LCD MODULE SPECIFICATION FOR APPROVAL	DATE	02/02/07
	VER.	1.0
JHD12232D	PAGE	1

CUSTOMER:

P/N : JHD12232D

CUSTOMER APPROVAL

CHECKED	CHECKED	APPROVAL

SUPPLIER APPROVAL

CHECKED	CHECKED	APPROVAL

•REVISION RECORD

REV. NO.	REV. DATE	DESCRIPTION OF REVISION	PAGE	REMARK
0	14/01/04	INITIAL RELEASE	ALL	

CONTENTS

1. FEATURES

- Display construction..... 122*32 DOTS
- Display mode..... STN
- Display type..... Positive Transflective
- Backlight..... LED/5.0V
- Viewing direction..... 6 o'clock
- Operating temperature..... Indoor
- Driving voltage..... Single power
- Driving method..... 1/32 duty, 1/6 bias
- Type..... COB (Chip On Board)
- Number of data line..... 8-bit parallel
- Connector..... Pin

2. MECHANICAL DATA

ITEM		WIDTH	HEIGHT	THICKNESS	UNIT
Module size		84.0	44.0	13.0(MAX)	mm
Viewing area		59.70	17.86	-	mm
Dot	Size	0.35	0.40	-	mm
	Pitch	0.4	0.45	-	mm
Diameter of mounting hole		2.45			mm
Weight		About 50			g

3. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Standard	Unit
Supply voltage (1)	V_{SS}	–8.0 ~ +0.3	V
Supply voltage (2)	V_5	–16.5 ~ +0.3	V
Supply voltage (3)	V_1, V_4 V_2, V_3	V_5 ~ +0.3	V
Input voltage	V_{IN}	V_{SS} – 0.3 ~ +0.3	V
Output voltage	V_O	V_{SS} – 0.3 ~ +0.3	V
Allowable loss	P_D	250	mW
Operating temperature	T_{OPR}	–30 ~ +85	°C
Storage temperature	T_{STG}	–65 ~ +150	°C
Soldering temperature/time	T_{SOLDER}	260/10 (at leads)	°C/Sec

4. ELECTRICAL CHARACTERISTICS

V_{DD} = 0V, Ta = –20 ~ 75°C

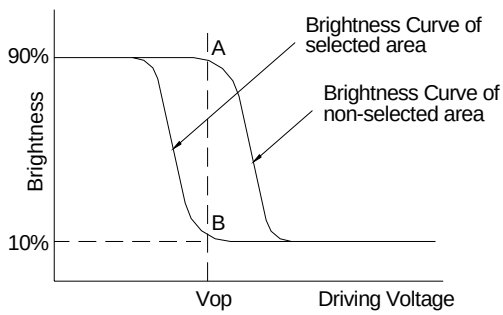
Parameter		Symbol	Condition		Min.	Typ.	Max.	Unit	Applicable pin
Operating voltage (1)*1	Recommended	V_{SS}			–5.5	–5.0	–4.5	V	V_{SS}
	Allowable				–7.0		–2.4		
Operating voltage (2)	Recommended	V_5			–13.0		–3.5	V	V_5 *10
	Allowable				–13.0				
	Allowable	V_1, V_2			0.6 × V_5		V_{DD}	V	V_1, V_2
	Allowable	V_3, V_4			V_5		0.4 × V_5	V	V_3, V_4
High level input voltage		V_{IHT}			V_{SS} + 2.0		V_{DD}	V	*2 *3
		V_{IHC}			0.2 × V_{SS}		V_{DD}		
Low level input voltage		V_{ILT}			V_{SS}		V_{SS} + 0.8	V	*2 *3
		V_{ILC}			V_{SS}		0.8 × V_{SS}		
High level output voltage		V_{OHT}	I_{OH} = –3.0mA		V_{SS} + 2.4			V	*4 *5 OSC2
		V_{OHC1}	I_{OH} = –2.0mA		V_{SS} + 2.4				
		V_{OHC2}	I_{OH} = –120µA		0.2 × V_{SS}				
Low level output voltage		V_{OLT}	I_{OL} = 3.0mA				V_{SS} + 0.4	V	*4 *5 OSC2
		V_{OLC1}	I_{OL} = 2.0mA				V_{SS} + 0.4		
		V_{OLC2}	I_{OL} = 120µA				0.8 × V_{SS}		
Input leakage current		I_{LI}			–1.0		1.0	µA	*6
Output leakage current		I_{LO}			–3.0		3.0	µA	*7
LCD driver ON resistor		R_{ON}	Ta = 25°C	V_5 = –5.0V		5.0	7.5	KΩ	SEG 0 ~ 79 *11 COM 0 ~ 15
				V_5 = –3.5V		10.0	50.0		
Static current dissipation		I_{DDQ}	$\overline{CS}$ = CL = V_{DD}			0.05	1.0	µA	V_{DD}
Dynamic current dissipation		I_{DD} (1)	During display V_5 = –5.0V	f_{CL} = 2KHz		2.0	5.0	µA	V_{DD} *12 *13 *14
				Rf = 1MΩ		9.5	15.0		
				f_{CL} = 18KHz		5.0	10.0		
		I_{DD} (2)	During access t_{CYC} = 200KHz			300	500	µA	*8
Input pin capacitance		C_{IN}	Ta = 25°C f = 1MHz			5.0	8.0	pF	All input pins

