INNOLUX 群創光電

PRODUCT SPECIFICATION

Doc. Number:

■ Tentative Specification

□ Preliminary Specification

□ Approval Specification

MODEL NO.: DJ123KC
SUFFIX: 01A

Customer:

APPROVED BY **SIGNATURE**

Name / Title

Note :

Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By
KJ Cheng	Pam Liang	Doris Fang

REVISION HISTORY

Version	Date	Page	Description
0.1	2021/08/30	All	Product specification first issue

Contents

1. General Specifications

1.1 Overview

DJ123KC-01A is a normally black IPS TFT Liquid Crystal Display module. This panel has a 12.3 inches diagonally measured active display area with 1920RGB x 720 resolution. This product is composed of a TFT LCD panel, Polarizer, IC, FPCA and backlight. The following describes the features of this product.

1.2 TFT LCD Module General Specifications

No.	Item	Specification	Remark
1	LCD size	12.3 inch (Diagonal)	
2	Driver element	LTPS TFT active matrix	
3	Resolution	1920 × 3(RGB) × 720	
4	Display mode	Normally Black, Transmissive, AAS	
5	Dot pitch	0.1521 (W) × 0.1521 (H) mm	
6	Active area	292.032 (W) × 109.512 (H) mm	
7	Module size	300.03 (W) × 123.51 (H) × 6.7 (D) mm (Total Thickness)	Note 1
8	Surface treatment	HC	
9	Color arrangement	RGB-stripe	
10	Interface	2-port LVDS (DE mode only)	
11	Backlight power consumption	Typ. 9.486 W	Note 2
12	Panel power consumption	TBD	Note 3
13	Weight	TBD	

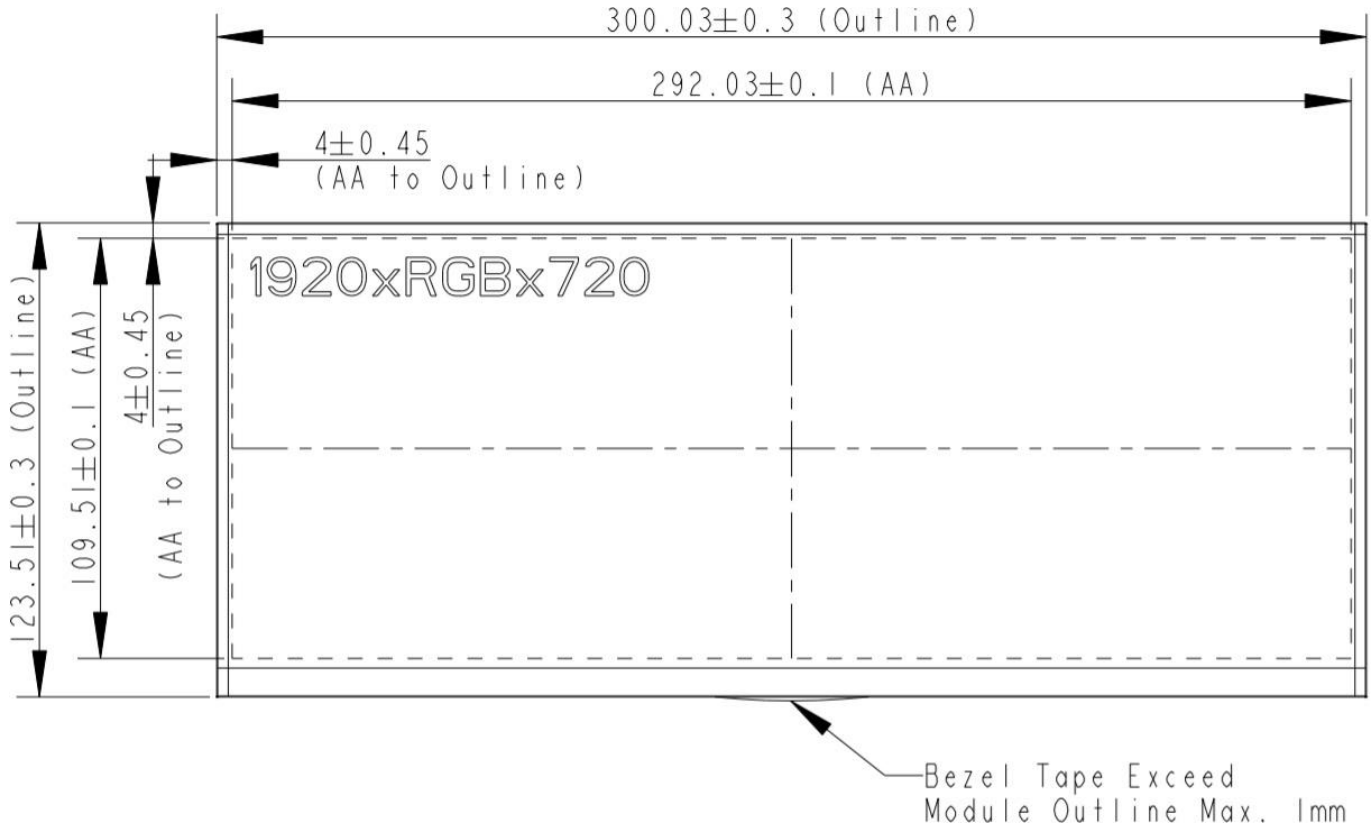
Note 1: Refer to Mechanical Drawing.
Note 2: Base on I_L = 80 mA
Note 3: Full white pattern.

1.3 Touch General Specifications

Key Parameters	Description	Unit
Touch Technology	Capacitive Multi-Touch	
Numbers of Channels	960 [X=48, Y=20]	Ch
Touch Method	Finger / Glove	-
Numbers of Touch	5	point
Accuracy of Finger(non-border)	±1.0	mm
Accuracy of Finger (border)	±2.0	mm
Linearity of Finger (non-border)	≦1	mm
Linearity of Finger (border)	≦2	mm
Finger Separation (Horizontal/Vertical)	<14	mm
Reporting rate	120	Hz
Response time	≦30	ms
Stylus diameter	8	mm
Glove (12mm acrylic)	2	mm

<Note> 1.Border is defined as the distance 5mm to the edge of AA
2. Materials used in gloves are silk, cotton and leather

2. Module Construction



3. Input / output pinning and connector description

3.1 Input Connector

Pin	Input signal name	I/O pin	Description
1	GND	Power	Ground
2	NC	NC	NC
3	LED+	Power	LED Anode1
4	LED+	Power	LED Anode1
5	NC	NC	NC
6	LED_CH1	Power	LED Cathode 1
7	LED_CH2	Power	LED Cathode 2
8	LED_CH3	Power	LED Cathode 3
9	LED_CH4	Power	LED Cathode 4
10	NTC1	Input	The thermistor for sense LED thermal temperature, If not use please keep floating.
11	NTC2	Output	The thermistor for sense LED thermal temperature, If not use please keep floating.
12	NC	NC	NC
13	VDDI	Power	External main and I/O power supply ;
14	VDDI	Power	External main and I/O power supply ;
15	VDDI	Power	External main and I/O power supply ;
16	NC	NC	NC
17	TCH_ATTN	Input	Touch Interrupt Pin. If not used, please let these pins open.
18	TCH_IO_SCL	Input	Touch I2C clock input. Normally pulled high.
19	TCH_IO_SDA	I/O	Touch I2C data input pin. Normally pulled high, output mode open drain.
20	TP_EN	Input	TP reset TP_EN = “H”, normal operation. (Default) TP_EN = “L”, The controller is in TP reset state.
21	GND	Power	Ground
22	NC	NC	NC
23	IND_OUT	Output	Abnormal indicator pin. AB_IND =H when detect abnormal
24	NC	NC	NC

