

1.General Specifications

Operating Temp.	:	min. 0°C ~ max. 50°C
Storage Temp.	:	min. -20°C ~ max. 60°C
Dot Pixels	:	240 (W) × 64 (H) dots
Dot Size	:	0.50 (W) × 0.50 (H) mm
Dot Pitch	:	0.53 (W) × 0.53 (H) mm
Viewing Area	:	132.0 (W) × 39.0 (H) mm
Outline Dimensions	:	180.0 (W) × 70.0 (H) × 14.0* max. (D) mm * Without CFL Cable
Weight	:	180g max.
LCD Type	:	NTD-12222 (F-STN / Black&White -mode / Transmissive)
Viewing Angle	:	6:00
Control LSI	:	T6963C-0101 (Produced by TOSHIBA)
Data Transfer	:	8-bit data transfer
Backlight	:	Cold Cathode Fluorescent Lamp (CFL) × 1
Additional Spec.	:	(1) Nega/Posi Reverse Circuit (2) Holder and PWB ground are connected by soldering.
Drawings	:	Dimensional Outline UE-35433

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	28.0	V
Input Voltage	V _I	–	-0.3	V _{CC} +0.3	V

2.2. DC Characteristics

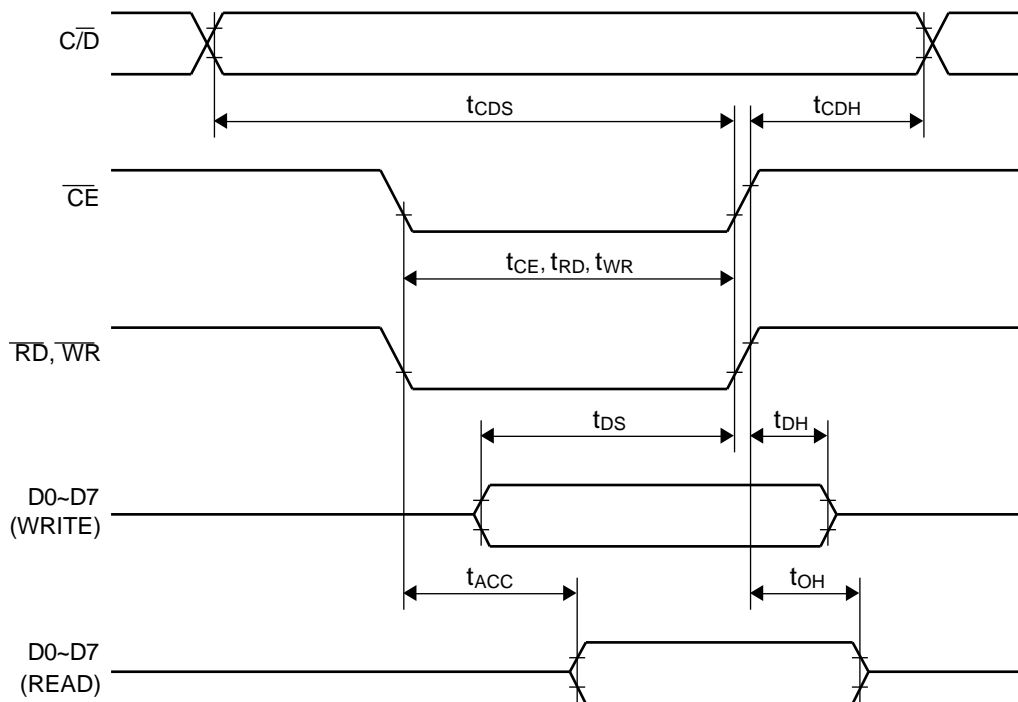
T_a=25°C, V_{SS}=0V

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%	V _{CC} -2.2	–	V _{CC}	V
Low Level Input Voltage	V _{IL}	V _{CC} =5.0V±10%	0	–	0.8	V
High Level Output Voltage	V _{OH}	I _{OH} =-0.75mA	V _{CC} -0.3	–	V _{CC}	V
Low Level Output Voltage	V _{OL}	I _{OL} =0.75mA	0	–	0.3	V
Supply Current	I _{CC}	V _{CC} -V _{SS} =5.0V	–	–	20.0	mA
	I _{EE}	V _{CC} -V _{EE} =13.3V	–	–	10.0	mA

