LCD Module Specification

First Edition	Approved by	Production Div.
June 2, 1997	Checked by	Quality Assurance Div.
Final Revision	Checked by	Design Engineering Div.
******	Prepared by	Production Div.

Type No. DMC-50593NFJ-SLY-2

Table of Contents

Revision History

Rev.	Date	Page	Comment

PRELIMINARY

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1.General Specifications

Operating Temp.	:	min. -20℃ ~ max. 70℃
Storage Temp.	:	min. -20℃ ~ max. 70℃
Display Format	:	12 characters × 3 lines + 18 flags
Display Fonts	:	5 × 7 dots (1 character)
Viewing Area	:	44.9 min. (W) × 24.4 min. (H) mm
Outline Dimensions	:	50.0 (W) × 33.0* (H) × 5.0 (D) mm * Without Heat-seal & Connector
Weight	:	8.4g max.
LCD Type	:	NSD-14242 (F-STN / Black & White-mode / Transflective)
Viewing Angle	:	6:00
Data Transfer	:	Serial data transfer
Backlight	:	LED Backlight / Yellow-green
Additional Spec.	:	The dots incline at an angle of 3 degrees.
Drawings	:	Module Dimensional Outline UE-21321C Module Circuit Diagram UE-36312B Panel Dimensional Outline YU-54076

2.Electrical Specifications

2.1.Absolute Maximum Ratings

GND=0V

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage	Vcc-GND	—	-0.3	7.0	V
Input Voltage	V_I	—	-0.3	Vcc+0.3	V

2.2.DC Characteristics

Ta=25℃, GND=0V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage	Vcc-GND	—	3.0	—	3.6	V
High Level Input Voltage	V_{IH}	Vcc=3.0~3.6V	0.7×Vcc	—	Vcc	V
Low Level Input Voltage	V_{IL}	Vcc=3.0~3.6V	0	—	0.6	V
High Level Output Voltage	V_{OH}	I_{OH}=-0.1mA	0.75×Vcc	—	Vcc	V
Low Level Output Voltage	V_{OL}	I_{OL}=0.1mA	0	—	0.2×Vcc	V
Supply Current	Icc	Vcc-GND=3.3V Checker Pattern	—	2.5	5.0	mA

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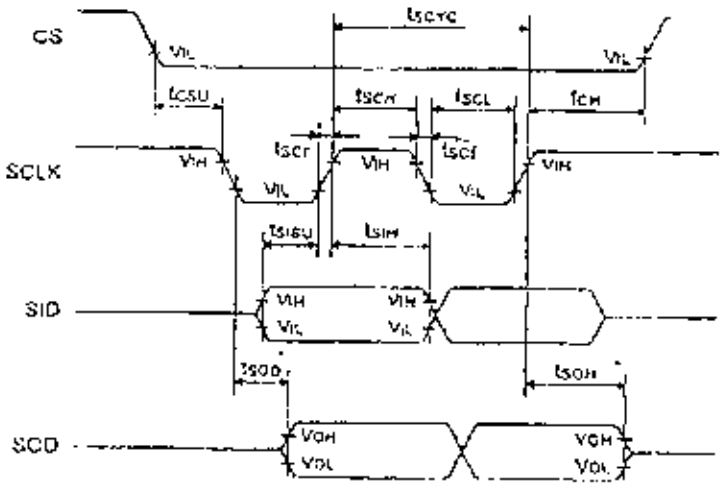
2.3.AC Characteristics

2.3.1.Serial Interface Sequence

V_{DD}=3.0~3.6V

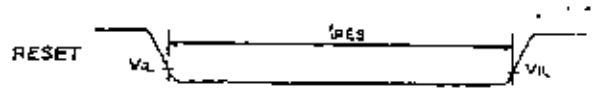
Parameter	Symbol	Min.	Max.	Units
Serial Clock Cycle Time	t_{SCYC}	1	20	μs
Serial Clock High Level Width	t_{SCH}	400	--	ns
Serial Clock Low Level Width	t_{SCL}	400	--	ns
Serial Clock Rise/Fall Time	t_{SCr}, t_{SCf}	--	50	ns
Chip Select Setup Time	t_{CSU}	60	--	ns
Chip Select Hold Time	t_{CSH}	200	--	ns
Serial Input Data Setup Time	t_{SISU}	200	--	ns
Serial Input Data Hold Time	t_{SIH}	200	--	ns
Serial Output Data Delay Time	t_{SOD}	--	360	ns
Serial Output Data Hold Time	t_{SOH}	0	--	ns



