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650V *e*SiC MOSFET Selection Guide 2024

Advanced Power Master Semiconductor's Silicon Carbide Technology

650V *e*SiC MOSFET

Smaller, Faster and More Efficient Products

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Key Features

- Extremely low switching losses
- Good FOM ; Q_G x $R_{DS(ON)}$
- Fast intrinsic diode
- Robust Avalanche Capability

Key Benefits

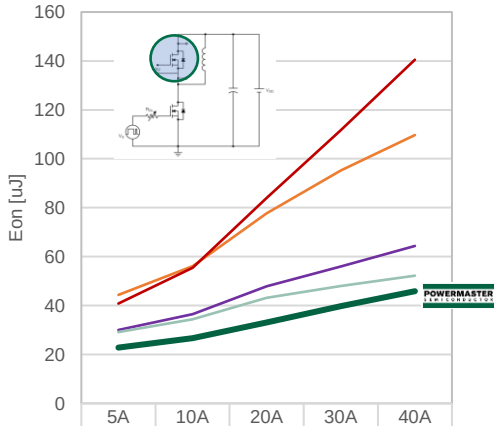
- Higher System Efficiency & Reliability
- Reduced Cooling Effort
- Higher frequency applicability
- Increased power density

Applications

AI Server PSU | xEV | Telecom/ Server PSU | Solar Inverter | EV Charging Pole

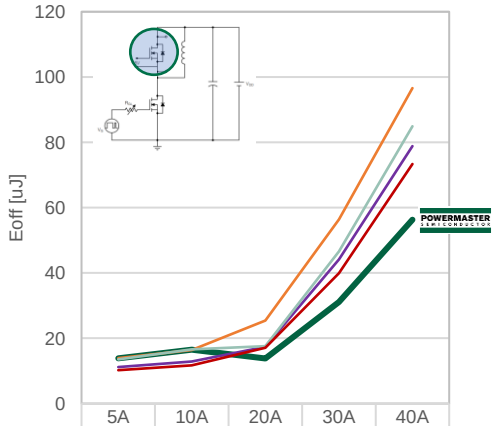
Switching Losses

Turn-on Loss



	5A	10A	20A	30A	40A
PMS	23	27	33	40	46
Comp. A	30	36	48	56	64
Comp. B	44	56	78	95	110
Comp. C	29	34	43	48	52
Comp. D	41	55	84	112	141

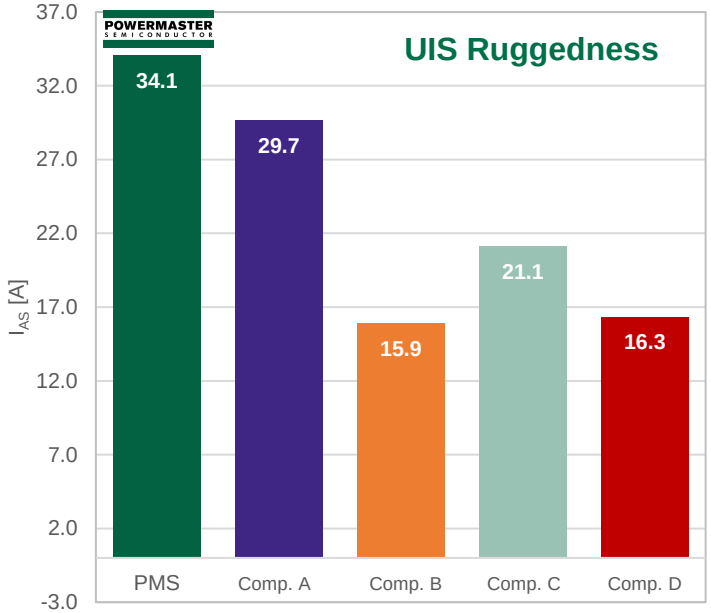
Turn-off Loss



	5A	10A	20A	30A	40A
PMS	14	17	14	31	56
Comp. A	11	13	17	44	79
Comp. B	14	16	25	56	97
Comp. C	14	17	18	47	85
Comp. D	10	12	17	40	73

Test condition : V_{DD}=400V, I_D=5~40A, V_{GS}=-3/+18V, R_G=2.7Ω, FWD : Same DUT

I_{AS} [A] @ L=1mH



650V / 45mΩ *e*SiC MOSFET
PCZ65N45M1 Benchmark

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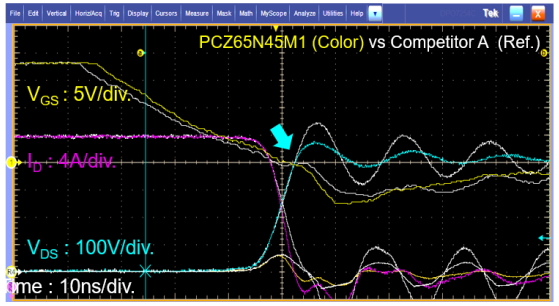

