Generation 4 eGaN® Technology

Efficient Power Conversion Corporation

IIC China 9.2014

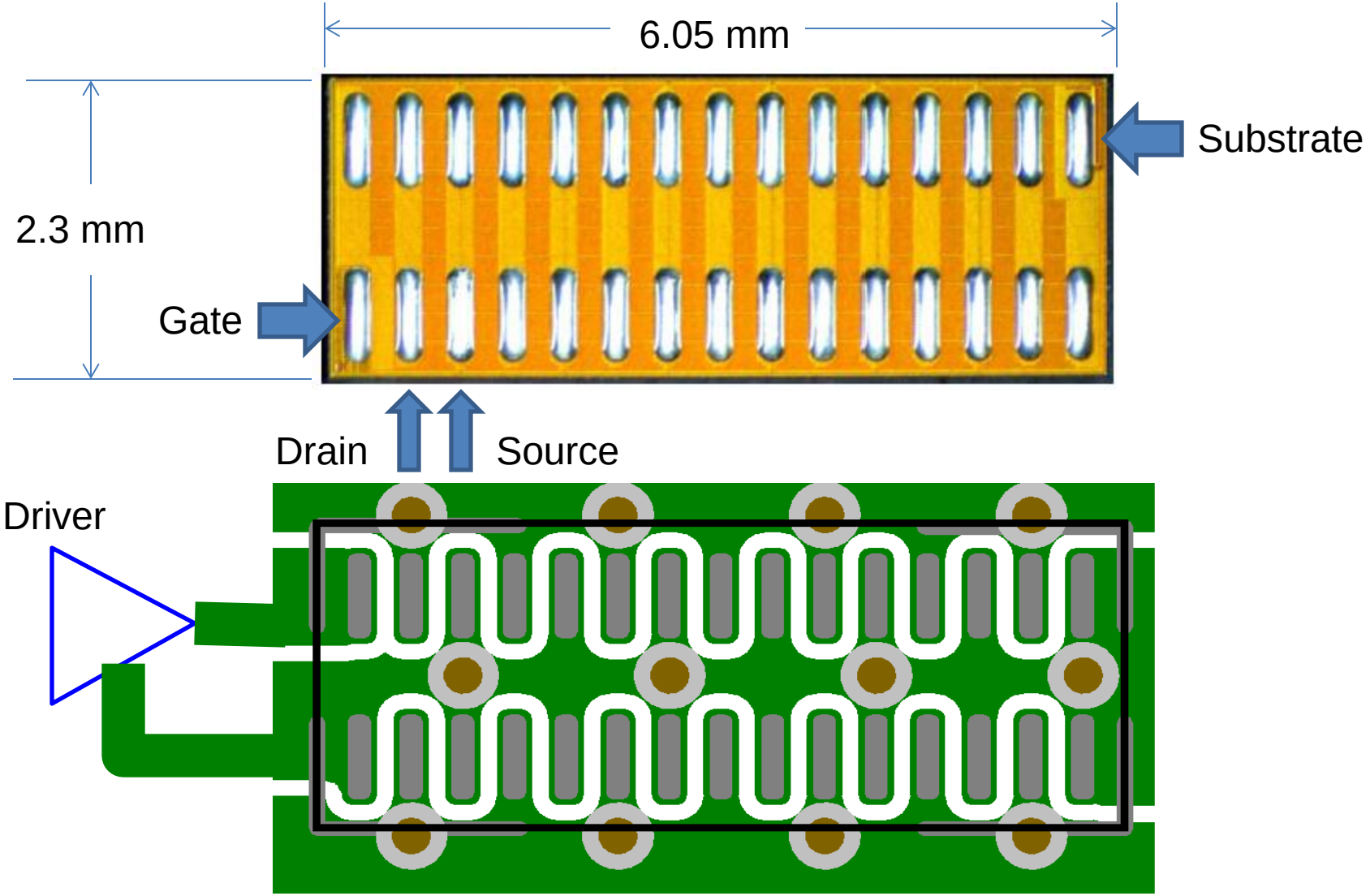
Agenda

- Introducing Generation 4 eGaN® FETs
- $R_{DS(ON)}$ Improvements
- Figure of Merit Improvements
- Miller Ratio Improvement
- DC-DC Converter Efficiency Improvements
- Summary

