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SPECIFICATION

CUSTOMER : _____

MODULE NO.: **WF43ETLAEDNTO#**

APPROVED BY: (FOR CUSTOMER USE ONLY)		
	PCB VERSION:	DATA:

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

VERSION	DATE	REVISED PAGE NO.	SUMMARY
0	2012.06.27		First issue



DOC. FIRST ISSUE

SUMMARY

REVISED
PAGE NO.

First issue

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1.Module Classification Information

<u>W</u>	<u>F</u>	<u>43</u>	<u>E</u>	<u>T</u>	<u>L</u>	<u>A</u>	<u>E</u>	<u>D</u>	<u>N</u>	<u>T</u>	<u>0</u>	#
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬

- ① Brand : WINSTAR DISPLAY CORPORATION
- ② Display Type : H→Character Type, G→Graphic Type F→TFT Type
- ③ Display Size : 4.3" TFT
- ④ Model serials no.
- ⑤ Backlight Type : F→CCFL, White T→LED, White
- ⑥ LCD Polarize I→Transmissive, W. T, 6:00
Type/ Temperature L→Transmissive, W.T,12:00
range/ Gray Scale
Inversion Direction
- ⑦ A : TFT LCD G: TFT+FR
B : TFT+FR+CONTROL BOARD H: TFT+D/V BOARD
C : TFT+FR+A/D BOARD I: TFT+FR+D/V BOARD
D : TFT+FR+A/D BOARD+CONTROL BOARD
E: TFT+FR+POWER BOARD
F: TFT+CONTROL BOARD
- ⑧ Solution: A: 128160 B:320234 C:320240 D:480234 E : 480272 Dots
- ⑨ D: Digital L : LVDS
- ⑩ Interface : N : without control board A : 8Bit B : 16Bit
- ⑪ TS : N : Without TS T : resistive touch panel C : capacitive touch panel
- ⑫ Version
- ⑬ Special Code #:Fit in with ROHS directive regulations

2. General Specifications

Feature		Spec
Display Spec.	Size	4.3 inch
	Resolution	480(RGB) x 272
	Interface	RGB 24 bits
	Color Depth	16.7M
	Technology Type	a-Si
	Pixel Pitch (mm)	0.198x0.198
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Anti-Glare(3H)
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
	LCM (W x H x D) (mm)	105.50x67.20x4.0
Mechanical Characteristics	Active Area(mm)	95.04x53.86
	With /Without TSP	With TSP
	Weight (g)	58
	LED Numbers	10 LEDs

Note 1: Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.

Note 2: Requirements on Environmental Protection: Q/S0002

Note 3: LCM weight tolerance: $\pm 5\%$

3. Input/Output Terminals

No	Symbol	I/O	Description	Remark
1	VLED-	P	Back light cathode	
2	VLED+	P	Back light anode	
3	GND	P	Ground	
4	VDD	P	Power supply	
5	R0	I	Data input	
6	R1	I	Data input	
7	R2	I	Data input	
8	R3	I	Data input	
9	R4	I	Data input	
10	R5	I	Data input	
11	R6	I	Data input	
12	R7	I	Data input	
13	G0	I	Data input	
14	G1	I	Data input	
15	G2	I	Data input	
16	G3	I	Data input	
17	G4	I	Data input	
18	G5	I	Data input	
19	G6	I	Data input	
20	G7	I	Data input	
21	B0	I	Data input	
22	B1	I	Data input	
23	B2	I	Data input	
24	B3	I	Data input	
25	B4	I	Data input	
26	B5	I	Data input	
27	B6	I	Data input	
28	B7	I	Data input	
29	GND	P	Ground	
30	DCLK	I	Clock for input data. Data latched at rising edge of this signal.	
31	DISP	I	Standby mode. DISP = "1": Normally operation. DISP = "0": Standby mode.	
32	HSYNC	I	Horizontal sync input with negative polarity. If unused, please pull high level.	
33	VSYNC	I	Vertical sync input with negative polarity. If unused, please pull high level.	
34	DE	I	Data input enable. If unused, please pull low level.	
35	NC	--	No connection	
36	GND	P	Ground.	
37	X_R	O	Right electrode – differential analog (X2)	
38	Y_B	O	Bottom electrode – differential analog (Y1)	
39	X_L	O	Left electrode – differential analog (X1)	
40	Y_T	O	Top electrode – differential analog (Y2)	

Note : I--Input , O--Output , P--Power/Ground

Table 3.1 Input Terminal Pin Assignment

4. Absolute Maximum Ratings

4.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

Item	Symbol	Min	Max	Unit	Remark
Supply Voltage	VDD	-0.3	4.0	V	
Back Light Forward Current	I_{LED}		25	mA	For each LED
Operating Temperature	T_{OPR}	-20	70	°C	
Storage Temperature	T_{STG}	-30	80	°C	

Note1: The parameter is for driver IC (gate driver, source driver) only.

Note2: Signals include R0~R5, G0~G5, B0~B5, DCLK, DISP, HSYNC, VSYNC, DE

Table 4.1 absolute maximum rating

5. Electrical Characteristics

5.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

Item		Symbol	Min	Typ	Max	Unit	Remark
Supply Voltage		VDD	3.0	3.3	3.6	V	
Input Signal Voltage	Low Level	V_{IL}	0	--	0.3xVDD	V	R0~R5, G0~G5, B0~B5, DCLK, DISP, HSYNC, VSYNC, DE
	High Level	V_{IH}	0.7xVDD	--	VDD	V	
Output Signal Voltage	Low Level	V_{OL}	--	--	0.2xVDD	V	
	High Level	V_{OH}	0.8xVDD	--	VDD	V	
(Panel+LSI) Power Consumption		Black Mode (60Hz)		74.0		mW	
		Standby Mode		50		uW	Note1

Note1: To test the current dissipation, use “all Black Pattern”.

Table 5.1 LCD module electrical characteristics

5.2 Driving Backlight

Item	Symbol	Min	Typ	Max	Unit	Remark
Channel	$I_{channel}$	--	20.0	25.0	mA	Note 1
Forward Voltage	V_{BL}	--	16	--	V	
Backlight Power Consumption	W_{BL}	--	640	--	mW	
Life Time	--	10,000	(20,000)	--	Hrs	Note 3

Note 1: Each LED : IF =20 mA, VF =3.2V.

