

- Tentative Specification
- Preliminary Specification
- Approval Specification

## MODEL NAME: XA070Y2-L01

### Version: LA01

<b>Customer: Common</b>	
<b>APPROVED BY</b>	<b>SIGNATURE</b>
<b>Name / Title</b> _____	_____
Note	
_____	
Please return 1 copy for your confirmation with your signature and comments.	

Approved By	Checked By	Prepared By

# SPECIFICATION FOR LCD MODULE

**Customer** : \_\_\_\_\_

**Product Model:** XA070Y2 - L01

**Sample code:** \_\_\_\_\_

Designed by	Checked by	Approved by

## Final Approval by Customer

<input type="checkbox"/> <b>LCM Machinery OK</b>  Checked By _____  <input type="checkbox"/> <b>LCM Display OK</b>  Checked By _____	<input type="checkbox"/> <b>LCM OK</b>  <input type="checkbox"/> <b>NG , Problem survey:</b>  Approved By _____
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※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

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REVISION HISTORY

Version	Revise Date	Page	Content
V1.0	2022/03/01		Initial release.

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

XA070Y2-L01 is a 7 inch IAV TFT Liquid Crystal Display module with a LED backlight unit and a-20pin 6/8bit LVDS interface controller board. The converter for the LED Backlight Unit is built in. This module supports 800 (R.G.B) x 480 WVGA mode which main application is the automotive display and industrial field.

### 1.2 FEATURES

- Free viewing angle .
- Fast response time
- Wide operating temperature
- Reversible scan function
- 6/8 bit convertible
- High Color gamut ( NTSC : 72% )

### 1.3 APPLICATION

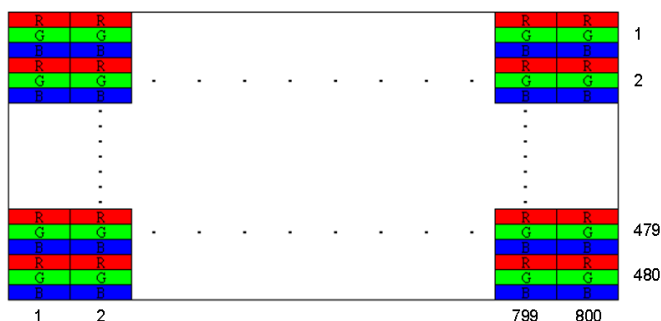
- Automotive Display
- Industry Application

### 1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Diagonal Size	7	inch	
Active Area	152.4x91.44	mm	(1)
Bezel Opening Area	155.3x94.3	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	800 x R.G.B. x 480	pixel	-
Pixel Pitch	0.1905 x 0.1905	mm	-
Pixel Arrangement	RGB Horizontal stripe	-	(2)
Display Colors	262k or 16.2M	color	-
Display Mode	Normal Black	-	-
Surface Treatment	Anti-glare, Hard Coating ( 3H )	-	-
Module Power Consumption	TBD	W	Typ.

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2)



### 1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	164.3	165	165.3	mm	(1)
	Vertical (V)	103.3	104	104.3	mm	
	Depth (D)		5.3		mm	
Weight			TBD		g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

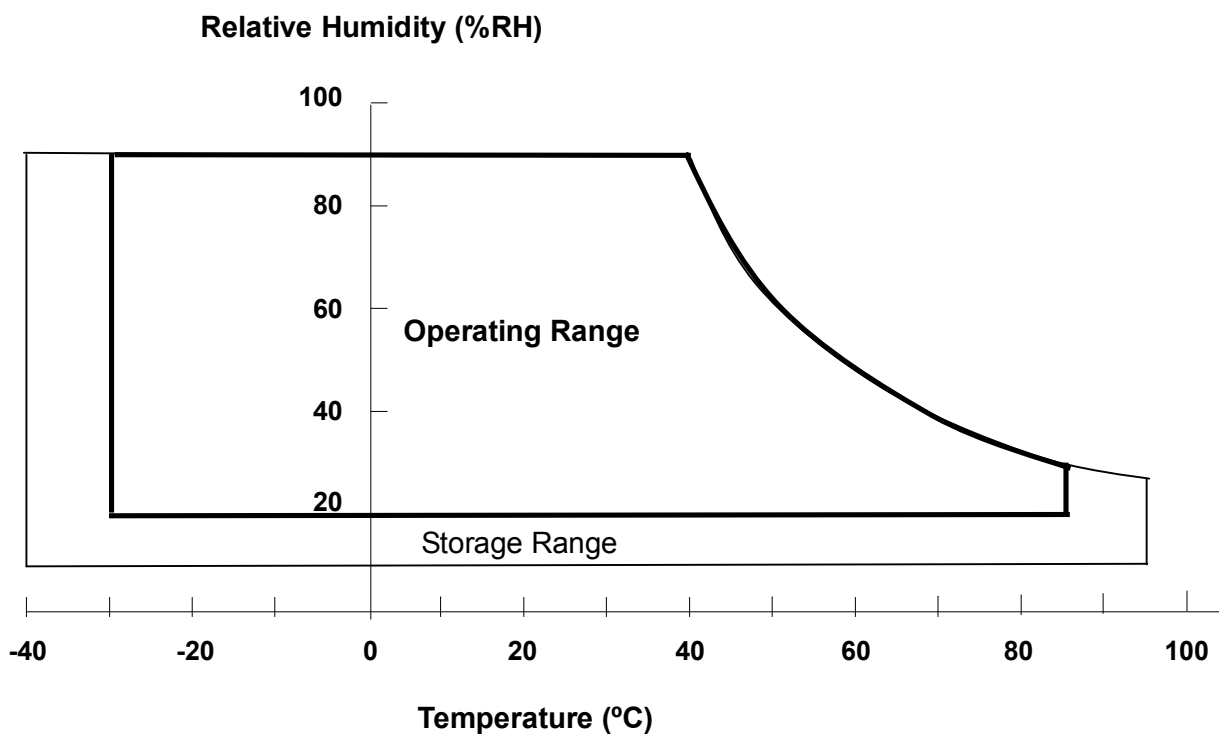
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T <sub>OP</sub>	-30	+85	°C	
Storage Temperature	T <sub>ST</sub>	-40	+95	°C	

Note (1) Temperature and relative humidity range is shown in the figure below.

(2) Wet-bulb temperature should be 39 °C Max.

(3) No condensation.

(4) The absolute maximum rating values of this product are not allowed to be exceeded at any times. The module should not be used over the absolute maximum rating value. It will cause permanently unrecoverable function fail in such an condition.



## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

Ta = 25 ± 2 °C

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	4.5	V	(1)

### 2.2.2 LED CONVERTER

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Converter Voltage	V <sub>i</sub>	-0.3	18	V	(1), (2)
Enable Voltage	EN	---	5	V	
Backlight Adjust	ADJ	---	5	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED converter (Refer to 3.2 for further information).

### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 RECOMMENDED OPERATION CONDITION

Ta = 25 ± 2 °C

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V <sub>CC</sub>	3.0	3.3	3.6	V	(1)
Rush Current	I <sub>RUSH</sub>			1.5	A	
Power Supply Current	White		140	168	mA	(2)a
	Black		170	204	mA	(2)b
LVDS Differential Input High Threshold	V <sub>TH(LVDS)</sub>			100	mV	-
LVDS Differential Input Low Threshold	V <sub>TL(LVDS)</sub>	-100			mV	-
LVDS Common Mode Voltage	V <sub>CM</sub>		1.2		V	-
Logic High Input Voltage	V <sub>IH</sub>	2.64	-	3.3	V	
Logic Low Input Voltage	V <sub>IL</sub>	0	-	0.6	V	

Note (1) The assembly should be always operated within above ranges.