5. ELECTRO-OPTICAL CHARACTERISTICS

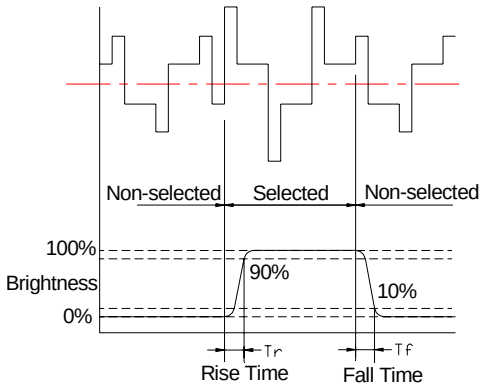
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast ratio	K	φ=0	1.4	4	-	-	1
Response time (rise)	Tr	φ=0	-	250	300	ms	2
Response time (fall)	Tf	φ=0		250	350	ms	2
Viewing angle	φ	K ≥2.0	-40 -- +40			deg.	3
	θ		-30 -- +30				

Note 1: Definition of Contrast Ratio "K"

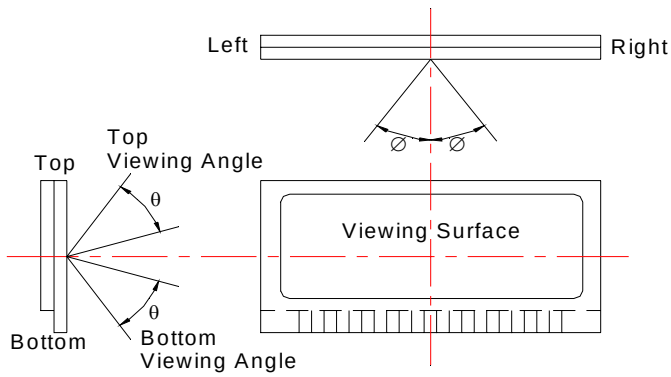
$$K = \frac{\text{Brightness of non-selected segment(A)}}{\text{Brightness of selected segment(B)}}$$



