ISO 9001:2000 FM86067

BONA Display Specialist

BT8224XTTDA

Product

Standard LCD Module
800（RGB）x 480 Dots graphic type
7.0” TFT LCD
COG bonding type
Wide temperature
With touch panel
With LED back light

Version	Prepared / dd-mm-yy	Approved / dd-mm-yy
A	CSB 12-12-2012	Zhanghong 12/12-2012

Table of Contents

1. Revision History

Version	Summary	Date dd-mm-yy
A	Original	12/12-2012

2. MODULE CLASSIFICATION INFORMATION

BT□□□□□ - □ □ - □ □ - □
(a) (b) (c) (d) (e) (f) (g) (h)

(a) BT**:** Company Name Abbreviation

(b) Product Type
T—TFT（NUL）
C—CSTN
S—STN
O—OTHER

(c) Product Serial Number

(d) Number of Columns
A-16 B-32 C-64 D-67 E-80 F-96 G-100 H-102
I-112 J-120 K-128 L-130 M-132 N-160 O-176
P-220 Q-234 R-240 S-320 T-480 U-640 V-960
W-272 X-800

(e) Number of Rows
A-16 B-32 C-64 D-67 E-80 F-96 G-100 H-102
I-112 J-120 K-128 L-130 M-132 N-160 O-176
P-220 Q-234 R-240 S-320 T-480 U-640 V-960
W-272 X-800

(f) Display Mode
T:Transmissive R:Reflective F:Transflective C:Oled Color
M:Oled Mono

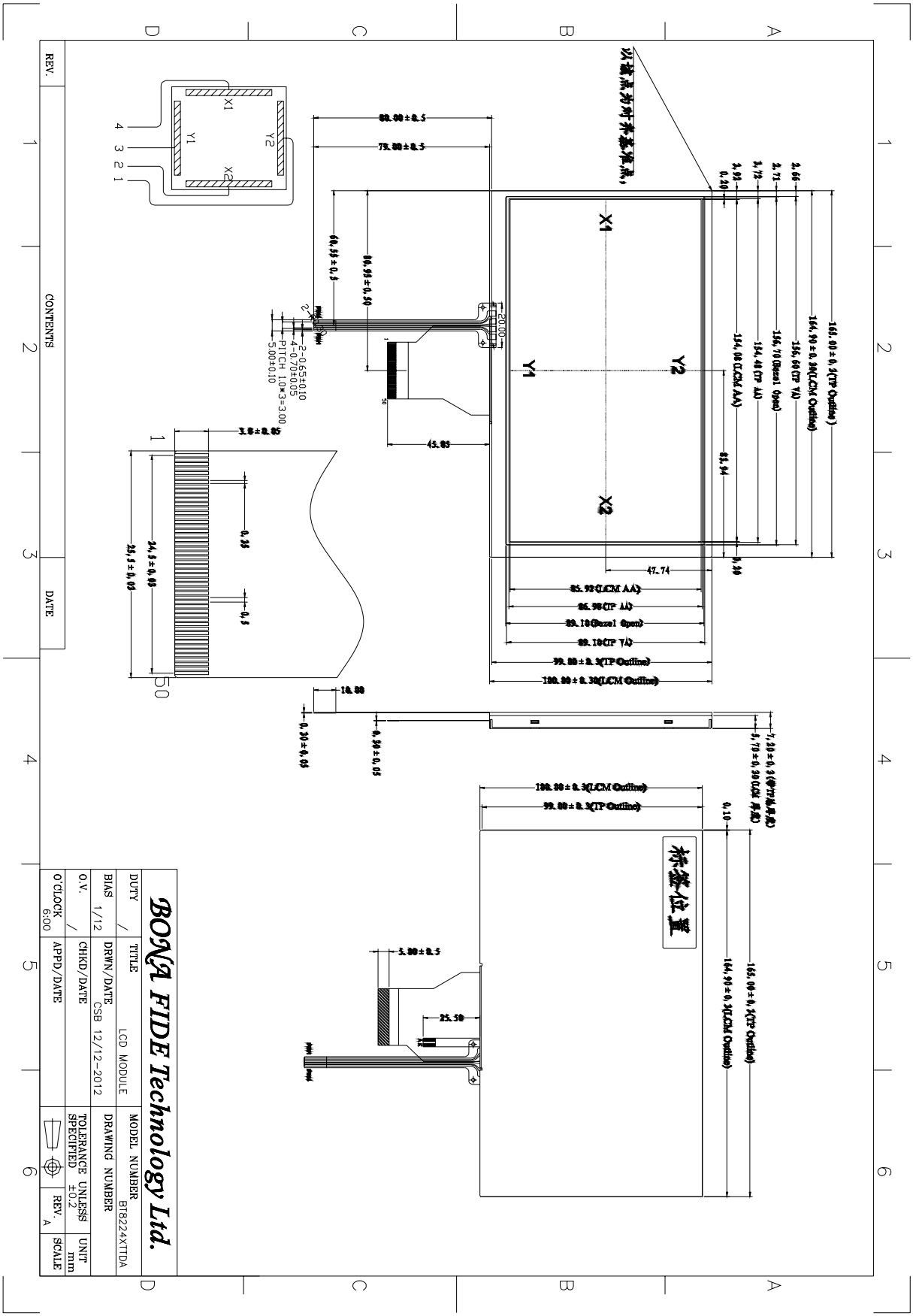
(g) Optimal View Direction
D---6 O'CLOCK
U—12 O'CLOCK
L—9 O'CLOCK
R—3 O'CLOCK
O—Other

