

Record of Letter Ballot Review by TC Chapter for Procedural Review

Region/Locale: **China**

Global Technical Committee: **CSM**

TC Chapter Cochairs: **Jiangbo Wang/HC-SemiTek, Guoyou Liu/CRRC TIMES**

Standards Staff: **Cassie Li**

	Scheduled in Background Statement	Actual
Date	4/27/2022	4/27/2022
Location	Dongguan City, Guangdong Province	OVTCCM
Reason for Change of Date and/or Location (if changed)	COVID-19	

Note: See *Regulations* ¶ 9.5 Exceptions for allowable reason to change.

I. Document Number and Title

Document Number 6693	Document Title New Standard: Specification for 4H-SiC Homoepitaxial Wafer
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II. Tally

Standards staff to fill in.

Voting Tally: **As-cast tally after close of voting period**

Note: A minimum of 60% of the Voting Interests that have TC Members within the global technical committee that issued the Letter Ballot must return Votes. (*Regulations* ¶ 9.6.2.1.1)

Voting Tally (with example values):

Voting Interest:	Returned Votes		Distribution		Return Rate	
Letter Ballot	64	÷	106	=	60.4%	≥60%
Intercommittee Ballot	22					
Voting Interest Reject(s)	1		Total Voters with Rejects			1
Voting Interest Accept(s)	51					

Note: See *Regulations* § 3.2.1 for definition of Voting Interest.

III. Rejects

Voting Interest Reject 1 (Voting Interest Name: Cree)

Voter Reject 1 (Voter: Barbieri, Tom and Cree)

Negative 1

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.		
	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied. SiC epi is a highly customizable product/process in today's market. The standard is written toward a specific application (thickness, doping, etc.), which doesn't seem appropriate for a general 4H_SiC homoepitaxy spec.		
TF input (optional)				
Withdrawal (check one)	<input checked="" type="checkbox"/>	No Negative withdrawal made by Voter.	GO TO "Related" subsection	
	<input type="checkbox"/>	Withdrawal document received by Standards staff on MM/DD/YYYY.	GO TO "Final" subsection → (A)	
Related	Motion and Reason (check one)	<input checked="" type="checkbox"/>	'Related' is mutually agreed upon. (Needs no motion.)	GO TO "Persuasive" subsection
		<input type="checkbox"/>	Negative is not related. (Needs ≥2/3 votes to pass.)	
		Reason	XXXX	
	Motion by/ 2 nd by	Name (Company)/Name (Company)		
	Discussion			
	Result of Vote (check one)	XX Y-XX N; Motion passed/failed.		
<input type="checkbox"/>		[Negative is not related.] < 2/3	GO TO "Persuasive" subsection	
<input type="checkbox"/>		2/3 ≤ [Negative is not related.]	GO TO "Final" subsection → (B)	
Persuasive	Motion and Reason (check one)	<input type="checkbox"/>	Negative is related and persuasive. (Needs >1/3 votes to pass.)	
		<input checked="" type="checkbox"/>	Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)	
		Reason	1. Although the epiwafer is customized product, but some general parameters are still needed to be defined for reference when discussing between the supplier and the purchaser, and other epi, such as Si epi, GaN epi, also have the standards. 2. In addition, this standard is a general standard for reference between the supplier and the purchaser. Special product requirements shall be agreed upon between the supplier and the purchaser.	
	Motion by/ 2 nd by	Gan Feng(Epiworld)/Min Lu (Mige Lab)		
	Discussion	None		
Result of Vote	22 Y-0 N; Motion passed.			

	(check one)	<input type="checkbox"/>	[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)	<input type="checkbox"/>	Y	GO TO "Address by Technical Change Option" subsection	
		<input type="checkbox"/>	[Negative is related and not persuasive.] < 2/3		<input type="checkbox"/>	N	GO TO "Final" subsection → (E)	
		<input type="checkbox"/>	2/3 ≤ [Negative is related and not persuasive.] < 90%	GO TO "Final" subsection → (C)				
		<input checked="" type="checkbox"/>	90% ≤ [Negative is related and not persuasive.]	GO TO "Not Significant Finding Option" subsection				
Not Significant Finding Option	This option can be used only "if the TC Chapter finds a Negative not persuasive by a vote equal to or greater than 90% of the persons voting on the action". (Regulations ¶ 9.6.1.4.5.2)							
	Use of "Not significant finding option" (check one)	<input checked="" type="checkbox"/>	It is mutually agreed upon to term the Negative "not significant".				GO TO "Final" subsection → (D)	
		<input type="checkbox"/>	It is mutually agreed upon to term the Negative "significant".				GO TO "Final" subsection → (C)	
		<input type="checkbox"/>	Whether or not the Negative is "not significant" is decided by a vote.					
	Motion	The Negative is "not significant".						
Motion by/ 2 nd by	Name (Company)/Name (Company)							
Vote	<input type="checkbox"/>	XX Y-XX N; Motion passed with simple majority				GO TO "Final" subsection → (D)		
	<input type="checkbox"/>	XX Y-XX N; Motion failed with simple majority				GO TO "Final" subsection → (C)		
Final	(check if applicable)	<input type="checkbox"/>	(A)	Withdrawn (counted under h in disposition)				
		<input type="checkbox"/>	(B)	Not related (counted under i in disposition)				
		<input type="checkbox"/>	(C)	Related and not persuasive (significant)				
		<input checked="" type="checkbox"/>	(D)	Not significant (counted under j in disposition)				
		<input type="checkbox"/>	(E)	Related and persuasive and not addressed by technical change			DOCUMENT FAILS	
		<input type="checkbox"/>	(F)	Addressed by technical change (counted under k disposition)				
	(check if applicable)	<input type="checkbox"/>	Comment generated. See Section V-(ii) Comment # X.					

This table is needed for each Negative.

Negative 2

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.
		Section 5.2: Ordering information for substrates
	Negative Text	<p>*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.</p> <p>The list for substrate ordering requirements is more exhaustive than M55-0921. Recommend alignment of this list with the list in M55. Specific items not included in M55-0921 ordering requirements are identification of test method to be used, TSD, TED, BPD, flat orientation, flat length.</p>

TF input (optional)							
Withdrawal (check one)		X	No Negative withdrawal made by Voter.				GO TO "Related" subsection
			Withdrawal document received by Standards staff on MM/DD/YYYY.				GO TO "Final" subsection → (A)
Related	Motion and Reason (check one)	X	'Related' is mutually agreed upon. (Needs no motion.)				GO TO "Persuasive" subsection
			Negative is not related. (Needs ≥2/3 votes to pass.)				
			Reason	XXXX			
	Motion by/ 2 nd by	Name (Company)/Name (Company)					
	Discussion						
	Result of Vote (check one)	XX Y-XX N; Motion passed/failed.					
			[Negative is not related.] < 2/3				GO TO "Persuasive" subsection
			2/3 ≤ [Negative is not related.]				GO TO "Final" subsection → (B)
Persuasive	Motion and Reason (check one)	X	Negative is related and persuasive. (Needs >1/3 votes to pass.)				
			Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)				
			Reason				
	Motion by/ 2 nd by	Gan Feng(Epiworld)/Min Lu (Mige Lab)					
	Discussion	None					
	Result of Vote (check one)	23 Y-0 N; Motion passed.					
		X	[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)	X	Y	GO TO "Address by Technical Change Option" subsection
			[Negative is related and not persuasive.] < 2/3			N	GO TO "Final" subsection → (E)
		2/3 ≤ [Negative is related and not persuasive.] < 90%	GO TO "Final" subsection → (C)				
		90% ≤ [Negative is related and not persuasive.]	GO TO "Not Significant Finding Option" subsection				
Address by Technical Change Option	Technical Change Recommendations Original section/paragraph number and at least one full sentence are required in "FROM" and "TO" fields.						

Technical Changes	1	FROM: Section/Paragraph 5.1 5.1 Purchase orders for 4H-SiC epitaxial wafers furnished to this specification shall include the following items from substrate, buffer layer and epitaxial layer. In addition, the purchase order must indicate the test method to be used in evaluating each of the specified items for which alternate test procedures exist.			
		TO: Section/Paragraph 5.1 5.1 Purchase orders for 4H-SiC epitaxial wafers furnished to this specification shall include the following items from substrate, buffer layer and epitaxial layer. In addition, the purchase order must indicate the test method to be used in evaluating each of the specified items for which alternate test procedures exist. <u>Special requirements of ordering information shall be agreed upon between the supplier and the purchaser.</u>			
		Justification (If necessary) 1. The test methods for all substrate parameters (including TSD, TED, BPD, Flat orientation, and Flat Length) are defined in Table 12. 2. "Special requirements of ordering information shall be agreed upon between the supplier and the purchaser." is added in section 5.1.			
Motion		Negative is addressed by the technical change(s).			
Motion by/2 nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)			
Discussion		Gan Feng (Epiworld): We agree with his comment and the modification is attached in the PPT shown in the screen.			
Result of Vote (check one)		22 Y-0 N; Motion passed.			
		X	2/3 ≤ [Negative is addressed by the technical change(s).]	GO TO "Incorporation of the Technical Change" subsection	
			[Negative is not addressed by the technical change(s).] < 2/3	GO TO "Final" subsection → (E)	
Incorporation of the Technical Change	Motion	To incorporate the technical change(s).			
	Motion by/2 nd by	Gan Feng(Epiworld)/Min Lu (Mige Lab)			
	Discussion	None			
	22 Y-0 N; Motion passed.				
	Result of Vote (check one)	X	90% ≤ [Agree to incorporate.]	GO TO "Final" subsection → (F)	
		[Disagree to incorporate.] > 10%	GO TO "Final" subsection → (E)		
Final	(check if applicable)		(A)	Withdrawn (counted under h in disposition)	
			(B)	Not related (counted under i in disposition)	
			(C)	Related and not persuasive (significant)	
			(D)	Not significant (counted under j in disposition)	
			(E)	Related and persuasive and not addressed by technical change	DOCUMENT FAILS
		X	(F)	Addressed by technical change (counted under k disposition)	
	(check if applicable)		Comment generated. See Section V-(ii) Comment # X.		

This table is needed for each Negative.