2.3.AC Characteristics

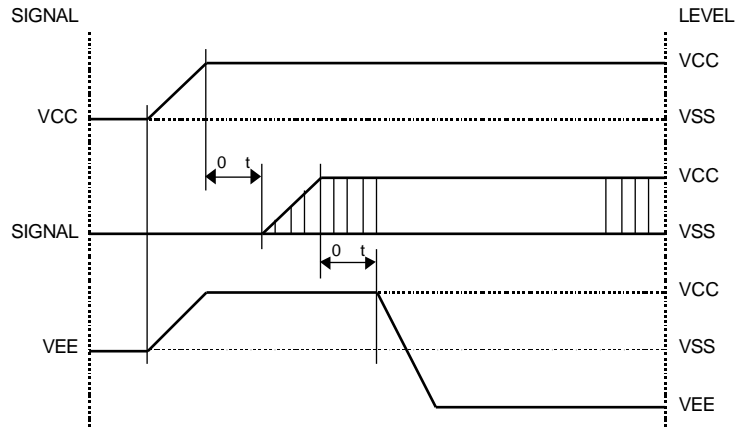
V_{CC}=5.0V±10%

Parameter	Symbol	Min.	Max.	Units
C/D Setup Time	t _{CDS}	100	–	ns
C/D Hold Time	t _{CDH}	10	–	ns
CE, RD, WR Pulse Width	t _{CE} , t _{RD} , t _{WR}	80	–	ns
Data Setup Time	t _{DS}	80	–	ns
Data Hold Time	t _{DH}	40	–	ns
Access Time	t _{ACC}	–	150	ns
Output Hold Time	t _{OH}	10	50	ns

