

# SPECIFICATION

OF

## LIQUID CRYSTAL DISPLAY MODULE



CUSTOMER : URT-STD

Model No. : UMNH-8748MD-T

Model version : 0

Document Revision : 0

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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To Whom It May Concern:

In continuing to develop and promote the strategic partnership between United Radiant Technology (URT) and Microtips USA (MTUSA), URT is please to announce that we have entered into an agreement with MTUSA to support some key projects only through MTUSA and as such the attached spec with URT Part no. will be manufactured by URT but support and logistic of the sales will be handled by MTUSA.

URT is confident that this arrangement between our two companies will ultimately benefit the end customer.


Thank You.

Raymond Chen

A handwritten signature in cursive script that reads "Raymond Chen". The signature is written in black ink and is positioned above a horizontal line.

Sales Manager: URT

## Revision record

Document Revision	Model No. Version No.	Description	Revision by
0	UMNH-8748MD-T (UFNH-K141EY-FT) Version No. 0	<ol style="list-style-type: none"> <li>1. Change the TFT glass and driver IC.</li> <li>2. Modify the module number from UMNH-8061MD-7T to UMNH-8748MD-T.</li> </ol>	Y. D. Shie Jeffry Chen 26-Jun-2012
		Revision 0 ; UMNH-8748MD-T Ver. 0 ; June-26-2012	<b>Page: 2</b>

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# 1. BASIC SPECIFICATION

## 1.1 Mechanical specifications

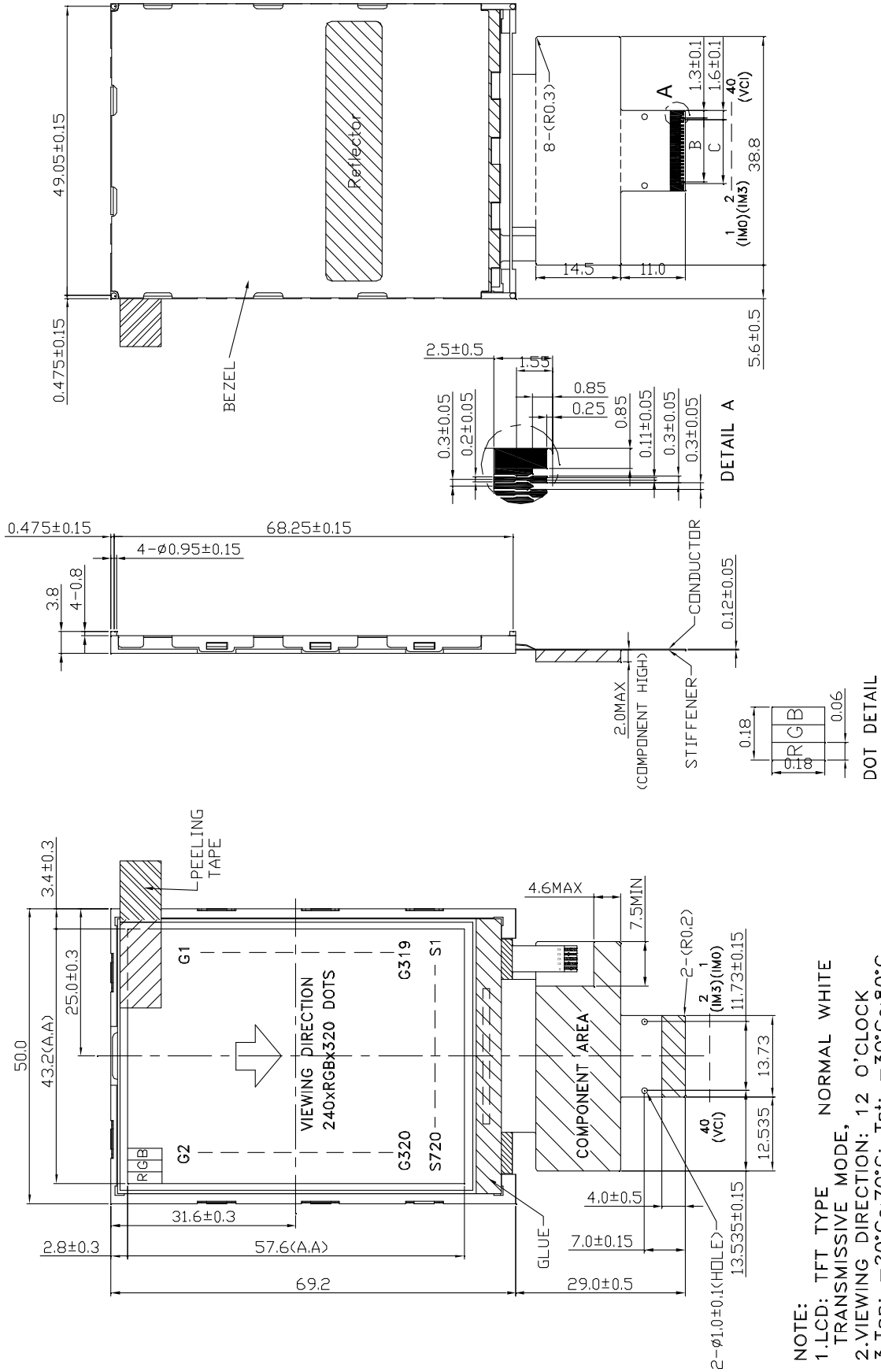
Items	Nominal Dimension	Unit
Active screen size	2.8" diagonal	-
Dot Matrix	240 x RGB x 320	Pixel
Module Size (W x H x T)	50 x 69.2 x 3.8	mm.
Active Area (W x H)	43.2 x 57.6	mm.
Pixel Size ( W×H )	0.18 × 0.18	mm.
Color depth	262K	color
Interface	8/9/16/18-bit MPU parallel	-
Driving IC Package	COG	-
Module Weight	19±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 inversion)	12 O'clock Direction	1

