

# 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.

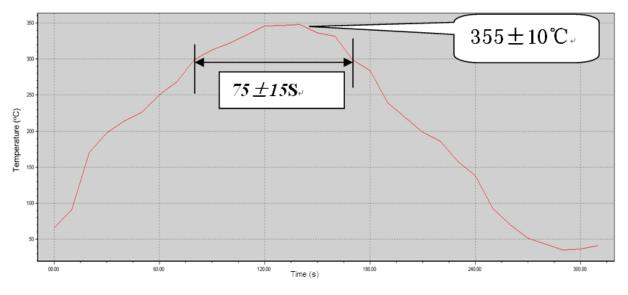
The solder reflow profile used is shown on figure 1.

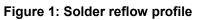
		Temperatu	ire Cycling	High Tem Humidity	perature / / storage	Temperature / Humidity storage					
		1000 cycles 1500cycles		1000 hour	4000 hour	1000 hour	4000 hour				
per 01A 5a	Class 2		45µm		40µm		40µm				
le D2	Class 1		50µm		50µm		50µm				
Criter JESI Tab	Class 1A	50µm		50µm		20µm					
t	Precondition B	23.50µm	23.58µm	0.00µm	10.28µm	0.00µm	0.00µm				
Result	Precondition B+C	18.86µm	23.71µm	0.00µm	0.00µm	0.00µm	0.00µm				
Test R	Precondition B+D	25.45µm	34.83µm	0.00µm	0.00µm	0.00µm	0.00µm				
Ĕ	Classification	Passed Class 1, class 1A and class 2 criteria									

#### Table 1: Test result summary



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		
	SiC Schottky Rectifiers, Commercial	GBxxSLTxx-247, GBxxSLTxx-247x		
TO-247	SiC Junction Transistors, Commercial	GAxxJTxx-247		
	SiC Modules Co-pack, Commercial	GAxxSICPxx-247		