Note 2: Optical performance should be evaluated at Ta=25°C only.

Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED

will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

Table 5.2 LED backlight characteristics

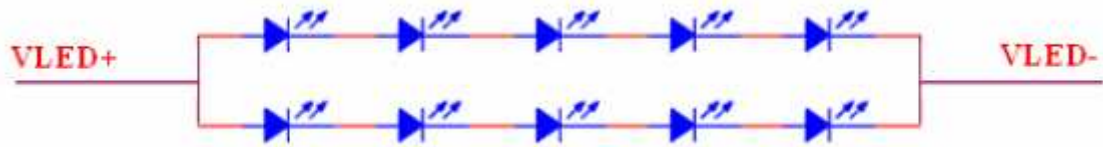


Figure 5.2 LED connection of backlight

5.3 Block Diagram

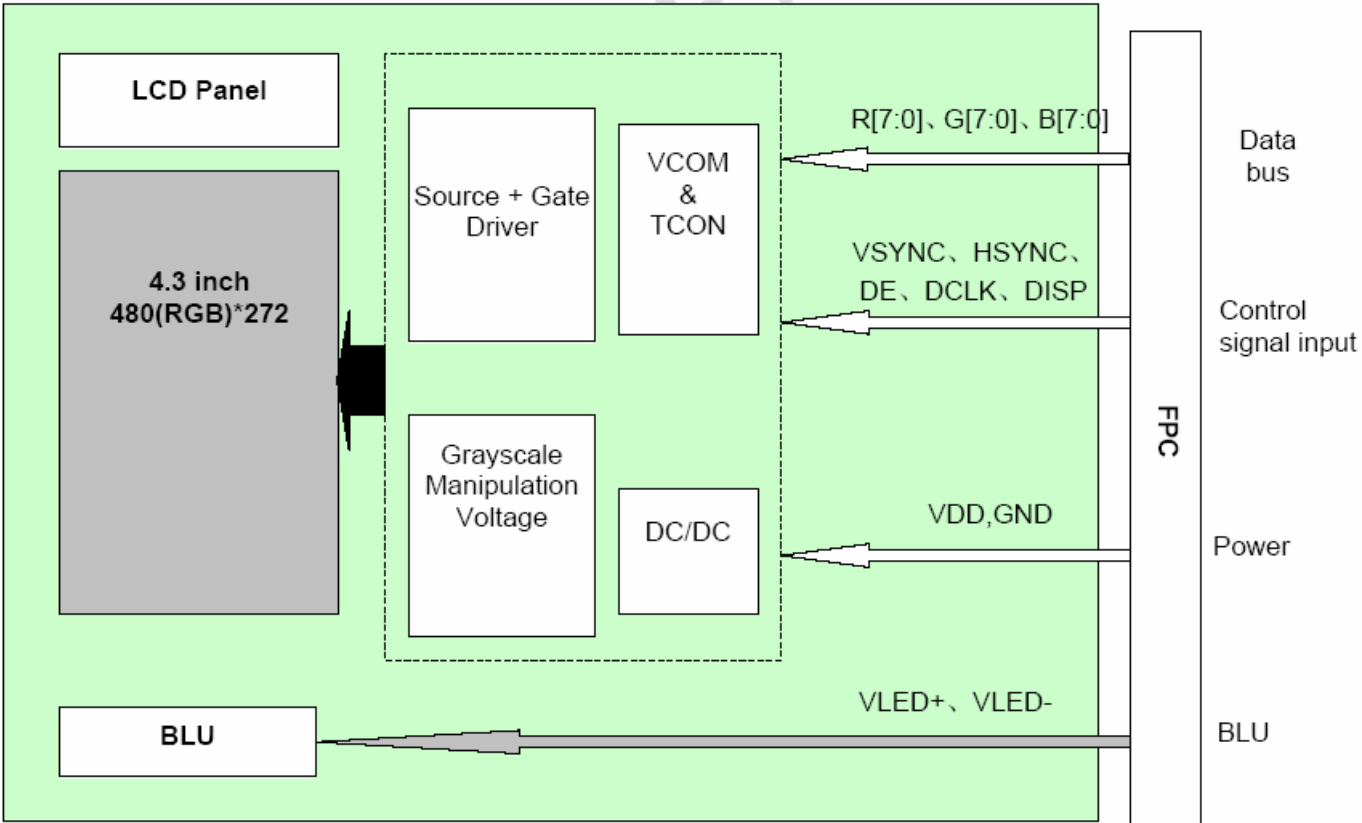


Figure 5.3 LCD Module Diagram

6. Interface timing

6.1 Input Setup Timing Setting

6.1.1 Input Setup Timing Parameter Setting

VDD=3.3V Ta=25°C

Normal Write Mode

Parameter	Symbol	Min	Typ	Max	Unit	Remark
DCLK Cycle Time	T_{pw}	66.7	-	-	ns	
DCLK Pulse High Width	T_{pwh}	26.7	-	-	ns	
DCLK Pulse Low Width	T_{pwl}	26.7	-	-	ns	
DE Setup Time	T_{des}	10	-	-	ns	
DE Hold Time	T_{deh}	10	-	-	ns	
HSYNC Setup Time	T_{hs}	10	-	-	ns	
HSYNC Hold Time	T_{hh}	10	-	-	ns	
VSYNC Setup Time	T_{vhs}	10	-	-	ns	
VSYNC Hold Time	T_{vhh}	10	-	-	ns	
Data Setup Time	T_{ds}	10	-	-	ns	
Data Hold Time	T_{dh}	10	-	-	ns	
DISP Setup Time	T_{diss}	10	-	-	us	
DISP Hold Time	T_{dish}	10	-	-	ms	

Note 1 : $t_r = t_f = 2ns$, t_r , t_f is defined 10% to 90% of signal amplitude.

Note 2 : For parallel interface, maximum clock frequency is 15MHz.

