LCD Module Specification

First Edition	Approved by	Production Div.
Mar 7, 2000	Checked by	Quality Assurance Div.
Final Revision	Checked by	Design Engineering Div.
*******	Prepared by	Production Div.

Type No. DMF682ANF-EW

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Revision History

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1. General Specifications

Operating Temp.	:	min. 0℃ ～ max. 50℃
Storage Temp.	:	min. -20℃ ～ max. 60℃
Dot Pixels	:	256 (W) × 128 (H) dots
Dot Size	:	0.43 (W) × 0.43 (H) mm
Dot Pitch	:	0.47 (W) × 0.47 (H) mm
Viewing Area	:	127.0 (W) × 70.0 (H) mm
Outline Dimensions	:	147.0 (W) × 116.0 (H) × 12.0 max. (D) mm
Weight	:	160g max.
LCD Type	:	NSD-7451 (F-STN / Black&White-mode / Transflective)
Viewing Angle	:	6:00
Data Transfer	:	4-bit parallel data transfer
Backlight	:	Electro Luminescence (EL) / White
Drawings	:	Dimensional Outline UE-34760

2. Electrical Specifications

2.1. Absolute Maximum Ratings

V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage (Logic)	V_{DD}-V_{SS}	—	-0.3	6.0	V
Supply Voltage (LCD Drive)	V_{DD}-V_{EE}	—	0	30.0	V
Input Voltage	V_I	—	-0.3	V_{DD}+0.3	V

2.2. DC Characteristics

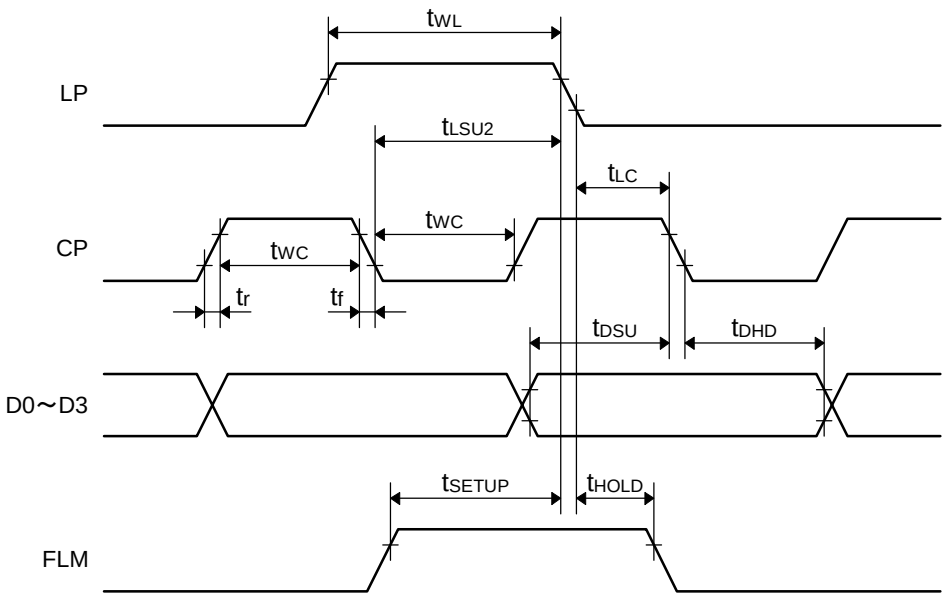
Ta=25℃, V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage (Logic)	V_{DD}-V_{SS}	—	4.5	—	5.5	V
Supply Voltage (LCD Drive)	V_{DD}-V_{EE}	Shown in 3.1				V
High Level Input Voltage	V_{IH}	V_{DD}=5.0V±10%	0.8×V_{DD}	—	V_{DD}	V
Low Level Input Voltage	V_{IL}	V_{DD}=5.0V±10%	0	—	0.2×V_{DD}	V
High Level Output Voltage	V_{OH}	I_{OH}=-0.2mA	V_{DD}-0.4	—	—	V
Low Level Output Voltage	V_{OL}	I_{OL}=0.2mA	—	—	0.4	V
Supply Current	I_{DD}	V_{DD}-V_{SS}=5.0V	—	3.6	20.0	mA
	I_{EE}	V_{DD}-V_{EE}=13.2V	—	2.9	15.0	mA
Clock Frequency	f_{CP}	Duty=50%	—	—	3.4	MHz

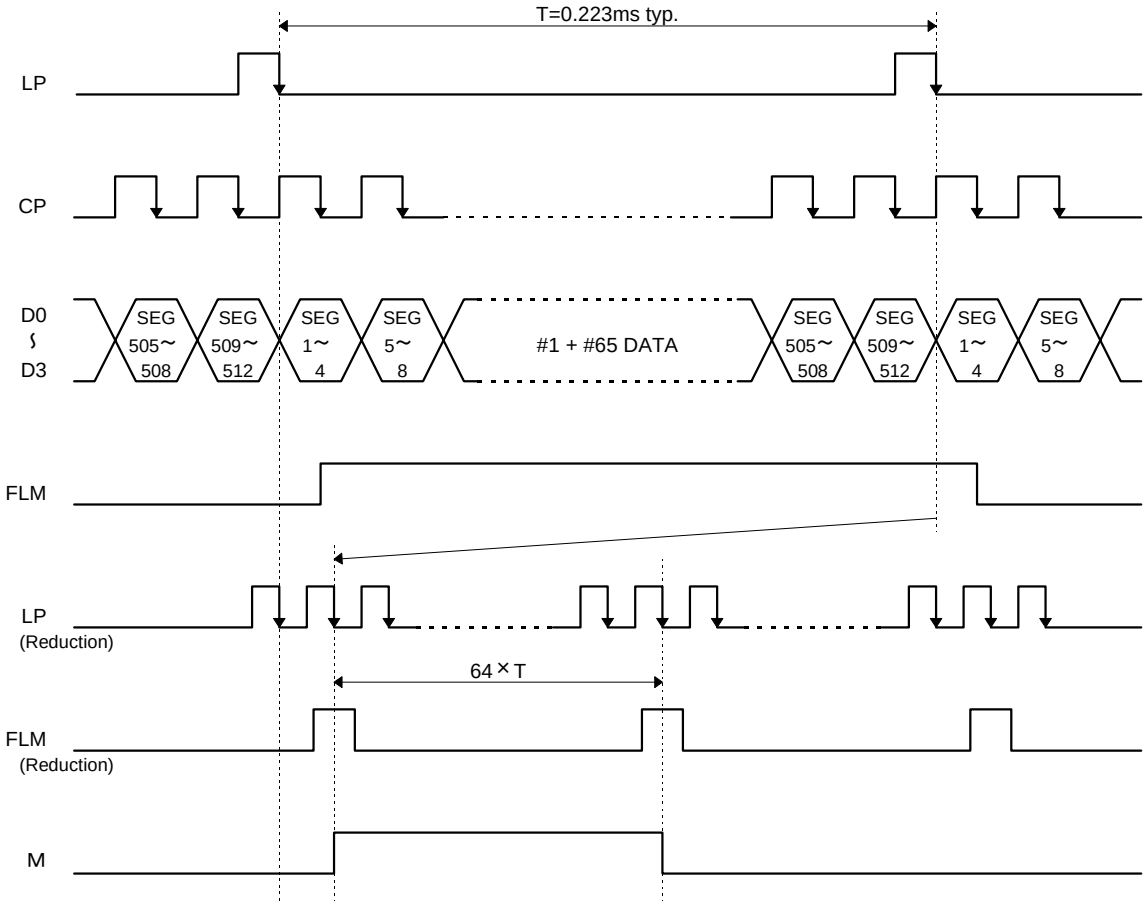
2.3.AC Characteristics

V_{DD}=5.0V±10%

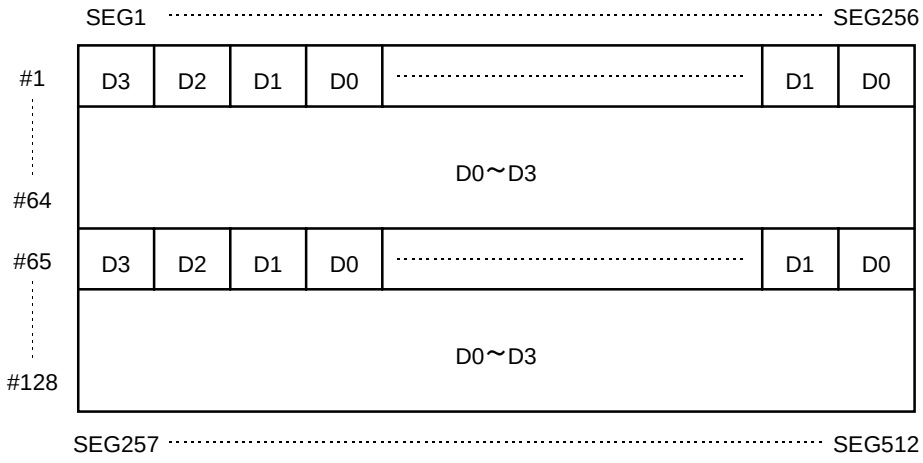
Parameter	Symbol	Min.	Max.	Units
Clock Pulse Width	t_{WC}	100	–	ns
Latch Pulse High Level Width	t_{WL}	125	–	ns
Clock Pulse Rise/Fall Time	tr, tf	–	50	ns
CP→LP Fall Time	t_{LSU2}	90	–	ns
LP→CP Fall Time	t_{LC}	200	–	ns
Data Setup Time	t_{DSU}	50	–	ns
Data Hold Time	t_{DHD}	80	–	ns
FLM Data Setup Time	t_{SETUP}	100	–	ns
FLM Data Hold Time	t_{HOLD}	100	–	ns



2.4.Timing Chart

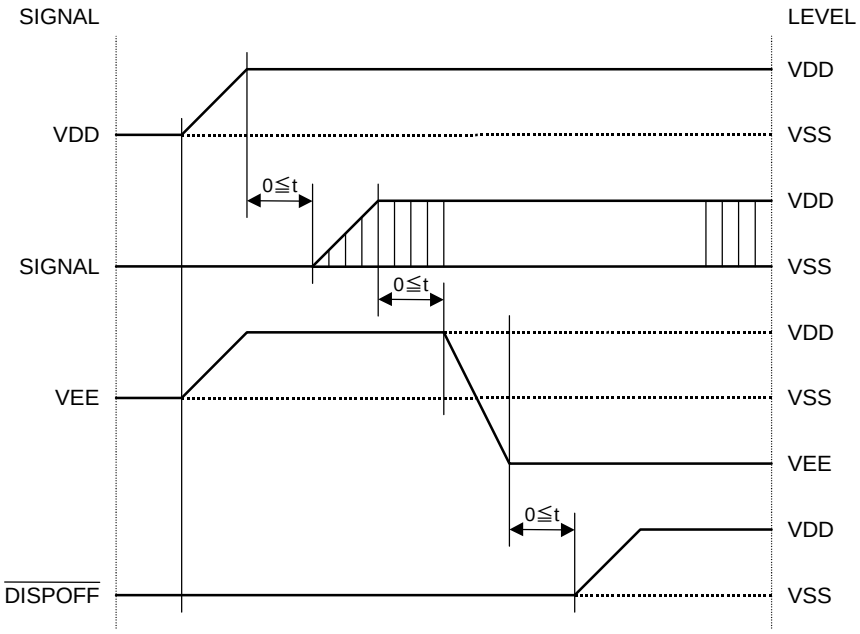


2.5.Comparison of Display and Data

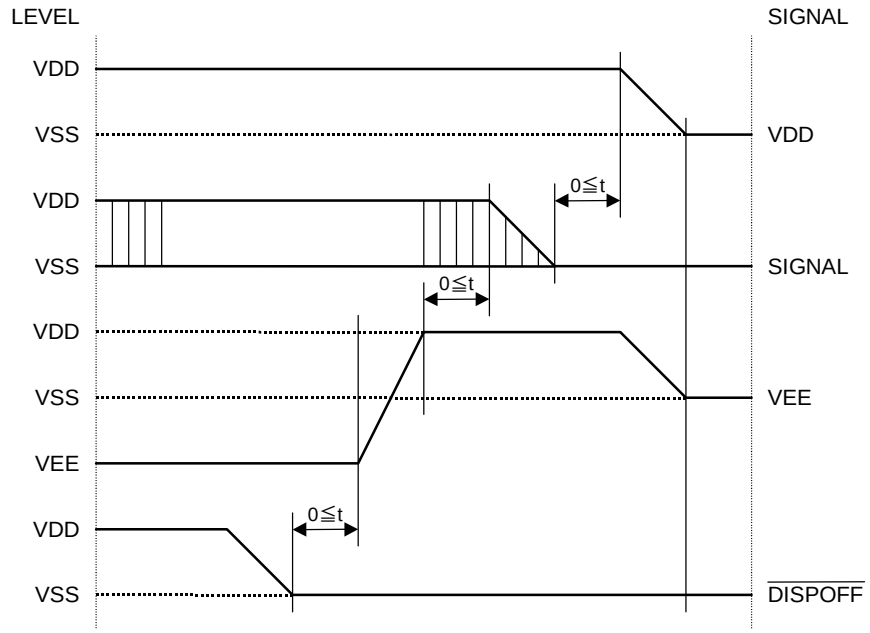


2.6.Power Supply ON/OFF Sequence

2.6.1.ON Sequence



2.6.2.OFF Sequence



Please maintain the above sequence when turning on and off the power supply of the module. If $\overline{\text{DISPOFF}}$ is supplied to the module while internal alternate signal for LCD driving (M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

2.7.Lighting Specifications

2.7.1.Absolute Maximum Rating

Ta=25℃

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage	—	—	—	150	Vrms
Input Frequency	AC100Vrms	—	—	800	Hz

2.7.2.Operating Characteristics

Ta=25℃

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage	—	—	100	—	Vrms
Input Frequency	—	—	400	—	Hz
Current	AC100Vrms, 400Hz	—	11.3	14.4	mA
Luminance of Backlight Surface	AC100Vrms, 400Hz	54	72	—	cd/㎡
Life	AC100Vrms, 400Hz Ta=20℃, 60%RH	1800	—	—	hrs

Recommended Inverter : NS-106 (DC 5.0V±10%, Produced by NEC)

3. Optical Specifications

3.1.LCD Driving Voltage

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Recommended	V_{DD}-V_{EE}	Ta= 0℃	—	—	15.4	V
LCD Driving Voltage		Ta=25℃	12.3	13.2	14.1	V
Note 1		Ta=50℃	11.2	—	—	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℃, 1/64 Duty, 1/8.8 Bias, V_D=13.2V (Note 4), $\theta = 0^\circ$, $\phi = -^\circ$

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Units
Contrast Ratio Note 1		CR	$\theta = 0^\circ$, $\phi = -^\circ$	—	7	—	
Viewing Angle			Shown in 3.3				
Response	Rise Note 2	T_{ON}	—	—	70	140	ms
Time	Decay Note 3	T_{OFF}	—	—	330	500	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.

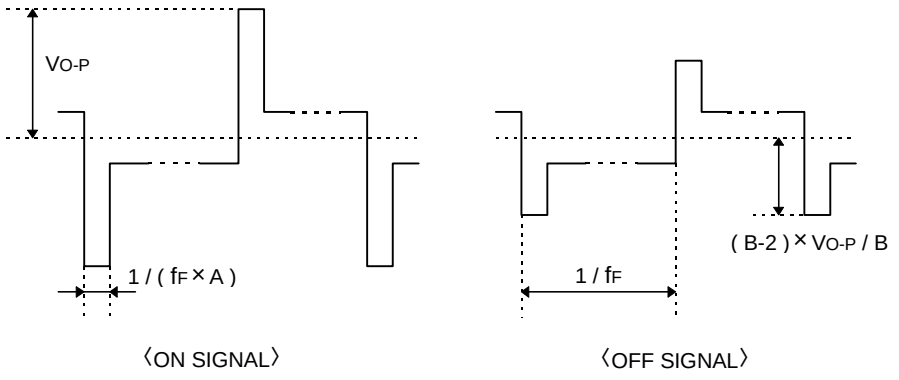
Note 4 : Definition of Driving Voltage V_D

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.

$V_D = (Vth1+Vth2) / 2$

Vth1 : 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.

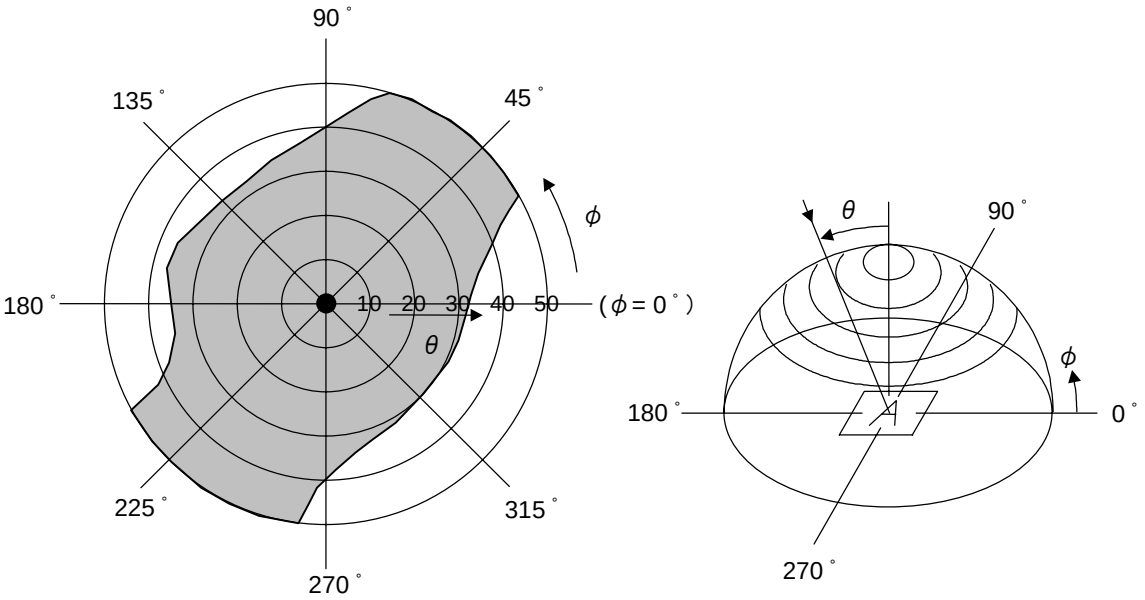
Vth2 : The voltage V_{O-P} that should provide 50% of the saturation level in the luminance at the segment which the OFF signal is applied to.



