

Whisker Test Report

Product Covered Commercial SiC Schottky Rectifiers, Commercial SiC Junction Transistors and Modules Co-pack in the DO-214 (SMB), TO-252, TO-220, and TO-247 package. See page 2 for part numbers covered by this report.

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Issued by GeneSiC Semiconductor, Inc.

This is to report the whisker test result conducted by GeneSiC Semiconductor over all SMB and TO products manufactured in GeneSiC Semiconductor plant. Test is executed based on JEDEC JESD201A, per its table 4a and 4c, except preconditioning A was substituted by preconditioning B.

Test result summary

Three production lots were selected to represent all SMB and TO products manufactured by GeneSiC Semiconductor plant. Outside lead plating is 100% Sn, Matte-Tin plating with whisker mitigation per JEDEC JP002. This plating process is common to all SMB and TO products. Sample preparation and preconditioning, and also stress tests and whisker measurements were done by GeneSiC Semiconductor.

Test result successfully satisfied requirements of Class 1, 1A and 2 per JEDEC JESD201 table 5a.

The solder reflow profile used is shown on figure 1.

Table 1: Test result summary

		Temperature Cycling		High Temperature / Humidity storage		Temperature / Humidity storage	
		1000 cycles	1500cycles	1000 hour	4000 hour	1000 hour	4000 hour
Criteria per JESD201A Table 5a	Class 2	---	45µm	---	40µm	---	40µm
	Class 1	---	50µm	---	50µm	---	50µm
	Class 1A	50µm	---	50µm	---	20µm	---
Test Result	Precondition B	23.50µm	23.58µm	0.00µm	10.28µm	0.00µm	0.00µm
	Precondition B+C	18.86µm	23.71µm	0.00µm	0.00µm	0.00µm	0.00µm
	Precondition B+D	25.45µm	34.83µm	0.00µm	0.00µm	0.00µm	0.00µm
	Classification	Passed Class 1, class 1A and class 2 criteria					

Table 2: Part Numbers cover by this report

Package	Product Type	Part Numbers
DO-214	SiC Schottky Rectifiers, Commercial	GBxxSLTxx-214, GAxxSLTxx-214
TO-252	SiC Schottky Rectifiers, Commercial	GBxxSLTxx-252
TO-220	SiC Schottky Rectifiers, Commercial	GBxxSLTxx-220, GAxxSLTxx-220xx
TO-247	SiC Schottky Rectifiers, Commercial	GBxxSLTxx-247, GBxxSLTxx-247x
	SiC Junction Transistors, Commercial	GAxxJTxx-247
	SiC Modules Co-pack, Commercial	GAxxSICPxx-247

