

# SPECIFICATION

## OF

### LIQUID CRYSTAL DISPLAY MODULE



CUSTOMER : URT-STD

Model No. : UMOH-9153MD-5T

Model version : 1

Document Revision : 2

## 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**

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Dec-05-2024  
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## Revision record

[illegible]

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## 1. BASIC SPECIFICATION

### 1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Active screen size	4.3" diagonal	-
Dot Matrix	480 x RGB x 272	Pixel
Module Size (W x H x T)	105.4 x 67.1 x 2.8	mm.
Active Area (W x H)	95.04 x 53.856	mm.
Pixel Size ( W×H )	0.198 x 0.198	mm.
Color depth	16.7M	color
Interface	Parallel 24-bit RGB	-
Driving IC Package	COG	-
Module weight	TBD±10%	g

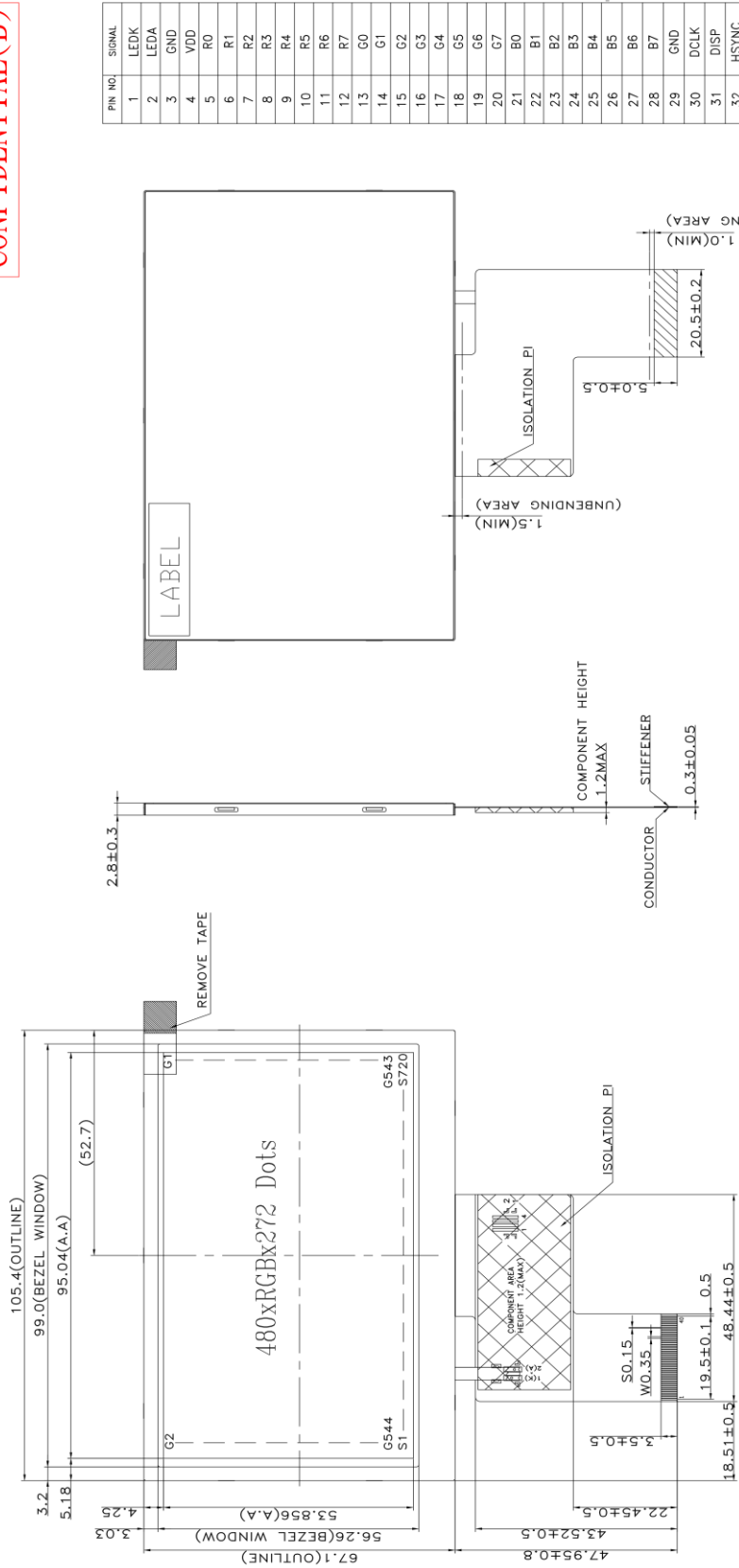
### 1.2 Display specification

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

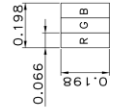
\*Color tone is slightly changed by temperature and driving voltage.

1.3 Outline dimension

CONFIDENTIAL(B)