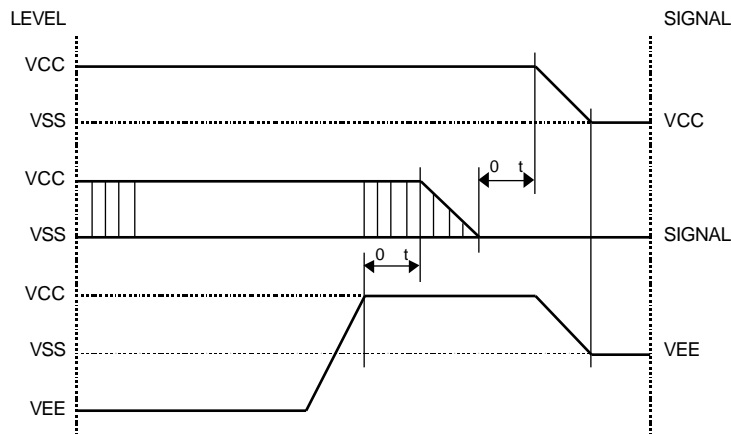


2.4. Power Supply ON/OFF Sequence

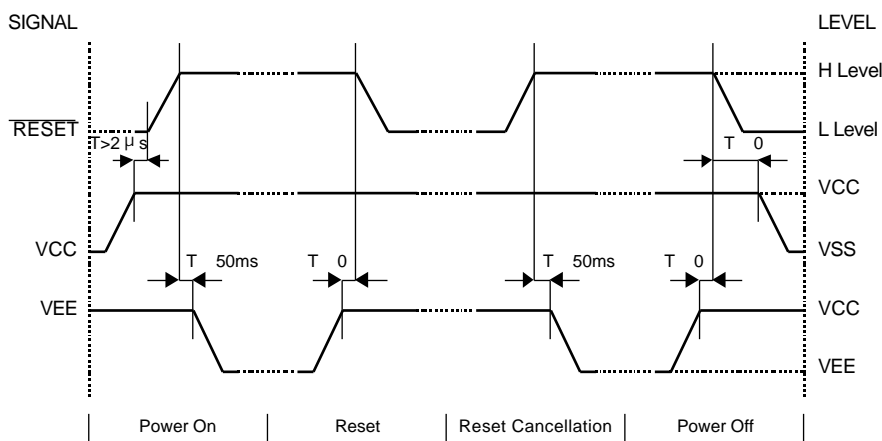
2.4.1. ON Sequence



2.4.2. OFF Sequence



2.4.3. Reset Sequence



Please maintain the above sequence when turning on and off the power supply of the module.
 If VEE is supplied to the module while internal alternate signal for LCD driving (M) is unstable or RESET is active, DC component will be supplied to the LCD panel. This may cause damage to the LCD module.

2.5. Lighting Specifications

Ta=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Notes
Lamp Voltage	V _L	–	–	310	–	V _{rms}	1
Lamp Current	I _L	–	4.0	5.0	6.0	mArms	2
Starting Voltage	V _S	–	–	–	800	V _{rms}	3
Surface Luminance	L	I _L = 5.0mA	70	130	–	cd/m ²	4
Average Life	T _{AL}	I _L = 5.0mA	8000	10000	–	hrs	5

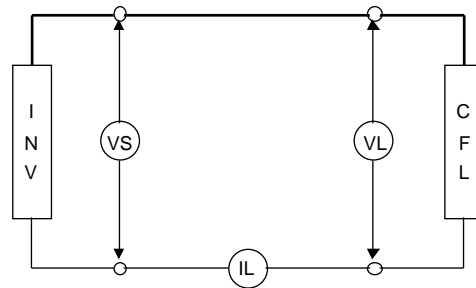
Note 1 : The voltage (r.m.s.) to maintain the electric discharge of the lamp. It is measured after lighting for 3 minutes .

Note 2 : The current (r.m.s.) to flow through the lamp with the electric discharge. It is measured after lighting for 3 minutes.

Note 3 : The voltage at starting the electric discharge when the voltage is increased gradually from 0V.

Note 4 : Surface Luminance is specified by the initial data of luminance measured at the center of display surface after 20 minutes power on. (All ON pattern)

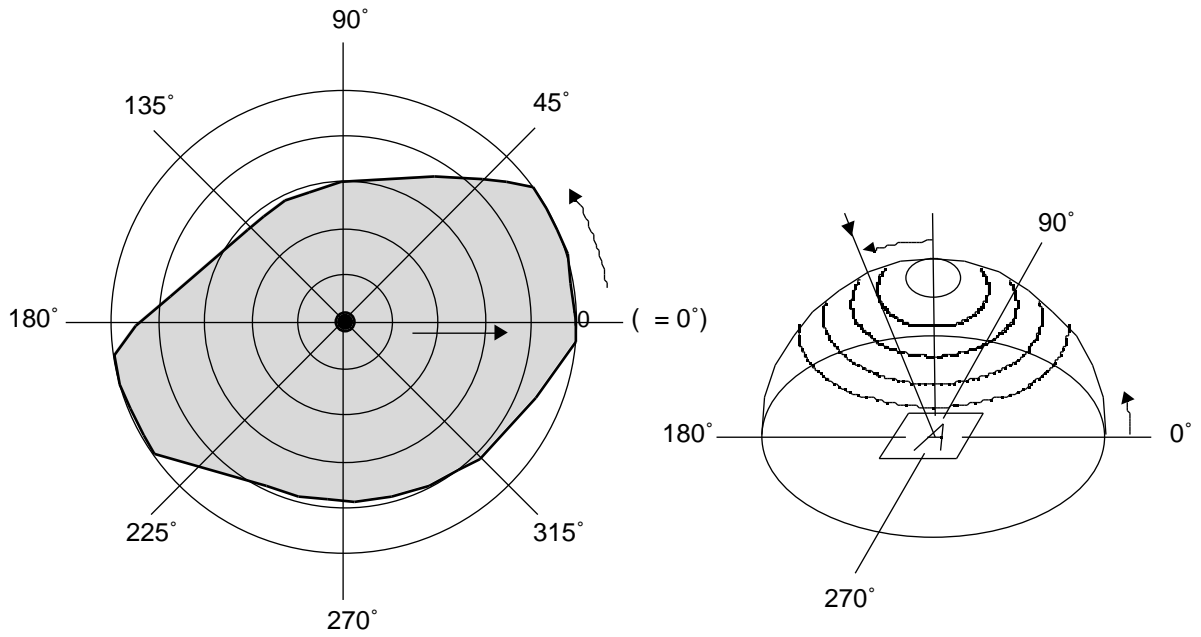
Note 5 : CFL life is defined as the time for which the initial luminance is attenuated by 50% of the luminance value. Average Life represents the time elapsed at the point of time when the residual ratio becomes below 50% when plural lamps are lighted in comparison with the definition of life mentioned above.