Negative 3

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.				
		Section 6.4.3.1 and 6.4.4.1: Test pattern for epi doping and thickness				
	Negative Text	<p>*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.</p> <p>The proposed pattern is not aligned with how most vendors are current performing the measurement. Requiring a pattern change for these vendors would require a significant adjustment to metrology, reporting, and specifications. This section should be struck, or a note should be added that this is a suggested measurement pattern for situations where no pre-existing pattern exists.</p>				
TF input (optional)						
Withdrawal (check one)	<input checked="" type="checkbox"/>	No Negative withdrawal made by Voter.			GO TO "Related" subsection	
	<input type="checkbox"/>	Withdrawal document received by Standards staff on MM/DD/YYYY.			GO TO "Final" subsection → (A)	
Related	<input checked="" type="checkbox"/>	'Related' is mutually agreed upon. (Needs no motion.)			GO TO "Persuasive" subsection	
		Negative is not related. (Needs ≥2/3 votes to pass.)				
		Reason	XXXX			
	Motion by/ 2 nd by	Name (Company)/Name (Company)				
	Discussion					
	Result of Vote (check one)	XX Y-XX N; Motion passed/failed.				
		<input type="checkbox"/>	[Negative is not related.] < 2/3			GO TO "Persuasive" subsection
<input type="checkbox"/>		2/3 ≤ [Negative is not related.]			GO TO "Final" subsection → (B)	
Persuasive	<input checked="" type="checkbox"/>	Negative is related and persuasive. (Needs >1/3 votes to pass.)				
		Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)				
		Reason				
	Motion by/ 2 nd by	Gan Feng(Epiworld)/Min Lu (Mige Lab)				
	Discussion	None				
	Result of Vote (check one)	22 Y-0 N; Motion passed.				
<input checked="" type="checkbox"/>		[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)	<input checked="" type="checkbox"/>	Y	GO TO "Address by Technical Change Option" subsection

	X	(F)	Addressed by technical change (counted under k disposition)
(check if applicable)		Comment generated. See Section V-(ii) Comment # X.	

This table is needed for each Negative.

Negative 4

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary. Table 3: The specification of Carrier Concentration		
	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied. The table references SEMI MF1392 as the applicable technique. SEMI MF1392 only accounts for Hg CV as the measurement tool. As the industry is transitioning towards new non_Hg CV techniques, Table 3 should be modified to "SEMI MF1392 or equivalent".		
		TF input (optional)		
Withdrawal (check one)	X	No Negative withdrawal made by Voter.	GO TO "Related" subsection	
		Withdrawal document received by Standards staff on MM/DD/YYYY.	GO TO "Final" subsection → (A)	
Related	Motion and Reason (check one)	X	'Related' is mutually agreed upon. (Needs no motion.)	GO TO "Persuasive" subsection
			Negative is not related. (Needs ≥2/3 votes to pass.)	
			Reason	XXXX
	Motion by/ 2 nd by	Name (Company)/Name (Company)		
	Discussion			
	Result of Vote (check one)	XX Y-XX N; Motion passed/failed.		
			[Negative is not related.] < 2/3	GO TO "Persuasive" subsection
			2/3 ≤ [Negative is not related.]	GO TO "Final" subsection → (B)
Persuasive	Motion and Reason (check one)	X	Negative is related and persuasive. (Needs >1/3 votes to pass.)	
			Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)	
			Reason	
	Motion by/ 2 nd by	Gan Feng(Epiworld)/Min Lu (Mige Lab)		

		Discussion Hao Hu(AST):This is just a technique not a transition. Gan Feng(Epiworld): We quoted SEMI MF1392. If SEMI MF1392 only accounts for Hg CV as the measurement tool, all these similar measurement of carrier concentration can use that. So we will modify to "SEMI MF1392 or equivalent". We need to avoid the scope being too narrow to influence the development of technology.																												
		Result of Vote (check one) <table border="1"> <tr> <td>X</td> <td>[Negative is related and persuasive.] > 1/3</td> <td rowspan="2">Is a technical change recommended? (check one)</td> <td>X</td> <td>Y</td> <td>GO TO "Address by Technical Change Option" subsection</td> </tr> <tr> <td></td> <td>[Negative is related and not persuasive.] < 2/3</td> <td></td> <td>N</td> <td>GO TO "Final" subsection → (E)</td> </tr> <tr> <td></td> <td>2/3 ≤ [Negative is related and not persuasive.] < 90%</td> <td colspan="4">GO TO "Final" subsection → (C)</td> </tr> <tr> <td></td> <td>90% ≤ [Negative is related and not persuasive.]</td> <td colspan="4">GO TO "Not Significant Finding Option" subsection</td> </tr> </table>						X	[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)	X	Y	GO TO "Address by Technical Change Option" subsection		[Negative is related and not persuasive.] < 2/3		N	GO TO "Final" subsection → (E)		2/3 ≤ [Negative is related and not persuasive.] < 90%	GO TO "Final" subsection → (C)					90% ≤ [Negative is related and not persuasive.]	GO TO "Not Significant Finding Option" subsection			
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	[Negative is related and not persuasive.] < 2/3			N	GO TO "Final" subsection → (E)																									
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Address by Technical Change Option	Technical Changes	FROM: Section/Paragraph Table 3																												
		Table 1 The specification of Carrier Concentration																												
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		Parameter	Specification			Test Condition / Technique																								
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TO: Section/Paragraph Table 3																														
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Parameter	Specification			Test Condition / Technique																										
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		Justification (If necessary) The test method of carrier concentration is agreed to be modified to "SEMI MF1392 or equivalent."																												

2	FROM: Section/Paragraph Table 12		
	Table 3 Parameter and Recommended Test Method		
	<i>Category</i>	<i>Parameter</i>	<i>Test Method</i>
	Substrate	Polytype	None as yet
		Conductivity Type (Dopant)	None as yet
		Diameter	SEMI MF2074
		Thickness	SEMI MF533 or SEMI MF1530
		Surface Orientation	SEMI MF26
		Resistivity	SEMI MF673
		Primary Flat Length	SEMI MF671
		Primary Flat Orientation	SEMI MF847
		Secondary Flat Length	SEMI MF671
		Secondary Flat Orientation	SEMI MF847
		MP Density	None as yet
		TSD density	KOH etched surface, SEMI M83 or ASTM F1404
		TED density	KOH etched surface, SEMI M83 or ASTM F1404
		BPD density	KOH etched surface, SEMI M83 or ASTM F1404
		GBIR	SEMI MF1530
		SBIR	SEMI MF1530
		Warp	SEMI MF1390
		Bow	SEMI MF1390
	Buffer layer	Polytype	None as yet
		Conductivity Type (Dopant)	None as yet
		Carrier Concentration	None as yet
		Thickness	None as yet
	Epitaxial layer	Polytype	None as yet
		Conductivity Type (Dopant)	None as yet
		Carrier Concentration	SEMI MF1392
		Thickness	SEMI MF95
		Surface killer defect	Determine by a method agreed upon between the supplier and the customer
		Surface scratch	SEMI MF523
		Surface roughness	SEMI M40
		Edge chip	SEMI MF523
		Crack	SEMI MF523
		Area contamination	SEMI MF523
		GBIR	SEMI MF1530
		SBIR	SEMI MF1530
		Warp	SEMI MF1390
		Bow	SEMI MF1390

TO: Section/Paragraph Table 12
Table 4 Parameter and Recommended Test Method

Category	Parameter	Test Method
Substrate	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Diameter	SEMI MF2074
	Thickness	SEMI MF533 or SEMI MF1530
	Surface Orientation	SEMI MF26
	Resistivity	SEMI MF673
	Primary Flat Length	SEMI MF671
	Primary Flat Orientation	SEMI MF847
	Secondary Flat Length	SEMI MF671
	Secondary Flat Orientation	SEMI MF847
	MP Density	None as yet
	TSD density	KOH etched surface, SEMI M83 or ASTM F1404
	TED density	KOH etched surface, SEMI M83 or ASTM F1404
	BPD density	KOH etched surface, SEMI M83 or ASTM F1404
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390
Buffer layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	None as yet
	Thickness	None as yet
Epitaxial layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	SEMI MF1392 or equivalent
	Thickness	SEMI MF95
	Surface killer defect	Determine by a method agreed upon between the supplier and the customer
	Surface scratch	SEMI MF523
	Surface roughness	SEMI M40
	Edge chip	SEMI MF523
	Crack	SEMI MF523
	Area contamination	SEMI MF523
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390

Justification (If necessary)

The test method of carrier concentration is agreed to be modified to "SEMI MF1392 or equivalent."

Motion		Negative is addressed by the technical change(s).	
Motion by/2nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)	
Discussion		None	
Result of Vote (check one)		21 Y-0 N; Motion passed.	
		X 2/3 ≤ [Negative is addressed by the technical change(s).]	GO TO "Incorporation of the Technical Change" subsection
		[Negative is not addressed by the technical change(s).] < 2/3	GO TO "Final" subsection → (E)
Inc	Motion	To incorporate the technical change(s).	

	Motion by/2 nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)		
	Discussion		None		
	Result of Vote (check one)		21 Y-0 N; Motion passed.		
			X	90% ≤ [Agree to incorporate.]	GO TO “Final” subsection → (F)
				[Disagree to incorporate.]>10%	GO TO “Final” subsection → (E)
Final	(check if applicable)		(A)	Withdrawn (counted under h in disposition)	
			(B)	Not related (counted under i in disposition)	
			(C)	Related and not persuasive (significant)	
			(D)	Not significant (counted under j in disposition)	
			(E)	Related and persuasive and not addressed by technical change	DOCUMENT FAILS
		X	(F)	Addressed by technical change (counted under k disposition)	
	(check if applicable)		Comment generated. See Section V-(ii) Comment # X.		

This table is needed for each Negative.

Negative 5

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.				
		Table 3: The specification of Carrier Concentration				
	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.				
		Permissible Average carrier concentration and tolerance does not fully represent the available range of the industry.				
TF input (optional)						
Withdrawal (check one)	X	No Negative withdrawal made by Voter.		GO TO “Related” subsection		
		Withdrawal document received by Standards staff on MM/DD/YYYY.		GO TO “Final” subsection → (A)		
Related	Motion and Reason (check one)	X	‘Related’ is mutually agreed upon. (Needs no motion.)		GO TO “Persuasive” subsection	
			Negative is not related. (Needs ≥2/3 votes to pass.)			
			Reason	XXXX		
	Motion by/ 2 nd by	Name (Company)/Name (Company)				
	Discussion					
	Result of Vote (check one)	XX Y-XX N; Motion passed/failed.				
			[Negative is not related.] < 2/3		GO TO “Persuasive” subsection	
		2/3 ≤ [Negative is not related.]		GO TO “Final” subsection → (B)		

Persuasive	Motion and Reason (check one)		Negative is related and persuasive. (Needs >1/3 votes to pass.)				
		X	Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)				
			Reason	1. The range of carrier concentration specified in this standard ($1 \times 10^{15} \text{ cm}^{-3} \sim 5 \times 10^{17} \text{ cm}^{-3}$) can cover the range used in current mass production(The range of epi thickness is “(2 ~ 30)μm” which has been defined in Table4) . 2. For more clarified, the range of epi thickness would also be added into the scope of the standard. (see section 2.1). The detailed modification will be shown in the other technical issue section #1.			
	Motion by/ 2 nd by	Gan Feng(Epiworld)/Min Lu (Mige Lab)					
	Discussion	Yang Gan(HIT): Is this range of carrier concentration and tolerance available in the market? Gan Feng(Epiworld): Yes. Yang Gan (HIT): I suggest that you can give some example sources to clarify such data. Gan Feng (Epiworld): We have defined these data at the beginning of the document. So no need to add these.					
	Result of Vote (check one)	23 Y-0 N; Motion passed.					
			[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)		Y	GO TO “Address by Technical Change Option” subsection
			[Negative is related and not persuasive.] < 2/3		N	GO TO “Final” subsection → (E)	
			$2/3 \leq$ [Negative is related and not persuasive.] < 90%	GO TO “Final” subsection → (C)			
		X	$90\% \leq$ [Negative is related and not persuasive.]	GO TO “Not Significant Finding Option” subsection			
Not Significant Finding Option	This option can be used only “if the TC Chapter finds a Negative not persuasive by a vote equal to or greater than 90% of the persons voting on the action”. (Regulations ¶ 9.6.1.4.5.2)						
	Use of “Not significant finding option” (check one)	X	It is mutually agreed upon to term the Negative “not significant”.				GO TO “Final” subsection → (D)
			It is mutually agreed upon to term the Negative “significant”.				GO TO “Final” subsection → (C)
			Whether or not the Negative is “not significant” is decided by a vote.				
	Motion	The Negative is “not significant”.					
	Motion by/ 2 nd by	Name (Company)/Name (Company)					
Vote		XX Y-XX N; Motion passed with simple majority				GO TO “Final” subsection → (D)	
		XX Y-XX N; Motion failed with simple majority				GO TO “Final” subsection → (C)	
Final	(check if applicable)		(A)	Withdrawn (counted under h in disposition)			
			(B)	Not related (counted under i in disposition)			
			(C)	Related and not persuasive (significant)			

		X	(D)	Not significant (counted under j in disposition)	
			(E)	Related and persuasive and not addressed by technical change	DOCUMENT FAILS
			(F)	Addressed by technical change (counted under k disposition)	
	(check if applicable)		Comment generated. See Section V-(ii) Comment # X.		

