CONFIDENTIAL(B)

SPECIFICATION

OF

LIQUID CRYSTAL DISPLAY MODULE

UNITED RADIANT TECHNOLOGY CORP. 光聯科技 Aug-03-2022 品管部 QC DEPT.

CUSTOMER : URT-STD

Model No. : UMOH-9601MD-1T

Model version : 1

Document Revision : 1

CUSTOMER APPROVED SIGNATURE			

This specification need to be signed by purchaser or customer as a specification of products production and delivery from URT. Without signature of this specification , any purchase order for this model no. will be treated and considered that this specification is automatically acknowledged and accepted by purchaser or customer.

U.R.T. UNITED RADIANT TECHNOLOGY CORPORATION

Joe Wu	Ashin Chiu	Jenny Wang	Aug-03-2022
APPROVED	CHECKED	PREPARED	Date

COMPANY : No. 2,Fu-hsing Road,Taichung Tanzi Technology Industrial Park,Tantzu,Taichung,Taiwan,R.O.C.
TEL: 886-4-25314277 FAX: 886-4-25313067

Revision record

Document Revision	Model No. Version No.	Description	Revision by
0	UMOH-9601MD-1T Version No. 0	1. Change 7” TFT panel & LCD driver IC. 2. Modify module number from UMSH-8596MD-1T(REVD) to UMOH-9601MD-1T.	H.F. Kuo Emir Lu Mar/04/2022
1	UMOH-9601MD-1T Version No. 1	1. Add packing mode. 2. Modify the 8.4 inspection standard of TFT-LCD.	H.F. Kuo Emir Lu Aug/03/2022

CONTENTS:

1. BASIC SPECIFICATION

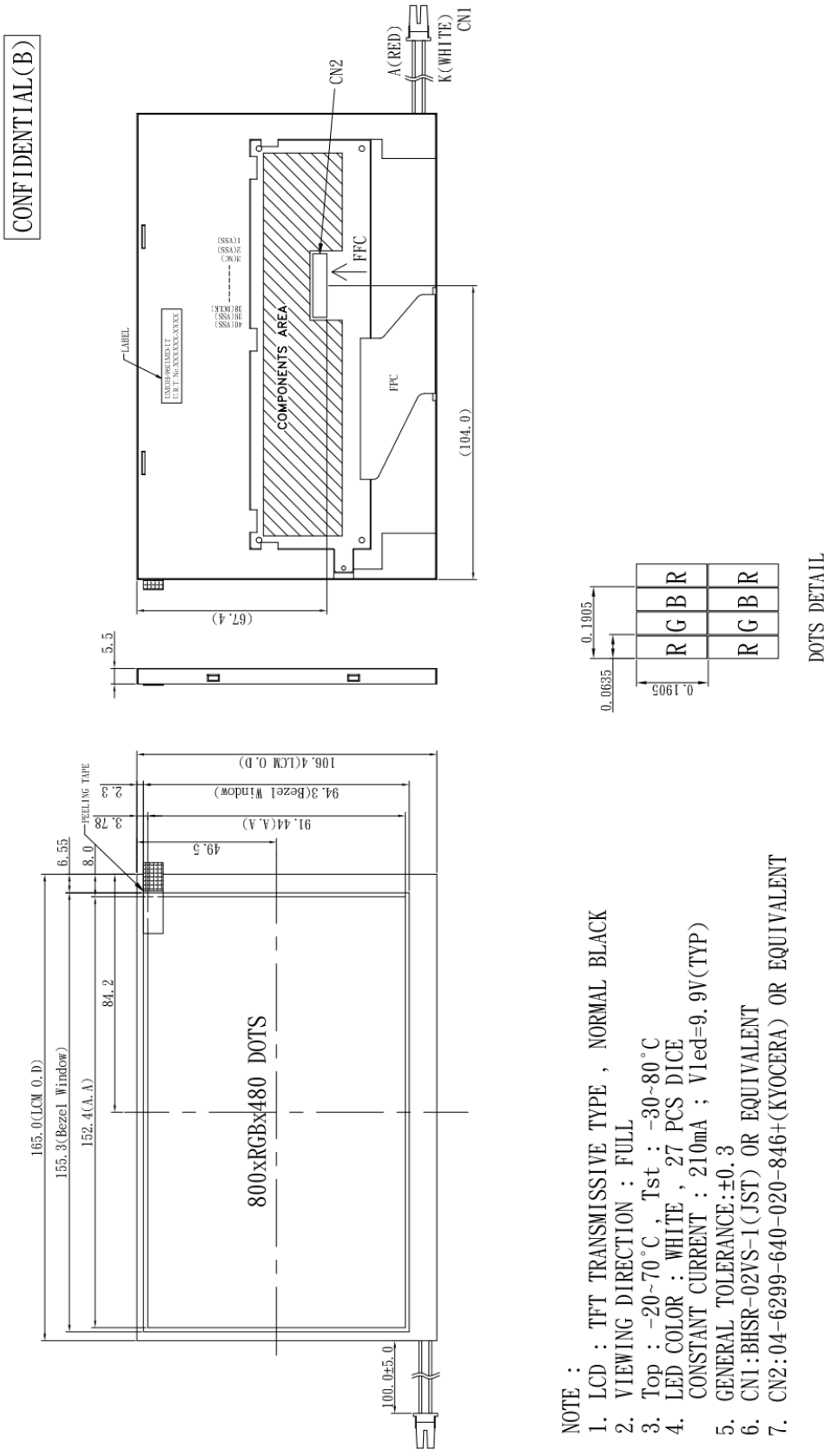
1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Active screen size	7.0” Diagonal	-
Dot Matrix	800 x RGB x 480	dots
Module Size (W x H x T)	165.0 x 106.4 x 5.5	mm.
Active Area (W x H)	152.4 x 91.44	mm.
Pixel Size (W×H)	0.1905 x 0.1905	mm.
Color depth	262K	color
Interface	Parallel 18-bit RGB	-
Driving IC Package	COG	-
Module weight	128±10%	g