Table 6.1 Input Setup Timing Parameters Requirement

6.1.2 Input Setup Timing Diagram

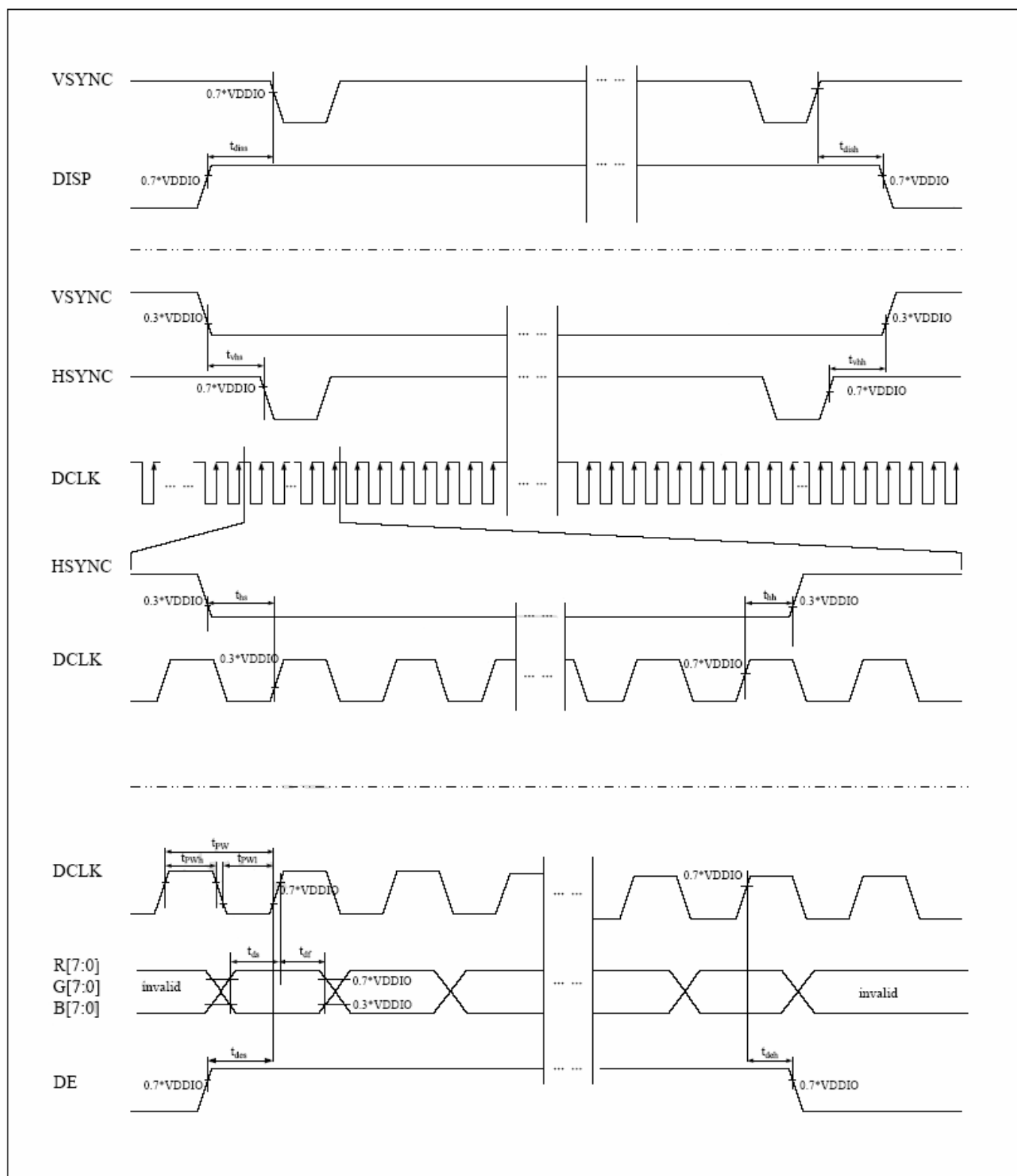


Figure 6.1.2 Input Setup Timing Diagram

6.2 Data Input Format

6.2.1 Data Input Timing Parameter Setting

Parameter	Symbol	Min	Typ	Max	Unit	Remark
DCLK frequency	f_{clk}	--	9	15	MHZ	
HSYNC frequency	$1/t_h$	--	17.14	--	KHz	
VSYNC frequency	$1/t_v$	--	59.94	--	Hz	
Horizontal cycle	t_h	525	525	605	DCLK	
Horizontal display period	t_{hd}	480			DCLK	
Horizontal pulse width	t_{hp}	2	41	41	DCLK	
Horizontal back porch	t_{hb}	2	2	41	DCLK	
Horizontal front porch	t_{hf}	2	2	82	DCLK	
Vertical cycle	t_v	285	286	399	HSYNC	
Vertical display period	t_{vd}	272			HSYNC	
Vertical pulse width	t_{vp}	1	10	11	HSYNC	
Vertical back porch	t_{vb}	1	2	11	HSYNC	
Vertical front porch	t_{vf}	1	2	227	HSYNC	

Note 1: Unit: CLK=1/ f_{CLK} , H= t_h ,

Note 2: It is necessary to keep $t_{vp}+t_{vb}=12$ and $t_{hp}+t_{hb}= 43$ in sync mode. DE mode is unnecessary to keep it.

