TFT LCD Tentative Specification

MODEL NO.: G070Y1-T01

Customer: _____

Approved by: _____

Note:

Liquid Crystal Display Division	
QRA Division.	OA Head Division.
Approval	Approval

- CONTENTS -

REVISION HISTORY

Version	Date	Section	Description
Ver 0.0	Aug ,08, 06'	All	G070Y1-T01 Specifications was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G070Y1-T01 is a 7inch TFT Liquid Crystal Display module with a CCFL Backlight unit and a-50-pin-and-1ch-TTL interface. This module supports 800 (R.G.B)x 480 WVGA mode which main application is the Automotive Monitor and Industrial field.

1.2 FEATURES

- Wide viewing angle.
- Fast response time
- WVGA (800 x 480 pixels) resolution
- Wide operating temperature
- Reversible - scan function

1.3 APPLICATION

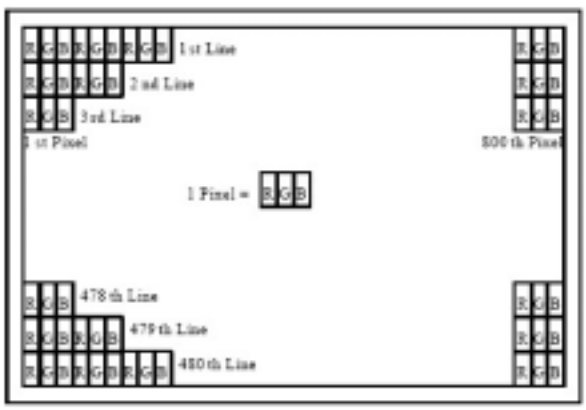
- Automotive Monitor
- Factory Application

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Diagonal Size	177.7 (7 Inch)	mm	
Active Area	152.4x91.44	mm	(1)
Bezel Opening Area	155x94.04	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	800xR.G.B.x480	pixel	-
Pixel Pitch	0.1905x0.1905	mm	-
Pixel Arrangement	RGB vertical stripe	-	(2)
Display Colors	262.144 (6 bits)	color	-
Display Mode	Normal White	-	-
Surface Treatment	Hard Coating (TBD), AG (Haze 25 %)	-	-
Weight	170(Typ)	g	

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)	164.7	165	165.3	mm	(1)
	Vertical(V)	103.7	104	104.3	mm	
	Depth(D)	-	5.5	5.8	mm	

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.		
Storage Temperature	T_{ST}	(-40)	(95)	ºC	(1)
Operating Ambient Temperature	T_{OP}	(-35)	(85)	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	100	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	TBD	G	(4) (5)

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

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 80 ºC Max.

Note (3) 11ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) TBD.

Note (5) 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.

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	Vcc	-0.5	-	5	V	-
	AVDD	6.5	-	13.5	V	-
	VGH	7	-	VGL+40	V	-
	VGL	-20	-	-5	V	-
	VGH-VGL	12	-	40	V	-
Input Signal Voltage	Vi	-0.5	-	Vcc+0.5	V	-
	V1~V5	0.4AVDD	-	AVDD-0.1	V	-
	V6~V10	0.1	-	0.6AVDD	V	-
	VCOM	-	3.6	-	V	-

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	2.5K	V_{RMS}	(1), (2), I_L = (5.5)mA
Lamp Current	I_L	3.0	8.0	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	40	80	KHz	

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 lamp (Refer to 3.2 for further I_L information).

3. ELECTRICAL CHARACTERISTIC

3.1 Recommended Operation condition (GND = AVSS = 0V)

Ta = 25 ± 2 ºC

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	
		AVDD	9.1	9.25	9.4	V	
		VGH	17.5	18	18.5	V	
		VGL	-7.5	-7	-6.5	V	
Input Signal Voltage		V1~V5	0.4AVDD	-	AVDD-0.1	V	
		V6~V10	0.1	-	0.6AVDD	V	
		VCOM	-	3.6	-	V	
Digital Input Voltage	High Level	VIH	0.7Vcc	-	Vcc	V	
	Low Level	VIL	0	-	0.3Vcc	V	

3.2 Current Consumption (GND = AVSS =0V)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Supply Current for Source/Gate Driver (Digital)	I_{CC}	-	(2.78)	TBD	mA	(1)
Supply Current for Source Driver (Analog)	I_{DD}	-	(21.76)	TBD	mA	(1)
Supply Current for Gate Driver (High Level)	I_{GG}	-	(0.13)	TBD	mA	(1)
Supply Current for Gate Driver (Low Level)	I_{EE}	-	(0.13)	TBD	mA	(1)

Note: (1) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

Black Pattern

Active Area

3.3 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	740	630	550	V_{RMS}	(1), I_L = (5.5) mA
Lamp Current	I_L	3.0	5.5	8.0	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	970 (25 °C)	V_{RMS}	(2)
		-	-	1260 (0 °C)	V_{RMS}	(2)
		-	-	1460 (-35°C)	V_{RMS}	(2)
Operating Frequency	F_L	40	-	80	KHz	(3)
Lamp Life Time	L_{BL}	35000	-	-	Hrs	(5)
Power Consumption	P_L	-	3.46	-	W	(4), I_L = (5.5) mA

Note (1) I_L means the lamp current of one lamp.