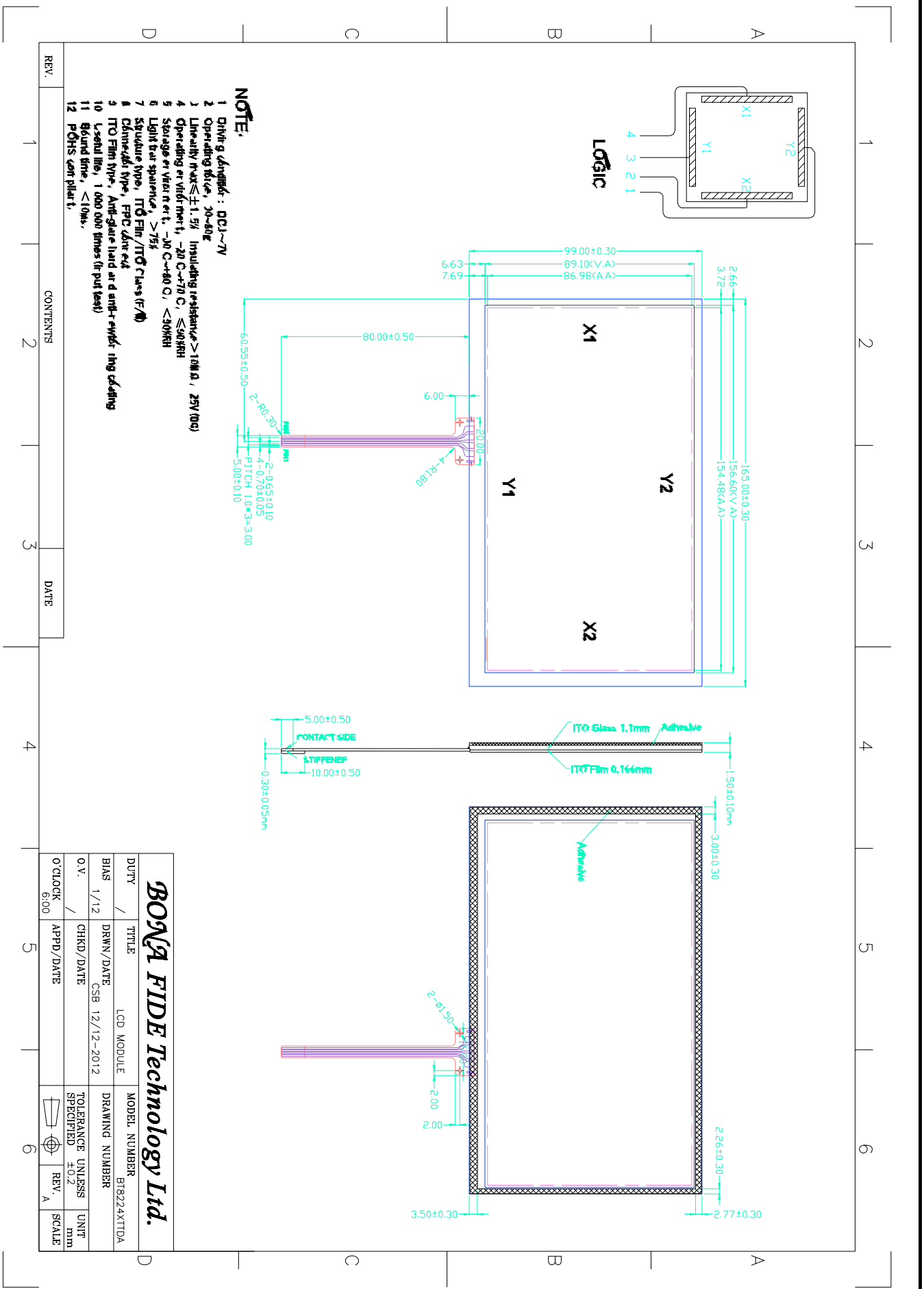
(h) Product Version: From A to Z

3. PHYSICAL DATA

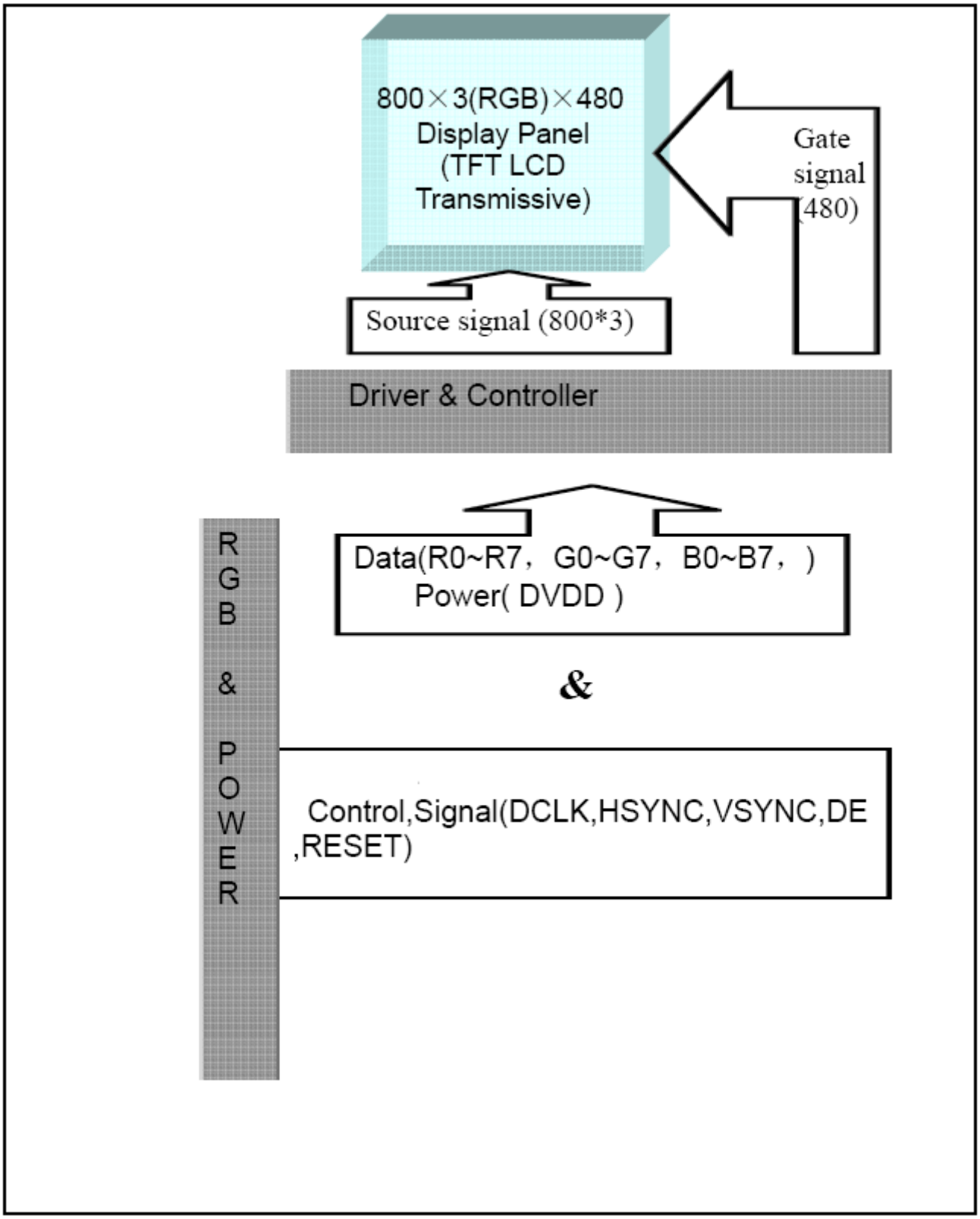
Item	Spec	Remark
Display Mode	Normally White transmissive	
Viewing Direction	12 O'CLOCK	
Input Signals	RGB 24 bit	
Outside Dimensions	164.9 (W) x100(H) x7.2(D) Max	With TP
Active Area	154.08mm(W)×85.92mm(H)	
Number of Pixels	800(RGB)×480	
Dot Pitch	0.0642mm(H) ×0.1790mm(W)	
Pixel Arrangement	RGB Vertical stripes	

4. OUTLINE DIMENSION




NOTE:
1 Driving voltage : DC1~7V
2 Operating temperature, 20~60℃
3 Linearity max≤±1.5% Insulating resistance>10MΩ, 25V (DC)
4 Operating environment, -20 C~+70 C, ≤90%RH
5 Storage environment, -30 C~+80 C, <90%RH
6 Light transmittance, >75%
7 Structure type, ITO Film /ITO Glass (F/G)
8 Connector type, FPC connector
9 ITO Film type, Anti-glare hard and anti-rewriting coating
10 Useful life, 1 000 000 times (input test)
11 Rebound time, <10ms,
12 PCHS compliant,
LOGIC
X1
Y1
Y2
X2
99.00±0.30
89.10(V.A)
86.98(A.A)
