

AEC-Q102

Reliability Test Report

Shenzhen Chengxing Electronic Technology Co., Ltd.

Room 1405-07, Block A, Jiahe Building, Shennan Middle Road, Huaqiang North Street, Futian District, Shenzhen, China.

Test Model: XL-2214UYC

Report Type:	<u>Reliability Testing And Report According to AEC-Q102-RevA April 6,2020</u>
Application:	☒ Only interior of automotive lighting ☐ Only exterior of automotive lighting ☐ Interior and exterior lighting for automotive
Reviewed By:	Lewis Wang <i>Lewis Wang</i>
Report Number:	2402Z48783E-EE
Test Date:	2024-12-03 to 2025-02-16
Report Date:	2025-03-04
Approved by:	Blake Zhang Andrew Luo
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Test Facility:	Test facility was located at Room 301, No.113, Pingkang Road, Dalang, Dongguan, Guangdong, China.

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1 Product Description[#]

General Information:

Samples were in good condition and received on 2024-12-03, and used for testing.

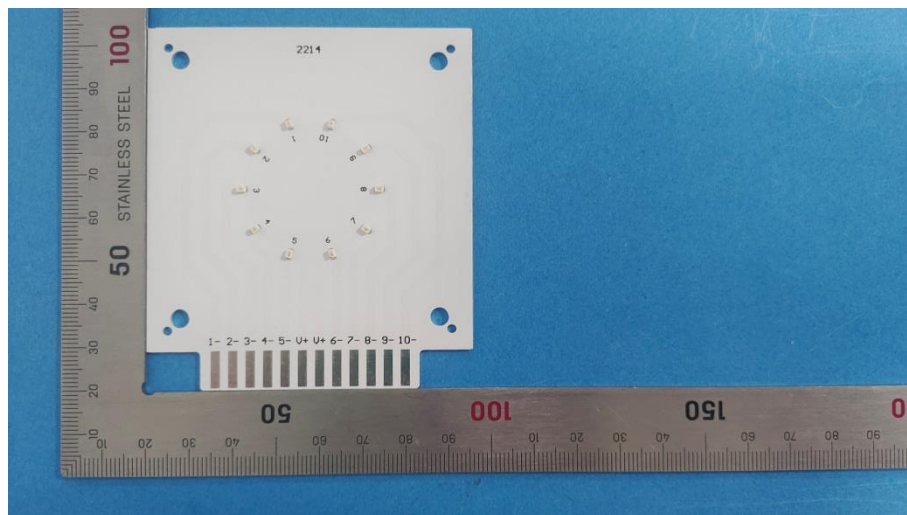
Model Tested: XL-2214UYC

Sample name: LED PACKAGE

Manufacturer: Shenzhen Chengxing Electronic Technology Co., Ltd.

Brand Name: /

The typical receiving state of some samples



2 Test Result Summary

Item No.	Test Item	Test Method	Test Conditions	Qty	Failure
A1	Pre-conditioning(PC)	JEDEC JESD22-A113	Pre-conditioning required before WHTOL1, WHTOL2, PTC and TC tests, MSL2	104pcs*3	0
A2a	Wet High Temperature Operating Life (WHTOL1)	JEDEC JESD22-A101	Duration:1000hrs, T _a =85°C, RH=85%, IF=30mA, On/off=30min	26pcs*3	0
A2b	Wet High Temperature Operating Life (WHTOL2)	JEDEC JESD22-A101	Duration:1000hrs, T _a =85°C, RH=85%, IF=2mA	26pcs*3	0
A3a	Power Temperature Cycling(PTC)	JEDEC JESD22-A105	Duration:1000cycles, T _{solder} =-40°C~85°C, IF=30mA, on/off=5min, Dwell time more than 10min, Transfer time no more than 20min	26pcs*3	0
A4	Temperature Cycling (TC)	JEDEC JESD22-A104	Duration:1000cycles, T _{solder} =-40°C~85°C, soak & dwell time 15min, Transfer time no more than 20min	26pcs*3	0
B1a	High Temperature Operating Life1 (HTOL1)	JEDEC JESD22-A108	Duration:1000hrs, T _{solder} =100°C, IF=20mA	26pcs*3	0
B1b	High Temperature Operating Life2 (HTOL2)	JEDEC JESD22-A108	Duration:1000hrs, T _{solder} =85°C, IF=30mA	26pcs*3	0
B3	Pulsed Operating Life (PLT)	JEDEC JESD22-A108	Duration:1000hrs, T _{solder} =25°C, I _{pulse} =100mA, Plus width:100μs, Duty cycle:3%	26pcs*3	0
C1	Destructive Physical Analysis(DPA)	Appendix 6	Random sample of parts that have successfully completed TC, PTC, HTOL1, HTOL2, WHTOL1, WHTOL2, H2S and FMG. (2 samples each).	2pcs each	0
C2	Physical Dimension (PD)	JEDEC JESD22-B100	Per Section 3	10pcs*3	0
C7	Dew(DEW)	AEC-Q102-001	Duration:10cycles(6.5hrs/cycle), Cycle temperature:10°C~80°C, RH=50%~100%, IF=2mA	26pcs*3	0
C9	Thermal Resistance (TR)	JEDEC JESD51-50 JESD51-51 JESD51-52	IF=20mA	10pcs	0
C10	Solderability(SD)	IEC 60068-2-58	Surface mount process simulation	10pcs*3	0
C12	Hydrogen Sulphide (H ₂ S)	IEC 60068-2-43	Corrosion Class A: Duration:336hrs, T _a =40°C, RH=90%, H ₂ S concentration:15ppm	26pcs*3	0
C13	Flowing Mixed Gas (FMG)	IEC 60068-2-60 Test method 4	Duration:500hrs, T _a =25°C, RH=75%, H ₂ S concentration:10ppb, SO ₂ concentration:200ppb, NO ₂ concentration:200ppb, Cl ₂ concentration:10ppb	26pcs*3	0
C14	Board Flex(BF)	AEC-Q102-002	IF=20mA, Deformation displacement:≥2mm, Duration:60(+5)Sec	10pcs*3	0
E0	External Visual Test Summary(EV)	JEDECJESD22-B101	Inspect part construction, marking and workmanship.	all	0
E2	Parametric Verification(PV)	Individual AEC user specification	Test all parameters according to the part specification over the part temperature range to insure the part compliance	26pcs*3	0
E3	Electrostatic Discharge Human Body Model (HBM)	ANSI/ESDA/J EDECJS-001	±2000V	10pcs*3	0

Item No.	Test Item	Test Method	Test Conditions	Qty	Failure
E4	Electrostatic Discharge Charged Device Model(CDM)	AEC Q101-005	±1000V	10pcs*3	0
G2	Vibration Variable Frequency(VVF)	JEDEC JESD22-B103 Condition1	Frequency:(20~2000)Hz, Displacement:1.5mm, Peak acceleration:20g, Cross-over frequency:80Hz, Direction: X, Y and Z axis, 4min/cycle; 4times in each of the orientations (total of 12 times)	10pcs*3	0
G3	Mechanical Shock(MS)	JEDEC JESD22-B110	Wave: half-sine, Acceleration peak:1500g, Pulse duration:0.5ms, Direction:±X, ±Y, ±Z axis, Shock time:5 times / direction (total 30 shocks)		

3 Acceptance Criteria

3.1 External Visual

No.	Item	Descriptions	Test Item
1	Color deviation	The luminescent surface color of the sample device cannot be deviated	PC/ WHTOL1/ WHTOL2/ PTC/ TC/ HTOL1/ HTOL2/ PLT/ DEW/ TR/ SD/ H2S/ FMG/ HBM/ CDM/ VVF/ MS
2	Pollution	Product surface shall not be contaminated	
3	Crack or break	Packaging surface, heat sink plate intact, crack-free	
4	Identification	Positive and negative electrodes and other marks complete and clear	
5	defect or residue	Surface no defect, no more parts	
6	Electrode Bridging	There can be no bridging between positive and negative levels	
7	Adhesive surface	Rubber surface flat or micro-concave, no overflow, no leakage chip	

Note: Zero failures shall be accepted, and the test items are listed in Section 4.

3.2 Shift for Electrical and Optical Parameters of pre- & post- Stress Test

Parameter	Symbol	Acceptance criteria	Test condition	Test Item
Luminous Intensity	IV(mcd)	±20%	IF=20mA	PC/ WHTOL1/ WHTOL2/ PTC/ TC/ HTOL1/ HTOL2/ PLT/ DEW/ H2S/ FMG/ HBM/ CDM/ VVF/ MS
Forward Voltage	Vf(V)	±10%	IF=20mA	
Forward Voltage(@maximum of the current)	Vf _{max} (V)	±10%	IF=30mA	
Forward Voltage(@minimum of the current)	Vf _{min} (V)	±10%	IF=2mA	
Wavelength	λ _d (nm)	±2	IF=20mA	

3.3 Light / No Light Test

Parameter	Acceptance criteria	Test condition	Test Item
Forward Voltage (Nominal Rated Current)	Light / No Light	Ta=-40°C	WHTOL/TC/PTC/VVF/MS/H2S/FMG
		Ta=85°C	

3.4 Acceptance Criteria for Other Test Item

Test item	Acceptance criteria
PV	Per Spec
DPA	No delamination and metallization voids in the bonding of wafers, and no cracks or defects in the structure of wafers and substrates
SD	Each pin of the device has a continuous tin loading rate of more than 95%
PD	Per Spec
TR	Per Spec
BF	No part cracks or causes abnormality phenomena after test

Note: Acceptance criteria above were confirmed by Client.

4 Detailed Test Result

4.1 Pre-conditioning(PC)

4.1.1 Test Information

Sample size:	3 lots 104 pcs. Each(Samples for WHTOL1,WHTOL2,PTC and TC before test)
Test period:	2024-12-13 to 2024-12-25
Reference document:	JEDEC JESD22-A113
Power supply :	Unpowered
Temperature cycling	Not applicable
Bake:	125°C/24h
MSL:	2(85°C/60%RH,168h)
Reflow profile:	3 cycles reflow, profile can be defined in J-STD-020 E
Test point:	Initial test/final test
Acceptance criteria:	Per Section 3

4.1.2 Environmental Conditions

Environmental temperature:	(24.0~26.1)°C
Environmental humidity:	(53~66)%RH

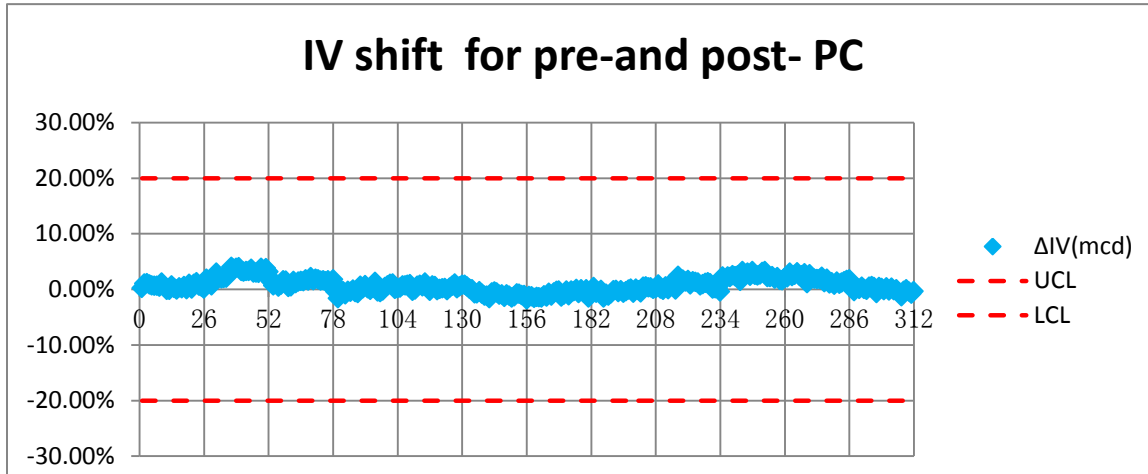
4.1.3 Test Data

4.1.3.1 Test Result for PC

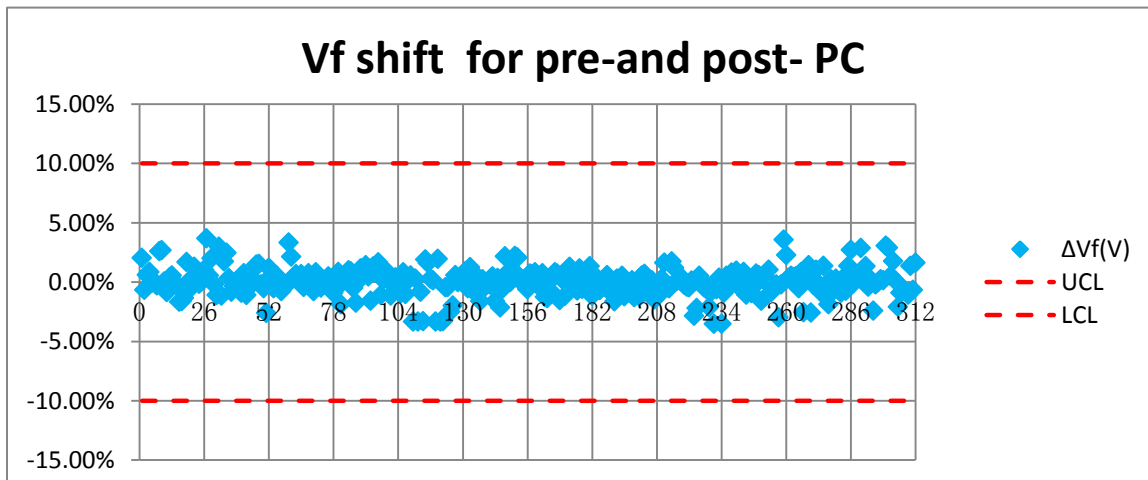
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	104	104	0
	Test			0
	Light / no light	NA	NA	NA
B	External Visual	104	104	0
	Test			0
	Light / no light	NA	NA	NA
C	External Visual	104	104	0
	Test			0
	Light / no light	NA	NA	NA

4.1.3.2 Summary

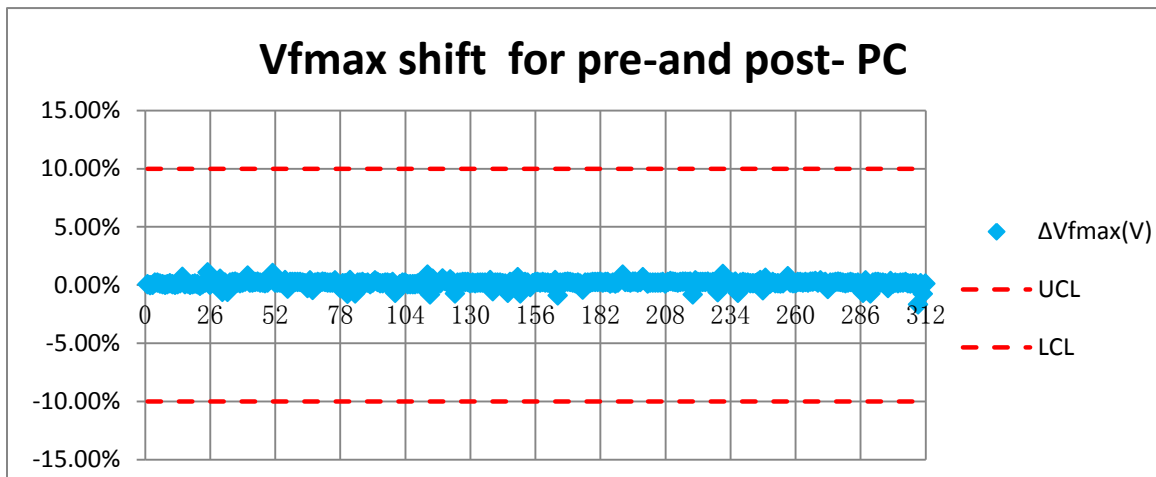
IV shift for pre- and post- PC test



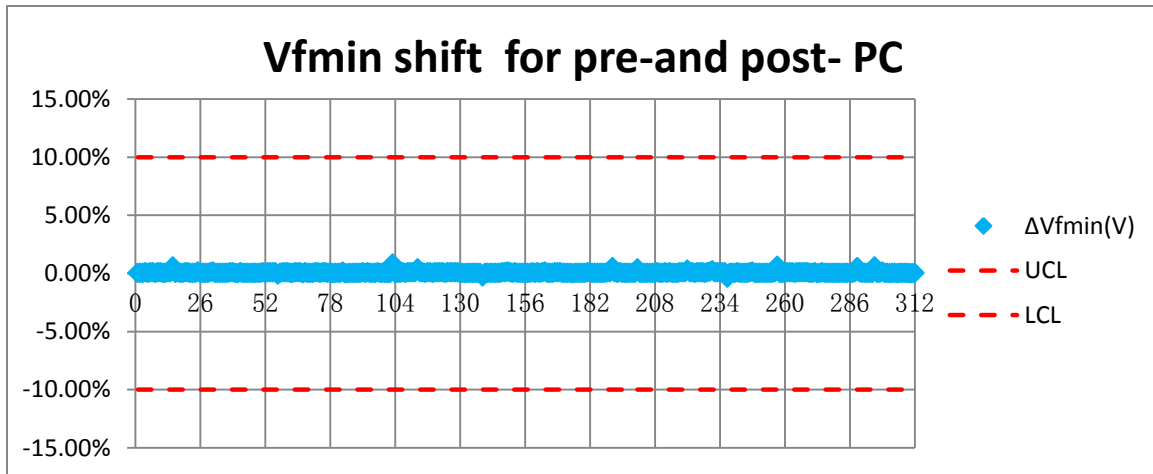
Vf shift for pre- and post- PC test



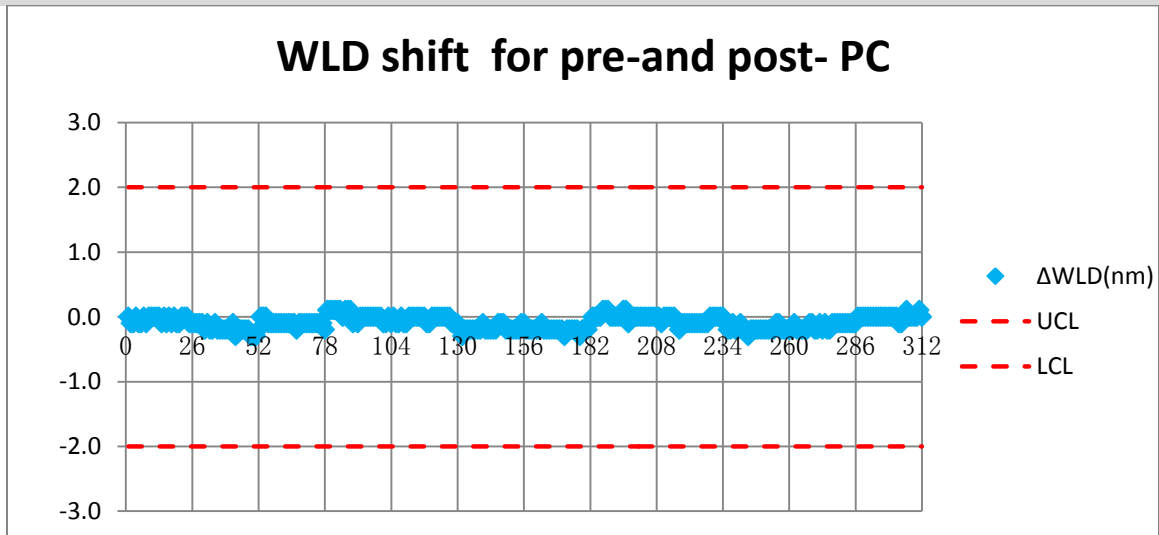
Vf_{max} shift for pre- and post- PC test



V_{fmin} shift for pre- and post- PC test



λ_d shift for pre- and post- PC test



4.1.3.3 PC Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL1-A1	2.093	327.7	588.5	2.167	1.897	2.136	328.4	588.5	2.168	1.898	2.05%	0.21%	0.0	0.05%	0.05%
WHTOL1-A2	2.128	329.6	588.6	2.176	1.897	2.114	333.0	588.5	2.175	1.898	-0.66%	1.03%	-0.1	-0.05%	0.05%
WHTOL1-A3	2.105	328.7	588.9	2.162	1.893	2.118	332.3	588.8	2.162	1.894	0.62%	1.10%	-0.1	0.00%	0.05%
WHTOL1-A4	2.106	330.1	589.0	2.177	1.893	2.124	332.9	589.0	2.181	1.895	0.85%	0.85%	0.0	0.18%	0.11%
WHTOL1-A5	2.055	330.8	589.1	2.175	1.892	2.054	333.0	589.0	2.179	1.893	-0.05%	0.67%	-0.1	0.18%	0.05%
WHTOL1-A6	2.125	318.1	589.0	2.159	1.895	2.126	320.1	588.9	2.161	1.897	0.05%	0.63%	-0.1	0.09%	0.11%
WHTOL1-A7	2.119	327.6	589.0	2.165	1.892	2.113	329.5	589.0	2.166	1.894	-0.28%	0.58%	0.0	0.05%	0.11%
WHTOL1-A8	2.062	325.1	589.1	2.184	1.894	2.116	326.5	589.0	2.184	1.895	2.62%	0.43%	-0.1	0.00%	0.05%
WHTOL1-A9	2.051	329.1	589.0	2.175	1.892	2.106	332.9	589.0	2.176	1.894	2.68%	1.15%	0.0	0.05%	0.11%
WHTOL1-A10	2.045	323.4	589.3	2.163	1.890	2.046	325.2	589.3	2.166	1.892	0.05%	0.56%	0.0	0.14%	0.11%
WHTOL1-A11	2.126	343.4	589.0	2.159	1.894	2.108	342.9	589.0	2.160	1.895	-0.85%	-0.15%	0.0	0.05%	0.05%
WHTOL1-A12	2.125	338.5	589.5	2.157	1.889	2.133	338.1	589.5	2.157	1.890	0.38%	-0.12%	0.0	0.00%	0.05%
WHTOL1-A13	2.126	333.6	589.4	2.154	1.889	2.138	335.9	589.4	2.155	1.891	0.56%	0.69%	0.0	0.05%	0.11%
WHTOL1-A14	2.088	333.5	589.8	2.162	1.886	2.089	334.1	589.7	2.165	1.888	0.05%	0.18%	-0.1	0.14%	0.11%
WHTOL1-A15	2.072	335.4	588.5	2.174	1.890	2.066	335.1	588.5	2.189	1.901	-0.29%	-0.09%	0.0	0.69%	0.58%
WHTOL1-A16	2.127	335.4	589.0	2.158	1.892	2.092	336.4	588.9	2.159	1.893	-1.65%	0.30%	-0.1	0.05%	0.05%
WHTOL1-A17	2.137	331.7	588.9	2.165	1.896	2.103	332.1	588.9	2.167	1.898	-1.59%	0.12%	0.0	0.09%	0.11%
WHTOL1-A18	2.099	329.9	589.4	2.177	1.890	2.071	331.8	589.3	2.177	1.891	-1.33%	0.58%	-0.1	0.00%	0.05%
WHTOL1-A19	2.058	328.9	589.3	2.175	1.892	2.093	328.8	589.3	2.176	1.893	1.70%	-0.03%	0.0	0.05%	0.05%
WHTOL1-A20	2.041	328.8	589.5	2.160	1.888	2.043	332.0	589.4	2.162	1.890	0.10%	0.97%	-0.1	0.09%	0.11%
WHTOL1-A21	2.128	337.8	589.0	2.158	1.891	2.119	338.1	588.9	2.159	1.893	-0.42%	0.09%	-0.1	0.05%	0.11%
WHTOL1-A22	2.095	334.4	588.4	2.180	1.898	2.122	337.6	588.4	2.178	1.899	1.29%	0.96%	0.0	-0.09%	0.05%
WHTOL1-A23	2.124	333.2	588.7	2.165	1.895	2.130	337.3	588.7	2.166	1.896	0.28%	1.23%	0.0	0.05%	0.05%
WHTOL1-A24	2.106	330.9	589.0	2.171	1.893	2.103	333.0	589.0	2.175	1.894	-0.14%	0.63%	0.0	0.18%	0.05%
WHTOL1-A25	2.065	334.7	588.5	2.175	1.898	2.066	336.2	588.4	2.198	1.901	0.05%	0.45%	-0.1	1.06%	0.16%
WHTOL1-A26	2.091	328.3	588.6	2.167	1.896	2.113	328.6	588.5	2.167	1.897	1.05%	0.09%	-0.1	0.00%	0.05%
WHTOL2-A1	2.057	333.1	589.5	2.164	1.886	2.133	339.3	589.4	2.168	1.887	3.69%	1.86%	-0.1	0.18%	0.05%
WHTOL2-A2	2.116	334.4	589.1	2.160	1.891	2.128	339.1	589.0	2.163	1.892	0.57%	1.41%	-0.1	0.14%	0.05%
WHTOL2-A3	2.082	341.1	588.7	2.160	1.895	2.124	343.3	588.6	2.164	1.896	2.02%	0.64%	-0.1	0.19%	0.05%
WHTOL2-A4	2.148	334.8	589.7	2.158	1.887	2.144	341.0	589.6	2.169	1.889	-0.19%	1.85%	-0.1	0.51%	0.11%
WHTOL2-A5	2.102	334.2	588.5	2.176	1.881	2.079	344.2	588.3	2.163	1.884	-1.09%	2.99%	-0.2	-0.60%	0.16%
WHTOL2-A6	2.083	333.4	589.7	2.169	1.884	2.145	340.4	589.6	2.173	1.885	2.98%	2.10%	-0.1	0.18%	0.05%
WHTOL2-A7	2.108	336.8	589.7	2.163	1.886	2.084	343.3	589.5	2.150	1.887	-1.14%	1.93%	-0.2	-0.60%	0.05%
WHTOL2-A8	2.055	340.3	589.7	2.169	1.888	2.091	347.1	589.5	2.173	1.889	1.75%	2.00%	-0.2	0.18%	0.05%
WHTOL2-A9	2.065	313.7	589.1	2.171	1.896	2.116	320.2	589.0	2.176	1.897	2.47%	2.07%	-0.1	0.23%	0.05%
WHTOL2-A10	2.058	328.1	588.6	2.175	1.897	2.065	338.0	588.4	2.181	1.898	0.34%	3.02%	-0.2	0.28%	0.05%
WHTOL2-A11	2.098	326.3	588.7	2.160	1.896	2.081	339.4	588.5	2.164	1.897	-0.81%	4.01%	-0.2	0.19%	0.05%
WHTOL2-A12	2.126	334.2	588.6	2.171	1.895	2.119	346.4	588.4	2.174	1.897	-0.33%	3.65%	-0.2	0.14%	0.11%
WHTOL2-A13	2.114	331.5	588.9	2.157	1.892	2.115	344.2	588.7	2.161	1.894	0.05%	3.83%	-0.2	0.19%	0.11%
WHTOL2-A14	2.114	333.3	588.6	2.185	1.897	2.117	346.5	588.4	2.191	1.898	0.14%	3.96%	-0.2	0.27%	0.05%
WHTOL2-A15	2.088	339.2	588.7	2.171	1.899	2.069	350.3	588.5	2.188	1.899	-0.91%	3.27%	-0.2	0.78%	0.00%
WHTOL2-A16	2.113	325.9	590.1	2.160	1.886	2.129	336.1	590.0	2.164	1.888	0.76%	3.13%	-0.1	0.19%	0.11%
WHTOL2-A17	2.136	335.6	588.8	2.163	1.896	2.113	346.6	588.5	2.167	1.897	-1.08%	3.28%	-0.3	0.18%	0.05%
WHTOL2-A18	2.071	334.1	588.6	2.189	1.899	2.080	345.0	588.4	2.194	1.900	0.43%	3.26%	-0.2	0.23%	0.05%
WHTOL2-A19	2.098	329.9	588.6	2.181	1.897	2.093	341.9	588.4	2.187	1.898	-0.24%	3.64%	-0.2	0.28%	0.05%

No.	Lot A													
	pre-test					post-test					change			
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)
WHTOL2-A20	2.048	337.8	589.3	2.161	1.892	2.052	347.8	589.1	2.165	1.893	0.20%	2.96%	-0.2	0.19%
WHTOL2-A21	2.105	336.0	588.8	2.154	1.892	2.136	346.0	588.6	2.158	1.893	1.47%	2.98%	-0.2	0.19%
WHTOL2-A22	2.109	336.7	588.5	2.173	1.898	2.141	346.5	588.3	2.176	1.899	1.52%	2.91%	-0.2	0.14%
WHTOL2-A23	2.112	330.9	588.6	2.168	1.897	2.108	343.6	588.3	2.172	1.898	-0.19%	3.84%	-0.3	0.18%
WHTOL2-A24	2.094	326.6	590.0	2.154	1.889	2.083	336.4	589.7	2.164	1.890	-0.53%	3.00%	-0.3	0.46%
WHTOL2-A25	2.110	331.8	589.1	2.167	1.892	2.055	344.3	588.8	2.189	1.894	-2.61%	3.77%	-0.3	1.02%
WHTOL2-A26	2.097	337.2	589.3	2.151	1.890	2.122	347.8	589.1	2.155	1.891	1.19%	3.14%	-0.2	0.19%
PTC-A1	2.086	343.2	589.7	2.174	1.886	2.097	347.8	589.7	2.178	1.888	0.53%	1.34%	0.0	0.18%
PTC-A2	2.136	331.0	589.1	2.162	1.891	2.125	333.2	589.1	2.166	1.893	-0.51%	0.66%	0.0	0.19%
PTC-A3	2.077	330.5	589.0	2.157	1.892	2.089	333.9	589.0	2.161	1.894	0.58%	1.03%	0.0	0.19%
PTC-A4	2.084	340.7	589.6	2.161	1.888	2.081	342.2	589.5	2.170	1.890	-0.14%	0.44%	-0.1	0.42%
PTC-A5	2.082	329.6	589.8	2.172	1.893	2.066	332.2	589.7	2.165	1.891	-0.77%	0.79%	-0.1	-0.32%
PTC-A6	2.114	338.1	589.1	2.151	1.891	2.108	343.5	589.0	2.156	1.892	-0.28%	1.60%	-0.1	0.23%
PTC-A7	2.128	328.6	588.4	2.172	1.898	2.122	333.6	588.3	2.177	1.900	-0.28%	1.52%	-0.1	0.23%
PTC-A8	2.062	332.4	588.7	2.186	1.896	2.131	333.6	588.6	2.191	1.898	3.35%	0.36%	-0.1	0.23%
PTC-A9	2.052	338.4	589.4	2.164	1.890	2.096	340.0	589.3	2.169	1.892	2.14%	0.47%	-0.1	0.23%
PTC-A10	2.038	331.4	589.7	2.153	1.887	2.045	336.3	589.6	2.158	1.888	0.34%	1.48%	-0.1	0.23%
PTC-A11	2.074	339.4	589.0	2.155	1.892	2.088	343.0	588.9	2.159	1.893	0.68%	1.06%	-0.1	0.19%
PTC-A12	2.122	333.3	588.9	2.165	1.894	2.130	337.9	588.8	2.168	1.896	0.38%	1.38%	-0.1	0.14%
PTC-A13	2.110	332.9	589.4	2.175	1.891	2.124	337.8	589.3	2.169	1.893	0.66%	1.47%	-0.1	-0.28%
PTC-A14	2.133	334.6	588.9	2.178	1.895	2.124	339.4	588.8	2.186	1.897	-0.42%	1.43%	-0.1	0.37%
PTC-A15	2.066	336.0	588.7	2.178	1.896	2.065	342.0	588.5	2.168	1.896	-0.05%	1.79%	-0.2	-0.46%
PTC-A16	2.107	335.7	588.5	2.166	1.897	2.123	340.8	588.4	2.170	1.899	0.76%	1.52%	-0.1	0.18%
PTC-A17	2.111	339.3	589.4	2.153	1.892	2.102	346.7	589.3	2.158	1.893	-0.43%	2.18%	-0.1	0.23%
PTC-A18	2.085	341.6	590.1	2.165	1.887	2.069	347.0	590.0	2.169	1.888	-0.77%	1.58%	-0.1	0.18%
PTC-A19	2.071	300.9	589.4	2.167	1.896	2.088	306.6	589.3	2.173	1.897	0.82%	1.89%	-0.1	0.28%
PTC-A20	2.043	333.2	589.4	2.158	1.889	2.048	339.0	589.3	2.163	1.891	0.24%	1.74%	-0.1	0.23%
PTC-A21	2.103	340.3	588.2	2.169	1.899	2.093	345.5	588.1	2.173	1.901	-0.48%	1.53%	-0.1	0.18%
PTC-A22	2.114	338.0	589.5	2.153	1.888	2.110	343.4	589.4	2.157	1.889	-0.19%	1.60%	-0.1	0.19%
PTC-A23	2.113	329.7	588.7	2.159	1.896	2.111	334.3	588.6	2.163	1.898	-0.09%	1.40%	-0.1	0.19%
PTC-A24	2.123	342.9	588.8	2.178	1.897	2.133	348.3	588.7	2.186	1.899	0.47%	1.57%	-0.1	0.37%
PTC-A25	2.055	335.9	589.5	2.152	1.888	2.055	339.3	589.4	2.152	1.889	0.00%	1.01%	-0.1	0.00%
PTC-A26	2.127	332.1	589.4	2.175	1.890	2.108	337.9	589.2	2.169	1.892	-0.89%	1.75%	-0.2	-0.28%
TC-A1	2.141	334.0	588.9	2.154	1.894	2.129	332.6	589.0	2.157	1.894	-0.56%	-0.42%	0.1	0.14%
TC-A2	2.119	332.8	588.8	2.159	1.892	2.137	327.4	588.9	2.162	1.893	0.85%	-1.62%	0.1	0.14%
TC-A3	2.137	317.7	589.5	2.168	1.892	2.097	317.1	589.6	2.151	1.893	-1.87%	-0.19%	0.1	-0.78%
TC-A4	2.083	332.2	589.5	2.165	1.890	2.090	330.9	589.6	2.174	1.891	0.34%	-0.39%	0.1	0.42%
TC-A5	2.088	335.1	588.5	2.178	1.896	2.093	331.9	588.6	2.174	1.899	0.24%	-0.95%	0.1	-0.18%
TC-A6	2.102	337.2	589.2	2.168	1.889	2.123	336.1	589.3	2.152	1.889	1.00%	-0.33%	0.1	-0.74%
TC-A7	2.113	335.2	589.4	2.154	1.889	2.132	333.6	589.4	2.158	1.889	0.90%	-0.48%	0.0	0.19%
TC-A8	2.072	333.8	588.8	2.179	1.895	2.062	333.6	588.9	2.183	1.896	-0.48%	-0.06%	0.1	0.18%
TC-A9	2.120	336.5	588.4	2.178	1.897	2.083	334.7	588.5	2.183	1.898	-1.75%	-0.53%	0.1	0.23%
TC-A10	2.052	327.2	588.9	2.167	1.892	2.054	324.8	589.0	2.170	1.893	0.10%	-0.73%	0.1	0.14%
TC-A11	2.093	342.1	589.0	2.155	1.892	2.117	344.1	588.9	2.159	1.893	1.15%	0.58%	-0.1	0.19%
TC-A12	2.099	333.7	589.4	2.161	1.890	2.123	334.2	589.4	2.162	1.891	1.14%	0.15%	0.0	0.05%
TC-A13	2.096	335.3	589.1	2.151	1.889	2.126	337.7	589.0	2.155	1.891	1.43%	0.72%	-0.1	0.19%

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
TC-A14	2.116	331.5	589.2	2.171	1.896	2.126	332.0	589.2	2.179	1.897	0.47%	0.15%	0.0	0.37%	0.05%
TC-A15	2.110	339.0	588.5	2.165	1.895	2.077	338.5	588.5	2.170	1.897	-1.56%	-0.15%	0.0	0.23%	0.11%
TC-A16	2.121	335.4	589.1	2.156	1.891	2.149	336.2	589.1	2.159	1.892	1.32%	0.24%	0.0	0.14%	0.05%
TC-A17	2.074	331.6	588.6	2.164	1.896	2.102	335.9	588.6	2.167	1.897	1.35%	1.30%	0.0	0.14%	0.05%
TC-A18	2.096	334.6	589.0	2.178	1.892	2.131	333.2	589.0	2.182	1.893	1.67%	-0.42%	0.0	0.18%	0.05%
TC-A19	2.094	335.3	588.6	2.178	1.897	2.071	333.4	588.6	2.182	1.899	-1.10%	-0.57%	0.0	0.18%	0.11%
TC-A20	2.058	328.0	588.6	2.177	1.897	2.062	327.2	588.6	2.180	1.898	0.19%	-0.24%	0.0	0.14%	0.05%
TC-A21	2.089	343.6	588.3	2.165	1.898	2.108	344.9	588.3	2.170	1.899	0.91%	0.38%	0.0	0.23%	0.05%
TC-A22	2.086	343.8	590.1	2.168	1.884	2.102	346.1	590.1	2.153	1.885	0.77%	0.67%	0.0	-0.69%	0.05%
TC-A23	2.125	337.7	589.5	2.173	1.889	2.101	340.9	589.4	2.168	1.889	-1.13%	0.95%	-0.1	-0.23%	0.00%
TC-A24	2.093	333.0	589.0	2.174	1.892	2.088	336.3	588.9	2.175	1.893	-0.24%	0.99%	-0.1	0.05%	0.05%
TC-A25	2.077	336.2	588.5	2.175	1.882	2.085	336.3	588.5	2.179	1.898	0.39%	0.03%	0.0	0.18%	0.85%
TC-A26	2.112	335.2	589.1	2.150	1.889	2.119	335.7	589.0	2.154	1.890	0.33%	0.15%	-0.1	0.19%	0.05%
Min	2.038	300.9	588.2	2.150	1.881	2.043	306.6	588.1	2.150	1.884	-2.61%	-1.62%	-0.3	-0.78%	-0.11%
Max	2.148	343.8	590.1	2.189	1.899	2.149	350.3	590.1	2.198	1.901	3.69%	4.01%	0.1	1.06%	0.85%
Average	2.096	333.2	589.1	2.167	1.892	2.102	337.1	589.0	2.169	1.894	0.28%	1.17%	-0.1	0.13%	0.08%
Stdev	0.027	6.2	0.4	0.009	0.004	0.027	7.3	0.4	0.011	0.004	1.13%	1.26%	0.1	0.28%	0.10%

4.1.3.4 PC Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL1-B1	2.106	331.6	588.9	2.164	1.894	2.086	332.4	588.9	2.165	1.895	-0.95%	0.24%	0.0	0.05%	0.05%
WHTOL1-B2	2.068	333.2	588.6	2.193	1.899	2.085	335.5	588.5	2.194	1.900	0.82%	0.69%	-0.1	0.05%	0.05%
WHTOL1-B3	2.062	328.5	588.8	2.180	1.895	2.041	330.6	588.7	2.181	1.897	-1.02%	0.64%	-0.1	0.05%	0.11%
WHTOL1-B4	2.057	331.9	588.7	2.179	1.898	2.060	334.5	588.7	2.180	1.899	0.15%	0.78%	0.0	0.05%	0.05%
WHTOL1-B5	2.114	327.5	588.7	2.163	1.896	2.126	330.5	588.6	2.165	1.898	0.57%	0.92%	-0.1	0.09%	0.11%
WHTOL1-B6	2.111	340.5	589.0	2.164	1.895	2.041	339.4	588.9	2.165	1.897	-3.32%	-0.32%	-0.1	0.05%	0.11%
WHTOL1-B7	2.116	338.0	588.9	2.159	1.895	2.122	337.8	588.9	2.161	1.897	0.28%	-0.06%	0.0	0.09%	0.11%
WHTOL1-B8	2.106	335.0	588.8	2.177	1.896	2.036	337.0	588.8	2.183	1.898	-3.32%	0.60%	0.0	0.28%	0.11%
WHTOL1-B9	2.079	327.1	588.7	2.172	1.890	2.062	329.6	588.7	2.191	1.898	-0.82%	0.76%	0.0	0.87%	0.42%
WHTOL1-B10	2.118	328.6	589.3	2.169	1.887	2.048	330.2	589.3	2.151	1.889	-3.31%	0.49%	0.0	-0.83%	0.11%
WHTOL1-B11	2.084	330.8	590.1	2.173	1.883	2.124	334.8	590.1	2.184	1.885	1.92%	1.21%	0.0	0.51%	0.11%
WHTOL1-B12	2.046	330.5	589.8	2.168	1.886	2.079	331.6	589.8	2.168	1.887	1.61%	0.33%	0.0	0.00%	0.05%
WHTOL1-B13	2.071	327.7	589.2	2.170	1.890	2.077	326.7	589.2	2.173	1.892	0.29%	-0.31%	0.0	0.14%	0.11%
WHTOL1-B14	2.051	322.6	589.0	2.171	1.893	2.054	324.8	588.9	2.174	1.895	0.15%	0.68%	-0.1	0.14%	0.11%
WHTOL1-B15	2.102	333.6	590.0	2.170	1.883	2.032	335.5	589.9	2.182	1.884	-3.33%	0.57%	-0.1	0.55%	0.05%
WHTOL1-B16	2.083	335.2	588.6	2.168	1.895	2.124	334.5	588.6	2.175	1.897	1.97%	-0.21%	0.0	0.32%	0.11%
WHTOL1-B17	2.105	334.5	588.7	2.162	1.894	2.035	334.7	588.7	2.166	1.896	-3.33%	0.06%	0.0	0.19%	0.11%
WHTOL1-B18	2.128	311.3	589.2	2.170	1.896	2.058	311.7	589.2	2.180	1.898	-3.29%	0.13%	0.0	0.46%	0.11%
WHTOL1-B19	2.055	334.9	589.4	2.151	1.887	2.046	335.6	589.4	2.157	1.889	-0.44%	0.21%	0.0	0.28%	0.11%
WHTOL1-B20	2.114	338.1	589.4	2.168	1.889	2.105	337.5	589.4	2.152	1.890	-0.43%	-0.18%	0.0	-0.74%	0.05%
WHTOL1-B21	2.139	325.2	589.0	2.161	1.892	2.086	326.1	589.0	2.165	1.894	-2.48%	0.28%	0.0	0.19%	0.11%
WHTOL1-B22	2.128	331.3	588.5	2.192	1.899	2.086	333.4	588.5	2.196	1.901	-1.97%	0.63%	0.0	0.18%	0.11%
WHTOL1-B23	2.060	330.7	589.0	2.171	1.894	2.072	334.0	589.0	2.176	1.896	0.58%	1.00%	0.0	0.23%	0.11%
WHTOL1-B24	2.051	337.1	589.2	2.166	1.894	2.051	337.6	589.1	2.171	1.896	0.00%	0.15%	-0.1	0.23%	0.11%
WHTOL1-B25	2.119	340.8	588.3	2.166	1.897	2.123	342.4	588.2	2.171	1.899	0.19%	0.47%	-0.1	0.23%	0.11%
WHTOL1-B26	2.115	335.1	588.8	2.169	1.894	2.122	337.7	588.7	2.172	1.895	0.33%	0.78%	-0.1	0.14%	0.05%
WHTOL2-B1	2.094	329.6	588.8	2.164	1.894	2.113	332.1	588.6	2.168	1.895	0.91%	0.76%	-0.2	0.18%	0.05%
WHTOL2-B2	2.100	326.2	588.6	2.191	1.900	2.089	327.8	588.3	2.194	1.900	-0.52%	0.49%	-0.3	0.14%	0.00%
WHTOL2-B3	2.051	328.8	589.0	2.173	1.893	2.077	329.1	588.8	2.177	1.894	1.27%	0.09%	-0.2	0.18%	0.05%
WHTOL2-B4	2.057	324.8	588.7	2.175	1.896	2.063	324.8	588.5	2.179	1.897	0.29%	0.00%	-0.2	0.18%	0.05%
WHTOL2-B5	2.130	320.3	588.9	2.158	1.896	2.111	317.9	588.7	2.162	1.897	-0.89%	-0.75%	-0.2	0.19%	0.05%
WHTOL2-B6	2.119	337.9	588.6	2.171	1.896	2.128	335.3	588.4	2.175	1.897	0.42%	-0.77%	-0.2	0.18%	0.05%
WHTOL2-B7	2.120	330.8	588.5	2.166	1.897	2.086	329.5	588.3	2.169	1.898	-1.60%	-0.39%	-0.2	0.14%	0.05%
WHTOL2-B8	2.119	333.1	589.2	2.168	1.891	2.124	330.3	589.0	2.177	1.892	0.24%	-0.84%	-0.2	0.42%	0.05%
WHTOL2-B9	2.065	337.6	589.2	2.174	1.897	2.057	333.6	589.0	2.162	1.892	-0.39%	-1.18%	-0.2	-0.55%	-0.26%
WHTOL2-B10	2.123	335.7	588.4	2.166	1.897	2.120	331.8	588.3	2.170	1.898	-0.14%	-1.16%	-0.1	0.18%	0.05%
WHTOL2-B11	2.135	334.7	588.7	2.161	1.894	2.130	329.2	588.5	2.165	1.895	-0.23%	-1.64%	-0.2	0.19%	0.05%
WHTOL2-B12	2.072	331.5	588.7	2.187	1.896	2.082	329.6	588.5	2.191	1.897	0.48%	-0.57%	-0.2	0.18%	0.05%
WHTOL2-B13	2.117	332.9	588.9	2.175	1.893	2.083	331.5	588.7	2.178	1.894	-1.61%	-0.42%	-0.2	0.14%	0.05%
WHTOL2-B14	2.055	326.8	588.8	2.173	1.895	2.062	324.9	588.6	2.175	1.896	0.34%	-0.58%	-0.2	0.09%	0.05%
WHTOL2-B15	2.111	337.2	589.2	2.167	1.890	2.066	333.8	589.0	2.152	1.891	-2.13%	-1.01%	-0.2	-0.69%	0.05%
WHTOL2-B16	2.137	332.3	588.3	2.178	1.899	2.125	329.2	588.2	2.183	1.900	-0.56%	-0.93%	-0.1	0.23%	0.05%
WHTOL2-B17	2.080	338.0	588.3	2.169	1.898	2.125	333.2	588.2	2.174	1.900	2.16%	-1.42%	-0.1	0.23%	0.11%
WHTOL2-B18	2.093	337.2	589.3	2.164	1.888	2.110	334.0	589.2	2.168	1.890	0.81%	-0.95%	-0.1	0.18%	0.11%
WHTOL2-B19	2.058	333.3	589.0	2.168	1.892	2.058	329.3	588.8	2.182	1.895	0.00%	-1.20%	-0.2	0.65%	0.16%

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL2-B20	2.126	333.5	589.2	2.169	1.888	2.148	328.5	589.0	2.153	1.890	1.03%	-1.50%	-0.2	-0.74%	0.11%
WHTOL2-B21	2.083	334.5	588.8	2.159	1.894	2.129	330.1	588.6	2.163	1.895	2.21%	-1.32%	-0.2	0.19%	0.05%
WHTOL2-B22	2.074	329.2	588.8	2.183	1.894	2.117	326.6	588.6	2.188	1.896	2.07%	-0.79%	-0.2	0.23%	0.11%
WHTOL2-B23	2.058	330.0	589.3	2.172	1.892	2.062	327.2	589.1	2.176	1.893	0.19%	-0.85%	-0.2	0.18%	0.05%
WHTOL2-B24	2.038	325.7	589.9	2.159	1.888	2.043	322.2	589.7	2.155	1.889	0.25%	-1.07%	-0.2	-0.19%	0.05%
WHTOL2-B25	2.089	342.5	588.6	2.163	1.894	2.083	338.9	588.5	2.166	1.895	-0.29%	-1.05%	-0.1	0.14%	0.05%
WHTOL2-B26	2.118	334.5	588.4	2.173	1.899	2.105	328.2	588.3	2.178	1.900	-0.61%	-1.88%	-0.1	0.23%	0.05%
PTC-B1	2.074	333.7	588.8	2.161	1.896	2.089	329.6	588.6	2.166	1.897	0.72%	-1.23%	-0.2	0.23%	0.05%
PTC-B2	2.096	335.8	588.8	2.184	1.898	2.110	331.5	588.6	2.188	1.899	0.67%	-1.28%	-0.2	0.18%	0.05%
PTC-B3	2.072	328.0	589.2	2.167	1.890	2.089	322.9	589.0	2.172	1.892	0.82%	-1.55%	-0.2	0.23%	0.11%
PTC-B4	2.057	328.8	588.7	2.175	1.897	2.062	324.2	588.5	2.179	1.898	0.24%	-1.40%	-0.2	0.18%	0.05%
PTC-B5	2.108	339.8	588.8	2.159	1.893	2.099	334.9	588.6	2.163	1.895	-0.43%	-1.44%	-0.2	0.19%	0.11%
PTC-B6	2.122	340.6	589.0	2.163	1.894	2.138	335.4	588.8	2.166	1.895	0.75%	-1.53%	-0.2	0.14%	0.05%
PTC-B7	2.086	342.3	590.1	2.171	1.885	2.060	338.5	590.0	2.169	1.887	-1.25%	-1.11%	-0.1	-0.09%	0.11%
PTC-B8	2.119	331.0	588.9	2.176	1.894	2.090	326.6	588.7	2.185	1.897	-1.37%	-1.33%	-0.2	0.41%	0.16%
PTC-B9	2.072	325.5	589.2	2.187	1.893	2.058	323.4	589.0	2.167	1.894	-0.68%	-0.65%	-0.2	-0.91%	0.05%
PTC-B10	2.122	327.5	588.8	2.158	1.894	2.128	323.7	588.6	2.162	1.895	0.28%	-1.16%	-0.2	0.19%	0.05%
PTC-B11	2.074	322.0	588.9	2.159	1.893	2.091	320.0	588.7	2.163	1.894	0.82%	-0.62%	-0.2	0.19%	0.05%
PTC-B12	2.060	331.4	588.8	2.186	1.896	2.075	330.4	588.6	2.191	1.898	0.73%	-0.30%	-0.2	0.23%	0.11%
PTC-B13	2.125	326.2	589.1	2.171	1.896	2.093	325.3	588.9	2.177	1.898	-1.51%	-0.28%	-0.2	0.28%	0.11%
PTC-B14	2.038	337.6	590.0	2.153	1.887	2.043	333.1	589.8	2.158	1.889	0.25%	-1.33%	-0.2	0.23%	0.11%
PTC-B15	2.131	339.0	588.7	2.162	1.895	2.106	335.5	588.5	2.166	1.896	-1.17%	-1.03%	-0.2	0.19%	0.05%
PTC-B16	2.090	333.8	588.5	2.174	1.899	2.089	333.0	588.2	2.177	1.900	-0.05%	-0.24%	-0.3	0.14%	0.05%
PTC-B17	2.089	332.3	588.8	2.161	1.894	2.116	328.6	588.6	2.165	1.895	1.29%	-1.11%	-0.2	0.19%	0.05%
PTC-B18	2.115	332.4	589.0	2.173	1.894	2.106	331.5	588.8	2.175	1.895	-0.43%	-0.27%	-0.2	0.09%	0.05%
PTC-B19	2.055	333.2	588.7	2.170	1.895	2.063	331.9	588.5	2.161	1.895	0.39%	-0.39%	-0.2	-0.41%	0.00%
PTC-B20	2.137	333.2	588.7	2.161	1.895	2.122	333.4	588.5	2.165	1.896	-0.70%	0.06%	-0.2	0.19%	0.05%
PTC-B21	2.079	310.9	589.2	2.157	1.895	2.103	308.6	589.0	2.161	1.896	1.15%	-0.74%	-0.2	0.19%	0.05%
PTC-B22	2.111	332.4	588.7	2.189	1.897	2.099	332.3	588.4	2.193	1.898	-0.57%	-0.03%	-0.3	0.18%	0.05%
PTC-B23	2.097	331.5	588.5	2.185	1.900	2.103	329.5	588.3	2.190	1.901	0.29%	-0.60%	-0.2	0.23%	0.05%
PTC-B24	2.052	324.8	589.0	2.170	1.895	2.060	324.8	588.8	2.175	1.896	0.39%	0.00%	-0.2	0.23%	0.05%
PTC-B25	2.097	338.9	588.7	2.155	1.893	2.125	333.7	588.5	2.160	1.895	1.34%	-1.53%	-0.2	0.23%	0.11%
PTC-B26	2.128	336.2	588.6	2.168	1.895	2.104	335.1	588.5	2.174	1.897	-1.13%	-0.33%	-0.1	0.28%	0.11%
TC-B1	2.114	331.9	588.7	2.163	1.893	2.126	333.1	588.7	2.167	1.894	0.57%	0.36%	0.0	0.18%	0.05%
TC-B2	2.065	338.0	589.6	2.167	1.887	2.055	335.7	589.6	2.172	1.888	-0.48%	-0.68%	0.0	0.23%	0.05%
TC-B3	2.083	338.3	588.7	2.177	1.895	2.069	336.7	588.7	2.182	1.896	-0.67%	-0.47%	0.0	0.23%	0.05%
TC-B4	2.048	335.0	589.0	2.165	1.891	2.049	334.6	589.0	2.167	1.892	0.05%	-0.12%	0.0	0.09%	0.05%
TC-B5	2.094	344.5	588.6	2.162	1.895	2.086	339.3	588.7	2.166	1.896	-0.38%	-1.51%	0.1	0.19%	0.05%
TC-B6	2.097	335.7	588.4	2.172	1.898	2.109	333.0	588.5	2.174	1.899	0.57%	-0.80%	0.1	0.09%	0.05%
TC-B7	2.130	334.9	588.8	2.156	1.891	2.113	330.9	588.9	2.160	1.893	-0.80%	-1.19%	0.1	0.19%	0.11%
TC-B8	2.142	331.8	588.7	2.175	1.897	2.130	329.2	588.7	2.187	1.899	-0.56%	-0.78%	0.0	0.55%	0.11%
TC-B9	2.086	335.0	589.2	2.154	1.889	2.052	334.3	589.2	2.173	1.899	-1.63%	-0.21%	0.0	0.88%	0.53%
TC-B10	2.102	339.8	588.6	2.160	1.895	2.108	339.4	588.6	2.165	1.897	0.29%	-0.12%	0.0	0.23%	0.11%
TC-B11	2.097	333.6	588.3	2.174	1.900	2.094	331.8	588.3	2.179	1.901	-0.14%	-0.54%	0.0	0.23%	0.05%
TC-B12	2.086	336.9	589.5	2.168	1.887	2.097	336.3	589.5	2.172	1.889	0.53%	-0.18%	0.0	0.18%	0.11%
TC-B13	2.093	337.1	589.6	2.160	1.888	2.068	334.8	589.7	2.166	1.889	-1.19%	-0.68%	0.1	0.28%	0.05%

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
TC-B14	2.062	336.0	588.4	2.178	1.899	2.063	334.8	588.5	2.184	1.900	0.05%	-0.36%	0.1	0.28%	0.05%
TC-B15	2.089	338.4	588.5	2.164	1.895	2.071	338.1	588.4	2.168	1.896	-0.86%	-0.09%	-0.1	0.18%	0.05%
TC-B16	2.125	341.0	588.3	2.169	1.897	2.128	341.3	588.3	2.174	1.898	0.14%	0.09%	0.0	0.23%	0.05%
TC-B17	2.133	330.5	590.1	2.165	1.886	2.106	328.3	590.1	2.179	1.887	-1.27%	-0.67%	0.0	0.65%	0.05%
TC-B18	2.130	334.8	589.0	2.169	1.892	2.121	335.1	589.0	2.177	1.893	-0.42%	0.09%	0.0	0.37%	0.05%
TC-B19	2.117	337.0	588.5	2.172	1.896	2.091	336.4	588.5	2.174	1.904	-1.23%	-0.18%	0.0	0.09%	0.42%
TC-B20	2.118	335.9	588.3	2.169	1.899	2.130	333.9	588.3	2.173	1.900	0.57%	-0.60%	0.0	0.18%	0.05%
TC-B21	2.126	328.0	588.9	2.162	1.893	2.141	329.4	588.9	2.166	1.894	0.71%	0.43%	0.0	0.19%	0.05%
TC-B22	2.077	333.9	590.2	2.158	1.883	2.074	335.5	590.2	2.162	1.884	-0.14%	0.48%	0.0	0.19%	0.05%
TC-B23	2.113	328.7	589.6	2.157	1.886	2.091	329.8	589.6	2.161	1.887	-1.04%	0.33%	0.0	0.19%	0.05%
TC-B24	2.052	328.2	588.6	2.169	1.895	2.055	329.2	588.6	2.173	1.896	0.15%	0.30%	0.0	0.18%	0.05%
TC-B25	2.131	349.6	588.5	2.163	1.897	2.100	349.8	588.5	2.168	1.898	-1.45%	0.06%	0.0	0.23%	0.05%
TC-B26	2.123	334.9	588.4	2.175	1.898	2.096	335.3	588.4	2.177	1.899	-1.27%	0.12%	0.0	0.09%	0.05%
Min	2.038	310.9	588.3	2.151	1.883	2.032	308.6	588.2	2.151	1.884	-3.33%	-1.88%	-0.3	-0.91%	-0.26%
Max	2.142	349.6	590.2	2.193	1.900	2.148	349.8	590.2	2.196	1.904	2.21%	1.21%	0.1	0.88%	0.53%
Average	2.095	332.9	588.9	2.169	1.894	2.090	331.6	588.8	2.172	1.895	-0.24%	-0.37%	-0.1	0.16%	0.08%
Stdev	0.028	5.9	0.4	0.009	0.004	0.029	5.8	0.5	0.010	0.004	1.21%	0.72%	0.1	0.28%	0.08%

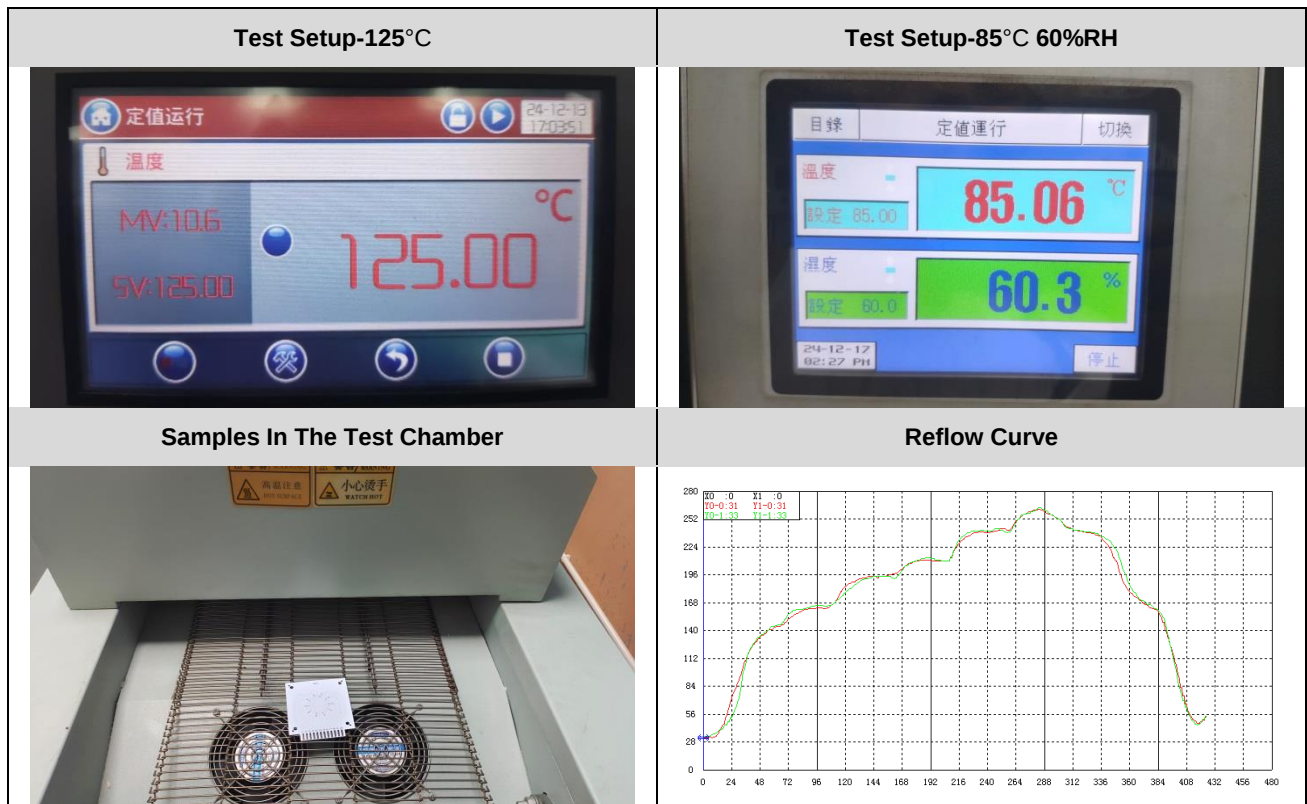
4.1.3.5 PC Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL1-C1	2.106	334.7	588.9	2.155	1.891	2.093	337.5	588.9	2.160	1.893	-0.62%	0.84%	0.0	0.23%	0.11%
WHTOL1-C2	2.105	331.2	588.7	2.176	1.896	2.111	331.5	588.6	2.183	1.897	0.29%	0.09%	-0.1	0.32%	0.05%
WHTOL1-C3	2.060	336.0	588.8	2.160	1.896	2.094	335.6	588.8	2.166	1.897	1.65%	-0.12%	0.0	0.28%	0.05%
WHTOL1-C4	2.111	331.5	588.5	2.165	1.896	2.101	333.1	588.5	2.170	1.898	-0.47%	0.48%	0.0	0.23%	0.11%
WHTOL1-C5	2.141	333.1	588.8	2.164	1.894	2.130	333.1	588.8	2.168	1.895	-0.51%	0.00%	0.0	0.18%	0.05%
WHTOL1-C6	2.055	339.8	589.2	2.180	1.894	2.091	343.0	589.2	2.185	1.896	1.75%	0.94%	0.0	0.23%	0.11%
WHTOL1-C7	2.074	327.1	588.7	2.175	1.896	2.099	329.4	588.7	2.181	1.897	1.21%	0.70%	0.0	0.28%	0.05%
WHTOL1-C8	2.046	328.9	589.2	2.164	1.891	2.048	328.7	589.1	2.170	1.892	0.10%	-0.06%	-0.1	0.28%	0.05%
WHTOL1-C9	2.077	336.8	588.9	2.156	1.892	2.083	344.9	588.7	2.161	1.893	0.29%	2.40%	-0.2	0.23%	0.05%
WHTOL1-C10	2.122	330.6	588.5	2.172	1.898	2.130	335.6	588.4	2.178	1.900	0.38%	1.51%	-0.1	0.28%	0.11%
WHTOL1-C11	2.114	304.0	589.6	2.170	1.892	2.109	309.1	589.5	2.152	1.894	-0.24%	1.68%	-0.1	-0.83%	0.11%
WHTOL1-C12	2.127	321.4	588.9	2.173	1.896	2.119	325.7	588.8	2.181	1.898	-0.38%	1.34%	-0.1	0.37%	0.11%
WHTOL1-C13	2.072	329.1	588.7	2.178	1.896	2.063	334.6	588.6	2.183	1.902	-0.43%	1.67%	-0.1	0.23%	0.32%
WHTOL1-C14	2.145	330.9	588.6	2.165	1.896	2.148	333.7	588.5	2.170	1.898	0.14%	0.85%	-0.1	0.23%	0.11%
WHTOL1-C15	2.144	328.3	588.8	2.163	1.893	2.083	332.9	588.7	2.168	1.895	-2.85%	1.40%	-0.1	0.23%	0.11%
WHTOL1-C16	2.108	327.4	589.3	2.174	1.890	2.062	331.6	589.2	2.179	1.891	-2.18%	1.28%	-0.1	0.23%	0.05%
WHTOL1-C17	2.049	325.7	589.3	2.167	1.889	2.060	329.6	589.2	2.173	1.891	0.54%	1.20%	-0.1	0.28%	0.11%
WHTOL1-C18	2.052	329.0	588.9	2.170	1.894	2.055	331.1	588.8	2.174	1.896	0.15%	0.64%	-0.1	0.18%	0.11%
WHTOL1-C19	2.099	339.6	588.7	2.159	1.892	2.090	342.6	588.6	2.164	1.894	-0.43%	0.88%	-0.1	0.23%	0.11%
WHTOL1-C20	2.125	337.5	588.3	2.178	1.900	2.112	341.3	588.2	2.182	1.901	-0.61%	1.13%	-0.1	0.18%	0.05%
WHTOL1-C21	2.128	335.9	589.1	2.169	1.892	2.083	340.1	589.1	2.155	1.894	-2.11%	1.25%	0.0	-0.65%	0.11%
WHTOL1-C22	2.134	336.7	589.1	2.168	1.891	2.117	340.3	589.1	2.180	1.894	-0.80%	1.07%	0.0	0.55%	0.16%
WHTOL1-C23	2.130	337.6	589.3	2.154	1.889	2.055	337.9	589.3	2.174	1.894	-3.52%	0.09%	0.0	0.93%	0.26%
WHTOL1-C24	2.126	336.6	588.8	2.156	1.892	2.113	337.0	588.8	2.161	1.894	-0.61%	0.12%	0.0	0.23%	0.11%
WHTOL1-C25	2.106	332.3	589.0	2.158	1.892	2.114	332.9	589.0	2.163	1.894	0.38%	0.18%	0.0	0.23%	0.11%
WHTOL1-C26	2.130	333.9	589.3	2.171	1.892	2.055	332.5	589.3	2.176	1.894	-3.52%	-0.42%	0.0	0.23%	0.11%
WHTOL2-C1	2.141	335.9	588.3	2.169	1.898	2.122	343.5	588.2	2.173	1.900	-0.89%	2.26%	-0.1	0.18%	0.11%
WHTOL2-C2	2.105	332.9	589.0	2.172	1.892	2.116	338.8	588.8	2.178	1.894	0.52%	1.77%	-0.2	0.28%	0.11%
WHTOL2-C3	2.063	333.7	588.7	2.190	1.898	2.062	341.3	588.5	2.175	1.891	-0.05%	2.28%	-0.2	-0.68%	-0.37%
WHTOL2-C4	2.101	334.7	588.6	2.163	1.896	2.118	342.0	588.5	2.167	1.897	0.81%	2.18%	-0.1	0.18%	0.05%
WHTOL2-C5	2.116	332.6	588.7	2.164	1.894	2.123	341.0	588.5	2.169	1.895	0.33%	2.53%	-0.2	0.23%	0.05%
WHTOL2-C6	2.054	337.8	589.6	2.170	1.889	2.074	345.6	589.4	2.174	1.890	0.97%	2.31%	-0.2	0.18%	0.05%
WHTOL2-C7	2.085	328.7	589.2	2.164	1.891	2.077	336.7	589.1	2.168	1.893	-0.38%	2.43%	-0.1	0.18%	0.11%
WHTOL2-C8	2.037	338.1	590.1	2.152	1.886	2.043	343.0	589.9	2.155	1.887	0.29%	1.45%	-0.2	0.14%	0.05%
WHTOL2-C9	2.083	338.6	588.7	2.160	1.894	2.101	349.6	588.5	2.163	1.895	0.86%	3.25%	-0.2	0.14%	0.05%
WHTOL2-C10	2.100	343.3	588.7	2.169	1.896	2.078	352.7	588.4	2.172	1.897	-1.05%	2.74%	-0.3	0.14%	0.05%
WHTOL2-C11	2.107	337.9	589.4	2.175	1.887	2.097	347.9	589.2	2.180	1.888	-0.47%	2.96%	-0.2	0.23%	0.05%
WHTOL2-C12	2.137	331.1	588.6	2.181	1.897	2.117	339.0	588.4	2.190	1.899	-0.94%	2.39%	-0.2	0.41%	0.11%
WHTOL2-C13	2.069	332.1	588.8	2.172	1.896	2.062	343.0	588.6	2.162	1.899	-0.34%	3.28%	-0.2	-0.46%	0.16%
WHTOL2-C14	2.105	333.1	589.6	2.163	1.886	2.120	341.6	589.4	2.176	1.887	0.71%	2.55%	-0.2	0.60%	0.05%
WHTOL2-C15	2.071	331.8	588.9	2.158	1.891	2.083	340.0	588.7	2.162	1.892	0.58%	2.47%	-0.2	0.19%	0.05%
WHTOL2-C16	2.091	334.6	589.5	2.171	1.889	2.058	343.3	589.3	2.173	1.890	-1.58%	2.60%	-0.2	0.09%	0.05%
WHTOL2-C17	2.052	327.9	590.0	2.152	1.884	2.055	338.1	589.8	2.157	1.885	0.15%	3.11%	-0.2	0.23%	0.05%
WHTOL2-C18	2.041	328.5	589.6	2.154	1.891	2.048	339.2	589.4	2.157	1.892	0.34%	3.26%	-0.2	0.14%	0.05%
WHTOL2-C19	2.108	341.2	588.2	2.171	1.899	2.130	348.6	588.0	2.174	1.900	1.04%	2.17%	-0.2	0.14%	0.05%

