CONFIDENTIAL(B)

SPECIFICATION

OF

LIQUID CRYSTAL DISPLAY MODULE

UNITED RADIANT TECHNOLOGY CORP. 光聯科技 Oct-30-2020 品管部 QC DEPT.

CUSTOMER : URT-STD

Model No. : UMOH-9516MD-1T

Model version : 0

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	Oct-30-2020
APPROVED	CHECKED	PREPARED	Date

COMPANY : No. 2,Fu-hsing Road,Taichung Econamic Processing Zone,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-9516MD-T Version No. 0	7” TFT	K.F. Kuo Titan Lo 30-Oct-2020
1	UMOH-9516MD-1T Version No. 0	1. Increase the backlight brightness. 2. Modify the module number from UMOH-9516MD-T to UMOH-9516MD-1T.	K.F. Kuo Titan Lo 30-Oct-2020

CONTENTS:

1. BASIC SPECIFICATION

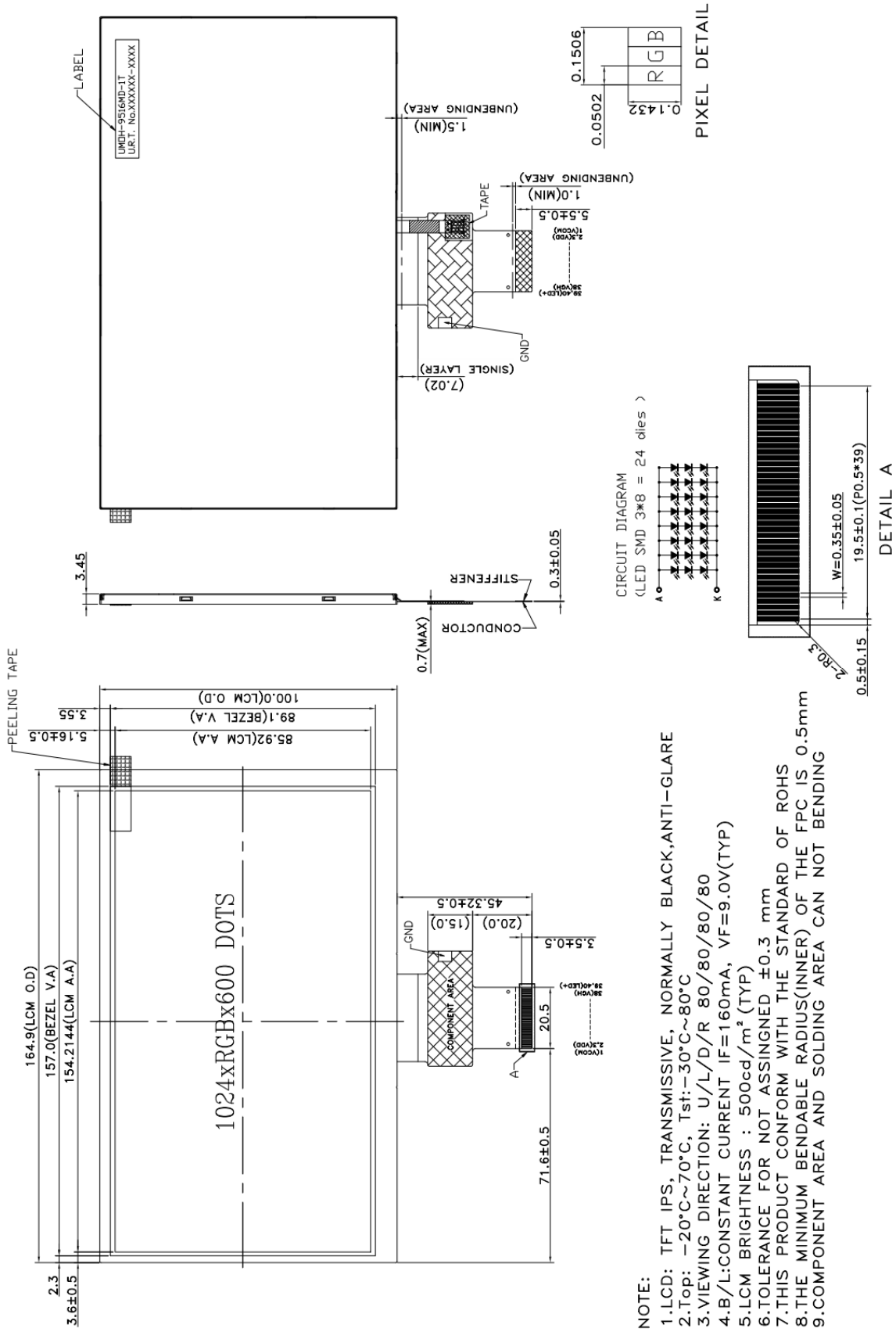
1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Active screen size	7.0” Diagonal	-
Dot Matrix	1024 x RGB x 600	Pixel
Module Size (W x H x T)	164.90 x 100.0 x 3.45	mm.
Active Area (W x H)	154.21 x 85.92	mm.
Sub Pixel Size (W×H)	50.2 x 143.2	um.
Color depth	16.7M	color
Interface	LVDS - 18-bit / 24bit	-
Driving IC Package	COG	-
Module weight	109±10%	g

