

Product Specification

SPECIFICATION
FOR
APPROVAL

- () Preliminary Specification
(●) Final Specification

Title	12.3”FHD (1920 X RGB X 720) TFT- LCD
-------	--------------------------------------

BUYER	Harman
MODEL	-

SUPPLIER	LG Display Co.,Ltd.
MODEL	LA123WF3
SUFFIX	SR02

SIGNATURE	DATE
<div>/</div>	
<div>/</div>	
<div>/</div>	

APPROVED BY	DATE
<div>S. G. Kim / Chief Engineer</div>	
REVIEWED BY	
<div>S.Y.Kim / Senior Engineer</div>	
PREPARED BY	
<div>J.H.Lee / Engineer</div>	

Product Engineering Dept.
LG Display Co., Ltd

Record of Revisions

2 / 38

Product Specification

Contents

No.	Item	Page
	Record of Revisions	2
1	SUMMARY	4
2	FEATURES	4
3	GENERAL SPECIFICATION	5
4	PIN CONFIGURATION	6
4-1	60 PIN FPC PIN CONFIGURATION	6
4-2	50 PIN FPC PIN CONFIGURATION	8
4-3	BACKLIGHT LED FPC PIN CONFIGURATION	10
4-4	TOUCH FPC PIN CONFIGURATION	11
5	ABSOLUTE MAXIMUM RATINGS	12
6	ELECTRICAL SPECIFICATION	13
6-1	ELECTRICAL CHARACTERISTICS	13
6-2	POWER ON/OFF SEQUENCE	16
6-3	LED CHARACTERISTICS	17
6-4	TIMING CHARACTERISTICS OF INPUT SIGNALS	18
6-5	RSDS INPUT CHARACTERISTICS	19
7	TOUCH SPECIFICATIONS	24
8	ELECTRO-OPTICAL CHARACTERISTICS	26
9	MECHANICAL CHARACTERISTICS	29
10	RELIABILITY TEST	32
11	INTERNATIONAL STANDARDS	34
11-1	Safety	34
11-2	EMC	34
11-3	ENVIRONMENT	34
12	PACKING	35
12-1	DESIGNATION OF LOT MARK	35
12-2	PACKING FORM	36
13	PRECAUTIONS	37
13-1	MOUNTING PRECAUTIONS	37
13-2	OPERATING PRECAUTIONS	37
13-3	ELECTROSTATIC DISCHARGE CONTROL	38
13-4	PRECAUTIONS FOR STRONG LIGHT EXPOSURE	38
13-5	STORAGE	38
13-6	HANDLING PRECAUTIONS FOR PROTECTION FILM	38

Product Specification

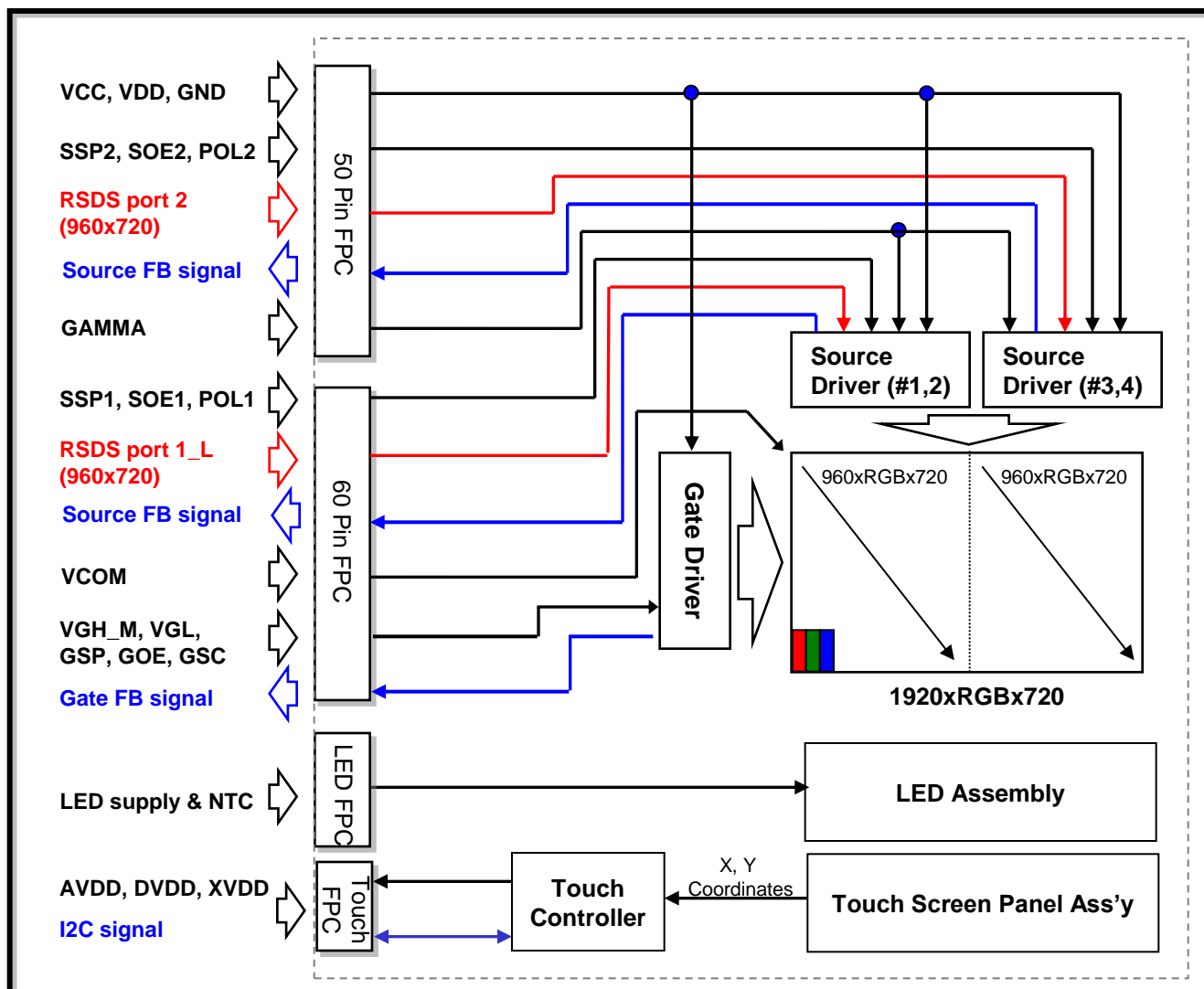
1. SUMMARY

This module utilizes amorphous silicon thin film transistors and a 8:3 aspect ratio. A 12.3" active matrix liquid crystal display allows 16,777,216 colors to be displayed.

The applications are Cluster/CID (Center Information Display) and others AV system.

2. FEATURES

- Utilizes a panel with a 8:3 aspect ratio, which makes the module suitable for use in wide-screen systems.
- The " screen produces a high resolution image that is composed of 4,147,200 pixel elements in a stripe arrangement.
- Wide viewing angle technology is employed.
- By adopting an active matrix drive, a picture with high contrast is realized.
- A thin, light and compact module is accomplished through the use of COG mounting technology.
- By adopting a high aperture panel, high transmittance color filter and high transmission polarizing plates, transmittance ratio is realized.
- Gray scale or the brightness of the sub-pixel color is determined with a 8bit gray scale signal.



Product Specification

3. GENERAL SPECIFICATION

Characteristic Item		Specification
Interface		RSDS 2port
Display Mode		Normally Black, Transmitting Type
Screen Size (Diagonal)		12.3"(312.42mm)
Aspect Ratio		8:3
Outline Dimension (W x H x D)	With Touch	330.0(W) [mm] X 141.25 (H) [mm] X 9.23 (D) [mm]
Active Area		292.032(H) [mm] X 109.512 (V) [mm]
View Area		293.10(H) [mm] X 110.60 (V) [mm]
Number Of dots		1920(H) X 3(R, G, B) X 720(V)
Color Depth		8 Bit, 16.7M Colors
Pixel Pitch		0.1521mm(H) × 0.1521mm(V)
Color Filter Array		RGB vertical stripes
Weight	With Touch	552g (Typ.) /562g (Max.)
Backlight		White LED
Surface Treatment	Touch	None(w/ASF, AGARAF)
	LCM	HC
Touch Substrate	Type	OGS
	Input Method	Single & Multi Finger
Touch Sensor Channel Pitch		5.53mm(X) x 5.64mm(Y), Single Diamond Pattern
Number of Touch Sensor Ch.		52ea(X) x 20ea(Y)
Touch Cover Glass Type		Armortex 1.1t (w/o ASF)
Touch IC		mxT1664S-AT (Atmel社)
Number of Touch		2 Point
Minimum Finger Size		6mm
Pitch Separation		13mm
Single Touch Report Rate		100Hz
Response Time		15ms
Active Area Accuracy		± 1mm
Edge Area Accuracy		± 2mm

Product Specification

4. PIN CONFIGURATION

4-1. 60 PIN FPC PIN CONFIGURATION

Pin No.	Pin name	Function	Notes
1	VGL	Low level power supply for gate	
2	NC	not connected	
3	VGH	High level power supply for gate	
4	NC	not connected	
5	SCAN1	U/D Scan direction	
6	GSP_FB1	Gate synchronization signal feedback	
7	GND	Ground	
8	VCC	Power supply for logic	
9	GND	Ground	
10	RSRAP3	RSDS input data (Red, left side)	
11	RSRAN3	RSDS input data (Red, left side)	
12	RSRAP2	RSDS input data (Red, left side)	
13	RSRAN2	RSDS input data (Red, left side)	
14	RSRAP1	RSDS input data (Red, left side)	
15	RSRAN1	RSDS input data (Red, left side)	
16	RSRAP0	RSDS input data (Red, left side)	
17	RSRAN0	RSDS input data (Red, left side)	
18	GND	Ground	
19	RSGAP3	RSDS input data (Green, left side)	
20	RSGAN3	RSDS input data (Green, left side)	
21	RSGAP2	RSDS input data (Green, left side)	
22	RSGAN2	RSDS input data (Green, left side)	
23	RSGAP1	RSDS input data (Green, left side)	
24	RSGAN1	RSDS input data (Green, left side)	
25	RSGAP0	RSDS input data (Green, left side)	
26	RSGAN0	RSDS input data (Green, left side)	
27	GND	Ground	
28	RSBAP3	RSDS input data (Blue, left side)	
29	RSBAN3	RSDS input data (Blue, left side)	
30	RSBAP2	RSDS input data (Blue, left side)	
31	RSBAN2	RSDS input data (Blue, left side)	
32	RSBAP1	RSDS input data (Blue, left side)	
33	RSBAN1	RSDS input data (Blue, left side)	
34	RSBAP0	RSDS input data (Blue, left side)	
35	RSBAN0	RSDS input data (Blue, left side)	
36	GND	Ground	
37	RSCLKAP	RSDS input clock (left side)	
38	RSCLKAN	RSDS input clock (left side)	
39	GSP_1	Gate start pulse	
40	GSC_1	Gate shift clock	

Product Specification

4-1. 60 PIN FPC PIN CONFIGURATION

Pin No.	Pin name	Function	Notes
41	GOE_1	Gate output enable	
42	SSP_1	Source start pulse	
43	SOE_1	Source on enable	
44	POL_1	Polarity signal	
45	SCAN2	L/R Scan direction	
46	SSP_FB1	Source synchronization signal feedback	
47	GND	Ground	
48	VCOM	Common electrode power supply	
49	VCOM	Common electrode power supply	
50	VDD	Power supply for source	
51	VDD	Power supply for source	
52	V0	Gamma reference voltage (highest voltage)	
53	V1	Gamma reference voltage	
54	V2	Gamma reference voltage	
55	V3	Gamma reference voltage	
56	V4	Gamma reference voltage	
57	V5	Gamma reference voltage	
58	V6	Gamma reference voltage	
59	V7	Gamma reference voltage	
60	V8	Gamma reference voltage	