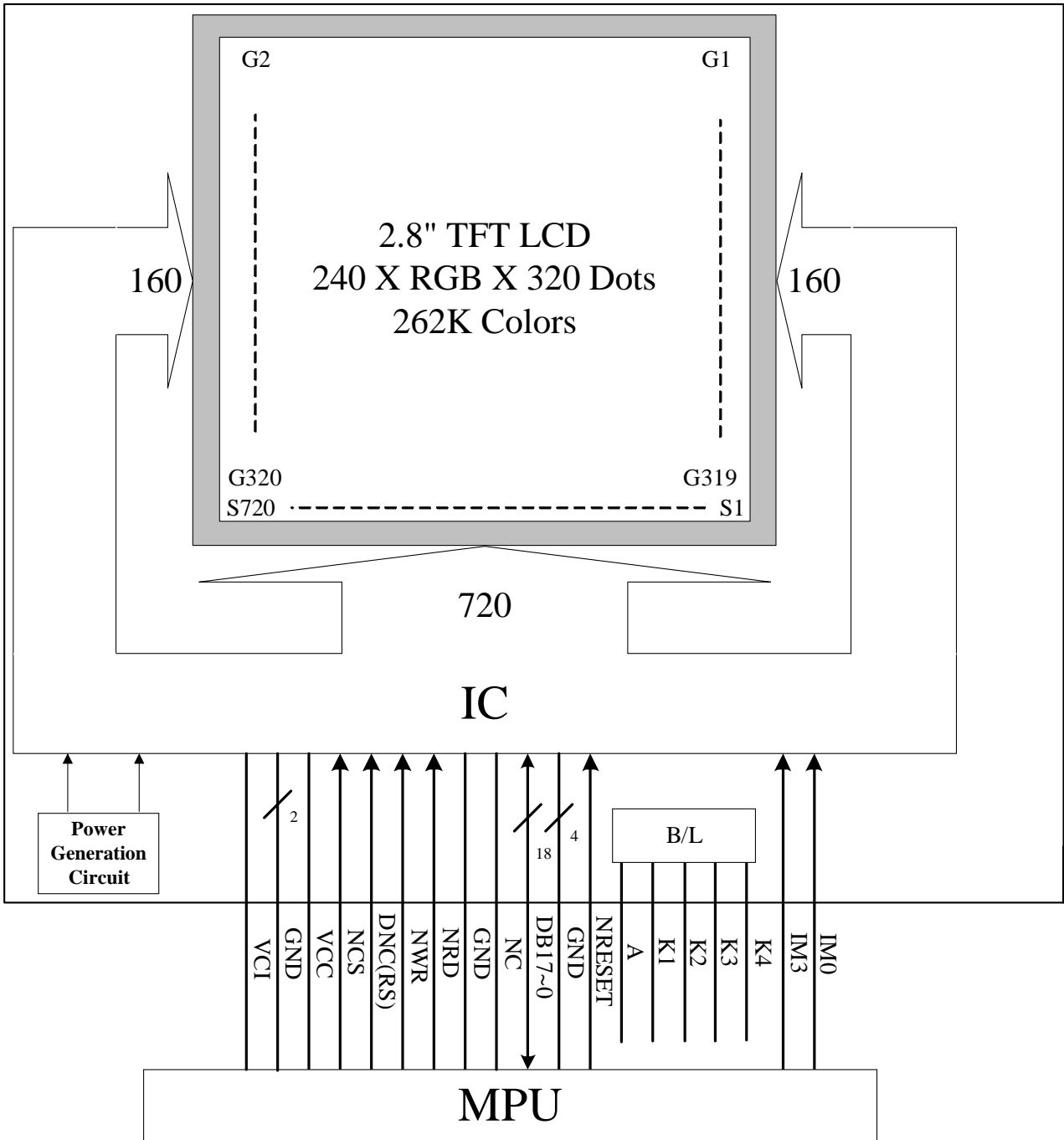
Note 1 : The viewing direction defined in this specification follows the rubbing direction of its mother TFT surface treatment. The grayscale inversion is at this direction as well.  
The optimized viewing direction applied into end-device is decided by customers.

# 1.3 Outline dimension



- NOTE:
- 1.LCD: TFT TYPE NORMAL WHITE TRANSMISSIVE MODE,
  - 2.VIEWING DIRECTION: 12 O'CLOCK
  - 3.Top: -20°C~70°C; Tst: -30°C~80°C
  - 4.TOLERANCE FOR NOT ASSIGNED: ±0.2mm
  - 5.LED: WHITE 4 PCS ,Vled = 3.5V(TYP) , IF= 80.0 mA( CONSTANT CURRENT)
  - 6.THE MINIMUM BENDING RADIUS(INNER) OF THE FPC IS 0.5mm
  - 7.B:10.8±0.1(P0.6X18) ; C:10.8±0.1(P0.6X18)

**1.4 Block diagram:**



## 1.5 Interface pin :

Pin No.	Pin Symbol	I/O	Description			
1	IM0	I	Select the MPU system interface mode			
			IM3	IM0	MPU-Interface Mode	DB Pin in use
			0	0	i80-system 16-bit interface	DB[17:10], DB[8:1]
			0	1	i80-system 8-bit interface	DB[17:10]
			1	0	i80-system 18-bit interface	DB[17:0]
2	IM3		1	1	i80-system 9-bit interface	DB[17:9]
3	K4	P	Cathode4 input for LED backlight.			
4	K3	P	Cathode3 input for LED backlight.			
5	K2	P	Cathode2 input for LED backlight.			
6	K1	P	Cathode1 input for LED backlight.			
7	A	P	Anode input for LED backlight.			
8	NRESET	I	Reset pin. Setting either pin low initializes the LSI Must be reset after power is supplied			
9~12	GND	P	Power Supply for Ground(0V).			
13~30	DB17~DB0	I/O	18-bit bi-directional data bus. The unused pins let to open.			
31	NC	-	No connection.			
32	GND	P	Power Supply for Ground(0V).			
33	NRD	I	Read enable pin I80 parallel bus system interface.			
34	NWR	I	Write enable pin I80 parallel bus system interface.			
35	DNC(RS)	I	Command / parameter or display data selection pin.			
36	NCS	I	Chip select signal.			
			Low: chip can be accessed; High: chip cannot be accessed.			
37	VCC	P	Digital IO Pad power supply. (+2.8V)			
38~39	GND	P	Power Supply for Ground(0V).			
40	VCI	P	Analog power supply. (+2.8V)			



## 2. ELECTRICAL CHARACTERISTICS

### 2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Supply voltage for logics	VCC	-0.3	+4.6	V
Supply voltage for analog	VCI	-0.3	+4.6	V
Input voltage	V <sub>i</sub>	-0.3	VCC+0.3	V
Operating temperature range	T <sub>OP</sub>	-20	+70	°C
Storage temperature range	T <sub>ST</sub>	-30	+80	°C

## 2.2 DC Characteristics

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage (Logic)	VCC	1.65	2.8	3.3	V	NOTE
Supply voltage (analog)	VCI	2.3	2.8	3.3	V	NOTE
Input high level voltage	V <sub>IH</sub>	0.8VCC	-	VCC	V	-
Input low level voltage	V <sub>IL</sub>	-0.3	-	0.2VCC	V	-
Power supply current	I <sub>CC</sub> +I <sub>CI</sub>	-	-	11	mA	NOTE

NOTE :

Measuring Condition :

Standard Value MAX.

