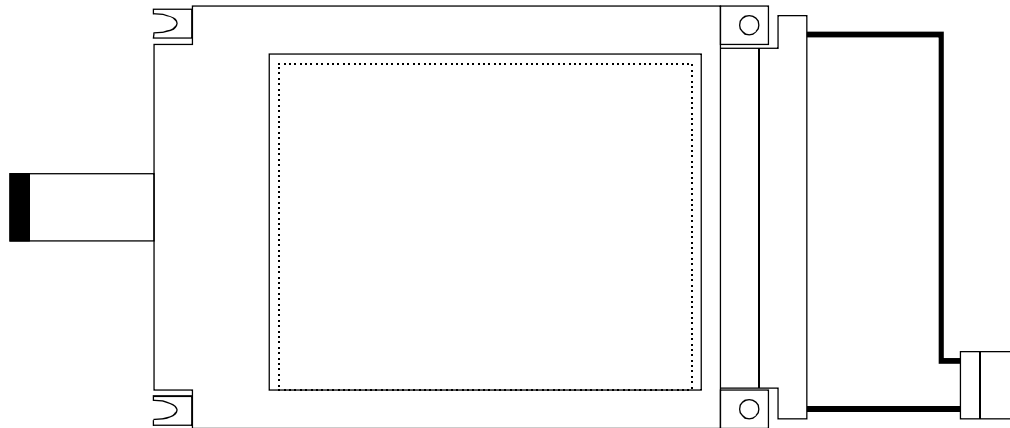




PRODUCT SPECIFICATION

HDM3224-2

320 x 240 GRAPHICS
LCD DISPLAY MODULE



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1. MECHANICAL DATA

(1) Product No.	HDM3224-2
(2) Module Size	168 (W)mm x 111.0 (H)mm x 7.4 (D)mm (CCFT B.L.)
(3) Dot Size	0.33 (W)mm x 0.33 (H)mm
(4) Dot Pitch	0.36 (W)mm x 0.36 (H)mm
(5) Number of Dots	320 (W) x 240 (H)Dots
(6) Duty	1/240
(7) LCD Display Mode	FSTN: Black and White(Normally Black/Negative Image) Rear Polarizer: Transmission
(8) Viewing Direction	6 O'clock
(9) Backlight	CCFT
(10) Controller	Excluded
(11) DC/DC Converter	Excluded
(12) Weight	180 g(APPROX)

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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V STANDARD

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	7.0	V	
Power Supply for LCM	VEE-VSS	0	30.0	V	
Input Voltage	VI	-0.3	VDD	V	
Static Electricity	-	-	-	-	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-30	80
Humidity (Without Condensation)	Note 2,3,5		Note 2,4	

Note 1 LCM should be grounded during handling LCM.

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

Note 3 $T_a \leq 70^\circ\text{C}$: 75%RH max
 $T_a > 70^\circ\text{C}$: Absolute humidity must be lower
than the humidity of 75%RH at 70°C

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

Note 5 Operation temp not include CCFL Lamp

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3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS OF LCM

(VDD = 5V±5%)

ITEM			SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Power Supply for Logic			VDD-VSS	-	4.75	5.0	5.25	V	
Recommended LC Driving Voltage (Wide Temp. LCM)			VLCD-VSS	Duty=1/240 Bias=1/13	-20°C	24.6	25.0	25.4	V
					0°C	23.6	24.0	24.4	
					25°C	22.8	23.2	23.6	
					50°C	21.7	22.1	22.5	
					70°C	20.8	21.2	21.6	
Input Voltage			V _{IH}	H level	0.7VDD	-	VDD	V	
			V _{IL}	L level	0	-	0.3VDD		
Power Supply Current			IDD	FLM = 70 Hz VSS = 0 V VLCD = 23.2 V VLCD-VSS= 23.2 V	-	0.5	-	mA	
			I _{LCD}	PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □	-	6.0	-		
LCM	Surface Luminance	CCFL	T203G1K	VSS=0V VLCD-VSS=23.2V	PATTERN: (Dots All Off)	-	12	-	cd/m ²
			T203G1K		PATTERN: (Dots All ON)	-	170	-	

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used CCFL Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp voltage	V _L	-	260	-	Vrms	-
Lamp current	I _L	2	5	6	mArms	-
Lamp power consumption	P _L	-	2.53	-	W	(*1)
Lamp frequency	F _L	20	35	50	KHz	-
Lamp life time	L _L	-	20000	-	hrs	I _L = 5 mArms (*2)

(*1) Power consumption excluded inverter loss .

