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lsv

Customer:
MODEL: AMSA70FD01-0

Specification for Approval

Any modification of this specification is not allowed without SAMSUNG DISPLAY's permission.

Proposed by			Customer's Approval
Designed	Checked	Approved	
CHOI NAM GON	H.P.LEE	G.Y.Chang	

Next Generation Product Development Group
OLED BUSINESS

SAMSUNG DISPLAY CO., LTD.

Revision History

Date	Rev. No.	Contents	Remark
5.Dec.2023	000	- Release draft version. All of modification points has been written blue color text for descriptions	
8.Dec.2023	001	- 6page : Added TCON has OTA F/W update - 9page : Added operating ESD and ESD test point figures - 14page : Added surface temperature at active area of front side Added Black a*b* specification - 14page : Added surface temperature at active area - 47page : Warpage modified spec and ground-rule for MP start	*Request By Customer
8.Dec.2023	002	- *9page : Modified ESD test point - *36page : note3) related cover panel bubble after reliability test , Added heat dissipation is as same as without cover panel bubble case	*Request By Customer
11.Dec.2023	003	- 6page : production site number was corrected : 3) to 4) - 9page : Added ESD test point description - 10page : 1.LSVDD range was modified to consider Flash memory operating range *2.PMIC voltage name was change from VDD to TCONVDD for matching connector pin name - *18page : Added Cross-talk test equipment - *23page : Description was changed from VDD to TCON VDD at block diagram	*Request By Customer
		- *9page : Added operating ESD test level as class A - *15 page : 1. The ranges of GAMMA was modified from 30℃ ~ -10℃ to - 30℃ ~ - 10℃。 - *2. Surface temperature Ta condition was changed from 24℃ to 25℃ . And measure point description was changed to “Active Area”	*Request By Customer
12.Dec.2023	005	- *6page : Added 10bit display colors - *15page : Added 72Hr short-term burn in	*Request By Customer
14.Dec.2023	006	- *6page : Added 10bit output description	*Request By Customer

Contents

1. Scope

This Specification defines general provisions as well as inspection standards for AMOLED module supplied by SAMSUNG Display Co., Ltd.,

If the event of unforeseen problems or unspecified items occurs, supplier shall negotiate and agree to solution with customer.

2. Warranty

This Specification stipulates the final and comprehensive requirements for the respective products hereof. Beyond this Specification, it is responsibility of the customer to explicitly disclose any additional requirements, information or reservations regarding these requirements to Samsung Display prior to implementation, where any and all disclosures of the customer shall be with an authorized representative of Samsung Display in writing. Samsung Display shall not be responsible for safety, performance, functionality, compatibility of the system with which the SAMSUNG DISPLAY-supplied components are integrated unless such features have been expressly communicated and described in the Specification. SAMSUNG DISPLAY MAKES NO GUARANTY OR WARRANTY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, TO ANY PARTY. Moreover, any party should do their own due diligence regarding these requirements prior to implementation.

3. Features

1) Description

The AMSA70FD01-0 Uses an organic light emitting diode display (OLED) that uses low temperature poly silicon TFTs as switching components. This model is composed of a TFT OLED panel and driver circuits.

2) General Information

Item	Specifications	Unit	Note
Driver Element	Active Matrix (LTPS)	-	
Display Area	376.13(H) x 211.57(V)	mm	17.0 inch
Display Weight	372.28	g	
Display Colors	16.7M / 1,074M	Colors	Input 8bit /10bit Output 8bit /10bit
Number of Pixels	2880(H) x RGB x 1620(V)	-	-
Pixel Arrangement	RGB S-stripe	-	
Pixel Pitch	130.6(H) x 130.6(V)	um	191ppi
TCON	ANA38409	-	ANAPASS Note 1) 2)
Interface	eDP + I2C	-	
Module Structure	POL+OCTA+COVER+Gap-Tape	-	-
Surface Hardness	HC (3H) (Only polarizer film without adhesive)	-	-
Polarizer	Absorption axis angle 0°	-	Nitto

Note 1) : TCON has Pixel Shift function.

Note 2) : TCON has OTA(Over-The-Air) firmware update.

3) TSP / Cover-Glass Information

Item	Specifications	Unit
TSP Type	OCTA (On Cell Touch AMOLED)	-
Surface hardness	N/A	mm
Interface	I2C (address : 0x4B)	-
TSP IC Maker	Microchips (mXT2912TD)	-
Number of Sensing Channel	68 x 38	-

4) Production Site

Item	Location	Factory	Note
FAB	Asan, Korea	A2	-
Module	Dongguan, China	SDD	-

4. Mechanical Specification

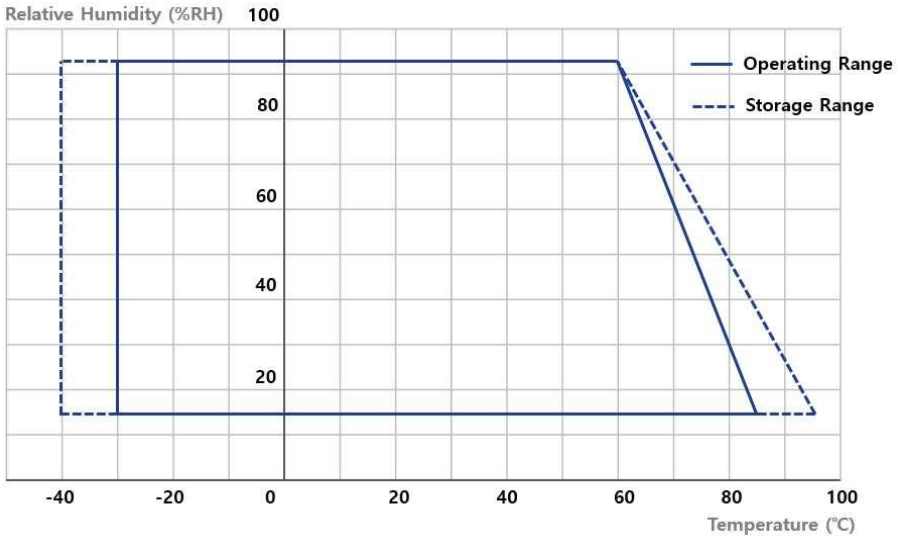
Item	Specifications	Unit	Note
Panel Outline	382.33(H) x 220.97(V)	mm	w/o Circuit
Glass Thickness	0.411 (LTPS+S/P) 0.505 (ENCAP+SEAL)	mm	-

*note: refer to “Mechanical Drawing” for more details

5. Absolute Maximum Ratings

5.1 Absolute Ratings of Environment

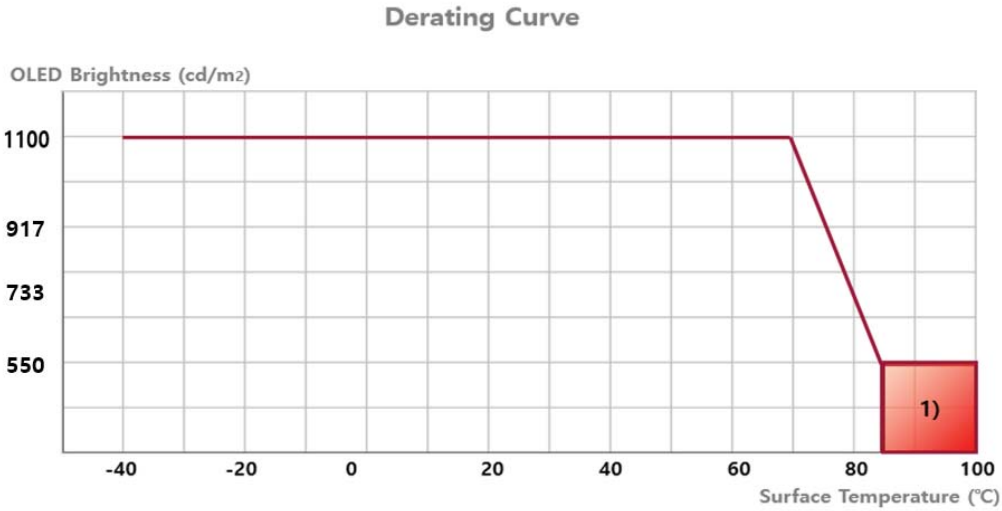
Item	Symbol	Condition	Unit
Storage temperature	T_{STG}	-40 ~ 95	℃
Operating temperature (Panel Surface temperature)	T_{OPR}	-30 ~ 85	℃



Note. Derating

For preventing OLED performance degra at on rom eat, t e OLED rightness must be derated at high temperature as shown below. Regarding OLED brightness derating, see the following chart.

(The following chart is based on the only OLED module level without customer system. And depending on customer's system condition, the following chart can be changed)



Note 1) The driving characteristics and device quality cannot be guaranteed in this environmental condition.

5.2 Electrical Absolute Ratings

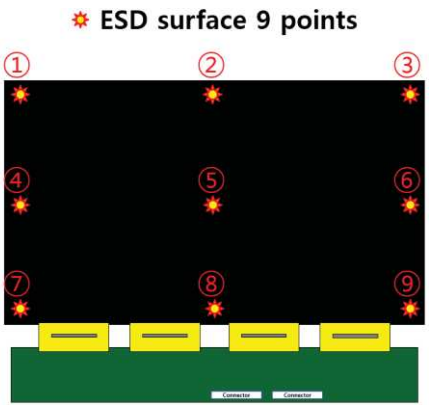
Item			Symbol	Condition	Unit
Supply voltage (Display)	Logic/Analog		LSVDD	-0.3 to 2.25	V
	Analog		TCONVDD	0 to 3.63	
	Analog		PMVDD	-0.3 to 6.0	
	Analog		ELVDD	-0.3 to 6.0	
	Analog		ELVSS	-14.0 to -2.6	
Supply voltage (TSP)	Logic/Analog		TSPVDD	-0.3 to 3.6	

Note. The absolute maximum rating is the limit value. When the display module is exposed to the operating environment beyond this range, the OLED Module does not assure normal operations and may be damaged permanently, not be able to be recovered.

5.3 Electro Static Discharge Resistance

Item	Test Condition	Remark
Contact Discharge	±6kV, 150pF, 330ohm @8points [①②③④⑥⑦⑧⑨] ±8kV, 150pF, 330ohm @Center [⑤]	Non-Operating
Air Discharge	±8kV, 150pF, 330ohm @8points [①②③④⑥⑦⑧⑨] ±15kV, 150pF, 330ohm @Center [⑤]	Non-Operating
Contact Discharge	Class A : ± 4 kV, 150pF, 330ohm @9 points [below figure :ESD surface 9 points]	Operating
Air Discharge	Class A : ± 4 kV, 150pF, 330ohm @9 points [below figure :ESD surface 9 points]	Operating
PCB	±2kV (@Human Body Model)	Non-Operating

※[①②③④⑥⑦⑧⑨] 10mm : Distance from panel edge(Up/Down/Left/Right)



6. Electrical Characteristics

6.1 AMOLED

(Ta = 25℃, 1100nit Normal Mode)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Supply Voltage	Logic /Analog	LSVDD	-	1.7	1.8	1.95	V	-
	Analog	TCONVDD	-	3.0	3.3	3.6		
	Analog	PMVDD	-	4.1	4.3	4.5		
	EL Power	ELVDD	-	-	5.0	-	V	(1)
		ELVSS	-	Individual driving (Variable)				
Input Voltage	"H" level	VIH	-	0.7*VDD18	-	VDD18	V	(4)
	"L" level	VIL	-	0	-	0.3*VDD18		
Output Voltage	"H" level	VOH	-	0.65*VDD18	-	VDD18	V	(5)
	"L" level	VOL	-	0	-	0.3*VDD18		
PM_I2C Voltage	"H" level	VIH_PM	-	0.7*TCONVDD	-	TCONVDD	V	(6)
	"L" level	VIL_PM	-	0	-	0.3*TCONVDD		
Operating Current		I_BAT	VBAT=8.0V (1100cd/m^2 Full White)	-	3826	5892	mA	(1) (2)
		I_LSVDD	Full White	-	178	208	mA	(1) (2)
		I_TCONVDD	Full White	-	0.2	10	mA	(1) (2)
		I_PMVDD	Full White	-	555	638	mA	(1) (2)
Frame Frequency		F_frame	-	-	60/90		Hz	(3)
Power Consumption		-	VBAT (8.0V)	-	-	47,136	mW	(1) (2)
			LSVDD (1.8V)	-		374	mW	(1) (2)
		-	TCONVDD (3.3V)	-	-	33	mW	
		-	PMVDD (4.3V)	-	-	2743	mW	

Note(1): Full White Pattern, Temperature = 25±3℃

Note(2): Measured using SDC Standard Operating Circuit including DC-DC-IC (SM3501Q)
Current Consumption could be different under customer's DC-DC circuit design.

Note(3): Frame Frequency is followed by SET Software Setting

Note(4): BIST_EN, MSDA/MSCL

Note(5): TCON_RDY, TCON_INTR, MSDA/MSCL

Note(6): PMIC_SDA/PMIC_SCL (If the PM_I2C voltage range is observed, there's no problem with the operation)

6.2 Touch Screen Panel

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	Logic /Analog	TSPVDD	3.14	3.3	3.47	V	-
Operating Current	Logic /Analog	I_TSPVDD			66	mA	
Power Consumption	Logic /Analog	P_TSPVDD	-	-	229	mW	(1)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Input Voltage	"H" level	VIH_TSP	-	0.7*TSPVDD	-	TSPVDD	V	(2)
	"L" level	VIL_TSP	-	-0.3	-	0.3*TSPVDD		
Output Voltage	"H" level	VOH_TSP	-	0.8*TSPVDD	-	TSPVDD	V	(3)
	"L" level	VOL_TSP	-	0		0.2*TSPVDD		

Item	Firmware	Config ID
version	mXT2912TDAT_0x38_2.0.AA_PROD.enc	lixinag_Foryou_COF_17Inches_2912TD_V2.08_20230914.x cfg

Note(1): Depends on the touch firmware version and valid for the current firmware version
Note(2): TSP_SDA/TSP_SCL, TSP_RESET
Note(3): TSP_SDA/TSP_SCL, TSP_ATTN,

Test Item Spec

- Firmware : mXT2912TDAT_0x38_2.0.AA_PROD.enc
- Config : lixinag_Foryou_COF_17Inches_2912TD_V2.08_20230914.xcfg

1) Command test
   - Reset, Attention Test : Pass
   - T-IC F/W Version Test : 0x20
   - T-IC Family ID Test : 0xaa
   - T-IC Variant ID Test : 0xa4
   - T-IC Build Number Test : 0x38
   - T-IC CFG Checksum Test : 0x2ff989
2) Self Test : Pass
3) Reference Cap Test : 22732 ~ 30517
4) Gap Test : Corner 15 Normal 10
5) Jitter(Delta) Test : -200 ~ 200
6) Self Reference Cap Test
   - Self_REF_TX : 5000 ~ 9500
   - Self_REF_RX : 4300 ~ 8900
7) Self Jitter(Delta) Test
   - Self_Del_Tx : -350 ~ 350
   - Self_Del_Rx : -300 ~ 300

