

LCD Module Technical Specification

Type No. **DMC16230NY-LY-EEE-EGN**

Customer : **STANDARD**

Customer's Product No : -----

KYOCERA Display Corporation

Approved: Teruo Kuragane
QUALITY ASSURANCE DIVISION

Checked: Masayuki Kato
Design Div.

Prepared: Yasutaka Oiwa
Design Div.

APPROVED

By

Signature :

Date :

Please return this specification within two month with your signature.
If not returned within two month, specification will be considered
as having been accepted.

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Revision History

Rev.	Date	Page	Comment
1	Apr. 13. 2012	-	Changing company's name

1. General Specifications

Operating Temp.	:	min. 0°C ~ max. 50°C
Storage Temp.	:	min. -20°C ~ max. 70°C
Display Format	:	16 characters × 2 lines
Display Fonts	:	5 × 7 dots + cursor (1 character)
Viewing Area	:	99.0 (W) × 24.0 (H) mm
Outline Dimensions	:	122.0 (W) × 44.0 (H) × 14.6 max. (D) mm
Weight	:	75g max.
LCD Type	:	NTD-7136 (STN / Yellow-mode / Transmissive)
Viewing Angle	:	6:00
Backlight	:	LED Backlight / Yellow-green
Drawings	:	Dimensional Outline DMC16230 ED series (Rev. A)
RoHS regulation	:	To our best knowledge, this product satisfies material requirement of RoHS regulation. Our company is doing the best efforts to obtain the equivalent certificate from our suppliers.

2. Electrical Specifications

2.1. Absolute Maximum Ratings

V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage (Logic)	V _{CC} -V _{SS}	-	-0.3	7.0	V
Supply Voltage (LCD Drive)	V _{CC} -V _{EE}	-	0	13.0	V
Input Voltage	V _I	-	-0.3	V _{CC} +0.3	V

2.2. DC Characteristics

T_a=25°C, V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage (Logic)	V _{CC} -V _{SS}	-	4.5	-	5.5	V
Supply Voltage (LCD Drive)	V _{CC} -V _{EE}	Shown in 3.1				V
High Level Input Voltage	V _{IH}	V _{CC} =5.0V±10%	2.2	-	V _{CC}	V
Low Level Input Voltage	V _{IL}	V _{CC} =5.0V±10%	-0.3	-	0.8	V
High Level Output Voltage	V _{OH}	I _{OH} =-0.205mA	2.4	-	-	V
Low Level Output Voltage	V _{OL}	I _{OL} =1.2mA	-	-	0.4	V
Supply Current	I _{CC}	V _{CC} -V _{SS} =5.0V	-	1.8	3.0	mA

2.3.AC Characteristics

V_{CC}=5.0V±10%

Parameter	Symbol	Conditions	Min.	Max.	Units
Enable Cycle Time	t _{CYC}	Fig.1, 2	500	-	ns
Enable Pulse Width	PW _{EH}	Fig.1, 2	300	-	ns
Enable Rise/Fall Time	t _{Er} , t _{Ef}	Fig.1, 2	-	25	ns
Address Setup Time	t _{AS}	Fig.1, 2	60	-	ns
Address Hold Time	t _{AH}	Fig.1, 2	10	-	ns
Write Data Setup Time	t _{DSW}	Fig.1	100	-	ns
Write Data Hold Time	t _{DHW}	Fig.1	10	-	ns
Read Data Delay Time	t _{DDR}	Fig.2	-	190	ns
Read Data Hold Time	t _{DHR}	Fig.2	20	-	ns

