CONFIDENTIAL(B)

SPECIFICATION

OF

LIQUID CRYSTAL DISPLAY MODULE

CUSTOMER : URT-STD

Model No. : UMOH-P238MD-1T(REV1)

Model version : 1

Document Revision : 4

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

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Revision record

Document Revision	Model No. Version No.	Description	Revision by
0	UMOH-P238MD-T Version No. 0	3.5” TFT.	C.K.T. Chen Eric Wang 18-Mar-2019
1	UMOH-P238MD-T Version No. 1	Adding Command Sequence.	C.K.T. Chen Eric Wang 22-Jul-2019
2	UMOH-P238MD-1T Version No. 0	1. Modify MIPI Interface to RGB Interface. 2. Change Driver IC to NV3052C. 3. Modify Module number from UMOH-P238MD-T to UMOH-P238MD-1T.	C.K.T. Chen Eric Wang 04-Sep-2019
3	UMOH-P238MD-1T(REV1) Version No. 0	1.Increase the backlight brightness. 2.Change the driving condition for backlight. 3.Modify Module number from UMOH-P238MD-1T to UMOH-P238MD-1T(REV1).	C.K.T. Chen Eric Wang 12-Oct-2020
4	UMOH-P238MD-1T(REV1) Version No.1	Modify the Power supply current to 40mA(Max.).	C.K.T. Chen Eric Wang 12-May-2021

CONTENTS:

1. BASIC SPECIFICATION

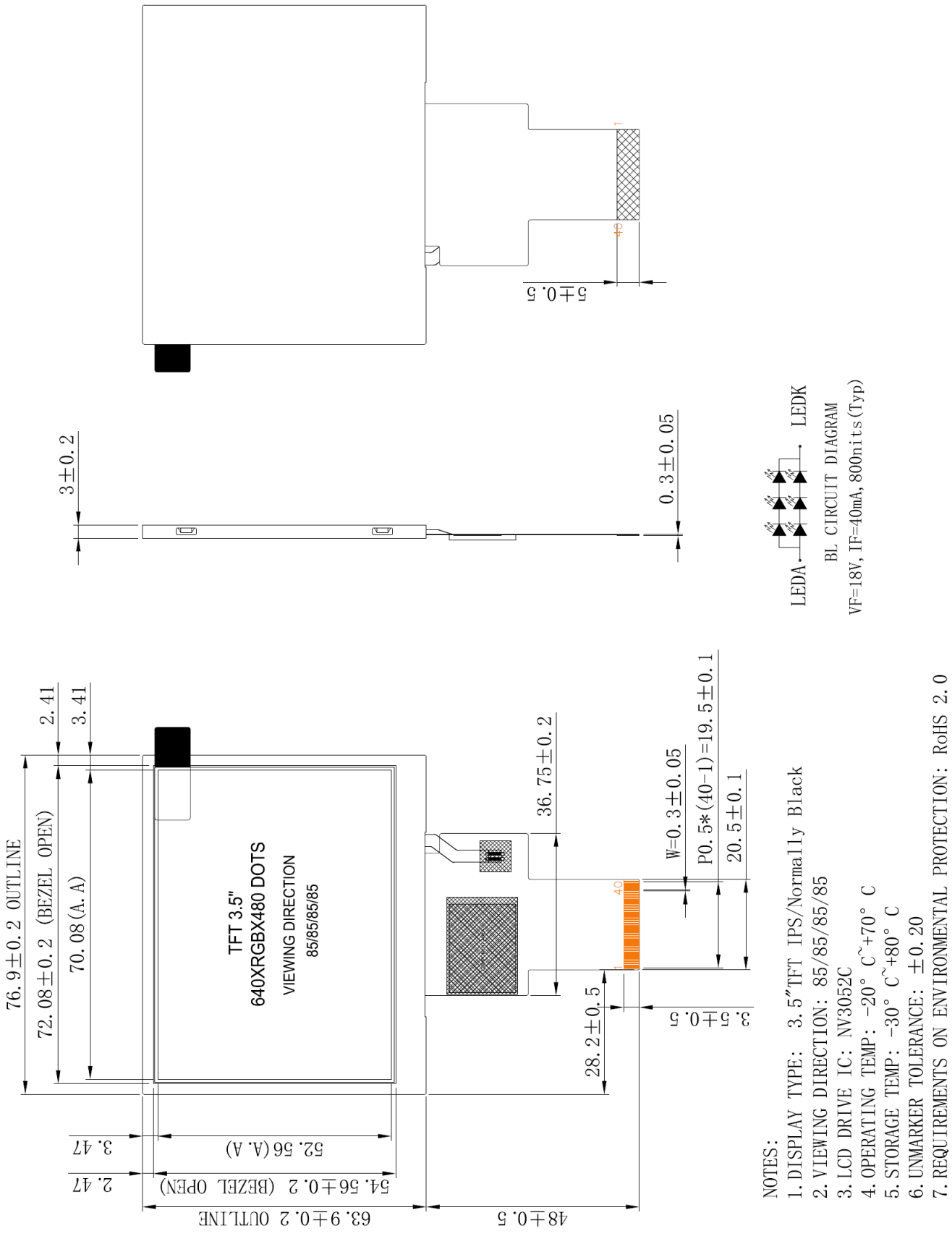
1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Active screen size	3.5” Diagonal	--
Dot Matrix	640 × R.G.B. × 480	Pixel
Module Size (H×V×T)	76.9 x 63.9 x 3.0	mm.
Active Area (H×V)	70.08 x 52.56	mm.
Dot Pitch (W×V)	0.1095 x 0.1095	mm.
Color depth	16.7M	color
Interface	RGB INTERFACE	--
Driving IC Package	COG	--
Driving IC	NV3052C	--
Module weight	TBD	g