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL2-C20	2.113	341.9	588.8	2.166	1.893	2.095	349.3	588.6	2.168	1.894	-0.85%	2.16%	-0.2	0.09%	0.05%
WHTOL2-C21	2.127	337.8	588.9	2.156	1.892	2.121	345.6	588.8	2.159	1.893	-0.28%	2.31%	-0.1	0.14%	0.05%
WHTOL2-C22	2.114	334.9	588.7	2.180	1.895	2.110	341.1	588.6	2.187	1.897	-0.19%	1.85%	-0.1	0.32%	0.11%
WHTOL2-C23	2.120	338.5	589.0	2.161	1.892	2.057	345.9	588.8	2.177	1.904	-2.97%	2.19%	-0.2	0.74%	0.63%
WHTOL2-C24	2.125	343.4	588.7	2.161	1.896	2.121	349.1	588.5	2.165	1.897	-0.19%	1.66%	-0.2	0.19%	0.05%
WHTOL2-C25	2.071	331.3	588.7	2.167	1.895	2.145	336.6	588.5	2.170	1.896	3.57%	1.60%	-0.2	0.14%	0.05%
WHTOL2-C26	2.091	335.4	588.4	2.194	1.900	2.139	342.0	588.2	2.197	1.901	2.30%	1.97%	-0.2	0.14%	0.05%
PTC-C1	2.091	343.8	589.7	2.150	1.888	2.098	351.1	589.5	2.155	1.890	0.33%	2.12%	-0.2	0.23%	0.11%
PTC-C2	2.120	335.9	589.7	2.164	1.887	2.131	345.8	589.6	2.169	1.889	0.52%	2.95%	-0.1	0.23%	0.11%
PTC-C3	2.063	331.0	588.7	2.165	1.895	2.072	338.7	588.5	2.169	1.897	0.44%	2.33%	-0.2	0.18%	0.11%
PTC-C4	2.124	332.3	590.0	2.166	1.884	2.135	340.8	589.8	2.171	1.885	0.52%	2.56%	-0.2	0.23%	0.05%
PTC-C5	2.094	330.9	588.5	2.170	1.897	2.083	341.0	588.3	2.174	1.899	-0.53%	3.05%	-0.2	0.18%	0.11%
PTC-C6	2.065	331.6	588.7	2.185	1.896	2.082	339.6	588.5	2.191	1.898	0.82%	2.41%	-0.2	0.27%	0.11%
PTC-C7	2.128	342.1	590.2	2.161	1.886	2.074	350.6	590.0	2.167	1.888	-2.54%	2.48%	-0.2	0.28%	0.11%
PTC-C8	2.051	330.8	588.7	2.165	1.894	2.055	340.3	588.6	2.172	1.896	0.20%	2.87%	-0.1	0.32%	0.11%
PTC-C9	2.117	344.9	588.4	2.166	1.896	2.147	348.5	588.3	2.170	1.898	1.42%	1.04%	-0.1	0.18%	0.11%
PTC-C10	2.136	340.0	588.4	2.174	1.899	2.081	349.1	588.2	2.182	1.900	-2.57%	2.68%	-0.2	0.37%	0.05%
PTC-C11	2.129	337.7	588.3	2.171	1.899	2.124	344.2	588.1	2.175	1.900	-0.23%	1.92%	-0.2	0.18%	0.05%
PTC-C12	2.103	335.7	589.0	2.171	1.895	2.125	341.9	588.9	2.176	1.897	1.05%	1.85%	-0.1	0.23%	0.11%
PTC-C13	2.054	335.5	589.9	2.168	1.886	2.051	341.5	589.7	2.160	1.886	-0.15%	1.79%	-0.2	-0.37%	0.00%
PTC-C14	2.108	332.8	590.0	2.172	1.887	2.090	338.9	589.9	2.176	1.888	-0.85%	1.83%	-0.1	0.18%	0.05%
PTC-C15	2.055	338.5	589.3	2.154	1.890	2.083	346.0	589.1	2.158	1.892	1.36%	2.22%	-0.2	0.19%	0.11%
PTC-C16	2.086	332.0	589.6	2.166	1.890	2.066	336.1	589.4	2.171	1.891	-0.96%	1.23%	-0.2	0.23%	0.05%
PTC-C17	2.094	332.1	589.3	2.169	1.896	2.055	338.3	589.2	2.175	1.897	-1.86%	1.87%	-0.1	0.28%	0.05%
PTC-C18	2.041	328.2	589.4	2.155	1.888	2.046	331.5	589.3	2.160	1.889	0.24%	1.01%	-0.1	0.23%	0.05%
PTC-C19	2.136	346.4	588.6	2.161	1.894	2.120	350.6	588.5	2.165	1.895	-0.75%	1.21%	-0.1	0.19%	0.05%
PTC-C20	2.106	337.7	588.9	2.158	1.892	2.112	340.4	588.8	2.161	1.893	0.28%	0.80%	-0.1	0.14%	0.05%
PTC-C21	2.110	337.7	588.7	2.161	1.894	2.102	342.3	588.6	2.165	1.895	-0.38%	1.36%	-0.1	0.19%	0.05%
PTC-C22	2.142	337.3	588.4	2.188	1.899	2.123	340.5	588.3	2.193	1.900	-0.89%	0.95%	-0.1	0.23%	0.05%
PTC-C23	2.051	334.4	589.0	2.156	1.890	2.058	338.3	588.9	2.160	1.891	0.34%	1.17%	-0.1	0.19%	0.05%
PTC-C24	2.141	335.6	588.7	2.161	1.894	2.125	340.3	588.6	2.164	1.895	-0.75%	1.40%	-0.1	0.14%	0.05%
PTC-C25	2.068	333.1	588.5	2.170	1.897	2.096	338.6	588.4	2.174	1.898	1.35%	1.65%	-0.1	0.18%	0.05%
PTC-C26	2.055	330.4	589.3	2.174	1.889	2.111	336.3	589.2	2.176	1.890	2.73%	1.79%	-0.1	0.09%	0.05%
TC-C1	2.126	326.6	589.6	2.168	1.889	2.124	328.1	589.6	2.153	1.890	-0.09%	0.46%	0.0	-0.69%	0.05%
TC-C2	2.106	344.8	588.8	2.173	1.894	2.118	343.6	588.8	2.181	1.896	0.57%	-0.35%	0.0	0.37%	0.11%
TC-C3	2.040	334.1	590.0	2.184	1.886	2.051	335.0	590.0	2.173	1.896	0.54%	0.27%	0.0	-0.50%	0.53%
TC-C4	2.079	334.5	589.3	2.166	1.887	2.139	334.7	589.3	2.150	1.889	2.89%	0.06%	0.0	-0.74%	0.11%
TC-C5	2.093	331.7	588.5	2.171	1.897	2.108	333.1	588.5	2.175	1.898	0.72%	0.42%	0.0	0.18%	0.05%
TC-C6	2.080	337.6	588.8	2.181	1.895	2.108	337.8	588.8	2.186	1.896	1.35%	0.06%	0.0	0.23%	0.05%
TC-C7	2.096	336.7	589.5	2.161	1.888	2.088	336.3	589.5	2.166	1.889	-0.38%	-0.12%	0.0	0.23%	0.05%
TC-C8	2.058	331.5	588.5	2.174	1.897	2.062	333.0	588.5	2.178	1.898	0.19%	0.45%	0.0	0.18%	0.05%
TC-C9	2.119	343.8	588.7	2.156	1.892	2.068	345.7	588.7	2.160	1.893	-2.41%	0.55%	0.0	0.19%	0.05%
TC-C10	2.124	341.9	588.3	2.177	1.890	2.120	343.2	588.3	2.180	1.901	-0.19%	0.38%	0.0	0.14%	0.58%
TC-C11	2.086	345.1	590.0	2.167	1.884	2.086	342.7	590.0	2.161	1.885	0.00%	-0.70%	0.0	-0.28%	0.05%
TC-C12	2.119	335.0	589.2	2.166	1.889	2.124	336.2	589.2	2.173	1.890	0.24%	0.36%	0.0	0.32%	0.05%
TC-C13	2.049	330.9	589.2	2.171	1.895	2.052	331.5	589.2	2.173	1.898	0.15%	0.18%	0.0	0.09%	0.16%

No.	Lot C													
	pre-test					post-test					change			
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)
TC-C14	2.080	336.0	589.0	2.152	1.892	2.144	335.4	589.0	2.156	1.893	3.08%	-0.18%	0.0	0.19%
TC-C15	2.065	336.0	589.1	2.157	1.892	2.125	337.1	589.1	2.160	1.893	2.91%	0.33%	0.0	0.14%
TC-C16	2.117	333.7	588.5	2.191	1.899	2.128	332.8	588.5	2.195	1.899	0.52%	-0.27%	0.0	0.18%
TC-C17	2.083	325.6	589.6	2.165	1.894	2.120	326.4	589.5	2.169	1.895	1.78%	0.25%	-0.1	0.18%
TC-C18	2.046	327.0	589.6	2.159	1.890	2.048	326.4	589.5	2.164	1.891	0.10%	-0.18%	-0.1	0.23%
TC-C19	2.116	337.5	588.7	2.158	1.893	2.072	337.5	588.7	2.161	1.893	-2.08%	0.00%	0.0	0.14%
TC-C20	2.132	340.4	588.6	2.168	1.895	2.113	338.5	588.7	2.170	1.896	-0.89%	-0.56%	0.1	0.09%
TC-C21	2.098	328.6	588.7	2.159	1.896	2.083	324.4	588.7	2.162	1.897	-0.71%	-1.28%	0.0	0.14%
TC-C22	2.139	323.2	590.3	2.151	1.886	2.123	322.2	590.3	2.154	1.887	-0.75%	-0.31%	0.0	0.14%
TC-C23	2.071	340.3	589.6	2.189	1.891	2.049	340.2	589.6	2.152	1.892	-1.06%	-0.03%	0.0	-1.69%
TC-C24	2.102	334.0	588.8	2.152	1.893	2.131	332.6	588.8	2.155	1.893	1.38%	-0.42%	0.0	0.14%
TC-C25	2.094	323.4	589.5	2.168	1.892	2.080	320.8	589.6	2.151	1.892	-0.67%	-0.80%	0.1	-0.78%
TC-C26	2.063	342.3	588.8	2.182	1.895	2.097	341.1	588.8	2.184	1.896	1.65%	-0.35%	0.0	0.09%
Min	2.037	304.0	588.2	2.150	1.884	2.043	309.1	588.0	2.150	1.885	-3.52%	-1.28%	-0.3	-1.69%
Max	2.145	346.4	590.3	2.194	1.900	2.148	352.7	590.3	2.197	1.904	3.57%	3.28%	0.1	0.93%
Average	2.096	334.3	589.0	2.167	1.893	2.095	338.4	588.9	2.170	1.894	-0.02%	1.25%	-0.1	0.13%
Stdev	0.030	6.0	0.5	0.010	0.004	0.029	7.1	0.5	0.010	0.004	1.32%	1.11%	0.1	0.33%

4.1.4 Test Photo



4.2 Wet High Temperature Operating Life(WHTOL1)

4.2.1 Test Information

Sample size: 3 lots 26 pcs. each

Test period: 2024-12-29 to 2025-02-12

Reference document: JEDEC JESD22-A101

Power supply: IF=30mA(on 30min/off 30min)

Test temperature: $T_a=85^{\circ}\text{C}$

Test humidity: 85%RH

Test duration: 1000hrs

Test point: 0hrs/1000hrs

Acceptance criteria: Per Section 3

4.2.2 Environmental Conditions

Environmental temperature: $(24.3\sim 25.6)^{\circ}\text{C}$

Environmental humidity: $(48\sim 54)\%\text{RH}$

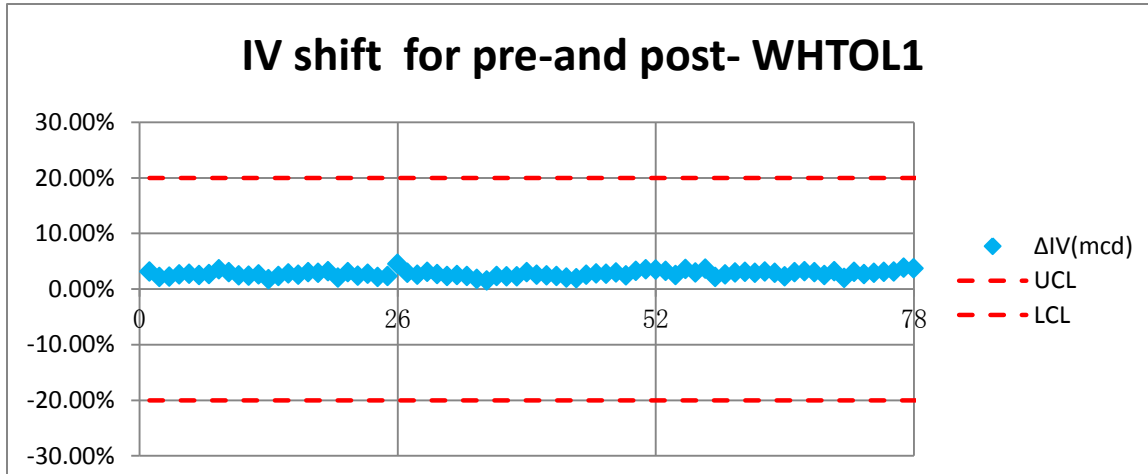
4.2.3 Test Data

4.2.3.1 Test Result for WHTOL1

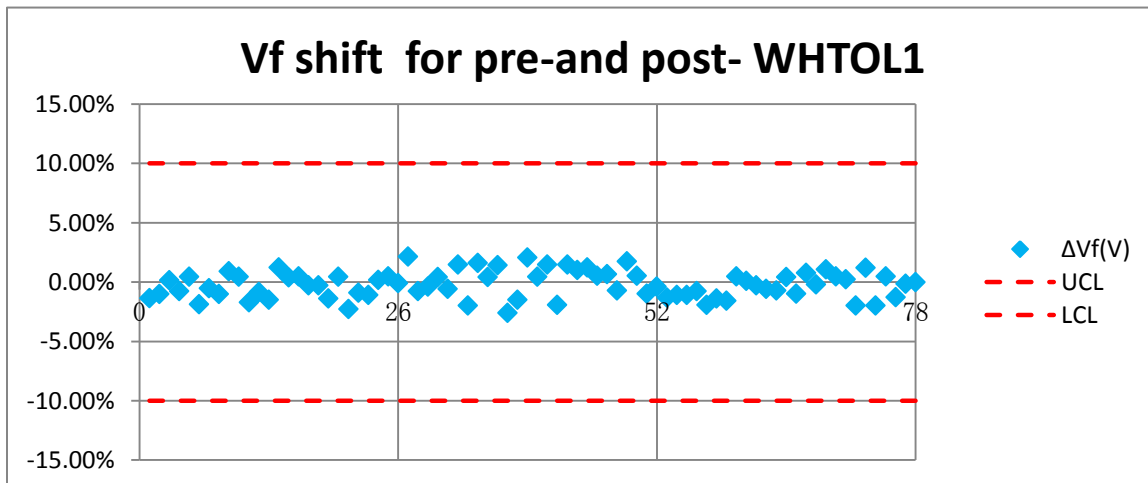
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light			0
B	External Visual	26	26	0
	Test			0
	Light / no light			0
C	External Visual	26	26	0
	Test			0
	Light / no light			0

4.2.3.2 Summary

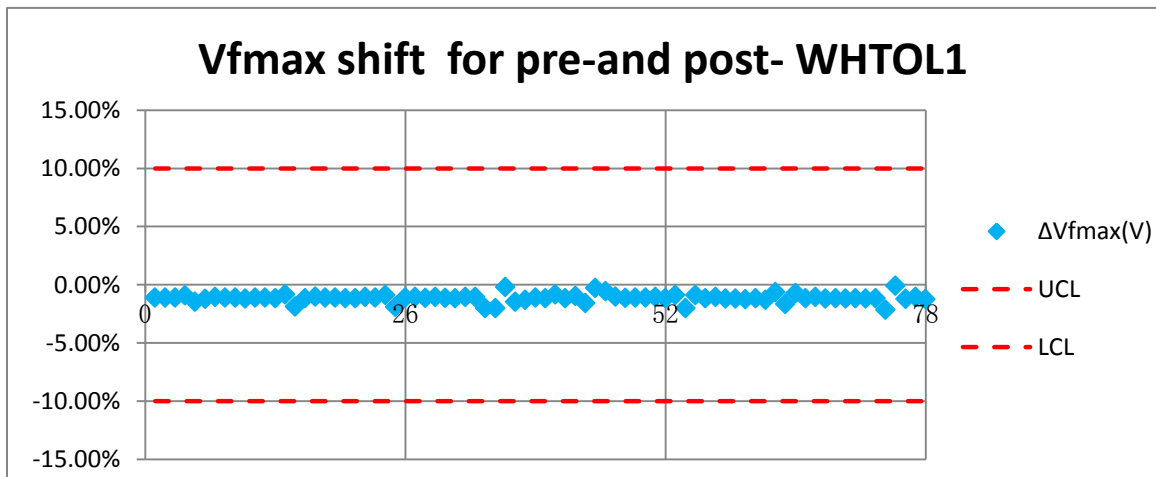
IV shift for pre- and post- WHTOL1



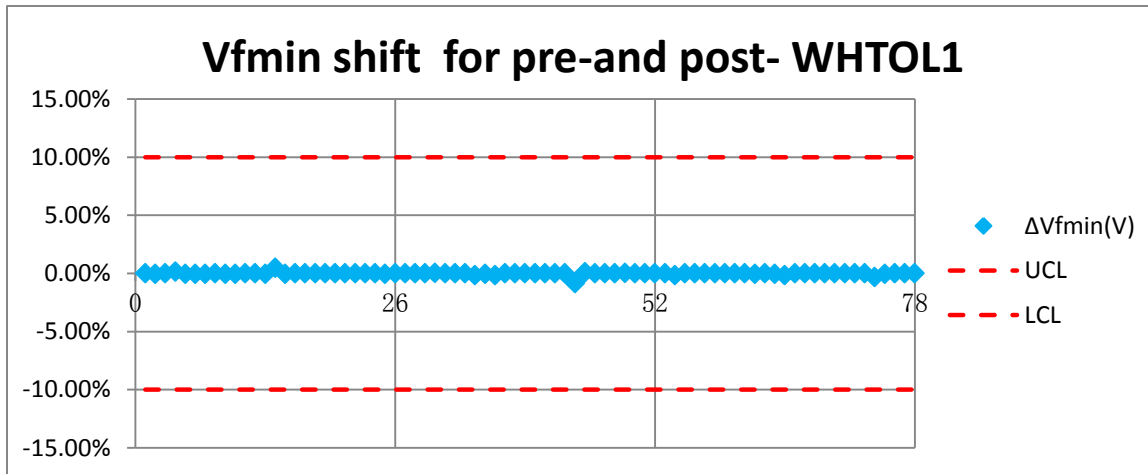
Vf shift for pre- and post- WHTOL1



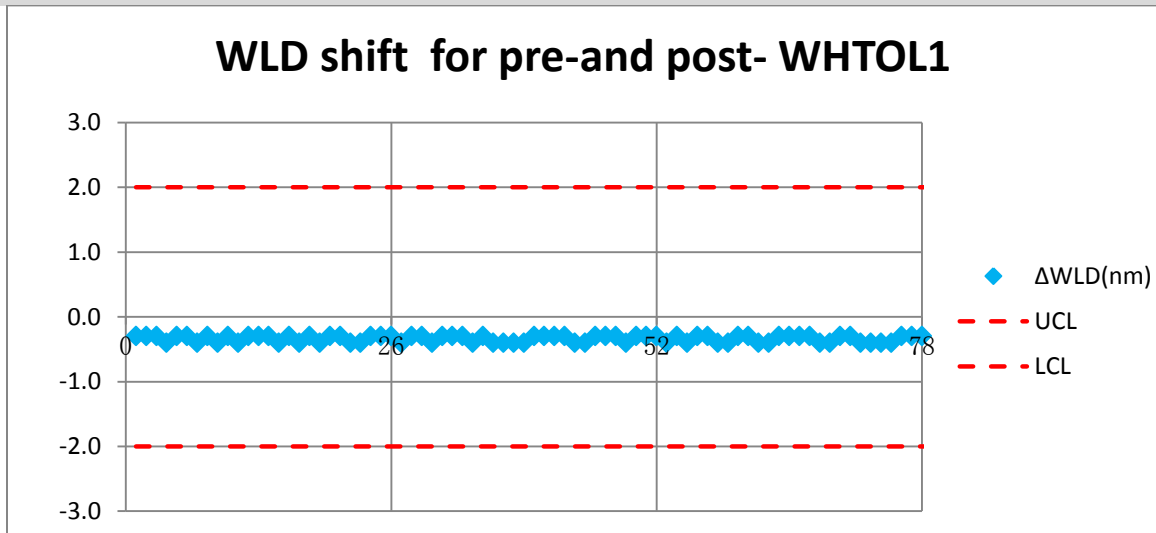
Vf_{max} shift for pre- and post- WHTOL1



V_{fmin} shift for pre- and post- WHTOL1



λ_d shift for pre- and post - WHTOL1



4.2.3.3 WHTOL1 Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL1-A1	2.136	328.4	588.5	2.168	1.898	2.107	338.8	588.2	2.144	1.898	-1.36%	3.17%	-0.3	-1.11%	0.00%
WHTOL1-A2	2.114	333.0	588.5	2.175	1.898	2.093	340.2	588.2	2.151	1.897	-0.99%	2.16%	-0.3	-1.10%	-0.05%
WHTOL1-A3	2.118	332.3	588.8	2.162	1.894	2.121	339.7	588.5	2.138	1.894	0.14%	2.23%	-0.3	-1.11%	0.00%
WHTOL1-A4	2.124	332.9	589.0	2.181	1.895	2.108	341.7	588.6	2.161	1.898	-0.75%	2.64%	-0.4	-0.92%	0.16%
WHTOL1-A5	2.054	333.0	589.0	2.179	1.893	2.063	342.1	588.7	2.147	1.892	0.44%	2.73%	-0.3	-1.47%	-0.05%
WHTOL1-A6	2.126	320.1	588.9	2.161	1.897	2.086	328.1	588.6	2.135	1.896	-1.88%	2.50%	-0.3	-1.20%	-0.05%
WHTOL1-A7	2.113	329.5	589.0	2.166	1.894	2.102	338.3	588.6	2.143	1.893	-0.52%	2.67%	-0.4	-1.06%	-0.05%
WHTOL1-A8	2.116	326.5	589.0	2.184	1.895	2.095	338.1	588.7	2.160	1.895	-0.99%	3.55%	-0.3	-1.10%	0.00%
WHTOL1-A9	2.106	332.9	589.0	2.176	1.894	2.125	342.9	588.6	2.152	1.893	0.90%	3.00%	-0.4	-1.10%	-0.05%
WHTOL1-A10	2.046	325.2	589.3	2.166	1.892	2.055	333.2	589.0	2.140	1.891	0.44%	2.46%	-0.3	-1.20%	-0.05%
WHTOL1-A11	2.108	342.9	589.0	2.160	1.895	2.072	351.1	588.6	2.136	1.895	-1.71%	2.39%	-0.4	-1.11%	0.00%
WHTOL1-A12	2.133	338.1	589.5	2.157	1.890	2.115	346.9	589.2	2.133	1.890	-0.84%	2.60%	-0.3	-1.11%	0.00%
WHTOL1-A13	2.138	335.9	589.4	2.155	1.891	2.106	341.8	589.1	2.130	1.890	-1.50%	1.76%	-0.3	-1.16%	-0.05%
WHTOL1-A14	2.089	334.1	589.7	2.165	1.888	2.115	341.9	589.4	2.147	1.897	1.24%	2.33%	-0.3	-0.83%	0.48%
WHTOL1-A15	2.066	335.1	588.5	2.189	1.901	2.074	344.4	588.1	2.148	1.900	0.39%	2.78%	-0.4	-1.87%	-0.05%
WHTOL1-A16	2.092	336.4	588.9	2.159	1.893	2.102	345.1	588.6	2.134	1.893	0.48%	2.59%	-0.3	-1.16%	0.00%
WHTOL1-A17	2.103	332.1	588.9	2.167	1.898	2.097	342.2	588.5	2.145	1.898	-0.29%	3.04%	-0.4	-1.02%	0.00%
WHTOL1-A18	2.071	331.8	589.3	2.177	1.891	2.065	341.4	589.0	2.153	1.891	-0.29%	2.89%	-0.3	-1.10%	0.00%
WHTOL1-A19	2.093	328.8	589.3	2.176	1.893	2.064	339.4	588.9	2.152	1.893	-1.39%	3.22%	-0.4	-1.10%	0.00%
WHTOL1-A20	2.043	332.0	589.4	2.162	1.890	2.052	338.8	589.1	2.137	1.890	0.44%	2.05%	-0.3	-1.16%	0.00%
WHTOL1-A21	2.119	338.1	588.9	2.159	1.893	2.071	348.4	588.6	2.134	1.893	-2.27%	3.05%	-0.3	-1.16%	0.00%
WHTOL1-A22	2.122	337.6	588.4	2.178	1.899	2.103	345.7	588.0	2.155	1.899	-0.90%	2.40%	-0.4	-1.06%	0.00%
WHTOL1-A23	2.130	337.3	588.7	2.166	1.896	2.107	346.5	588.3	2.142	1.896	-1.08%	2.73%	-0.4	-1.11%	0.00%
WHTOL1-A24	2.103	333.0	589.0	2.175	1.894	2.107	340.2	588.7	2.156	1.894	0.19%	2.16%	-0.3	-0.87%	0.00%
WHTOL1-A25	2.066	336.2	588.4	2.198	1.901	2.076	344.0	588.1	2.156	1.900	0.48%	2.32%	-0.3	-1.91%	-0.05%
WHTOL1-A26	2.113	328.6	588.5	2.167	1.897	2.111	343.5	588.2	2.143	1.897	-0.09%	4.53%	-0.3	-1.11%	0.00%
Min	2.043	320.1	588.4	2.155	1.888	2.052	328.1	588.0	2.130	1.890	-2.27%	1.76%	-0.4	-1.91%	-0.05%
Max	2.138	342.9	589.7	2.198	1.901	2.125	351.1	589.4	2.161	1.900	1.24%	4.53%	-0.3	-0.83%	0.48%
Average	2.102	332.8	589.0	2.170	1.895	2.092	341.7	588.6	2.145	1.895	-0.45%	2.69%	-0.3	-1.16%	0.01%
Stdev	0.028	4.8	0.4	0.011	0.003	0.022	4.7	0.4	0.009	0.003	0.93%	0.55%	0.0	0.24%	0.11%

4.2.3.4 WHTOL1 Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL1-B1	2.086	332.4	588.9	2.165	1.895	2.131	342.0	588.5	2.142	1.895	2.16%	2.89%	-0.4	-1.06%	0.00%
WHTOL1-B2	2.085	335.5	588.5	2.194	1.900	2.069	344.1	588.2	2.169	1.900	-0.77%	2.56%	-0.3	-1.14%	0.00%
WHTOL1-B3	2.041	330.6	588.7	2.181	1.897	2.033	340.8	588.4	2.158	1.897	-0.39%	3.09%	-0.3	-1.05%	0.00%
WHTOL1-B4	2.060	334.5	588.7	2.180	1.899	2.069	343.4	588.3	2.155	1.900	0.44%	2.66%	-0.4	-1.15%	0.05%
WHTOL1-B5	2.126	330.5	588.6	2.165	1.898	2.114	338.2	588.3	2.140	1.898	-0.56%	2.33%	-0.3	-1.15%	0.00%
WHTOL1-B6	2.041	339.4	588.9	2.165	1.897	2.071	347.9	588.6	2.142	1.897	1.47%	2.50%	-0.3	-1.06%	0.00%
WHTOL1-B7	2.122	337.8	588.9	2.161	1.897	2.080	345.6	588.6	2.138	1.897	-1.98%	2.31%	-0.3	-1.06%	0.00%
WHTOL1-B8	2.036	337.0	588.8	2.183	1.898	2.069	343.1	588.4	2.139	1.895	1.62%	1.81%	-0.4	-2.02%	-0.16%
WHTOL1-B9	2.062	329.6	588.7	2.191	1.898	2.071	334.7	588.4	2.147	1.897	0.44%	1.55%	-0.3	-2.01%	-0.05%
WHTOL1-B10	2.048	330.2	589.3	2.151	1.889	2.077	337.9	588.9	2.147	1.886	1.42%	2.33%	-0.4	-0.19%	-0.16%
WHTOL1-B11	2.124	334.8	590.1	2.184	1.885	2.069	342.4	589.7	2.152	1.885	-2.59%	2.27%	-0.4	-1.47%	0.00%
WHTOL1-B12	2.079	331.6	589.8	2.168	1.887	2.048	339.2	589.4	2.140	1.887	-1.49%	2.29%	-0.4	-1.29%	0.00%
WHTOL1-B13	2.077	326.7	589.2	2.173	1.892	2.120	336.6	588.8	2.149	1.892	2.07%	3.03%	-0.4	-1.10%	0.00%
WHTOL1-B14	2.054	324.8	588.9	2.174	1.895	2.063	333.2	588.6	2.149	1.895	0.44%	2.59%	-0.3	-1.15%	0.00%
WHTOL1-B15	2.032	335.5	589.9	2.182	1.884	2.062	343.8	589.6	2.164	1.884	1.48%	2.47%	-0.3	-0.82%	0.00%
WHTOL1-B16	2.124	334.5	588.6	2.175	1.897	2.083	342.3	588.3	2.150	1.897	-1.93%	2.33%	-0.3	-1.15%	0.00%
WHTOL1-B17	2.035	334.7	588.7	2.166	1.896	2.065	341.6	588.4	2.145	1.896	1.47%	2.06%	-0.3	-0.97%	0.00%
WHTOL1-B18	2.058	311.7	589.2	2.180	1.898	2.079	317.7	588.8	2.146	1.882	1.02%	1.92%	-0.4	-1.56%	-0.84%
WHTOL1-B19	2.046	335.6	589.4	2.157	1.889	2.071	344.3	589.0	2.151	1.891	1.22%	2.59%	-0.4	-0.28%	0.11%
WHTOL1-B20	2.105	337.5	589.4	2.152	1.890	2.116	347.0	589.1	2.140	1.890	0.52%	2.81%	-0.3	-0.56%	0.00%
WHTOL1-B21	2.086	326.1	589.0	2.165	1.894	2.100	335.0	588.7	2.143	1.894	0.67%	2.73%	-0.3	-1.02%	0.00%
WHTOL1-B22	2.086	333.4	588.5	2.196	1.901	2.071	343.3	588.2	2.171	1.901	-0.72%	2.97%	-0.3	-1.14%	0.00%
WHTOL1-B23	2.072	334.0	589.0	2.176	1.896	2.108	342.2	588.6	2.152	1.897	1.74%	2.46%	-0.4	-1.10%	0.05%
WHTOL1-B24	2.051	337.6	589.1	2.171	1.896	2.062	348.5	588.8	2.147	1.896	0.54%	3.23%	-0.3	-1.11%	0.00%
WHTOL1-B25	2.123	342.4	588.2	2.171	1.899	2.102	354.5	587.9	2.148	1.899	-0.99%	3.53%	-0.3	-1.06%	0.00%
WHTOL1-B26	2.122	337.7	588.7	2.172	1.895	2.114	349.4	588.4	2.147	1.895	-0.38%	3.46%	-0.3	-1.15%	0.00%
Min	2.032	311.7	588.2	2.151	1.884	2.033	317.7	587.9	2.138	1.882	-2.59%	1.55%	-0.4	-2.02%	-0.84%
Max	2.126	342.4	590.1	2.196	1.901	2.131	354.5	589.7	2.171	1.901	2.16%	3.53%	-0.3	-0.19%	0.11%
Average	2.076	332.9	589.0	2.173	1.895	2.081	341.5	588.7	2.149	1.894	0.27%	2.57%	-0.3	-1.11%	-0.04%
Stdev	0.032	6.0	0.5	0.012	0.005	0.024	6.9	0.4	0.009	0.005	1.34%	0.48%	0.0	0.40%	0.17%

4.2.3.5 WHTOL1 Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL1-C1	2.093	337.5	588.9	2.160	1.893	2.066	348.5	588.5	2.141	1.893	-1.29%	3.26%	-0.4	-0.88%	0.00%
WHTOL1-C2	2.111	331.5	588.6	2.183	1.897	2.088	339.9	588.3	2.139	1.894	-1.09%	2.53%	-0.3	-2.02%	-0.16%
WHTOL1-C3	2.094	335.6	588.8	2.166	1.897	2.071	347.6	588.4	2.147	1.897	-1.10%	3.58%	-0.4	-0.88%	0.00%
WHTOL1-C4	2.101	333.1	588.5	2.170	1.898	2.085	342.9	588.2	2.145	1.898	-0.76%	2.94%	-0.3	-1.15%	0.00%
WHTOL1-C5	2.130	333.1	588.8	2.168	1.895	2.089	345.3	588.5	2.145	1.895	-1.92%	3.66%	-0.3	-1.06%	0.00%
WHTOL1-C6	2.091	343.0	589.2	2.185	1.896	2.062	350.5	588.8	2.159	1.896	-1.39%	2.19%	-0.4	-1.19%	0.00%
WHTOL1-C7	2.099	329.4	588.7	2.181	1.897	2.066	338.0	588.3	2.155	1.897	-1.57%	2.61%	-0.4	-1.19%	0.00%
WHTOL1-C8	2.048	328.7	589.1	2.170	1.892	2.058	338.5	588.8	2.143	1.892	0.49%	2.98%	-0.3	-1.24%	0.00%
WHTOL1-C9	2.083	344.9	588.7	2.161	1.893	2.085	355.6	588.4	2.136	1.893	0.10%	3.10%	-0.3	-1.16%	0.00%
WHTOL1-C10	2.130	335.6	588.4	2.178	1.900	2.124	345.4	588.0	2.150	1.899	-0.28%	2.92%	-0.4	-1.29%	-0.05%
WHTOL1-C11	2.109	309.1	589.5	2.152	1.894	2.097	318.8	589.1	2.138	1.894	-0.57%	3.14%	-0.4	-0.65%	0.00%
WHTOL1-C12	2.119	325.7	588.8	2.181	1.898	2.104	335.2	588.5	2.145	1.897	-0.71%	2.92%	-0.3	-1.65%	-0.05%
WHTOL1-C13	2.063	334.6	588.6	2.183	1.902	2.072	342.3	588.3	2.167	1.899	0.44%	2.30%	-0.3	-0.73%	-0.16%
WHTOL1-C14	2.148	333.7	588.5	2.170	1.898	2.127	343.8	588.2	2.145	1.898	-0.98%	3.03%	-0.3	-1.15%	0.00%
WHTOL1-C15	2.083	332.9	588.7	2.168	1.895	2.099	343.6	588.4	2.145	1.895	0.77%	3.21%	-0.3	-1.06%	0.00%
WHTOL1-C16	2.062	331.6	589.2	2.179	1.891	2.058	341.6	588.8	2.153	1.891	-0.19%	3.02%	-0.4	-1.19%	0.00%
WHTOL1-C17	2.060	329.6	589.2	2.173	1.891	2.082	337.9	588.8	2.148	1.891	1.07%	2.52%	-0.4	-1.15%	0.00%
WHTOL1-C18	2.055	331.1	588.8	2.174	1.896	2.065	341.6	588.5	2.148	1.896	0.49%	3.17%	-0.3	-1.20%	0.00%
WHTOL1-C19	2.090	342.6	588.6	2.164	1.894	2.095	349.5	588.3	2.139	1.894	0.24%	2.01%	-0.3	-1.16%	0.00%
WHTOL1-C20	2.112	341.3	588.2	2.182	1.901	2.070	351.9	587.8	2.156	1.901	-1.99%	3.11%	-0.4	-1.19%	0.00%
WHTOL1-C21	2.083	340.1	589.1	2.155	1.894	2.108	349.2	588.7	2.130	1.894	1.20%	2.68%	-0.4	-1.16%	0.00%
WHTOL1-C22	2.117	340.3	589.1	2.180	1.894	2.075	350.2	588.7	2.133	1.888	-1.98%	2.91%	-0.4	-2.16%	-0.32%
WHTOL1-C23	2.055	337.9	589.3	2.174	1.894	2.065	348.3	588.9	2.172	1.893	0.49%	3.08%	-0.4	-0.09%	-0.05%
WHTOL1-C24	2.113	337.0	588.8	2.161	1.894	2.086	347.5	588.5	2.135	1.894	-1.28%	3.12%	-0.3	-1.20%	0.00%
WHTOL1-C25	2.114	332.9	589.0	2.163	1.894	2.111	345.7	588.7	2.140	1.894	-0.14%	3.84%	-0.3	-1.06%	0.00%
WHTOL1-C26	2.055	332.5	589.3	2.176	1.894	2.055	344.8	589.0	2.149	1.894	0.00%	3.70%	-0.3	-1.24%	0.00%
Min	2.048	309.1	588.2	2.152	1.891	2.055	318.8	587.8	2.130	1.888	-1.99%	2.01%	-0.4	-2.16%	-0.32%
Max	2.148	344.9	589.5	2.185	1.902	2.127	355.6	589.1	2.172	1.901	1.20%	3.84%	-0.3	-0.09%	0.00%
Average	2.093	334.1	588.9	2.171	1.895	2.083	344.0	588.5	2.146	1.895	-0.46%	2.98%	-0.3	-1.16%	-0.03%
Stdev	0.027	7.0	0.3	0.009	0.003	0.020	7.1	0.3	0.010	0.003	0.96%	0.45%	0.1	0.39%	0.07%

4.2.4 Test Photo

Samples During Test



Test Setup-1



Light /no Light for(-40°C)-1

Test Setup-2



Light /no Light for(-40°C)-2



Light /no Light for(85°C)-1



Light /no Light for(85°C)-2



4.3 Wet High Temperature Operating Life(WHTOL2)

4.3.1 Test Information

Sample size: 3 lots 26 pcs. each

Test period: 2024-12-29 to 2025-02-12

Reference document: JEDEC JESD22-A101

Power supply: IF=2mA

Test temperature: T_a=85°C

Test humidity: 85%RH

Test duration: 1000hrs

Test point: 0hrs/1000hrs

Acceptance criteria: Per Section 3

4.3.2 Environmental Conditions

Environmental temperature: (24.6~25.7)°C

Environmental humidity: (49~56)%RH

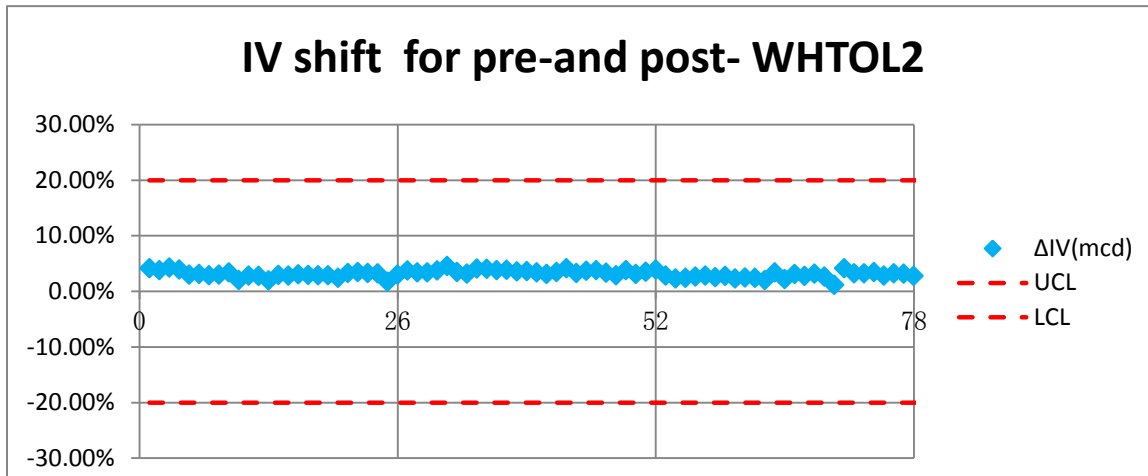
4.3.3 Test Data

4.3.3.1 Test Result for WHTOL2

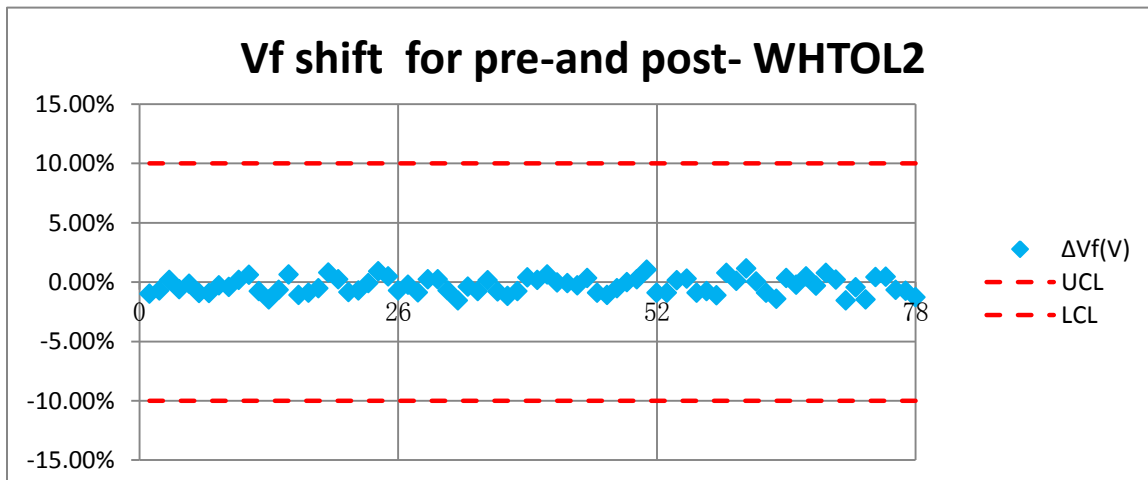
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light			0
B	External Visual	26	26	0
	Test			0
	Light / no light			0
C	External Visual	26	26	0
	Test			0
	Light / no light			0

4.3.3.2 Summary

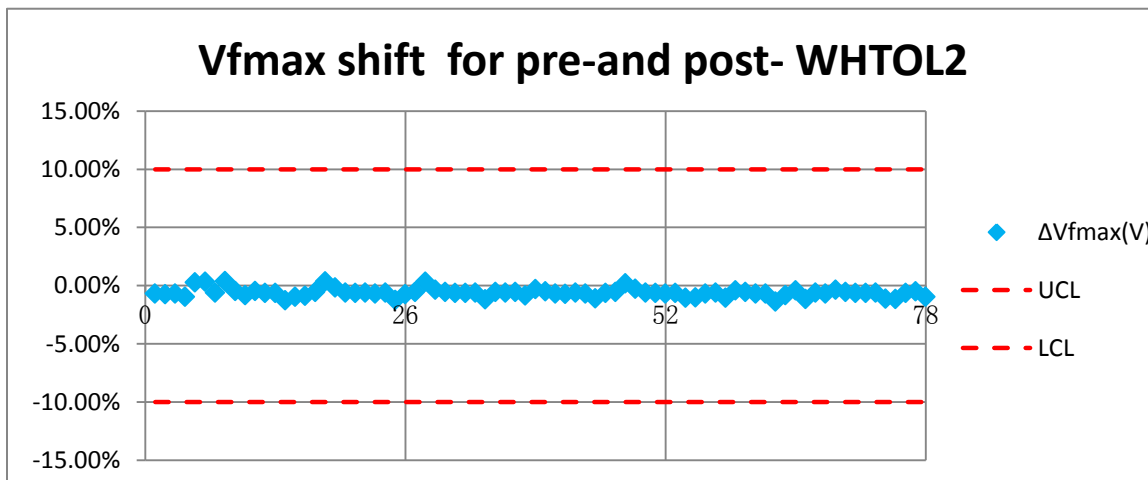
IV shift for pre- and post- WHTOL2 test



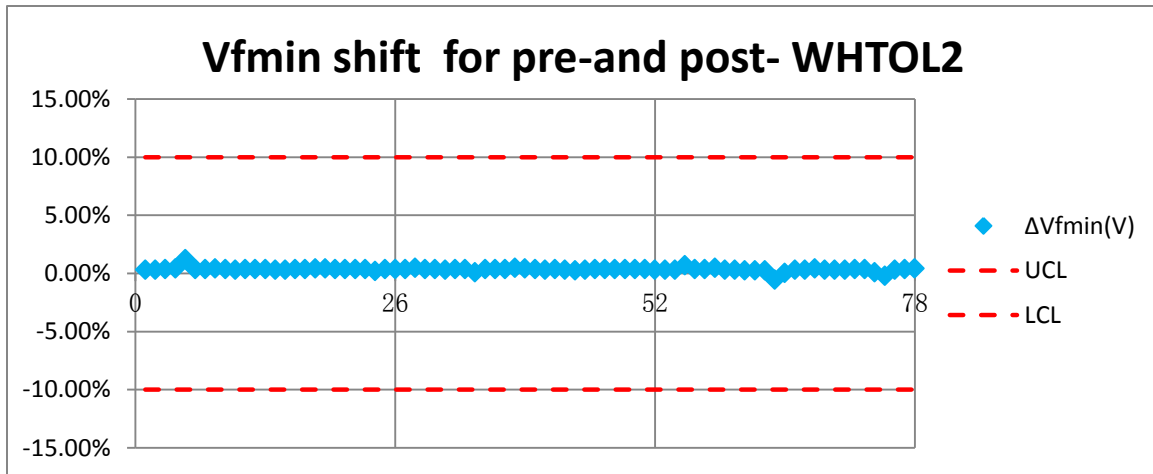
Vf shift for pre- and post- WHTOL2 test



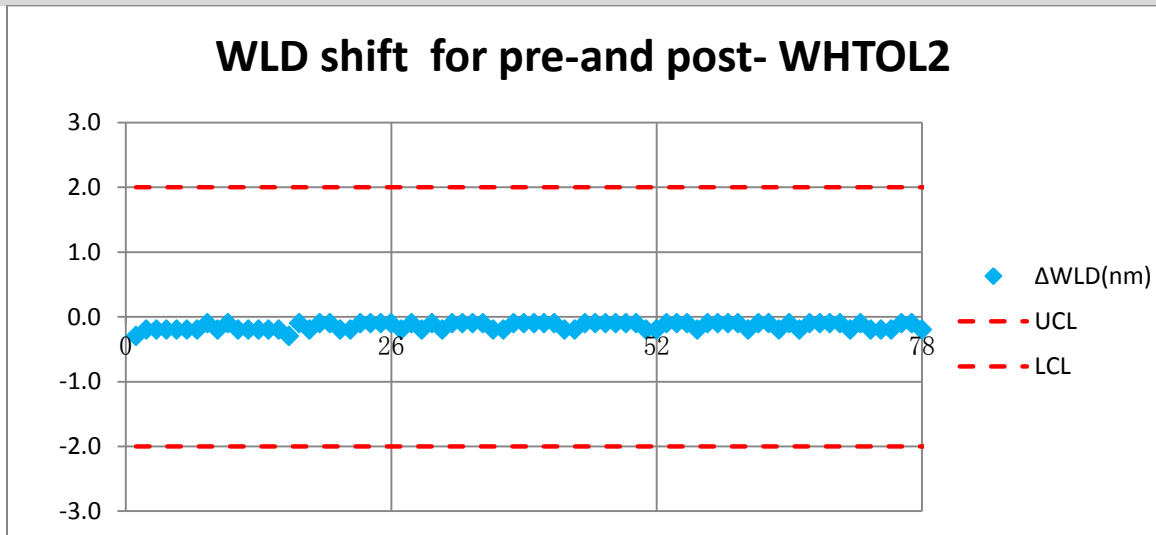
Vf_{max} shift for pre- and post- WHTOL2 test



V_{fmin} shift for pre- and post- WHTOL2 test



λ_d shift for pre- and post- WHTOL2 test



4.3.3.3 WHTOL2 Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL2-A1	2.133	339.3	589.4	2.168	1.887	2.112	353.2	589.1	2.153	1.893	-0.98%	4.10%	-0.3	-0.69%	0.32%
WHTOL2-A2	2.128	339.1	589.0	2.163	1.892	2.113	351.8	588.8	2.147	1.898	-0.70%	3.75%	-0.2	-0.74%	0.32%
WHTOL2-A3	2.124	343.3	588.6	2.164	1.896	2.128	357.9	588.4	2.149	1.903	0.19%	4.25%	-0.2	-0.69%	0.37%
WHTOL2-A4	2.144	341.0	589.6	2.169	1.889	2.131	354.2	589.4	2.148	1.897	-0.61%	3.87%	-0.2	-0.97%	0.42%
WHTOL2-A5	2.079	344.2	588.3	2.163	1.884	2.076	354.4	588.1	2.169	1.907	-0.14%	2.96%	-0.2	0.28%	1.22%
WHTOL2-A6	2.145	340.4	589.6	2.173	1.885	2.125	350.9	589.4	2.180	1.892	-0.93%	3.08%	-0.2	0.32%	0.37%
WHTOL2-A7	2.084	343.3	589.5	2.150	1.887	2.065	353.1	589.3	2.137	1.894	-0.91%	2.85%	-0.2	-0.60%	0.37%
WHTOL2-A8	2.091	347.1	589.5	2.173	1.889	2.085	357.3	589.4	2.181	1.897	-0.29%	2.94%	-0.1	0.37%	0.42%
WHTOL2-A9	2.116	320.2	589.0	2.176	1.897	2.107	331.0	588.8	2.166	1.904	-0.43%	3.37%	-0.2	-0.46%	0.37%
WHTOL2-A10	2.065	338.0	588.4	2.181	1.898	2.069	344.8	588.3	2.163	1.904	0.19%	2.01%	-0.1	-0.83%	0.32%
WHTOL2-A11	2.081	339.4	588.5	2.164	1.897	2.094	348.9	588.3	2.154	1.904	0.62%	2.80%	-0.2	-0.46%	0.37%
WHTOL2-A12	2.119	346.4	588.4	2.174	1.897	2.103	355.8	588.2	2.160	1.904	-0.76%	2.71%	-0.2	-0.64%	0.37%
WHTOL2-A13	2.115	344.2	588.7	2.161	1.894	2.084	350.9	588.5	2.147	1.901	-1.47%	1.95%	-0.2	-0.65%	0.37%
WHTOL2-A14	2.117	346.5	588.4	2.191	1.898	2.103	356.5	588.2	2.163	1.904	-0.66%	2.89%	-0.2	-1.28%	0.32%
WHTOL2-A15	2.069	350.3	588.5	2.188	1.899	2.082	360.0	588.3	2.167	1.905	0.63%	2.77%	-0.2	-0.96%	0.32%
WHTOL2-A16	2.129	336.1	590.0	2.164	1.888	2.106	346.2	589.7	2.145	1.895	-1.08%	3.01%	-0.3	-0.88%	0.37%
WHTOL2-A17	2.113	346.6	588.5	2.167	1.897	2.094	356.6	588.4	2.155	1.904	-0.90%	2.89%	-0.1	-0.55%	0.37%
WHTOL2-A18	2.080	345.0	588.4	2.194	1.900	2.069	354.9	588.2	2.202	1.908	-0.53%	2.87%	-0.2	0.36%	0.42%
WHTOL2-A19	2.093	341.9	588.4	2.187	1.898	2.110	351.7	588.3	2.183	1.906	0.81%	2.87%	-0.1	-0.18%	0.42%
WHTOL2-A20	2.052	347.8	589.1	2.165	1.893	2.057	356.2	589.0	2.152	1.900	0.24%	2.42%	-0.1	-0.60%	0.37%
WHTOL2-A21	2.136	346.0	588.6	2.158	1.893	2.118	357.3	588.4	2.144	1.900	-0.84%	3.27%	-0.2	-0.65%	0.37%
WHTOL2-A22	2.141	346.5	588.3	2.176	1.899	2.126	358.3	588.1	2.163	1.906	-0.70%	3.41%	-0.2	-0.60%	0.37%
WHTOL2-A23	2.108	343.6	588.3	2.172	1.898	2.106	354.7	588.2	2.157	1.905	-0.09%	3.23%	-0.1	-0.69%	0.37%
WHTOL2-A24	2.083	336.4	589.7	2.164	1.890	2.102	347.1	589.6	2.151	1.894	0.91%	3.18%	-0.1	-0.60%	0.21%
WHTOL2-A25	2.055	344.3	588.8	2.189	1.894	2.065	350.1	588.7	2.162	1.901	0.49%	1.68%	-0.1	-1.23%	0.37%
WHTOL2-A26	2.122	347.8	589.1	2.155	1.891	2.107	358.2	589.0	2.139	1.898	-0.71%	2.99%	-0.1	-0.74%	0.37%
Min	2.052	320.2	588.3	2.150	1.884	2.057	331.0	588.1	2.137	1.892	-1.47%	1.68%	-0.3	-1.28%	0.21%
Max	2.145	350.3	590.0	2.194	1.900	2.131	360.0	589.7	2.202	1.908	0.91%	4.25%	-0.1	0.37%	1.22%
Average	2.105	342.5	588.9	2.171	1.893	2.098	352.8	588.7	2.159	1.901	-0.33%	3.00%	-0.2	-0.55%	0.39%
Stdev	0.028	5.9	0.5	0.012	0.005	0.021	6.0	0.5	0.015	0.005	0.65%	0.60%	0.1	0.45%	0.17%

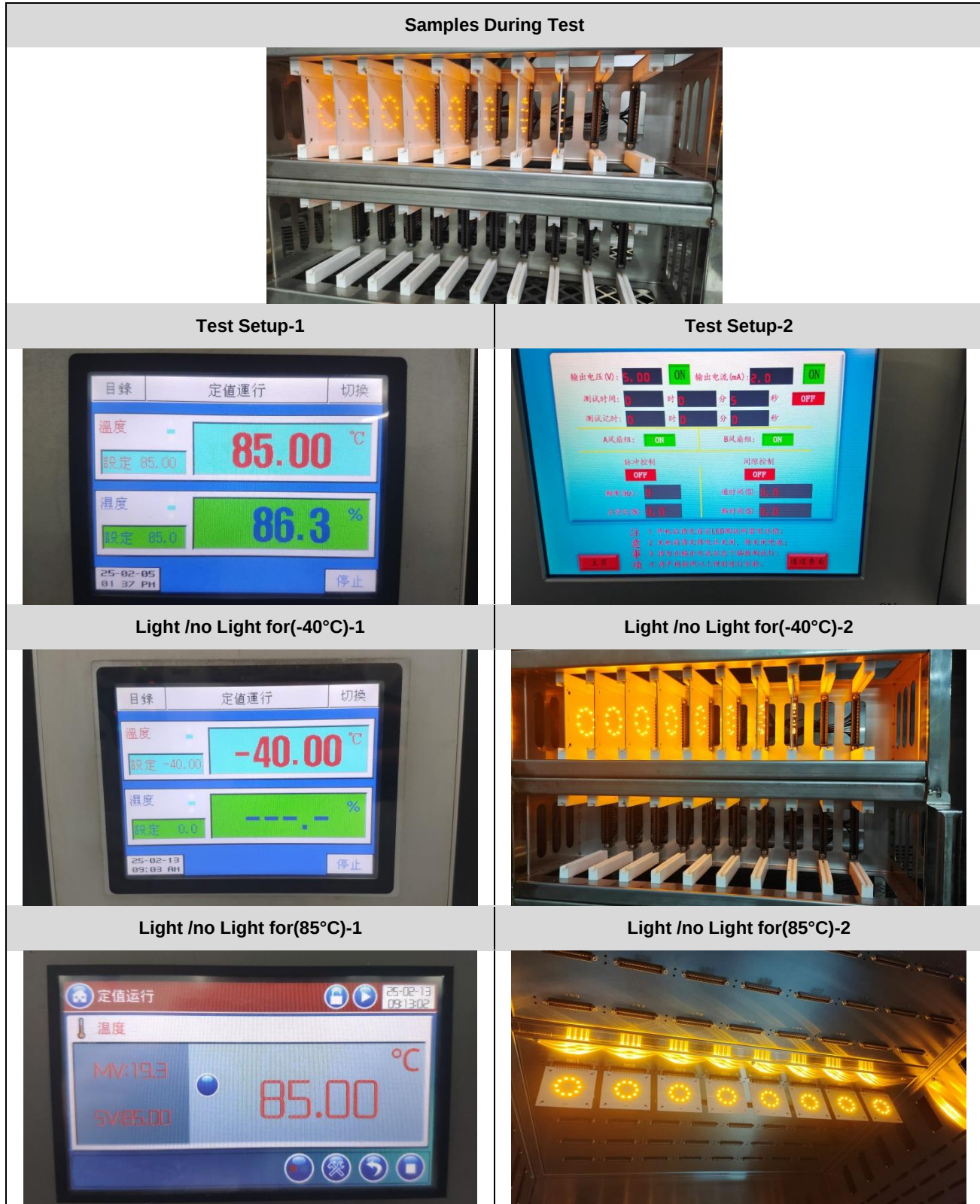
4.3.3.4 WHTOL2 Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL2-B1	2.113	332.1	588.6	2.168	1.895	2.108	344.5	588.4	2.156	1.902	-0.24%	3.73%	-0.2	-0.55%	0.37%
WHTOL2-B2	2.089	327.8	588.3	2.194	1.900	2.071	338.9	588.2	2.201	1.909	-0.86%	3.39%	-0.1	0.32%	0.47%
WHTOL2-B3	2.077	329.1	588.8	2.177	1.894	2.082	340.2	588.6	2.169	1.901	0.24%	3.37%	-0.2	-0.37%	0.37%
WHTOL2-B4	2.063	324.8	588.5	2.179	1.897	2.068	336.9	588.4	2.167	1.904	0.24%	3.73%	-0.1	-0.55%	0.37%
WHTOL2-B5	2.111	317.9	588.7	2.162	1.897	2.096	332.3	588.5	2.148	1.903	-0.71%	4.53%	-0.2	-0.65%	0.32%
WHTOL2-B6	2.128	335.3	588.4	2.175	1.897	2.095	346.7	588.3	2.161	1.904	-1.55%	3.40%	-0.1	-0.64%	0.37%
WHTOL2-B7	2.086	329.5	588.3	2.169	1.898	2.078	339.8	588.2	2.156	1.905	-0.38%	3.13%	-0.1	-0.60%	0.37%
WHTOL2-B8	2.124	330.3	589.0	2.177	1.892	2.108	343.7	588.9	2.151	1.894	-0.75%	4.06%	-0.1	-1.19%	0.11%
WHTOL2-B9	2.057	333.6	589.0	2.162	1.892	2.060	347.0	588.9	2.150	1.899	0.15%	4.02%	-0.1	-0.56%	0.37%
WHTOL2-B10	2.120	331.8	588.3	2.170	1.898	2.103	344.3	588.1	2.157	1.905	-0.80%	3.77%	-0.2	-0.60%	0.37%
WHTOL2-B11	2.130	329.2	588.5	2.165	1.895	2.105	341.8	588.3	2.153	1.902	-1.17%	3.83%	-0.2	-0.55%	0.37%
WHTOL2-B12	2.082	329.6	588.5	2.191	1.897	2.066	341.3	588.4	2.172	1.906	-0.77%	3.55%	-0.1	-0.87%	0.47%
WHTOL2-B13	2.083	331.5	588.7	2.178	1.894	2.091	343.5	588.6	2.171	1.902	0.38%	3.62%	-0.1	-0.32%	0.42%
WHTOL2-B14	2.062	324.9	588.6	2.175	1.896	2.066	335.9	588.5	2.164	1.903	0.19%	3.39%	-0.1	-0.51%	0.37%
WHTOL2-B15	2.066	333.8	589.0	2.152	1.891	2.079	344.1	588.9	2.137	1.897	0.63%	3.09%	-0.1	-0.70%	0.32%
WHTOL2-B16	2.125	329.2	588.2	2.183	1.900	2.124	340.4	588.1	2.167	1.907	-0.05%	3.40%	-0.1	-0.73%	0.37%
WHTOL2-B17	2.125	333.2	588.2	2.174	1.900	2.123	347.0	588.0	2.161	1.906	-0.09%	4.14%	-0.2	-0.60%	0.32%
WHTOL2-B18	2.110	334.0	589.2	2.168	1.890	2.104	344.8	589.0	2.153	1.895	-0.28%	3.23%	-0.2	-0.69%	0.26%
WHTOL2-B19	2.058	329.3	588.8	2.182	1.895	2.065	341.4	588.7	2.158	1.901	0.34%	3.67%	-0.1	-1.10%	0.32%
WHTOL2-B20	2.148	328.5	589.0	2.153	1.890	2.129	340.9	588.9	2.139	1.897	-0.88%	3.77%	-0.1	-0.65%	0.37%
WHTOL2-B21	2.129	330.1	588.6	2.163	1.895	2.106	341.1	588.5	2.151	1.902	-1.08%	3.33%	-0.1	-0.55%	0.37%
WHTOL2-B22	2.117	326.6	588.6	2.188	1.896	2.106	335.9	588.5	2.192	1.903	-0.52%	2.85%	-0.1	0.18%	0.37%
WHTOL2-B23	2.062	327.2	589.1	2.176	1.893	2.062	339.5	589.0	2.170	1.900	0.00%	3.76%	-0.1	-0.28%	0.37%
WHTOL2-B24	2.043	322.2	589.7	2.155	1.889	2.048	332.2	589.6	2.142	1.896	0.24%	3.10%	-0.1	-0.60%	0.37%
WHTOL2-B25	2.083	338.9	588.5	2.166	1.895	2.105	350.8	588.3	2.152	1.902	1.06%	3.51%	-0.2	-0.65%	0.37%
WHTOL2-B26	2.105	328.2	588.3	2.178	1.900	2.086	341.0	588.1	2.163	1.906	-0.90%	3.90%	-0.2	-0.69%	0.32%
Min	2.043	317.9	588.2	2.152	1.889	2.048	332.2	588.0	2.137	1.894	-1.55%	2.85%	-0.2	-1.19%	0.11%
Max	2.148	338.9	589.7	2.194	1.900	2.129	350.8	589.6	2.201	1.909	1.06%	4.53%	-0.1	0.32%	0.47%
Average	2.096	329.6	588.7	2.172	1.895	2.090	341.4	588.5	2.160	1.902	-0.29%	3.59%	-0.1	-0.57%	0.36%
Stdev	0.029	4.3	0.4	0.011	0.003	0.022	4.4	0.4	0.014	0.004	0.63%	0.38%	0.0	0.31%	0.07%