T<sub>a</sub> = 25°C

VCC-VSS = +2.8V

VCI-VSS = +2.8V

Fosc = 2.75 MHz

Display Patten



0 gray black pattern

### 2-2.1 Back-light Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	Unit	Test Condition	NOTE
Supply Current	I <sub>f</sub>	-	80	-	mA	T <sub>a</sub> =25°C I <sub>f</sub> =80mA	-
Supply Voltage	V <sub>F</sub>	-	3.3	-	V	T <sub>a</sub> =25°C I <sub>f</sub> =80mA	-
Half-Life Time	L <sub>f</sub>	-	10000	-	hrs	T <sub>a</sub> =25°C I <sub>f</sub> =80mA	1

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

### 2.3 Command Sequence ( Recommend by U.R.T. )

LCD\_Initial\_HX8347-G:

Start Initial Sequence:

COMMAND	CODE	DESCRIPTION
--	LCD_RESET=1 delay 5ms LCD_RESET=0 delay 10ms	
Cycle control register	002EH 0088H	
Frame control 1 register	0029H 008FH	
Frame control 3 register	002BH 0004H	
Power control internal used (1) register	00EAH 0000H	
Power control internal used (2) register	00EBH 0020H	
Source control internal used (1) register	00ECH 000CH	
Source control internal used (2) register	00EDH 00C4H	
Source OP control register	00E8H 0040H	

## Gamma 2.2 Setting:

COMMAND	CODE	DESCRIPTION
Gamma Control 1 Register	0040H 0001H	
Gamma Control 2 Register	0041H 0007H	
Gamma Control 3 Register	0042H 0007H	
Gamma Control 4 Register	0043H 001FH	
Gamma Control 5 Register	0044H 00CH	
Gamma Control 6 Register	0045H 003EH	
Gamma Control 7 Register	0046H 001BH	
Gamma Control 8 Register	0047H 006BH	
Gamma Control 9 Register	0048H 0007H	
Gamma Control 10 Register	0049H 0013H	
Gamma Control 11 Register	004AH 0019H	
Gamma Control 12 Register	004BH 0019H	
Gamma Control 13 Register	004CH 0016H	
Gamma Control 14 Register	0050H 0001H	
Gamma Control 15 Register	0051H 0023H	
Gamma Control 16 Register	0052H 0020H	

<b>Gamma Control 17 Register</b>	0053H 0038H	
<b>Gamma Control 18 Register</b>	0054H 0038H	
<b>Gamma Control 19 Register</b>	0055H 003EH	
<b>Gamma Control 20 Register</b>	0056H 0014H	
<b>Gamma Control 21 Register</b>	0057H 0064H	
<b>Gamma Control 22 Register</b>	0058H 0009H	
<b>Gamma Control 23 Register</b>	0059H 0006H	
<b>Gamma Control 24 Register</b>	005AH 0006H	
<b>Gamma Control 25 Register</b>	005BH 0006H	
<b>Gamma Control 26 Register</b>	005CH 0018H	
<b>Gamma Control 27 Register</b>	005DH 00CCH	

### Power Voltage Setting:

COMMAND	CODE	DESCRIPTION
<b>Power Control 2 Register</b>	001BH 001BH	
<b>Power Control 1 Register</b>	001AH 0001H	
<b>Vcom Control 2 Register</b>	0024H 0069H	/VMH
<b>Vcom Control 3 Register</b>	0025H 0075H	/VML
<b>Vcom Control 1 Register</b>	0023H 0049H	

## Power on Setting:

COMMAND	CODE	DESCRIPTION
OSC Control 1 Register	0018H 0036H	/I/P_RADJ,N/P_RADJ, Normal mode 70Hz
OSC Control 2 Register	0019H 0001H	OSC_EN='1', start Osc
Display Mode Control Register	0001H 0000H	DP_STB='0', out deep sleep
Power Control 6 Register	001FH 0088H delay 5ms	GAS=1, VOMG=00, PON=0, DK=1, XDK=0, DVDH_TRI=0, STB=0
Power Control 6 Register	001FH 0080H delay 5ms	GAS=1, VOMG=00, PON=0, DK=0, XDK=0, DVDH_TRI=0, STB=0
Power Control 6 Register	001FH 0090H delay 5ms	GAS=1, VOMG=00, PON=1, DK=0, XDK=0, DVDH_TRI=0, STB=0
Power Control 6 Register	001FH 00D4H delay 5ms	GAS=1, VOMG=10, PON=1, DK=0, XDK=1, DDVDH_TRI=0, STB=0

## 262k/65k color selection:

COMMAND	CODE	DESCRIPTION
COLMOD Control Register	0017H 0006H	default 0x06 262k color // 0x05 65k color

## SET PANEL:

COMMAND	CODE	DESCRIPTION
Panel Characteristic Control Register	0036H 0001H	/SS_P, GS_P,REV_P,BGR_P
Display Control 3 Register	0028H 0038H delay 40ms	GON=1, DTE=1, D=1000
Display Control 3 Register	0028H 003CH	GON=1, DTE=1, D=1100

### Set GRAM Area:

COMMAND	CODE	DESCRIPTION
Column Address Start Register Upper Byte	0002H 0000H	
Column Address Start Register Low Byte	0003H 0000H	Column Start
Column Address End Register Upper Byte	0004H 0000H	
Column Address End Register Low Byte	0005H 00EFH	Column End
Row Address Start Register Upper Byte	0006H 0000H	
Row Address Start Register Low Byte	0007H 0000H	Row Start
Row Address End Register Upper Byte	0008H 0001H	
Row Address End Register Low Byte	0009H 003FH	Row End
	0022H	Start GRAM write

### Enter Sleep mode Setting:

COMMAND	CODE	DESCRIPTION
Display Control 1 Register	0028H 0038H delay 40ms	GON='1' DTE='1' D[1:0]='10'
Power Control 6 Register	001FH 0089H delay 40ms	GAS=1, VOMG=00, PON=0, DK=1, XDK=0, DVDH_TRI=0, STB=1
Display Control 1 Register	0028H 0020H delay 40ms	/GON='1' DTE='0' D[1:0]='00'
OSC Control 2 Register	0019H 0000H delay 5 ms	OSC_EN='0'

## Exit Sleep mode Setting:

COMMAND	CODE	DESCRIPTION
OSC Control 2 Register	0019H 0001H	/OSC_EN='1', start Osc
Power Control 6 Register	001FH 0088H delay 5ms	GAS=1, VOMG=00, PON=0, DK=1, XDK=0, DVDH_TRI=0, STB=0
Power Control 6 Register	001FH 0080H delay 5ms	GAS=1, VOMG=00, PON=0, DK=0, XDK=0, DVDH_TRI=0, STB=0
Power Control 6 Register	001FH 0090H delay 5ms	GAS=1, VOMG=00, PON=1, DK=0, XDK=0, DVDH_TRI=0, STB=0
Power Control 6 Register	001FH 00D4H delay 5ms	GAS=1, VOMG=10, PON=1, DK=0, XDK=1, DDVDH_TRI=0, STB=0
Display Control 1 Register	0028H 0038H delay 40ms	GON=1, DTE=1, D=1000
Display Control 1 Register	0028H 003CH	GON=1, DTE=1, D=1100



