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OPTOELECTRONICS CORP.

TFT LCD Tentative Specification

MODEL NO.: V201V2 - T01

LCD TV Head Division	
Director	

QRA Dept. Approval	TD Division Approval	DDII Approval	DDI Approval

LCD TV Marketing and Product Management Dept.	
Project Manager	

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REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 0.0	Jun.12,'03	All	All	Tentative Specification was first issued.

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1. GENERAL DESCRIPTION

1.1 OVERVIEW

V201V2-T01 is a 20.1" TFT Liquid Crystal Display module with 12-CCFL Backlight unit and 1ch-TTL interface. This module supports 640 x 480 VGA format and can display true 16.7M colors (8-bit/color).

1.2 FEATURES

- High brightness (450 nits)

- High contrast ratio (500:1)

- Fast response time

- High color saturation NTSC 75%

- VGA (640 x 480 pixels) resolution

- DE (Data Enable) only mode

- TTL interface

1.3 APPLICATION

- TFT LCD TVs

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	408 (H) x 306 (V) (20.1" diagonal)	mm	(1)
Bezel Opening Area	412 (H) x 310 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	640 x R.G.B. x 480	pixel	-
Pixel Pitch(Sub Pixel)	0.2125 (H) x 0.6375 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Display Operation Mode	Transmissive mode / Normally black	-	-
Surface Treatment	Hardness : 2H, Haze : 40% Anti-reflective coating < 2% reflection	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	435.7	436.0	436.4	mm	(1)
	Vertical(V)	329.0	329.3	329.7	mm	
	Depth(D)	-		43.0	mm	with PCB Cover
Weight		-	2200(Typ.)			-

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

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2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.0	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 area surface should be 0 ºC Min. and 60 ºC Max.

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

Note (4) 10 ~ 500 Hz, 10 min, 1 time each X, Y, Z.

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.

Relative Humidity (%RH)

Temperature (ºC)
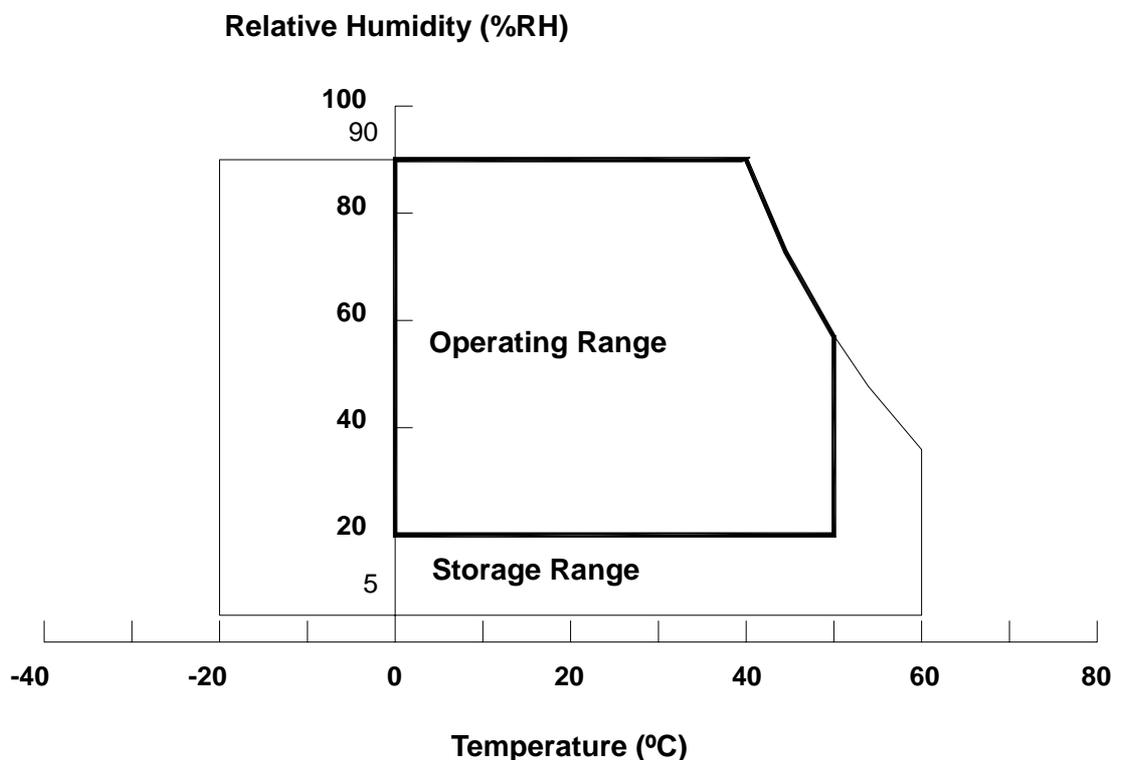
2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	(-0.3)	(+5.5)	V	

2.2.2 BACKLIGHT INVERTER UNIT

Item	Symbol	Test Condition	Min.	Type	Max.	Unit	Note
Input Voltage	VBL	-	0	-	30	V	
On/Off Control Voltage	VBLON	-					
Internal/External PWM Select Voltage	VSEL	-	-0.3	-	7	V	
Internal PWM Control Voltage	VIPWM	-					
External PWM Control Voltage	VEPWM	-					
Operating Temperature	Top	5 95%RH	0	-	60		(1)
Storage Temperature	T_{ST}	5 95%RH	-30	-	70		

Note (1) Protect inverters from moisture condensation and freezing.

