

# Record of Letter Ballot Review by TC Chapter for Procedural Review

Region/Locale: **China**  
 Global Technical Committee: **Photovoltaic**  
 TC Chapter Cochairs: **Guangchun Zhang/CSI**  
 Standards Staff: **Isadora Jin/SEMI China**

	<b>Scheduled in Background Statement</b>	<b>Actual</b>
<b>Date</b>	<b>10/25/2019</b>	<b>10/25/2019</b>
<b>Location</b>	<b>Beijing</b>	<b>Beijing</b>
<b>Reason for Change of Date and/or Location (if changed)</b>		

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

## I. Document Number and Title

<b>Document Number</b> <b>5842D</b>	<b>Document Title</b> <b>New Standard: Test Method for Metal-Wrap-Through Solar Cell Via Resistance</b>
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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 Vote	Distributio	Return Rate	
Letter Ballot	93	÷ 153	= 60.8%	≥60%
Intercommittee Ballot	40			
Voting Interest Reject(s)	2	Total Voters with Rejects		2
Voting Interest Accept(s)	70			

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

### III. Rejects

#### Voting Interest Reject 1 (Voting Interest Name: Peter Wagner Consulting)

#### Voter Reject 1 (Voter: Peter Wagner and Peter Wagner Consulting)

#### Negative 1

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.	
		¶ 1 Purpose	
Negative	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.	
		The Purpose section is inadequate. It does not tell the reader why this standard would be needed. Is the via resistance an issue between customer and supplier? I'd guess that it is the series resistance that is specified. Or is there a specification for the via filling paste that needs to be tested? For internal measurements of a supplier of solar cells a standardized test method is not needed. Standardized test methods are needed only when measurement data are exchanged between different parties.	
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 <sup>nd</sup> by	Name (Company)/Name (Company)	
	Discussion		
Result of Vote (check one)	<input type="checkbox"/>	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	Via is a must and key design for MWT cell. The quality of via determines the quality of a cell. It is not only designed for efficiency, but also designed for long time reliability. But the design of MWT pattern remains lots of choices, from the numbers to the distribution of the vias. It is necessary to setup a standard of the testing method for vias. This is important for the characterization of MWT cells and longtime reliability.	

	<b>Motion by/ 2<sup>nd</sup> by</b>	Jingbing Dong (CSI) / Zhixin Li (LINTON)		
	<b>Discussion</b>	Guangchun Zhang (CSI): Please add the development history into the background. This will help the members in other region review and avoid repeated rejects.		
	<b>Result of Vote (check one)</b>	47 Y-6 N; Motion passed.		
		<input type="checkbox"/>	[Negative is related and persuasive.] > 1/3	Is a technical change recommended? (check one) <input type="checkbox"/> Y
		<input type="checkbox"/>	[Negative is related and not persuasive.] < 2/3	<input type="checkbox"/> N
		<input checked="" 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
<b>Not Significant Finding Option</b>	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)			
	<b>Use of "Not significant finding option" (check one)</b>	<input 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.	
	<b>Motion</b>	The Negative is "not significant".		
<b>Motion by/ 2<sup>nd</sup> by</b>	Name (Company)/Name (Company)			
<b>Vote</b>	<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)	
<b>Final</b>	<b>(check if applicable)</b>	<input type="checkbox"/>	(A)	Withdrawn (counted under h in disposition)
		<input type="checkbox"/>	(B)	Not related (counted under i in disposition)
		<input checked="" type="checkbox"/>	(C)	Related and not persuasive (significant)
		<input type="checkbox"/>	(D)	Not significant (counted under j in disposition)
		<input type="checkbox"/>	(E)	Related and persuasive and not addressed by technical change
	<input type="checkbox"/>	(F)	Addressed by technical change (counted under k disposition)	
<b>(check if applicable)</b>	<input type="checkbox"/>	Comment generated. See Section V-(ii) Comment # X.		

## Negative 2

<b>Negative</b>	<b>Referenced Section/ Paragraph</b>	*TF/TC Chapter to fill in, including text in the ballot if necessary. ¶ 4 Figure 1 and Figure 2
	<b>Negative Text</b>	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied. Figs. 1 and 2: The schematic drawings for current source and voltmeter are not according to international standards.
<b>TF input (optional)</b>		