BACKLIGHT CIRCUIT DIAGRAM

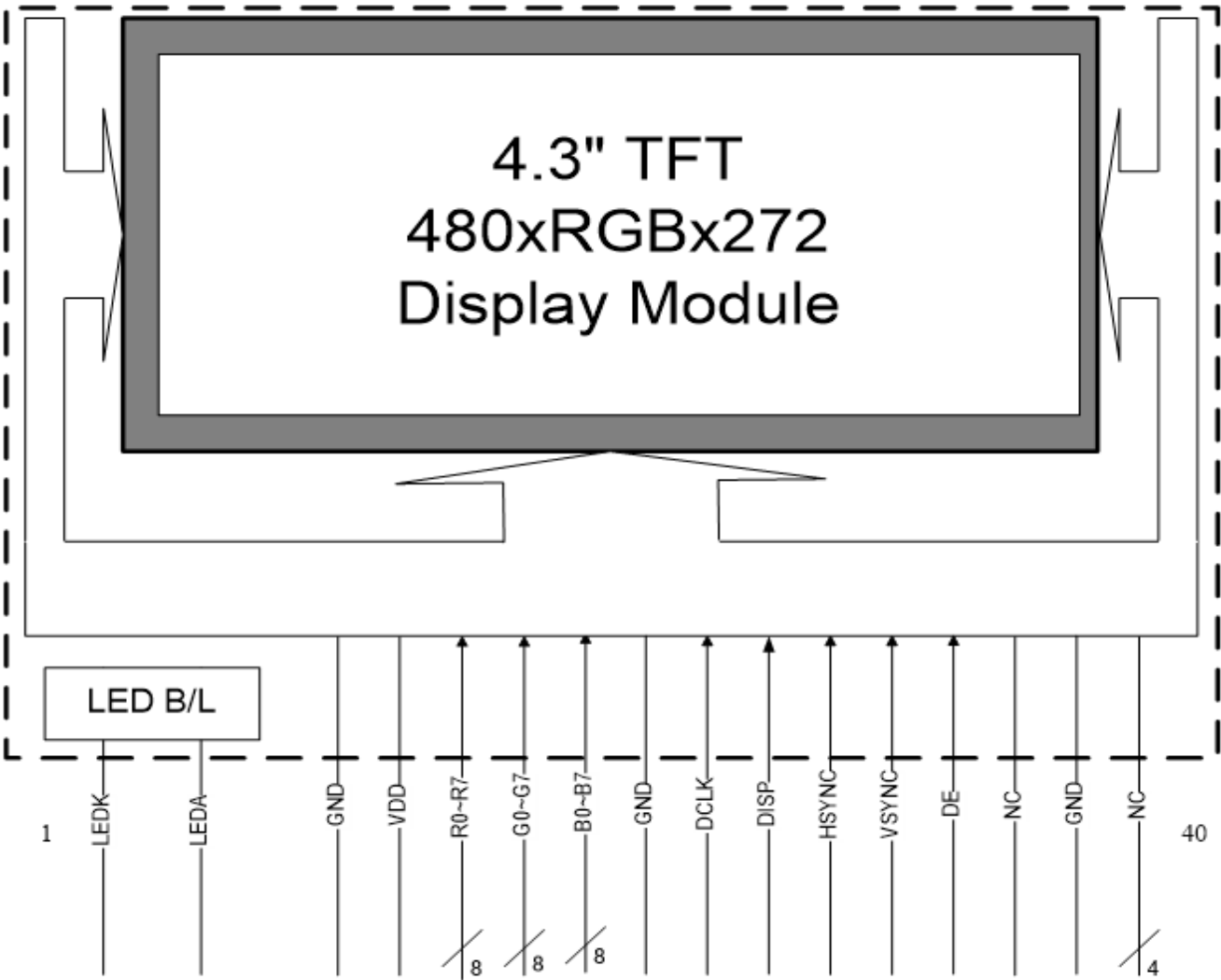


PIXEL DETAIL

NOTE:

1. LCD: TFT, TRANSMISSIVE, NORMALLY WHITE,ANTI-GLARE
2. Top: (-30°C~80°C, Tst:-30°C~85°C)
3. VIEWING DIRECTION: U/L/D/R 80/80/80/80
4. THIS PRODUCT CONFORM WITH THE STANDARD OF ROHS
5. TOLERANCE FOR NOT ASSIGNED ±0.2
6. THE MINIMUM BENDABLE RADIUS(INNER) OF THE FPC IS 0.5mm
7. LED B/L: WHITE\*18PCS
8. B/L:CONSTANT CURRENT IF=40mA, VF=24.3V~28.8V
9. IC: ST7282A
10. COMPONENT AREA AND SOLDER AREA CAN NOT BENDING

1.4 Block diagram:



## 1.5 Interface Pin Connection :

Pin No.	Pin Symbol	I/O	Description
1	LEDK	P	Power for LED backlight cathode.
2	LEDA	P	Power for LED backlight anode.
3	GND	P	Power Ground.
4	VDD	P	Power Voltage.
5 ~ 12	R0 ~ R7	I	Red data signal.
13 ~ 20	G0 ~ G7	I	Green data signal.
21 ~ 28	B0 ~ B7	I	Blue data signal.
29	GND	P	Power Ground.
30	DCLK	I	Dot data clock.
31	DISP	I	Display on/off.
32	HSYNC	I	Horizontal sync signal.
33	VSYNC	I	Vertical sync signal.
34	DE	I	Data Enable.
35	NC	-	No connect.
36	GND	P	Power Ground.
37~40	NC	-	No connect.

## 2. ELECTRICAL CHARACTERISTICS

### 2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Power supply voltage	VDD	-0.3	4.0	V
Operate temperature range	TOP	-30	(80)	°C
Storage temperature range	TST	-30	85	°C

\*Note1 :

The operating temperature is for product's functionality, please pay attention to human injury when using the product under extreme temperature.



## 2.2 DC Characteristics

$T_a = 25^{\circ}\text{C}$

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage	VDD	3.0	3.3	3.6	V	-
Input Voltage	V <sub>IL</sub>	0	-	0.3VDD	V	L level
	V <sub>IH</sub>	0.7VDD	-	VDD	V	H level
Current consumption	I <sub>VDD</sub>	-	-	40	mA	Note 1

\*Note1 :

Measuring Condition:

Standard Value MAX.

$T_a = 25^{\circ}\text{C}$

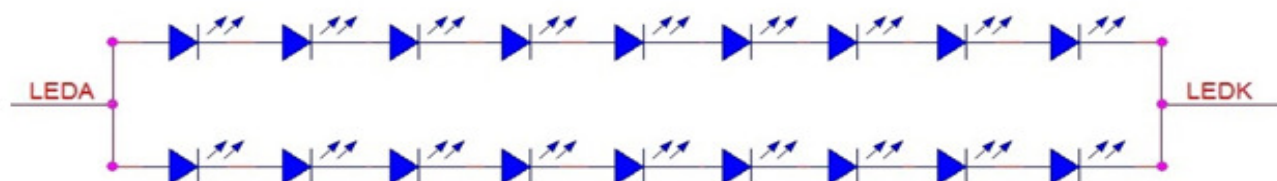
VDD -GND = 3.3V

Display Pattern

## 2.3 Back-light only Specification

PARAMETER	SYMBOL	MIN	TYP	MAX	Unit	Test Condition	NOTE
Supply Current	If	-	40	-	mA	Ta=25°C	-
Supply Voltage	Vf	24.3	-	28.8	V	Ta=25°C	-
Half-Life Time	Lf	-	50000	-	hrs	Ta=25°C	1

Note 1 : The "Half-Life Time" is defined as the LED chip brightness decreases to 50% than original brightness, Based on Ta 25±2°C, 60±10% RH condition.



