PACIFIC DISPLAY DEVICES

LCD Component Data Sheet

Model Number: 320240-C57

320 x 240 Dot
CSTN Color Graphic LCD Assembly
With Row and Column Drivers
CCFL Lit Backlight Assembly

CONTENTS

516 N. Diamond Bar Blvd – Suite 103 – Diamond Bar, CA – 91765
Tel: 909-396-5128 – Fax: 909-396-1155 – Web: www.pacificdisplay.com

1. GENERAL INFORMATION

1.1 Product Overview

- 320 x RGB x 240 dot matrix LCD
- 5.7" Diagonal Viewing Area
- CSTN (Color Super Twisted Nematic) Technology
- High Brightness: 175 nits
- LH1562 Row/Common and Column/Segment (or equivalent) Driver ICs.
- Multiplex drive: 1/240 duty, 1/17 bias
- LCD Module Service Life: 15,000 hours minimum (Limited by backlight)

1.2 Part Options and Numbering System

320240	-C	-57	-M	-ST	-CFL	-6	-TS

➢ **Operating Mode:**
- (-C) CSTN operating mode

➢ **Custom Option Designator:**
- (Rev / Config / Size designator)

➢ **Rear Polarizer Options:**
- (-M) Transmissive

➢ **Operating Temperature:**
- (-ST) Standard (0 to +50 ºC)
- (-ET) Extended (-20 to +70 ºC)

➢ **Backlight Options:**
- (-CFL) Cold Cathode Florescent (White)

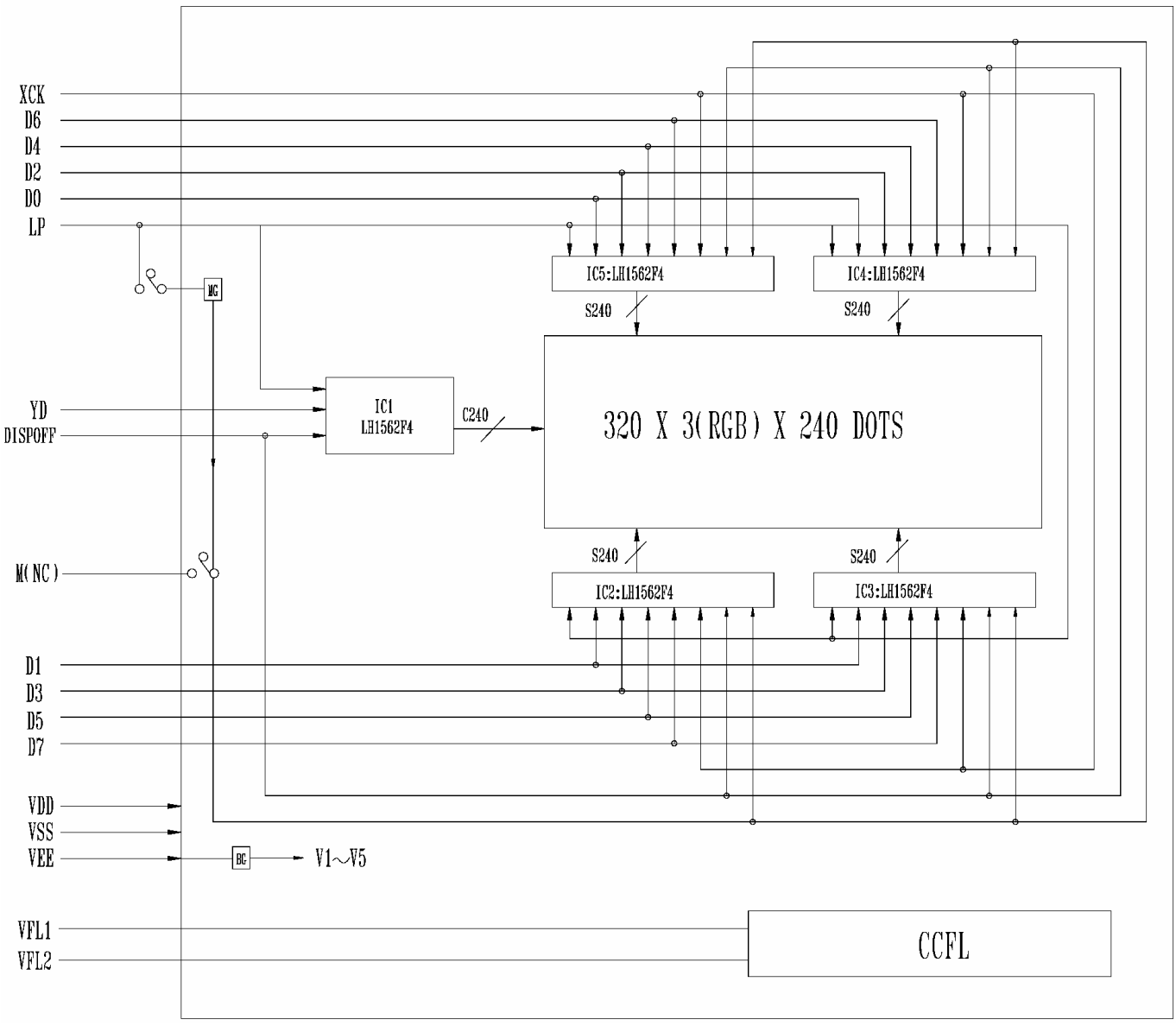
➢ **Viewing Angle:**
- (-6) 6 o'clock
- (-12) 12 0'clock

