CONFIDENTIAL(B)

SPECIFICATION

OF

LIQUID CRYSTAL DISPLAY MODULE

UNITED RADIANT TECHNOLOGY CORP. 光聯科技 Jan-08-2025 品管部 QC DEPT.

CUSTOMER : URT-STD

Model No. : UMOH-9854JD-T

Model version : 0

Document Revision : 0

Preliminary

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	Jan-08-2025
APPROVED	CHECKED	PREPARED	Date

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Revision record

Document Revision	Model No. Version No.	Description	Revision by
0	UMOH-9854JD-T Version No. 0	5” TFT First release.	C.K.T Chen George Pan 08-Jan-2025

CONTENTS:

1. BASIC SPECIFICATION

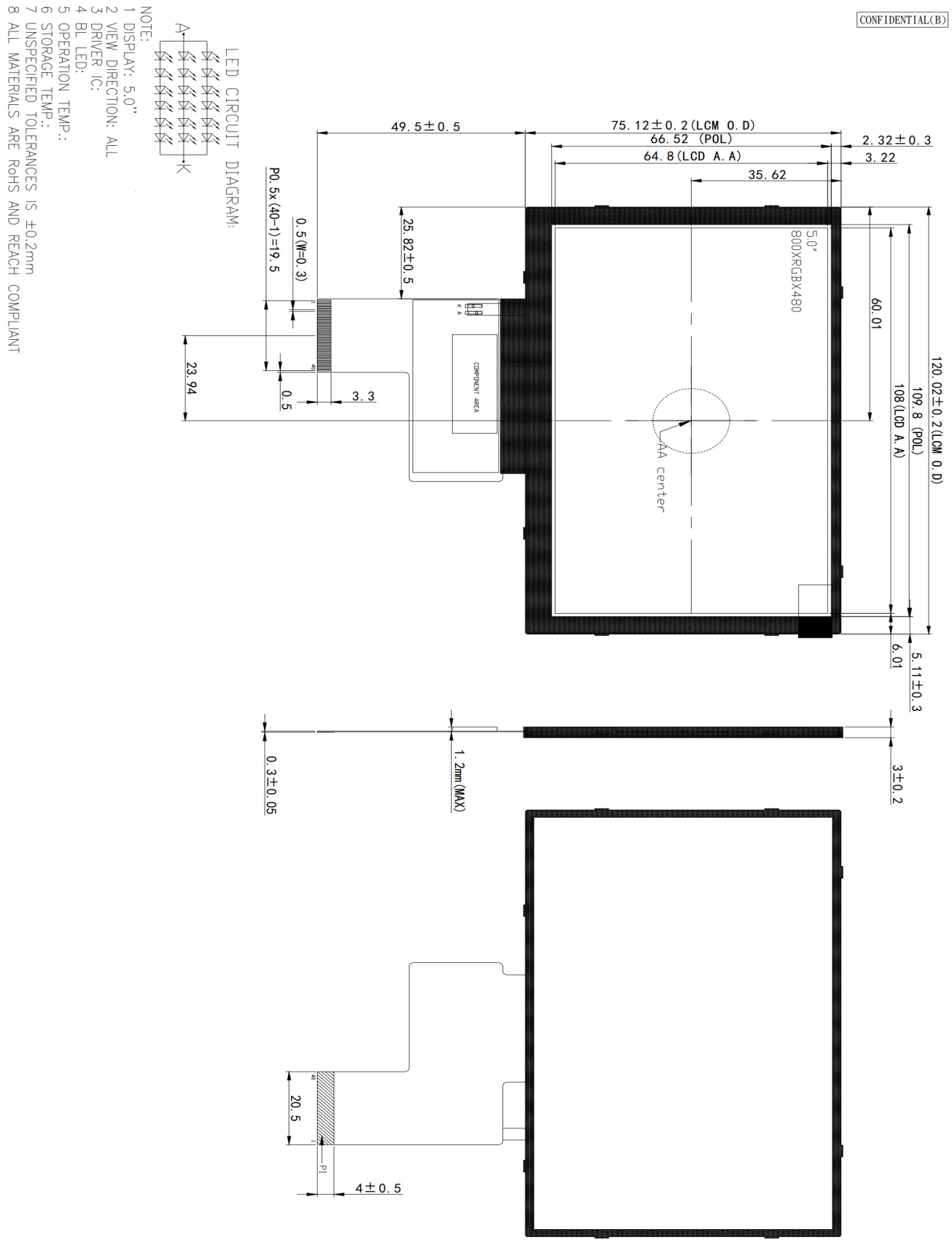
1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Active screen size	5.0” Diagonal	-
Number of Pixel	800 x RGB x 480	Pixels
Module Size (W x H x T)	120.02 x 75.12 x 3.0	mm.
Active Area (W x H)	108.0 x 64.8	mm.
Pixel Size (W x H)	0.135 x 0.135	mm.
Color depth	16.7M	color
Interface	Parallel 24-bit RGB	-
Driving IC Package	COG	-
Module weight	70±10%	g