Note 2: Definition of Optical Response Time

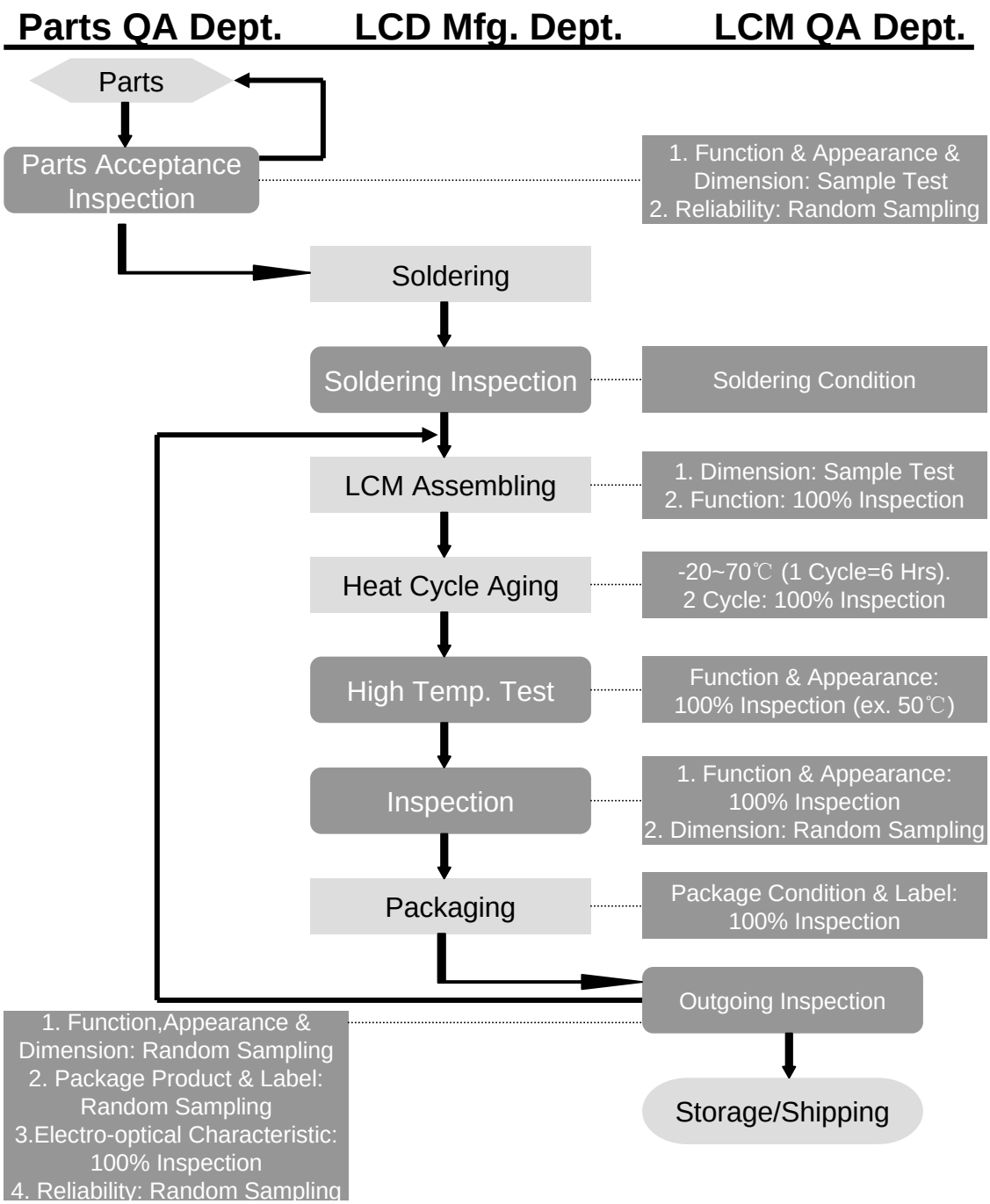


Note 3: Definition of Viewing Angle



Please select either top or bottom viewing angle

6. QC/QA PROCEDURE



7. RELIABILITY

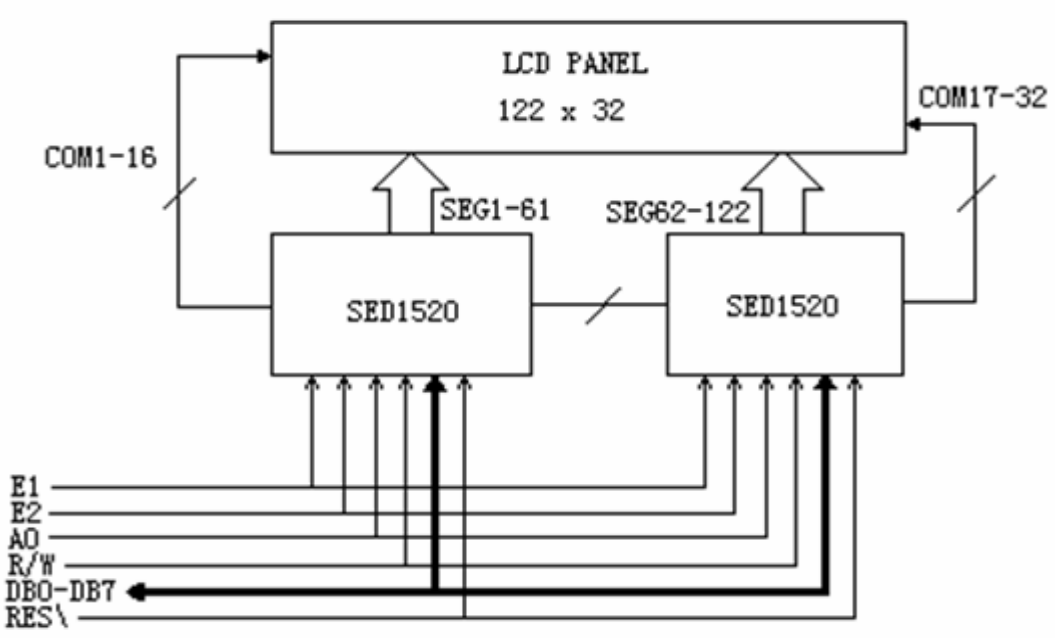
•Operating life time:

Longer than 50000 hours (at room temperature without direct irradiation of sunlight)

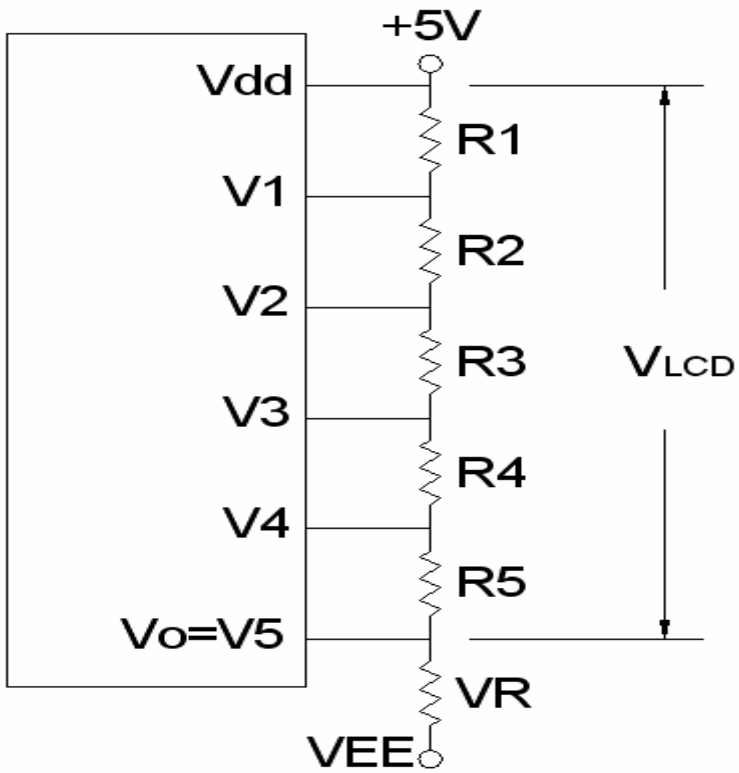
•Reliability Characteristics:

Item	Test	Criterion
High temp	70℃ / 200 Hrs	■Total current consumption should be below double of initial value ■Contrast ratio should be within initial value±50% ■No defect in cosmetic and operational function is allowable
Low temp.	-20℃ / 200 Hrs	
High humidity	40℃ * 90%RH / 200 Hrs	
Thermal shock	-20℃→25℃→70℃→25℃ /5 Cycles (30min) (5min) (30min) (5min)	
Vibration	1.Operating time: Thirty minutes exposure in each direction (x, y, z) 2.Sweep Frequency (1min):10Hz→ 55Hz →10Hz 3.Amplitude: 0.75mm double amplitude	

