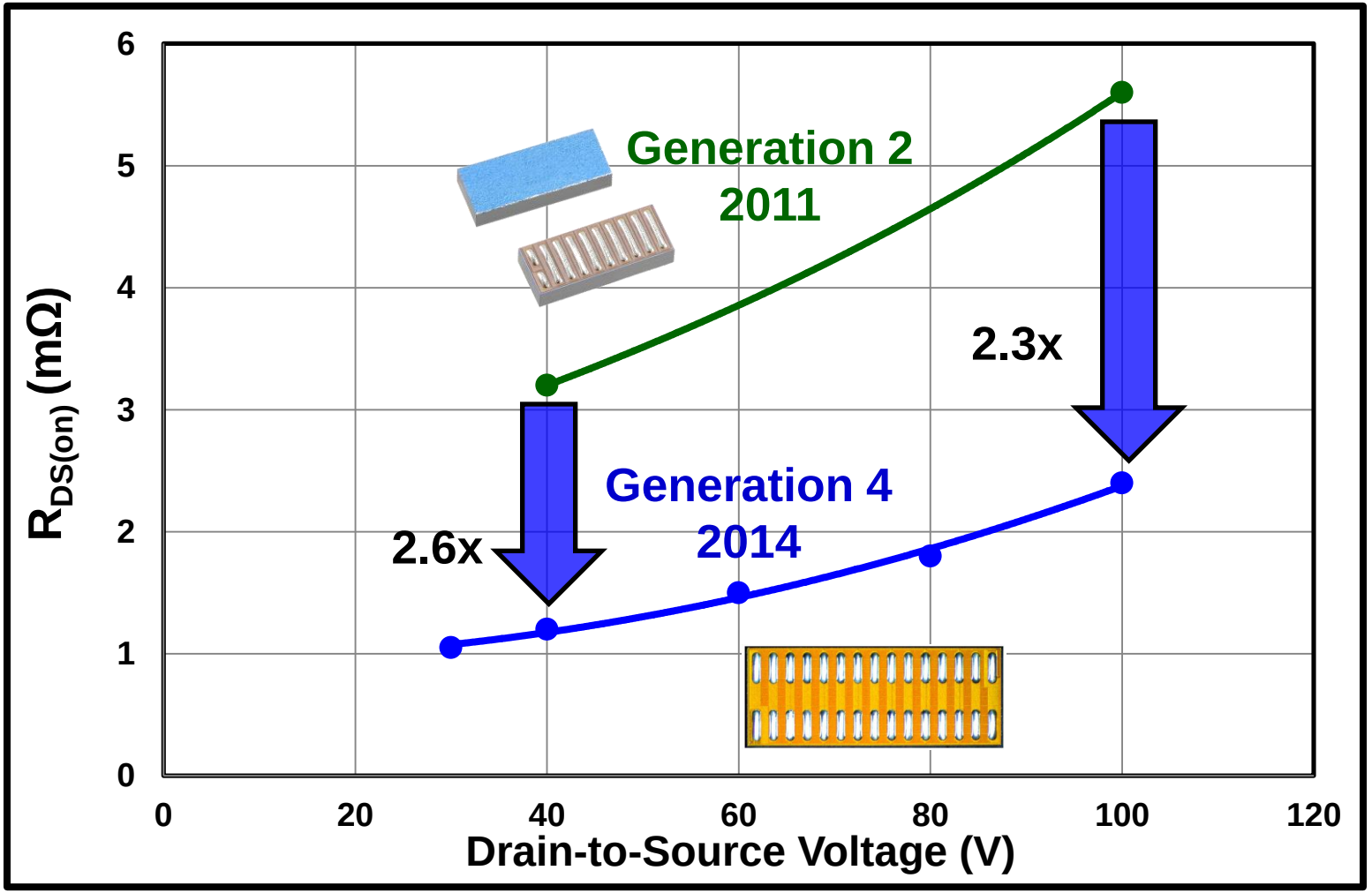
第四代產品數據表一覽

Part Number	Gen	BV (V)	$R_{DS(on)}$ (mΩ) (V_{GS} = 5V, at I_D Cont.)		Peak I_D (A) (Pulsed 25˚C)	Max T_J	Typical Charge (nC) @ V_{ds}= BV/2;					Typ R_g (Ω)	Cont. I_D (A)
			Typ.	Max			Q_G	Q_{GD}	Q_{GS}	Q_{OSS}	Q_{RR}		
EPC2023	4	30	1.0	1.3	590 A	150˚C	27.5	1.9	5.8	27	0	0.3	60
EPC2024	4	40	1.2	1.5	550 A	150˚C	26	2.0	6.4	32	0	0.3	60
EPC2020	4	60	1.5	2.0	470 A	150˚C	22	2.0	5.0	42	0	0.3	60
EPC2021	4	80	1.8	2.5	420 A	150˚C	20	2.1	3.8	60	0	0.3	60
EPC2022	4	100	2.4	3.2	360 A	150˚C	17	2.0	3.7	60	0	0.3	60
EPC2019	4	200	33	43	42 A	125˚C	2	0.33	0.63	17.5	0	0.3	9
EPC2015	2	40	3.2	4	150 A	125˚C	10.5	2.2	3	18.5	0	0.3	33
EPC2001	2	100	5.6	7	100 A	125˚C	8	2.2	2.3	35	0	0.3	25
EPC2012	2	200	70	100	15 A	125˚C	1.5	0.57	0.33	11	0	0.3	3

晶片版圖

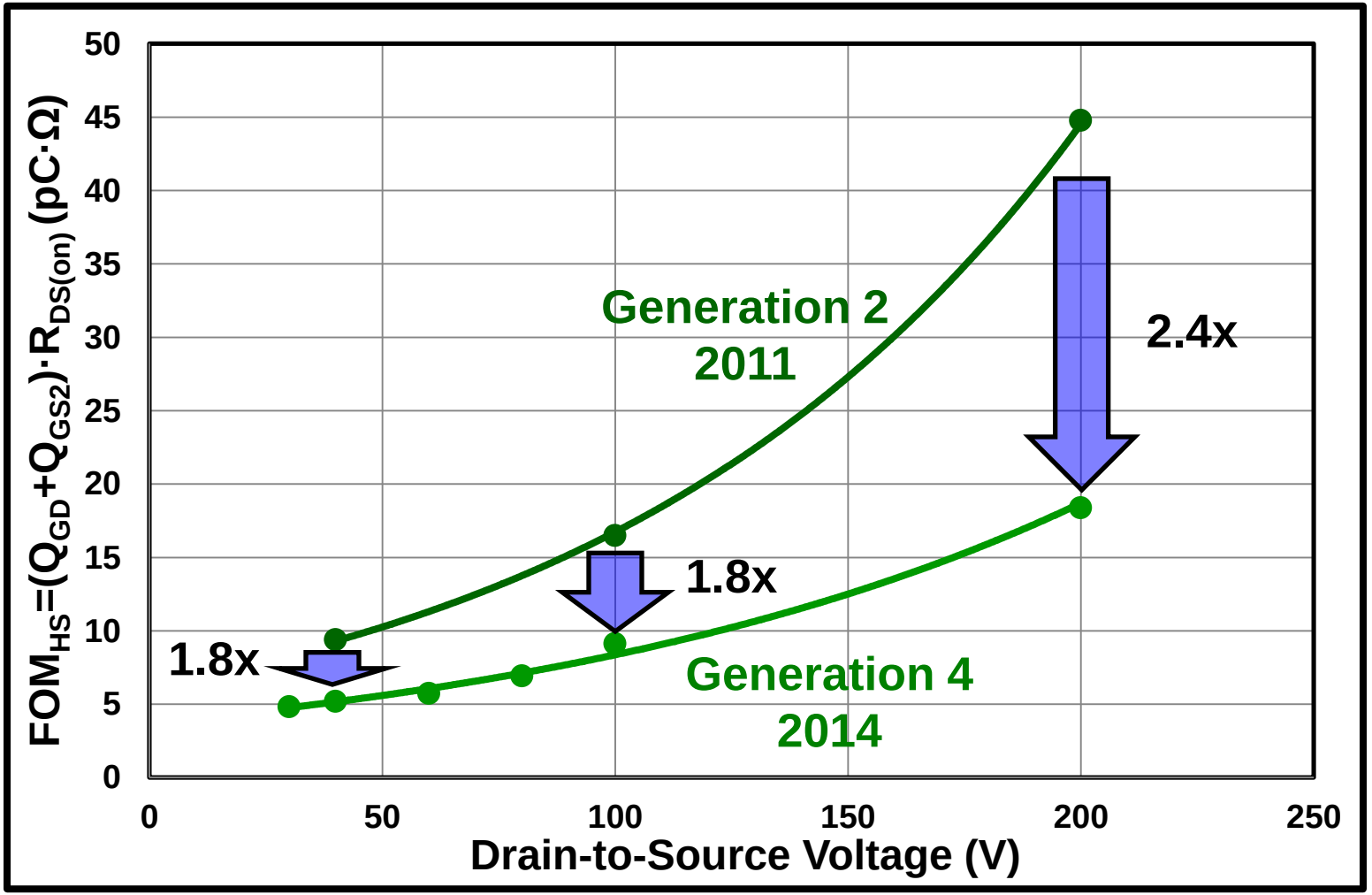


阻抗的比較


Generation 2
2011
Generation 4
2014
2.3x
2.6x
$R_{DS(on)}$ (mΩ)
Drain-to-Source Voltage (V)
0
1
2
3
4
5
6
0
20
40
60
80
100
120