This table is needed for each Negative.

Negative 6

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.				
		Table 4: The specification of the surface killer defect				
Negative	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.				
		Table contents are too restrictive. The table does not specify which killer defects are to be counted. Three killer defect types are defined in Section 4; however this does not reflect the true breadth of killer defect types or killer defect classes used in the industry. In addition, the definition of defects is inconsistent from vendor to vendor. A standard must be defined for epitaxial killer defects, similar to Semi M81, before this table can be effective				
TF input (optional)						
	Withdrawal (check one)	X	No Negative withdrawal made by Voter.	GO TO "Related" subsection		
			Withdrawal document received by Standards staff on MM/DD/YYYY.	GO TO "Final" subsection → (A)		
Related	Motion and Reason (check one)	X	'Related' is mutually agreed upon. (Needs no motion.)		GO TO "Persuasive" subsection	
			Negative is not related. (Needs ≥2/3 votes to pass.)			
			Reason	XXXX		
	Motion by/ 2 nd by	Name (Company)/Name (Company)				
	Discussion					
	Result of Vote (check one)	XX Y-XX N; Motion passed/failed.				
		[Negative is not related.] < 2/3	GO TO "Persuasive" subsection			
		2/3 ≤ [Negative is not related.]	GO TO "Final" subsection → (B)			
Persuasive	Motion and Reason (check one)	X	Negative is related and persuasive. (Needs >1/3 votes to pass.)			
			Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)			
			Reason			

Motion by/ 2 nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)											
Discussion		None											
Result of Vote (check one)		19 Y-0 N; Motion passed.											
		X	[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)	X	Y	GO TO “Address by Technical Change Option” subsection						
			[Negative is related and not persuasive.] < 2/3			N	GO TO “Final” subsection → (E)						
			2/3 ≤ [Negative is related and not persuasive.] < 90%	GO TO “Final” subsection → (C)									
			90% ≤ [Negative is related and not persuasive.]	GO TO “Not Significant Finding Option” subsection									
Technical Change Recommendations Original section/paragraph number and at least one full sentence are required in “FROM” and “TO” fields.													
Address by Technical Change Option	Technical Changes	1	FROM: Section/Paragraph 4.2.18 4.2.18 surface killer defect — surface killer defects of 4H-SiC epitaxial wafers are including downfall, triangular defect and carrot defect.										
			TO: Section/Paragraph 4.2.18 4.2.18 surface killer defect — surface killer defects of 4H-SiC epitaxial wafers are including downfall, triangular defect and carrot defect. caused by epitaxial growth are including downfall and triangular defect.										
			Justification (If necessary) Carrot defect is not killer defect, so we removed carrot defects from killer defect list.										
		2	FROM: Section/Paragraph 4.2.4 4.2.4 carrot defect — a carrot-shaped defect on the epitaxial layer surface, which is consisting a basal plane stacking fault terminating at a Frank partial dislocation and a prismatic fault terminating at the epitaxial layer surface.										
			TO: Section/Paragraph 4.2.4 4.2.4 carrot defect — a carrot shaped defect on the epitaxial layer surface, which is consisting a basal plane stacking fault terminating at a Frank partial dislocation and a prismatic fault terminating at the epitaxial layer surface.										
			Justification (If necessary) Carrot defect is not killer defect, so we removed carrot defects from killer defect list.										
	3	FROM: Section/Paragraph Table 5 Table 5 The specification of surface killer defect											
		<table><tr><td>Parameter</td><td>Specification</td><td>Test Condition / Technique</td><td>Note</td></tr><tr><td>Total usable area (%)</td><td>≥95</td><td>Determine by a method agreed upon between the supplier and the customer.</td><td>#1</td></tr></table>				Parameter	Specification	Test Condition / Technique	Note	Total usable area (%)	≥95	Determine by a method agreed upon between the supplier and the customer.	#1
		Parameter	Specification	Test Condition / Technique	Note								
	Total usable area (%)	≥95	Determine by a method agreed upon between the supplier and the customer.	#1									
	#1: The parameter of total usable area is defined in § 4.2.21, and it is calculated by 2 mm × 2 mm grid size. The measurement area is the entire wafer surface except for 3 mm EE area.												

		TO: Section/Paragraph Table 5									
		Table 6 The specification of surface killer defect <table> <tr> <th>Parameter</th><th>Specification</th><th>Test Condition / Technique</th><th>Note</th></tr> <tr> <td>Total usable area (%)</td><td>≥9590</td><td>Determine by a method agreed upon between the supplier and the customer.</td><td>#1</td></tr> </table> <p>#1: The parameter of total usable area is defined in § 4.2.24.2.18, and it is calculated by 2 mm × 2 mm grid size. The measurement area is the entire wafer surface except for 3 mm EE area.</p>		Parameter	Specification	Test Condition / Technique	Note	Total usable area (%)	≥95 90	Determine by a method agreed upon between the supplier and the customer.	#1
Parameter	Specification	Test Condition / Technique	Note								
Total usable area (%)	≥95 90	Determine by a method agreed upon between the supplier and the customer.	#1								
		Justification (If necessary) The specification of surface killer defect is re-defined for a wider range of applications.									
		FROM: Section/Paragraph 6.1 6.1 The specified parameters of epitaxial wafer shall conform to the requirements of §§ 6.2–6.4, otherwise agreed to between the supplier and the customer.									
4		TO: Section/Paragraph 6.1 6.1 The specified parameters of epitaxial wafer shall conform to the requirements of §§ 6.2–6.4, otherwise agreed to between the supplier and the customer. <u>The following specified parameters of the epitaxial wafer in § 6.2 & § 6.3 & § 6.4 are recommended, final parameters and process shall be agreed upon between the supplier and the customer.</u>									
		Justification (If necessary) Use the formal sentence.									
Motion		Negative is addressed by the technical change(s).									
Motion by/2nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)									
Discussion		None									
Result of Vote (check one)		21 Y-0 N; Motion passed.									
		X 2/3 ≤ [Negative is addressed by the technical change(s).]	GO TO “Incorporation of the Technical Change” subsection								
		[Negative is not addressed by the technical change(s).] < 2/3	GO TO “Final” subsection → (E)								
Incorporation of the Technical Change	Motion		To incorporate the technical change(s).								
	Motion by/2nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)								
	Discussion		None								
	Result of Vote (check one)		21 Y-0 N; Motion passed.								
			X 90% ≤ [Agree to incorporate.] GO TO “Final” subsection → (F)								
		[Disagree to incorporate.]>10%	GO TO “Final” subsection → (E)								
Final	(check if applicable)	(A)	Withdrawn (counted under h in disposition)								
		(B)	Not related (counted under i in disposition)								
		(C)	Related and not persuasive (significant)								
		(D)	Not significant (counted under j in disposition)								
		(E)	Related and persuasive and not addressed by technical change DOCUMENT FAILS								
		X (F)	Addressed by technical change (counted under k disposition)								

(check if applicable)	Comment generated. See Section V-(ii) Comment # X.
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This table is needed for each Negative.

Negative 7

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.		
		Section 6.4.10: Flatness		
	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied. Post-epi wafer shape is a function of epi thickness and conditions and should only be defined as to be loose enough to accommodate all thickness ranges. Have the writers of this draft considered all thicknesses, including 30micron epi?		
TF input (optional)				
Withdrawal (check one)	<input checked="" type="checkbox"/>	No Negative withdrawal made by Voter.	GO TO "Related" subsection	
	<input type="checkbox"/>	Withdrawal document received by Standards staff on MM/DD/YYYY.	GO TO "Final" subsection → (A)	
Related	Motion and Reason (check one)	<input checked="" type="checkbox"/>	'Related' is mutually agreed upon. (Needs no motion.)	GO TO "Persuasive" subsection
		<input type="checkbox"/>	Negative is not related. (Needs ≥2/3 votes to pass.)	
		Reason	XXXX	
	Motion by/ 2 nd by	Name (Company)/Name (Company)		
	Discussion			
	Result of Vote (check one)	XX Y-XX N; Motion passed/failed.		
		<input type="checkbox"/>	[Negative is not related.] < 2/3	GO TO "Persuasive" subsection
<input type="checkbox"/>		2/3 ≤ [Negative is not related.]	GO TO "Final" subsection → (B)	
Persuasive	Motion and Reason (check one)	<input type="checkbox"/>	Negative is related and persuasive. (Needs >1/3 votes to pass.)	
		<input checked="" type="checkbox"/>	Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)	
		Reason	1. The standard of wafer shape is established based on the requirements of devices fab. Wafer shape must meet the standard to ensure a smooth device fabrication process. 2. According to the current epitaxial results, the shape of 30 micron epitaxial wafer can also meet the standards.	
	Motion by/ 2 nd by	Gan Feng(Epiworld)/Min Lu (Mige Lab)		
Discussion	None			

		19 Y-0 N; Motion passed.					
	Result of Vote (check one)	<input type="checkbox"/>	[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)	<input type="checkbox"/>	Y	GO TO "Address by Technical Change Option" subsection
		<input type="checkbox"/>	[Negative is related and not persuasive.] < 2/3		<input type="checkbox"/>	N	GO TO "Final" subsection → (E)
		<input type="checkbox"/>	2/3 ≤ [Negative is related and not persuasive.] < 90%	GO TO "Final" subsection → (C)			
		<input checked="" type="checkbox"/>	90% ≤ [Negative is related and not persuasive.]	GO TO "Not Significant Finding Option" subsection			
Not Significant Finding Option	This option can be used only "if the TC Chapter finds a Negative not persuasive by a vote equal to or greater than 90% of the persons voting on the action". (Regulations ¶ 9.6.1.4.5.2)						
	Use of "Not significant finding option" (check one)	<input checked="" type="checkbox"/>	It is mutually agreed upon to term the Negative "not significant".				GO TO "Final" subsection → (D)
		<input type="checkbox"/>	It is mutually agreed upon to term the Negative "significant".				GO TO "Final" subsection → (C)
		<input type="checkbox"/>	Whether or not the Negative is "not significant" is decided by a vote.				
	Motion	The Negative is "not significant".					
Motion by/ 2 nd by	Name (Company)/Name (Company)						
	Vote	<input type="checkbox"/>	XX Y-XX N; Motion passed with simple majority				GO TO "Final" subsection → (D)
		<input type="checkbox"/>	XX Y-XX N; Motion failed with simple majority				GO TO "Final" subsection → (C)
Final	(check if applicable)	<input type="checkbox"/>	(A)	Withdrawn (counted under h in disposition)			
		<input type="checkbox"/>	(B)	Not related (counted under i in disposition)			
		<input type="checkbox"/>	(C)	Related and not persuasive (significant)			
		<input checked="" type="checkbox"/>	(D)	Not significant (counted under j in disposition)			
		<input type="checkbox"/>	(E)	Related and persuasive and not addressed by technical change			DOCUMENT FAILS
		<input type="checkbox"/>	(F)	Addressed by technical change (counted under k disposition)			
	(check if applicable)	<input type="checkbox"/>	Comment generated. See Section V-(ii) Comment # X.				