4.3.3.5 WHTOL2 Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
WHTOL2-C1	2.122	343.5	588.2	2.173	1.900	2.103	353.1	588.1	2.159	1.906	-0.90%	2.79%	-0.1	-0.64%	0.32%
WHTOL2-C2	2.116	338.8	588.8	2.178	1.894	2.119	346.6	588.7	2.155	1.900	0.14%	2.30%	-0.1	-1.06%	0.32%
WHTOL2-C3	2.062	341.3	588.5	2.175	1.891	2.068	349.4	588.4	2.153	1.904	0.29%	2.37%	-0.1	-1.01%	0.69%
WHTOL2-C4	2.118	342.0	588.5	2.167	1.897	2.099	350.9	588.3	2.152	1.904	-0.90%	2.60%	-0.2	-0.69%	0.37%
WHTOL2-C5	2.123	341.0	588.5	2.169	1.895	2.107	350.6	588.4	2.156	1.902	-0.75%	2.82%	-0.1	-0.60%	0.37%
WHTOL2-C6	2.074	345.6	589.4	2.174	1.890	2.051	354.2	589.3	2.151	1.899	-1.11%	2.49%	-0.1	-1.06%	0.48%
WHTOL2-C7	2.077	336.7	589.1	2.168	1.893	2.093	345.9	589.0	2.159	1.899	0.77%	2.73%	-0.1	-0.42%	0.32%
WHTOL2-C8	2.043	343.0	589.9	2.155	1.887	2.045	350.9	589.8	2.143	1.893	0.10%	2.30%	-0.1	-0.56%	0.32%
WHTOL2-C9	2.101	349.6	588.5	2.163	1.895	2.125	358.1	588.3	2.148	1.900	1.14%	2.43%	-0.2	-0.69%	0.26%
WHTOL2-C10	2.078	352.7	588.4	2.172	1.897	2.079	361.1	588.3	2.157	1.902	0.05%	2.38%	-0.1	-0.69%	0.26%
WHTOL2-C11	2.097	347.9	589.2	2.180	1.888	2.078	354.8	589.1	2.150	1.893	-0.91%	1.98%	-0.1	-1.38%	0.26%
WHTOL2-C12	2.117	339.0	588.4	2.190	1.899	2.087	350.4	588.2	2.172	1.889	-1.42%	3.36%	-0.2	-0.82%	-0.53%
WHTOL2-C13	2.062	343.0	588.6	2.162	1.899	2.069	350.4	588.5	2.153	1.900	0.34%	2.16%	-0.1	-0.42%	0.05%
WHTOL2-C14	2.120	341.6	589.4	2.176	1.887	2.115	352.2	589.2	2.151	1.893	-0.24%	3.10%	-0.2	-1.15%	0.32%
WHTOL2-C15	2.083	340.0	588.7	2.162	1.892	2.093	349.3	588.6	2.149	1.898	0.48%	2.74%	-0.1	-0.60%	0.32%
WHTOL2-C16	2.058	343.3	589.3	2.173	1.890	2.052	354.1	589.2	2.158	1.898	-0.29%	3.15%	-0.1	-0.69%	0.42%
WHTOL2-C17	2.055	338.1	589.8	2.157	1.885	2.071	347.0	589.7	2.149	1.891	0.78%	2.63%	-0.1	-0.37%	0.32%
WHTOL2-C18	2.048	339.2	589.4	2.157	1.892	2.052	343.1	589.3	2.145	1.898	0.20%	1.15%	-0.1	-0.56%	0.32%
WHTOL2-C19	2.130	348.6	588.0	2.174	1.900	2.097	362.9	587.8	2.160	1.906	-1.55%	4.10%	-0.2	-0.64%	0.32%
WHTOL2-C20	2.095	349.3	588.6	2.168	1.894	2.086	360.5	588.5	2.154	1.901	-0.43%	3.21%	-0.1	-0.65%	0.37%
WHTOL2-C21	2.121	345.6	588.8	2.159	1.893	2.090	356.6	588.6	2.146	1.900	-1.46%	3.18%	-0.2	-0.60%	0.37%
WHTOL2-C22	2.110	341.1	588.6	2.187	1.897	2.119	352.8	588.4	2.162	1.899	0.43%	3.43%	-0.2	-1.14%	0.11%
WHTOL2-C23	2.057	345.9	588.8	2.177	1.904	2.066	355.6	588.6	2.152	1.900	0.44%	2.80%	-0.2	-1.15%	-0.21%
WHTOL2-C24	2.121	349.1	588.5	2.165	1.897	2.107	360.2	588.4	2.151	1.903	-0.66%	3.18%	-0.1	-0.65%	0.32%
WHTOL2-C25	2.145	336.6	588.5	2.170	1.896	2.129	347.1	588.4	2.159	1.903	-0.75%	3.12%	-0.1	-0.51%	0.37%
WHTOL2-C26	2.139	342.0	588.2	2.197	1.901	2.112	351.3	588.0	2.176	1.909	-1.26%	2.72%	-0.2	-0.96%	0.42%
Min	2.043	336.6	588.0	2.155	1.885	2.045	343.1	587.8	2.143	1.889	-1.55%	1.15%	-0.2	-1.38%	-0.53%
Max	2.145	352.7	589.9	2.197	1.904	2.129	362.9	589.8	2.176	1.909	1.14%	4.10%	-0.1	-0.37%	0.69%
Average	2.095	343.3	588.8	2.171	1.894	2.089	352.7	588.7	2.155	1.900	-0.29%	2.74%	-0.1	-0.76%	0.28%
Stdev	0.031	4.3	0.5	0.010	0.005	0.024	5.1	0.5	0.008	0.005	0.77%	0.57%	0.0	0.27%	0.23%

4.3.4 Test Photo



4.4 Power Temperature Cycling(PTC)

4.4.1 Test Information

Sample size: 3 lots 26 pcs. each

Test period: 2024-12-29 to 2025-02-12

Reference document: JEDEC JESD22-A105

Power supply: 30mA(Power on 5 min /off 5min)

Soak temp.(MIN/ MAX): $T_{\text{solder}} = -40^{\circ}\text{C} \sim 85^{\circ}\text{C}$

Minimum Soak time: 10min (Transfer time no more than 20min)

Test duration: 1000 cycles

Test point: Initial test/Final test

Acceptance criteria: Per Section 3

4.4.2 Environmental Conditions

Environmental temperature: $(24.2 \sim 26.9)^{\circ}\text{C}$

Environmental humidity: $(43 \sim 61)\% \text{RH}$

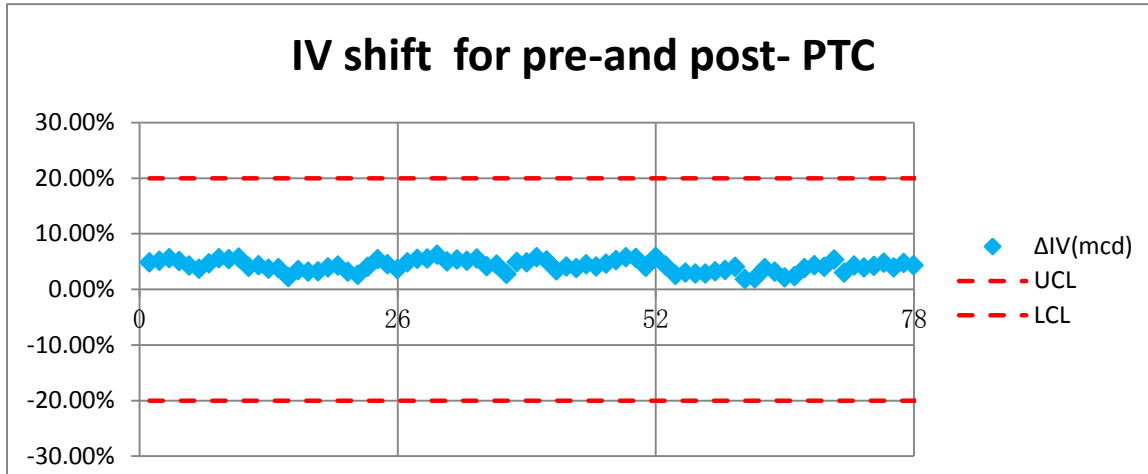
4.4.3 Test Data

4.4.3.1 Test Result for PTC

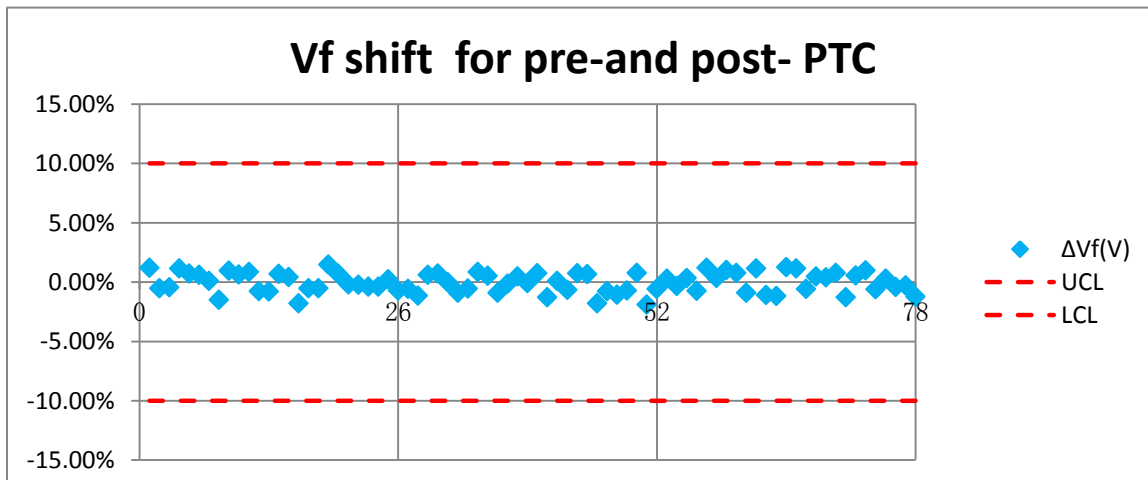
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light			0
B	External Visual	26	26	0
	Test			0
	Light / no light			0
C	External Visual	26	26	0
	Test			0
	Light / no light			0

4.4.3.2 Summary

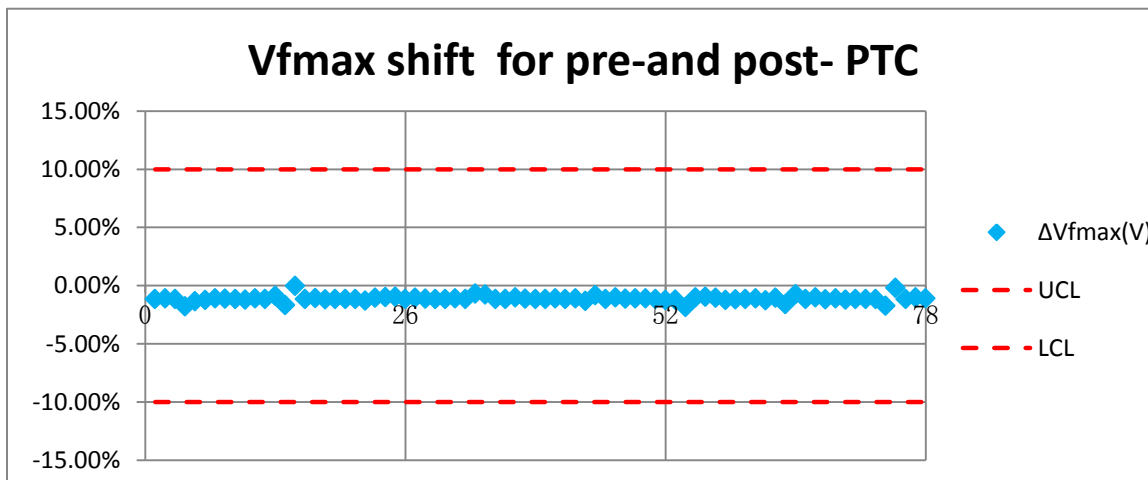
IV shift for pre- and post- PTC test



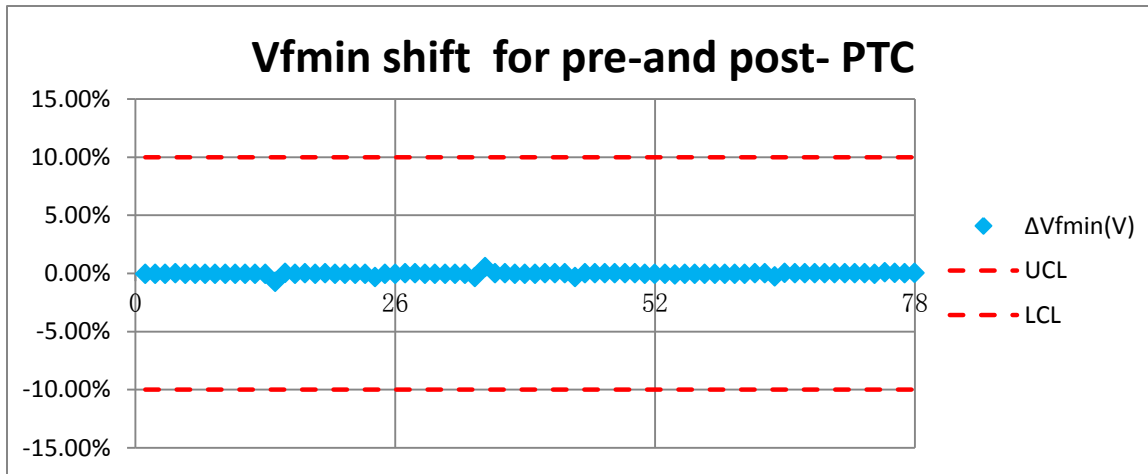
Vf shift for pre- and post- PTC test



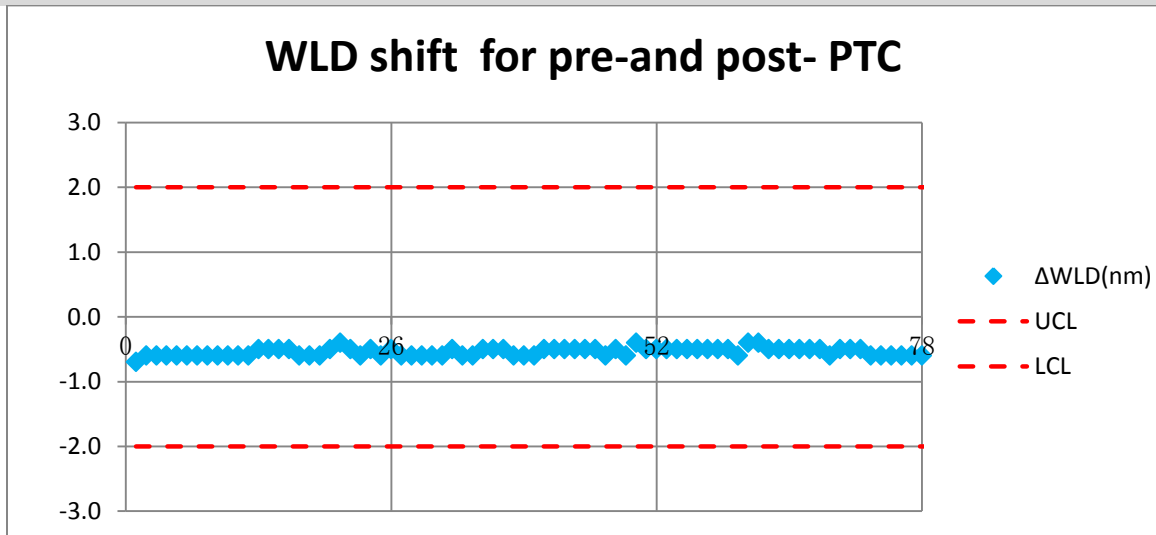
Vf_{max} shift for pre- and post- PTC test



V_{fmin} shift for pre- and post- PTC test



λ_d shift for pre- and post- PTC test



4.4.3.3 PTC Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
PTC-A1	2.097	347.8	589.7	2.178	1.888	2.122	364.6	589.0	2.153	1.887	1.19%	4.83%	-0.7	-1.15%	-0.05%
PTC-A2	2.125	333.2	589.1	2.166	1.893	2.114	350.2	588.5	2.142	1.892	-0.52%	5.10%	-0.6	-1.11%	-0.05%
PTC-A3	2.089	333.9	589.0	2.161	1.894	2.080	352.5	588.4	2.136	1.893	-0.43%	5.57%	-0.6	-1.16%	-0.05%
PTC-A4	2.081	342.2	589.5	2.170	1.890	2.105	359.5	588.9	2.131	1.890	1.15%	5.06%	-0.6	-1.80%	0.00%
PTC-A5	2.066	332.2	589.7	2.165	1.891	2.081	346.2	589.1	2.136	1.890	0.73%	4.21%	-0.6	-1.34%	-0.05%
PTC-A6	2.108	343.5	589.0	2.156	1.892	2.121	356.0	588.4	2.129	1.891	0.62%	3.64%	-0.6	-1.25%	-0.05%
PTC-A7	2.122	333.6	588.3	2.177	1.900	2.124	349.1	587.7	2.153	1.899	0.09%	4.65%	-0.6	-1.10%	-0.05%
PTC-A8	2.131	333.6	588.6	2.191	1.898	2.099	352.1	588.0	2.166	1.897	-1.50%	5.55%	-0.6	-1.14%	-0.05%
PTC-A9	2.096	340.0	589.3	2.169	1.892	2.116	358.3	588.7	2.144	1.891	0.95%	5.38%	-0.6	-1.15%	-0.05%
PTC-A10	2.045	336.3	589.6	2.158	1.888	2.058	355.3	589.0	2.132	1.887	0.64%	5.65%	-0.6	-1.20%	-0.05%
PTC-A11	2.088	343.0	588.9	2.159	1.893	2.106	356.8	588.3	2.135	1.892	0.86%	4.02%	-0.6	-1.11%	-0.05%
PTC-A12	2.130	337.9	588.8	2.168	1.896	2.114	352.4	588.2	2.143	1.895	-0.75%	4.29%	-0.6	-1.15%	-0.05%
PTC-A13	2.124	337.8	589.3	2.169	1.893	2.107	350.2	588.8	2.150	1.892	-0.80%	3.67%	-0.5	-0.88%	-0.05%
PTC-A14	2.124	339.4	588.8	2.186	1.897	2.139	352.2	588.3	2.149	1.883	0.71%	3.77%	-0.5	-1.69%	-0.74%
PTC-A15	2.065	342.0	588.5	2.168	1.896	2.074	349.3	588.0	2.167	1.897	0.44%	2.13%	-0.5	-0.05%	0.05%
PTC-A16	2.123	340.8	588.4	2.170	1.899	2.085	352.5	587.9	2.145	1.898	-1.79%	3.43%	-0.5	-1.15%	-0.05%
PTC-A17	2.102	346.7	589.3	2.158	1.893	2.091	357.6	588.7	2.135	1.893	-0.52%	3.14%	-0.6	-1.07%	0.00%
PTC-A18	2.069	347.0	590.0	2.169	1.888	2.058	358.1	589.4	2.143	1.887	-0.53%	3.20%	-0.6	-1.20%	-0.05%
PTC-A19	2.088	306.6	589.3	2.173	1.897	2.119	318.5	588.7	2.148	1.897	1.48%	3.88%	-0.6	-1.15%	0.00%
PTC-A20	2.048	339.0	589.3	2.163	1.891	2.062	353.3	588.8	2.138	1.890	0.68%	4.22%	-0.5	-1.16%	-0.05%
PTC-A21	2.093	345.5	588.1	2.173	1.901	2.089	356.3	587.7	2.148	1.900	-0.19%	3.13%	-0.4	-1.15%	-0.05%
PTC-A22	2.110	343.4	589.4	2.157	1.889	2.105	352.2	588.9	2.129	1.888	-0.24%	2.56%	-0.5	-1.30%	-0.05%
PTC-A23	2.111	334.3	588.6	2.163	1.898	2.103	347.7	588.0	2.140	1.897	-0.38%	4.01%	-0.6	-1.06%	-0.05%
PTC-A24	2.133	348.3	588.7	2.186	1.899	2.125	367.1	588.2	2.164	1.893	-0.38%	5.40%	-0.5	-1.01%	-0.32%
PTC-A25	2.055	339.3	589.4	2.152	1.889	2.060	354.5	588.8	2.131	1.888	0.24%	4.48%	-0.6	-0.98%	-0.05%
PTC-A26	2.108	337.9	589.2	2.169	1.892	2.093	350.0	588.7	2.144	1.891	-0.71%	3.58%	-0.5	-1.15%	-0.05%
Min	2.045	306.6	588.1	2.152	1.888	2.058	318.5	587.7	2.129	1.883	-1.79%	2.13%	-0.7	-1.80%	-0.74%
Max	2.133	348.3	590.0	2.191	1.901	2.139	367.1	589.4	2.167	1.900	1.48%	5.65%	-0.4	-0.05%	0.05%
Average	2.097	338.7	589.1	2.168	1.894	2.098	352.8	588.5	2.144	1.892	0.04%	4.18%	-0.6	-1.14%	-0.08%
Stdev	0.027	8.1	0.5	0.010	0.004	0.023	8.5	0.5	0.011	0.004	0.84%	0.96%	0.1	0.29%	0.15%

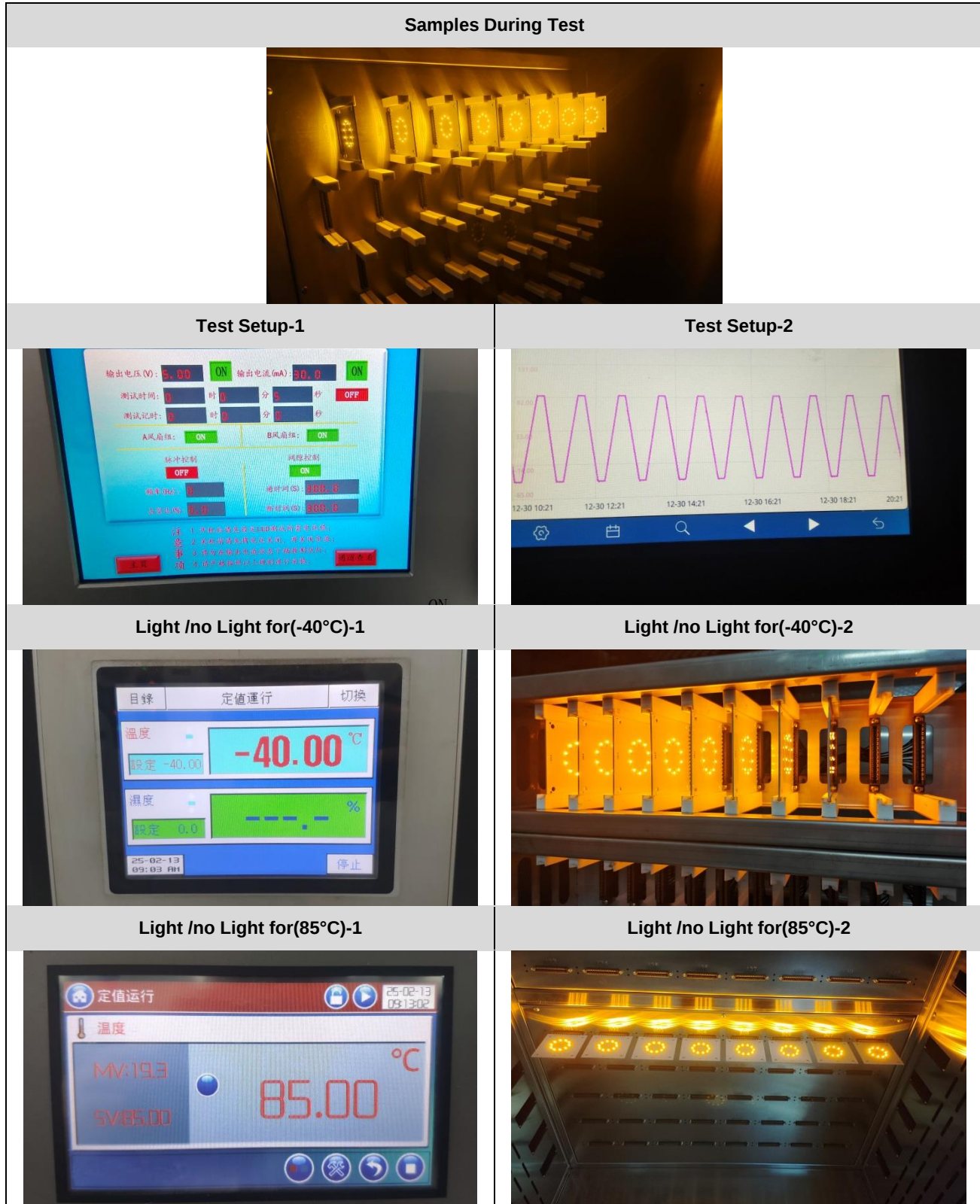
4.4.3.4 PTC Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
PTC-B1	2.089	329.6	588.6	2.166	1.897	2.077	345.5	588.0	2.143	1.897	-0.57%	4.82%	-0.6	-1.06%	0.00%
PTC-B2	2.110	331.5	588.6	2.188	1.899	2.086	349.6	588.0	2.163	1.899	-1.14%	5.46%	-0.6	-1.14%	0.00%
PTC-B3	2.089	322.9	589.0	2.172	1.892	2.102	340.7	588.4	2.147	1.891	0.62%	5.51%	-0.6	-1.15%	-0.05%
PTC-B4	2.062	324.2	588.5	2.179	1.898	2.077	344.2	587.9	2.154	1.897	0.73%	6.17%	-0.6	-1.15%	-0.05%
PTC-B5	2.099	334.9	588.6	2.163	1.895	2.099	351.6	588.0	2.139	1.894	0.00%	4.99%	-0.6	-1.11%	-0.05%
PTC-B6	2.138	335.4	588.8	2.166	1.895	2.119	353.3	588.3	2.141	1.894	-0.89%	5.34%	-0.5	-1.15%	-0.05%
PTC-B7	2.060	338.5	590.0	2.169	1.887	2.049	355.8	589.4	2.154	1.886	-0.53%	5.11%	-0.6	-0.69%	-0.05%
PTC-B8	2.090	326.6	588.7	2.185	1.897	2.108	344.5	588.1	2.168	1.891	0.86%	5.48%	-0.6	-0.78%	-0.32%
PTC-B9	2.058	323.4	589.0	2.167	1.894	2.069	336.8	588.5	2.142	1.904	0.53%	4.14%	-0.5	-1.15%	0.53%
PTC-B10	2.128	323.7	588.6	2.162	1.895	2.109	337.9	588.1	2.137	1.895	-0.89%	4.39%	-0.5	-1.16%	0.00%
PTC-B11	2.091	320.0	588.7	2.163	1.894	2.088	328.8	588.2	2.141	1.894	-0.14%	2.75%	-0.5	-1.02%	0.00%
PTC-B12	2.075	330.4	588.6	2.191	1.898	2.085	346.5	588.0	2.166	1.897	0.48%	4.87%	-0.6	-1.14%	-0.05%
PTC-B13	2.093	325.3	588.9	2.177	1.898	2.091	341.0	588.3	2.152	1.897	-0.10%	4.83%	-0.6	-1.15%	-0.05%
PTC-B14	2.043	333.1	589.8	2.158	1.889	2.058	352.1	589.2	2.133	1.888	0.73%	5.70%	-0.6	-1.16%	-0.05%
PTC-B15	2.106	335.5	588.5	2.166	1.896	2.079	352.7	588.0	2.142	1.896	-1.28%	5.13%	-0.5	-1.11%	0.00%
PTC-B16	2.089	333.0	588.2	2.177	1.900	2.091	344.3	587.7	2.152	1.900	0.10%	3.39%	-0.5	-1.15%	0.00%
PTC-B17	2.116	328.6	588.6	2.165	1.895	2.102	341.9	588.1	2.141	1.895	-0.66%	4.05%	-0.5	-1.11%	0.00%
PTC-B18	2.106	331.5	588.8	2.175	1.895	2.122	344.0	588.3	2.146	1.889	0.76%	3.77%	-0.5	-1.33%	-0.32%
PTC-B19	2.063	331.9	588.5	2.161	1.895	2.077	346.8	588.0	2.143	1.895	0.68%	4.49%	-0.5	-0.83%	0.00%
PTC-B20	2.122	333.4	588.5	2.165	1.896	2.084	346.9	588.0	2.140	1.896	-1.79%	4.05%	-0.5	-1.15%	0.00%
PTC-B21	2.103	308.6	589.0	2.161	1.896	2.087	322.7	588.4	2.139	1.896	-0.76%	4.57%	-0.6	-1.02%	0.00%
PTC-B22	2.099	332.3	588.4	2.193	1.898	2.077	349.6	587.9	2.168	1.898	-1.05%	5.21%	-0.5	-1.14%	0.00%
PTC-B23	2.103	329.5	588.3	2.190	1.901	2.088	348.4	587.7	2.166	1.901	-0.71%	5.74%	-0.6	-1.10%	0.00%
PTC-B24	2.060	324.8	588.8	2.175	1.896	2.076	343.1	588.4	2.151	1.896	0.78%	5.63%	-0.4	-1.10%	0.00%
PTC-B25	2.125	333.7	588.5	2.160	1.895	2.085	347.0	588.0	2.135	1.894	-1.88%	3.99%	-0.5	-1.16%	-0.05%
PTC-B26	2.104	335.1	588.5	2.174	1.897	2.092	354.4	588.0	2.147	1.896	-0.57%	5.76%	-0.5	-1.24%	-0.05%
Min	2.043	308.6	588.2	2.158	1.887	2.049	322.7	587.7	2.133	1.886	-1.88%	2.75%	-0.6	-1.33%	-0.32%
Max	2.138	338.5	590.0	2.193	1.901	2.122	355.8	589.4	2.168	1.904	0.86%	6.17%	-0.4	-0.69%	0.53%
Average	2.093	329.1	588.7	2.172	1.896	2.088	345.0	588.2	2.148	1.895	-0.26%	4.82%	-0.5	-1.09%	-0.02%
Stdev	0.024	6.3	0.4	0.010	0.003	0.017	7.5	0.4	0.011	0.004	0.84%	0.83%	0.1	0.14%	0.14%

4.4.3.5 PTC Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
PTC-C1	2.098	351.1	589.5	2.155	1.890	2.104	365.9	589.0	2.129	1.889	0.29%	4.22%	-0.5	-1.21%	-0.05%
PTC-C2	2.131	345.8	589.6	2.169	1.889	2.124	354.7	589.1	2.129	1.887	-0.33%	2.57%	-0.5	-1.84%	-0.11%
PTC-C3	2.072	338.7	588.5	2.169	1.897	2.079	348.7	588.0	2.147	1.896	0.34%	2.95%	-0.5	-1.01%	-0.05%
PTC-C4	2.135	340.8	589.8	2.171	1.885	2.119	350.4	589.3	2.150	1.884	-0.75%	2.82%	-0.5	-0.97%	-0.05%
PTC-C5	2.083	341.0	588.3	2.174	1.899	2.108	350.5	587.8	2.151	1.898	1.20%	2.79%	-0.5	-1.06%	-0.05%
PTC-C6	2.082	339.6	588.5	2.191	1.898	2.089	350.4	588.0	2.164	1.897	0.34%	3.18%	-0.5	-1.23%	-0.05%
PTC-C7	2.074	350.6	590.0	2.167	1.888	2.095	362.6	589.5	2.141	1.887	1.01%	3.42%	-0.5	-1.20%	-0.05%
PTC-C8	2.055	340.3	588.6	2.172	1.896	2.071	353.9	588.0	2.147	1.895	0.78%	4.00%	-0.6	-1.15%	-0.05%
PTC-C9	2.147	348.5	588.3	2.170	1.898	2.128	354.8	587.9	2.146	1.897	-0.88%	1.81%	-0.4	-1.11%	-0.05%
PTC-C10	2.081	349.1	588.2	2.182	1.900	2.105	355.9	587.8	2.154	1.900	1.15%	1.95%	-0.4	-1.28%	0.00%
PTC-C11	2.124	344.2	588.1	2.175	1.900	2.101	357.2	587.6	2.152	1.900	-1.08%	3.78%	-0.5	-1.06%	0.00%
PTC-C12	2.125	341.9	588.9	2.176	1.897	2.100	352.7	588.4	2.141	1.892	-1.18%	3.16%	-0.5	-1.61%	-0.26%
PTC-C13	2.051	341.5	589.7	2.160	1.886	2.077	348.6	589.2	2.144	1.887	1.27%	2.08%	-0.5	-0.74%	0.05%
PTC-C14	2.090	338.9	589.9	2.176	1.888	2.114	346.9	589.4	2.151	1.888	1.15%	2.36%	-0.5	-1.15%	0.00%
PTC-C15	2.083	346.0	589.1	2.158	1.892	2.071	359.1	588.6	2.136	1.892	-0.58%	3.79%	-0.5	-1.02%	0.00%
PTC-C16	2.066	336.1	589.4	2.171	1.891	2.076	350.5	588.9	2.145	1.891	0.48%	4.28%	-0.5	-1.20%	0.00%
PTC-C17	2.055	338.3	589.2	2.175	1.897	2.063	351.9	588.6	2.151	1.897	0.39%	4.02%	-0.6	-1.10%	0.00%
PTC-C18	2.046	331.5	589.3	2.160	1.889	2.062	349.1	588.8	2.134	1.889	0.78%	5.31%	-0.5	-1.20%	0.00%
PTC-C19	2.120	350.6	588.5	2.165	1.895	2.093	361.1	588.0	2.140	1.895	-1.27%	2.99%	-0.5	-1.15%	0.00%
PTC-C20	2.112	340.4	588.8	2.161	1.893	2.124	354.8	588.3	2.136	1.893	0.57%	4.23%	-0.5	-1.16%	0.00%
PTC-C21	2.102	342.3	588.6	2.165	1.895	2.123	355.6	588.0	2.140	1.895	1.00%	3.89%	-0.6	-1.15%	0.00%
PTC-C22	2.123	340.5	588.3	2.193	1.900	2.110	354.7	587.7	2.155	1.899	-0.61%	4.17%	-0.6	-1.73%	-0.05%
PTC-C23	2.058	338.3	588.9	2.160	1.891	2.064	354.4	588.3	2.156	1.893	0.29%	4.76%	-0.6	-0.19%	0.11%
PTC-C24	2.125	340.3	588.6	2.164	1.895	2.116	353.6	588.0	2.139	1.896	-0.42%	3.91%	-0.6	-1.16%	0.05%
PTC-C25	2.096	338.6	588.4	2.174	1.898	2.090	354.4	587.8	2.152	1.898	-0.29%	4.67%	-0.6	-1.01%	0.00%
PTC-C26	2.111	336.3	589.2	2.176	1.890	2.085	350.8	588.6	2.152	1.891	-1.23%	4.31%	-0.6	-1.10%	0.05%
Min	2.046	331.5	588.1	2.155	1.885	2.062	346.9	587.6	2.129	1.884	-1.27%	1.81%	-0.6	-1.84%	-0.26%
Max	2.147	351.1	590.0	2.193	1.900	2.128	365.9	589.5	2.164	1.900	1.27%	5.31%	-0.4	-0.19%	0.11%
Average	2.094	342.0	588.9	2.170	1.894	2.096	354.0	588.4	2.145	1.893	0.09%	3.52%	-0.5	-1.15%	-0.02%
Stdev	0.029	5.0	0.6	0.009	0.005	0.021	4.5	0.6	0.009	0.005	0.85%	0.92%	0.1	0.30%	0.07%

4.4.4 Test Photo



4.5 Temperature Cycling(TC)

4.5.1 Test Information

Sample size:	3 lots 26 pcs. each
Test period:	2024-12-29 to 2025-02-12
Reference document:	JEDEC JESD22-A104
Power supply:	Unpowered
Soak temp.(MIN/ MAX):	T _{solder} =-40°C~85°C
Soak time:	15min (Transfer time no more than 20min)
Test duration:	1000 cycles
Test point:	Initial test/Final test
Acceptance criteria:	Per Section 3

4.5.2 Environmental Conditions

Environmental temperature:	(24.3~25.6)°C
Environmental humidity:	(45~68)%RH

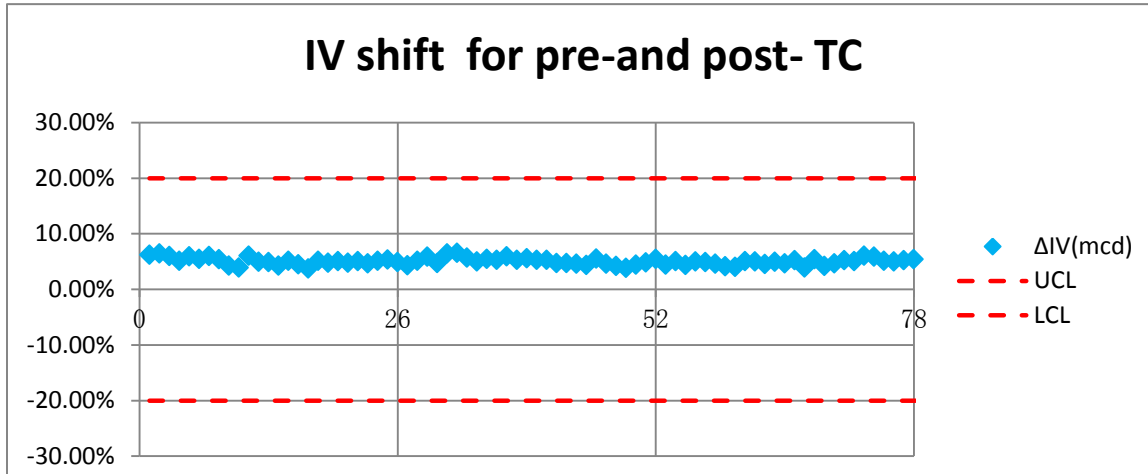
4.5.3 Test Data

4.5.3.1 Test Result for TC

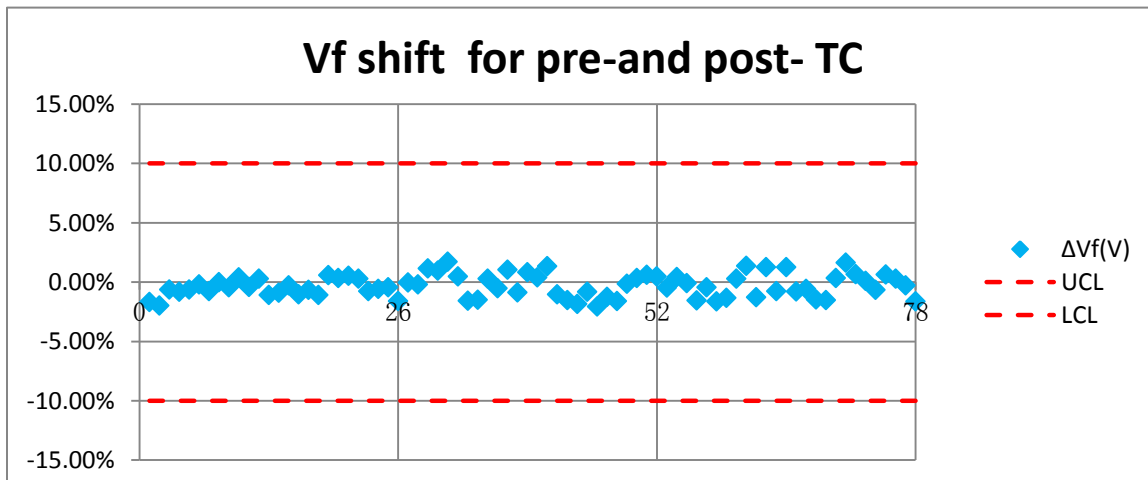
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light			0
B	External Visual	26	26	0
	Test			0
	Light / no light			0
C	External Visual	26	26	0
	Test			0
	Light / no light			0

4.5.3.2 Summary

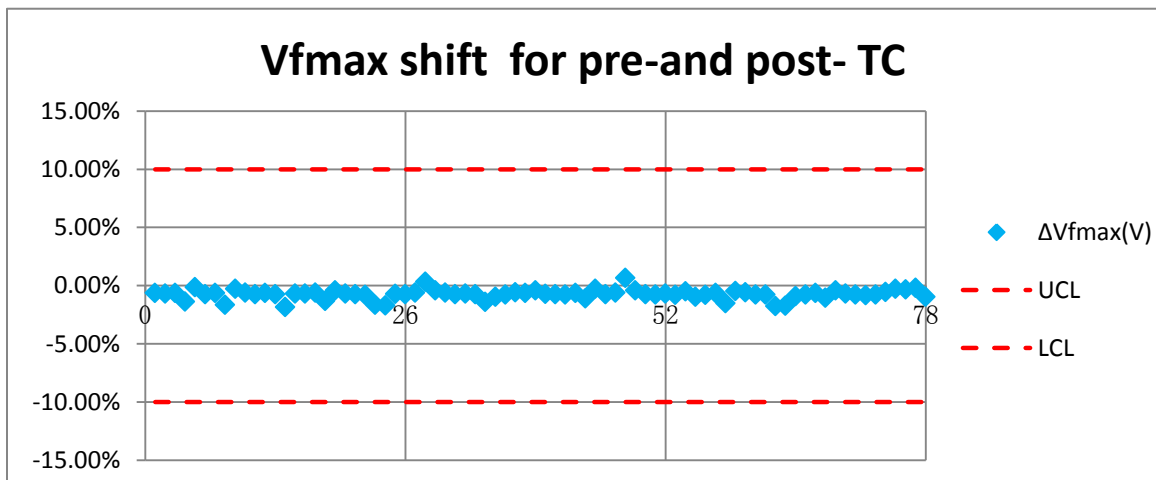
IV shift for pre- and post- TC test



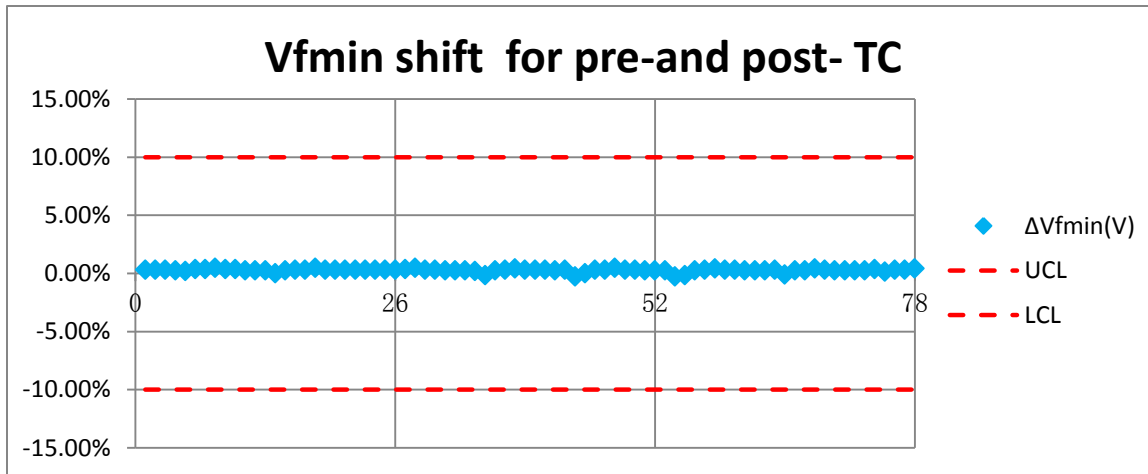
Vf shift for pre- and post- TC test



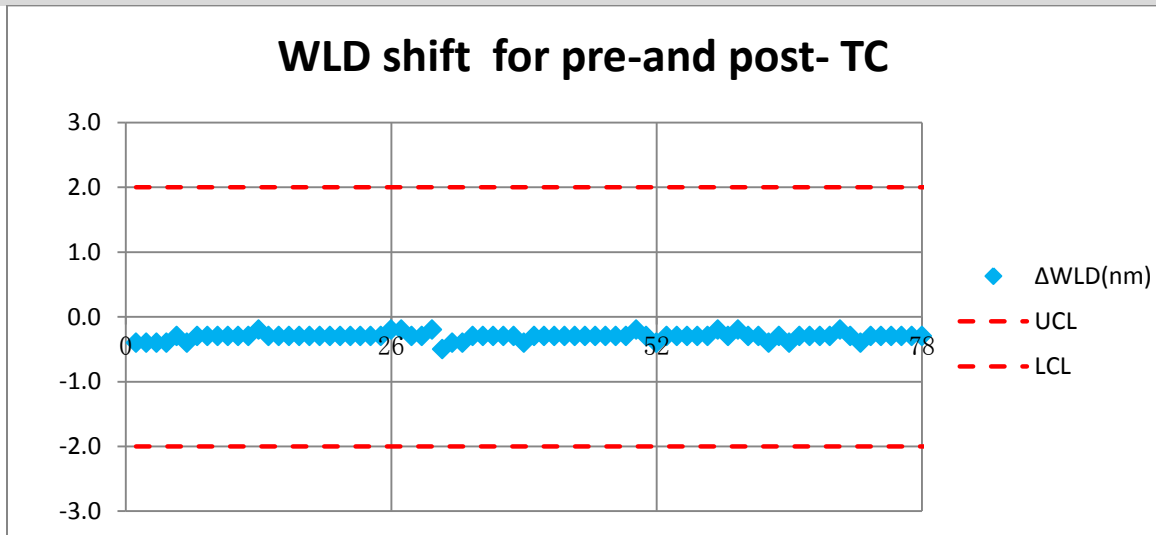
Vf_{max} shift for pre- and post- TC test



V_{fmin} shift for pre- and post- TC test



λ_d shift for pre- and post- TC test



4.5.3.3 TC Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
TC-A1	2.129	332.6	589.0	2.157	1.894	2.093	353.1	588.6	2.143	1.900	-1.69%	6.16%	-0.4	-0.65%	0.32%
TC-A2	2.137	327.4	588.9	2.162	1.893	2.095	348.4	588.5	2.147	1.899	-1.97%	6.41%	-0.4	-0.69%	0.32%
TC-A3	2.097	317.1	589.6	2.151	1.893	2.084	336.0	589.2	2.137	1.899	-0.62%	5.96%	-0.4	-0.65%	0.32%
TC-A4	2.090	330.9	589.6	2.174	1.891	2.073	347.7	589.2	2.144	1.896	-0.81%	5.08%	-0.4	-1.38%	0.26%
TC-A5	2.093	331.9	588.6	2.174	1.899	2.080	351.4	588.3	2.171	1.903	-0.62%	5.88%	-0.3	-0.14%	0.21%
TC-A6	2.123	336.1	589.3	2.152	1.889	2.119	354.3	588.9	2.136	1.896	-0.19%	5.42%	-0.4	-0.74%	0.37%
TC-A7	2.132	333.6	589.4	2.158	1.889	2.116	353.5	589.1	2.144	1.896	-0.75%	5.97%	-0.3	-0.65%	0.37%
TC-A8	2.062	333.6	588.9	2.183	1.896	2.062	351.6	588.6	2.147	1.905	0.00%	5.40%	-0.3	-1.65%	0.47%
TC-A9	2.083	334.7	588.5	2.183	1.898	2.074	348.8	588.2	2.177	1.905	-0.43%	4.21%	-0.3	-0.27%	0.37%
TC-A10	2.054	324.8	589.0	2.170	1.893	2.062	337.5	588.7	2.157	1.900	0.39%	3.91%	-0.3	-0.60%	0.37%
TC-A11	2.117	344.1	588.9	2.159	1.893	2.108	364.9	588.6	2.143	1.898	-0.43%	6.04%	-0.3	-0.74%	0.26%
TC-A12	2.123	334.2	589.4	2.162	1.891	2.129	350.7	589.1	2.148	1.896	0.28%	4.94%	-0.3	-0.65%	0.26%
TC-A13	2.126	337.7	589.0	2.155	1.891	2.103	354.1	588.8	2.139	1.896	-1.08%	4.86%	-0.2	-0.74%	0.26%
TC-A14	2.126	332.0	589.2	2.179	1.897	2.107	346.1	588.9	2.139	1.897	-0.89%	4.25%	-0.3	-1.84%	0.00%
TC-A15	2.077	338.5	588.5	2.170	1.897	2.071	355.8	588.2	2.155	1.902	-0.29%	5.11%	-0.3	-0.69%	0.26%
TC-A16	2.149	336.2	589.1	2.159	1.892	2.127	351.2	588.8	2.144	1.898	-1.02%	4.46%	-0.3	-0.69%	0.32%
TC-A17	2.102	335.9	588.6	2.167	1.897	2.088	348.3	588.3	2.154	1.903	-0.67%	3.69%	-0.3	-0.60%	0.32%
TC-A18	2.131	333.2	589.0	2.182	1.893	2.108	350.2	588.7	2.153	1.902	-1.08%	5.10%	-0.3	-1.33%	0.48%
TC-A19	2.071	333.4	588.6	2.182	1.899	2.083	349.2	588.3	2.173	1.905	0.58%	4.74%	-0.3	-0.41%	0.32%
TC-A20	2.062	327.2	588.6	2.180	1.898	2.069	343.6	588.3	2.165	1.904	0.34%	5.01%	-0.3	-0.69%	0.32%
TC-A21	2.108	344.9	588.3	2.170	1.899	2.119	361.3	588.0	2.154	1.905	0.52%	4.76%	-0.3	-0.74%	0.32%
TC-A22	2.102	346.1	590.1	2.153	1.885	2.108	363.6	589.8	2.136	1.891	0.29%	5.06%	-0.3	-0.79%	0.32%
TC-A23	2.101	340.9	589.4	2.168	1.889	2.085	356.8	589.1	2.132	1.895	-0.76%	4.66%	-0.3	-1.66%	0.32%
TC-A24	2.088	336.3	588.9	2.175	1.893	2.076	353.5	588.6	2.138	1.899	-0.57%	5.11%	-0.3	-1.70%	0.32%
TC-A25	2.085	336.3	588.5	2.179	1.898	2.076	354.3	588.2	2.163	1.904	-0.43%	5.35%	-0.3	-0.73%	0.32%
TC-A26	2.119	335.7	589.0	2.154	1.890	2.085	352.0	588.8	2.138	1.896	-1.60%	4.86%	-0.2	-0.74%	0.32%
Min	2.054	317.1	588.3	2.151	1.885	2.062	336.0	588.0	2.132	1.891	-1.97%	3.69%	-0.4	-1.84%	0.00%
Max	2.149	346.1	590.1	2.183	1.899	2.129	364.9	589.8	2.177	1.905	0.58%	6.41%	-0.2	-0.14%	0.48%
Average	2.103	334.4	589.0	2.168	1.894	2.092	351.5	588.7	2.149	1.900	-0.52%	5.09%	-0.3	-0.85%	0.31%
Stdev	0.026	6.2	0.4	0.011	0.004	0.020	6.6	0.4	0.012	0.004	0.68%	0.69%	0.1	0.45%	0.09%

4.5.3.4 TC Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
TC-B1	2.126	333.1	588.7	2.167	1.894	2.125	347.3	588.5	2.154	1.901	-0.05%	4.26%	-0.2	-0.60%	0.37%
TC-B2	2.055	335.7	589.6	2.172	1.888	2.051	352.8	589.3	2.179	1.897	-0.19%	5.09%	-0.3	0.32%	0.48%
TC-B3	2.069	336.7	588.7	2.182	1.896	2.093	356.4	588.4	2.173	1.902	1.16%	5.85%	-0.3	-0.41%	0.32%
TC-B4	2.049	334.6	589.0	2.167	1.892	2.069	350.3	588.8	2.154	1.898	0.98%	4.69%	-0.2	-0.60%	0.32%
TC-B5	2.086	339.3	588.7	2.166	1.896	2.122	361.0	588.2	2.150	1.901	1.73%	6.40%	-0.5	-0.74%	0.26%
TC-B6	2.109	333.0	588.5	2.174	1.899	2.119	354.8	588.1	2.159	1.904	0.47%	6.55%	-0.4	-0.69%	0.26%
TC-B7	2.113	330.9	588.9	2.160	1.893	2.080	349.7	588.5	2.144	1.898	-1.56%	5.68%	-0.4	-0.74%	0.26%
TC-B8	2.130	329.2	588.7	2.187	1.899	2.098	345.6	588.4	2.156	1.903	-1.50%	4.98%	-0.3	-1.42%	0.21%
TC-B9	2.052	334.3	589.2	2.173	1.899	2.058	352.4	588.9	2.152	1.896	0.29%	5.41%	-0.3	-0.97%	-0.16%
TC-B10	2.108	339.4	588.6	2.165	1.897	2.097	357.2	588.3	2.148	1.902	-0.52%	5.24%	-0.3	-0.79%	0.26%
TC-B11	2.094	331.8	588.3	2.179	1.901	2.116	351.3	588.0	2.166	1.907	1.05%	5.88%	-0.3	-0.60%	0.32%
TC-B12	2.097	336.3	589.5	2.172	1.889	2.079	354.0	589.2	2.158	1.897	-0.86%	5.26%	-0.3	-0.64%	0.42%
TC-B13	2.068	334.8	589.7	2.166	1.889	2.085	353.4	589.3	2.157	1.895	0.82%	5.56%	-0.4	-0.42%	0.32%
TC-B14	2.063	334.8	588.5	2.184	1.900	2.071	352.4	588.2	2.168	1.906	0.39%	5.26%	-0.3	-0.73%	0.32%
TC-B15	2.071	338.1	588.4	2.168	1.896	2.099	356.0	588.1	2.152	1.902	1.35%	5.29%	-0.3	-0.74%	0.32%
TC-B16	2.128	341.3	588.3	2.174	1.898	2.106	357.3	588.0	2.157	1.903	-1.03%	4.69%	-0.3	-0.78%	0.26%
TC-B17	2.106	328.3	590.1	2.179	1.887	2.074	343.8	589.8	2.165	1.893	-1.52%	4.72%	-0.3	-0.64%	0.32%
TC-B18	2.121	335.1	589.0	2.177	1.893	2.082	350.4	588.7	2.153	1.888	-1.84%	4.57%	-0.3	-1.10%	-0.26%
TC-B19	2.091	336.4	588.5	2.174	1.904	2.074	351.0	588.2	2.168	1.904	-0.81%	4.34%	-0.3	-0.28%	0.00%
TC-B20	2.130	333.9	588.3	2.173	1.900	2.086	352.2	588.0	2.157	1.906	-2.07%	5.48%	-0.3	-0.74%	0.32%
TC-B21	2.141	329.4	588.9	2.166	1.894	2.114	344.4	588.6	2.153	1.900	-1.26%	4.55%	-0.3	-0.60%	0.32%
TC-B22	2.074	335.5	590.2	2.162	1.884	2.041	349.5	589.9	2.176	1.893	-1.59%	4.17%	-0.3	0.65%	0.48%
TC-B23	2.091	329.8	589.6	2.161	1.887	2.088	342.4	589.3	2.152	1.893	-0.14%	3.82%	-0.3	-0.42%	0.32%
TC-B24	2.055	329.2	588.6	2.173	1.896	2.062	343.7	588.4	2.157	1.902	0.34%	4.40%	-0.2	-0.74%	0.32%
TC-B25	2.100	349.8	588.5	2.168	1.898	2.113	366.7	588.2	2.151	1.903	0.62%	4.83%	-0.3	-0.78%	0.26%
TC-B26	2.096	335.3	588.4	2.177	1.899	2.106	353.6	588.0	2.162	1.904	0.48%	5.46%	-0.4	-0.69%	0.26%
Min	2.049	328.3	588.3	2.160	1.884	2.041	342.4	588.0	2.144	1.888	-2.07%	3.82%	-0.5	-1.42%	-0.26%
Max	2.141	349.8	590.2	2.187	1.904	2.125	366.7	589.9	2.179	1.907	1.73%	6.55%	-0.2	0.65%	0.48%
Average	2.093	334.8	588.9	2.172	1.895	2.089	351.9	588.6	2.159	1.900	-0.20%	5.09%	-0.3	-0.61%	0.26%
Stdev	0.027	4.6	0.6	0.007	0.005	0.023	5.6	0.6	0.009	0.005	1.11%	0.67%	0.1	0.40%	0.17%

4.5.3.5 TC Data(Lot C)

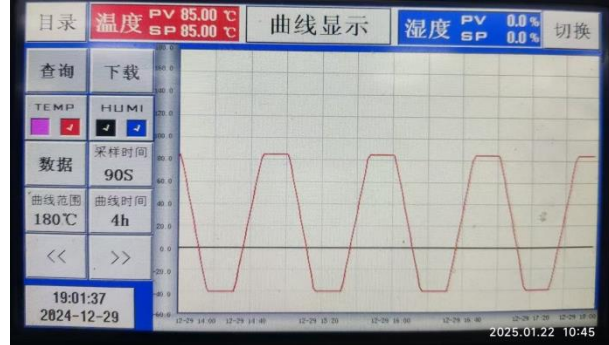
No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
TC-C1	2.124	328.1	589.6	2.153	1.890	2.114	342.6	589.3	2.136	1.895	-0.47%	4.42%	-0.3	-0.79%	0.26%
TC-C2	2.118	343.6	588.8	2.181	1.896	2.127	360.9	588.5	2.170	1.891	0.42%	5.03%	-0.3	-0.50%	-0.26%
TC-C3	2.051	335.0	590.0	2.173	1.896	2.049	349.5	589.7	2.152	1.893	-0.10%	4.33%	-0.3	-0.97%	-0.16%
TC-C4	2.139	334.7	589.3	2.150	1.889	2.106	351.3	589.0	2.133	1.894	-1.54%	4.96%	-0.3	-0.79%	0.26%
TC-C5	2.108	333.1	588.5	2.175	1.898	2.099	349.3	588.2	2.161	1.904	-0.43%	4.86%	-0.3	-0.64%	0.32%
TC-C6	2.108	337.8	588.8	2.186	1.896	2.074	353.3	588.6	2.153	1.904	-1.61%	4.59%	-0.2	-1.51%	0.42%
TC-C7	2.088	336.3	589.5	2.166	1.889	2.060	350.1	589.2	2.156	1.895	-1.34%	4.10%	-0.3	-0.46%	0.32%
TC-C8	2.062	333.0	588.5	2.178	1.898	2.068	346.4	588.3	2.165	1.904	0.29%	4.02%	-0.2	-0.60%	0.32%
TC-C9	2.068	345.7	588.7	2.160	1.893	2.096	363.1	588.4	2.143	1.898	1.35%	5.03%	-0.3	-0.79%	0.26%
TC-C10	2.120	343.2	588.3	2.180	1.901	2.093	360.2	588.0	2.163	1.906	-1.27%	4.95%	-0.3	-0.78%	0.26%
TC-C11	2.086	342.7	590.0	2.161	1.885	2.112	358.2	589.6	2.123	1.890	1.25%	4.52%	-0.4	-1.76%	0.27%
TC-C12	2.124	336.2	589.2	2.173	1.890	2.108	352.7	588.9	2.135	1.896	-0.75%	4.91%	-0.3	-1.75%	0.32%
TC-C13	2.052	331.5	589.2	2.173	1.898	2.078	346.9	588.8	2.153	1.896	1.27%	4.65%	-0.4	-0.92%	-0.11%
TC-C14	2.144	335.4	589.0	2.156	1.893	2.127	352.8	588.7	2.139	1.898	-0.79%	5.19%	-0.3	-0.79%	0.26%
TC-C15	2.125	337.1	589.1	2.160	1.893	2.113	350.3	588.8	2.146	1.898	-0.56%	3.92%	-0.3	-0.65%	0.26%
TC-C16	2.128	332.8	588.5	2.195	1.899	2.097	350.8	588.2	2.172	1.907	-1.46%	5.41%	-0.3	-1.05%	0.42%
TC-C17	2.120	326.4	589.5	2.169	1.895	2.088	340.0	589.2	2.160	1.901	-1.51%	4.17%	-0.3	-0.41%	0.32%
TC-C18	2.048	326.4	589.5	2.164	1.891	2.055	341.5	589.3	2.149	1.896	0.34%	4.63%	-0.2	-0.69%	0.26%
TC-C19	2.072	337.5	588.7	2.161	1.893	2.106	355.1	588.4	2.144	1.898	1.64%	5.21%	-0.3	-0.79%	0.26%
TC-C20	2.113	338.5	588.7	2.170	1.896	2.127	355.5	588.3	2.152	1.901	0.66%	5.02%	-0.4	-0.83%	0.26%
TC-C21	2.083	324.4	588.7	2.162	1.897	2.085	343.9	588.4	2.145	1.902	0.10%	6.01%	-0.3	-0.79%	0.26%
TC-C22	2.123	322.2	590.3	2.154	1.887	2.109	341.1	590.0	2.142	1.894	-0.66%	5.87%	-0.3	-0.56%	0.37%
TC-C23	2.049	340.2	589.6	2.152	1.892	2.062	357.6	589.3	2.146	1.895	0.63%	5.11%	-0.3	-0.28%	0.16%
TC-C24	2.131	332.6	588.8	2.155	1.893	2.137	349.1	588.5	2.148	1.899	0.28%	4.96%	-0.3	-0.32%	0.32%
TC-C25	2.080	320.8	589.6	2.151	1.892	2.074	337.5	589.3	2.147	1.898	-0.29%	5.21%	-0.3	-0.19%	0.32%
TC-C26	2.097	341.1	588.8	2.184	1.896	2.063	359.4	588.5	2.163	1.904	-1.62%	5.36%	-0.3	-0.96%	0.42%
Min	2.048	320.8	588.3	2.150	1.885	2.049	337.5	588.0	2.123	1.890	-1.62%	3.92%	-0.4	-1.76%	-0.26%
Max	2.144	345.7	590.3	2.195	1.901	2.137	363.1	590.0	2.172	1.907	1.64%	6.01%	-0.2	-0.19%	0.42%
Average	2.099	334.5	589.1	2.167	1.894	2.093	350.7	588.8	2.150	1.898	-0.24%	4.86%	-0.3	-0.79%	0.25%
Stdev	0.030	6.7	0.5	0.012	0.004	0.025	6.9	0.5	0.012	0.005	1.01%	0.52%	0.0	0.39%	0.17%

4.5.4 Test Photo

Sample During Test



Typical Curve



Light /no Light for(-40°C)-1



Light /no Light for(-40°C)-2



Light /no Light for(85°C)-1



Light /no Light for(85°C)-2



4.6 High Temperature Operating Life1(HTOL1)

4.6.1 Test Information

Sample size: 3 lots 26 pcs. each

Test period: 2024-12-12 to 2025-01-25

Reference document: JEDEC JESD22-A108

Power supply: IF=20mA

Test temperature: $T_{\text{solder}}=100^{\circ}\text{C}$

Test duration: 1000hrs

Test point: 0hrs/1000hrs

Acceptance criteria: Per Section 3

4.6.2 Environmental Conditions

Environmental temperature: $(24.1\sim 26.1)^{\circ}\text{C}$

Environmental humidity: $(50\sim 69)\%\text{RH}$

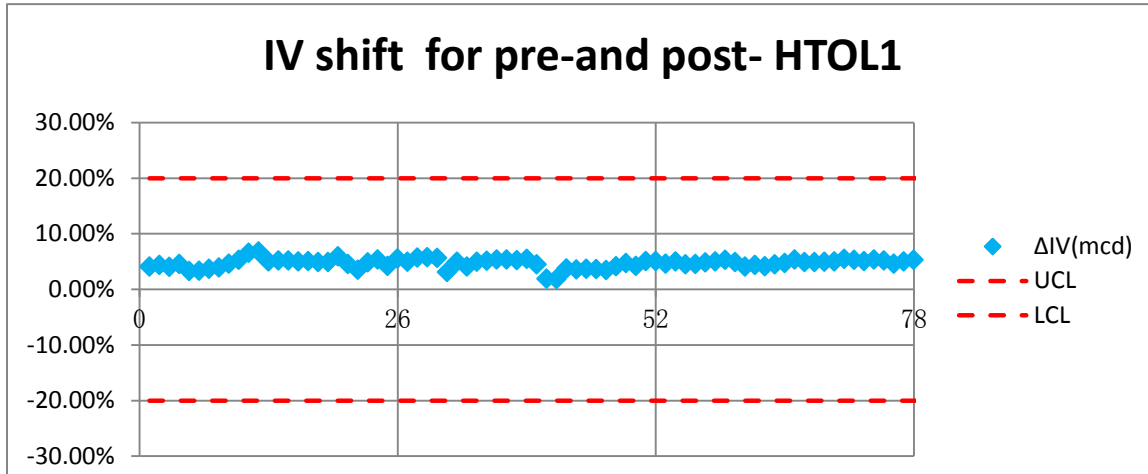
4.6.3 Test Data

4.6.3.1 Test Result for HTOL1

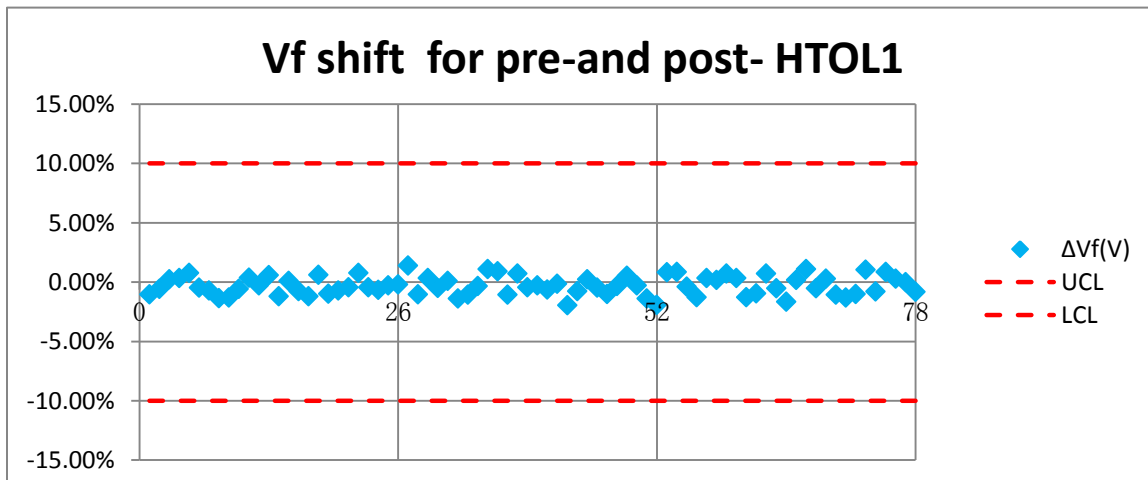
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
B	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
C	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA

4.6.3.2 Summary

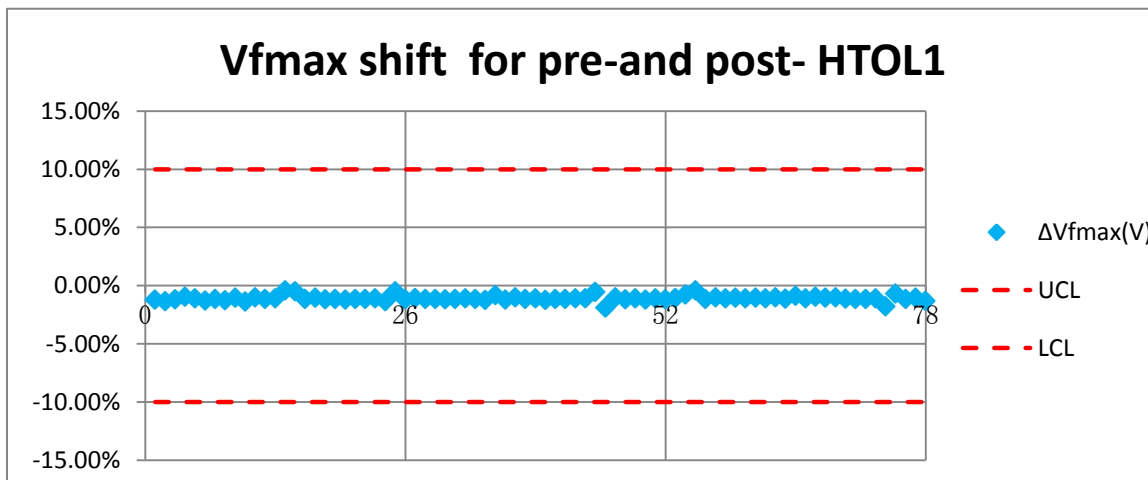
IV shift for pre- and post- HTOL1 test



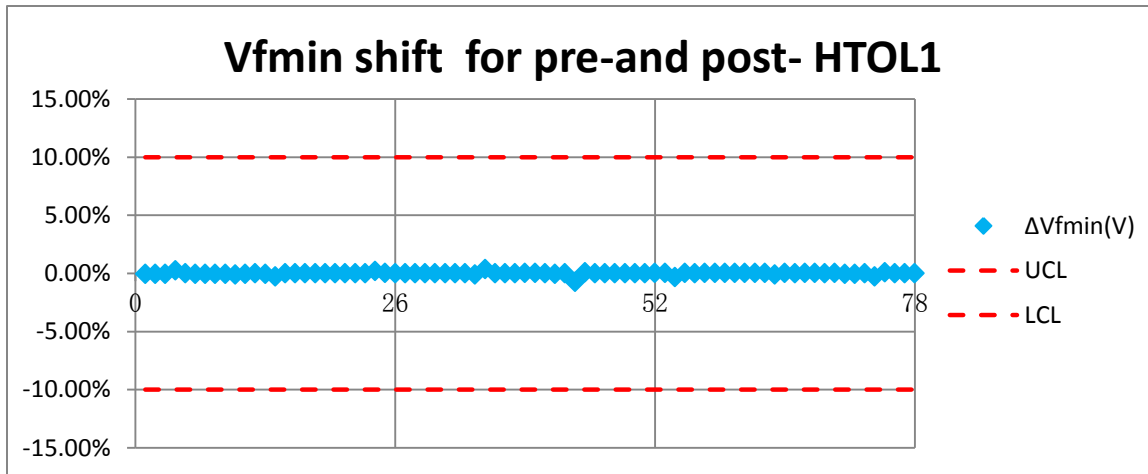
Vf shift for pre- and post- HTOL1 test



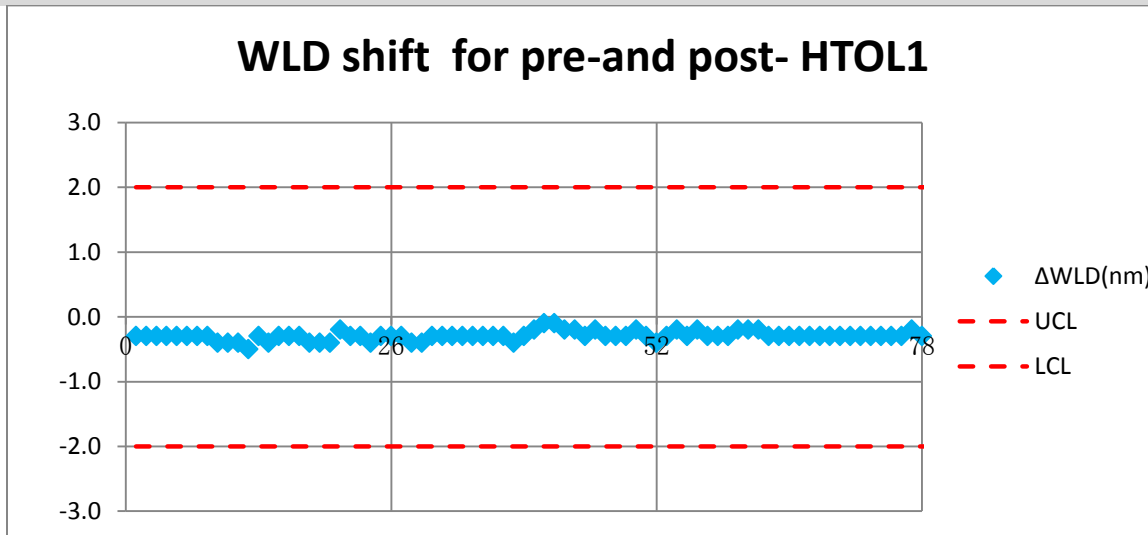
Vf_{max} shift for pre- and post- HTOL1 test



