SPECIFICATION
FOR
LCD Module
KD20050

MODULE:	**KD 20050**
CUSTOMER:	

REV	DESCRIPTION	DATE
1	FIRST ISSUE	2011.07.22

TZD	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

Data	Rev. No.	Page	Summary
2011.07.22	1.0		FIRST ISSUE

Contents

General Description

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 5.0" TFT-LCD contains 800 x 480 pixels, and can display up to 262K colors.

* Features

-Low Input Voltage: VDD: 5.0V
-Display Colors of TFT LCD: 262K colors
-CPU Interface: 8080 parallel 16 bit
-Internal Power Supply Circuit.

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	108.0(H) *64.8(V) (5.0 inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	262K	colors	-
Number of pixels	800(RGB) *480	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.198 (H) x 0.198 (V)	mm	-
Viewing angle	6：00	o'clock	-
Controller IC	KD45789	-	-
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		121		mm	-
	Vertical(V)		76		mm	-
	Depth(D)		14.1		mm	-
Weight			TBD		g	-

1. Optical Characteristics

1.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Threshold voltage		Vsat		—	2.4	—		(6)
		Vth		—	1.4	—		(6)
Transmittance (With PZ)		T		—	6.78	—		
Contrast		CR	Θ=0 Normal viewing angle	480	600	—		(1)(2)
Response time	Rising	T_R		—	3	6	msec	(1)(3)
	Falling	T_F		—	7	14		
Color gamut		S		—	50	—	%	C light
Color chromaticity (CIE1931)	White	W_x		0.292	0.307	0.322		(1)(4) CF Glass C light
		W_y		0.333	0.348	0.363		
	Red	Rx		0.616	0.631	0.646		
		Ry		0.327	0.342	0.357		
	Green	Gx		0.306	0.321	0.336		
		Gy		0.538	0.553	0.568		
	Blue	Bx		0.134	0.149	0.164		
		By		0.168	0.183	0.198		
Viewing angle	Hor.	Θ_L	CR>10	65	75	—		
		Θ_R		65	75	—		
	Ver.	Θ_U		50	60	—		
		Θ_D		60	70	—		
Optima View Direction		6 O' clock						(5)

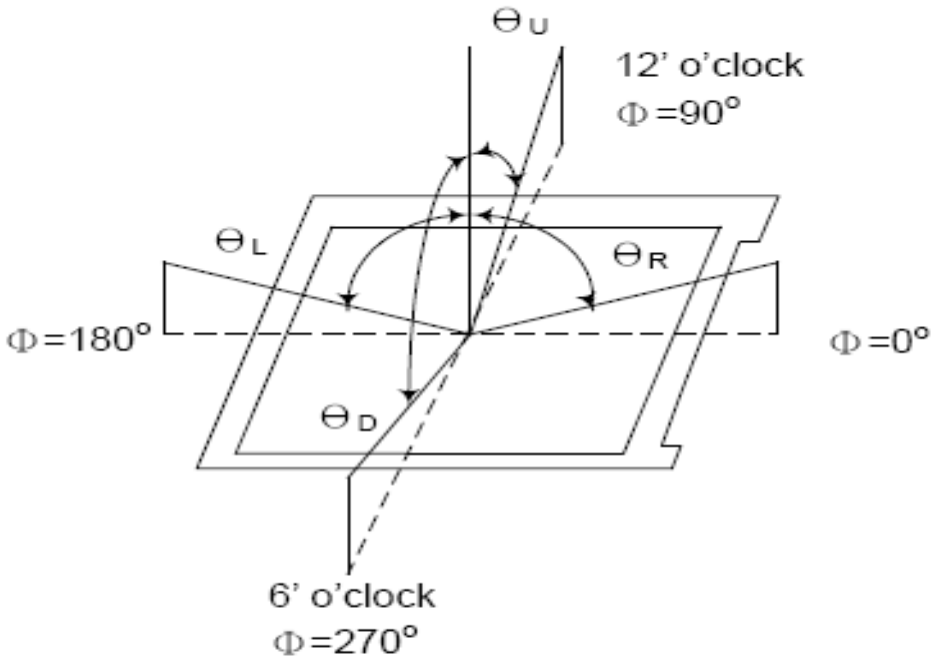
1.2 Measuring Condition

- Measuring surrounding: dark room
- Ambient temperature: 25±2oC
- 15min. warm-up time.

