

AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

5" VGA Very High Brightness TFT-LCD

ATM050AD-LLV-BFL

(Based on PVI: PD050VL1)

COLOR LIQUID CRYSTAL DISPLAY

Revision History

Rev.	Issued Date	Revised
1.0	May 7, 2007	New
2.0	Mar 12, 2008	Delete Page4 2. Features: Image Reversion : Up/Down and Left/Right
3.0	March.24.2008	Add Page 19 14.Handling Cautions 14-1 item e)
4.0	Aug. 18,2009	Modified Page 22 16.Packing Diagram

TECHNICAL SPECIFICATION**CONTENTS**

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1. General Description

ATM050AD-LLV-BFL is a 5" Color Active Matrix Liquid Crystal display with HighBright LED backlight system. The matrix employs amorphous silicon Thin Film Transistor as the active element. It is a transmissive type display operating in the normally white mode. This TFT-LCD has a 5-inch diagonally measured active display area with VGA resolution (640 horizontal by 480 vertical pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus presenting a palette of more than 262,144 colors.

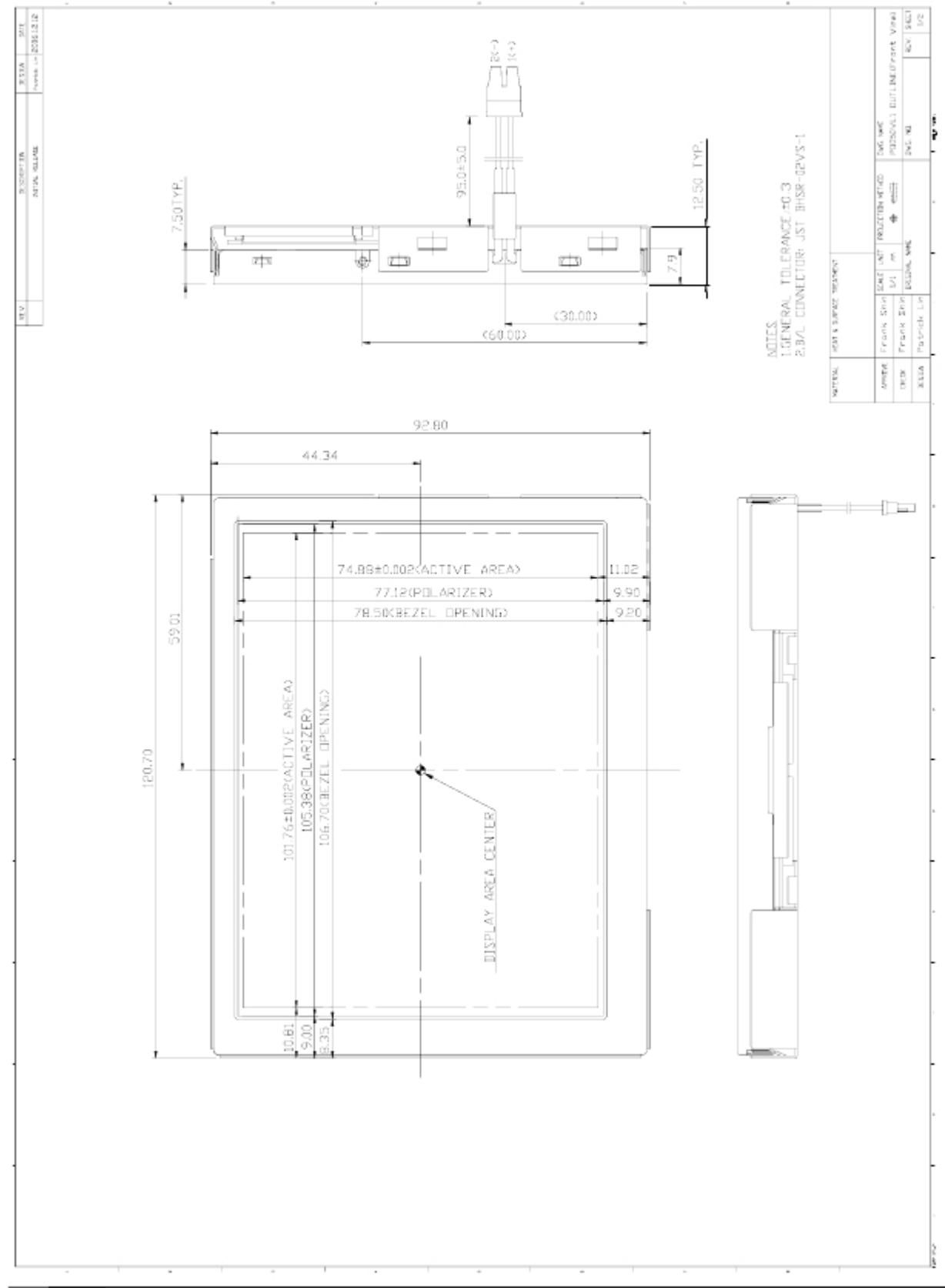
ATM050AD-LLV-BFL is intended to support applications where high brightness is a critical factor. In combination with the vertical arrangement of the sub-pixels, the ATM050AD-LLV-BFL characteristics provide an excellent flat panel display for office or industrial automation products or daylight applications.