V_{fmin} shift for pre- and post- HTOL1 test



λ_d shift for pre- and post- HTOL1 test



4.6.3.3 HTOL1 Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
HTOL1-A1	2.108	346.8	589.5	2.152	1.889	2.086	360.9	589.2	2.126	1.888	-1.04%	4.07%	-0.3	-1.21%	-0.05%
HTOL1-A2	2.120	344.2	589.4	2.161	1.890	2.108	359.2	589.1	2.132	1.889	-0.57%	4.36%	-0.3	-1.34%	-0.05%
HTOL1-A3	2.072	336.8	588.5	2.170	1.897	2.077	350.2	588.2	2.144	1.896	0.24%	3.98%	-0.3	-1.20%	-0.05%
HTOL1-A4	2.108	341.7	589.9	2.167	1.890	2.115	357.2	589.6	2.146	1.895	0.33%	4.54%	-0.3	-0.97%	0.26%
HTOL1-A5	2.092	342.3	589.5	2.180	1.891	2.108	353.5	589.2	2.156	1.891	0.76%	3.27%	-0.3	-1.10%	0.00%
HTOL1-A6	2.123	338.4	589.0	2.156	1.891	2.113	349.6	588.7	2.128	1.890	-0.47%	3.31%	-0.3	-1.30%	-0.05%
HTOL1-A7	2.121	334.7	588.8	2.167	1.894	2.106	346.9	588.5	2.142	1.893	-0.71%	3.65%	-0.3	-1.15%	-0.05%
HTOL1-A8	2.084	333.1	588.9	2.186	1.895	2.056	346.1	588.6	2.158	1.894	-1.34%	3.90%	-0.3	-1.28%	-0.05%
HTOL1-A9	2.093	335.8	588.9	2.174	1.896	2.066	351.1	588.5	2.151	1.895	-1.29%	4.56%	-0.4	-1.06%	-0.05%
HTOL1-A10	2.102	326.2	589.0	2.174	1.894	2.090	343.3	588.6	2.144	1.892	-0.57%	5.24%	-0.4	-1.38%	-0.11%
HTOL1-A11	2.096	344.2	588.6	2.165	1.895	2.104	366.7	588.2	2.143	1.894	0.38%	6.54%	-0.4	-1.02%	-0.05%
HTOL1-A12	2.076	341.2	589.5	2.160	1.890	2.070	364.3	589.0	2.135	1.890	-0.29%	6.77%	-0.5	-1.16%	0.00%
HTOL1-A13	2.073	339.2	589.2	2.150	1.893	2.085	356.1	588.9	2.126	1.892	0.58%	4.98%	-0.3	-1.12%	-0.05%
HTOL1-A14	2.112	336.9	588.7	2.188	1.897	2.087	354.2	588.3	2.179	1.892	-1.18%	5.14%	-0.4	-0.41%	-0.26%
HTOL1-A15	2.091	338.4	588.5	2.171	1.898	2.093	355.9	588.2	2.160	1.898	0.10%	5.17%	-0.3	-0.51%	0.00%
HTOL1-A16	2.124	332.1	588.7	2.164	1.895	2.108	348.7	588.4	2.139	1.895	-0.75%	5.00%	-0.3	-1.16%	0.00%
HTOL1-A17	2.100	336.1	588.6	2.164	1.895	2.075	353.0	588.3	2.141	1.895	-1.19%	5.03%	-0.3	-1.06%	0.00%
HTOL1-A18	2.096	343.0	589.2	2.181	1.894	2.109	359.7	588.8	2.155	1.894	0.62%	4.87%	-0.4	-1.19%	0.00%
HTOL1-A19	2.122	338.6	589.2	2.173	1.893	2.101	355.1	588.8	2.148	1.893	-0.99%	4.87%	-0.4	-1.15%	0.00%
HTOL1-A20	2.124	330.7	589.4	2.162	1.889	2.109	350.2	589.0	2.136	1.889	-0.71%	5.90%	-0.4	-1.20%	0.00%
HTOL1-A21	2.073	341.8	589.1	2.154	1.890	2.064	357.3	588.9	2.129	1.890	-0.43%	4.53%	-0.2	-1.16%	0.00%
HTOL1-A22	2.083	345.1	589.7	2.156	1.888	2.099	357.2	589.4	2.131	1.888	0.77%	3.51%	-0.3	-1.16%	0.00%
HTOL1-A23	2.084	339.8	589.3	2.153	1.890	2.075	356.2	589.0	2.129	1.890	-0.43%	4.83%	-0.3	-1.11%	0.00%
HTOL1-A24	2.124	331.0	590.0	2.161	1.890	2.110	348.6	589.6	2.132	1.894	-0.66%	5.32%	-0.4	-1.34%	0.21%
HTOL1-A25	2.097	333.0	588.6	2.170	1.896	2.091	346.9	588.3	2.159	1.897	-0.29%	4.17%	-0.3	-0.51%	0.05%
HTOL1-A26	2.076	326.2	588.7	2.165	1.896	2.072	344.2	588.4	2.139	1.896	-0.19%	5.52%	-0.3	-1.20%	0.00%
Min	2.072	326.2	588.5	2.150	1.888	2.056	343.3	588.2	2.126	1.888	-1.34%	3.27%	-0.5	-1.38%	-0.26%
Max	2.124	346.8	590.0	2.188	1.898	2.115	366.7	589.6	2.179	1.898	0.77%	6.77%	-0.2	-0.41%	0.26%
Average	2.099	337.6	589.1	2.166	1.893	2.091	353.6	588.8	2.143	1.893	-0.36%	4.73%	-0.3	-1.09%	-0.01%
Stdev	0.018	5.6	0.4	0.010	0.003	0.018	6.0	0.4	0.013	0.003	0.65%	0.89%	0.1	0.25%	0.09%

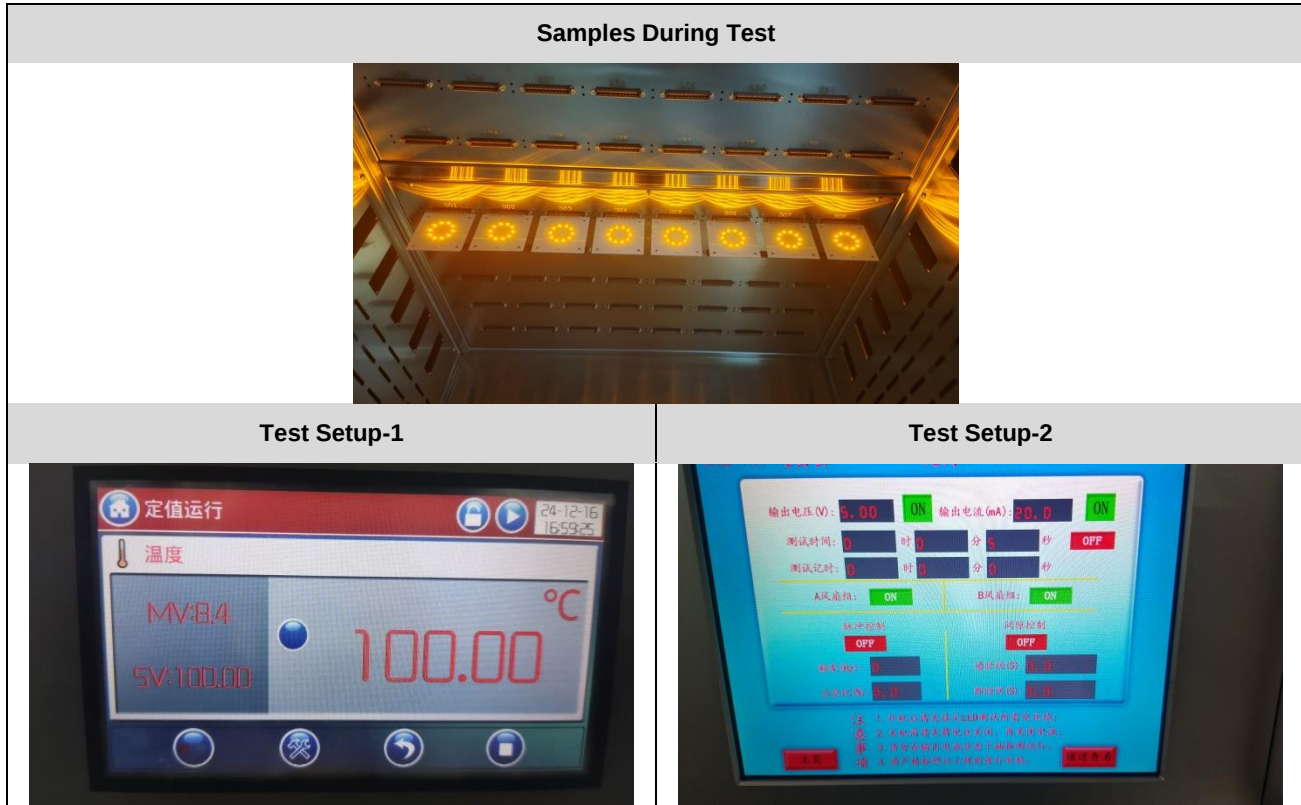
4.6.3.4 HTOL1 Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
HTOL1-B1	2.087	335.1	589.3	2.155	1.889	2.116	351.6	589.0	2.132	1.889	1.39%	4.92%	-0.3	-1.07%	0.00%
HTOL1-B2	2.129	330.1	589.2	2.179	1.892	2.107	348.8	588.8	2.154	1.892	-1.03%	5.66%	-0.4	-1.15%	0.00%
HTOL1-B3	2.076	328.8	589.8	2.161	1.887	2.083	347.7	589.4	2.136	1.887	0.34%	5.75%	-0.4	-1.16%	0.00%
HTOL1-B4	2.083	328.9	588.5	2.182	1.899	2.073	347.4	588.2	2.156	1.899	-0.48%	5.62%	-0.3	-1.19%	0.00%
HTOL1-B5	2.109	341.7	589.2	2.155	1.891	2.111	352.2	588.9	2.130	1.891	0.09%	3.07%	-0.3	-1.16%	0.00%
HTOL1-B6	2.095	338.1	588.6	2.172	1.896	2.066	354.8	588.3	2.148	1.896	-1.38%	4.94%	-0.3	-1.10%	0.00%
HTOL1-B7	2.074	328.9	588.9	2.160	1.897	2.052	342.3	588.6	2.135	1.897	-1.06%	4.07%	-0.3	-1.16%	0.00%
HTOL1-B8	2.066	336.5	588.9	2.179	1.896	2.059	353.1	588.6	2.152	1.894	-0.34%	4.93%	-0.3	-1.24%	-0.11%
HTOL1-B9	2.091	333.3	589.4	2.151	1.888	2.114	350.2	589.1	2.133	1.895	1.10%	5.07%	-0.3	-0.84%	0.37%
HTOL1-B10	2.093	342.3	588.9	2.159	1.895	2.112	360.5	588.6	2.133	1.895	0.91%	5.32%	-0.3	-1.20%	0.00%
HTOL1-B11	2.072	332.6	588.9	2.163	1.897	2.050	350.3	588.6	2.141	1.897	-1.06%	5.32%	-0.3	-1.02%	0.00%
HTOL1-B12	2.070	336.1	590.1	2.165	1.886	2.085	353.7	589.7	2.140	1.886	0.72%	5.24%	-0.4	-1.15%	0.00%
HTOL1-B13	2.072	333.3	588.8	2.177	1.894	2.063	351.4	588.5	2.153	1.895	-0.43%	5.43%	-0.3	-1.10%	0.05%
HTOL1-B14	2.073	335.2	589.4	2.165	1.891	2.067	350.2	589.2	2.138	1.892	-0.29%	4.47%	-0.2	-1.25%	0.05%
HTOL1-B15	2.109	353.4	590.0	2.146	1.885	2.096	360.1	589.9	2.121	1.885	-0.62%	1.90%	-0.1	-1.16%	0.00%
HTOL1-B16	2.099	338.9	589.0	2.161	1.891	2.096	345.1	588.9	2.136	1.890	-0.14%	1.83%	-0.1	-1.16%	-0.05%
HTOL1-B17	2.106	338.1	588.8	2.163	1.894	2.065	350.6	588.6	2.139	1.894	-1.95%	3.70%	-0.2	-1.11%	0.00%
HTOL1-B18	2.129	342.9	588.9	2.182	1.894	2.113	355.0	588.7	2.158	1.880	-0.75%	3.53%	-0.2	-1.10%	-0.74%
HTOL1-B19	2.109	334.5	589.0	2.184	1.895	2.114	346.8	588.7	2.172	1.897	0.24%	3.68%	-0.3	-0.55%	0.11%
HTOL1-B20	2.127	337.6	589.5	2.160	1.890	2.117	349.7	589.3	2.119	1.890	-0.47%	3.58%	-0.2	-1.90%	0.00%
HTOL1-B21	2.107	339.5	588.7	2.166	1.897	2.086	351.1	588.4	2.144	1.897	-1.00%	3.42%	-0.3	-1.02%	0.00%
HTOL1-B22	2.115	334.4	589.1	2.179	1.894	2.108	348.1	588.8	2.153	1.894	-0.33%	4.10%	-0.3	-1.19%	0.00%
HTOL1-B23	2.092	332.6	588.8	2.181	1.896	2.103	348.2	588.5	2.157	1.896	0.53%	4.69%	-0.3	-1.10%	0.00%
HTOL1-B24	2.112	331.4	589.5	2.158	1.891	2.106	345.3	589.3	2.132	1.891	-0.28%	4.19%	-0.2	-1.20%	0.00%
HTOL1-B25	2.098	343.0	588.2	2.174	1.899	2.069	360.2	587.9	2.150	1.899	-1.38%	5.01%	-0.3	-1.10%	0.00%
HTOL1-B26	2.119	342.0	589.1	2.166	1.892	2.078	359.3	588.7	2.140	1.893	-1.93%	5.06%	-0.4	-1.20%	0.05%
Min	2.066	328.8	588.2	2.146	1.885	2.050	342.3	587.9	2.119	1.880	-1.95%	1.83%	-0.4	-1.90%	-0.74%
Max	2.129	353.4	590.1	2.184	1.899	2.117	360.5	589.9	2.172	1.899	1.39%	5.75%	-0.1	-0.55%	0.37%
Average	2.097	336.5	589.1	2.167	1.893	2.089	351.3	588.8	2.142	1.893	-0.37%	4.40%	-0.3	-1.14%	-0.01%
Stdev	0.019	5.6	0.4	0.011	0.004	0.022	4.8	0.5	0.012	0.005	0.87%	1.07%	0.1	0.21%	0.17%

4.6.3.5 HTOL1 Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
HTOL1-C1	2.078	339.8	589.6	2.144	1.885	2.095	355.4	589.3	2.121	1.886	0.82%	4.59%	-0.3	-1.07%	0.05%
HTOL1-C2	2.111	342.2	589.3	2.175	1.891	2.129	359.2	589.1	2.158	1.885	0.85%	4.97%	-0.2	-0.78%	-0.32%
HTOL1-C3	2.112	338.9	590.2	2.147	1.883	2.104	354.1	589.9	2.138	1.884	-0.38%	4.49%	-0.3	-0.42%	0.05%
HTOL1-C4	2.110	336.9	590.2	2.137	1.882	2.083	352.2	590.0	2.112	1.882	-1.28%	4.54%	-0.2	-1.17%	0.00%
HTOL1-C5	2.089	335.1	589.0	2.160	1.894	2.096	351.2	588.7	2.138	1.895	0.34%	4.80%	-0.3	-1.02%	0.05%
HTOL1-C6	2.115	336.5	590.0	2.164	1.885	2.119	353.3	589.7	2.140	1.886	0.19%	4.99%	-0.3	-1.11%	0.05%
HTOL1-C7	2.112	335.8	588.9	2.175	1.893	2.127	353.4	588.6	2.152	1.894	0.71%	5.24%	-0.3	-1.06%	0.05%
HTOL1-C8	2.099	332.5	588.8	2.171	1.893	2.106	348.7	588.6	2.147	1.894	0.33%	4.87%	-0.2	-1.11%	0.05%
HTOL1-C9	2.095	344.2	588.7	2.161	1.893	2.068	358.1	588.5	2.138	1.894	-1.29%	4.04%	-0.2	-1.06%	0.05%
HTOL1-C10	2.107	350.1	589.9	2.153	1.886	2.087	365.3	589.7	2.129	1.887	-0.95%	4.34%	-0.2	-1.11%	0.05%
HTOL1-C11	2.090	311.1	589.3	2.156	1.895	2.105	324.0	589.0	2.134	1.896	0.72%	4.15%	-0.3	-1.02%	0.05%
HTOL1-C12	2.083	340.9	588.8	2.185	1.896	2.072	356.2	588.5	2.160	1.894	-0.53%	4.49%	-0.3	-1.14%	-0.11%
HTOL1-C13	2.101	337.6	589.0	2.178	1.896	2.066	353.5	588.7	2.159	1.897	-1.67%	4.71%	-0.3	-0.87%	0.05%
HTOL1-C14	2.129	334.0	588.4	2.169	1.898	2.133	351.7	588.1	2.145	1.898	0.19%	5.30%	-0.3	-1.11%	0.00%
HTOL1-C15	2.093	333.5	588.9	2.165	1.893	2.116	349.8	588.6	2.144	1.894	1.10%	4.89%	-0.3	-0.97%	0.05%
HTOL1-C16	2.117	329.9	588.9	2.181	1.895	2.106	345.9	588.6	2.158	1.896	-0.52%	4.85%	-0.3	-1.05%	0.05%
HTOL1-C17	2.107	330.8	589.4	2.170	1.891	2.113	347.0	589.1	2.148	1.891	0.28%	4.90%	-0.3	-1.01%	0.00%
HTOL1-C18	2.090	332.6	588.6	2.180	1.897	2.068	349.1	588.3	2.155	1.898	-1.05%	4.96%	-0.3	-1.15%	0.05%
HTOL1-C19	2.093	340.2	589.5	2.146	1.887	2.066	358.8	589.2	2.121	1.886	-1.29%	5.47%	-0.3	-1.16%	-0.05%
HTOL1-C20	2.105	326.3	588.5	2.174	1.899	2.084	343.4	588.2	2.149	1.898	-1.00%	5.24%	-0.3	-1.15%	-0.05%
HTOL1-C21	2.094	338.2	588.7	2.160	1.895	2.116	355.2	588.4	2.136	1.895	1.05%	5.03%	-0.3	-1.11%	0.00%
HTOL1-C22	2.126	335.0	588.5	2.185	1.898	2.109	352.9	588.2	2.146	1.893	-0.80%	5.34%	-0.3	-1.78%	-0.26%
HTOL1-C23	2.107	334.7	590.2	2.174	1.884	2.125	351.9	589.9	2.159	1.886	0.85%	5.14%	-0.3	-0.69%	0.11%
HTOL1-C24	2.108	337.0	588.5	2.169	1.897	2.114	352.5	588.2	2.144	1.897	0.28%	4.60%	-0.3	-1.15%	0.00%
HTOL1-C25	2.125	337.1	588.4	2.175	1.899	2.125	353.9	588.2	2.152	1.899	0.00%	4.98%	-0.2	-1.06%	0.00%
HTOL1-C26	2.085	332.9	589.5	2.172	1.889	2.068	350.5	589.2	2.143	1.889	-0.82%	5.29%	-0.3	-1.34%	0.00%
Min	2.078	311.1	588.4	2.137	1.882	2.066	324.0	588.1	2.112	1.882	-1.67%	4.04%	-0.3	-1.78%	-0.32%
Max	2.129	350.1	590.2	2.185	1.899	2.133	365.3	590.0	2.160	1.899	1.10%	5.47%	-0.2	-0.42%	0.11%
Average	2.103	335.5	589.1	2.166	1.892	2.100	351.8	588.9	2.143	1.892	-0.15%	4.85%	-0.3	-1.06%	0.00%
Stdev	0.014	6.9	0.6	0.013	0.005	0.022	7.2	0.6	0.013	0.005	0.85%	0.37%	0.0	0.23%	0.10%

4.6.4 Test Photo



4.7 High Temperature Operating Life2(HTOL2)

4.7.1 Test Information

Sample size: 3 lots 26 pcs. each

Test period: 2024-12-12 to 2025-01-25

Reference document: JEDEC JESD22-A108

Power supply: IF=30mA

Test temperature: $T_{\text{solder}}=85^{\circ}\text{C}$

Test duration: 1000hrs

Test point: 0hrs/1000hrs

Acceptance criteria: Per Section 3

4.7.2 Environmental Conditions

Environmental temperature: $(24.1\sim 26.1)^{\circ}\text{C}$

Environmental humidity: $(50\sim 69)\%\text{RH}$

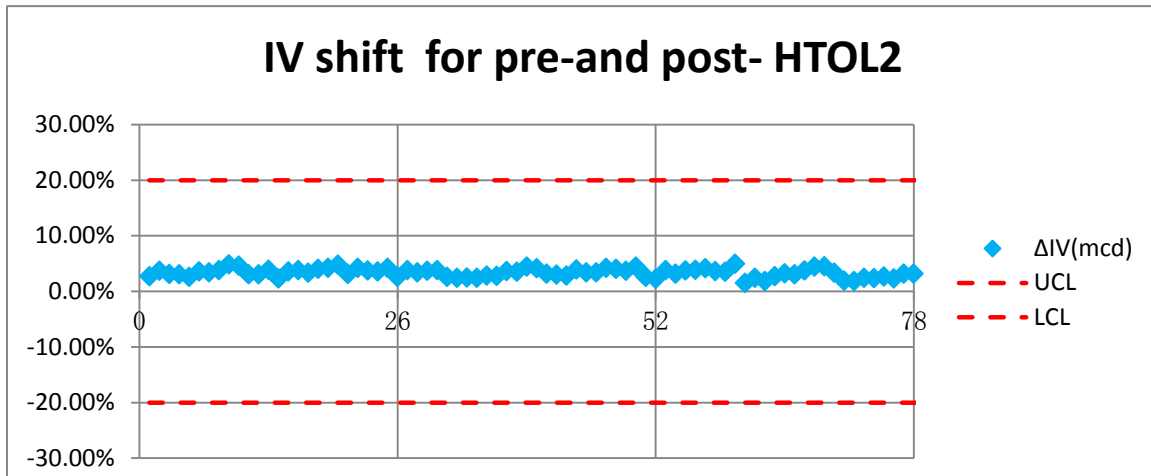
4.7.3 Test Data

4.7.3.1 Test Result for HTOL2

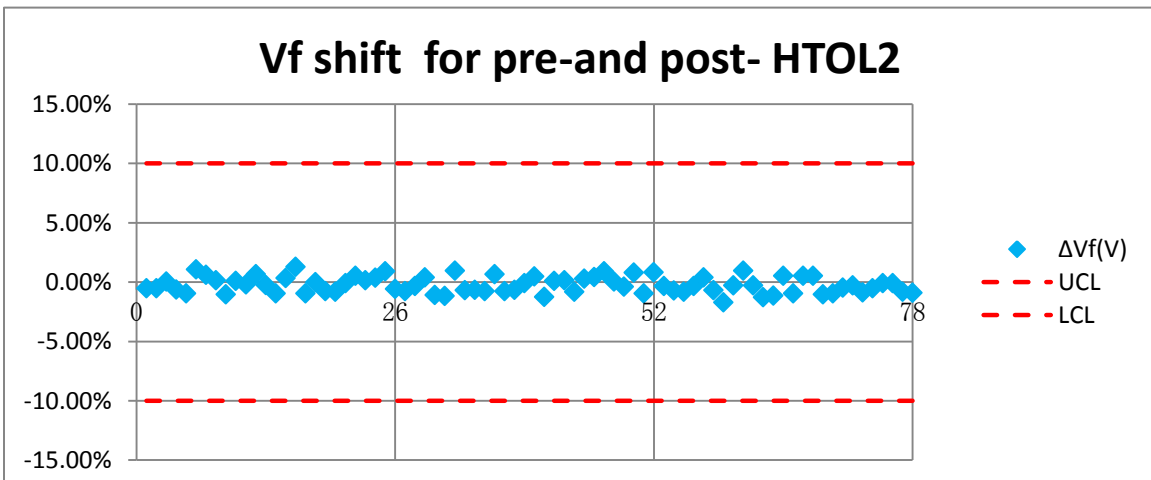
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
B	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
C	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA

4.7.3.2 Summary

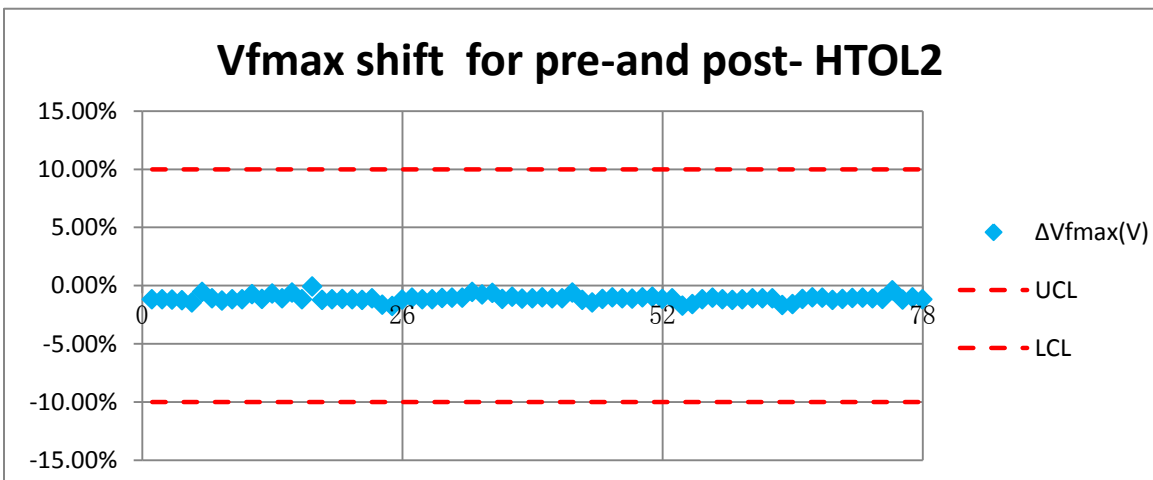
IV shift for pre- and post- HTOL2 test



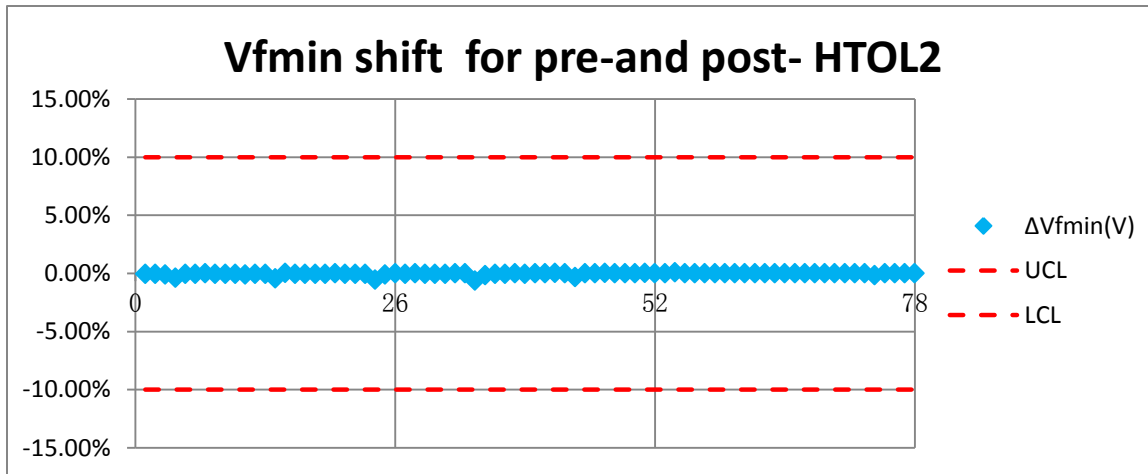
Vf shift for pre- and post- HTOL2 test



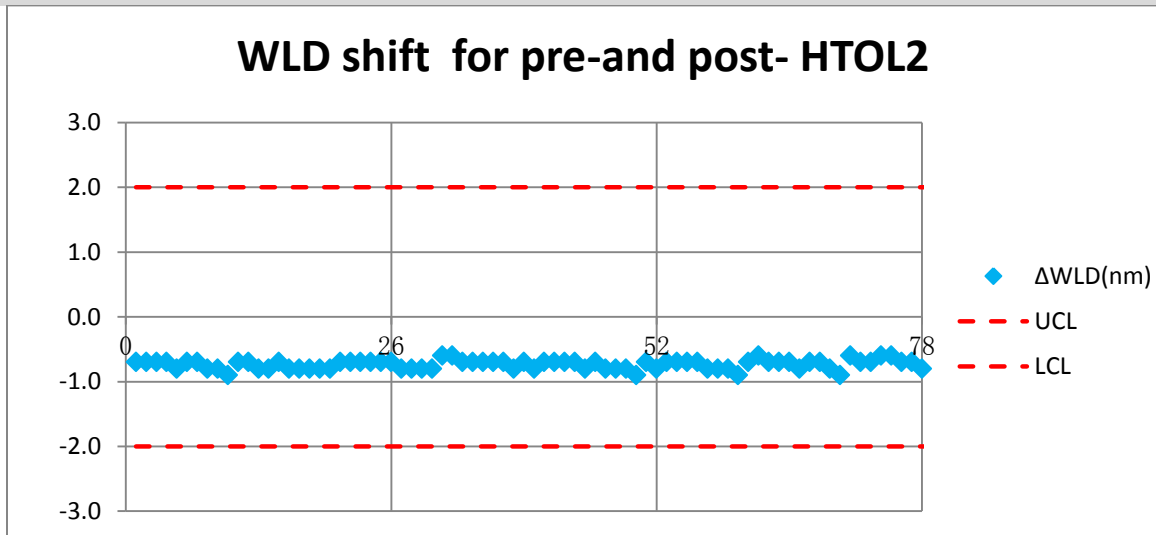
Vf_{max} shift for pre- and post- HTOL2 test



V_{fmin} shift for pre- and post- HTOL2 test



λ_d shift for pre- and post- HTOL2 test



4.7.3.3 HTOL2 Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
HTOL2-A1	2.094	333.4	588.4	2.173	1.899	2.083	342.3	587.7	2.147	1.898	-0.53%	2.67%	-0.7	-1.20%	-0.05%
HTOL2-A2	2.087	334.0	588.8	2.170	1.895	2.076	346.2	588.1	2.144	1.894	-0.53%	3.65%	-0.7	-1.20%	-0.05%
HTOL2-A3	2.073	337.5	589.1	2.159	1.893	2.074	347.9	588.4	2.133	1.891	0.05%	3.08%	-0.7	-1.20%	-0.11%
HTOL2-A4	2.078	331.9	588.8	2.186	1.897	2.065	342.0	588.1	2.158	1.890	-0.63%	3.04%	-0.7	-1.28%	-0.37%
HTOL2-A5	2.089	325.6	588.7	2.202	1.900	2.069	333.9	587.9	2.170	1.899	-0.96%	2.55%	-0.8	-1.45%	-0.05%
HTOL2-A6	2.070	327.0	589.1	2.155	1.890	2.092	338.5	588.4	2.143	1.889	1.06%	3.52%	-0.7	-0.56%	-0.05%
HTOL2-A7	2.091	332.6	589.6	2.156	1.890	2.104	343.8	588.9	2.132	1.890	0.62%	3.37%	-0.7	-1.11%	0.00%
HTOL2-A8	2.106	335.0	589.8	2.169	1.887	2.109	347.6	589.0	2.141	1.886	0.14%	3.76%	-0.8	-1.29%	-0.05%
HTOL2-A9	2.109	328.4	588.6	2.188	1.899	2.087	344.2	587.8	2.162	1.898	-1.04%	4.81%	-0.8	-1.19%	-0.05%
HTOL2-A10	2.107	331.2	589.2	2.167	1.892	2.109	346.4	588.3	2.141	1.891	0.09%	4.59%	-0.9	-1.20%	-0.05%
HTOL2-A11	2.089	340.4	589.4	2.152	1.890	2.085	350.7	588.7	2.136	1.888	-0.19%	3.03%	-0.7	-0.74%	-0.11%
HTOL2-A12	2.074	342.7	588.6	2.173	1.899	2.088	353.1	587.9	2.148	1.898	0.68%	3.03%	-0.7	-1.15%	-0.05%
HTOL2-A13	2.104	337.4	589.4	2.151	1.890	2.099	350.3	588.6	2.136	1.889	-0.24%	3.82%	-0.8	-0.70%	-0.05%
HTOL2-A14	2.104	328.6	588.6	2.189	1.900	2.084	336.1	587.8	2.165	1.892	-0.95%	2.28%	-0.8	-1.10%	-0.42%
HTOL2-A15	2.094	334.6	588.7	2.173	1.899	2.101	346.4	588.0	2.160	1.900	0.33%	3.53%	-0.7	-0.60%	0.05%
HTOL2-A16	2.083	338.1	588.5	2.171	1.900	2.110	350.8	587.7	2.145	1.899	1.30%	3.76%	-0.8	-1.20%	-0.05%
HTOL2-A17	2.095	332.7	590.3	2.144	1.885	2.075	343.7	589.5	2.142	1.884	-0.95%	3.31%	-0.8	-0.09%	-0.05%
HTOL2-A18	2.084	331.4	589.3	2.177	1.891	2.084	344.7	588.5	2.150	1.890	0.00%	4.01%	-0.8	-1.24%	-0.05%
HTOL2-A19	2.081	330.0	588.6	2.186	1.901	2.065	343.7	587.8	2.160	1.900	-0.77%	4.15%	-0.8	-1.19%	-0.05%
HTOL2-A20	2.104	334.3	589.3	2.161	1.892	2.087	350.1	588.5	2.136	1.892	-0.81%	4.73%	-0.8	-1.16%	0.00%
HTOL2-A21	2.075	339.1	588.5	2.169	1.898	2.073	349.5	587.8	2.143	1.897	-0.10%	3.07%	-0.7	-1.20%	-0.05%
HTOL2-A22	2.097	337.9	588.6	2.175	1.898	2.108	352.1	587.9	2.148	1.897	0.52%	4.20%	-0.7	-1.24%	-0.05%
HTOL2-A23	2.073	331.5	588.5	2.168	1.900	2.076	343.9	587.8	2.144	1.899	0.14%	3.74%	-0.7	-1.11%	-0.05%
HTOL2-A24	2.094	335.0	588.8	2.179	1.899	2.102	346.9	588.1	2.143	1.889	0.38%	3.55%	-0.7	-1.65%	-0.53%
HTOL2-A25	2.087	336.6	588.5	2.201	1.900	2.106	350.7	587.8	2.162	1.898	0.91%	4.19%	-0.7	-1.77%	-0.11%
HTOL2-A26	2.093	329.8	589.1	2.157	1.896	2.081	338.3	588.4	2.131	1.896	-0.57%	2.58%	-0.7	-1.21%	0.00%
Min	2.070	325.6	588.4	2.144	1.885	2.065	333.9	587.7	2.131	1.884	-1.04%	2.28%	-0.9	-1.77%	-0.53%
Max	2.109	342.7	590.3	2.202	1.901	2.110	353.1	589.5	2.170	1.900	1.30%	4.81%	-0.7	-0.09%	0.05%
Average	2.090	333.7	589.0	2.171	1.895	2.088	345.5	588.2	2.147	1.894	-0.08%	3.54%	-0.7	-1.12%	-0.09%
Stdev	0.012	4.2	0.5	0.015	0.005	0.015	5.0	0.5	0.011	0.005	0.67%	0.67%	0.1	0.34%	0.13%

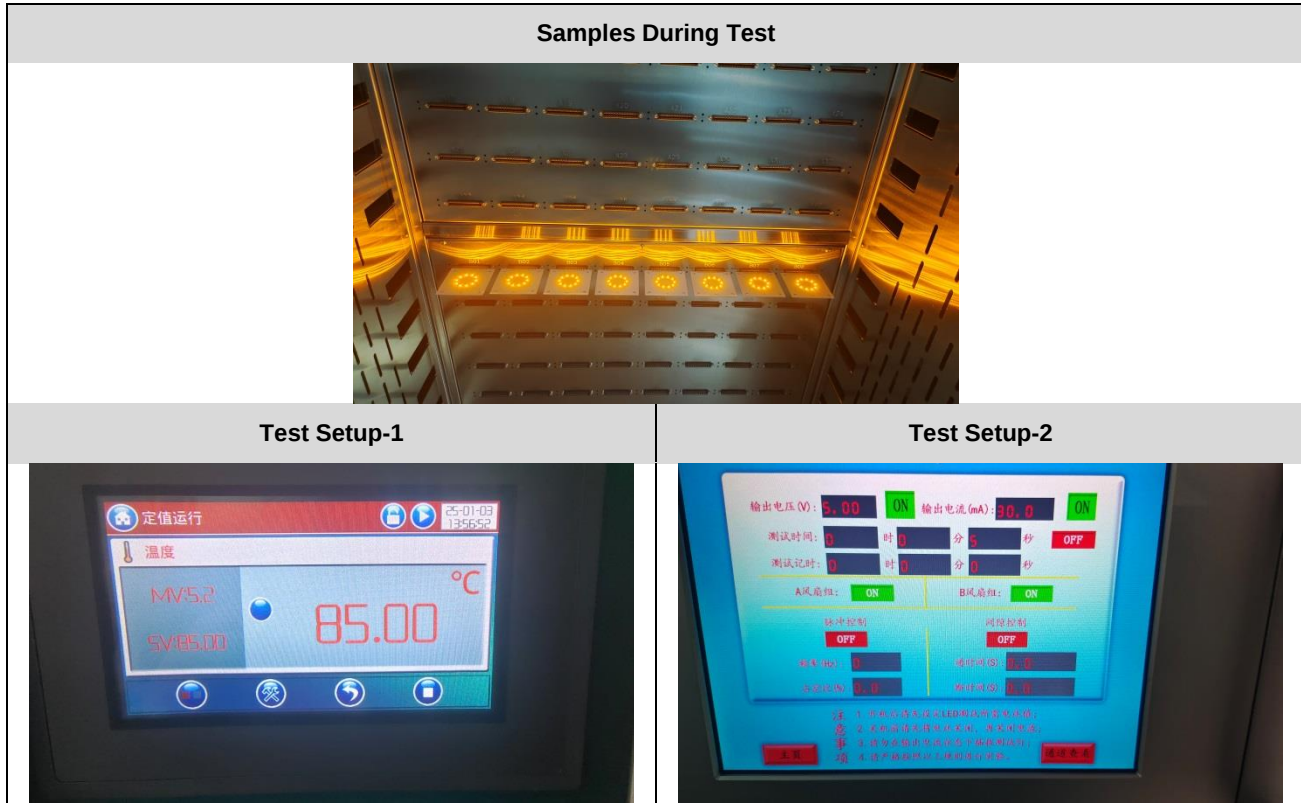
4.7.3.4 HTOL2 Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
HTOL2-B1	2.081	331.5	588.6	2.166	1.897	2.065	344.1	587.8	2.143	1.896	-0.77%	3.80%	-0.8	-1.06%	-0.05%
HTOL2-B2	2.079	336.9	588.8	2.189	1.897	2.072	348.3	588.0	2.163	1.897	-0.34%	3.38%	-0.8	-1.19%	0.00%
HTOL2-B3	2.083	329.3	588.6	2.187	1.899	2.091	341.3	587.8	2.161	1.898	0.38%	3.64%	-0.8	-1.19%	-0.05%
HTOL2-B4	2.108	328.5	589.7	2.155	1.888	2.085	340.9	588.9	2.132	1.887	-1.09%	3.77%	-0.8	-1.07%	-0.05%
HTOL2-B5	2.079	334.6	588.3	2.172	1.901	2.055	343.2	587.7	2.149	1.900	-1.15%	2.57%	-0.6	-1.06%	-0.05%
HTOL2-B6	2.078	334.6	588.5	2.175	1.898	2.098	342.6	587.9	2.152	1.898	0.96%	2.39%	-0.6	-1.06%	0.00%
HTOL2-B7	2.073	321.2	589.9	2.149	1.893	2.059	329.1	589.2	2.137	1.893	-0.68%	2.46%	-0.7	-0.56%	0.00%
HTOL2-B8	2.099	326.6	588.6	2.168	1.900	2.085	334.4	587.9	2.151	1.888	-0.67%	2.39%	-0.7	-0.78%	-0.63%
HTOL2-B9	2.076	329.9	589.0	2.174	1.901	2.060	339.2	588.3	2.160	1.898	-0.77%	2.82%	-0.7	-0.64%	-0.16%
HTOL2-B10	2.074	342.1	590.0	2.146	1.888	2.088	351.4	589.3	2.121	1.887	0.68%	2.72%	-0.7	-1.16%	-0.05%
HTOL2-B11	2.108	332.9	588.4	2.176	1.901	2.092	344.8	587.7	2.155	1.900	-0.76%	3.57%	-0.7	-0.97%	-0.05%
HTOL2-B12	2.107	332.4	588.6	2.195	1.900	2.093	344.0	587.8	2.170	1.900	-0.66%	3.49%	-0.8	-1.14%	0.00%
HTOL2-B13	2.104	332.8	588.3	2.193	1.903	2.102	347.4	587.6	2.169	1.902	-0.10%	4.39%	-0.7	-1.09%	-0.05%
HTOL2-B14	2.070	329.2	589.6	2.160	1.894	2.080	342.7	588.8	2.138	1.894	0.48%	4.10%	-0.8	-1.02%	0.00%
HTOL2-B15	2.079	337.4	588.6	2.166	1.896	2.053	347.9	587.9	2.142	1.896	-1.25%	3.11%	-0.7	-1.11%	0.00%
HTOL2-B16	2.080	340.6	589.2	2.163	1.892	2.082	350.7	588.5	2.139	1.893	0.10%	2.97%	-0.7	-1.11%	0.05%
HTOL2-B17	2.107	333.5	590.2	2.138	1.883	2.110	342.8	589.5	2.125	1.883	0.14%	2.79%	-0.7	-0.61%	0.00%
HTOL2-B18	2.088	331.2	588.9	2.186	1.896	2.071	344.1	588.2	2.159	1.890	-0.81%	3.89%	-0.7	-1.24%	-0.32%
HTOL2-B19	2.099	332.8	588.8	2.186	1.896	2.105	344.0	588.0	2.154	1.896	0.29%	3.37%	-0.8	-1.46%	0.00%
HTOL2-B20	2.076	335.7	589.1	2.156	1.892	2.085	347.0	588.4	2.131	1.892	0.43%	3.37%	-0.7	-1.16%	0.00%
HTOL2-B21	2.079	336.8	588.9	2.166	1.894	2.098	350.8	588.1	2.144	1.895	0.91%	4.16%	-0.8	-1.02%	0.05%
HTOL2-B22	2.079	333.2	589.1	2.180	1.896	2.080	346.6	588.3	2.156	1.896	0.05%	4.02%	-0.8	-1.10%	0.00%
HTOL2-B23	2.078	329.8	588.6	2.185	1.898	2.070	341.9	587.8	2.160	1.898	-0.38%	3.67%	-0.8	-1.14%	0.00%
HTOL2-B24	2.091	326.0	589.0	2.171	1.898	2.108	340.3	588.1	2.149	1.898	0.81%	4.39%	-0.9	-1.01%	0.00%
HTOL2-B25	2.107	337.5	588.8	2.164	1.895	2.087	346.1	588.1	2.143	1.896	-0.95%	2.55%	-0.7	-0.97%	0.05%
HTOL2-B26	2.074	329.5	589.6	2.162	1.890	2.091	336.8	588.8	2.137	1.890	0.82%	2.22%	-0.8	-1.16%	0.00%
Min	2.070	321.2	588.3	2.138	1.883	2.053	329.1	587.6	2.121	1.883	-1.25%	2.22%	-0.9	-1.46%	-0.63%
Max	2.108	342.1	590.2	2.195	1.903	2.110	351.4	589.5	2.170	1.902	0.96%	4.39%	-0.6	-0.56%	0.05%
Average	2.087	332.6	589.0	2.170	1.896	2.083	343.6	588.2	2.148	1.895	-0.17%	3.31%	-0.7	-1.04%	-0.05%
Stdev	0.013	4.6	0.5	0.015	0.005	0.016	5.0	0.5	0.013	0.005	0.71%	0.67%	0.1	0.20%	0.14%

4.7.3.5 HTOL2 Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
HTOL2-C1	2.076	333.5	589.2	2.153	1.889	2.069	346.1	588.5	2.129	1.889	-0.34%	3.78%	-0.7	-1.11%	0.00%
HTOL2-C2	2.105	333.7	589.5	2.170	1.889	2.090	344.2	588.8	2.132	1.891	-0.71%	3.15%	-0.7	-1.75%	0.11%
HTOL2-C3	2.103	334.5	589.2	2.176	1.893	2.086	347.0	588.5	2.141	1.893	-0.81%	3.74%	-0.7	-1.61%	0.00%
HTOL2-C4	2.082	334.0	588.7	2.165	1.896	2.075	346.8	588.0	2.139	1.896	-0.34%	3.83%	-0.7	-1.20%	0.00%
HTOL2-C5	2.084	325.9	589.2	2.165	1.893	2.092	339.4	588.4	2.142	1.893	0.38%	4.14%	-0.8	-1.06%	0.00%
HTOL2-C6	2.089	331.3	589.1	2.182	1.894	2.075	343.3	588.3	2.156	1.894	-0.67%	3.62%	-0.8	-1.19%	0.00%
HTOL2-C7	2.107	324.3	589.0	2.179	1.898	2.071	335.6	588.2	2.152	1.898	-1.71%	3.48%	-0.8	-1.24%	0.00%
HTOL2-C8	2.093	326.6	588.9	2.177	1.896	2.087	342.6	588.0	2.151	1.896	-0.29%	4.90%	-0.9	-1.19%	0.00%
HTOL2-C9	2.083	339.7	588.9	2.161	1.893	2.103	344.6	588.2	2.137	1.893	0.96%	1.44%	-0.7	-1.11%	0.00%
HTOL2-C10	2.093	337.5	589.2	2.162	1.892	2.087	345.5	588.6	2.138	1.892	-0.29%	2.37%	-0.6	-1.11%	0.00%
HTOL2-C11	2.097	337.8	589.2	2.154	1.890	2.070	344.0	588.5	2.130	1.890	-1.29%	1.84%	-0.7	-1.11%	0.00%
HTOL2-C12	2.109	334.6	588.6	2.190	1.898	2.085	343.6	587.9	2.153	1.898	-1.14%	2.69%	-0.7	-1.69%	0.00%
HTOL2-C13	2.096	334.6	589.0	2.175	1.894	2.107	345.3	588.3	2.140	1.894	0.52%	3.20%	-0.7	-1.61%	0.00%
HTOL2-C14	2.082	332.6	588.7	2.164	1.896	2.062	342.6	587.9	2.139	1.896	-0.96%	3.01%	-0.8	-1.16%	0.00%
HTOL2-C15	2.093	332.7	589.0	2.160	1.895	2.104	345.0	588.3	2.138	1.895	0.53%	3.70%	-0.7	-1.02%	0.00%
HTOL2-C16	2.094	329.7	588.9	2.182	1.894	2.105	344.3	588.2	2.159	1.894	0.53%	4.43%	-0.7	-1.05%	0.00%
HTOL2-C17	2.106	326.5	588.8	2.178	1.897	2.084	341.1	588.0	2.151	1.897	-1.04%	4.47%	-0.8	-1.24%	0.00%
HTOL2-C18	2.110	323.7	588.9	2.174	1.895	2.090	334.4	588.0	2.149	1.895	-0.95%	3.31%	-0.9	-1.15%	0.00%
HTOL2-C19	2.085	341.7	589.0	2.154	1.890	2.075	348.1	588.4	2.131	1.890	-0.48%	1.87%	-0.6	-1.07%	0.00%
HTOL2-C20	2.072	338.4	589.0	2.167	1.893	2.066	344.6	588.3	2.144	1.893	-0.29%	1.83%	-0.7	-1.06%	0.00%
HTOL2-C21	2.098	337.7	588.8	2.161	1.894	2.080	345.8	588.1	2.137	1.894	-0.86%	2.40%	-0.7	-1.11%	0.00%
HTOL2-C22	2.109	336.7	588.9	2.177	1.893	2.098	344.6	588.3	2.152	1.890	-0.52%	2.35%	-0.6	-1.15%	-0.16%
HTOL2-C23	2.083	334.8	589.6	2.156	1.891	2.081	343.5	589.0	2.147	1.891	-0.10%	2.60%	-0.6	-0.42%	0.00%
HTOL2-C24	2.075	332.5	588.9	2.162	1.893	2.073	340.1	588.2	2.136	1.893	-0.10%	2.29%	-0.7	-1.20%	0.00%
HTOL2-C25	2.088	335.3	589.0	2.160	1.894	2.071	345.8	588.3	2.138	1.894	-0.81%	3.13%	-0.7	-1.02%	0.00%
HTOL2-C26	2.096	326.8	589.0	2.181	1.895	2.077	337.1	588.2	2.155	1.895	-0.91%	3.15%	-0.8	-1.19%	0.00%
Min	2.072	323.7	588.6	2.153	1.889	2.062	334.4	587.9	2.129	1.889	-1.71%	1.44%	-0.9	-1.75%	-0.16%
Max	2.110	341.7	589.6	2.190	1.898	2.107	348.1	589.0	2.159	1.898	0.96%	4.90%	-0.6	-0.42%	0.11%
Average	2.093	333.0	589.0	2.169	1.894	2.083	343.3	588.3	2.143	1.894	-0.45%	3.10%	-0.7	-1.19%	0.00%
Stdev	0.011	4.9	0.2	0.010	0.002	0.013	3.4	0.3	0.009	0.002	0.64%	0.90%	0.1	0.26%	0.04%

4.7.4 Test Photo



4.8 Pulsed Operating Life(PLT)

4.8.1 Test Information

Sample Size: 3 lots 26 pcs. each

Test period: 2024-12-12 to 2025-01-25

Reference Document: JEDEC JESD22-A108

Power Supply: $I_{\text{pulse}}=100\text{mA}$

Pulse Width: $100\mu\text{s}$

Duty Cycle: 3%

Test Temperature: $T_{\text{solder}}=25^{\circ}\text{C}$

Test Duration: 1000hrs

Electrical Test Point: Initial test/Final test

Acceptance criteria: Per Section 3

4.8.2 Environmental Conditions

Environmental temperature: $(23.7\sim26.4)^{\circ}\text{C}$

Environmental humidity: $(47\sim66)\%\text{RH}$

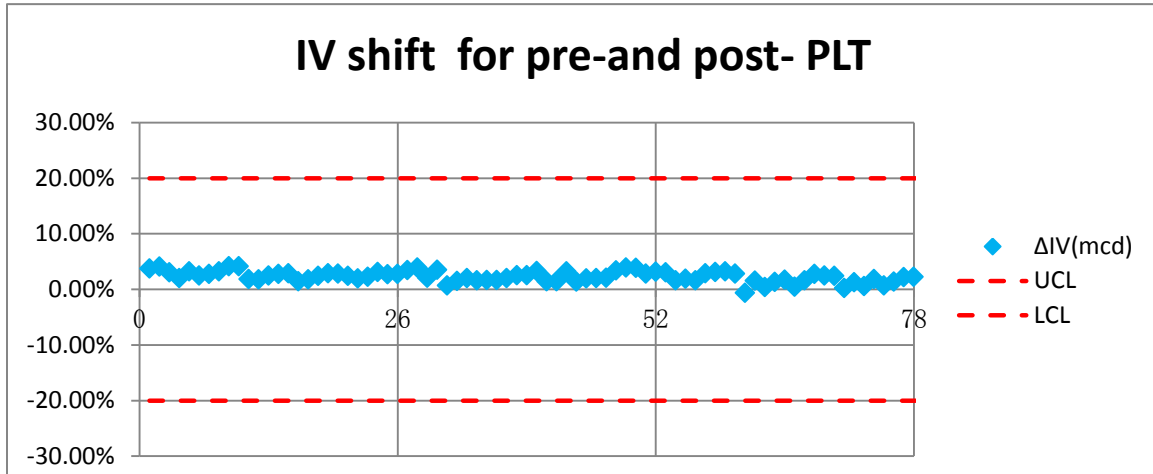
4.8.3 Test Data

4.8.3.1 Test Result for PLT

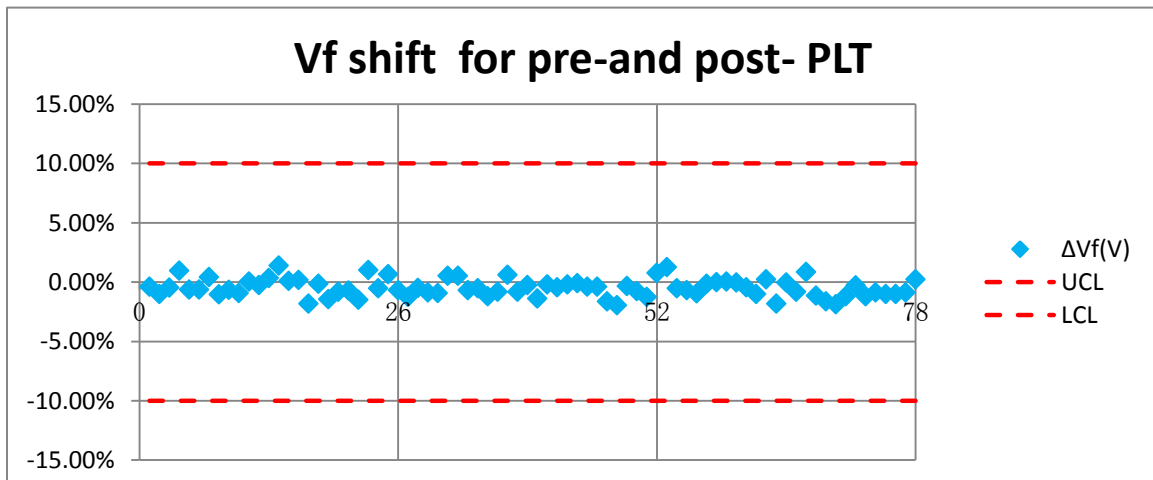
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
B	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
C	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA

4.8.3.2 Summary

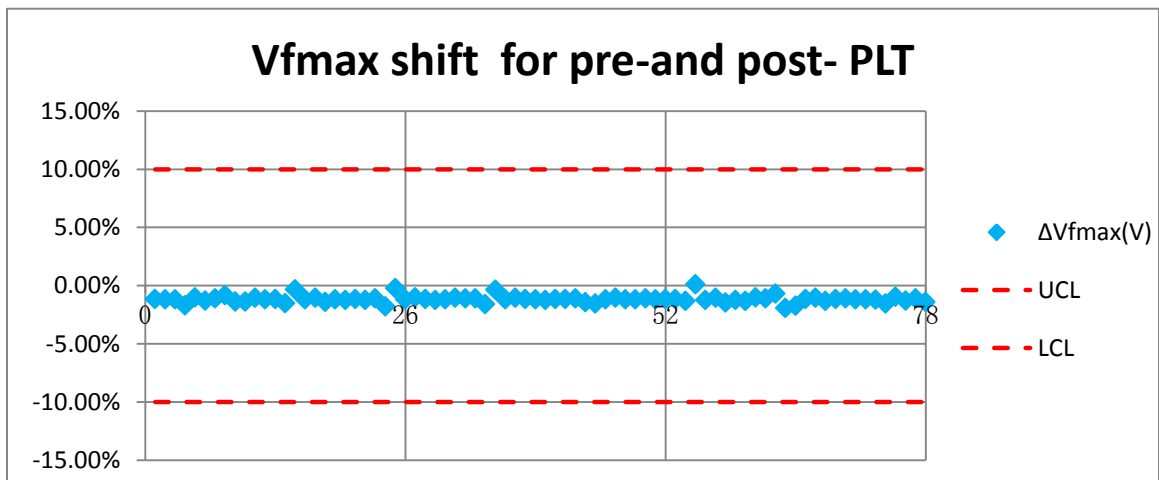
IV shift for pre- and post- PLT test



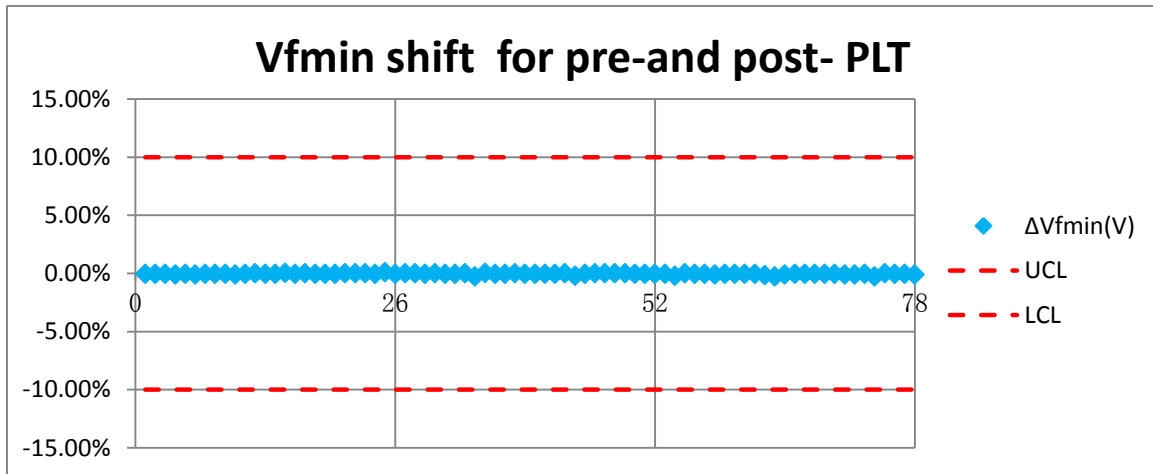
Vf shift for pre- and post- PLT test



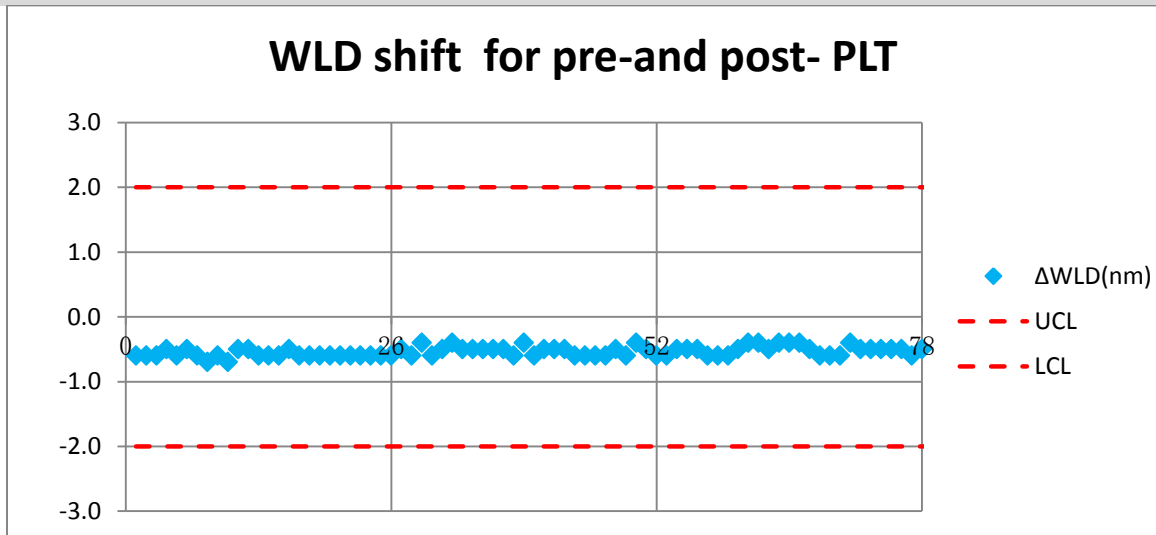
Vf_{max} shift for pre- and post- PLT test



V_{fmin} shift for pre- and post- PLT test



λ_d shift for pre- and post- PLT test



4.8.3.3 PLT Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
PLT-A1	2.093	332.3	588.6	2.170	1.899	2.085	344.6	588.0	2.145	1.898	-0.38%	3.70%	-0.6	-1.15%	-0.05%
PLT-A2	2.107	323.9	588.7	2.173	1.900	2.086	337.1	588.1	2.147	1.899	-1.00%	4.08%	-0.6	-1.20%	-0.05%
PLT-A3	2.103	332.1	588.4	2.178	1.902	2.093	342.2	587.8	2.152	1.901	-0.48%	3.04%	-0.6	-1.19%	-0.05%
PLT-A4	2.089	333.6	589.3	2.175	1.893	2.109	340.3	588.8	2.138	1.891	0.96%	2.01%	-0.5	-1.70%	-0.11%
PLT-A5	2.086	327.1	588.8	2.173	1.898	2.073	337.6	588.2	2.151	1.897	-0.62%	3.21%	-0.6	-1.01%	-0.05%
PLT-A6	2.095	332.5	588.5	2.170	1.901	2.082	340.7	588.0	2.142	1.899	-0.62%	2.47%	-0.5	-1.29%	-0.11%
PLT-A7	2.071	328.3	590.2	2.154	1.888	2.080	337.3	589.6	2.130	1.887	0.43%	2.74%	-0.6	-1.11%	-0.05%
PLT-A8	2.109	319.4	588.5	2.187	1.903	2.087	329.7	587.8	2.169	1.902	-1.04%	3.22%	-0.7	-0.82%	-0.05%
PLT-A9	2.097	330.8	588.6	2.187	1.900	2.083	344.4	588.0	2.157	1.899	-0.67%	4.11%	-0.6	-1.37%	-0.05%
PLT-A10	2.075	325.8	589.0	2.181	1.898	2.056	339.2	588.3	2.151	1.896	-0.92%	4.11%	-0.7	-1.38%	-0.11%
PLT-A11	2.071	333.9	588.5	2.168	1.900	2.072	340.0	588.0	2.145	1.899	0.05%	1.83%	-0.5	-1.06%	-0.05%
PLT-A12	2.089	333.0	588.6	2.175	1.900	2.084	338.9	588.1	2.149	1.900	-0.24%	1.77%	-0.5	-1.20%	0.00%
PLT-A13	2.102	328.6	588.9	2.167	1.897	2.109	336.6	588.3	2.142	1.896	0.33%	2.43%	-0.6	-1.15%	-0.05%
PLT-A14	2.071	336.8	589.0	2.186	1.897	2.100	346.1	588.4	2.153	1.896	1.40%	2.76%	-0.6	-1.51%	-0.05%
PLT-A15	2.093	331.4	589.1	2.169	1.895	2.095	340.9	588.5	2.162	1.896	0.10%	2.87%	-0.6	-0.32%	0.05%
PLT-A16	2.102	328.6	588.9	2.165	1.897	2.106	333.2	588.4	2.139	1.896	0.19%	1.40%	-0.5	-1.20%	-0.05%
PLT-A17	2.101	328.5	589.1	2.165	1.895	2.063	334.3	588.5	2.142	1.895	-1.81%	1.77%	-0.6	-1.06%	0.00%
PLT-A18	2.106	329.0	588.8	2.194	1.899	2.103	336.9	588.2	2.163	1.898	-0.14%	2.40%	-0.6	-1.41%	-0.05%
PLT-A19	2.090	330.1	588.8	2.184	1.901	2.060	339.6	588.2	2.158	1.900	-1.44%	2.88%	-0.6	-1.19%	-0.05%
PLT-A20	2.087	333.5	589.4	2.167	1.892	2.070	342.8	588.8	2.140	1.891	-0.81%	2.79%	-0.6	-1.25%	-0.05%
PLT-A21	2.082	335.5	589.0	2.161	1.894	2.067	343.6	588.4	2.136	1.894	-0.72%	2.41%	-0.6	-1.16%	0.00%
PLT-A22	2.081	337.5	589.0	2.169	1.895	2.050	344.1	588.4	2.142	1.895	-1.49%	1.96%	-0.6	-1.24%	0.00%
PLT-A23	2.076	331.6	588.9	2.164	1.899	2.097	338.9	588.3	2.140	1.899	1.01%	2.20%	-0.6	-1.11%	0.00%
PLT-A24	2.080	336.3	589.1	2.182	1.896	2.069	346.7	588.5	2.143	1.895	-0.53%	3.09%	-0.6	-1.79%	-0.05%
PLT-A25	2.094	335.6	589.3	2.161	1.893	2.108	344.6	588.7	2.156	1.895	0.67%	2.68%	-0.6	-0.23%	0.11%
PLT-A26	2.078	336.7	588.8	2.165	1.899	2.064	345.9	588.2	2.139	1.898	-0.67%	2.73%	-0.6	-1.20%	-0.05%
Min	2.071	319.4	588.4	2.154	1.888	2.050	329.7	587.8	2.130	1.887	-1.81%	1.40%	-0.7	-1.79%	-0.11%
Max	2.109	337.5	590.2	2.194	1.903	2.109	346.7	589.6	2.169	1.902	1.40%	4.11%	-0.5	-0.23%	0.11%
Average	2.090	331.2	588.9	2.173	1.897	2.083	340.2	588.3	2.147	1.897	-0.32%	2.72%	-0.6	-1.17%	-0.04%
Stdev	0.012	4.3	0.4	0.010	0.003	0.017	4.3	0.4	0.009	0.003	0.80%	0.74%	0.1	0.33%	0.05%

