APPROVAL

PART NO.	DESCRITION	REMARKS
HT2204L	**LCD MODULE** (240 × RGB × 320 Dots)	**This is ROHS compliant**

CUSTOMER APPLICATION P/N	
APPROVED BY	
DATE	

PLEASE KINDLY FIND AND APPROVE THE SPECIFICATIONS INSERTED
HEREIN AND RETURN ONE COPY HERE OF WITH YOUR SIGNATURE OF APPROVAL.

PERPARED BY	CHECKED BY	CONFIRMED BY

HYES Optoelectronics, Inc.
2000 Wyatt Drive Suite 6
Santa Clara, CA 95054 USA

REVISION HISTORY

Date	Rev. No.	Page	Summary
Apr. 18, 2008	-	ALL	- 1'st Issue

CONTENTS

1. Basic Specfications

1.1 Display Specifications

Item	Description	Note
Resolution	240 × RGB × 320	
Display mode	TFT, Normally White, Transmissive	262K Color
Viewing direction	6 O'clock	
Driving method	720Ch-Source, 320Ch-Gate	
Backlighting	LED, White (4 chips in Serial)	
Diver IC	R61505U, COG	
Others	8/9/16/18-Bit, 80-Series	

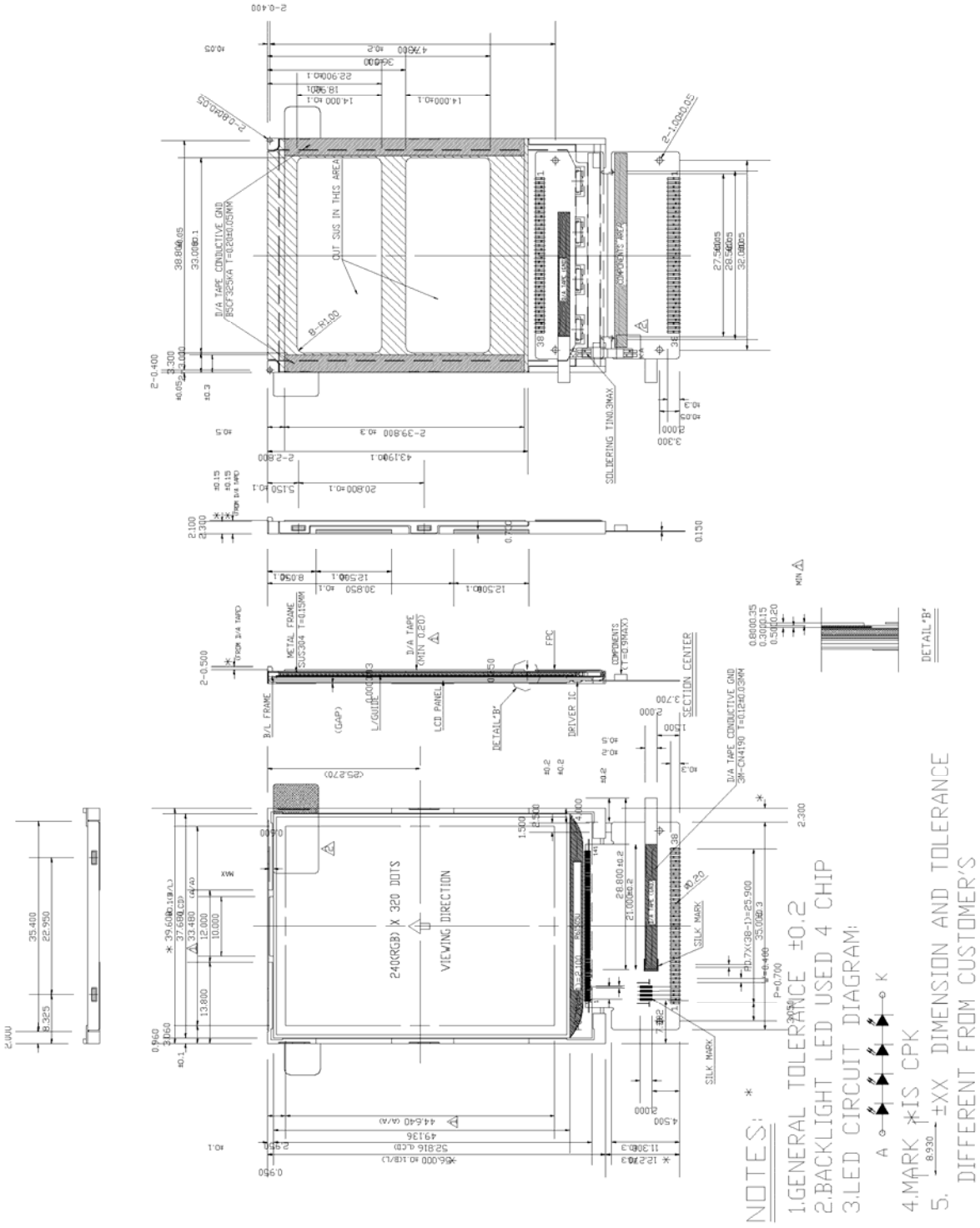
1.2 Mechanical Specifications

Item	Specification	Unit
Module Size (W × H × T)	39.6 × 56.0 × 2.30	mm
Viewing Area (W × H)	-	mm
Active Area (W × H)	33.48 × 44.64	mm
Dot Size (W × H)	0.037 × 0.131	mm
Dot Pitch (W × H)	0.047 × 0.141	mm
Weight	About 9	g

