Chunghwa Picture Tubes, Ltd.
Technical Specification

To : **Studio Technology Co.,Ltd**
Date : 2007/06/26

CPT TFT-LCD
CLAA170WA02

ACCEPTED BY：

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Doc.No:	**CLAA170WA02**	Issue Date:	**2007/06/26**

1. OVERVIEW

CLAA170WA02 is 17” color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, LVDS driver ICs, control circuit and backlight. By applying 6 bit digital data, 1280×720, 262K-color images are displayed on the 17” diagonal screen. Interface of data and control signals is Typ. 65.49 MHz digital. Inverter for backlight is not included in this module. General specification are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	372.5(H) x 209(V)
Number of Pixels	1280 (H) × 720(V)
Pixel Pitch (mm)	0.291(H) × 0.291(V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white, TN
Number of Colors	262K(6bits)
Brightness (cd/m^2)	250 nits (center,typ.,@CCFL=8.0mA)
Viewing Angle	140/130 (Typ.)
Wide Viewing Angle Technology	Optical Compensation Film
Surface Treatment	Anti-glare, 3H
Response Time	8 ms
Color Saturation	65 %
Total Module Power (W)	12.5 (Typ.)
Optimum Viewing Angle	6 o’clock
Module Size (mm)	393.5 (W) × 235.9 (H) × 11.0(D) (Typ.)
Module Weight (g)	2100 (Typ.)
Backlight Unit	CCFL, 2 tubes, edge-light (top/bottom)

The LCD Products listed on this document are not suitable for use of aerospace equipment, Submarine cables, and nuclear reactor control system and life support systems. If customers intend to use these LCD products for above application or not listed in "Standard" as follows, please contact our sales people in advance.

Standard: Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tool, Industrial robot, Audio and Visual equipment, Other consumer products.

2. ABSOLUTE MAXIMUM RATINGS

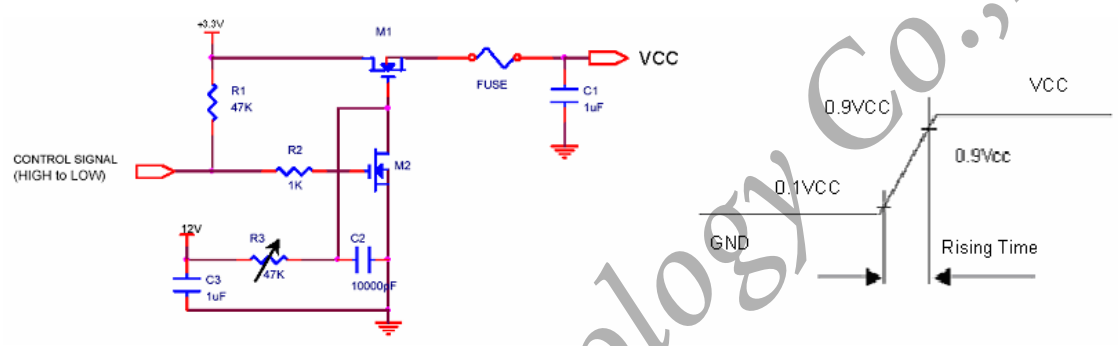
The following are maximun values which, if exceeded, may cause faulty operation or damage to the unit.

ITEM	SYMBOL	MIN.	MAX.	UNIT	Remark
Power Supply Voltage For LCD	VCC	--	6.0	V	--
ICC Rush Current	IRUSHd	--	(4.0)	A	*1)
Lamp Voltage	VL	(531)	(786)	Vrms	*2)
Lamp Current	IL	3	8.5	mArms	*2)
Lamp Frequency	FL	40	80	kHz	*2)*3)
Operation Temperature (Surrounding) *1)	T_{op}	0	50	℃	*4),5),6),7),8)
Storage Temperature *1)	T_{stg}	-20	60	℃	*4), 5), 6)

[Note]

*1) I Rush Measurement Condition

The rising time of VCC is 550 μ sec (measured conditions are described below), If VCC rise time increase then I_{RUSH} decrease.



*2) These are properties of single lamp(without backlight)

a. Lamp life-time relate to the lamp current, please operate following statement Back light system at page 6.

b. When lamp current over the definition of absolute max. value, life-time of the product will decay rapidly or operate unusual.

*3) The frequency range will not affect to lamp life and reliability characteristics.

a. Electrical and optical characteristics will display well at 40~60 kHz frequency.

b. It would not damage the lifetime and reliability of the panel at 40~80 kHz frequency.

*4) The relative temperature and humidity range are as below sketch, 90%RH is Max. value. (Ta≦ 40℃)

Humidity：

Humidity≦85%RH without condensation.

Relative Humidity ≦90% (Ta≦ 40℃)

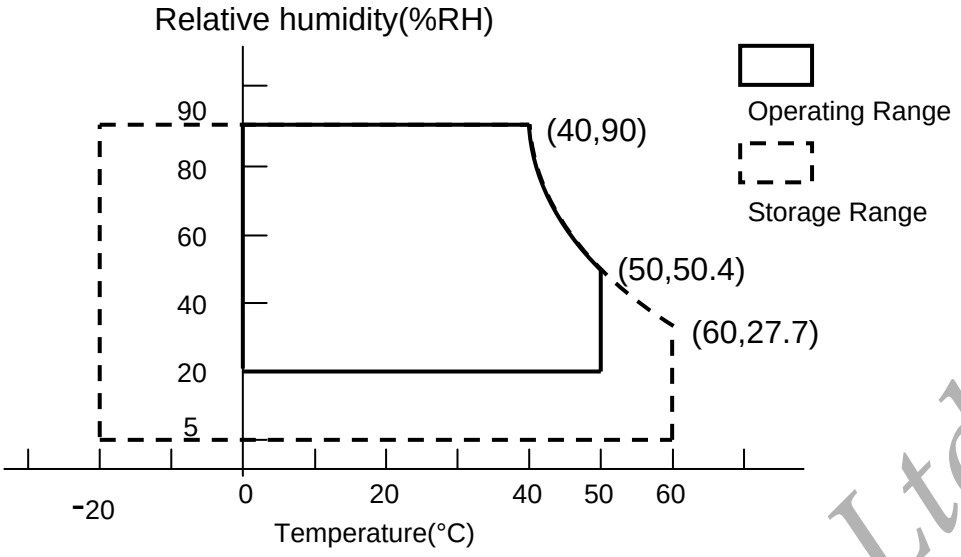
Wet Bulb Temperature ≦39℃(Ta≧40℃)

*5) The maximum wet bulb temperature ≦39℃(Ta＞40℃) and without dewing.

*6) If you use the product in a environment which over the definition of temperature and humidity , it will concern for visual quality.

*7) The relationship between Lamp current and lamp life-time, you can refer to the statement of backlight(3.2) in page. 6.

*8) If you operated the product in normal temperature range, the center surface of panel should be under 60℃.



3. ELECTRICAL CHARACTERISTICS

3.1 TFT-LCD Ta=25℃

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Power Supply Voltage for Logic	VCC	4.5	5.0	5.5	V	*1)
Power Supply Current for Logic	ICC	--	(300)	(450)	mA	*2)
Permissive Ripple Voltage for Logic	VRPd	--	--	100	mVp-p	Vin=+5.0V