(*2) Lamp life time is defined as follows : The final brightness is at 50% of original brightness

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4. OPTICAL CHARACTERISTICS

(For Wide Temperature Mode LCM)

AT Vop

ITEM		Cr(Contrast Ratio)										θ (Viewing Angle)		ϕ (Viewing Angle)	
		-20°C		0°C		25°C		50°C		70°C		50°C		50°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	G	10.0	10.5	20.0	20.5	22.5	23.0	8.0	8.5	3.5	4.0	-	F: 55 R: 55	-	R: 50 L: 40
NOTE		NOTE 6										NOTE 5			

NOTE :

T : TRANSMISSIVE

G : NORMALLY BLACK

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20°C	-	2000	3300	ms	NOTE 2
		0°C	-	350	450		
		25°C	-	140	190		
		50°C	-	70	90		
		70°C	-	60	75		
Response Time (fall)	Tf	-20°C	-	3400	4400	ms	NOTE 2
		0°C	-	680	880		
		25°C	-	230	280		
		50°C	-	110	130		
		70°C	-	70	85		

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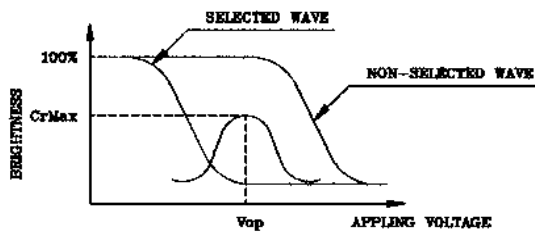
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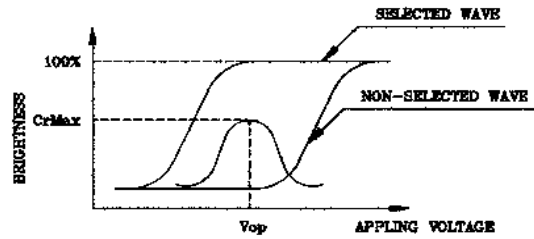
DATE:
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



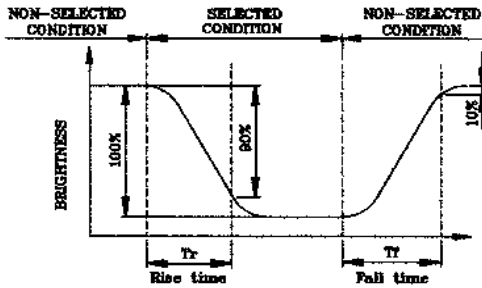
(negative type)

*Conditions

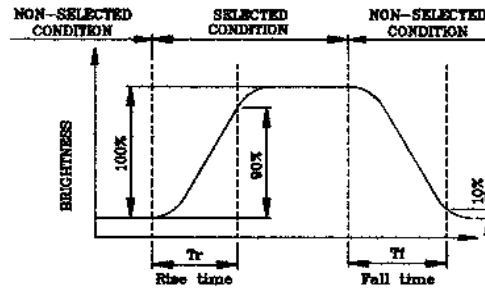
Viewing Angle : 0
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



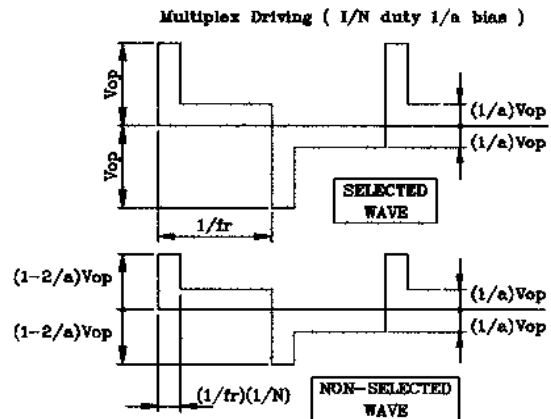
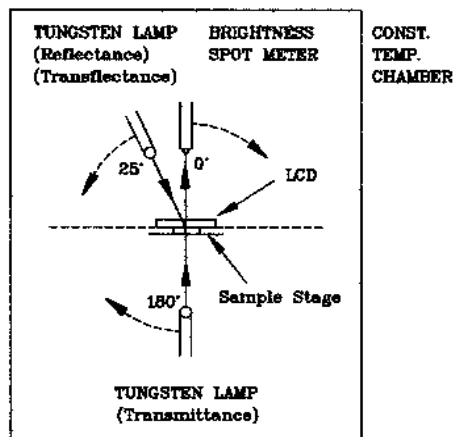
(negative type)

*Conditions

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

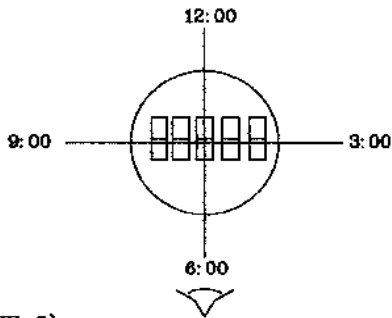
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