[Connector] Kyocera 6288 060

Product Specification

4-2. 50 PIN FPC PIN CONFIGURATION

Pin No.	Pin name	Function	Notes
1	V9	Gamma reference voltage	
2	V10	Gamma reference voltage	
3	V11	Gamma reference voltage	
4	V12	Gamma reference voltage	
5	V13	Gamma reference voltage	
6	V14	Gamma reference voltage	
7	V15	Gamma reference voltage	
8	V16	Gamma reference voltage	
9	V17	Gamma reference voltage (lowest voltage)	
10	GND	Ground	
11	SSP_2	Source start pulse	
12	SOE_2	Source on enable	
13	POL_2	Polarity signal	
14	SCAN2	L/R Scan direction	
15	SSP_FB2	Source synchronization signal feedback	
16	GND	Ground	
17	RSRBP3	RSDS input data (Red, right side)	
18	RSRBN3	RSDS input data (Red, right side)	
19	RSRBP2	RSDS input data (Red, right side)	
20	RSRBN2	RSDS input data (Red, right side)	
21	RSRBP1	RSDS input data (Red, right side)	
22	RSRBN1	RSDS input data (Red, right side)	
23	RSRBP0	RSDS input data (Red, right side)	
24	RSRBN0	RSDS input data (Red, right side)	
25	GND	Ground	
26	RSGBP3	RSDS input data (Green, right side)	
27	RSGBN3	RSDS input data (Green, right side)	
28	RSGBP2	RSDS input data (Green, right side)	
29	RSGBN2	RSDS input data (Green, right side)	
30	RSGBP1	RSDS input data (Green, right side)	
31	RSGBN1	RSDS input data (Green, right side)	
32	RSGBP0	RSDS input data (Green, right side)	
33	RSGBN0	RSDS input data (Green, right side)	
34	GND	Ground	
35	RSBBP3	RSDS input data (Blue, right side)	
36	RSBBN3	RSDS input data (Blue, right side)	
37	RSBBP2	RSDS input data (Blue, right side)	
38	RSBBN2	RSDS input data (Blue, right side)	
39	RSBBP1	RSDS input data (Blue, right side)	
40	RSBBN1	RSDS input data (Blue, right side)	

Product Specification**4-2. 50 PIN FPC PIN CONFIGURATION**

Pin No.	Pin name	Function	Notes
41	RSBBP0	RSDS input data (Blue, right side)	
42	RSBBN0	RSDS input data (Blue, right side)	
43	GND	Ground	
44	RSCLKBP	RSDS input clock (right side)	
45	RSCLKBN	RSDS input clock (right side)	
46	VCC	Power supply for logic	
47	GND	Ground	
48	VGL	Low level power supply for gate	
49	NC	not connected	
50	VGH	High level power supply for gate	

[Connector] Kyocera 6288 050

Product Specification

4-3. BACKLIGHT LED FPC PIN CONFIGURATION

Pin No.	Pin name	Function	Notes
1	ANODE 1	LED Anode Terminal 1	
2	ANODE 2	LED Anode Terminal 2	
3	-	-	
4	ANODE 3	LED Anode Terminal 3	
5	-	-	
6	-	-	
7	-	-	
8	-	-	
9	-	-	
10	CATHODE 1	LED Cathode Terminal 1	
11	CATHODE 2	LED Cathode Terminal 2	
12	-	-	
13	CATHODE 3	LED Cathode Terminal 3	
14	-	-	
15	-	-	
16	-	-	
17	-	-	
18	-	-	
19	THERMISTOR+	Thermal Sensor	
20	THERMISTOR-	Thermal Sensor	

[Connector] 04 6288 020 000 846+ Kyocera

Product Specification

4-4. TOUCH FPC PIN CONFIGURATION

Pin No.	Pin name	Function	Notes
1	GND	Ground	
2	AVDD	Analog voltage supply	
3	GND	Ground	
4	DVDD	Digital voltage supply	
5	XVDD	Tx line drive voltage	
6	RESET	Reset	
7	SDA	Serial interface data	
8	SCL	Serial interface clock	
9	CHG	State change interrupt	
10	GND	Ground	

[Connector] FH28D-10S-0.5SH, Hirose

Product Specification

5. ABSOLUTE MAXIMUM RATINGS

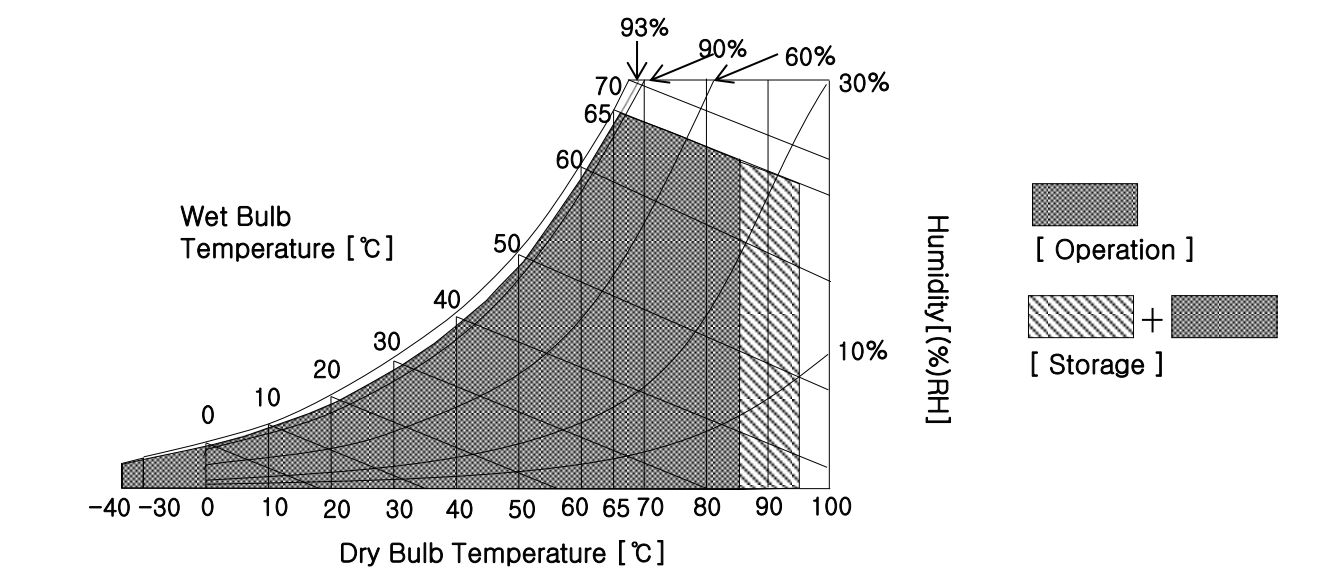
Parameter		Symbol	Min.	Max.	Unit	Notes
Display	Digital Supply Voltage	VCC/V _{CTRL_D}	-0.5	4	V	5-1
	Gamma Reference Voltage	V _{GMA} (GMA 0~17)	GND+0.2	VDD-0.2	V	
	Source Driver Analog Voltage	VDD	-0.5	14	V	
	Gate Driver Voltage	VGH-VGL	-0.3	39.0	V	
		VGL	-12.0	0.3	V	
	RSDS Data Voltage	V _{RSDS}	-0.5	4	V	
	LED Current	I _{LED}	-	80	mA	
	LED Power Consumption	P _{LED}	-	7.65	W	
Touch	Analog Supply Voltage	AVDD	2.57	3.47	V	
	Digital Supply Voltage	DVDD/V _{CTRL_T}	2.57	3.47	V	
	TX Line Drive Voltage	XVDD	2.57	11	V	
	I2C	SCL/SDA	2.57	3.47	V	
	Interrupt	V _{CHG}	2.57	3.47	V	
Storage Temperature		T _a	-40	95	℃	5-2,3
Operating Temperature		T _a	-40	85	℃	5-2,3,4

[Note 5-1] V_{CTRL}: SCAN1/GSP_FB1/GSP_1/GSC_1/GOE_1/SSP_1,2/SOE_1,2/POL_1,2/SCAN2/SSP_FB1,2

[Note 5-2] This rating applies to all parts of the module and should not be exceeded.

[Note 5-3] Maximum wet-bulb temperature is 58℃. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

[Note 5-4] The operating temperature only guarantees operation of the LCM and doesn't guarantee all the contents of Electro-optical specification.



Product Specification

6. ELECTRICAL SPECIFICATION

6-1. ELECTRICAL CHARACTERISTICS

Ta=25℃

Parameter			Symbol	Min.	Typ.	Max.	Unit	Notes
Source Driver	Digital Supply Voltage		VCC	3.0	3.3	3.6	V	
	Supply Voltage		VDD	12.6	13	13.5	V	
	Gamma Reference Voltage		V _{GMA} (GMA0~17)	GND+0.2	-	VDD-0.2	V	6-1.1
Gate Driver	TFT	Hi	VGH	16	20	22	V	6-1.2
		Low	VGL	-10	-8.7	-8.0	V	
		Modulation Voltage	VDD_M	6	13	16	V	6-1.2
		Voltage Difference	VGH-VGL	17	-	32	V	
	Logic Supply Voltage		VCC	3.0	3.3	3.6	V	
Control Signal			V _{CTRL}	3.0	3.3	3.6	V	6-1.3
Common Voltage			VCOM	5.0	5.35	7.0	V	6-1.4
Digital Supply Voltage Current			I _{VCC}	-	77	100	mA	6-1.5
Source Driver Analog Voltage Current			I _{VDD}	-	94	130	mA	6-1.5
Gate High Voltage Current			I _{VGH}	-	0.7	3	mA	6-1.6
Gate Low Voltage Current			I _{VGL}	-	0.7	3	mA	6-1.6
Common Voltage Current			I _{VCOM}	-	0.23	1	mA	6-1.6

Product Specification

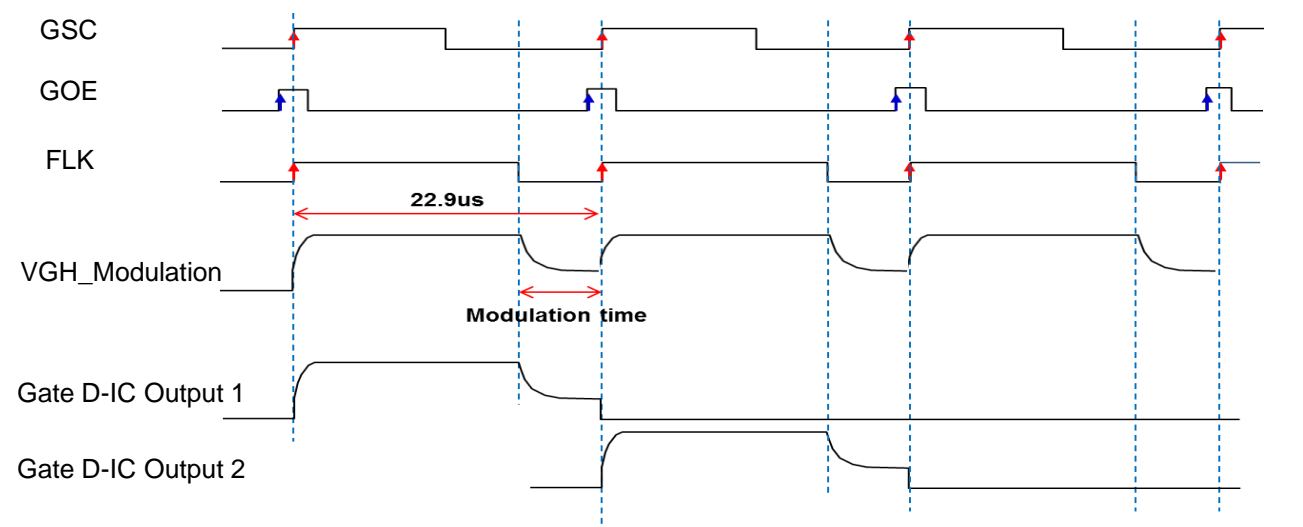
[Note 6-1.1] Recommended Gamma Correction Voltage for Gamma Curve 2.35
[Reference Only, GMA0 to GMA17]

