SPECIFICATION

OF

LIQUID CRYSTAL DISPLAY MODULE

UNITED RADIANT TECHNOLOGY CORP. 光聯科技 18-Jun-2020 品管部 QC DEPT.

CUSTOMER : URT-STD

Model No. : UMOH-P238MD-T

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 CORPORATION

Joe Wu	Ashin Chiu	Jenny Wang	Jun-18-2020
APPROVED	CHECKED	PREPARED	Date

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Revision record

Document Revision	Model No. Version No.	Description	Revision by
0	UMOH-P238MD-T Version No. 0	3.5” TFT.	C.K.T. Chen Eric Wang 18-Mar-2019
1	UMOH-P238MD-T Version No. 1	Adding Command Sequence.	C.K.T. Chen Eric Wang 22-Jul-2019
2	UMOH-P238MD-T Version No. 2	Modify the brightness.	C.K.T. Chen Eric Wang 18-Jun-2020

CONTENTS:

1. BASIC SPECIFICATION

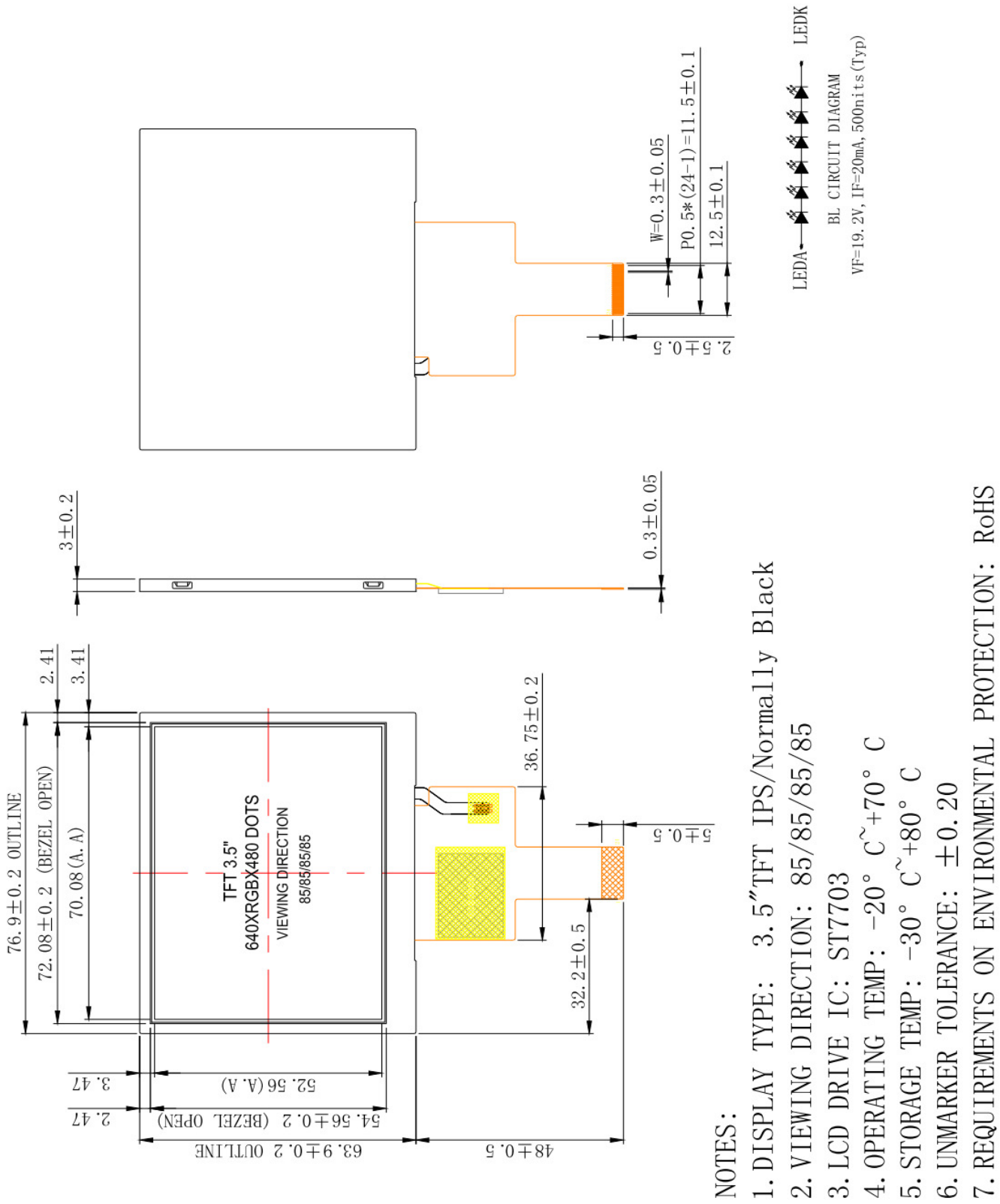
1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Active screen size	3.5” Diagonal	--
Dot Matrix	640 × R.G.B. × 480	Pixel
Module Size (H×V×T)	76.9 x 63.9 x 3.0	mm.
Active Area (H×V)	70.08 x 52.56	mm.
Dot Pitch (W×V)	0.1095 x 0.1095	mm.
Color depth	16.7M	color
Interface	4-LANE MIPI	--
Driving IC Package	COG	--
Module weight	TBD	g

1.2 Display specification

Display	Descriptions	Note
LCD Type	IPS	--
LCD Mode	Normally Black	--
Polarizer Surface	Anti-Glare	--
Pixel arrangement	RGB vertical stripe	--
Backlight Type	6 White LEDS	--
Viewing Direction	Free viewing	--