2. Mechanical Specifications

Parameter	Specifications	Unit
Screen Size	5(diagonal)	inch
Display Format	640 (R,G,B) 480	dot
Display Colors	262K	
Active Area	101.76 (H) 74.88(V)	mm
Pixel Pitch	0.159(H) 0.156(V)	mm
Pixel Configuration	Stripe	
Outline Dimension	120.7(H) 92.8(V) 12.5(D) (Typ.)	mm
Back-light	TBD	
Weight	173.6+10	g
Surface treatment	Anti-glare and SWV film	
Display mode	Normally white	
Gray scale inversion direction	6 (ref to Note 13-1)	o'clock

3. Mechanical Drawing of TFT-LCD Module

Outline Drawing : Front View (unit mm)



ATM050AD-LLV-BFL

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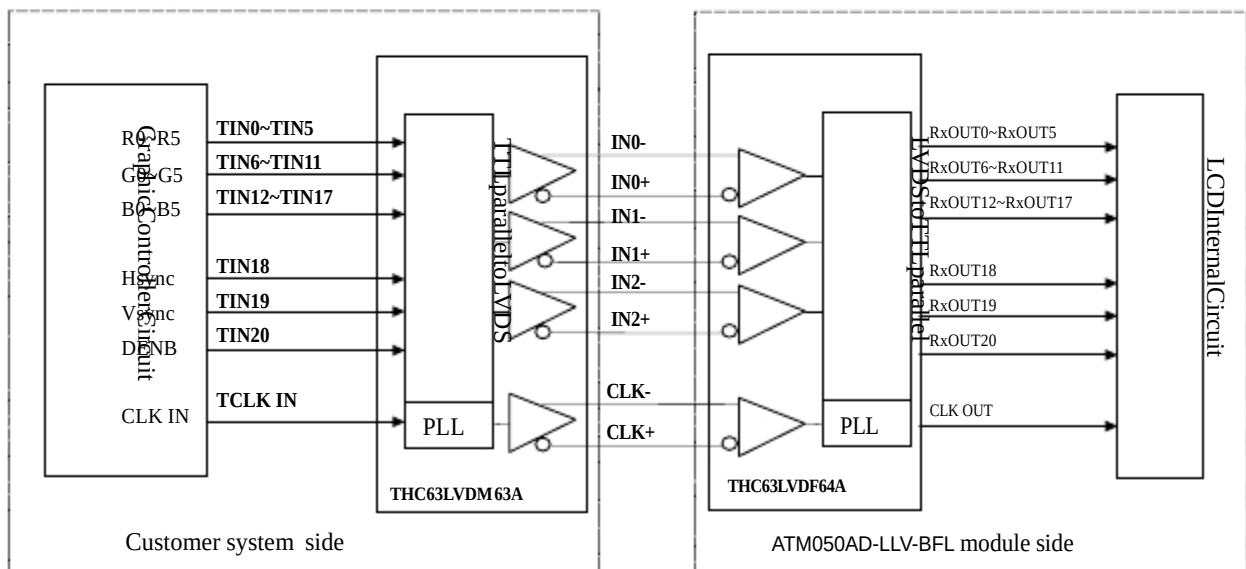
4. Input Terminals

4-1) TFT-LCD Panel Driving

Connector type: DFL19K-20P-1H(HRS)

Pin No.	Symbol	Function	Remark
1	Vcc	+3.3V Power Supply	
2	Vcc	+3.3V Power Supply	
3	GND	Ground	
4	GND	Ground	
5	INO-	LVDS receiver signal channel 0	
6	INO+	LVDS receiver signal channel 0	
7	GND	Ground	
8	IN1-	LVDS receiver signal channel 1	
9	IN1+	LVDS receiver signal channel 1	
10	GND	Ground	
11	IN2-	LVDS receiver signal channel 2	
12	IN2+	LVDS receiver signal channel 2	
13	GND	Ground	
14	CLK-	LVDS receiver signal clock	
15	CLK+	LVDS receiver signal clock	
16	GND	Ground	
17	NC	No connection	
18	NC	No connection	
19	GND	Ground	
20	GND	Ground	

LVDS Interface Block Diagram

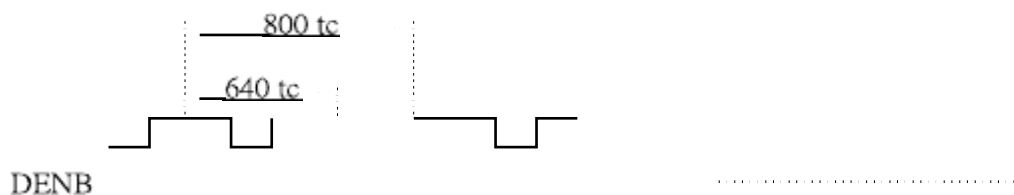


Recommended Transmitter (THC63LVDM63A Thane) to ATM050AD-LLV-BFL interface Assignment:

Input terminal of THC63LVDM63A		Graphic controller output signal		Output signal symbol	To PD050VL1 interface terminal (Symbol)
Symbol	No.	Symbol	Function		
TIN0	44	R0	Red pixel data (LSB)	Tout0- Tout0+	No.5 : IN0- No.6 : IN0+
TIN1	45	R1	Red pixel data		
TIN2	47	R2	Red pixel data		
TIN3	48	R3	Red pixel data		
TIN4	1	R4	Red pixel data		
TIN5	3	R5	Red pixel data(MSB)		
TIN6	4	G0	Green pixel data (LSB)	Tout1- Tout1+	No.8 : IN1- No.9 : IN1+
TIN7	6	G1	Green pixel data		
TIN8	7	G2	Green pixel data		
TIN9	9	G3	Green pixel data		
TIN10	10	G4	Green pixel data		
TIN11	12	G5	Green pixel data(MSB)		
TIN12	13	B0	Blue pixel data(LSB)	Tout2- Tout2+	No.11 : IN2- No.12 : IN2+
TIN13	15	B1	Blue pixel data		
TIN14	16	B2	Blue pixel data		
TIN15	18	B3	Blue pixel data		
TIN16	19	B4	Blue pixel data		
TIN17	20	B5	Blue pixel data(MSB)		
TIN18	22	Hsync	Horizontal Synchronous Signal	TCLK out- TCLK out+	No.14 : CLK No.15 : CLK
TIN19	23	Vsync	Vertical Synchronous Signal		
TIN20	25	DENB	Compound Synchronization signal		
CLK in	26	CLK	Data sampling clock		

DENB input signal.

If customer wanted to off the DENB mode , you must keep the DENB always High or Low.



(tc: the period of sampling clock)

4-2) Backlight driving

Connector type: Molex 51004-0200 or equivalent connectors for the LED Backlight

Pin No	Symbol	Description	Remark
1	+	Input terminal (Positive electrode side)	Wire color : Red/Pink
2	-	Input terminal (Ground side)	Wire Color : White

5. Absolute Maximum Ratings

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

GND=0V, Ta=25 °C

Parameters	Symbol	MIN.	MAX.	Unit	Remark
Supply Voltage	V _{CC}	-0.3	+7.0	V	
Input Signals Voltage	V _{sig}	-0.3	V _{CC} +0.3	V	Note 6-1

Note 6-1 : Input signals include CLK , Hsync , Vsync , DENB , R[0:5] , G[0:5] and B[0:5].

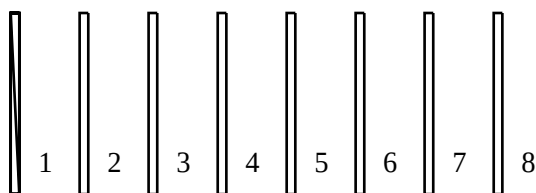
6. Electrical Characteristics

6-1) Recommended Operating Conditions:

GND = 0V Ta = 25 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage	V _{CC}	3.0	3.3	3.6	V	
Current Dissipation	I _{CC}	-	77.90	-	mA	Note 7-1
LVDS Differential input high threshold	V _{TH}	-	-	100	mV	Note7-2
LVDS Differential input low threshold	V _{TL}	-100	-	-		
V _{com} Voltage	V _{com}	-	2.7	-	V	

Note 6-1 : To test the current dissipation of VCC using the “color bars” testing pattern shown as below



1. White
2. Yellow
3. Cyan
4. Green
5. Magenta
6. Red
7. Blue
8. Black

Idd current dissipation testing pattern

Note6-2 : Please refers to THC63LVDF64A specification by THINE Corporation.
This LCD module conforms to LVDS standard.

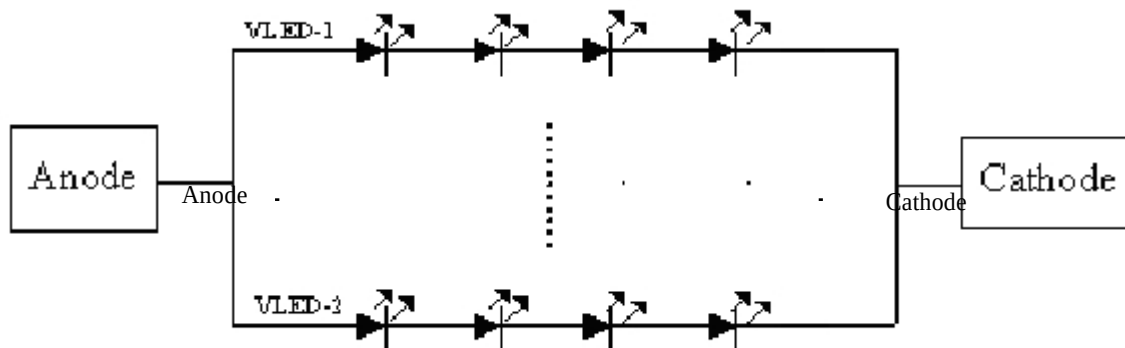
6-2) Recommended driving condition for LED backlight

GND = 0V Ta = 25 °C

Parameter	Symbol	Min	TYP	MAX	Unit	Remark
Supply voltage of LED backlight	V _{LED}	-	12.0	12.3	V	I _L = 20 mA
Supply current of LED backlight	I _{LED}	-	270	400	mA	Note 7-3
Backlight Power Consumption	P _{LED}	-	3.2	4.9	W	Note 7-4