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE
Ta = 25 ± 2 ºC

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	4.5	5.0	5.5	V	(1)
Ripple Voltage		V_{RP}	-	150	-	mV	(2)
Rush Current		I_{RUSH}	-	1.9	TBD	A	
Power Supply Current	White	Icc	-	0.5	-	A	(3)
	Black		-	0.4	-	A	
	Vertical Stripe		-	TBD	-	A	
TTL input high threshold voltage		V_{IH}	(2.7)	-	(3.3)	V	
TTL input low threshold voltage		V_{IL}	0	-	(0.7)	V	

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

Note (2) Measurement Conditions:

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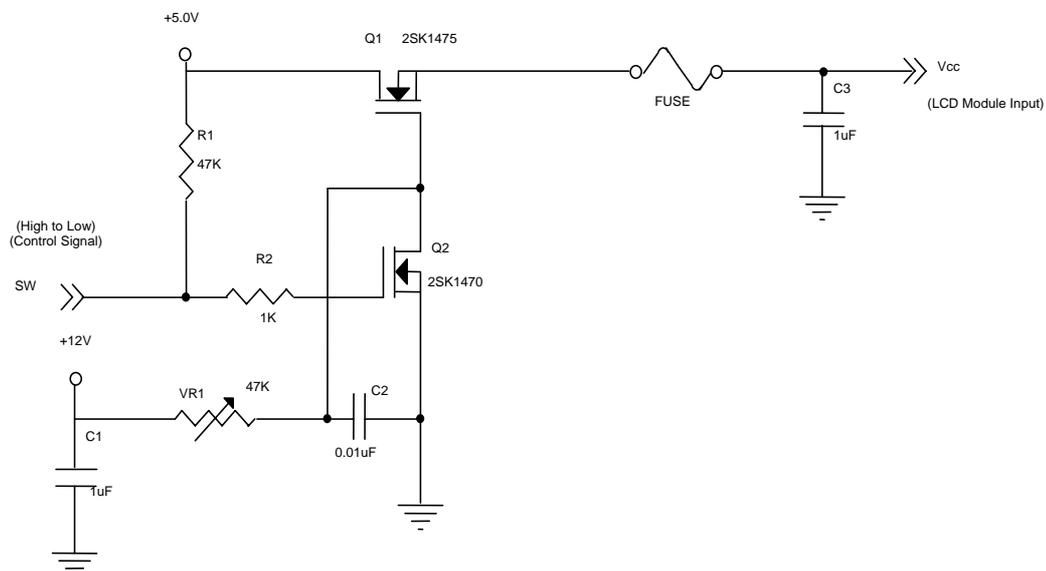
Vcc rising time is 470μs

+5V

0.9Vcc

0.1Vcc

GND

470μs
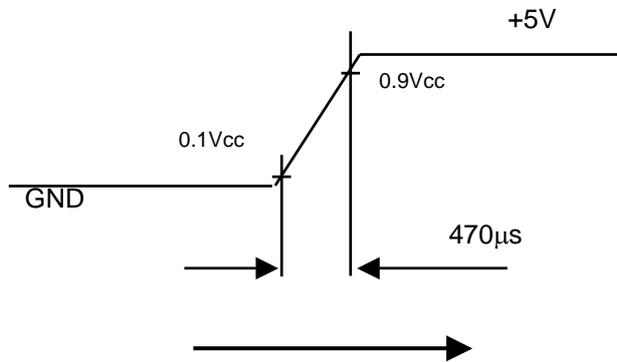
Note (3) The specified power supply current is under the conditions at Vcc = 5 V, Ta = 25 ± 2 ℃, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern
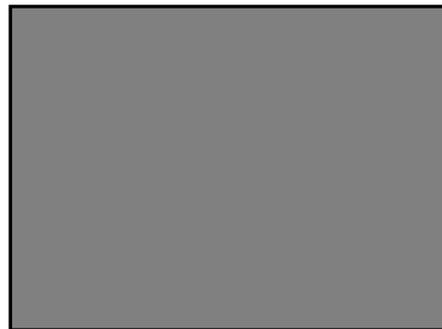
Active Area