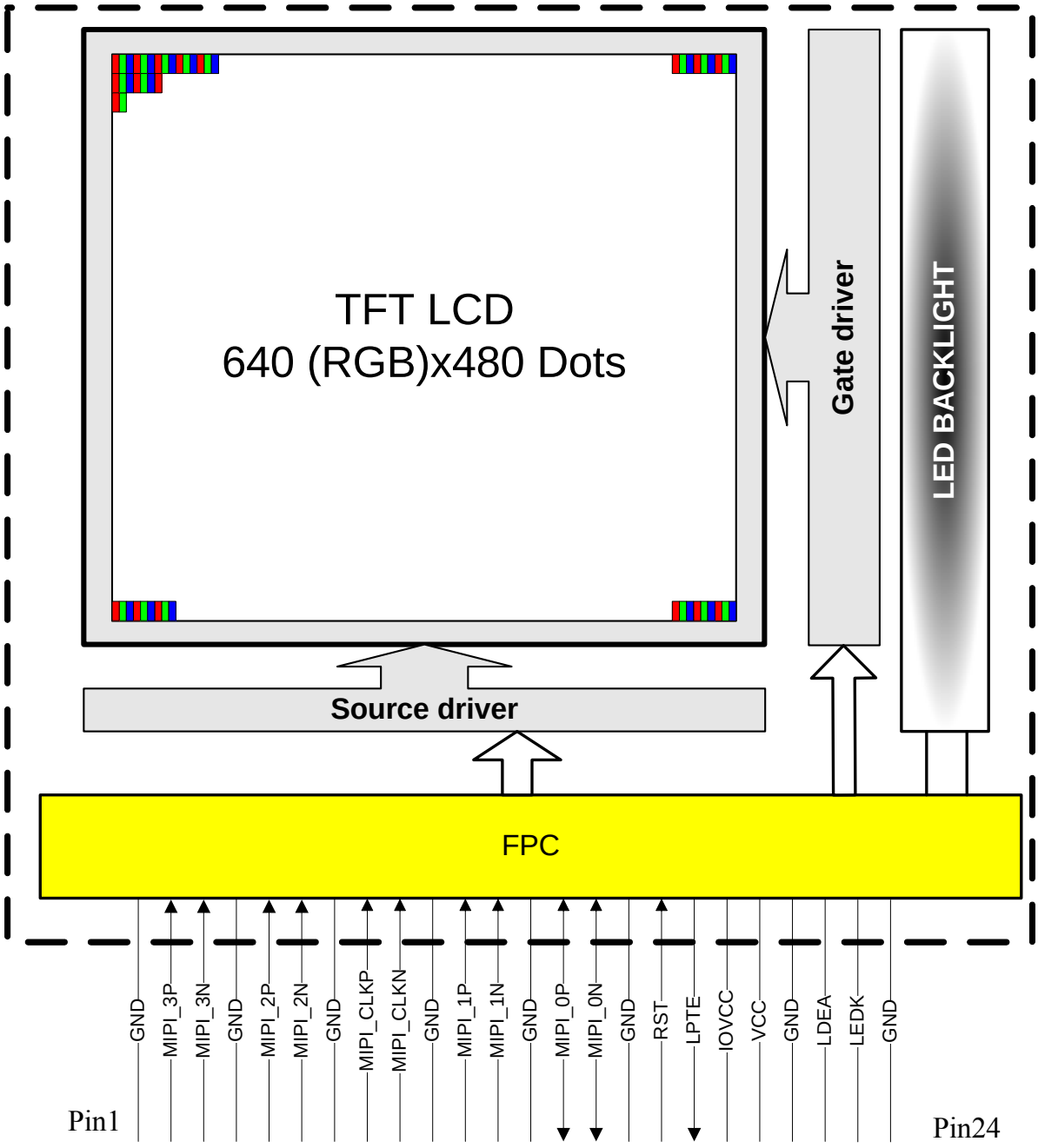
1.3 Outline dimension



NOTES:

1. DISPLAY TYPE: 3.5"TFT IPS/Normally Black
2. VIEWING DIRECTION: 85/85/85/85
3. LCD DRIVE IC: ST7703
4. OPERATING TEMP: -20° C~+70° C
5. STORAGE TEMP: -30° C~+80° C
6. UNMARKER TOLERANCE: ±0.20
7. REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS

1.4 Block diagram:



1.5 Interface Pin Connection: (LCM Interface):

Pin No.	Pin Symbol	I/O	Description
1	GND	P	Ground
2	MIPI-3P	I	MIPI-DSI Data differential signal input pins. (Data lane 3)
3	MIPI-3N	I	MIPI-DSI Data differential signal input pins. (Data lane 3)
4	GND	P	Ground
5	MIPI-2P	I	MIPI-DSI Data differential signal input pins. (Data lane 2)
6	MIPI-2N	I	MIPI-DSI Data differential signal input pins. (Data lane 2)
7	GND	P	Ground
8	MIPI-CLKP	I	MIPI-DSI CLOCK differential signal input pins.
9	MIPI-CLKN	I	MIPI-DSI CLOCK differential signal input pins.
10	GND	P	Ground
11	MIPI-1P	I	MIPI-DSI Data differential signal input pins. (Data lane 1)
12	MIPI-1N	I	MIPI-DSI Data differential signal input pins. (Data lane 1)
13	GND	P	Ground
14	MIPI-0P	I/O	MIPI-DSI Data differential signal input pins. (Data lane 0)
15	MIPI-0N	I/O	MIPI-DSI Data differential signal input pins. (Data lane 0)
16	GND	P	Ground
17	RST	I	Device reset signal. (Note2)
18	LPTE	O	TE Signal
19	IOVCC	P	Logic Supply Voltage
20	VCC	P	A power supply for the analog power.
21	GND	P	Ground
22	LEDA	P	LED Backlight Anode
23	LEDK	P	LED Backlight Cathode
24	GND	P	Ground

2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	IOVCC	-0.5	5.0	V	1,2
Analog supply voltage	VCC	-0.5	5.0	V	1,2
Operate temperature range	TOP	-20	70	℃	3,4
Storage temperature range	TST	-30	80	℃	3,4

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. VCC >VSS must be maintained.
3. The response time will become lower when operated at low temperature.
4. Background color changes slightly depending on ambient temperature.
   The phenomenon is reversible.

2.2 Typical Operation Conditions:

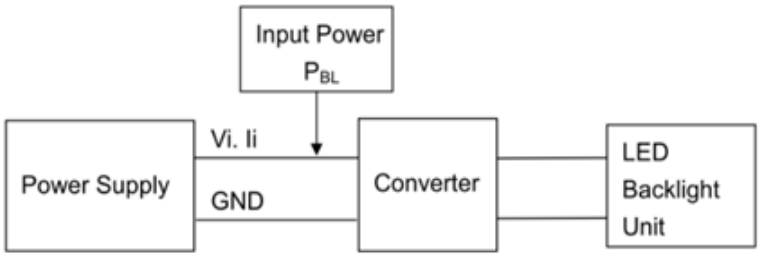
The ambient temperature is Ta = 25 ºC

Item	Symbol	Min.	Typ.	Max	Unit
Power supply voltage	IOVCC	1.65	1.8	2.0	V
Analog supply voltage	VCC	2.5	3.3	4.8	V
Input logic high/low Voltage	VIH	0.7*IOVCC	-	IOVCC	V
	VIL	GND	-	0.3*IOVCC	V
Output logic high/low Voltage	VOH	0.8*IOVCC	-	IOVCC	V
	VOL	GND	-	0.2*IOVCC	V
I/O Leak Current	ILI	-	-	1	uA

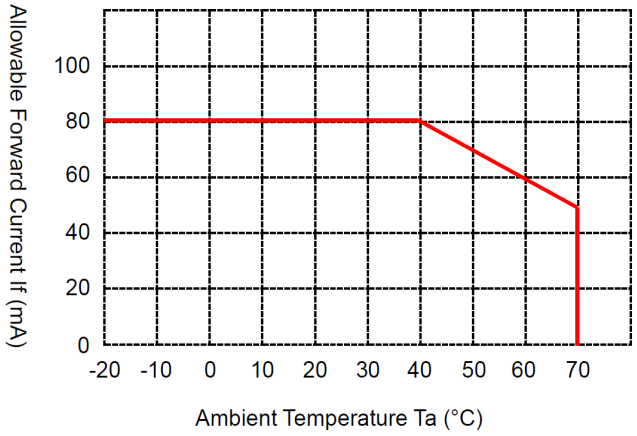
2.3 Back-light only Specification :

Item	Symbol	Min	Typ	Max	Unit	Note
LED Supply voltage	Vf	16.8	19.2	21	V	1
LED Supply Current	If	-	20	-	mA	2
Life Time	-	-	20000	-	Hr	3,4

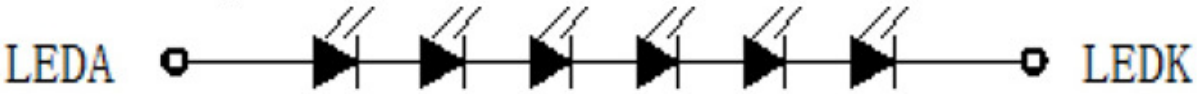
Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and If =20mA.
Note 2: LED current is measured by utilizing a high frequency current meter as shown below:



Note 3: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and If =20mA.The LED lifetime could be decreased if operating If is larger than 20mA.



