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DOCUMENT NUMBER AND REVISION

**FS-TJ022A01-01 REV. A  
(17622W2HEG06HX)**

DOCUMENT TITLE:  
**SPECIFICATION  
OF  
LCD MODULE TYPE**

CUSTOMER	
MODEL NUMBER	<b>TJ022A01-01</b>
CUSTOMER APPROVAL	
DATE	

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## Specification of LCD Module Type Item No.: TJ022A01-01

### 1. General Description

- 176(R.G.B) x 220 dots.
- 2.2" TFT-LCD 262K color Transmissive LCD Module.
- Normal black.
- Viewing Angle: 6 O'clock direction.
- 'HIMAX' HX8309 (COG) LCD Controller & Driver or equivalent.
- Interface: 8080/16bit
- Flexible Printed Circuit (FPC).
- White LED backlight (side LED).

### 2. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Parameter	Specifications	Unit
Outline dimensions	41.90(W) x 89.68(H) x 4.20(D)(Include FPC, Backlight)	mm
Active area	34.848(W) x 43.56(H)	mm
Display format	176(H) dots x 220(V) dots	-
Dot size	0.18(W) x 0.18(H)	mm
Overall Weight	<b>Approx.</b>	grams

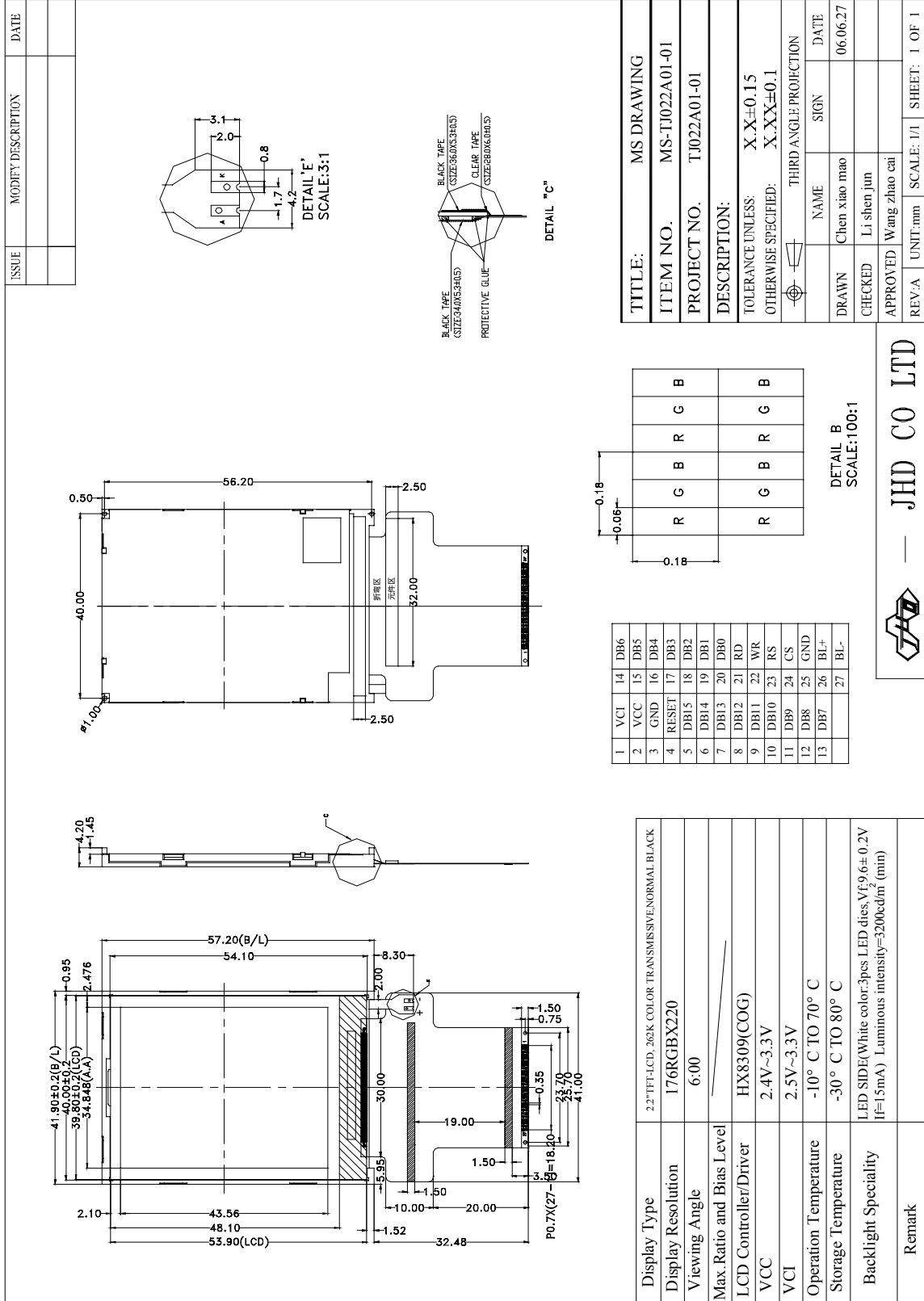


Figure 1: Module Specification

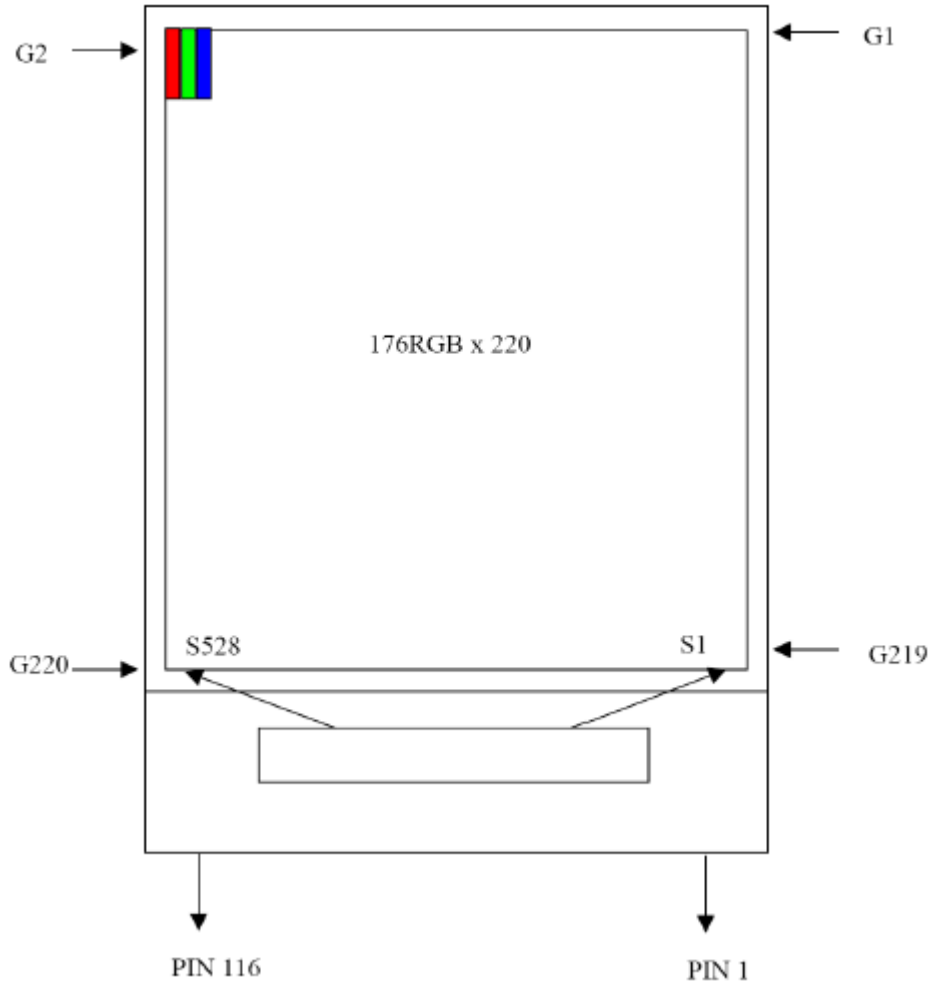


Figure 2: Block Diagram



### 3. Interface signals

Table 2 for FPC

Pin No.	Symbol	Description
1	VCI	Supply voltage for step-up circuit.
2	VCC	Logic power.
3	GND	Ground.
4	RESET	Reset pin.
5	DB15	Data bus pin.
6	DB14	Data bus pin.
7	DB13	Data bus pin.
8	DB12	Data bus pin.
9	DB11	Data bus pin.
10	DB10	Data bus pin.
11	DB9	Data bus pin.
12	DB8	Data bus pin.
13	DB7	Data bus pin.
14	DB6	Data bus pin.
15	DB5	Data bus pin.
16	DB4	Data bus pin.
17	DB3	Data bus pin.
18	DB2	Data bus pin.
19	DB1	Data bus pin.
20	DB0	Data bus pin.
21	RD	Read pin.
22	WR	Write pin.
23	RS	Command(L),Data(H).
24	CS	Chip select pin.
25	GND	Ground.
26	BL+	Anode of the LED backlight.
27	BL-	Cathode of the LED backlight.



#### 4. Absolute Maximum Ratings

##### 4.1 Electrical Maximum Ratings (Ta = 25 °C)

Table 3

Parameter	Symbol	Min.	Max.	Unit	Note
Power Supply voltage range	VCC	-0.3	+4.6	V	1
Supply voltage for step-up circuit	VCI	-0.3	+4.6	V	1
Power Supply Voltage	VLCD	-0.3	+6.0	V	1
LCD Supply Voltage range	VGH – VGL	-0.3	+18.5	V	1
