CONFIDENTIAL(B)

SPECIFICATION

OF

LIQUID CRYSTAL DISPLAY MODULE

UNITED RADIANT TECHNOLOGY CORP. 光聯科技 Dec-27-2024 品管部 QC DEPT.

CUSTOMER : URT-STD

Model No. : UMOH-9846JD-T

Model version : 0

Document Revision : 0

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

Joe Wu	Ashin Chiu	Jenny Wang	Dec-27-2024
APPROVED	CHECKED	PREPARED	Date

COMPANY : No. 2,Fu-hsing Road,Taichung Tanzi Technology Industrial Park,Tantzu,Taichung,Taiwan,R.O.C.
TEL: 886-4-25314277 FAX: 886-4-25313067

Revision record

Document Revision	Model No. Version No.	Description	Revision by
0	UMOH-9846JD-T Version No. 0	First release	C.K.T. Chen Eric Wang 27-Dec-2024

CONTENTS:

1. BASIC SPECIFICATION

1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Active screen size	2.8” Diagonal	-
Dot Matrix	240 x RGB x 400	Pixel
Module Size (W x H x T)	43.08 x 73.25 x 2.77	mm.
Active Area (W x H)	36.72 x 61.2	mm.
Pixel pitch (W×H)	0.153 x 0.153	mm.
Interface	16-bit MCU interface	-
Driving IC Package	COG	-
Module weight	TBD±10%	g

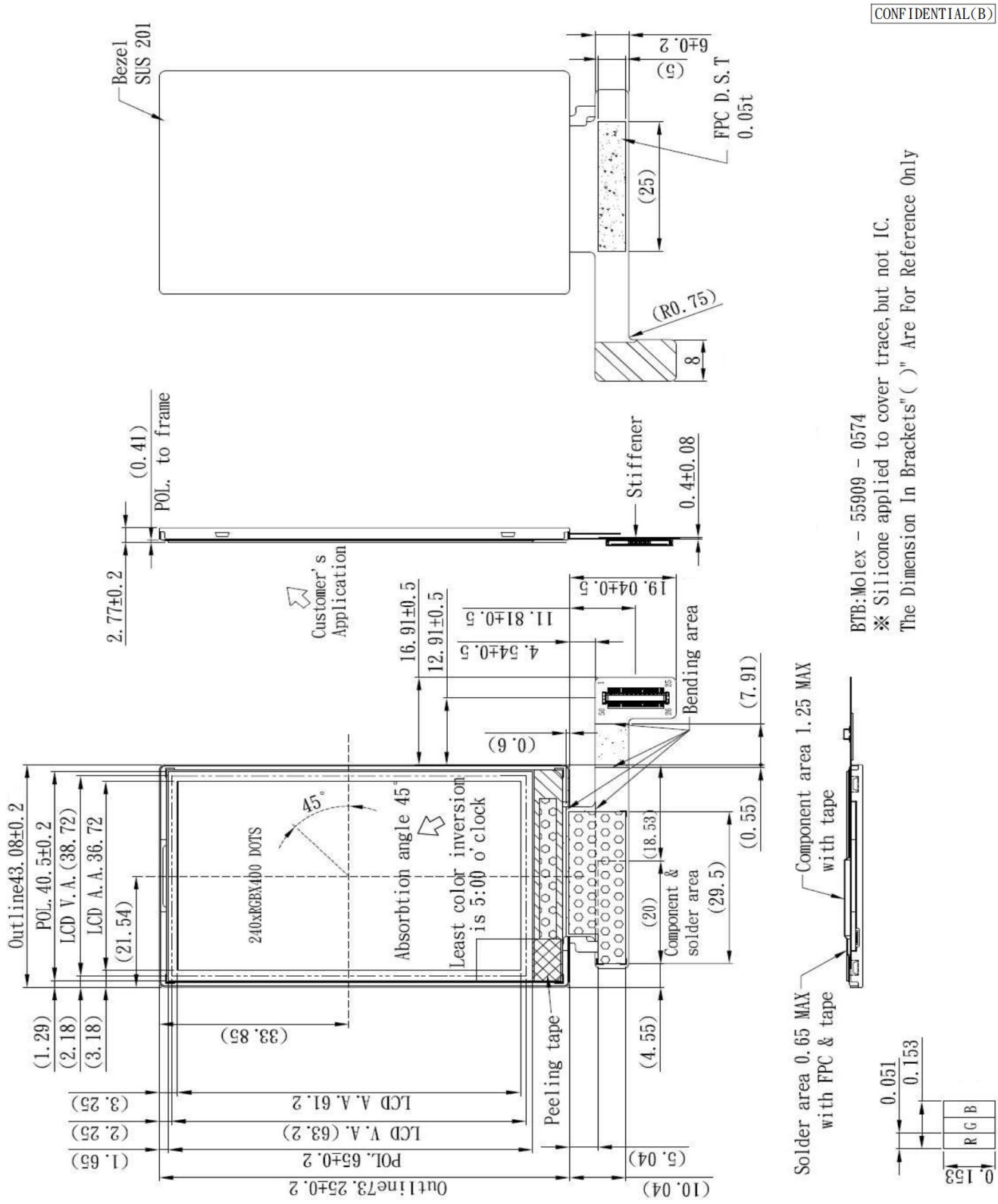
1.2 Display specification

Display	Descriptions	Note
LCD Type	a-Si TFT	-
LCD Mode	Positive mode	-
Polarizer Mode	LR+HC(Inner Haze:80%)	-
Pixel arrangement	RGB-stripe	-
Gray Scale Inversion Direction	11 O‘clock	1
Back Light	White LEDS	-