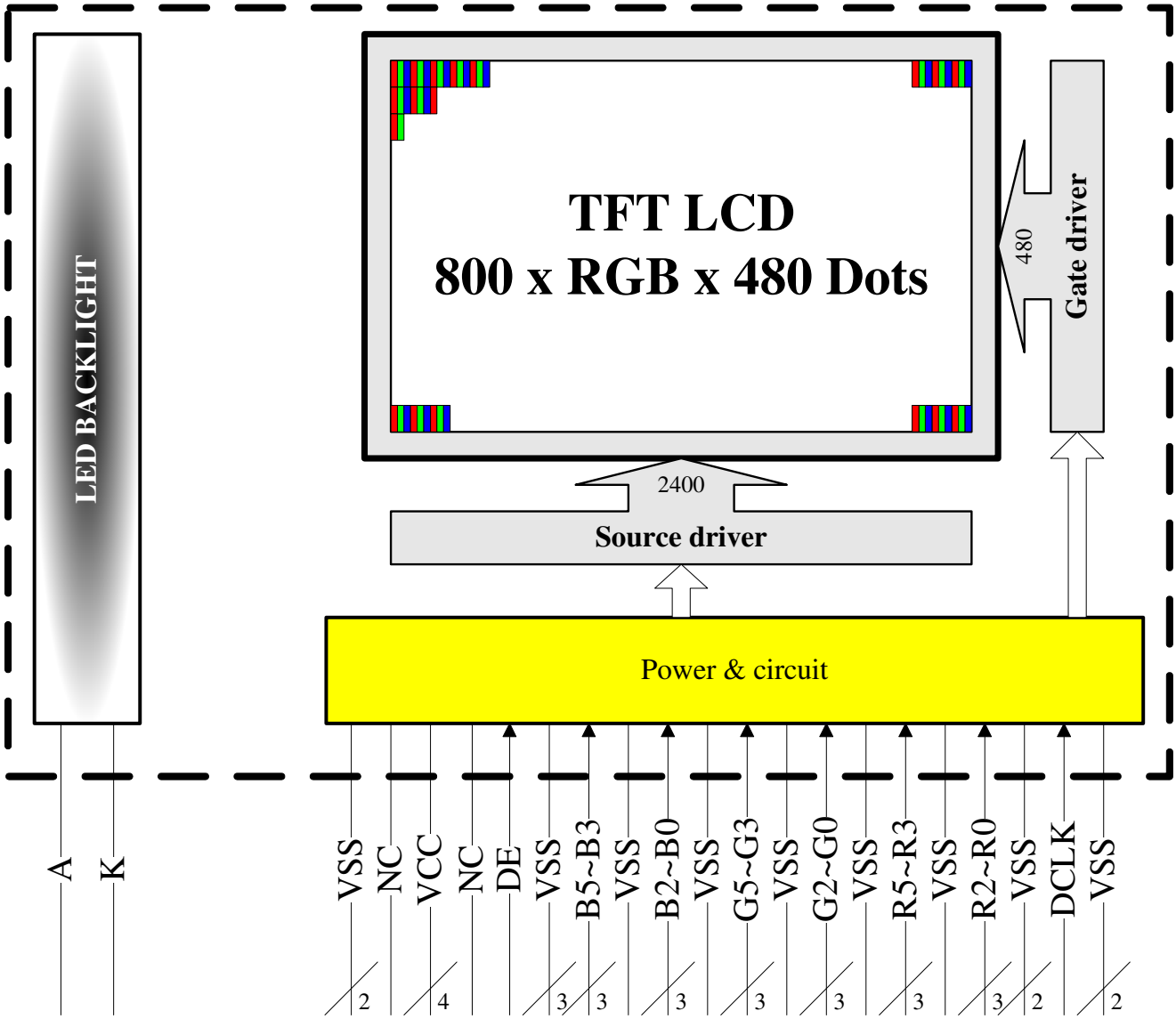
1.2 Display specification

Display	Descriptions	Note
LCD Type	IPS	-
LCD Mode	Normally Black	-
Polarizer Mode	Transmissive	-
Polarizer Surface	Anti-glare	-
Pixel arrangement	RGB-stripe	-
Backlight Type	LED	-
Viewing Direction	Full	-

1.3 Outline dimension



1.4 Block diagram:



1.5 Interface Pin Connection:

Pin No.	Pin Symbol	I/O	Description
1~2	VSS	P	GND
3	NC	-	No connection
4~7	VCC	P	Power supply for Module (+3.3V)
8	NC	-	No connection
9	DE	I	Data enable
10~12	VSS	P	GND
13~15	B5~B3	I	Blue data input
16	VSS	P	GND
17~19	B2~B0	I	Blue data input
20	VSS	P	GND
21~23	G5~G3	I	Green data input
24	VSS	P	GND
25~27	G2~G0	I	Green data input
28	VSS	P	GND
29~31	R5~R3	I	Red data input
32	VSS	P	GND
33~35	R2~R0	I	Red data input
36~37	VSS	P	GND
38	DCLK	I	Dot clock
39~40	VSS	P	GND

B/L interface pin：

Pin No.	Pin Symbol	I/O	Description
1	A	P	Power supply for LED+
2	K	P	Power supply for LED-

2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Power supply voltage	VCC	-0.3	4.5	V
Input voltage	Vin	-0.3	4.5	V
Operate temperature range	TOP	-20	70	℃
Storage temperature range	TST	-30	80	℃

2.2 DC Characteristics:

T_a= 25℃

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage	VCC	3.0	3.3	3.6	V	-
Input Voltage	V_{IL}	0	-	0.3*VCC	V	Note 1
	V_{IH}	0.7*VCC	-	VCC	V	Note 1
Current consumption	I_{VCC}	-	130	250	mA	Note 2

*Note1 :

HSYNC, VSYNC, DE, Digital Data.

*Note2 :

Measuring Condition:

Standard Value MAX.

Ta = 25℃

VCC -GND = 3.3V

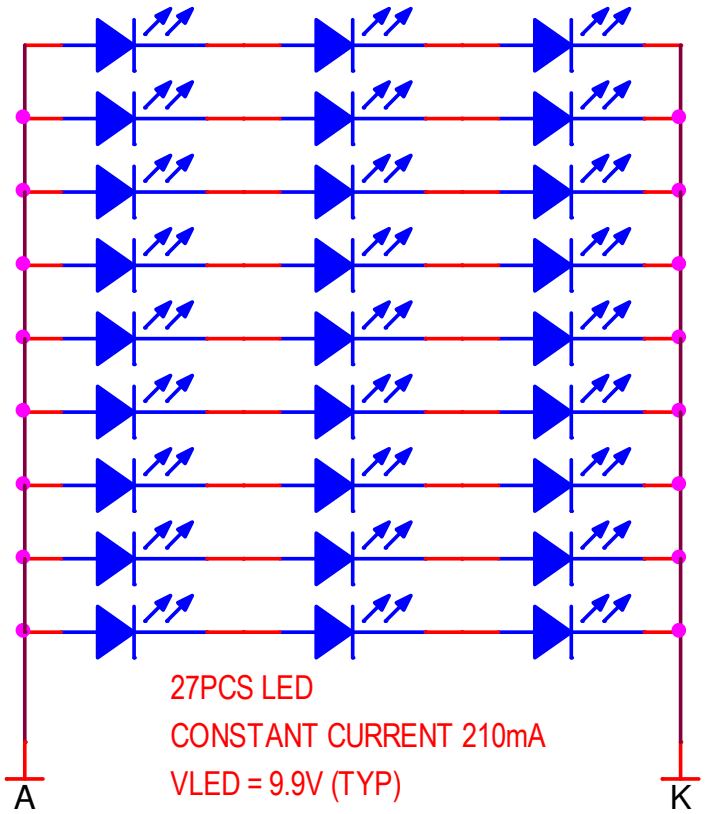
Display Pattern = Check pattern

2.3 Back-light only Specification :

PARAMETER	SYMBOL	MIN	TYP	MAX	Unit	Test Condition	NOTE
Supply Current	If	-	210	-	mA	Ta=25℃	-
Supply Voltage	Vf	7.95	9.9	10.35	V	Ta=25℃	-
Half-Life Time	Lf	-	50000	-	hrs	Ta=25℃	1

Note 1：The "Half-Life Time" is defined as the LED chip brightness decreases to 50% than original brightness, Based on Ta 25±2℃,60±10% RH condition.