## 2.4 AC Characteristics

### Parallel RGB Input Timing Requirement

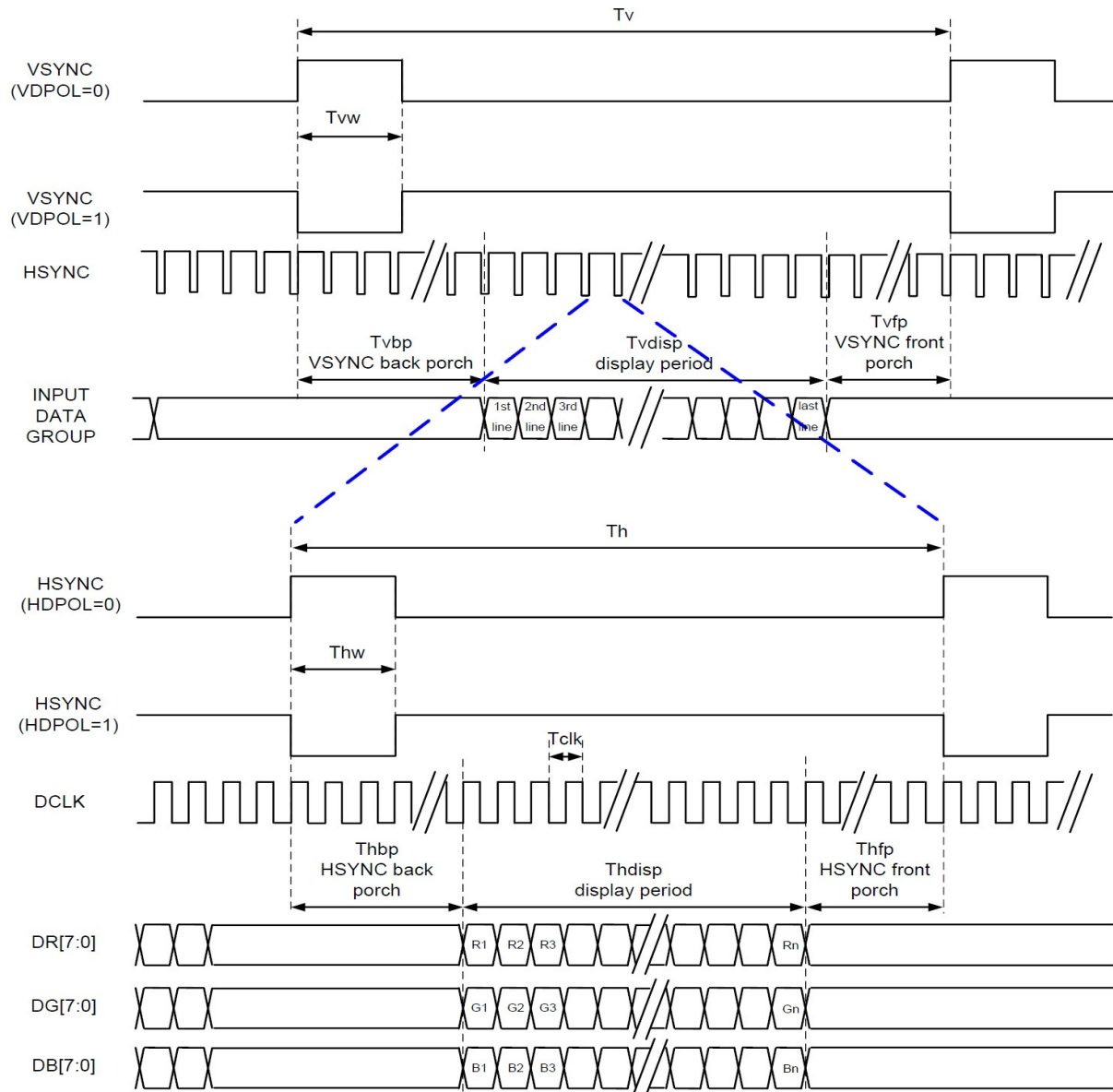
Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

480RGB X 272 Resolution Timing Table							
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency		Fclk	8	9	12	MHz	
DCLK Period		Tclk	83	111	125	ns	
HSYNC	Period Time	Th	485	531	598	DCLK	
	Display Period	Thdisp	-	480	-	DCLK	
	Back Porch	Thbp	3	43	43	DCLK	By H_BLANKING setting
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	75	DCLK	
VSYNC	Period Time	Tv	276	292	321	HSYNC	
	Display Period	Tvdisp	-	272	-	HSYNC	
	Back Porch	Tvbp	2	12	12	HSYNC	By V_BLANKING setting
	Front Porch	Tvfp	2	8	37	HSYNC	
	Pulse Width	Tvw	2	4	37	HSYNC	