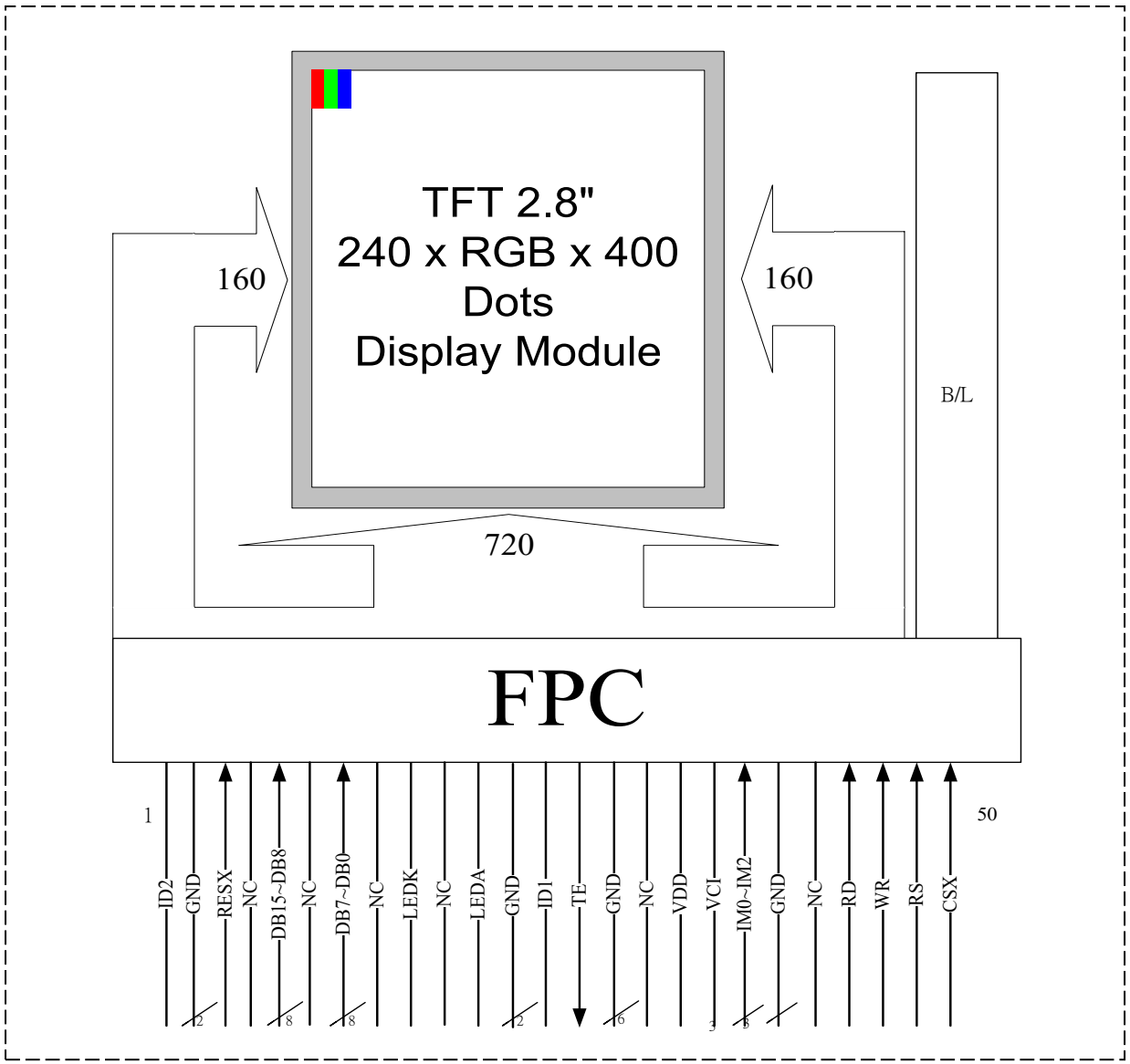
*Color tone is slightly changed by temperature and driving voltage.

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



1.4 Block diagram:



1.5 Interface Pin :LCM

Pin No.	Pin Symbol	I/O	Description
1	ID2	O	Identification(pull low internally , Tied to GND internally)
2~3	GND	P	Ground
4	RESX	I	System Reset.
5	NC	-	No Connector
6~13	DB15~DB8	I	Data bus.
14	NC	-	No Connector
15~22	DB7~DB0	I	Data bus.
23	NC	-	No Connector
24	LEDK	P	Cathode input for LED backlight.
25	NC	-	No Connector
26	LEDA	P	Anode input for LED backlight.
27~28	GND	P	System Ground.
29	ID1	O	Identification(pull High internally , Tied to VDD=1.8V internally)
30	TE	O	Tearing effect output pin
31~36	GND	P	Ground
37	NC	-	No Connector
38	VDD	P	Power supply to interface pins
39	VCI	P	Power supply to power supply analog circuit.
40	IM0	I	16-bit data bus DB[15:0]interface IM[2:0]:010
41	IM1	I	
42	IM2	I	
43~45	GND	P	Ground
46	NC	-	No Connector
47	RD	I	Read control pin for the DBI interface. If not used, please connect this pin to IOVCC.
48	WRX	I	Write control pin
49	RS	I	Display data / Command selection pin D/CX='1': Display data. D/CX='0': Command data.
50	CSX	I	Chip select input pin ("Low" enable).

