SPECIFICATION

OF

LIQUID CRYSTAL DISPLAY MODULE

UNITED RADIANT TECHNOLOGY CORP. 光聯科技 14-Mar-2005 品管部 QC DEPT.

CUSTOMER : U.R.T. STANDARD

Model No. : UMS-7580MC-CS

Model version : 2

Document Revision : 2

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 CORP.

Rex Li	Calvin Lo	Lingling Chen	14-Mar-2005
APPROVED	CHECKED	PREPARED	Date

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Revision record

Document Revision	Model No. Version No.	Description	Revision by
0	UMS-7580MC-CS (UCSH-E737EN-2FT) Version No. 0	1. UMS-7517MC-1CS transformed standard. 2. Modify product number from UMS-7517MC-1CS to UMS-7580MC-CS.	Aaron Chen Wilson Liang 21-Oct-2004
1	UMS-7580MC-CS (UCSH-E737EN-2FT) Version No. 1	Add SPEC of the CCFL.	Aaron Chen Wilson Liang 4-Mar-2005
2	UMS-7580MC-CS (UCSH-E737EN-2FT) Version No. 2	1. Modify backlight SPEC. 2. Add the replace step of CCFL lamp.	Aaron Chen Wilson Liang 14-Mar-2005

CONTENTS:

1. BASIC SPECIFICATION

1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Dot Matrix	320 x RGB x 240	dots
Module Size (W x H x T)	154.6 x 114.8 x 8.5	mm.
Viewing Area (W x H)	118.2 x 89.4	mm.
Active Area (W x H)	115.19 x 86.39	mm.
Dot Size (W x H)	0.345 x 0.345	mm.
Dot Pitch (W x H)	0.36 x 0.36	mm.
Driving method	1/240	Duty
	1/16	Bias
Driving IC Package	TAB	

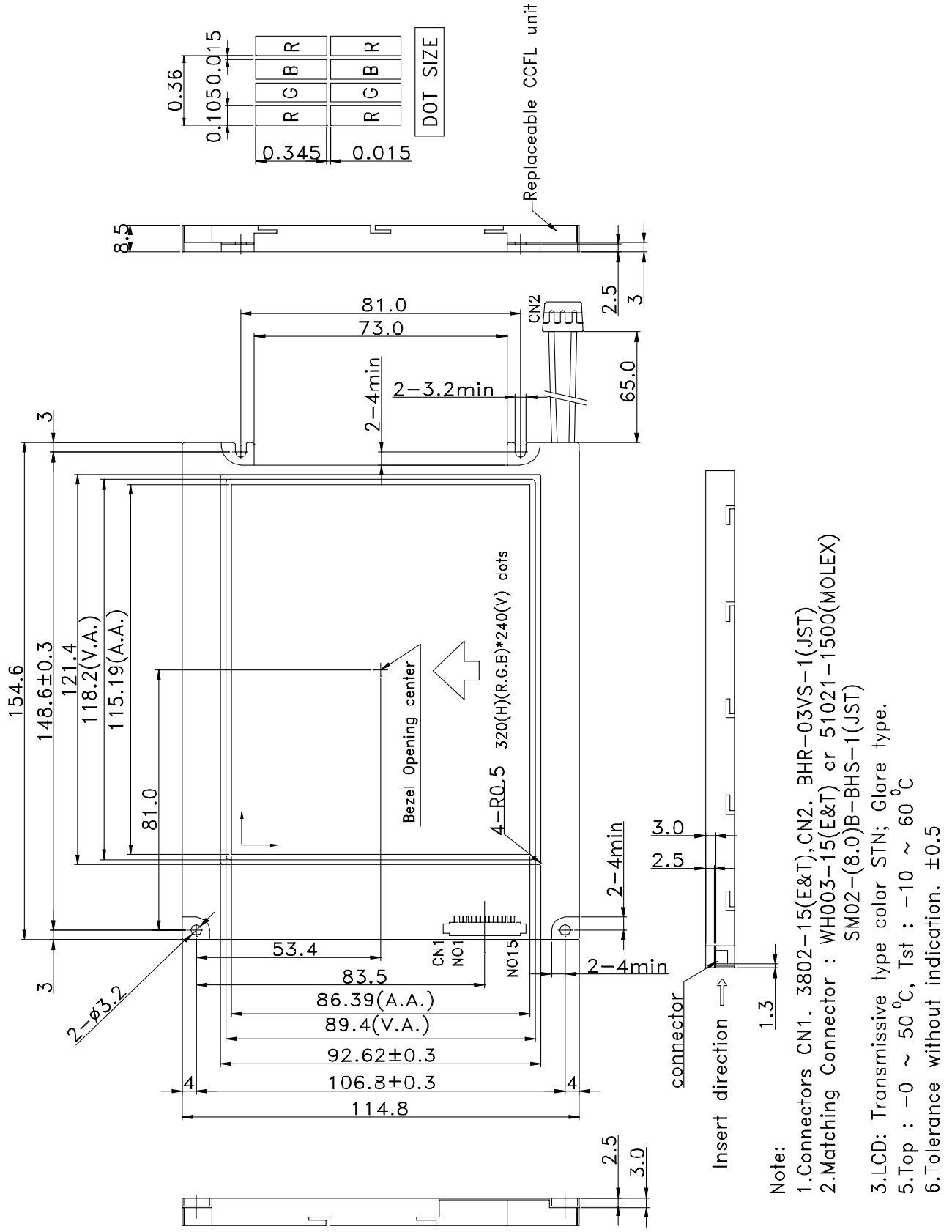
* Expose the driver IC under blaze (luminosity over than 1 cd) when using the LCM may cause IC operating failure.

1.2 Display specification

Display	Descriptions	Note
LCD Type	Color STN	
LCD Mode	Negative	
Polarizer Mode	Transmissive	
Polarizer UV-Cutting	With	
Polarizer Surface	Normal	
Background Color	Black	
Backlight Type	CCFL	
Backlight Color	White	
Viewing Direction	6 O'clock Direction	

