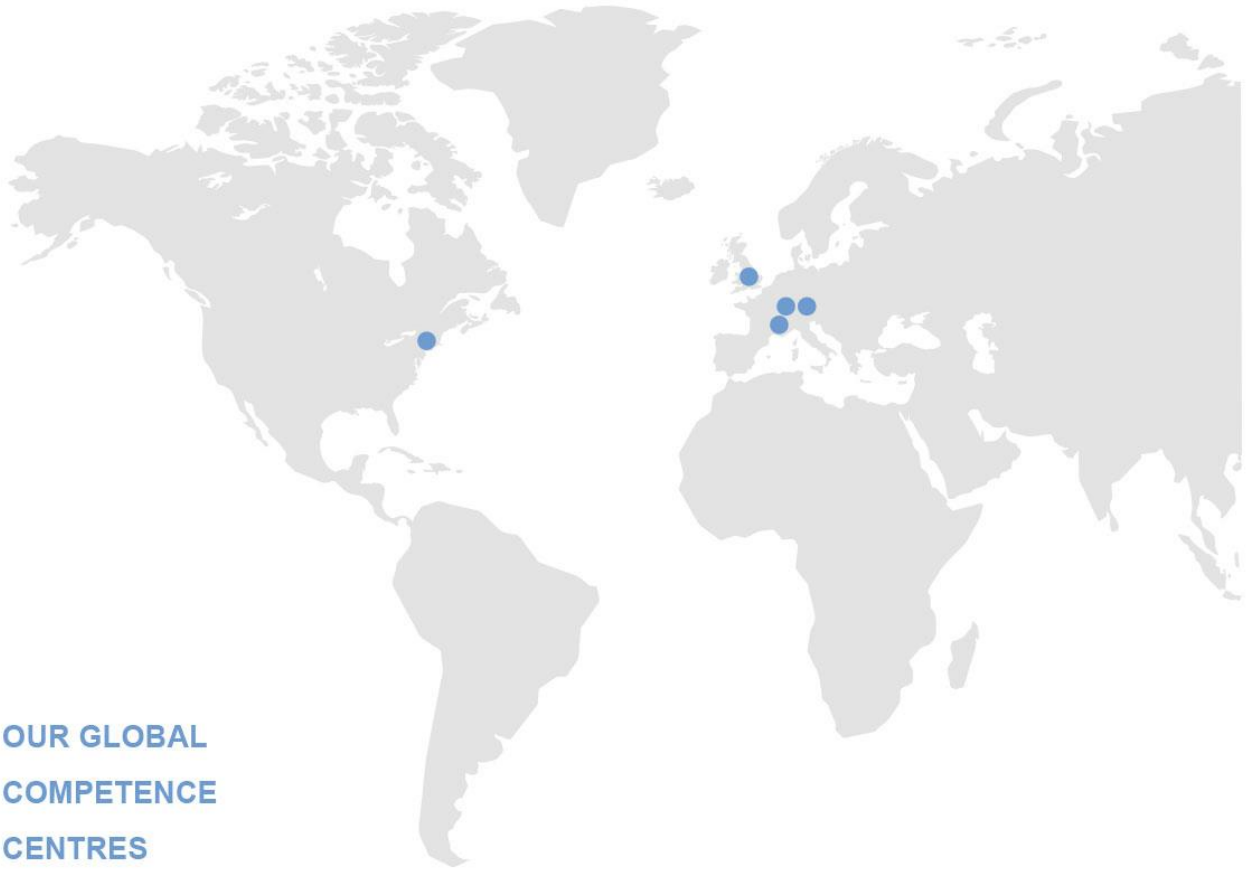
FORTEC
ELEKTRONIK AG



OUR GLOBAL COMPETENCE CENTRES

APOLLO DISPLAY TECHNOLOGIES

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Datasheet

Apollo

G141I1-L01-V516A

Based on ChiMei TFT G141I1-L01
With LED Backlight

CH-03-020

- CONTENTS -

REVISION HISTORY

Version	Date	Section	Description
Ver 1.0	June.17, 2010	All	G141I1-L01-V516A Approval Spec. was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G141I1 - L01 - V516A is a 14.1” TFT Liquid Crystal Display module and 20 pins LVDS interface. This module supports 1280 x 800 WXGA mode and can display 262,144 colors. The converter module for LED-Backlight is not built in.

1.2 FEATURES

- WXGA (1280 x 800 pixels) resolution
- DE only mode
- LVDS interface
- High brightness
- High color saturation
- High contrast ratio
- Wide operating temperature range

- Sunlight readable
- Reversible scan function
- RoHS compliance

1.3 APPLICATION

- TFT LCD Monitor
- Factory Application
- Industrial Application
- Amusement

1.4 GENERAL SPECIFICATI0NS

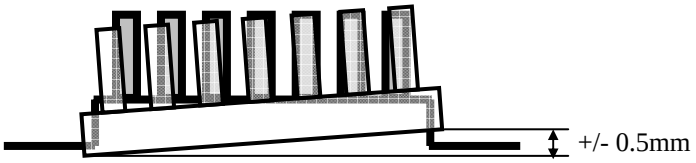
Item	Specification	Unit	Note
Active Area	303.4 x 189.6	mm	(1)
Bezel Opening Area	306.4 x 192.6	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280xR.G.Bx800	pixel	-
Pixel Pitch	0.237(H) x 0.237(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Glare	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	325.5	326	326.5	mm	(1)
	Vertical(V)	216	216.5	217	mm	
	Depth(D)	15.5	16	16.5	mm	
Weight		-	1140	1170	g	-
I/F connector mounting position		The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.				(2)

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

Note (2) Connector mounting position



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-40	90	ºC	(1)
Operating Ambient Temperature	T_{OP}	-30	80	ºC	(1)

Test Item	Test Condition	Note
High Temperature Storage Test	90ºC, 240hours	(1) (3)
Low Temperature Storage Test	-40ºC, 240hours	
Thermal Shock Storage Test	-40ºC, 0.5hour ~ 85ºC, 0.5hour, 100 cycles	
High Temperature Operation Test	80ºC, 240hours	
Low Temperature Operation Test	-30ºC, 240hours	
High Temperature & High Humidity Operation Test	60ºC 90%RH, 240hours	
ESD Test (Operation)	150pF, 330Ω, 1sec/cycle Condition 1 : panel contact, ±8KV Condition 2 : panel non-contact ±15KV	(1)
Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for ± X, ± Y, ± Z direction	(1)(2)
Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz sine wave, 10min/cycle, 3 cycles each X, Y, Z direction	(1)(2)

Note (1) Criteria for judgement：No display malfunctions.

Note (2) 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 (3) Temperature of panel display surface area should be 85 ºC Max.

