



**DEVETECH ELECTRONICS CO. LTD**

**3,5'' TFT- LCD MODULE  
CUSTOMER: DACHS ELECTRONICA  
P/N: DVD35045-1**

DESIGNED BY	
CHECKED BY	
APPROVED BY	

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CONTENTS		
N°	Contents	Page
-	Cover	1
-	Contents	2
-	Revision record	3
1	General specifications	4
2	Absolute maximum ratings	5
3	Electrical characteristics	5
4	Backlight characteristics	5
5	Dimensional drawing	6
6	Interface pin connections	7
7	Electro-optical characteristics	10
8	Inspection criteria	14
9	Reliability	16
10	Precautions for using LCD module	17
11	Using LCD modules	18



<b>REVISION RECORD</b>			
REV. N°	REV DATE	CONTENTS	REMARKS
1.0	2013-11-08	First release	



## 1. General specifications

DVD35045-1 is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC, FPC, TP and a back light unit. The module display area contains 320x480 pixels. This product accords with RoHS environment criterion.

Item	Contents	Unit
LCD Type	TFT Transmissive	/
Viewing direction	12:00	O'clock
Module outline (WxHxD)	55.5x84.96x2.5	mm
Active area (WxH)	73.44x48.96	mm
Number of dots	320(RGB)x480	/
Driver IC	ILI9488	/
Backlight type	6 chips white LEDS,parallel	/
Interface Type	RGB interface	/
Input voltage	2.8±0.1	V

## 2. Absolute maximum ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	Vcc	-0.3	4.6	V
Input voltage	Vin	-0.3	VCC+0.3	V
Operating temperature	Top	-10	60	°C
Storage temperature	Tst	-20	70	°C
Humidity	RH	--	90%(Max60C)	RH

## 3. Electrical characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	Vcc-Vss	2.6	2.8	3.3	V
Input current	Idd	-	9.94	14.91	mA
Input voltage 'H' level	Vih	0.7Iovcc	--	Iovcc	V
Input voltage 'L' level	Vil	0	--	0.3Iovcc	V
Output voltage 'H' level	Voh	0.8Iovcc	--	Iovcc	V
Output voltage 'L' level	Vol	0	--	0.2Iovcc	V

## 4. Backlight characteristics

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward voltage	Vf	3.0	3.2	3.3	V	If=90mA
Luminance	Lv	3500	-	-	cd/m2	If=90mA
Number of LED	--	6			piece	--
Connection mode	P	series			--	--

### 5. Dimensional drawing

ISSUE	MODIFY DESCRIPTION	DATE
△	FIRST ISSUE	2013.05.11
No	PIN NAME	No PIN NAME

1	LEDA	23	G4
2	LEDK	24	G5
3	LEDK	25	G6
4	LEDK	26	G7
5	LEDK	27	B0
6	LEDK	28	B1
7	LEDK	29	B2
8	GND	30	B3
9	VCC	31	B4
10	IOVCC	32	B5
11	R0	33	B6
12	R1	34	B7
13	R2	35	GND
14	R3	36	CLK
15	R4	37	HSYNC
16	R5	38	VSYNC
17	R6	39	DEN
18	R7	40	GND
19	G0	41	SDO
20	G1	42	SDI
21	G2	43	SCL
22	G3	44	CS
		45	RESET

CIRCUIT DIAGRAM

Display Type	TFT /NORMAL WHITE /TRANSMISSIVE
Display Resolution	3.5" DOTS: 320 (R.G.B)* 480
Viewing Angle	12/00
LCD Controller/Driver	IL9488
Logic Voltage	2.8V
LCD Driving Voltage	
Operation Temperature	-20°C ~ 70°C
Storage Temperature	-30°C ~ 80°C
Backlight Speciality	White LED Backlight(6* dices parallel connection)
Remark	TFT LCD(HIC+LBL+FPIC) B/M NEED EXTENDED TO GLASS EDGE LCD TRANSMISSION RATE : 6.0% TYP. 5.5%MIN TOLERANCE UNLESS: ±0.2

ITEM NO	DVD35045-1
PROJECT NO	
VER	VER:01
DEVETECH ELECTRONICS, CO. LTD.	
	THIRD ANGLE PROJECTION
UNIT: mm	SCALE: N.T.S.
DRAWN	CHECKED
	APPROVED