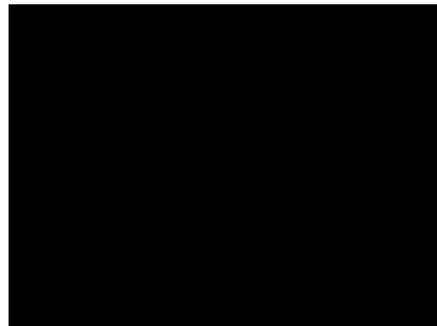
Note (2) The specified power supply current is under the conditions at  $V_{cc} = 3.3V$  ,  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$  ,  $f_v = 60$  Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area

### 3.2 BACKLIGHT UNIT

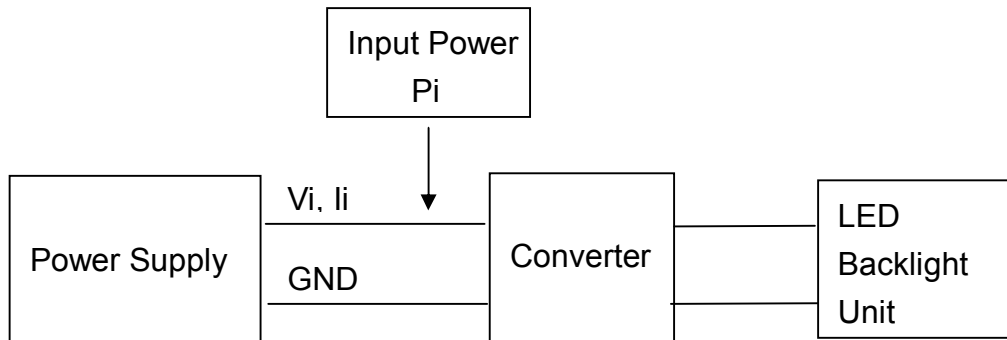
Ta = 25 ± 2 °C

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Converter Power Supply Voltage	$V_i$	10.8	12.0	13.2	V	
Converter Power Supply Current	$I_i$	---	0.24	0.264	A	@ $V_i = 12V$ (Duty 100%)
Converter Power Consumption	$P_{LED}$	---	2.8	3.08	W	@ $V_i = 12V$ (Duty 100%)
EN Control Level	Backlight on	2.5	---	5	V	
	Backlight off	0	---	0.3	V	
PWM Control Voltage		0.7	---	2.5	V	
PWM Control Duty Ratio		10		100	%	
PWM Control Frequency	$f_{PWM}$	100		500	Hz	
LED Life Time	$L_L$	50,000			Hrs	(2)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below:

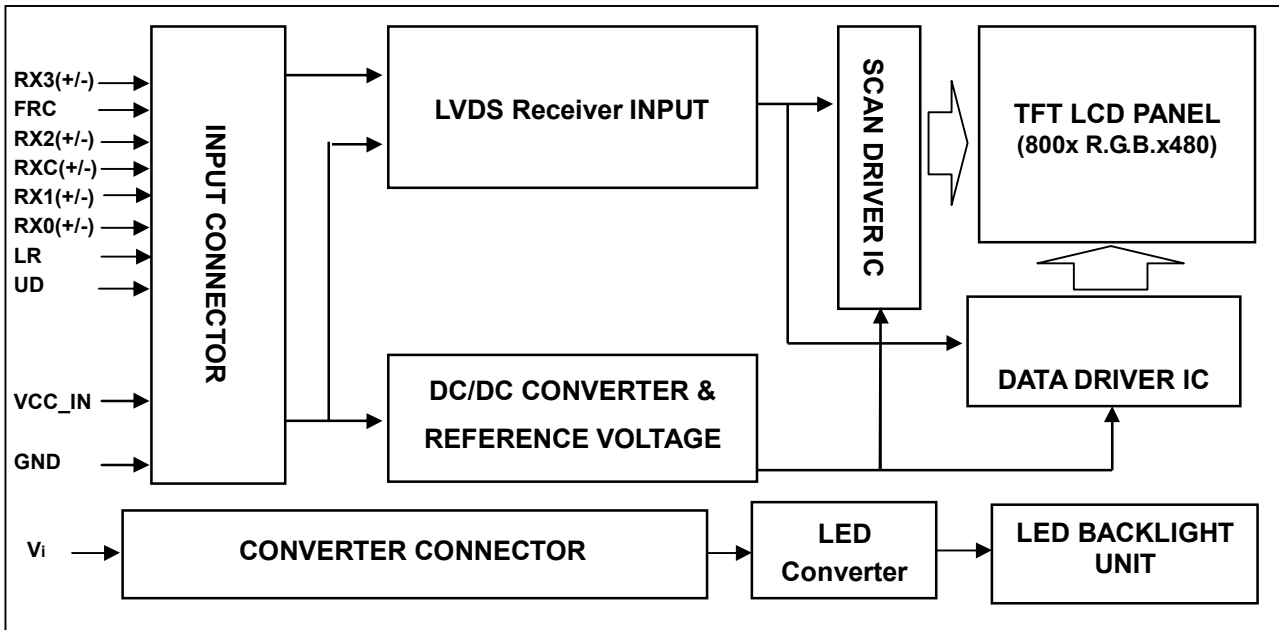
Note (2) The lifetime of LED is defined as the time when it continues to operate under the conditions at  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$  and  $I_{LED} = 50\text{mA}_{DC}$ (LED forward current) until the brightness becomes  $\leq 50\%$  of its original value.

Note (3) Please note that LED life will be shorter than the average life described in the specification if operate in higher ambient temperature.



#### 4. BLOCK DIAGRAM

##### 4.1 TFT LCD MODULE



## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 LVDS I/O PIN ASSIGNMENT

Pin	Name	I/O	Description
1	RX3+	I	LVDS differential data input Pair 3.
2	RX3-	I	
3	NC	I	No Connected
4	FRC	I	Dithering control setting When FRC=H, the width of data input 8 bits When FRC=L, the width of data input 6 bits
5	GND	I	Ground
6	RXC+	I	LVDS differential Clock input Pair
7	RXC-	I	
8	GND	I	Ground
9	RX2+	I	LVDS differential data input Pair 2
10	RX2-	I	
11	GND	I	Ground
12	RX1+	I	LVDS differential data input Pair 1
13	RX1-	I	
14	GND	I	Ground
15	RX0+	I	LVDS differential data input Pair 0
16	RX0-	I	
17	LR	I	Shift direction of Source Driver IC internal shift register is controlled by this pin as show below: LR=H SO1→ .....SO1200 (Default pull high) LR=L SO1200→ .....SO1
18	UD	I	Gate Driver Up/down scan setting When UD=H, reverse scan When UD=L, normal scan (Default pull low)
19	VCC_IN	I	Digital power supply (+3.3V)
20	VCC_IN	I	Digital power supply (+3.3V)

Note (1) Connector Part No.: 076B20-0048RA-G4,Starconn or equivalent

### 5.2 BACKLIGHT PIN ASSIGNMENT (Converter connector pin)

No	Symbol	I/O	Description
1	Vi	I	Converter input voltage
2	ADJ	I	Backlight Adjust
3	EN	I	Enable pin
4	V <sub>GND</sub>		Converter ground

Note (1) Connector Part No: LM123S004HTF13 or compitable,4 PIN,UNE

### 5.3 SCANNING DIRECTION

The following figures show the image see from the front view. The arrow indicates the direction of scan.

Fig.1 Normal Scan



Fig.2 Reverse Scan



Fig.3 Reverse Scan



Fig.4 Reverse Scan



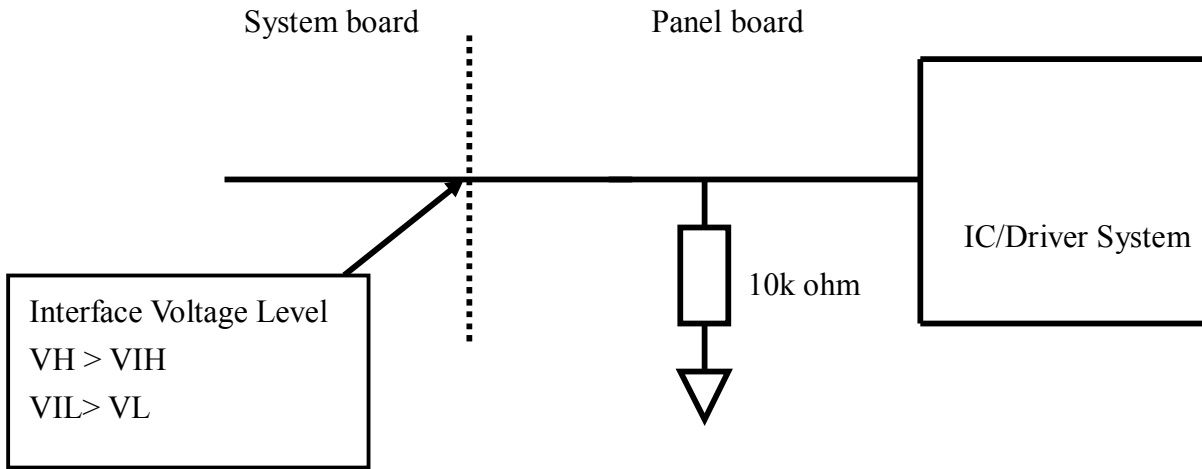
Fig. 1 Normal scan ( pin 17, LR = High ; pin 18, UD = Low )