3.3.Definition of Viewing Angle and Optimum Viewing Area

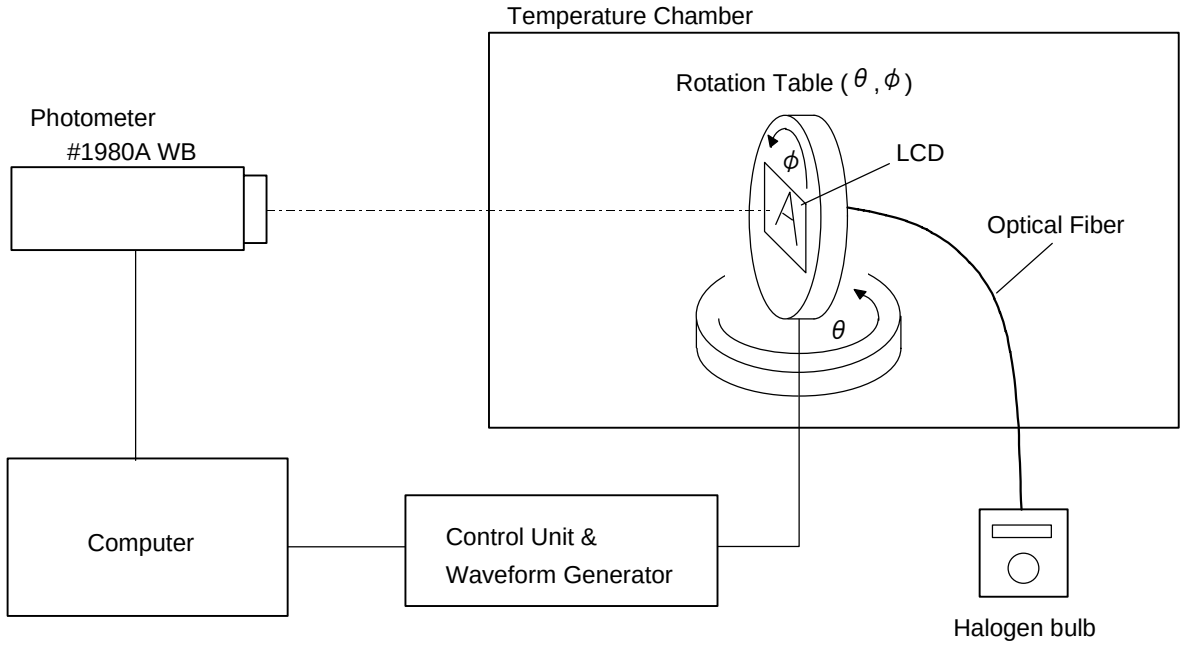
・Point ● shows the point where contrast ratio is measured. : $\theta = 0^\circ$, $\phi = -^\circ$

・Driving condition : 1/64 Duty, 1/8.8 Bias, V_D=13.2V, f_F=70Hz



・Area ▭ shows typ. CR≧2

3.4.System Block Diagram



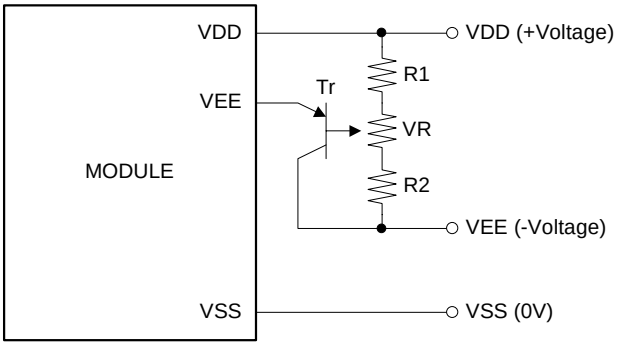
4.I/O Terminal

4.1.Pin Assignment

No.	Symbol	Level	Function
1	V_{DD}	—	Power Supply for Logic
2	V_{SS}	—	Power Supply (0V, GND)
3	V_{EE}	—	Power Supply for LCD Drive
4	LP	H / L	Data Latch Signal
5	M	H / L	Alternate Signal for LCD Drive
6	$\overline{\text{DISPOFF}}$	H / L	Display Control Signal H : Display on L : Display off
7	NC	—	Non-connection
8	FLM	H / L	First Line Marker
9	CP	H / L	Clock Signal for Shifting Data
10	NC	—	Non-connection
11	D0	H / L	Display Data
12	D1	H / L	Display Data
13	D2	H / L	Display Data
14	D3	H / L	Display Data
15	EL	—	Power Supply for EL
16	EL	—	Power Supply for EL

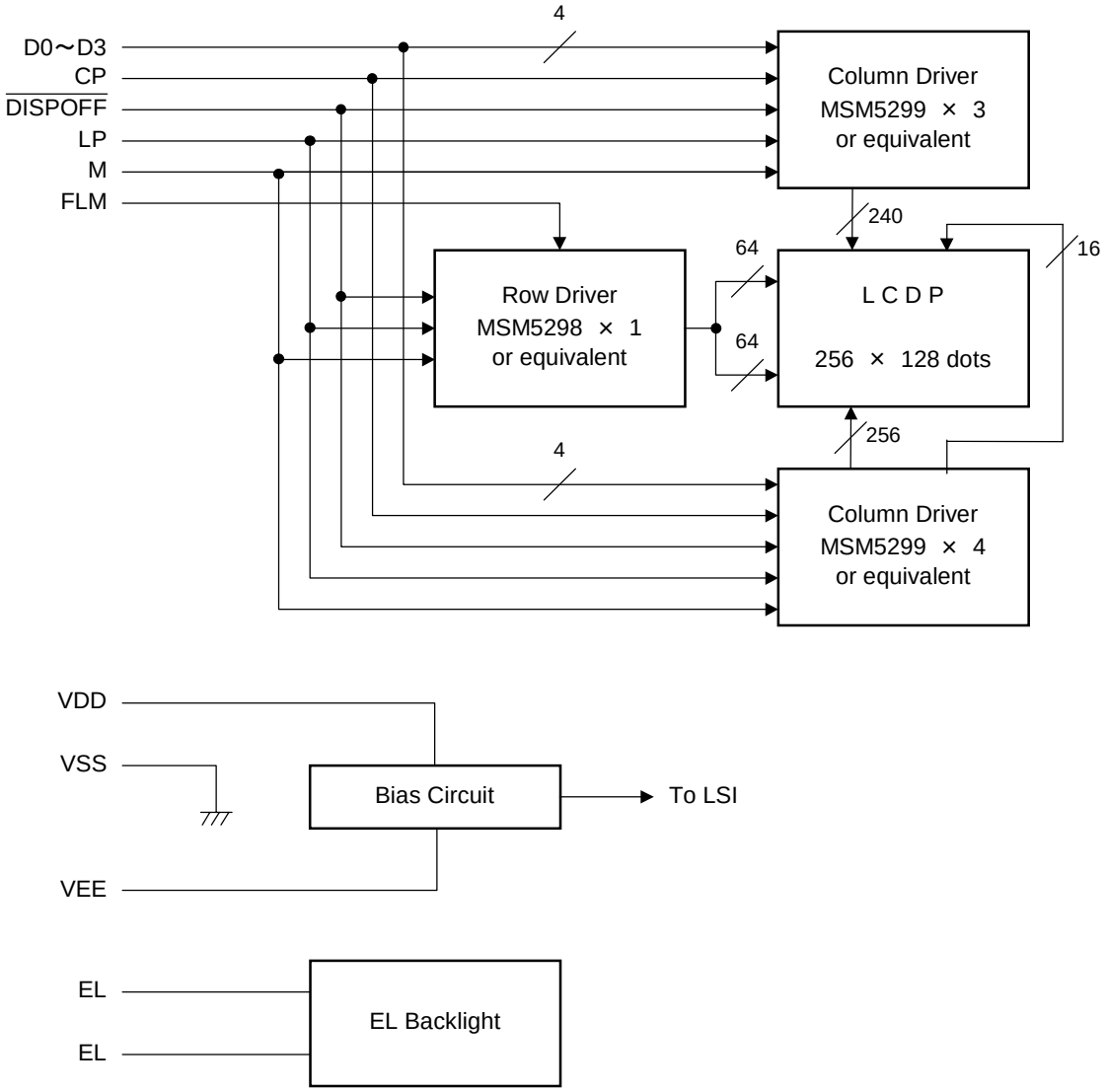
4.2.Example of Power Supply

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



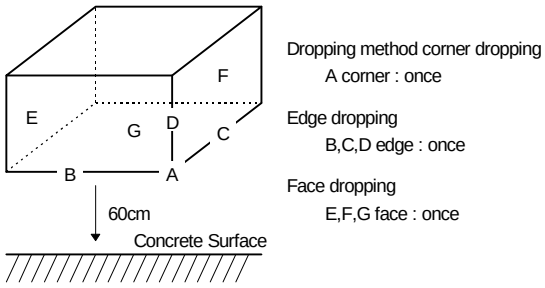
R1+R2+VR=10～20KΩ
Tr=2SA1202 or equivalent

4.3.Block Diagram



5. Test

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

No.	Parameter	Conditions	Notes
1	High Temperature Operating	50℃±2℃, 96hrs (operation state)	
2	Low Temperature Operating	0℃±2℃, 96hrs (operation state)	3
3	High Temperature Storage	60℃±2℃, 96hrs	4
4	Low Temperature Storage	-20℃±2℃, 96hrs	3, 4
5	Damp Proof Test	40℃±2℃, 90～95%RH, 96hrs	3, 4
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	5
7	Shock Test	To be measured after dropping from 60cm high on the concrete surface in packing state. 	

Note 1 : Unless otherwise specified, tests will be conducted under the following condition.
Temperature : 20±5℃
Humidity : 65±5%

Note 2 : Unless otherwise specified, tests will be not conducted under functioning state.

Note 3 : No dew condensation to be observed.

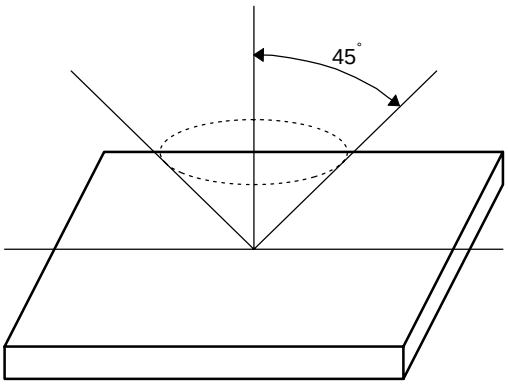
Note 4 : The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

Note 5 : Vibration test will be conducted to the product itself without putting it in a container.

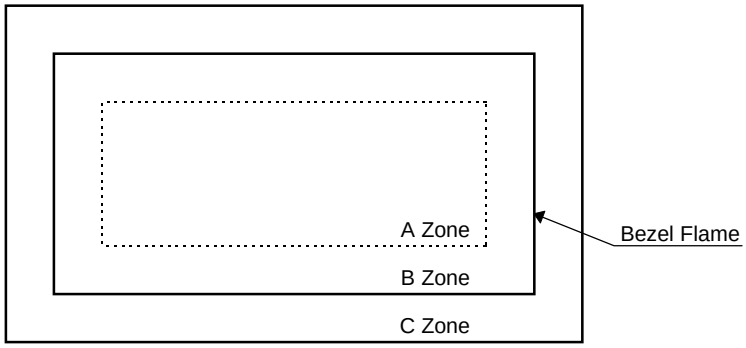
6. Appearance Standards

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

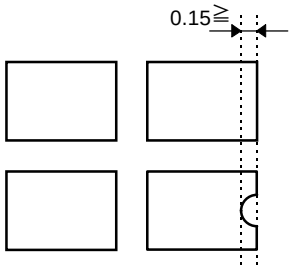
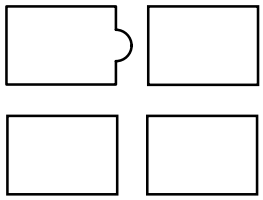
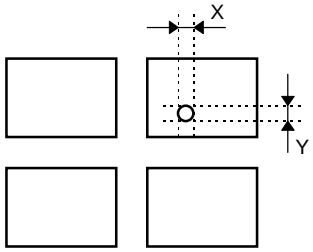
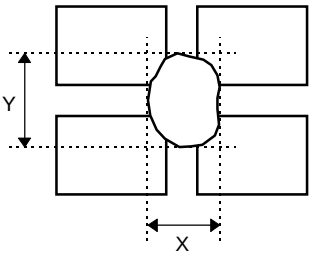


A Zone : Active display area
B Zone : Area from outside of "A Zone" to validity viewing area
C Zone : Rest parts

A Zone + B Zone = Validity viewing area

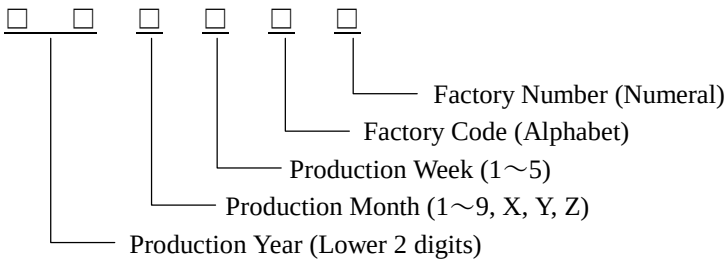
6.3.Standards

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black and White Spots, Foreign Substances</td><td>(1) Round Shape
<table>
<tr><th rowspan="2">Zone
Dimension (mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≦0.1</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.1 ＜ D ≦0.2</td><td>3</td><td>5</td><td>*</td></tr>
<tr><td>0.2 ＜ D ≦0.25</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>0.25＜ D ≦0.3</td><td>0</td><td>1</td><td>*</td></tr>
<tr><td>0.3 ＜ D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
D = (Long + Short) / 2 * : Disregard
(2) Line Shape
<table>
<tr><th colspan="2">Zone
X (mm) Y (mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th></th><th></th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>—</td><td>0.03≧W</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>2.0≧L</td><td>0.05≧W</td><td>3</td><td>3</td><td>*</td></tr>
<tr><td>1.0≧L</td><td>0.1 ≧W</td><td>3</td><td>3</td><td>*</td></tr>
<tr><td>—</td><td>0.1 ＜W</td><td colspan="3">In the same way (1)</td></tr>
</table>
X : Length Y : Width * : Disregard
Total defects shall not exceed 5.</td></tr>
<tr><td>2</td><td>Air Bubbles (between glass & polarizer)</td><td>
<table>
<tr><th rowspan="2">Zone
Dimension (mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≦ 0.3</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.3 ＜ D ≦ 0.4</td><td>3</td><td>*</td><td>*</td></tr>
<tr><td>0.4 ＜ D ≦ 0.6</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>0.6 ＜ D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
* : Disregard
Total defects shall not exceed 3.</td></tr>
</table>

No.	Parameter	Criteria
3	The Shape of Dot	(1) Dot Shape (with Dent)  As per the sketch of left hand. (2) Dot Shape (with Projection)  Should not be connected to next dot. (3) Pin Hole  (X+Y) / 2≦0.2mm (Less than 0.1mm is no counted.) (4) Deformation  (X+Y) / 2≦0.2mm Total acceptable number : 1/dot, 5/cell (Defect number of (4) : 1pc.)
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	Complex Foreign Substance Defects	Black spots, line shaped foreign substances or air bubbles between glass & polarizer should be 5pcs maximum in total.
7	Distance between Different Foreign Substance Defects	D≦0.2 : 20mm or more 0.2＜D : 40mm or more

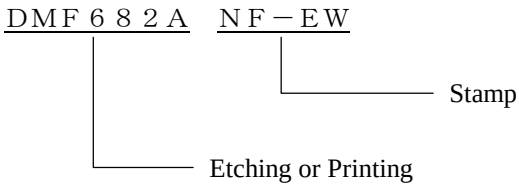
7. Code System of Production Lot

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) Conduc1tivity 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.
③The use of CFLs for extended periods of time at low temperatures will significantly shorten their service life.

8) For models which use touch panels:

①Do not stack up modules since they can be damaged by components on neighboring modules.
②Do not place heavy objects on top of the product. This could cause glass breakage.

9) For models which use COG,TAB,or COF:

①The 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.
②Given 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:

①In order to maintain reliability, do not touch or hold by the connector area.
②Avoid any bending, pulling, or other excessive force, which can result in broken connections.

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 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, Display LC delivery which ever comes later.