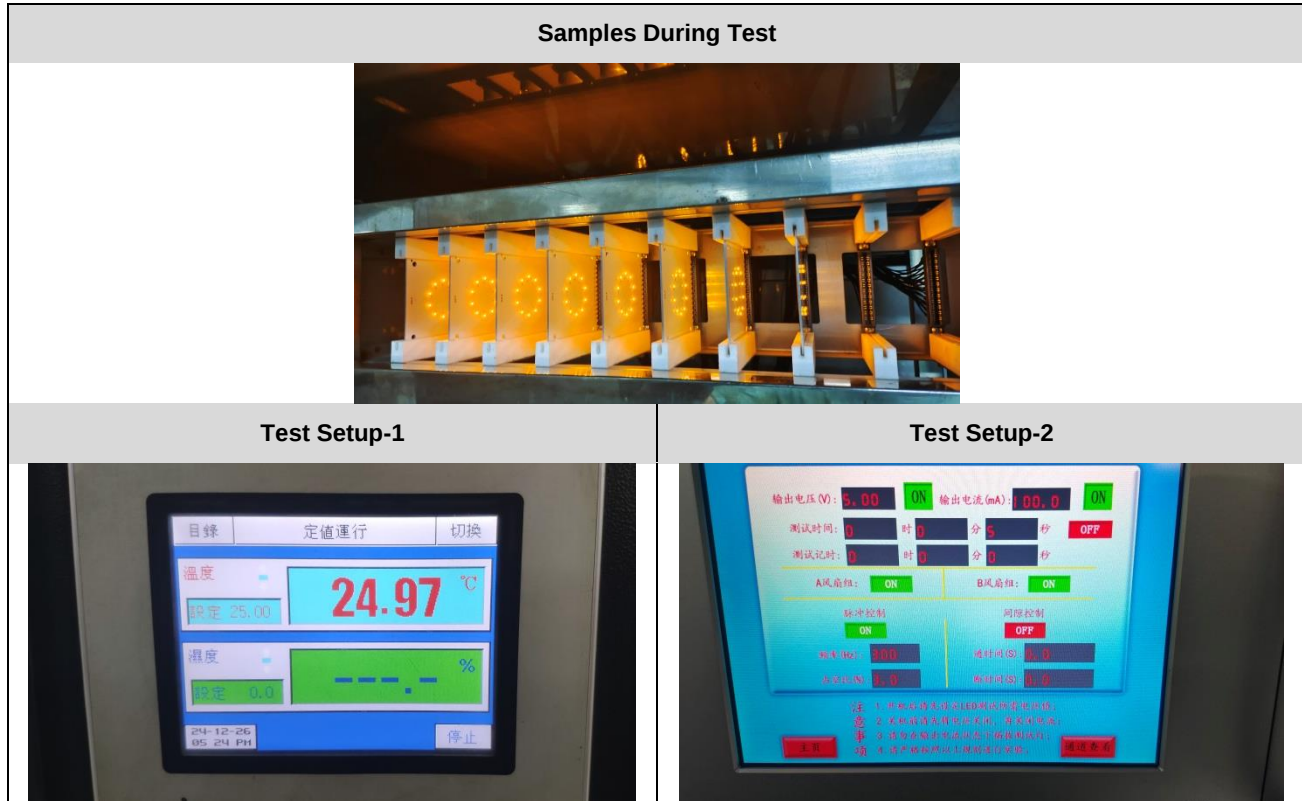
4.8.3.4 PLT Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
PLT-B1	2.093	331.6	588.8	2.165	1.896	2.067	343.0	588.3	2.143	1.896	-1.24%	3.44%	-0.5	-1.02%	0.00%
PLT-B2	2.071	329.3	589.4	2.175	1.894	2.061	342.1	588.8	2.150	1.894	-0.48%	3.89%	-0.6	-1.15%	0.00%
PLT-B3	2.074	334.5	589.2	2.172	1.895	2.056	341.3	588.8	2.145	1.894	-0.87%	2.03%	-0.4	-1.24%	-0.05%
PLT-B4	2.076	332.4	588.5	2.188	1.902	2.057	343.9	587.9	2.162	1.902	-0.92%	3.46%	-0.6	-1.19%	0.00%
PLT-B5	2.090	338.5	589.0	2.161	1.898	2.101	340.8	588.5	2.138	1.897	0.53%	0.68%	-0.5	-1.06%	-0.05%
PLT-B6	2.083	344.8	590.0	2.161	1.890	2.094	349.8	589.6	2.137	1.889	0.53%	1.45%	-0.4	-1.11%	-0.05%
PLT-B7	2.085	330.8	588.8	2.166	1.897	2.071	337.3	588.3	2.142	1.897	-0.67%	1.96%	-0.5	-1.11%	0.00%
PLT-B8	2.107	338.2	590.0	2.175	1.891	2.096	343.5	589.5	2.140	1.886	-0.52%	1.57%	-0.5	-1.61%	-0.26%
PLT-B9	2.080	335.1	588.5	2.180	1.901	2.055	340.6	588.0	2.172	1.902	-1.20%	1.64%	-0.5	-0.37%	0.05%
PLT-B10	2.071	327.0	588.6	2.172	1.900	2.054	332.3	588.1	2.146	1.899	-0.82%	1.62%	-0.5	-1.20%	-0.05%
PLT-B11	2.090	325.8	588.9	2.169	1.897	2.103	332.3	588.4	2.146	1.896	0.62%	2.00%	-0.5	-1.06%	-0.05%
PLT-B12	2.074	334.4	589.6	2.179	1.895	2.057	342.8	589.0	2.154	1.895	-0.82%	2.51%	-0.6	-1.15%	0.00%
PLT-B13	2.081	326.6	588.7	2.189	1.901	2.076	334.8	588.3	2.163	1.900	-0.24%	2.51%	-0.4	-1.19%	-0.05%
PLT-B14	2.098	323.7	589.0	2.178	1.897	2.069	334.3	588.4	2.151	1.896	-1.38%	3.27%	-0.6	-1.24%	-0.05%
PLT-B15	2.095	335.7	588.4	2.172	1.901	2.091	340.5	587.9	2.147	1.900	-0.19%	1.43%	-0.5	-1.15%	-0.05%
PLT-B16	2.078	327.2	589.8	2.156	1.894	2.069	331.8	589.3	2.131	1.893	-0.43%	1.41%	-0.5	-1.16%	-0.05%
PLT-B17	2.106	331.3	589.7	2.152	1.891	2.102	341.8	589.2	2.128	1.891	-0.19%	3.17%	-0.5	-1.12%	0.00%
PLT-B18	2.105	335.8	589.2	2.177	1.894	2.103	340.4	588.6	2.146	1.890	-0.10%	1.37%	-0.6	-1.42%	-0.21%
PLT-B19	2.092	330.5	588.9	2.193	1.898	2.084	336.9	588.3	2.159	1.897	-0.38%	1.94%	-0.6	-1.55%	-0.05%
PLT-B20	2.071	334.8	588.5	2.172	1.900	2.063	341.5	587.9	2.146	1.900	-0.39%	2.00%	-0.6	-1.20%	0.00%
PLT-B21	2.097	332.8	589.3	2.161	1.893	2.063	339.7	588.7	2.138	1.893	-1.62%	2.07%	-0.6	-1.06%	0.00%
PLT-B22	2.093	329.2	588.5	2.197	1.901	2.052	340.3	588.0	2.171	1.901	-1.96%	3.37%	-0.5	-1.18%	0.00%
PLT-B23	2.086	326.4	588.8	2.185	1.898	2.079	339.0	588.2	2.159	1.898	-0.34%	3.86%	-0.6	-1.19%	0.00%
PLT-B24	2.073	334.5	588.7	2.182	1.900	2.057	347.4	588.3	2.158	1.899	-0.77%	3.86%	-0.4	-1.10%	-0.05%
PLT-B25	2.086	336.2	588.4	2.174	1.900	2.060	345.6	587.9	2.148	1.899	-1.25%	2.80%	-0.5	-1.20%	-0.05%
PLT-B26	2.081	334.5	589.0	2.170	1.896	2.097	345.0	588.4	2.145	1.895	0.77%	3.14%	-0.6	-1.15%	-0.05%
Min	2.071	323.7	588.4	2.152	1.890	2.052	331.8	587.9	2.128	1.886	-1.96%	0.68%	-0.6	-1.61%	-0.26%
Max	2.107	344.8	590.0	2.197	1.902	2.103	349.8	589.6	2.172	1.902	0.77%	3.89%	-0.4	-0.37%	0.05%
Average	2.086	332.4	589.0	2.174	1.897	2.075	340.3	588.5	2.149	1.896	-0.55%	2.40%	-0.5	-1.16%	-0.04%
Stdev	0.011	4.8	0.5	0.011	0.003	0.018	4.6	0.5	0.011	0.004	0.69%	0.93%	0.1	0.21%	0.07%

4.8.3.5 PLT Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
PLT-C1	2.068	332.6	588.5	2.174	1.901	2.094	342.7	587.9	2.149	1.900	1.26%	3.04%	-0.6	-1.15%	-0.05%
PLT-C2	2.103	329.3	589.0	2.176	1.897	2.092	334.6	588.5	2.147	1.893	-0.52%	1.61%	-0.5	-1.33%	-0.21%
PLT-C3	2.074	334.0	589.1	2.185	1.895	2.060	340.3	588.6	2.187	1.895	-0.68%	1.89%	-0.5	0.09%	0.00%
PLT-C4	2.107	339.1	590.0	2.155	1.890	2.087	344.5	589.5	2.128	1.889	-0.95%	1.59%	-0.5	-1.25%	-0.05%
PLT-C5	2.088	330.8	588.4	2.175	1.901	2.085	340.2	587.8	2.152	1.900	-0.14%	2.84%	-0.6	-1.06%	-0.05%
PLT-C6	2.106	334.6	588.5	2.203	1.904	2.106	345.0	587.9	2.171	1.902	0.00%	3.11%	-0.6	-1.45%	-0.11%
PLT-C7	2.073	337.6	589.9	2.166	1.890	2.074	348.3	589.3	2.139	1.889	0.05%	3.17%	-0.6	-1.25%	-0.05%
PLT-C8	2.081	338.4	588.5	2.187	1.902	2.080	347.9	588.0	2.158	1.901	-0.05%	2.81%	-0.5	-1.33%	-0.05%
PLT-C9	2.099	338.2	589.5	2.148	1.893	2.090	336.0	589.1	2.126	1.892	-0.43%	-0.65%	-0.4	-1.02%	-0.05%
PLT-C10	2.108	337.6	588.9	2.170	1.896	2.087	342.7	588.5	2.146	1.895	-1.00%	1.51%	-0.4	-1.11%	-0.05%
PLT-C11	2.100	335.4	590.2	2.164	1.885	2.105	336.7	589.7	2.149	1.882	0.24%	0.39%	-0.5	-0.69%	-0.16%
PLT-C12	2.103	331.9	588.8	2.181	1.898	2.065	336.3	588.4	2.139	1.893	-1.81%	1.33%	-0.4	-1.93%	-0.26%
PLT-C13	2.077	333.7	588.5	2.198	1.901	2.076	339.4	588.1	2.160	1.899	-0.05%	1.71%	-0.4	-1.73%	-0.11%
PLT-C14	2.105	336.5	589.9	2.143	1.887	2.088	338.0	589.5	2.118	1.886	-0.81%	0.45%	-0.4	-1.17%	-0.05%
PLT-C15	2.076	329.2	588.5	2.176	1.900	2.094	334.4	588.0	2.153	1.899	0.87%	1.58%	-0.5	-1.06%	-0.05%
PLT-C16	2.109	330.5	589.4	2.179	1.892	2.085	339.5	588.8	2.150	1.891	-1.14%	2.72%	-0.6	-1.33%	-0.05%
PLT-C17	2.098	334.5	589.4	2.172	1.893	2.064	342.7	588.8	2.147	1.892	-1.62%	2.45%	-0.6	-1.15%	-0.05%
PLT-C18	2.095	329.0	589.7	2.164	1.892	2.056	336.9	589.1	2.140	1.891	-1.86%	2.40%	-0.6	-1.11%	-0.05%
PLT-C19	2.086	342.4	588.3	2.176	1.902	2.061	343.1	587.9	2.150	1.900	-1.20%	0.20%	-0.4	-1.19%	-0.11%
PLT-C20	2.078	339.9	589.0	2.167	1.895	2.072	344.1	588.5	2.141	1.893	-0.29%	1.24%	-0.5	-1.20%	-0.11%
PLT-C21	2.105	334.6	589.1	2.159	1.894	2.080	336.4	588.6	2.133	1.893	-1.19%	0.54%	-0.5	-1.20%	-0.05%
PLT-C22	2.094	334.8	588.6	2.193	1.900	2.076	340.8	588.1	2.159	1.895	-0.86%	1.79%	-0.5	-1.55%	-0.26%
PLT-C23	2.096	333.8	589.2	2.187	1.899	2.075	336.1	588.7	2.166	1.899	-1.00%	0.69%	-0.5	-0.96%	0.00%
PLT-C24	2.106	338.1	589.2	2.158	1.893	2.085	342.7	588.7	2.130	1.892	-1.00%	1.36%	-0.5	-1.30%	-0.05%
PLT-C25	2.076	336.9	589.3	2.160	1.893	2.058	344.1	588.7	2.136	1.892	-0.87%	2.14%	-0.6	-1.11%	-0.05%
PLT-C26	2.076	335.6	589.0	2.187	1.896	2.081	343.1	588.5	2.156	1.894	0.24%	2.23%	-0.5	-1.42%	-0.11%
Min	2.068	329.0	588.3	2.143	1.885	2.056	334.4	587.8	2.118	1.882	-1.86%	-0.65%	-0.6	-1.93%	-0.26%
Max	2.109	342.4	590.2	2.203	1.904	2.106	348.3	589.7	2.187	1.902	1.26%	3.17%	-0.4	0.09%	0.00%
Average	2.092	335.0	589.1	2.173	1.896	2.080	340.6	588.6	2.147	1.894	-0.57%	1.70%	-0.5	-1.19%	-0.09%
Stdev	0.013	3.5	0.5	0.015	0.005	0.014	4.0	0.5	0.015	0.005	0.76%	1.00%	0.1	0.36%	0.07%

4.8.4 Test Photo



4.9 Destructive Physical Analysis(DPA)

4.9.1 Test Information

Sample size:	2 random samples for the samples after TC, PTC, HTOL1, HTOL2, WHTOL1, WHTOL2, H2S and FMG test,16 samples total.
Test period:	2025-02-14 to 2025-02-16
Reference document:	AEC Q102 RevA April 6 2020 Appendix 6
Power supply:	No applicable
Test point:	No applicable
Acceptance criteria:	Per Section 3

4.9.2 Environmental Conditions

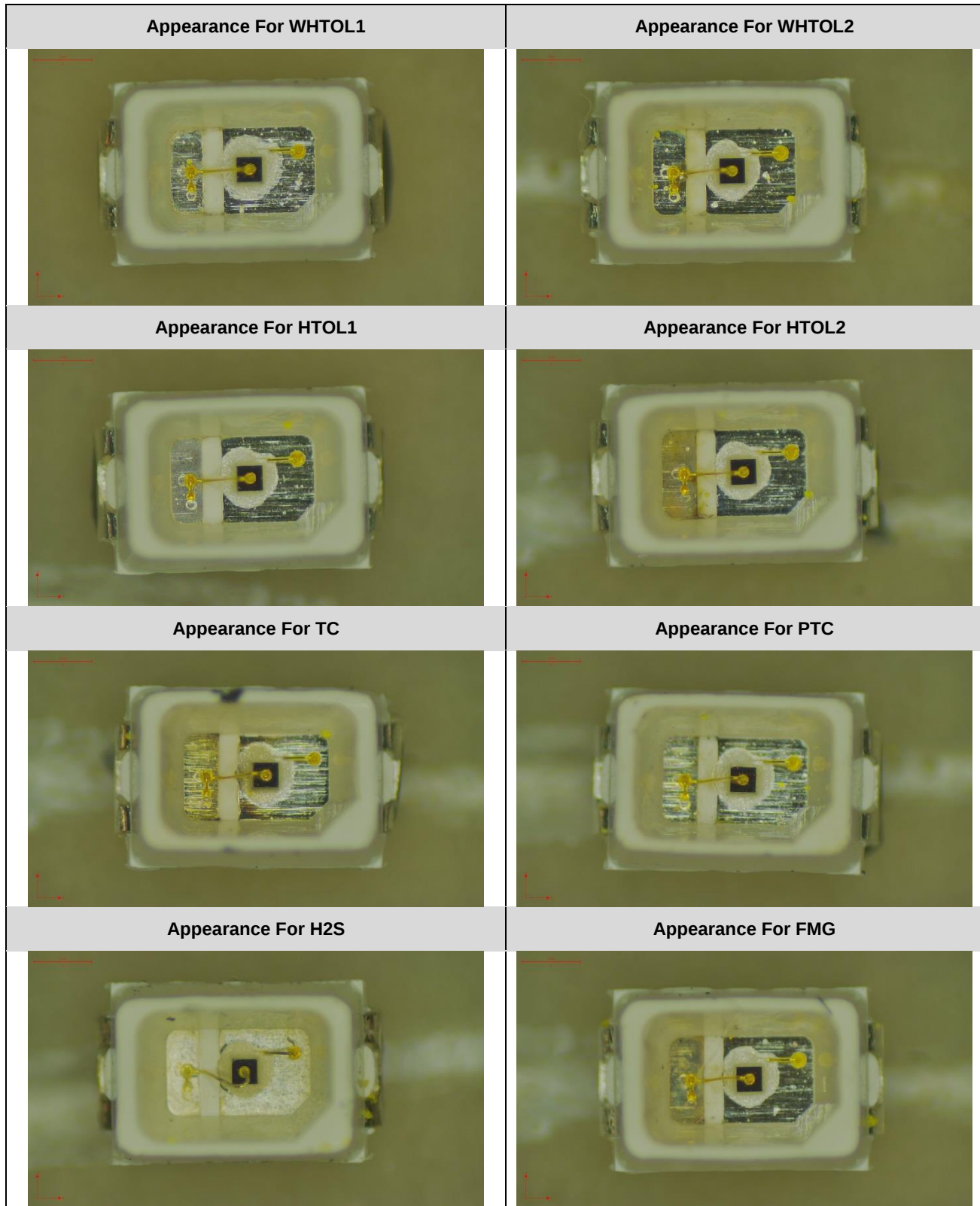
Environmental temperature:	(21.5~25.9)°C
Environmental humidity:	(47~65)%RH

4.9.3 Test Result

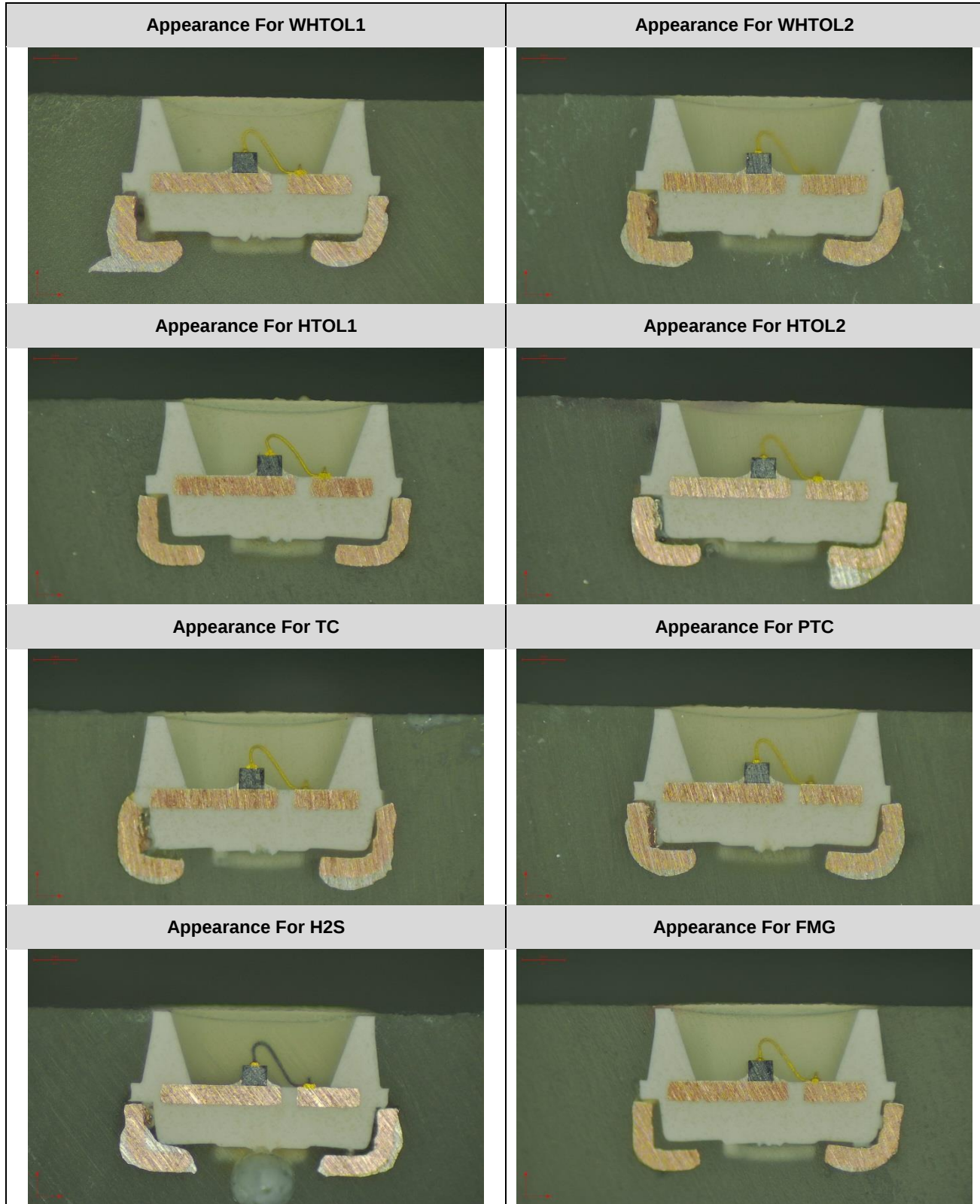
Test Item	De-Capsulation	Cross section
WHTOL1	Pass	Pass
WHTOL2	Pass	Pass
HTOL1	Pass	Pass
HTOL2	Pass	Pass
TC	Pass	Pass
PTC	Pass	Pass
H2S	Pass	Pass
FMG	Pass	Pass

4.9.4 Test Photo

4.9.4.1 Test Photos after De-Capsulation



4.9.4.2 Test Photos after Cross section



4.10 Physical Dimension(PD)

4.10.1 Test Information

Sample size: 3 lots 10 pcs. each

Test period: 2024-12-13 to 2024-12-23

Reference document: JEDEC JESD22-B100

Power supply: No applicable

Test point: No applicable

Acceptance criteria: Per Section 3

4.10.2 Environmental Conditions

Environmental temperature: (24.0~26.2)°C

Environmental humidity: (46~58)%RH

4.10.3 Test Data

4.10.3.1 Test Result

Test Item	Tested Samples (pcs)	Number of pass samples (pcs)	Number of failed samples (pcs)
PD	30	30	0

4.10.3.2 PD Data(Lot A)

Lot A			
Unit: mm			
Spec size	1	2	3
	2.20±0.25	1.40±0.25	1.30±0.25
PD-A1	2.21	1.40	1.32
PD-A2	2.22	1.42	1.28
PD-A3	2.22	1.39	1.28
PD-A4	2.19	1.39	1.30
PD-A5	2.22	1.39	1.30
PD-A6	2.21	1.41	1.30
PD-A7	2.22	1.42	1.31
PD-A8	2.20	1.40	1.32
PD-A9	2.22	1.41	1.29
PD-A10	2.22	1.41	1.26
Min	2.19	1.39	1.26
Max	2.22	1.42	1.32
Average	2.21	1.40	1.30
Stdev	0.01	0.01	0.02

4.10.3.3PD Data(Lot B)

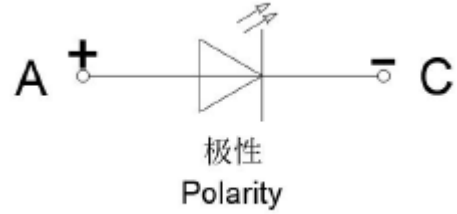
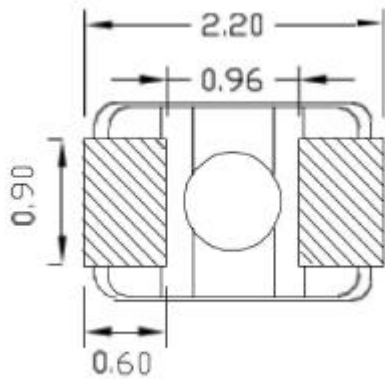
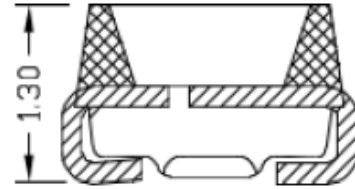
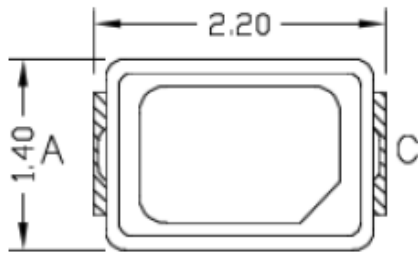
Lot B			
Unit: mm			
Spec size	1	2	3
	2.20±0.25	1.40±0.25	1.30±0.25
PD-B1	2.22	1.40	1.25
PD-B2	2.22	1.40	1.30
PD-B3	2.23	1.40	1.29
PD-B4	2.23	1.40	1.30
PD-B5	2.22	1.40	1.29
PD-B6	2.23	1.40	1.32
PD-B7	2.22	1.41	1.28
PD-B8	2.22	1.40	1.31
PD-B9	2.20	1.41	1.28
PD-B10	2.22	1.40	1.28
Min	2.20	1.40	1.25
Max	2.23	1.41	1.32
Average	2.22	1.40	1.29
Stdev	0.01	0.00	0.02

4.10.3.4PD Data(Lot C)

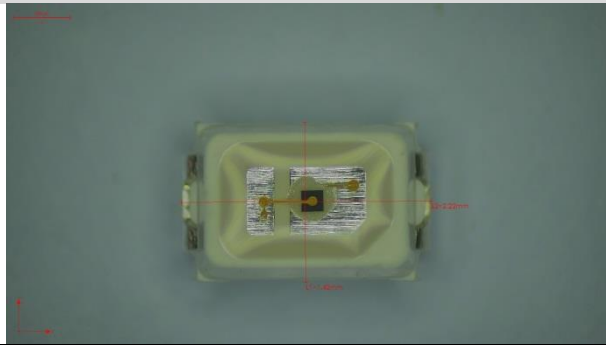
Lot C			
Unit: mm			
Spec size	1	2	3
	2.20±0.25	1.40±0.25	1.30±0.25
PD-C1	2.22	1.41	1.30
PD-C2	2.21	1.40	1.30
PD-C3	2.20	1.40	1.28
PD-C4	2.21	1.39	1.30
PD-C5	2.22	1.40	1.30
PD-C6	2.20	1.38	1.30
PD-C7	2.19	1.39	1.29
PD-C8	2.23	1.40	1.29
PD-C9	2.22	1.40	1.31
PD-C10	2.22	1.42	1.30
Min	2.19	1.38	1.28
Max	2.23	1.42	1.31
Average	2.21	1.40	1.30
Stdev	0.01	0.01	0.01

4.10.4 Test Photo

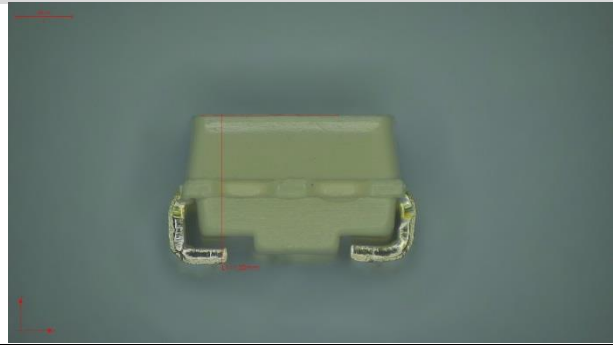
Size In Specification



Test Setup-1



Test Setup-2



4.11 Dew(DEW)

4.11.1 Test Information

Sample size: 3 lots 26 pcs. each

Test period: 2024-12-16 to 2024-12-21

Reference document: AEC-Q102-001

Power supply: IF=2mA

Test duration: 10 cycles(6.5hrs/cycle)

Test point: Initial test/Final test

Acceptance criteria: Per Section 3

4.11.2 Environmental Conditions

Environmental temperature: (25.4~25.8)°C

Environmental humidity: (52~55)%RH

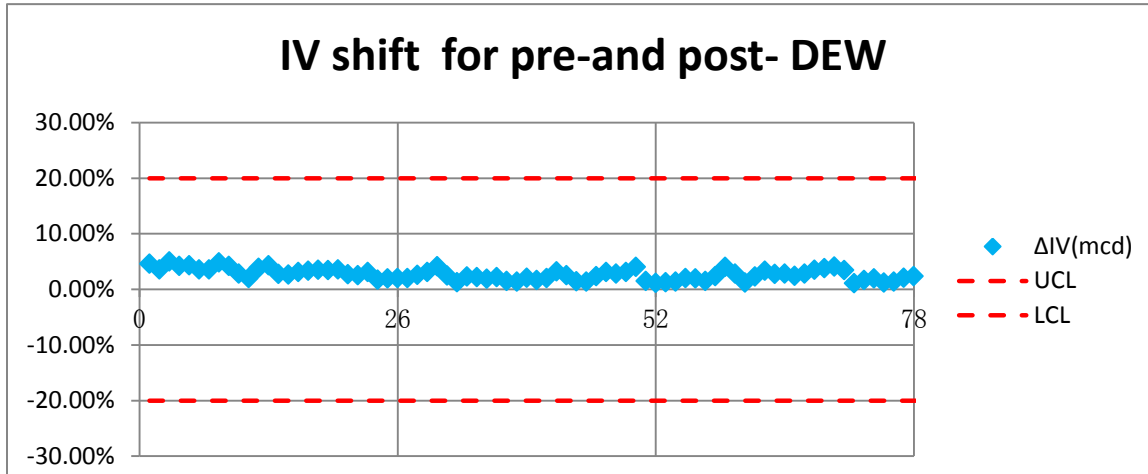
4.11.3 Test Data

4.11.3.1 Test Result for DEW

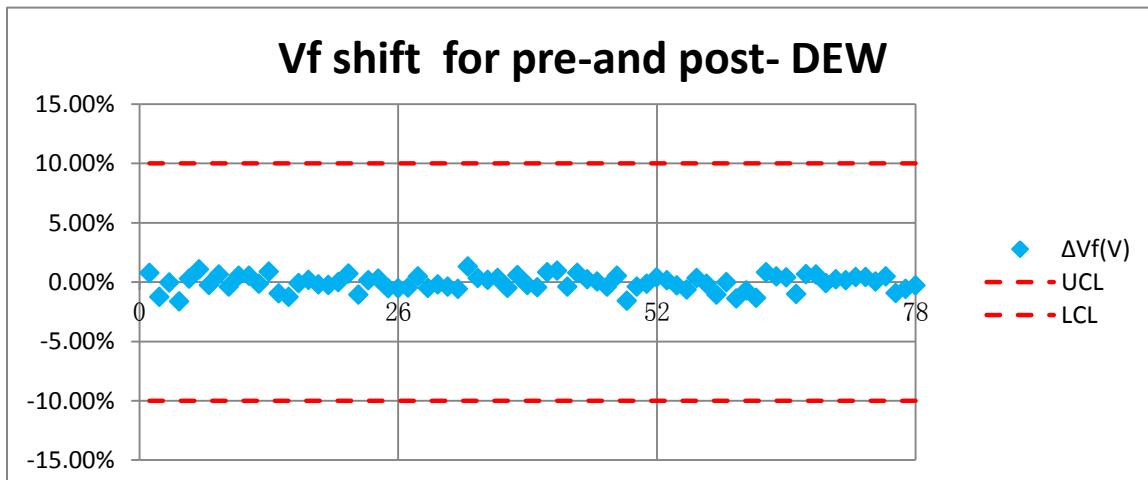
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
B	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
C	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA

4.11.3.2 Summary

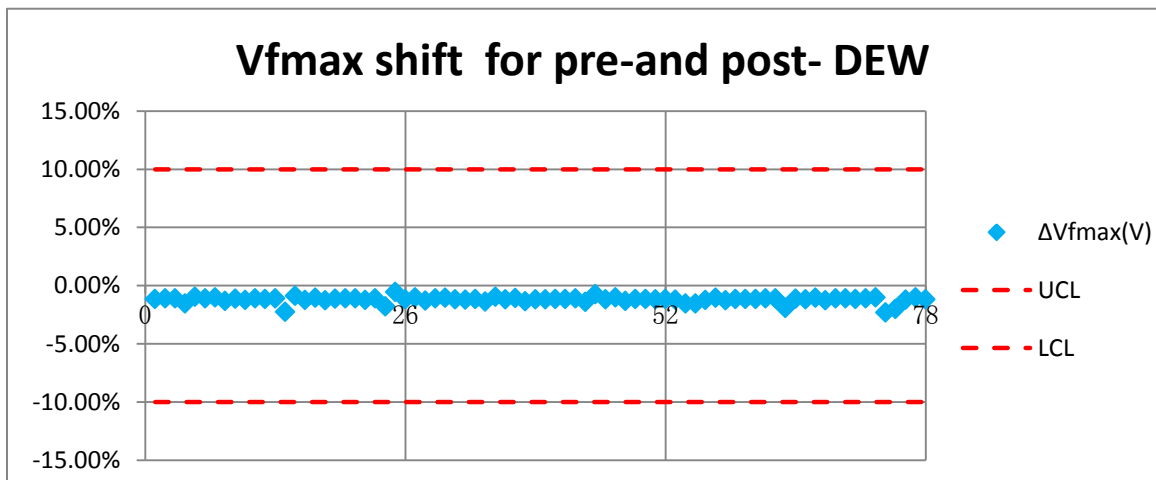
IV shift for pre- and post- DEW test



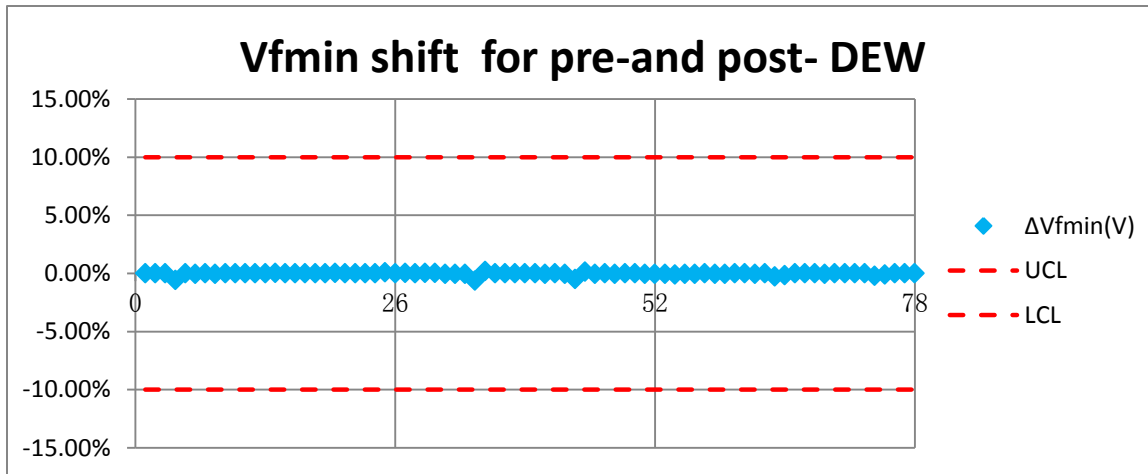
Vf shift for pre- and post- DEW test



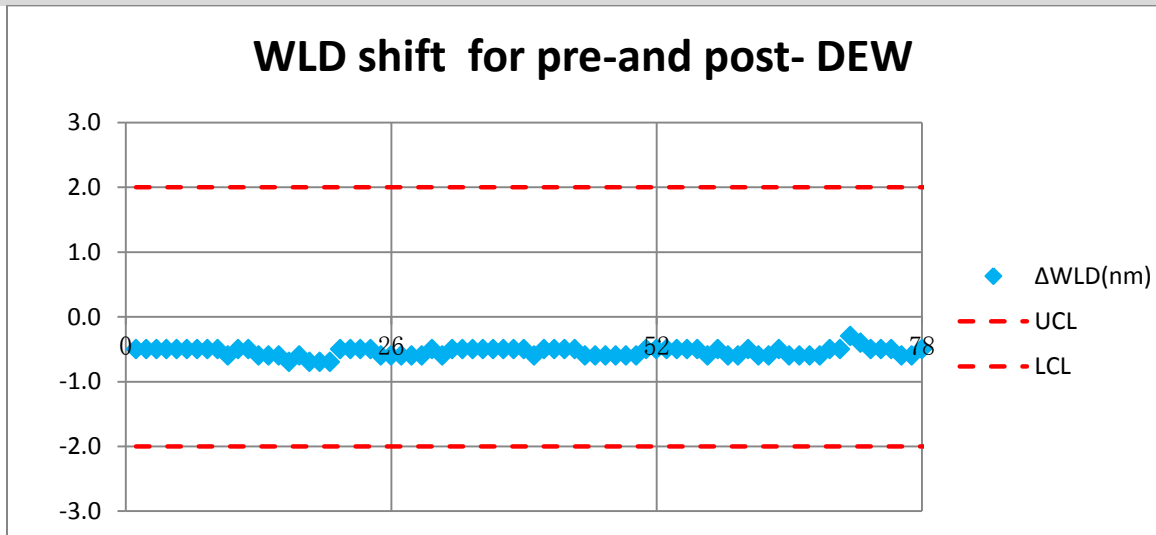
Vf_{max} shift for pre- and post- DEW test



V_{fmin} shift for pre- and post- DEW test



λ_d shift for pre- and post- DEW test



4.11.3.3DEW Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
DEW-A1	2.067	330.3	589.8	2.150	1.888	2.083	345.5	589.3	2.125	1.888	0.77%	4.60%	-0.5	-1.16%	0.00%
DEW-A2	2.082	329.6	589.5	2.161	1.895	2.056	341.2	589.0	2.137	1.895	-1.25%	3.52%	-0.5	-1.11%	0.00%
DEW-A3	2.068	326.9	588.6	2.166	1.898	2.067	343.1	588.1	2.142	1.898	-0.05%	4.96%	-0.5	-1.11%	0.00%
DEW-A4	2.087	323.5	588.5	2.194	1.902	2.053	337.0	588.0	2.160	1.891	-1.63%	4.17%	-0.5	-1.55%	-0.58%
DEW-A5	2.076	329.7	588.5	2.186	1.901	2.082	343.8	588.0	2.165	1.901	0.29%	4.28%	-0.5	-0.96%	0.00%
DEW-A6	2.064	302.5	589.5	2.154	1.896	2.086	313.3	589.0	2.130	1.895	1.07%	3.57%	-0.5	-1.11%	-0.05%
DEW-A7	2.072	332.6	589.3	2.160	1.893	2.067	344.3	588.8	2.138	1.893	-0.24%	3.52%	-0.5	-1.02%	0.00%
DEW-A8	2.071	333.5	589.2	2.184	1.896	2.084	349.6	588.7	2.155	1.895	0.63%	4.83%	-0.5	-1.33%	-0.05%
DEW-A9	2.078	329.5	588.8	2.181	1.899	2.070	343.3	588.3	2.156	1.899	-0.38%	4.19%	-0.5	-1.15%	0.00%
DEW-A10	2.076	335.2	589.2	2.173	1.894	2.087	344.6	588.6	2.146	1.894	0.53%	2.80%	-0.6	-1.24%	0.00%
DEW-A11	2.061	337.5	588.5	2.168	1.897	2.072	344.3	588.0	2.144	1.897	0.53%	2.01%	-0.5	-1.11%	0.00%
DEW-A12	2.061	333.8	589.0	2.164	1.896	2.058	346.6	588.5	2.139	1.896	-0.15%	3.83%	-0.5	-1.16%	0.00%
DEW-A13	2.067	334.5	588.9	2.159	1.896	2.085	348.9	588.3	2.135	1.896	0.87%	4.30%	-0.6	-1.11%	0.00%
DEW-A14	2.081	334.3	589.5	2.180	1.893	2.061	343.4	588.9	2.131	1.894	-0.96%	2.72%	-0.6	-2.25%	0.05%
DEW-A15	2.083	333.2	589.4	2.156	1.893	2.057	341.9	588.8	2.137	1.893	-1.25%	2.61%	-0.6	-0.88%	0.00%
DEW-A16	2.063	333.2	588.5	2.170	1.900	2.061	343.4	587.8	2.143	1.900	-0.10%	3.06%	-0.7	-1.24%	0.00%
DEW-A17	2.068	332.8	588.8	2.163	1.895	2.072	343.9	588.2	2.140	1.895	0.19%	3.34%	-0.6	-1.06%	0.00%
DEW-A18	2.074	334.9	589.2	2.183	1.894	2.070	346.5	588.5	2.155	1.894	-0.19%	3.46%	-0.7	-1.28%	0.00%
DEW-A19	2.073	332.0	588.8	2.184	1.898	2.068	343.4	588.1	2.159	1.898	-0.24%	3.43%	-0.7	-1.14%	0.00%
DEW-A20	2.076	334.1	589.0	2.172	1.894	2.076	346.0	588.3	2.148	1.895	0.00%	3.56%	-0.7	-1.10%	0.05%
DEW-A21	2.068	336.9	589.2	2.154	1.891	2.083	345.9	588.7	2.130	1.891	0.73%	2.67%	-0.5	-1.11%	0.00%
DEW-A22	2.089	336.0	589.6	2.158	1.890	2.067	344.4	589.1	2.131	1.890	-1.05%	2.50%	-0.5	-1.25%	0.00%
DEW-A23	2.061	325.0	589.0	2.160	1.894	2.064	335.0	588.5	2.136	1.894	0.15%	3.08%	-0.5	-1.11%	0.00%
DEW-A24	2.073	333.9	589.0	2.179	1.895	2.079	339.6	588.5	2.140	1.895	0.29%	1.71%	-0.5	-1.79%	0.00%
DEW-A25	2.077	335.2	589.0	2.169	1.895	2.066	341.7	588.4	2.157	1.897	-0.53%	1.94%	-0.6	-0.55%	0.11%
DEW-A26	2.068	335.5	588.6	2.169	1.899	2.057	342.2	588.0	2.143	1.899	-0.53%	2.00%	-0.6	-1.20%	0.00%
Min	2.061	302.5	588.5	2.150	1.888	2.053	313.3	587.8	2.125	1.888	-1.63%	1.71%	-0.7	-2.25%	-0.58%
Max	2.089	337.5	589.8	2.194	1.902	2.087	349.6	589.3	2.165	1.901	1.07%	4.96%	-0.5	-0.55%	0.11%
Average	2.072	331.4	589.0	2.169	1.895	2.070	342.4	588.5	2.143	1.895	-0.10%	3.33%	-0.6	-1.20%	-0.02%
Stdev	0.008	6.8	0.4	0.012	0.003	0.011	6.7	0.4	0.011	0.003	0.71%	0.91%	0.1	0.30%	0.12%

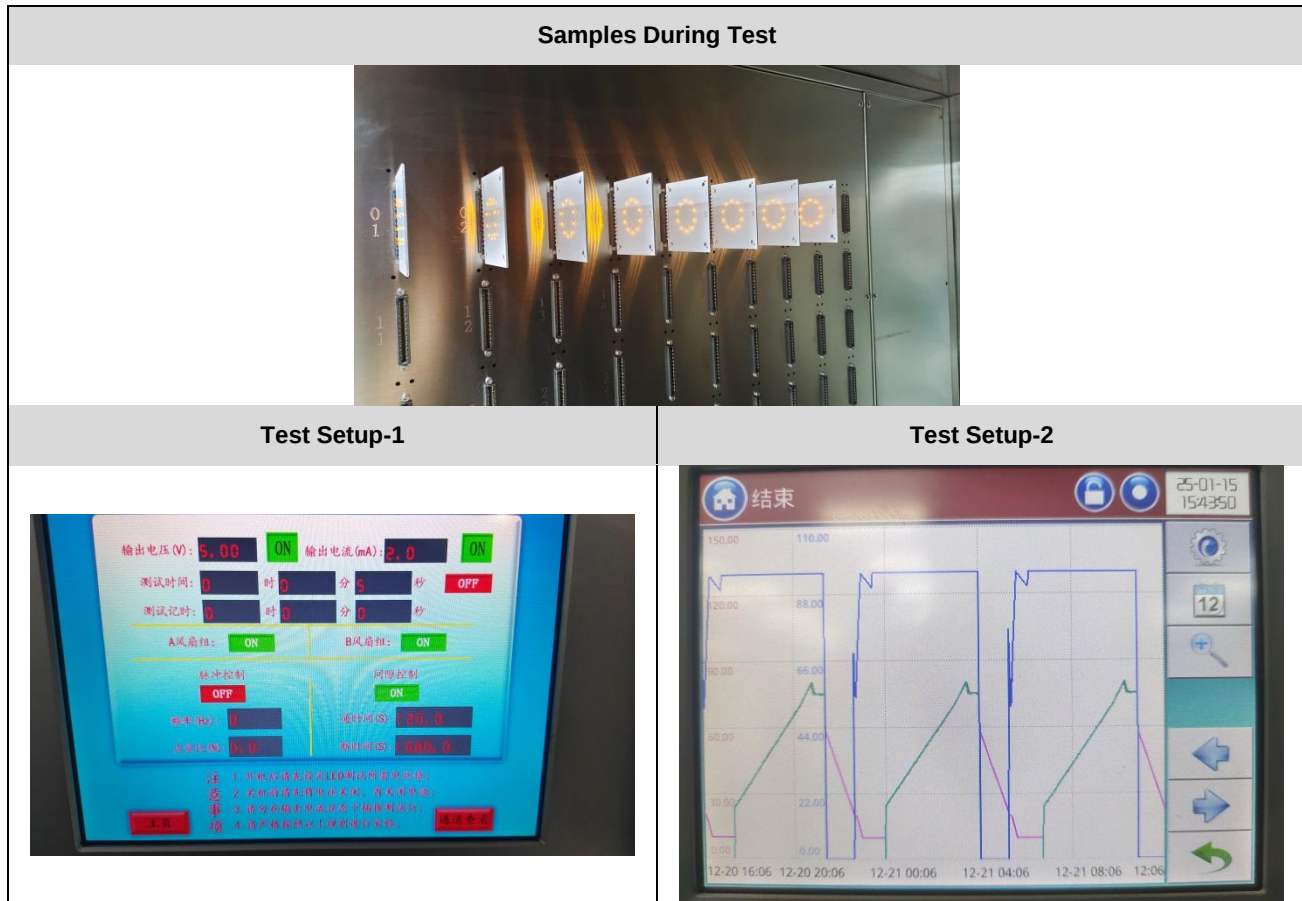
4.11.3.4DEW Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
DEW-B1	2.088	327.6	589.6	2.152	1.888	2.078	334.1	589.0	2.130	1.889	-0.48%	1.98%	-0.6	-1.02%	0.05%
DEW-B2	2.064	329.8	589.3	2.180	1.893	2.074	338.3	588.7	2.152	1.893	0.48%	2.58%	-0.6	-1.28%	0.00%
DEW-B3	2.082	330.1	590.1	2.159	1.886	2.072	340.2	589.5	2.135	1.887	-0.48%	3.06%	-0.6	-1.11%	0.05%
DEW-B4	2.064	326.8	588.5	2.183	1.900	2.060	340.2	588.0	2.160	1.901	-0.19%	4.10%	-0.5	-1.05%	0.05%
DEW-B5	2.072	336.1	588.4	2.174	1.900	2.064	344.3	587.8	2.148	1.899	-0.39%	2.44%	-0.6	-1.20%	-0.05%
DEW-B6	2.079	334.0	589.1	2.163	1.893	2.067	338.1	588.6	2.137	1.892	-0.58%	1.23%	-0.5	-1.20%	-0.05%
DEW-B7	2.060	331.4	588.8	2.161	1.897	2.087	338.9	588.3	2.136	1.896	1.31%	2.26%	-0.5	-1.16%	-0.05%
DEW-B8	2.062	333.7	588.5	2.187	1.901	2.069	340.9	588.0	2.157	1.889	0.34%	2.16%	-0.5	-1.37%	-0.63%
DEW-B9	2.080	333.2	588.7	2.171	1.897	2.084	339.5	588.2	2.150	1.901	0.19%	1.89%	-0.5	-0.97%	0.21%
DEW-B10	2.076	341.1	588.7	2.167	1.898	2.083	348.5	588.2	2.141	1.898	0.34%	2.17%	-0.5	-1.20%	0.00%
DEW-B11	2.078	341.3	590.1	2.156	1.888	2.068	346.3	589.6	2.133	1.888	-0.48%	1.46%	-0.5	-1.07%	0.00%
DEW-B12	2.073	327.2	588.5	2.198	1.902	2.085	331.6	588.0	2.168	1.902	0.58%	1.34%	-0.5	-1.36%	0.00%
DEW-B13	2.084	323.7	588.8	2.182	1.899	2.079	330.4	588.3	2.156	1.899	-0.24%	2.07%	-0.5	-1.19%	0.00%
DEW-B14	2.073	336.3	590.1	2.167	1.890	2.064	341.9	589.5	2.141	1.890	-0.43%	1.67%	-0.6	-1.20%	0.00%
DEW-B15	2.063	339.1	588.9	2.158	1.896	2.080	345.9	588.4	2.133	1.895	0.82%	2.01%	-0.5	-1.16%	-0.05%
DEW-B16	2.065	333.7	588.4	2.178	1.901	2.085	344.4	587.9	2.153	1.901	0.97%	3.21%	-0.5	-1.15%	0.00%
DEW-B17	2.085	333.4	588.8	2.159	1.895	2.077	341.7	588.3	2.135	1.894	-0.38%	2.49%	-0.5	-1.11%	-0.05%
DEW-B18	2.061	333.9	588.3	2.199	1.903	2.077	338.6	587.8	2.168	1.894	0.78%	1.41%	-0.5	-1.41%	-0.47%
DEW-B19	2.064	326.7	589.3	2.169	1.893	2.069	331.2	588.7	2.153	1.896	0.24%	1.38%	-0.6	-0.74%	0.16%
DEW-B20	2.084	328.9	588.8	2.168	1.897	2.085	336.6	588.2	2.142	1.896	0.05%	2.34%	-0.6	-1.20%	-0.05%
DEW-B21	2.064	330.6	588.8	2.164	1.896	2.056	340.7	588.2	2.142	1.896	-0.39%	3.06%	-0.6	-1.02%	0.00%
DEW-B22	2.074	329.1	589.6	2.184	1.893	2.085	338.3	589.0	2.155	1.892	0.53%	2.80%	-0.6	-1.33%	-0.05%
DEW-B23	2.088	322.1	590.1	2.160	1.890	2.055	332.0	589.5	2.135	1.890	-1.58%	3.07%	-0.6	-1.16%	0.00%
DEW-B24	2.065	328.0	589.3	2.170	1.897	2.057	341.1	588.7	2.145	1.897	-0.39%	3.99%	-0.6	-1.15%	0.00%
DEW-B25	2.063	335.4	588.6	2.168	1.897	2.060	340.4	588.1	2.142	1.896	-0.15%	1.49%	-0.5	-1.20%	-0.05%
DEW-B26	2.064	335.7	589.3	2.159	1.891	2.072	339.5	588.8	2.134	1.890	0.39%	1.13%	-0.5	-1.16%	-0.05%
Min	2.060	322.1	588.3	2.152	1.886	2.055	330.4	587.8	2.130	1.887	-1.58%	1.13%	-0.6	-1.41%	-0.63%
Max	2.088	341.3	590.1	2.199	1.903	2.087	348.5	589.6	2.168	1.902	1.31%	4.10%	-0.5	-0.74%	0.21%
Average	2.072	331.9	589.1	2.171	1.895	2.073	339.4	588.5	2.145	1.895	0.03%	2.26%	-0.5	-1.16%	-0.04%
Stdev	0.009	4.9	0.6	0.013	0.005	0.010	4.7	0.6	0.011	0.004	0.62%	0.81%	0.1	0.14%	0.17%

4.11.3.5DEW Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
DEW-C1	2.082	339.7	588.9	2.162	1.895	2.085	344.0	588.4	2.136	1.894	0.14%	1.27%	-0.5	-1.20%	-0.05%
DEW-C2	2.084	336.0	588.8	2.182	1.897	2.078	340.5	588.3	2.148	1.895	-0.29%	1.34%	-0.5	-1.56%	-0.11%
DEW-C3	2.078	332.1	588.6	2.195	1.900	2.065	338.7	588.1	2.161	1.899	-0.63%	1.99%	-0.5	-1.55%	-0.05%
DEW-C4	2.076	332.6	589.3	2.153	1.890	2.083	339.0	588.8	2.126	1.889	0.34%	1.92%	-0.5	-1.25%	-0.05%
DEW-C5	2.061	330.2	589.1	2.165	1.894	2.058	335.1	588.5	2.142	1.894	-0.15%	1.48%	-0.6	-1.06%	0.00%
DEW-C6	2.080	339.8	588.8	2.191	1.899	2.058	347.7	588.3	2.163	1.898	-1.06%	2.32%	-0.5	-1.28%	-0.05%
DEW-C7	2.079	327.6	589.2	2.177	1.898	2.079	340.8	588.6	2.152	1.897	0.00%	4.03%	-0.6	-1.15%	-0.05%
DEW-C8	2.085	331.4	589.0	2.172	1.895	2.056	340.6	588.4	2.147	1.895	-1.39%	2.78%	-0.6	-1.15%	0.00%
DEW-C9	2.079	332.6	588.5	2.169	1.899	2.064	336.6	588.0	2.144	1.899	-0.72%	1.20%	-0.5	-1.15%	0.00%
DEW-C10	2.089	331.5	589.1	2.165	1.894	2.061	339.1	588.5	2.141	1.893	-1.34%	2.29%	-0.6	-1.11%	-0.05%
DEW-C11	2.061	332.4	588.6	2.170	1.898	2.078	343.5	588.0	2.146	1.898	0.82%	3.34%	-0.6	-1.11%	0.00%
DEW-C12	2.063	333.0	588.5	2.191	1.901	2.073	342.1	588.0	2.149	1.896	0.48%	2.73%	-0.5	-1.92%	-0.26%
DEW-C13	2.066	331.7	588.5	2.203	1.902	2.074	341.0	587.9	2.178	1.899	0.39%	2.80%	-0.6	-1.13%	-0.16%
DEW-C14	2.081	332.2	588.7	2.166	1.898	2.060	340.1	588.1	2.140	1.898	-1.01%	2.38%	-0.6	-1.20%	0.00%
DEW-C15	2.073	332.3	588.7	2.172	1.898	2.087	341.5	588.1	2.149	1.898	0.68%	2.77%	-0.6	-1.06%	0.00%
DEW-C16	2.067	329.8	589.0	2.187	1.895	2.080	341.2	588.4	2.159	1.895	0.63%	3.46%	-0.6	-1.28%	0.00%
DEW-C17	2.083	331.1	588.6	2.184	1.900	2.081	343.5	588.1	2.160	1.899	-0.10%	3.75%	-0.5	-1.10%	-0.05%
DEW-C18	2.076	328.3	588.8	2.179	1.898	2.081	341.7	588.3	2.155	1.898	0.24%	4.08%	-0.5	-1.10%	0.00%
DEW-C19	2.069	334.4	589.0	2.161	1.897	2.072	345.9	588.7	2.136	1.897	0.14%	3.44%	-0.3	-1.16%	0.00%
DEW-C20	2.078	335.3	588.8	2.163	1.895	2.087	338.9	588.4	2.139	1.895	0.43%	1.07%	-0.4	-1.11%	0.00%
DEW-C21	2.062	335.0	588.7	2.163	1.897	2.071	340.6	588.2	2.141	1.897	0.44%	1.67%	-0.5	-1.02%	0.00%
DEW-C22	2.078	335.0	588.5	2.191	1.900	2.079	341.4	588.0	2.140	1.896	0.05%	1.91%	-0.5	-2.33%	-0.21%
DEW-C23	2.069	341.9	588.6	2.190	1.900	2.079	346.0	588.1	2.146	1.898	0.48%	1.20%	-0.5	-2.01%	-0.11%
DEW-C24	2.075	338.4	589.3	2.156	1.892	2.056	343.0	588.7	2.130	1.892	-0.92%	1.36%	-0.6	-1.21%	0.00%
DEW-C25	2.073	334.6	588.9	2.166	1.895	2.061	341.5	588.3	2.144	1.895	-0.58%	2.06%	-0.6	-1.02%	0.00%
DEW-C26	2.083	336.6	590.0	2.170	1.888	2.077	344.4	589.5	2.144	1.888	-0.29%	2.32%	-0.5	-1.20%	0.00%
Min	2.061	327.6	588.5	2.153	1.888	2.056	335.1	587.9	2.126	1.888	-1.39%	1.07%	-0.6	-2.33%	-0.26%
Max	2.089	341.9	590.0	2.203	1.902	2.087	347.7	589.5	2.178	1.899	0.82%	4.08%	-0.3	-1.02%	0.00%
Average	2.075	333.7	588.9	2.175	1.897	2.072	341.5	588.3	2.147	1.896	-0.12%	2.34%	-0.5	-1.28%	-0.05%
Stdev	0.008	3.5	0.3	0.013	0.003	0.010	2.8	0.3	0.011	0.003	0.65%	0.92%	0.1	0.33%	0.07%

4.11.4 Test Photo



4.12 Thermal Resistance(TR)

4.12.1 Test Information

Sample size: 1 lot 10 pcs.

