

LCD Module Specification

First Edition

Approved by

Production Div.

February 24, 1997

Checked by

Quality Assurance Div.

Final Revision

Checked by

Design Engineering Div.

April 9, 1997

Prepared by

Production Div.

Type No.

DMF-50834NFJ-SEB

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Revision History

Rev.	Date	Page	Comment
2	April 9, 1997	10	Correction of "Example of Power Supply" (chap.4.2)
		—	Addition of component parts list (appendix)

1. General Specifications

Operating Temp. : min. -10°C ~ max. 60°C (Without Backlight)

Storage Temp. : min. -20°C ~ max. 70°C

Dot Pixels : 119 (W) × 73 (H) dots

Dot Size : 0.33 (W) × 0.33 (H) mm

Dot Pitch : 0.36 (W) × 0.36 (H) mm

Viewing Area : 46.8 (W) × 30.24 (H) mm

Outline Dimensions : 58.8* (W) × 39.6** (H) × 7.0 max. (D) mm

* Without Backlight

** Without Flat Cable

Weight : 17g max.

LCD Type : NSD-15958
(F-STN / Black & White - mode / Transflective)

Viewing Angle : 6:00

Data Transfer : 8-bit parallel data transfer

Backlight : Electro Luminescence (EL) / Blue-green

Appendix : Component Parts List

Drawings : Dimensional Outline UE-36983
Circuit Diagram UE-36981B

2. Electrical Specifications

2.1. Absolute Maximum Ratings

GND=0V

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage (Logic)	V _{CC} -GND	—	-0.3	7.0	V
Supply Voltage (LCD Drive)	V _{DD} -GND	—	0	15.0	V
Input Voltage	V _I	—	-0.3	V _{CC} +0.3	V

2.2. DC Characteristics

T_a=25°C, GND=0V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage (Logic)	V _{CC} -GND	—	2.7	—	3.6	V
Supply Voltage (LCD Drive)	V _{DD} -GND	—	2.0	—	3.0	V
High Level Input Voltage	V _{IH}	V _{CC} =2.7~3.6V	2.2	—	V _{CC}	V
Low Level Input Voltage	V _{IL}	V _{CC} =2.7~3.6V	0	—	0.6	V
High Level Output Voltage	V _{OH}	I _{OH} =-0.205mA	2.4	—	V _{CC}	V
Low Level Output Voltage	V _{OL}	I _{OL} =1.2mA	0	—	0.4	V
Supply Current	I _{CC}	V _{CC} -GND=3.0V	—	6.0	10.0	mA
Clock Frequency	f _{osc}	Duty=50%	3.77	4.19	4.61	MHz