Symbol	Min.	Typ.	Max.	Unit
GMA0	12.07	12.12	12.17	V
GMA1	12.05	12.1	12.15	V
GMA2	10.72	10.77	10.82	V
GMA3	10.16	10.21	10.26	V
GMA4	9.46	9.51	9.56	V
GMA5	8.78	8.83	8.88	V
GMA6	8.22	8.27	8.32	V
GMA7	6.62	6.67	6.72	V
GMA8	6.59	6.64	6.69	V
GMA9	6.59	6.64	6.69	V
GMA10	6.57	6.62	6.67	V
GMA11	4.44	4.49	4.54	V
GMA12	3.96	4.01	4.06	V
GMA13	3.38	3.43	3.48	V
GMA14	2.71	2.76	2.81	V
GMA15	2.1	2.15	2.2	V
GMA16	0.29	0.34	0.39	V
GMA17	0.26	0.31	0.36	V

Product Specification

[Note 6-1.2] VGH Modulation Method

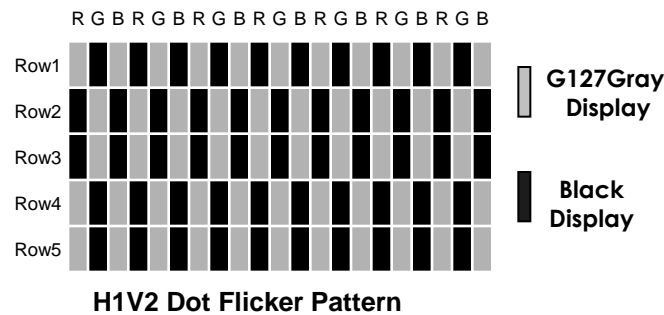
Parameter	Min.	Typ.	Max.	Unit	Notes
VGH_DC	16	20	22	V	
VDD_M	12.6	-	16	V	
Modulation time	1.5	3	6	us	Frame frequency : 60Hz



[Note 6-1.3] V_{CTRL}: SCAN1/GSP_FB1/GSP_1/GSC_1/GOE_1/SSP_1,2/SOE_1,2/POL_1,2/SCAN2/SSP_FB1,2

[Note 6-1.4] VCOM adjustment method.

- * Pattern : Flicker pattern (H1V2 Dot)
- * VCOM adjustment temperature : 20~40℃
- * Method
 - Adjust the VCOM Voltage to the minimum flicker phenomenon.
 - adjustment must be finished within 30 sec
 - Precaution : 1hr waiting after failed adjustment Vcom. For remove remained panel DC charge



[Note 6-1.5] f_{CLK} = 44.7MHz, VCC = 3.3V, VDD = 13V, GMA0 = 12.12V / GMA17 = 0.31V, with Probe Load.

* Test pattern : White (256 Gray)

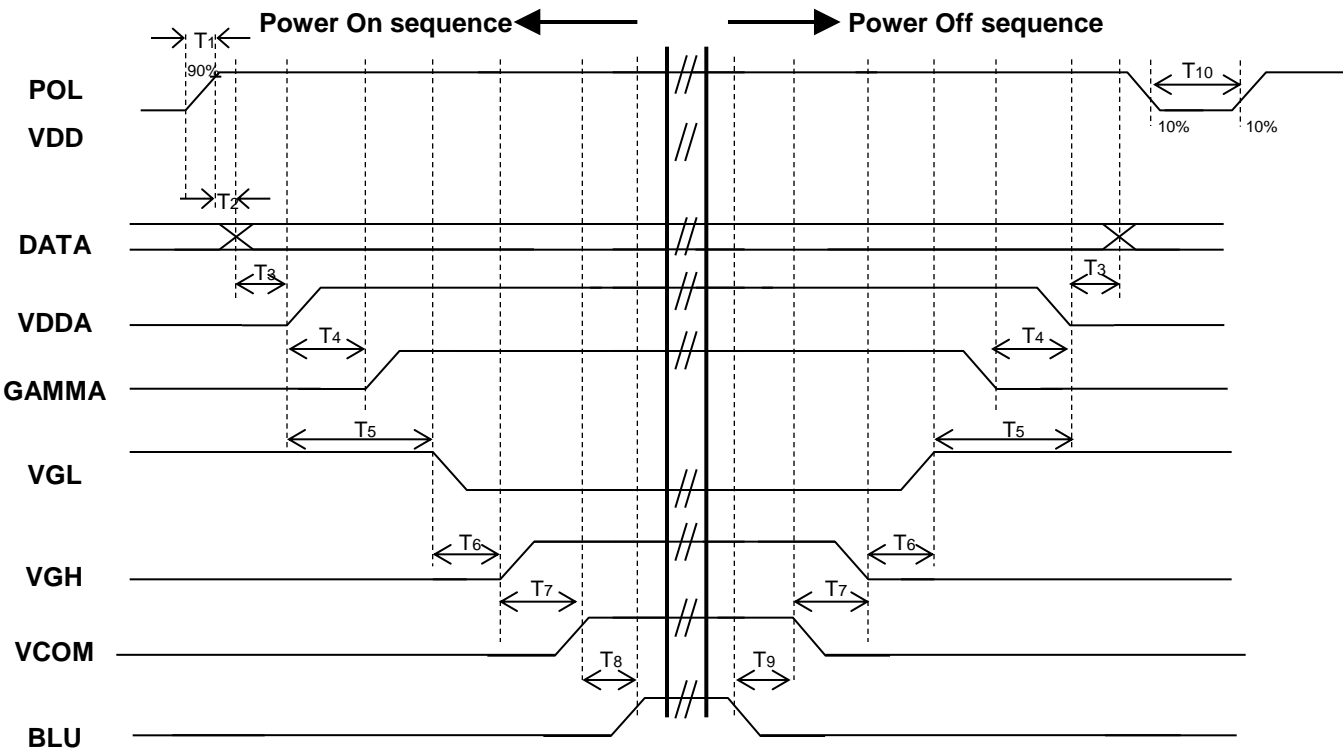
[Note 6-1.6] f_{CLK} = 44.7MHz, VGH = 20V, VGL = -8.7V, with Probe Load.

* Test pattern : White (256 Gray)

Product Specification

6-2. POWER ON/OFF SEQUENCE

Parameter		Timing				Notes
		Min.	Typ.	Max.	Unit	
Power On/Off	T1	0	-	20	ms	
	T2	20	-	-		
	T3	5	-	-		
	T4	0.2	-	-		
	T5	5	-	-		
	T6	5	-	-		
	T7	5	-	-		
	T8	200	-	-		
	T9	500	-	-		
	T10	1500	-	-		



※ DATA : RSDS Signal, SCAN1/2, GSP, GSC, GOE, SSP, SSC, SOE

Product Specification

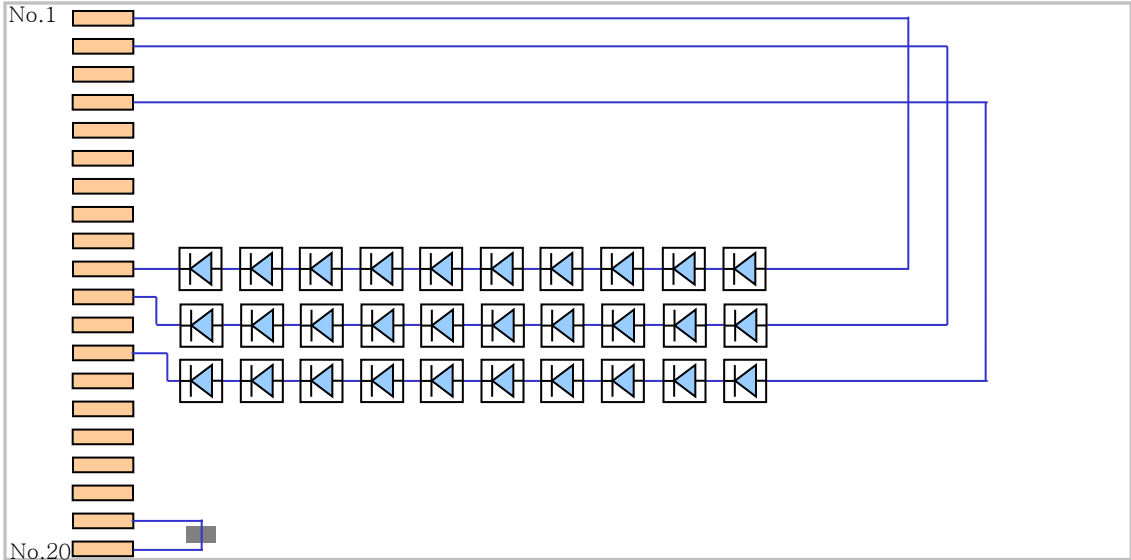
6-3. LED BACKLIGHT CHARACTERISTICS

6-3-1. LED BACKLIGHT CHARACTERISTICS

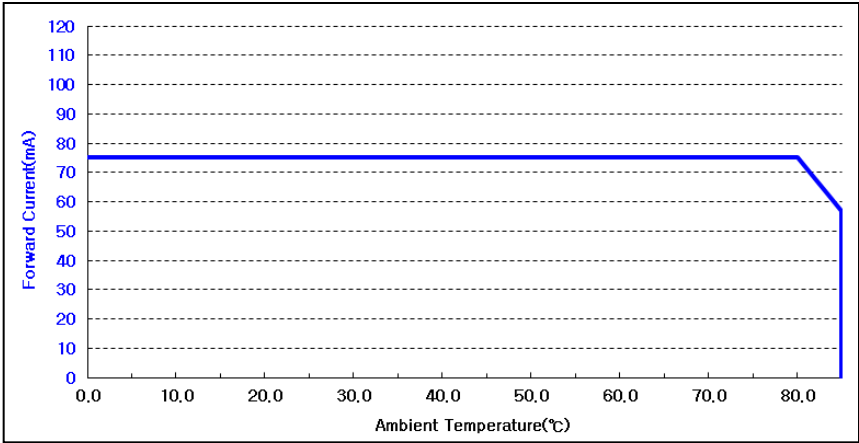
Ta=25℃

Parameter		Symbol	Values			Unit	Notes
			Min.	Typ.	Max.		
LED Current		I _{LED}	-	75	95	mA	Per LED
LED Voltage	-30℃	V _{LED}	31.5	32.3	35.3	V	Per chain
	25℃		29.0	32.0	34.0		
	85℃		28.4	29.8	32.6		
LED Power		P _{LED}	6.52	7.20	10.06	W	
LED chain			-	3	-	EA	6-3.1

[Note 6-3.1] LED PCB chain



Thermistor P/N: NCP15XH103F0SRC



Product Specification

6-4. TIMING CHARACTERISTICS OF INPUT SIGNALS

6-4-1. INPUT SIGNALS TIMING

This is the signal timing required at the input of the RSDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for it's proper operation.