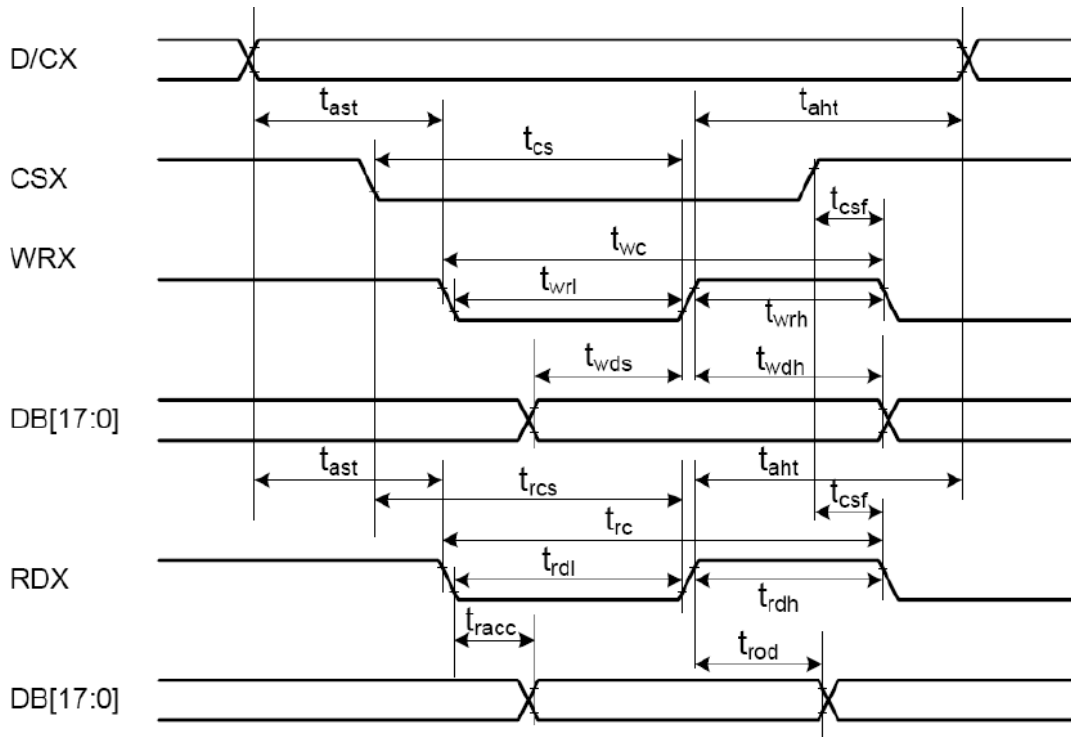
## 6. Interface pin connections

Pin No.	Symbol	Function
1	LEDA	Back light power supply positive
2	LEDK	Back light power supply negative
3	LEDK	Back light power supply negative
4	LEDK	Back light power supply negative
5	LEDK	Back light power supply negative
6	LEDK	Back light power supply negative
7	LEDK	Back light power supply negative
8	GND	Ground
9	VCC	Power supply (+2.8)
10	IOVCC	Power supply (+1.8/+2.8)
11-18	R0-R7	Data bit R0-R7
19-26	G0-G7	Data bit G0-G7
27-34	B0-B7	Data bit B0-B7
35	GND	Ground
36	CLK	Dot clock signal for RGB interface operation
37	HSYNC	Line synchronizing signal for RGB interface operation
38	VSYNC	Frame synchronizing signal for RGB interface operation
39	DEN	Data enable signal for RGB interface operation
40	GND	Ground
41	SDO	-Serial data output Leave the pin to open when not in use
42	SDI	-Serial data input/output Fix to IOVCC or DGND level when not in use

43	SCL	-8080 system (WRX): Serves as a write signal and writes data at the rising edge -3/4 line serial interface (SCL): The pin used as a serial colck pin Fix to IOVCC or DGND level when not in use
44	CS	-A chip select signal Low: the chip is selected and accessible High: the chip is not selected and not accessible Fix to IOVCC or DGND level when not in use
45	RESET	A reset pin