25	RESET	Input	Global reset pin. GRB = “H”, normal operation. (Default) GRB = “L”, The controller is in reset state. Control GRB by the host or connect it to VDDI with RC (10K ohm, 1uF) reset circuit for stability.
26	BIST_EN	Input	BIST = “H”, BIST mode BIST = ”L”, Normal Operation. (Default)
27	NC	NC	NC
28	DISP_I2C_SDA	Input	Serial communication data input pin. SDA for I2C interface.
29	DISP_I2C_SCL	Input	Serial communication clock input. Note: I2C mode normally pulled high.
30	GND	Power	Ground
31	DA_N_E	Input	LVDS even data 0-
32	DA_P_E	Input	LVDS even data 0+
33	GND	Power	Ground
34	DB_N_E	Input	LVDS even data 1-
35	DB_P_E	Input	LVDS even data 1+
36	GND	Power	Ground
37	DC_N_E	Input	LVDS even data 2-
38	DC_P_E	Input	LVDS even data 2+
39	GND	Power	Ground
40	DCLK_N_E	Input	LVDS even clk +
41	DCLK_P_E	Input	LVDS even clk -
42	GND	Power	Ground
43	DD_N_E	Input	LVDS even data 3-
44	DD_P_E	Input	LVDS even data 3+
45	GND	Power	Ground
46	DA_N_O	Input	LVDS odd data 0-
47	DA_P_O	Input	LVDS odd data 0+
48	GND	Power	Ground
49	DB_N_O	Input	LVDS odd data 1-
50	DB_P_O	Input	LVDS odd data 1+
51	GND	Power	Ground
52	DC_N_O	Input	LVDS odd data 2-
53	DC_P_O	Input	LVDS odd data 2+

54	GND	Power	Ground
55	DCLK_N_O	Input	LVDS odd clk +
56	DCLK_P_O	Input	LVDS odd clk -
57	GND	Power	Ground
58	DD_N_O	Input	LVDS odd data 3-
59	DD_P_O	Input	LVDS odd data 3+
60	GND	Power	Ground

3.2 Backlight

TBD

3.3 Backlight NTC Registor

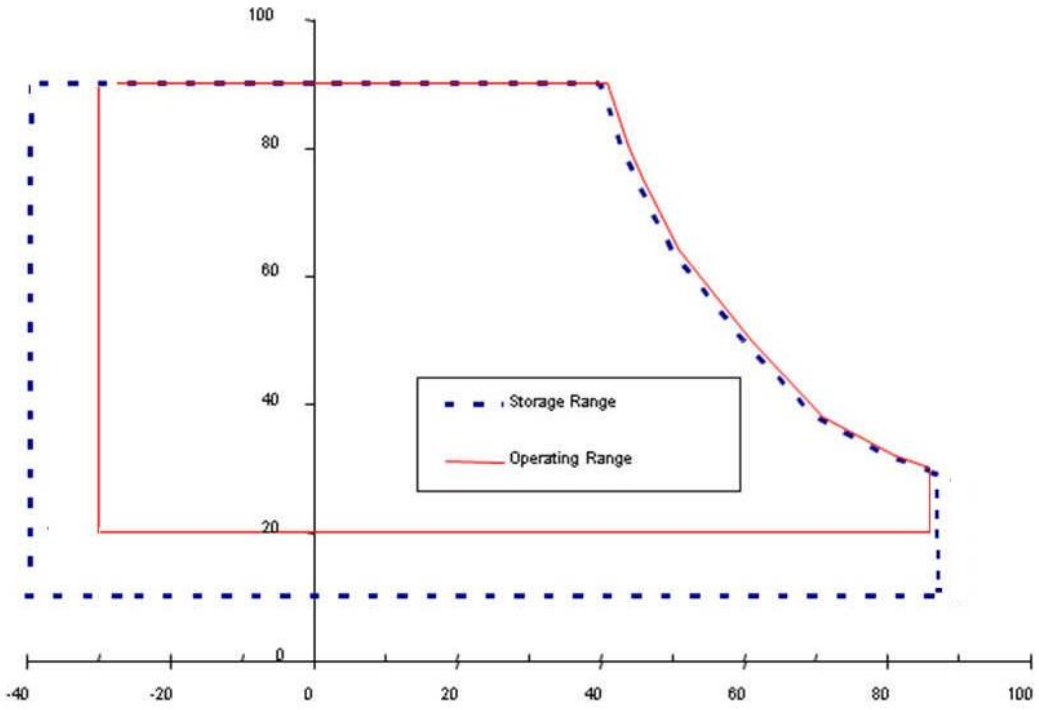
To limit the heat dissipation under high ambient temperature (Ta). The LED string has a NTC (Negative Temperature Coefficient) to detect the ambient temperature of LED string. This NTC was located in the middle of FPC mounted with LED that acts as an indicator to show if the module is operated under safe operation region without overheating and damage. The detail application for this NTC, please refer to data sheet of Murata P/N : NCU15XH103F6SRC. About Murata NCU15XH103F6SRC application. Please follow component data sheet.

4. Absolute Ratings of Environment

There is a difference between the maximum value of a parameter's specification and its absolute maximum value. The maximum value indicates that the performance will be reduced when you go beyond this value, but this is reversible. Where the absolute maximum value as indicated in this section is a value beyond which permanent damage to the product or its function may be expected.
Function operation should be restricted to the conditions described under Normal Operating Conditions

Item	Symbol	Min.	Max.	Unit	Remark
Operating Temperature	OTR	-30	+85	°C	Note 1,2
Storage Temperature	STR	-40	+90	°C	Note 1

Note 1: Panel surface temperature, no condensation allowed under any condition.
Note 2: Operating from -40/-30'C possible, readable to some extent, cosmetic defects can happen.



4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply(+3.3V)	VDDI	-0.5	3.8	V	

4.2 Absolute Ratings of Backlight

Item	Symbol	Min.	Max.	Unit	Remark
LED Light Bar Power Supply Current	LED	10	150	mA	Per chain

Note: LED characteristics (for micro module only)

5. Electrical characteristics

5.1 Recommended operation conditions (based on GND=0V; Ta 25'C±2'C)

Item	Symbol	Min.	Typ	Max.	Unit	Remark
Power Supply Input Voltage	VDDI	3.1	3.3	3.6	V	
Power Supply Input Current	IVDDI	(TBD)	(TBD)	(TBD)	mA	Note
High Level Intput Voltage	VIH	GND		0.3* VDDI	V	
Low Level Intput Voltage	VIL	0.7* VDDI		VDDI	V	

Note : VDDI=3.3V, fv=60Hz, fCLK=75MHz, 25℃, Test Pattern : White Pattern

5.2 Backlight Unit (based on GND=0V; Ta 25'C±2'C)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Power Supply Voltage		25.2	27.9	29.7	V	Per chain
LED Power Supply Voltage		2.8	3.1	3.3	V	Per LED *
LED Power Supply current		-	85		mA	Per chain, Control by fixed current mode
Power Consumption	P	8.568	9.486	10.098	W	Total backlight
LED Life Time	Lbl	10000			hours	
Number of Chains		-	4	-		
LEDs per Chain		-	9	-		

Note: The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 'C and IL = 150mA setting (Per EA) until the brightness becomes 70% of its original value.

De-rating diagram (Recommended)
TBD

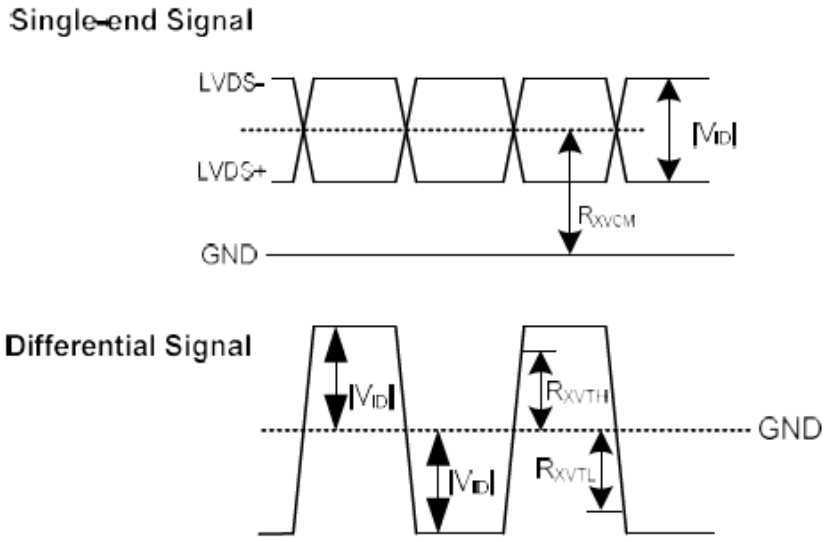
5.3 Self-Protection Function

Item	Failure mode detection	Condition of IND_OUT=H	IC detection OK	IC detection NG
Power	Low voltage detection	AVDD error VDD error	IND_out: Low level	IND_out: High level
Interface	Clock	Clock signal error	IND_out: Low level	IND_out: High level
	H_sync	H_sync error	IND_out: Low level	IND_out: High level
	V_sync	V_sync error	IND_out: Low level	IND_out: High level
	DE	DE error	IND_out: Low level	IND_out: High level
Gate driver	STV_R	STV_R error	IND_out: Low level	IND_out: High level