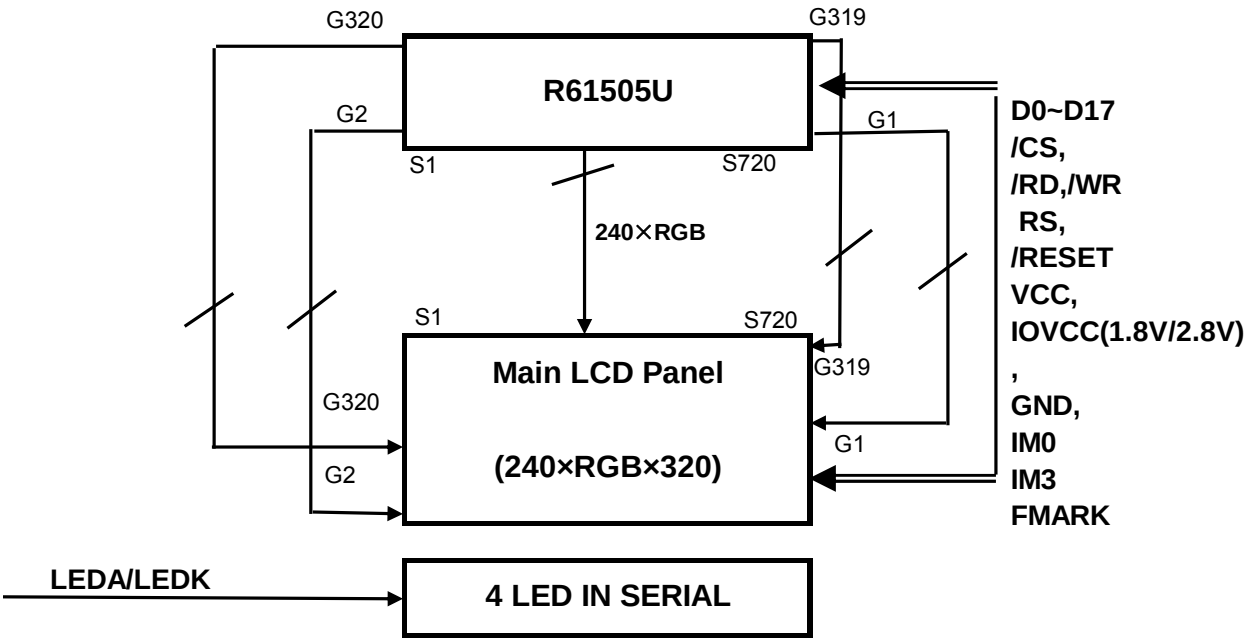
1.3 Outline Dimension

FPC CONNECTION

1	GND
2	XL
3	YD
4	XR
5	YU
6	GND
7	LCM_ID
8	VCC&VCI
9	IOVCC
10	FMARK
11	/CS
12	RS
13	/WR
14	/RD
15	DB00
16	DB01
17	DB02
18	DB03
19	DB04
20	DB05
21	DB06
22	DB07
23	DB08
24	DB09
25	DB10
26	DB11
27	DB12
28	DB13
29	DB14
30	DB15
31	DB16
32	DB17
33	/RESET
34	IM3
35	IM0
36	LEDA
37	LEDK
38	GND

