First Edition
Sep 13, 2002

LCD Module Technical Specification

Final Revision
******

Type No. **F-51661GNCJU-MLW-AA**

Approved by (Production Div.)

Checked by (Quality Assurance Div.)

Checked by (Mobile Engineering Div.)

Prepared by (Production Div.)

Table of Contents

Revision History

Rev.	Date	Page	Comment

1.General Specifications

Operating Temp.	:	min. -20°C ~max. 70°C
Storage Temp.	:	min. -20°C ~max. 70°C
Dot Pixels	:	120× 3 [R.G.B] (W) × 160 (H) dots
Dot Size	:	0.069 (W) × 0.222 (H) mm
Dot Pitch	:	0.079 (W) × 0.237 (H) mm
Viewing Area	:	32.5 (W) × 39.835 (H) mm
Outline Dimensions	:	35.7* (W) × 48.8* (H) × 3.094** (D) mm * Without FPC and Area of Injection Port **Without Parts Area
Weight	:	10g max.
LCD Type	:	CSD-21148 (F-STN / Color-mode / Transflective)
Viewing Angle	:	12:00
Data Transfer	:	16-bit parallel data transfer
Backlight	:	LED Backlight / White
Drawings	:	Dimensional Outline UE-311418 Circuit Diagram UE-210538A

2.Electrical Specifications

2.1.Absolute Maximum Ratings

GND=0V

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage	V_{CC}-GND	-	-0.3	4.6	V
Input Voltage	V_I	-	-0.3	V_{CC}+0.3	V

2.2.DC Characteristics

Ta=25°C, GND=0V

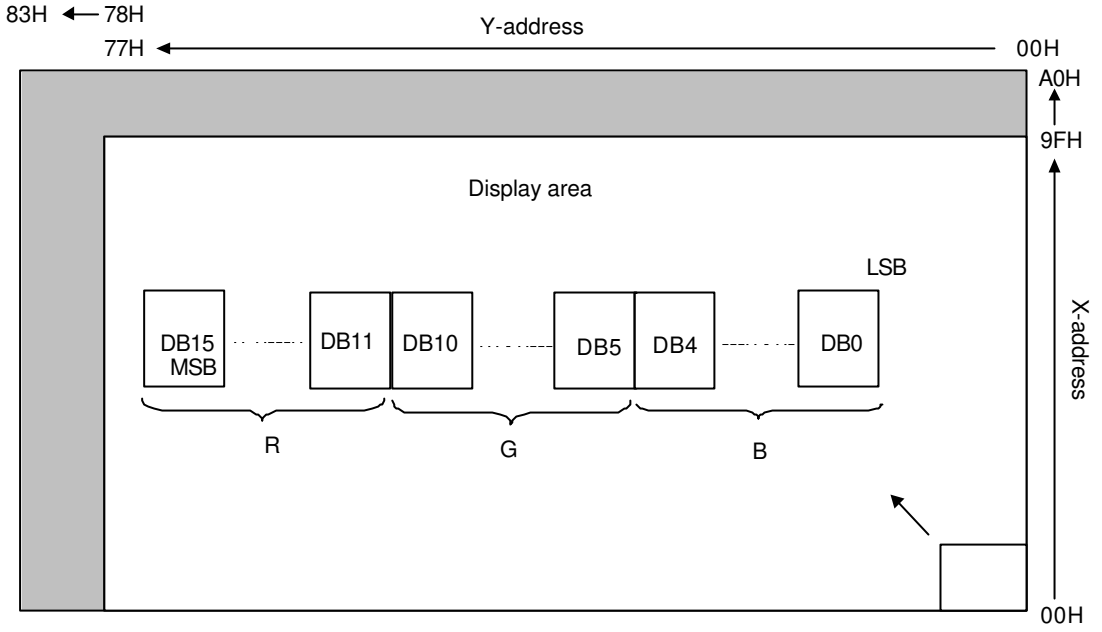
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage	V_{CC}-GND	-	2.20	2.25	2.29	V
High Level Input Voltage	V_{IH}	-	0.7× V_{CC}	-	V_{CC}	V
Low Level Input Voltage	V_{IL}	-	GND	-	0.15× V_{CC}	V
High Level Output Voltage	V_{OH}	I_{OH}=-0.1mA	0.75× V_{CC}	-	V_{CC}	V
Low Level Output Voltage	V_{OL}	I_{OL}=0.1mA	GND	-	0.15× V_{CC}	V
Supply Current	I_{CC}		-	1.8	2.7	mA