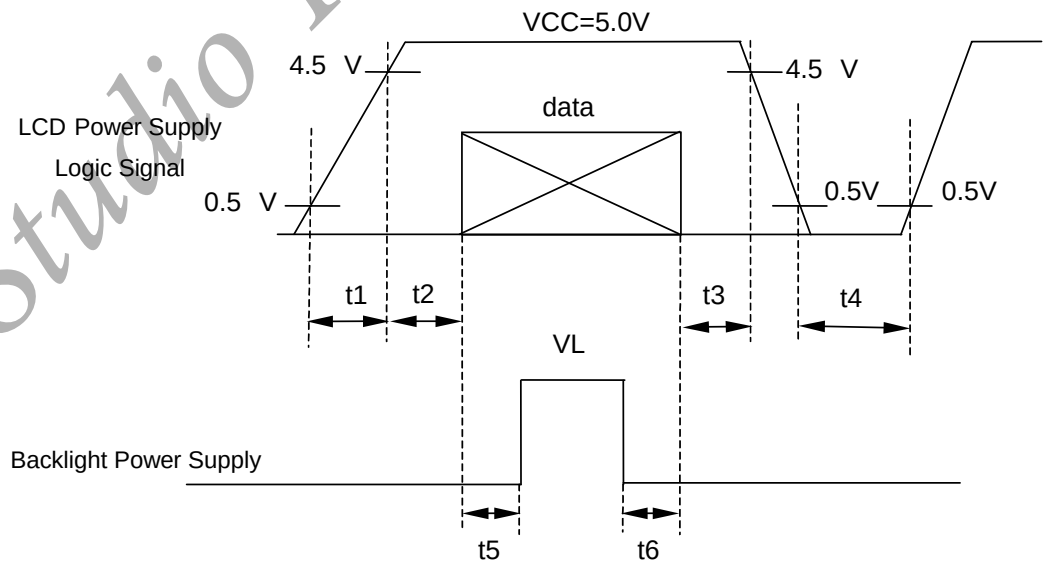
[Note]

*1)Power、data sequence

0.5ms≦t1≦10ms 500ms≦t4

0＜t2≦50ms 200ms≦t5

0＜t3≦50ms 200ms≦t6



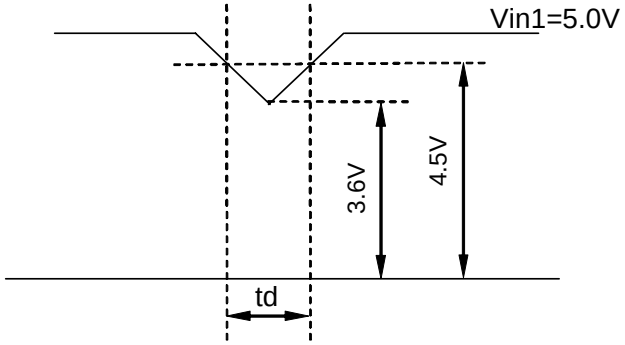
Data: RGB DATA, DCLK, DENA

,

VCC-dip state：

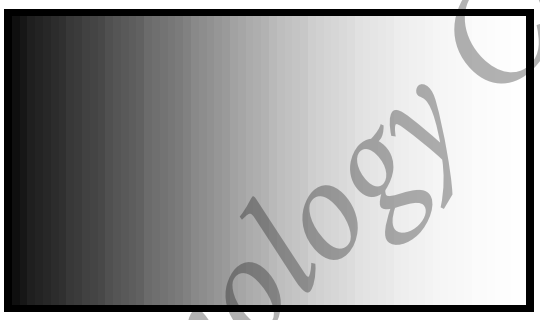
1) When 3.6 V≦VCC＜4.5V, td≦10 ms.

2) VCC＞4.5V,VCC-dip condition should also follow the VCC-power sequence condition.

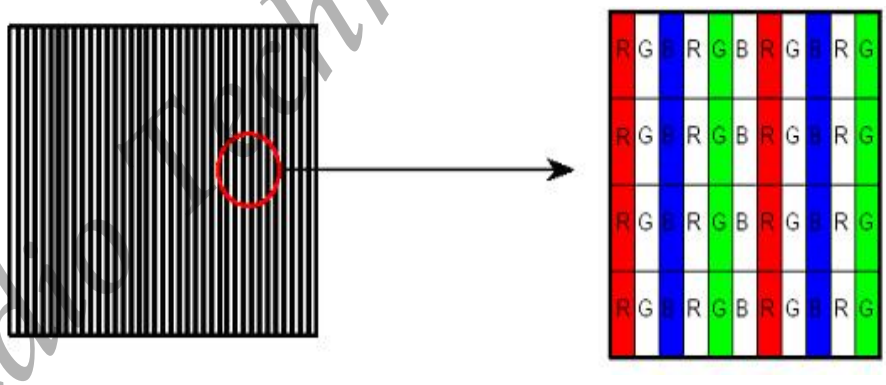


*2) Current situation:

1.Typical:0~64-gray-bar pattern, 720 line mode, VCC=+5.0V, f_{CLK}=65.49 MHz.



2.Maximum: 720 line mode, VCC=+5.0V, f_{CLK}=65.49 MHz.



3.2 Backlight

(a) Electrical Characteristics Ta=25℃

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Lamp Voltage	VL	(540)	(600)	(660)	Vrms	*1)；IL=8.0mA
Lamp Current	IL	7.5	8.0	8.5	mArms	*2)
Inverter Frequency	FI	40	50	60	kHz	*3)
Starting Lamp Voltage	VS	--	--	(1270)	Vrms	Ta=25℃ *1),*5)
		--	--	(1780)	Vrms	Ta=0℃*1),*5)

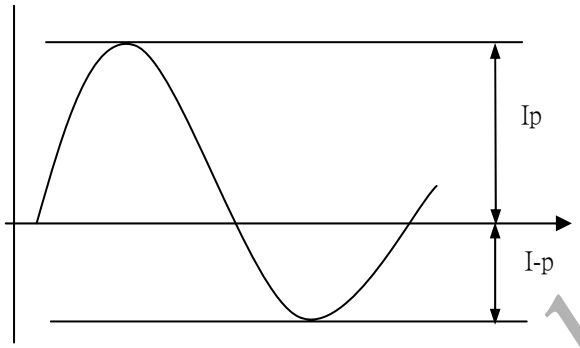
(b) Lamp Life Time

ITEM	IL @3.0 mA	IL @7.5 mA	IL @8.0 mA	IL @8.5 mA	UNIT	REMARK
Lamp Life Time	Min. 50,000	Min. 35,000	Min. 30,000 Typ. 40,000	Min. 20,000	hr	Continuous Operation*6)
Turn-on and Turn-off Operation	--		Min. 100,000	--	time	Continuous Operation*7)

[Note]

If the waveform of light up-driving is asymmetric, the distribution of mercury inside the lamp tube will become unequally or will deplete the Ar gas in it. Then it may cause the abnormal phenomenon of lighting-up. Therefore, designers have to try their best to forfill the conditions under the inverter designing-stage as below:

- The degrees of unbalance： ＜10%
- The ratio of wave height：＜$\sqrt{2}$ ±10%



Ip：high side peak

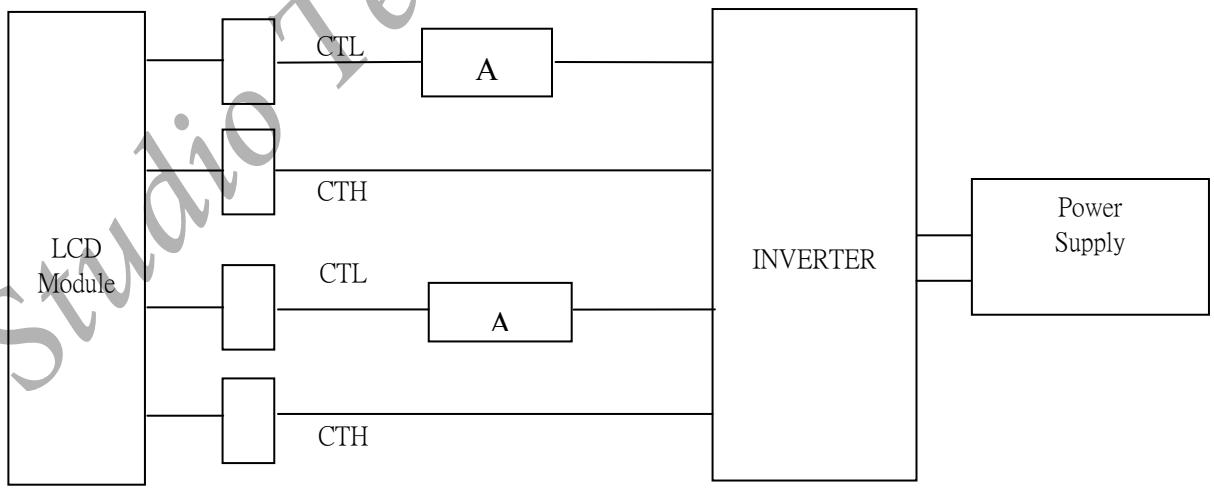
I-p：low side peak

A：The degrees of unbalance = | Ip – I-p | / Irms ×100 (%)

B：The ratio of wave height = Ip (or I-p) / Irms

*1) These are properties of single lamp(without backlight).