Digital Input signal	V <sub>IN</sub>	-0.3	VCC+0.3	V	1,2

Note: 1.) All voltage values are based on GND = 0V.

2.) Stress beyond The modules ranges listed above may cause permanent damages to the device.

##### 4.2 Environmental Condition

Table 4

Item	Operating Temperature (Topr)		Storage Temperature (Tstg)		Remark
	Min.	Max.	Min.	Max.	
Ambient Temperature	-10°C	+70°C	-30°C	+80°C	Dry



### 4.3 DC Characteristics

At Ta = 25 °C, GND=0V.

Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (Logic)	VCC-GND		2.4	-	3.3	V
Supply voltage for step-up circuit	VCI-GND		2.5	-	3.3	V
Input signal voltage	V <sub>IH</sub>	“H” level	0.8VCC	-	VCC	V
	V <sub>IL</sub>	“L” level	-0.3	-	0.2V <sub>C</sub>	V
Supply Current (Logic & LCD)	IDD	Note 1	-	1.8	2.7	mA

### 4.4 Backlight Electrical Specification

Table 6. Backlight Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	V <sub>f</sub>	I <sub>F</sub> =15mA	9.4	9.6	9.8	V
Reverse Current	I <sub>r</sub>	V <sub>r</sub> =3.0V	-	-	15	mA
Average Brightness	L <sub>v</sub>	I <sub>f</sub> =15mA	3200	-	-	cd/m <sup>2</sup>
CIE Color Coordinate	X	I <sub>f</sub> =15mA	0.260	-	0.315	-
	Y		0.260	-	0.315	
Uniformity *1	△B	I <sub>F</sub> =15mA	80	--	--	%
Color	White					

Note:\*1 △B=B(min)/B(max).



## 5 Optical Characteristics

Table 7.

Item	Symbol	Conditions	Specifications			Unit	Note	
			Min.	Typ.	Max.			
Transmittance	T%	Viewing normal angle $\theta_x = \theta_y = 0^\circ$	-	6.0	-	%	All left side data are based on CMO's following condition -- Type 6 NTSC: 58% LC: 5001 Light : C light (Machine:BM5A) Polarizer without DBEF <b>Reference Only</b>	
Contrast Ratio	CR		150	250	-	--		
Response Time	T <sub>R</sub>		-	15	30	ms		
	T <sub>F</sub>		-	35	50	ms		
Chromaticity	Red		X <sub>R</sub>	0.610	0.640	0.670		
			Y <sub>R</sub>	0.314	0.344	0.374		
	Green		X <sub>G</sub>	0.268	0.298	0.328		
			Y <sub>G</sub>	0.553	0.583	0.613		
	Blue		X <sub>B</sub>	0.102	0.132	0.162		
			Y <sub>B</sub>	0.107	0.137	0.167		
White	X <sub>W</sub>	0.282	0.312	0.342				
	Y <sub>W</sub>	0.319	0.349	0.379				
Viewing Angle	Hor.	$\theta_{x+}$	-	45		deg.		
		$\theta_{x-}$	-	45				
	Ver.	$\theta_{y+}$	-	35				
		$\theta_{y-}$	-	15				
		Center CR $\geq$ 10						