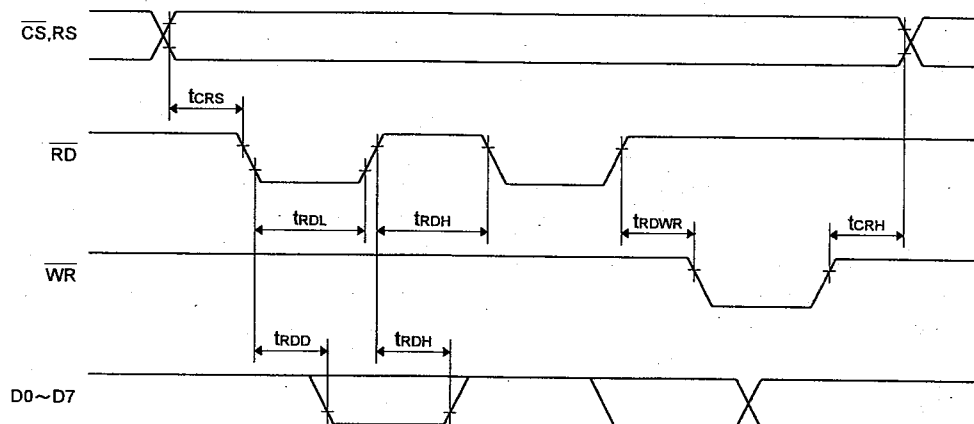
2.3.AC Characteristics

2.3.1.Timing Characteristics

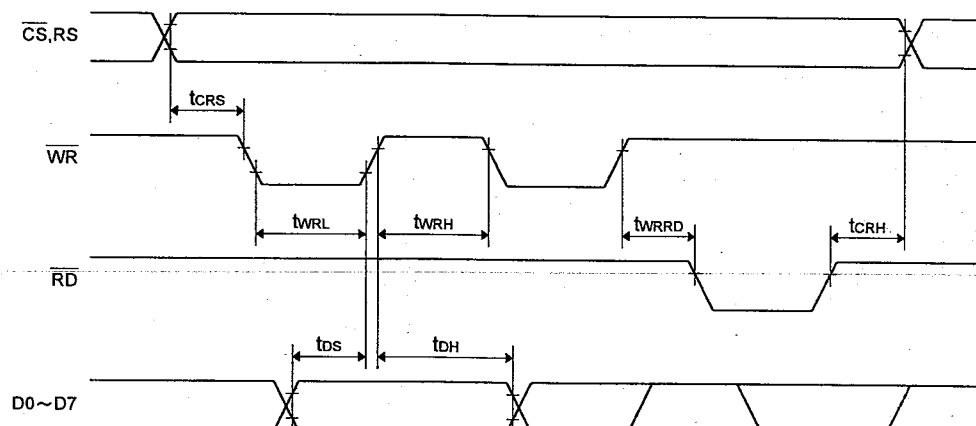
$V_{CC}=2.7\sim 3.6V$

Parameter	Symbol	Min.	Max.	Units
$\overline{RD}$ High Level Width	t_{RDH}	400	—	ns
$\overline{RD}$ Low Level Width	t_{RDL}	400	—	ns
$\overline{WR}$ High Level Width	t_{WRH}	400	—	ns
$\overline{WR}$ Low Level Width	t_{WRL}	400	—	ns
$\overline{RD} - \overline{WR}$ Time	t_{RDWR}	400	—	ns
$\overline{WR} - \overline{RD}$ Time	t_{WRRD}	400	—	ns
$\overline{CS}$, $\overline{RS}$ Setup Time	t_{CRS}	0	—	ns
$\overline{CS}$, $\overline{RS}$ Hold Time	t_{CRH}	600	—	ns
$\overline{RD}$ Data Delay Time	t_{RDD}	—	500	ns
$\overline{RD}$ Data Hold Time	t_{RDH}	15	—	ns
Input Data Setup Time	t_{DS}	0	—	ns
Input Data Hold Time	t_{DH}	400	—	ns

Read Timing



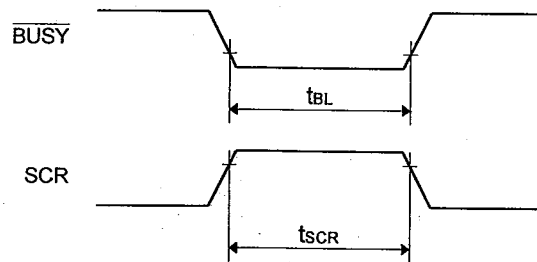
Write Timing



2.3.2.Switching Characteristics

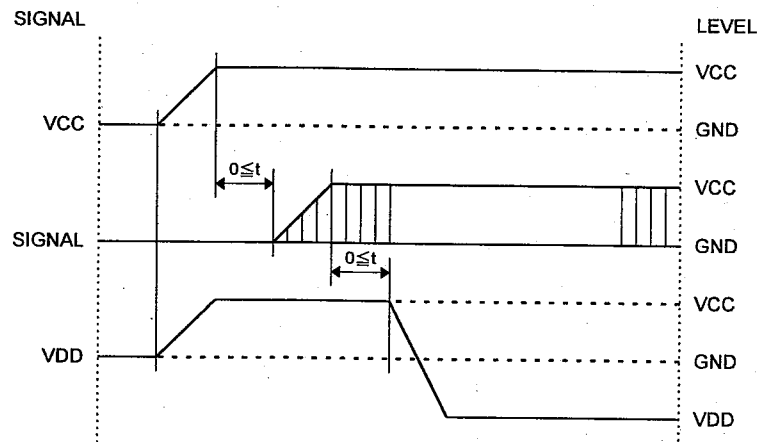
$V_{CC}=2.7\sim 3.6V$

Parameter	Symbol	Min.	Max.	Units
BUSY Low Level Time	t_{BL}	3	9	$4/f_{osc}$
SCR High Level Time	t_{SCR}	100	550	μs

