

SPECIFICATION

OF

LIQUID CRYSTAL DISPLAY MODULE



CUSTOMER : URT-STD

Model No. : UMSH-8247MD-1T(REV3)

Model version : 0

Document Revision : 7

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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Sep-02-2024
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Revision record

Document Revision	Model No. Version No.	Description	Revision by
0	UMSH-8247MD-T (UFNH-K080EY-1FT) Version No. 0		Albert Lin Nick Liu
1	UMSH-8247MD-1T (UFNH-K080EY-1FT) Version No. 0	1. Remove the MPU board. 2. Modify the module number from UMSH-8247MD-T to UMSH-8247MD-1T.	Albert Lin Nick Liu 03-Mar-2009
2	UMSH-8247MD-1T (UFNH-K080EY-1FT) Version No. 1	Modify the ADJ pin from low level to high level.	Albert Lin Nick Liu 03-Apr-2009
3	UMSH-8247MD-1T (UFNH-K080EY-1FT) Version No. 2	Modify the AC Characteristics (page 9, 10, 11 and 12).	Albert Lin Nick Liu 19-Nov-2012
4	UMSH-8247MD-1T(REV2) (UFNH-K080EY-6FT) Version No.0	1. Modify PCB. 2. Modify module number from UMSH-8247MD-1T to UMSH-8247MD-1T(REV2).	H.F. Kuo Danny Jhuaung 27-Apr-2015
5	UMSH-8247MD-1T(REV2) Version No.1	Add description of B/L adjustment.	Ai Ching Cheng George Pan 15-Jun-2022
6	UMSH-8247MD-1T(REV2G) Version No.0	1. Change TFT LCD. 2. Modify module number from UMSH-8247MD-1T(REV2) to UMSH-8247MD-1T(REV2G).	Ai Ching Cheng George Pan 13-Feb-2023
7	UMSH-8247MD-1T(REV3) Version No.0	1. Modify TFT LCD color filter. 2. Modify module number from UMSH-8247MD-1T(REV2G) to UMSH-8247MD-1T(REV3).	Ai Ching Cheng George Pan 02-Sep-2024
		Revision 7 ; UMSH-8247MD-1T(REV3) Ver. 0 ; September-02-2024	Page: 2

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1. BASIC SPECIFICATION

1.1 Mechanical specifications

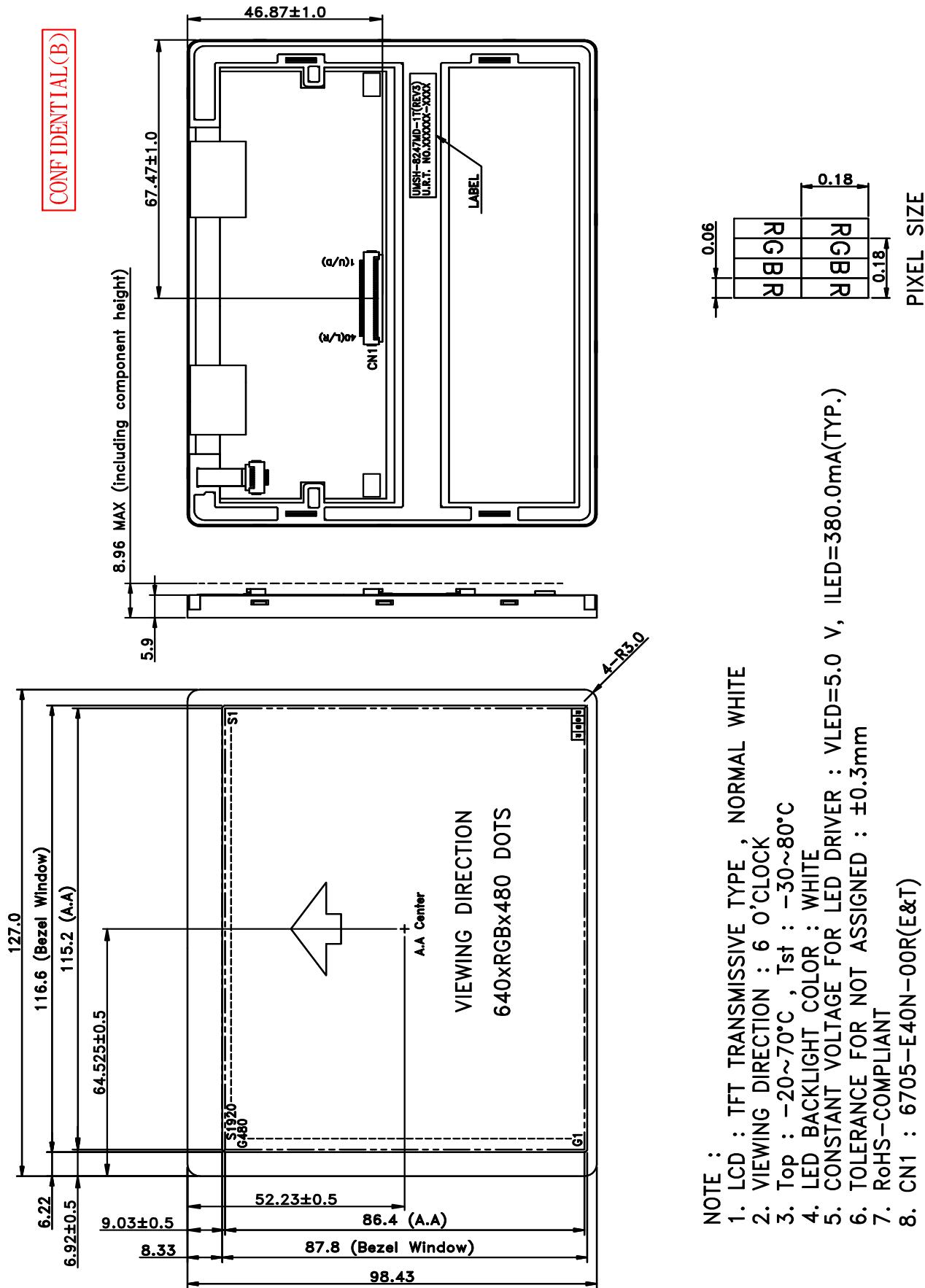
Items	Nominal Dimension	Unit
Active screen size	5.7" diagonal	-
Dot Matrix	640 x RGB x 480	Pixel
Module Size (W x H x T)	127.00 x 98.43 x 8.96	mm.
Active Area (W x H)	115.2 x 86.4	mm.
Pixel Size (WxH)	0.18 x 0.18	mm.
Color depth	262K	color
Interface	Parallel 18-bit RGB	-
Driving IC Package	COG	-
Driving IC	HX8250-A (Source Driver) *2 + HX8678-A (Gate Driver) *1	-
Module weight	106±10%	g