*2) Lamp Current measurement method (The current meter is inserted in cold line)



The lowest lamp current is IL(IL=3mArms). If lamp current over 8.5mA, it will come up safety issue and lamp life-time will drop rapidly.

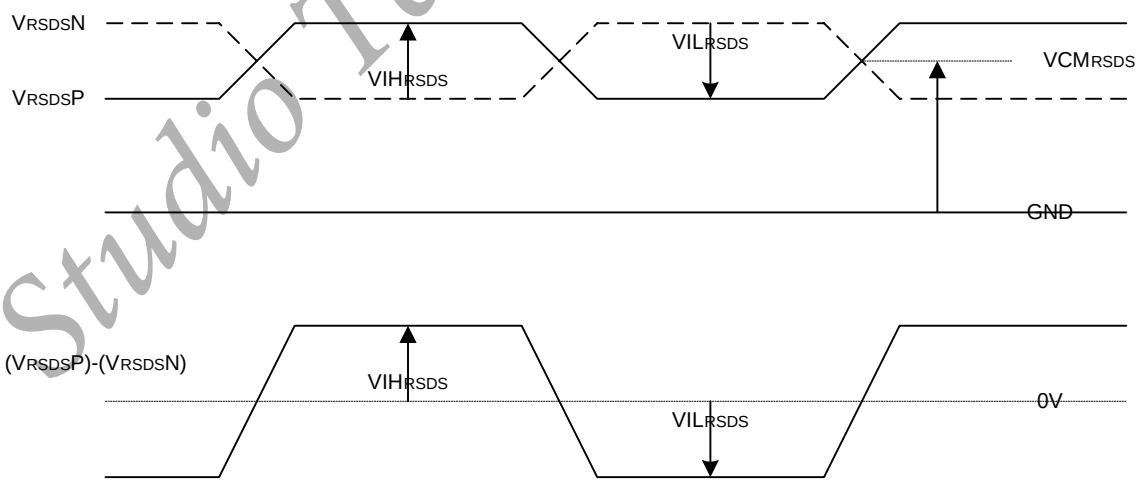
*3) The frequency range can be kept within +/- 10% range of electrical and optical characterisitics.
*4) Lamp frequency of inverter may produce interference with horizontal synchronous frequency, and this may cause horizontal beat on the display. Therefore, please adjust lamp frequency, and keep inverter as far from module as possible or use electronic shielding between inverter and module to avoid the interference.
*5) The Maximum value of starting lamp voltage is defined as the probably biggest value of starting lamp voltage, hence the design of starting lamp voltage for inverter must be equal to or higher than maximum starting lamp voltage.
*6) Definition of the lamp life time：
a. Luminance (L) reduced 50% of initial value.
b. When lamp current over 8.5mA, lamp life time will drop rapidly. If over 8.5mA, it will come up safety issue. But if it lower than 3.0mA, the lamp will be damaged.
*7) The condition of Turn-on and Turn-off operation is as below:
a. Lamp current is 8.0mA, Ta=25±5℃.
b. Frequency is 10 sec.(on)/10 sec.(off)
c. Repeat it for 100,000 times
d. Starting lamp voltage should not exceed 130% of the initial value

3.3 RSDS Signal definition

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
RSDS High Level Input Voltage	VIHRSDS	100	200	-	mV	VCMRSDS = + 1.2 V
RSDS Low Level Input Voltage	VILRSDS	-	- 200	- 100	mV	VCMRSDS = + 1.2 V
RSDS Common mode Input Voltage Range	VCMRSDS (1)	1.0	-	1.4	V	VDIFFRSDS (2) = 200 mV (minimum value)
RSDS Input leakage current	IDL	-10	-	10	uA	DxxP,DxxN,CLKP,CLKN

Notes:
1. VCMRSDS = (VCLKP + VCLKN) / 2 or VCMRSDS = (VDxxP + VDxxN) / 2
2. VDIFFRSDS = VCLKP– VCLKN or VDIFFRSDS = VDxxP – VDxxN

RSDS Standard difference Voltage(Peak to Peak) is 400mV, from –200mV to +200mV



RSDS signal definition

4. INTERFACE PIN CONNECTION

4.1 CN1

Outlet connector:AF7506-N2G11 or equivalent

Pin NO.	SYMBOL	FUNCTION
1	GND	Ground
2	B2P	Postive blue RSDS output data pair 2
3	B2N	Negative blue RSDS output data pair 2
4	GND	Ground
5	B1P	Postive blue RSDS output data pair 1
6	B1N	Negative blue RSDS output data pair 1
7	GND	Ground
8	B0P	Postive blue RSDS output data pair 0
9	B0N	Negative blue RSDS output data pair 0
10	GND	Ground
11	G2P	Postive green RSDS output data pair 2
12	G2N	Negative green RSDS output data pair 2
13	GND	Ground
14	G1P	Postive green RSDS output data pair 1
15	G1N	Negative green RSDS output data pair 1
16	GND	Ground
17	G0P	Postive green RSDS output data pair 0
18	G0N	Negative green RSDS output data pair 0
19	GND	Ground
20	CLKP	Postive RSDS differential clock output
21	CLKN	Negative RSDS differential clock output
22	GND	Ground
23	R2P	Postive red RSDS output data pair 2
24	R2N	Negative red RSDS output data pair 2
25	GND	Ground
26	R1P	Postive red RSDS output data pair 1
27	R1N	Negative red RSDS output data pair 1
28	GND	Ground
29	R0P	Postive red RSDS output data pair 0
30	R0N	Negative red RSDS output data pair 0
31	GND	Ground
32	STH1	Source driver horizontal start pulse signal
33	LP	Source driver line latch signal
34	POL	Source driver data polarity signal
35	HMS	TEST
36	GND	Ground
37	CLKV	Gate driver clock output
38	STV1	Gate driver data start pulse
39	OE	Gate driver enable signal
40	VCOM	TEST
41	GND	Ground
42	5 V	LCD power
43	5 V	LCD power
44	5 V	LCD power
45	GND	Ground
46	NC	NC
47	NC	NC
48	NC	NC
49	GND	Ground
50	NC	NC

1) Keep the NC Pin and don't connect it to GND or other signals.
2) GND Pin must connect to the ground, don't let it be a vacant pin.

4.2 CN2, 3 (BACKLIGHT)
Backlight-side connector: BHR-03VS-1 (JST)
Inverter-side connector: SM03B-BHS-1-TB (JST)
CN2

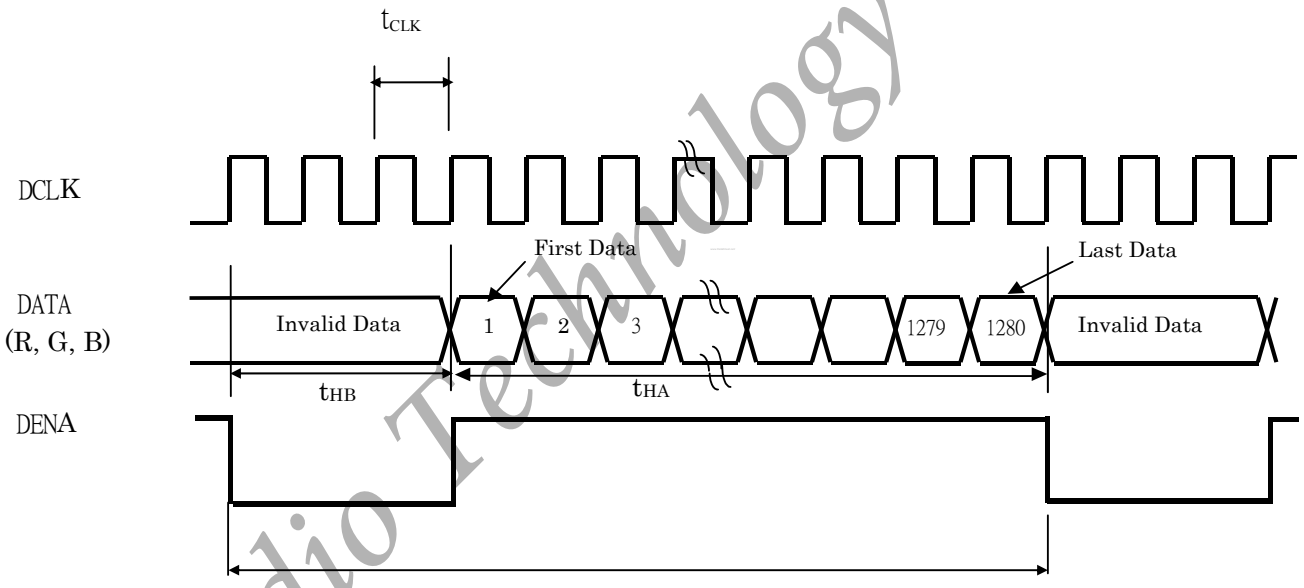
PIN #	SYMBOL	FUNCTION
1	CTH1	High Voltage
2	--	Empty
3	CTL1	Low Voltage