			1 1000	1004		perature	-	
Stress Type	Precondition Treatment	Lot	Sample	Term.			gth (µm)	Whisker photo
		No.	No.	No.	500 cycles	1000 cycles	1500 cycles	(Two longest whiskers at 1,500cycles)
		1	1	1	0.00	0.00	12.01	ETR27V08 Temp Cycle 1500cy w/Pie-8 5.05M0J28CA Sample D3 T2
		1	1	2	0.00	14.00	15.41	
		1	2	1	0.00	10.03	12.32	9.61µm
		1	2	2	0.00	3.89	8.91	A STALL AND LE
		1	3	1	0.00	10.85	15.75	Overall 23,58µm
		1	3	2	0.00	6.35	8.62	4.21µm
	Precondition B	2	1	1	0.00	9.88	12.79	
		2	1	2	0.00	7.69	9.24	9.76µm
	Deem temperature	2	2	1	11.56	14.31	16.82	
	Room temperature storage	2	2	2	0.00	13.78	14.35	EE3 SKV WEI12mm SSK3 X3,500 opm ETR27608Temp Cycle 1500cyw/Pe-8 5.05M0J28CASempleD111
		2	3	1	0.00	7.28	11.50	Overall 18.51µm
	Substituting precondtion	2	3	2	0.00	5.91	11.81	5.45µm
	A	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	8.94µm
		3	2	2	0.00	11.23	12.95	
		3	3	1	4.61	12.80	14.00	E - E - BALL
		3 Maxim	3 um Wisker	2	13.20	23.50	23.58	and the second second
		iviaxim	1 1	length 1	13.20 0.00	23.50 8.27	23.58 10.52	DCS DXV WD12/mm SS43 X4,500 Syme
		1	1	2	0.00	8.27 18.86	10.52	Citezania intercente de la constantia de la Constantia de la constantia de
		1	2	2	0.00	10.27	17.70	
		1	2	2	0.00	7.62	10.92	16.64µm
		1	3	1	0.00	6.98	11.23	
		1	3	2	0.00	14.40	15.72	
		2	1	1	6.97	8.85	13.50	7.07µm
Temperature	Precondition B+C	2	1	2	5.39	13.48	16.11	
	Treconductor B. C	2	2	1	7.84	9.64	15.26	and the second second
Cycling		2	2	2	5.84	8.79	12.67	BES SAV WD13mm SS43 x3,600 Sµm
	4-weeks storage + Sn-Pb Temperature	2	3	1	15.32	17.44	23.71	ETR27008Temp Dycle 1500cyw/Pee-C & 05M0./28CA Sample D1 12
-55°C to +85°C	preconditioning	2	3	2	11.20	15.47	17.75	T Overall 17.88µm
Air to Air	proconditioning	3	1	1	10.31	10.46	14.79	Carries 1 1 1 1 1 1 1 1 1 1 1 1
10 minutes soak		3	1	2	7.69	9.62	17.88	9.07µm
		3	2	1	8.64	8.91	15.40	
		3	2	2	12.85	15.21	16.93	
		3	3	1	8.45	12.21	14.54	4.80µm
		3	3	2	9.92	11.72	16.01	4.01µm
		Maxim	um Wisker	length	15.32	18.86	23.71	BES 5kV WD12mm SS43 4300 5µm
		1	1	1	0.00	4.35	5.88	ETH2001 Texe Cycle 1000cy w/He-O B.05MDJ2RCA Sample 03 12
		1	1	2	0.00	8.18	20.95	and the second second
		1	2	1	0.00	9.94	10.75	5.40µm
		1	2	2	0.00	7.12	13.18	×
		1	3	1	0.00	10.35	10.64	7.95µm
		1	3	2	0.00	10.06	15.16	<u>16.41µm 🔭 5.07µm</u>
	Dreeendition D.D.	2	1	1	9.43	14.12	25.97	Overall 34.83µm
	Precondition B+D	2	1	2	12.43 10.29	24.85 10.51	22.88	
		2	2	1	9.86	10.51	15.17 16.34	BES 5kV WD12mm SS43 x3,000 5µm
	4-weeks storage +	2	3		9.86	15.51 6.86	16.34	ETR20001 Temp Cycle 1500cyw/Per-D 5.05MDJ28CA Sample D3 T1
	Pb-free Temperature	2	3	1	9.76	11.67	11.02	7.93µm Overall 32.70µm
	preconditioning	3	1	1	10.64	14.85	12.01	5.85µm
		3	1	2	8.29	14.85	23.83	
		3	2	- 2	0.00	7.59	13.13	6.54µm
		3	2	2	0.00	4.74	4.99	4.32µm
		3	3	1	7.72	21.97	32.70	3.06µm
		3	3	2	16.11	21.97	34.83	
			um Wisker		16.11	25.45	34.83	BES 5kV WD12mm \$\$43 x2,700 5µm
	Maximum Wisker le				16.11	25.45	34.83	Passed
Whisker Test (		Class 2					45	Class 2,
JEDEC JESD2	Class 1					50	Class 1 and	
JEDEC JESDZ	VIA	Class 1A				50		Class 1A

