NL154PW01 V.0

15.4 ” WIDE

1440 × 900

TFT-LCD MODULE

Spec. Issue Date: Oct. 20, 2007

1. General Description

NL154PW01 V.0 is a Color Active Matrix Liquid Crystal Display composed of a TFT LCD panel, a driver circuit, and backlight system. The screen format is intended to support the WXGA+ (1440(H) x 900(V)) screen and 262k colors (RGB 6-bits data driver). All input signals are LVDS interface compatible. Inverter of backlight is not included. NL154PW01 V.0 is designed for a display unit of personal computer and industrial machine.

1.1 General Specification

The following items are characteristics summary on the table at 25 ℃ condition:

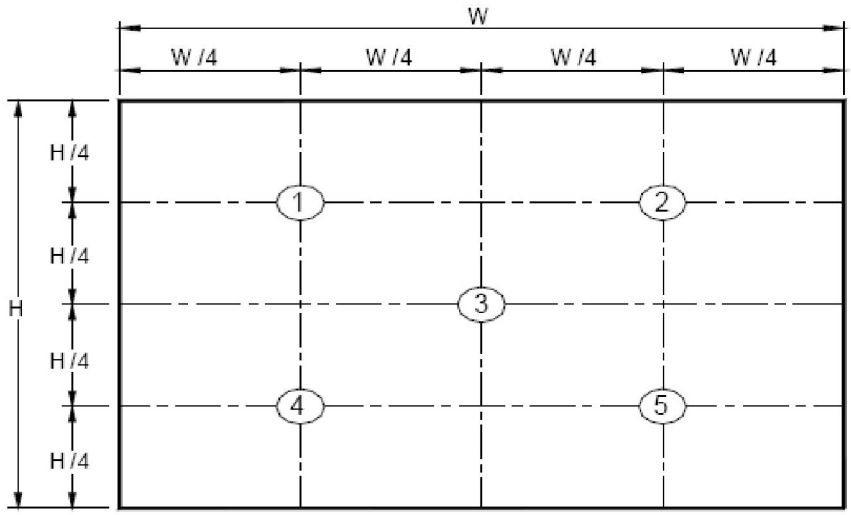
Items	Unit	Specifications
Screen Diagonal	[mm]	391 (15.4”W)
Active Area	[mm]	331.560 (H) x 207.225 (V)
Pixels H x V		1440 x 3(RGB) x 900
Pixel Pitch	[mm]	0.23025X0.23025
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		Normally White
White Luminance(ICCFL=19mA)	[cd/m2]	450 typ.
Contrast Ratio		500 typ
Optical Rise Time/Fall Time	[msec]	4/12 typ.
Nominal Input Voltage VDD	[Volt]	+3.3 typ.
Power Consumption	[Watt]	17.0max
Weight	[Grams]	1350 typ
Physical Size	[mm]	346.0 x 231.0x 11.9
Electrical Interface		2 channel LVDS
Surface Treatment		Anti-Glare, Hardness 2H
Support Color		262K colors (RGB 6-bit)
Temperature Range Operating Storage (Non-Operating)	 [oC] [oC]	 0 to +50 -20 to +60
RoHS Compliance		RoHS Compliance

Optical Characteristics

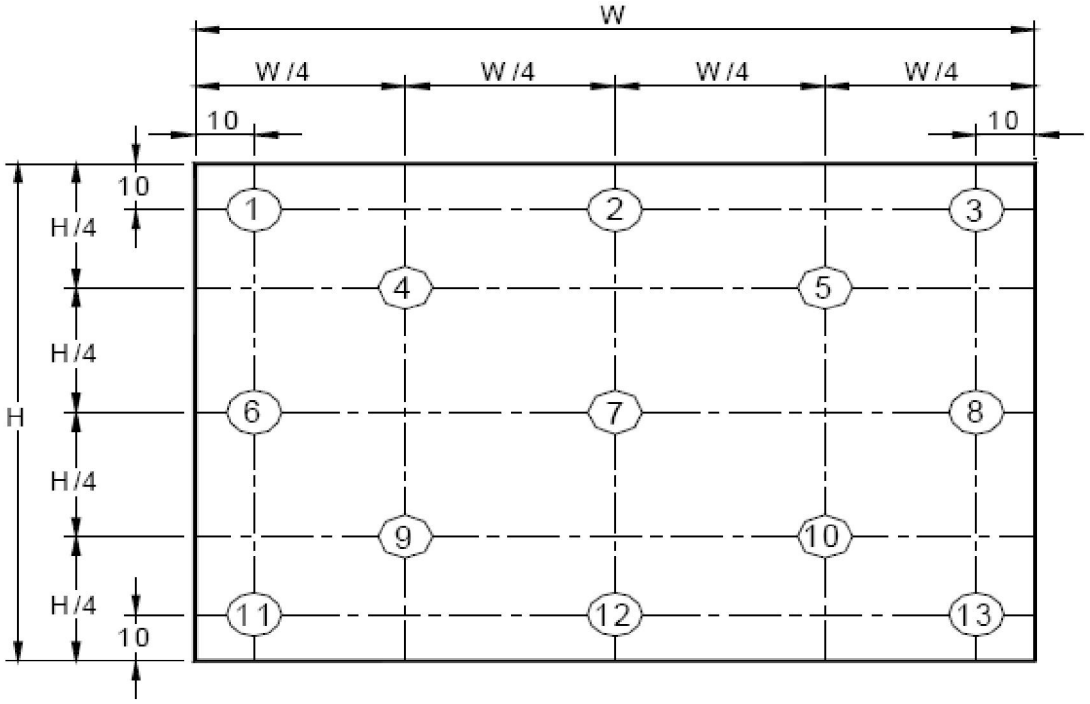
The optical characteristics are measured under stable conditions at 25℃ (Room Temperature):

Item	Unit	Conditions	Min.	Typ.	Max.	Note
White Luminance ILED=6.5mA	[cd/m^2]	13 points average	415	450	-	1,2,4
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	65 65	70 70		8
	[degree] [degree]	Vertical (Upper) CR = 10 (Lower)	65 60	60 60		
Response Time	[msec]	Rising	-	4	8	7
		Falling	-	12	17	
	[msec]	Rising + Falling		16	25	
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.570	0.600	0.630	2,7
		Red y	0.315	0.345	0.375	
		Green x	0.290	0.320	0.350	
		Green y	0.525	0.555	0.585	
		Blue x	0.120	0.150	0.180	
		Blue y	0.090	0.120	0.150	
		White x	0.290	0.313	0.343	
		White y	0.299	0.329	0.359	

Note 1: 5 points position (Display area : 331.2mm x 207.0mm)



