

TINSHARP ELECTRONIC LTD. CO.

LCD Module Specification

ITEM NO.: TG320240B

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2. GENERAL SPECIFICATION

Display Format : 320 dots (W) × 240 dots (H)
Dot Size : 0.33 (W) × 0.33 (H) mm
View Area : 121 (W) × 91.5 (H) mm
Outline Dimensions : 178.0 (W) × 110.0 (H) × 10.5 (T) mm Max.
Weight : g max.

LCD Type : ☐ STN Gray ☒ STN BLUE ☐ FSTN ☐ TN

Polarizer mode : ☐ Reflective ☐ Transflective

☐ Transmissive ☒ Negative

View Angle : ☒ 6 O'clock ☐ 12 O'clock ☐ Others _____

Backlight : ☐ LED ☐ EL ☒ CCFL

Backlight Color : ☐ Yellow green ☐ Amber ☐ Blue Green

☒ White ☐ Others

Controller / Driver : HD66206

Temperature Range : ☒ Normal ☐ Wide Temperature
Operating 0 to 40°C Operating -20 to 70°C
Storage -20 to 70°C Storage -30 to 80°C

Drawing :

3. ABSOLUTELY MAXIMUM RATINGS

3.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

$V_{SS}=0V$, $T_a=25^{\circ}C$

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	$V_{DD}-V_{SS}$	0	6.5	V
Supply Voltage (LCD Driver)	$V_{DD}-V_{EE}$	0	27.5	V
Input Voltage	V_I	V_{SS}	V_{DD}	V
Operating Temperature	T_{OP}	0	40	$^{\circ}C$
Storage Temperature	T_{STG}	-20	70	$^{\circ}C$

3.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Comment
	(Min.)	Max.)	(Min.)	(Max.)	
Ambient Temp	0	40	-20	70	Note (1)
Humidity	Note (2)		Note(2)		Without Condensation
Vibration	--	$4.9M/S^2$	--	$19.6M/S^2$	XYZ Direction
Shock	--	$29.4M/S^2$	--	$490M/S^2$	XYZ Direction

Note(1) $T_a = 0^{\circ}C$: 50Hr Max.

Note(2) $T_a \leq 40^{\circ}C$: 90% RH Max.

$T_a \geq 40^{\circ}C$: Absolute humidity must be lower than the humidity of 90% at $40^{\circ}C$.

4. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)	V _{DD} -V _{SS}		4.5	5.0	5.5	V
Supply Voltage (LCD)	V _{DD} -V _O	0°C	--	23.6	--	V
		25°C	--	22.6	--	
		50°C	--	21.6	--	
Input Voltage	V _{IH}	--	0.8*V _{DD}	--	V _{DD}	V
	V _{IL}		V _{SS}	--	0.2*V _{DD}	
Logic Supply Current	I _{CC} I _{EE}	V _{DD} =5V V _{EE} = -20V	--	20 15	--	mA

5. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	Symbol	Condition	Min.	Typ.	Max.	Unit	Ref.
Rise Time	Tr	0°C	--	--	--	ms	Note (1)
		25°C		250	500		
Fall Time	Tf	0°C	--	--	--	ms	
		25°C		150	300		
Contrast	CR	25°C		2.7		Degree	Note (3)
View Angle	θ1–θ2 Ø1, Ø2	25°C & CR ≥ 3	50	--	--		Note (2)
			-40	--	40		
Frame Frequency	Ff	25°C	--	64	--	Hz	