1.2 Display specification

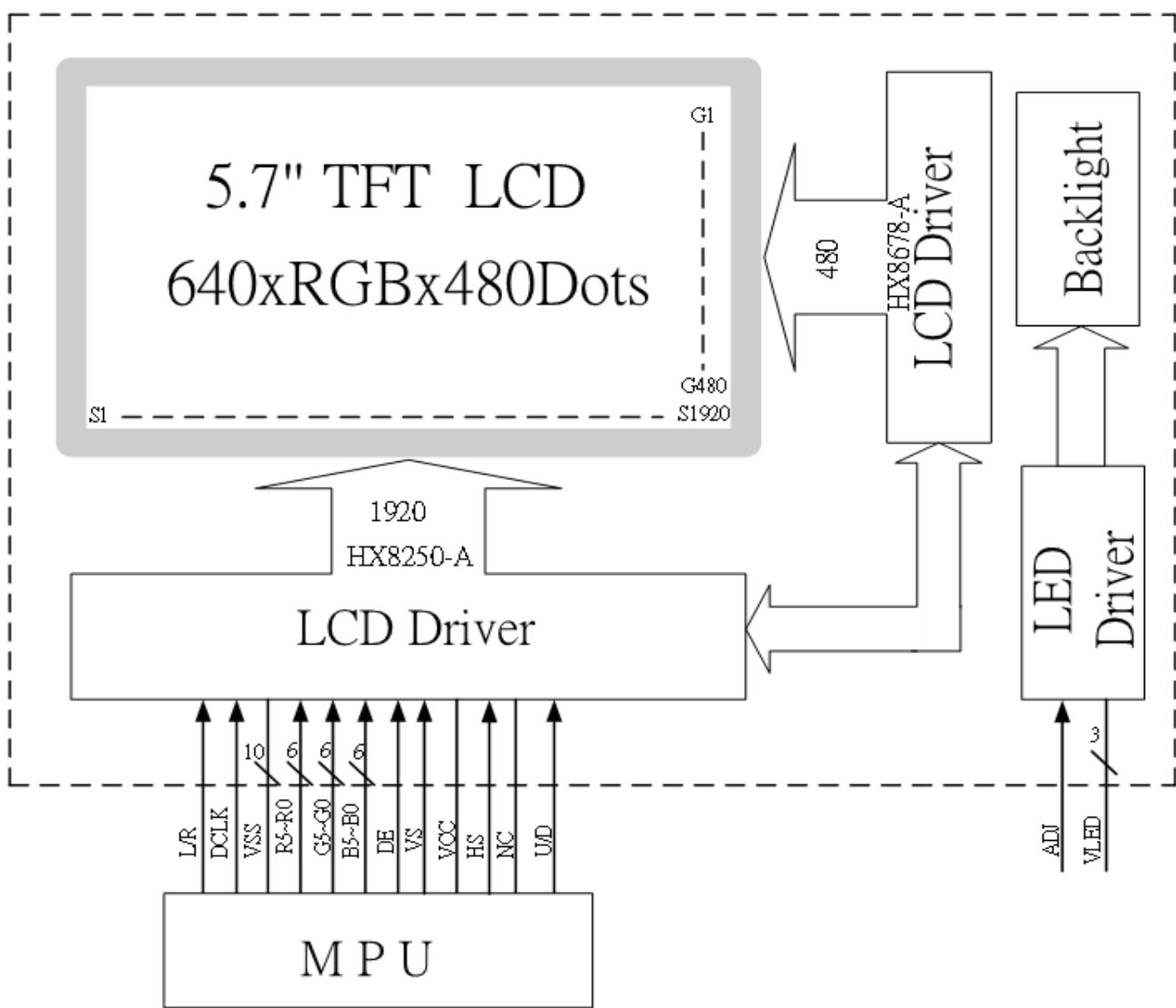
Display	Descriptions	Note
LCD Type	a-Si TFT	-
LCD Mode	TN / Normal white	-
Polarizer Mode	Transmissive	-
Polarizer Surface	Normal	-
Pixel arrangement	RGB-stripe	-
Backlight Type	LED	-
Viewing Direction (Gray scale inversion)	6 O'clock Direction	-

Color tone is slightly changed by temperature and driving voltage.

1.3 Outline dimension



1.4 Block diagram:



1.5 Interface Pin Connection:

Pin No.	Pin Symbol	I/O	Description
1	U/D	I	Up or Down Display Control.
2	NC	-	Customer non-connect.
3	HS	I	Hsync Horizontal SYNC.
4~6	VLED	P	Power supply for digital circuit LED.(+5.0V)
7	VCC	P	Power supply for digital circuit LCD. (+3.3V)
8	VS	I	Vsync Vertical SYNC.
9	DE	I	Data enable.
10~11	VSS	P	Power ground.
12	ADJ	I	Adjust for LED brightness (PWM), HIGH active. (+5.0V)
13	B5	I	Blue data input. (MSB)
14 ~ 15	B4 ~ B3	I	Blue data input.
16	VSS	P	Power ground.
17 ~ 18	B2 ~ B1	I	Blue data input.
19	B0	I	Blue data input. (LSB)
20	VSS	P	Power ground.
21	G5	I	Green data input. (MSB)
22 ~ 23	G4 ~ G3	I	Green data input.
24	VSS	P	Power ground.
25 ~ 26	G2 ~ G1	I	Green data input.
27	G0	I	Green data input. (LSB)
28	VSS	P	Power ground.

Pin No.	Pin Symbol	I/O	Description
29	R5	I	Red data input. (MSB)
30 ~ 31	R4 ~ R3	I	Red data input.
32	VSS	P	Power ground.
33 ~ 34	R2 ~ R1	I	Red data input.
35	R0	I	Red data input. (LSB)
36~37	VSS	P	Power ground.
38	DCLK	I	Clock signals.
39	VSS	P	Power ground.
40	L/R	I	Left or Right Display Control.