2.3.2.Reset Timing

Vcc=3.0~3.6V

Parameter	Symbol	Min.	Max.	Units
Reset Low Level Width	t_{RES}	10	--	ms

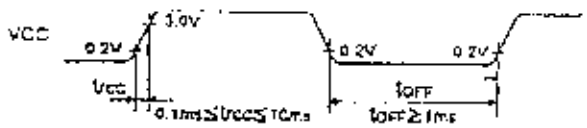


Note: When power is supplied, initializing by the internal reset circuit has priority. Accordingly the above RESET input is ignored during internal reset period.

2.3.3.Power Supply Conditions Using Internal Reset Circuit

Vcc=3.0~3.6V

Parameter	Symbol	Min.	Max.	Units
Power Supply Rise Time	t_{rcc}	0.1	10	ms
Power Supply Off Time	t_{OFF}	1	--	ms



Note 1 : toff compensates for the power oscillation period caused by momentary power supply oscillations.

Note 2 : If the above electrical conditions are not satisfied,the internal reset circuit will not operate normally. In this initialize by instruction.

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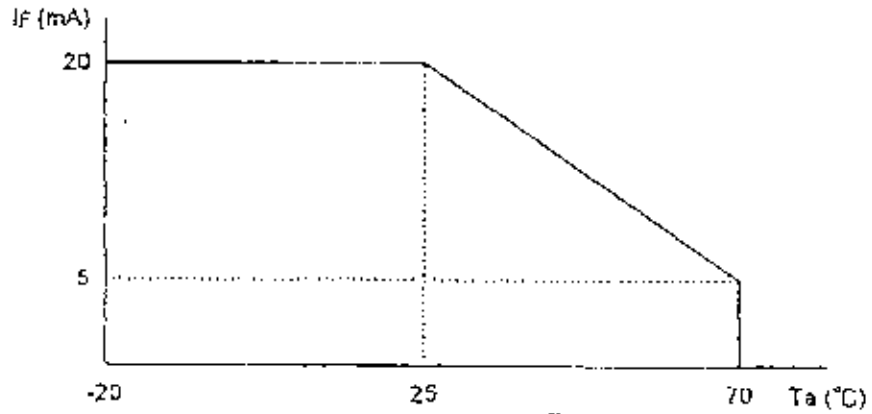
2.4.Lighting Specifications

2.4.1.Absolute Maximum Ratings

Ta=25℃

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Foward Current	I_F	Note 1	–	–	40	mA
Reverse Voltage	V_R	–	–	–	8	V
LED Power Dissipation	Po	–	–		250	W

Note 1 : Refer to the foward current derating curve.



2.4.2.Operating Characteristics

Ta=25℃

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Foward Voltage	V_F	I_F=20mA	3.65	4.10	4.45	V
Luminance of Backlight Surface	L	I_F=20mA	5	–	–	cd/m²

3.Optical Specifications

3.1.Optical Characteristics

Ta=25℃, 1/33 Duty, 1/5 Bias, V_{OP}=8.1V (Note 4), θ = 0°, ϕ = —°

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Units
Contrast Ratio Note 1		CR	θ = 0°, ϕ = —°	—	10	—	
Viewing Angle			Shown in 3.3				
Response Time	Rise Note 2	T_{ON}	—	—	75	150	ms
	Decay Note 3	T_{OFF}	—	—	120	200	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.

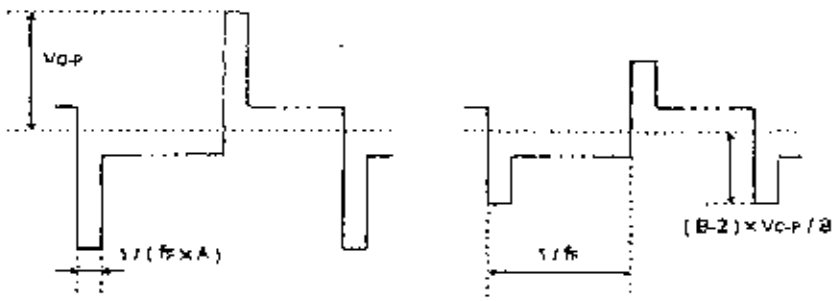
Note 4 : Definition of Driving Voltage V_D

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.