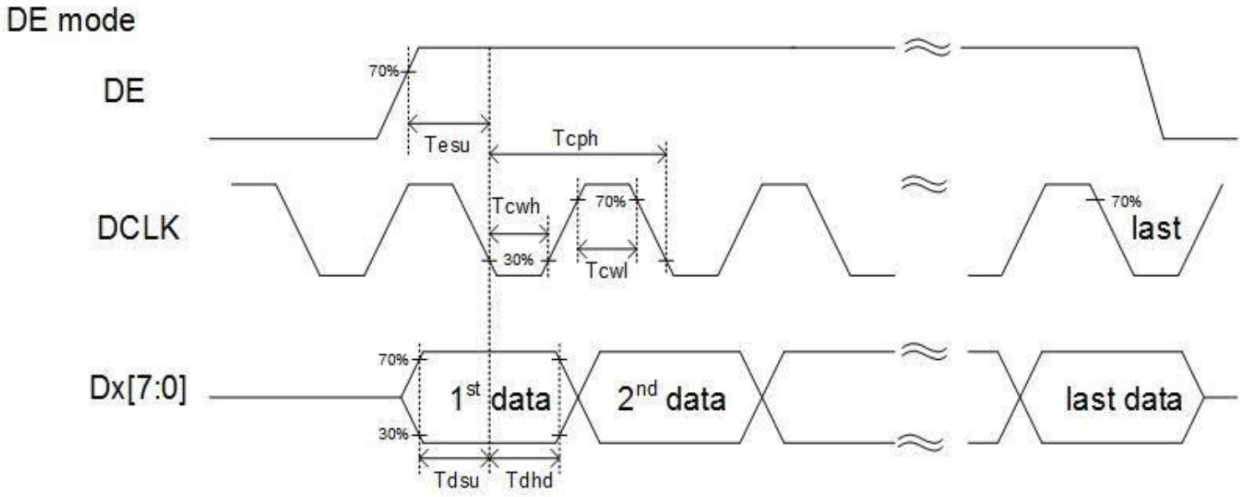
Note 2：LED backlight is 27 LEDs.



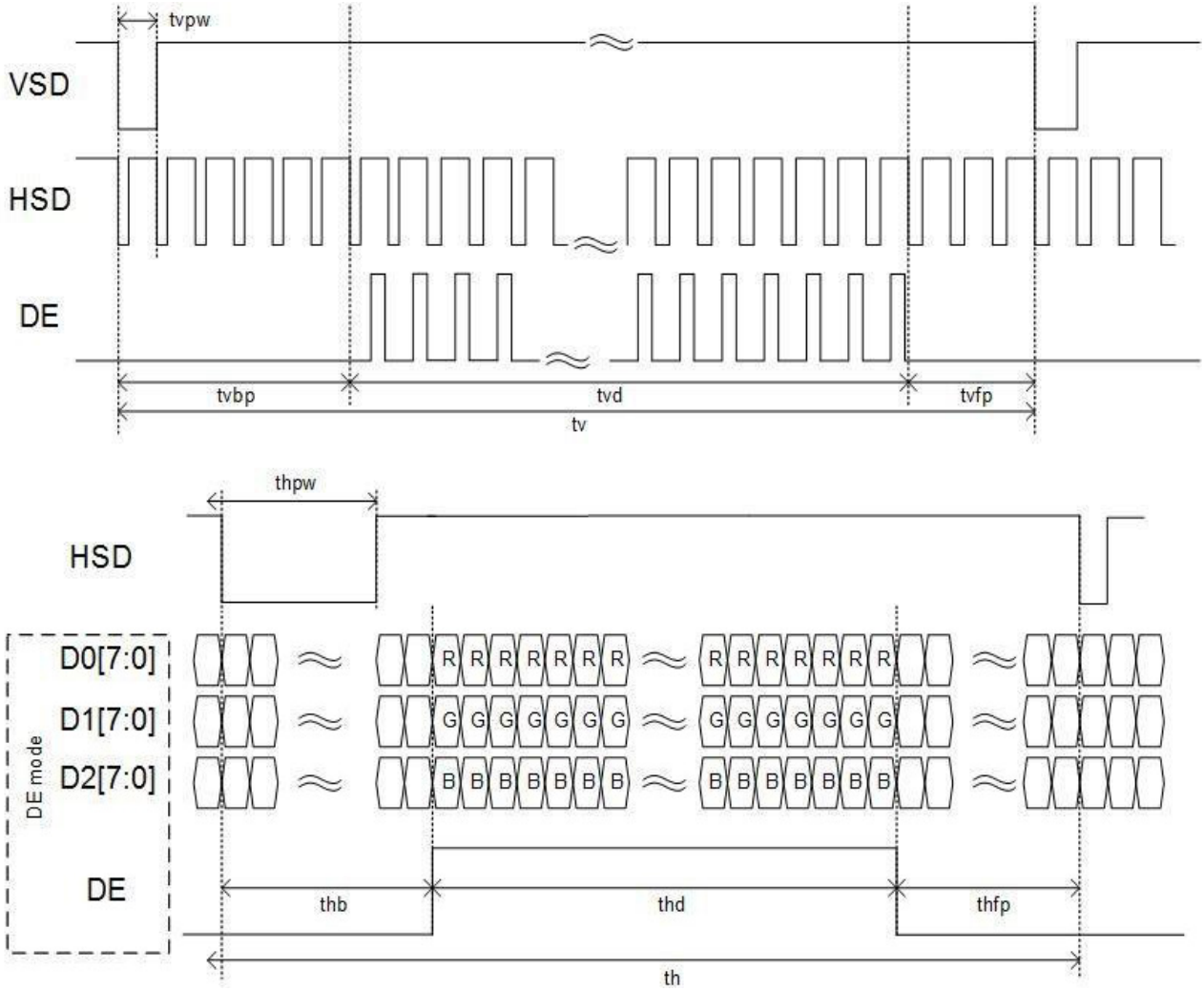
2.4 AC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK cycle time	Tcph	20		220	ns	
DCLK pulse duty	Tcwh	35	50	65	%	
VSD setup time	Tvst	8			ns	
VSD hold time	Tvhd	8			ns	
HSD setup time	Thst	8			ns	
HSD hold time	Thhd	8			ns	
Data setup time	Tdsu	8			ns	
Data hold time	Tdhd	8			ns	
DE setup time	Tesu	8			ns	
DE hold time	Tehd	8			ns	
DCLK frequency	fclk	28	30	32	MHz	
Horizontal display area	thd		800		Tcph	
HSD period time	th	889	902	915	Tcph	
HSD pulse width	thpw	5	10	15	Tcph	
HSD back porch	thb		32		Tcph	
HSD front porch	thfp	52	60	68	Tcph	
Vertical display area	tvd		480		th	
VSD period time	tv	546	555	564	th	
VSD pulse width	tvpw	6	10	14	Th	
VSD back porch	tvb		5		th	
VSD front porch	tvfp	55	60	65	th	