1.2 Display specification

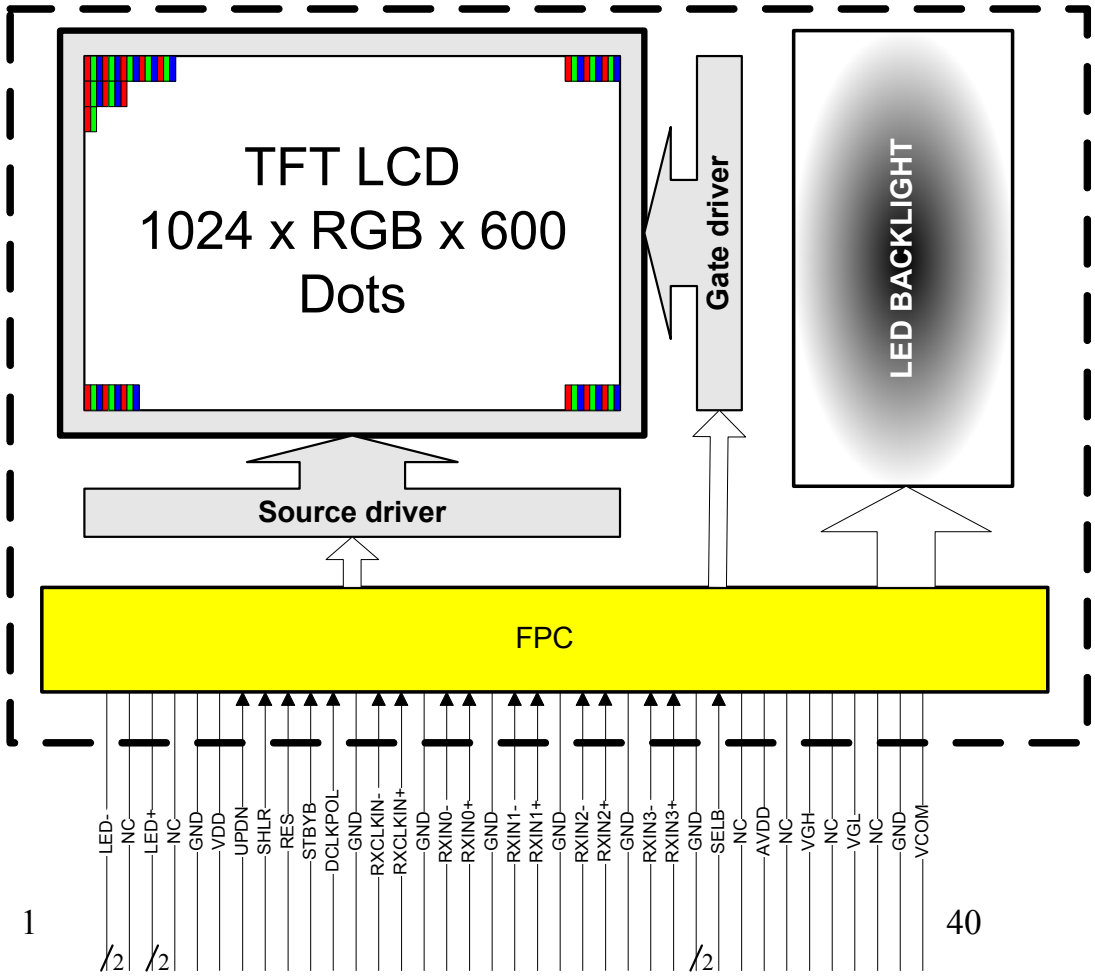
Display	Descriptions	Note
LCD Type	a-Si TFT	-
LCD Mode	Normally Black	-
Polarizer Mode	Transmissive	
Polarizer Surface	Anti-Glare	
Pixel arrangement	RGB- stripe	-
Backlight Type	LED	-
Viewing Direction (Gray scale inversion)	Free	-

1.3 Outline dimension



NOTE:
1.LCD: TFT IPS, TRANSMISSIVE, NORMALLY BLACK,ANTI-GLARE
2.Top: -20°C~70°C, Tst:-30°C~80°C
3.VIEWING DIRECTION: U/L/D/R 80/80/80/80
4.B/L:CONSTANT CURRENT IF=160mA, VF=9.0V(TYP)
5.LCM BRIGHTNESS : 500cd/m² (TYP)
6.TOLERANCE FOR NOT ASSINGNED ±0.3 mm
7.THIS PRODUCT CONFORM WITH THE STANDARD OF ROHS
8.THE MINIMUM BENDABLE RADIUS(INNER) OF THE FPC IS 0.5mm
9.COMPONENT AREA AND SOLDING AREA CAN NOT BENDING