## 6.1. Timing characteristics

### 6.1.1. DBI Type B (18/16/9/8 bit) Interface timing characteristics



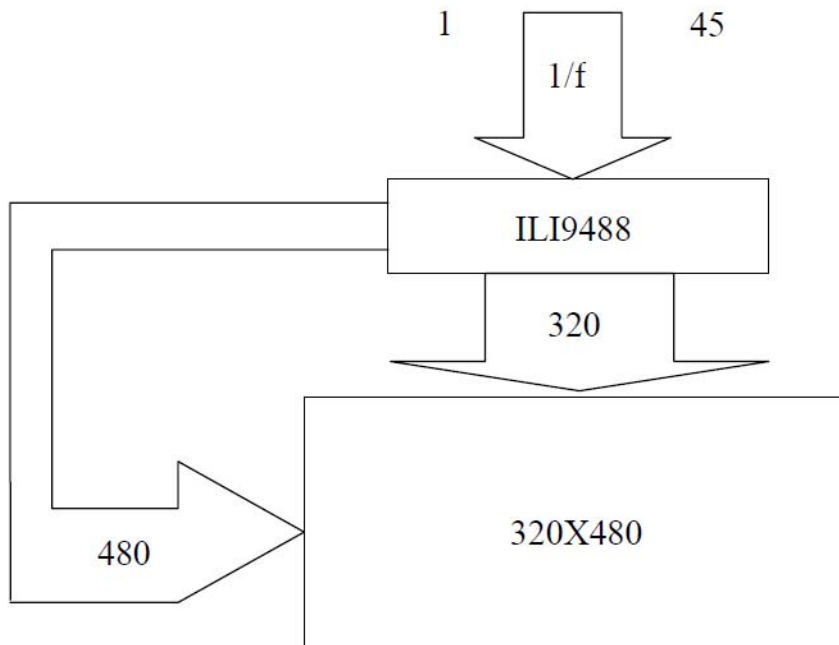


Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	tast	Adress setup time	10	-	ns	
	taht	Adress hold time (Write/Read)	10	-	ns	
CSX	tcs	Chip select setup time (Write)	20	-	ns	
	trcs	Chip select setup time (Read)	20	-	ns	
	tcsf	Chip select wait time (Write/Read)	20	-	ns	
WRX	twc	Write cycle	100	-	ns	
	twrh	Write control pulse H duration	30	-	ns	
	twrl	Write control pulse L duration	20	-	ns	
RDX	trc	Read cycle	450	-	ns	
	trdh	Read control pulse H duration	250	-	ns	
	trdl	Read control pulse L duration	170	-	ns	
DB[17:0], DB[15:0], DB[8:0], DB[7:0]	twds	Write data setup time	15	-	ns	For maximum CL=30pF For minimum CL=8pF
	twdh	Write data hold time	25	-	ns	
	tracc	Read access time	10	340	ns	
	trod	Read output disable time	10	-	ns	

Note: Logic high and low levels are specified as 30% and 70% of IOVCC for input signals

Note: Ta=-30 to 70°C, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, GND=0V

