

# APPROVAL

PART NO.	DESCRIPTION	REMARKS
<b>HT1802L</b>	<b>LCD MODULE</b> (128 x RGB x 160 Dots)	<b>This is ROHS compliant</b> LGPD4513

CUSTOMER APPLICATION P/N	
APPROVED BY	
DATE	

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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



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## 1. Basic Specifications

### 1.1 Display Specifications

Item	Description	Note
Resolution	128 × RGB × 160	
Display mode	a-Si TFT, Normally White, Transmissive	262K Color
Viewing direction	6 O'clock	
Driving method	384Ch-Source, 160Ch-Gate	
Backlighting	LED, White (2 chips in Serial)	
Diver IC	LGPD4513, COG	
Others	80-Series, 8-Bit Parallel Data	

### 1.2 Mechanical Specifications

Item	Specification	Unit
Module Size (W × H × T)	34.0 × 47.2 × 2.5	mm
Viewing Area (W × H)	-	mm
Active Area (W × H)	28.032 × 35.04	mm
Dot Size (W × H)	-	mm
Dot Pitch (W × H)	0.073 × 0.219	mm
Weight	About 6	g

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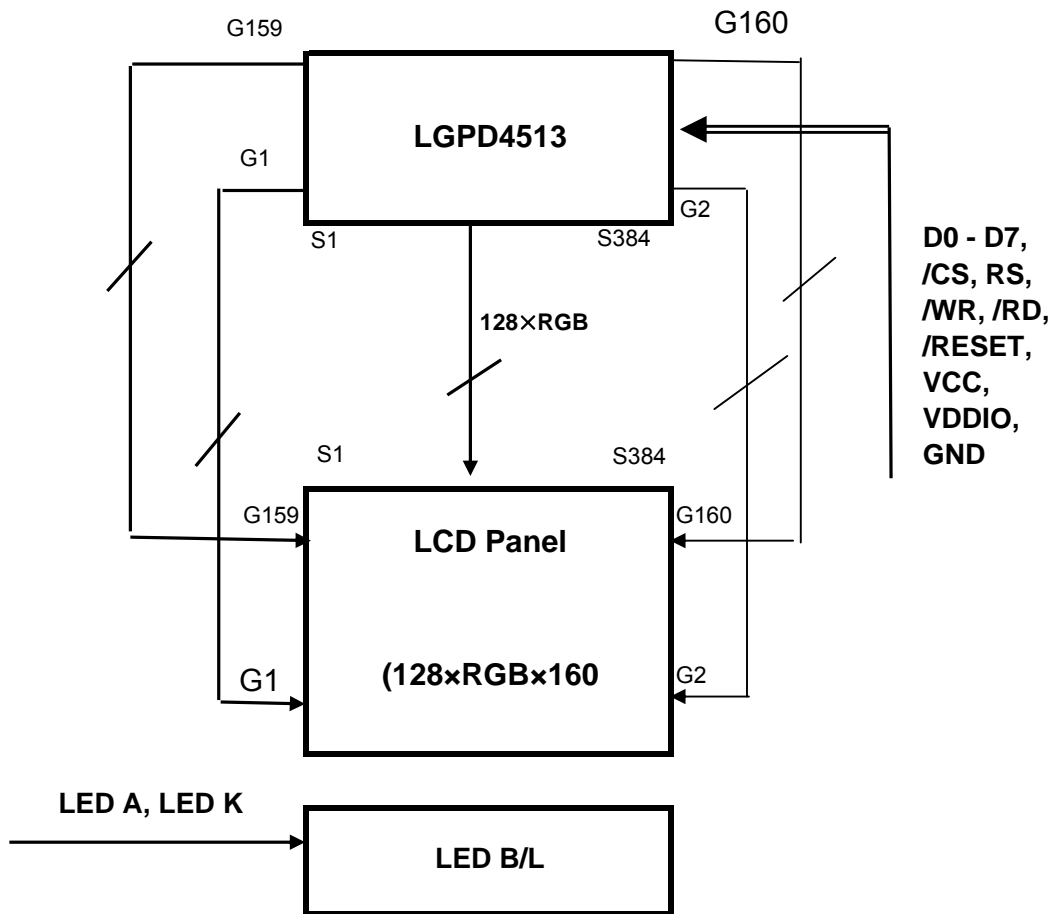
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## 1.4 Block Diagram