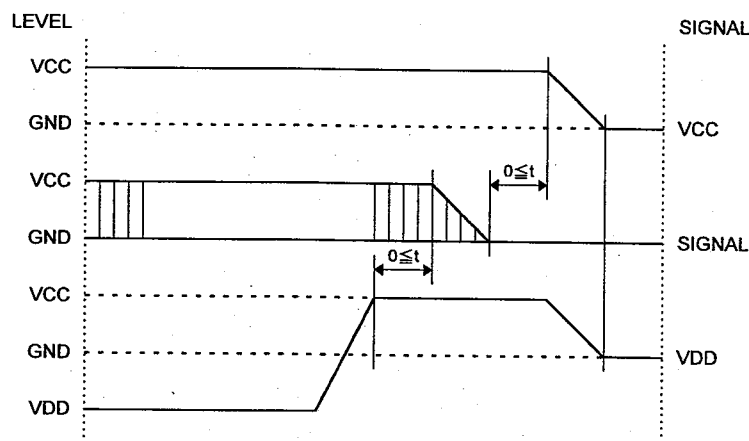


2.4. Power Supply ON/OFF Sequence

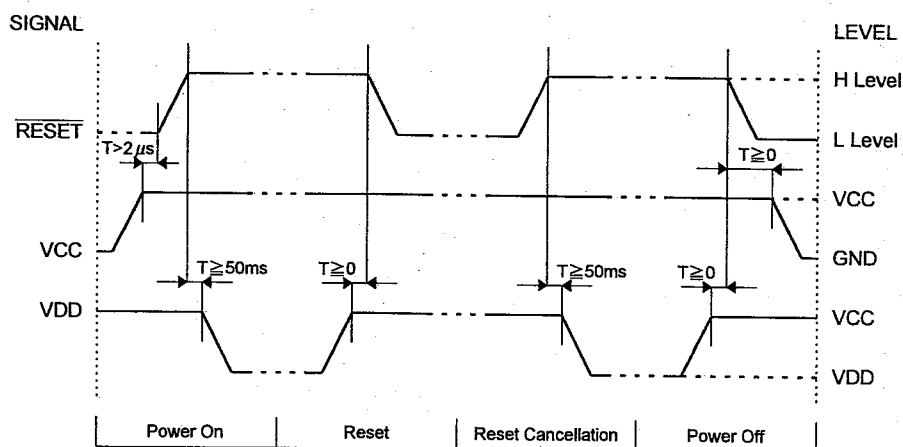
2.4.1. ON Sequence



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 VDD is supplied to the module while internal alternate signal for LCD driving (M) is unstable or $\overline{\text{RESET}}$ 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	Conditions	Min.	Typ.	Max.	Units
Inverter Input Voltage	VEL - GND2	2.4	3.0	3.5	V
Inverter Output Voltage	ELA - ELB	160	180	200	Vrms
Input Frequency	ELA - ELB	150	200	250	Hz
Luminance of Backlight Surface	—	1.0	2.2	—	cd/m ²
Life	Ta=25°C, 65%RH	1500	—	—	hrs

3. Optical Specifications

3.1. LCD Driving Voltage

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Recommended LCD Driving Voltage Note 1	V _D Note 2	Ta=-10°C	—	—	16.2	V
		Ta=25°C	11.6	12.5	13.4	V
		Ta=60°C	10.6	—	—	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.

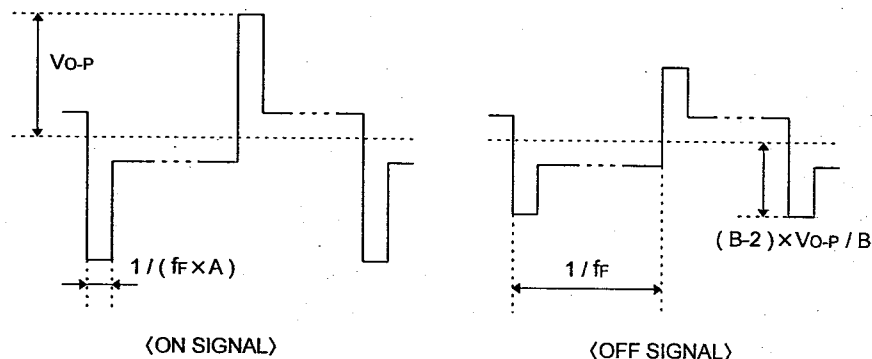
Note 2 : Definition of Driving Voltage V_D

Assuming that the typical driving waveforms shown below are applied to the LCD Panel at 1/A Duty - 1/B Bias (A : Duty Number, B : Bias Number). Driving voltage V_D is defined as follows.