1.2 Display specification

Display	Descriptions	Note
LCD Type	IPS	--
LCD Mode	Normally Black	--
Polarizer Surface	Anti-Glare	--
Pixel arrangement	RGB vertical stripe	--
Backlight Type	6 White LEDS	--
Viewing Direction	Free viewing	--

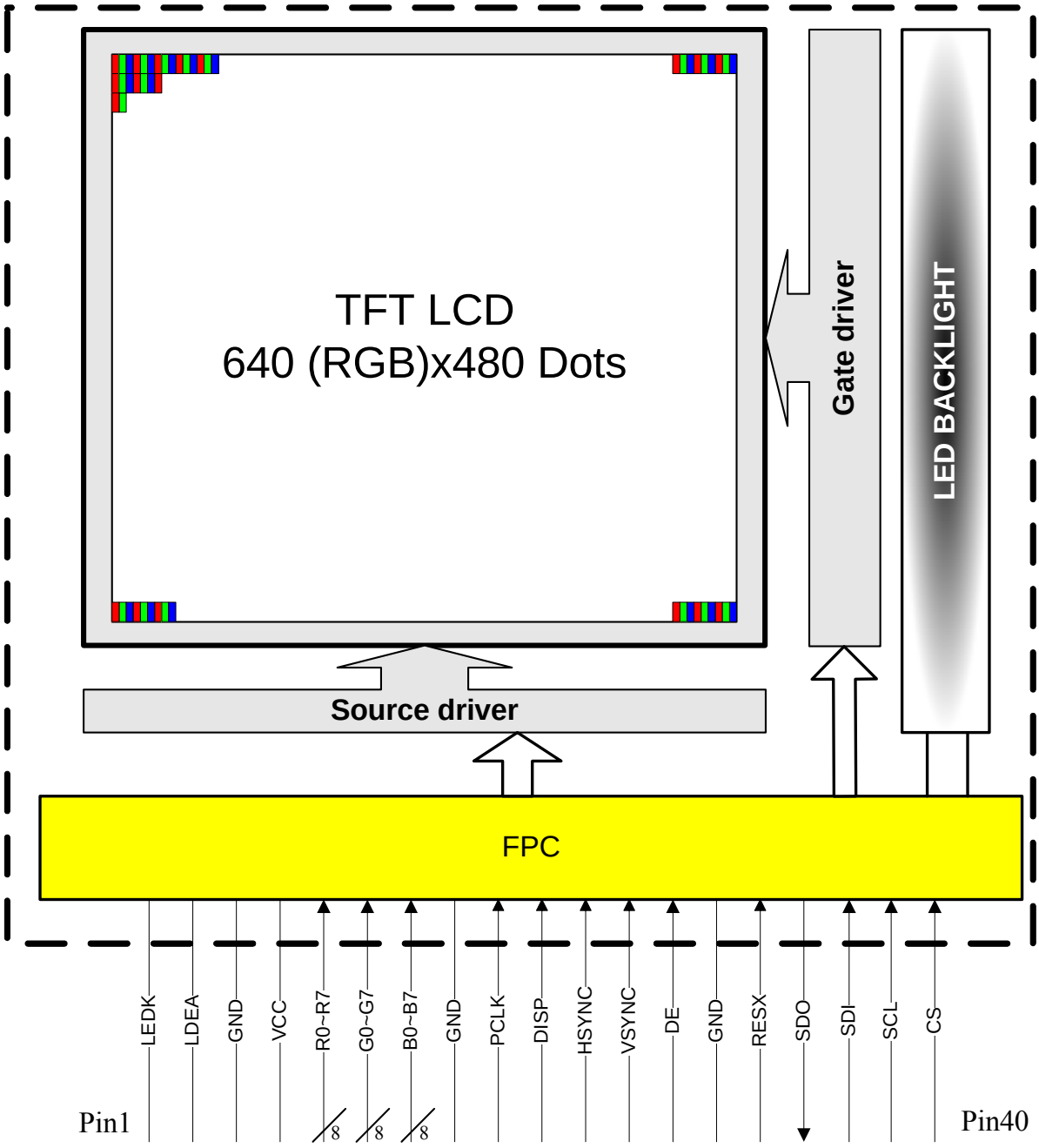
1.3 Outline dimension



NOTES:

1. DISPLAY TYPE: 3.5"TFT IPS/Normally Black
2. VIEWING DIRECTION: 85/85/85/85
3. LCD DRIVE IC: NV3052C
4. OPERATING TEMP: -20° C~+70° C
5. STORAGE TEMP: -30° C~+80° C
6. UNMARKER TOLERANCE: ±0.20
7. REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS 2.0

1.4 Block diagram:



1.5 Interface Pin Connection:

Pin No.	Pin Symbol	I/O	Description
1	LEDK	P	LED Backlight Cathode
2	LEDA	P	LED Backlight Anode
3	GND	P	Ground
4	VCC	P	A power supply for the analog power.
5~12	R0~R7	I	Graphic display Red data.
13~20	G0~G7	I	Graphic display Green data.
21~28	B0~B7	I	Graphic display Blue data.
29	GND	P	Ground
30	PCLK	I	Pixel clock signal in RGB mode
31	DISP	I	Display on/off
32	HSYNC	I	Horizontal sync input in RGB mode.
33	VSYNC	I	Vertical sync input in RGB mode.
34	DE	I	Data enable signal in RGB mode.
35	GND	P	Ground
36	RESX	I	Device reset signal.
37	SDO	O	Serial output signal in SPI I/F
38	SDI	I	Serial input signal in SPI I/F.
39	SCL	I	A synchronous clock signal in SPI I/F.
40	CS	I	Chip select input pin (“Low” enable) in MPU I/F and SPI I/F.