2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Power supply voltage	VCC	-0.3	7.0	V
Input voltage	V _{in}	-0.3	VCC+0.3	V
Operate temperature range	T _{OP}	-20	70	°C
Storage temperature range	T _{ST}	-30	80	°C

2.2 DC Characteristics

T_a = 25°C

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage	V _{CC}	-	3.3	-	V	-
Input Voltage	V _{IL}	0	-	0.3V _{CC}	V	L level
	V _{IH}	0.7V _{CC}	-	V _{CC}	V	H level
Current consumption	I _{CC}	-	100	150	mA	Note 1

*Note1:

Measuring Condition:

Standard Value MAX.

T_a = 25°C

V_{CC} - GND = 3.3V

Display Pattern = Check pattern



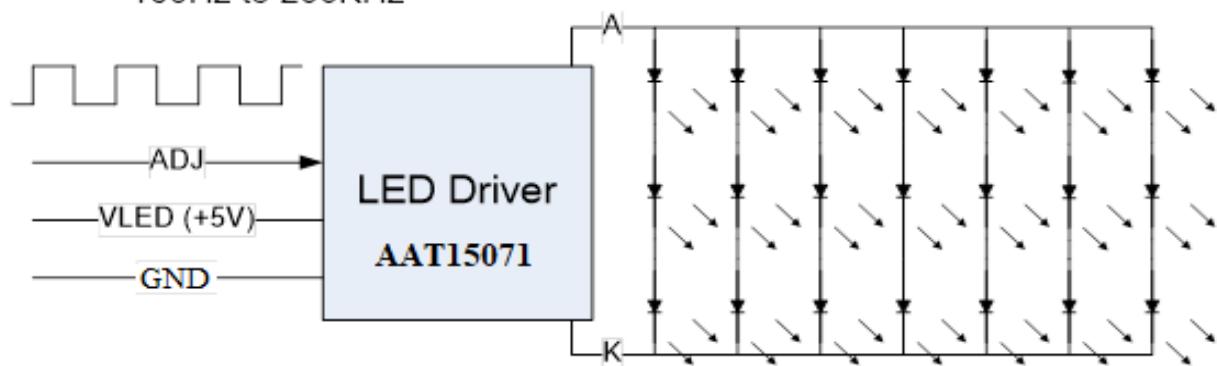
0 gray black pattern

2.2.1 Back-light Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	Unit	Test Condition	NOTE
Supply Current for LED Driver	I _{LED}	-	380	760	mA	T _a =25°C	-
Supply Voltage for LED Driver	V _{LED}	-	5	-	V	T _a =25°C	-
LED Forward Voltage	V _F	-	9.9	-	V	-	-
LED Forward Current	I _F	-	140	-	mA	-	-
Input Voltage	V _{IL}	0	-	0.4	V	L level	-
	V _{IH}	1.4	-	5	V	H level	-
Half-Life Time	L _f	-	50000	-	hrs	T _a =25°C 60 RH%	1

Note 1 : The " Half-Life Time " is defined as the module brightness decrease to 50% original brightness.

Wide PWM Dimming Range :
100Hz to 200KHz



For interface pin12 (ADJ)

ADJ signal=0~5V, operating frequency=100Hz~200K Hz (Duty=5%~100%)

B/L adjustment:

The backlight can be on from 1.4V through 5.0V range, can be off under 0.4V, in between 0.4 to 1.4V there is no function. As long as the input voltage is over 1.4V, the LED driver will sense it as "high". Then customer can adjust the frequency to adjust the brightness.

The frequency from 100 to 200K HZ is for dimming speed and power consumption.

The frequency can be adjusted to allocate the ratio of the time of being on and being off for having the brightness adjusted.

2.3 AC Characteristics :

2.3.1 AC Electrical Characteristics :

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
HS setup time	T_{hst}	10	-	-	ns
HS hold time	T_{hhd}	10	-	-	ns
VS setup time	T_{vst}	10	-	-	ns
VS hold time	T_{vhd}	10	-	-	ns
Data setup time	T_{dsu}	10	-	-	ns
Data hold time	T_{dhd}	10	-	-	ns
DEN setup time	T_{esu}	10	-	-	ns
VS falling to HS falling time on odd field @ RGB mode	T_{HV_O}	-4	0	+4	T_{CPH}
VS falling to HS falling time on even field @ RGB mode	T_{HV_E}	0.4	0.5	0.6	T_H
Source output settling time	T_{ST}	-	12	20	μs
Source output loading R	R_{SL}	-	2	-	K ohm
Source output loading C	C_{SL}	-	60	-	pF
POL output delay time	T_{DP}	-	-	40	ns

2.3.2 Digital Parallel RGB interface (1920x480 resolution) :

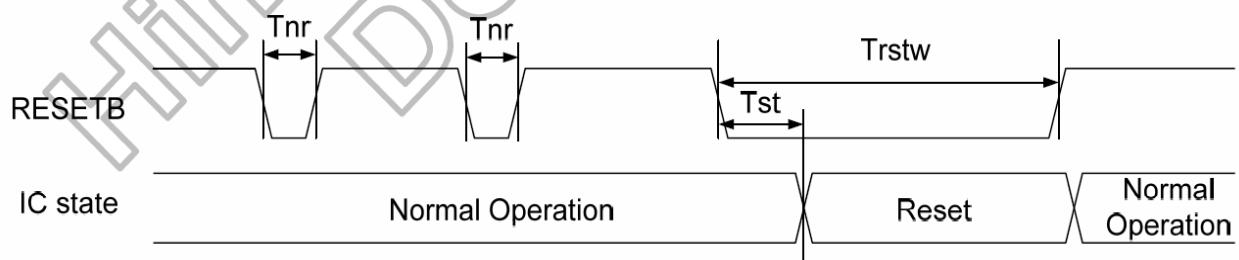
PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
CLK frequency	F_{CPH}	-	25.175	-	MHz
CLK period	T_{CPH}	-	39.7	-	ns
CLK pulse duty	T_{CWH}	40	50	60	%
HS period	T_H	-	800	-	T_{CPH}
HS pulse width	T_{WH}	5	30	-	T_{CPH}
HS-first horizontal data time	T_{HS}	112	144	175	T_{CPH}
DEN pulse width	T_{EP}	-	640	-	T_{CPH}
VS pulse width	T_{WV}	1	3	5	T_H
VS-DEN time	T_{STV}	-	35	-	T_H
VS period	T_V	-	525	-	T_H