\*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L63 / L0$$

L63: Luminance of gray level 63

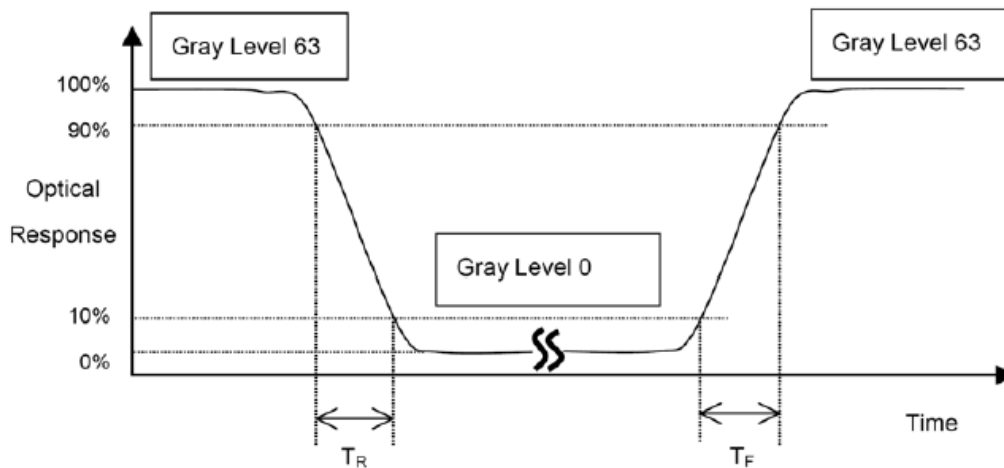
L0: Luminance of gray level 0

$$\text{CR} = \text{CR} (10)$$

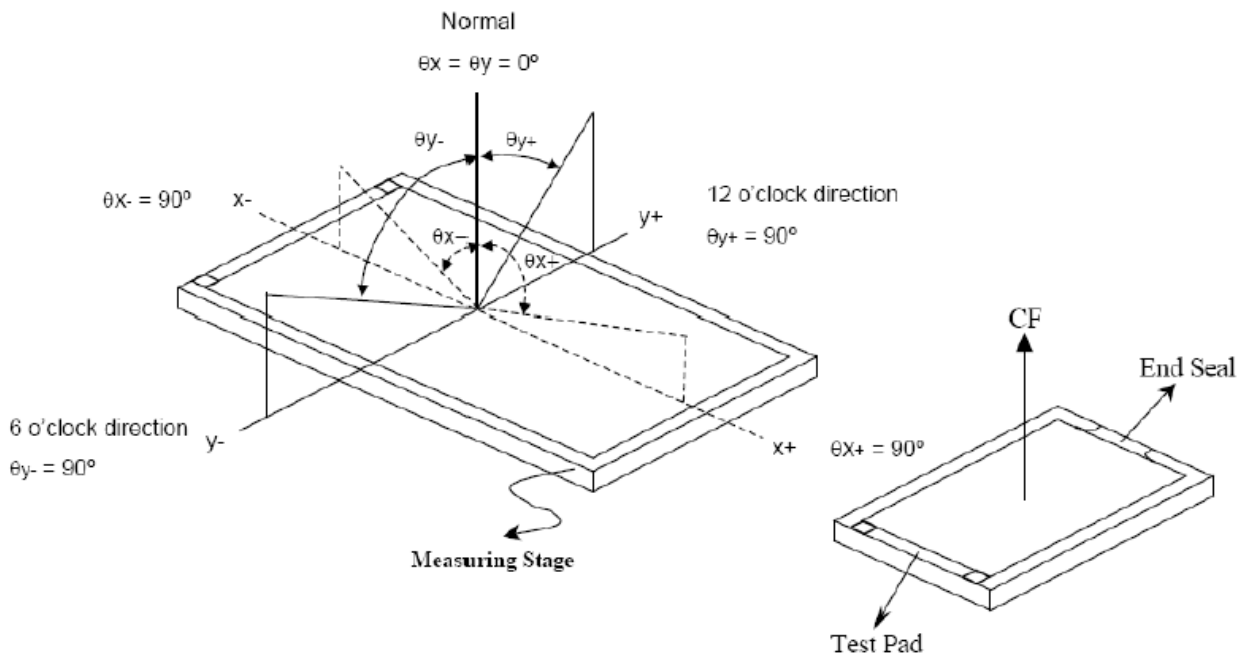
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).



\*Note (2) Definition of Response Time ( $T_R$ ,  $T_F$ ):



\*Note(3) Definition of Viewing Angle

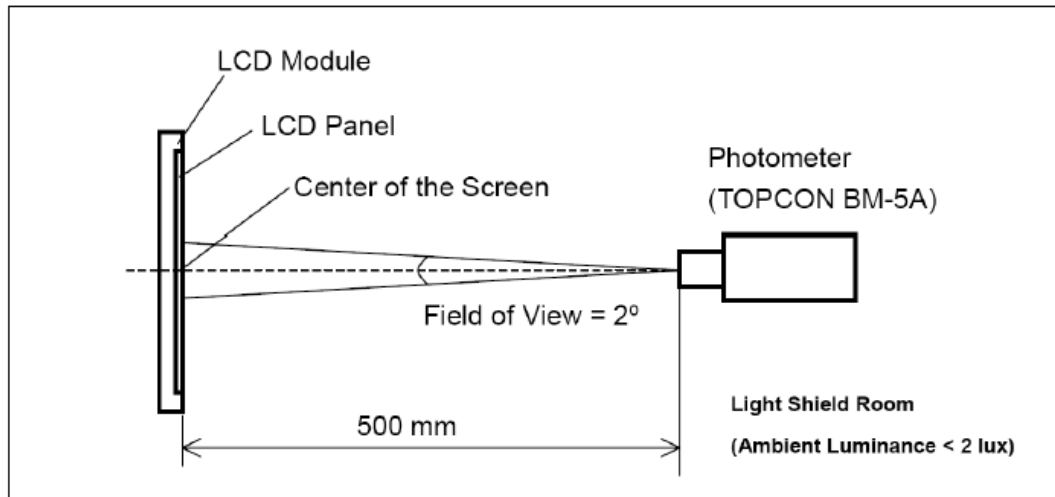


\*\*\* The above "Viewing Angle" is the measuring position with Largest Contrast Ratio; not for good image quality. View Direction for good image quality is 6 O'clock. Module maker can increase the "Viewing Angle" by applying Wide View Film.

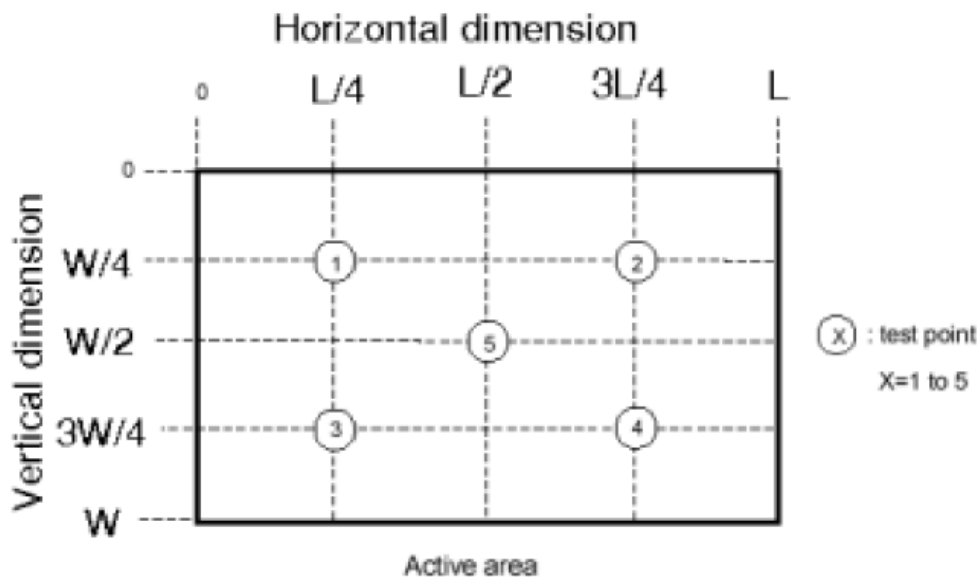


\*Note (4) Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



\*Note (5)





## 6. Timing Specifications

At  $T_a = -10^{\circ}\text{C}$  To  $+70^{\circ}\text{C}$ ,  $V_{CC} = +2.4$  to  $+3.3\text{V}$ ,  $GND = 0\text{V}$ .

Refer to Fig. 4, the bus timing diagram for 8080-series MPU.

Table 8

### Normal Write Mode (HWM = 0),18/16bit

Item		Symbol	Unit	Min.	Typ.	Max.
Bus cycle time	Write	$t_{CYCW}$	ns	300	-	-
	Read	$t_{CYCR}$	ns	500	-	-
Write low-level pulse width		$PW_{LW}$	ns	40	-	-
Read low-level pulse width		$PW_{LR}$	ns	250	-	-
Write high-level pulse width		$PW_{HW}$	ns	30	-	-
Read high-level pulse width		$PW_{HR}$	ns	200	-	-
Write / Read rise / fall time		$t_{WRr}, t_{WRf}$	ns	-	-	25
Setup time	Write (RS to NCS, E_NWR)	$t_{AS}$	ns	5	-	-
	Read (RS to NCS, RW_NRD)			5	-	-
Address hold time		$t_{AH}$	ns	5	-	-
Write data setup time		$t_{DSW}$	ns	15	-	-
Write data hold time		$t_H$	ns	15	-	-
Read data delay time		$t_{DDR}$	ns	-	-	80
Read data hold time		$t_{DHR}$	ns	5	-	-

### High-Speed Write Mode (HWM = 1),18/16bit

Item		Symbol	Unit	Min.	Typ.	Max.
Bus cycle time	Write	$t_{CYCW}$	ns	100	-	-
	Read	$t_{CYCR}$	ns	500	-	-
Write low-level pulse width		$PW_{LW}$	ns	40	-	-
Read low-level pulse width		$PW_{LR}$	ns	250	-	-
Write high-level pulse width		$PW_{HW}$	ns	30	-	-
Read high-level pulse width		$PW_{HR}$	ns	200	-	-
Write / Read rise / fall time		$t_{WRr}, t_{WRf}$	ns	-	-	25
Setup time	Write (RS to NCS, E_NWR)	$t_{AS}$	ns	5	-	-
	Read (RS to NCS, RW_NRD)			5	-	-
Address hold time		$t_{AH}$	ns	5	-	-
Write data set up time		$t_{DSW}$	ns	15	-	-
Write data hold time		$t_H$	ns	20	-	-
Read data delay time		$t_{DDR}$	ns	-	-	200
Read data hold time		$t_{DHR}$	ns	5	-	-