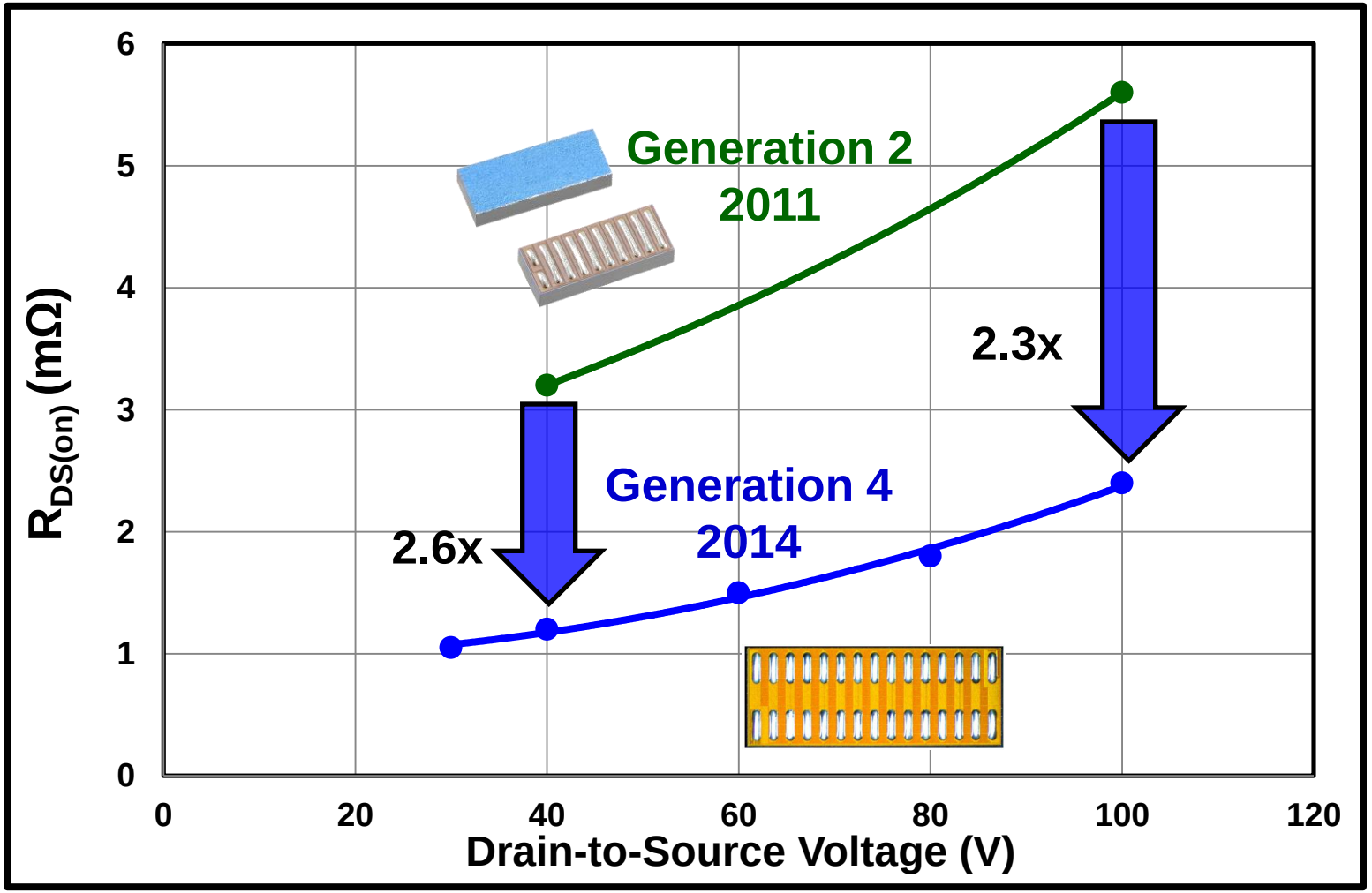
Gen 4 Datasheet Summary

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

Die Layout

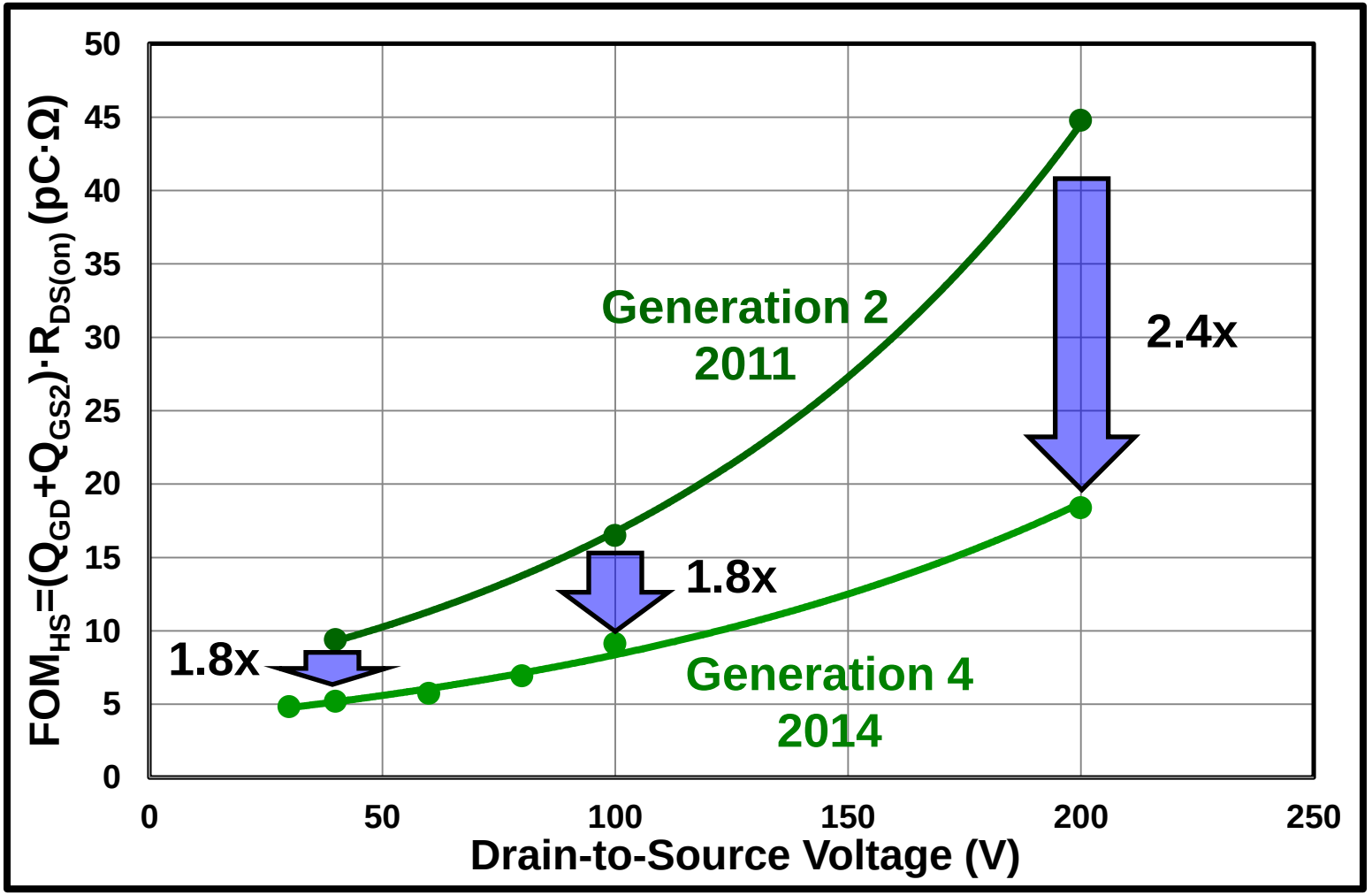


On-Resistance Comparison



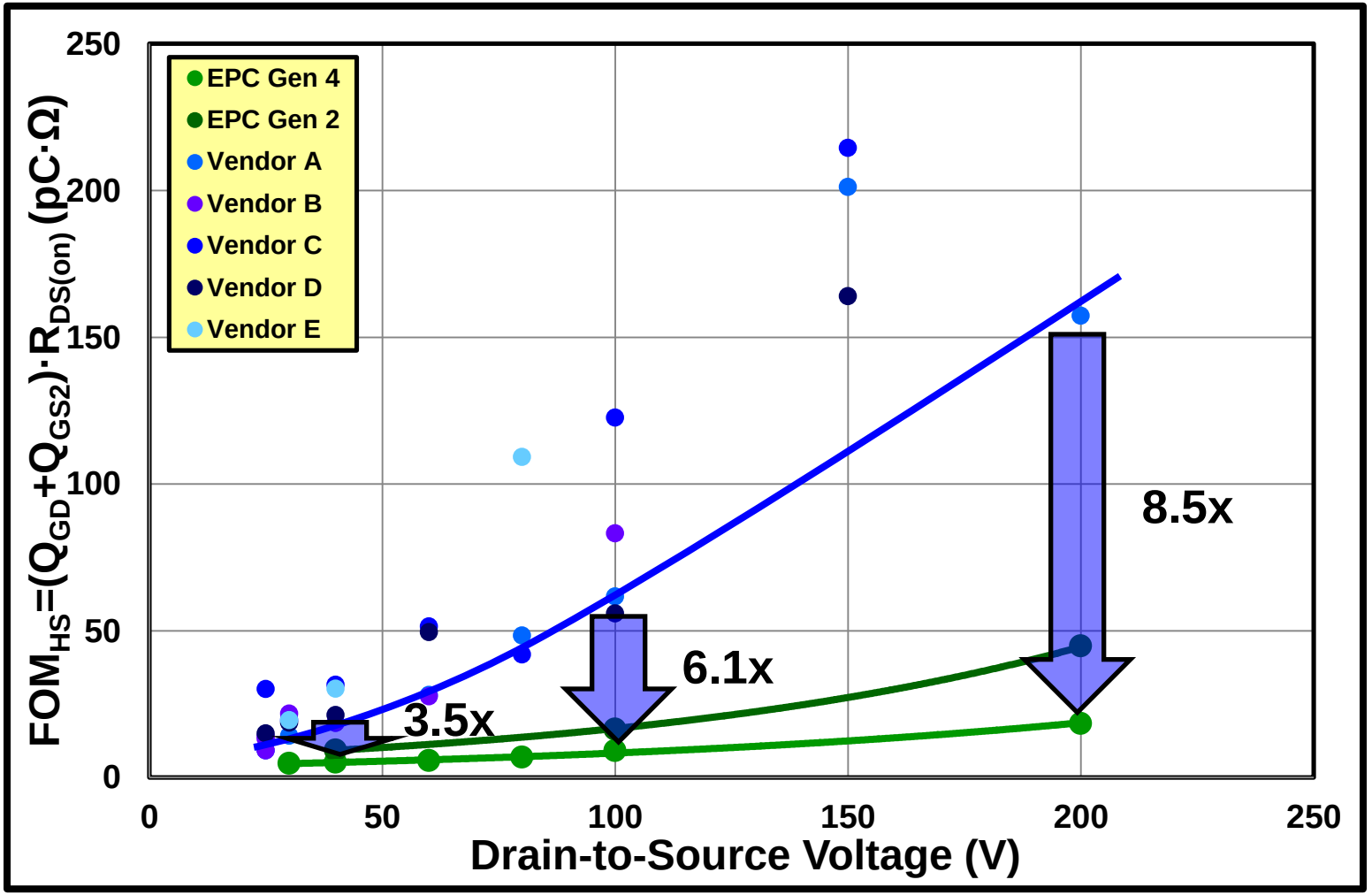