Note: When SYNC mode is used, 1st data start from 144th CLK after HS falling (when STHD[5:0]=00000)

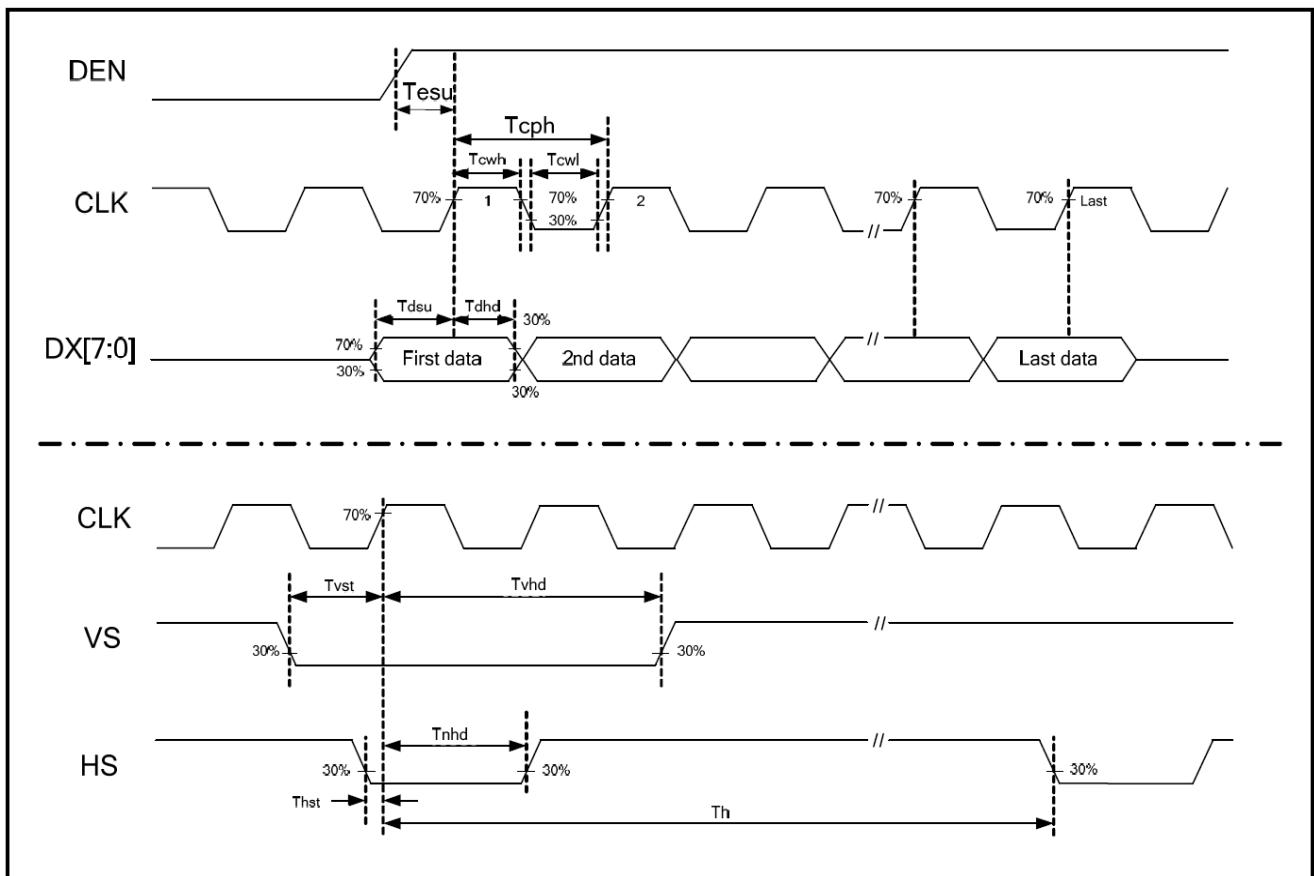
PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
OEV pulse width	T_{OEV}	-	100	-	T_{CPH}
CKV pulse width	T_{CKV}	-	96	-	T_{CPH}
HS-CKV time	T_1	-	52	-	T_{CPH}
HS-OEV time	T_2	-	8	-	T_{CPH}
HS-POL time	T_3	-	72	-	T_{CPH}
STV setup time	T_{SUV}	-	46	-	T_{CPH}
STV pulse width	T_{WSTV}	-	1	-	T_H

2.3.3 Hardware reset timing :

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
RESETB low pulse width	T_{rstw}	10	-	-	μs
Negative noise pulse width	T_{nr}		-	2	μs
Reset start time	T_{st}	2	-		μs