6. LCM Interface Timing

6.1 LVDS Interface DC characteristics

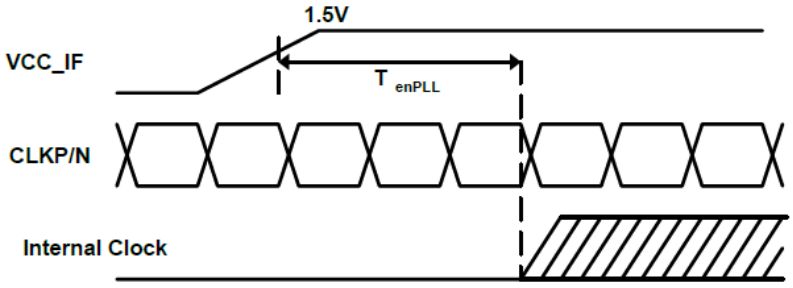
Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Differential input high threshold voltage	RxVTH	+100	-	-	mV	RxVCM =1.2V
Differential input low threshold voltage	RxVTL	-	-	-100	mV	RxVCM =1.2V
Differential input common mode voltage	RxVCM	1.0	1.2	1.5	V	
Differential input voltage	|VID|	0.4	-	0.6	V	



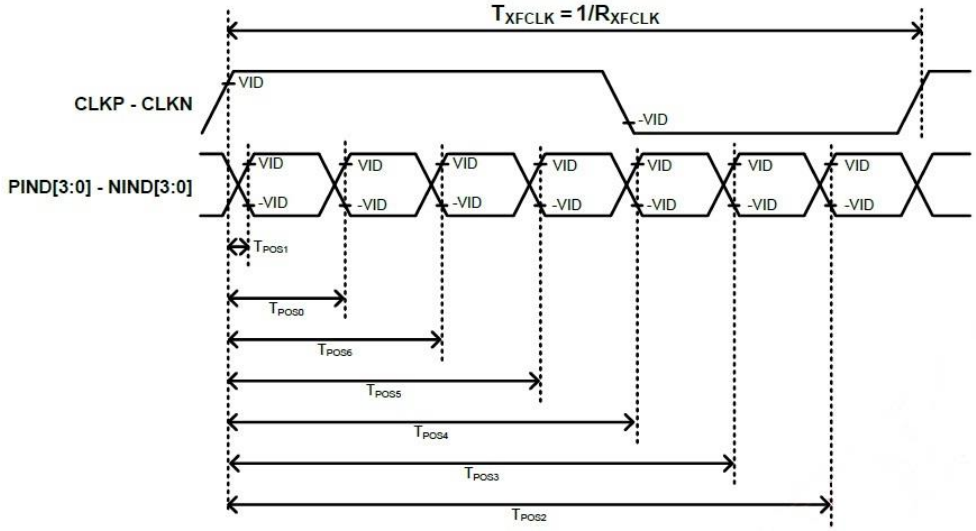
6.2 LVDS Interface AC characteristics

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Clock frequency	RxFCLK	40	-	100	MHz	.
Input data skew margin	TRSKM	-	-	0.25	UI	
1 data bit time	UI	-	1/7	-	TLVCLK	
Position 1	TPOS1	-0.25	0	0.25		
Position 0	TPOS0	0.75	1	1.25		
Position 6	TPOS6	1.75	2	2.25		
Position 5	TPOS5	2.75	3	3.25		
Position 4	TPOS4	3.75	4	4.25		
Position 3	TPOS3	4.75	5	5.25		
Position 2	TPOS2	5.75	6	6.25		
Clock high time	TLVCH	2/7	4/7	4/7	TLVCLK	
Clock low time	TLVCL	3/7	3/7	5/7	TLVCLK	
DLL wake up time	TenDLL	-	-	500	us	-
Modulation Frequency	SSCMF	30	-	93	KHz	LVDS clock = 85MHz | SSCMR | ≦ 3%
Modulation Rate	SSCMR	-3%		+3%	%	LVDS clock = 85MHz center spread SSCMF = 30~93KHz

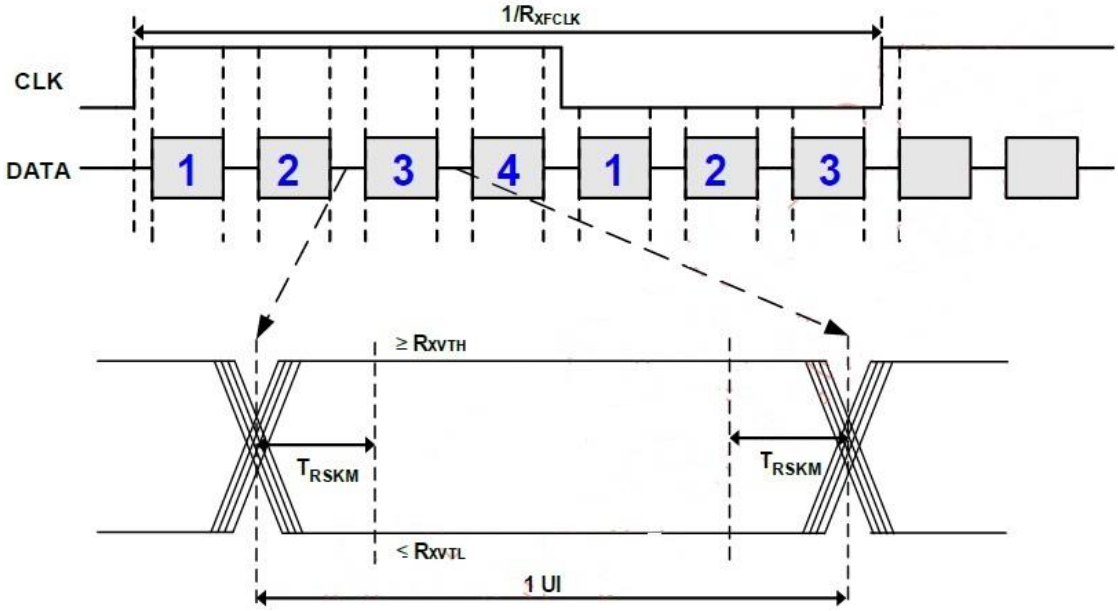
Relationship between VCC_IF, LVDS clock, and internal clock:



LVDS input timing:

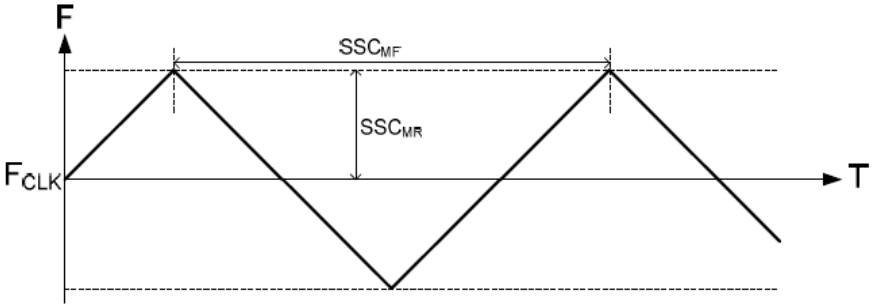


LVDS Data Skew:



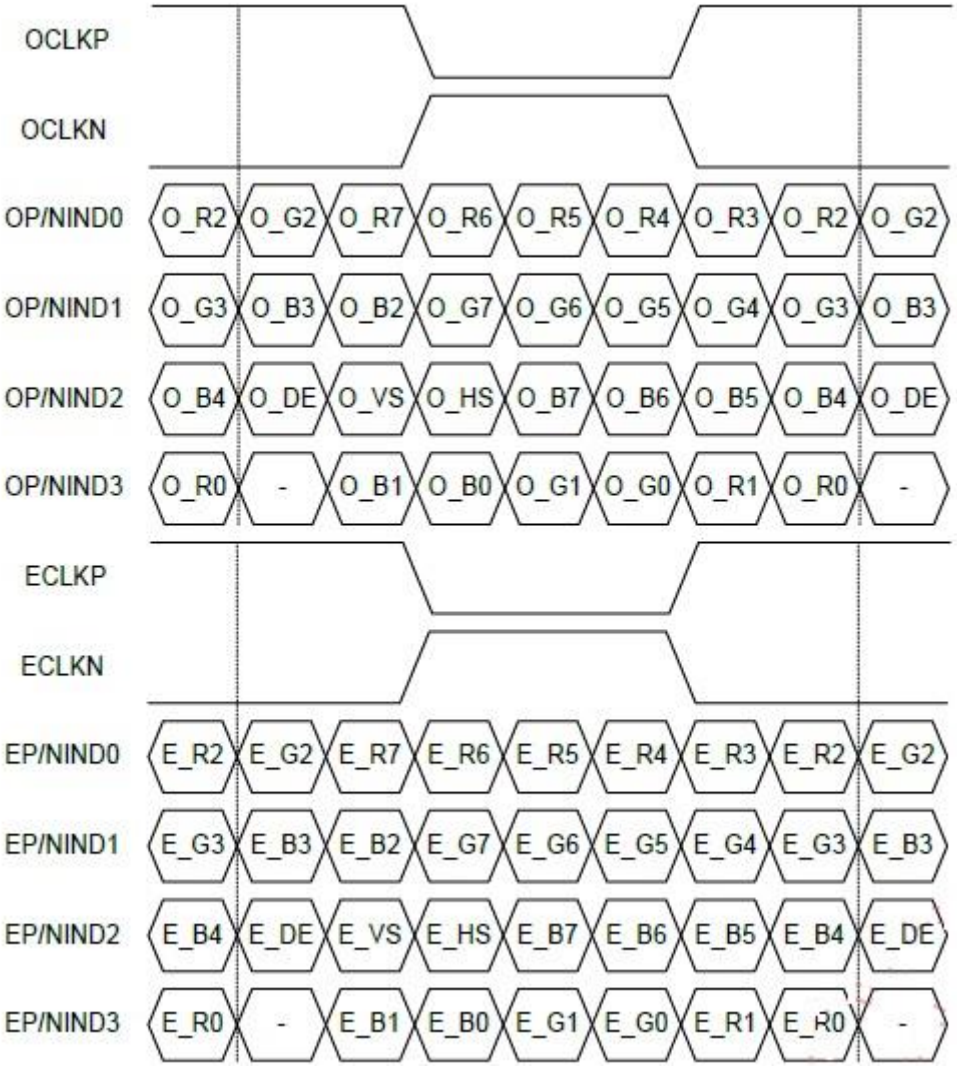
LVDS Data Skew

Frequency Modulation:

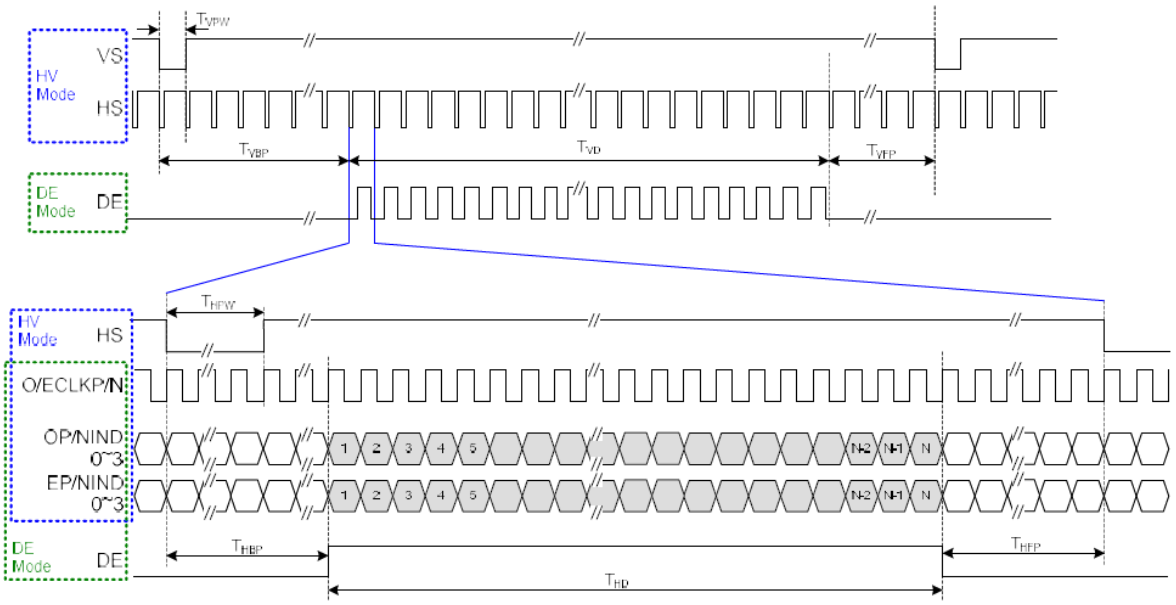


6.3 LVDS input format

LVDS, 8-bit, two port, VESA format:



6.4 Data Input format (DE mode)

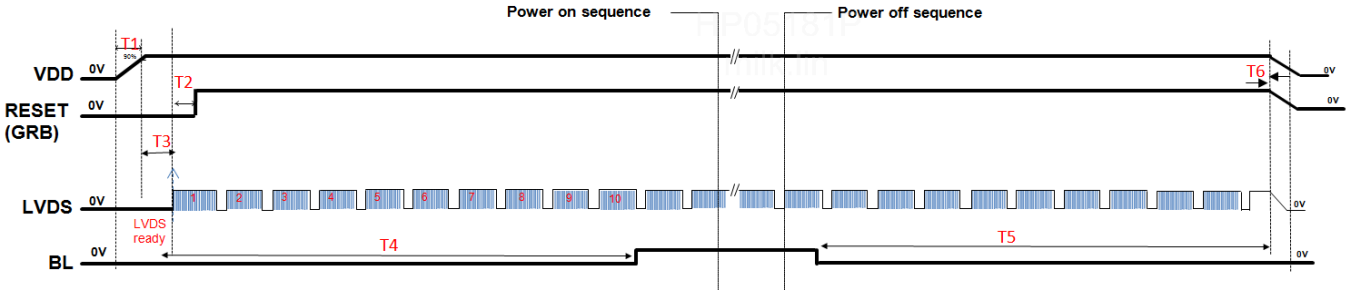


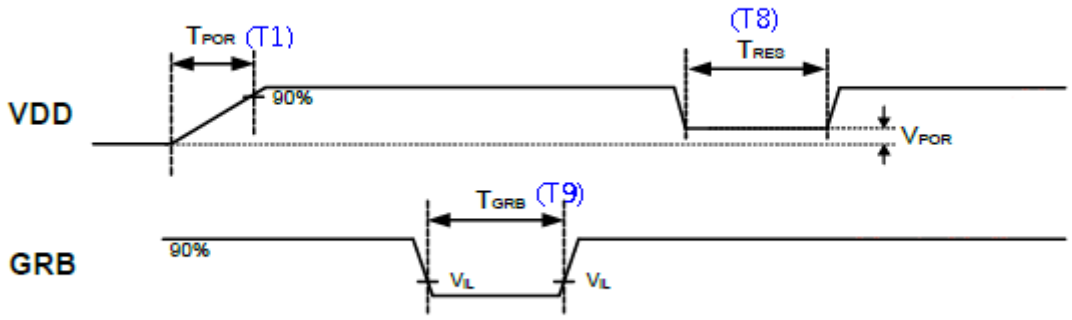
6.5 Data Input Timing

Table 1. DE mode for 1920RGBx720

Parameter	Symbol	Min.	Typ.	Max.	Unit
DCLK frequency	FDCLK	46.5	46.9	49.2	MHz
Horizontal display area	THD		960		
HS period time	TH	1020	1024	1066	DCLK
HS blanking	THFP +THBP	60	64	106	DCLK
Vertical display area	TVD		720		
VS period time	TV	760	764	770	H
VS blanking	TVBP +TVFP	40	44	50	H