## 2.4 AC Characteristics

### 2.4.1 Parallel Interface Characteristics (8080-series MPU)

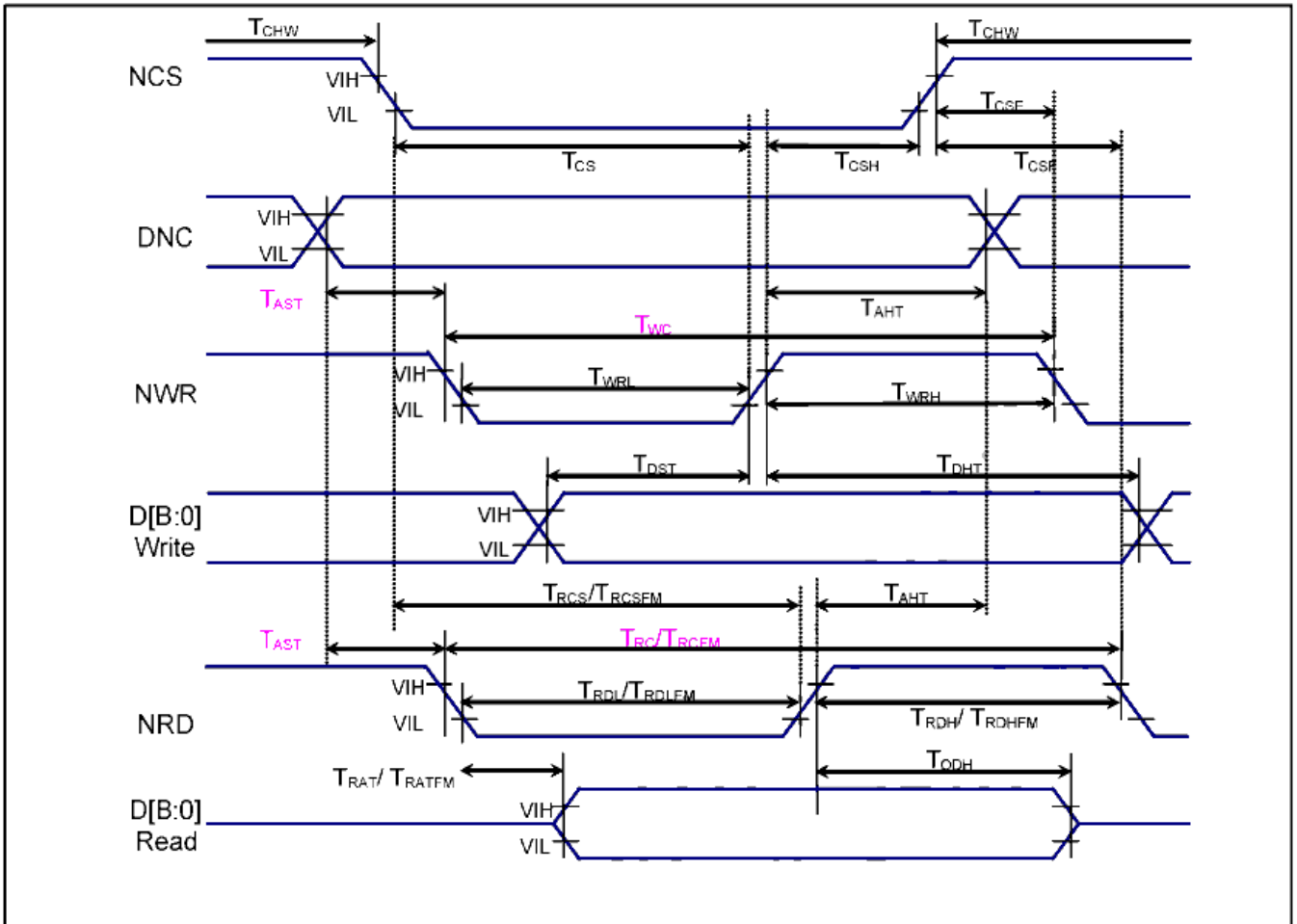


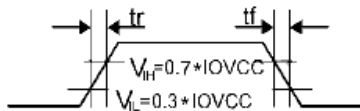
Figure 8.1: Parallel interface characteristics (8080-series MPU)

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, T<sub>A</sub> = -30 to 70° C)

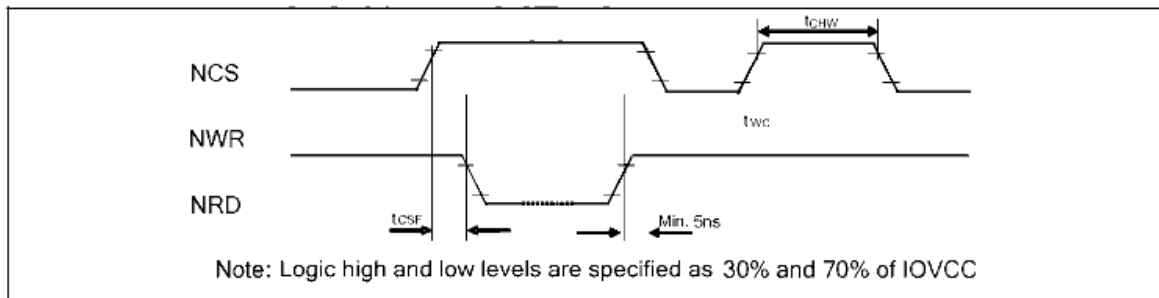
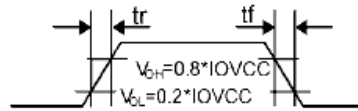
Signal	Symbol	Parameter	Spec.			Unit	Description
			Min.	Typ	Max.		
DNC_SCL	tAST	Address setup time	10	-	-	ns	-
	tAHT	Address hold time (Write/Read)	10	-	-		
NCS	tCHW	Chip select "H" pulse width	0	-	-	ns	-
	tCS	Chip select setup time (Write)	15	-	-		
	tRCS	Chip select setup time (Read ID)	45	-	-		
	tRCSFM	Chip select setup time (Read FM)	355	-	-		
	tCSF	Chip select wait time (Write/Read)	10	-	-		
	tCSH	Chip select hold time	10	-	-		
NWR_SCL	tWC	Write cycle (1 pixel for one write)	100	-	-	ns	-
	tWC	Write cycle (1 pixel for 2 or 3 write)	50	-	-		
	tWRH	Control pulse "H" duration	15	-	-		
	tWRL	Control pulse "L" duration	15	-	-		
NRD(ID)	tRC	Read cycle (ID)	160	-	-	ns	When read ID data
	tRDH	Control pulse "H" duration (ID)	90	-	-		
	tRDL	Control pulse "L" duration (ID)	45	-	-		
NRD(FM)	tRCFM	Read cycle (FM) (1 pixel for one read)	600	-	-	ns	When read from frame memory
	tRCFM	Read cycle (FM) (1 pixel for 2 or 3 read)	400	-	-		
	tRDHFM	Control pulse "H" duration (FM)	90	-	-		
	tRDLFM	Control pulse "L" duration (FM)	355	-	-		
DB17 to DB0	tDST	Data setup time	10	-	-	ns	For maximum CL=30pF For minimum CL=8pF
	tDHT	Data hold time	10	-	-		
	tRAT	Read access time (ID)	-	-	100		
	tRATFM	Read access time (FM)	-	-	340		
	tODH	Output disable time	20	-	80		