Reference Cap Test Spec_Max

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0	30517	29527	29198	29003	28866	28775	28704	28650	28595	28551	28526	28501	28481	28468	28443	28415	28402	28378	28360
1	29908	29331	29112	28974	28868	28801	28742	28698	28648	28612	28588	28563	28544	28527	28504	28474	28457	28434	28418
2	29546	29140	28984	28879	28796	28740	28699	28661	28617	28584	28560	28539	28524	28509	28488	28456	28438	28414	28395
3	29390	29078	28960	28876	28810	28758	28728	28694	28655	28624	28605	28583	28568	28554	28534	28500	28485	28459	28441
4	29186	28948	28852	28784	28723	28676	28655	28621	28586	28558	28540	28522	28505	28491	28467	28435	28422	28393	28375
5	29130	28940	28856	28795	28738	28700	28685	28650	28619	28590	28575	28557	28542	28528	28502	28473	28456	28429	28412
6	29040	28875	28802	28746	28699	28665	28649	28618	28584	28554	28537	28519	28507	28496	28470	28439	28424	28396	28380
7	28994	28851	28783	28732	28691	28659	28638	28610	28577	28550	28533	28516	28503	28489	28462	28434	28416	28392	28379
8	28932	28807	28745	28697	28660	28631	28610	28581	28547	28520	28503	28489	28475	28460	28434	28405	28389	28363	28351
9	28941	28825	28765	28721	28683	28655	28631	28603	28575	28546	28529	28511	28499	28483	28460	28428	28413	28389	28379
10	28866	28753	28698	28656	28623	28593	28571	28545	28513	28486	28469	28450	28442	28425	28399	28369	28353	28330	28318
11	28833	28736	28682	28642	28606	28578	28556	28531	28497	28471	28452	28436	28427	28411	28386	28353	28340	28315	28303
12	28808	28723	28678	28640	28599	28574	28554	28528	28495	28470	28451	28432	28420	28404	28383	28352	28336	28311	28298
13	28757	28678	28633	28591	28553	28527	28508	28479	28449	28425	28404	28382	28373	28359	28335	28303	28291	28265	28251
14	28769	28685	28636	28598	28560	28536	28511	28484	28457	28430	28411	28383	28379	28363	28338	28313	28298	28270	28256
15	28747	28673	28623	28585	28544	28518	28494	28472	28440	28409	28394	28368	28360	28346	28323	28294	28282	28256	28239
16	28691	28621	28572	28534	28494	28470	28444	28422	28388	28361	28341	28317	28309	28295	28273	28243	28228	28202	28187
17	28694	28619	28570	28532	28494	28473	28446	28419	28388	28361	28341	28321	28311	28295	28272	28245	28229	28203	28185
18	28650	28576	28523	28488	28450	28427	28404	28376	28341	28316	28297	28276	28267	28251	28228	28198	28187	28157	28140
19	28643	28577	28532	28496	28455	28434	28410	28378	28346	28321	28303	28279	28272	28253	28230	28202	28189	28163	28143
20	28668	28605	28561	28521	28482	28458	28435	28403	28377	28347	28326	28305	28297	28279	28257	28227	28213	28184	28165
21	28635	28580	28535	28494	28458	28434	28407	28376	28351	28321	28303	28283	28271	28255	28229	28203	28187	28162	28141
22	28621	28575	28531	28488	28450	28425	28400	28372	28345	28318	28301	28280	28271	28258	28230	28205	28188	28162	28138
23	28616	28572	28525	28486	28449	28421	28398	28372	28340	28313	28296	28275	28266	28254	28227	28198	28184	28161	28133
24	28594	28555	28506	28466	28427	28403	28378	28352	28321	28294	28279	28260	28247	28231	28209	28180	28162	28137	28111
25	28610	28582	28534	28492	28453	28430	28404	28379	28353	28325	28306	28287	28276	28259	28239	28209	28194	28162	28138
26	28578	28551	28510	28468	28428	28403	28379	28355	28323	28296	28279	28259	28244	28230	28214	28183	28170	28139	28116
27	28568	28558	28512	28474	28435	28410	28385	28359	28329	28302	28286	28267	28253	28235	28214	28183	28172	28144	28122
28	28538	28538	28495	28455	28418	28391	28368	28341	28312	28285	28260	28247	28232	28216	28194	28163	28151	28125	28104
29	28525	28550	28504	28468	28428	28399	28376	28349	28322	28296	28277	28256	28242	28228	28208	28177	28162	28139	28117
30	28502	28561	28515	28480	28445	28414	28391	28363	28335	28308	28292	28270	28255	28239	28220	28189	28180	28151	28130
31	28455	28544	28502	28467	28427	28398	28378	28350	28320	28293	28276	28256	28243	28227	28206	28179	28163	28138	28120
32	28523	28555	28519	28480	28441	28408	28389	28368	28334	28309	28291	28269	28258	28239	28218	28191	28177	28149	28130
33	28531	28531	28491	28454	28414	28383	28364	28339	28307	28283	28267	28240	28229	28210	28192	28162	28150	28123	28102
34	28519	28512	28473	28433	28392	28364	28344	28322	28290	28265	28245	28219	28209	28192	28175	28144	28132	28103	28083
35	28458	28481	28440	28400	28363	28339	28316	28292	28260	28237	28215	28190	28176	28159	28139	28111	28096	28069	28048
36	28564	28654	28610	28572	28539	28513	28488	28465	28443	28415	28394	28371	28356	28343	28326	28295	28281	28257	28234
37	28621	28686	28642	28605	28566	28545	28525	28500	28470	28443	28425	28403	28392	28377	28357	28323	28312	28286	28266
38	28627	28657	28613	28574	28536	28516	28494	28463	28435	28413	28393	28371	28358	28339	28321	28290	28279	28255	28234
39	28630	28643	28602	28562	28525	28499	28477	28449	28419	28395	28374	28356	28344	28323	28304	28275	28265	28235	28216
40	28669	28678	28633	28589	28556	28531	28505	28479	28453	28426	28405	28384	28373	28356	28332	28304	28293	28263	28247
41	28691	28676	28633	28588	28552	28525	28506	28475	28443	28422	28404	28386	28369	28354	28331	28306	28289	28263	28246
42	28710	28673	28631	28582	28548	28522	28501	28476	28441	28417	28399	28379	28363	28346	28328	28301	28286	28261	28239
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47	28683	28632	28581	28542	28510	28480	28461	28439	28402	28378	28358	28335	28322	28309	28284	28258	28243	28215	28194
48	28716	28660	28613	28575	28541	28516	28498	28469	28434	28412	28388	28368	28356	28342	28317	28289	28275	28250	28228
49	28712	28645	28596	28559	28526	28503	28485	28451	28418	28391	28375	28351	28338	28324	28300	28268	28260	28230	28210
50	28721	28657	28605	28563	28531	28509	28490	28459	28423	28395	28376	28353	28345	28330	28307	28278	28264	28239	28218
51	28764	28700	28647	28602	28569	28544	28529	28495	28462	28436	28413	28394	28382	28367	28343	28318	28305	28278	28257
52	28764	28694	28644	28598	28561	28538	28521	28489	28456	28428	28403	28385	28373	28358	28338	28310	28298	28270	28251
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61	28986	28833	28756	28691	28646	28613	28587	28559	28520	28492	28469	28455	28444	28430	28408	28380	28370	28341	28326
62	29033	28851	28764	28691	28639	28604	28578	28548	28507	28479	28456	28442	28428	28415	28396	28368	28355	28325	28308
63	29148	28925	28821	28739	28679	28637	28610	28575	28536	28504	28478	28465	28450	28437	28421	28388	28380	28345	28328
64	29282	28986	28859	28760	28690	28642	28612	28573	28531	28495	28472	28456	28444	28430	28409	28376	28364	28336	28317
65	29486	29093	28928	28804	28721	28661	28623	28582	28535	28498	28474	28455	28442	28429	28408	28377	28363	28335	28315
66	29806	29238	29010	28852	28745	28668	28618	28570	28519	28481	28451	28435	28419	28403	28381	28354	28337	28312	28294
67	30334	29371	29038	28823	28683	28584	28524	28465	28410	28372	28340	28320	28303	28290	28268	28243	28226	28203	28183

	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
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2	28394	28382	28359	28343	28320	28304	28288	28278	28266	28258	28249	28234	28220	28215	28205	28208	28217	28224	28170
3	28442	28431	28408	28390	28368	28353	28332	28328	28314	28306	28295	28281	28266	28258	28252	28256	28261	28270	28213
4	28374	28366	28344	28326	28302	28290	28268	28261	28249	28240	28230	28216	28201	28192	28186	28187	28194	28203	28143
5	28412	28401	28380	28362	28337	28322	28304	28293	28281	28274	28264	28249	28236	28226	28218	28220	28226	28235	28173
6	28381	28367	28348	28331	28305	28290	28272	28261	28250	28244	28232	28215	28205	28195	28187	28189	28195	28203	28140
7	28376	28363	28346	28326	28300	28285	28270	28258	28247	28239	28228	28214	28203	28196	28186	28186	28193	28199	28135
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9	28373	28360	28340	28320	28294	28283	28265	28254	28240	28231	28223	28208	28196	28191	28178	28181	28185	28187	28120
10	28314	28300	28280	28259	28233	28224	28206	28196	28181	28174	28166	28150	28138	28134	28121	28125	28126	28127	28064
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16	28183	28166	28145	28127	28099	28086	28068	28056	28042	28038	28029	28011	28001	27995	27984	27984	27987	27989	27923
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34	28080	28064	28042	28025	27997	27985	27969	27957	27945	27940	27933	27909	27892	27888	27880	27881	27882	27887	27819
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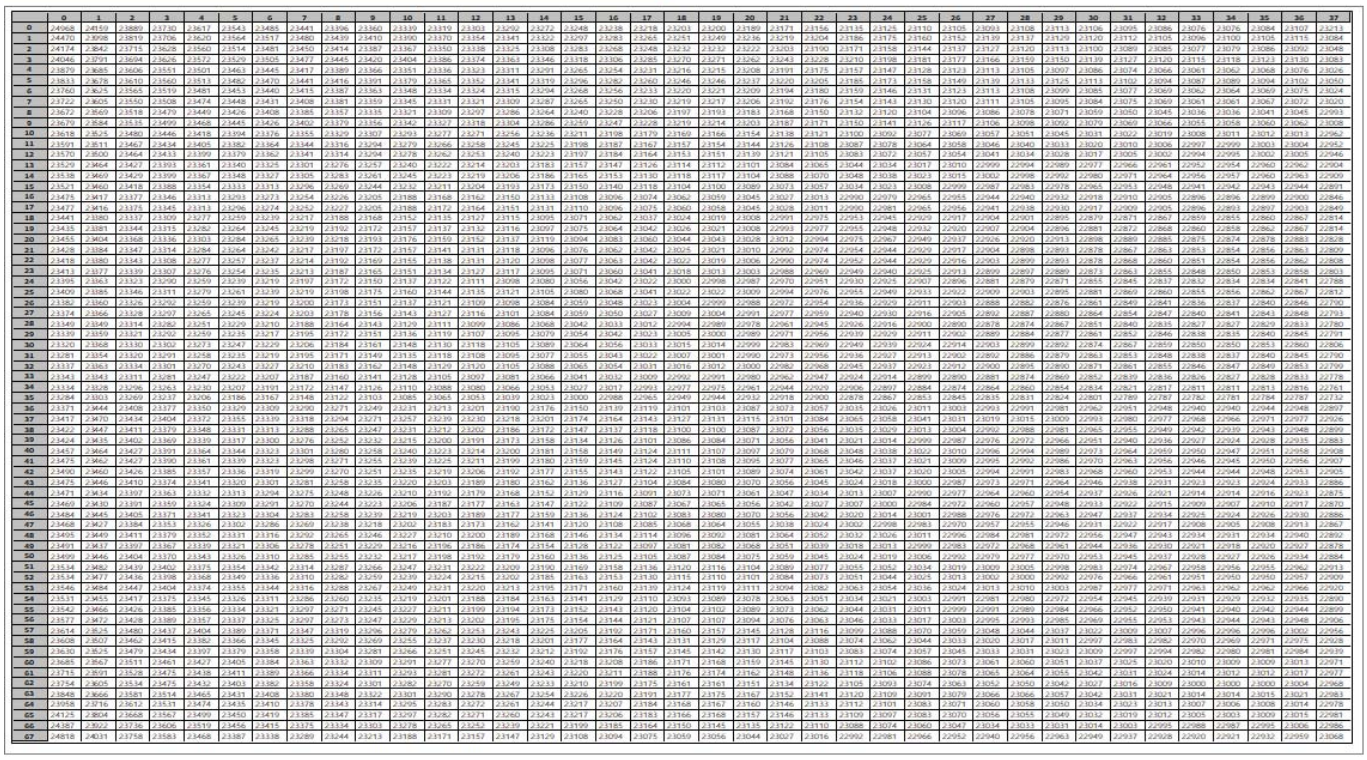
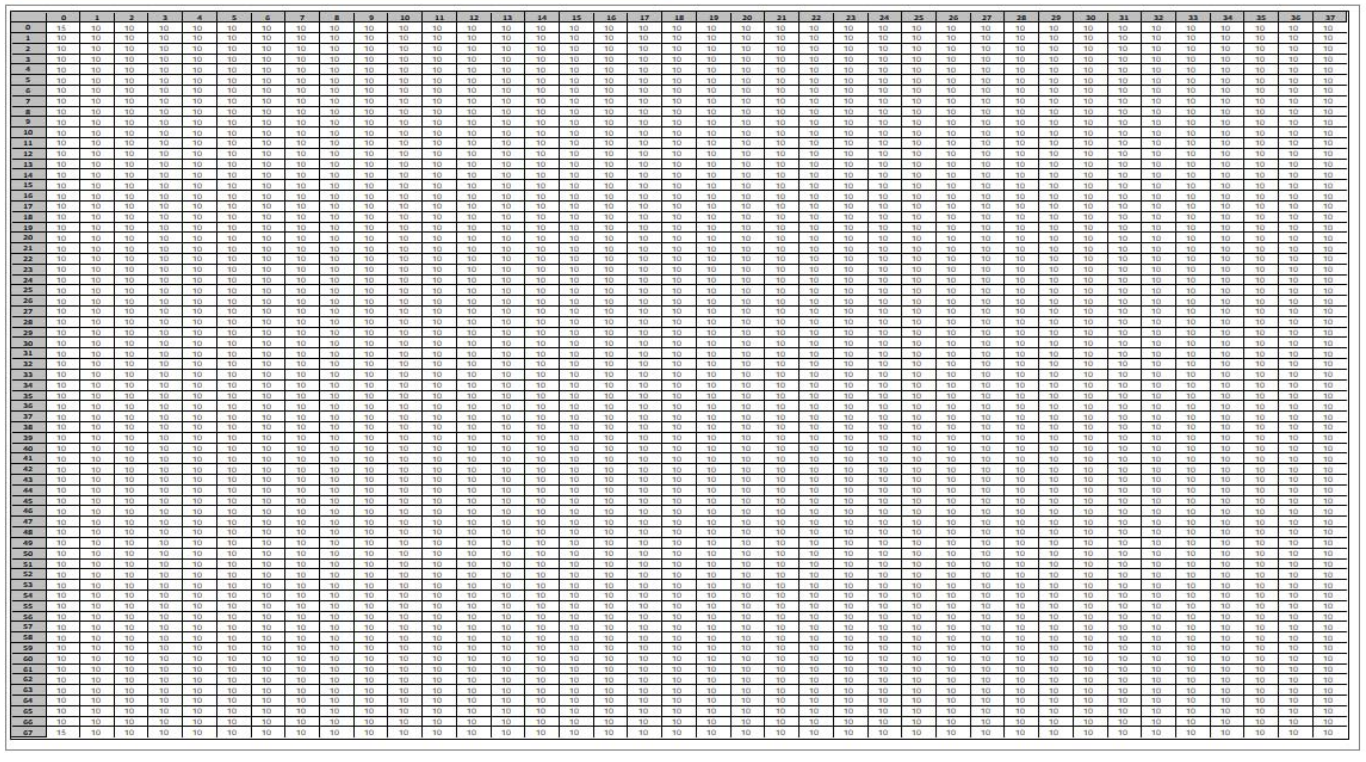
66	28289	28276	28260	28245	28219	28202	28185	28169	28153	28152	28149	28128	28115	28105	28096	28096	28105	28118	28095
67	28180	28165	28144	28131	28102	28088	28069	28052	28038	28058	28066	28049	28034	28023	28014	28014	28028	28062	28194

Reference Cap Test Spec_Min



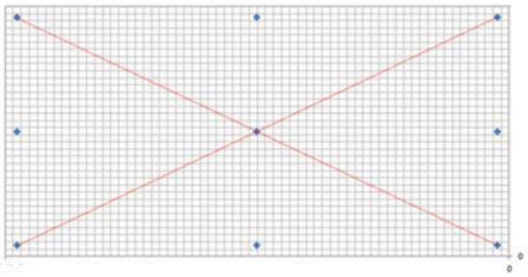
Gap Test Spec



APL Performance

- Firmware : mXT2912TDAT_0x38_2.0.AA_PROD.enc
- Config : lixinag_Foryou_COF_17Inches_2912TD_V2.08_20230914.xcfg

1. Test Equipment : CL-T5
2. Test Pie : 8Φ
3. Test Result
   - ① Accuracy
     - Spec : Center 1.0mm / Edge 1.5mm
     - Result : 0.94mm / 1.30mm
   - ② Linearity
     - Spec : Center 1.0mm / Edge 1.5mm
     - Result : 0.52mm / 0.98mm

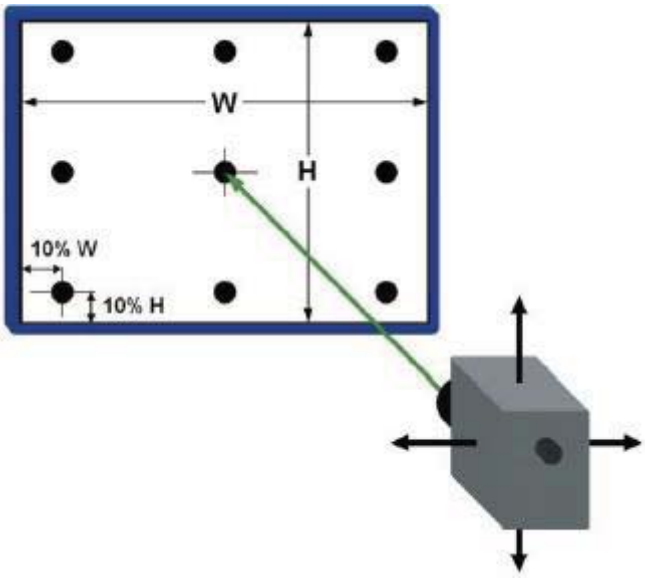


7. Electro-Optical Characteristics

Item		Symbol	Condition		Min.	Typ.	Max.	Unit	Note
Brightness		Center	YLNORMAL	25℃, White (@OPR100%)	1000	1100	1200	cd/m^2	(3),(5)
Contrast ratio		Center	C/R	25℃	200,000:1	2,000,000 :1	-	-	(2),(3)
Response Time			25℃, TG2G		-	1	2	msec	(6)
			-30℃, TG2G		-	1	2		
White Uniformity			25℃	Normal White 1100nit	85	-	-	%	(1)
Color of CIE Coordinate	White	Wx	25℃	Φ=0° θ=0° 1100nit	0.285	0.305	0.325	-	(3),(4)
		Wy			0.300	0.320	0.340	-	
	Red	Rx			0.678	0.688	0.700	-	
		Ry			0.301	0.311	0.323	-	
	Green	Gx			0.260	0.300	0.340	-	
		Gy			0.651	0.679	0.707	-	
	Blue	Bx			0.131	0.136	0.147	-	
		By			0.040	0.054	0.064	-	
Gamma			+10℃~40℃ / -10℃ to +10℃, +40℃ to 60℃ / -30℃ to -10℃, +60℃ to 85℃ Measure gray and brightness : 32G ~ 255G (Normal White 1100 nit)		2.0 / 1.9 / 1.8	2.2	2.4 / 2.5 / 2.6	Gamma	(3)
Dimming			25℃		5	-	-	cd/m2	
PWM Dimming frequency(Hz)			60Hz/90Hz		-	1920/1980	-	Hz	
Color Gamut			@CIE1931		85	95	-	%	
Crosstalk			(SDC Pattern)		-	-	1.5	%	(7)
Flicker			60Hz @Full white 255G		-	-	-30	dB	(8)
Lifetime			9800hrs,LT80(@25℃, B10)		9800			hr	(9)
Long-term Burn in			△L 3.5%, 670nit @Tp 40℃ / △L 3.5%, 1100nit@Tp 30℃		7000 / 6500			hr	
Short-term Burn in			Aging : 1Hr/72Hr chess pattern Check : △L (Transient after 127Gray 5min.)		3.5 / 4.5			%	
Color shift			Measure : 45º @WAD center shift (x, y = -0.010, -0.005@45° Center)		6.25			JNCD	
Surface temperature @front of active area			1Hr aging @Ta 25℃ Full white 670nit , refresh rate : 60Hz Measure : Active Area		-	-	41	℃	
Black a*b*			Display off : SCI@ Φ=90° θ=10° D65: Standard illuminant				±3	-	