Note 2: 13 points position



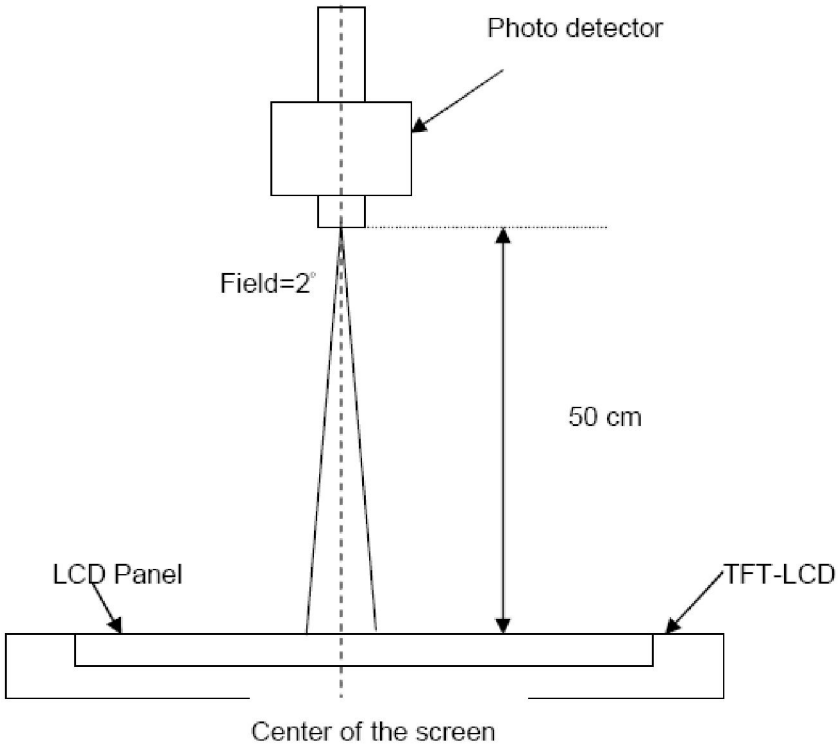
Note 3: The luminance uniformity of 5 and 13 points is defined by dividing the maximum luminance values by the minimum test point luminance.

$$\delta_{W5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

$$\delta_{W13} = \frac{\text{Maximum Brightness of thirteen points}}{\text{Minimum Brightness of thirteen points}}$$

Note 4: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room.



Note 5： Definition of Average Luminance of White (YL):

Measure the luminance of gray level 63 at 5 points，YL= [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / 5
L (x) is corresponding to the luminance of the point X at Figure in Note (1).

Note 6： Definition of contrast ratio:

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the “White” state}}{\text{Brightness on the “Black” state}}$$

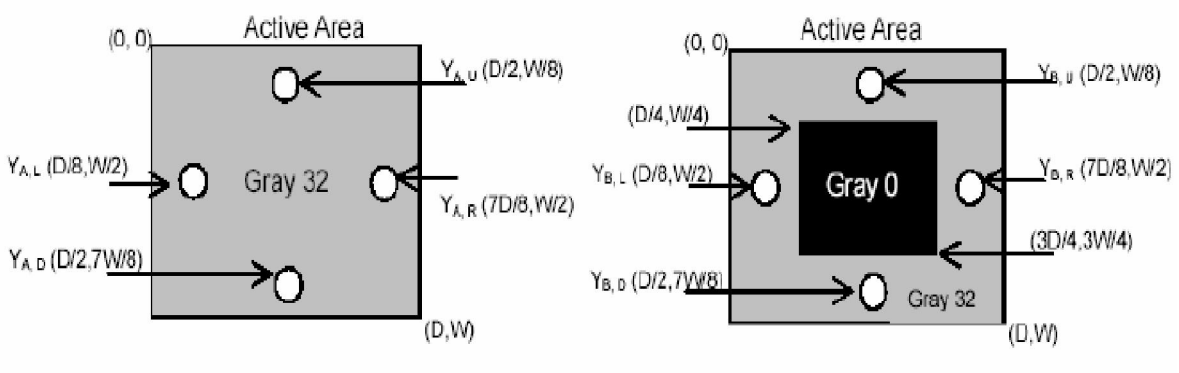
Note 7： Definition of Cross Talk (CT)

$$CT = |YB - YA| / YA \times 100\ (\%)$$

Where

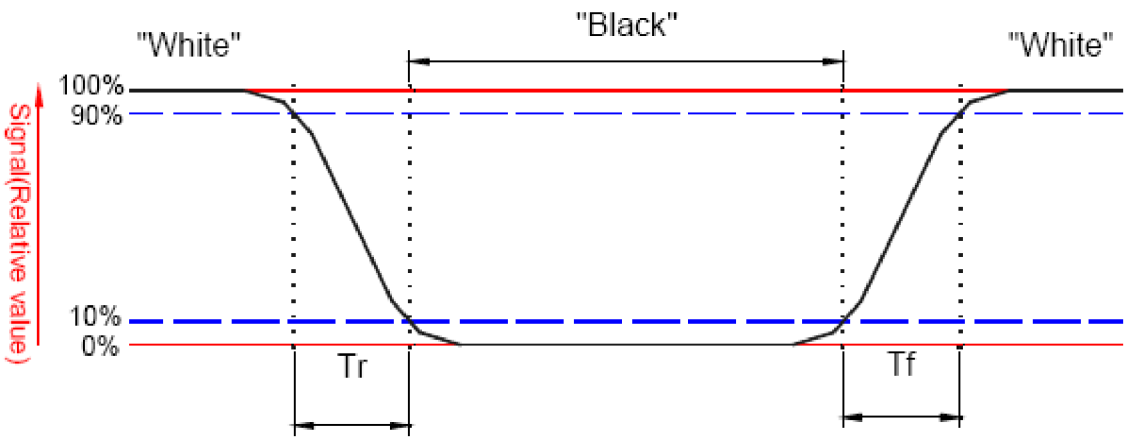
YA = Luminance of measured location without gray level 0 pattern (cd/m2)

YB = Luminance of measured location with gray level 0 pattern (cd/m2)