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

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	V_{CC}+0.3	V	

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

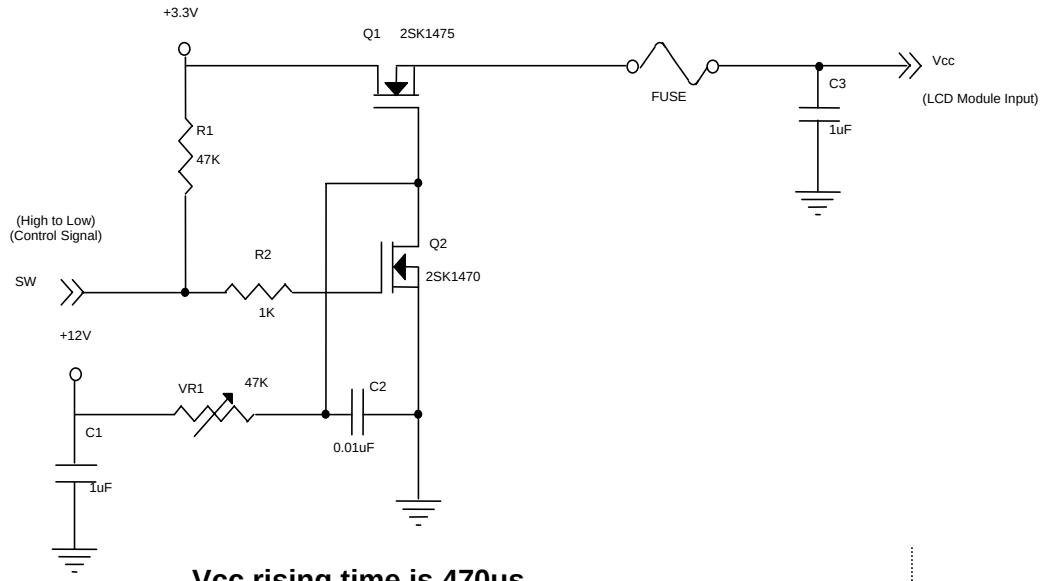
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Permissive Ripple Voltage		V_{RP}	-	50	-	mV	-
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Initial Stage Current		I_{IS}	-	-	1.0	A	(2)
Power Supply Current	White	Icc	-	340	380	mA	(3)a
	Black		-	440	480	mA	(3)b
LVDS Differential Input High Threshold		$V_{TH(LVDS)}$	-	-	+100	mV	(4), V_{CM}=1.2V
LVDS Differential Input Low Threshold		$V_{TL(LVDS)}$	-100	-	-	mV	(4) V_{CM}=1.2V
LVDS Common Mode Voltage		V_{CM}	1.125	-	1.375	V	(4)
LVDS Differential Input Voltage		$\|V_{ID}\|$	100	-	600	mV	(4)
Terminating Resistor		R_T	-	100	-	Ohm	-

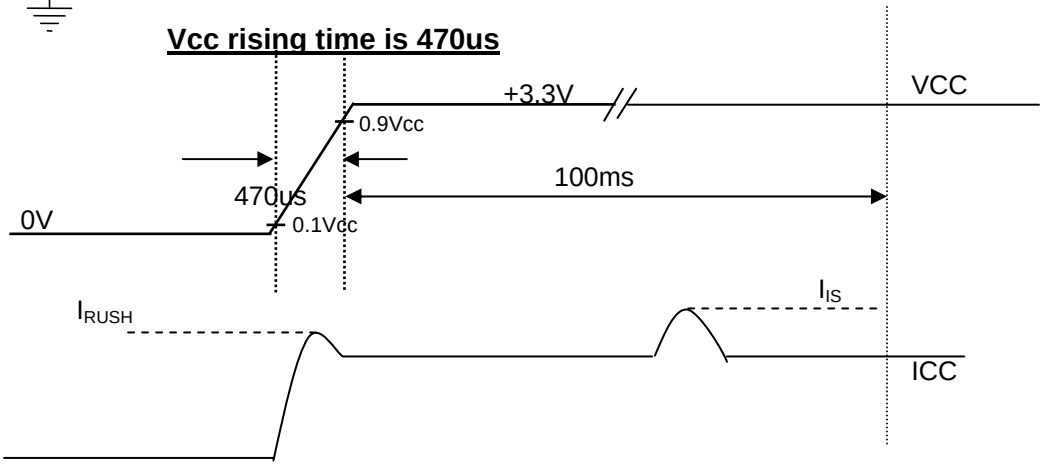
Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) I_{RUSH}: the maximum current when Vcc is rising

I_{IS}: the maximum current of the first 100ms after power-on

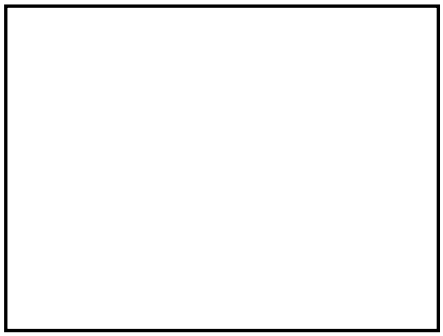
Measurement Conditions: Shown as the following figure. Test pattern: black.





Note (3) 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.

a. White Pattern



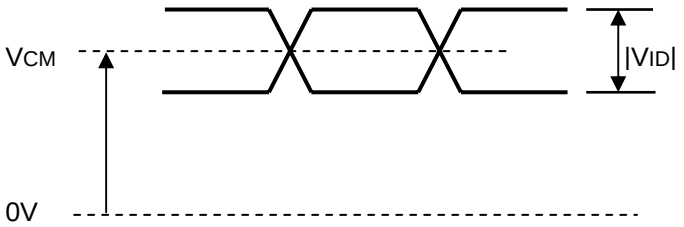
Active Area

b. Black Pattern

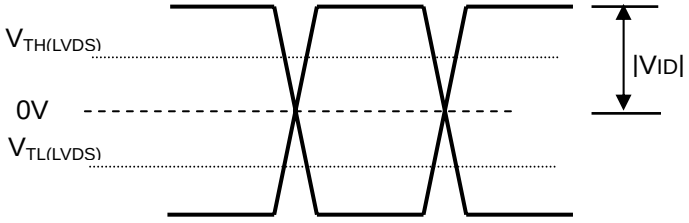
Active Area

Note (4) The parameters of LVDS signals are defined as the following figures.

Single Ended



Differential



3.2. Backlight Specifications

$Ta = 25^{0}C$

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
LED Forward Voltage	V_L	--	8.69	9.59	V	*1), I_L = 820mA
LED Forward Current	I_L	--	--	820	mA	*2)
Power Consumption	W_L	--	7.12	--	W	I_L = 820mA
Backlight Lifetime	B_L	--	50,000	--	h	*3),*4), I_L = 820mA

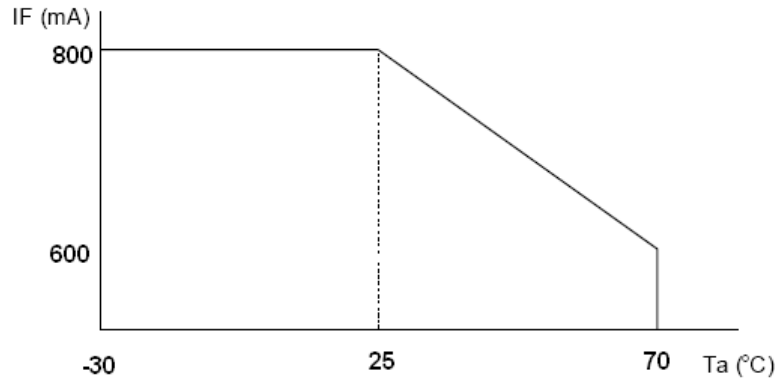
*1) V_L is specified as the sum of the white LED forward voltages.