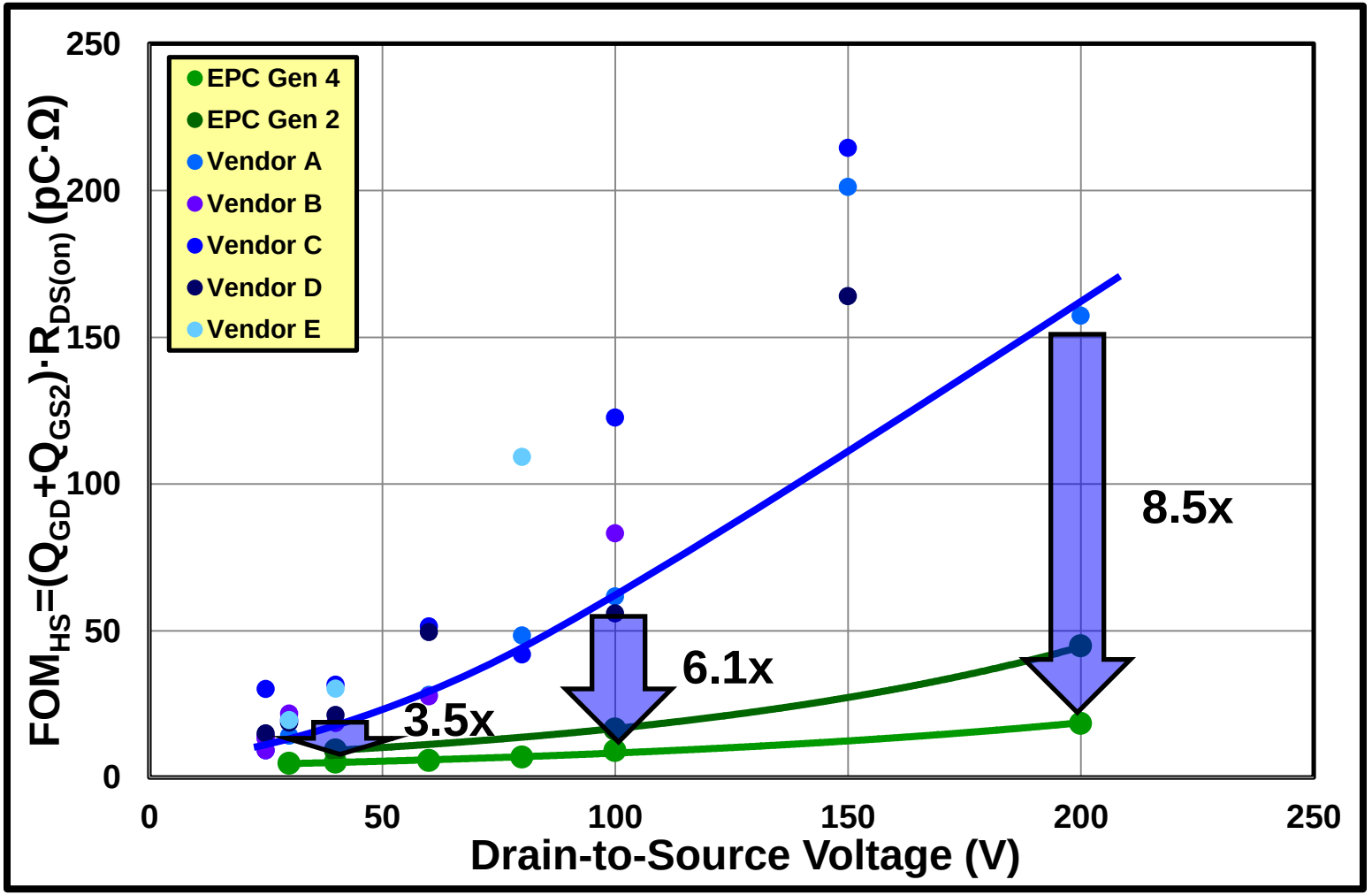
V_{GS}=5 V

硬開關的品質因數FOM_{HS}



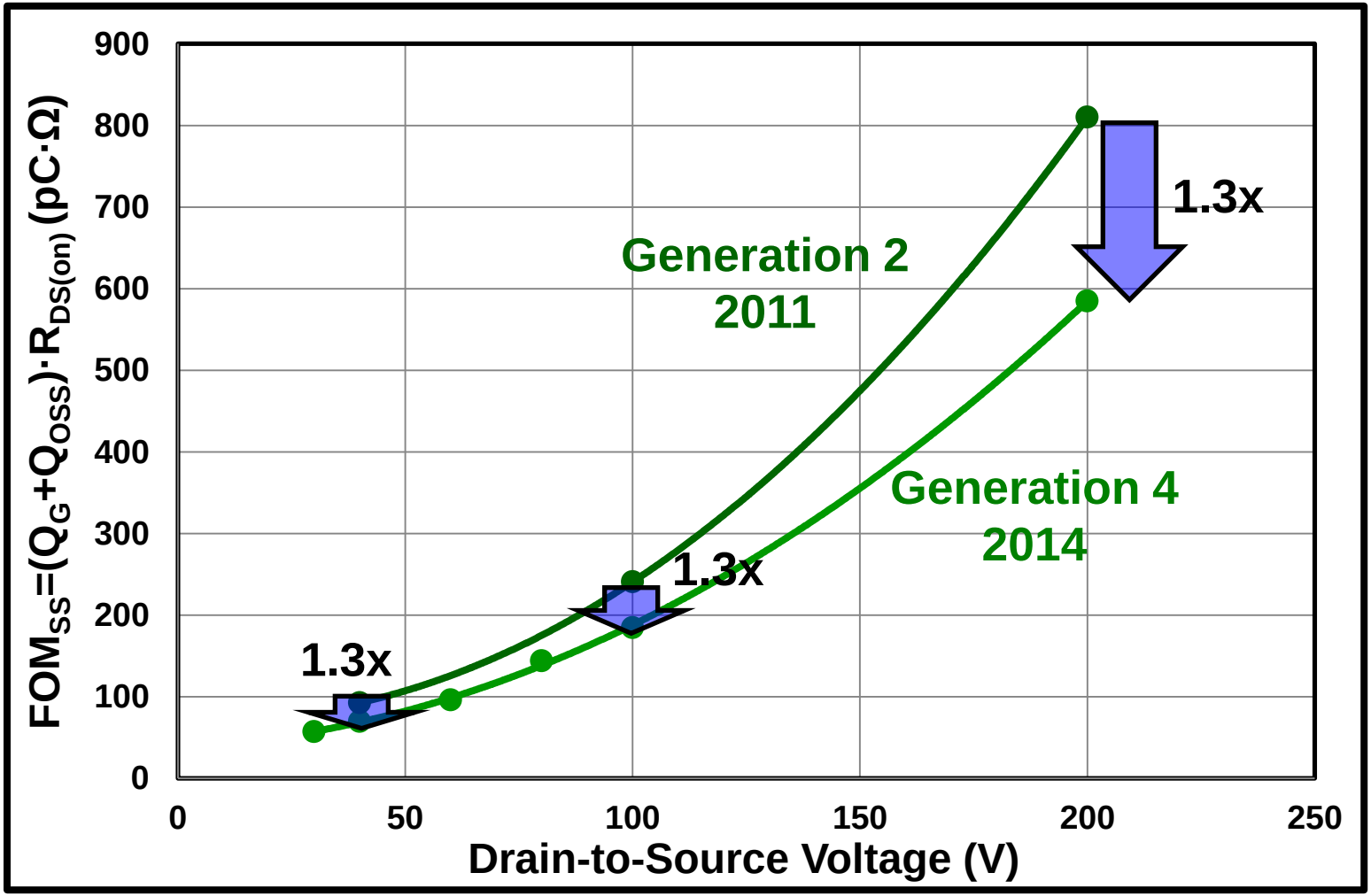