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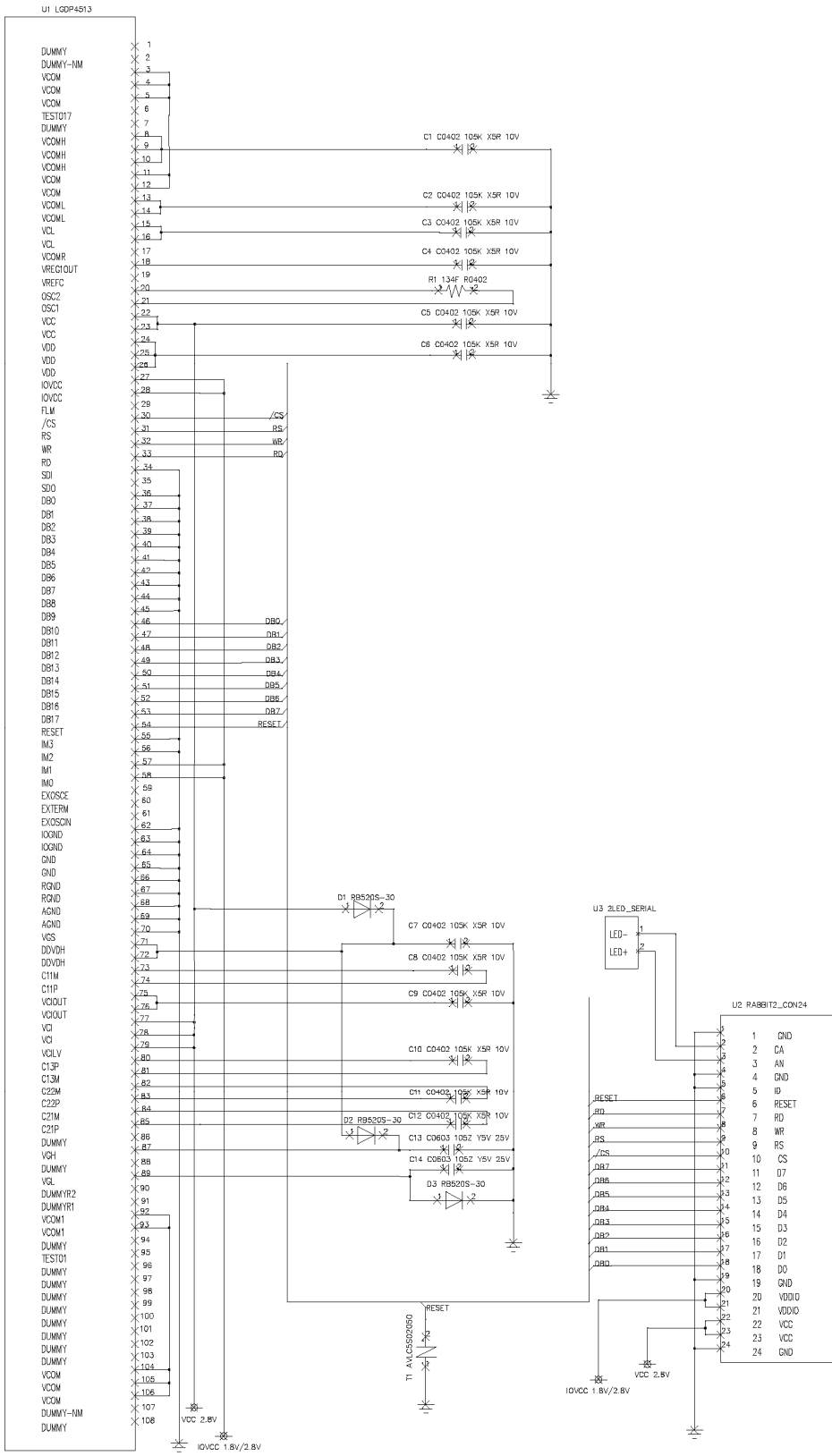
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# 1.5 Schematic



