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1200V Gen2 *e*SiC MOSFET Selection Guide 2024

Advanced Power Master Semiconductor's Silicon Carbide Technology

1200V / 40mΩ *e*SiC MOSFET

Key Parameter Comparison

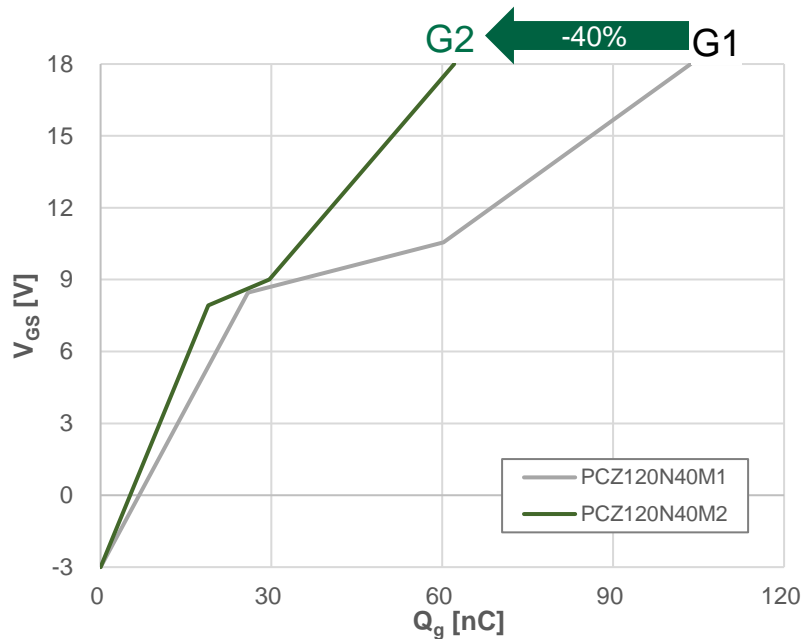


Datasheet	PMS G1	PMS G2
	PCZ120N40M1	PCZ120N40M2
BV_{DSS} [V]	1200	1200
I_D [A]	60	57
Max V_{GS} [V]	-10 / 22 (DC)	-10 / 22 (DC)
I_{GSS} [nA]_Max.	±100 (-10V / 22V)	±100 (-10V / 22V)
Recommended v_{GS} [V]	-5 / 18	-5...-3 / 18
R_{DS(on)} [mΩ] (typ) / (max)	40 / 56	40 / 56
V_{TH} [V]	2.0 / 3.0 / 4.5	2.0 / 3.0 / 4.5
Q_G [nC] (typ)	104	62
Int. R_G [Ω]	3.5	3.0

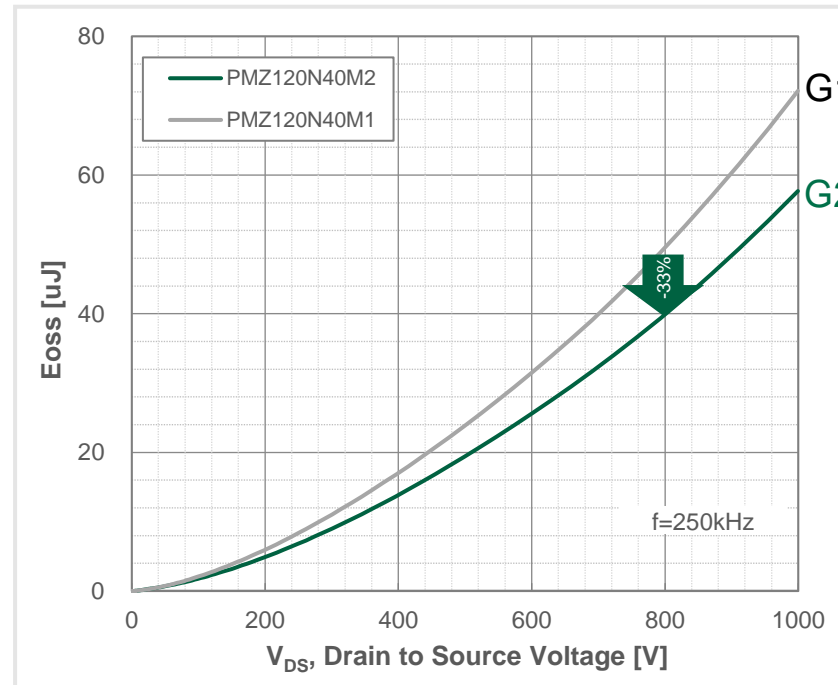
Gate Charge(Q_G), E_{OSS} & Q_{OSS} : G1 vs. G2