2.3.AC Characteristics

Shown in LCD Controller Specification HD66766 and HD66750S(HITACHI)

2.4. Display screen

2.4.1. Correspondence of data and display screen



This part is ineffective data

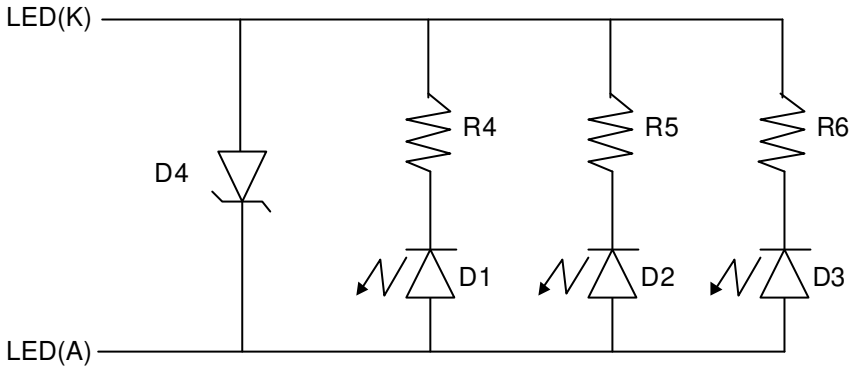
2.5. Lighting Specifications

2.5.1. Absolute Maximum Ratings (Only 1 chip)

Ta=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Foward Current	I_F	Note 1	-	-	30	mA
Reverse Voltage	V_R	-	-	-	5	V
LED Power Dissipation	P_D	-	-	-	120	mW

Note 1 : Refer to the foward current derating curve.



2.5.2. Operating Characteristics

Ta=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Foward Voltage	V_F	I_F=11mA	4.8	5	5.2	V
Luminance of Backlight Surface	L	I_F=11mA		-	-	cd/m^2

3.Optical Specifications

3.1.LCD Driving Voltage

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Recommended	VCC-GND	Ta= -20°C	-	-	17.6	V
LCD Driving Voltage		Ta=25°C	16.9	17.5	18.0	V
Note 1		Ta=70°C	16.0	-	-	V

Note 1 : Voltage (Applied actual waveform to LCD Module) for the best contrast. The range of minimum and maximum shows tolerance of the operating voltage. The specified contrast ratio and response time are not guaranteed over the entire range.

3.2.Optical Characteristics

Ta=25°C, 1/160 Duty, 1/12 Bias, V_{OD}=17.5V (Note 4), θ= 0°C, ϕ=-°

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Units
Contrast Ratio Note 1		CR	θ= 0°C , ϕ=-°	-	14	-	
Viewing Angle			Shown in 3.3				
Response	Rise Note 2	T_{ON}	-	-	210	320	ms
Time	Decay Note 3	T_{OFF}	-	-	120	200	ms

Note 1 :Contrast ratio is defined as follows. (CR = L_{ON} / L_{OFF})