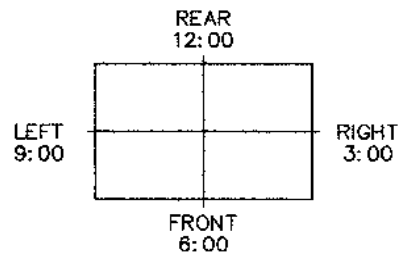
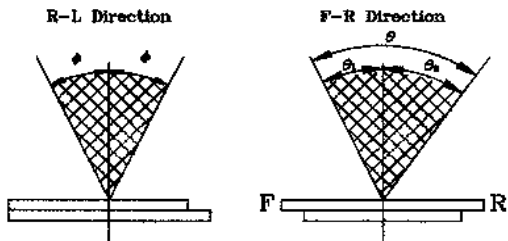
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

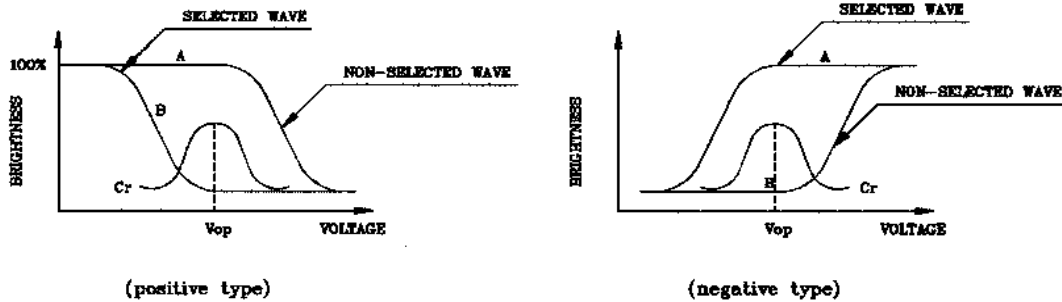
$$\theta = \theta_1 + \theta_2$$

*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)



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

*Conditions

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

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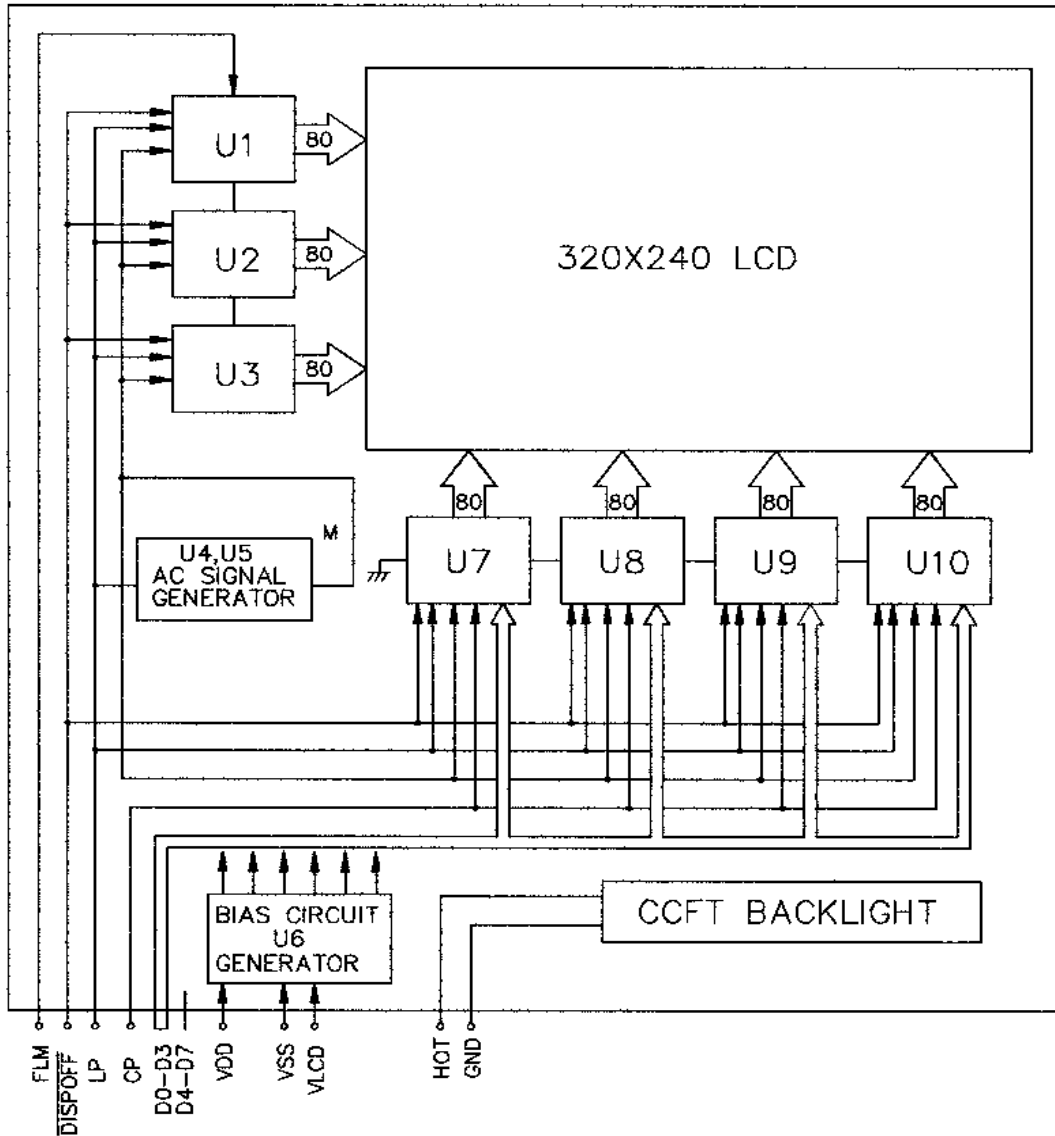
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5. BLOCK DIAGRAM