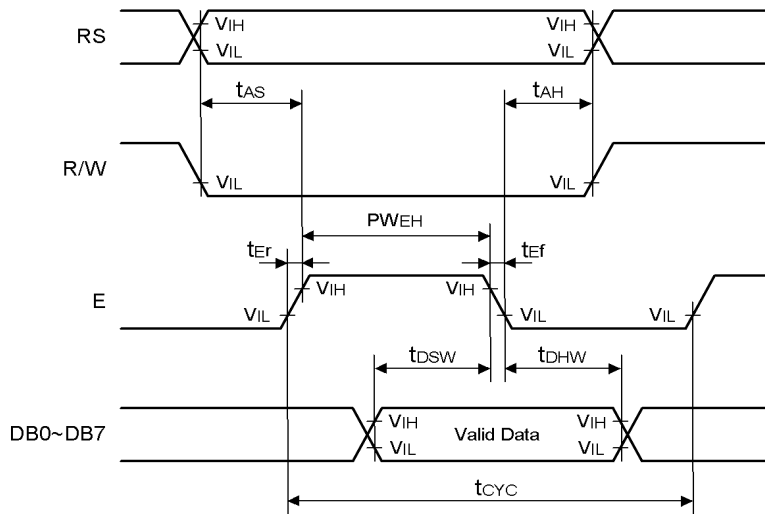


Fig.1 Write Operation Timing

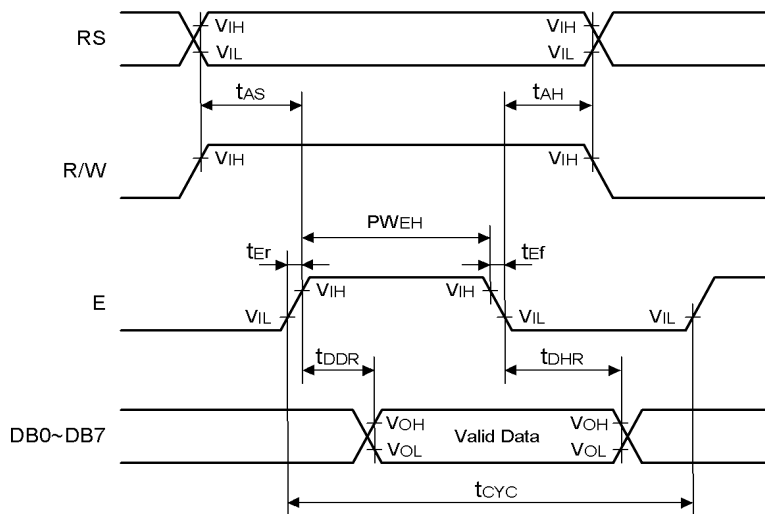


Fig.2 Read Operation Timing

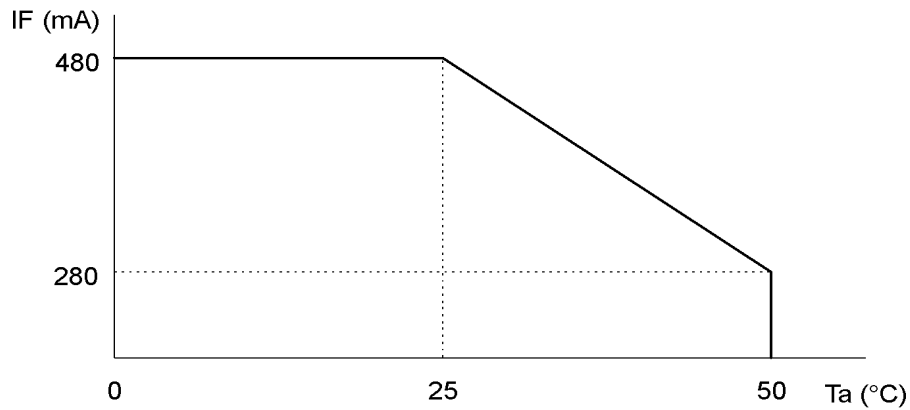
2.4. Lighting Specifications

2.4.1. Absolute Maximum Ratings

Ta=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Foward Current	I _F	Note 1	-	-	480	mA
Reverse Voltage	V _R	-	-	-	8	V
LED Power Dissipation	P _D	-	-	-	2.1	W

Note 1 : Refer to the foward current derating curve.