<b>Withdrawal (check one)</b>	<input checked="" type="checkbox"/>	No Negative withdrawal made by Voter.		<b>GO TO “Related” subsection</b>		
	<input type="checkbox"/>	Withdrawal document received by Standards staff on MM/DD/YYYY.		<b>GO TO “Final” subsection → (A)</b>		
<b>Related</b>	<b>Motion and Reason (check one)</b>	<input checked="" type="checkbox"/>	‘Related’ is mutually agreed upon. <b>(Needs no motion.)</b>		<b>GO TO “Persuasive” subsection</b>	
		<input type="checkbox"/>	Negative is not related. <b>(Needs ≥2/3 votes to pass.)</b>			
		Reason				
	<b>Motion by/ 2<sup>nd</sup> by</b>					
	<b>Discussion</b>					
	<b>Result of Vote (check one)</b>	<b>XX Y-XX N; Motion passed/failed.</b>				
<input type="checkbox"/>		[Negative is not related.] < 2/3		<b>GO TO “Persuasive” subsection</b>		
<input type="checkbox"/>		2/3 ≤ [Negative is not related.]		<b>GO TO “Final” subsection → (B)</b>		
<b>Persuasive</b>	<b>Motion and Reason (check one)</b>	<input type="checkbox"/>	Negative is related and persuasive. <b>(Needs &gt;1/3 votes to pass.)</b>			
		<input checked="" type="checkbox"/>	Negative is related and not persuasive. <b>(Needs ≥2/3 votes to pass.)</b>			
		Reason	Figs.1 and 2 uses the standard four-probe testing method for determine the thin film resistivity.			
	<b>Motion by/ 2<sup>nd</sup> by</b>	Jingbing Dong (CSI) / Zhixin Li (LINTON)				
	<b>Discussion</b>	None				
	<b>Result of Vote (check one)</b>	<b>48 Y- 5 N; Motion passed.</b>				
<input type="checkbox"/>		[Negative is related and persuasive.] > 1/3	<b>Is a technical change recommended? (check one)</b>	<input type="checkbox"/>	<b>Y</b>	<b>GO TO “Address by Technical Change Option” subsection</b>
<input type="checkbox"/>		[Negative is related and not persuasive.] < 2/3		<input type="checkbox"/>	<b>N</b>	<b>GO TO “Final” subsection → (E)</b>
<input type="checkbox"/>		2/3 ≤ [Negative is related and not persuasive.] < 90%	<b>GO TO “Final” subsection → (C)</b>			
<input checked="" type="checkbox"/>	90% ≤ [Negative is related and not persuasive.]	<b>GO TO “Not Significant Finding Option” subsection</b>				
<b>Not Significant Finding Option</b>	<b>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)</b>					
	<b>Use of “Not significant finding option” (check one)</b>	<input checked="" type="checkbox"/>	It is mutually agreed upon to term the Negative “not significant”.		<b>GO TO “Final” subsection → (D)</b>	
		<input type="checkbox"/>	It is mutually agreed upon to term the Negative “significant”.		<b>GO TO “Final” subsection → (C)</b>	
		Whether or not the Negative is “not significant” is decided by a vote.				
	<b>Motion</b>	The Negative is “not significant”.				
<b>Motion by/ 2<sup>nd</sup> by</b>	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.		

### Negative 3

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.			
		§12.1.2			
Negative	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.			
		12.1.2: This is too general. Here it has to be listed which characteristics and conditions have to be reported.			
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 <sup>nd</sup> 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	This standard only defines a testing method. The data is related with cell structure and process conditions, which is not part of this standard.			

	Motion by/ 2 <sup>nd</sup> by	Jingbing Dong (CSI) / Zhixin Li (LINTON)				
	Discussion	None				
	Result of Vote (check one)	48 Y- 5 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)			
<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 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 checked="" type="checkbox"/>	Whether or not the Negative is "not significant" is decided by a vote.			
	Motion	The Negative is "not significant".				
Motion by/ 2 <sup>nd</sup> by	Jingbing Dong (CSI) / Zhixin Li (LINTON)					
Vote	<input checked="" type="checkbox"/>	48 Y-7 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.				

#### Negative 4

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary.  Appendix 1 § A1-1.2 and § A1-1.3
	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.

		A1-1.2 and A1-1.3: Details how the tests were performed are missing. Were they performed on one day one measurement after the other. Or were they performed on several days. A correct R&R study would be needed. Assuming a tolerance for the via resistance on 1 mOhm (based on Figure A1-2) and the standard deviation of 0.2176 this would result in a P(6 sigma)/T ratio of 130 % (see SEMI M32). Usually a value of at least 20 % is required for a good test method.			
	<b>TF input (optional)</b>				
	<b>Withdrawal (check one)</b>	<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)
<b>Related</b>	<b>Motion and Reason (check one)</b>	<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		
	<b>Motion by/ 2<sup>nd</sup> by</b>	Name (Company)/Name (Company)			
	<b>Discussion</b>				
	<b>Result of Vote (check one)</b>	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)
<b>Persuasive</b>	<b>Motion and Reason (check one)</b>	<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	The appendix paragraph is just to show an applied case using the standard and give evidence that the testing method works.		
	<b>Motion by/ 2<sup>nd</sup> by</b>	Jingbing Dong (CSI) / Zhixin Li (LINTON)			
	<b>Discussion</b>				
	<b>Result of Vote (check one)</b>	48 Y-7 N; Motion passed.			
<input type="checkbox"/>		[Negative is related and persuasive.] > 1/3	<b>Is a technical change recommended? (check one)</b>	<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		
<b>Not Significant</b>	<b>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)</b>				
	<input type="checkbox"/>	It is mutually agreed upon to term the Negative "not significant".			GO TO "Final" subsection → (D)