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

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

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



3.2. Optical Specifications

Ta=25°C, 1/73 Duty, 1/6.7 Bias, V_D=12.5V, 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 Time	Rise Note 2	τ _r	—	120	200	ms
	Decay Note 3	τ _d	—	130	200	ms

Note 1 : Contrast ratio is defined as follows.

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

L_{ON} : Luminance of the ON segments

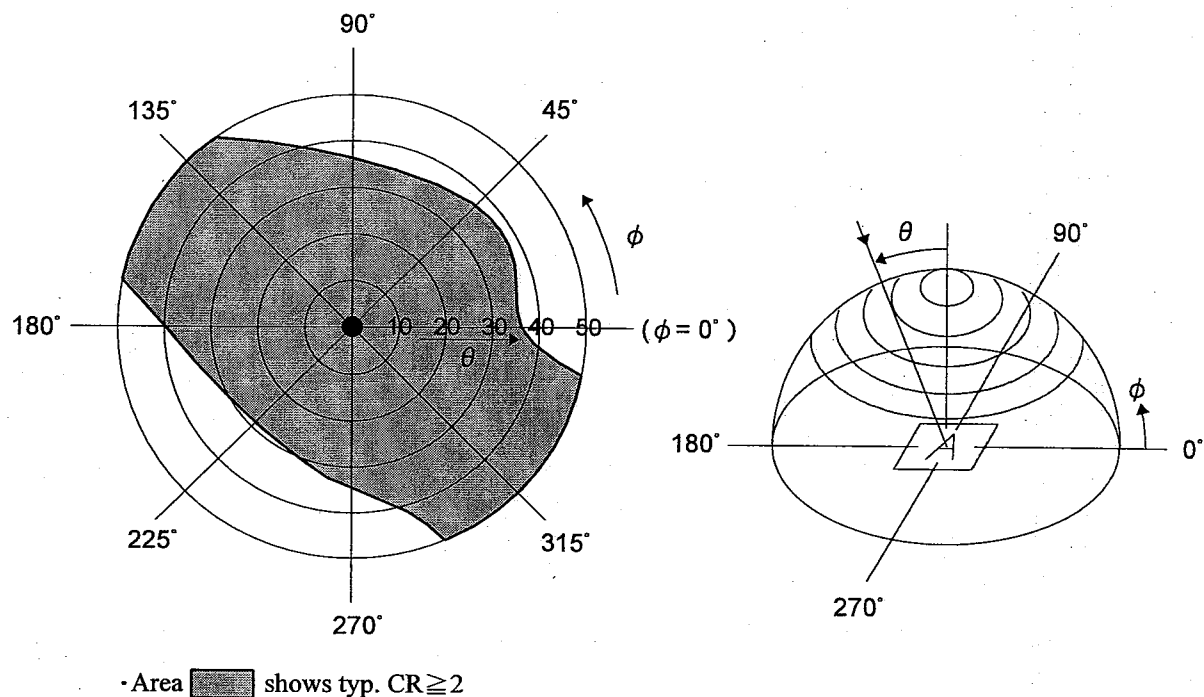
L_{OFF} : Luminance of the OFF segments

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

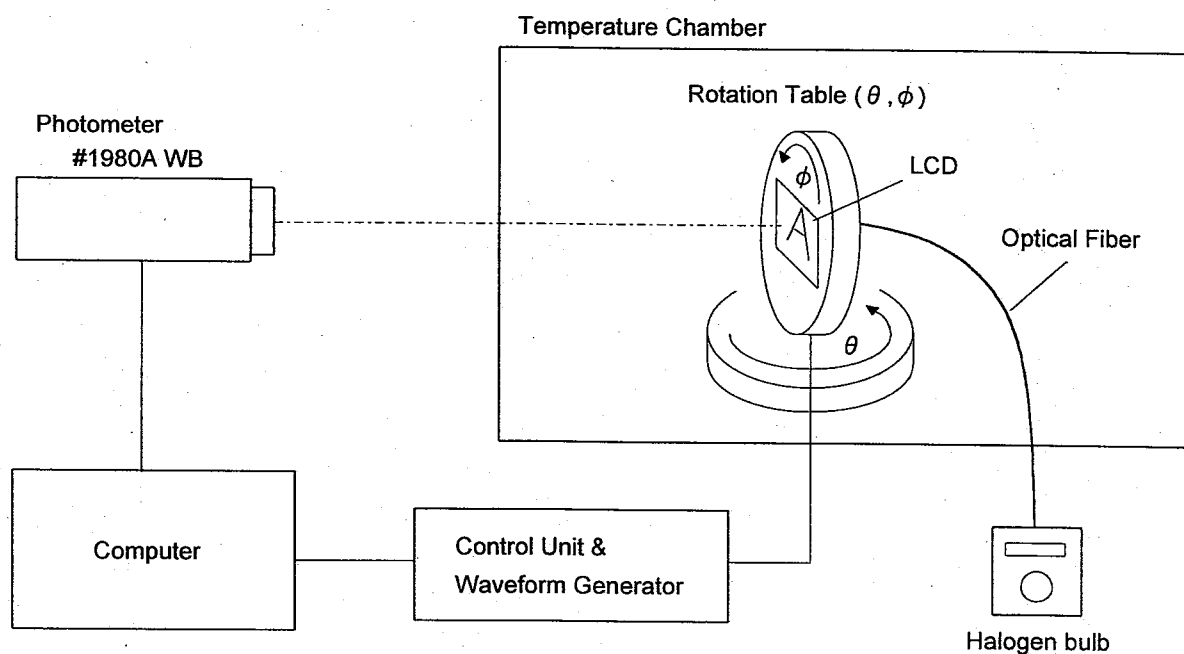
Note 3 : The time that the luminance level reaches 10% of the saturation level from 100% when OFF signal is applied.

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 : 1/73 Duty, 1/6.7 Bias, $V_D=12.5V$, $f_F=70Hz$