Test period: 2024-12-13 to 2024-12-28

Reference document: JEDEC JESD51-50/JESD51-51/JESD51-52

Heating current: 20mA

4.12.2 Environmental Conditions

Environmental temperature: (24.8~26.4)°C

Environmental humidity: (65~69)%RH

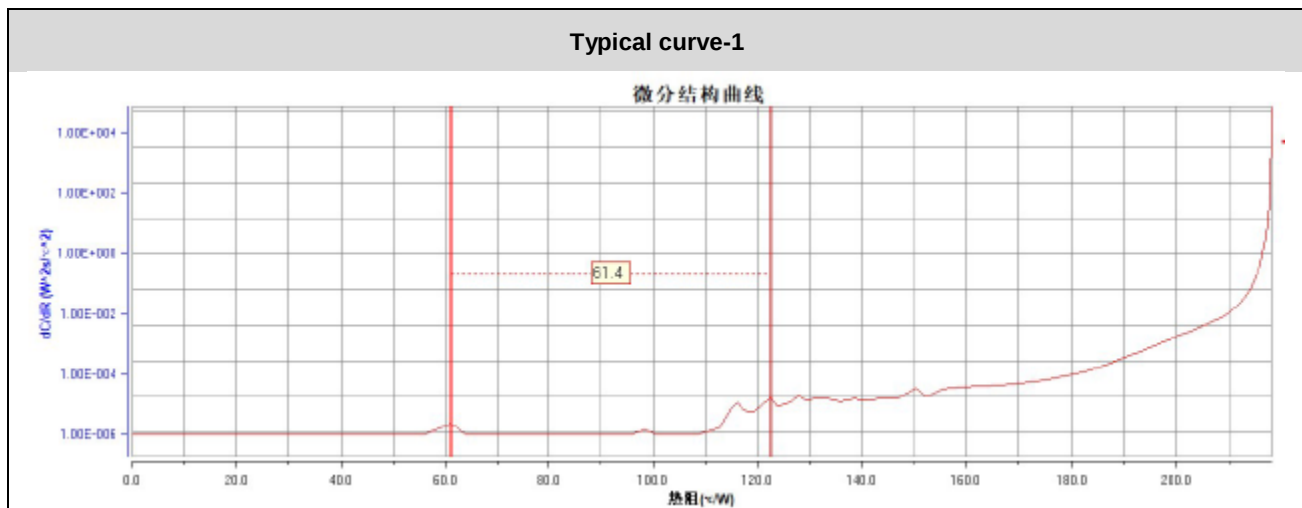
4.12.3 Test Result

Test Item	Tested Samples (pcs)	Number of pass samples (pcs)	Number of failed samples (pcs)
TR	10	10	0

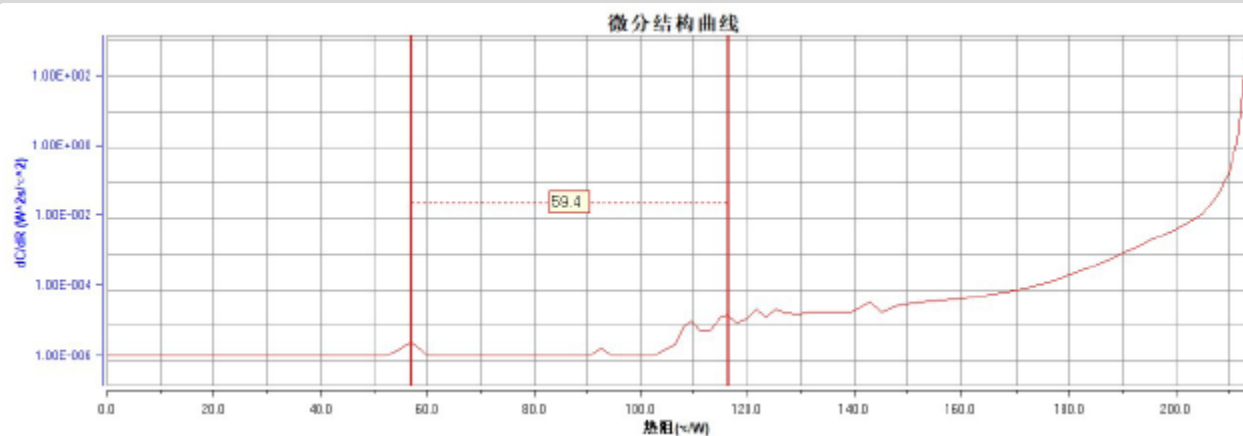
4.12.4 Test Data

No.	Temperature of control	Pel	Popt	Tsolder temperature	Tj	ΔT	Rjs-real
Unit	°C	mW	mW	°C	°C	°C	°C/W
TR-A1	25	41.24	2.03	32.39	34.80	2.41	61.4
TR-A2	25	40.97	2.02	32.64	34.95	2.31	59.4
TR-A3	25	40.98	1.99	32.52	34.95	2.43	62.2
TR-A4	25	40.79	2.14	32.09	34.29	2.20	56.9
TR-A5	25	41.15	1.96	32.53	34.97	2.44	62.3
TR-A6	25	41.24	1.95	32.68	35.09	2.41	61.3
TR-A7	25	41.01	1.96	32.53	34.90	2.37	60.8
TR-A8	25	41.02	1.99	32.50	34.82	2.32	59.5
TR-A9	25	41.09	1.96	32.61	35.04	2.43	62.0
TR-A10	25	41.13	1.95	33.20	35.78	2.58	65.9

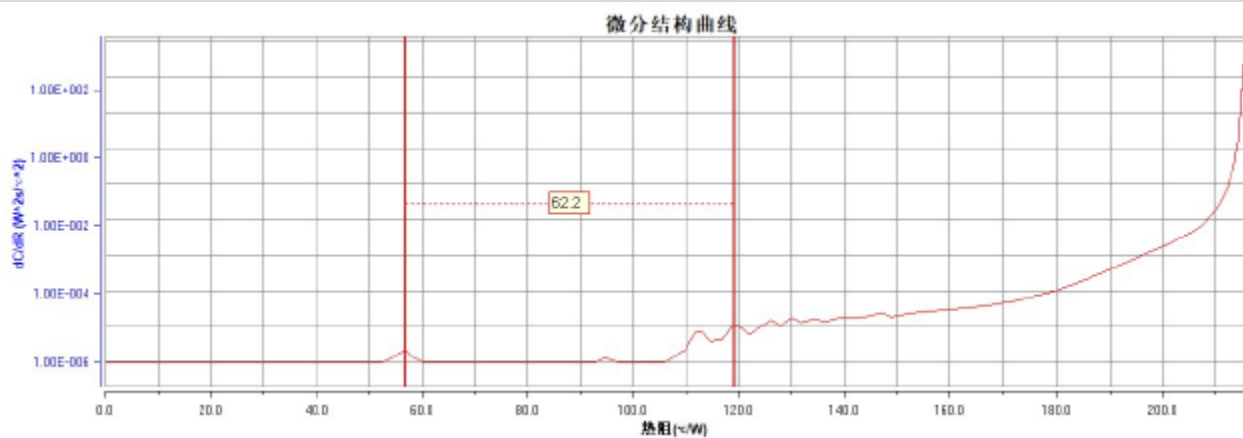
4.12.5 Test Photo



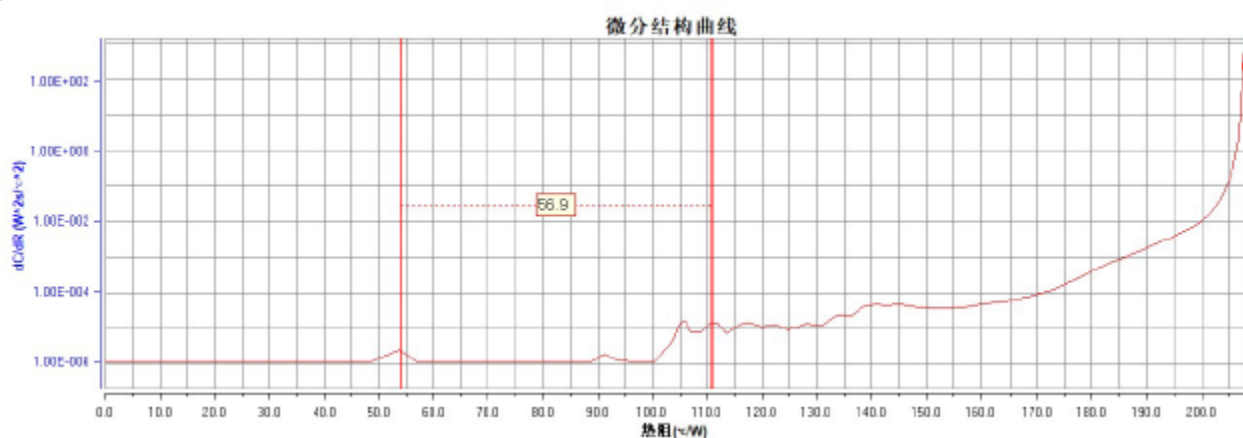
Typical curve-2



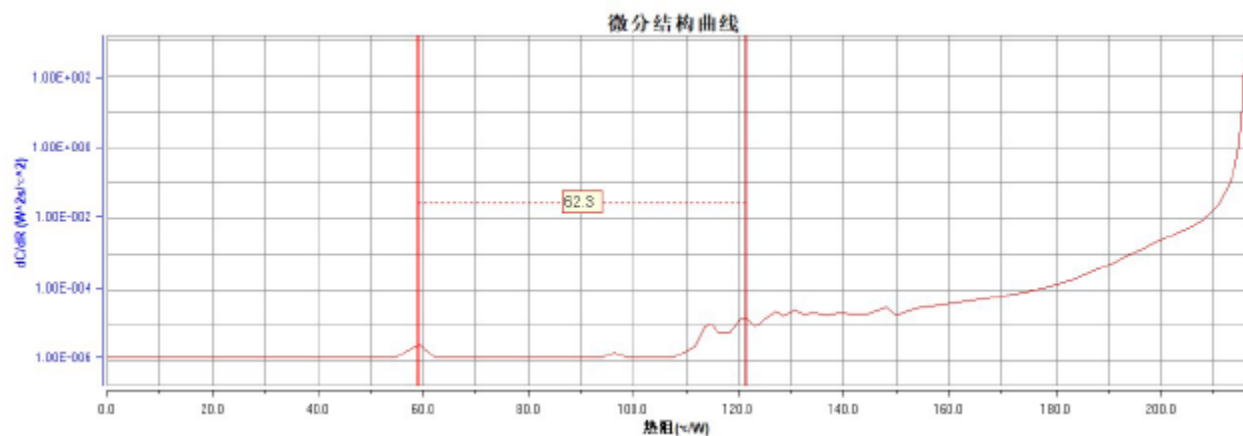
Typical curve-3



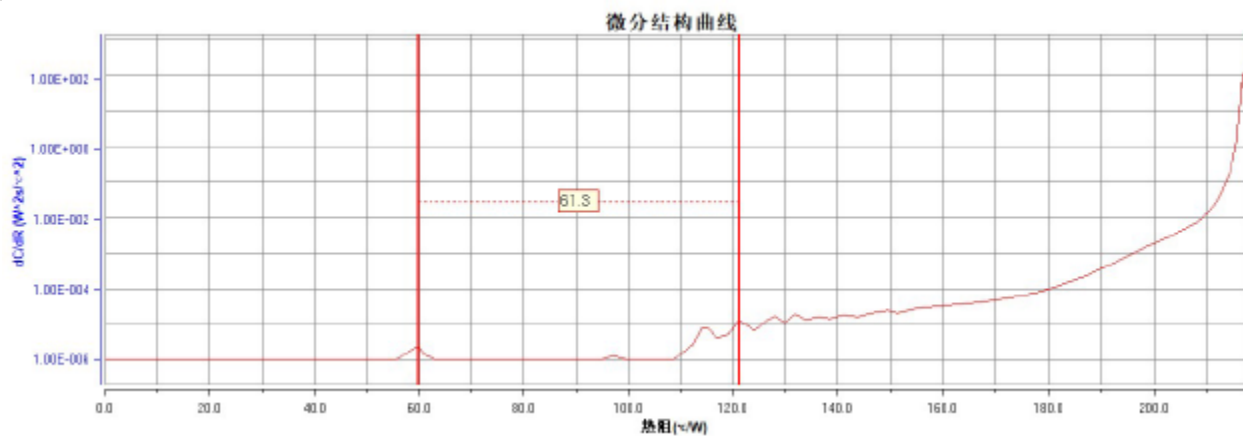
Typical curve-4



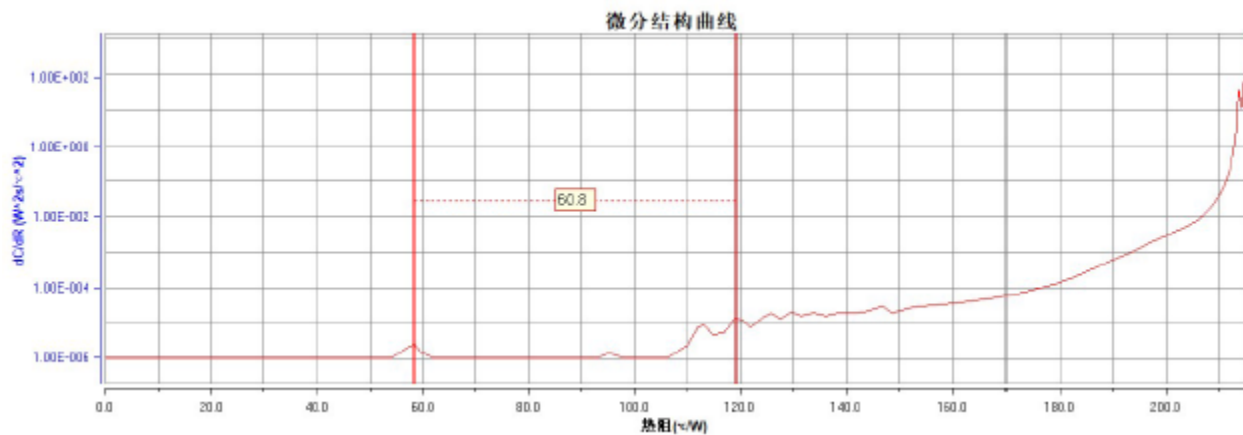
Typical curve-5



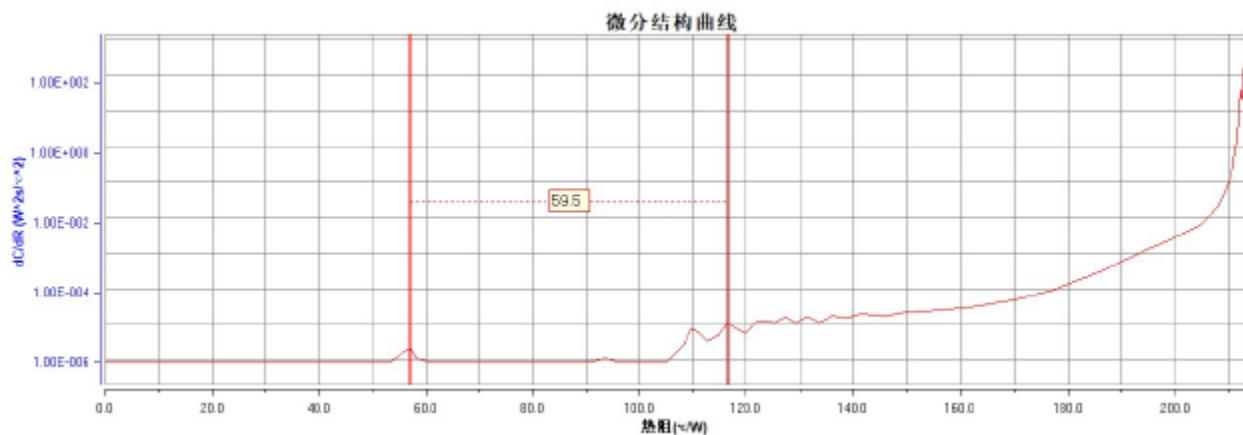
Typical curve-6



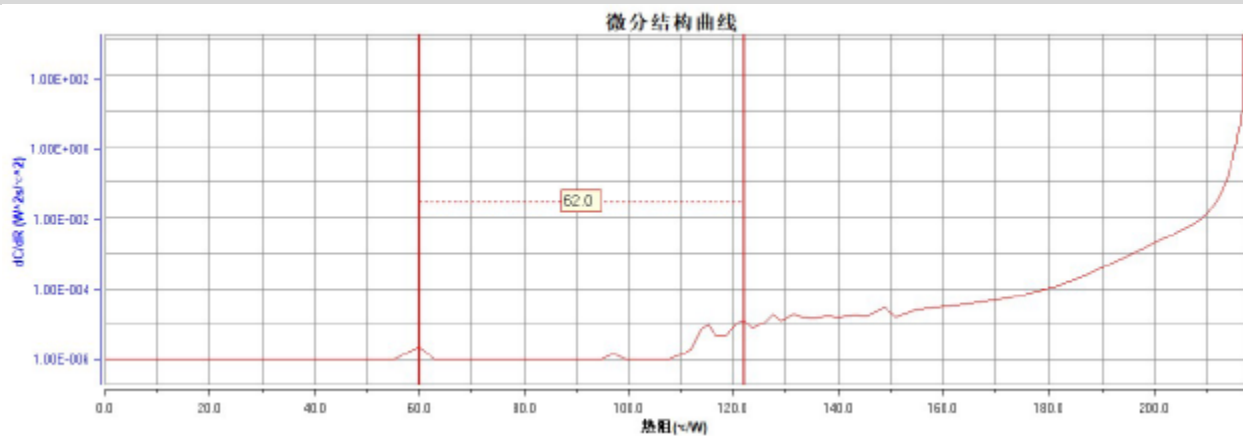
Typical curve-7



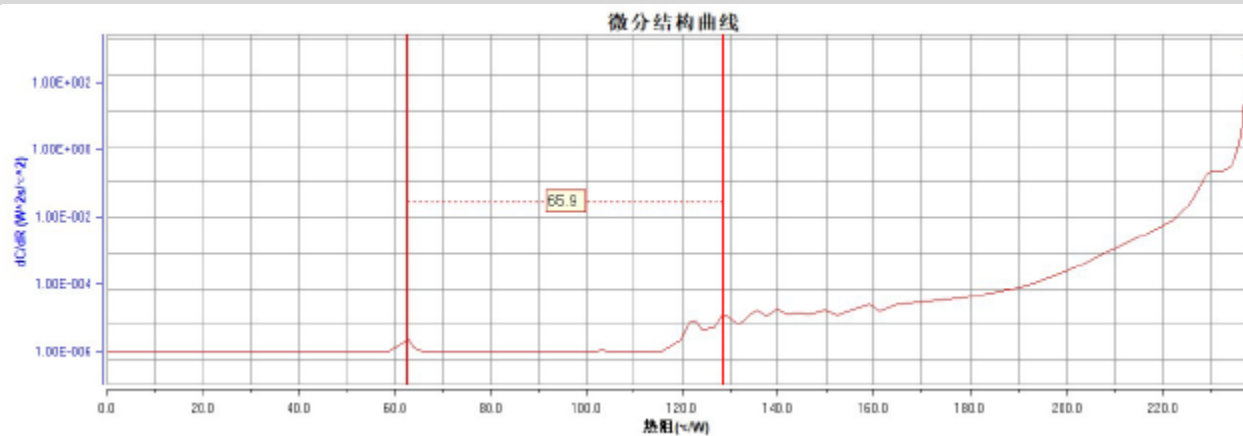
Typical curve-8



Typical curve-9



Typical curve-10



4.13 Solderability(SD)

4.13.1 Test Information

Sample size: 3 lots 10 pcs. each

Test period: 2024-12-13 to 2024-12-23

Reference document: IEC 60068-2-58

Precondition: Bake:155°C/4h

Solder: Sn99.3Cu0.7

Solder temperature: 260°C

Test point: Not applicable

4.13.2 Environmental Conditions

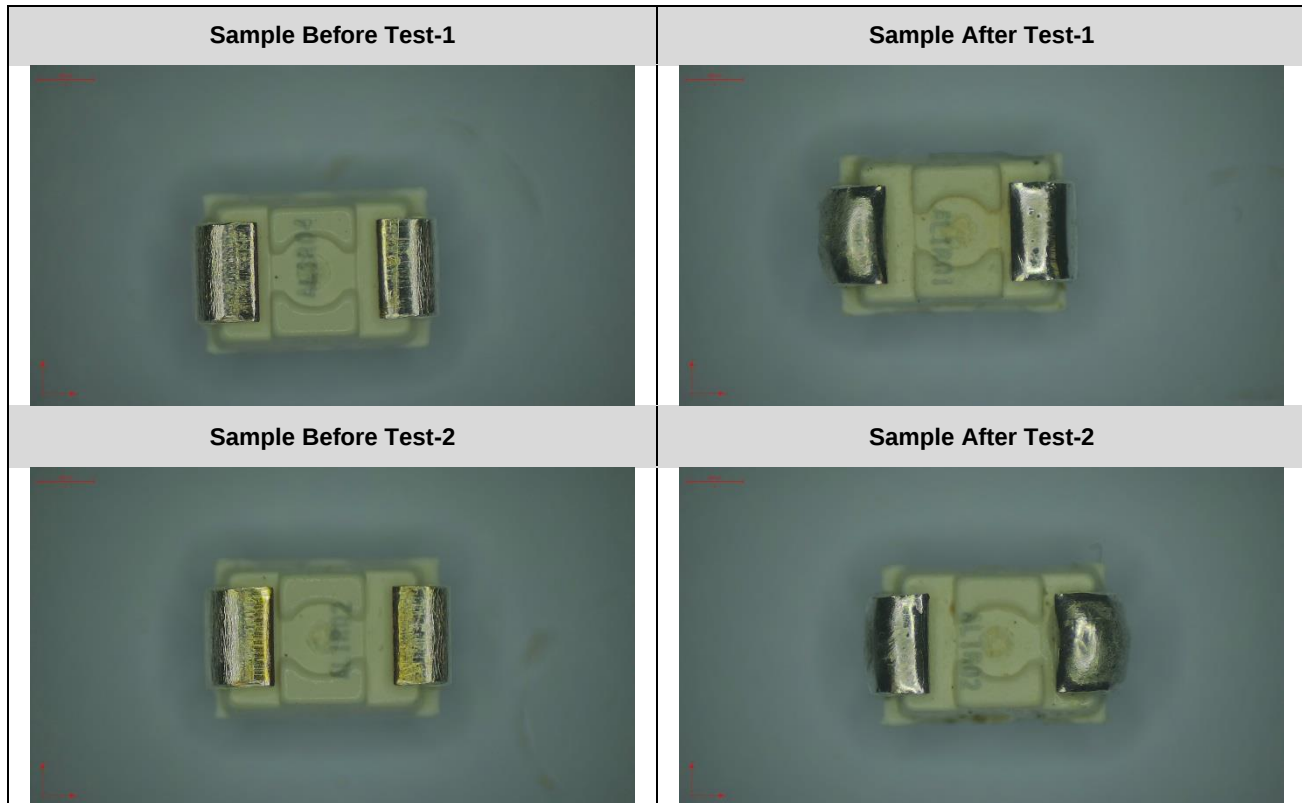
Environmental temperature: (23.5~26.2)°C

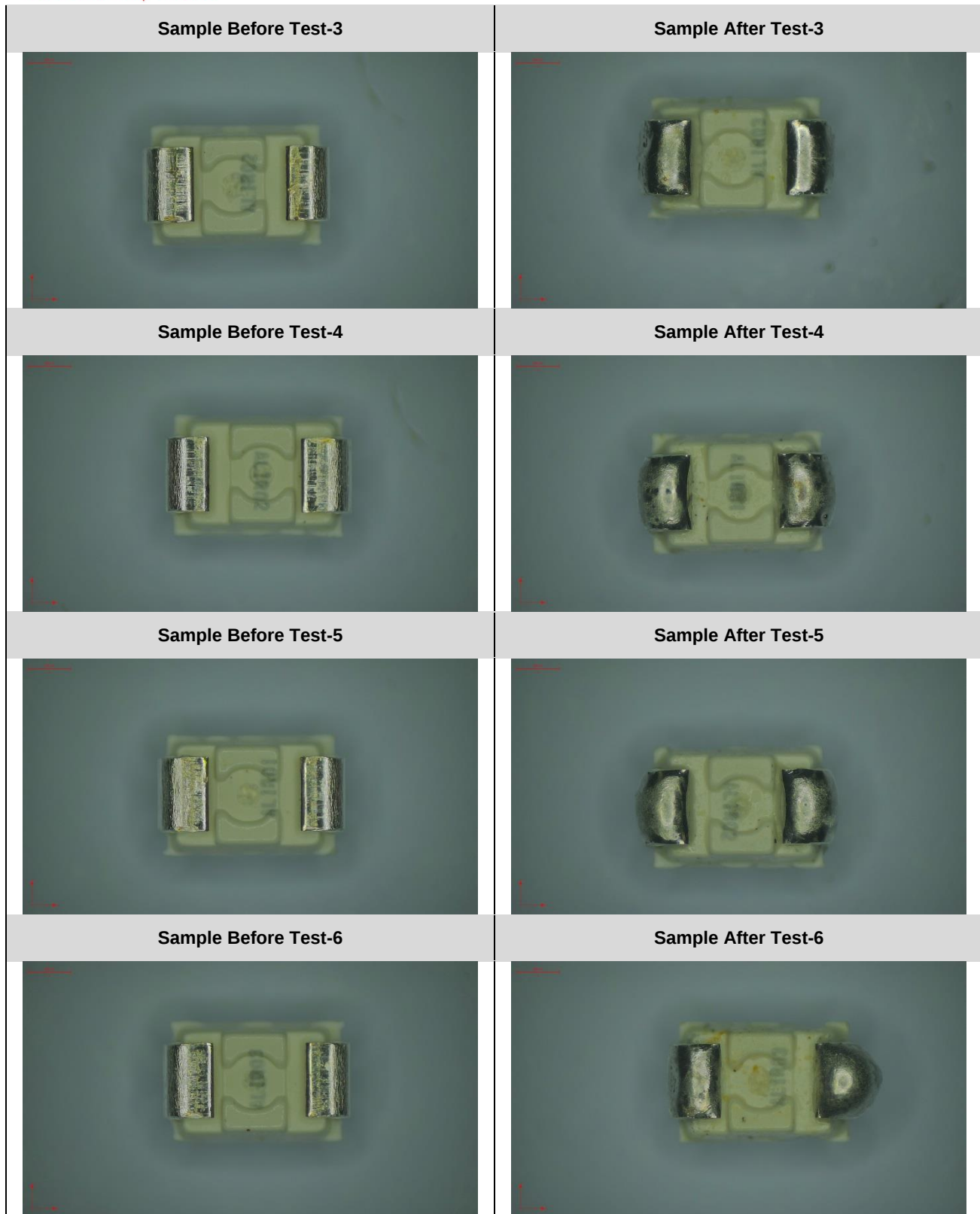
Environmental humidity: (47~59)%RH

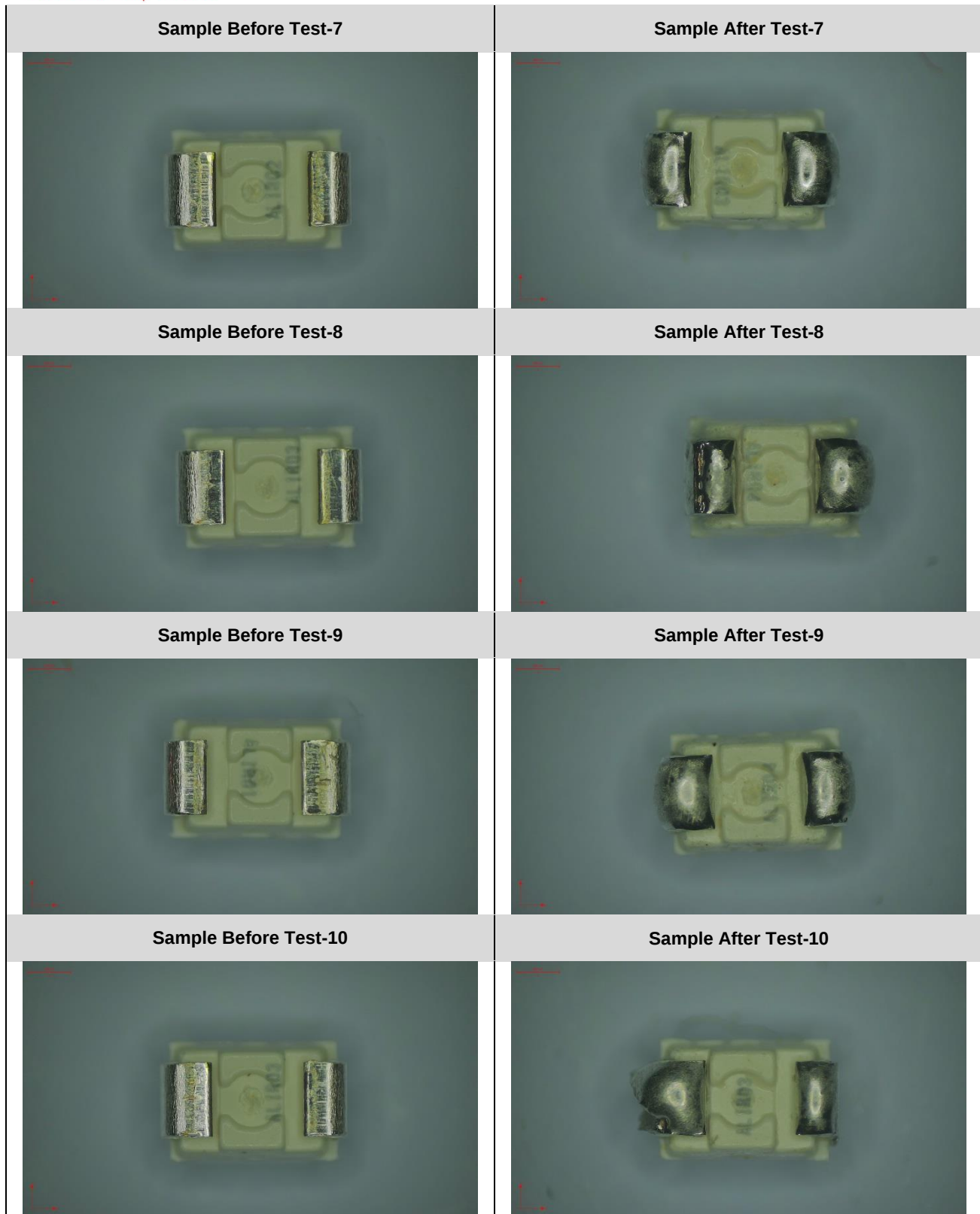
4.13.3 Test Result

Test Item	Tested Samples (pcs)	Number of pass samples (pcs)	Number of failed samples (pcs)
SD	30	30	0

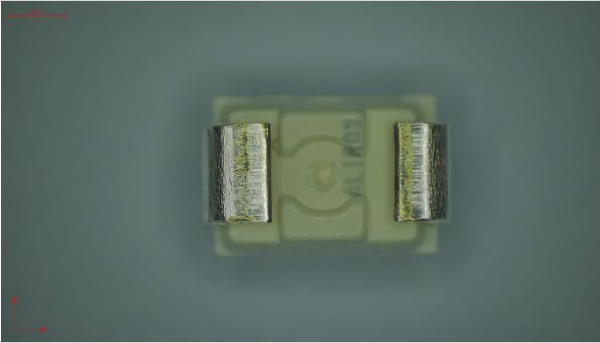
4.13.4 Test Photo







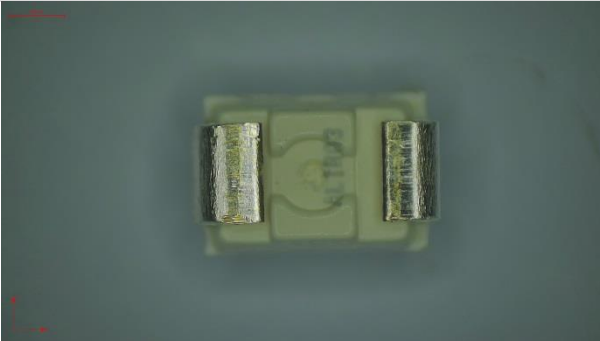
Sample Before Test-11



Sample After Test-11



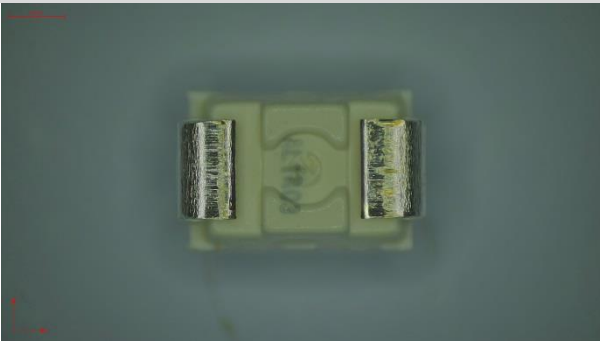
Sample Before Test-12



Sample After Test-12



Sample Before Test-13



Sample After Test-13



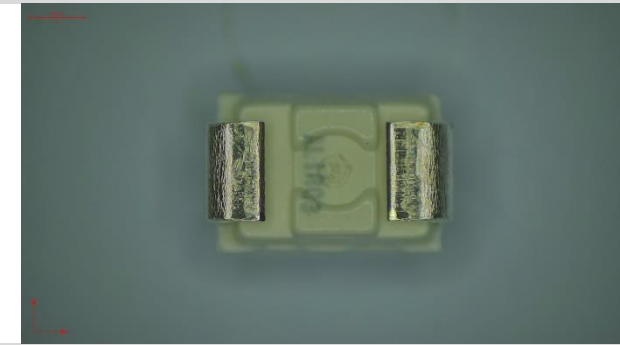
Sample Before Test-14



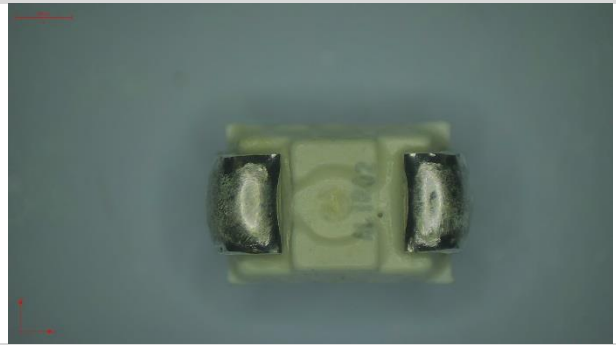
Sample After Test-14



Sample Before Test-15



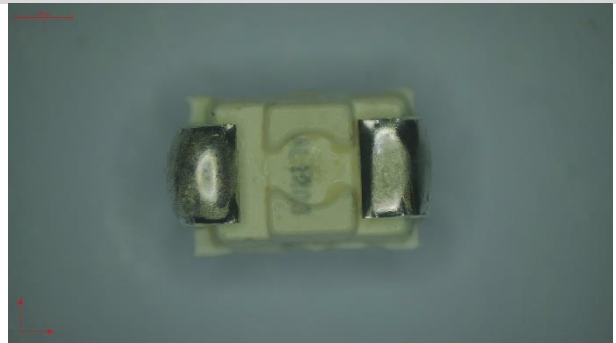
Sample After Test-15



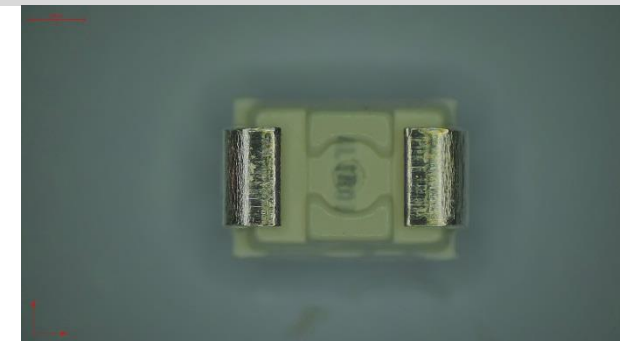
Sample Before Test-16



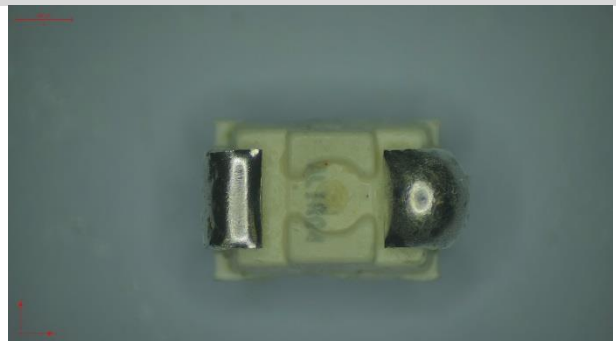
Sample After Test-16



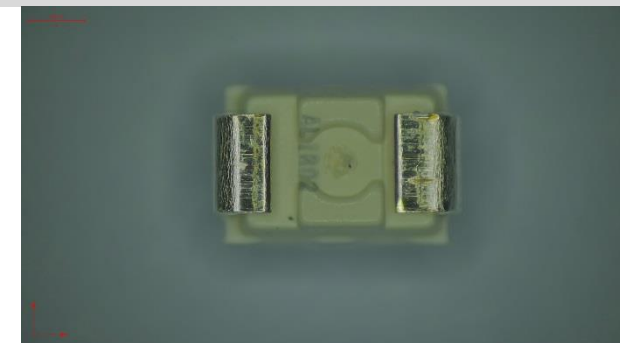
Sample Before Test-17



Sample After Test-17



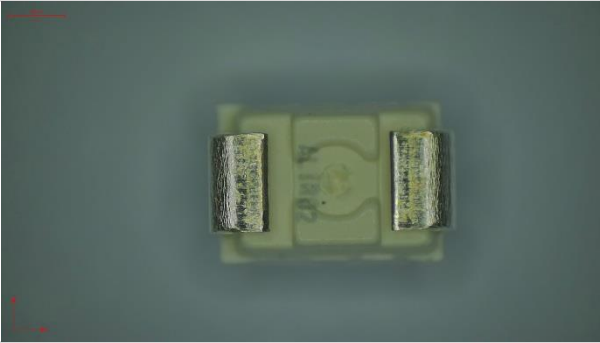
Sample Before Test-18



Sample After Test-18



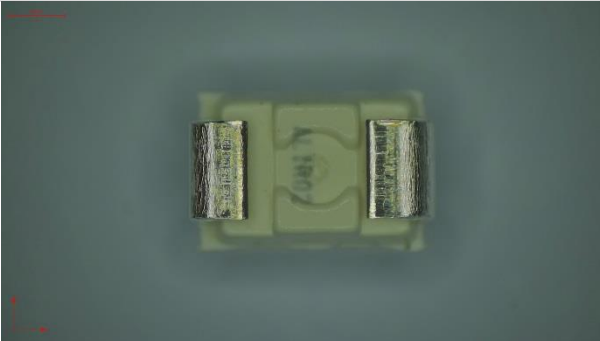
Sample Before Test-19



Sample After Test-19



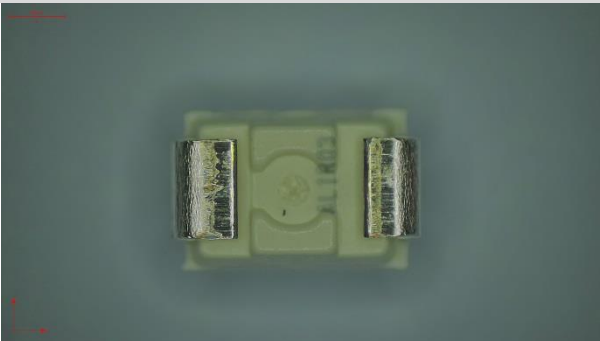
Sample Before Test-20



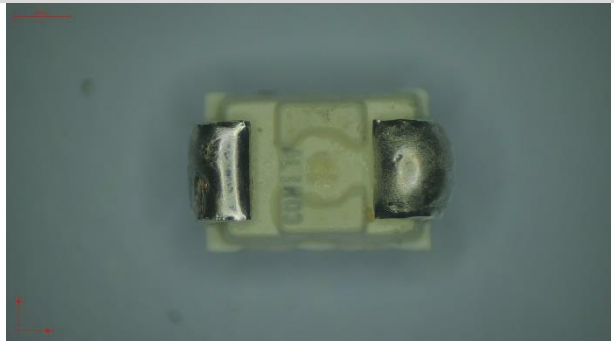
Sample After Test-20



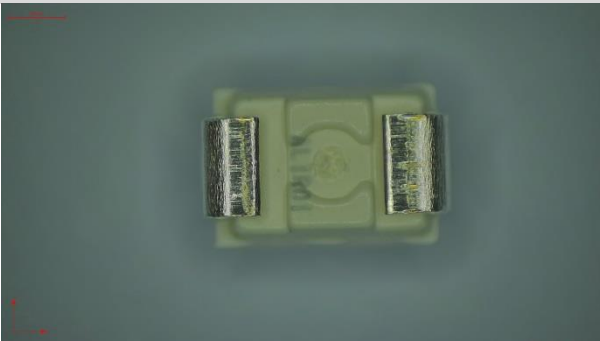
Sample Before Test-21



Sample After Test-21



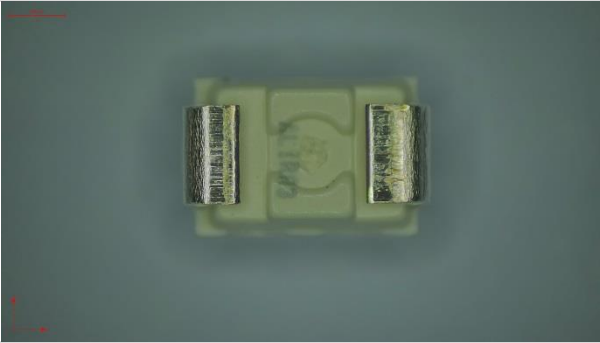
Sample Before Test-22



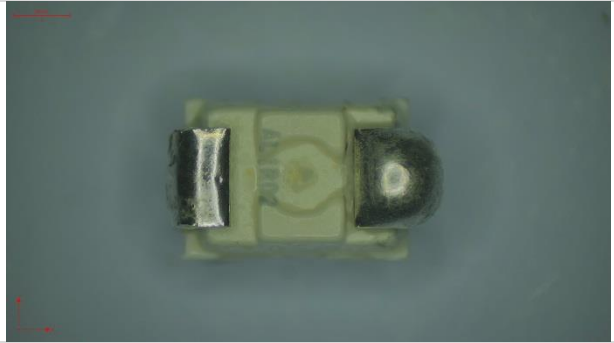
Sample After Test-22



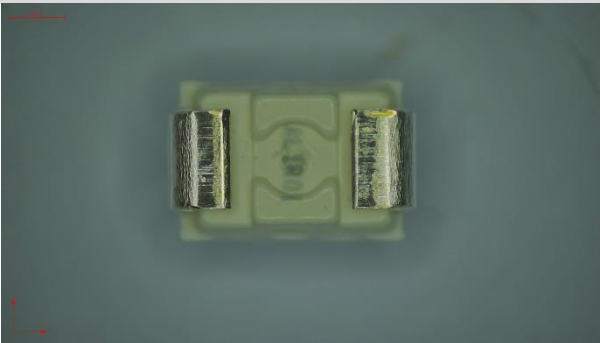
Sample Before Test-23



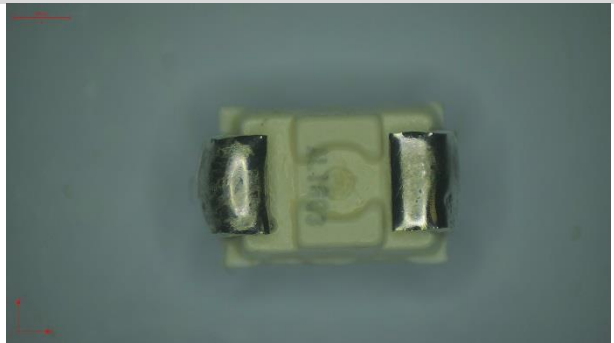
Sample After Test-23



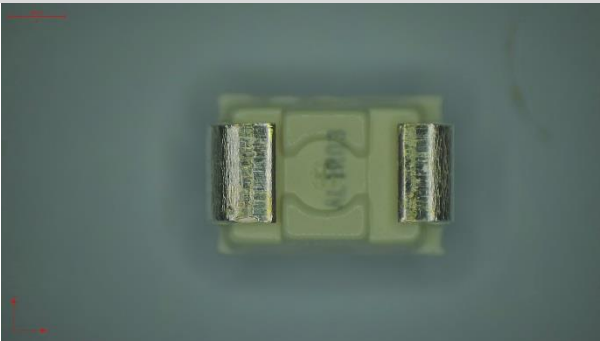
Sample Before Test-24



Sample After Test-24



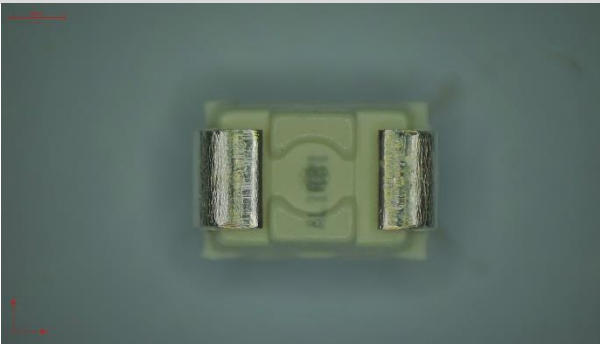
Sample Before Test-25



Sample After Test-25



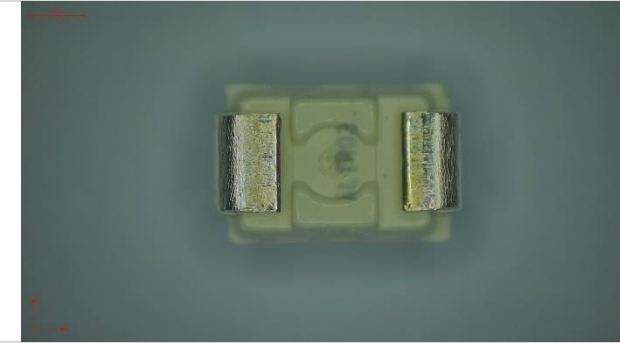
Sample Before Test-26



Sample After Test-26



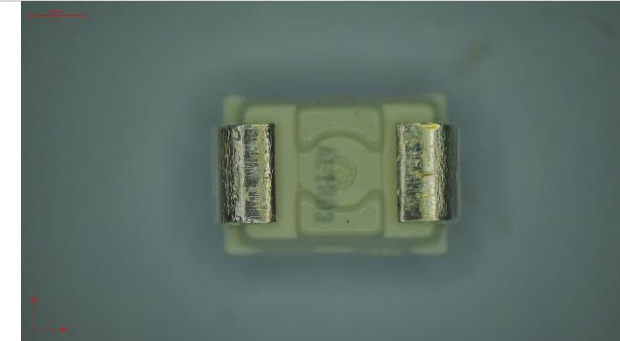
Sample Before Test-27



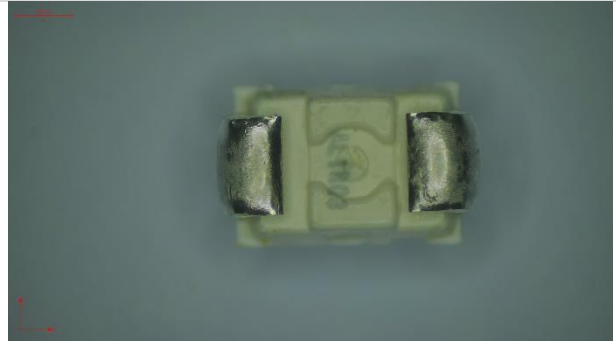
Sample After Test-27



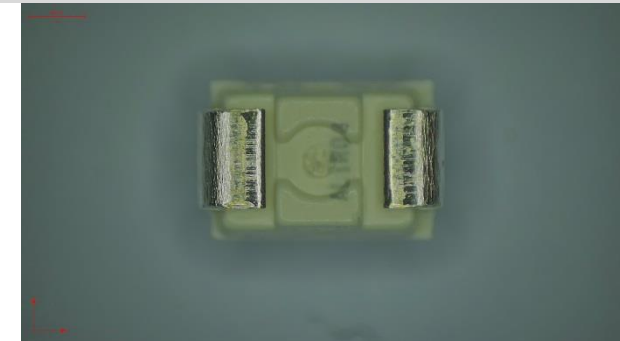
Sample Before Test-28



Sample After Test-28



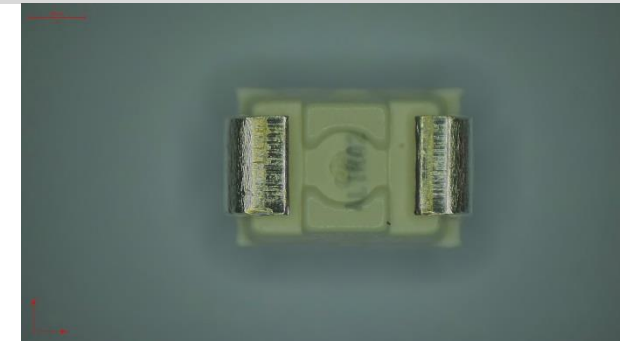
Sample Before Test-29



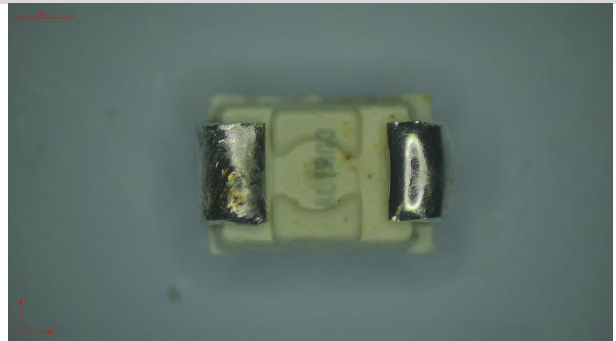
Sample After Test-29



Sample Before Test-30



Sample After Test-30



4.14 Hydrogen Sulphide(H₂S)

4.14.1 Test Information

Sample size: 3 lots 26 pcs. each

Test period: 2024-12-26 to 2025-01-11

Reference document: IEC 60068-2-43

Power supply: Unpowered

Test temperature: T_a=40°C(Class A)

Test humidity: 90%RH(Class A)

Gas concentration: H₂S:15ppm

Test duration: 336hrs

Test point: Initial test/Final test

Acceptance criteria: Per Section 3

4.14.2 Environmental Conditions

Environmental temperature: (24.7~26.8)°C

Environmental humidity: (47~61)%RH

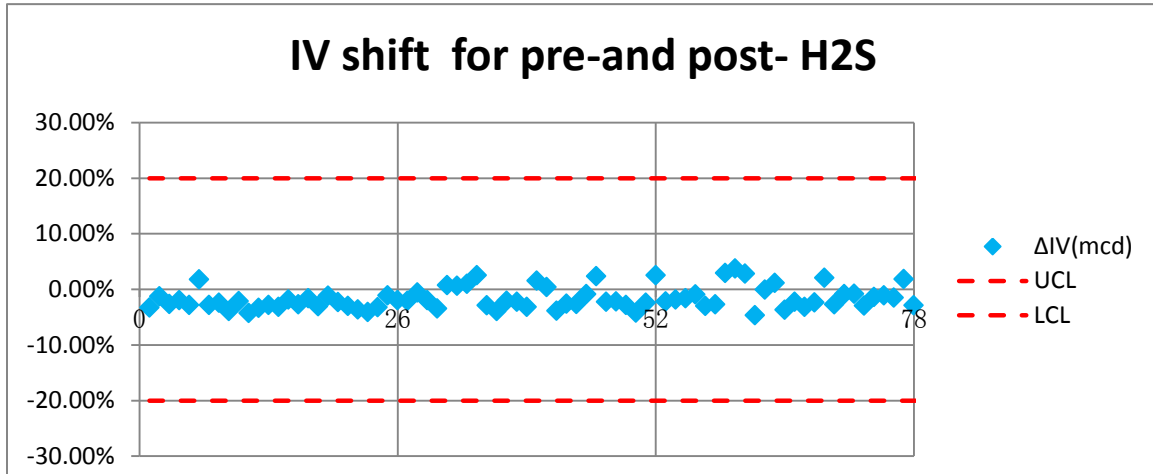
4.14.3 Test Data

4.14.3.1 Test Result for H₂S

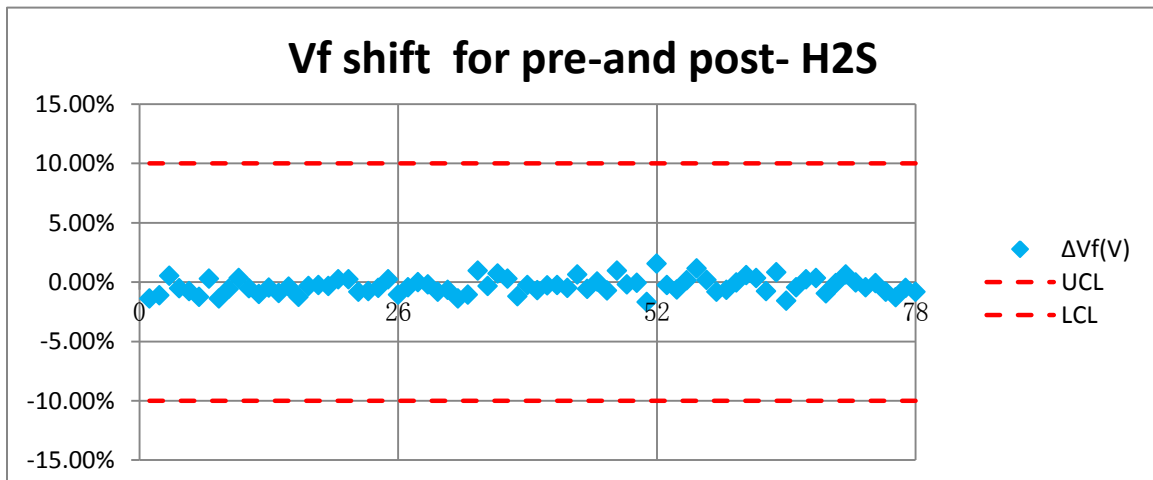
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light			0
B	External Visual	26	26	0
	Test			0
	Light / no light			0
C	External Visual	26	26	0
	Test			0
	Light / no light			0

4.14.3.2 Summary

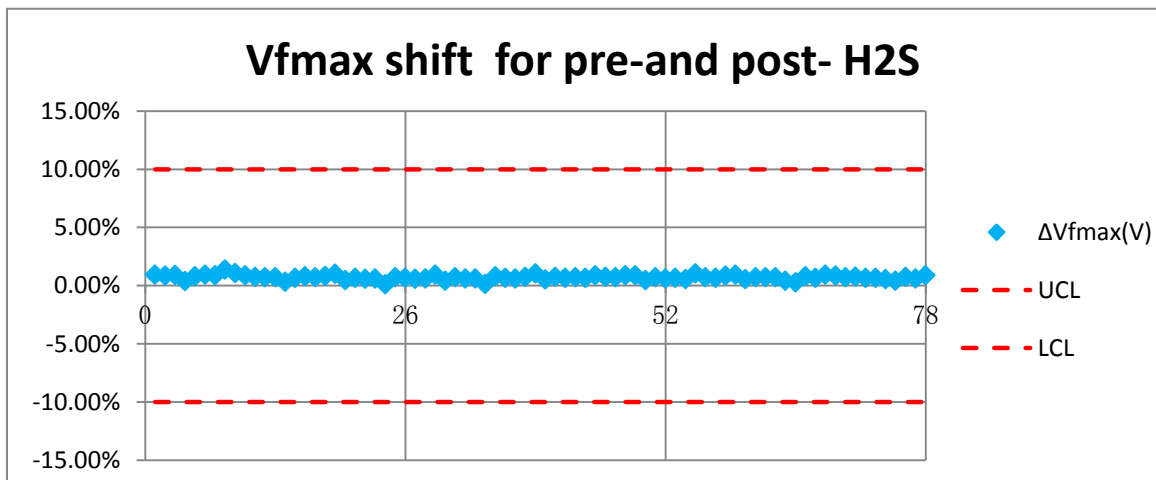
IV shift for pre- and post- H2S test



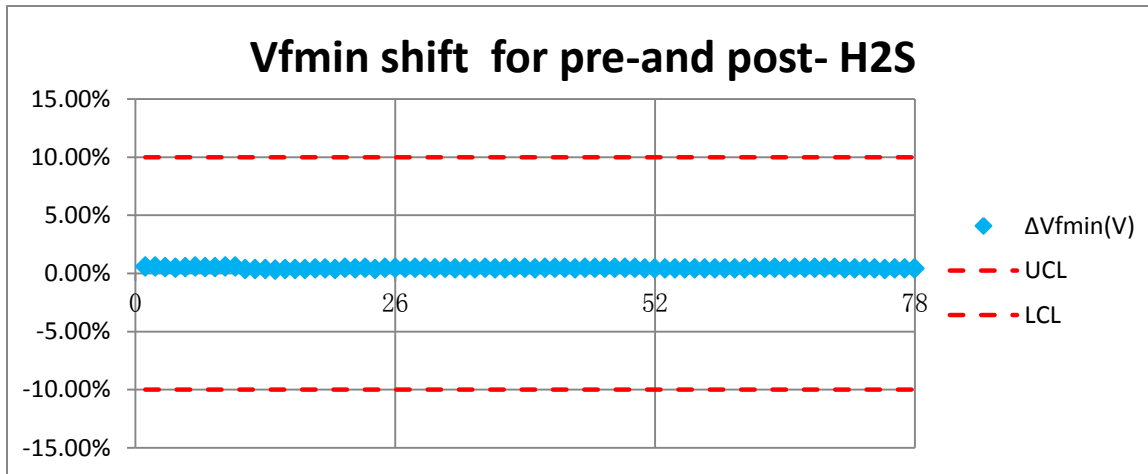
Vf shift for pre- and post- H2S test



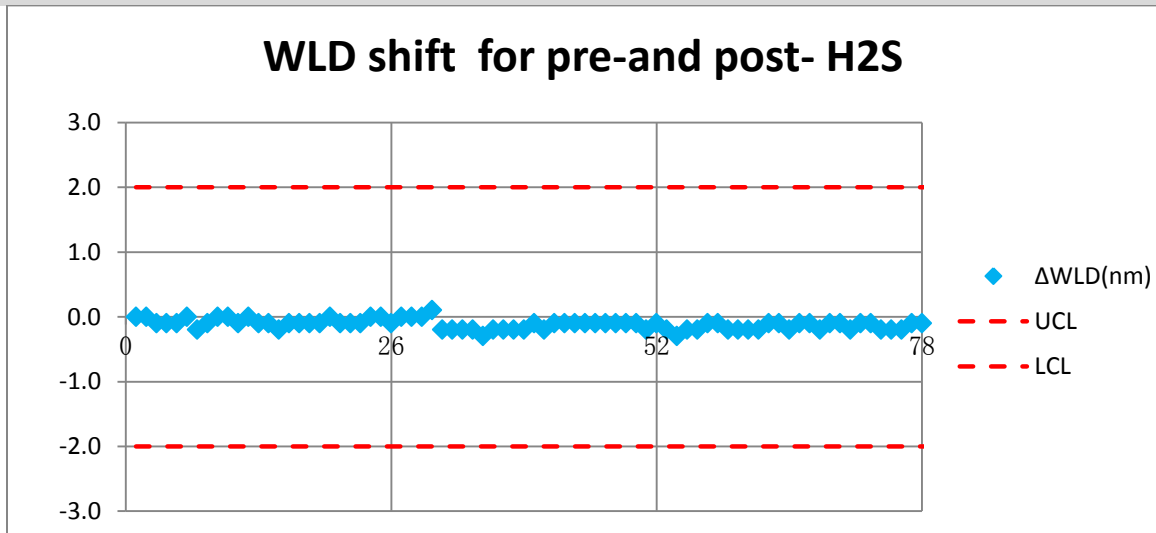
Vf_{max} shift for pre- and post- H2S test



V_{fmin} shift for pre- and post- H2S test



λ_d shift for pre- and post- H2S test



4.14.3.H2S Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
H2S-A1	2.080	335.5	589.4	2.131	1.886	2.051	324.4	589.4	2.151	1.897	-1.39%	-3.31%	0.0	0.94%	0.58%
H2S-A2	2.085	336.4	589.7	2.134	1.885	2.062	332.1	589.7	2.152	1.896	-1.10%	-1.28%	0.0	0.84%	0.58%
H2S-A3	2.073	342.4	588.8	2.140	1.891	2.084	333.3	588.7	2.159	1.901	0.53%	-2.66%	-0.1	0.89%	0.53%
H2S-A4	2.074	339.1	589.4	2.165	1.890	2.063	332.4	589.3	2.173	1.899	-0.53%	-1.98%	-0.1	0.37%	0.48%
H2S-A5	2.070	334.3	588.7	2.148	1.892	2.054	324.8	588.6	2.165	1.902	-0.77%	-2.84%	-0.1	0.79%	0.53%
H2S-A6	2.085	331.4	588.8	2.140	1.890	2.059	337.3	588.8	2.160	1.901	-1.25%	1.78%	0.0	0.93%	0.58%
H2S-A7	2.086	337.9	588.5	2.152	1.896	2.092	328.3	588.3	2.171	1.906	0.29%	-2.84%	-0.2	0.88%	0.53%
H2S-A8	2.077	336.3	590.0	2.127	1.881	2.048	328.0	589.9	2.156	1.891	-1.40%	-2.47%	-0.1	1.36%	0.53%
H2S-A9	2.093	334.9	588.8	2.154	1.894	2.081	321.7	588.8	2.177	1.905	-0.57%	-3.94%	0.0	1.07%	0.58%
H2S-A10	2.073	330.6	588.8	2.157	1.891	2.080	323.4	588.8	2.176	1.902	0.34%	-2.18%	0.0	0.88%	0.58%
H2S-A11	2.095	348.3	588.9	2.141	1.893	2.084	333.4	588.8	2.157	1.900	-0.53%	-4.28%	-0.1	0.75%	0.37%
H2S-A12	2.084	340.7	589.0	2.148	1.893	2.063	329.2	589.0	2.163	1.900	-1.01%	-3.38%	0.0	0.70%	0.37%
H2S-A13	2.093	346.6	589.8	2.127	1.886	2.083	336.7	589.7	2.142	1.893	-0.48%	-2.86%	-0.1	0.71%	0.37%
H2S-A14	2.083	333.2	588.5	2.180	1.899	2.064	322.6	588.4	2.187	1.905	-0.91%	-3.18%	-0.1	0.32%	0.32%
H2S-A15	2.071	334.9	588.5	2.156	1.898	2.063	328.6	588.3	2.170	1.905	-0.39%	-1.88%	-0.2	0.65%	0.37%
H2S-A16	2.096	325.3	590.3	2.118	1.885	2.070	316.5	590.2	2.135	1.892	-1.24%	-2.71%	-0.1	0.80%	0.37%
H2S-A17	2.093	336.3	588.9	2.145	1.893	2.086	330.7	588.8	2.160	1.900	-0.33%	-1.67%	-0.1	0.70%	0.37%
H2S-A18	2.075	334.6	588.5	2.164	1.898	2.070	324.3	588.4	2.182	1.906	-0.24%	-3.08%	-0.1	0.83%	0.42%
H2S-A19	2.066	310.3	589.4	2.147	1.894	2.059	306.7	589.3	2.169	1.902	-0.34%	-1.16%	-0.1	1.02%	0.42%
H2S-A20	2.071	335.5	589.8	2.148	1.886	2.076	327.7	589.8	2.158	1.893	0.24%	-2.32%	0.0	0.47%	0.37%
H2S-A21	2.075	341.7	589.0	2.140	1.891	2.080	331.4	588.9	2.154	1.900	0.24%	-3.01%	-0.1	0.65%	0.48%
H2S-A22	2.091	342.6	590.1	2.130	1.886	2.074	330.0	590.0	2.142	1.894	-0.81%	-3.68%	-0.1	0.56%	0.42%
H2S-A23	2.086	339.7	589.3	2.130	1.889	2.070	325.8	589.2	2.143	1.898	-0.77%	-4.09%	-0.1	0.61%	0.48%
H2S-A24	2.082	338.5	589.5	2.156	1.887	2.072	327.6	589.5	2.158	1.894	-0.48%	-3.22%	0.0	0.09%	0.37%
H2S-A25	2.077	342.2	589.8	2.129	1.884	2.082	338.4	589.8	2.144	1.893	0.24%	-1.11%	0.0	0.70%	0.48%
H2S-A26	2.093	333.2	589.2	2.132	1.887	2.071	326.6	589.1	2.146	1.896	-1.05%	-1.98%	-0.1	0.66%	0.48%
Min	2.066	310.3	588.5	2.118	1.881	2.048	306.7	588.3	2.135	1.891	-1.40%	-4.28%	-0.2	0.09%	0.32%
Max	2.096	348.3	590.3	2.180	1.899	2.092	338.4	590.2	2.187	1.906	0.53%	1.78%	0.0	1.36%	0.58%
Average	2.082	336.2	589.2	2.144	1.890	2.071	327.8	589.1	2.160	1.899	-0.53%	-2.51%	-0.1	0.74%	0.46%
Stdev	0.009	7.3	0.5	0.014	0.005	0.012	6.7	0.6	0.013	0.005	0.57%	1.23%	0.1	0.25%	0.09%

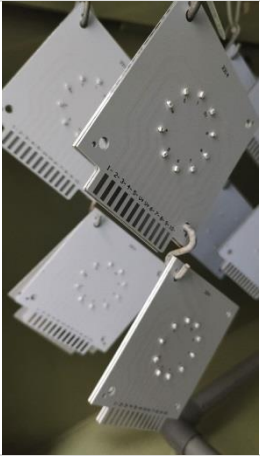
4.14.3.4H2S Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
H2S-B1	2.085	339.8	588.5	2.151	1.896	2.076	332.6	588.5	2.163	1.905	-0.43%	-2.12%	0.0	0.56%	0.47%
H2S-B2	2.088	338.5	589.8	2.140	1.883	2.088	336.5	589.8	2.153	1.892	0.00%	-0.59%	0.0	0.61%	0.48%
H2S-B3	2.097	340.2	588.3	2.161	1.896	2.093	333.5	588.3	2.181	1.905	-0.19%	-1.97%	0.0	0.93%	0.47%
H2S-B4	2.095	335.5	588.7	2.159	1.893	2.078	323.9	588.8	2.168	1.901	-0.81%	-3.46%	0.1	0.42%	0.42%
H2S-B5	2.106	330.6	589.3	2.133	1.886	2.092	333.0	589.1	2.148	1.895	-0.66%	0.73%	-0.2	0.70%	0.48%
H2S-B6	2.085	330.2	588.7	2.154	1.895	2.056	332.2	588.5	2.167	1.903	-1.39%	0.61%	-0.2	0.60%	0.42%
H2S-B7	2.094	329.4	589.5	2.133	1.888	2.072	332.5	589.3	2.146	1.896	-1.05%	0.94%	-0.2	0.61%	0.42%
H2S-B8	2.072	327.3	589.1	2.168	1.892	2.092	335.5	588.9	2.171	1.900	0.97%	2.51%	-0.2	0.14%	0.42%
H2S-B9	2.082	333.3	589.9	2.129	1.883	2.075	323.7	589.6	2.146	1.892	-0.34%	-2.88%	-0.3	0.80%	0.48%
H2S-B10	2.066	327.9	589.5	2.136	1.888	2.081	314.9	589.3	2.150	1.896	0.73%	-3.96%	-0.2	0.66%	0.42%
H2S-B11	2.068	334.2	590.3	2.123	1.881	2.074	327.2	590.1	2.136	1.889	0.29%	-2.09%	-0.2	0.61%	0.43%
H2S-B12	2.074	333.4	590.2	2.136	1.881	2.049	325.9	590.0	2.152	1.890	-1.21%	-2.25%	-0.2	0.75%	0.48%
H2S-B13	2.087	320.4	590.3	2.129	1.885	2.082	310.2	590.1	2.151	1.894	-0.24%	-3.18%	-0.2	1.03%	0.48%
H2S-B14	2.093	329.6	588.6	2.165	1.896	2.079	334.6	588.5	2.176	1.904	-0.67%	1.52%	-0.1	0.51%	0.42%
H2S-B15	2.084	339.2	588.3	2.150	1.895	2.078	340.4	588.1	2.166	1.904	-0.29%	0.35%	-0.2	0.74%	0.47%
H2S-B16	2.072	340.5	588.5	2.152	1.895	2.067	327.3	588.4	2.166	1.904	-0.24%	-3.88%	-0.1	0.65%	0.47%
H2S-B17	2.067	337.1	588.3	2.153	1.897	2.057	328.2	588.2	2.168	1.906	-0.48%	-2.64%	-0.1	0.70%	0.47%
H2S-B18	2.075	339.8	589.4	2.155	1.889	2.088	330.8	589.3	2.169	1.897	0.63%	-2.65%	-0.1	0.65%	0.42%
H2S-B19	2.095	332.2	588.7	2.145	1.893	2.083	329.3	588.6	2.164	1.902	-0.57%	-0.87%	-0.1	0.89%	0.48%
H2S-B20	2.072	335.0	588.6	2.142	1.894	2.073	342.8	588.5	2.158	1.903	0.05%	2.33%	-0.1	0.75%	0.48%
H2S-B21	2.086	329.9	589.3	2.139	1.889	2.071	322.5	589.2	2.154	1.898	-0.72%	-2.24%	-0.1	0.70%	0.48%
H2S-B22	2.072	319.9	588.9	2.155	1.891	2.092	312.8	588.8	2.174	1.900	0.97%	-2.22%	-0.1	0.88%	0.48%
H2S-B23	2.060	330.6	588.8	2.157	1.895	2.056	321.2	588.7	2.176	1.904	-0.19%	-2.84%	-0.1	0.88%	0.47%
H2S-B24	2.062	331.0	588.8	2.165	1.894	2.061	317.0	588.7	2.175	1.903	-0.05%	-4.23%	-0.1	0.46%	0.48%
H2S-B25	2.084	339.4	589.0	2.134	1.888	2.049	331.1	588.8	2.149	1.896	-1.68%	-2.45%	-0.2	0.70%	0.42%
H2S-B26	2.061	336.8	588.5	2.152	1.894	2.093	345.3	588.4	2.165	1.902	1.55%	2.52%	-0.1	0.60%	0.42%
Min	2.060	319.9	588.3	2.123	1.881	2.049	310.2	588.1	2.136	1.889	-1.68%	-4.23%	-0.3	0.14%	0.42%
Max	2.106	340.5	590.3	2.168	1.897	2.093	345.3	590.1	2.181	1.906	1.55%	2.52%	0.1	1.03%	0.48%
Average	2.080	333.1	589.1	2.147	1.891	2.075	328.7	588.9	2.161	1.899	-0.23%	-1.35%	-0.1	0.67%	0.46%
Stdev	0.013	5.7	0.6	0.013	0.005	0.014	8.8	0.6	0.012	0.005	0.76%	2.11%	0.1	0.18%	0.03%

4.14.3.5H2S Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
H2S-C1	2.062	344.8	588.7	2.146	1.895	2.057	337.1	588.5	2.160	1.903	-0.24%	-2.23%	-0.2	0.65%	0.42%
H2S-C2	2.094	315.2	589.2	2.161	1.895	2.081	309.4	588.9	2.173	1.903	-0.62%	-1.84%	-0.3	0.56%	0.42%
H2S-C3	2.066	339.3	589.0	2.143	1.894	2.069	333.7	588.8	2.165	1.902	0.15%	-1.65%	-0.2	1.03%	0.42%
H2S-C4	2.070	334.5	589.5	2.126	1.888	2.094	331.4	589.3	2.141	1.896	1.16%	-0.93%	-0.2	0.71%	0.42%
H2S-C5	2.070	334.2	589.1	2.142	1.890	2.074	324.2	589.0	2.156	1.898	0.19%	-2.99%	-0.1	0.65%	0.42%
H2S-C6	2.092	331.2	589.4	2.146	1.887	2.075	322.2	589.3	2.164	1.895	-0.81%	-2.72%	-0.1	0.84%	0.42%
H2S-C7	2.099	332.4	588.7	2.160	1.895	2.085	342.1	588.5	2.180	1.903	-0.67%	2.92%	-0.2	0.93%	0.42%
H2S-C8	2.073	327.8	588.8	2.163	1.894	2.072	339.9	588.6	2.175	1.902	-0.05%	3.69%	-0.2	0.55%	0.42%
H2S-C9	2.082	346.9	589.2	2.134	1.888	2.094	356.5	589.0	2.149	1.896	0.58%	2.77%	-0.2	0.70%	0.42%
H2S-C10	2.087	341.6	588.5	2.150	1.894	2.094	325.6	588.3	2.165	1.903	0.34%	-4.68%	-0.2	0.70%	0.48%
H2S-C11	2.096	337.5	589.1	2.134	1.887	2.080	337.2	589.0	2.149	1.896	-0.76%	-0.09%	-0.1	0.70%	0.48%
H2S-C12	2.069	333.7	588.6	2.169	1.895	2.086	337.5	588.5	2.178	1.904	0.82%	1.14%	-0.1	0.41%	0.47%
H2S-C13	2.097	337.2	588.8	2.151	1.894	2.064	324.7	588.6	2.157	1.902	-1.57%	-3.71%	-0.2	0.28%	0.42%
H2S-C14	2.075	328.8	589.3	2.133	1.888	2.066	321.3	589.2	2.150	1.897	-0.43%	-2.28%	-0.1	0.80%	0.48%
H2S-C15	2.080	338.8	589.9	2.128	1.883	2.085	327.9	589.8	2.142	1.892	0.24%	-3.22%	-0.1	0.66%	0.48%
H2S-C16	2.084	336.3	589.0	2.154	1.891	2.091	328.3	588.8	2.174	1.900	0.34%	-2.38%	-0.2	0.93%	0.48%
H2S-C17	2.095	336.5	588.8	2.157	1.892	2.075	343.3	588.7	2.175	1.901	-0.95%	2.02%	-0.1	0.83%	0.48%
H2S-C18	2.065	331.2	589.0	2.152	1.892	2.063	322.2	588.9	2.167	1.901	-0.10%	-2.72%	-0.1	0.70%	0.48%
H2S-C19	2.067	339.4	589.4	2.132	1.887	2.080	336.4	589.2	2.148	1.895	0.63%	-0.88%	-0.2	0.75%	0.42%
H2S-C20	2.069	332.8	588.8	2.146	1.891	2.068	330.1	588.7	2.160	1.899	-0.05%	-0.81%	-0.1	0.65%	0.42%
H2S-C21	2.061	339.3	588.8	2.142	1.892	2.052	329.2	588.7	2.156	1.900	-0.44%	-2.98%	-0.1	0.65%	0.42%
H2S-C22	2.087	335.4	588.4	2.175	1.898	2.085	330.7	588.2	2.187	1.906	-0.10%	-1.40%	-0.2	0.55%	0.42%
H2S-C23	2.089	335.8	589.0	2.144	1.890	2.072	332.1	588.8	2.153	1.897	-0.81%	-1.10%	-0.2	0.42%	0.37%
H2S-C24	2.096	337.7	589.1	2.134	1.892	2.069	332.6	588.9	2.150	1.900	-1.29%	-1.51%	-0.2	0.75%	0.42%
H2S-C25	2.074	340.3	588.5	2.151	1.895	2.064	346.4	588.4	2.164	1.903	-0.48%	1.79%	-0.1	0.60%	0.42%
H2S-C26	2.073	338.8	588.3	2.169	1.899	2.056	328.9	588.2	2.188	1.907	-0.82%	-2.92%	-0.1	0.88%	0.42%
Min	2.061	315.2	588.3	2.126	1.883	2.052	309.4	588.2	2.141	1.892	-1.57%	-4.68%	-0.3	0.28%	0.37%
Max	2.099	346.9	589.9	2.175	1.899	2.094	356.5	589.8	2.188	1.907	1.16%	3.69%	-0.1	1.03%	0.48%
Average	2.080	335.7	589.0	2.148	1.892	2.075	332.0	588.8	2.163	1.900	-0.22%	-1.10%	-0.2	0.69%	0.44%
Stdev	0.012	6.1	0.4	0.013	0.004	0.012	9.4	0.4	0.013	0.004	0.66%	2.22%	0.1	0.17%	0.03%