First Edition
Aug 8, 2005

LCD Module Technical Specification

Final Revision
******

Type No. **DMF682ANF-EW-BFN**

Approved by (Quality Assurance Division)

Checked by (ACI Engineering Division)

T. Yuchi
Prepared by (ACI Engineering Division)

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Revision History

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1.General Specifications

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Storage Temp.	:	min. -20℃ ～ max. 60℃
Dot Pixels	:	256 (W) × 128 (H) dots
Dot Size	:	0.43 (W) × 0.43 (H) mm
Dot Pitch	:	0.47 (W) × 0.47 (H) mm
Viewing Area	:	127.0 (W) × 70.0 (H) mm
Outline Dimensions	:	147.0 (W) × 116.0 (H) × 12.0 max. (D) mm
Weight	:	160g max.
LCD Type	:	NSD-7451 (F-STN / Black &White-mode / Transflective)
Viewing Angle	:	6:00
Data Transfer	:	4-bit parallel data transfer
Backlight	:	Electro Luminescence (EL) / White
Drawings	:	Dimensional Outline DMF682BF base
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_{DD}-V_{SS}	–	-0.3	6.0	V
Supply Voltage (LCD Drive)	V_{DD}-V_{EE}	–	0	30.0	V
Input Voltage	V_I	–	-0.3	V_{DD}+0.3	V

2.2.DC Characteristics

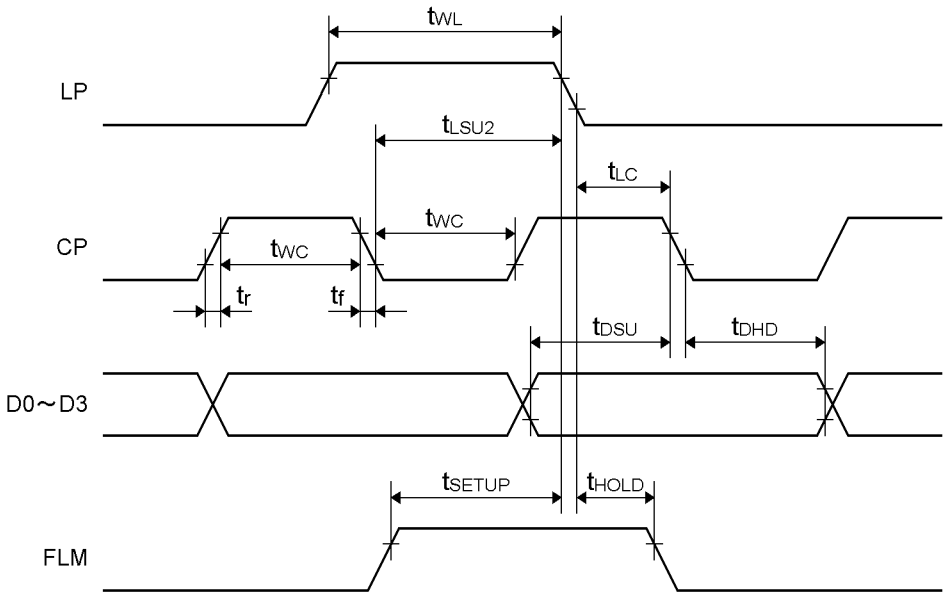
Ta=25℃, V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage (Logic)	V_{DD}-V_{SS}	–	4.5	–	5.5	V
Supply Voltage (LCD Drive)	V_{DD}-V_{EE}	Shown in 3.1				V
High Level Input Voltage	V_{IH}	V_{DD}=5.0V±10%	0.8×V_{DD}	–	V_{DD}	V
Low Level Input Voltage	V_{IL}	V_{DD}=5.0V±10%	0	–	0.2×V_{DD}	V
High Level Output Voltage	V_{OH}	I_{OH}=-0.2mA	V_{DD}-0.4	–	–	V
Low Level Output Voltage	V_{OL}	I_{OL}=0.2mA	–	–	0.4	V
Supply Current	I_{DD}	V_{DD}-V_{SS}=5.0V	–	3.6	20.0	mA
	I_{EE}	V_{DD}-V_{EE}=13.2V	–	2.9	15.0	mA
Clock Frequency	f_{CP}	Duty=50%	–	–	3.4	MHz

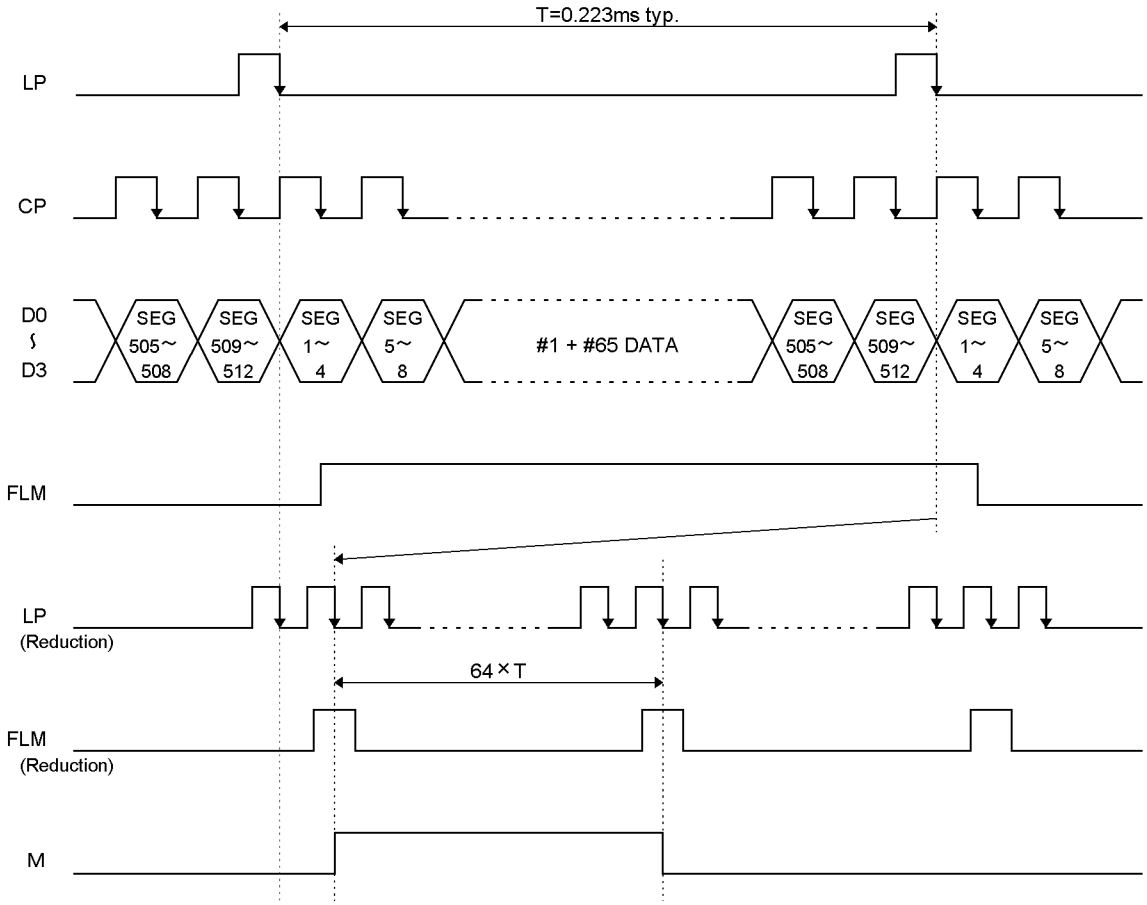
2.3.AC Characteristics

V_{DD}=5.0V±10%

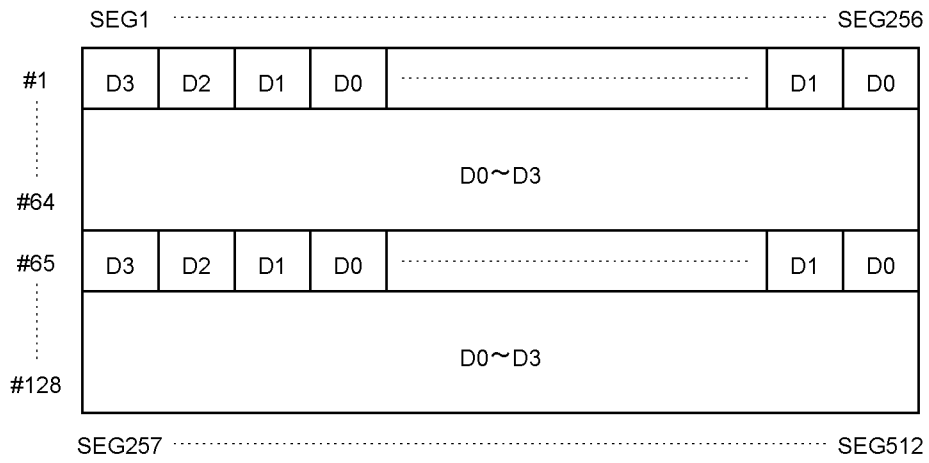
Parameter	Symbol	Min.	Max.	Units
Clock Pulse Width	t_{WC}	100	—	ns
Latch Pulse High Level Width	t_{WL}	125	—	ns
Clock Pulse Rise/Fall Time	t_r, t_f	—	50	ns
CP→LP Fall Time	t_{LSU2}	90	—	ns
LP→CP Fall Time	t_{LC}	200	—	ns
Data Setup Time	t_{DSU}	50	—	ns
Data Hold Time	t_{DHD}	80	—	ns
FLM Data Setup Time	t_{SETUP}	100	—	ns
FLM Data Hold Time	t_{HOLD}	100	—	ns



2.4.Timing Chart

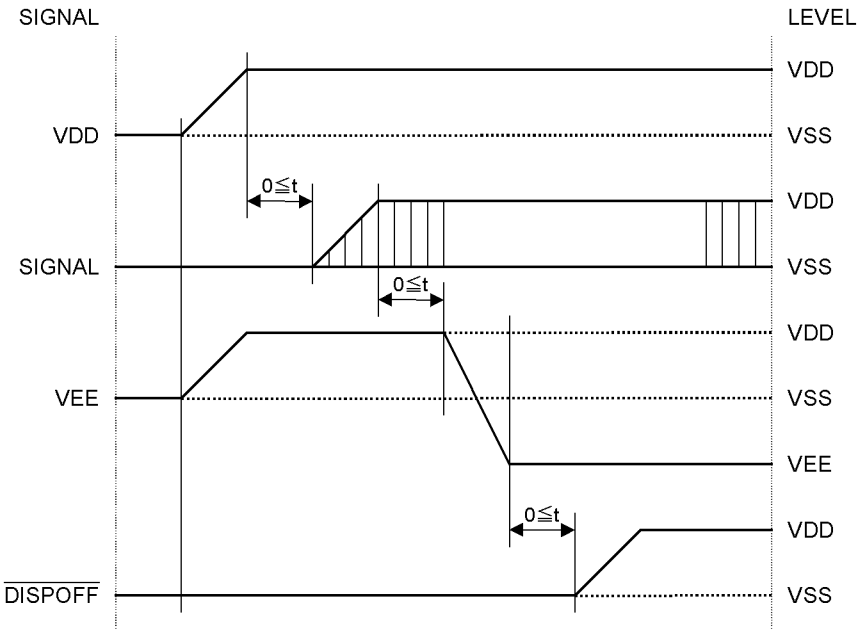


2.5.Comparison of Display and Data

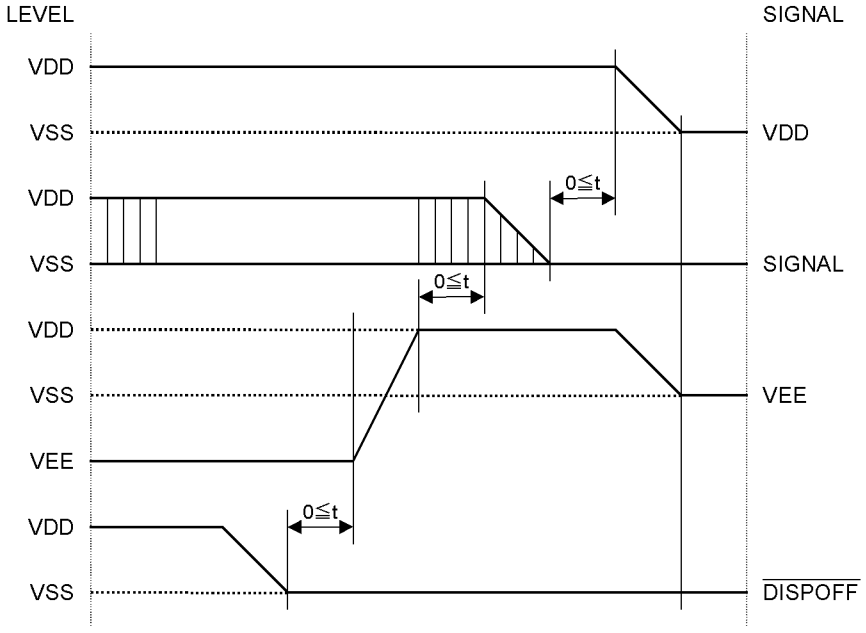


2.6.Power Supply ON/OFF Sequence

2.6.1.ON Sequence



2.6.2.OFF Sequence



Please maintain the above sequence when turning on and off the power supply of the module.

If $\overline{\text{DISPOFF}}$ is supplied to the module while internal alternate signal for LCD driving (M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

2.7.Lighting Specifications

2.7.1.Absolute Maximum Rating

Ta=25℃

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage	—	—	—	150	Vrms
Input Frequency	AC100Vrms	—	—	800	Hz

2.7.2.Operating Characteristics

Ta=25℃

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage	—	—	100	—	Vrms
Input Frequency	—	—	400	—	Hz
Current	AC100Vrms, 400Hz	—	11.3	14.4	mA
Luminance of Backlight Surface	AC100Vrms, 400Hz	54	72	—	cd/㎡
Life	AC100Vrms, 400Hz Ta=20℃, 60%RH	1800	—	—	hrs

Recommended Inverter : NS-106 (DC 5.0V±10%, Produced by NEC)

3.Optical Specifications

3.1.LCD Driving Voltage

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Recommended	V_{DD}-V_{EE}	Ta= 0℃	–	–	15.4	V
LCD Driving Voltage		Ta=25℃	12.3	13.2	14.1	V
Note 1		Ta=50℃	11.2	–	–	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℃, 1/64 Duty, 1/8.8 Bias, V_D=13.2V (Note 4), $\theta = 0^\circ$, $\phi = -^\circ$

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Units
Contrast Ratio Note		CR	$\theta = 0^\circ$, $\phi = -^\circ$	–	7	–	
Viewing Angle			Shown in 3.3				
Response	Rise Note 2	T_{ON}	–	–	70	140	ms
Time	Decay Note	T_{OFF}	–	–	330	500	ms

Note 1 :Contrast ratio is definded 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.

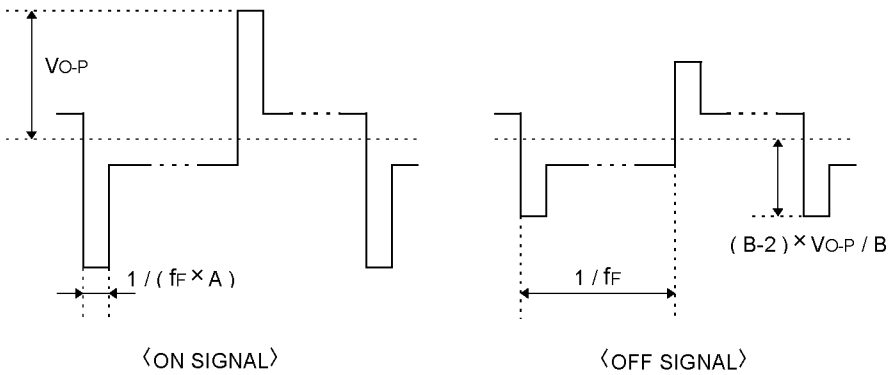
Note 4 :Definition of Driving Voltage V_D

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 definded as follows.

$V_D = (Vth1+Vth2) / 2$

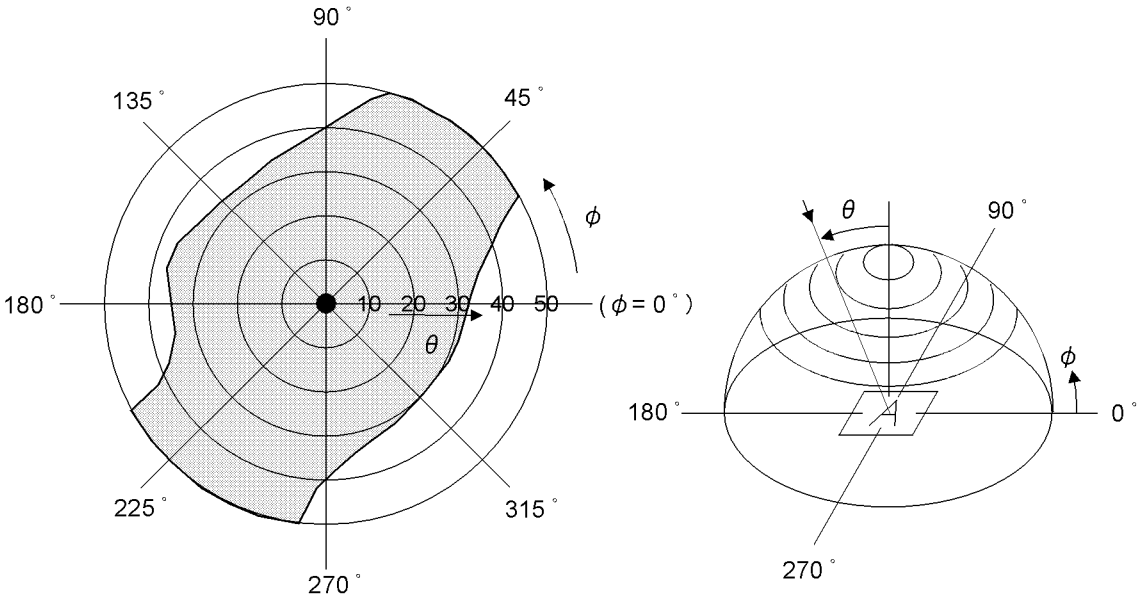
Vth1 : The voltage V_{O-P} that should provide 50% of the saturation level in the luminance at the segment which the ON signal is applied to.

Vth2 : 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.