Table 6.2.2 Data Input Timing Parameters Requirement

6.2.2 Data Input Timing Diagram

6.2.2.1 Data Input Timing Diagram under SYNC Mode

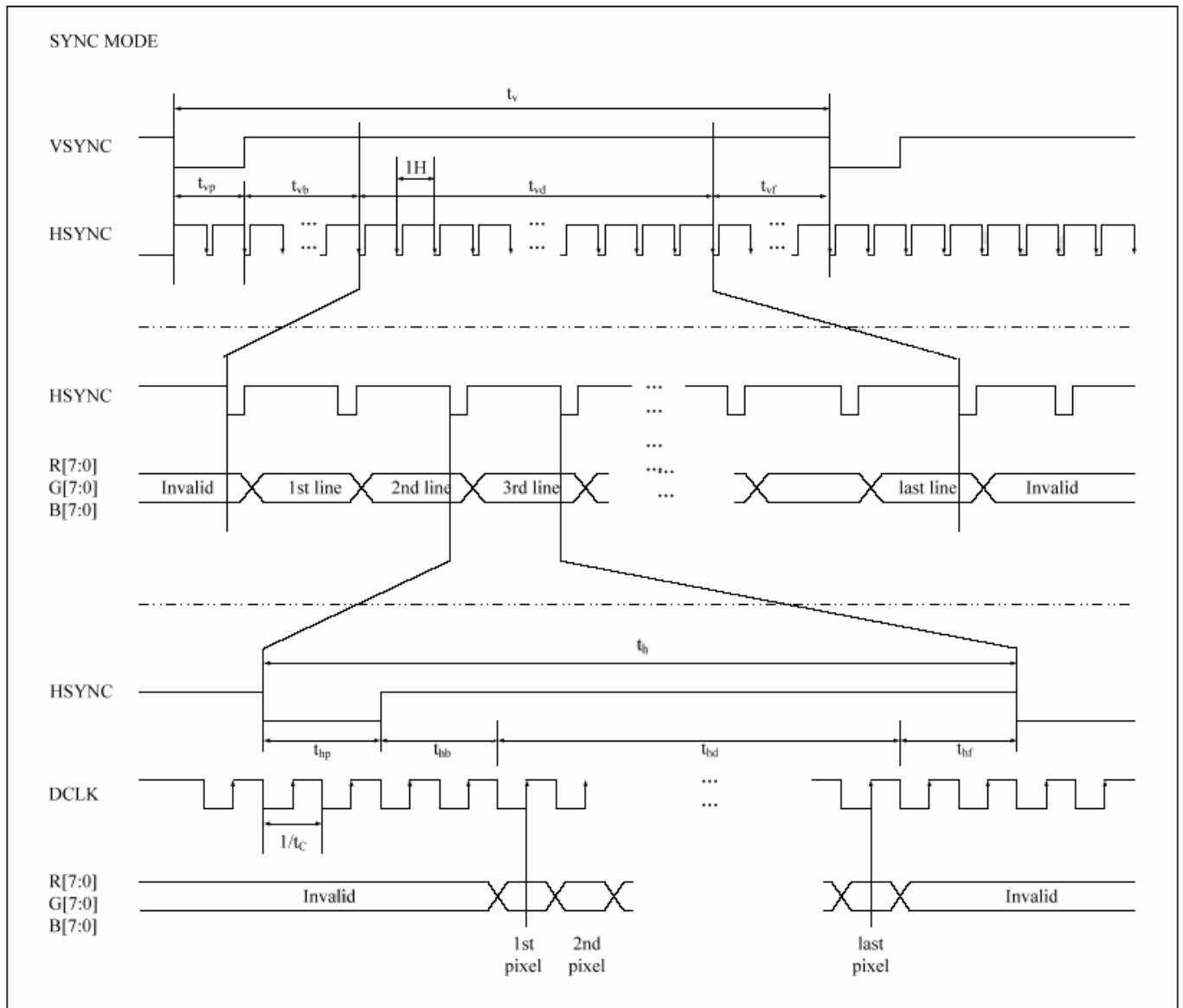


Figure 6.2.1 Data Input Timing Diagram Under SYNC Mode(DE="L")

6.2.2.2 Data Input Timing Diagram under DE Mode

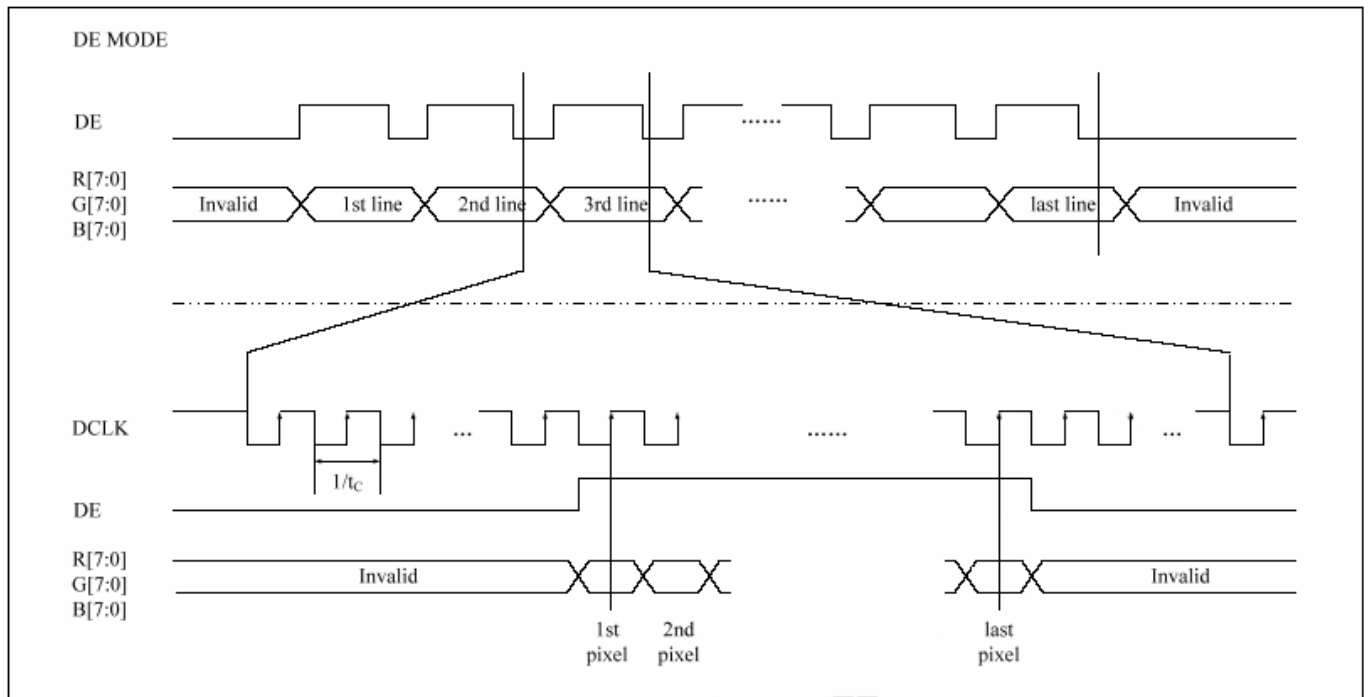


Figure 6.2.2 Data Input Timing Diagram Under DE Mode(VSYNC/HSYNC="H")