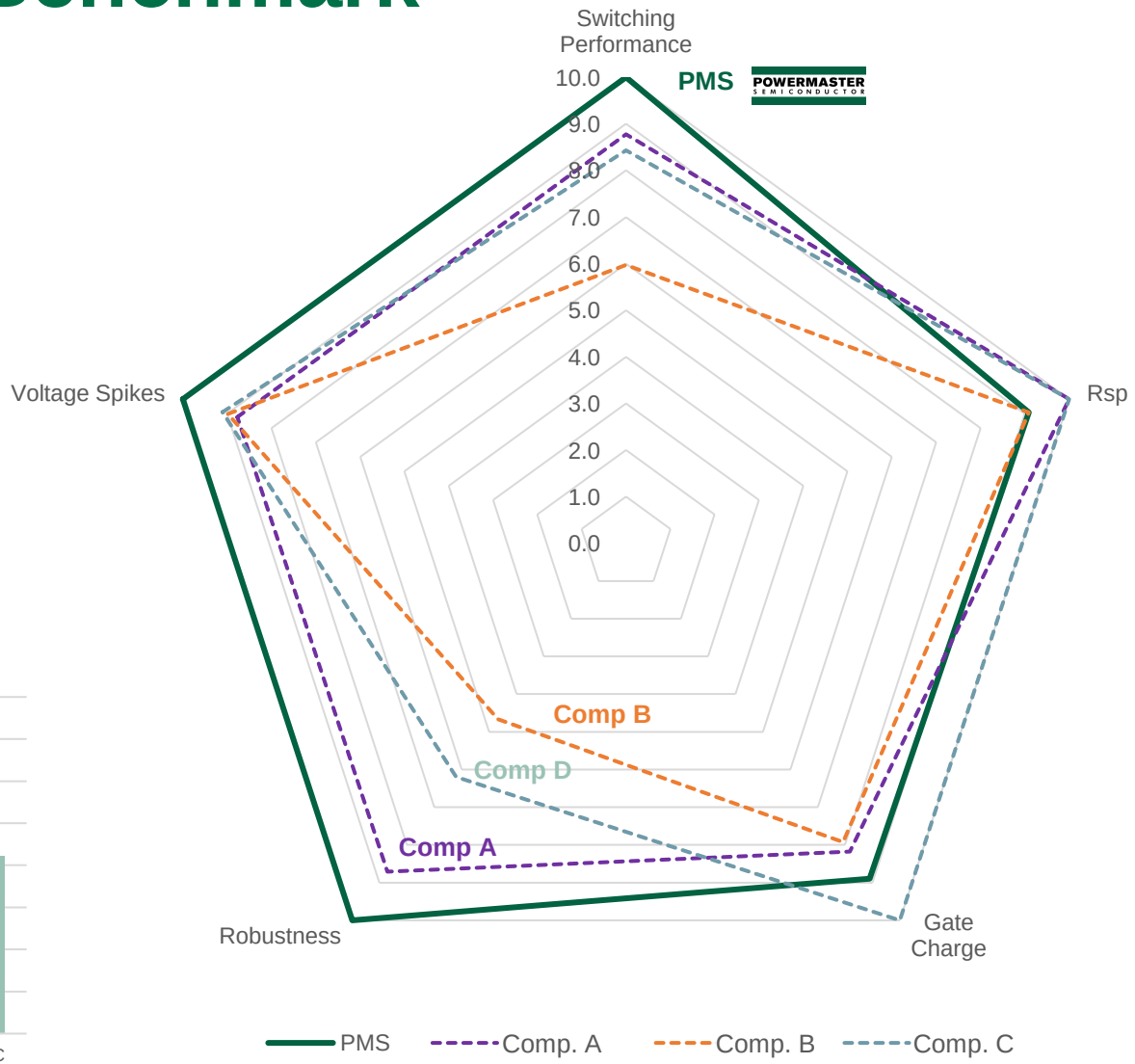

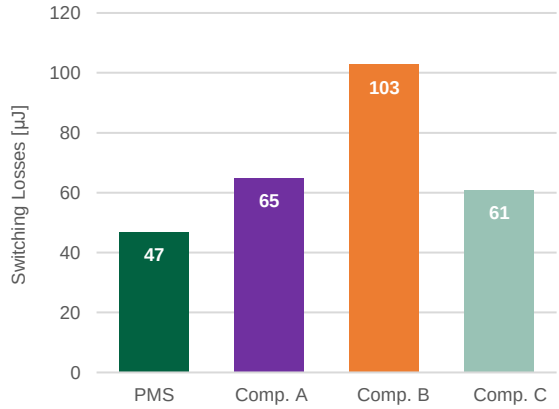

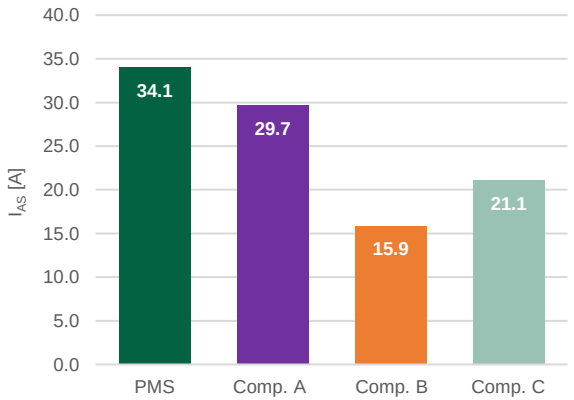

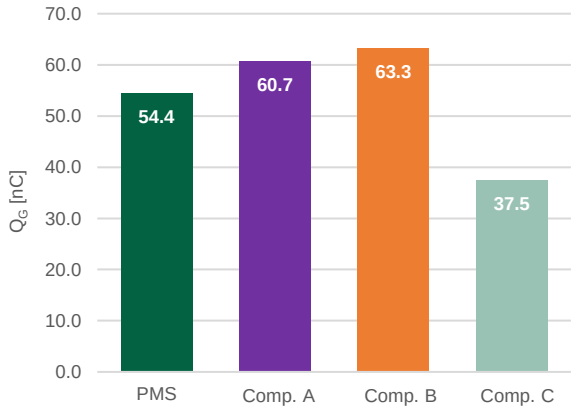

650V/45mΩ *e*SiC MOSFET Gen1 Switching Performance

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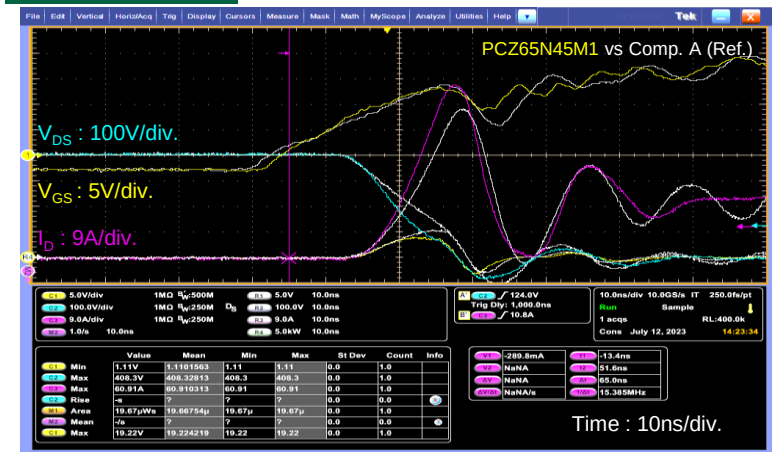