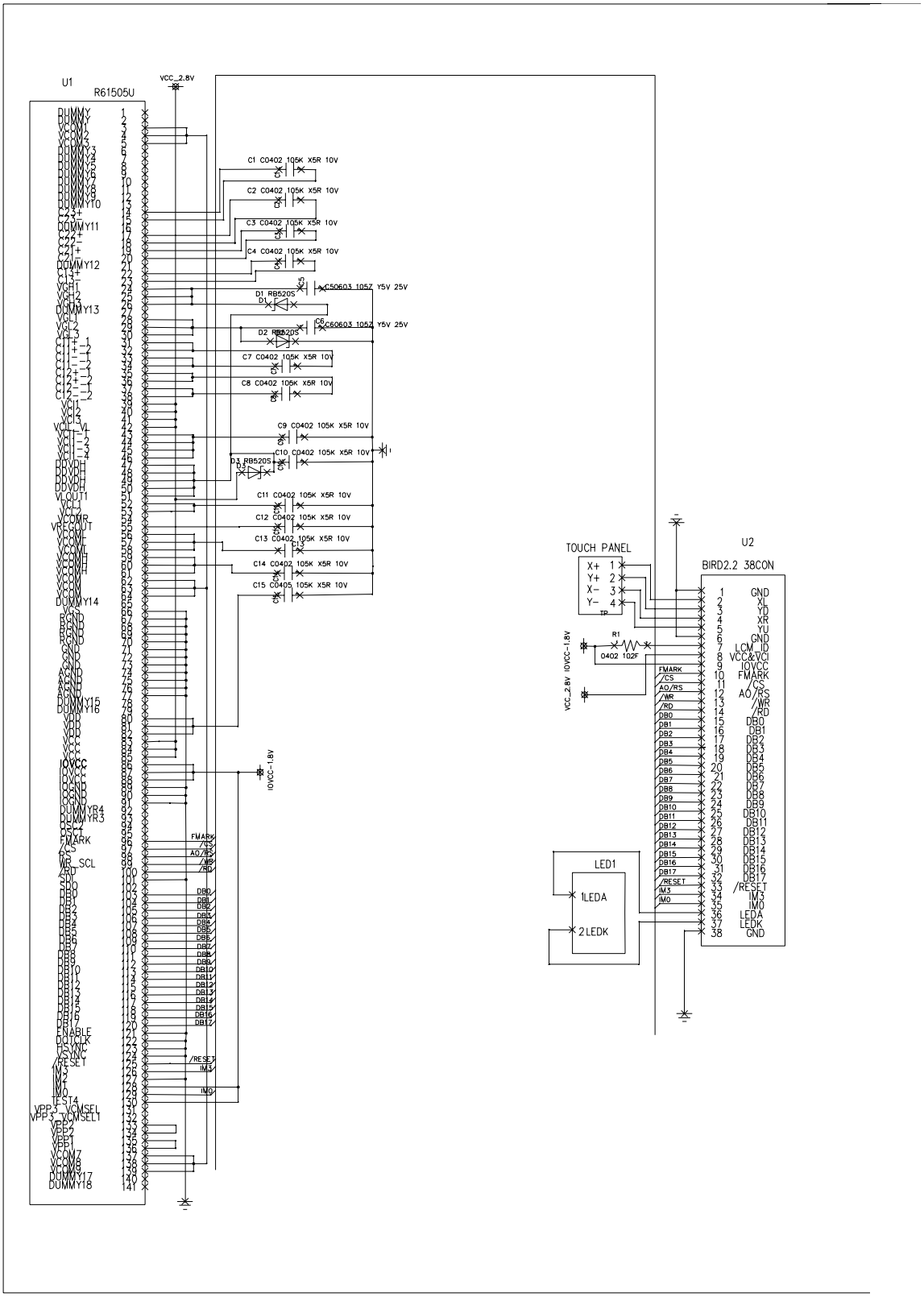


1.4 Block Diagram



IM3	IM0	Interface	Databus
0	0	16-bit interface	DB17-10 , DB8-1
0	1	8-bit interface	DB17-10
1	0	18-bit interface	DB17-0
1	1	9-bit interface	DB17-9

1.5 Schematic



2. Electrical Characteristics

2.1 Absolute Maximum Ratings

Item		Symbol	Value			Unit	Condition	Remark
			Min.	Typ.	Max			
Supply Voltage Range	Logic	Vcc	-0.3	-	5.0	V	Ta =25℃	
	LCD	VGH-VGL	-0.3	-	35	V	Ta =25℃	
			-	-	-	V	Ta =26℃	
Input Voltage		V_{IN}	-0.3	-	VCC	V	Ta =25℃	

2-2 Environmental Conditions

Item	Symbol	Min.	Max.	Unit
Operating temperature	Topr	-20	70	℃
Storage temperature	Tstg	-30	80	℃
Humidity (Ambient temperature=Ta)	Ta ≤ 60℃		90% RH max.	

2-3 DC Characteristics

Items		Symbol	Spec. Value			Unit	Condition
			MiN.	Typ.	Max.		
Operating voltage	Logic	VCC	2.72	2.8	2.88	V	
		IOVCC	1.78	1.8	1.83	V	
	GATE	VGH-VGL	18	-	26	V	Note 1)
Supply current		ICC	-	6.0	9.0	mA	Note 2)
Input voltage	High level	V_{IH}	0.8 × IOV_{CC}	-	IOV_{CC}	V	-
	Low level	V_{IL}	-0.3	-	0.2 × IOV_{CC}	V	-

Note 1) The value can be adjusted by software to optimize display quality

Note 2) Display White

3. Optical Characteristics

Transmissive mode

(Ta = 25℃)

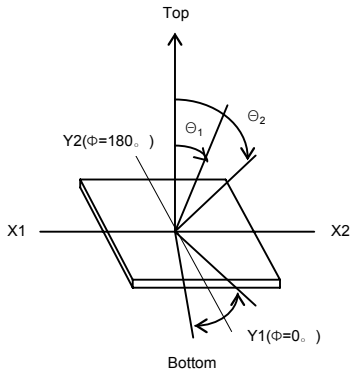
Item		Symbol		Min.	Typ.	Max.	Unit	Condition	Note
Viewing		θ2-θ1	Ø=0 (Y1-Y2)	60	70	-	Deg	Cr > 10	
			Ø=90 (X1-X2)	80	90	-			
Contrast ratio		Cr		200	300	-	-	θ = 0 Ø = 0	
Response Time		Tr + Tf		-	25	40	ms	θ = 0 Ø = 0	
CIE Coordi - nate	R	(x,y)		0.58, 0.30	0.63, 0.35	0.68, 0.40		θ = 0 Ø = 0	
	G	(x,y)		0.28, 0.55	0.33, 0.60	0.38, 0.65			
	B	(x,y)		0.09, 0.03	0.14, 0.08	0.19, 0.13			
	W	(x,y)		0.24, 0.25	0.29, 0.30	0.34, 0.35			
Brightness		L		200	240	-	cd/m2	18mA/LED	
Uniformity				70	-	-			

* Ø = 0˚, Ø = 90˚ means viewing direction.