V_{DS}=0.5·V_{DSS}, I_{DS}=20 A

硬開關的品質因數FOM_{HS}



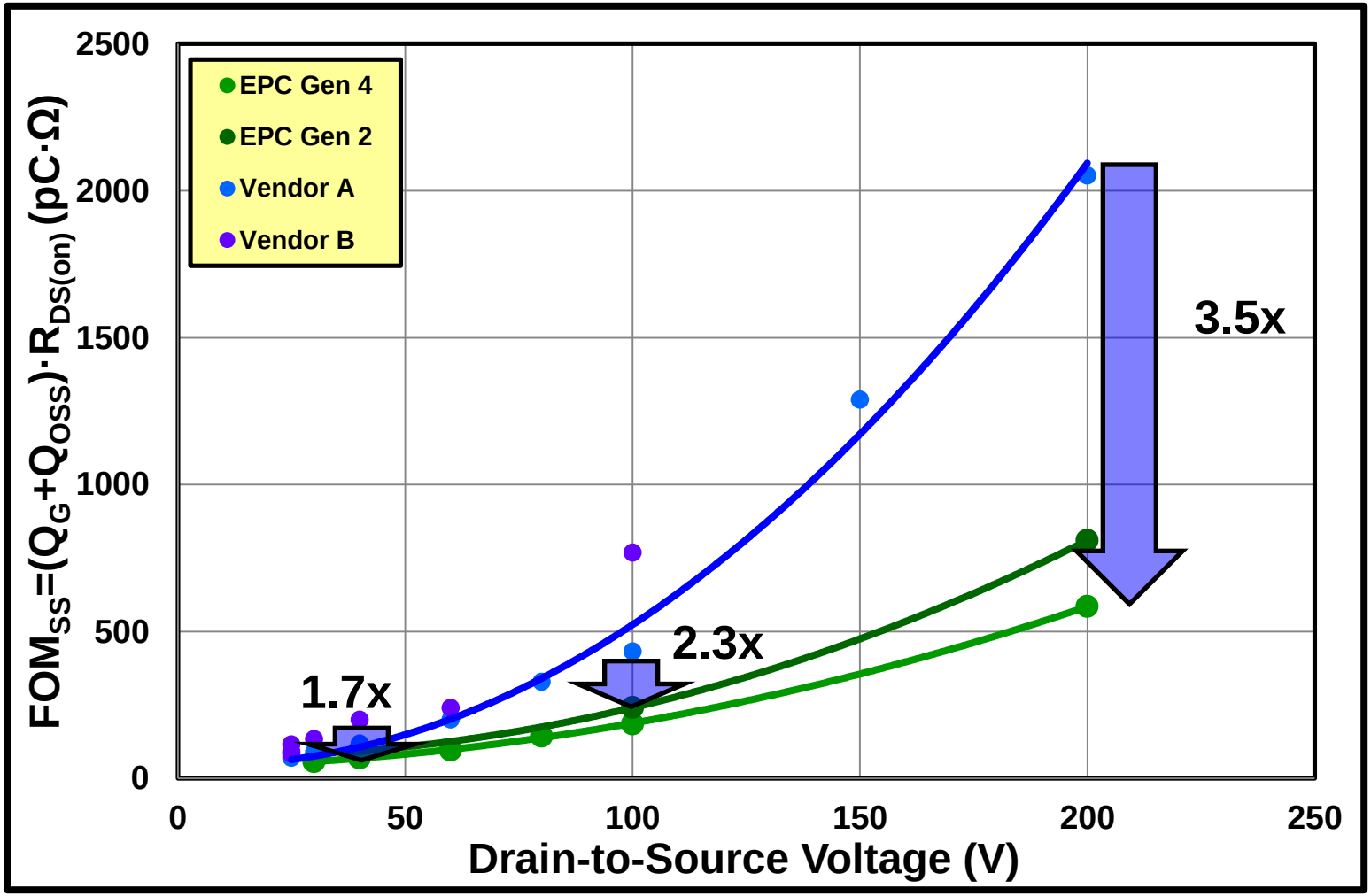
$V_{DS}=0.5\cdot V_{DSS}$, $I_{DS}=20$ A