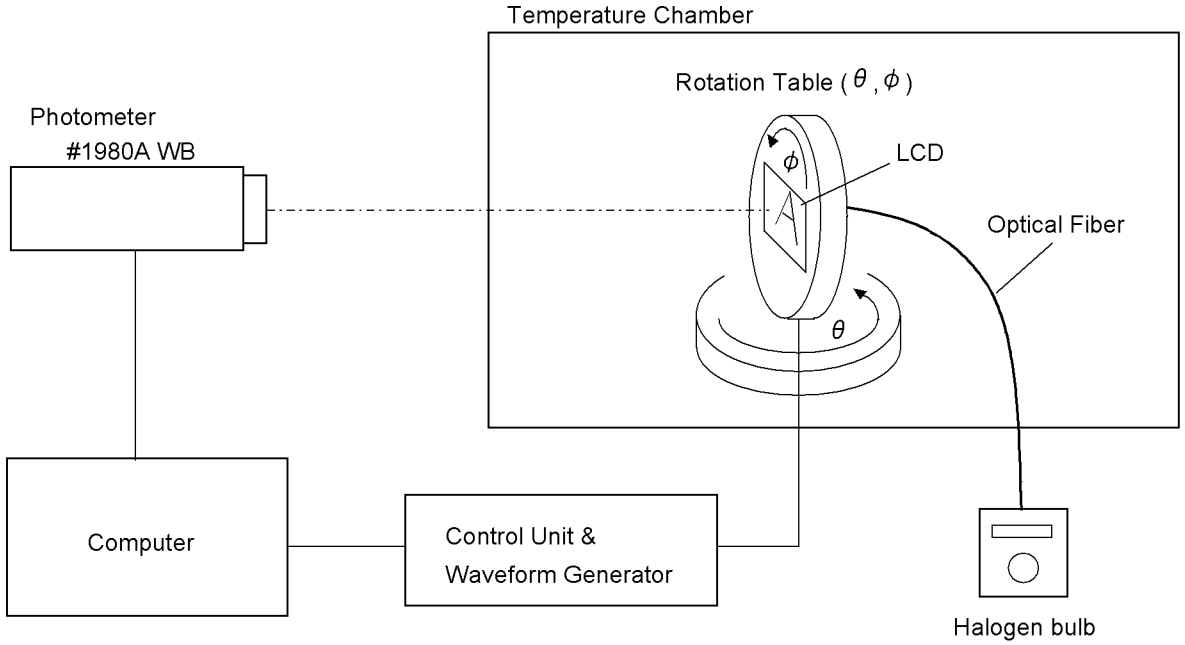
3.3.Definition of Viewing Angle and Optimum Viewing Area

・Point ● shows the point where contrast ratio is measured. : $\theta = 0^\circ$, $\phi = -^\circ$
・Driving condition : 1/64 Duty, 1/8.8 Bias, V_D=13.2V, f_F=70Hz



・Area ▭ shows typ. CR≧2

3.4.System Block Diagram



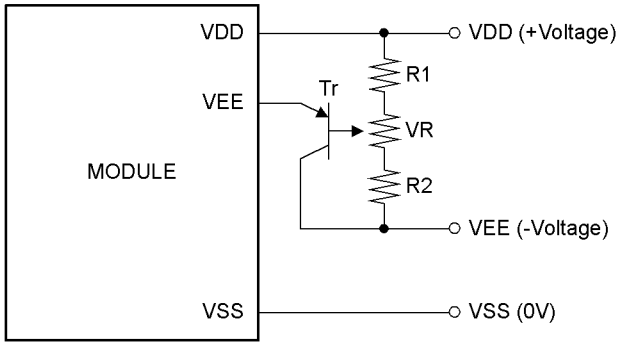
4.I/O Terminal

4.1.Pin Assignment

No.	Symbol	Level	Function
1	V_{DD}	—	Power Supply for Logic
2	V_{SS}	—	Power Supply (0V, GND)
3	V_{EE}	—	Power Supply for LCD Drive
4	LP	H / L	Data Latch Signal
5	M	H / L	Alternate Signal for LCD Drive
6	$\overline{\text{DISPOFF}}$	H / L	Display Control Signal H : Display on L : Display off
7	NC	—	Non-connection
8	FLM	H / L	First Line Marker
9	CP	H / L	Clock Signal for Shifting Data
10	NC	—	Non-connection
11	D0	H / L	Display Data
12	D1	H / L	Display Data
13	D2	H / L	Display Data
14	D3	H / L	Display Data
15	EL	—	Power Supply for EL
16	EL	—	Power Supply for EL

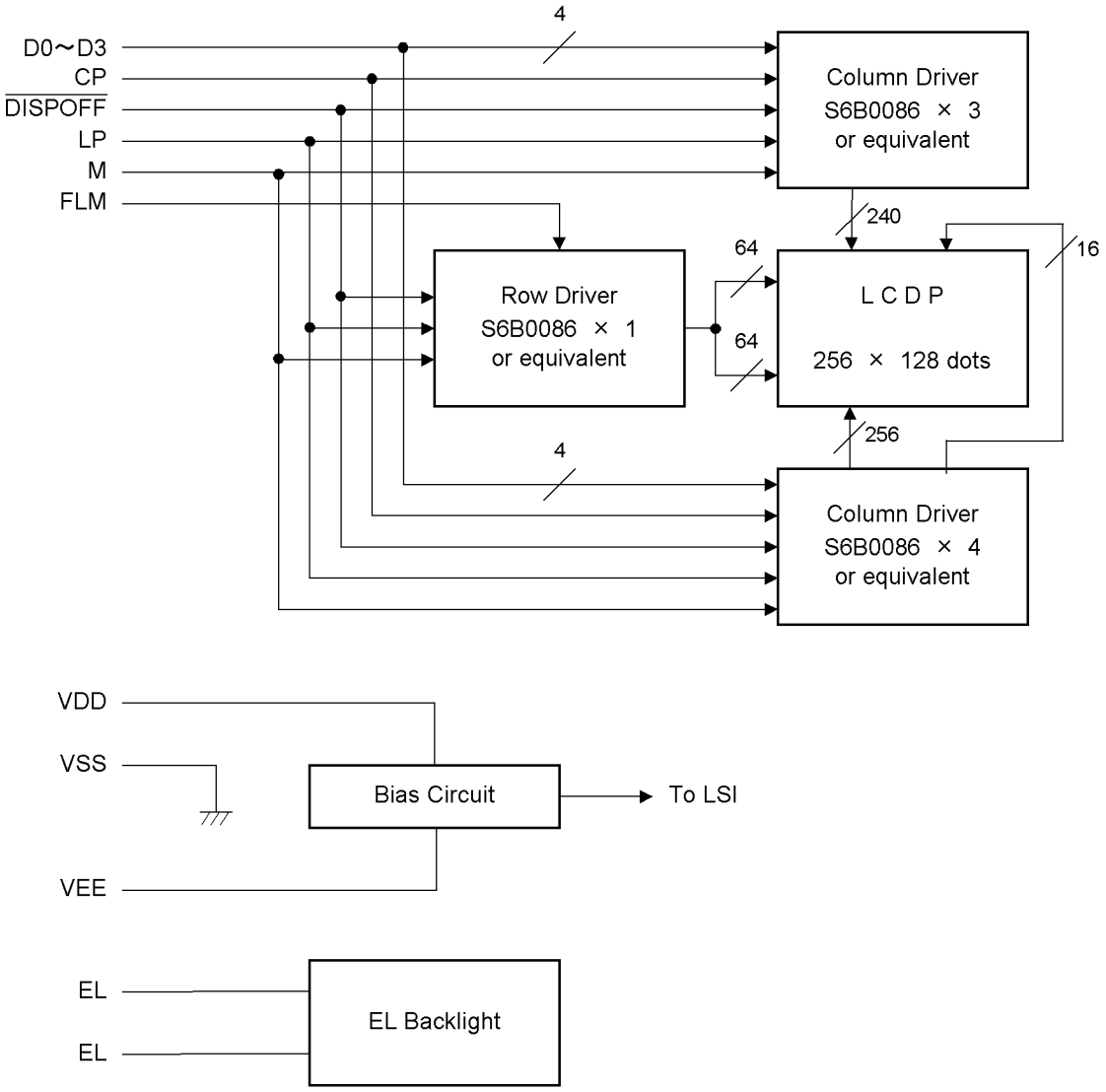
4.2.Example of Power Supply

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



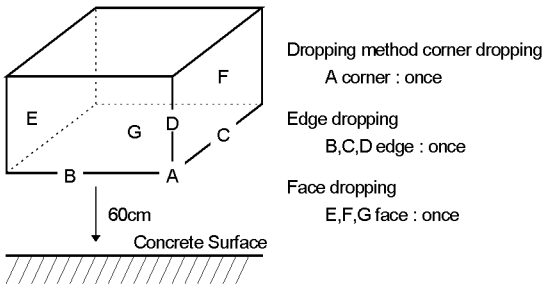
R1+R2+VR=10～20KΩ
Tr=2SA1202 or equivalent

4.3.Block Diagram



5. Test

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

No.	Parameter	Conditions	Notes
1	High Temperature Operating	50℃±2℃, 96hrs (operation state)	
2	Low Temperature Operating	0℃±2℃, 96hrs (operation state)	3
3	High Temperature Storage	60℃±2℃, 96hrs	4
4	Low Temperature Storage	-20℃±2℃, 96hrs	3, 4
5	Damp Proof Test	40℃±2℃, 90～95%RH, 96hrs	3, 4
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	5
7	Shock Test	To be measured after dropping from 60cm high the concrete surface in packing state. 	

Note 1 :Unless otherwise specified, tests will be conducted under the following condition.
Temperature: 20±5℃
Humidity : 65±5%

Note 2 :Unless otherwise specified, tests will be not conducted under functioning state.

Note 3 :No dew condensation to be observed.

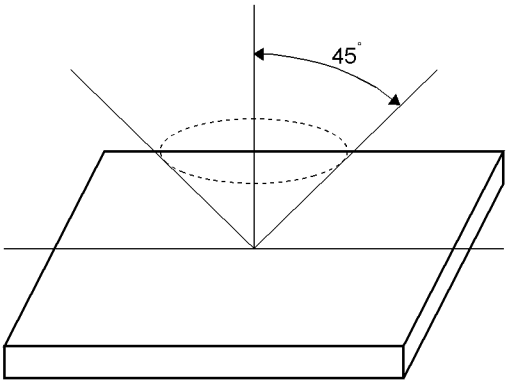
Note 4 :The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

Note 5 :Vibration test will be conducted to the product itself without putting it in a container.

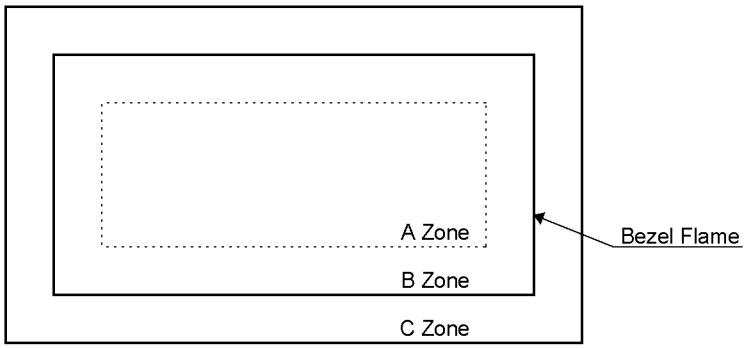
6.Appearance Standards

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

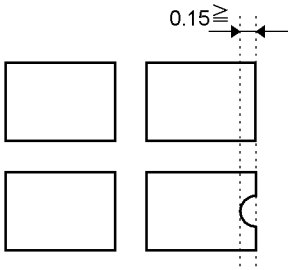
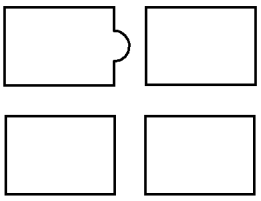
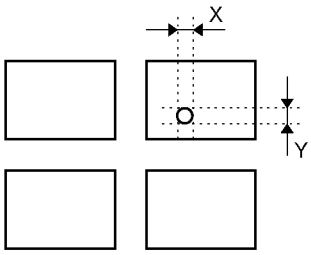
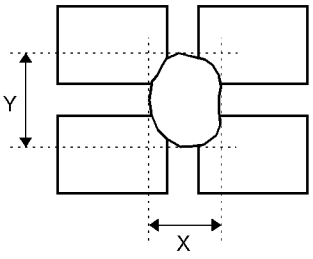


A Zone : Active display area
B Zone : Area from outside of "A Zone" to validity viewing area
C Zone : Rest parts

A Zone + B Zone = Validity viewing area

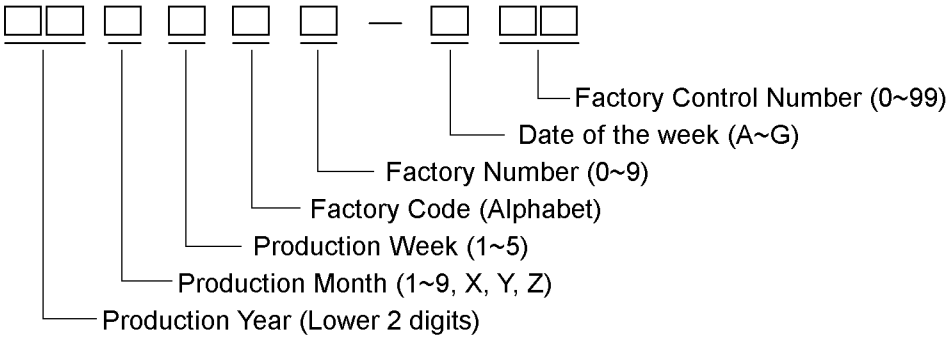
6.3.Standards

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black and White Spots, Foreign Substances</td><td>(1) Round Shape
<table>
<tr><th rowspan="2">Zone / Dimension (mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≦0.1</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.1 ＜ D ≦0.2</td><td>3</td><td>5</td><td>*</td></tr>
<tr><td>0.2 ＜ D ≦0.25</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>0.25＜ D ≦0.3</td><td>0</td><td>1</td><td>*</td></tr>
<tr><td>0.3 ＜ D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
D = (Long + Short) / 2 * : Disregard
(2) Line Shape
<table>
<tr><th rowspan="2">X (mm) \ Zone / Y (mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>—</td><td>0.03≧W</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>2.0≧L</td><td>0.05≧W</td><td>3</td><td>3</td><td>*</td></tr>
<tr><td>1.0≧L</td><td>0.1 ≧W</td><td>3</td><td>3</td><td>*</td></tr>
<tr><td>—</td><td>0.1 ＜W</td><td colspan="3">In the same way (1)</td></tr>
</table>
X : Length Y : Width * : Disregard
Total defects shall not exceed 5.</td></tr>
<tr><td>2</td><td>Air Bubbles (between glass & polarizer)</td><td>
<table>
<tr><th rowspan="2">Zone / Dimension (mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≦ 0.3</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.3 ＜ D ≦ 0.4</td><td>3</td><td>*</td><td>*</td></tr>
<tr><td>0.4 ＜ D ≦ 0.6</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>0.6 ＜ D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
* : Disregard
Total defects shall not exceed 3.</td></tr>
</table>

No.	Parameter	Criteria
3	The Shape of Dot	(1) Dot Shape (with Dent)  As per the sketch of left hand. (2) Dot Shape (with Projection)  Should not be connected to next dot. (3) Pin Hole  (X+Y) / 2≦0.2mm (Less than 0.1mm is no counted.) (4) Deformation  (X+Y) / 2≦0.2mm Total acceptable number : 1/dot, 5/cell (Defect number of (4) : 1pc.)
4	Polarizer Scratches	Not to be conspicuous defects.
5	Polarizer Dirts	If the stains are removed easily from LCDP surface, the module is defective.
6	Complex Foreign Substance Defects	Black spots, line shaped foreign substances or air bubbles between glass & polarizer should be 5pcs maximum in total.
7	Distance between Different Foreign Substance Defects	D≦0.2 : 20mm or more 0.2＜D : 40mm or more

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 as follows.

DMF682ANF-EW-BFN

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.

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.

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. 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.