Note (2) The voltage that must be larger than Vs should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L$

Note (5) The lifetime of lamp can be defined as the time in which it continues to operate under the condition Ta = 25 ±2 °C and I_L = (5.5) mArms until one of the following events occurs:

(a) When the brightness becomes or lower than 50% of its original value.

(b) When the effective ignition length becomes or lower than 80% of its original value. (Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid producing too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

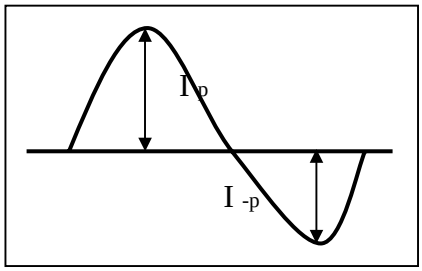
Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its

leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;

b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;

c. The ideal sine wave form shall be symmetric in positive and negative polarities.



* Asymmetry rate:

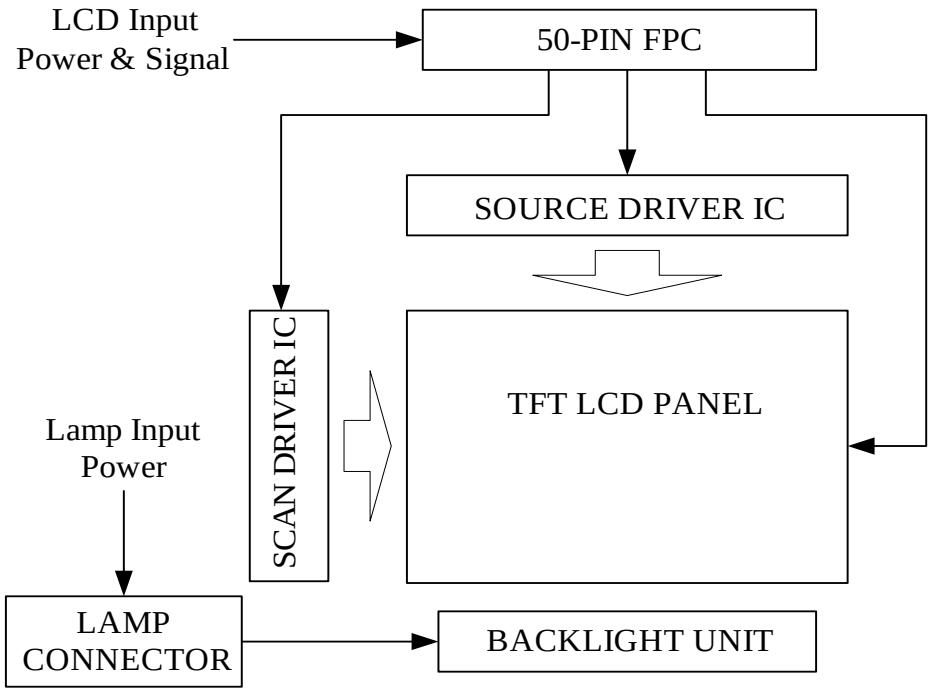
$$| I_p - I_{-p} | / I_{rms} * 100\%$$

* Distortion rate

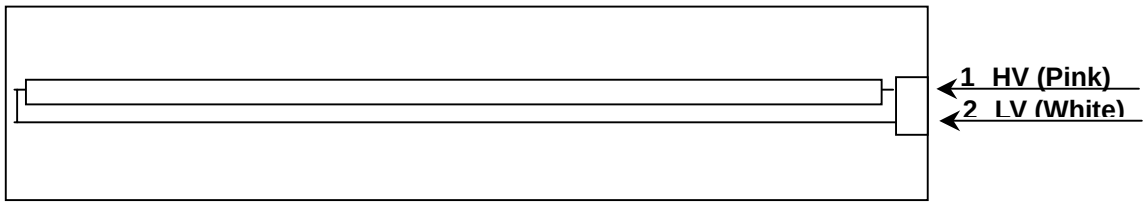
$$I_p \text{ (or } I_{-p}) / I_{rms}$$

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 FPC I/O Pin Assignment

Pin	Name	I/O	Description
1	GND	I	Ground
2	Vcc	I	Digital Voltage
3	VGL	I	TFT Low Voltage
4	VGH	I	TFT High Voltage
5	STVD	I/O	Start Pulse Signal Input / Output (Vertical)
6	STVU	I/O	Start Pulse Signal Input / Output (Vertical)
7	CKV	I	Gate Driver Shift Clock Input
8	U/D	I	Up / Down Scan Selection
9	OE	I	Scan Driver Output Enable Control
10	VCOM	I	VCOM Voltage
11	DIO1	I/O	Start Pulse Signal Input / Output (Horizontal)
12	AVDD	I	Source Driver Analog Voltage
13	GND	I	Ground
14	GND	I	Ground
15	Vcc	I	Digital Voltage
16	EDGSL	I	Source Driver Clock Edge Select Input
17	CLK	I	Source Driver Shift Clock Input
18	SHL	I	Source Driver Shift Direction Control Input
19	R0	I	Red Data
20	R1	I	Red Data
21	R2	I	Red Data
22	R3	I	Red Data
23	R4	I	Red Data
24	R5	I	Red Data
25	G0	I	Green Data
26	G1	I	Green Data
27	G2	I	Green Data
28	G3	I	Green Data
29	G4	I	Green Data
30	G5	I	Green Data
31	V1	I	Gamma Voltage 1
32	V2	I	Gamma Voltage 2
33	V3	I	Gamma Voltage 3
34	V4	I	Gamma Voltage 4
35	V5	I	Gamma Voltage 5
36	V6	I	Gamma Voltage 6
37	V7	I	Gamma Voltage 7
38	V8	I	Gamma Voltage 8
39	V9	I	Gamma Voltage 9
40	V10	I	Gamma Voltage 10