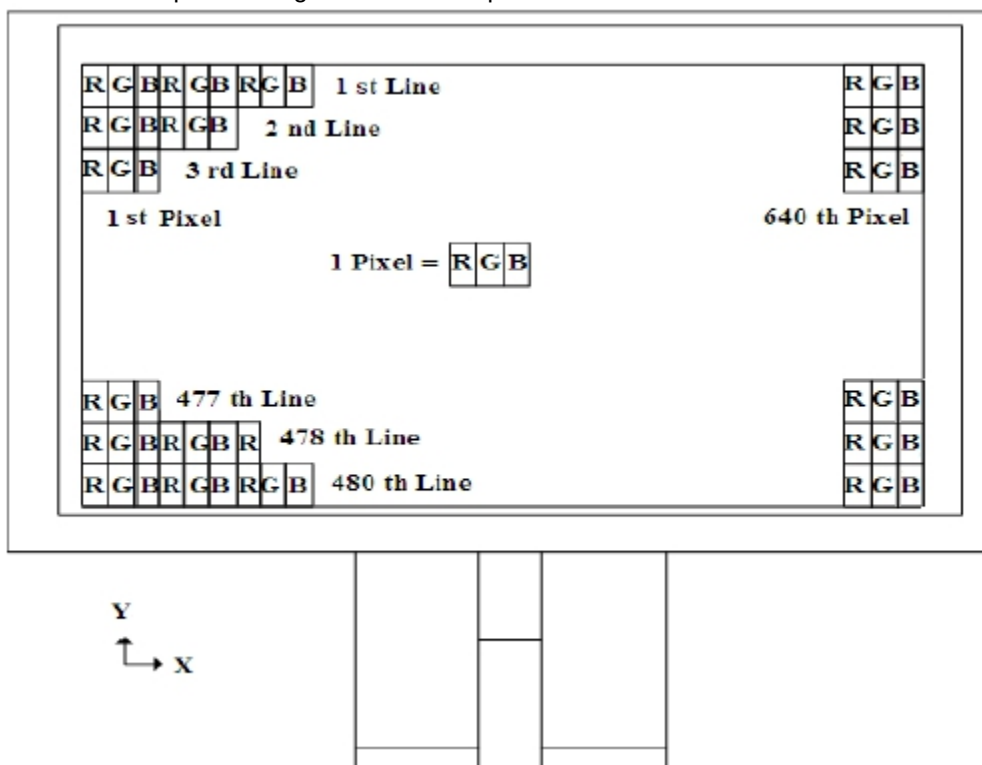
Note 6-3: The LED driving condition is defined for each LED module. (3 LED Serial)

Note 6-4: $P_{LED} = V_{LED1} * I_{LED1} + V_{LED2} * I_{LED2} + \dots + V_{LED6} * I_{LED6} + V_{LED7} * I_{LED7}$



7. Pixel Arrangement

The LCD module pixel arrangement is the stripe.

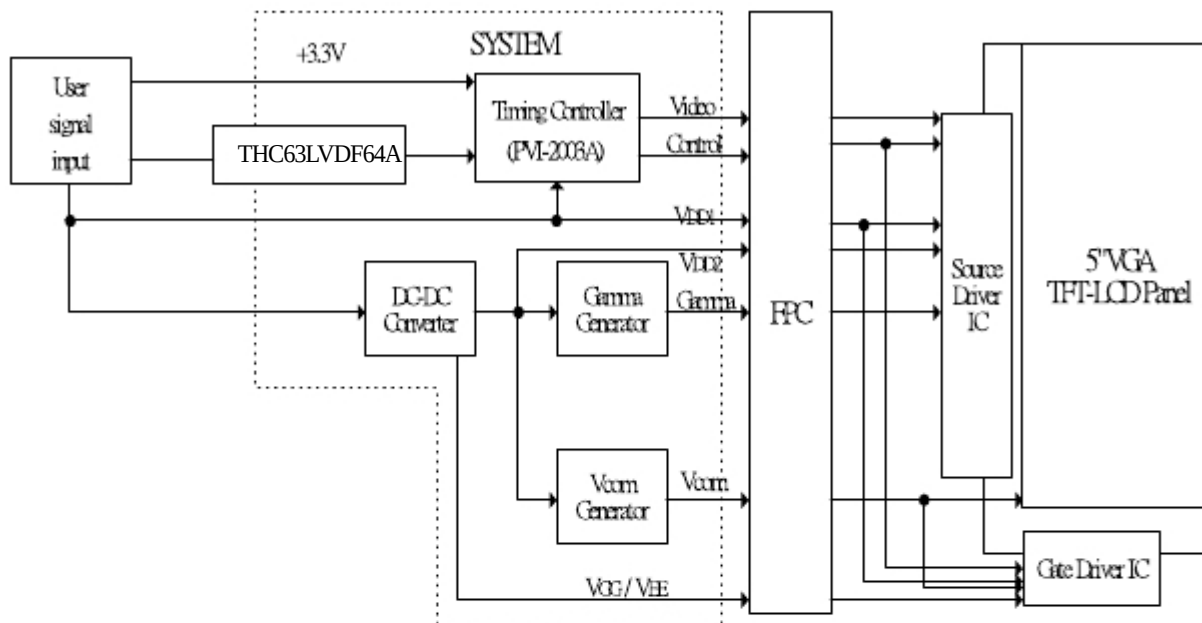


8. Display Color and Gray Scale Reference

Color		Input Color Data																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	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 (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (01)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red (02)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker																		
	Brighter							0	0	0	0	0	0	0	0	0	0	0	0
	Red (61)	1	1	1	1	0	1	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 (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (01)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green (02)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker																		
	Brighter													0	0	0	0	0	0
	Green (61)	0	0	0	0	0	0	1	1	1	1	0	1	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 (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (02)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	Darker																		
	Brighter							0	0	0	0	0	0	0	0	0	0	0	0
	Blue (61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	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	