CN3

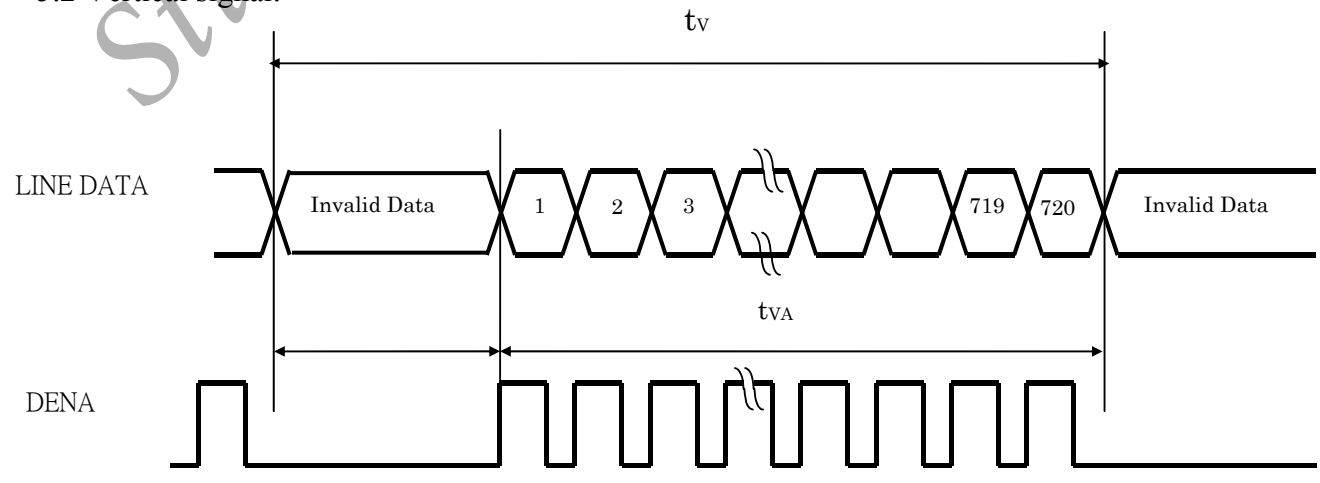
PIN #	SYMBOL	FUNCTION
1	CTH2	High Voltage
2	--	Empty
3	CTL2	Low Voltage

5. INTERFACE TIMING

5.1 Horizontal signal:



5.2 Vertical signal:



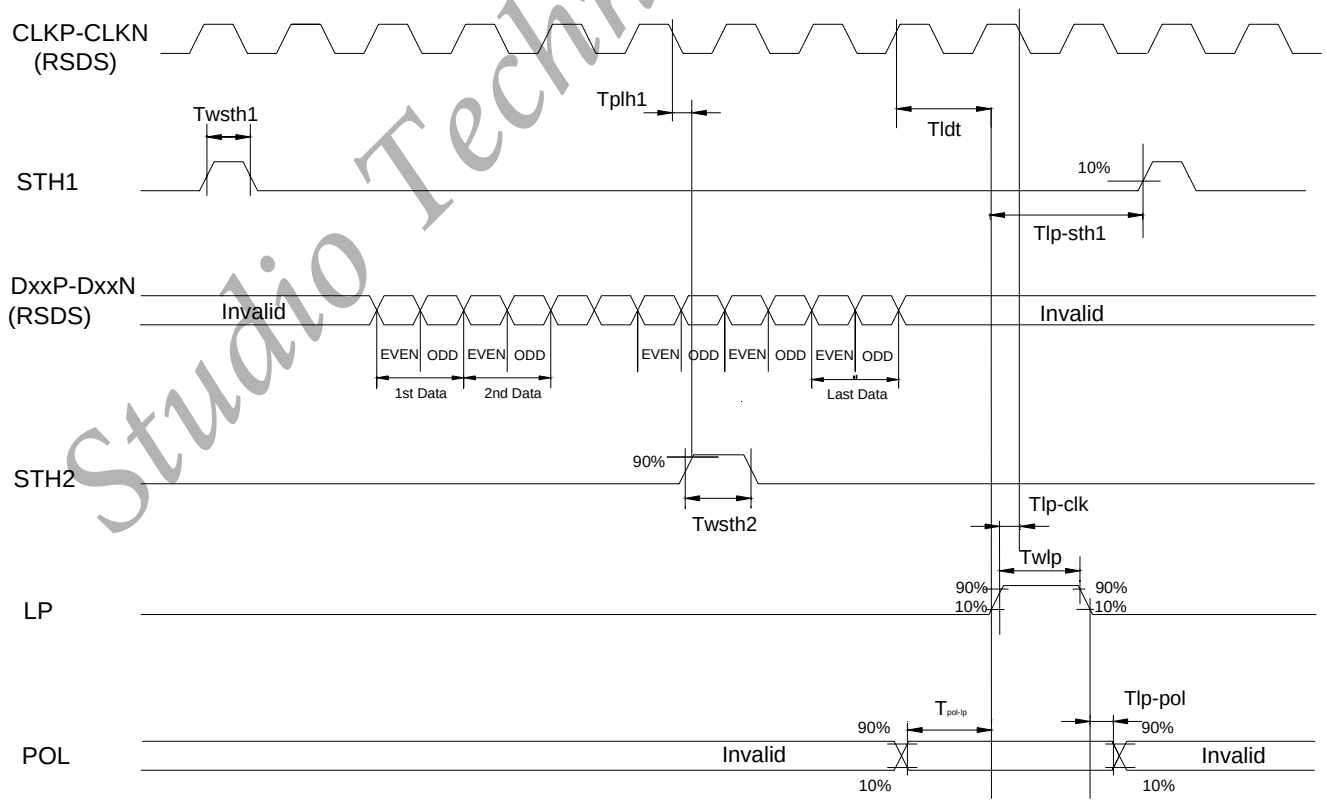
5.3 Timing Chart

ITEM				SYMBOL	MIN.	TYP.	MAX.	UNIT
LCD Timing	DCLK		Freq.	f_{CLK}	54	65.49	81	MHz
			Cycle	t_{CLK}	12.35	15.27	18.52	ns
	DENA	Horizontal	Vertical line Rate	f_H	36.5	45.48	57.75	kHz
			Horizontal total time	t_H	1340	1440	1600	t_{CLK}
			Horiaontal effective time	t_{HA}	1280	1280	1280	t_{CLK}
			Horizontal blank time	t_{HB}	60	160	320	t_{CLK}
		Vertical	Vertical frame Rate	Fr	50	60	75	Hz
			Vertical total time	t_V	730	758	770	t_H
			Vertical effective time	t_{VA}	720	720	720	t_H
			Vertical blank time	t_{VB}	10	38	50	t_H

