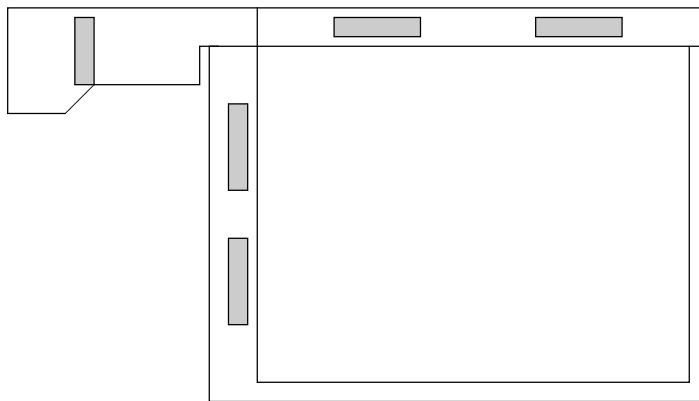




PRODUCT SPECIFICATION

HDG320240

320 x 240 GRAPHICS
LCD DISPLAY MODULE
CHIP-ON-GLASS



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1. MECHANICAL DATA

(1) Product No.	HDG320240
(2) Module Size	88.3 (W)mm X 69.1 (H)mm X 2.2MAX (D)mm
(3) Dot Size	0.225 (W)mm X 0.225 (H)mm
(4) Dot Pitch	0.24 (W)mm X 0.24 (H)mm
(5) Number of Dots	320 (W) X 240 (H) Dots
(6) Duty	1/240
(7) LCD Display Mode	FSTN: <input type="checkbox"/> Black and White(Normally White/Positive Image) <input type="checkbox"/> Black and White(Normally White,Paper White/ Positive Image) Rear Polarizer: <input type="checkbox"/> Transflective(Normal) <input type="checkbox"/> Transflective(High Transparency)
(8) Viewing Direction	9 O'clock
(9) Backlight	W/O
(10) Weight	24.5 g(Approx)
(11) Controller	Excluded
(12) DC/DC Converter	Excluded

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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

GND=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-GND	-0.3	7.0	V	
Power Supply for LC Drive	VLCD-GND	-0.3	36.0	V	
Input Voltage	VI	-0.3	VDD+0.3	V	
Static Electricity	-	-	-	-	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	WIDE TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-30	80
Humidity(Without Condensation)	Note 2,3		Note 2,4	

Note 1 LCM should be grounded during handling LCM.

Note 2 Background color will change slightly depending on ambient temperature.
This phenomenon is reversible.

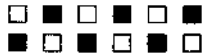
Note 3 Ta \leq 70°C : 75%RH max
Ta > 70°C : Absolute humidity must be lower
than the humidity of 75%RH at 70°C

Note 4 Ta at -30°C will be < 48hrs, at 80°C will be < 120hrs

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3. ELECTRICAL CHARACTERISTICS

(VDD = 3.0V ± 10%)

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Input Voltage	VIH	H level		0.8VDD	–	VDD	V
	VIO	L level		0	–	0.2VDD	V
Recommended LC Driving Voltage (WIDE TEMP. LCM)	VLCD-GND (Vop)	1/240 Duty 1/12 Bias	-20°C	17.3	17.5	17.7	V
			0°C	15.7	15.9	16.1	
			25°C	15.2	15.4	15.6	
			50°C	14.4	14.6	14.8	
			70°C	13.5	13.7	13.9	
Power Supply Current	IDD	VDD=3.0V GND=0V VDD-GND=15.4V FLM=70Hz		–	0.1	0.3	mA
	ILCD	PATTERN : 		–	0.55	1.0	

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4. OPTICAL CHARACTERISTICS

AT Vop

ITEM		Cr(Contrast Ratio)										θ (Viewing Angle)		ϕ (Viewing Angle)	
		-20°C		-0°C		25°C		50°C		70°C		25°C		25°C	
MODE		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
Z	T	2.5	3.0	3.5	4.0	5.0	5.5	3.0	3.5	2.0	2.5	-	F: 30 R: 25	-	±30
note		NOTE 6										NOTE 5			

NOTE :

Z: OTHER

T: NORMALLY WHITE(9 O'clock)

AT $\theta=0^\circ$ $\phi=0^\circ$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20°C	5200	6700	10000	ms	NOTE 2
		0°C	950	1200	1800		
		25°C	280	350	500		
		50°C	130	160	250		
		70°C	80	100	150		
Response Time (fall)	Tf	-20°C	3400	4300	6500	ms	NOTE 2
		0°C	550	700	1000		
		25°C	200	250	350		
		50°C	70	90	140		
		70°C	50	70	110		