2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

TFT-LCD Panel Absolute Maximum Ratings **Ta=25°C**

Item	Symbol	Standard Value		Unit	Remark
		Min.	Max		
Analog Operation Voltage	VCI	-0.3	4.6	V	--
I/O pin Operation Voltage	VDD	-0.3	4.6	V	
Operation temperature range	Top	-20	70	°C	
Storage temperature range	Tst	-30	85	°C	

(1) All of the voltages listed above are with respective to GND= 0V

(2) Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

2.2 DC Characteristics:

Item	Symbol	Mini.	Typ.	Max.	Unit	Condition
Analog Operation Voltage	VCI	2.9	3.0	3.1	V	-
I/O pin Operation Voltage	VDD	1.65	1.8	1.95	V	-
Input high level voltage	V_{IH}	0.7VDD	-	VDD	V	-
Input low level voltage	V_{IL}	GND	-	0.3 VDD	V	-
Output high level voltage	V_{OH}	0.8 VDD	-	VDD	V	-
Output low level voltage	V_{OL}	GND	-	0.2 VDD	V	-
Power supply current	I_{CI}	-	-	TBD	mA	
	I_{DD}	-	-	TBD	mA	

Measuring Condition :

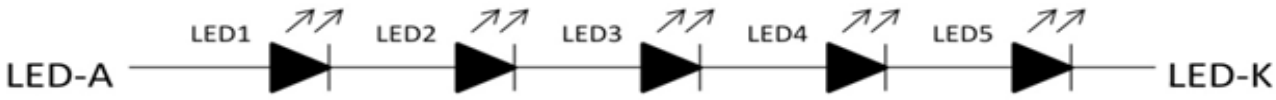
Standard Value MAX.

Ta = 25℃

Display Patten = Checkered pattern

2.3 Back-light only Specification

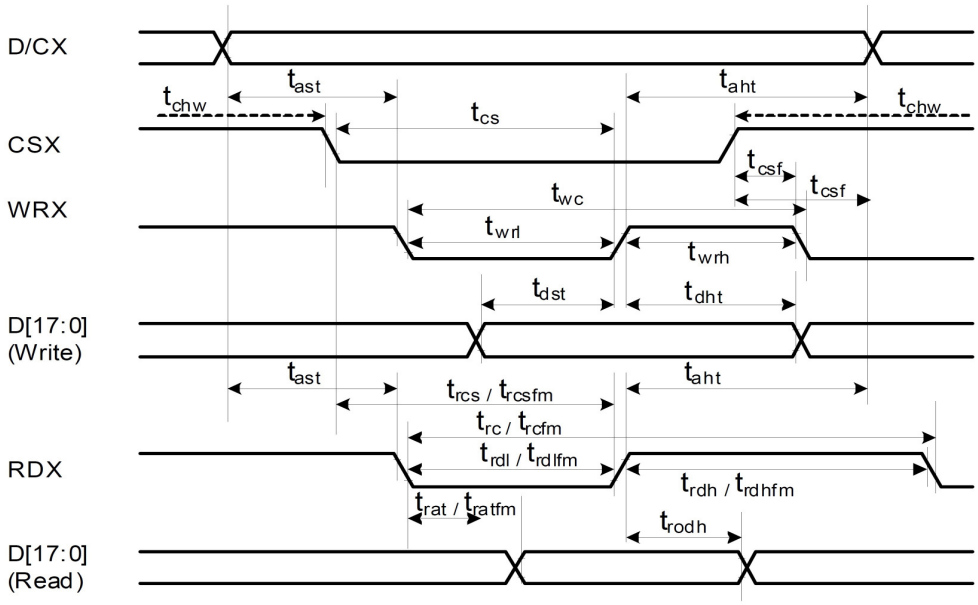
PARAMETER	SYMBOL	MIN	TYP	MAX	Unit	NOTE
Supply Current	If	-	20	-	mA	
Supply Voltage	Vf	14	-	17.5	V	1
Life Time	Lf	-	20000	-	Hr	2



2.4 AC Characteristics :

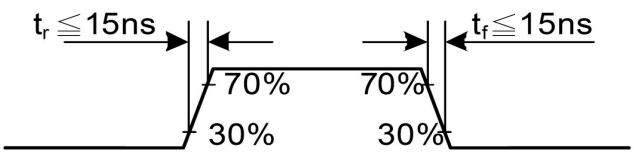
2.4.1 MCU Interface Timing

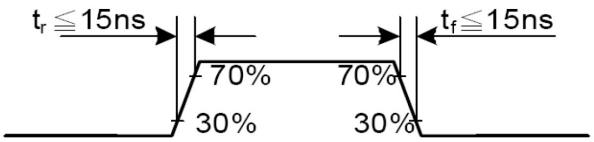
DBI Type B (18/16/9/8 bit) Interface Timing Characteristics