3.4. System Block Diagram



4. I/O Terminal

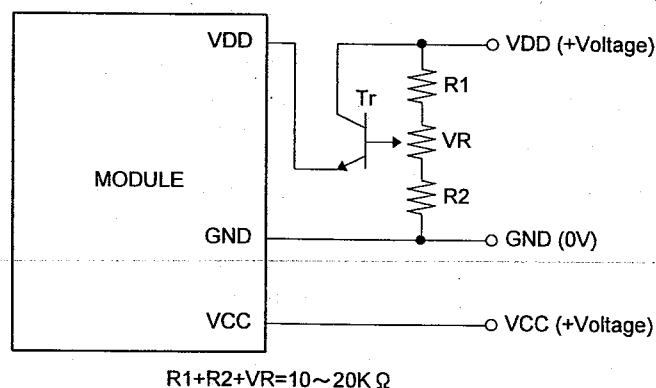
4.1. Pin Assignment

CN1

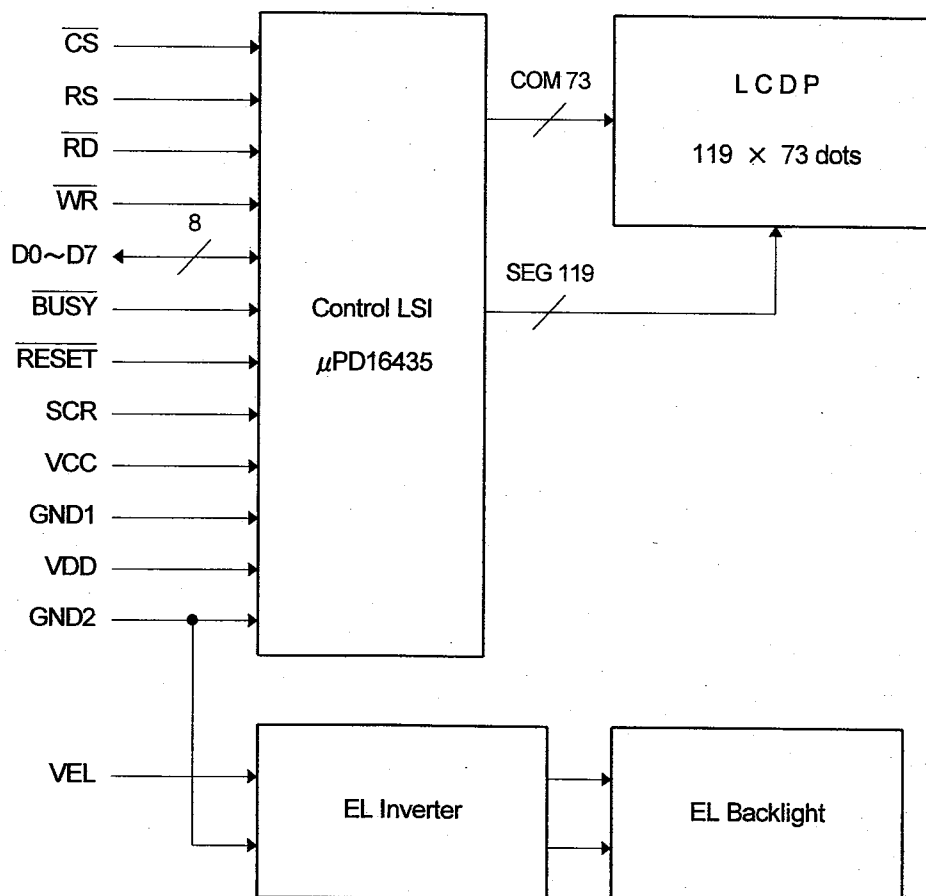
No.	Symbol	Level	Function
1	$\overline{CS}$	H / L	Chip Select Signal
2	RS	H / L	Register Select Signal
3	$\overline{RD}$	H / L	Read Enable Signal
4	$\overline{WR}$	H / L	Write Enable Signal
5	D0	H / L	Display Data
6	D1	H / L	Display Data
7	D2	H / L	Display Data
8	D3	H / L	Display Data
9	D4	H / L	Display Data
10	D5	H / L	Display Data
11	D6	H / L	Display Data
12	D7	H / L	Display Data
13	$\overline{BUSY}$	H / L	"0" indicates busy state.
14	$\overline{RESET}$	H / L	Reset Signal
15	SCR	H / L	Signal is output to CPU on completion of one-character scroll.
16	VCC	—	Power Supply for Logic