1.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size: 20 ~ 21 mm

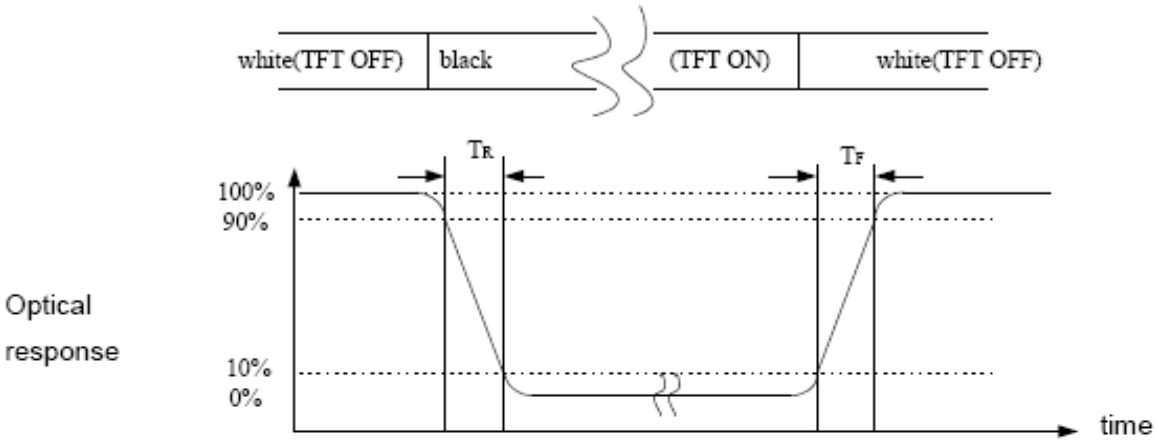
Note (1) Definition of Viewing Angle:



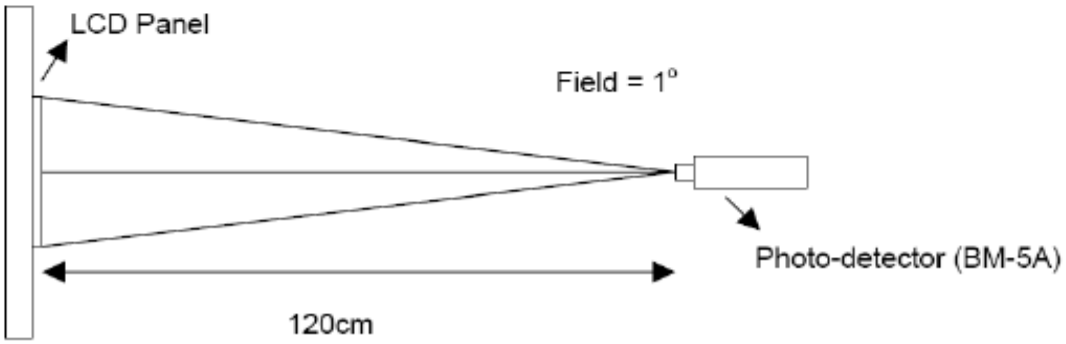
Note (2) Definition of Contrast Ratio (CR):
Measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Response Time: Sum of T_R and T_F

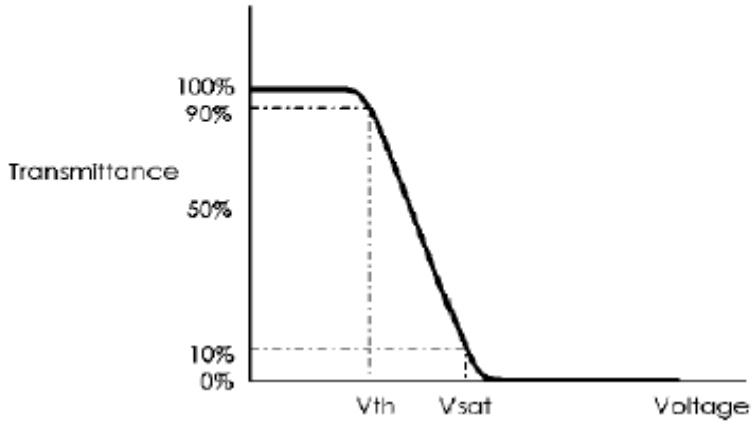


Note (4) Definition of optical measurement setup



Note (5) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction.