1.4 Block diagram:

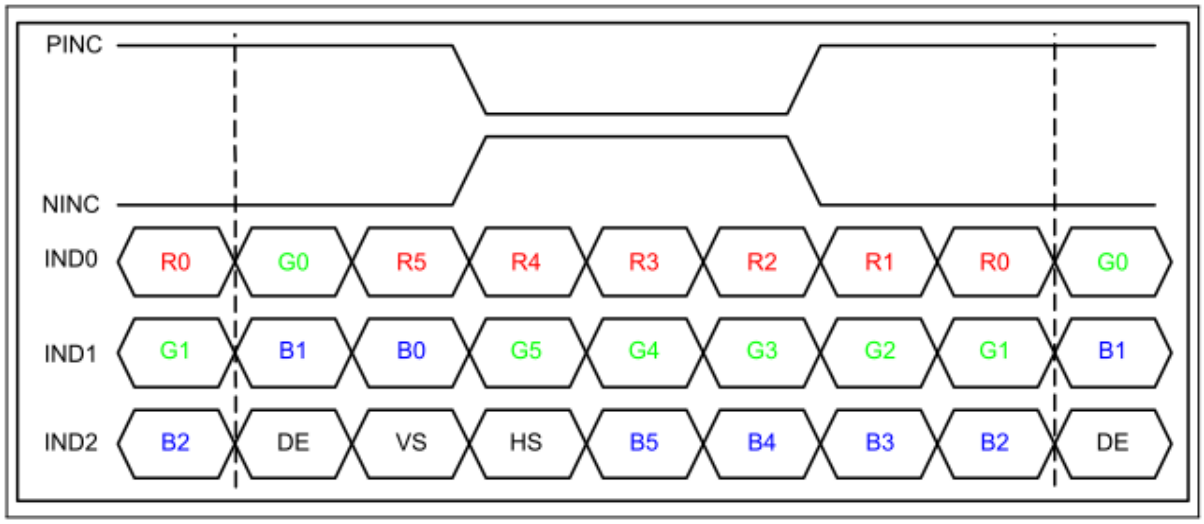


1.5 Interface Pin Connection:

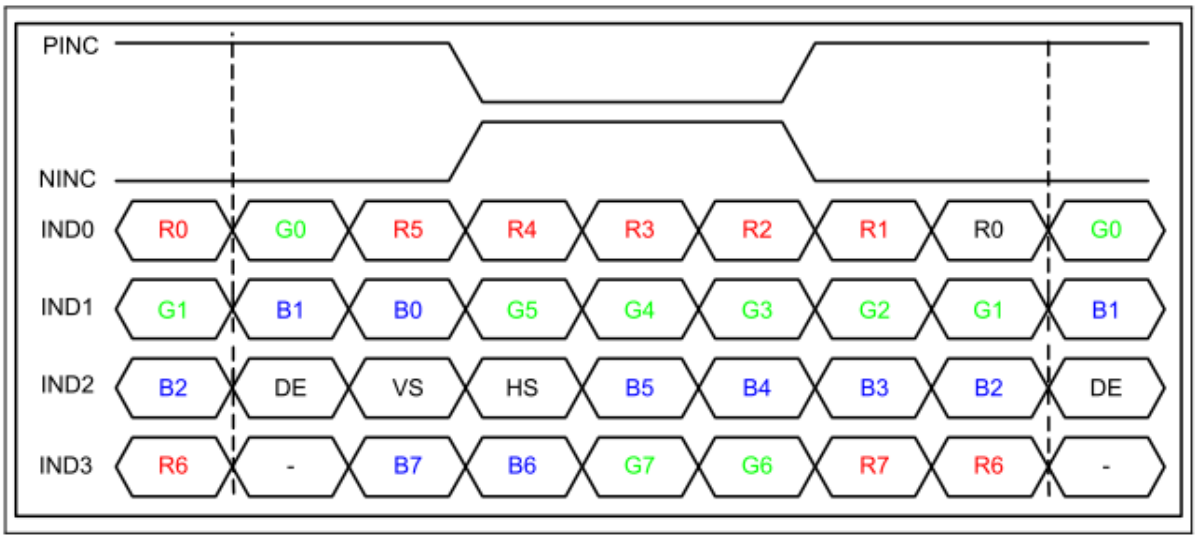
Pin No.	Pin Symbol	I/O	Description
1~2	LED-	P	LED Cathode.
3	NC	-	No connection.
4~5	LED+	P	LED Anode
6	NC	-	No connection.
7	GND	P	Ground.
8	VDD	P	Power Voltage for digital circuit.
9	UPDN	I	Vertical inversion
10	SHLR	I	Horizontal inversion
11	RES	I	Global reset pin. Active low to enter reset state. Normally pull High.
12	STBYB	I	Standby mode, Normally pulled high. STBYB = "1", normal operation STBYB = "0", timing controller, source driver will turn off, all output are High-Z
13	DCLKPOL	I	Input clock edge selection. Normally pull low CLKPOL = "1", Latch data at DCLK rising edge. CLKPOL = "0", Latch data at DCLK falling edge. (Default)
14	GND	P	Ground.
15~16	RXCLKIN- / RXCLKIN+	I	LVDS differential clock input.
17	GND	P	Ground.
18~19	RXIN0- / RXIN0+	I	LVDS differential data input.
20	GND	P	Ground.
21~22	RXIN1- / RXIN1+	I	LVDS differential data input.
23	GND	P	Ground
24~25	RXIN2- / RXIN2+	I	LVDS differential data input.
26	GND	P	Ground.
27~28	RXIN3- / RXIN3+	I	LVDS differential data input.
29~30	GND	P	Ground.
31	SELB	I	6bit/8bit mode select. SELB = L , 8-bit ; SELB = H , 6-bit.(Note1)
32	NC	-	No connection.
33	AVDD	P	Power for Analog Circuit.
34	NC	-	No connection.
35	VGH	P	Gate ON Voltage.
36	NC	-	No connection.
37	VGL	P	Gate OFF Voltage.
38	NC	-	No connection.
39	GND	P	Ground.
40	VCOM	P	Common Voltage.

Note1 :

6bit LVDS input



8bit LVDS input



2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Power supply voltage	VDD	-0.3	5.0	V
	VGH	-0.3	+42.0	V
	VGL	VGH-42	+0.3	V
	AVDD	-0.5	+15.0	V
Operate temperature range	TOP	-20	70	℃
Storage temperature range	TST	-30	80	℃

2.2 DC Characteristics:

Typical Operation Conditions

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage	VDD	3.0	3.3	3.6	V	
	AVDD	-	12.1	-	V	-
	VGH	-	17	-	V	Note2
	VGL	-	-7	-	V	Note3
Input signal voltage	VCOM	-	4.2	-	V	Note1
Input Voltage	V_{IH}	0.7VDD	-	VDD	V	
	V_{IL}	0	-	0.3VDD	V	

Note1 : Vcom must be adjusted to optimize display quality : cross-talk , contrast ratio and etc.