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

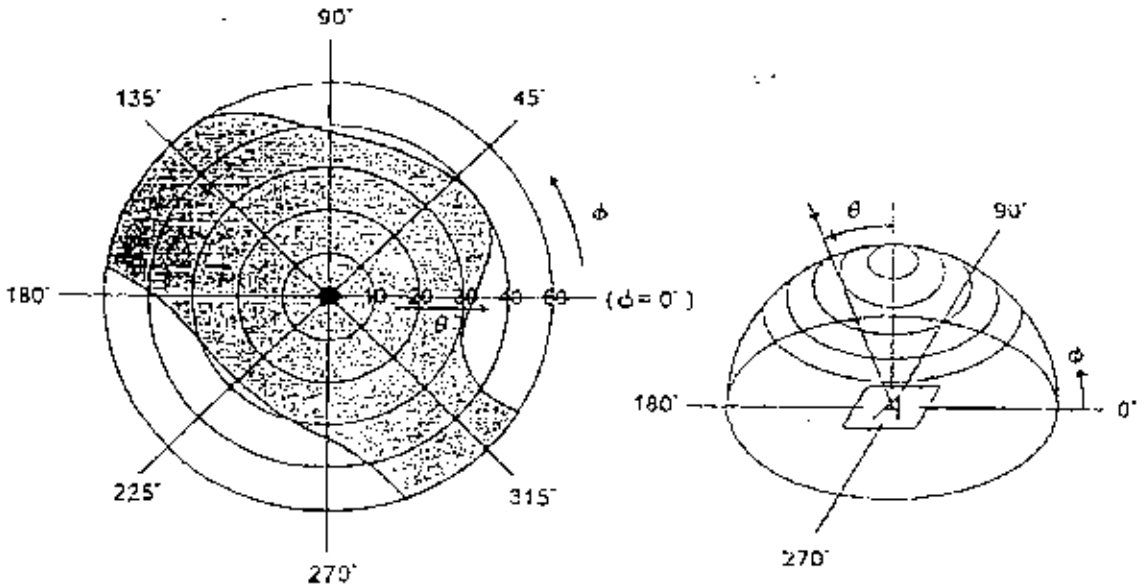
V_{th1} : The voltage V_{O-P} that should provide 50% of the satulation level in the luminance at the segment which the ON signal is applied to.

V_{th2} : 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.



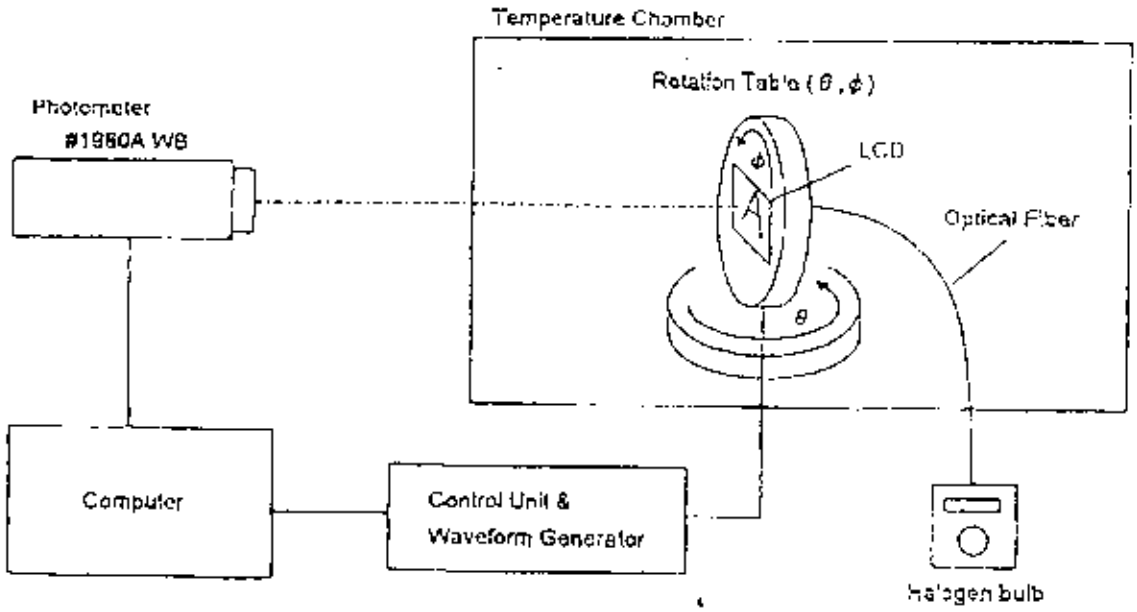
3.2.Definition of Viewing Angle and Optimum Viewing Area