Fig. 2 Reverse scan ( pin 17, LR = Low ; pin 18, UD = Low )

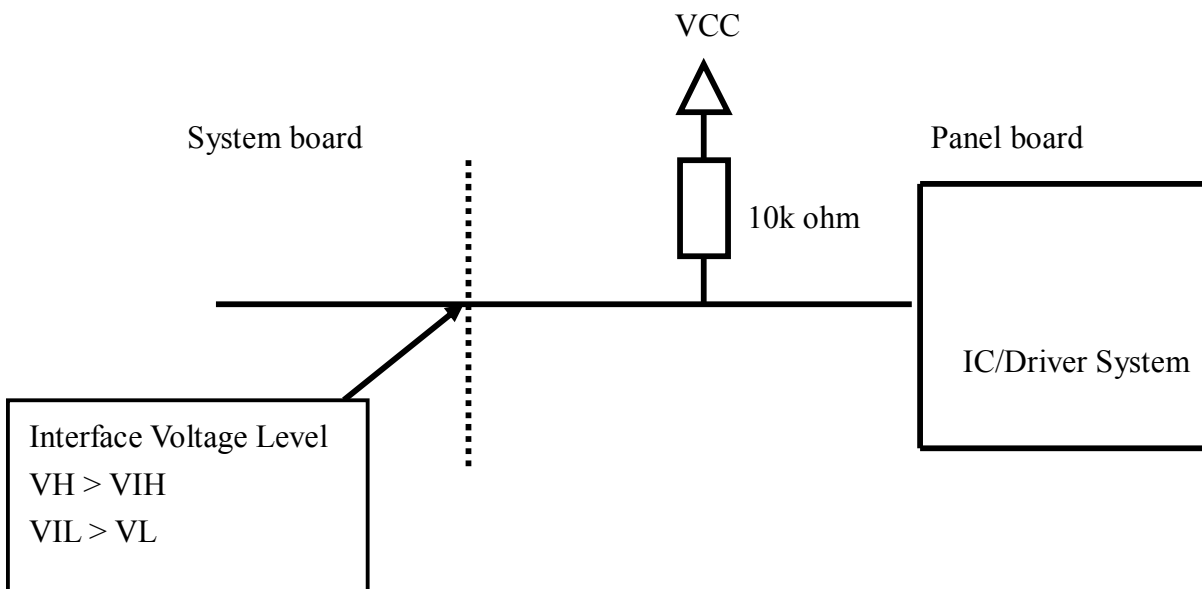
Fig. 3 Reverse scan ( pin 17, LR = High ; pin 18, UD = High )

Fig. 4 Reverse scan ( pin 17, LR = Low ; pin 18, UD = High )

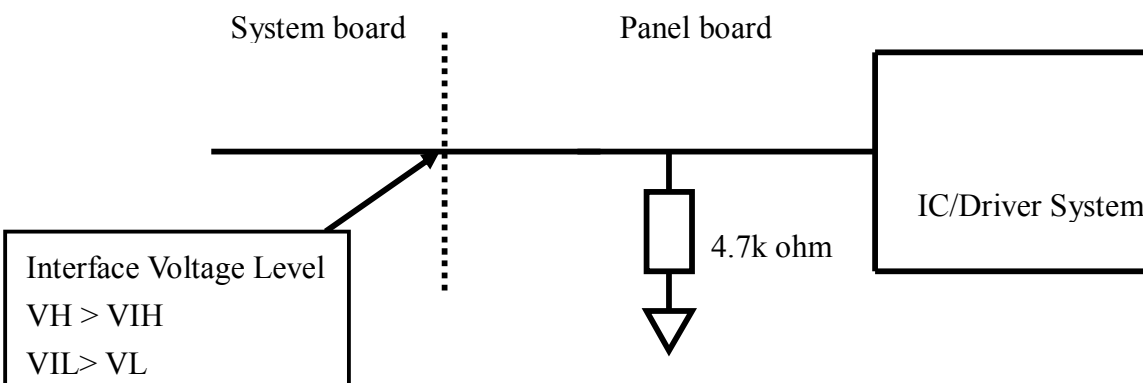
**UD Signal**



**LR Signal**



**FRC Signal**



### 5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input. ( 0: Low Level Voltage, 1: High Level Voltage)

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
Gray Scale Of Red	Red(0) / Dark	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	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	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	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	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	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

( 0: Low Level Voltage, 1: High Level Voltage)

Color		Data Signal																						
		Red								Green								Blue						
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1
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
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	Blue	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
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Yellow	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
Gray Scale Of 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	
	Red(1)	0	0	0	0	0	0	0	1	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	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	Red(253)	1	1	1	1	1	1	0	1	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	
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of 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	
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	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	
Gray Scale Of 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	
	Blue(1)	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	1	0	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	