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## 2. Electrical Characteristics

### 2.1 Absolute Maximum Ratings

Item	Symbol	Value			Unit	Condition	Remark
		Min.	Typ.	Max			
Supply Voltage Range	Logic	VDDIO	- 0.3	-	4.6	V	Ta =25℃
	Power Supply	VCC	- 0.3	-	4.6	V	Ta =25℃
	LCD	VGH-VGL	- 0.3	-	30.0	V	Ta =25℃
Input Voltage	V <sub>IN</sub>	- 0.3	-	VCC + 0.3	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	Sysbol	Spec. Value			Unit	Condition	
		Min.	Typ.	Max.			
Operating voltage	Logic	VDDIO	1.65	1.8	3.3	V	
	Power Supply	VCC	2.5	2.8	3.3	V	
	Gate	VGH	12	-	16	V	Note1
		VGL	-10		-6	V	
Input current	ICC	-	3.0	6.0	mA	Note2	
Input voltage	High level	V <sub>IH</sub>	0.8 Vcc	-	Vcc	V	-
	Low level	V <sub>IL</sub>	-0.3	-	0.2 Vcc	V	-

Note1) The value can be adjusted by software to optimize display quality.

Note2) Display Black

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### 3. Optical Characteristics

Transmissive mode

(Ta = 25°C)

Item	Symbol		Min.	Typ.	Max.	Unit	Condition	Note
Viewing	θ2-θ1	∅=0 (Y1-Y2)	50	60	-	Deg	Cr > 10	
		∅=90 (X1-X2)	80	90	-			
Contrast ratio	Cr		200	300	-	-	θ = 0 ∅ = 0	
Response Time	Tr + Tf		-	25	40	ms	θ = 0 ∅ = 0	
CIE Coordi- -nate	R	(x,y)	0.55,0.29	0.60,0.33	0.65,0.37		θ = 0 ∅ = 0	
	G	(x,y)	0.30,0.54	0.34,0.58	0.38,0.62			
	B	(x,y)	0.10,0.06	0.14,0.10	0.18,0.14			
	W	(x,y)	0.27,0.28	0.31,0.32	0.35,0.36			
Brightness	L		200	250	-	cd/m <sup>2</sup>	18mA/LED	
Uniformity			70	-	-			

\* ∅ = 0°, ∅ = 90° means viewing direction.

\* B/L is turned on.

\* Remark ; As for contrast ratio, it is measured in only panel.

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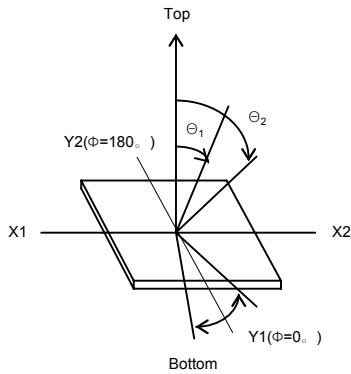
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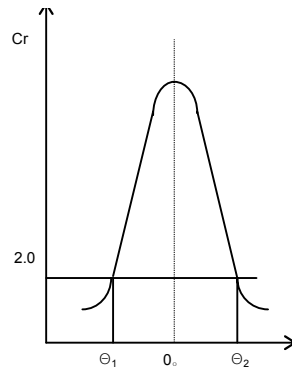
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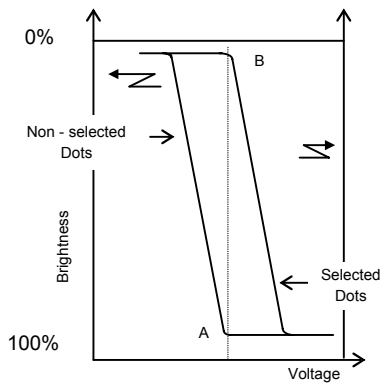
Note 1 . Definition of angle  $\Theta$  and  $\Phi$