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

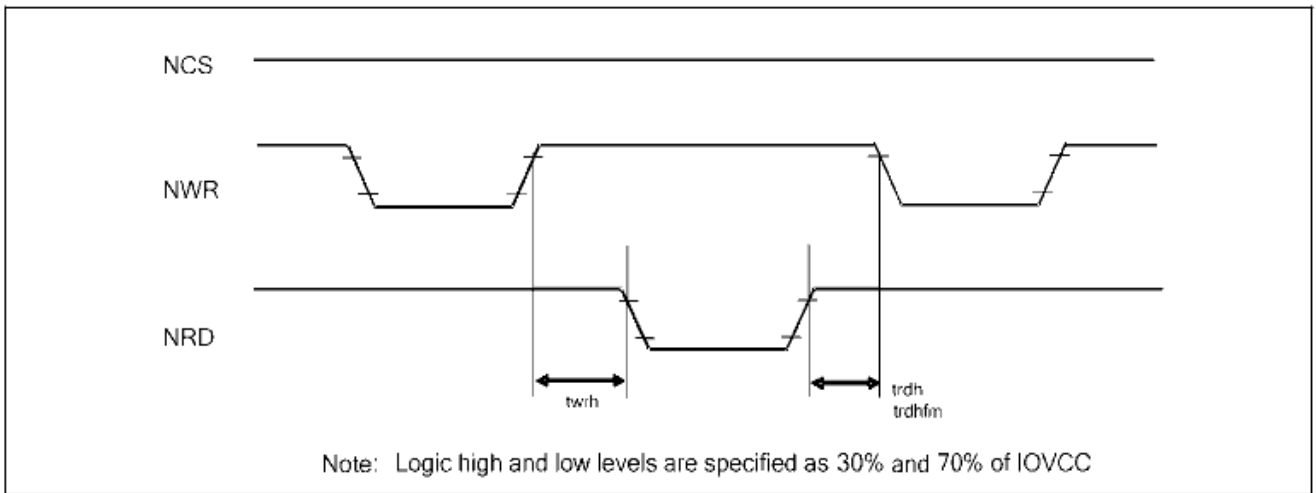
Input Signal Slope



Output Signal Slope

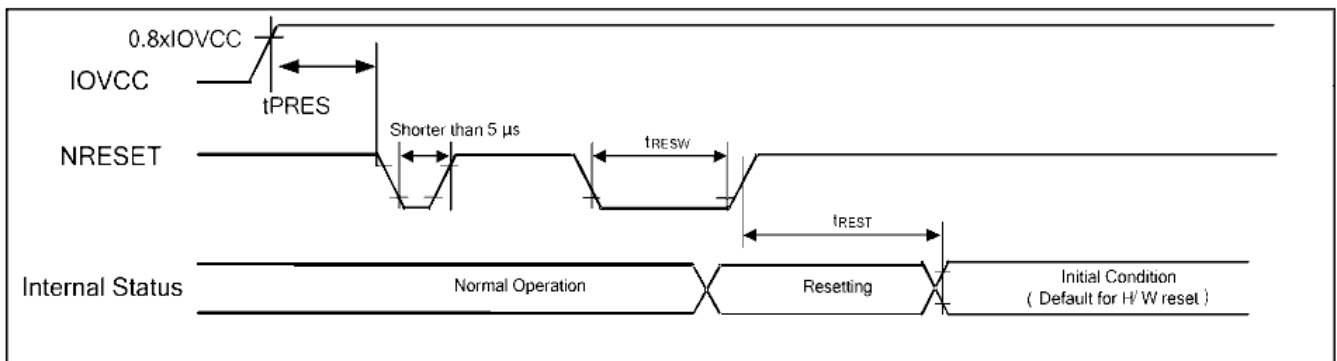


**Figure 8.2: Chip select timing**



**Figure 8.3: Write to read and read to write timing**

2.4.2 Reset Timing Characteristics



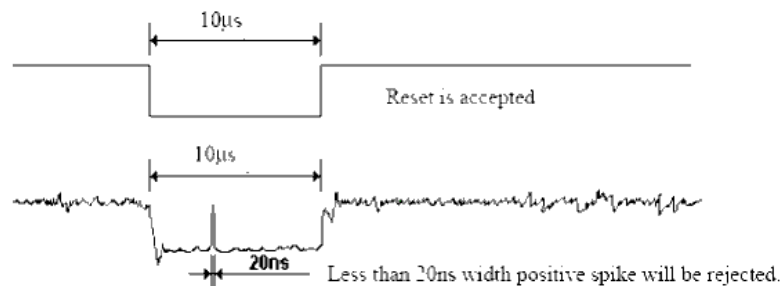
**Figure 8.5: Reset input timing**

Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width <sup>(1)</sup>	NRESET	10	-	-	-	µs
tREST	Reset complete time <sup>(2)</sup>	-	5	-	-	When reset applied during STB OUT mode	ms
		-	120	-	-	When reset applied during STB mode	ms
tPRES	Reset goes high level after Power on time	NRESET & IOVCC	1	-	-	Reset goes high level after Power on	ms

**Note:** (1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the table below.

NRESET Pulse	Action
Shorter than 5 µs	Reset Rejected
Longer than 10 µs	Reset
Between 5 µs and 10 µs	Reset Start

- (2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in STB Out –mode. The display remains the blank state in STB –mode) and then return to Default condition for H/W reset.
- (3) During Reset Complete Time, VMF value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of NRESET.
- (4) Spike Rejection also applies during a valid reset pulse as shown below:



- (5) It is necessary to wait 5msec after releasing !RES before sending commands. Also STB Out

### 3. OPTICAL CHARACTERISTICS

#### 3.1 Characteristics

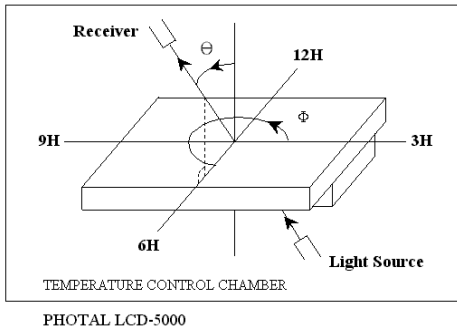
Electrical and Optical Characteristics

No.	Item			symbol / temp.	Min.	Typ.	Max.	Unit	Note	
1	Response Time			Tr	25 °C	-	15	ms	2	
				Tf	25 °C	-	35			
2	Viewing Angle	Hor.	$\Phi = 90^\circ$	$\Theta_{2+}$	0°	45	60	-	degree	3
				$\Theta_{2-}$	180°	45	60	-		
		Ver.	$Cr \geq$	$\Theta_{1-}$	270°	25	35	-		
				$\Theta_{1+}$	90°	30	45	-		
3	Contrast Ratio			Cr	25 °C	150	250	-	4	
4	Red x-code			Rx	25 °C	0.56	0.61	0.66	-	5
	Red y-code			Ry		0.28	0.33	0.38		
	Green x-code			Gx		0.30	0.35	0.40		
	Green y-code			Gy		0.54	0.59	0.64		
	Blue x-code			Bx		0.09	0.14	0.19		
	Blue y-code			By		0.03	0.08	0.13		
	White x-code			Wx		0.24	0.29	0.34		
	White y-code			Wy		0.27	0.32	0.37		
	Brightness			Y		200	250	-		
5	Brightness Uniformity				25 °C	80	-	-	%	6