	<b>Use of “Not significant finding option” (check one)</b>	<input type="checkbox"/>	It is mutually agreed upon to term the Negative “significant”.	<b>GO TO “Final” subsection → (C)</b>	
		<input checked="" type="checkbox"/>	Whether or not the Negative is “not significant” is decided by a vote.		
	<b>Motion</b>	The Negative is “not significant”.			
	<b>Motion by/ 2<sup>nd</sup> by</b>	Jingbing Dong (CSI) / Li Huang (SEMILAB)			
	<b>Vote</b>	<input checked="" type="checkbox"/>	46 Y-7 N; Motion passed with simple majority	<b>GO TO “Final” subsection → (D)</b>	
		<input type="checkbox"/>	XX Y-XX N; Motion failed with simple majority	<b>GO TO “Final” subsection → (C)</b>	
<b>Final</b>	<b>(check if applicable)</b>	<input type="checkbox"/>	<b>(A)</b>	Withdrawn <b>(counted under h in disposition)</b>	
		<input type="checkbox"/>	<b>(B)</b>	Not related <b>(counted under i in disposition)</b>	
		<input type="checkbox"/>	<b>(C)</b>	Related and not persuasive (significant)	
		<input checked="" type="checkbox"/>	<b>(D)</b>	Not significant <b>(counted under j in disposition)</b>	
		<input type="checkbox"/>	<b>(E)</b>	Related and persuasive and not addressed by technical change	<b>DOCUMENT FAILS</b>
		<input type="checkbox"/>	<b>(F)</b>	Addressed by technical change <b>(counted under k disposition)</b>	
	<b>(check if applicable)</b>	<input type="checkbox"/>	Comment generated. <b>See Section V-(ii) Comment # X.</b>		

### Disposition of Voting Interest Reject 1

Check only when the Document has not been failed.

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

*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)*



**Voting Interest Reject 2 (Voting Interest Name: U.A. Associates)  
Voter Reject 1 (Voter: Larry Hartsough and U.A. Associates)  
Negative 1**

<b>Negative</b>	<b>Referenced Section/ Paragraph</b>	<b>*TF/TC Chapter to fill in, including text in the ballot if necessary.</b>	
	<b>Negative Text</b>	<p><b>*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.</b></p> <p>Per the Regulations, an Appendix is a necessary part of the Standard:  4.2.7 Appendix, n. — Official material required for using a Standard or Safety Guideline, published as a separate and distinct section within that Document.  This Appendix merely contains experimental results showing examples of the types of results and repeatability. It should be included as Related Information (see Regulations 4.2.8). This could probably be accomplished via a Ratification Ballot.</p> <p>Comment 3, in A1– 1.1, “mainly” should be “many”; also “...see Figure A3 1” should read “...see Figure A1 1” (would be changed to R11 1 after changing the Appendix to Related Information).</p>	
<b>TF input (optional)</b>			
<b>Withdrawal (check one)</b>	<input checked="" type="checkbox"/>	No Negative withdrawal made by Voter.	<b>GO TO “Related” subsection</b>
	<input type="checkbox"/>	Withdrawal document received by Standards staff on MM/DD/YYYY.	<b>GO TO “Final” subsection → (A)</b>
<b>Related</b>	<b>Motion and Reason (check one)</b>	<input checked="" type="checkbox"/>	‘Related’ is mutually agreed upon. <b>(Needs no motion.)</b> <span style="float: right;"><b>GO TO “Persuasive” subsection</b></span>
		<input type="checkbox"/>	Negative is not related. <b>(Needs ≥2/3 votes to pass.)</b>
	<input type="checkbox"/>	Reason	XXXX
	<b>Motion by/ 2<sup>nd</sup> by</b>	Name (Company)/Name (Company)	
	<b>Discussion</b>		
	<b>Result of Vote (check one)</b>	XX Y-XX N; Motion passed/failed.	
<input type="checkbox"/>		[Negative is not related.] < 2/3	<b>GO TO “Persuasive” subsection</b>
<input type="checkbox"/>		2/3 ≤ [Negative is not related.]	<b>GO TO “Final” subsection → (B)</b>
<b>Persuasive</b>	<b>Motion and Reason (check one)</b>	<input checked="" type="checkbox"/>	Negative is related and persuasive. <b>(Needs &gt;1/3 votes to pass.)</b>
		<input type="checkbox"/>	Negative is related and not persuasive. <b>(Needs ≥2/3 votes to pass.)</b>
	<input type="checkbox"/>	Reason	XXXX
	<b>Motion by/ 2<sup>nd</sup> by</b>	Jingbing Dong (CSI) / Zhixin Li (Linton)	
	<b>Discussion</b>	Jingbing Dong (CSI): This modification should be processed via a ratification ballot.	
		48 Y-5 N; Motion passed.	