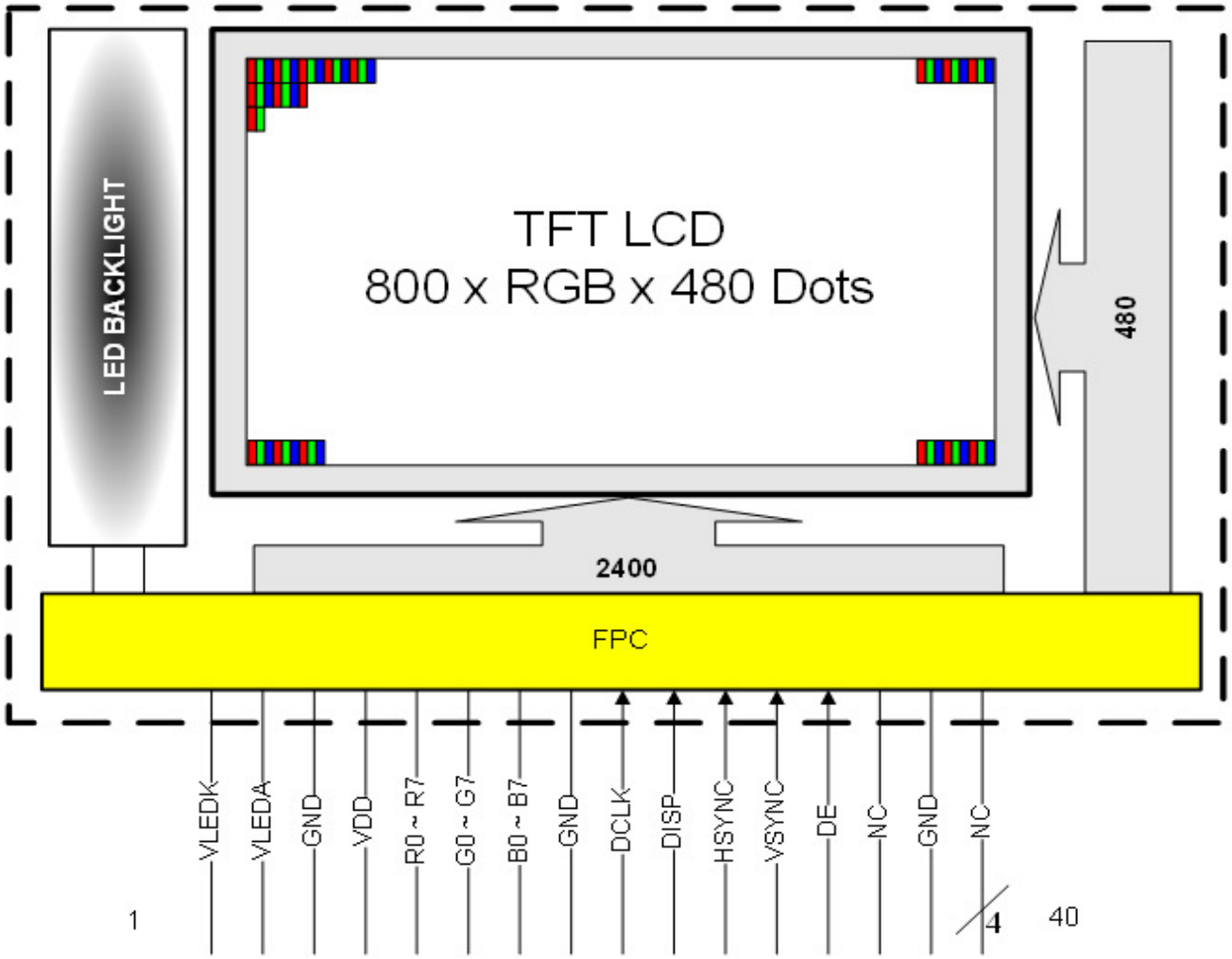
1.2 Display specification

Display	Descriptions	Note
LCD Type	a-Si TFT	-
LCD Mode	Transflective type	-
Polarizer Surface	Anti-Glare / Hard-Coating (3H)	-
Pixel arrangement	RGB-stripe	-
Backlight Type	LED	-
Viewing Direction	ALL	-

1.3 Outline dimension



1.4 Block diagram:



1.5 Interface Pin Connection:

FPC Down Connector, [FH19SC-40S-0.5SH(HIROSE), 40pin, pitch = 0.5mm]

Pin No.	Pin Symbol	I/O	Description
1	VLEDK	P	Power for LED backlight cathode.
2	VLEDA	P	Power for LED backlight anode.
3	GND	P	Ground.
4	VDD	P	Power supply. (+3.3V)
5 ~ 12	R0 ~ R7	I	8 bit data bus display red data.
13 ~ 20	G0 ~ G7	I	8 bit data bus display green data.
21 ~ 28	B0 ~ B7	I	8 bit data bus display blue data.
29	GND	P	Ground.
30	PCLK	I	Pixel clock input pin.
31	DISP	I	DISP sets the display mode. When DISP =L, Standby mode. When DISP =H, Normal display mode.
32	HSYNC	I	Horizontal sync signal applied to the RGB interface, default is negative polarity.
33	VSYNC	I	Vertical sync signal applied to the RGB interface, default is negative polarity.
34	DE	I	Data input enable applied to the RGB interface. Display access is enabled when DE is “H”.
35	NC	-	No connect.
36	GND	P	Ground.
37	NC / XR	-	Right electrode - differential analog.
38	NC / YD	-	Bottom electrode - differential analog.
39	NC / XL	-	Left electrode - differential analog.
40	NC / YU	-	Top electrode - differential analog.

2. Electrical Characteristics

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Power supply voltage	VDD	-0.5	+5.0	V
Input voltage	VIN	0	VDD+0.3	V
Operate temperature range	TOP	-30	+80	℃
Storage temperature range	TST	-40	+90	℃

2.2 DC Characteristics:

T_a= 25℃

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage	VDD	3.0	3.3	3.6	V	-
Input Signal Voltage	V_{IL}	GND	-	0.3VDD	V	L level
	V_{IH}	0.7VDD	-	VDD	V	H level
Current consumption	IDD	-	-	160	mA	Note1

*Note1:

Measuring Condition:

Standard Value MAX.

Ta = 25℃

VDD -GND = 3.3V

Display Pattern = Check pattern

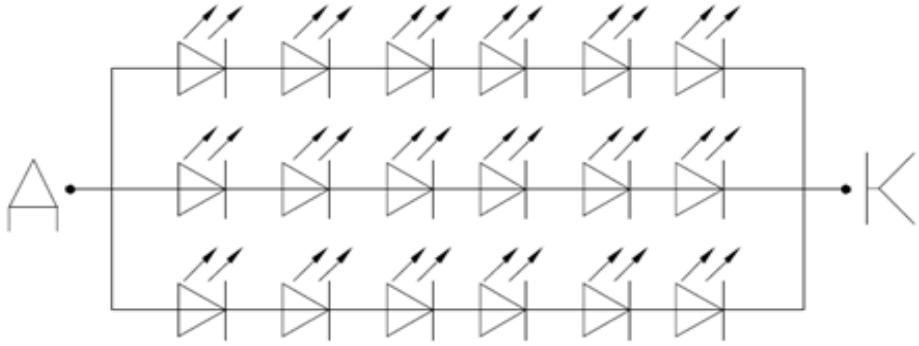
2.3 Back-light only Specification :

Parameter	Symbol	Min.	Typ.	Max.	Unit	NOTE
LED B/L Forward Current	I_F	-	60	-	mA	(2)
LED B/L Forward Voltage	V_F	18.0	19.2	21.0	V	
LED Life Time	Lf	50000	-	-	Hour	(1) (2)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ℃, typical I_F value indicated in the above table until the brightness becomes less than 50%.

Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and I_F = 60mA. The LED lifetime could be decreased if operating I_F is larger than 100mA. The constant current driving method is suggested.

LED CIRCUIT DIAGRAM:

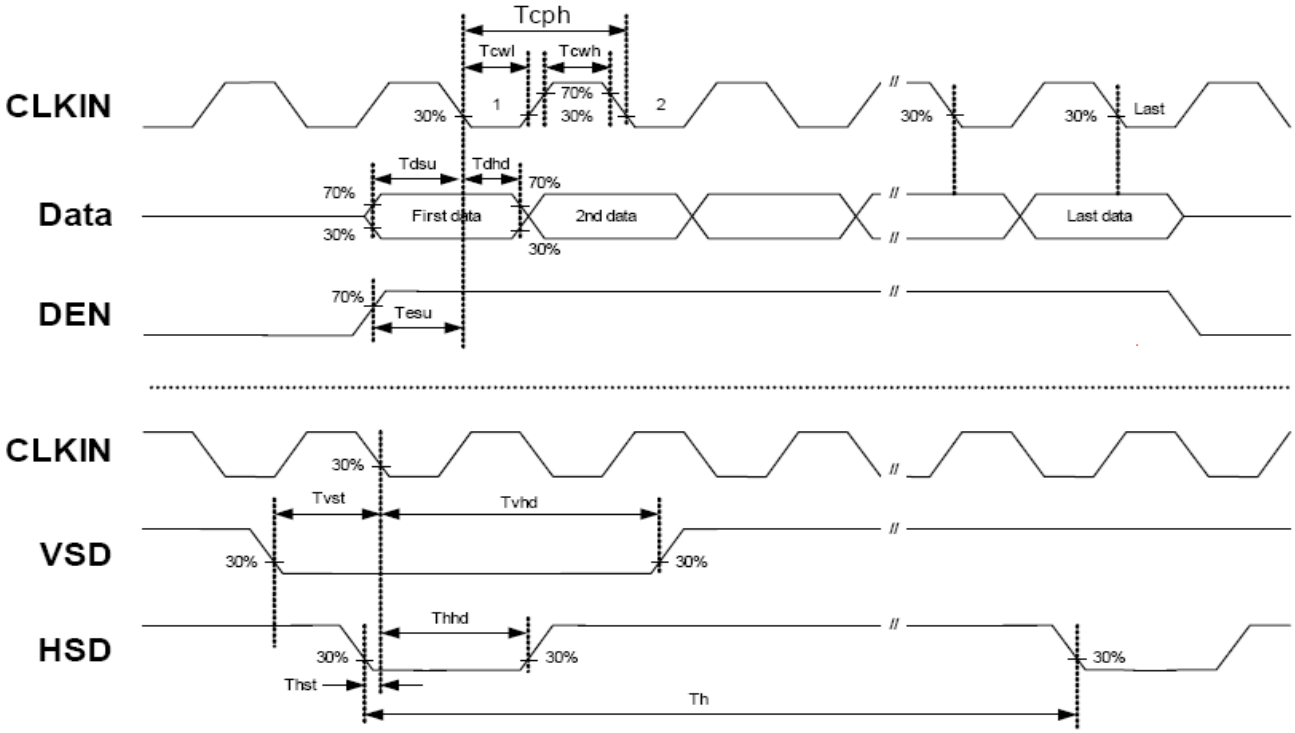


2.4 AC Characteristics

2.4.1 AC Timing characteristics

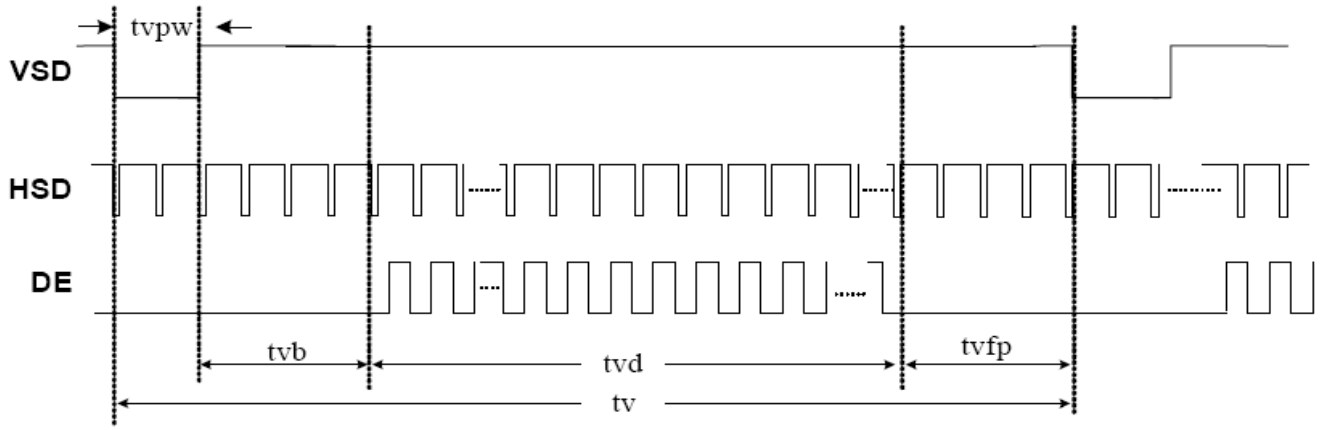
Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK cycle time	Tcph	25			ns	
DCLK frequency	fclk		30	40	MHz	
DCLK pulse duty	Tcwh	40	50	60	%	
VSD setup time	Tvst	8			ns	
VSD hold time	Tvhd	8			ns	
HSD setup time	Thst	8			ns	
HSD hold time	Thhd	8			ns	
Data setup time	Tdsu	8			ns	
Data hold time	Tdhd	8			ns	
DE setup time	Tesu	8			ns	
DE hold time	Tehd	8			ns	
Horizontal display area	thd		800		Tcph	
HSD period time	th		928		Tcph	
HSD pulse width	thpw	1	48		Tcph	
HSD back porch	thb		40		Tcph	
HSD front porch	thfp		40		Tcph	
Vertical display area	tvd		480		th	
VSD period time	tv		525		th	
VSD pulse width	tvpw		3		th	
VSD back porch	tvb		29		th	
VSD front porch	tvfp		13		th	

