INNOLUX DISPLAY CORPORATION

LCD MODULE

SPECIFICATION

Customer: _____

Model Name: ZJ035BF-01C

Date: 2025/05/28

Version: 0.1

■ **Preliminary Specification**

□ **Final Specification**

For Customer's Acceptance

Approved by	Comment

Approved by	Reviewed by	Prepared by

CONTENTS

RECORD OF REVISIONS

Revision	Date	Page	Description
0.0	2025/03/11	all	New Creation
0.1	2025/05/28	P8-P13	Update AC CHARATERISTICS

1. FEATURES

ZJ035BF-01C is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver ICs, FPC, backlight unit.

2. GENERAL SPECIFICATIONS

Parameter		Specifications	Unit
Screen size		3.45(Diagonal)	Inch
Display Format		320 RGB x 240	Dot
Active area		70.08(H) x 52.56(V)	mm
Dot size		73x 219	um
Pixel Configuration		RGB-Stripe	
Outline dimension		76.9(W) x 63.9(H) x 3.26(D)	mm
Display Mode		Normally Black	
Surface Treatment		Anti-Glare	
Display Garmut		NTSC 57%	
Input Interface		Digital Parallel 24-bit RGB/SERIAL 8-bit RGB	
Weight		30	g
View Angle direction		6 o'clock	
Temperature Range	Operation	-30~80	℃
	Storage	-30~85	℃

3. ABSOLUTE MAXIMUM RATINGS

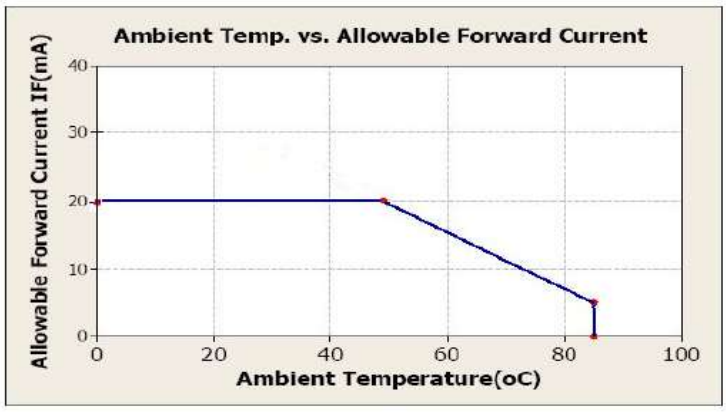
Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power Voltage	VCC	GND=0	-0.3	4.0	V	
Input Signal Voltage	V_{in}	GND=0	-0.3	VDD+0.3	V	NOTE
Logic Output Voltage	V_{OUT}	GND=0	-0.3	VDD+0.3	V	NOTE

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1. Temp. ≤ 60℃, 90% RH MAX.

   Temp.＞ 60℃, Absolute humidity shall be less than 90% RH at 60℃

2.

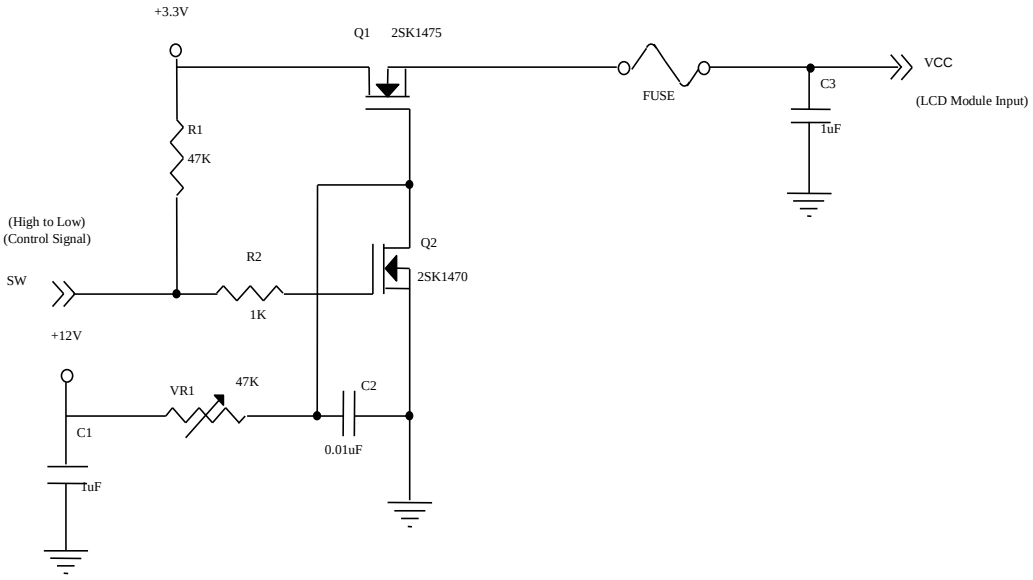


4. ELECTRICAL CHARACTERISTICS

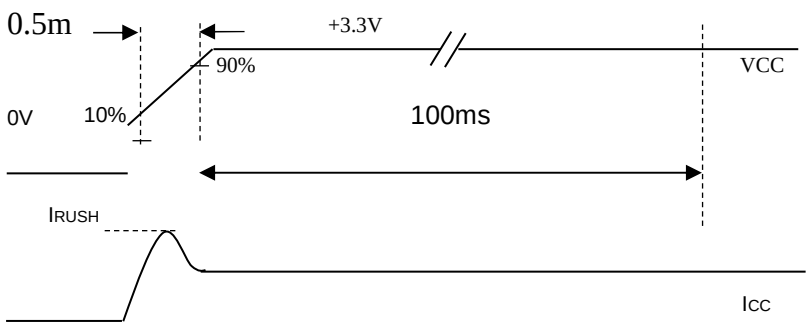
4.1. Operating conditions:

Parameter	Symbol	Rating			Unit	Condition
		Min.	Typ.	Max.		
Power Voltage	VCC	3.0	3.3	3.6	V	
Digital Operation Current	Icc	-	20	28	mA	
Inrush Current	I_{RUSH}	-	-	260	mA	Note

Note: I_{RUSH}: The maximum current when VCC is rising.



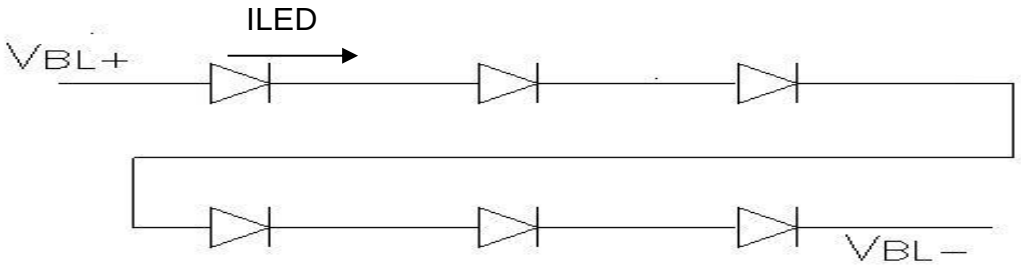
VCC rising time is 0.5ms



4.2 LightBar driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Light Bar current	I_{LED}	-	20	-	mA	
Power Consumption		-	354	384	mW	
Light Bar voltage	VL	16.2	17.7	19.2	V	Note 1
LED Life Time	-	15000	-	-	Hr	Note 2,3