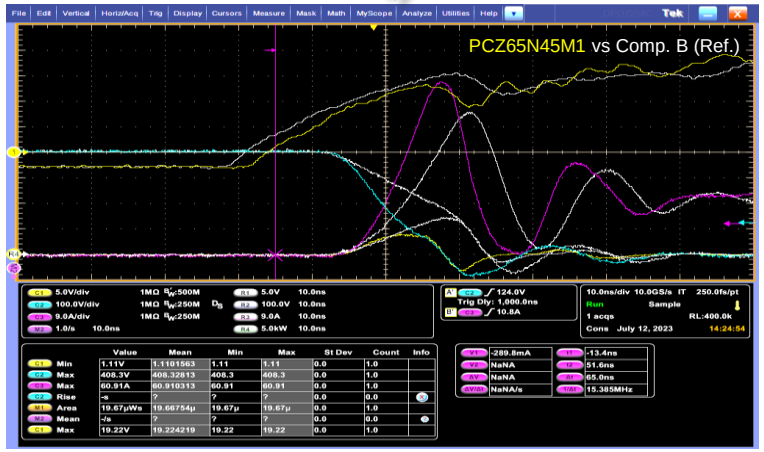
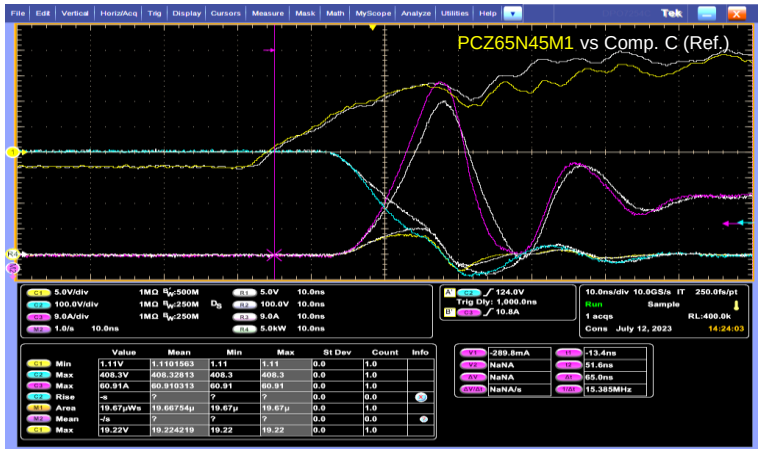
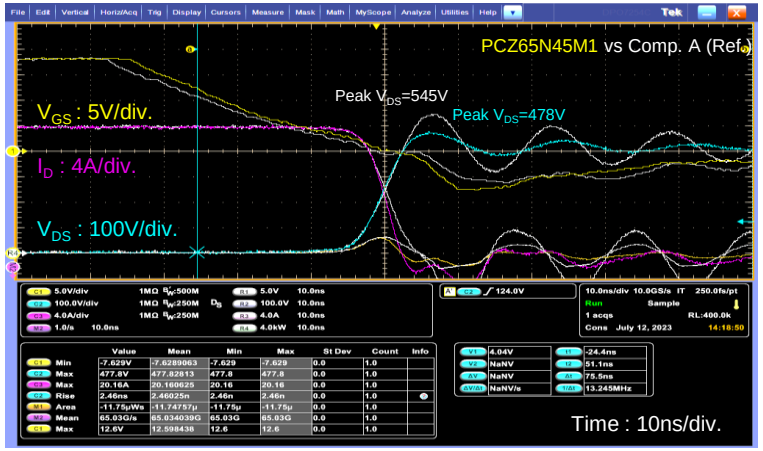
Turn-on

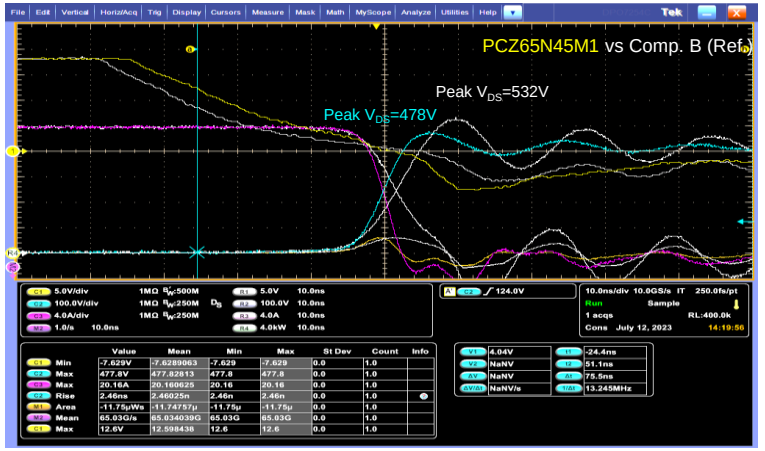


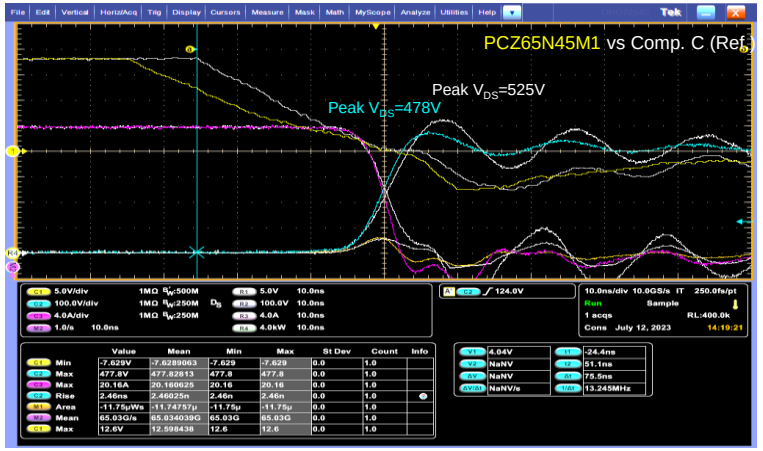




Turn-off







Test condition : V_{DD}=400V, I_D=5~40A, V_{GS}=-3/+18V, R_G=2.7Ω, FWD : Same DUT

