



1200V Gen2 *e*SiC MOSFET Selection Guide 2024

Advanced Faster Semiconductor's Silicon Carbide Technology

1200V / 40mΩ *e*SiC MOSFET

Key Parameter Comparison



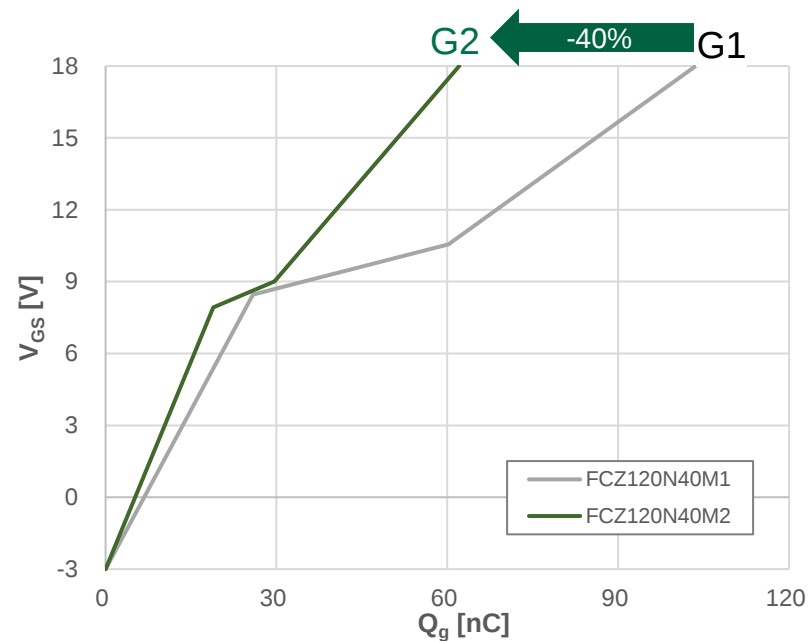
FASTER
SEMICONDUCTOR

Datasheet	FASTER G1	FASTER G2
	FCZ120N40M1	FCZ120N40M2
BV_{DSS} [V]	1200	1200
I_D [A]	60	57
Max V_{GS} [V]	-10 / 22 (DC)	-10 / 22 (DC)
I_{GSS} [nA]_Max.	±100 (-10V / 22V)	±100 (-10V / 22V)
Recommended v_{GS} [V]	-5 / 18	-5...-3 / 18
$R_{DS(on)}$ [mΩ] (typ) / (max)	40 / 56	40 / 56
V_{TH} [V]	2.0 / 3.0 / 4.5	2.0 / 3.0 / 4.5
Q_G [nC] (typ)	104	62
Int. R_G [Ω]	3.5	3.0

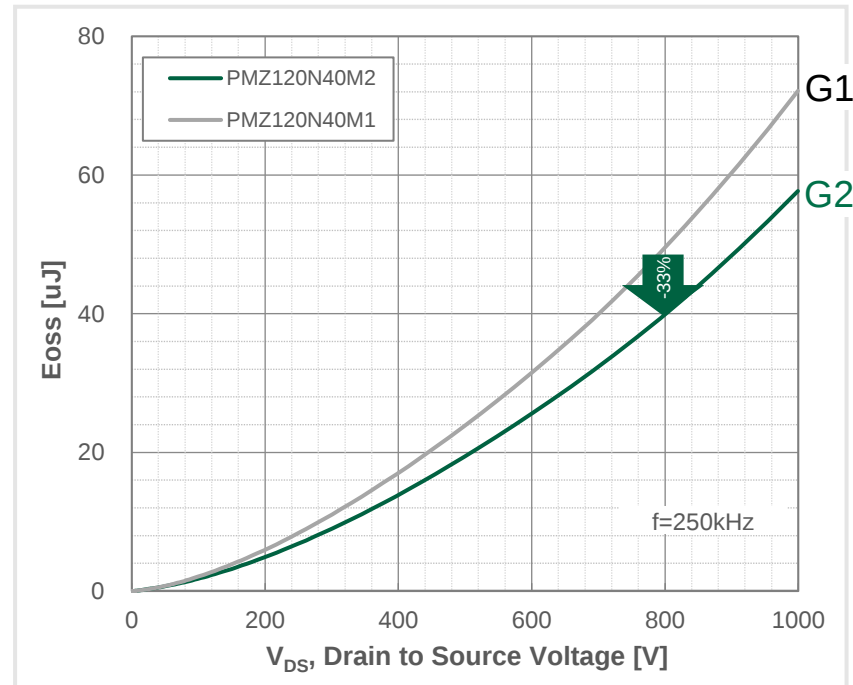
Gate Charge(Q_G), E_{OSS} & Q_{OSS} : G1 vs. G2