Note (1) Definition of Uniformity

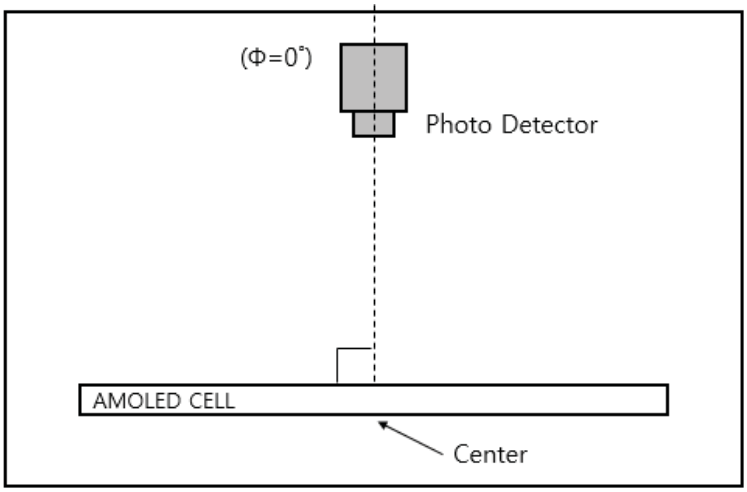
- "Uniformity = Lmin / Lmax" (@9point)



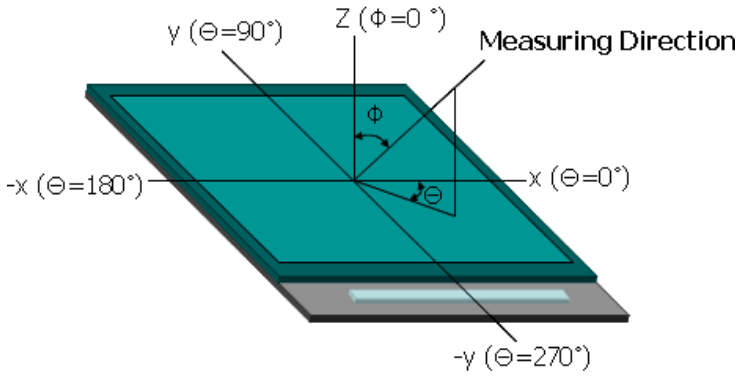
Note (2) Definition of contrast ratio(K)

$$\text{Contrast Ratio(K)} = \frac{\text{Brightness of Center area (White pattern at 1100cd/m}^2\text{)}}{\text{Brightness of Center area (Black pattern at 1100cd/m}^2\text{)}}$$

Note (3) Optical measuring system, temperature regulated chamber
external Light: dark stated
(SDC Condition: SR-UL2, 1deg field, Distance 500mm)



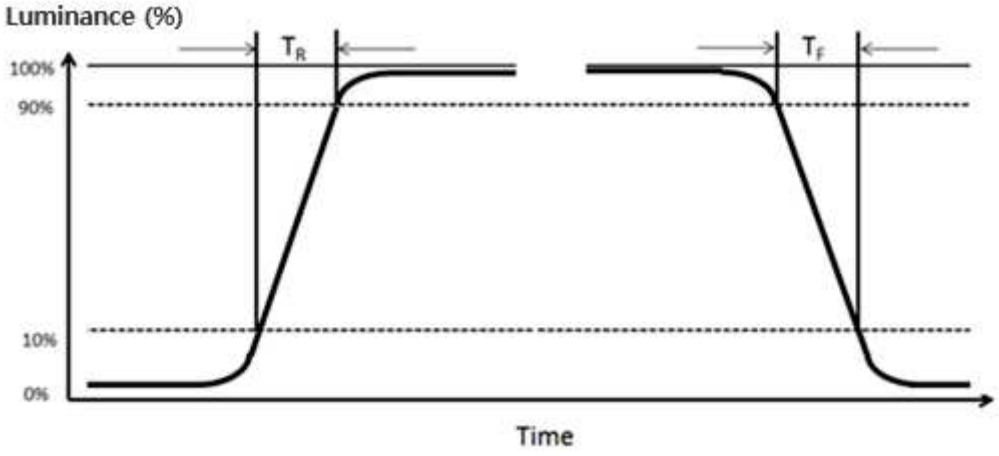
Note (4) Definition of Φ, θ



Note (5) Definition of OPR(%)

<OPR 100%> <OPR 30%>

Note (6) Definition of Response time: $T_R + T_F$ (@1st frame)



Note (7) Definition of Crosstalk ※ Test Equipment: SR-UL2

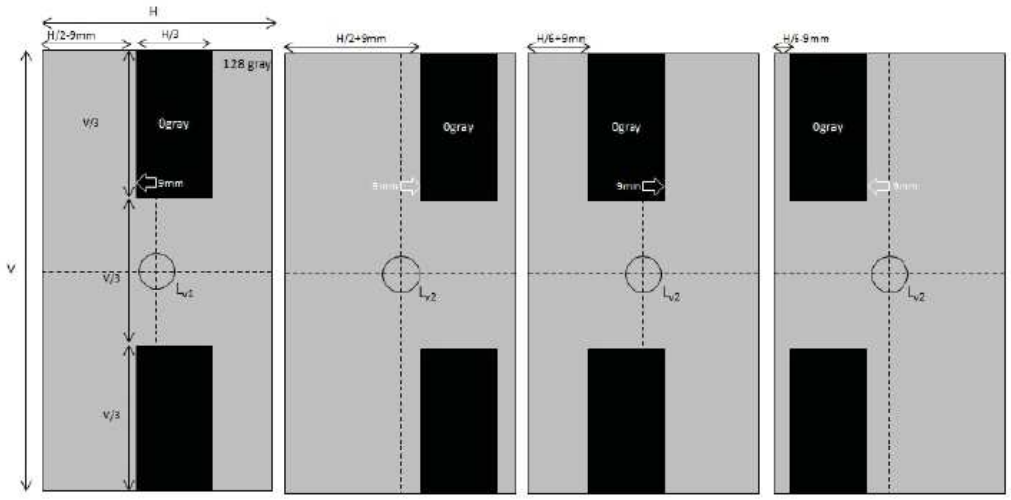
a. measure luminance at the position center.

b. calculate crosstalk as below equation.

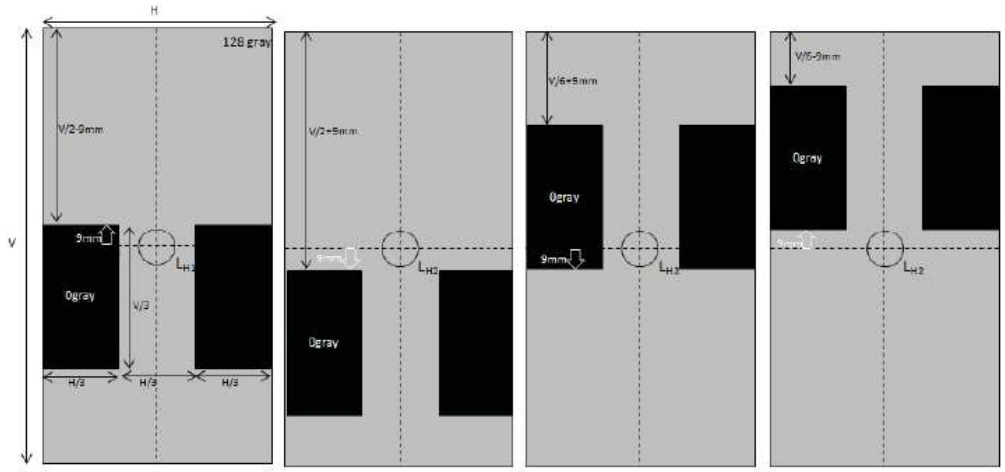
$$Crosstalk(V) = \max\left(\left|\frac{L_{V1}-L_{V2}}{L_{V2}}\right|\times 100, \left|\frac{L_{V3}-L_{V4}}{L_{V4}}\right|\times 100\right)$$

$$Crosstalk(H) = \max\left(\left|\frac{L_{H1}-L_{H2}}{L_{H2}}\right|\times 100, \left|\frac{L_{H3}-L_{H4}}{L_{H4}}\right|\times 100\right)$$

(a) Vertical Crosstalk measuring pattern



(b) Horizontal Crosstalk measuring pattern



Note (8) Definition of Flicker

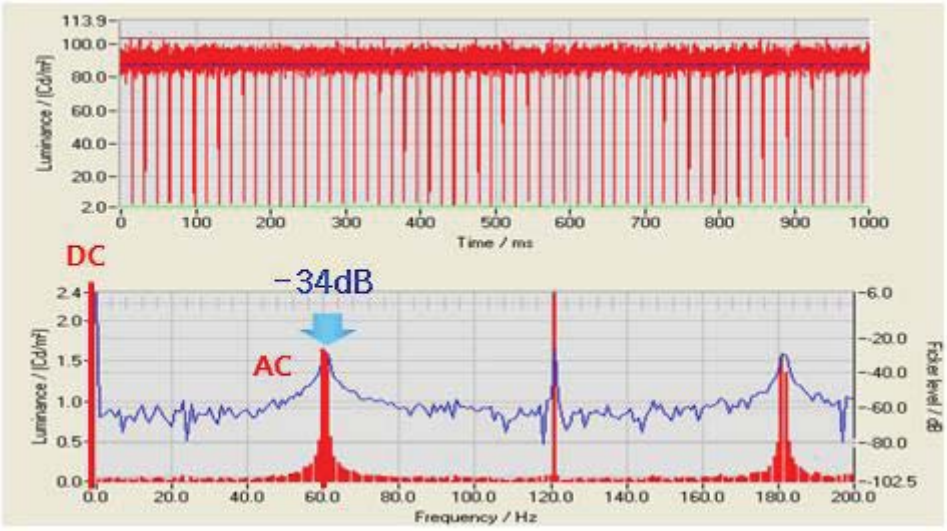
Test Pattern: Full White (G255 @Normal mode, 25℃)
Test Equipment: DMS 803 + PMT(3mm pinhole)

$$Flicker = 20\log_{10}\left(2\frac{f_{FFTC}(n)}{f_{FFTC}(0)}\right) + FS(Hz) \quad (dB)$$

Table 1. Flicker Weighting Factors
Use linear interpolation between the listed frequencies.
"Scaling: dB" is equivalent to "Scaling: Factor"

Frequency: Hz	Scaling: dB	Scaling: Factor
20	0	1.00
30	-3	0.708
40	-6	0.501
50	-12	0.251
>= 60	-40	0.010

* Example of Flicker test
Flicker = -34dB + (-40) = -74dB



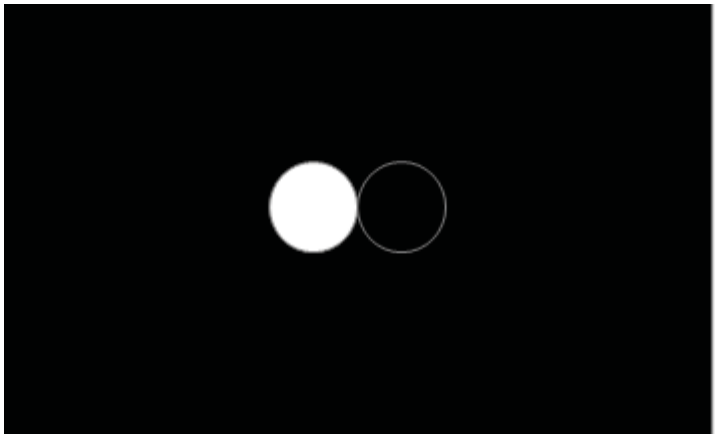
Note (9) Definition of Lifetime

Room Temp. Condition

- Ambient Temperature 25℃ & Panel Surface Temperature 30℃
- White area Luminance: typ. 1100cd/m2
- White Luminance Lifetime: 9,800hrs @ T80, B10

High Temp. Condition

- Panel Surface Temperature 85℃
- White area Luminance: typ. 550cd/m2 (50% derating from 1100cd/m2)
- White Luminance Lifetime: 1,000hrs @ T80, B10



8. Input/Output Terminal Assignment

8.1 I/O Connection

[Connector: HRS FH28-60S-0.5SH]

No	Description	I/O	Note	No	Description	I/O	Note
1	NC	-	-	31	ELVDD	P	@SM3501Q
2	TSP_ATTN[2)]	I	pull-up to TSP_VDD in the SET	32	ELVDD	P	
3	TSP_SDA	I/O	pull-up to TSP_VDD in the SET	33	ELVDD	P	
4	TSP_SCL	I/O	pull-up to TSP_VDD in the SET	34	ELVDD	P	
5	TSP_RESET[3)]	O	for touch (3.3V)	35	ELVDD	P	
6	TSP_HSYNC	I		36	ELVDD	P	
7	N.C.			37	ELVDD	P	
8	TSP_VDD	P	3.3V	38	ELVDD	P	
9	TSP_VDD	P		39	ELVDD	P	
10	N.C.	-		40	ELVDD	P	
11	GND	-		41	N.C.	-	
12	GND	-		42	VDD18	P	1.8V
13	N.C.	-		43	VDD18	P	
14	N.C.	-		44	N.C.	-	
15	N.C.	-		45	GND	-	
16	N.C.	-		46	GND	-	
17	GND	-		47	THE_IN	I/O	Thermistor
18	GND	-		48	THE_OUT	I/O	Thermistor
19	N.C.	-		49	PM_SDA	I/O	PMIC SDA
20	ELVSS	P	@SM3501Q	50	PM_SCL	I/O	PMIC SCL
21	ELVSS	P		51	GND	-	
22	ELVSS	P		52	NC	-	
23	ELVSS	P		53	N.C.		
24	ELVSS	P		54	GND	-	
25	ELVSS	P		55	GND	-	
26	ELVSS	P		56	N.C.	-	
27	ELVSS	P		57	PM_VDD	P	4.3V
28	ELVSS	P		58	PM_VDD	P	
29	ELVSS	P		59	PM_VDD	P	
30	N.C.	-		60	N.C.	-	

[Connector: HRS FH52-40S-0.5SH]

No	Description	I/O	Note	No	Description	I/O	Note
1	N.C.	-		21	DP_3N	O	for eDP
2	HPD [4]	O	Hot Plug for eDP (3.3V)	22	GND	-	
3	BIST_EN [5]	O	BIST_mode (1.8V)	23	SPI_IO3_SP	I/O	SDC only
4	N.C.	-		24	SPI_IO2_SP	I/O	SDC only
5	TCON_RDY [6]	O	TCON_Ready (1.8V)	25	SPI_IO1_SP	I/O	SDC only
6	RSTI	O	RSTI, Internal turn on	26	SPI_SO0_SP	I/O	SDC only
7	GND	-		27	SPI_CS_SP	I/O	SDC only
8	AUX_N0	I/O	for eDP	28	SPI_CK_SP	I/O	SDC only
9	AUX_P0	I/O	for eDP	29	MSDA	I/O	TCON SDA
10	GND	-		30	MSCL	I/O	TCON SCL
11	DP_0P	O	for eDP	31	GND	-	
12	DP_0N	O	for eDP	32	ESWIRE	O	connect to SM3501Q
13	GND	-		33	N.C.	-	
14	DP_1P	O	for eDP	34	N.C.	-	
15	DP_1N	O	for eDP	35	TCON_INTR [7]	O	ERROR_FLAG, (1.8V)
16	GND	-		36	GND	-	
17	DP_2P	O	for eDP	37	GND	-	
18	DP_2N	O	for eDP	38	N.C.	-	
19	GND	-		39	TCON_VDD	P	3.3V
20	DP_3P	O	for eDP	40	TCON_VDD	P	3.3V

Note 1) Need to add the circuit for level shifter 1.8V(#53)→3.3V(#52)

Note 2) When ATTN is high, Host could send command

Note 3) Active low

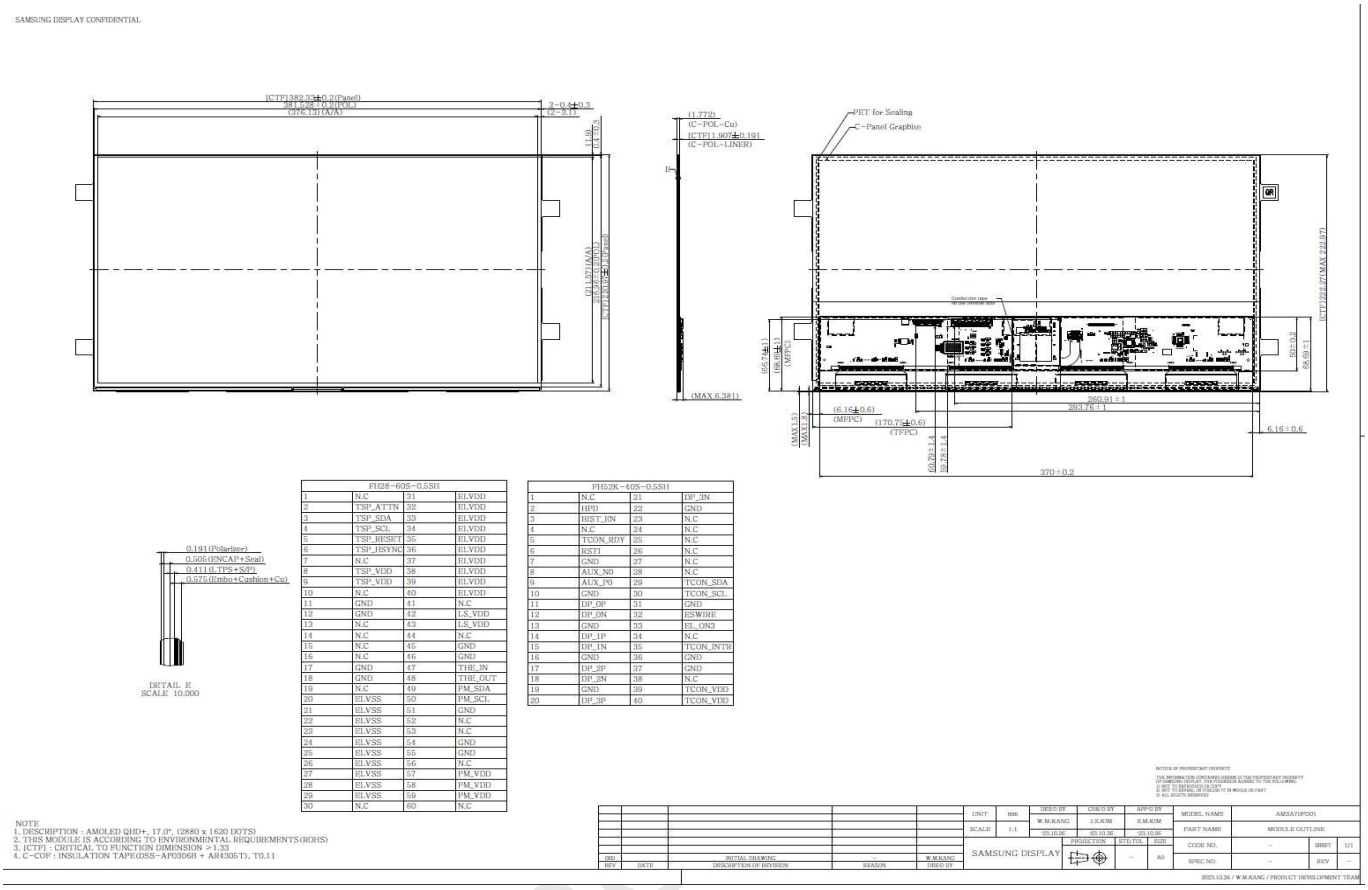
Note 4) eDP signal allowed after HPD goes to high (refer to “Operating code” for more details)