650V/45mΩ *e*SiC MOSFET Gen1
Efficiency Results @ 3kW Totem-Pole PFC

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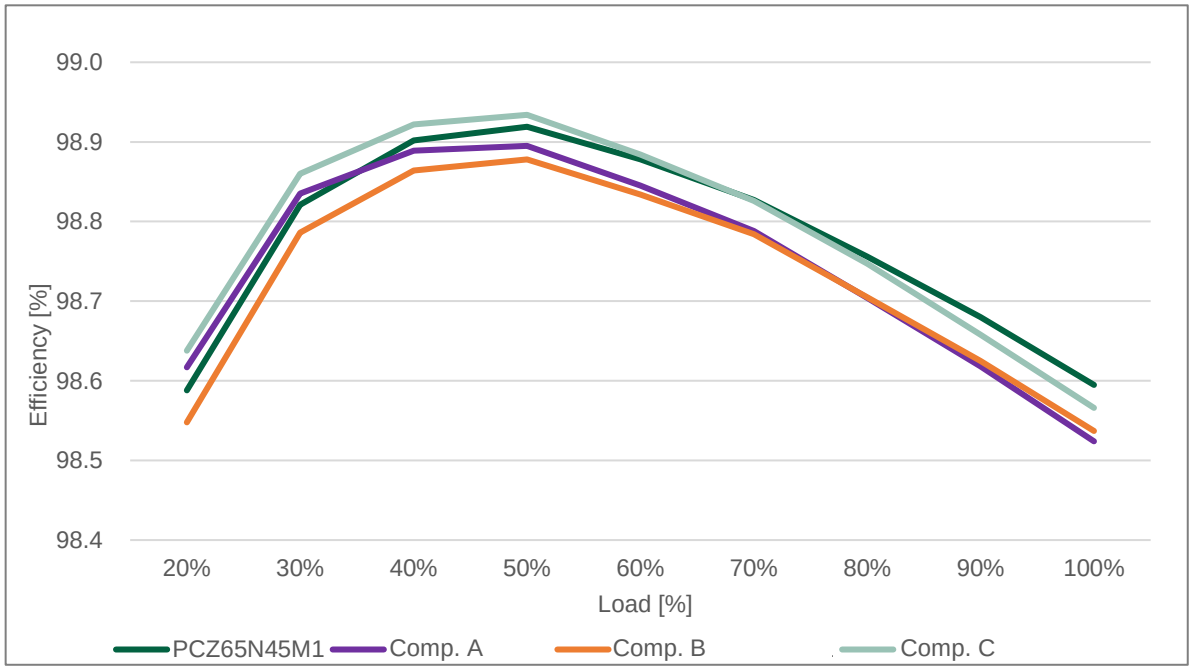
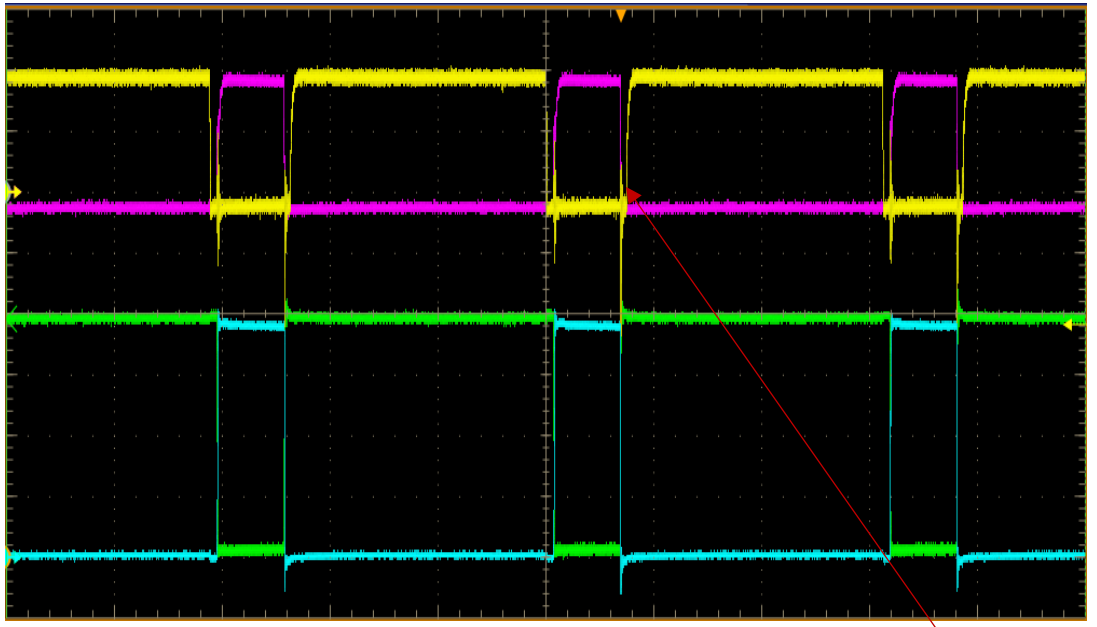
Efficiency @ 3kW Totem-pole PFC





DUT	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
PCZ65N45M1	97.66	98.59	98.82	98.90	98.92	98.88	98.83	98.76	98.68	98.60
Comp. A	97.68	98.62	98.84	98.89	98.90	98.85	98.79	98.70	98.62	98.52
Comp. B	97.63	98.55	98.79	98.86	98.88	98.83	98.78	98.71	98.63	98.54
Comp. C (Trench)	97.68	98.64	98.86	98.92	98.93	98.88	98.83	98.75	98.66	98.57

Io=8A, 3kW	Low side - trigger			High side - trigger			Low side V_{GS} by HS MOS
	Peak V_{DS}	V_{GS}-	V_{GS}+	Peak V_{DS}	V_{GS}-	V_{GS}+	
PCZ65N45M1	489	-11.2	19.6	513	-6.0	19.2	-13.3
Comp. A	520	-14.5	19.7	541	-8.5	19.0	-26.4
Comp. B	512	-13.2	19.7	537	-6.4	18.8	-19.6
Comp. C (Trench)	516	-14.4	20.4	532	-9.6	19.3	-26.4