6.6 Power on/off sequence





Symbol	Min.	Typ.	Max.	Unit	Remark
T1(T_{POR})	**1**	**-**	**20**	ms	VDDI power source slew time (From 0V to 90% VDDI)
T2	**1**	**-**	**-**	ms	
T3	**0**	**-**	**-**	ms	
T4	**10**	**-**	**-**	frame	
T5	**6**	**-**	**-**	frame	
T6	**-**	**-**	**0**	us	
T8(T_{RES})	**1**	**-**	**-**	s	VDDI resettle time
T9(T_{GRB})	**1**	**-**	**-**	ms	GRB active pulse width (VDDI = 3.3V)
V_{POR}	**0**	**-**	**100**	mV	Power on reset voltage

7. I2C communication protocol : I2C Event Buffer format

Touch I2C Addr	0x01
Touch report	Should support polling mode. Make sure the data is ready for read.
Touch INT	1. no move no trigger after touch down
	2. Always trigger after touch down.
Status	Touch down, touch stable, touch move, touch leave

	Address	R/W	Def. Value	B7	B6	B5	B4	B3	B2	B1	B0
1	0x00	R	0xFF	Protocol version[1:0]		DP ASIL ERR	TP ASIL ERR	Number of touches[3:0]			
2	0x01	R	0xFF	ID				Touch type	Status		
3	0x02	R	0xFF	Coord_X[11:4]							
4	0x03	R	0xFF	Coord_Y[11:4]							
5	0x04	R	0xFF	Coord_X[3:0]				Coord_Y[3:0]			
6	0x05	R	0xFF	Touch delta[7:0]							
7	0x06	R	0xFF	Touch delta[15:8]							
8	0x07	R	0xFF	Area[7:0]							
9	0x08	R	0xFF	ID				Touch type	Status		
10	0x09	R	0xFF	Coord_X[11:4]							
11	0x0A	R	0xFF	Coord_Y[11:4]							
12	0x0B	R	0xFF	Coord_X[3:0]				Coord_Y[3:0]			
13	0x0C	R	0xFF	Touch delta[7:0]							
14	0x0D	R	0xFF	Touch delta[15:8]							
15	0x0E	R	0xFF	Area[7:0]							
16	0x0F	R	0xFF	ID				Touch type	Status		
17	0x10	R	0xFF	Coord_X[11:4]							
18	0x11	R	0xFF	Coord_Y[11:4]							
19	0x12	R	0xFF	Coord_X[3:0]				Coord_Y[3:0]			
20	0x13	R	0xFF	Touch delta[7:0]							
21	0x14	R	0xFF	Touch delta[15:8]							
22	0x15	R	0xFF	Area[7:0]							
23	0x16	R	0xFF	ID				Touch type	Status		
24	0x17	R	0xFF	Coord_X[11:4]							
25	0x18	R	0xFF	Coord_Y[11:4]							
26	0x19	R	0xFF	Coord_X[3:0]				Coord_Y[3:0]			
27	0x1A	R	0xFF	Touch delta[7:0]							
28	0x1B	R	0xFF	Touch delta[15:8]							

29	0x1C	R	0xFF	Area[7:0]		
30	0x1D	R	0xFF	ID	Touch type	Status
31	0x1E	R	0xFF	Coord_X[11:4]		
32	0x1F	R	0xFF	Coord_Y[11:4]		
33	0x20	R	0xFF	Coord_X[3:0]	Coord_Y[3:0]	
34	0x21	R	0xFF	Touch delta[7:0]		
35	0x22	R	0xFF	Touch delta[15:8]		
36	0x23	R	0xFF	Area[7:0]		
37	0x24	R	0xFF	ID	Touch type	Status
38	0x25	R	0xFF	Coord_X[11:4]		
39	0x26	R	0xFF	Coord_Y[11:4]		
40	0x27	R	0xFF	Coord_X[3:0]	Coord_Y[3:0]	
41	0x28	R	0xFF	Touch delta[7:0]		
42	0x29	R	0xFF	Touch delta[15:8]		
43	0x2A	R	0xFF	Area[7:0]		
44	0x2B	R	0xFF	ID	Touch type	Status
45	0x2C	R	0xFF	Coord_X[11:4]		
46	0x2D	R	0xFF	Coord_Y[11:4]		
47	0x2E	R	0xFF	Coord_X[3:0]	Coord_Y[3:0]	
48	0x2F	R	0xFF	Touch delta[7:0]		
49	0x30	R	0xFF	Touch delta[15:8]		
50	0x31	R	0xFF	Area[7:0]		
51	0x32	R	0xFF	ID	Touch type	Status
52	0x33	R	0xFF	Coord_X[11:4]		
53	0x34	R	0xFF	Coord_Y[11:4]		
54	0x35	R	0xFF	Coord_X[3:0]	Coord_Y[3:0]	
55	0x36	R	0xFF	Touch delta[7:0]		
56	0x37	R	0xFF	Touch delta[15:8]		
57	0x38	R	0xFF	Area[7:0]		
58	0x39	R	0xFF	ID	Touch type	Status
59	0x3A	R	0xFF	Coord_X[11:4]		
60	0x3B	R	0xFF	Coord_Y[11:4]		
61	0x3C	R	0xFF	Coord_X[3:0]	Coord_Y[3:0]	
62	0x3D	R	0xFF	Touch delta[7:0]		
63	0x3E	R	0xFF	Touch delta[15:8]		
64	0x3F	R	0xFF	Area[7:0]		
65	0x40	R	0xFF	ID	Touch type	Status
66	0x41	R	0xFF	Coord_X[11:4]		

67	0x42	R	0xFF	Coord_Y[11:4]						
68	0x43	R	0xFF	Coord_X[3:0]				Coord_Y[3:0]		
69	0x44	R	0xFF	Touch delta[7:0]						
70	0x45	R	0xFF	Touch delta[15:8]						
71	0x46	R	0xFF	Area[7:0]						
72	0x47	R	0xFF	Button Status (0xF8)						
73	0x48	R	0xFF	Button Status						
74	0x49	R	0xFF	Noise Effect [2:0]			short	open	FW status	
75	0x4A	R	0xFF	FLASH CRC ERR	OTP CRC ERR	Reserved				rawdata
76	0x4B	R	0xFF	IC BONDING ERR	PANEL BROKEN	VDDI LVD	VCOM LVD	VGLO LVD	VGHO LVD	AVEE LVD	AVDD LVD
77	0x4C	R	0xFF	GATE ERR	SOURCE ERR	VDDI OVD	VCOM OVD	VGL OVD	VGH OVD	AVEE OVD	AVDD OVD
78	0x4D	R	0xFF	OVER TEMP.	HSVSDE short	VIDEO CRC ERR	LVDS FAIL SAFE	LVDS LOCK ERR	NO HSDE	NO VS	NO CLOCK
79	0x4E	R	0xFF	Read valid pass word						
80	0x4F	R	0xFF	CRC Value [7:0]						
81	0x50	R/W	0xFF	INX reserve						
82	0x51	R/W	0xFF	INX reserve						
83	0x52	R	0xFF	Reserved						
84	0x53	R	0xFF	Reserved						
85	0x54	R	0xFF	Reserved						
86	0x55	R	0xFF	Reserved						
87	0x56	R	0xFF	Reserved						
88	0x57	R	0xFF	Reserved						
89	0x58	R	0xFF	Reserved						
90	0x59	R	0xFF	Reserved						
91	0x5A	R	0xFF	Reserved						
92	0x5B	R	0xFF	Reserved						
93	0x5C	R	0xFF	Reserved						
94	0x5D	R	0xFF	Reserved						
95	0x5E	R	0xFF	Reserved						
96	0x5F	R	0xFF	Reserved						
97	0x60	R	0xFF	INX reserve						
98	0x61	R	0xFF	Reserved						
99	0x62	R	0xFF	Reserved						
100	0x63	R	0xFF	Reserved						
101	0x64	R	0xFF	Reserved						
102	0x65	R	0xFF	Reserved						