Note 4: LED light bar circuit:



2.4 MIPI Characteristics

DSI Interface Timing Characteristics

High Speed Mode

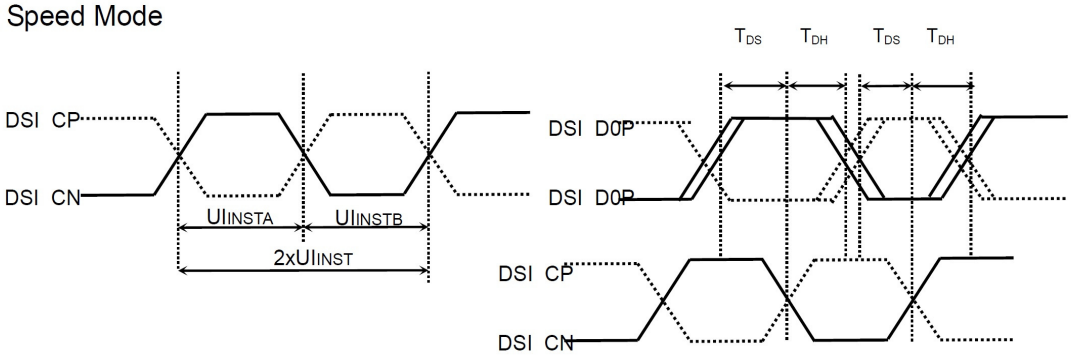
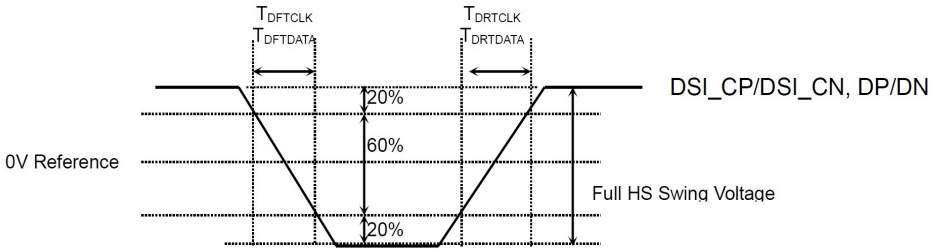


Figure 7.4: DSI clock timing Characteristics



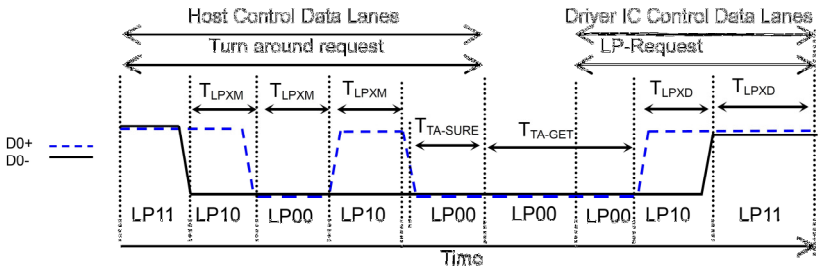
Rising and falling time on clock and data channel

(VSSA=0V, IOVCC=1.65V to 3.3V,VCC=2.5V to 3.3V,T_A = -30 to 70°C)

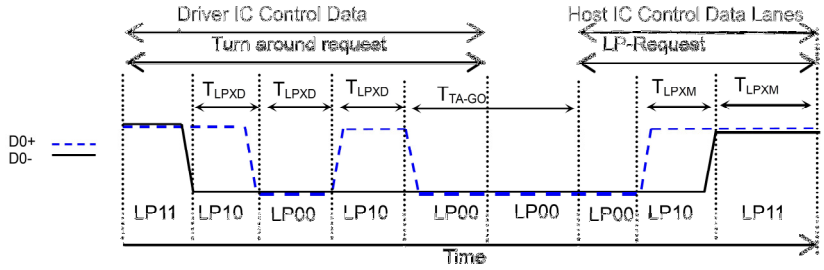
Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Double UI instantaneous	$2xUI_{INST}$	TBD	-	25	ns
	UI instantaneous	UI_{INSTA} UI_{INSTB}	TBD	-	12.5	ns
DP/DN	Data to clock setup time	T_{DS}	0.15xUI	-	-	ps
	Data to clock hold time	T_{DH}	0.15xUI	-	-	ps
DSI_CP/ DSI_CN	Differential rise time for clock	T_{DRTCLK}	150	-	0.3UI	ps
	Differential fall time for clock	T_{DFTCLK}	150	-	0.3UI	ps
DP/DN	Differential rise time for data	$T_{DRTDATA}$	150	-	0.3UI	ps
	Differential fall time for data	$T_{DFTDATA}$	150	-	0.3UI	ps

DSI High Speed Mode Characteristics

Low Power Mode



BTA from HOST to Display Module Timing



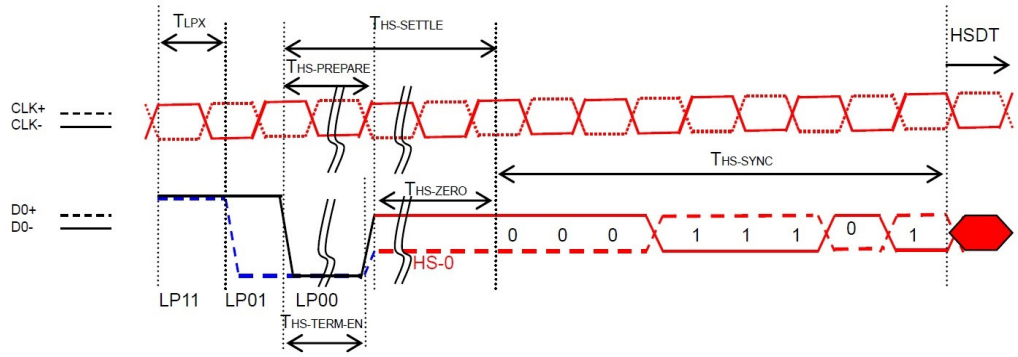
BTA from Display Module Timing to HOST

(VSSA=0V, IOVCC=1.65V to 3.3V,VCC=2.3V to 3.3V,T_A = -30 to 70°C)

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11 Host→ Display module	T_{LPXM}	50	-	-	ns
	Length of LP-00/LP01/LP10/LP11 Display module →Host	T_{LPXD}	50	-	-	ns
	Time-out before the MPU start driver	$T_{TA-SURE}$	T_{LPXD}	-	2xT_{LPXD}	ns
	Time to drive LP-00 by display module	T_{TA-GET}	5xT_{LPXD}	-	-	ns
	Time to drive LP-00 after turnaround request Host	T_{TAGO}	4xT_{LPXD}	-	-	ns

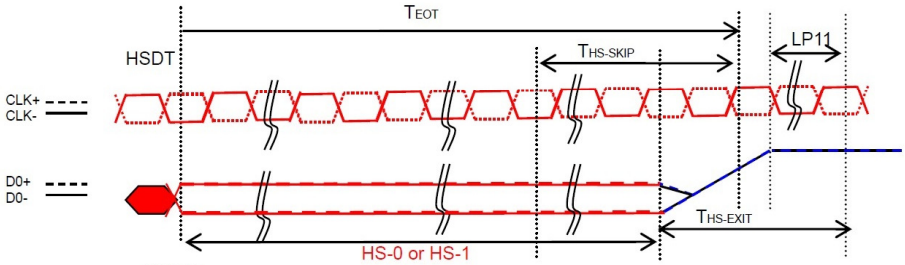
DSI Low Power Mode Characteristics

DSI BURSTS



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11	T_{LPX}	50	-	-	ns
	Time to Driver LP-00 to prepare for HS transmission	$T_{HS-PREPARE}$	40+4UI	-	85+6UI	ns
	Time to enable data receiver line termination	$T_{HS-TERM-EN}$	-	-	35+4xUI	ns
	Time to drive LP-00 by display module	T_{TA-GET}	5xT_{LPXD}	-	-	ns
	Time to drive LP-00 after turnaround request Host	T_{TAGO}	4xT_{LPXD}	-	-	ns