Note (6) Definition of Vsat and Vth (at 20°C)



2. Electrical Characteristics

2.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Core power supply	V_{DDD}	-0.5	-	1.8	V	
PLL power supply	V_{DDPLL}	-0.5	-	1.8	V	
LCD Interface power supply	V_{DDDLCD}	-0.5	-	4.6	V	
I/O power supply	V_{DDDIO}	-0.5	-	4.6	V	
Input Voltage	V_{IN}	-0.5	-	4.6		
Output Voltage	V_{OUT}	-0.5		4.6		
Operating temperature	T_{OP}	−20		+70	℃	
Storage temperature	T_{ST}	−30		+80	℃	

Note: Maximum ratings are those values beyond which damages to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics tables or Pin Description section This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that VIN and VOUT be constrained to the range VSS < (VIN or VOUT) < VDDIO. Reliability of operation is enhanced if unused input is connected to an appropriate logic voltage level (e.g., either VSS or VDDIO). Unused outputs must be left open. This device may be light sensitive. Caution should be taken to avoid exposure of this device to any light source during normal operation. This device is not radiation protected.

2.2 DC Electrical Characteristics

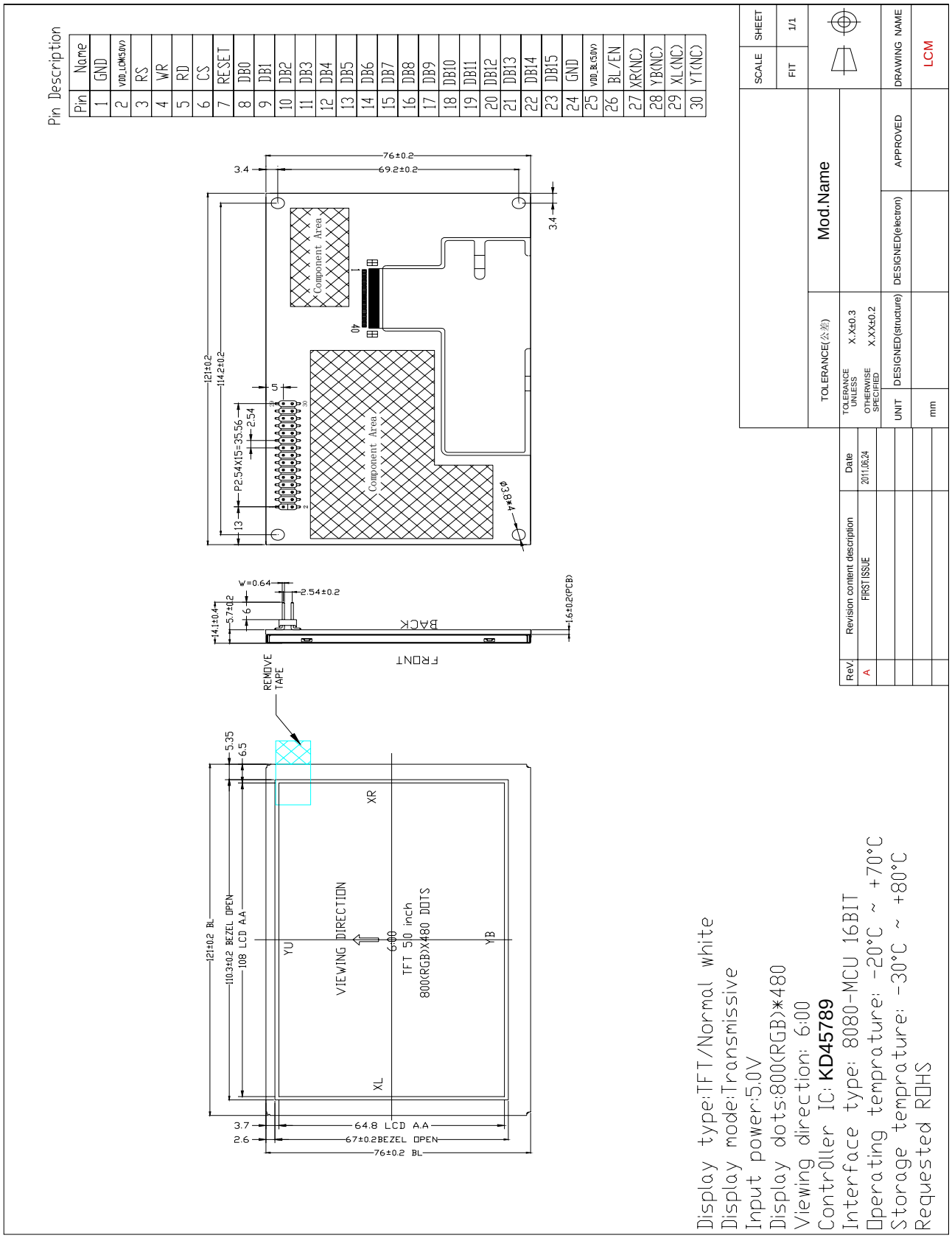
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
System voltage	Vcc	4.5	5.0	6	V	
Normal mode Current consumption	Vcc_I		350		mA	
Level input voltage	V_{IH}	0.8V_{DDIO}		–	V	
	V_{IL}	–		0.2V_{DDIO}	V	
Level output voltage	V_{OH}	0.8V_{DDIO}		–	V	
	V_{OL}	–		0.2V_{DDIO}	V	