41	B0	I	Blue Data
42	B1	I	Blue Data
43	B2	I	Blue Data
44	B3	I	Blue Data
45	B4	I	Blue Data
46	B5	I	Blue Data
47	LD	I	Latching and Data Switching input
48	REV	I	Data Inversion Input
49	POL	I	Polarity Inverting Input
50	DIO2	I/O	Start Pulse Signal Input / Output (Horizontal)

Note (1) User's connector Part No: (FH12-50S-0.5 (Hiroses)) or equivalent

5.2 SCANNING DIRECTION

The following figures are seen from a front view and the arrow shows the direction of scan.

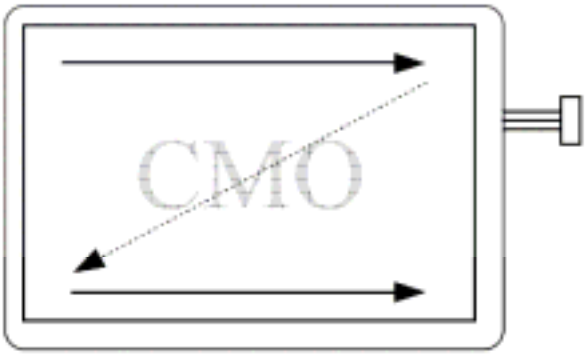


Figure1.Normal scan

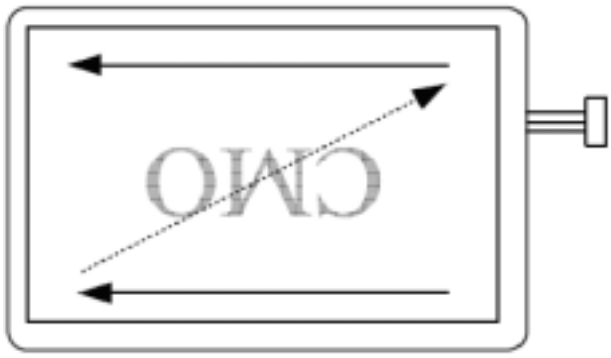


Figure 2. Reverse scan

Note : (1) Select left or right shift

SHL	DIO1	DIO2	Shift
1	Input	Output	Left to right
0	Output	Input	Right to left

(2) Select up or down shift

U/D	STVU	STVD	Shift
0	Input	Output	Up to down
1	Output	Input	Down to up

5.3 BACKLIGHT UNIT

Pin	Symbol	Description	Remark
1	HV1	High Voltage	Pink
2	N/A	N/A	N/A
3	LV	Low Voltage	White-

Note (1) Connector Part No.: BHR-03VS-1 (J.S.T Mfg,Co,Ltd)

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.

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
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	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
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	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
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	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