Timing Controller Timing Chart

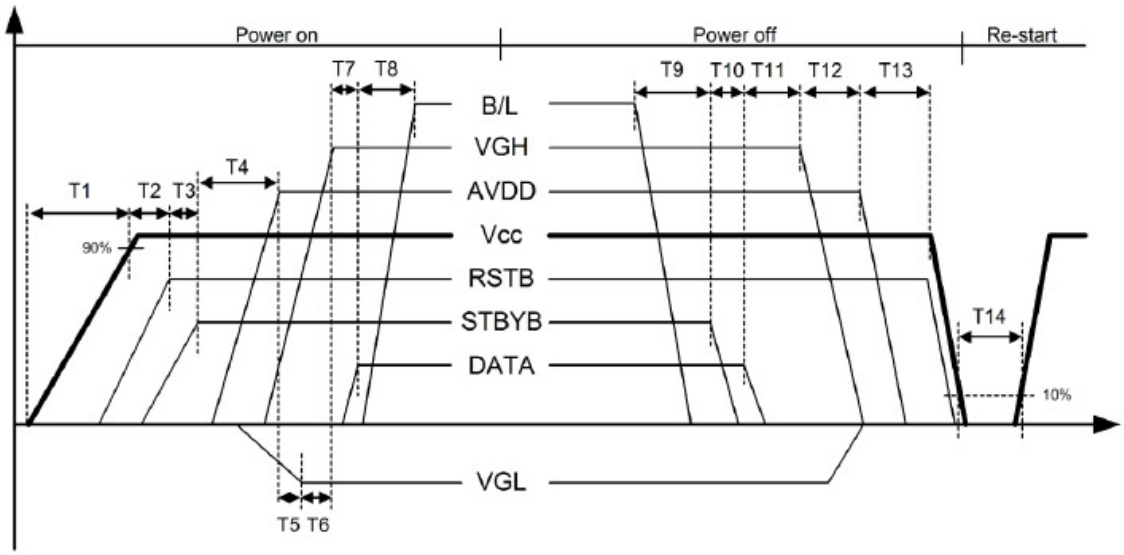


Input clock and timing diagram.



Data Input Format.

2.5 Power Sequence :



Item	Min	Typ.	Max.	Unit
T1	--	--	20	ms
T2	1	--	--	ms
T3	1	--	--	ms
T4	50	--	--	ms
T5	32	--	--	ms
T6	16	--	--	ms
T7	16	--	--	ms
T8	32	--	--	ms
T9	32	--	--	ms
T10	32	--	--	ms
T11	50	--	--	ms
T12	16	--	--	ms
T13	32	--	--	ms
T14	1000	--	--	ms

The Data are included in the R0~R7, G0~G7, B0~B7, HSD, VSD, DCLK, DE, MODE, SHLR, and UPDN.

3. OPTICAL CHARACTERISTICS

3.1 Characteristics

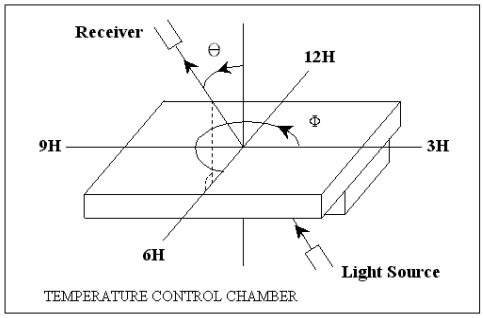
Electrical and Optical Characteristics

No.	Item			symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	Response Time			Tr+Tf	25 ℃	-	30	40	ms	2
2	Viewing Angle	Hor.	Cr≧10	θ_{2+}	Φ= 0°	80	85	-	degree	3
				θ_{2-}	Φ= 180°	80	85	-		
		Ver.		θ_{1+}	Φ= 270°	80	85	-		
				θ_{1-}	Φ= 90°	80	85	-		
3	Contrast Ratio			Cr	25 ℃	700	1000	-	-	4
4	Red x-code			Rx	25 ℃	0.59	0.64	0.69	-	5
	Red y-code			Ry		0.29	0.34	0.39		
	Green x-code			Gx		0.28	0.33	0.38		
	Green y-code			Gy		0.58	0.63	0.68		
	Blue x-code			Bx		0.10	0.15	0.20		
	Blue y-code			By		0.00	0.05	0.10		
	White x-code			Wx		0.26	0.31	0.36		
	White y-code			Wy		0.29	0.34	0.39		
	Brightness			Y		400	500	-	cd/m^2	
5	Brightness Uniformity			U	25 ℃	80	-	-	%	6

3.2 Definition of optical characteristics

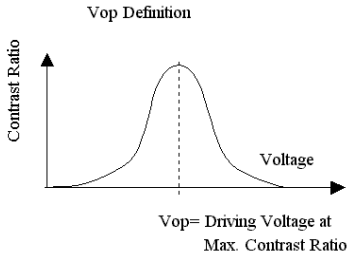
Measurement condition :

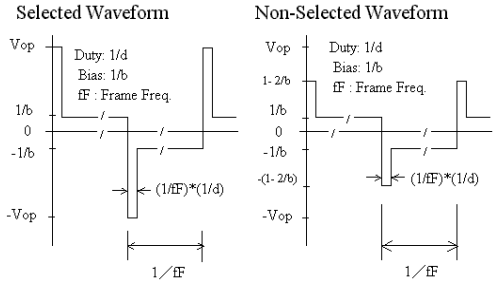
Transmissive and Transflective type



PHOTAL LCD-5000

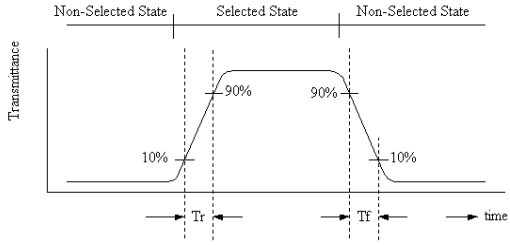
[Note 1] Definition of LCD Driving Vop and Waveform :



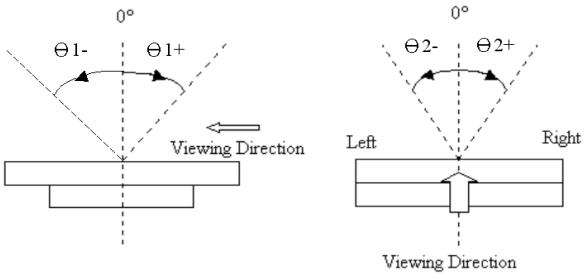


[Note 2] Definition of Response Time

for Negative type :

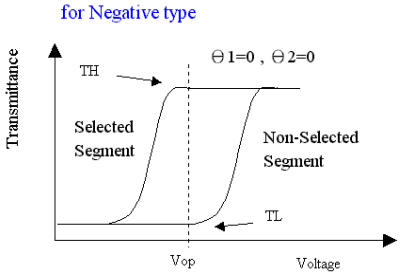


[Note 3] Definition of Viewing Angle :