2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VCC	-0.3	4.5	V	1,2
Operate temperature range	Top	-20	70	℃	3,4
Storage temperature rang	Tst	-30	80	℃	3,4
Storage Humidity	HD	20	90	%RH	

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. VCC >VSS must be maintained.
3. The response time will become lower when operated at low temperature.
4. Background color changes slightly depending on ambient temperature.
   The phenomenon is reversible.

2.2 Typical Operation Conditions:

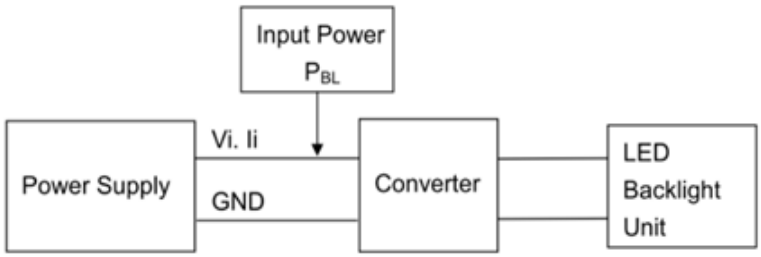
The ambient temperature is Ta = 25 °C

Item	Symbol	Min.	Typ.	Max	Unit
Power supply voltage	VCC	2.5	2.8	3.6	V
Input logic high/low Voltage	VIH	0.7*VCC	-	VCC	V
	VIL	GND	-	0.3*VCC	V
Output logic high/low Voltage	VOH	0.8*VCC	-	VCC	V
	VOL	GND	-	0.2*VCC	V
I/O Leak Current	ILI	-0.1	-	1	uA
Power supply current	ICC	-	20.0	40.0	mA

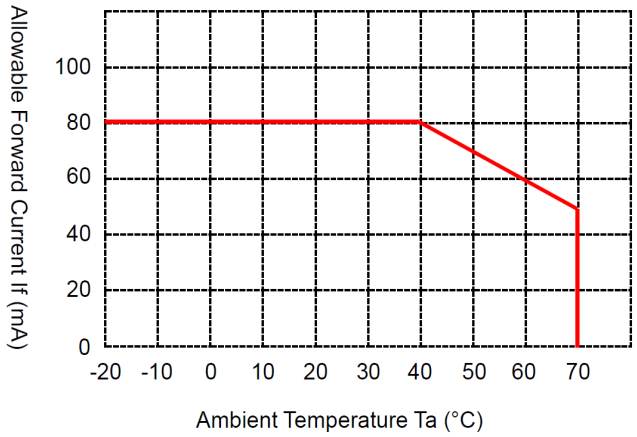
2.3 Back-light only Specification :

Item	Symbol	Min	Typ	Max	Unit	Note
LED Supply voltage	Vf	16.5	18.0	19.5	V	1
LED Supply Current	If	-	40	-	mA	2
Life Time	-	-	30000	-	Hr	3,4

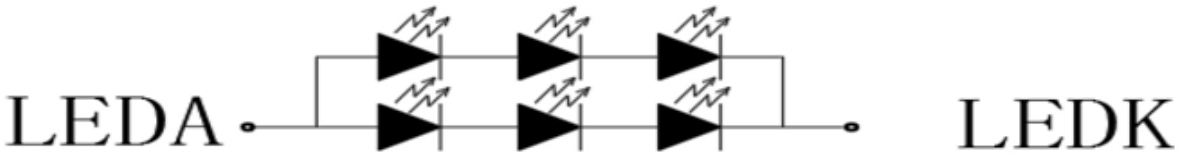
Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and If =40mA.
Note 2: LED current is measured by utilizing a high frequency current meter as shown below:



Note 3: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and If =20mA. The LED lifetime could be decreased if operating If is larger than 20mA.



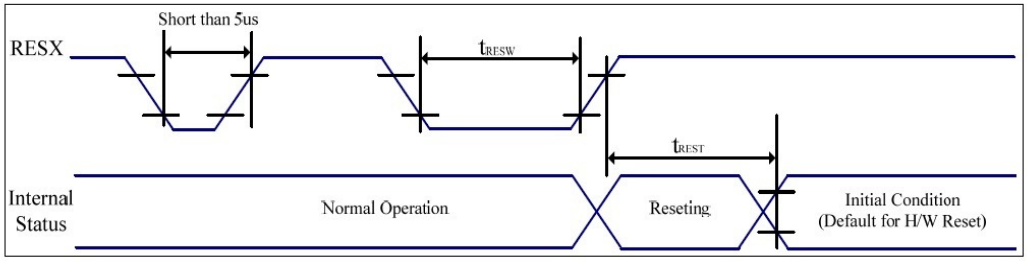
Note 4: LED light bar circuit:



2.4 AC Characteristics

2.4.1 RESET Timing

Reset timing characteristics



VSS=0V, VCC=2.5Vto 3.6V, Ta = -30℃ to 70℃

Symbol	Parameter	Related Pins	MIN	TYP	MAX	Note	Unit
t_{RESW}	*1) Reset low pulse width	RESX	10	-	-	-	us
t_{REST}	*2) Reset complete time	-	-	-	5	When reset applied during Sleep in mode	ms
		-	-	-	120	When reset applied during Sleep out mode	ms