103	0x66	R	0xFF	Reserved
104	0x67	R	0xFF	Reserved
105	0x68	R	0xFF	Reserved
106	0x69	R	0xFF	Reserved
107	0x6A	R	0xFF	Reserved
108	0x6B	R	0xFF	Reserved
109	0x6C	R	0xFF	Reserved
110	0x6D	R	0xFF	Reserved
111	0x6E	R	0xFF	Reserved
112	0x6F	R	0xFF	Reserved
113	0x70	R	0xFF	Reserved
114	0x71	R	0xFF	Reserved
115	0x72	R	0xFF	Reserved
116	0x73	R	0xFF	Reserved
117	0x74	R	0xFF	Reserved
118	0x75	R	0xFF	Reserved
119	0x76	R	0xFF	Reserved
120	0x77	R	0xFF	Reserved
121	0x78	R	0xFF	INX reserve
122	0x79	R	0xFF	INX reserve
123	0x7A	R	0xFF	INX reserve
124	0x7B	R	0xFF	INX reserve
125	0x7C	R	0xFF	INX reserve
126	0x7D	R	0xFF	INX reserve
127	0x7E	R	0xFF	INX reserve
128	0x7F	R	0xFF	INX reserve
129	0x80	R	0xFF	INX reserve
130	0x81	R	0xFF	INX reserve
131	0x82	R	0xFF	INX reserve
132	0x83	R	0xFF	INX reserve
133	0x84	R	0xFF	INX reserve
134	0x85	R	0xFF	INX reserve
135	0x86	R	0xFF	INX reserve
136	0x87	R	0xFF	INX reserve
137	0x88	R	0xFF	INX reserve
138	0x89	R	0xFF	INX reserve
139	0x8A	R	0xFF	INX reserve
140	0x8B	R	0xFF	INX reserve
141	0x8C	R	0xFF	INX reserve

142	0x8D	R	0xFF	INX reserve
143	0x8E	R	0xFF	INX reserve
144	0x8F	R	0xFF	INX reserve
145	0x90	R	0xFF	INX reserve
146	0x91	R	0xFF	INX reserve
147	0x92	R	0xFF	INX reserve
148	0x93	R	0xFF	INX reserve
149	0x94	R	0xFF	INX reserve
150	0x95	R	0xFF	INX reserve
151	0x96	R	0xFF	INX reserve
152	0x97	R	0xFF	Reserved
153	0x98	R	0xFF	Reserved
154	0x99	R	0xFF	Reserved
155	0x9A	R	0xFF	Reserved
156	0x9B	R	0xFF	Reserved
157	0x9C	R	0xFF	Reserved
158	0x9D	R	0xFF	Reserved
159	0x9E	R	0xFF	Reserved
160	0x9F	R	0xFF	Reserved
161	0xA0	R	0xFF	Open fail pad1 X axis
162	0xA1	R	0xFF	Open fail pad1 Y axis
163	0xA2	R	0xFF	Open fail pad2 X axis
164	0xA3	R	0xFF	Open fail pad2 Y axis
165	0xA4	R	0xFF	Open fail pad3 X axis
166	0xA5	R	0xFF	Open fail pad3 Y axis
167	0xA6	R	0xFF	Open fail pad4 X axis
168	0xA7	R	0xFF	Open fail pad4 Y axis
169	0xA8	R	0xFF	Open fail pad5 X axis
170	0xA9	R	0xFF	Open fail pad5 Y axis
171	0xAA	R	0xFF	Short fail pad1 X axis
172	0xAB	R	0xFF	Short fail pad1 Y axis
173	0xAC	R	0xFF	Short fail pad2 X axis
174	0xAD	R	0xFF	Short fail pad2 Y axis
175	0xAE	R	0xFF	Short fail pad3 X axis
176	0xAF	R	0xFF	Short fail pad3 Y axis
177	0xB0	R	0xFF	Short fail pad4 X axis
178	0xB1	R	0xFF	Short fail pad4 Y axis
179	0xB2	R	0xFF	Short fail pad5 X axis
180	0xB3	R	0xFF	Short fail pad5 Y axis
181	0xB4	R	0xFF	Rawdata fail pad1 X axis

182	0xB5	R	**0xFF**	**Rawdata fail pad1 Y axis**
183	0xB6	R	**0xFF**	**Rawdata fail pad2 X axis**
184	0xB7	R	**0xFF**	**Rawdata fail pad2 Y axis**
185	0xB8	R	**0xFF**	**Rawdata fail pad3 X axis**
186	0xB9	R	**0xFF**	**Rawdata fail pad3 Y axis**
187	0xBA	R	**0xFF**	**Rawdata fail pad4 X axis**
188	0xBB	R	**0xFF**	**Rawdata fail pad4 Y axis**
189	0xBC	R	**0xFF**	**Rawdata fail pad5 X axis**
190	0xBD	R	**0xFF**	**Rawdata fail pad5 Y axis**

8. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Luminance	L	Normal θ=Φ=0°	800	1000	-	cd/m²	Note 2
Contrast ratio	CR		1000	1300	-	-	Note 2 Note 3
Viewing angle (CR≥ 10)	θ_L	Φ=180° (9 o'clock)	80	-	-	degree	Note 3 Note 4
	θ_R	Φ=0° (3 o'clock)	80	-	-		
	θ_T	Φ=90° (12 o'clock)	80	-	-		
	θ_B	Φ=270° (6 o'clock)	80	-	-		
Luminance uniformity	Y_U		75	80	-	%	Note 5
Response time	T_r	Temperature=25 ℃	-	12	16	msec	Note 6
	T_f		-	10	14		
	T_r	Temperature=-20 ℃	-	110	160		
	T_f		-	90	140		
	T_r	Temperature=-30 ℃	-	240	340		
	T_f		-	190	290		
Color chromaticity (CIE 1931)	W_X	Normal θ=Φ=0°	0.27	0.31	0.35	-	Note 1
	W_Y		0.29	0.33	0.37	-	Note 2
NTSC (CIE 1931)	NTSC			70	-	%	Note 1 Note 2

Basic testing conditions if not specified:
1. Driving voltage: 3.3V; I_{LED}= 85 mA (backlight LED driving current per LED)
2. Ambient temperature: Ta = 25 ± 3℃
3. Testing point: measure in the display center point and the test angle θ =0°
4. Elapsed time from switch ON module (including backlight) is greater than 30 minutes.

Note 1: Color chromaticity is defined by CIE1931.
Note 2: Definition of optical measurement system. The backlight has been light on for 30 minutes then measured the optical properties at the center point of the LCD screen in dark room. The color chromaticity, contrast ratio are measured by DMS 803.

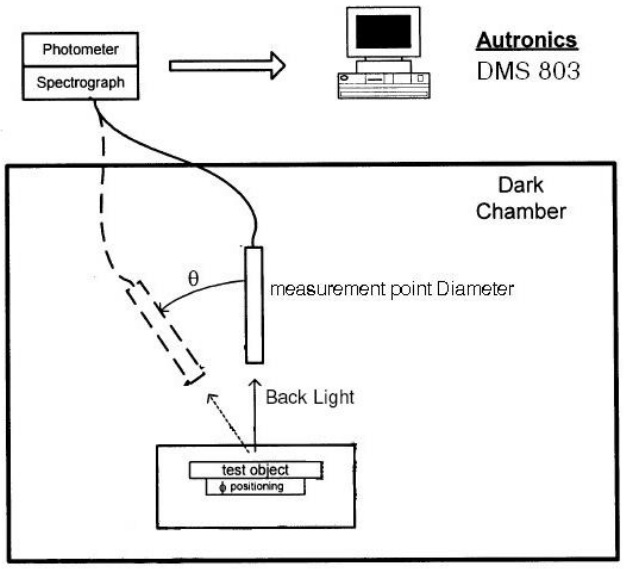


Fig. 7-1 Optical measurement system setup

Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 4: Definition of viewing angle range.