2.4.2. Operating Characteristics

Ta=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Foward Voltage	V _F	I _F =240mA	3.8	4.0	4.2	V
Luminance of Backlight Surface	L	I _F =240mA	60	-	-	cd/m ²

3. Optical Specifications

3.1. LCD Driving Voltage

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Recommended LCD Driving Voltage Note 1	$V_{CC}-V_{EE}$	Ta= 0°C	-	-	5.5	V
		Ta=25°C	4.6	4.9	5.2	V
		Ta=50°C	4.2	-	-	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, 1/16 Duty, 1/4.5 Bias, $V_D=4.9V$ (Note 4), $\theta= 0^\circ$, $\phi= -^\circ$

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Contrast Ratio Note 1	CR	$\theta= 0^\circ$, $\phi= -^\circ$	-	12	-	
Viewing Angle		Shown in 3.3				
Response Time	Rise Note 2	T_{ON}	-	130	200	ms
	Decay Note 3	T_{OFF}	-	180	280	ms

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

L_{ON} : Luminance of the ON segments

L_{OFF} : Luminance of the OFF segments

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.

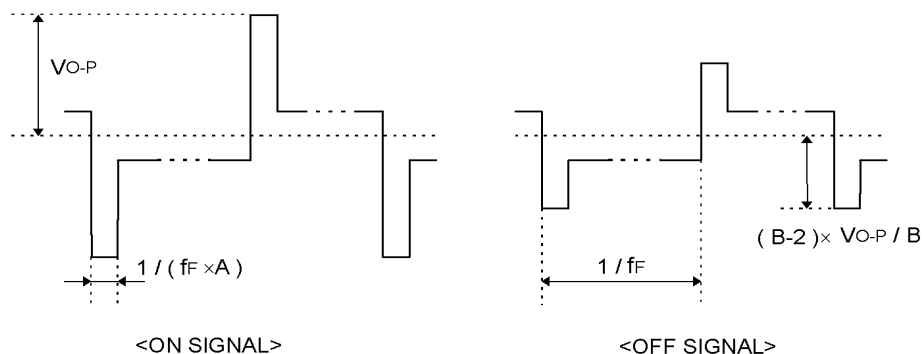
Note 4 : Definition of Driving Voltage V_D

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_D is defined as follows.

$$V_D = (V_{th1} + V_{th2}) / 2$$

V_{th1} : The voltage V_{O-P} that should provide 50% of the saturation level in the luminance at the segment which the ON signal is applied to.

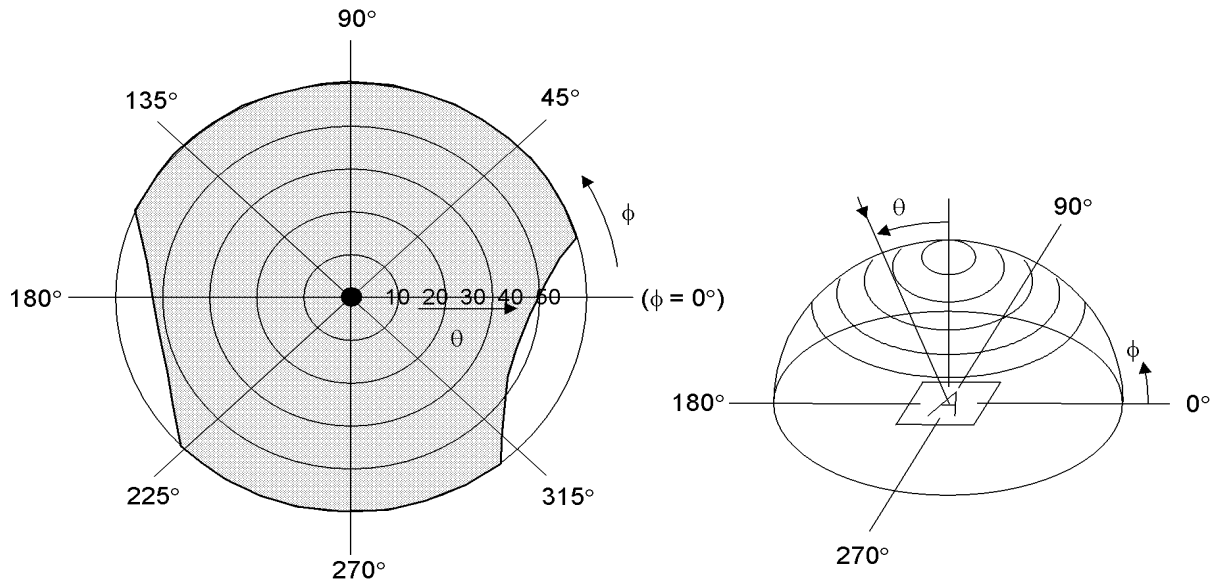
V_{th2} : The voltage V_{O-P} that should provide 50% of the saturation level in the luminance at the segment which the OFF signal is applied to.