Ta=25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit
CLK frequency	Fclk	44.4	44.7	54.4	MHz
Horizontal display area	THD	960			CLK
HS period time	TH	1020	1024	1120	CLK
HS blanking	THBW + THBP	60	64	160	CLK
Vertical display area	TVD	720			H
VS period time	TV	726	728	810	H
VS blanking	TVBW + TVBP	6	8	90	H

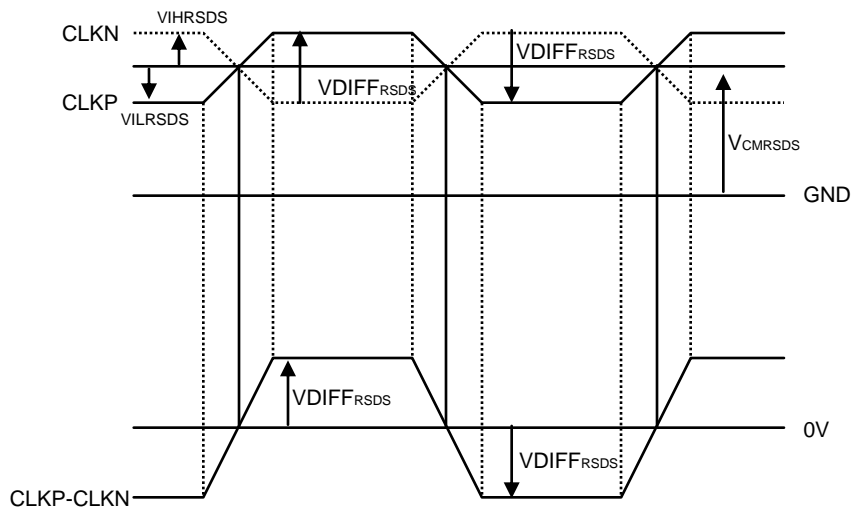
Product Specification

6-5. RSDS INPUT CHARACTERISTICS

6-5-1. DC SPECIFICATIONS

(VDD_IF=VDD=3.0V to 3.6V, VDDA = 8V to 13.5V, GND_IF=GND=GNDA=0V, TA=-40℃ to 85℃)

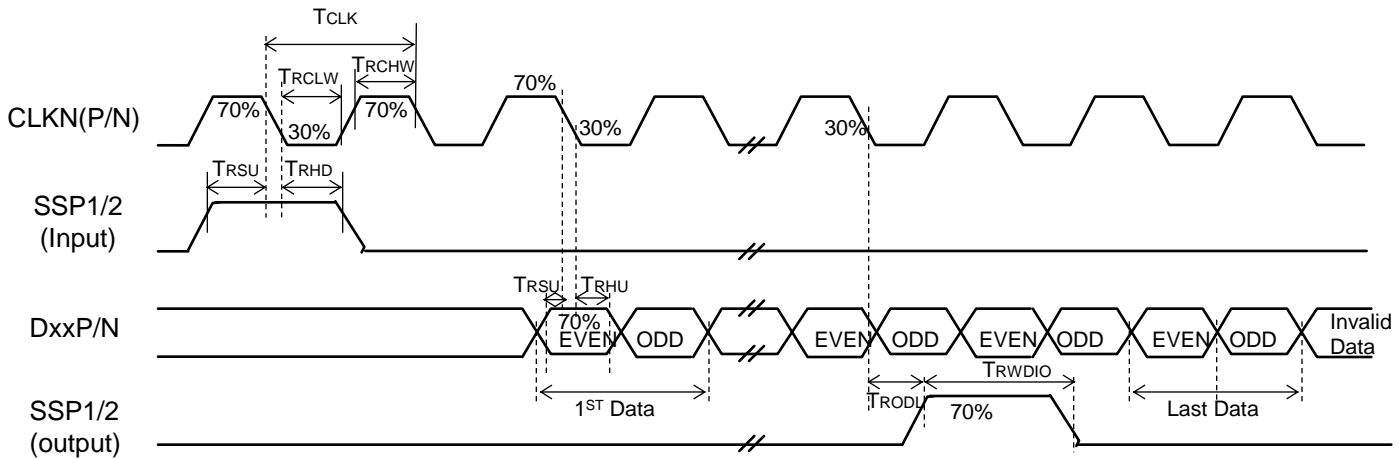
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
RSDS Low Level Input Voltage	VILRSDS	-	-150	-100	mV	
RSDS High Level Input Voltage	VIHRSDS	100	150	-	mV	
RSDS Differential Input Voltage	VDIFFRSDS	200	300	600	mV	
RSDS Common Voltage	VCMRSDS	0.5	1.2	VDD-1.6	V	
RSDS input Leakage Current	ILRSDS	-	-	±1	uA	Other input pins
RSDS Digital Stand-by Current	ISTRSDS	-	-	3	mA	CLK is stopped, Inputs are default, VDD_IF=3.3V
RSDS Operating Current	IVDDRSDS	-	-	60	mA	Fclk = 80MHz, FLD=70KHz, VDD_IF=3.3V, Input pattern: Data Pattern='101010...'



Product Specification

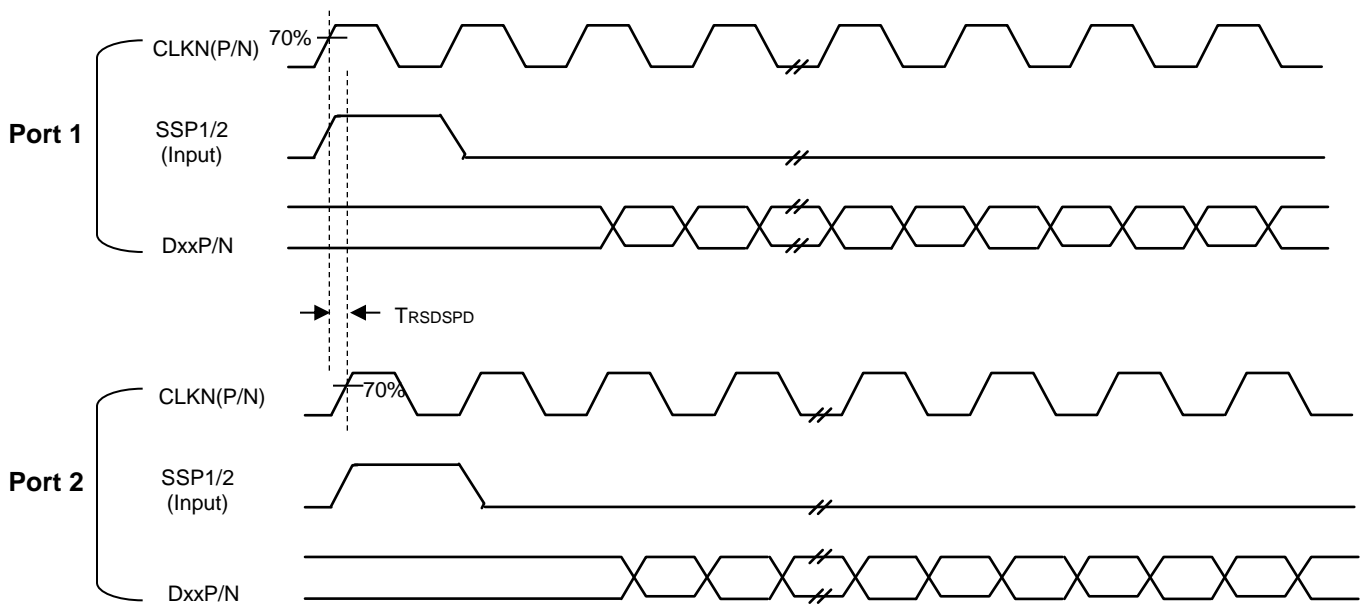
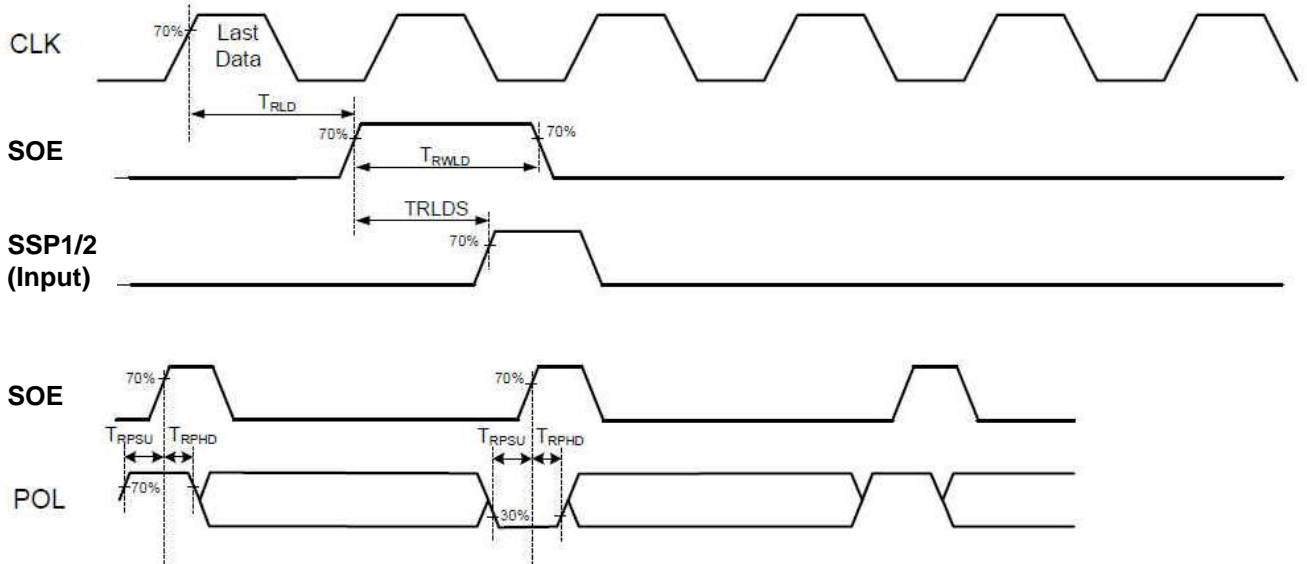
6-5-2. AC SPECIFICATION FOR SOURCE D-IC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Frequency	FCLK	44.4	44.7	54.4	MHz	
CLK Period	TCLK		-	-	ns	
CLK High Width	TRCHW	40%		60%	TCLK	
CLK Low Width	TRCLW	40%		60%	TCLK	
Data setup time	TRSU	3	-	-	ns	
Data hold time	TRHD	3.5	-	-	ns	
Output Delay of SSP2/1	TRDL	-	-	15	TCLK	CL=25pF (Output)
Last data to SOE	TRLD	16	-	-	TCLK	
Pulse width of SOE	TRWLD	16	-	-	TCLK	
Pulse width of SSP	TRWDIO	-	1	-	TCLK	
Time that SOE to SSP1/2	TRLDS	16	-	-	TCLK	
POL set-up time	TRPSU	6	-	-	TCLK	POL to SOE
POL hold time	TRPHD	6	-	-	TCLK	POL to SOE
2 PORT Delay	TRSDSPD	-	-	50	ns	