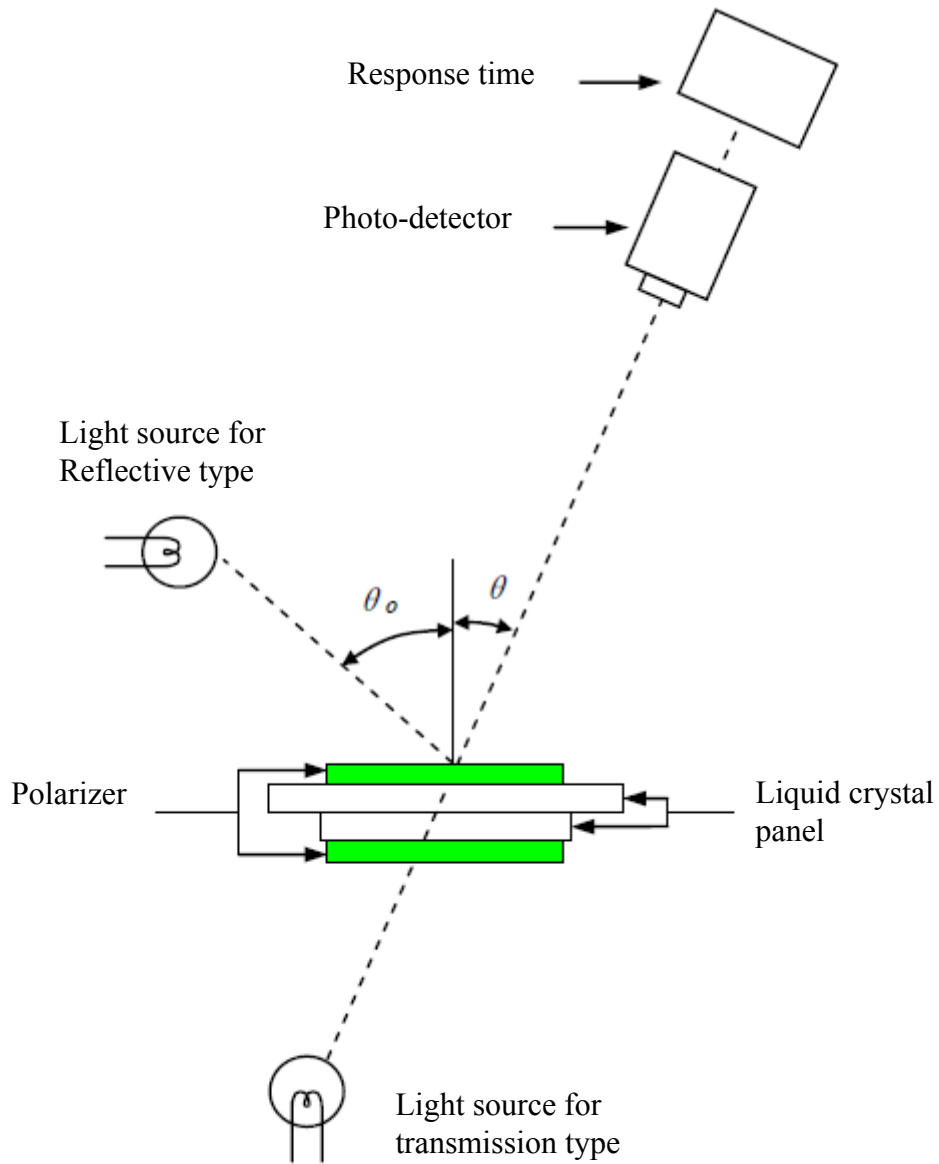
## 6.2. Block diagram of LCM



## 7. Electro-optical characteristics

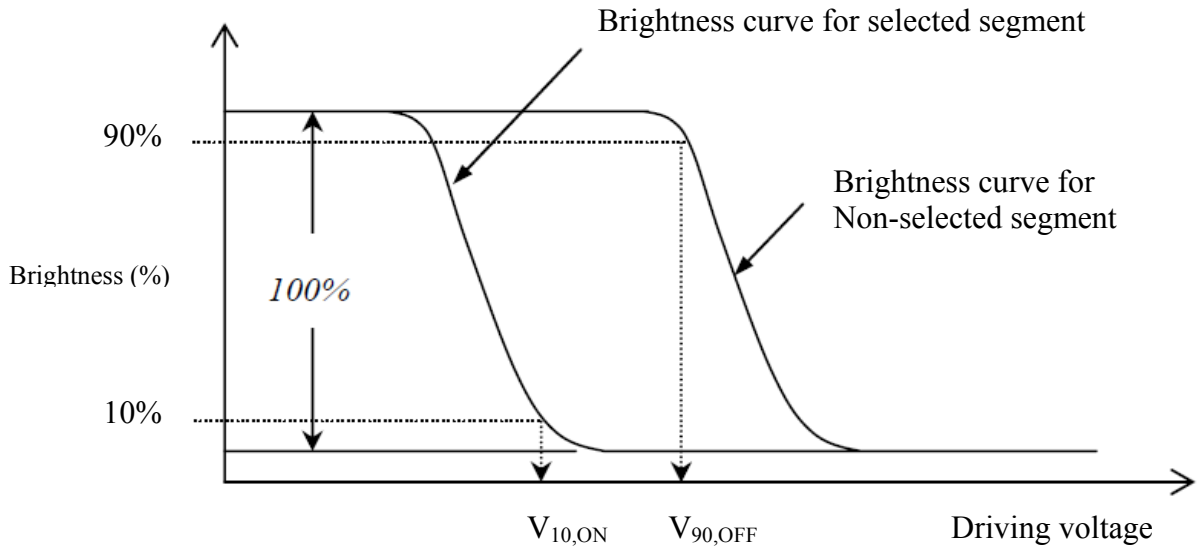
Item	Symbol	Condition	Temp	Min	Typ	Max	Units	Note
Operating volt.	$V_{LCD}$	$\theta = \psi = 0$	-10°C	---	---	---	V	8.1
			25°C	---	8.5	---		
			60°C	---	---	---		
Response time	Rise time (Tr)	$\theta = \psi = 0$	-10°C	---	---	---	msec	8.2
	Decay time (Td)			---	---	---		
	Rise time (Tr)		25°C	---	---	240		
	Decay time (Td)			---	---	240		
	Rise time (Tr)		60°C	---	---	---		
	Decay time (Td)			---	---	---		
Viewing angle range	$\theta$	$\psi=0^\circ$	25°C	---	---	30	Deg	8.3 CR $\geq$ 2
		$\psi=90^\circ$		---	---	45		
		$\psi=180^\circ$		---	---	30		
		$\psi=270^\circ$		---	---	45		
Contrast ratio	Cr	$\theta = \psi = 0$	25°C	3	4.5	---	---	8.4