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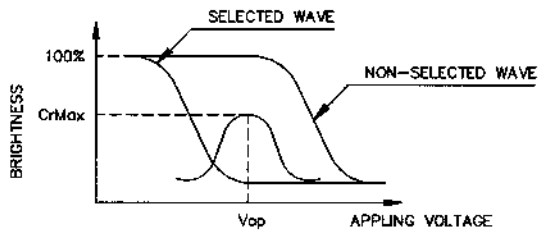
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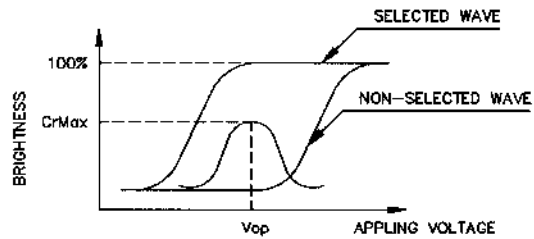
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



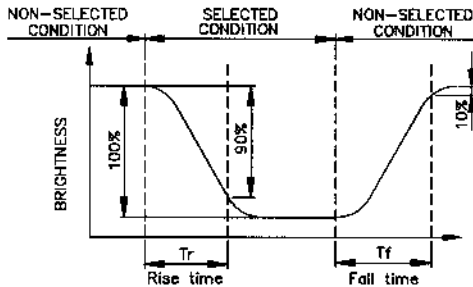
(negative type)

*Conditions

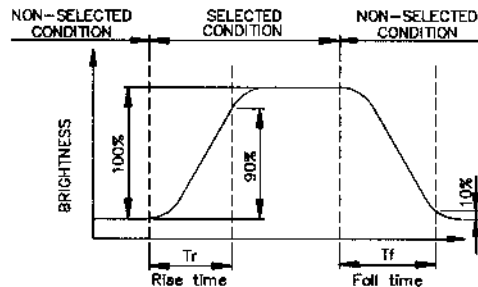
- Viewing Angle : 0
- Frame Frequency : 70Hz
- Appling Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



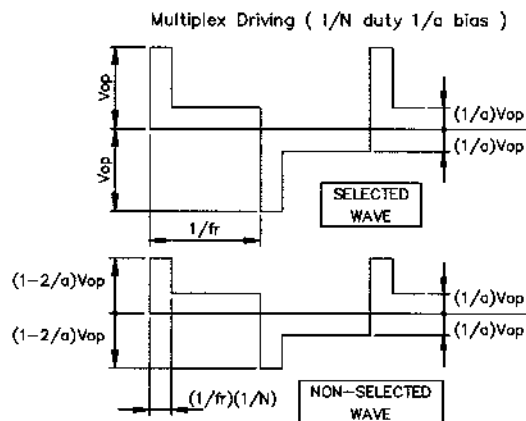
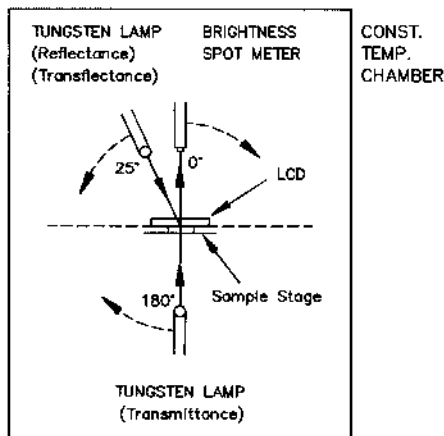
(negative type)

*Conditions

- Operating Voltage : Vop
- Viewing Angle (θ,φ) : (0,0)
- Frame Frequency : 70Hz
- Appling Waveform : 1/N duty 1/a bias

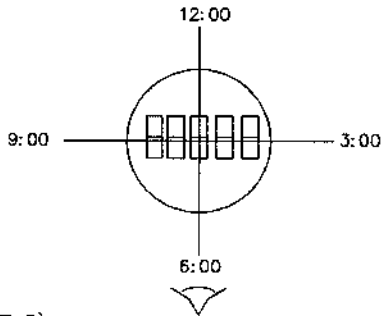
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



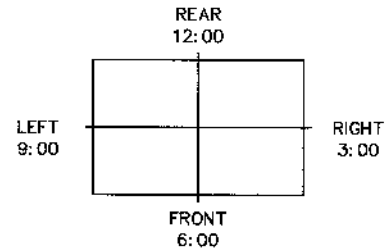
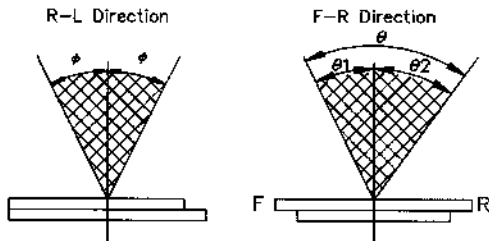
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product
The Viewing Direction is 6 O'clock
So $\theta_1 > \theta_2$