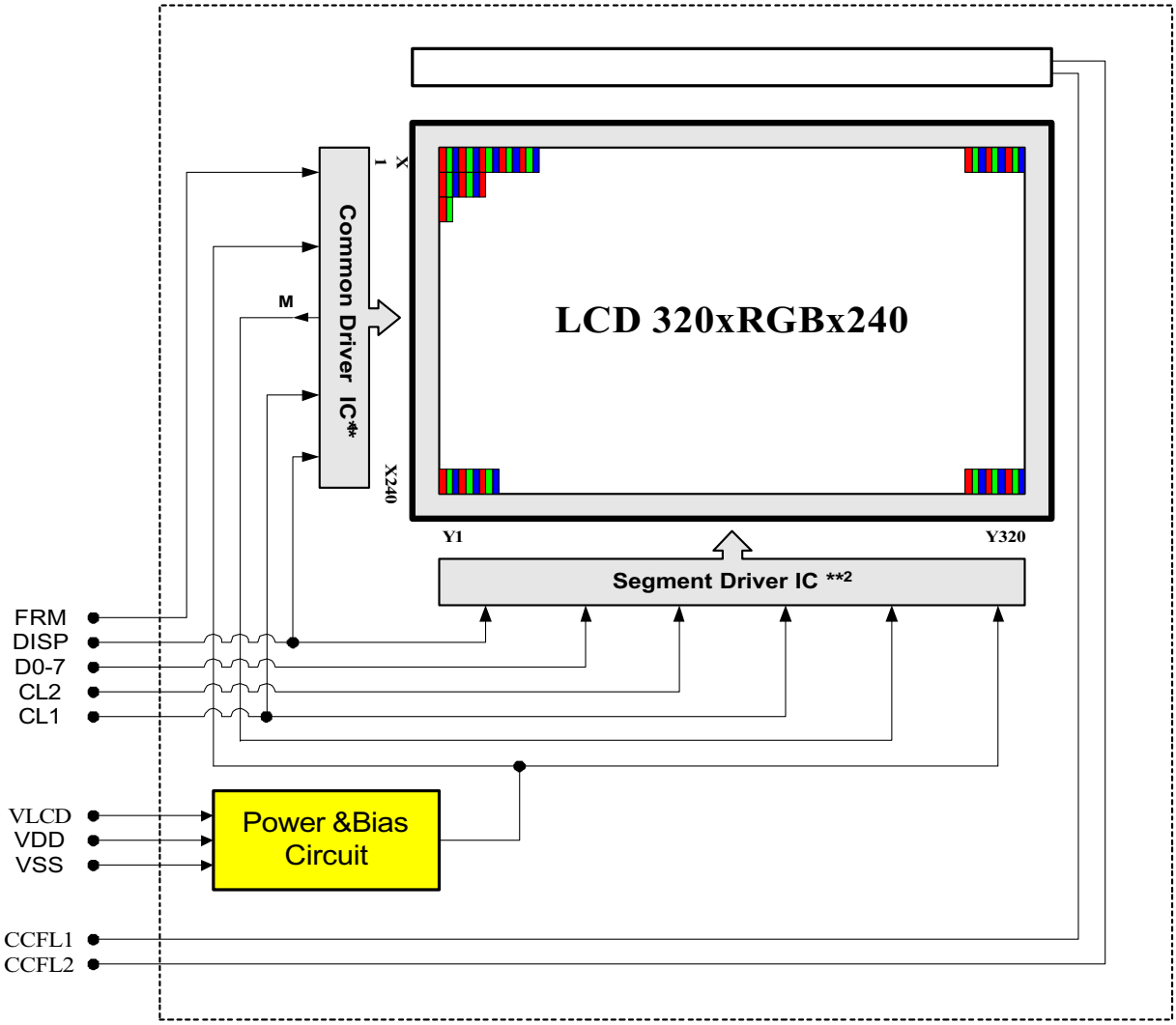
* Color tone is slightly changed by temperature and driving voltage.

1.3 Outline dimension

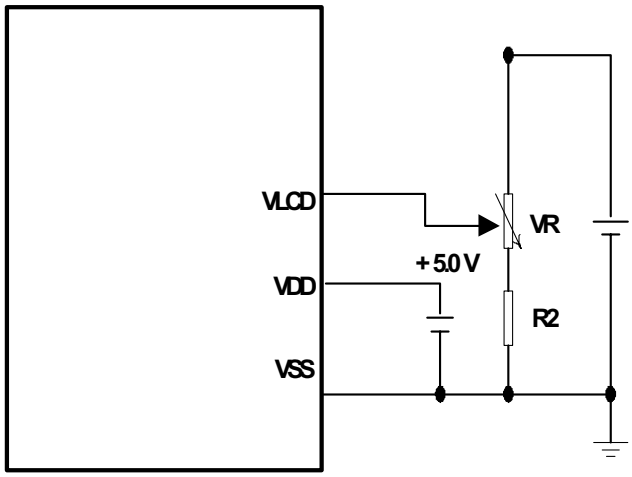


Note:
1.Connectors CN1. 3802-15(E&T),CN2. BHR-03VS-1(JST)
2.Matching Connector : WH003-15(E&T) or 51021-1500(MOLEX)
SM02-(8.0)B-BHS-1(JST)
3.LCD: Transmissive type color STN; Glare type.
5.Top : -0 ~ 50 °C, Tst : -10 ~ 60 °C
6.Tolerance without indication. ±0.5

1.4 Block diagram:



Recommended Circuit for Contrast Adjustment



1.5 Interface pin :

Pin No.	Symbol	Description	Level
1	FRM	Synchronous signal for driving scanning line.	H
2	CL1	Data signal latch clock.	H→L
3	CL2	Data signal shift clock.	H→L
4	DISP	Display control signal.	H (On), L (Off)
5	VDD	Power supply for logic (+5.0V)	-
6	VSS	Ground.	-
7	VLCD	Power supply for LCD.	-
8~15	D7~D0	Display data.	H (On), L (Off)

PIN No.	SYMBOL	Description	Level
1	CCFL1	Power supply for CCFL.	AC
2	N.C	-	-
3	CCFL2	Ground line (from inverter).	-

2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Supply voltage for logics	VDD	-0.3	7.0	V
Supply voltage for driving LCD	VLCD	-0.3	40	V
Input voltage	V_t	-0.3	VDD+0.3	V
Operate temperature range	T_{OP}	0	50	℃
Storage temperature range	T_{ST}	-10	60	℃

2.2 DC Characteristics

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage (Logic)	VDD-VSS	2.5	5	5.5	V	
Supply voltage (LCD)	VEE-VSS	24.8	25.8	26.8	V	
Input high level voltage	V_{IH}	0.8VDD	-	-	V	
Input low level voltage	V_{IL}	-	-	0.2VDD	V	
Output high level voltage	V_{OH}	VDD-0.4	-	-	V	
Output low level voltage	V_{OL}	-		0.4	V	
Display data shift clock	XCK	-	2.268	-	MHZ	
AC-converting signal input for LCD driver wavefrom(1)	FRAME	70	-	90	HZ	For 256 colors
AC-converting signal input for LCD driver wavefrom(2)	FRAME	120	-	150	HZ	For 4096 colors
AC-converting signal input for LCD driver wavefrom(3)	FRAME	160	-	240	HZ	For 65K colors
Power supply current	IDD	-	0.5	1	mA	*NOTE1
Power supply current (LCD)	IEE	-	7	14	mA	*NOTE1

*NOTE1 : Min. and Max. Voltage is specified as the voltage within the condition of operational temperature range 0℃ ~ 50℃.
Typ.Voltage is specified as module driving condition: T_a=25℃,V_{OP} at Optimum Contrast.