Note 5) Active high

Note 6) Valid video data allowed after TCON_RDY goes to high (refer to “Operating code” for more details)

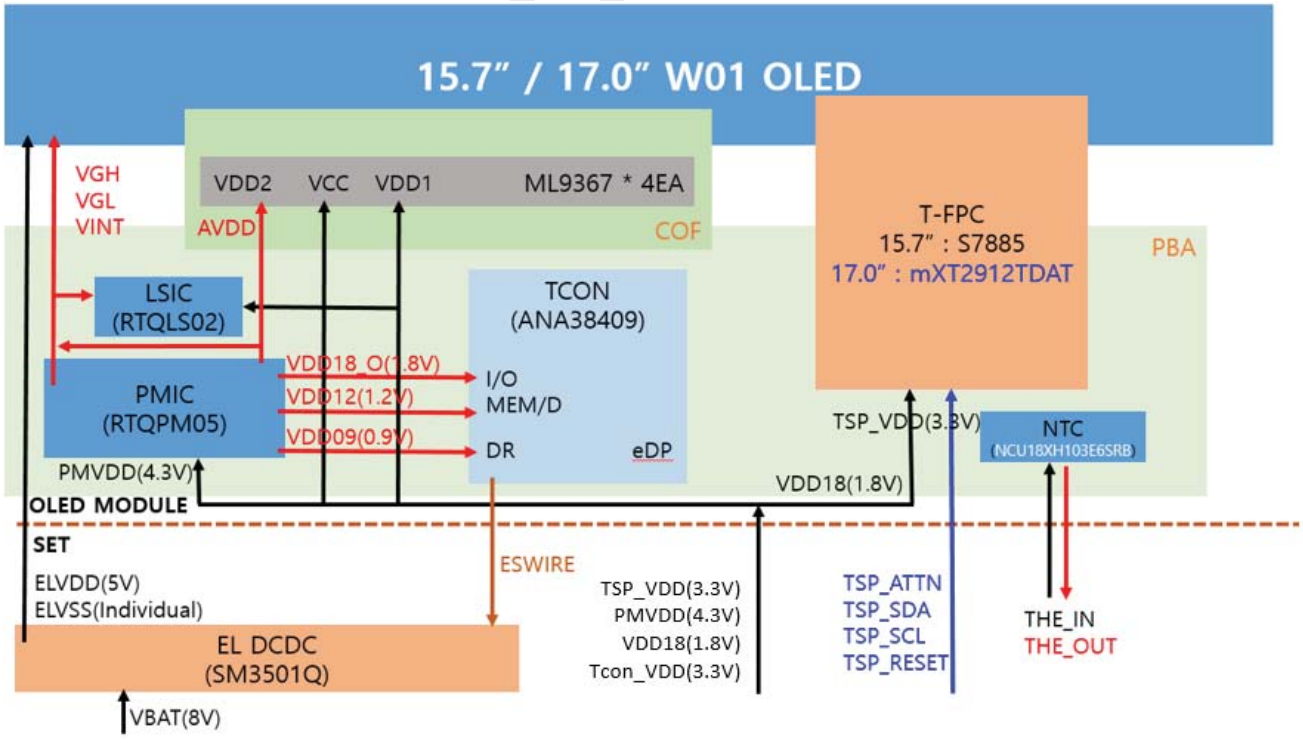
Note 7) When timing error is occurred, TCON_INTR goes to high (refer to “Operating code” for more details)

8.2 Block Diagram (Module)



FH28-60S-0.5SH			
1	N.C	31	ELVDD
2	TSP_ATTN	32	ELVDD
3	TSP_SDA	33	ELVDD
4	TSP_SCL	34	ELVDD
5	TSP_RESET	35	ELVDD
6	TSP_HSYNC	36	ELVDD
7	N.C	37	ELVDD
8	TSP_VDD	38	ELVDD
9	TSP_VDD	39	ELVDD
10	N.C	40	ELVDD
11	GND	41	N.C
12	GND	42	LS_VDD
13	N.C	43	LS_VDD
14	N.C	44	N.C
15	N.C	45	GND
16	N.C	46	GND
17	GND	47	THE_IN
18	GND	48	THE_OUT
19	N.C	49	PM_SDA
20	ELVSS	50	PM_SCL
21	ELVSS	51	GND
22	ELVSS	52	N.C
23	ELVSS	53	N.C
24	ELVSS	54	GND
25	ELVSS	55	GND
26	ELVSS	56	N.C
27	ELVSS	57	PM_VDD
28	ELVSS	58	PM_VDD
29	ELVSS	59	PM_VDD
30	N.C	60	N.C

PH52K-40S-0.5SH			
1	N.C	21	DP_3N
2	HPD	22	GND
3	HST_EN	23	N.C
4	N.C	24	N.C
5	TCON_RDY	25	N.C
6	HST1	26	N.C
7	GND	27	N.C
8	AUX_N0	28	N.C
9	AUX_P0	29	TCON_SDA
10	GND	30	TCON_SCL
11	DP_0P	31	GND
12	DP_0N	32	ESWIRE
13	GND	33	EL_ON3
14	DP_1P	34	N.C
15	DP_1N	35	TCON_INTB
16	GND	36	GND
17	DP_2P	37	GND
18	DP_2N	38	N.C
19	GND	39	TCON_VDD
20	DP_3P	40	TCON_VDD



9. eDP Interface

9.1 Displayport Main Link Receiver Characteristics

Symbol and Parameter	Test Condition	Min	Typ	Max	Unit
VRX-DIFFp-p: Differential peak-to-peak input voltage at package pins		75			mV
Maximum adaptive/programmable equalization level at 1.35GHz			9		dB
VRX_DC_CM : Rx input DC common mode voltage			0		V
RRX-DIFF : Differential termination resistance		80	100	120	Ω
RRX-SE : Single-ended termination resistance		40		60	Ω
IRX_SHORT : Rx short circuit current limit				10	mA

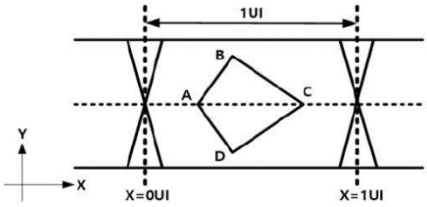
9.2 Display AUX channel Characteristics

Symbol and Parameter	Test Condition	Min	Typ	Max	Unit
UI : Unit Interval for AUX channel		0.4		0.6	um
VAUX-DIFF-p-p : AUX differantial peak-to-peak voltage at TP1 when driving the bus		180	200	1380	mV
VAUX-DC-CM-RX : AUX common mode voltage when receiving			0		V
VAUX-DC-CM-TX : AUX common mode voltage when transmitting			0.32		V
RAUX-DIFF : Differantial termination resistance		80	100	120	Ω
RAUX-SE : Single-ended termination resistance		40	50	60	Ω
CAUX : AUX AC coupling capacitor		75		200	nF

* Receiver_EQ Eye Specification

- Any Passing UI location between 0.375 and 0.625UI

The Eye is measured after application of the data rate appropriate reference Rx equlizer



	X(UI)	Y(mV)
A	0.25	0
B	0.375~0.625	37.5
C	0.75	0
D	0.375~0.625	-37.5

10. Handling Precautions

10.1 Mounting Method

The AMOLED Panel of SAMSUNG Display CO.,LTD. module consists of two slim glasses with polarizer which can easily get damaged. Since the module is constructed as to be fixed by utilizing fitting holes in the printed circuit board. Extreme care should be used when handling the AMOLED modules.

10.2 Caution of AMOLED Handling and Cleaning

When cleaning the display surface, use soft cloth solvent as recommended below and wipe gently.

◎ Isopropyl alcohol

◎ Ethyl alcohol

◎ Trichlorotriflorothane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent.

◎ Water

◎ Ketone

◎ Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns. Do not use the following solvent on the pad and prevent it from being contaminated.

◎ HCFC

◎ Soldering flux

◎ Chlorine(Cl), Sulfur(S)

◎ Spittle, Fingerprint

If the product is not wrapped with a desiccant added pad, ITO pattern can be damaged by corrosion. SAMSUNG Display CO,.LTD. suggests wrapping a product with a desiccant unless customers particularly indicate that they do not want it. In case ITO pattern corrodes due to the usage of chlorine, sulfur or customer's mishandling of the product, the responsibility lies with the customer.

10.3 Caution Against Static Charge

For AMOLED module, use C-MOS LSI drivers, therefore we recommend that you ;
Connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity. It could occur static electricity when taping off the film which protects AMOLED. Against static charge, you should make sure that the product is safe or not by experiment in advance.

10.4 Packing

◎ The packing principle is that AMOLED module should keep its packing condition at the time of delivery. When storing the AMOLED after unpacking, note the followings.

◎ AMOLED module is consisted of GLASS and assemblies. It should avoid pressure, strong impact, and being dropped from a height.

◎ To prevent modules from degradation, do not operate or store them in a place where they are directly exposed to sunlight or high temperature/humidity.

10.5 Caution for Operation

◎ If you do not follow normal POWER ON, OFF sequence or abnormal operating, then AMOLED module can be damaged Electro-optically and does not recover.

◎ Response time may extremely delay at a temperature lower than operating range, AMOLED does not normally operate at a high temperature. But this may recover at a proper temperature.

◎ When you set optimal operating voltage to AMOLED module, you can see the optimal contrast of AMOLED. So, add voltage controllable function at SET Module.

◎ AMOLED module may not display normally when twisting power or pressing power is added. Therefore you should secure AMOLED module maximum thickness at set assembly not to have any pressure affect AMOLED module.

◎ Electro-chemical reaction may occur when there is humidity on pad, therefore, you should use AMOLED Module below maximum operating humidity.

◎ AMOLED Module Power Vdd should be designed to protect surge current at SET Module.

◎ You should not damage connector and cable for AMOLED module assembly by force folding or by applying extreme power.

◎ AMOLED may not display normally when it is interfered by surrounding elements, therefore you should consider setting design not to damage AMOLED module by surrounding elements.

◎ To satisfy EMI standards, you should plan your design after considering emitting energy.

◎ We cannot guarantee display characteristics outside viewing area, therefore your set window should be fixed into viewing area.

◎ Image-sticking may occur if AMOLED displays same image for a long time, so you need to make a pattern change for AMOLED.

10.6 Storage

◎ Place in a dark place where neither exposure to direct sunlight or any fluorescent light is permitted and keep at room temperature & room humidity.

(room condition : Temp. 23 ℃ ±5℃ , humidity 50 %RH ± 20 %RH)

◎ It is recommended to store them as they have been contained in the inner container when we delivered them.

Please keep the pol surface of the product facing the floor and stay in the inner container.

If the customer fails to maintain its warehouse temperature or humidity condition in accordance with the above storage condition, the customer acknowledges that such failure will cause malfunction and unrecoverable damages to the product.

10.7 Safety Precautions

◎ Disassembly or modification may cause electric shock, damages to sensitive part inside of the AMOLED module, dust adhesion, or scratches on the display part.

◎ In the event that the contents of AMOLED module are on skin, wipe them with a paper towel or gauge and wash the part well, and receive medical attention if necessary.

◎ Do not use the AMOLED module for the Special purpose besides display units.

◎ Be careful of the glass chips that may cause injury to fingers of skin, when the display part is broken.

10.8 Precautions before Use

You should discuss the following case with SAMSUNG Display CO.,LTD.

◎ in case of any questions about contents of this "Specification For Approval".

◎ in case of occurring new problems not mentioned at this "Specification For Approval".

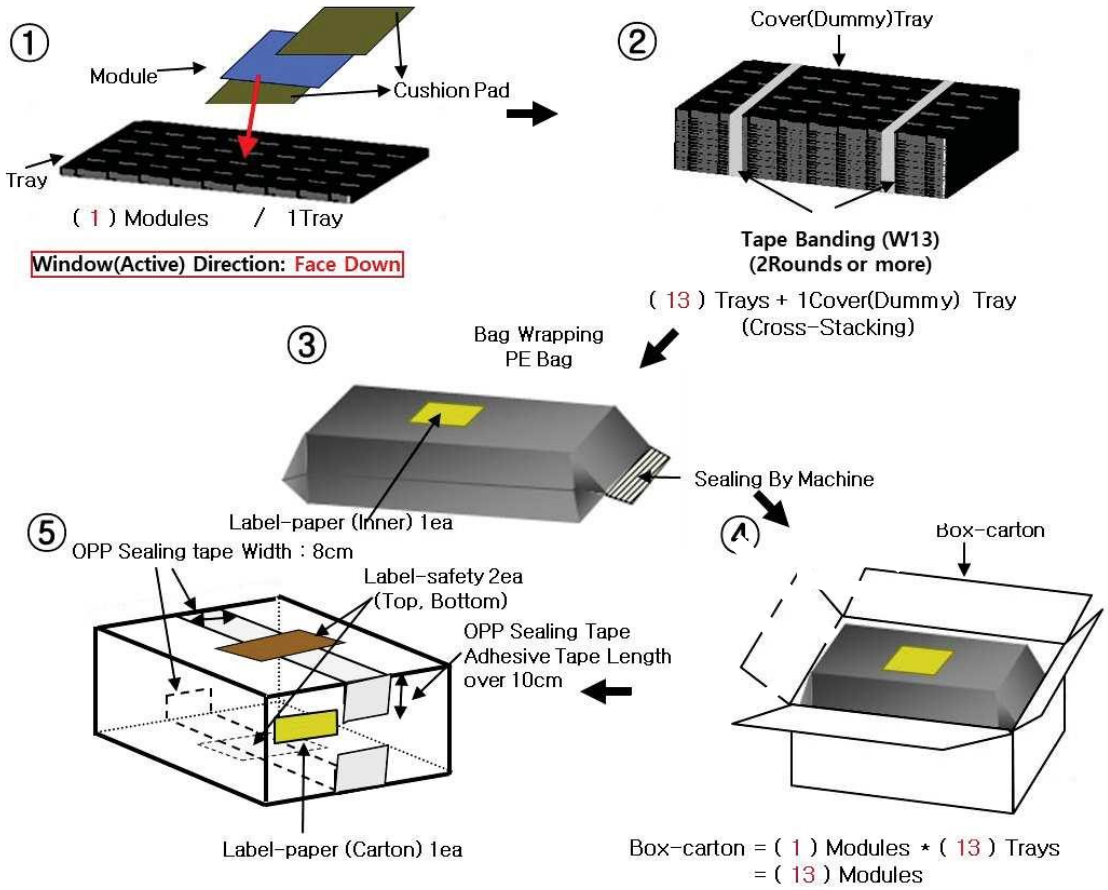
◎ in case of your request about income inspection Specification change.

◎ in case of occurring new problem at your driving test.

※ If SDC has to change the conditions Specified in the Specification, previously the negotiation shall be held and decided.

11. Packing

11.1 Box Pack



Note

(1) Total Box-carton approx.: Max (10) kg

(2) Size: 583(L) x 388(W) x 210(H)

(3) Place the Module in the tray facing the active area direction.

(4) Stack the trays and cover (dummy) tray.

(5) Resistance of tray surface: $1x10^{5} \sim 1x10^{9}\ \Omega$

* Measure Point (Ref. Tray Drawing)

Top direction: In pocket, area of placed Module

Bottom direction: In pocket, the nearest “11” shape Stopper with Module

(6) Triboelectric Charge of tray surface: Max 100V

* Measure Point In Pocket (Top / Bottom), 2kgf over 10 times with Clean Wiper

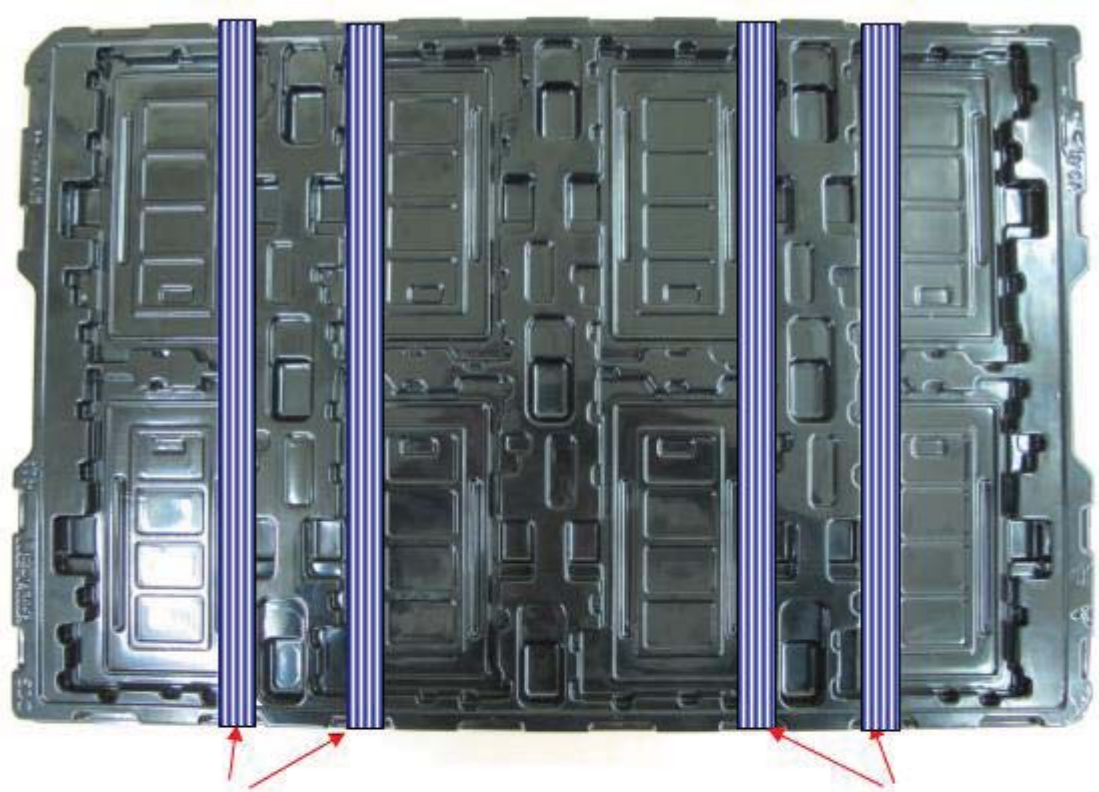
* Measurement condition: 22±3℃/50±5%, measure on antistatic mats

(7) Wrap the PE bag by packing machine and affix the Label-Paper on Bag.