c. Vertical Stripe Pattern

Active Area

R	G	B	R	G	B
B	R	G	B	R	G	B	R
B	R	G	B	R	G	B	R
R	G	B	R	G	B

7
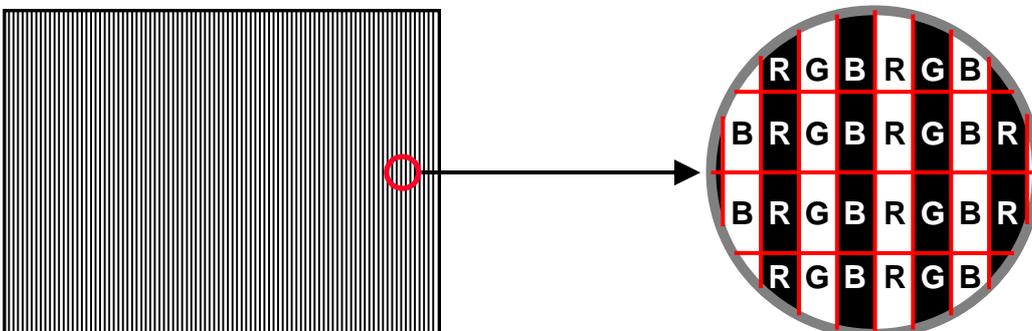
3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	733	815	896	V_{RMS}	I_L = 5.5 mA
Lamp Current	I_L	5.2	5.5	5.8	mA_{RMS}	
Lamp Turn On Voltage	V_S	1650	-	3000	V_{RMS}	Ta = 0 ºC
		1320	-	3000	V_{RMS}	Ta = 25 ºC
Operating Frequency	F_L	35	39	43	KHz	
Lamp Life Time	L_{BL}	50000	60000	-	Hrs	
Power Consumption	P_L	-	68	-	W	Inverter Input

Note (1) Lamp current is measured by utilizing high frequency current meters as shown below:

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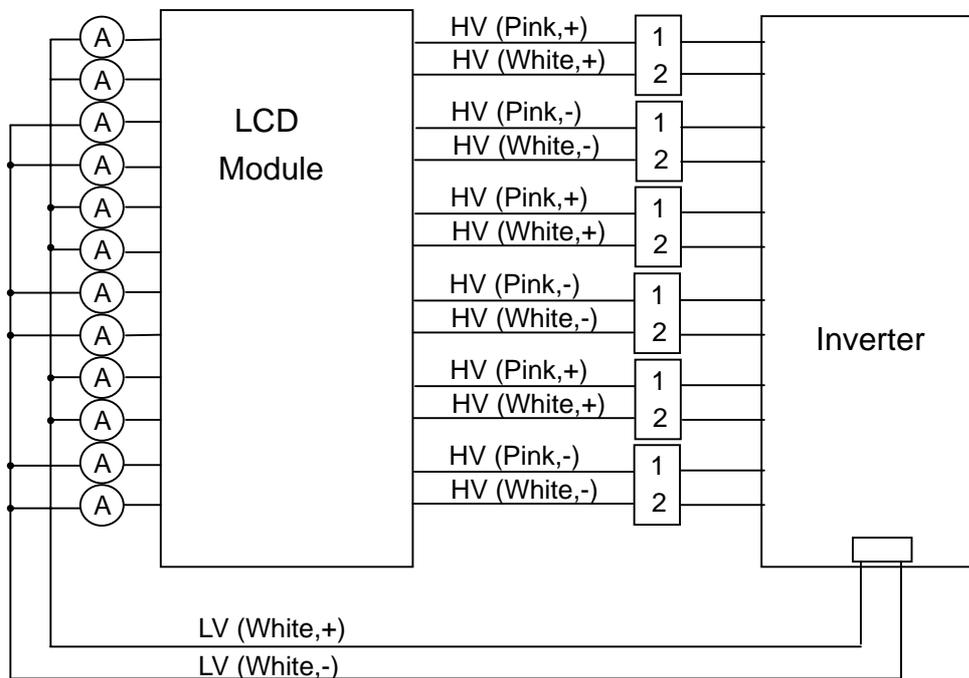
4. BLOCK DIAGRAM

4.1 TFT LCD MODULE

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Tentative
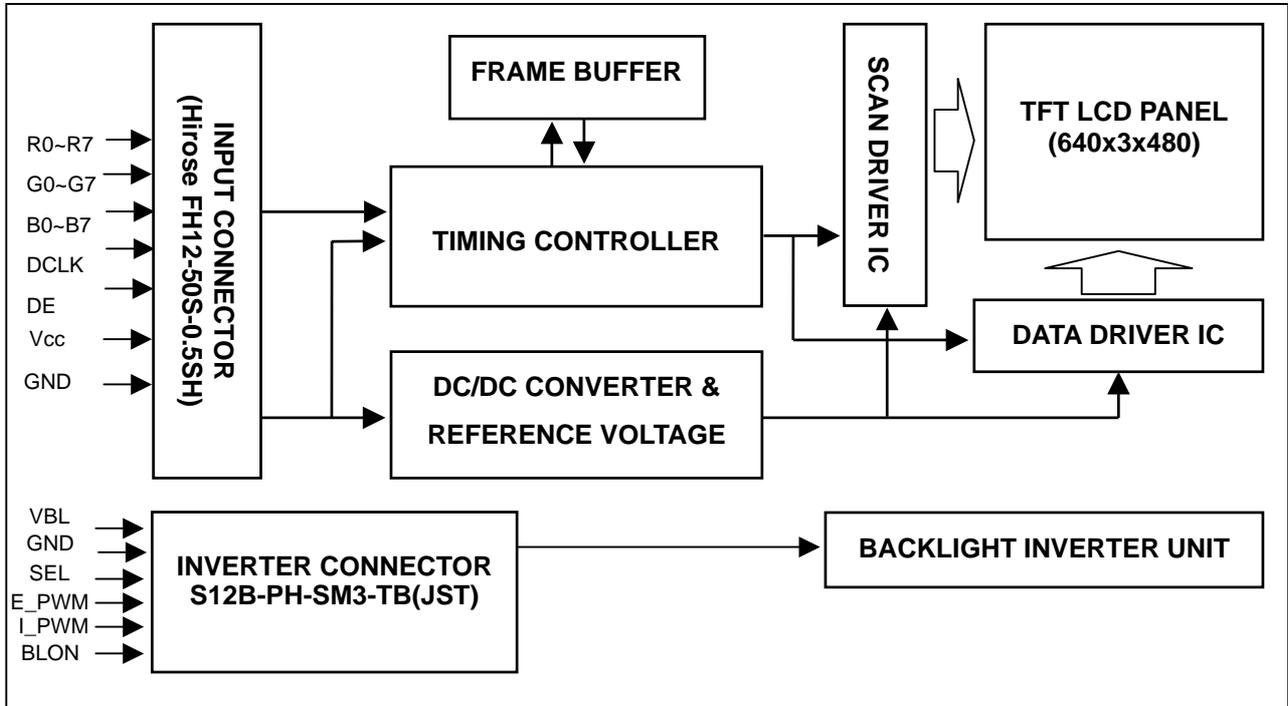
5. INTERFACE PIN CONNECTION