17	GND1	—	Power Supply (0V, GND)
18	VDD	—	Power Supply for LCD Drive
19	GND2	—	Power Supply (0V, GND)
20	VEL	—	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.

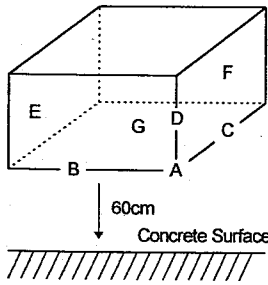


4.3. Block Diagram



5. Test

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

No.	Parameter	Conditions	Notes
1	High Temperature Operating	60°C ± 2°C, 96hrs (operation state)	
2	Low Temperature Operating	-10°C ± 2°C, 96hrs (operation state)	3
3	High Temperature Storage	70°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.

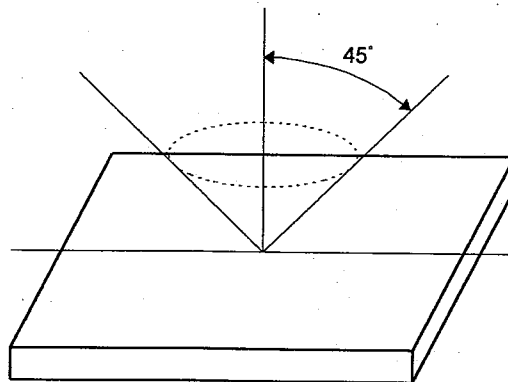
6. Appearance Standards

6.1. Inspection conditions

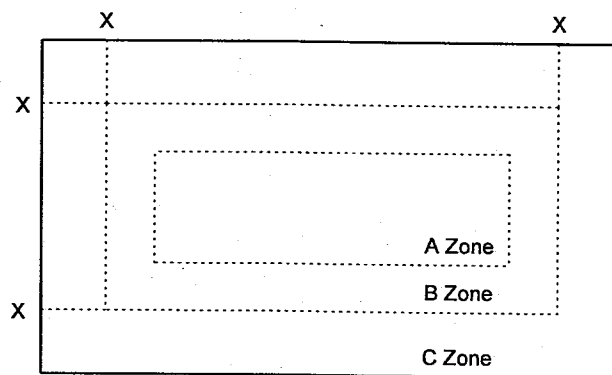
The LCD shall be inspected under 40W white fluorescent light.