(8) Put the bag in the Box-carton.

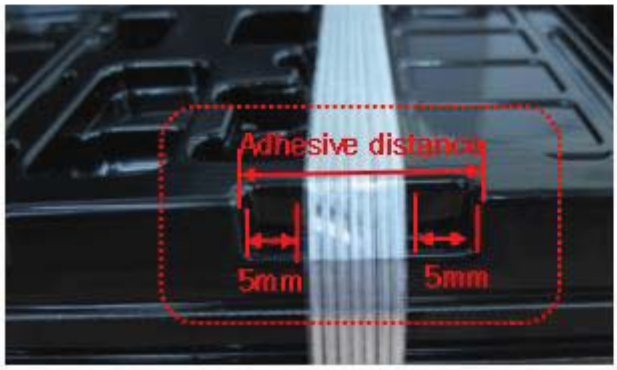
(9) Seal the Box-carton and affix the Label-safety & Label-paper.

Tray Tape Banding Method (A TYPE TRAY)



[Tape Adhesive position : 2nd , 3rd groove]

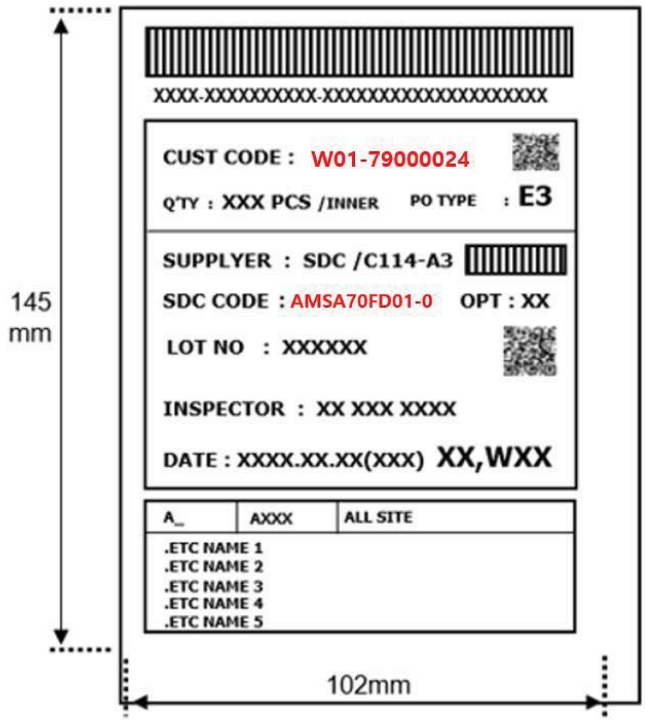
[Tape Adhesive position : 6th , 7th groove]



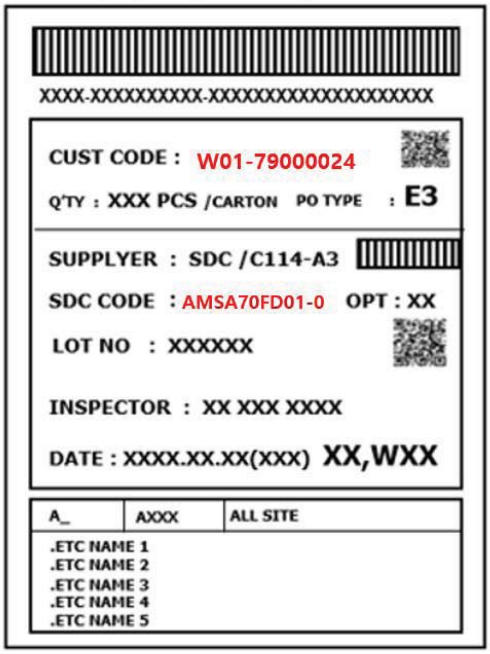
[Adhesive point of the tape]

11.2 Label

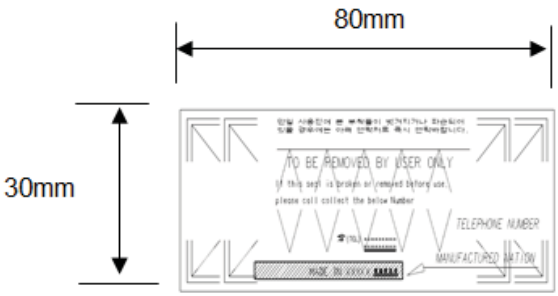
* Label-paper (Inner)



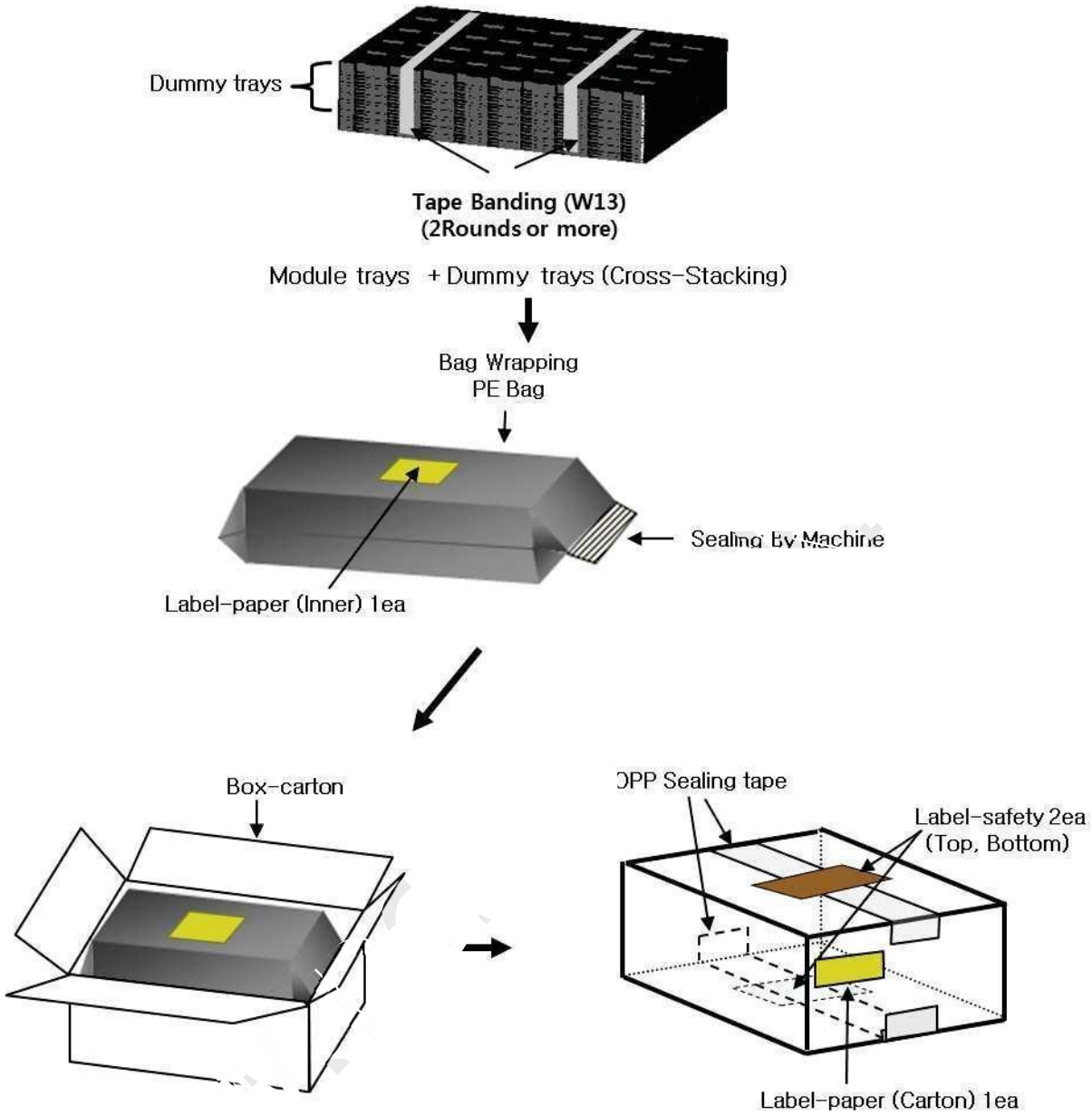
* Label-paper (Carton)



* Label-safety



11.3 Packing for Small Quantites



Note

When package quantity is small, Modules containing trays are stacked the bottom,

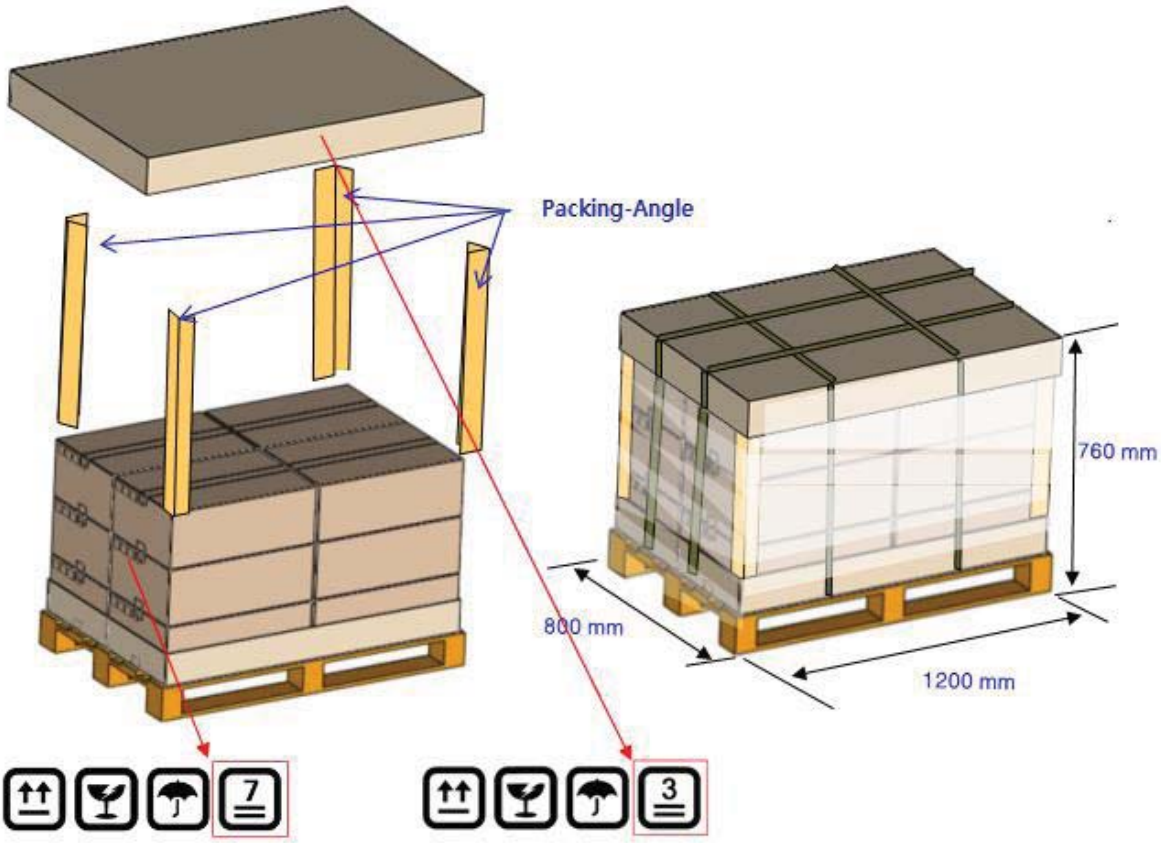
and dummy trays are stacked at the top of package,

then wrap the PE bag by packing machine and affix the Label-Paper on Bag.

Put the Bag in the Box-carton.

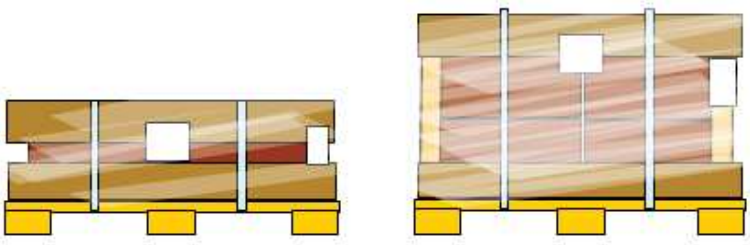
Seal the Box-carton and affix the Label-safety & Label-Paper.

11.4 Over Pack



[Carton-box level : Max. 7 stage loading] [Pallet level : Max. 3 stage loading]

※ Packing spec. for small quantities

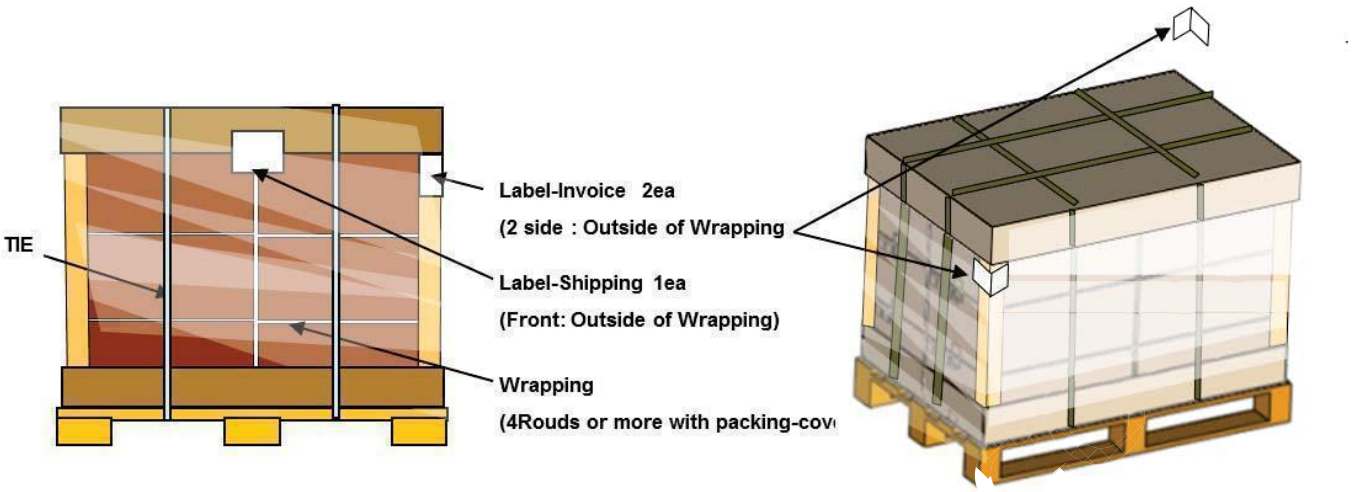


1 step
[Carton Box : 1~4 Box]

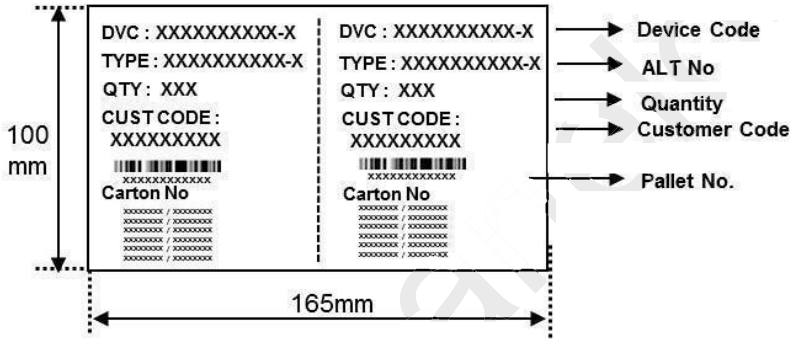
2 step
[Carton Box : 5~8 Box]

-. Small Quantities (1step ,2 step) must stack on the Top.