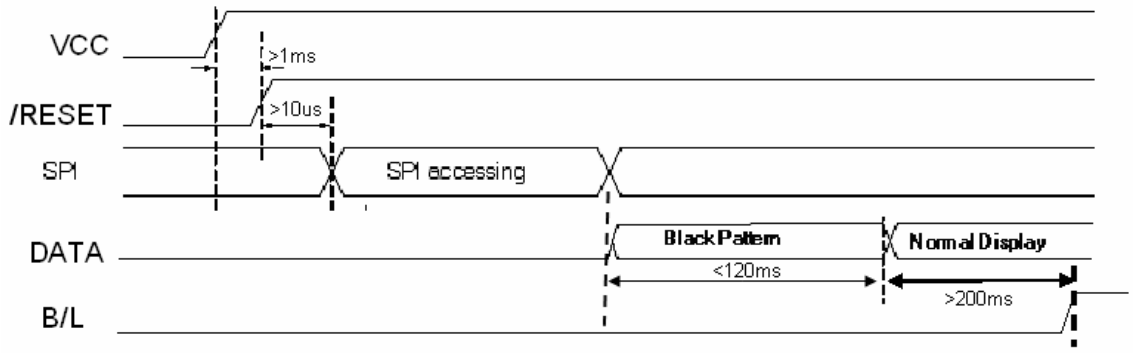
Note 1 : There are 1 Groups LED



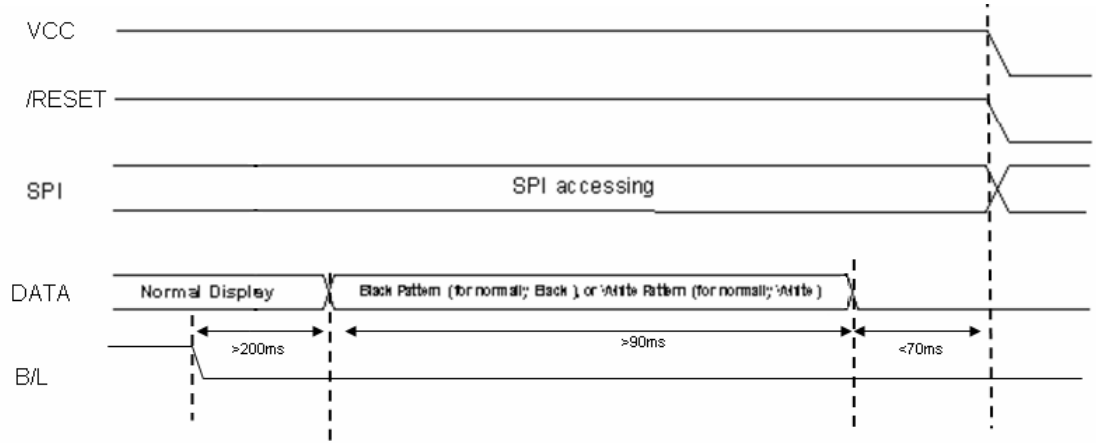
Note 2 : Ta = 25℃

Note 3 : Brightess to be decreased to 50% of the initial value

4.3 POWER ON/OFF SEQUENCE



power on sequence



power off sequence

5. DC CHARATERISTICS

Parameter	Symbol	Rating			Unit	Condition
		Min.	Typ.	Max.		
Low level input voltage	V_{IL}	0	-	0.3 VCC	V	
Hight level input voltage	V_{IH}	0.7 VCC	-	VCC	V	

6. AC CHARATERISTICS

Digital Parallel RGB interface:

Signal	Item	Symbol	Min	SYNC mode	DE/ SYNC+DE	Max	Unit	Remark
Dclk	DCLK Frequency	Tclk	5	5.79	6.42	8	MHZ	
	DCLK Period	Tosc	125	172	156	200	ns	
	High Time	Tch	-	86	78	-	ns	
	Low Time	Tcl	-	86	78	-	ns	
Data	Setup Time	Tsu	12	-	-	-	ns	
	Hold Time	Thd	12	-	-	-	ns	
Hsync	Period	TH	-	371	408	-	Tosc	
	Pulse Width	THS	-	4	30		Tosc	
	Back-Porch	Thb	-	39	38	-	Tosc	
	Display Period	TEP	-	320	320	-	Tosc	
	Hsync-den time	THE	3	43	68	-	Tsoc	
	Front-Porch	Thf	2	8	20	-	Tosc	
Vsync	Period	Tv	-	260	262	-	TH	
	Pulse Width	Tvs	1	4	3	-	TH	
	Back-Porch	Tvb	-	8	15	-	TH	
	Display Period	Tvd	-	240	240	-	TH	
	Vsync-den time	TVE	-	12	18		TH	
	Front-Porch	Tvf	2	8	4	-	TH	

Note: 1. Tv = Tvs + Tvb + Tvd + Tvf , the user is make up by yourself.

2. It is necessary to keep TVE =12 and THE =43 in sync mode. DE mode is unnecessary to keep it.

3. DEN Positive: Polarity

Digital Serial RGB interface:

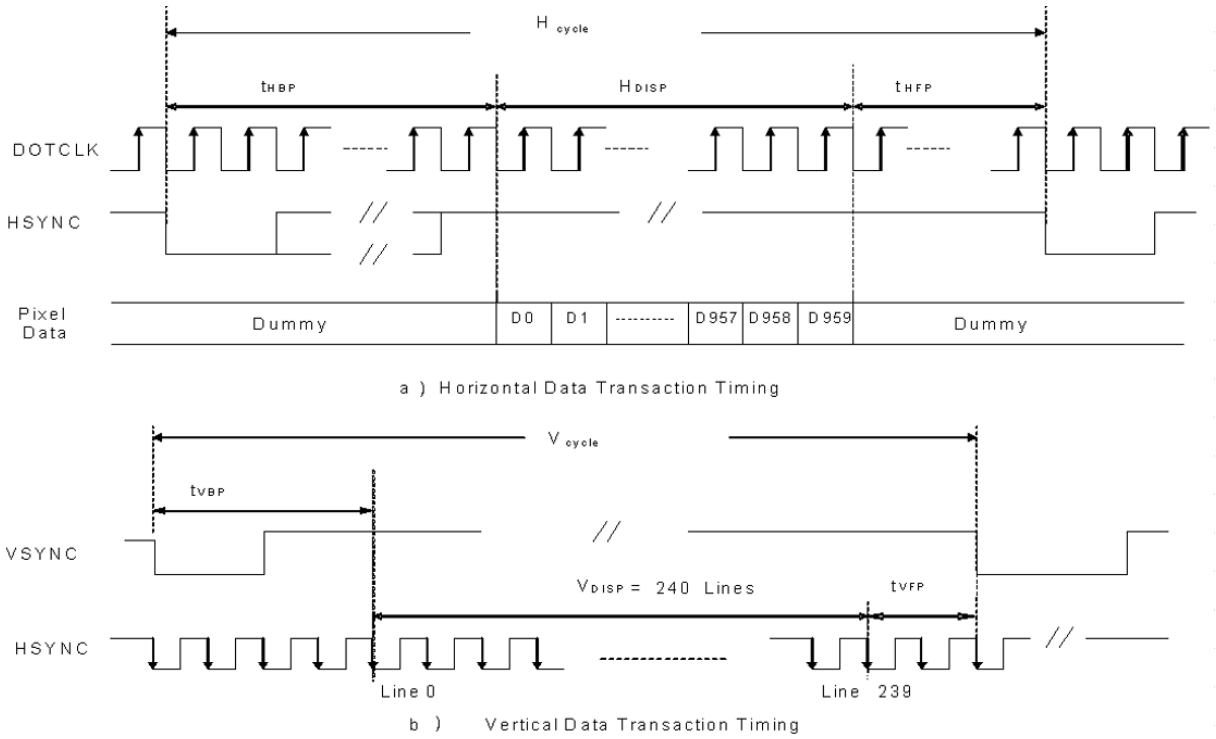
Signal	Item	Symbol	Min	SYNC mode	DE/ SYNC+DE	Max	Unit	Remark
Dclk	DCLK Frequency	Tclk	15	15.77	19.24	21	MHZ	
	Frequency	Tosc	-	64	52	-	ns	
	High Time	Tch	-	32	26	-	ns	
	Low Time	Tcl	-	32	26	-	ns	
Data	Setup Time	Tsu	12	-	-	-	ns	
	Hold Time	Thd	12	-	-	-	ns	
Hsync	Period	TH	-	1011	1224	-	Tosc	
	Pulse Width	THS	5	4	90	-	Tosc	
	Back-Porch	Thb		39	114		Tosc	
	Display Period	TEP	-	960	960	-	Tosc	
	Hsync-den time	THE	3	43	204	-		
	Front-Porch	Thf	2	8	60	-	Tosc	
Vsync	Period	Tv	-	260	262	-	TH	
	Pulse Width	Tvs	1	4	3	-	TH	
	Back-Porch	Tvb	-	8	15	-	TH	
	Display Period	Tvd	-	240	240	-	TH	
	Vsync-den time	TVE	-	12	18	-	TH	
	Front-Porch	Tvf	2	8	4	-	TH	

Note: 1. Tv = Tvs + Tvb + Tvd + Tvf , the user is make up by yourself.