軟開關的品質因數FOM_{SS}



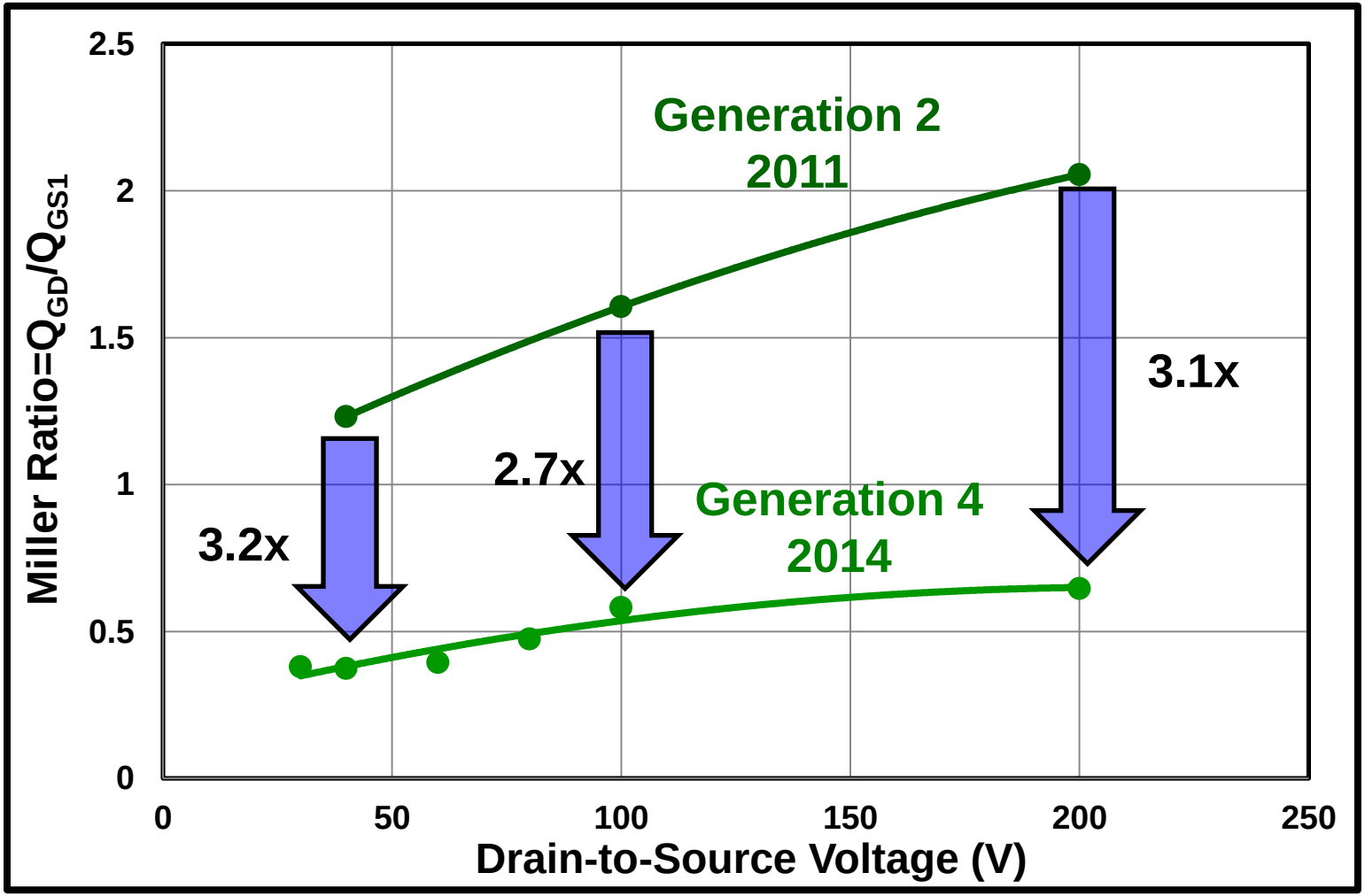
$V_{DS}=0.5\cdot V_{DSS}$

軟開關的品質因數FOM_{SS}



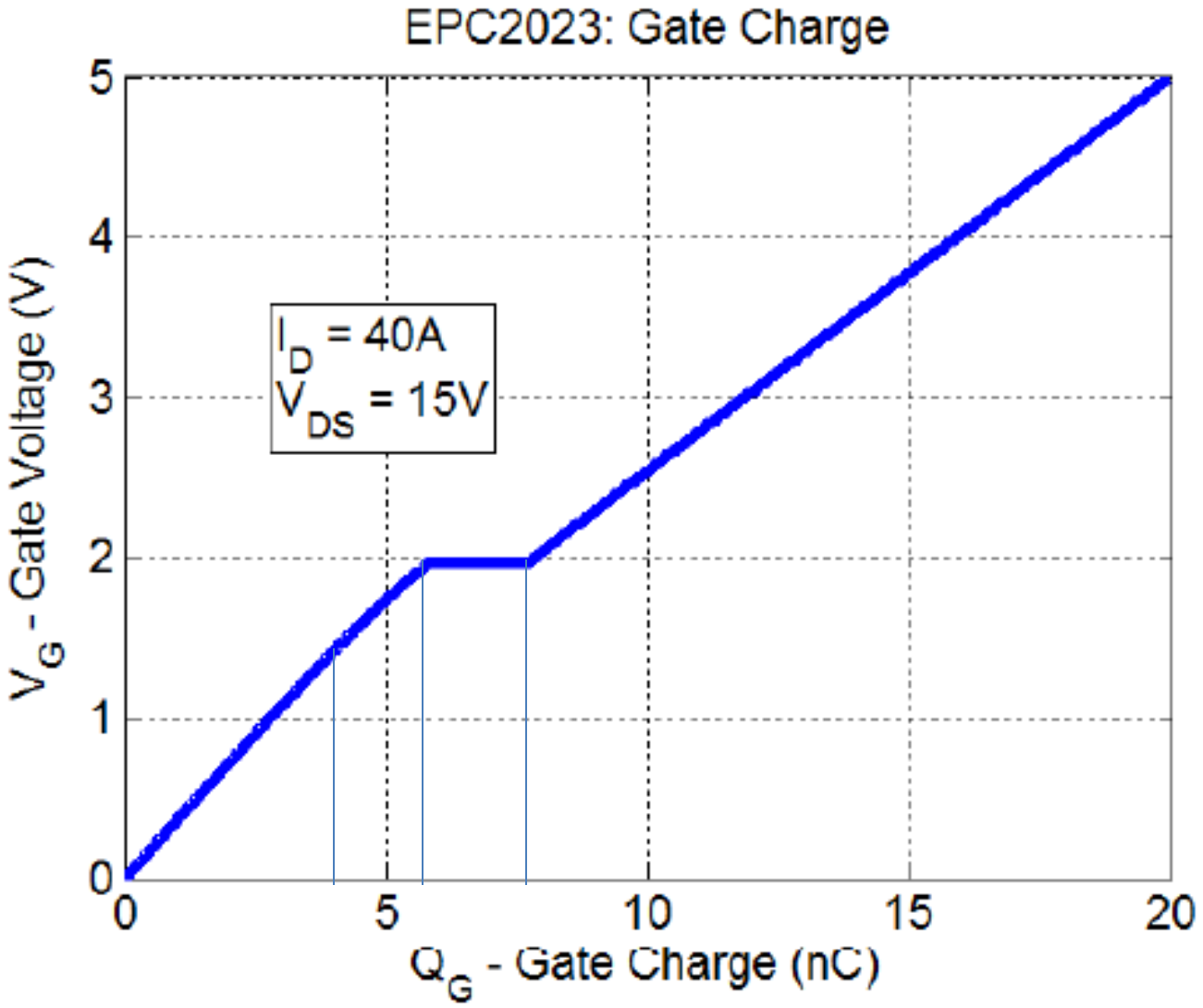
$V_{DS}=0.5\cdot V_{DSS}$

米勒比

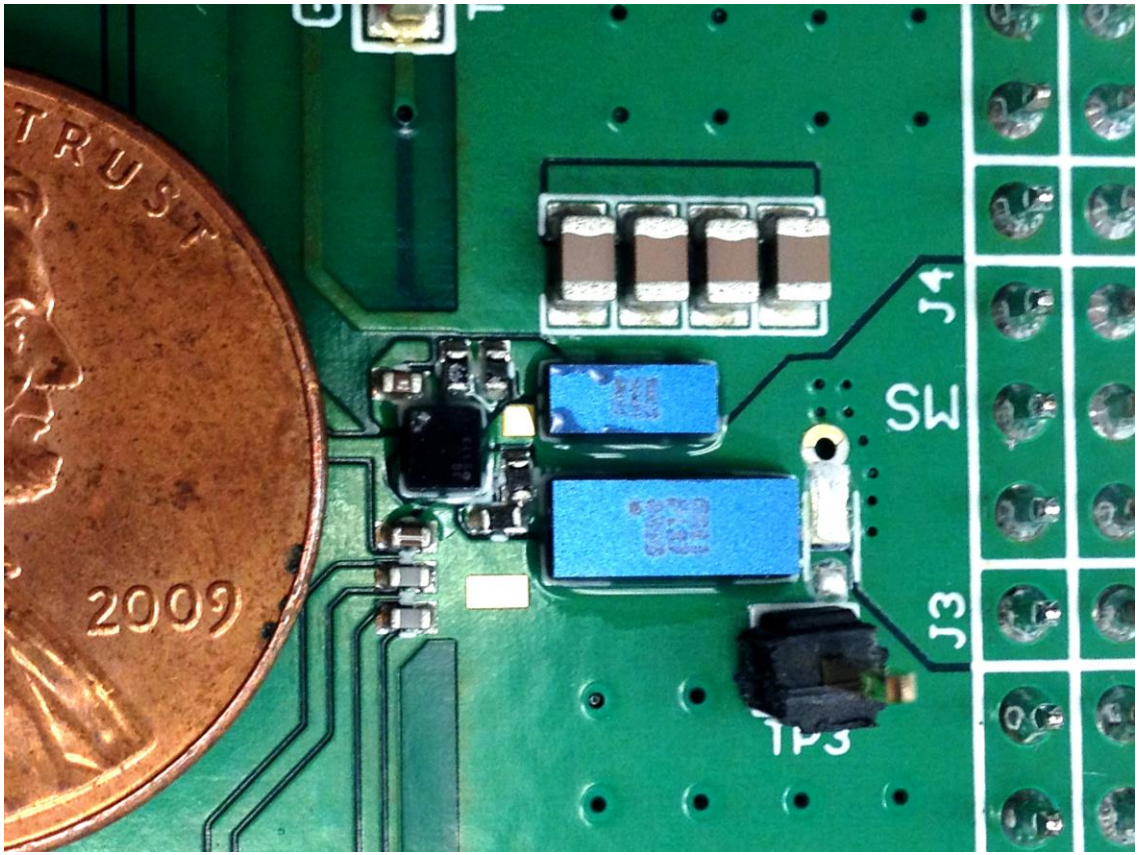


V_{DS}=0.5·V_{DSS}, I_{DS}=20 A

閘極電荷