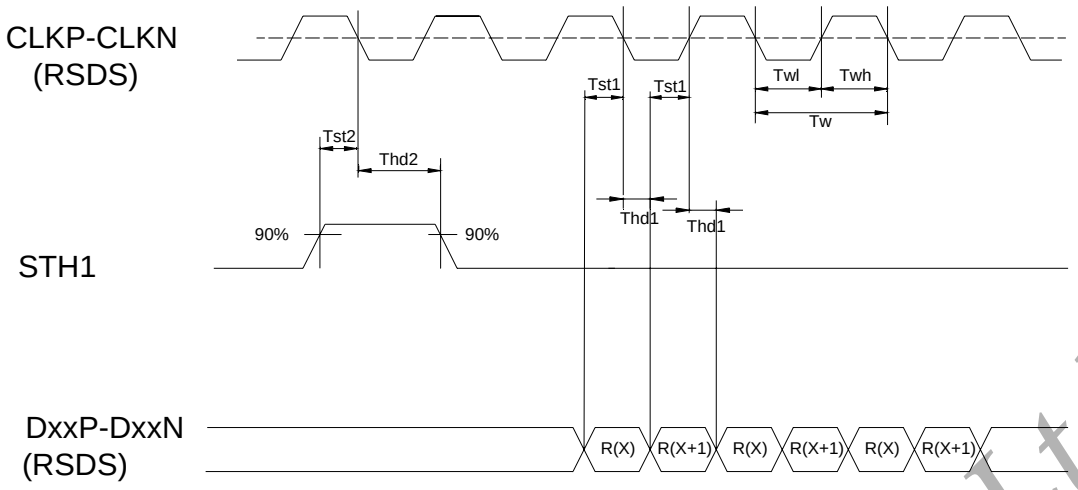
5.4 Horizontal Timing

(a) Horizontal Timing chart

Timing Diagram 1



Timing Diagram 2

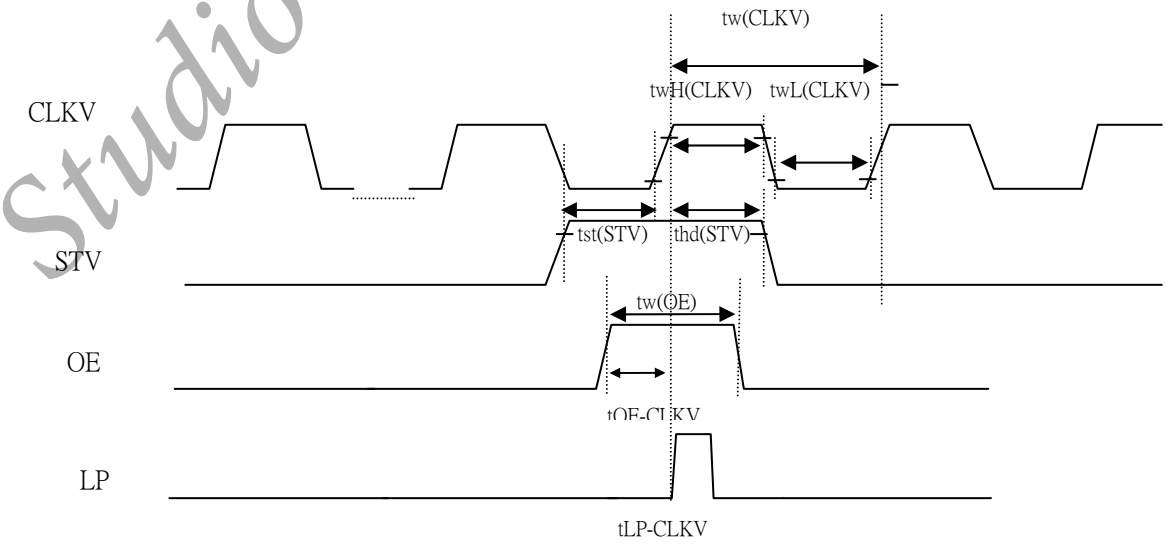


(b) Timing characteristics

Item	Symbol	Min	Typ	Max	Unit
CLK pulse width	Tw	12.35	15.27	18.52	ns
CLK pulse width (H)	Twh	6	-	-	ns
CLK pulse width (L)	Twl	6	-	-	ns
DATA set-up time	Tst1	4	-	-	ns
DATA hold time	Thd1	0.2	-	-	ns
STH set-up time	Tst2	4	-	-	ns
STH hold time	Thd2	4	-	-	ns
STH pulse width	Twsth	1	1	2	CLKP period
LP pulse width (H)	Twlp	15	-	-	CLKP period
Last data time	Tldt	1	-	-	CLKP period
CLK-LP time	Tclk-lp	4	-	-	ns
LP – STH time	Tlp-sth	6	-	-	CLKP period

5.5 Vertical Timing

(a) Vertical Timing chart



[Note]：The standard output signal of STV、CLKV are based on $V_{OL(MAX)}$=80%、$V_{OH(MIN)}$=20%

(b) Timing characteristics

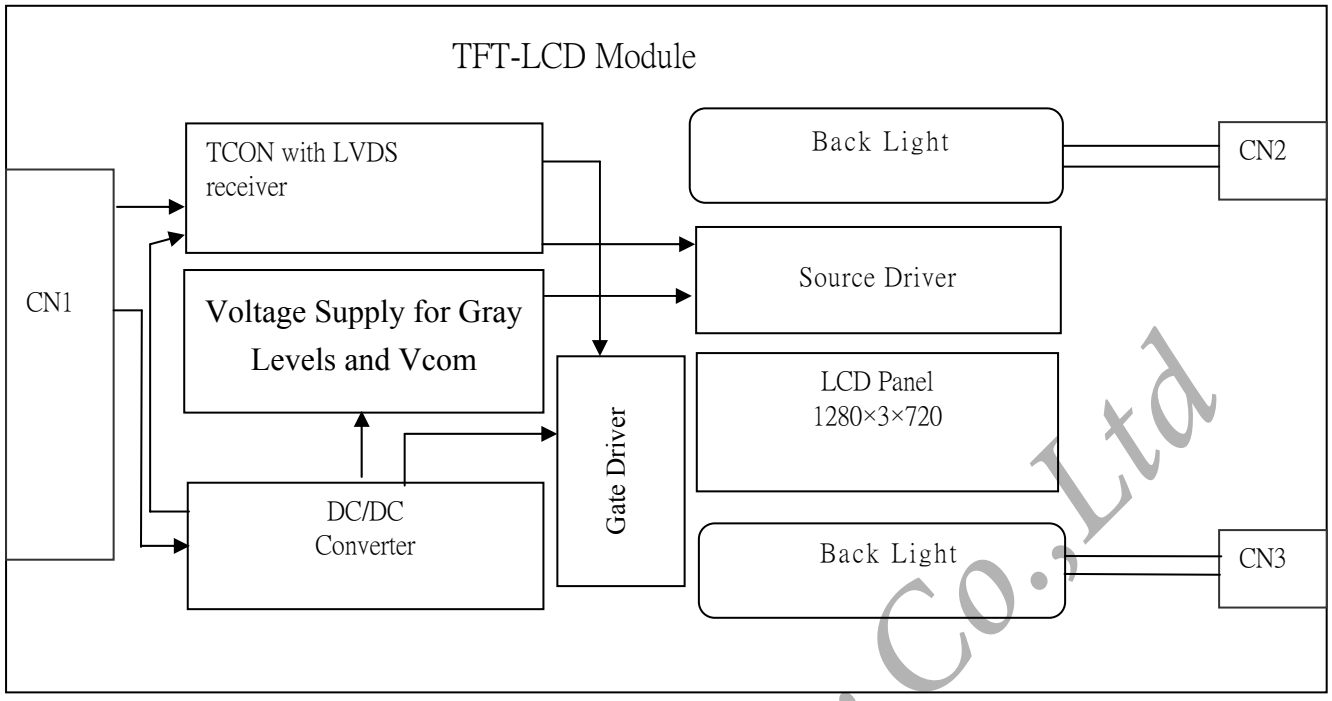
ITEM	SYMBOL	SPECIFICATION			UNIT
		MIN	TYP	MAX	
STV set-up time	tst(STV)	1	-	-	μs
STV hold time	thd(STV)	1	-	-	μs
CLKV pulse width	tw(CLKV)	8	-	-	μs
CLKV High pulse width	twH(CLKV)	3.5	-	-	μs
CLKV Low pulse width	twL(CLKV)	3.5	-	-	μs
OE pulse width	Tw(OE)	2.4	2.9	3.4	μs
OE-CLKV time	tOE-CLKV	1.5	2	3	μs
LP –CLKV time	tLP-CLKV	0	0	0	ns