- Point ● shows the point where contrast ratio is measured. : $\theta = 0°$, $\phi = -°$
- Driving condition : 1/53 Duty, 1/5 Bias, V_D=8.1V, f_F=81.5Hz



- Area [ ] shows typ. CR≧2

3.3.System Block Diagram

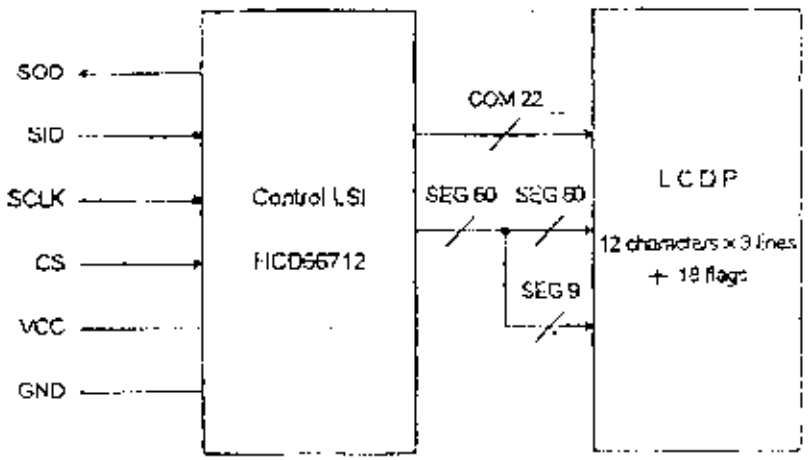


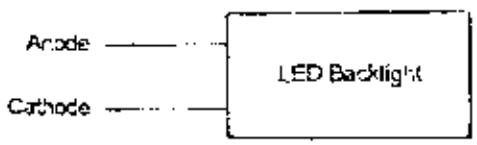
4.I/O Terminal

4.1.Pin Assignment

No.	Symbol	Level	Function
1	Anode	—	LED Anode Terminal
2	Cathode	—	LED Cathode Terminal
3	GND	—	Power Supply (0V, GND)
4	VCC	—	Power Supply for Logic
5	CS	H / L	Chip Select Signal L : Active
6	SCLK	H / L	Input for Serial Clock
7	SID	H / L	Input for Serial Data
8	SOD	H / L	Output for Serial Data

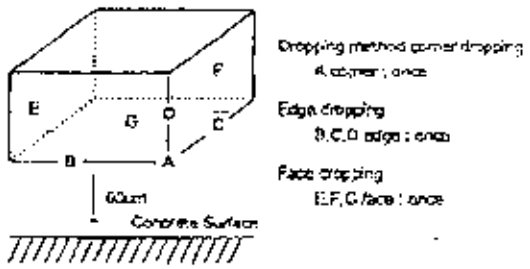
4.2.Block Diagram





5. Test

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

No.	Parameter	Conditions	Notes
1	High Temperature Operating	70℃±2℃, 96hrs (operation state)	
2	Low Temperature Operating	-20℃±2℃, 96hrs (operation state)	3
3	High Temperature Storage	70℃±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.

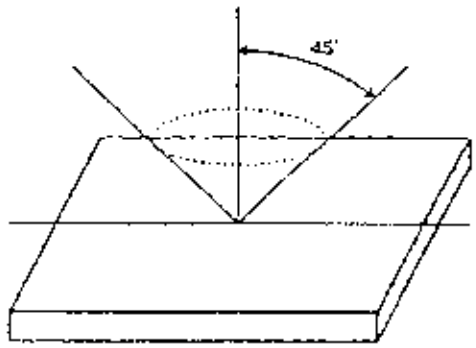
Note 4 : The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