Note 2. Definition of viewing angle  $\Theta_1$  and  $\Theta_2$



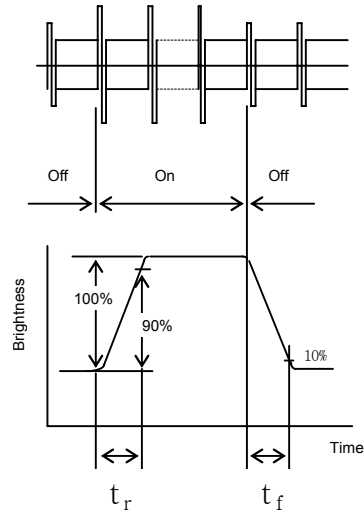
Note 3. Definition of contrast Cr



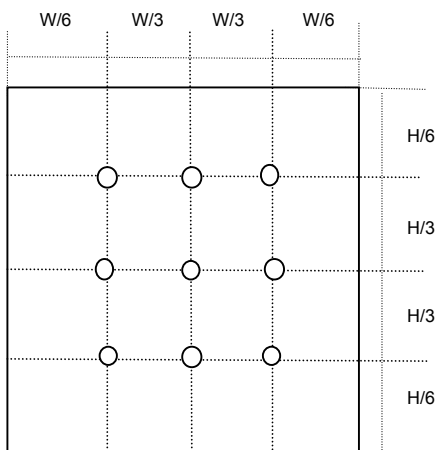
$Cr = (A/B)^P$  Negative : P = -1 Set Point  
Positive : P = +1 Point

Lens  $\varnothing = 3\text{mm}$

Note 4. Definition of Optical response



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



Rating is defined as the average brightness inside the viewing area

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## 5. Backlight Specification (LED Unit)

Item	Symbol	Spec. Value			Unit	Condition
		Min.	Typ.	Max.		
Real Current	$I_{LED}$	-	18	20	mA	note 1.
Power dissipation	$P_D$	-	-	160	mW	note 2.
Operation temp.	Topr	-20----70			°C	-
Storage temp.	Tstr	-30----80			°C	-

note1. B/L: 2EA LED in series, the typical current is 18mA(FULL BRIGHTNESS)

note2. Total power consumption(max) depends on LED current/ LED driver efficiency, etc.

## 6. Recommended Software Setting Values (Initial code)

LDI: LGDP4513

Register name	RD	WR	RS	Reg.No. (instruction)	WR	RS	D15-D0(data,Hex display)
System control	1	0	0	0X0000	0	1	0X0000
System control	1	0	0	0X0000	0	1	0X0001 delay 40ms
<b>Power supply on sequence</b>							
Display Control 1	1	0	0	0X0007	0	1	0X0000 delay 20ms
Power Control 2	1	0	0	0X0011	0	1	0X0302
Power Control 1	1	0	0	0X0010	0	1	0X0514
Power Control 3	1	0	0	0X0012	0	1	0X0019 delay 40ms
Power Control 1	1	0	0	0X0010	0	1	0X2210
Power Control 4	1	0	0	0X0013	0	1	0X3050 delay 30ms
<b>other mode setting</b>							
Driver Output Control	1	0	0	0X0001	0	1	0X0113
LCD Driving Wave Control	1	0	0	0X0002	0	1	0X0700
Power Control 1	1	0	0	0X0003	0	1	0X1030
Display Control 2	1	0	0	0X0008	0	1	0X0808
Display Control 3	1	0	0	0X0009	0	1	0X0011
Frame Cycle Control 1	1	0	0	0X000B	0	1	0X0800
<b>Gamma setting</b>							
Gamma control 1	1	0	0	0X0030	0	1	0X0000
Gamma control 2	1	0	0	0X0031	0	1	0X0507
Gamma control 3	1	0	0	0X0032	0	1	0X0204
Gamma control 4	1	0	0	0X0033	0	1	0X0101
Gamma control 5	1	0	0	0X0034	0	1	0X0305
Gamma control 6	1	0	0	0X0035	0	1	0X0002
Gamma control 7	1	0	0	0X0036	0	1	0X0707
Gamma control 8	1	0	0	0X0037	0	1	0X0101
Gamma control 9	1	0	0	0X0038	0	1	0X0D0A
Gamma control 10	1	0	0	0X0039	0	1	0X0A0D
Gamma control 11	1	0	0	0X003A	0	1	0X0101
Gamma control 12	1	0	0	0X003B	0	1	0X0101
Gamma control 13	1	0	0	0X003C	0	1	0X0101
Gamma control 14	1	0	0	0X003D	0	1	0X0101
Gamma control 15	1	0	0	0X003E	0	1	0X0001
Gamma control 16	1	0	0	0X003F	0	1	0X0001
<b>Display on sequence</b>							
Display Control 1	1	0	0	0X0007	0	1	0X0005 delay 30ms
Display Control 1	1	0	0	0X0007	0	1	0X0025 delay 30ms
Display Control 1	1	0	0	0X0007	0	1	0X0027
Display Control 1	1	0	0	0X0007	0	1	0X0037