* AC SIGNAL SETTING

J1	J2	J3	J4	J5	J6	J7	J8
L	H	L	L	H	L	L	L

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6. INTERNAL PIN CONNECTION

LCD :

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	FLM	H	SCAN START-UP SIGNAL
2	LP	H→L	INPUT DATA LATCH SIGNAL
3	CP	H→L	DATA INPUT CLOCK SIGNAL
4	DISPOFF	H/L	H: ON/L: OFF
5	VDD	-	POWER SUPPLY FOR LOGIC(+5V)
6	VSS	-	SIGNAL GROUND(0V)
7	VLCD	-	POWER SUPPLY FOR LCD
8	D0	H/L	DISPLAY DATA SIGNAL
9	D1	H/L	
10	D2	H/L	
11	D3	H/L	
12	D4	-	NO CONNECTION
13	D5	-	
14	D6	-	
15	D7	-	
16	VSS	-	SIGNAL GROUND(0V)

CCFL CONNECTOR : M63M83-04(MITSUMI)

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	HOT	-	POWER SUPPLY FOR CCFT (HOT)
2	NC	-	NO CONNECTION
3	NC	-	NO CONNECTION
4	GND	-	POWER SUPPLY FOR CCFT (GND)

LCD INTERFACE CABLE :

FFC,N16,Pitch 1.0 mm (Thickness = 0.3 mm)

CORRESPONDABLE LCD CONNECTOR :

MOLEX 52207-1690 or COMPATIBLE

CCFL CONNECTOR :

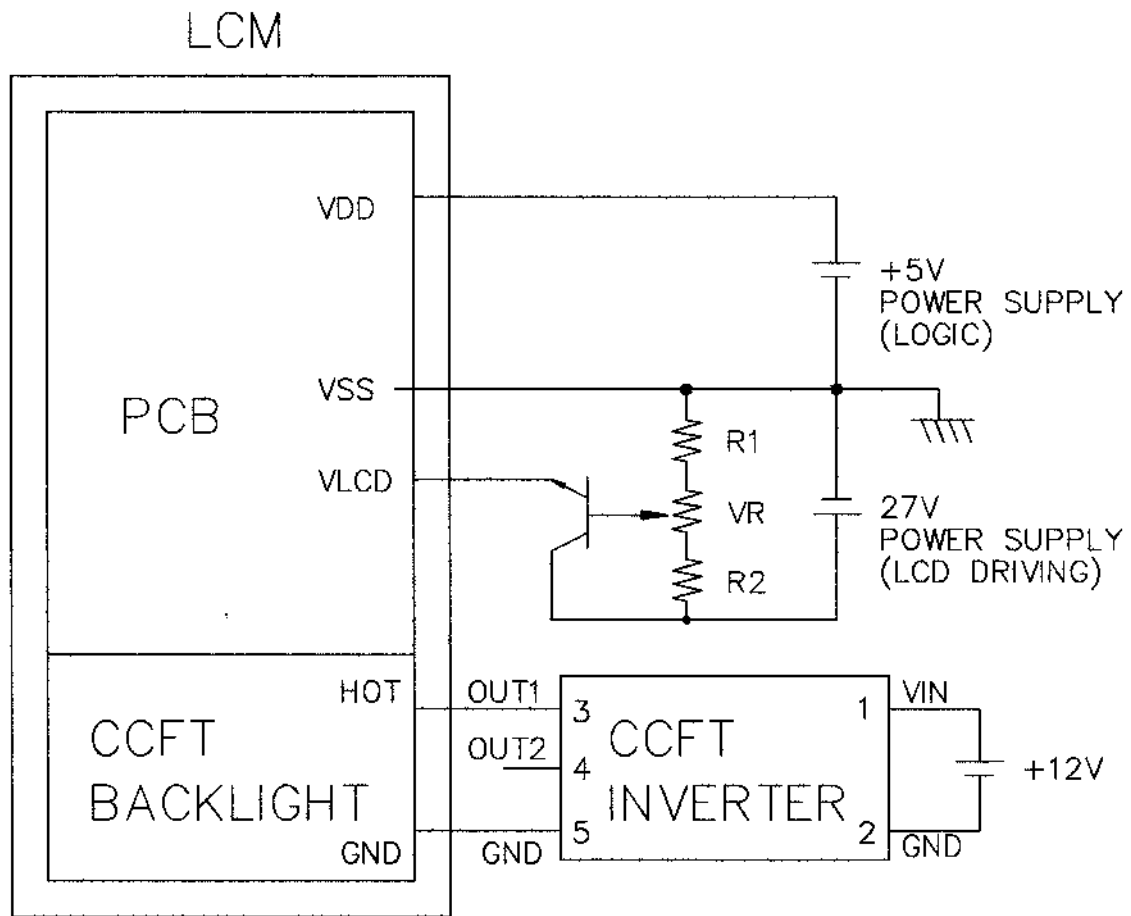
M63M83-04 (MITSUMI)