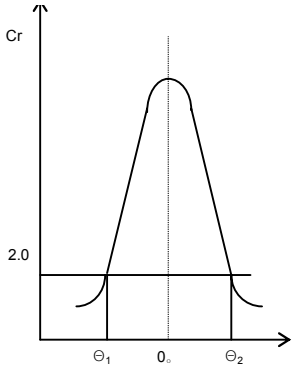
* B/L is turned on.

* Remark : as for contrast ratio, it is measured in panel only.

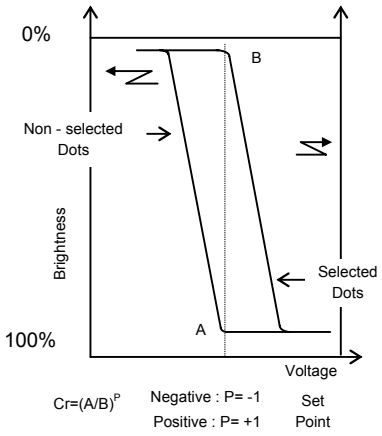
Note 1 . Definition of angle Θ and Φ



Note 2. Definition of viewing angle Θ_1 and Θ_2

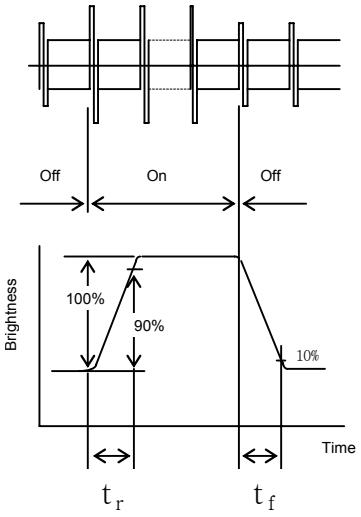


Note 3. Definition of contrast Cr

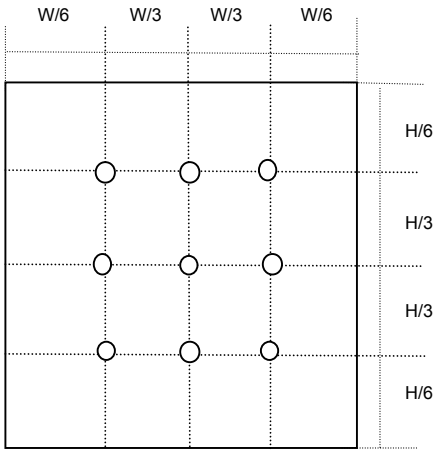


Lens Ø = 3mm

Note 4. Definition of Optical response



Note 5. Measuring Point(9 POINTS) (WxH)



Rating is defined as the average brightness inside the viewing area

4. Interface Pins

no	symbol	Description
1	GND	GND
2	XL	Touch panel X-
3	YD	Touch panel Y-
4	XR	Touch panel X+
5	YU	Touch panel Y+
6	GND	GND
7	LCM_ID	Connect a 1K Resistor to IOVCC(1.8V/2.8V)
8	VCC&VCI	VCC(2.8V)
9	IOVCC	IOVCC(1.8V/2.8V)
10	FMARK	Frame head pulse signal
11	/CS	Chip select signal(low active)
12	RS	RS Signal (RS=0 : Contro,RS=1 : data)
13	/WR	Write Signal (low active)
14	/RD	Read Signal(low active)
15	DB0	Data Bit0
16	DB1	Data Bit1
17	DB2	Data Bit2
18	DB3	Data Bit3
19	DB4	Data Bit4
20	DB5	Data Bit5
21	DB6	Data Bit6
22	DB7	Data Bit7
23	DB8	Data Bit8
24	DB9	Data Bit9
25	DB10	Data Bit10
26	DB11	Data Bit11
27	DB12	Data Bit12
28	DB13	Data Bit13
29	DB14	Data Bit14
30	DB15	Data Bit15
31	DB16	Data Bit16
32	DB17	Data Bit17
33	/RESET	RESET signal(low active)
34	IM3	system interface control
35	IM0	system interface control
36	LEDA	LED Anode
37	LEDK	LED Cathode
38	GND	GND

5. Backlight Specfication (LED Unit)

Item	Symbol	Spec. Value			Unit	Condition
		Min.	Typ.	Max.		
Real Current	I_{LED}	-	18	20	mA	note 1.
Power dissipation	P_D	-	-	300	mW	note 2.
Operation temp.	Topr	- 20 ~ 70			℃	-
Storage temp.	Tstr	- 30 ~ 80			℃	-

Note 1. B/L: 4EA LED in Serial, the typical current is 20mA (full brightness).

Note2. Total power consumpation(max) depends on LED current/ LED driver efficiency, etc.