9. Block Diagram

10-1) TFT-module Block Diagram

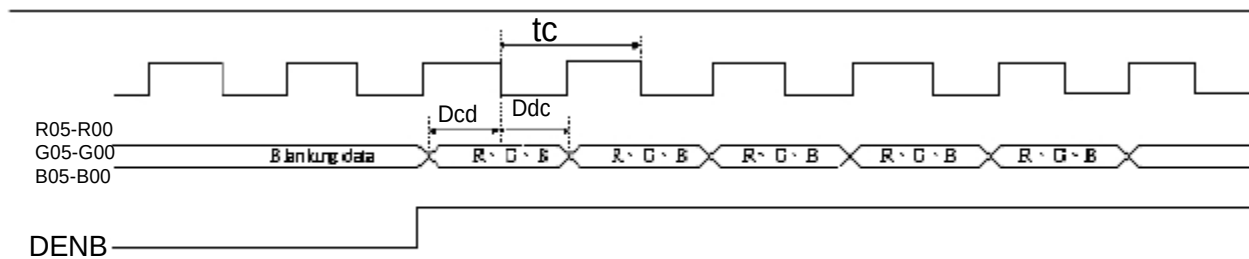


10. Interface Timing

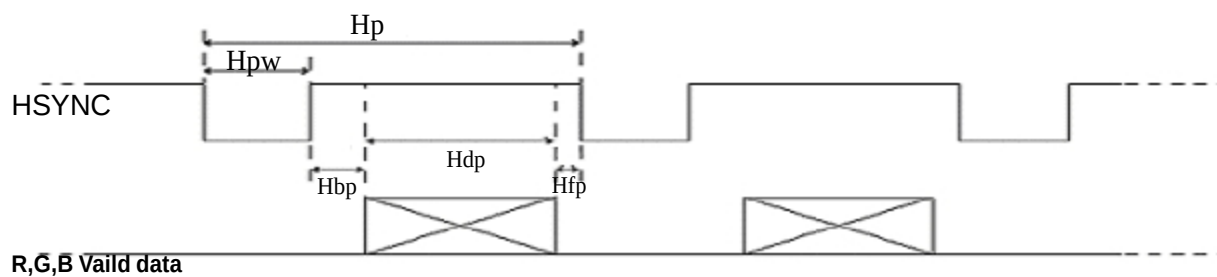
10-1) Timing Parameters

		Symbol	Min.	Typ.	Max.	Unit
Power supply		VCC	3.0	3.3	3.6	V
CLK	Frequency	1/tc	-	25	-	MHz
		tc	-	40	-	ns
HSYNC	Period	Hp	-	32	-	us
			-	800	-	tc
	Display period	Hdp	-	640	-	tc
	Pulse width	Hp _w	-	96	-	tc
	Back-porch	Hb _p	-	46	-	tc
	Front-porch	Hf _p	-	18	-	tc
	Hp _w +Hb _p		-	142	-	tc
	Hsync-CLK	Hhc	10	-	Tc-10	ns
Vsync-Hsync		Hvh	0	0	200	tc
VSYNC	Period	Vp	-	16.8	-	ms
			-	525	-	Hp
	Display period	Vdp	-	480	-	Hp
	Pulse width	Vp _w	-	2	-	Hp
	Back-porch	Vb _p	-	33	-	Hp
	Front-porch	Vf _p	-	10	-	Hp
	Vp _w +Vb _p		-	35	-	Hp
DENB	Horizontal scanning period	T1	-	800	-	tc
	Horizontal display period	T2	-	640	-	tc
	Vertical display period	T3	-	480	-	T1
	Frame cycling period	T4	520	525	800	T1
R,G,B	CLK-DATA	Dcd	10	-	-	ns
	DATA-CLK	Ddc	8	-	-	ns