4.14.4 Test Photo

Test setup	Test parameter
	
Light /no Light for(-40°C)-1	Light /no Light for(-40°C)-2
	
Light /no Light for(85°C)-1	Light /no Light for(85°C)-2
	

Gas concentration photos



4.15 Flowing Mixed Gas(FMG)

4.15.1 Test Information

Sample size: 3 lots 26 pcs. each

Test period: 2024-12-26 to 2025-01-18

Reference document: IEC 60068-2-60 Test method 4

Power supply: Unpowered

Test temperature: $T_a=25^{\circ}\text{C}$

Test humidity: 75%RH

Gas concentration: $\text{H}_2\text{S}:10\text{ppb}; \text{SO}_2:200\text{ppb}; \text{NO}_2:200\text{ppb}; \text{Cl}_2:10\text{ppb}$

Test duration: 500hrs

Test point: Initial test/Final test

Acceptance criteria: Per Section 3

4.15.2 Environmental Conditions

Environmental temperature: $(23.7\sim26.8)^{\circ}\text{C}$

Environmental humidity: $(46\sim61)\%\text{RH}$

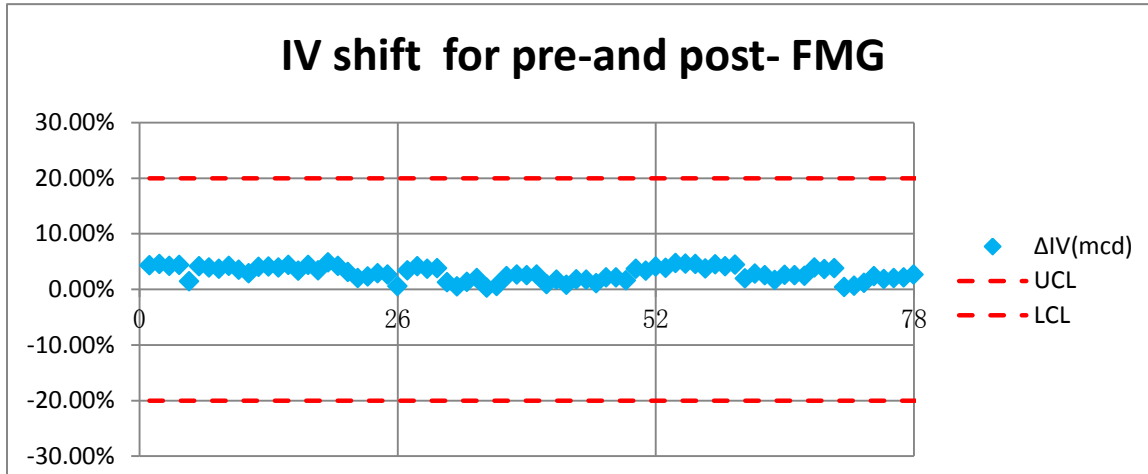
4.15.3 Test Data

4.15.3.1 Test Result for FMG

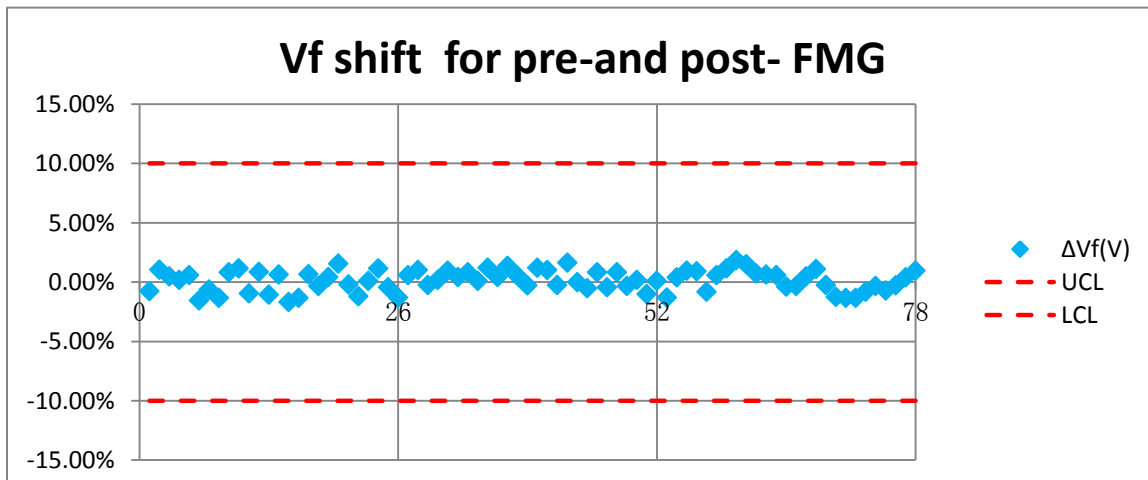
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light			0
B	External Visual	26	26	0
	Test			0
	Light / no light			0
C	External Visual	26	26	0
	Test			0
	Light / no light			0

4.15.3.2 Summary

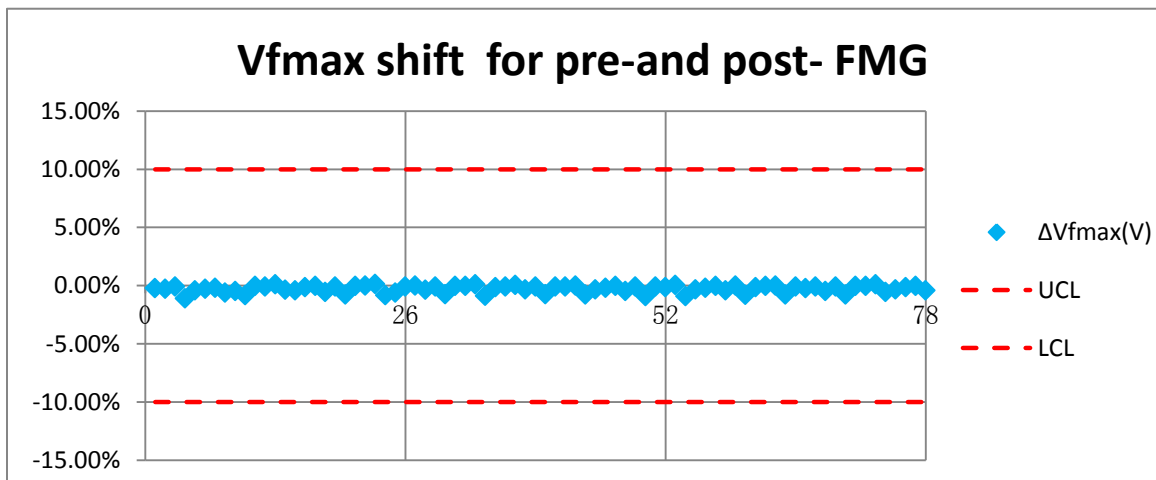
IV shift for pre- and post- FMG test



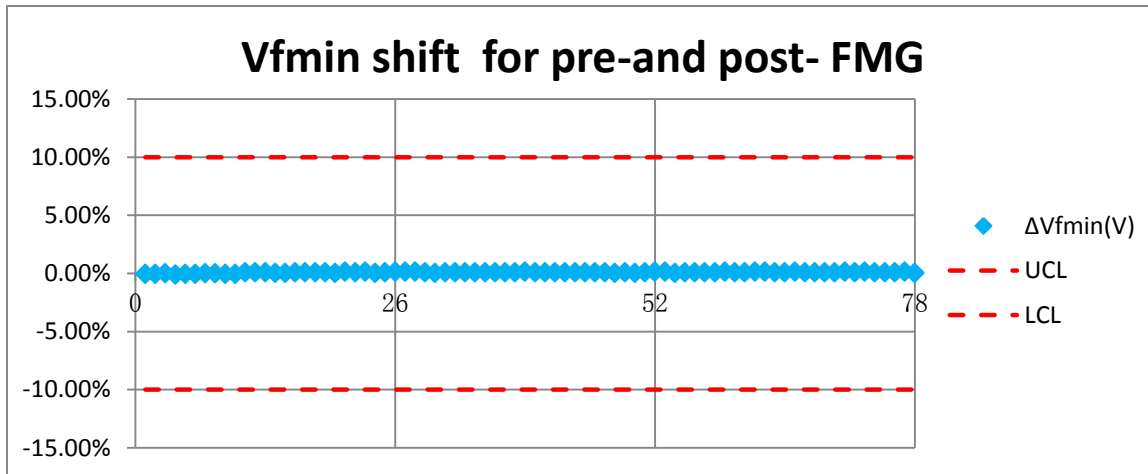
Vf shift for pre- and post- FMG test



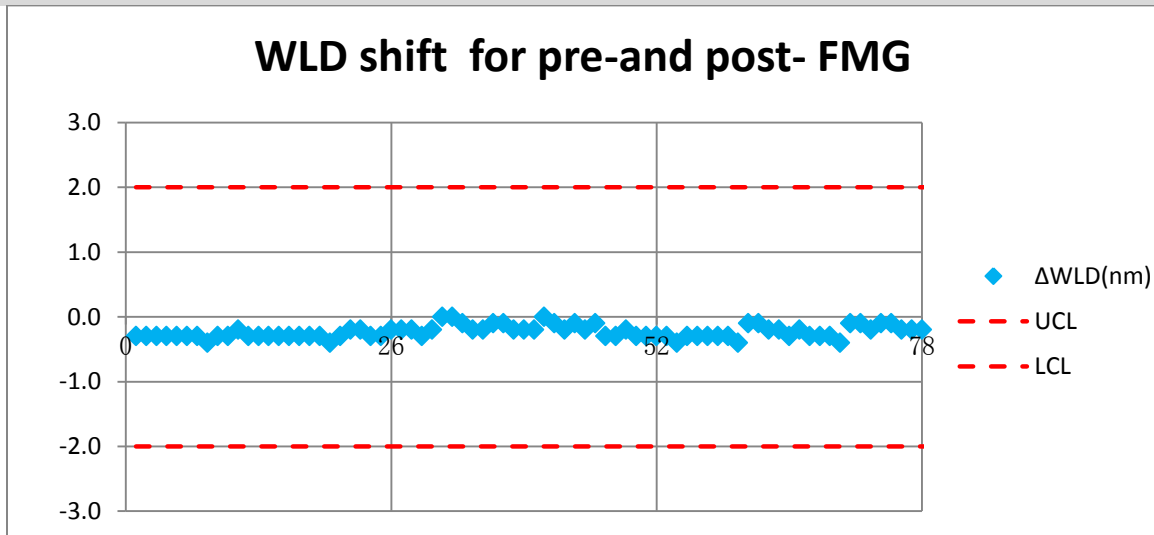
Vf_{max} shift for pre- and post- FMG test



V_{fmin} shift for pre- and post- FMG test



λ_d shift for pre- and post- FMG test



4.15.3FMG Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
FMG-A1	2.091	327.8	588.8	2.141	1.893	2.075	341.9	588.5	2.136	1.892	-0.77%	4.30%	-0.3	-0.23%	-0.05%
FMG-A2	2.081	331.1	589.2	2.140	1.889	2.103	346.0	588.9	2.134	1.888	1.06%	4.50%	-0.3	-0.28%	-0.05%
FMG-A3	2.082	332.6	588.5	2.148	1.897	2.092	346.5	588.2	2.146	1.897	0.48%	4.18%	-0.3	-0.09%	0.00%
FMG-A4	2.076	329.3	589.7	2.155	1.890	2.080	343.6	589.4	2.131	1.888	0.19%	4.34%	-0.3	-1.11%	-0.11%
FMG-A5	2.077	336.7	588.4	2.159	1.898	2.089	341.4	588.1	2.150	1.897	0.58%	1.40%	-0.3	-0.42%	-0.05%
FMG-A6	2.085	332.4	588.5	2.145	1.896	2.053	346.0	588.2	2.139	1.895	-1.53%	4.09%	-0.3	-0.28%	-0.05%
FMG-A7	2.080	332.9	588.6	2.155	1.896	2.067	345.8	588.3	2.151	1.896	-0.62%	3.88%	-0.3	-0.19%	0.00%
FMG-A8	2.086	329.5	589.4	2.147	1.887	2.058	341.6	589.0	2.134	1.887	-1.34%	3.67%	-0.4	-0.61%	0.00%
FMG-A9	2.069	331.3	588.5	2.167	1.898	2.086	345.1	588.2	2.157	1.897	0.82%	4.17%	-0.3	-0.46%	-0.05%
FMG-A10	2.061	324.9	588.7	2.162	1.896	2.085	336.3	588.4	2.144	1.895	1.16%	3.51%	-0.3	-0.83%	-0.05%
FMG-A11	2.086	331.4	589.7	2.129	1.889	2.066	340.9	589.5	2.128	1.891	-0.96%	2.87%	-0.2	-0.05%	0.11%
FMG-A12	2.078	344.0	589.8	2.138	1.886	2.096	357.7	589.5	2.136	1.888	0.87%	3.98%	-0.3	-0.09%	0.11%
FMG-A13	2.093	333.5	589.1	2.135	1.888	2.071	347.1	588.8	2.137	1.890	-1.05%	4.08%	-0.3	0.09%	0.11%
FMG-A14	2.060	328.2	589.9	2.148	1.888	2.073	340.9	589.6	2.140	1.889	0.63%	3.87%	-0.3	-0.37%	0.05%
FMG-A15	2.090	334.9	588.7	2.150	1.893	2.055	349.4	588.4	2.141	1.894	-1.67%	4.33%	-0.3	-0.42%	0.05%
FMG-A16	2.094	334.7	589.4	2.133	1.888	2.066	345.7	589.1	2.130	1.890	-1.34%	3.29%	-0.3	-0.14%	0.11%
FMG-A17	2.067	332.0	589.0	2.141	1.889	2.081	346.5	588.7	2.140	1.891	0.68%	4.37%	-0.3	-0.05%	0.11%
FMG-A18	2.071	336.9	590.2	2.139	1.882	2.064	348.3	589.9	2.127	1.884	-0.34%	3.38%	-0.3	-0.56%	0.11%
FMG-A19	2.064	329.1	589.2	2.143	1.887	2.073	345.0	588.9	2.141	1.889	0.44%	4.83%	-0.3	-0.09%	0.11%
FMG-A20	2.069	331.9	589.3	2.154	1.892	2.101	345.7	588.9	2.137	1.893	1.55%	4.16%	-0.4	-0.79%	0.05%
FMG-A21	2.093	337.3	588.5	2.148	1.894	2.089	347.6	588.2	2.147	1.897	-0.19%	3.05%	-0.3	-0.05%	0.16%
FMG-A22	2.079	336.8	588.5	2.149	1.894	2.054	343.5	588.3	2.149	1.896	-1.20%	1.99%	-0.2	0.00%	0.11%
FMG-A23	2.093	338.3	588.9	2.138	1.890	2.095	346.0	588.7	2.141	1.893	0.10%	2.28%	-0.2	0.14%	0.16%
FMG-A24	2.075	344.6	590.1	2.151	1.885	2.099	354.5	589.8	2.133	1.886	1.16%	2.87%	-0.3	-0.84%	0.05%
FMG-A25	2.062	335.5	589.1	2.144	1.890	2.053	344.2	588.8	2.131	1.892	-0.44%	2.59%	-0.3	-0.61%	0.11%
FMG-A26	2.080	331.9	589.3	2.127	1.888	2.053	333.7	589.1	2.125	1.891	-1.30%	0.54%	-0.2	-0.09%	0.16%
Min	2.060	324.9	588.4	2.127	1.882	2.053	333.7	588.1	2.125	1.884	-1.67%	0.54%	-0.4	-1.11%	-0.11%
Max	2.094	344.6	590.2	2.167	1.898	2.103	357.7	589.9	2.157	1.897	1.55%	4.83%	-0.2	0.14%	0.16%
Average	2.079	333.4	589.1	2.146	1.891	2.076	345.0	588.8	2.139	1.892	-0.12%	3.48%	-0.3	-0.32%	0.05%
Stdev	0.011	4.6	0.5	0.010	0.004	0.016	4.8	0.5	0.008	0.004	0.98%	1.04%	0.0	0.32%	0.08%

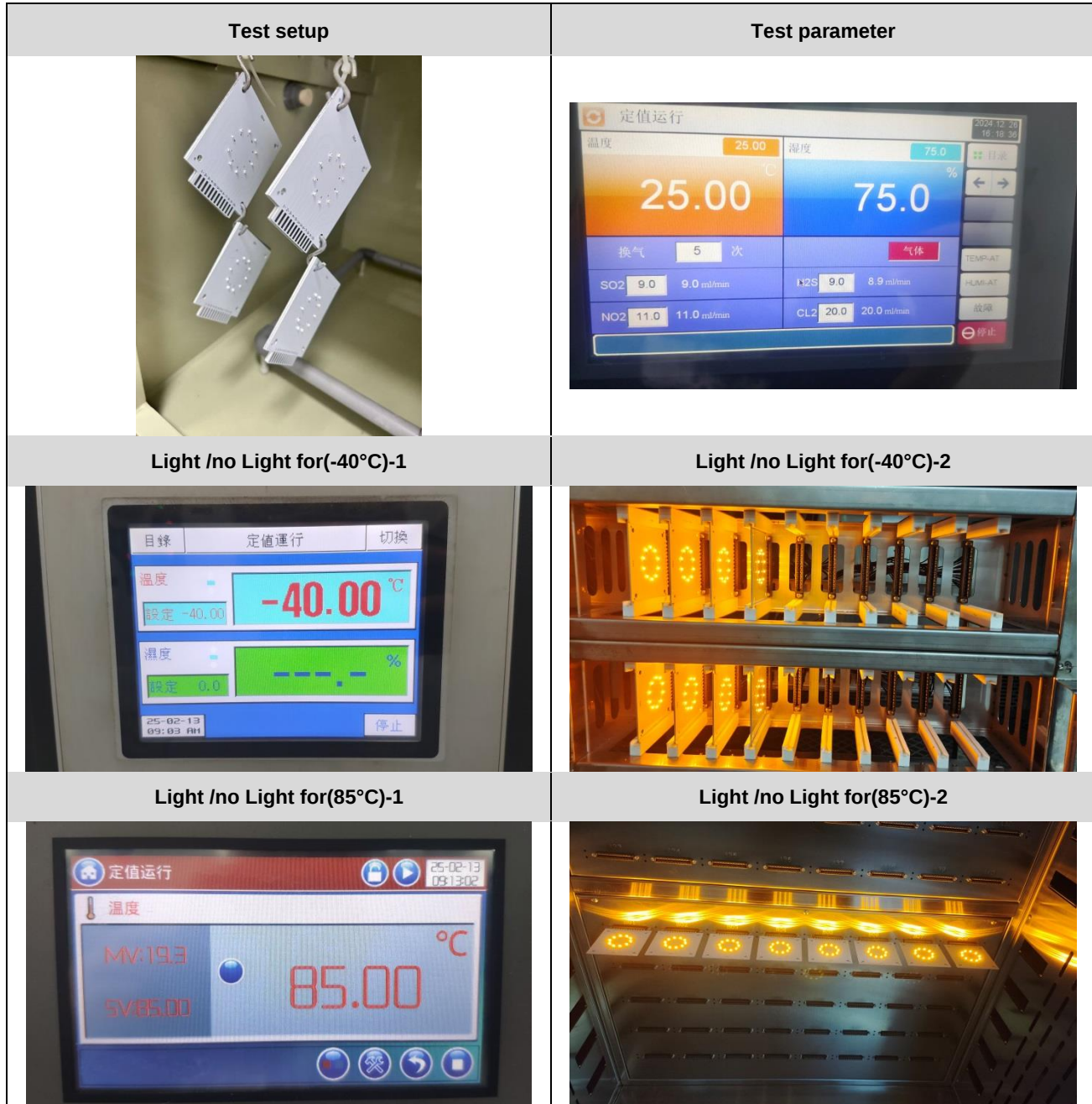
4.15.3.4FMG Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
FMG-B1	2.064	335.0	589.4	2.140	1.888	2.076	346.2	589.2	2.140	1.891	0.58%	3.34%	-0.2	0.00%	0.16%
FMG-B2	2.077	333.5	589.0	2.151	1.889	2.098	347.3	588.8	2.143	1.892	1.01%	4.14%	-0.2	-0.37%	0.16%
FMG-B3	2.086	328.3	588.7	2.151	1.893	2.081	340.3	588.4	2.149	1.895	-0.24%	3.66%	-0.3	-0.09%	0.11%
FMG-B4	2.089	331.6	589.0	2.154	1.890	2.093	344.1	588.8	2.138	1.891	0.19%	3.77%	-0.2	-0.74%	0.05%
FMG-B5	2.081	335.1	588.6	2.139	1.892	2.101	339.2	588.6	2.138	1.894	0.96%	1.22%	0.0	-0.05%	0.11%
FMG-B6	2.063	331.3	590.3	2.122	1.884	2.072	332.9	590.3	2.121	1.886	0.44%	0.48%	0.0	-0.05%	0.11%
FMG-B7	2.068	330.6	588.5	2.146	1.896	2.085	334.8	588.4	2.148	1.898	0.82%	1.27%	-0.1	0.09%	0.11%
FMG-B8	2.085	335.5	588.5	2.178	1.896	2.087	342.1	588.3	2.159	1.898	0.10%	1.97%	-0.2	-0.87%	0.11%
FMG-B9	2.068	335.3	589.0	2.143	1.890	2.093	336.1	588.8	2.140	1.892	1.21%	0.24%	-0.2	-0.14%	0.11%
FMG-B10	2.069	331.2	589.8	2.120	1.885	2.078	333.1	589.7	2.118	1.887	0.43%	0.57%	-0.1	-0.09%	0.11%
FMG-B11	2.067	335.7	588.3	2.155	1.897	2.095	343.5	588.2	2.156	1.899	1.35%	2.32%	-0.1	0.05%	0.11%
FMG-B12	2.080	332.4	589.8	2.138	1.884	2.091	341.2	589.6	2.131	1.886	0.53%	2.65%	-0.2	-0.33%	0.11%
FMG-B13	2.093	329.2	588.5	2.160	1.895	2.087	337.5	588.3	2.158	1.898	-0.29%	2.52%	-0.2	-0.09%	0.16%
FMG-B14	2.077	327.1	588.7	2.161	1.895	2.102	335.6	588.5	2.145	1.897	1.20%	2.60%	-0.2	-0.74%	0.11%
FMG-B15	2.070	341.0	589.2	2.128	1.888	2.091	344.0	589.2	2.126	1.890	1.01%	0.88%	0.0	-0.09%	0.11%
FMG-B16	2.073	336.7	588.9	2.146	1.891	2.068	342.5	588.8	2.144	1.893	-0.24%	1.72%	-0.1	-0.09%	0.11%
FMG-B17	2.069	342.8	590.3	2.121	1.882	2.103	345.4	590.1	2.121	1.884	1.64%	0.76%	-0.2	0.00%	0.11%
FMG-B18	2.064	329.9	588.7	2.174	1.894	2.064	335.7	588.6	2.157	1.896	0.00%	1.76%	-0.1	-0.78%	0.11%
FMG-B19	2.076	337.2	588.5	2.155	1.896	2.065	342.9	588.3	2.148	1.898	-0.53%	1.69%	-0.2	-0.32%	0.11%
FMG-B20	2.073	338.0	590.0	2.119	1.882	2.090	341.6	589.9	2.115	1.884	0.82%	1.07%	-0.1	-0.19%	0.11%
FMG-B21	2.078	331.6	588.5	2.155	1.896	2.069	338.5	588.2	2.154	1.898	-0.43%	2.08%	-0.3	-0.05%	0.11%
FMG-B22	2.071	341.5	590.1	2.139	1.884	2.088	348.7	589.8	2.129	1.885	0.82%	2.11%	-0.3	-0.47%	0.05%
FMG-B23	2.081	328.9	589.2	2.147	1.890	2.074	334.2	589.0	2.145	1.892	-0.34%	1.61%	-0.2	-0.09%	0.11%
FMG-B24	2.079	331.6	588.6	2.168	1.896	2.083	343.8	588.3	2.148	1.897	0.19%	3.68%	-0.3	-0.92%	0.05%
FMG-B25	2.100	334.0	588.7	2.139	1.892	2.079	345.1	588.4	2.137	1.894	-1.00%	3.32%	-0.3	-0.09%	0.11%
FMG-B26	2.100	336.6	589.6	2.131	1.884	2.102	350.3	589.3	2.128	1.887	0.10%	4.07%	-0.3	-0.14%	0.16%
Min	2.063	327.1	588.3	2.119	1.882	2.064	332.9	588.2	2.115	1.884	-1.00%	0.24%	-0.3	-0.92%	0.05%
Max	2.100	342.8	590.3	2.178	1.897	2.103	350.3	590.3	2.159	1.899	1.64%	4.14%	0.0	0.09%	0.16%
Average	2.077	333.9	589.1	2.145	1.890	2.085	341.0	588.9	2.140	1.892	0.40%	2.13%	-0.2	-0.26%	0.11%
Stdev	0.010	4.1	0.6	0.016	0.005	0.012	4.9	0.6	0.013	0.005	0.67%	1.17%	0.1	0.31%	0.03%

4.15.3.FMG Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
FMG-C1	2.090	328.1	588.6	2.145	1.893	2.063	340.6	588.3	2.146	1.896	-1.29%	3.81%	-0.3	0.05%	0.16%
FMG-C2	2.066	325.1	588.9	2.172	1.894	2.074	340.4	588.5	2.152	1.895	0.39%	4.71%	-0.4	-0.92%	0.05%
FMG-C3	2.072	331.2	588.8	2.150	1.892	2.092	346.3	588.5	2.143	1.894	0.97%	4.56%	-0.3	-0.33%	0.11%
FMG-C4	2.068	327.6	588.8	2.136	1.891	2.087	342.5	588.5	2.132	1.893	0.92%	4.55%	-0.3	-0.19%	0.11%
FMG-C5	2.093	330.4	589.4	2.133	1.886	2.076	342.6	589.1	2.132	1.888	-0.81%	3.69%	-0.3	-0.05%	0.11%
FMG-C6	2.089	325.3	588.6	2.163	1.895	2.101	339.8	588.3	2.154	1.897	0.57%	4.46%	-0.3	-0.42%	0.11%
FMG-C7	2.071	327.3	589.8	2.132	1.888	2.095	340.7	589.5	2.132	1.891	1.16%	4.09%	-0.3	0.00%	0.16%
FMG-C8	2.063	331.5	590.0	2.149	1.886	2.101	346.1	589.6	2.132	1.888	1.84%	4.40%	-0.4	-0.79%	0.11%
FMG-C9	2.073	346.7	588.7	2.143	1.893	2.104	353.4	588.6	2.140	1.895	1.50%	1.93%	-0.1	-0.14%	0.11%
FMG-C10	2.088	336.9	588.5	2.150	1.894	2.103	346.4	588.4	2.149	1.897	0.72%	2.82%	-0.1	-0.05%	0.16%
FMG-C11	2.061	339.9	589.5	2.136	1.887	2.074	348.4	589.3	2.136	1.890	0.63%	2.50%	-0.2	0.00%	0.16%
FMG-C12	2.090	337.7	588.7	2.172	1.896	2.102	343.2	588.5	2.155	1.898	0.57%	1.63%	-0.2	-0.78%	0.11%
FMG-C13	2.094	330.3	590.1	2.123	1.887	2.086	338.8	589.8	2.121	1.889	-0.38%	2.57%	-0.3	-0.09%	0.11%
FMG-C14	2.083	333.6	589.5	2.126	1.884	2.076	342.0	589.3	2.121	1.887	-0.34%	2.52%	-0.2	-0.24%	0.16%
FMG-C15	2.081	339.7	590.3	2.125	1.882	2.091	347.9	590.0	2.123	1.884	0.48%	2.41%	-0.3	-0.09%	0.11%
FMG-C16	2.079	327.3	589.1	2.152	1.894	2.102	340.0	588.8	2.142	1.896	1.11%	3.88%	-0.3	-0.46%	0.11%
FMG-C17	2.098	337.1	589.5	2.141	1.889	2.093	349.2	589.2	2.139	1.891	-0.24%	3.59%	-0.3	-0.09%	0.11%
FMG-C18	2.078	328.5	588.7	2.164	1.895	2.052	340.9	588.3	2.147	1.897	-1.25%	3.77%	-0.4	-0.79%	0.11%
FMG-C19	2.089	340.1	588.6	2.144	1.892	2.061	341.4	588.5	2.143	1.895	-1.34%	0.38%	-0.1	-0.05%	0.16%
FMG-C20	2.094	337.9	588.7	2.146	1.892	2.066	339.9	588.6	2.145	1.894	-1.34%	0.59%	-0.1	-0.05%	0.11%
FMG-C21	2.090	338.0	588.5	2.147	1.894	2.073	341.8	588.3	2.149	1.897	-0.81%	1.12%	-0.2	0.09%	0.16%
FMG-C22	2.090	333.0	588.8	2.170	1.896	2.083	340.7	588.7	2.158	1.898	-0.33%	2.31%	-0.1	-0.55%	0.11%
FMG-C23	2.077	332.7	588.5	2.153	1.894	2.062	338.8	588.4	2.146	1.896	-0.72%	1.83%	-0.1	-0.33%	0.11%
FMG-C24	2.082	335.3	588.6	2.143	1.893	2.076	341.9	588.4	2.140	1.895	-0.29%	1.97%	-0.2	-0.14%	0.11%
FMG-C25	2.084	337.8	589.0	2.137	1.888	2.092	344.9	588.8	2.136	1.891	0.38%	2.10%	-0.2	-0.05%	0.16%
FMG-C26	2.062	333.6	588.9	2.152	1.891	2.082	342.4	588.7	2.143	1.892	0.97%	2.64%	-0.2	-0.42%	0.05%
Min	2.061	325.1	588.5	2.123	1.882	2.052	338.8	588.3	2.121	1.884	-1.34%	0.38%	-0.4	-0.92%	0.05%
Max	2.098	346.7	590.3	2.172	1.896	2.104	353.4	590.0	2.158	1.898	1.84%	4.71%	-0.1	0.09%	0.16%
Average	2.081	333.6	589.0	2.146	1.891	2.083	343.1	588.8	2.141	1.893	0.12%	2.88%	-0.2	-0.26%	0.12%
Stdev	0.011	5.4	0.5	0.014	0.004	0.015	3.7	0.5	0.010	0.004	0.93%	1.26%	0.1	0.29%	0.03%

4.15.4 Test Photo



4.16 Board Flex(BF)

4.16.1 Test Information

Sample size: 3 lots 10 pcs. each

Test period: 2024-12-13 to 2024-12-20

Reference document: AEC-Q102-002

PCB thick: 1.6mm(FR4)

Power Supply: IF=20mA

Press tool: Radius:340mm, WD:20mm

Displacement: ≥2mm

Test duration: 60(+5)s

4.16.2 Environmental Conditions

Environmental temperature: (18-28)°C

Environmental humidity: (35-75)%RH

4.16.3 Test Data

4.16.3.1BF Data(Lot A)

Lot A						
No.	Current before test(mA)	Voltage before test (V)	Current after test (mA)	Voltage after test(V)	Appearance after test	Conclusion
BF-A1	20	2.071	20	2.074	No abnormal	PASS
BF-A2	20	2.055	20	2.057	No abnormal	PASS
BF-A3	20	2.068	20	2.072	No abnormal	PASS
BF-A4	20	2.056	20	2.059	No abnormal	PASS
BF-A5	20	2.064	20	2.067	No abnormal	PASS
BF-A6	20	2.073	20	2.076	No abnormal	PASS
BF-A7	20	2.061	20	2.064	No abnormal	PASS
BF-A8	20	2.062	20	2.064	No abnormal	PASS
BF-A9	20	2.059	20	2.062	No abnormal	PASS
BF-A10	20	2.063	20	2.066	No abnormal	PASS

4.16.3.2BF Data(Lot B)

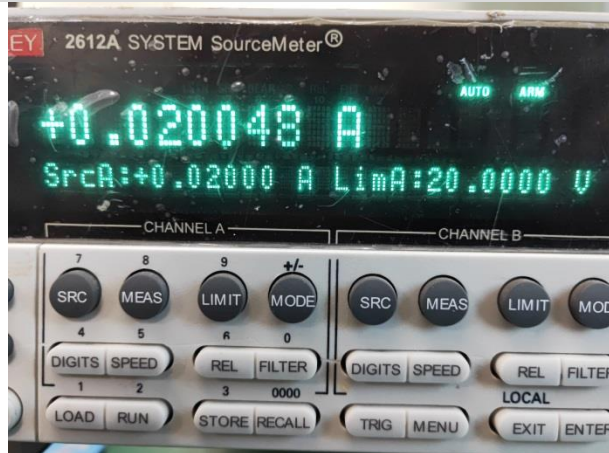
Lot B						
No.	Current before test(mA)	Voltage before test (V)	Current after test (mA)	Voltage after test(V)	Appearance after test	Conclusion
BF-B1	20	2.072	20	2.075	No abnormal	PASS
BF-B2	20	2.074	20	2.077	No abnormal	PASS
BF-B3	20	2.069	20	2.072	No abnormal	PASS
BF-B4	20	2.064	20	2.066	No abnormal	PASS
BF-B5	20	2.046	20	2.049	No abnormal	PASS
BF-B6	20	2.073	20	2.075	No abnormal	PASS
BF-B7	20	2.071	20	2.073	No abnormal	PASS
BF-B8	20	2.053	20	2.056	No abnormal	PASS
BF-B9	20	2.065	20	2.067	No abnormal	PASS
BF-B10	20	2.063	20	2.065	No abnormal	PASS

4.16.3.3BF Data(Lot C)

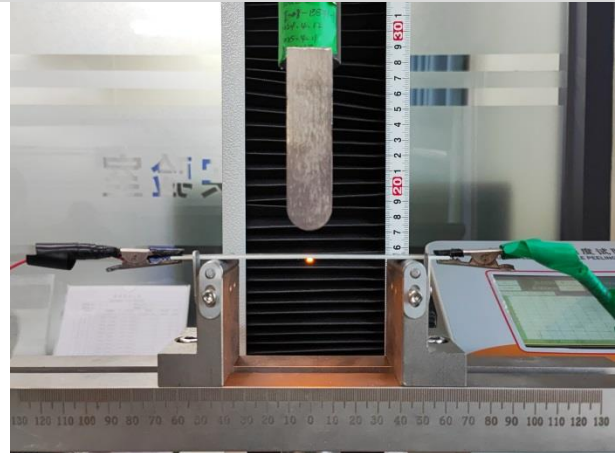
Lot C						
No.	Current before test(mA)	Voltage before test (V)	Current after test (mA)	Voltage after test(V)	Appearance after test	Conclusion
BF-C1	20	2.072	20	2.080	No abnormal	PASS
BF-C2	20	2.071	20	2.074	No abnormal	PASS
BF-C3	20	2.068	20	2.072	No abnormal	PASS
BF-C4	20	2.082	20	2.085	No abnormal	PASS
BF-C5	20	2.079	20	2.083	No abnormal	PASS
BF-C6	20	2.073	20	2.076	No abnormal	PASS
BF-C7	20	2.082	20	2.085	No abnormal	PASS
BF-C8	20	2.060	20	2.062	No abnormal	PASS
BF-C9	20	2.072	20	2.076	No abnormal	PASS
BF-C10	20	2.075	20	2.079	No abnormal	PASS

4.16.4 Test Photo

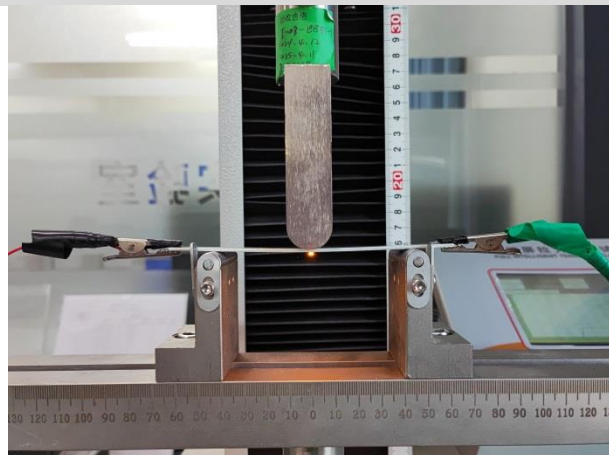
Samples During Test-1



Samples During Test-2



Samples During Test-3



Typical Curve



4.17 External Visual Test Summary(EV)

No.	Item	Descriptions	Failed
1	Color deviation	The luminescent surface color of the sample device cannot be deviated	0
2	Pollution	Product surface shall not be contaminated	0
3	Crack or break	Packaging surface, heat sink plate intact, crack-free	0
4	Identification	Positive and negative electrodes and other marks complete and clear	0
5	defect or residue	Surface no defect, no more parts	0
6	Electrode Bridging	There can be no bridging between positive and negative levels	0
7	Adhesive surface	Rubber surface flat or micro-concave, no overflow, no leakage chip	0

4.18 Parametric Verification(PV)

4.18.1 Test Information

Sample size: 3 lots 26 pcs.each

Test period: 2024-12-06 to 2024-12-09

Reference document: Per spec

Test point: Not applicable

Acceptance criteria: Per spec

The photoelectric parameters test the current: 20mA

4.18.2 Environmental Conditions

Environmental temperature: (24.0~26.1)°C

Environmental humidity: (53~66)%RH

4.18.3 Test Data

4.18.3.1Test Result for PV

Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
B	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA
C	External Visual	26	26	0
	Test			0
	Light / no light	NA	NA	NA

4.18.3.2PV Data(Lot A)

PV-No.	V _f	I _V	λ _d
Unit	V	mcd	nm
Test Condition	20mA	20mA	20mA
Test temp	Room temp		
Spec LSL	1.800	230.0	585.0
Spec USL	2.400	430.0	595.0
PV-A1	2.206	333.8	588.8
PV-A2	2.136	333.4	590.3
PV-A3	2.163	334.5	588.8
PV-A4	2.146	330.9	588.5
PV-A5	2.079	336.5	588.9
PV-A6	2.170	332.6	588.8
PV-A7	2.184	306.4	589.5
PV-A8	2.213	333.5	588.5
PV-A9	2.063	332.0	588.9
PV-A10	2.054	332.3	588.7
PV-A11	2.136	342.0	588.8
PV-A12	2.215	333.4	588.8
PV-A13	2.181	336.6	588.3
PV-A14	2.197	338.8	588.4
PV-A15	2.060	336.6	588.9
PV-A16	2.215	342.3	588.8
PV-A17	2.085	338.7	588.4
PV-A18	2.063	336.4	588.7
PV-A19	2.116	338.8	588.5
PV-A20	2.060	325.0	588.7
PV-A21	2.110	343.5	589.2
PV-A22	2.233	332.4	588.8
PV-A23	2.189	338.2	588.3
PV-A24	2.130	330.2	589.3
PV-A25	2.043	321.1	590.1
PV-A26	2.133	334.6	588.5
Min	2.043	306.4	588.3
Max	2.233	343.5	590.3
Average	2.138	333.6	588.9
Stdev	0.060	7.4	0.5

4.18.3.3PV Data(Lot B)

PV-No.	Vf	IV	λ_d
Unit	V	mcd	nm
Test Condition	20mA	20mA	20mA
Test temp	Room temp		
Spec LSL	1.800	230.0	585.0
Spec USL	2.400	430.0	595.0
PV-B1	2.174	335.6	589.5
PV-B2	2.130	333.1	589.0
PV-B3	2.089	339.1	588.5
PV-B4	2.062	333.8	588.5
PV-B5	2.065	342.7	588.8
PV-B6	2.182	337.3	588.4
PV-B7	2.109	325.7	588.7
PV-B8	2.142	335.9	588.9
PV-B9	2.077	336.1	588.4
PV-B10	2.119	334.2	588.4
PV-B11	2.195	330.6	589.0
PV-B12	2.077	335.5	588.4
PV-B13	2.062	330.4	589.8
PV-B14	2.066	335.0	588.3
PV-B15	2.088	339.5	588.3
PV-B16	2.153	339.0	589.1
PV-B17	2.109	341.4	588.8
PV-B18	2.125	335.1	588.8
PV-B19	2.045	343.0	590.2
PV-B20	2.121	331.4	589.3
PV-B21	2.178	334.2	588.8
PV-B22	2.077	334.2	588.5
PV-B23	2.071	327.1	589.4
PV-B24	2.041	330.2	589.4
PV-B25	2.142	338.6	589.3
PV-B26	2.080	345.2	589.6
Min	2.041	325.7	588.3
Max	2.195	345.2	590.2
Average	2.107	335.5	588.9
Stdev	0.045	4.8	0.5

4.18.3.4PV Data(Lot C)

PV-No.	V _f	I _V	λ _d
Unit	V	mcd	nm
Test Condition	20mA	20mA	20mA
Test temp	Room temp		
Spec LSL	1.800	230.0	585.0
Spec USL	2.400	430.0	595.0
PV-C1	2.216	324.3	588.6
PV-C2	2.130	335.6	589.9
PV-C3	2.065	340.4	588.4
PV-C4	2.183	277.3	588.4
PV-C5	2.147	332.2	588.8
PV-C6	2.058	334.5	588.8
PV-C7	2.077	332.4	589.3
PV-C8	2.055	330.4	589.0
PV-C9	2.158	331.7	588.3
PV-C10	2.194	320.8	588.9
PV-C11	2.194	337.3	589.2
PV-C12	2.181	337.7	588.7
PV-C13	2.046	337.0	589.5
PV-C14	2.148	334.5	588.5
PV-C15	2.157	334.9	588.3
PV-C16	2.054	333.1	588.9
PV-C17	2.062	333.7	589.4
PV-C18	2.060	334.8	588.5
PV-C19	2.077	338.1	588.8
PV-C20	2.131	334.0	588.8
PV-C21	2.143	332.7	588.7
PV-C22	2.130	338.2	588.7
PV-C23	2.052	332.7	588.7
PV-C24	2.076	335.3	588.7
PV-C25	2.091	340.3	589.4
PV-C26	2.110	334.7	588.7
Min	2.046	277.3	588.3
Max	2.216	340.4	589.9
Average	2.115	331.9	588.8
Stdev	0.053	11.9	0.4

4.19 Electrostatic Discharge Human Body Model(HBM)

4.19.1 Test Information

Sample size: 3 lots 10 pcs. each

Test period: 2024-12-18 to 2024-12-25

Reference document: ANSI/ESDA/JEDEC JS-001

Test voltage: $\pm 2000V$

Test duration: not applicable

Test point: Initial test/Final test

Acceptance criteria: Per Section 3

4.19.2 Environmental Conditions

Environmental temperature: (24.4~26.2)°C

Environmental humidity: (41~60)%RH

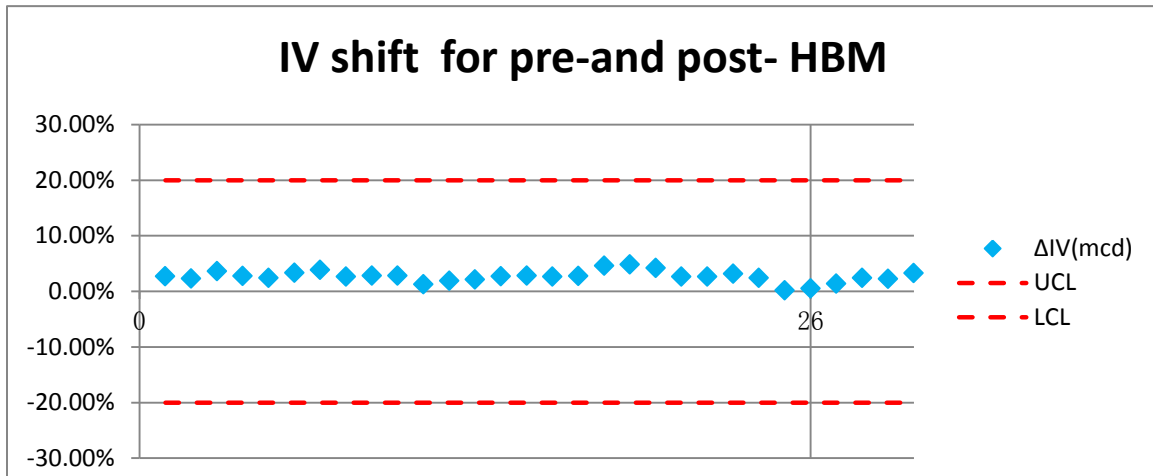
4.19.3 Test Data

4.19.3.1 Test Result for HBM

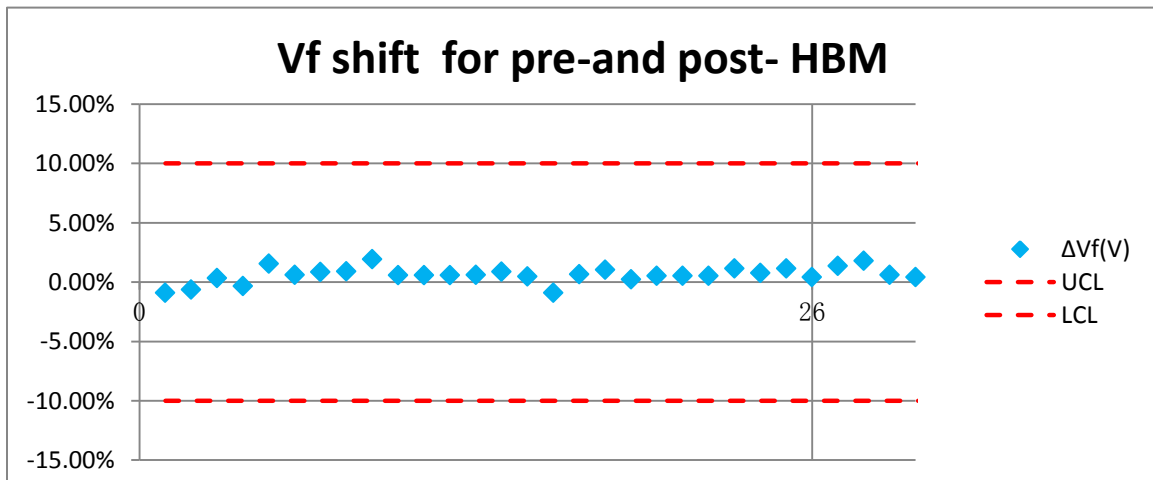
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	10	10	0
	Test			0
	Light / no light	NA	NA	NA
B	External Visual	10	10	0
	Test			0
	Light / no light	NA	NA	NA
C	External Visual	10	10	0
	Test			0
	Light / no light	NA	NA	NA

4.19.3.2 Summary

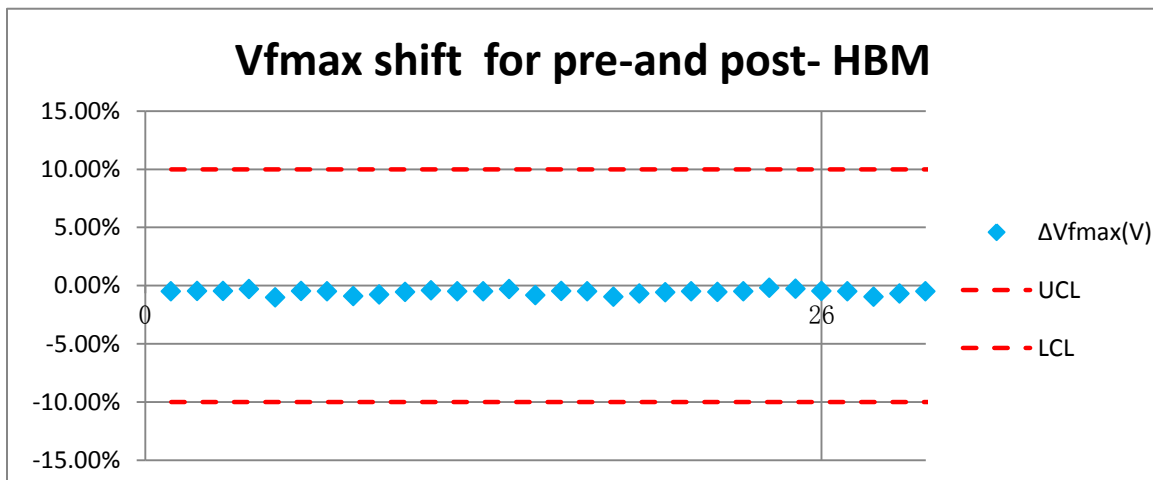
IV shift for pre- and post- HBM test



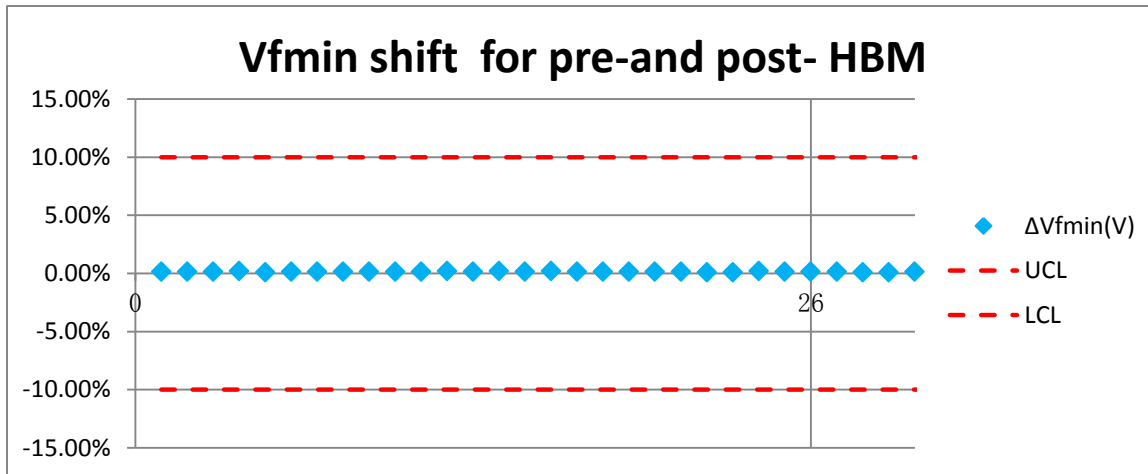
Vf shift for pre- and post- HBM test



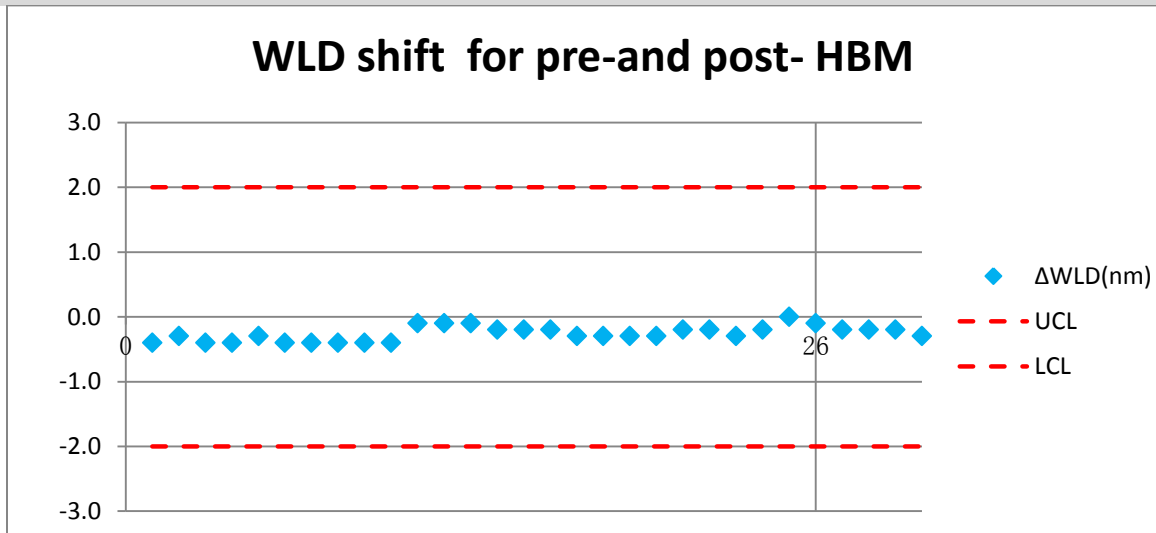
Vf_{max} shift for pre- and post- HBM test



V_{fmin} shift for pre- and post- HBM test



λ_d shift for pre- and post- HBM test



4.19.3.3HBM Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
HBM-A1	2.126	337.0	589.4	2.149	1.887	2.107	346.0	589.0	2.138	1.890	-0.89%	2.67%	-0.4	-0.51%	0.16%
HBM-A2	2.107	335.4	588.5	2.173	1.897	2.094	343.0	588.2	2.163	1.900	-0.62%	2.27%	-0.3	-0.46%	0.16%
HBM-A3	2.067	347.2	588.4	2.167	1.897	2.074	359.7	588.0	2.157	1.900	0.34%	3.60%	-0.4	-0.46%	0.16%
HBM-A4	2.074	340.3	588.4	2.185	1.898	2.067	349.6	588.0	2.178	1.902	-0.34%	2.73%	-0.4	-0.32%	0.21%
HBM-A5	2.052	343.4	590.4	2.162	1.886	2.084	351.6	590.1	2.140	1.888	1.56%	2.39%	-0.3	-1.02%	0.11%
HBM-A6	2.126	342.9	589.0	2.156	1.892	2.139	354.2	588.6	2.146	1.895	0.61%	3.30%	-0.4	-0.46%	0.16%
HBM-A7	2.099	338.4	589.3	2.160	1.890	2.117	351.3	588.9	2.149	1.893	0.86%	3.81%	-0.4	-0.51%	0.16%
HBM-A8	2.063	340.8	589.2	2.176	1.890	2.082	349.7	588.8	2.156	1.893	0.92%	2.61%	-0.4	-0.92%	0.16%
HBM-A9	2.065	339.6	590.1	2.156	1.883	2.105	349.1	589.7	2.139	1.886	1.94%	2.80%	-0.4	-0.79%	0.16%
HBM-A10	2.054	344.3	588.9	2.170	1.893	2.066	353.9	588.5	2.158	1.896	0.58%	2.79%	-0.4	-0.55%	0.16%
Min	2.052	335.4	588.4	2.149	1.883	2.066	343.0	588.0	2.138	1.886	-0.89%	2.27%	-0.4	-1.02%	0.11%
Max	2.126	347.2	590.4	2.185	1.898	2.139	359.7	590.1	2.178	1.902	1.94%	3.81%	-0.3	-0.32%	0.21%
Average	2.083	340.9	589.2	2.165	1.891	2.094	350.8	588.8	2.152	1.894	0.50%	2.90%	-0.4	-0.60%	0.16%
Stdev	0.029	3.6	0.7	0.011	0.005	0.024	4.6	0.7	0.013	0.005	0.91%	0.51%	0.0	0.23%	0.02%

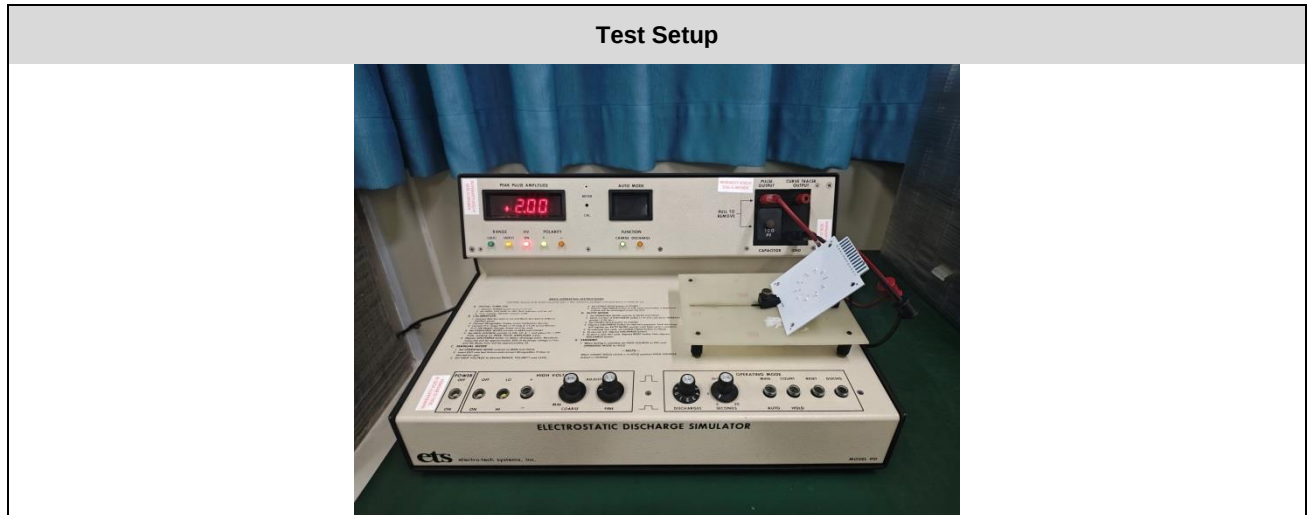
4.19.3.4HBM Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
HBM-B1	2.093	353.4	588.5	2.161	1.893	2.105	357.7	588.4	2.152	1.896	0.57%	1.22%	-0.1	-0.42%	0.16%
HBM-B2	2.064	337.5	589.6	2.151	1.888	2.076	343.9	589.5	2.140	1.892	0.58%	1.90%	-0.1	-0.51%	0.21%
HBM-B3	2.090	346.3	588.3	2.165	1.897	2.103	353.5	588.2	2.154	1.900	0.62%	2.08%	-0.1	-0.51%	0.16%
HBM-B4	2.068	343.5	588.4	2.183	1.898	2.086	352.8	588.2	2.176	1.902	0.87%	2.71%	-0.2	-0.32%	0.21%
HBM-B5	2.069	343.1	588.5	2.182	1.896	2.079	352.6	588.3	2.164	1.899	0.48%	2.77%	-0.2	-0.82%	0.16%
HBM-B6	2.127	341.8	589.3	2.154	1.889	2.108	350.7	589.1	2.144	1.893	-0.89%	2.60%	-0.2	-0.46%	0.21%
HBM-B7	2.104	339.0	588.8	2.165	1.893	2.118	348.3	588.5	2.154	1.896	0.67%	2.74%	-0.3	-0.51%	0.16%
HBM-B8	2.105	338.6	588.4	2.194	1.898	2.127	354.2	588.1	2.173	1.901	1.05%	4.61%	-0.3	-0.96%	0.16%
HBM-B9	2.097	338.9	588.3	2.189	1.900	2.102	355.2	588.0	2.174	1.903	0.24%	4.81%	-0.3	-0.69%	0.16%
HBM-B10	2.063	333.9	588.5	2.179	1.897	2.074	347.9	588.2	2.166	1.900	0.53%	4.19%	-0.3	-0.60%	0.16%
Min	2.063	333.9	588.3	2.151	1.888	2.074	343.9	588.0	2.140	1.892	-0.89%	1.22%	-0.3	-0.96%	0.16%
Max	2.127	353.4	589.6	2.194	1.900	2.127	357.7	589.5	2.176	1.903	1.05%	4.81%	-0.1	-0.32%	0.21%
Average	2.088	341.6	588.7	2.172	1.895	2.098	351.7	588.5	2.160	1.898	0.47%	2.96%	-0.2	-0.58%	0.17%
Stdev	0.021	5.4	0.4	0.015	0.004	0.018	4.0	0.5	0.013	0.004	0.53%	1.20%	0.1	0.19%	0.03%

4.19.3.5HBM Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
HBM-C1	2.065	347.5	588.2	2.170	1.897	2.076	356.7	588.0	2.159	1.900	0.53%	2.65%	-0.2	-0.51%	0.16%
HBM-C2	2.099	336.7	588.4	2.174	1.898	2.110	345.5	588.2	2.162	1.900	0.52%	2.61%	-0.2	-0.55%	0.11%
HBM-C3	2.085	337.8	588.4	2.163	1.897	2.109	348.4	588.1	2.152	1.899	1.15%	3.14%	-0.3	-0.51%	0.11%
HBM-C4	2.092	343.4	589.3	2.163	1.888	2.108	351.7	589.1	2.159	1.892	0.76%	2.42%	-0.2	-0.18%	0.21%
HBM-C5	2.062	341.6	588.8	2.162	1.893	2.086	342.2	588.8	2.156	1.896	1.16%	0.18%	0.0	-0.28%	0.16%
HBM-C6	2.100	342.9	589.4	2.146	1.887	2.109	344.5	589.3	2.136	1.890	0.43%	0.47%	-0.1	-0.47%	0.16%
HBM-C7	2.108	334.2	589.0	2.160	1.895	2.137	338.8	588.8	2.149	1.898	1.38%	1.38%	-0.2	-0.51%	0.16%
HBM-C8	2.069	339.8	588.3	2.197	1.900	2.106	348.0	588.1	2.176	1.902	1.79%	2.41%	-0.2	-0.96%	0.11%
HBM-C9	2.111	337.5	588.4	2.187	1.900	2.124	344.9	588.2	2.172	1.902	0.62%	2.19%	-0.2	-0.69%	0.11%
HBM-C10	2.060	341.7	588.6	2.174	1.897	2.069	352.8	588.3	2.163	1.900	0.44%	3.25%	-0.3	-0.51%	0.16%
Min	2.060	334.2	588.2	2.146	1.887	2.069	338.8	588.0	2.136	1.890	0.43%	0.18%	-0.3	-0.96%	0.11%
Max	2.111	347.5	589.4	2.197	1.900	2.137	356.7	589.3	2.176	1.902	1.79%	3.25%	0.0	-0.18%	0.21%
Average	2.085	340.3	588.7	2.170	1.895	2.103	347.4	588.5	2.158	1.898	0.88%	2.07%	-0.2	-0.52%	0.14%
Stdev	0.020	3.9	0.4	0.014	0.005	0.021	5.3	0.5	0.011	0.004	0.47%	1.06%	0.1	0.21%	0.04%

4.19.4 Test Photo



4.20 Electrostatic Discharge Charged Device Model(CDM)

4.20.1 Test Information

Sample size: 3 lots 10 pcs. each

Test period: 2024-12-18 to 2024-12-25

Reference document: AEC Q101-005

Test voltage: $\pm 1000V$

Discharge times: 3times

Chamber relative humidity: 20%RH(Must be $\leq 30\%RH$)

Test duration: Not applicable

Test point: Initial test/Final test

Acceptance criteria: Per Section 3

4.20.2 Environmental Conditions

Environmental temperature: (24.3~25.7)°C

Environmental humidity: (53~66)%RH

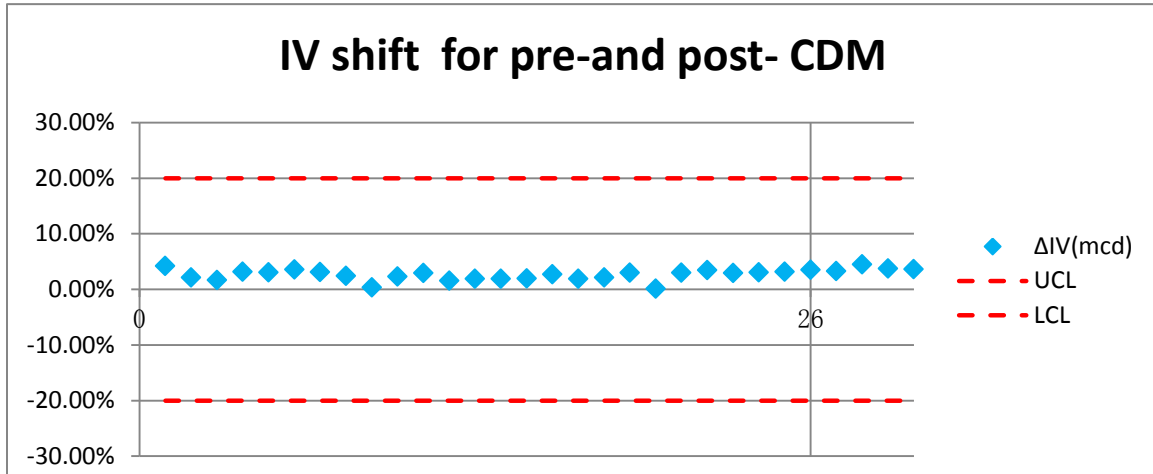
4.20.3 Test Data

4.20.3.1 Test Result for CDM

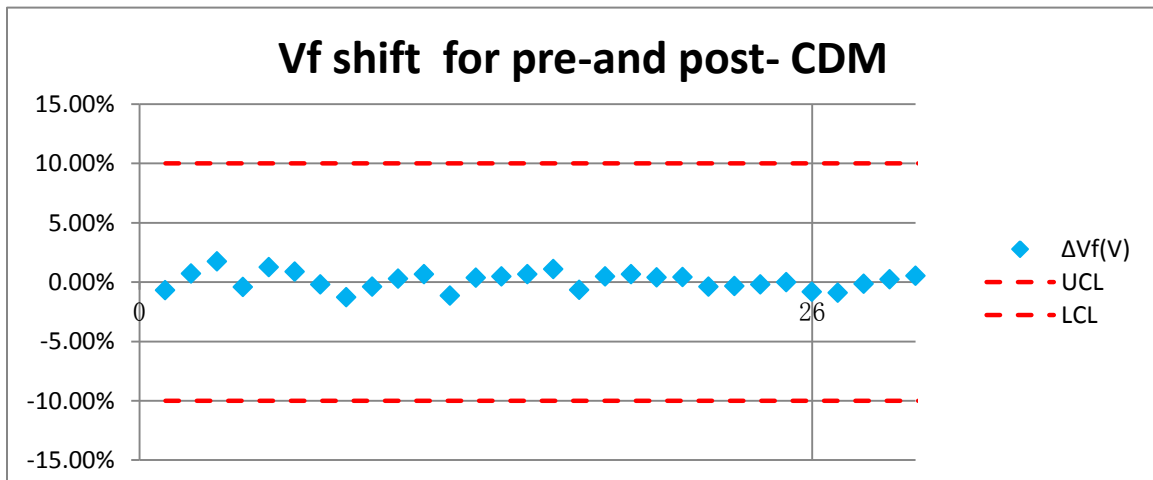
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	10	10	0
	Test			0
	Light / no light	NA	NA	NA
B	External Visual	10	10	0
	Test			0
	Light / no light	NA	NA	NA
C	External Visual	10	10	0
	Test			0
	Light / no light	NA	NA	NA