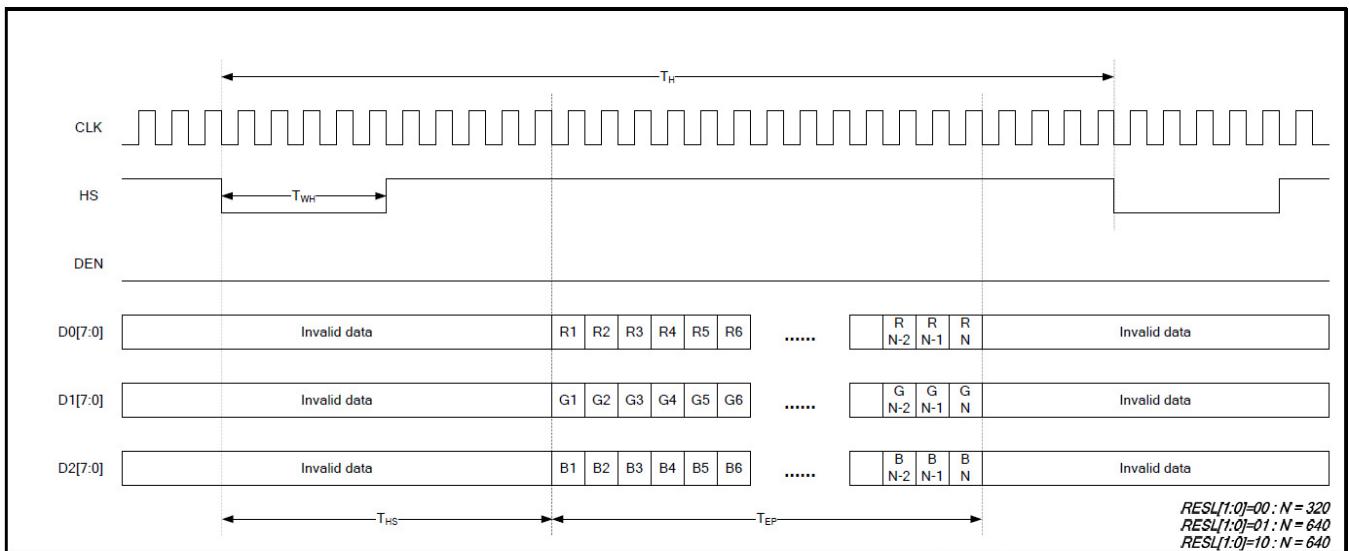


2.3.4 Interface Timing Chart:

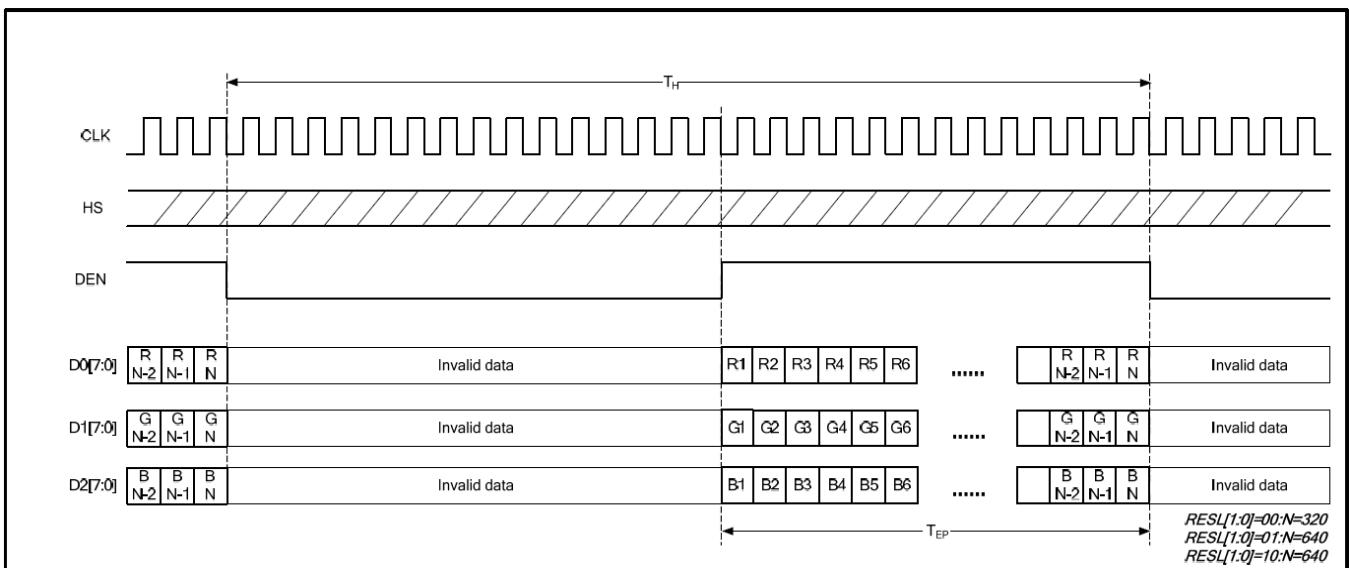


2.3.5 Data input format for RGB Mode:

Parallel RGB SYNC Mode Horizontal Data Format :



Parallel RGB DE Mode Horizontal Data Format :



3. OPTICAL CHARACTERISTICS

3.1 Characteristics

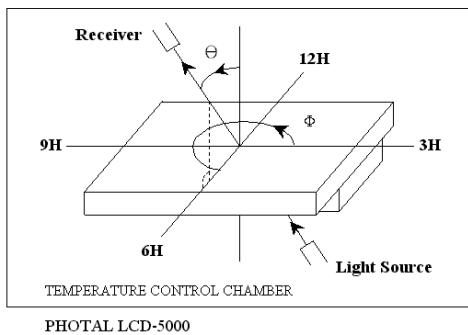
Electrical and Optical Characteristics

No.	Item	symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	Response Time		Tr	25 °C	-	10	20	ms
			Tf	25 °C	-	15	30	
2	Viewing Angle	Hor. Cr. ≥ 10	θ_{2+}	$\Phi = 0^\circ$	-	70	-	degree
			θ_2	$\Phi = 180^\circ$	-	70	-	
			θ_{1+}	$\Phi = 270^\circ$	-	60	-	
			θ_{1-}	$\Phi = 90^\circ$	-	50	-	
3	Contrast Ratio	Cr	25 °C	600	800	-	-	4
4	Red x-code	Rx	25 °C	0.558	0.608	0.658	-	5
	Red y-code	Ry		0.300	0.350	0.400		
	Green x-code	Gx		0.317	0.367	0.417		
	Green y-code	Gy		0.531	0.581	0.631		
	Blue x-code	Bx		0.100	0.150	0.200		
	Blue y-code	By		0.071	0.121	0.171		
	White x-code	Wx		0.267	0.317	0.367		
	White y-code	Wy		0.296	0.346	0.396		
	Brightness	Y		600	600	-	cd/m ²	
5	Brightness Uniformity		25 °C	80	-	-	%	6

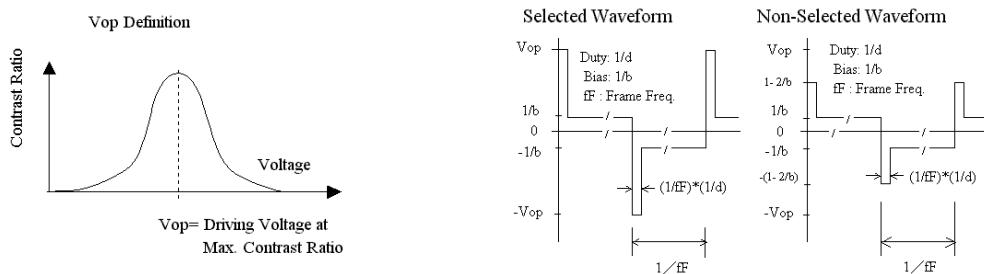
3.2 Definition of optical characteristics