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.

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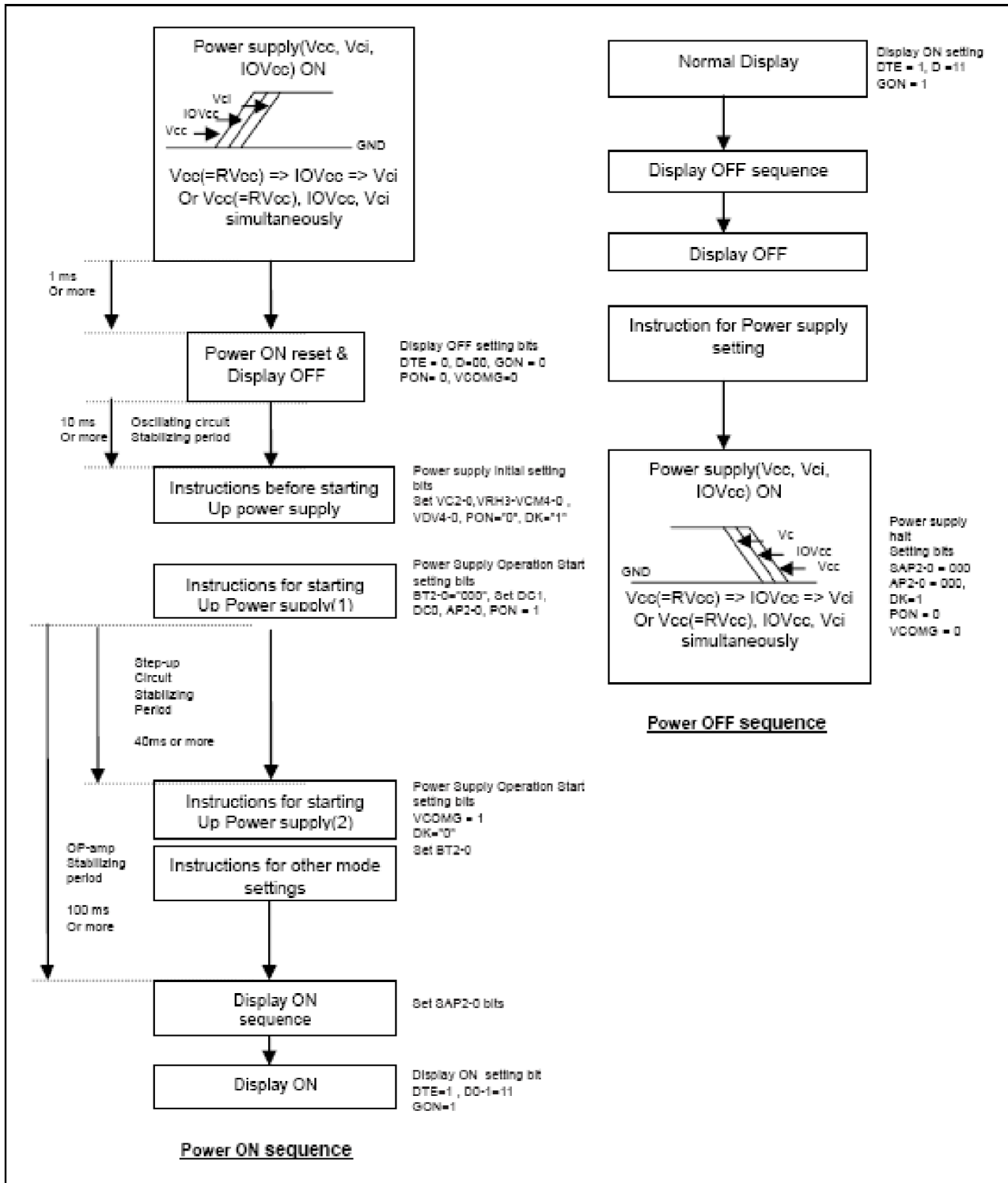
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## 7. Power Supply Sequence