L_{ON} : Luminance of the ON segments

L_{OFF} : Luminance of the OFF segments

Measuring Spot : 3.0mmϕ

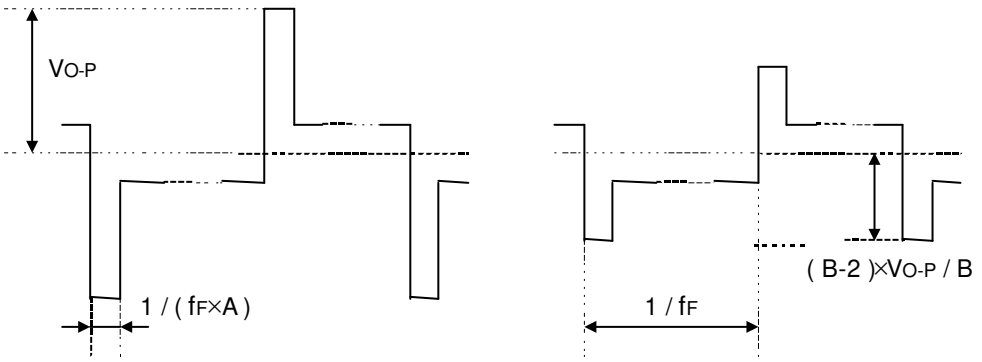
Note 2 :The time that the luminance level reaches 90% of the saturation level from 0% when ON signal is applied.

Note 3 :The time that the luminance level reaches 10% of the saturation level from 100% when OFF signal is applied.

Note 4 :Definition of Driving Voltage V_{OD}

$V_{OD}=V_{CC}-V_{ADJ}-V_{BE}$

Assuming that the typical driving waveforms shown below are applied to the LCD Panel at 1/A Duty - 1/B Bias (A: Duty Number, B: Bias Number). Driving voltage V_{OD} is defined as the voltage V_{O-P} when the contrast ratio (CR=L_{ON} / L_{OFF}) is at its maximum.

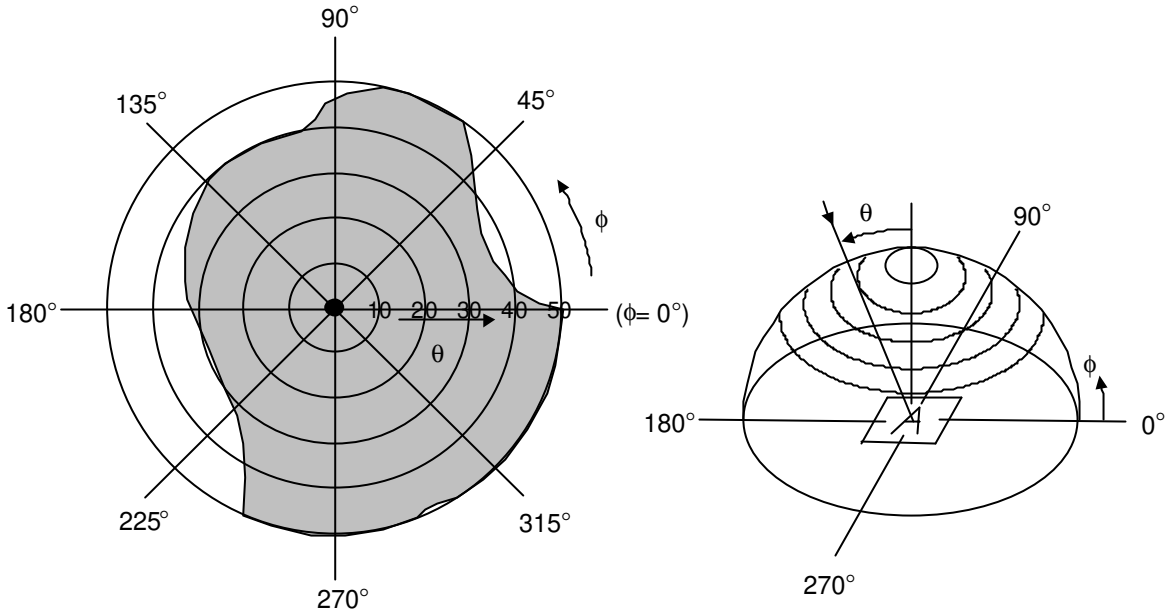


<ON SIGNAL> <OFF SIGNAL>

3.3. Definition of Viewing Angle and Optimum Viewing Area (Main)

*Point • show the point where Contrast ratio measured.: θ=10°, ϕ=90°

*Driving condition: 1/160 Duty, 1/12 Bias, V_{OD}=17.5V, f_F=80Hz



Typ. CR≥3 (Measuring Spot : 3.0mmϕ)