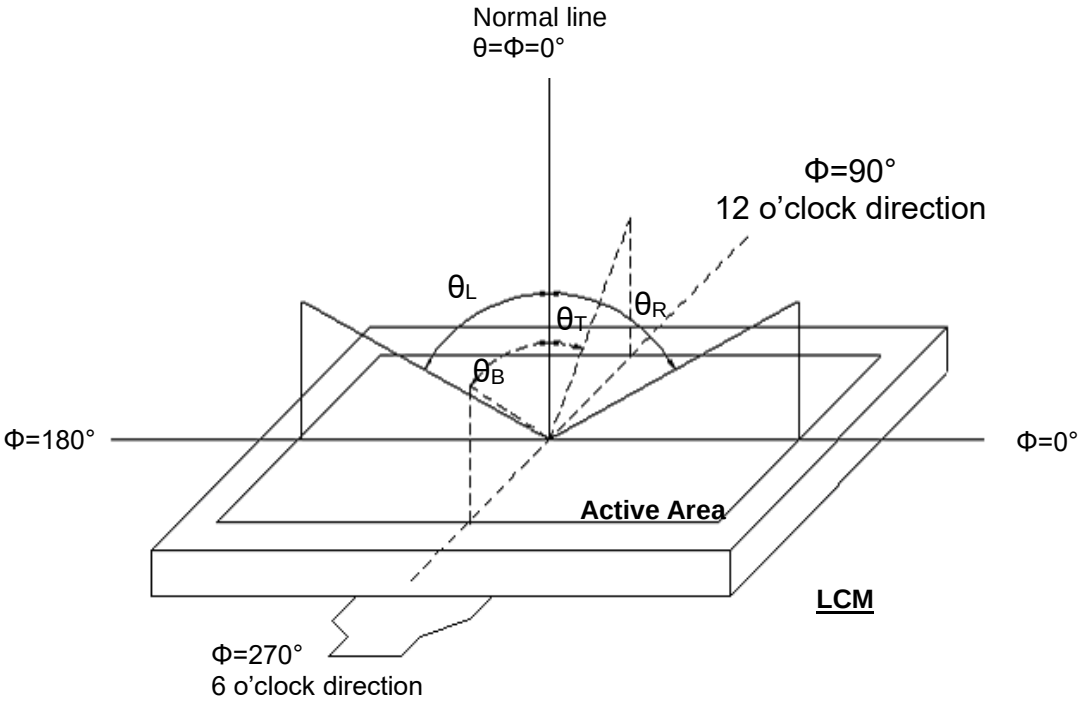


Fig. 7-2 Definition of viewing angle

Note 5: Definition of luminance uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 7-3).

L----- Active area length W----- Active area width

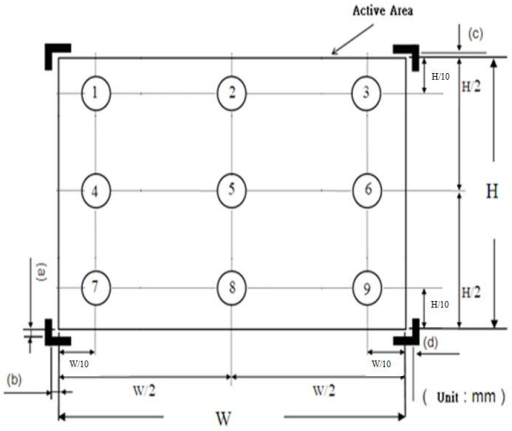


Fig. 7-3 Definition of measuring points

$$\text{Luminance Uniformity (Yu)} = \frac{B_{min}}{B_{max}}$$

Bmax: The measured maximum luminance of all measurement position.

Bmin : The measured minimum luminance of all measurement position.

Note 6: Definition of response time. The response time is measured by photo detector of oscilloscope.

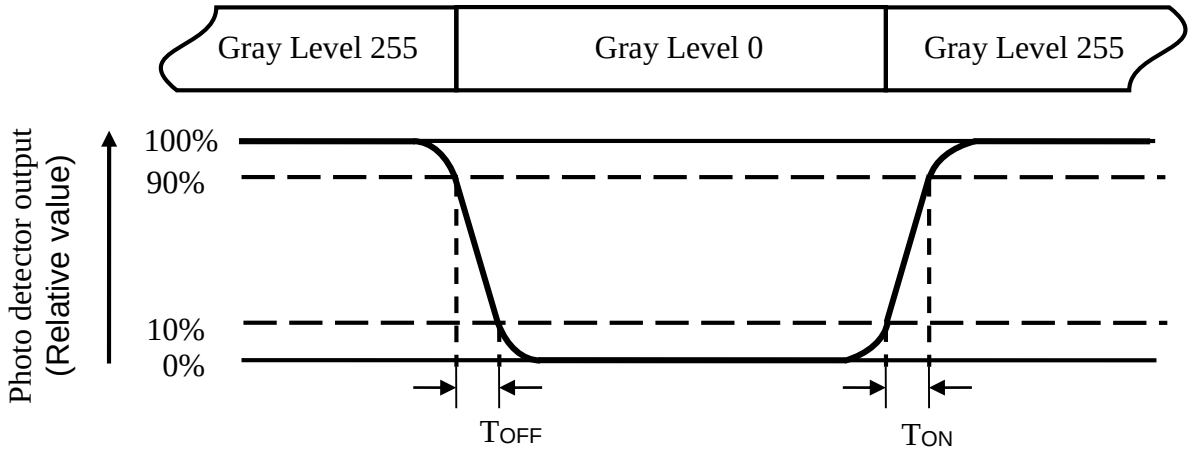


Fig. 4-3 Definition of response time

9. Reliability Test Items

Item	Test Conditions	Remark
High Temperature Storage Test	Ta=90ºC, 500 hours	Note 1 Note 2 Note 3 Note 5
Low Temperature Storage Test	Ta=-40ºC, 500 hours	
High Temperature Operation Test	Tp=85ºC, 500 hours	
Low Temperature Operation Test	Tp=-30ºC, 500 hours	
High Temperature & High Humidity Operation/Storage Test	Ta=60ºC, RH 90%, 500 hours	
Thermal Shock	[(Ta=-40℃ 30min)~(Ta=85℃ 30min)]/cycle，(Ramp rate≧ 16℃/min) , 100cycles	
ESD Test (Operation)	Condition 1 : C = 150pF, R = 330Ω Contact Discharge, ± 8KV Condition 2 : C = 150pF, R = 330Ω, Air Discharge, ± 15KV	Note 6
Mechanical Shock	100G, 6ms, half sine wave, 3 times for each direction of ±X, ±Y, ±Z	Note 2 Note 4
Mechanical Vibration	Frequency: 10 ~55~10Hz;Sweep Mode: Log Sweep Sweep time: 1Oct/min; Acceleration: 1.5G;Test time:2 hr for each direction of X, Y, Z.	Note 2 Note 4
Packaging Vibration Test	1.14Grms X, Y, Z three axes (30min /axis) [Frequency：5Hz(0.015G2/Hz)，100Hz(0.015G2/Hz)，200Hz(0.0037G2/Hz)]	
Packaging Drop Test	1corner, 3edges, 6faces (1 time/direction) <follow ISTA(1A) Height> 0kg≦ W <10kg：76cm, 10kg≦ W <19kg：61cm, 19kg≦ W <28kg：46cm,	

Note 1: Ta = Ambient Temperature, Tp = Panel Surface Temperature.

Note 2: Criteria: Normal display image with no Function NG, or line defects.

Note 3: Evaluation should be tested after storage at room temperature for more than two hour

Note 4: At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

Note 5: A certain level of Mura (non-uniformity) of dark / black image will happen several days after high temperature testing (H.T.T.). There is a slowly part recovery over a long time (several months). Such a long exposure time like in H.T.T. will normally not happen in a real application. Therefore the test H.T.T. was introduced to simulate cycles with normal conditions in-between but with the same total exposure time what show a significant reduced Mura.

