Electronics for the Future

No.**2224001**

SiC wafers change of chips within SiC 3G Module (4→6inch) PCN Details

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ROHM Co., Ltd.
SiC Device Division

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1. Background of the change

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【SiC wafers change of chips within SiC 3G Module (4→6inch)】

In order to increase and stabilize our supply volumes, we are planning to introduce larger wafer sizes, 6inch instead of 4inch.
We kindly ask for your understanding and cooperation to approve this change notification.

The wafer and assembly manufacturing plants of the new products have proven track records with SiC 4GMOSFET and other Si products.

For the 4inch line, production is scheduled to end after the 6inch line transition.

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2. Summary of this approval

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Scope	SiC module BSM180D12P3C007, BSM180C12P3C201 BSM300C12P3E201, BSM300C12P3E301
Content	Regarding the above products, we will change the wafer manufacturing process from 4inch to 6inch. The specifications and performances of the final product, including electrical characteristics and reliability, are unchanged.
Reason	1. To increase production volume 2. End of production of 4inch SiC wafers due to the transition to 6inch SiC wafers
Verification	1. Verification of changes between current products and new products. 2. Comparison of specifications and performance between current products and new products.
Schedule	From 1st Oct 2024, after customer approval. Please respond within half year after receipt of the application.

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3.Summary of changes

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Fabrication (Wafer manufacturing)

	Current	After change
Factory	ROHM Apollo co., ltd. (Chikugo plant)	LAPIS co., ltd. (Miyazaki plant)
SiC Wafers	4 inch	6 inch

Specification

	Current	After change
Datasheet (Electrical Characteristics)	No changed	
Reliability Test	OK	OK

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4. Affected Products

Current PNs	After change (No change)
BSM180D12P3C007	BSM180D12P3C007
BSM180C12P3C202	BSM180C12P3C202
BSM300C12P3E201	BSM300C12P3E201
BSM300C12P3E301	BSM300C12P3E301

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5. After diameter change

5-1.List of changes

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■ List of changes from conventional products

Item	Current products	New products	Purpose of change
Wafer size	4inch	6inch	improve productivity
Top metal	Al	AlCu	improve productivity
Back side metal	Ti-Ni(0.6μm)-Au(70nm)-Ag(0.3μm)	Ti-Ni(1.2μm)-Au(70nm)-Ag(0.3μm)	improve productivity
Passivation	Polybenzoxazole (PBO)	SiN/PBO	improve reliability

For 6inch products, the top metal material, the back metal thickness and passivation structure will change.

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5-2.5M Change Point Verification

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		Target	Production plant: current products	Production plant: new products	Concern	Verification	Decision
			4inch	6inch			
Changes at **5M** level	Man	Operator	Adoption of licensing system	Adoption of licensing system	-	-	No problem
	Machine	Production equipment	6inch wafer-compatible equipment (4inch combined use)	6inch wafer-compatible equipment (4inch combined use)	Difference in specification	Process change point verification Electrical characteristics Workmanship confirmation Reliability	No problem
	Material*	Wafer	4inch wafer	6inch wafer	Difference in specification, Reliability		
		Passivation	Polybenzoxazole	SiN/Polybenzoxazole			
		Top metal	Al	AlCu			
	Method	Job method	6inch wafer process line (4inch combined use)	6inch wafer process line (4inch combined use)	Difference in specification		
	Measurement	After wafer process measurement	6inch wafer-compatible equipment (4inch combined use)	6inch wafer-compatible equipment (4inch combined use)	-	-	No problem

*Materials are mentioned only those that have changed.

In accordance with the 5M change point, we confirmed that there are no problems.

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5-3. Wafer Process Change Point Verification

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No	Process operation	Differences and concerns	Validation results	Judgement ○ or ×
1	Fab Input	Difference in inch diameter	No difference in specification No failure in reliability test	○
2	Cleaning	Nothing	No difference in specification No failure in reliability test	○
3	Oxidation	Nothing	No difference in specification No failure in reliability test	○
4	Photolithography (resist coating)	Nothing	No difference in specification No failure in reliability test	○
5	Photolithography (exposure)	Nothing	No difference in specification No failure in reliability test	○
6	Photolithography (resist development)	Nothing	No difference in specification No failure in reliability test	○
7	Wet Etching	Nothing	No difference in specification No failure in reliability test	○
8	Resist remove (ashing)	Nothing	No difference in specification No failure in reliability test	○
9	Implantation	Nothing	No difference in specification No failure in reliability test	○
10	Activation annealing	Nothing	No difference in specification No failure in reliability test	○

We have confirmed that there are no problem with all the changes in each process.