			Min	Typ	Max	
Reflectance *		25°C	15	20	25	%
Transmittance **		25°C	2.0	2.5	3.0	%
Contrast ratio	Reflection	25°C	8	13	18	
		60°C	3	5	8	
	Transmission	25°C	9	15	21	
		60°C	3	6	9	
Chromaticity (Reflection)	White	X	0.27	0.31	0.35	
		Y	0.31	0.34	0.38	
	Red	X	0.42	0.46	0.50	
		Y	0.28	0.32	0.36	
	Green	X	0.24	0.28	0.32	
		Y	0.41	0.45	0.49	
	Blue	X	0.15	0.19	0.23	
		y	0.15	0.19	0.23	
Color area*** (×1000)	Reflection	25°C	24	29	34	
	Transmission	25°C	10	13	17	

*Instrument Colorimeter: 520/02 (Yokogawa M&C Corporation)

Incident angle Incident angle: 15° Measured angle: 0°

(Angle is defined from normal direction)

Light source Ring light (C light source)

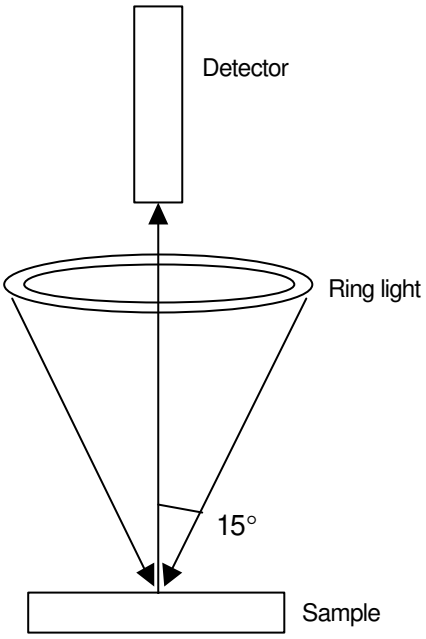
Definition of reflectance Reflection of reflection standard is defined as 100%

**Brightness of LCD/brightness of backlight ×100 in all white pattern

(Measured condition: PNL with DBEF)