V_{GS}=5 V

Hard Switching FOM_{HS}



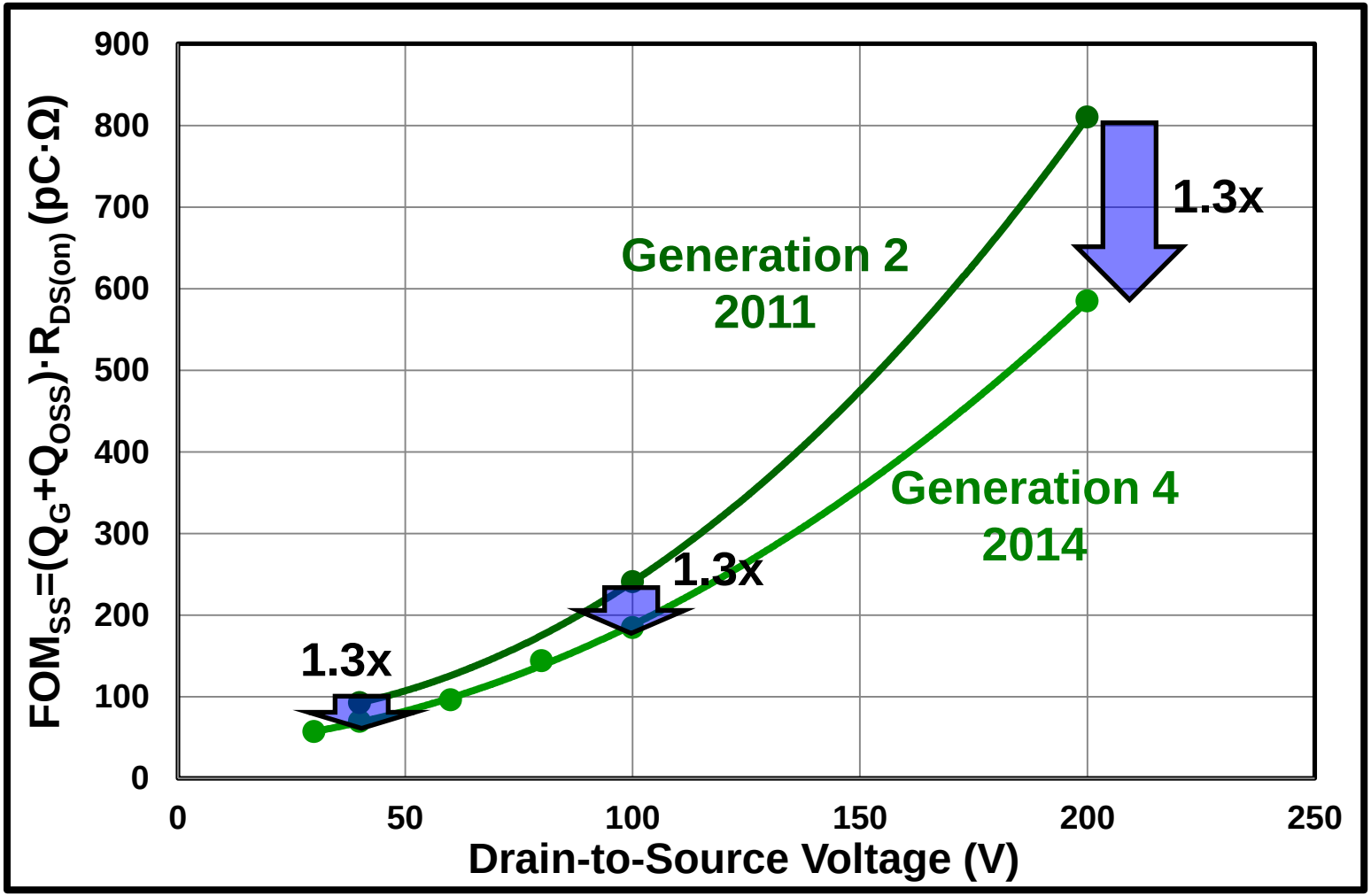
V_{DS}=0.5·V_{DSS}, I_{DS}=20 A

Hard Switching FOM_{HS}



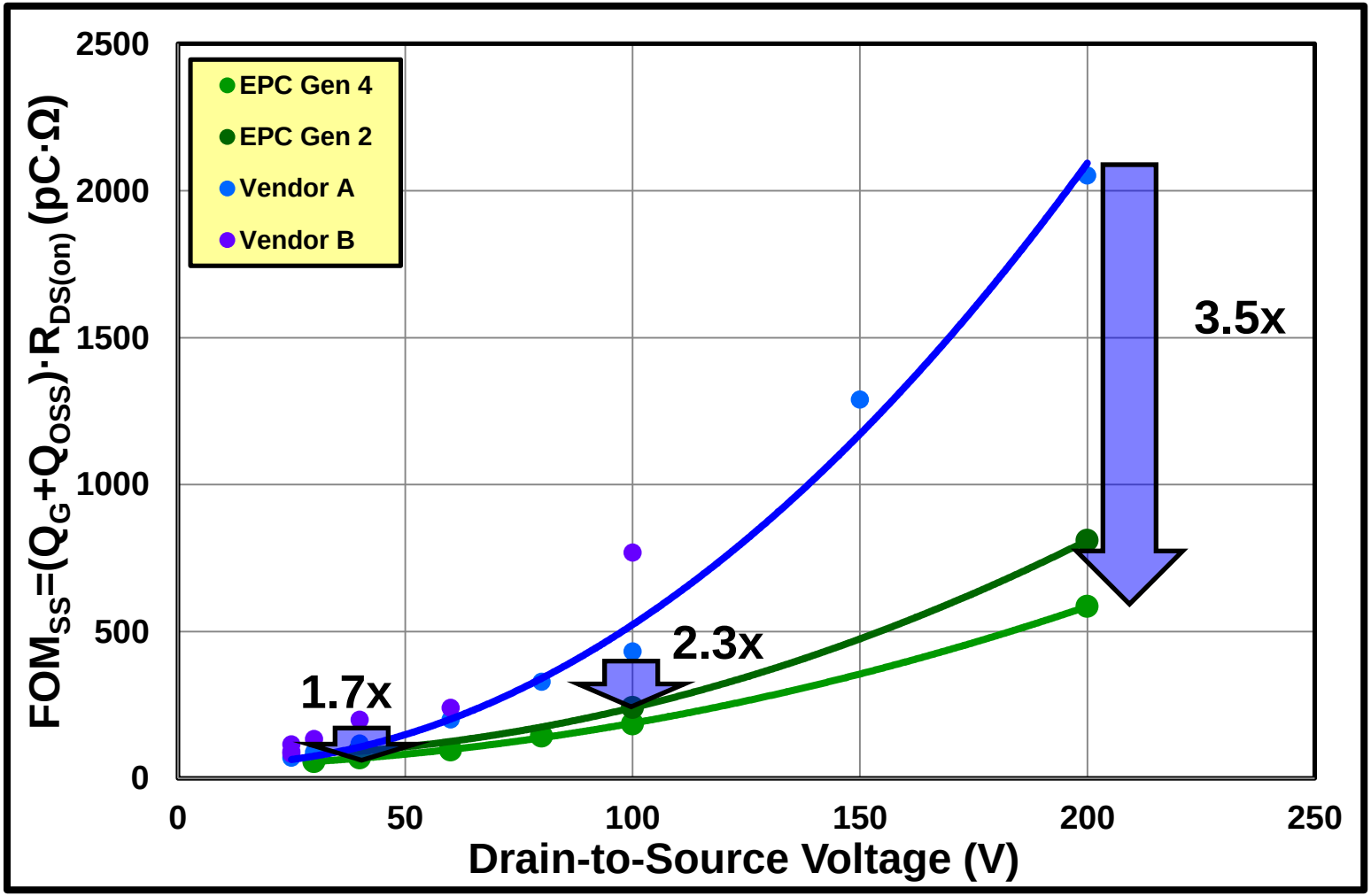
$V_{DS}=0.5\cdot V_{DSS}$, $I_{DS}=20$ A