This table is needed for each Negative.

Negative 8

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.
		Section 5.4.13, Table 11, and Table 12: References to wafer bow
	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.

		SEMI M55 specifically excludes any reference to wafer bow due to IP considerations. Have the authors of this standard considered all potential IP conflicts prior to including wafer bow in this proposed standard?					
TF input (optional)							
Withdrawal (check one)		<input checked="" type="checkbox"/>	No Negative withdrawal made by Voter.				GO TO "Related" subsection
		<input type="checkbox"/>	Withdrawal document received by Standards staff on MM/DD/YYYY.				GO TO "Final" subsection → (A)
Related	Motion and Reason (check one)	<input checked="" type="checkbox"/>	'Related' is mutually agreed upon. (Needs no motion.)				GO TO "Persuasive" subsection
		<input type="checkbox"/>	Negative is not related. (Needs ≥2/3 votes to pass.)				
			Reason	XXXX			
	Motion by/ 2 nd by	Name (Company)/Name (Company)					
	Discussion						
	Result of Vote (check one)	XX Y-XX N; Motion passed/failed.					
		<input type="checkbox"/>	[Negative is not related.] < 2/3				GO TO "Persuasive" subsection
		<input type="checkbox"/>	2/3 ≤ [Negative is not related.]				GO TO "Final" subsection → (B)
Persuasive	Motion and Reason (check one)	<input type="checkbox"/>	Negative is related and persuasive. (Needs >1/3 votes to pass.)				
		<input checked="" type="checkbox"/>	Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)				
			Reason	There is no IP conflict for 4H-SiC epitaxial wafer.			
	Motion by/ 2 nd by	Gan Feng(Epiworld)/Min Lu (Mige Lab)					
	Discussion	Gan Feng(Epiworld): There is no IP conflict for 4H-SiC epitaxial wafer. Yang Gan(HIT): Have you consider all of the potential IP conflicts? Gan Feng(Epiworld): Absolutely right.					
	Result of Vote (check one)	19 Y-0 N; Motion passed.					
		<input type="checkbox"/>	[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)	<input type="checkbox"/>	Y	GO TO "Address by Technical Change Option" subsection
		<input type="checkbox"/>	[Negative is related and not persuasive.] < 2/3		<input type="checkbox"/>	N	GO TO "Final" subsection → (E)
<input type="checkbox"/>	2/3 ≤ [Negative is related and not persuasive.] < 90%		GO TO "Final" subsection → (C)				

		X	90% ≤ [Negative is related and not persuasive.]	GO TO “Not Significant Finding Option” subsection	
Not Significant Finding Option	This option can be used only “if the TC Chapter finds a Negative not persuasive by a vote equal to or greater than 90% of the persons voting on the action”. (<i>Regulations</i> ¶ 9.6.1.4.5.2)				
	Use of “Not significant finding option” (check one)	X	It is mutually agreed upon to term the Negative “not significant”.		GO TO “Final” subsection → (D)
			It is mutually agreed upon to term the Negative “significant”.		GO TO “Final” subsection → (C)
			Whether or not the Negative is “not significant” is decided by a vote.		
	Motion	The Negative is “not significant”.			
	Motion by/ 2 nd by	Name (Company)/Name (Company)			
	Vote		XX Y-XX N; Motion passed with simple majority		GO TO “Final” subsection → (D)
			XX Y-XX N; Motion failed with simple majority		GO TO “Final” subsection → (C)
Final	(check if applicable)		(A)	Withdrawn (counted under h in disposition)	
			(B)	Not related (counted under i in disposition)	
			(C)	Related and not persuasive (significant)	
		X	(D)	Not significant (counted under j in disposition)	
			(E)	Related and persuasive and not addressed by technical change	DOCUMENT FAILS
			(F)	Addressed by technical change (counted under k disposition)	
	(check if applicable)		Comment generated. See Section V-(ii) Comment # X.		

This table is needed for each Negative.

Negative 9

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.
		Table 12: Parameter and Recommended Test Method
	Negative Text	<p>*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.</p> <p>Substrate items should be aligned with SEMI M55-0921. Surface orientation test method should be updated to “SEMI MF26 (Method A)”. MP Density should be updated to “Determine by a method agreed upon between the supplier and the purchaser”. TSD, TED, and BPD should be combined to “Etch Pit Density” with a test method of “SEMI M83 (etching procedure#5) and SEMI M81 (etch pit classification) or by a method agreed upon between the supplier and the purchaser”.</p>

TF input (optional)							
Withdrawal (check one)		<input checked="" type="checkbox"/>	No Negative withdrawal made by Voter.		GO TO "Related" subsection		
		<input type="checkbox"/>	Withdrawal document received by Standards staff on MM/DD/YYYY.		GO TO "Final" subsection → (A)		
Related	Motion and Reason (check one)	<input checked="" type="checkbox"/>	'Related' is mutually agreed upon. (Needs no motion.)		GO TO "Persuasive" subsection		
		<input type="checkbox"/>	Negative is not related. (Needs ≥2/3 votes to pass.)				
		<input type="checkbox"/>	Reason	XXXX			
	Motion by/ 2 nd by	Name (Company)/Name (Company)					
	Discussion						
	Result of Vote (check one)	XX Y-XX N; Motion passed/failed.					
		<input type="checkbox"/>	[Negative is not related.] < 2/3			GO TO "Persuasive" subsection	
<input type="checkbox"/>		2/3 ≤ [Negative is not related.]			GO TO "Final" subsection → (B)		
Persuasive	Motion and Reason (check one)	<input checked="" type="checkbox"/>	Negative is related and persuasive. (Needs >1/3 votes to pass.)				
		<input type="checkbox"/>	Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)				
		<input type="checkbox"/>	Reason				
	Motion by/ 2 nd by	Gan Feng(Epiworld)/Min Lu (Mige Lab)					
	Discussion	None					
	Result of Vote (check one)	21 Y-0 N; Motion passed.					
		<input checked="" type="checkbox"/>	[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)	<input checked="" type="checkbox"/>	Y	GO TO "Address by Technical Change Option" subsection
		<input type="checkbox"/>	[Negative is related and not persuasive.] < 2/3		<input type="checkbox"/>	N	GO TO "Final" subsection → (E)
<input type="checkbox"/>		2/3 ≤ [Negative is related and not persuasive.] < 90%	GO TO "Final" subsection → (C)				
<input type="checkbox"/>		90% ≤ [Negative is related and not persuasive.]	GO TO "Not Significant Finding Option" subsection				

Technical Change Recommendations Original section/paragraph number and at least one full sentence are required in “FROM” and “TO” fields.																																																																														
Address by Technical Change Option	Technical Changes	FROM: Section/Paragraph Table 12 Table 7 Parameter and Recommended Test Method																																																																												
		<table> <tr> <th>Category</th><th>Parameter</th><th>Test Method</th></tr> <tr> <td rowspan="20">Substrate</td><td>Polytype</td><td>None as yet</td></tr> <tr> <td>Conductivity Type (Dopant)</td><td>None as yet</td></tr> <tr> <td>Diameter</td><td>SEMI MF2074</td></tr> <tr> <td>Thickness</td><td>SEMI MF533 or SEMI MF1530</td></tr> <tr> <td>Surface Orientation</td><td>SEMI MF26</td></tr> <tr> <td>Resistivity</td><td>SEMI MF673</td></tr> <tr> <td>Primary Flat Length</td><td>SEMI MF671</td></tr> <tr> <td>Primary Flat Orientation</td><td>SEMI MF847</td></tr> <tr> <td>Secondary Flat Length</td><td>SEMI MF671</td></tr> <tr> <td>Secondary Flat Orientation</td><td>SEMI MF847</td></tr> <tr> <td>MP Density</td><td>None as yet</td></tr> <tr> <td>TSD density</td><td>KOH etched surface, SEMI M83 or ASTM F1404</td></tr> <tr> <td>TED density</td><td>KOH etched surface, SEMI M83 or ASTM F1404</td></tr> <tr> <td>BPD density</td><td>KOH etched surface, SEMI M83 or ASTM F1404</td></tr> <tr> <td>GBIR</td><td>SEMI MF1530</td></tr> <tr> <td>SBIR</td><td>SEMI MF1530</td></tr> <tr> <td>Warp</td><td>SEMI MF1390</td></tr> <tr> <td>Bow</td><td>SEMI MF1390</td></tr> <tr> <td>Polytype</td><td>None as yet</td></tr> <tr> <td>Conductivity Type (Dopant)</td><td>None as yet</td></tr> <tr> <td rowspan="6">Buffer layer</td><td>Carrier Concentration</td><td>None as yet</td></tr> <tr> <td>Thickness</td><td>None as yet</td></tr> <tr> <td>Polytype</td><td>None as yet</td></tr> <tr> <td>Conductivity Type (Dopant)</td><td>None as yet</td></tr> <tr> <td>Carrier Concentration</td><td>SEMI MF1392</td></tr> <tr> <td>Thickness</td><td>SEMI MF95</td></tr> <tr> <td rowspan="10">Epitaxial layer</td><td>Surface killer defect</td><td>Determine by a method agreed upon between the supplier and the customer</td></tr> <tr> <td>Surface scratch</td><td>SEMI MF523</td></tr> <tr> <td>Surface roughness</td><td>SEMI M40</td></tr> <tr> <td>Edge chip</td><td>SEMI MF523</td></tr> <tr> <td>Crack</td><td>SEMI MF523</td></tr> <tr> <td>Area contamination</td><td>SEMI MF523</td></tr> <tr> <td>GBIR</td><td>SEMI MF1530</td></tr> <tr> <td>SBIR</td><td>SEMI MF1530</td></tr> <tr> <td>Warp</td><td>SEMI MF1390</td></tr> <tr> <td>Bow</td><td>SEMI MF1390</td></tr> </table>	Category	Parameter	Test Method	Substrate	Polytype	None as yet	Conductivity Type (Dopant)	None as yet	Diameter	SEMI MF2074	Thickness	SEMI MF533 or SEMI MF1530	Surface Orientation	SEMI MF26	Resistivity	SEMI MF673	Primary Flat Length	SEMI MF671	Primary Flat Orientation	SEMI MF847	Secondary Flat Length	SEMI MF671	Secondary Flat Orientation	SEMI MF847	MP Density	None as yet	TSD density	KOH etched surface, SEMI M83 or ASTM F1404	TED density	KOH etched surface, SEMI M83 or ASTM F1404	BPD density	KOH etched surface, SEMI M83 or ASTM F1404	GBIR	SEMI MF1530	SBIR	SEMI MF1530	Warp	SEMI MF1390	Bow	SEMI MF1390	Polytype	None as yet	Conductivity Type (Dopant)	None as yet	Buffer layer	Carrier Concentration	None as yet	Thickness	None as yet	Polytype	None as yet	Conductivity Type (Dopant)	None as yet	Carrier Concentration	SEMI MF1392	Thickness	SEMI MF95	Epitaxial layer	Surface killer defect	Determine by a method agreed upon between the supplier and the customer	Surface scratch	SEMI MF523	Surface roughness	SEMI M40	Edge chip	SEMI MF523	Crack	SEMI MF523	Area contamination	SEMI MF523	GBIR	SEMI MF1530	SBIR	SEMI MF1530	Warp	SEMI MF1390
Category	Parameter	Test Method																																																																												
Substrate	Polytype	None as yet																																																																												
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	Primary Flat Length	SEMI MF671																																																																												
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	Conductivity Type (Dopant)	None as yet																																																																												
Buffer layer	Carrier Concentration	None as yet																																																																												
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	SBIR	SEMI MF1530																																																																												
	Warp	SEMI MF1390																																																																												
	Bow	SEMI MF1390																																																																												