6.63
7.69
2.66
3.72
80.00±0.50
60.55±0.50
2-R0.30
6.00
20.00
4-P1.80
2-0.65±0.10
4-0.70±0.05
PITCH 1.0*3=3.00
5.00±0.10
165.00±0.30
156.60(V.A)
154.48(A.A)
5.00±0.50
CONTACT SIDE
STIFFENER
10.00±0.50
0.30±0.05mm
ITO Glass 1.1mm
Adhesive
ITO Film 0.144mm
1.50±0.10mm
3.00±0.30
Adhesive
2-Ø1.50
2.00
2.00
2.26±0.30
3.50±0.30
2.77±0.30
REV.
CONTENTS
DATE
BONA FIDE Technology Ltd.
DUTY / TITLE LCD MODULE
BIAS 1/12 DRWN/DATE CSB 12/12-2012
O.V. / CHKD/DATE
O'CLOCK 6:00 APPD/DATE
MODEL NUMBER BT8224XTTDA
DRAWING NUMBER
TOLERANCE UNLESS SPECIFIED ±0.2
UNIT mm
REV. A
SCALE

5. BLOCK DIAGRAM



6. ABSOLUTE MAXIMUM RATINGS

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

ITEM	Sym.	Min.	Typ.	Max.	Unit	Remark
Power Voltage	DVDD	-0.3	-	5	V	
	AVDD	6.5	-	13.5	V	
	VGH	-0.3		40		
	VGL	-20		0.3		
	VGH-VGL	-		40		
Storage Humidity	H_{ST}	10	-		%RH	At 25±5℃
Storage Temperature	T_{ST}	-30	-	80	℃	
Operating Ambient Humidity	H_{OP}	10	-		%RH	
Operating Ambient temperature	T_{OP}	-20	-	70	℃	