Note2 : VGH is TFT gate operating voltage.(acceptable variation : ±0.2V)

Note3 : VGL is TFT gate operating voltage.(acceptable variation : ±0.2V)

Note4: Environmental condition : 25±5℃

2.3 Back-light only Specification :

PARAMETER	SYMBOL	MIN	TYP	MAX	Unit	Test Condition	Remark
Voltage for LED backlight	VL	-	9	-	V	Ta=25℃	
Current for LED backlight	IL	-	160	-	mA	Ta=25℃	-
LED life time	Lf	-	30000	-	hrs	Ta=25℃	

2.4 Timing Characteristics:

DE mode :

Parameter	Symbol	Value			Unit
		Min	Typ.	Max	
DCLK frequency Frame rate = 60Hz	fclk	42.6	51.2	67.2	MHz
Horizontal display area	thd		1024		DCLK
HSYNC period time	th	1164	1344	1400	DCLK
HSYNC blanking	thb+thfp	140	320	376	DCLK
Vertical display area	tvd		600		H
VSYNC period time	tv	610	635	800	H
VSYNC blanking	tvb+tvfp	10	35	200	H

HV mode :

a. Horizontal input timing

Parameter		Symbol	Value			Unit
Horizontal display area		thd	1024			DCLK
DCLK frequency Frame rate = 60Hz		fclk	Min	Typ.	Max	
			44.9	51.2	63	MHz
1 Horizontal Line		th	1200	1344	1400	DCLK
HSYNC pulse width	Min	thpw	1			DCLK
	Typ.		-			
	Max		140			
HSYNC blanking		thb	160	160	160	
HSYNC front porch		thfp	16	160	216	

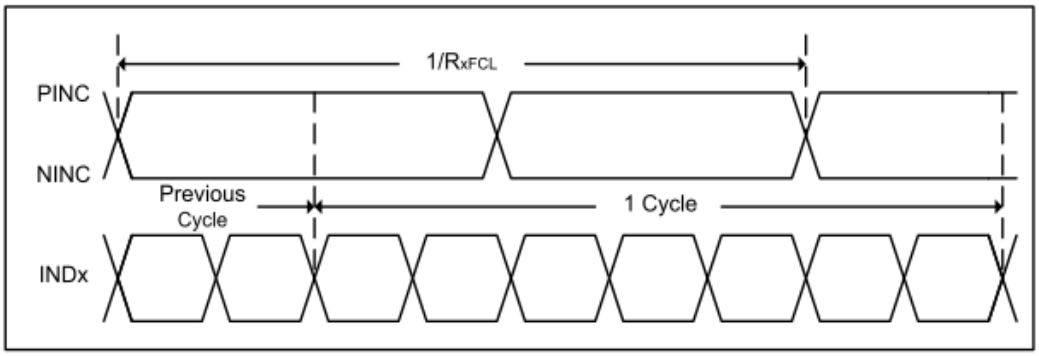
b. Vertical input timing

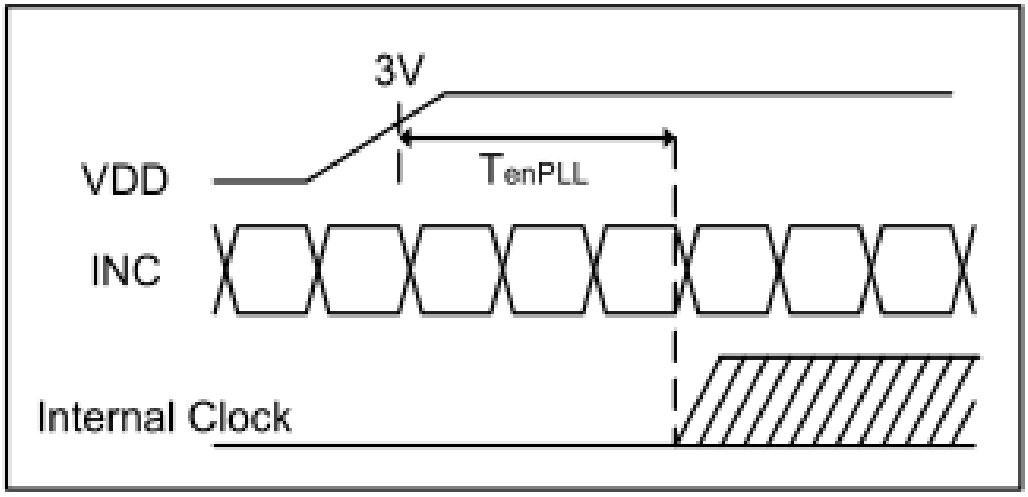
Parameter	Symbol	Value			Unit
		Min	Typ.	Max	
Vertical display area	tvd		600		H
VSYNC period time	tv	624	635	750	H
VSYNC pulse width	tvpw	1	-	20	H
VSYNC blanking	tvb	23	23	23	H
VSYNC front porch	tvfp	1	12	127	H