➢ **Additional Options:**
- (-TS) Analog Resistive touch screen

1.3 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	V_{DD}-V_{SS}	-0.3	+6.0	V
Supply voltage for LCD	$V_{LCD} - V_{SS}$	0	+40.0	V
Input voltage	VI	V_{SS} -0.3	V_{DD} +0.3	V
Standard Operating temperature	TOP (-ST)	0	50	ºC
Standard Storage temperature	TST (-ST)	-20	70	ºC
Extended Operating temperature	TOP (-ET)	-20	70	ºC
Extended Storage temperature	TST (-ET)	-30	80	ºC

1.4 Circuit Block Diagram



1.5 Mechanical Characteristics

Item	Contents	Unit
Module size (W×H×T)	158.50 x 109.00 x 8.5	mm
Viewing area (W×H)	119.18 x 90.38	mm
Active area (W×H)	115.18 x 86.38	mm
Number of dots	320 x 3 (RGB) x 240	dots
Dot size (W×H)	0.10 x 0.34	mm
Dot pitch (W×H)	0.12 RGB x 0.36	mm
Weight	155	g

1.6 Input Signal Function

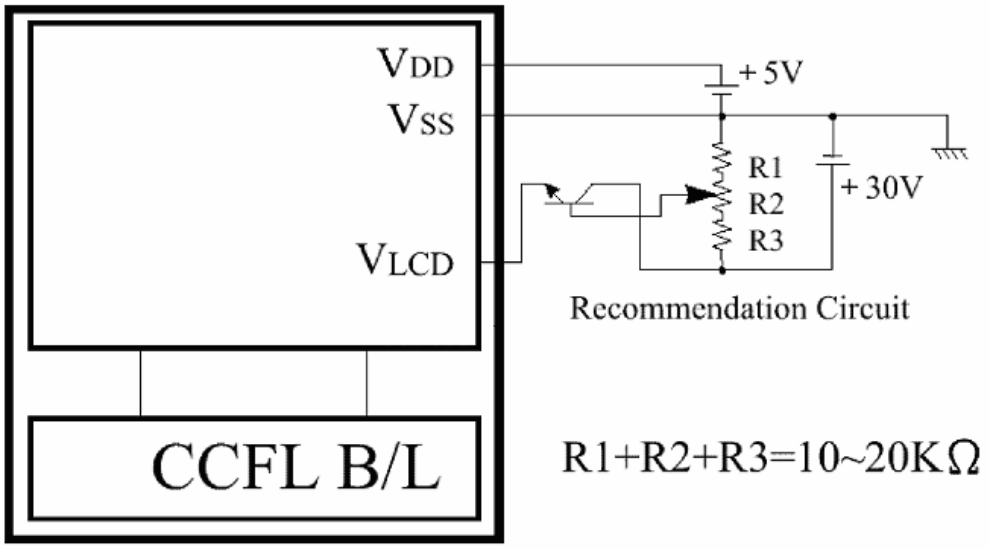
CON 1

Pin No.	Symbol	Level	Description
1	M	H/L	Input of signal to AC electrify the LC drive output
2	YD	H/L	Scan Start Pulse
3	LP	H/L	Data Latch Pulse
4	XSCL	H/L	Display Data Shift Clock Input
5	/DISP OFF	H/L	H: Display On, L: Display Off
6	VDD	3.3V or 5V	Power supply for Logic circuit (+)
7	VSS	0V	Ground (0V)
8	V_{LCD}	+23V (Typ)	Power supply for LCD
9	UD3	H/L	Display Data Bit D7
10	UD2	H/L	Display Data Bit D6
11	UD1	H/L	Display Data Bit D5
12	UD0	H/L	Display Data Bit D4
13	LD3	H/L	Display Data Bit D3
14	LD2	H/L	Display Data Bit D2
15	LD1	H/L	Display Data Bit D1
16	LD0	H/L	Display Data Bit D0