2.4.2 Timing Controller Timing Chart

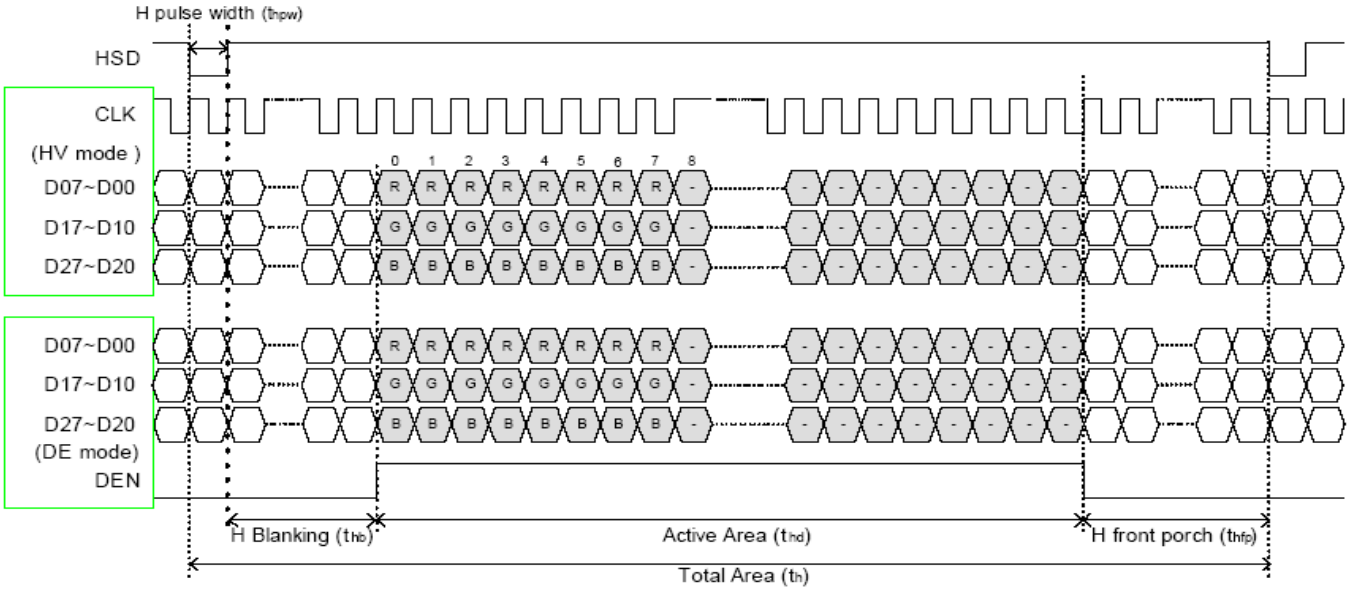


Sampling clock timing

2.4.3 Input Clock and Data Timing

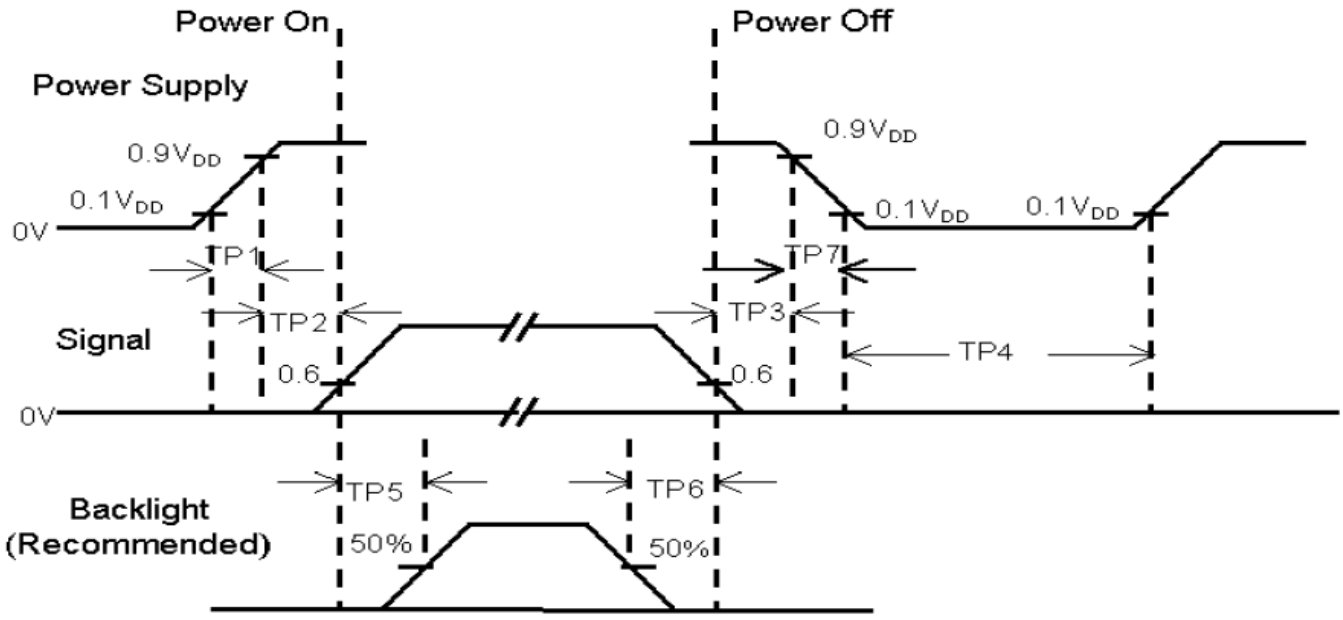


Vertical timing



Horizontal display timing range

2.5 Power Sequence



3. OPTICAL CHARACTERISTICS

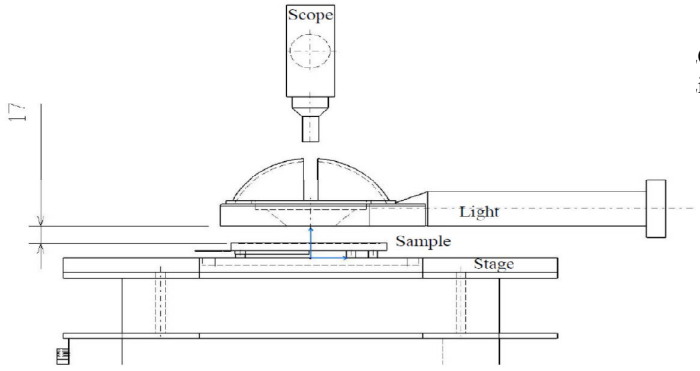
3.1 Characteristics

Electrical and Optical Characteristics

No.	Item			symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	Response Time (Reflectance mode)			Tr+Tf	θ=Φ=0° (25℃)	-	5	-	ms	2
	Response Time (Transmittance mode)					-	5	-		
2	Viewing Angle	Hor.	CR≧10	θ_{2+}	Φ = 0°	-	60	-	degree	3
				θ_{2-}	Φ = 180°	-	60	-		
		Ver.		θ_{1+}	Φ = 270°	-	55	-		
				θ_{1-}	Φ = 90°	-	55	-		
3	Contrast Ratio			Cr	25 ℃	-	8	-	-	4
4	Red x-code			Rx	25 ℃	-	-	-	-	5
	Red y-code			Ry		-	-	-		
	Green x-code			Gx		-	-	-		
	Green y-code			Gy		-	-	-		