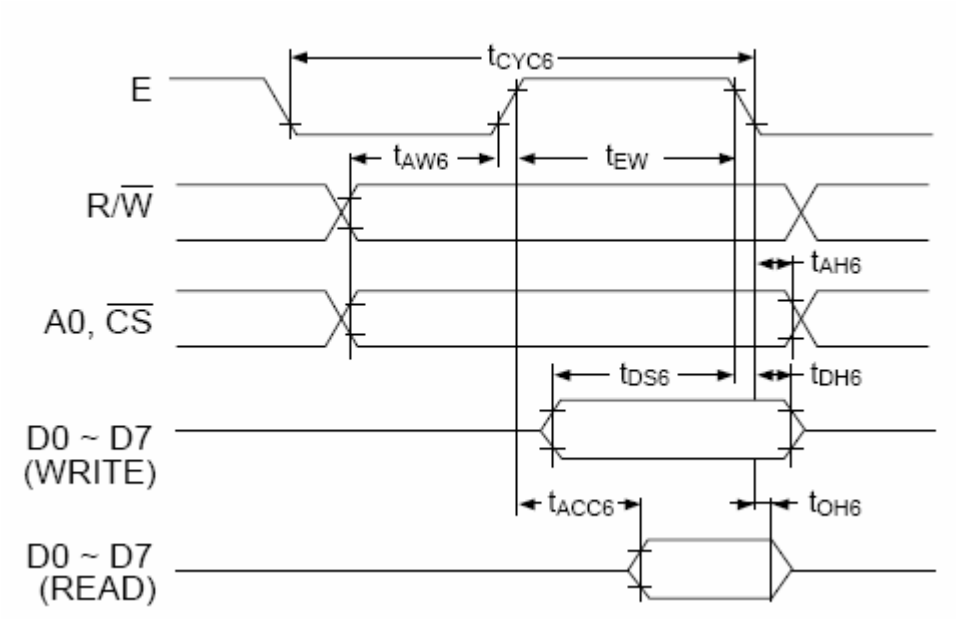
8. BLOCK DIAGRAM



9. VOLTAGE REGULATOR CIRCUITS



10. TIMING DIAGRAM



11. AC CHARACTERISTICS

Ta = –20 to 75°C, Vss = –5.0V ± 10%, Unit: ns

Signal	Symbol	Parameter		Min.	Max.	Condition
A0, $\overline{CS}$ R/$\overline{W}$	t_{CYC6}*1	System cycle time		1000		
	t_{AW6}	Address setup time		20		
	t_{AH6}	Address hold time		10		
D0–D7	t_{DS6}	Data setup time		80		
	t_{DH6}	Data hold time		10		
	t_{OH6}	Output disable time		10	60	CL = 100pF
	t_{ACC6}	Access time			90	
E	t_{EW}	Enable pulse width	Read	100		
			Write	80		