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5-3. Wafer Process Change Point Verification

No	Process operation	Differences and concerns	Validation results	Judgement ○ or ×
11	Formation of poly-Si	Nothing	No difference in specification No failure in reliability test	○
12	Poly-Si Etching (dry)	Nothing	No difference in specification No failure in reliability test	○
13	Deposition inter-layer	Nothing	No difference in specification No failure in reliability test	○
14	SiO2 interlayer Etching(dry)	Nothing	No difference in specification No failure in reliability test	○
15	Forming surface electrode	Use different materials Reliability	No difference in specification No failure in reliability test	○
16	Metal Etching (Wet)	Nothing	No difference in specification No failure in reliability test	○
17	Metal Etching (Dry)	Nothing	No difference in specification No failure in reliability test	○
18	Forming passivation layer	Layer structure change Reliability	No difference in specification No failure in reliability test	○
19	Back Side Grinding	New process	No difference in Wafer thickness No difference in specification No failure in reliability test	○
20	Forming backside electrode	Layer thickness change Reliability	No difference in specification No failure in reliability test	○
21	Electrical characteristic test	Nothing	No difference in specification	○
22	Dicing	Nothing	No difference in specification	○

We have confirmed that there are no problems with all the changes in each process.

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6. Evaluation results

6-1. Electrical characteristics evaluation Summary

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	4inch 3GMOSFET	6inch 3GMOSFET
Static Characteristics (I_{DSS},I_{GSS},V_{th},V_{SD},R_{on})	Same Value	
Dynamic Characteristics (C_{iss},C_{oss},C_{rss},Q_{g},Q_{gs},Q_{gd})	Same Value	
Switching Characteristics	Same Value	
Thermal Resistance	Same Value	
Electrical Static Discharge	Same Value	
Gate Oxide Reliability	Same Value checked by TDDB* test	
Reliability Test Result	OK	OK

*TDDB(Time Dependent Dielectric Breakdown)

There is no difference in electrical characteristics between 4inch products and 6inch products.

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6-2. Reliability test items

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Test Item	Condition	Standard	Sample size	Failure size
Temperature cycle(TCY)	Ta-40℃ 30min ～ 125℃ 30min	EIAJ ED-4701/100-105A	5pcs	0pcs
Power cycle(PCY)	Tj50℃～150℃ DMOS	EIAJ ED-4701/100-106A	5pcs	0pcs
High Temperature Reverse Bias(HTRB)	Vgs=0V, Vds=960V, Tc=175℃	EIAJ ED-4701/101A	5pcs	0pcs
High Temperature Gate Bias(HTGB)	Vgs=22V, Vds=0V, Tc=175℃ Vgs=-6V, Vds=0V, Tc=175℃	EIAJ ED-4701/101A	5pcs	0pcs

Measurement item and failure criteria

Measurement Item	Condition	Failure criteria
On - state resistance(Ron)	Depends on specification conditions	Rate of change over initial value ±20%
Threshold voltage(Vth)	Depends on specification conditions	Rate of change over initial value ±20%
Drain – source leakage current(Idss)	Depends on specification conditions	Outside the specification range
Gate – source leakage current(Igss)	Depends on specification conditions	Outside the specification range

As a result of the reliability test, it was confirmed that there was no problem.

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7. Other

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・Data sheet

There is no change in the characteristics and items described in the datasheet.

・Identification of 4inch and 6inch

The finished product cannot be identified by its external appearance.
However, it can be identified by the lot No.

・Changing 6inch product from 4inch

It is planned to ship out 6inch products from 1st Oct. 2024 to 30th Mar.2025 after your approval.
For the 4inch line, production is scheduled to end after the 6inch line transition.

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