Beverly Display Solutions

SPECIFICATION FOR LCD MODULE

Customer : _____

Product Model: BD050GTT02

Sample code: _____

Designed by	Checked by	Approved by

Final Approval by Customer

☐ LCM Machinery OK **Checked By** _____ ☐ LCM Display OK **Checked By** _____	☐ LCM OK ☐ NG，Problem survey: **Approved By** _____

※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

Revision History

Version	Contents	Date	Note
A	Original	2011.03.25	

Contents

2 Scope

This specification applies to the TFT LCD module

3 Normative Reference

GB/T4619-1996 《 Liquid Crystal Display Test Method》

GB/T2424 《Basic environmental Testing Procedures for Electric and Electronic Products.》

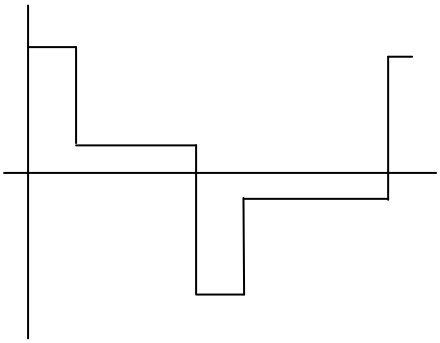
GB/T2423 《Basic Testing Procedures for Electric and Electronic Products》

IEC61747-1 《SIXTH PARTGB2828`2829-87《National Standard of PRC》

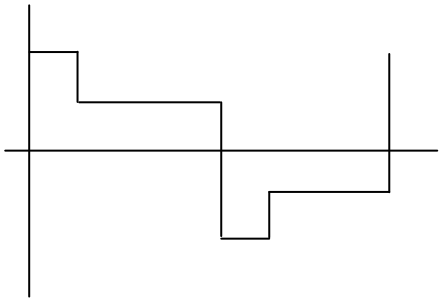
4 Definitions

4.1 Definitions of Vop

The definitions of threshold voltage Vth1, Vth2 the following typical waveforms are applied on liquid crystal by the method of equalized voltage for each duty and bias.



【 selected waveform 】



【 non-selected waveform 】

① Vth1: The voltage which the brightness of segment indicates 50% of saturated value on the conditions of selected waveform

(f_f=80Hz, Φ=10° θ=270° at 25℃)

② Vth2: The voltage which the brightness of segment indicates 50% of saturated value on the conditions of non-selected waveform

(f_f=80Hz, Φ=10° θ=270° at 25℃)

③ Vop: (Vth1(50%)+Vth2(50%))/2 (f_f=80Hz, Φ=10° θ=270° at 25℃)

4.2 Definition of Response Time Tr, Td

①Tr: The time required which the brightness of segment becomes 10% from 100% when waveform is switched to selected one from non-selected one. (f_f=80Hz, Φ=10°θ=270°at 25 ℃)

②Td: The time required which the brightness of segment becomes 90% from 10% when waveform is switched to selected one from selected one. (f_f=80Hz, Φ=10°θ=270°at 25 ℃)