6. Recommended Software Setting Values (Initial code)

LDI :R61505U

REG NO	VALUE
0007	0000
0012	0000（DALAY 20)ms
00A4	0001（DALAY 20)ms
0060	2700
0008	0404
0030	0307
0031	0303
0032	0303
0033	0202
0034	0202
0035	0202
0036	1F1F
0037	0303
0038	0303
0039	0303
003A	0202
003B	0102
003C	0204
003D	0000
0007	0001
0017	0001
0010	17B0
0011	0007（DALAY 50)ms
0029	0010
0012	0119
0013	1000
0012	0139（DALAY 20)ms
0001	0100
0002	0700
0003	1030
0004	0000
0009	0000
000A	0008
000C	0000
000D	0000
0015	2203
0050	0000
0051	00EF
0052	0000
0053	013F

REG NO	VALUE
0061	0001
0090	0010
0092	0100
0093	0001(DALAY 20)ms
0007	0021
0007	0061(DALAY 20)ms
0007	0063
0007	0173
0017	0000
0022	

Deep standby on sequence

display off sequence	
0007	0072(DALAY 20)ms
0007	0001(DALAY 20)ms
0007	0000
set deep standby mode	
0010	0004

Deep standby off sequence

exit deep standby mode	
cs=low 6 times	
00A4	0001(DALAY 20)ms
call initial code	

Power supply off sequence

0010	0780
0011	0067
0012	0109(DALAY 20)ms
0010	0700

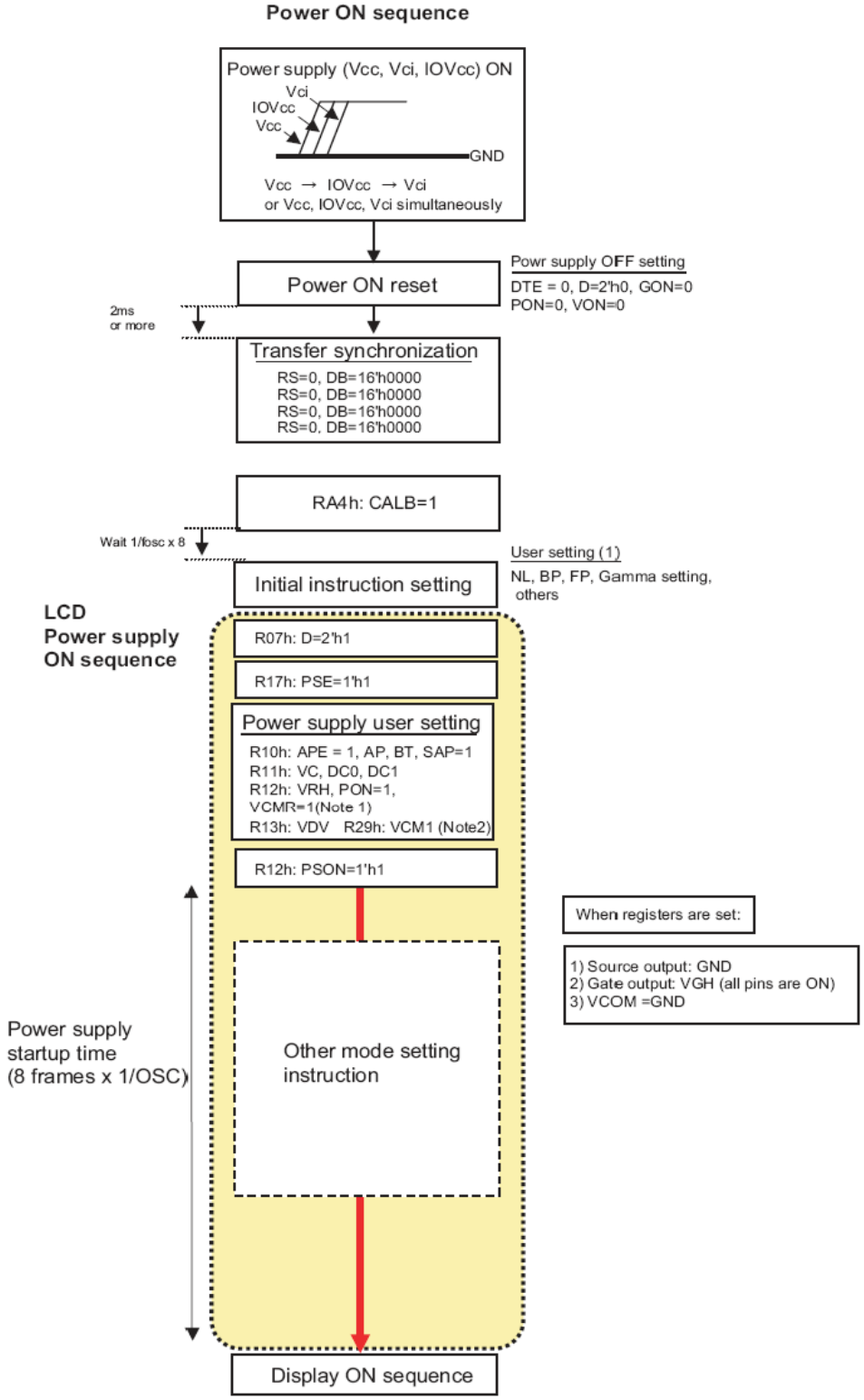
Partial display sequence

0080	0020(1st display area)
0081	0020(1st display area)
0082	0050(1st display area)
0083	0070(2st display area)
0084	0070(2st display area)
0085	00FF(2st display area)
partial display on	
0007	3073
partial display off	
0007	0173

NOTE: HYES requires the customer to follow the above instructions strictly. If customer would like to change the above instructions, the customer should inform HYES and get re-check from HYES, or the customer will be responsible for any unexpected result because of the change.