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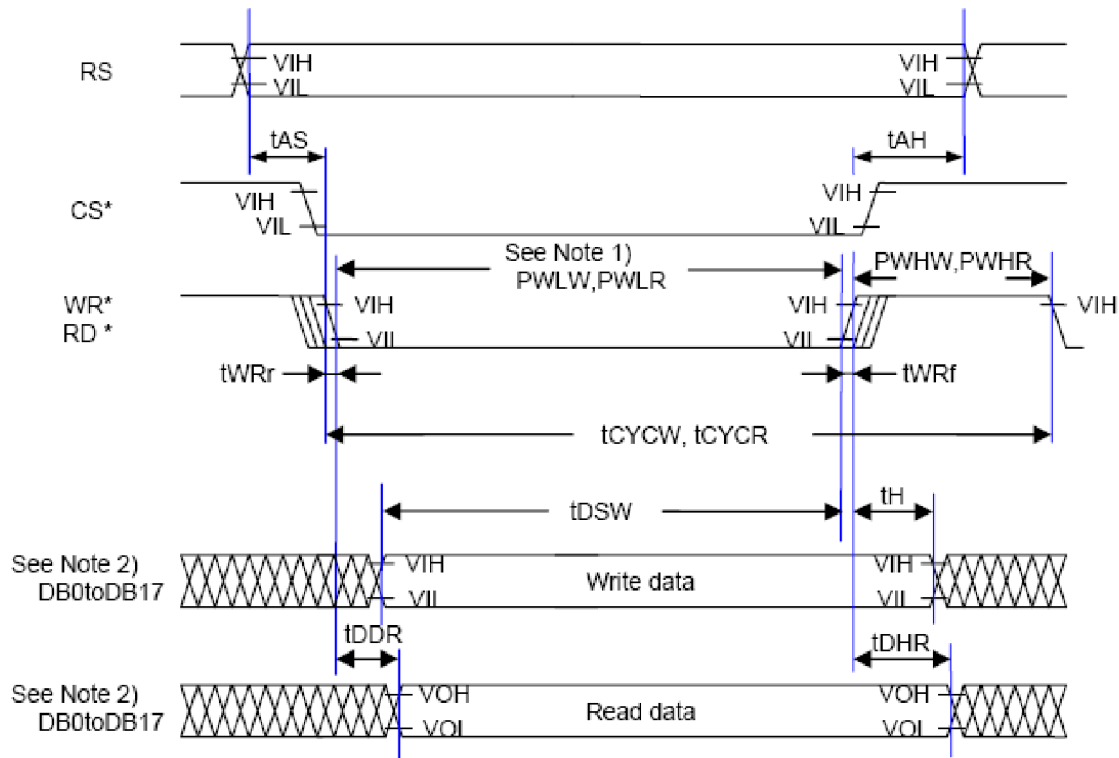
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## 8. Read/Write Timing characteristics (80 series MPU)

### 1) Read/Write Timing



Note 1) PWLW and PWLR are defined by the overlap period when CS\* is "Low" and WR\* or RD\* is "Low"  
 Note 2) Unused DB pins must be fixed at "Vcc" or "GND".