6.3 Power ON/OFF Sequence

6.3.1 Power ON Sequence

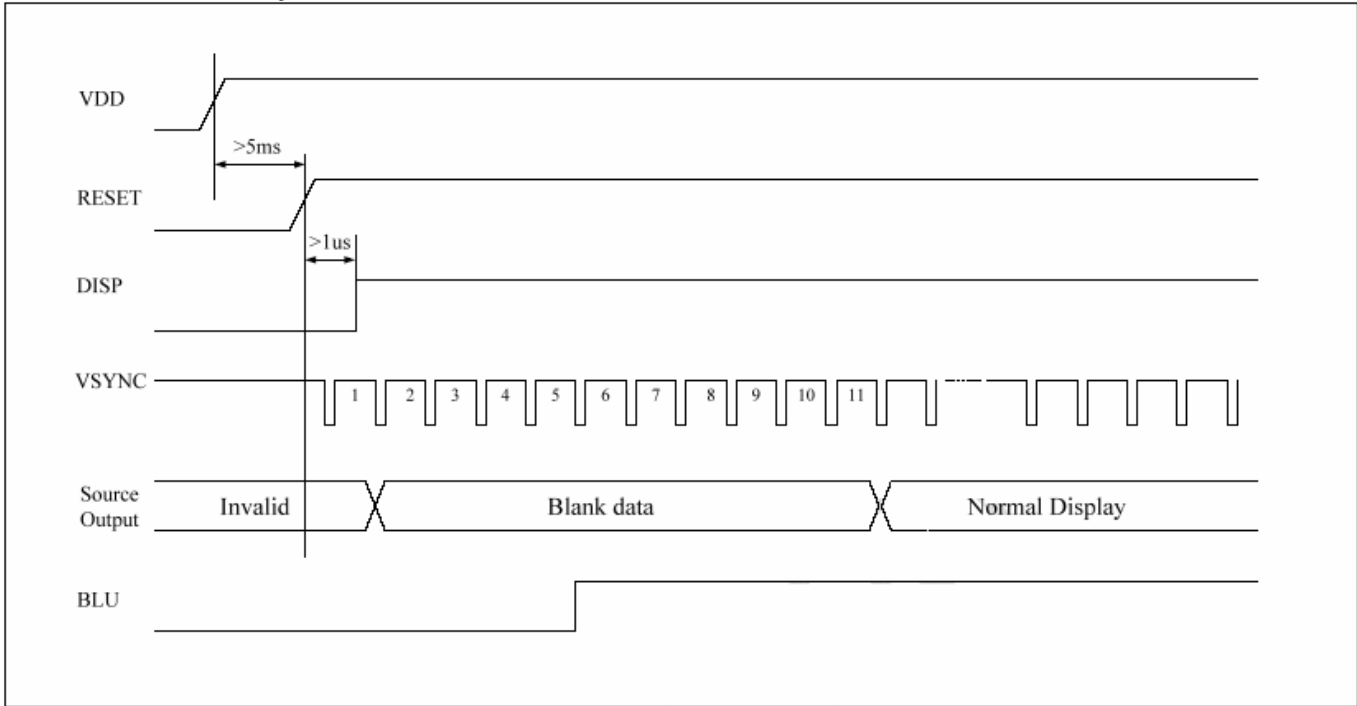


Figure 6.3.1 Power on sequence

6.3.2 Power OFF Sequence

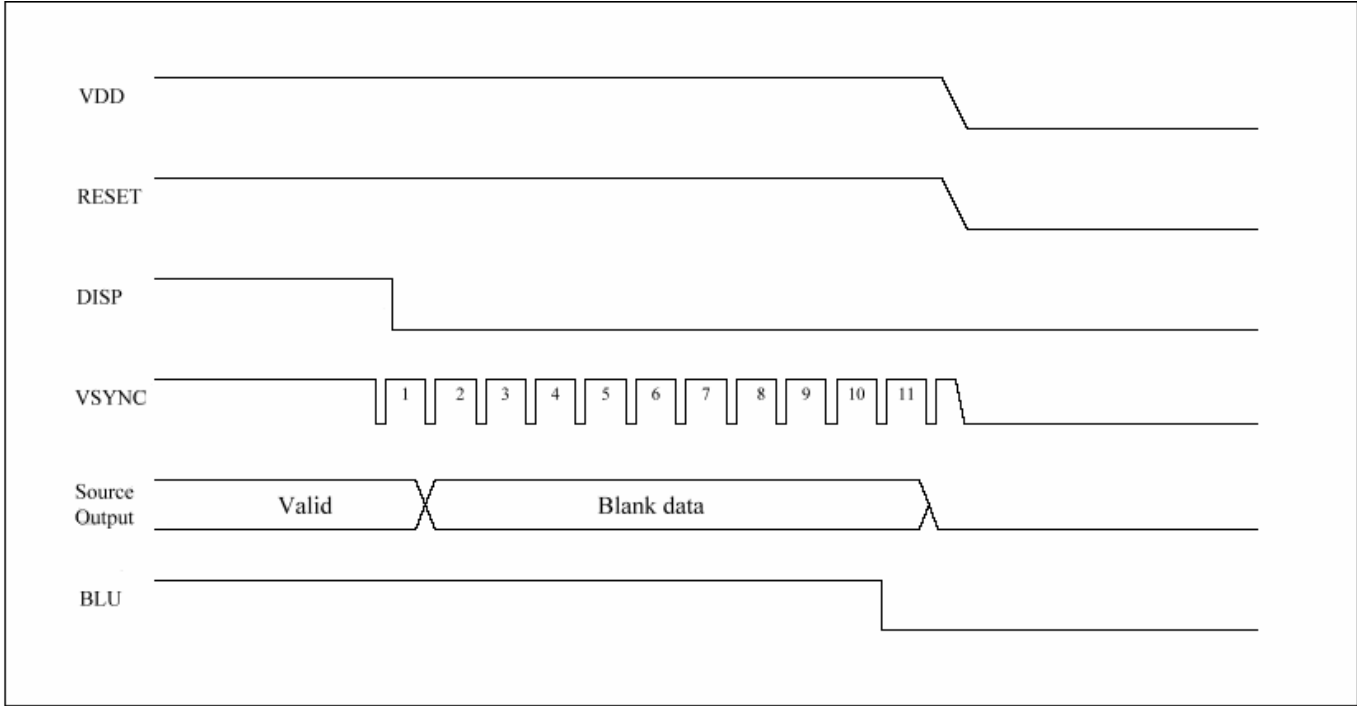


Figure 6.3.2 Power off sequence

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥10	60	70	--	Degree	Note 2
		θB		40	50	--		
		θL		60	70	--		
		θR		60	70	--		
Contrast Ratio		CR	θ=0°	400	500	--		Note1、 Note3
Response Time		T _{ON}	25℃	--	20	30	ms	Note1
		T _{OFF}						Note4
Chromaticity	White	x	Backlight is on	0.265	0.315	0.365		Note5 Note1
		y		0.285	0.335	0.385		
	Red	x		0.531	0.581	0.631		
		y		0.295	0.345	0.395		
	Green	x		0.298	0.348	0.395		
		y		0.531	0.581	0.631		
	Blue	x		0.103	0.153	0.203		
		y		0.045	0.095	0.145		
Uniformity		U		75	80	--	%	Note1、 Note6
NTSC				--	50	--	%	Note 5
Luminance		L	I _{LED} =40mA	200	250	--	cd/m ²	Note1、 Note7