Soft Switching FOM_{SS}



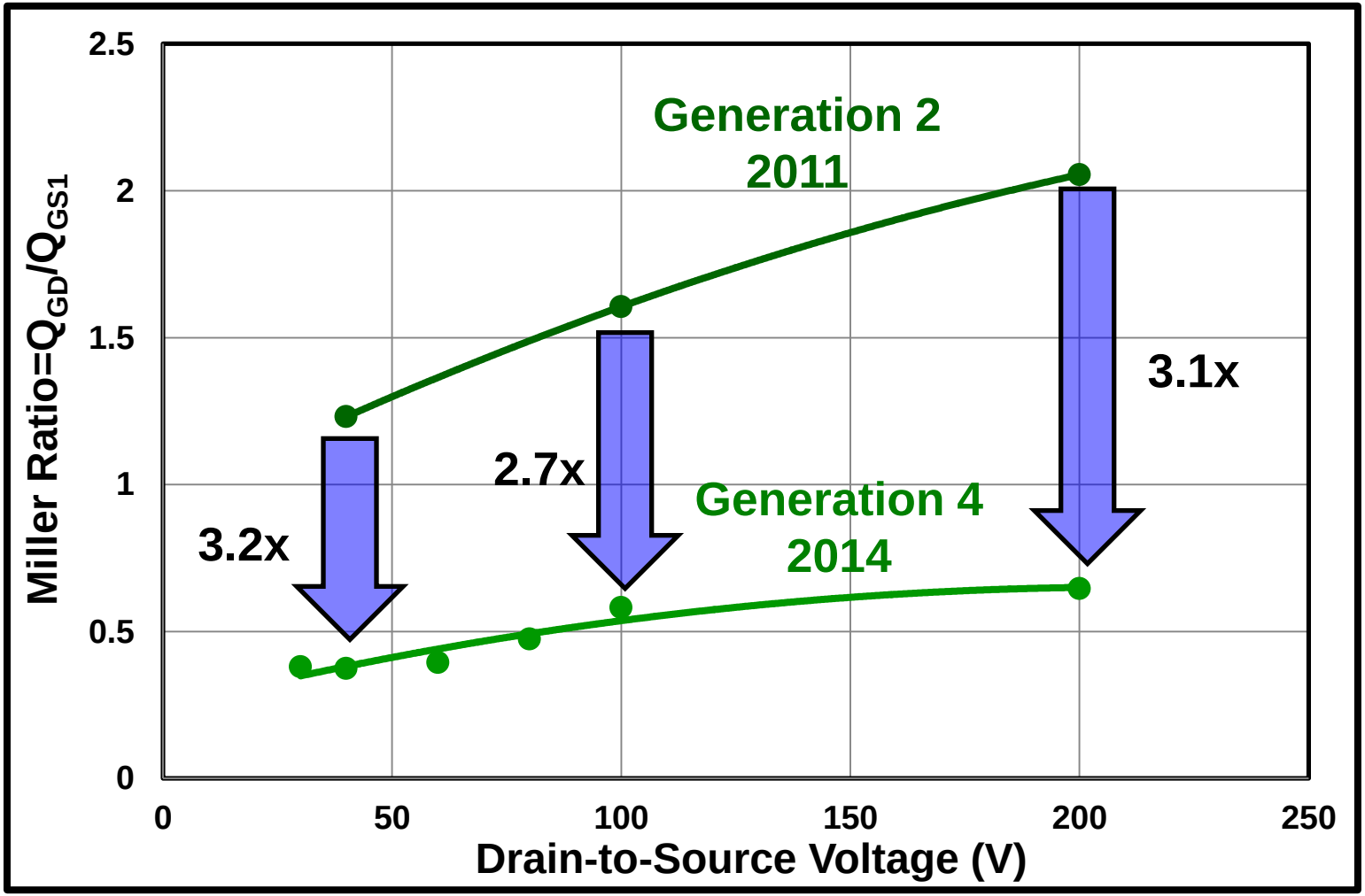
$V_{DS}=0.5\cdot V_{DSS}$

Soft Switching FOM_{SS}



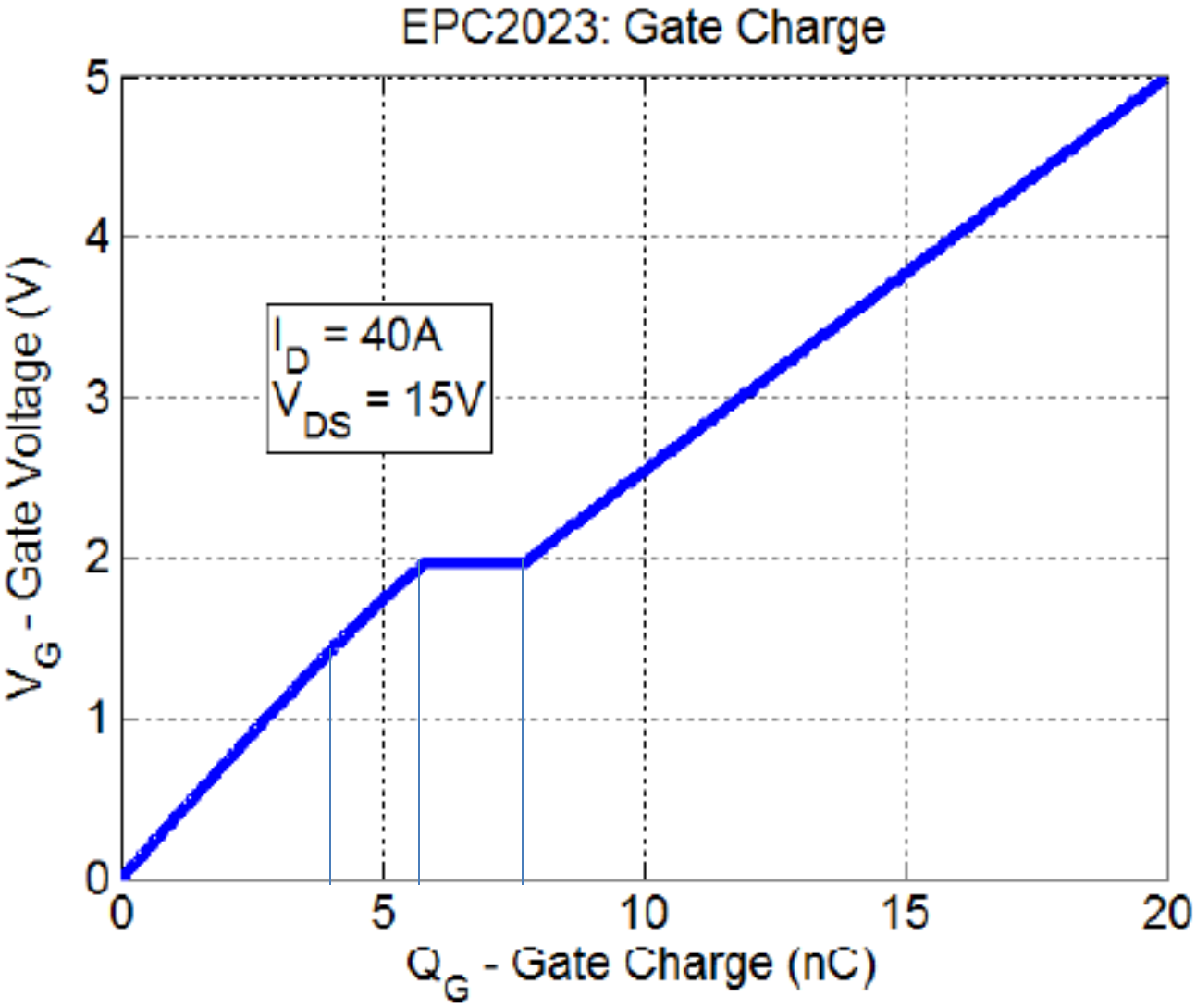
$V_{DS}=0.5\cdot V_{DSS}$

Miller Ratio

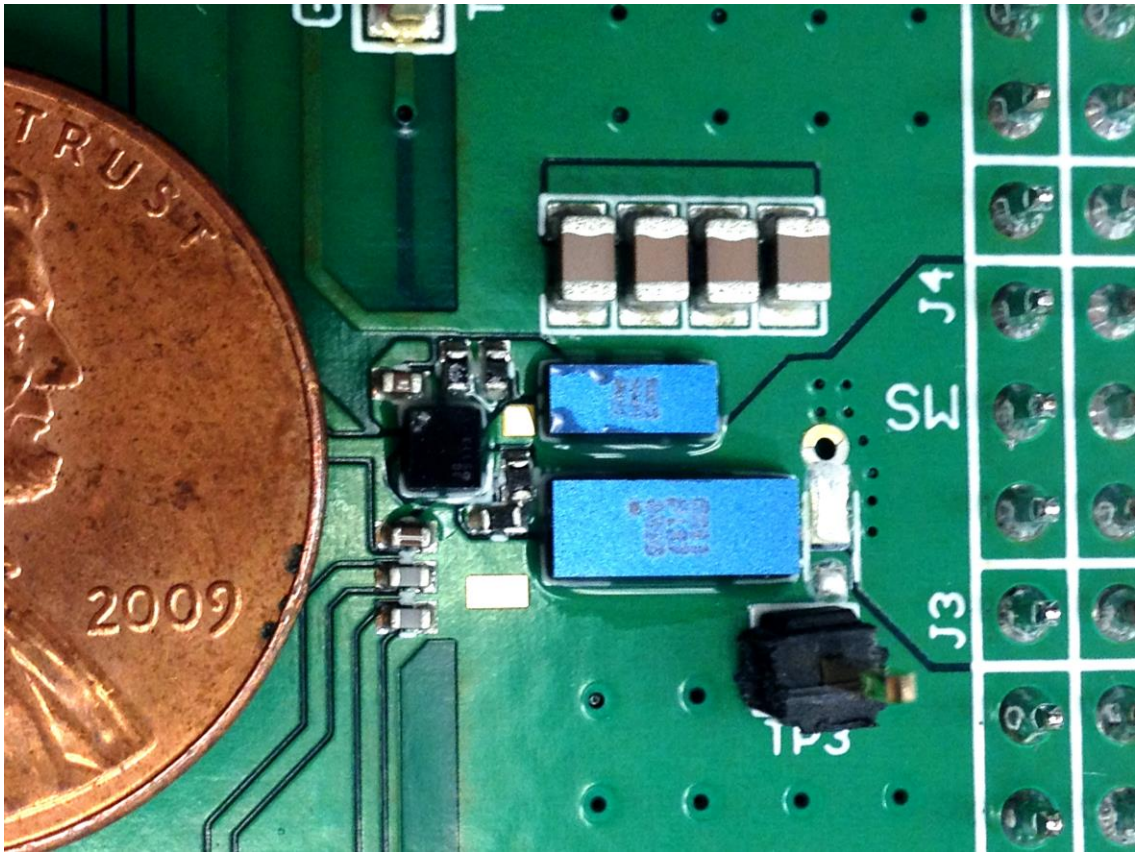


V_{DS}=0.5·V_{DSS}, I_{DS}=20 A

Gate Charge