TO: Section/Paragraph Table 12

Table 8 Parameter and Recommended Test Method

Category	Parameter	Test Method
Substrate	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Diameter	SEMI MF2074
	Thickness	SEMI MF533 or SEMI MF1530
	Surface Orientation	SEMI MF26 (Method A)
	Resistivity	SEMI MF673
	Primary Flat Length	SEMI MF671
	Primary Flat Orientation	SEMI MF847
	Secondary Flat Length	SEMI MF671
	Secondary Flat Orientation	SEMI MF847
	MP Density	None as yet
	TSD density	KOH etched surface, SEMI M83 or ASTM F1404
	TED density	KOH etched surface, SEMI M83 or ASTM F1404
	BPD density	KOH etched surface, SEMI M83 or ASTM F1404
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390
Buffer layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	None as yet
	Thickness	None as yet
Epitaxial layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	SEMI MF1392
	Thickness	SEMI MF95
	Surface killer defect	Determine by a method agreed upon between the supplier and the customer
	Surface scratch	SEMI MF523
	Surface roughness	SEMI M40
	Edge chip	SEMI MF523
	Crack	SEMI MF523
	Area contamination	SEMI MF523
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390

Justification (If necessary)

The surface orientation test method is agreed to be modified from “SEMI MF26” to “SEMI MF26 (Method A)”.

2	FROM: Section/Paragraph Table 12		
	Table 9 Parameter and Recommended Test Method		
	<i>Category</i>	<i>Parameter</i>	<i>Test Method</i>
	Substrate	Polytype	None as yet
		Conductivity Type (Dopant)	None as yet
		Diameter	SEMI MF2074
		Thickness	SEMI MF533 or SEMI MF1530
		Surface Orientation	SEMI MF26
		Resistivity	SEMI MF673
		Primary Flat Length	SEMI MF671
		Primary Flat Orientation	SEMI MF847
		Secondary Flat Length	SEMI MF671
		Secondary Flat Orientation	SEMI MF847
		MP Density	None as yet
		TSD density	KOH etched surface, SEMI M83 or ASTM F1404
		TED density	KOH etched surface, SEMI M83 or ASTM F1404
		BPD density	KOH etched surface, SEMI M83 or ASTM F1404
		GBIR	SEMI MF1530
		SBIR	SEMI MF1530
		Warp	SEMI MF1390
		Bow	SEMI MF1390
	Buffer layer	Polytype	None as yet
		Conductivity Type (Dopant)	None as yet
		Carrier Concentration	None as yet
		Thickness	None as yet
	Epitaxial layer	Polytype	None as yet
		Conductivity Type (Dopant)	None as yet
		Carrier Concentration	SEMI MF1392
		Thickness	SEMI MF95
		Surface killer defect	Determine by a method agreed upon between the supplier and the customer
		Surface scratch	SEMI MF523
		Surface roughness	SEMI M40
		Edge chip	SEMI MF523
		Crack	SEMI MF523
		Area contamination	SEMI MF523
		GBIR	SEMI MF1530
		SBIR	SEMI MF1530
		Warp	SEMI MF1390
		Bow	SEMI MF1390

TO: Section/Paragraph Table 12

Table 10 Parameter and Recommended Test Method

Category	Parameter	Test Method
Substrate	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Diameter	SEMI MF2074
	Thickness	SEMI MF533 or SEMI MF1530
	Surface Orientation	SEMI MF26
	Resistivity	SEMI MF673
	Primary Flat Length	SEMI MF671
	Primary Flat Orientation	SEMI MF847
	Secondary Flat Length	SEMI MF671
	Secondary Flat Orientation	SEMI MF847
	MP Density	None as yet Determine by a method agreed upon between the supplier and the purchaser
	TSD density	KOH etched surface, SEMI M83 or ASTM F1404
	TED density	KOH etched surface, SEMI M83 or ASTM F1404
	BPD density	KOH etched surface, SEMI M83 or ASTM F1404
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390
Buffer layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	None as yet
	Thickness	None as yet
Epitaxial layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	SEMI MF1392
	Thickness	SEMI MF95
	Surface killer defect	Determine by a method agreed upon between the supplier and the customer
	Surface scratch	SEMI MF523
	Surface roughness	SEMI M40
	Edge chip	SEMI MF523
	Crack	SEMI MF523
	Area contamination	SEMI MF523
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390

Justification (If necessary)

The MP density test method is agreed to be modified from “None as yet ” to “Determine by a method agreed upon between the supplier and the purchaser”.

FROM: Section/Paragraph 4.2

4.2 Definitions

- 4.2.1 *area contamination* — any foreign matter on the surface in localized areas that is revealed under the inspection lighting conditions as discolored, mottled, or cloudy appearance resulting from smudges, stains or waters, etc.
- 4.2.2 *basal plane dislocation (BPD)* — dislocation lying on the basal plane.
- 4.2.3 *buffer layer* — a transition layer epitaxially-formed between a substrate and the first epitaxial layer.
- 4.2.4 *carrot defect* — a carrot-shaped defect on the epitaxial layer surface, which is consisting a basal plane stacking fault terminating at a Frank partial dislocation and a prismatic fault terminating at the epitaxial layer surface.
- 4.2.5 *crack* — cleavage or fracture that extends to the surface of a wafer.
- 4.2.6 *dislocation* — a line imperfection in a crystal lattice that is characterized by a closure failure of Burgers' circuit that may form the boundary between slipped and non-slipped areas of a crystal or occur at the edge of stacking faults or around precipitates.
- 4.2.7 *downfall* — a macroscopic size particle existing within or extending beyond the epitaxial layer. The crystal structure of the particles is usually 3C.
- 4.2.8 *edge chip* — region where material has been unintentionally removed from the edge of the wafer.
- 4.2.9 *edge exclusion (EE)* — the distance from the fixed quality area (FQA) boundary to periphery of a wafer of nominal dimensions. See the definition of FQA below.
- 4.2.10 *fixed quality area (FQA)* — the central area of a wafer surface, defined by a nominal EE, over which the specified values of a parameter apply. Because the nominal EE relates to the nominal diameter of a wafer, the size of the FQA is independent of wafer diameter and flat length tolerances.
- 4.2.11 *homoepitaxial layer* — thin monocrystalline film epitaxially-formed on a substrate of the same material and crystallographic orientation, inheriting the atomic order of the substrate.
- 4.2.12 *micropipe (MP)* — small hollow tube basically parallel to the crystallographic c-axis and extending typically through larger parts of the crystal boule and thus affecting several neighboring wafers. MPs may be generated at bulk defects e.g. inclusions, polytype defects or crystallites. (See SEMI M81)
- 4.2.13 *polytype* — one of the modifications of monocrystalline material which shows polytypism.
- 4.2.14 *polytypism* — phenomenon where a material occurs in several structural modifications, each of which can be regarded as built up by stacking layers of identical structure and chemical composition.
- 4.2.15 *scratch* — a shallow groove or cut below the established plane of the surface of a semiconductor wafer, with a length to width ratio greater than 5:1.
- 4.2.16 *silicon carbide (SiC)* — semiconductor crystal composed of silicon and carbon, which will exhibits a large number of polytypes such as 3C, 4H, 6H, and 15R.
- NOTE 2: A symbol like 4H- gives the number of periodic stacking bilayers (2, 3, 4.....) and the crystal symmetry (H=hexagonal, C=cubic, and R= Rhombohedral) of each polytype.
- 4.2.17 *substrate* — a wafer that is the basis for subsequent processing operations in the fabrication of semiconductor devices or circuits that may be fabricated directly in the substrate or in a film of the same or another material grown or deposited on the substrate.
- 4.2.18 *surface killer defect* — surface killer defects of 4H-SiC epitaxial wafers are including downfall, triangular defect and carrot defect.
- 4.2.19 *threading edge dislocation (TED)* — edge dislocation penetrating through the crystal approximately normal to the basal plane.

- | | | | |
|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | <p>4.2.20 <i>threading screw dislocation (TSD)</i> — screw dislocation penetrating through the crystal approximately normal to the basal plane.</p> <p>4.2.21 <i>total usable area</i> — the proportion of the area of the wafer without surface killer defects to the area of the entire wafer.</p> <p>4.2.22 <i>triangular defect</i> — a triangle-shaped defect on the 4H-SiC epitaxial layer surface, which is a lamellar inclusion with a cubic (3C) stacking sequence, so-called “3C inclusion”, extending toward the epitaxial layer surface.</p> |
|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

TO: Section/Paragraph 4.2

4.2 Definitions

4.2.1 *area contamination* — any foreign matter on the surface in localized areas that is revealed under the inspection lighting conditions as discolored, mottled, or cloudy appearance resulting from smudges, stains or waters, etc.