*NOTE2 :
Measuring Condition:
Standard Value MAX.
T_a = 25℃
VDD - GND = 5.0V
VLCD - GND = VOP at optimum Contrast
Duty = 1/240 Duty
Bias = 1/16 Bias
Display Pattern = Checkered pattern

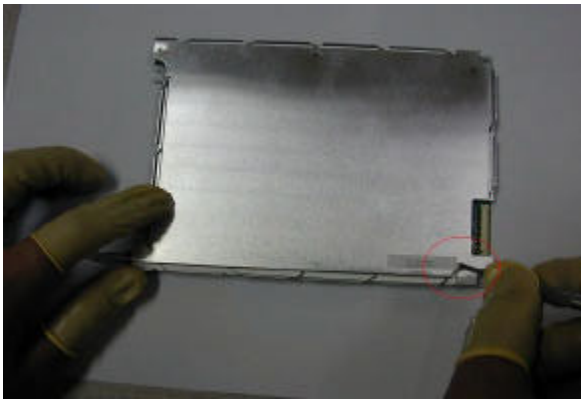
2.2.1 Back-light Specification :

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Frequency	F_L	25	35	45	KHz	T=25 ±3℃
Lamp Current	I_L	-	5.0	-	mArms	T=25 ±3℃
Start voltage	Vs	410			Vrms	T=25 ±3℃
Output Open Voltage	V_{open}	-	-	460	Vrms	T=25 ±3℃
Lamp Voltage	V_{Load}	320	340	360	Vrms	T=25 ±3℃
Brightness	B	2500	-	-	cd/m^2	T=25 ±3℃ I_L=5mA(*Note3)
Brightness Uniformity	Bu	75	-	-	%	(*Note4)
Operating Life	TB	50000	-	-	Hrs	T=25 ±3℃ I_L=5mA(*Note5)

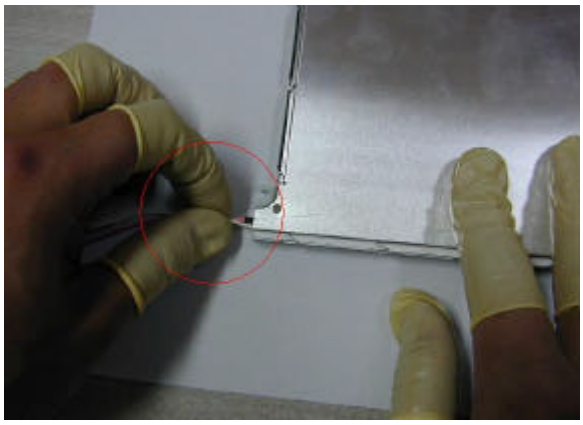
*Note3: These specifications are on the surface of the Backlight unit.
*Note4: Brightness uniformity = (B_{min} / B_{max})× 100%
*Note5: Until half of initial brightness

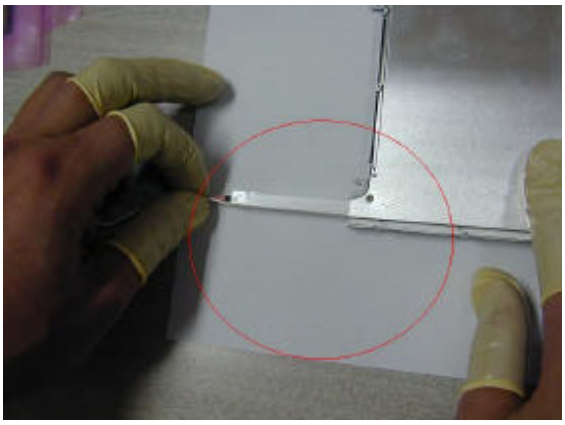
2.2.2 The replace step of CCFL lamp

Step 1. Take off the right down screw.

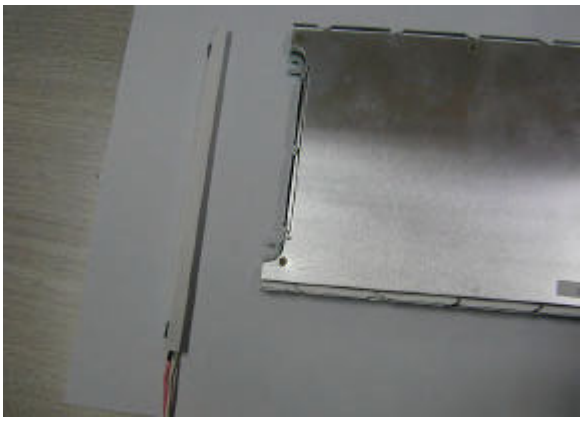


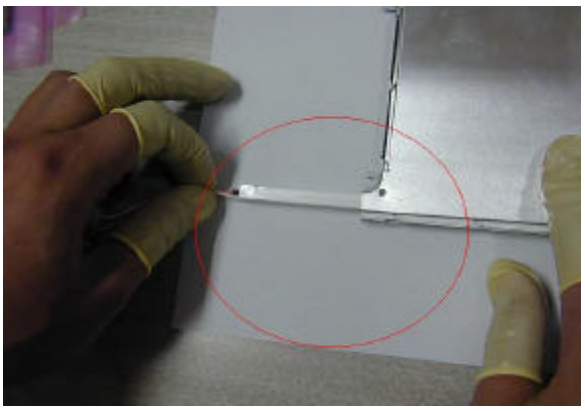
Step 2. Draw out CCFL lamp.

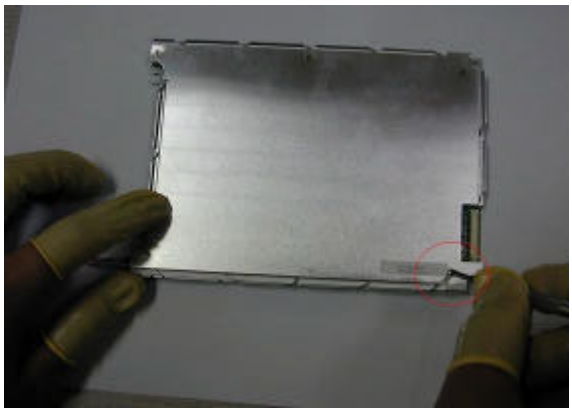




Step 3 & 4. Replace the new CCFL lamp.