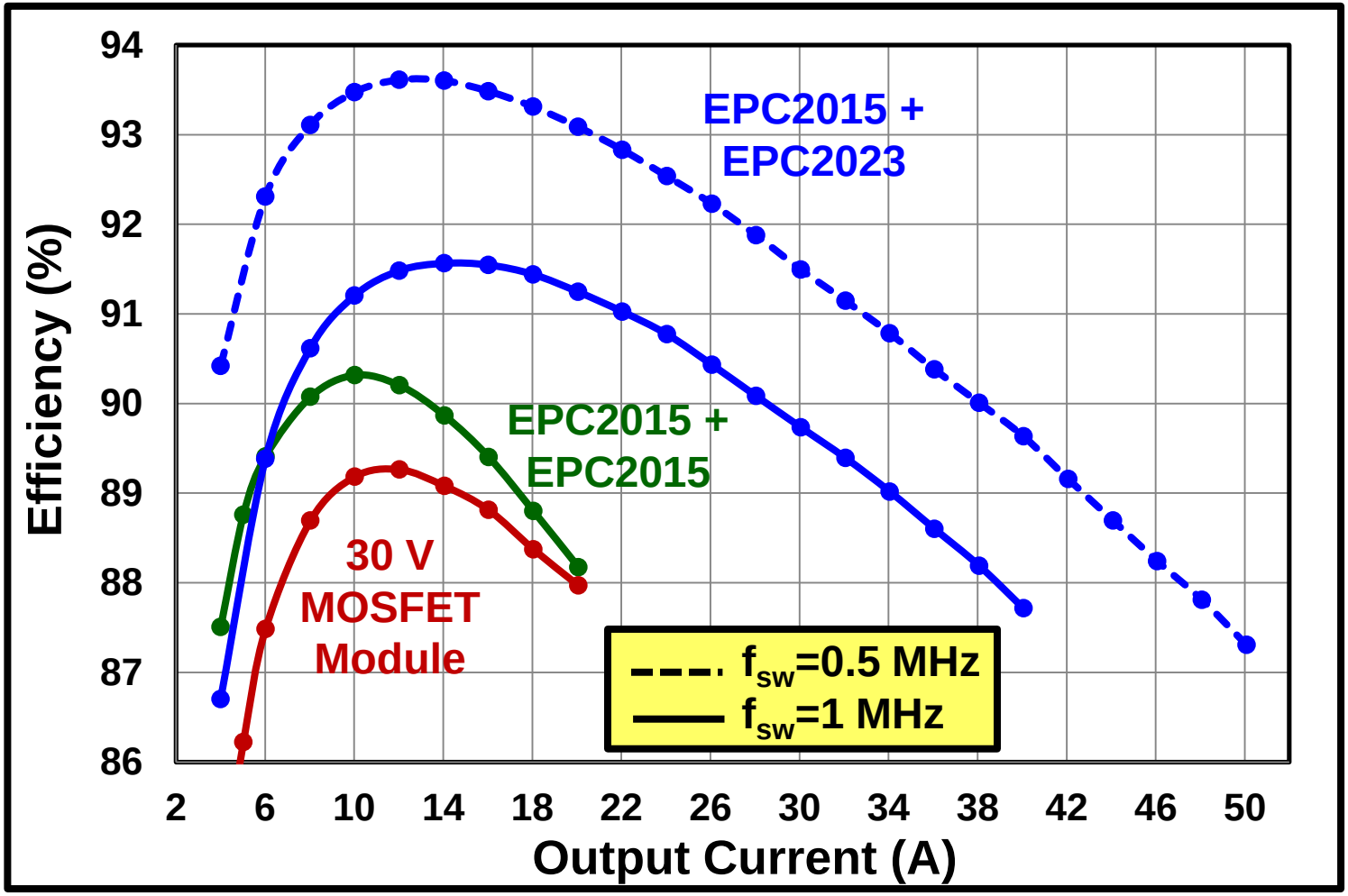

EPC2023: Gate Charge
I_D = 40A
V_{DS} = 15V
V_G - Gate Voltage (V)
Q_G - Gate Charge (nC)
0
1
2
3
4
5
0
5
10
15
20

硬開關降壓轉換器



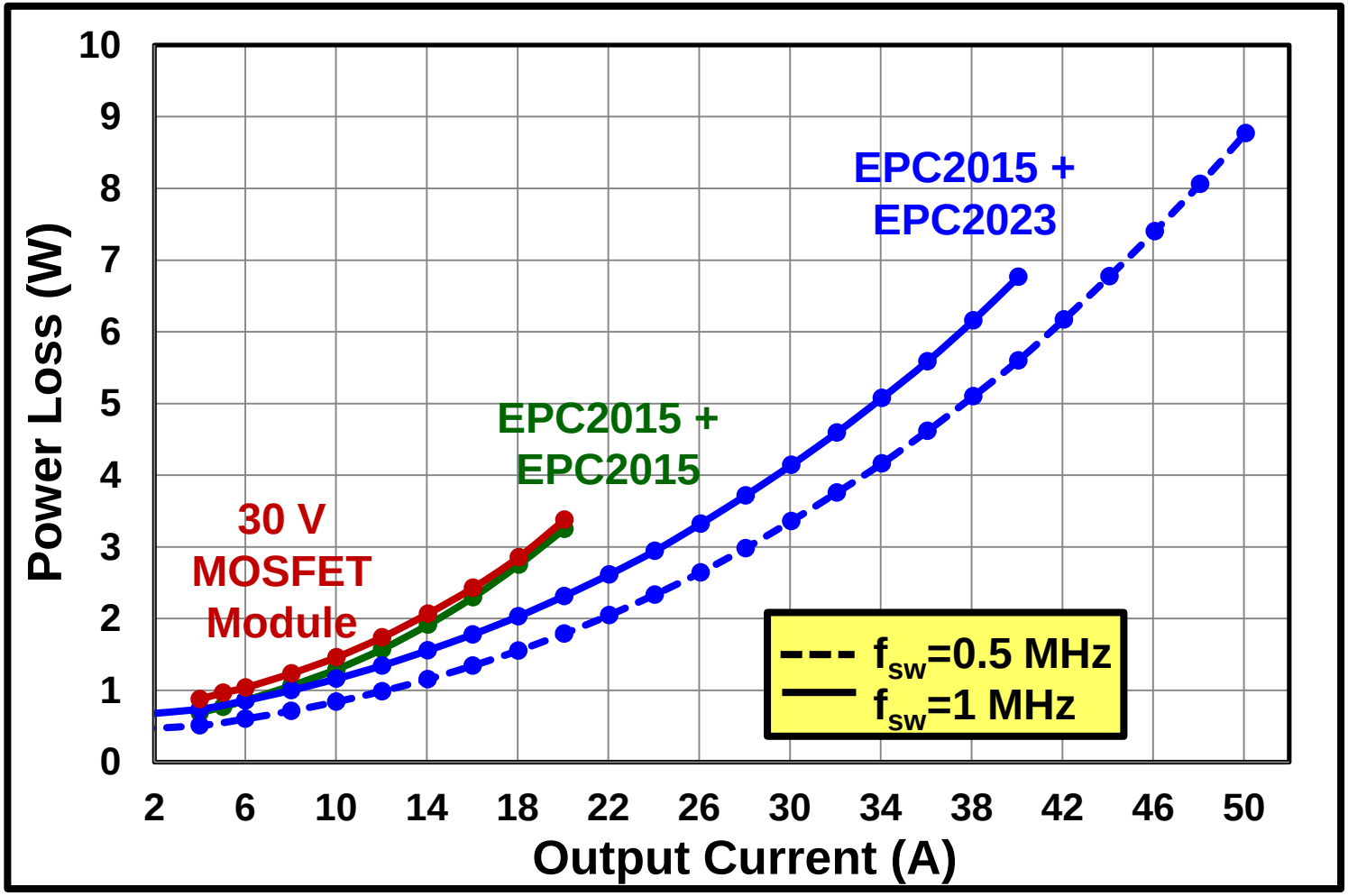
EPC9018, EPC2015 + EPC2023
EPC9019, EPC2001 + EPC2021