## Table 3: Test result – Temperature Cycling



Table 4: Test res		suit -	suit – High				
Stress Type	Precondition Treatment	Lot	Sample	Term.	Maximum whisker length (µm)		Whisker photo
eactor type	Frecondition freatment	No.	No.	No.	1000 hour	4000 hour	(Two longest whiskers at 4,000 hours)
		1	1	1	0.00	0.00	21827878 High Tempe-tumolog 6000 nm (Fig. 8: 34/0-14004.58/mp.in 00212
		1	1	2	0.00	0.00	Overall 10.28um
		1	2	1	0.00	0.00	Overall 10.28 jm
		1	2	2	0.00	0.00	10.28um
		1	3	1	0.00	0.00	
		1	3	2	0.00	0.00	and the second second
	Precondition B	2	1	1	0.00	0.00	and the second
		2	1	2	0.00	0.00	
	Room temperature	2	2	1	0.00	0.00 10.28	BES 3.0kV WD10mm \$\$40 x1,500 - 10µm
	storage	2	3	1	0.00	0.00	ETR27417 High Temp & Humidity 4009hrs w/ Pre-B SMCJ04ASample D1 T1
	Substituting precondtion	2	3	2	0.00	0.00	No whisker identified
	A	3	1	1	0.00	0.00	the man stranger and strain and age
		3	1	2	0.00	0.00	Carton and Strate and
		3	2	1	0.00	0.00	7
		3	2	2	0.00	0.00	
		3	3	1	0.00	0.00	Land and the second second
		3	3	2	0.00	0.00	
		Maxim	um Wisker	length	0.00	10.28	BES 3.0kV WD11mm \$\$40 x40 500µmi
		1	1	1	0.00	0.00	ETR27819High Temp & Humidity 4000hrs w/Pre-C SMCJ84A Sample D1T1
		1	1	2	0.00	0.00	No whisker identified
		1	2	1	0.00	0.00	Care and the second second second
		1	2	2	0.00	0.00	
		1	3	1	0.00	0.00	and the second
		1	3	2	0.00	0.00	in the second second
High	Des sou dition D ( 0	2	1	1	0.00	0.00	and the second se
-	Precondition B+C	2	1 2	2	0.00	0.00	
Temperature /		2	2	1	0.00	0.00	BES 5kV WD11mm \$\$40 x40 500µm
Humidity	4-weeks storage +	2	3	1	0.00	0.00	ETR27879 High Temp Humidity 4000hrw/Pre-C SMCJ400A Sample D1 T1
Storage	Sn-Pb Temperature preconditioning	2	3	2	0.00	0.00	No whisker identified
	preconditioning	3	1	1	0.00	0.00	Da
55°C, 85% RH		3	1	2	0.00	0.00	
		3	2	1	0.00	0.00	The second second second second
		3	2	2	0.00	0.00	and the second second
		3	3	1	0.00	0.00	
		3	3	2	0.00	0.00	States and a second sec
		Maxim	um Wisker	length	0.00	0.00	BES 3.0kV WD11mm SS40 x40 500µm
		1	1	1	0.00	0.00	ETR27E77High Temp & Hamidity 4000km w/Pre-D SMCJ64ASempteD1T1
		1	1	2	0.00	0.00	No whisker identified
		1	2	1	0.00	0.00	Construction of the second
		1	2	2	0.00	0.00	and the second second second second second
		1	3	2	0.00	0.00	
		2	1	1	0.00	0.00	
	Precondition B+D	2	1	2	0.00	0.00	
		2	2	1	0.00	0.00	Charles and Charles
	A weaks at an	2	2	2	0.00	0.00	BES         5kV         WD12mm         \$\$40         500µm           ETR27880 High Temp-Humidity 4000hrst/Pipe D         SMR-H00A Sample DI TI         500         500
	4-weeks storage + Pb-free Temperature	2	3	1	0.00	0.00	
	preconditioning	2	3	2	0.00	0.00	
		3	1	1	0.00	0.00	
		3	1	2	0.00	0.00	The starge state was a state of the
		3	2	1	0.00	0.00	
		3	2	2	0.00	0.00	A second second second
		3	3	1	0.00	0.00	No whisker identified
		3	3	2	0.00	0.00	
			um Wisker	length	0.00	0.00	BES 3.0kV WD10mm \$\$40 x40 500µm
	Maximum Wisker le	ength			0.00	10.28	Passed
Whisker Test (	Critoria	Class 2				40	Class 2,
WINSKEI TESU	Class 1				50	Class 1 and	
JEDEC JESD2	01 0	Class 1A			20		Class 1A