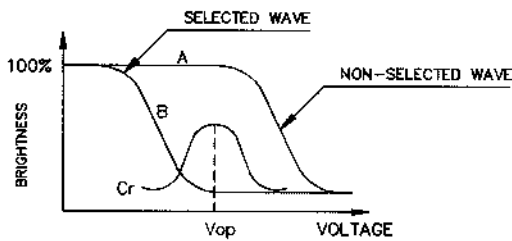
$$\theta = \theta_1 + \theta_2$$

*Conditions

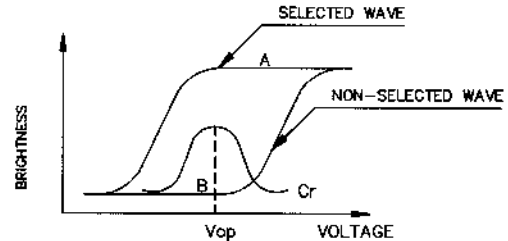
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

$$\text{Contrast Ratio : } Cr = A/B$$

*Conditions

Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

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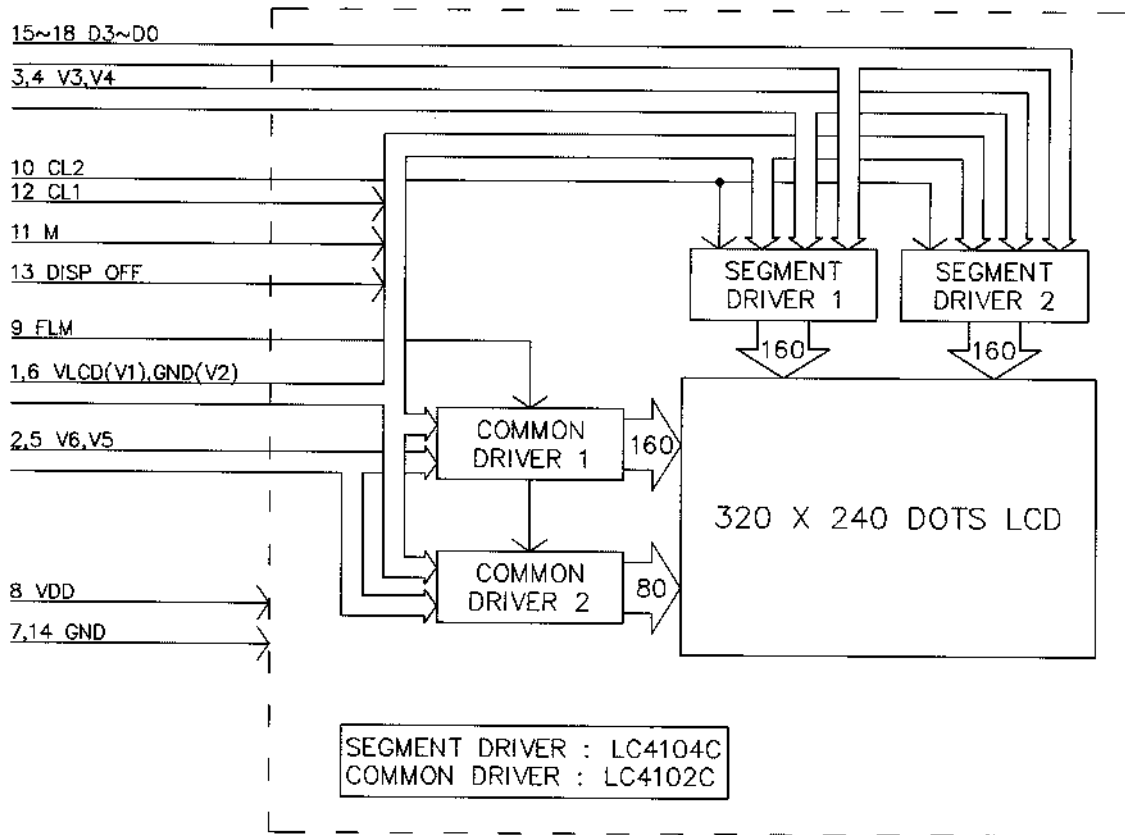
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5. BLOCK DIAGRAM



Note :