6.COLOR DATA ASSIGNMENT

Color	Input Data	R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MSB					LSB	MSB					LSB	MSB					LSB
Basic Color	Black	0	0	0	0	0	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(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	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	RED(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	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	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	Green(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	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	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	Blue(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	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	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

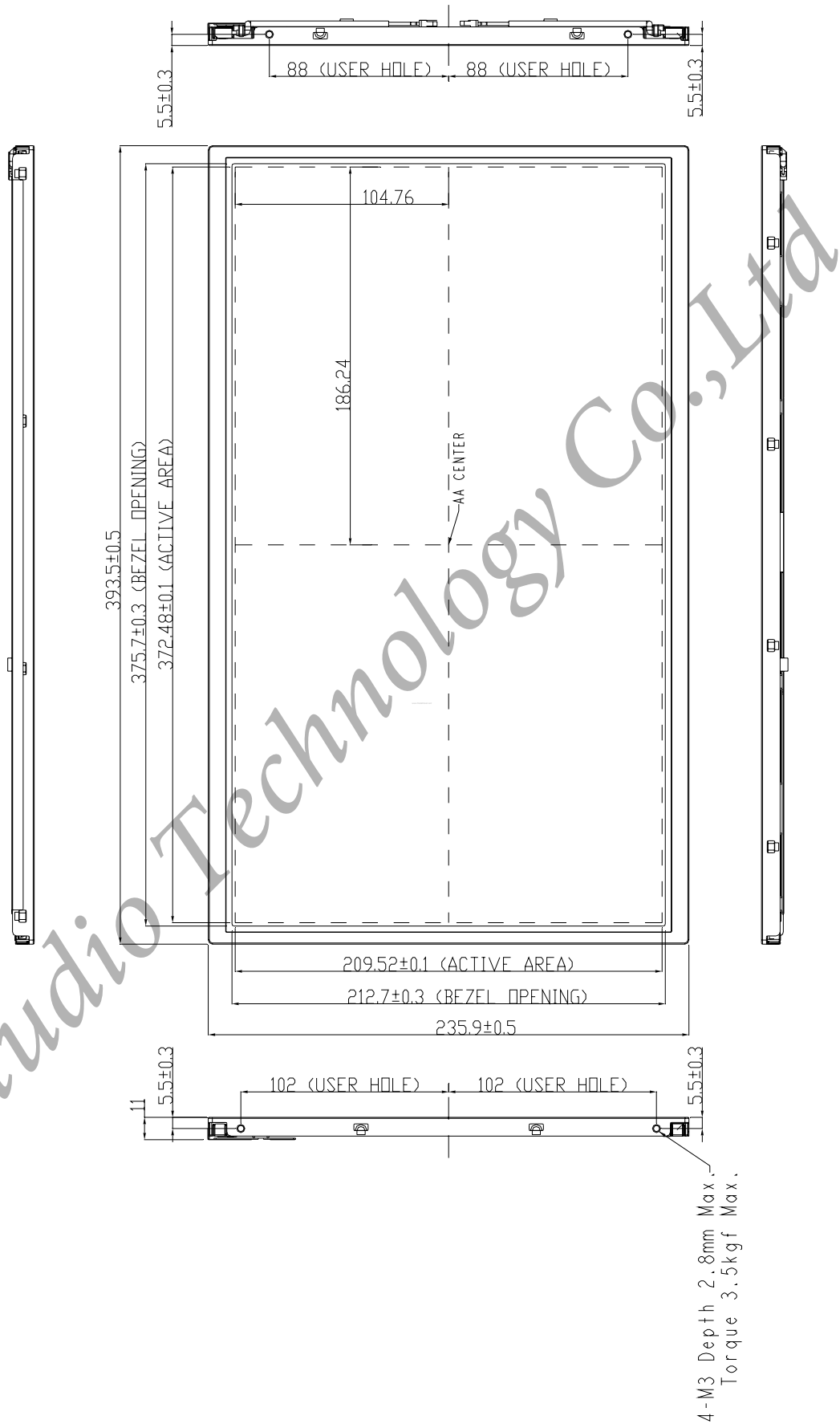
[Note]
1) Definition of gray scale:
Color (n): n indicates gray scale level; larger n means brighter level.
2) Data: 1-High, 0-Low.