### 7.1. Electro-optical characteristics test method

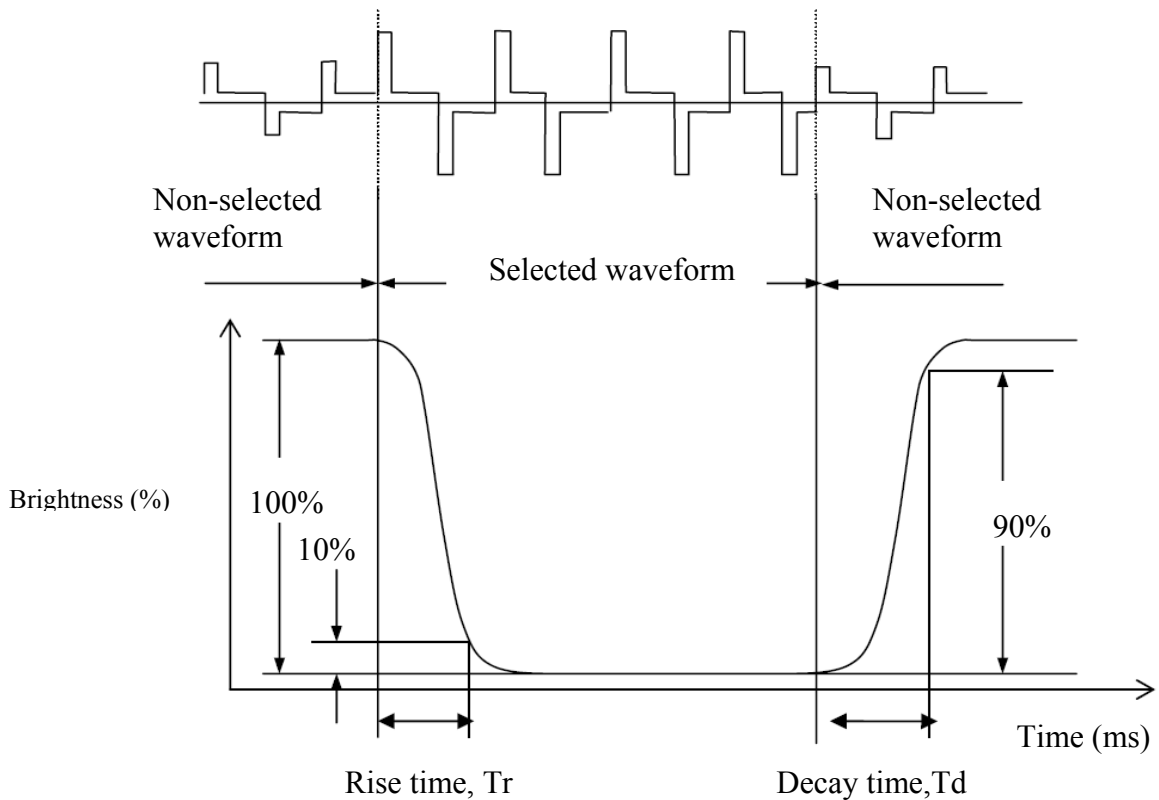


### 7.2. Definition of operating voltage, VOP

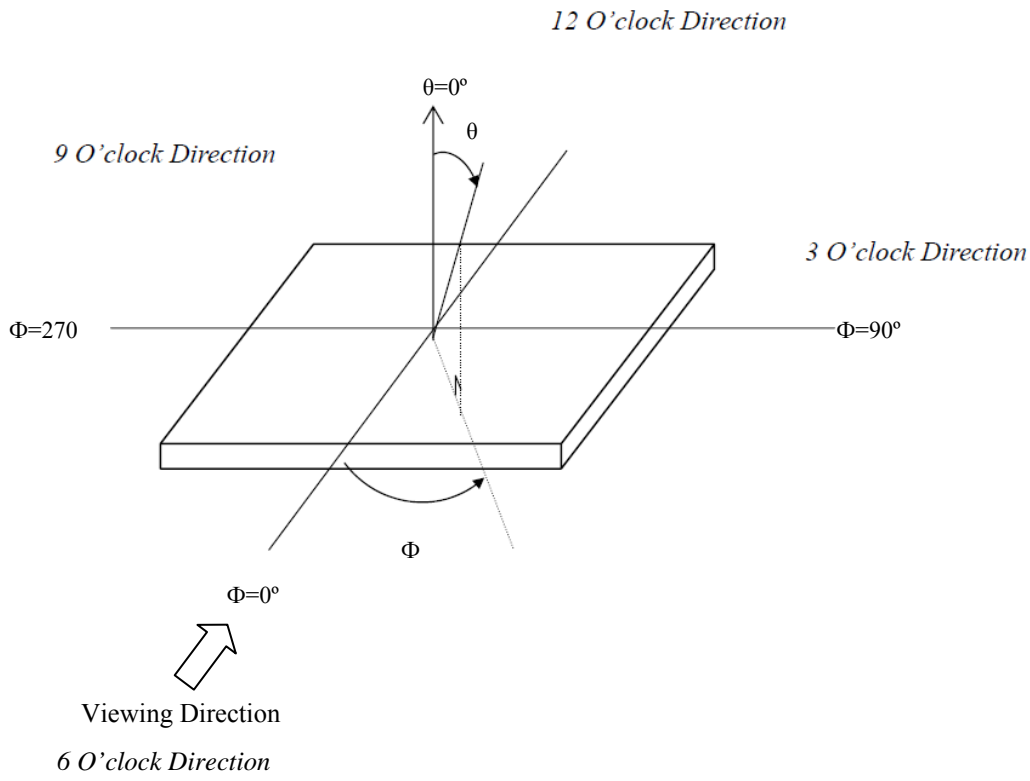
$$V_{op} = (V_{10,ON} + V_{90,OFF}) / 2$$