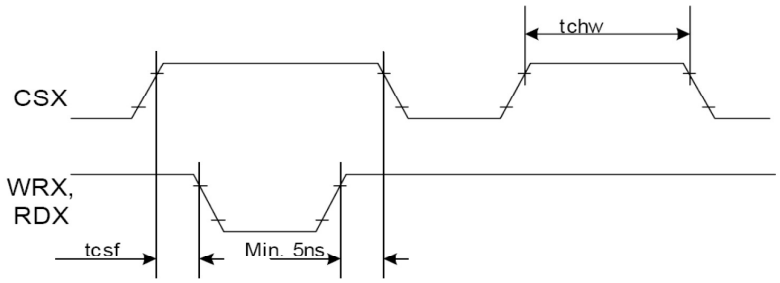
Signal	Symbol	Parameter	min	max	Unit	Description
D/CX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	10	-	ns	
CSX	tchw	CSX "H" Pulse Width	0	-	ns	
	tcs	Chip Select setup time (Write)	20	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	80	-	ns	
	twrh	Write Control pulse H duration	25	-	ns	
	twrl	Write Control pulse L duration	25	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration (ID)	90	-	ns	
	trdl	Read Control pulse L duration (ID)	45	-	ns	
RDX (FM)	trcfm	Read cycle (FM)	450	-	ns	
	trdhfm	Read Control pulse H duration (FM)	90	-	ns	
	trdlfm	Read Control pulse L duration (FM)	355	-	ns	
DB[17:0], DB[15:0], DB[8:0], DB[7:0]	tdst	Data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Data hold time	10	-	ns	
	trat	Read access time (ID)	-	40	ns	
	tratfm	Read access time (FM)	-	340	ns	
	todh	Output disable time	20	-	ns	

Note: Ta = -30 to 70 °C, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.0V, DGND=0V

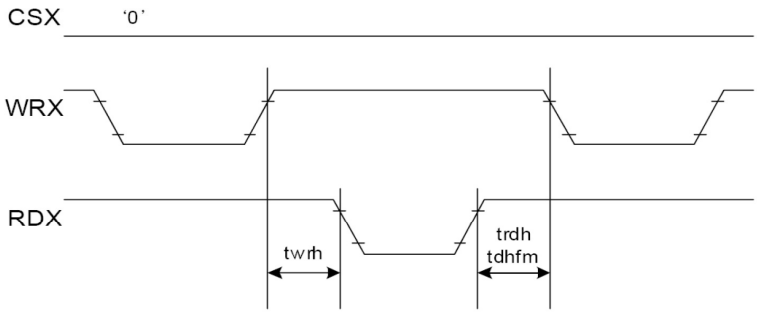




CSX Timing

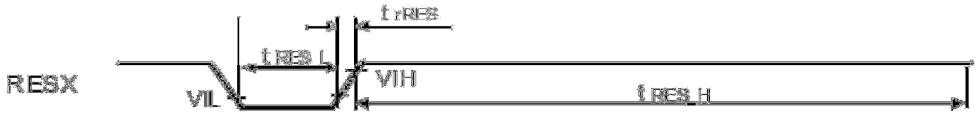


Write to read or read to write timing:



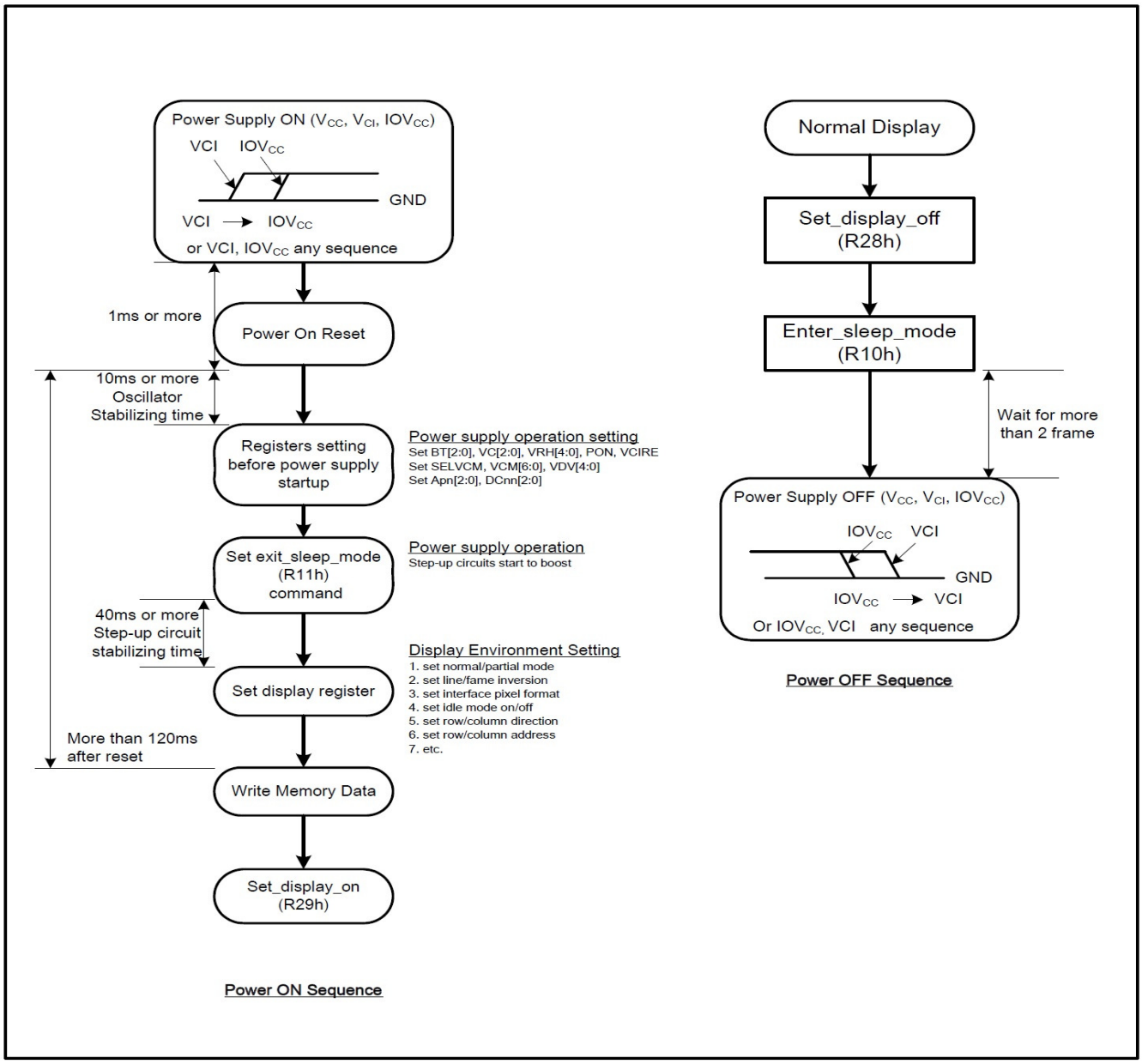
Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Reset timing:



Item	Symbol	Rating			Unit
		MIN	TYP	MAX	
Reset low-level width	tRES_L	1	-	-	ms
Reset rise time	trRES	-	-	10	us
Reset high-level width	tRES_H	120	-	-	ms

2.4.2 Power ON/OFF Sequence



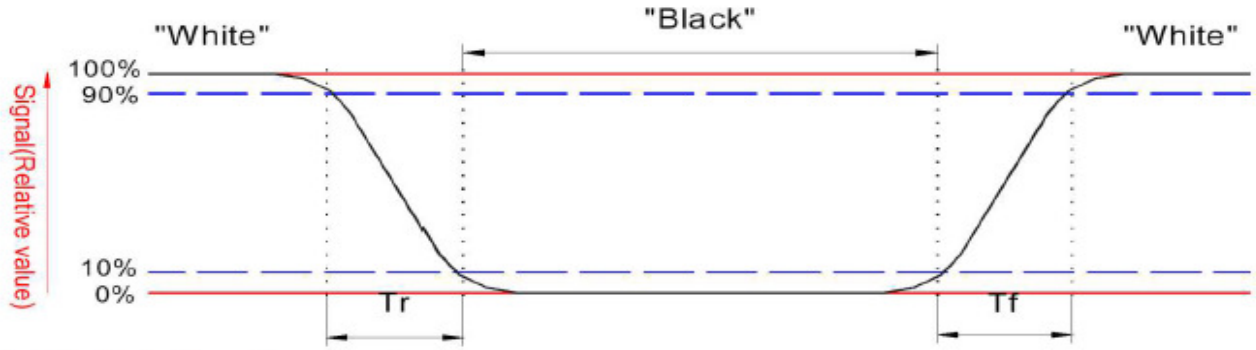
3. OPTICAL CHARACTERISTICS

3.1 Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in dark room or equivalent state with the methods shown in Note 1,Note2,Note3.

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
Response time		T_R+T_F	T = 25℃		30	50	ms	Note 4,6
Contrast ratio		CR	Transmissive(Ta=25℃)	50	60			Note 5,6
Contrast ratio		CR	Reflective(Ta=25℃)	(11)				Note 5,6
Viewing Angle (TM)	Hor.	Θ_R	CR≧10		(30)	-	Deg.	Note 6,7
		Θ_L			(30)	-		
	Ver.	φ_H			(40)	-		
		φ_L			(30	-		
Viewing Angle (TF)	Hor.	Θ_R	CR≧5		(30)		Deg.	
		Θ_L			(30)			
	Ver.	φ_H			(30)			
		φ_L			(30)			
Reflective		R%	T=25℃	(5.5)	(6.5)		%	Note9
Transmission		T%	T=25℃	(0.85)			%	Note8
Color Coordinate (Transmissive)		Rx	T=25℃	0.425	0.475	0.525		
		Ry		0.263	0.313	0.363		
		Gx		0.278	0.328	0.378		
		Gy		0.47	0.52	0.57		
		Bx		0.112	0.162	0.212		
		By		0.07	0.12	0.17		
		Wx		0.244	0.294	0.344		
		Wy		0.265	0.315	0.365		
		NTSC			30		%	
Color Coordinate (Reflective)		Rx	T=25℃	(0.364)	(0.399)	(0.434)		
		Ry		(0.308)	(0.343)	(0.378)		
		Gx		(0.272)	(0.307)	(0.342)		
		Gy		(0.364)	(0.399)	(0.434)		
		Bx		(0.193)	(0.228)	(0.263)		
		By		(0.215)	(0.250)	(0.285)		
		Wx		(0.281)	(0.316)	(0.351)		
		Wy		(0.313)	(0.348)	(0.383)		
		NTSC			(7)		%	

