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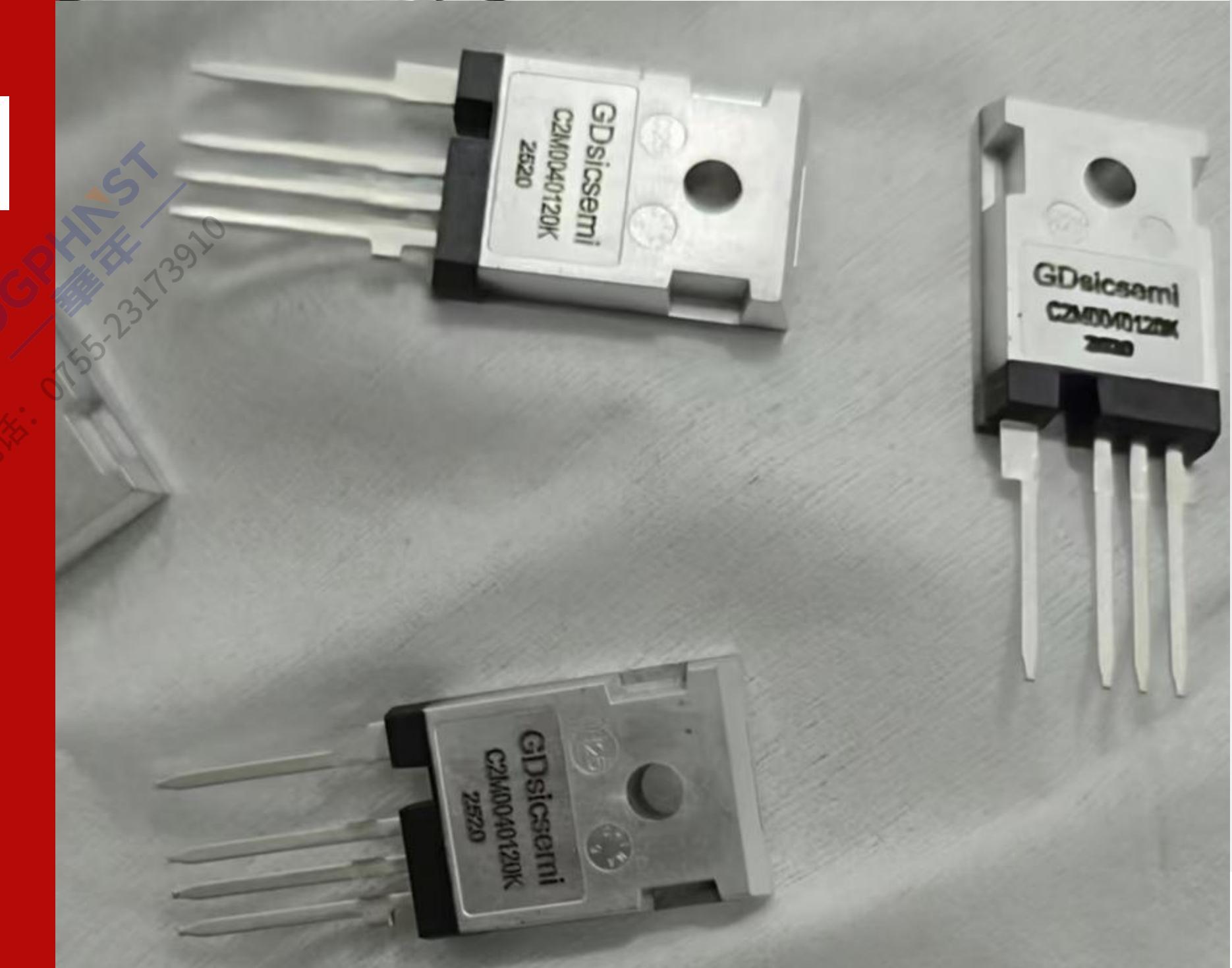
Innovator of

Nano Meter Coating (NMC) Techniques

GD SiC Semi Co.

COMPANY PROFILE

~a Great Deal for the Future!

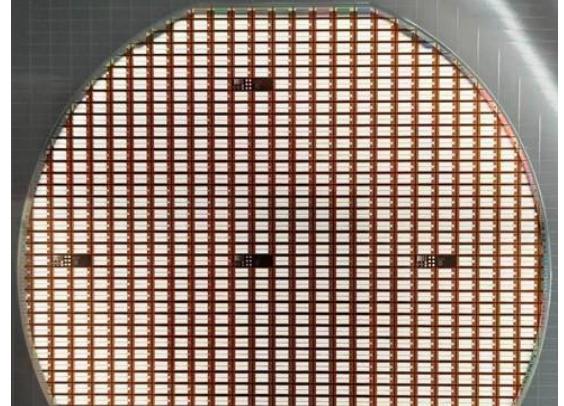


惠州市广大碳基半导体有限公司

Business Scope

01

**SiC Chip Design
Foundry Services**



02

**SiC Chip Assembly/
Testing Services**



03

**SiC Discrete &
Module
Solution**



04

**Nano Meter
Coating Services**



Company Qualifications



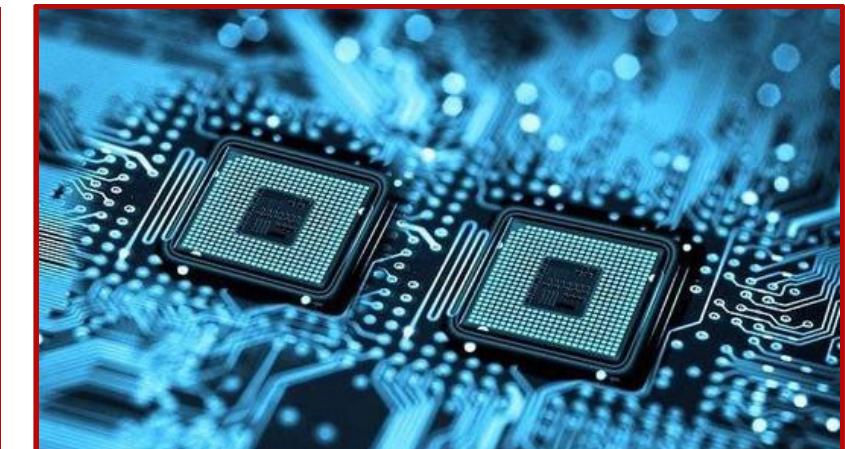
Obtained the
**IATF16949 quality
management system
standard certification**



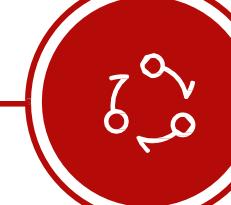
Obtained the
**ISO9001:2015 quality
management system
standard certification**



The component has
passed **100 hours of
reliability certification**



The product is doing
AEC-Q101 certification
and is expected to pass
in March 2024