### 7.3. Definition of optical response time

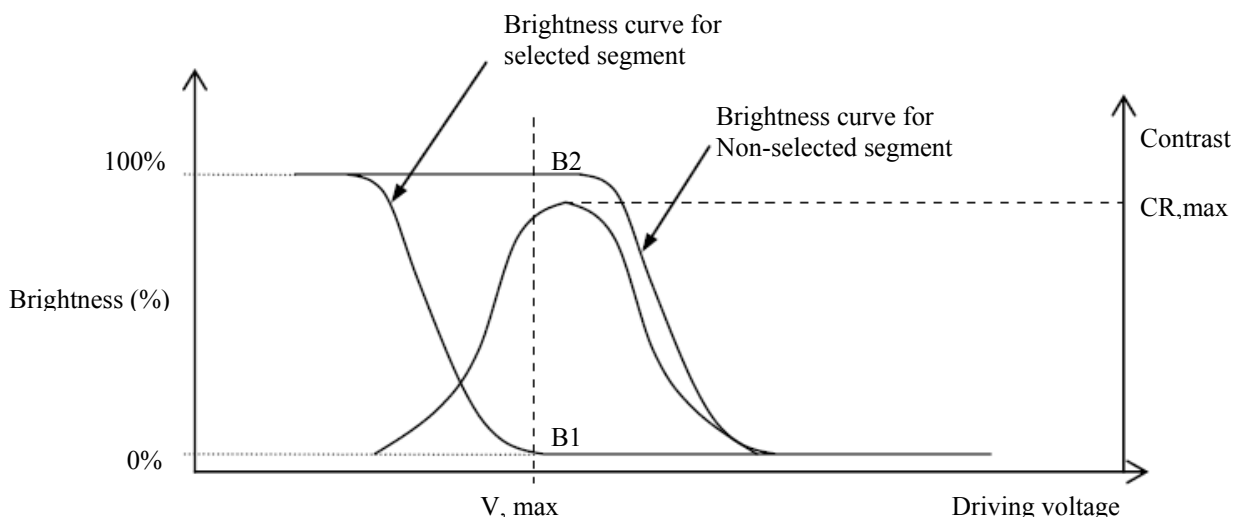


### 7.4. Definition of viewing angle, AND



### 7.5. Definition of contrast ratio, CR

$$CR = \frac{\text{Brightness of non-selected segment (B2)}}{\text{Brightness of selected segment (B1)}}$$



## 8. Inspection criteria

### 8.1. Inspection conditions

#### 8.1.1. Environmental conditions

The environmental conditions for inspection shall be as follows:

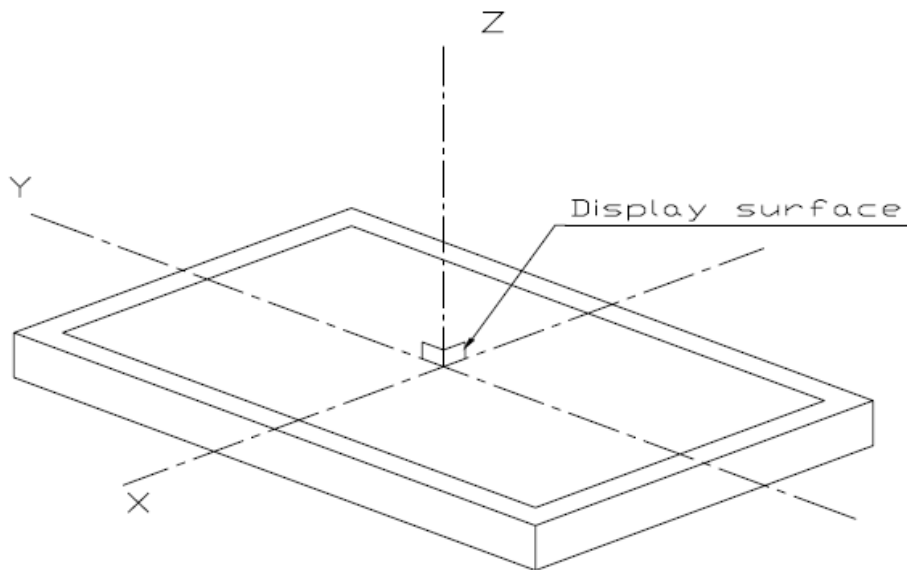
Room temperature:  $20\pm 3^{\circ}\text{C}$