2.5 LVDS mode AC electrical characteristics:

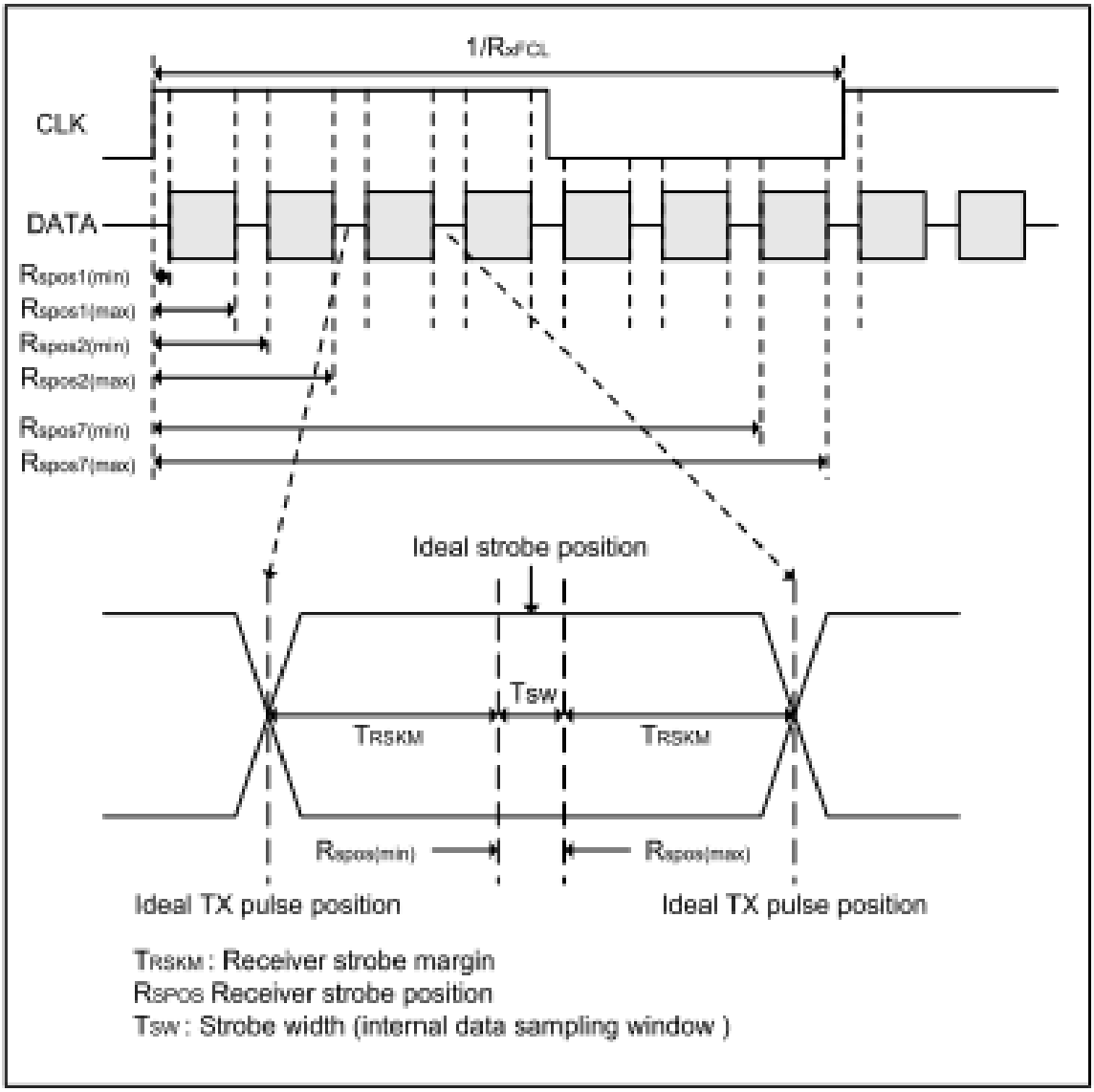
LVDS mode

Parameter	Symbol	Min	Typ.	Max	Unit	Conditions
Clock frequency	RxFCLK	26.2		71	MHz	
Input data skew margin	TRSKM	500			ps	|VID|=400mv RxVCM=1.2V RxFCLK=71MHz
Clock high time	TLVCH		4/(7x RxFCLK)		ns	
Clock low time	TLVCL		3/(7xRxFCLK)		ns	
VSD setup time	TenPLL			150	us	





2.5.1 LVDS mode AC electrical characteristics:



SSC torence of LVDS receiver

symbol	parameter	condition	Min	Typ.	Max	Units
SSCMF	Modulation Freq.		23		93	KHz
SSCMR	Modulation Rate	LVDS clock=71MHz center spread			+/-3	%

2.6 Power Sequence

Power On/Off Sequence

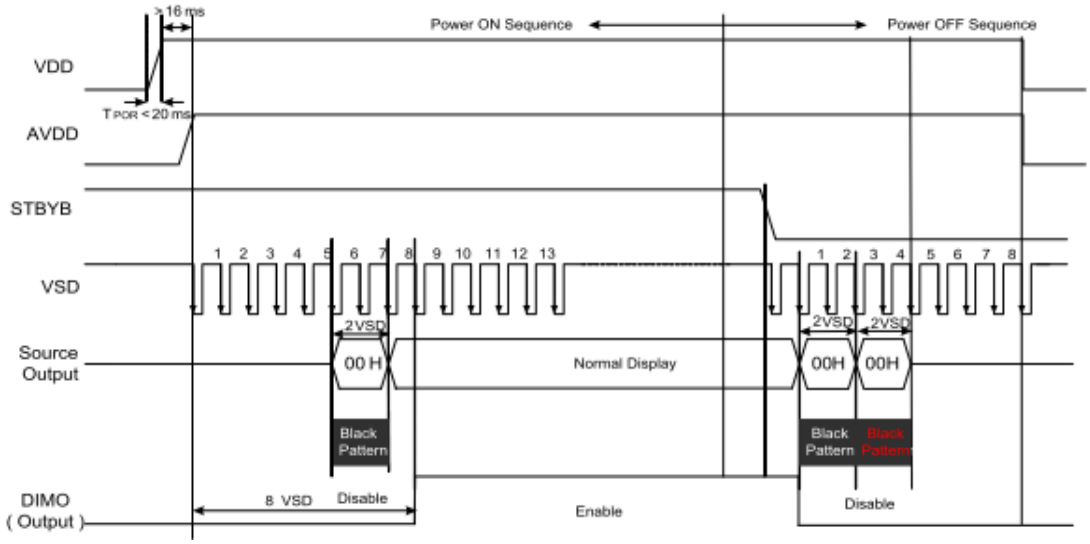
To prevent the device damage from latch up, the power On-Off sequence must be followed.
Power On: VDD,GND→AVDD,AGND→V1~V14→Input Signals
Power Off: Input Signals→V1~V14→ AVDD,AGND→ VDD,GND

Power On/Off and Standby Control

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. Refer to "AC Characteristics" for more detail on timing.