***Area of RGB triangle in (x,y) coordinate ×1000

Schematic diagram of instrument



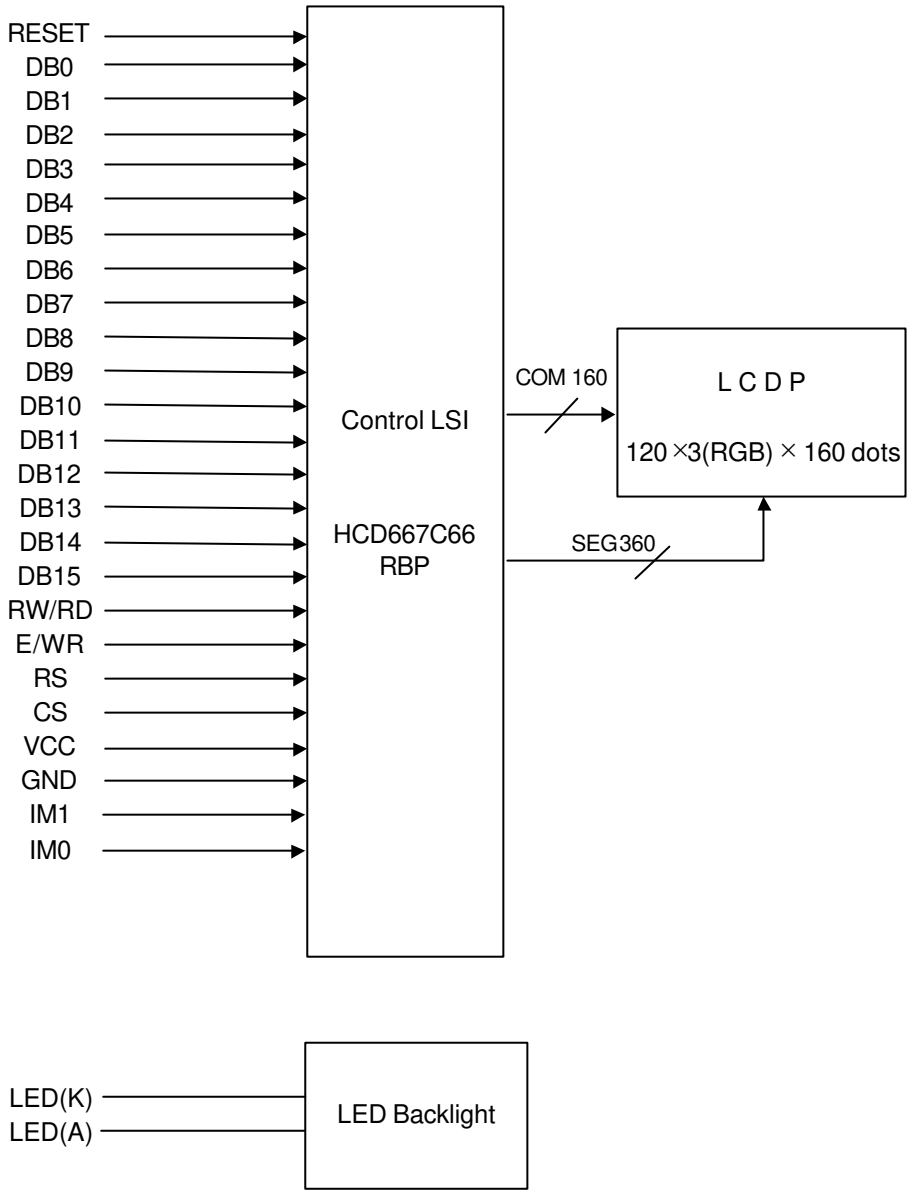
4. I/O Terminal

4.1. Pin Assignment

CN1

No.	Symbol	Function
1	RESET	Reset Signal L : Reset
2	DB15	Display Data
3	DB14	Display Data
4	DB13	Display Data
5	DB12	Display Data
6	DB11	Display Data
7	DB10	Display Data
8	DB9	Display Data
9	DB8	Display Data
10	DB7	Display Data
11	DB6	Display Data
12	DB5	Display Data
13	DB4	Display Data
14	DB3	Display Data
15	DB2	Display Data
16	DB1	Display Data
17	DB0	Display Data
18	RW/RD	80 family CPU:Read Signal 68 family CPU:Read/Write Signal
19	E/WR	80 family CPU :Write Signal 68 family CPU: Enable Signal
20	RS	Selct the regigster. Low:Index/statu High:Control
21	/CS	Chip Select Signal L : Active
22	VCC	Power Supply
23	GND	Power Supply (0V, GND)
24	IM1	Terminal to Select the MPU Interface Mode L:16bits H:8bits
25	IM0	Terminal to Select the MPU Interface Mode L:68 family CPU H:80 family CPU
26	LED(K)	LED Terminal
27	LED(A)	LED Terminal
28	NC	Non-connection

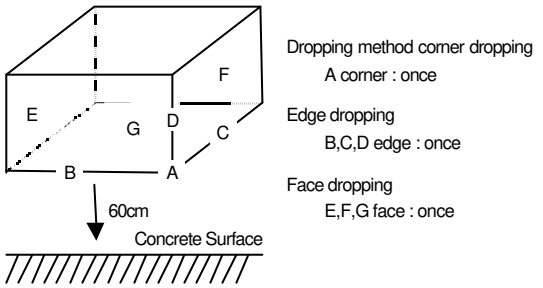
4.2. Block Diagram



5.Test

No change on display and in operation under the following test condition.

Conditions: Unless otherwise specified, tests will be conducted under the following condition.
Temperature: 20±5°C
Humidity : 65±5%RH
tests will be not conducted under functioning state.