*2) LEDs are best driven using a constant current source. To avoid chromaticity shifts while dimming pulse-width modulation (PWM) techniques may be employed (0-100% duty cycle). I_L is the current into one backlight connector (rail).

*3) Backlight lifetime is defined as the time when the brightness becomes 50% of the initial value.

*4) The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under high temperature unless LED forward current is reduced accordingly.

*5) LED forward current derating curve:



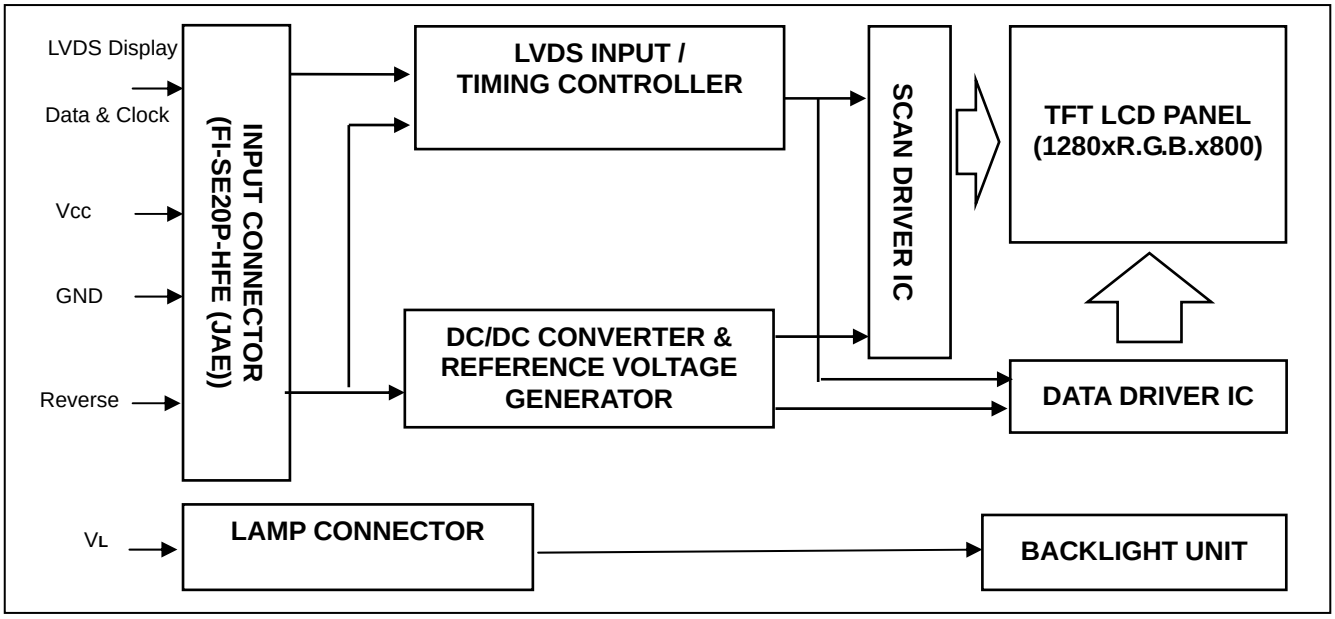
*5) Recommended backlight power supply:

PART NUMBER	MANUFACTURER
CCBR-2-800	Apollo Display Technologies, LLC.

3.3 TBD

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. INPUT TERMINAL PIN ASSIGNMENT

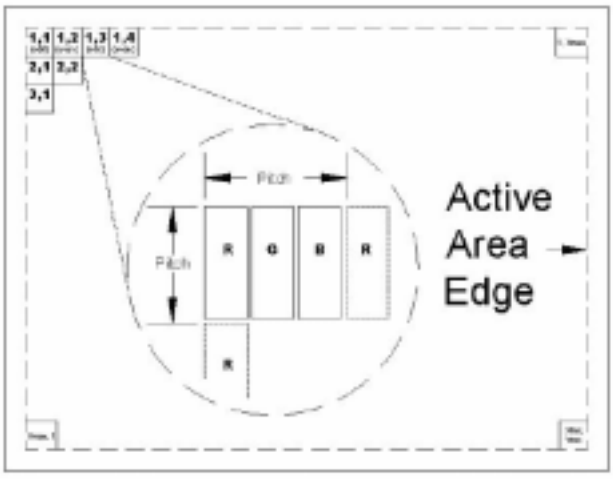
5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	VCCS	Power Supply +3.3 V (typical)	-	-
2	VCCS	Power Supply +3.3 V (typical)	-	-
3	GND	Ground	-	-
4	GND	Ground	-	-
5	RX0-	LVDS Differential Data Input	Negative	R0~R5,G0
6	RX0+	LVDS Differential Data Input	Positive	-
7	GND	Ground	-	G1~G5, B0, B1
8	RX1-	LVDS Differential Data Input	Negative	
9	RX1+	LVDS Differential Data Input	Positive	-
10	GND	Ground	-	B2~B5, DE, Hsync, Vsync
11	RX2-	LVDS Differential Data Input	Negative	
12	RX2+	LVDS Differential Data Input	Positive	-
13	GND	Ground	-	-
14	CLK-	LVDS Clock Data Input	Negative	LVDS Level Clock
15	CLK+	LVDS Clock Data Input	Positive	-
16	GND	Ground	-	-
17	NC	Non-Connection	-	-
18	NC	Non-Connection	-	-
19	Reverse	+3.3VReverse, GND/NC No Reverse	-	Refer to 6.2 POWER ON/OFF SEQUENCE Note(5)
20	NC	Non-Connection	-	-

Note (1) Connector Part No.: FI-SE20P-HFE (JAE) or equivalent

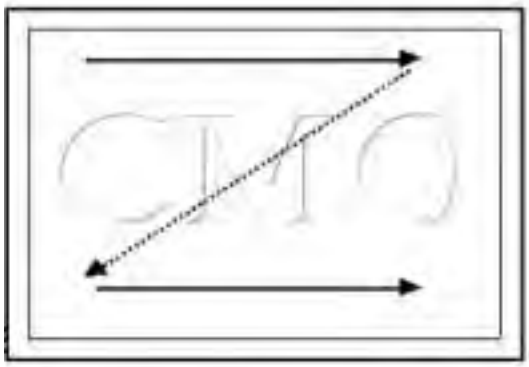
Note (2) User's connector Part No: FI-SE20ME (JAE) or equivalent

Note (3) The first pixel is odd as shown in the following figure.