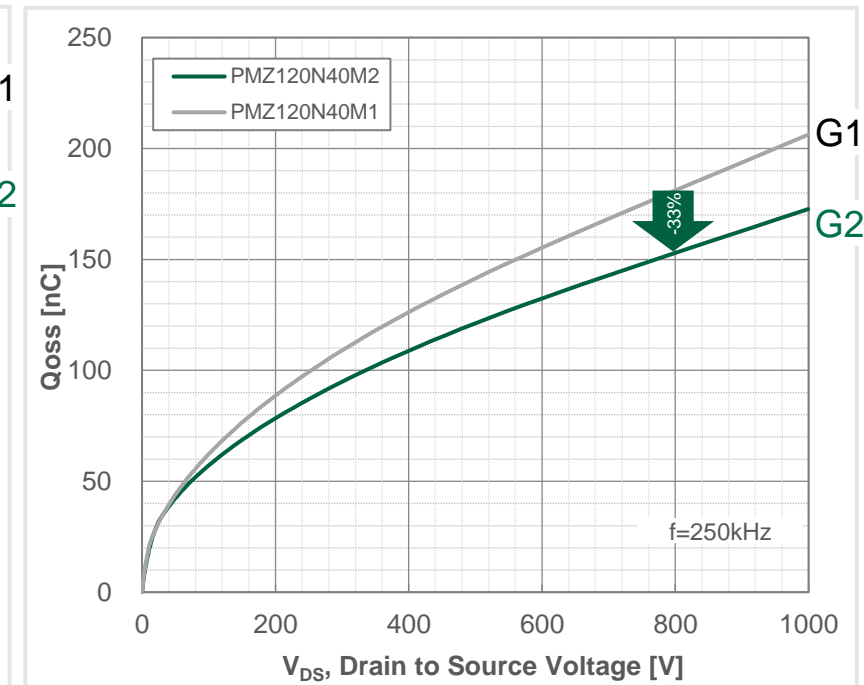
- Gate Charge(Q_G) Comparison



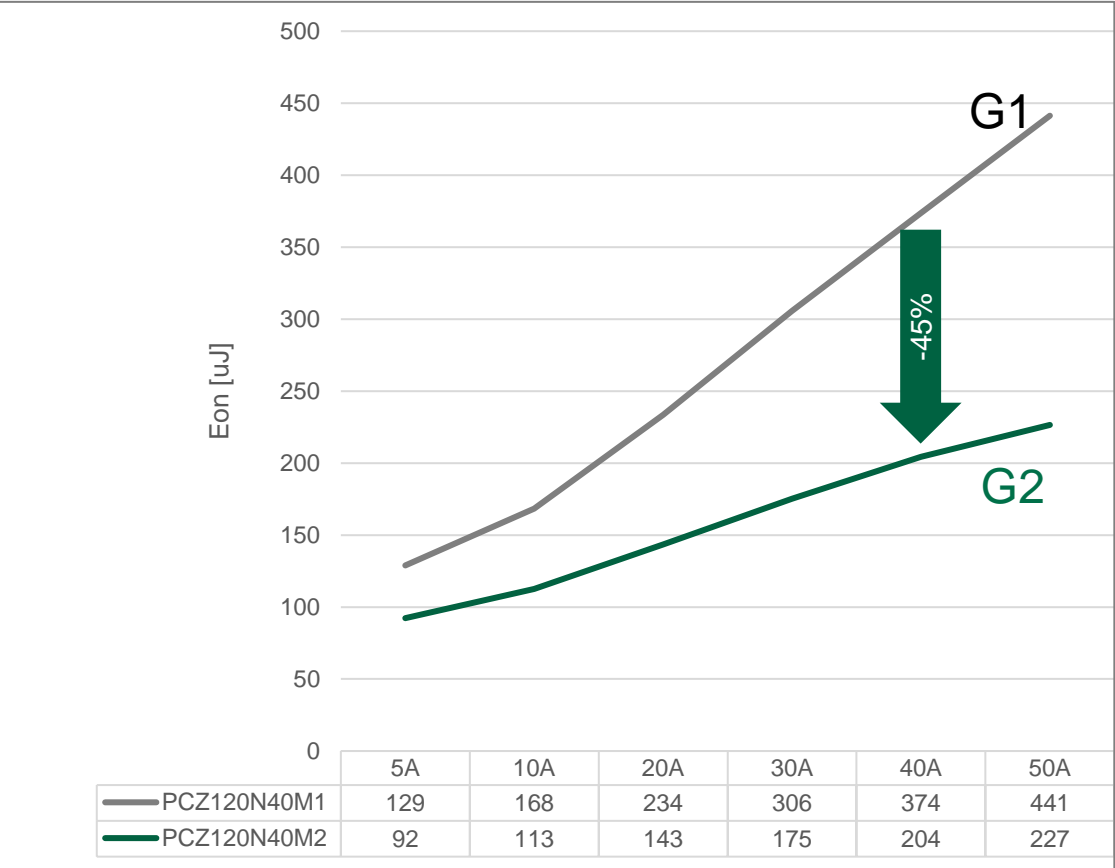
- E_{OSS} Comparison



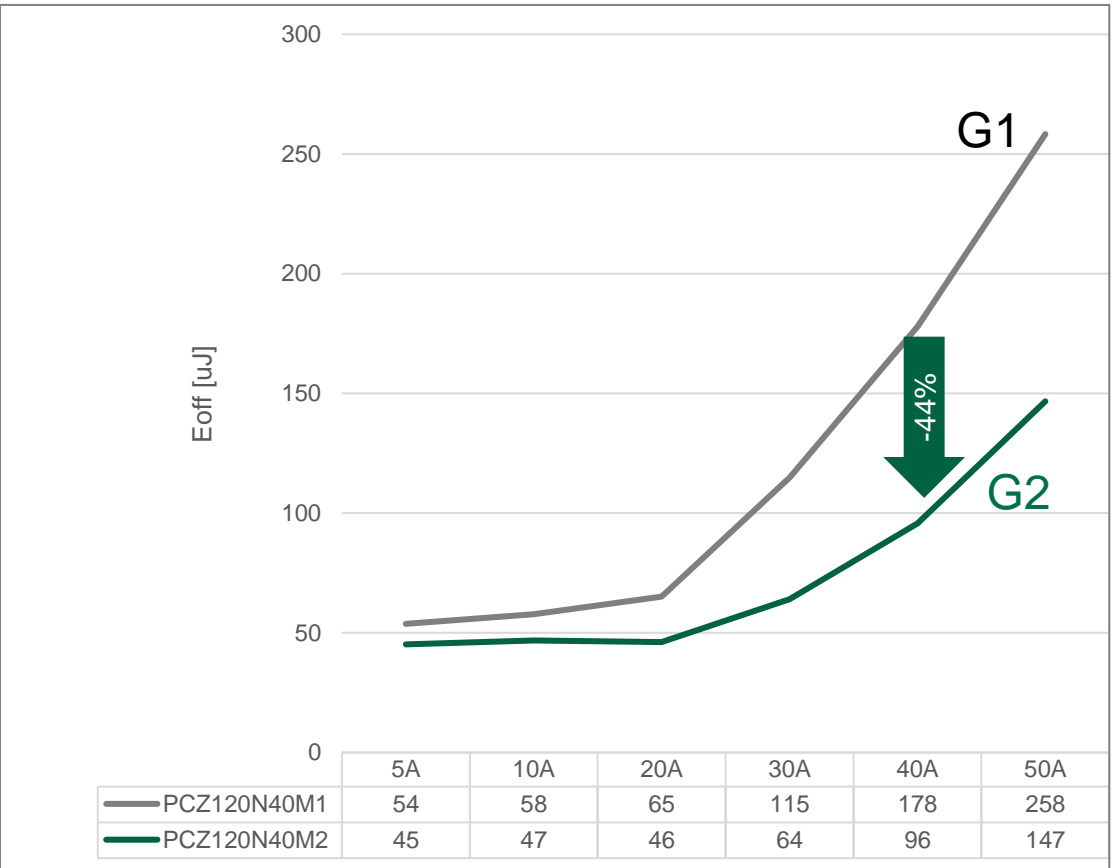
- Q_{OSS} Comparison



1200V / 40mΩ *e*SiC MOSFET Switching Losses : G1 vs. G2



Lower E_{on} Loss

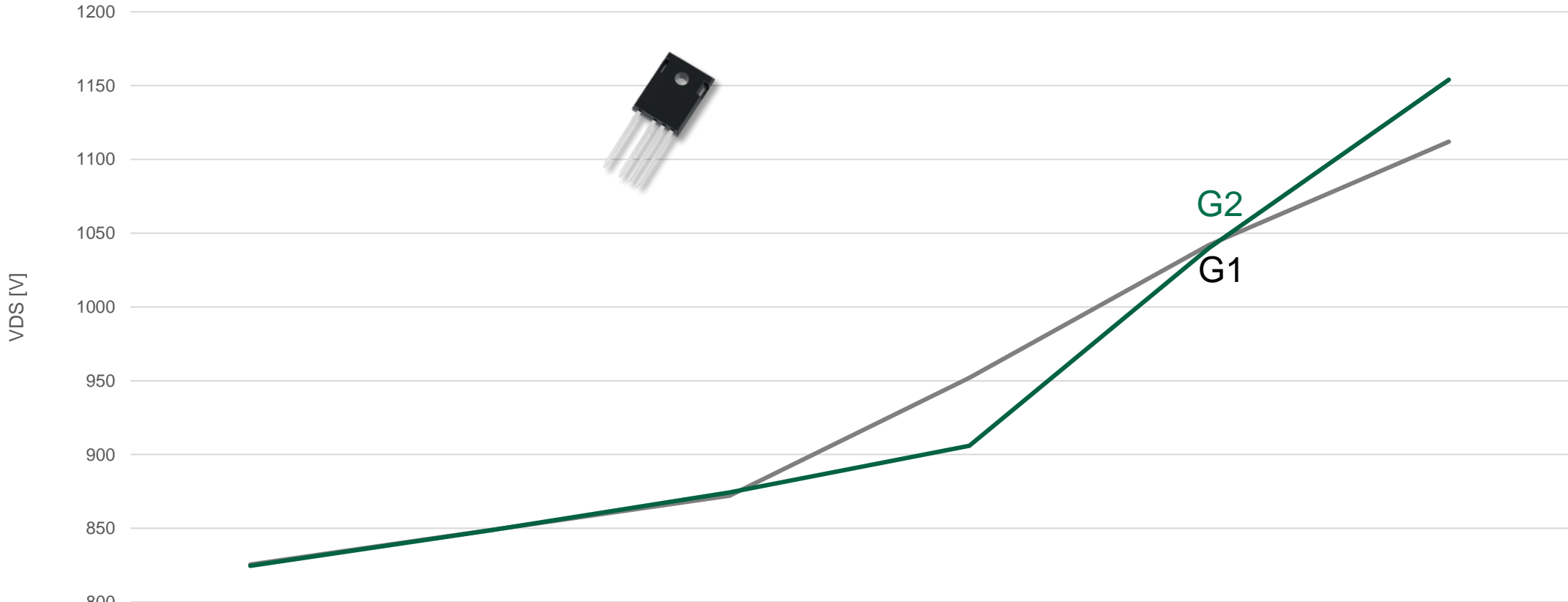


Lower E_{off} Loss

1200V / 40mΩ *e*SiC MOSFET

Switching Noise : G1 vs. G2

Similar Voltage (V_{DS}) Spikes !