CFL Testing Circuit

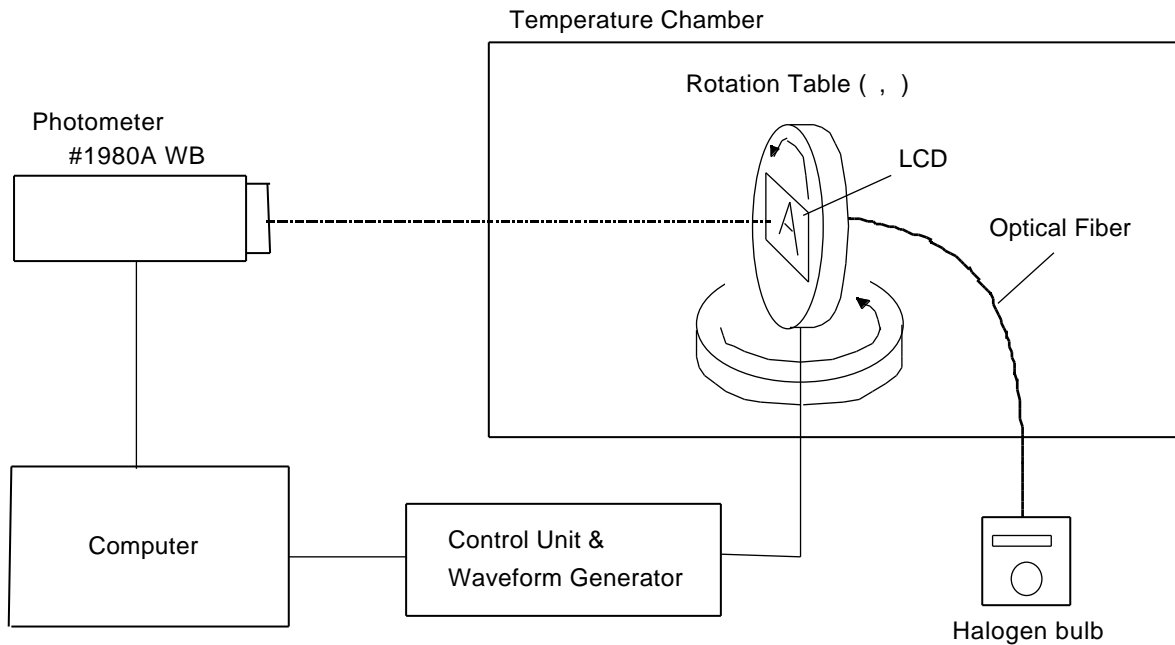
3.3. Definition of Viewing Angle and Optimum Viewing Area