Table: Reset input timing

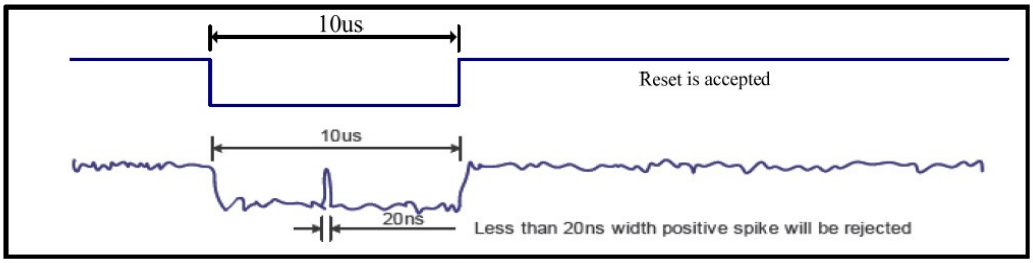
Note 1: Due to an electrostatic discharge on RESX line,spike does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts (It depends on voltage and temperature condition.)

Note 2: During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120ms, when Reset Starts in Sleep Out mode. The display remains the blank state in Sleep In mode) , then return to default condition for H/W reset.

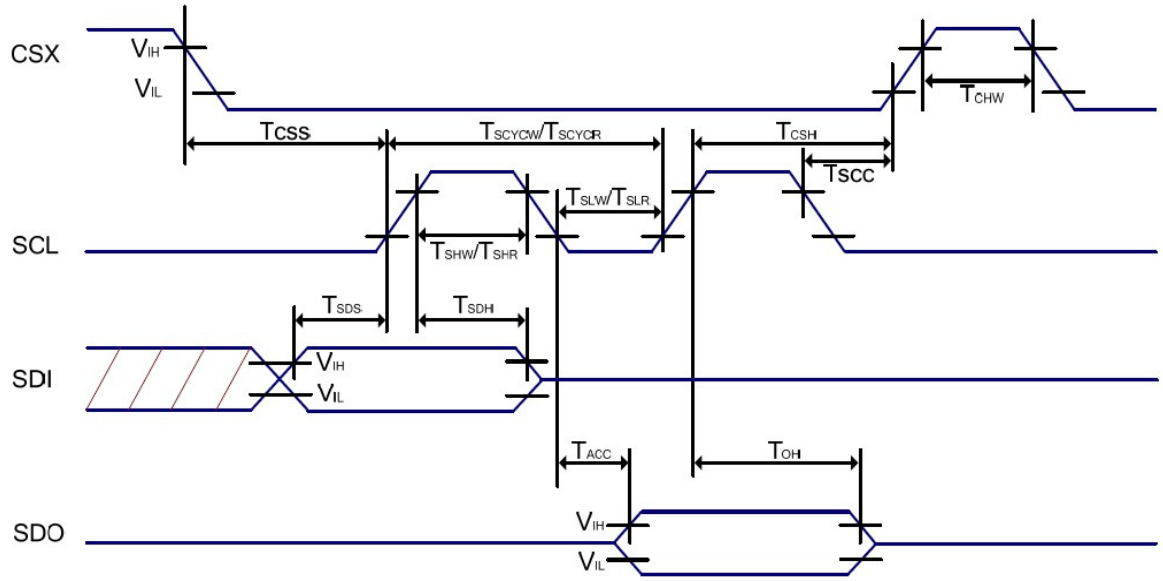
Note 3: During Reset Complete Time, ID1/ID2/ID3 and VCOM value in OTP will be latched to internal register. After a rising edge of RESX, there is a H/W reset complete time (Trest) which lasted 5ms..The loading operation will be done every time during this reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120 msec.

2.4.2 Serial interface characteristics



3-pin Serial Interface Characteristics

Table: SPI Interface Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	Tcss	Chip select setup time	15	-	ns	-
	Tcsh	Chip select hold time	15	-	ns	
	Tscc	Chip select setup time	20	-	ns	
	Tchw	Chip "H" pulse width	40	-	ns	
SCL	Tscycw	Serial clock cycle (Write)	66	-	ns	-
	Tshw	SCL "H" pulse width (Write)	10	-	ns	
	Tslw	SCL "L" pulse width (Write)	10	-	ns	
	Tscycr	Serial clock cycle (Read)	150	-	ns	-
	Tshr	SCL"H" pulse width (Read)	60	-	ns	
	Tslr	SCL"L" pulse width (Read)	60	-	ns	
SDI	TSDS	Data setup time	10	-	ns	-
	Tsdh	Data hold time	10	-	ns	
	Tacc	Access time	10	50	ns	For maximum CL=30pF For minimum CL=8pF
	Toh	Output disable time	15	50	ns	

Note 1: VCC=2.5 to 3.6V, VSSA=VSS=0V, Ta=-30 to 70℃

Note 2: The rise time and fall time (tr, tf) of input signal is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of VCC for Input signals.

2.4.3 RGB Interface Definition

The display operation via the RGB interface is synchronized with the VSYNC, HSYNC, and DOTCLK signals. The data can be written only within the specified area with low power consumption by using window address function. The back porch and front porch are used to set the RGB interface timing.