7. ELECTRICAL SPECIFICATION

7-1. TFT-LCD Module

Item		Sym.	Min	Typ.	Max	Unit	Note
Power Voltage		DV_{DD}	3.0	3.3	3.6	V	
		AV_{DD}	10.2	10.4	10.6	V	
		V_{GH}	15.3	16.0	16.7	V	
		V_{GL}	-7.7	-7.0	-6.3	V	
		V_{COM}	3.6	3.8	4.0	V	
Logic Input Voltage	Low Voltage	V_{IL}	0.	-	0.3VDD	V	
	High Voltage	V_{IH}	0.7VDD	-	VDD	V	
Power Consumption	Black Mode	P_b	T.B.D	T.B.D	T.B.D	mW	
	Standby Mode	P_w	T.B.D	T.B.D	T.B.D	mW	

7-2. Driving Backlight

Item	Sym.	Min	Typ.	Max	Unit	Note
Backlight driving voltage	V_F	9.0	9.6	10.2	V	
Backlight driving current	I_F	75	100	125	mA	
Backlight Power Consumption	W_{BL}	-	960	-	mW	
Life Time	-	-	20,000	-		Note 3

7-3. Current Consumption

Item	Sym.	Min	Typ.	Max	Unit	Note
Current for Driver	I_{GH}	-	0.2	1.0	mA	$V_{GH=16V}$
	I_{GL}	-	0.2	1.0	mA	$V_{GL=7V}$
	IDV_{DD}	-	4.0	10	mA	$DV_{DD=3.3V}$
	IAV_{DD}	-	20	50		$AV_{DD=10.4V}$

Note 1: (Unless specified, the ambient temperature Ta=25℃)
Note 2: The recommended operating conditions refer to a range in which operation of this product is guaranteed. Should this range is exceeded, the operation cannot be guaranteed even if the values may be without the absolute maximum ratings.
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.

8. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 ℃. The values specified are at an approximate distance 500mm from the LCD surface at a viewing angle of Φ and θ equal to 0°.

Item	Sym.	Values			Unit	Note
		Min.	Typ.	Max.		
1)Contrast Ratio	C/R	350	500	-		FIG.1
2)Module Luminance	L	170	200	-	cd/m^2	FIG.1
3)Response time	Tr+Tf	-	35	-	ms	FIG.2
4)Viewing Angle	θ_T	60	70	-	Degree	FIG.3
	θ_B	40	50	-		
	θ_L	60	70	-		
	θ_R	60	70	-		
5)Chromaticity	Wx	0.26	0.31	0.36		
	Wy	0.28	0.33	0.38		
	Rx	-	-	-		
	Ry	-	-	-		
	Gx	-	-	-		
	Gy	-	-	-		
	Bx	-	-	-		
	By	-	-	-		

◆ Measurement System

Notes:

1. Contrast Ratio(CR) is defined mathematically as :

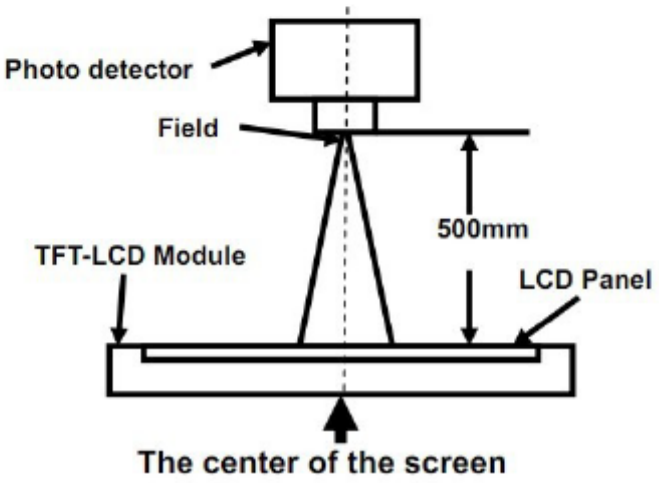
$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

2. Surface luminance is the center point across the LCD surface 500mm from the surface with all pixels displaying white. For more information see FIG 1.

3. Response time is the time required for the display to transition from white to black (Rising Time, Tr) and from black to white (Falling Time, Tf). For additional information see FIG 2.

4. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

FIG. 1 Optical Characteristic Measurement Equipment and Method



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

FIG. 2 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

Response Time = Rising Time(Tr) + Falling Time(Tf)

- Rising Time(Tr) : Full White 90% → Full White 10% Transmittance.
- Falling Time(Tf) : Full White 10% → Full White 90% Transmittance.