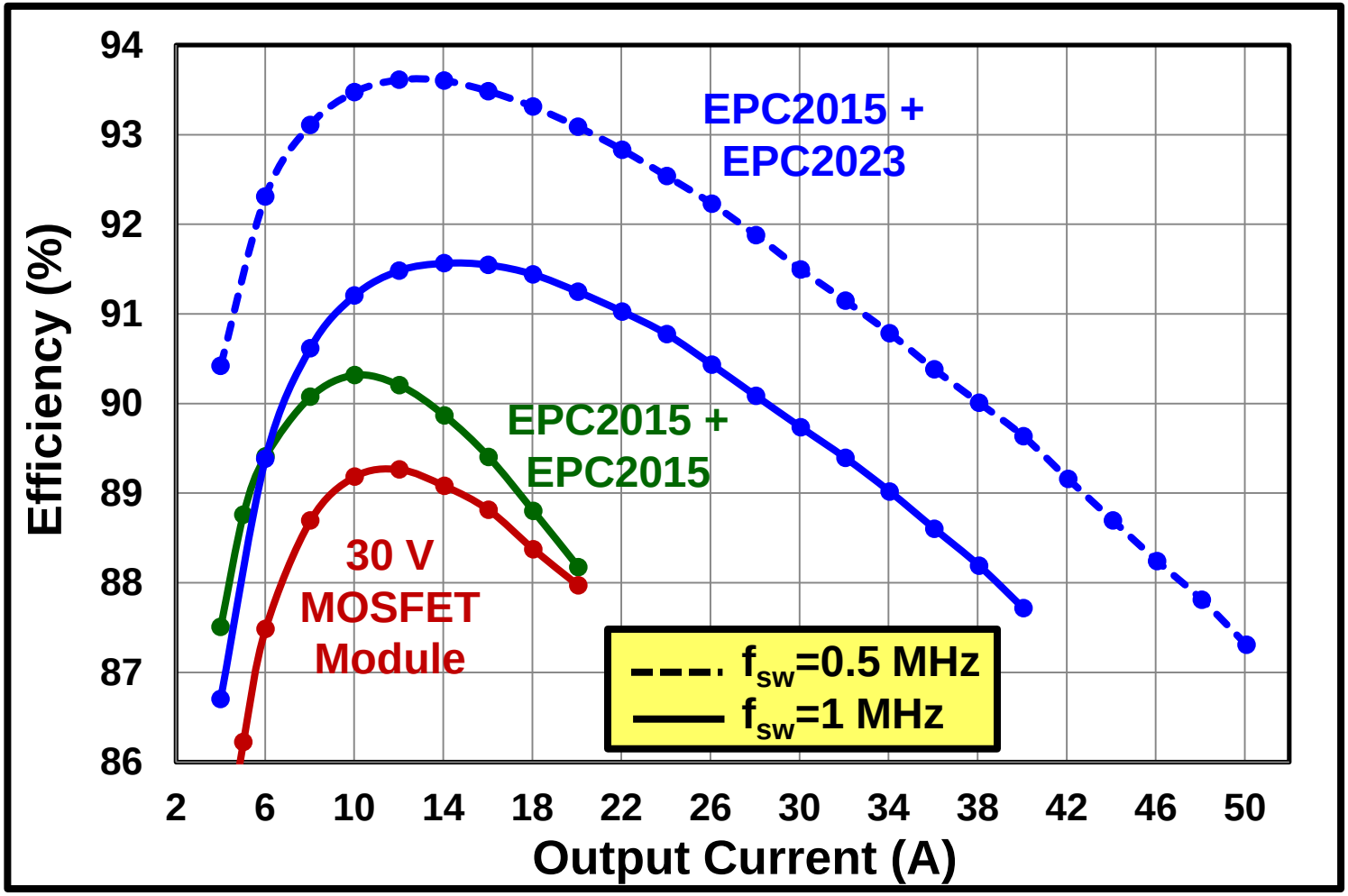

EPC2023: Gate Charge
I_D = 40A
V_{DS} = 15V
V_G - Gate Voltage (V)
Q_G - Gate Charge (nC)
0
1
2
3
4
5
0
5
10
15
20

Hard Switching Buck Converter



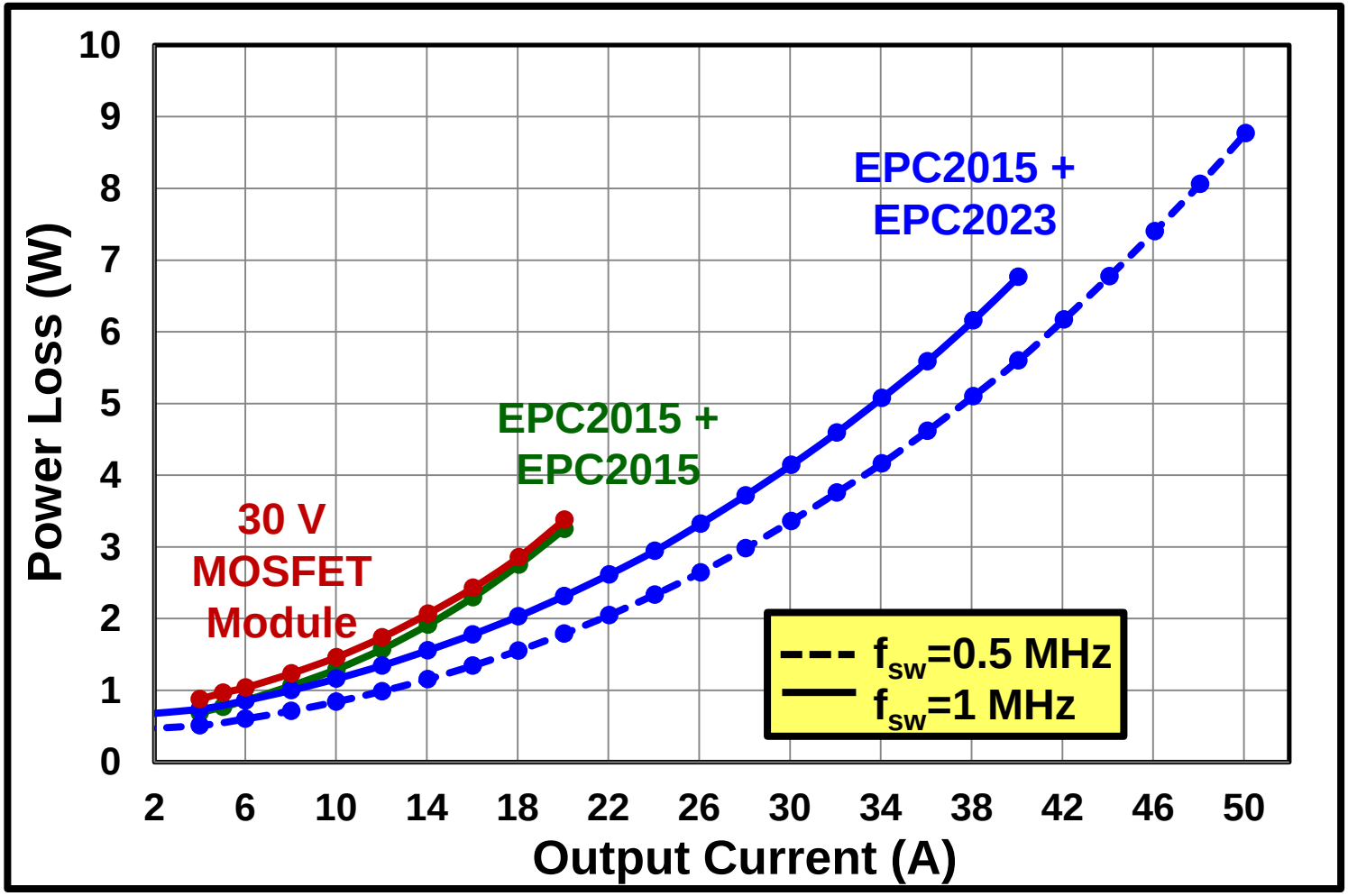
EPC9018, EPC2015 + EPC2023
EPC9019, EPC2001 + EPC2021