- 1) Controller and bias voltage supply circuit are not included.
- 2) VLCD(V1), GND(V2), V6, V3, V4 and V5 are power supply voltage for LCD.
(V1 > V6 > V3 > V4 > V5 > V2)

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6. INTERNAL PIN CONNECTION

PIN NO.	SYMBOL	FUNCTION
1	VLCD(V1)	Bias voltage(Liquid crystal drive voltage)
2	V6	Bias voltage(V1>V6>V3>V4>V5>V2)
3	V3	
4	V4	
5	V5	
6	GND(V2)	(GND:0V)
7	GND	0V
8	VDD	Power supply voltage: +3.0V typ
9	FLM	Frame signal(sync. Of display)
10	CL2	Display data shift clock
11	M	LCD drive signal(AC signal)
12	CL1	Display data latch signal
13	DISP OFF	Display ON/OFF control signal("H": Display ON, "L": Display OFF)
14	GND	0V
15	D3	Display data
16	D2	
17	D1	
18	D0	

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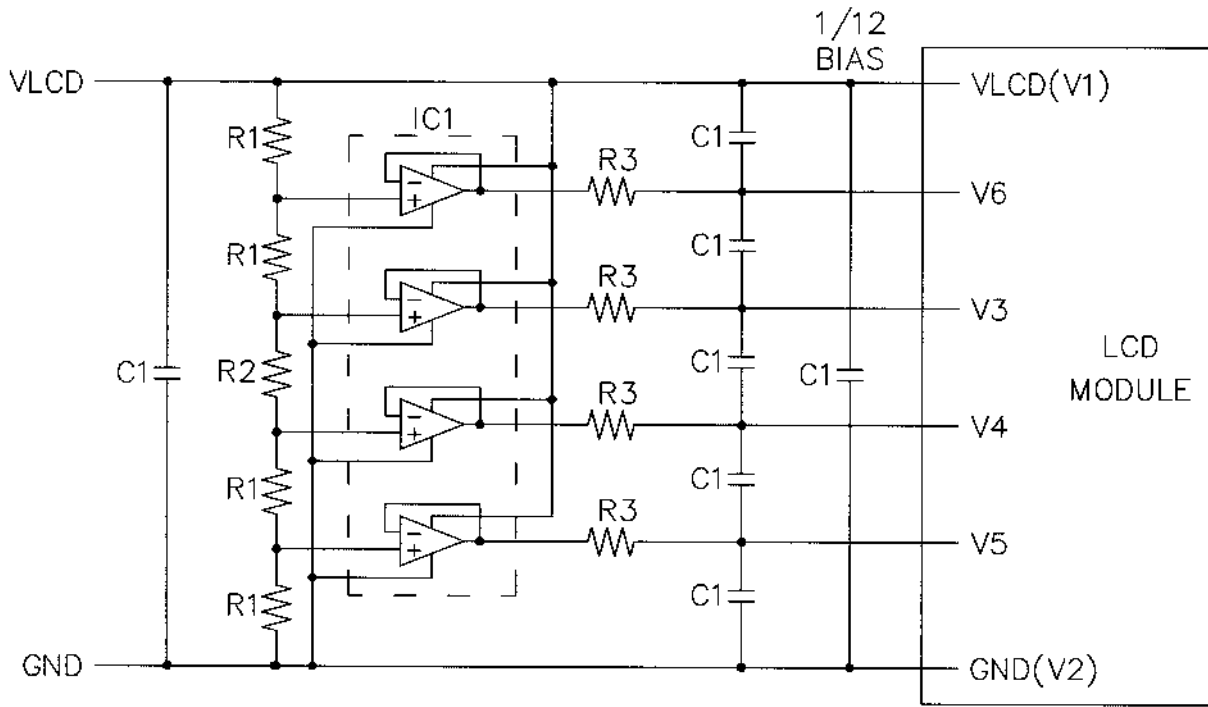
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7. POWER SUPPLY



IC1 : LP324M(NATIONAL SEMICONDUCTOR)
 R1 : 22(KOHM) \pm 0.5%, R2 : 180(KOHM) \pm 2%, R3 : 4.7(OHM) \pm 5%
 C1 : 2.2-4.7(uF)

Note : These are general values.
 In case to decrease LCD driving voltage with minimizing bias value, set these values with check display to avoid display's deterioration (response etc).