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

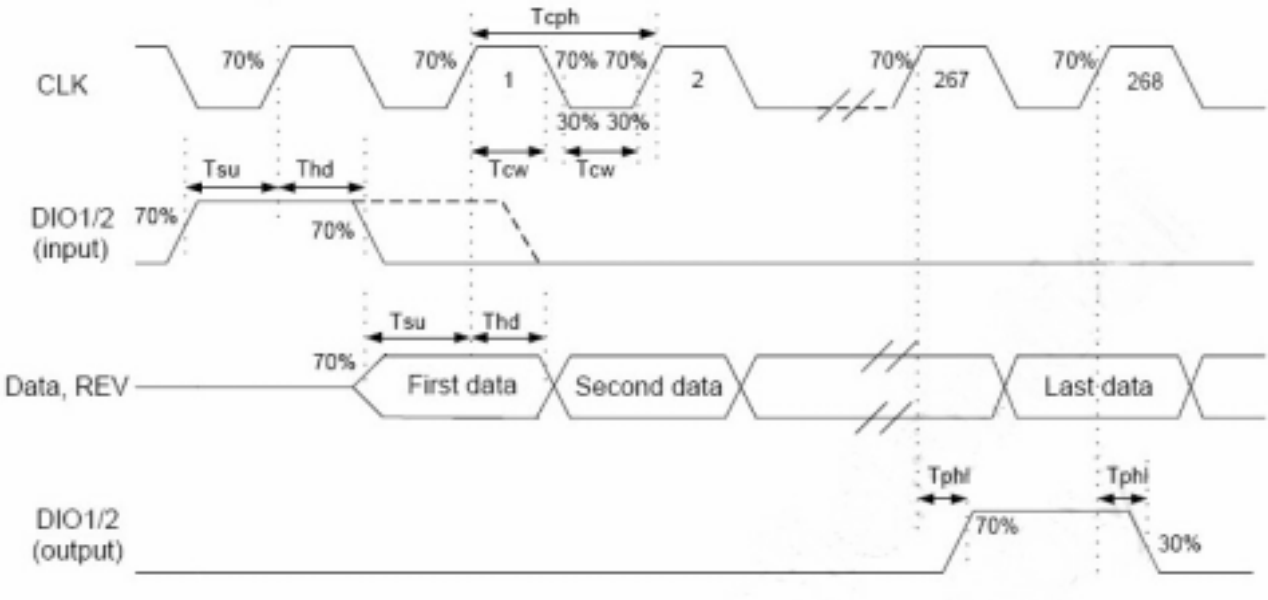
6. INTERFACE TIMING

6.1 AC Electrical Characteristics (Vcc = 3.3V, AVDD = 8.4V, AVSS = GND = 0V, Ta = 25℃)

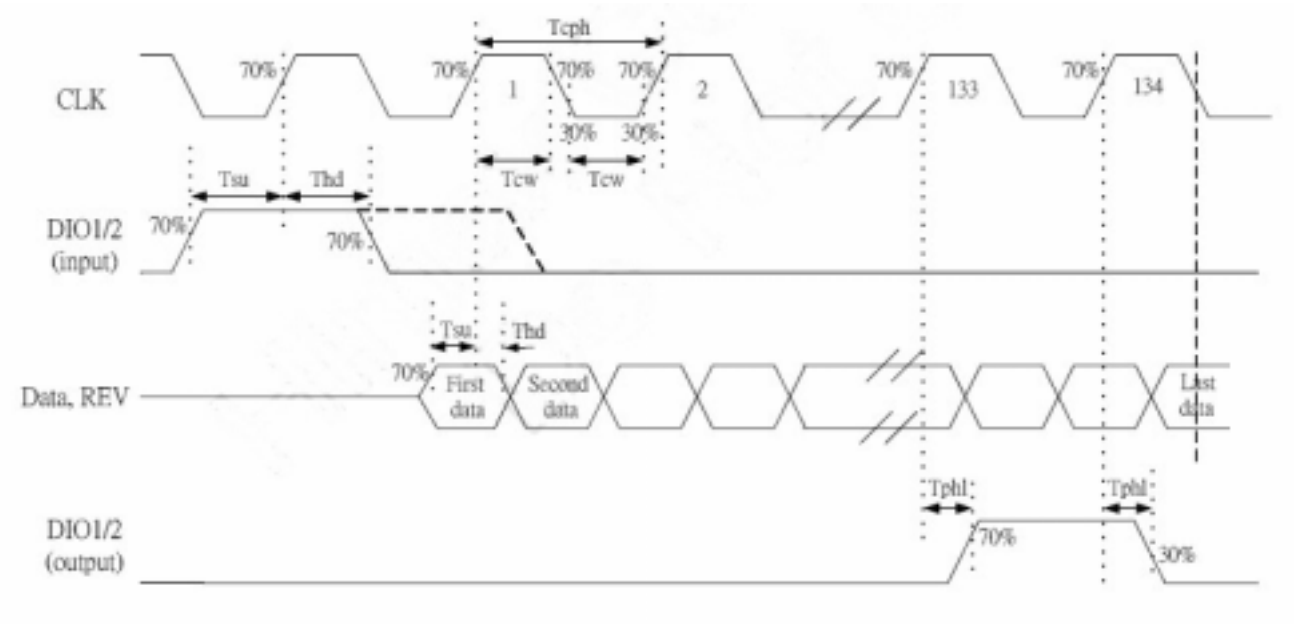
Parameter	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
CLK frequency	Fclk	-	40	47	MHz	-
CLK Pulse width	Tcw	6	-	-	ns	-
Data setup time	Tsu	4	-	-	ns	D00~D55, REV and DIO1/2 to CLK
Data hold time	Thd	2	-	-	ns	D00~D55, REV and DIO1/2 to CLK
Propagation delay of DIO2/1	Tphl	6	10	15	ns	CL = 25pF (Output)
Time that the last data to LD	Tld	1	-	-	Tcw	-
Pulse width of LD	Twld	2	-	-	Tcw	-
Time that LD to DIO1/2	Tlds	5	-	-	Tcw	-
POL setup time	Tpsu	6	-	-	ns	POL to LD
POL hold time	Tphd	6	-	-	ns	POL to LD
Output stable time	Tst	-	-	12	us	10% or 90% target voltage, CL = 60pF, R = 2KΩ
CKV period	t_{CPV}	5	-	-	us	-
CKV pulse width	t_{CPVH},t_{CPVL}	2.5	-	-	us	50% duty cycle
OE pulse width	t_{WOE}	1	-	-	us	-
Data setup time	t_{SU}	700	-	-	ns	-
Data hold time	t_{HD}	700	-	-	ns	-
CKV to output delay time	t_{PD1}	-	-	1000	ns	CL = 300pF
Start pulse output delay time	t_{PD2}	-	-	800	ns	CL = 30pF
OE to output delay time	t_{PD3}	-	-	800	ns	CL = 300pF

■Timing Diagram 1 (CHNSL[1:0] = “11”, Default)