~~4.2.2 *basal plane dislocation (BPD)* — dislocation lying on the basal plane.~~

~~4.2.3~~ 4.2.2 *buffer layer* — a transition layer epitaxially-formed between a substrate and the first epitaxial layer.

~~4.2.4 *carrot defect* — a carrot-shaped defect on the epitaxial layer surface, which is consisting a basal plane stacking fault terminating at a Frank partial dislocation and a prismatic fault terminating at the epitaxial layer surface.~~

~~4.2.5~~ 4.2.3 *crack* — cleavage or fracture that extends to the surface of a wafer.

~~4.2.6~~ 4.2.4 *dislocation* — a line imperfection in a crystal lattice that is characterized by a closure failure of Burgers' circuit that may form the boundary between slipped and non-slipped areas of a crystal or occur at the edge of stacking faults or around precipitates.

4.2.5 *dislocation etch pit* — a pit generated by a preferential etch where a dislocation meets the surface of a wafer.

~~4.2.7~~ 4.2.6 *downfall* — a macroscopic size particle existing within or extending beyond the epitaxial layer. The crystal structure of the particles is usually 3C.

~~4.2.8~~ 4.2.7 *edge chip* — region where material has been unintentionally removed from the edge of the wafer.

~~4.2.9~~ 4.2.8 *edge exclusion (EE)* — the distance from the fixed quality area (FQA) boundary to periphery of a wafer of nominal dimensions. See the definition of FQA below.

~~4.2.10~~ 4.2.9 *fixed quality area (FQA)* — the central area of a wafer surface, defined by a nominal EE, over which the specified values of a parameter apply. Because the nominal EE relates to the nominal diameter of a wafer, the size of the FQA is independent of wafer diameter and flat length tolerances.

~~4.2.11~~ 4.2.10 *homoepitaxial layer* — thin monocrystalline film epitaxially-formed on a substrate of the same material and crystallographic orientation, inheriting the atomic order of the substrate.

~~4.2.12~~ 4.2.11 *micropipe (MP)* — small hollow tube basically parallel to the crystallographic c-axis and extending typically through larger parts of the crystal boule and thus affecting several neighboring wafers. MPs may be generated at bulk defects e.g. inclusions, polytype defects or crystallites. (See SEMI M81)

~~4.2.13~~ 4.2.12 *polytype* — one of the modifications of monocrystalline material which shows polytypism.

~~4.2.14~~ 4.2.13 *polytypism* — phenomenon where a material occurs in several structural modifications, each of which can be regarded as built up by stacking layers of identical structure and chemical composition.

~~4.2.15~~ 4.2.14 *scratch* — a shallow groove or cut below the established plane of the surface of a semiconductor wafer, with a length to width ratio greater than 5:1.

~~4.2.16~~ 4.2.15 *silicon carbide (SiC)* — semiconductor crystal composed of silicon and carbon, which will exhibits a large number of polytypes such as 3C, 4H, 6H, and 15R.

NOTE 2: A symbol like 4H- gives the number of periodic stacking bilayers (2, 3, 4.....) and the crystal symmetry (H=hexagonal, C=cubic, and R= Rhombohedral) of each polytype.

~~4.2.17~~ 4.2.16 *substrate* — a wafer that is the basis for subsequent processing operations in the fabrication of semiconductor devices or circuits that may be fabricated directly in the substrate or in a film of the same or another material grown or deposited on the substrate.

~~4.2.18~~ 4.2.17 *surface killer defect* — surface killer defects of 4H-SiC epitaxial wafers are including downfall, triangular defect and carrot defect.

~~4.2.19 threading edge dislocation (TED) — edge dislocation penetrating through the crystal approximately normal to the basal plane.~~

~~4.2.20 threading screw dislocation (TSD) — screw dislocation penetrating through the crystal approximately normal to the basal plane.~~

~~4.2.21~~ [4.2.18](#) *total usable area* — the proportion of the area of the wafer without surface killer defects to the area of the entire wafer.

~~4.2.22~~ [4.2.19](#) *triangular defect* — a triangle-shaped defect on the 4H-SiC epitaxial layer surface, which is a lamellar inclusion with a cubic (3C) stacking sequence, so-called “3C inclusion”, extending toward the epitaxial layer surface.

Justification (If necessary)

1. TSD, TED, and BPD are agreed to be combined to "Dislocation Etch Pit", so delete 4.2.2.
2. 4.2.4 is deleted according to negative 6.
3. TSD, TED, and BPD are agreed to be combined to "Dislocation Etch Pit", so add the term definition of dislocation etch pit (section 4.2.5).
4. TSD, TED, and BPD are agreed to be combined to "Dislocation Etch Pit", so delete 4.2.19
5. TSD, TED, and BPD are agreed to be combined to "Dislocation Etch Pit", so delete 4.2.20
6. Reorder the definitions above

FROM: Section/Paragraph [5.2.14](#)&[5.2.15](#)&[5.2.16](#)

5.2.14 TSD density

5.2.15 TED density

5.2.16 BPD density

TO: Section/Paragraph [5.2.14](#)

~~5.2.14 TSD density~~

~~5.2.15 TED density~~

~~5.2.16 BPD density~~ [5.2.14 Dislocation etch pit density](#)

Justification (If necessary)

TSD, TED, and BPD are agreed to be combined to "Dislocation Etch Pit"

FROM: Section/Paragraph Table 12
Table 11 Parameter and Recommended Test Method

<i>Category</i>	<i>Parameter</i>	<i>Test Method</i>
Substrate	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Diameter	SEMI MF2074
	Thickness	SEMI MF533 or SEMI MF1530
	Surface Orientation	SEMI MF26
	Resistivity	SEMI MF673
	Primary Flat Length	SEMI MF671
	Primary Flat Orientation	SEMI MF847
	Secondary Flat Length	SEMI MF671
	Secondary Flat Orientation	SEMI MF847
	MP Density	None as yet
	TSD density	KOH etched surface, SEMI M83 or ASTM F1404
	TED density	KOH etched surface, SEMI M83 or ASTM F1404
	BPD density	KOH etched surface, SEMI M83 or ASTM F1404
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390
Buffer layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	None as yet
	Thickness	None as yet
Epitaxial layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	SEMI MF1392
	Thickness	SEMI MF95
	Surface killer defect	Determine by a method agreed upon between the supplier and the customer
	Surface scratch	SEMI MF523
	Surface roughness	SEMI M40
	Edge chip	SEMI MF523
	Crack	SEMI MF523
	Area contamination	SEMI MF523
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390

TO: Section/Paragraph Table 12

Table 12 Parameter and Recommended Test Method

Category	Parameter	Test Method
Substrate	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Diameter	SEMI MF2074
	Thickness	SEMI MF533 or SEMI MF1530
	Surface Orientation	SEMI MF26
	Resistivity	SEMI MF673
	Primary Flat Length	SEMI MF671
	Primary Flat Orientation	SEMI MF847
	Secondary Flat Length	SEMI MF671
	Secondary Flat Orientation	SEMI MF847
	MP Density	None as yet
	TSD density Dislocation Etch Pit Density	KOH etched surface, SEMI M83 or ASTM F1404 KOH Etched Surface, SEMI M83 and SEMI M81 or by a method agreed upon between the supplier and the purchaser
	TED density	KOH etched surface, SEMI M83 or ASTM F1404
	BPD density	KOH etched surface, SEMI M83 or ASTM F1404
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390
Buffer layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	None as yet
	Thickness	None as yet
Epitaxial layer	Polytype	None as yet
	Conductivity Type (Dopant)	None as yet
	Carrier Concentration	SEMI MF1392
	Thickness	SEMI MF95
	Surface killer defect	Determine by a method agreed upon between the supplier and the customer
	Surface scratch	SEMI MF523
	Surface roughness	SEMI M40
	Edge chip	SEMI MF523
	Crack	SEMI MF523
	Area contamination	SEMI MF523
	GBIR	SEMI MF1530
	SBIR	SEMI MF1530
	Warp	SEMI MF1390
	Bow	SEMI MF1390

Justification (If necessary)

1. TSD, TED, and BPD are agreed to be combined to "Dislocation Etch Pit".
2. The test method of TSD, TED, and BPD density(Dislocation Etch Pit Density) are agreed to be modified from "KOH etched surface, SEMI M83 or ASTM F1404" to "KOH Etched Surface, SEMI M83 and SEMI M81 or by a method agreed upon between the suppliers and the purchaser."

	6	FROM: Section/Paragraph 3.2 3.2 ASTM Standard ¹ ASTM E122 — Standard Practice for Calculating Sample Size to Estimate, With a Specified Tolerable Error, the Average for Characteristic of a Lot or Process ASTM F1404 — Test Method for Crystallographic Perfection of Gallium Arsenide by Molten Potassium Hydroxide (KOH) Etch Technique			
		TO: Section/Paragraph 3.2 3.2 ASTM Standard ¹ ASTM E122 — Standard Practice for Calculating Sample Size to Estimate, With a Specified Tolerable Error, the Average for Characteristic of a Lot or Process ASTM F1404 — Test Method for Crystallographic Perfection of Gallium Arsenide by Molten Potassium Hydroxide (KOH) Etch Technique			
		Justification (If necessary) The test method of TSD, TED, and BPD density (Dislocation Etch Pit Density) are agreed to be modified from "KOH etched surface, SEMI M83 or ASTM F1404" to "KOH Etched Surface, SEMI M83 and SEMI M81 or by a method agreed upon between the suppliers and the purchaser." So delete.			
	Motion		Negative is addressed by the technical change(s).		
	Motion by/2nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)		
	Discussion		None		
	Result of Vote (check one)		20 Y-0 N; Motion passed.		
			X	2/3 ≤ [Negative is addressed by the technical change(s).]	GO TO "Incorporation of the Technical Change" subsection
				[Negative is not addressed by the technical change(s).] < 2/3	GO TO "Final" subsection → (E)
	Incorporation of the Technical Change	Motion		To incorporate the technical change(s).	
		Motion by/2nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)	
		Discussion		None	
		Result of Vote (check one)		20 Y-0 N; Motion passed.	
				X	90% ≤ [Agree to incorporate.]
				[Disagree to incorporate.]>10%	GO TO "Final" subsection → (E)
Final	(check if applicable)		(A)	Withdrawn (counted under h in disposition)	
			(B)	Not related (counted under i in disposition)	
			(C)	Related and not persuasive (significant)	
			(D)	Not significant (counted under j in disposition)	
			(E)	Related and persuasive and not addressed by technical change	DOCUMENT FAILS
		X	(F)	Addressed by technical change (counted under k disposition)	

(check if applicable)	Comment generated. See Section V-(ii) Comment # X.
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This table is needed for each Negative.

Disposition of Voting Interest Reject 1

Check only when the Document has not been failed.

9	Original number (#) of Negatives		(g)
#	Number of Negatives withdrawn		(h)
#	Number of Negatives found not related		(i)
4	Number of Negatives found not significant		(j)
5	Number of Negatives addressed by technical change (Negative becomes not significant)		(k)
Final	X	$g - (h + i + j + k) = 0$	Reject is Not Valid and is not included in the denominator of § VI. Approval Conditions Check
		$g - (h + i + j + k) > 0$	Reject is included in the denominator of § VI. Approval Conditions Check
		Reject without a Negative	Not Valid

This table is needed for each Voting Interest Reject.