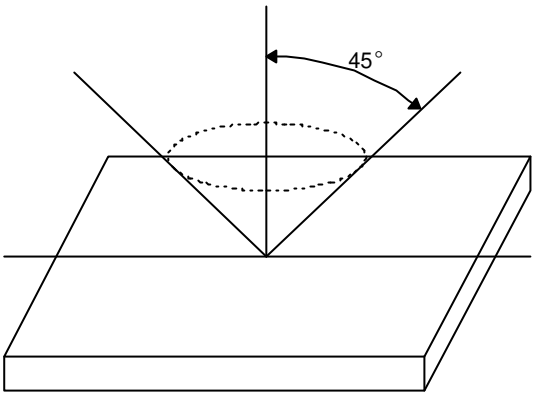
No.	Parameter	Conditions	Notes
1	High Temperature Operating	70°C±2°C, 96hrs (operation state)	
2	Low Temperature Operating	-20°C±2°C, 96hrs (operation state)	1
3	High Temperature Storage	70°C±2°C, 96hrs	2
4	Low Temperature Storage	-20°C±2°C, 96hrs	1,2
5	Damp Proof Test	40°C±2°C,90~95%RH, 96hrs	1,2
6	Vibration Test	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X, Y, Z for each 15 minutes	3
7	Shock Test	To be measured after dropping from 60cm high on the concrete surface in packing state. 	

Note 1 :No dew condensation to be observed.
Note 2 :The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after removed from the test chamber.
Note 3 :Vibration test will be conducted to the product itself without putting it in a container.

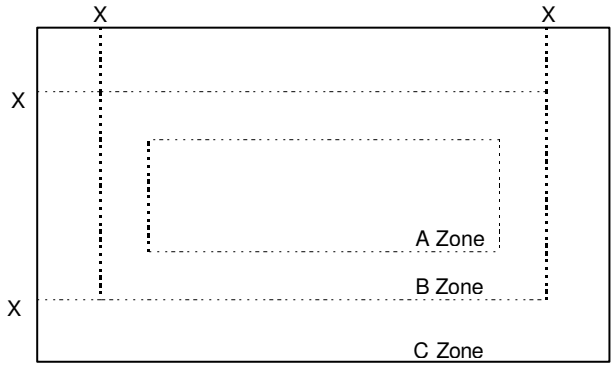
6.Appearance Standards

6.1.Inspection conditions

The LCD shall be inspected under 40W white fluorescent light.
The distance between the eyes and the sample shall be more than 30cm.
All directions for inspecting the sample should be within 45°against perpendicular line.



6.2.Definition of applicable Zones



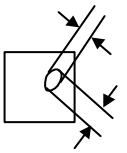
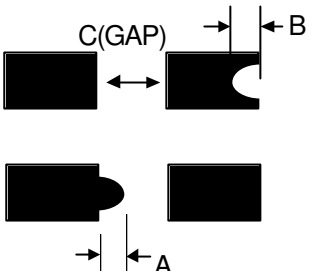
X : Maximum Seal Line

A Zone : Active display area
B Zone : Out of active display area ~ Maximum Viewing Area
C Zone : Rest parts