2.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 6 chips White LED in series*2

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	–	40	–	mA	
Forward Voltage	V_F		19.2		V	–
LCM Luminance	L_V		250	–	cd/m2	
Uniformity	AVg	80	–	–	%	–

3. Outline dimension



4. Input terminal Pin Assignment

Pin NO.	Symbol	Typ	Function
1	GND	P	Ground.
2	VDD_LCM	P	Power supply for LCM
3	RS	I	Data/Command select.
4	WR	I	write strobe signal.
5	RD	I	read strobe signal.
6	CS	I	Chip select.
7	RESET	I	Master synchronize reset.
8-23	DB0-DB15	I/O	Data bus. Pins not used should be floating.
24	GND		Ground.
25	VDD_BL		Power supply for BL
26	BL/EN	I	Backlight Enable Control Input.
27	XR		Touch panel coordinate(Right)
28	YB		Touch panel coordinate(Down)
29	XL		Touch panel coordinate(Left)
30	YT		Touch panel coordinate(Up)

5. Operating Principle & Methods

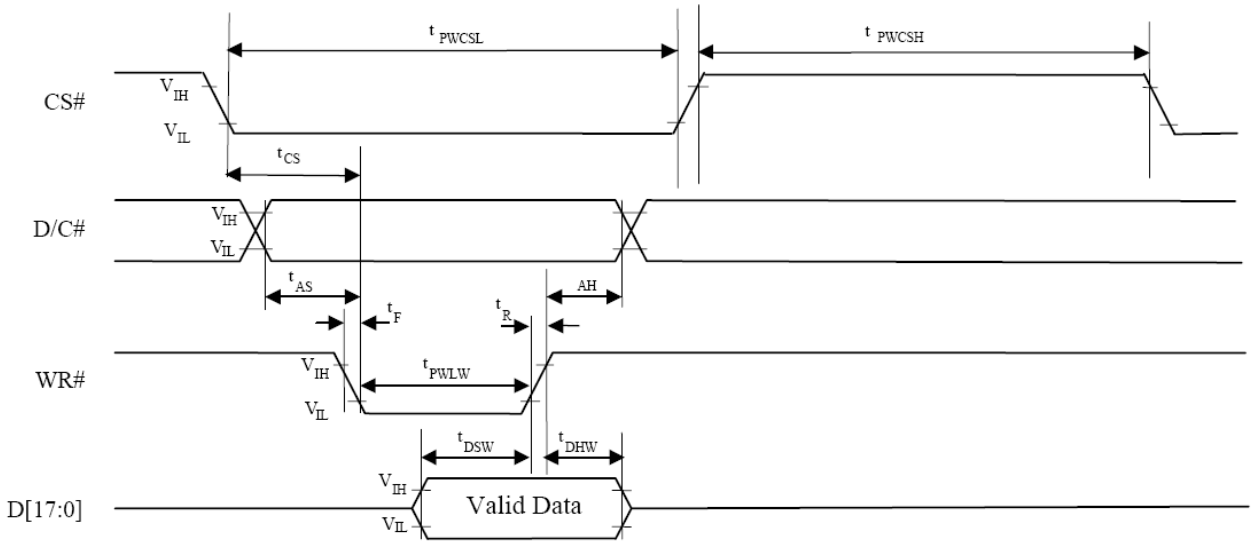
Please refer to SSD1963 datasheet for more details.80-System Bus operation Interface Timing Characteristics .