5.1 TFT LCD MODULE

Pin assignment

Pin	Name	Description	Pin	Name	Description
1	NC	No Connection	26	R0	Red Data
2	NC	No Connection	27	GND	Ground
3	NC	No Connection	28	G7	Green Data (G7:MSB)
4	GND	Ground	29	G6	
5	GND	Ground	30	G5	
6	VCC	Power Input (+5.0V)	31	G4	
7	VCC		32	GND	Ground
8	VCC		33	G3	Green Data
9	VCC		34	G2	
10	GND	Ground	35	G1	
11	NC		36	G0	
12	NC		37	GND	Ground
13	GND	Ground	38	B7	Blue Data (B7:MSB)
14	DE	Data Enable	39	B6	
15	GND	Ground	40	B5	
16	DCLK	Dot Clock	41	B4	
17	GND	Ground	42	GND	Ground
18	R7	Red Data (R7:MSB)	43	B3	Blue Data
19	R6		44	B2	
20	R5		45	B1	
21	R4		46	B0	
22	GND	Ground	47	GND	Ground
23	R3	Red Data	48	GND	Ground
24	R2		49	NC	No Connection
25	R1		50	NC	No Connection

Note (1) Connector Part No.: FH12-50S-0.5SH (Hirose) or compatible

Note (2) NC pin has to keep high impedance

5.2 COLOR DATA INPUT ASSIGNMENT

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.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	R7	R6	G5	G4	G3	G2	G1	G0	R7	R6	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	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	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	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
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	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)	1	1	1	1	1	1	1	1	0	0	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	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)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	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	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	1	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

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

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6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/Tc	(20)	25.175	(30)	MHz	-
Vertical Active Display Term	Frame Rate	Fr	(50)	60	(70)	Hz	-
	Total	Tv	(500)	525	(550)	Th	Tv=Tvd+Tvb
	Display	Tvd	480	480	480	Th	-
	Blank	Tvb	(20)	45	(70)	Th	-
Horizontal Active Display Term	Total	Th	(700)	800	(900)	Tc	Th=Thd+Thb
	Display	Thd	640	640	640	Tc	-
	Blank	Thb	(60)	160	(260)	Tc	-

Note: Because of this module is operated by DE only mode, Hsync and Vsync input signals should be set