A Zone + B Zone = Validity viewing area

6.3. Standards

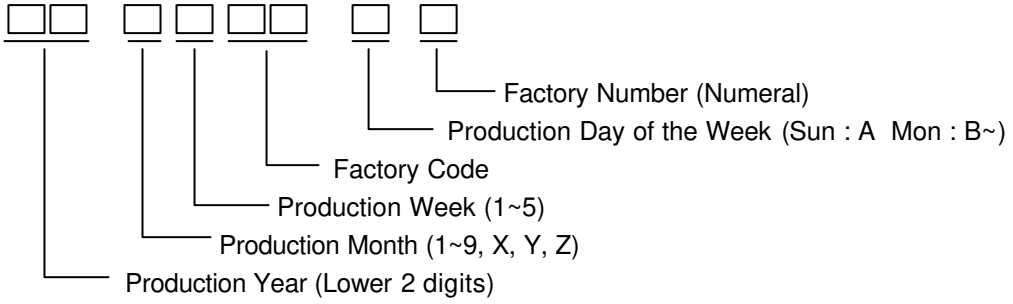
<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black and White Spots, Foreign Substances and LR/AR Coat Bright point</td><td>(1) Round Shape
<table>
<tr><th rowspan="2">Dimension (mm) \ Zone</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≤ 0.10</td><td colspan="2">*</td><td>*</td></tr>
<tr><td>0.10 < D ≤ 0.15</td><td colspan="2">2</td><td>*</td></tr>
<tr><td>0.15 < D ≤ 0.20</td><td colspan="2">1</td><td>*</td></tr>
<tr><td>0.20 < D</td><td colspan="2">0</td><td>*</td></tr>
</table>
D = (Long + Short) / 2 * : Disregard
(2) Line Shape
<table>
<tr><th rowspan="2">X(mm) \ Y(mm) \ Zone</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>-</td><td>W≤0.01</td><td colspan="2">*</td><td>*</td></tr>
<tr><td>L≤2.0</td><td>W≤0.02</td><td colspan="2">2</td><td>*</td></tr>
<tr><td>L≤1.0</td><td>W≤0.03</td><td colspan="2">1</td><td>*</td></tr>
<tr><td>L>2.0</td><td>-</td><td colspan="2">0</td><td>*</td></tr>
<tr><td>-</td><td>W>0.03</td><td colspan="3">In the same way (1)</td></tr>
</table>
X : Length Y : Width * : Disregard</td></tr>
<tr><td>2</td><td>Air Bubbles (between glass and polarizer)</td><td>
<table>
<tr><th rowspan="2">Dimension (mm) \ Zone</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≤ 0.10</td><td colspan="2">*</td><td>*</td></tr>
<tr><td>0.10< D ≤0.15</td><td colspan="2">1</td><td>*</td></tr>
<tr><td>0.15 < D ≤0.20</td><td colspan="2">1</td><td>*</td></tr>
<tr><td>D<0.20</td><td colspan="2">0</td><td>*</td></tr>
</table>
* : Disregard</td></tr>
</table>

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>3</td><td>The Shape of Dot</td><td>(1) Pin Hole:
 
<table><tr><th>Dimension</th><th>Acceptable Number</th></tr><tr><td>D ≦ 0.1</td><td>Less than 1 piece / dot
less than 3 pieces/ sell</td></tr><tr><td>0.1 < D ≦ 0.2</td><td>0</td></tr></table>D = (Long + Short) / 2
(2) Lacking, Deformation
 

<table><tr><th>Dimension</th><th>Acceptable Number</th></tr><tr><td>A</td><td>Should not be connected to next dot.</td></tr><tr><td>0.1 < B ≦ 0.15</td><td>One or less 1 piece / dot</td></tr></table></td></tr>
<tr><td>4</td><td>Contrast Variation</td><td>Not to be conspicuous defects.(Without C Zone)</td></tr>
<tr><td>5</td><td>Illumination black and white spot (Mode changes by Voltage Transformation)</td><td><table><tr><th>Zone
Dimension(mm)</th><th>Acceptable Number</th></tr><tr><td>D ≦ 0.10</td><td>Disregard</td></tr><tr><td>0.10<D ≦ 0.15</td><td>2</td></tr><tr><td>0.15<D ≦ 0.20</td><td>1</td></tr><tr><td>0.20<D</td><td>0</td></tr></table></td></tr>
<tr><td>6</td><td>Color Variation</td><td>Not to be conspicuous defects. (Without C Zone)</td></tr>
<tr><td>7</td><td>Polarizer Scratches, Stroke marks</td><td>Not to be conspicuous defects.(Without C Zone)</td></tr>
<tr><td>8</td><td>Polarizer Dirts</td><td>If the stains are removed easily from LCDP surface, the module is not defective.</td></tr>
<tr><td>9</td><td>Distance between Different Foreign Substance Defects</td><td>D≤0.2 : 20mm or more. (Without C Zone)</td></tr>
<tr><td>10</td><td>Overcoat Pin Hole</td><td>D≤0.4 Disregard
0.4<D≤0.6 2 pieces</td></tr>
</table>

7.Code System of Production Lot

The production lot of module is specified as follows.