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

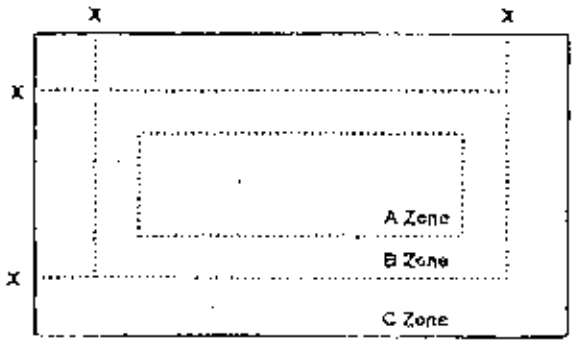
6.Appearance Standards

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



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

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6.3 Standards

No.	Parameter	Criteria
1	Black and White Spots, Foreign Substances	(1) Round Shape

Dimension (mm) \ Zone	Acceptable Number A	B	C
D ≦ 0.1	*	*	*
0.1 < D ≦ 0.2	5	5	*
0.2 < D ≦ 0.3	0	1	*
0.3 < D	0	0	*

D = (Long + Short) / 2 * : Disregard

(2) Line Shape

X(mm) \ Zone / Y(mm)		Acceptable Number A	B	C
—	0.02≧W	*	*	*
2.0≧L	0.03≧W	3	3	*
1.0≧L	0.04≧W	1	2	*
1.0≧L	0.05≧W	0	2	*
—	0.05<W	In the same way (1)		

X : Length Y : Width * : Disregard

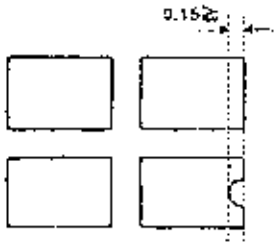
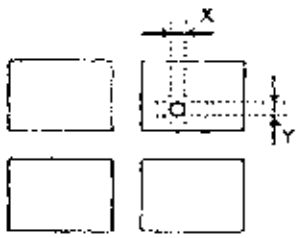
Total defects shall not exceed 5.

2	Air Bubbles (between glass & polarizer)	

Dimension (mm) \ Zone	Acceptable Number A	B	C
D ≦0.15	*	*	*
0.15< D ≦0.3	2	3	*
0.3 < D ≦0.5	1	2	*
0.5 < D ≦1.0	0	1	*

* : 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≦0.2mm (Less then 0.1mm is no counted.) Total defects shall not exceed 5.
4	Polarizer Scratches	Not to be conspicuous defects.
5	Polarizer Dirts	If the stains are removed easily from LCDP surface, the module is not defective.
6	Color Variation	Not to be conspicuous defects.

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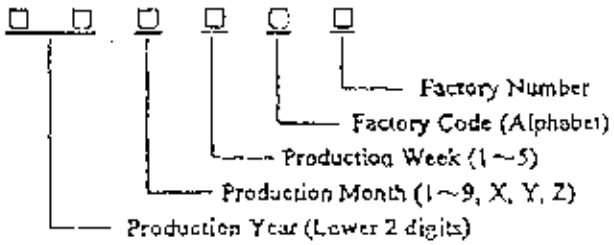
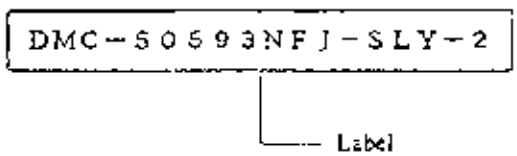
7.Code System of Production Lot

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.

N/A

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.