Product Specification

6-5-2. AC SPECIFICATION FOR SOURCE D-IC



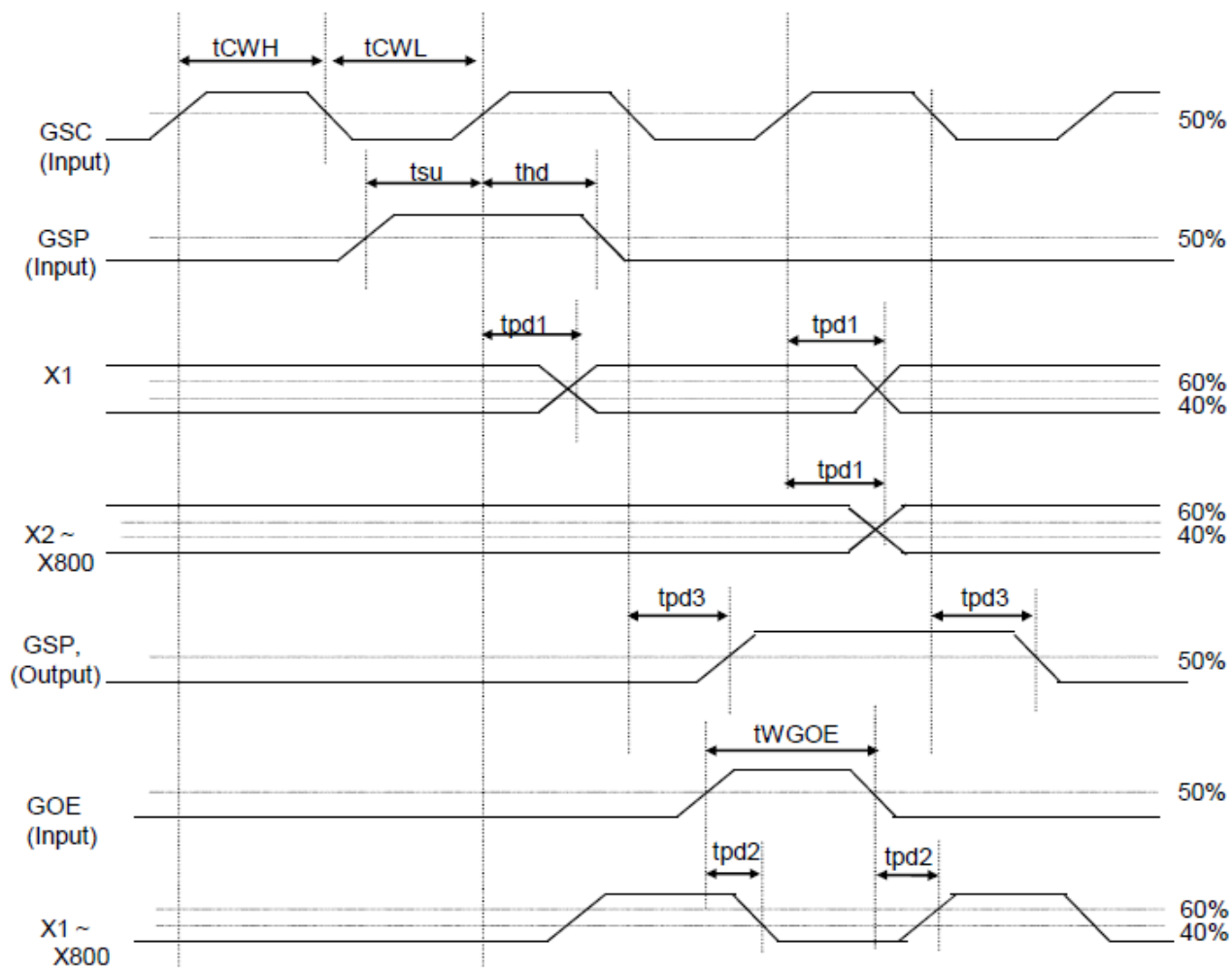
Product Specification

6-5-3. AC SPECIFICATION FOR GATE D-IC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
GSC Clock Frequency	tGSC	-	-	200	KHz	
GSC Clock Pulse Width	tCWH	2	-	-	us	
	tCWL	2	-	-	us	
Input signal Rising Time	tr _{in}	-	-	100	ns	
Input signal Falling Time	t _{fin}	-	-	100	ns	
GOE Enable Time	tWGOE	1	-	-	us	
Data Setup Time	t _{su}	500	-	-	ns	
Data Hold Time	t _{hd}	500	-	-	ns	
Output Delay to GSC	t _{pd1}	-	500	1000	ns	CL=300pF
Output Delay to GOE	t _{pd2}	-	500	1000	ns	CL=300pF
Data Output Delay Time	t _{pd3}	-	500	1000	ns	CL=30pF

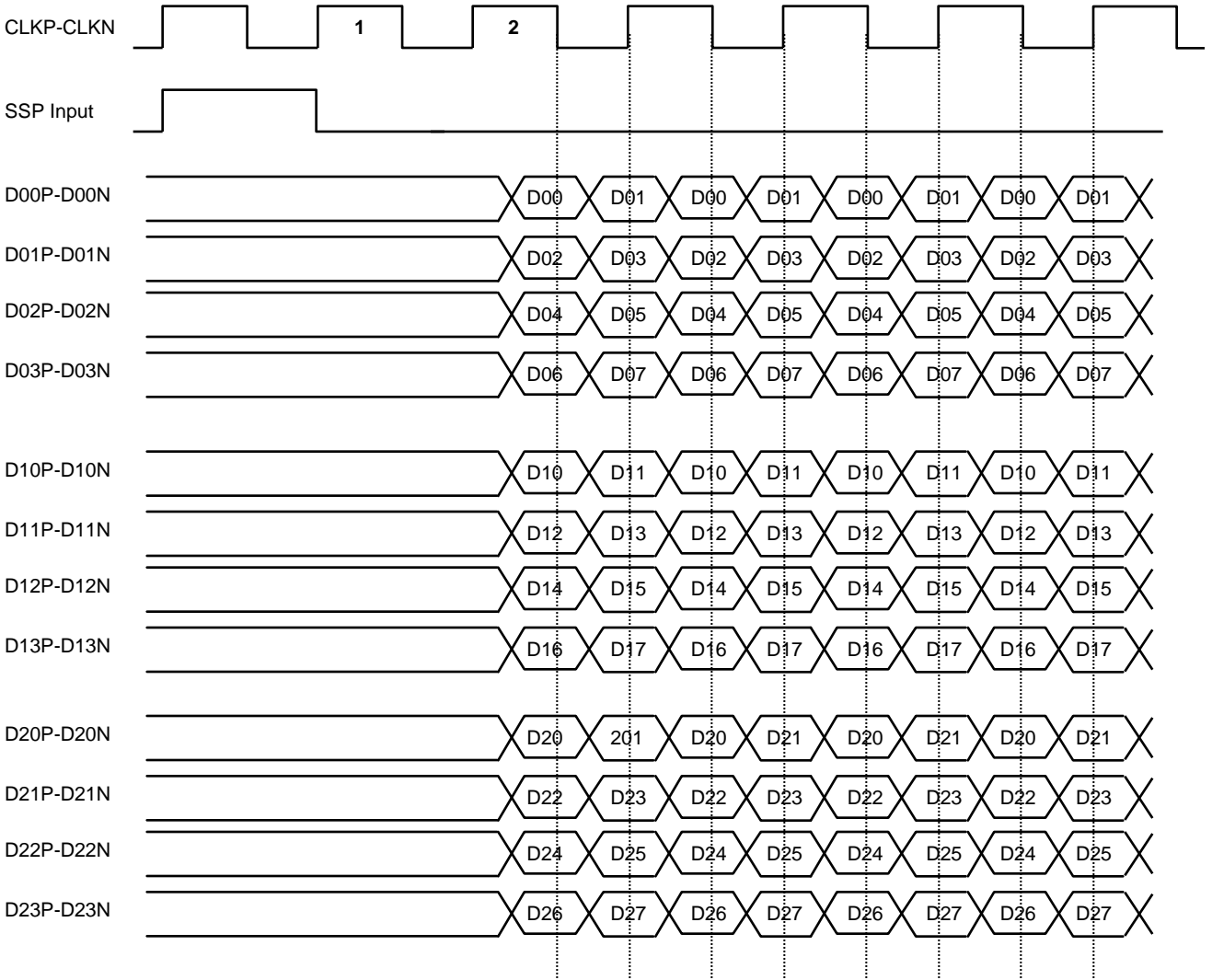
Note:

- Rising Time and Falling Time is measured between 20% to 80% of the signal.



Product Specification

6-5-4. RSDS DATATINPUT FORMAT (8BIT)



Product Specification

7. TOUCH SPECIFICATIONS

7-1. GENERAL SPECIFICATION

The contents provide general characteristics for the model LA123WF3

	Item		Spec.	Notes
General Specification	System		Projected Capacitive type	
	Multi Touch Points		2 points	
	Cover Glass	Outline	330mm(H) X 141.25mm(V)	
		View Area	293.1mm(H) X 110.60mm(V)	
		Type/Thickness	Armorex / 1.1t	
		Surface Coating	None	
	Sensor	Type	OGS	
		Sensor Channel Pitch	5.53mm(X) X 5.64mm(Y)	Single Diamond Pattern
	Touch IC Information	IC	mXT1664S-AT	
		Firmware	1.0.AA	
		Config. Checksum	0x07381D	
	AG/AR/AF Film	Haze	Max 10%	
		Reflectance	Max 6%	Max 4%, with Display
		Hardness	<3H	500g force
	Number of Sensor Channel		52ea(X) x 20ea(Y)	
	Interface		I2C	
Other Feature	Weight		155g (max)	w/o Protect film