	Blue x-code			Bx		-	-	-		
	Blue y-code			By		-	-	-		
	White x-code			Wx		0.295	0.325	0.355		
	White y-code			Wy		0.333	0.363	0.393		
	Brightness			Y		150	200	-	cd/m^2	
5	Brightness Uniformity			Yu	25 ℃	-	75	-	%	6
6	White (Reflectance)			RW%	25 ℃	-	12.5	-	%	7
7	White (Transmittance)			TR%	25 ℃	-	0.85	-	%	7

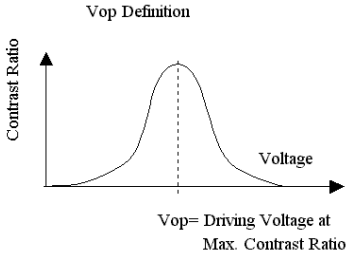
3.2 Definition of optical characteristics

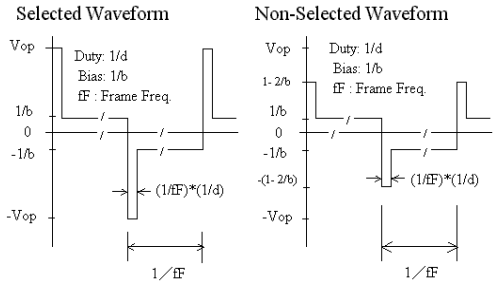
Measurement condition :



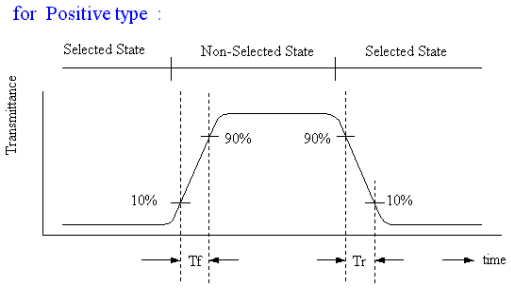
LCD Evaluation System : DMS-803
Light Source : Halogen Lamp.

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

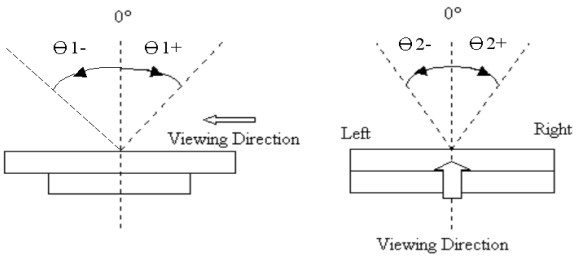




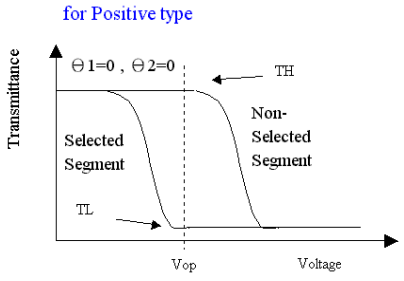
[Note 2] Definition of Response Time



[Note 3] Definition of Viewing Angle :

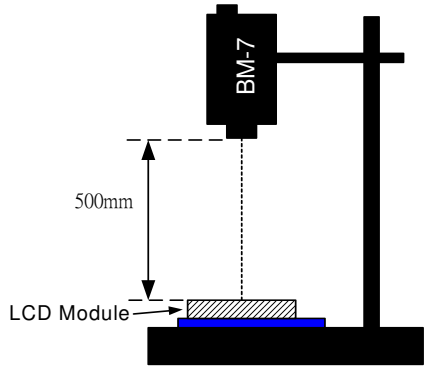


[Note 4] Definition of Contrast Ratio :