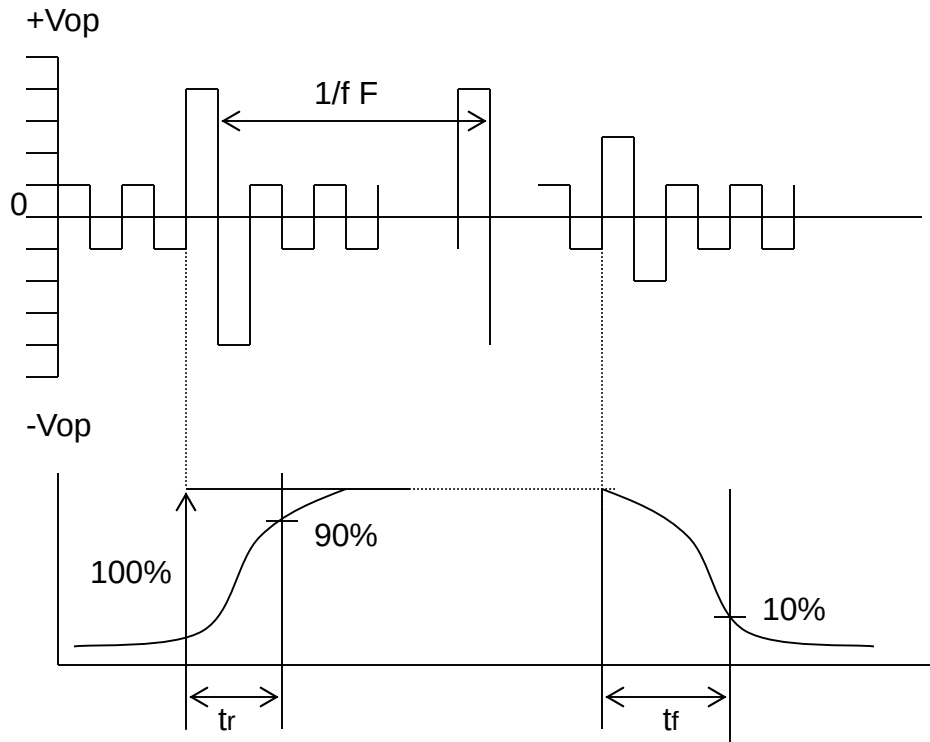
Note (1) & (2) : See next page

Note (3) : Contrast ration is defined under the following condition,

$$CR = \frac{\text{Reflectance value of non-selected condition}}{\text{Reflectance value of selected condition}}$$

- (a). Temperature ----- 25°C
- (b). Frame frequency ---- 64Hz
- (c). Viewing angle ----- θ= 0°, Ø = 0°
- (d). Operating voltage --- 22.6V

Note (1) Response time is measured as the shortest period of time possible between the change in state of an LCD segment as demonstrated below:

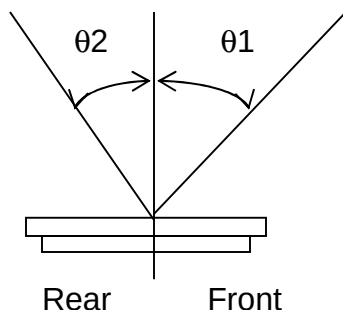


Condition:

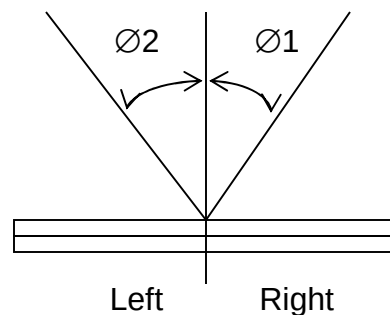
- (a) . Temperature -----25°C
- (b) . Frame frequency ----- 64Hz
- (c) . View Angle ----- $\theta = 0^\circ$, $\phi = 0^\circ$
- (d) . Operating voltage ----- 22.6V