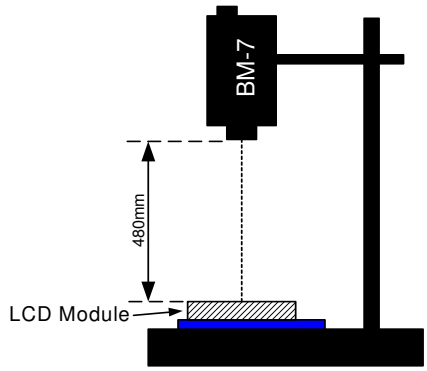
[Note 4] Definition of Contrast Ratio :

for Negative type

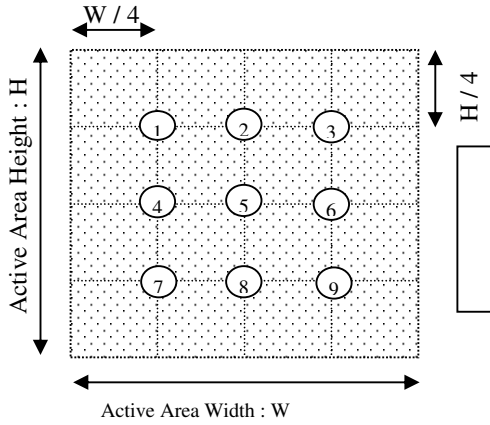


$$\text{Contrast Ratio} = \frac{TH}{TL}$$

[Note 5] Definition of measurement of Color Chromaticity and Brightness

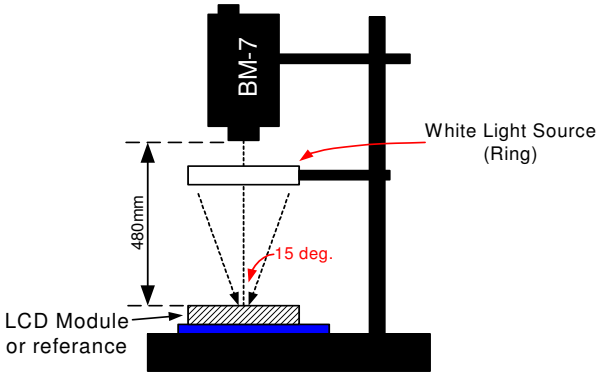


[Note 6] Definition of Brightness Uniformity



$$\text{Brightness Uniformity} = \frac{\text{Minimum Brightness of Point 1~9}}{\text{Maximum Brightness of Point 1~9}}$$

[Note 7] Definition of Measurement of Reflectance



4. RELIABILITY :

Item No	Items	Condition	Note
1	High temperature operating	70 ℃ , 200 hours	1
2	Low temperature operating	-20 ℃ , 200 hours	1
3	High temperature storage	80 ℃ , 200 hours	1
4	Low temperature storage	-30 ℃ , 200 hours	1
5	High temperature & humidity storage	60℃, 90%RH, 100 hours	2
6	Thermal Shock storage	-30℃, 30min.<=> 80℃, 30min. 10 Cycles	1
7	Vibration test	10 => 55 =>10 => 55 => 10 Hz , within 1 minute Amplitude : 1.5mm. 15 minutes for each Direction (X,Y,Z)	
8	Drop test	Packed, 100CM free fall, 6 sides, 1 corner, 3edges	
9	Life time	50,000 hours 25℃ , 60%RH , specification condition driving	

Note 1：The product move into the room temperature for at least 2 hours with no condensation.
Note 2：The product move into the room temperature for at least 24 hours with no condensation.
Note 3 : Please change the display picture (autorun) during operating mode. Avoid displaying static images to avoid image sticking , and the image sticking is accelerated by temperature.

* One single product test for only one item.
* Judgment after test : keep in room temperature for more than 2 hours.
- Current consumption < 2 times of initial value
- Function : work normally

5. PRODUCT HANDLING AND APPLICATION

☐ PRECAUTION FOR HANDLING LCM

- The LCD module contains a C-MOS LSI. People who operate the LCM should wear ESD protection eguipement to prevent ESD hurt on products.
- Do not input any signal before power is turned on.
- Do not take LCM from its packaging bag until it is assembled.
- Peel off the LCM protective film slowly since static electricity may be generated.
- Pay attention to the humidity of the work shop, 50~60%RH is satisfactory.
- Use a non-leak iron for soldering LCM.
- Do not touch the display surface or connection terminals area with bare hands.Smudges on the display surface reduce the insulation between terminals.
- Cautions for soldering to LCM:

  Condition for soldering I/O terminals:
  Temperature at iron tip :350℃±15℃.
  Soldering time : 3~4sec./ terminals.
  Type of solder : Eutectic solder(rosin flux filled).

☐ PRECAUTION IN USE OF LCM

- Do not contact or scratch the front surface and the contact pads of a LCM with hard materials such as metal or glass or with one's nail.
- To clean the surface , wipe it gently with soft cloth dampened by alcohol.
- Do not attempt to wiped off the contact pads.
- Keep LCM panels away from direct sunlight , also avoid them in high-temperature & high humidity environment for a long period.
- Do not expose LCM to organic solvent.
- Liquid in LCM is hazardous substance. In case a contact with liquid crystal material is occured, be sure to immediately wash such material away by soap and water.
- The polarizer is easily damaged and should be handle with special care. Don't press or rub it with hard objects.

☐ PRECAUTION FOR STORING AND USE OF LCM

- To avoid degradation of the device , do not store the module under the conditions of direct sunlight , high temperature or high humidity . Keep the module in bags designed to prevent static electricity charging under low temperature / normal humidity conditions(avoid high temperature / high humidity and low temperature below 0℃)
- Never use the LCD , LCM under 45 Hz , the liquid crystal will decomposition and cause permently damage on display !!

☐ USING ON MEDICAL CARE , SAFETY OR HAZARDOUS APPLICATION OR SYSTEM

- For the application in medical care, safety and hazardous prodcuts or systems, an authorization from URT is required. URT will not responsible for any damage or loss which caused by the products without any authorization given by URT.
- This product is not allowed to be designed and used for military application and/or purpose.
- The delivery of this product to the countries and/or regions where the embargoes are imposed by U.N. is prohibited.
- The application and delivery of this product must comply with Startegic High-Tech Commodities (SHTC) export control and the sales to the embargoed and/or sanctioned countries or regions are strictly prohibited.

6. DATE CODE OF PRODUCTS

- Date code will be shown on each product :