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8. TIMING CHARACTERISTICS

8-1. INTERFACE TIMING

Ⓢ VDD=3.0V±10%, Ta=-20~70 °C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CL2 Cycle Time	tC	Fig.a	82	-	-	ns
CL2 Pulse Width	tSWH,tSWL	Fig.a	28	-	-	ns
CL2 Rise/Fall Time	tCR,tCF	Fig.a	-	-	50	ns
Data Set Up Time	tDSU	Fig.a , Fig.b	100	-	-	ns
Data Hold Time	tDHD	Fig.a , Fig.b	30	-	-	ns
CL1 Cycle Time	tL	Fig.b	250	-	-	ns
CL1 "H" Pulse Width	tLWH	Fig.a , Fig.b	100	-	-	ns
CL1 Rise/Fall Time	tLR,tLF	Fig.b	-	-	30	ns
CL2 To CL1 Delay Time	tCL	Fig.a	30	-	-	ns
CL1 To CL2 Delay Time	tLC	Fig.a	-	-	200	ns
FLM TO CL1 SETUP TIME	tFLS	Fig.b	30	-	-	ns
FLM TO CL1 HOLD TIME	tFLH	Fig.b	50	-	-	ns

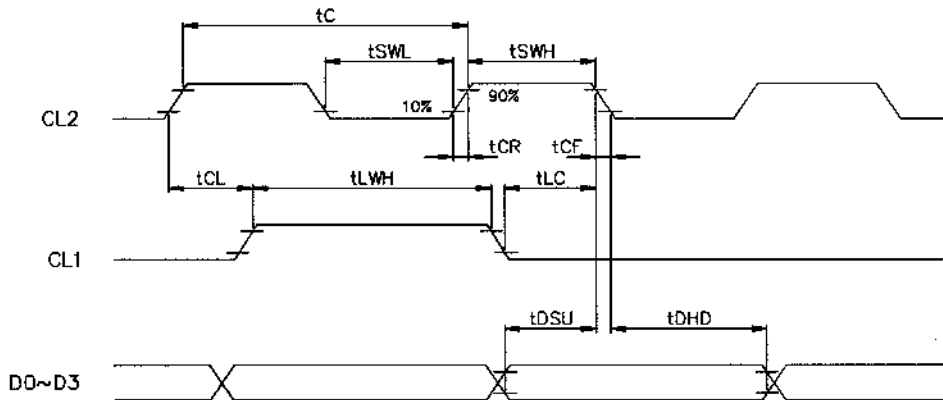


Fig . a Interface timing (SEGMENT)

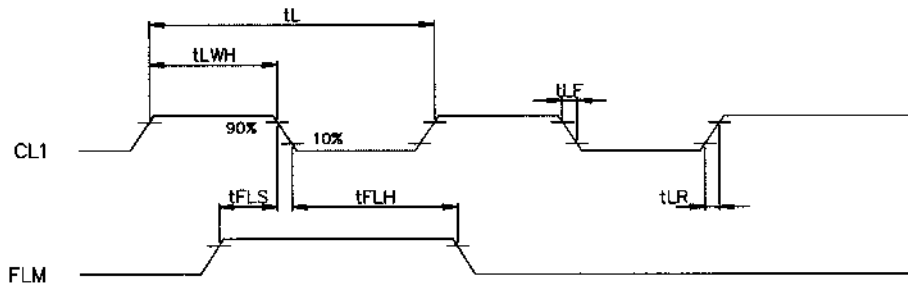


Fig . b Interface timing (COMMON)