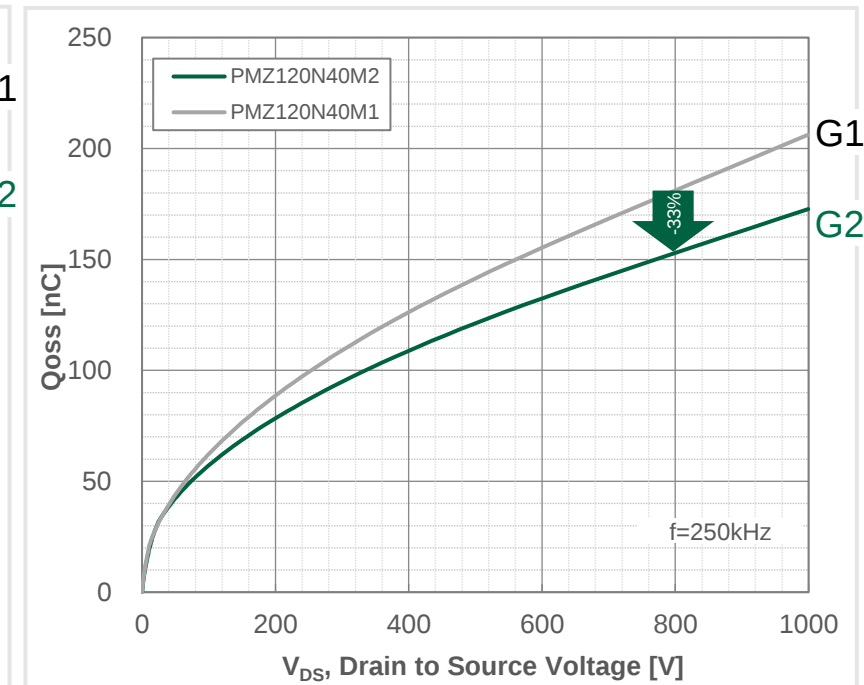
- Gate Charge(Q_G) Comparison



- E_{OSS} Comparison

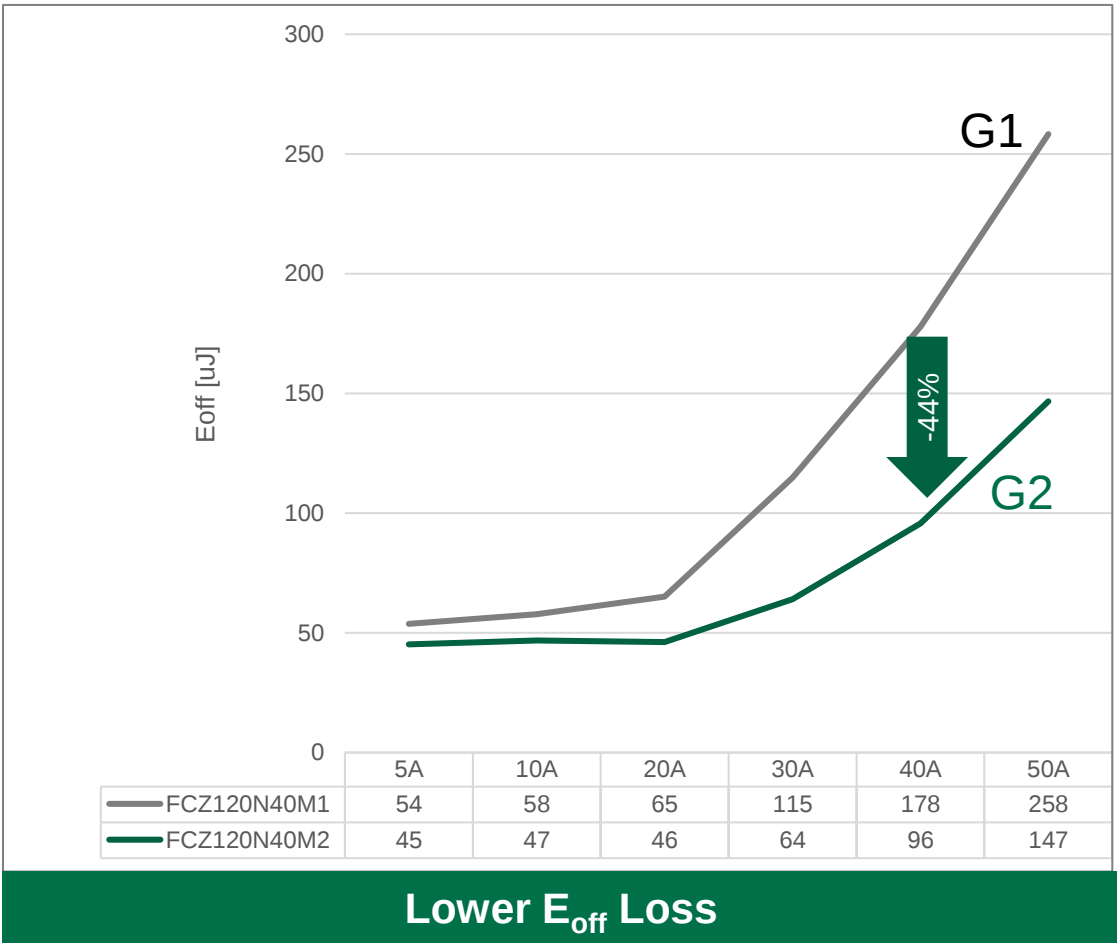
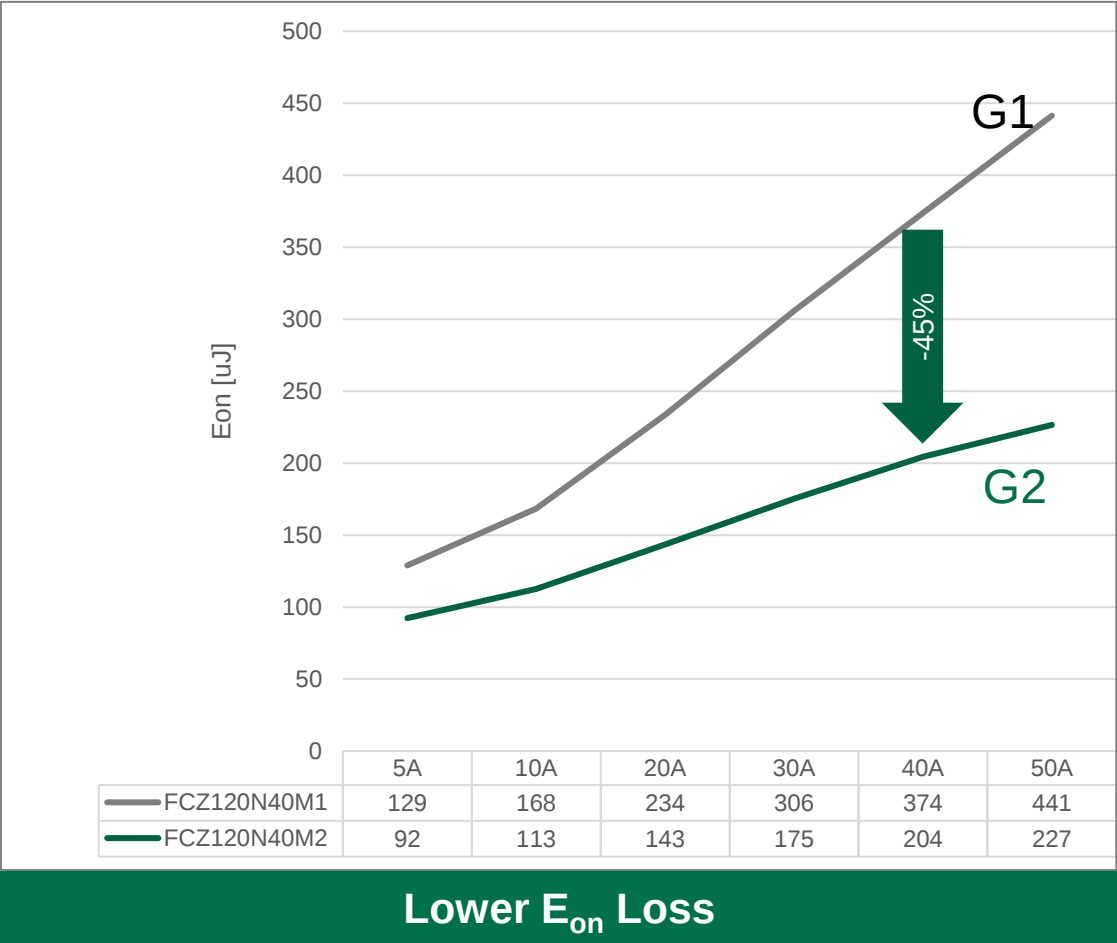


- Q_{OSS} Comparison



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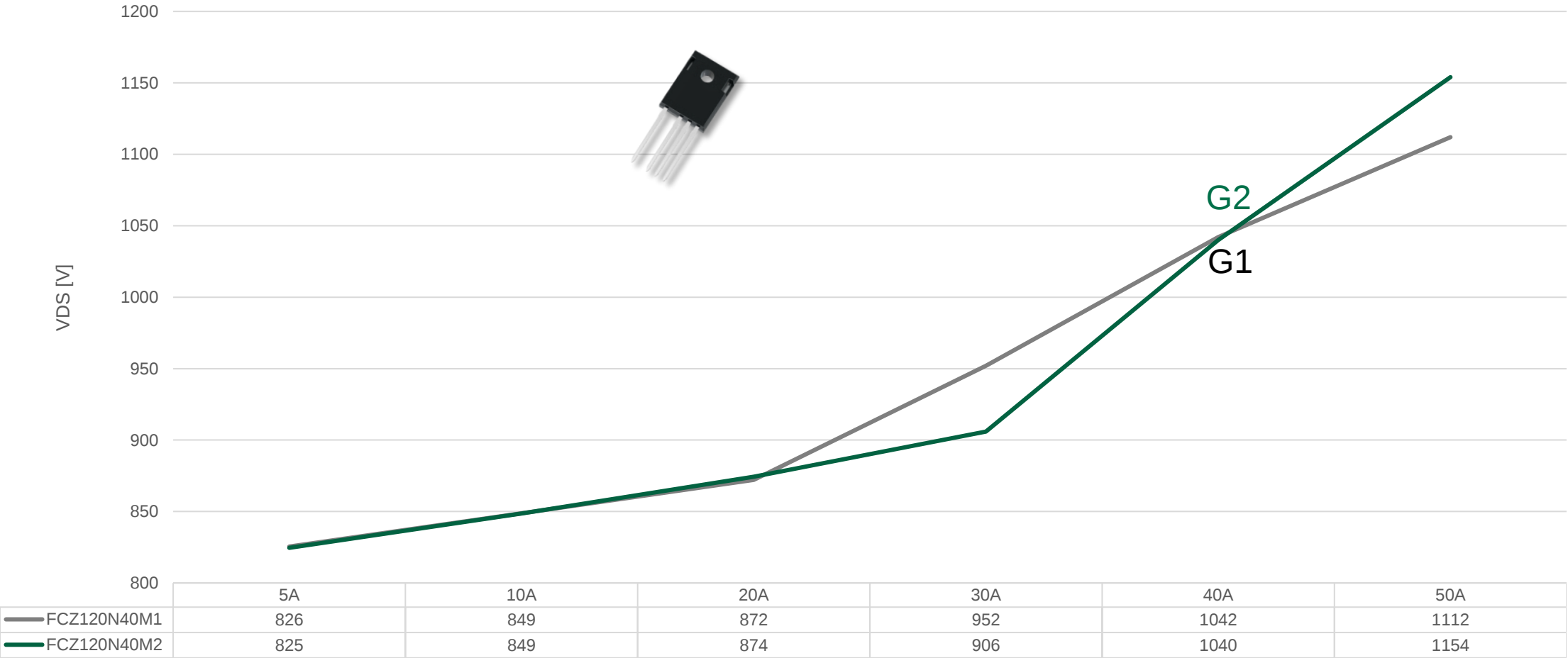
Switching Losses : G1 vs. G2