to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM

The information described in this technical specification is tentative and it is possible to be changed without prior
notice. Please contact CMO 's representative while your product design is based on this specification. **Version0.0**
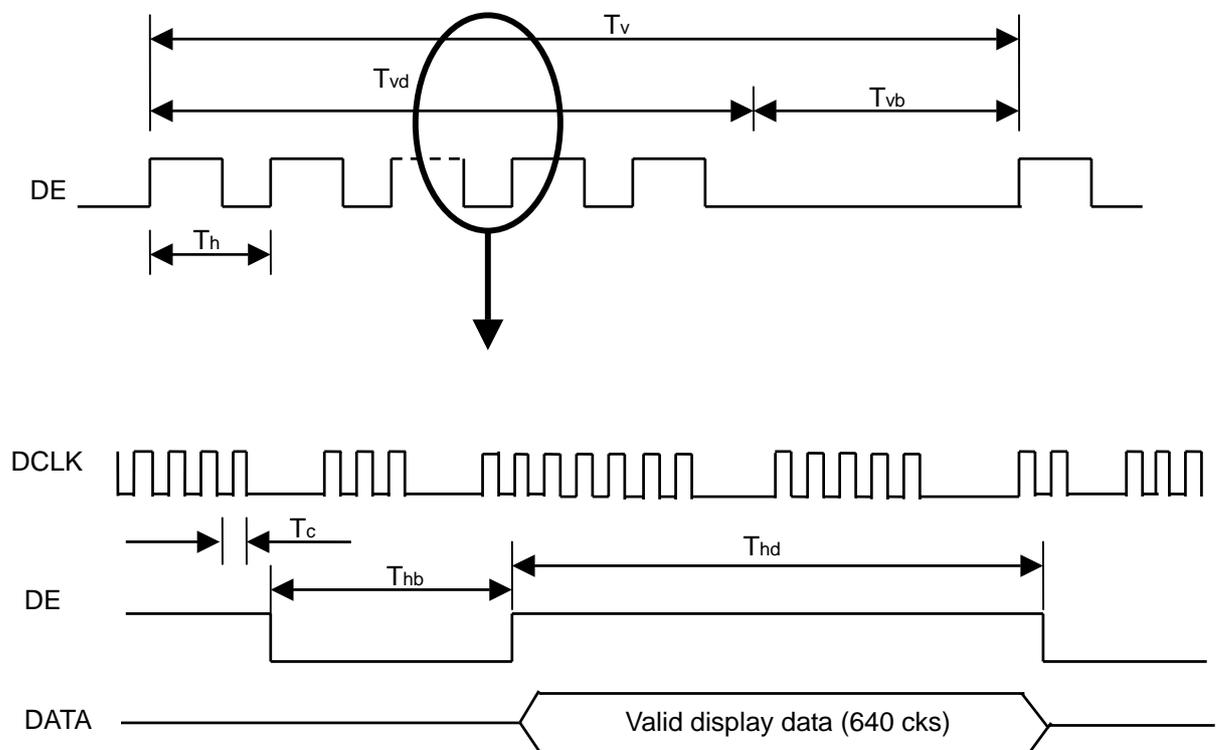
6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.

Power Supply

Vcc

0.9 Vcc
0.1Vcc
0V

0 T₁ (10ms)
0 T₂ (50ms)
0 T₃ (50ms)
(2s) T₄

Signals

0.9 Vcc
0.1V_DD

VALID

Power On   Power Off

Backlight (Recommended)
(100)ms T₅
100ms T₆

50%   50%
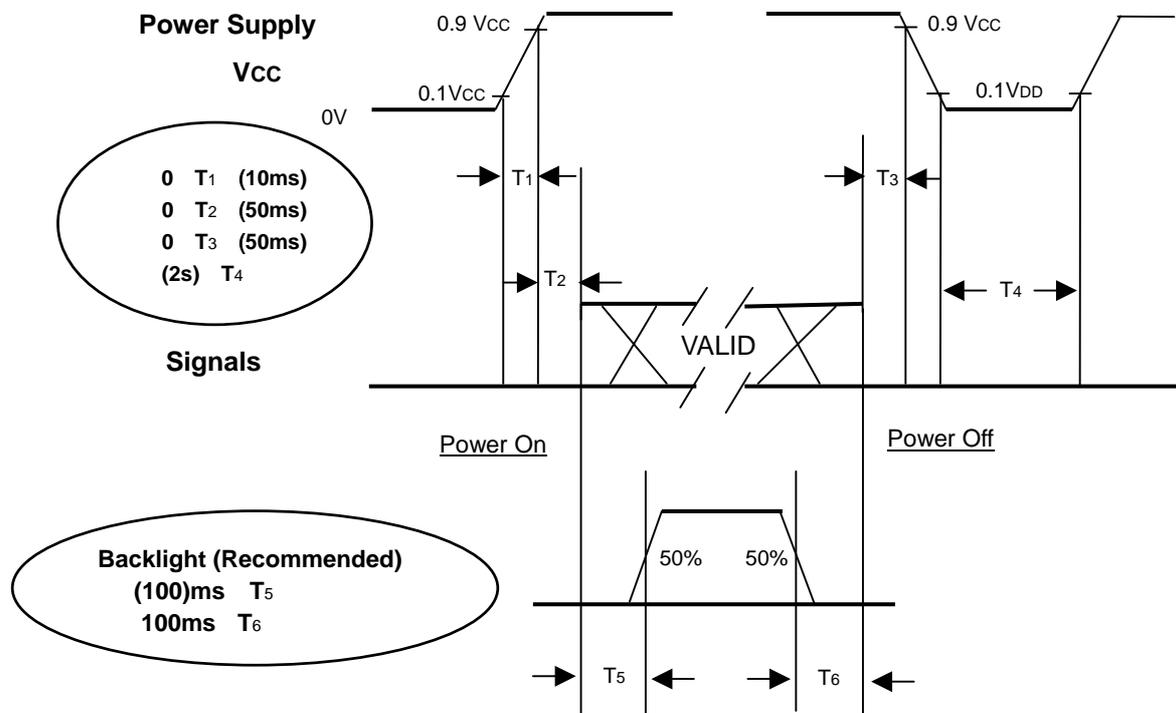
Power ON/OFF Sequence

Note (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

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7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

| Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	^{o}C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	(5.5)	mA
Inverter Driving Frequency	F_L	(39)	KHz
Inverter	(DELTA)		