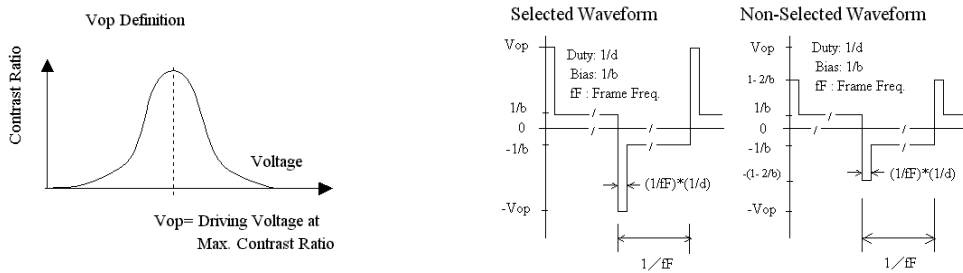
### 3.2 Definition of optical characteristics

Measurement condition :

Transmissive and Transflective type

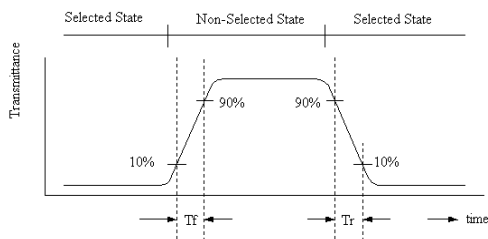


[Note 1] Definition of LCD Driving Vop and Waveform :



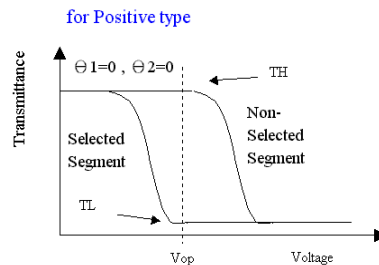
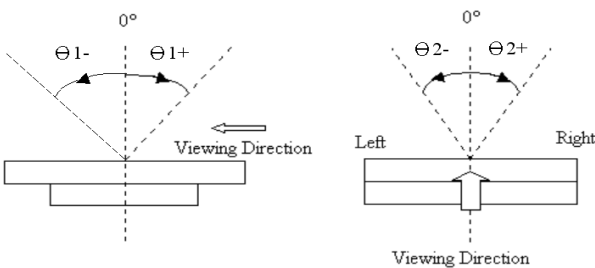
[Note 2] Definition of Response Time

for Positive type :



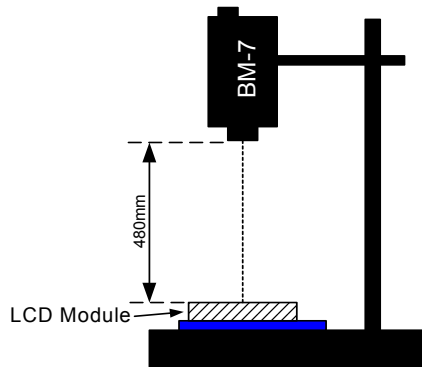
[Note 3] Definition of Viewing Angle :

[Note 4] Definition of Contrast Ratio :

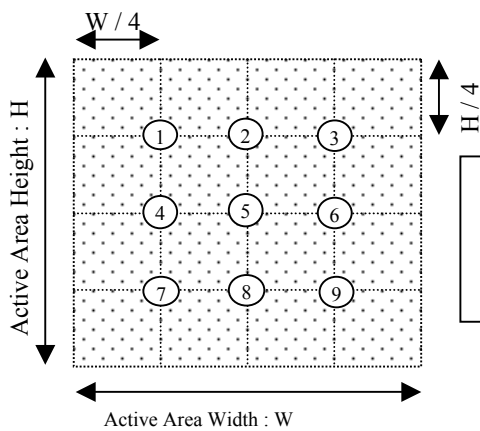


$$\text{Contrast Ratio} = \frac{TH}{TL}$$

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

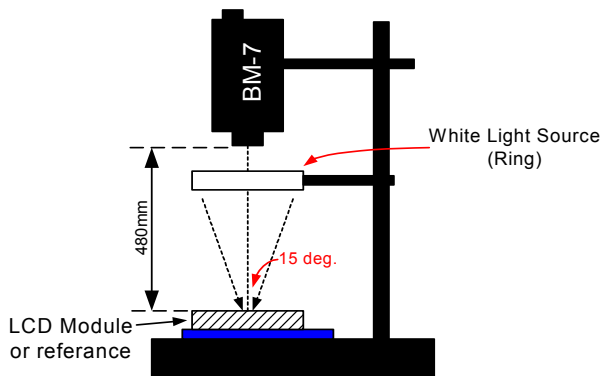


**[Note 6] Definition of Brightness Uniformity**



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

**[Note 7] Definition of Measurement of Reflectance**



#### 4. RELIABILITY :

Item No	Items	Condition
1	High temperature operating	70 , 200 hours
2	Low temperature operating	-20 , 200 hours
3	High temperature storage	80 , 200 hours
4	Low temperature storage	-30 , 200 hours
5	High temperature & humidity storage	60 , 90%RH, 100 hours
6	Thermal Shock storage	-30 , 30min.<=> 80 , 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	Life time	50,000 hours 25 , 60%RH , specification condition driving

- \* 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. 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 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.

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 wipe 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 LCM 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 occurred, 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 permanently damage on display !!

### 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 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 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 :

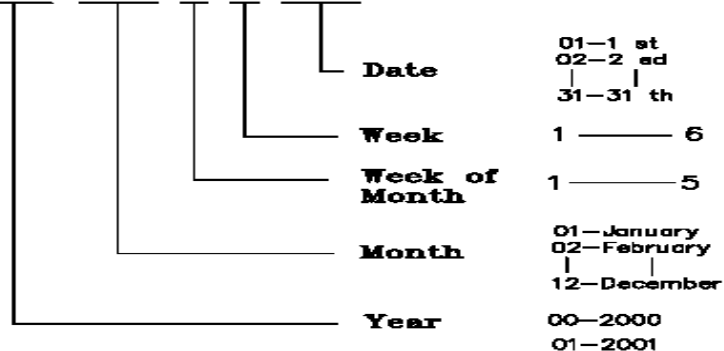
**YY MM DD - XXXX**  
|     |     |     |  
Year Month Day - Production lots