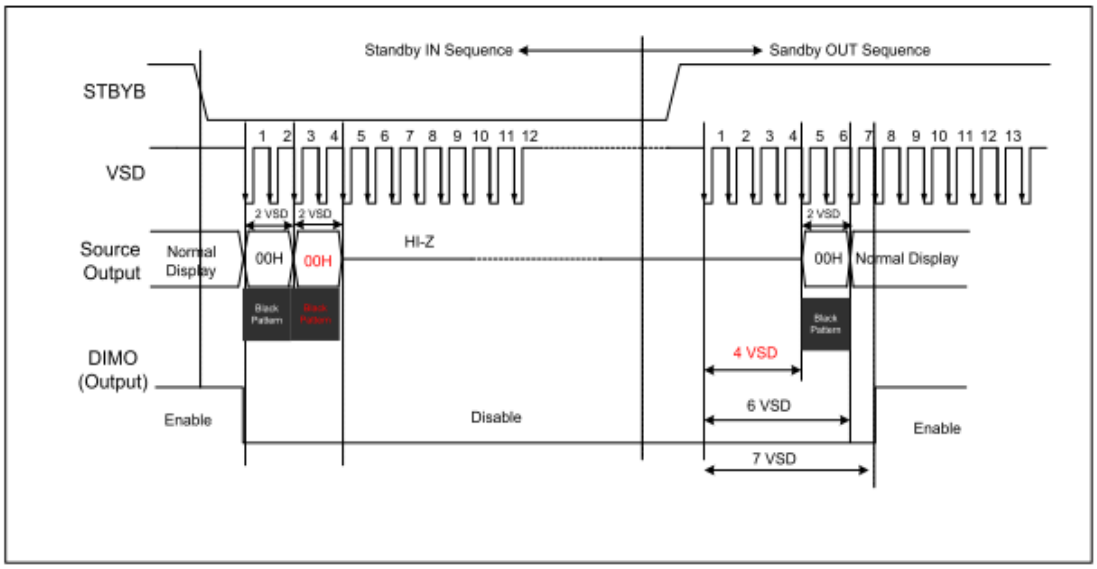
Power On-Off Sequence Timing

NBW = H / REV= L (Default)



2.6.1 Standby On-Off Sequence

NBW = H / REV= L (Default)



3. OPTICAL CHARACTERISTICS

3.1 Characteristics

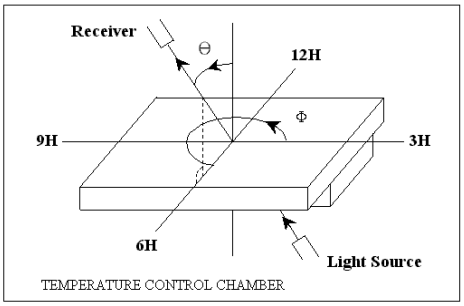
Electrical and Optical Characteristics

No.	Item			symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	Response Time			Tr+Tf	θ=Φ=0°	-	25	35	ms	2
2	Viewing Angle	Hor.	CR＞10	θ_{2+}	Φ = 0°	-	80	-	degree	3
				θ_{2-}	Φ = 180°	-	80	-		
		Ver.		θ_{1+}	Φ = 270°	-	80	-		
				θ_{1-}	Φ = 90°	-	80	-		
3	Contrast Ratio			Cr	25 ℃	400	500	-	-	4
4	Red x-code			Rx	25 ℃	0.556	0.606	0.656	-	5
	Red y-code			Ry		0.308	0.358	0.408		
	Green x-code			Gx		0.296	0.346	0.396		
	Green y-code			Gy		0.511	0.561	0.611		
	Blue x-code			Bx		0.098	0.148	0.198		
	Blue y-code			By		0.062	0.112	0.162		
	White x-code			Wx		0.272	0.322	0.372		
	White y-code			Wy		0.295	0.345	0.395		
	Brightness			Y		425	500	-	cd/m^2	
5	Brightness Uniformity				25 ℃	80	-	-	%	6

3.2 Definition of optical characteristics

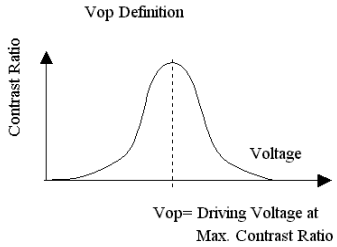
Measurement condition :

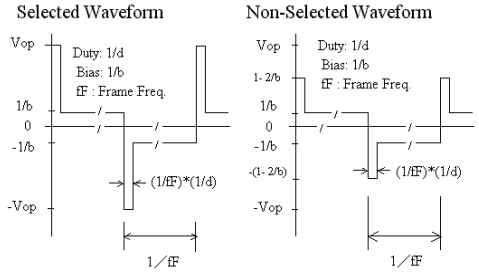
Transmissive and Transflective type



PHOTAL LCD-5000

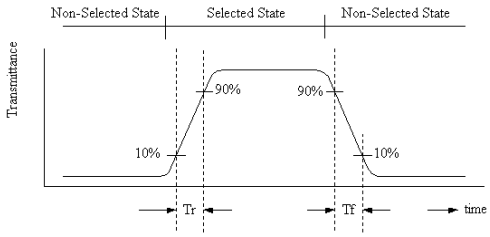
[Note 1] Definition of LCD Driving Vop and Waveform :