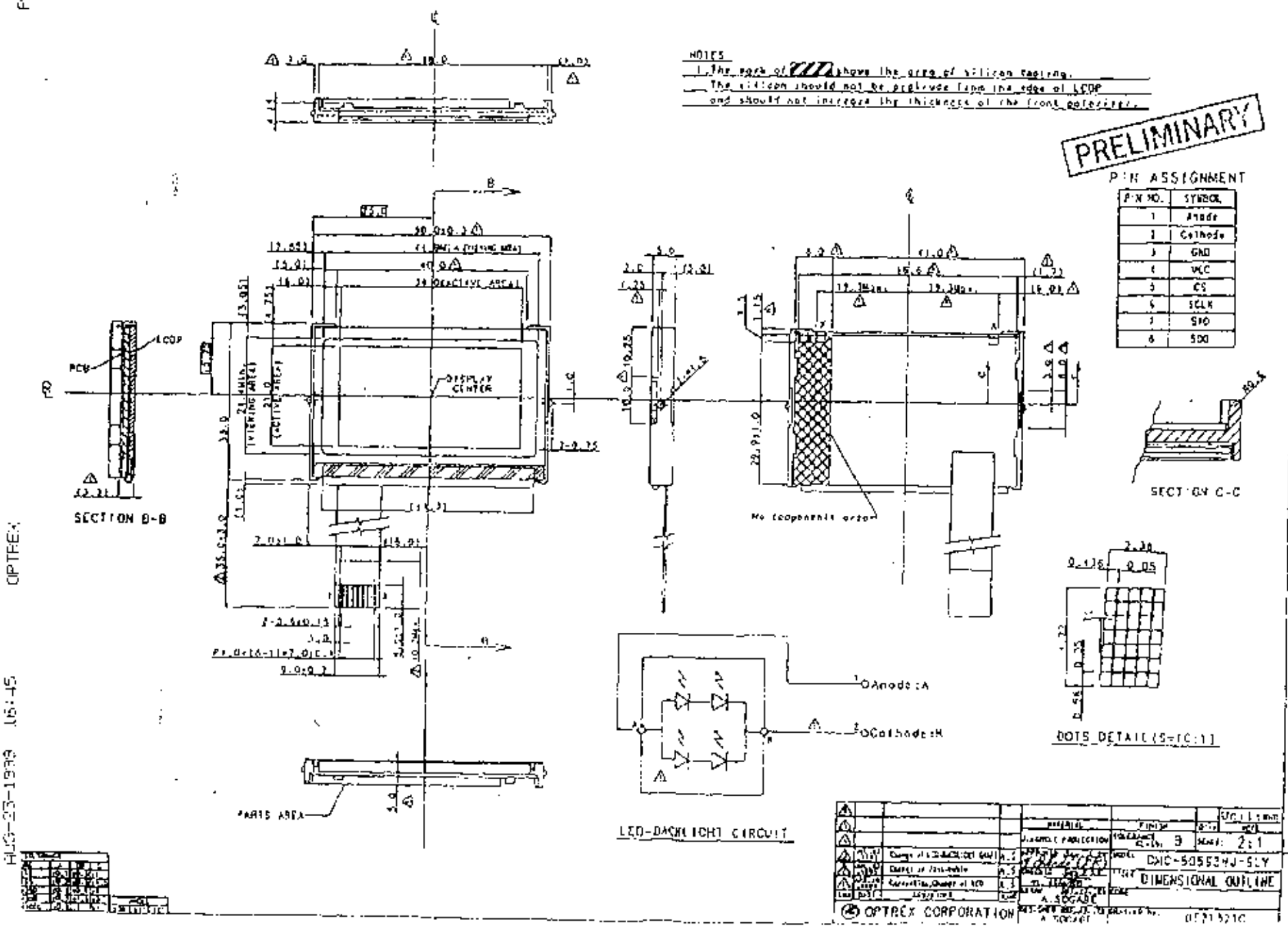
4) If it is necessary to store LCD modules for a long time, please comply with the following procedures. If storage condition is not satisfactory, display (especially polarizer) may be deteriorated or soldering I/O terminals may become difficult (some oxide is generated at I/O terminals plating).