Humidity:  $65\pm 20\%RH$

#### 8.1.2. The external visual inspection

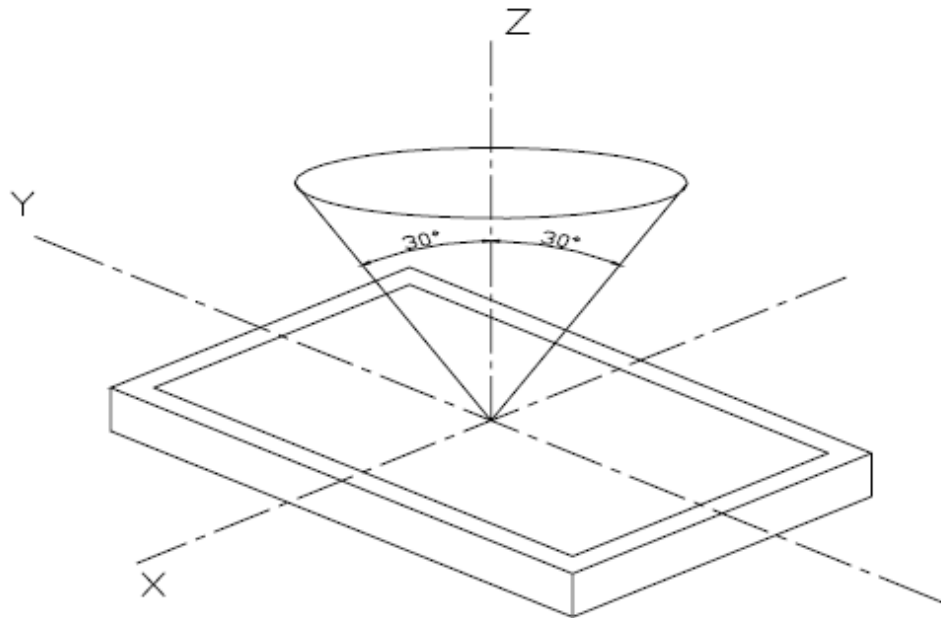
With a single 20-watt fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes.

### 8.2. Light method



Fluorescent lamp perpendicular to the display surface.

### Inspection distance and angle



Inspection should be performed within angle  $\Phi$  ( $\Phi$  is usually  $30^\circ$ ) from Z axis to each X and Y.

Inspection distance in any direction within  $\Phi$  must be kept  $30\pm 5$ cm from the display surface.

## 8.3. Classification of defects

### 8.3.1. Major defect

A major defect refers to a defect that may substantially degrade usability for product applications.

### 8.3.2. Minor defect

A minor defect refers to a defect which is not considered to be able substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation.

## 9. Reliability

### 9.1. MTBF

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal. (25°C in the room without sunlight).

### 9.2. Tests

No.	Test item	Test condition	Criterion
1	High temperature storage	70°C±2°C 96H Restore 2H at 25°C Power off	After testing, cosmetic and electrical defects should not happen.
2	Low temperature storage	-20°C±2°C 96H Restore 2H at 25°C Power off	
3	High temperature operation	60°C±2°C 96H Restore 2h at 25°C Power on	
4	Low temperature operation	-10°C±2°C 96H Restore 2H at 25°C Power on	
5	High temperature & humidity operation	60°C±2°C 90%RH 96H Power on	
6	Temperature cycle	-30°C←→25°C←→80°C 30min 5min 30min after 10 cycle, restore 2H at 25°C Power off	
7	Vibration test	10Hz~150Hz, 100m/s <sup>2</sup> , 120min	
8	Shock test	Half-sine wave, 300m/s <sup>2</sup> , 11ms	
9	Drop test (package state)	800mm, concrete floor, 1 corner, 3 edges, 6 sides each time	1. After testing, cosmetic and electrical defects should not happen 2. The product should remain at initial place. 3. Product uncovered or package broken is not permitted.





