

15” HIGH BRIGHTNESS TFT - LCD

MODEL : S150X1-L1600

(BASED ON CMO M150X4-L06)

Customer : _____

Approved by : _____

Note : All information in this technical data sheet is tentative
and subject to change without notice.

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REVISION HISTORY

Rev.No.	Date	Page	Description
000	June 22, 2004	All	Tentative Specification is issued for the first time.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

S150X1-L1600 is a 15" High Brightness TFT Liquid Crystal Display module with 21 Lamps and 20 pins LVDS interface which generates 1,600 nits brightness. This module supports 1024 x 768 (XGA) mode and can display 16M colors. It is designed for sunlight readable applications.

1.2 FEATURES

- XGA(1024 x 768 pixels) resolution
- DE(Data Enable) only mode

1.3 APPLICATION

- Outdoor Advertisement
- Gas-Station
- Outdoor Information Kiosk

1.4 GENERAL SPECIFICATIONS

ITEM	SPECIFICATION	UNIT	NOTE
Active Area	304.1(H) x 228.1(V) (15.0" diagonal)	mm	(1)
Bezel Opening Area	307.5(H) x 231.4(V)	mm	
Driver Element	a-Si TFT active matrix	-	
Pixel Number	1024 x R.G.B. x 768	Pixel	
Pixel Pitch	0.297(H) x 0.297(W)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Color	16,194,277	Color	
Transmissive Mode	Normally white	-	

1.5 MECHANICAL SPECIFICATIONS

ITEM		MIN.	TYP.	MAX.	UNIT	NOTE
Module Size	Horizontal(H)	-	332.0	-	mm	(1)
	Vertical(V)	-	258.0	-	mm	
	Depth(D)	-	19.0	-	mm	(1)
Weight		-	-	(1100)	gram	

NOTE (1) Please refer to the Appendix A for more information of front and back outline dimensions.

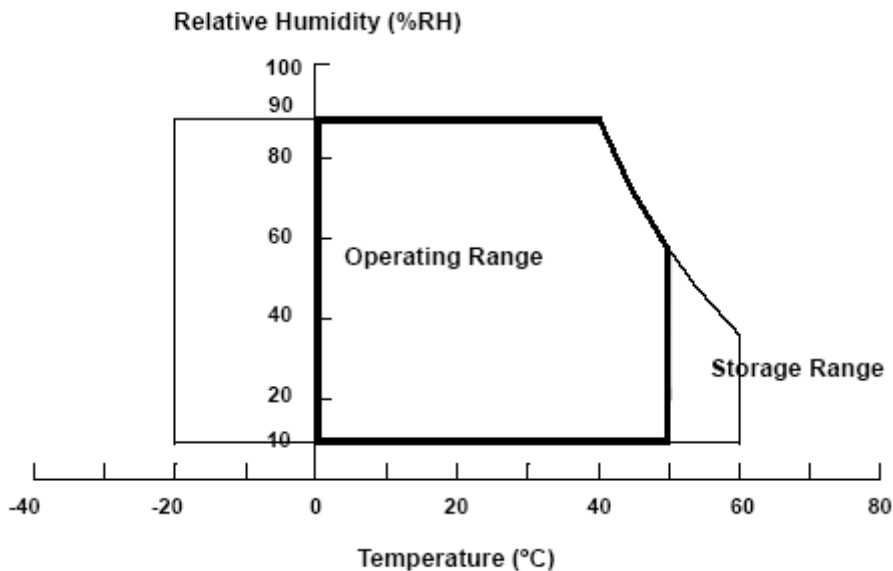
2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

ITEM	SYMBOL	VALUE		UNIT	NOTE
		MIN.	MAX.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1),(2)
Storage Humidity	H _{ST}	10	90	%	-
Operation Humidity	H _{OP}	10	90	%	-
Shock (Non-Operating)	S _{NOP}	-	TBD	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. ($T_A \leq 40^\circ\text{C}$).
- (b) Wet-bulb temperature should be 39°C Max. ($T \geq 40^\circ\text{C}$)
- (c) No condensation of water.



NOTE(2) The temperature of panel surface should be 0°C Min. and 60°C Max.

NOTE(3) 11ms, 1 time each $\pm X$, $\pm Y$ and $\pm Z$ directions.

NOTE(4) 10 ~ 500Hz, 1 cycle/20min. 1.5mm max, 1 hour each X, Y and Z directions.

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

ITEM	SYMBOL	VALUE		UNIT	NOTE
		MIN.	MAX.		
Power Supply Voltage	V_{DD}	-0.3	4.0	V	

2.2.2 BACKLIGHT UNIT

ITEM	SYMBOL	VALUE		UNIT	NOTE
		MIN.	MAX.		
Lamp Voltage	V_L	500	610	V_{RMS}	(1),(2)
Lamp Current	I_L	42	(189)	mA_{Rms}	(1),(2)
Lamp Frequency	F_L	25	100	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 Section 3.2 for further information).