3.3. Definition of Viewing Angle and Optimum Viewing Area

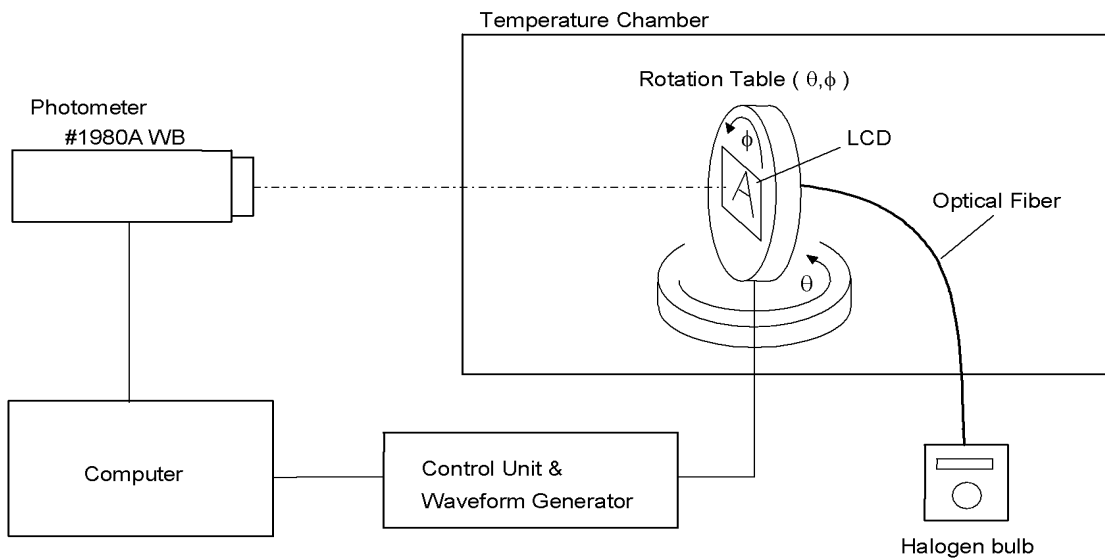
*Point ● shows the point where contrast ratio is measured. : $\theta = 0^\circ$, $\phi = 0^\circ$