CORRESPONDABLE CCFL CONNECTOR :

M60-04-30-134P or M60-04-30-114P or M61M73-04 (MITSUMI)

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7. POWER SUPPLY



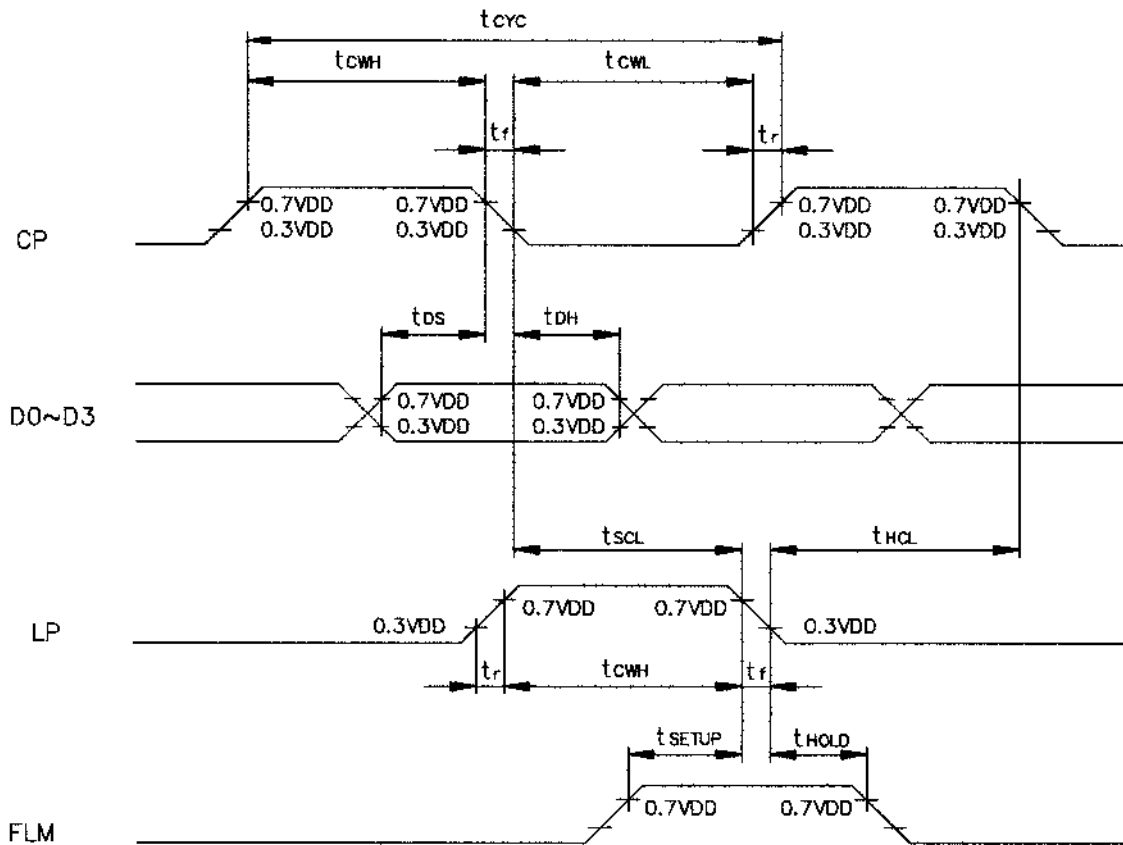
1. $R1 + VR + R2 = 10K \sim 20K \Omega$

2. RECOMMENDED CCFT INVERTER : CXA-M10L-L(TDK)
CXA-L10L(TDK)

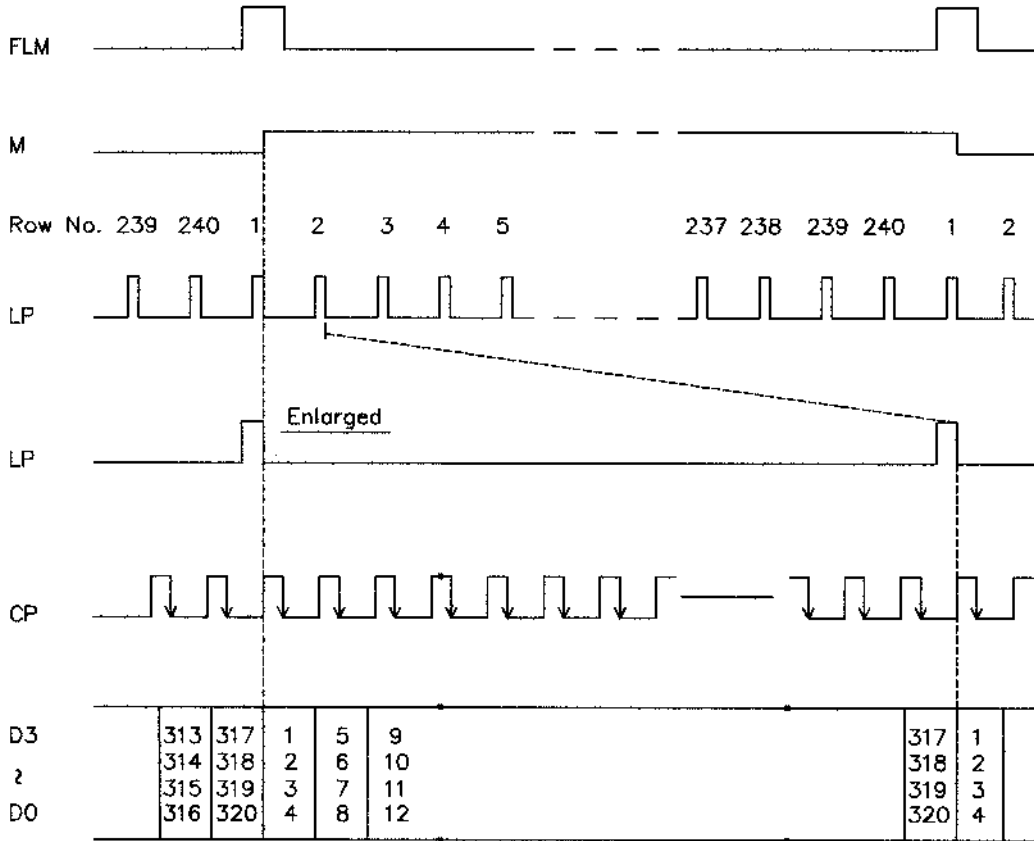
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8-1. TIMING CHARACTERISTICS

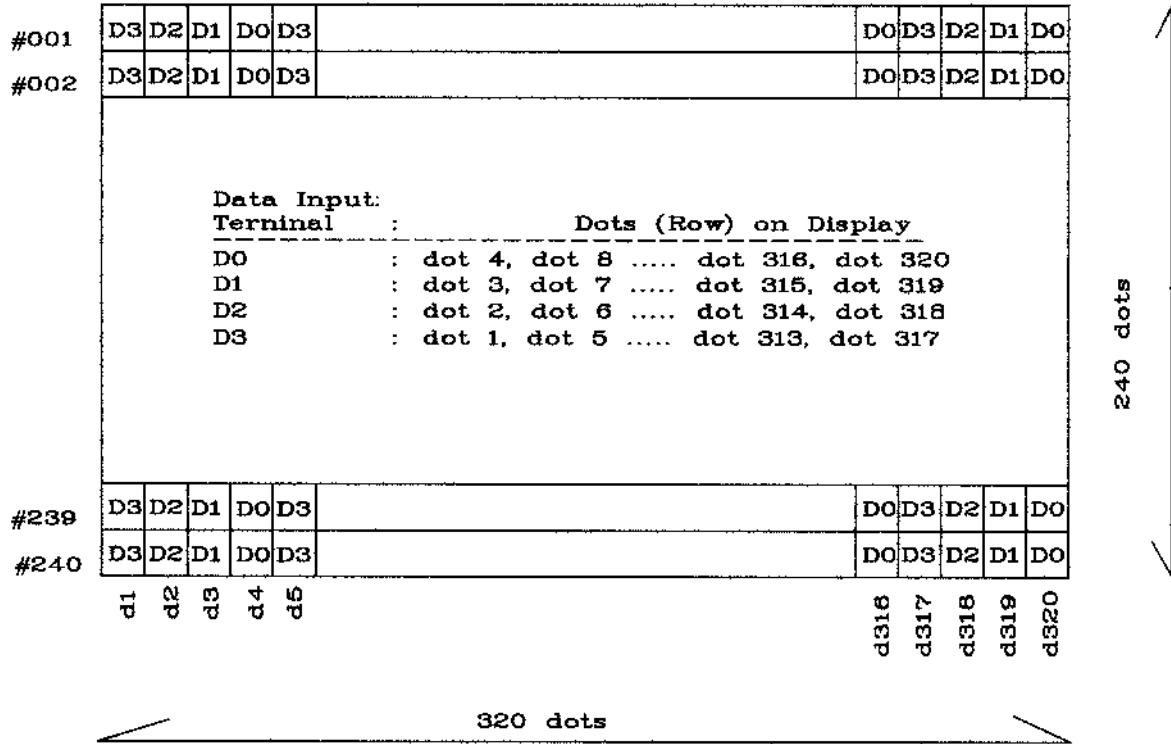
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLOCK CYCLE TIME	t_{cyc}	152	-	-	ns
CLOCK HIGH LEVEL WIDTH	t_{cwh}	65	-	-	ns
CLOCK LOW LEVEL WIDTH	t_{cwl}	65	-	-	ns
CLOCK RISE TIME	t_r	-	-	50	ns
CLOCK FALL TIME	t_f	-	-	50	ns
DATA SETUP TIME	t_{ds}	50	-	-	ns
DATA HOLD TIME	t_{dh}	40	-	-	ns
CLOCK SETUP TIME	t_{scl}	65	-	-	ns
CLOCK HOLD TIME	t_{hcl}	65	-	-	ns
FRAME SETUP TIME	t_{setup}	100	-	-	ns
FRAME HOLD TIME	t_{hold}	100	-	-	ns