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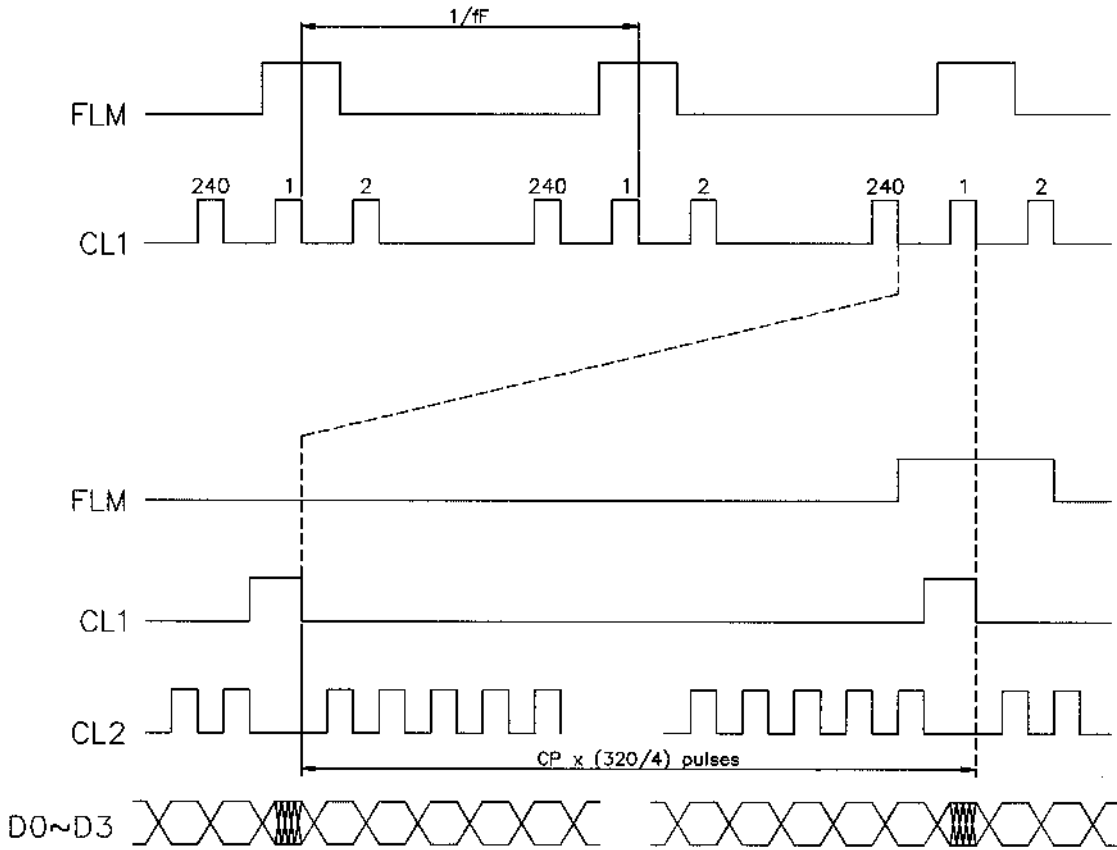
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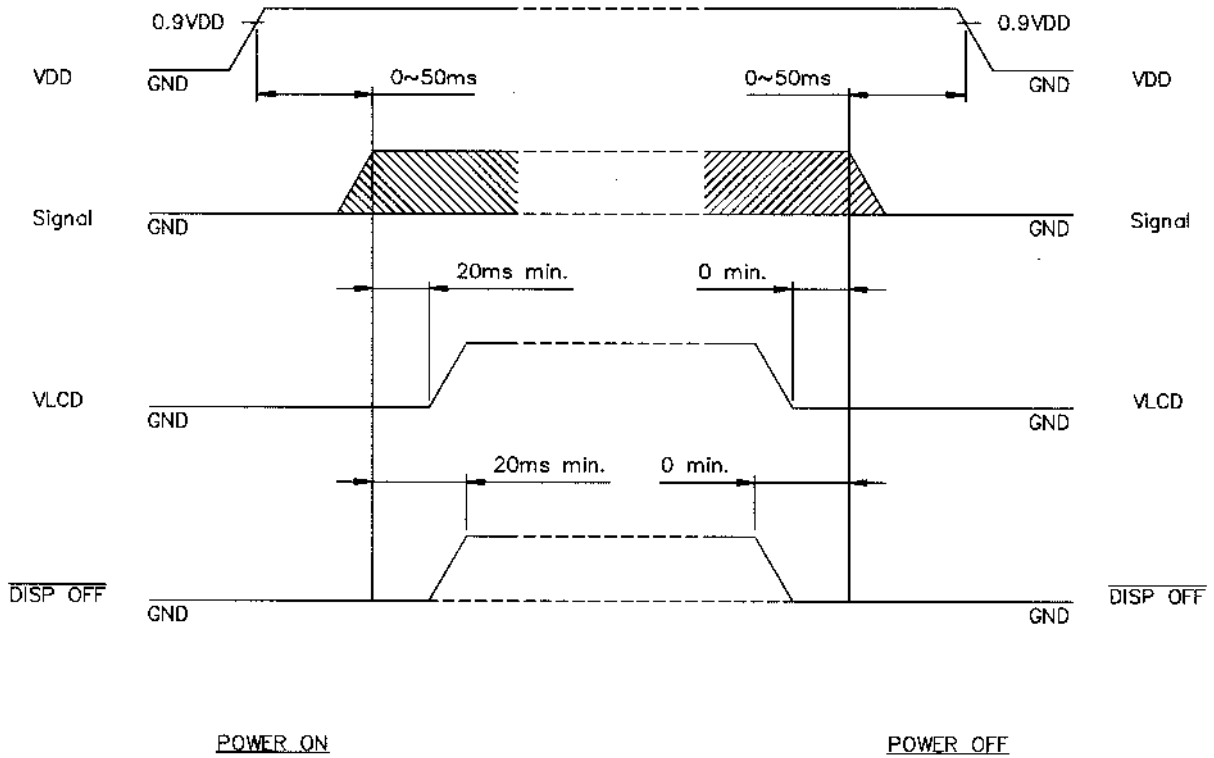
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8-2.TIMING CHART OF INPUT SIGNAL



