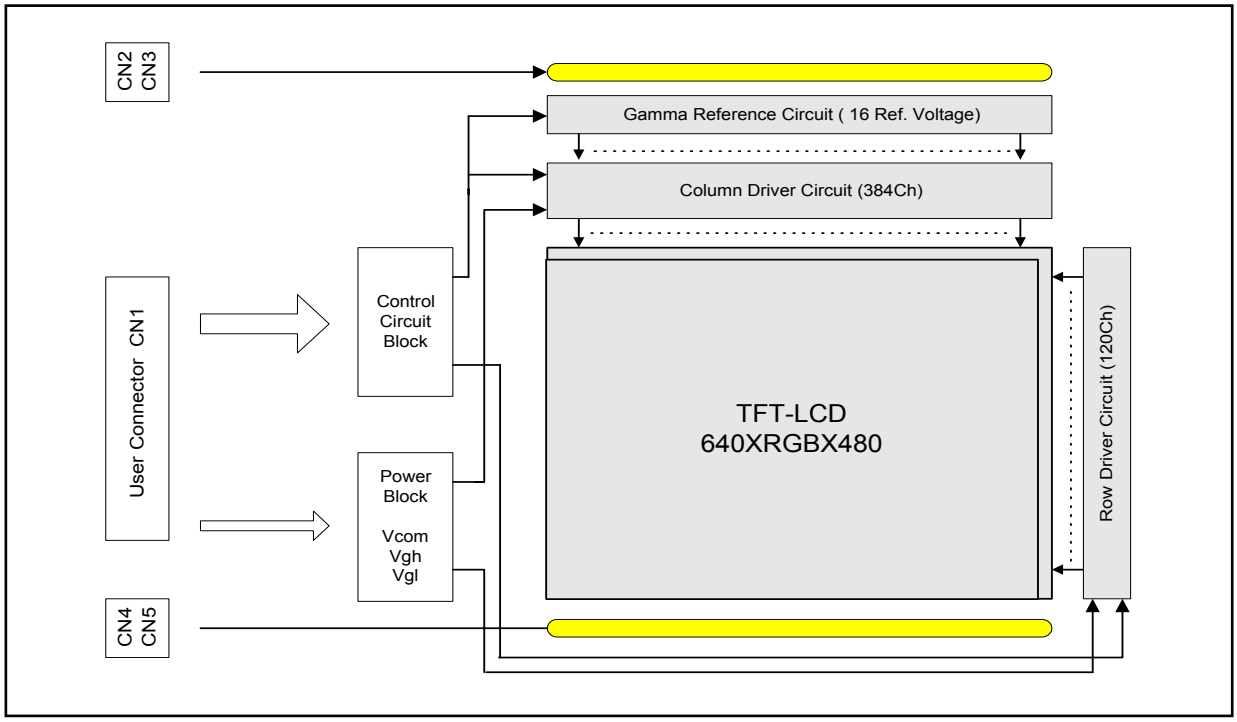
1. General Description

The LC201V1 is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally white mode. This TFT-LCD has a 20.1 inches diagonally measured active display area with VGA resolution(480 vertical by 640 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 8-bit gray scale signal for each dot.

The LC201V1 is intended to support applications where thin thickness, low power and fast response time for moving pictures. In combination with the vertical arrangement of the sub-pixels, the LC201V1 characteristics provide an excellent flat panel display for Digital TV and AV amusement.



General Features

Active screen size	20.1 inches(510mm) diagonal
Outline dimensions	450.0(H) ×348.7(V) ×20.0(D) mm (Typ.), 24.0mm(max) :Devices Area
Pixel pitch	0.6375 mm ×0.6375 mm
Pixel format	640 horiz. by 480 vert. pixels RGB stripe arrangement
Color depth	8-bit, 16.7M colors
Luminance,White	400 cd/m^2 (Typ.)
Power Consumption	Total 34 Watt(Typ.)
Weight	3200g (Typ.)
Display operating mode	Transmissive mode, normally white
Surface treatments	Hard coating (3H), Anti-glare treatment of the front polarizer