Certificates

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IATF
16949:2016

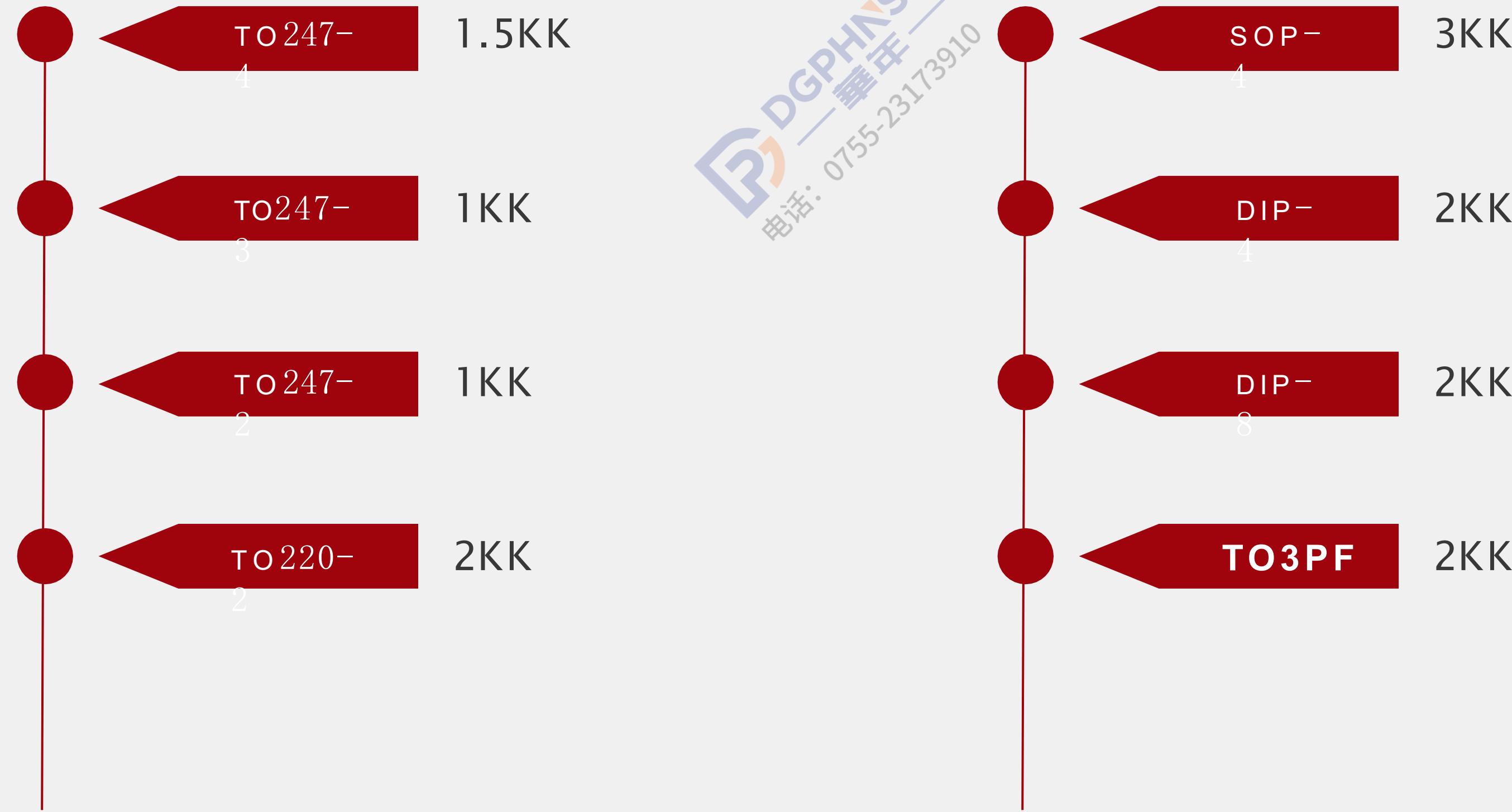
Certificates

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ISO 9001:2015

Production capacity

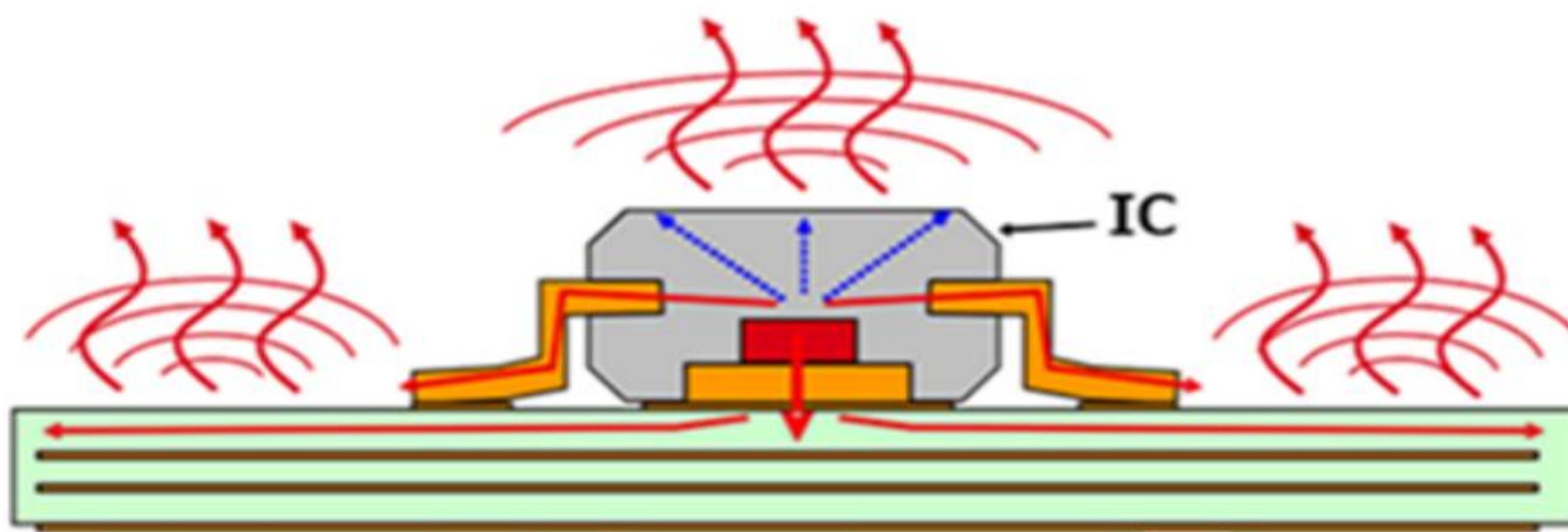