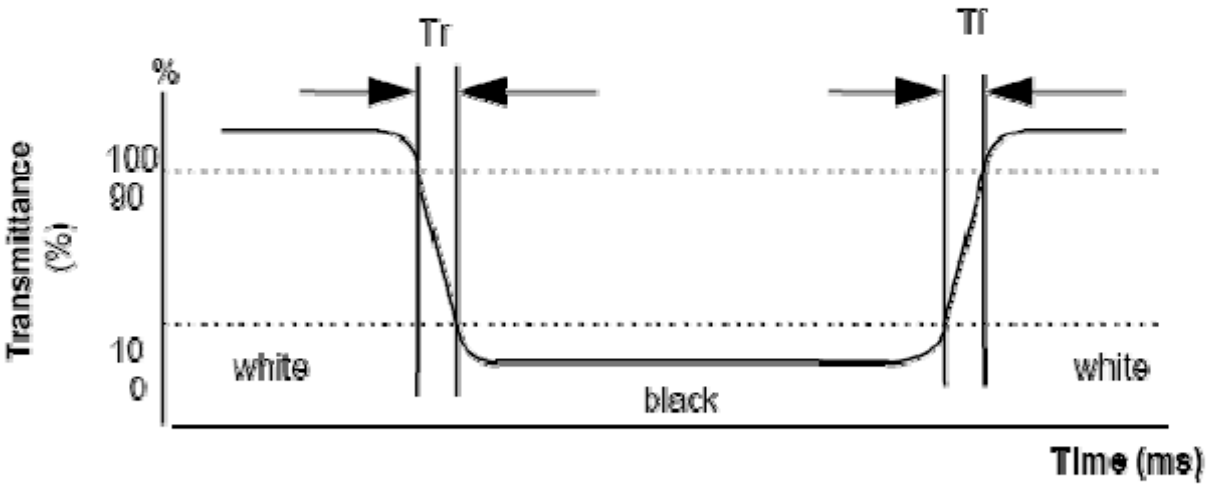
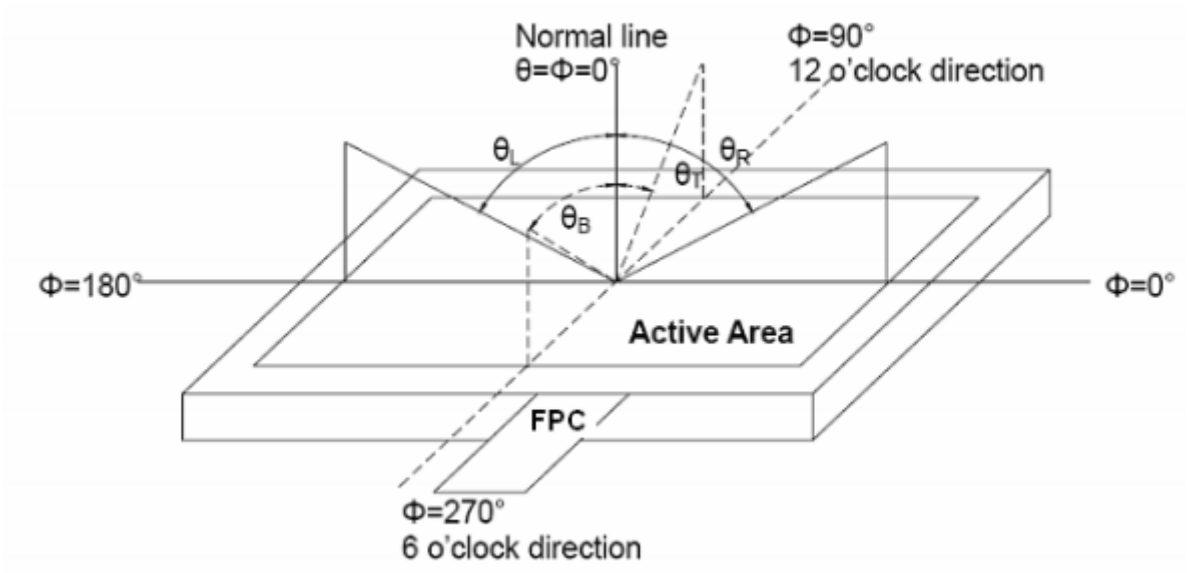


FIG. 3 The definition of Viewing Angle

Use Fig. 1(Test Procedure) under Measurement System to measure the contrast from the measuring direction specified by the conditions as the following figure.



9. Pin Description

Item	Terminal	I/O	Functions	
1	V_{LED+}	P	Power for LED backlight (Anode)	
2	V_{LED+}	P	Power for LED backlight (Anode)	
3	V_{LED-}	P	Power for LED backlight (Cathode)	
4	V_{LED-}	P	Power for LED backlight (Cathode)	
5	GND	P	Power ground	
6	V_{COM}	I	Common voltage	
7	DV_{DD}	P	Power for Digital Circuit	
8	MODE	I	DE/SYNC mode select	Note 1
9	DE	I	Data Input Enable	
10	VS	I	Vertical Sync Input	
11	HS	I	Horizontal Sync Input	
12	B7	I	Blue data(MSB)	
13	B6	I	Blue data	
14	B5	I	Blue data	
15	B4	I	Blue data	
16	B3	I	Blue data	
17	B2	I	Blue data	
18	B1	I	Blue data	Note 2
19	B0	I	Blue data(LSB)	Note 2
20	G7	I	Gree data(MSB)	
21	G6	I	Gree data	
22	G5	I	Gree data	
23	G4	I	Gree data	
24	G3	I	Gree data	
25	G2	I	Gree data	
26	G1	I	Gree data	Note 2
27	G0	I	Gree data(LSB)	Note 2

28	R7	I	Red data(MSB)	
29	R6	I	Red data	
30	R5	I	Red data	
31	R4	I	Red data	
32	R3	I	Red data	
33	R2	I	Red data	
34	R1	I	Red data	Note 2
35	R0	I	Red data(LSB)	Note 2
36	GND	P	Power Ground	
37	DCLK	P	Sample clock	Note 2
38	GND	P	Power Ground	
39	L/R	I	Left / right selection	Note 4,5
40	U/D	I	Up/down selection	Note 4,5
41	V_{GH}	P	Gate ON Voltage	
42	V_{GL}	P	Gate OFF Voltage	
43	AV_{DD}	P	Power for Analog Circuit	
44	RESET	I	Global reset pin.	Note 6
45	NC	-	No connection	
46	V_{COM}	I	Common Voltage	
47	DITHB	I	Dithering function	Note 7
48	GND	P	Power Ground	
49	NC	-	No connection	
50	NC	-	No connection	

I: input, O: output, P: Power

Note 1: DE/SYNC mode select. Normally pull high.
When select DE mode, MODE="1", VS and HS must pull high.
When select SYNC mode, MODE= "0", DE must be grounded.