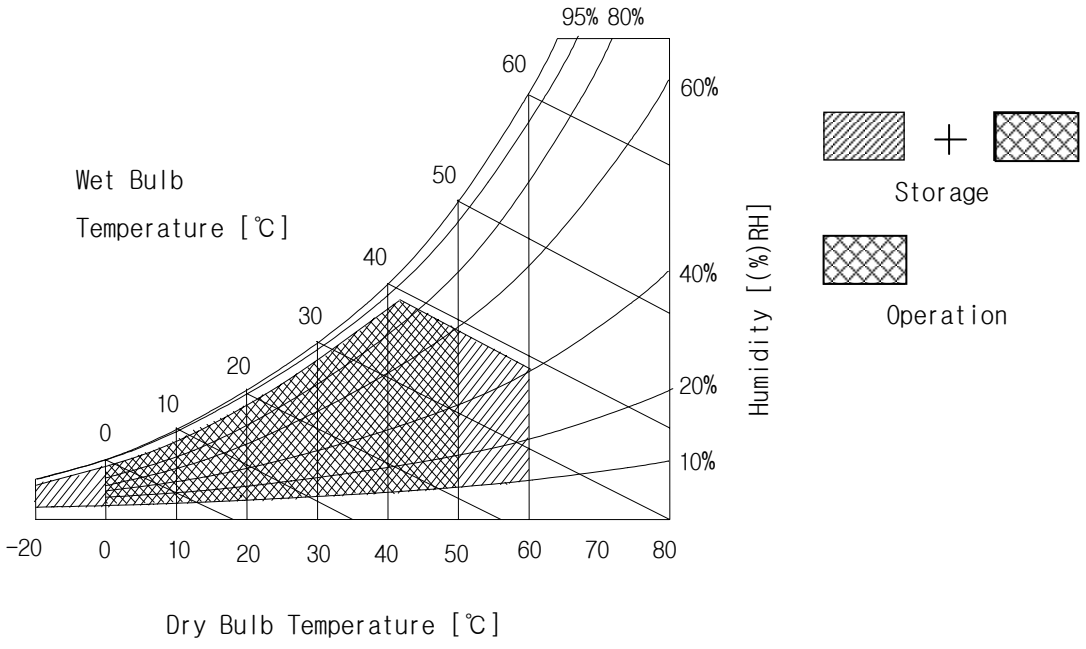
2. Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

Table 1 ABSOLUTE MAXIMUM RATINGS

Parameter	symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage	V_{IN}	-0.3	+6.0	Vdc	at 25 ±5℃
Logic Input Voltage	$V_{L/H}$	-0.3	+3.6	Vdc	at 25 ±5℃
Operating Temperature	T_{OP}	0	50	℃	1
Storage Temperature	T_{ST}	-20	60	℃	1
Operating Ambient Humidity	H_{OP}	10	90	%RH	1
Storage Humidity	H_{ST}	10	90	%RH	1

Note: 1. Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39℃ Max, and no condensation of water.



3. Electrical Specifications

3-1. Electrical Characteristics

The LC201V1 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal and the other input which power to the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCD Module.

Table 2 ELECTRICAL CHARACTERISTICS(Module) :

Parameter		Symbol	Values			Unit	Notes.
			Min.	Typ.	Max.		
Module	Power Supply Input Voltage	Vcc	4.5	5.0	5.5	Vdc	1
	Power Supply Input current	Icc	-	0.3	0.45	A	1
	Logic High Level Input	V_H	$0.7V_{L/H}$				3.3V Logic
	Logic Low Level Input	V_L			$0.3V_{L/H}$		3.3V Logic
	Rush Current	I_{RUSH}			2.0	A	2

Notes: 1. The specified current and power consumption are under the condition ; V_{IN} = 5.0V , 25℃, 65%RH, fv = 60Hz and the test pattern is ' 8X6 Mosaic'(black and white).
The variance of the each voltage is ±10%.
2. Refer to Appendix 1.

The LC201V1 LCD have two CCFL assemblies and a CCFL assembly consist of three CCFLs per assembly.

Table 3 ELECTRICAL CHARACTERISTICS(Lamp) :

Parameter		Symbol	Values			Unit	Notes.
			Min.	Typ.	Max.		
Lamp	Voltage	V_{BL}	684	760	836	Vrms	at I_{BL} = 7mArms
	Current (CCFL assembly)	I_{BL}	**3.0** **(9.0)**	**7.0** **(21.0)**	**8.0** **(24.0)**	mA rms mA rms	
	Established Starting Voltage at 25 ℃ at 0 ℃	 V_{BL} V_{BL}			 1,080 1,500	Vrms	
	Operating Frequency	f_{BL}	30	50	80	kHz	
	Discharge Stabilization Time	T_S			3	minutes	
	Power Consumption(6 CCFLs)	P_{BL}		31.92	35.1	W	
	Life Time		30,000	40,000		hrs	at 7mA

Notes: The design of the inverter must have specifications for the lamp in LCD Assembly.
The performance of the Lamp in LCM, for example life time or brightness, is extreamly influenced by the characteristics of the DC-AC inverter. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.
When you design or order the inverter, please make sure unwanted lightning caused by the mismatch of the lamp and the inverter(no lightning, flicker and etc.,) never occurs. When you confirm it, the LCD assembly should be operated in the same condition as installed in your instruments.

1. The voltage V_{BL} should be applied to the lamps for more than 1 second for start-up. Otherwise, the lamps may not be turned on.
2. 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 interference with horizontal synchronous frequency and as a result this may caused beat on the display. Therefore lamp frequency shall be arpart from the horizontal synchronous frequency and from its harmonics in order to prevent interference.
3. Let's define the brightness of the lamp after being lighted for 5 minutes as 100%. T_S is the time required for the brightness of the center of lamp to be not less than 95%.
4. The lamp power consumption shown above does not include loss of external inverters.
5. The life time is determined as the time at which brightness of lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25±2℃.