650V/45mΩ *e*SiC MOSFET Gen1 Switching Performance @ 3kW TP PFC

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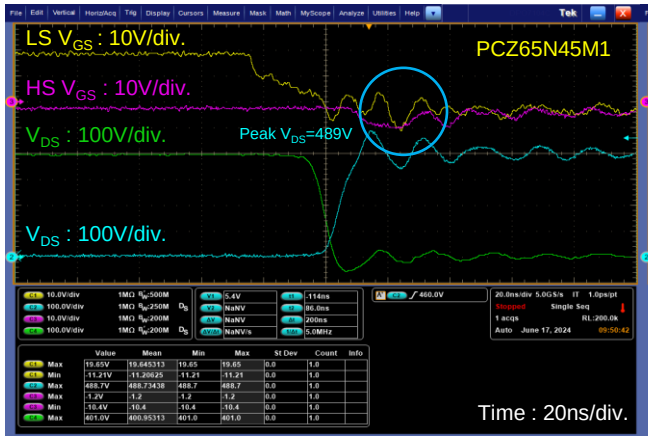
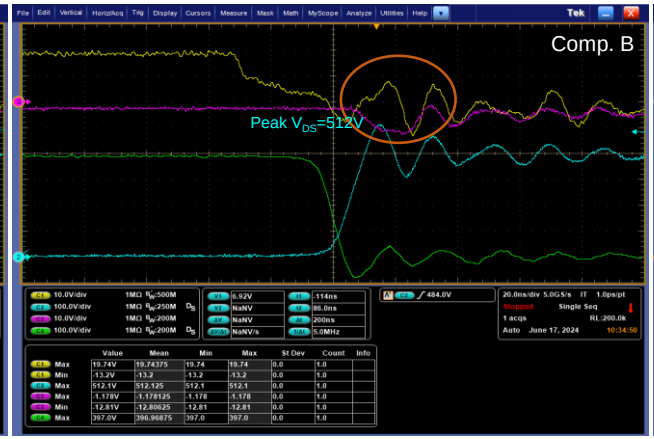
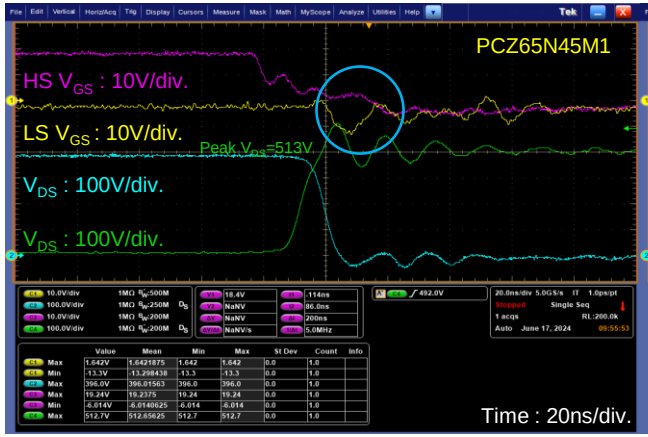
Low Side Turn-off



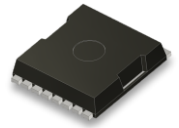


High Side Turn-off



Test condition : Pout=3kW, V_{GS}=-2.5/+18V, R_{ON}=22Ω / R_{ON}=4.7Ω+1N4148

650V/27mΩ eSiC MOSFET Gen1
PCT65N27M1 Switching Loss



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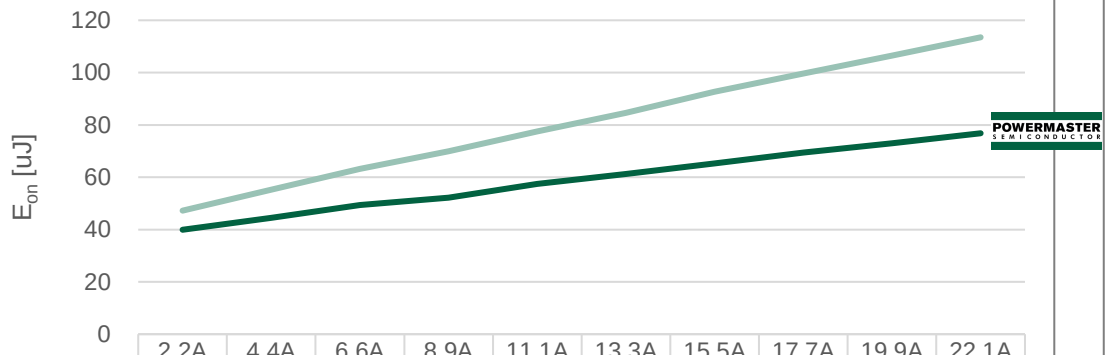
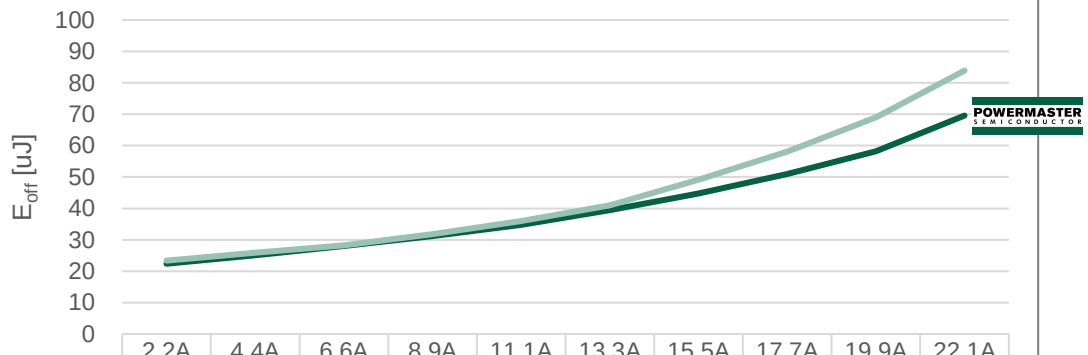
Turn-on Loss