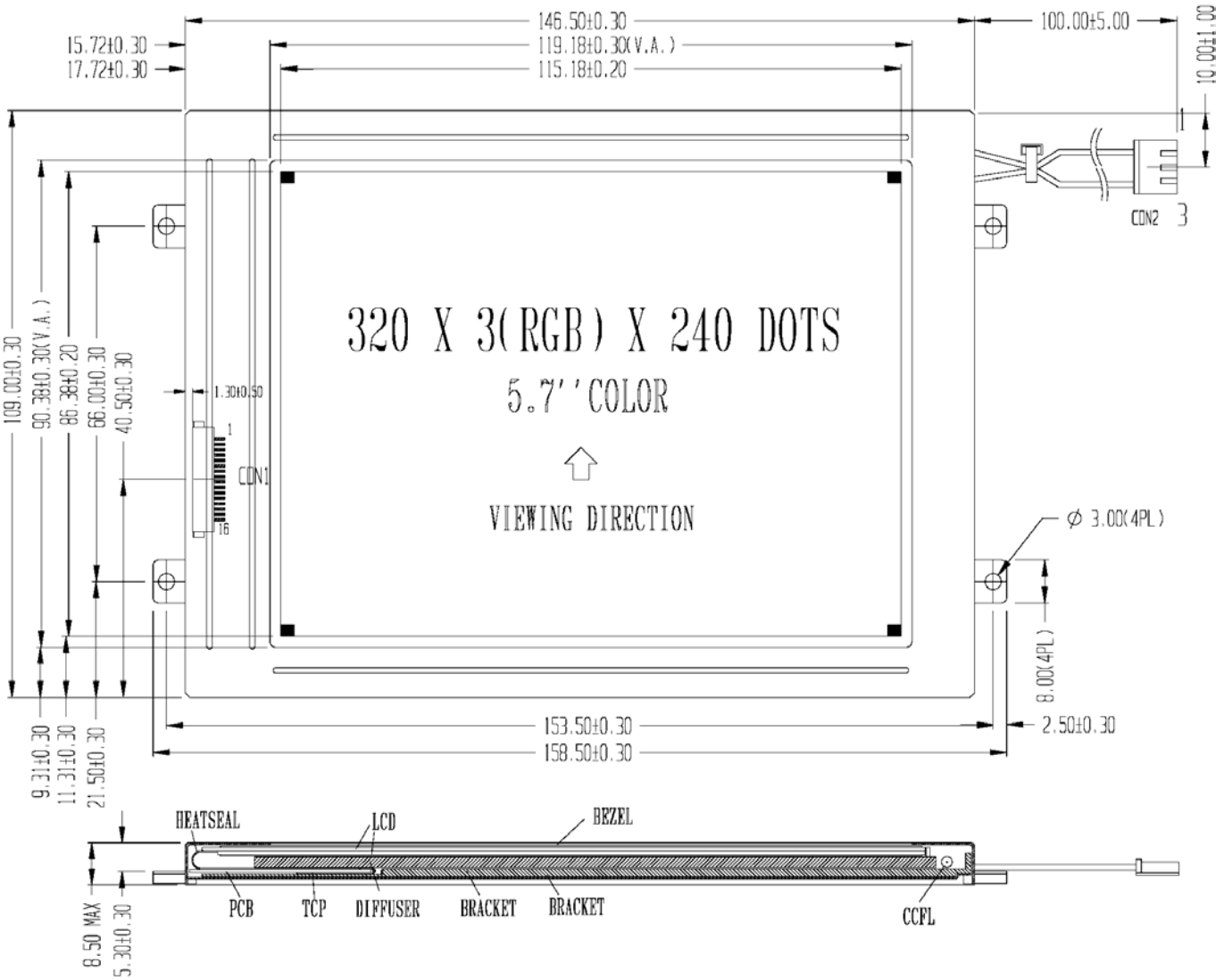
CON 2

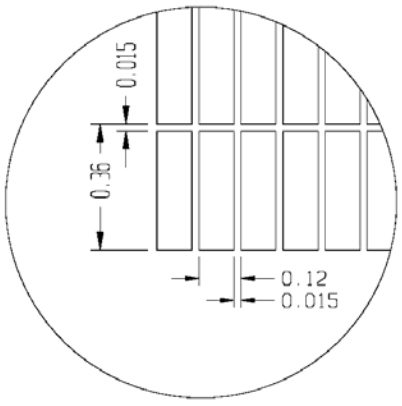
Pin No.	Symbol	Level	Description
1	VFL 1		VFL Power
2	NC		No Connection
3	VFL 2		VFL Power

1.7 LCM Power, Contrast Control and Bias

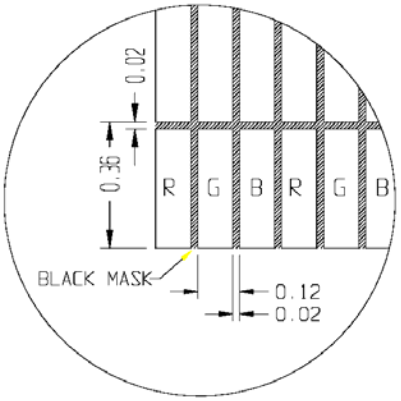


1.8 LCM Dimensions





ITO



COLOR FILTER

2. ELECTRICAL / OPTICAL CHARACTERISTICS

2.1 DC Electrical Characteristics

(V_{DD} = +5V±10% , V_{SS} = 0V, Ta = 25°C)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage for logic	V_{DD}	---	2.8	3.3 or 5.0	5.5	V
Supply current for logic	I_{DD}	---	---	2.0	4.0	mA
LCD Supply Voltage	V_{LCD}	$V_{LCD} - V_{SS}$	20	---	25	V
Supply current for LCD Glass	I_{LCD}	---	---	7.0	11.0	mA
Operating voltage for LCD	$V_{LCD} - V_{SS}$	0°C	22.5	24.0	24.7	V
		25°C	21.7	22.4	23.9	V
		50°C	20.7	21.8	22.9	V
Input voltage ' H ' level	V_{IH}	---	0.8 V_{DD}	---	V_{DD}	V
Input voltage ' L ' level	V_{IL}	---	0	---	0.2 V_{DD}	V