LCD Module Specification	First Edition	Approved by	Production Div.
	April 9, 1997	Checked by	Quality Assurance Div.
	Final Revision	Checked by	Design Engineering Div.
	*******	Prepared by	Production Div.
Type No.	**DMF682AN–EW**		

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Revision History

Rev.	Date	Page	Comment

1.General Specifications

Operating Temp.	:	min. 0˚C ~ max. 50˚C
Storage Temp.	:	min. -20˚C ~ max. 60˚C
Dot Pixels	:	256 (W) × 128 (H) dots
Dot Size	:	0.43 (W) × 0.43 (H) mm
Dot Pitch	:	0.47 (W) × 0.47 (H) mm
Viewing Area	:	127.0 (W) × 70.0 (H) mm
Outline Dimensions	:	147.0 (W) × 116.0 (H) × 12.0 max. (D) mm
Weight	:	240g max.
LCD Type	:	NSD-7451 (STN / Neutral-mode / Transflective)
Viewing Angle	:	6:00
Data Transfer	:	4-bit parallel data transfer
Backlight	:	Electro Luminescence (EL) / White
Drawings	:	Dimensional Outline UE-34760

2. Electrical Specifications

2.1. Absolute Maximum Ratings

V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage (Logic)	V_{DD}-V_{SS}	–	-0.3	6.0	V
Supply Voltage (LCD Drive)	V_{DD}-V_{EE}	–	0	30.0	V
Input Voltage	V_I	–	-0.3	V_{DD}+0.3	V

2.2. DC Characteristics

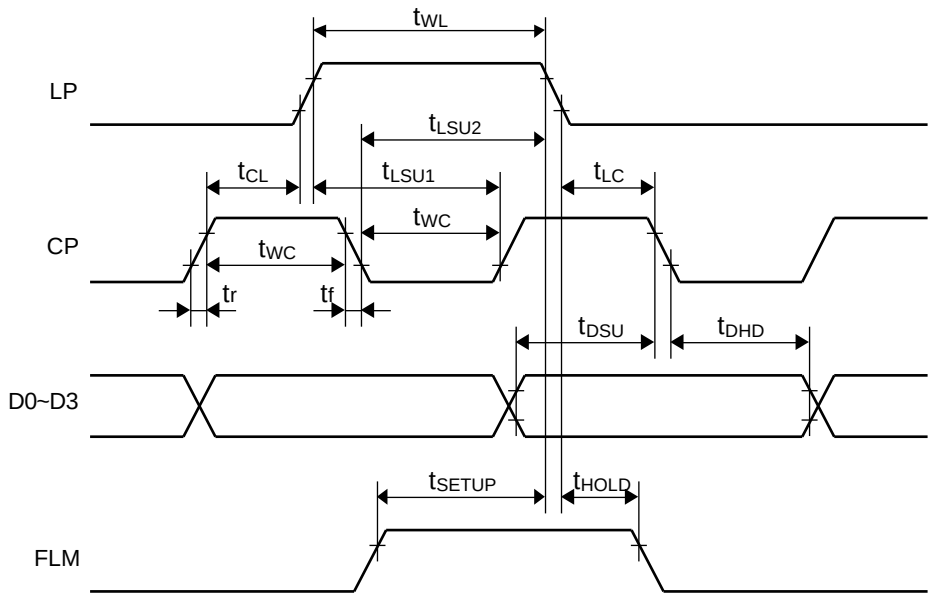
Ta=25˚C, V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage (Logic)	V_{DD}-V_{SS}	–	4.5	–	5.5	V
Supply Voltage (LCD Drive)	V_{DD}-V_{EE}	Shown in 3.1				V
High Level Input Voltage	V_{IH}	V_{DD}=5.0V±10%	0.8 × V_{DD}	–	V_{DD}	V
Low Level Input Voltage	V_{IL}	V_{DD}=5.0V±10%	0	–	0.2 × V_{DD}	V
High Level Output Voltage	V_{OH}	I_{OH}=-0.2mA	V_{DD}-0.4	–	V_{DD}	V
Low Level Output Voltage	V_{OL}	I_{OL}=0.2mA	0	–	0.4	V
Supply Current	I_{DD}	V_{DD}-V_{SS}=5.0V	–	3.6	20.0	mA
	I_{EE}	V_{DD}-V_{EE}=13.1V	–	2.9	15.0	mA
Clock Frequency	f_{CP}	Duty=50%	–	–	3.4	MHz

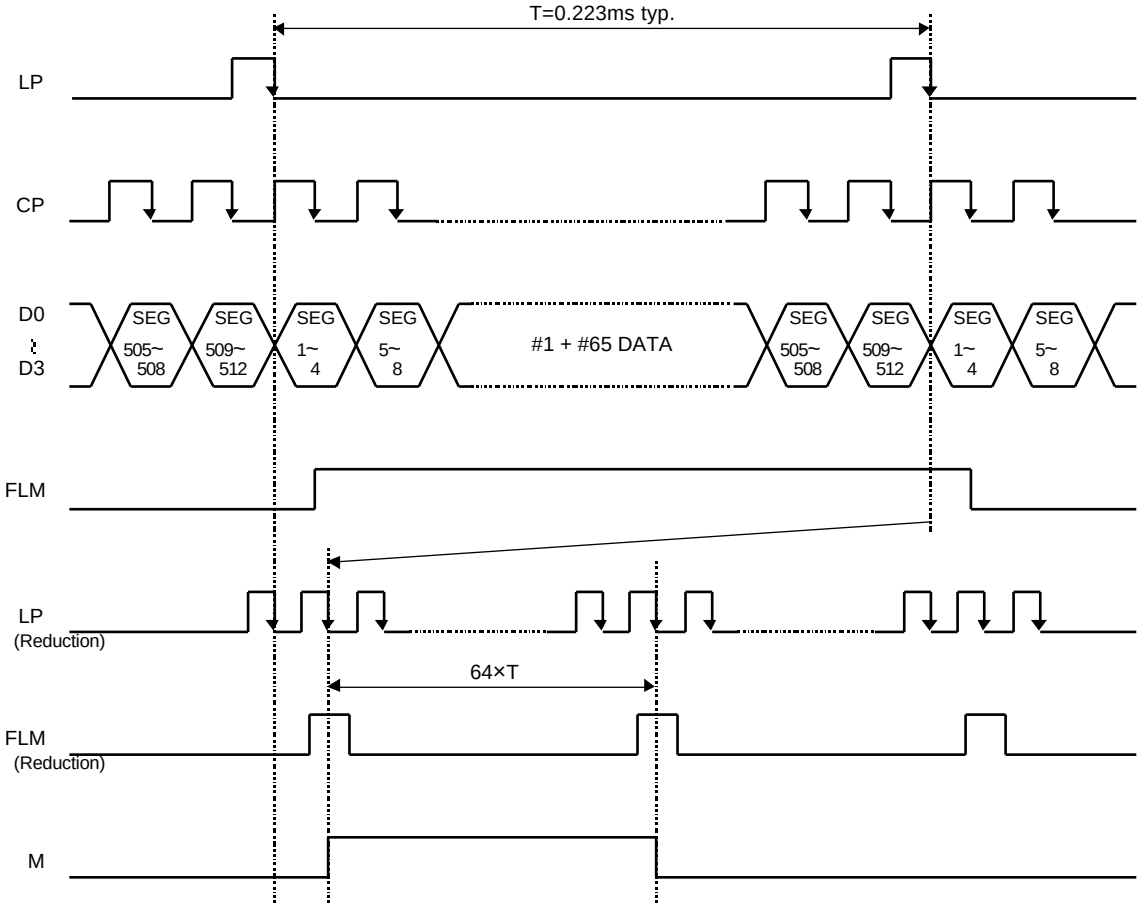
2.3.AC Characteristics

V_{DD}=5.0V±10%

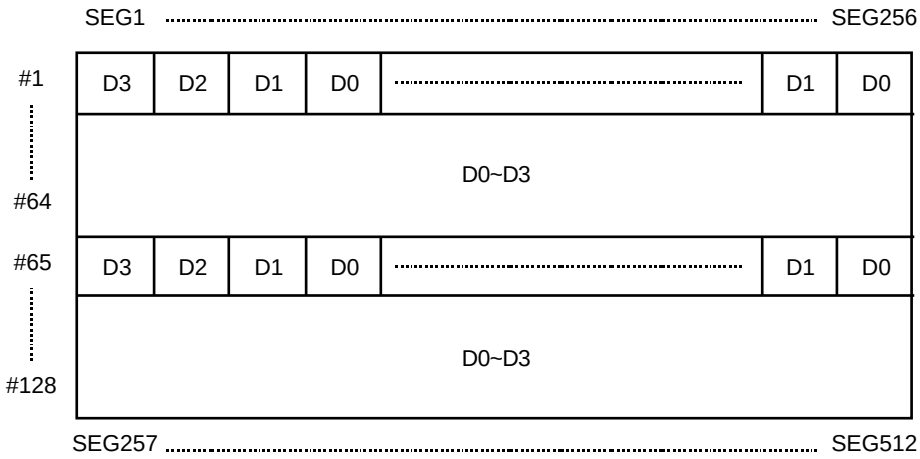
Parameter	Symbol	Min.	Max.	Units
Clock Pulse Width	t_{WC}	100	–	ns
Latch Pulse High Level Width	t_{WL}	125	–	ns
Clock Pulse Rise/Fall Time	tr, tf	–	50	ns
CP→LP Rise Time	t_{CL}	63	–	ns
CP→LP Fall Time	t_{LSU2}	90	–	ns
LP→CP Rise Time	t_{LSU1}	90	–	ns
LP→CP Fall Time	t_{LC}	63	–	ns
Data Setup Time	t_{DSU}	50	–	ns
Data Hold Time	t_{DHD}	80	–	ns
FLM Data Setup Time	t_{SETUP}	100	–	ns
FLM Data Hold Time	t_{HOLD}	100	–	ns



2.4. Timing Chart

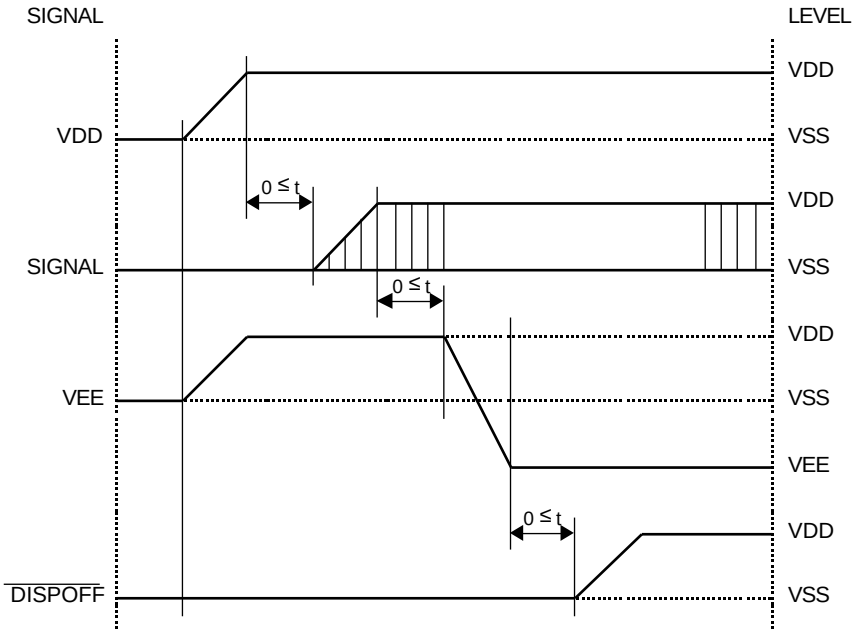


2.5. Comparison of Display and Data

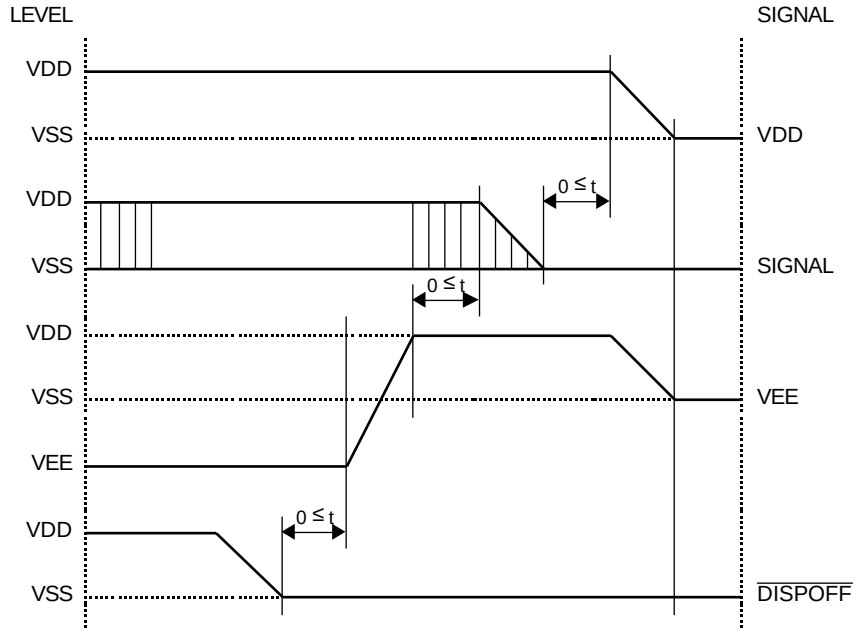


2.6.Power Supply ON/OFF Sequence

2.6.1.ON Sequence



2.6.2.OFF Sequence



Please maintain the above sequence when turning on and off the power supply of the module.
If $\overline{\text{DISPOFF}}$ is supplied to the module while alternate signal for LCD driving (M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

2.7. Lighting Specifications

2.7.1. Absolute Maximum Rating

Ta=25˚C

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage	–	–	–	150	Vrms
Input Frequency	AC 100Vrms	–	–	800	Hz

2.7.2. Operating Characteristics

Ta=25˚C

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage	–	–	100	–	Vrms
Input Frequency	–	–	400	–	Hz
Current	AC 100Vrms, 400Hz	–	11.3	14.4	mA
Luminance of Backlight Surface	AC 100Vrms, 400Hz	54	72	–	cd/m^2
Life	AC 100Vrms, 400Hz Ta=20˚C, 60%RH	1800	–	–	hrs

3.Optical Specifications

3.1.LCD Driving Voltage

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Recommended	V_{DD}-V_{EE}	Ta= 0˚C	–	–	15.4	V
LCD Driving Voltage		Ta=25˚C	12.2	13.1	14.0	V
Note 1		Ta=50˚C	10.4	–	–	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, 1/64 Duty, 1/8.8 Bias, V_D=13.1V (Note 4), θ= 0˚, φ= –˚

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Units
Contrast Ratio Note 1		CR	θ= 0˚, φ= –˚	–	3	–	
Viewing Angle			Shown in 3.3				
Response	Rise Note 2	τr	–	–	120	200	ms
Time	Decay Note 3	τd	–	–	200	300	ms

Note 1 : Contrast ratio is defined as follows.

$C_R = L_{OFF} / L_{ON}$

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.

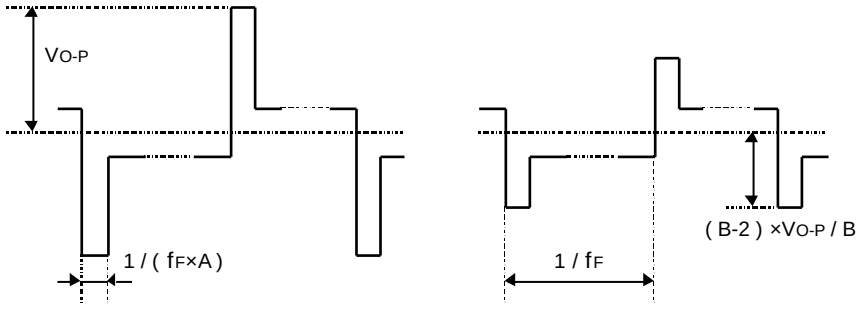
Note 4 : Definition of Driving Voltage V_D

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.

$V_D = (Vth1+Vth2) / 2$

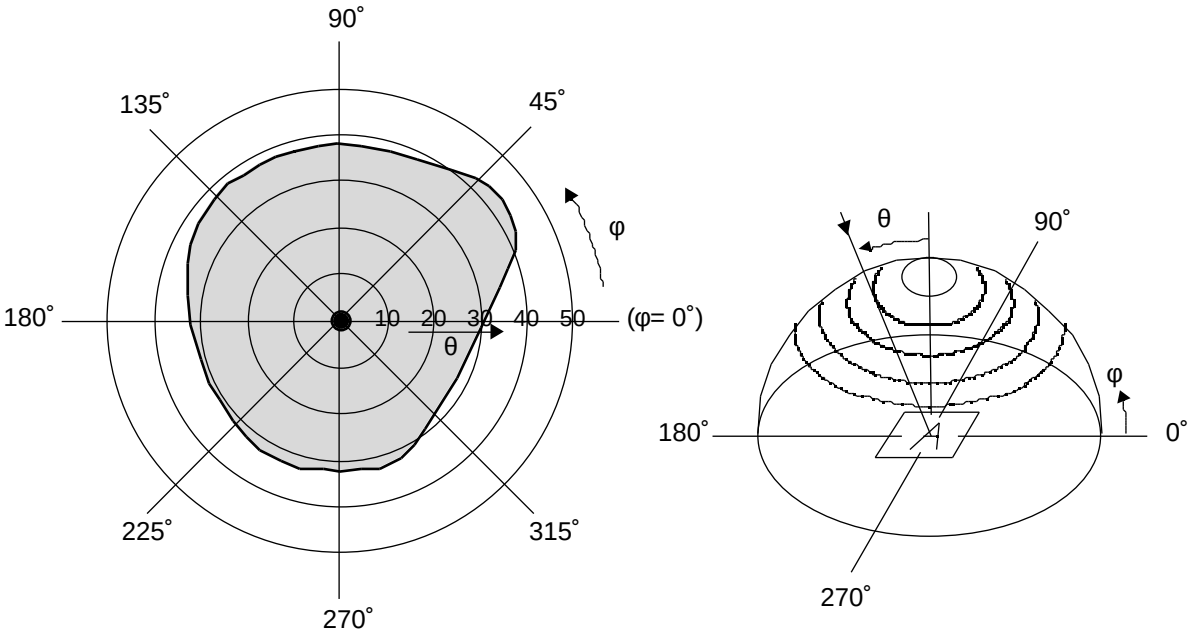
Vth1 :The voltage V_{O-P} that should provide 50% of the satulation level in the luminance at the segment which the ON signal is applied to.

Vth2 :The voltage V_{O-P} that should provide 50% of the satulation level in the luminance at the segment which the OFF signal is applied to.