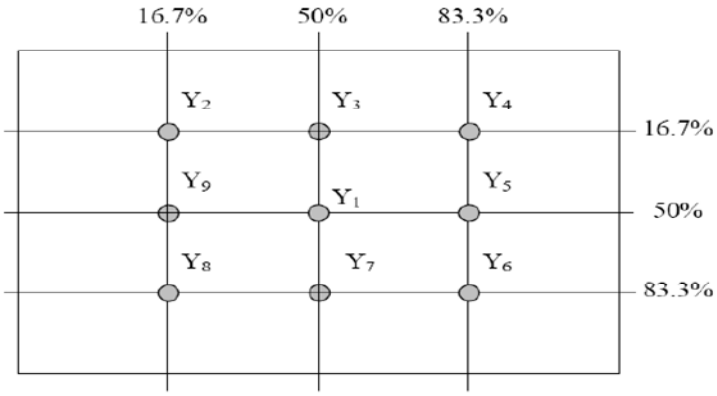


$$\text{Contrast Ratio} = \frac{TH}{TL}$$

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

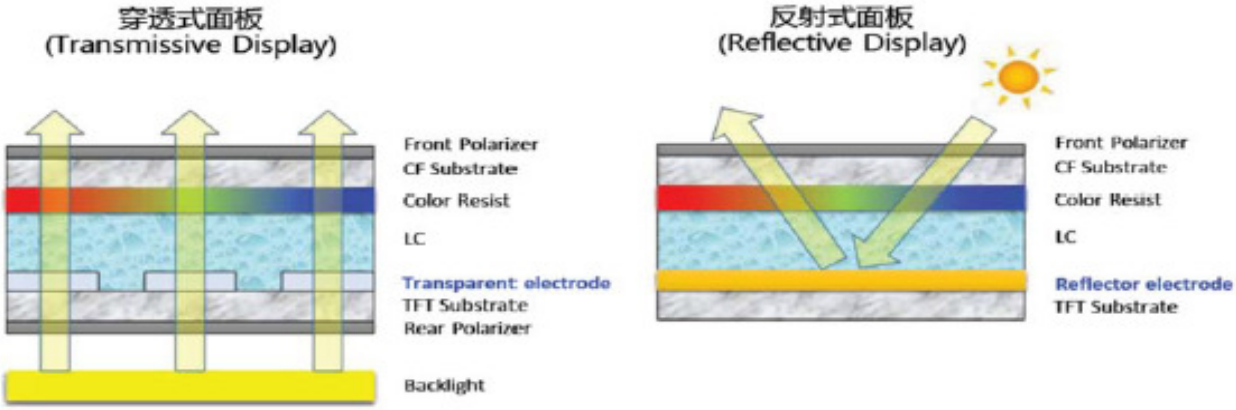


[Note 6] Definition of Brightness Uniformity

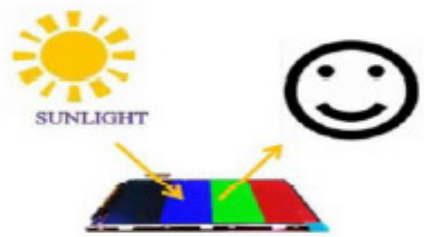


$$\text{Brightness Uniformity} = \frac{\text{Minimum Brightness of Point 1~9}}{\text{Maximum Brightness of Point 1~9}}$$

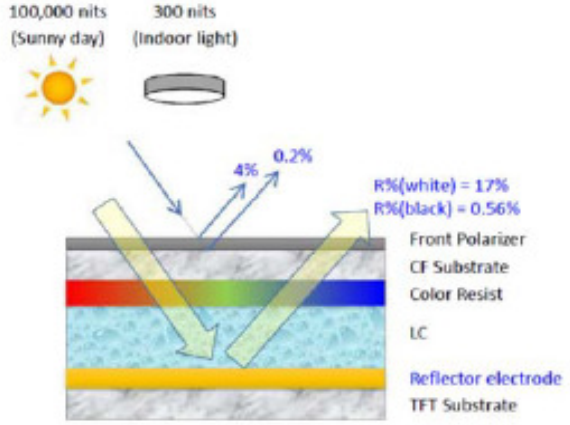
[Note 7] Definition of Transmissive VS Reflectance display characteristics :



Transmissive vs. Reflective LCD Visibility



Reflective LCD under stronger light

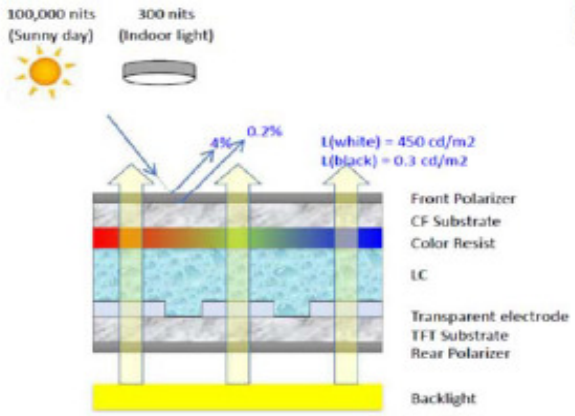


Display reflected light intensity > Surface reflectied light intensity

$$CR = \frac{(100{,}000 \text{ or } 300) \times 17\%}{(100{,}000 \text{ or } 300) \times 0.56\%} = \text{keep } 30.35$$

- Perfect readability under any ambient light conditions
- No need for backlight, with advantages of lightweight, energy-saving, power-saving, and eye protection
- Adequate ambient light sources are required to ensure readability

Transmissive LCD under stronger light



The intensity of light reflected on the surface is greater than the intensity of light transmitted through it

$$CR = \frac{(100{,}000 \text{ or } 300) \times 4.2\% + 450}{(100{,}000 \text{ or } 300) \times 4.2\% + 0.3} = 1.11 \text{ or } 35.86$$

- Penetrating displays are suitable for indoor use and can be viewed in sunlight Poor readability
- Improving surface brightness can enhance outdoor readability, but there are some limitations

- Disadvanages :

- Relative increase in backlight power consumption
- **The increase in backlight current is prone to overheating**
- Increased backlight thickness

4. RELIABILITY :

Item No	Items	Condition	Note
1	High temperature operating	80 ℃ , 240 hours	Inspection after2～4 hours storage at room temperature, the sample shall be free from defects 1. Air bubble in the LCD 2. Sealleak 3. non-display 4. missing segmnents 5. glass crack 6. current idd is twice higher than initial value.
2	Low temperature operating	-30 ℃ , 240 hours	
3	High temperature storage	90 ℃ , 240 hours	
4	Low temperature storage	-40 ℃ , 240 hours	
5	High temperature & humidity storage	60℃, 90%RH, 240 hours	
6	Thermal Shock storage	-30℃, 30min.<=> 80℃, 30min. 10 Cycles	
7	ESD Test	200V 200pf(0ohm) 1time/each terminal	
8	Vibration (with carton)	Random:0.015G＾2/HZ, 5～200HZ -6dB/octave,200～400HZ XYZ each dirction:1hr	
9	Drop Test (with carton)	Height：60 cm 1 corner, 3 edges, 6 surfaces	

REMARK:

1.There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

2.The test samples should be applied to only one test item.