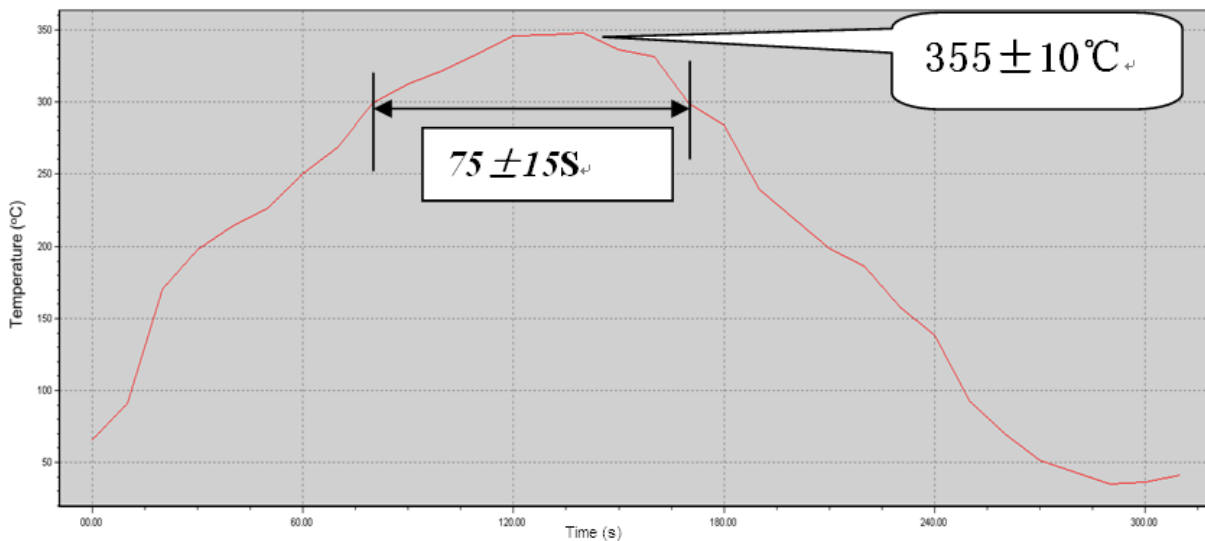


Figure 1: Solder reflow profile

Table 3: Test result – Temperature Cycling

Stress Type	Precondition Treatment	Lot No.	Sample No.	Term. No.	Maximum whisker length (µm)			Whisker photo (Two longest whiskers at 1,500cycles)				
					500 cycles	1000 cycles	1500 cycles					
Temperature Cycling -55°C to +85°C Air to Air 10 minutes soak	Precondition B Room temperature storage Substituting precondition A	1	1	1	0.00	0.00	12.01					
		1	1	2	0.00	14.00	15.41					
		1	2	1	0.00	10.03	12.32					
		1	2	2	0.00	3.89	8.91					
		1	3	1	0.00	10.85	15.75					
		1	3	2	0.00	6.35	8.62					
		2	1	1	0.00	9.88	12.79					
		2	1	2	0.00	7.69	9.24					
		2	2	1	11.56	14.31	16.82					
		2	2	2	0.00	13.78	14.35					
		2	3	1	0.00	7.28	11.50					
		2	3	2	0.00	5.91	11.81					
		3	1	1	10.66	17.49	18.51					
		3	1	2	0.00	7.23	14.95					
		3	2	1	6.64	12.61	15.11					
	3	2	2	0.00	11.23	12.95						
	3	3	1	4.61	12.80	14.00						
	3	3	2	13.20	23.50	23.58						
	Maximum Wisker length					13.20	23.50	23.58				
	Precondition B+C					1	1	1	0.00	8.27	10.52	
	Precondition B+C					1	1	2	0.00	18.86	17.70	
	Precondition B+C					1	2	1	0.00	10.27	10.92	
	Precondition B+C					1	2	2	0.00	7.62	10.44	
	Precondition B+C					1	3	1	0.00	6.98	11.23	
	Precondition B+C					1	3	2	0.00	14.40	15.72	
	Precondition B+C					2	1	1	6.97	8.85	13.50	
	Precondition B+C					2	1	2	5.39	13.48	16.11	
	Precondition B+C					2	2	1	7.84	9.64	15.26	
	Precondition B+C					2	2	2	5.84	8.79	12.67	
	Precondition B+C					2	3	1	15.32	17.44	23.71	
	Precondition B+C					2	3	2	11.20	15.47	17.75	
	Precondition B+C					3	1	1	10.31	10.46	14.79	
	Precondition B+C					3	1	2	7.69	9.62	17.88	
	Precondition B+C					3	2	1	8.64	8.91	15.40	
	Precondition B+C					3	2	2	12.85	15.21	16.93	
	Precondition B+C					3	3	1	8.45	12.21	14.54	
	Precondition B+C					3	3	2	9.92	11.72	16.01	
	Maximum Wisker length					15.32	18.86	23.71				
	Precondition B+D					1	1	1	0.00	4.35	5.88	
	Precondition B+D					1	1	2	0.00	8.18	20.95	
	Precondition B+D					1	2	1	0.00	9.94	10.75	
	Precondition B+D					1	2	2	0.00	7.12	13.18	
	Precondition B+D					1	3	1	0.00	10.35	10.64	
	Precondition B+D					1	3	2	0.00	10.06	15.16	
	Precondition B+D					2	1	1	9.43	14.12	25.97	
Precondition B+D					2	1	2	12.43	24.85	22.88		
Precondition B+D					2	2	1	10.29	10.51	15.17		
Precondition B+D					2	2	2	9.86	15.51	16.34		
Precondition B+D					2	3	1	0.00	6.86	11.02		
Precondition B+D					2	3	2	9.76	11.67	12.81		
Precondition B+D					3	1	1	10.64	14.85	19.34		
Precondition B+D					3	1	2	8.29	15.28	23.83		
Precondition B+D					3	2	1	0.00	7.59	13.13		
Precondition B+D					3	2	2	0.00	4.74	4.99		
Precondition B+D					3	3	1	7.72	21.97	32.70		
Precondition B+D					3	3	2	16.11	25.45	34.83		
Maximum Wisker length					16.11	25.45	34.83					
Maximum Wisker length					16.11	25.45	34.83	Passed Class 2, Class 1 and Class 1A				
Whisker Test Criteria		Class 2			---	---	45					
JEDEC JESD201A		Class 1			---	---	50					
		Class 1A			---	50	---					