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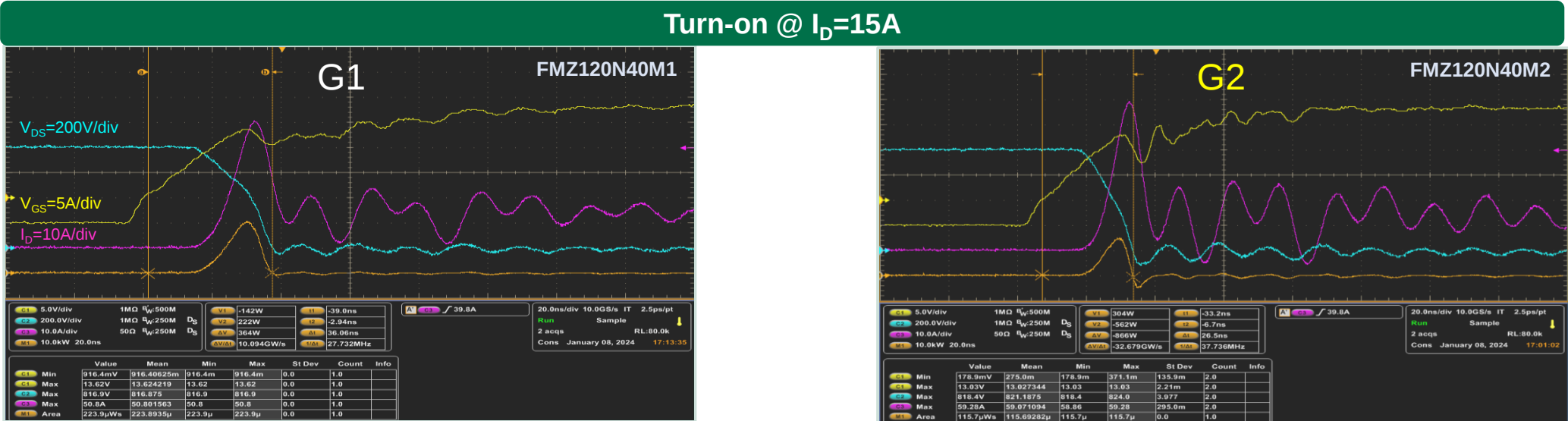
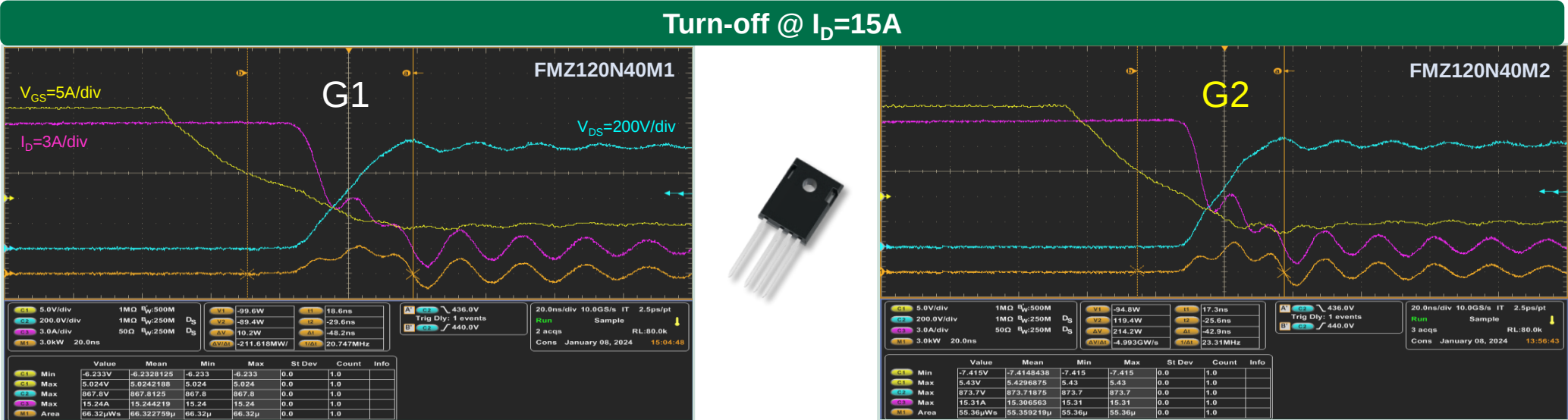
Switching Noise : G1 vs. G2

Similar Voltage (V_{DS}) Spikes !