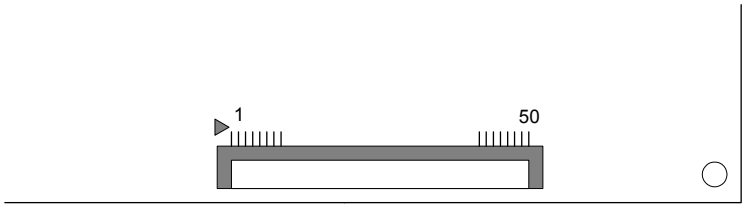
3-2. Interface Connections

This LCD employs five interface connections, a 50 pin connector is used for the module electronics and two kinds of four connectors are used for the integrated backlight units.
The electronics interface connector is a model FH12-50S-0.5SH manufactured by Hirose Electric Co., Ltd.
The pin configuration for the connector is shown in the table below.

Table 4 MODULE CONNECTOR PIN CONFIGURATION

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

Notes : 1. All GND(ground) pins should be connected together and the LCD's metal frame.
2. All Vcc(power input) pins should be connected together.



< A placement of user connector : Rear Side>

The backlight interface connectors are BHSR-02VS-1 and BHR03VS-1 manufactured by JST. The mating connectors are SM02B-BHS-1-TB and SM03(4.0)B-BHS-1-TB manufactured by JST or equivalents. And the pin configuration for the connectors are shown in the table below.

Table 5 BACKLIGHT CONNECTOR PIN CONFIGURATION

< CN 2, CN4>

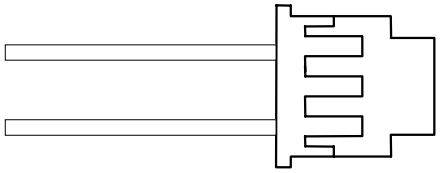
Pin No	SYMBOL	Description	NOTE
1	HV	High voltage (Pink color cable)	-
2	NC		
3	HV	High voltage (Pink color cable)	-

< CN 3, CN5>

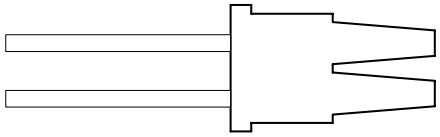
Pin No	SYMBOL	Description	NOTE
1	HV	High voltage (Pink color cable)	-
2	LV	Ground (White color cable)	-

Notes: 1. The high voltage side terminal is colored pink. The low voltage side terminal is white.