Example: 090508 - 0 0 0 3 ==>Year 2009, May.,08rd , Batch no.03

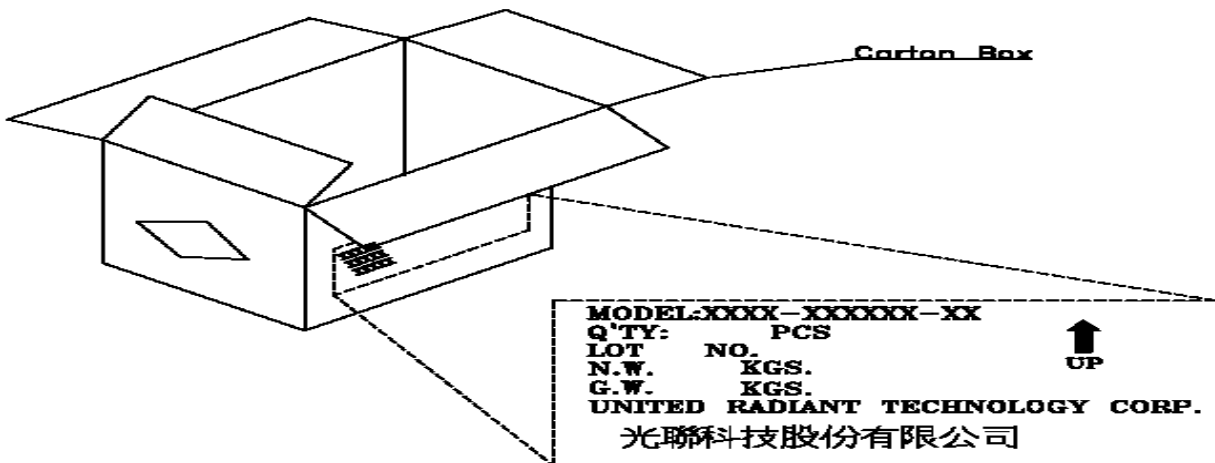
## 7. PACKING

Instruction of lot number:

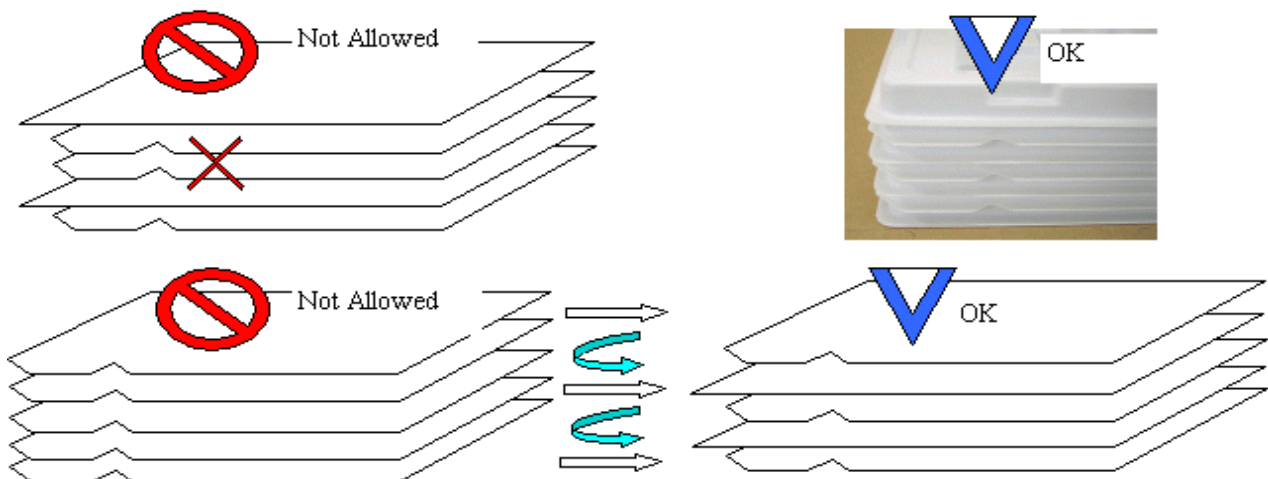
LOT NO. : 0 0 0 8 3 5 2 5 (EX)



Label of carton:



Packing tray must be stacked with alternated direction to each others.  
 To tacks packing trays in same direction will cause product damaged.



MODEL NO: UM\*

T.B.D pcs / Tray

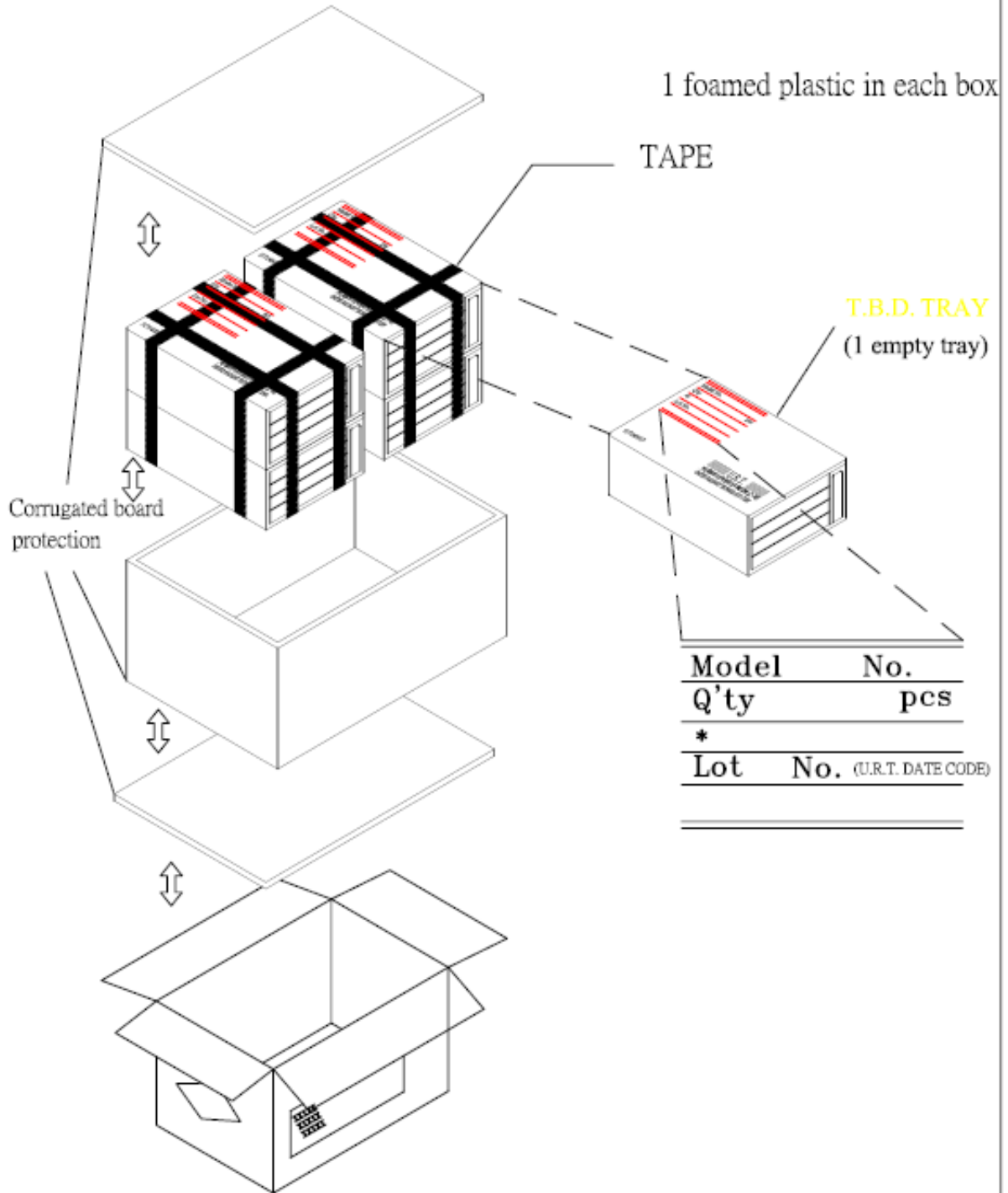
T.B.D Tray / Box

T.B.D. Box / Carton

T.B.D. pcs / Carton

NOTE:

- (1) Be warned, the direction of the tray has to turn it by 180 degree before stack it up. Otherwise, it will be packager's responsibility!!
- (2) Safe Stack : 5 cartons only



## 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 TO 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-105E ) , LEVEL 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. 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. CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

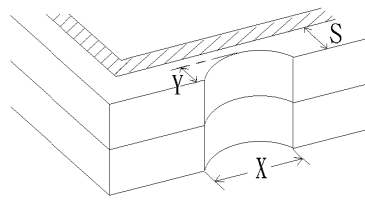
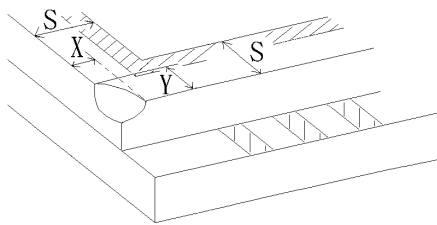
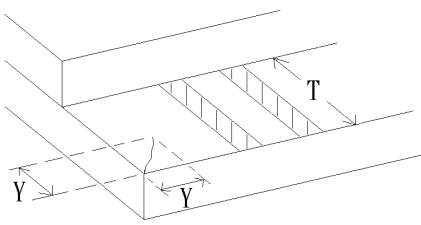
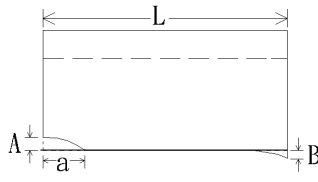
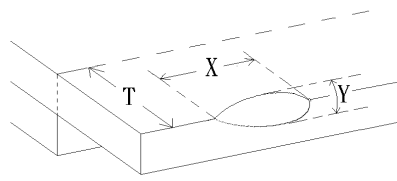
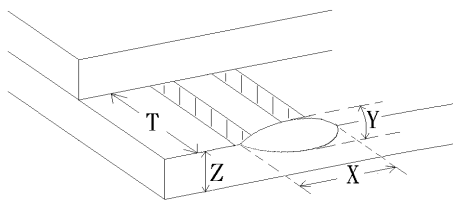
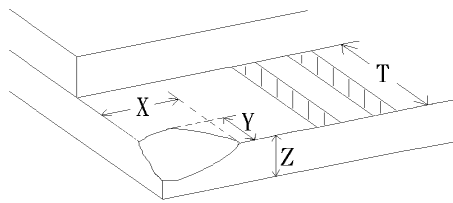
8.2.2. CHECKER SHALL SEE OVER 30 cm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

### 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 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, 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	. BLEMISH, BLACK SPOT, WHITE SPOT IN THE LCD.  . BLEMISH, BLACK SPOT, WHITE SPOT AND SCRATCH ON THE POLARIZER	<p>(A) ROUND TYPE: <span style="float: right;">unit : mm.</span></p> <table border="1"> <thead> <tr> <th>DIAMETER (mm.)</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>0.1</td> <td>DISREGARD</td> </tr> <tr> <td>0.1 &lt; 0.2</td> <td>2</td> </tr> <tr> <td>0.2 &lt; 0.25</td> <td>1</td> </tr> <tr> <td>0.25 &lt;</td> <td>0</td> </tr> </tbody> </table> <p>NOTE: <math>=(\text{LENGTH}+\text{WIDTH})/2</math></p> <p>(B) LINER TYPE: <span style="float: right;">unit : mm.</span></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 0.03</td> <td>DISREGARD</td> </tr> <tr> <td>L 5.0</td> <td>0.03 &lt; W 0.05</td> <td>3</td> </tr> <tr> <td>L 5.0</td> <td>0.05 &lt; W 0.07</td> <td>1</td> </tr> <tr> <td>-----</td> <td>0.07 &lt; W</td> <td>FOLLOW ROUND TYPE</td> </tr> </tbody> </table>	DIAMETER (mm.)	ACCEPTABLE Q'TY	0.1	DISREGARD	0.1 < 0.2	2	0.2 < 0.25	1	0.25 <	0	LENGTH	WIDTH	ACCEPTABLE Q'TY	-----	W 0.03	DISREGARD	L 5.0	0.03 < W 0.05	3	L 5.0	0.05 < W 0.07	1	-----	0.07 < W	FOLLOW ROUND TYPE								
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8.4.2	MINOR	BUBBLE IN POLARIZER	<p style="text-align: right;">unit : mm.</p> <table border="1"> <thead> <tr> <th>DIAMETER</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>0.15</td> <td>DISREGARD</td> </tr> <tr> <td>0.15 &lt; 0.5</td> <td>2</td> </tr> <tr> <td>0.5 &lt;</td> <td>0</td> </tr> </tbody> </table>	DIAMETER	ACCEPTABLE Q'TY	0.15	DISREGARD	0.15 < 0.5	2	0.5 <	0																									
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8.4.3	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 4</td> </tr> <tr> <td>Dark dot</td> <td>N 4</td> </tr> </tbody> </table> <p>Pixel Define</p> <table border="1"> <tbody> <tr> <td>R</td><td>G</td><td>B</td><td>R</td><td>G</td><td>B</td><td>R</td><td>G</td><td>B</td> </tr> <tr> <td>R</td><td>G</td><td>B</td><td>R</td><td>G</td><td>B</td><td>R</td><td>G</td><td>B</td> </tr> <tr> <td>R</td><td>G</td><td>B</td><td>R</td><td>G</td><td>B</td><td>R</td><td>G</td><td>B</td> </tr> </tbody> </table> <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 4	Dark dot	N 4	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
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R	G	B	R	G	B	R	G	B																												
R	G	B	R	G	B	R	G	B																												

NO.	CLASS	ITEM	JUDGEMENT
8.4.4	MINOR	LCD GLASS CHIPPING	 $Y > S$ Reject
8.4.5	MINOR	LCD GLASS CHIPPING	 $X \text{ or } Y > S$ Reject
8.4.6	MAJOR	LCD GLASS GLASS CRACK	 $Y > (1/2) T$ Reject
8.4.7	MAJOR	LCD GLASS SCRIBE DEFECT	 <ol style="list-style-type: none"> <li><math>a &gt; L/3</math>, <math>A &gt; 1.5\text{mm}</math>. Reject</li> <li>B : ACCORDING TO DIMENSION</li> </ol>
8.4.8	MINOR	LCD GLASS CHIPPING ( ON THE TERMINAL AREA )	 $= (x+y)/2 > 2.5 \text{ mm}$ 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