*Driving condition : 1/16 Duty, 1/4.5 Bias, $V_D = 4.9V$, $f_F = 84.4Hz$



*Area  shows typ. $CR \geq 2$

3.4. System Block Diagram



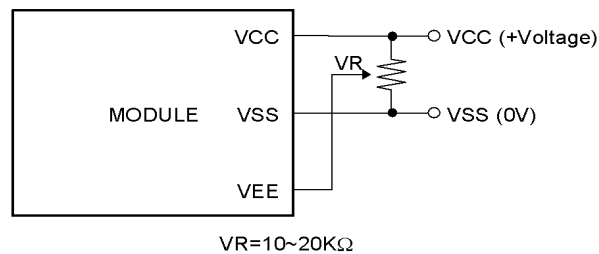
4. I/O Terminal

4.1. Pin Assignment

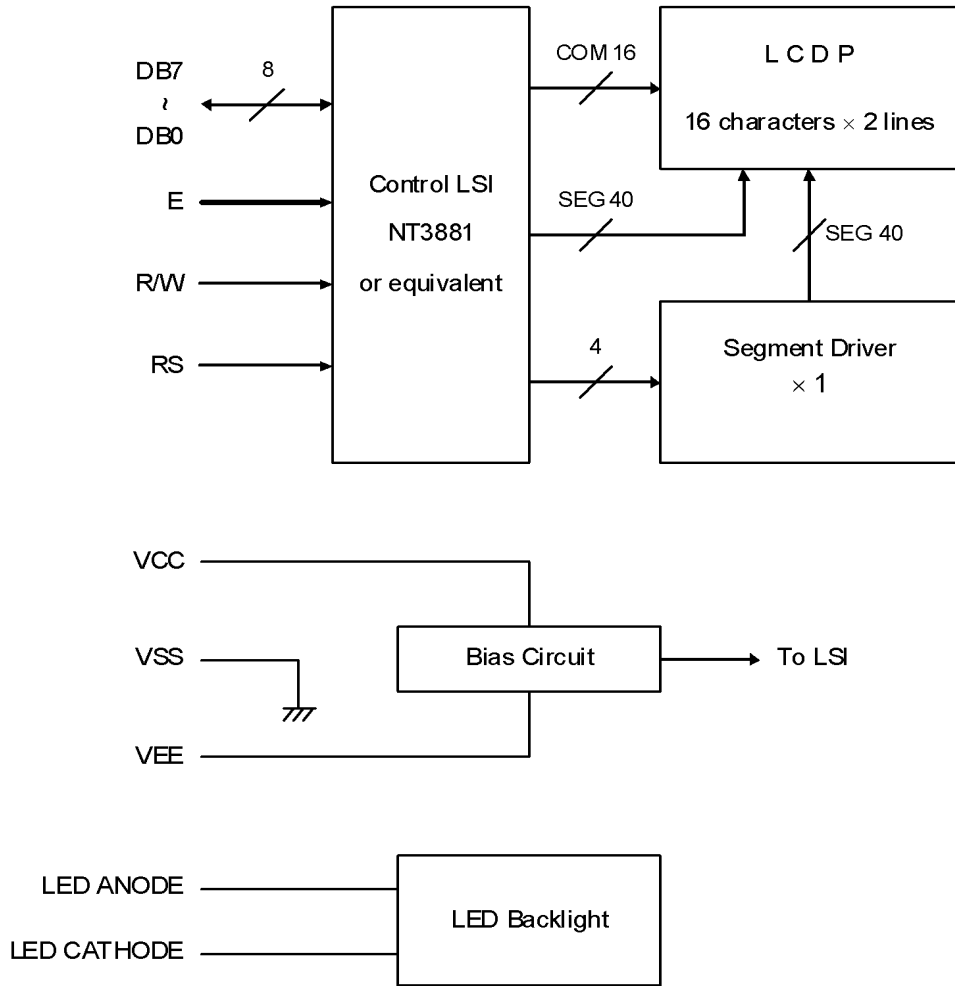
No.	Symbol	Level	Function
1	V _{SS}	-	Power Supply (0V, GND)
2	V _{CC}	-	Power Supply for Logic
3	V _{EE}	-	Power Supply for LCD Drive
4	RS	H / L	Register Select Signal
5	R/W	H / L	Read/Write Select Signal H : Read L : Write
6	E	H / L	Enable Signal (No pull-up Resister)
7	DB0	H / L	Data Bus Line / Non-connection at 4-bit operation
8	DB1	H / L	Data Bus Line / Non-connection at 4-bit operation
9	DB2	H / L	Data Bus Line / Non-connection at 4-bit operation
10	DB3	H / L	Data Bus Line / Non-connection at 4-bit operation
11	DB4	H / L	Data Bus Line
12	DB5	H / L	Data Bus Line
13	DB6	H / L	Data Bus Line
14	DB7	H / L	Data Bus Line
15	LED CATHODE	-	LED Cathode Terminal
16	LED ANODE	-	LED Anode Terminal

4.2. Example of Power Supply

It is recommended to apply a potentiometer for the contrast adjust due to the tolerance of the driving voltage and its temperature dependence.



4.3. Block Diagram



5. Test

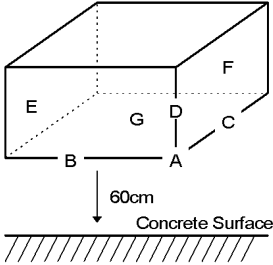
No change on display and in operation under the following test condition.

Conditions: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: $20\pm 5^{\circ}\text{C}$

Humidity : $65\pm 5\% \text{RH}$

tests will be not conducted under functioning state.