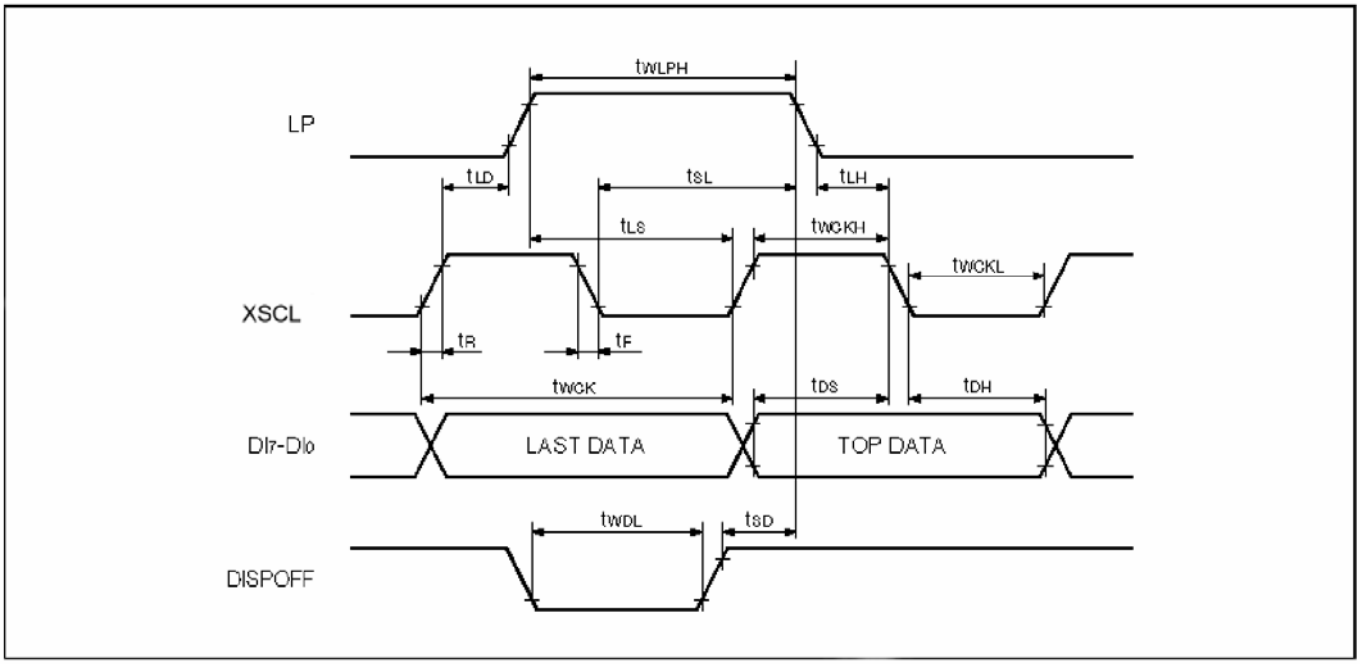
2.2 AC Electrical Characteristics

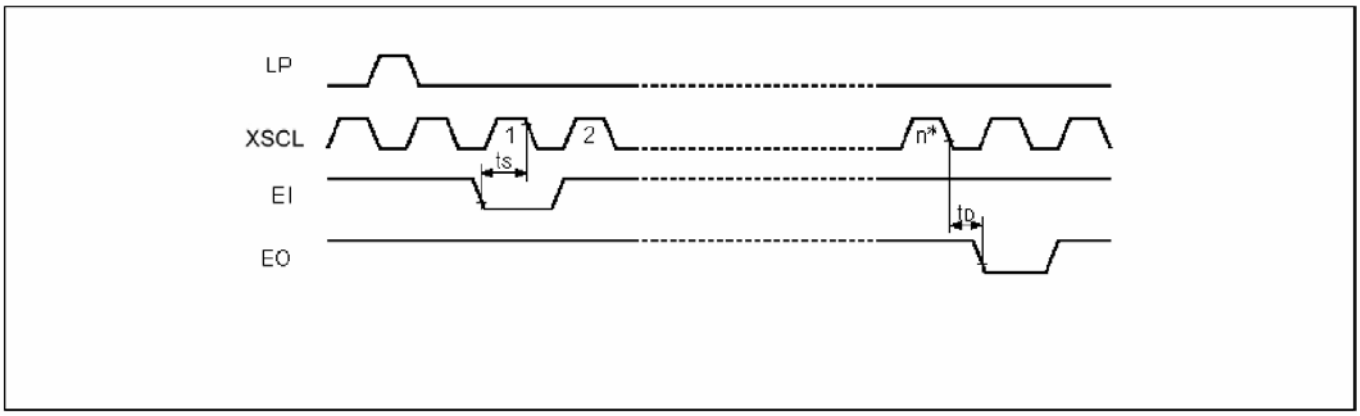
(V_{SS} = V_5 = 0 V, V_{DD} = +5.0±0.5 V, V_0 = +15.0 to +42.0 V, T_{OPR} = −20 to +85 °C)