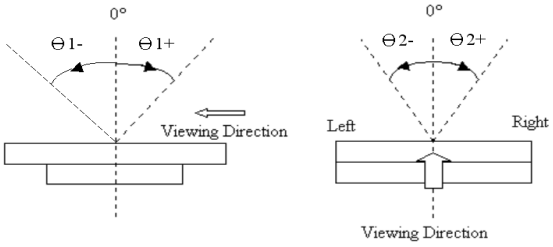


[Note 2] Definition of Response Time

for Negative type :

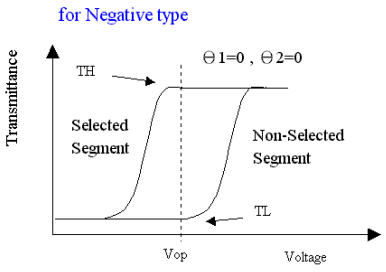


[Note 3] Definition of Viewing Angle :



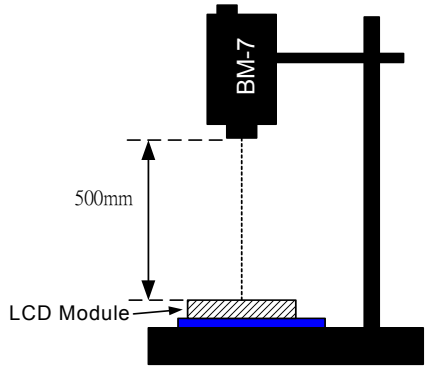
[Note 4] Definition of Contrast Ratio :

for Negative type

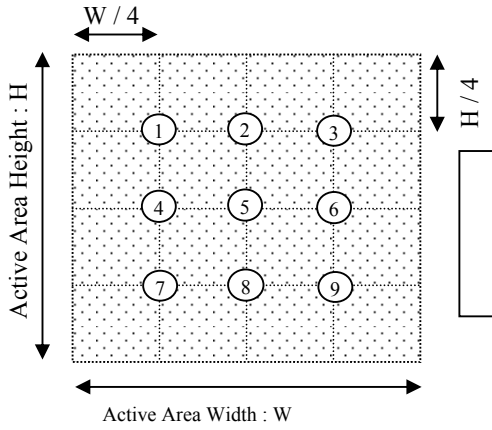


$$\text{Contrast Ratio} = \frac{TH}{TL}$$

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



[Note 6] Definition of Brightness Uniformity



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

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	

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 drive LCD panel and/or module by DC voltage.
- 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**

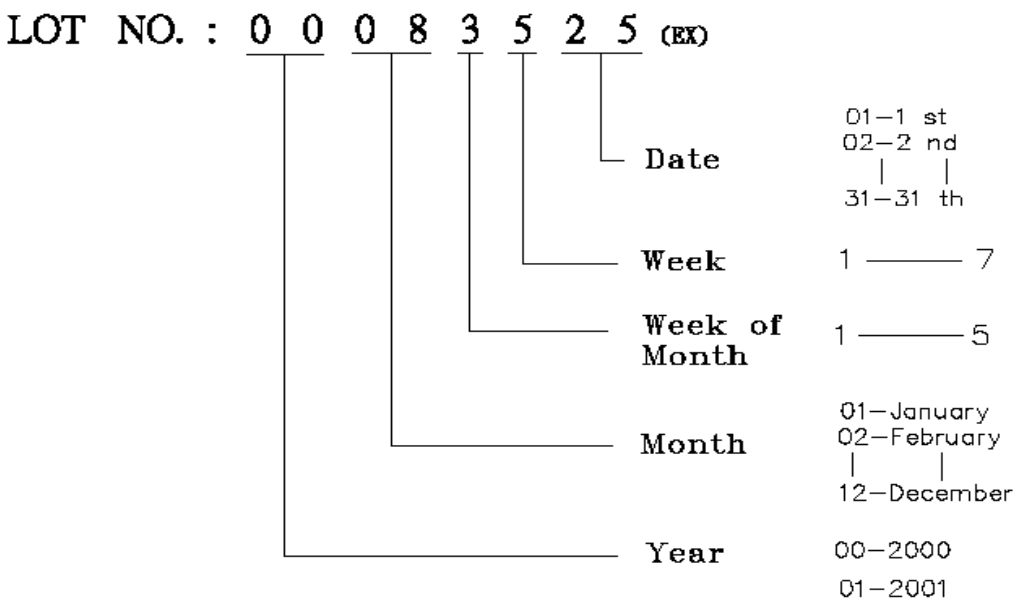
  Year Month Day - Production lots no.