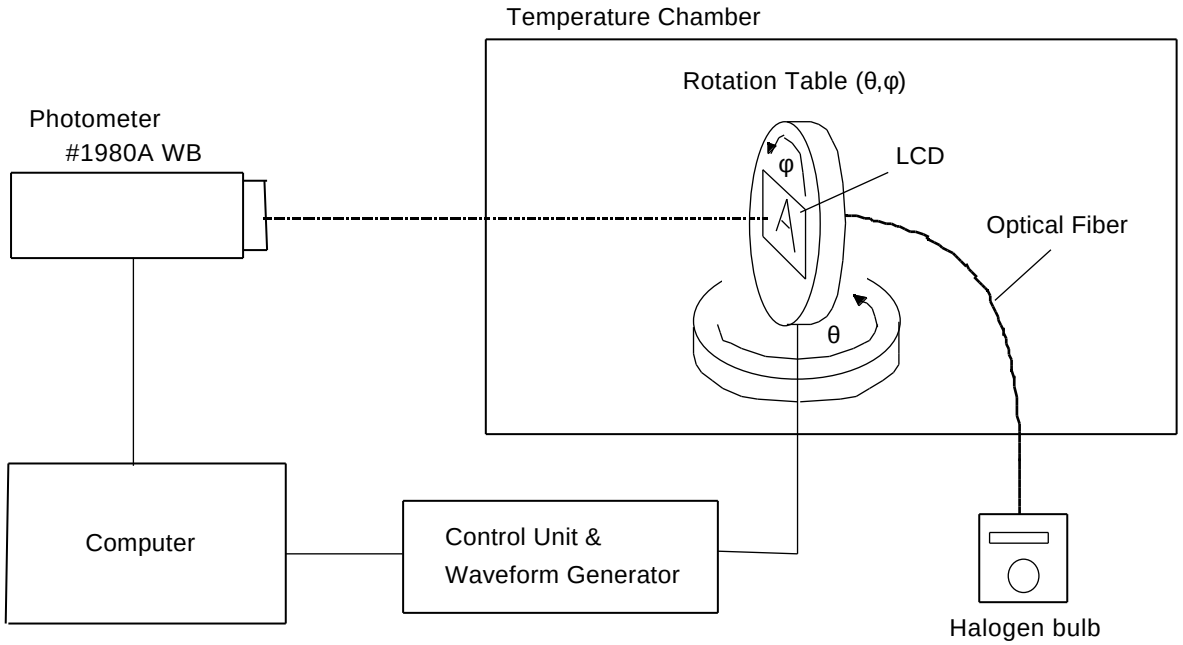
3.3. Definition of Viewing Angle and Optimum Viewing Area

•Point ● shows the point where contrast ratio is measured. : θ= 0˚, φ= –˚
•Driving condition : 1/64 Duty, 1/8.8 Bias, V_D=13.1V, f_F=70Hz



•Area ▭ shows typ. CR≥2

3.4. System Block Diagram



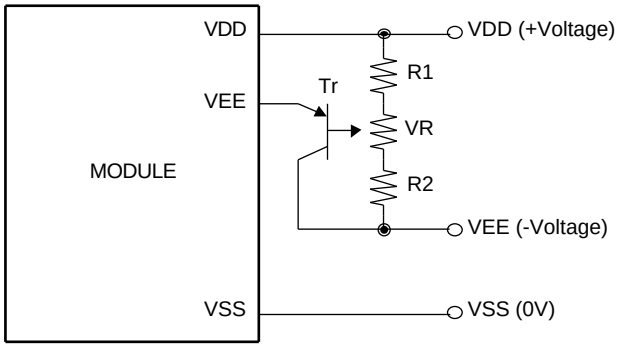
4.I/O Terminal

4.1.Pin Assignment

No.	Symbol	Level	Function
1	V_{DD}	–	Power Supply for Logic
2	V_{SS}	–	Power Supply (0V, GND)
3	V_{EE}	–	Power Supply for LCD Drive
4	LP	H→L	Data Latch Signal
5	M	H / L	Alternate Signal for LCD Drive
6	$\overline{\text{DISPOFF}}$	H / L	Display Control Signal H : Display on L : Display off
7	NC	–	Non-connection
8	FLM	H / L	First Line Marker
9	CP	H→L	Clock Signal for Shifting Data
10	NC	–	Non-connection
11	D0	H / L	Display Data
12	D1	H / L	Display Data
13	D2	H / L	Display Data
14	D3	H / L	Display Data
15	EL	–	Power Supply for EL
16	EL	–	Power Supply for EL

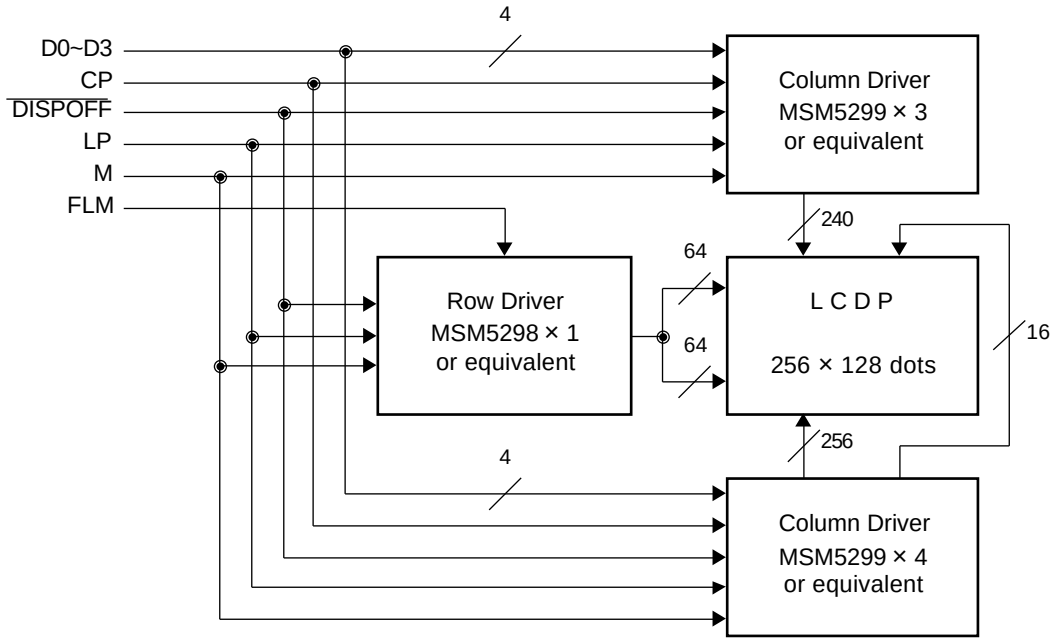
4.2.Example of Power Supply

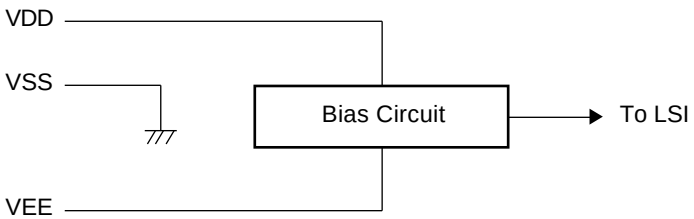
It is recommended to apply a potentiometer for the contrast adjust due to the tolerance of the driving voltage and its temperature dependence.

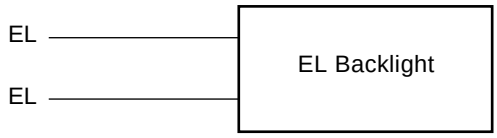


R1+R2+VR=10~20 K Ω
Tr=2SA1202 or equivalent

4.3. Block Diagram

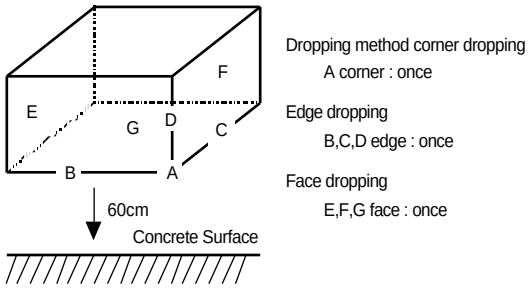






5. Test

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

No.	Parameter	Conditions	Notes
1	High Temperature Operating	50˚C±2˚C, 96hrs (operation state)	
2	Low Temperature Operating	0˚C±2˚C, 96hrs (operation state)	3
3	High Temperature Storage	60˚C±2˚C, 96hrs	4
4	Low Temperature Storage	-20˚C±2˚C, 96hrs	3, 4
5	Damp Proof Test	40˚C±2˚C, 90~95%RH, 96hrs	3, 4
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	5
7	Shock Test	To be measured after dropping from 60cm high on the concrete surface in packing state. 	

Note 1 : Unless otherwise specified, tests will be conducted under the following condition.
Temperature : 20±5˚C
Humidity : 65±5%

Note 2 : Unless otherwise specified, tests will be not conducted under functioning state.

Note 3 : No dew condensation to be observed.

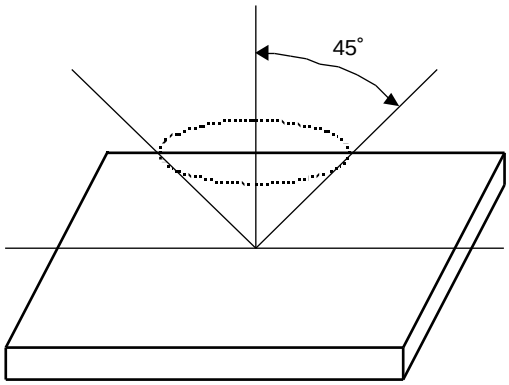
Note 4 : The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

Note 5 : Vibration test will be conducted to the product itself without putting it in a container.

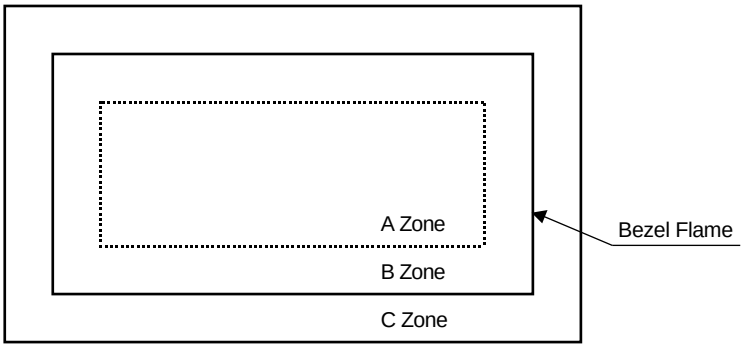
6. Appearance Standards

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

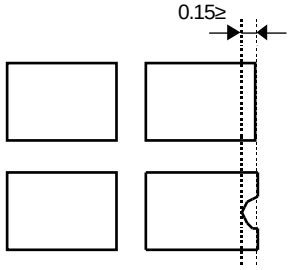
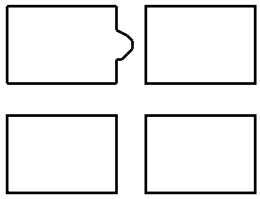
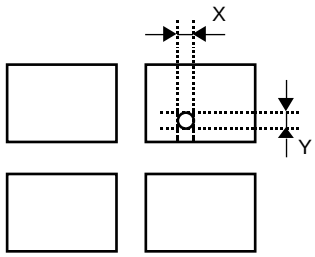
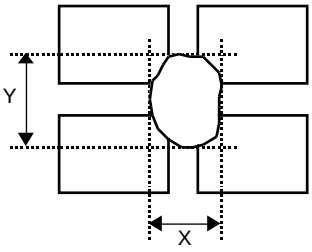
A Zone + B Zone = Validity viewing area

6.3.Standards

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black and White Spots, Foreign Substances</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 ≤0.1</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.1 < D ≤0.2</td><td>3</td><td>5</td><td>*</td></tr>
<tr><td>0.2 < D ≤0.25</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>0.25< D ≤0.3</td><td>0</td><td>1</td><td>*</td></tr>
<tr><td>0.3 < D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
D = (Long + Short) / 2 * : Disregard

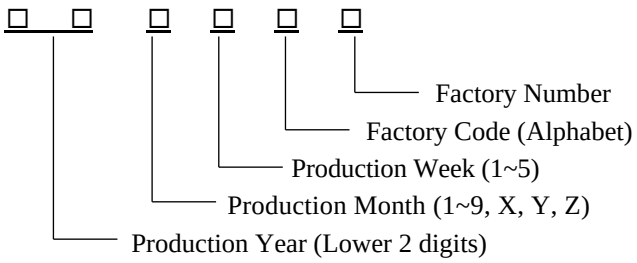
(2) Line Shape
<table>
<tr><th rowspan="2">X (mm) \ Y (mm) \ Zone</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>–</td><td>0.03≥W</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>2.0≥L</td><td>0.05≥W</td><td>3</td><td>3</td><td>*</td></tr>
<tr><td>1.0≥L</td><td>0.1 ≥W</td><td>3</td><td>3</td><td>*</td></tr>
<tr><td>–</td><td>0.1 <W</td><td colspan="3">In the same way (1)</td></tr>
</table>
X : Length Y : Width * : Disregard

Total defects shall not exceed 5.</td></tr>
<tr><td>2</td><td>Air Bubbles (between glass & 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 ≤ 0.3</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.3 < D ≤ 0.4</td><td>3</td><td>*</td><td>*</td></tr>
<tr><td>0.4 < D ≤ 0.6</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>0.6 < D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
* : Disregard
Total defects shall not exceed 3.</td></tr>
</table>

No.	Parameter	Criteria
3	The Shape of Dot	(1) Dot Shape (with Dent)  As per the sketch of left hand. (2) Dot Shape (with Projection)  Should not be connected to next dot. (3) Pin Hole  (X+Y) / 2≤0.2mm (Less than 0.1mm is no counted.) (4) Deformation  (X+Y) / 2≤0.2mm Total acceptable number : 1/dot, 5/cell (Defect number of (4) : 1pc.)
4	Polarizer Scratches	Refer to the sample.
5	Polarizer Dirts	If the stains are removed easily from LCDP surface, the module is not defective.
6	Complex Foreign Substance Defects	Black spots, line shaped foreign substances or air bubbles between glass & polarizer should be 5pcs maximum in total.
7	Distance between Different Foreign Substance Defects	D≤0.2 : 20mm or more 0.2<D : 40mm or more

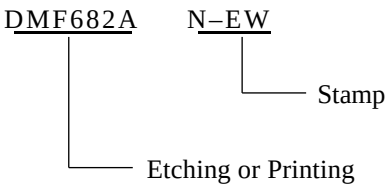
7.Code System of Production Lot

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. Handling Precautions

Operex Products are designed for use in ordinary electronic devices such as business machines, telecommunications equipment, measurement devices and etc..
Optrex Products are not designed, intended, or authorized for use in any application in which the failure of the product could result in a situation where personal injury or death may occur. These applications include, but are not limited to, life-sustaining equipment, nuclear control devices, aerospace equipment, devices related to hazardous or flammable materials, etc. (If Buyer intends to purchase or use the Optrex Products for such unintended or unauthorized applications, Buyer must secure prior written consent to such use by a responsible officer of Optrex Corporation.) Should Buyer purchase or use Optrex Products for any such unintended or unauthorized application (without such consent), Buyer shall indemnify and hold Optrex and its officers, employees, subsidiaries, affiliates and distributors harmless against all claims, costs, damages and expenses, and reasonable attorney's fees, arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Optrex was negligent regarding the design or manufacture of the part.

1) LCD may be broken because it is made of glass.

2) Polarizer is a soft material and can easily be scratched.

3) Please avoid static electricity.

   ① Please be sure to ground human body and electric appliances during work.
   ② It is preferable to use conductive mat on table and wear cotton clothes or conduction processed fiber. Synthetic fiber is not recommended.
   ③ Please slowly peel off protective film, because static electricity may be charged.

4) If it is necessary to store LCD modules for a long time, please comply with the following procedures. If storage condition is not satisfactory, display (especially polarizer) may be deteriorated or soldering I/O terminals may become difficult (some oxide is generated at I/O terminals plating).

   ① Store as delivered by Optrex
   ② If you store as unpacked, put in anti-static bag, seal its opening and store where it is not subjected to direct sunshine nor fluorescent lamp.
   ③ Store at temperature 0 to +35˚C and at low humidity. Please refer to our specification sheets for storage temperature range and humidity condition.

5) The module does not contain excess current limiter.
   Please design the limiter to cut excess current in your power supply circuit.

6) Liquid crystal may be leaked when display is broken. Never taste it. If your hands or clothes touch it, please immediately wash using soap.

7) The connection between the bezel and Vss (GND) is not specified in the module.
   (Some module do not maintain connection between them.)
   Please consult OPTREX to specify the connection.

Optrex shall not be responsible for any infringement of industrial property rights of third parties in any country arising out of the application or use of Optrex Products, except which directly concern the structure or production of such products.

LCD Module Specification	First Edition	Approved by	Production Div.
	Mar 6, 2000	Checked by	Quality Assurance Div.
	Final Revision	Checked by	Design Engineering Div.
	*******		
Type No. **DMF682ANY−EB**		Prepared by	Production Div.

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Revision History

Rev.	Date	Page	Comment

1. General Specifications

Operating Temp.	:	min. 0℃ ～ max. 50℃
Storage Temp.	:	min. -20℃ ～ max. 60℃
Dot Pixels	:	256 (W) × 128 (H) dots
Dot Size	:	0.43 (W) × 0.43 (H) mm
Dot Pitch	:	0.47 (W) × 0.47 (H) mm
Viewing Area	:	127.0 (W) × 70.0 (H) mm
Outline Dimensions	:	147.0 (W) × 116.0 (H) × 12.0 max. (D) mm
Weight	:	160g max.
LCD Type	:	NSD-7451 (STN / Yellow-mode / Transflective)
Viewing Angle	:	6:00
Data Transfer	:	4-bit parallel data transfer
Backlight	:	Electro Luminescence (EL) / Blue-green
Drawings	:	Dimensional Outline UE-34760

2.Electrical Specifications

2.1.Absolute Maximum Ratings

V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage (Logic)	V_{DD}-V_{SS}	—	-0.3	6.0	V
Supply Voltage (LCD Drive)	V_{DD}-V_{EE}	—	0	30.0	V
Input Voltage	V_I	—	-0.3	V_{DD}+0.3	V

2.2.DC Characteristics

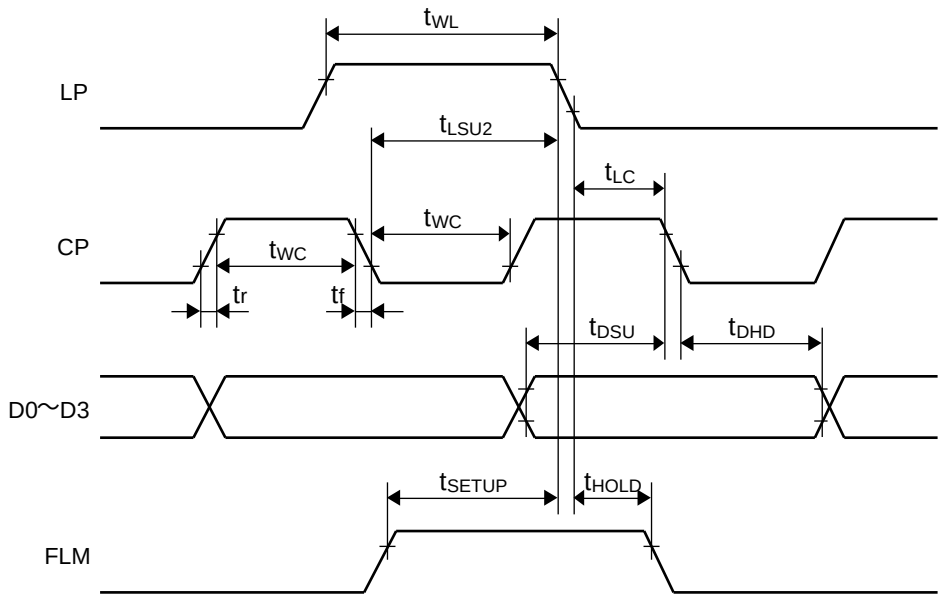
Ta=25℃, V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage (Logic)	V_{DD}-V_{SS}	—	4.5	—	5.5	V
Supply Voltage (LCD Drive)	V_{DD}-V_{EE}	Shown in 3.1				V
High Level Input Voltage	V_{IH}	V_{DD}=5.0V±10%	0.8×V_{DD}	—	V_{DD}	V
Low Level Input Voltage	V_{IL}	V_{DD}=5.0V±10%	0	—	0.2×V_{DD}	V
High Level Output Voltage	V_{OH}	I_{OH}=-0.2mA	V_{DD}-0.4	—	—	V
Low Level Output Voltage	V_{OL}	I_{OL}=0.2mA	—	—	0.4	V
Supply Current	I_{DD}	V_{DD}-V_{SS}=5.0V	—	3.6	20.0	mA
	I_{EE}	V_{DD}-V_{EE}=13.1V	—	2.9	15.0	mA
Clock Frequency	f_{CP}	Duty=50%	—	—	3.4	MHz