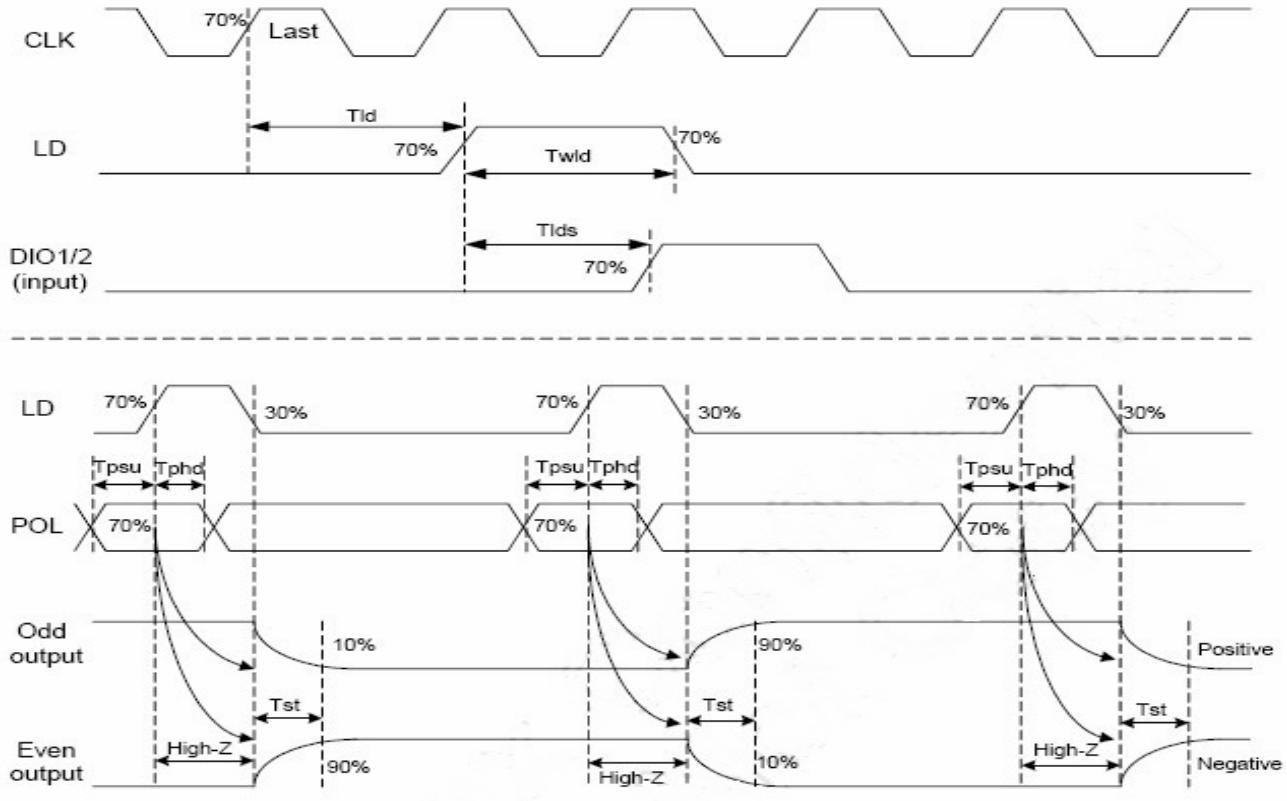
●EDGSL = “0”, Default



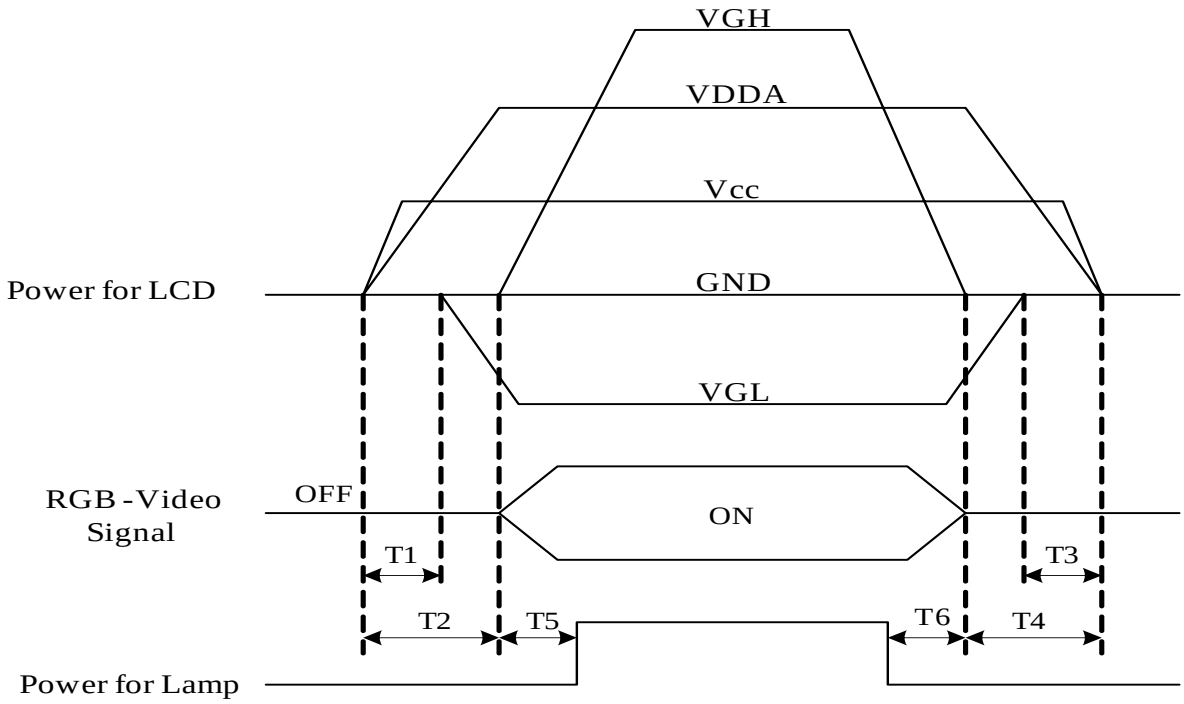
●EDGSL = “1”