5.1 Parallel 8080-series Interface Timing Characteristics

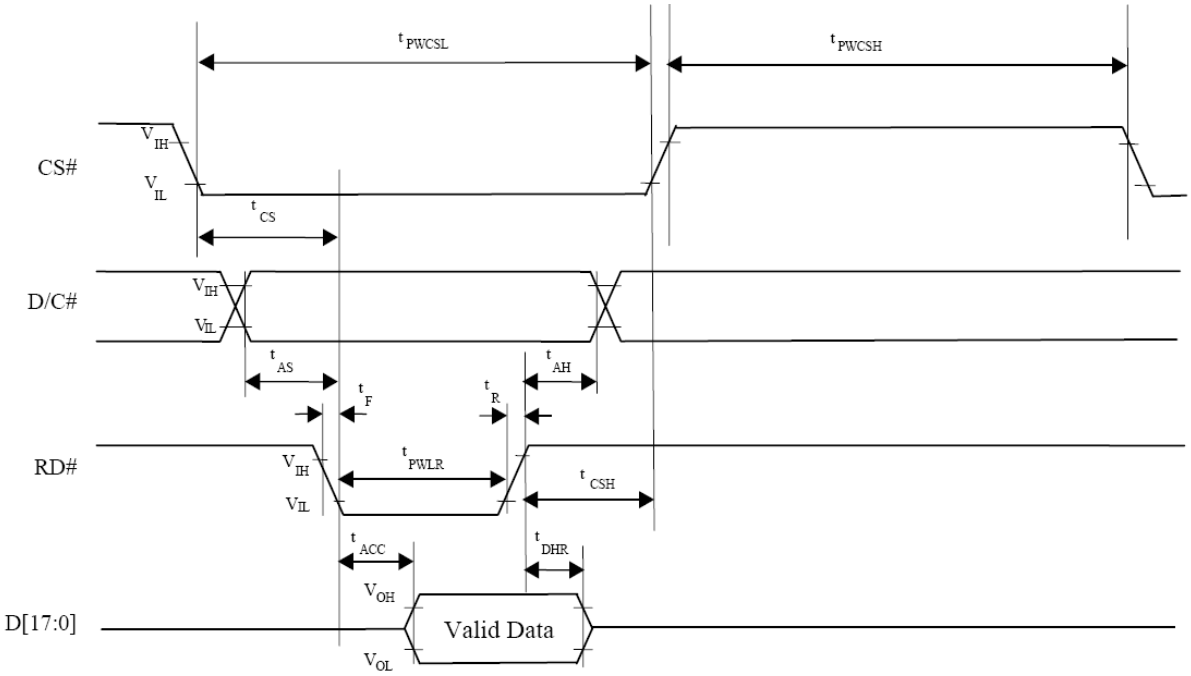
Symbol	Parameter		Min	Typ	Max	Unit
f_{MCLK}	System Clock Frequency*		1	-	110	MHz
t_{MCLK}	System Clock Period*		1/ f_{MCLK}	-	-	ns
t_{PWCSL}	Control Pulse High Width	Write Read	13 30	1.5* t_{MCLK} 3.5* t_{MCLK}	-	ns
t_{PWCSH}	Control Pulse Low Width	Write (next write cycle) Write (next read cycle) Read	13 80 80	1.5* t_{MCLK} 9* t_{MCLK} 9* t_{MCLK}	-	ns
t_{AS}	Address Setup Time		1	-	-	ns
t_{AH}	Address Hold Time		2	-	-	ns
t_{DSW}	Write Data Setup Time		4	-	-	ns
t_{DHW}	Write Data Hold Time		1	-	-	ns
t_{PWLW}	Write Low Time		12	-	-	ns
t_{DHR}	Read Data Hold Time		1	-	-	ns
t_{ACC}	Access Time		32	-	-	ns
t_{PWLR}	Read Low Time		36	-	-	ns
t_R	Rise Time		-	-	0.5	ns
t_F	Fall Time		-	-	0.5	ns
t_{CS}	Chip select setup time		2	-	-	ns
t_{CSH}	Chip select hold time to read signal		3	-	-	ns

* System Clock denotes external input clock (PLL-bypass) or internal generated clock (PLL-enabled)

5.2 Parallel 8080-series Interface Timing Diagram (Write Cycle)



5.3 Parallel 8080-series Interface Timing Diagram (Read Cycle)



6. Reliability Test Result

6.1 Condition

Item	Condition	Sample Size	Test Result	Note
Low Temperature Operating Life test	-20℃, 96HR	3ea	pass	-
Thermal Humidity Operating Life test	40℃, 90%RH, 96HR	3ea	pass	-
Temperature Cycle ON/OFF test	-20℃ ↔ 70℃, ON/OFF, 20CYC	3ea	pass	(1)
High Temperature Storage test	80℃, 96HR	3ea	pass	-
Low Temperature Storage test	－30℃, 96HR	3ea	pass	-
Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours	3ea	pass	
Box Drop Test	1 Corner 3 Edges 6 faces, 66㎝(MEDIUM BOX)	1box	pass	-

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

7. Cautions and Handling Precautions

7.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

7.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.