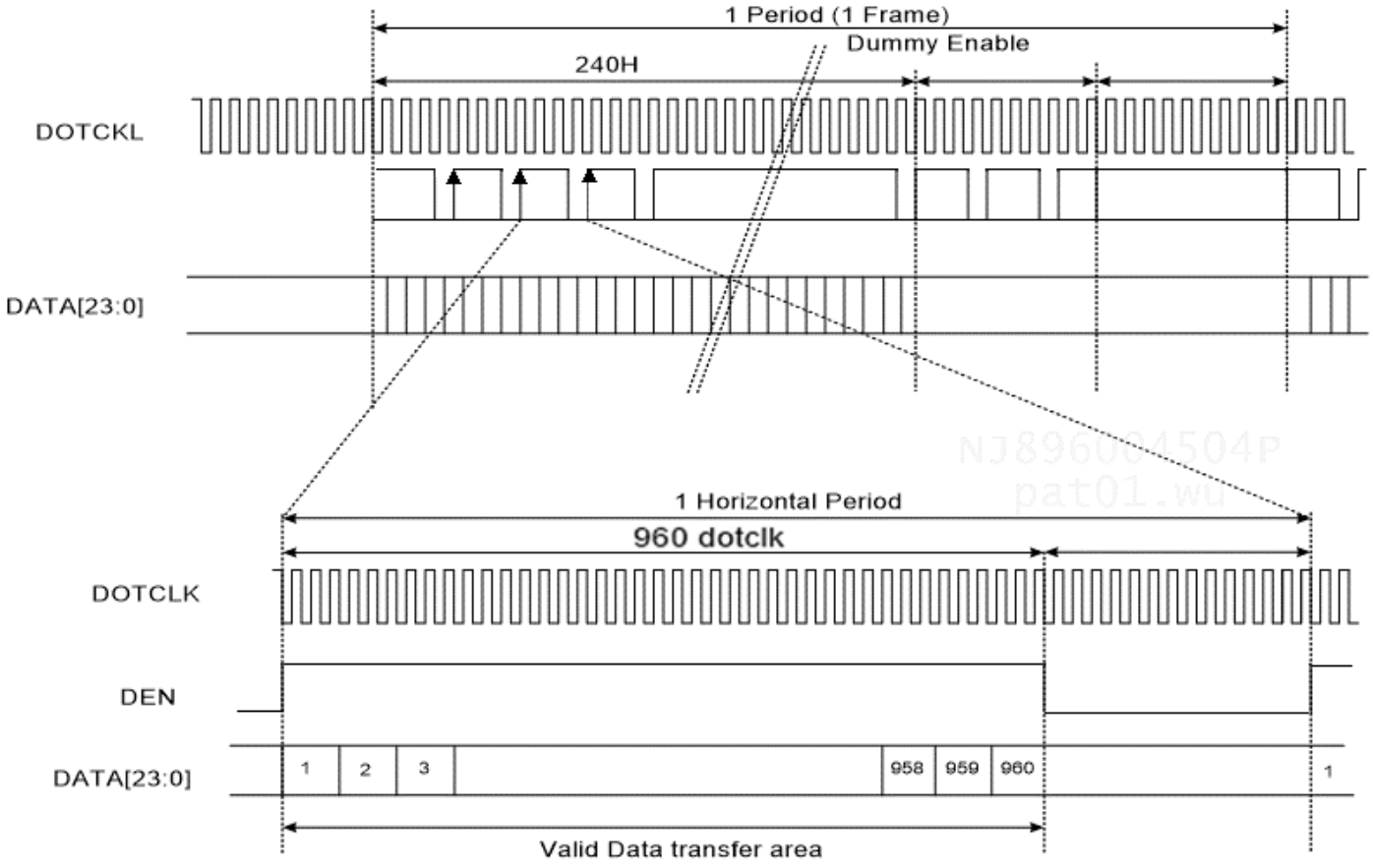
2. It is necessary to keep TVE =12 and THE =43 in sync mode. DE mode is unnecessary to keep it.