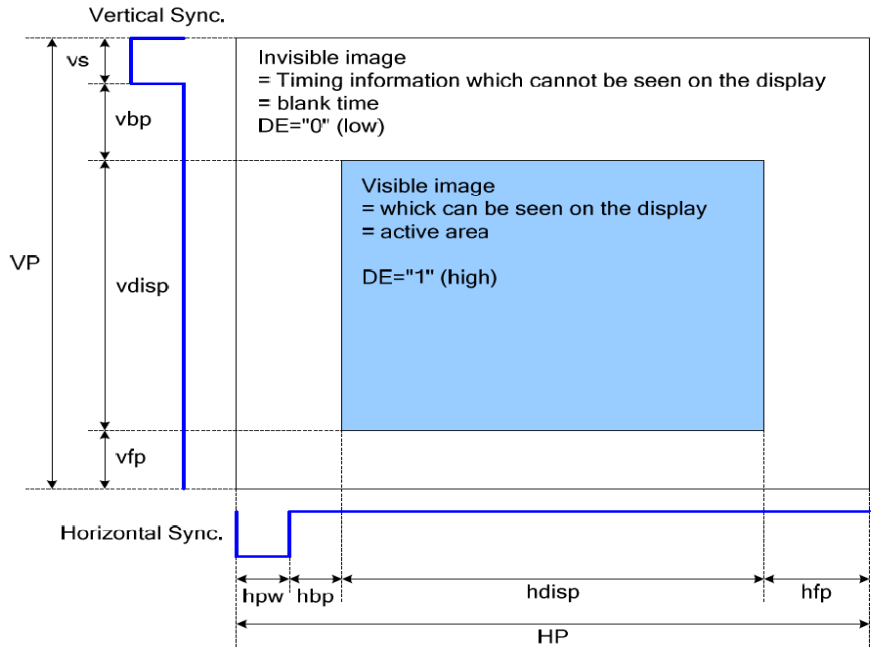


Figure DRAM Access Area by RGB Interface

Please refer to the following table for the setting limitation of RGB interface signals

Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	-	2	-	Clock
Horizontal Sync. Back Porch	hbp	-	20		Clock
Horizontal Sync. Front Porch	hfp	-	20	-	Clock
Vertical Sync. Width	vs	-	2	-	Line
Vertical Sync. Back Porch	vbp	-	6		Line
Vertical Sync. Front Porch	vfp	-	12	-	Line

Typical value are related to the setting of dot clock is 20MHz

2.5 Command Sequence (Recommend by U.R.T.)

```
SPI_WriteComm(0xFF);      SPI_WriteData(0x30);
SPI_WriteComm(0xFF);      SPI_WriteData(0x52);
SPI_WriteComm(0xFF);      SPI_WriteData(0x01);
SPI_WriteComm(0xE3);      SPI_WriteData(0x00);
SPI_WriteComm(0x40);      SPI_WriteData(0x00);
SPI_WriteComm(0x03);      SPI_WriteData(0x40);
SPI_WriteComm(0x04);      SPI_WriteData(0x00);
SPI_WriteComm(0x05);      SPI_WriteData(0x03);
SPI_WriteComm(0x08);      SPI_WriteData(0x00);
SPI_WriteComm(0x09);      SPI_WriteData(0x07);
SPI_WriteComm(0x0A);      SPI_WriteData(0x01);
SPI_WriteComm(0x0B);      SPI_WriteData(0x32);
SPI_WriteComm(0x0C);      SPI_WriteData(0x32);
SPI_WriteComm(0x0D);      SPI_WriteData(0x0B);
SPI_WriteComm(0x0E);      SPI_WriteData(0x00);
SPI_WriteComm(0x23);      SPI_WriteData(0xA2);

SPI_WriteComm(0x24);      SPI_WriteData(0x0c);
SPI_WriteComm(0x25);      SPI_WriteData(0x06);
SPI_WriteComm(0x26);      SPI_WriteData(0x14);
SPI_WriteComm(0x27);      SPI_WriteData(0x14);

SPI_WriteComm(0x38);      SPI_WriteData(0x9C);
SPI_WriteComm(0x39);      SPI_WriteData(0xA7);
SPI_WriteComm(0x3A);      SPI_WriteData(0x3a);

SPI_WriteComm(0x28);      SPI_WriteData(0x40);
SPI_WriteComm(0x29);      SPI_WriteData(0x01);
SPI_WriteComm(0x2A);      SPI_WriteData(0xdf);
SPI_WriteComm(0x49);      SPI_WriteData(0x3C);
SPI_WriteComm(0x91);      SPI_WriteData(0x57);
SPI_WriteComm(0x92);      SPI_WriteData(0x57);
SPI_WriteComm(0xA0);      SPI_WriteData(0x55);
SPI_WriteComm(0xA1);      SPI_WriteData(0x50);
SPI_WriteComm(0xA4);      SPI_WriteData(0x9C);
SPI_WriteComm(0xA7);      SPI_WriteData(0x02);
SPI_WriteComm(0xA8);      SPI_WriteData(0x01);
SPI_WriteComm(0xA9);      SPI_WriteData(0x01);
SPI_WriteComm(0xAA);      SPI_WriteData(0xFC);
SPI_WriteComm(0xAB);      SPI_WriteData(0x28);
SPI_WriteComm(0xAC);      SPI_WriteData(0x06);
SPI_WriteComm(0xAD);      SPI_WriteData(0x06);
SPI_WriteComm(0xAE);      SPI_WriteData(0x06);
SPI_WriteComm(0xAF);      SPI_WriteData(0x03);
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SPI_WriteComm(0xB0);       SPI_WriteData(0x08);
SPI_WriteComm(0xB1);       SPI_WriteData(0x26);
SPI_WriteComm(0xB2);       SPI_WriteData(0x28);
SPI_WriteComm(0xB3);       SPI_WriteData(0x28);
SPI_WriteComm(0xB4);       SPI_WriteData(0x33);
SPI_WriteComm(0xB5);       SPI_WriteData(0x08);
SPI_WriteComm(0xB6);       SPI_WriteData(0x26);
SPI_WriteComm(0xB7);       SPI_WriteData(0x08);
SPI_WriteComm(0xB8);       SPI_WriteData(0x26);
SPI_WriteComm(0xF0);       SPI_WriteData(0x00);
SPI_WriteComm(0xF6);       SPI_WriteData(0xC0);

SPI_WriteComm(0xFF);       SPI_WriteData(0x30);
SPI_WriteComm(0xFF);       SPI_WriteData(0x52);
SPI_WriteComm(0xFF);       SPI_WriteData(0x02);
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SPI_WriteComm(0xB2);       SPI_WriteData(0x17);
SPI_WriteComm(0xB3);       SPI_WriteData(0x2C);
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SPI_WriteComm(0xDF);       SPI_WriteData(0x10);
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SPI_WriteComm(0xCA);        SPI_WriteData(0x17);
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SPI_WriteComm(0xFF);        SPI_WriteData(0x02);
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SPI_WriteComm(0x10);        SPI_WriteData(0x2B);
SPI_WriteComm(0xFF);        SPI_WriteData(0x30);
SPI_WriteComm(0xFF);        SPI_WriteData(0x52);
SPI_WriteComm(0xFF);        SPI_WriteData(0x00);
SPI_WriteComm(0x36);        SPI_WriteData(0x0a);

SPI_WriteComm(0x11);        SPI_WriteData(0x00);      //sleep out
Delay( 200 );
SPI_WriteComm(0x29);        SPI_WriteData(0x00);       //display on
Delay(10);
```