Nano Meter Coating Introduction

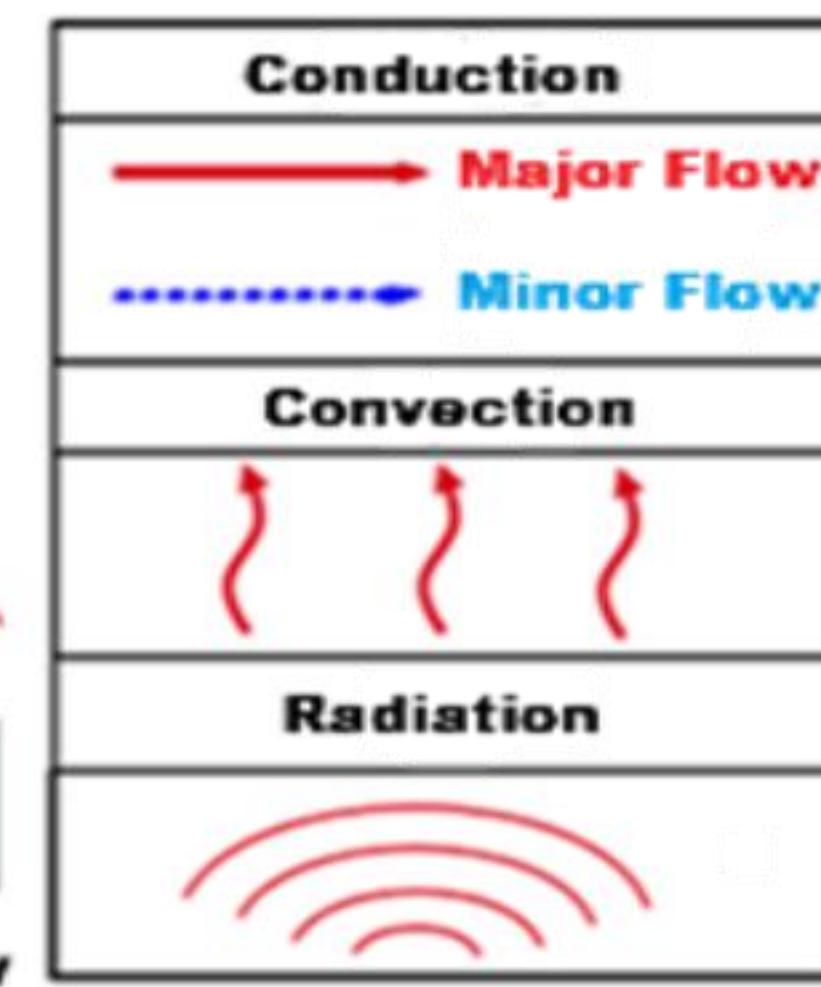
1. Theory

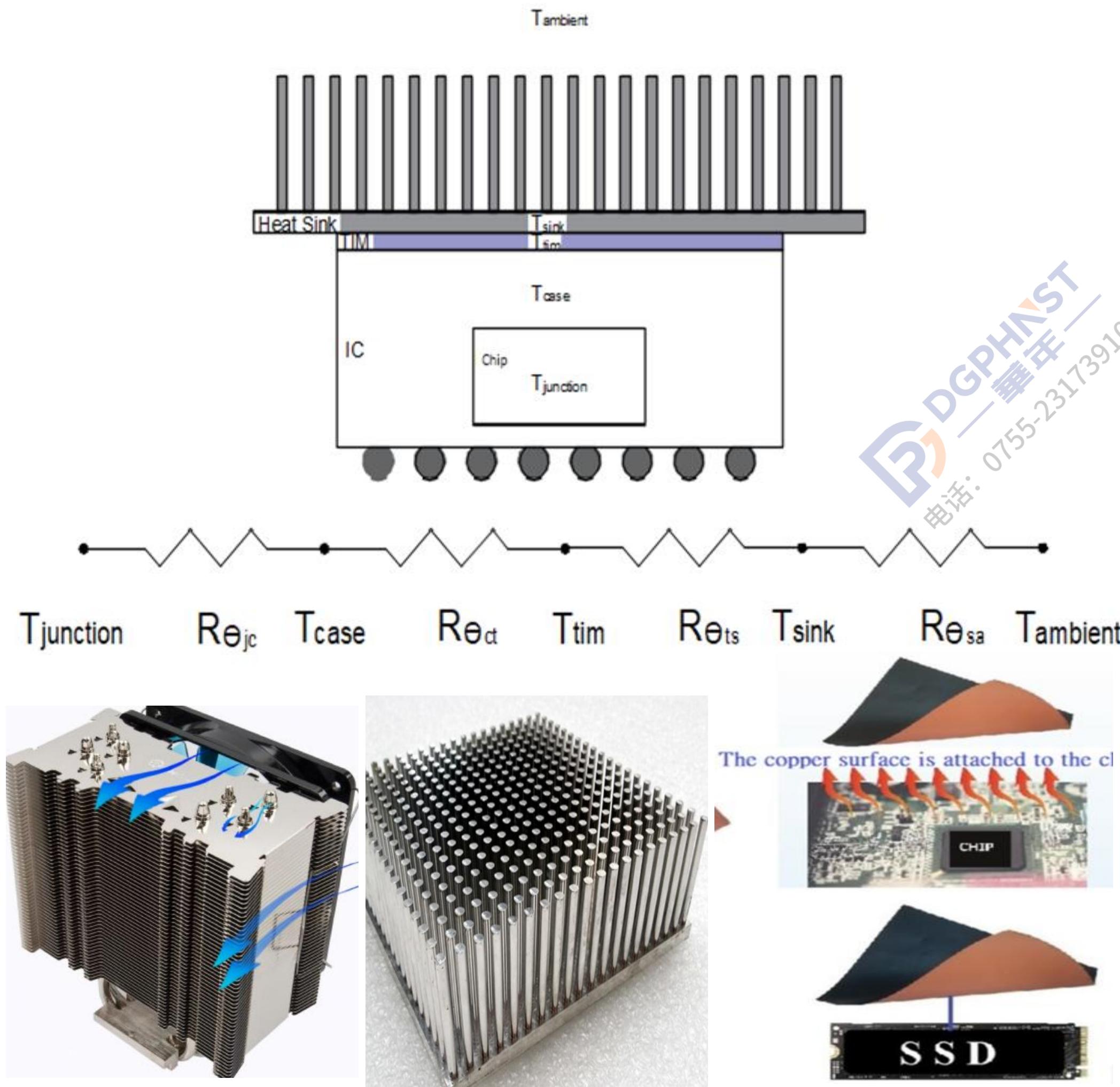
2. Examples

3. Applicable Criteria



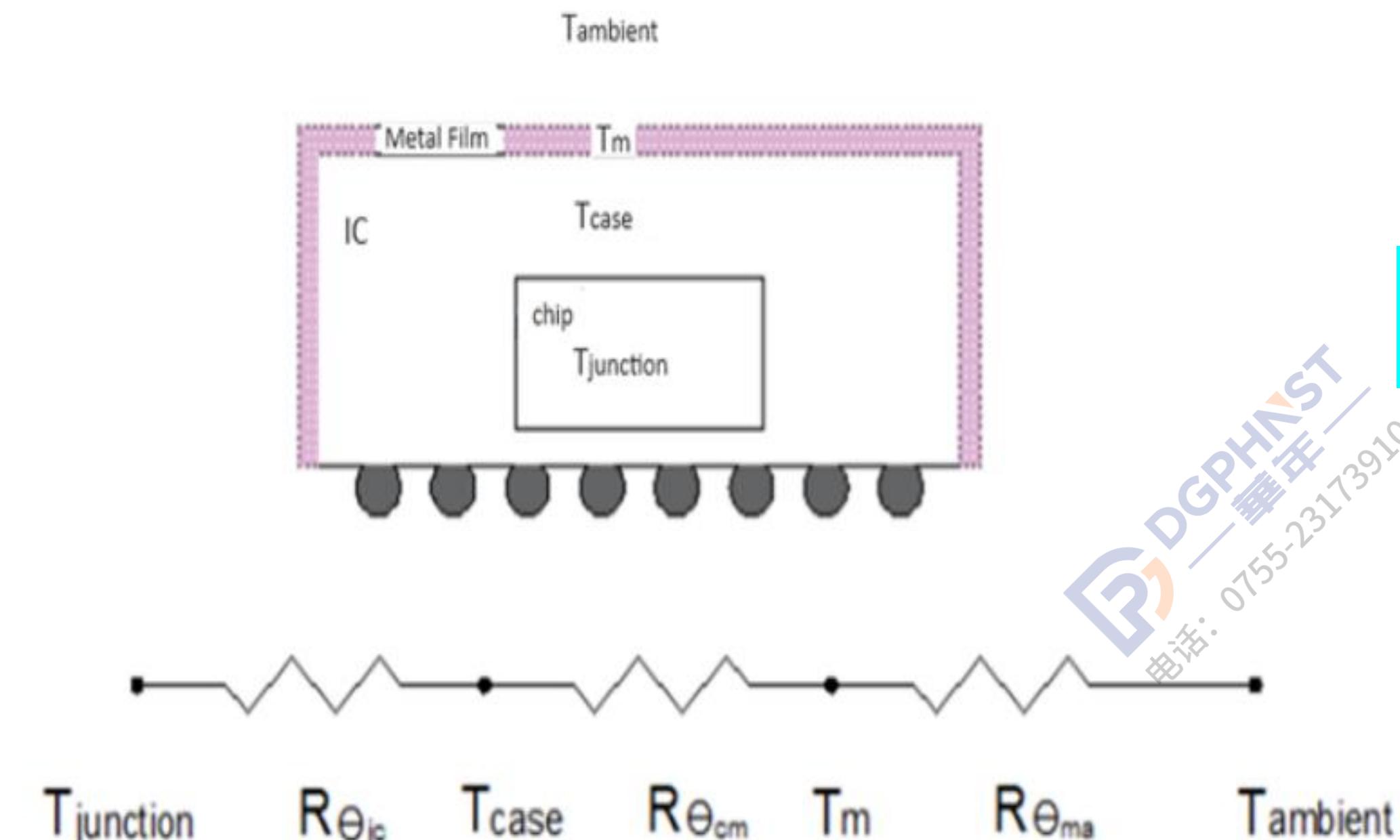
Heat Dissipation flows of Lead Type Devices on FR4 in sectional view