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



							<u> </u>
Stress Type	Precondition Treatment	Lot No.	Sample No.	Term. No.	Maximum whisker length (μm)		(Two longest whickers at 4 000 hours)
					1000 hour	4000 hour	(Two longest whiskers at 4,000 hours)
		1	1	1	0.00	0.00	ETR27979 Temp & Humidity 4000hrs w/Pre-B SMC364A Sample D111
		1	2	2	0.00	0.00	
		1	2	2	0.00	0.00	
		1	3	1	0.00	0.00	and the second states to reach the
		1	3	2	0.00	0.00	
	Precondition B	2	1	1	0.00	0.00	and the second and the second second
	Frecondition B	2	1	2	0.00	0.00	Pression of the state of the st
		2	2	1	0.00	0.00	No whisker identified
	Room temperature storage	2	2	2	0.00	0.00	BES 3.0kV WD10mm SS40 x40 500µm ET827882 Term A Maximitity 4000rs w/Prc8 346CH00A Senate D1 11
	stolage	2	3	1	0.00	0.00	
	Substituting precondtion	2	3	2	0.00	0.00	and the second
	A	3	1	1	0.00	0.00	and the set of and and and
		3	1	2	0.00	0.00	Bearing the second of the second second second
		3	2	1	0.00	0.00	
		3	2	2	0.00	0.00	the second of the second of the
		3	3	1	0.00	0.00	Menubisker identified
			um Wisker		0.00	0.00	No whisker identified
		1	1	1 1	0.00	0.00	ETR27980 Terep & Hamid By 4000krs w/Pro-C 5MCJ94ASample DI TS
		1	1	2	0.00	0.00	No whisker identified
		1	2	1	0.00	0.00	
		1	2	2	0.00	0.00	A second second second second second
		1	3	1	0.00	0.00	
		1	3	2	0.00	0.00	And the second
		2	1	1	0.00	0.00	in a second and the build
Temperature /	Precondition B+C	2	1	2	0.00	0.00	and the second second
Humidity	4-weeks storage +	2	2	1	0.00	0.00	BES 3.0kV WD10mm \$\$40 x40 500µm
-		2	2	2	0.00	0.00	ETIR27084 Temp & Humidity 4000krs w/Pre-C SM03400A Sample D111
Storage	Sn-Pb Temperature	2	3	1	0.00	0.00	
	preconditioning	3	1	1	0.00	0.00	
30°C, 60% RH		3	1	2	0.00	0.00	a state and the second
		3	2	1	0.00	0.00	
		3	2	2	0.00	0.00	and the second sec
		3	3	1	0.00	0.00	and a second and a second second
		3	3	2	0.00	0.00	No whisker identified
		Maxim	um Wisker	length	0.00	0.00	BES 3.0kV WD11mm \$\$40 500µm
		1	1	1	0.00	0.00	ETR27801 Temp & Humidity 4000hrs w/Pre-D SMCJ64A Sample D1T1
		1	1	2	0.00	0.00	<u>No whisker identified</u>
		1	2	1	0.00	0.00	and the second
		1	2	2	0.00	0.00	a set in a property of
		1	3	2	0.00	0.00	The second se
		2	1	1	0.00	0.00	and the second sec
	Precondition B+D	2	1	2	0.00	0.00	State of the state
		2	2	1	0.00	0.00	and the second
	4-weeks storage +	2	2	2	0.00	0.00	BES 3.0kV WD11mm SS40 x40 500µm ETR27080 Temp & Humidity 4000rs w/Pre-0_5MCJ400A Sample D111
	4-weeks storage + Pb-free Temperature	2	3	1	0.00	0.00	No whisker identified
	preconditioning	2	3	2	0.00	0.00	18 H Self and a self sector sector
		3	1	1	0.00	0.00	a second a second
		3	1	2	0.00	0.00	a a a a a a a a a a a a a a a a a a a
		3	2	1	0.00	0.00	1
		3	2	2	0.00	0.00	
		3	3	2	0.00	0.00	Manager and I
			um Wisker		0.00	0.00	and a second sec
	Maximum Wisker le				0.00	0.00	Passed
		Class 2					Class 2,
Whisker Test (	Whisker Test Criteria Class 2 Class 1					40 50	Class 1 and
JEDEC JESD2	01A	Class 1 Class 1A			20		Class 1A
	JIUSS IA			20			

## Table 5: Test result – Temperature / Humidity Storage