Note (2) Definition of View Angle

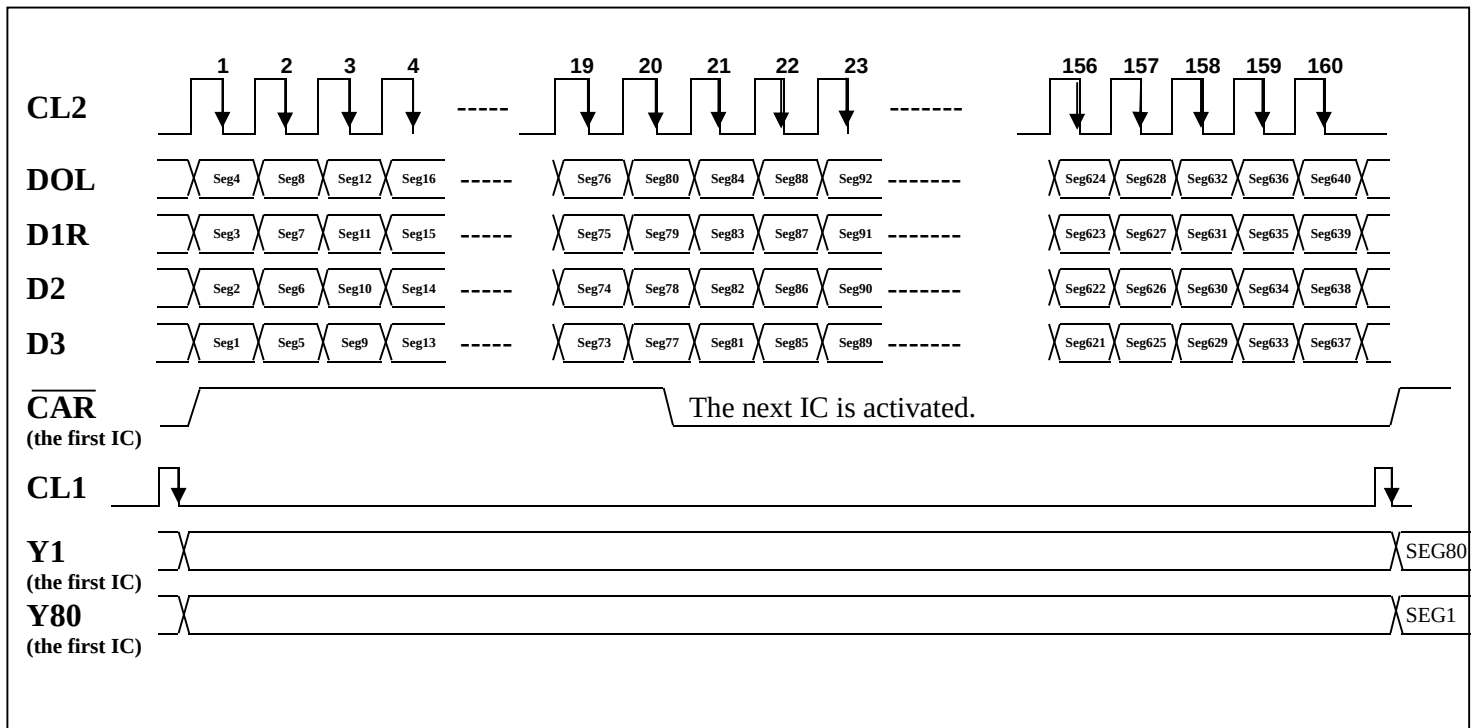
Front – Rear direction



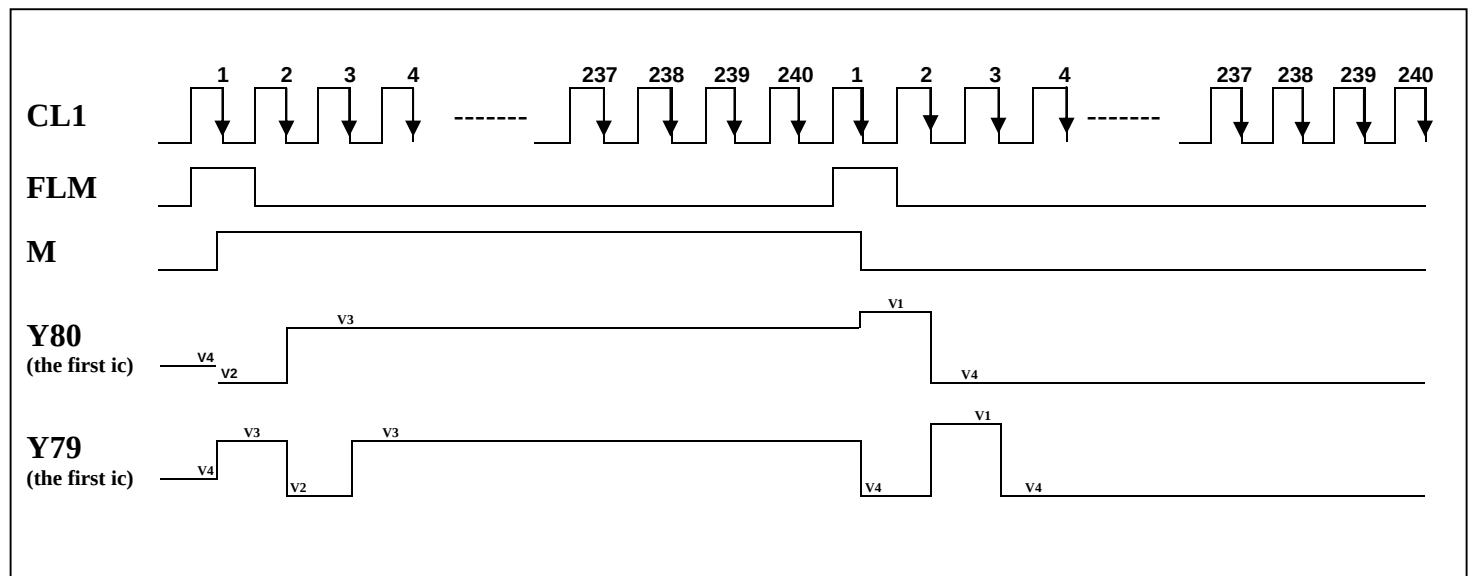
Right -- Left direction



6. TIMING CHARACTERISTIC



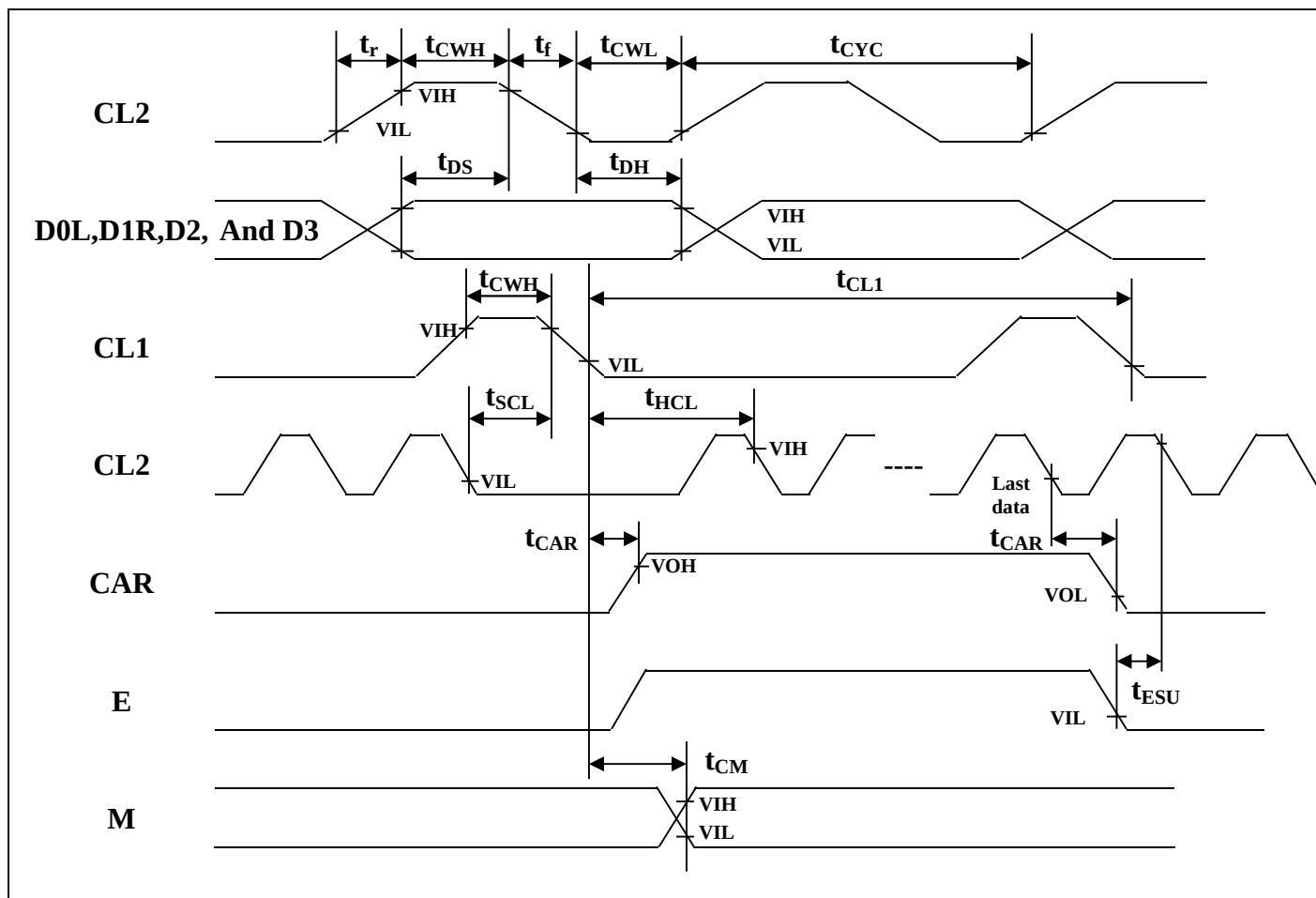
Timing Charts for Application Example in Column Driver Operation



Timing Charts for Application Example in Column Driver Operation

AC Characteristics 2 (In Column Driver Operation) ($V_{CC} = 2.7$ to $5.5V$, $GND = 0V$, $V_{CC} - V_{EE} = 6$ to $28V$, And $T_a = -20$ to $+75^{\circ}C$, unless otherwise stated)