## 10. Precautions for using LCD module

### 10.1. Handling precautions

1. The display panel is made of glass. Do not subject it to a mechanical shock or impact by dropping it.
2. If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
4. The polarizer covering the display surface of the LCD Module is soft and easily scratched. Handle this polarizer carefully.
5. If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten a cloth with one of the following solvents:
  - Isopropyl alcohol
  - Ethyl alcohol
6. Solvents other than those above mentioned may damage the polarizer. Especially, do not use the following:
  - Water
  - Ketone
  - Aromatic solvents
7. Extra care to minimize corrosion of the electrode. Water droplets, moisture condensation or a current flow in a high-humidity environment accelerates corrosion of the electrode.
8. Install the LCD Module by using the mounting holes. When mounting the LCD Module, make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
9. Do not attempt to disassemble or process the LCD Module.
10. NC terminal should be open. Do not connect anything.
11. If the logic circuit power is off, do not apply the input signals.
12. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD Module.
  - Tools required for assembling, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
  - The LCD Module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.



## 10.2. Storage precautions

When storing the LCD Module, avoid exposure to direct sunlight or fluorescent lamps. Keep the modules in bags (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD Module should be stored in the same conditions in which they were shipped from our company.

## 10.3. Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD Module has been operating for a long time showing the same display patterns the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be recovered by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD Module resulting from destruction caused by static electricity etc. exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.
- Terminal electrode sections.

## 11. Using LCD Modules

### 11.1. Liquid crystal display modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

1. Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
2. Do not touch, push or rub the exposed polarizers with anything harder than a HB pencil lead (glass, tweezers, etc).
3. N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances, which will be damaged by chemicals such as acetone, toluene, ethanol and isopropyl alcohol.
4. When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum ether. Do not scrub hard to avoid damaging the display surface.
5. Wipe of saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.
6. Avoid contacting oil and fats.



7. Condensation on the surface and contact with terminals due to cold will damage, stain or polarizers. After products are tested at low temperature they must be warmed up in a container before coming in contact with room temperature air.
8. Do not put or attach anything on the display area to avoid leaving marks on.
9. Do not touch the display with bare hands. This will stain the display area and degrade insulation between terminals (some cosmetics are detrimental to the polarizer).
10. As a glass is fragile, it tends to become chipped during handling especially on the edges. Please avoid dropping or jarring.

## 11.2. Installing LCD Module

Attend to the following items when installing the LCM.

1. Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
2. When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be  $\pm 0.1\text{mm}$ .

## 11.3. Electro-static discharge control

Since this module uses a CMOS LSI, the same careful attention should be paid for electrostatic discharge as for an ordinary CMOS IC.

1. Make certain that you are grounded when handling LCM.
2. Before removing LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.
3. When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
4. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potential to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
5. As far as possible, make the electric potential of your work clothes and that of the workbenches to the ground potential.
6. To reduce the generation of static electricity, be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.



#### 11.4. Precaution for soldering to the LCM

1. Observe the following when soldering lead wire, connector cable and etc. to the LCM.
  - Soldering iron temperature:  $280\pm 10^{\circ}\text{C}$ .
  - Soldering time: 3-4 sec.
  - Solder: eutectic solder

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux). It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.
2. When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.
3. When removing the electroluminescent panel from the PC board, be sure the solder has completely melted, otherwise the soldered pad on the PC board could be damaged.

#### 11.5. Precaution for operation

1. Viewing angle varies with the change of liquid crystal driving voltage ( $V_0$ ). Adjust  $V_0$  to show the best contrast.
2. Driving the LCD in the voltage above the limit will shorten its lifetime.
3. Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
4. If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then on.
5. Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of  $40^{\circ}\text{C}$ , 50% RH.
6. When turning the power on, input each signal after the positive/negative voltage becomes stable.

#### 11.6. Storage

When storing LCDs as spares for some years, the following precaution are necessary:

1. Store them in a sealed polyethylene bag. If properly sealed, there is no need for desiccant.
2. Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between  $0^{\circ}\text{C}$  and  $35^{\circ}\text{C}$ .
3. The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped.)



4. Environmental conditions:

- Do not leave them for more than 168hrs. at 60°C.
- Should not be left for more than 48hrs. at -20°C.

### 11.7. Safety

1. It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
2. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

### 11.8. Limited warranty

Unless agreed between DEVETECH and customer, DEVETECH will replace or repair any of its LCD and modules which are found to be functionally defective when inspected in accordance with DEVETECH acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to DEVETECH within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DEVETECH is limited to repair and/or replacement on the terms set forth above. DEVETECH will not be responsible for any subsequent or consequential events.

### 11.9. Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:

- Broken LCD glass.
- PCB eyelet's damage or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet's conductors and terminals.