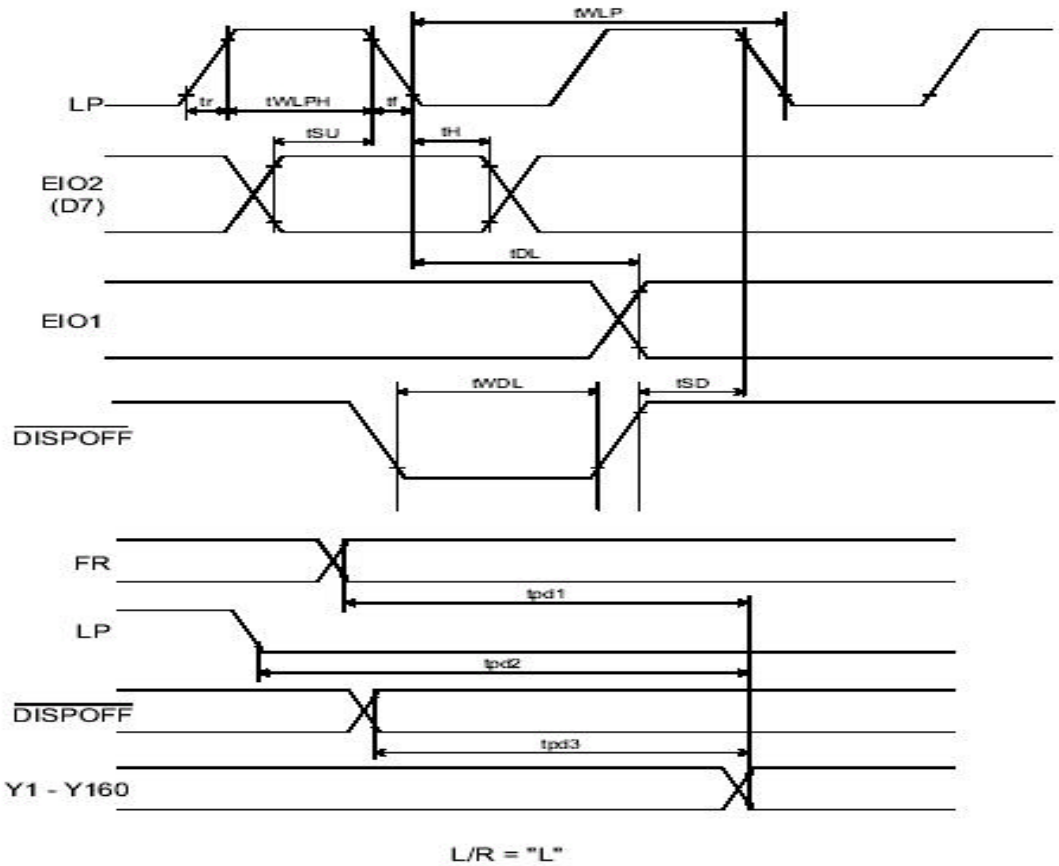
2.3 AC Characteristics

NT7705

Common Mode (V_{SS} = V_5 = 0V, V_{DD} = 2.5 - 5.5V, V_0 = 15 to 40V and T_A = -30 to +85°C, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	t_{WLP}	250	-	-	ns	tr, tf ≦ 20ns
Shift clock "H" pulse width	t_{WLPH}	15	-	-	ns	V_{DD} = +5.0V ± 10%
		30	-	-	ns	V_{DD} = +2.5 - +4.5V
Data setup time	t_{SU}	30	-	-	ns	
Data hole time	t_H	50	-	-	ns	
Input signal rise time	t_r		-	50	ns	
Input signal fall time	t_f		-	50	ns	
$\overline{DISPOFF}$ Removal time	t_{SD}	100	-	-	ns	
$\overline{DISPOFF}$ enable pulse width	t_{WDL}	1.2	-	-	µs	
Output delay time (1)	t_{DL}	-	-	200	ns	C_L = 15pF
Output delay time (2)	t_{pd1}, t_{pd2}	-	-	1.2	µs	C_L = 15pF
Output delay time (3)	t_{pd3}	-	-	1.2	µs	C_L = 15pF

Timing Characteristics of Common Mode



L/R = "L"

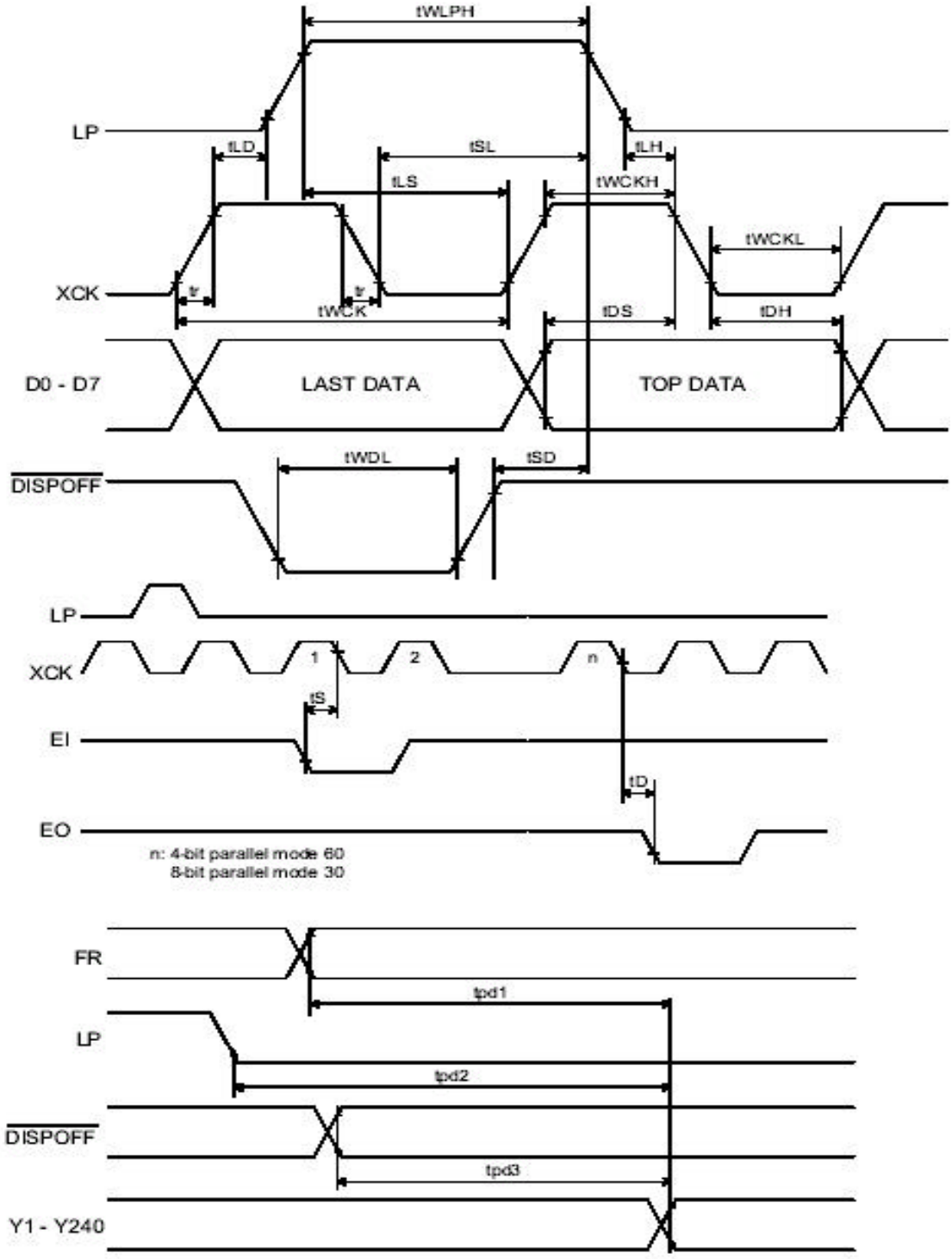
Segment Mode 1 (V_{SS} = V_5 = 0V, V_{DD} = 4.5 - 5.5V, V_0 = 15 to 40V, and T_A = -30 to +85°C, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	t_{WCK}	50	-		ns	tr, tf ≦ 10ns, Note 1
Shift clock "H" pulse width	t_{WCKH}	15	-		ns	
Shift clock "L" pulse width	t_{WCKL}	15	-		ns	
Data setup time	t_{DS}	10	-		ns	
Data hole time	t_{DH}	12	-		ns	
Latch pulse "H" pulse width	t_{WLPH}	15	-		ns	
Shift clock rise to Latch pulse rise time	t_{LD}	0	-		ns	
Shift clock fall to Latch pulse fall time	t_{SL}	30	-		ns	
Latch pulse rise to Shift clock rise time	t_{LS}	25	-		ns	
Latch pulse fall to Shift clock rise time	t_{LH}	25	-		ns	
Input signal rise time	t_r		-	50	ns	Note 2
Input signal fall time	t_f		-	50	ns	Note 2
Enable setup time	t_S	10	-		ns	
$\overline{\text{DISPOFF}}$ Removal time	t_{SD}	100	-		ns	
$\overline{\text{DISPOFF}}$ enable pulse width	t_{WDL}	1.2	-		μs	
Output delay time (1)	t_D		-	30	ns	CL = 15pF
Output delay time (2)	t_{pd1}, t_{pd2}		-	1.2	μs	CL = 15pF
Output delay time (3)	t_{pd3}		-	1.2	μs	CL = 15pF