Item		Symbol	Unit	Min	Typ	Max
Bus cycle time	Write	$t_{CYCW}$	ns	70	-	-
	Read	$t_{CYCR}$		250	-	-
Write "Low" level pulse width	Write	$PW_{LW}$	ns	40	-	-
Read "Low" level pulse width	Read	$PW_{LR}$		150	-	-
Write "High" level pulse width	Write	$PW_{HW}$	ns	30	-	-
Read "High" level pulse width	Read	$PW_{HR}$		100	-	-
Write/Read rise/fall time		$t_{WRr}, t_{WRf}$	ns	-	-	25
Setup time	Write (RS to CS*/WR*)	$t_{AS}$	ns	0	-	-
	Read (RS to CS*/RD*)			10	-	-
Address hold time		$t_{AH}$	ns	2	-	-
Write data setup time		$t_{DSW}$	ns	25	-	-
Write data hold time		$t_H$	ns	5	-	-
Read data delay time		$t_{DDR}$	ns	-	-	200
Read data hold time		$t_{DHR}$	ns	5	-	-

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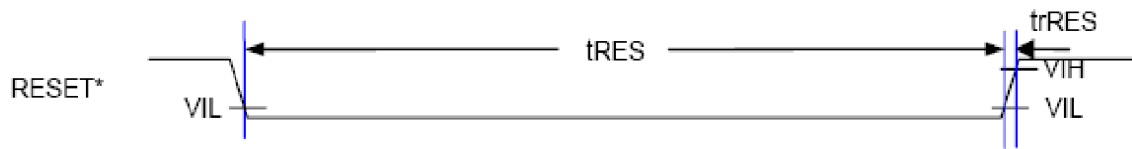
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## 2) Reset Timing characteristics



Item	Symbol	Unit	Min	Typ	Max
Reset "Low" level width	$t_{RES}$	ms	1	-	-
Reset rise time	$t_{rRES}$	us	-	-	10



## 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, Scratches(Glass & Pol.) Air Bubbles between Glass & Polarizer, Color Variation, Solder Ball, Misalignment	1.0	

Note) AQL- Acceptable Quality Level

#### (3.2) Appearance Standards

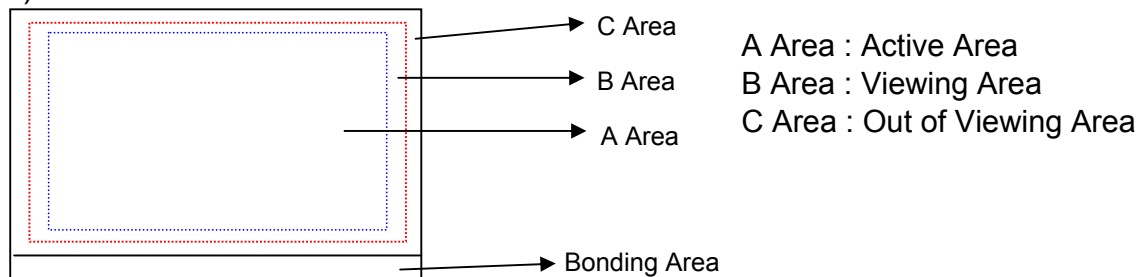
##### 1) Inspection Conditions

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



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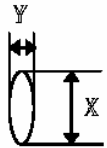
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(3.3) Appearance Spec

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 permissible tolerance.	MA																																														
4	Cold Solder	Cold solder is not allowed.	MA																																														
5	Black(White) Spots, Foreign Substances	<p>1) Round Type</p> <table border="1"> <thead> <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> </thead> <tbody> <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 &lt;</td> <td>0</td> <td>Ignore</td> </tr> </tbody> </table> <p>2) Liner Type</p> <table border="1"> <thead> <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> </thead> <tbody> <tr> <td>-</td> <td>≤ 0.025</td> <td colspan="2">Ignore</td> <td rowspan="4"></td> </tr> <tr> <td>≤ 2.5</td> <td>≤ 0.05</td> <td>3</td> <td>Ignore</td> </tr> <tr> <td>≤ 1.5</td> <td>≤ 0.075</td> <td>2</td> <td>Ignore</td> </tr> <tr> <td></td> <td>0.075 &lt;</td> <td colspan="2">Follow round type</td> </tr> </tbody> </table> <p>At (1) &amp; (2) total defect q'ty is must not exceed 5 pieces.</p>	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	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		MI	 <p>*** : Mean Diameter (X + Y)/2</p>
Area Dimension***	Acceptable Q'ty			Remark																																													
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Total	5	Ignore																																															