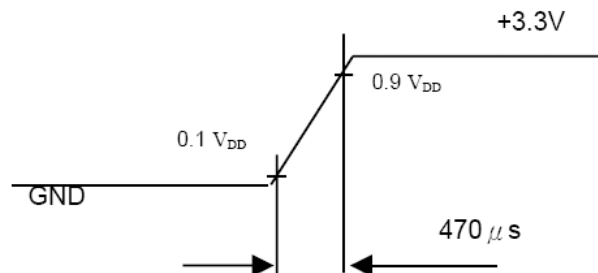
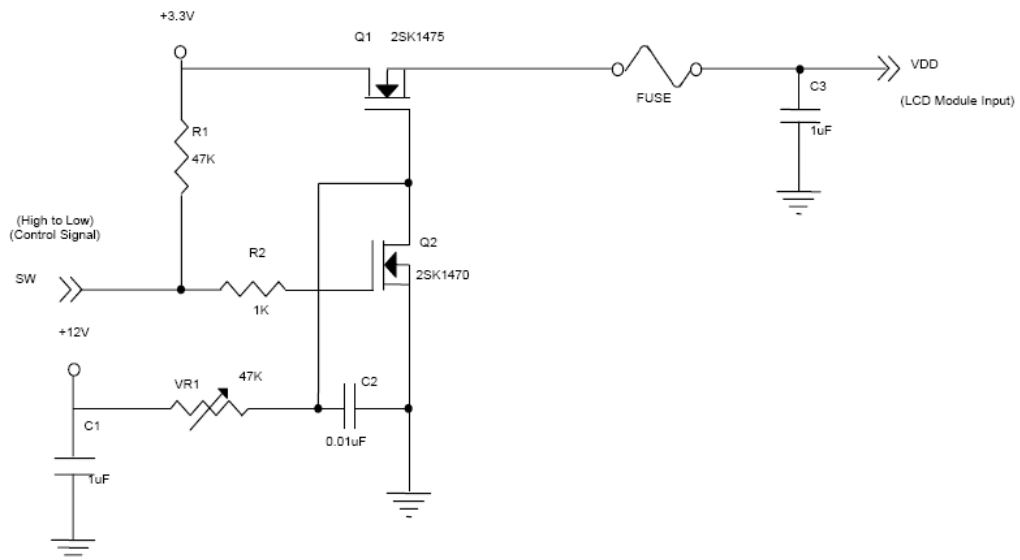
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE (1)

PARAMETER	SYMBOL	VALUE			UNIT	NOTE	
		MIN.	TYP.	MAX.			
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	-	
Ripple Voltage	V_{RP}	-	-	100	mV _{p-p}		
Rush Current	I_{RUSH}	-	-	2.0	A	(2)	
Power Supply Current	White	-	400		mA	(3)a	
	Black	-	500		mA	(3)b	
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V_{IH}	-	-	100	mV	-
	"L" Level	V_{IL}	-100	-	-	mV	-
Terminating Resistor	R_T	-	100	-	Ohm	-	

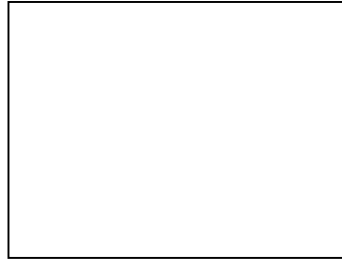
NOTE(1) The module should be always operated within above ranges.

NOTE(2) Measurement Conditions :



NOTE(3) The specified power supply current is under the conditions at $V_{DD} = 3.3V$, $T_A = 25 \pm 2 \text{ }^\circ\text{C}$, DC Current and $f_V = 60\text{Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active area

3.2 BACKLIGHT UNIT

PARAMETER	SYMBOL	VALUE			UNIT	NOTE
		MIN.	TYP.	MAX.		
Lamp Input Voltage	V_L	500	555	610	V_{RMS}	$I_L = (105) \text{ mA}$
Lamp Current	I_L	42.0	(105)	(189)	mA_{RMS}	
Starting Voltage	V_S	-	-	740	V_{RMS}	(1), 25°C
		-	-	1110	V_{RMS}	(1), 0°C
Operating Frequency	F_L	25	(55)	100	KHz	(2)
Lamp Life Time	L_{BL}	40000		-	Hrs	(3)
Power Consumption	P_L	-	58.8	-	W	(4), $I_L=(105)\text{mA}$

NOTE(1) All the tubes shall be lighted. Slidein method shall be used for voltage application.

NOTE(2) The lamp frequency may generate 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.