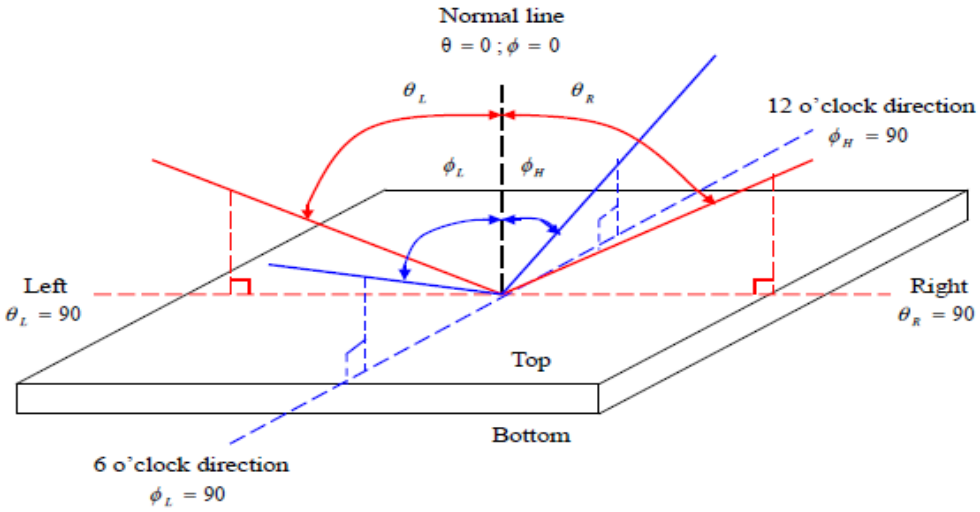
Note1:Ambient temperature=25℃
Note2:To be measured in the dark room.
Note3:To be measured on the center area of panel with a field angle of 1° by Topcon luminance meter BM-5,after 10 minutes operation.
Note4:Definition of response time:
The output signals of photo detector are measured when the input signals are changed from “black”to”white”(falling time) and from “white”to”black” (rising time),respectively.
The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note5: Definition of contrast ratio:
Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness measured when LCD is at “white state”}}{\text{Brightness measured when LCD is at “black state”}}$$

Note6:White $V_i=V_{ISO} \overline{+} 1.5V$
Black $V_i=V_{ISO} \pm 2.0V$
“±”means that the analog input signal swings in phase with COM signal.
“+”means that the analog input signal swings out of phase with COM signal.
V_{ISO} :The analog input voltage when transmission is 50%
The 100% transmission is defined as the transmission of LCD panel when all The input terminals of module are electrically opened.
Note7:Definition of viewing angle:
Refer to figure as below.



Note8:Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

Note9: The reflective mode is verified with CM-700D

4. RELIABILITY :

Item No	Items	Condition	Note
1	High temperature operating	70 ℃ , 240 hours	1. Function check should be executing immediately during operating test in the chamber 2. Function check should be executing immediately after the storage tes Note 1
2	Low temperature operating	-20 ℃ , 240 hours	
3	High temperature storage	80 ℃ , 240 hours	
4	Low temperature storage	-30 ℃ , 240 hours	
5	High temperature & humidity storage	60℃, 90%RH, 240 hours	
6	Thermal Shock storage	-30℃, 30min.<=> 80℃, 30min. 10 Cycles	
7	Electrostatic Discharge TestNon-Operating	HBM: ±2kv	

Note 1: The sampling above is individually for each reliability testing condition.

Note 2: The color fading of polarizing filter should not care.

Note 3: All of the reliability testing chamber above, is using D.I. water.(Min value:10Mohm-cm)

Note 4: In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

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 eguipement to prevent ESD hurt on products.
- Do not input any signal before power is turned on.
- Do not take LCM from its packaging bag until it is assembled.
- Peel off the LCM protective film slowly since static electricity may be generated.
- Hand Soldering : Soldering temperature less than 260℃,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 wiped 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 how 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 permently damage on display !!
- Liquid in LCM is hazardous substance. In case a contact with liquid crystal material is occured, be sure to immediately wash such material away by soap and water.
- The polarizer is easily damaged and should be handle with special care. Don't press or rub it with hard objects.

5.2 PRECAUTION FOR STORING

- Store the module in a dark room where must keep at 25±10℃ 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 prodcuts or systems, an authorization from URT is required. URT will not responsible for any damage or loss which caused by the products without any authorization given by URT.
- This product is not allowed to be designed and used for military application and/or purpose.
- The delivery of this product to the countries and/or regions where the embargoes are imposed by U.N. is prohibited.
- The application and delivery of this product must comply with Startegic High-Tech Commodities (SHTC) export control and the sales to the embargoed and/or sanctioned countries or regions are strictly prohibited.

6. DATE CODE OF PRODUCTS

- Date code will be shown on each product :

- **YY MM DD - XXXX**

  Year Month Day - Serial No.