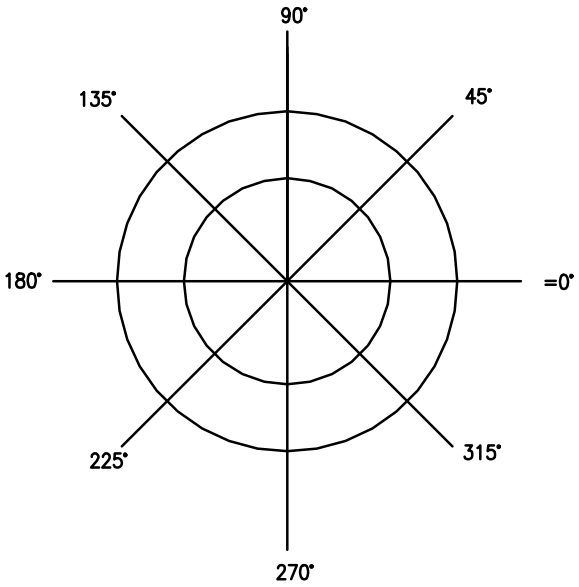
4.3 Definition of Contrast Ratio Cr

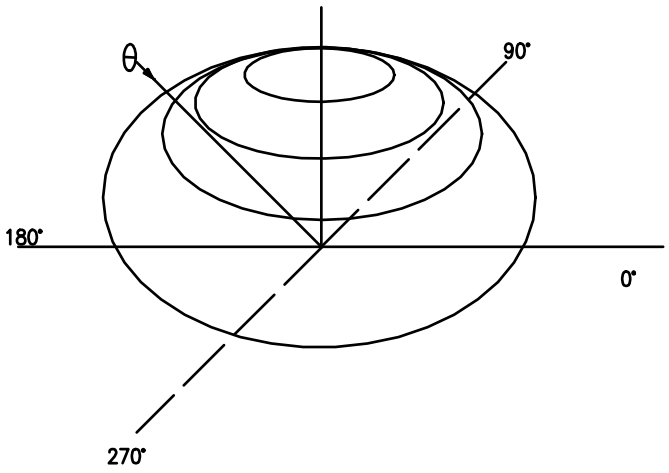
Cr=A/B

① A: Segments brightness in case of non-selected waveform

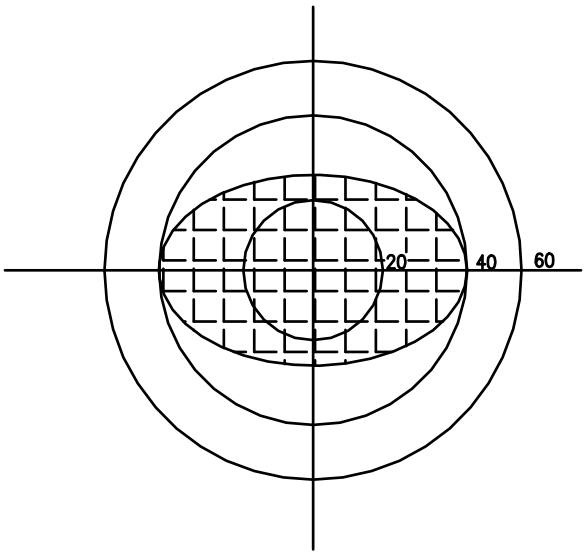
② B: Segments brightness in case of selected waveform

4.4 Definition of Angle and Viewing Range





Angular Graph: Constrast Ratio



Such as:
Viewing Angle Range:
80(Cr>2) Horizontal
70(Cr>2) Vertical

5 Technology Specifications

5.1 Feature

This single-display module is suitable for use in Multidedia Player products. The LCD adopts one backlight with High brightness 12-lamps white LED.

1) Construction: 5.0″ a-Si color TFT-LCD ,White LED backlight.
2) LCD:
   - 2.1 Amorphous-TFT 5.0-inch display, transmissive, normally white type.
   - 2.2 800(RGB)×480 dots Matrix.
   - 2.3 Narrow-contact ledge technique.
   - 2.4 LCD Driver IC: HX8264D × 1 and HX8664D × 1.
3) Low cross talk by frame rate modulation.
4) RGB interface.
5) Video signal interface: Parallel RGB or serial.

5.2 Mechanical Specifications

Item	Specifications	Unit
Dimensional outline	120.70(W) ×75.8(H)×4.3 Max(T)	mm
Active area	108.0(W) ×64.8 (H)	mm
Pixel size	135(W) ×135(H)	um
Resolution	800(RGB) × 480	pixel
Luminance	170（Typ）	cd/m^2

5.3 Absolute Max. Rating

Item	Symbol	Value			Unit	Remark
		Min	typ	Max		
Logic power supply	DVDD	3.0	3.3	3.6	V	
Driver power supply	AVDD	11	12	13	V	
Input high voltage	V_{IH}	0.7DVDD	-	DVDD	V	
Input low voltage	V_{IL}	0	-	0.3DVDD	V	
Operating temperature	T_{OPR}	-20		+70	℃	
Storage temperature	T_{STG}	-30		+80	℃	

5.4 Electrical Characteristics (VSS=0V,Ta=-20 to 70℃)

Parameter	Symbol	Applicable pin	Condition	Spec.			Unit
				Min.	Typ.	Max.	
Input H voltage	V_{IH}	All input pins(2)	-	0.7VDD	-	VDD	V
Input L voltage	V_{IL}	All input pins(2)	-	VSS	-	0.3VDD	
Input H voltage	V_{IH}	/XAO		0.8VDD	-	VDD	
Input L voltage	V_{IL}	/XAO		VSS	-	0.2VDD	
Output H voltage	V_{OH}	STV1,2	I_{OH}=40μA	VDD-0.4	-	VDD	
Output L voltage	V_{OL}	STV1,2	I_{OL}=40μA	VSS	-	VSS+0.4	
Output H resistance	R_{OH}	OUT0~ OUT961	V_{OUT}= VGH-0.5V	-	-	1000	Ω
Output L resistance	R_{OL}	OUT0~ OUT961	V_{OUT}= VEE+0.5V	-	-	1000	Ω
Input leakage current	I_{IN}	Note(2)	-	-5.0	-	+5.0	μA
Pull high resistance	R_{PU}	/XAO,MODE, SEL	VDD=3.3V, TA=25C	70	160	400	kΩ
VGH Power consumption	I_{VGH}	-	Note(1)	-	-	200	μA
VDD Power consumption	I_{VDD}	-		-	-	200	

Note: (1) Power consumption in the following condition:
Output no load, VGH=20V, VEE=-8V, VDD=3.0V, V_{IH}=VDD, V_{IL}=VSS, F_{CPV}=50KHz, OE=V_{IL}, /XAO=V_{IH}.
(2)All input pins except /XAO, MODE, SEL

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
CPV period	t_{CPV}	-	5	-	-	μs
CPV pulse width	t_{CPVH}, t_{CPVL}	50% duty cycle	2.5	-	-	
OE pulse width	t_{WOE}	-	1	-	-	
/XAO pulse width	t_{WXAO}	-	30	-	-	
Data setup time	t_{SU}	-	0.3	-	-	
Data hold time	t_{HD}	-	0.3	-	-	
CPV to output delay time	t_{PD1}	CL=200pF	-	-	0.9	
Start pulse output delay time	t_{PD2}	Loading=20pF	-	-	0.5	
OE to output delay time	t_{PD3}	CL=200pF	-	-	0.9	
/XAO to output delay time	t_{PD4}	CL=200pF	-	-	50	

Note: The measurement point for all of above signals is at 50% of input/output amplitude under Typical condition.