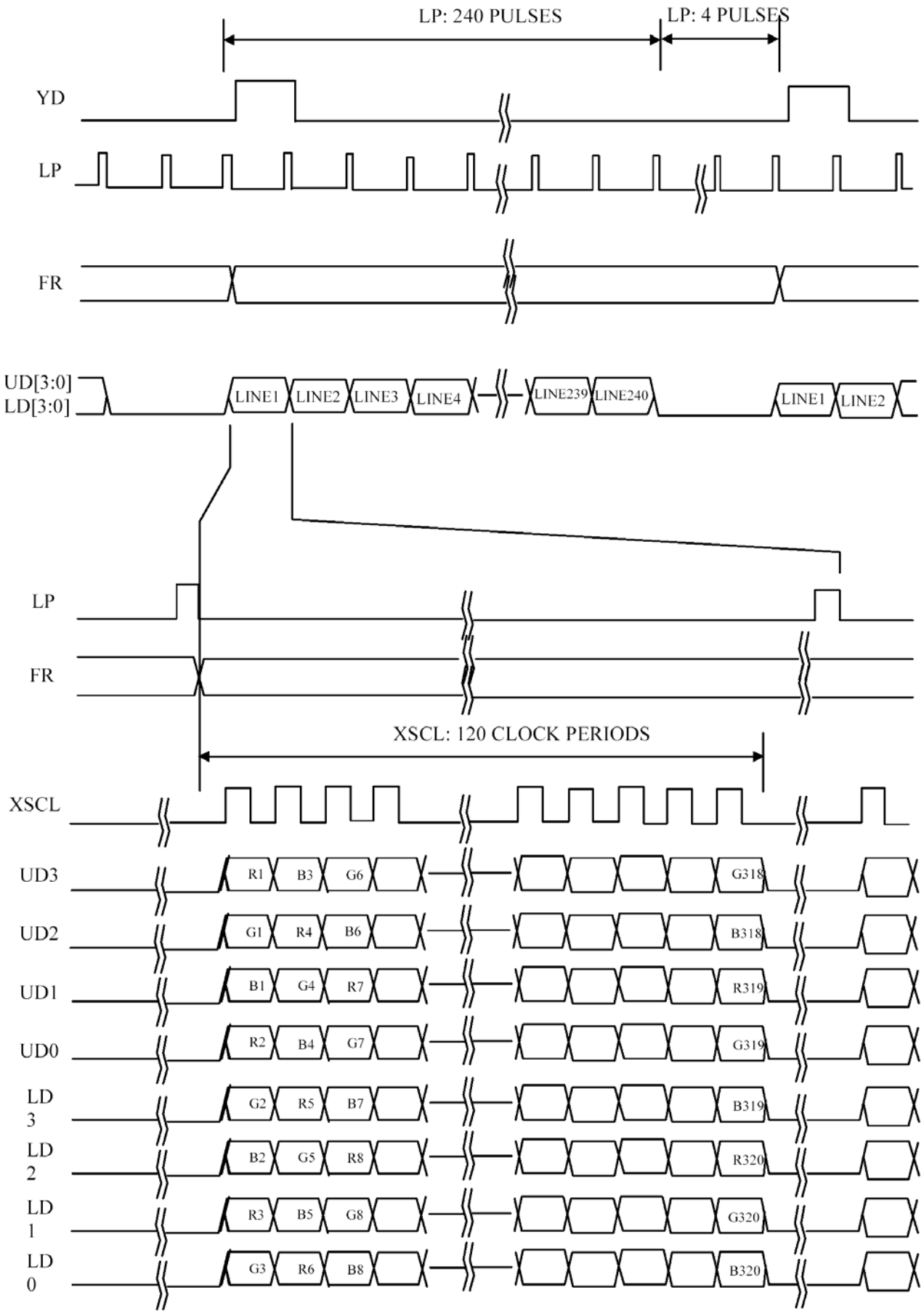
PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Shift clock period	t_{WCK}	t_R, $t_F \leq$ 10 ns	50			ns	1
Shift clock "H" pulse width	t_{WCKH}		15			ns	
Shift clock "L" pulse width	t_{WCKL}		15			ns	
Data setup time	t_{DS}		10			ns	
Data hold time	t_{DH}		12			ns	
Latch pulse "H" pulse width	t_{WLPH}		15			ns	
Shift clock rise to latch pulse rise time	t_{LD}		0			ns	
Shift clock fall to latch pulse fall time	t_{SL}		30			ns	
Latch pulse rise to shift clock rise time	t_{LS}		25			ns	
Latch pulse fall to shift clock fall time	t_{LH}		25			ns	
Enable setup time	t_S		10			ns	
Input signal rise time	t_R				50	ns	2
Input signal fall time	t_F				50	ns	2
$\overline{\text{DISPOFF}}$ removal time	t_{SD}		100			ns	
$\overline{\text{DISPOFF}}$ "L" pulse width	t_{WDL}		1.2			µs	
Output delay time (1)	t_D	C_L = 15 pF			30	ns	
Output delay time (2)	t_{PD1}, t_{PD2}	C_L = 15 pF			1.2	µs	
Output delay time (3)	t_{PD3}	C_L = 15 pF			1.2	µs	

NOTES :

1. Takes the cascade connection into consideration.
2. (t_{WCK} – t_{WCKH} – t_{WCKL})/2 is maximum in the case of high speed operation.