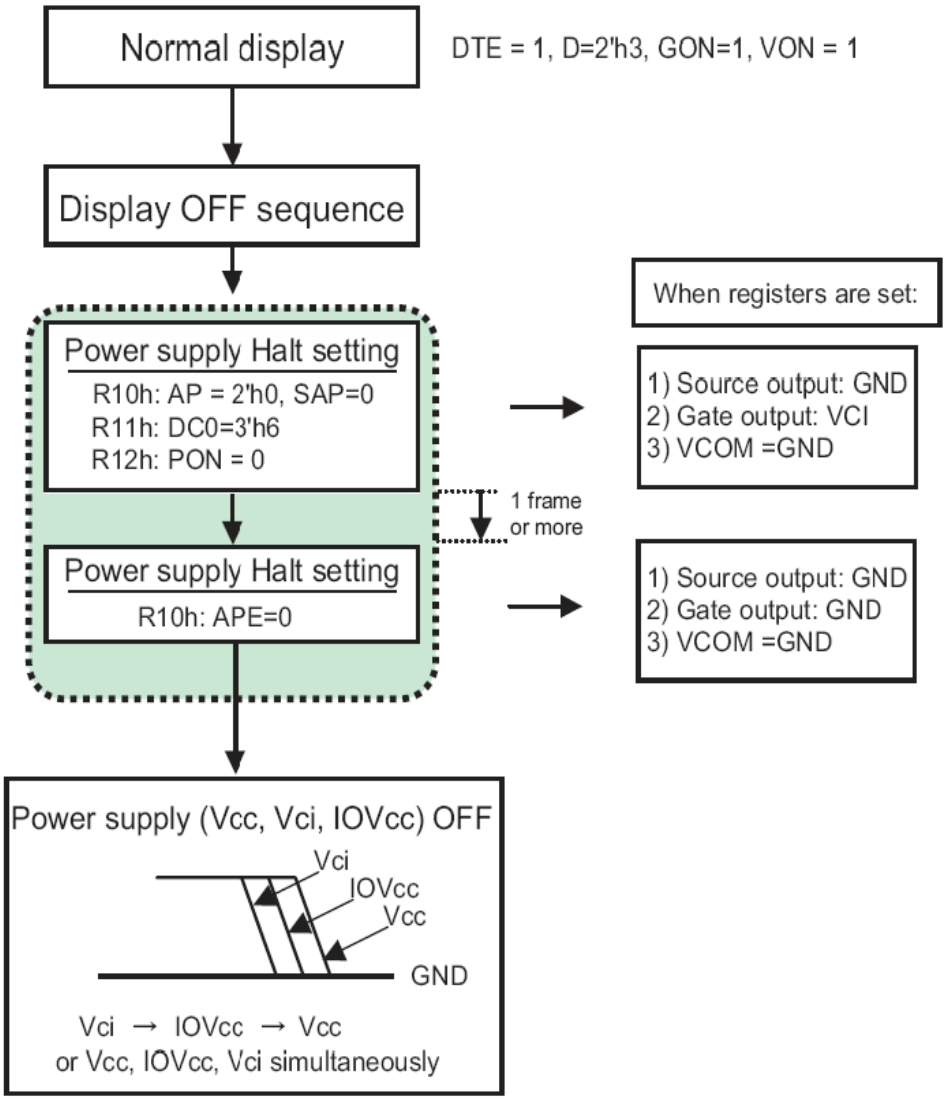
7. Power Supply Sequence

7.1 Power Supply On/Off Sequence



7.2 Off Sequence

Power supply OFF sequence



8. Read/Write Timing characteristics (80 series MPU)

1）Read/Write Timing

2. 80-System Bus Interface Timing Characteristics (18-/ 16- bit interface)

Table 94 Normal write operation (HWM=0), IOVCC=1.65V~3.30V

Item		Symbol	Unit	Timing Diagram	Min.	Typ.	Max.
Bus cycle time	Write	tCYCW	ns	Figure 98	125	–	–
	Read	tCYCR	ns	Figure 98	450	–	–
Write low-level pulse width		PWLW	ns	Figure 98	45	–	–
Read low-level pulse width		PWLR	ns	Figure 98	170	–	–
Write high-level pulse width		PWHW	ns	Figure 98	70	–	–
Read high-level pulse width		PWHR	ns	Figure 98	250	–	–
Write / Read rise/ fall time		tWRr, WRf	ns	Figure 98	–	–	25
Setup time	Write (RS to CS*, WR*)	tAS	ns	Figure 98	0	–	–
	Read (RS to CS*, RD*)		ns	Figure 98	10	–	–
Address hold time		tAH	ns	Figure 98	2	–	–
Write data setup time		tDSW	ns	Figure 98	25	–	–
Write data hold time		tH	ns	Figure 98	10	–	–
Read data delay time		tDDR	ns	Figure 98	–	–	150
Read data hold time		tDHR	ns	Figure 98	5	–	–