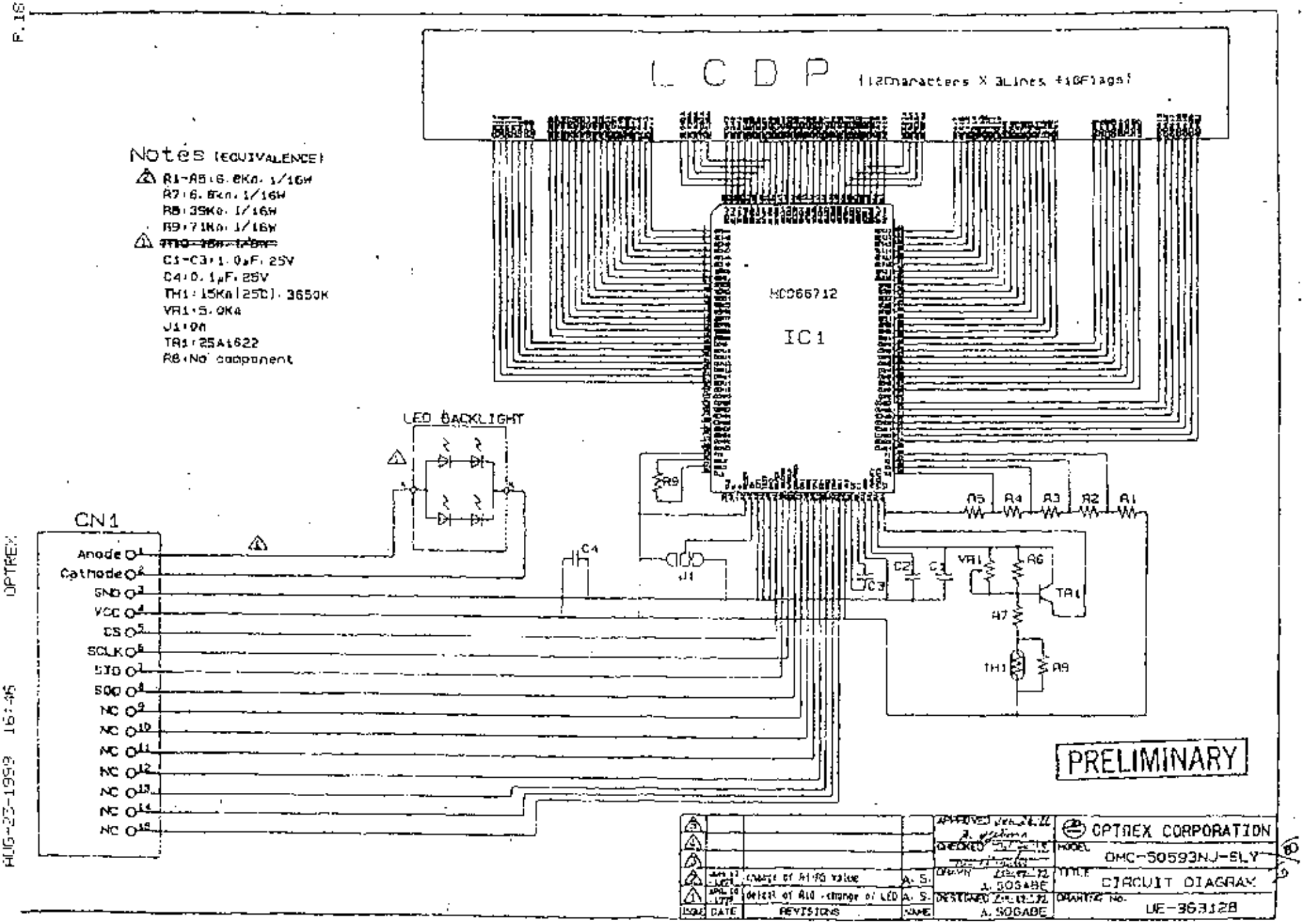
① Store as delivered by Optrex
② If you store as unpacked, put in anti-static bag, seal its opening and store where it is not subjected to direct sunshine nor fluorescent lamp.
③ Store at temperature 0 to +35℃ and at low humidity. Please refer to our specification sheets for storage temperature range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