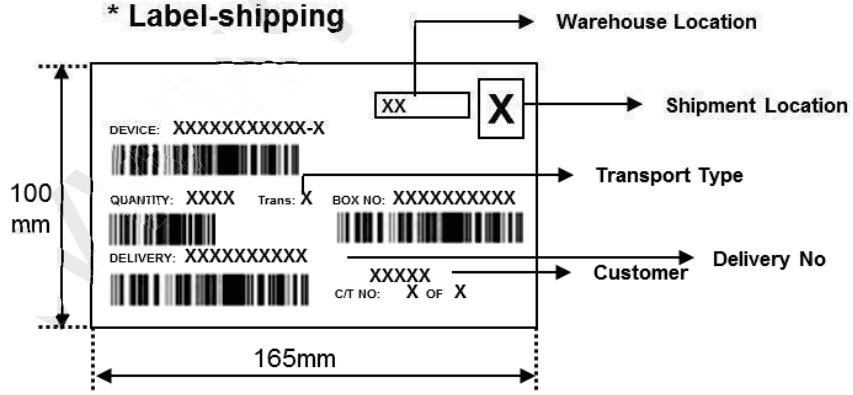
11.5 Over Pack Attach



* Label-invoice



* Label-shipping



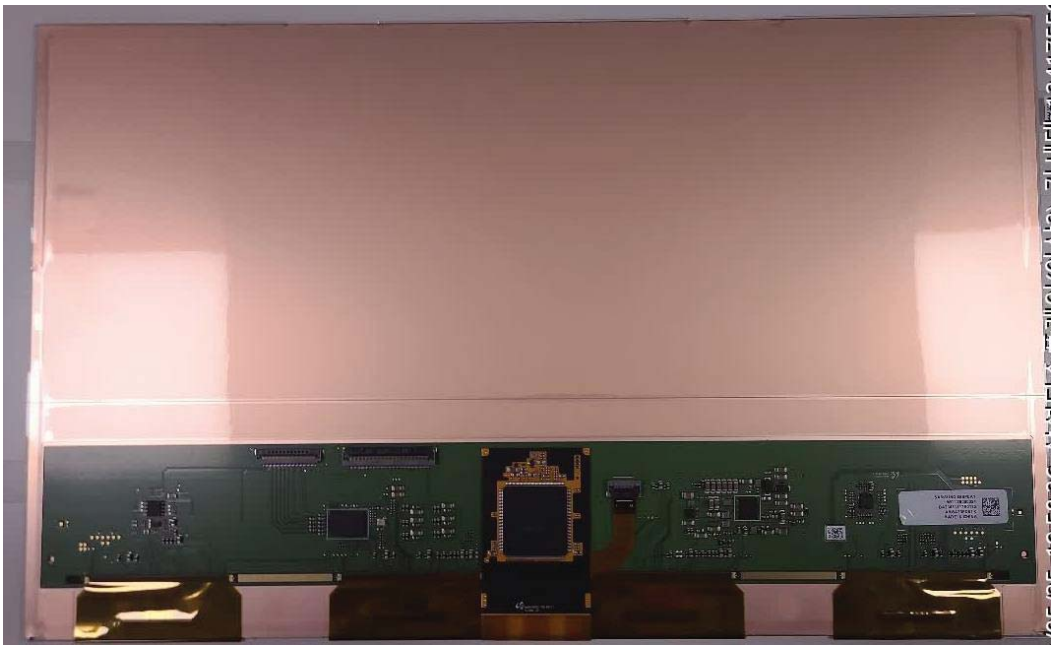
* Reference Image (Except Label and Wrap)

Carton Box		
Pallet		

Caution

For keeping Safe quality from outer exposure or contamination, modules should be consumed within 2 months after unpacking.

11.6 Label



Ex) Label Code:

1) Customer P/N: W01-79000024

2) LOT Marking : DB21122717E0363

3) SDC Code : AMSA70FD01-0

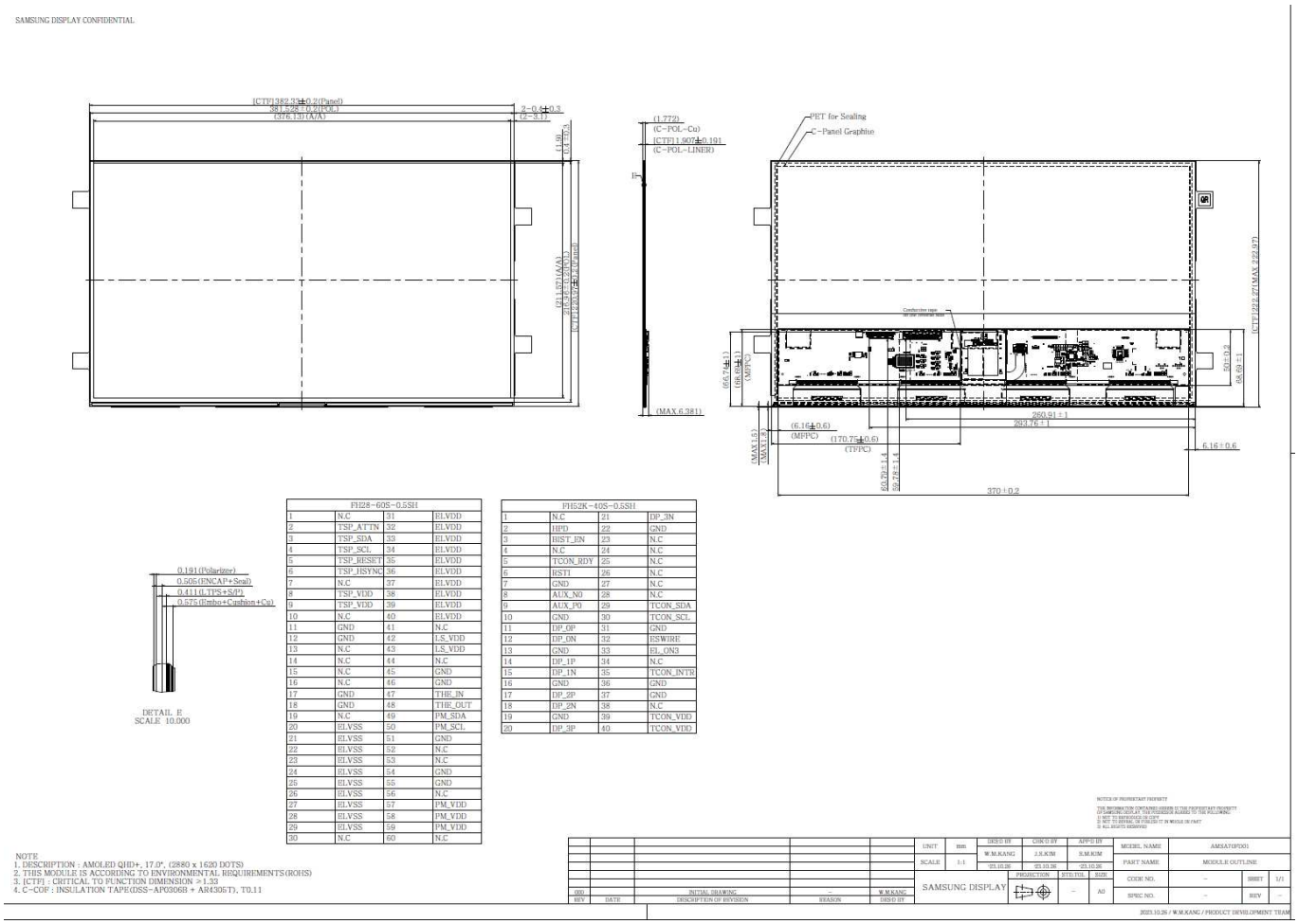
※ LOT Marking

D	B	211227	17	E	0363
Module Site	Shift	YYMMD	Assy Line	SPL Rev	Serial No.
D : SDD	A : A shift B : B shift	Manu. Date	01 02 ... Etc.	O : MP or C/S P : PCN Sample E : E/S W : W/S	0000~9999

*Note: It is a code for managing internal module process and panel code.

12. Mechanical Drawing

File Name : 9-1_AMSA70FD01_Module_Outline_231026.pdf



FH28-60S-0.5SH			
1	N.C	31	ELVDD
2	TSP_ATTN	32	ELVDD
3	TSP_SDA	33	ELVDD
4	TSP_SCL	34	ELVDD
5	TSP_RESET	35	ELVDD
6	TSP_HSYNC	36	ELVDD
7	N.C	37	ELVDD
8	TSP_VDD	38	ELVDD
9	TSP_VDD	39	ELVDD
10	N.C	40	ELVDD
11	GND	41	N.C
12	GND	42	LS_VDD
13	N.C	43	LS_VDD
14	N.C	44	N.C
15	N.C	45	GND
16	N.C	46	GND
17	GND	47	THE_IN
18	GND	48	THE_OUT
19	N.C	49	PM_SDA
20	ELVSS	50	PM_SCL
21	ELVSS	51	GND
22	ELVSS	52	N.C
23	ELVSS	53	N.C
24	ELVSS	54	GND
25	ELVSS	55	GND
26	ELVSS	56	N.C
27	ELVSS	57	PM_VDD
28	ELVSS	58	PM_VDD
29	ELVSS	59	PM_VDD
30	N.C	60	N.C

FH52K-40S-0.5SH			
1	N.C	21	DP_3N
2	HPD	22	GND
3	HIST_IIN	23	N.C
4	N.C	24	N.C
5	TCON_RDY	25	N.C
6	HST1	26	N.C
7	GND	27	N.C
8	AUX_N0	28	N.C
9	AUX_P0	29	TCON_SDA
10	GND	30	TCON_SCL
11	DP_0P	31	GND
12	DP_0N	32	ESWIRE
13	GND	33	EL_ON3
14	DP_1P	34	N.C
15	DP_1N	35	TCON_INTR
16	GND	36	GND
17	DP_2P	37	GND
18	DP_2N	38	N.C
19	GND	39	TCON_VDD
20	DP_3P	40	TCON_VDD

13. Reliability

Item		Condition	Time/Cycle	n	Result
Operation	HTOL	85°C	1000 hrs	10	PASS
	LTOL	-30°C	120 hrs	10	PASS
	THB	60°C, 93%	1000 hrs	10	PASS
Storage	HTS	95°C	1000 hrs	10	PASS
	LTS	-40°C	120 hrs	10	PASS
	UHAST	65°C, 90%	500 hrs	10	PASS
	TC	-40°C /30min ~ 95°C /30min	300 cycles	10	PASS
	Solar	Tp 85°C/55%RH, 830W/m2 [2)]	600 hrs [2)]	10	PASS
ESD		Contact : ± 8kV, 150 pF, 330Ω	center 1point	5	PASS
		Contact : ± 6kV, 150 pF, 330Ω	front 4point	5	PASS
		Air : ± 15kV, 150 pF, 330Ω	center 1point	5	PASS
		Air : ± 8kV, 150 pF, 330Ω	front 4point	5	PASS

Note1) Warranty condition of this product is 85℃ (panel surface temp.),
but if any issues caused by 85℃ (environment temp.) and ESD (operating ±15 kV) happens during mass production, SDC analyzes the failure and cooperates to improve this failure in the view of SET.

Note2) refer to below “Condition of Solar test” for more details

Note3) After Reliability test , Cover –panel has possibility of bubbles on the surface. These item should be no recognized when look a front-side, no any effect to optical and electrical and heat dissipation when module operating condition.

13-1. The criteria of the reliability test

- There should not be image quality issue or appearance defect
  (Pixel, Line, AD, ND, stain, tremor, discoloration, etc.)
- Some evaluation items need to check optical characteristics.
  Note 1) Luminance variation of 500hr evaluation need to be lower than 10%

13-2. Condition of Solar test

- Lamp : Metal halide
- BPT (Black Panel Temperature) : 85℃
- Chamber Temperature : 65℃
- Solar irradiation time : 360hr
- Total radiation intensity : 830W/m2

Spectral radiation distribution of artificial global radiation

Wave length range nm	Proportion of total radiation intensity %	Transmittance by 4 mm thick window glass %	Proportion of total radiation intensity behind 4 mm thick window glass %
280 to 230	0.5 ± 0.2	0.07	< 0.04
320 to 360	2.4 ± 0.6	0.61	1.8 ± 0.5
360 to 400	$3.2^{+1.2*)}_{-0.8}$	0.88	$3.4^{+1.2*)}_{-0.8}$
400 to 520	17.9 ± 1.8	0.89	19.2 ± 1.9
520 to 640	16.6 ± 1.7	0.89	17,.8 ± 1.8
640 to 800	$17.3^{+1.7*)}_{-4.5}$	0.83	$17.3^{+1.7*}_{-4.5}$
800 to 3000	42.1 ± 8.4	0.80	40.5 ± 8.1

		On/Off	Time	Chamber Temp, Humidity	Total Irradiance (280~3000nm)	BPT Temp.
Step1. DRY Solar on time = 240hr (16hr x 15cyc)	1cyc	Solar On	8hr	+65℃, < 30%	830W/m²	+85℃
		Off	3.5hr	+10℃, >55%	-	-
		Solar On	8hr	+65℃, < 30%	830W/m²	+85℃
		Off	3.5hr	+10℃, >55%	-	-
		Off	1hr	room temp, humidity	-	-
	Total Cycle	15cyc				

		On/Off	Time	Chamber Temp, Humidity	Total Irradiance (280~3000nm)	BPT Temp.
Step2. Humid Solar on time = 120hr (12hr x 10cyc)	1cyc	Off	5hr	-10℃, condensation permissible humidity	-	-
		Solar On	12hr	+65℃, > 50%	830W/m²	+85℃
		Off	6hr	-10℃, condensation permissible humidity	-	-
		Off	1hr	room temp, humidity	-	-
	Total Cycle	10cyc				

Cosmetic Specification

for 17.0” modules

(AMSA70FD01)

Any modification of spec is not allowed without SAMSUNG DISPLAY's permission.

Proposed by			Customer's Approval
Designed	Checked	Approved	
S.D.KI	H.P.LEE	G.Y.Chang	

SAMSUNG DISPLAY CO., LTD.

1. Environment Conditions for Display Visual Inspection

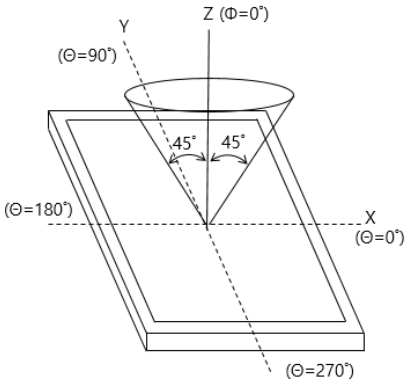
The environmental conditions for inspection shall be as follows

(1) Temperature: Room Temp. 22± 5℃

(2) Humidity : 50±15% RH

(3) Viewing Distance: 30± 5cm

(4) Viewing angle(Cone): 90 ± 45degrees



(5) Ambient Light

AFT process ≤ 50lux

Other inspection ≤ 150lux

Cosmetic Inspection: 1,500~2,500 lux

(6) Inspection method

Bare eyes in reflective mode or black

(7) Appearance inspection is all direction

(8) Inspection area : Actual Viewing area which is operating with pixels

2. Sampling Procedure for each item's acceptance table

Defect Type	Sampling Procedure	AQL
Major[1)]	MIL-STD-105D Inspection Level I Normal inspection Single sample inspection	0.65
Minor[2) 3)]		0.65

Note 1) **A major defect** refers to a defect which may substantially degrade usability for product applications.

In IQC sampling, major defects would be applied 0/1 criteria.

Note 2) **A minor defect** either is a defect that is not likely to reduce materially the usability of the product in the vehicle or is a departure from an established ideal situation but which has little bearing(impact) on the effective use or operation of the product.

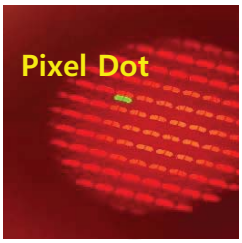
The judgment shall be done at a viewing distance of 35cm and a viewing time of 45s.

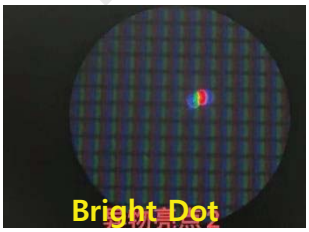
Defects which are not inside the specified limits or dimensions will be handled as major.

Note 3) **Each minor defect** can not cause driving function error or REL spec NG.

3. Inspection Criteria

(1) Dot defects

<table>
<tr><th>No.</th><th>Item</th><th>Criterion for Defect</th></tr>
<tr><td>1</td><td>Bright dots
(red / green / blue)</td><td>
<table>
<tr><th>R,G,B Dots</th><th>Acceptable numbers</th></tr>
<tr><td>Red</td><td>0</td></tr>
<tr><td>Green</td><td>0</td></tr>
<tr><td>Blue</td><td>0</td></tr>
<tr><td>R+G+B</td><td>0</td></tr>
</table>
. Display brightness at full white picture calibrated to min. 150cd/m²
. No additional filters allowed
. Inspection after switch to black picture (0,0,0; 8bit)
No visible bright dot allowed
. Ambient light : ~150 lux, Viewing distance : 35± 5cm
.Not allowed Phenomenon as below (Pixel Dot, Bright dot)


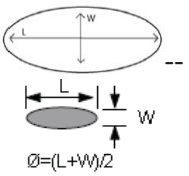
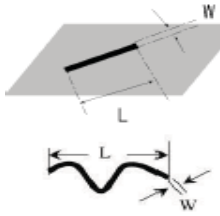
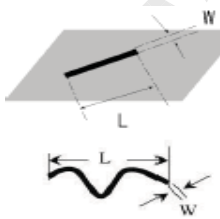


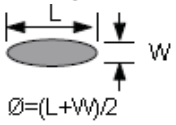
</td></tr>
<tr><td>2</td><td>Weak Bright dots
(red / green / blue)</td><td>Same criterion of ‘Bright dots’</td></tr>
<tr><td>3</td><td>Black dots</td><td>Max 5</td></tr>
<tr><td>4</td><td>Joined black dots</td><td>Within a radius of 25mm any additional black dot is not allowed</td></tr>
</table>

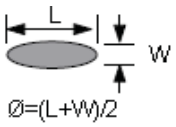
(2) Major defects

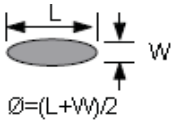
No.	Item	Criterion for Defect
1	Function defect	Not allowed
2	Abnormal operation including distinct line defects	Not allowed
3		Not allowed / Not applicable (In case of SPEC violation)
4	RGB timing error	Not allowed
5	Wrong color (Yellowing)	
6	Broken	Not allowed

(3) Minor defects

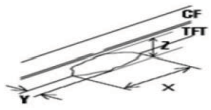
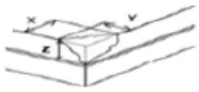
<table>
<tr><th>No.</th><th>Item</th><th>Criterion for Defect</th></tr>
<tr><td>1</td><td>Dot
Foreign matters
 
</td><td>- On panel of viewing area and polarizer
- Display-On Inspection / Non-Operating Inspection
<table><tr><th>Size Ø (mm)</th><th>Acceptable numbers</th></tr><tr><td>Ø≤0.15</td><td>Ignore</td></tr><tr><td>0.15 < Ø ≤ 0.30</td><td>3</td></tr><tr><td>0.30 < Ø</td><td>0</td></tr></table>※ Within a radius of 25mm any additional foreign matter is not allowed
※ If the foreign material is removed with a soft cloth, it is allowable. Lints which appear when or frontal lightning is operating</td></tr>
<tr><td>2</td><td>Linear
Foreign matters
 
</td><td>- On panel of viewing area and polarizer
- Display-On Inspection / Non-Operating Inspection
<table><tr><th>Width (㎜)</th><th>Length (㎜)</th><th>Acceptable numbers</th></tr><tr><td>W<0.05</td><td>L ≤ 2</td><td>Ignore
(DS>5mm)</td></tr><tr><td>0.05≤W≤0.1</td><td>L ≤ 2</td><td>3
(DS≥ 25mm)</td></tr><tr><td>W>0.1</td><td>L > 2</td><td>0
Not allow</td></tr></table>※ Within a radius of 25mm any additional linear foreign matter is not allowed
※ If the foreign material is removed with a soft cloth, it is allowable.
※ W≥0.1mm or L>2mm, Not allow</td></tr>
<tr><td>3</td><td>Scratch
 