Note: If all of the Negatives included with a Reject Vote are withdrawn, determined to be not related, or determined to be not significant, the Reject Vote is not valid. (Regulations ¶ 9.4.3.3)

Note: A Negative addressed by a technical change is automatically considered to be not significant. (Regulations ¶ 9.6.1.4.5.2)

IV. Other Technical Issues

Origin	*TF/TC Chapter to choose Comment # (Voter: Name and company) Barbieri, Tom and Cree		
Referenced Section/ Paragraph	*TF/TC Chapter to fill in including text in the ballot as appropriate.		
	Table 3: The specification of Carrier Concentration		
Reason	*Original Comment text, if applicable, and problem statement, including justification and suggestion, should be copied.		
	Original Comment Text: Permissible Average carrier concentration and tolerance does not fully represent the available range of the industry.		
Handle technical issue identified above as a Negative.			
Motion and Reason (check one)	X	'Related' is mutually agreed upon. (Needs no motion.)	GO TO "Persuasive" subsection
		Negative is not related and assigned to TF. (Needs ≥2/3 votes to pass.)	

		Negative is not related and placed on agenda of current TC Chapter meeting as new business. (Needs ≥2/3 votes to pass.)				
		Reason	XXXX			
Motion by/ 2nd by	Name (Company)/Name (Company)					
Discussion						
Result of Vote (check one)	XX Y-XX N; Motion passed/failed.					
		[Negative is not related.] <2/3			GO TO "Persuasive" subsection	
		2/3 ≤ [Negative is not related] and assigned to TF.			GO TO "Final" subsection → (B)	
		2/3 ≤ [Negative is not related] and placed on agenda of current TC Chapter meeting as new business.				
Motion and Reason (check one)	X	Negative is related and persuasive. (Needs >1/3 votes to pass.)				
		Negative is related and not persuasive. (Needs ≥2/3 votes to pass.)				
		Reason	XXXX			
Motion by/ 2 nd by	Gan Feng (Epiworld) / Min Lu (Mige Lab)					
Discussion	None					
Result of Vote (check one)	23 Y-0 N; Motion passed.					
	X	[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one)	X	Y	GO TO "Address by Technical Change Option" subsection
		[Negative is related and not persuasive.] < 2/3			N	GO TO "Final" subsection → (E)
		2/3 ≤ [Negative is related and not persuasive.] < 90%		GO TO "Final" subsection → (C)		
Technical Change Recommendations Original section/paragraph number and at least one full sentence are required in "FROM" and "TO" fields.						
Technical Changes	1	FROM: Section/Paragraph 2.1 2.1 The specification specifies the parameters of 4H-SiC homoepitaxial wafers with a single epitaxial layer grown on an n-type substrate.				
		TO: Section/Paragraph 2.1 2.1 The specification specifies the parameters of 4H-SiC homoepitaxial wafers with a single epitaxial layer grown on an n-type substrate, up to and including 30 μm total thickness.				
		Justification (If necessary) 1. The range of carrier concentration specified in this standard ($1 \times 10^{15} \text{ cm}^{-3} \sim 5 \times 10^{17} \text{ cm}^{-3}$) can cover the range used in current mass production(The range of epi thickness is "(2 ~ 30) μm" which has been defined in Table4) . 2. For more clarified, The range of epi thickness is also be added into the scope of the standard. Discussed in negative 5.				

Motion		Negative is addressed by the technical change(s).	
Motion by/2nd by		Gan Feng (Epiworld) / Min Lu (Mige Lab)	
Discussion		None	
Result of Vote (check one)		23 Y-0 N; Motion passed.	
		<input checked="" type="checkbox"/> $2/3 \leq$ [Negative is addressed by the technical change(s).]	GO TO "Incorporation of the Technical Change" subsection
		<input type="checkbox"/> [Negative is not addressed by the technical change(s).] < 2/3	GO TO "Final" subsection → (E)
Incorporation of the Technical Change	Motion	To incorporate the technical change(s).	
	Motion by/2nd by	Gan Feng (Epiworld) / Min Lu (Mige Lab)	
	Discussion	None	
	Result of Vote (check one)	23 Y-0 N; Motion passed.	
		<input checked="" type="checkbox"/> $90\% \leq$ [Agree to incorporate.]	GO TO "Final" subsection → (F)
<input type="checkbox"/> [Disagree to incorporate.] > 10%		GO TO "Final" subsection → (E)	
(check one)	<input type="checkbox"/> (B)	Not related	
	<input type="checkbox"/> (C)	Related and not persuasive	
	<input type="checkbox"/> (E)	Related and persuasive and not addressed by technical change	DOCUMENT FAILS
	<input checked="" type="checkbox"/> (F)	Addressed by technical change	
(check if applicable)	<input type="checkbox"/>	Comment generated. See Section V-(ii) Comment # X.	

V. Comments

V- (i) Voters' Comments

Commenter 1 (Vargas-Bernal, Rafael /ITSdl) - Comment 1

Comment	*TF/TC Chapter to fill in section/paragraph #, if necessary.	
	Some '!' are required, please to verify.	
Action	The TC Chapter agreed to do one of the following actions.	
	*No motion is required in this step.	
	<input type="checkbox"/>	Already addressed by Commenter #, Comment #
	<input type="checkbox"/>	No further action was taken by the TC Chapter.
	<input type="checkbox"/>	Refer to the TF for more consideration.
	<input type="checkbox"/>	New Business
	<input checked="" type="checkbox"/>	Editorial Change
	Options for editorial change (check one)	<input type="checkbox"/> Case 1: No vote in this section: To be included and voted on as a group in § VI. Editorial Changes Other than Those Voted on in § V.
		<input checked="" type="checkbox"/> Case 2: Voted in this section:

			Original section number and at least one full sentence are required in "FROM" and "TO" fields.
Editorial Changes	1	FROM: Section/Paragraph 2.2 2.1 Dimensional requirements are provided for the following categories of epitaxial wafers: 2.1.1 100.0 mm 4H-SiC epitaxial wafers 2.1.2 150.0 mm 4H-SiC epitaxial wafers	
		TO: Section/Paragraph 2.2 2.1 Dimensional requirements are provided for the following categories of epitaxial wafers: 2.1.1 • 100.0 mm 4H-SiC epitaxial wafers 2.1.2 • 150.0 mm 4H-SiC epitaxial wafers	
		Justification (If necessary)	

	<p>FROM: Section/Paragraph 5.2</p> <p>5.2 Substrate</p> <p>5.2.1 Substrate Vendor</p> <p>5.2.2 Crystal Polytype</p> <p>5.2.3 Conductivity Type</p> <p>5.2.4 Dopant</p> <p>5.2.5 Diameter</p> <p>5.2.6 Thickness</p> <p>5.2.7 Wafer Surface Orientation</p> <p>5.2.8 Resistivity</p> <p>5.2.9 Primary Flat Length</p> <p>5.2.10 Primary Flat Orientation</p> <p>5.2.11 Secondary Flat Length (or none)</p> <p>5.2.12 Secondary Flat Orientation (or none)</p> <p>5.2.13 MP density</p> <p>5.2.14 TSD density</p> <p>5.2.15 TED density</p> <p>5.2.16 BPD density</p> <p>5.2.17 GBIR</p> <p>5.2.18 SBIR</p> <p>5.2.19 Warp</p> <p>5.2.20 Bow</p> <p>5.3 Buffer layer</p> <p>5.3.1 The conductivity type and dopant of buffer layer</p> <p>5.3.2 The thickness and carrier concentration of buffer layer and a description of the test method used to measure it and/or calibrate the growth conditions of that layer.</p> <p>5.4 Epitaxial Layer</p> <p>5.4.1 Conductivity type and dopant of each layer</p> <p>5.4.2 Carrier concentration of each epitaxial layer and a description of the test method used to measure it and/or calibrate the growth conditions of that layer (Tolerance / Intra-wafer Uniformity / Test Pattern / Test Method / EE)</p> <p>5.4.3 Thickness of each epitaxial layer and a description of the test method used to measure it and/or calibrate the growth conditions of that layer (Tolerance / Intra-wafer Uniformity / Test Pattern / Test Method / EE)</p> <p>5.4.4 Surface killer defect and a description of the test method used to measure it (Total usable area / EE)</p> <p>5.4.5 Surface roughness, and a description of the test method used to measure it</p> <p>5.4.6 Surface scratch</p> <p>5.4.7 Edge Chip</p> <p>5.4.8 Crack</p> <p>5.4.9 Area contamination (Surface / Backside)</p> <p>5.4.10 GBIR</p> <p>5.4.11 SBIR</p> <p>5.4.12 Warp</p> <p>5.4.13 Bow</p>
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	<p>TO: Section/Paragraph 5.2</p> <p>5.2 Substrate</p> <p>5.2.1 Substrate Vendor₁</p> <p>5.2.2 Crystal Polytype₂</p> <p>5.2.3 Conductivity Type₂</p> <p>5.2.4 Dopant₂</p> <p>5.2.5 Diameter₂</p> <p>5.2.6 Thickness₂</p> <p>5.2.7 Wafer Surface Orientation₂</p> <p>5.2.8 Resistivity₂</p> <p>5.2.9 Primary Flat Length₂</p> <p>5.2.10 Primary Flat Orientation₂</p> <p>5.2.11 Secondary Flat Length (or none)₂</p> <p>5.2.12 Secondary Flat Orientation (or none)₂</p> <p>5.2.13 MP density₂</p> <p>5.2.14 TSD densityDislocation etch pit density₂</p> <p>5.2.15 TED density</p> <p>5.2.16 BPD density</p> <p>5.2.17 5.2.15 GBIR,</p> <p>5.2.18 5.2.16 SBIR,</p> <p>5.2.19 5.2.17 Warp₂ and</p> <p>5.2.20 5.2.18 Bow₂</p> <p>5.3 Buffer layer</p> <p>5.3.1 The conductivity type and dopant of buffer layer₂ and</p> <p>5.3.2 The thickness and carrier concentration of buffer layer and a description of the test method used to measure it and/or calibrate the growth conditions of that layer.</p> <p>5.4 Epitaxial Layer</p> <p>5.4.1 Conductivity type and dopant of each layer₂</p> <p>5.4.2 Carrier concentration of each epitaxial layer and a description of the test method used to measure it and/or calibrate the growth conditions of that layer (Tolerance / Intra-wafer Uniformity / Test Pattern / Test Method / EE)₂</p> <p>5.4.3 Thickness of each epitaxial layer and a description of the test method used to measure it and/or calibrate the growth conditions of that layer (Tolerance / Intra-wafer Uniformity / Test Pattern / Test Method / EE)₂</p> <p>5.4.4 Surface killer defect and a description of the test method used to measure it (Total usable area / EE)₂</p> <p>5.4.5 Surface roughness, and a description of the test method used to measure it₂</p> <p>5.4.6 Surface scratch₂</p> <p>5.4.7 Edge Chip₂</p> <p>5.4.8 Crack₂</p> <p>5.4.9 Area contamination (Surface / Backside)₂</p> <p>5.4.10 GBIR₂</p> <p>5.4.11 SBIR₂</p> <p>5.4.12 Warp₂ and</p> <p>5.4.13 Bow₂</p>
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	<p>Justification (If necessary) Section 5.2.14 is modified for Negative 9 change 3. Reorder the definitions.</p>
3	<p>FROM: Section/Paragraph 6.2</p> <p>6.2 Substrate</p> <p>6.2.1 Polytype: 4H</p> <p>6.2.2 Conductivity type: n-type</p> <p>6.2.3 Dopant: Nitrogen</p> <p>6.2.4 Surface orientation: (0001) face 4.0° toward $\langle 11\bar{2}0 \rangle$</p> <p>6.2.5 Other specific technical parameters of substrates must meet the requirements of SEMI M55, or must meet the requirements of the specification agreed by the supplier and the customer.</p> <p>TO: Section/Paragraph 6.2</p> <p>6.2 Substrate</p> <p>6.2.1 Polytype: 4H₂</p> <p>6.2.2 Conductivity type: n-type₂</p> <p>6.2.3 Dopant: Nitrogen₂</p> <p>6.2.4 Surface orientation: (0001) face 4.0° toward $\langle 11\bar{2}0 \rangle$₂</p> <p>6.2.5 Other specific technical parameters of substrates must meet the requirements of SEMI M55, or must meet the requirements of the specification agreed by the supplier and the customer.</p> <p>Justification (If necessary) Add".</p>
4	<p>FROM: Section/Paragraph 6.3.1</p> <p>6.3.1 Polytype: 4H</p> <p>TO: Section/Paragraph 6.3.1</p> <p>6.3.1 Polytype: 4H₂</p> <p>Justification (If necessary) Add".</p>
5	<p>FROM: Section/Paragraph 6.3.2</p> <p>6.3.2 Conductivity type: n-type</p> <p>TO: Section/Paragraph 6.3.2</p> <p>6.3.2 Conductivity type: n-type₂</p> <p>Justification (If necessary) Add".</p>
6	<p>FROM: Section/Paragraph 6.4.1</p> <p>6.4.1 Conduction type: n-type / p-type</p>