	<b>Result of Vote (check one)</b>	X	[Negative is related and persuasive.] > 1/3	<b>Is a technical change recommended? (check one)</b>	X	Y	GO TO "Address by Technical Change Option" subsection	
			[Negative is related and not persuasive.] < 2/3			N	GO TO "Final" subsection → (E)	
			$2/3 \leq$ [Negative is related and not persuasive.] < 90%	GO TO "Final" subsection → (C)				
			$90\% \leq$ [Negative is related and not persuasive.]	GO TO "Not Significant Finding Option" subsection				
<b>Add ress</b>	<b>Technical Change Recommendations</b> <b>Original section/paragraph number and at least one full sentence are required in "FROM" and "TO" fields.</b>							

FROM: Section/Paragraph

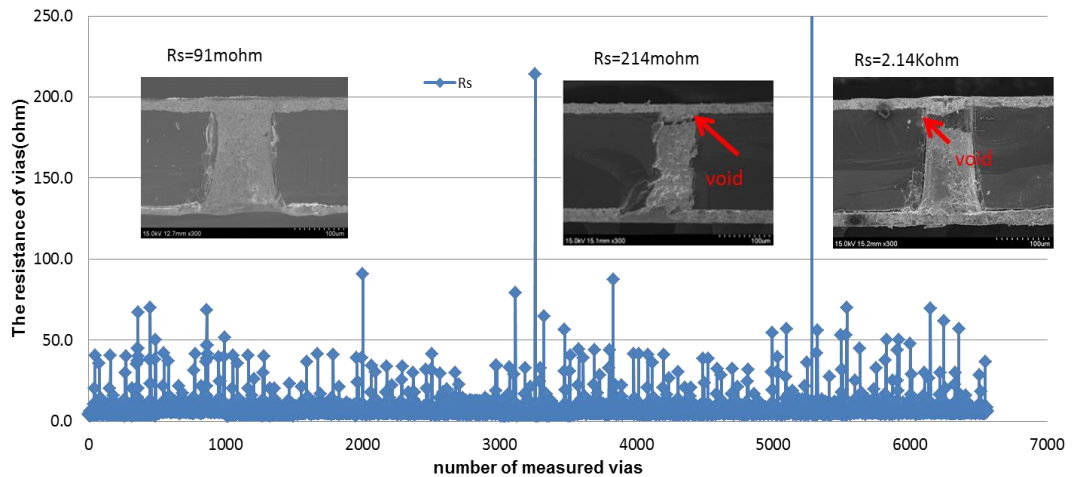
**APPENDIX 1**

**REPEATABILITY AND REPRODUCIBILITY OF FOUR POINTS TEST**

**NOTICE:** The material in this Appendix is an official part of SEMI [document 5842D] and was approved by full letter ballot procedures on [A&R approval date].

**A1-1 Repeatability and reproducibility of Four Points Test**

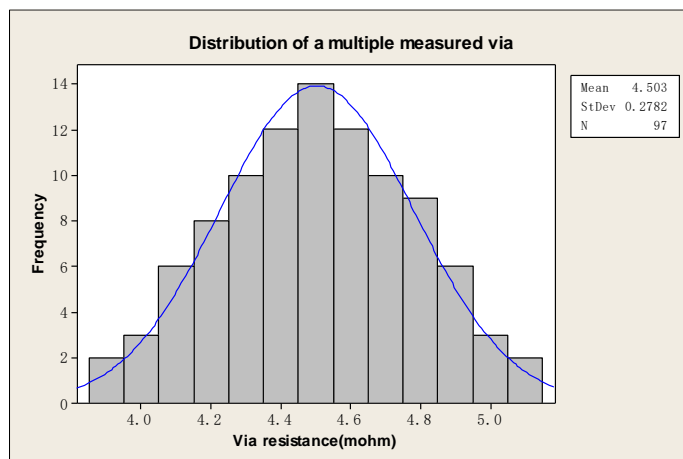
**A1-1.1** More than 6500 via-holes have been measured with the four points test method on a mass production line, and the typical SEM pictures of **mainly** cross-sections were carried out with a microscope, see Figure A3-1. Line SOP standard is less than 100 mΩ.