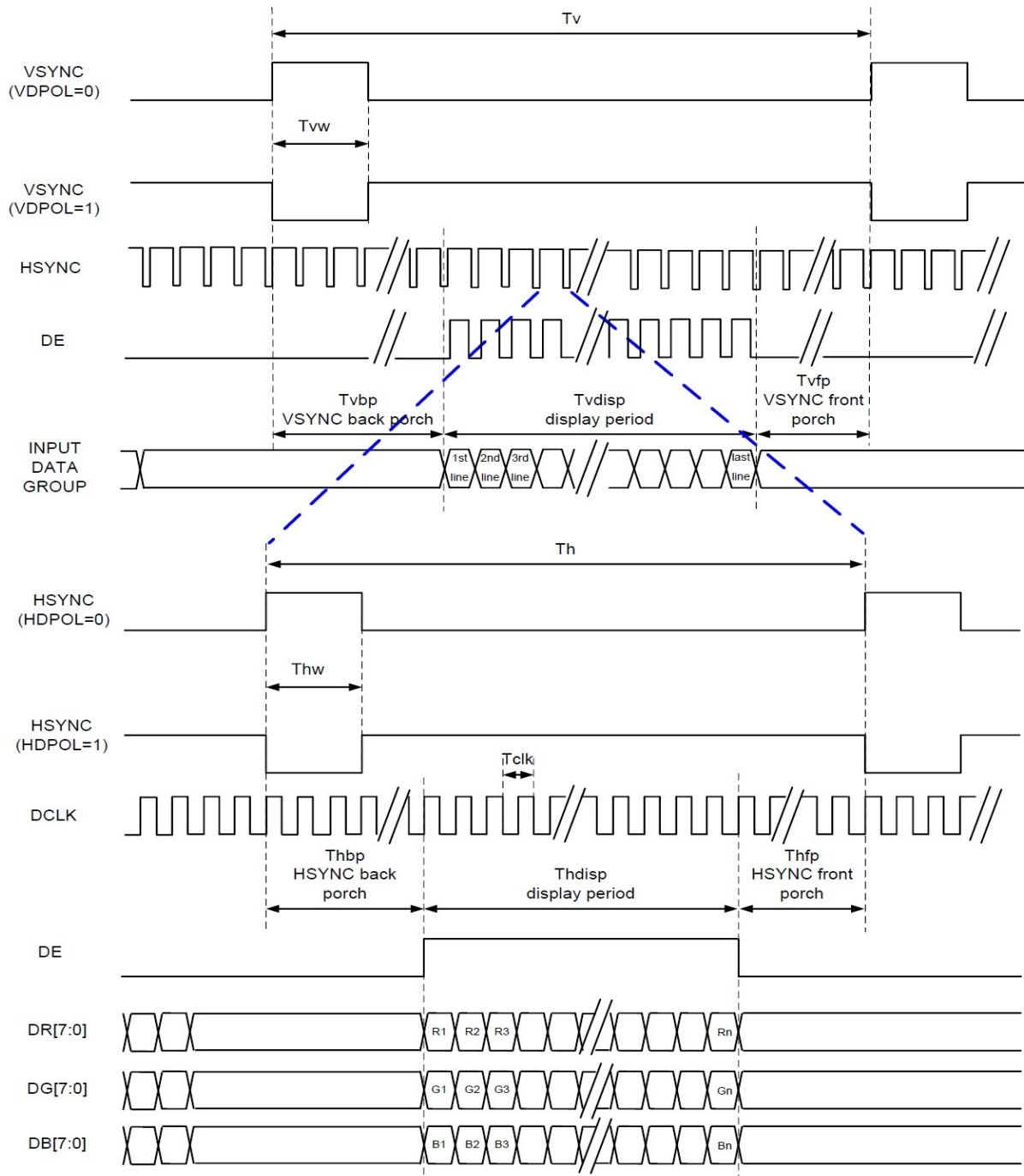
Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.