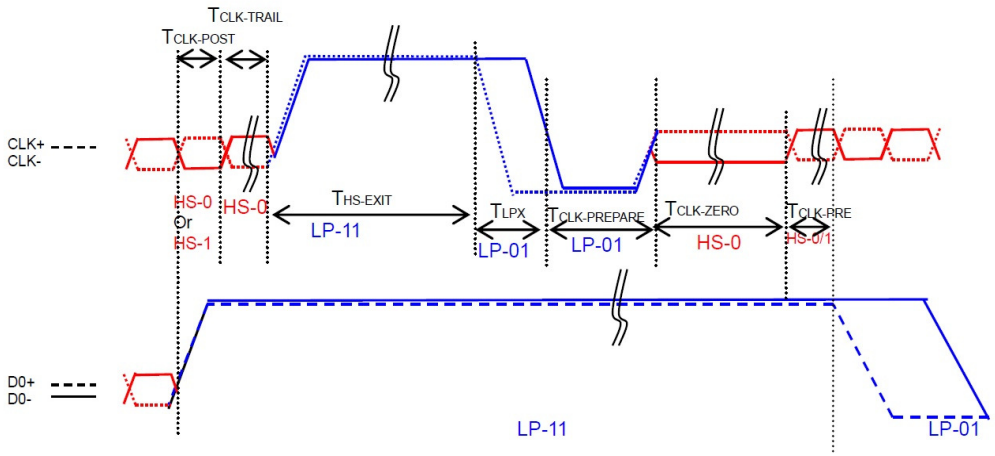
DSI Low Power Mode to High Speed Mode Timing



NOTE:
If the last bit is HS-0, the transmitter changes from HS-0 to HS-1
If the last bit is HS-0, the transmitter changes from HS-1 to HS-0

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Time-Out at Display Module to Ignore Transition Period of EoT	$T_{HS-SKIP}$	40	-	55+4xUI	ns
	Time to Driver LP-11 after HS Burst	$T_{HS-EXIT}$	100	-	-	ns

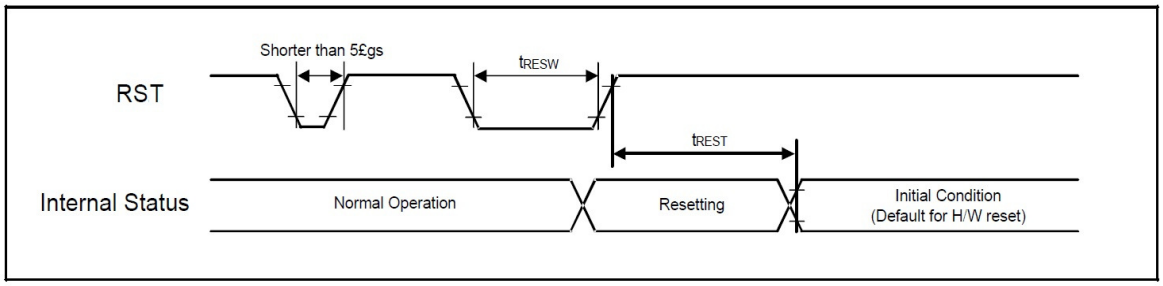
DSI Low Power Mode to High Speed Mode Timing



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Time that the MCU shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	$T_{CLK-POST}$	60+52xUI	-	-	ns
	Time to drive HS differential state after last payload clock bit of a HS transmission burst	$T_{CLK-TRAIL}$	60	-	-	ns
	Time to drive LP-11 after HS burst	$T_{HS-EXIT}$	100	-	-	ns
	Time to drive LP-00 to prepare for HS transmission	$T_{CLK-PREPARE}$	38	-	95	ns
	Time-out at Clock Lane Display Module to enable HS Termination	$T_{CLK-TERM-EN}$	-	-	38	ns
	Minimum lead HS-0 drive period before starting Clock	$T_{CLK-PREPARE}$ + $T_{CLK-ZERO}$	300	-	-	ns
	Time that the HS clock shall be driven prior to any associated data Lane beginning the transition from LP to HS mode	$T_{CLK-PRE}$	8xUI			

Clock Lanes High Speed Mode to/from Low Power Mode Timing

2.5 Reset Timing Characteristics:



Reset input timing

Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width(1)	RST	10	-	-	-	µs
tREST	Reset complete time(2)	-	15	-	-	When reset applied during SLPIN mode	ms
		-	120	-	-	When reset applied during SLPOUT mode	ms

Reset Input Timing

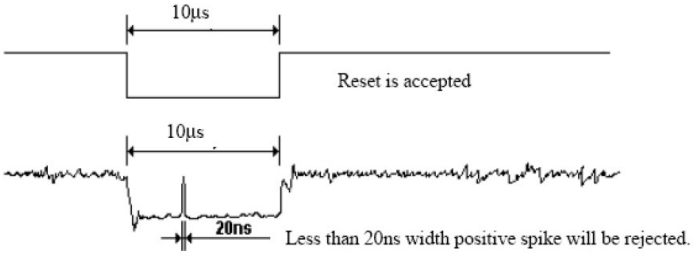
Note: (1) Spike due to an electrostatic discharge on RST line does not cause irregular system reset according to the following table.

RESET 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 Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then return to Default condition for H/W reset.

(3) During Reset Complete Time, ID and VCOM 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 15ms after a rising edge of NRESET.

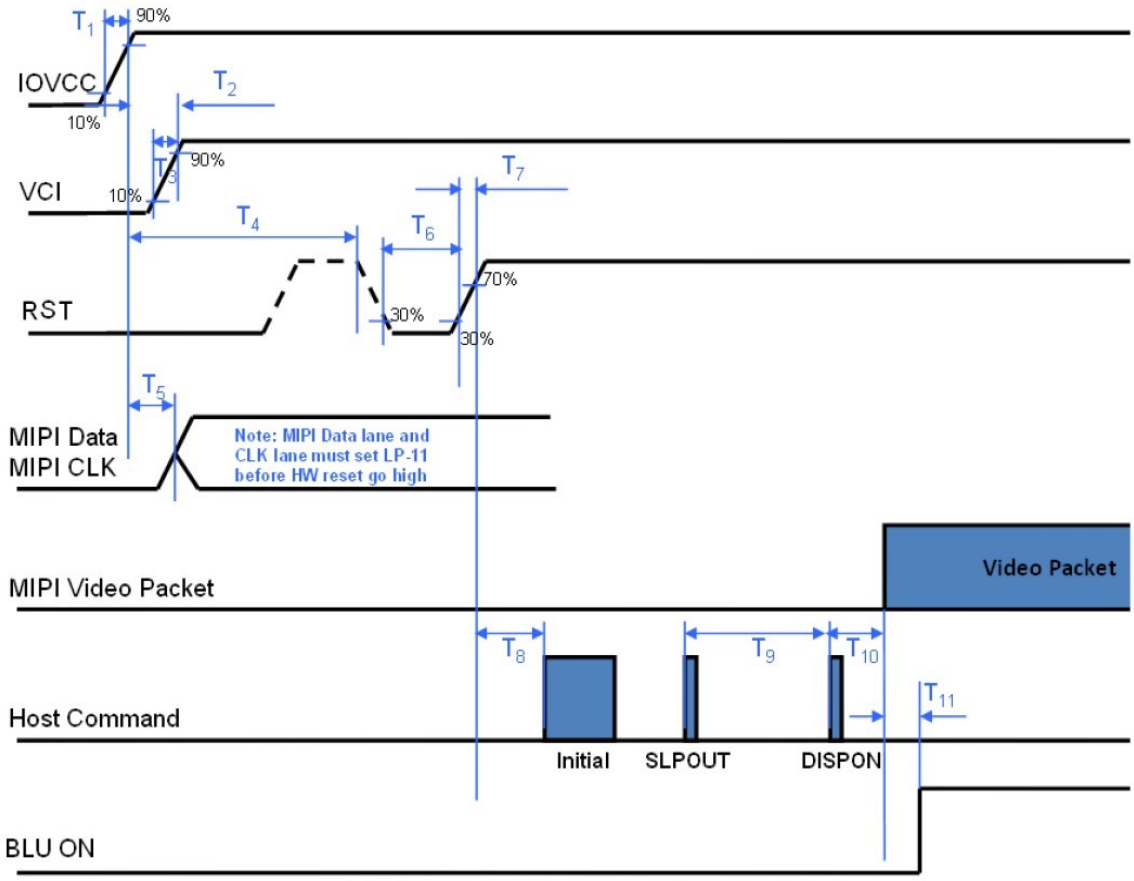
(4) Spike Rejection also applies during a valid reset pulse as shown as below:



(5) It is necessary to wait 15msec after releasing NRESET before sending commands. Also Sleep Out command cannot be sent for 120msec.