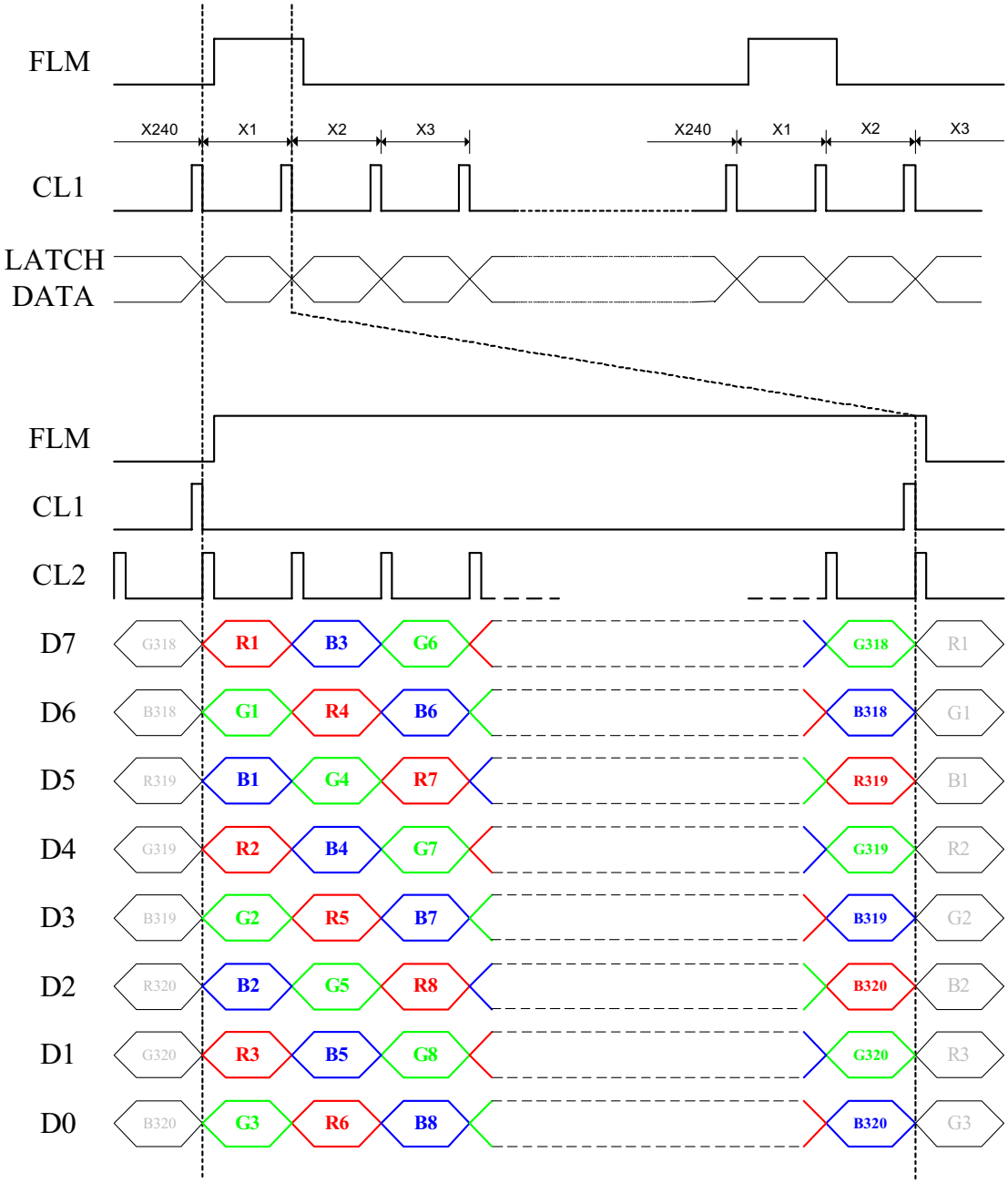
Note

1. Take the cascade connection into consideration.
2. (t_{CK}-t_{WCKII}-t_{wckI})/2 is the maximum in the case of high speed operation.

Timing waveform of the Segment Mode



2.4 Interface Timing Chart



Data and Screen

	Y1			Y2			Y3					Y320		
X1	D7 R1	D6 G1	D5 B1	D4 R2	D3 G2	D2 B2	D1 R3	D0 G3	D7 B3			D2 R320	D1 G320	D0 B320
	Y1			Y2								Y320		
X240	D7 R1	D6 G1	D5 B1	D4 R2	D3 G2	D2 B2						D2 R320	D1 G320	D0 B320

3. OPTICAL CHARACTERISTICS

3.1 Characteristics

Driving condition

Item	Duty	Bias	Note
Value	1/240	1/16	1

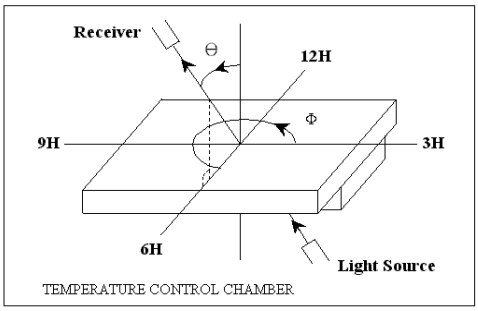
Electrical and Optical Characteristics

No.	Item		symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	LCD Driving Vop		-10 ℃		-	25.8	-	V	1
			25 ℃		-	25.3	-		
			60 ℃		-	24.1	-		
2	Response Time		Tr	25 ℃	-	140	280	ms	2
			Tf	25 ℃	-	80	160		
3	Viewing Angle	Front-Rear	Θ1	Φ = 270°	-10	-	30	degree	3
		Left-Right	Θ2		-30	-	30		
4	Contrast Ratio		Cr	25 ℃	-	25	-	-	4
5	Red x-code		Rx	25 ℃	0.48	0.53	0.58	-	5
	Red y-code		Ry		0.26	0.31	0.36		
	Green x-code		Gx		0.24	0.29	0.34		
	Green y-code		Gy		0.48	0.53	0.58		
	Blue x-code		Bx		0.10	0.15	0.20		
	Blue y-code		By		0.08	0.13	0.18		
	White x-code		Wx		0.25	0.30	0.35		
	White y-code		Wy		0.27	0.32	0.37		
	Brightness		Y		-	130	-	cd/m^2	

3.2 Definition of optical characteristics

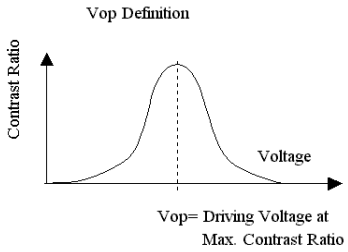
Measurement condition :