3. DEN Positive: Polarity

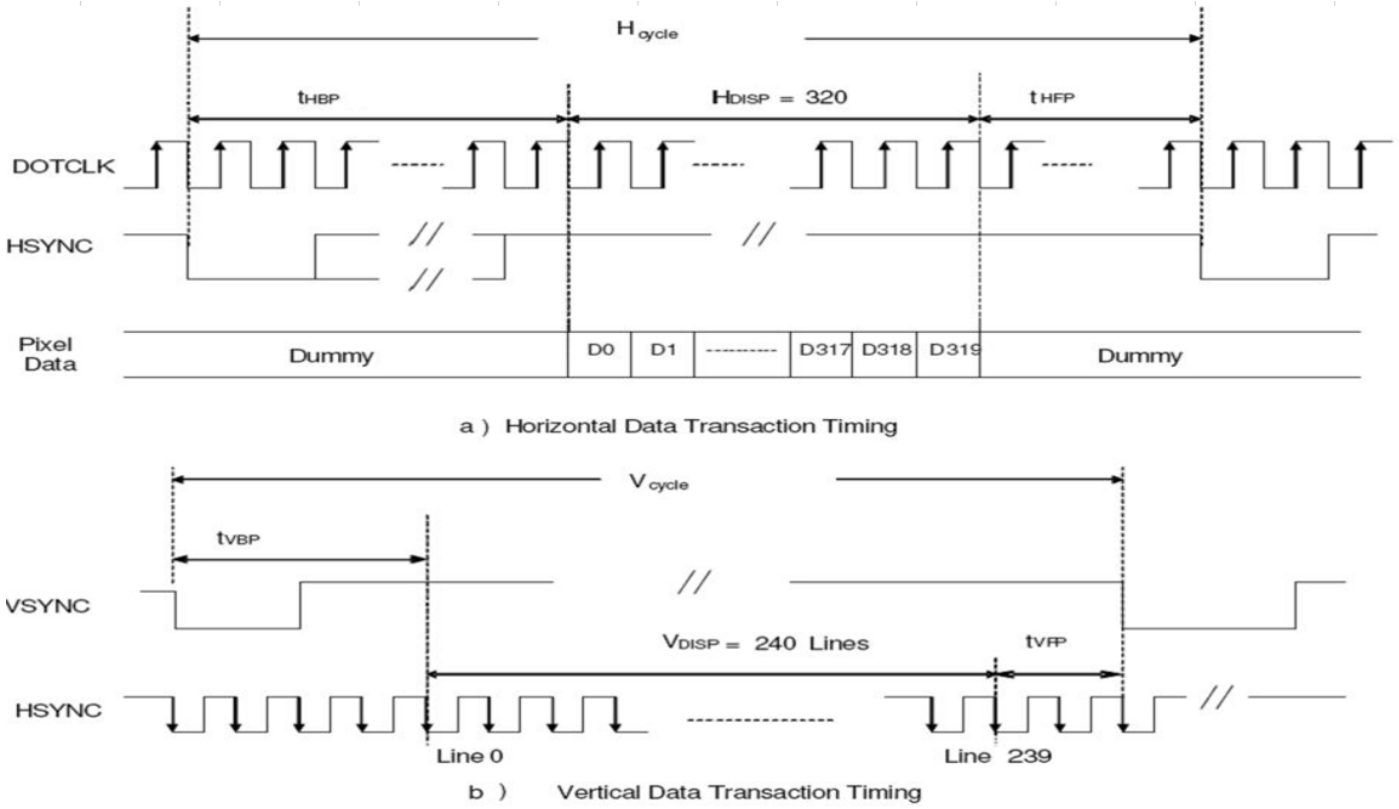
6.1 Waveform



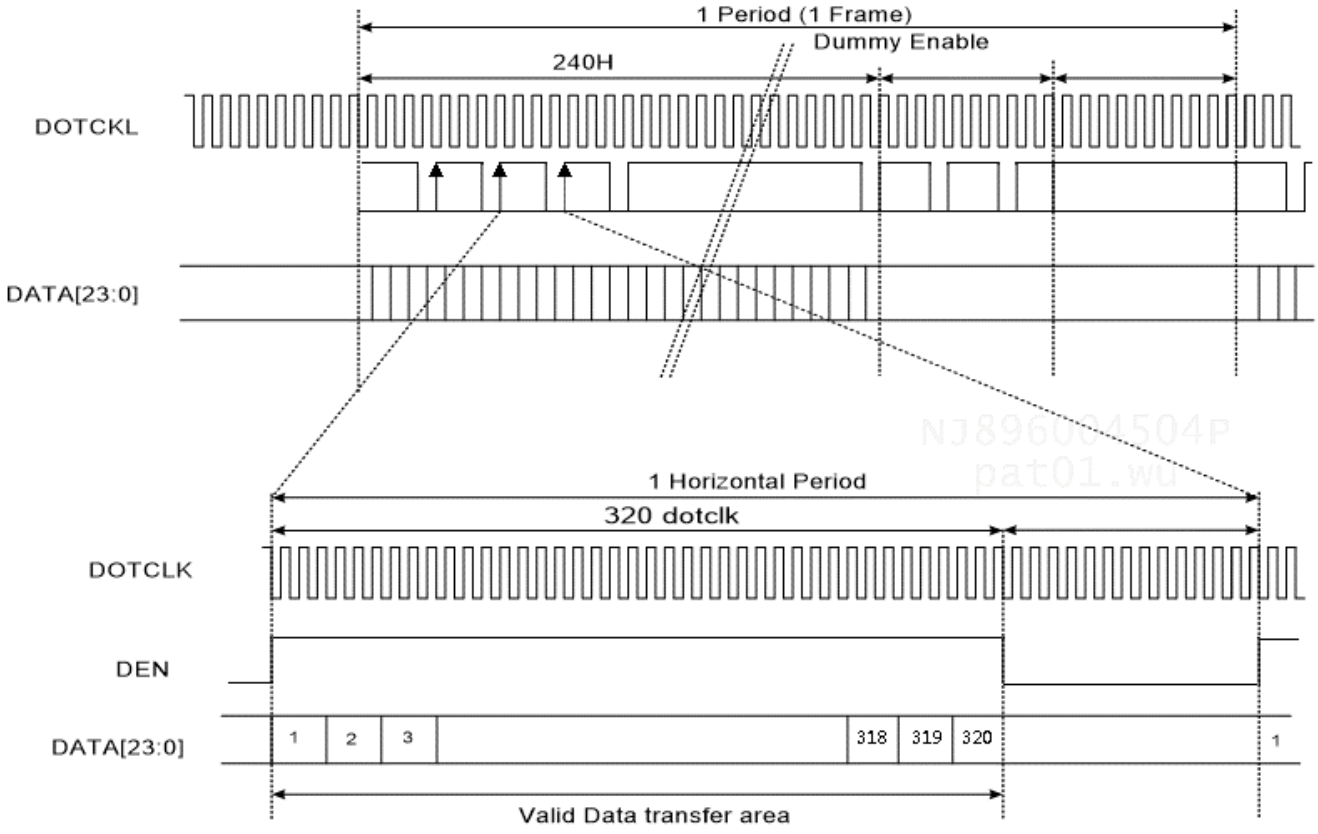
Data Transaction Timing in Serial RGB (8 bit) Interface (SYNC Mode)



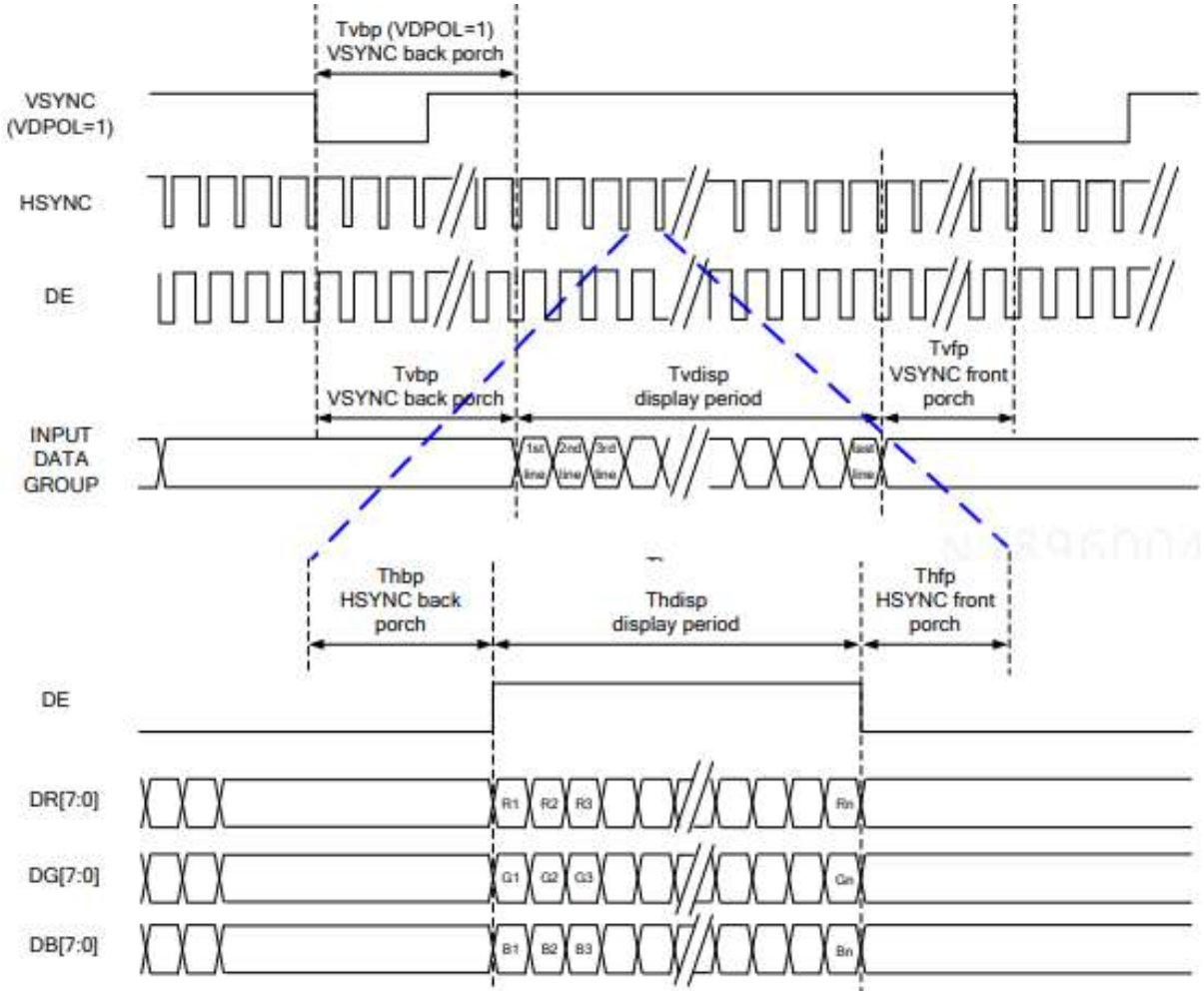
Data Transaction Timing in Serial RGB (8 bit) Interface (DE Mode)



Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)



Data Transaction Timing in Parallel RGB (24 bit) Interface (DE Mode)