2.6 Power Sequence:

2.6.1 Power On Timing of External Power IC

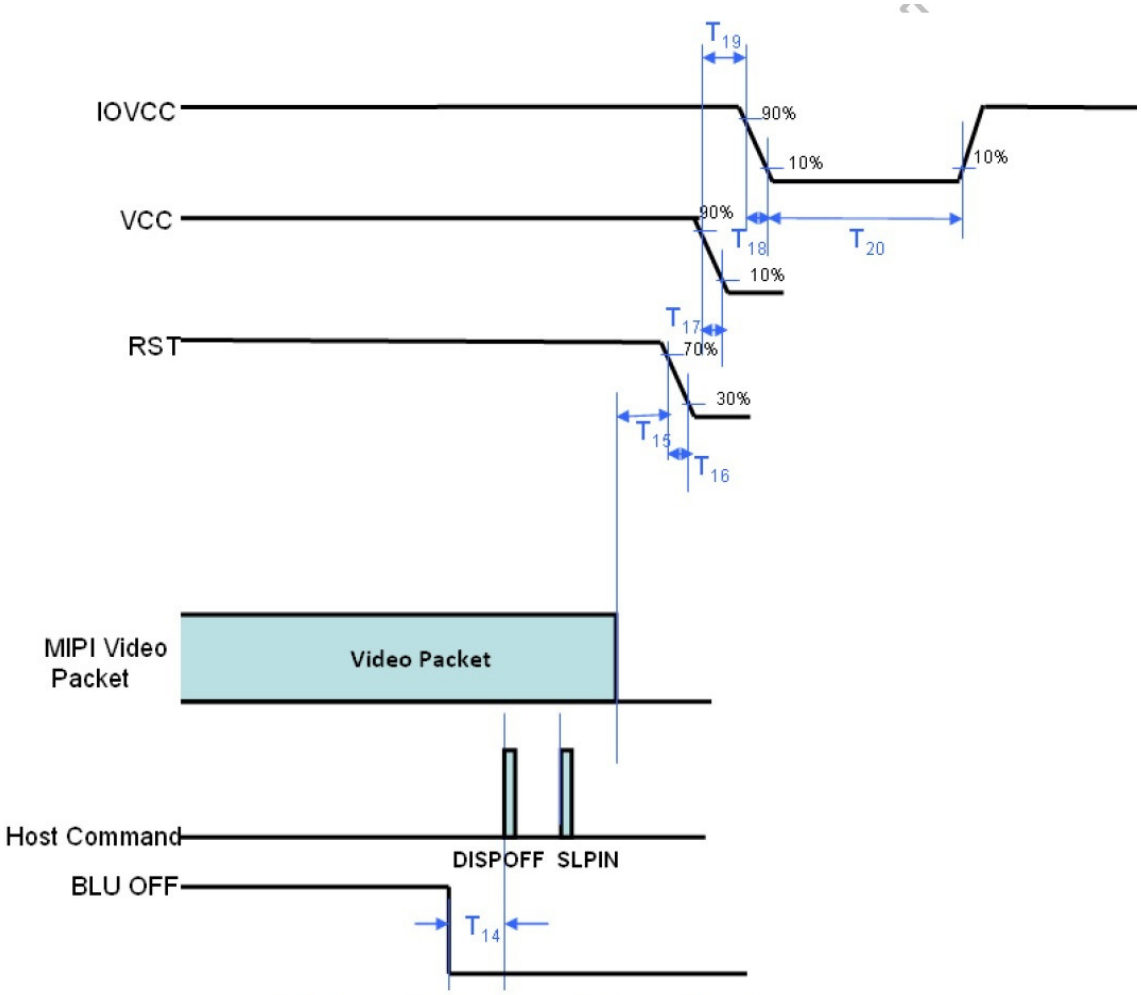


DSI Power On Sequence of Power IC Mode

	Min.	Typ.	Max.	Unit
T1	0.01	-	10	ms
T2		No Limit		ms
T3	0.01	-	10	ms
T4	1	-	-	ms
T5	1	-	-	ms
T6	10	-	-	us
T7		No Limit		ns
T8	15	-	-	ms
T9	120	-	-	ms
T10		No Limit		ms
T11	100	150	-	ms

DSI Power On Timing of Power IC Mode

2.6.2 Power Off Timing of External Power IC



DSI Power Off Sequence of Power IC Mode

	Min.	Typ.	Max.	Unit
T14	40	100	-	ms
T15	10	-	-	ms
T16	No Limit			ms
T17	No Limit			ms
T18	No Limit			ms
T19	No Limit			ms
T20	500			ms