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
Contrast Ratio		CR			(500)	-	-	Note(2)
Response Time		T_R		-	(15)	-	ms	Note(3)
		T_F		-	(10)	-	ms	
		Gray to gray			(16.6)			Note(4)
Center Luminance of White		L_C		(400)	(450)	-	cd/m^2	Note(5)
White Variation		δW		-	-	(1.6)	-	Note(8)
Cross Talk		CT	$θ_x$=0°, $θ_Y$=0° Viewing Normal Angle	-	-	(4)	%	Note(6)
Color Chromaticity	Red	Rx			TBD		-	Note(7)
		Ry			TBD		-	
	Green	Gx			TBD		-	
		Gy			TBD		-	
	Blue	Bx			TBD		-	
		By			TBD		-	
	White	Wx			(0.285)		-	
		Wy			(0.293)		-	
	Color Gamut				(75)	-	%	
Viewing Angle	Horizontal	$θ_x$+	CR≥10		(85)	-	Deg.	Note(1)
		$θ_x$-			(85)	-		
	Vertical	$θ_Y$+			(85)	-		
		$θ_Y$-			(85)	-		

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

Viewing angles are measured by Eldim EZ-Contrast 160R

Normal

$\theta x = \theta y = 0^{\circ}$

$\theta y-$ $\theta y+$

$\theta X- = 90^{\circ}$ x-

12 o'clock direction

y+ $\theta y+ = 90^{\circ}$

$\theta x-$

$\theta x+$

6 o'clock

y-   x+ $\theta X+ = 90^{\circ}$

$\theta y- = 90^{\circ}$
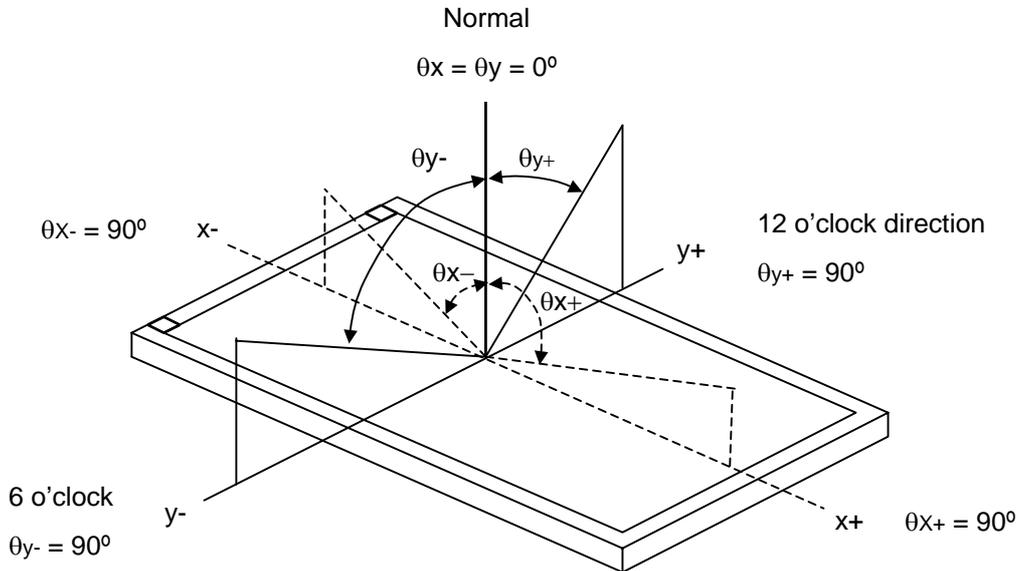
Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