- Example: 121108 - 0 0 0 3 ==> Year 2012, November,8th , Serial No.0003

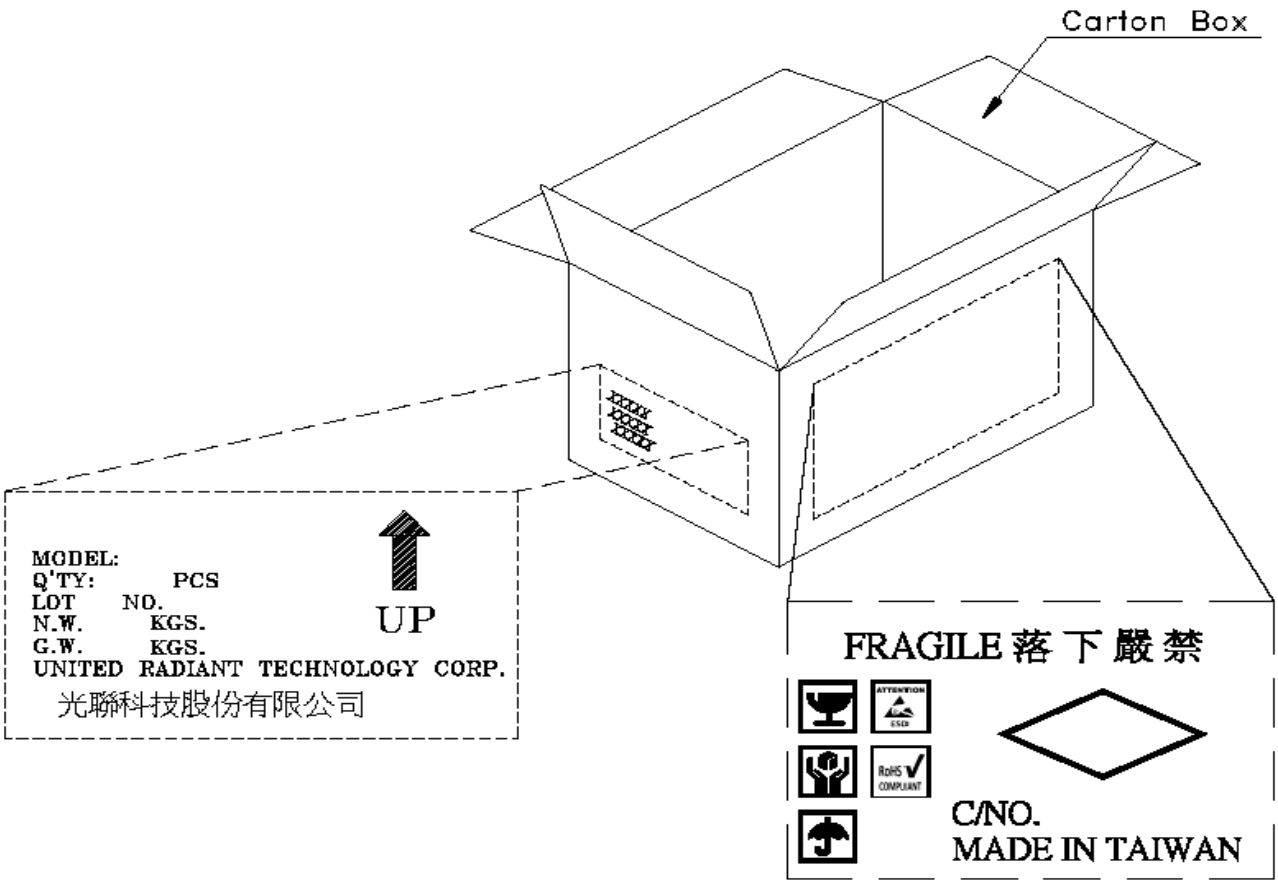
Note ： The lot no. attached on the packing box will be used for tracking once the part is too small to print the date code.

7. LOT NO

Instruction of lot number:

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

- Date: 01–1 st, 02–2 ed, ... 31–31 th
- Week: 1 ——— 6
- Week of Month: 1 ——— 5
- Month: 01–January, 02–February, ... 12–December
- Year: 00–2000, 01–2001



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 fromU.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 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

Acceptable quality level- 1916 Level III.

8.1.3 Warranty Policy

(A) U.R.T. will provied 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. The environmental conditions for inspection shall be as follows

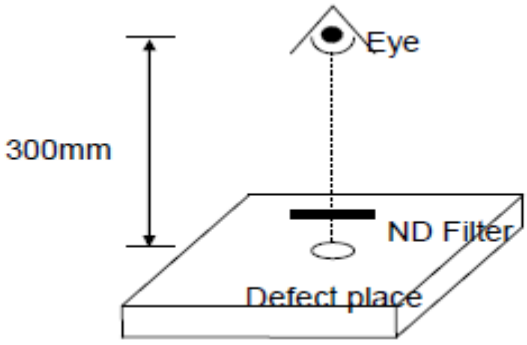
Room temperature: 23±5°C Humidity: 50±20%RH

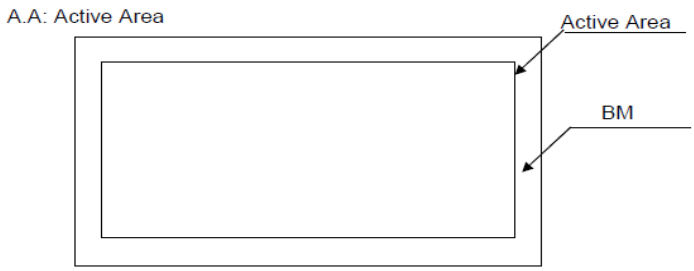
8.2.2. With a single 1000±200lux fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes.