# Interface Timing Chart

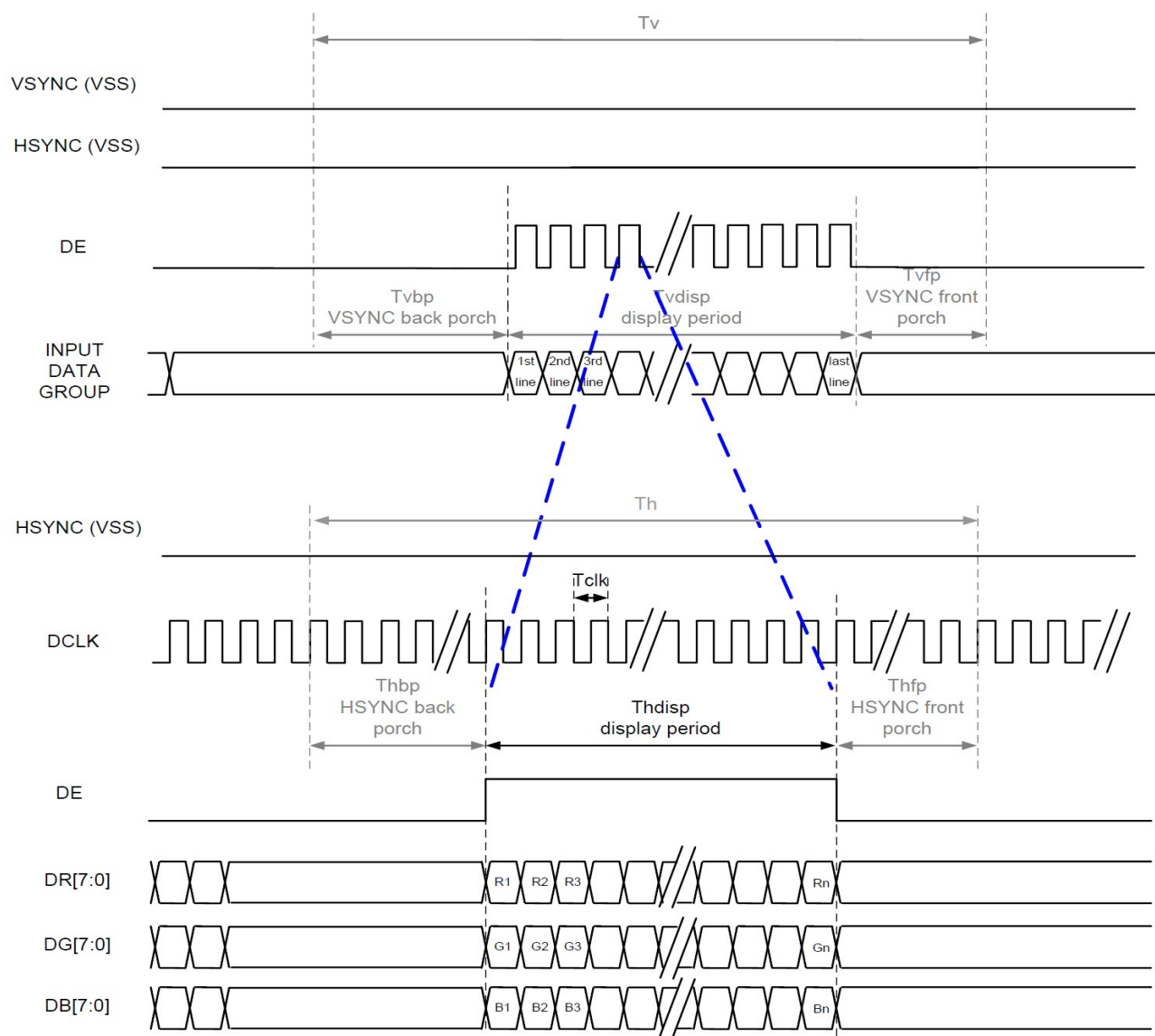
## RGB Interface SYNC Mode



## SYNC-DE Mode



DE Mode

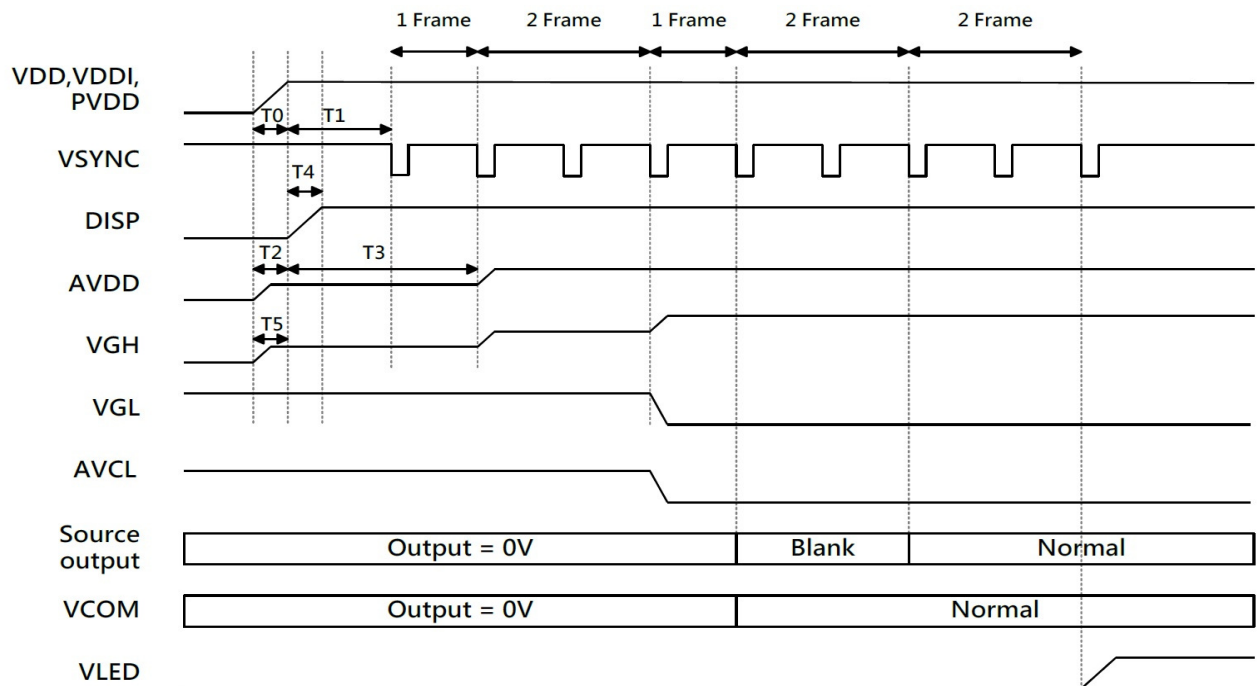


RGB Mode Selection Table	DCLK	HSYNC	VSYNC	DE
SYNC - DE Mode	Input	Input	Input	Input
SYNC Mode	Input	Input	Input	GND
DE Mode	Input	GND	GND	Input

Note: "Input" means these signals are driven by host side.

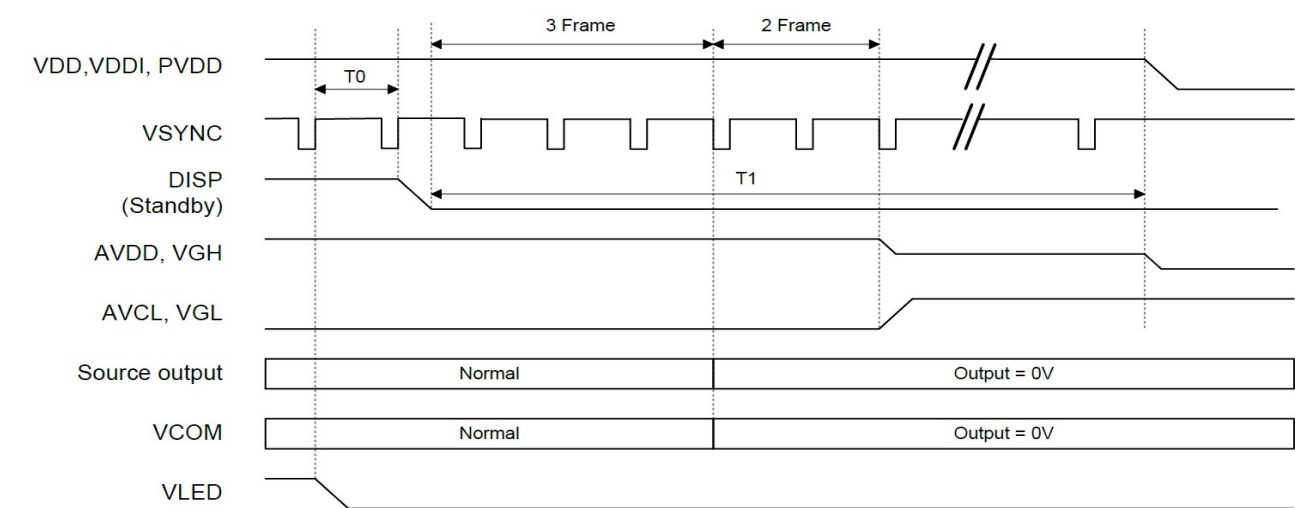
## 2.5 Power Sequence Timing

### Power On Sequence



	Description	Min. Time
T0	Determined by the external power	
T1	Time from stable VDD, VDDI, PVDD set-up to the first VSYNC	T1=0
T2	Time from AVDD=0V to AVDD=3.3V	T2=T0
T3	Time from AVDD=3.3V to AVDD=6.0V	T3=T1+ (1*Frame)
T4	Time from stable VDD, VDDI, PVDD set-up to DISP asserted	T4=0
T5	Time from VGH=0V to VGH=3.3V	T5=T0