<CN2,CN4>



<CN3,CN5>



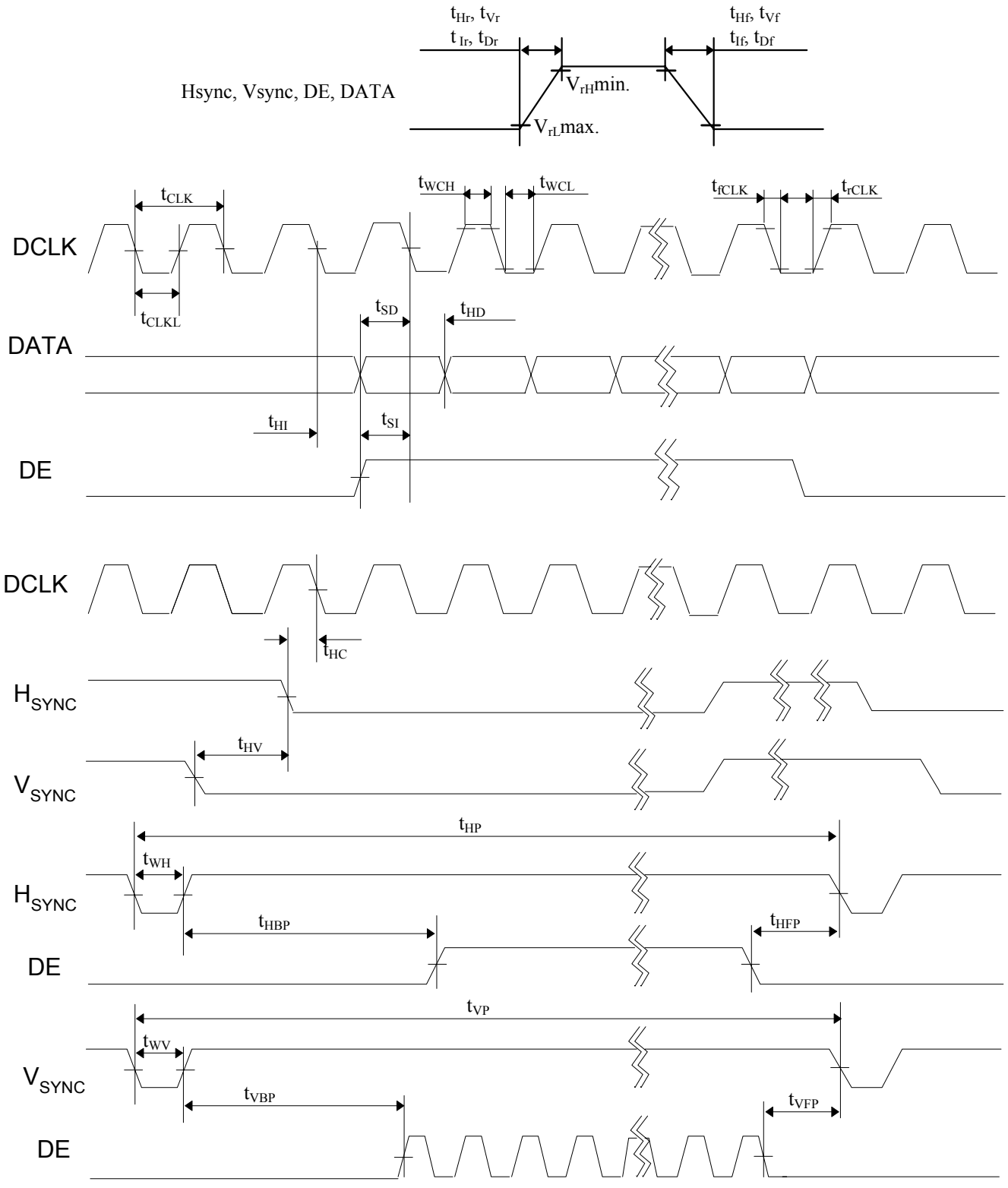
3-3. Signal Timing Specifications

All of the interface signal timing should be satisfied with the following specifications for it's proper operation.

Table 6 Timing Table

ITEM		SYMBOL	MIN	TYP	MAX	Unit	Notes
Dclk	Frequency	$f_{CLK}(=1/t_{CLK})$	20.0	25.0	30.0	MHz	Dclk :
	High duration	t_{WCH}	0.4 t_{CLK}	0.6 t_{CLK}	0.8 t_{CLK}	ns	25MHz
	Low duration	t_{WCL}	0.2 t_{CLK}	0.4 t_{CLK}	0.6 t_{CLK}	ns	-
Data	Setup duration	t_{SD}	5.0	-	-	ns	for f_{CLK}
	Hold duration	t_{HD}	10.0	-	-	ns	
Hsync	Period	t_{HP}	-	31.8	-	μs	-
			770	800	900	clock	-
	Pulse width	t_{WH}	2	96	200	clock	-
Vsync	Period	t_{VP}	-	16.67	-	msec	-
			515	525	560	lines	-
	Pulse width	t_{WV}	2	3	34	lines	-
Data Enable (DE)	Setup duration	t_{SI}	5.0	-	-	ns	for f_{CLK}
	Hold duration	t_{HI}	10.0	-	-	ns	for f_{CLK}
	Horizontal back porch	t_{HBP}	12	48	-	clock	-
	Horizontal Active		640	640	640	clock	-
	Horizontal front porch	t_{HFP}	8	16	-	clock	-
	Vertical back porch	t_{VBP}	1	33	-	lines	-
	Vertical Active		480	480	480	lines	-
	Vertical front porch	t_{VFP}	1	10	-	lines	
Hsync-clock phase difference		t_{HC}	t_{CLK}-10	-	T_{wcl}	ns	-
Hsync-Vsync phase difference		t_{HV}	-	-	t_{HP} -T_{wH}	ns	-

3-4. Signal Timing Waveforms



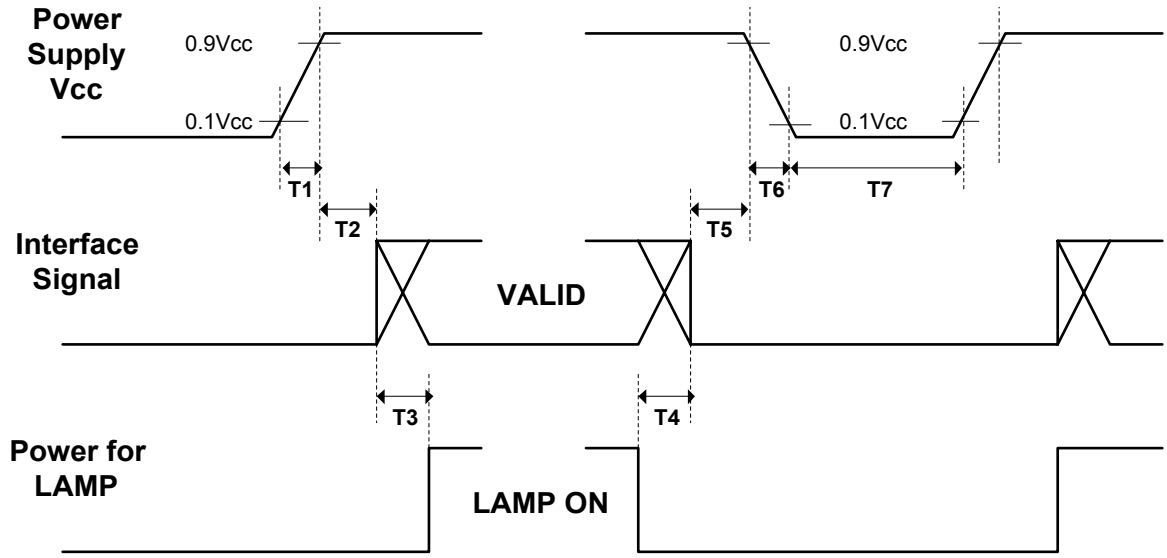
3-5. Color Input Data Reference

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 a reference for color versus data input.