**Figure A1-1**

The distribution of via-holes resistance using the four points test method on production line and typical microscope pictures of via-hole cross-sections

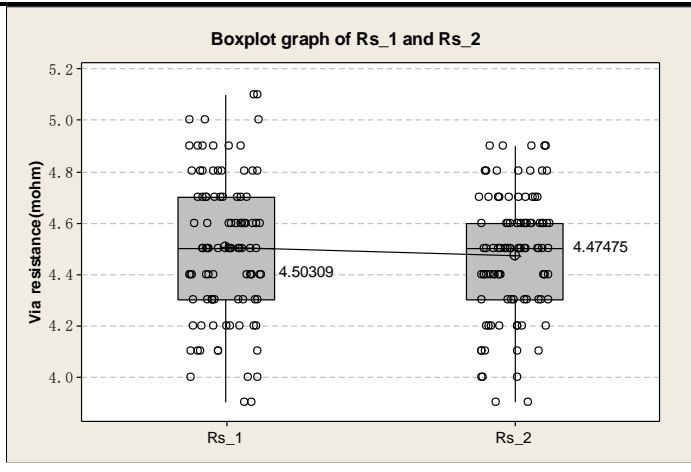
**A1-1.2** 97 repeated tests were carried out with four points test method for a via-hole by the same person. The normal distribution was shown in figure A1-2. StDev is 0.2176.



**Figure A1-2**

The data distribution of via-holes resistance measured by using four points test method for a via-hole by the same person

**A1-1.3** 100 repeated tests were carried out with four points test method for a via-hole by 2 people. The statistical data distribution is shown in Figure A1-3. The deviation of Rs\_1 and Rs\_2 mean value is 0.028 mΩ.



**Figure A1-3**

The data distribution of via-holes resistance measured by using four points test method for a via-hole by 2 people

TO: Section/Paragraph

## RELATED INFORMATION 1

### REPEATABILITY AND REPRODUCIBILITY OF FOUR POINTS TEST

#### R1-1 Repeatability and reproducibility of Four Points Test

R1-1.1 More than 6500 via-holes have been measured with the four points test method on a mass production line, and the typical SEM pictures of **mainly many** cross-sections were carried out with a microscope, see Figure R1-1. Line SOP standard is less than 100 mΩ.

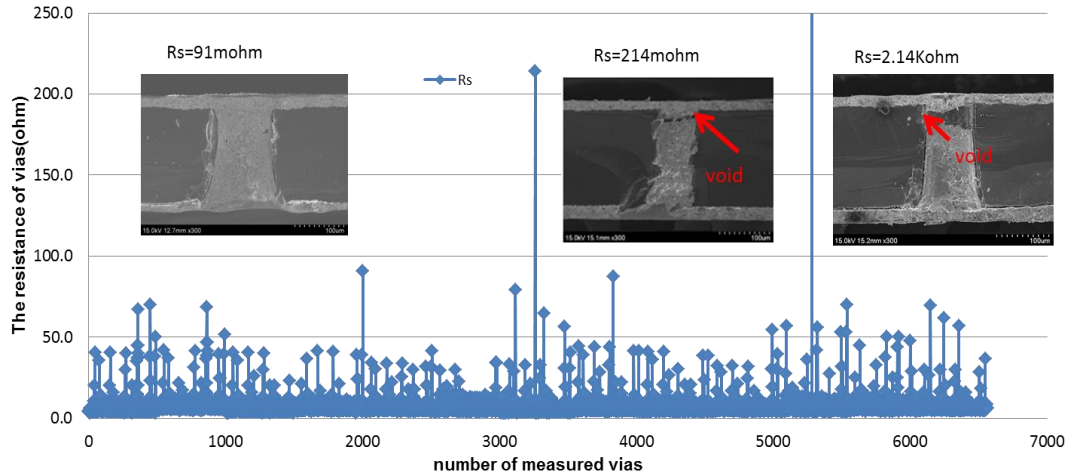


Figure R1-1

The distribution of via-holes resistance using the four points test method on production line and typical microscope pictures of via-hole cross-sections

R1-1.2 97 repeated tests were carried out with four points test method for a via-hole by the same person. The normal distribution was shown in Figure R1-2. StDev is 0.2176.