Measurement condition :

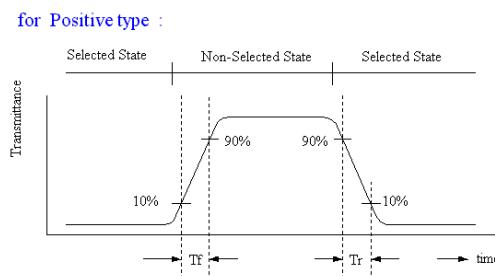
Transmissive and Transflective type



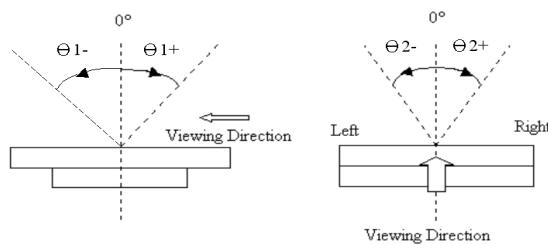
[Note 1] Definition of LCD Driving Vop and Waveform :



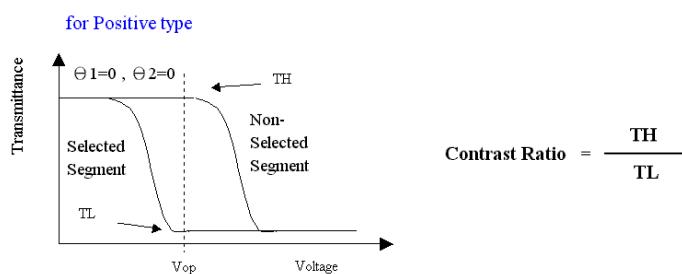
[Note 2] Definition of Response Time



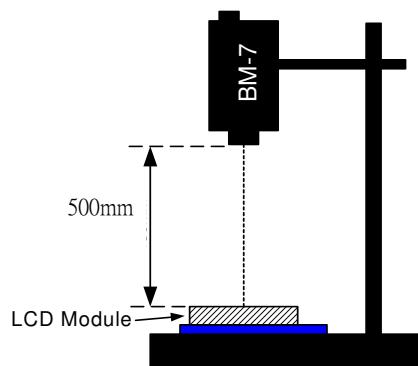
[Note 3] Definition of Viewing Angle :



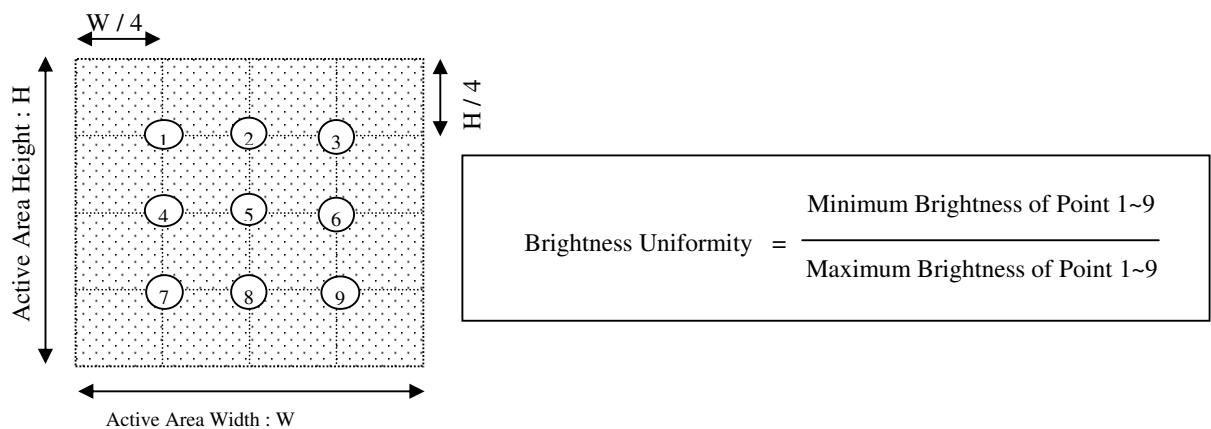
[Note 4] Definition of Contrast Ratio :



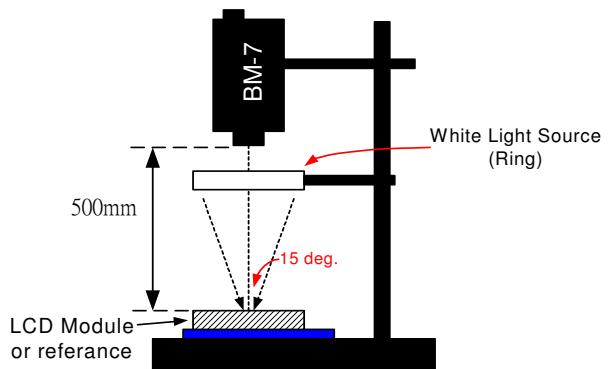
[Note 5] Definition of measurement of Color Chromaticity and Brightness



[Note 6] Definition of Brightness Uniformity



[Note 7] Definition of Measurement of Reflectance



4. RELIABILITY :

Item No	Items	Condition	Note
1	High temperature operating	70 °C , 200 hours	1
2	Low temperature operating	-20 °C , 200 hours	1
3	High temperature storage	80 °C , 200 hours	1
4	Low temperature storage	-30 °C , 200 hours	1
5	High temperature & humidity storage	60°C, 90%RH, 100 hours	2
6	Thermal Shock storage	-30°C, 30min.<=> 80°C, 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°C , 70%RH below , 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.

* 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

5.1 PRECAUTION FOR HANDLING LCM

- The LCD module contains a C-MOS LSI. People who operate the LCM should wear ESD protection equipment 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.
- Use a non-leak iron for soldering LCM, soldering Temperature at iron tip : $350^{\circ}\text{C} \pm 20^{\circ}\text{C}$.
- 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 wipe 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 than the operating temperature range and on the other hand at higher temperature LCD's show 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 decompose and cause permanent damage on display !!
- Liquid in LCM is hazardous substance. In case a contact with liquid crystal material is occurred, be sure to immediately wash such material away by soap and water.
- The polarizer is easily damaged and should be handled 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 $25 \pm 10^{\circ}\text{C}$ 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 products or systems, an authorization from URT is required. URT will not be responsible for any damage or loss which is 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 Strategic 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.