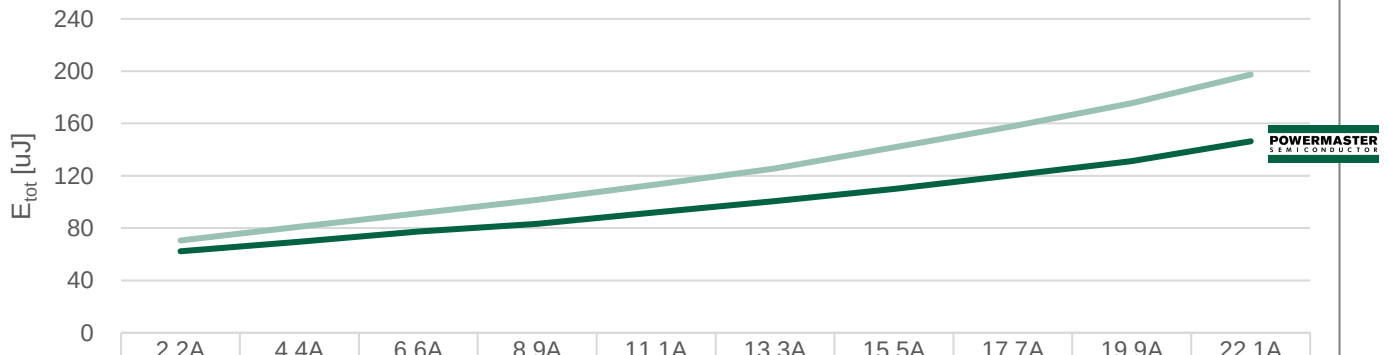
	2.2A	4.4A	6.6A	8.9A	11.1A	13.3A	15.5A	17.7A	19.9A	22.1A
PCT65N27M1	39.9	44.4	49.4	52.1	57.4	61.2	65.3	69.4	73.0	76.8
Best Comp.	47.2	55.3	63.2	69.9	77.5	84.6	92.6	99.7	106.5	113.5

Turn-off Loss



	2.2A	4.4A	6.6A	8.9A	11.1A	13.3A	15.5A	17.7A	19.9A	22.1A
PCT65N27M1	22.4	25.1	28.1	31.2	34.8	39.4	44.8	51.0	58.2	69.6
Best Comp.	23.4	25.9	28.2	31.8	36.0	41.0	49.1	58.1	69.0	83.9

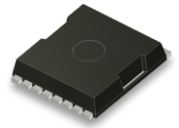
Total SW Loss



	2.2A	4.4A	6.6A	8.9A	11.1A	13.3A	15.5A	17.7A	19.9A	22.1A
PCT65N27M1	62.3	69.5	77.5	83.3	92.2	100.6	110.1	120.4	131.2	146.4
Best Comp.	70.6	81.2	91.4	101.7	113.4	125.6	141.7	157.8	175.5	197.4

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

650V/27mΩ eSiC MOSFET Gen1
PCT65N27M1 Switching Noise



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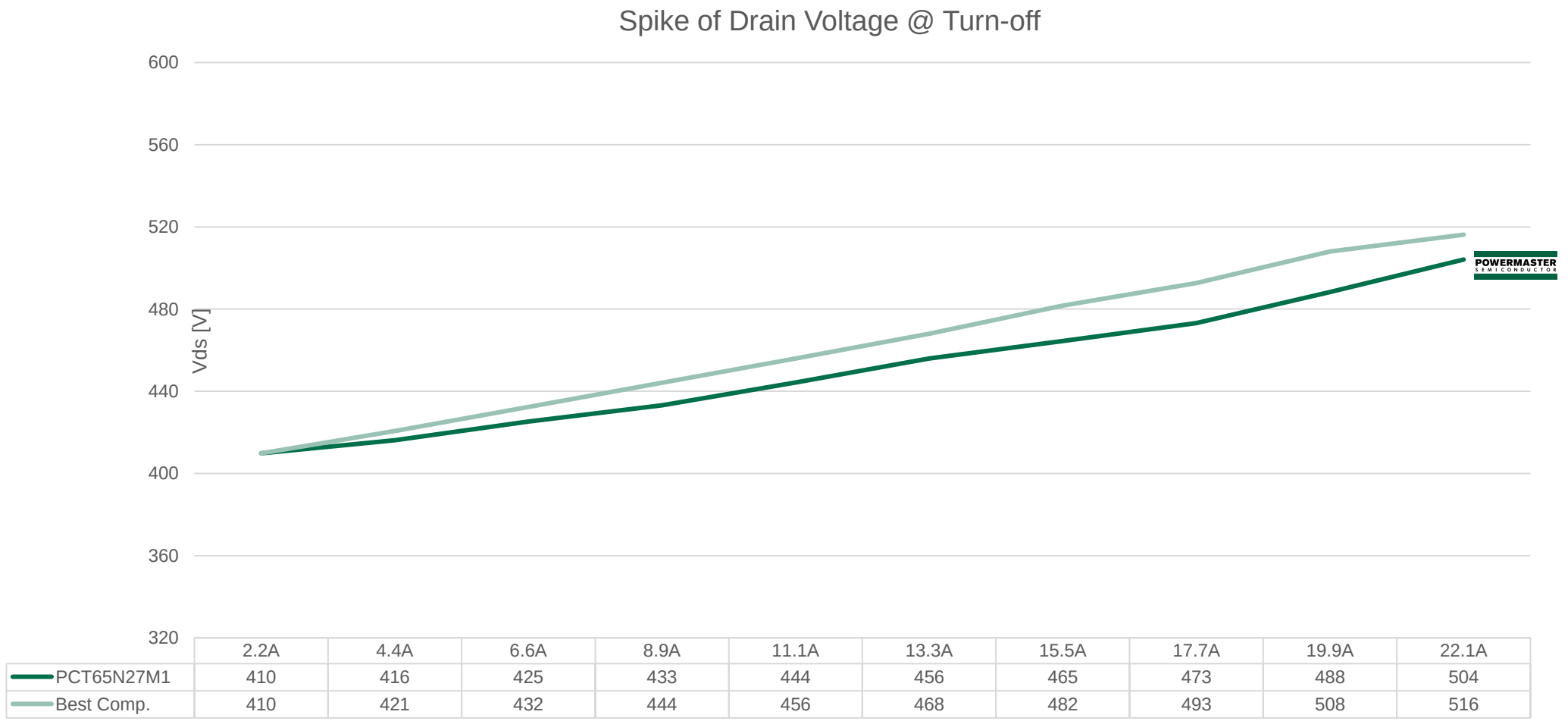
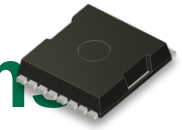