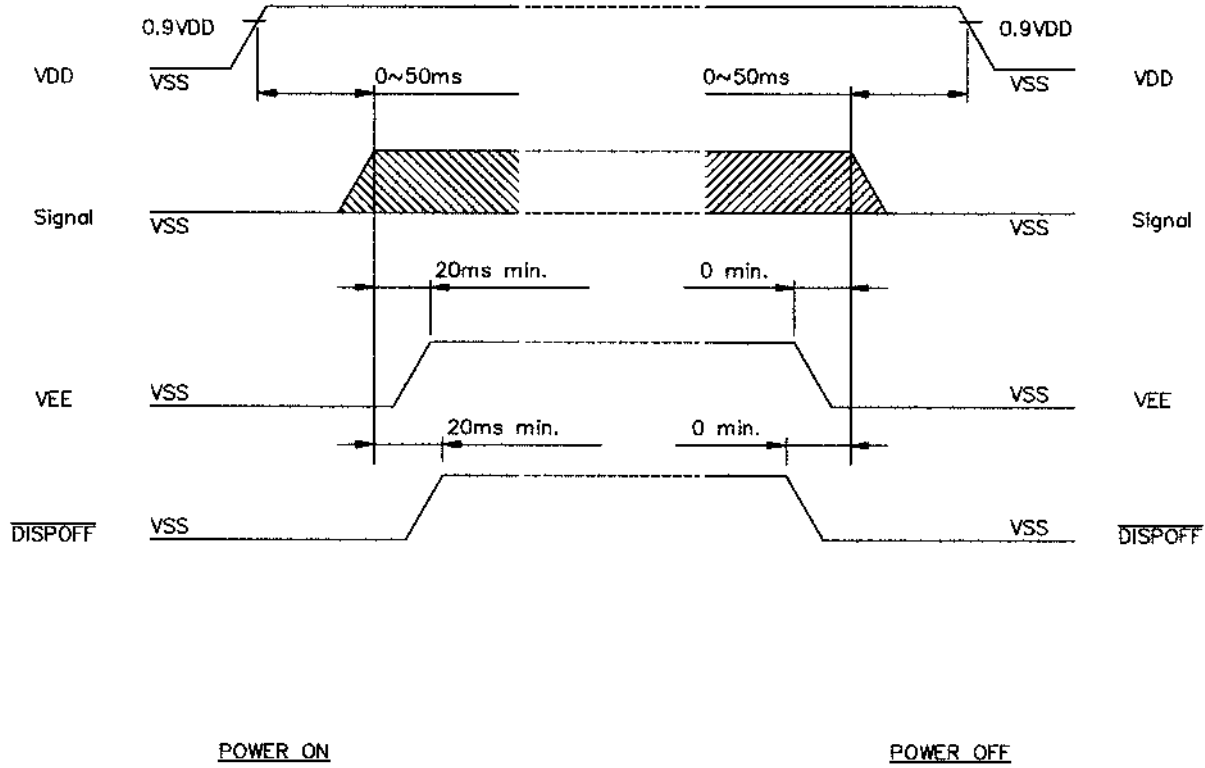
8-2. TIMING CHART OF INPUT SIGNALS



8-3.DISPLAY PATTERN



8-4. POWER ON/OFF TIMING



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

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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.