Table 7 COLOR DATA REFERENCE

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(000)	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(001)	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(002)	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
Green	Green(000)	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(001)	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(002)	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
Blue	Blue(000)	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(001)	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(002)	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

3.6 Power Sequence



Parameter	Value			Unit	Notes
	Min.	Typ.	Max.		
T1	-	-	10	ms	
T2	0	-	50	ms	
T3	200	-	-	ms	
T4	200	-	-	ms	
T5	0	-	50	ms	
T6	-	-	10	ms	
T7	400	-	-	ms	

Notes: 1. Please avoid floating state of interface signal at invalid period.
2. When the interface signal is invalid, be sure to pull down the power supply for LCD V_{CC} to 0V.
3. Lamp power must be turn on after power supply for LCD and interface signal are valid.

4. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25℃. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0°.

FIG. 1 presents additional information concerning the measurement equipment and method.

FIG. 1 Optical Characteristic Measurement Equipment and Method

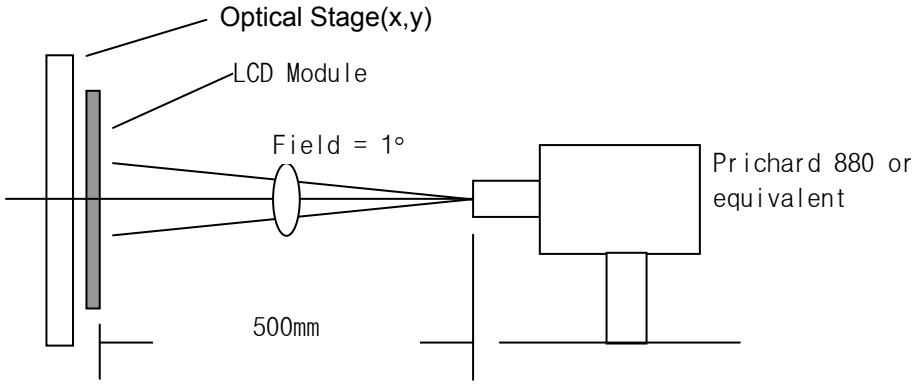


Table 8 OPTICAL CHARACTERISTICS (Ta=25℃, V_{IN}=5.0V, f_V =60Hz, Dclk=25MHz, I_{BL}=7mA x 3)

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
Contrast Ratio	CR	200	400	-		1
Surface Luminance, white	L_{WH}	360	400	-	cd/m^2	2
Luminance Variation	δ WHITE	-	1.3	1.5		3
Response Time	Tr				ms	4
Rise Time	Tr_R	-	7	10		
Decay Time	Tr_D	-	18	20		
CIE Color Coordinates						
Red	x_R	0.609	0.639	0.669		
	y_R	0.306	0.336	0.366		
Green	x_G	0.257	0.287	0.317		
	y_G	0.556	0.586	0.616		
Blue	x_B	0.112	0.142	0.172		
	y_B	0.053	0.083	0.113		
White	x_W	0.261	0.291	0.321		
	y_W	0.262	0.292	0.322		
Viewing Angle			-			5
x axis, right (Φ=0°)	θ r	60	-	-	degree	
x axis, left(Φ=180°)	θ l	60				
y axis, up(Φ=90°)	θ u	45	-			
y axis, down (Φ=270°)	θ d	45				
Gray Scale		-	-			6

Notes 1. Contrast Ratio (CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

2. Surface luminance is an average of the five point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG. 2.
When I_{BL}=7mA x 3 at each assembly, L_{WH}= 360cd/m^2 (Min.) 400cd/m^2 (Typ.)

3. The variation in surface luminance, δ WHITE is determined by measuring L_{ON} at each test position 1 through 5, and then dividing the maximum L_{ON} of 5 points luminance by minimum L_{ON} of 5 points luminance. For more information see FIG. 2

$$\delta \text{ WHITE} = \text{Maximum } (L_{ON1}, L_{ON2}, ...L_{ON5}) \div \text{Minimum } (L_{ON1}, L_{ON2}, ...L_{ON5})$$

4. Response time is the time required for the display to transition from white to black (Rise Time, Tr_R) and from black to white (Decay Time, Tr_D). For additional information see FIG. 3.

5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG. 4

6. Gray scale specification.

n	Gs(S)	Relative Brightness (%)			Note
		Min.	Typ.	Max.	
0	**0**	**0.1**	0.2	**0.3**	
1	**15**	**0.2**	0.5	**0.8**	
2	**31**	**0.6**	1.2	**2.0**	
3	**47**	**1.1**	2.2	**3.6**	
4	**63**	**1.9**	3.7	**6.0**	
5	**79**	**2.8**	5.4	**8.5**	
6	**95**	**4.4**	7.9	**12.1**	
7	**111**	**6.6**	11.5	**17.2**	
8	**127**	**10.2**	16.6	**24.0**	
9	**143**	**14.4**	22.1	**30.9**	
10	**159**	**19.7**	28.8	**39.2**	
11	**175**	**26.8**	36.7	**47.9**	
12	**191**	**35.4**	45.8	**57.5**	
13	**207**	**44.7**	54.8	**66.3**	
14	**223**	**59.9**	68.2	**77.7**	
15	**239**	**78.8**	83.8	**89.4**	
16	**255**	**100**	100	**100**	

FIG. 2 Luminance

Measuring point for luminance variation and surface luminance.