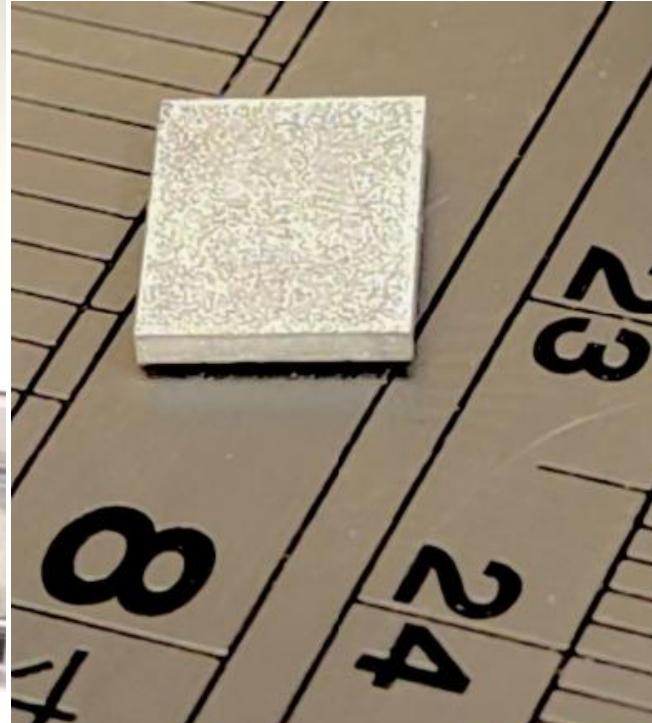
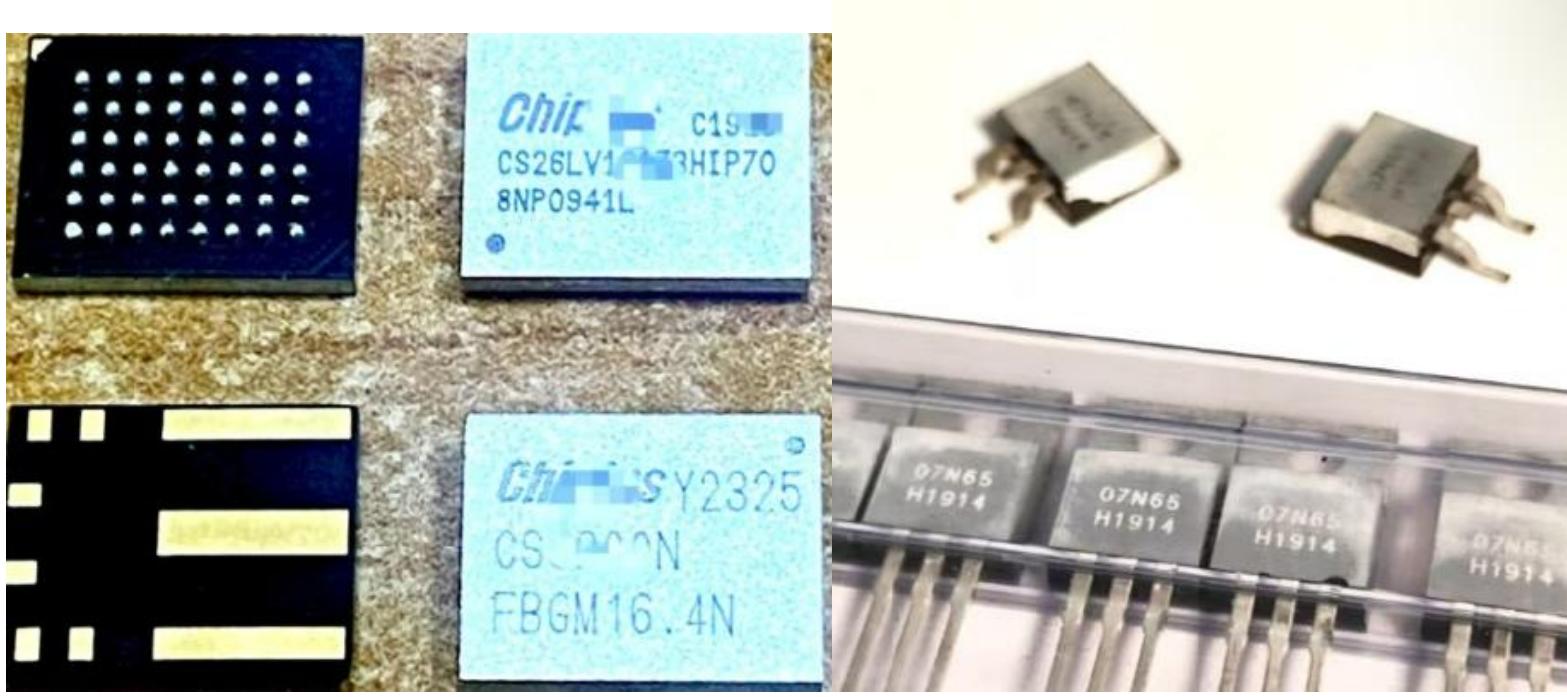
Current solution and hotspots

Traditional method is to use TIM(adhesive) to conduct Heat Sink with huge size and complex procedures to bring heat from chip junction to surface in order to gain heat convection and radiation Effects with extra ventilation with air- cooled or even liquid cooled solution. A migration improved techniques or materials from Nickel films and Graphite layers are all with similar purposes to help sinking heat. But truth is, with TIM(or adhesive) To attach either either metal or graphite would hugely lower down heat conduction, in addition, the Thermal Conductivity and Diffusivity of different material i.e. Nickel and Graphite are relatively much lower with another difficulty to be formed in $< 5\text{um}$ that also prominently decrease heat dissipation both on devices and systems... Furthermore, complex manufacturing accomplished with longer production time and low UPH with higher costs generated.



Now, the revolutionary Nano Meter Coating (NMC) on Chips debuts

With NMC on chips, metal coated on 1 or even 5 surfaces on Any package types of ICs and discrete devices can effectively and efficiently conduct, convect and radiate heat generated inside molding compound to open air with ventilation or even liquid-cooled solution. Comparing with traditional heatsink with adhesive or TIM, only < 200nm metal film is Coated on products with low costs and high productivity to remain almost similar heat dissipation performance without huge size in occupied system. Also, better Anti-EMI ability can be anticipated.



Experiment # 1: M.2 SSD Module Comparison

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Controller (Marvell_SS1331_356- Ball FC_BGA) Average Temp. Comparison

Ambient Temp (°C)	W/ NMC Avg. Temp (°C)	Non- NMC Avg. Temp(°C)	Avg. Δ T (°C) After NMC
0	35.55	46.83	-11.28
25	71.15	78.70	-7.55
70	96.73	102.55	-5.82

Controller (Marvell_SS1331_356- Ball FC_BGA) Peak Temp. Comparison

Ambient Temp (°C)	W/ NMC Peak Temp (°C)	Non- NMC Peak Temp(°C)	Δ T (°C) After NMC
0	73.00	82.50	-9.50
25	111.50	128.00	-16.50
70	119.50	138.50	-19.00

FLASH Memory (512GB 291- Ball FC_BGA) Average Temp. Comparison

Ambient Temp (°C)	W/ NMC Avg. Temp (°C)	Non- NMC Avg. Temp(°C)	Avg. Δ T (°C) After NMC
0	32.80	36.95	-4.15
25	59.20	64.45	-5.25
70	84.63	89.95	-5.32

Experiment #2: Cool MOS & SiC MOSFET w/ or w/o active Ventilation

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PPAK5*6 Cool MOS Coating V.S. Non Coating									TO-247 SiC MOSFET Coating V.S. Non Coating								
w/o Ventilation	IR Thermometer								IR Thermometer								
	Body Diode	IF	VF	Power	T1	T2	Delta T	ΔT	Body Diode	IF	VF	Power	T1	T2	Delta T	ΔT	
	Non Coating	1.799	0.554	0.997	24	85.8	61.8	-15.8	Non Coating	1.5	2.183	3.275	24	105	81	-69.1	
	Coating	1.799	0.555	0.998	24	70	46	Coating	1.5	2.115	3.173	24	35.9	11.9			
	Thermocouple								Thermocouple								
	Body Diode	IF	VF	Power	T1	T2	Delta T	ΔT	Body Diode	IF	VF	Power	T1	T2	Delta T	ΔT	
	Non Coating	1.8	0.554	0.997	24	68	44	-10.1	Non Coating	1.5	2.182	3.273	24	95.2	71.2	-10.3	
	Coating	1.8	0.55	0.99	24	57.9	33.9		Coating	1.5	2.115	3.173	24	84.9	60.9		
With Ventilation	IR Thermometer								IR Thermometer								
	Body Diode	IF	VF	Power	T1	T2	Delta T	ΔT	Body Diode	IF	VF	Power	T1	T2	Delta T	ΔT	
	Non Coating	1.8	0.59	1.062	24	66.2	42.2	-21.6	Non Coating	1.5	2.286	3.429	24	74	50	-43.1	
	Coating	1.8	0.594	1.069	24	44.6	20.6		Coating	1.5	2.142	3.213	24	30.9	6.9		
	Thermocouple								Thermocouple								
	Body Diode	IF	VF	Power	T1	T2	Delta T	ΔT	Body Diode	IF	VF	Power	T1	T2	Delta T	ΔT	
	Non Coating	1.8	0.59	1.062	24	47.8	23.8	-14.1	Non Coating	1.5	2.284	3.426	24	64.9	40.9	-15.2	
	Coating	1.8	0.595	1.071	24	33.7	9.7		Coating	1.5	2.178	3.267	24	49.7	25.7		

Note: T1= Ambient Temp.

Experiment # 3: DDR5 mini DIMM with i7 13xx Series @ 7800 MT/ s

Non- NMC Items	IC # 2	IC # 7	PMIC	SPD Hub Readings	Room Temp	Unit: °C
Dimm #2, Air- cooled	IC # 2	IC # 7	PMIC	SPD Hub Readings	21.3	In comparing Burn- in test of DDR5 accompanied with INTEL CPU i7 Gen 13, Running R/W frequency @ 7800 MT/ S. Ventilation with Air- cooling fan. Per experience, the system reaches heat balance state after 5 min. We noticed some clues that DIMM with NMC preforms
Stand- by Temp.	21.9	22.1	22.3	22		
3 Min. Burn- in	46.2	47.1	39.9	53		
5 Min. Burn- in	52.8	51.3	40.6	55		
Peak Temp.	53.3	49.6	41.2	56		
Off after 1 Min.	38	39.4	36.1	41		
Off after 3 Min.	27	28.7	28.6	31		

NMC Items	IC # 2	IC # 7	PMIC	SPD Hub Readings	Room Temp
Dimm #2, Air- cooled	IC # 2	IC # 7	PMIC	SPD Hub Readings	21.6
Stand- by Temp.	22.1	23.6	21.7	23	
3 Min. Burn- in	40.0	39.9	33.2	41	
5 Min. Burn- in	40.1	40.0	33.1	40	
Peak Temp.	41.6	41.2	33.6	41	
Off after 1 Min.	32.9	33.5	29.5	33	
Off after 3 Min.	22.0	22.5	22.3	23	