</td><td>- On panel of viewing area and polarizer
- Display-On Inspection / Non-Operating Inspection
<table><tr><th>Width (㎜)</th><th>Length (㎜)</th><th>Acceptable numbers</th></tr><tr><td>W<0.05</td><td>L ≤ 2</td><td>Ignore
(DS>5mm)</td></tr><tr><td>0.05≤W≤0.1</td><td>L ≤ 2</td><td>3
(DS≥ 25mm)</td></tr><tr><td>W>0.1</td><td>L > 2</td><td>0
Not allow</td></tr></table>※Within a radius of 25mm any additional scratch is not allowed
※ W≥0.1mm or L>2mm, Not allow</td></tr>
</table>

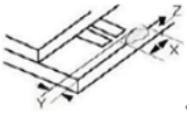
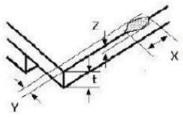
<table>
<tr>
<td>4</td>
<td>Dent, Fish eye, Roughness
 
</td>
<td>- On panel of viewing area and polarizer
- Display-On Inspection / Non-Operating Inspection

<table>
<tr><th>Size Ø (mm)</th><th>Acceptable numbers</th></tr>
<tr><td>Ø ≤ 0.15</td><td>Ignore
(DS>5mm)</td></tr>
<tr><td>0.15 < Ø ≤ 0.3</td><td>3
(DS≥ 25mm)</td></tr>
<tr><td>0.3 < Ø</td><td>0</td></tr>
</table>
※ Within a radius of 25mm any additional dent is not allowed
※ Ignore Pol dent caused by bubble between pol and Pol Protection film, if it is not seen when we check it with Pol Protection film</td>
</tr>
<tr>
<td>5</td>
<td>Bubbles
 
</td>
<td>- On panel of viewing area and polarizer
- Display-On Inspection / Non-Operating Inspection

<table>
<tr><th>Size Ø (mm)</th><th>Acceptable numbers</th></tr>
<tr><td>Ø ≤ 0.1</td><td>Ignore</td></tr>
<tr><td>0.1 < Ø ≤ 0.3, & DS≥ 25mm</td><td>2</td></tr>
<tr><td>0.3 < Ø</td><td>0</td></tr>
</table>
※ Within a radius of 25mm any additional bubble is not allowed</td>
</tr>
<tr>
<td>6</td>
<td>Bump(凸点)
 
</td>
<td>- Surface of polarizer
- Non-Operating Inspection
- The height(“z”) is ignored in the judgment criteria.

<table>
<tr><th>Size Ø (mm)</th><th>Acceptable numbers</th></tr>
<tr><td>Ø ≤ 0.3</td><td>Ignore</td></tr>
<tr><td>0.3 < Ø</td><td>0</td></tr>
</table>
</td>
</tr>
</table>

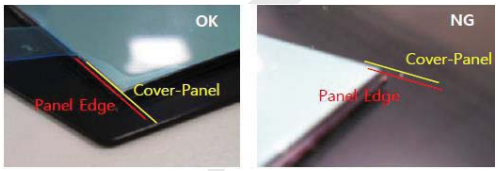
<table>
<tr>
<td>7</td>
<td>Chipping – Panel</td>
<td>
Side  Corner 

Pad(Pattern area)  Pad(Rear sidea) 

<table>
<tr><th>Location</th><th>X(mm)</th><th>Y(mm)</th><th>Z(mm)</th></tr>
<tr><td>Corner</td><td>≤2.0</td><td>≤1.0</td><td>≤t*</td></tr>
<tr><td>Side</td><td>≤2.0</td><td>≤1.0</td><td>≤t*</td></tr>
<tr><td>Pad (Pattern)</td><td>Disregard</td><td>≤0.3</td><td>≤t*</td></tr>
<tr><td>Pad (Rear)</td><td>≤3.0</td><td>≤0.4</td><td>≤t*</td></tr>
</table>

Panel Circuit damage is not allowed

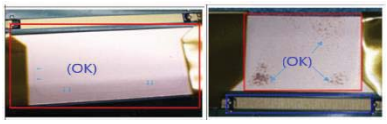
※ Note t: Panel Glass Thickness
</td>
</tr>
<tr>
<td>8</td>
<td>Cover Panel
(Protection Cushion tape)</td>
<td>
. Edge of the cover panel should not over outside of the panel edge.

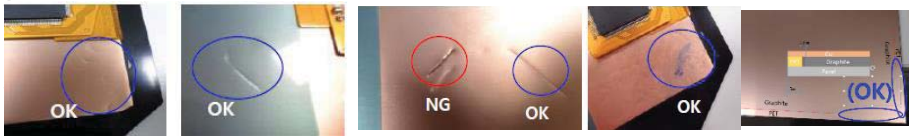


. Bubble, Wrinkle, Dent, Picking, Stain, Foreign materials, changing of color and other appearance: Ignore

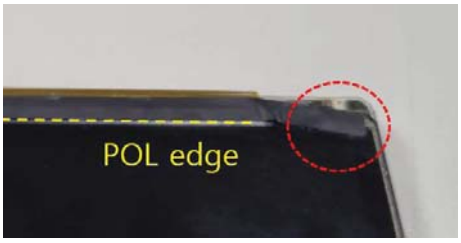
. Torn (Panel Glass expose) : NG

. Driving function error is not allowed



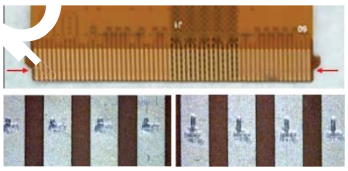


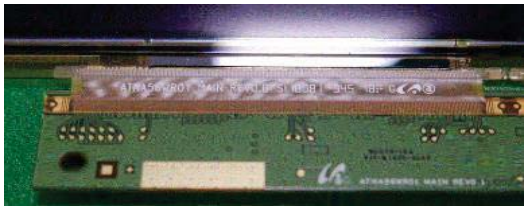
</td>
</tr>
<tr>
<td>9</td>
<td>Cover COF
(Protection tape of glass circuit)</td>
<td>
. Cover COF should not over outside of the panel edge, should not cover pol surface upwards

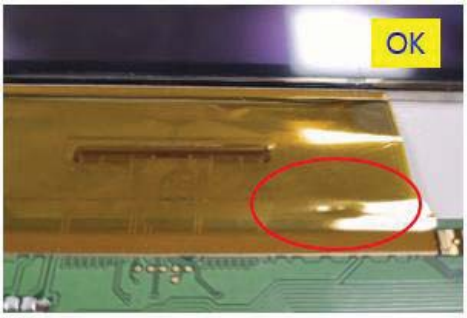
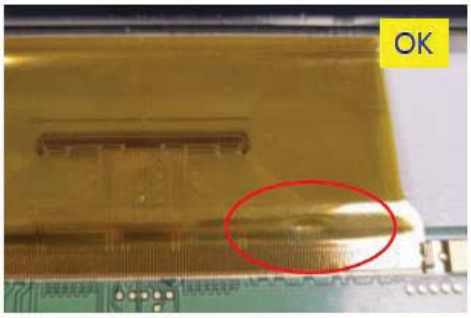
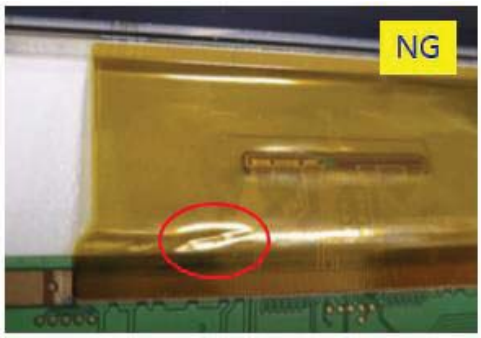
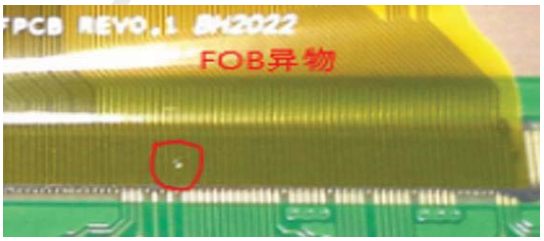
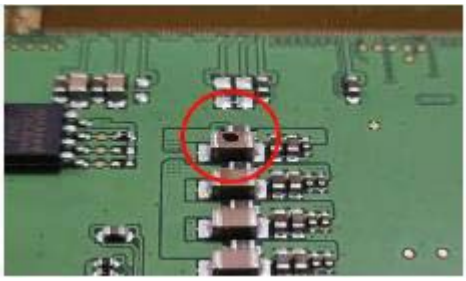


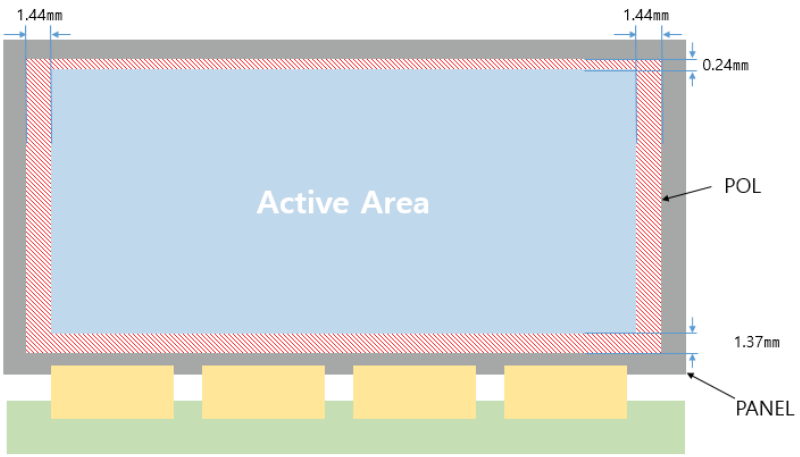
. Bubble, Wrinkle, Dent, Picking, Stain, Foreign materials, changing of color and other appearance: Ignore
</td>
</tr>
</table>

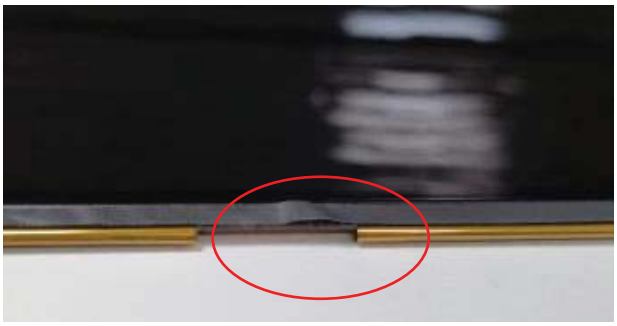
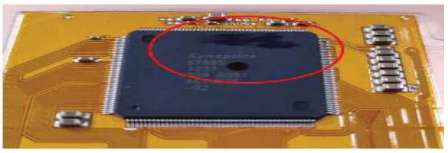
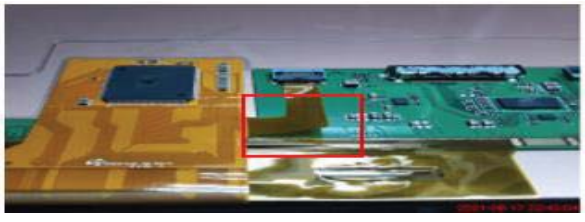
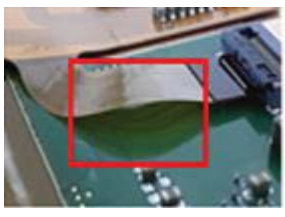
<table>
<tr><td>10</td><td>Surface Contamination & foreign material</td><td>There should be no defect which cannot be removed when being cleaned with a soft cloth, blower, brush or etc.</td></tr>
<tr><td>11</td><td>Appearance of Back-side</td><td>Ignore appearance items of back-side ; Scratch, Stain, Contamination and Discoloration. Those items should be no recognized when look a front-side, no any effect to optical and electrical when module operating condition.</td></tr>
<tr><td>12</td><td>FPC / PCB</td><td>
<table>
<tr><th rowspan="2">Category</th><th colspan="2">Area</th></tr>
<tr><th>Metal</th><th>Non-Metal</th></tr>
<tr><td>Scratch</td><td>Not allowed</td><td>Ignore[1)]</td></tr>
<tr><td>Stain</td><td>Ignore[2)]</td><td>Ignore</td></tr>
<tr><td>Oxidation</td><td>Not allowed</td><td>Ignore</td></tr>
<tr><td>Stab</td><td>Not allowed</td><td>Ignore[1)]</td></tr>
<tr><td>Dent (by Pressure)</td><td>Ignore</td><td>Ignore</td></tr>
<tr><td>Disconnection/Bent</td><td>Not allowed</td><td>Not allowed</td></tr>
<tr><td>Bubble</td><td>Not allowed</td><td>Ignore</td></tr>
</table>
※ 1) Do not allow when copper foil open
2) The stain that cannot be cleared is not allowed

- FPC lift allow : ≤2.0mm
. Applied area: adhesive area of T-FPCB


- FPC wrinkle : Ignore

</td></tr>
</table>

13	FPC Stamping	- “U” shape Stamping (Wave, Wrinkle) : Ignore - “V” shape Stamping (Bent) : Not allowed - Driving function error is not allowed    
14	FOG/FOB Foreign materials	Ignore, if there is no problem with electrical operation 
15	Component Appearance	- Ignore component appearance what no effect to optical and electrical during display operating condition : Scratch, Stain, Contamination and Discoloration - Driving function error is not allowed 

16	ELA Mura /Color Mura	Judge by SDC Internal limit samples
17	Polarizer Protection film	Ignore bubble, dent, foreign material, protrusion, wrinkle, etc. Tearing and unattached are not allowed.
18	Cover Panel Protection film	Ignore bubble, dent, foreign material, protrusion, wrinkle, etc. Tearing and unattached are not allowed.
19	Polarizer Edge area	Ignore all defect in edge area of Polarizer ※ Edge Area : Up 0.24mm, L/R 1.44mm, Down 1.37mm  ※ Bubble in edge area is allowed ※ Unattached pol in edge area is not allowed 

20	Cover, PBA etc. Adhesion quality	The swelling is allowed up to 2.0mm or less (Except intentional-gap by C-PAD) After pressing C-COF bubbles, Over 0.6mm is not allowed  
21	Surface stain of IC (Touch, TCON, etc.)	Ignore if there is no problem in operation Driving function error is not allowed 
22	Warpage	The warpage of panel is allowed to -0.3~2.5mm Ground-rule : Even though the module has somewhat warpage value during 6months after MP start, Li-auto confirm that SDC can delivery product not met warpage specification ※ If there is no issue for 6months after MP, SPEC will be confirmed, And if issue occurs, Spec needs to be re-adjusted
23	Tail of TSP FPC	Ignore the wrinkle of FPC-tail Driving function error is not allowed  

- End of document -

AMSA70FD01

(eDP)

Operating Code

Rev.D

SAMSUNG DISPLAY

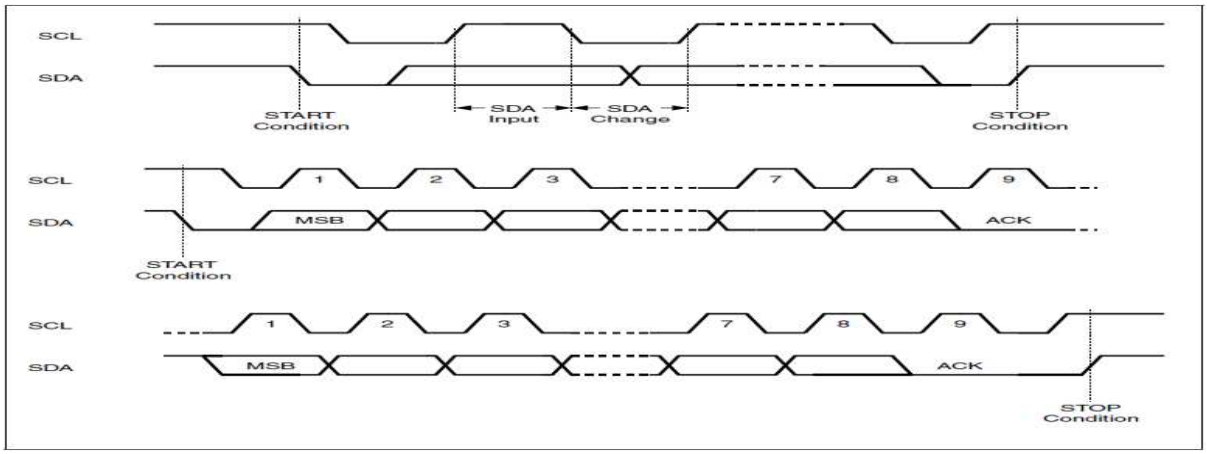
Table of Contents

OP-1. Model Information

Model	AMSA70FD01		
T-con	ANA38409 (ANAPASS)		
EL PMIC	SM3501Q (Silicon Mitus)		
Resolution	2880(H) x 1620(V)		
	I/F	eDP + **I2C**[Note1]	
	eDP Speed	Typ.	**2.7 Gbps / 5.4 Gbps**
	Frame Freq.	Typ.	**60Hz / 90Hz**
	Porch (Video only)	H blank	560
		V blank	VBP+VSA+VFP = 28H (VFP = 8H, VSA = 8H, VBP = 12H)
Input Voltage	**PM_VDD**	Typ.	4.3V
	TCON_VCI	Typ.	3.3V
	LS_VDD	Typ.	1.8V
	TSP_VDD	Typ.	3.3V

[Note1] I2C Interface

a) I2C Bus Protocol



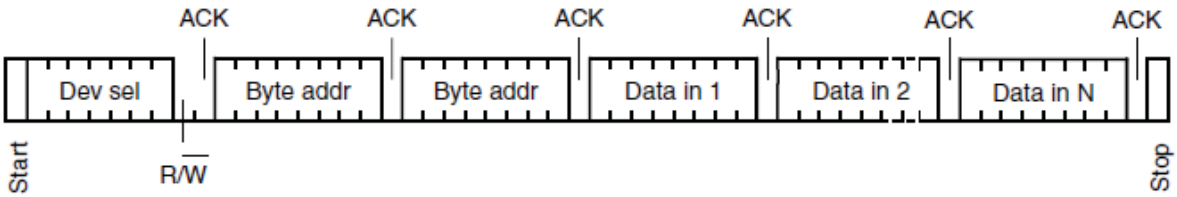
b) Addressing

The device requires a8-bit device address word following a start condition to enable the chip for a read or write operation.