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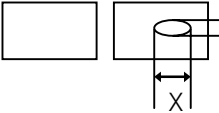
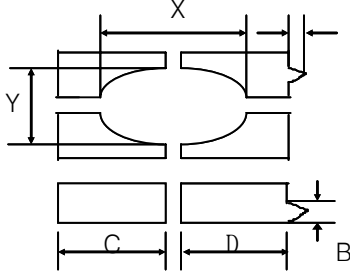
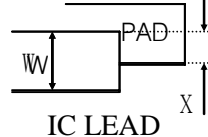
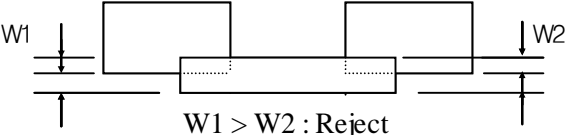
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(3.3) Appearance Spec

No	Item	Criteria	Rank	Remark								
8	Pin hole (On Segment)	 <p> <math>(X+Y)/2 \leq 0.2\text{mm}</math>                      Within 1 per one segment (Less than 0.1mm is not counted)                      Total defects q'ty is must not exceed 5 pieces.                 </p>	MI									
9	Segment Deformation	 <p> <math>(X+Y)/2 \leq 0.2\text{mm}</math>  <math>A \leq 0.2\text{mm}</math>  <math>B \leq 0.2\text{mm}</math>  <math>(C-D) \leq 0.2\text{mm}</math> </p> <table border="1" data-bbox="518 862 1173 996"> <thead> <tr> <th></th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>Dot, Segment</td> <td>1</td> </tr> <tr> <td>LCD</td> <td>5</td> </tr> <tr> <td><math>\leq 0.1</math></td> <td>Ignore all defect</td> </tr> </tbody> </table> <p>Each visible dot must be more than half effective dot area</p>		Acceptable Q'ty	Dot, Segment	1	LCD	5	$\leq 0.1$	Ignore all defect	MI	$(X + Y)/2 \leq 0.2\text{mm}$
	Acceptable Q'ty											
Dot, Segment	1											
LCD	5											
$\leq 0.1$	Ignore all defect											
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 0.18mm 2)Acceptable if a solder ball is not movable 3)Rejectable if the solder ball exceed 5EA in $2.54 \times 2.54\text{mm}$ area.	MI									
13	Miss Alignment	1)Acceptable if it dose not exceed 50% of the lead width IC.  <p> <math>X \leq W/2</math> : Accept  <math>X &gt; W/2</math> : Reject                 </p> 2)Rejectable, provided that it does exceed 50% of the component termination width.  <p> <math>W1 &gt; W2</math> : Reject                 </p>										

Note : A limitation sample is given top priority

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#### (4.0) Reliability Condition

Item	Content
Room Temperature Operation	50,000 hrs

#### (4.1) Reliability Test

No.	Item	Condition	Test Time	Sample Numbers	Creteria (Acc/Rej)	Note
1	High Temp Operation	70 ± 3°C	120 hrs	3	0/1	
2	Low Temp Operation	-20 ± 3°C	120 hrs	3	0/1	
3	High Humidity Storage	60°C 90%rh	120 hrs	3	0/1	
4	Thermal Shock	30mn stage -20°C ↔70°C	10 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.

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## 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 permanant 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°C or higher than 50°C). But this doesn't mean LCD functional defect. LCD will display normally in regular temperature. Therefore, don't use LCD product in extrem temperature.

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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 humidity may add static, while high humidity may corrode the ITO circuit of LCD product. The suitable storage environment is: temperature:  $22 \pm 5^{\circ}\text{C}$ , humidity:  $55\% \pm 10\%$ .
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.

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