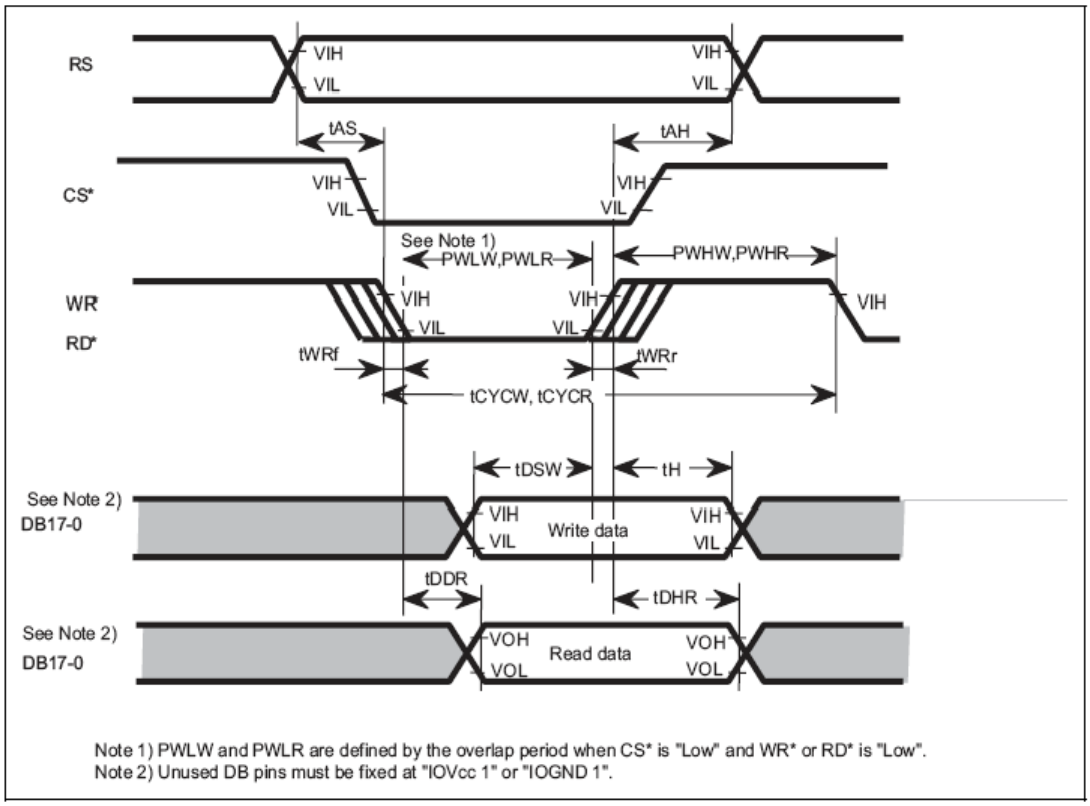


Figure 98 80-System Bus Interface

Reset Timing characteristics

5. Reset Timing Characteristics (IOVCC=1.65~3.30V)

Table 98

Item	Symbol	Unit	Timign Diagram	Min.	Typ.	Max.
Reset low-level width	tRES	ms	Figure 100	1	–	–
Reset rise time	trRES	μs	Figure 100	–	–	10

Reset Operation

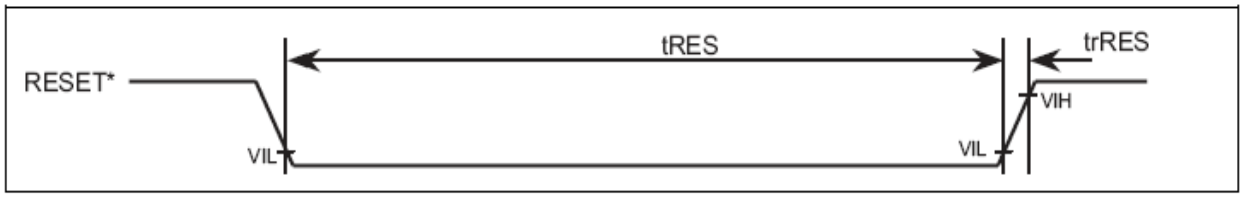


Figure 100 Reset Operation

9. 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 HYES are based on GB/T2828.1, Apply Level II, normal inspection by single sampling.

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

Note) AQL- Acceptable Quality Level

(3.2) Appearance Standards

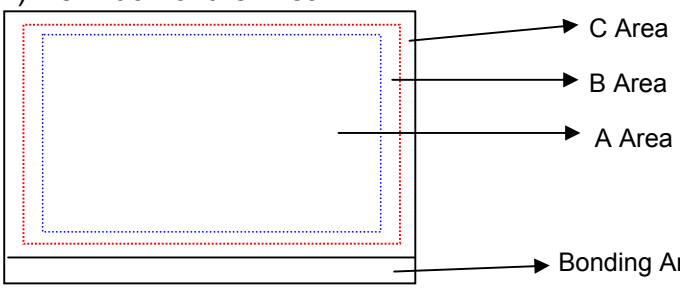
1) Inspection Conditions

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

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

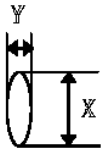
All directions for inspecting the sample should be within 30° to perpendicular line.