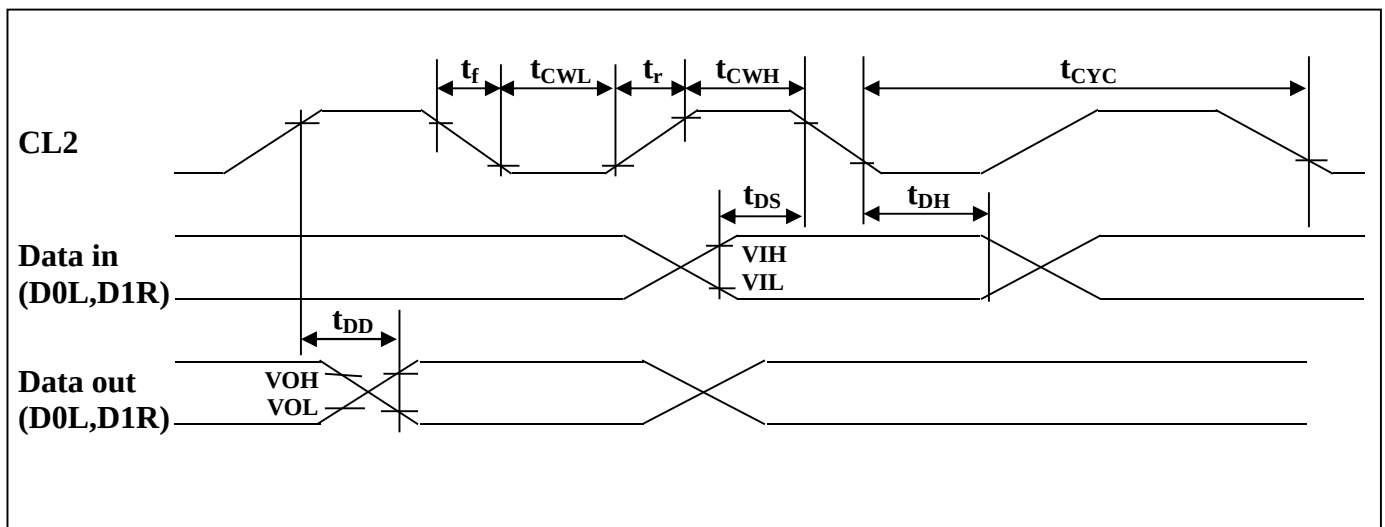
Item	Symbol	Applicable Pins	Min.	Max.	Unit	Note
Clock cycle time	t_{CYC}	CL2	10	--	us	--
Clock high level width	t_{CWH}	CL2	80	--	ns	--
Clock low level width	t_{CWL}	CL2	1.0	--	us	--
Clock rise time	t_r	CL2	--	30	ns	--
Clock fall time	t_f	CL2	--	30	ns	--
Data setup time	t_{DS}	D0L,D1R,and CL2	100	--	ns	--
Data hold time	t_{DH}	D0L,D1R,and CL2	100	--	ns	--
Data output delay time	t_{DD}	D0L,D1R,and CL2	--	7.0	us	



Common Driver Operation Timing

AC Characteristics 1 (In Column Driver Operation) ($V_{CC} = 5V \pm 10\%$, $GND = 0V$, $V_{CC} - V_{EE} = 6$ to $28V$, And $T_a = -20$ to $+70^\circ C$, unless otherwise stated)

Item	Symbol	Applicable Pins	Min.	Max.	Unit	Note
Clock cycle time	t_{CYC}	CL2	125	--	ns	--
Clock high level width	t_{CWH}	CL2 and CL1	40	--	ns	--
Clock low level width	t_{CWL}	CL2	40	--	ns	--
Clock setup time	t_{SCL}	CL1 and CL2	80	--	ns	--
Clock hold time	t_{HCL}	CL1 and CL2	80	--	ns	--
Clock rise time	t_r	CL1 and CL2	--	1	ns	1
Clock fall time	t_f	CL1 and CL2	--	1	ns	1
Data setup time	t_{DS}	D0L,D1R,D2,D3,and CL2	20	--	ns	--
Data hold time	t_{DH}	D0L,D1R,D2,D3,and CL2	20	--	ns	--
Enable setup time	t_{ESU}	$\overline{E}$ and CL2	20	--	ns	--
Carry output delay time	t_{CAR}	$\overline{CAR}$ and CL2	--	70	ns	2
M phase difference	t_{CM}	M and CL1	--	300	ns	--
CL1 cycle time	t_{CL1}	CL1	$t_{CYC} \cdot 50$	--	ns	--