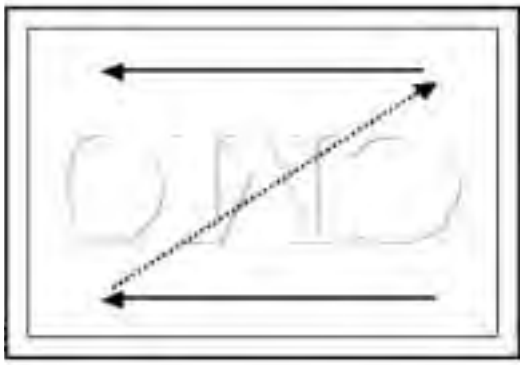


Note (4) Scanning direction:

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



Reverse = GND/NC : normal display (default)



Reverse = High : display with 180 degree rotation

5.2 BACKLIGHT UNIT

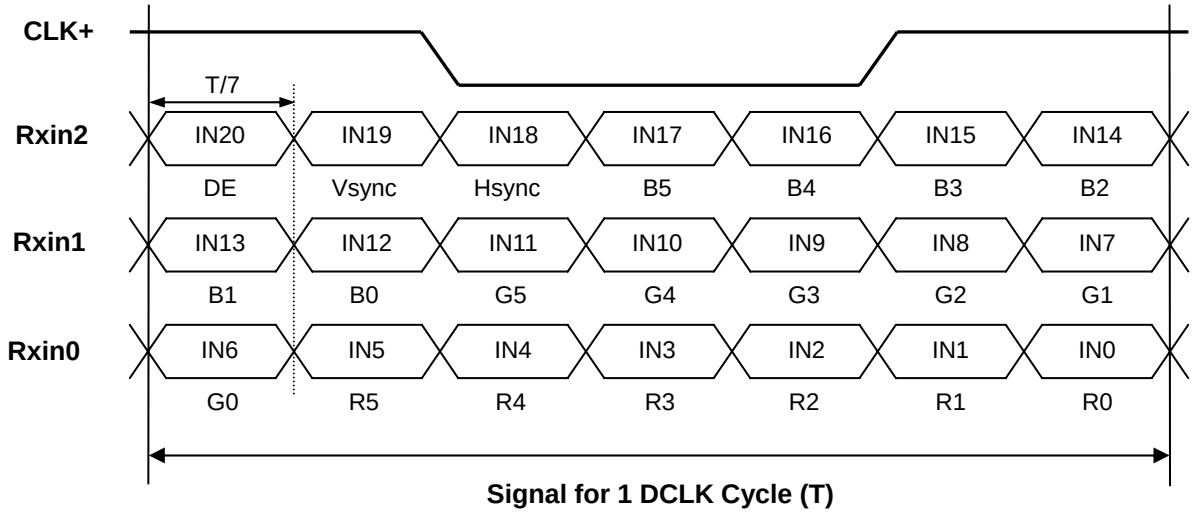
Pin	Symbol	Description	Color
1	HV	High Voltage	Pink
2	LV	Ground	White

Note (1) Connector Part No.: 22-01-3027 (Molex)

Note (2) User's connector Part No.: 22-05-3021 (Molex)

Note (3) : VL = HV - LV

5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL



Signal for 1 DCLK Cycle (T)

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
	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
Basic	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Colors	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
	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
Gray	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Scale	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Of	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Red	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
	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
Gray	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Scale	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Of	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Green	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
	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
Gray	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Scale	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Of	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Blue	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

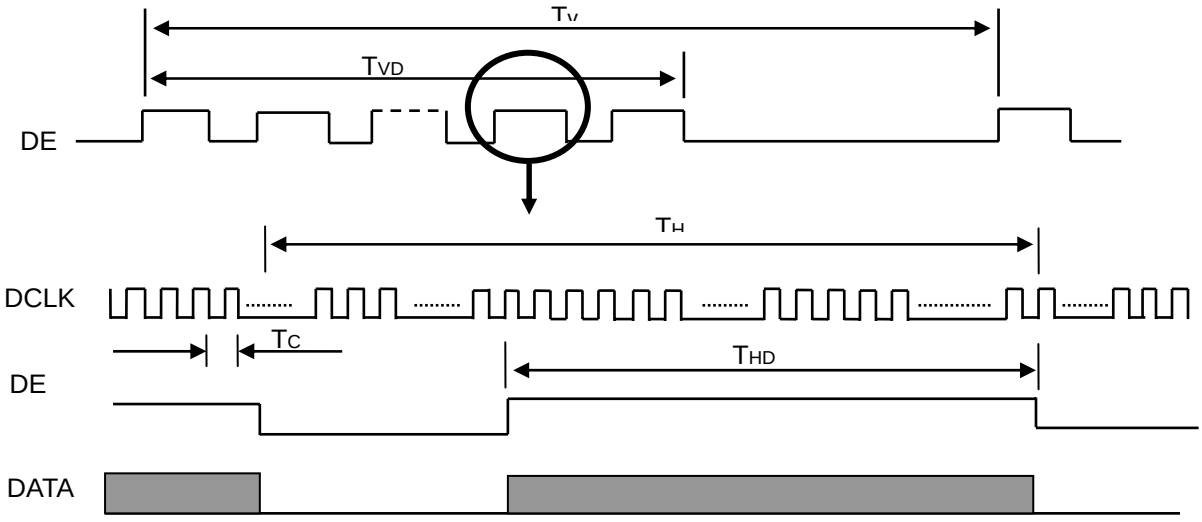
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The specifications of input signal timing are as the following table and timing diagram**.**

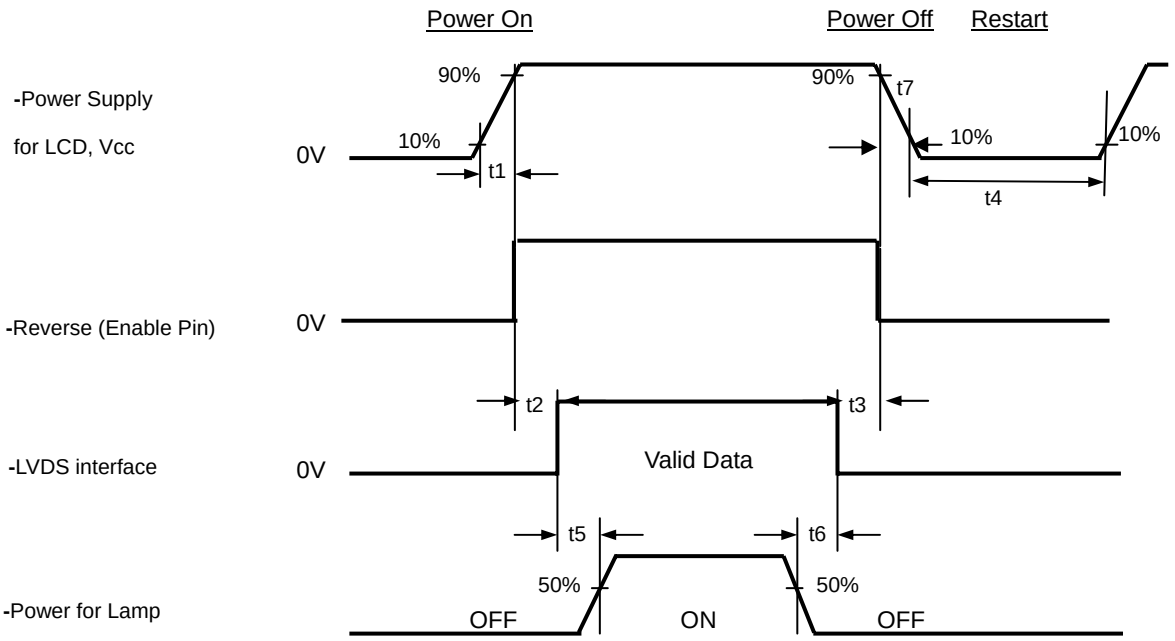
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	63.9	71	74.5	MHz	-
DE	Vertical Total Time	TV	802	823	1030	TH	-
	Vertical Active Display Period	TVD	800	800	800	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	23	TV-TVD	TH	
	Horizontal Total Time	TH	1360	1440	1600	Tc	-
	Horizontal Active Display Period	THD	1280	1280	1280	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	160	TH-THD	Tc	

Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

0.5 ≦t1≦ 10 ms

0 ≦t2≦ 50 ms

0 ≦t3≦ 50 ms

t4 ≧ 500 ms

t5 ≧ 200 ms

t6 ≧ 200 ms

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time is better to follow 5≦t7≦300 ms.