In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

8. LCD Module Out-Going Quality Level

11. LCD Module Out-Going Quality Level

(1.0) Purpose

The LCD specification provides outgoing provision and its expected quality level based on our outgoing inspection of LCD.

(2.0) Applicable Scope

The LCD specification is applicable to the arrangement in regard to outgoing Inspection and quality assurance after it.

(3.0) Quality Specification

(3.1) Quality Level

The quality level of BHL&BMDT are based on GB/T2828.1, Apply Level II, normal inspection by single sampling.

Rank	Item	AQL	Note
Major(MA)	Segment Short	0.65	
	Segment Missing		
	Solder Bridging		
	Outside Dimension		
	Cold Solder		
Minor (MI)	Black Spots, Foreign Substance, White Spots, Pinhole, Segment Deformation Air Bubbles between Glass & Polarizer, Scratchs(Glass & Polarizer), Color Variation, Solder Ball, Misalignment	1.0	

Note) AQL- Acceptable Quality Level

(3.2) Appearance Standards

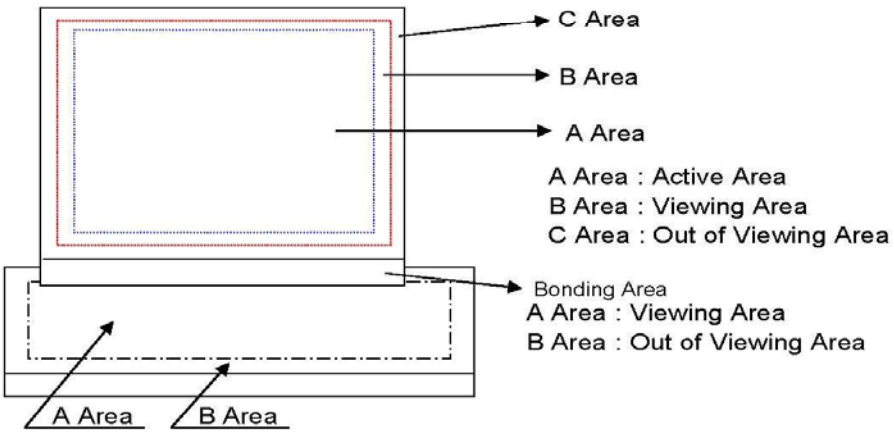
1) Inspection Conditions

The LCD shall be inspected under 20W white fluorescent lamp light.

The distance between the eyes and the sample shall be 30cm.

All directions for inspecting the sample should be within 3C° to perpendicular line.

2) Definition of the Area



(3.3) Apperance Spec

Y

X

No	Item	Criteria	Rank	Remark
1	Segment Short Segment Missing	Not allowed	MA	
2	Solder Bridging	Any bridging between components, except common circuit, is not allowed.	MA	
3	Outside Dimension	Drawing & specification must be within permitable tolerance.	MA	
4	Cold Solder	Cold solder is not allowed.	MA	
5	Black(White) Spots, Foreign Substances	1) Round Type 2) Liner Type At (1) & (2) total defect q'ty is must not exceed 5 pieces.	MI	** : Mean Diameter (X + Y)/2
6	OC Spot		MI	
7	Air Bubles Between Glass & Polarizer (Polarizer Defects)		MI	

1) Round Type

Area Dimension**	Acceptable Q'ty		Remark
	A Area	B Area	
≤ 0.1	Ignore		
≤ 0.2	2	Ignore	
≤ 0.3	1	Ignore	
0.3 <	0	Ignore	

2) Liner Type

Dimension		Acceptable Q'ty		Remark
Length	Width	A Area	B Area	
-	≤ 0.025	Ignore		
≤ 2.5	≤ 0.05	3	Ignore	
≤ 1.5	≤ 0.075	2	Ignore	
	0.075 <	Follow round type		

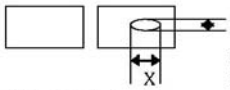
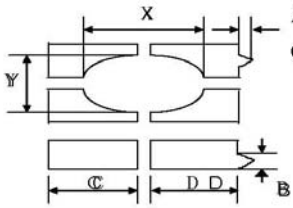
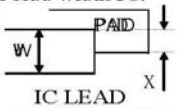
A Area B Area

At (1) & (2) total defect q'ty is must not exceed 5 pieces.