- Point ● shows the point where contrast ratio is measured. : = 0°, = -°
- Driving condition : 1/64 Duty, 1/9 Bias, $V_D=13.3V$, $f_F=75Hz$



• Area  shows typ. CR 2

3.4. System Block Diagram



4.I/O Terminal

4.1.Pin Assignment

CN1

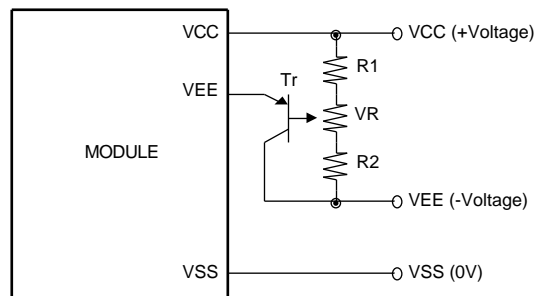
No.	Symbol	Level	Function
1	FG	–	Frame Ground
2	V _{SS}	–	Power Supply (0V, GND)
3	V _{CC}	–	Power Supply for Logic
4	V _{EE}	–	Power Supply for LCD Drive
5	$\overline{\text{WR}}$	H / L	Write Signal L : Read
6	$\overline{\text{RD}}$	H / L	Read Signal L : Write
7	$\overline{\text{CE}}$	H / L	Chip Enable Signal L : Enable
8	C/D	H / L	Write Mode H : Command Write L : Data Write Read Mode H : Status Read L : Data Read
9	NC	–	Non-connection
10	$\overline{\text{RESET}}$	H / L	Reset Signal L : Reset
11	D0	H / L	Data Bus Line
12	D1	H / L	Data Bus Line
13	D2	H / L	Data Bus Line
14	D3	H / L	Data Bus Line
15	D4	H / L	Data Bus Line
16	D5	H / L	Data Bus Line
17	D6	H / L	Data Bus Line
18	D7	H / L	Data Bus Line
19	FS	H / L	H:6 × 8dots L:8 × 8dots (Pulled up by 10 k Ω)
	$\overline{\text{INVERT}}$	H / L	Display data Reverse signal (Pulled up by 22 k Ω) H:Positive Image L:Negative Image

CN2

No.	Symbol	Level	Function
1	CFL	–	Power Supply for CFL (HOT)
2	NC	–	Non-connection
3	NC	–	Non-connection
4	CFL (GND)	–	Power Supply for CFL (GND)