Lower Voltage Performance



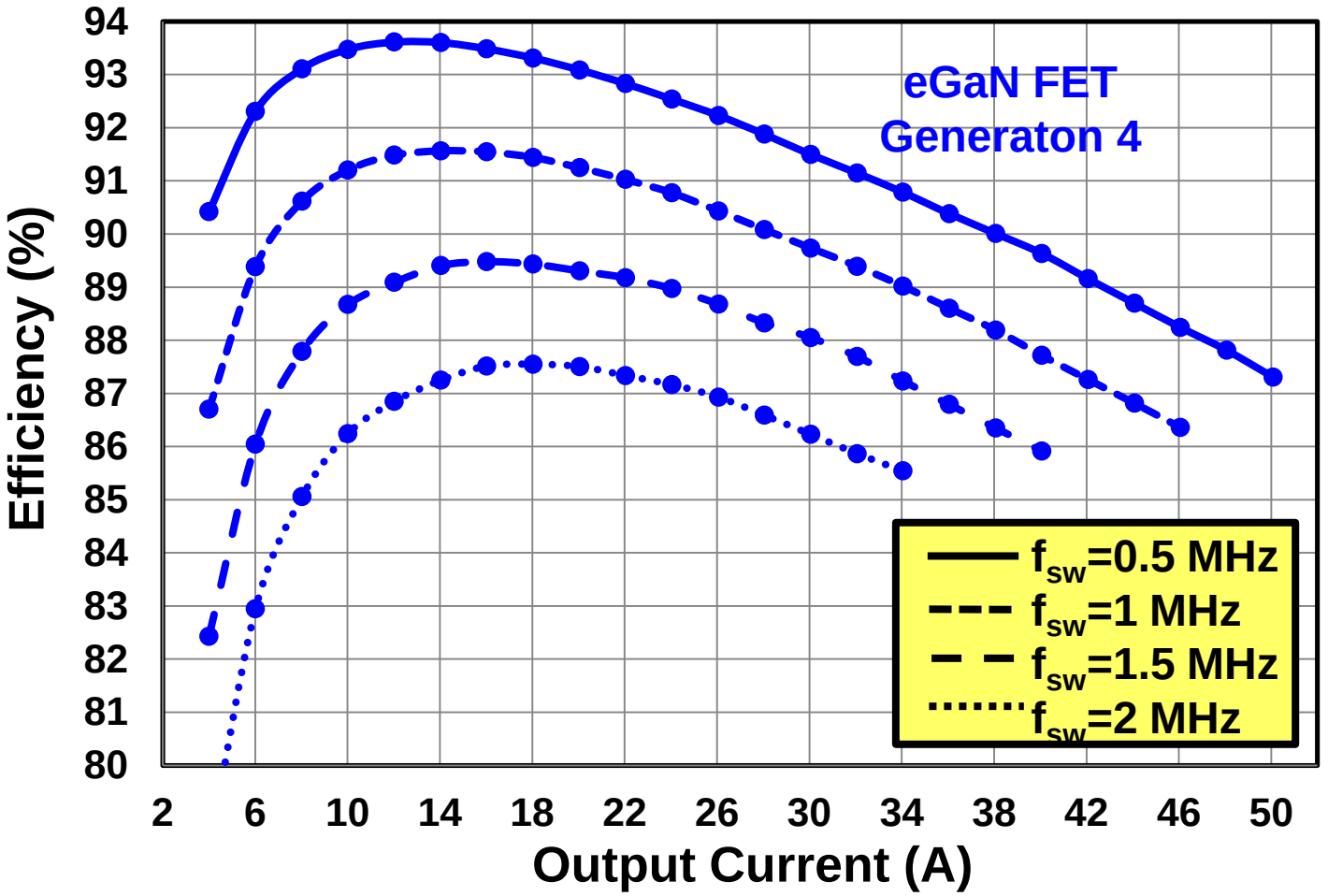
V_{IN}=12 V V_{OUT}=1.2 V

Lower Voltage Performance



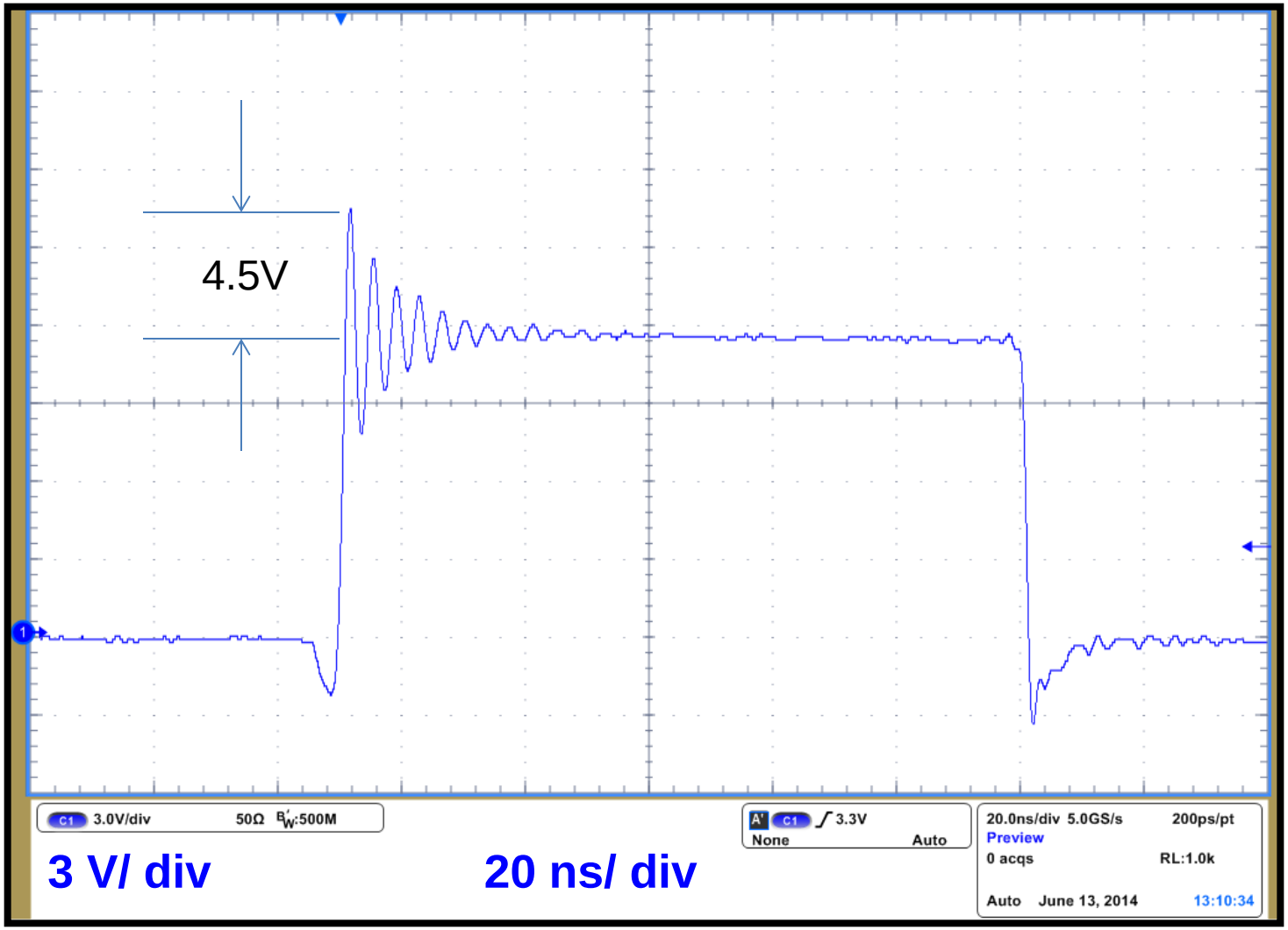
V_{IN}=12 V V_{OUT}=1.2 V

Lower Voltage Performance



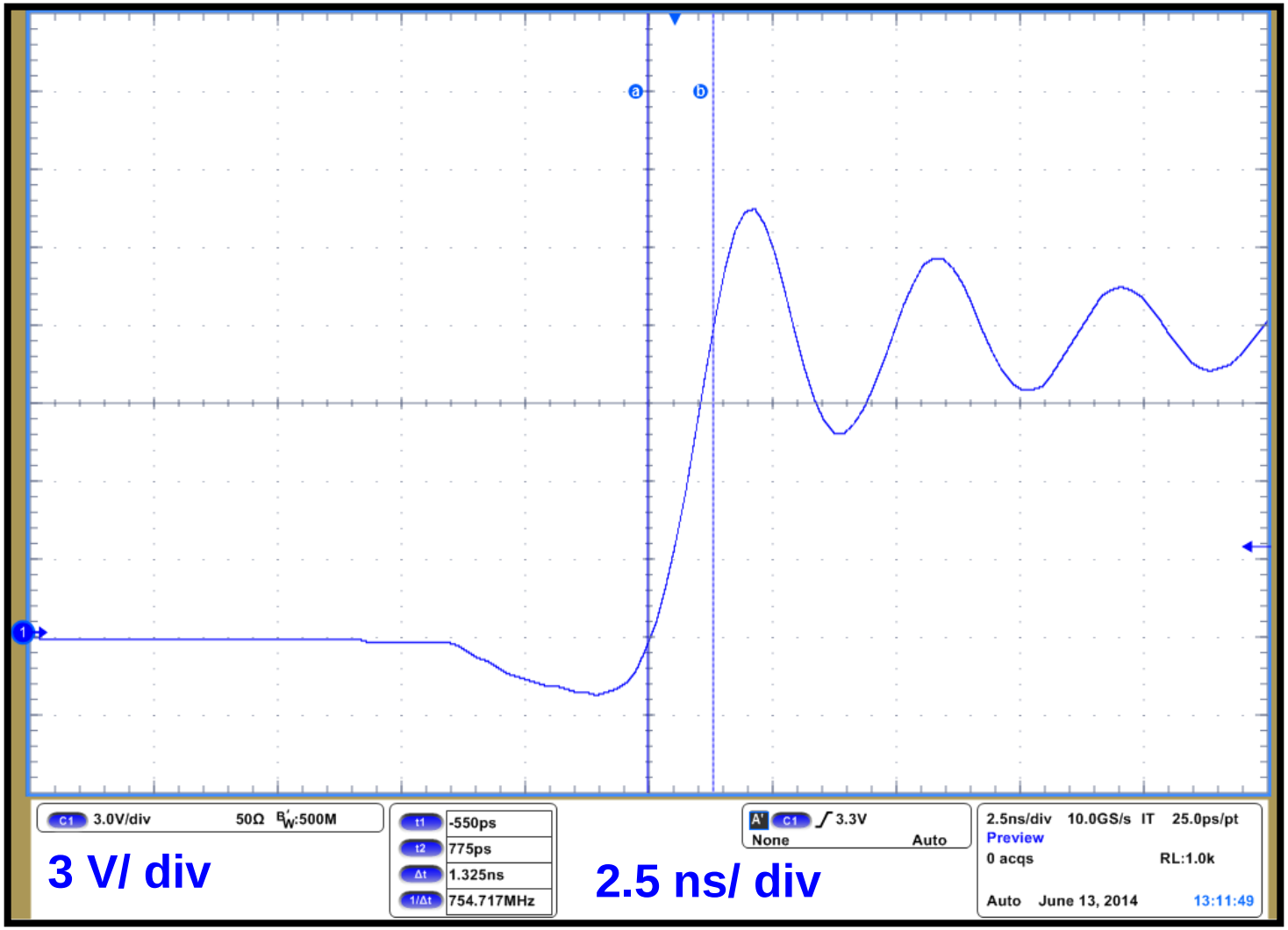