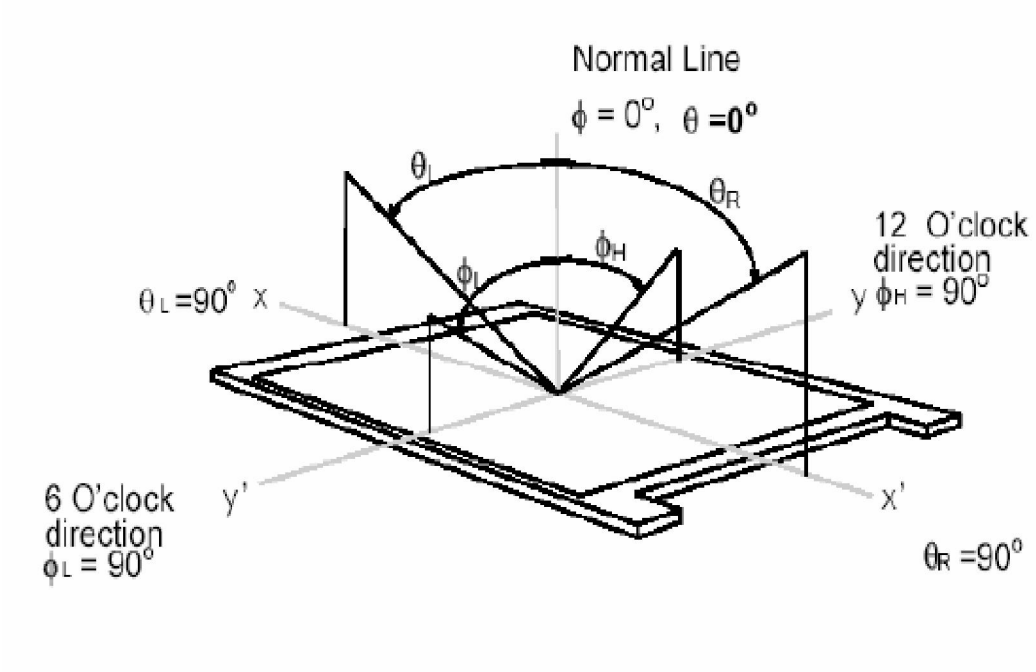
Note 8: Definition of response time:

The output signals of BM-7 or equivalent are measured when the input signals are changed from “Black” to “White” (falling time) and from “ White “ to “ Black “ (rising time), respectively. The response time interval between the 10% and 90% of amplitudes. Refer to figure as below.



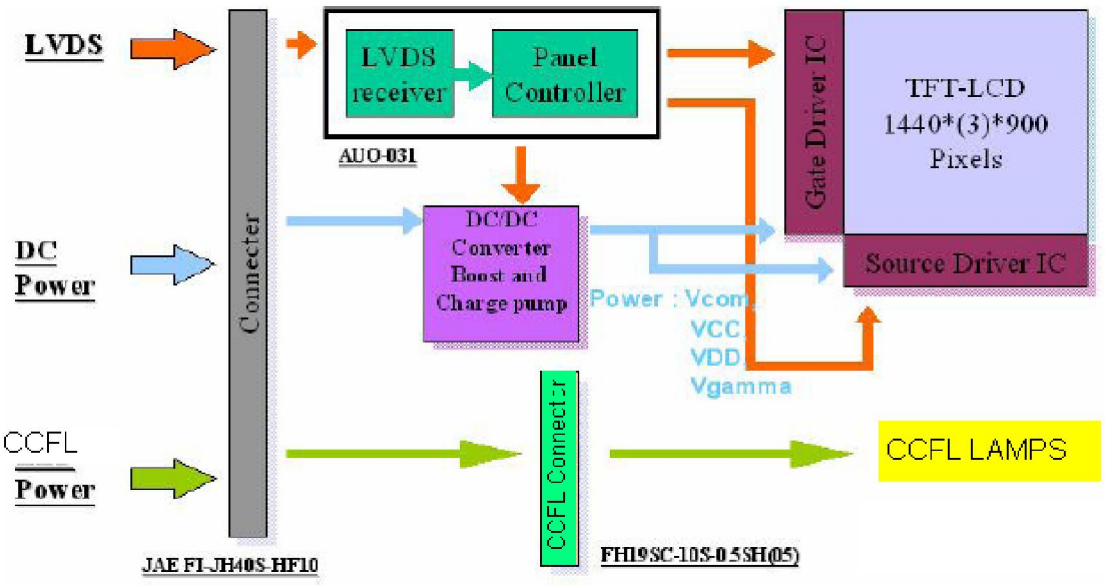
Note 9. Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≧10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (Φ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.



2. Functional Block Diagram

The following diagram shows the functional block of the 15.4WXGA+ TFT/LCD Module:



3. Absolute Maximum Ratings

Absolute maximum ratings of the module is as following:

3.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive	Vin	-0.3	+4.0	[Volt]	Note 1,2

3.2 Absolute Ratings of Backlight Unit

Item	Symbol	Min	Max	Unit	Conditions
CCFL Current	ILED	-	8.0	[mA] rms	Note 1,2

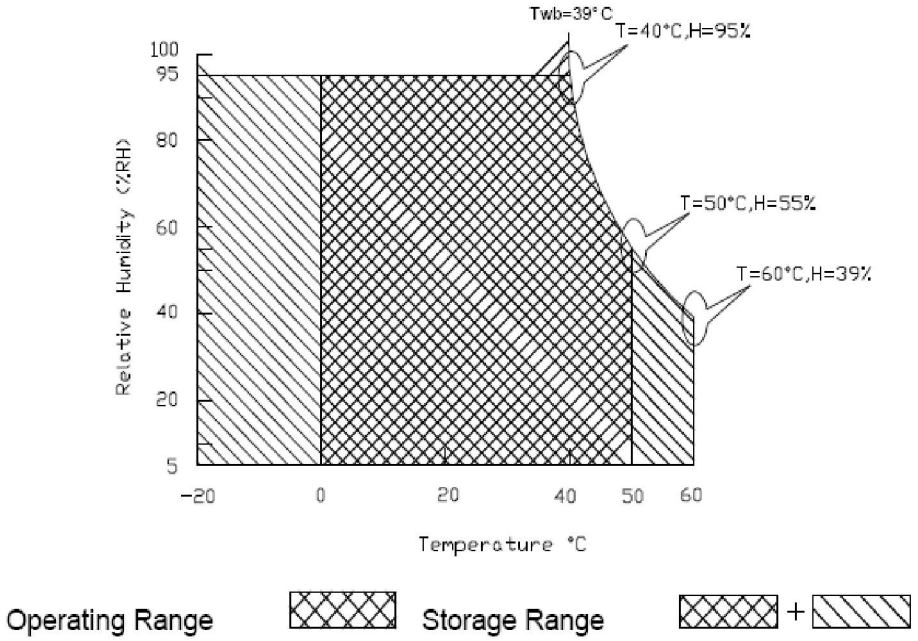
3.3 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	Note 3
Operation Humidity	HOP	--	95	[%RH]	Note 3
Storage Temperature	TST	-20	+60	[°C]	Note 3
Storage Humidity	HST	5	95	[%RH]	Note 3

Note 1: At Ta (25℃)

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: For quality performance, please refer to AUO IIS (Incoming Inspection Standard).