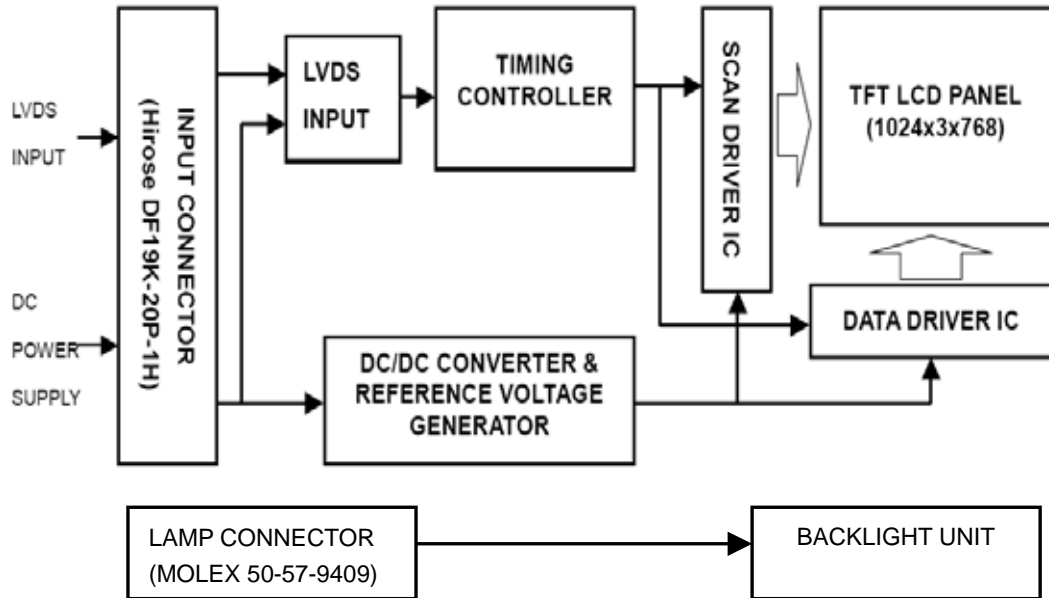
NOTE(3) The lifetime of lamp is defined as the time when it continues to operate under the conditions at $T_A = 25 \pm 2^\circ\text{C}$ and $I_L = 105.0\text{mA}_{RMS}$ until one of the following events occurs :

- (a) When the brightness becomes $\leq 50\%$ of its original value.
- (b) Not normal lighting.
- (c) When a severe appearance failure is found.

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

NOTE(5) 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 generating too much current leakage form 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 situationis confirmed, the module should be operated in the same manners when it is installed in your instrument.

4. BLOCK DIAGRAM



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

PIN NO.	SYMBOL	FUNCTION	POLARITY	NOTE
1	VDD	Power Supply +3.3V(typical)		
2	VDD	Power Supply +3.3V(typical)		
3	GND	Ground		
4	GND	Ground		
5	RX0-	LVDS Differential Data Input	Negative	
6	RX0+	LVDS Differential Data Input	Positive	
7	GND	Ground		
8	RX1-	LVDS Differential Data Input	Negative	
9	RX1+	LVDS Differential Data Input	Positive	
10	GND	Ground		
11	RX2-	LVDS Differential Data Input	Negative	
12	RX2+	LVDS Differential Data Input	Positive	
13	GND	Ground		
14	RXCLK-	LVDS Differential Data Input	Negative	
15	RXCLK+	LVDS Differential Data Input	Positive	
16	GND	Ground		
17	RX3-	LVDS Differential Data Input	Negative	
18	RX3+	LVDS Differential Data Input	Positive	
19	GND	Ground		
20	NC	Reserved		

NOTE(1) Connector Part No. : [Hirose] DF 19K-20P-1H

NOTE(2) Matching socket Part No. : [Hirose] DF 19-20S-1C

5.2 BACKLIGHT UNIT

PIN	SYMBOL	DESCRIPTION	COLOR
1	LV	Ground	White
5	HV	High Voltage	White(Red Tube)

NOTE(1) Connector Part No. : Molex 70066-0183

NOTE(2) Matching Connector Part No. : Molex 70543-0043

5.3 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	0	0	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	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	1	1	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	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	
	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	
	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	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	Red(252)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(252)	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	
	Green(1)	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	1	0	0	0	0	0	0	0	0	0	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	Green(252)	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	
	Green(252)	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	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	
	Blue(1)	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	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮		
	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1	
	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	
Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1		

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

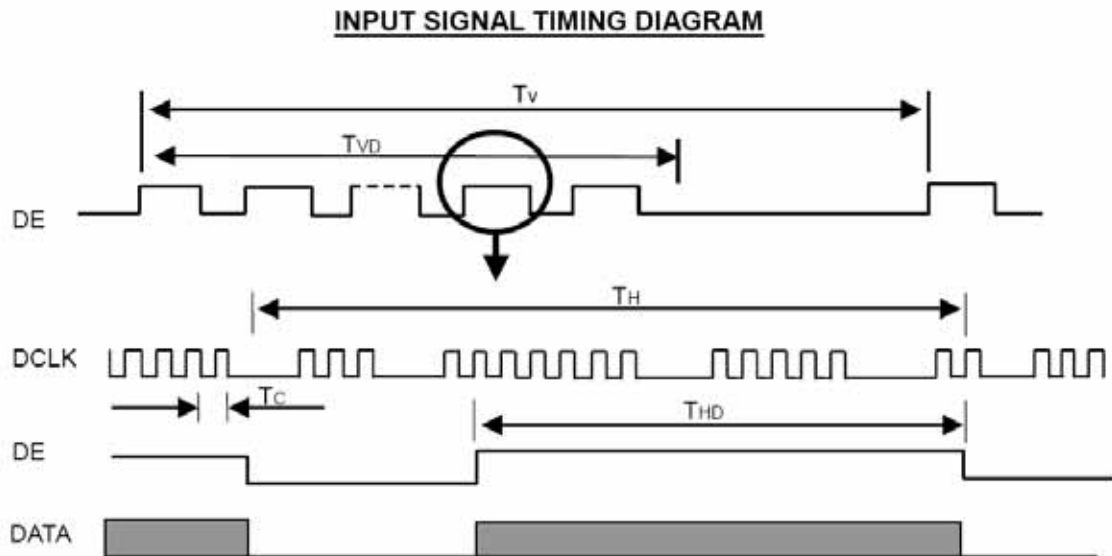
6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