1200V / 40mΩ *e*SiC MOSFET

Switching Noise : G1 vs. G2



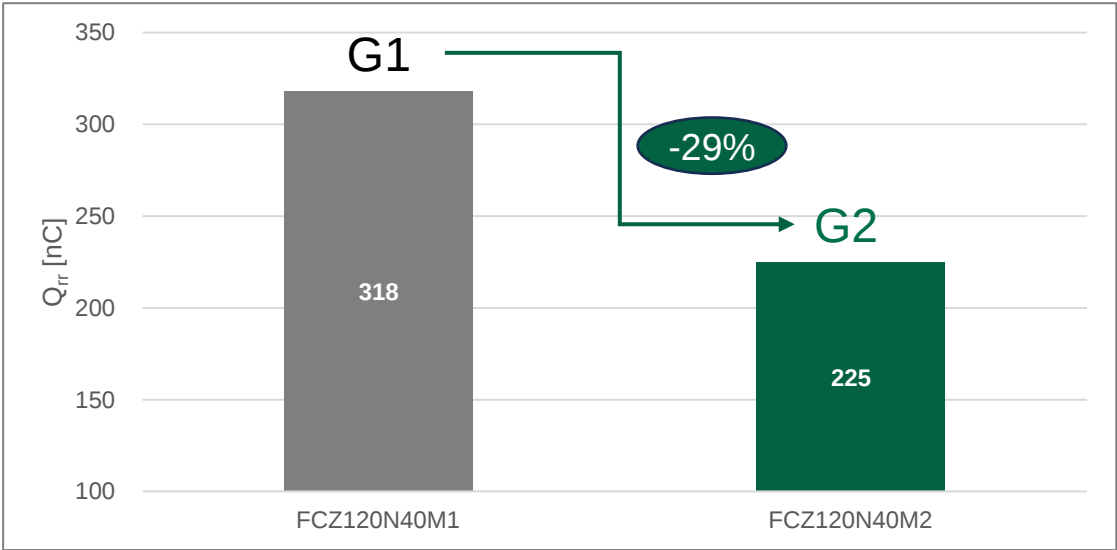
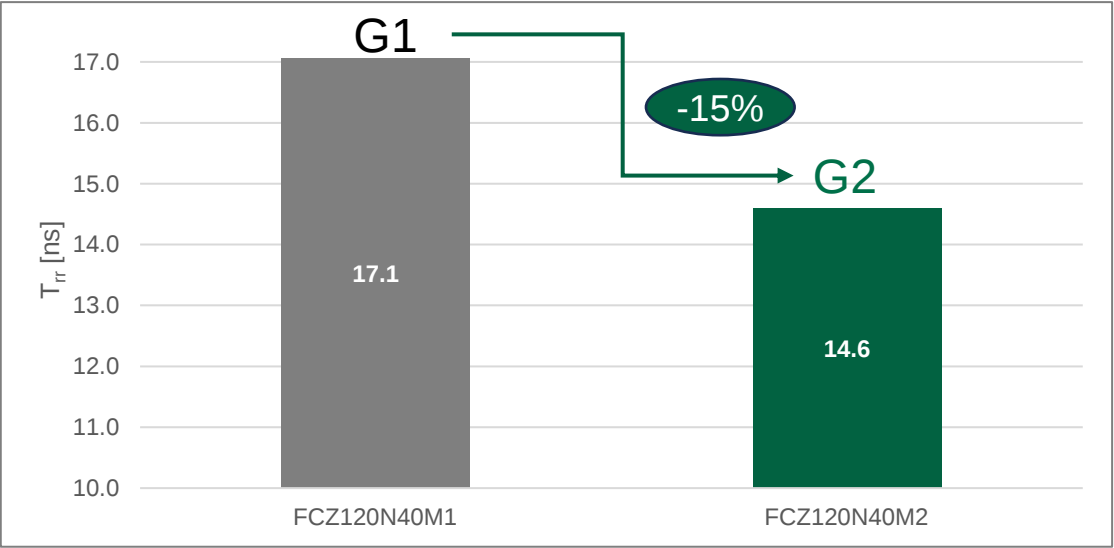
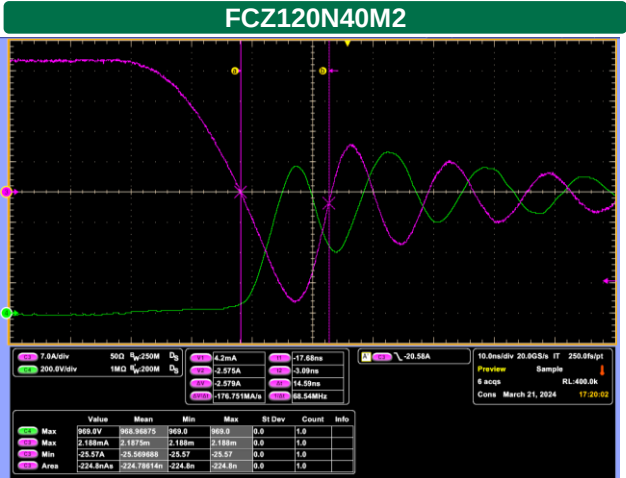
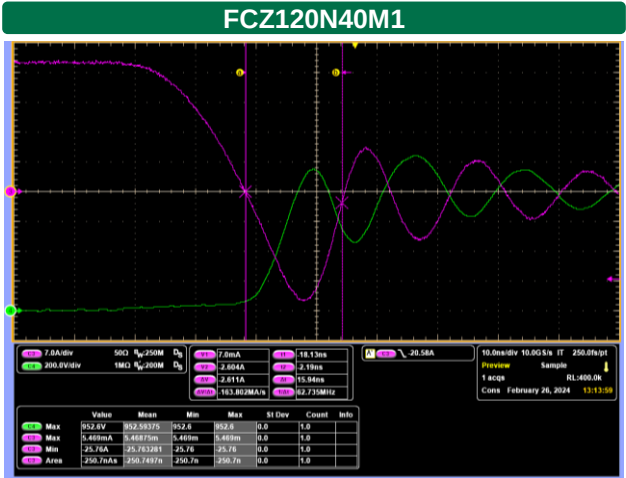
1200V / 40mΩ *e*SiC MOSFET

Body Diode Performance : G1 vs. G2



- Body Diode Performance Comparison

DUTs	T _{rr}	Q _{rr}
	[ns]	[nC]
FCZ120N40M1 (G1)	17.1	318
FCZ120N40M2 (G2)	14.6	225



* $V_{DD}=800V$, $I_{SD}=30A$, $di/dt=3000A/us$, S-DUT=FCZ120N40M1, $V_{GS(S-DUT)}=-5V/+18V$

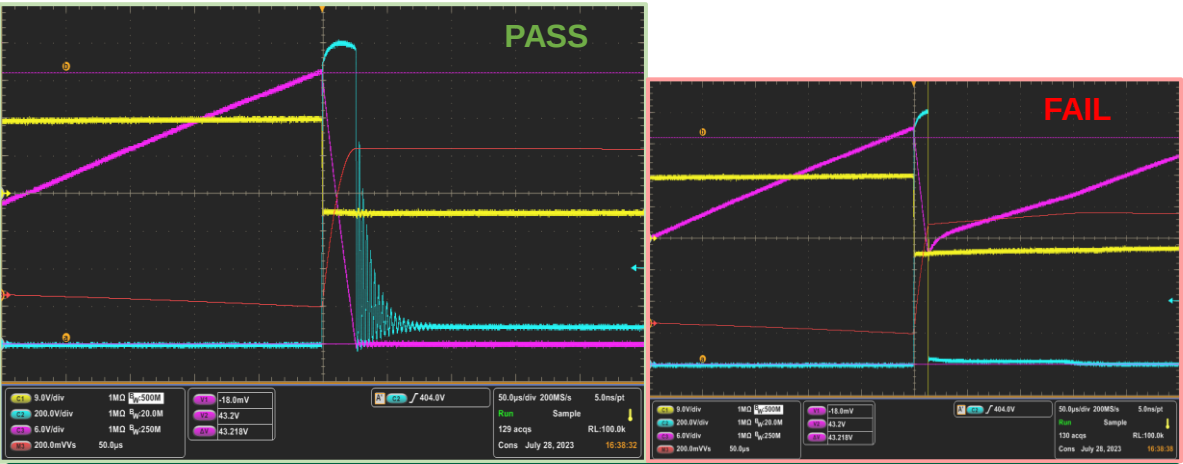
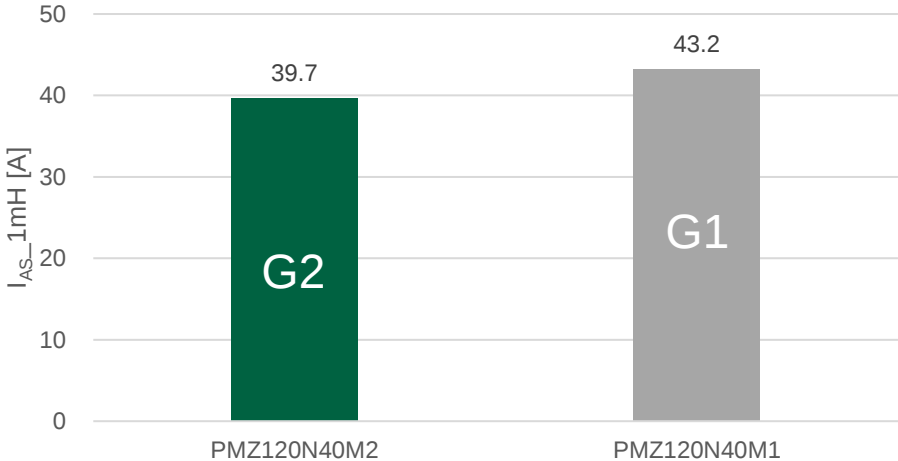
1200V / 40mΩ *e*SiC MOSFET