5.5 Optical specifications

Ta=25℃

Item		Symbol	Condition	Min	Typ.	Max	Unit	Remark
View Angle		θT	CR≧10	40	50	-	Degree	Note 2
		θB		60	70	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	θ=0°	400	500	-	-	Note1
Response Time		T_{ON}	25℃	-	20	25	ms	Note1 Note4
		T_{OFF}						
Color Filter Chromaticity	White	x	C-light	0.260	0.310	0.360	-	Just CF, without polarizer
		y		0.280	0.330	0.380		
	Red	x		0.540	0.590	0.640		
		y		0.300	0.350	0.400		
	Green	x		0.298	0.348	0.398		
		y		0.520	0.570	0.620		
	Blue	x		0.095	0.145	0.195		
		y		0.060	0.110	0.160		
NTSC		-	-	45	50	-	%	Note 5
Transmittance		L	-	3.8	4.1	-	%	Note1

Test Conditions:

1. The ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.
3. Viewing angle, contrast ratio and transmittance are test the panel include EWV polarizer (NWF-LNSW) with LED backlight.
4. The value of transmittance in this spec is a reference which will be affected by polarizer finally.

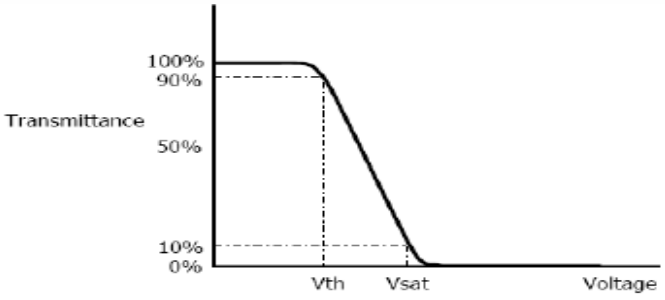
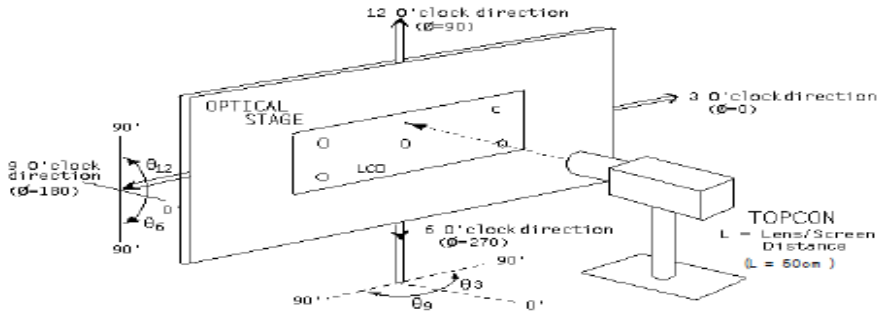


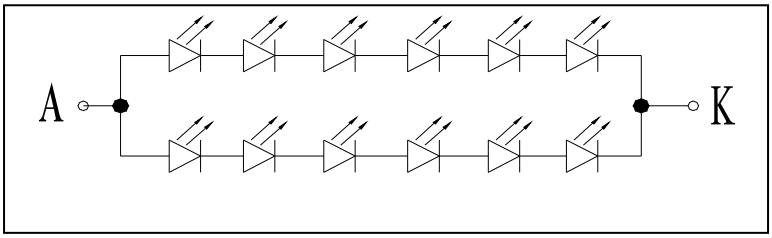
Figure 2. Measurement Set Up



5.6 LED back light specification (12 White Chips)

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	Vf	If=40mA	18	19.2	20.4	V
Uniformity (with L/G)	ΔB_p	If=40mA	80	-	-	%
Luminance	L_V	If=40mA	-	4500	-	cd/m^2