### Normal Write Mode (HWM = 0),9/8bit

Item		Symbol	Unit	Min.	Typ.	Max.
Bus cycle time	Write	$t_{CYCW}$	ns	300	-	-
	Read	$t_{CYCR}$	ns	500	-	-
Write low-level pulse width		$PW_{LW}$	ns	40	-	-
Read low-level pulse width		$PW_{LR}$	ns	250	-	-
Write high-level pulse width		$PW_{HW}$	ns	30	-	-
Read high-level pulse width		$PW_{HR}$	ns	200	-	-
Write / Read rise / fall time		$t_{WRr}, t_{WRf}$	ns	-	-	25
Setup time	Write (RS to NCS, E_NWR)	$t_{AS}$	ns	5	-	-
	Read (RS to NCS, RW_NRD)			5	-	-
Address hold time		$t_{AH}$	ns	5	-	-
Write data set up time		$t_{DSW}$	ns	15	-	-
Write data hold time		$t_H$	ns	20	-	-
Read data delay time		$t_{DDR}$	ns	-	-	120
Read data hold time		$t_{DHR}$	ns	5	-	-

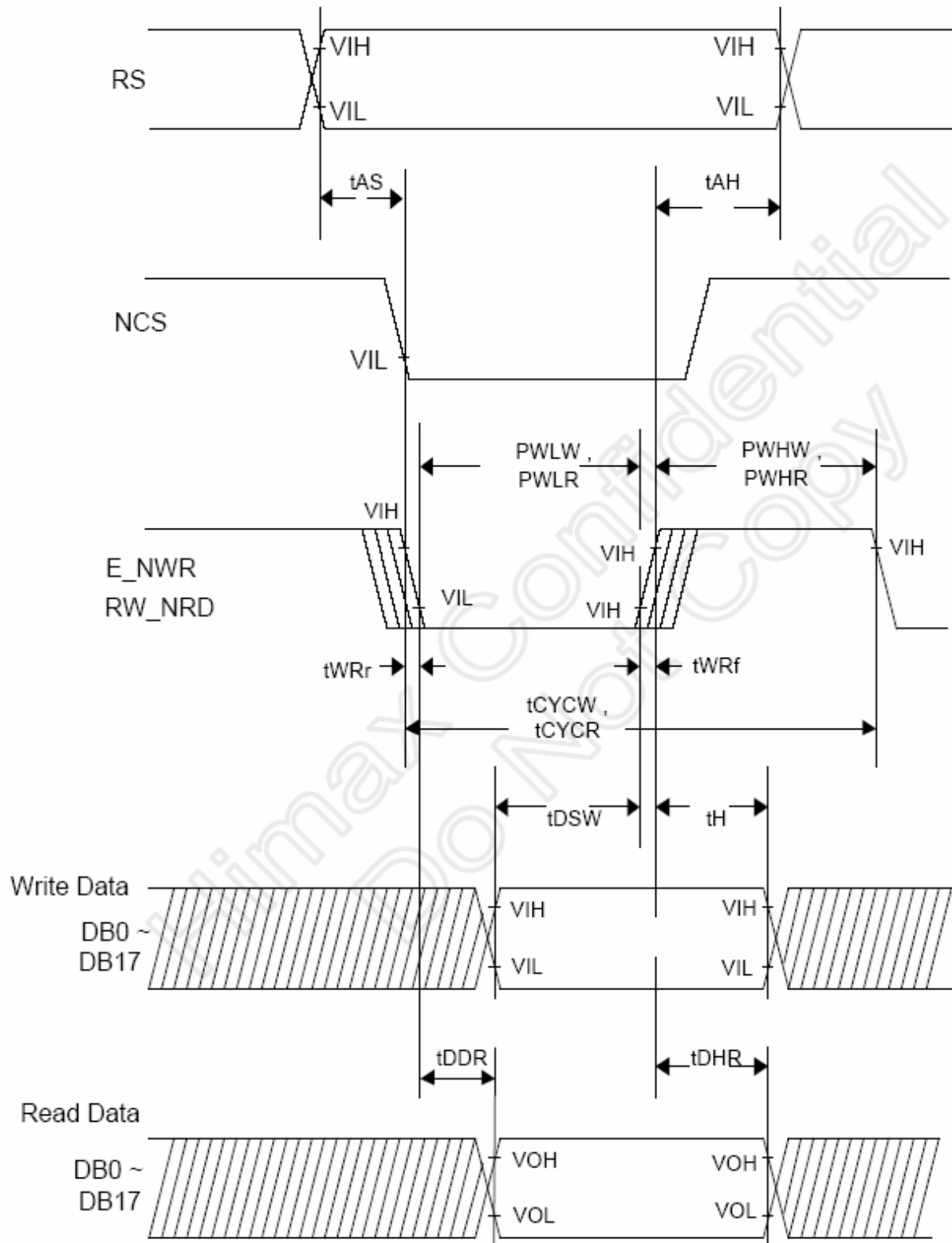


Figure 4: Parallel Interface (8080-series MPU) Timing Diagram



At  $T_a = -10^{\circ}\text{C}$  To  $+70^{\circ}\text{C}$ ,  $V_{CC} = +2.4$  to  $+3.3\text{V}$ ,  $GND = 0\text{V}$ .

Refer to Fig. 5, the bus timing diagram for Serial interface.

Table 9

Item	Symbol	Unit	Min.	Typ.	Max.	
Serial clock cycle time	Write ( received )	$t_{SCYC}$	$\mu\text{S}$	100	-	>1ms
	Read ( transmitted )	$t_{SCYC}$	$\mu\text{S}$	350	-	>1ms
Serial clock high – level pulse width	Write ( received )	$t_{SCH}$	ns	40	-	-
	Read ( transmitted )	$t_{SCH}$	ns	150	-	-
Serial clock low – level pulse width	Write ( received )	$t_{SCL}$	ns	40	-	-
	Read ( transmitted )	$t_{SCL}$	ns	150	-	-
Serial clock rise / fall time	$t_{scr}, t_{scf}$	ns	-	-	-	
Chip select set up time	$t_{CSU}$	ns	20	-	-	
Chip select hold time	$t_{CH}$	ns	60	-	-	
Serial input data set up time	$t_{SISU}$	ns	20	-	-	
Serial input data hold time	$t_{SIH}$	ns	20	-	-	
Serial output data set up time	$t_{SOD}$	ns	-	-	120	
Serial output data hold time	$t_{SOH}$	ns	5	-	-	