10-2) The Timing Diagram a.1 Input signal range



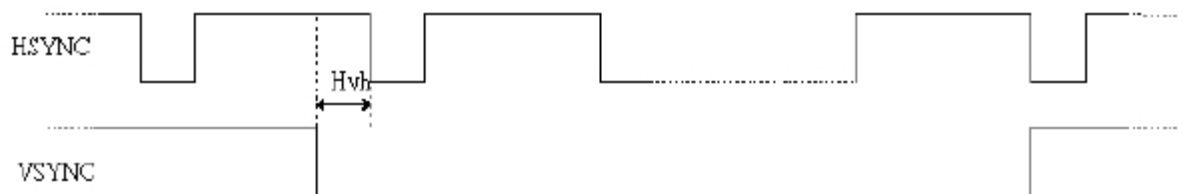
a.2 HSYNC timing



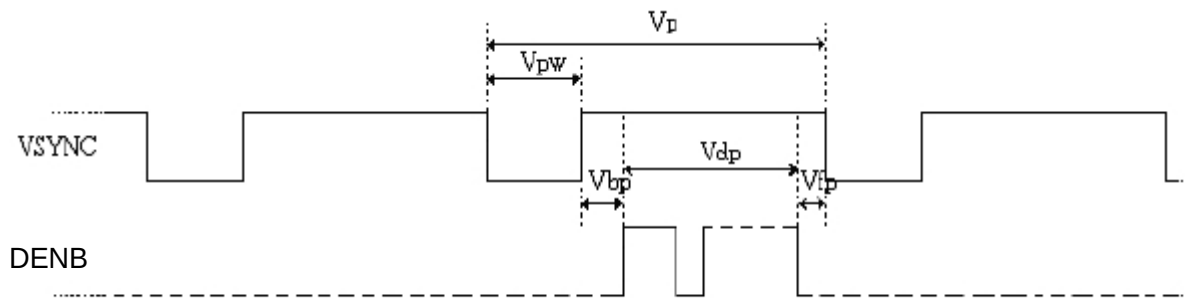
a.3 CLK, HSYNC relationship



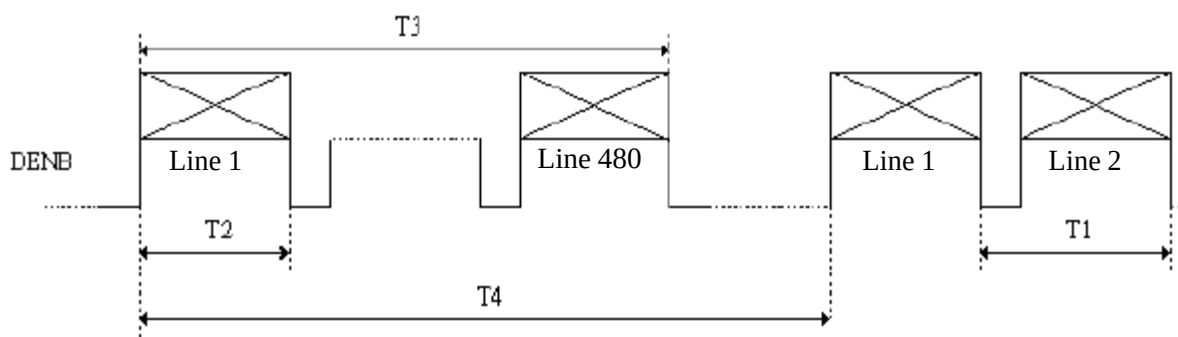
a.4 HSYNC, VSYNC relationship



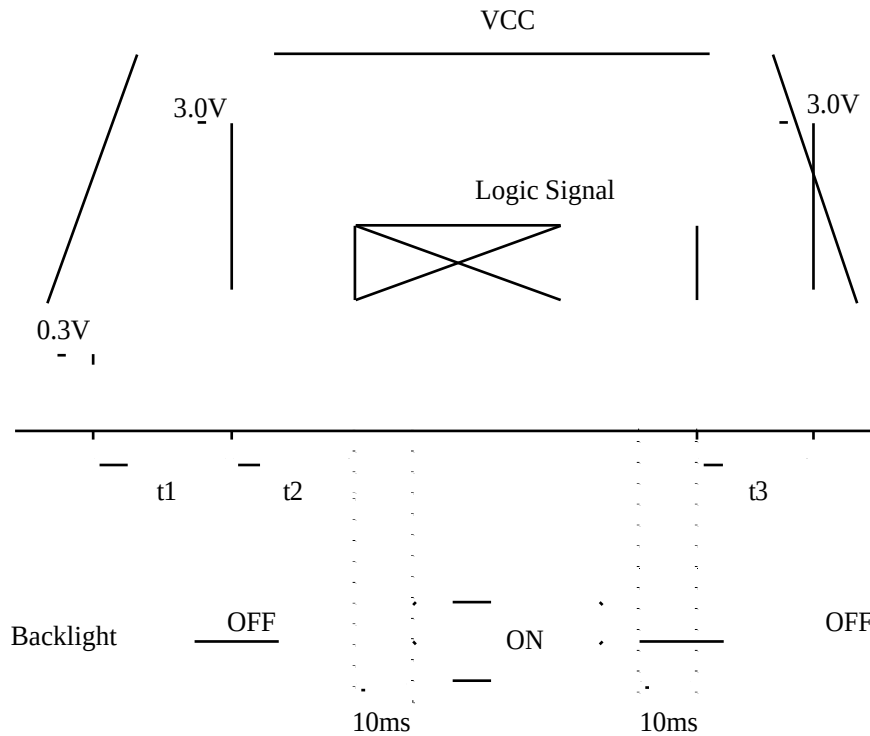
a.5 VSYNC timing



a.6 DENB timing



11. Power On Sequence



1. 0 t_1 20ms
2. 0 t_2 50ms
3. 0 t_3 1s

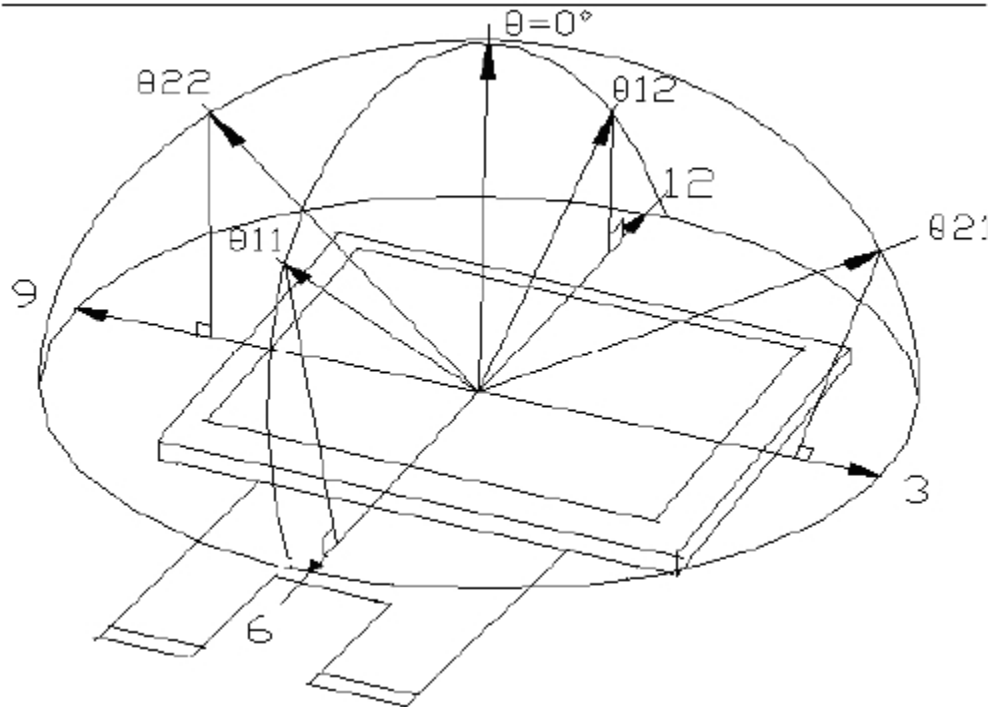
12. Optical Characteristics

12-1) Specification:

$T_a = 25^\circ\text{C}$

Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
Viewing Angle	Horizontal	θ_{21}, θ_{22}	CR 10	55	60	-	deg	Note 13-1
	Vertical	θ_{12}		35	40	-	deg	
		θ_{11}		50	55	-	deg	
Contrast Ratio		CR	At optimized Viewing angle	200	400	-	-	Note 13-2
Response time	Rise	Tr	$\theta = 0^\circ$	-	15	30	ms	Note 13-4
	Fall	Tf		-	25	50	ms	
Brightness		L	$\theta = 0^\circ$	-	1000	-	cd/m2	Note 13-3
Uniformity		U		70	80	-	%	Note 13-6
Cross Talk		-	$\theta = 0^\circ$	-	-	3.5	%	Note 13-7
White Chromaticity		x	$\theta = 0^\circ$	0.28	0.31	0.34	-	Note 13-3
		y		0.31	0.34	0.37	-	