DSI Power Off Timing of Power IC Mode

2.7 Command Sequence (Recommend by U.R.T.)

```
SPI_WriteData(0xB9); // Command //Set EXTC
SPI_WriteData(0xF1);
SPI_WriteData(0x12);
SPI_WriteData(0x83);

SPI_WriteData(0xBA); /// Command //Set MIPI
SPI_WriteData(0x33);
SPI_WriteData(0x81);
SPI_WriteData(0x05);
SPI_WriteData(0xF9);
SPI_WriteData(0x0E);
SPI_WriteData(0x0E);
SPI_WriteData(0x20);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x44);
SPI_WriteData(0x25);
SPI_WriteData(0x00);
SPI_WriteData(0x91);
SPI_WriteData(0x0A);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x02);
SPI_WriteData(0x4F);
SPI_WriteData(0xD1);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x37);

SPI_WriteData(0xB8); // Command //Set ECP
SPI_WriteData(0x26);

SPI_WriteData(0xBF); //Command//Set PCR
SPI_WriteData(0x02);
SPI_WriteData(0x11);
SPI_WriteData(0x00);
```

```
SPI_WriteData(0xB3); // Command // SET RGB
SPI_WriteData(0x0C);
SPI_WriteData(0x10);
SPI_WriteData(0x0A);
SPI_WriteData(0x50);
SPI_WriteData(0x03);
SPI_WriteData(0xFF);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);

SPI_WriteData(0xC0); // Command // Set SCR
SPI_WriteData(0x73);
SPI_WriteData(0x73);
SPI_WriteData(0x50);
SPI_WriteData(0x50);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x08);
SPI_WriteData(0x70);
SPI_WriteData(0x00);

SPI_WriteData(0xBC); // Command // Set VDC
SPI_WriteData(0x49);

SPI_WriteData(0xCC); // Command // Set Panel
SPI_WriteData(0x0B);

SPI_WriteData(0xB4); // Command// Set Panel Inversion
SPI_WriteData(0x80);

SPI_WriteData(0xB2); // Command // Set RSO
SPI_WriteData(0x00);
SPI_WriteData(0x13);
SPI_WriteData(0xF0);

SPI_WriteData(0xE3); // Command // Set EQ
SPI_WriteData(0x07);
SPI_WriteData(0x07);
SPI_WriteData(0x0B);
SPI_WriteData(0x0B);
SPI_WriteData(0x03);
SPI_WriteData(0x0B);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0xFF);
SPI_WriteData(0x00);
SPI_WriteData(0xC0);
SPI_WriteData(0x10);
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```
SPI_WriteData(0xC1); // Command // Set POWER
SPI_WriteData(0x53);
SPI_WriteData(0x00);
SPI_WriteData(0x1E);
SPI_WriteData(0x1E);
SPI_WriteData(0x77);
SPI_WriteData(0xE1);
SPI_WriteData(0xCC);
SPI_WriteData(0xDD);
SPI_WriteData(0x67);
SPI_WriteData(0x77);
SPI_WriteData(0x33);
SPI_WriteData(0x33);

SPI_WriteData(0xB5); // Command // Set BGP
SPI_WriteData(0x10);
SPI_WriteData(0x10);

SPI_WriteData(0xB6); // Command // Set VCOM
SPI_WriteData(0x8E);
SPI_WriteData(0x4C);

SPI_WriteData(0xE9); // Command // Set GIP
SPI_WriteData(0x08);
SPI_WriteData(0x00);
SPI_WriteData(0x0E);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0xB0);
SPI_WriteData(0xB1);
SPI_WriteData(0x11);
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SPI_WriteData(0x88);
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SPI_WriteData(0xBA);
SPI_WriteData(0x60);
SPI_WriteData(0x24);
SPI_WriteData(0x08);
SPI_WriteData(0x88);
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SPI_WriteData(0x00);
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SPI_WriteData(0x00);
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SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);

SPI_WriteData(0xEA); // Command //SETGIP2
SPI_WriteData(0x97);
SPI_WriteData(0x0A);
SPI_WriteData(0x82);
SPI_WriteData(0x02);
SPI_WriteData(0x13);
SPI_WriteData(0x07);
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SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x80);
SPI_WriteData(0x88);
```

```
SPI_WriteData(0xBA);
SPI_WriteData(0x17);
SPI_WriteData(0x53);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x81);
SPI_WriteData(0x88);
SPI_WriteData(0xBA);
SPI_WriteData(0x06);
SPI_WriteData(0x42);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x88);
SPI_WriteData(0x23);
SPI_WriteData(0x10);
SPI_WriteData(0x00);
SPI_WriteData(0x02);
SPI_WriteData(0x80);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
SPI_WriteData(0x00);
```

```
SPI_WriteData(0xE0); // Command //Set Gamma
SPI_WriteData(0x00);
SPI_WriteData(0x07);
SPI_WriteData(0x0B);
SPI_WriteData(0x27);
SPI_WriteData(0x2D);
SPI_WriteData(0x3F);
SPI_WriteData(0x3B);
SPI_WriteData(0x37);
SPI_WriteData(0x05);
SPI_WriteData(0x0A);
SPI_WriteData(0x0B);
SPI_WriteData(0x0F);
SPI_WriteData(0x11);
SPI_WriteData(0x0F);
SPI_WriteData(0x12);
SPI_WriteData(0x12);
SPI_WriteData(0x18);
SPI_WriteData(0x00);
SPI_WriteData(0x07);
SPI_WriteData(0x0B);
SPI_WriteData(0x27);
SPI_WriteData(0x2D);
SPI_WriteData(0x3F);
SPI_WriteData(0x3B);
SPI_WriteData(0x37);
SPI_WriteData(0x05);
SPI_WriteData(0x0A);
SPI_WriteData(0x0B);
SPI_WriteData(0x0F);
SPI_WriteData(0x11);
SPI_WriteData(0x0F);
SPI_WriteData(0x12);
SPI_WriteData(0x12);
SPI_WriteData(0x18);

SPI_WriteData(0x11); // Command //Sleep Out
Delay(250);

SPI_WriteData(0x29); // Command //Display On
Delay(250);
```

3. OPTICAL CHARACTERISTICS

3.1 Characteristics

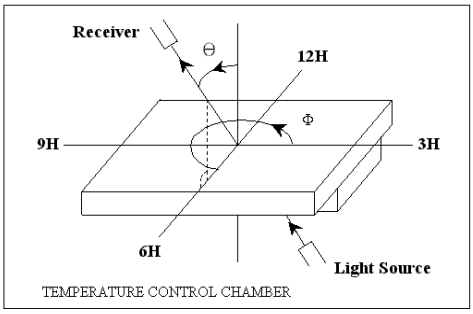
Electrical and Optical Characteristics

No.	Item			symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	Response Time			Tr+Tf	θ=Φ=0°	-	25	50	ms	2
2	Viewing Angle	Hor.	Cr＞10	θ_{2+}	Φ= 0°	75	85	-	degree	3
				θ_{2-}	Φ= 180°	75	85	-		
		Ver.		θ_{1+}	Φ= 270°	75	85	-		
				θ_{1-}	Φ= 90°	75	85	-		
3	Contrast Ratio			Cr	25 ℃	600	800	-	-	4
4	Red x-code			Rx	25 ℃	0.50	0.55	0.60	-	5
	Red y-code			Ry		0.28	0.33	0.38		
	Green x-code			Gx		0.28	0.33	0.38		
	Green y-code			Gy		0.48	0.53	0.58		
	Blue x-code			Bx		0.09	0.14	0.19		
	Blue y-code			By		0.02	0.07	0.12		
	White x-code			Wx		0.26	0.31	0.36		
	White y-code			Wy		0.28	0.33	0.38		
	Brightness			Y		400	500	-	cd/m^2	
5	Brightness Uniformity				25 ℃	75	80	-	%	6

3.2 Definition of optical characteristics

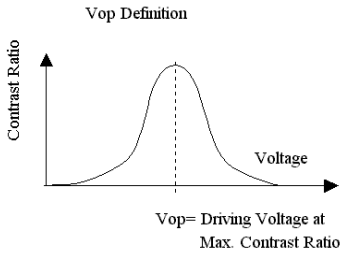
Measurement condition :

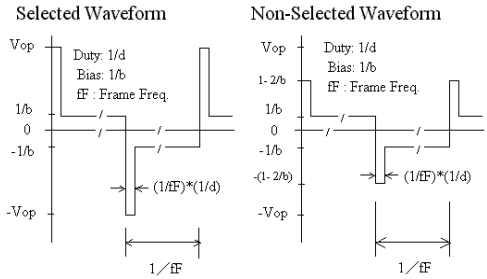
Transmissive and Transflective type



PHOTAL LCD-5000

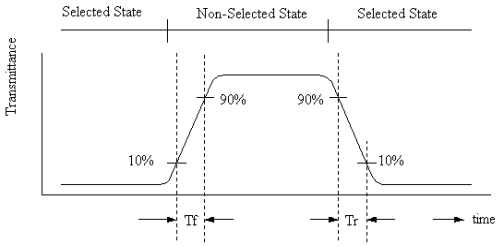
[Note 1] Definition of LCD Driving Vop and Waveform :



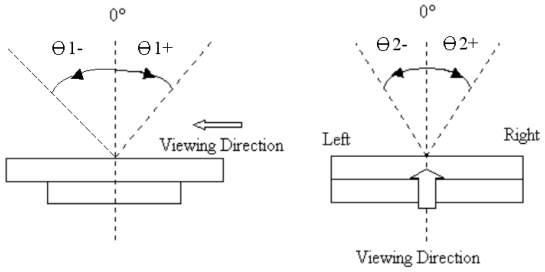


[Note 2] Definition of Response Time

for Positive type :