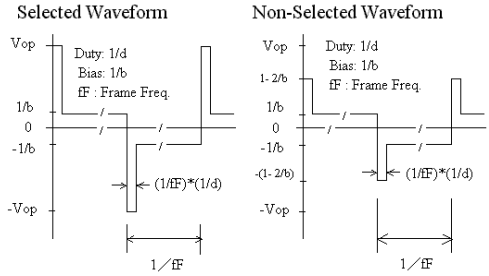
Transmissive and Transflective type



PHOTAL LCD-5000

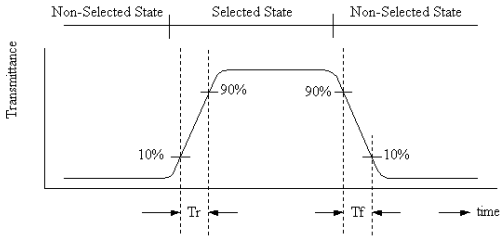
[Note 1] Definition of LCD Driving Vop and Waveform :



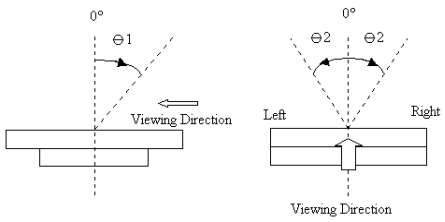


[Note 2] Definition of Response Time

for Negative type :

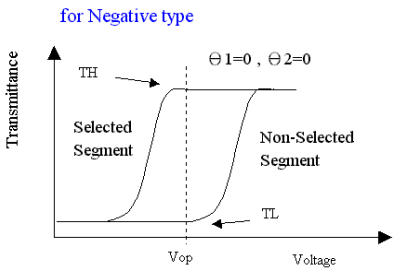


[Note 3] Definition of Viewing Angle :



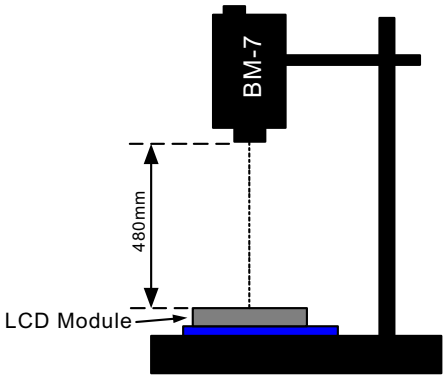
[Note 4] Definition of Contrast Ratio :

for Negative type

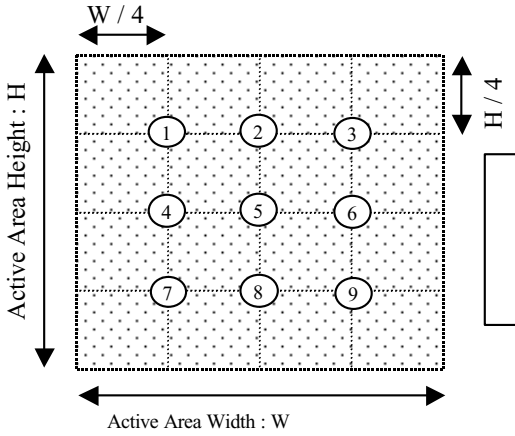


$$\text{Contrast Ratio} = \frac{TH}{TL}$$

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

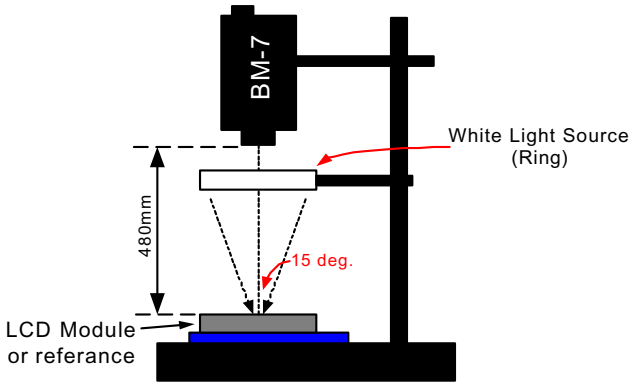


[Note 6] Definition of Brightness Uniformity



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

[Note 7] Definition of Measurement of Reflectance



4. RELIABILITY :

Item No	Items	Condition	Remark
1	High temperature operating	50 ℃ , 200 hours	Finish product (With polarizer)
2	Low temperature operating	0 ℃ , 200 hours	Finish product (With polarizer)
3	High temperature storage	60 ℃ , 200 hours	Finish product (With polarizer)
4	Low temperature storage	-10 ℃ , 200 hours	Finish product (With polarizer)
5	High temperature & humidity storage	40℃, 90%RH, 100 hours	Finish product (With polarizer)
6	Thermal Shock storage	-10℃, 30min.<=> 60℃, 30min. 10 Cycles	Finish product (With polarizer)
7	Vibration test	10 => 55 =>10 => 55 => 10 Hz , within 1 minute Amplitude : 1.5mm. 15 minutes for each Direction (X,Y,Z)	Finish product (With polarizer)
8	Drop test	Packed, 100CM free fall, 6 sides, 1 corner, 3edges	Finish product (With polarizer)
9	Life time	50,000 hours 25℃ , 70%RH below , specification condition driving	Finish product (With polarizer)

* 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
- Contrast > 1/2 initial value
- Function : work normally

5. HANDLING PRECAUTION

☐ PRECAUTION FOR HANDLING LCM

- The LCD module contains a C-MOS LSI. To avoid damage tom the LSI from static electricity generated while working,Ground your body, work/assembly areas and assembly equipment to protect the module against STATIC ELECTRICITY.
- Do not input any signal before power is turned on.
- Do not take LCM from it' s packaging bag unit it is assembled.
- Peel off take 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 :280℃± 10℃.
  Soldering time : 3~4sec./ terminals.
  Type of solder : Eutectic solder(rosin flux filled).

☐ PRECAUTION IN USE OF LCD

- Do not contact or scratch the front surface and the contact pads of ac LCD panel with hard. materials such as metal or glass or with one' s nail.
- To clean the surface , wipe it gently with soft cloth dampened alcohol.
- Do not attempt to wiped off the contact pads.
- Keep LCD panels away from direct sunlight , also avoid them in high-temperature & high humidity environment for a long period.
- Do not drive LCD panels by DC voltage.
- Do not expose LCD panels to organic solvent.
- Liquid in LCD is hazardous substance , any contacts with liquid crystal materials , wash it off immediately with 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 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℃)

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

- An authorization from URT is required for medical care, safety and hazardous product, application or system . URT will not be responsible of any damage or loss which caused by this products without any authorization given by URT .