No.	Parameter	Conditions	Notes
1	High Temperature Operating	$50^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96hrs (operation state)	
2	Low Temperature Operating	$0^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96hrs (operation state)	1
3	High Temperature Storage	$70^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96hrs	2
4	Low Temperature Storage	$-20^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96hrs	1,2
5	Damp Proof Test	$40^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 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 each 15 minutes	3
7	Shock Test	To be measured after dropping from 60cm high 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.

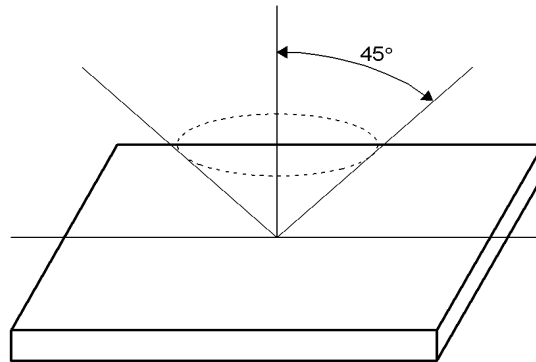
6. Appearance Standards

6.1. Inspection conditions

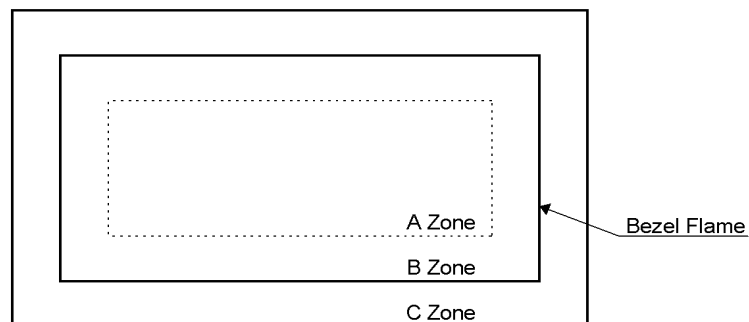
The LCD shall be inspected under 40W white fluorescent light.

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



A Zone : Active display area

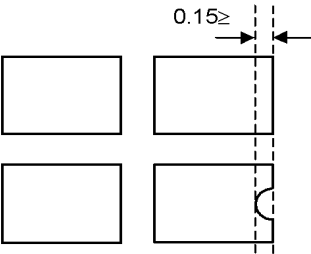
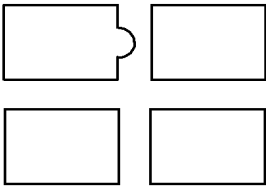
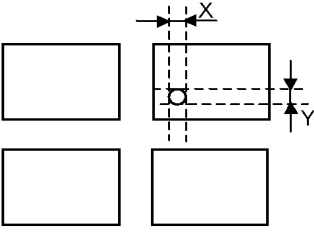
B Zone : Area from outside of "A Zone" to validity viewing area