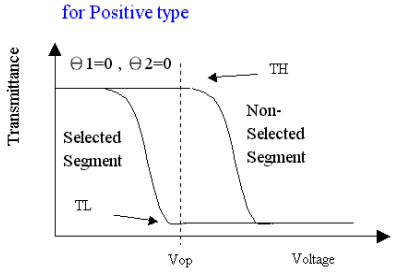


[Note 3] Definition of Viewing Angle :



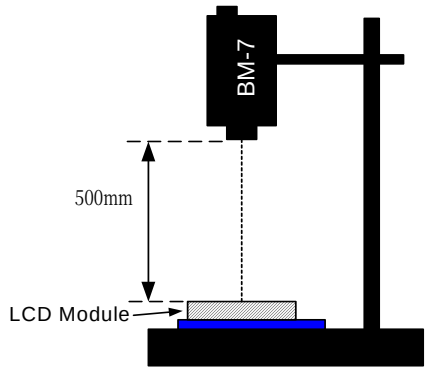
[Note 4] Definition of Contrast Ratio :

for Positive type

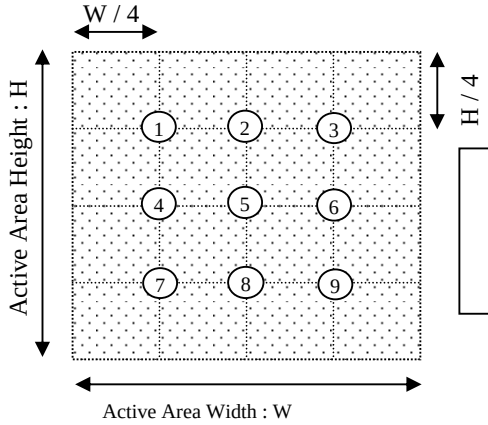


$$\text{Contrast Ratio} = \frac{TH}{TL}$$

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

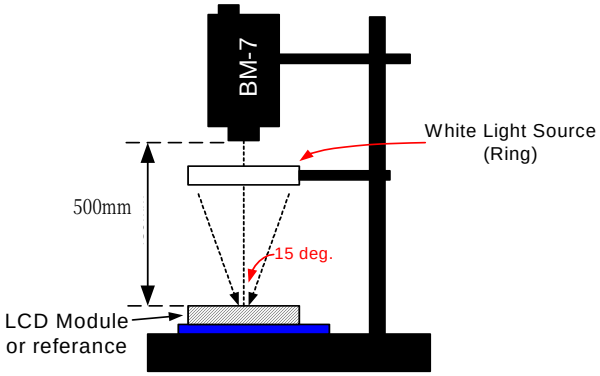


[Note 6] Definition of Brightness Uniformity



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

[Note 7] Definition of Measurement of Reflectance



4. RELIABILITY :

Item No	Items	Condition	Note
1	High temperature operating	70 °C , 96 hours	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1. Air bubble in the LCD. 2. Seal leak. 3. Non-display. 4. Missing segments. 5. Glass crack. 6. Current IDD is twice higher than initial value. 7. The surface shall be free from damage. 8. The electric characteristic requirements shall be satisfied.
2	Low temperature operating	-20 °C , 96 hours	
3	High temperature storage	80 °C , 96 hours	
4	Low temperature storage	-30 °C , 96 hours	
5	High temperature & humidity storage	50°C, 90%RH, 96hours	
6	Thermal Shock storage	-20°C, 30min.<=> 70°C, 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	ESD Test	Voltage:±8KV,R:330Ω,C:150PF, Air Mode,10times	

1. The Test samples should be applied to only one test item.
2. For Damp Proof Test, Pure water(Resistance＞10MΩ)should be used.
3. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
4. EL evaluation should be accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
5. Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

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 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.
- 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 wiped 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 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.

☐ 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 permently damage on display !!

☐ 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**

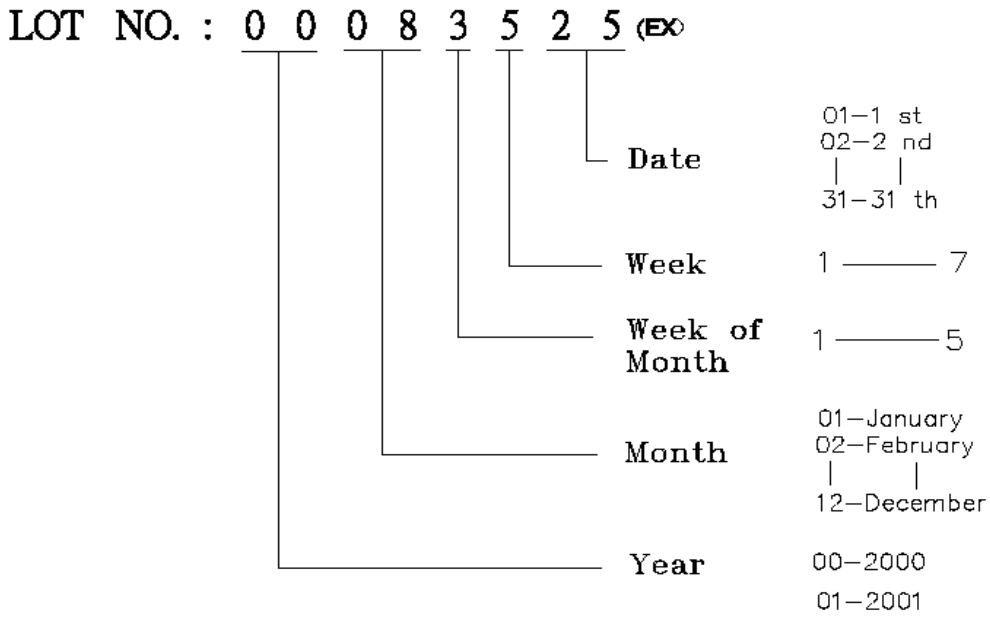
  Year Month Day - Serial no.

- Example: 141108 - 0003 ==> Year 2014, November,8th , Serial no. 0003

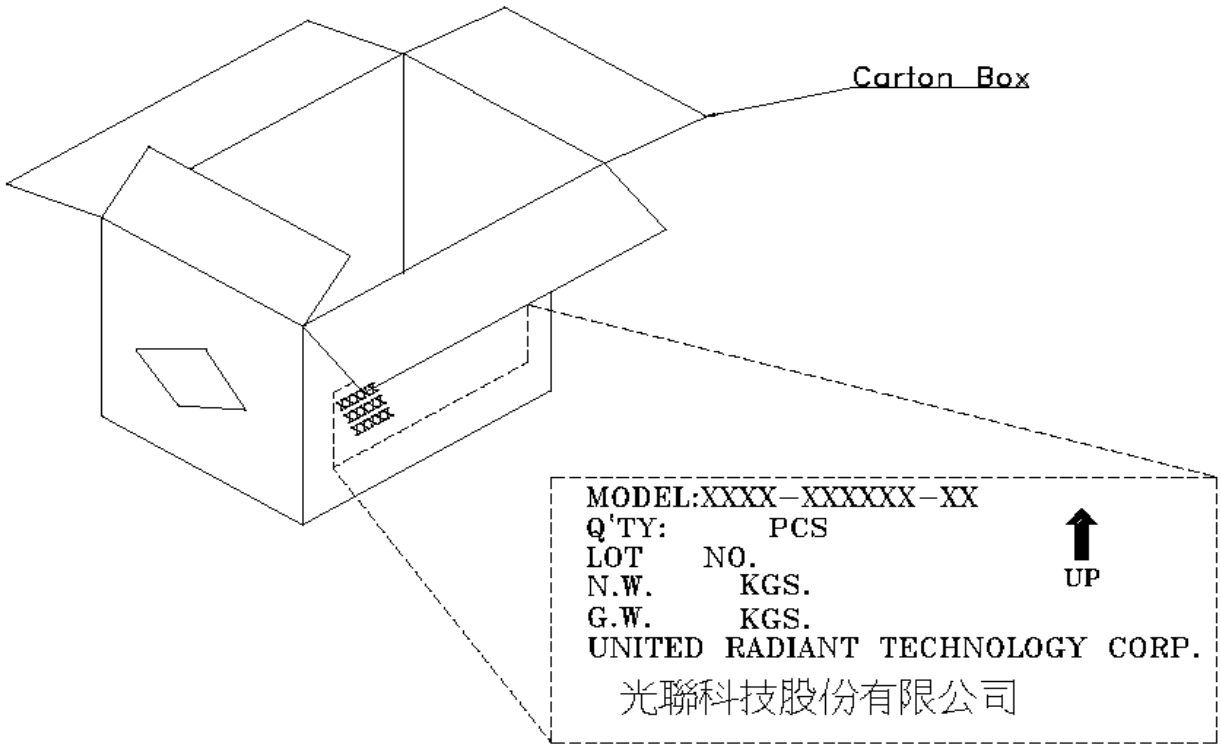
Note ： The lot no. attached on the packing box will be used for tracking once the part is too small to print the date code.