Table 4: Test result – High Temperature / High Humidity Storage

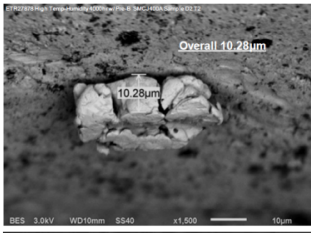

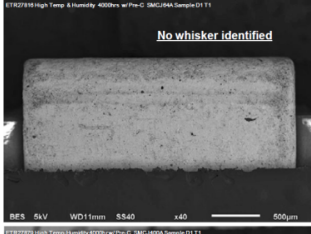
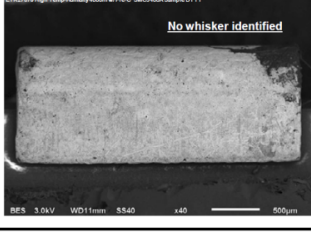
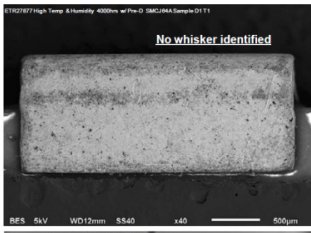

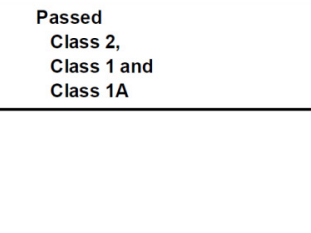
Stress Type	Precondition Treatment	Lot No.	Sample No.	Term. No.	Maximum whisker length (µm)		Whisker photo (Two longest whiskers at 4,000 hours)			
					1000 hour	4000 hour				
High Temperature / Humidity Storage 55°C, 85% RH	Precondition B	1	1	1	0.00	0.00	 Overall 10.28µm  No whisker identified			
		1	1	2	0.00	0.00				
		1	2	1	0.00	0.00				
		1	2	2	0.00	0.00				
		1	3	1	0.00	0.00				
		1	3	2	0.00	0.00				
		2	1	1	0.00	0.00				
		2	1	2	0.00	0.00				
		2	2	1	0.00	0.00				
		Room temperature storage	2	2	2	0.00		10.28	 No whisker identified	
		2	3	1	0.00	0.00				
		Substituting precondition A	2	3	2	0.00		0.00		 No whisker identified
		3	1	1	0.00	0.00				
		3	1	2	0.00	0.00				
		3	2	1	0.00	0.00				
		3	2	2	0.00	0.00				
		3	3	1	0.00	0.00				
		3	3	2	0.00	0.00				
		Maximum Wisker length						0.00		
	Precondition B+C	1	1	1	0.00	0.00	 No whisker identified			
		1	1	2	0.00	0.00				
		1	2	1	0.00	0.00				
		1	2	2	0.00	0.00				
		1	3	1	0.00	0.00				
		1	3	2	0.00	0.00				
		2	1	1	0.00	0.00				
		2	1	2	0.00	0.00				
		2	2	1	0.00	0.00				
		4-weeks storage + Sn-Pb Temperature preconditioning	2	2	2	0.00		0.00	 No whisker identified	
		2	3	1	0.00	0.00				
		2	3	2	0.00	0.00				
		3	1	1	0.00	0.00				
		3	1	2	0.00	0.00				
		3	2	1	0.00	0.00				
		3	2	2	0.00	0.00				
		3	3	1	0.00	0.00				
		3	3	2	0.00	0.00				
		Maximum Wisker length						0.00		0.00
	Precondition B+D	1	1	1	0.00	0.00	 No whisker identified			
		1	1	2	0.00	0.00				
		1	2	1	0.00	0.00				
		1	2	2	0.00	0.00				
		1	3	1	0.00	0.00				
		1	3	2	0.00	0.00				
		2	1	1	0.00	0.00				
		2	1	2	0.00	0.00				
		2	2	1	0.00	0.00				
		4-weeks storage + Pb-free Temperature preconditioning	2	2	2	0.00		0.00	 No whisker identified	
		2	3	1	0.00	0.00				
		2	3	2	0.00	0.00				
		3	1	1	0.00	0.00				
		3	1	2	0.00	0.00				
		3	2	1	0.00	0.00				
		3	2	2	0.00	0.00				
		3	3	1	0.00	0.00				
		3	3	2	0.00	0.00				
		Maximum Wisker length						0.00		0.00
	Maximum Wisker length					0.00	10.28	Passed Class 2, Class 1 and Class 1A		
	Whisker Test Criteria		Class 2			---	40			
	JEDEC JESD201A		Class 1			---	50			
			Class 1A			20	---			