LED CIRCUIT

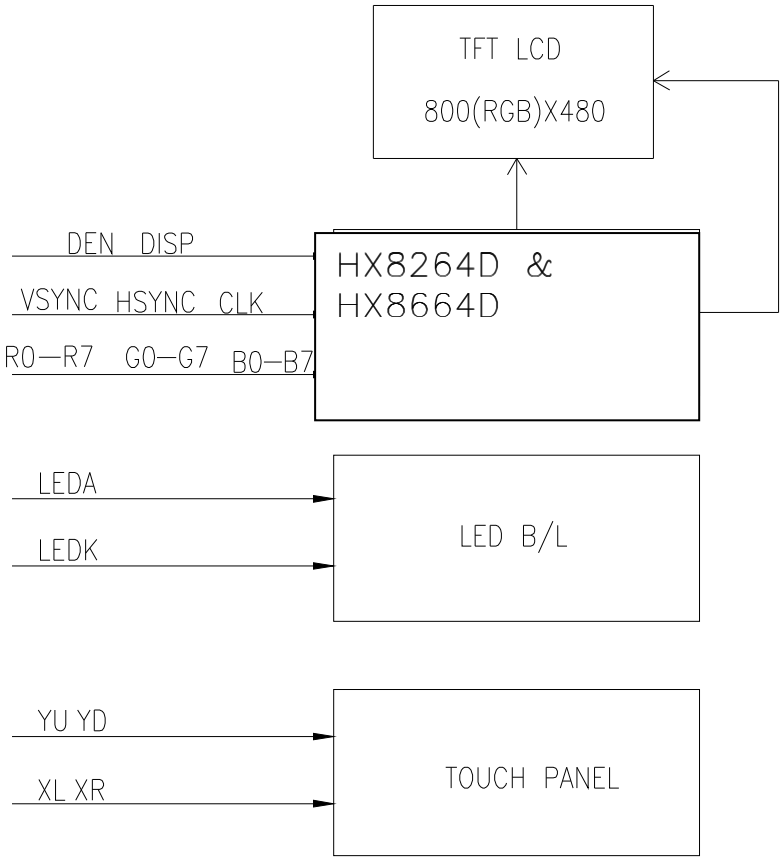


5.7 Interface Pin Connections

PIN NO.	Symbol	Description
1	LED-K	LED backlight(Cathode)
2	LED-A	LED backlight(anode)
3	GND	Ground
4	VDD	Power supply (Digital +3.0V)
5-12	R0-R7	Red Data
13-20	G0-G7	Green Data
21-28	B0-B7	Blue Data
29	GND	Ground
30	CLK	Clodk（**Latch data at clk falling edge**）
31	DISP	Display on/off
32	HSYNC	Horizontal sync input in RGB mode (short to GND if not used)
33	VSYNC	Vertical sync input in RGB mode (short to GND if not used)
34	DEN	Data Enable
35	NC	NC
36	GND	Ground
37	XR	T/p X-Right
38	YD	T/p Y-Bottom
39	XL	T/p X-Left
40	YU	T/p Y-Up

6 Signal timing diagram and Circuit block diagram

6.1 Circuit block diagram



6.2 Signal Timing Diagram

6.2.1 Power ON/OFF Sequence

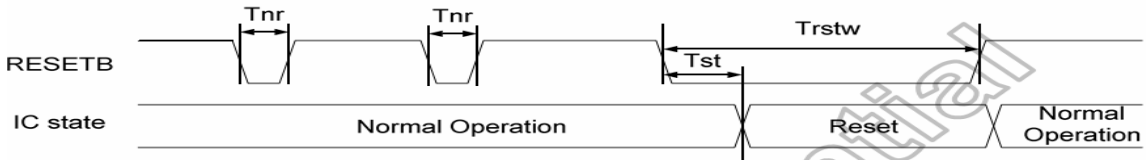
HX8264-D02 has a power on/off sequence control function. In order to prevent IC from power on reset fail, the rising time (T_{POR}) of the digital power supply VDD should be maintained within the given specifications. Please refer to "AC Characteristics" for more detail on timing.

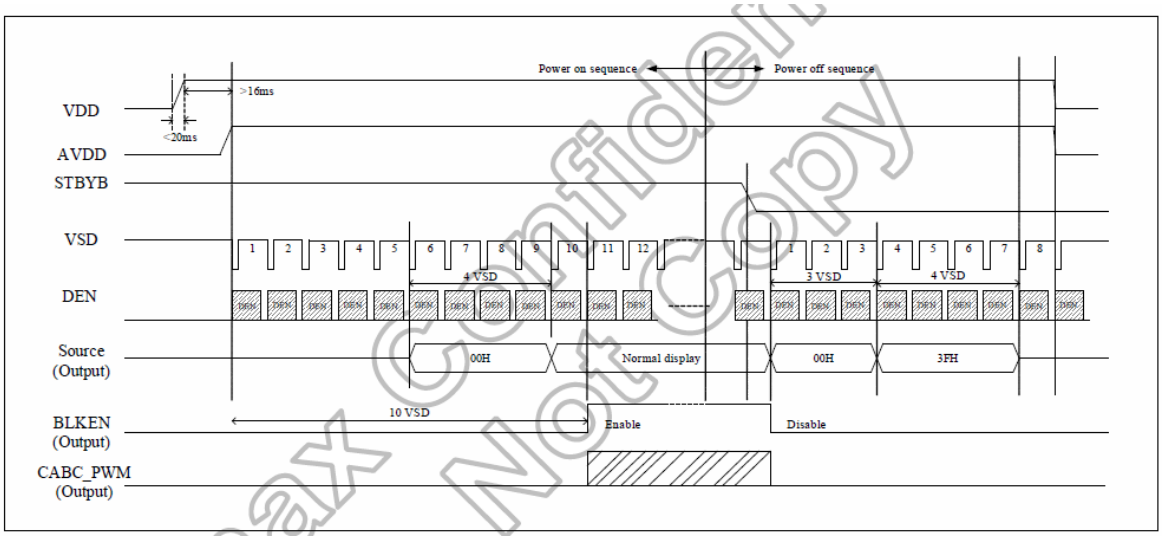
6.2.2 Reset timing

The reset input must be held for at least 1ms after power is stable.