Note (5) Do not change Reverse Pin signal when panel normally displaying.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

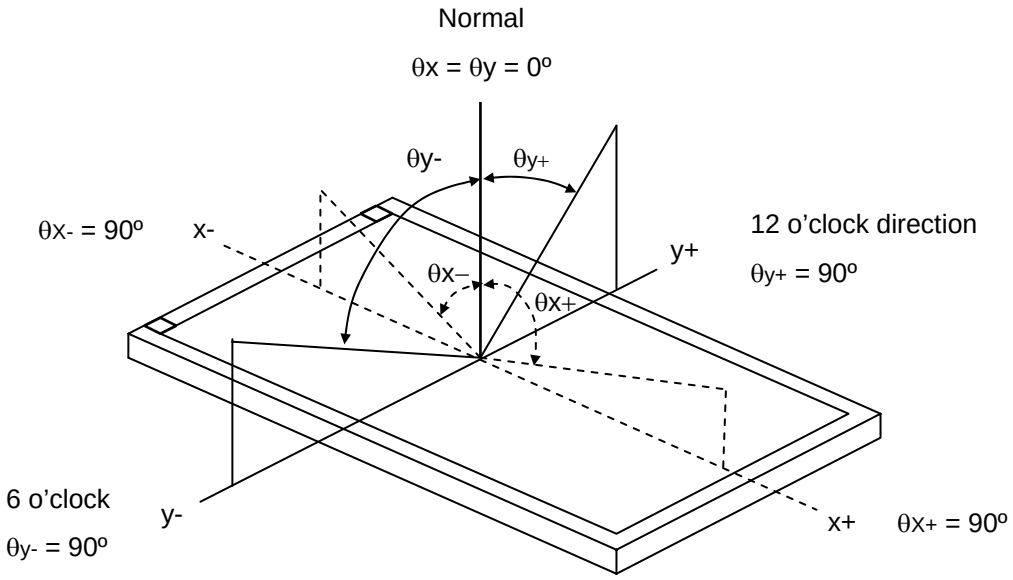
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	7	mA
Inverter Driving Frequency	F_L	61	KHz
Inverter	Darfon VK13165.101		

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).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Normal Angle	500	700	-	-	(2), (5)
Contrast Ratio in daylight				100	120	-	-	(7)
Response Time		T_R		-	5	10	ms	(3)
		T_F		-	11	16	ms	
Center Luminance of White		L_{CEN}		600	700		cd/m^2	(4), (5)
White Variation		δW		-	1.25	1.4	-	(5), (6)
Color Chromaticity	Red	Rx		Typ-0.03	0.618	Typ+0.03	-	(1)
		Ry			0.343		-	
	Green	Gx			0.306		-	
		Gy			0.587		-	
	Blue	Bx			0.145		-	
		By			0.103		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θ_x+	CR≥10	70	80	-	Deg.	
		θ_x-		70	80	-		
	Vertical	θ_Y+		70	80	-		
		θ_Y-		70	80	-		

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

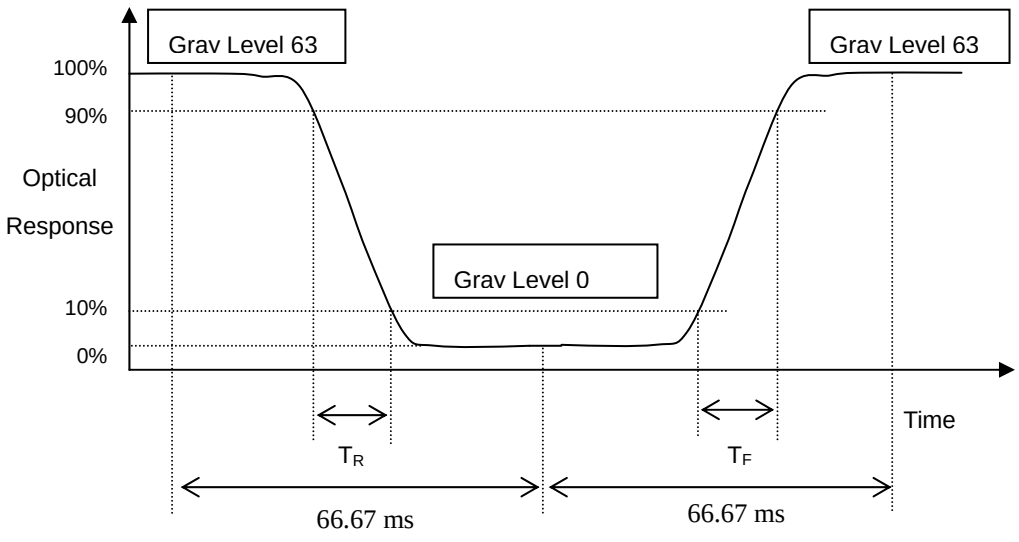
L63: Luminance of gray level 63

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 (6).

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



Note (4) Definition of Average Luminance of White (L_{CEN}):

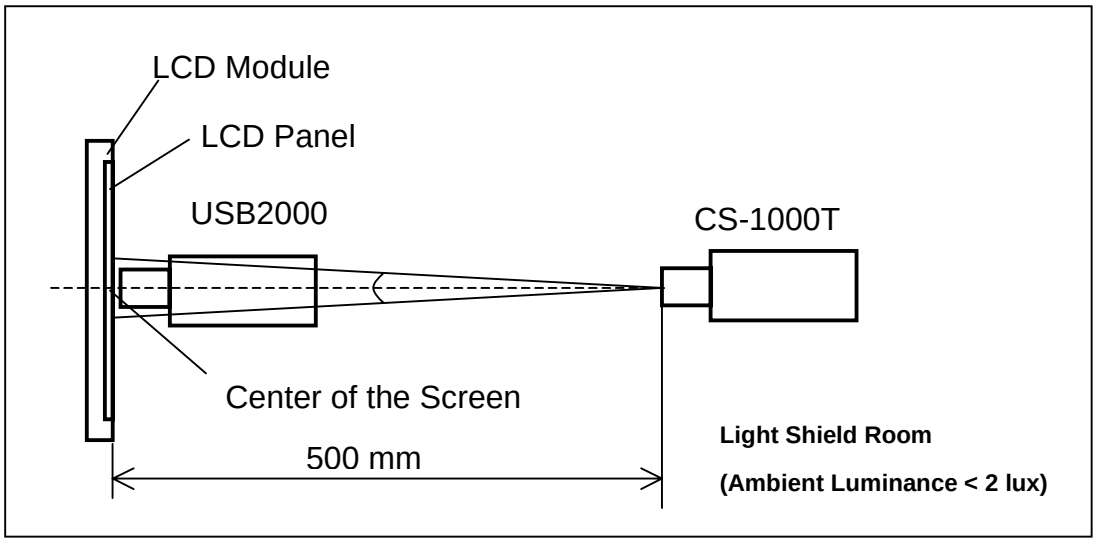
Measure the luminance of gray level 63 at 5 points