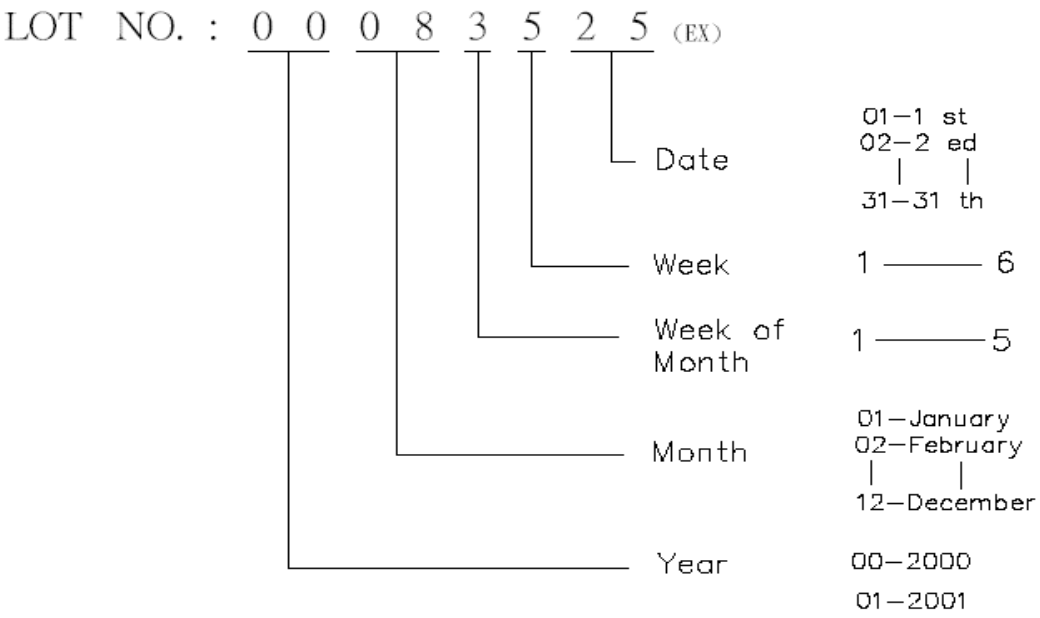
- **YY MM DD - XXXX**
  Year Month Day - Production Lot No.

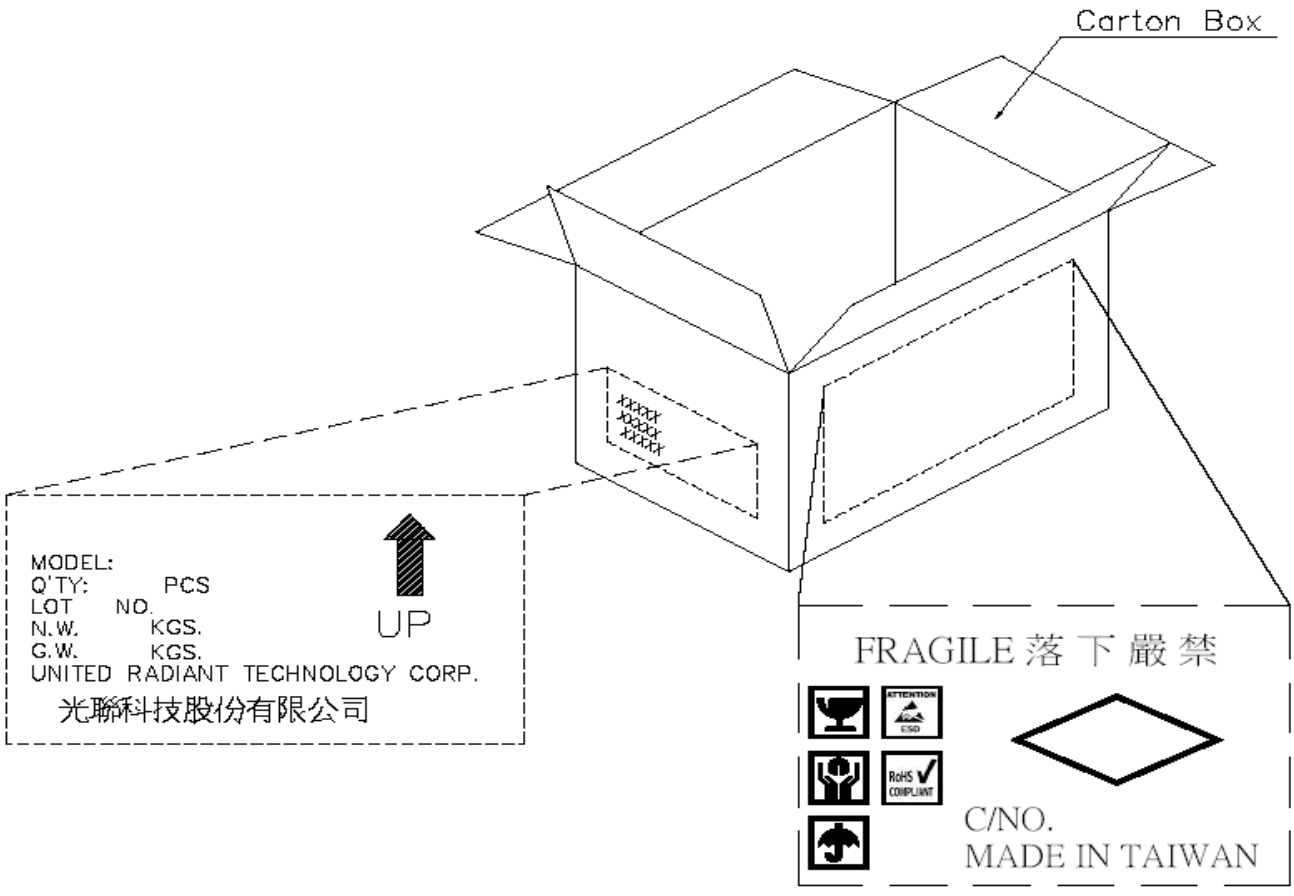
- Example: 121108 - 0003 ==> Year 2012, November,8th , Production Lot No. 0003

Note ： The lot no. attached on the packing box will be used for tracking once the part is too small to print the date code.

7. LOT NO. & PACKING

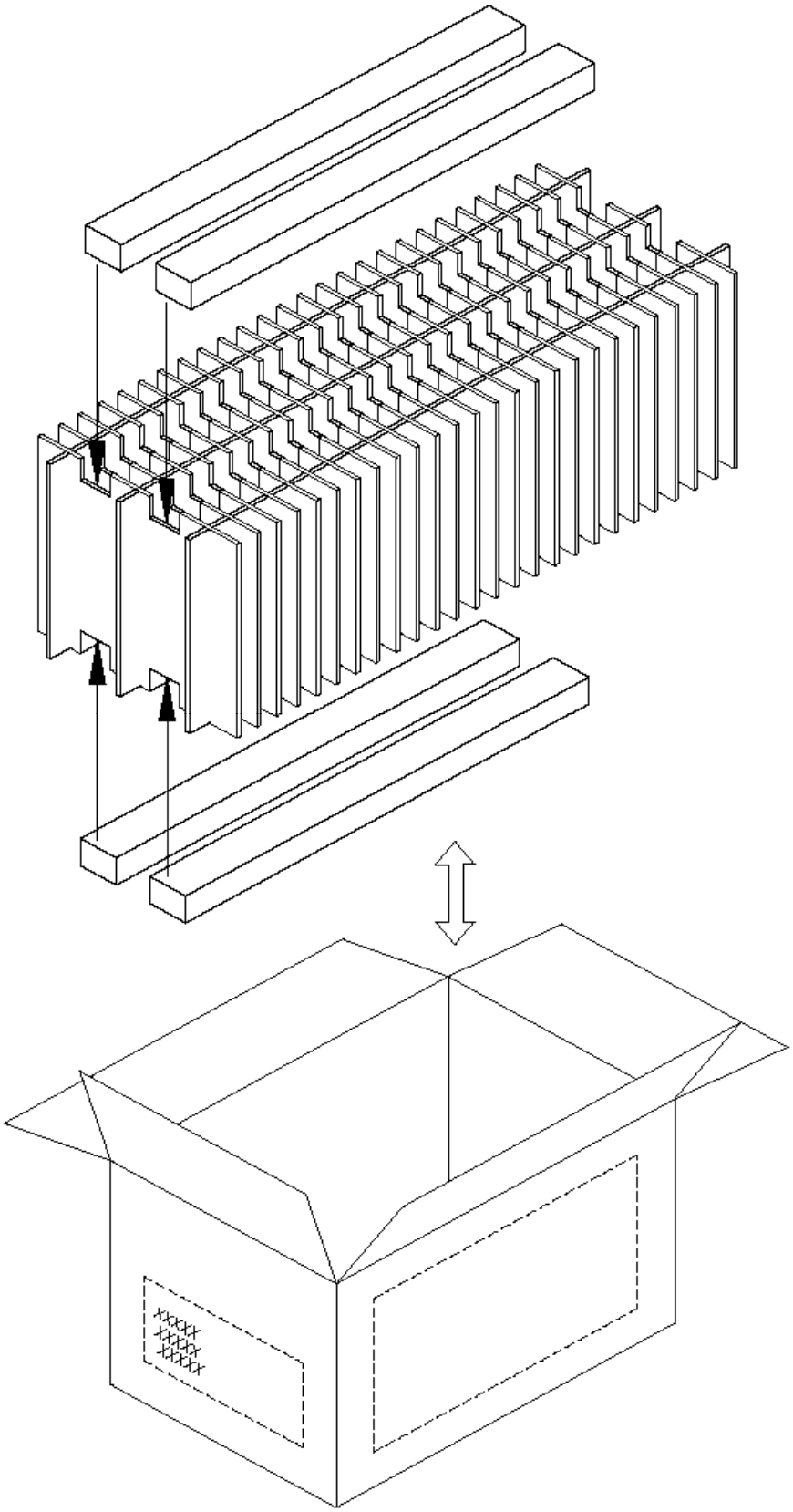
Instruction of lot number:





MODEL NO: UMOH-9601MD-1T NOTE:

50 PCS/CARTON Kg/carton (gross weight)



8. INSPECTION STANDARD

8.1. QUALITY :

THE QUALITY OF GOODS SUPPLIED TO PURCHASER SHALL COME UP TO THE FOLLOWING STANDARD.

8.1.1. THE METHOD OF PRESERVING GOODS

AFTER DELIVERY OF GOODS FROM U.R.T. TO PURCHASER. PURCHASER SHALL CONTROL THE LCM AT -10 ℃ TO 40 ℃ ,AND IT MIGHT BE DESIRABLE TO KEEP AT THE NORMAL ROOM TEMPERATURE AND HUMIDITY UNTIL INCOMING INSPECTION OR THROWING INTO PROCESS LINE.

8.1.2. INCOMING INSPECTION

(A) THE METHOD OF INSPECTION

IF PURCHASER MAKE AN INCOMING INSPECTION , A SAMPLING PLAN SHALL BE APPLIED ON THE CONDITION THAT QUALITY OF ONE DELIVERY SHALL BE REGARDED AS ONE LOT.

(B) THE STANDARD OF QUALITY

ISO2859-1 (SAME AS MIL-STD-105E) , LEVEL Ⅱ SINGLE PLAN.

CLASS	AQL(%)
MAJOR	0.65 %
MINOR	1.5 %

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

(C) MEASURE

IF AS THE RESULT OF ABOVE RECEIVING INSPECTION , A LOT OUT IS DISCOVERED. PURCHASER SHALL BE INFORM SELLER OF IT WITHIN SEVEN DAYS. BUT FIRST SHIPMENT WITHIN FOURTEEN DAYS.

8.1.3. WARRANTY POLICY

U.R.T. WILL PROVIDE ONE-YEAR WARRANTY FOR THE PRODUCTS ONLY IF UNDER SPECIFICATION OPERATING CONDITIONS. U.R.T. WILL REPLACE NEW PRODUCTS FOR THESE DEFECT PRODUCTS WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF U.R.T.

8.2. CHECKING CONDITION

8.2.1. VIEWING DISTANCE IS APPROXIMATELY：30 ± 5 CM.

8.2.2. VIEWING ANGLE IS NORMAL TO THE LCD PANEL WITH 45°.

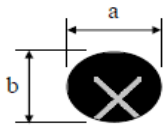
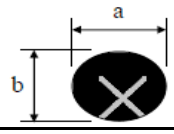
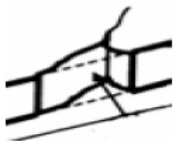
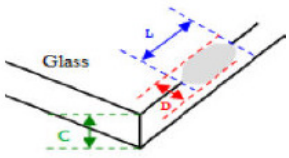
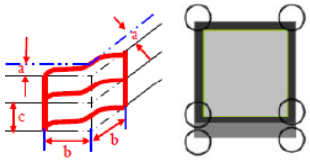
8.2.3. AMBIENT ILLUMINANCE：1000±200 LUX.

8.2.4. AMBIENT TEMPERATURE IS IN THE ROOM TEMPERATURE : 25℃±5℃

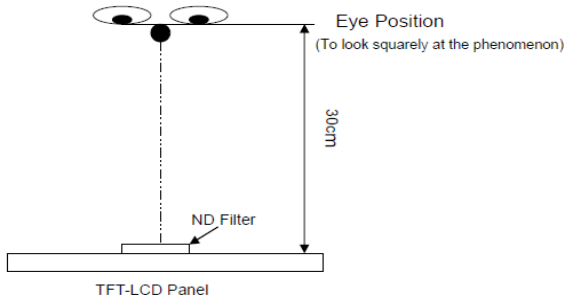
8.3. INSPECTION PLAN :

CLASS	ITEM	JUDGEMENT	CLASS
PACKING & INDICATE	1. OUTSIDE AND INSIDE PACKAGE	"MODEL NO." , "LOT NO." AND "QUANTITY" SHOULD INDICATE ON THE PACKAGE.	Minor
	2. MODEL MIXED AND QUANTITY	OTHER MODEL MIXED.....REJECTED QUANTITY SHORT OR OVER.....REJECTED	Major
	3. PRODUCT INDICATION	"MODEL NO." SHOULD INDICATE ON THE PRODUCT	Major
ASSEMBLY	4. DIMENSION, LCD GLASS SCRATCH AND SCRIBE DEFECT.	ACCORDING TO SPECIFICATION OR DRAWING.	Major
APPEARANCE	5. VIEWING AREA	POLARIZER EDGE OR LCD'S SEALING LINE IS VISABLE IN THE VIEWING AREA ……..REJECTED	Minor
	6. CANNOT BE REMOVED, BLEMISH BLACK SPOTS, WHITE SPOTS, ON THE LCD AND LCD GLASS CRACKS.	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	7. BLEMISH、BLACK SPOT WHITE SPOT AND SCRATCH ON THE POLARIZER	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	8. BUBBLE IN POLARIZER	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	9. LCD'S RAINBOW COLOR	STRONG DEVIATION COLOR (OR NEWTON RING) OF LCD.....REJECTED. OR ACCORDING TO LIMITED SAMPLE (IF NEEDED, AND INSIDE VIEWING AREA)	Minor
ELECTRICAL	10. ELECTRICAL AND OPTICAL CHARACTERISTICS (CONTRAST、VOP、 CHROMATICITY … ETC)	ACCORDING TO SPECIFICATION OR DRAWING . (INSIDE VIEWING AREA)	Major
	11.MISSING LINE	MISSING DOT、LINE、CHARACTER ....REJECTED	Major
	12.SHORT CIRCUIT、 WRONG PATTERN DISPLAY	NO DISPLAY、WRONG PATTERN DISPLAY、CURRENT CONSUMPTION OUT OF SPECIFICATION..... REJECTED	Major
	13. DOT DEFECT (FOR COLOR AND TFT)	ACCORDING TO STANDARD OF VISUAL INSPECTION	Minor