LP
XSCL
DI7-DI0
DISPOFF
tWLPH
tLD
tSL
tLH
tLS
tWCKH
tWCKL
tR
tF
tWCK
tDS
tDH
LAST DATA
TOP DATA
tWDL
tSD

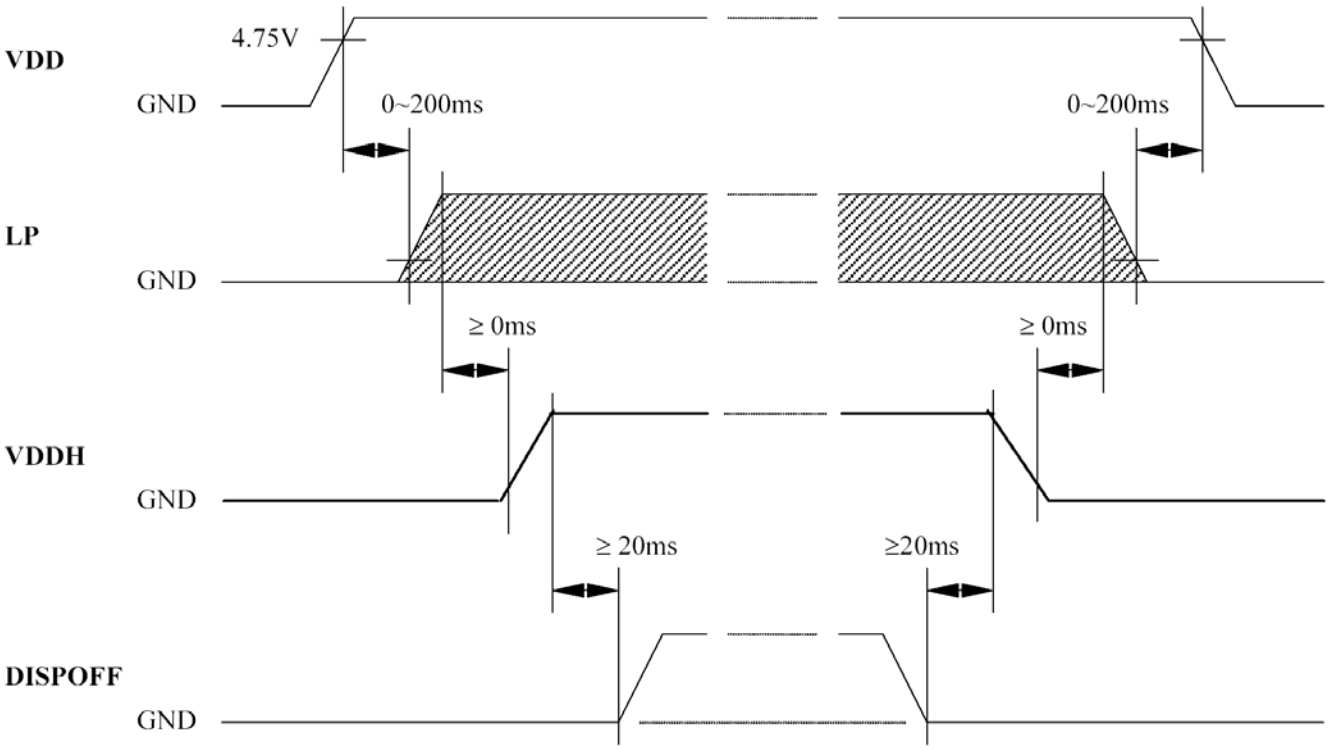

LP
XSCL
EI
EO
1
2
n*
ts
tD


LP: 240 PULSES
LP: 4 PULSES
YD
LP
FR
UD[3:0]
LD[3:0]
LINE1
LINE2
LINE3
LINE4
LINE239
LINE240
LINE1
LINE2
LP
FR
XSCL: 120 CLOCK PERIODS
XSCL
UD3
R1 B3 G6 G318
UD2
G1 R4 B6 B318
UD1
B1 G4 R7 R319
UD0
R2 B4 G7 G319
LD 3
G2 R5 B7 B319
LD 2
B2 G5 R8 R320
LD 1
R3 B5 G8 G320
LD 0
G3 R6 B8 B320

■ DISPLAY DATA PATTERN

COM												
		UD2		UD0		• • • • • •	UD0		LD2		LD0	Data bit
		S2		S4		• • • • • •	S956		S958		S960	SEG
C1	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C2	R	G	B	G	B	• • • • • •	G	B	R	G	B	
C1	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C2	R	G	B	G	B	• • • • • •	G	B	R	G	B	
C1	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C2	R	G	B	G	B	• • • • • •	G	B	R	G	B	
C1	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C2	R	G	B	G	B	• • • • • •	G	B	R	G	B	
•	•	•	•	•	•	• • • • • •	•	•	•	•	•	
•	•	•	•	•	•	• • • • • •	•	•	•	•	•	
•	•	•	•	•	•	• • • • • •	•	•	•	•	•	
•	•	•	•	•	•	• • • • • •	•	•	•	•	•	
•	•	•	•	•	•	• • • • • •	•	•	•	•	•	
•	•	•	•	•	•	• • • • • •	•	•	•	•	•	
•	•	•	•	•	•	• • • • • •	•	•	•	•	•	
•	•	•	•	•	•	• • • • • •	•	•	•	•	•	
C239	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C240	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C239	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C240	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C239	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C240	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C239	R	G	B	R	G	• • • • • •	G	B	R	G	B	
C240	R	G	B	R	G	• • • • • •	G	B	R	G	B	
	S1		S3		S5	• • • • • •		S957		S959		SEG
	UD3		UD1		UD3	• • • • • •		LD3		LD1		Data bit
COM												