■Timing Diagram 2



6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

0ms ≦ T1 ＜ T2

0ms ＜ T3 ≦ T4

0ms ≦ T5

0ms ≦ T6

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_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I_L	5.5	mA_{RMS}
Inverter Operating Frequency	F_L	61	KHz
Inverter	(Sumida IV40090T/B2)		

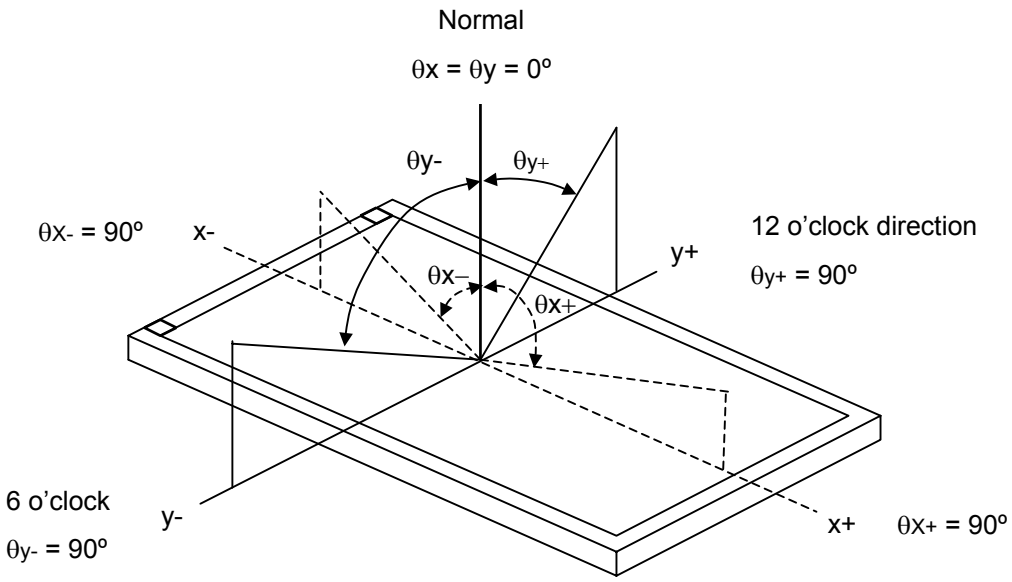
Note (1) I_L means the lamp current of one lamp.

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	Rx	θ_x=0°, θ_Y =0° Viewing Normal Angle	Typ – 0.03	TBD	Typ + 0.03		(1), (6)
		Ry			TBD			
	Green	Gx			TBD			
		Gy			TBD			
	Blue	Bx			TBD			
		By			TBD			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White		L_C		TBD	(450)	-	cd/m^2	(4), (6)
Contrast Ratio		CR		TBD	(500)	-	-	(2), (6)
Response Time		T_R		-	(5)	(10)	Ms	(3)
		T_F		-	(11)	(16)	Ms	
White Variation		δW		-	(1.25)	(1.4)	-	(5), (6)
Viewing Angle	Horizontal	θ_x+	CR ≧ 10	(65)	(70)	-	Deg.	(1), (6)
		θ_x-		(65)	(70)	-		
	Vertical	θ_Y+		(55)	(60)	-		
		θ_Y-		(55)	(60)	-		

Note (1) Definition of Viewing Angle (θx, θy):



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

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

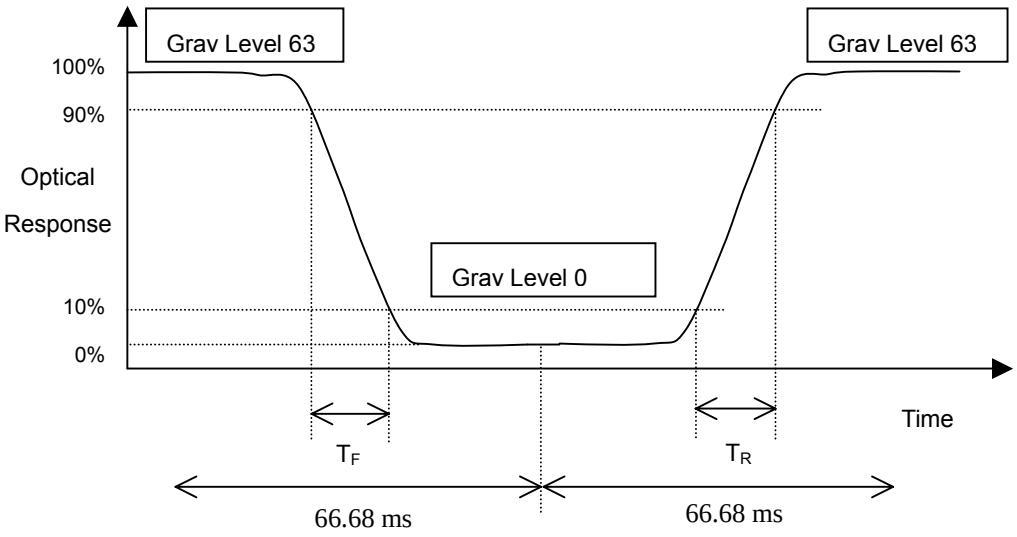
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = 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