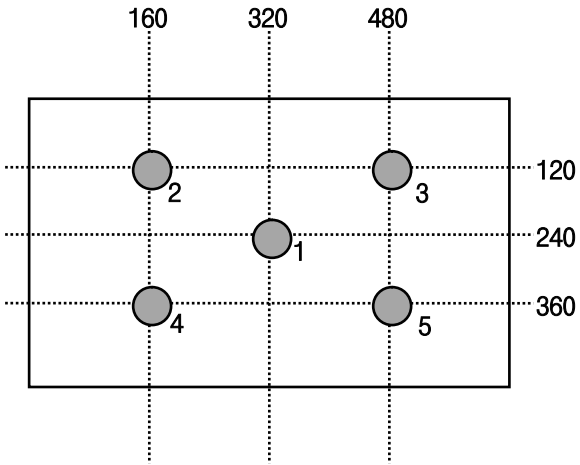


FIG. 3 Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

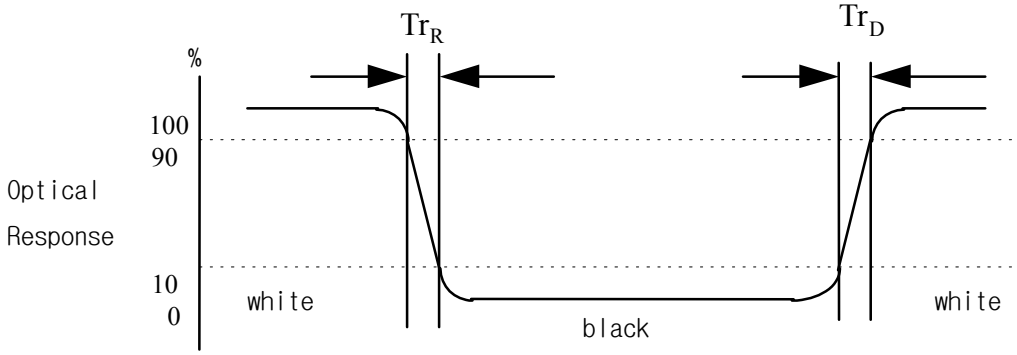
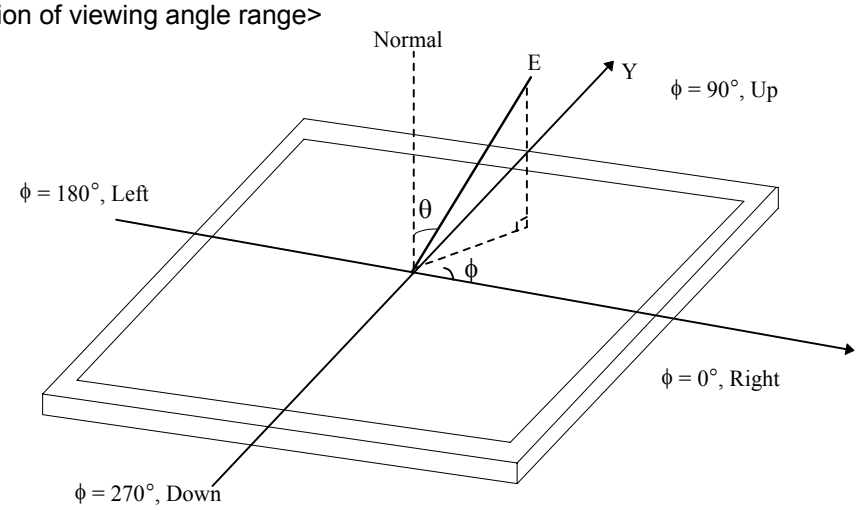