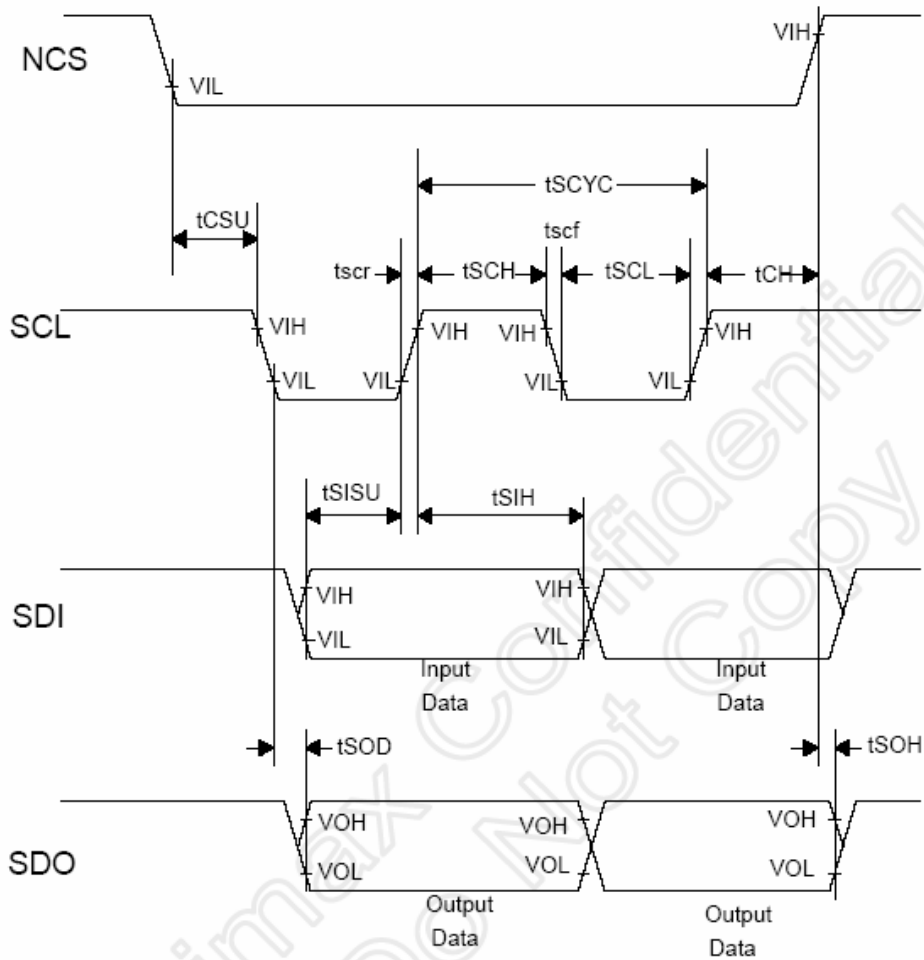


Figure 5: Serial interface Timing Diagram



At  $T_a = -20^{\circ}\text{C}$  To  $+70^{\circ}\text{C}$ ,  $V_{CC} = +2.4$  to  $+3.3\text{V}$ ,  $GND = 0\text{V}$ .

Refer to Fig. 6, the bus timing diagram for RGB interface.

Table 10

**18-/16-bit Bus RGB Interface Mode and High-Speed Write Mode**

Item	Symbol	Unit	Min.	Typ.	Max.
VSYNC / HSYNC set up time	$t_{SYNCS}$	ns	0	-	-
ENABLE set up time	$t_{ENS}$	ns	10	-	-
ENABLE hold time	$t_{ENH}$	ns	20	-	-
DOTCK "low" level pulse width	$PW_{DL}$	ns	40	-	-
DOTCK "high" level pulse width	$PW_{DH}$	ns	40	-	-
DOTCK cycle time	$t_{CYCD}$	ns	100	-	-
DATA set up time	$t_{PDS}$	ns	20	-	-
DATA hold time	$t_{PDH}$	ns	20	-	-
DOTCLK, VSYNC, HSYNC rising and falling time	$t_{rRGB}, t_{fRGB}$	ns	-	-	25

**6-bit Bus RGB Interface Mode, High-Speed Write Mode (HWM = 1)**

Item	Symbol	Unit	Min.	Typ.	Max.
VSYNC / HSYNC set up time	$t_{SYNCS}$	ns	0	-	-
ENABLE set up time	$t_{ENS}$	ns	10	-	-
ENABLE hold time	$t_{ENH}$	ns	20	-	-
DOTCK "low" level pulse width	$PW_{DL}$	ns	40	-	-
DOTCK "high" level pulse width	$PW_{DH}$	ns	40	-	-
DOTCK cycle time	$t_{CYCD}$	ns	100	-	-
DATA set up time	$t_{PDS}$	ns	20	-	-
DATA hold time	$t_{PDH}$	ns	20	-	-
DOTCLK, VSYNC, HSYNC rising and falling time	$t_{rRGB}, t_{fRGB}$	ns	-	-	25

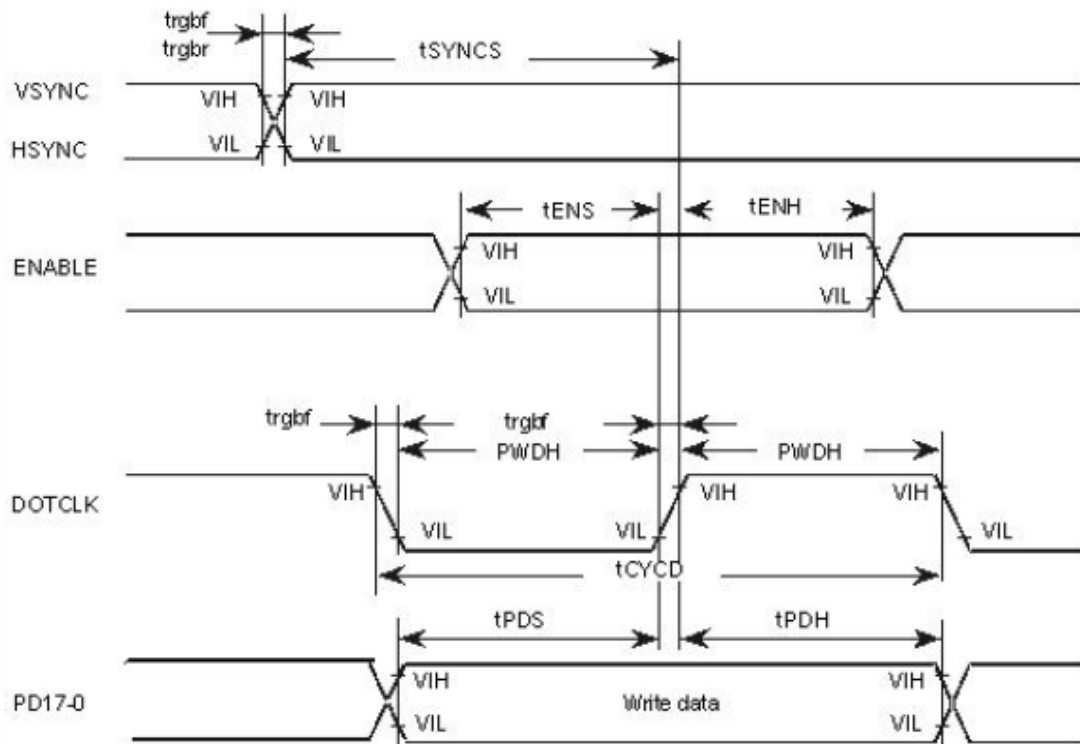


Figure 6: RGB interface Timing Diagram

At  $T_a = -10^{\circ}\text{C}$  To  $+70^{\circ}\text{C}$ ,  $V_{CC} = +2.4$  to  $+3.3\text{V}$ ,  $GND = 0\text{V}$ .

Refer to [Fig.7](#), the bus timing diagram for Reset timing.

Table 11

Item	Symbol	Unit	Min.	Typ.	Max.	Test Condition
Reset low level width	$t_{RES}$	ms	1	-	-	Figure6.5
Reset rise time	$t_{RES}$	ns	-	-	10	Figure6.5

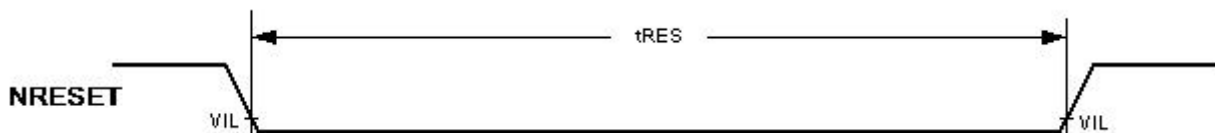


Figure 7: Reset timing



## 6.1. Instruction Table

### Output Pin Initialization

1. Driver output pins (Source outputs): Output VSSD level
2. Driver output pins (Gate outputs): Output VGH level
3. Oscillator output pin (OSC2): Output oscillation signal