Test Conditions:

1. $I_F = 20mA$ (one channel), the ambient temperature is $25^\circ C$
2. The test systems refer to Note 1 and Note 2.

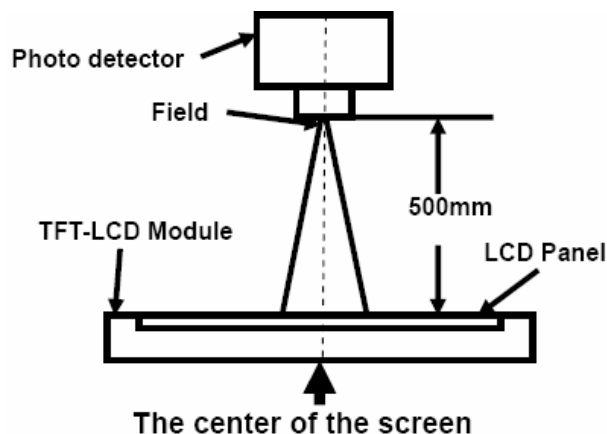
Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.

Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		

Luminance		
Chromaticity		

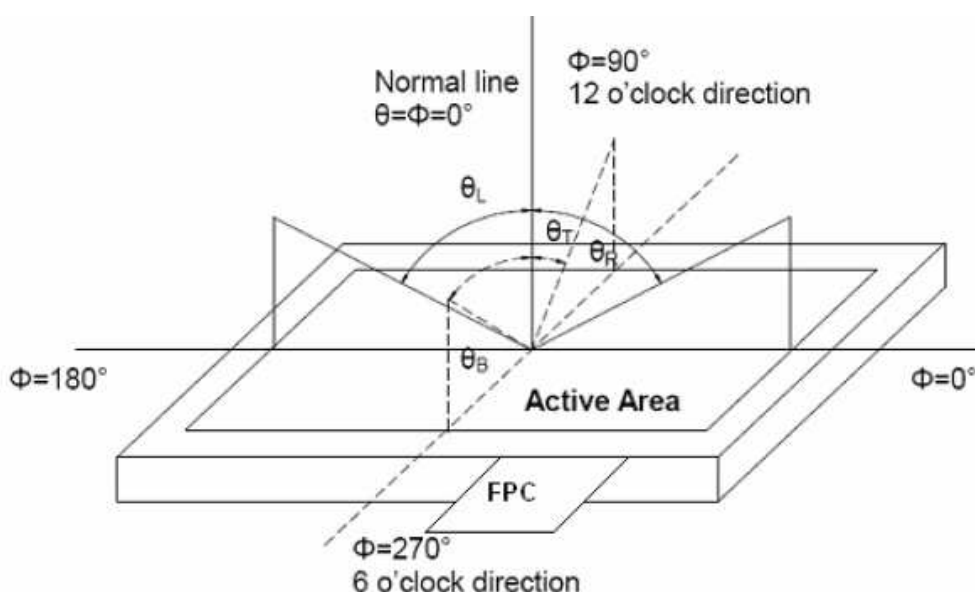
Chromaticity		
Lum Uniformity		



Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80) .



Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

“White state “: The state is that the LCD should drive by V_{white} .

“Black state”: The state is that the LCD should drive by V_{black} .

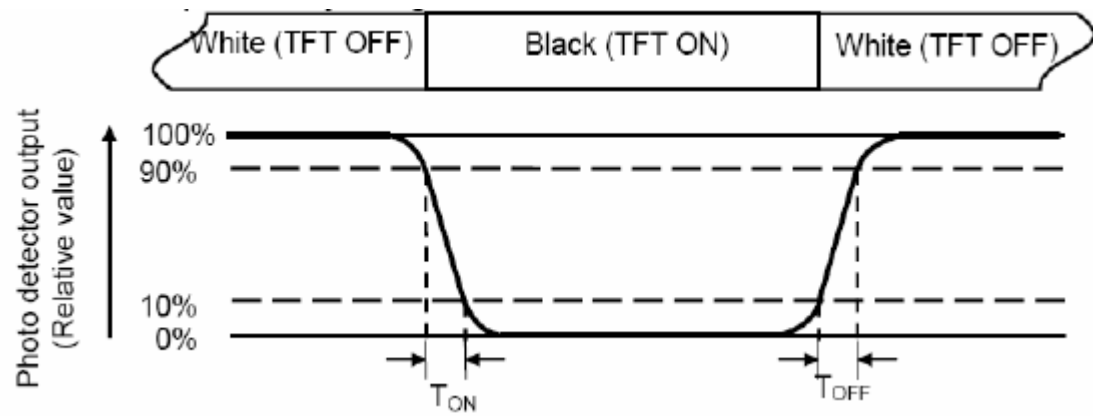
V_{white} : To be determined V_{black} : To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state.

Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF})

is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

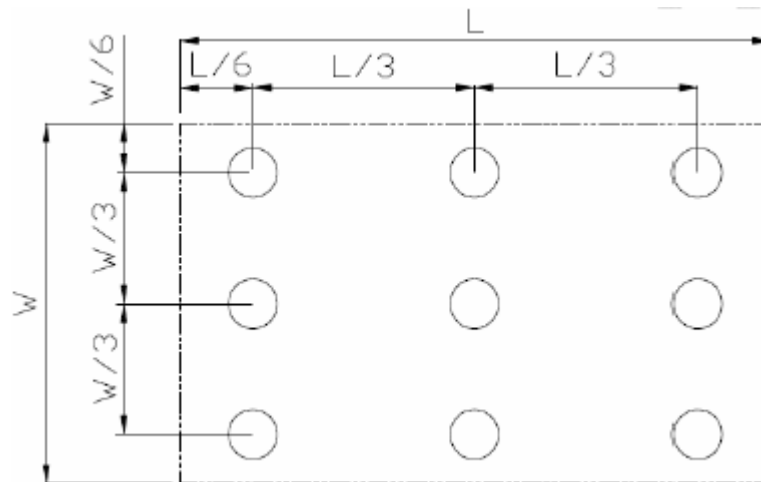
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\min} / L_{\max}$$

L-----Active area length W----- Active area width



$L_{\max}$: The measured Maximum luminance of all measurement position.

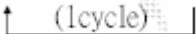
$L_{\min}$: The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

8. Reliability Tests

WIDE TEMPERATURE RELIABILITY TEST

N O.	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	80℃	240 Hrs		Appearance without defect	
2	Low Temp. Storage	-30℃	240 Hrs		Appearance without defect	
3	High Temp. & High Humi. Storage	60 ℃ 90%RH	240 Hrs		Appearance without defect	
4	High Temp. Operating Display	70℃	240 Hrs		Appearance without defect	
5	Low Temp. Operating Display	-20℃	240 Hrs		Appearance without defect	
6	Thermal Shock	-20 ℃, 30min. → 70℃, 30min. 			Appearance without defect	10 cycles

Inspection Provision

1.Purpose

The WINSTAR inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of WINSTAR LCD produces.

2.Applicable Scope

The WINSTAR inspection provision is applicable to the arrangement in regard to outgoing inspection and quality assurance after outgoing.

3.Technical Terms

3-1 WINSTAR Technical Terms



4.Outgoing Inspection

4-1 Inspection Method

MIL-STD-105E Level II Regular inspection

4-2 Inspection Standard

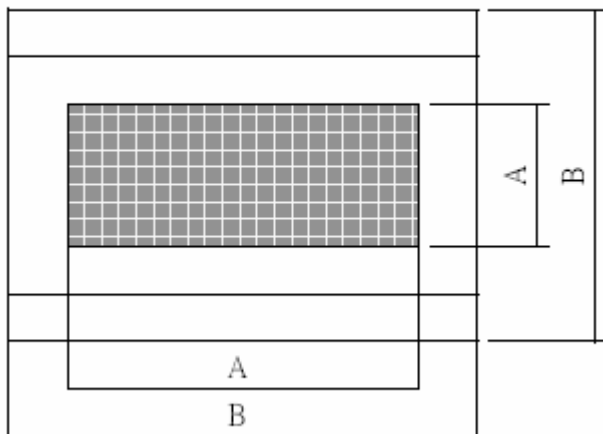
	Item		AQL(%)	Remarks
Major Defect	Dots	Opens Shorts Erroneous operation	0.4	Faults which substantially lower the practicality and the initial purpose difficult to achieve
	Solder appearance	Shorts Loose		
	Cracks	Display surface cracks		

	Dimensions	External from Dimensions	0.4	
Minor Defect	Inside the glass	Black spots	0.65	Faults which appear to pose almost no obstacle to the practicality, effective use, and operation
	Polarizing plate	Scratches, foreign Matter, air bubbles, and peeling		
	Dots	Pinhole, deformation		
	Color tone	Color unevenness		
	Solder appearance	Cold solder Solder projections		

4-3 Inspection Provisions

*Viewing Area Definition

Fig. 1



A : Zone Viewing Area

B : Zone Glass Plate Outline

*Inspection place to be 500 to 1000 lux illuminance uniformly without glaring.

The distance between luminous source(daylight fluorescent lamp and cool white fluorescent lamp) and sample to be 30 cm to 50 cm.

*Test and measurement are performed under the following conditions, unless otherwise specified.

Temperature $20 \pm 15^{\circ}\text{C}$

Humidity $65 \pm 20\%\text{R.H.}$

Pressure 860~1060hPa(mmbar)

In case of doubtful judgment, it is performed under the following conditions.

Temperature $20 \pm 2^{\circ}\text{C}$

Humidity $65 \pm 5\%\text{R.H.}$

Pressure 860~1060hPa(mmbar)

5.Specification for quality check

5-1-1 Electrical characteristics :

NO.	Item	Criterion
1	Non operational	Fail
2	Miss operating	Fail
3	Contrast irregular	Fail
4	Response time	Within Specified value

5-1-2 Components soldering :

Should be no defective soldering such as shorting, loose terminal cold solder, peeling of printed circuit board pattern, improper mounting position, etc.

5-2 Inspection Standard for TFT panel

5-2-1 The environmental condition of inspection :

The environmental condition and visual inspection shall be conducted as below.