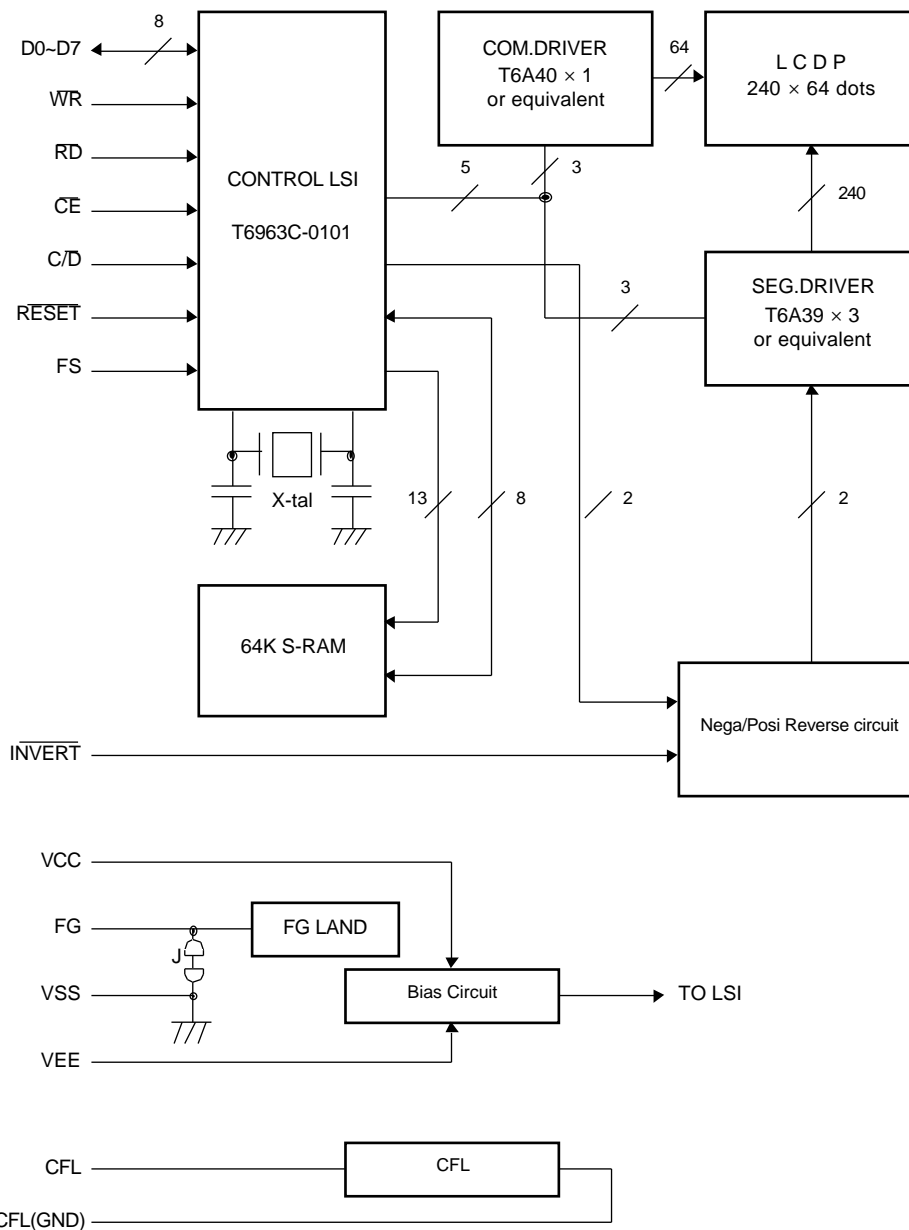
4.2.Example of Power Supply

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



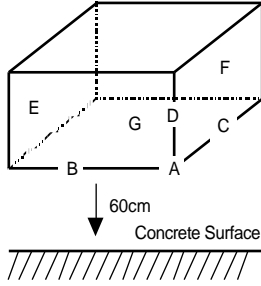
$R1+R2+VR=10 \sim 20 \text{ K}$
 $Tr=2SA1202 \text{ or equivalent}$

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.

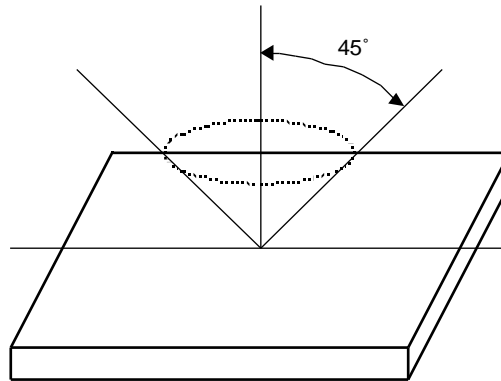
6. Appearance Standards

6.1. Inspection conditions

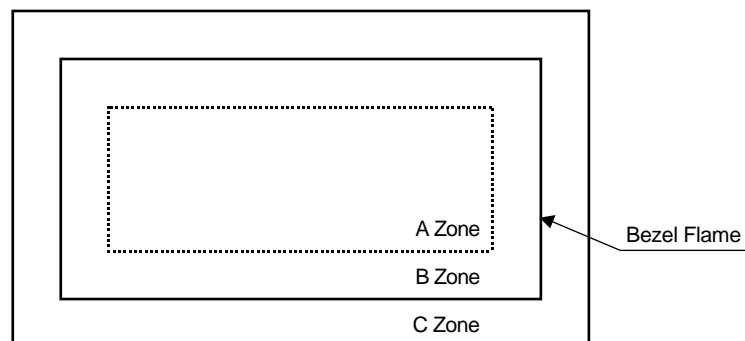
The LCD shall be inspected under 40W white fluorescent light.