Avalanche Capability : G1 vs. G2

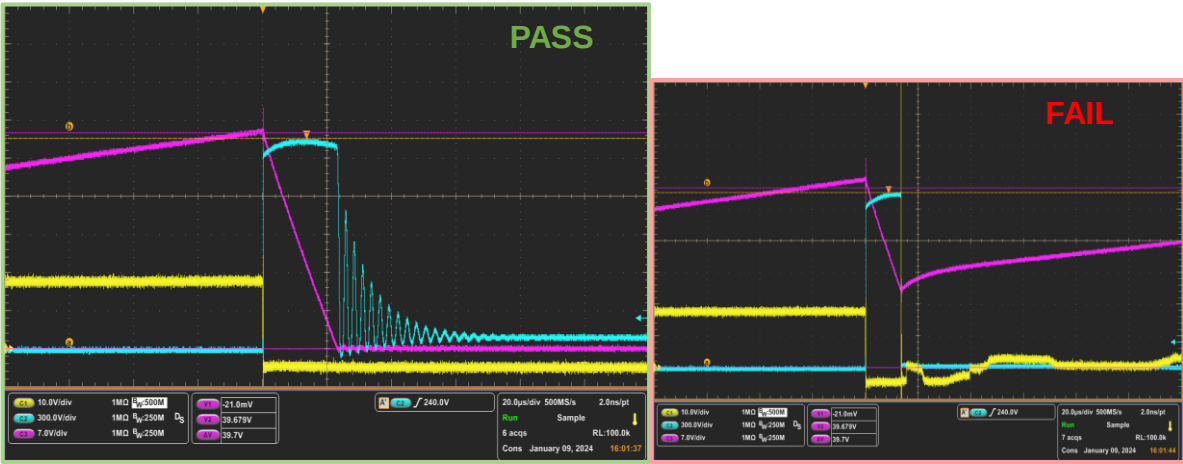


- Avalanche Current Comparison

DUTs	I _{AS} [A]
	PASS
FCZ120N40M1 (G1)	43.2
FCZ120N40M2 (G2)	39.7



FCZ120N40M1



FCZ120N40M2

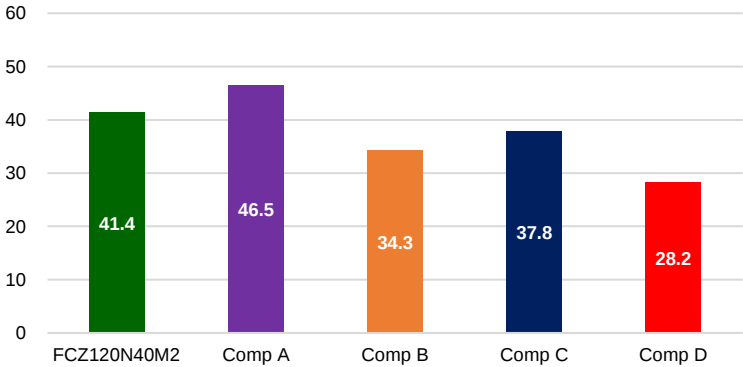
** V_{DD}=100V, L=1mH, V_{GS}=-3V/+18V, R_G=25Ω

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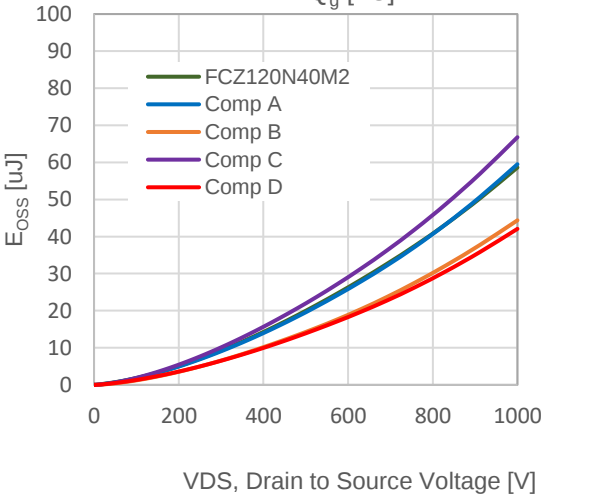
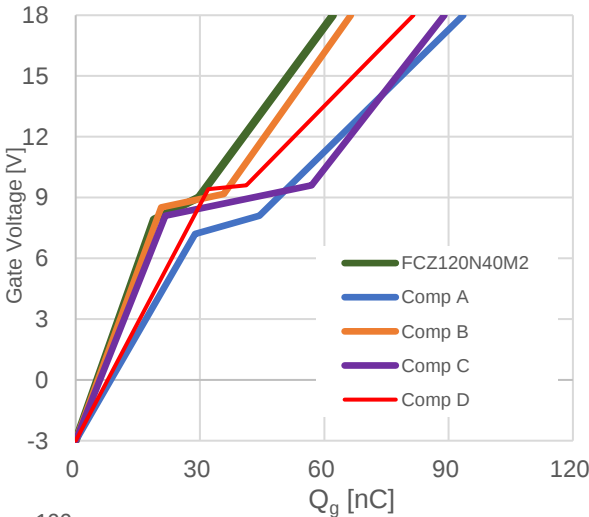
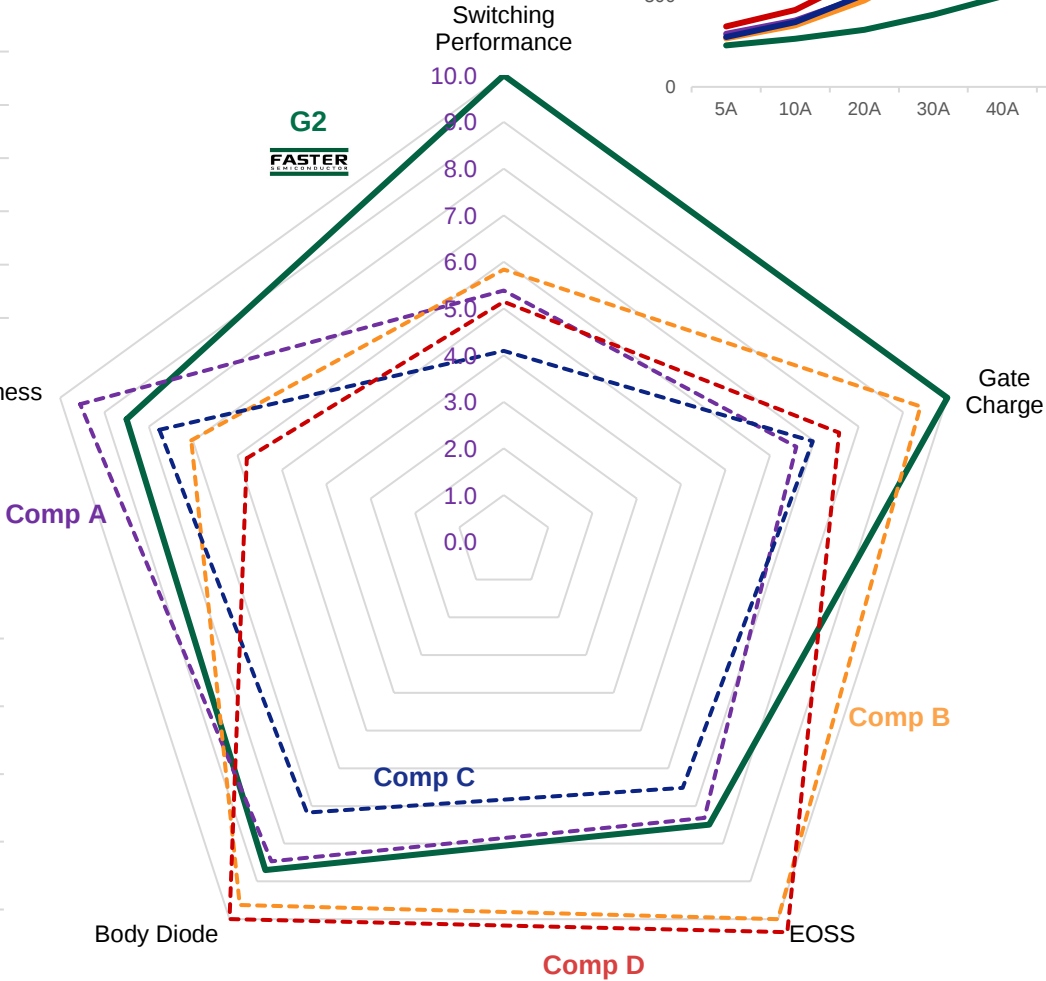
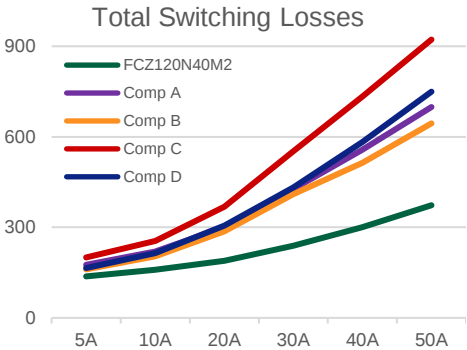
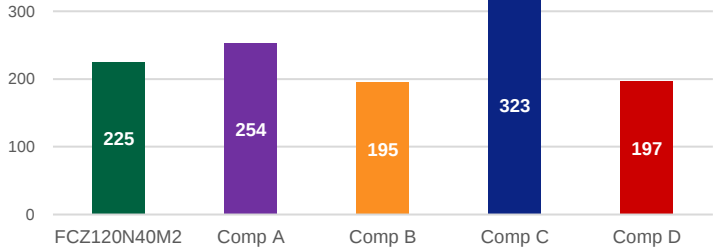
Key Parameter Comparison