Data Transaction Timing in RGB Interface SYNC +DE Mode

6.1.1 Clock and Sync waveforms

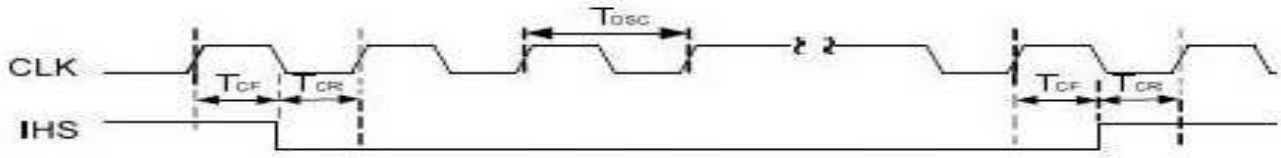
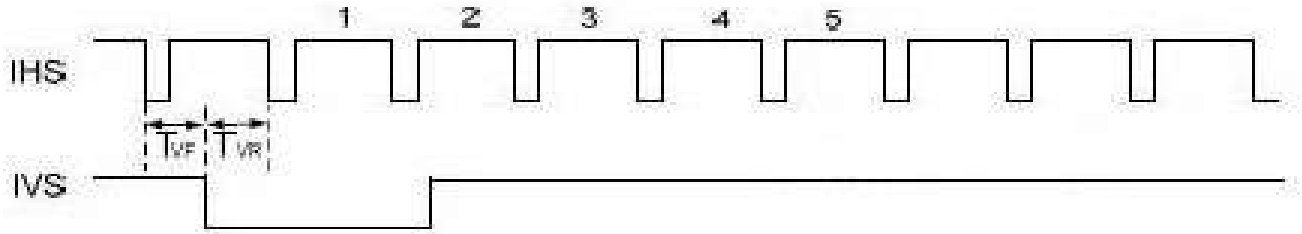
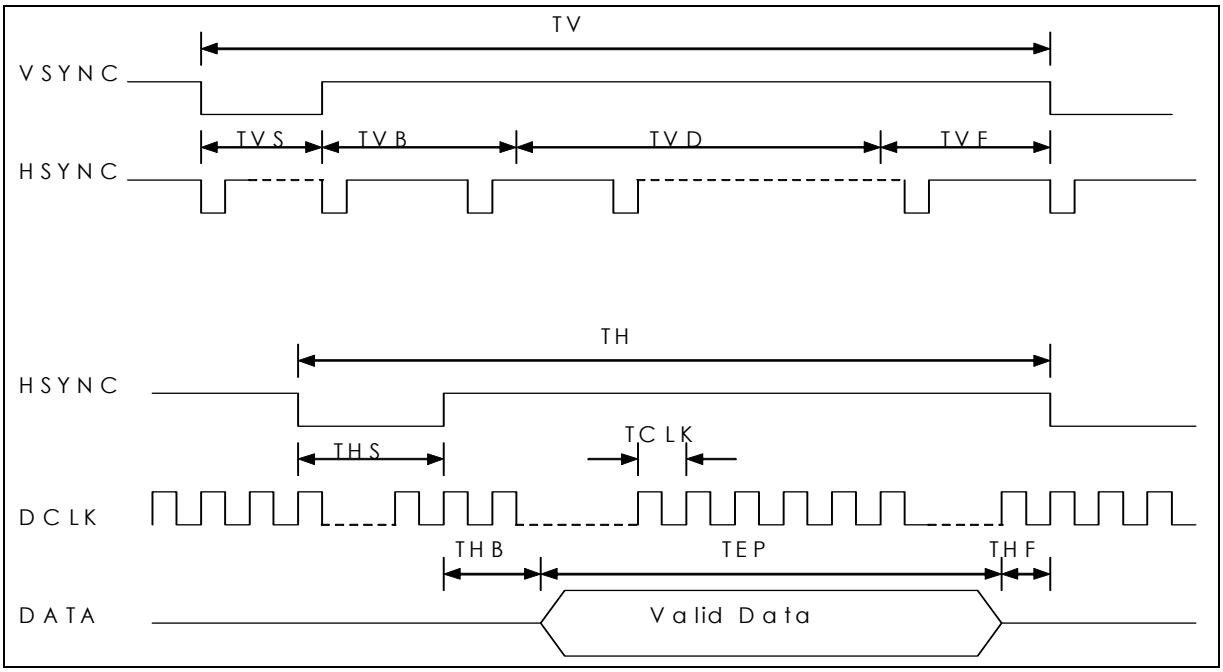
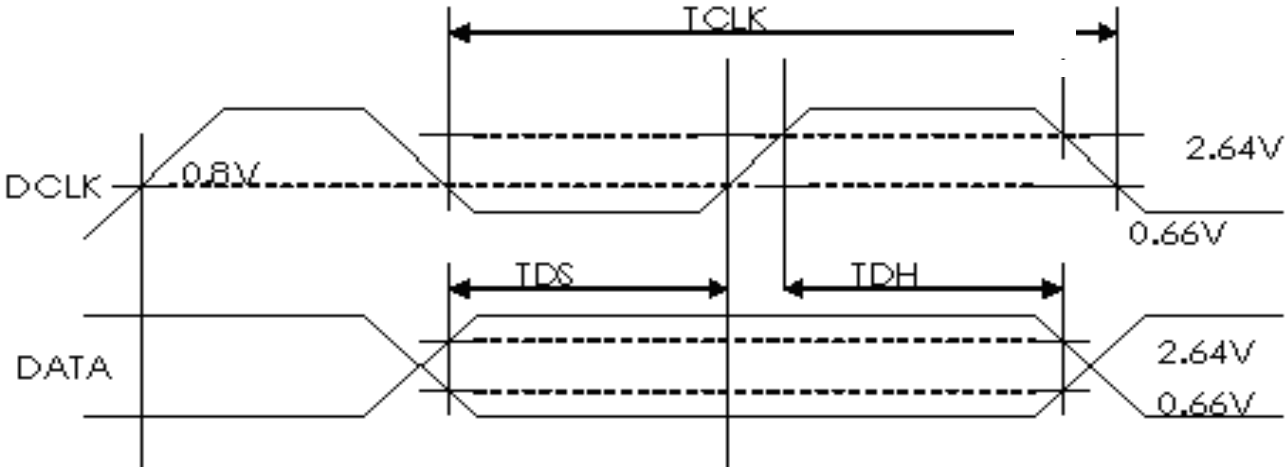


Figure 6 CLK and IHS timing waveform



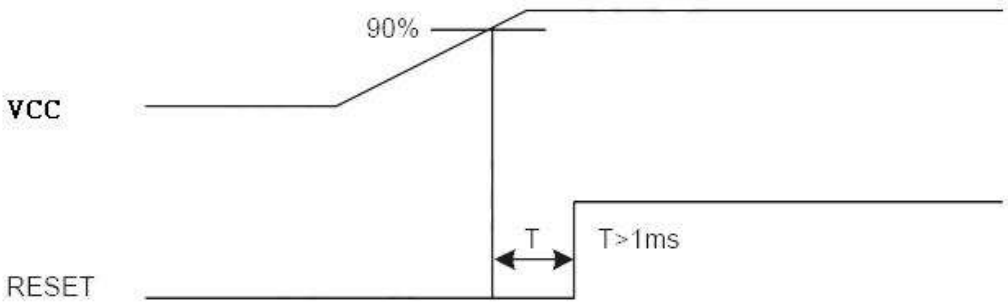
IHS and IVS timing waveforms





6.2 Reset Timing Chart

The RESET input must be held at least 1ms after power is stable



Reset timing

7. OPTICAL CHARACTERISTIC

Ta=25±2℃, ILED=20mA

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time		T_{on}+ T_{off}	θ =0°、Φ=0°	-	25	35	ms	Note 3,
Contrast ratio		CR	At optimized viewing angle	600	800	-	-	Note 4,
Color Chromaticity	White	Wx	θ =0°、Φ=0	0.26	0.31	0.36	-	Note 2,5,6
		Wy		0.28	0.33	0.38	-	
Viewing angle	Hor.	ΘR	CR≧10	70	80	-	Deg.	Note 1
		ΘL		70	80	-		
	Ver.	ΦT		70	80	-		
		ΦB		70	80	-		
Brightness		-	-	350	450	-	cd/m^2	Center of display

Ta=25±2℃, I_L=20mA

Note 1: Definition of viewing angle range

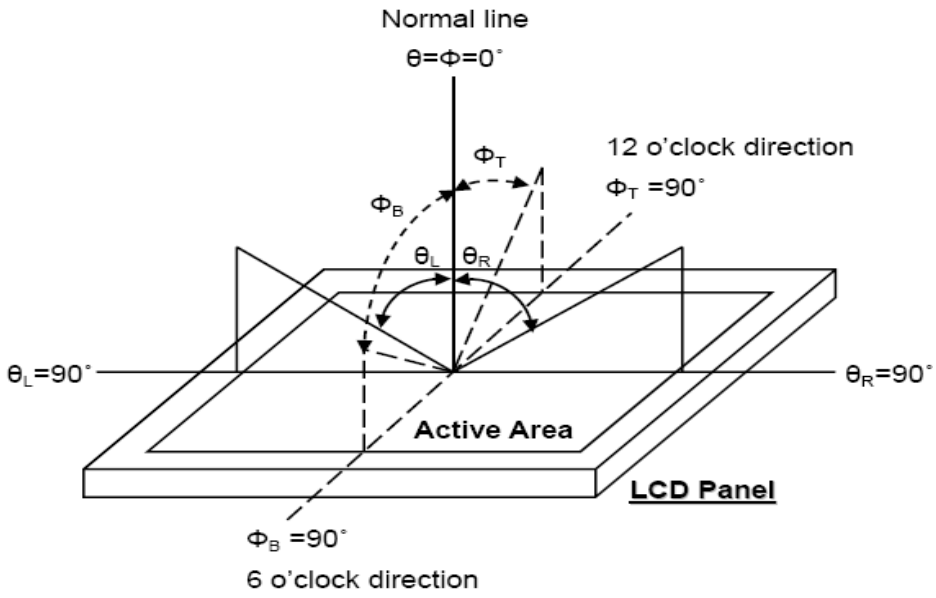


Fig. 8-1 Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 / CS2000 luminance meter 1.0°field of view at a distance o f 500mm and normal direction.