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

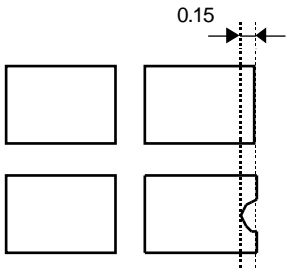
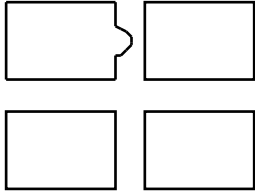
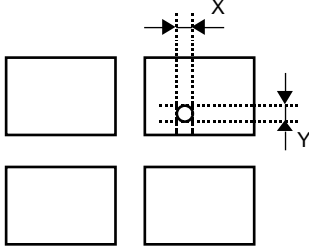
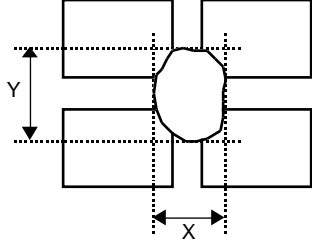
B Zone : Area from outside of "A Zone" to validity viewing area

C Zone : Rest parts

A Zone + B Zone = Validity viewing area

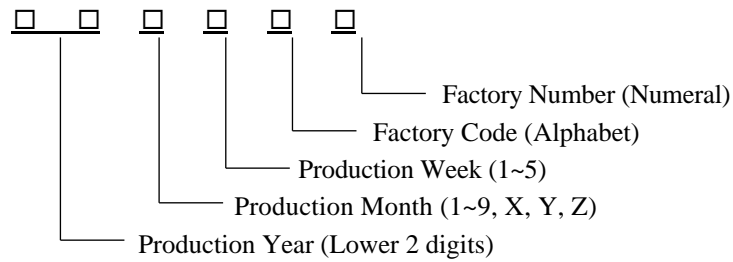
6.3. Standards

No.		<p>(2) Line Shape</p> <table border="1"> <thead> <tr> <th colspan="2" data-bbox="603 320 911 421" rowspan="2">Zone X (mm) \ Y (mm)</th> <th colspan="3" data-bbox="911 320 1369 371">Acceptable Number</th> </tr> <tr> <th data-bbox="911 371 1062 421">A</th> <th data-bbox="1062 371 1214 421">B</th> <th data-bbox="1214 371 1369 421">C</th> </tr> </thead> <tbody> <tr> <td data-bbox="603 421 762 465">-</td> <td data-bbox="762 421 911 465">0.03 W</td> <td data-bbox="911 421 1062 465">*</td> <td data-bbox="1062 421 1214 465">*</td> <td data-bbox="1214 421 1369 465">*</td> </tr> <tr> <td data-bbox="603 465 762 510">2.0 L</td> <td data-bbox="762 465 911 510">0.05 W</td> <td data-bbox="911 465 1062 510">3</td> <td data-bbox="1062 465 1214 510">3</td> <td data-bbox="1214 465 1369 510">*</td> </tr> <tr> <td data-bbox="603 510 762 555">1.0 L</td> <td data-bbox="762 510 911 555">0.1 W</td> <td data-bbox="911 510 1062 555">3</td> <td data-bbox="1062 510 1214 555">3</td> <td data-bbox="1214 510 1369 555">*</td> </tr> <tr> <td data-bbox="603 555 762 607">-</td> <td data-bbox="762 555 911 607">0.1 < W</td> <td colspan="3" data-bbox="911 555 1369 607">In the same way (1)</td> </tr> </tbody> </table> <p data-bbox="603 622 1077 656">X : Length Y : Width * : Disregard</p> <p data-bbox="603 667 938 701">Total defects shall not exceed 5.</p>	Zone X (mm) \ Y (mm)		Acceptable Number			A	B	C	-	0.03 W	*	*	*	2.0 L	0.05 W	3	3	*	1.0 L	0.1 W	3	3	*	-	0.1 < W	In the same way (1)		
Zone X (mm) \ Y (mm)		Acceptable Number																												
		A	B	C																										
-	0.03 W	*	*	*																										
2.0 L	0.05 W	3	3	*																										
1.0 L	0.1 W	3	3	*																										
-	0.1 < W	In the same way (1)																												