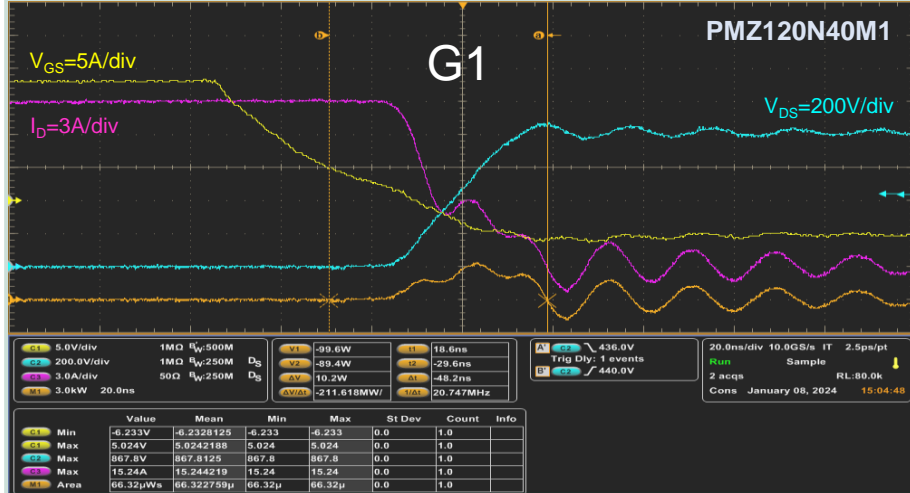


	5A	10A	20A	30A	40A	50A
— PCZ120N40M1	826	849	872	952	1042	1112
— PCZ120N40M2	825	849	874	906	1040	1154

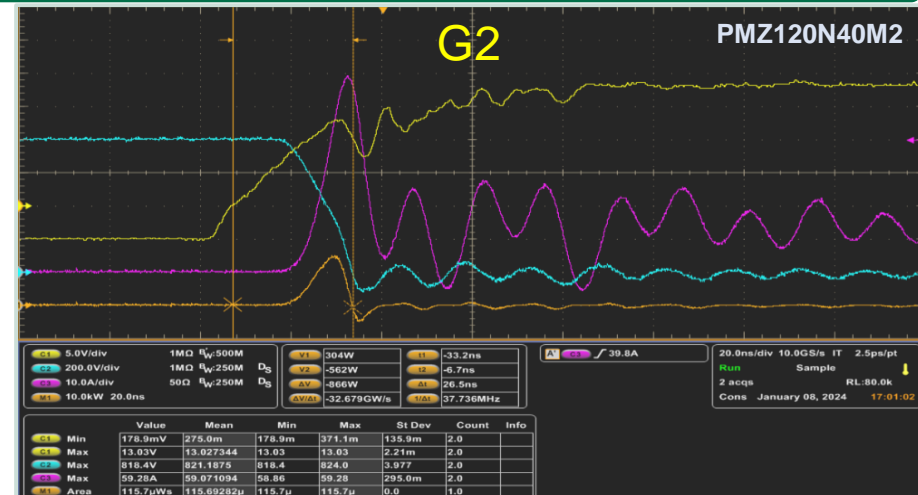
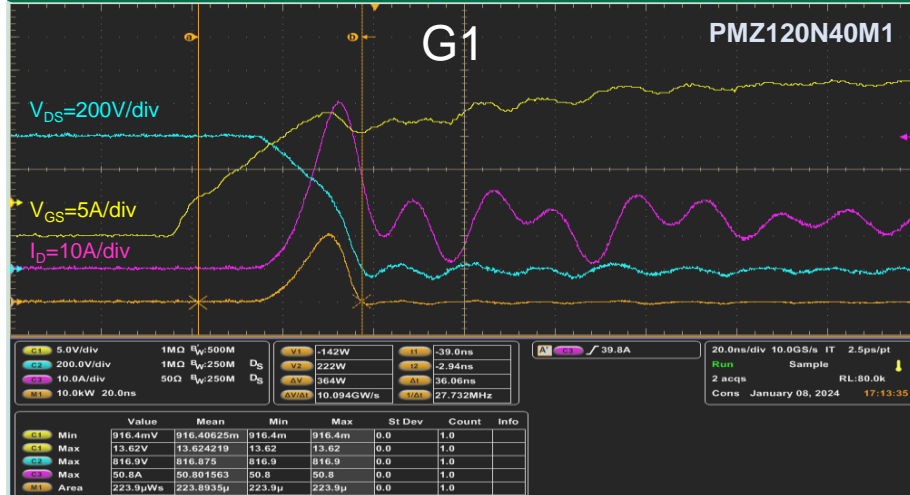
1200V / 40mΩ *e*SiC MOSFET