### Instruction Set Initialization:

1. Start oscillation executed
2. Driver output control (NL4-0 = 11101, SS = 0, GS = 0)
3. LCD driving AC control (FLD1-0 = 01, B/C = 0, EOR = 0, NW5-0 = 00000)
4. Entry mode set (HWM = 0, I/D1-0 = 11: Increment by 1, AM = 0: Horizontal move, LG2-0 = 00: Replace mode)
5. Compare register (CP17-0: 00000h)
6. Display control 1 (PT1-0 = 00, VLE2-1 = 00: No vertical scroll, SPT = 0, GON = 0, DTE = 0, CL = 0: 262144-color mode, REV = 0, D1-0 = 00: Display off)
7. Frame cycle control (GD1-0 = 00, SDT1-0 = 00, CE1-0 = 00: No equalization, DIV1-0 = 00: 1-divided clock, RTN3-0 = 0000: 16 clocks in 1-line period)
8. External display interface control 1 (RIM1-0 = 00: 18-bit RGB interface, DM1-0 = 00: internal clock operation, RM = 0: System interface)
9. Power control 1 (BT2-0 = 000, DC2-0 = 000, AP2-0 = 000: LCD power off, DK = 1: step-up circuit 1 off, SLP = 0, STB = 0: Standby mode off)
10. Power control 2 (VC2-0 = 000)
11. Power control 3 (PON=0, VRH3-0 = 0000)
12. Power control 4 (VCOMG = 0, VDV4-0 = 00000, VCM4-0 = 00000)
13. RAM address set (AD15-0 = 0000h)
14. RAM write data mask (WM17-0 = 000000000000000000: No mask)
15. Gamma control  
(MP02-00 = 000, MP12-10 = 000, MP22-20 = 000, MP32-30 = 000,  
MP42-40 = 000, MP52-50 = 000, CP02-00 = 000, CP12-10 = 000)  
(MN02-00 = 000, MN12-10 = 000, MN22-20 = 000, MN32-30 = 000,  
MN42-40 = 000, MN52-50 = 000, CN02-00 = 000, CN12-10 = 000)  
(OP03-00 = 0000, OP14-10 = 00000, ON03-00 = 0000, ON14-10 = 0000)
16. Gate scan starting position (SCN4-0 = 00000)
17. Vertical scroll (VL7-0 = 00000000)
18. 1st screen division (SE17-10 = 11011011, SS17-10 = 00000000)
19. 2nd screen division (SE27-20 = 11011011, SS27-20 = 00000000)
20. Horizontal RAM address position (HEA7-0 = 10101111, HSA7-0 = 00000000)
21. Vertical RAM address position (VEA7-0 = 11011011, VSA7-0 = 00000000)



## 6.2. Initialization Code

```
#include<stdio.h>
```

```
#include<reg51.h>
```

```
#include<intrins.h>
```

```
#include<ctype.h>
```

```
typedef unsigned char Uchar;
```

```
typedef unsigned int word;
```

```
Uchar code fonnet[];
```

```
//************************************************************************
```

```
sbit RESET= P3^5;//3
```

```
sbit CS= P3^4;//2
```

```
sbit RS= P3^2;//5
```

```
sbit W_R= P3^1;//6
```

```
sbit R_D= P3^0;//7
```

```
sbit step= P3^3;
```

```
//************************************************************************
```

```
void intial(void);
```

```
void inti_data(word cindex,word cdata);
```

```
void writec(word c1);
```

```
void writed(word c1);
```

```
void dispbmp(word *bmp);
```

```
void pause();
```

```
void dispdot(word dot);
```

```
void delay(word COUNT);
```

```
//************************************************************************
```

```
void inti_data(word cindex,word cdata)
```

```
{
```

```
    //word cindex;
```

```
    //word cdata;
```

```
    writec(cindex);
```

```
    writed(cdata);
```

```
}
```



```
void intial()
{
    inti_data(0x0001,0x011B);
    inti_data(0x0002,0x0700);

    inti_data(0x0003,0x6020);

    inti_data(0x0004,0x0000);

    inti_data(0x0005,0x0000);

    inti_data(0x0007,0x0004);

    inti_data(0x0008,0x0202);

    inti_data(0x0009,0x0000);

    inti_data(0x000B,0x0004);

    inti_data(0x000C,0x0003);

    inti_data(0x0040,0x0000);

    inti_data(0x0041,0x00EF);

    inti_data(0x0042,0xDB00);

    inti_data(0x0043,0xDB00);

    inti_data(0x0044,0xAF00);

    inti_data(0x0045,0xDB00);
    delay(1000);
    //=====POWER SET =====//
    inti_data(0x0000,0x0001);
}
```



**delay(100);**

**inti\_data(0x0010,0x0000);**

**inti\_data(0x0011,0x0000);**

**inti\_data(0x0012,0x0000);**

**inti\_data(0x0013,0x0000);**

**inti\_data(0x0011,0x0000);**

**inti\_data(0x0013,0x1518);**

**inti\_data(0x0012,0x0008);**

**inti\_data(0x0010,0x4040);**

**delay(100);**

**inti\_data(0x0011,0x0000);**

**inti\_data(0x0010,0x0054);**

**inti\_data(0x0012,0x0013);**

**inti\_data(0x0013,0x3518);**

**delay(1000);**

**//=====Gamma control=====//**

**inti\_data(0x0030,0x0000);**

**inti\_data(0x0031,0x0704);**



**inti\_data(0x0032,0x0004);**

**inti\_data(0x0033,0x0604);**

**inti\_data(0x0034,0x0307);**

**inti\_data(0x0035,0x0103);**

**inti\_data(0x0036,0x0707);**

**inti\_data(0x0037,0x0603);**

**inti\_data(0x0038,0x0000);**

**inti\_data(0x0039,0x0000);**

**//===== display on =====REV D1 D0 GON DTE**

**inti\_data(0x0010,0x4040);**

**inti\_data(0x0007,0x0005);**

**delay(600);//400**

**inti\_data(0x0007,0x0025);**

**inti\_data(0x0007,0x0027);**

**delay(600);//400**

**inti\_data(0x0007,0x0037);**

**delay(100);//**

**inti\_data(0x0021,0x0000);//RAM address set**

**}**



## 7. Reliability

ITEM	CONDITIONS	CRITERIA
High temperature operation	70°C for 240 hours	<ul style="list-style-type: none"> <li>◆ No defect in cosmetic and operational functions</li> <li>◆ Total current consumption below double of initial value</li> </ul>
Low temperature operation	-10°C for 240 hours	
High humidity storage	40°C, 90%RH for 240 hours	
High temperature storage	80°C for 240 hours	
Low temperature storage	-30°C for 240 hours	
Temperature cycling	-30°C (30 min) ↓ ↑ 25°C (5 min) ↓ ↑ 80°C (30 min) CYCLES : 10	

Note1: Operation test should be mounted with the driver IC, we hereby provide the operation test conditions with the square ac waveforms.

Note2: The test LCD cell shall be inspected 2hrs latter storage at room temperature & humidity after it was removed from the chambers.

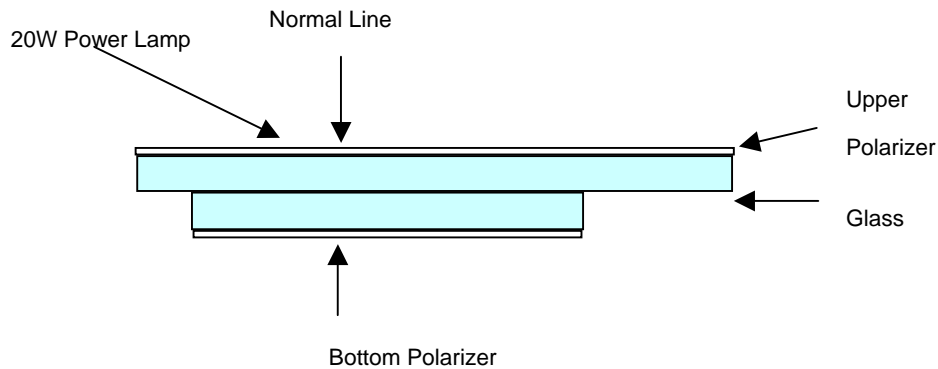
Note3: No dew condensations would be observed.