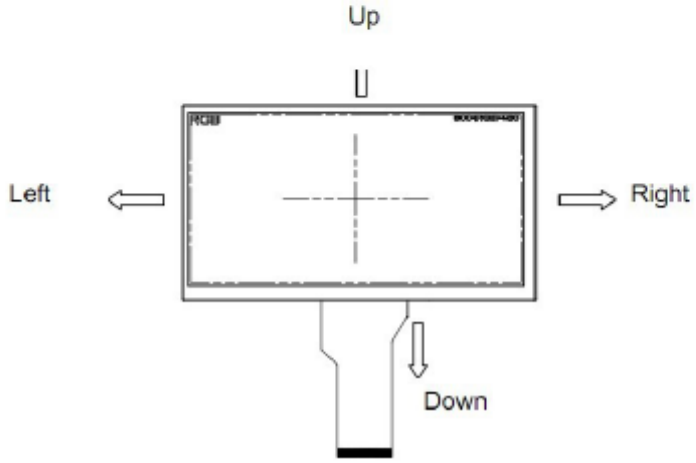
Note 2: When input 18 bits RGB data, the two low bits of R,G and B data must be grounded.

Note 3: Data shall be latched at the falling edge of DCLK.

Note 4: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	L/R	
GND	DV_{DD}	Up to down, left to right
DV_{DD}	GND	Down to up, right to left
GND	GND	Up to down, right to left
DV_{DD}	DV_{DD}	Down to up, left to right

Note 5: Definition of scanning direction.
Refer to the figure as below:



Note 6: Global reset pin. Active low to enter reset state. Suggest to connect with an RC reset circuit for stability. Normally pull high.

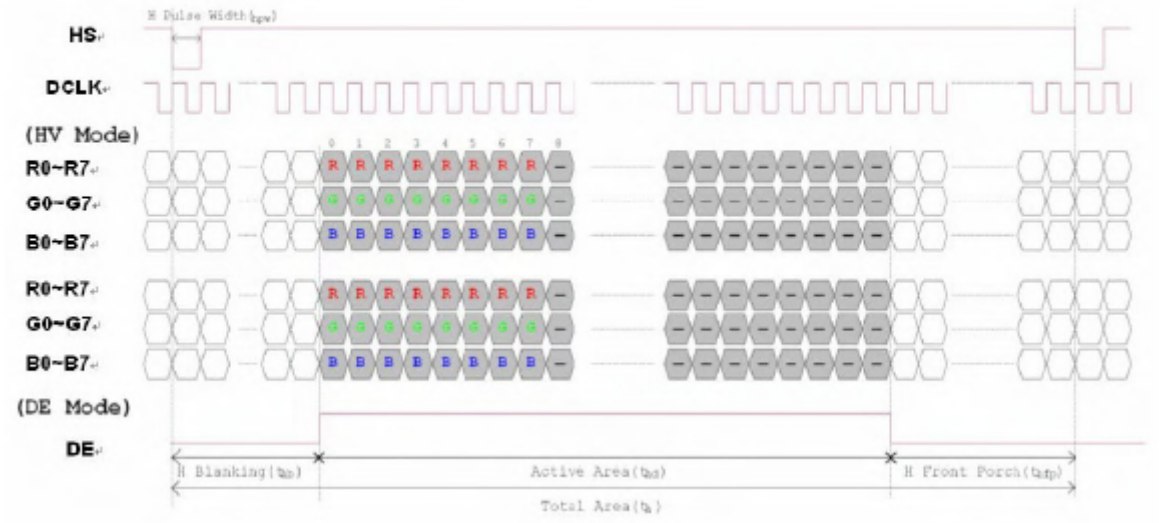
Note 7: Dithering function enable control, normally pull high.
When DITHB="1",Disable internal dithering function,
When DITHB="0",Enable internal dithering function,