The root cause is related to tension generated due to different amount of shrinking in the stack of layers in the polarizer sheet. The effect is more significant on larger displays like this size. An investigation into alternative polarizer material showed that there is no better alternative currently available.

Note 6 : Criteria Class B

10. General Precautions

9.1 Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or cloths, wash it off immediately by using soap and water.

9.2 Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.

2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.

3. To avoid contamination on the display surface, do not touch the module surface with bare hands.

4. Keep a space so that the LCD panels do not touch other components.

5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.

6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.

7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

9.3 Static Electricity

1. Be sure to ground module before turning on power or operating module.

2. Do not apply voltage which exceeds the absolute maximum rating value.

9.4 Storage

1. Store the module in a dark room where must keep at 25±10℃ and 65%RH or less.

2. Do not store the module in surroundings containing organic solvent or corrosive gas.

3. Store the module in an anti-electrostatic container or bag.

9.5 Cleaning

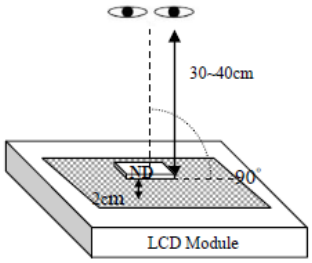
1. Do not wipe the polarizer with dry cloth. It might cause scratch.

2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

11. Quality Requirement

The defect categories covered in this specification are comprised of defects in the active area such as dot defects, blemishes and partly completely mal functioning displays as well as visual appearance of the complete product and packaging of the product.

10.1 Inspection conditions and test patterns

Item	Condition	
Lighting	Equivalent Illumination. Ambient Illumination: 800 ~ 1200 Lux for external appearance inspection Ambient Illumination: 300 ~ 500 Lux for light on inspection	
Temperature	20~30°C	
Humidity	25~75 %RH	
Driving condition	Equipment	Product specific test tool
	Test pattern	Black, White, R, G, B
	Supply voltage	Typical voltages as given in the specification
Inspection method	Time	≤ 1 minute
	Distance	Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 40~50cm or more between the LCD module and eyes of inspector.
	Viewing angle	±15 degree to the front surface of display panel in vertical direction. ±15 degree to the front surface of display panel in horizontal direction.
ND Filter	When using ND Filter for judging Mura, placing ND Filter near Mura defect and get close to the surface of LCD Panel (its distance shall be 1~2cm between the surface of Panel and ND Filter). Don't touch the surface of polarizer to avoid scratching polarizer, and then move to the defect position to judge mura by view angle 0 degree within 3 seconds.	

10.2 Classification of defects

Defects are classified two types, major defect and minor defect according to the defect. And, the definition of defects is classified as below.

(1) Major defect
Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

(2) Minor defect
A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, sub-pixel defect and etc..

The criteria on major and/or minor judgment will be according with the classification of defects.

Inspection Item	Criteria and Description	Defect type
Vertical line	Signal input, vertical line off or irregular V-line appears	Major
Horizontal line	Signal input, horizontal line off or irregular H-line appears	Major
Cross line	Pattern signal input, a correct display is not obtained	Major
No display	Signal input, display is dead	Major
Irregular display	Pattern signal input, a correct display is not obtained	Major
Sub-pixel defect	Exceed specified standards	Minor
Scratch and Dent on polarizer	Exceed specified standards	Minor
Foreign material	Exceed specified standards	Minor
Mura	The Mura criteria follows: 10.3 Inspection Criteria (2) Display Inspection items "Mura"	Minor
External Appearance	Deformation, irregular plating, coating missing etc.	Minor

	A appearance defect that do not affect function or performance	
Bezel claw	Bezel claw missing or not bent	Major
Polarizer bubble	Exceed specified standards	Minor

10.3 Inspection Criteria

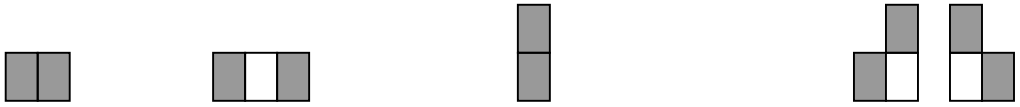
(1) Definition of dot defect induced from the panel inside

a) Full bright dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

b) Full dark dot：Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

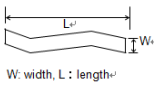
c) 2 adjacent dots = 1pair = 2 sub-pixel

Picture:



2 adjacent dots　2 adjacent dots　2 adjacent dots(vertical)　2 adjacent dots (slant)

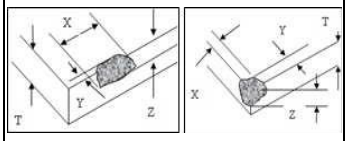
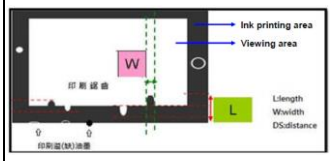
(2) Display Inspection standards when power on

Items		Acceptable count
Full Bright dot	Random	N≦ 0
	2 adjacent dots	N≦ 0
	3 adjacent dots or more	N≦ 0
Full Dark dot	Random	N≦ 4
	2 adjacent dots	N≦ 0
	3 adjacent dots or more	N≦ 0
Total bright and dark dots		N≦ 4
Distance	Minimum Distance Between Dark dots	≧ 5mm
Foreign Black/White/Bright Spot 		D＜0.15mm, ignore 0.15mm≦ D≦ 0.3mm , N≦ 4 D＞0.3mm, N=0
Foreign Black/White/Bright Lint 		W≦ 0.05mm, ignore 0.05<W≦ 0.10mm, L≦ 3.0mm, N≦ 4 W＞0.10mm, L＞3.0mm, N=0
Display failure (V-line/H-line/Cross line etc.)		Not allowable
Mura/ Waving/ Hot spot	Not visible through 5% ND filter in 50% Gray pattern or judge by limit sample if necessary	

Note：Defect which is on the Black Matrix (outside of Active Area) are not considered as a defect

10.4 External Appearance Inspection Criteria (power off)

Item	Contents
Line Shape in display area (Particle / Scratch / Lint / Bubble)	W≦ 0.05mm, ignore 0.05<W≦ 0.10mm, L≦ 3.0mm, N≦ 4 W＞0.10mm, L＞3.0mm, N=0
Dot Shape in display area (Particle / Dent / Bubble)	D＜0.15mm, ignore 0.15mm≦ D≦ 0.3mm , N≦ 4 D＞0.3mm, N=0
Protective Film	Any defects on the protective film are ignored, such as protective film scratches, protective film bubbles and particles on protective film.
FPC	Break-off 、Connector Break-off / Burn-off is not permitted
Metal frame (Bezel)	Assembly NG or Function fail caused by deformation is not permitted

Backlight	Scratch	The scratch which may causes a problem in practical use is not permitted.
	Break-off	Breaking off is not permitted.
	Crack	The crack is not permitted.
Tape/Label	Incorrect position, missed label is not permitted.	
Connector	Assembly NG or Function fail caused by deformation is not permitted	
Outline size	Spec. out is not permitted.	
Touch panel	Broken & chipping 	(1)For Edge type: a. Y≦ 0.15mm，N / X / Distance，Ignore b. X≦ 0.3mm，0.15<Y≦ 0.3mm，Z≦ 1/2 T，N≦ 6 (2) For Corner type: X≦ 0.3mm，0.15<Y≦ 0.3mm，Z≦ 1/2 T，N≦ 3 Distance Ignore
	BM Printing Pinhole	D≦ 0.3mm，Ignore 0.3mm＜D≦ 0.5mm，N≦ 4，Distance≧ 5mm If RoHS-Qualified oil pen can fix it，ignore
	BM Printing sawtooth 	L≦ 0.1 mm，Ignore 0.1mm＜L≦ 0.15 mm, W≦ 1mm，N≦ 2 Distance＞5mm

Notes: 1. Any defect can be wiped off, ignore.

2. If any specific defect is not included in the above defect table, this defect should be judged by INX/ODM/Brand customer discussion.

3.Defect was ignored if invisible at the user side.

12. Package Drawing

TBD

13. Label

TBD