6. DATE CODE OF PRODUCTS

- Date code will be shown on each product :

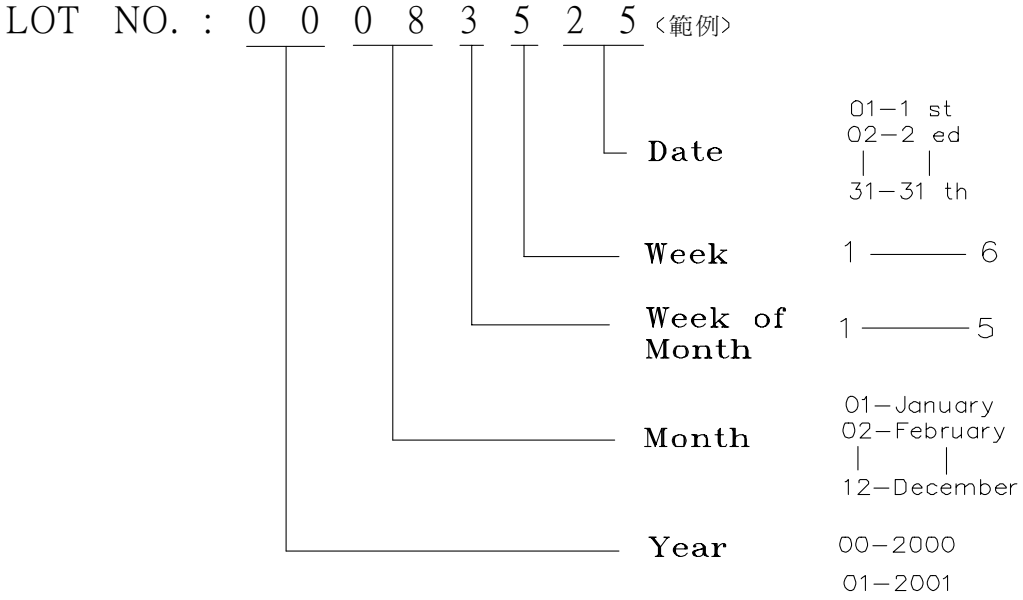
- **Y MM DD - XXX**

  Year Month Day - Production lots

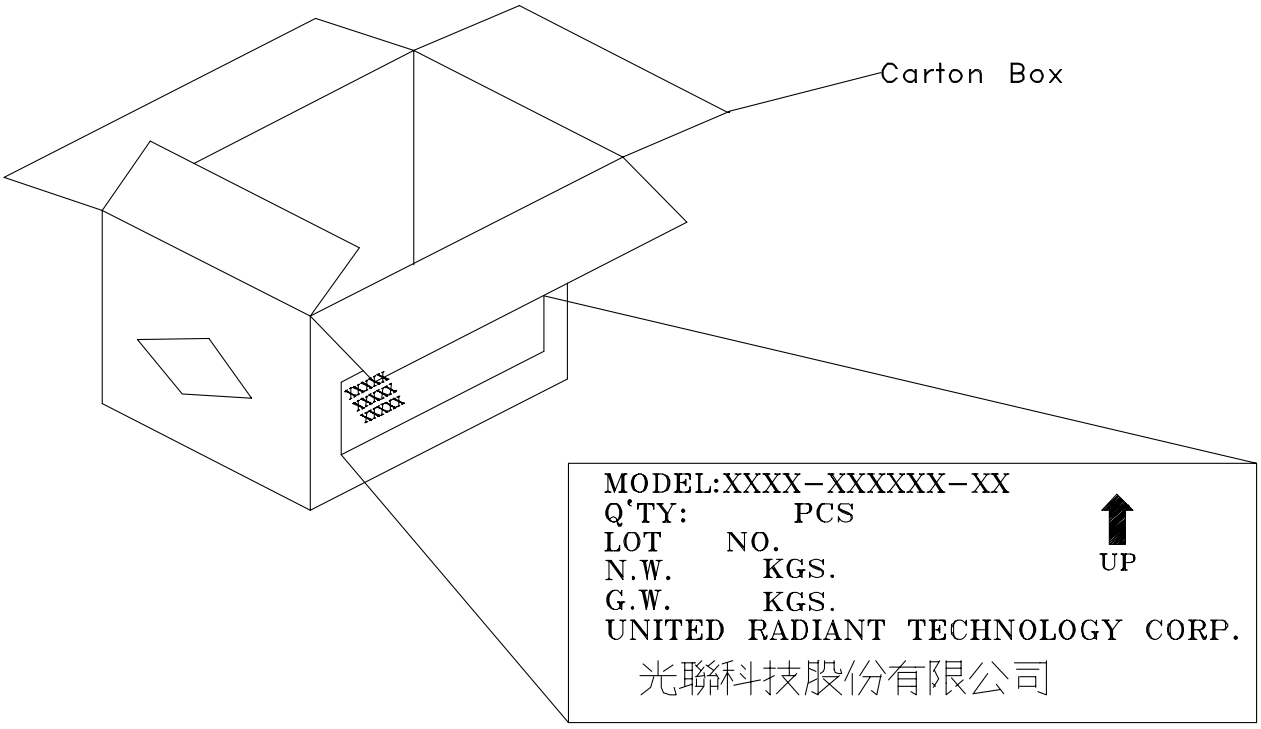
- Example: 2 1 2 2 3 - 0 0 3 ==>Year 2002, Dec.,23rd , Batch no.03

7. PACKING

Instruction of lot number:

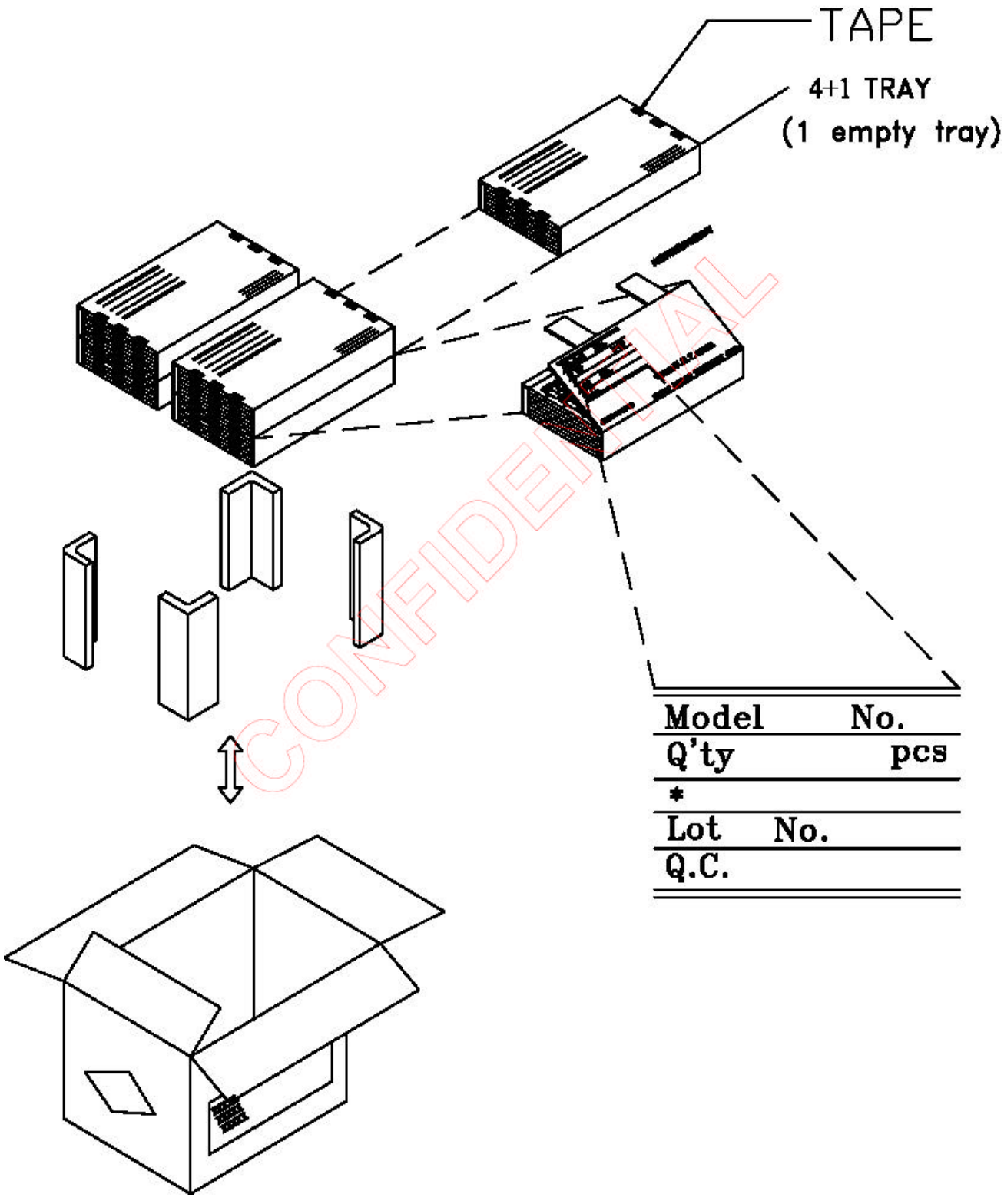


Lable of carton:



NOTE: TRAY盤擺放請注意方向，
務必180°交錯疊放，
否則 LCD壓損，
請自行負責。

4 pcs / Tray
4+1 Tray / Box
4 Box / Carton
64 pcs / 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 (or MIL-STD-105D) , 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.

8.2. CHECKING CONDITION

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

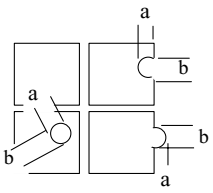
8.2.2. CHECKER SHALL SEE OVER 30 cm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

8.3. INSPECTION PLAN :

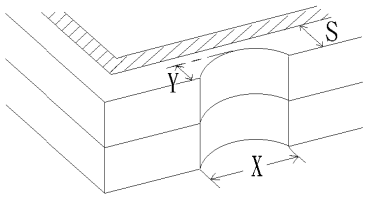
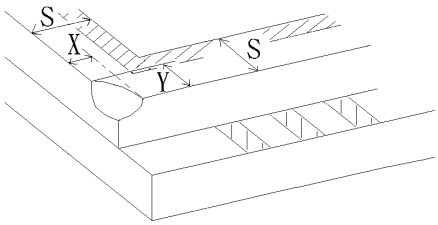
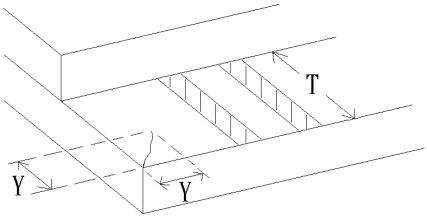
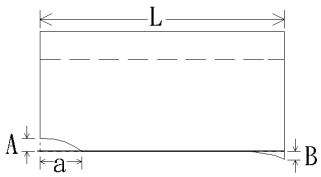
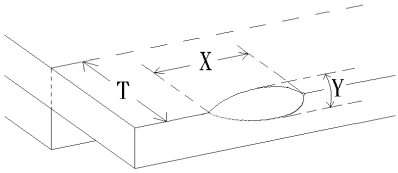
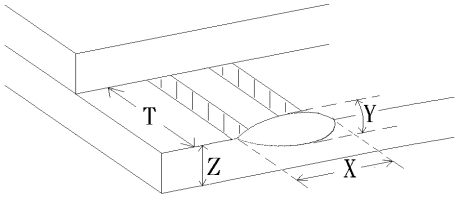
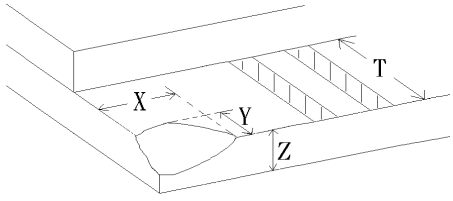
CLASS	ITEM	JUDGEMENT	CLASS
PACKING & INDICATE	1. OUTSIDE AND INSIDE PACKAGE	"MODEL NO." , "LOT NO." AND "QUANTITY" SHOULD INDICATE ON THE PACKAGE.	Minor
	2. MODEL MIXED AND QUANTITY	OTHER MODEL MIXED.....REJECTED QUANTITY SHORT OR OVER.....REJECTED	Critical
	3. PRODUCT INDICATION	"MODEL NO." SHOULD INDICATE 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 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 SCRTCH 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 PATTERN	MISSING DOT、LINE、CHARACTER ....REJECTED	Critical
	12.SHORT CIRCUIT、 WRONG PATTERN DISPLAY	NON DISPLAY、WRONG PATTERN DISPLAY、CURRENT CONSUMPTION OUT OF SPECIFICATION..... REJECTED	Critical
	13. PIN HOLE、PATTERN DEFORMITY	ACCORDING TO STANDARD OF VISUAL INSPECTION	Minor
	14. BLACK SPOT、WHITE SPOT、BLACK LINE 、WHITE LINE、SLANT LINE、BACKGROUND UNEVEN、COLOR UNEVEN	STRONG DEVIATION COLOR.....REJECTED. OR ACCORDING TO LIMITED SAMPLE FULL OFF SCREEN (ALL BLACK) . DISREGARDS	Minor
	15. STICK IMAGE (RETENTION IMAGE)	FIXED TEST PICTURE WITHIN TWO HOURS . REJECTED	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>· BLEMISH、BLACK SPOT、
WHITE SPOT IN THE LCD.

· BLEMISH、BLACK SPOT、
WHITE SPOT AND SCRATCH
ON THE POLARIZER</td><td>(A) ROUND TYPE: unit : mm.
<table>
<tr><th>DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>Φ ≦ 0.1</td><td>DISREGARD</td></tr>
<tr><td>0.1 < Φ ≦ 0.2</td><td>2</td></tr>
<tr><td>0.2 < Φ ≦ 0.25</td><td>1</td></tr>
<tr><td>0.25 < Φ</td><td>0</td></tr>
</table>
NOTE: Φ=(LENGTH+WIDTH)/2
(B) LINER 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 ≦0.05</td><td>3</td></tr>
<tr><td>L ≦ 5.0</td><td>0.05 < W ≦0.07</td><td>1</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</td><td>unit : mm.
<table>
<tr><th>DIAMETER</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>Φ ≦0.15</td><td>DISREGARD</td></tr>
<tr><td>0.15 < Φ ≦ 0.5</td><td>2</td></tr>
<tr><td>0.5 < Φ</td><td>0</td></tr>
</table></td></tr>
<tr><td>8.4.3</td><td>MINOR</td><td>PIN HOLE 、
PATTERN DEFORMITY</td><td> 

Φ=(a+b)/2
unit : mm.
<table>
<tr><th>DIAMETER</th><th>ACC. Q'TY</th></tr>
<tr><td>Φ ≦ 0.1</td><td>DISREGARD</td></tr>
<tr><td>0.1 < Φ ≦ 0.25</td><td>3</td></tr>
<tr><td>0.25 < Φ</td><td>0</td></tr>
</table></td></tr>
</table>

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