Table 5: Test result – Temperature / Humidity Storage

Stress Type	Precondition Treatment	Lot No.	Sample No.	Term. No.	Maximum whisker length (µm)		Whisker photo (Two longest whiskers at 4,000 hours)		
					1000 hour	4000 hour			
Temperature / Humidity Storage 30°C, 60% RH	Precondition B Room temperature storage Substituting precondition A	1	1	1	0.00	0.00			
		1	1	2	0.00	0.00			
		1	2	1	0.00	0.00			
		1	2	2	0.00	0.00			
		1	3	1	0.00	0.00			
		1	3	2	0.00	0.00			
		2	1	1	0.00	0.00			
		2	1	2	0.00	0.00			
		2	2	1	0.00	0.00			
		2	2	2	0.00	0.00			
		2	3	1	0.00	0.00			
		2	3	2	0.00	0.00			
		3	1	1	0.00	0.00			
		3	1	2	0.00	0.00			
		3	2	1	0.00	0.00			
		3	2	2	0.00	0.00			
		3	3	1	0.00	0.00			
		3	3	2	0.00	0.00			
		Maximum Wisker length						0.00	0.00
		Precondition B+C 4-weeks storage + Sn-Pb Temperature preconditioning	1	1	1	0.00		0.00	
	1		1	2	0.00	0.00			
	1		2	1	0.00	0.00			
	1		2	2	0.00	0.00			
	1		3	1	0.00	0.00			
	1		3	2	0.00	0.00			
	2		1	1	0.00	0.00			
	2		1	2	0.00	0.00			
	2		2	1	0.00	0.00			
	2		2	2	0.00	0.00			
	2		3	1	0.00	0.00			
	2		3	2	0.00	0.00			
	3		1	1	0.00	0.00			
	3		1	2	0.00	0.00			
	3		2	1	0.00	0.00			
	3		2	2	0.00	0.00			
	3		3	1	0.00	0.00			
	3		3	2	0.00	0.00			
	Maximum Wisker length					0.00	0.00		
	Precondition B+D 4-weeks storage + Pb-free Temperature preconditioning		1	1	1	0.00	0.00		
		1	1	2	0.00	0.00			
		1	2	1	0.00	0.00			
		1	2	2	0.00	0.00			
		1	3	1	0.00	0.00			
		1	3	2	0.00	0.00			
		2	1	1	0.00	0.00			
		2	1	2	0.00	0.00			
		2	2	1	0.00	0.00			
		2	2	2	0.00	0.00			
		2	3	1	0.00	0.00			
		2	3	2	0.00	0.00			
		3	1	1	0.00	0.00			
		3	1	2	0.00	0.00			
		3	2	1	0.00	0.00			
		3	2	2	0.00	0.00			
		3	3	1	0.00	0.00			
		3	3	2	0.00	0.00			
		Maximum Wisker length					0.00		0.00
		Maximum Wisker length					0.00		0.00
	Whisker Test Criteria		Class 2			---	40		
	JEDEC JESD201A		Class 1			---	50		
			Class 1A			20	---		