4.20.3.2 Summary

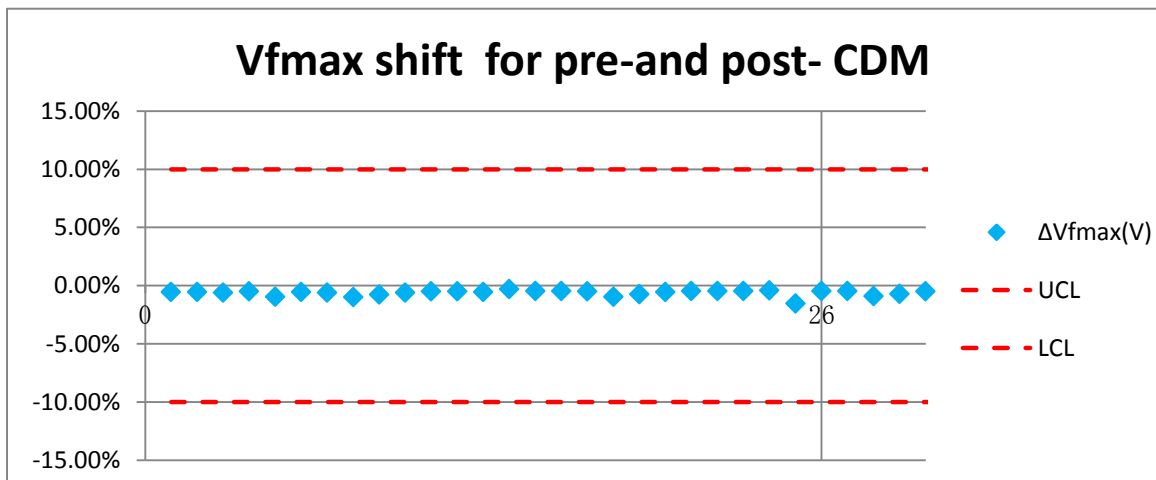
IV shift for pre- and post- CDM test



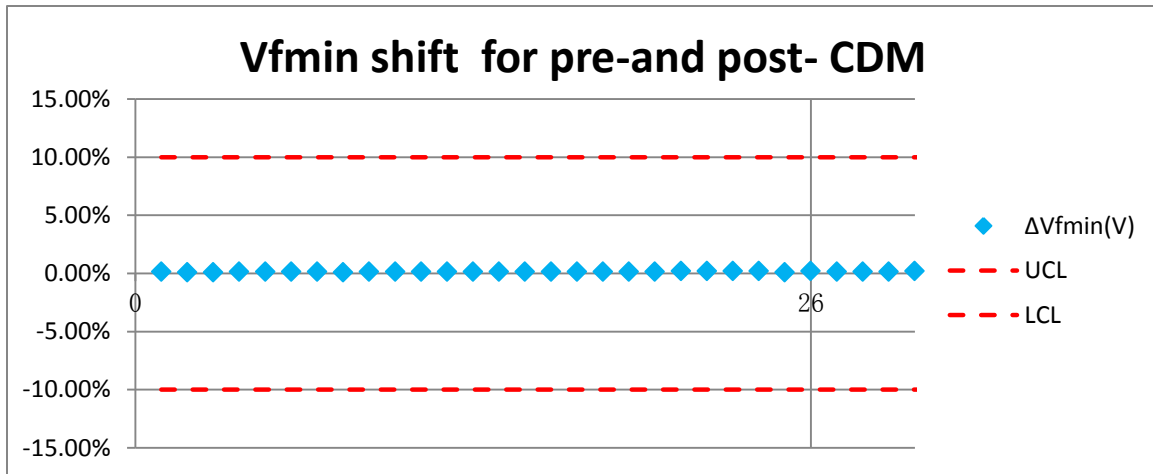
Vf shift for pre- and post- CDM test



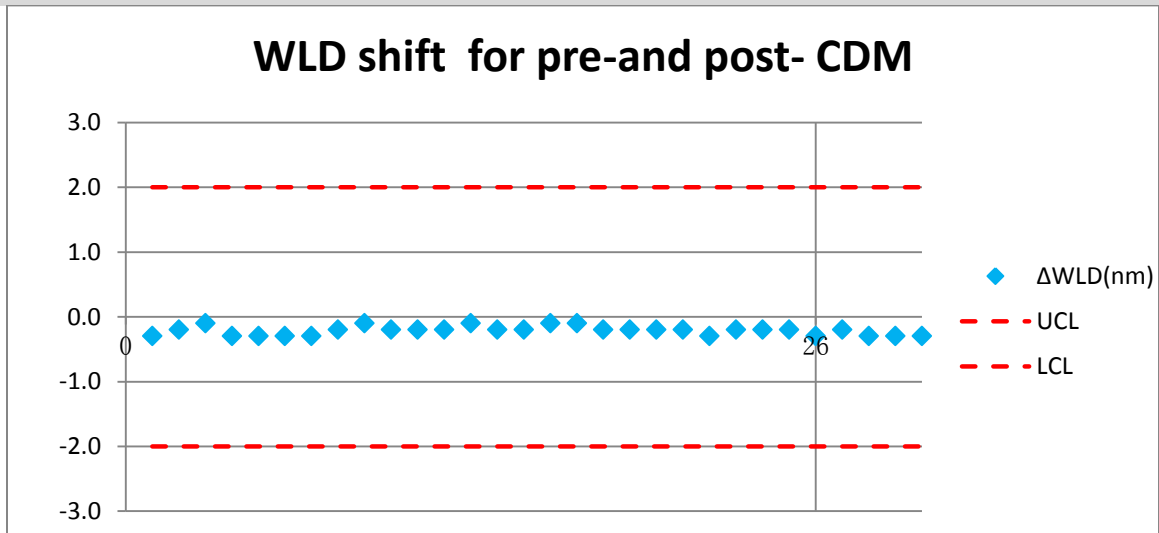
Vf_{max} shift for pre- and post- CDM test



V_{fmin} shift for pre- and post- CDM test



λ_d shift for pre- and post- CDM test



4.20.3.3CDM Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
CDM-A1	2.089	348.3	589.3	2.147	1.886	2.075	362.8	589.0	2.135	1.889	-0.67%	4.16%	-0.3	-0.56%	0.16%
CDM-A2	2.072	347.7	588.4	2.171	1.897	2.087	355.1	588.2	2.159	1.899	0.72%	2.13%	-0.2	-0.55%	0.11%
CDM-A3	2.071	343.5	589.0	2.155	1.890	2.107	349.1	588.9	2.142	1.892	1.74%	1.63%	-0.1	-0.60%	0.11%
CDM-A4	2.124	350.5	588.4	2.183	1.896	2.115	361.6	588.1	2.172	1.899	-0.42%	3.17%	-0.3	-0.50%	0.16%
CDM-A5	2.076	346.0	588.5	2.188	1.895	2.102	356.5	588.2	2.167	1.898	1.25%	3.03%	-0.3	-0.96%	0.16%
CDM-A6	2.072	343.2	588.5	2.159	1.894	2.090	355.3	588.2	2.147	1.897	0.87%	3.53%	-0.3	-0.56%	0.16%
CDM-A7	2.061	342.3	588.4	2.168	1.896	2.057	352.8	588.1	2.155	1.899	-0.19%	3.07%	-0.3	-0.60%	0.16%
CDM-A8	2.099	349.7	588.3	2.187	1.897	2.072	358.1	588.1	2.165	1.899	-1.29%	2.40%	-0.2	-1.01%	0.11%
CDM-A9	2.088	333.7	588.4	2.181	1.897	2.080	334.8	588.3	2.164	1.900	-0.38%	0.33%	-0.1	-0.78%	0.16%
CDM-A10	2.065	348.8	588.2	2.175	1.897	2.071	356.7	588.0	2.162	1.900	0.29%	2.26%	-0.2	-0.60%	0.16%
Min	2.061	333.7	588.2	2.147	1.886	2.057	334.8	588.0	2.135	1.889	-1.29%	0.33%	-0.3	-1.01%	0.11%
Max	2.124	350.5	589.3	2.188	1.897	2.115	362.8	589.0	2.172	1.900	1.74%	4.16%	-0.1	-0.50%	0.16%
Average	2.082	345.4	588.5	2.171	1.895	2.086	354.3	588.3	2.157	1.897	0.19%	2.57%	-0.2	-0.67%	0.14%
Stdev	0.019	5.0	0.3	0.014	0.004	0.018	7.9	0.3	0.012	0.004	0.95%	1.08%	0.1	0.18%	0.03%

4.20.3.4CDM Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
CDM-B1	2.066	347.2	588.9	2.154	1.889	2.080	357.3	588.7	2.143	1.892	0.68%	2.91%	-0.2	-0.51%	0.16%
CDM-B2	2.096	347.9	588.8	2.165	1.892	2.072	353.2	588.6	2.154	1.895	-1.15%	1.52%	-0.2	-0.51%	0.16%
CDM-B3	2.098	343.0	588.7	2.158	1.891	2.106	349.5	588.6	2.146	1.894	0.38%	1.90%	-0.1	-0.56%	0.16%
CDM-B4	2.075	344.7	588.7	2.175	1.893	2.085	351.1	588.5	2.168	1.896	0.48%	1.86%	-0.2	-0.32%	0.16%
CDM-B5	2.066	349.6	589.0	2.161	1.892	2.080	356.3	588.8	2.151	1.895	0.68%	1.92%	-0.2	-0.46%	0.16%
CDM-B6	2.070	348.7	589.3	2.146	1.887	2.093	358.1	589.2	2.136	1.890	1.11%	2.70%	-0.1	-0.47%	0.16%
CDM-B7	2.119	342.2	588.8	2.159	1.890	2.105	348.7	588.7	2.148	1.893	-0.66%	1.90%	-0.1	-0.51%	0.16%
CDM-B8	2.072	344.4	589.3	2.172	1.888	2.082	351.6	589.1	2.151	1.891	0.48%	2.09%	-0.2	-0.97%	0.16%
CDM-B9	2.076	342.3	588.8	2.172	1.894	2.090	352.5	588.6	2.156	1.897	0.67%	2.98%	-0.2	-0.74%	0.16%
CDM-B10	2.060	343.3	588.8	2.171	1.896	2.068	343.7	588.6	2.159	1.899	0.39%	0.12%	-0.2	-0.55%	0.16%
Min	2.060	342.2	588.7	2.146	1.887	2.068	343.7	588.5	2.136	1.890	-1.15%	0.12%	-0.2	-0.97%	0.16%
Max	2.119	349.6	589.3	2.175	1.896	2.106	358.1	589.2	2.168	1.899	1.11%	2.98%	-0.1	-0.32%	0.16%
Average	2.080	345.3	588.9	2.163	1.891	2.086	352.2	588.7	2.151	1.894	0.31%	1.99%	-0.2	-0.56%	0.16%
Stdev	0.019	2.8	0.2	0.009	0.003	0.013	4.4	0.2	0.009	0.003	0.68%	0.82%	0.0	0.18%	0.00%

4.20.3.5CDM Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
CDM-C1	2.076	344.0	588.7	2.160	1.892	2.085	354.2	588.5	2.150	1.896	0.43%	2.97%	-0.2	-0.46%	0.21%
CDM-C2	2.110	341.7	588.6	2.171	1.894	2.102	353.5	588.3	2.161	1.898	-0.38%	3.45%	-0.3	-0.46%	0.21%
CDM-C3	2.070	344.9	589.5	2.145	1.885	2.063	355.0	589.3	2.135	1.889	-0.34%	2.93%	-0.2	-0.47%	0.21%
CDM-C4	2.062	349.6	588.8	2.176	1.894	2.058	360.1	588.6	2.167	1.898	-0.19%	3.00%	-0.2	-0.41%	0.21%
CDM-C5	2.082	342.9	588.3	2.197	1.899	2.082	353.6	588.1	2.163	1.901	0.00%	3.12%	-0.2	-1.55%	0.11%
CDM-C6	2.085	342.9	588.8	2.159	1.892	2.068	354.9	588.5	2.149	1.896	-0.82%	3.50%	-0.3	-0.46%	0.21%
CDM-C7	2.125	332.6	590.0	2.142	1.886	2.106	343.4	589.8	2.132	1.889	-0.89%	3.25%	-0.2	-0.47%	0.16%
CDM-C8	2.114	333.4	590.2	2.160	1.882	2.111	348.2	589.9	2.140	1.885	-0.14%	4.44%	-0.3	-0.93%	0.16%
CDM-C9	2.099	342.6	588.6	2.180	1.895	2.104	355.3	588.3	2.164	1.898	0.24%	3.71%	-0.3	-0.73%	0.16%
CDM-C10	2.065	332.4	588.6	2.174	1.895	2.076	344.3	588.3	2.163	1.899	0.53%	3.58%	-0.3	-0.51%	0.21%
Min	2.062	332.4	588.3	2.142	1.882	2.058	343.4	588.1	2.132	1.885	-0.89%	2.93%	-0.3	-1.55%	0.11%
Max	2.125	349.6	590.2	2.197	1.899	2.111	360.1	589.9	2.167	1.901	0.53%	4.44%	-0.2	-0.41%	0.21%
Average	2.089	340.7	589.0	2.166	1.891	2.086	352.3	588.8	2.152	1.895	-0.16%	3.39%	-0.3	-0.64%	0.19%
Stdev	0.022	5.9	0.7	0.017	0.005	0.019	5.3	0.7	0.013	0.005	0.48%	0.46%	0.1	0.36%	0.04%

4.20.4 Test Photo



4.21 Vibration Variable Frequency(VVF)

4.21.1 Test Information

Sample size: 3 lots 10 pcs. each

Test period: 2024-12-21 to 2024-12-26

Reference document: JEDEC JESD22-B103 Condition 1

Frequency range: (20~2000)Hz

Displacement: 1.5mm

Peak acceleration: 20g

Cross Frequency: 80Hz

Sweep time: 4 min/cycle(total 4 cycles for each orientation)

Orientation: X / Y / Z

Test point: Initial test/Final test

Acceptance criteria: Per Section 3

4.21.2 Environmental Conditions

Environmental temperature: (24.4~26.2)°C

Environmental humidity: (47~59)%RH

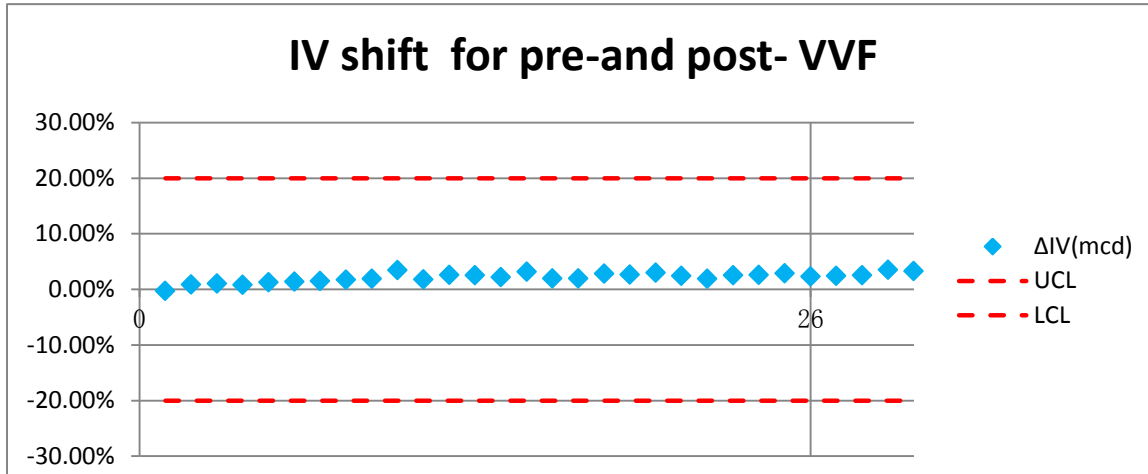
4.21.3 Test Data

4.21.3.1 Test Result for VVF

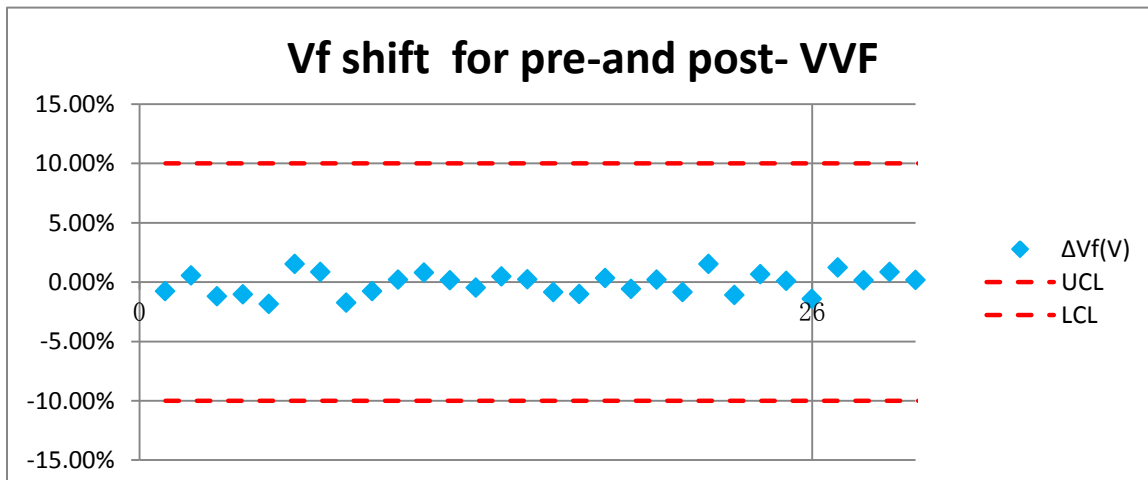
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	10	10	0
	Test			0
	Light / no light			0
B	External Visual	10	10	0
	Test			0
	Light / no light			0
C	External Visual	10	10	0
	Test			0
	Light / no light			0

4.21.3.2Summary

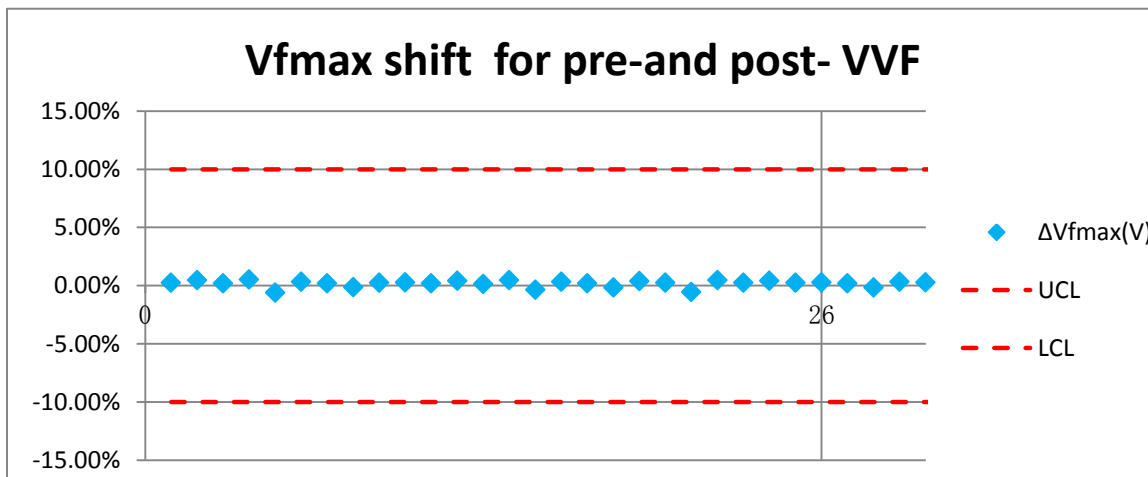
IV shift for pre- and post- VVF test



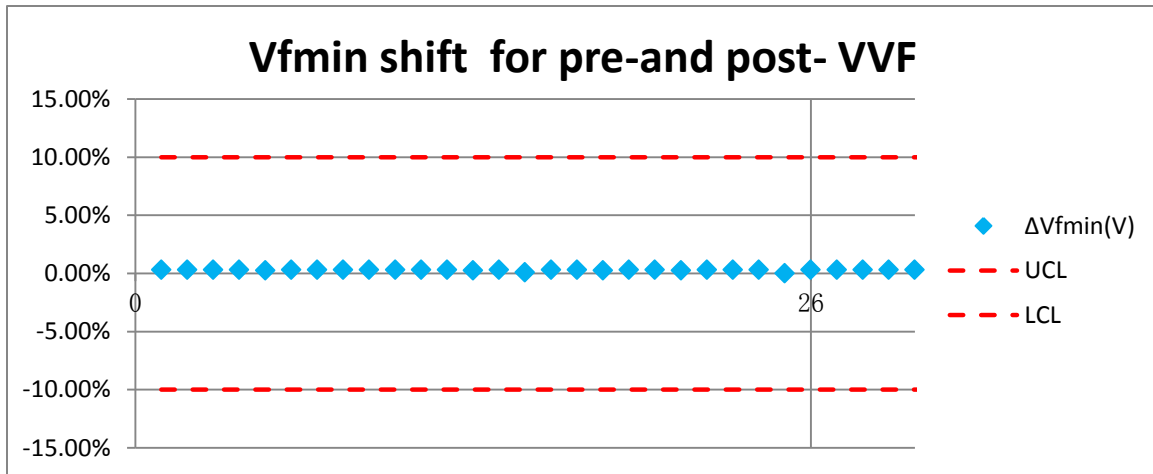
Vf shift for pre- and post- VVF test



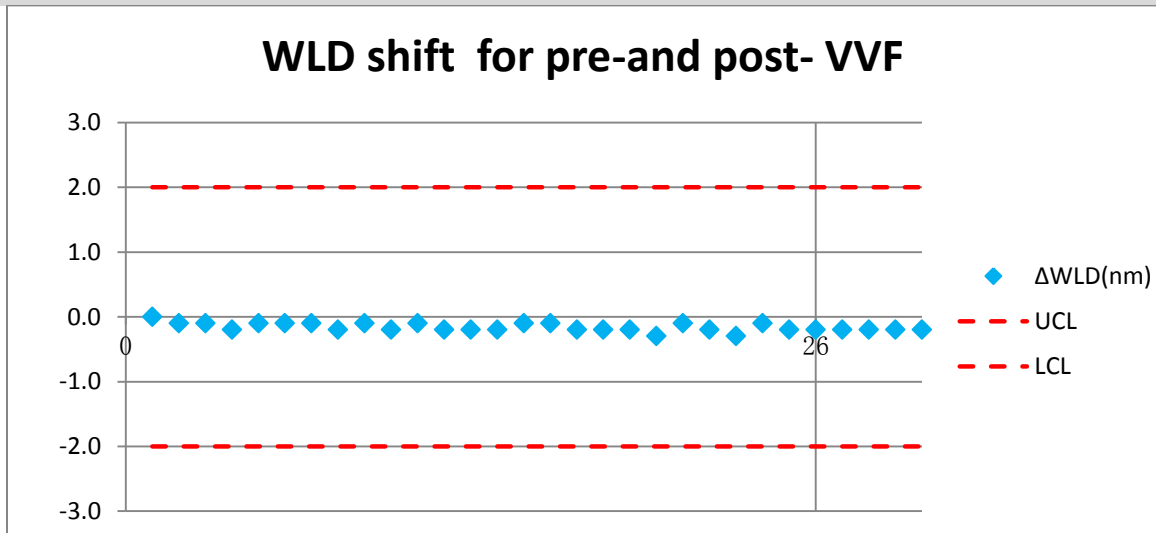
Vf_{max} shift for pre- and post- VVF test



V_{fmin} shift for pre- and post- VVF test



λ_d shift for pre- and post- VVF test



4.21.3.3VVF Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
VVF-A1	2.121	338.2	588.6	2.163	1.894	2.105	337.1	588.6	2.168	1.900	-0.75%	-0.33%	0.0	0.23%	0.32%
VVF-A2	2.116	340.7	588.3	2.179	1.897	2.128	343.5	588.2	2.189	1.903	0.57%	0.82%	-0.1	0.46%	0.32%
VVF-A3	2.106	341.2	588.4	2.167	1.895	2.081	344.7	588.3	2.171	1.901	-1.19%	1.03%	-0.1	0.18%	0.32%
VVF-A4	2.114	341.0	588.7	2.176	1.894	2.092	343.7	588.5	2.187	1.900	-1.04%	0.79%	-0.2	0.51%	0.32%
VVF-A5	2.113	340.0	589.0	2.173	1.890	2.074	344.2	588.9	2.160	1.895	-1.85%	1.24%	-0.1	-0.60%	0.26%
VVF-A6	2.079	338.0	588.4	2.165	1.897	2.111	342.6	588.3	2.172	1.903	1.54%	1.36%	-0.1	0.32%	0.32%
VVF-A7	2.084	334.1	589.6	2.146	1.887	2.102	339.0	589.5	2.150	1.893	0.86%	1.47%	-0.1	0.19%	0.32%
VVF-A8	2.122	341.0	588.8	2.182	1.894	2.085	346.8	588.6	2.179	1.900	-1.74%	1.70%	-0.2	-0.14%	0.32%
VVF-A9	2.093	340.9	588.4	2.186	1.898	2.077	347.2	588.3	2.191	1.904	-0.76%	1.85%	-0.1	0.23%	0.32%
VVF-A10	2.058	330.9	588.7	2.174	1.894	2.062	342.2	588.5	2.180	1.900	0.19%	3.41%	-0.2	0.28%	0.32%
Min	2.058	330.9	588.3	2.146	1.887	2.062	337.1	588.2	2.150	1.893	-1.85%	-0.33%	-0.2	-0.60%	0.26%
Max	2.122	341.2	589.6	2.186	1.898	2.128	347.2	589.5	2.191	1.904	1.54%	3.41%	0.0	0.51%	0.32%
Average	2.101	338.6	588.7	2.171	1.894	2.092	343.1	588.6	2.175	1.900	-0.42%	1.33%	-0.1	0.17%	0.31%
Stdev	0.021	3.5	0.4	0.011	0.003	0.020	3.1	0.4	0.013	0.003	1.15%	0.95%	0.1	0.32%	0.02%

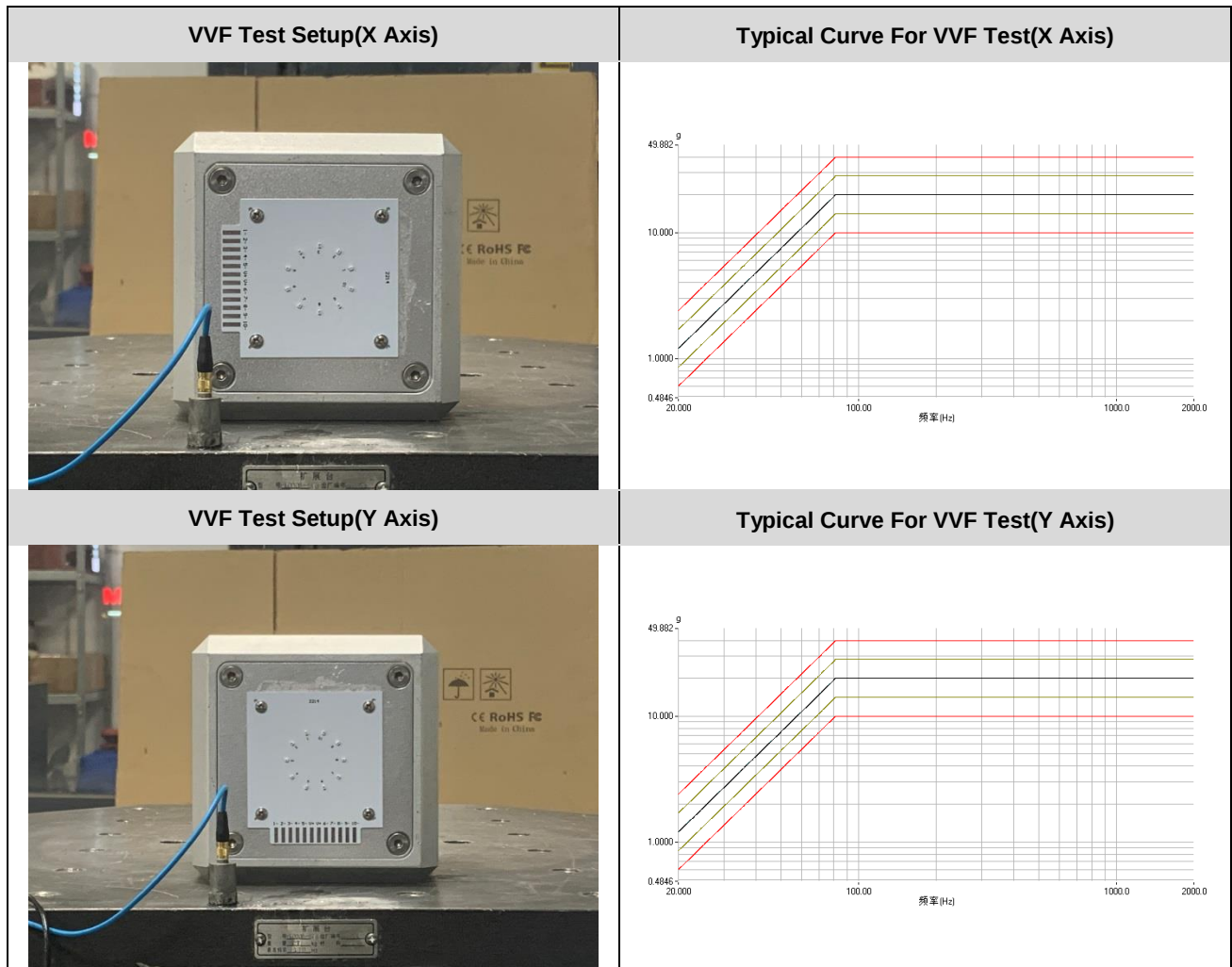
4.21.3.4VVF Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
VVF-B1	2.093	346.2	588.1	2.168	1.897	2.110	352.3	588.0	2.172	1.903	0.81%	1.76%	-0.1	0.18%	0.32%
VVF-B2	2.105	343.7	590.1	2.147	1.883	2.108	352.6	589.9	2.156	1.889	0.14%	2.59%	-0.2	0.42%	0.32%
VVF-B3	2.114	343.1	589.1	2.152	1.888	2.104	351.7	588.9	2.155	1.893	-0.47%	2.51%	-0.2	0.14%	0.26%
VVF-B4	2.098	338.2	589.0	2.170	1.894	2.108	345.6	588.8	2.180	1.900	0.48%	2.19%	-0.2	0.46%	0.32%
VVF-B5	2.049	329.9	589.8	2.188	1.892	2.054	340.3	589.7	2.180	1.894	0.24%	3.15%	-0.1	-0.37%	0.11%
VVF-B6	2.104	332.4	588.5	2.163	1.896	2.086	338.9	588.4	2.170	1.902	-0.86%	1.96%	-0.1	0.32%	0.32%
VVF-B7	2.115	343.3	588.3	2.177	1.899	2.094	350.0	588.1	2.181	1.905	-0.99%	1.95%	-0.2	0.18%	0.32%
VVF-B8	2.095	337.1	589.7	2.178	1.889	2.102	346.5	589.5	2.174	1.894	0.33%	2.79%	-0.2	-0.18%	0.26%
VVF-B9	2.086	337.7	588.9	2.174	1.892	2.074	346.6	588.7	2.182	1.898	-0.58%	2.64%	-0.2	0.37%	0.32%
VVF-B10	2.054	325.3	589.1	2.167	1.895	2.058	334.9	588.8	2.172	1.901	0.19%	2.95%	-0.3	0.23%	0.32%
Min	2.049	325.3	588.1	2.147	1.883	2.054	334.9	588.0	2.155	1.889	-0.99%	1.76%	-0.3	-0.37%	0.11%
Max	2.115	346.2	590.1	2.188	1.899	2.110	352.6	589.9	2.182	1.905	0.81%	3.15%	-0.1	0.46%	0.32%
Average	2.091	337.7	589.1	2.168	1.893	2.090	345.9	588.9	2.172	1.898	-0.07%	2.45%	-0.2	0.18%	0.29%
Stdev	0.023	6.8	0.7	0.012	0.005	0.021	6.1	0.6	0.010	0.005	0.61%	0.47%	0.1	0.26%	0.07%

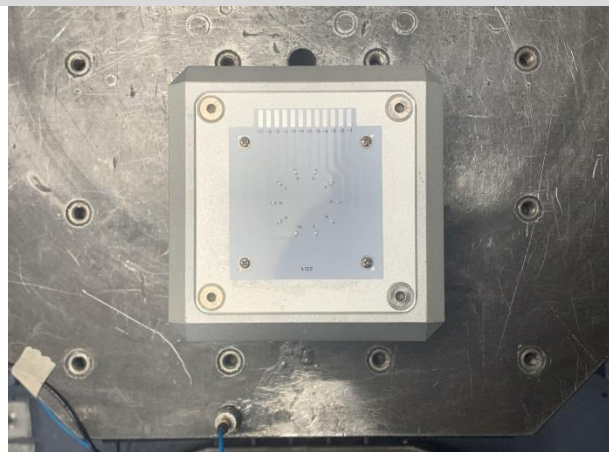
4.21.3.VVF Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
VVF-C1	2.125	335.5	589.9	2.139	1.886	2.107	343.6	589.8	2.127	1.891	-0.85%	2.41%	-0.1	-0.56%	0.27%
VVF-C2	2.093	341.3	588.6	2.168	1.895	2.125	347.6	588.4	2.178	1.901	1.53%	1.85%	-0.2	0.46%	0.32%
VVF-C3	2.118	342.4	588.8	2.159	1.892	2.095	350.9	588.5	2.164	1.898	-1.09%	2.48%	-0.3	0.23%	0.32%
VVF-C4	2.110	341.3	588.9	2.175	1.893	2.124	350.1	588.8	2.184	1.899	0.66%	2.58%	-0.1	0.41%	0.32%
VVF-C5	2.060	334.3	588.8	2.166	1.899	2.062	343.8	588.6	2.171	1.899	0.10%	2.84%	-0.2	0.23%	0.00%
VVF-C6	2.128	338.9	588.8	2.156	1.893	2.098	346.7	588.6	2.162	1.899	-1.41%	2.30%	-0.2	0.28%	0.32%
VVF-C7	2.099	344.1	588.9	2.162	1.892	2.125	352.4	588.7	2.166	1.898	1.24%	2.41%	-0.2	0.19%	0.32%
VVF-C8	2.068	337.2	588.5	2.192	1.897	2.071	345.6	588.3	2.188	1.903	0.15%	2.49%	-0.2	-0.18%	0.32%
VVF-C9	2.077	334.9	588.5	2.182	1.896	2.095	346.5	588.3	2.189	1.902	0.87%	3.46%	-0.2	0.32%	0.32%
VVF-C10	2.062	329.1	588.5	2.175	1.896	2.066	339.9	588.3	2.181	1.902	0.19%	3.28%	-0.2	0.28%	0.32%
Min	2.060	329.1	588.5	2.139	1.886	2.062	339.9	588.3	2.127	1.891	-1.41%	1.85%	-0.3	-0.56%	0.00%
Max	2.128	344.1	589.9	2.192	1.899	2.125	352.4	589.8	2.189	1.903	1.53%	3.46%	-0.1	0.46%	0.32%
Average	2.094	337.9	588.8	2.167	1.894	2.097	346.7	588.6	2.171	1.899	0.14%	2.61%	-0.2	0.17%	0.28%
Stdev	0.026	4.6	0.4	0.015	0.004	0.024	3.8	0.4	0.018	0.003	0.99%	0.47%	0.1	0.31%	0.10%

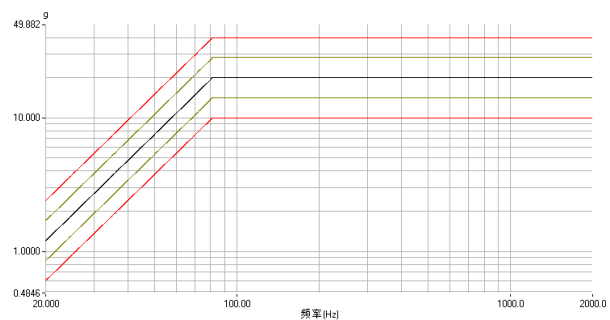
4.21.4 Test Photo



VVF Test Setup(Z Axis)



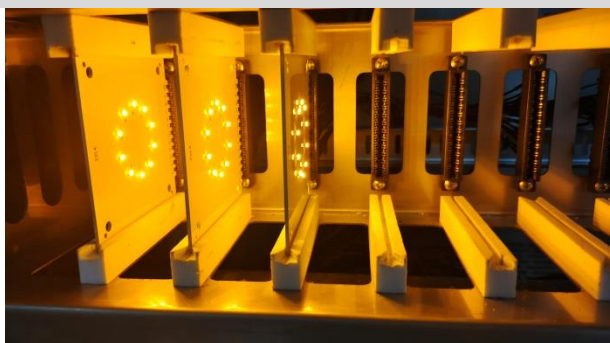
Typical Curve For VVF Test(Z Axis)



Light /no Light for(-40°C)-1



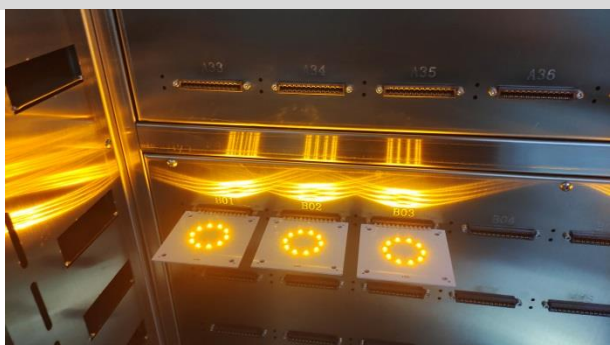
Light /no Light for(-40°C)-2



Light /no Light for(85°C)-1



Light /no Light for(85°C)-2



4.22 Mechanical Shock(MS)

4.22.1 Test Information

Sample size: 3 lots 10 pcs. each

Test period: 2024-12-28 to 2025-01-02

Reference document: JEDEC JESD22-B110

Acceleration peak: 1500g

Pulse duration: 0.5ms

Orientation: $\pm X$, $\pm Y$, $\pm Z$

Shock time: 5 shocks in each direction(total 30 shocks)

Test point: Initial test/Final test

Acceptance criteria: Per Section 3

4.22.2 Environmental Conditions

Environmental temperature: (25.1~26.0)°C

Environmental humidity: (53~68)%RH

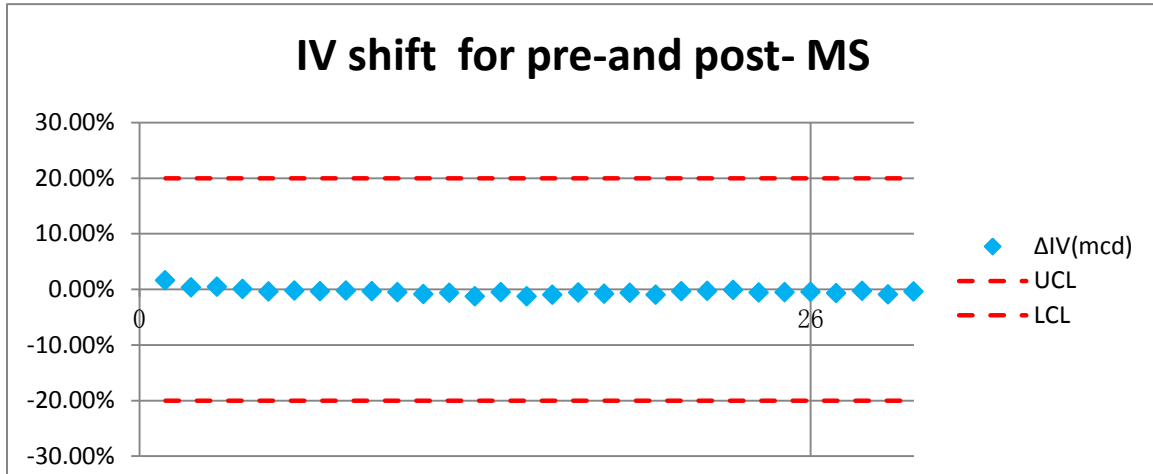
4.22.3 Test Data

4.22.3.1 Test Result for MS

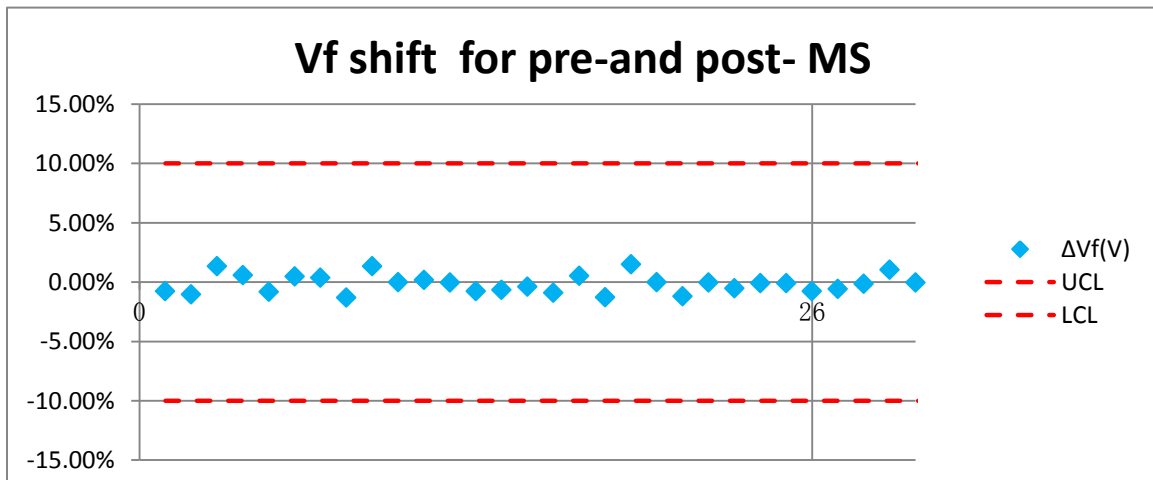
Lot	Test Item	Tested Samples (pcs)	Number of pass samples(pcs)	Number of failures samples(pcs)
A	External Visual	10	10	0
	Test			0
	Light / no light			0
B	External Visual	10	10	0
	Test			0
	Light / no light			0
C	External Visual	10	10	0
	Test			0
	Light / no light			0

4.22.3.2 Summary

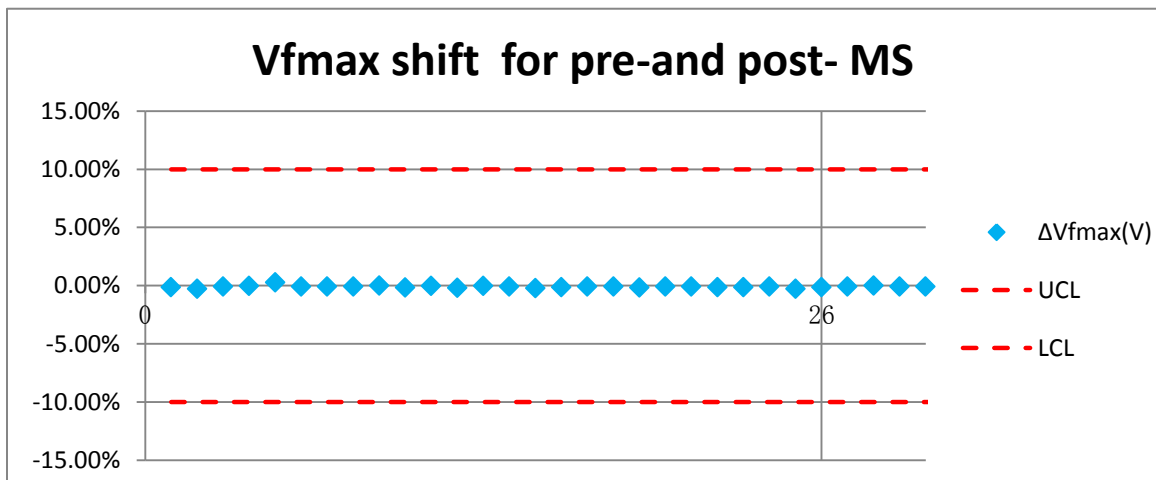
IV shift for pre- and post- MS test



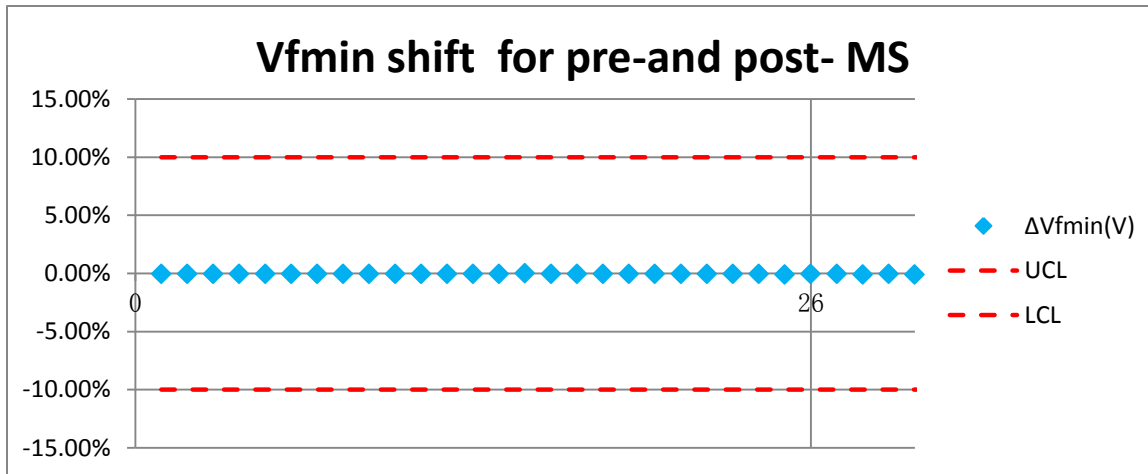
Vf shift for pre- and post- MS test



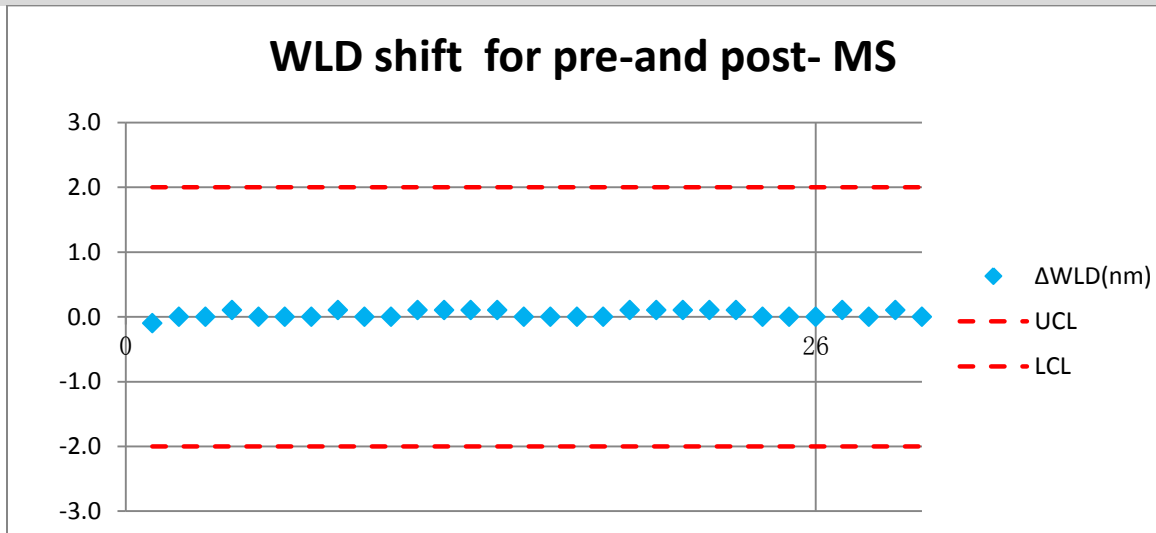
Vf_{max} shift for pre- and post- MS test



V_{fmin} shift for pre- and post- MS test



λ_d shift for pre- and post- MS test



4.22.3.3MS Data(Lot A)

No.	Lot A														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
MS-A1	2.105	337.1	588.6	2.168	1.900	2.089	342.5	588.5	2.165	1.899	-0.76%	1.60%	-0.1	-0.14%	-0.05%
MS-A2	2.128	343.5	588.2	2.189	1.903	2.106	344.6	588.2	2.183	1.902	-1.03%	0.32%	0.0	-0.27%	-0.05%
MS-A3	2.081	344.7	588.3	2.171	1.901	2.109	346.2	588.3	2.169	1.900	1.35%	0.44%	0.0	-0.09%	-0.05%
MS-A4	2.092	343.7	588.5	2.187	1.900	2.104	343.9	588.6	2.186	1.899	0.57%	0.06%	0.1	-0.05%	-0.05%
MS-A5	2.074	344.2	588.9	2.160	1.895	2.057	342.8	588.9	2.166	1.894	-0.82%	-0.41%	0.0	0.28%	-0.05%
MS-A6	2.111	342.6	588.3	2.172	1.903	2.121	341.8	588.3	2.170	1.902	0.47%	-0.23%	0.0	-0.09%	-0.05%
MS-A7	2.102	339.0	589.5	2.150	1.893	2.110	337.7	589.5	2.148	1.892	0.38%	-0.38%	0.0	-0.09%	-0.05%
MS-A8	2.085	346.8	588.6	2.179	1.900	2.058	345.9	588.7	2.177	1.899	-1.29%	-0.26%	0.1	-0.09%	-0.05%
MS-A9	2.077	347.2	588.3	2.191	1.904	2.105	346.0	588.3	2.191	1.903	1.35%	-0.35%	0.0	0.00%	-0.05%
MS-A10	2.062	342.2	588.5	2.180	1.900	2.062	340.4	588.5	2.176	1.899	0.00%	-0.53%	0.0	-0.18%	-0.05%
Min	2.062	337.1	588.2	2.150	1.893	2.057	337.7	588.2	2.148	1.892	-1.29%	-0.53%	-0.1	-0.27%	-0.05%
Max	2.128	347.2	589.5	2.191	1.904	2.121	346.2	589.5	2.191	1.903	1.35%	1.60%	0.1	0.28%	-0.05%
Average	2.092	343.1	588.6	2.175	1.900	2.092	343.2	588.6	2.173	1.899	0.02%	0.03%	0.0	-0.07%	-0.05%
Stdev	0.020	3.1	0.4	0.013	0.003	0.024	2.7	0.4	0.012	0.003	0.96%	0.64%	0.1	0.14%	0.00%

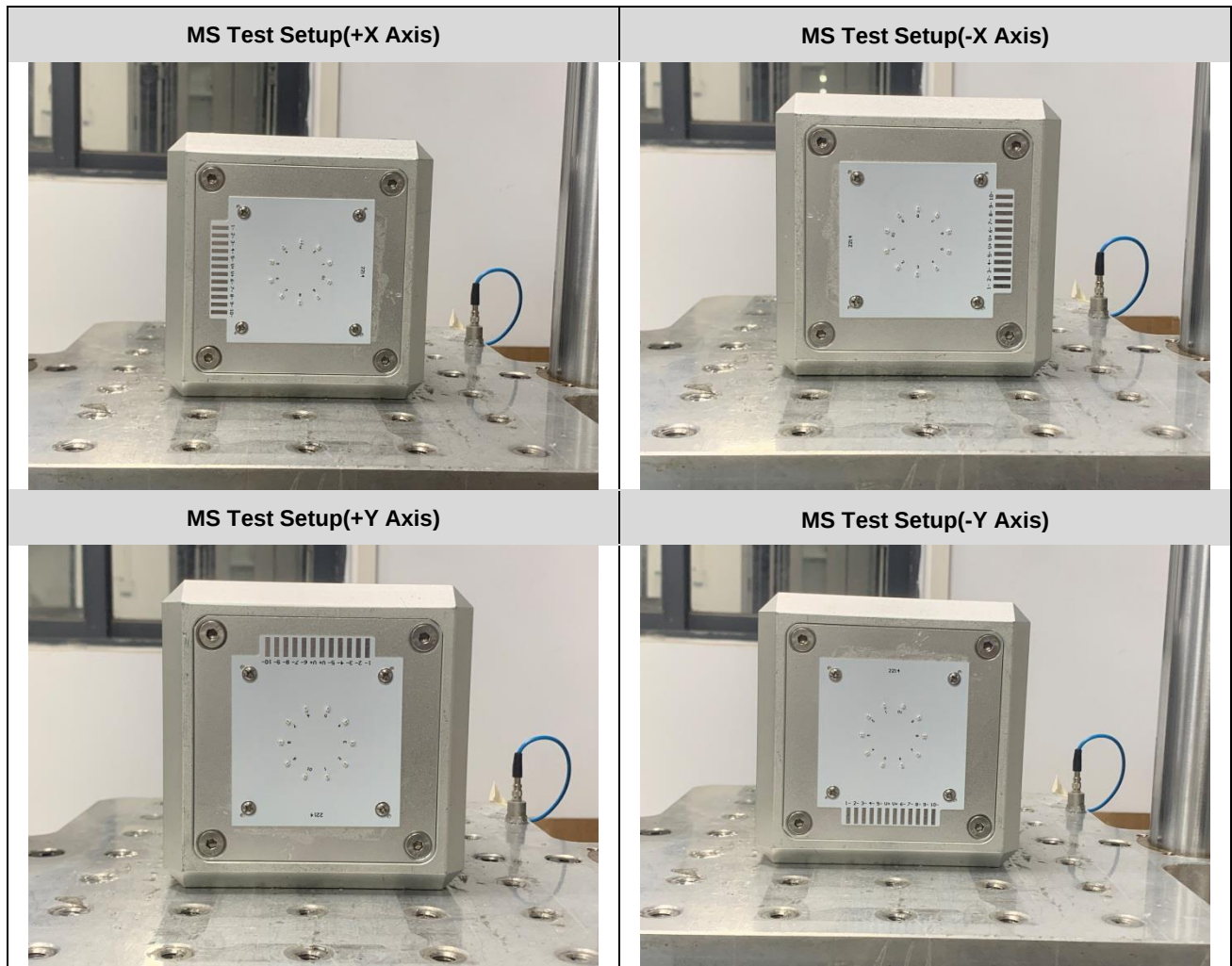
4.22.3.4MS Data(Lot B)

No.	Lot B														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
MS-B1	2.110	352.3	588.0	2.172	1.903	2.114	349.2	588.1	2.171	1.902	0.19%	-0.88%	0.1	-0.05%	-0.05%
MS-B2	2.108	352.6	589.9	2.156	1.889	2.107	350.3	590.0	2.152	1.888	-0.05%	-0.65%	0.1	-0.19%	-0.05%
MS-B3	2.104	351.7	588.9	2.155	1.893	2.088	347.1	589.0	2.154	1.892	-0.76%	-1.31%	0.1	-0.05%	-0.05%
MS-B4	2.108	345.6	588.8	2.180	1.900	2.094	343.7	588.9	2.178	1.899	-0.66%	-0.55%	0.1	-0.09%	-0.05%
MS-B5	2.054	340.3	589.7	2.180	1.894	2.046	335.9	589.7	2.175	1.894	-0.39%	-1.29%	0.0	-0.23%	0.00%
MS-B6	2.086	338.9	588.4	2.170	1.902	2.067	335.5	588.4	2.167	1.901	-0.91%	-1.00%	0.0	-0.14%	-0.05%
MS-B7	2.094	350.0	588.1	2.181	1.905	2.105	347.8	588.1	2.179	1.904	0.53%	-0.63%	0.0	-0.09%	-0.05%
MS-B8	2.102	346.5	589.5	2.174	1.894	2.075	343.7	589.5	2.172	1.893	-1.28%	-0.81%	0.0	-0.09%	-0.05%
MS-B9	2.074	346.6	588.7	2.182	1.898	2.105	344.3	588.8	2.178	1.897	1.49%	-0.66%	0.1	-0.18%	-0.05%
MS-B10	2.058	334.9	588.8	2.172	1.901	2.058	331.6	588.9	2.170	1.900	0.00%	-0.99%	0.1	-0.09%	-0.05%
Min	2.054	334.9	588.0	2.155	1.889	2.046	331.6	588.1	2.152	1.888	-1.28%	-1.31%	0.0	-0.23%	-0.05%
Max	2.110	352.6	589.9	2.182	1.905	2.114	350.3	590.0	2.179	1.904	1.49%	-0.55%	0.1	-0.05%	0.00%
Average	2.090	345.9	588.9	2.172	1.898	2.086	342.9	588.9	2.170	1.897	-0.18%	-0.88%	0.1	-0.12%	-0.05%
Stdev	0.021	6.1	0.6	0.010	0.005	0.023	6.4	0.6	0.010	0.005	0.81%	0.27%	0.1	0.06%	0.02%

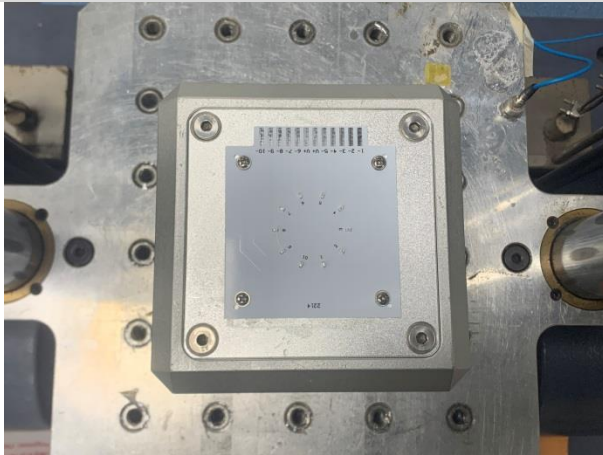
4.22.3.5MS Data(Lot C)

No.	Lot C														
	pre-test					post-test					change				
	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Vf(V)	IV(mcd)	λ_d (nm)	Vf _{max} (V)	Vf _{min} (V)	Δ Vf(V)	Δ IV(mcd)	$\Delta\lambda_d$ (nm)	Δ Vf _{max} (V)	Δ Vf _{min} (V)
MS-C1	2.107	343.6	589.8	2.127	1.891	2.082	342.3	589.9	2.125	1.890	-1.19%	-0.38%	0.1	-0.09%	-0.05%
MS-C2	2.125	347.6	588.4	2.178	1.901	2.124	346.6	588.5	2.175	1.900	-0.05%	-0.29%	0.1	-0.14%	-0.05%
MS-C3	2.095	350.9	588.5	2.164	1.898	2.084	350.4	588.6	2.161	1.897	-0.53%	-0.14%	0.1	-0.14%	-0.05%
MS-C4	2.124	350.1	588.8	2.184	1.899	2.122	347.9	588.8	2.182	1.898	-0.09%	-0.63%	0.0	-0.09%	-0.05%
MS-C5	2.062	343.8	588.6	2.171	1.899	2.060	342.0	588.6	2.165	1.897	-0.10%	-0.52%	0.0	-0.28%	-0.11%
MS-C6	2.098	346.7	588.6	2.162	1.899	2.082	345.1	588.6	2.159	1.898	-0.76%	-0.46%	0.0	-0.14%	-0.05%
MS-C7	2.125	352.4	588.7	2.166	1.898	2.113	349.9	588.8	2.164	1.897	-0.56%	-0.71%	0.1	-0.09%	-0.05%
MS-C8	2.071	345.6	588.3	2.188	1.903	2.068	344.5	588.3	2.188	1.901	-0.14%	-0.32%	0.0	0.00%	-0.11%
MS-C9	2.095	346.5	588.3	2.189	1.902	2.117	343.3	588.4	2.187	1.901	1.05%	-0.92%	0.1	-0.09%	-0.05%
MS-C10	2.066	339.9	588.3	2.181	1.902	2.065	338.4	588.3	2.179	1.900	-0.05%	-0.44%	0.0	-0.09%	-0.11%
Min	2.062	339.9	588.3	2.127	1.891	2.060	338.4	588.3	2.125	1.890	-1.19%	-0.92%	0.0	-0.28%	-0.11%
Max	2.125	352.4	589.8	2.189	1.903	2.124	350.4	589.9	2.188	1.901	1.05%	-0.14%	0.1	0.00%	-0.05%
Average	2.097	346.7	588.6	2.171	1.899	2.092	345.0	588.7	2.169	1.898	-0.24%	-0.48%	0.1	-0.12%	-0.07%
Stdev	0.024	3.8	0.4	0.018	0.003	0.025	3.8	0.5	0.019	0.003	0.59%	0.23%	0.1	0.07%	0.03%

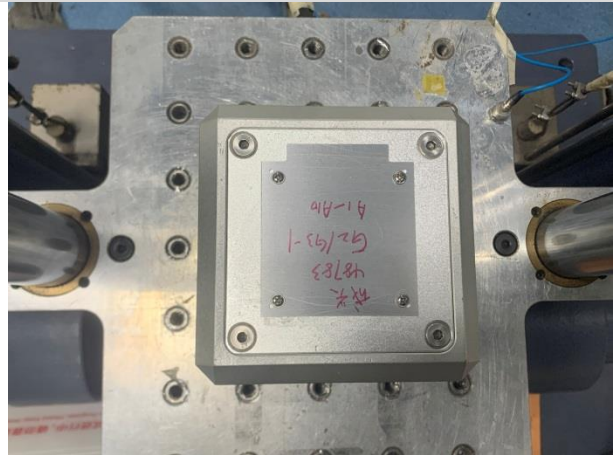
4.22.4 Test Photo



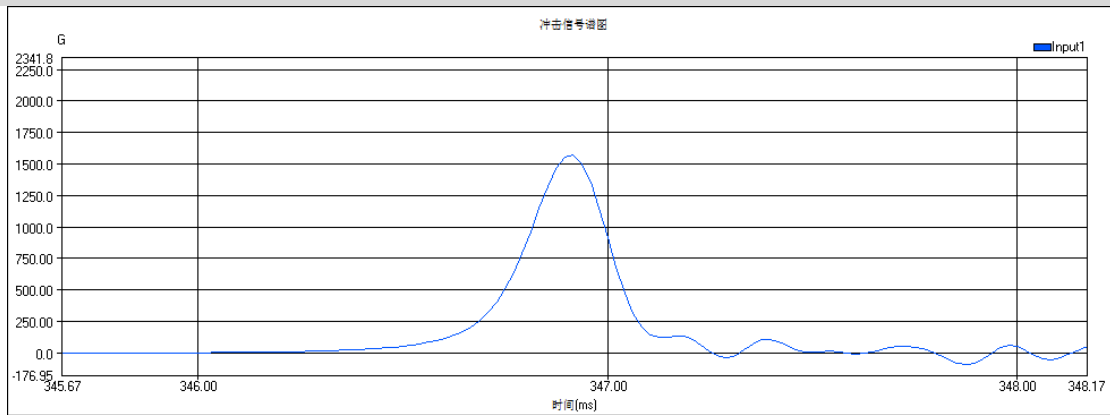
MS Test Setup(+Z Axis)



MS Test Setup(-Z Axis)



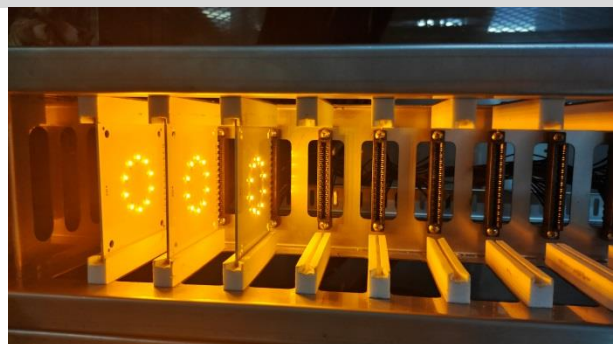
Typical Curve For MS Test



Light /no Light for(-40°C)-1



Light /no Light for(-40°C)-2



Light /no Light for(85°C)-1



Light /no Light for(85°C)-2



5 Equipment and Instrument

Device	Model No	Calibration date	Calibration due date
Industrial microscope	AO-21TZ	2024-07-25	2025-07-24
Metallographic Microscope	NX30T-HD228S	2024-07-25	2025-07-24
Multilayer aging machine	B2-270	2024-07-26	2025-07-25
Reflow Welder	KCB-835-PC-8	2024-07-25	2025-07-24
Precision High Oven	BPO-2000-200	2024-09-05	2025-09-04
Electrostatic Tester	910OP	2024-07-25	2025-07-24
Vacuum Mosaic machine	HSR-C1000R	N/A	N/A
Manual precision cutting machine	HSR-Auto 200B	N/A	N/A
Double disk and double control manual grinding machine	HSR-2502D	N/A	N/A
Microcomputer controlled intelligent heater	NBW-3020	N/A	N/A
Tin furnace	JF-118A	2024-07-25	2025-07-24
Electric Vibration Test Machine	ES-10-240	2024-04-13	2025-04-12
Hydraulic vertical impact testing machine	SY10-25	2024-04-13	2025-04-12
Condensation test chamber	BTH-800-0-DEW	2024-05-20	2025-05-19
Mixed gas corrosion test chamber	BD/FQX-300	2024-09-06	2025-09-05
Hydrogen sulfide gas corrosion test chamber	BD/H2S-300	2024-09-06	2025-09-05
Multifunctional shear push tension tester	LB-8100A	2024-04-16	2025-04-15
Touch screen test and control tensile strength tester	HTS-BLY2500C	2024-07-25	2025-07-24
Hygrothermograph	HTC-1	2024-07-26	2025-07-25
Hygrothermograph	HTC-1	2024-07-26	2025-07-25
Hygrothermograph	HTC-1	2024-07-26	2025-07-25
Hygrothermograph	HTC-1	2024-07-26	2025-07-25
Hygrothermograph	HTC-1	2024-07-26	2025-07-25

Hygrothermograph	HTC-1	2024-07-26	2025-07-25
Hygrothermograph	HTC-1	2024-07-26	2025-07-25
Hygrothermograph	HTC-1	2024-07-26	2025-07-25
Hygrothermograph	HTC-1	2024-07-26	2025-07-25
Hygrothermograph	HTC-1	2024-07-26	2025-07-25
LED thermal resistance structure analysis system	TRA-300	2024-07-25	2025-07-24
Constant temperature and humidity box	BTH-1500-50	2024-09-05	2025-09-04
LED device life aging system	BP0-230-200-3	2024-07-26	2025-07-25
Rapid temperature change aging test chamber	BTC-1000-55	2024-07-25	2025-07-24
Programmable rapid temperature change test chamber	BTC-1000-55-15L	2024-07-25	2025-07-24
0.3m integrating sphere	Diameter 0.3m	2024-07-25	2025-07-24
Sleeve Device	N/A	2024-07-25	2025-07-24
High-precision rapid spectral radiometer	HAAS-2000	2024-07-25	2025-07-24
Standard Light Source	D062	2023-05-12	2025-05-11
LED Test Source	LTS-300	2024-07-25	2025-07-24

Directions

1. The information marked “superscript #” is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.
2. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.
3. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
4. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor $K=2$ with the 95% confidence interval.
5. This report cannot be reproduced except in full, without prior written approval of the Company.
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*****END OF REPORT*****