在較低電壓的性能



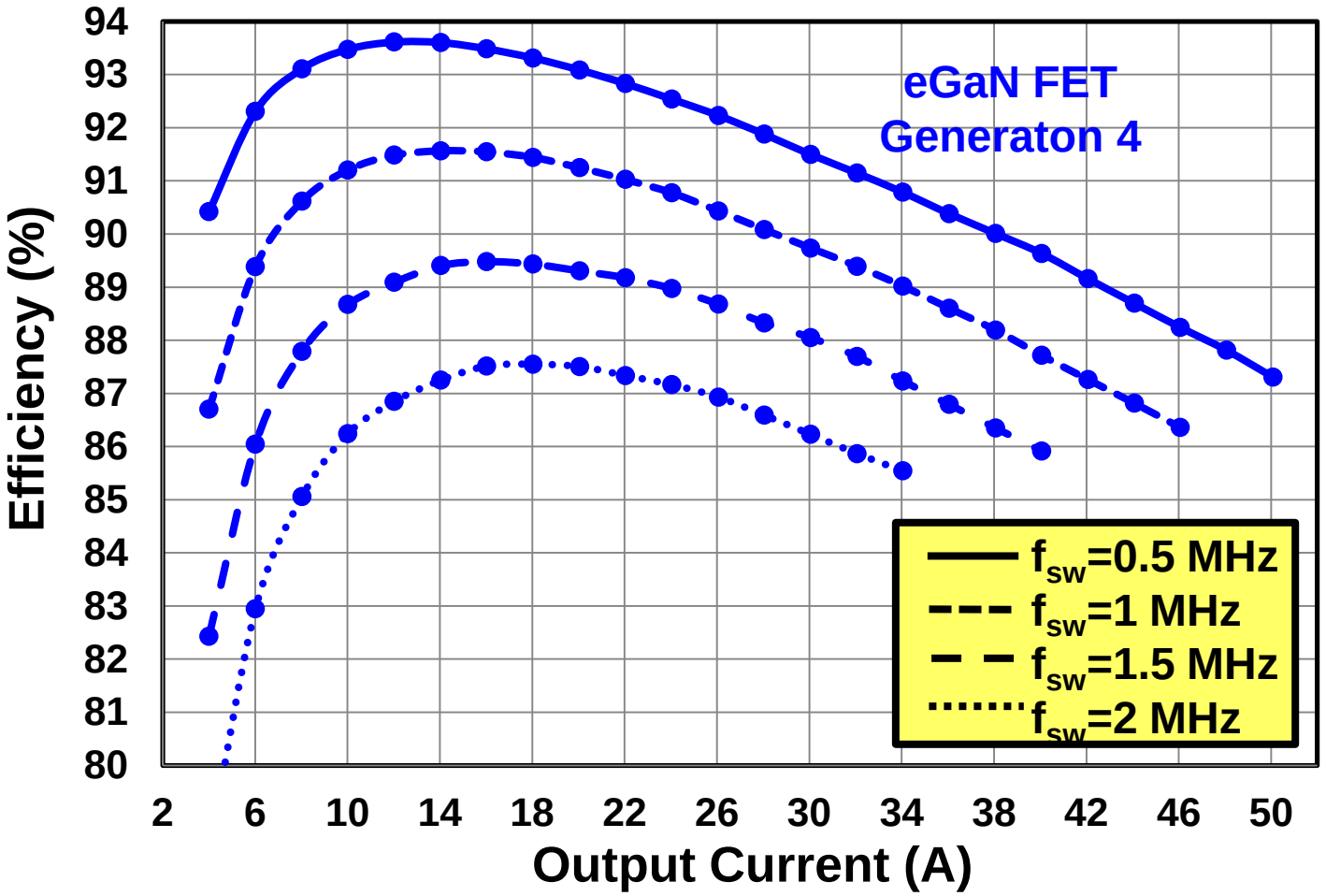
V_{IN}=12 V V_{OUT}=1.2 V

在較低電壓的性能



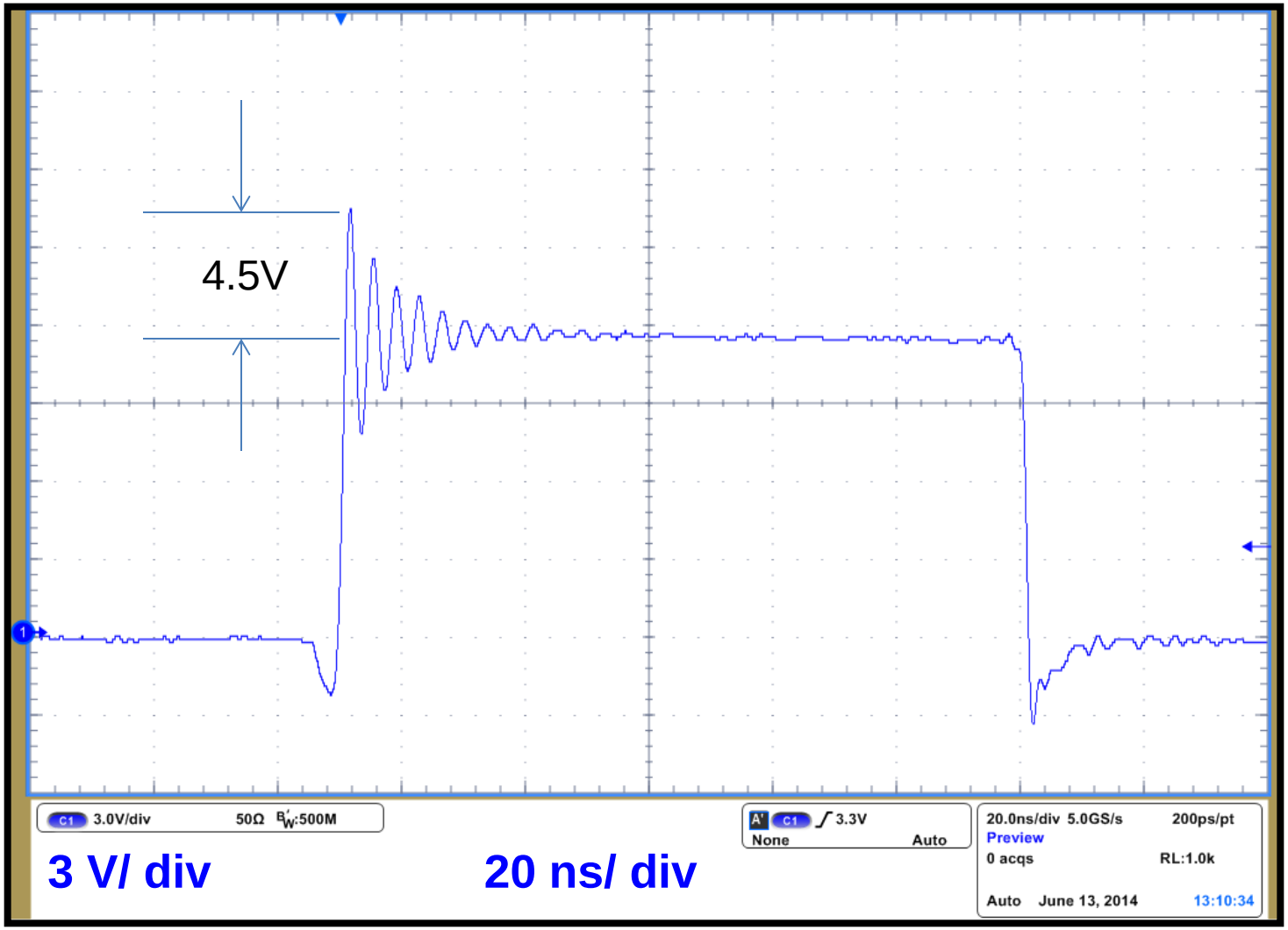
V_{IN}=12 V V_{OUT}=1.2 V

在較低電壓的性能



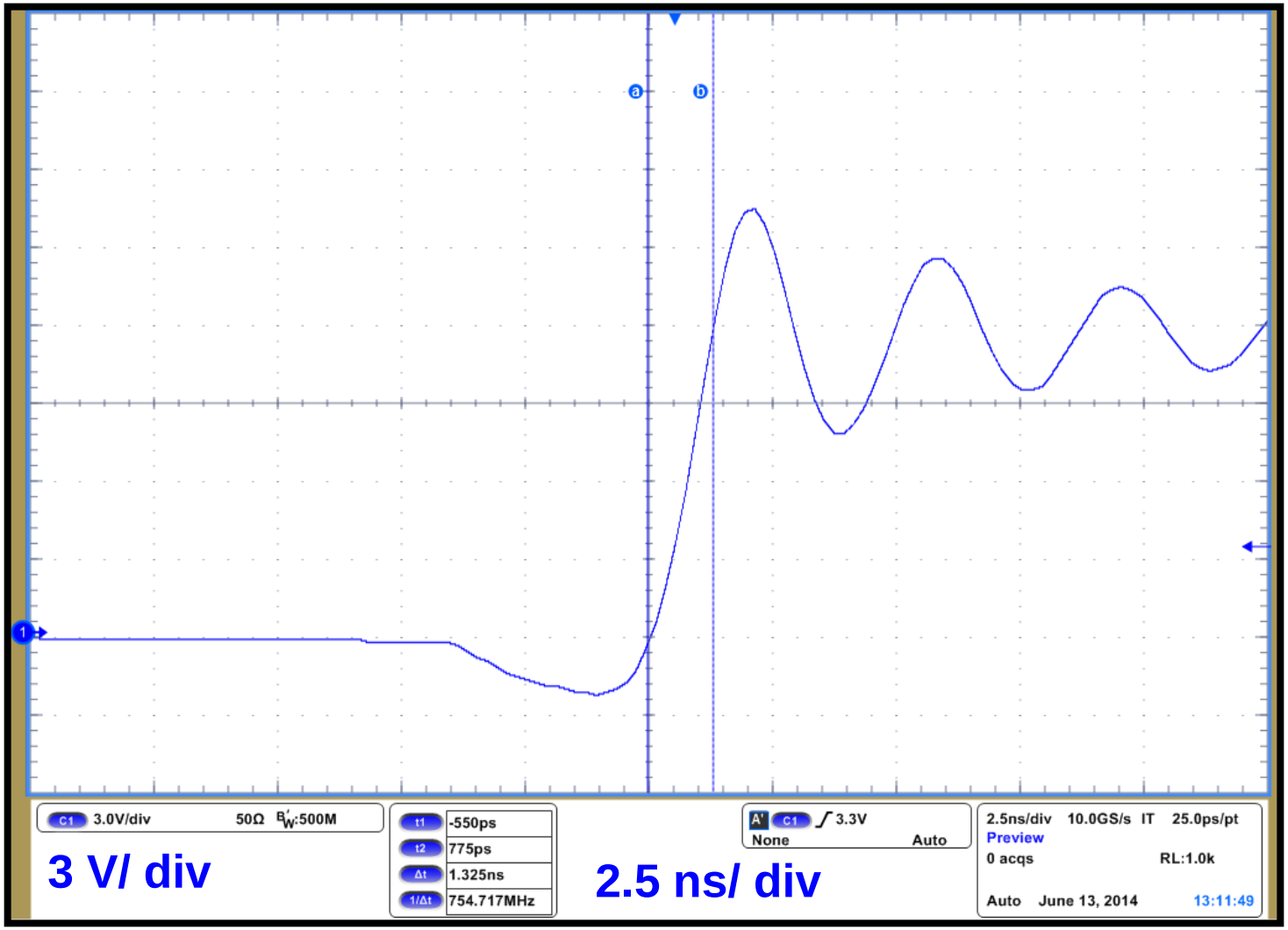
V_{IN}=12 V V_{OUT}=1.2 V