LED Life Time			+25℃	-	30,000	-	hrs	Note 13-5

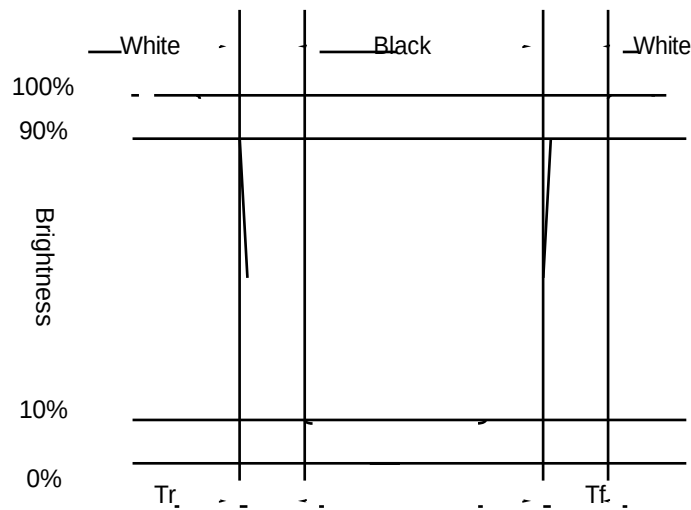
Note 12-1 : The definitions of viewing angle diagrams :



Note 12-2: $CR = \frac{\text{Luminance when LCD is White}}{\text{Luminance when LCD is Black}}$
 Contrast Ratio is measured in optimum common electrode voltage.

Note 12-3 : Topcon BM-7 (fast) luminance meter 1 field of view is used in the testing (after 20~30 minutes operation).

Note 12-4 : The definitions of response time T_r and T_f :



Note 12-5: The "LED Life time " is defined as the module brightness decrease to 50% original
 Brightness that the ambient temperature is 25 °C and $I_{LED} = 160mA$.

Note 12-6 : The uniformity of LCD is defined as

$$U = \frac{\text{The Minimum Brightness of the 9 testing Points}}{\text{The Maximum Brightness of the 9 testing Points}}$$

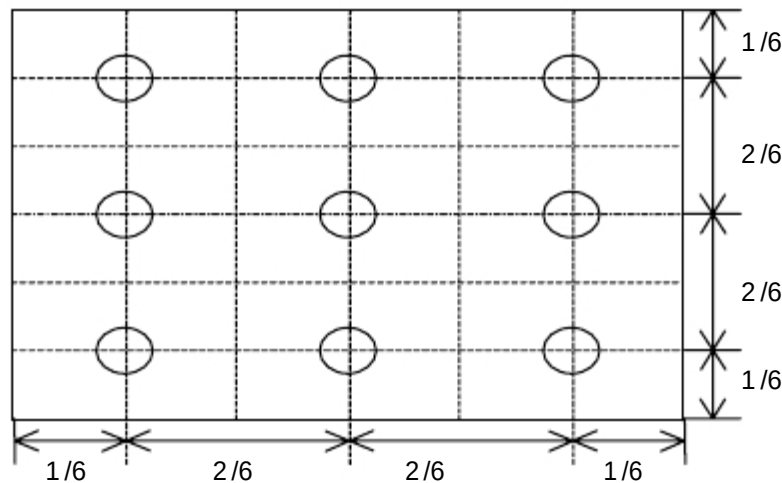
Luminance meter : BM-5A or BM-7 fast (TOPCON)

Measurement distance : 500 mm +/- 50 mm

Ambient illumination : < 1 Lux

Measuring direction : Perpendicular to the surface of module

The test pattern is white (Gray Level 63).