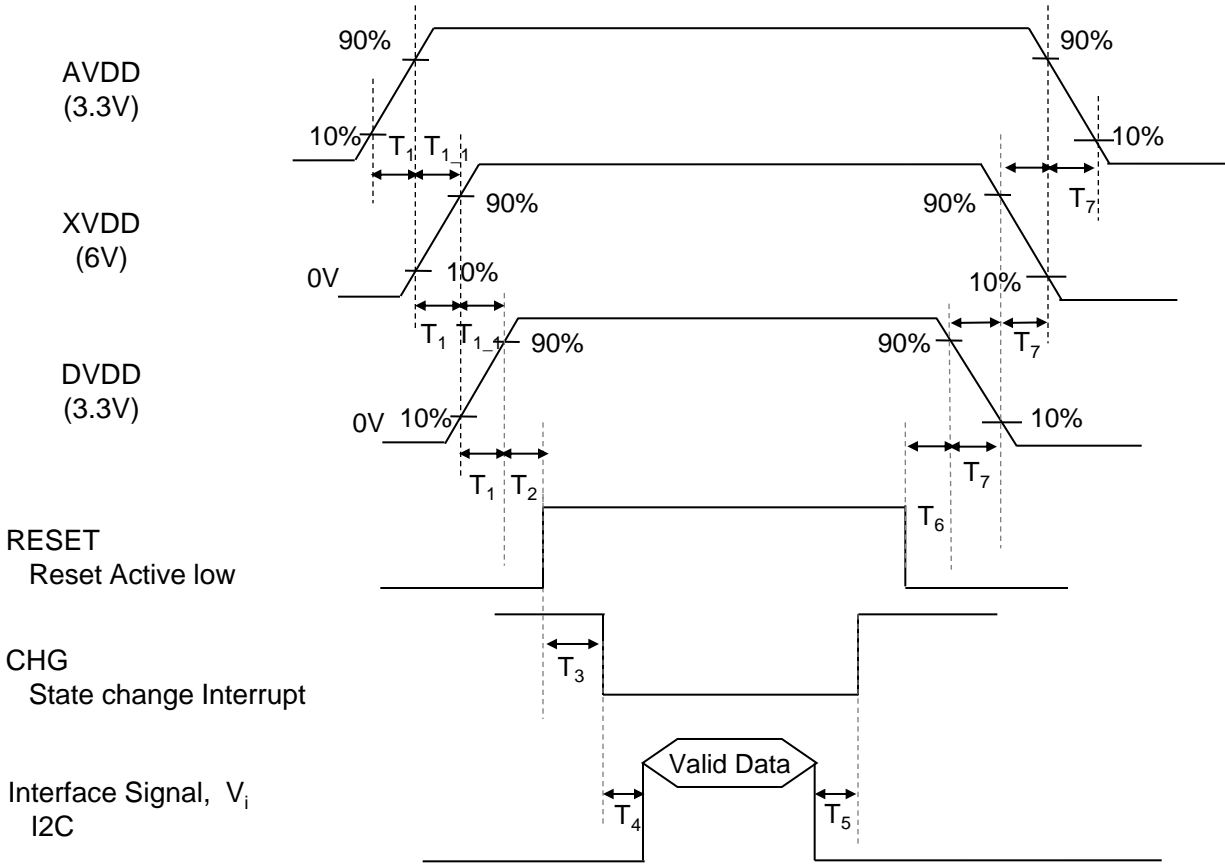
7-2. TOUCH ELECTRICAL CHARACTERISTICS

The contents provide general Electrical characteristics for the model LA123WF3

Parameter		Symbol	Values			Units	Notes
			Min.	Typ.	Max.		
Power Supply Input Voltage		AVDD	2.57	3.3	3.47	V	
		DVDD	2.57	3.3	3.47	V	
		XVDD	2.57	6	11	V	
Power Supply Input Current	Active	ITSP_A	-	87.2	100.3	mA	
	Idle	ITSP_I	-	87.2	100.3	mA	
Power Consumption	Active	PTSP_A	-	0.3	0.36	W	
	Idle	PTSP_I	-	0.3	0.36	W	

Product Specification

7-4. POWER SEQUENCE FOR TOUCH



POWER SEQUENCE TABLE

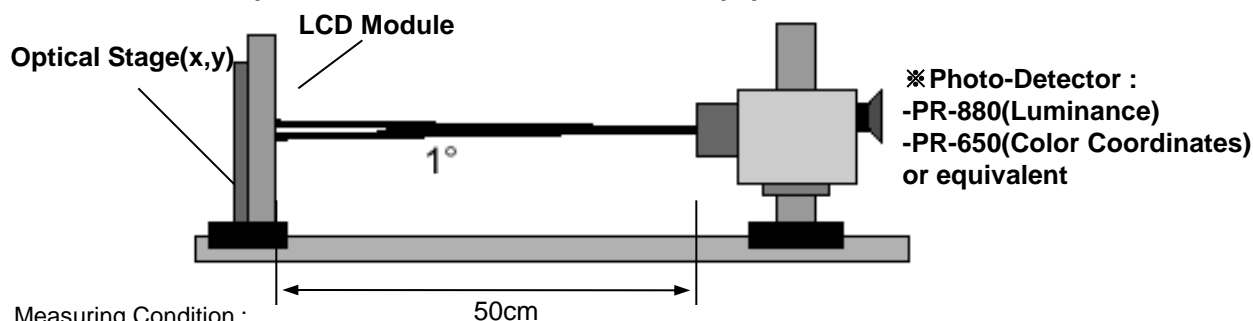
Parameter	Value			Units
	Min.	Typ.	Max.	
T_1	0.5	-	10	ms
T_{1_1}	0	-	1	ms
T_2	90	-	-	ns
T_3	-	100	-	ms
T_4	0	-	-	ms
T_5	-	-	0	ms
T_6	0	-	-	ns
T_7	-	-	-	ms

Product Specification

8. ELECTRO-OPTICAL CHARACTERISTICS

8-1. ELECTRO-OPTICAL CHARACTERISTICS

Optical Characteristic Measurement Equipment and Method



Measuring Condition ;

-Measuring surroundings : Dark Room

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

-Adjust operating voltage to get optimum contrast at the center of the display.

-Measured value at the center point of LCD panel after more than 30 minutes while backlight turning on.

VCC=3.3V, VDD=13V, fv=60Hz, fclk= 44.7MHz, ILED = 75mA, $T_a=25^{\circ}\text{C}$

Parameter		Symbol	Condition	Values			Unit	Notes
				Min.	Typ.	Max.		
Contrast Ratio		CR	Optimal	700	1000	-	-	8-1.1
Response Time		$Tr_R + Tr_D$	+25℃	-	25	30	ms	8-1.2
			-10℃ (Ta)	-	100	160		8-1.2 (Reference)
			-20℃ (Ta)	-	180	250		
			-30℃ (Ta)	-	390	600		
Luminance		L_{WH}	Optimal	540	630	-	cd/m ²	
White Uniformity		δ_{WHITE}	9Point	80	85	-	%	8-1.3
Color Coordinates [CIE1931]	RED	Rx		Typ -0.035	0.638	Typ +0.035		
		Ry			0.333			
	GREEN	Gx			0.288			
		Gy			0.625			
	BLUE	Bx			0.150			
		By			0.047			
	WHITE	Wx			0.293			
		Wy			0.320			
LED Life Time		Hrs		10,000	-	-	-	8-1.4
Color Temperature		-	-	-	7,800	-	K	
Color Gamut		-	-	-	70	-	%	
Cross Talk		-	-	-	-	2.5	%	8-1.5 (Reference)
Flicker		-	-	-	-	-10	dB	8-1.6 (Reference)
Viewing Angle	x axis, right(Φ =0°)	Θ_r	CR≥10	89		-	degree	
	x axis, left (Φ =180°)	Θ_l		89		-		
	y axis, up (Φ =90°)	Θ_u		89		-		
	y axis, down (Φ =270°)	Θ_d		89		-		

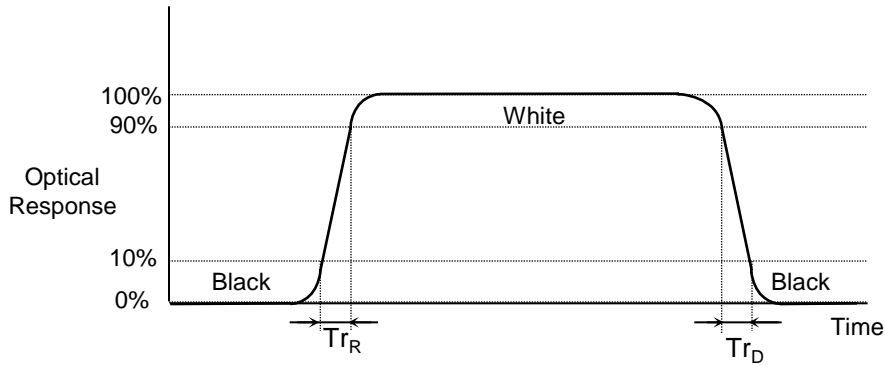
Product Specification

[Note 8-1.1]

Contrast Ratio

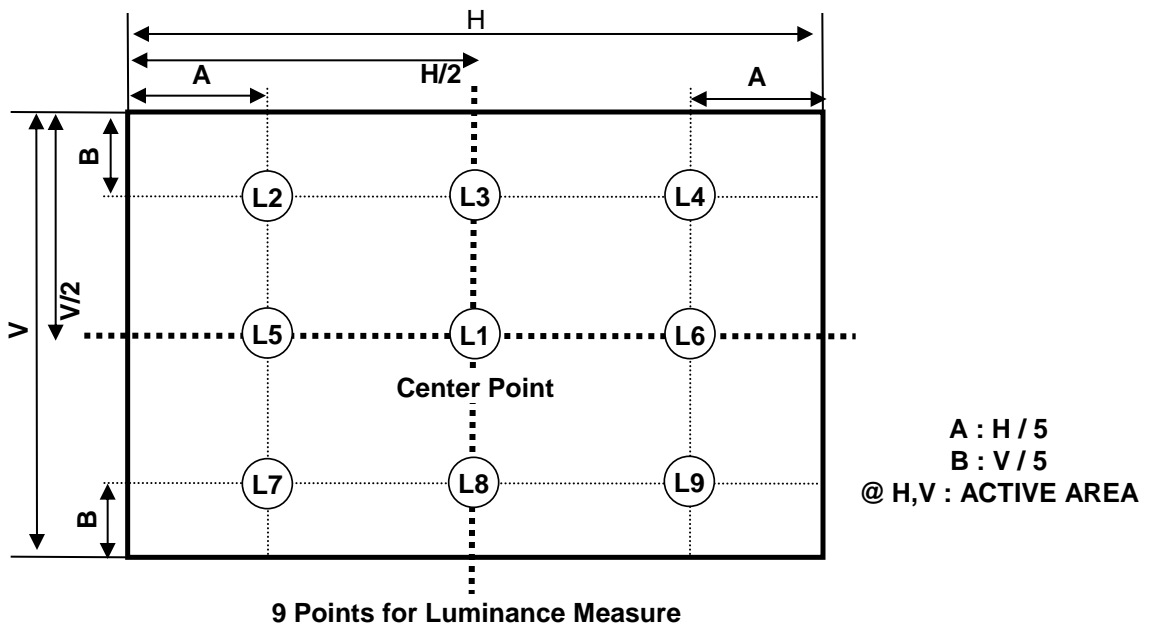
$$CR = \frac{\text{Gray 256 [White]}}{\text{Gray 0 [Black]}}$$

[Note 8-1.2]



[Note 8-1.3]

$$\text{Panel total variation } (\delta_{\text{WHITE}}) = \frac{\text{Minimum}(L1, L2, L3, \dots L9)}{\text{Maximum}(L1, L2, L3, \dots L9)} \times 100 (\%)$$



[Note 8-1.4]

The life time is determined as the time at which brightness of LED is 80% compare to that of initial value at the typical LED current.

Product Specification

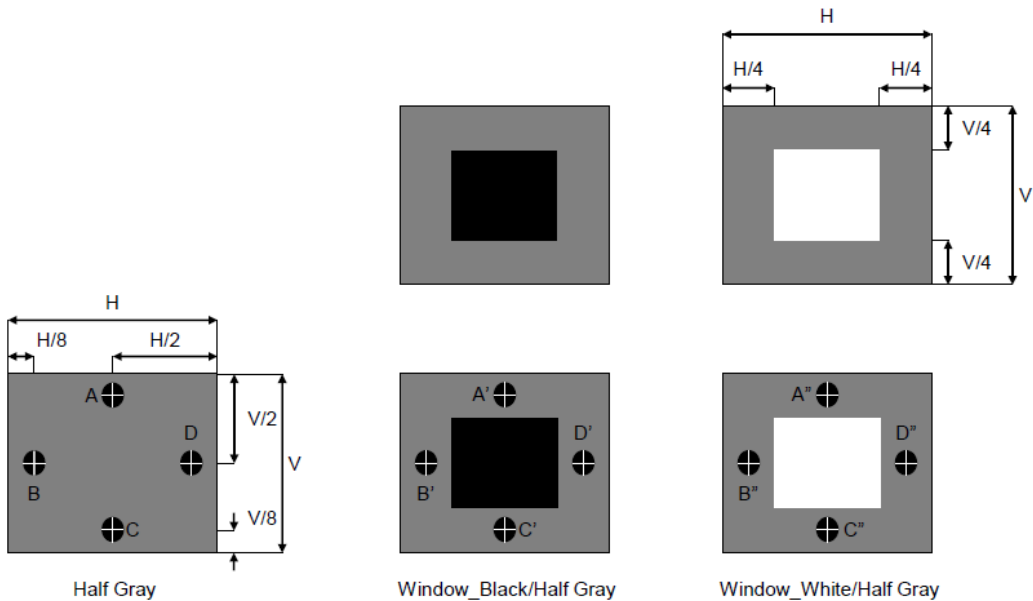
[Note 8-1.5]

Measure luminance of A, B, C, D and A', B', C', D' / A'', B'', C'', D''.