L_{CEN} = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

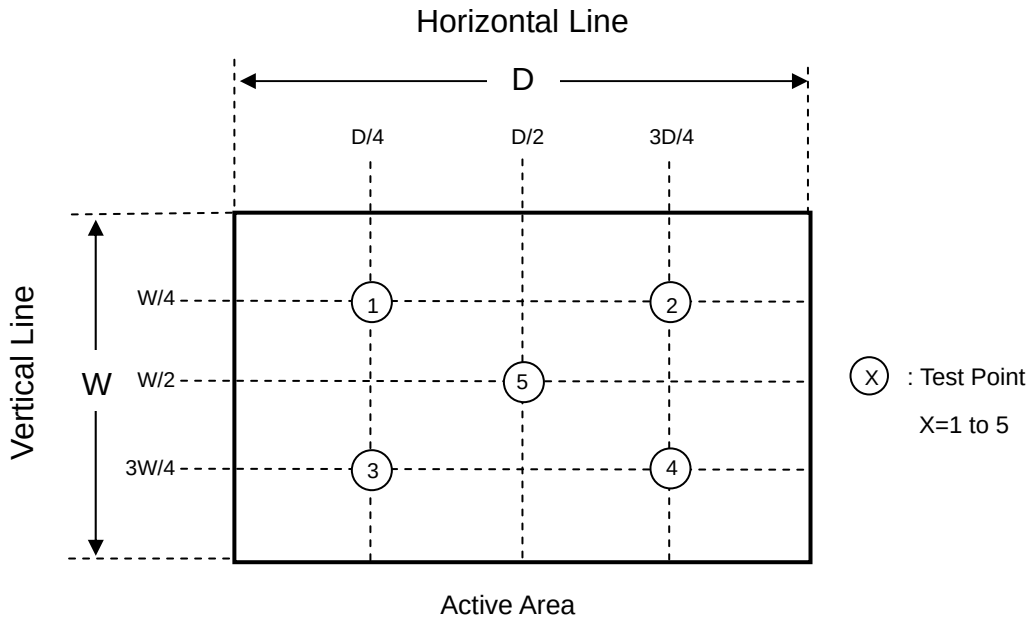
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) 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)]

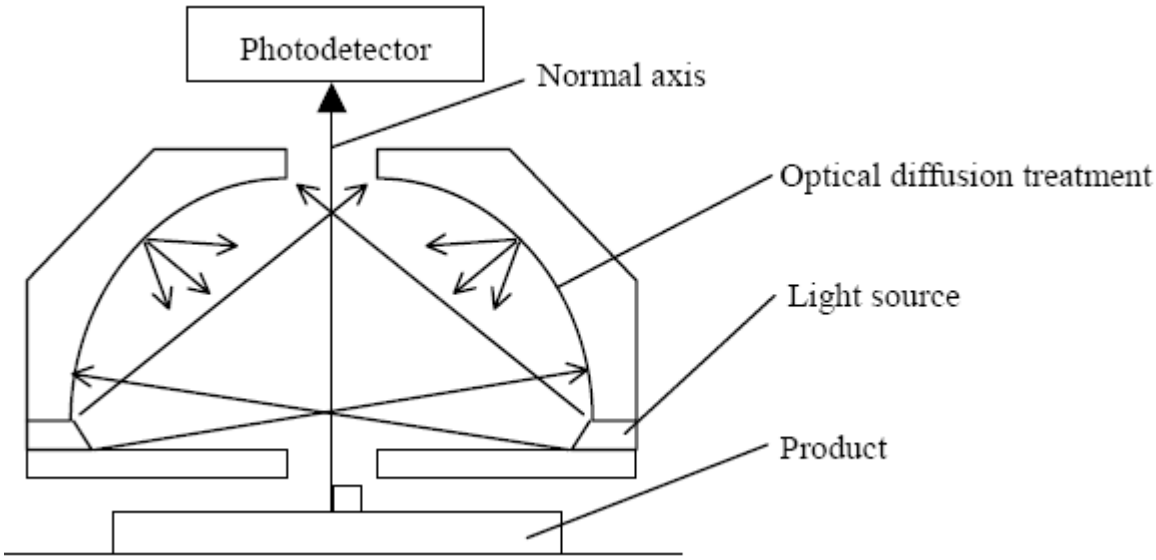


Note (7) Contrast Ratio in daylight:

Measuring method base on BLU ON

Sun lamp:10000 Lux

Contrast Ratio in daylight=Luminance of white screen/ Luminance of black screen



8. PRECAUTIONS

8.1 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 10ºC may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

(11) Do not keep same pattern in a long period of time. It may cause image sticking on LCD

8.2 SAFETY PRECAUTIONS

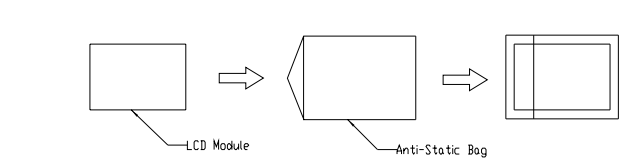
(1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

(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.

9. PACKAGING

9.1 CARTON



(1) 10pcs Modules/1 box
(2) Carton dimensions : 465(L)x362(W)x314(H)mm
(3) Weight : approximately 11.15kg(10 Module per box).