Switching Noise : G1 vs. G2

Turn-off @ $I_D=15A$



Turn-on @ $I_D=15A$

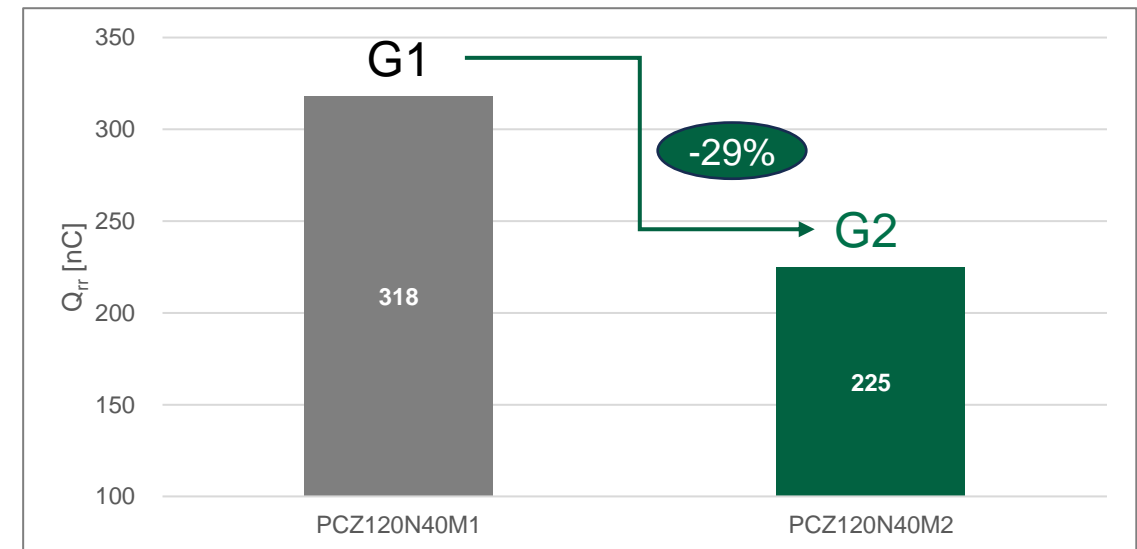
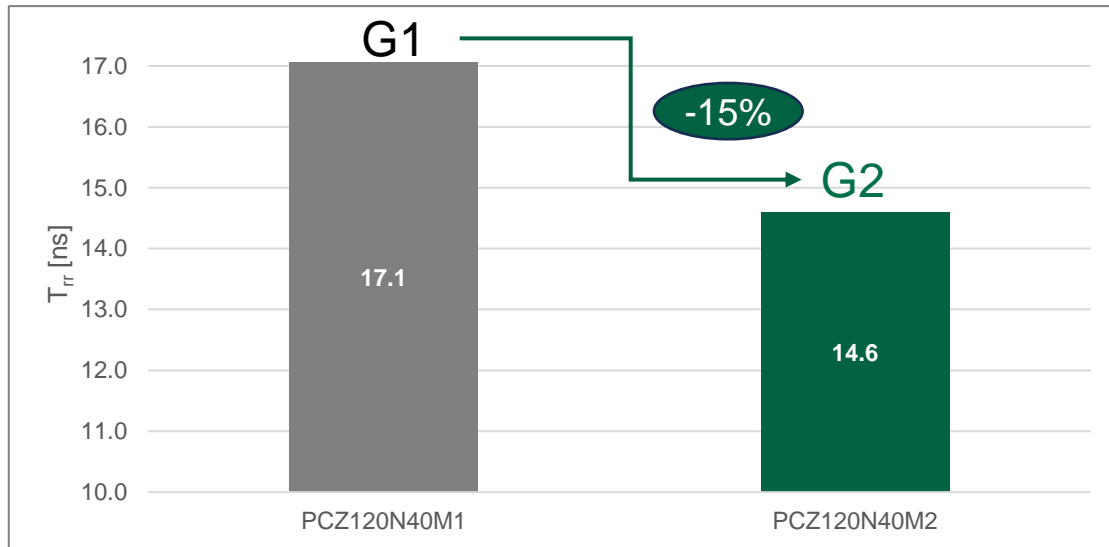
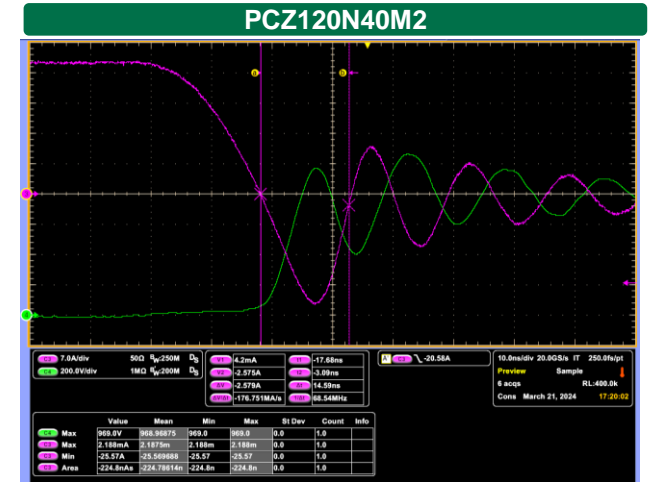
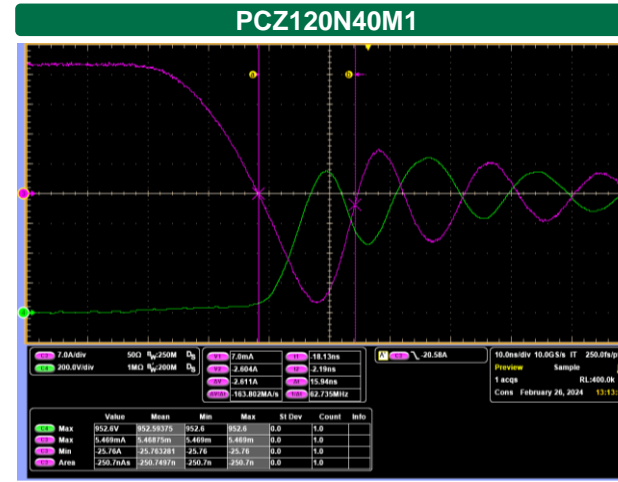


1200V / 40mΩ *e*SiC MOSFET

Body Diode Performance : G1 vs. G2