3.For damp proof test, Pure water(resistance>10M ohm)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.Failure Judgment Criterion:Basic Specification, Electrical Characteristic, Mechanical Charateristic,Optical Characteristic

5. PRODUCT HANDLING AND APPLICATION

5.1 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.
- Hand Soldering : Soldering temperature less than 260℃,within 5 sec, at 5 mm. Away from pin connection.
- Do not touch the display surface or connection terminals area with bare hands.Smudges on the display surface reduce the insulation between terminals.
- Do not twist or bend the modules and also avoid any inappropriate external force on display surface during assembly.
- Do not expose LCM to organic solvent. IF 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 or fluorescent light, , also avoid them in high-temperature & high humidity environment for a long period.
- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
- Do not drive LCM by DC voltage & avoid displaying at certain pattern for a long time otherwise it might cause image sticking.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- Never use the LCD , LCM under 45 Hz , the liquid crystal will decomposition and cause permently damage on display !!
- 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.

5.2 PRECAUTION FOR STORING

- Store the module in a dark room where must keep at 25±10℃ and 65%RH or less.
- Do not store the module in surroundings containing organic solvent or corrosive gas
- Store the module in an anti-electrostatic container or bag.

5.3 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**

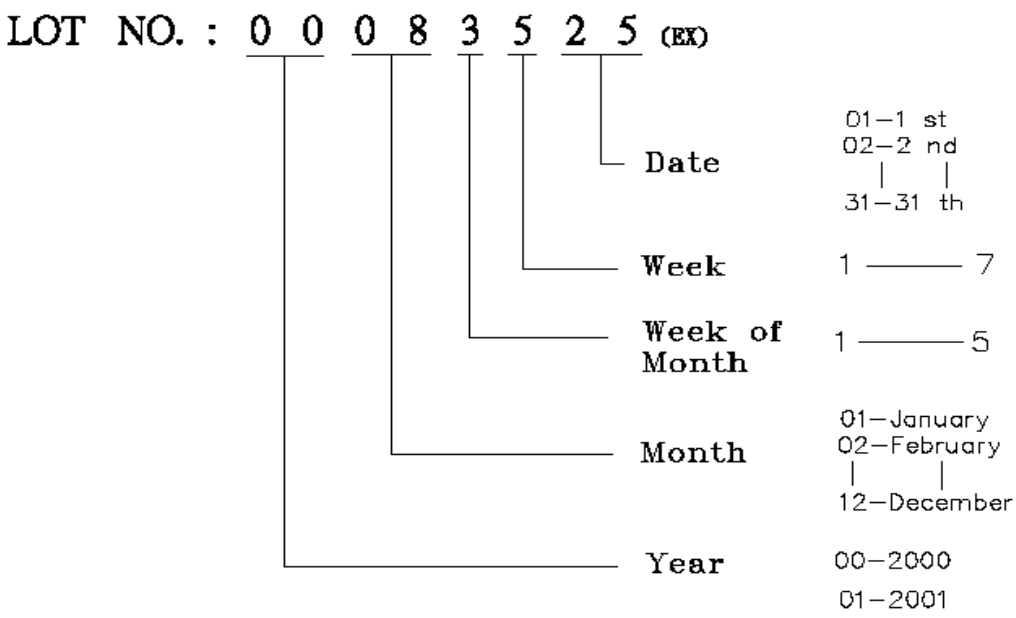
  Year Month Day - Production control number

- Example: 241108 - 0003 ==> Year 2024, November,8th ,
  Production control number no. 0003

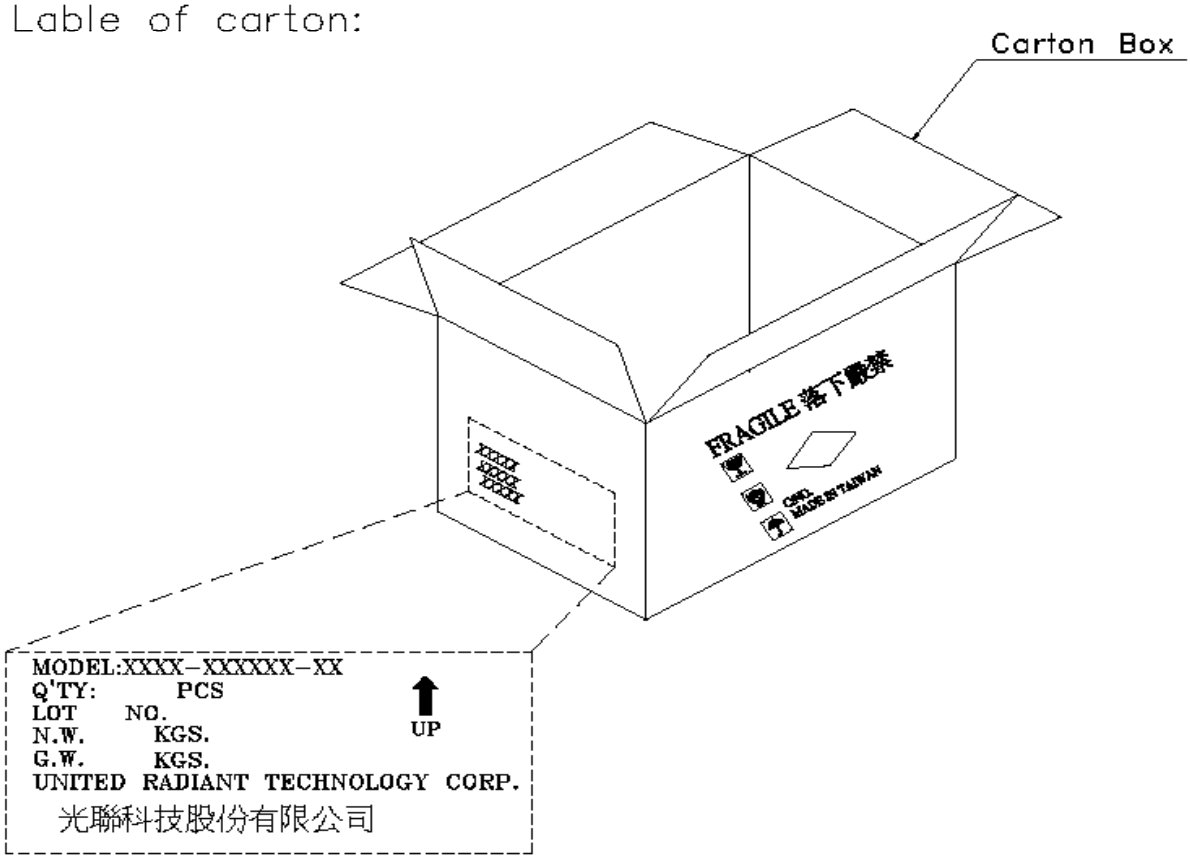
Note ： The lot no. attached on the packing box will be used for tracking once the part is too small to print the date code.