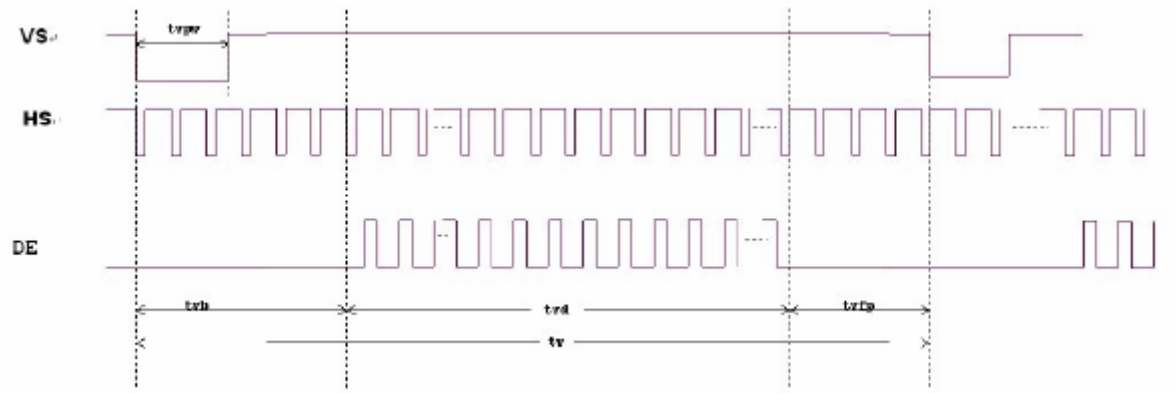
10.Timing Characteristics

10.1 AC Electrical Characteristics

Item	Symbol	Values			Unit	Remark
		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 hole time	T_{dhd}	8	-	-	ns	
DE setup time	T_{esu}	8	-	-	ns	
DE hole time	T_{ehd}	8	-	-	ns	
DV_{DD} Power On Slew rate	T_{POR}	-	-	20	ms	From 0 to 90% DV_{DD}
RESET pulse width	T_{Rst}	1	-	-	ms	
DCLK cycle time	T_{coh}	20	-	-	ns	
DCLK pulse duty	T_{cwh}	40	50	60	%	

.2 Data Input Format





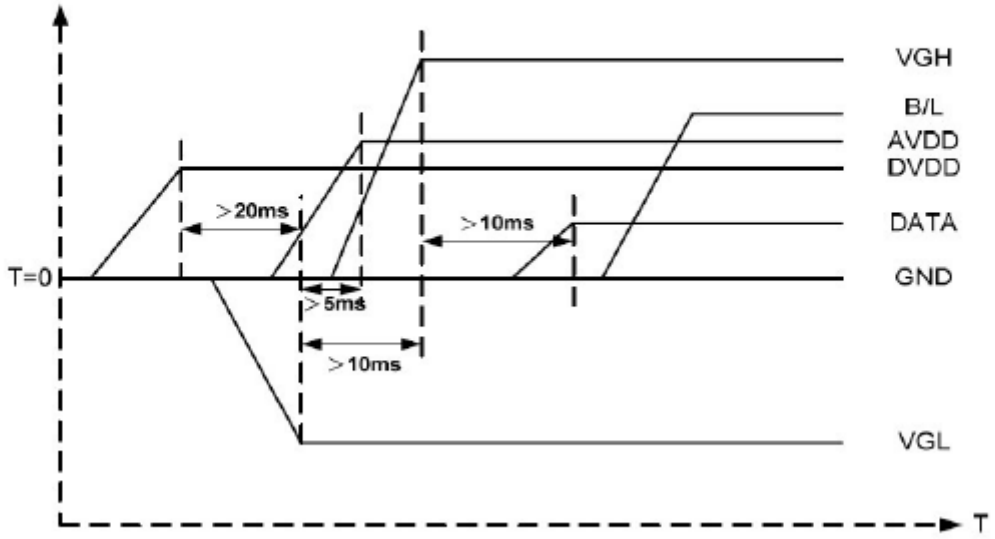
3 Timing

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK Frequency	fclk	26.4	33.3	46.8	MHz	
One Horizontal Line	th	862	1056	1200	DCLK	
HS pulse width	thpw	1	-	40	DCLK	
HS Blanking	thb	46	46	46	DCLK	
HS Front Porch	thfp	16	210	354	DCLK	

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Vertical Display Area	tvd	-	480	-	TH	
VS period time	tv	510	525	650	TH	
VS pulse width	tvpw	1	-	20	TH	
VS Blanking	tvb	23	23	23	TH	
VS Front Porch	tvfp	7	22	147	TH	

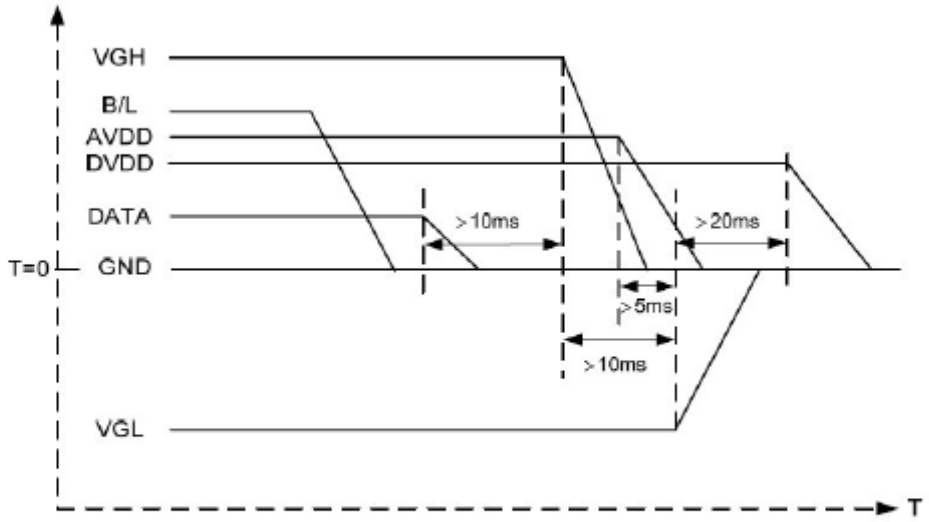
4 Power on/off Sequence

a. Power on:



DV_{DD}→VGL→VGH→Data→B/L

b. Power off:



B/L→Data→VGH→VGL→DV_{DD}

Note: Data include R0~R7, B0~B7, GO~G7, U/D, L/R, DCLK, HS,VS,DE.