7	TO: Section/Paragraph 6.4.1 6.4.1 Conduction type: n-type / p-type.	
	Justification (If necessary) Add".	
	FROM: Section/Paragraph 6.4.2 6.4.2 Dopant: Nitrogen / Aluminum	
	TO: Section/Paragraph 6.4.2 6.4.2 Dopant: Nitrogen / Aluminum.	
	Justification (If necessary) Add".	
Motion		To approve above editorial change(s)
Motion by/2 nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)
Discussion		None
Vote		19 Y-0 N; Motion passed.

This table is needed for each Comment accompanied a Vote

V-(ii) Comments Created by Handling Negative None

VI. Editorial Changes Other than Those Voted on in § V None

VII. Approval Conditions Check

VII. - (i). Approval Rate

APPROVAL CONDITION 1: All Negatives have been discussed and were withdrawn, found not related, found not persuasive, or addressed by a technical change. (*Regulations ¶ 9.6.2.1.2*)

APPROVAL CONDITION 2: At least 90% of the sum of valid Voting Interest Accept and Voting Interest Reject Votes must be Accept. (*Regulations ¶ 9.6.2.1.3*)

Note: If both approval conditions are not satisfied, the Document fails.

		Accepts		(Accepts + Valid Rejects)					
Approval Rate	=	51	/	51	=	100.0%		≥90%	

VII. – (ii) Approval Level (check one)

Note: See *Regulations* § 9.6.2 for further information.

<input type="checkbox"/>	Globally Approved (No Ratification Ballot needed): The Letter Ballot meets the Letter Ballot approval conditions for the global technical committee.
<input checked="" type="checkbox"/>	Need a Ratification Ballot: The Letter Ballot meets the Letter Ballot approval conditions for the TC Chapter and a Ratification Ballot will be issued to validate technical changes.

VIII. Safety Check

Note: See *Regulations* § 15 for further information.

Motion	<input checked="" type="checkbox"/>	This is not a Safety Document , when all safety-related information is removed, the Document is still technically sound and complete. (<i>Regulations</i> ¶ 8.7.1)
	<input type="checkbox"/>	This is a Safety Document , when all safety-related information is removed, the Document is not technically sound and complete. (<i>Regulations</i> ¶ 8.7.2)
	<input type="checkbox"/>	Safety Checklist (<i>Regulations</i> ¶ 15.3) is complete and has been included with the Document throughout the balloting process. (<i>Regulations</i> ¶ 15.1.2)
Motion by/2 nd by		Gan Feng(Epiworld)/Chengzhan Li (CRRC SEMICONDUCTOR)
Discussion		None
Vote		19 Y-0 N; Motion passed

IX. Intellectual Property (IP) Check

Note: This Letter Ballot may cover all or part of a Standard or Safety Guideline. Regardless of the coverage, this IP check applies to the entire Standard or Safety Guideline*. See *Regulations* § 16 for further information.

X	The TC Chapter meeting chair asked those participating, if they were aware of any patented technology that might be relevant (see <i>Regulations</i> ¶ 16.3.1.1) to the Standard or Safety Guideline; or, any copyrighted items or trademarks that are used/reproduced (see <i>Regulations</i> ¶ 16.4.1.2) in the Standard or Safety Guideline. (Also see, <i>Regulations</i> § 8.8)				
	X	The question is NOT answered in affirmative (No potentially material patented technology or use/reproduction of copyrighted items/trademarks is known.)	GO TO SECTION X.		
		The question is answered in affirmative	Is any of the known IPs a patented technology?	Yes, at least one of them is a patented technology	GO TO IX (a) “Patented Technology” subsection
				No	GO TO IX (b) “Copyright items” subsection

IX(a) Patented Technologies subsection

IX(a1) Total numbers of Patented Technologies to be dealt with

# Fill number	(l) Known Patented Technology that might be relevant to the Standard/Safety Guideline	# Fill number	(m) Number of patented technologies first became known to the TC Chapter on or after the day of the issuance of this Letter Ballot	Postpone assessment of such patented technologies to be performed at the next scheduled TC Chapter meeting.
		# Fill number	(n) Number of patented technologies first became known to the TC Chapter before the day of the issuance of this Letter Ballot	GO TO IX (a2)

IX(a2) Assessment of disclosed patented technologies

Disclosed patented technology #1 (Brief description, e.g., patent title and number):			Date of Assessment (If different from the date of Letter Ballot adjudication) MM/DD/YYYY		
Is disclosed patented technology #1 found to be “might be material” to the Standard/Safety Guideline?		YES (It is a PMPT)	Is the use of this PMPT technically justified?	YES	PROCEED to assess NEXT one, or if this is the last one, GO TO IX(a3)
				NO	The Document is failed and returned to the TF
		NO	No further action is needed for patented technology #1		

This table is needed for each disclosed patented technology.

IX(a3) LOA status check of PMPT of which inclusion assessed to be justified

LOA Status of PMPT #1						
Has an LOA for this patented technology been received from every owner ?		YES	PROCEED to check NEXT one, or if this is the last one, GO TO IX(b)			
		NO	MOTION		Ask ISC for special permission to publish.	
					Quit activity.	The Document is failed and returned to the TF
					Wait for LOA	PROCEED to check NEXT one, or if this is the last one, GO TO IX(b1)
			Motion by/ 2 nd by		Name (Company)/Name (Company)	
			Discussion		XXXX	
			Vote		XX Y-XX N; Motion passed (or failed)	

This table is needed for each PMPT of which inclusion assessed to be justified.

IX(b1) Total numbers of copyrighted items to be dealt with

# Fill number	(o) Known copyrighted items that are used or reproduced to the Standard/Safety Guideline	o > 0	There is at least one known copy righted items that might be relevant to the Standard/Safety Guideline	GO TO IX (b2)
		o = 0		
			There is no disclosed copyrighted item	GO TO IX (c)

IX(b2) Assessment of disclosed copyrighted items

Disclosed copyrighted item #1 (Brief description of its use in the Document):					
Is disclosed copyrighted item #1 used or reproduced in the Standard/Safety Guideline?		YES	Is the use/reproduction of this copyrighted item technically justified?	YES	PROCEED to assess NEXT one, or if this is the last one, GO TO IX(b3)
				NO	The Document is failed and returned to the TF
		NO	No further action is needed for copyrighted item #1		

This table is needed for each disclosed copyrighted item.

IX(b3) Copyright release status check of copyrighted item of which inclusion assessed to be justified

Copyright release Status of copyrighted item #1						
Has the copyright release been received from its owner ?.		YES	PROCEED to assess NEXT one, or if this is the last one, GO TO IX(c)			
		NO	MOTIO		Ask ISC for special permission to publish.	
					Quit activity.	The Document is failed and returned to the TF

				Wait for copyright release letter	PROCEED to check NEXT one, or if this is the last one, GO TO IX(c)
				Motion by/ 2nd by	Name (Company)/Name (Company)
				Discussion	XXXX
				Vote	XX Y-XX N; Motion passed (or failed)

This table is needed for each copyrighted item of which use/reproduction assessed to be justified.

IX(c) Assessment of disclosed (identified) trademark

Is there any trademark in the Standard/Safety Guideline?		YES	Is every instance of trademark use technically justified?		YES	GO TO IX(d)
					NO	The Document is failed and returned to the TF
		NO	GO TO IX(d)			

IX(d) IP check completion condition check

The co-chair checks if any Patented Technologies first become known to the TC Chapter on or after the day of the issuance of this Letter Ballot? i.e., m>0 in IX(a1)		YES	Sections IX(a2) and IX(a3) shall be completed and recorded for such patented technologies at next scheduled meeting of the TC Chapter. Until then, the TC Chapter shall NOT go to X (making motion to pass/fail this Document) (see Regulations ¶ 16.4.1.2) Until then this Letter Ballot Review is on hold.
		NO	GO TO X

X. Action for This Document

Motion		This Document passed TC Chapter review as balloted and will be forwarded to the ISC A&R SC for procedural review.
		This Document passed TC Chapter review with editorial changes and will be forwarded to the ISC A&R SC for procedural review.
	X	This Document passed TC Chapter review with technical changes and with or without editorial changes and will be forwarded to the ISC A&R SC for procedural review. A Ratification Ballot will be issued to verify the technical changes.
		This Document failed TC Chapter review and will be returned to the TF for rework.
		This Document failed TC Chapter review and work will be discontinued.
Motion by/ 2nd by		Gan Feng(Epiworld)/Min Lu (Mige Lab)
Discussion		None
Vote		18 Y-0 N
Final Action	X	Motion passed
		Motion failed

Note: If the use of PMPT or copyrighted item is justified by the TC Chapter, LOA or release form must be received before publication can proceed.