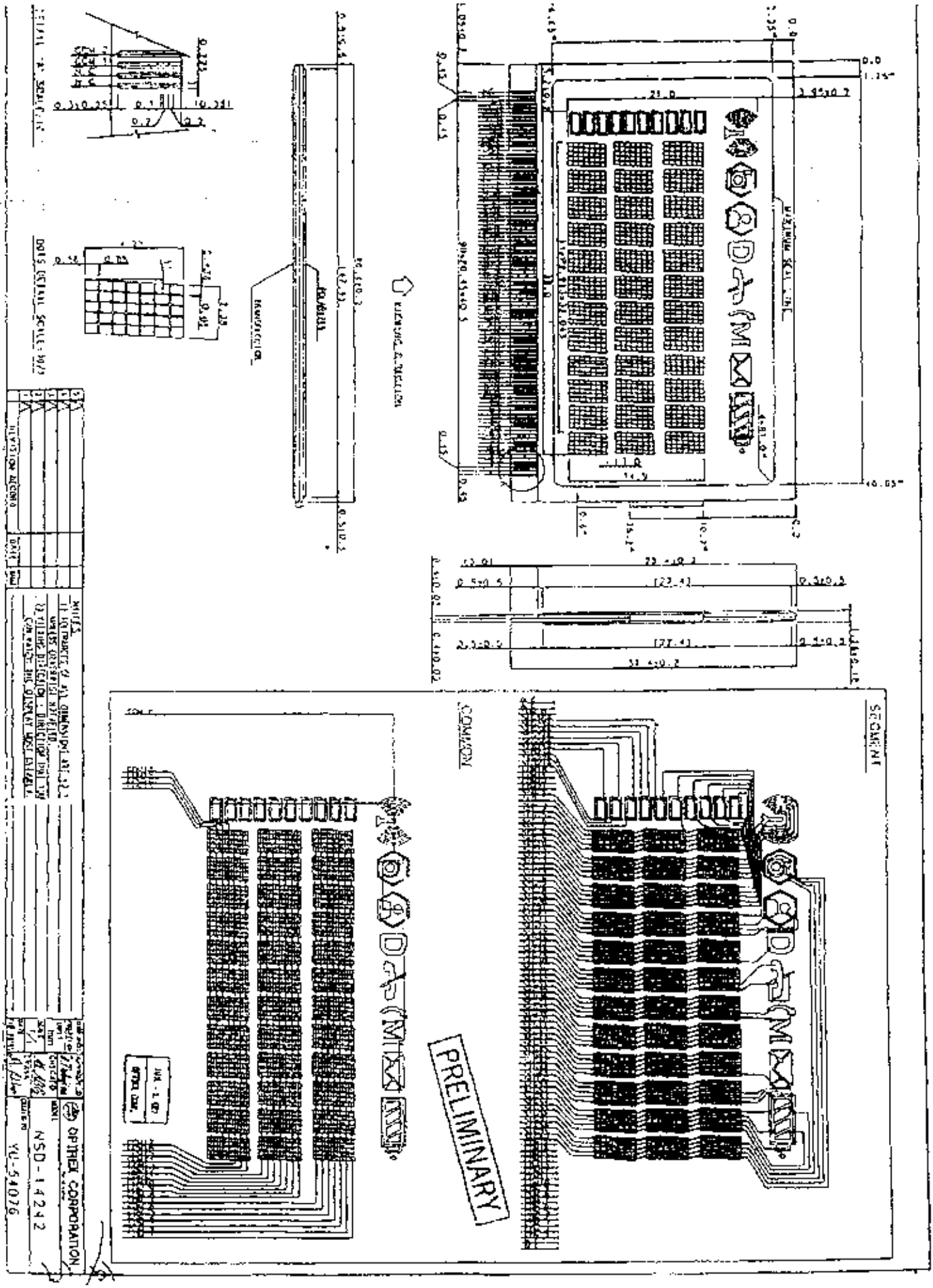
5) The module does not contain excess current limiter.
Please design the limiter to cut excess current in your power supply circuit.

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.


NOTES
1. The mark of ▨ shows the area of silicon sealing.
The silicon should not be protrude from the edge of LCDP
and should not increase the thickness of the front polarizer.
PRELIMINARY
PIN ASSIGNMENT
PIN NO. SYMBOL
1 Anode
2 Cathode
3 GND
4 VCC
5 CS
6 SCLK
7 SID
8 SOD
SECTION B-B
SECTION C-C
DISPLAY CENTER
ACTIVE AREA
PCB
LCDP
No components under
PARTS AREA
DOTS DETAIL (5=1C:1)
LED-BACKLIGHT CIRCUIT
1 Anode :A
2 Cathode :K
OPTREX CORPORATION
DMC-50563NJ-SLY
DIMENSIONAL OUTLINE
SCALE: 2:1
OPTREX
AUG-23-1999 16:45


LCDP (120characters X 3Lines +10Flags)
Notes (EQUIVALENCE)
R1~R5:6.8KΩ, 1/16W
R7:6.8KΩ, 1/16W
R8:39KΩ, 1/16W
R9:71KΩ, 1/16W
C1~C3:1.0μF, 25V
C4:0.1μF, 25V
TH1:15KΩ(25℃), 3650K
VR1:5.0KΩ
J1:0Ω
TA1:2SA1622
R8:No component
KC066712
IC1
LED BACKLIGHT
CN1
Anode
Cathode
GND
VCC
CS
SCLK
SID
SOD
NC
PRELIMINARY
OPTREX CORPORATION
DMC-50593NJ-SLY
CIRCUIT DIAGRAM
UE-363128
change of R1~R5 value
delete of R10 , change of LED


PRELIMINARY
COMMON
SEGMENT
OPTREX CORPORATION
NSD-14242
YU-54076