C Zone : Rest parts

A Zone + B Zone = Validity viewing area

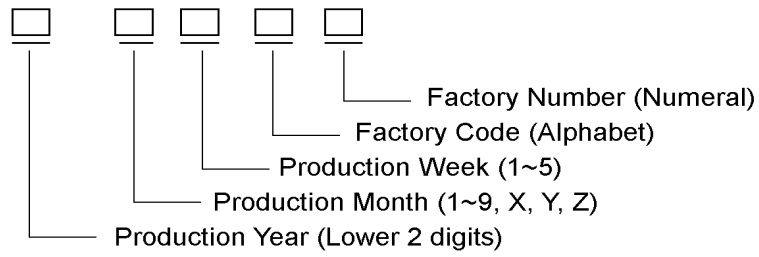
6.3.Standards

No.	Parameter	Criteria																																																											
1	Black and White Spots, Foreign Substances	<p>(1) Round Shape</p> <table border="1" data-bbox="615 300 1390 569"> <thead> <tr> <th data-bbox="615 300 927 390">Zone Dimension (mm)</th> <th colspan="3" data-bbox="927 300 1390 342">Acceptable Number</th> </tr> <tr> <th data-bbox="615 342 927 390"></th> <th data-bbox="927 342 1079 390">A</th> <th data-bbox="1079 342 1234 390">B</th> <th data-bbox="1234 342 1390 390">C</th> </tr> </thead> <tbody> <tr> <td data-bbox="615 390 927 432">$D \leq 0.1$</td> <td data-bbox="927 390 1079 432">*</td> <td data-bbox="1079 390 1234 432">*</td> <td data-bbox="1234 390 1390 432">*</td> </tr> <tr> <td data-bbox="615 432 927 474">$0.1 < D \leq 0.2$</td> <td data-bbox="927 432 1079 474">5</td> <td data-bbox="1079 432 1234 474">5</td> <td data-bbox="1234 432 1390 474">*</td> </tr> <tr> <td data-bbox="615 474 927 516">$0.2 < D \leq 0.3$</td> <td data-bbox="927 474 1079 516">0</td> <td data-bbox="1079 474 1234 516">1</td> <td data-bbox="1234 474 1390 516">*</td> </tr> <tr> <td data-bbox="615 516 927 569">$0.3 < D$</td> <td data-bbox="927 516 1079 569">0</td> <td data-bbox="1079 516 1234 569">0</td> <td data-bbox="1234 516 1390 569">*</td> </tr> </tbody> </table> <p data-bbox="634 579 1102 611">$D = (\text{Long} + \text{Short}) / 2$ * : Disregard</p> <p>(2) Line Shape</p> <table border="1" data-bbox="615 657 1390 972"> <thead> <tr> <th colspan="2" data-bbox="615 657 927 699">Zone</th> <th colspan="3" data-bbox="927 657 1390 699">Acceptable Number</th> </tr> <tr> <th data-bbox="615 699 773 741">X(mm)</th> <th data-bbox="773 699 927 741">Y(mm)</th> <th data-bbox="927 699 1079 741">A</th> <th data-bbox="1079 699 1234 741">B</th> <th data-bbox="1234 699 1390 741">C</th> </tr> </thead> <tbody> <tr> <td data-bbox="615 741 773 783">-</td> <td data-bbox="773 741 927 783">$0.02 \geq W$</td> <td data-bbox="927 741 1079 783">*</td> <td data-bbox="1079 741 1234 783">*</td> <td data-bbox="1234 741 1390 783">*</td> </tr> <tr> <td data-bbox="615 783 773 825">$2.0 \geq L$</td> <td data-bbox="773 783 927 825">$0.03 \geq W$</td> <td data-bbox="927 783 1079 825">3</td> <td data-bbox="1079 783 1234 825">3</td> <td data-bbox="1234 783 1390 825">*</td> </tr> <tr> <td data-bbox="615 825 773 867">$1.0 \geq L$</td> <td data-bbox="773 825 927 867">$0.04 \geq W$</td> <td data-bbox="927 825 1079 867">1</td> <td data-bbox="1079 825 1234 867">2</td> <td data-bbox="1234 825 1390 867">*</td> </tr> <tr> <td data-bbox="615 867 773 909">$1.0 \geq L$</td> <td data-bbox="773 867 927 909">$0.05 \geq W$</td> <td data-bbox="927 867 1079 909">0</td> <td data-bbox="1079 867 1234 909">2</td> <td data-bbox="1234 867 1390 909">*</td> </tr> <tr> <td data-bbox="615 909 773 972">-</td> <td data-bbox="773 909 927 972">$0.05 < W$</td> <td colspan="3" data-bbox="927 909 1390 972">In the same way (1)</td> </tr> </tbody> </table> <p data-bbox="634 982 1073 1014">X : Length Y : Width * : Disregard</p> <p data-bbox="597 1024 987 1056">Total defects shall not exceed 5.</p>	Zone Dimension (mm)	Acceptable Number				A	B	C	$D \leq 0.1$	*	*	*	$0.1 < D \leq 0.2$	5	5	*	$0.2 < D \leq 0.3$	0	1	*	$0.3 < D$	0	0	*	Zone		Acceptable Number			X(mm)	Y(mm)	A	B	C	-	$0.02 \geq W$	*	*	*	$2.0 \geq L$	$0.03 \geq W$	3	3	*	$1.0 \geq L$	$0.04 \geq W$	1	2	*	$1.0 \geq L$	$0.05 \geq W$	0	2	*	-	$0.05 < W$	In the same way (1)		