FIG. 4 Viewing angle

<Definition of viewing angle range>

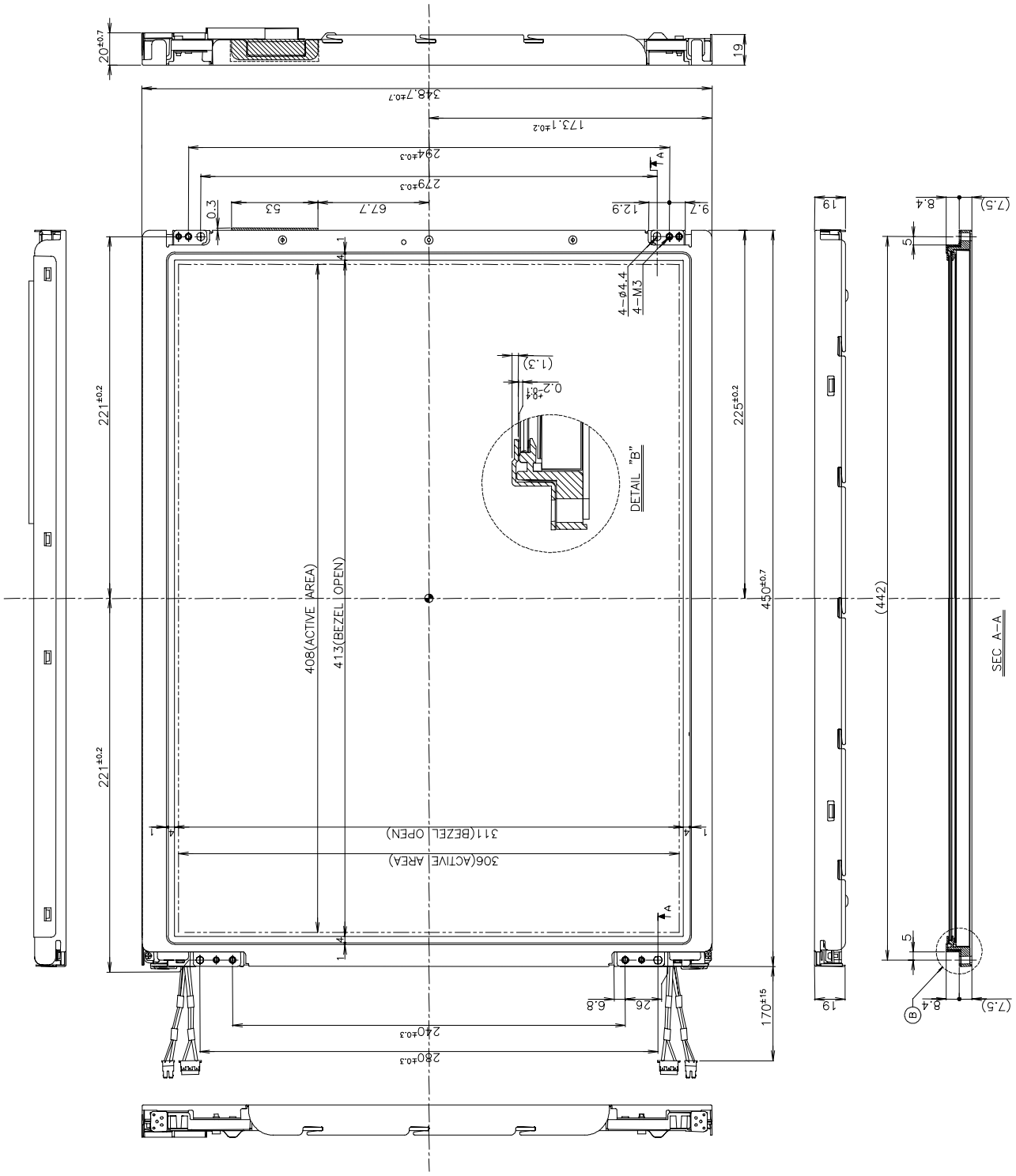


5. Mechanical Characteristics

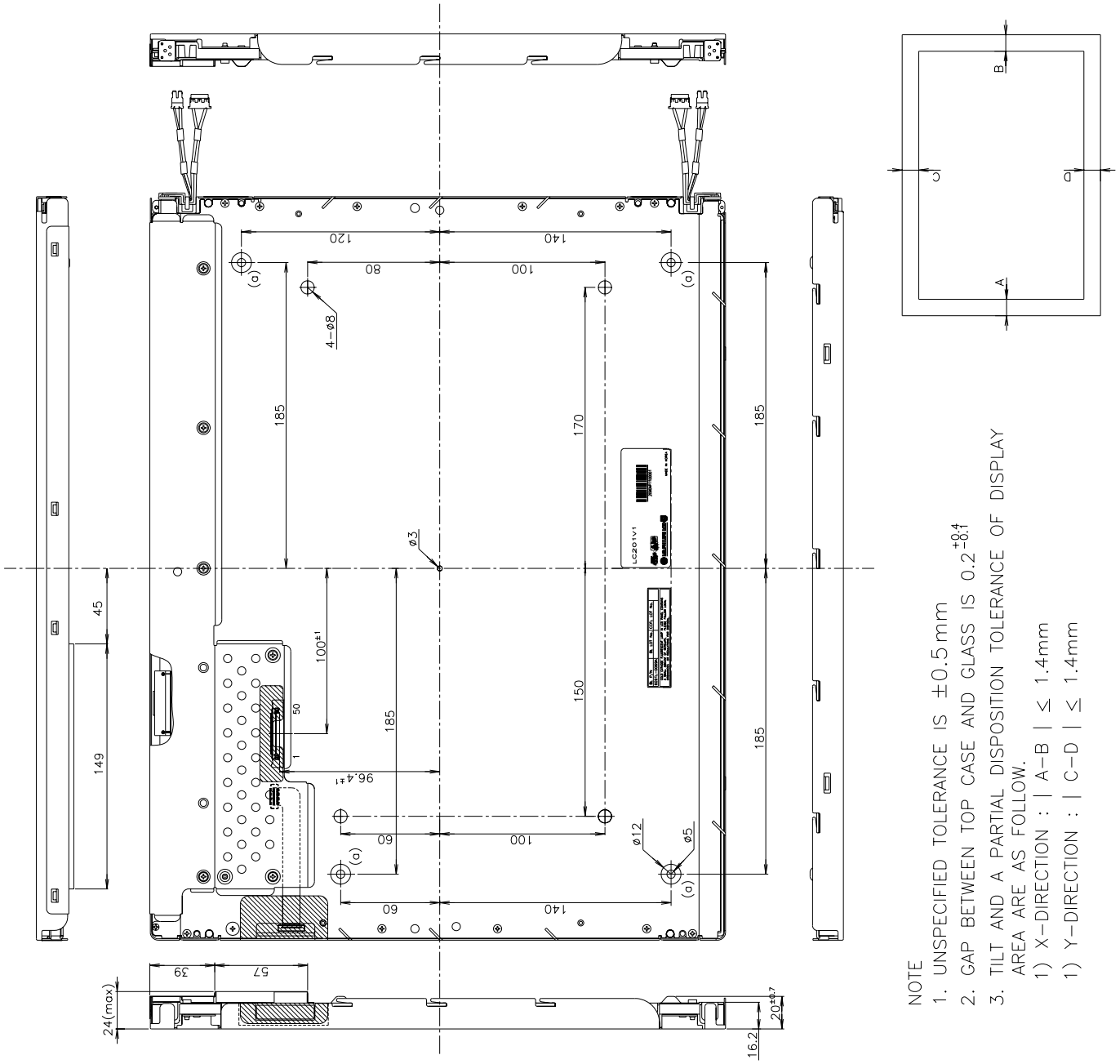
The contents provide general mechanical characteristics for the model LC201V1 LCD. In addition, the figures in the next page are detailed mechanical drawings of the LCD.