1. Shorter time to achieve heat balance with red circles within maybe 3 mins. and

2. 11 °C cooler on DDR Chips, and 6 °C on PMICs

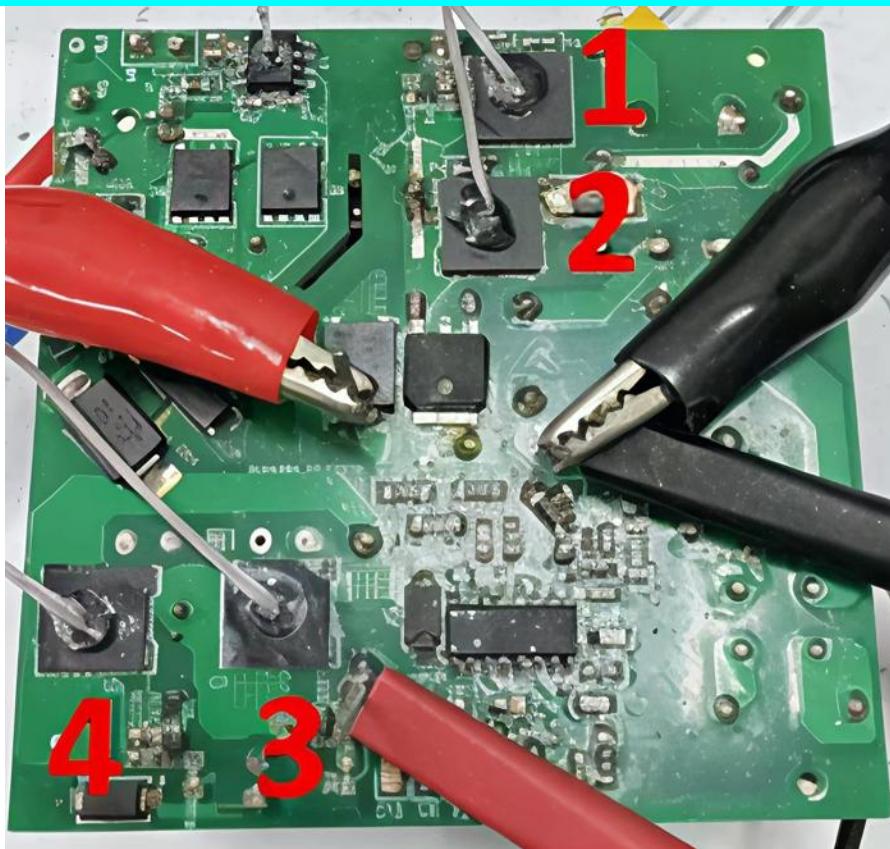
3. Quicker heat dissipation after system being turned- off

To conclude, NMC might help enhancing AC parameters on DDR Chips and system stability affiliated to cooler PMICs. Also, Overclocking with CPU might be much easier and sustain longer when boosting.

Experiment # 4: DFN Gan HEMT in open frame themal impedance test

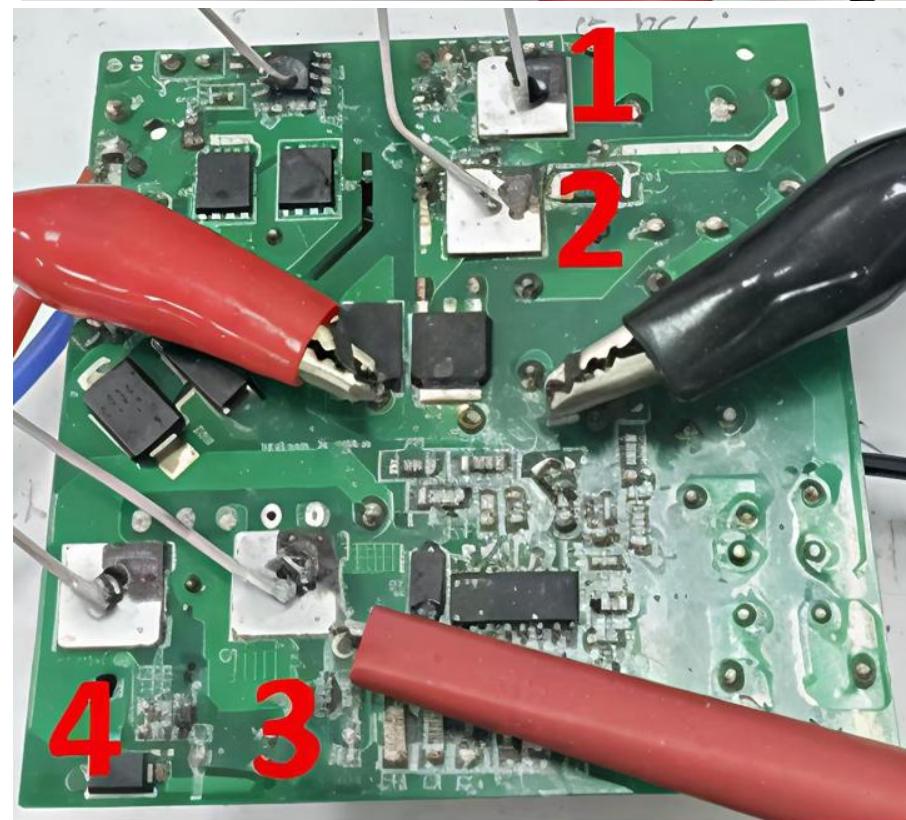
NON-NMC

Vin: 115 VAC
Output: 5A/ 20V

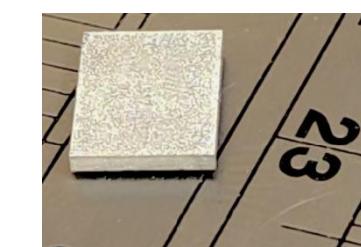


After NMC

Vin: 115VAC
Output: 5A/ 20V



Gan HEMT P/N: MGZ18N65, 130mΩ/ 650V



100W Full Load Burn- in for 1 Min.

Unit: °C

	w/o NMC	with NMC	Δ T
CH1	61.7	66.4	4.7
CH2	65.1	69.2	4.1
CH3	53.6	57.0	3.4
CH4	52.4	56.2	3.8

100W Full Load Burn- in for 5 Min.

Unit: °C

	w/o NMC	with NMC	Δ T
CH1	78.8	69.4	-9.4
CH2	81.6	71.9	-9.7
CH3	71.7	62.6	-9.1
CH4	72.4	63.2	-9.2