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2	Air Bubbles (between glass & polarizer)	<table border="1" data-bbox="615 1108 1390 1377"> <thead> <tr> <th data-bbox="615 1108 927 1199">Zone Dimension (mm)</th> <th colspan="3" data-bbox="927 1108 1390 1150">Acceptable Number</th> </tr> <tr> <th data-bbox="615 1150 927 1199"></th> <th data-bbox="927 1150 1079 1199">A</th> <th data-bbox="1079 1150 1234 1199">B</th> <th data-bbox="1234 1150 1390 1199">C</th> </tr> </thead> <tbody> <tr> <td data-bbox="615 1199 927 1241">$D \leq 0.15$</td> <td data-bbox="927 1199 1079 1241">*</td> <td data-bbox="1079 1199 1234 1241">*</td> <td data-bbox="1234 1199 1390 1241">*</td> </tr> <tr> <td data-bbox="615 1241 927 1283">$0.15 < D \leq 0.3$</td> <td data-bbox="927 1241 1079 1283">2</td> <td data-bbox="1079 1241 1234 1283">3</td> <td data-bbox="1234 1241 1390 1283">*</td> </tr> <tr> <td data-bbox="615 1283 927 1325">$0.3 < D \leq 0.5$</td> <td data-bbox="927 1283 1079 1325">1</td> <td data-bbox="1079 1283 1234 1325">2</td> <td data-bbox="1234 1283 1390 1325">*</td> </tr> <tr> <td data-bbox="615 1325 927 1377">$0.5 < D \leq 1.0$</td> <td data-bbox="927 1325 1079 1377">0</td> <td data-bbox="1079 1325 1234 1377">1</td> <td data-bbox="1234 1325 1390 1377">*</td> </tr> </tbody> </table> <p data-bbox="634 1388 792 1419">* : Disregard</p> <p data-bbox="597 1430 987 1461">Total defects shall not exceed 3.</p>	Zone Dimension (mm)	Acceptable Number				A	B	C	$D \leq 0.15$	*	*	*	$0.15 < D \leq 0.3$	2	3	*	$0.3 < D \leq 0.5$	1	2	*	$0.5 < D \leq 1.0$	0	1	*																																			
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No.	Parameter	Criteria
3	The Shape of Dot	<p>(1) Dot Shape (with Dent)</p>  <p>As per the sketch of left hand.</p> <p>(2) Dot Shape (with Projection)</p>  <p>Should not be connected to next dot.</p> <p>(3) Pin Hole</p>  <p>$(X+Y) / 2 \leq 0.2\text{mm}$ (Less than 0.1mm is no counted.)</p> <p>Total defects shall not exceed 5.</p>
4	Polarizer Scratches	Not to be conspicuous defects.
5	Polarizer Dirts	If the stains are removed easily from LCDP surface, the module is not defective.
6	Color Variation	Not to be conspicuous defects.

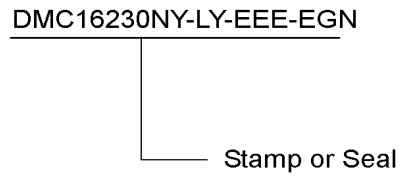
7. Code System of Production Lot

The production lot of module is specified as follows.



8. Type Number

The type number of module is specified on the back of module as follows.



9. Applying Precautions

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

10. 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.
 4. After storing the product (or LCD) under low temperature and/or in dark atmosphere for a long period of time, CCFL may take longer time to reach its specified brightness.
- 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.

- 13) Flickering due to optical interference may occur by combination of a) LCD driving frame frequency decided by either internal oscillator in driver IC or external clock input by the customer and b) lighting frequency of either backlight or other light sources.
Please evaluate enough at the environment of actual use, and decide the driving condition that does not cause flickering.

11. 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. We will not be held responsible for any quality guarantee issue for defect products judged as our-origin in 2 (two) years from our production or 1(one) year from KYOCERA Display Group delivery which ever is shorter