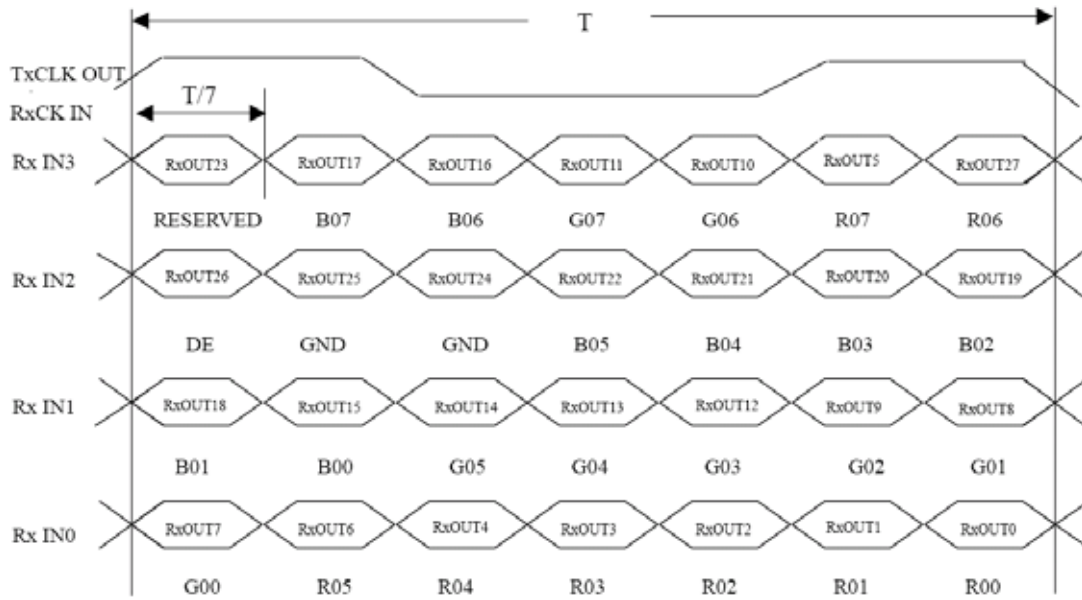
The input signal timing specifications are shown as the following table and timing diagram.

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
DCLK	Pixel Clock	$1/T_C$	-	65	80	MHz	-
DE	Vertical Total Time	T_V	769	806	1200	T_H	-
	Vertical Address Time	T_{VD}	768	768	768	T_H	-
	Horizontal Total Time	T_H	1120	1344	1600	T_C	-
	Horizontal Address Time	T_{HD}	1024	1024	1024	T_C	-

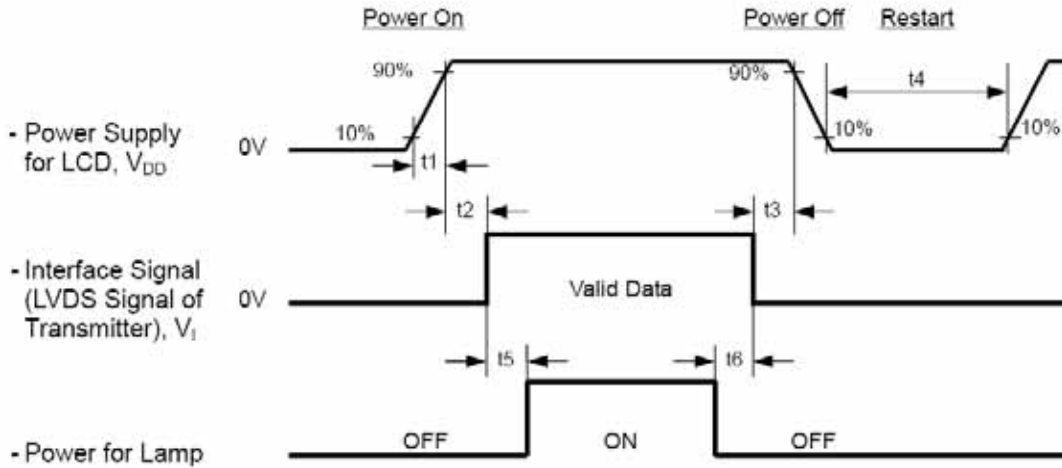
NOTE(1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.