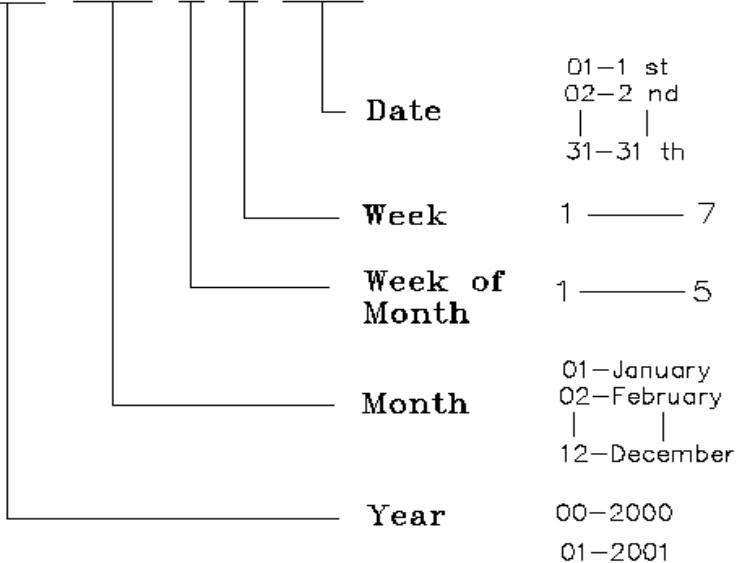
- Example: 121108 - 0003 ==> Year 2012, November, 8th, Serial No.0003

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.

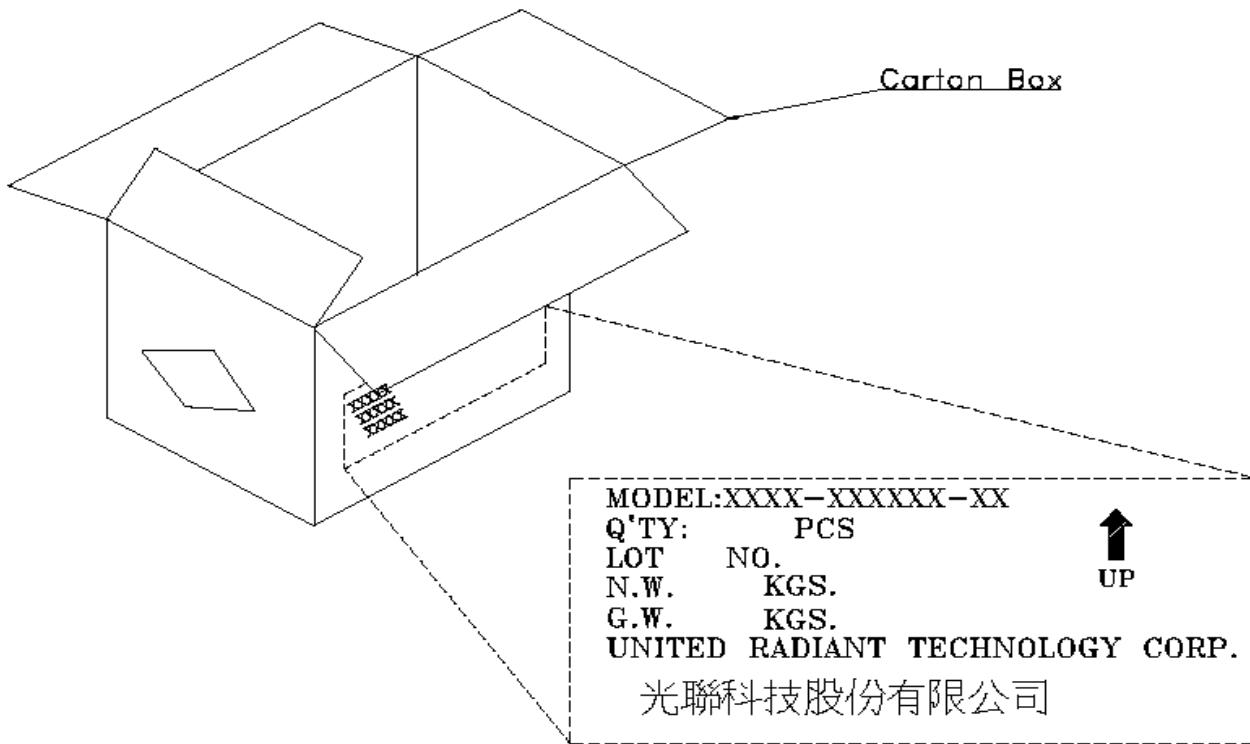
7. LOT NO

Instruction of lot number:

LOT NO. : 0 0 0 8 3 5 2 5 (EX)



Label 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 °C TO 40 °C ,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	1.0 %
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.

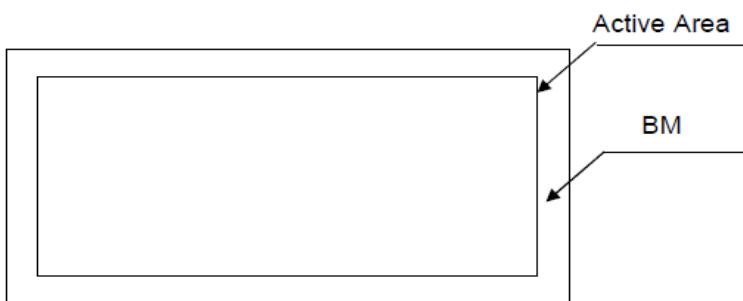
8.2. CHECKING CONDITION

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 : 2 PCS OF 20W FLUORESCENT LAMPS(DISTANCE TO THE SAMPLE >100 CM) OR 1000 ± 200 LUX.