12. INSTRUCTION SET

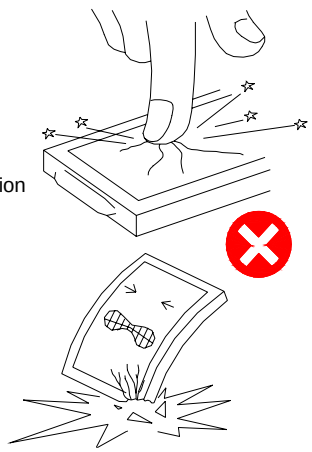
	Command	Code											Function
		A0	$\overline{RD}$	$\overline{WR}$	D7	D6	D5	D4	D3	D2	D1	D0	
(1)	Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0/1	Turns all display on or off, independently of display RAM data or internal status. 1: ON 0: OFF (Power-saving mode with static drive on)*
(2)	Display start line	0	1	0	1	1	0	Display Start Address (0–31)					Specifies RAM line corresponding to uppermost line (COM0) of display.
(3)	Set page address	0	1	0	1	0	1	1	1	0	Page (0–3)		Sets display RAM page in page address register.
(4)	Set column (segment) address	0	1	0	0	Column Address (0–79)							Sets display RAM column address in column address register.
(5)	Read status	0	0	1	Busy	ADC	ON/OFF	RESET	0	0	0	0	Reads the following status: BUSY 1: Internal operation, 0: Ready ADC 1: CW output (forward), 0: CCW output (reverse) ON/OFF 1: Display off, 0: Display on RESET 1: Being reset, 0: Normal
(6)	Write display data	1	1	0	Write Data								Writes data from data bus into display RAM.
(7)	Read display data	1	0	1	Read Data								Reads data from display RAM onto data bus.
													Display RAM location whose address has been preset is accessed. After access, the column address is incremented by 1.
(8)	Select ADC	0	1	0	1	0	1	0	0	0	0	0/1	Used to invert relationship of assignment between display RAM column addresses and segment driver outputs. 0: CW output (forward) 1: CCW output (reverse)
(9)	Static drive ON/OFF	0	1	0	1	0	1	0	0	1	0	0/1	Selects normal display or static driving operation. 1: Static drive (power-saving mode) 0: Normal driving
(10)	Select duty	0	1	0	1	0	1	0	1	0	0	0/1	Selects LCD cell driving duty. 1: 1/32 0: 1/16
(11)	Read modify write	0	1	0	1	1	1	0	0	0	0	0	Increments column address counter by 1 when display data is written. (This is not done when data is read.)
(12)	End	0	1	0	1	1	1	0	1	1	1	0	Clears read modify write mode.
(13)	Reset	0	1	0	1	1	1	0	0	0	1	0	Sets display start line register on the first line. Also sets column address counter and page address counter to 0.

13. Handling Precautions

1. Limitation of Application:
Optrex products are designed for use in ordinary electronic devices such as business machines, telecommunications equipment,measurement devices and etc. Please handle the products with care. (see below)
Optrex products are not designed,intended ,or authorized for use in any application 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.
2.Industrial Rights and Patents
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.

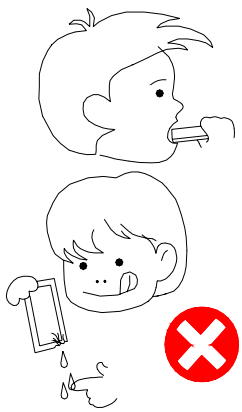
No Press and Shock!

If pressure to LCD, orientation may be disturbed.
LCD will broken by shock!



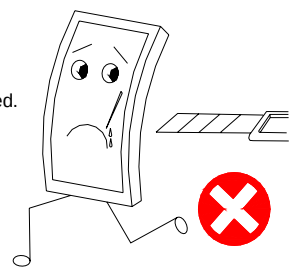
Don't Swallow or Touch Liquid Crystal!

Liquid Crystal may be leaked when display is broked.
If it accidentally gets your hands, wash then with water!



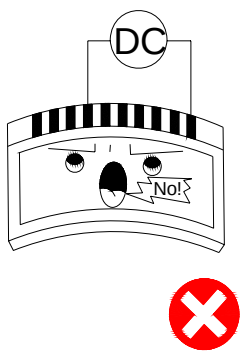
Don't not Scratch!

Polarizer is a soft material and can easily be scratched.



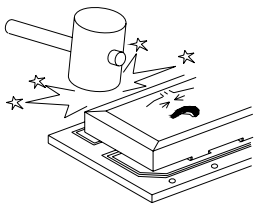
No DC Voltage to LCD!

DC volrage or driveing higher than the specified voltage will reduce the lifetime of the LCD.

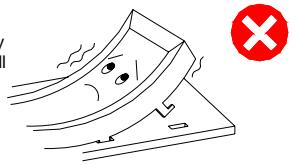


Don't Press the Metallic Frame and Disassemble the LCM

Pressure on the metallic frame and PCB may deform the conductive rubber or break the liquid crystal cell and back light, which will cause defects.