## 6. INTERFACE TIMING

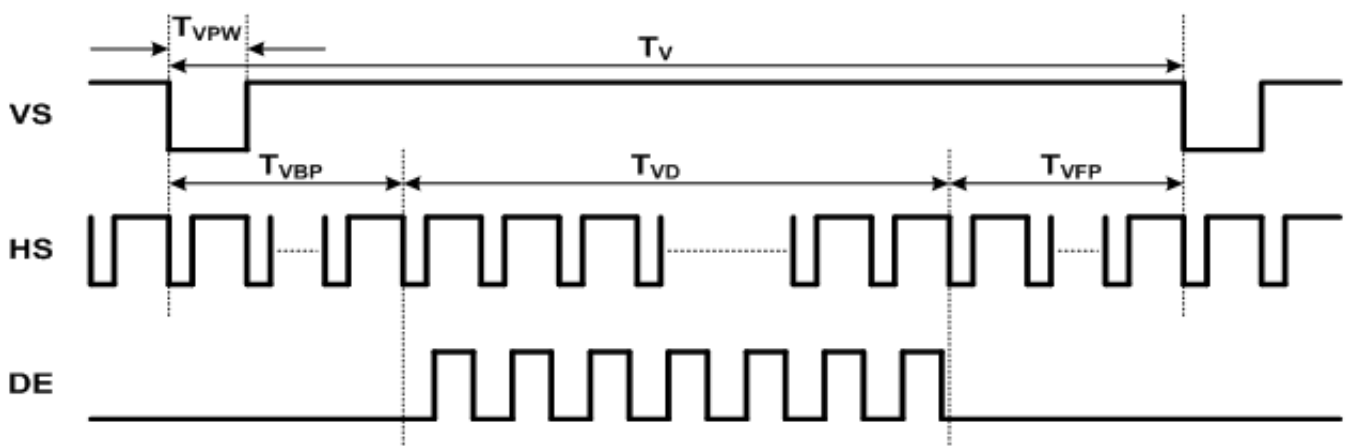
### 6.1 TIMING CONDITION

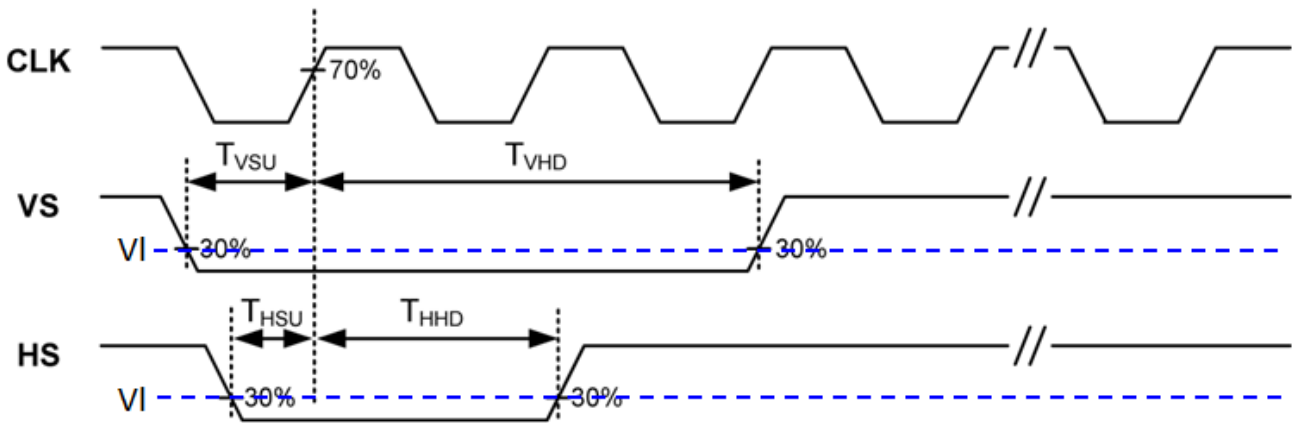
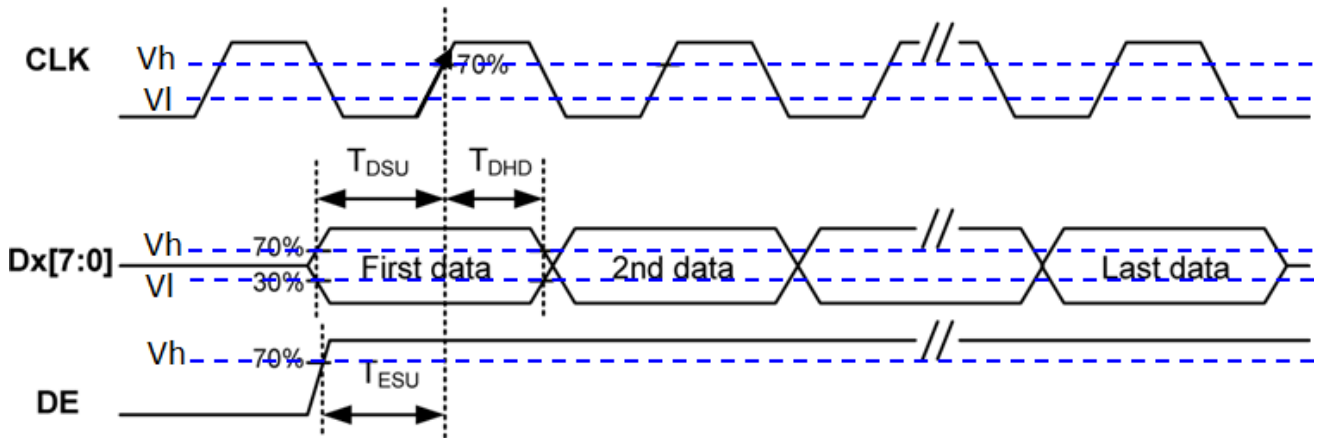
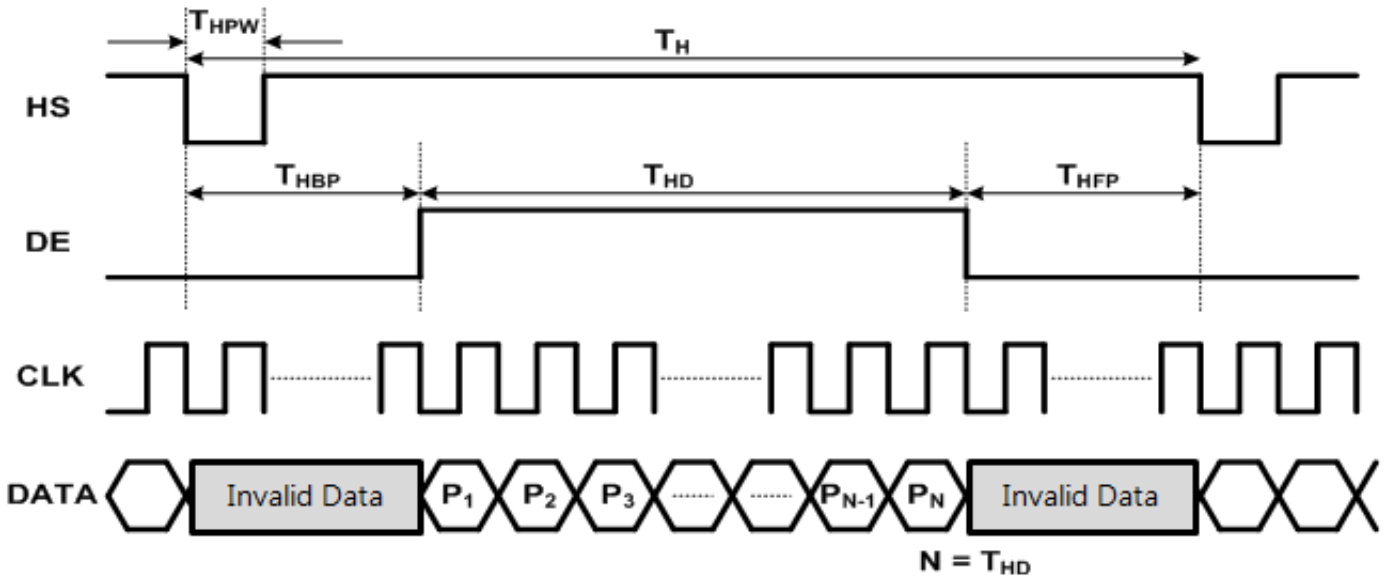
Item	Symbol	Min	Typ	Max	Unit	Remark
Clock frequency	F <sub>CLK</sub>	27.027	29.988	40.0	MHz	
Vertical display area	T <sub>VD</sub>	480			H	
Vertical period area	T <sub>V</sub>	525	525	530	H	
Vertical blanking area	T <sub>VB</sub>	45	45	50	H	Note1
Vertical pulse width	T <sub>VPW</sub>	3			H	
Vertical back porch	T <sub>VBP</sub>	20			H	
Vertical front porch	T <sub>VFP</sub>	25	25	30	H	
Horizontal display area	T <sub>HD</sub>	800			dclk	
Horizontal period area	T <sub>H</sub>	858	952	1258	dclk	
Horizontal blanking area	T <sub>HB</sub>	58	152	458	dclk	Note2
Horizontal pulse width	T <sub>HPW</sub>	3			dclk	
Horizontal back porch	T <sub>HBP</sub>	48			dclk	
Horizontal front porch	T <sub>HFP</sub>	10	104	410	dclk	
HS setup time	T <sub>HSU</sub>	6	-	-	ns	
HS hold time	T <sub>HHD</sub>	6	-	-	ns	
VS setup time	T <sub>VSU</sub>	6	-	-	ns	
VS hold time	T <sub>VHD</sub>	6	-	-	ns	
Data setup time	T <sub>DSU</sub>	6	-	-	ns	
Data hold time	T <sub>DHU</sub>	6	-	-	ns	
DE setup time	T <sub>ESU</sub>	6	-	-	ns	

Note1:  $T_{VB} = T_V - T_{VD}$

Note2:  $T_{HB} = T_H - T_{HD}$

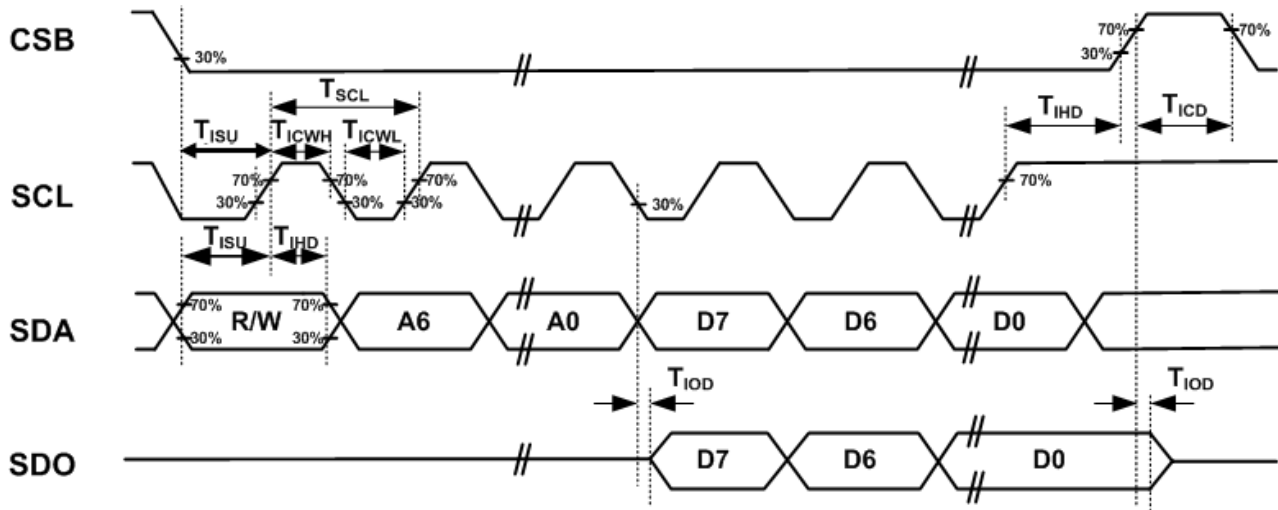
### 6.2 TIMING DIAGRAM





Note : Latch data at CLK Rising Edge.