8.4. INSPECTION STANDARD OF TFT-LCD

<table>
<tr><th>NO.</th><th>CLASS</th><th colspan="2">ITEM</th><th>JUDGEMENT</th></tr>
<tr><td rowspan="2">8.4.1</td><td rowspan="2">MINOR</td><td rowspan="2">Foreign Material</td><td>Circular Foreign Material
※Φ=(a+b)/2
 
</td><td>unit : mm.
<table><tr><th>DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr><tr><td>Φ ≦ 0.20</td><td>DISREGARD</td></tr><tr><td>0.2 < Φ ≦ 0.50</td><td>4</td></tr><tr><td>0.50 < Φ</td><td>0</td></tr></table></td></tr>
<tr><td>Linear Foreign Material</td><td>unit : mm.
<table><tr><th>LENGTH</th><th>WIDTH</th><th>ACCEPTABLE Q'TY</th></tr><tr><td>------</td><td>W ≦0.05</td><td>DISREGARD</td></tr><tr><td>1.0<L≦ 5.0</td><td>0.05 < W ≦0.10</td><td>4</td></tr><tr><td>5.0<L</td><td>0.10 < W</td><td>0</td></tr></table></td></tr>
<tr><td rowspan="3">8.4.2</td><td rowspan="3">MINOR</td><td rowspan="3">Polarizer</td><td>Bubble(Circular Dent)
※Φ=(a+b)/2
 
</td><td>BM area：No count; AA area： unit : mm.
<table><tr><th>DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr><tr><td>Φ ≦ 0.20</td><td>DISREGARD</td></tr><tr><td>0.2 < Φ ≦ 0.50</td><td>4</td></tr><tr><td>0.50 < Φ</td><td>0</td></tr></table></td></tr>
<tr><td>Linear Scratch</td><td>unit : mm.
<table><tr><th>LENGTH</th><th>WIDTH</th><th>ACCEPTABLE Q'TY</th></tr><tr><td>------</td><td>W ≦0.05</td><td>DISREGARD</td></tr><tr><td>1.0<L≦ 5.0</td><td>0.05 < W ≦0.20</td><td>4</td></tr><tr><td>5.0<L</td><td>0.20 < W</td><td>0</td></tr></table></td></tr>
<tr><td>Peeling</td><td>BM area：No count
AA area：Pixel area：Not allowable.</td></tr>
<tr><td>8.4.3</td><td>MINOR</td><td colspan="2">Mura & Leak</td><td>ND 5 % (Note1)</td></tr>
<tr><td rowspan="6">8.4.4</td><td rowspan="6">MINOR</td><td colspan="2" rowspan="6">Light on defect</td><td>Bright Dots (Note 2)</td><td>N≦ 0</td></tr>
<tr><td>Dark Dots (Note 3)</td><td>N≦ 4</td></tr>
<tr><td>Bright Dot- 2 Adjacent</td><td>N≦ 0</td></tr>
<tr><td>Dark Dots- 2 Adjacent (Note 4)</td><td>N≦ 0</td></tr>
<tr><td>Total Bright and Dark Dots</td><td>N≦ 4</td></tr>
<tr><td>Minimum Distance Between Dark Dots(Note 5)</td><td>≧5mm</td></tr>
<tr><td>8.4.5</td><td>MINOR</td><td colspan="2">Glass Crack</td><td>Not allowable</td><td>  </td></tr>
<tr><td>8.4.6</td><td>MINOR</td><td colspan="2">Edge Chipping</td><td>TFT & CF side:
Have not affected the pixel area or
ITO lines---Ignore</td><td> 
</td></tr>
<tr><td>8.4.7</td><td>MINOR</td><td colspan="2">Corner Chipping</td><td>TFT & CF side:
Have not affected the pixel area or
ITO lines---Ignore</td><td> 
</td></tr>
</table>

Note (1) Bright dot, mura and leak are defined through transmission ND Filter as following.

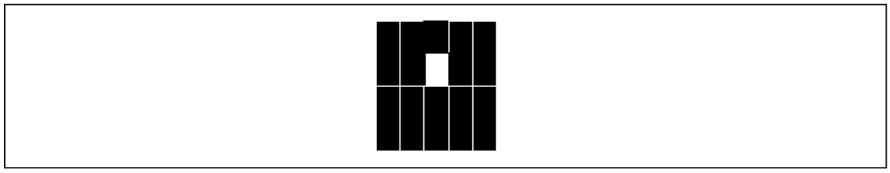


Light on defect:

a. Every dot herein means sub-pixel(Each Red, Green, Blue Color).
b. Damaged less than half size of sub-pixel is not counted as defect.
c. Extraneous substances which can be wiped out are not considered as defect.
d. Defects which is on the Black Matrix(Outside of Active Area) are not considered as defe.

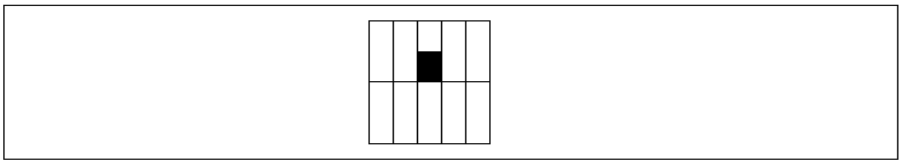
Note (2) Bright dot defect definition:

Bright area is more than 50% of one dot .All bright dot defect must be visible through 5% ND filter.

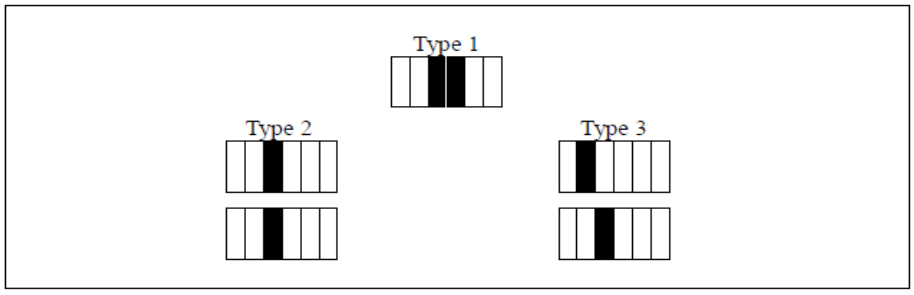


Note (3) Dark dot defect definition:

Dark area is more than 50% of one dot . All bright dot defect must be visible through 5% ND filter.



Note (4) Dark dot defect description--Two adjacent



Note (5) Minimum distance between dot defects--Dark dot to dark dot