Note 12-7: Cross Talk (CTK) = $\frac{|YA - YB|}{YA} \times 100\%$

YA: Brightness of Pattern A

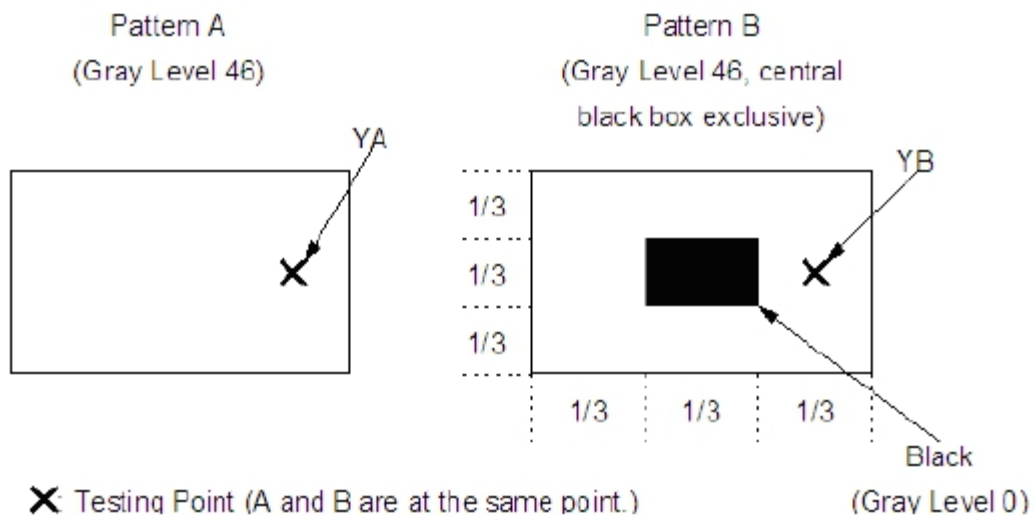
YB: Brightness of Pattern B

Luminance meter : BM 5A or BM-7 fast (TOPCON)

Measurement distance : 500 mm +/- 50 mm

Ambient illumination : < 1 Lux

Measuring direction : Perpendicular to the surface of module



13. Handling Cautions**13-1) Mounting of module**

- a) Please power off the module when you connect the input/output connector.
- b) Please connect the ground pattern of the inverter circuit surely. If the connection is not perfect, some following problems may happen possibly.
 - 1. The noise from the backlight unit will increase.
 - 2. The output from inverter circuit will be unstable.
 - 3. In some cases a part of module will heat.
- c) Polarizer which is made of soft material and susceptible to flaw must be handled carefully.
- d) Protective film (Laminator) is applied on surface to protect it against scratches and dirt.
- e) Please following the tear off direction as figure14-1 to remove the protective film as slowly as possible, so that electrostatic charge can be minimized.

13-2) Precautions in mounting

- a) When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth.
- b) Wipe off water drops or finger grease immediately. Long contact with water may cause discoloration or spots.
- c) TFT-LCD module uses glass, which breaks or cracks easily if dropped or bumped on hard surface. Please handle with care.
- d) Since CMOS LSI is used in the module. So take care of static electricity and earth yourself when handling.

13-3) Adjusting module

- a) Adjusting volumes on the rear face of the module have been set optimally before shipment.
- b) Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described may not be satisfied.

13-4) Others

- a) Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours.
- b) Store the module at a room temperature place.
- c) The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around.
- d) If LCD panel breaks, it is possibly that the liquid crystal escapes from the panel. Avoid putting it into eyes or mouth. When liquid crystal sticks on hands, clothes or feet. Wash it out immediately with soap.
- e) Observe all other precautionary requirements in handling general electronic components.
- f) Please adjust the voltage of common electrode as material of attachment by 1 module.



Figure 14-1 the way to peel off protective film

Figure 14-1 the way to peel off protective film

14. Reliability Test

No	Test Item	Test Condition
1	High Temperature Storage Test	Ta = +90 °C 240 hrs
2	Low Temperature Storage Test	Ta = -40 °C 240 hrs
3	High Temperature Operation Test	Ta = +80 °C 240 hrs
4	Low Temperature Operation Test	Ta = -30 °C 240 hrs
5	High Temperature & High Humidity Operation Test	Ta = +60 °C 90%RH, 240 hrs
6	Thermal Cycling Test (non-operating)	-30°C → +80°C , 200 Cycles 30 min 30 min
7	Vibration Test (non-operating)	Frequency 10 ~ 55 Hz Amplitude 1 mm Sweep time: 11 mins Test Period: 6 Cycles for each direction of X, Y, Z
8	Shock Test (non-operating)	100G, 6ms Direction: X, Y, Z Cycle: 3 times
9	Electrostatic Discharge Test (non-operating)	150pF, 330 Air : 15KV ; Contact : 8KV 10 times/point , 9 points/panel face

Ta: ambient temperature

[Criteria]

In the standard conditions, there is not display function NG issue occurred. (including: line defect ,no image).All the cosmetic specification is judged before the reliability stress.

Preliminary Technical Specifications

15. Packing Diagram