TIMING DIAGRAM of LVDS



6.2 POWER ON/OFF SEQUENCE



Timing Specifications :

- $0 < t_1 \leq 10$ msec
- $0 < t_2 \leq 50$ msec
- $0 < t_3 \leq 50$ msec
- $t_4 \geq 1$ sec
- $t_5 \geq 100$ msec
- $t_6 \geq 100$ msec

NOTE(1) Please avoid floating stage of interface signal at invalid period.

NOTE(2) When the interface signal is invalid, be sure to pull down the power supply of LCD V_{DD} to 0V.

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.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

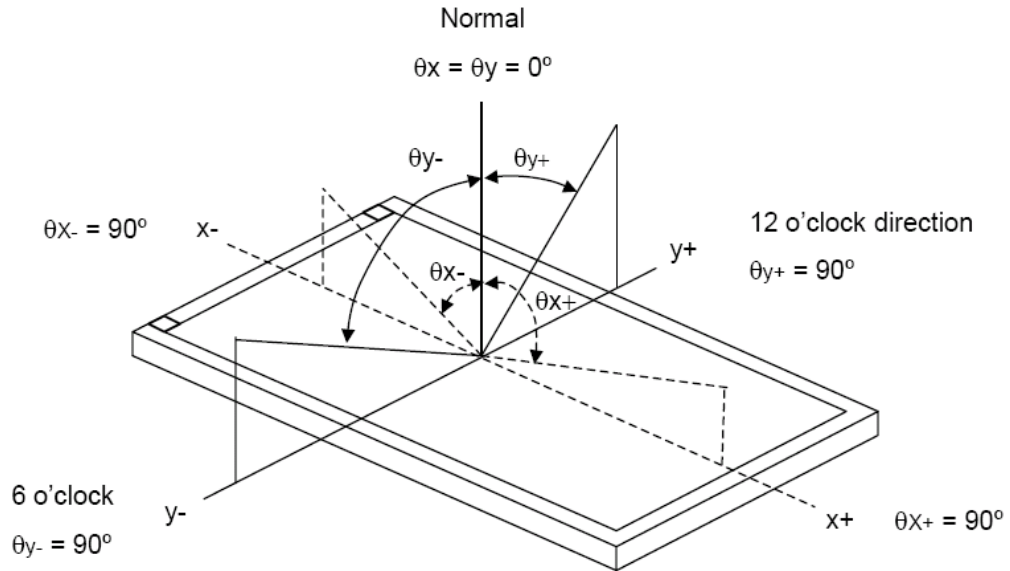
ITEM	SYMBOL	VALUE	UNIT
Ambient Temperature	T_A	25 ± 2	$^{\circ}\text{C}$
Ambient Humidity	H_A	50 ± 10	%RH
Supply Voltage	V_{DD}	3.3	V
Input Signal	According to typical value in "3.ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	(105.0)	mA

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in NOTE(4).

7.2 OPTICAL SPECIFICATIONS

ITEM		SYMBOL	CONDITION	MIM.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio		CR	$\theta_x = 0^{\circ}, \theta_y = 0^{\circ}$ Viewing Normal Angle	(200)	(350)	-	-	(2),(4)
Response Time		T_R		-	6	10	ms	(3)
		T_F		-	17	25	ms	
Luminance of White (Center point)		L		-	(1600)	-	Cd/m^2	(4),(5)
White Variation		δW		-	1.25	(1.35)	-	(4),(5)
Color Chromaticity	Red	Rx		(0.597)	(0.627)	(0.657)	-	(1),(4)
		Ry		(0.327)	(0.357)	(0.387)	-	
	Green	Gx		(0.265)	(0.295)	(0.325)	-	
		Gy		(0.559)	(0.589)	(0.619)	-	
	Blue	Bx		(0.114)	(0.114)	(0.174)	-	
		By	(0.064)	(0.094)	(0.124)	-		
	White	Wx	(0.283)	(0.313)	(0.343)	-		
		Wy	(0.299)	(0.329)	(0.359)	-		
Viewing Angle	Horizontal	θ_{x+}	(50)	(60)	-	Deg.		
		θ_{x-}	(50)	(60)	-			
	Vertical	θ_{y+}	(30)	(40)	-			
		θ_{y-}	(50)	(60)	-			

NOTE(1) Definition of Viewing Angle (θ_x, θ_y) :



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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