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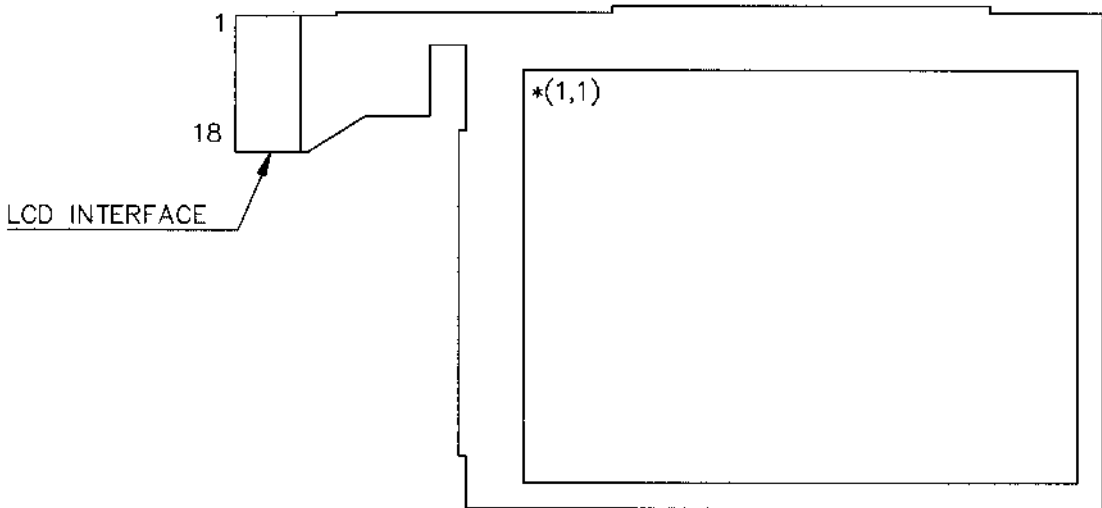
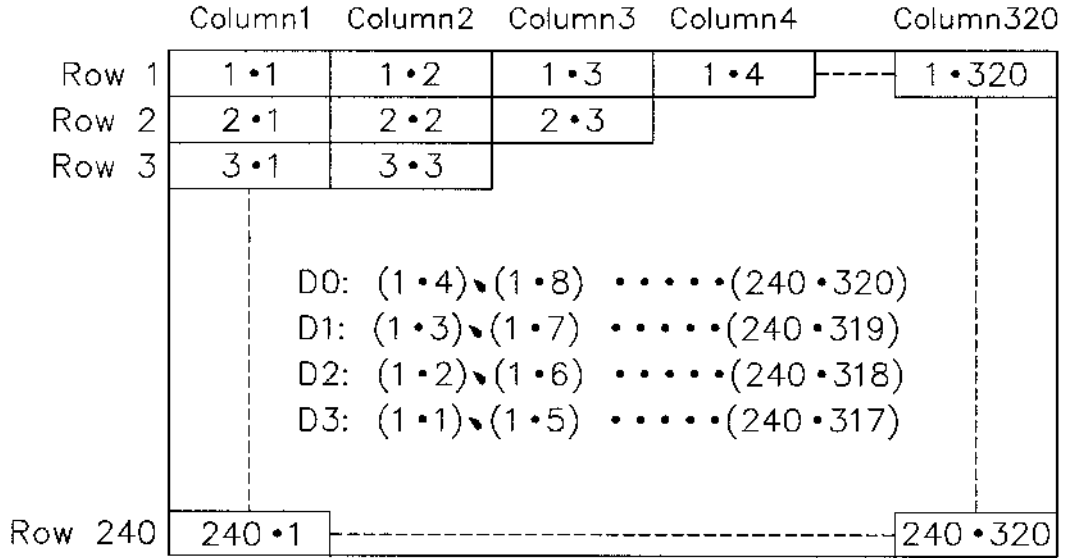
8-3. POWER ON/OFF TIMING



The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

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8-4.DISPLAY PATTERN



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9. RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	HIGH TEMP. Storage	70°C	120HR		Appearance without defect	
2	LOW TEMP. Storage	-20°C	120HR		Appearance without defect	
3	HIGH TEMP. & HIGH HUMI. Storage	40°C 90%RH	120HR		Appearance without defect	
4	THERMAL SHOCK	-20°C, 30min → 25°C, 5min → 70°C, 30min → 25°C, 5min (1cycle)			Appearance without defect	5 cycles