(1) Ambient temperature : $25 \pm 5^{\circ}\text{C}$

(2) Humidity : 25~75% RH

(3) External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.

(4) Visual inspection on the operation condition for cosmetic shall be conducted at the distance 30cm or more between the LCD panels and eyes of inspector. The viewing angle shall be 90 degree to the front surface of display panel.

(5) Ambient Illumination : 300~500 Lux for external appearance inspection.

(6) Ambient Illumination : 100~200 Lux for light on inspection.

5-2-2 Inspection Criteria

(1) Definition of dot defect induced from the panel inside

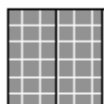
a) The definition of dot : The size of a defective dot over 1/2 of whole dot is regarded as one defective dot

b) Bright dot : Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

c) Dark dot : Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

d) 2 dot adjacent = 1 pair = 2 dots

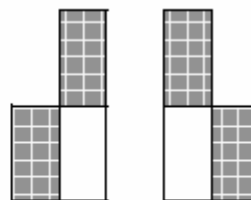
Picture :



2 dot adjacent



2 dot adjacent (vertical)



2 dot adjacent (slant)

(2) Display Inspection

NO.	Item		Acceptable Count
1	Dot defect	Bright Dot	Random $N \leq 2$
			2 dots adjacent $N \leq 0$
		Dark Dot	Random $N \leq 3$
			2 dots adjacent $N \leq 1$
		Total bright and dark dot $N \leq 4$	
	Functional failure (V-line/ H-line/Cross line etc.)		Not allowable
	Mura	It's OK if mura is slight visible through 6% ND filter. (Judged by limit sample if it is necessary)	
2	Newton ring (touch panel)	Orbicular of interference fringes is not allowed in the optimum contrast within the active area under viewing angle.	

(3) Appearance inspection

NO.	Item	Standards
1	Panel Crack	Not allow. It is shown in Fig.1.
2	Broken CF Non -lead Side of TFT	The broken in the area of $W > 2\text{mm}$ is ignored, L is ignored. It is shown in Fig.2.
3	Broken Lead Side of TFT	FPC lead, electrical line or alignment mark can't be damaged. It is shown in Fig.3.
4	Broken Corner of TFT at Lead Side	FPC lead. electrical line or alignment mark can't be damaged. It is shown in Fig.4.
5	Burr of TFT / CF Edge	The distance of burr from the edge of TFT / CF, $W \leq 0.3\text{mm}$. It is shown in Fig.5.
6	Foreign Black / White/Bright Spot	(1) $0.15 < D \leq 0.5 \text{ mm}$, $N \leq 4$; (2) $D \leq 0.15\text{mm}$, Ignore. It is shown in Fig.6.
7	Foreign Black / White/Bright Line	(1) $0.05 < W \leq 0.1 \text{ mm}$, $0.3 < L \leq 2 \text{ mm}$, $N \leq 4$.
		(2) $W \leq 0.05\text{mm}$ and $L \leq 0.3\text{mm}$ Ignore.
		It is shown in Fig.7.
8	Color irregular	Not remarkable color irregular.

Fig 1.

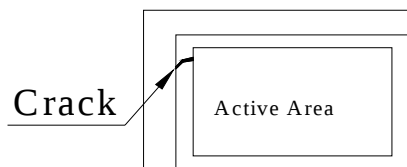


Fig 2.

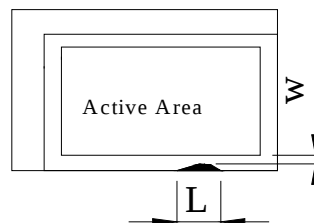


Fig 3.

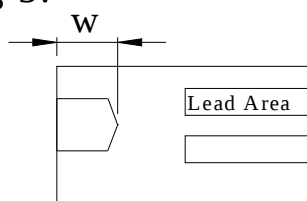


Fig 4.

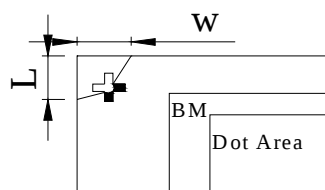


Fig 5.

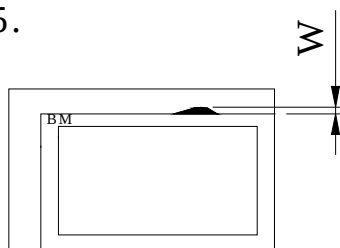
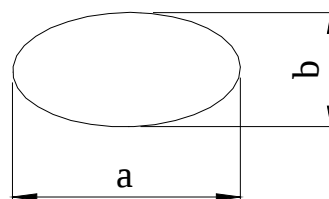


Fig 6.



$$D = (a + b) / 2$$

Fig 7.

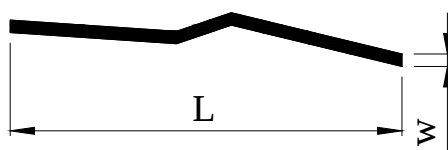
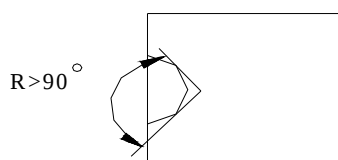


Fig8.



Notes

1.W:Width

2.Length

3.D:Average Diameter

4.N:Count

5.All the anhle of the broken must be larger than 90°.It is shown in Fig.8.(R>90°)

NOTICE:

• SAFETY

1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

• HANDLING

1. Avoid static electricity which can damage the CMOS LSI.
2. Do not remove the panel or frame from the module.
3. The polarizing plate of the display is very fragile. So, please handle it very carefully.
4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
5. Do not use ketonics solvent & Aromatic solvent. Use a soft cloth soaked with a cleaning naphtha solvent.

• STORAGE

1. Store the panel or module in a dark place where the temperature is $25\pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
2. Do not place the module near organics solvents or corrosive gases.
3. Do not crush, shake, or jolt the module.

• TERMS OF WARRANT

1. Acceptance inspection period

The period is within one month after the arrival of contracted commodity at the buyer's factory site.

2. Applicable warrant period

The period is within twelve months since the date of shipping out under normal using and storage conditions.

9. Mechanical Drawing