	2.2A	4.4A	6.6A	8.9A	11.1A	13.3A	15.5A	17.7A	19.9A	22.1A
PCT65N27M1	410	416	425	433	444	456	465	473	488	504
Best Comp.	410	421	432	444	456	468	482	493	508	516

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

650V/27mΩ *e*SiC MOSFET Gen1
PCT65N27M1 Turn-off Switching Waveform



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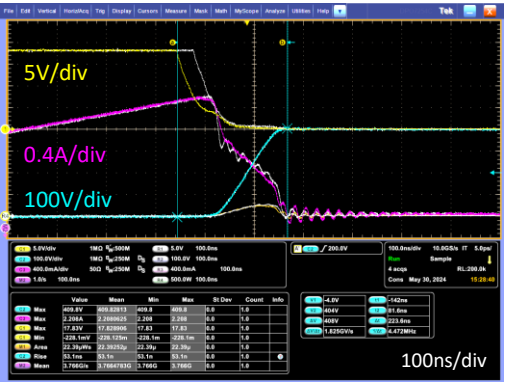
2.21A



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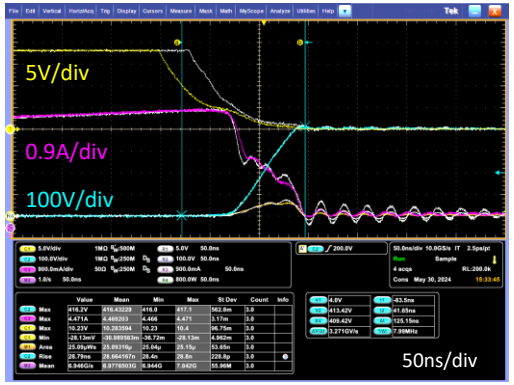
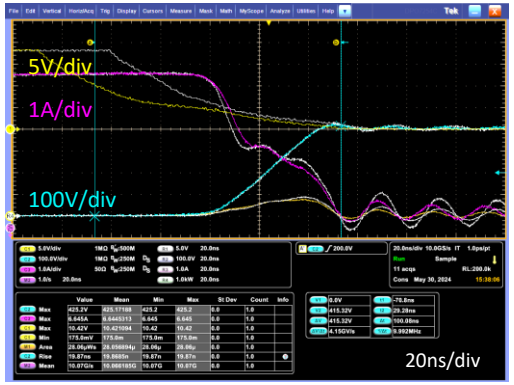


6.64A



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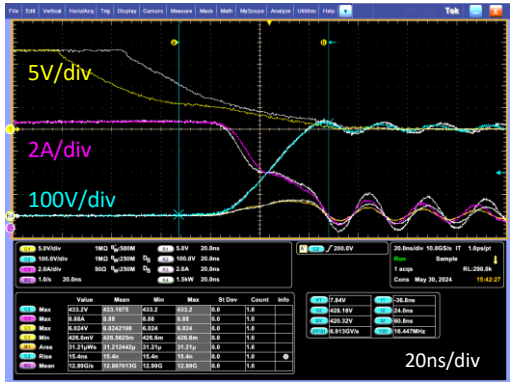

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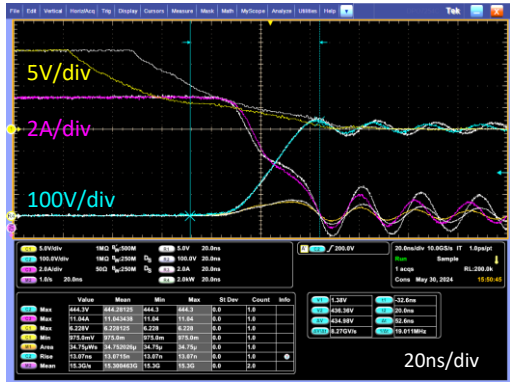
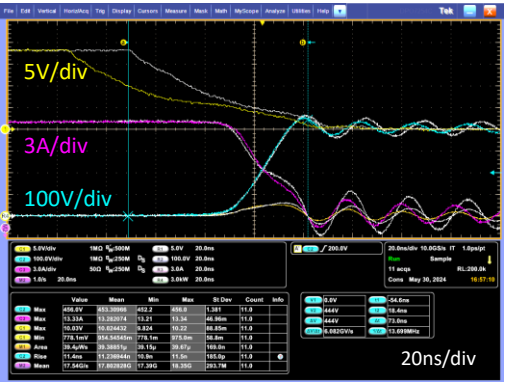
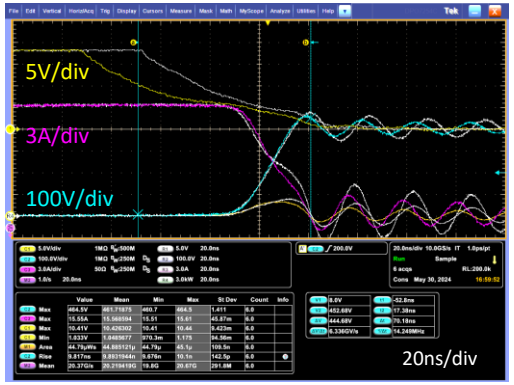