- Body Diode Performance Comparison

DUTs	T _{rr}	Q _{rr}
	[ns]	[nC]
PCZ120N40M1 (G1)	17.1	318
PCZ120N40M2 (G2)	14.6	225



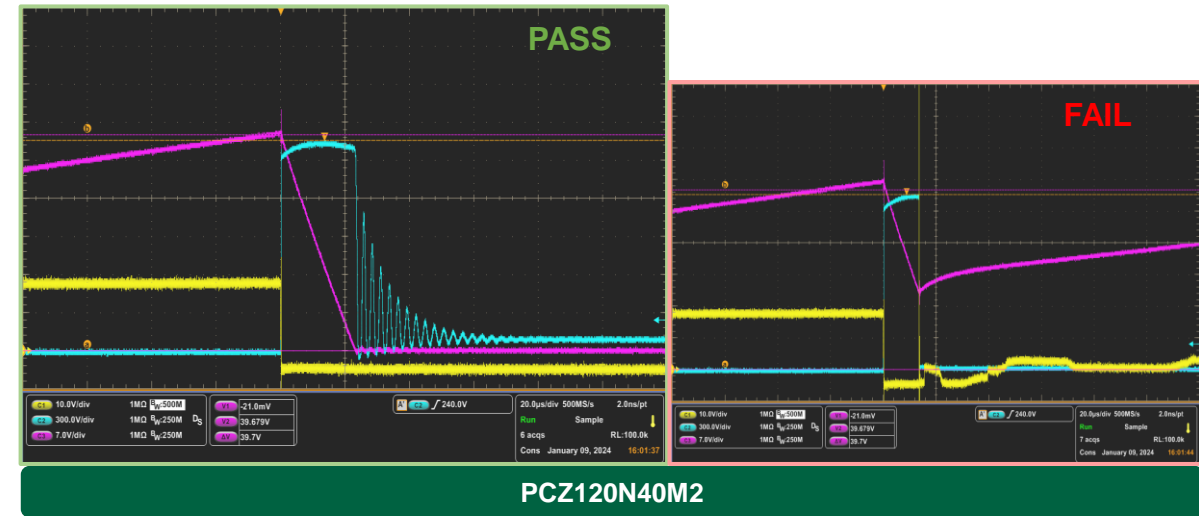
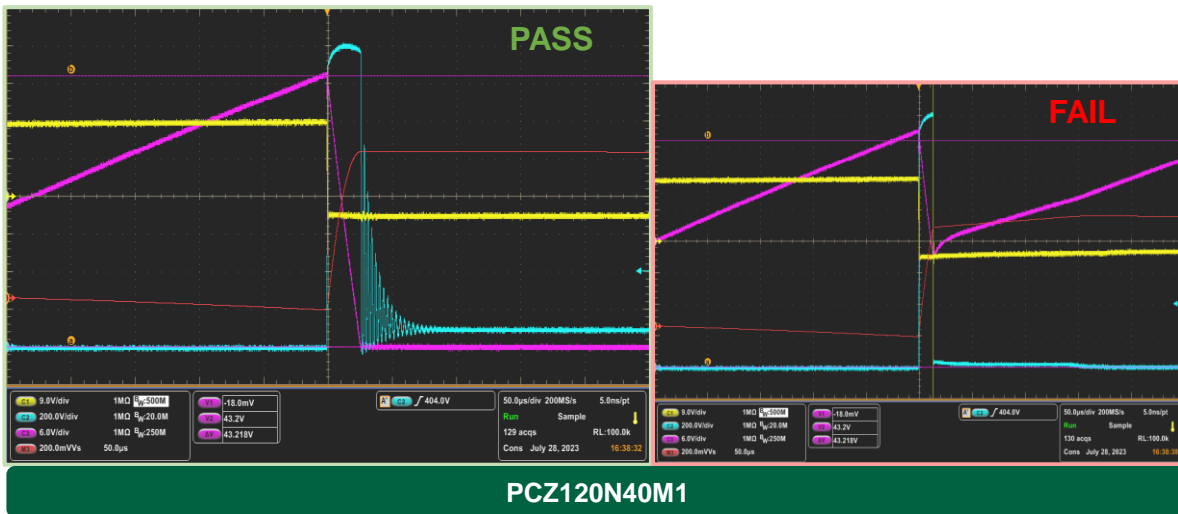
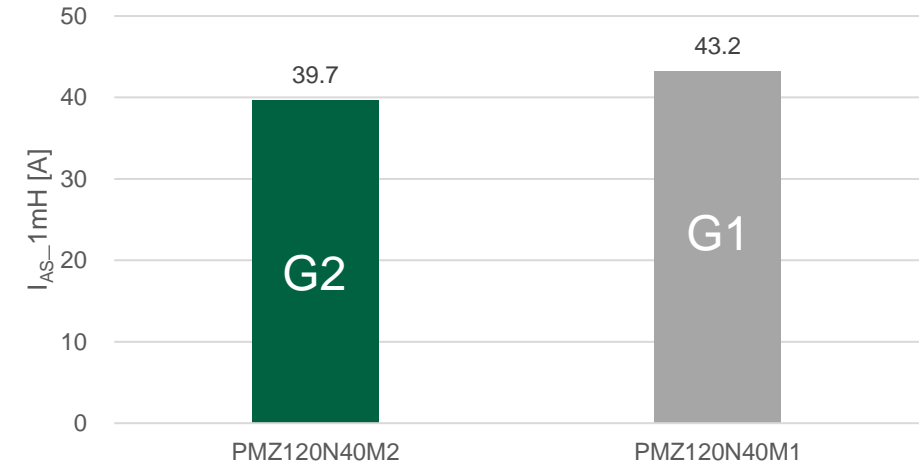
* V_{DD}=800V, I_{SD}=30A, di/dt=3000A/us, S-DUT=PCZ120N40M1, V_{GS(S-DUT)}=-5V/+18V