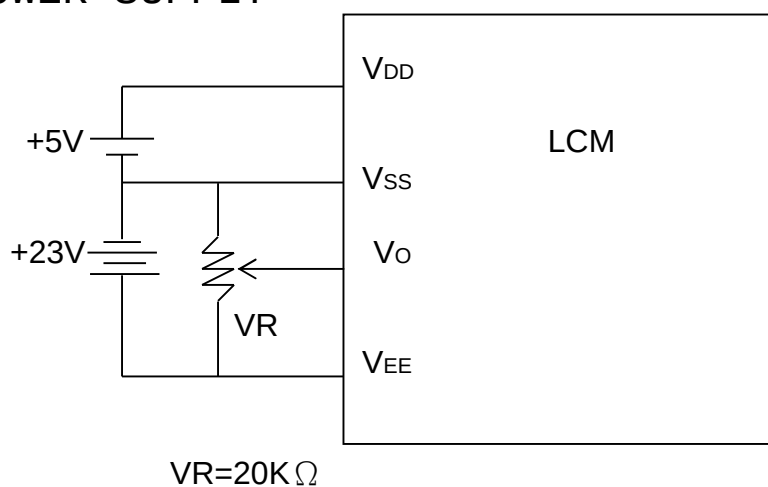


Common Driver Operation Timing

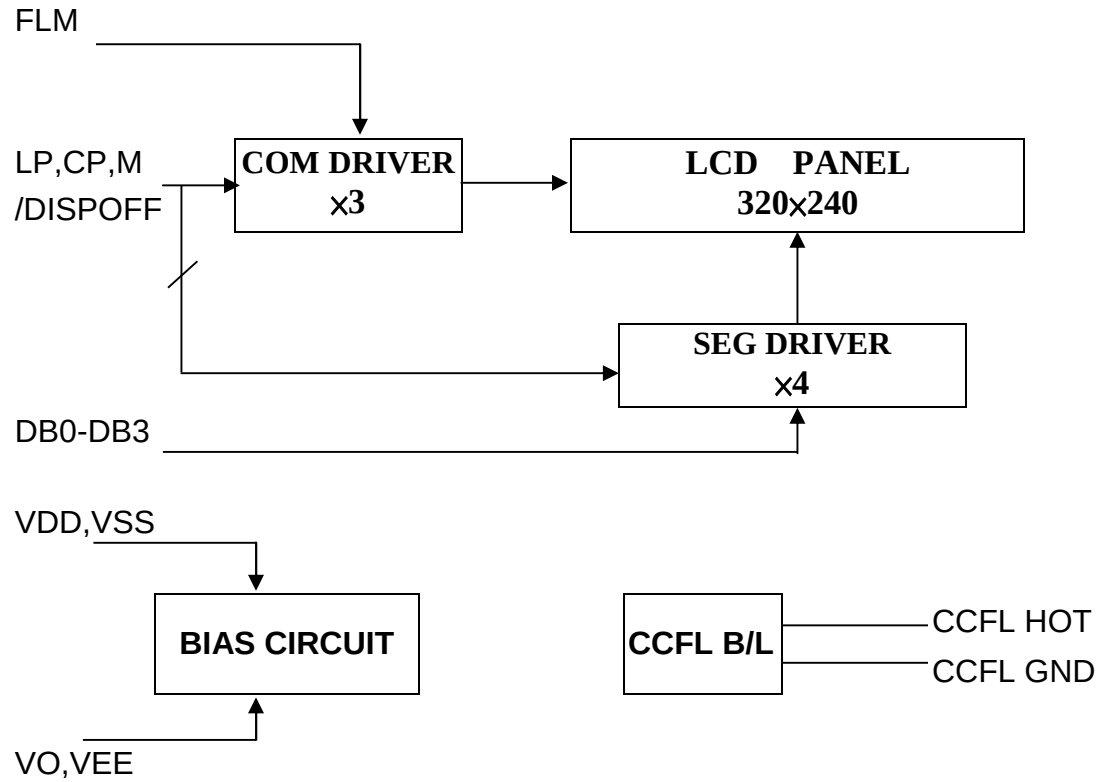
7. PIN CONNECTIONS

No.	Symbol	Function
1	FLM	First Line Mark
2	LP (CL1)	Data Latch Pulse
3	CP (CL2)	Data Shift Pulse
4	VDD	Power Supply For Logic
5	VSS	GND
6	/DISPOFF	Display on/off control, High= ON Low= OFF
7-10	DB0-DB3	Data bus line 0~3
11	VO	Input voltage for LCD contrast adjustment
12	VEE	Power Supply For LCD(+23V)