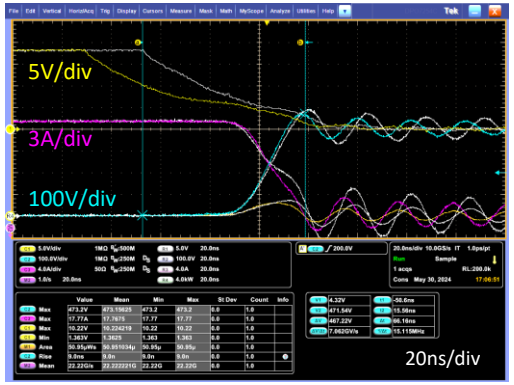
13.28A



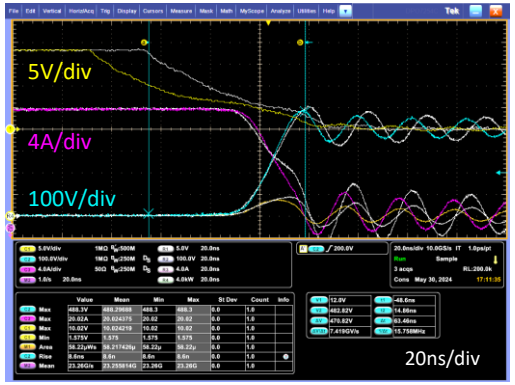
15.49A



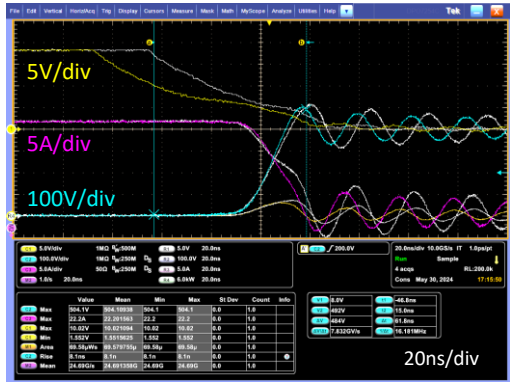
17.71A



19.92A



22.14A



Color : PCT65N27M1
Ref. : Best Comp.

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

650V *e*SiC MOSFET Gen1. Portfolio

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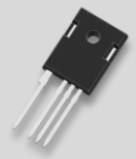
Available now
On Planning [Release Target]

Solar | Server / Telecom | UPS | ESS PCS | EV(OBC) | EV Charger

Package / $R_{DS(ON)\_typ}$	Bare Die	TOLL	D2PAK-7L	TO-247-3L	TO-247-4L
					
15mΩ	PCO65N15M1	PCT65N15M1	PCBF65N15M1	PCW65N15M1	PCZ65N15M1
22mΩ	PCO65N22M1	PCT65N22M1			
27mΩ	**PCO65N27M1**	PCT65N27M1	PCBF65N27M1	**PCW65N27M1**	**PCZ65N27M1**
39mΩ	PCO65N39M1	PCT65N39M1			
45mΩ	**PCO65N45M1**	PCT65N45M1	PCBF65N45M1	**PCW65N45M1**	**PCZ65N45M1**

Ordering System (SiC MOSFET)

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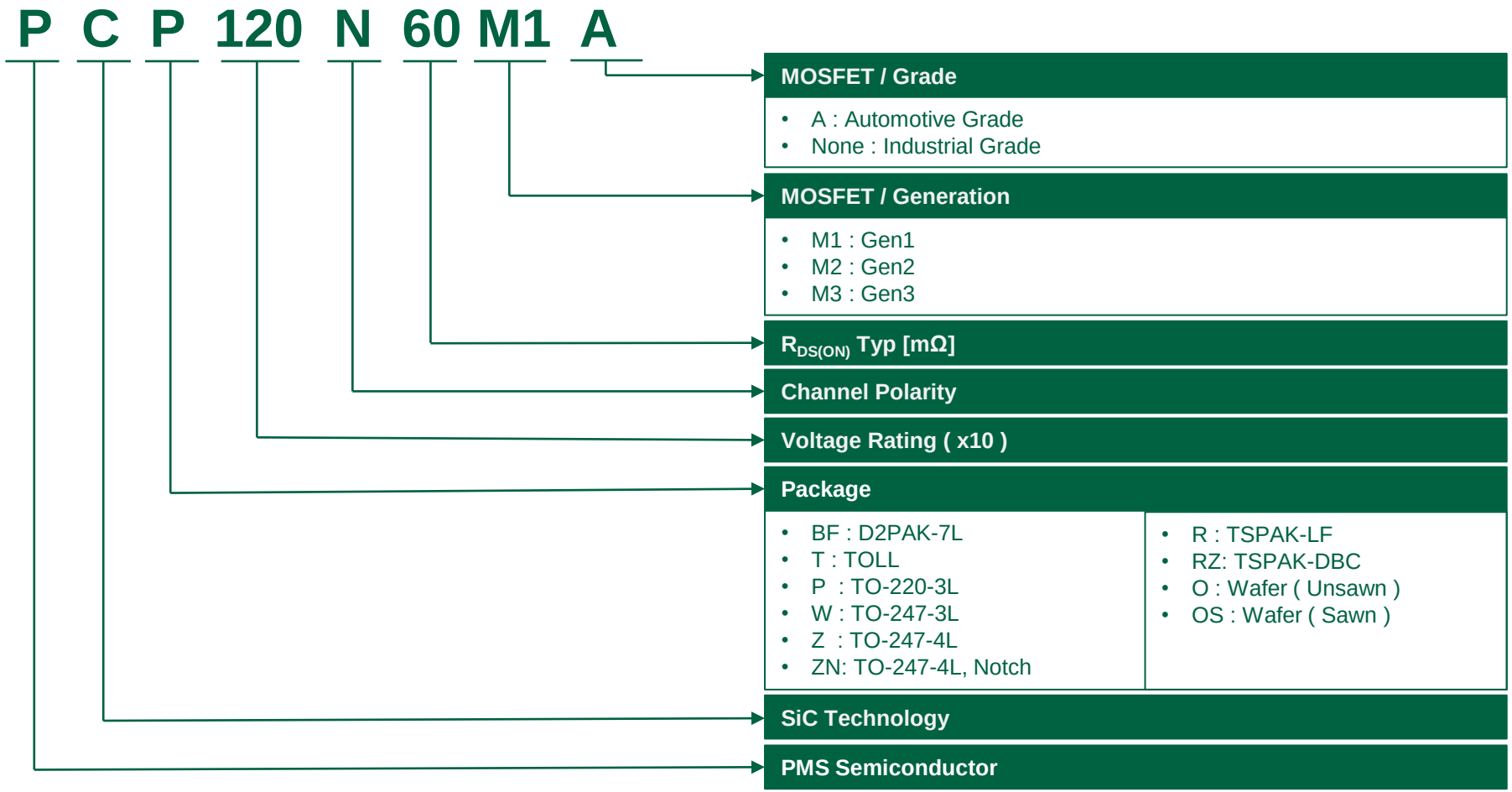

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