Ta= 29.8 °C

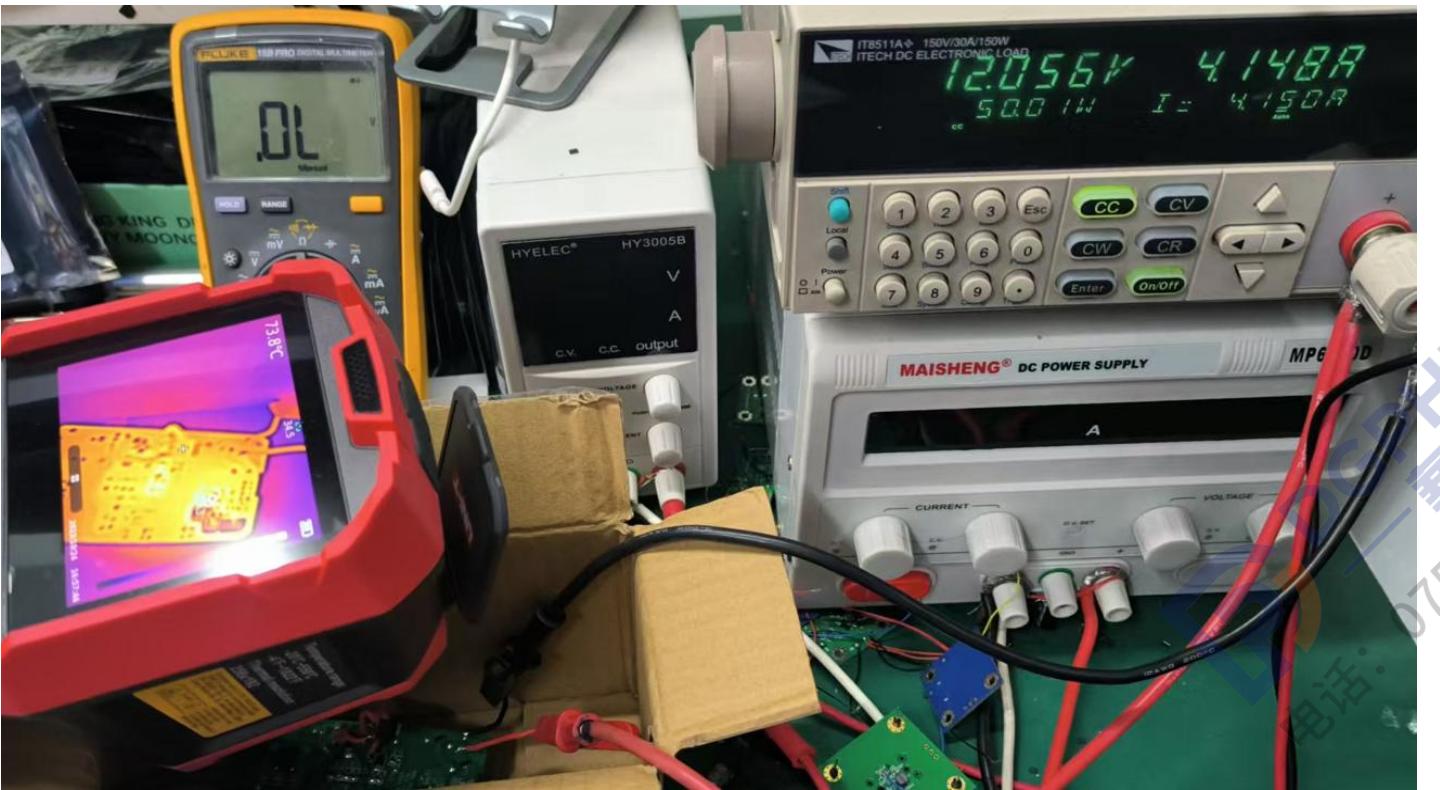
Due to thin DFN package and high duty cycle and operating frequency, at the very early stage **before thermal balance**, the heat generated by the rapid rising junction Temp. is conducted through molding compound with high thermal impedance to the surface with ultra-thin **aluminum film (< 150nm)**, the thermal impedance **sharply** declines to almost **Zero**, GaN HEMT with NMC rapidly conducts and convets heat through metal films compared with non-Coating FETs, this reflects on around **4°C higher** surface Temp. in early stages.

After reaching **thermal balance** in open frame without active ventilation, **NMC HEMTs are > 9 °C cooler than non NMC ones.**

Experiment # 5: TO-252 SiC MOSFET on 50W Charger in enclosed space

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NON-NMC
Vin: 225 Vac
Output: 4.15A/ 12V



50W Full Load Burn- in for 15 Min.
@ > 70°C

T_a = 26.8 °C

After NMC
Vin: 225 VAC
Output: 4.15A/ 12V



50W Full Load Burn- in for 15 Min.
@ < 45 °C

In this significant experiment imitating confined switching adaptor/ charger with effective output of 50W(12V/ 4.15A) under restrained space of sample box, reaching out thoroughly thermal balance after 15 min. of burn- in, Engineer opened up sample box and immediately measured SiC MOSFETs w/ and W/O NMC to compare top side Temp. of each FET. We therefore conclude accordingly the prominent Temp. gap between FETs with and without NMC to be outrageously > 25 °C with such a small output power device with no ventilation assisted.

Another stunning rapid heat dissipation evidence coming from Zero Thermal Impedance of NMC is remarked that during the sudden exposure to open air, FETs with NMC performed sharply temp. decline comparing with non NMC FETs. The NMC FETs Temp. drop > 15 °C within 10 sec. when being encountered fresh air.

SiC MOSFET P/N: SMC300N065DAS, 260mΩ/ 650V

TCT Verification Report: Thermal Shock Resistance of NMC Nanocoating



Integrated Service Technology Inc.
Reliability & Failure Analysis Engineering Group
No.10-1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan (R.O.C.).
Tel: 886-3-579-9909, Fax: 886-3-563-4868
<http://www.istgroup.com>

Report No. : HS2507280123A
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2. TEMPERATURE CYCLING TEST

2.1 TEST EQUIPMENT

Test Equipment	Serial Number	Calibration Expiration
KSON TSC-E5T-150	A0886	AUG 19, 2025

2.2 LABORATORY AMBIENCE CONDITION

Temperature : $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$

Relative humidity : $55\% \pm 15\%$ (RH)

2.3 REFERENCE DOCUMENT

The test is based on customer specification. (as 2.4 test condition)

2.4 TEST CONDITION

Units are non-operating.