7. Lot No.

Instruction of lot number:



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 ℃ 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 (SAME AS MIL-STD-105E) , LEVEL Ⅱ SINGLE PLAN.

CLASS	AQL(%)
MAJOR	0.65 %
MINOR	1.5 %

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

(C) MEASURE

IF AS THE RESULT OF ABOVE RECEIVING INSPECTION , A LOT OUT IS DISCOVERED. PURCHASER SHALL BE INFORM SELLER OF IT WITHIN SEVEN DAYS. BUT FIRST SHIPMENT WITHIN FOURTEEN DAYS.

8.1.3. WARRANTY POLICY

U.R.T. WILL PROVIDE ONE-YEAR WARRANTY FOR THE PRODUCTS ONLY IF UNDER SPECIFICATION OPERATING CONDITIONS. U.R.T. WILL REPLACE GOOD PRODUCTS FOR THESE DEFECT PRODUC′ WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF U.R.T.

8.2. CHECKING CONDITION

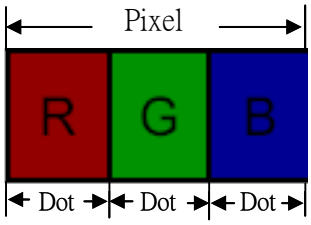
8.2.1. CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA FROM VIEWING DIRECTION.

8.2.2. CHECKER SHALL SEE OVER 350±50 mm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

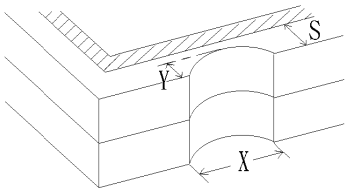
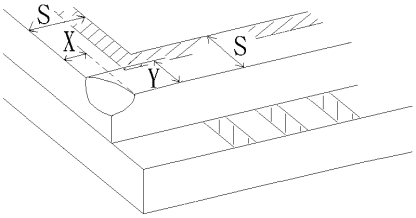
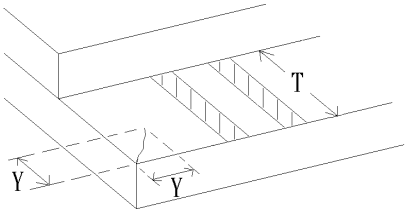
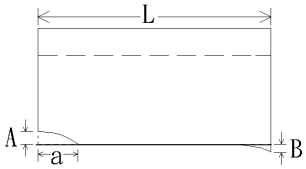
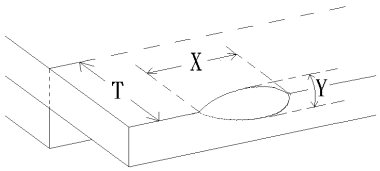
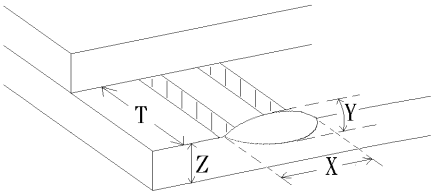
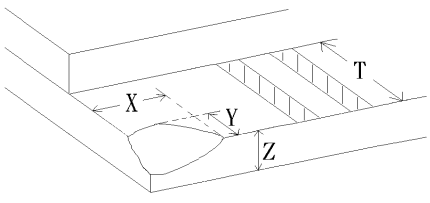
8.3. INSPECTION PLAN :

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. POLARIZER EDGE OR LCD'S SEALING LINE IS VISABLE IN THE VIEWING AREA.	ACCORDING TO DRAWING REJECTED.	Minor
	6. BLEMISH、BLACK SPOT、 WHITE SPOT IN THE LCD AND LCD GLASS CRACKS (INSIDE VIEWING AREA)	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	7. BLEMISH、BLACK SPOT WHITE SPOT AND SCRATCH ON THE POLARIZER (INSIDE VIEWING AREA)	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	8. BUBBLE IN POLARIZER (INSIDE VIEWING AREA)	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	NON 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

<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>BLACK AND WHITE SPOT
FOREIGN MATERIEL
DUST IN THE CELL
BLEMISH
SCRATCH
(IN THE VIEWING AREA)</td><td>(A) ROUND TYPE: unit : mm.
<table>
<tr><th colspan="3">DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td colspan="3">Φ ≦0.10</td><td>DISREGARD</td></tr>
<tr><td>0.10 <</td><td>Φ ≦ 0.25</td><td></td><td>2 (Distance>5mm)</td></tr>
<tr><td colspan="3">0.25 < Φ</td><td>0</td></tr>
</table>
NOTE: Φ=(LENGTH+WIDTH)/2
(B) LINEAR TYPE: unit : mm.
<table>
<tr><th>LENGTH</th><th colspan="2">WIDTH</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>------</td><td colspan="2">W ≦0.03</td><td>DISREGARD</td></tr>
<tr><td>L ≦ 5.0</td><td>0.03 < W</td><td>≦0.07</td><td>2 (Distance>5mm)</td></tr>
<tr><td>------</td><td colspan="2">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
DENT ON POLARIZER
(IN THE VIEWING AREA)</td><td>unit : mm.
<table>
<tr><th colspan="3">DIAMETER</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td colspan="3">Φ ≦0.20</td><td>DISREGARD</td></tr>
<tr><td>0.20 <</td><td>Φ ≦ 0.50</td><td></td><td>2 (Distance>5mm)</td></tr>
<tr><td colspan="3">0.50 < Φ</td><td>0</td></tr>
</table></td></tr>
<tr><td>8.4.3</td><td>MINOR</td><td>Dot Defect</td><td>
<table>
<tr><th>Items</th><th>ACC. Q'TY</th></tr>
<tr><td>Bright dot</td><td>N≦ 2</td></tr>
<tr><td>Dark dot</td><td>N≦ 3</td></tr>
<tr><td>Total dot</td><td>N≦ 4</td></tr>
</table>
Pixel Define :
 

Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.
Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green ,blue pattern.
Note 4：The bright dot defect must be visible through 2% ND filter</td></tr>
</table>

NO.	CLASS	ITEM	JUDGEMENT
8.4.4	MINOR	LCD GLASS CHIPPING	 Y > S Reject
8.4.5	MINOR	LCD GLASS CHIPPING	 X 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	 1. a> L/3 , A>1.5mm. Reject 2. B : ACCORDING TO DIMENSION
8.4.8	MINOR	LCD GLASS CHIPPING (ON THE TERMINAL AREA)	 Φ = (x+y)/2 > 2.5 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