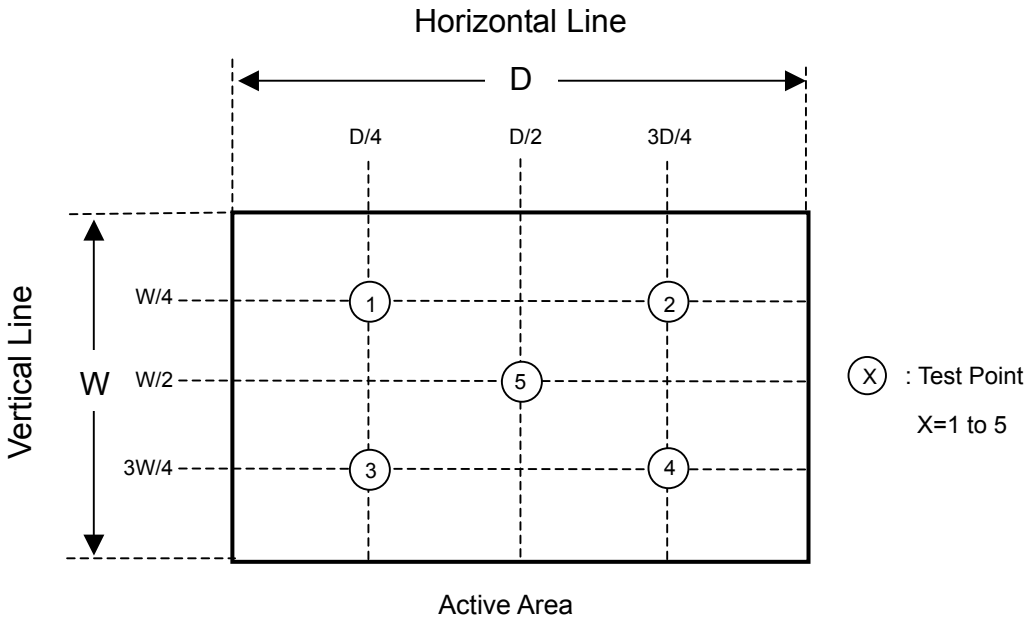
L_C = L (5)

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

Note (5) Definition of White Variation (δW):

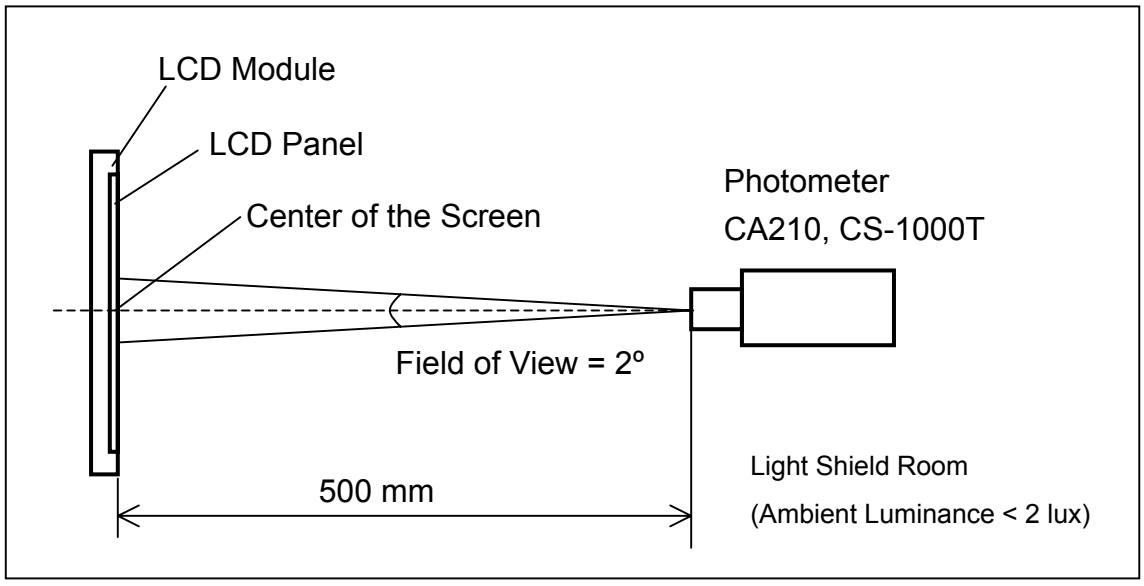
Measure the luminance of gray level 63 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]