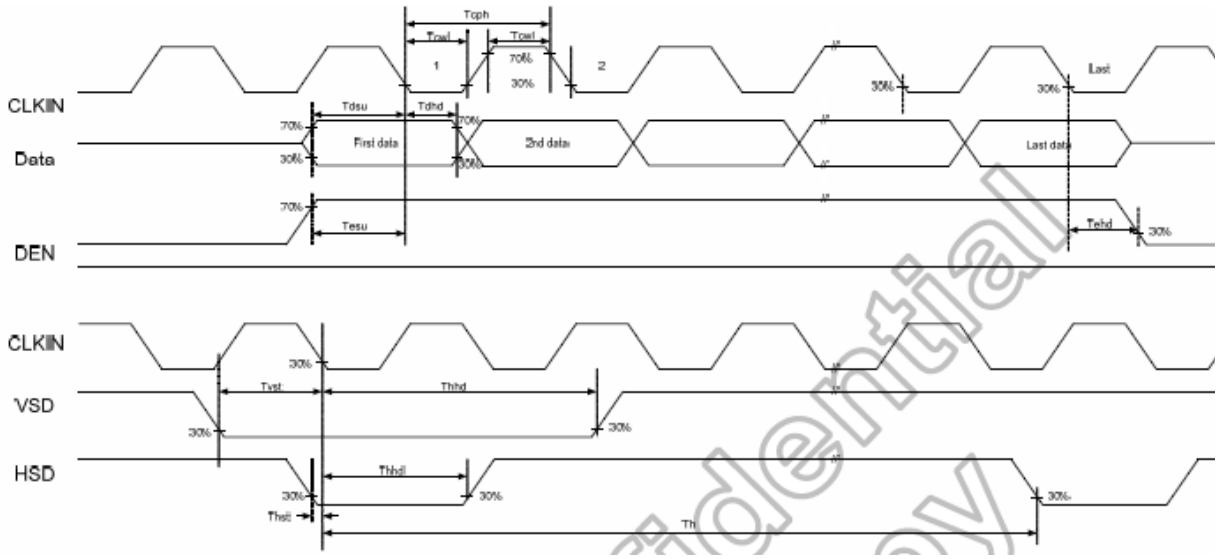
Hardware reset timing

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
RESETB low pulse width	T_{rstw}	10	-	-	μs
Negative noise pulse width	T_{nr}		-	2	μs
Reset start time	T_{st}	2	-		μs