1200V / 40mΩ *e*SiC MOSFET

Avalanche Capability : G1 vs. G2

- Avalanche Current Comparison

DUTs	I_{AS} [A]
	PASS
PCZ120N40M1 (G1)	43.2
PCZ120N40M2 (G2)	39.7

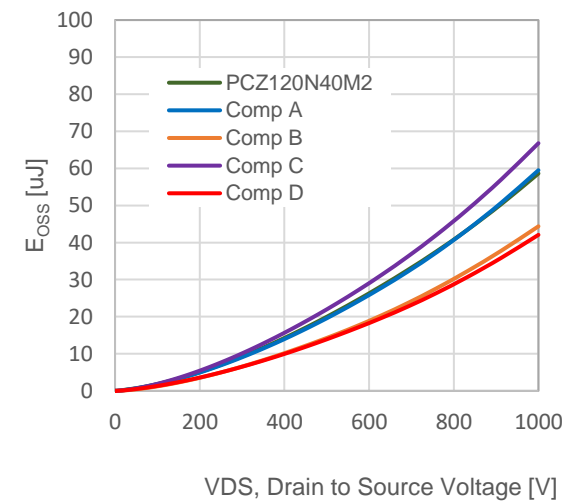
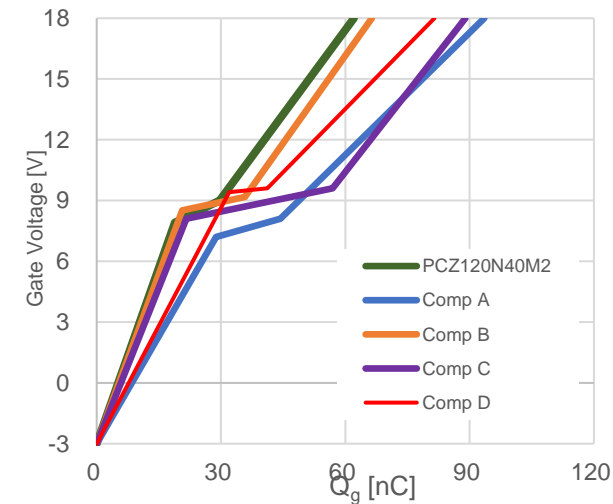
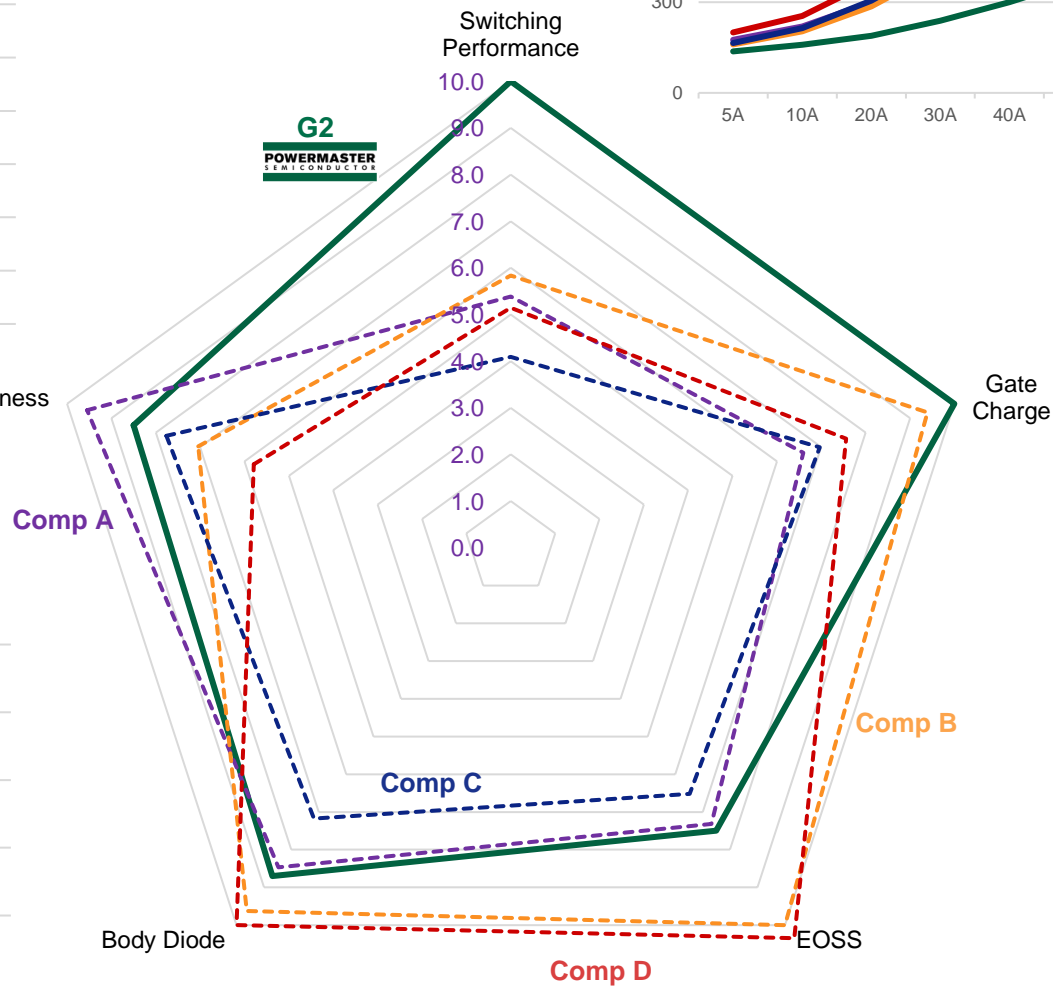
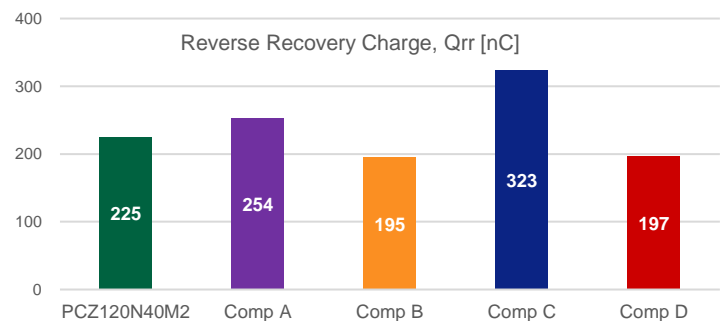
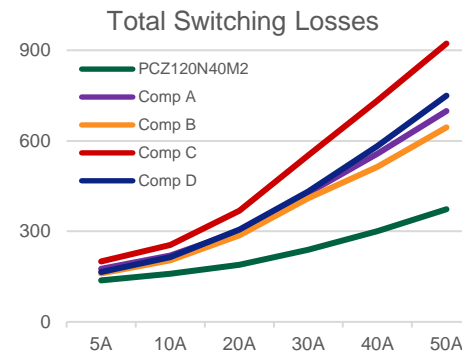
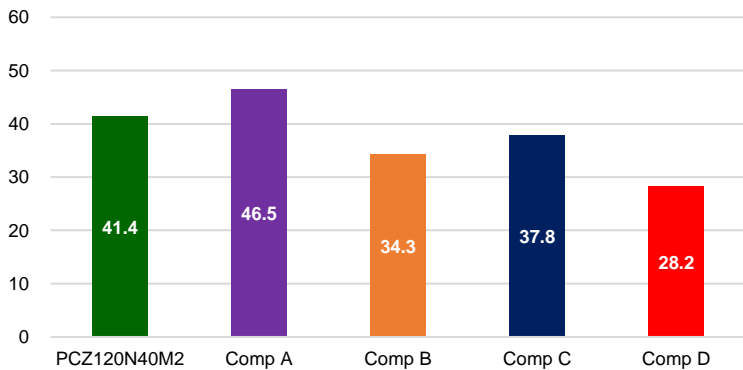