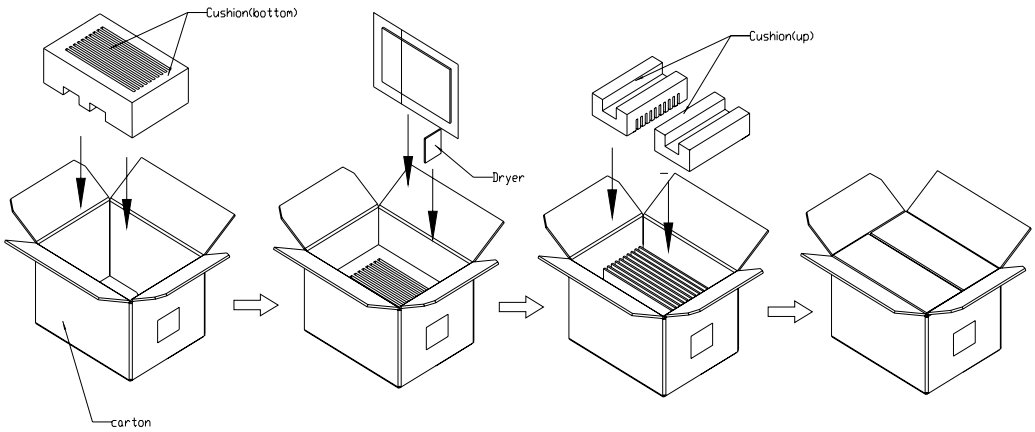


Figure. 8-1 Packing method

9.2 PALLET

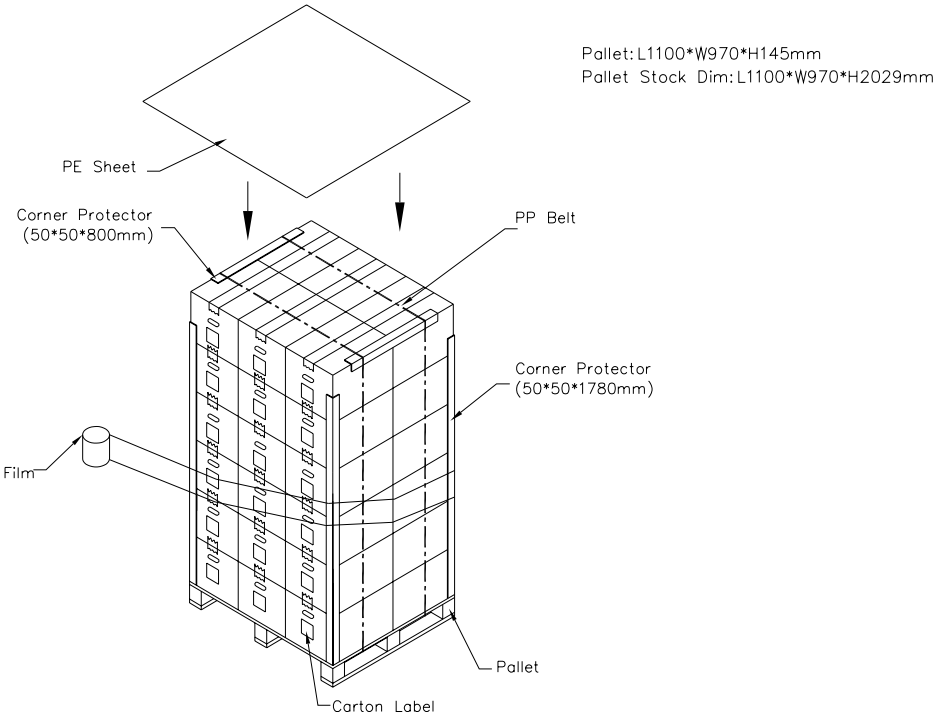


Figure. 9-2 Packing method

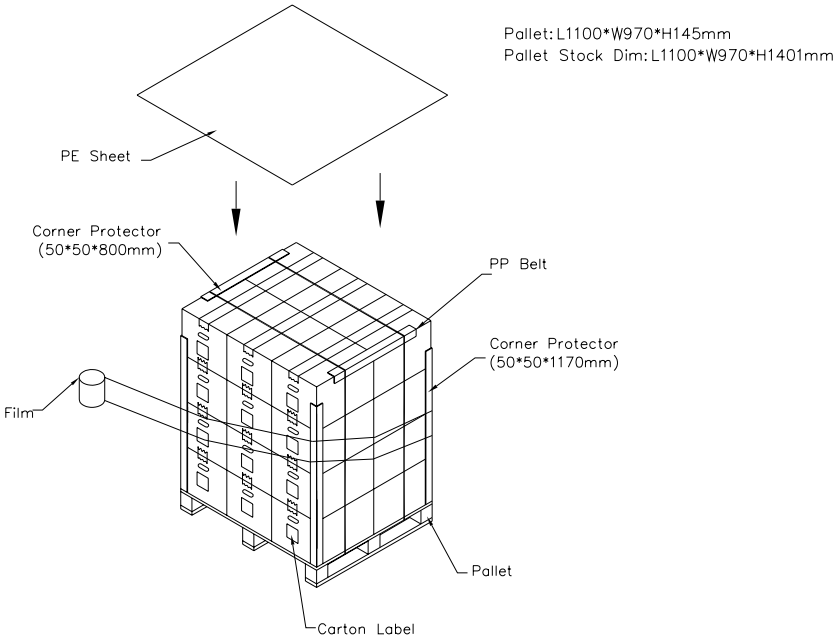


Figure. 9-3 Packing method

10. DEFINITION OF LABELS

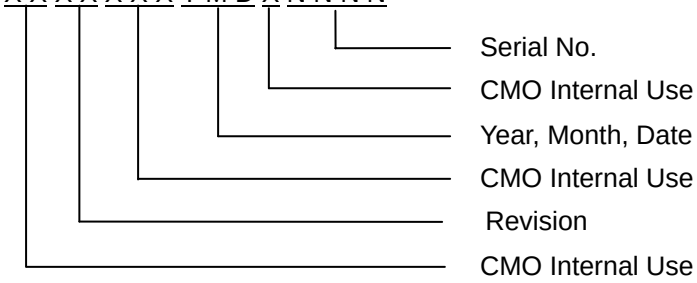
10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: G141I1 - L01

(b) Revision: Rev. XX, for example: A1, …C1, C2 …etc.

(c) Serial ID: X X X X X X X Y M D X N N N N



Serial ID includes the information as below:

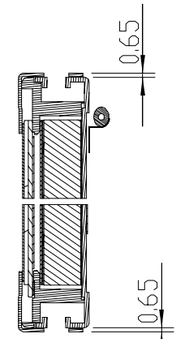
(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.

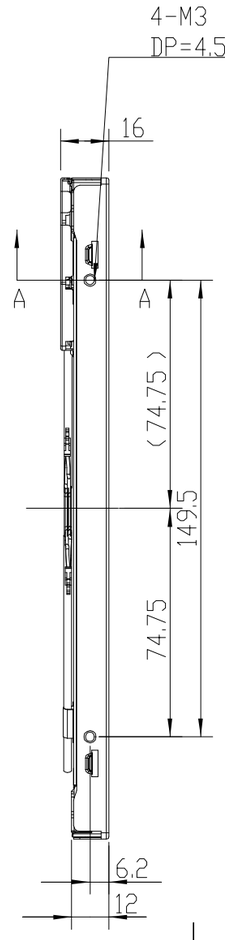
Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