Avalanche Current, I_{AS} [A]



Reverse Recovery Charge, Q_{rr} [nC]

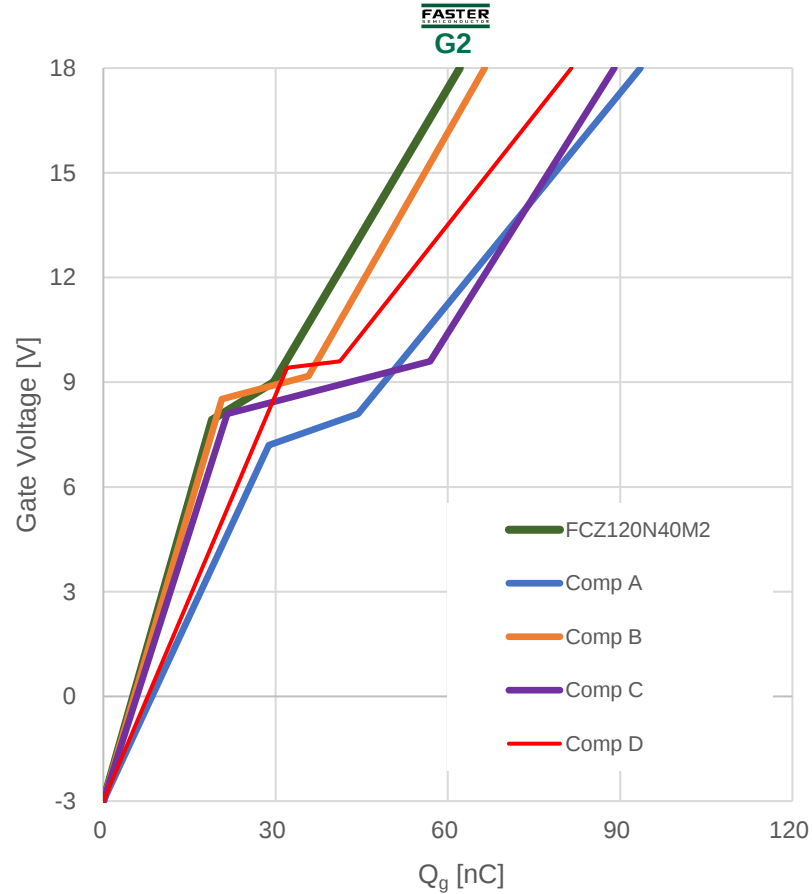


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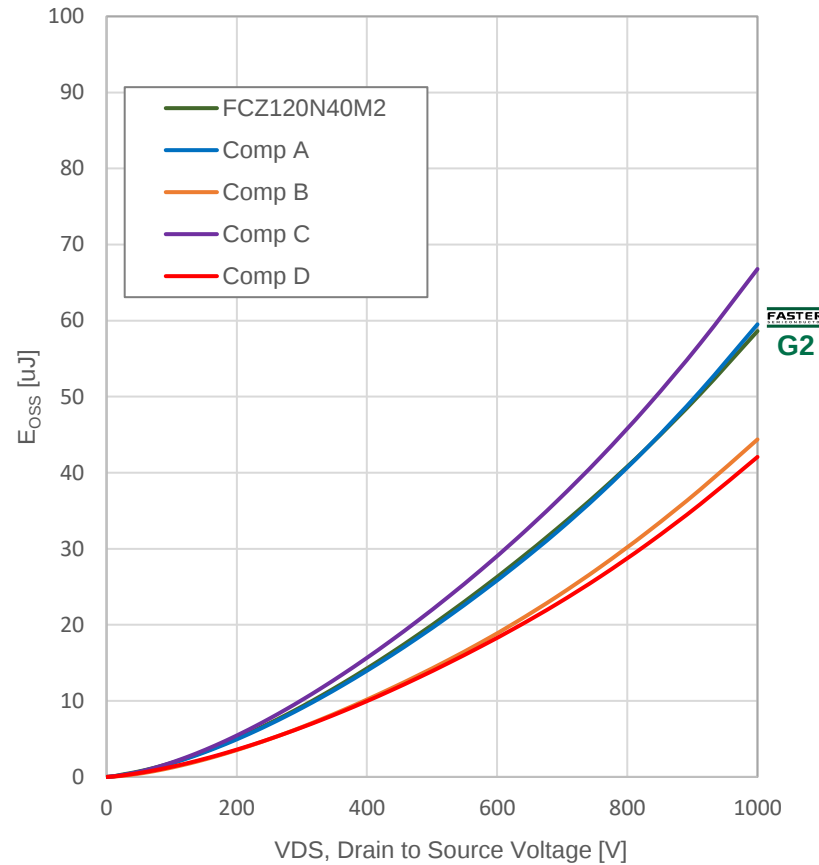
Gate Charge(Q_G), E_{OSS} & Q_{OSS}