** $V_{DD}=100V$, $L=1mH$, $V_{GS}=-3V/+18V$, $R_G=25\Omega$

1200V / 40mΩ *e*SiC MOSFET

Key Parameter Comparison

Avalanche Current, I_{AS} [A]

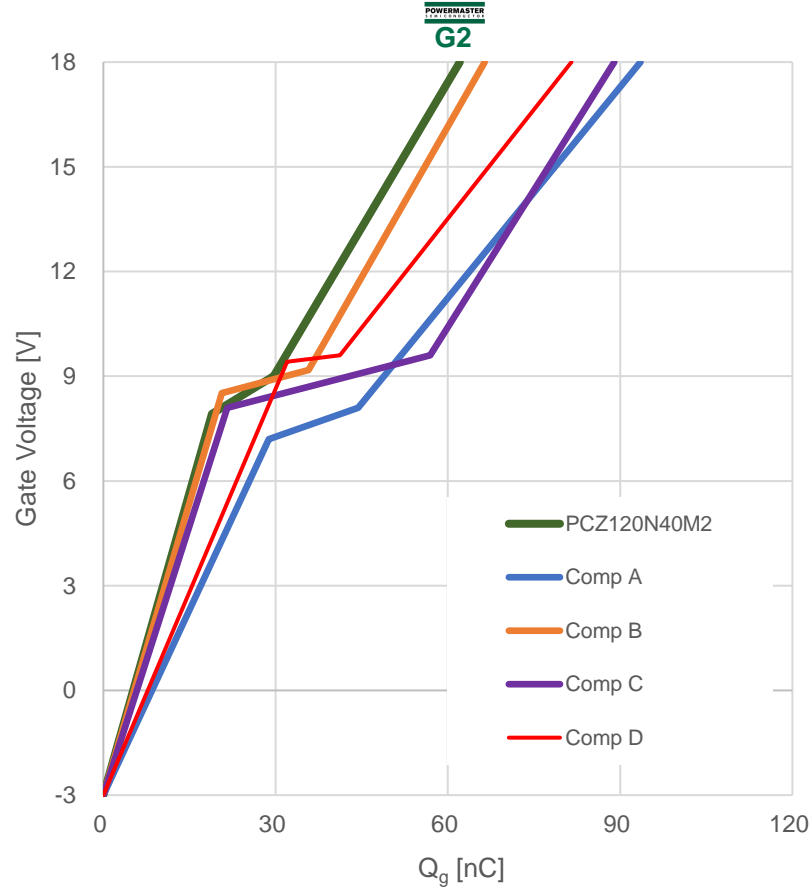


1200V / 40mΩ *e*SiC MOSFET

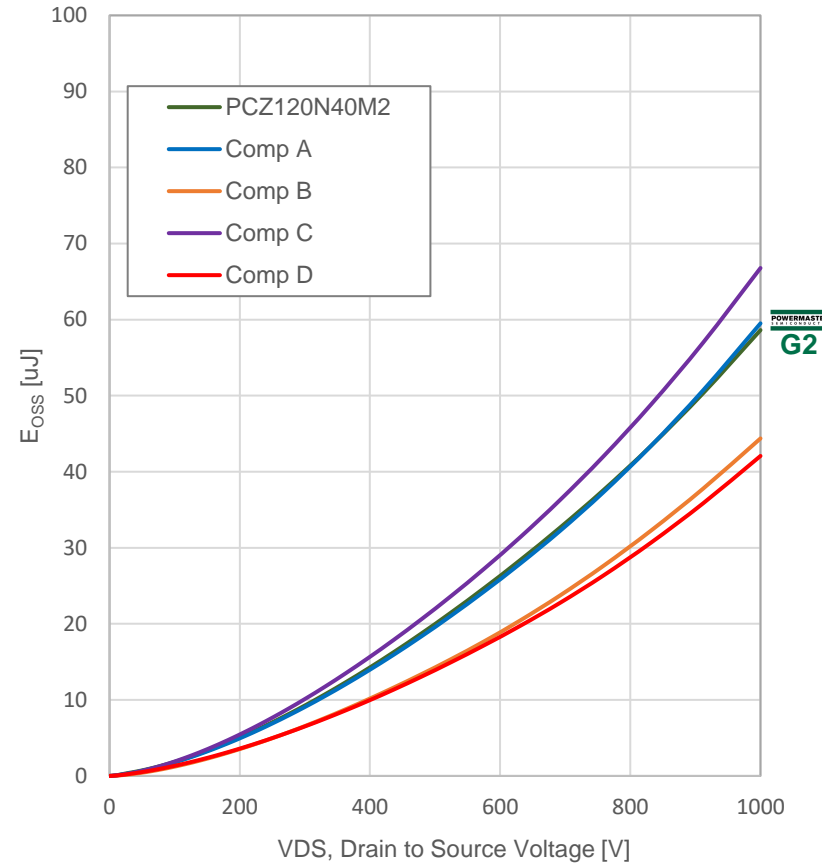
Gate Charge(Q_G), E_{OSS} & Q_{OSS}



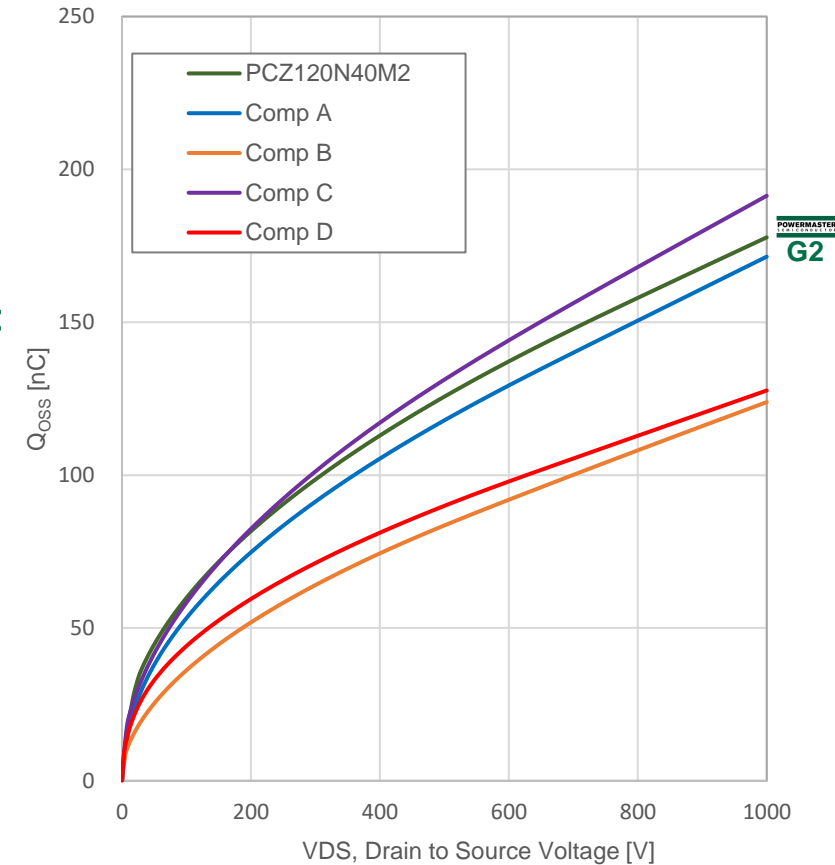
- Gate Charge(Q_G) Comparison



- E_{OSS} Comparison



- Q_{OSS} Comparison

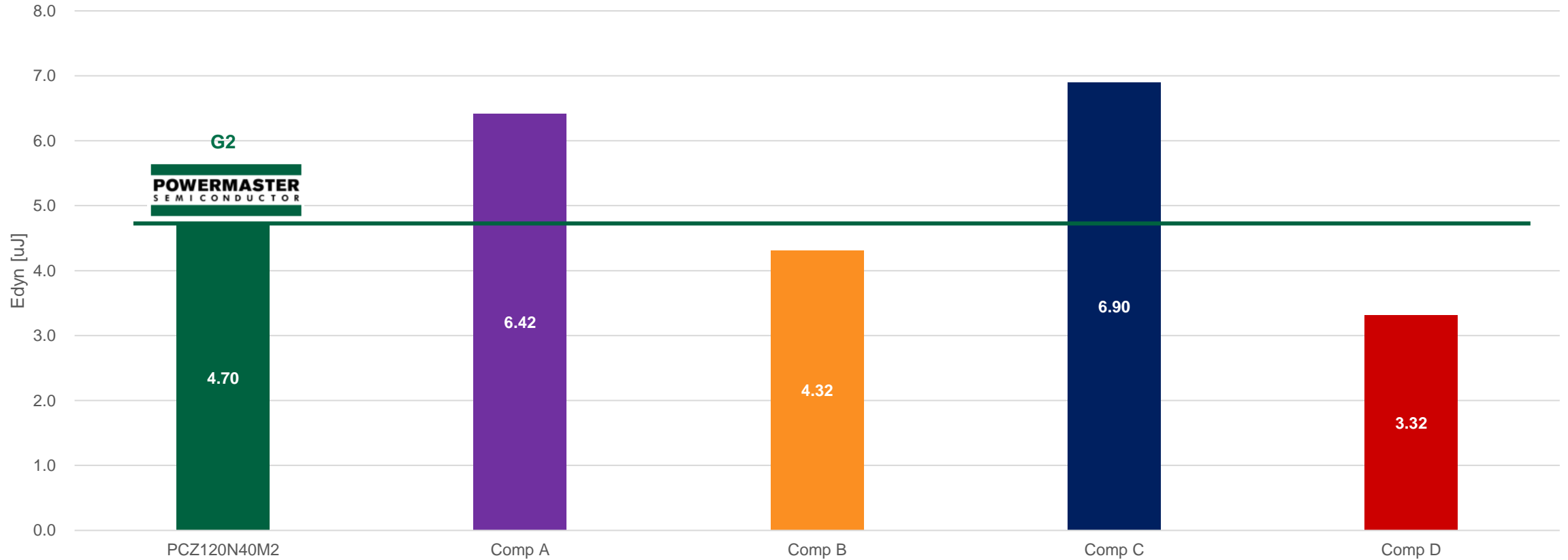


1200V / 40mΩ *e*SiC MOSFET

Hysteresis Loss in Output Capacitance



Dynamic Capacitive Loss



DUTs	PCZ120N40M2	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
Q_g [nC]	PCZ120N40M2 62	Comp B 66	Comp D 82	Comp C 89	Comp A 94
E_{dyn} [uJ]	Comp D 3.32	Comp B 4.32	PCZ120N40M2 4.70	Comp A 6.42	Comp C 6.90
E_{oss} [uJ]	Comp D 29	Comp B 30	PCZ120N40M2 40	Comp A 41	Comp C 46
Q_{oss} [nC]	Comp B 108	Comp D 113	PCZ120N40M2 150	Comp A 151	Comp C 168
T_{rr} [ns]	Comp D 12.7	Comp B 13.2	PCZ120N40M2 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]	PCZ120N40M2 204	Comp B 348	Comp A 378	Comp C 449	Comp D 489
Turn-off Loss [uJ]	Comp D 94	PCZ120N40M2 96	Comp B 166	Comp A 178	Comp C 284
Total SW Loss [uJ]	PCZ120N40M2 300	Comp B 514	Comp A 557	Comp D 583	Comp C 733
Peak Vds [V]	Comp B 994	Comp C 1035	PCZ120N40M2 1040	Comp A 1040	Comp D 1048

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

	Best ←————→ Worst				
I_{AS} [A]	Comp A 46.5	PCZ120N40M2 41.4	Comp C 37.8	Comp B 34.3	Comp D 28.2

1200V / 40mΩ *e*SiC MOSFET PCZ120N40M2 Switching Loss



0	5A	10A	20A	30A	40A	50A
PCZ120N40M2	137	159	190	239	300	373
Comp A	176	220	300	426	557	699
Comp B	161	204	286	410	514	645
Comp C	200	255	369	551	733	922
Comp D	165	214	306	432	583	750