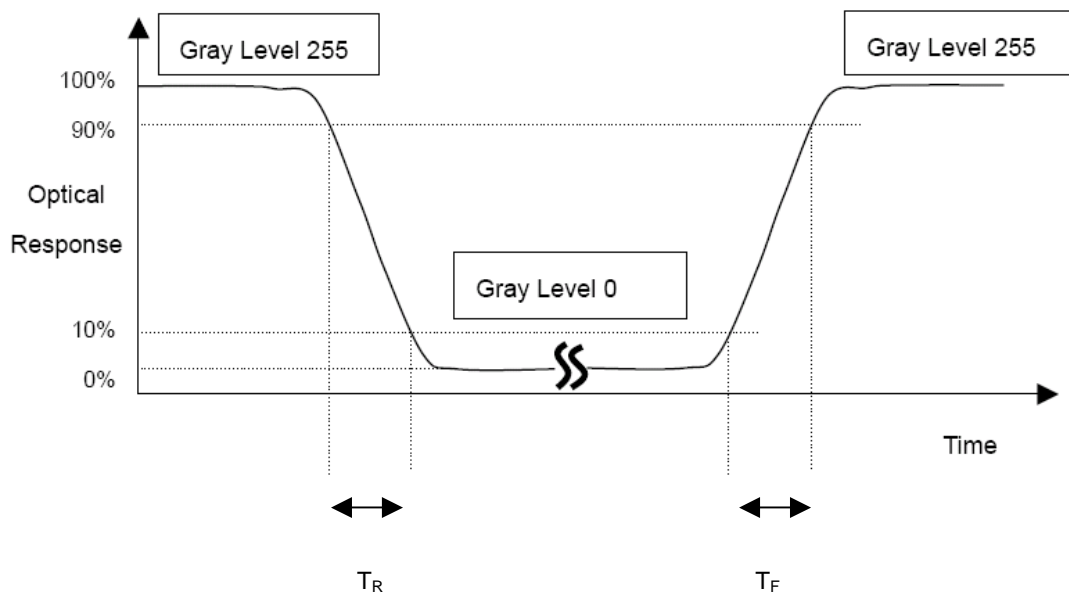
L_{255} : Luminance of gray level 255

L_0 : Luminance of gray level 0

$$\text{CR} = \text{CR} (1)$$

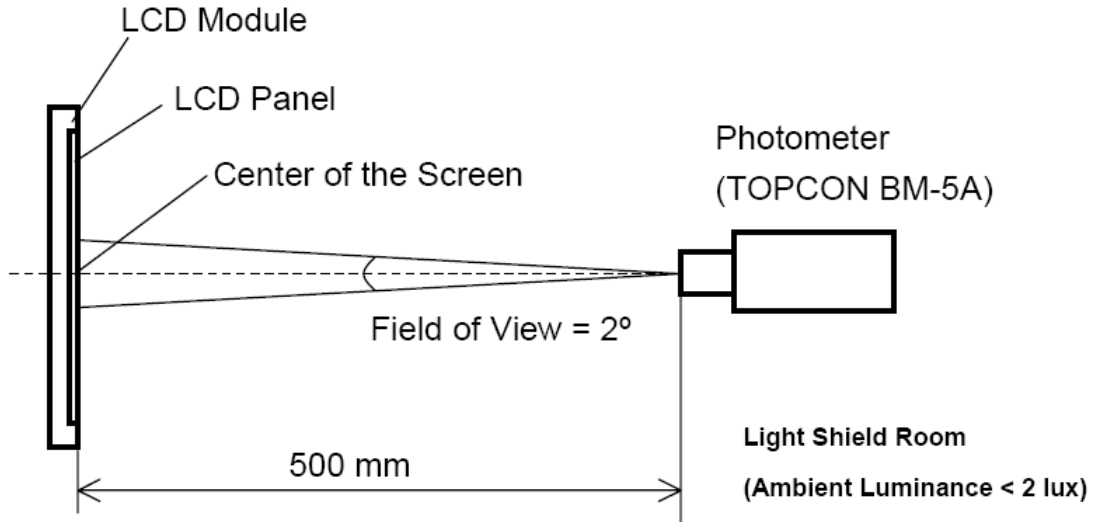
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in NOTE(5).

NOTE(3) Definition of Response Time (T_R, T_F)



NOTE(4) Measurement Setup :

The LCD module should be stabilized at given temperature for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 15 minutes in a windless room



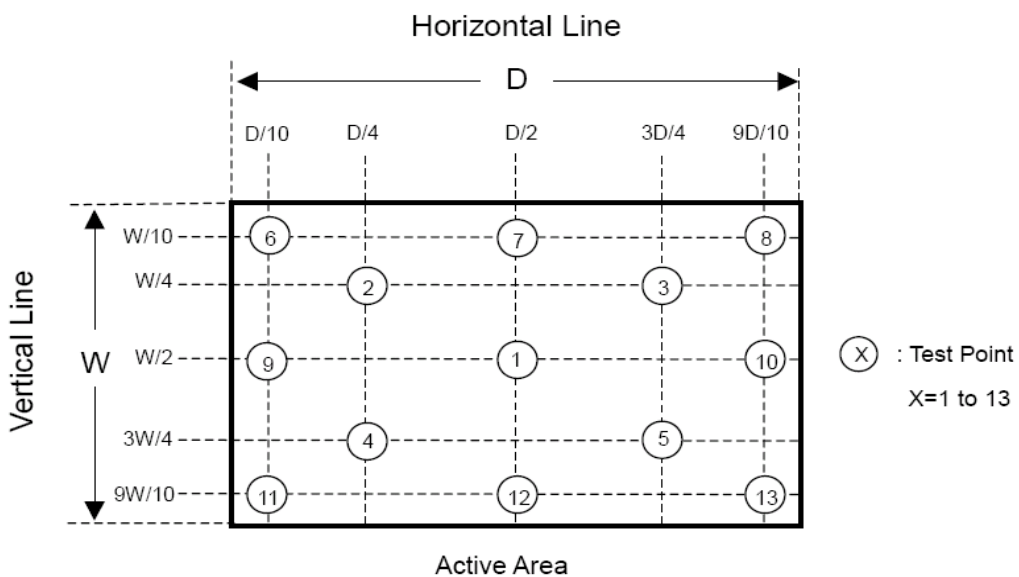
NOTE(5) Definition of luminance measured points :