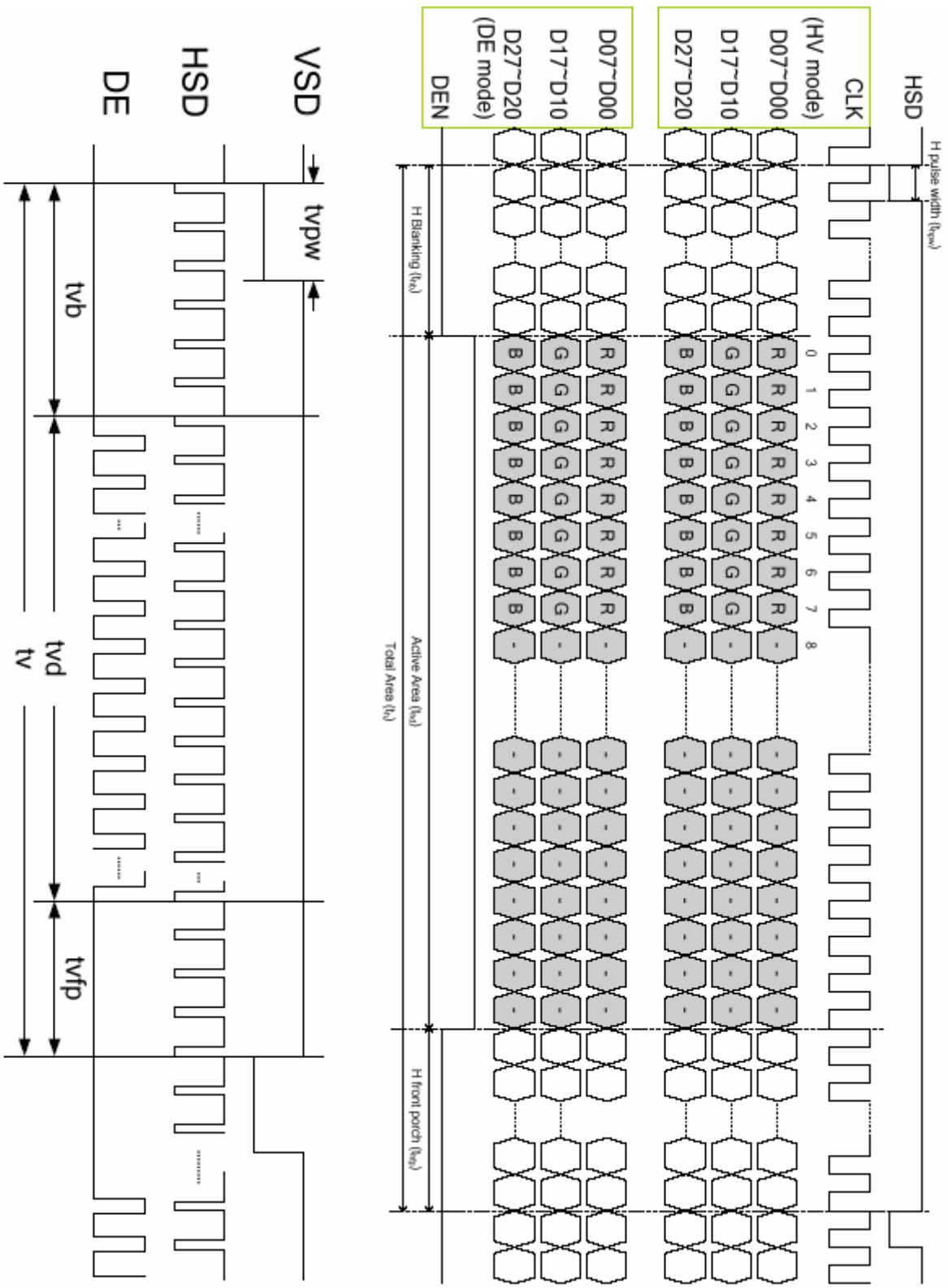




6.2.3 Timing Diagram of interface Signal



Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
HS setup time	T_{hst}	8	-	-	ns
HS hold time	T_{hhd}	8	-	-	ns
VS setup time	T_{vst}	8	-	-	ns
VS hold time	T_{vhd}	8	-	-	ns
Data setup time	T_{dsu}	8	-	-	ns
Data hold time	T_{dhd}	8	-	-	ns
DE setup time	T_{esu}	8	-	-	ns
DE hold time	T_{ehd}	8	-	-	ns
VDD Power On Slew rate	T_{POR}	-	-	20	ms
RSTB pulse width	T_{Rst}	10	-	-	us
CLKIN cycle time	T_{cph}	20	-	-	ns
CLKIN pulse duty	T_{cwh}	40	50	60	%
Output stable time	T_{sst}	-	-	6	us


VSD
HSD
DE
tvpw
tvb
tvd
tv
tvfp
HSD
CLK
(HV mode)
D07~D00
D17~D10
D27~D20
DEN
D07~D00
D17~D10
D27~D20
(DE mode)
H pulse width (thpw)
H Blanking (thb)
Active Area (thd)
Total Area (th)
H front porch (thfp)

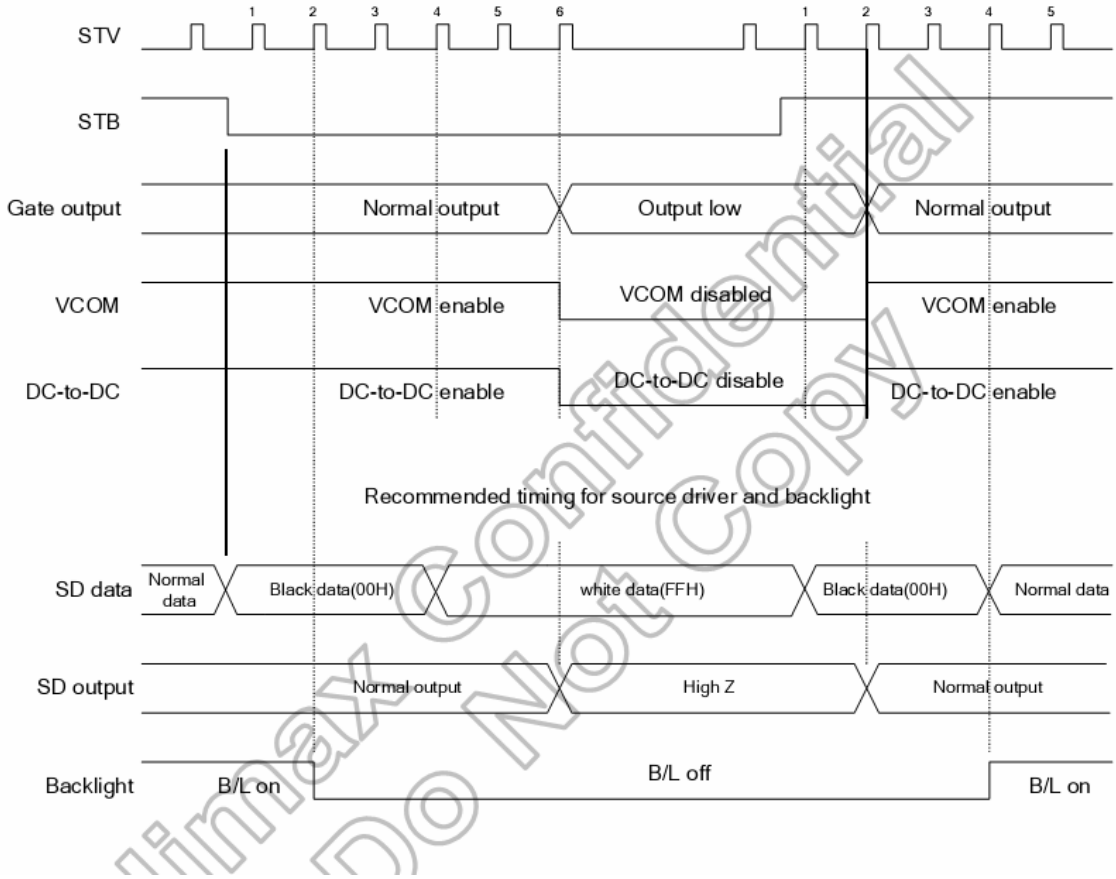
Horizontal timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Horizontal Display Area	thd		800		DCLK
DCLK frequency	fclk	-	30	50	MHz
One Horizontal Line	th	889	928	1143	DCLK
HS pulse width	thpw	1	48	255	DCLK
HS Back Porch (Blanking)	thb		88		DCLK
HS Front Porch	thfp	1	40	255	DCLK
DE mode Blanking	th-thd	85	128	512	DCLK

Vertical timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd		480		T_H
VS period time	tv	513	525	767	T_H
VS pulse width	tvpw	3	3	255	T_H
VS Back Porch (Blanking)	tvb		32		T_H
VS Front Porch	tvfp	1	13	255	T_H
DE mode Blanking	tv-tvd	4	45	255	T_H