在較低電壓的性能



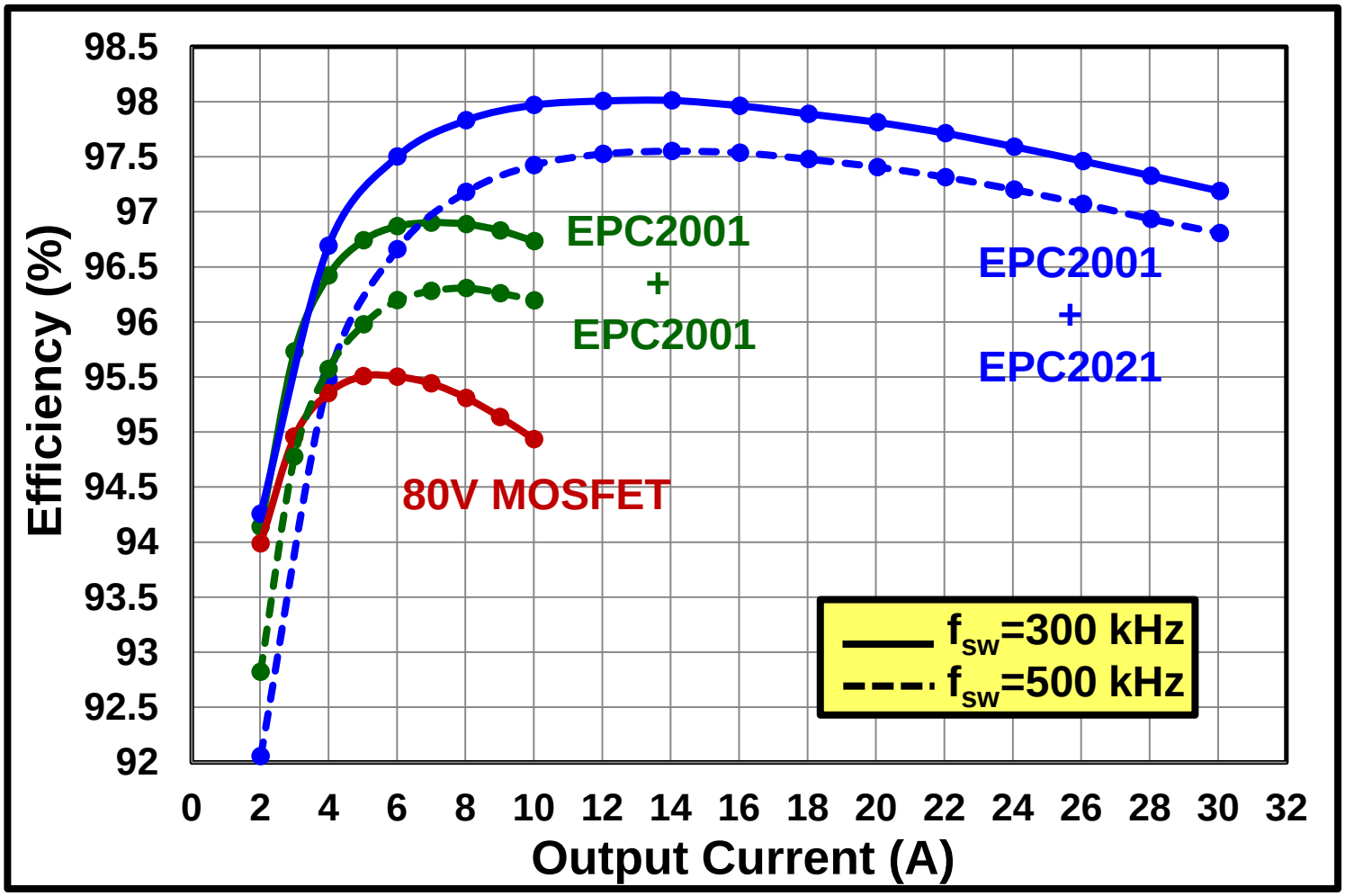
V_{IN}=12 V, V_{OUT}=1.2 V, f_{sw}=1MHz, I_{OUT}=40 A

在較低電壓的性能



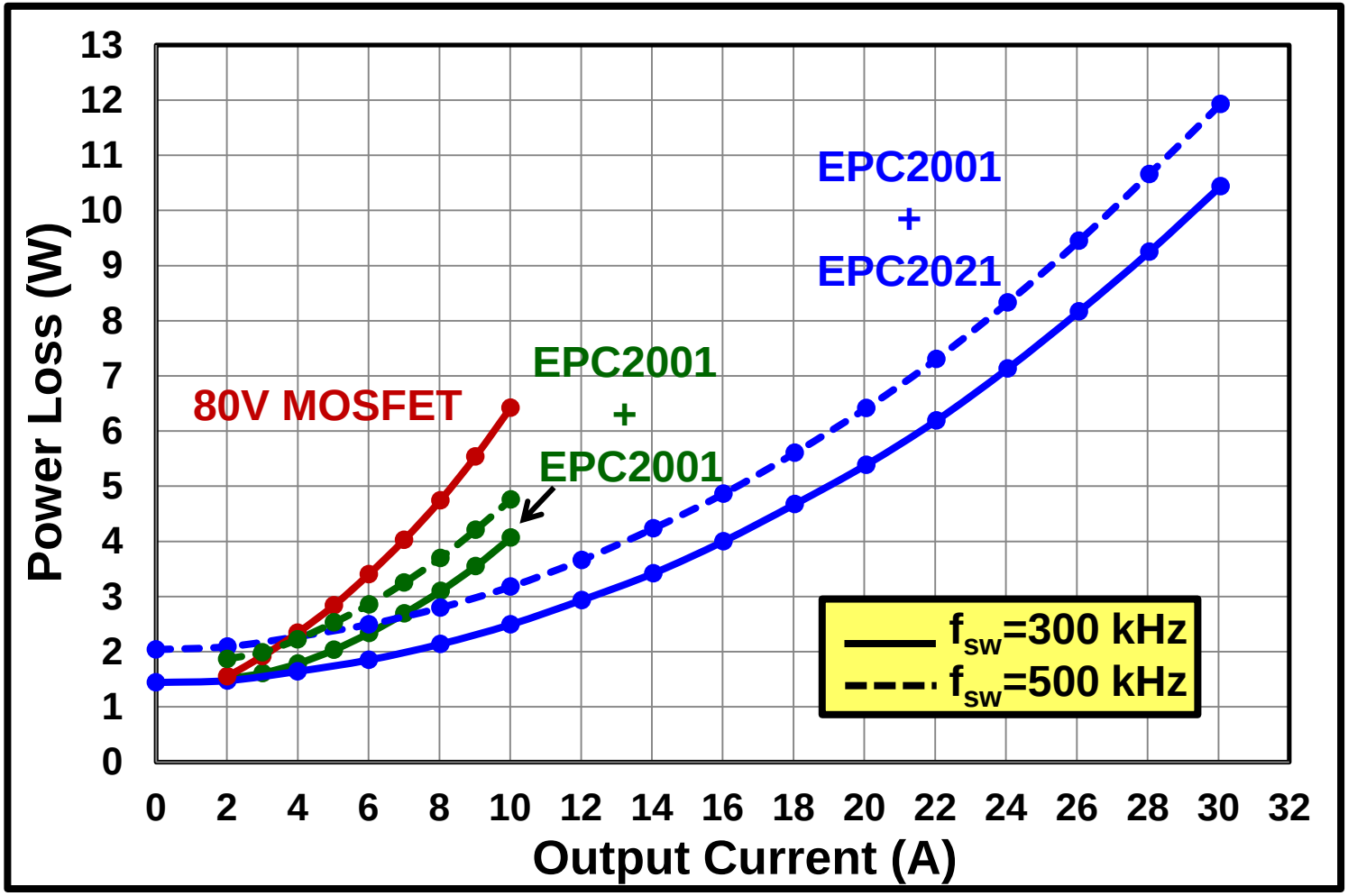
V_{IN}=12 V, V_{OUT}=1.2 V, f_{sw}=1 MHz, I_{OUT}=40 A