Power Off Sequence



Item	Description	Min. Time
T0	Time from backlight power off to DISP="L"	1*Frame
T1	Time from DISP="L" to LCM Power off	5*Frame



### 3. OPTICAL CHARACTERISTICS

#### 3.1 Characteristics

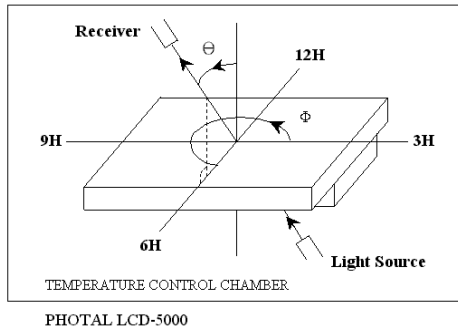
##### Electrical and Optical Characteristics

No.	Item			symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	Response Time			Tr	25 °C	-	TBD	-	ms	2
				Tf	25 °C	-	TBD	-		
2	Viewing Angle	Hor.	Cr≥10	θ <sub>2+</sub>	Φ = 0°	-	TBD	-	degree	3
				θ <sub>2-</sub>	Φ = 180°	-	TBD	-		
		Ver.		θ <sub>1+</sub>	Φ = 270°	-	TBD	-		
				θ <sub>1-</sub>	Φ = 90°	-	TBD	-		
3	Contrast Ratio			Cr	25 °C	-	TBD	-	-	4
4	Red x-code			Rx	25 °C	-	TBD	-	-	5
	Red y-code			Ry		-	TBD	-		
	Green x-code			Gx		-	TBD	-		
	Green y-code			Gy		-	TBD	-		
	Blue x-code			Bx		-	TBD	-		
	Blue y-code			By		-	TBD	-		
	White x-code			Wx		-	TBD	-		
	White y-code			Wy		-	TBD	-		
	Brightness			Y		-	TBD	-	cd/m <sup>2</sup>	
5	Brightness Uniformity				25 °C	-	TBD	-	%	6

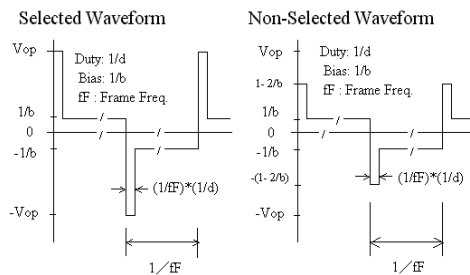
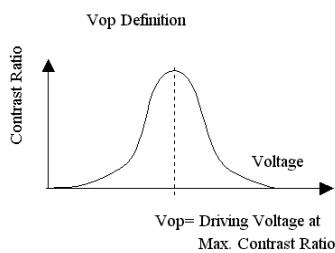
### 3.2 Definition of optical characteristics

Measurement condition :

Transmissive and Transflective type

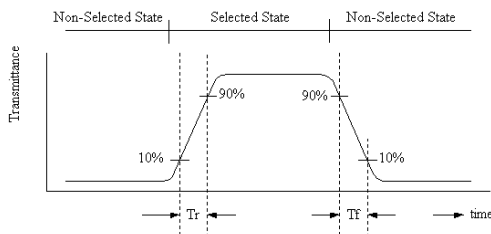


[Note 1] Definition of LCD Driving Vop and Waveform :



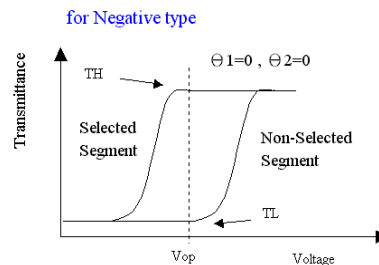
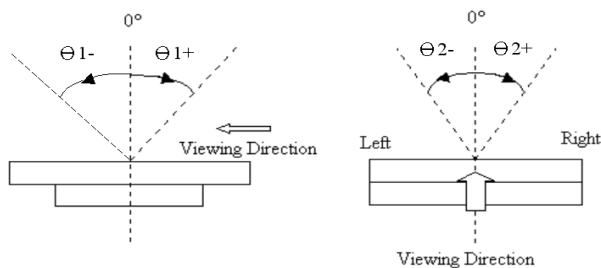
[Note 2] Definition of Response Time

for Negative type :



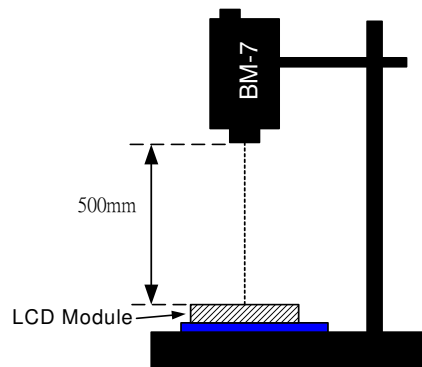
[Note 3] Definition of Viewing Angle :

[Note 4] Definition of Contrast Ratio :