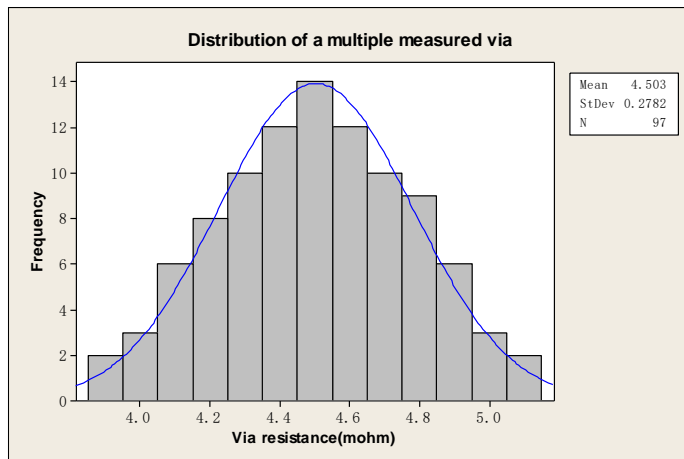
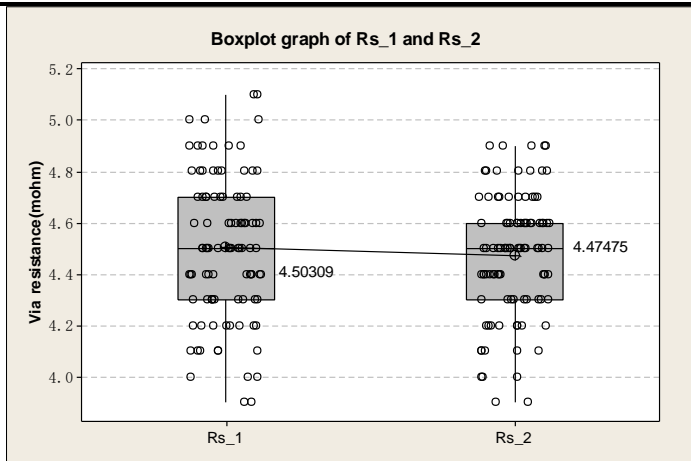


Figure R1-2

The data distribution of via-holes resistance measured by using four points test method for a via-hole by the same person

R1-1.3 100 repeated tests were carried out with four points test method for a via-hole by 2 people. The statistical data distribution is shown in Figure R1-3. The deviation of Rs\_1 and Rs\_2 mean value is 0.028 mΩ.



**Figure R1-3**

The data distribution of via-holes resistance measured by using four points test method for a via-hole by 2 people

**Justification (if necessary)**  
 Accept rejecter's suggestion.  
 The content is included as Related Information. Change the Appendix to Related Information.  
 Modify mainly to many.  
 Figure A3-1 is wrong and it will be changed to R1-1 after changing the Appendix to Related Information.

FROM: Section/Paragraph XXX

TO: Section/Paragraph xxx

**Justification (if necessary)**

**Motion** Negative is addressed by the technical change(s).

**Motion by/2<sup>nd</sup> by** Jingbing Dong (CSI) / Zhixin Li (Linton)

**Discussion**

**Result of Vote (check one)** 48 Y-5 N; Motion passed.

<input checked="" type="checkbox"/>	2/3 ≤ [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)

**Motion** To incorporate the technical change(s).

**Motion by/2<sup>nd</sup> by** Jingbing Dong (CSI) / Zhixin Li (Linton)

**Discussion**

**Result of Vote (check one)** 48 Y-5 N; Motion passed.

<input checked="" type="checkbox"/>	90% ≤ [Agree to incorporate.]	GO TO "Final" subsection → (F)
<input type="checkbox"/>	[Disagree to incorporate.] > 10%	GO TO "Final" subsection → (E)

**(A)** Withdrawn (counted under h in disposition)

	(check if applicable)	<input type="checkbox"/>	(B)	Not related (counted under i in disposition)	
		<input type="checkbox"/>	(C)	Related and not persuasive (significant)	
		<input 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 checked="" 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.			

**Negative 2**

Negative	Referenced Section/ Paragraph	*TF/TC Chapter to fill in, including text in the ballot if necessary. § 4.1.1			
	Negative Text	*Original complete Negative text (e.g., issue, justification, suggestion) should be copied. in 4.1.1, “frontages” should be “front”			
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 <sup>nd</sup> 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.)		
		Reason	None		
	Motion by/ 2 <sup>nd</sup> by	Jingbing Dong (CSI) / Zhixin Li (Linton)			
	Discussion				
		48 Y-5 N; Motion passed.			

	Result of Vote (check one)	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	<b>Technical Change Recommendations</b> Original section/paragraph number and at least one full sentence are required in "FROM" and "TO" fields.							
	Technical Changes 1	<b>FROM: Section/Paragraph 4.1.1</b> 4.1.1 Via B in the dashed box is the measured hole, Via A and Via C are adjacent to Via B. The letters b, d, and f indicate the <b>frontages</b> of these three holes, which Via B, Via C and Via A are connected through grid lines of the cell.						
		<b>TO: Section/Paragraph 4.1.1</b> 4.1.1 Via B in the dashed box is the measured hole, Via A and Via C are adjacent to Via B. The letters b, d, and f indicate the <b>frontages</b> fronts of these three holes, which Via B, Via C and Via A are connected through grid lines of the cell.						
		<b>Justification (If necessary)</b> Accept rejecter's suggestion and change frontages to fronts.						
	Motion		Negative is addressed by the technical change(s).					
	Motion by/2 <sup>nd</sup> by		Jingbing Dong (CSI) / Zhixin Li (Linton)					
	Discussion							
	Result of Vote (check one)		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 <sup>nd</sup> by		Jingbing Dong (CSI) / Zhixin Li (Linton)						
Discussion								
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.					