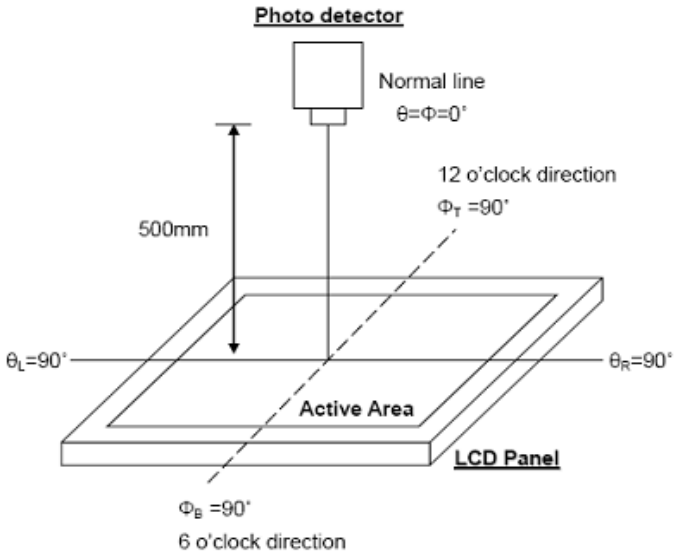
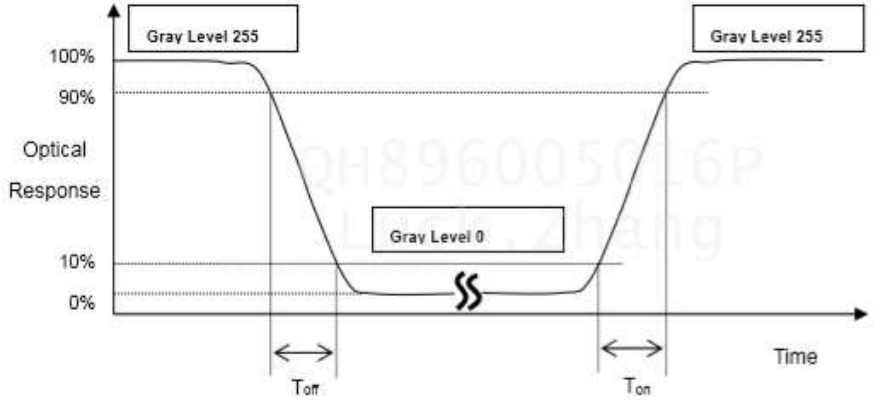


Fig. 8-2 Optical measurement system setup

Note 3: Definition of Response Time (T_R, T_F):



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

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

Note 5: Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

Note 6: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

8. INTERFACE

8.1. LCM PIN Definition

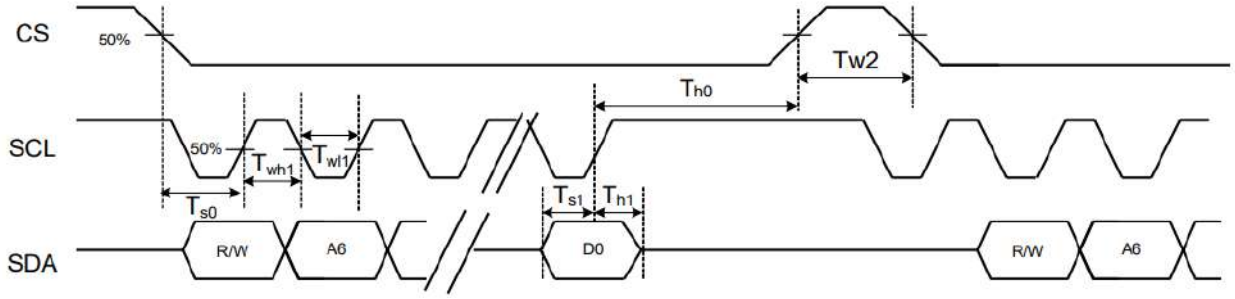
Pin	Symbol	I/O	Function	Remark
1	LED-	I	Backlight LED Ground	
2	LED-	I	Backlight LED Ground	
3	LED+	I	Backlight LED Power	
4	LED+	I	Backlight LED Power	
5	TOUCH_PANEL_Y1	O	LCD Touch Panle Y1	
6	TOUCH_PANEL_X1	O	LCD Touch Panle X1	
7	NC	-	Not Use	
8	/RESET	-	Hardware Reset	
9	SPENA	I	SPI Interface Data Enable Signal	Note 1
10	SPCLK	I	SPI Interface Data Clock	
11	SPDAT	I	SPI Interface Data	
12	B0	I	Blue Data Bit 0	
13	B1	I	Blue Data Bit 1	
14	B2	I	Blue Data Bit 2	
15	B3	I	Blue Data Bit 3	
16	B4	I	Blue Data Bit 4	
17	B5	I	Blue Data Bit 5	
18	B6	I	Blue Data Bit 6	
19	B7	I	Blue Data Bit 7	
20	G0	I	Green Data Bit0 /DX0	Note 2
21	G1	I	Green Data Bit1 /DX1	
22	G2	I	Green Data Bit2 /DX2	
23	G3	I	Green Data Bit3 /DX3	
24	G4	I	Green Data Bit4 /DX4	
25	G5	I	Green Data Bit5 /DX5	
26	G6	I	Green Data Bit6 /DX6	
27	G7	I	Green Data Bit7 /DX7	
28	R0	I	Red Data Bit0	
29	R1	I	Red Data Bit1	
30	R2	I	Red Data Bit2	
31	R3	I	Red Data Bit3	
32	R4	I	Red Data Bit4	

33	R5	I	Red Data Bit5	
34	R6	I	Red Data Bit6	
35	R7	I	Red Data Bit7	
36	HSYNC	I	Horizontal Sync Input	Note 3
37	VSYNC	I	Vertical Sync Input	
38	DCLK	I	Dot Data Clock	
39	NC	-	Not Use	
40	NC	-	Not Use	
41	Vcc	I	Digital Power	
42	Vcc	I	Digital Power	
43	TOUCH_PANEL_Y2	O	LCD Touch Panel Y2	
44	TOUCH_PANEL_X2	O	LCD Touch Panel X2	
45	NC	-	Internal test use	
46	NC	-	Not Use	
47	NC	-	Internal test use	
48	NC	I	Not Use	
49	NC	I	Not Use	
50	SEL0	I	Control the input data format L:Parallel RGB (24-bit) ; H: serial RGB(8-bit)	
51	NC	-	Not Use	
52	DE	I	Data Enable Input	Note 3
53	DGND	I	Ground	
54	AVSS	I		

Note:

1. Usually pull high.
2. IF select serial RGB(8-bit) input mode is selected, only DX0-DX7 used, and the other short to GND, only selected serial RGB interface, DX BUS will enable. Digital input mode DX0 is LSB and DX7 is MSB.
3. For digital RGB input data format, SYNC mode ,DE mode and DE+SYNC mode are supported. Suggest used DE or DE+SYNC mode. (It is necessary to keep TVE =12 and THE =43 in SYNC mode).