4. Electrical characteristics

4.1 TFT LCD Module

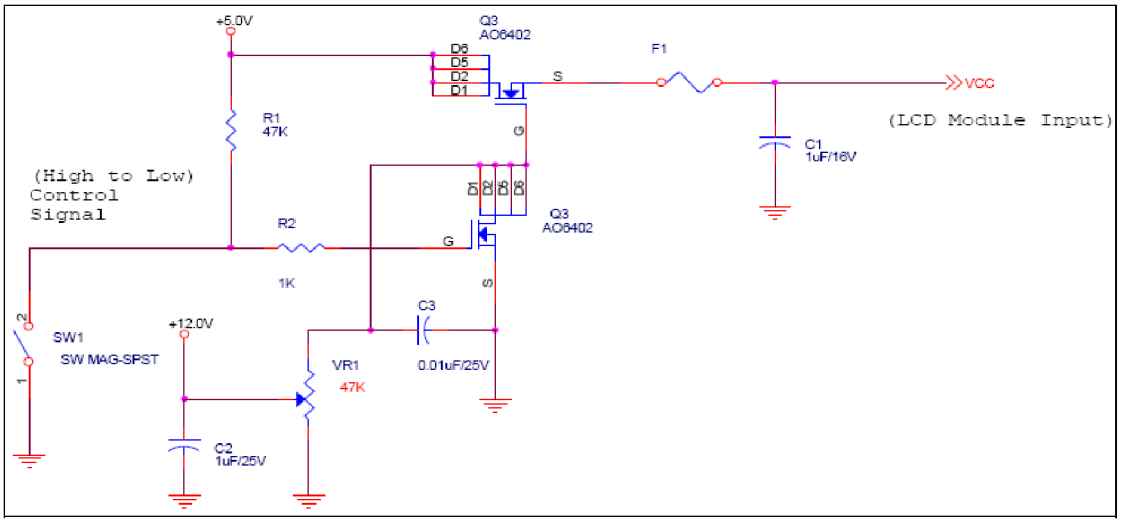
4.1.1 Power Specification

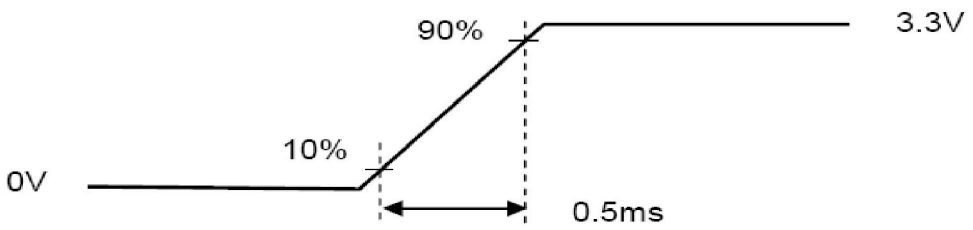
Input power specifications are as follows;

Symble	Parameter	Min	Typ	Max	Units	Note
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
PDD	VDD Power			1.3	[Watt]	Note 1
IDD	IDD Current		280	394	[mA]	Note 1
IRush	Inrush Current			1500	[mA]	Note 2
VDDrp	Allowable Logic/LCD Drive Ripple Voltage			100	100 [mV] p-p	

Note 1：Maximum Measurement Condition：Black Patterm

Note 2：Measure Condition





Vin rising time

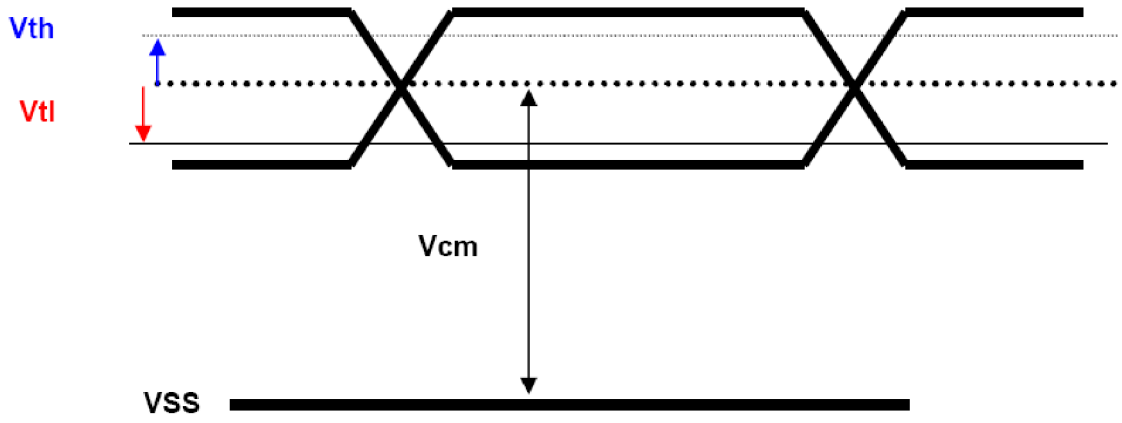
4.1.2 Signal Electrical Characteristics

Input signals shall be low or High-impedance state when VDD is off.
It is recommended to refer the specifications of THC63LVDF84A(Thine Electronics Inc.) in detail.

Signal electrical characteristics are as follows:

Parameter	Condition	Min	Max	Unit
Vth	Differential Input High Threshold (Vcm=+1.2V)		100	[mV]
Vtl	Differential Input Low Threshold (Vcm=+1.2V)	-100		[mV]
Vtl	Differential Input Common Mode Voltage	1.1	1.45	[V]

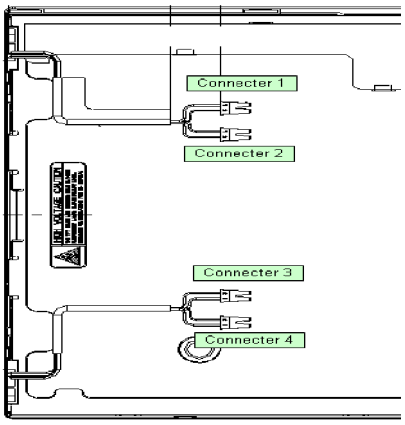
Note : LVDS Signal Waveform



4.2 Backlight Unit

4.2.1 Signal for Lamp connector

Connector #	signal Name
1	Lamp High Voltage---Blue Lamp Low Voltage---Gray
2	Lamp High Voltage---Pink Lamp Low Voltage---White
3	Lamp High Voltage---Blue Lamp Low Voltage---Gray
4	Lamp High Voltage---Pink Lamp Low Voltage---White



4.2.2 Parameter guide line for CCFL Inverter

Symble	Parameter	Min	Typ	Max	Units	Condition
IRCFL	CCFL operation range	6.0	6.5	7.0	[mA] rms	(Ta=25℃)
ICFL	CCFL Inrush current	-	5.7	-	[mA]	
fCFL	CCFL Frequency	40	65	80	[KHz]	(Ta=25℃)
ViCFL (25℃) (reference)	CCFL Ignition Voltage	-	-	880	[Volt] rms	(Ta= 25℃)
ViCFL (0℃) (reference)	CCFL Ignition Voltage			1150	[Volt] rms	(Ta= 0℃)
VCFL	CCFL Discharge Voltage (Reference)	522	580	638	[Volt] rms	(Ta=25℃)
PCFL	CCFL Power consumption @ 5.5mA (excluding inverter)	14	15	17	[Watt]	(Ta=25℃)

Note 1: CCFL Frequency should be carefully determined to avoid interference between inverter and TFT LCD