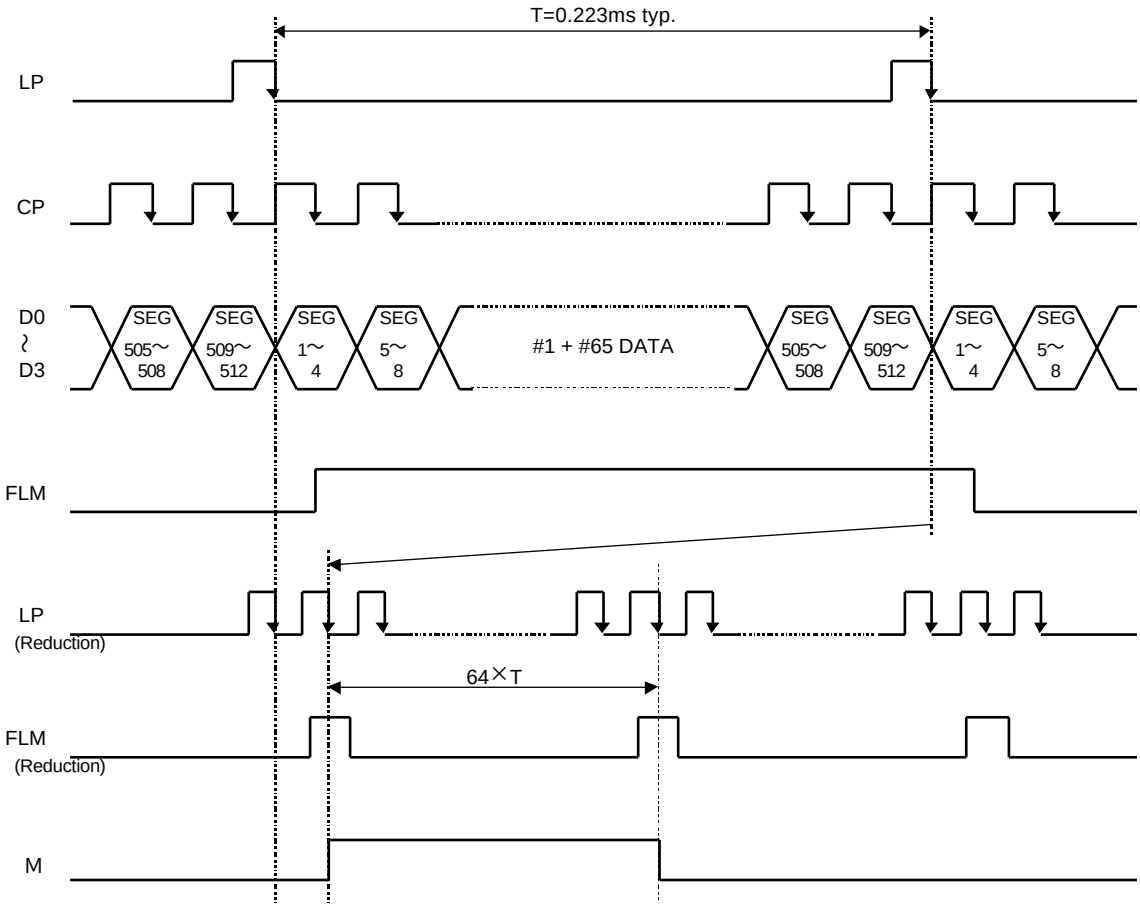
2.3.AC Characteristics

V_{DD}=5.0V±10%

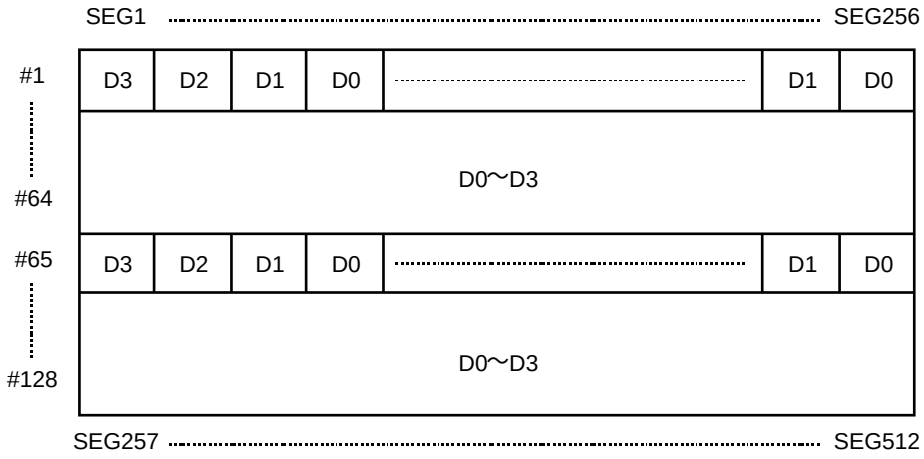
Parameter	Symbol	Min.	Max.	Units
Clock Pulse Width	t_{WC}	100	—	ns
Latch Pulse High Level Width	t_{WL}	125	—	ns
Clock Pulse Rise/Fall Time	tr, tf	—	50	ns
CP→LP Fall Time	t_{LSU2}	90	—	ns
LP→CP Fall Time	t_{LC}	200	—	ns
Data Setup Time	t_{DSU}	50	—	ns
Data Hold Time	t_{DHD}	80	—	ns
FLM Data Setup Time	t_{SETUP}	100	—	ns
FLM Data Hold Time	t_{HOLD}	100	—	ns



2.4.Timing Chart

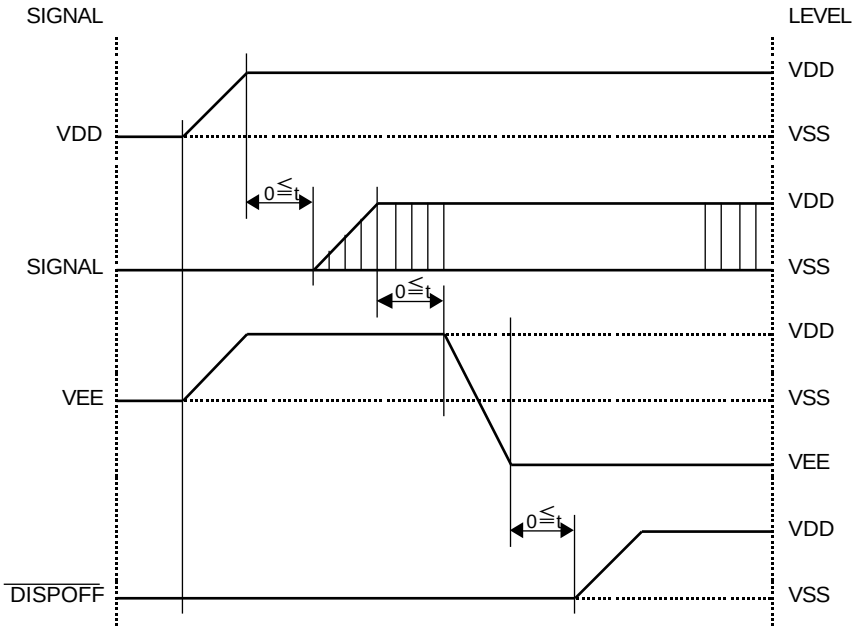


2.5.Comparison of Display and Data

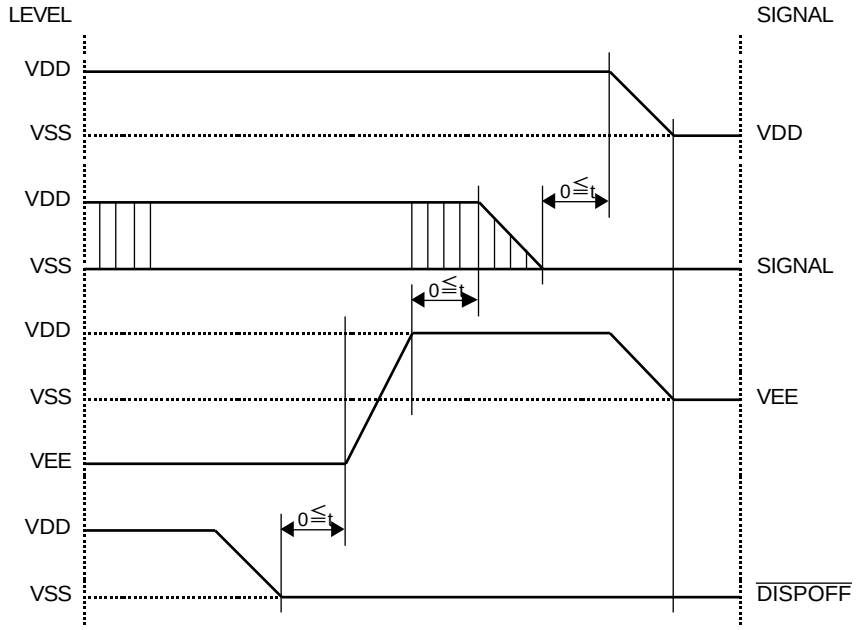


2.6.Power Supply ON/OFF Sequence

2.6.1.ON Sequence



2.6.2.OFF Sequence



Please maintain the above sequence when turning on and off the power supply of the module. If $\overline{\text{DISPOFF}}$ is supplied to the module while internal alternate signal for LCD driving (M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

2.7.Lighting Specifications

2.7.1.Absolute Maximum Rating

Ta=25℃

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage	450Hz	—	—	150	Vrms
Input Frequency	AC100Vrms	—	—	800	Hz

2.7.2.Operating Characteristics

Ta=25℃

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage	—	—	100	—	Vrms
Input Frequency	—	—	400	—	Hz
Current	AC100Vrms, 400Hz	—	2.9	4.0	mA
Life	AC100Vrms, 400Hz Ta=20℃, 60%RH	2000	—	—	hrs

Recommended Inverter : NS-106 (DC 5.0V±10%, Produced by NEC)

3.Optical Specifications

3.1.LCD Driving Voltage

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Recommended	V_{DD}-V_{EE}	Ta= 0℃	—	—	15.4	V
LCD Driving Voltage		Ta=25℃	12.2	13.1	14.0	V
Note 1		Ta=50℃	10.4	—	—	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℃, 1/64 Duty, 1/8.8 Bias, V_D=13.1V (Note 4), θ = 0 °, φ=— °

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Units
Contrast Ratio Note 1		CR	θ = 0 °, φ=— °	—	7	—	
Viewing Angle			Shown in 3.3				
Response	Rise Note 2	T_{ON}	—	—	140	210	ms
Time	Decay Note 3	T_{OFF}	—	—	180	270	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.

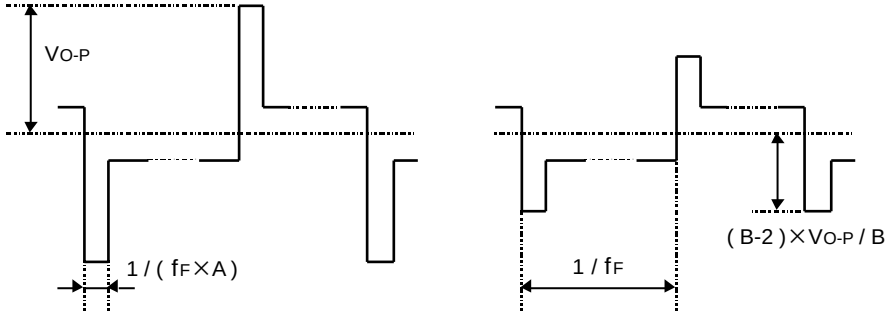
Note 4 : Definition of Driving Voltage V_D

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.

$V_D = (Vth1+Vth2) / 2$

Vth1 :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.

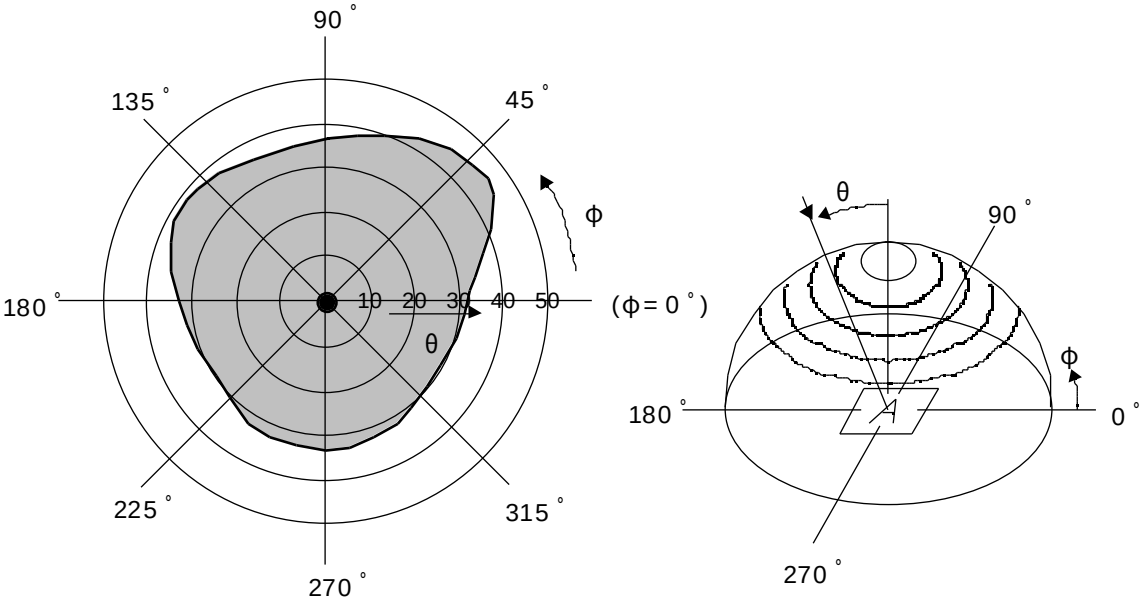
Vth2 :The voltage V_{O-P} that should provide 50% of the saturation level in the luminance at the segment which the OFF signal is applied to.



3.3. Definition of Viewing Angle and Optimum Viewing Area

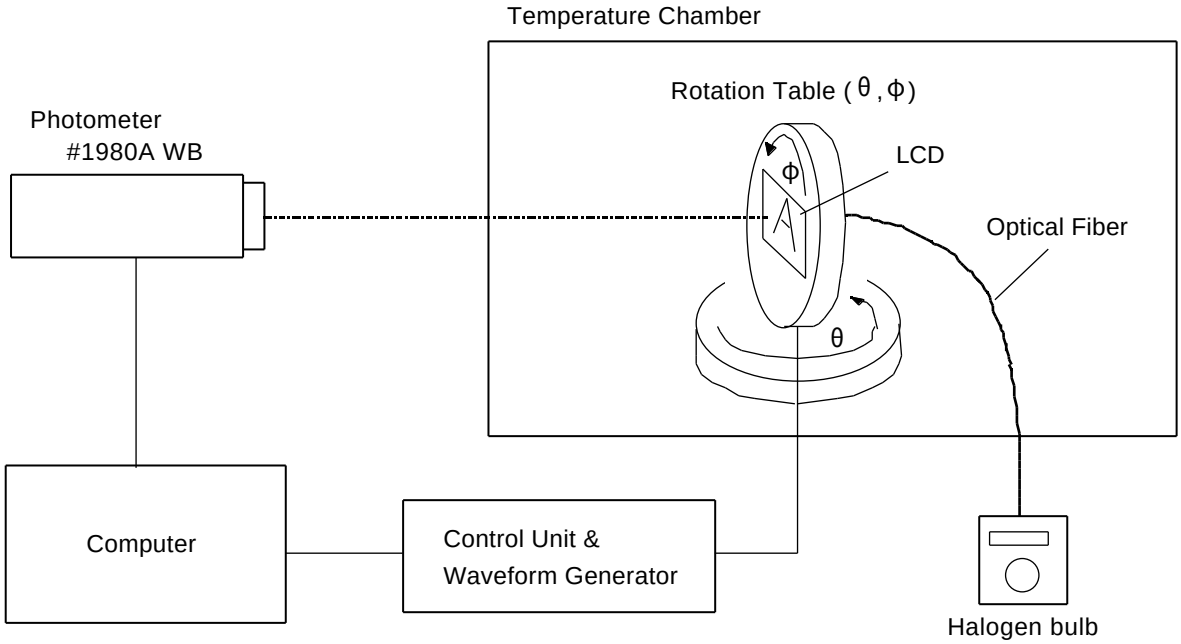
•Point ● shows the point where contrast ratio is measured. : θ = 0 °, ϕ = — °