■ Timing of Power Supply



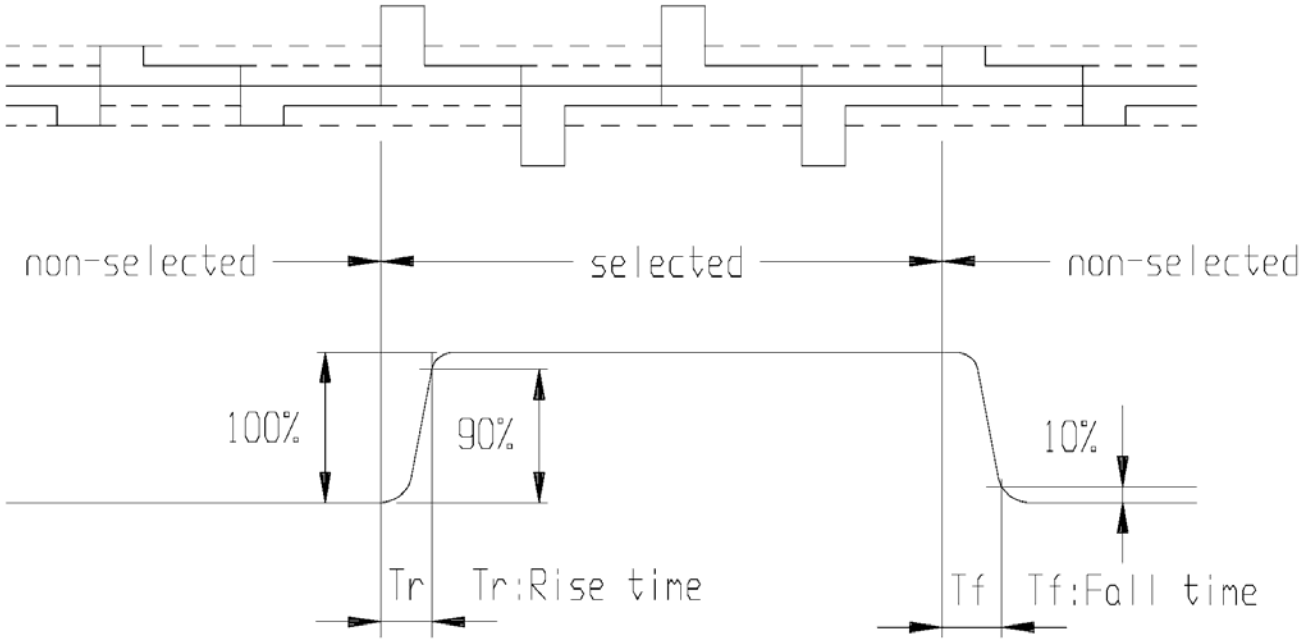
Note : The missing pixels may occur when the LCM is driven except above power supply timing sequence.

2.3 Optical Characteristics

(V_{LCD} = 22.8V, Ta = 25°C)

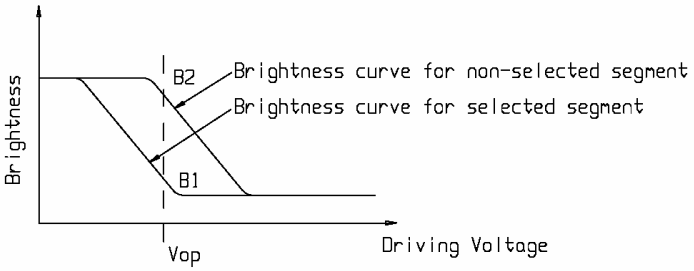
Item	Symbol	Condition	Min	Typ	Max	Unit	Remarks	Note
Brightness	---	25°C	---	175	---	nits	---	---
Frame Frequency	f_{FRM}	---	---	70	---	Hz	---	---
Response time	Tr	25°C	---	216.6	---	ms	---	1
	Tf		---	108.7	---	ms	---	
Contrast ratio	Cr	25°C	---	43	---		---	2
Viewing angle range	Ø	Cr ≥ 2	35	---	---	deg	Ø = 90°	3
			60	---	---	deg	Ø = 270°	
			55	---	---	deg	Ø = 0°	
			40	---	---	deg	Ø = 180°	

Note 1. Definition of response time

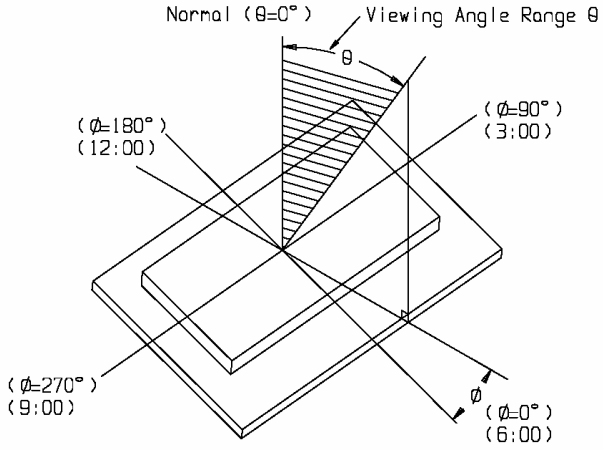


Note 2. Definition of Contrast Ratio 'Cr'

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



Note 3. Definition of Viewing Angle Range 'θ'



2.4 CCFL Backlight Characteristics

Item	Symbol	Conditions	Min	Typ	Max	Unit	Notes
Lamp Voltage *1	V_{FL}	Ta = 25°C	---	270	300	Vrms	1
Starting Voltage *2	V_S	Ta = 0°C	270	---	---	Vrms	2
Lamp Current *1	I_{FL}	Ta = 25°C	4.0	5	6.0	mArms	1
Frequency	f_{FL}	Ta = 25°C	---	36.6	---	KHz	1
Lamp Life	VFL_{LIFE}	Ta = 25°C	15,000	---	---	Hours	3

Notes:

1. FL Inverter: CXA-L10L
2. The voltage capable of starting discharge and keeping a stable discharge. When the voltage gradually increases, glow discharge will increase and the FL Tube terminals will be connected electrically.
3. FL Driving Conditions: IFL (Lamp Current) = 5mA RMS. This is the time until the VFL output intensity decreases to one-half of it's initial brightness.