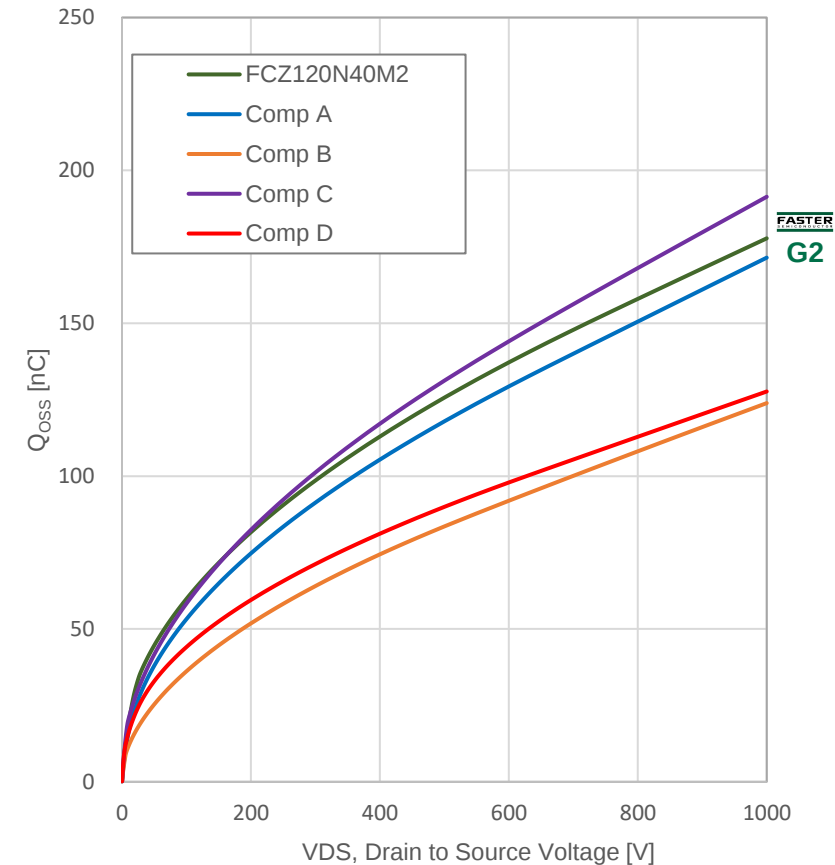
- Gate Charge(Q_G) Comparison



- E_{OSS} Comparison



- Q_{OSS} Comparison

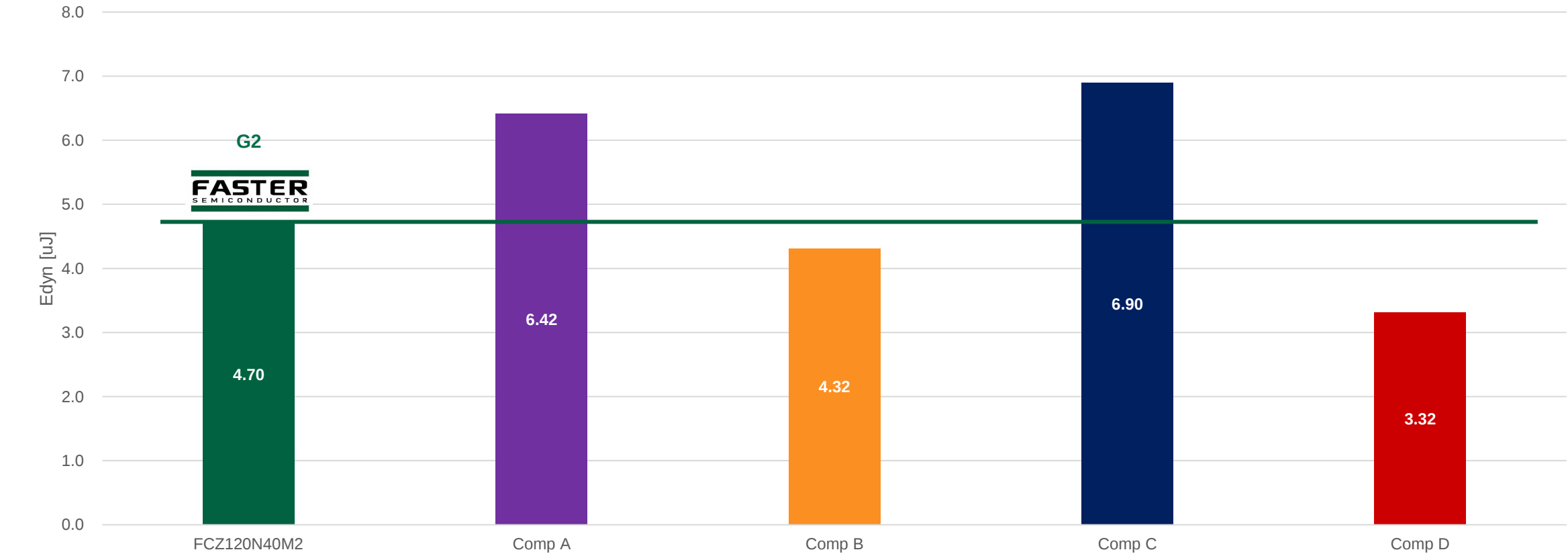


1200V / 40mΩ *e*SiC MOSFET

Hysteresis Loss in Output Capacitance



Dynamic Capacitive Loss



DUTs	FCZ120N40M2	Comp A	Comp B	Comp C	Comp D
E_{dyn} [uJ] @ 800V	4.70	6.42	4.32	6.9	3.32

1200V / 40mΩ *e*SiC MOSFET Performance Benchmark



• AC Parameter’s Comparison Table under Same test condition

	Best					Worst
	FCZ120N40M2	Comp B	Comp D	Comp C	Comp A	
Q _g [nC]	62	66	82	89	94	
E _{dyn} [uJ]	Comp D 3.32	Comp B 4.32	FCZ120N40M2 4.70	Comp A 6.42	Comp C 6.90	
E _{oss} [uJ]	Comp D 29	Comp B 30	FCZ120N40M2 40	Comp A 41	Comp C 46	
Q _{oss} [nC]	Comp B 108	Comp D 113	FCZ120N40M2 150	Comp A 151	Comp C 168	
T _{rr} [ns]	Comp D 12.7	Comp B 13.2	FCZ120N40M2 14.6	Comp A 15.0	Comp C 17.7	

1200V / 40mΩ *e*SiC MOSFET

Switching Performance Benchmark



- Switching Performance Comparison @ Same test condition

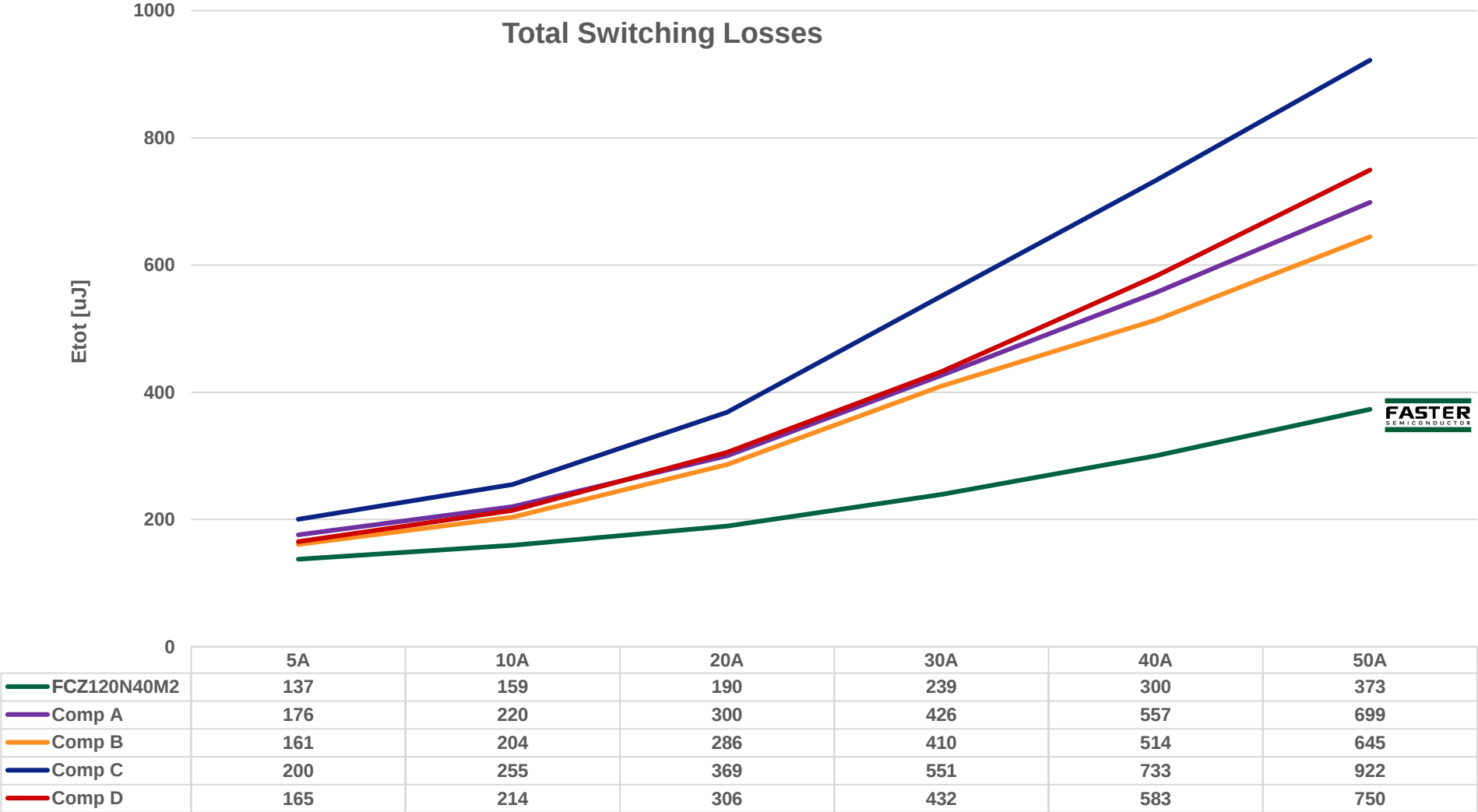
I _D =40A	Best ←————→ Worst				
Turn-on Loss [uJ]	FCZ120N40M2 204	Comp B 348	Comp A 378	Comp C 449	Comp D 489
Turn-off Loss [uJ]	Comp D 94	FCZ120N40M2 96	Comp B 166	Comp A 178	Comp C 284
Total SW Loss [uJ]	FCZ120N40M2 300	Comp B 514	Comp A 557	Comp D 583	Comp C 733
Peak V _{ds} [V]	Comp B 994	Comp C 1035	FCZ120N40M2 1040	Comp A 1040	Comp D 1048