11. RELIABILITY

No.	Test Item		Test Conditions	Remark
1	High Temperature	Storage	80℃, 120Hr	Note
		Operation	70℃, 120Hr	Note
2	Low Temperature	Storage	-30℃, 120Hr	Note
		Operation	-20℃, 120Hr	
3	High Temperature and High Humidity		60℃, 90%RH, 240Hr	Note
4	Peeling Off (Storage)		≧500gf/cm	Note
5	FPC Bending Test		≧6,000 times, 2/sec	Note
6	Vibration Test(Storage)		50HZ, 30min, Amplitude: 2 cm, X/Y/Z directions	Note
7	Drop Test		60cm/ 3Corner/ 8Face, 1Cycle	Note

Note:

1) The test samples should be applied to only one test item.
2) Sample size for each test item is 5~10pcs.
3) For Damp Proof Test, pure water(Resistance>1MΩ) should be used.
4) In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
5) EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and fluorescence EL has.
6) After the reliability test, the test samples should be inspected after 2 hours at least.
7) Functional test is OK. Missing segment, shorts, unclear segment, non display, display abnormally, liquid crystal leak are not allowed.
8) After testing, the current Idd should be within initial value ±20%.
9) No low temperature bubbles ,end seal loose and fall, frame rainbow, ACF bubble growing are allowable in the appearance test.

12. USING LCD MODULES

12-1. Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

1. Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
2. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc).
3. N-hexane is recommended for cleaning the adhesive used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropylalcohol.
4. When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. Do not scrub hard to avoid damaging the display surface.
5. Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.
6. Avoid contacting oil and fats.
7. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.
8. Do not put or attach anything on the display area to avoid leaving marks on.
9. Do not touch the display with bare hands .This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).
10. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

12-2. Precaution for Handling LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

1. Do not alter, modify or change the shape of the tab on the metal frame.
2. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
3. Do not damage or modify the pattern writing on the printed circuit board.
4. Absolutely do no modify the zebra rubber strip (conductive rubber) or heat seal connector.
5. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
6. Do not drop, bend or twist LCM.

12-3. Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

1. Make certain that you are grounded when handing LCM.

2. Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.
3. When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
4. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
5. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
6. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%~60% is recommended.

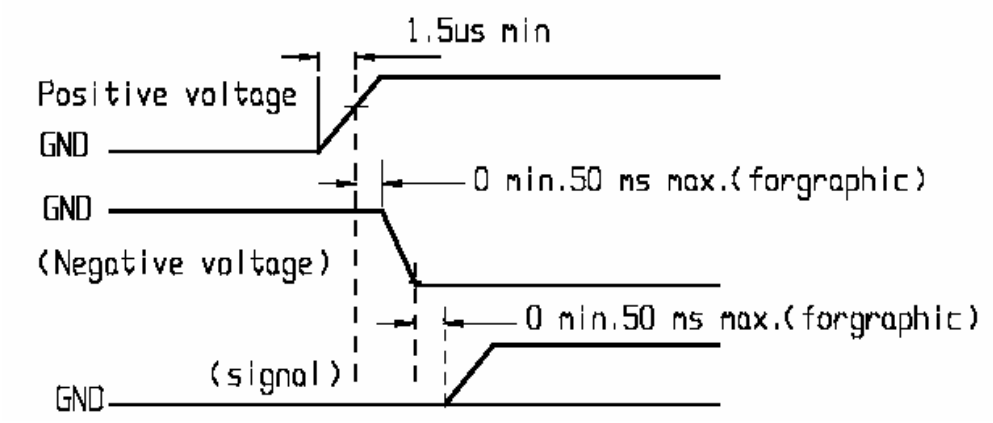
12-4. Precaution for soldering to the LCM

1. Observe the following when soldering lead wire, connector cable and etc. to the LCM.
   - Soldering iron temperature: 280℃±10℃
   - Soldering time: 3-4 sec.
   - Solder: eutectic solder.

   If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non- halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage dug to flux spatters.
2. When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature of the soldering iron.
3. When remove the electroluminescent panel form the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged

12-5. Precaution for Operation

1. Viewing angle varies with the change of liquid crystal driving voltage (Vo). Adjust Vo to show the best contrast.
2. Driving the LCD in the voltage above the limit shortens its life.
3. Response time is greatly at temperature below the operating temperature range. However, this does not mean the LCM will be out of the order. It will recover when it returns to the specified temperature range.
4. If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
5. Condensation of terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of 40℃,50%RH .
6. When turning the power on, input each signal after the positive/negative voltage becomes stable.



12-6. Storage

When storing LCD as spares for some years, the following precaution are necessary.

1. Store them in a sealed polyethylene bag. If properly sealed, there is no need for dessicant.
2. Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0℃ and 35℃.
3. The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped.)
4. Environmental conditions:
   - Do not leave them for more than 168hrs. at 60℃.
   - Should not be left for more than 48hrs. at -20℃.

12-7. Safety

1. It is recommended to crush damaged or unnecessary LCD into pieces and wash off with solvents such as acetone and ethanol, which should later be burned.
2. If any liquid leak out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

12-8. Limited Warranty

Unless agreed between BONA and customer, BONA will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with BONA LCD acceptance standards(copies available upon request) for a period of one year from date of shipments. Cosmetic/ visual defects must be returned to BONA within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of BONA limited to repair and/or replacement on the terms set forth above. BONA will not be responsible for any subsequent or consequential events.

12-9. Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:

- Broken LCD glass.
- PCB eyelet's damaged.

- PCB conductors damaged.

-Circuit modified in any way, including addition of components.

- PCB tampered with by grinding, engraving or painting varnish.

-Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet's conductors and terminals.