3. OPTICAL CHARACTERISTICS

3.1 Characteristics

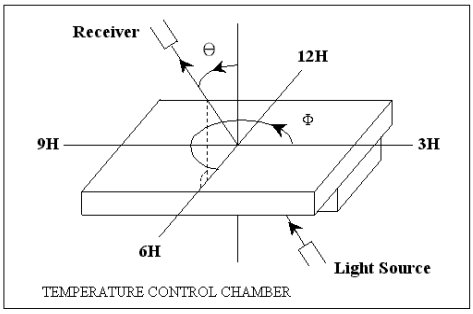
Electrical and Optical Characteristics

No.	Item			symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	Response Time			Tr+Tf	θ=Φ=0°	-	25	50	ms	2
2	Viewing Angle	Hor.	Cr＞10	θ_{2+}	Φ= 0°	75	85	-	degree	3
				θ_{2-}	Φ= 180°	75	85	-		
		Ver.		θ_{1+}	Φ= 270°	75	85	-		
				θ_{1-}	Φ= 90°	75	85	-		
3	Contrast Ratio			Cr	25 ℃	600	800	-	-	4
4	Red x-code			Rx	25 ℃	0.4810	0.5310	0.5810	-	5
	Red y-code			Ry		0.2770	0.3270	0.3770		
	Green x-code			Gx		0.2666	0.3166	0.3666		
	Green y-code			Gy		0.5223	0.5723	0.6223		
	Blue x-code			Bx		0.0920	0.1420	0.1920		
	Blue y-code			By		0.0132	0.0632	0.1132		
	White x-code			Wx		0.2323	0.2823	0.3323		
	White y-code			Wy		0.2671	0.3171	0.3671		
	Brightness			Y		700	800	-	cd/m^2	
5	Brightness Uniformity				25 ℃	75	80	-	%	6

3.2 Definition of optical characteristics

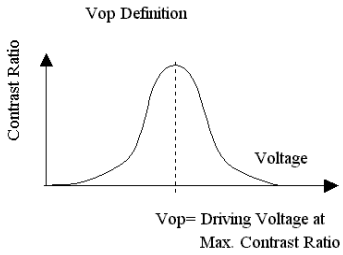
Measurement condition :

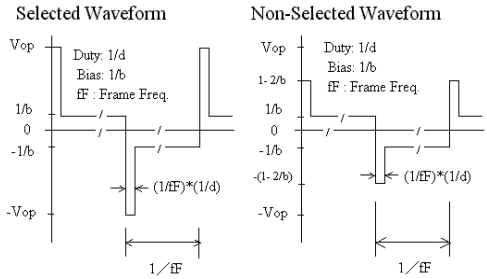
Transmissive and Transflective type



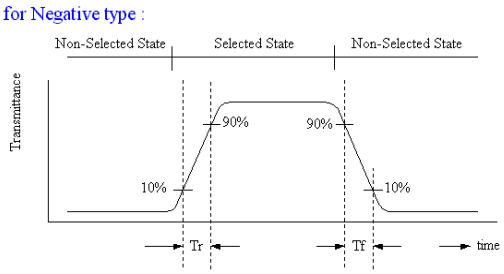
PHOTAL LCD-5000

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

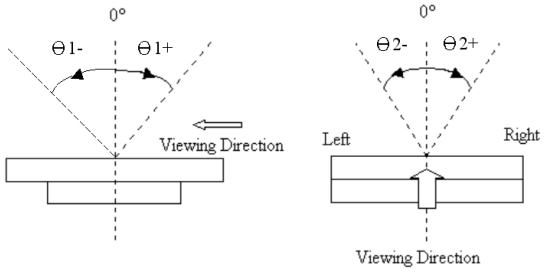




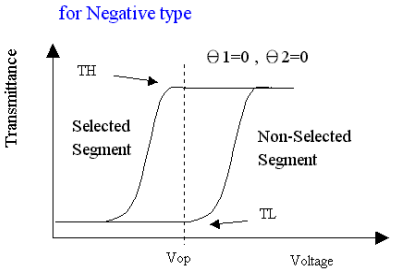
[Note 2] Definition of Response Time



[Note 3] Definition of Viewing Angle :