2) Definition of the Area



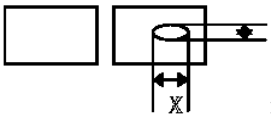
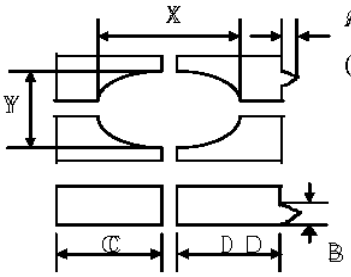
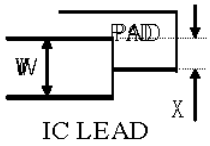
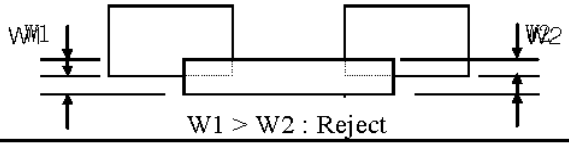
A Area : Active Area
B Area : Viewing Area
C Area : Out of Viewing Area

(3.3) Apperance Spec

<table>
<tr><th>No</th><th>Item</th><th>Criteria</th><th>Rank</th><th>Remark</th></tr>
<tr><td>1</td><td>Segment Short
Segment Missing</td><td>Not allowed</td><td>MA</td><td></td></tr>
<tr><td>2</td><td>Solder Bridging</td><td>Any bridging between components,
except common circuit, is not allowed.</td><td>MA</td><td></td></tr>
<tr><td>3</td><td>Outside Dimension</td><td>Drawing & specification must be within
permitable tolerance.</td><td>MA</td><td></td></tr>
<tr><td>4</td><td>Cold Solder</td><td>Cold solder is not allowed.</td><td>MA</td><td></td></tr>
<tr><td>5</td><td>Black(White)
Spots, Foreign
Substances</td><td>1) Round Type
<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></td></tr>
<tr><td>≤ 0.2</td><td>2</td><td>Ignore</td><td></td></tr>
<tr><td>≤ 0.3</td><td>1</td><td>Ignore</td><td></td></tr>
<tr><td>0.3 <</td><td>0</td><td>Ignore</td><td></td></tr>
</table>
2) Liner Type
<table>
<tr><th colspan="2">Dimension</th><th colspan="2">Acceptable Q'ty</th><th rowspan="2">Remark</th></tr>
<tr><th>Length</th><th>Width</th><th>A Area</th><th>B Area</th></tr>
<tr><td>-</td><td>≤ 0.025</td><td colspan="2">Ignore</td><td></td></tr>
<tr><td>≤ 2.5</td><td>≤ 0.05</td><td>3</td><td>Ignore</td><td></td></tr>
<tr><td>≤ 1.5</td><td>≤0.075</td><td>2</td><td>Ignore</td><td></td></tr>
<tr><td></td><td>0.075 <</td><td colspan="2">Follow round type</td><td></td></tr>
</table>
At (1) & (2) total defect q'ty is must not exceed 5 pieces.</td><td>MI</td><td rowspan="3"> 

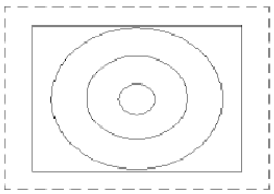
** : Mean Diameter (X + Y)/2</td></tr>
<tr><td>6</td><td>OC Spot</td><td>
<table>
<tr><th rowspan="2">Area
Dimension***</th><th colspan="2">Acceptable Q'ty</th><th rowspan="2">Remark</th></tr>
<tr><th>A Area</th><th>B Area</th></tr>
<tr><td>≤ 0.2</td><td colspan="2">Ignore</td><td></td></tr>
<tr><td>≤ 0.8</td><td>3</td><td>Ignore</td><td></td></tr>
<tr><td>≤ 1.0</td><td>1</td><td>Ignore</td><td></td></tr>
</table></td><td>MI</td></tr>
<tr><td>7</td><td>Air Bubles
Between Glass &
Polarizer
(Polarizer Defects)</td><td>
<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>≤ 0.15</td><td colspan="2">Ignore</td><td></td></tr>
<tr><td>≤ 0.3</td><td>3</td><td>Ignore</td><td></td></tr>
<tr><td>≤ 0.5</td><td>2</td><td>Ignore</td><td></td></tr>
<tr><td>≤ 0.7</td><td>1</td><td>Ignore</td><td></td></tr>
<tr><td>Total</td><td>5</td><td>Ignore</td><td></td></tr>
</table></td><td>MI</td></tr>
</table>

(3.3) Appearance Spec

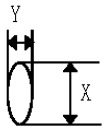
No	Item	Criteria	Rank	Remark
8	Pin hole (On Segment)	 (X+Y)/2 ≤ 0.2㎜ Within 1 per one segment (Less than 0.1㎜ is not counted) Total defects q'ty is must not exceed 5 pieces.	MI	
9	Segment Deformation	 (X+Y)/2 ≤ 0.2㎜ A ≤ 0.2㎜ B ≤ 0.2㎜ (C-D) ≤ 0.2㎜ Each visible dot must be more than half effective dot 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 IC LEAD 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 rowspan="2">Remark</th></tr>
<tr><th>Length</th><th>Width</th><th>A Area</th><th>B Area</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>

(4.0) Reliability Condition

Item	Content
Room Temperature Operation	50,000 hrs

(4.1) Reliability Test - Module Middle Reliability

No.	Item	Condition	Test Time	Sample Numbers	Creteria (Acc/Rej)	Note
1	High Temp Operation	70 ± 2℃	120 hrs	3	0/1	
2	Low Temp Operation	-20 ± 2℃	120 hrs	3	0/1	
3	High Humidity Storage	60℃ 90%rh	120 hrs	3	0/1	
4	Thermal Shock	30mn stage -20℃ ↔70℃	100 cycles /6days	3	0/1	

(4.2) Criteria

a. No changes for indication and appearance.

b. Leave the all samples under roon temperature 4 hours after reliability test ends.

10. LCD Module Operation Instruction

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 candamage 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 HYES 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 HYES.
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 whenthe 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.