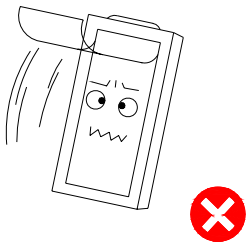


LCD may be shifted or conductive rubber may be reshaped, which will cause defects.



Slowly Peel Off Protective Film!

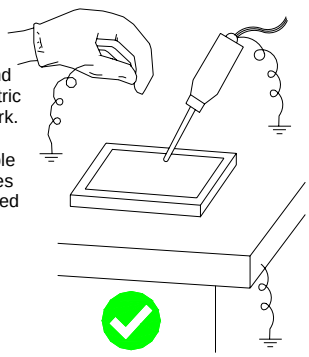
Avoid static electricity.



Avoid Static Electricity!

Please be sure to ground human body and electric apploances during work.

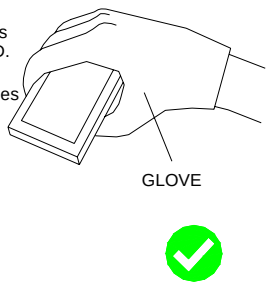
It is preferable to use conductive mat on table and wear cotton clothes or conduction processed fiber. Synthetic fiber is not recommended.



Wear Gloves While Handing!

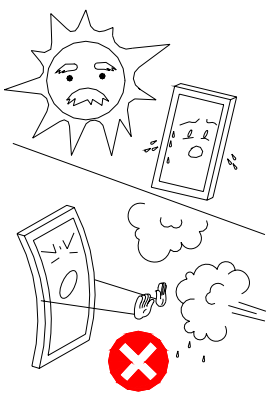
It is preferable to wear gloves to avoid damaging the LCD.

Please do not touch electrodes with bare hands or make them dirty.



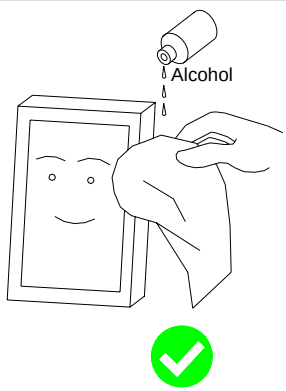
Keep Away From Extreme Heat and Humidity!

LCD deteriorates.



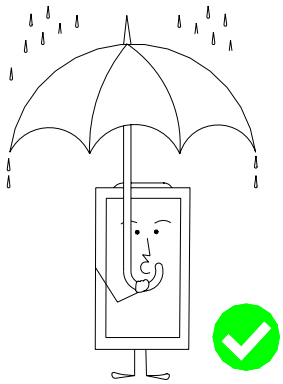
Use Alcohol to Clean Terminals!

When attaching with the heat seal or anisontropically conductive film, wipe off with alcohol before use.



Don't Drop Water on LCD!

Note that the presence of waterdrops or dew in the LCD panel may deteriorate the polarizer or corrade electrode.



Precaution in Soldering LCD Module

Basic instructions: Solder I/O terminals only.
Use soldering iron without leakage.
(1)Soldering condition to I/O terminals
Temperature at tip of the iron: 280±10℃
Soldering time: 3~4 sec.
Type of solder: Eutectic solder (containing colophony-flux)
*Please do not use flux because it may soak into LCD Module or contaminate it.
*It is preferable to peel off protective film on display surface after soldering I/O terminals is finished.
(2)Remove connector or cable
*When you remove connector or cable soldered to I/O terminals, please confirm that solder is fully melted. If you remove by force, electrodes at I/O terminals may be damaged(or stripped off).
*It is recommended to use solder suction machine.