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



X : Maximum Seal Line

A Zone : Active display area

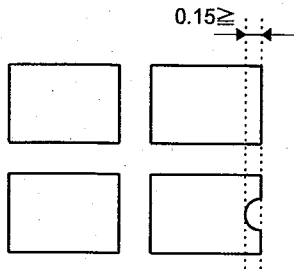
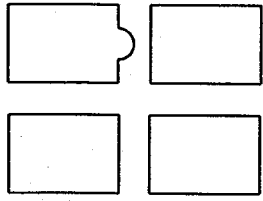
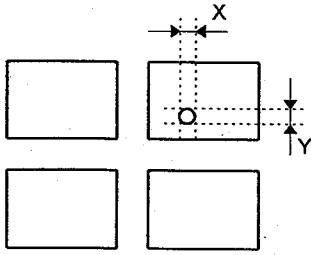
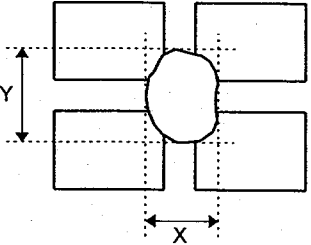
B Zone : Out of active display area ~ Maximum seal line

C Zone : Rest parts

A Zone + B Zone = Validity viewing area

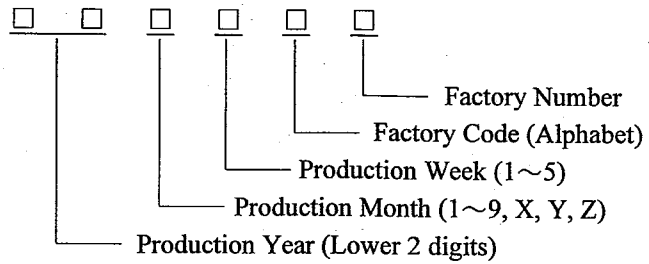
6.3.Standards

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

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  $(X+Y) / 2 \leq 0.2\text{mm}$ (Less than 0.1mm is no counted.) (4) Deformation  $(X+Y) / 2 \leq 0.2\text{mm}$ 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	$D \leq 0.2$: 20mm or more $0.2 < D$: 40mm or more

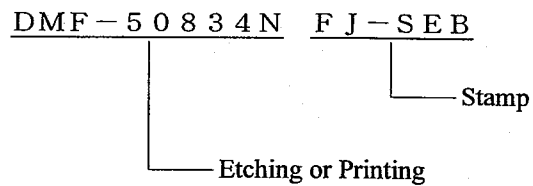
7. Code System of Production Lot

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..

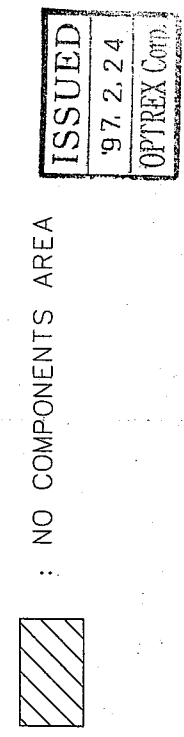
Optrex Products are not designed, intended, or authorized for use in any application in which the failure of the product could result in a situation where personal injury or death may occur. These applications include, but are not limited to, life-sustaining equipment, nuclear control devices, aerospace 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.

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.

COMPONENT PARTS LIST

[illegible]



DOTS DETAIL (S=20:1)

TOLERANCE				THIRD ANGLE PROJECTION	DATE Jul 11 '96	OPTREX CORPORATION
MEASURE	A	B	C			
Ls16	±0.1	±0.3	±1	UNIT	APPROVED	TITLE
16xL±s63	±0.2	±0.5	±1.5	mm	<i>of Richard (SS)</i>	DIMENSIONAL OUTLINE
63xL±250	±0.3	±0.8	±2	SCALE	CHECKED	CODE
250xL±500	±0.5	±1.2	±3	2:1	<i>of Richard</i>	DMF-50834N Series
500xL	±0.8	±2	±4	DRAWN	<i>of Richard</i>	DMG NO
ANGLE	±1°	±5°	±10°		S.Fujiyama	UE-36983