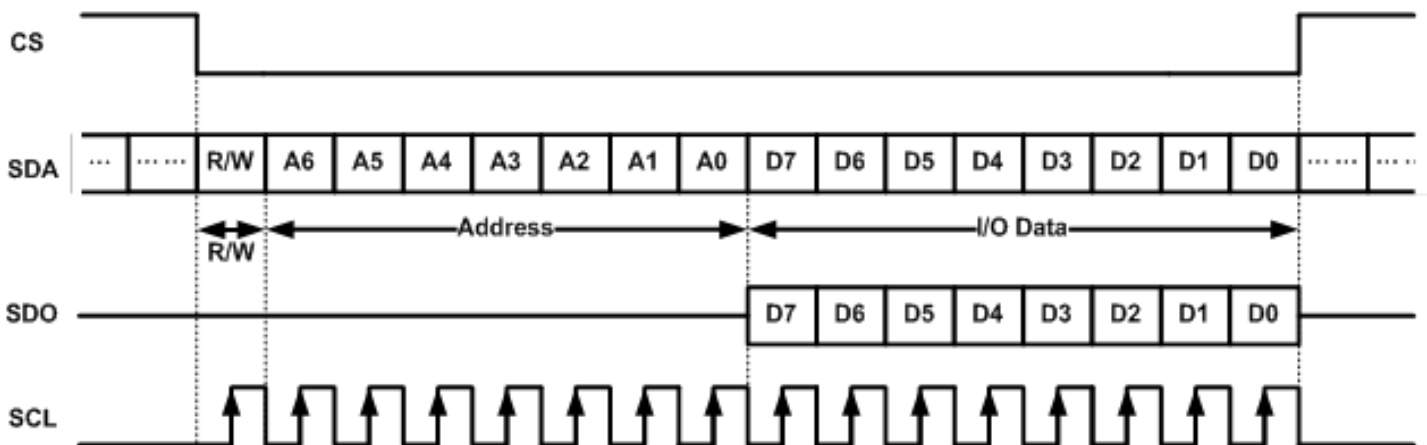
### Serial control interface AC characteristic



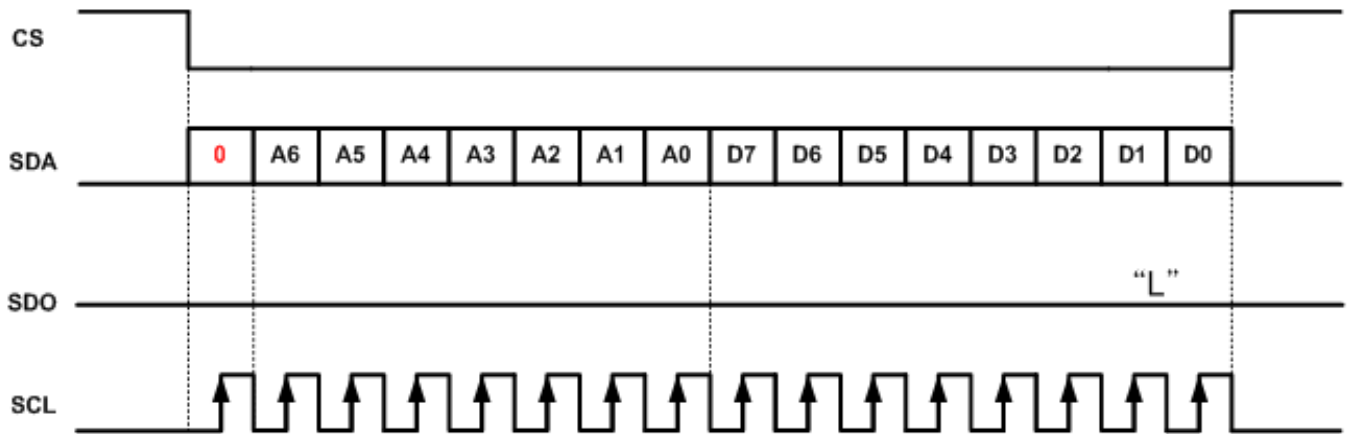
Item	Symbol	Min	Typical	Max	Unit
Serial clock	T <sub>SCL</sub>	330	-	-	ns
SCL HIGH period	T <sub>ICWH</sub>	150	-	-	ns
SCL LOW period	T <sub>ICWL</sub>	150	-	-	ns
Serial data setup time	T <sub>ISU</sub>	120	-	-	ns
Serial data hold time	T <sub>IHD</sub>	120	-	-	ns
Serial output delay time	T <sub>IOD</sub>	-	-	30	ns
Chip select distinguish	T <sub>ICD</sub>	1	-	-	us

### Timing chart

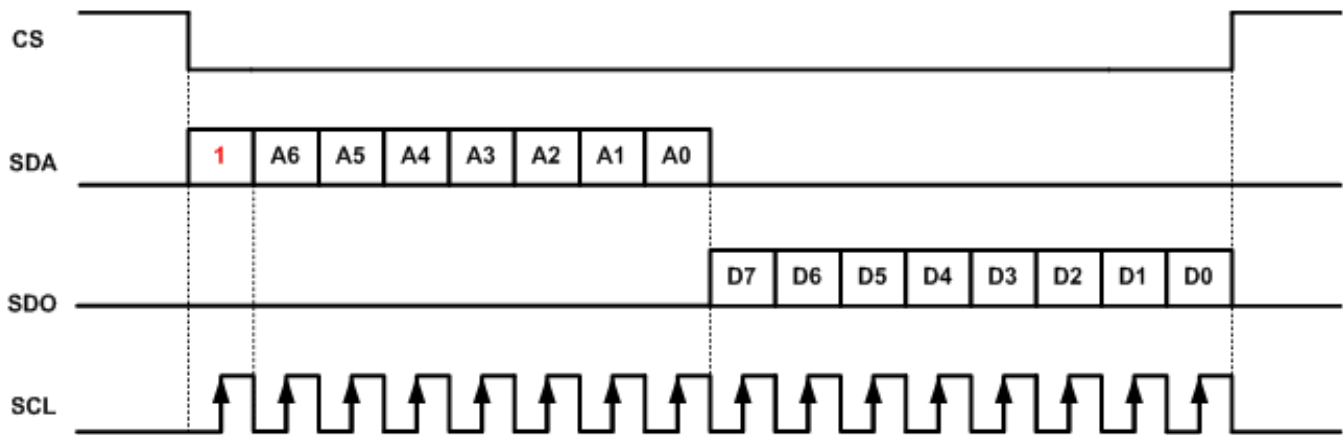
MSB															LSB
R/W	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
R/W	Address							I/O Data							



Write Mode:



Read Mode:



### 6.3 POWER ON/OFF SEQUENCE

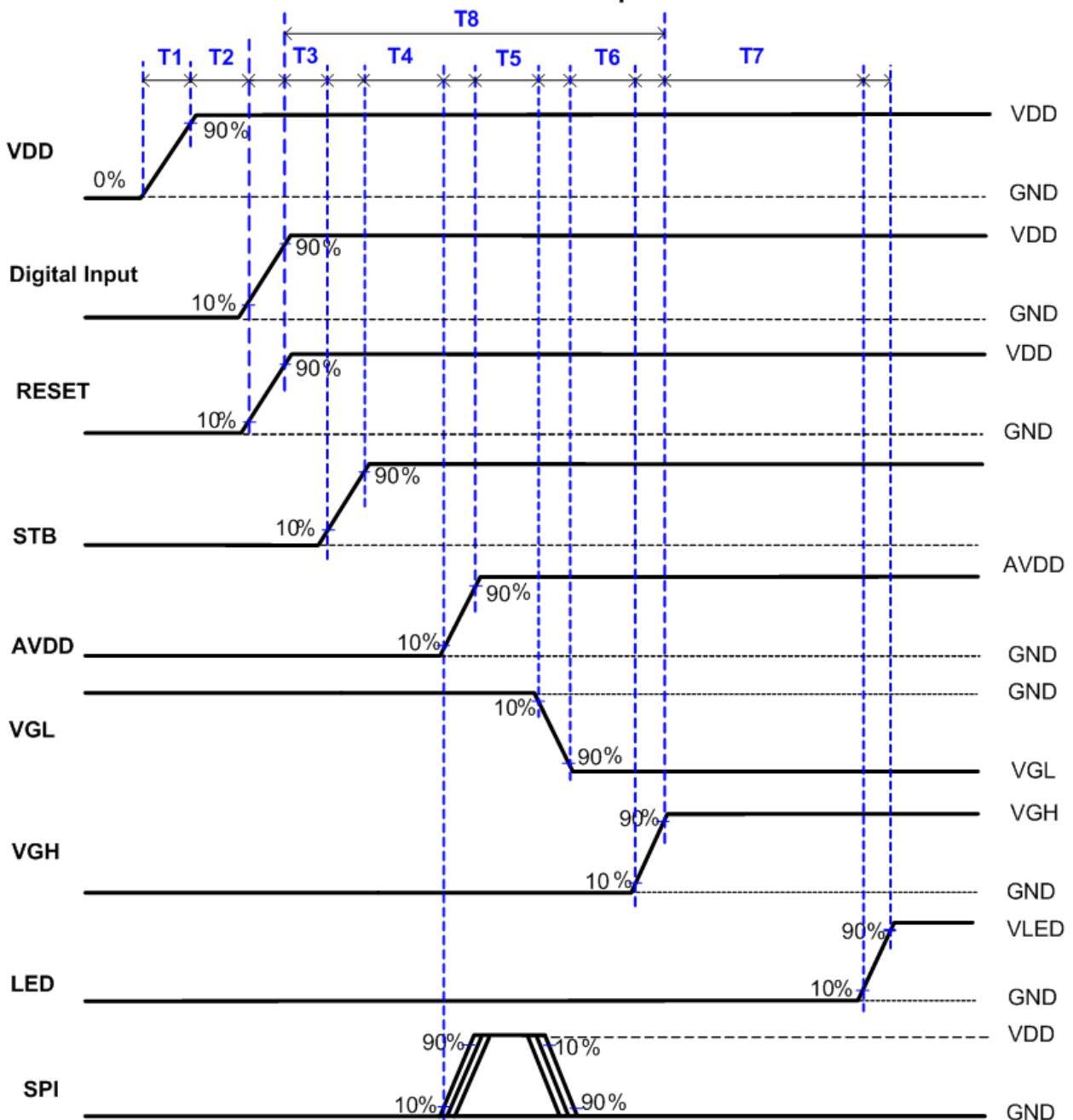
The suggested LCD power sequence is below. The LCD suggested voltage is 0V, so it will be permanently damaged under a wrong power on/off sequence.

#### Panel Power on sequence:

Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0.5ms	--	20	ms
T2	1	--	--	ms
T3	0	--	--	ms
T4	20	--	--	ms
T5	1	--	--	ms
T6	1	--	--	ms
T7	$T7+T8 \geq 140ms$	--	--	ms
T8	--	--	80	ms

VDD → Digital Input & RESET → STB → AVDD & SPI → VGL → VGH → LED:

#### Power on sequence

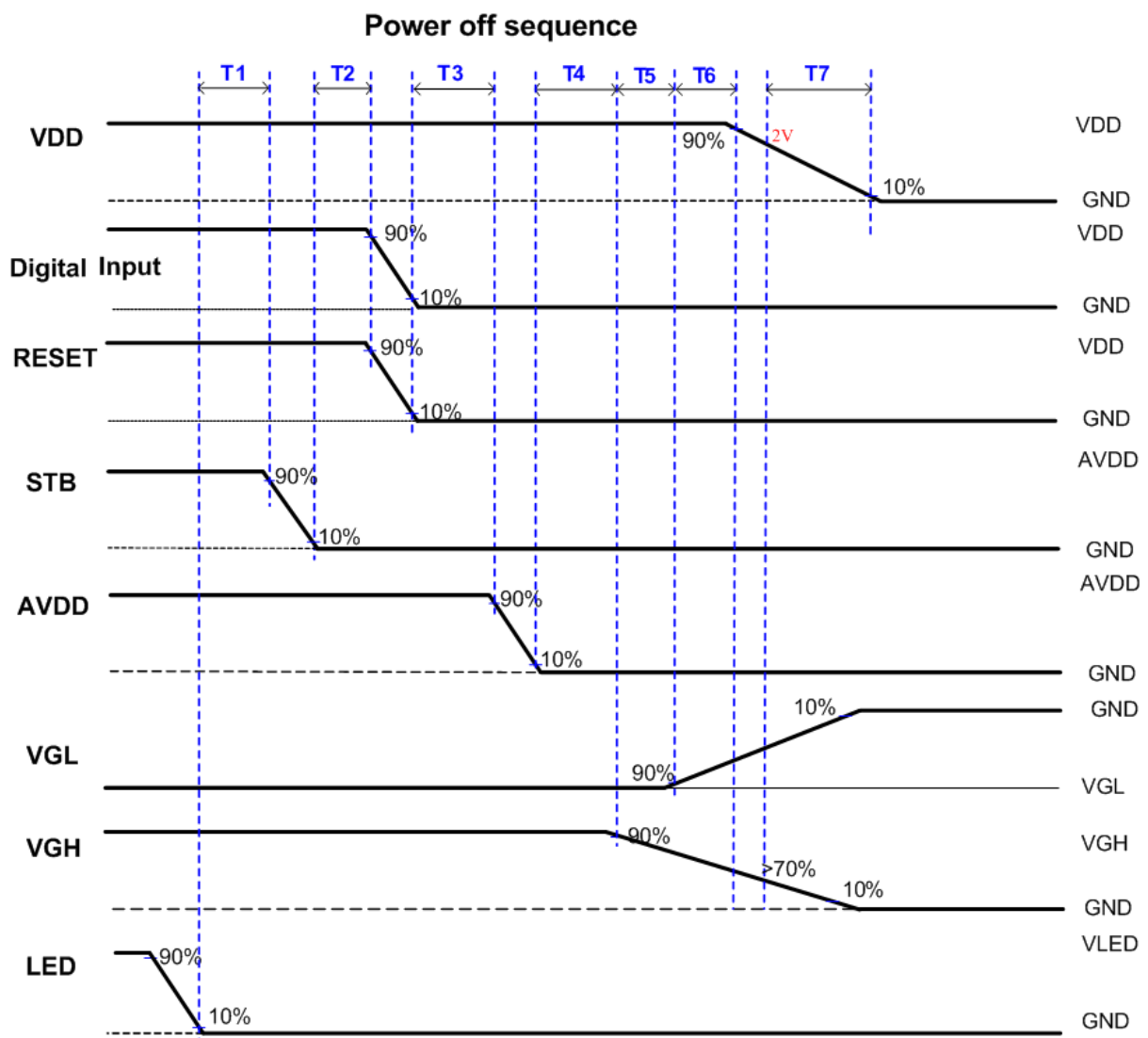


Note: Reset signal must rising after VDD signal

**Panel Power off sequence:**

Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0	--	-	ms
T2	100	--	120	ms
T3	0	--	1	ms
T4	0	--	1	ms
T5	0	--	1	ms
T6	0	--	1	ms
T7	0	--	--	ms

LED → STB → Digital input & RESET → AVDD → VGH → VGL → VDD



Note: All signal must be discharge to zero voltage when power off.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V <sub>CC</sub>	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Current	I <sub>f</sub>	50±3	mA
Converter Duty		100	%