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 ℃ ～ 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.

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

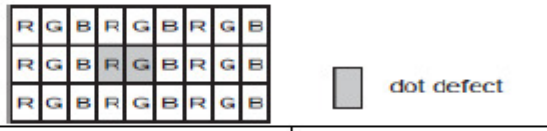
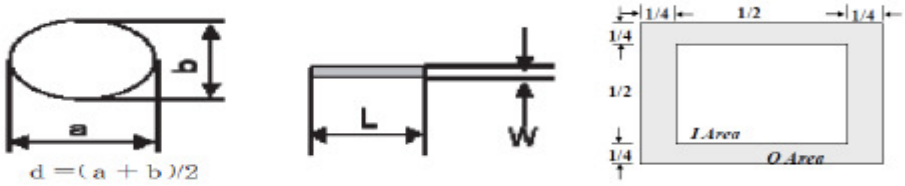
(C) MEASURE

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 PRODUCTS WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF U.R.T.

8.2 Visuals Specification:

<table>
<tr><td>General</td><td colspan="3">1. Customer identified anomalies not defined within this inspection standard shall be reviewed by LowKey, and an additional standard shall be determined by mutual consent.
2. This inspection standard about the image quality shall be applied to any defect within the effective viewing area and shall not be applicable to outside of the area.
3. Inspection conditions
Luminance : 500 Lux min.
Inspection distance : 300 mm.
Temperature : 25±5°C
Direction : Directly above</td></tr>
<tr><td rowspan="6">Definition of inspection item</td><td rowspan="3">Dot defect</td><td>Bright dot defect</td><td>The dot is constantly “on” when power applied to the LCD, even when all “Black” data sent to the screen. Inspection tool: 5% Transparency neutral density filter.Count dot: If the dot is visible through the filter. Don’t count dot: If the dot is not visible through the filter.
 
</td></tr>
<tr><td>Black dot defect</td><td>The dot is constantly “off” when power applied to the LCD, even when all “White” data sent to the screen.</td></tr>
<tr><td>Adjacent dot</td><td>Adjacent dot defect is defined as two or more bright dot defects or black dot defects.
 
</td></tr>
<tr><td rowspan="2">External inspection</td><td>Bubble ,scratch(foreign Particle polarizer, Cell, Backlight)</td><td>Visible operating (all pixels “Black” or “White”) and non operating.</td></tr>
<tr><td>Appearance inspection</td><td>Does not satisfy the value at the spec.</td></tr>
<tr><td>Others</td><td>LED wires</td><td>Damaged to the LED wires, connector, pin, functional failure or appearance failure.</td></tr>
<tr><td>Definition of Size</td><td colspan="2">Definition of circle : definition of linear size definition Area I/O
 
</td></tr>
</table>

Classification		Inspection item		Judgment Standard	
Defect (in LCD glass)	Dot defect	Area		I	O
		Bright dots(Note: Visible under:ND5%) 1:D≤0.15mm:No count); D>0.15mm acceptable: 2		N≤0	N≤2
		Dark dots (0.15mm<D≤0.3mm), D>0.3mm Not allowable		N≤3	
		Bright dot-2Adjacent		N≤0	
		Dark dot-2Adjacent		N≤0	
		Dark or bright dots-3 and more adjacent(note6)		N≤0	
		Total bright and dark dots		N≤5	
		Minimum distance between bright dots		5mm	
		Minimum distance between dark dots		5mm	
		Minimum distance between bright and bright dots		5mm	
	Other	White dot ,dark dot (circle)	Size (mm)	Acceptable number	
			d≤0.2	Neglected	
			0.2mm<D≤0.3mm	N≤4	
			0.3mm<D≤0.4mm	N≤2	
			D>0.4mm	Not allowable	
Visual defect		Foreign partial	Circular foreign material: dark/bright sport	Visible under:ND5% 1:D≤0.15mm:No count 2:0.15mm<D≤0.3mm,N≤4 3:D>0.3mm:Not allowable	
			Linear foreign material: bright or dark line	Invisible under ND5% 0.1mm<W≤0.3mm, 0.3mm<L≤1.5mm,N≤4 Visible under ND5% 0.05mm≤w≤0.1mm, 0.3mm≤L≤0.7mm,N≤4	
		Polarizer	Linear scratch	1:BM:No Count 2:Pixel area 0.05mm≤w≤0.2mm, 1.0mm≤L≤5.0mm,N≤4	
			Bubble peeling	1:BM:No Count 2:Pixel area 0.15mm≤D<0.3mm,N≤4	
		Mura & leak		ND5%	