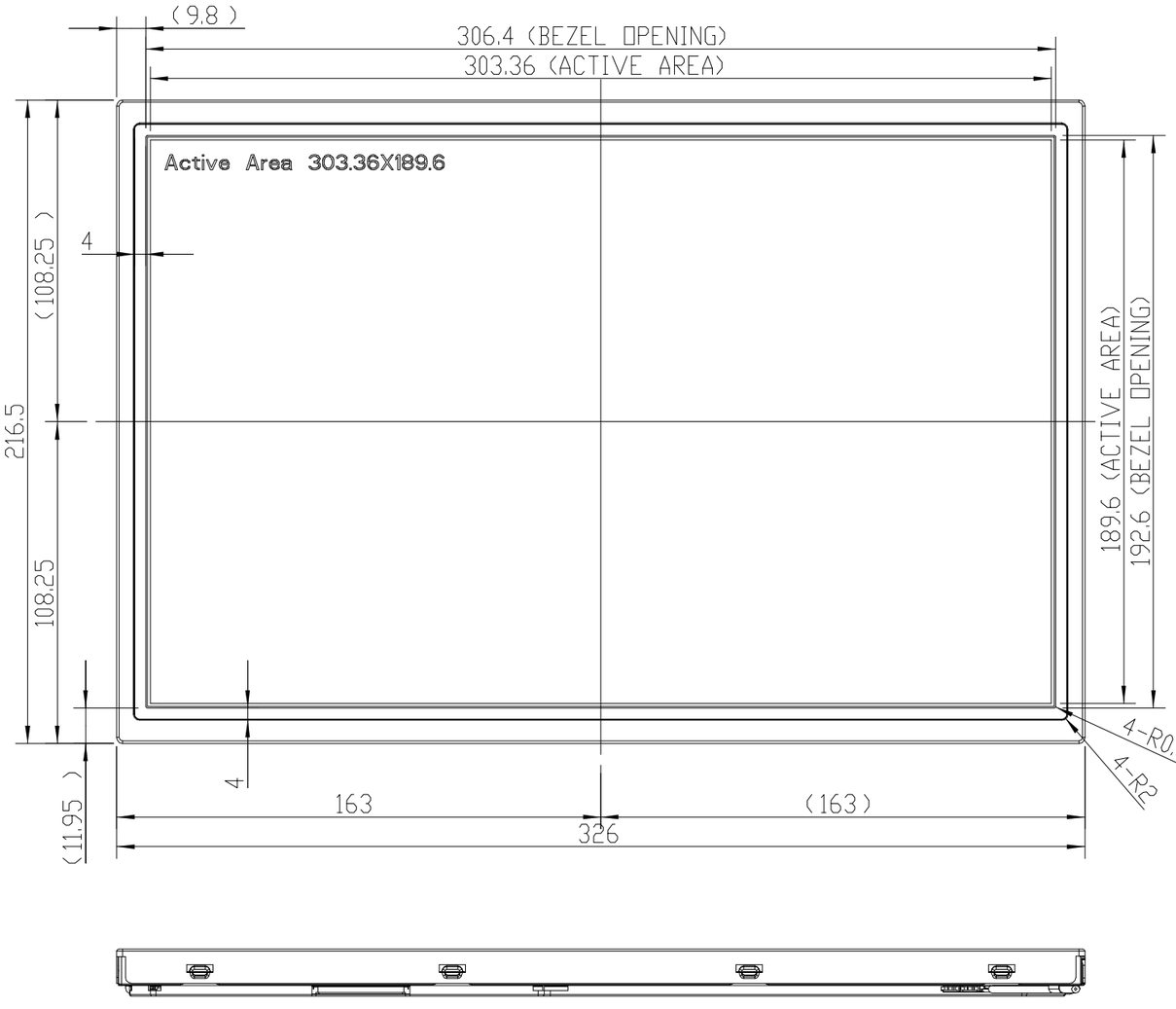
(b) Revision Code: cover all the change

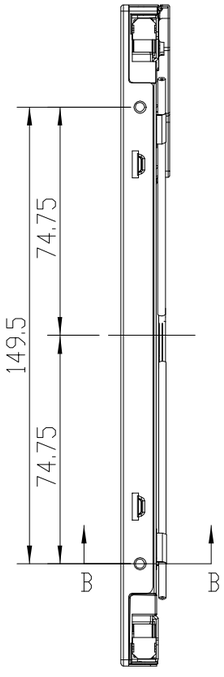
(c) Serial No.: Manufacturing sequence of product

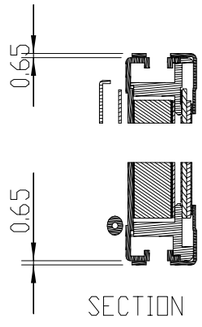


SECTION B-B









SECTION A-A

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

TITLE	ASSY_MODULE_G141I1-L01					2D REV.	01
						3D REV.	01
Approved	YULE_LIN	Drawing No.	G141141011				
Checked	TIGER_CHANG	Part No.	GE1I101901				
Drawer	TAURUS_HSIEH	Material	TBD		Sheet	1 / 2	A3
Designer	TAURUS_HSIEH	Date	15-May-2008	Scale	1:1	Unit:mm	

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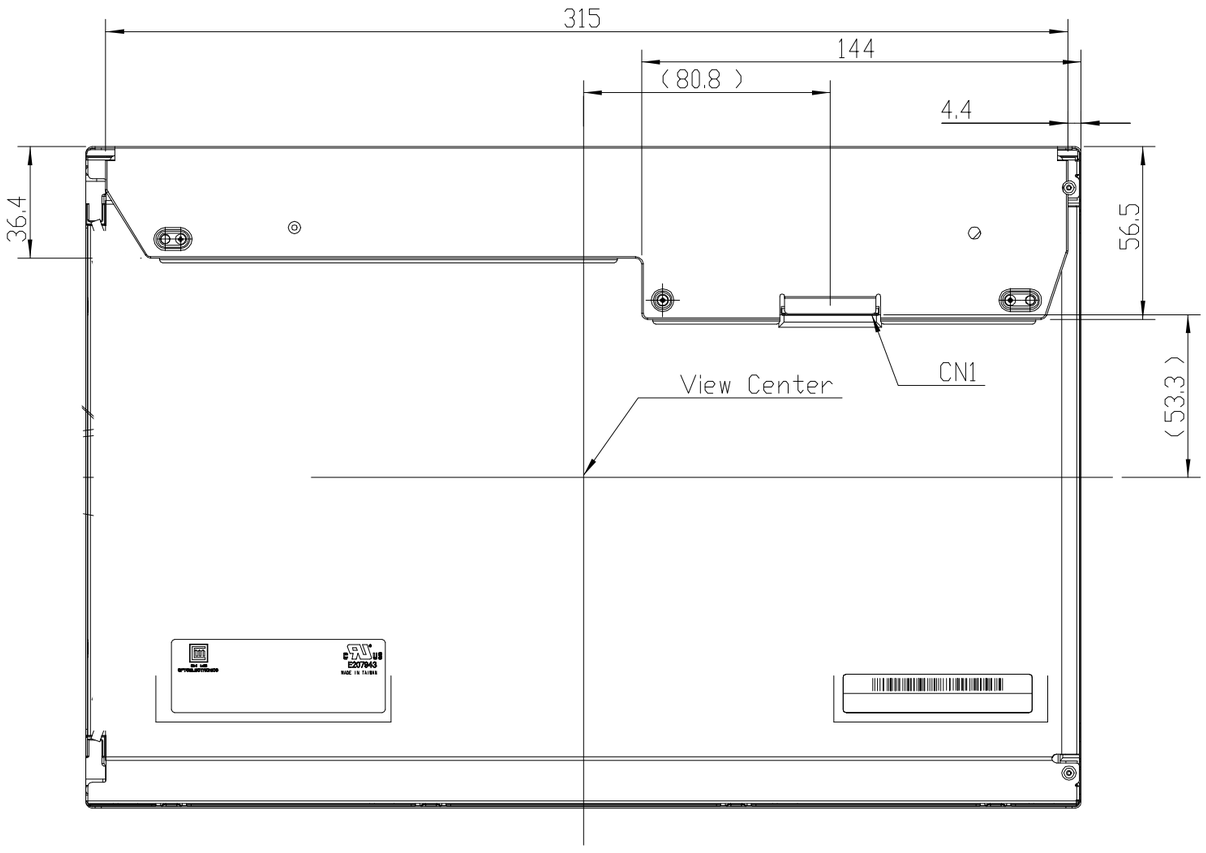

CN1:FI-SE20P-HFE(JAE)
CN2:35001HS-02L(YEONHO)

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

TITLE	ASSY_MODULE_G141I1-L01					2D REV.	01
						3D REV.	01
Approved	YULE_LIN	Drawing No.	G141141011				
Checked	TIGER_CHANG	Part No.	GE1I101901				
Drawer	TAURUS_HSIEH	Material	TBD		Sheet	2 / 2	A3
Designer	TAURUS_HSIEH	Date	15-May-2008	Scale 1:1	Unit:mm		

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