Note 2: Calculator value for reference (ICFL×VCFL×4=PCFL)

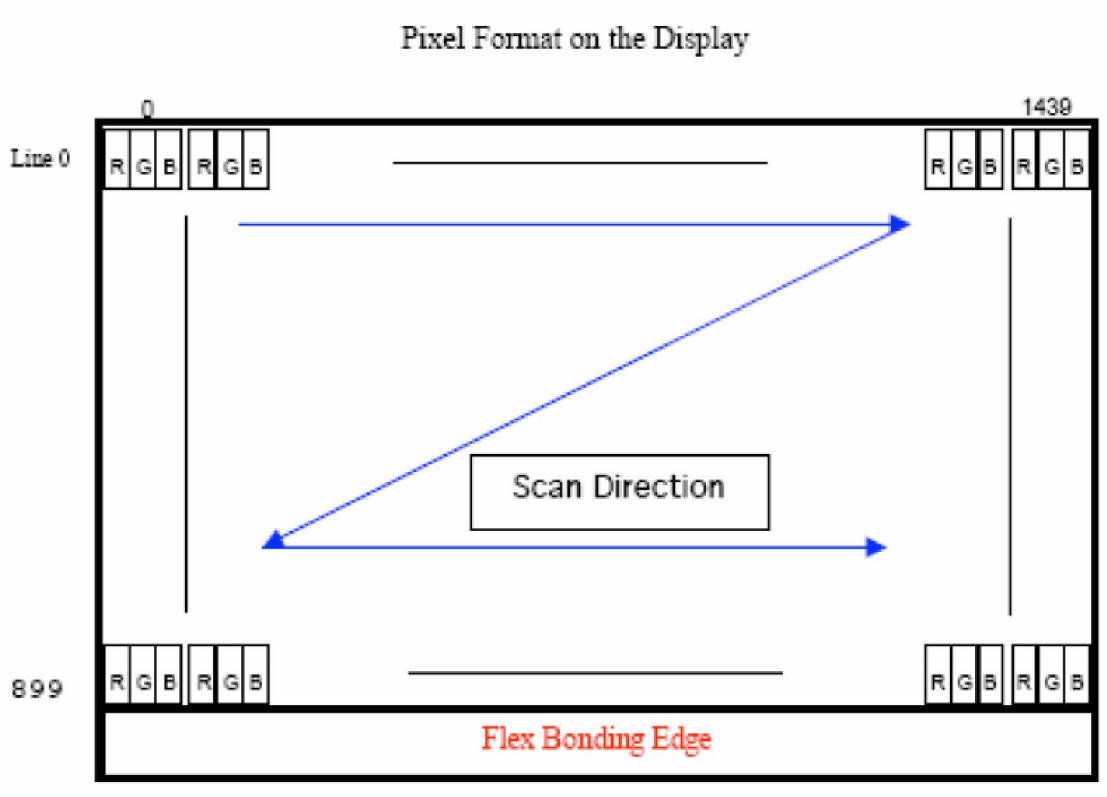
Note 3: CCFL inverter should be able to give out a power that has a generating capacity of over 800 voltage. Lamp units need 800 voltage minimum for ignition

Note 4: CCFL life time 50,000hr under 6mA,it's defined as when the brightness is reduced by half. To exceed 8.0mA,life time accelerate drop down and if to exceed 8.5mA has safety problem.

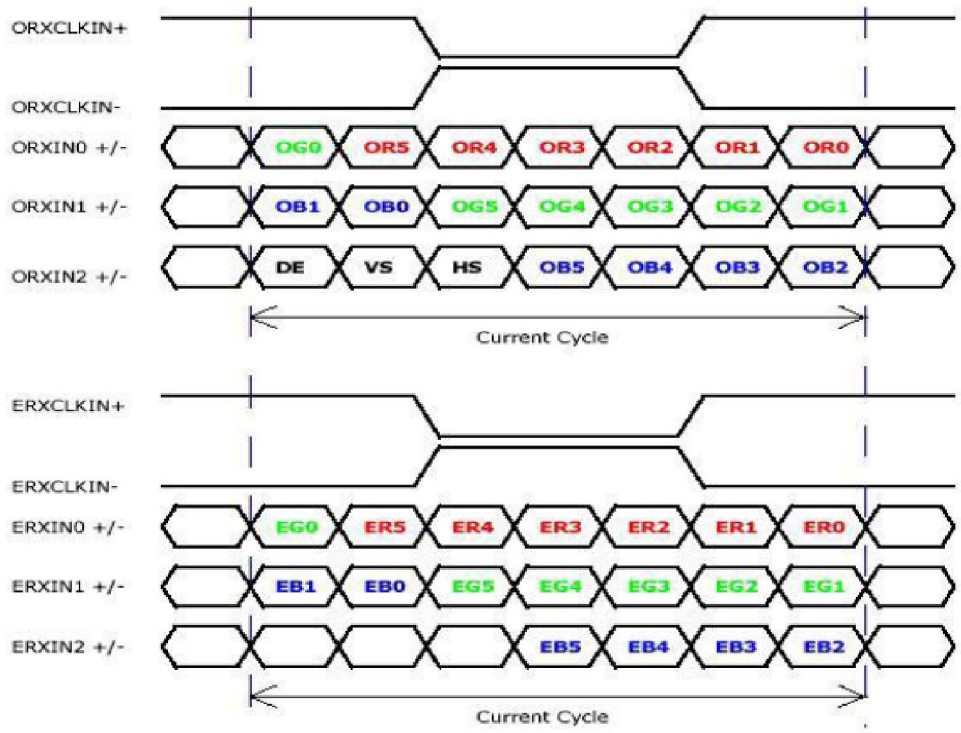
5. Signal Characteristic

5.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.



5.2 The input data format



Signal Name	Description
V_{EDID}	+3.3V EDID Power
CLK_{EDID}	EDID Clock Input
$DATA_{EDID}$	EDID Data Input
ORXIN0-, ORXIN0+	Odd LVDS differential data input(ORed0-ORed5, OGreen0)
ORXIN1-, ORXIN1+	Odd LVDS differential data input(OGreen1-OGreen5, OBlue0-OBlue1)
ORXIN2-, ORXIN2+	Odd LVDS differential data input(OBlue2-OBlue5, Hsync, Vsync, DE)
ORXCLKIN-, ORXCLKIN+	Odd LVDS differential clock input
ERXIN0-, ERXIN0+	Even LVDS differential data input(ERed0-ERed5, EGreen0)
ERXIN1-, ERXIN1+	Even LVDS differential data input(EGreen1-EGreen5, EBlue0-EBlue1)
ERXIN2-, ERXIN2+	Even LVDS differential data input(EBlue2-EBlue5)
ERXCLKIN-, ERXCLKIN+	Even LVDS differential clock input
VDD	+3.3V Power Supply
GND	Ground

Note: Output signals from any system shall be low or High-impedance state when VDD is off.