## 8. Outgoing Quality Spec.

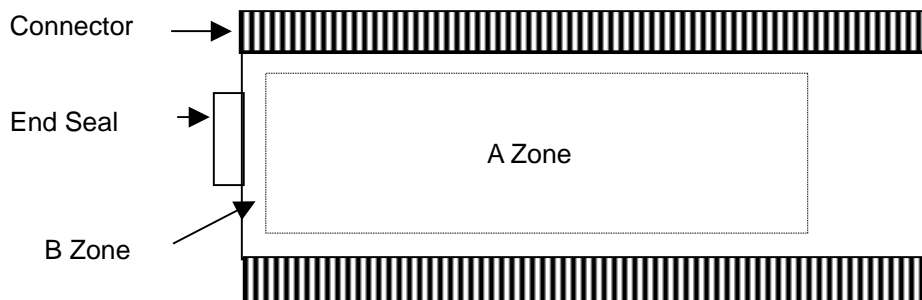
### 8.1 LCM VISUAL & ELECTRONIC INSPECTION STANDARD

A. Fluorescent Lamp: 20W ; viewing distance 30 cm



Viewing Angle: Normal to the Front Surface

### 8.2 Definition



A Zone: Effective Viewing

B Zone: Non-effective Viewing

### 8.3 Quality Level:

The AQL for major and minor defects is defined as follows:

Partition	Definition	AQL
Major defect	Functional defective as product.	0.4
Minor defect	Satisfy all functions as product but not satisfy cosmetic standard.	1.0



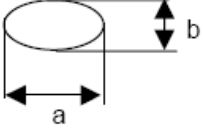
### 8.4 Visual Items

DEFECT	INSPECTION ITEM	CRITERIA
<p>1 Damage (Minor)</p>		<p>1.X,Y damage reaching effective viewing area <span style="float:right">Reject</span></p> <p>2.Damage causing exposure of cross-over dots &amp; the exposure area being larger than 1/3 of the entire area.(#) <span style="float:right">Reject</span></p> <p>3. Damage touching main seal &amp; being larger than 1/3 width of main seal.(#) ( #:damage between upper &amp; lower glass)</p>
<p>2 Poor Rifting (Major)</p>		<p>1.B &gt; 1/3 Length of connector <span style="float:right">Reject</span></p> <p>2. length of " L" <span style="float:right">Disregard</span></p>
<p>3 Poor Cutting (Major)</p>		<p>According to Engineering Drawing</p>
<p>4 Poor Cutting (Major)</p>		<p>1. X, Y damage touching main seal &amp; being larger than 1/3 width of main seal <span style="float:right">Reject</span></p> <p>2.Damage causing exposure of cross-over dots &amp; The exposure area being larger than 1/3 of the entire area <span style="float:right">Reject</span></p> <p>3. A &gt; 1/3 length of connector <span style="float:right">Reject</span></p>

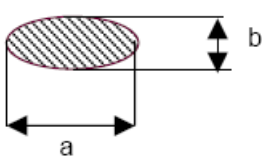


<p>5 Damage (Minor)</p>		<p>1. Y damage reaching effective viewing area <span style="float: right;">Reject</span></p> <p>2. Damage causing exposure of cross-over dots &amp; the exposure area being larger than 1/3 of the entire area.(#) <span style="float: right;">Reject</span></p> <p>3. Damage touching main seal &amp; being larger than 1/3 width of main seal.(#) ( #:damage between upper &amp; lower glass)</p>
<p>6 Damage (Minor)</p>		<p>1. <math>Y &lt; 1/3</math> length of connector, <math>Z &lt; 1/2T</math>, X disregard. <span style="float: right;">Accept</span></p> <p>2. <math>X \leq 3\text{mm}</math> (or <math>\leq 1/8</math> length of longer edge), <math>Y \leq 1/3</math> length of connector, <math>1/2T &lt; Z \leq T</math> <span style="float: right;">Accept</span></p> <p>If damage in another side of connector</p> <p>1. <math>X &gt; 1/8</math> length of longer edge <span style="float: right;">Reject</span></p> <p>2. <math>Y &gt; D</math> <span style="float: right;">Reject</span></p> <p>3. <math>Z &gt; 1/2 T</math> <span style="float: right;">Reject</span></p>
<p>7 Damage (Minor)</p>		<p>1. <math>X &gt; 3 \text{ mm}</math> <span style="float: right;">Reject</span></p> <p>2. Damage causing exposure of cross-over dots &amp; the exposure area being larger than 1/3 of the entire area. <span style="float: right;">Reject</span></p> <p>3. <math>Y &gt; 1/2 D</math> <span style="float: right;">Reject</span></p> <p>4. <math>X \leq 1\text{mm}</math> and <math>Y \leq D</math> <span style="float: right;">Accept</span></p>
<p>8 Cracks (Major)</p>		<p>Any Cracks <span style="float: right;">Reject</span></p>



9 (Minor)		Black Spots Foreign Substances $\varphi = (L+W)/2$	Dimension		Acceptable Numbers
			A: $\varphi \leq 0.1\text{mm}$		Disregard ※ 1
			B: $0.1\text{mm} < \varphi \leq 0.20\text{mm}$		3
			C: $0.20\text{mm} < \varphi \leq 0.25\text{mm}$		1
			D: $0.25\text{mm} < \varphi$		0
			Total defective point ( B.C.D )		3
			※ 1: 5pcs or more gatherings within 5 mm circuit is not acceptable .		
10 (Minor)	Slanted Polarizer, Shifted Polarizer	Tolerance > 1.2 mm (Measure from glass edge)		Reject	
11 (Minor)	Polarizer Scratch	Dimension		Acceptable Numbers	
		Length	Width		
		A: $W \leq 0.01\text{mm}$		Disregard ※ 1	
		B: $L \leq 5 \text{ mm}$	$0.01\text{mm} < W \leq 0.02\text{mm}$	3	
		C: $L \leq 3 \text{ mm}$	$0.01\text{mm} < W \leq 0.05\text{mm}$	1	
		D :	$0.05\text{mm} < W$	0	
Total defective point ( B.C.D )		3			
※ 1: 5pcs or more gatherings within 5 mm circuit is not acceptable					
12 (Minor)	Polarizer Bubble Visual Inspection $\varphi \psi = (L+W)/2$	Dimension		Acceptable Numbers	
		D > 1.0mm		Reject	
		0.5mm < D ≤ 1.0 mm		1	
		D < 0.5 mm		Disregard	
13 (Minor)	Polarizer Prick, Shape (point) Visual Inspection $\varphi = (L+W)/2$	Dimension		Acceptable Numbers	
		$\varphi \leq 0.1\text{mm}$		Disregard ※ 1	
		$0.1\text{mm} < \varphi \leq 0.20\text{mm}$		3	
		$0.20\text{mm} < \varphi \leq 0.25\text{mm}$		1	
		$0.30\text{mm} < \varphi$		0	
		The distance between two spots shall exceed 5 mm Outside Effective Viewing Area		Disregard	
14 (Major)	Dirty Conductive Pattern	Oil or Foreign Substances (Visual Inspection)		Reject	
15 (Minor)	Dirty Polarizer(After removing protection film)			Reject	
16 (Minor)	Protection Film not adhering to Polarizer			Reject	
17 (Minor)	NAP ( Fiber )	$L \leq 3\text{mm}$ Accept			
18 (Major)	The Deviation of the Basic Color	Base on Limited sample			