Long-term Storage

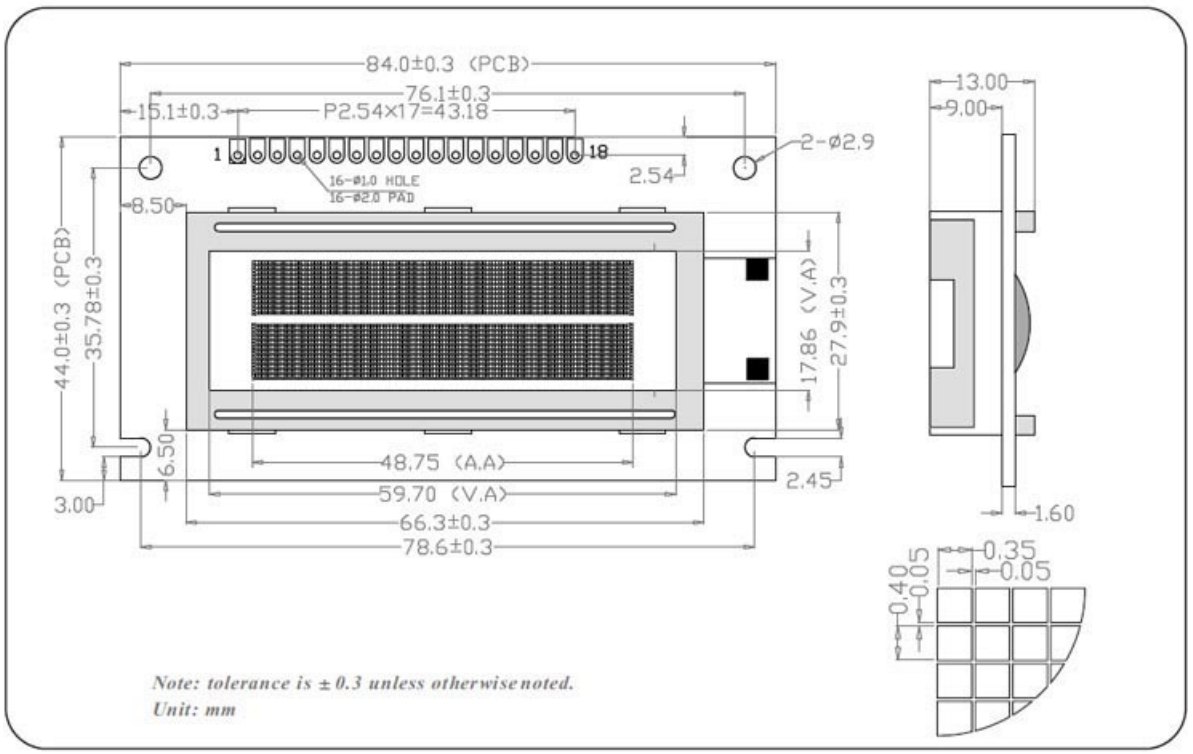
If it is necessary to store LCD modules for a long time, please comply with the following procedures.
If storage condition is not satisfactory, display(especially polarizer) may be deteriorated or soldering I/O terminals may become difficult(some oxide is generated at I/O terminals plating).
1.Store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

Long-term Storage

Please use power supply with built-in surge protection circuit.

14. EXTERNAL DIMENSION

■ DIMENSIONS/DISPLAY CONTENT



■ PIN CONFIGURATION

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
VDD	Vss	V0	RES	E1	E2	R/W	A0	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LEDA	LEDK

15.INTERFACE

PIN	SYMBOL	LEVEL	INSTRUCTION
1	VSS	0V	Ground contact（GND）
2	VDD	5.0V	Power Supply Voltage
3	Vo	LCD Drive Voltage	Adjust Contrast
4	RES	H/L	RESET SIGNAL
5	E1	H,H→L	CHIP Select Signal 1
6	E2	H,H→L	CHIP Select Signal 2
7	R/W	H/L	H:READ；L:WRITE
8	A0	H/L	H:DATA；L:COMMAND
9	D0	H/L	DATA 0
10	D1	H/L	DATA 1
11	D2	H/L	DATA 2
12	D3	H/L	DATA 3
13	D4	H/L	DATA 4
14	D5	H/L	DATA 5
15	D6	H/L	DATA 6
16	D7	H/L	DATA 7
17	LED+	BACK LED+	Back LED Anode
18	LED-	BACK LED-	Back LED Negative