•Driving condition : 1/64 Duty, 1/8.8 Bias, V_D=13.1V, f_F=70Hz



•Area ▭ shows typ. CR≧2

3.4. System Block Diagram



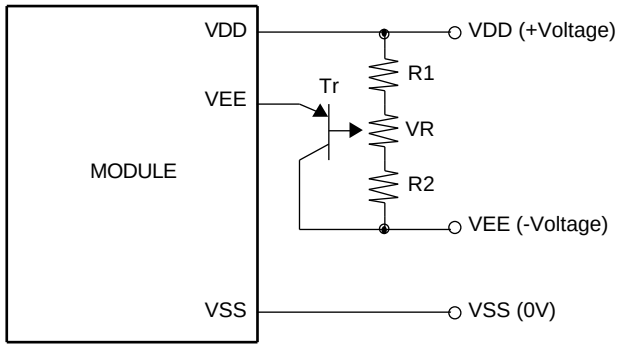
4.I/O Terminal

1.1.Pin Assignment

No.	Symbol	Level	Function
1	V_{DD}	—	Power Supply for Logic
2	V_{SS}	—	Power Supply (0V, GND)
3	V_{EE}	—	Power Supply for LCD Drive
4	LP	H / L	Data Latch Signal
5	M	H / L	Alternate Signal for LCD Drive
6	$\overline{\text{DISPOFF}}$	H / L	Display Control Signal H : Display on L : Display off
7	NC	—	Non-connection
8	FLM	H / L	First Line Marker
9	CP	H / L	Clock Signal for Shifting Data
10	NC	—	Non-connection
11	D0	H / L	Display Data
12	D1	H / L	Display Data
13	D2	H / L	Display Data
14	D3	H / L	Display Data
15	EL	—	Power Supply for EL
16	EL	—	Power Supply for EL

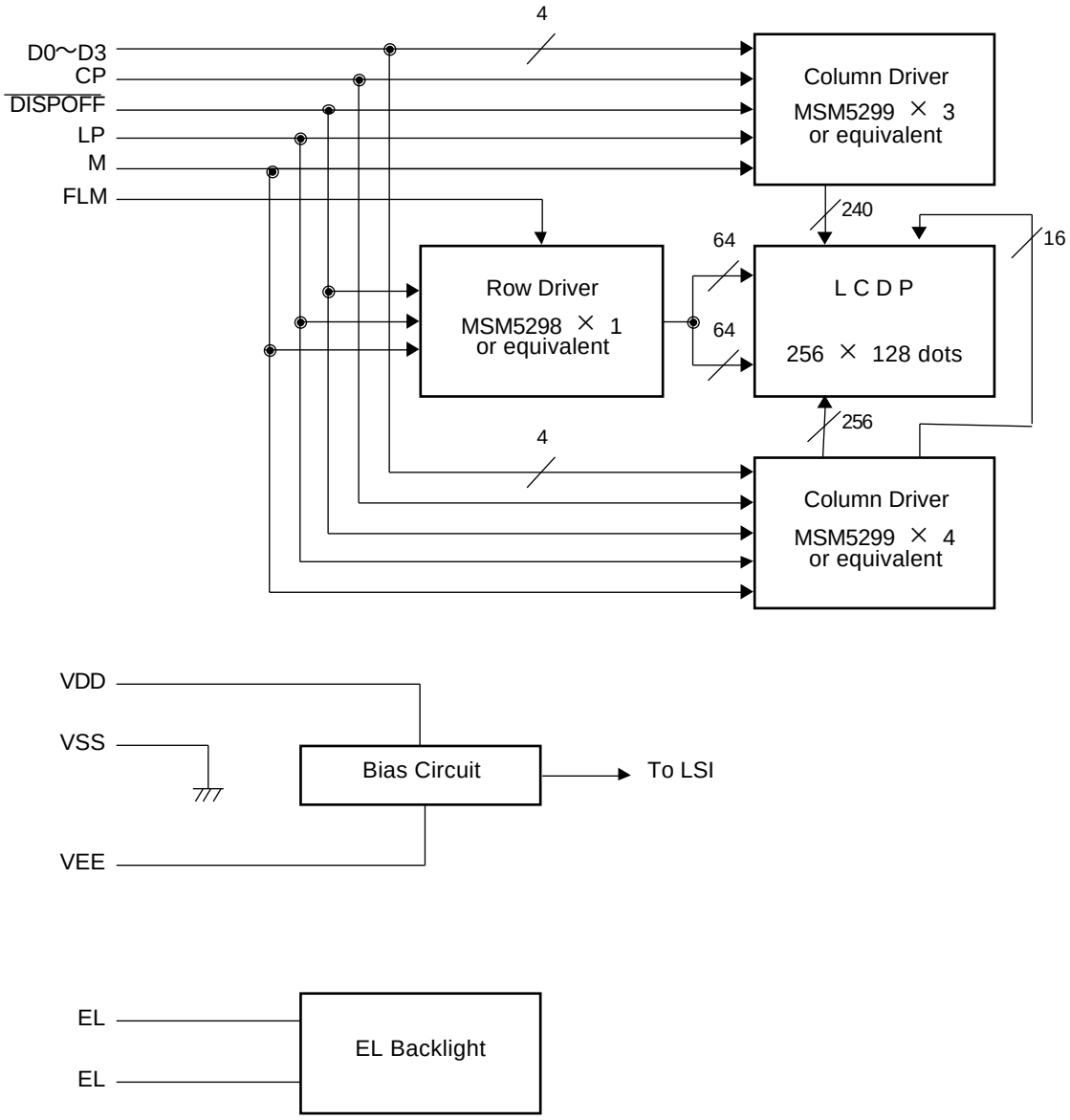
4.2.Example of Power Supply

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



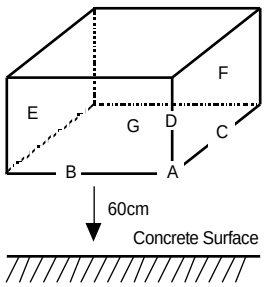
R1+R2+VR=10～20KΩ
Tr=2SA1202 or equivalent

4.3. Block Diagram



5. Test

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

No.	Parameter	Conditions	Notes
1	High Temperature Operating	50℃±2℃, 96hrs (operation state)	
2	Low Temperature Operating	0℃±2℃, 96hrs (operation state)	3
3	High Temperature Storage	60℃±2℃, 96hrs	4
4	Low Temperature Storage	-20℃±2℃, 96hrs	3, 4
5	Damp Proof Test	40℃±2℃, 90～95%RH, 96hrs	3, 4
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	5
7	Shock Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  Dropping method corner dropping A corner : once Edge dropping B,C,D edge : once Face dropping E,F,G face : once	

Note 1 : Unless otherwise specified, tests will be conducted under the following condition.
Temperature : 20±5℃
Humidity : 65±5%

Note 2 : Unless otherwise specified, tests will be not conducted under functioning state.

Note 3 : No dew condensation to be observed.

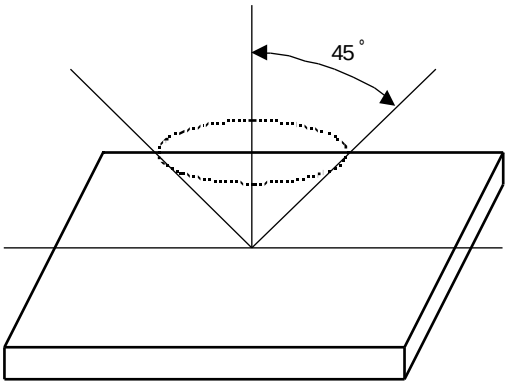
Note 4 : The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

Note 5 : Vibration test will be conducted to the product itself without putting it in a container.

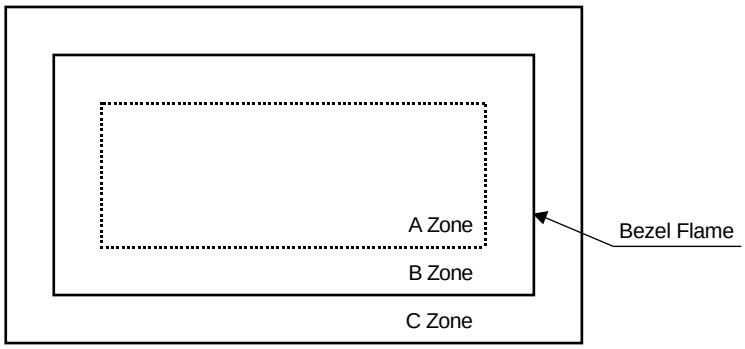
6. Appearance Standards

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

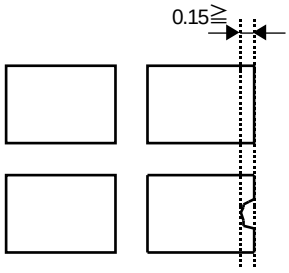
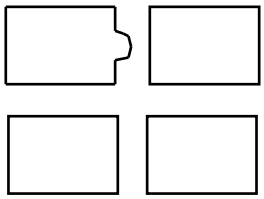
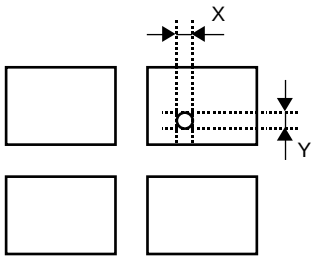
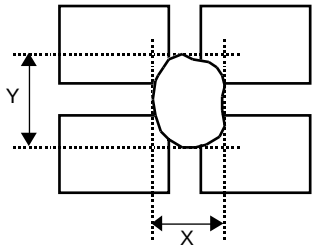


A Zone : Active display area
B Zone : Area from outside of "A Zone" to validity viewing area
C Zone : Rest parts

A Zone + B Zone = Validity viewing area

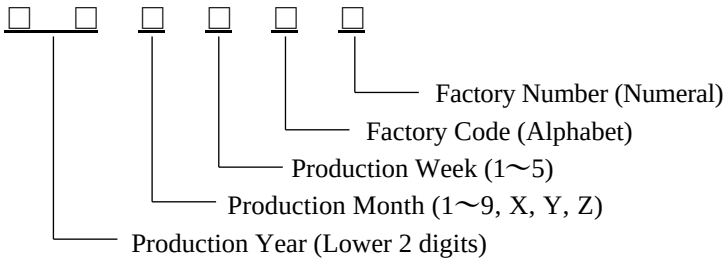
6.3.Standards

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black and White Spots, Foreign Substances</td><td>(1) Round Shape
<table>
<tr><th rowspan="2">Zone / Dimension (mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≦0.1</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.1 ＜ D ≦0.2</td><td>3</td><td>5</td><td>*</td></tr>
<tr><td>0.2 ＜ D ≦0.25</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>0.25＜ D ≦0.3</td><td>0</td><td>1</td><td>*</td></tr>
<tr><td>0.3 ＜ D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
D = (Long + Short) / 2 * : Disregard
(2) Line Shape
<table>
<tr><th rowspan="2">Zone / X (mm) / Y (mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>—</td><td>0.03≧W</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>2.0≧L</td><td>0.05≧W</td><td>3</td><td>3</td><td>*</td></tr>
<tr><td>1.0≧L</td><td>0.1 ≧W</td><td>3</td><td>3</td><td>*</td></tr>
<tr><td>—</td><td>0.1 ＜W</td><td colspan="3">In the same way (1)</td></tr>
</table>
X : Length Y : Width * : Disregard
Total defects shall not exceed 5.</td></tr>
<tr><td>2</td><td>Air Bubbles (between glass & polarizer)</td><td>
<table>
<tr><th rowspan="2">Zone / Dimension (mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D ≦ 0.3</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.3 ＜ D ≦ 0.4</td><td>3</td><td>*</td><td>*</td></tr>
<tr><td>0.4 ＜ D ≦ 0.6</td><td>2</td><td>3</td><td>*</td></tr>
<tr><td>0.6 ＜ D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
* : Disregard
Total defects shall not exceed 3.</td></tr>
</table>

No.	Parameter	Criteria
3	The Shape of Dot	(1) Dot Shape (with Dent)  As per the sketch of left hand. (2) Dot Shape (with Projection)  Should not be connected to next dot. (3) Pin Hole  (X+Y) / 2≦0.2mm (Less than 0.1mm is no counted.) (4) Deformation  (X+Y) / 2≦0.2mm Total acceptable number : 1/dot, 5/cell (Defect number of (4) : 1pc.)
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	Complex Foreign Substance Defects	Black spots, line shaped foreign substances or air bubbles between glass & polarizer should be 5pcs maximum in total.
7	Distance between Different Foreign Substance Defects	D≦0.2 : 20mm or more 0.2＜D : 40mm or more

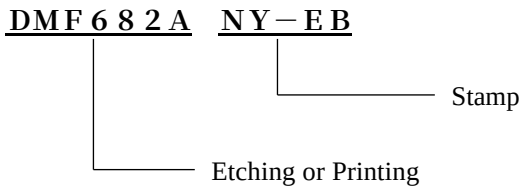
7. Code System of Production Lot

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) Conduc1tivity 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.
③The use of CFLs for extended periods of time at low temperatures will significantly shorten their service life.

8) For models which use touch panels:

①Do not stack up modules since they can be damaged by components on neighboring modules.
②Do not place heavy objects on top of the product. This could cause glass breakage.

9) For models which use COG,TAB,or COF:

①The 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.
②Given 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:

①In order to maintain reliability, do not touch or hold by the connector area.
②Avoid any bending, pulling, or other excessive force, which can result in broken connections.

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.

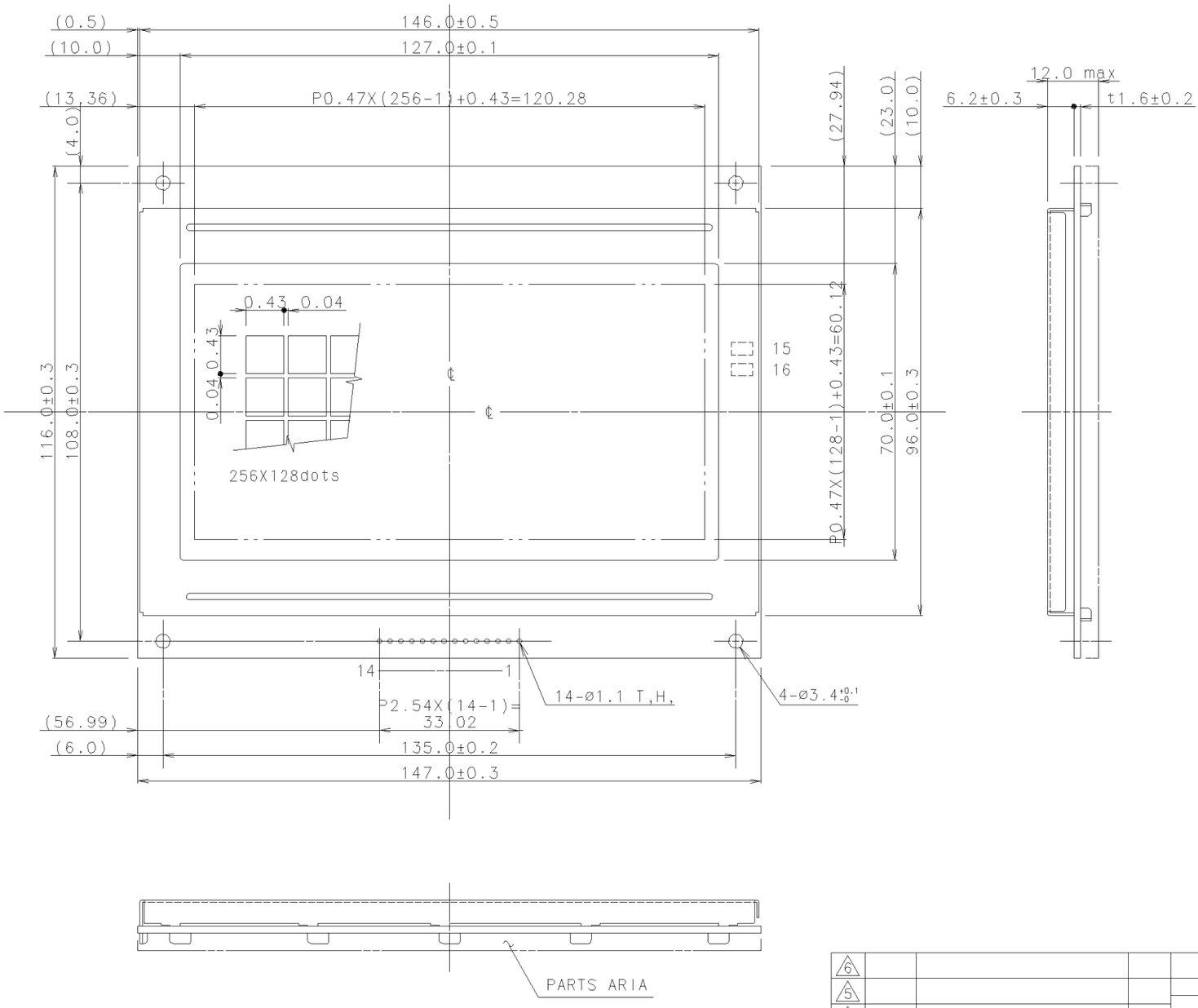
② We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.

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 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, Display LC delivery which ever comes later.



PIN ASSIGNMENT

PIN NO	SYMBOL
1	VDD
2	Vss
3	VEE
4	LP
5	M
6	DISP OFF
7	NC
8	FLM
9	CP
10	NC
11	DO
12	D1
13	D2
14	D3
15	EL
16	EL

TOLERANCE				
MEASURE	A	B	C	
l≤16	±0.1	±0.3	±1	
16<l≤63	±0.2	±0.5	±1.5	
63<l≤250	±0.3	±0.8	±2	
250<l≤500	±0.5	±1.2	±3	ANGLE
500<l≤1000	±0.8	±2	±4	±30' (±1°) ±2°

ISSUE	DATE	REVISIONS	NAME
6			
5			
4			
3			
2			
1			

OPTREX CORPORATION

MATERIAL	FINISH	Q'ty	NOTE
3rd ANGLE PROJECTION	TOLERANCE CLASS: B	SCALE: 1:1	
APPROVED _____	MODEL DMF682A-EL Series		
CHECKED _____	TITLE DIMENSIONAL OUTLINE		
DRAWN JAN06'93 Y.Hara	CODE		
DESIGNED JAN07'88 M.Shibamoto	DRAWING No. UE 34760		