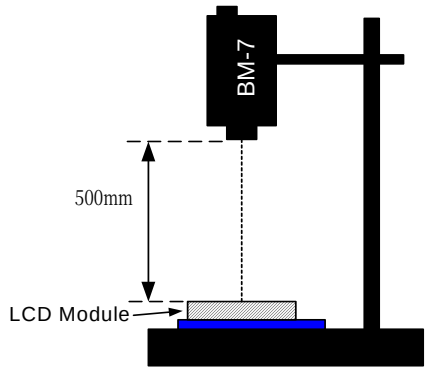


[Note 4] Definition of Contrast Ratio :

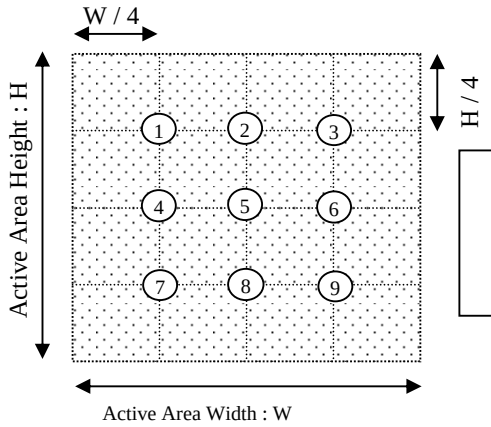


$$\text{Contrast Ratio} = \frac{TH}{TL}$$

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

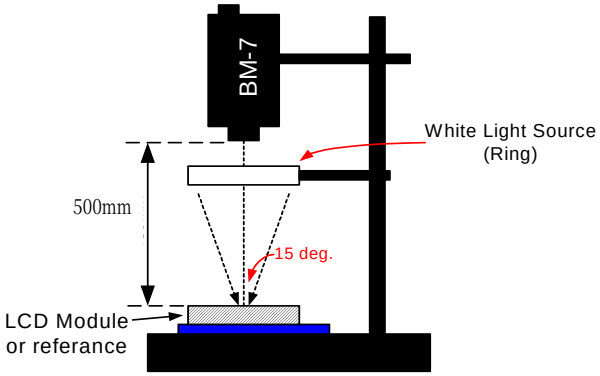


[Note 6] Definition of Brightness Uniformity



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

[Note 7] Definition of Measurement of Reflectance



4. RELIABILITY :

Item No	Items	Condition	Note
1	High temperature operating	70 ℃ , 96 hours	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1. Air bubble in the LCD. 2. Seal leak. 3. Non-display. 4. Missing segments. 5. Glass crack. 6. Current IDD is twice higher than initial value. 7. The surface shall be free from damage. 8. The electric characteristic requirements shall be satisfied.
2	Low temperature operating	-20 ℃ , 96 hours	
3	High temperature storage	80 ℃ , 96 hours	
4	Low temperature storage	-30 ℃ , 96 hours	
5	High temperature & humidity storage	50℃, 90%RH, 96hours	
6	Thermal Shock storage	-20℃, 30min.<=> 70℃, 30min. 10 Cycles	
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	ESD Test	Voltage:±8KV,R:330Ω,C:150PF, Air Mode,10times	

REMARK:

1. The Test samples should be applied to only one test item.
2. For Damp Proof Test, Pure water(Resistance＞10MΩ)should be used.
3. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
4. EL evaluation should be accepted 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.
5. Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, optical characteristic

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**

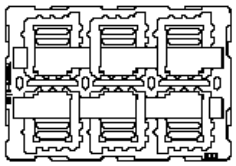
  Year Month Day - Serial no.

- Example: 141108 - 0003 ==> Year 2014, November,8th , Serial no. 0003

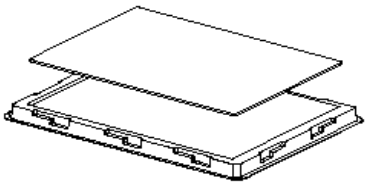
Note ： The lot no. attached on the packing box will be used for tracking once the part is too small to print the date code.

7. Packing

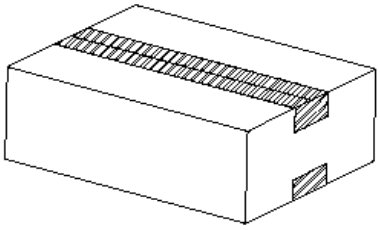
6pcs / Tray

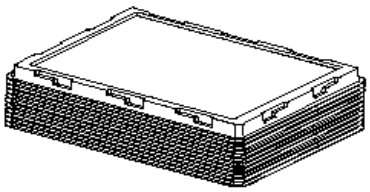


Put a piece EPE on each tray.



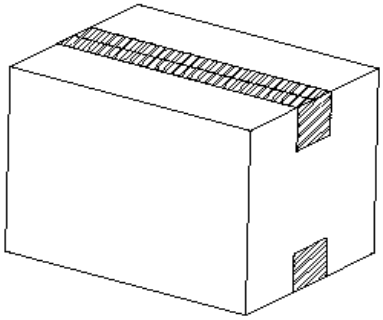
Inner box (72pcs TFT)
Carton Size:35.8*25.9*14.3（cm)

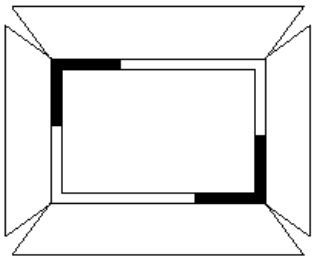




Cross-stacked tray, 13pcs, the top is empty tray.

Each two inner boxes into a outer carton.
Carton Size:
39.5*29.5*31.6（cm)





Next to the inner box to place two cardboard before sealing.