7. BLOCK DIAGRAM

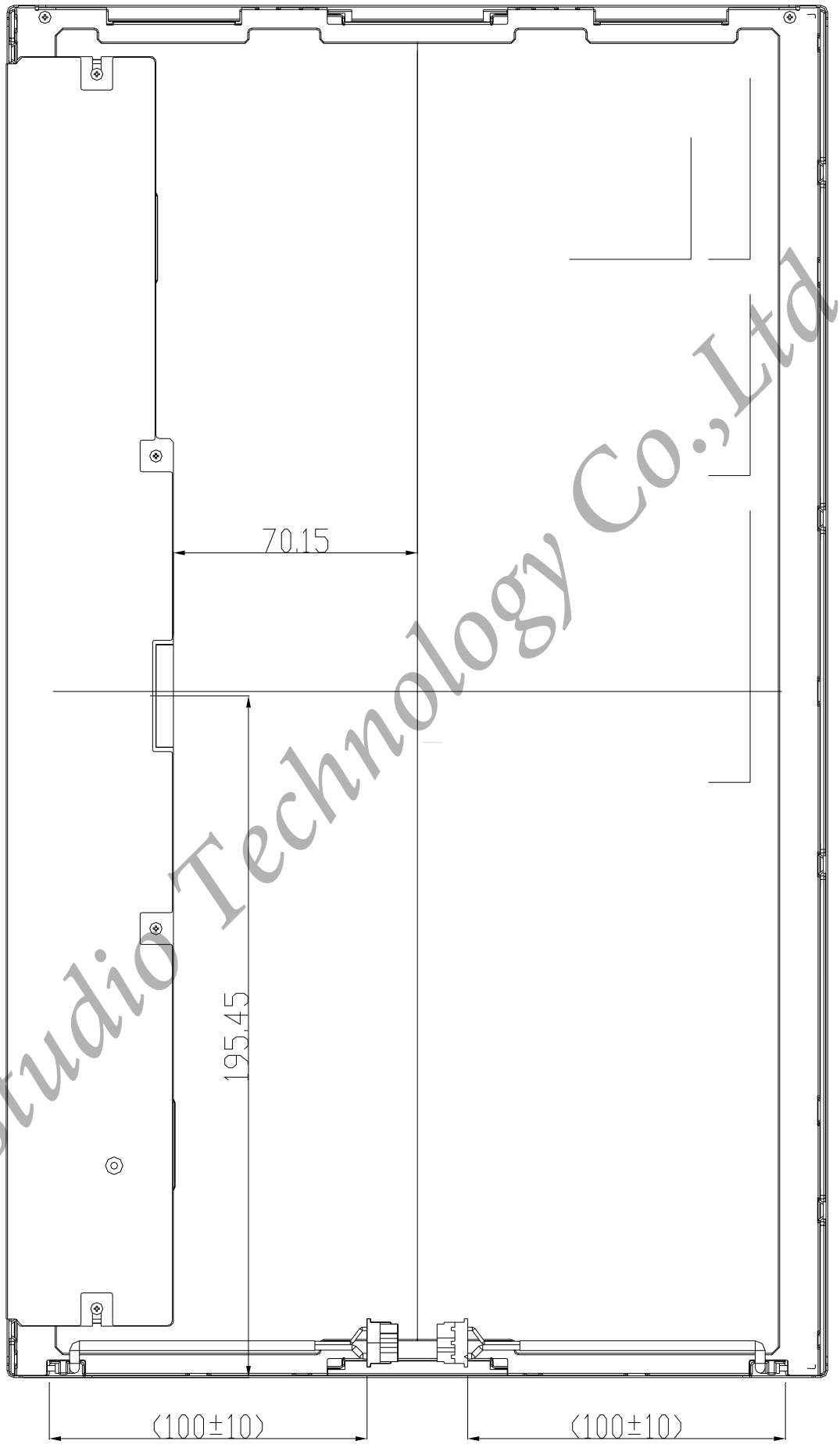


8. MECHANICAL SPECIFICATION

8.1 Front side (Tolerance is ± 0.5mm unless noted) [Unit: mm]



8.2 Rear side (Tolerance is ±0.5mm unless noted) [Unit: mm]



9.OPTICAL CHARACTERISTICS

Ta = 25°C, VCC=5.0V

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Contrast (CEN)		CR	θ= ϕ= 0°	450	500	--	--	*1)
Luminance (CEN)		L	θ= ϕ= 0°	200	250	--	cd/m^2	*2)
9P Luminance (AVG)		L	θ= ϕ= 0°	180	225	--	cd/m^2	*2)
9P Uniformity		ΔL	θ= ϕ= 0°	75	80	--	%	*2)
Response Time		Tr	θ= ϕ= 0°	--	(2)	(4)	ms	*4)
		Tf	θ= ϕ= 0°	--	(6)	(10)	ms	
Image sticking		Tis	4 hours	0	--	(3)	s	*5)
Cross talk		CMR	θ= ϕ= 0°	--	--	TBD	%	*6)
View angle	Horizontal	ϕ	CR≧5	(135)	(170)	--	Deg.	*3)
	Vertical	θ		(150)	(140)	--		
View angle	Horizontal	ϕ	CR≧10	(120)	(140)	--		
	Vertical	θ		(110)	(130)	--		
Color Coordinates	White	X Y	θ= ϕ= 0°	0.283 0.299	0.313 0.329	0.343 0.359	--	--
	Red	X Y		(TBD)	(TBD)	(TBD)		
	Green	X Y		(TBD)	(TBD)	(TBD)		
	Blue	X Y		(TBD)	(TBD)	(TBD)		
Color Temperature		K	--	--	6500	--	K	--
Gamma		γ	VESA	2.0	2.2	2.4	--	*7)

[Note]
These items are measured using BM-5A (TOPCON) under the dark room condition (no ambient light).
Measurement Condition: IL=8.0±0.1mA
Inverter Frequency: FI=50kHz.

Definition of these measurement items is as follows:
*1) Definition of Contrast Ratio
CR=ON (White) Luminance/OFF (Black) Luminance

*2) Definition of Luminance and Luminance uniformity
Central luminance: The white luminance is measured at the center position "5" on the screen, see Fig.1 below
9P Luminance (AVG): The white luminance is measured at measuring points 1 to 9, see Fig.1 below, and take the average value.
9P Uniformity: $\Delta L = (L_{MIN} / L_{MAX}) \times 100\%$

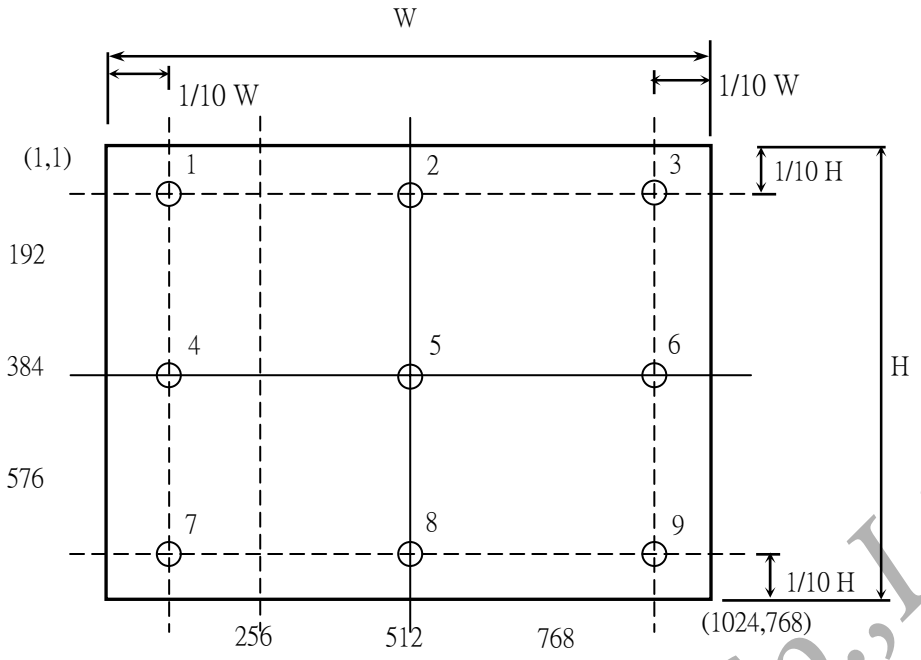
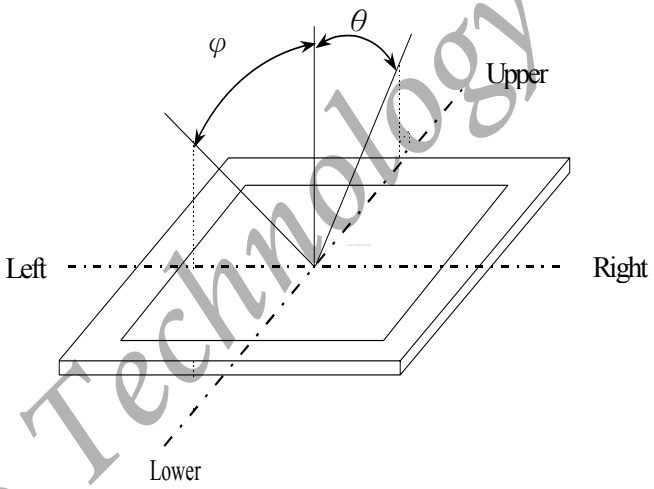


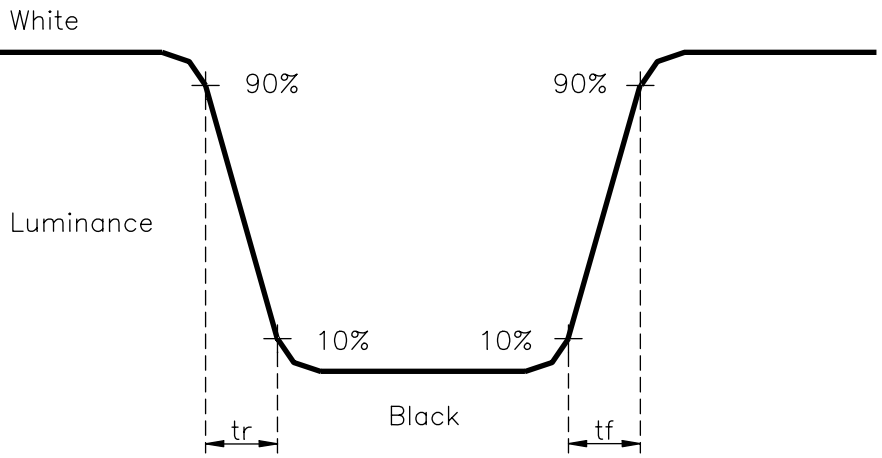
Figure 1. Measurement positions

*3) Definition of Viewing Angle (θ，ψ)



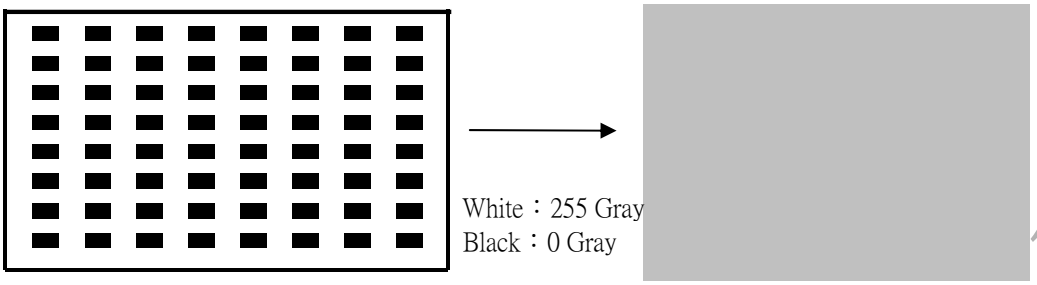
*4) Definition of Response Time

Change the module frame to Black/white pattern and use Westar TDR-100 to measure tr and tf under 25℃ room temperature.