Temperature range : -40°C to $+85^{\circ}\text{C}$

Dwell time : 10 minutes

Ramp up time : 40 minutes

Ramp down time : 90 minutes

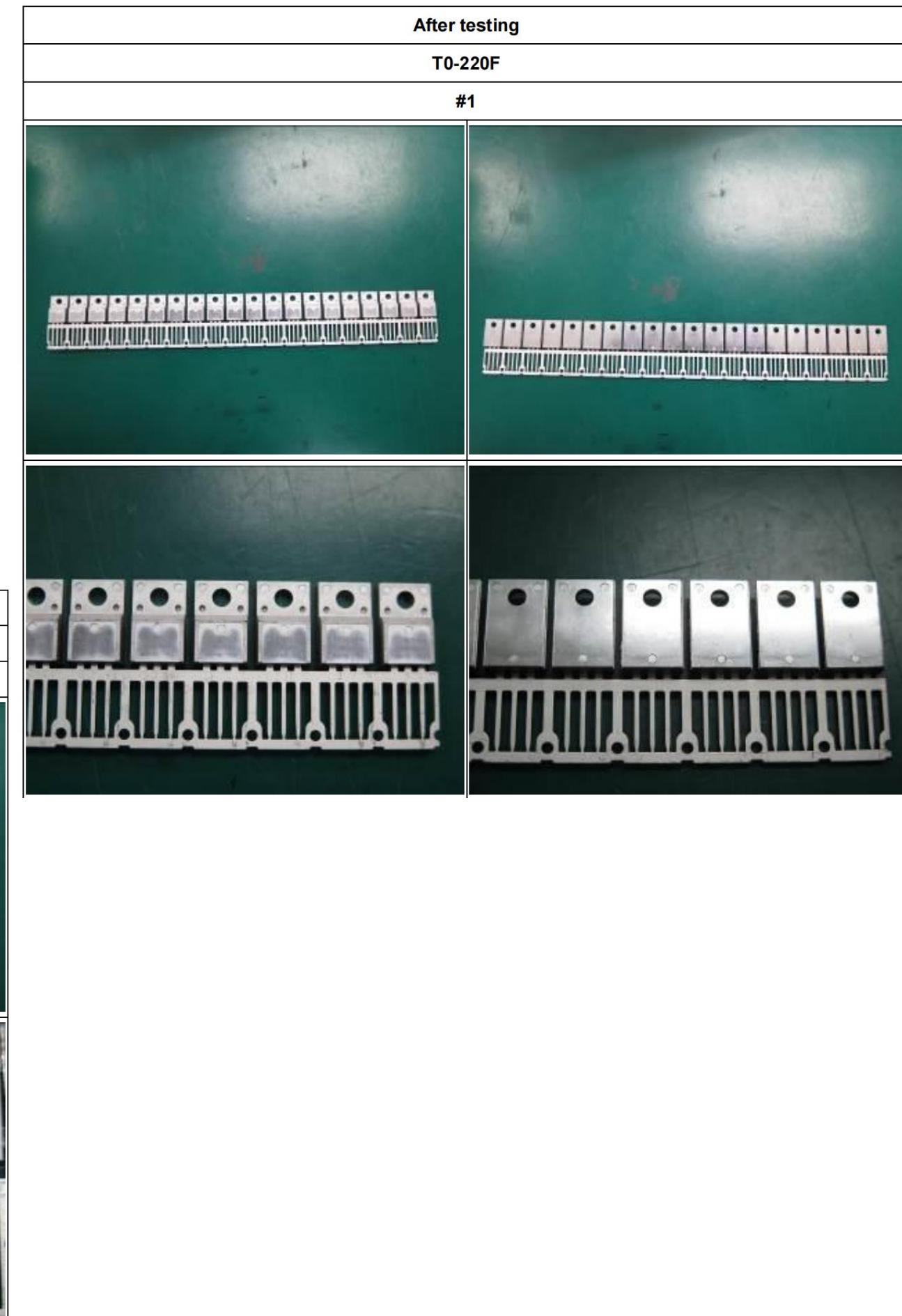
Cycle time : 150 minutes

Number of cycles : 200 cycles

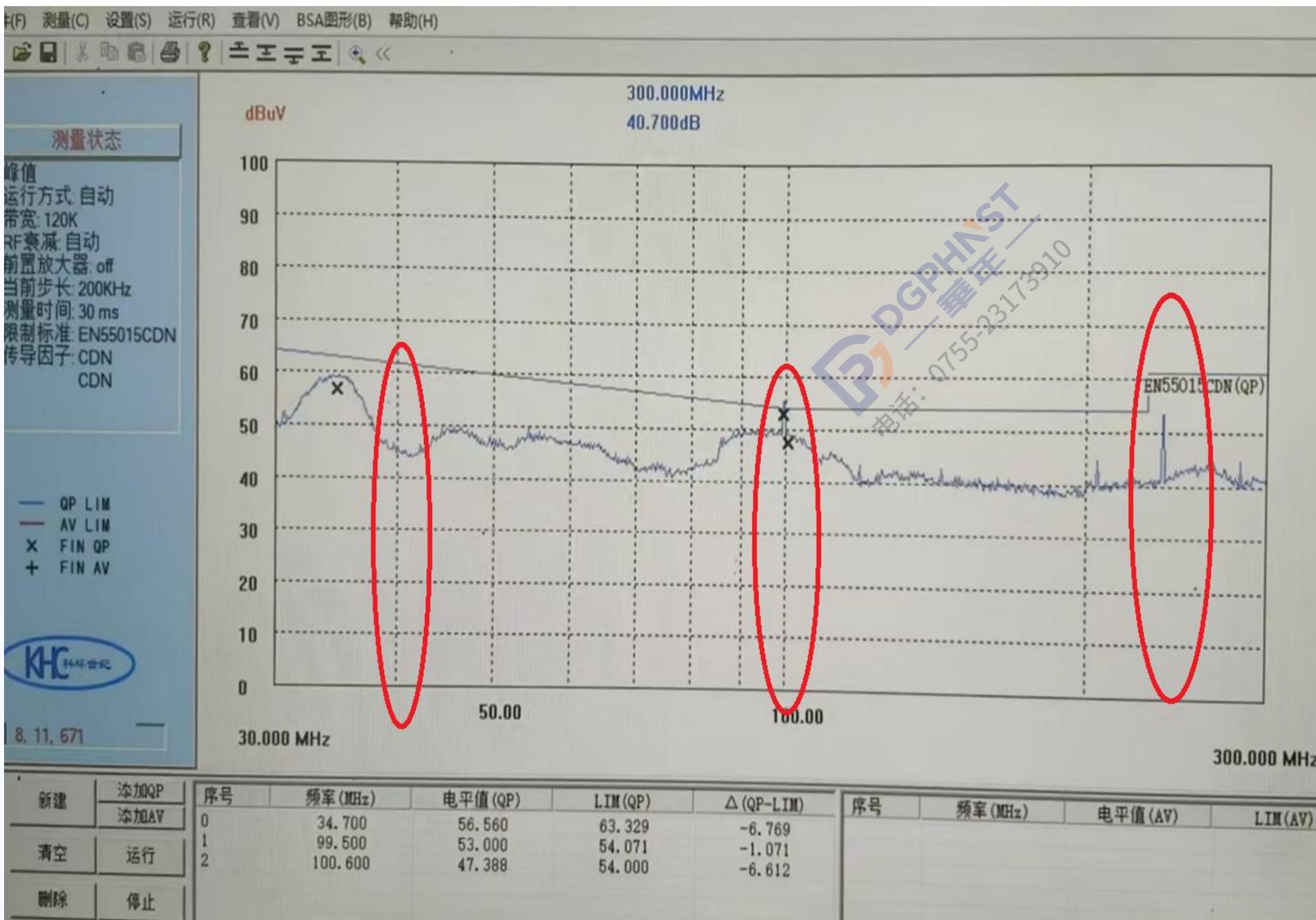
2.5 SUMMARY OF TEST

Functional check is performed by customer without 3rd party lab (iST) person participated.

After testing, visual inspection of sample surfaces showed no abnormality.



NMC Nanocoating Radiated Emissions (RE) Test Report



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Customer tests confirm that devices coated with NMC film demonstrate exceptional EMI radiation suppression in the challenging 30MHz~100MHz frequency band, achieving compliance with substantial margin.

Conduction Advantages via Third-Generation Materials

In conducted EMI scenarios, leveraging the inherent physical advantages of third-generation semiconductor materials:

- Zero parasitic oscillation
- Ultra-low output capacitance (C_{oss}) and reverse transfer capacitance (C_{rss})
- Faster switching characteristics (high di/dt during turn-on, steep dv/dt during turn-off)
- Low gate charge (Q_g)
- Absence of reverse recovery charge (Q_{rr})

These properties significantly reduce the need for magnetic filtering components on the PCB, lowering both BOM costs and layout space requirements.



DGPHMST
电话: 055-23173810

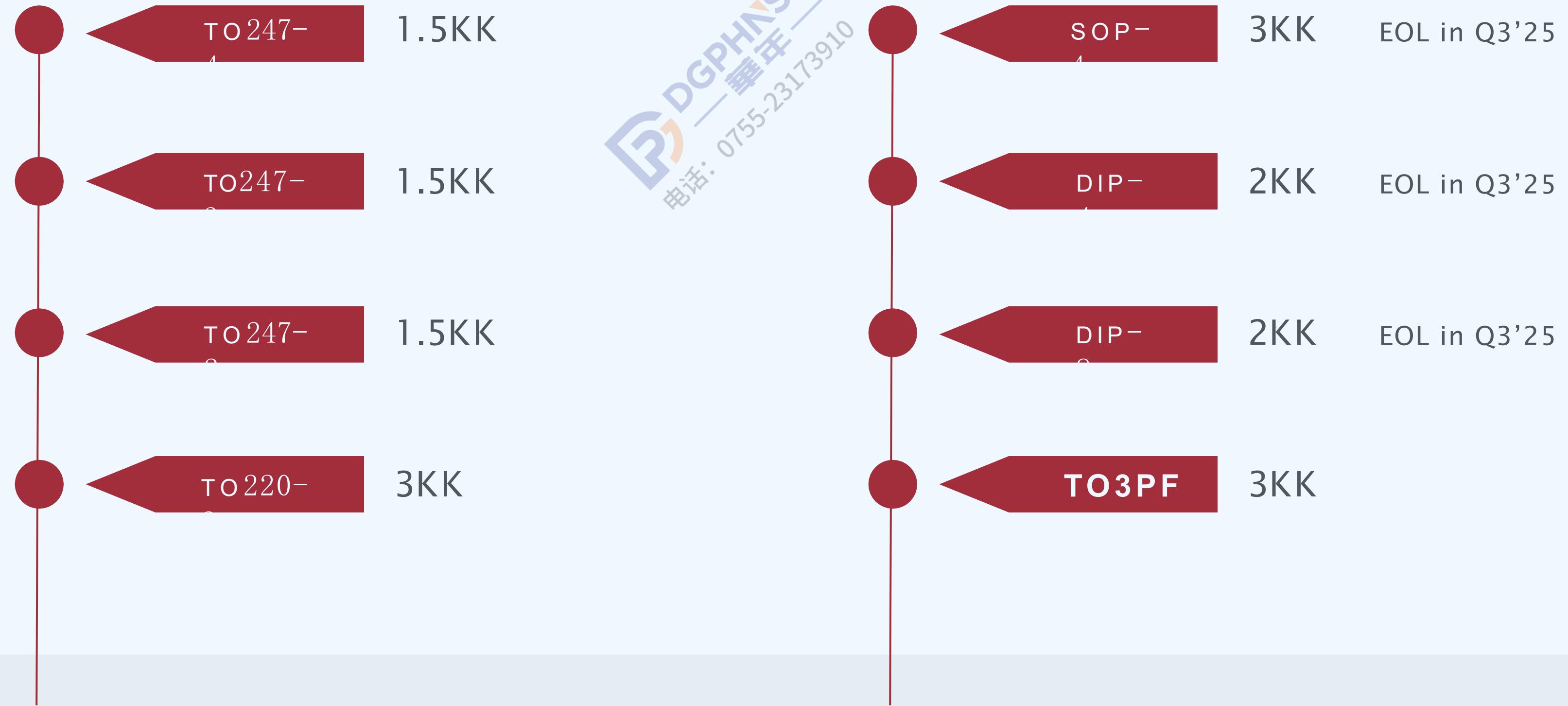
Product List

* **NMC SiC Schottky Barrier Dodes**
NMC 碳化硅肖特基二极管

* **NMC SiC MOSFET**
NMC 碳化硅场效应MOS管

* **Nano Meter Coating Services**
NMC 纳米金属镀层服务

月量产产能



- SiC SBD – A

SiC Schottky diodes	Voltage	Current	VF	Packaging
C3D10065A	650V	10A	1.4V	TO220-2
C3D20065A	650V	20A	1.4V	TO220-2
C3D20065D	650V	20A	1.4V	TO247-3
C6D06120A	1200V	6A	1.27V	TO220-2
C4D05120A	1200V	5A	1.4V	TO220-2
C4D08120A	1200V	8A	1.4V	TO220-2
C4D10120A	1200V	10A	1.35V	TO220-2
C4D12120A	1200V	12A	1.35V	TO220-2
C6D16120A	1200V	16A	1.27V	TO220-2
C6D15120A	1200V	15A	1.27V	TO220-2
C4D20120A	1200V	20A	1.4V	TO220-2
C3D10170A	1700V	10A	1.7V	TO220-2