- Ruggedness Comparison Table @ UIS (unclamped inductive switching test)

Best ←————→ Worst					
I _{AS} [A]	Comp A 46.5	FCZ120N40M2 41.4	Comp C 37.8	Comp B 34.3	Comp D 28.2

1200V / 40mΩ *e*SiC MOSFET

FCZ120N40M2 Switching Loss



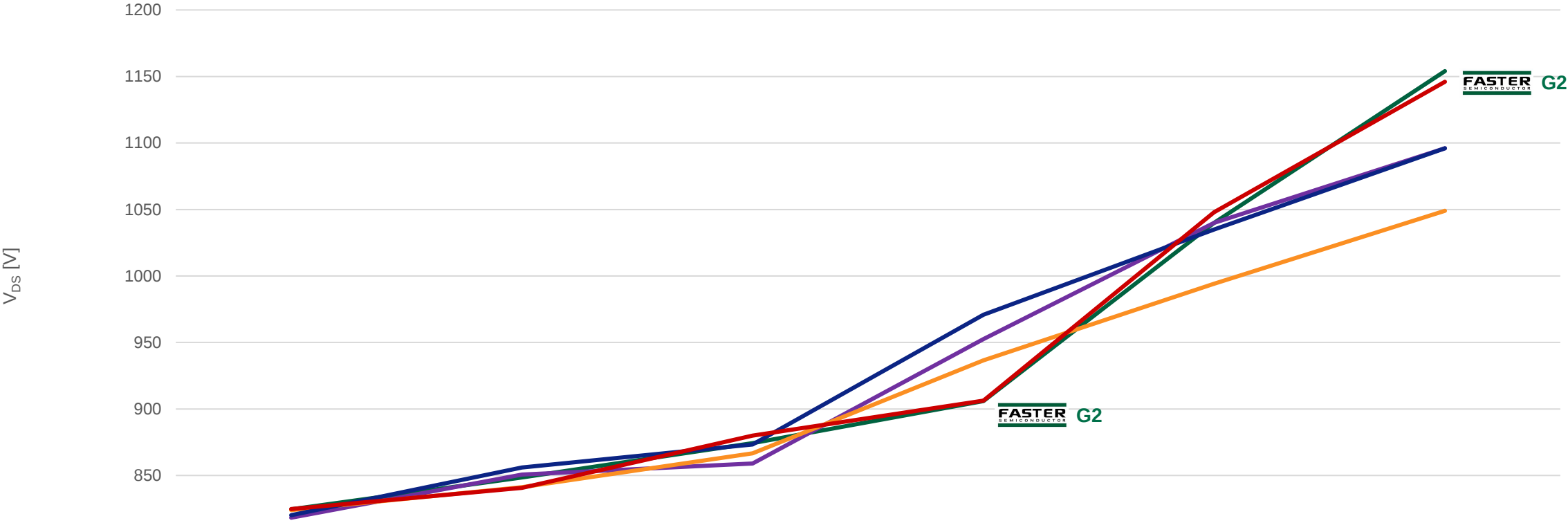
$V_{DD}=800V$, $V_{GS}=-3V/+18V$, Ext Rg=4.7Ω, FWD=PCH120S20D1

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FCZ120N40M2 Switching Noise



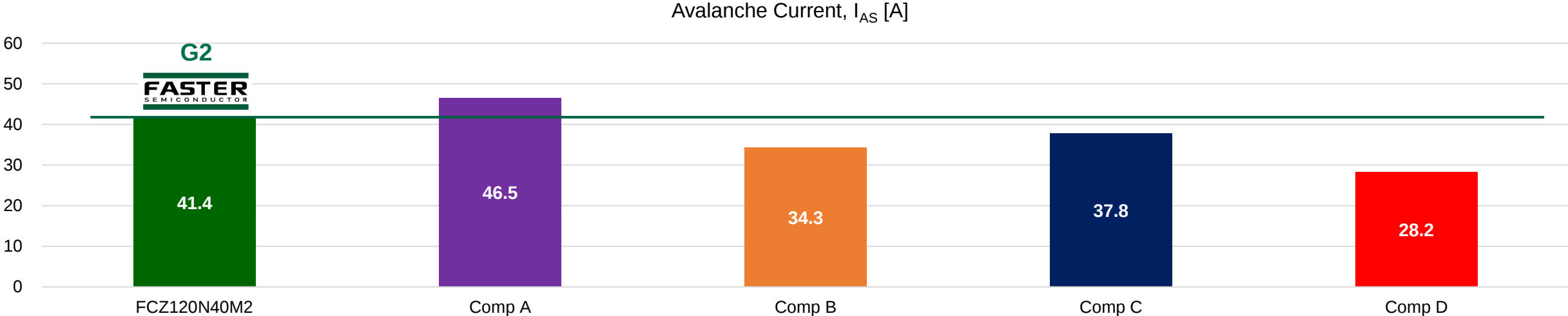
Peak Drain Voltage



	5A	10A	20A	30A	40A	50A
FCZ120N40M2	825	849	874	906	1040	1154
Comp A	818	851	859	953	1040	1096
Comp B	824	841	867	937	994	1049
Comp C	820	856	873	971	1035	1096
Comp D	825	841	880	906	1048	1146

1200V / 40mΩ *e*SiC MOSFET

Avalanche Capability



DUTs	I_{AS} [A]	BV [V]
	PASS	PASS
FCZ120N40M2	41.4	1536
Comp A	46.5	1776
Comp B	34.3	1696
Comp C	37.8	1568
Comp D	28.2	1704

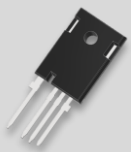
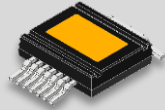
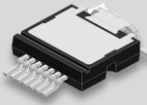
V_{DD} =150V, L =1mH, V_{GS} =-3V/+18V, R_G =25Ω

1200V *e*SiC MOSFET Gen2. Portfolio



Available now
Coming Soon



Package R _{DS(ON)_typ}	Grade	Bare Die	D2PAK-7L	TO-247-3L	TO-247-4L	TO-247-4L Notch	TSPAK-DBC	TSPAK-LF
								
16mΩ	Indus.	FCO120N16M2		FCW120N16M2	FCZ120N16M2	FCZN120N16M2		
	Auto.	FCO120N16M2A			FCZ120N16M2A		FCZN120N16M2A	
21mΩ	Indus.	FCO120N21M2	FCBF120N21M2	FCW120N21M2	FCZ120N21M2	FCZN120N21M2		
	Auto.	FCO20N21M2					FCRZ120N21M2A	FCR120N21M2A
31mΩ	Indus.	FCO120N31M2	FCBF120N31M2	FCW120N31M2	FCZ120N31M2	FCZN120N31M2		
40mΩ	Indus.	FCO120N40M2	FCBF120N40M2	FCW120N40M2	FCZ120N40M2	FCZN120N40M2		
	Auto.	FCO120N40M2A					FCRZ120N40M2A	FCR120N40M2A
60mΩ	Indus.	FCO120N60M2	FCBF120N60M2	FCW120N60M2		FCZN120N60M2		
	Auto.	FCO120N60M2A					FCRZ120N60M2A	FCR120N60M2A
80mΩ	Indus.	FCO120N80M2	FCBF120N80M2	FCW120N80M2	FCZ120N80M2	FCZN120N80M2		

Ordering System (SiC MOSFET)