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NOTICE:

- SAFETY

- 1.If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
- 2.If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- HANDLING

- 1.Avoid static electricity which can damage the CMOS LSI.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate of the display is very fragile. So, please handle it very carefully.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- 5.Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

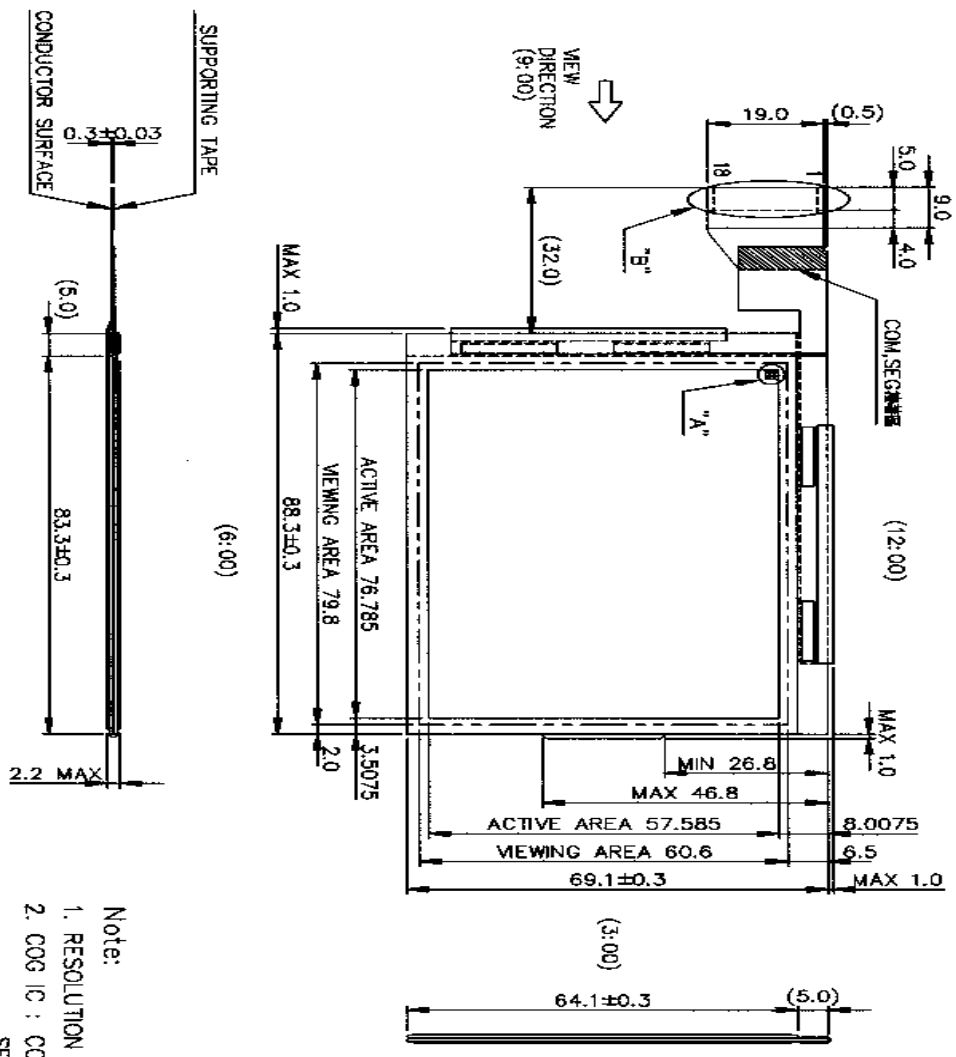
- STORAGE

- 1.Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
- 2.Do not place the module near organics solvents or corrosive gases.
- 3.Do not crush, shake, or jolt the module.

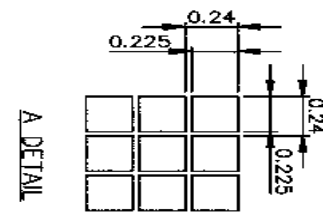
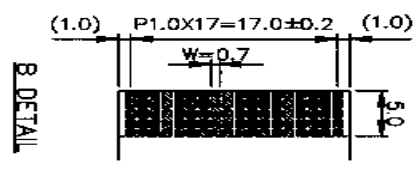
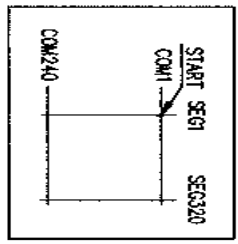
- TERMS OF WARRANT

- 1.Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.

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- Note:
1. RESOLUTION : 320x240 DOTS
 2. COG IC : COM LC4102C
SEG LC4104C



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