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

Gray Level 255   Gray Level 255

100%

90%

Optical

Response

Gray Level 0

10%

0%

T_F T_R Time
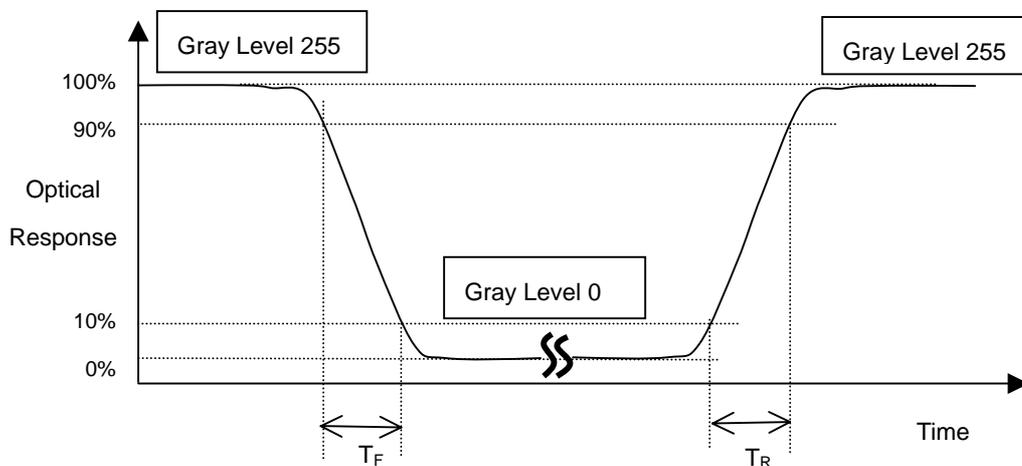
Note (4) Definition of Gray to Gray Switching Time:
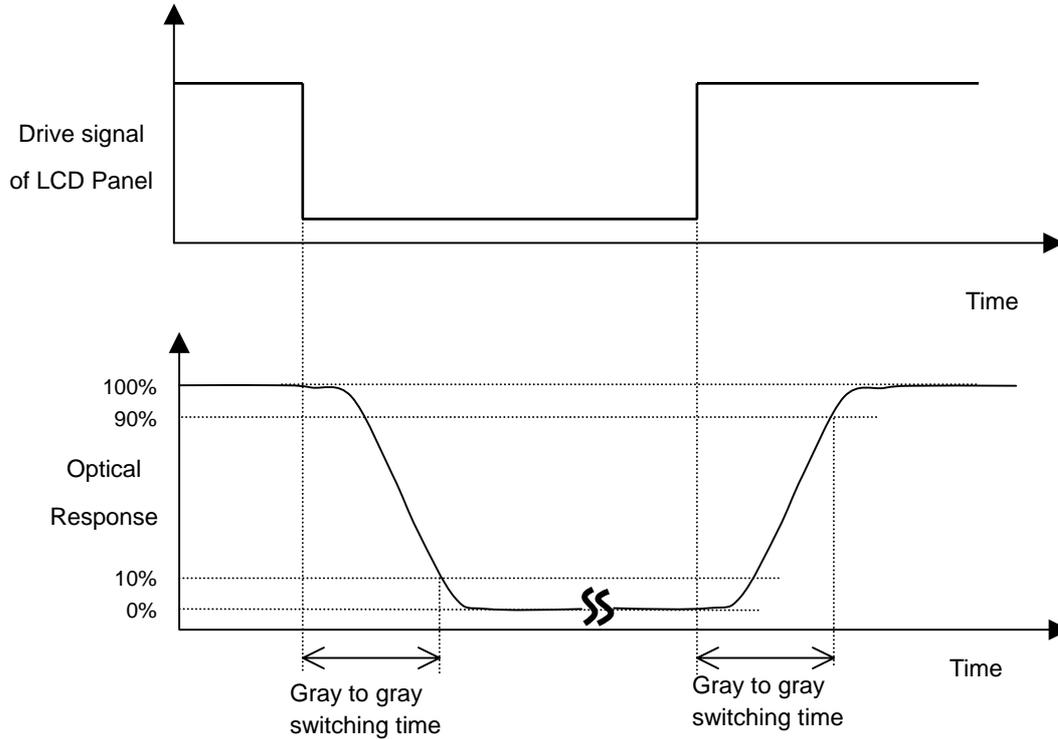
The driving signal means the signal of gray level 0, 63, 127, 191, 255.

Note (5) Definition of Luminance of White (L_C, L_{AVE}):

Measure the luminance of gray level 255 at center point and 5 points

$L_C = L (5)$

$L_{AVE} = [L (1) + L (2) + L (3) + L (4) + L (5)] / 5$

L (x) is corresponding to the luminance of the point X at the figure in Note (7).

Note (6) Definition of Cross Talk (CT):

$CT = | Y_B - Y_A | / Y_A \times 100$ (%)

Where:

Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)
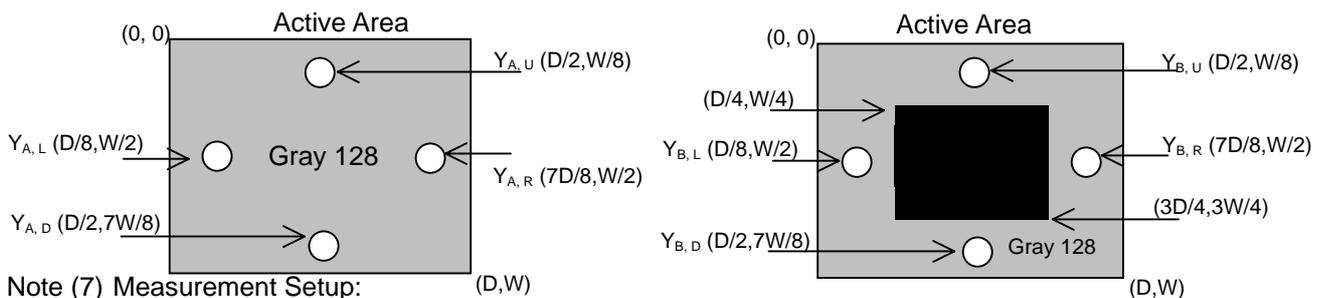
Note (7) Measurement Setup:

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The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.