8.2 SPI timing Characteristics



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CS Input Setup Time	Ts0	50	-	-	ns	
Serial Data Input Setup Time	Ts1	50	-	-	ns	
CS Input Hold Time	Th0	50	-	-	ns	
Serial Data Input Hold Time	Th1	50	-	-	ns	
SCL Write Pulse High Width	Twh1	50	-	-	ns	
SCL Write Pulse Low Width	Twl1	50	-	-	ns	
SCL Read Pulse High Width	Trh1	300			ns	
SCL Read Pulse Low Width	Trl1	300			ns	
CS Pulse High Width	Tw2	400	-	-	ns	

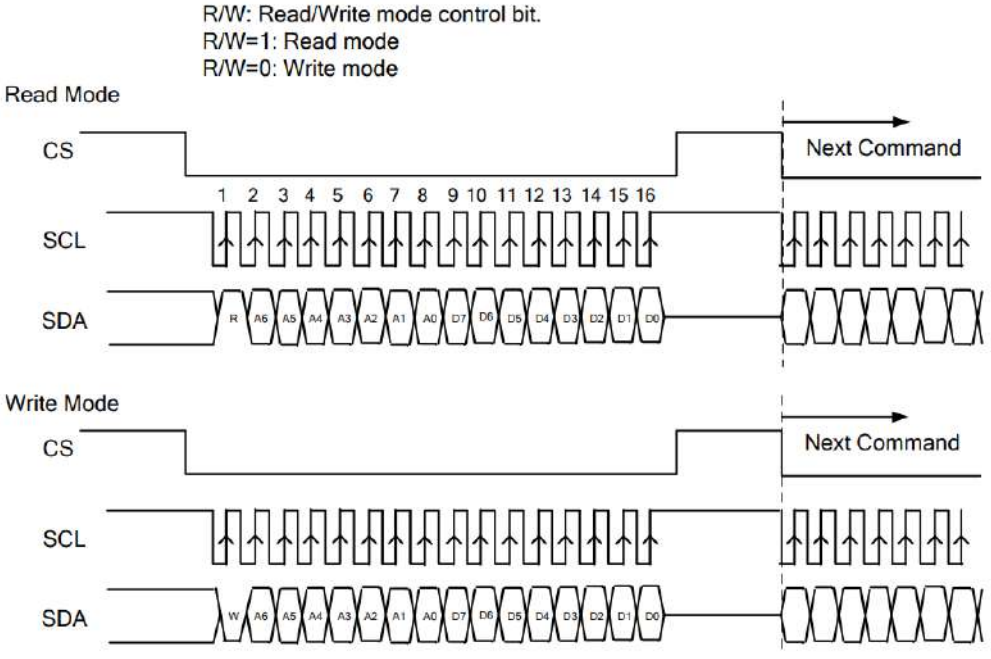


Figure 8 SPI read、write timing

a. Each serial command consists of 16 bits of data which is loaded one bit a time at the rising edge of serial clock SCL.

b. Command loading operation starts from the falling edge of CS and is completed at the next rising edge of

CS.

c. The serial control block is operational after power on reset, but commands are established by the VSYNC signal. If command is transferred multiple times for the same register, the last command before the VSYNC signal is valid.

d. If less than 16 bits of SCL are input while CS is low, the transferred data is ignored.

e. If 16 bits or more of SCL are input while CS is low, the previous 16 bits of transferred data before then rising edge of CS pulse are valid data.

f. Serial block operates with the SCL clock

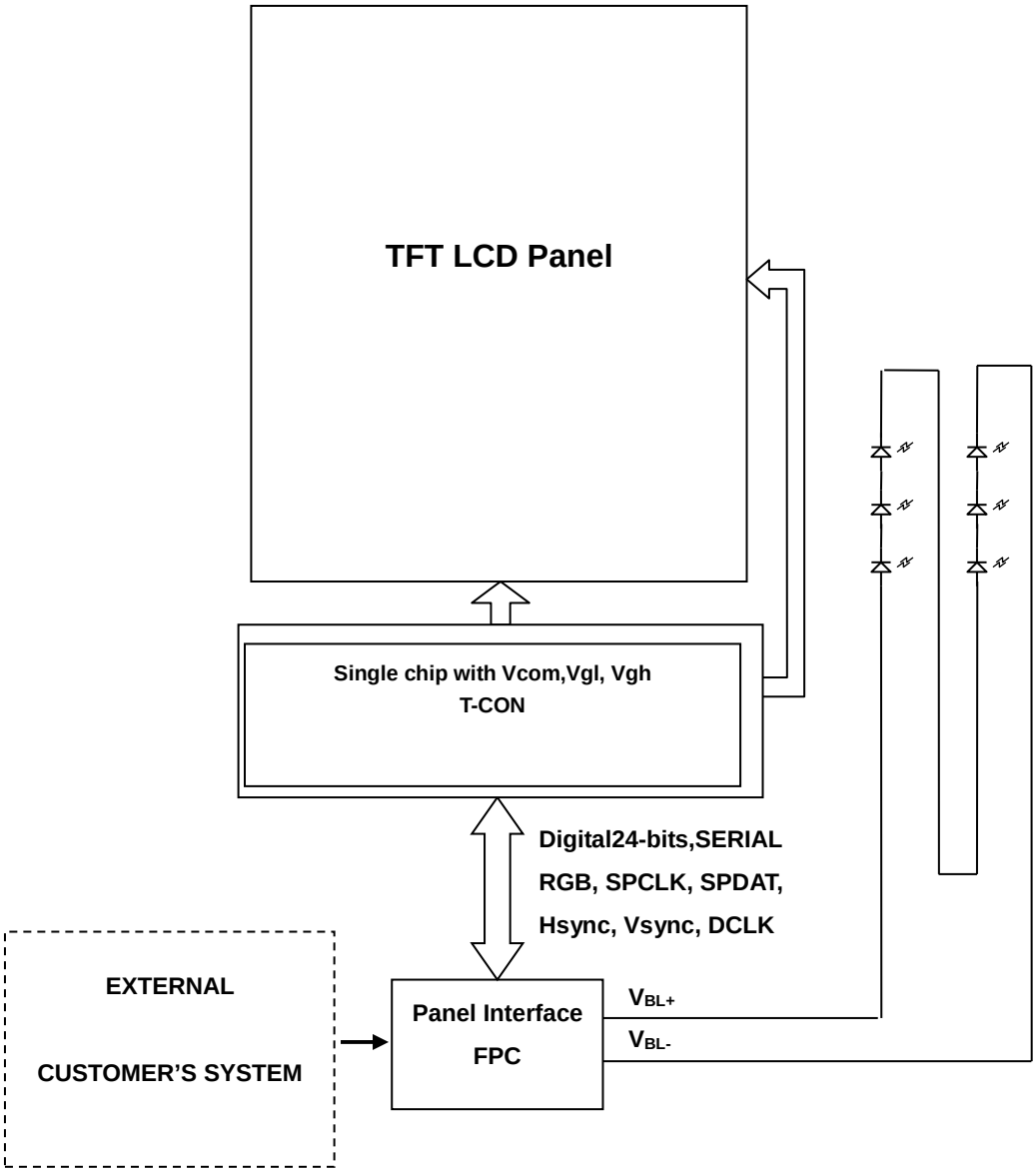
g. Serial data can be accepted in the power save mode.

h. After power on reset or GRB reset, it is required 100ms delay to begin SPI communication.

8.3 Basic Display Color and Gray Scale

Color		Input Color Data																							
		Red								Green								Blue							
		MSB							LSB	MSB							LSB	MSB							LSB
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255) Bright	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)Bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Blue(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		1	1	1	1	1	0
	Blue(255) Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		1	1	1	1	1	1

9. BLOCK DIAGRAM



10. QUALITY ASSURANCE

No.	Test Item	Test Condition	Remark
1	High Temp Storage	85℃, 240 hrs	
2	Low Temp Storasge	-30℃,240 hrs	
3	High Temp Operation	80℃, 240 hrs	
4	Low Temp Operation	-30℃, 240 hrs	
5	High Temp & High Humidity Operation	60℃,90%RH, 240 hrs	

Note:

(1) The test samples have recovery time need more than 2 hours at room temperature before the function check. In the standard conditions, there is no abnormal display function occurred.

(2) After the reliability test, the product only guarantees operation function, but don't guarantee all of the cosmetic specification.

(3) Under no condensation of dew.