Area Dimension**	Acceptable Q'ty		Remark
	A Area	B Area	
≤ 0.2	Ignore		
≤ 0.8	3	Ignore	
≤ 1.0	1	Ignore	

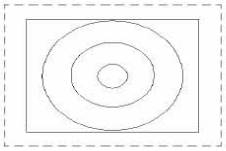
Area Dimension**	Acceptable Q'ty		Remark
	A Area	B Area	
≤ 0.15	Ignore		
≤ 0.3	3	Ignore	
≤ 0.5	2	Ignore	
≤ 0.7	1	Ignore	
Total	5	Ignore	

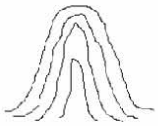
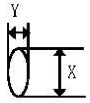
(3.3) Appearance Spec

No	Item	Criteria	Rank	Remark
8	Pin hole (On Segment)	 (X+Y)/2 ≤ 0.2㎜ Within 1 per one segment (Less than 0.1㎜ is not counted) Total defects q'ty is must not exceed 5 pieces.	MI	
9	Segment Deformation	 (X+Y)/2 ≤ 0.2㎜ A ≤ 0.2㎜ B ≤ 0.2㎜ (C-D) ≤ 0.2㎜ Each visible dot must be more than half effective dot area	MI	(X + Y)/2 ≤ 0.2㎜
10	Color Variation	Within the three colors, except LCD Standard color is acceptable.	MI	
11	Glass & Polarizer Scratch	Follow NO.5(2) condition	MI	
12	Solder Ball	1)Acceptable if the size of void is less than 0.18㎜ 2)Acceptable if a solder ball is not movable 3)Rejectable if the solder ball exceed 5EA in 2.54 × 2.54㎜ area.	MI	
13	Miss Alignment	1)Acceptable if it dose not exceed 50% of the lead width IC.  X ≤ W/2 : Accept X > W/2 : Reject 2)Rejectable, provided that it does exceed 50% of the component termination width.  W1 > W2 : Reject		

Note : A limitation sample is given top priority

(3.3) Appearance Spec

<table>
<tr><th>No</th><th>Item</th><th>Criteria</th><th>Rank</th><th>Remark</th></tr>
<tr><td>14</td><td>Touch Panel</td><td>
1) Round Type、Foreign Substances
<table>
<tr><th rowspan="2">Area
Dimension**</th><th colspan="2">Acceptable Q'ty</th><th rowspan="2">Remark</th></tr>
<tr><th>A Area</th><th>B Area</th></tr>
<tr><td>≤ 0.1</td><td colspan="2">Ignore</td><td rowspan="4"></td></tr>
<tr><td>≤ 0.2</td><td>2</td><td>Ignore</td></tr>
<tr><td>≤ 0.3</td><td>1</td><td>Ignore</td></tr>
<tr><td>0.3 <</td><td>0</td><td>Ignore</td></tr>
</table>
2) Liner Type & Scratch
<table>
<tr><th colspan="2">Dimension</th><th colspan="2">Acceptable Q'ty</th><th>Remark</th></tr>
<tr><th>Length</th><th>Width</th><th>A Area</th><th>B Area</th><th></th></tr>
<tr><td>-</td><td>W≤0.025</td><td colspan="2">Ignore</td><td rowspan="5">Ignore</td></tr>
<tr><td>L≤3.0</td><td rowspan="2">W≤0.05</td><td colspan="2">Ignore</td></tr>
<tr><td>3.0<L≤5.0</td><td colspan="2">2</td></tr>
<tr><td>≤ 7</td><td>W≤0.1</td><td colspan="2">1</td></tr>
<tr><td>-</td><td>W>0.1</td><td colspan="2">Follow round type</td></tr>
</table>
4) Newton Ring
a)Regular

The area of the Newton ring is more than 1/3area of the touch panel It's NG.
The area of the Newton ring is less than 1/3 area of the touch panel It's OK.

b)None-regularity

The area of the Newton ring is more than 1/2area of the touch panel It's NG.
The area of the Newton ring is less than 1/2 area of the touch panel It's OK.
</td><td>MI</td><td>


** : Mean Diameter (X + Y)/2
</td></tr>
</table>

9. BHL&BMDT Customer Quality Service Process

12. **BHL&BMDT Customer Quality Service Process**

In order to provide better service to Customer, BHL&BMDT shall apply the after-sales product quality service process as below:

1. According to the P/O from Customer, BHL&BMDT should deliver required product to the place appointed by Customer.
2. Customer will do IQC for the incoming procuct.
3. Inspection standard should be provided by BHL&BMDT, and it will be valid after confirmed by Customer.Inspection and Defects determination should be carried out according to the standard agreed by both Parties.
4. In order to guarantee in-time communication of product quality information and effective service, QA staff on Customer side should send Weekly Quality Report to the appointed CS staff in BHL&BMDT.
5. After BHL&BMDT get related information, both sides should arrange time and place to determin the defects found by Customer.
6. BHL&BMDT should cooperate with Customer for special quality requirement.
7. After confirmed by both side, BHL&BMDT should be responsible for the defect products which caused by its quality problem. BHL&BMDT should take back the confirmed defect product and return the good product to the place required by customer.
8. BHL&BMDT agree to provide related training of LCD product technology and usage.
9. Customer should use the LCD product according to the instruction. BHL&BMDT will not be responsible for the defect product caused by violation of Users' Instruction.
10. Both parties should deal with the quality problem with friendly cooperative policy. And both parties should negotiate to deal with the defect products of which the responsibility is not very clear.

10. LCD Module Operation Instruction

13. LCD Module Operation Instruction

BHL&BMDT

Part I. How to use the LCD Module

1. Don't hit the LCD Panel in any way because the LCD is made of glass.
2. Don't clean the surface of LCD with hard things. Please clean LCD with Air-gun or very soft cloth when necessary. The protective film on the POL can be removed just before assembly, otherwise, dust, spit or other foreign matter may attached on the LCD under the protective film. After the protective film is removed, only air-gun can be used to remove any dust or foreign matter. Fingure or cloth MUST NOT be used in such cases.
3. No chemical liquid is allowed to clean the LCD, such as alcohol, acetone and IPA. All of these can damage the LCD. Water on the LCD must be cleaned as soon as possible, for it will cause POL color change or other defect.
4. Please move and assemble LCD very carefully during assembly, and don't push or twist it.
5. Don't damage the FPC of LCD module. It will cause permanent defect.
6. Don't disassemble LCD module. It will cause permanent defect.
7. Don't expose LCD module under sunshine, strong fluorescence or ultraviolet radiation.
8. Please make sure that operators wear static-protective bands effectively and working tables are effectively earthing during operation.
9. Please place LCD module on the tray provided by BHL&BMDT while moving it, in order to avoid mechanical damage. Hold the module's side frames to avoide damage during moving.
10. Don't twist, disassemble, squeeze or hit the PCB. It will damage the circuit or component on PCB and cause functional defect.
11. Please use the connector according to the instruction provided by BHL&BMDT.
12. Please place dual module with the sub-panel upward. Trays should be placed in contrary direction. An empty tray should be placed on the top.
13. Sealing operation on PCB must be very careful to avoid short or cut the original circuit on PCB. Otherwise, it will cause permenant damage to the LCD.
14. Don't add direct DC or high voltage to LCD panel. It will cause functional damage to the LCD or shorten the life of LCD product.
15. LCD may respond slowly or display abnormally in extrem temperature (lower than -20℃ or higher than 50℃). But this doesn't mean LCD functional defect. LCD will display normally in regular temperature. Therefore, don't use LCD product in extrem temperature.
16. Don't push the display area of LCD panel, it will cause abnormal display. This doesn't mean LCD functional defect, neither. LCD will display normally in regular temperature.
17. Electrical test of LCD product is made by using mobile phone provided by Customer. We can use special test equipment to do the test, also.
18. The black band on IC on LCD product is used to protect the IC from light. Please do NOT remove it.
19. Please take great care to use connector. Customer should be responsible for connector defect caused by operation on Customer side.

Part II Storage

1. Physical status of liquid crystal will change in extrem temperature, and it can not be resumed when the temperature returns to be normal. So LCD module should be stored in required temperature.
2. LCD module should be stored in required humidity. Low hymidity may add static, while high humidity may corrode the ITO circuit of LCD product. The suitable storage environment is: temperature: 22±5℃, humidity: 55%±10%.
3. Don't expose LCD module under sunshine, strong fluorescence or ultraviolet radiation for a long time. It should be stored in dark area.
4. LCD should be stored in static-protective polythene bag. Don't expose it in the air for a long time.