*5) Definition of Image sticking:

Continuously display the test pattern showing in the below figure for 2hrs at 25℃.
Then switch to gray pattern (the 120nd gray level pattern), and the previous image should not persist more than 2 sec.



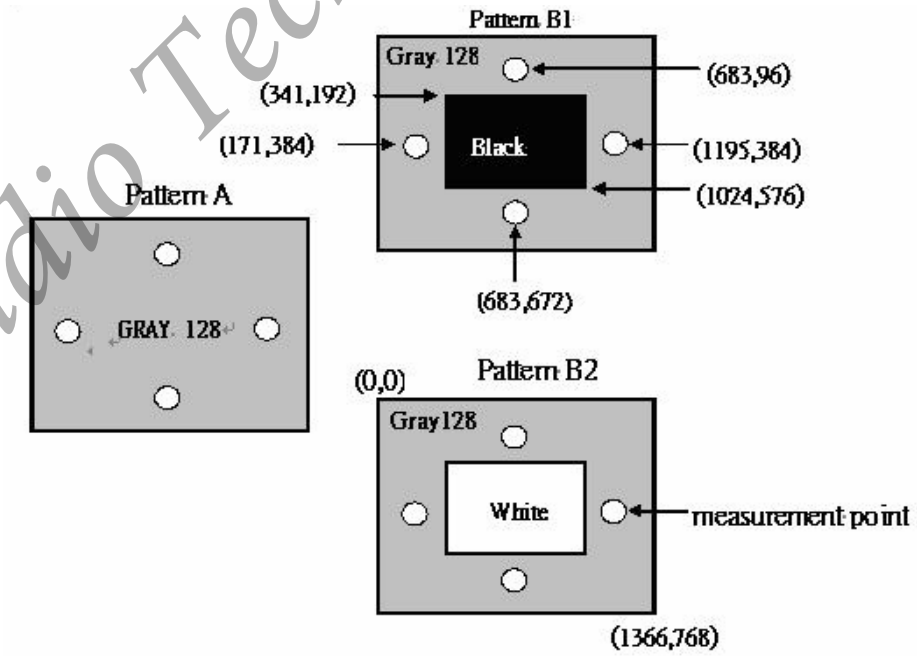
Judgment standard		
Rank	Statement	Judgment
Rank 0	No image sticking.	OK
Rank 1	Image doesn't disappear in 3 seconds.	OK
Rank 2	Image doesn't disappear in 3 seconds, but it looks like Mura Rank 2 as standard sample.	OK
Rank 3	Image doesn't disappear in 3 seconds, and it still looks serious 5 minutes later.	NG

*6) Cross talk Modulation Ratio:

CMR= MAX ((| (LB1-LA)/LA |)×100%, (| (LB2-LA)/LA |)×100%)

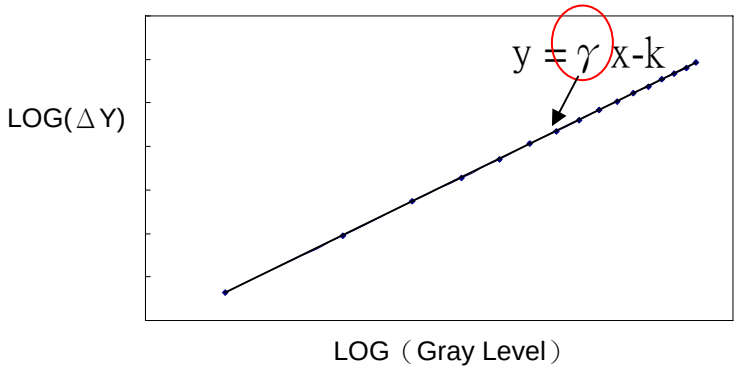
LA：Pattern A (Half-Tone pattern) measurement point luninance

LB1、LB2：Pattern B1、B2 measurement point luninance.



*7) Defination Gamma(VESA)

Based on Customer Sample, take the average value as a standard center value and the variation range of Gamma value caused by loop voltage error should be between +/- 0.2. the bellow figure shows how to obtain the gamma curve and γ (from gray level: 0、16、32-----224、240、255).



10.RELIABILITY TEST CONDITIONS

(1)Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature High Humidity Operation	50℃; 90%RH; 240hrs (No condensation)
High Temperature High Humidity Storage	60℃; 90%RH; 48hrs (No condensation)
Temperature & Pressure Operation	(25℃; 260hpa; 24hrs)
Temperature & Pressure Storage	(-30℃; 260hpa; 12hrs)
High Temperature Operation	50℃; 240hrs
High Temperature Storage	60℃; 240hrs
Low Temperature Operation	0℃; 240hrs
Low Temperature Storage	-20℃; 240hrs
Thermal Shock	Between -20℃(1hr) and 60℃(1hr);100 Cycles

(2) Shock & Vibration

ITEMS	CONDITIONS
Shock (Non-Operation)	Shock level: 1470 m/s^2 (150 G) Waveform: half sinusoidal wave, 2 ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs
Vibration (Non-Operation)	Vibration level: 9.8 m/s^2 (1.0 G) Waveform: sinusoidal wave Frequency range: 5 to 500 Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 5 to 500Hz in each of three mutually perpendicular axis(each x, y, z axis: 1 hour, total 3 hours)
	Vibration level: 11.27m/s^2(1.15G) zero to peak Waveform: random Frequency range: 5 to 200 Hz Duration: one sweep from 5 to 200Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour) It is testing with package.

(3)ESD test

Test Item	Test statements
Connector	200 pF, 0 Ω, ±250 V By using contact-mode to discharge each pin one time (every 1sec) and then check the module frame.
Module	1. Test statements:150 pF, 330 Ω, ±15kV Under non-operation testing conditions, by using air-mode to discharge each test point 25 times (discharge time space:1s) continueously and then check the module frame. 2. Test statements:150pF, 330Ω, ±2KV Under operation testing conditions, by using contact mode to discharge the front bezel and using air mode to discharge the points of panel.

(4) Judgment standard

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect.
Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

11.HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling- TFT-LCD products.

11.1 ASSEMBLY PRECAUTION

(1) Please use the mounting hole on the module side in installing and do not beading or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.

(2) Please design display housing in accordance with the following guidelines.

- Housing case must be destined carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
- Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0 mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
- When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.
- Design the inverter location and connector position carefully so as not to give stress to lamp cable, or not to interface the LCD module by the lamp cable.
- Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.

(3) Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)

(4) Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.

(5) Please wipe out LCD panel surface with absorbent cotton or soft clothe in case of it being soiled.

(6) Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.

(7) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

(8) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.

(9) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

11.2 OPERATING PRECAUTIONS

(1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.

(2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.

(3) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.

(4) A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.

(5) Please pay attention to displaying the same pattern for very long time. Image might stick on LCD. If then, time going on can make LCD work well.

(6) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

11.3 PRECAUTIONS WITH ELECTROSTATICS

(1) This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.

(2) Please remove protection film very slowly on the surface of LCD module to prevent from electrostatics occurrence.

11.4 STORAGE PRECAUTIONS

(1) When you store LCDs for a long time, it is recommended to keep the temperature between 0℃ ~40℃ without the exposure of sunlight and to keep the humidity less than 90%RH.

(2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60℃ 90%RH.

(3) Please do not leave the LCDs in the environment of low temperature; below -20℃.

11.5 SAFETY PRECAUTIONS

(1) When you waste LCDs, it is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged-glass cell and comes in contact with the hands, wash off throughly with soap and water.

11.6 OTHERS

(1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight Land strong UV rays.

(2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.

(3) For the packaging box, please pay attention to the followings:

- Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
- Please do not pile them up more than 3 boxes. (They are not designed so.) And please do not turn over.
- Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
- Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)

11. PACKING FORM

- Package quantity in one carton: 10 pieces.
- Carton size:485(L)×365(W)×365(H) (unit：mm)
- For domestic transportation only.

12. SAFETY

We will try our best comply the directive 2002/95/EC of the European, and that we will do our possible not to use or use exceeding the limits of banned substances. We also comply with product-related environmental laws and regulations in manufacturing process and do our best to achieve global environmental protection standards.