6.2.4 Gate Driver Timing Control

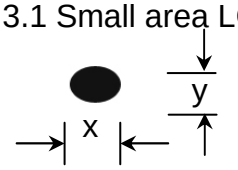


7 Reliability Test Conditions And Methods

NO	Item	Condition	Method
1	High / Low Temperature Storage	80℃/-30℃ 120hrs	Check and record every 48Hrs
2	High / Low Temperature Life	70℃/-20℃ 120hrs (operating mode)	Check and record every 48Hrs
3	High Temperature、High Humidity Operating	60℃,90% RH, 96Hrs	Check and record every 48hrs
4	Thermal Shock	-30℃(30Min) ⟶ 25℃(5Min) ⟶ 80℃(30Min) (conversion time, : 5 sec) 20 cycles	Each 10 cycles end , check

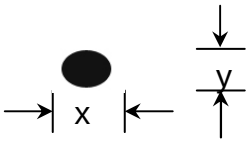
5	Vibration	10Hz~55Hz~10Hz Amplitude: 1.5mm 2hrs for each direction(X,Y,Z)	Each direction end, Check the Appearance and Electrical Characteristics
6	Static Electricity	Gap mood: ±1KV~±8KV (10 times air discharge with positive/negative voltage voltage gap : 1kv) Touch mood: ±1KV~±4KV	Each discharge end, Check the Electrical Characteristics
7	Curve	60 Thousand times, 40 times/min 150°（according to die if exist)	Check and record every 2~4 thousand times
8	Slump	Free faller movement for each side、cording、angle (75cm High、6 sides、2 angle、2 cording)	End

8 Inspection standard

<table>
<tr><th>No</th><th>Item</th><th>Criterion</th><th></th></tr>
<tr><td>01</td><td>Outline Dimension</td><td>In accord with drawing</td><td></td></tr>
<tr><td>02</td><td>Position-finding Dimension Assemble Dimension</td><td>In accord with drawing</td><td></td></tr>
<tr><td>03</td><td>LCD black spots, white spots (Round type)</td><td>Round type: non display
3.1 Small area LCD
 

Unit : mm
<table>
<tr><th>Dimension</th><th>Qualified Quantity</th></tr>
<tr><td>D≤0.1</td><td>Ignore</td></tr>
<tr><td>0.1＜D≤0.15</td><td>2</td></tr>
<tr><td>D＞0.15</td><td>0</td></tr>
</table></td><td></td></tr>
</table>

3.2Large area LCD



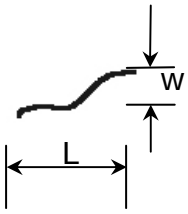
Dimension	Qualified Quantity
D≤0.1	Ignore
0.1＜D≤0.15	2
0.15＜D≤0.20	1
D＞0.20	0

C-STN : if D＞0.1 , unqualified

04 LCD black spots, white spots (Line Style)

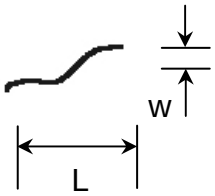
4.1 Small area LCD

Unit : mm



Length	Width	Qualified Quantity
-	≤0.015	Ignore
≤1.0	0.015＜W≤0.025	2
≤2.0		1
≤1.0	0.025＜W≤0.05	1
-	D＞0.05	According to circle

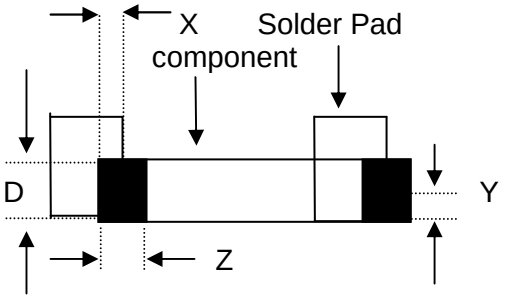
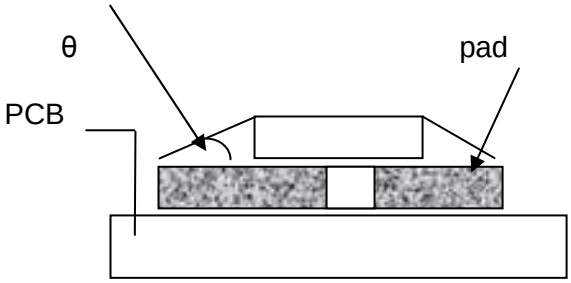
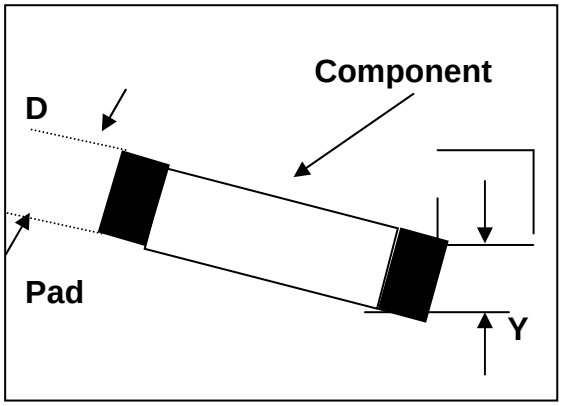
4.2Large area LCD