8. POWER SUPPLY



9. BLOCK DIAGRAM



10. QUALITY ASSURANCE

10.1 Test Condition

10.1.1 Temperature and Humidity

Temperature : $20 \pm ^\circ\text{C}$

Humidity : $65 \pm 5\%$

10.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

10.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

10.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

10.1.5 Test Method

10.1.6

No.	Parameter	Conditions	Regulations
1	High Temperature Operating	$50 \pm 2 ^\circ\text{C}$	Note 3
2	Low Temperature Operating	$0 \pm 2 ^\circ\text{C}$	Note 3
3	High Temperature Storage	$60 \pm 2 ^\circ\text{C}$	Note 3
4	Low Temperature Storage	$-20 \pm 2 ^\circ\text{C}$	Note 3
5	Vibration Test (Non-operation state)	Total fixed amplitude : 1.5mm Vibration Frequency : 10 ~ 55Hz One cycle 60 seconds to 3 directions of X.Y.Z. for each 15 minutes	Note 3
6	Damp Proof Test (Non-operation state)	$40^\circ\text{C} \pm 2^\circ\text{C}$, 90~95%RH, 96h	Note 1,2
7	Shock Test (Non-operation state)	To be measured after dropping from 60cm high once concrete surface in packing state	Note 3

Note 1: Returned under normal temperature and humidity for 4 hrs.

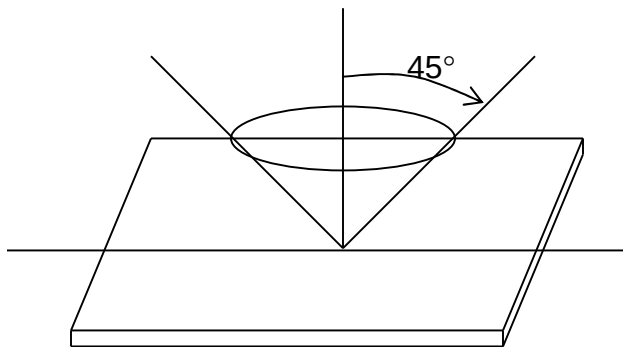
Note 2: No dew condensation to be observed.

Note 3: No change on display and in operation under the test condition

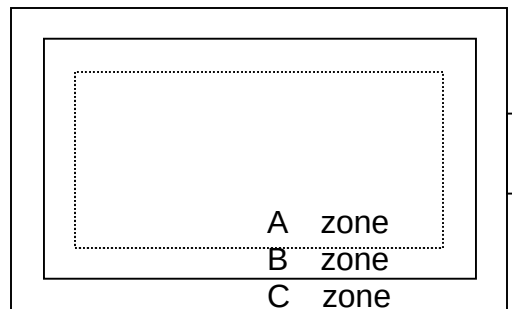
10.2 Inspection condition

10.2.1 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light. The distance between the eyes and the sample shall be more than 30 cm. All directions for inspecting the sample should be within 45° against perpendicular line.

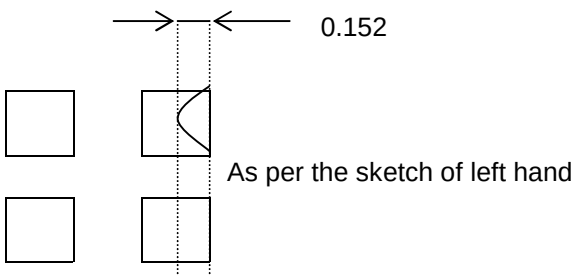
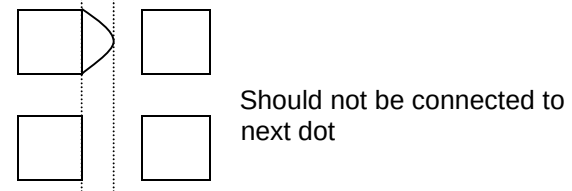
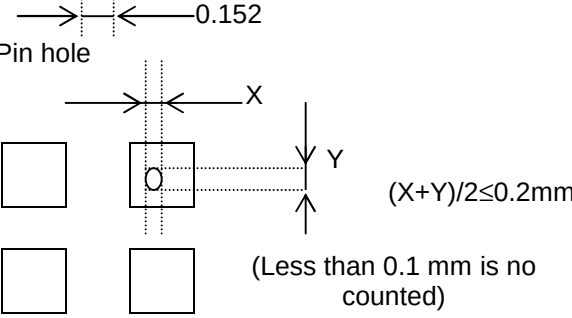
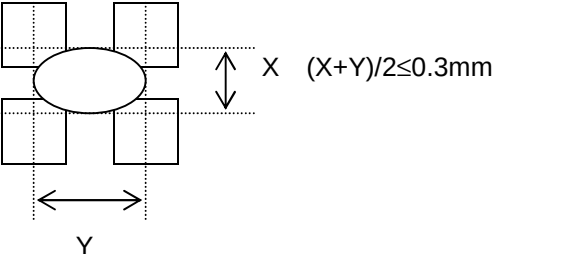