SiC SBD - B

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SiC Schottky diodes	Voltage	Current	VF	Packaging	
C3D30065D	650V	30A	1.4V	TO247-3	
C4D10120D	1200V	10A	1.4V	TO247-3	
C4D15120D	1200V	15A	1.4V	TO247-3	
C4D20120DSOI	1200V	20A	1.4V	TO247-3	Ceramic isolation
C4D20120D	1200V	20A	1.4V	TO247-3	
C4D30120DSOI	1200V	30A	1.4V	TO247-3	Ceramic isolation
C4D30120D	1200V	30A	1.4V	TO247-3	
C4D40120DSOI	1200V	40A	1.4V	TO247-3	Ceramic isolation
C4D40120D	1200V	40A	1.4V	TO247-3	
C4D60120D	1200V	60A	1.4V	TO247-3	
C4D10120H	1200V	10A	1.4V	TO247-2	
C4D15120H	1200V	15A	1.4V	TO247-2	

* 内陶瓷绝缘

SiC SBD - C

SiC Schottky diodes	Voltage	Current	VF	Packaging	
C4D20120H	1200V	20A	1.4V	TO247-2	
C4D30120H	1200V	30A	1.4V	TO247-2	
C4D40120H	1200V	40A	1.4V	TO247-2	
C4D50120H	1200V	50A	1.4V	TO247-2	
C4D60120H	1200V	60A	1.4V	TO247-2	
C3D10170H	1700V	10A	1.4V	TO247-2	
C5D10200H	2000V	10A	1.4V	TO247-2	
C5D20200H	2000V	20A	1.4V	TO247-2	
C5D20170H	1700V	20A	1.4V	TO247-2	
C3D25170H	1700V	25A	1.4V	TO247-2	
C3D50170H	1700V	50A	1.4V	TO247-2	

电话: 0755-23173910
DGP
HAST

SiCMOSFET - A

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SiC MOSFET	Vgs	Id	Rds(on)	Packaging
C2M1000065E	650V	4A	1000mΩ	TO252
C3M0380065F	650V	11A	380mΩ	TO252
C3M0380065N	650V	11A	380mΩ	TO220F
C3M0380065P	650V	11A	380mΩ	PDFN5*6
C3M0260065N	650V	14A	260mΩ	TO220F
C3M0260065E	650V	14A	260mΩ	TO220F
C3M0260065	650V	14A	260mΩ	PDFN5*6
C3M0180065M	650V	20A	380mΩ	TO252
C3M0180065F	650V	20A	380mΩ	TO220F
C3M0180065N	650V	20A	380mΩ	TO263-3
C3M0180065A	650V	20A	380mΩ	TO220
C3M0160065D	650V	23A	180mΩ	TO247-3
C3M0160065K	650V	23A	160mΩ	TO247-4
C3M0060065D	650V	39A	60mΩ	TO247-3
C3M0060065K	650V	39A	60mΩ	TO247-4
C3M0060065K	650V	39A	60mΩ	TOLL
C2M0040065K	650V	52A	40mΩ	TO247-4
C2M0040065D	650V	52A	40mΩ	TO247-3
C2M0020065K	650V	92A	20mΩ	TO247-4
C3M0015065K	650V	120A	15mΩ	TO247-4
C3M0015065D	650V	120A	15mΩ	TO247-3
C2M0010075D	750V	120A	10mΩ	TO247-3
C2M0010075K	750V	120A	10mΩ	TO247-4
C2M0010075T	750V	120A	10mΩ	TOLL
C3M0065090D	900V	36A	65mΩ	TO247-3

SiCMOSFET - B

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Part Number	Vgs	Id	Rds(on)	Packaging
C2M0011090K	900V	175A	11mΩ	TO247-4
C3M0065100K	1000V	36A	65mΩ	TO247-4
C2M0160120D	1200V	19A	160mΩ	TO247-3
C2M0160120K	1200V	19A	160mΩ	TO247-4
C2M0080120D	1200V	36A	80mΩ	TO247-3
C2M0080120K	1200V	36A	80mΩ	TO247-3
C2M0040120D	1200V	60A	40mΩ	TO247-3
C2M0040120K	1200V	60A	40mΩ	TO247-4
C3M0016120DiSO	1200V	120A	16mΩ	TO247-3
C3M0016120D	1200V	120A	16mΩ	TO247-3
C3M0016120K	1200V	120A	16mΩ	TO247-4
C2M0016120DiSO	1200V	120A	16mΩ	TO247-3
C2M0016120D	1200V	120A	16mΩ	TO247-3
C2M0016120K	1200V	120A	16mΩ	TO247-4
C3M0016120KiSO	1200V	120A	16mΩ	TO247-4
C2M0013120DiSO	1200V	157A	13mΩ	TO247-3
C2M0013120D	1200V	157A	13mΩ	TO247-3
C2M0013120KiSO	1200V	165A	13mΩ	TO247-4
C2M0013120K	1200V	165A	13mΩ	TO247-4
C3M0021120K	1200V	81A	21mΩ	TO247-4
C3M0021120D	1200V	81A	21mΩ	TO247-3
C2M0025120D	1200V	80A	25mΩ	TO247-3
C2M0025120K	1200V	80A	25mΩ	TO247-4
C2M0025120DiSO	1200V	80A	25mΩ	TO247-3
C2M0025120KiSO	1200V	80A	25mΩ	TO247-4
C3M0032120K	1200V	63A	32mΩ	TO247-4
C3M0032120KiSO	1200V	63A	32mΩ	TO247-4
C3M0032120D	1200V	63A	32mΩ	TO247-3

Part Number	Vgs	Id	Rds(on)	Packaging
C3M0032120DiSO	1200V	63A	32mΩ	TO247-3
C2M0035120D	1200V	55A	35mΩ	TO247-3
C3M0075120DiSO	1200V	32A	75mΩ	TO247-3
C3M0075120KiSO	1200V	32A	75mΩ	TO247-4
C3M0075120D	1200V	32A	75mΩ	TO247-3
C3M0075120K	1200V	32A	75mΩ	TO247-4
C3M0075120J	1200V	32A	75mΩ	TO263-7
GD3N150PF	1500V	3A	800mΩ	TO3PF-3
GD3N150DF	1500V	3A	800mΩ	TO252-3
GD4N150PF	1500V	4A	650mΩ	TO3PF-3
GD4N150DF	1500V	4A	650mΩ	TO252-3
GD9N150DF	1500V	9A	450mΩ	TO3PF-3
GD15N150PF	1500V	15A	160mΩ	TO3PF-3
C2M1000150D	1500V	3A	1000mΩ	TO247-3
C2M1200120L	1500V	2.5A	1200mΩ	TO268-2L
C2M1000170D	1700V	5A	1000mΩ	TO247-3
C2M1000170K	1700V	5A	1000mΩ	TO247-4
C2M1000170J	1700V	5A	1000mΩ	TO263-7
C2M0500170D	1700V	8A	500mΩ	TO247-3
C2M0040170D	1700V	67A	40mΩ	TO247-3
C2M0045170D	1700V	72A	45mΩ	TO247-3
C2M0045170DiSO	1700V	72A	45mΩ	TO247-3
C2M0045170P	1700V	72A	45mΩ	TO247-4
C2M0045170PiSO	1700V	72A	45mΩ	TO247-4
C2M0028170D	1700V	82A	28mΩ	TO247-3
C2M0028170P	1700V	82A	28mΩ	TO247-4
C2M0028170DiSO	1700V	82A	28mΩ	TO247-3
C2M0028170KiSO	1700V	82A	28mΩ	TO247-4
C2M5000330D	3300V	100MA	5000mΩ	TO247-3

SiCMOSFET - D

Part Number	Vgs	Id	Rds(on)	Packaging
C2M2000330D	3300V	1A	2000mΩ	TO3PF-3
C2M1000330D	3300V	8A	900mΩ	TO247-3
C2M1000330DiSO	3300V	8A	900mΩ	TO247-3
*C2M0050300K	3300V		50mΩ	TO247-4
*C2M0050330D	3300V		50mΩ	TO247-3
C2M0180650DiSOPLUS	6500V	20A	180mΩ	TO247-3PLUS

*: Suitable for AED



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