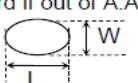
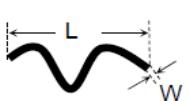
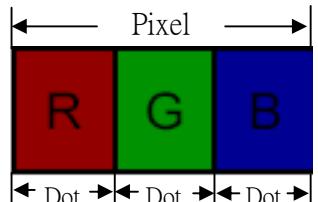
8.2.4. DEFINITION OF INSPECTION A.A.(ACTIVE AREA)

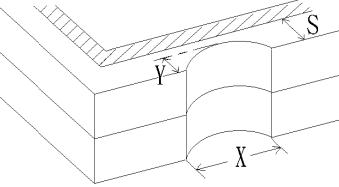
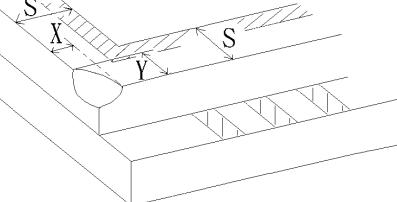
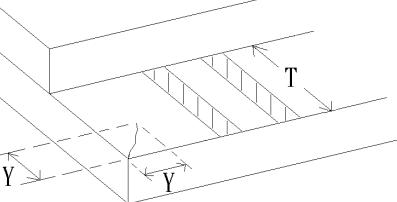
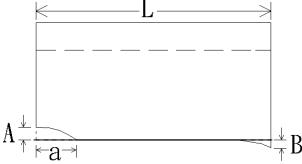
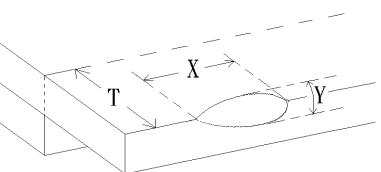
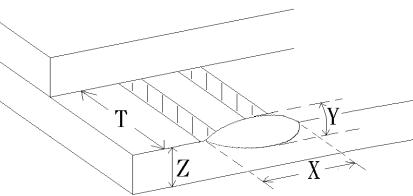
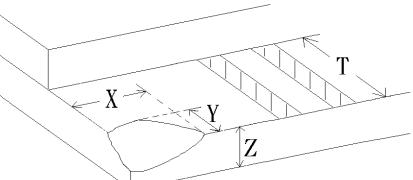


8.3. INSPECTION PLAN :

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	Critical
	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 AREAREJECTED	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)	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)	Critical
	11. MISSING LINE	MISSING DOT 、LINE 、CHARACTERREJECTED	Critical
	12. SHORT CIRCUIT 、 WRONG PATTERN DISPLAY	NO DISPLAY 、WRONG PATTERN DISPLAY 、CURRENT CONSUMPTION OUT OF SPECIFICATION..... REJECTED	Critical
	13. DOT DEFECT (FOR COLOR AND TFT)	ACCORDING TO STANDARD OF VISUAL INSPECTION	Minor

8.4. STANDARD OF VISUAL INSPECTION

NO.	CLASS	ITEM	JUDGEMENT																				
8.4.1	MINOR	BLACK AND WHITE SPOT FOREIGN MATERIEL DUST IN THE CELL BLEMISH SCRATCH ROUND TYPE: Disregard if out of A.A.  LINER TYPE: Disregard if out of A.A. 	<p>(A) ROUND TYPE: unit : mm.</p> <table border="1"> <thead> <tr> <th>DIAMETER (mm.)</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.15$</td> <td>DISREGARD</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.50$</td> <td>3</td> </tr> <tr> <td>$0.50 < \Phi$</td> <td>0</td> </tr> </tbody> </table> <p>NOTE: $\Phi = (\text{LENGTH} + \text{WIDTH})/2$</p> <p>(B) LINER TYPE: unit : mm.</p> <table border="1"> <thead> <tr> <th>LENGTH</th> <th>WIDTH</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>-----</td> <td>$W \leq 0.03$</td> <td>DISREGARD</td> </tr> <tr> <td>$L \leq 10$</td> <td>$0.03 < W \leq 0.07$</td> <td>4</td> </tr> <tr> <td>$L > 10$</td> <td>$0.07 < W$</td> <td>0</td> </tr> </tbody> </table>	DIAMETER (mm.)	ACCEPTABLE Q'TY	$\Phi \leq 0.15$	DISREGARD	$0.15 < \Phi \leq 0.50$	3	$0.50 < \Phi$	0	LENGTH	WIDTH	ACCEPTABLE Q'TY	-----	$W \leq 0.03$	DISREGARD	$L \leq 10$	$0.03 < W \leq 0.07$	4	$L > 10$	$0.07 < W$	0
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8.4.2	MINOR	FIBER 1. L: Length, W: Width 2. Disregard if out of A.A. 	<p>unit : mm.</p> <table border="1"> <thead> <tr> <th>LENGTH</th> <th>WIDTH</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>$L \leq 1.5$</td> <td>$W \leq 1.0$</td> <td>4</td> </tr> <tr> <td>$L > 1.5$</td> <td>$W > 1.0$</td> <td>0</td> </tr> </tbody> </table>	LENGTH	WIDTH	ACCEPTABLE Q'TY	$L \leq 1.5$	$W \leq 1.0$	4	$L > 1.5$	$W > 1.0$	0											
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8.4.3	MINOR	BUBBLE IN POLARIZER	<p>unit : mm.</p> <table border="1"> <thead> <tr> <th>DIAMETER</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.2$</td> <td>DISREGARD</td> </tr> <tr> <td>$0.2 < \Phi \leq 0.5$</td> <td>3</td> </tr> <tr> <td>$0.5 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	DIAMETER	ACCEPTABLE Q'TY	$\Phi \leq 0.2$	DISREGARD	$0.2 < \Phi \leq 0.5$	3	$0.5 < \Phi$	0												
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8.4.4	MINOR	Dot Defect	<table border="1"> <thead> <tr> <th>Items</th> <th>ACC. Q'TY</th> </tr> </thead> <tbody> <tr> <td>Bright dot</td> <td>$N \leq 4$</td> </tr> <tr> <td>Dark dot</td> <td>$N \leq 4$</td> </tr> </tbody> </table> <p>Pixel Define</p>  <p>Not 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot. Not 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern. Not 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.</p>	Items	ACC. Q'TY	Bright dot	$N \leq 4$	Dark dot	$N \leq 4$														
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Dark dot	$N \leq 4$																						
8.4.5	MINOR	MURA	By 2% ND filter invisible																				

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