Item	Part Name	Q'ty	NOTE
1	TFT	144	
2	TRAY	26	
3	EPE	24	
4	INNER BOX	2	
5	CARDBOARD	2	
6	OUTER CARTON	1	

光聯外箱標籤 ：

Model No. UMOH-P238MD-1T(REV1)

Q'ty pcs

*

Lot No.

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.

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 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. INSPECTION ANGLE：THE VISION OF INSPECTOR OR SHOULD BE PERPENDICULAR TO THE SURFACE OF THE MODULE.

8.2.2. CHECKER SHALL SEE OVER 350±50 mm. WITH BARE EYES FAR FROM SAMPLE.

8.2.3. ENVIRONMENT ILLUMINATION: 300 ~ 700 LUX.

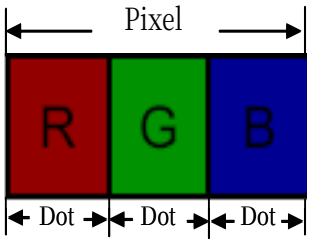
8.2.4. INSPECTION TIME：PERCEPTIBILITY TEST TIME : 20 SECONDS MAX.

8.2.5. ENVIRONMENT： ROOM TEMPERATURE： 25±5°C；HUMIDITY： 65±5% RH.

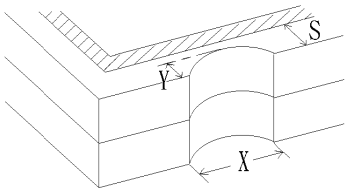
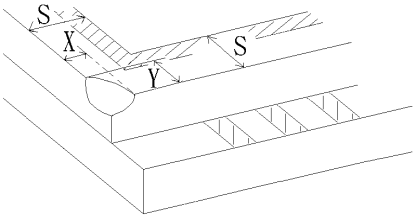
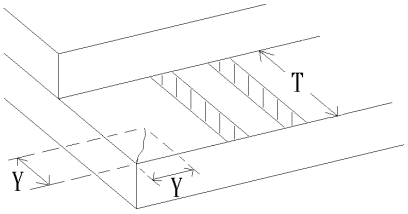
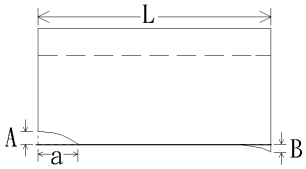
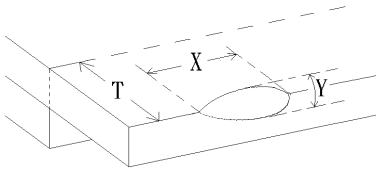
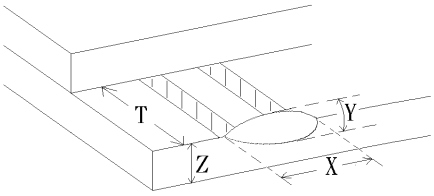
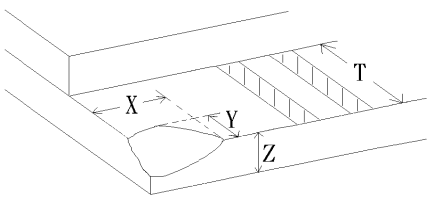
8.3. INSPECTION PLAN :

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. POLARIZER EDGE OR LCD'S SEALING LINE IS VISABLE IN THE VIEWING AREA.	ACCORDING TO DRAWING REJECTED.	Minor
	6. BLEMISH、BLACK SPOT、 WHITE SPOT IN THE LCD AND LCD GLASS CRACKS (INSIDE VIEWING AREA)	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	7. BLEMISH、BLACK SPOT WHITE SPOT AND SCRATCH ON THE POLARIZER (INSIDE VIEWING AREA)	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA) THAT CAN BE REMOVED------DISREGARD	Minor
	8. BUBBLE IN POLARIZER (INSIDE VIEWING AREA)	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	9. LCD'S RAINBOW COLOR (INSIDE VIEWING AREA)	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	NON 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 ≦0.20</td><td>DISREGARD</td></tr>
<tr><td>0.20 < Φ ≦ 0.25</td><td>3 (Distance>5mm)</td></tr>
<tr><td>0.25 < 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 ≦0.03</td><td>DISREGARD</td></tr>
<tr><td>L ≦ 5.0</td><td>0.03 < W ≦0.07</td><td>2 (Distance>5mm)</td></tr>
<tr><td>------</td><td>0.07 < 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</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>Φ ≦0.20</td><td>DISREGARD</td></tr>
<tr><td>0.20 < Φ ≦ 0.50</td><td>2 (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≦ 1</td></tr>
<tr><td>Dark dot</td><td>N≦ 2</td></tr>
<tr><td>Total dot</td><td>N≦ 3</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.
Note 4：The bright dot defect must be visible through 2% ND filter</td></tr>
</table>

NO.	CLASS	ITEM	JUDGEMENT
8.4.4	MINOR	LCD GLASS CHIPPING	 Y > S Reject
8.4.5	MINOR	LCD GLASS CHIPPING	 X or Y > S Reject
8.4.6	MAJOR	LCD GLASS GLASS CRACK	 Y > (1/2) T Reject
8.4.7	MAJOR	LCD GLASS SCRIBE DEFECT	 1. a> L/3 , A>1.5mm. Reject 2. B : ACCORDING TO DIMENSION
8.4.8	MINOR	LCD GLASS CHIPPING (ON THE TERMINAL AREA)	 Φ = (x+y)/2 > 2.5 mm Reject
8.4.9	MINOR	LCD GLASS CHIPPING (ON THE TERMINAL SURFACE)	 Y > (1/3) T Reject
8.4.10	MINOR	LCD GLASS CHIPPING	 Y > T Reject