LCD Module

LCD Panel

Center of the Screen

Display Color Analyzer
(Minolta CA210)

Light Shield Room

(Ambient Luminance < 2 lux)
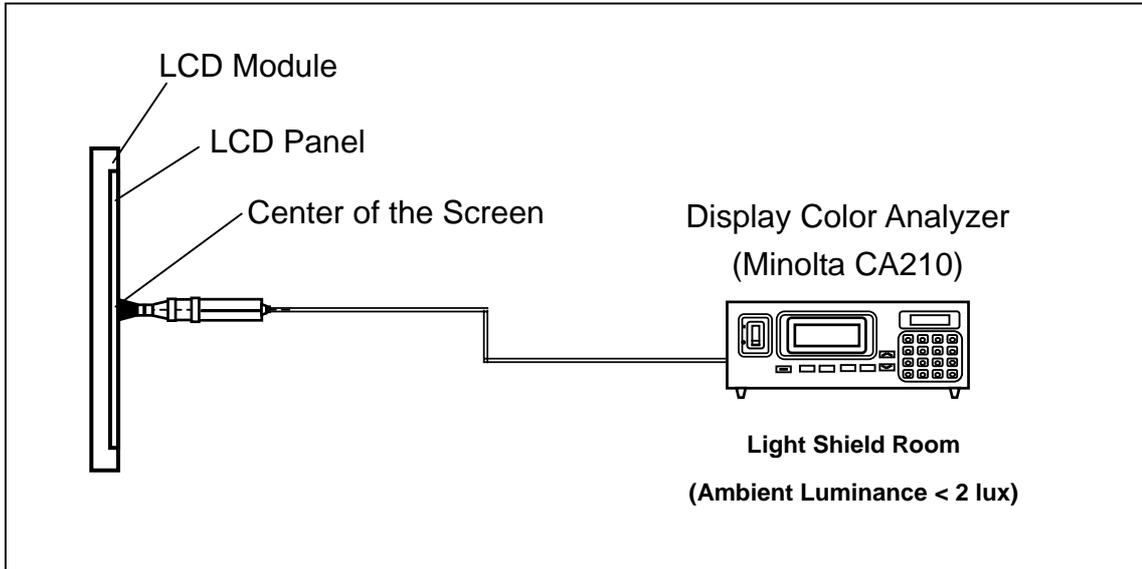
Note (8) Definition of White Variation (δW):

Measure the luminance of gray level 255 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)]

Horizontal Line

D

D/4   D/2   3D/4

Vertical Line

W

W/4

W/2

3W/4

①   ②

⑤

③   ④

Ⓧ : Test Point

X=1 to 5

Active Area

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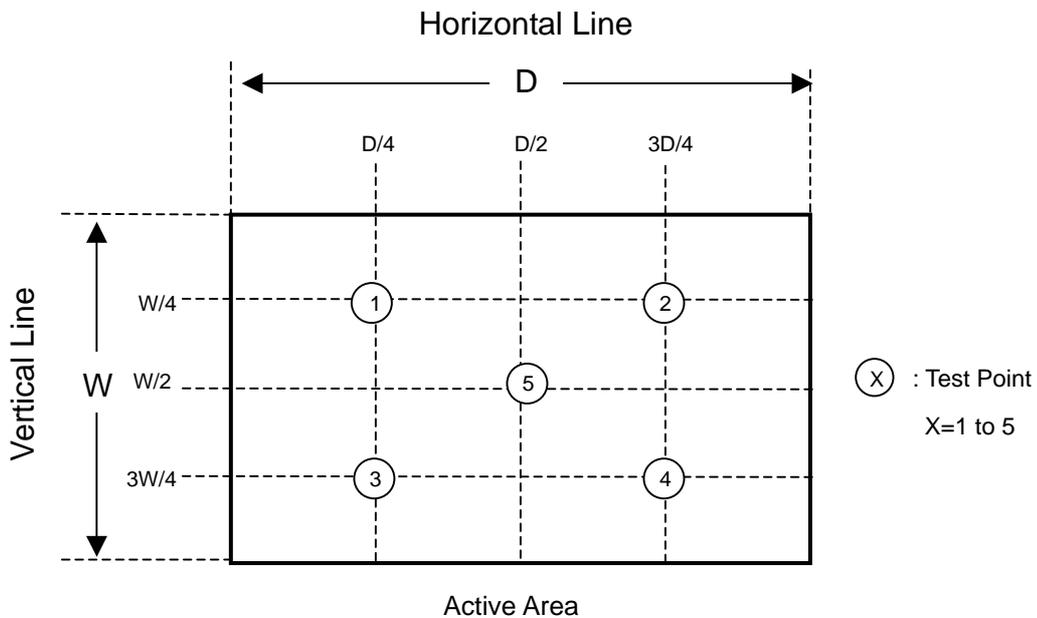
8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.

(4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

(5) Do not plug in or pull out the I/F connector while the module is in operation.

(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) Moisture can easily penetrate into LCD module and may cause the damage during operation.

(9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.

(10) When ambient temperature is lower than 10ºC, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

8.2 SAFETY PRECAUTIONS

(1) The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the 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.

CHI MEI OPTOELECTRONICS CORP.

Tentative

9. MECHANICAL CHARACTERISTICS

The information described in this technical specification is tentative and it is possible to be changed without prior notice. Please contact CMO 's representative while your product design is based on this specification.   **Version0.0**

50.00

40.00

114.00

HRS
FH12-50S-0.5SH