Outside dimensions	:	Horizontal	450.0 ±0.7 mm
		Vertical	348.7 ±0.7 mm
		Depth	20.0 ±0.7 mm
Bezel area	:	Horizontal	413.0 ±0.5 mm
		Vertical	311.0 ±0.5 mm
Active Display area	:	Horizontal	408.000 mm
		Vertical	306.000 mm
Weight (approximate)	:	3200g (Typ.), 3360g(Max.)	
Surface Treatment	:	Hard coating (3H) Anti-glare treatment of the front polarizer	

< FRONT VIEW >


DETAIL "B"
SEC A-A
408(ACTIVE AREA)
413(BEZEL OPEN)
306(ACTIVE AREA)
311(BEZEL OPEN)
4-Ø4.4
4-M3
348.7
173.1
294
279
240
280
221
225
450
170
(44.2)

< REAR VIEW >



NOTE
1. UNSPECIFIED TOLERANCE IS ±0.5mm
2. GAP BETWEEN TOP CASE AND GLASS IS $0.2^{+0.4}_{-0.1}$
3. TILT AND A PARTIAL DISPOSITION TOLERANCE OF DISPLAY AREA ARE AS FOLLOW.
   1) X-DIRECTION : | A-B | ≤ 1.4mm
   1) Y-DIRECTION : | C-D | ≤ 1.4mm

6. Reliability

Environment test condition.

No.	Test Parameters	Test Condition
1	Low temperature Operating	Ta = 0℃ 240h
2	High temperature Operating	Ta = 50℃ 240h
3	Low temperature Storage	Ta = -20℃ 50%RH 240h
4	High temperature Storage	Ta = 60℃ 240h
5	Vibration test (non-operating)	Random wave, 10~500~10Hz, 1.0G 3 axis, 20 min/axis
6	Shock test (non-operating)	Half sine wave, 100G, 2ms, one shock of each six faces (i.e. run 100G 2ms for all six faces.)
7	Humidity	90%(40℃) / 240Hr , without Film
8	Altitude Operating storage/shipment	 15,000 feet 45,000 feet
9	ESD	Panel/Case : ±12KV (150 Ohm/150pF) Connector : ±400V (0 Ohm/100pF)

{Result Evaluation Criteria}

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

7. International Standards

7-1. Safety

a) UL 1950 Third Edition, Underwriters Laboratories, Inc. Jan. 28, 1995. Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.

b) CAN/CSA C22.2 No. 950-95 Third Edition, Canadian Standards Association, Jan. 28, 1995. Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.

c) EN 60950 : 1992 + A1 : 1993 + A2 : 1993 + A3 : 1995 + A4 : 1997 + A11 : 1997
IEC 950 : 1991 + A1 : 1992 + A2 : 1993 + A3 : 1995 + A4 : 1996
European Committee for Electrotechnical Standardization (CENELEC)
EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

7-2. EMC (TBD)

a) ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.” American National Standards Institute(ANSI),1992.

b) C.I.S.P.R “Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment.” International Special Committee on Radio Interference

c) EN 55022 “Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment.” European Committee for Electrotechnical Standardization (CENELEC),1988

8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M

A, B ,C : SIZE
D : YEAR
E : MONTH
F,G : PANEL CODE
H : ASSEMBLY CODE
I,J,K,L,M : SERIAL NO.

Note : 1. YEAR

YEAR	97	98	99	2000	2001	2002	2003	2004	2005	2006	2007
Mark	7	8	9	0	1	2	3	4	5	6	7

2. MONTH

MONTH	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

Serial NO. Is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one box : 3 (pcs)

b) Box Size : 470mm ×253mm ×573Dmm

9.PRECAUTIONS

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

9.1 MOUNTING PRECAUTIONS

(1) You must mount a module using holes 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 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 desirable because the former generates corrosive gas of attacking the polalizer 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 detrimental to the polarizer.)
(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked 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.

9.2 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.

9.3 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 wrist band etc . And don't touch interface pin directly.

9.4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9.5 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.

9.6 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. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the 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.

(4) You can remove the glue easily. 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.