Calculate the cross talk based on the formula.

- Crosstalk (Vertical) = $\text{Max. } \{ (|A' \text{ or } C', A'' \text{ or } C''| - A \text{ or } C) / A \text{ or } C \} \times 100 (\%)$
- Crosstalk (Horizontal) = $\text{Max. } \{ (|B' \text{ or } D', B'' \text{ or } D''| - B \text{ or } D) / B \text{ or } D \} \times 100 (\%)$
- ※ Box Pattern should be masking to prevent luminance.

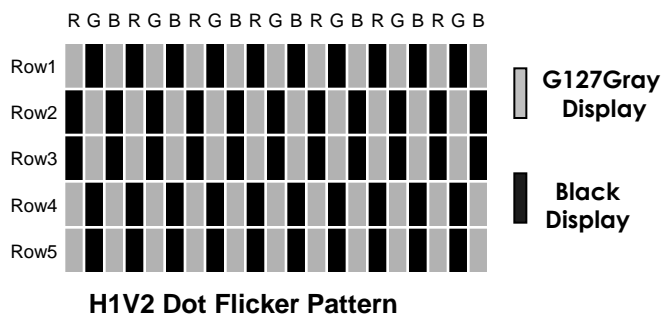
- Reference item can not guarantee in mass production stage, but LGD support to make a corrective action caused by LCD.



[Note 8-1.6]

The flicker level should be measured with Full Flicker PTN at the center point, a checker pattern (every other pixel) and a middle gray level. The flicker is essentially a ratio of the powers in the Frequency spectrum at 30Hz (PX) and 0Hz (P0-DC level).

$F=20\text{Log}(PX/PO)$, with backlight set to maximum.



- Measure Time : Flicker measure after optimizing Vcom immediately.
- Measure Point : Center 1 point
- Reference item can not guarantee in mass production stage, but LGD support to make a corrective action caused by LCD.

Product Specification	
-----------------------	--

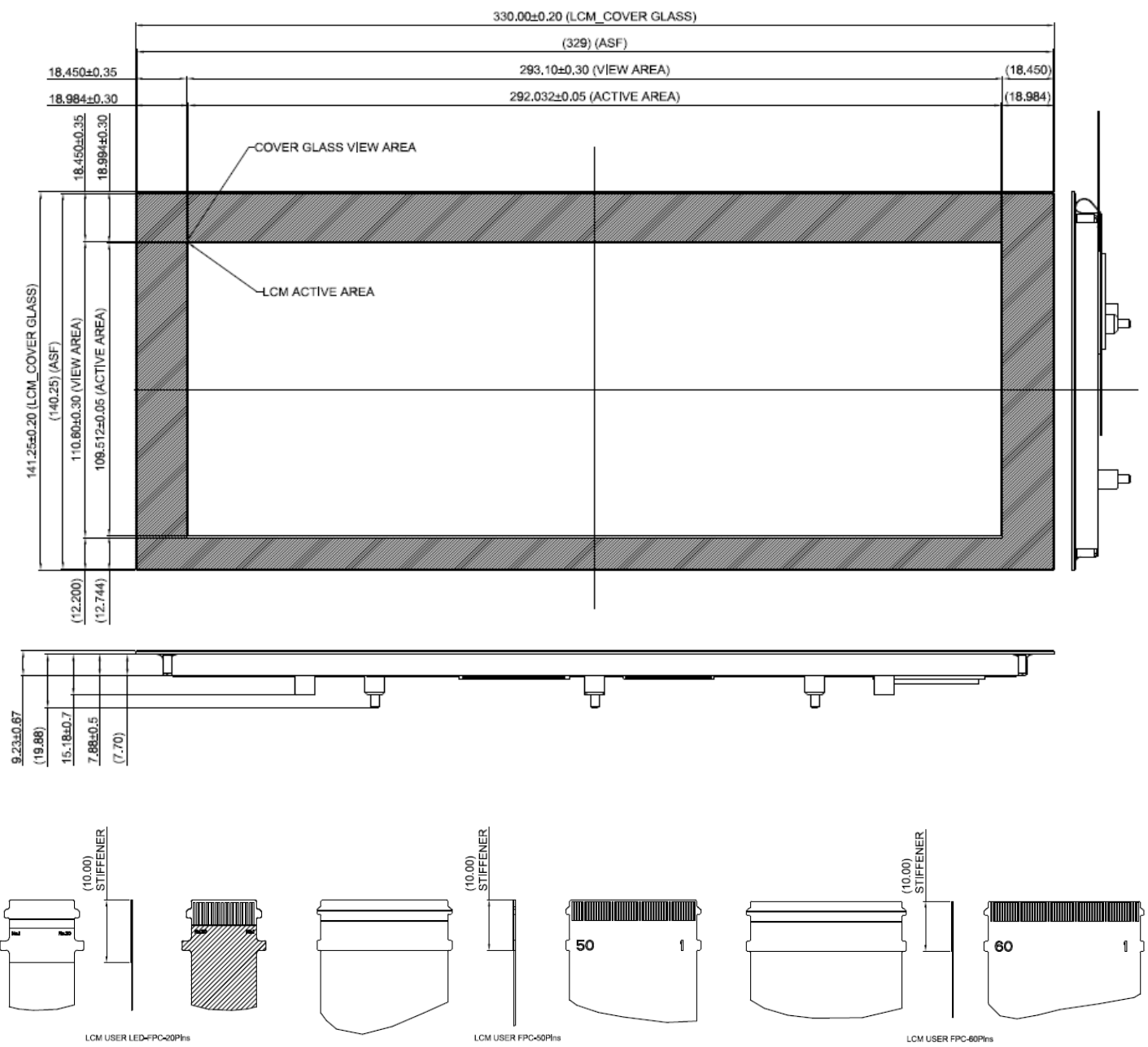
9. MECHANICAL CHARACTERISTICS

Parameter	Specification			Unit
Outline Dimension	LCM Only (Reference)	Width	310.0 ±0.3	mm
		Height	128.0 ±0.3	mm
		Depth	7.7 ±0.3	mm
	With Touch	Width	330.00 ±0.2	mm
		Height	141.25 ±0.2	mm
		Depth	9.23 ±0.67	mm
Active Display Area	Width		292.032	mm
	Height		109.512	mm
View Area	Width		293.10	mm
	Height		110.60	mm
Weight *Without Components and PWB	With Touch	552g (Typ.) /562g (Max.)		g

* For more detail dimensions, refer to the 2D drawing in CAS

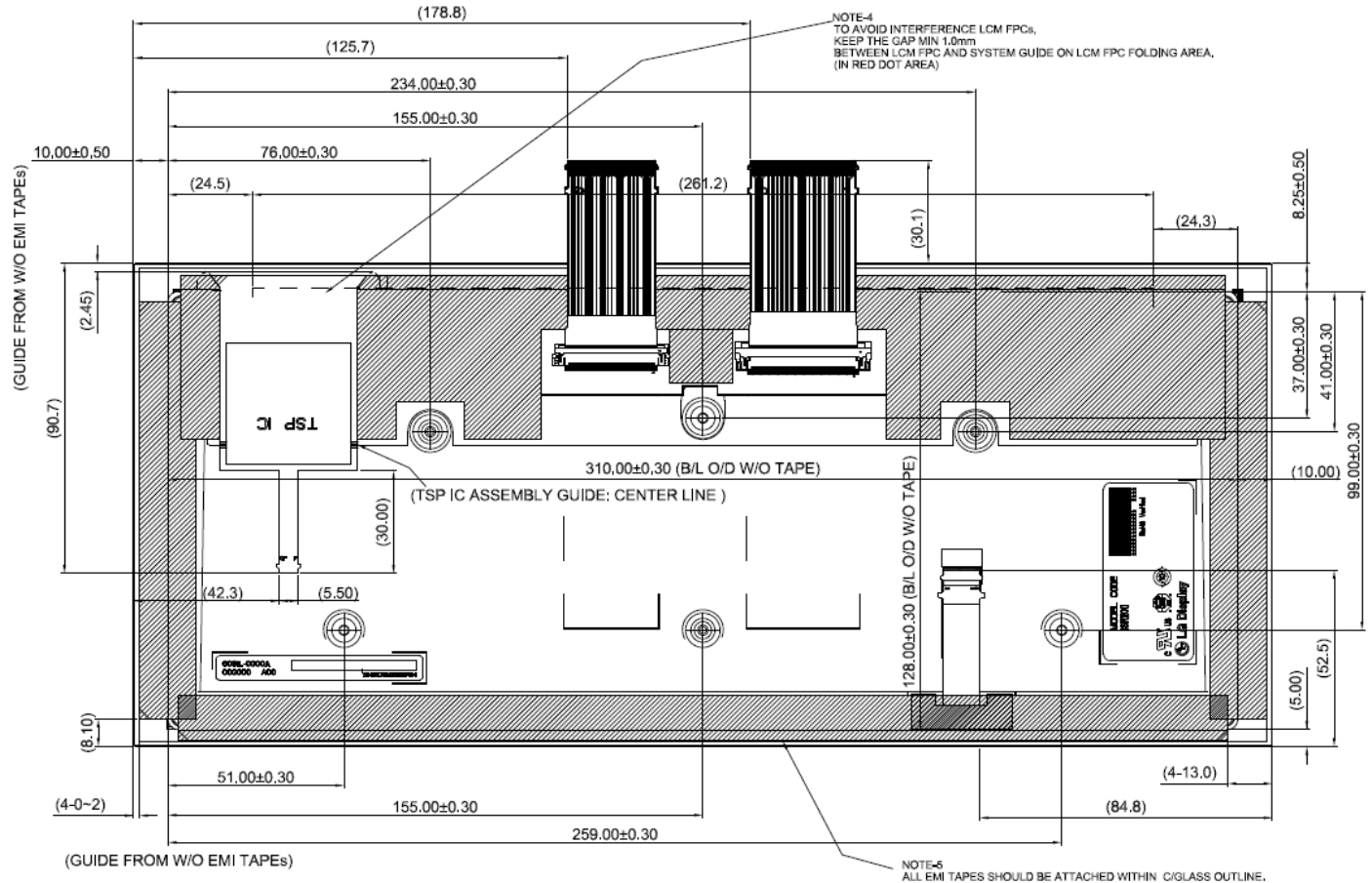
Product Specification

<FRONT VIEW>



Product Specification

<REAR VIEW>



NOTE-1
1. UNSPECIFIC SHAPE AND DIMENSION REFER TO 3D MODELING.
2. UNSPECIFIC TOLERANCES ARE ±0.5mm.
3. UNSPECIFIED RADIAL ARE R=0.3mm.
4. WITH () DIMENSIONS ARE FOR REFERENCE.
5. DO NOT COMPRESS ON LCM BACK-SURFACE.
IT CAN BE MADE DISPLAY PERFORMANCE CHANGED.
6. REFER TO THE NOTES BEFORE SYSTEM DESIGN.