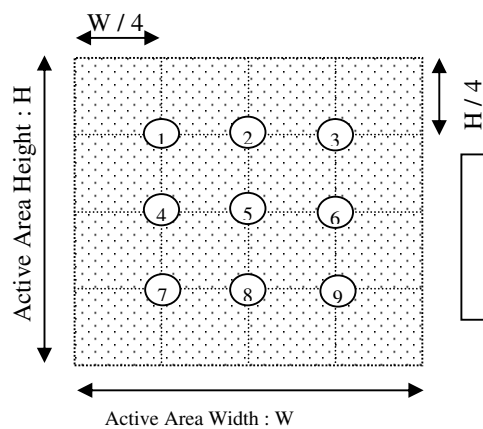


$$\text{Contrast Ratio} = \frac{TH}{TL}$$

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



**[Note 6] Definition of Brightness Uniformity**



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

#### 4. RELIABILITY :

Item No	Items	Condition	Note
1	High temperature operating	80 °C , 200 hours	IEC60068-2-2 Note 1
2	Low temperature operating	-30 °C , 200 hours	IEC60068-2-1 Note 1
3	High temperature storage	85 °C , 200 hours	IEC60068-2-2 Note 1
4	Low temperature storage	-30 °C , 200 hours	IEC60068-2-1 Note 1
5	High temperature & humidity storage	60°C, 90%RH, 100 hours	IEC60068-2-78 Note 2
6	Thermal Shock storage	-30°C, 30min.<=> 85°C, 30min. 10 Cycles	IEC60068-2-14 Note 1
7	Vibration test	10 => 55 =>10 => 55 => 10 Hz , within 1 minute Amplitude : 1.5mm. 15 minutes for each Direction ( X,Y,Z )	IEC60068-2-6
8	Drop test	>10Kg : 60 cm ; ≤10Kg : 80 cm 6 sides, 1 corner, 3edges, Free fall.	IEC60068-2-32

Note 1 : The product move into the room temperature for at least 2 hours with no condensation.

Note 2 : The product move into the room temperature for at least 24 hours with no condensation.

Note 3 : Please change the display picture (autorun) during operating mode. Avoid displaying static images

- \* One single product test for only one item.
- \* 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.
- Hand Soldering : Soldering temperature less than 260°C ,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 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 then 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 decomposition 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±10°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 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**

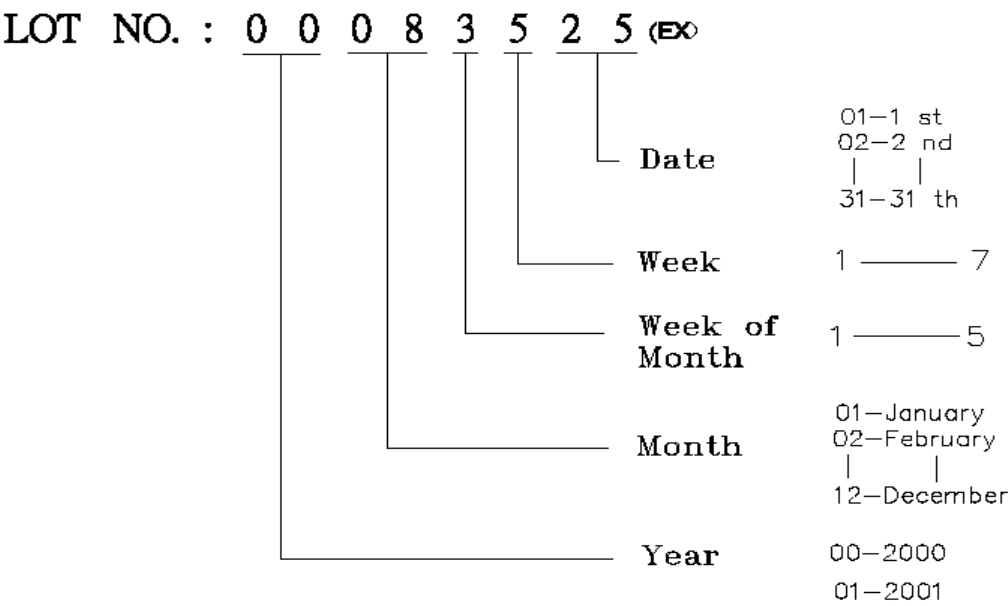
|   |   |   |  
Year   Month   Day - Production lots no.

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

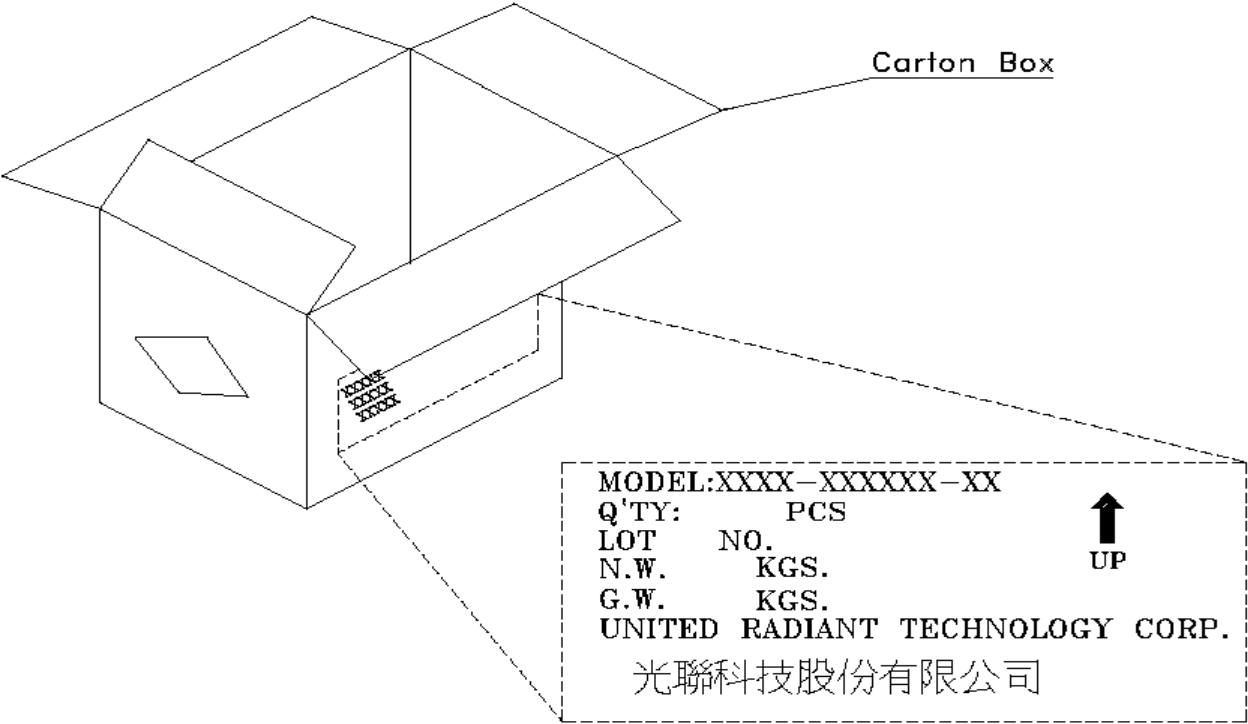
Note : The lot no. attached on the packing box will be used for tracking once the part is too small to print the date code.