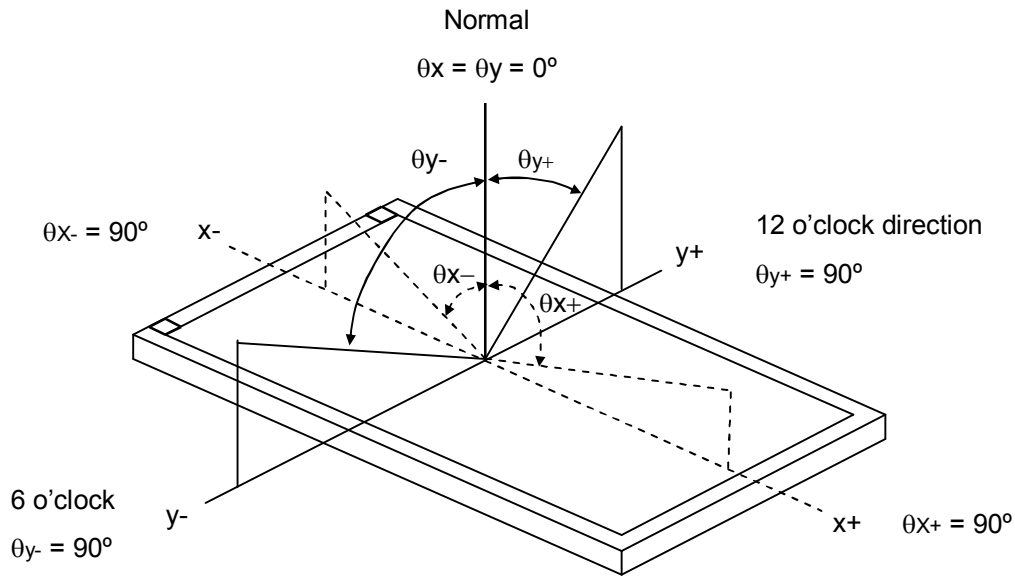
Note (1) I<sub>f</sub> means the forward current of each channel

### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note						
Color Chromaticity	Red	R <sub>x</sub>	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing Normal Angle	Typ - 0.03	0.645	Typ + 0.03		(1), (6)						
		R <sub>y</sub>			0.341									
	Green	G <sub>x</sub>			0.312									
		G <sub>y</sub>			0.625									
	Blue	B <sub>x</sub>			0.153									
		B <sub>y</sub>			0.053									
	White	W <sub>x</sub>			0.313									
		W <sub>y</sub>			0.329									
	Center Luminance of White				L <sub>C</sub>					400	500		cd/m <sup>2</sup>	(4), (6)
	Contrast Ratio				CR					800	1000		-	(2), (6)
Response Time		T <sub>R</sub> T <sub>F</sub>			20		Ms	(3)						
White Variation		δW			1.25	1.4	-	(5), (6)						
Viewing Angle	Horizontal	θ <sub>x+</sub>	CR ≥ 10	70	80		Deg.	(1), (6)						
		θ <sub>x-</sub>		70	80									
	Vertical	θ <sub>y+</sub>		70	80									
		θ <sub>y-</sub>		70	80									

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

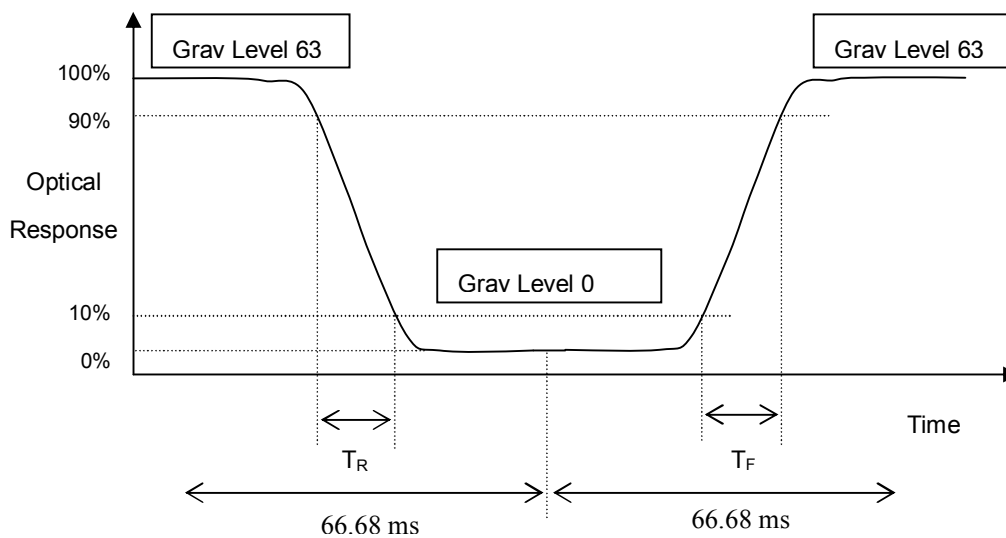
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

Note (3) Definition of Response Time ( $T_R$ ,  $T_F$ ) and measurement method:



Note (4) Definition of Luminance of White ( $L_C$ ):

Measure the luminance of gray level 63 at center point

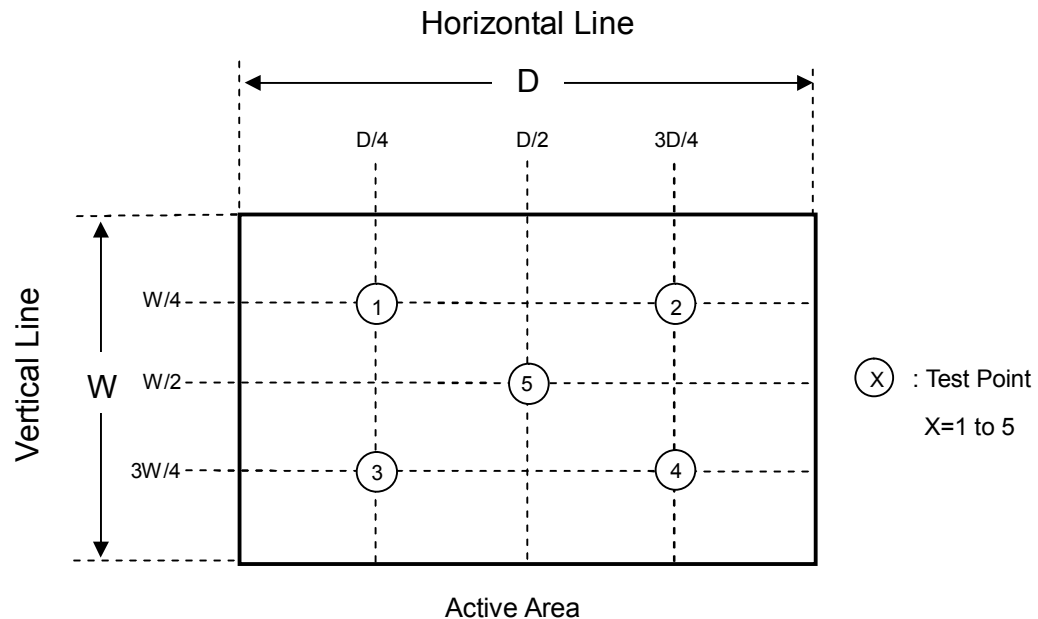
$$L_C = L(5)$$

$L(x)$  is corresponding to the luminance of the point X at Figure in Note (5).

Note (5) Definition of White Variation ( $\delta W$ ):

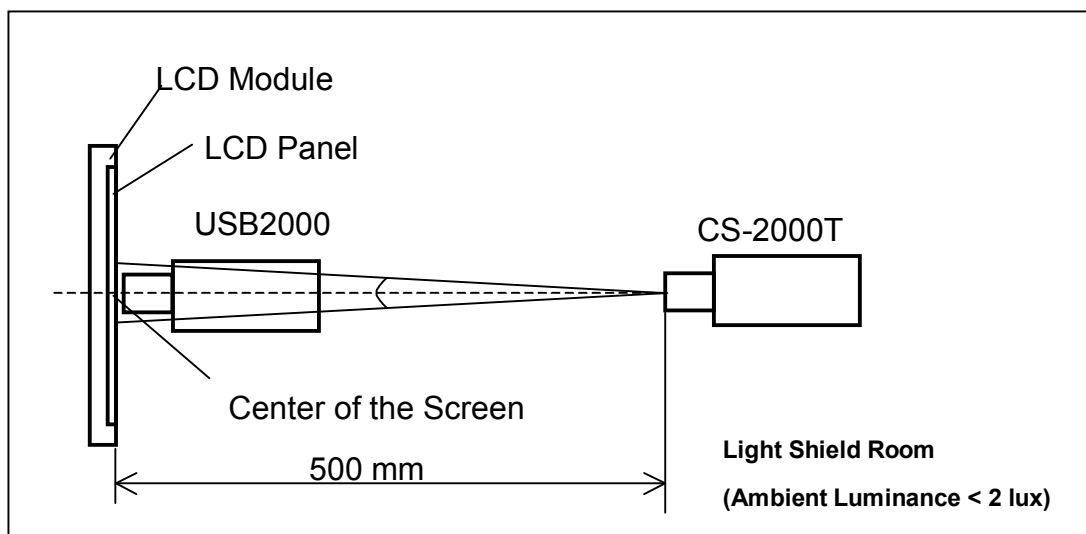
Measure the luminance of gray level 63 at 5 points