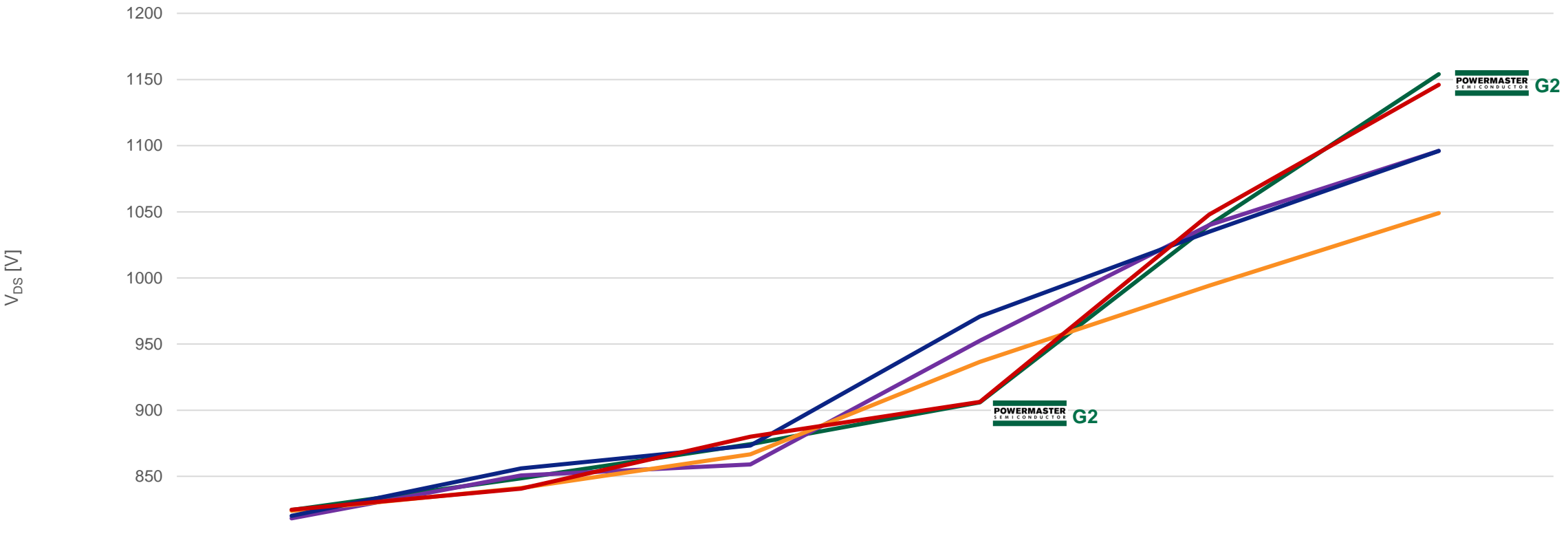
POWERMASTER SEMICONDUCTOR G2

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

1200V / 40mΩ *e*SiC MOSFET PCZ120N40M2 Switching Noise



Peak Drain Voltage

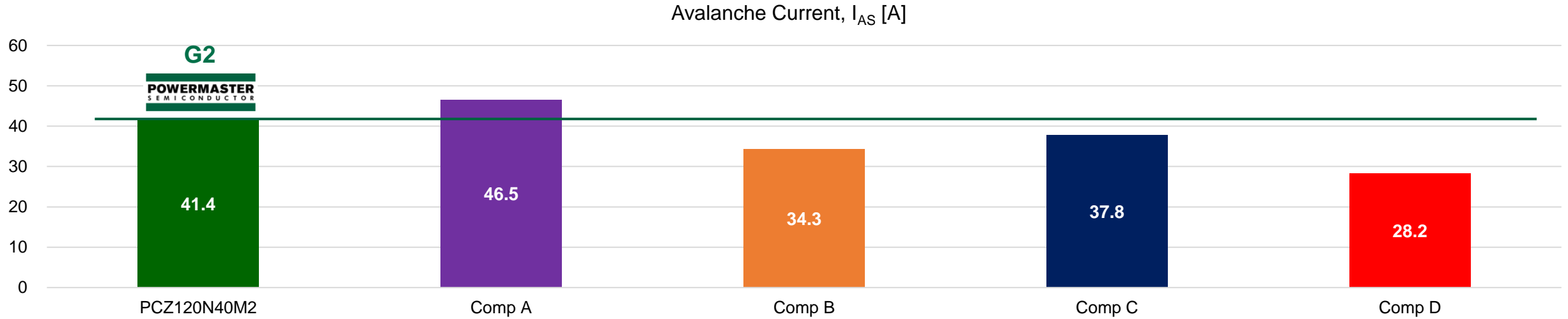


	5A	10A	20A	30A	40A	50A
PCZ120N40M2	825	849	874	906	1040	1154
Comp A	818	851	859	953	1040	1096
Comp B	824	841	867	937	994	1049
Comp C	820	856	873	971	1035	1096
Comp D	825	841	880	906	1048	1146

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

1200V / 40mΩ *e*SiC MOSFET

Avalanche Capability



DUTs	I_{AS} [A]	BV [V]
	PASS	PASS
PCZ120N40M2	41.4	1536
Comp A	46.5	1776
Comp B	34.3	1696
Comp C	37.8	1568
Comp D	28.2	1704

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

1200V *e*SiC MOSFET Gen2. Portfolio

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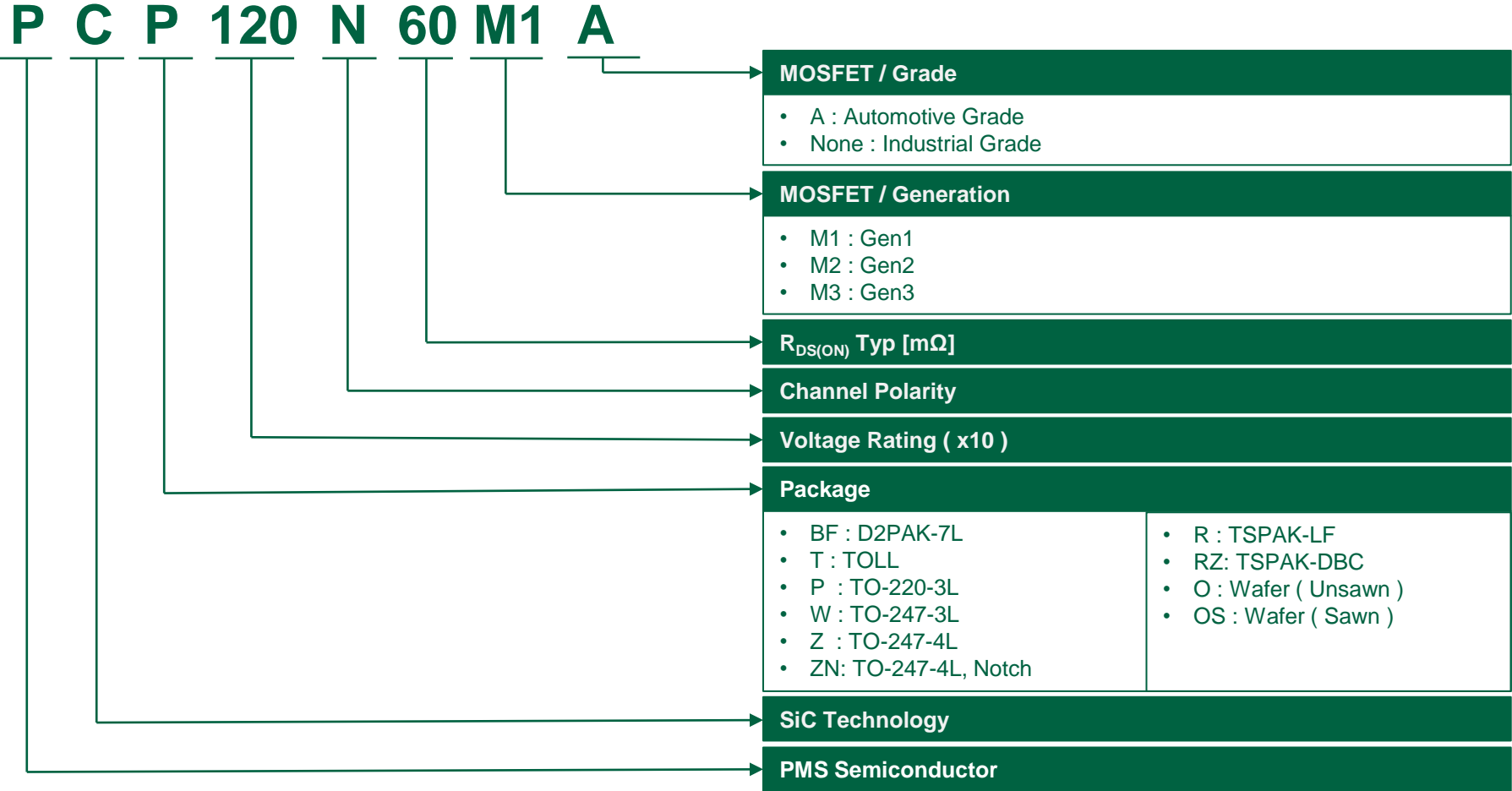
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Available now
Coming Soon



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.	PCO120N16M2		PCW120N16M2	PCZ120N16M2	PCZN120N16M2		
	Auto.	PCO120N16M2A			PCZ120N16M2A	PCZN120N16M2A		
21mΩ	Indus.	PCO120N21M2	PCBF120N21M2	PCW120N21M2	PCZ120N21M2	PCZN120N21M2		
	Auto.	PCO20N21M2					PCRZ120N21M2A	PCR120N21M2A
31mΩ	Indus.	PCO120N31M2	PCBF120N31M2	PCW120N31M2	PCZ120N31M2	PCZN120N31M2		
40mΩ	Indus.	PCO120N40M2	PCBF120N40M2	PCW120N40M2	PCZ120N40M2	PCZN120N40M2		
	Auto.	PCO120N40M2A					PCRZ120N40M2A	PCR120N40M2A
60mΩ	Indus.	PCO120N60M2	PCBF120N60M2	PCW120N60M2		PCZN120N60M2		
	Auto.	PCO120N60M2A					PCRZ120N60M2A	PCR120N60M2A
80mΩ	Indus.	PCO120N80M2	PCBF120N80M2	PCW120N80M2	PCZ120N80M2	PCZN120N80M2		

Ordering System (SiC MOSFET)



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