V_{IN}=12 V V_{OUT}=1.2 V

Lower Voltage Performance



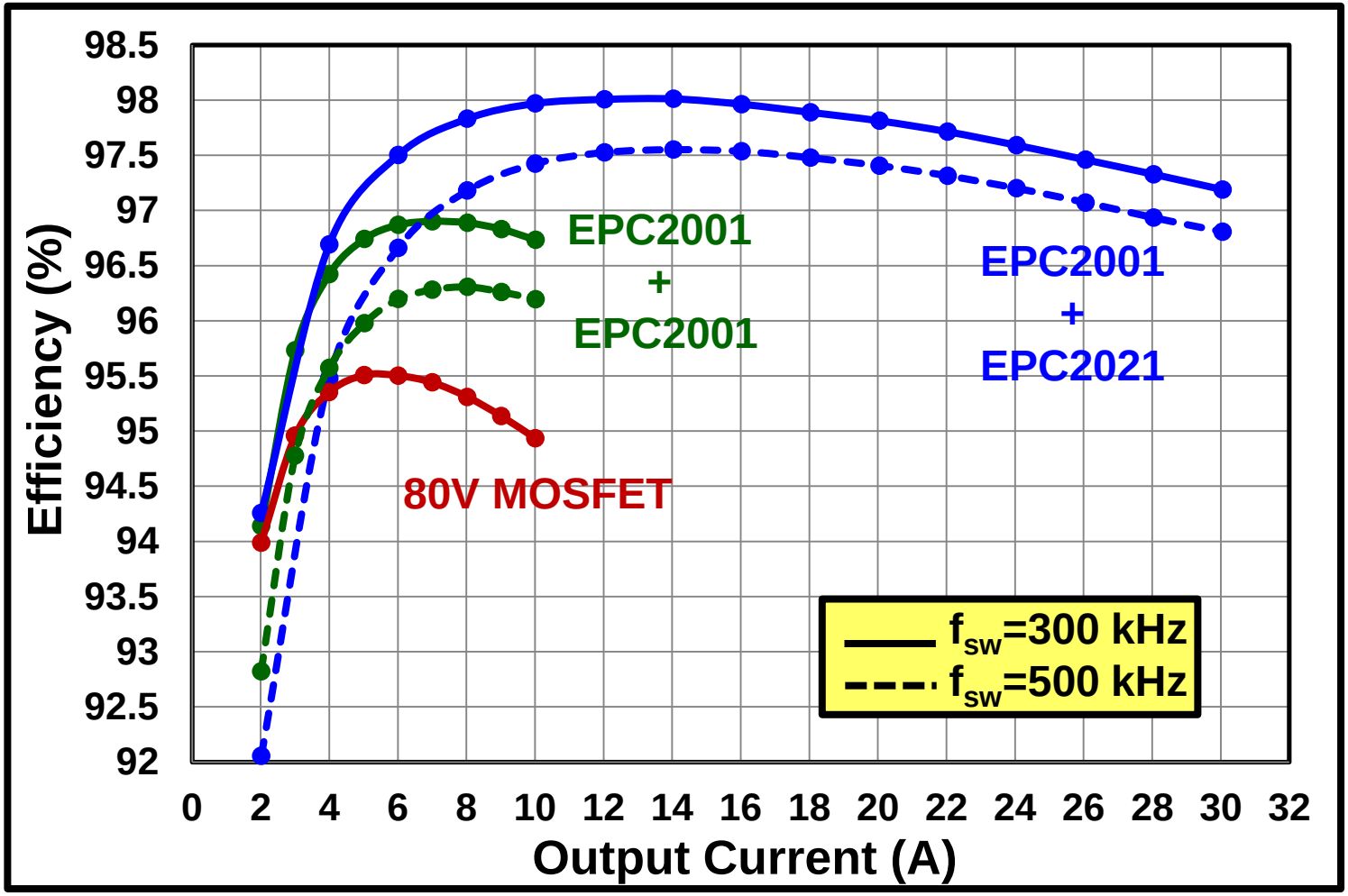
V_{IN}=12 V, V_{OUT}=1.2 V, f_{sw}=1MHz, I_{OUT}=40 A

Lower Voltage Performance



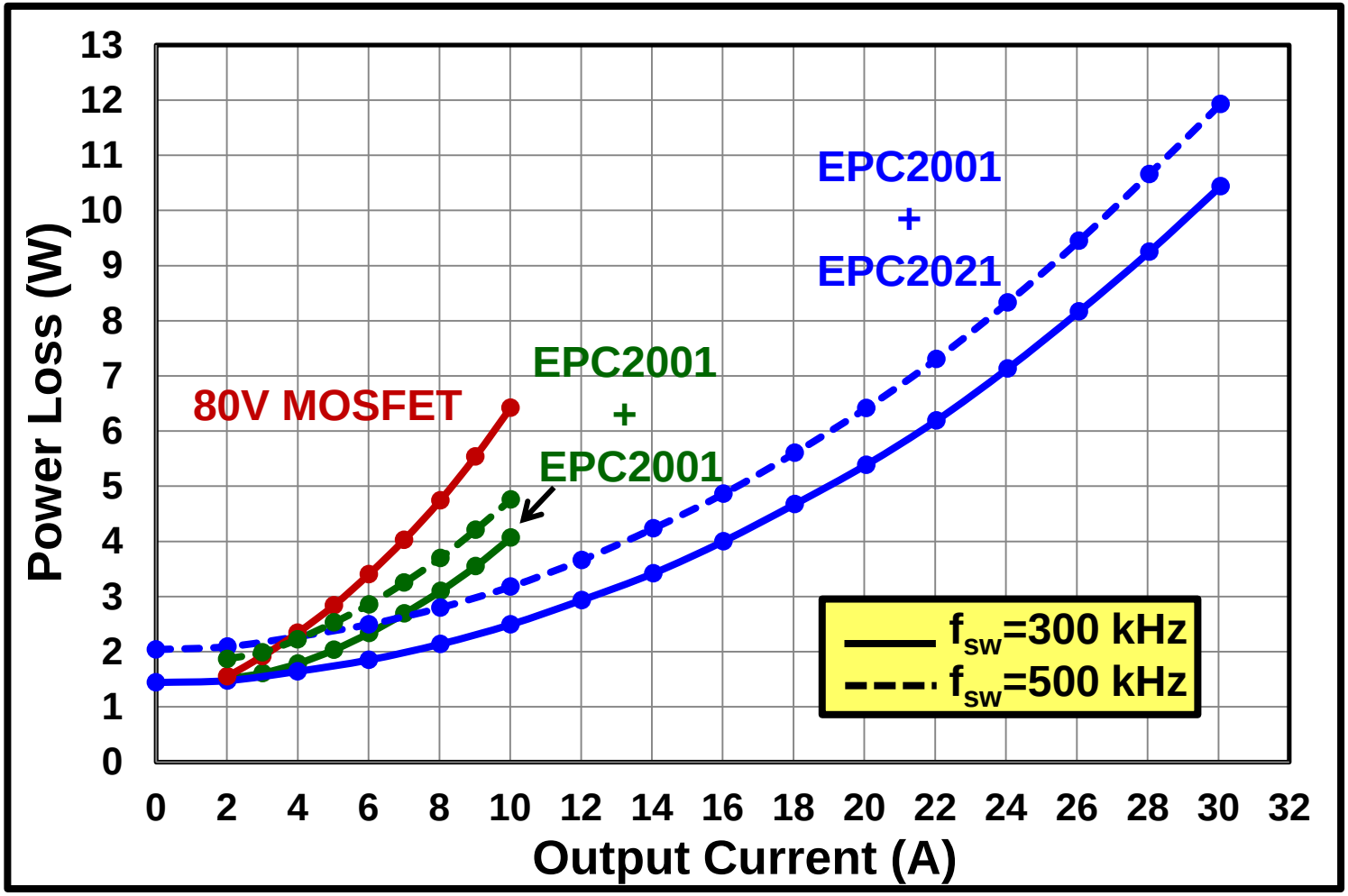
V_{IN}=12 V, V_{OUT}=1.2 V, f_{sw}=1 MHz, **I_{OUT}=40 A**