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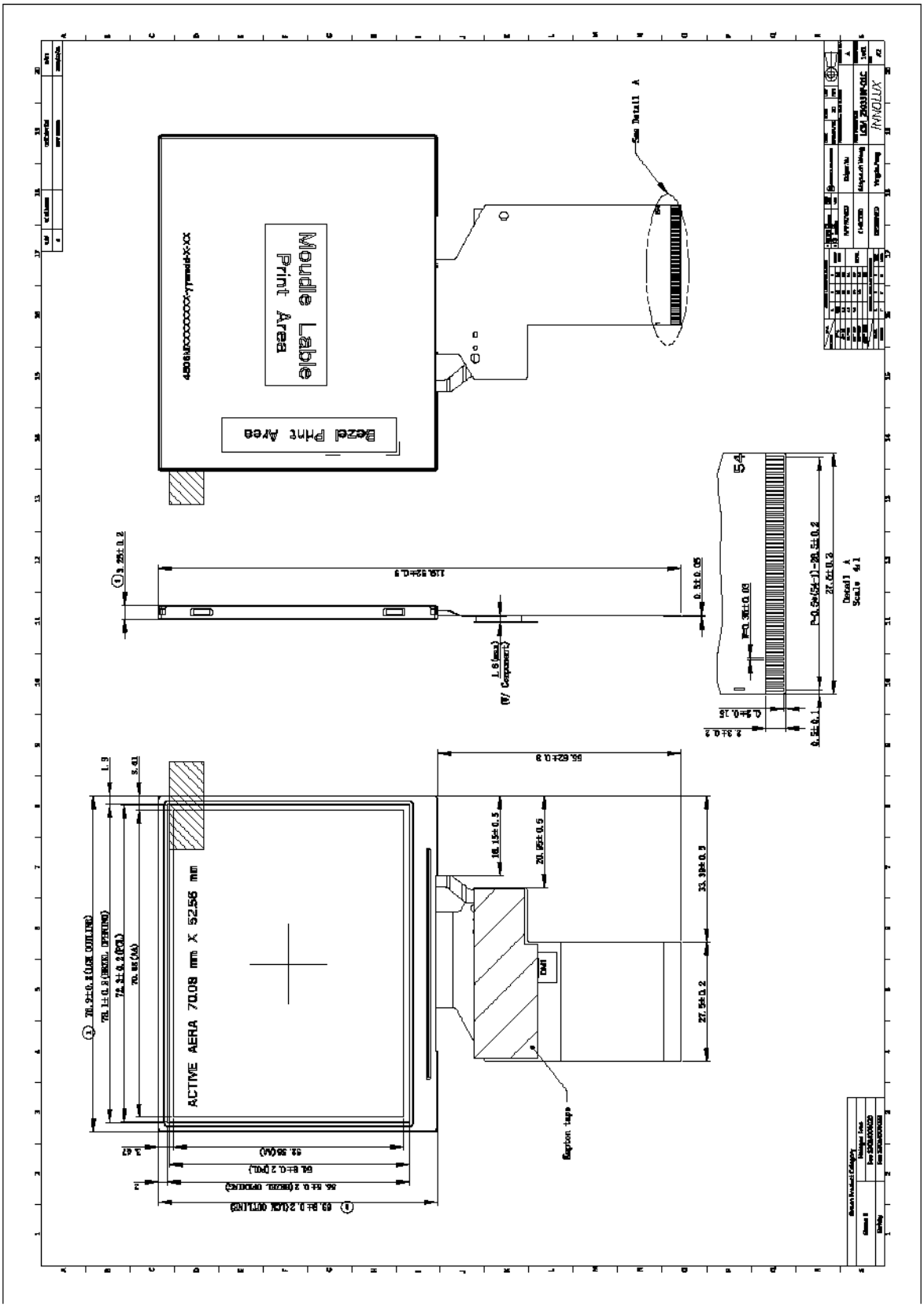
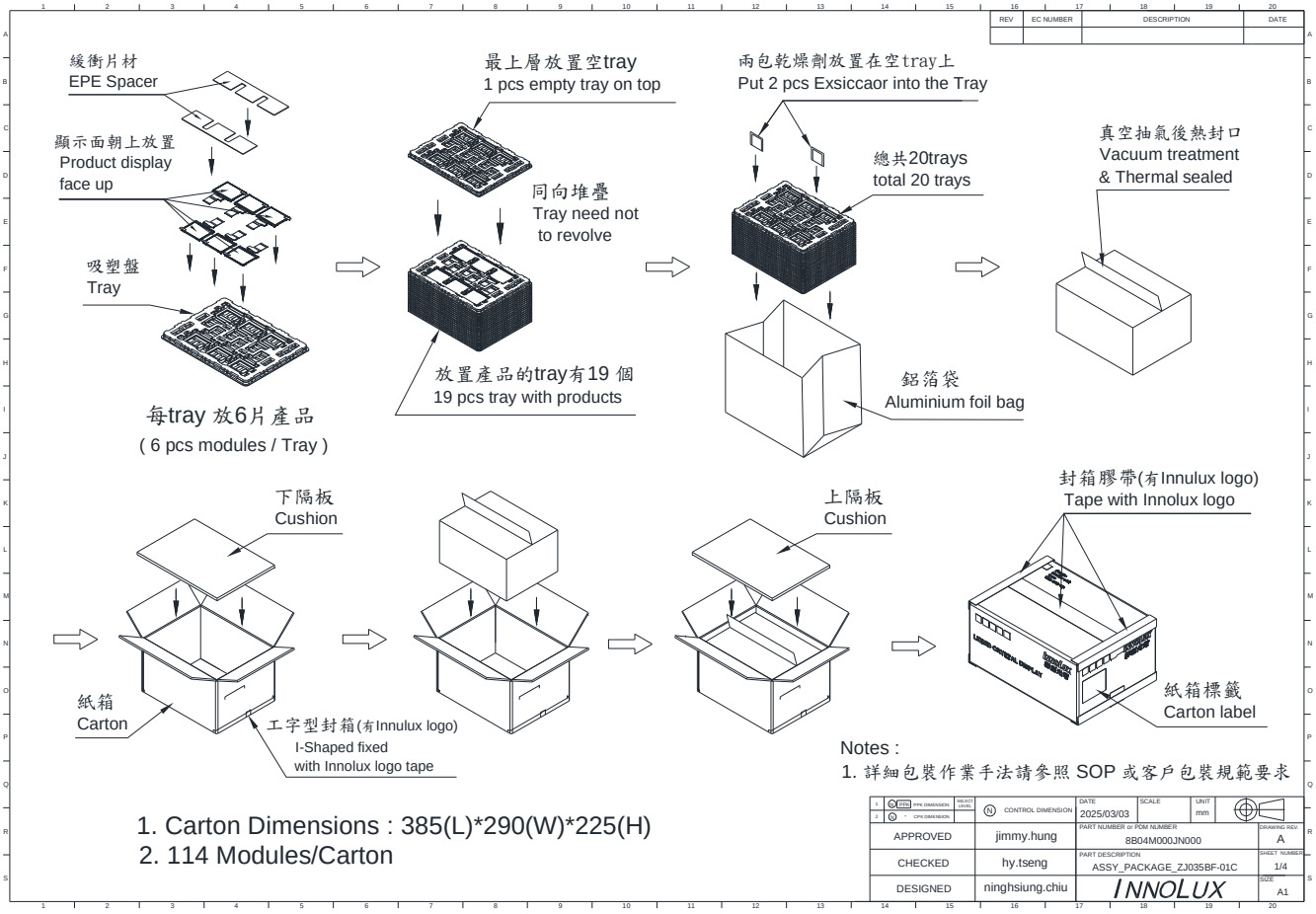
11. OUTLINE DRAWING



12. PACKAGE INFORMATION



3.5" module (ZJ035BF-01C) delivery packing method

(1). Module packed into tray cavity (with Module display face up).

(2). Next, place 2pcs EPE spacer above the display surface of the module..

(3). Tray stacking with 19 layers and with 1 empty tray above the stacking tray unit.

(4). 2pcs desiccant put on top of empty trays.

(5). Stacking tray unit put into the aluminium foil bag, and Sealed by Vacuum & Thermal treatment.

(6). Put 1pc EPE cushion inside the carton bottom, and then pack the package unit into the carton. Put 1pc EPE cushion above the package unit.

(7). Carton tapping with adhesive tape with INNOLUX logo.

13. RECAUTIONS

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

13.1 MOUNTING PRECAUTIONS

(1) You must mount a module using arranged in four corners or four sides.

(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 the 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 describe 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 are determined to the polarizer)

(7) When the surface becomes dusty, please wipe gently with adsorbent cotton or other soft materials like chamois soaks 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.

13.2 OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage：
V=±200mV(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 lower temperature, it becomes lower)
And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.

(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.

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 wristband 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℃ and 35℃ 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. 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. You can remove the glue easily.

(4) 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.