$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$$



Note (6) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



## 8. RELIABILITY TEST

### 8.1 RELIABILITY TEST CONDITION

No.	Test Item	Test Condition	Note
1	High Temperature Storage	90°C , 240 hours	(1),(2) (4),(5)
2	Low Temperature Storage	-40°C , 240 hours	
3	Thermal Shock Storage	{(-40°C , 0.5 hour) (85°C , 0.5 hour)}, 100 cycles	
4	High Temperature Operating	85°C , 240 hours	
5	Low Temperature Operating	-30°C , 240 hours	
6	High Temperature & High Humidity Operating	60°C , 90% RH, 240hours	(1),(2) (4),(6)
7	Shock (Non-Operating)	100G, 6ms, half sine wave, 3 times for ± X, ± Y, ± Z.	(3)
8	Vibration (Non-Operating)	3G, 10 ~ 200 Hz, 10min/cycle, 3 cycles each X, Y, Z	(3)

Note (1) There should be no condensation on the surface of panel during test.

Note (2) The temperature of panel display surface area should be 95°C Max.

Note (3) 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.

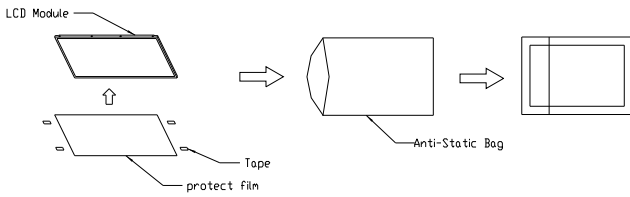
Note (4) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before the reliability test.

Note (5) Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

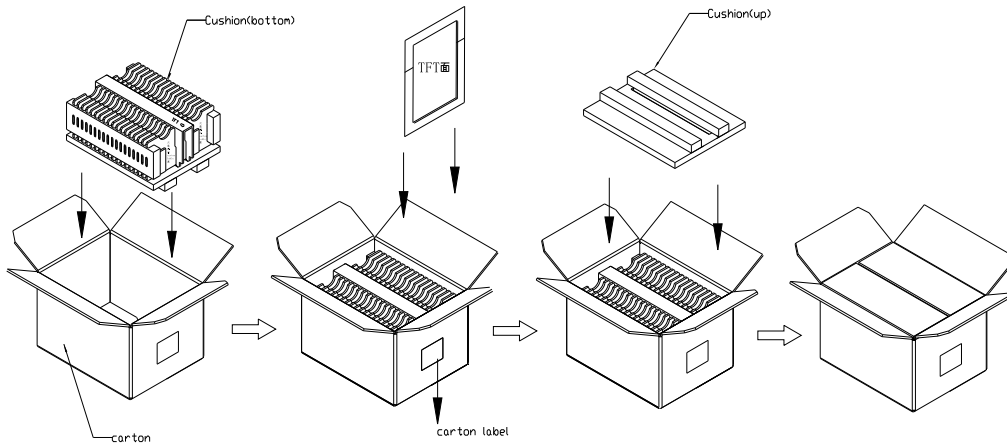
Note (6) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

## 9. PACKAGING

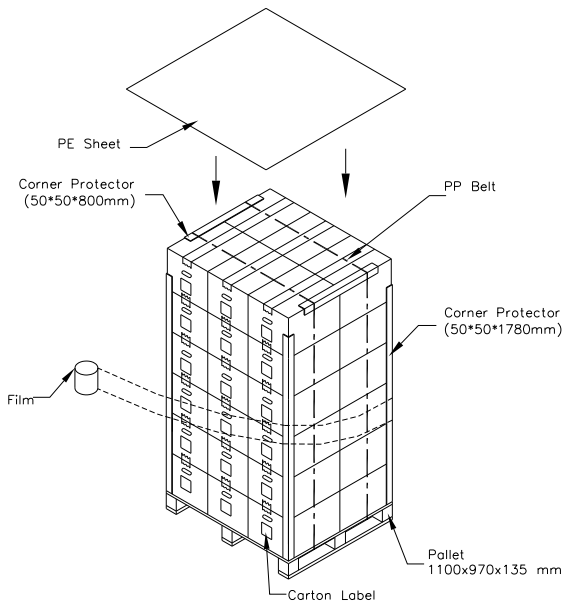
### 9.1 PACKING METHOD



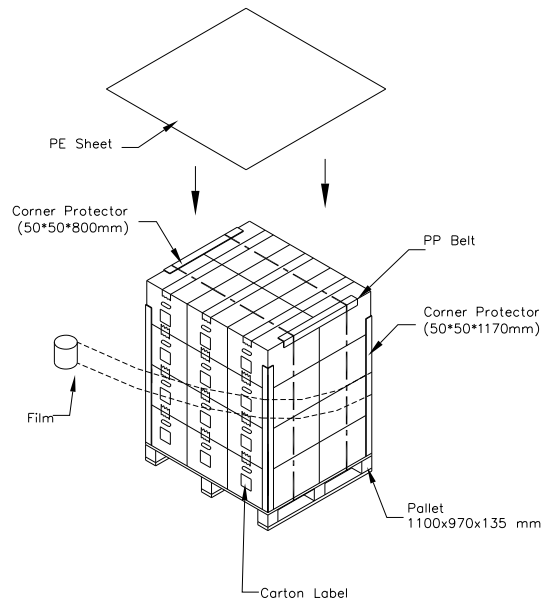
- (1) 34pcs Modules/1 box
- (2) Carton dimensions : 465(L)x362(W)x314(H)mm



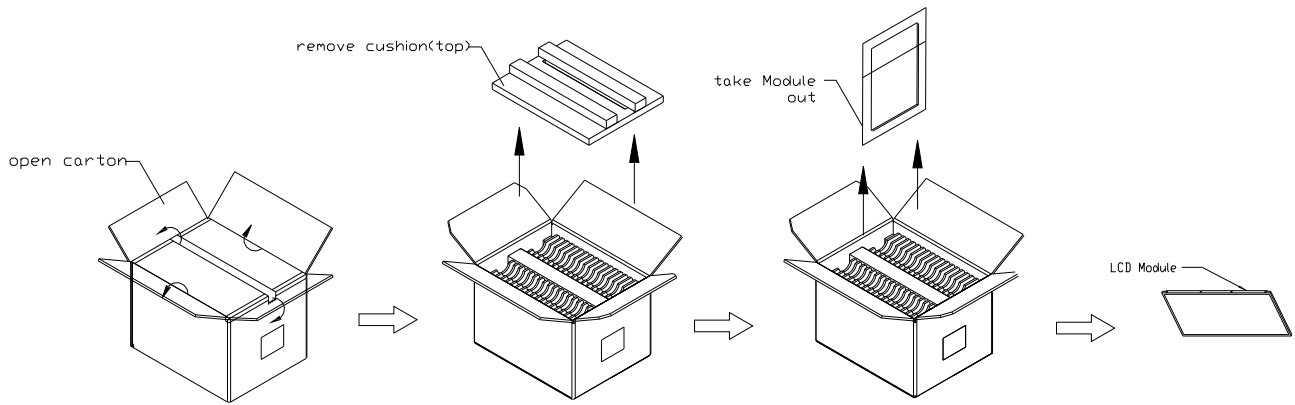
#### Sea / Land Transportation (40ft Container)



#### Air Transportation



## 9.2 UN-PACKING METHOD



## 10. PRECAUTIONS

### 10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly.
- (11) Do not keep same pattern in a long period of time. It may cause image sticking on LCD

### 10.2 SAFETY PRECAUTIONS

- (1) Do not disassemble the module or insert anything into the Backlight unit to prevent electrical shock.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

### 11. MECHANICAL CHARACTERISTICS