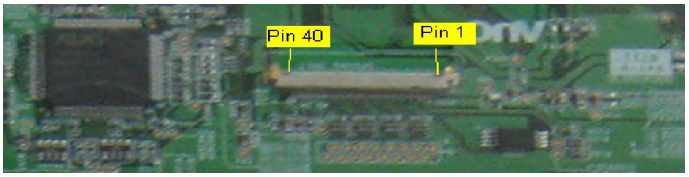
5.3 Signal Description/Pin Assignment

LVDS is a differential signal technology for LCD interface and high speed data transfer device.

Pin	Symbol	Description	Micro-coax cable gauge (AWG)
1	GND	Ground	40
2	Vcc	Power Supply (+3.3V)	36
3	Vcc	Power Supply (+3.3V)	36
4	VEDID	DDC 3.3V Power	40
5	Vcc	Power Supply (+3.3V)	36
6	Power Supply (+3.3V)	ClkEDID DDC Clock	40
7	DATAEDID	DDC Data	40
8	Odd_Rin0-	Odd Channel Differential Data Input	40
9	Odd_Rin0+	Odd Channel Differential Data Input	40
10	GND	Ground	40
11	Odd_Rin1-	Odd Channel Differential Data Input	40
12	Odd_Rin1+	Odd Channel Differential Data Input	40
13	GND	Ground	40
14	Odd_Rin2	Odd Channel Differential Data Input	40
15	Odd_Rin2+	Odd Channel Differential Data Input	40
16	GND	Ground	40
17	Odd_Clkin-	Odd Channel Differential Clock Input	40
18	Odd_Clkin+	Odd Channel Differential Clock Input	40
19	GND	Ground	40
20	Even_Rin0	Even	40
21	Even_Rin0+	Even Channel Differential Data Input	40
22	GND	Ground	40
23	Even_Rin1	Even Channel Differential Data Input	40
24	Even_Rin1+	Even Channel Differential Data Input	40
25	GND	Ground	40
26	Even_Rin2	Even Channel Differential Data Input	40
27	Even_Rin2+	Even Channel Differential Data Input	40
28	GND	Ground	40
29	Even_Clkin-	Even Channel Differential Clock Input	40
30	Even_Clkin+	Even Channel Differential Clock Input	40
31	Vdc1	LED Cathode (Negative)	40
32	Vdc2	LED Cathode (Negative)	40
33	Vdc3	LED Cathode (Negative)	40
34	Vdc4	LED Cathode (Negative)	40
35	Vdc5	LED Cathode (Negative)	40
36	Vdc6	LED Cathode (Negative)	40
37	AGINE	AGINE PIN	40
38	Vdc(1,2)	LED Annold (Positive)	40
39	Vdc(3,4,)	LED Annold (Positive)	40
40	Vdc(5,6)	LED Annold (Positive)	40

Note1 : Pin No.31~40 for LED BLU use.

Note2 : Star from right side.



5.4 Interface Timing

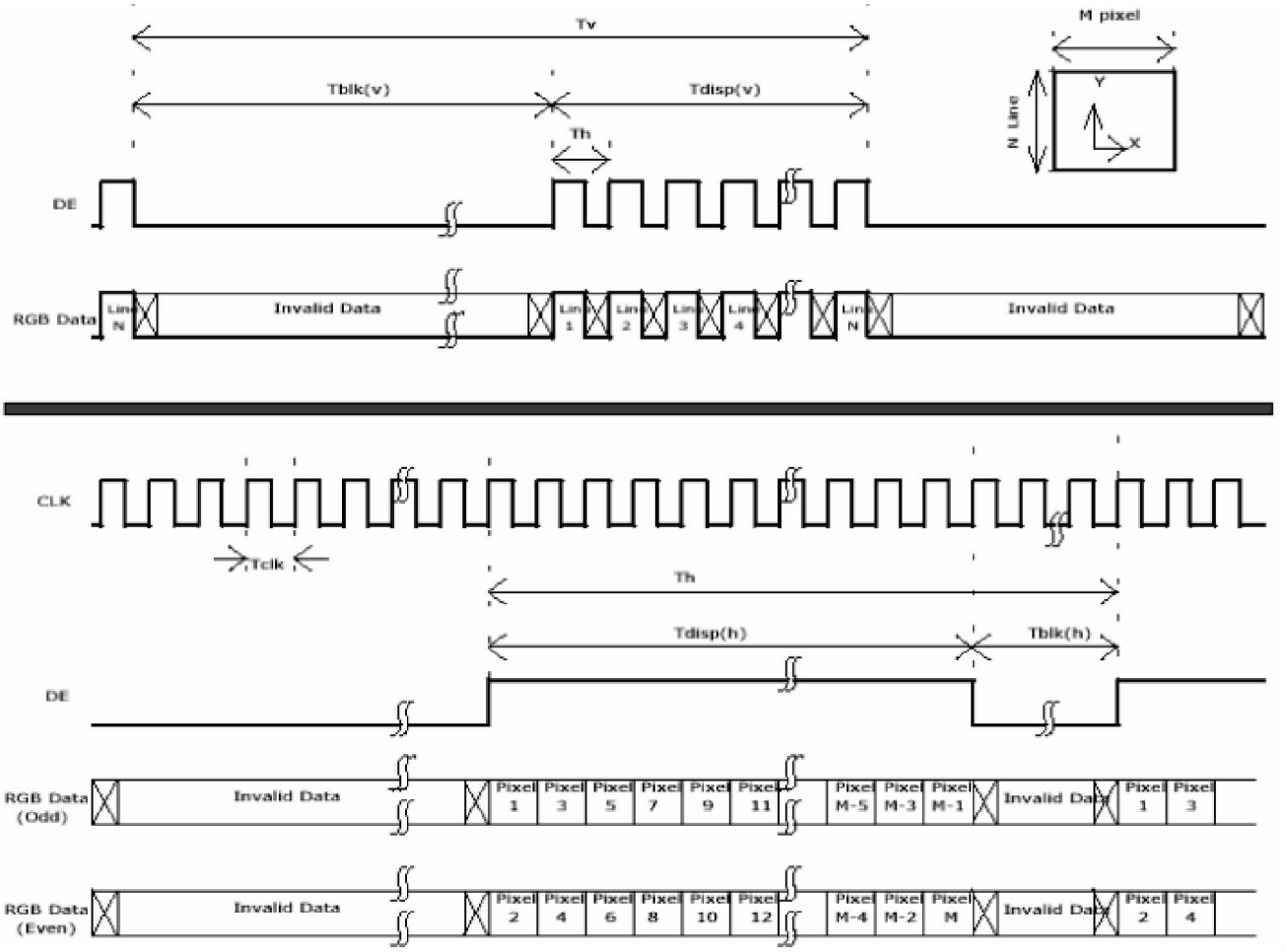
5.4.1 Timing Characteristics

Basically, interface timings should match the 1440X900 /60Hz manufacturing guide line timing.