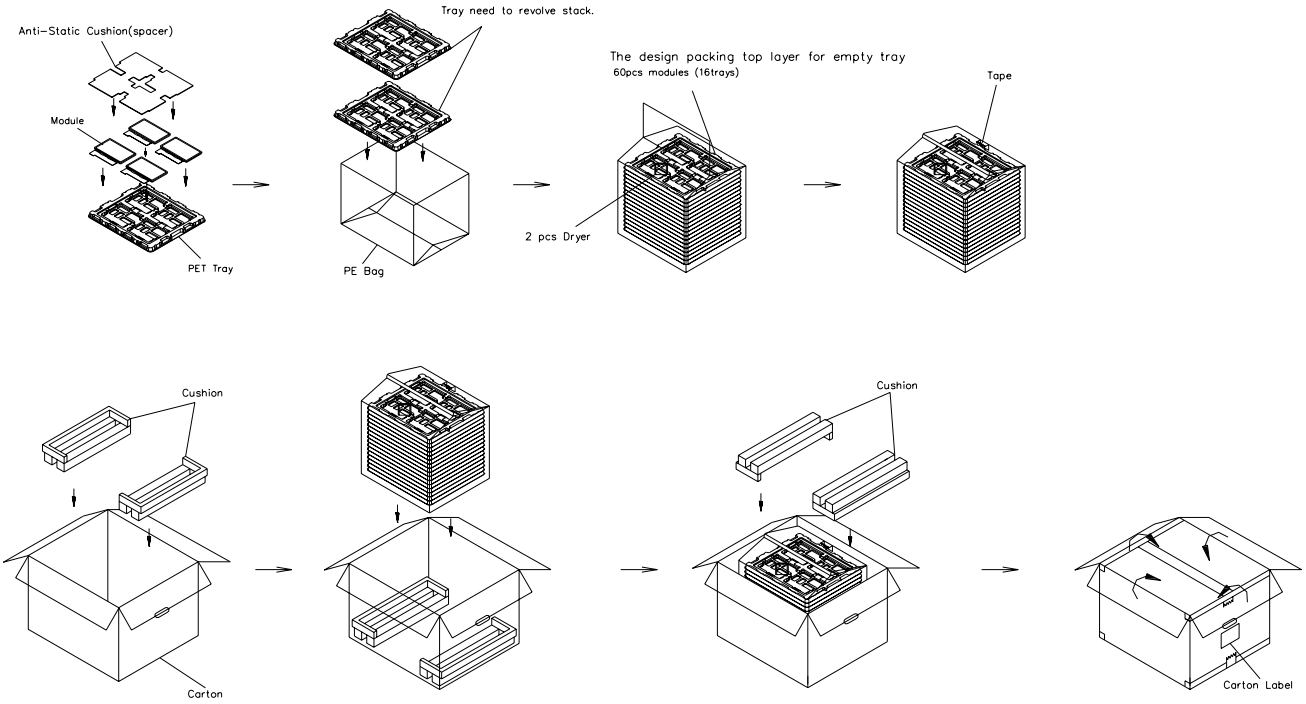


Note (6) Measurement Setup:

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.



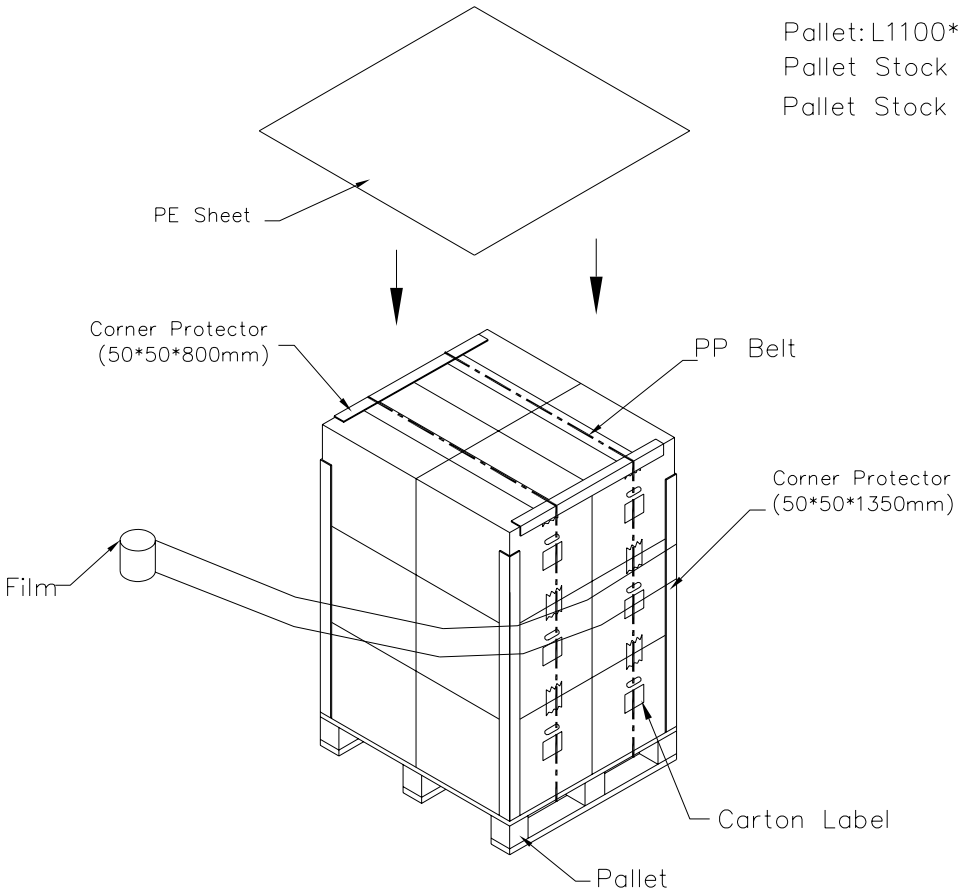
8. PACKAGING



(1) 60 LCM Modules/1 box

(2) Carton dimensions : 545(L)x480(W)x485(H)mm

(3) Weight : approximately kg(60 modules per Carton).



9. DEFINITION OF LABELS

TBD

10. PRECAUTIONS

TBD