8.2.3 Environment lamp under 1000±200 lux, Viewing direction for inspection over 30 cm.

8.2.4. The distance from eye to defect around 300mm, the distance from ND Filter to defect around 25~30mm.

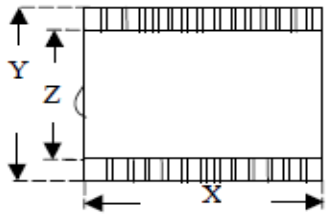
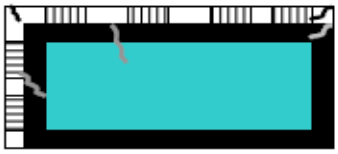
8.2.5. Definition Of Inspection Area



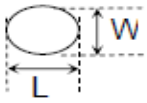
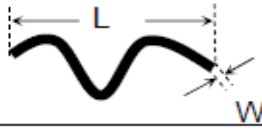
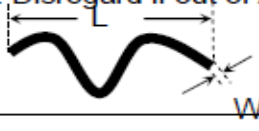


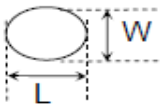
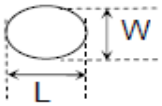
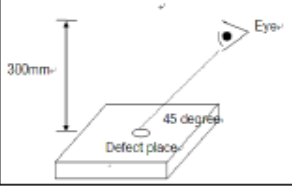
8.3. Cosmetic criterion

(1) Glassdefect

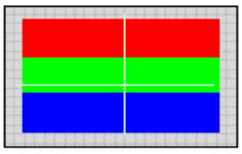
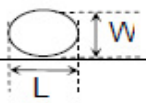
No	Defect	Criteria	Remark
1	Dimension (Minor)	By engineering diagram	
2	Cracks (Major)	Extensive crack 【Reject】	

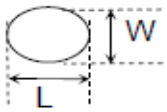
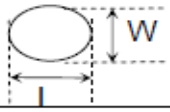
(2) LCM appearancedefect within A.A

No	Defect	Criteria		Remark
1	Round type (Minor)	Spec.	Permissible Qty	1. ϕ=(L+W)/2, L: Length, W: Width 2. Disregard if out of A.A. 3. Defect distance >5mm 
		$\phi \leqq$0.20mm	Disregard	
		0.20mm< $\phi \leqq$ 0.25mm	2	
		0.25mm< ϕ	0	
2	Line type (Minor)	Spec.	Permissible Qty	1. L: Length, W: Width 2. Disregard if out of A.A. 3. Defect distance >5mm 
		W≦0.05mm	Disregard	
		L≦3.0mm andW≦0.05mm	2	
3	Scratch (Minor)	Spec.	Permissible Qty	1. L: Length, W: Width 2. Disregard if out of A.A. 
		W≦0.05mm	Disregard	
		L≦3.0mm andW≦0.05mm	2	

4	Polarizer bubble (Minor)	Spec.	Permissible Qty	1. ϕ=(L+W)/2 , L: Length, W: Width 2. Disregard if out of A.A. 
		$\phi \leqq$0.20mm	Disregard	
		0.20mm< $\phi \leqq$ 0.25mm	2	
		0.25mm< ϕ	0	
5	Polarizer Dent (Minor)	Spec.	Permissible Qty	3. ϕ=(L+W)/2 , L: Length, W: Width 2. Disregard if out of A.A. 
		$\phi \leqq$0.20mm	Disregard	
		0.20mm< $\phi \leqq$ 0.25mm	2	
		0.25mm< ϕ	0	
6	Mura (Minor)	Invisible in 45 degree angle(No ND Filter)		Environment lamp under 2000±200lux 

(3) LCM electrical criterion

No	Defect	Criteria		Remark
1	No display (Major)	Not allowed		
2	Missing line (Major)	Not allowed		
3	Darker or lighter line (Major)	Not allowed		
4	Bright / Dark point (Minor)	Spec.	Permissible Qty	1:1sub-pixel: 1R or 1G or 1B
		Bright point	1	
		Dark point	2	
5	Round type (Minor)	Spec.	Permissible Qty	1. ϕ=(L+W)/2, L: Length, W: Width 2. Disregard if out of A.A. 3. Defect distance >5mm 
		$\phi \leqq$0.20mm	Disregard	
		0.20mm< $\phi \leqq$ 0.25mm	2	

		0.25mm< ϕ	0	
6	Line type (Minor)	Spec.	Permissible Qty	1. L: Length, W: Width 2. Disregard if out of A.A. 3. Defect distance >5mm
		W≦0.05mm	Disregard	
		L≦3.0mm andW≦0.05mm	2	
7	Scratch (Minor)	Spec.	Permissible Qty	1. L: Length, W: Width 2. Disregard if out of A.A.
		W≦0.05mm	Disregard	
		L≦3.0mm andW≦0.05mm	2	
8	Polarizer bubble (Minor)	Spec.	Permissible Qty	1. ϕ =(L+W)/2 , L: Length, W: Width 2. Disregard if out of A.A.
		ϕ ≦0.20mm	Disregard	
		0.20mm< ϕ ≦ 0.25mm	2	
		0.25mm< ϕ	0	
9	Polarizer Dent (Minor)	Spec.	Permissible Qty	1. ϕ =(L+W)/2 , L: Length, W: Width 2. Disregard if out of A.A.
		ϕ ≦0.20mm	Disregard	
		0.20mm< ϕ ≦ 0.25mm	2	
		0.25mm< ϕ	0	
10	PI Mura	Invisible (No ND Filter)		
11	Mura (Minor)	Invisible (No ND Filter)		