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		-	50	60	-	Hz
Clock frequency		1/ TClock	-	48.2	60.2	MHz
Vertical Section	Period	T_V	904	912	2048	T_{Line}
	Active	T_{VD}	900	900	900	
	Blanking	T_{VB}	4	12	-	
Horizontal Section	Period	T_H	760	880	1024	T_{Clock}
	Active	T_{HD}	720	720	720	
	Blanking	T_{HB}	40	160	-	

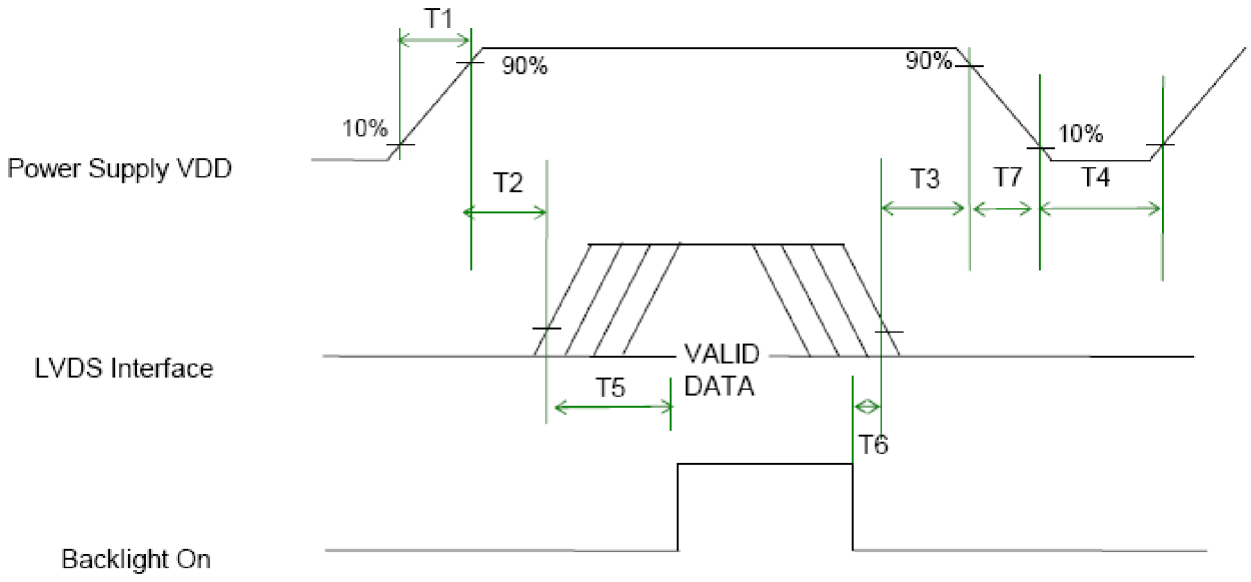
Note : DE mode only

5.4.2 Timing diagram



5.5 Power ON/OFF Sequence

VDD power and lamp on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Power Sequence Timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	(ms)
T2	5	-	50	(ms)
T3	0.5	-	50	(ms)
T4	400	-	-	(ms)
T5	200	-	-	(ms)
T6	200	-	-	(ms)
T7	0	-	10	(ms)

6. Connector Description

Physical interface is described as for the connector on module.
These connectors are capable of accommodating the following signals and will be following components.

6.1 TFT LCD Module

Connector Name / Designation	For Signal Connector
Manufacturer	JAE or equivalent
Type / Part Number	JAE FI-JH-40S-HF10 or equivalent
Mating Housing/Part Number	JAE FI-JH-40C series or equivalent (micro-coax type)

7. Vibration and Shock Test (Stand alone)

7.1 Vibration Test

Test Spec:

- Test method: Non-Operation
- Acceleration: 1.5G
- Frequency: 26 - 500Hz Random
- Sweep: 30 Minutes each Axis (X, Y, Z)

7.2 Shock Test Spec:

Test Spec:

- Test method: Non-Operation
- Acceleration: 260 G , Half sine wave
- Active time: 2 ms
- Pulse: X,Y,Z .one time for each side

8. Reliability

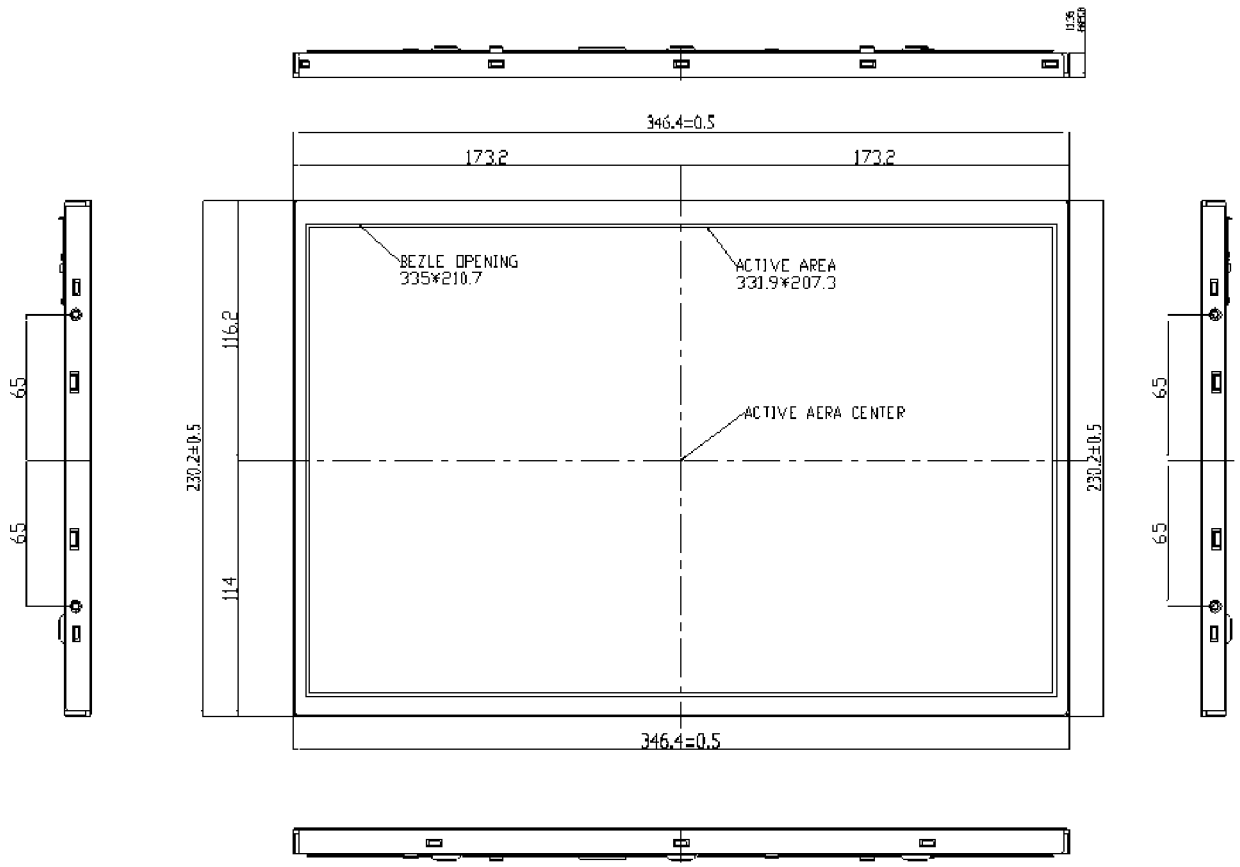
Items	Required Condition	Note
Temperature Humidity Bias	40℃/95%,300Hrs	
High Temperature Operation	50℃/Dry,300Hrs	
Low Temperature Operation	0℃,300Hrs	
On/Off Test	25℃,150hrs(ON/30 sec. OFF/30sec., 10,000 cycles)	
Hot Storage	65℃/20% RH ,300 hours	
Cold Storage	-25℃/50% RH ,300 hours	
Thermal Shock Test	-25℃/30 min ,65℃/30 min 100cycles non-OP	
Shock Test (Non-Operating)	260G, 2ms, Half-sine wave, +/- X, Y,Z direction,1 cycle	
Vibration Test (Non-Operating)	Sinusoidal vibration, 3.0 G zero-to-peak, 10 to 150 Hz, 30 mins in each of three mutually perpendicular axes.	
ESD	Contact : ±8KV/ operation Air : ±15KV / operation	Note 1
Image sticking	10X10 checker pattern, 10 hrs, 25℃. The persisting pattern should be disappeared in 5 minutes	