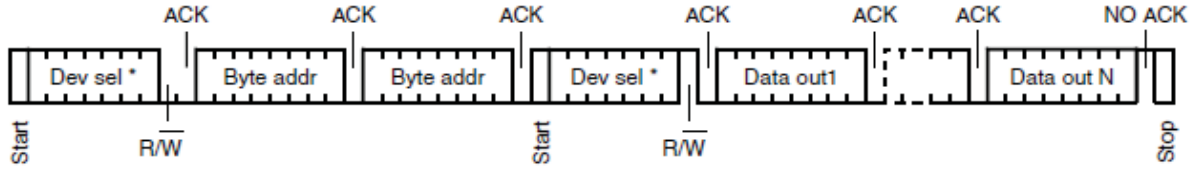
Bit	7	6	5	4	3	2	1	0
Address	1	1	0	0	0	0	1	R or /W

[I2C Device Address Format]

-Write multiple parameters



-Read multiple parameters



OP-2. Revision History

Rev.	Date	Description	Checked by
Preliminary	23.02.21	- Initial Release (60Hz only, Normal 1100nit)	MB JEON JS CHOI
Rev.A	23.04.14	- Brightness Control Update (Normal 670nit) - Frame Freq. & Porch Update (90Hz / 60Hz) - Power on Sequence Update - Freq. Setting Update	MB JEON JS CHOI
Rev.B	23.05.23	- Brightness Control Update (Normal 1100nit) - Frame Freq. & Porch Update (90Hz / 60Hz) - Power on Sequence Update - Freq. Setting Update - Safety Function Update	MB JEON JS CHOI
Rev.C	23.09.22	- Module Information Update - SP Control Setting	MB JEON JS CHOI
Rev.D	23.12.01	- Freq. Setting Update (update Key) - ELVSS Temp Compensation Update - Power Sequence spec Update	MB JEON JS CHOI

OP-3. Operating Sequence

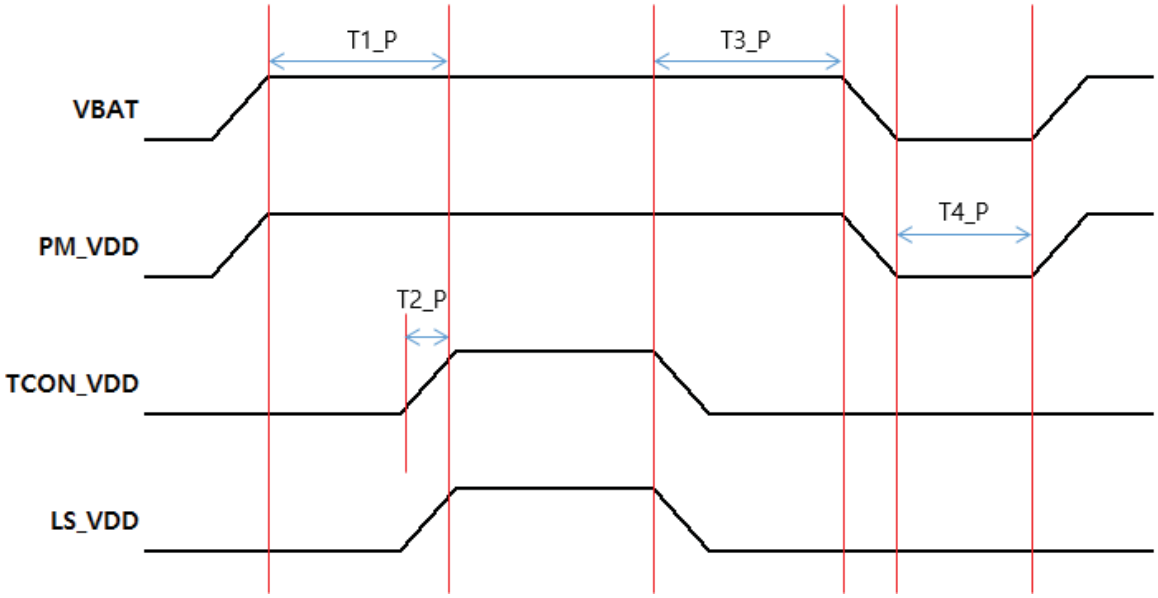
3.1 Power On Sequence

	Sequence	
1	Power Off Status	
2	System Power on (Turn on VBAT, PM_VDD, LS_VDD and TCON_VDD Refer to Note3)	Note3
3	Freq. Setting → Wait HPD (L → H)	Note4
4	Link Training	Note4
5	Wait TCON_RDY (L → H)	
6	Brightness Control	
7	Data Stream	Note4
8	Display On (Automatic Seq.)	Note4
9	Display On Status	

3.2 Power Off Sequence

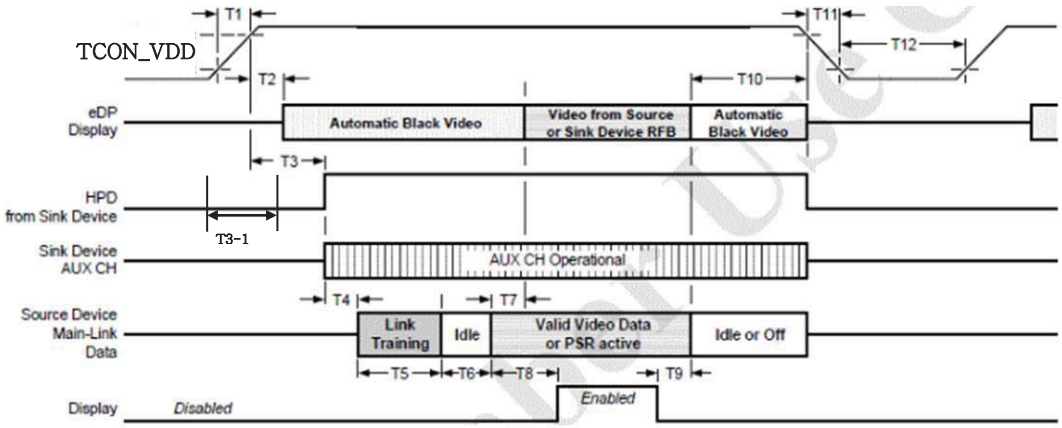
	Sequence	
1	Display On Status	
2	Display Off Command	Note4
3	Wait 150ms	Note4
4	System Power Off (Turn off VBAT, PM_VDD, LS_VDD and TCON_VDD Refer to Note3)	Note3
5	Power Off Status	

[Note3] Power rail Sequence



Signal	Symbol	Parameter	Specification			Unit	Note
			Min	Typ	Max		
Power	T1_P	VBAT(PM_VDD) → TCON_VDD(LS_VDD) delay timing	100			ms	
Power	T2_P	Power rail rise time, 10% to 90%	0.5		10	ms	
Power	-	VBAT → PM_VDD		0		ms	
Power	-	TCON_VDD → LS_VDD		0	2	ms	
Power	T3_P	TCON_VDD(LS_VDD) → VBAT(PM_VDD) down delay timing	0			ms	
Power	T4_P	PM_VDD Off → PM_VDD On timing	500			ms	

[Note4] eDP on/off Timing



Timing Para.	Description	Min (ms)	Max (ms)	
T1	Power rail rise time, 10% to 90%	0.5	10	
T2	VCC ~ Automatic Black Video	0	80	
T3	VCC ~ HPD high	0		
T3-1	VCC+80ms ~ Link Training initialization	-	-	4.3 Freq. Setting: Request to be executed **from** 80ms after VCC **until** Link Training initialization start
T4	HPD high ~ Link Training initialization	-	-	
T5	Link Training	-	-	
T6	Link idle / Tcon Ready	-	-	
T7	Valid Video Delay (or PSR active) from source to display	0	50	
T8	Valid Video ~ Display On	-	-	< Display On CMD > Automatic Sequence
T9	Display Off ~ Automatic Black Video	-	-	< Display Off CMD > Refer to 4.2
T10	Automatic Black Video ~ Power Off	150	500	
T11	Power rail fall time, 90% to 10%	-	10	
T12	Power Off Time	500	-	PM_VDD Off ~ PM_VDD On

OP-4. Operating Setting

4.1 Brightness Control

Addr.	R/W	Values	Description
0x054C	W	{ 0xXX, 0xXX }; /* 0x07, 0xFF : 1100nit */ ~ /* 0x04, 0xDF : 670nit */ ~ /* 0x00, 0x09 : 5nit */	{MSB, LSB} of percentage value

4.2 Display Off Command

Addr.	R/W	Values	Description
0x0348	W	{ 0x03 };	DISPLAY OFF

4.3 Freq. Setting

Addr.	R/W	Values	Description
0x0553	W	{ 0xXX }; /* 0x04 : 60Hz */ (default) /* 0x0C : 90Hz */	Frequency Select
0x056C	W	{ 0x0E }	Update Key for 90Hz

※ Sequence of action when changing frequency

1) Power Off Sequence (refer to 3.2)

2) T4_P (Min 500ms) required (refer to Note 3)

3) Power On Sequence (refer to 3.1)

OP-5. MODULE INFORMATION

Addr.	R/W	Values	Description
0x034E	W	{ 0xFD }	Unlock key
0x034D	W	{ 0x01 }	Unlock key
0x034F	R	Value /* 0x0B */	Firmware Version
0x1D7A	R	Value /* 0x01 */	Module Code
0x1D7B	R	Value /* 0x0D : SDC 13TH BUILD */	SDC Build Information

OP-6. SP Control Setting

6.1 SP Temperature Setting

Addr.	R/W	Values	Description
0x1EF9	R/W	{ Temperature Value };	SP Temperature Setting [Table 2]

[Table 2] Temperature Value

Temp. [℃]	Value	Temp. [℃]	Value	Temp. [℃]	Value	Temp. [℃]	Value
0	0x00	22	0x16	44	0x2C	65	0x41
1	0x01	23	0x17	45	0x2D	66	0x42
2	0x02	24	0x18	46	0x2E	67	0x43
3	0x03	25	0x19	47	0x2F	68	0x44
4	0x04	26	0x1A	48	0x30	69	0x45
5	0x05	27	0x1B		0x31	70	0x46
6	0x06	28	0x1C	50	0x32	71	0x47
7	0x07	29	0x1D	5	0x33	72	0x48
8	0x08	30	0x	52	0x34	73	0x49
9	0x09	31	0x1F	53	0x35	74	0x4A
10	0x0A	32	0x20	54	0x36	75	0x4B
11	0x0B	33	0x21	55	0x37	76	0x4C
12	0x0C	34	0x22	56	0x38	77	0x4D
13	0x0D	35	0x23	57	0x39	78	0x4E
14	0x0E	36	0x24	58	0x3A	79	0x4F
15	0x0F	37	0x25	59	0x3B	80	0x50
16	0x10	38	0x26	60	0x3C	81	0x51
17	0x11	39	0x27	61	0x3D	82	0x52
18	0x12	40	0x28	62	0x3E	83	0x53
19	0x13	41	0x29	63	0x3F	84	0x54
20	0x14	42	0x2A	64	0x40	85	0x55
21	0x15	43	0x2B	65	0x41	-	-

※ Needs to be kept at 0x00 (Temperature Value) at Temp. < 0℃

※ Needs to write SP temperature setting each max 5 seconds

7. ELVSS Temp Compensation

7.1 -30℃ ≤ T < 0℃

Address	R/W	Values	Description
0x1CA1	W	{ 0x0E };	Low Temp. Compensation ELVSS Setting

7.2 0℃ ≤ T ≤ 85℃

Address	R/W	Values	Description
0x1CA1	W	{ 0x1A };	ELVSS Setting Return

8. Appendix

8.1 Safety Function

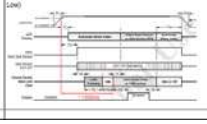
Monitoring Function	Condition	GPIO Output	Detection register Address	Value
ELVDD monitor	ELVDD ERROR (LOW) Abnormal Voltage Detect	Error LOW	0x0203	{0x01}
		Normal HIGH	0x0203	{0x00}
Input Interface error detect	eDP Error Abnormal Voltage Detect	Error LOW	0x0203	{0x02}
		Normal HIGH	0x0203	{0x00}

W01 : AMSA57FD01

DTC

20230714

Extracted and Captured
W01_OLED_DTC_20230714.xlsx : DTCList-SDC templete(W01)

序号	DTC显示码 DTC code	DTC含义 DTC content	DTC描述 DTC Description	问题现象 Display	检测方式 Detect	故障检测逻辑 Trouble Detection Logic	故障检测使能条件 Trouble Detection Enable condition	故障恢复条件 Trouble Recovery condition	故障描述 Trouble Check	DTC清除方式 DTC remove	可能故障原因 Possible Trouble cause	维修建议 Repair Proposal
1	-	eDP Interface Error	Input Interface Error	Black display	- Detection register read - GPIO Pin check	Check 0x0203 register: Check TCON_INTR (Normal:Low/Error: High)	-	-	- Detection register read 0x0203 Noramal:0x00, Error:0x02 - Tcon INTR Normal:Low, Error:High	Display Reset (Power off/ on) → after checking the repair proposal, if it is checked as a continuous error when checking n times, keep power off (hard failure possibility)	1.Display's FPC bridge or connect error 2. eDP SI quality low 3. HOST AP Tx output error	1.Reconnect the FPC or exchange 2.Check eDP output of host AP
2	-	ELVDD Error	Abnormal Voltage Detect	Black display	- Detection register read - GPIO Pin check	Check 0x0203 register: Check TCON_INTR (Normal:Low/Error: High)	-	-	- Detection register read 0x0203 Noramal:0x00, Error:0x01 - Tcon INTR Normal:Low, Error:High	Display Reset (Power off/ on) → after checking the repair proposal, if it is checked as a continuous error when checking n times, keep power off (hard failure possibility)	1.Display's FPC bridge or connect error 2. HOST DCDC output error	1.Reconnect the FPC or exchange 2.Check DCDC output of host AP
3	-	PMIC Error	*PMIC Fault	Black display or AD	PMIC read register	Check 0x2E register of PMIC/Tcon	-	-	Detection register read 0x02E - VGL Error : Bit5:1 - VINT Error : Bit3:1 ※ PMIC output voltage : VGL, VINT	Display Reset (Power off/ on) → after checking the repair proposal, if it is checked as a continuous error when checking n times, keep power off (hard failure possibility)	1.Display's FPC bridge or connect error 2. HOST 5V, & 4.3V output error	1.Reconnect the FPC or exchange 2.Check voltage output of host AP
4	-	Booting Error	EEPROM / Flash memory loading fail	Black display	GPIO Pin check	Check TCON_RDY (Normal: High/Error: Low)	-	-	TCON_RDY (Normal: High/Error: Low)	Display Reset (Power off/ on) → after checking the repair proposal, if it is checked as a continuous error when checking n times, keep power off (hard failure possibility)	1. Flash memory & TCON fail 2. Display's FPC bridge or connect error	1.Reconnect the FPC or exchange
5	-	PMIC Error	*PMIC Fault	Black display or AD	PMIC read register	Check 0x2D register of PMIC/Tcon	-	-	Detection register read 0x02D (Noramal:0x00, Error : NOT 0x00) - VDD1 Error : Bit7:1 - VDD2 Error : Bit5:1 - VDD3 Error : Bit3:1 - AVDD Error : Bit3:1 - VGH Error : Bit1:1 ※ PMIC output voltage : VDD1,2,3, AVDD, VGH	Display Reset (Power off/ on) → after checking the repair proposal, if it is checked as a continuous error when checking n times, keep power off (hard failure possibility)	1.Display's FPC bridge or connect error 2. HOST 5V, & 4.3V output error	1.Reconnect the FPC or exchange 2.Check voltage output of host AP
6	-	PMIC Error	*PMIC Fault	Black display or AD	PMIC read register	Check 0x2F register of PMIC/Tcon	-	-	Detection register read 0x02F (Noramal:0x00, Error : NOT 0x00) - PM_VDD Error : 0x40 ※ PMIC input voltage : Bit6:1	Display Reset (Power off/ on) → after checking the repair proposal, if it is checked as a continuous error when checking n times, keep power off (hard failure possibility)	1.Display's FPC bridge or connect error 2. HOST 5V, & 4.3V output error	1.Reconnect the FPC or exchange 2.Check voltage output of host AP
7	-	Version Check	Tracking sample version	-	Sample history check	Check ID1,2,3 value ※ From C sample, We will provide value in DP code	-	-	- ID1 : Tcon Firmware version - ID2 : Module code - ID3 : Build order	-	-	-
8	-	eDP Lane Symbol Locked Check	eDP Link status check	Black display or AD	eDP Link status check	Check 00202h (Lane0, 1), 00203h(Lane2,3) by AUX channel	-	-	- Detection 00202h (Normal : 0x77, Error : NOT 0x77) - Detection 00203h (Normal : 0x77, Error : NOT 0x77)	Display Reset (Power off/ on) → after checking the repair proposal, if it is checked as a continuous error when checking n times, keep power off (hard failure possibility)	1.Display's FPC bridge or connect error 2. eDP SI quality low 3. HOST AP Tx output error	1.Reconnect the FPC or exchange 2.Check eDP output of host AP
9	-	Tcon EPPROM Check	Tcon EPPROM Check	Black display	Tcon EPPROM Check	Check TCON_RDY during 1000ms after Power on (Normal: High/Error: Low)	-	-	TCON_RDY during 1000ms after Power on (Normal: High/Error: Low) 	Display Reset (Power off/ on) → after checking the repair proposal, if it is checked as a continuous error when checking n times, keep power off (hard failure possibility)	1.Display's FPC bridge or connect error 2. HOST 5V, & 4.3V output error	1.Reconnect the FPC or exchange 2.Check voltage output of host AP

*PMIC Fault Register

Fault Code #1								
Address	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x2D	VDD1	VDD2	VDD3	-	AVDD	-	VGH	-

Fault Code #2								
Address	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x2E	-		VGL	-	VINT		-	

Fault Code #3								
Address	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x2F	-	PM_VDD			-			