19 (Major)	Incomplete Etching		Reject	
20 (Major)	Excessive Etching		Reject	
21 (Minor)	The Width of Main seal	1. $\leq 1/2$ of the Average Width 2. $\geq 1/2$ of the Average Width	Reject Reject	
22 (Minor)	Shifting of Main Seal	Outside Effective Viewing Area	Reject	
23 (Minor)	Foreign Substance, Bubble in Main Seal	$\geq 1/2$ of the Main Seal Width	Reject	
24 (Major)	Main Seal color Being Non Uniform		Reject	
25 (Major)	Deviation of End Sealing Glue Color		Reject	
26 (Minor)	Shifting of End Sealing Glue	Out of Spec on the Engineering Drawing	Reject	
27 (Major)	End sealing Glue Intruding into the Cell	Outside Effective Viewing Area	Reject	
28 (Minor)	Black Dot/ White Dot	Dimension		
		Acceptable Numbers		
		A: $\varphi \leq 0.1\text{mm}$	Disregard ※ 1	
		B: $0.1\text{mm} < \varphi \leq 0.20\text{mm}$	3	
		C: $0.20\text{mm} < \varphi \leq 0.25\text{mm}$	1	
		D: $0.25\text{mm} < \varphi$	0	
		Total defective point ( B.C.D )	3	
※ 1: 5pcs or more gatherings within 5 mm circuit is not acceptable .				
29 (Minor)	Black Line White Line	Dimension		
		Acceptable Numbers		
		Length	Width	
		Disregard ※ 1		
		A: $W \leq 0.01\text{mm}$		
		B: $L \leq 5 \text{ mm}$	$0.01\text{mm} < W \leq 0.02\text{mm}$	3
		C: $L \leq 3 \text{ mm}$	$0.02\text{mm} < W \leq 0.05\text{mm}$	1
D:	$0.05\text{mm} < W$	0		
Total defective point ( B.C.D )		3		
※ 1: 5pcs or more gatherings within 5 mm circuit is not acceptable .				
30 (Minor)	Contrast Variation 	Dimension		
		Acceptable Numbers		
		Disregard ※ 1		
		A: $\varphi \leq 0.20\text{mm}$		
		B: $0.20\text{mm} < \varphi \leq 0.30\text{mm}$	2	
		C: $0.30\text{mm} < \varphi \leq 0.40\text{mm}$	1	
		D: $0.40\text{mm} < \varphi$	0	
Total defective point ( B.C.D )		3		



		※ 1: 5pcs or more gatherings within 5 mm circuit is not acceptable .												
31 (Minor)		Part A : Lack > 0.05 mm                      Reject Part B: Convex > 0.05 mm                      Reject												
32 (Minor)		A : Distortion of Square $\leq \pm 15\%$ Accept B : Distortion of Square $\leq \pm 15\%$ Accept												
33 (Minor)	Rainbow	According to the defect sample												
34 (Major)	Open, Short	Reject												
35 (Major)	Conductive Point Poor Conduction	Reject												
36 (Minor)	Low Speed	Reject												
37 (Major)	Large Current	$\geq 2 \text{ uA/Cm}^2$ Reject												
38 (Minor)	Surface is not uniform	<table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable Numbers</th> </tr> </thead> <tbody> <tr> <td>A: <math>\varphi \leq 0.20\text{mm}</math></td> <td>Disregard ※ 1</td> </tr> <tr> <td>B : <math>0.20\text{mm} &lt; \varphi \leq 0.30\text{mm}</math></td> <td>2</td> </tr> <tr> <td>C : <math>0.30\text{mm} &lt; \varphi \leq 0.40\text{mm}</math></td> <td>1</td> </tr> <tr> <td>D : <math>0.40\text{mm} &lt; \varphi</math></td> <td>0</td> </tr> <tr> <td>Total defective point (B.C.D)</td> <td>3</td> </tr> </tbody> </table>	Dimension	Acceptable Numbers	A: $\varphi \leq 0.20\text{mm}$	Disregard ※ 1	B : $0.20\text{mm} < \varphi \leq 0.30\text{mm}$	2	C : $0.30\text{mm} < \varphi \leq 0.40\text{mm}$	1	D : $0.40\text{mm} < \varphi$	0	Total defective point (B.C.D)	3
		Dimension	Acceptable Numbers											
		A: $\varphi \leq 0.20\text{mm}$	Disregard ※ 1											
		B : $0.20\text{mm} < \varphi \leq 0.30\text{mm}$	2											
		C : $0.30\text{mm} < \varphi \leq 0.40\text{mm}$	1											
		D : $0.40\text{mm} < \varphi$	0											
Total defective point (B.C.D)	3													
※ 1: 5pcs or more gatherings within 5 mm circuit is not acceptable .														



## 9 PRECAUTIONS

### 9.1 Static charge

Since this LCD module contains CMOS LSIs that are sensitive to static charge, care must be taken when handling it.

### 9.2 Power on sequence

1. Input signals should not be applied to the LCD module before the logic system voltage has reached the specified voltage. If the above sequence is not kept the LCD module might be permanently damaged.
2. When connecting the power supply, connect the LCD bias voltage after connecting the logic system voltage.
3. When disconnecting the power supply, disconnect the logic system voltage after the LCD bias voltage.

It is recommended to connect a serial resistor or fuse to the LCD bias power supply of the system, as a current limiter. The value of the resistor depends on the kind of LCD used, but is typically 50~100Ω.

### 9.3 Operation

1. It is essential to drive the LCD within the specified voltage limits, since a higher driving voltage than allowed causes a shorter LCD lifetime. Under these circumstances, electrochemical reactions will result in undesirable deterioration of the LCD.
2. The response time of the LC fluid is considerably longer at low temperatures than in the normal operating temperature range. On the other hand, the LCD will show a dark blue color at high temperatures. Those phenomena do not indicate a malfunction or defect of the LCD. Back at normal temperatures, the LCD will be return to its original behavior.
3. If the display area is pressed hard during operation, some abnormal display patterns might appear. However, the display will resume normal operation after turning the module off and on.
4. Moisture on the terminals could cause an electrochemical reaction resulting in an open terminal connection. If the environmental temperature is higher than 40°C, it is required that the relative humidity is 50% or less.

### 9.4 Packing

1. Do not leave the product in a place of high humidity for a long period. For storage in a location where the temperature is 35°C or higher, special care to protect the product from high humidity is required. A combination of high temperature and high humidity may cause polarization degradation and damage as well. Please keep the temperature and humidity within the specified range for storing.
2. Since LCD panels tend to be easily damaged, they should be handled with full care. Avoid any contact with materials that have a hardness of more than 2H.
3. Adhesives used for adhering upper/lower polarizers and aluminum plates are made of organic substances that will deteriorate by chemical reactions with for example chemicals such as acetone, toluene, ethanol, and isopropyl alcohol. Please prevent the use of these chemicals and contact us when it is necessary for you



to use other chemicals.

4. Immediately wipe off saliva or water drops from the display area with an absorbent cotton cloth, without scrubbing it. If adhered for a long period, such particles might cause deformation or faded color.
5. Moisture deposited on the display surface and contact terminals due to low temperatures will be a cause for polarizer damage, stains, and dirt. Before use, such panels should be slowly warmed up to a temperature that is higher than room temperature.
6. Touching the display area and contact terminals with bare hands is harmful to polarizer and may lead to poor insulation at the terminals.
7. The glass is fragile and can be cracked or chipped easily by handling, in particular on near its edge. Please prevent sudden shocks or exposing the glass to other sorts of stress.

### **9.5 Long-term storage**

For long-term storage the following methods are highly recommended:

1. Store the product in a polyethylene bag with a sealed opening to prevent fresh air entering from the outside. Placing it with a desiccant is not necessary.
2. Store the product in a dark place, with the temperature in the range from 0°C to 35°C.
3. Keep the sensitive polarizer surface of the LCD panels clear of any contact. We recommend using the container that was used by JHD to deliver the products.

### **9.6 Cleaning of the product**

To clean the product make sure to use absorbent cotton cloth or other soft material like chamois. Make sure to rub it gently, and do not use chemicals when cleaning.

## **10 FINAL REMARKS**

1. The above specifications are the binding criteria for JHD's outgoing quality inspection.
2. The customer is kindly requested to inform JHD as soon as possible on any questions, remarks, and disagreements regarding these specifications.
3. JHD is not responsible for damage to its products due to neglect of the precautions as described in the previous chapter.

“Shenzhen Jinghua Displays CO.,LTD. reserves the right to change this specification.”