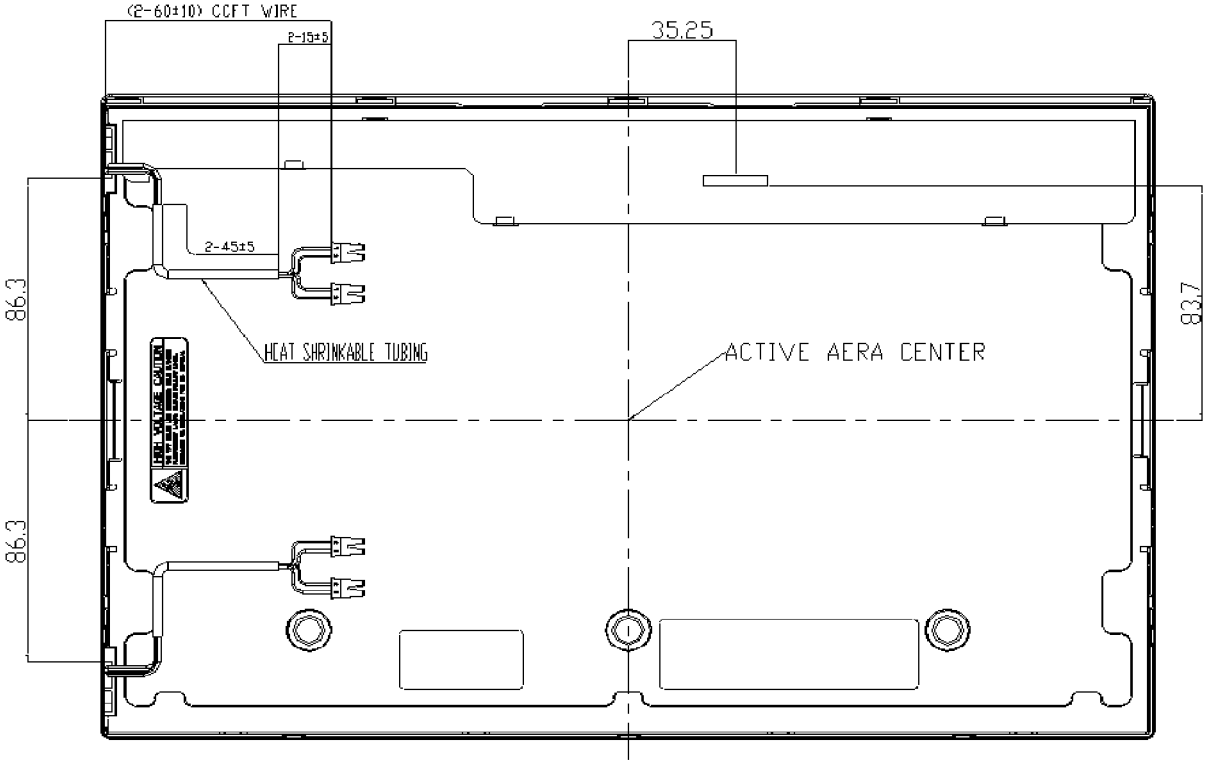
Note1: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost

. Self-recoverable. No hardware failures.

9. Mechanical Characteristics

9.1 LCM Outline Dimension





10. Shipping and Package

10.1. Carton package

The outside dimension of carton is 410 (L)mm x 380 (W)mm x 325 (H)mm

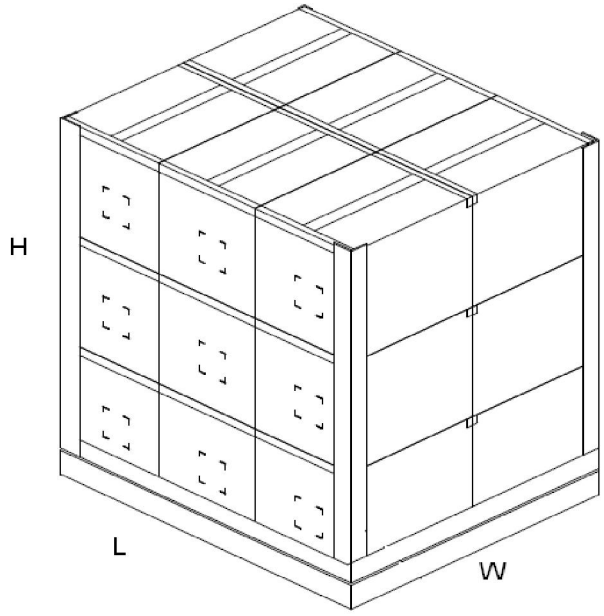
10.2 Shipping package of palletizing sequence

10.2.1 Packing

1 Carton = 10 PCS

1 layer = Max 6 cartons

1 Pallet = 3 layer × 6 cartons × 10 PCS = 180 PCS



1140mm(L) × 940mm (W) × 1140mm(H)

10.2.2 Weightiness

1 PCS PANEL = 1.35Kg (Net.)

1 Carton = 13.5Kg (N/W) ; 14.8Kg (G/W)

1 Pallet = 243Kg (N/W) ; 274.55Kg (G/W)