7. LOT NO.

Instruction of lot number:



Lable of carton:



## 8. Inspection Standard

### 8.1 Quality :

The quality of goods supplied to purchaser shall come up to the following standard.

#### 8.1.1 The Method Of Preserving Goods

After delivery of goods from U.R.T. to purchaser. Purchaser shall control the LCM at  $-10^{\circ}\text{C}$  to  $40^{\circ}\text{C}$  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 Insection

(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.

Definition	AQL(%)
CRITICAL	0.4 %
MAJOR	0.65 %
MINOR	1.5 %

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

#### 8.1.3 Warranty Policy

(A) 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.

(B) The warranty period starts from delivery date.

(C) Customer is responsible for proving delivery date when customer returns defective product which is out of warranty, otherwise, the warranty period will be based on date code.

## 8.2 Checking Condition

**8.2.1.** Viewing distance is approximately :  $30 \pm 5$  cm.

**8.2.2.** Viewing angle is normal to the LCD panel with  $45^{\circ}$ .

**8.2.3.** Ambient illuminance : 2 pcs of 20W fluorescent lamps( distance to the sample  $>100$  cm) or  $1000 \pm 200$  lux.



### 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. POLARIZER EDGE OR LCD'S SEALING LINE IS VISABLE IN THE VIEWING AREA.	ACCORDING TO DRAWING REJECTED.	Minor
	6. CANNOT BE REMOVED, BLEMISH BLACK SPOTS, WHITE SPOTS, ON 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 ( 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 )	Critical
	11.MISSING LINE	MISSING DOT · LINE · CHARACTER .....REJECTED	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	<div>(A) ROUND TYPE: <span>unit : mm.</span><table><tr><th>DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr><tr><td><math>\Phi \leq 0.1</math></td><td>DISREGARD</td></tr><tr><td><math>0.1 &lt; \Phi \leq 0.25</math></td><td>3 (Distance&gt;5mm)</td></tr><tr><td><math>0.25 &lt; \Phi</math></td><td>0</td></tr></table><div>NOTE: <math>\Phi=(\text{LENGTH}+\text{WIDTH})/2</math></div><div>(B) LINEAR TYPE: <span>unit : mm.</span><table><tr><th>LENGTH</th><th>WIDTH</th><th>ACCEPTABLE Q'TY</th></tr><tr><td>-----</td><td><math>W \leq 0.03</math></td><td>DISREGARD</td></tr><tr><td><math>L \leq 5.0</math></td><td><math>0.03 &lt; W \leq 0.07</math></td><td>3 (Distance&gt;5mm)</td></tr><tr><td>-----</td><td><math>0.07 &lt; W</math></td><td>FOLLOW ROUND TYPE</td></tr></table></div></div>	DIAMETER (mm.)	ACCEPTABLE Q'TY	$\Phi \leq 0.1$	DISREGARD	$0.1 < \Phi \leq 0.25$	3 (Distance>5mm)	$0.25 < \Phi$	0	LENGTH	WIDTH	ACCEPTABLE Q'TY	-----	$W \leq 0.03$	DISREGARD	$L \leq 5.0$	$0.03 < W \leq 0.07$	3 (Distance>5mm)	-----	$0.07 < W$	FOLLOW ROUND TYPE
DIAMETER (mm.)	ACCEPTABLE Q'TY																						
$\Phi \leq 0.1$	DISREGARD																						
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-----	$0.07 < W$	FOLLOW ROUND TYPE																					
8.4.2	MINOR	BUBBLE IN POLARIZER DENT ON POLARIZER	<div><span>unit : mm.</span><table><tr><th>DIAMETER</th><th>ACCEPTABLE Q'TY</th></tr><tr><td><math>\Phi \leq 0.2</math></td><td>DISREGARD</td></tr><tr><td><math>0.2 &lt; \Phi \leq 0.5</math></td><td>2 (Distance&gt;5mm)</td></tr><tr><td><math>0.5 &lt; \Phi</math></td><td>0</td></tr></table></div>	DIAMETER	ACCEPTABLE Q'TY	$\Phi \leq 0.2$	DISREGARD	$0.2 < \Phi \leq 0.5$	2 (Distance>5mm)	$0.5 < \Phi$	0												
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$0.2 < \Phi \leq 0.5$	2 (Distance>5mm)																						
$0.5 < \Phi$	0																						
8.4.3	MINOR	Dot Defect	<table><tr><th>Items</th><th>ACC. Q'TY</th></tr><tr><td>Bright dot</td><td><math>N \leq 4</math> (Distance&gt;5mm)</td></tr><tr><td>Dark dot</td><td><math>N \leq 4</math> (Distance&gt;5mm)</td></tr></table> <div>Pixel Define :<div><div>Pixel</div><div><div>R</div><div>G</div><div>B</div></div><div><div>Dot</div><div>Dot</div><div>Dot</div></div></div></div> <div>Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.</div> <div>Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</div> <div>Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green ,blue pattern.</div>	Items	ACC. Q'TY	Bright dot	$N \leq 4$ (Distance>5mm)	Dark dot	$N \leq 4$ (Distance>5mm)														
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