2	Air Bubbles (between glass & polarizer)	<table border="1"> <thead> <tr> <th colspan="2" data-bbox="603 752 911 853" rowspan="2">Zone Dimension (mm)</th> <th colspan="3" data-bbox="911 752 1369 804">Acceptable Number</th> </tr> <tr> <th data-bbox="911 804 1062 853">A</th> <th data-bbox="1062 804 1214 853">B</th> <th data-bbox="1214 804 1369 853">C</th> </tr> </thead> <tbody> <tr> <td data-bbox="603 853 762 898">D</td> <td data-bbox="762 853 911 898">0.3</td> <td data-bbox="911 853 1062 898">*</td> <td data-bbox="1062 853 1214 898">*</td> <td data-bbox="1214 853 1369 898">*</td> </tr> <tr> <td data-bbox="603 898 762 943">0.3 < D</td> <td data-bbox="762 898 911 943">0.4</td> <td data-bbox="911 898 1062 943">3</td> <td data-bbox="1062 898 1214 943">*</td> <td data-bbox="1214 898 1369 943">*</td> </tr> <tr> <td data-bbox="603 943 762 987">0.4 < D</td> <td data-bbox="762 943 911 987">0.6</td> <td data-bbox="911 943 1062 987">2</td> <td data-bbox="1062 943 1214 987">3</td> <td data-bbox="1214 943 1369 987">*</td> </tr> <tr> <td data-bbox="603 987 762 1039">0.6 < D</td> <td data-bbox="762 987 911 1039"></td> <td data-bbox="911 987 1062 1039">0</td> <td data-bbox="1062 987 1214 1039">0</td> <td data-bbox="1214 987 1369 1039">*</td> </tr> </tbody> </table> <p data-bbox="603 1055 770 1088">* : Disregard</p> <p data-bbox="603 1099 938 1133">Total defects shall not exceed 3.</p>	Zone Dimension (mm)		Acceptable Number			A	B	C	D	0.3	*	*	*	0.3 < D	0.4	3	*	*	0.4 < D	0.6	2	3	*	0.6 < D		0	0	*
Zone Dimension (mm)		Acceptable Number																												
		A	B	C																										
D	0.3	*	*	*																										
0.3 < D	0.4	3	*	*																										
0.4 < D	0.6	2	3	*																										
0.6 < D		0	0	*																										

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>(4) Deformation</p>  <p>$(X+Y) / 2 \leq 0.2\text{mm}$</p> <p>Total acceptable number : 1/dot, 5/cell (Defect number of (4) : 1pc.)</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	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	$D \geq 0.2$: 20mm or more $0.2 < D$: 40mm or more

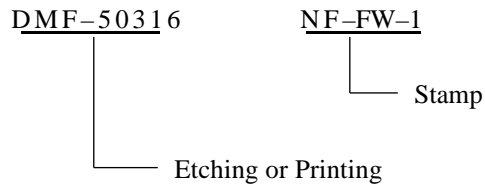
7. Code System of Production Lot

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

Optrex 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.
- 8) A high voltage over 1000V is applied at the connector of CFL cable when the CFL inverter is connected and energized. Please do not touch there incidentally or accidentally to avoid a skin burn. And please set the cable properly in the housing to avoid a worn-out of isolated cover of cable wire.

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