4. RELIABILITY

Environmental Test				
No.	**Test Item**	**Content of Test**	**Test Condition**	**Applicable Standard**
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	60 °C 200 hrs	------
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-10 °C 200 hrs	------
3	High temperature operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	50 °C 200 hrs	------
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	0 °C 200 hrs	------
5	High temperature / Humidity storage	Endurance test applying the high temperature and high humidity storage for a long time.	60 °C , 90 %RH 96 hrs	MIL-202E-103B JIS-C5023
6	High temperature / Humidity operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	40 °C , 90 %RH 96 hrs	MIL-202E-103B JIS-C5023
7	Temperature cycle	Endurance test applying the low and high temperature cycle. -20°C 30min ⇌ 25°C 5min. ⇌ 70°C 30min ⟷ 1 cycle	-10°C / 60°C 10 cycles	------
Mechanical Test				
8	Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz → 1.5mmp-p 22~500Hz → 1.5G Total 0.5hrs	MIL-202E-201A JIS-C5025 JIS-C7022-A-10
9	Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sign wave 11 msedc 3 times of each direction	MIL-202E-213B
10	Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115 mbar 40 hrs	MIL-202E-105C
Others				
11	Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V , RS=1.5 kΩ CS=100 pF 1 time	MIL-883B-3015.1

*** Supply voltage for logic system = VDD. Supply voltage for LCD system = Operating voltage at 25°C

■ LCD Panel Service Life (Exclusive of backlight)

Definition of panel service life

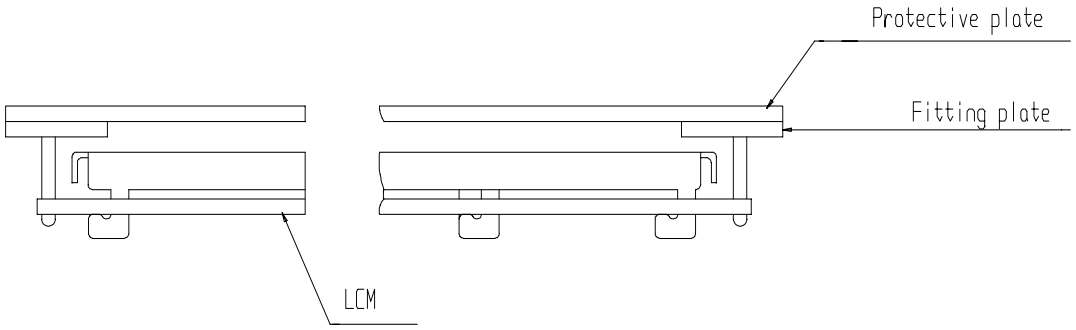
- LCD Glass has 100,000 hours minimum at 25° C ±10%. CCFL Lamp limits overall product life to 15,000 hours
- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

5. PRECAUTIONS FOR USING LCD MODULES

Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. 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 ±0.1mm.

Precaution for Handing LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
2) Do not alter, modify or change the shape of the tab on the metal frame.
3) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
4) Do not damage or modify the pattern writing on the printed circuit board.
5) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
6) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
7) Do not drop, bend or twist LCM.

Electro-Static Discharge Control

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

1) Make certain that you are grounded when handing LCM.
2) Before remove 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 potentiality 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 work bench 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.

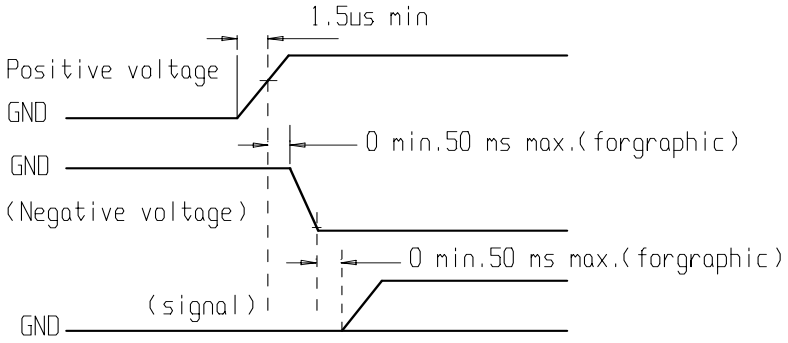
Precaution for soldering to the LCM

1) Observe the following when soldering lead wire, connector cable and etc. to the LCM.
   a) Soldering iron temperature : 280°C ± 10°C.
   b) Soldering time : 3-4 sec.
2) Solder : eutectic solder.

3) 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.
4) 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.
5) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

Precautions for Operation

1) Viewing angle varies with the change of liquid crystal driving voltage (V_{LCD}). Adjust V_{LCD} to show the best contrast.
2) Driving the LCD in the voltage above the limit shortens its life.
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 back 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°C , 50% RH.
6) When turning the power on, input each signal after the positive/negative voltage becomes stable.



Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Handling

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it or impact.
- 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.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 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 cloth with one of the following solvents :
    - Isopropyl alcohol
    - Ethyl alcohol
- Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
    - Water
    - Ketone
    - Aromatic solvents
- Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- 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.
- Do not attempt to disassemble or process the LCD module.
- NC terminal should be open. Do not connect anything.

- If the logic circuit power is off, do not apply the input signals.
- 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 modules.
    - 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.

Storage

- When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps
- Store the module in a dark place where the temperature is 25 ^{o}C ±10 ^{o}C and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzene.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

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 modules have 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 regained 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 modules 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.