10.2.2 Definition of applicable Zones



- A zone : Active display area
- A + B zone : Validity viewing area
- C zone : Sealing area

NO.	Parameter	Criteria																														
1	Black and white Spots Foreign Substances	Round Shape																														
		<table><tr><th rowspan="2">Zone Dimension</th><th colspan="3">Acceptable number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable level</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$D \leq 0.2$</td><td>*</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr><tr><td>$0.2 \leq D \leq 0.3$</td><td>3</td><td>4</td><td>*</td></tr><tr><td>$0.3 \leq D \leq 0.4$</td><td>2</td><td>3</td><td>*</td></tr><tr><td>$D < 0.3$</td><td>0</td><td>1</td><td>*</td></tr></table>	Zone Dimension	Acceptable number			Class Of Defects	Acceptable level	A	B	C	$D \leq 0.2$	*	*	*	Minor	2.5	$0.2 \leq D \leq 0.3$	3	4	*	$0.3 \leq D \leq 0.4$	2	3	*	$D < 0.3$	0	1	*			
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		$D = (\text{Long} + \text{Short}) / 2$ * : Disregard																														
		<table><tr><th rowspan="2">X(mm) \ Y(mm)</th><th rowspan="2">Zone</th><th colspan="3">Acceptable number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Accept- Able level</th></tr><tr><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><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr><tr><td>$3.0 \geq L$</td><td>$0.05 \geq W$</td><td>3</td><td>4</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></td><td></td><td></td></tr></table>	X(mm) \ Y(mm)	Zone	Acceptable number			Class Of Defects	Accept- Able level	A	B	C	*	$0.03 \geq W$	*	*	*	Minor	2.5	$3.0 \geq L$	$0.05 \geq W$	3	4		$1.0 \geq L$	$0.1 \geq W$	3	3		—	$0.1 < W$	
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X : Length Y : Width * : Disregard																																
Total defects should not exceed 5																																
2	Air Bubbles (between glass & polarizer)	<table><tr><th rowspan="2">Zone Dimension</th><th colspan="3">Acceptable number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable Level</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><td rowspan="4">Minor</td><td rowspan="4">2.5</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	Acceptable number			Class Of Defects	Acceptable Level	A	B	C	$D \leq 0.3$	*	*	*	Minor	2.5	$0.3 < D \leq 0.4$	3	*	*	$0.4 < D \leq 0.6$	2	3	*	$0.6 < D$	0	0	*			
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		$0.6 < D$	0	0	*																											
		* : Disregard																														
		Total defects shall not excess 3.																														

3	The Shape of Dot	(1) Dot shape (with Dent)  (2) Dot shape (with Projection)  (3) Pin hole  (4) Deformation  Total acceptable number : 1/dot, 5/cell
4	Polarizer Scratches	Refer to the sample
5	Polarizer Dirts	If the stains are removed easily from LCD panel 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 5 pieces maximum in total
7	Distance between Different Foreign Substance Defects	$D \leq 0.2$: 20 mm or more $0.2 \leq D$: 40mm or more

11 PRECAUTIONS IN USE OF LCM

11.1 Handling of LCM

- 11.1.1 LCM may be broken because it is made of glass. In case the liquid crystal touches human hand, skin, eye and cloth, must use water to wash it out thoroughly and immediately.
- 11.2.2 Leave the module in its package bag before use it.
- 11.2.2 Keep the module operated or storage within specified temperature and humidity range.
- 11.2.2 Polarizer is a soft material and can easily be scratched.
- 11.2.2 Please avoid static electricity.
- 11.2.2 When cleaning the display surface, use cloth (e.g. gauze) with asolvent, such as iso-propyl alcohol and ethyl alcohol, and wipe lightly.
- 11.2.2 Do not touch the connection rubber or heat seal, nor modify the location.
- 11.2.2 Do not move the tab of the metal holder nor make any rearrangement to it.

11.2 Storage

- 11.2.1 Store in an ambient temperature of 5 to 35°C and in a relative humidity of 40 – 60%.
- 11.2.2 If you store as unpacked, put in anti-static bag, seal its opening and store where it is not subjected to direct sunlight and fluorescent lamp.

11.3 Installing

- 11.3.1 Do not take off the protective firm attached on display surface.
- 11.3.2 Leave enough height to avoid stressing to the surface. A measurement tolerance $\pm 0.1\text{mm}$ is necessary.
- 11.3.3 Do not directly mark on the PCB while soldering the connector or cable.
- 11.3.4 Soldering iron, no higher than 260 °C and less than 3-4 second during soldering.
- 11.3.5 Connector rework soldering, no more than 3 times.

12 OUTLINE DRAWING