Measure the luminance of gray level 255 at point L(1)

Definition of White Variation (δW) :

Measure the luminance of gray level 255 at 9 points

$$\delta W = \frac{\text{Maximum [L(1), L(6), L(7), L(8), L(9), L(10), L(11), L(12), L(13)]}}{\text{Minimum [L(1), L(6), L(7), L(8), L(9), L(10), L(11), L(12), L(13)]}}$$



8. GENERAL PRECAUTIONS

8.1 HANDLING PRECAUTION

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC>
- (9) Do not disassemble the module.
- (10) Do not pull or fold the lamp wire
- (11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTION

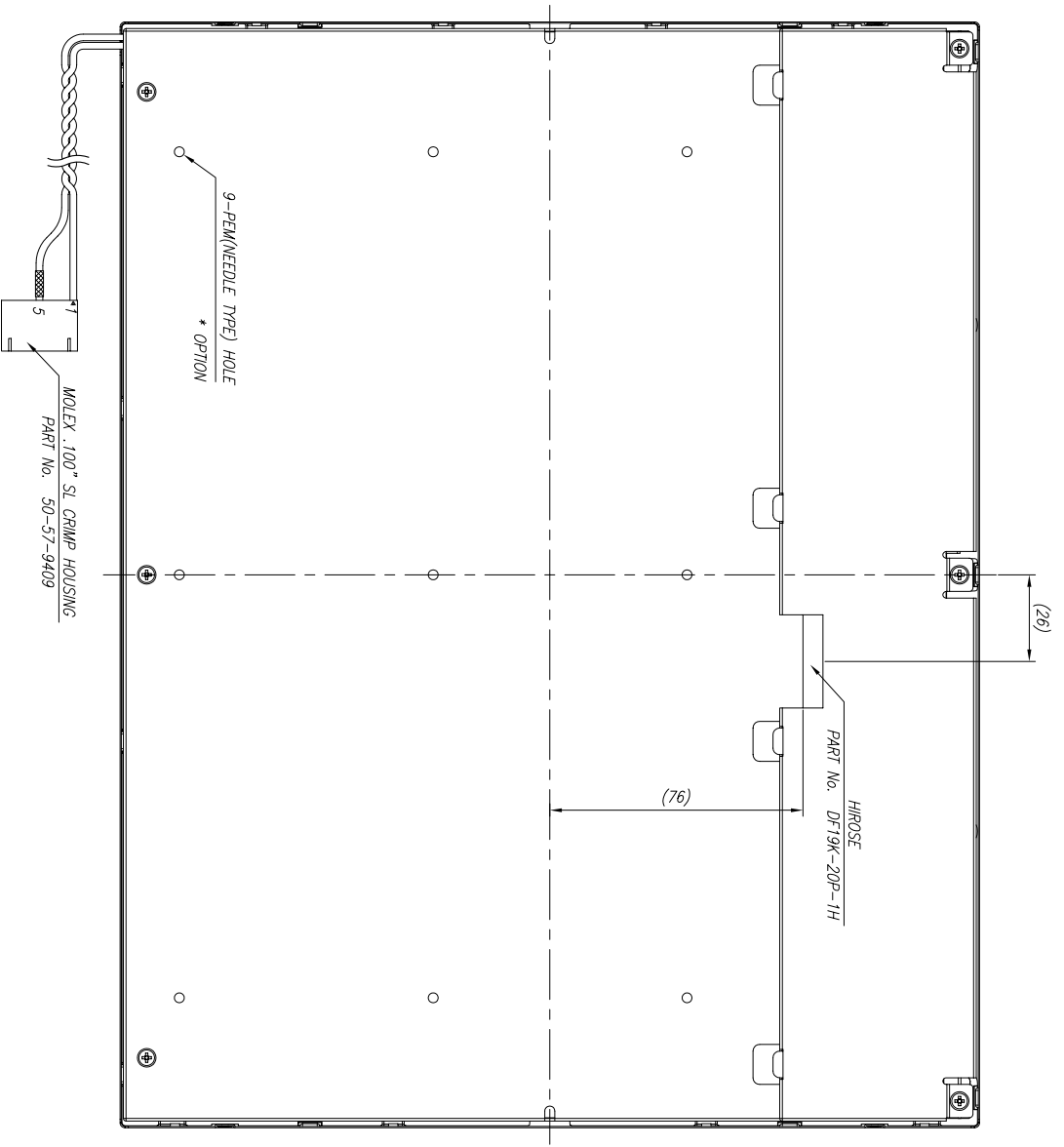
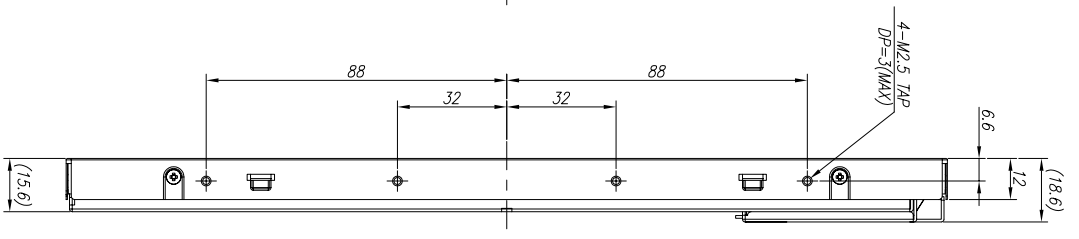
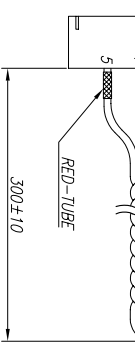
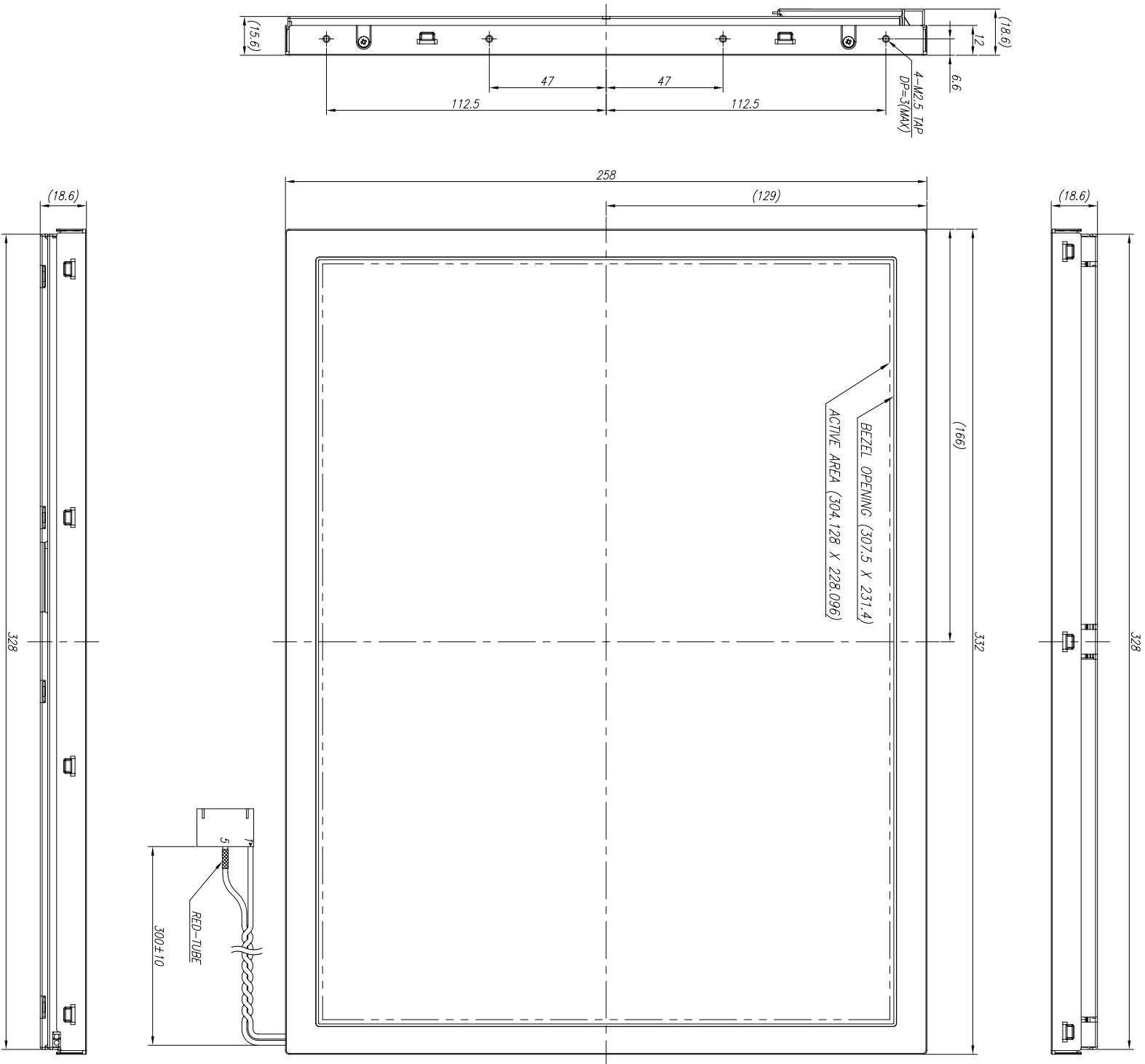
- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10°C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) 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.

APPENDIX A. OUTLINE DIMENSION

REV.	ECO No.	DESCRIPTION	DATE	APP'L



* UNSPECIFIED TOLERANCES TO BE ±0.5

No.	QTY	SCALE	APPROVED	TITLE
NAME	REMARK	1/1	CHECKED	BUYER
MAT'L			DRAWN	DATE
S150X1-L1600				04-8-10
				DWG. NO.