在較高電壓的性能



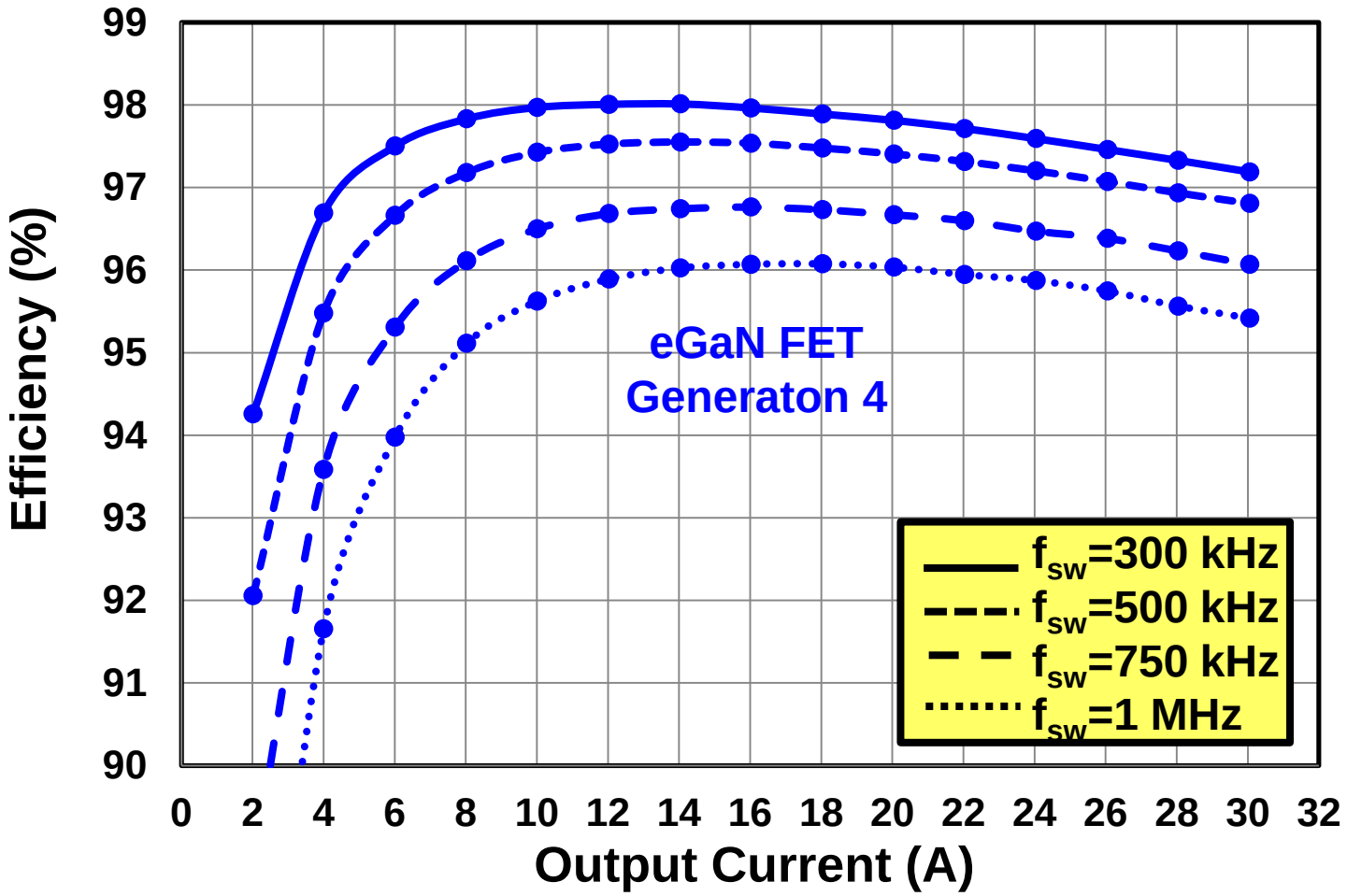
V_{IN}=48 V V_{OUT}=12 V

在較高電壓的性能



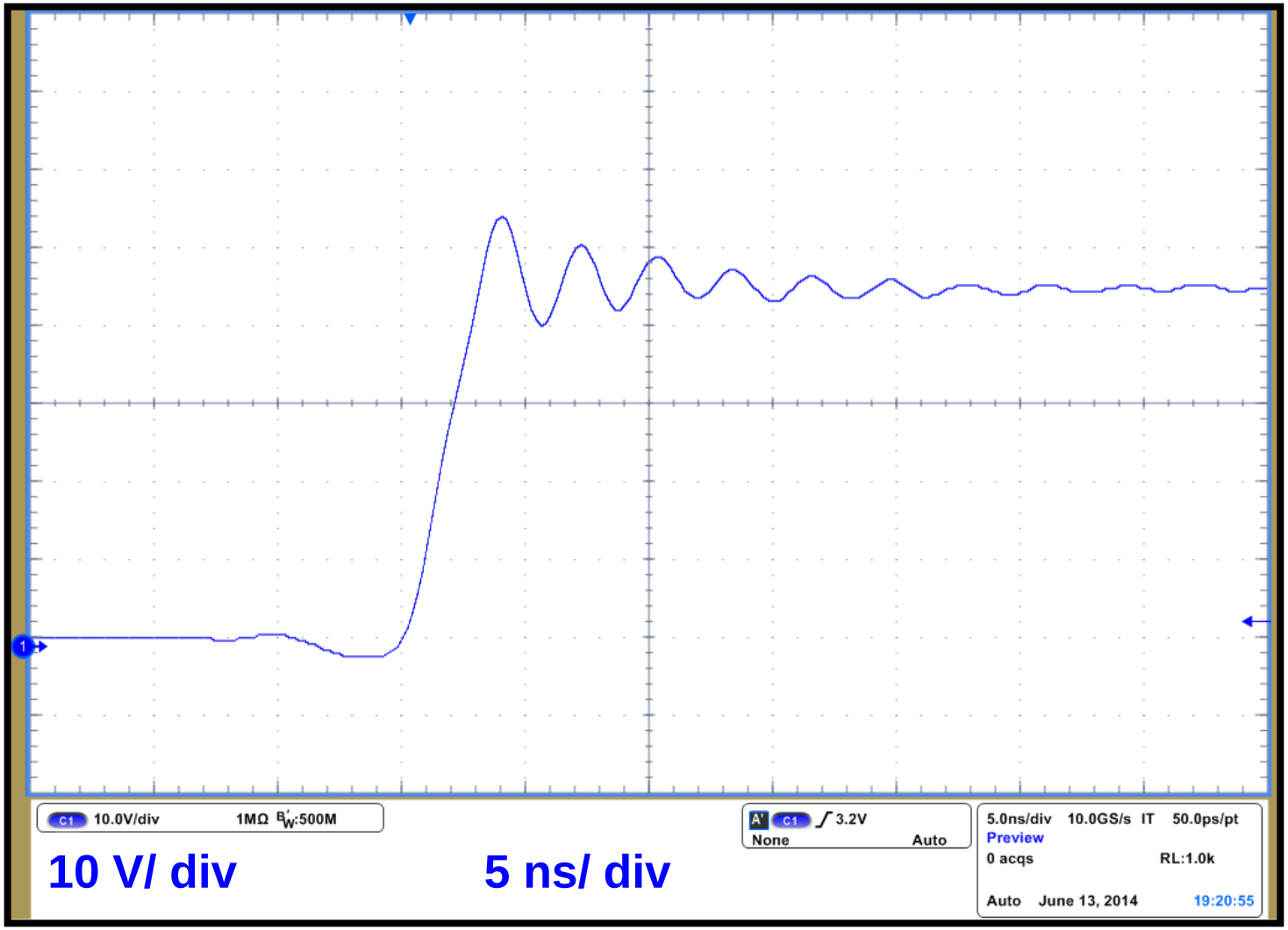
V_{IN}=48 V V_{OUT}=12 V

在較高電壓的性能



V_{IN}=48 V V_{OUT}=12 V

在較高電壓的性能



V_{IN}=48 V, V_{OUT}=12 V, f_{sw}=500 kHz, **I_{OUT}=30 A**

總結

- 新一代氮化鎵場效應電晶體（eGaN FET）現已推出
- 採用氮化鎵器件的硬開關應用可降低阻抗達兩倍及提高開關性能達兩倍
- 與矽MOSFET器件相比，採用氮化鎵場效應電晶體的硬開關負載點應用在效率方面可取得倍增的優勢

開發板

EPC Part No.	Voltage	Max $R_{DS(on)}$ (mΩ) (V_{GS} = 5 V)	Min. Peak Pulsed I_D (A) (25°C, T_{pulse} = 300 µs)	Half-Bridge Development Boards	
				Standard	Low Duty Cycle
EPC2023	30	1.3	590	EPC9031	EPC9018
EPC2024	40	1.5	550	EPC9032	
EPC2020	60	2	470	EPC9033	
EPC2021	80	2.5	420	EPC9034	EPC9019
EPC2022	100	3.2	360	EPC9035	
EPC2019	200	43	42	EPC9014	

謝謝大家的支持！

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