NOTE-2
SCREW SPEC AND RECOMMENDATIONS.
- SYSTEM SCREW PULL-OUT FORCE: MIN 200N
- SYSTEM SCREW TORQUE: MAX 10.0Kg²cm
- M3.0 (ISO)

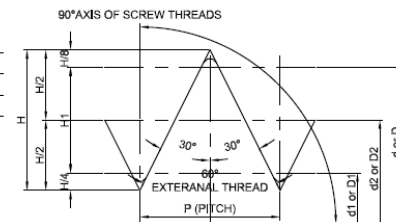
NOTE-3
THE LIMIT OF SIZE AND TOLERANCES DEFINED HERE ARE BASED ON THE TOLERANCES METHOD OF ISO 965/2.

<INTERNAL THREADS>

NAME OF SCREW	PITCH	CLASS	MINOR DIAMETER		PITCH DIAMETER		INNER DIAMETER
			D (MAX.)	D (MIN.)	D2 (MAX.)	D2 (MIN.)	
M3	0.5	6H	NO DEFINITION GIVEN		2.775	2.675	2.599

<EXTERNAL THREADS>

NAME OF SCREW	PITCH	CLASS	MINOR DIAMETER		PITCH DIAMETER	
			D (MAX.)	D (MIN.)	D2 (MAX.)	D2 (MIN.)
M3	0.5	6g	2.98	2.674	2.655	2.58



Product Specification

10. RELIABILITY TEST

No.	Test Items	Test Condition	Notes
1	High Temperature Storage Test	$T_a = 95^{\circ}\text{C}$ 500h	10-1,2,3
2	High Temperature Operation Test	$T_a = 85^{\circ}\text{C}$ 240h	10-1,2,3
3	Low Temperature Storage Test	$T_a = -40^{\circ}\text{C}$ 240h	10-1,3
4	Low Temperature Operation Test	$T_a = -30^{\circ}\text{C}$ 240h	10-1,3
5	High Temperature and High Humidity Operation Test	$T_a = 65^{\circ}\text{C}$ 93%RH 500h	10-1,2,3
6	Temperature and Humidity Cycle	$T_a = -10^{\circ}\text{C} \sim 65^{\circ}\text{C} / 80 \sim 96\% \text{RH}$ 240h (1cycle = 24h)	10-1,2,3
7	Light-proof	UV exposure 42°C , $750\text{W}/\text{m}^2$, 300hrs	10-1,2,3
8	Thermal Shock Test (non-operating)	$T_a = -40^{\circ}\text{C}$ to $T_p = +95^{\circ}\text{C}$ 10cycles 2h duration	10-1,2,3
9	ESD	Panel Surface : $\pm 15\text{kV}$ (Operation, 330 Ω , 150pF) User FPC : HBM $\pm 2\text{kV}$ (Non-operation, 1.5k Ω , 100pF) MM $\pm 0.2\text{kV}$ (Non-operation, 200pF, 0 Ω)	10-3,4
10	Shock Test (non-operating)	3 shocks in each direction Peak acceleration: 981 m/s ² Duration of nominal shock: 6 ms Waveform: saw-tooth with slow rise (2,94 m/s) or half-sine	10-3
11	Vibration Test (non-operating)	10 - 30 Hz: $\pm 0,75\text{mm}$ 30 - 500 Hz: 3g 1 Oct./min Random 3Grms 3 x (16 h sinusoidal and 8 h random) in X, Y, and Z direction	10-3

Product Specification

[Note 10-1] T_a = Ambient Temperature, T_p = Panel Surface Temperature

[Note 10-2] After this test has been done, a display is rejected when one of the following defects occurs:

- optical and electrical defects as specified in the test specification
- exceeding the specified "on" and "off" switching times
- reduction of the original contrast ratio perpendicular of more than 30%
- doubling of specified max. total consumption
- reduction of the original min. brightness from LED more than 50%
- TFT-LCD panels should take place at room temperature for 24 hours after the reliability tests finish.

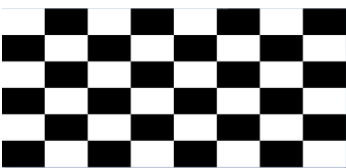

[Note 10-3] After this test has been done, the specimen should function normally without any fatal defect.
(no picture, line defect, out of synchronization)

[Note 10-4] Test Method

Operation	Type of Discharge	Discharge Location	RC Value	LEVEL	Criteria
ON	AIR	* Panel Surface	330Ω, 150pF	±15kV	C
OFF	Contact	* User FPC	1.5kΩ, 100pF 200pF, 0Ω	±2kV ±0.2kV	A

A	Normal Operating
B	Automatically recovered to normal operating after testing even if electrical performance is out of spec. during the testing.
C	Normal operating after testing with simple control (ex. LCM On/Off) even if electrical performance is out of spec. during the testing.
D	Not recovered after testing even with simple control.

[Note 10-5] Image Sticking (Reference)

Test Pattern	Test Condition
 < 8x6 Mosaic Pattern >	 < 127Gray Pattern >
	1. Temperature: 25℃ 2. Pattern: 8x6 Mosaic 30min. → 127G 3. Judgment - Invisible within 10minutes.

- Electronic Condition : Typ. standard
- Measure Time : Image sticking measure after optimizing Vcom immediately.
- Reference item can not guarantee in mass production stage, but LGD support to make a corrective action caused by LCD.

Product Specification**11. INTERNATIONAL STANDARDS****11-1. Safety**

- a) FMVSS 302, Federal Motor Vehicle Safety Standards
Flammability of Interior Materials
 - Burn Rate of less than 4 inch/min
- b) UL 60950-1, Underwriters Laboratories Inc.
Information Technology Equipment - Safety - Part 1: General Requirements
 - INPUT TEST, HEATING TEST, COMPONENT FAILURE TEST
- c) CAN/CSA-C22.2 No. 60950-1-07, Canadian Standards Association.
Information Technology Equipment - Safety - Part 1 : General Requirements.
 - INPUT TEST, HEATING TEST, COMPONENT FAILURE TEST

11-2. EMC

- a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9KHz to 40GHz. "American National Standards Institute(ANSI), 1992
- b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
- c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electro technical Standardization.(CENELEC), 1998
(Including A1: 2000)

11-3. Environment

- a) RoHS, Directive 2011/65/EU of the European Parliament and of the council of 8 June 2011

Product Specification

12. PACKING

12-1. Designation of Lot Mark

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M
---	---	---	---	---	---	---	---	---	---	---	---	---

A,B,C : SIZE(INCH)

E : MONTH

D : YEAR

F ~ M : SERIAL NO.

Note

1. YEAR

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mark	A	B	C	D	E	F	G	H	J	K

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

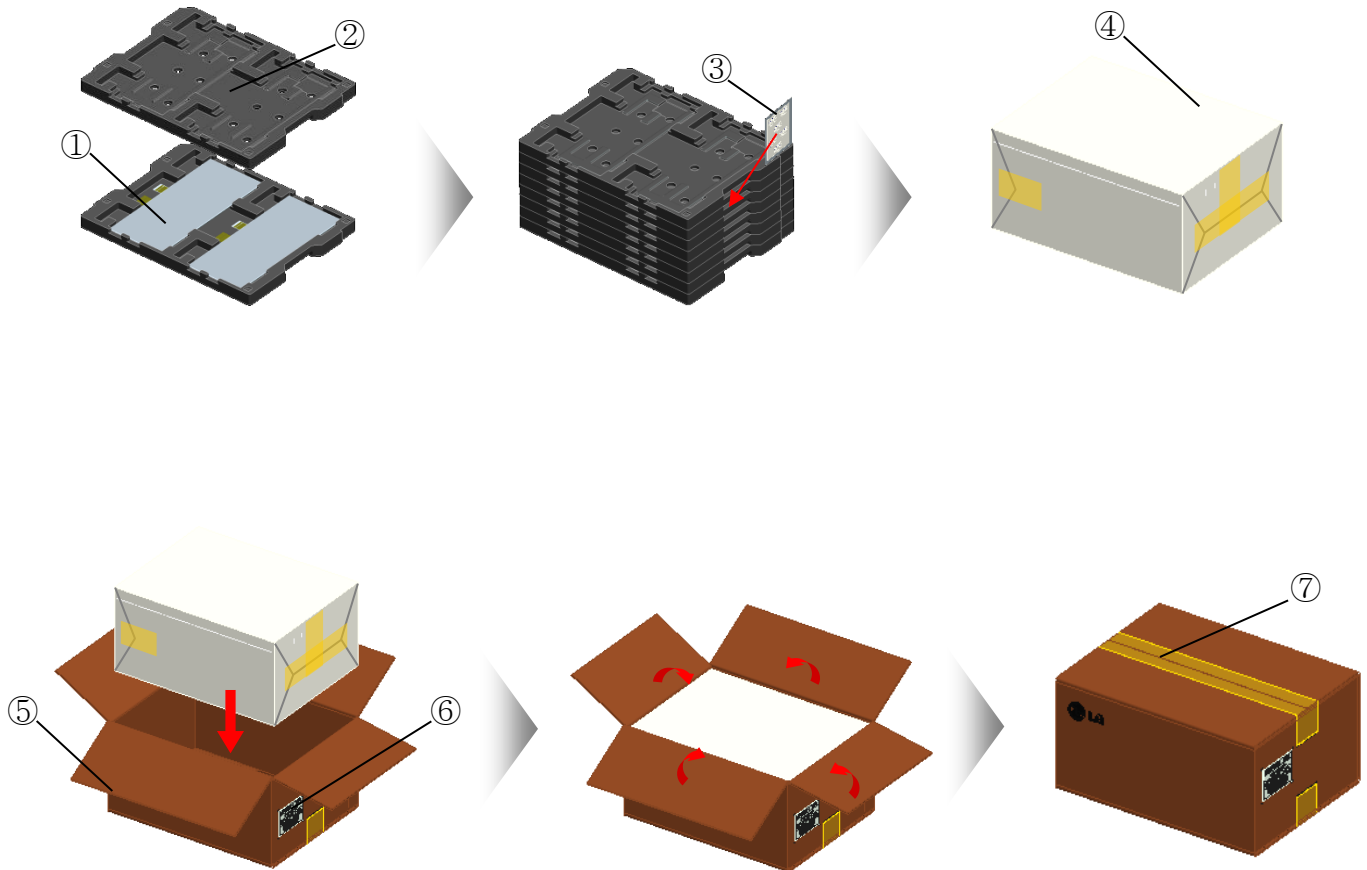
b) Location of Lot Mark

Serial No. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

Product Specification

12-2. Packing Form

- a) Package quantity in one box :14 pcs
b) Box Size : 478×365×244 (mm)



NO.	Description	Material
1	Module	-
2	Packing, Tray	EPP
3	Desiccant	POWER DRY, 60G, UX
4	Bag	AL, 610*800
5	Box	SW
6	Label	YUPO 100x70
7	Tape	OPP 70MMx300M

Product Specification**13. PRECAUTIONS**

Please pay attention to the following when you use this TFT LCD module.

13-1. MOUNTING PRECAUTIONS

- (1) You must mount a module using holes arranged in bottom.
- (2) You should consider the mounting structure so that uneven force(ex. Twisted stress) is not applied to the module.
And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach a transparent protective plate to the surface in order to protect the polarizer.
Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.
- (10) The metal case of a module should be contacted to electrical ground of your system.

13-2. OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
 $V = \pm 200\text{mV}$ (Over and under shoot voltage)
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (3) Brightness depends on the temperature. (In higher temperature, it becomes lower.)
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

Product Specification**13-3. ELECTROSTATIC DISCHARGE CONTROL**

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

13-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

13-5. STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

13-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) When the protection film is peeled off, static electricity is generated between the film and polarizer.
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer.
Please carefully peel off the protection film without rubbing it against the polarizer.
- (3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- (4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.