- Example: 121108 - 0003 ==> Year 2012, November,8th , Production lots no.0003

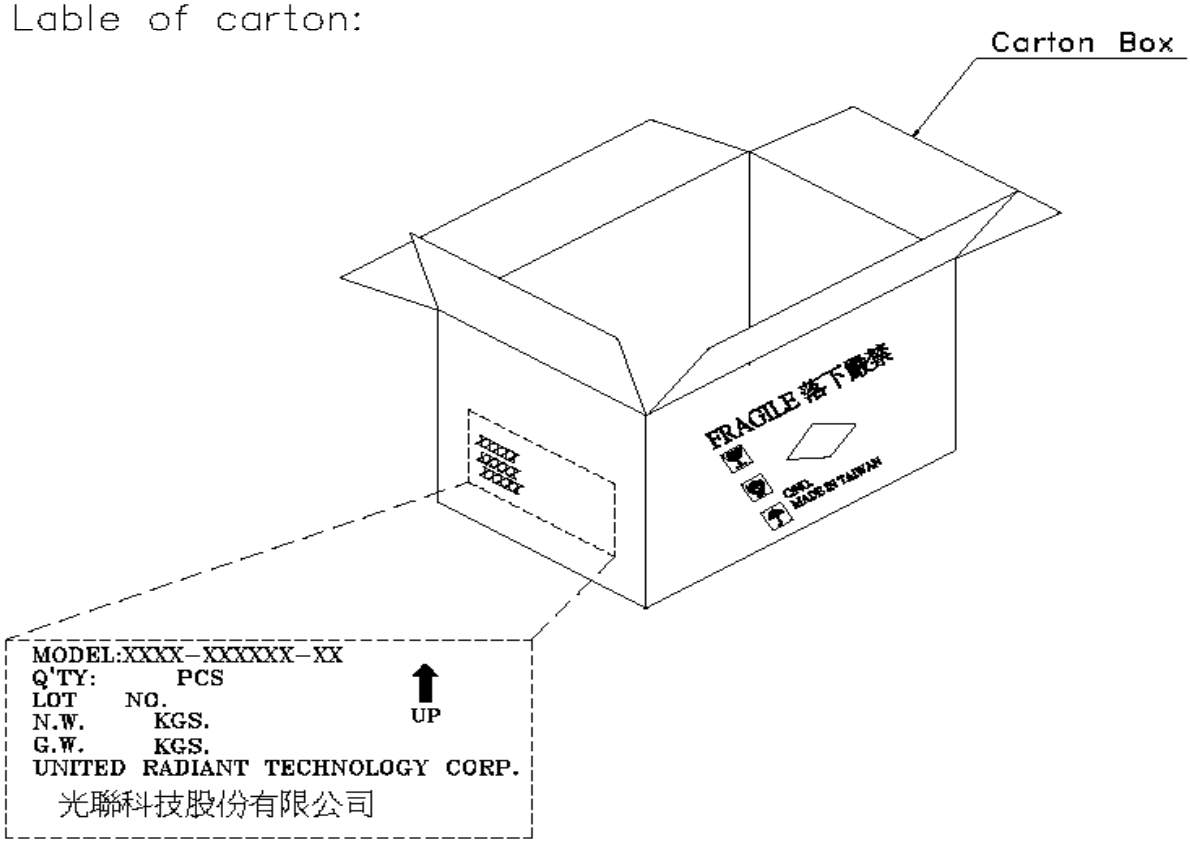
Note ： The lot no. attached on the packing box will be used for tracking once the part is too small to print the date code.

7. LOT NO

Instruction of lot number:



Lable of carton:



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

ISO-2859-1 (SAME AS MIL-STD-105E) , LEVEL Ⅱ SINGLE PLAN.

CLASS	AQL(%)
CRITICAL	0.4 %
MAJOR	0.65 %
MINOR	1.5 %
TOTAL	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 GOOD PRODUCTS FOR THESE DEFECT PRODUC′ WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF U.R.T.

8.2. CHECKING CONDITION

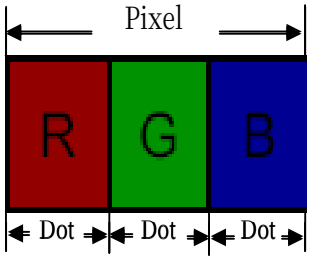
8.2.1. CHECKING VIEWING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO THE SAMPLE.

8.2.2. CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

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. BLEMISH、BLACK SPOT、 WHITE SPOT IN 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) THAT CAN BE REMOVED------DISREGARD	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. STANDARD OF VISUAL INSPECTION

<table>
<tr><th>NO.</th><th>CLASS</th><th>ITEM</th><th>JUDGEMENT</th></tr>
<tr><td>8.4.1</td><td>MINOR</td><td>BLACK AND WHITE SPOT
FOREIGN MATERIEL
DUST IN THE CELL
BLEMISH
SCRATCH
(IN THE VIEWING AREA)</td><td>(A) ROUND TYPE: unit : mm.
<table>
<tr><th>DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>Φ ≦ 0.25</td><td>DISREGARD</td></tr>
<tr><td>0.25 < Φ ≦ 0.50</td><td>3(Distance≧5mm)</td></tr>
<tr><td>0.50 < Φ</td><td>0</td></tr>
</table>
NOTE: Φ=(LENGTH+WIDTH)/2
(B) LINEAR TYPE: 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>L ≦ 5.0</td><td>0.05 < W ≦0.10</td><td>3(Distance≧5mm)</td></tr>
<tr><td>------</td><td>0.10 < W</td><td>FOLLOW ROUND TYPE</td></tr>
</table></td></tr>
<tr><td>8.4.2</td><td>MINOR</td><td>BUBBLE IN POLARIZER
DENT ON POLARIZER
(IN THE VIEWING AREA)</td><td>unit : mm.
<table>
<tr><th>DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>Φ ≦ 0.25</td><td>DISREGARD</td></tr>
<tr><td>0.25 < Φ ≦ 0.50</td><td>3 (Distance≧5mm)</td></tr>
<tr><td>0.50 < Φ</td><td>0</td></tr>
</table></td></tr>
<tr><td>8.4.3</td><td>MINOR</td><td>Dot Defect</td><td>
<table>
<tr><th>Items</th><th>ACC. Q'TY</th></tr>
<tr><td>Bright dot</td><td>N≦ 4 (Distance≧5mm)</td></tr>
<tr><td>Dark dot</td><td>N≦ 4 (Distance≧5mm)</td></tr>
</table>
Pixel Define :
 

Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.
Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green ,blue pattern.</td></tr>
</table>