### Negative 3

<b>Negative</b>	<b>Referenced Section/ Paragraph</b>	<b>*TF/TC Chapter to fill in, including text in the ballot if necessary.</b>				
		§ 12.1.4				
	<b>Negative Text</b>	<b>*Original complete Negative text (e.g., issue, justification, suggestion) should be copied.</b> in 12.1.4, what does “cure” mean?				
<b>TF input (optional)</b>						
<b>Withdrawal (check one)</b>	<input checked="" type="checkbox"/>	No Negative withdrawal made by Voter.		<b>GO TO “Related” subsection</b>		
	<input type="checkbox"/>	Withdrawal document received by Standards staff on MM/DD/YYYY.		<b>GO TO “Final” subsection → (A)</b>		
<b>Related</b>	<b>Motion and Reason (check one)</b>	<input checked="" type="checkbox"/>	‘Related’ is mutually agreed upon. <b>(Needs no motion.)</b>		<b>GO TO “Persuasive” subsection</b>	
		<input type="checkbox"/>	Negative is not related. <b>(Needs ≥2/3 votes to pass.)</b>			
			Reason	XXXX		
	<b>Motion by/ 2<sup>nd</sup> by</b>	Name (Company)/Name (Company)				
	<b>Discussion</b>					
	<b>Result of Vote (check one)</b>	XX Y-XX N; Motion passed/failed.				
		<input type="checkbox"/>	[Negative is not related.] < 2/3			<b>GO TO “Persuasive” subsection</b>
<input type="checkbox"/>		2/3 ≤ [Negative is not related.]			<b>GO TO “Final” subsection → (B)</b>	
<b>Persuasive</b>	<b>Motion and Reason (check one)</b>	<input checked="" type="checkbox"/>	Negative is related and persuasive. <b>(Needs &gt;1/3 votes to pass.)</b>			
		<input type="checkbox"/>	Negative is related and not persuasive. <b>(Needs ≥2/3 votes to pass.)</b>			
			Reason	None		
	<b>Motion by/ 2<sup>nd</sup> by</b>	Jingbing Dong (CSI) / Zhixin Li (Linton)				
	<b>Discussion</b>	Jingbing Dong (CSI): Use data here can be much clearer. Cure is mistake.				
	<b>Result of Vote (check one)</b>	48 Y-5 N; Motion passed.				
		<input checked="" type="checkbox"/>	[Negative is related and persuasive.] > 1/3	<b>Is a technical change recommended? (check one)</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>		[Negative is related and not persuasive.] < 2/3		<input type="checkbox"/>	<input type="checkbox"/>	<b>GO TO “Final” subsection → (E)</b>
<input type="checkbox"/>		2/3 ≤ [Negative is related and not persuasive.] < 90%	<b>GO TO “Final” subsection → (C)</b>			
<input type="checkbox"/>	90% ≤ [Negative is related and not persuasive.]	<b>GO TO “Not Significant Finding Option” subsection</b>				

Address by Technical Change Option	<b>Technical Change Recommendations</b> Original section/paragraph number and at least one full sentence are required in “FROM” and “TO” fields.			
	Technical Changes	1	<b>FROM: Section/Paragraph 12.1.4</b> 12.1.4 Test result (including the test <b>cure</b> and the calculation results).	
			<b>TO: Section/Paragraph 12.1.4</b> 12.1.4 Test result (including the test <b>cure data</b> and the calculation results).	
			<b>Justification (if necessary)</b> Accept rejecter’s suggestion and revise <b>cure</b> to <b>data</b> . Cure is mistake when editing the document.	
	Motion	Negative is addressed by the technical change(s).		
	Motion by/2 <sup>nd</sup> by	Jingbing Dong (CSI) / Zhixin Li (Linton)		
	Discussion			
	Result of Vote (check one)	48 Y-5 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 <sup>nd</sup> by	Jingbing Dong (CSI) / Zhixin Li (Linton)		
	Discussion			
	Result of Vote (check one)	48 Y-5 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.	

## Disposition of Voting Interest Reject 2

Check only when the Document has not been failed.