Higher Voltage Performance



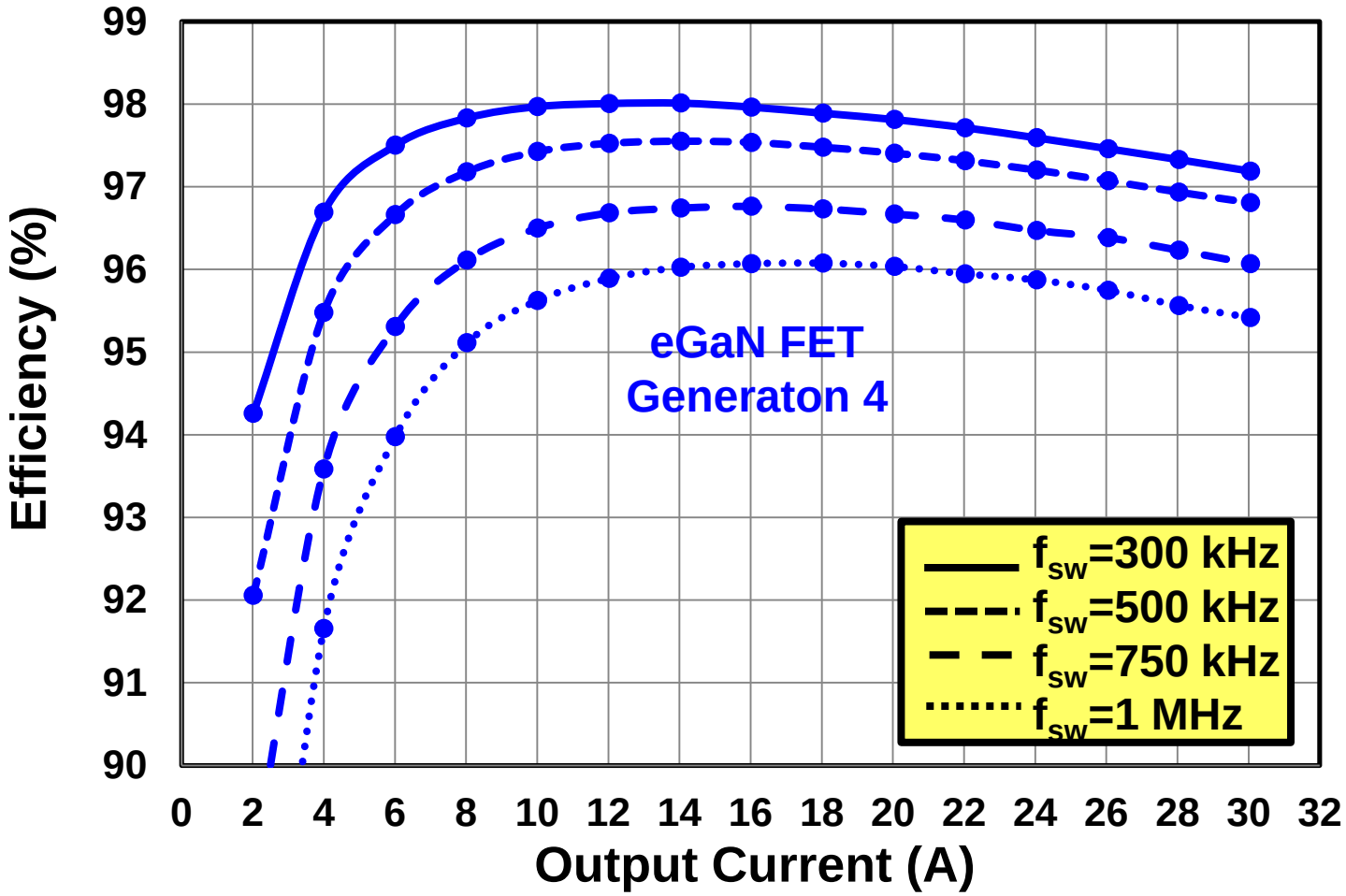
V_{IN}=48 V V_{OUT}=12 V

Higher Voltage Performance



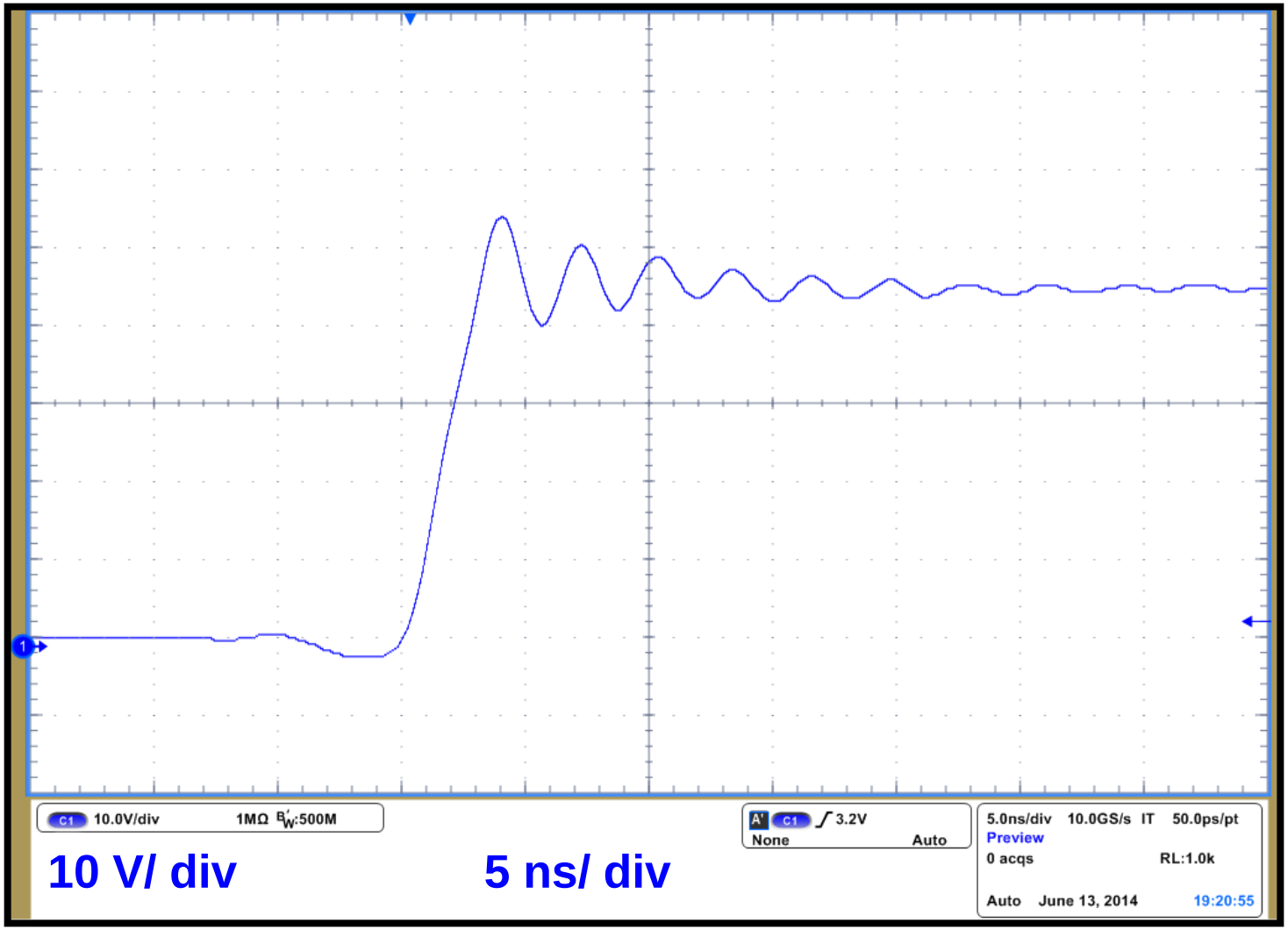
V_{IN}=48 V V_{OUT}=12 V

Higher Voltage Performance



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

Higher Voltage Performance



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

Summary

- A new generation of eGaN FETs is now available.
- They offer up to 2X lower on-resistance and 2X superior switching performance in hard-switched applications.
- Hard-switched POLs can about double the benefit in efficiency when comparing eGaN FETs and silicon MOSFETs.

Development Boards

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	