8.Applying Precautions

Please contact us when questions and/or new problems not specified in this Specifications arise.

9.Precautions Relating Product Handling

The Following precautions will guide you in handling our product correctly.

1) Liquid crystal display devices
   1. The liquid crystal display device panel used in the liquid crystal display module is made of plate glass. Avoid any strong mechanical shock. Should the glass break handle it with care.
   2. The polarizer adhering to the surface of the LCD is made of a soft material. Guard against scratching it.

2) Care of the liquid crystal display module against static electricity discharge.
   1. When working with the module, be sure to ground your body and any electrical equipment you may be using. We strongly recommend the use of anti static mats (made of rubber), to protect work tables against the hazards of electrical shock.
   2. Avoid the use of work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
   3. Slowly and carefully remove the protective film from the LCD module, since this operation can generate static electricity.

3) When the LCD module alone must be stored for long periods of time:
   1. Protect the modules from high temperature and humidity.
   2. Keep the modules out of direct sunlight or direct exposure to ultraviolet rays.
   3. Protect the modules from excessive external forces.

4) Use the module with a power supply that is equipped with an overcurrent protector circuit, since the module is not provided with this protective feature.

5) Do not ingest the LCD fluid itself should it leak out of a damaged LCD module. Should hands or clothing come in contact with LCD fluid, wash immediately with soap.

6) Conductivity is not guaranteed for models that use metal holders where solder connections between the metal holder and the PCB are not used. Please contact us to discuss appropriate ways to assure conductivity.

7) For models which use CFL:
   1. High voltage of 1000V or greater is applied to the CFL cable connector area. Care should be taken not to touch connection areas to avoid burns.
   2. Protect CFL cables from rubbing against the unit and thus causing the wire jacket to become worn.
   3. The use of CFLs for extended periods of time at low temperatures will significantly shorten their service life.

8) For models which use touch panels:
   1. Do not stack up modules since they can be damaged by components on neighboring modules.
   2. Do not place heavy objects on top of the product. This could cause glass breakage.

9) For models which use COG,TAB,or COF:
   1. The mechanical strength of the product is low since the IC chip faces out unprotected from the rear.
      Be sure to protect the rear of the IC chip from external forces.
   2. Given the fact that the rear of the IC chip is left exposed, in order to protect the unit from electrical damage, avoid installation configurations in which the rear of the IC chip runs the risk of making any electrical contact.

10) Models which use flexible cable, heat seal, or TAB:
   1. In order to maintain reliability, do not touch or hold by the connector area.
   2. Avoid any bending, pulling, or other excessive force, which can result in broken connections.

11) In case of buffer material such as cushion / gasket is assembled into LCD module, it may have an adverse effect on connecting parts (LCD panel-TCP / HEAT SEAL / FPC / etc., PCB-TCP / HEAT SEAL / FPC etc., TCP-HEAT SEAL, TCP-FPC, HEAT SEAL-FPC, etc.,) depending on its materials.
   Please check and evaluate these materials carefully before use.

12) In case of acrylic plate is attached to front side of LCD panel, cloudiness (very small cracks) can occur on acrylic plate, being influenced by some components generated from polarizer film.. Please check and evaluate those acrylic materials carefully before use.

10.Warranty

This product has been manufactured to your company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

1. We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.

2. We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.

3. We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed your company's acceptance inspection procedures.

4. When the product is in CFL models, CFL service life and brightness will vary according to the performance of the inverter used, leaks, etc. We cannot accept responsibility for product performance, reliability, or defect, which may arise.

5. We cannot accept responsibility for intellectual property of a third party, which may arise through the application of our product to your assembly with exception to those issues relating directly to the structure or method of manufacturing of our product.

6. Optrex will not be held responsible for any quality guarantee issue for defect products judged as Optrex-origin longer than 2 (two) years from Optrex production or 1(one) year from Optrex, Optrex America, Optrex Europe delivery which ever comes later.