3	Original number (#) of Negatives	(g)
#	Number of Negatives withdrawn	(h)
#	Number of Negatives found not related	(i)
#	Number of Negatives found not significant	(j)

3	Number of Negatives addressed by technical change ( <b>Negative becomes not significant</b> )		(k)
Final	X	$g - (h + i + j + k) = 0$	Reject is Not Valid and is not included in the denominator of § VI. <i>Approval Conditions Check</i>
		$g - (h + i + j + k) > 0$	Reject is included in the denominator of § VI. <i>Approval Conditions Check</i>
		Reject without a Negative	Not Valid

## IV. Other Technical Issues

None

## V. Comments

### V- (i) Voters' Comments

Commenter 1 (Yani He / LONGi LERRI) - Comment 1

Comment	*TF/TC Chapter to fill in section/paragraph #, if necessary.	
	1. The requirements of force to fulfill a good contact between surface and probe should be included.	
Action	The TC Chapter agreed to do one of the following actions.	
	*No motion is required in this step.	
		Already addressed by Commenter #, Comment #
		No further action was taken by the TC Chapter.
	X	A test standard is to provide a method, the detailed testing conditions vary with in different cases. The testing details are not specified in this standard. The recommended force value is provided by different testing equipment, this is not suggested to specify in Standards.
		Refer to the TF for more consideration.
		New Business
	Editorial Change	
Options for editorial change (check one)		Case 1: No vote in this section: To be included and voted on as a group in § VI. <i>Editorial Changes Other than Those Voted on in § V.</i>
		Case 2: Voted in this section: Original section number and at least one full sentence are required in "FROM" and "TO" fields.
	1	FROM: Section/Paragraph xxx
		TO: Section/Paragraph xxx
Justification (If necessary)		
Motion	To approve above editorial change(s)	
Motion by/2 <sup>nd</sup> by	Name (Company)/Name (Company)	

Discussion	XXXX
Vote	XX Y-XX N; Motion <i>passed/failed</i> .

### Comment 2

Comment	*TF/TC Chapter to fill in section/paragraph #, if necessary.	
	2. The morphology or shape of the top of probe should be emphasized.	
Action	The TC Chapter agreed to do one of the following actions.	
	*No motion is required in this step.	
		Already addressed by Commenter #, Comment #
	X	No further action was taken by the TC Chapter.
		The shape of probe's top is not recommended to emphasize in the document which makes no important sense. The detailed test method is illustrated very clearly in Section 4.
		Refer to the TF for more consideration.
		New Business
	Editorial Change	
Options for editorial change (check one)		<b>Case 1: No vote in this section:</b>
		To be included and voted on as a group in § VI. <i>Editorial Changes Other than Those Voted on in § V.</i>
		<b>Case 2: Voted in this section:</b>
		Original section number and at least one full sentence are required in "FROM" and "TO" fields.
Editorial Changes	1	FROM: Section/Paragraph xxx
		TO: Section/Paragraph xxx
		Justification (If necessary)
Motion	To approve above editorial change(s)	
Motion by/2 <sup>nd</sup> by	Name (Company)/Name (Company)	
Discussion	XXXX	
Vote	XX Y-XX N; Motion <i>passed/failed</i> .	

### 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	=	70	/	71	=	98.6%		≥90%

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

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

**Globally Approved (No Ratification Ballot needed):**  
The Letter Ballot meets the Letter Ballot approval conditions for the global technical committee.

**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"/>	<b>This is not a Safety Document</b> , when all safety-related information is removed, the Document is still technically sound and complete. ( <i>Regulations ¶ 8.7.1</i> )
	<input type="checkbox"/>	<b>This is a Safety Document</b> , when all safety-related information is removed, the Document is not technically sound and complete. ( <i>Regulations ¶ 8.7.2</i> )
	<input type="checkbox"/>	Safety Checklist ( <i>Regulations ¶ 15.3</i> ) is complete and has been included with the Document throughout the balloting process. ( <i>Regulations ¶ 15.1.2</i> )
	<b>Motion by/2<sup>nd</sup> by</b>	Jingbing Dong (CSI) / Zhixin Li (Linton)
	<b>Discussion</b>	None
	<b>Vote</b>	47 Y-6 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.)	<b>GO TO SECTION X.</b>		
	The question is answered in affirmative	Is any of the known IPs a patented technology?	<b>Yes, at least one of them is a patented technology</b>	<b>GO TO IX (a) "Patented Technology" subsection</b>
			<b>No</b>	<b>GO TO IX (b) "Copyright items" subsection</b>

## X. Action for This Document

<b>Motion</b>		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.
<b>Motion by/ 2<sup>nd</sup> by</b>		Jingbing Dong (CSI) / Zhixin Li (Linton)
<b>Discussion</b>		Guangchun Zhang (CSI): Please add the development history into the background. This will help the members in other region review.
<b>Vote</b>		47 Y-6 N
<b>Final Action</b>		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.**