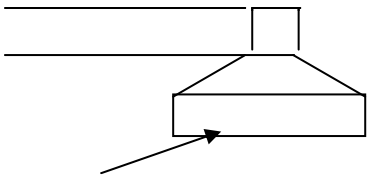


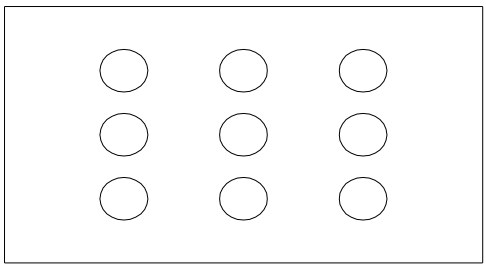
Length	Width	Qualified Quantity
-	≤0.015	Ignore
≤2.0	0.015＜W≤0.025	2
≤1.0	0.025＜W≤0.05	1
-	D＞0.05	According to circle

CSTN : If W ≥ 0.015 , unqualified
Ignore beyond viewing area

05	LCD Scratch 、Threadlike Fiber	Same to NO.3 circle sightline and surface of LCD is vertical (2)Same to NO.3 line style		
06	POL	It is not admissible that POL is beyond the edge of glass, else, unqualified. It is essential that POL is over the 50 percent of width of frame , else ,unqualified. According to the drawing in case of special definition.		
07	IC/FPC Bonding	Scratch	Reject	
		Intensity Of Adhesion	If lower than specification, reject	
		Gold Fold Twist	Reject	
07	IC/FPC Bonding	Silicon	According to outline, no gold outside, seal can not be higher than LCD	
		FPC Gold Sever	Reject	
08	SMT	Lack of Component、Polarity Inverse	If exist, reject	
		Leak Solder、Virtual Solder	If exist, reject	
		Short Circuit In Solder Point	If exist, reject	
		Tin Ball	If exist, reject	
		Tin Acumination	If visual, reject	
		Height Solder Point	If higher 0.5mm than component. reject	

		Height of component	Either side higher 0.5mm than component, reject	
		Component Shift	 X<3/4Z reject y＞1/3D reject	
08	SMT	Few Tin	 If θ≤20° reject	
		Component Deflection	 If Y >1/3D reject	
		Component Carcass Sideways	Reject	

		Component Carcass Sideways	If exist with visual inspection , reject	
		Lot Tin	A: Tin accrete the solder side completely , hollowly ,Ok B: Tin accrete the solder side completely , full circle arc , ok C: Jointing include whole solder side, height of tin>50 percent of height of component, reject	
		Few Tin	A: Tin accrete the solder side completely , hollowly ,Ok B: height of tin > 1/3 of solder side of component , ok C: height of tin ≤ 1/3 of solder side of component, reject	
08	SMT	Normal  Jointing side		
09	Light	Short circuit 、 Open circuit	Forbid	
		Quality of CSTN Display	1、Rolling strake with visual inspection, forbid 2、Differentness of color in viewing area with visual inspection (full white、red、green、blue), forbid 3 、 Display change with visual inspection , forbid	

<table>
<tr><td>10</td><td>Color Of CIE Coordinate</td><td><table><tr><td></td><td>x</td><td>y</td></tr><tr><td>white</td><td>±0.05</td><td>±0.05</td></tr><tr><td>Red</td><td>±0.05</td><td>±0.05</td></tr><tr><td>Green</td><td>±0.05</td><td>±0.05</td></tr><tr><td>Blue</td><td>±0.05</td><td>±0.05</td></tr></table>According to the specification or sample customer have approved</td><td colspan="2">Drive LCD under normal condition, 25℃ Φ=0 Θ=0
Test white、red、green blue with DMS Record</td><td></td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">Brightness</td><td rowspan="2">In accord with product specification</td><td>Drive condition is according to specification
Measure location is in Follow Picture 3、Adjust brightness instrument tozero , burrow against the surface of LCD , press “measure” , record when the display is steady.
(YOKOGAWA-3298)</td><td></td></tr>
<tr><td> 
Measure location</td><td></td></tr>
<tr><td>12</td><td>CR (Max)</td><td>According to specification</td><td colspan="2">According to product specification
Measure instrument (DMS-501)</td></tr>
<tr><td>13</td><td>Response time</td><td>According to specification</td><td colspan="2">According to product specification
Measure instrument (DMS-501)</td></tr>
<tr><td>14</td><td>Viewing angle</td><td>According to specification</td><td colspan="2">According to product specification
Measure instrument (DMS-501)</td></tr>
<tr><td>15</td><td>Vibration、Ring</td><td>Compare with the sample customer supply</td><td colspan="2">Compare with the sample customer supply when assemble</td></tr>
<tr><td>16</td><td>Frequency Of FPC Bend</td><td>According to the use of product (main FPC of foldaway cell phone ≥6 thousand)</td><td colspan="2">Measure instrument
Bend angle : 150°
Fix FPC in the casement when customer supply</td></tr>
</table>

9 Handling Precautions

9.1 Mounting method

The LCD panel of Daxian LCD module consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

9.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Salfur (S)

If goods were sent without being sili8con coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (CI), Salfur (S) from customer, Responsibility is on customer.

9.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

9.4 packing

- Module employ LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

9.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally

displayed but it resumes normal condition after turning off once.

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
  Usage under the maximum operating temperature, 50%Rh or less is required.

9.6 storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.
  [It is recommended to store them as they have been contained in the inner container at the time of delivery from us

9.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

10 Precaution for use

10.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

10.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to Daxian , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

11 Dimensional Outline