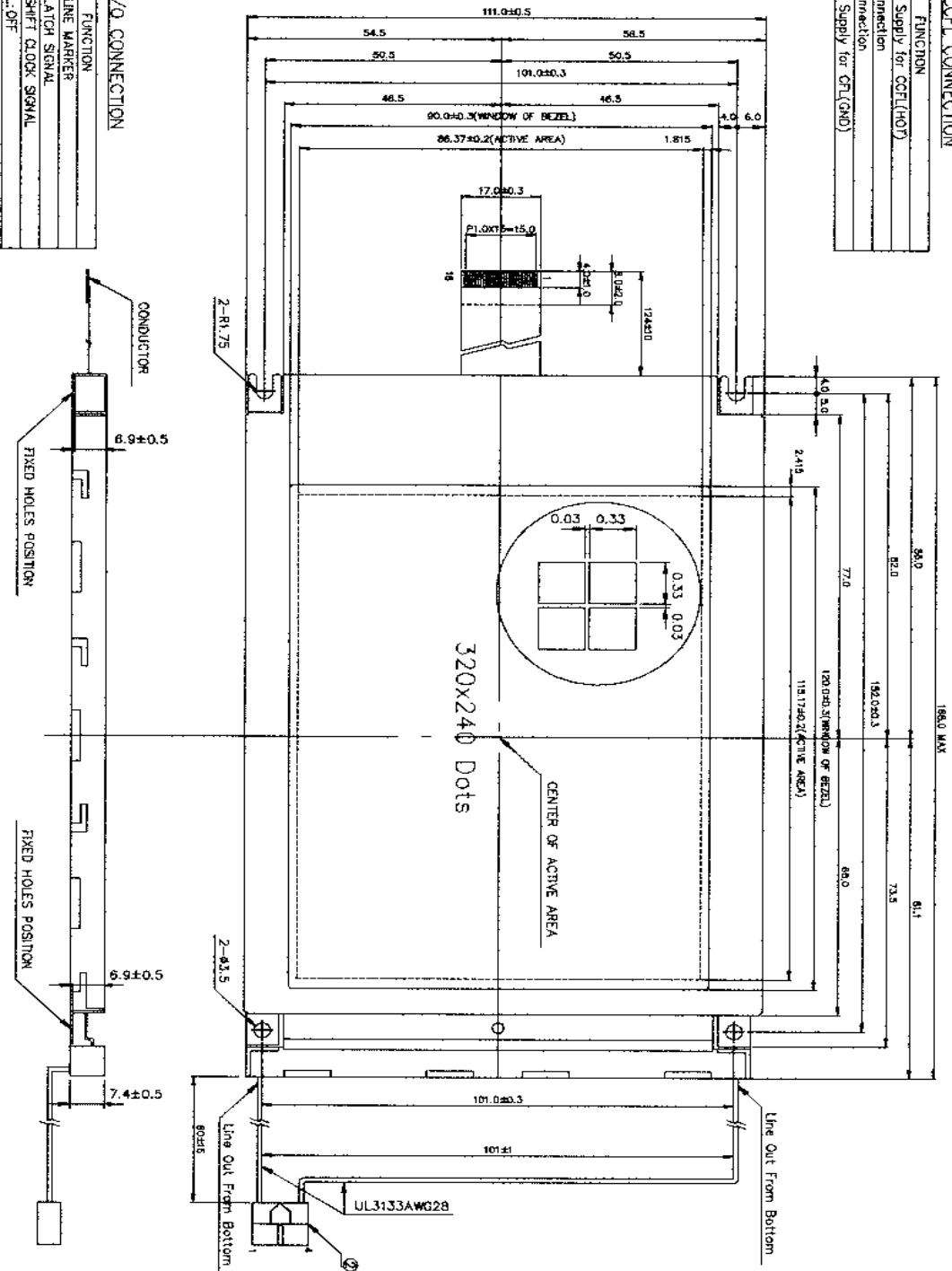
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PIN ASSIGNMENT OF COFL CONNECTION

Pin No.	SYMBOL	LEVEL	FUNCTION
1	HOT	-	Power Supply for COFL(HOT)
2	NC	-	No Connection
3	NC	-	No Connection
4	GND	-	Power Supply for COFL(GND)

PIN ASSIGNMENT OF I/O CONNECTION

Pin No.	SYMBOL	LEVEL	FUNCTION
1	FLM	H/L	FIRST LINE MARKER
2	LP	H/L	DATA LATCH SIGNAL
3	CP	H/L	DATA SHIFT CLOCK SIGNAL
4	DISPCK	H/L	H-ON/L-OFF
5	VDD	-	POWER SUPPLY FOR LOGIC
6	VSS	-	GND
7	VLCD	-	POWER SUPPLY FOR LCD DRIVER (+)
8	D0	H/L	Display Data
9	D1	H/L	Display Data
10	D2	H/L	Display Data
11	D3	H/L	Display Data
12	D4	-	No Connection
13	D5	-	No Connection
14	D6	-	No Connection
15	D7	-	No Connection
16	VSS	-	GND



NOTE :

1. RESOLUTION : 320 X 240 DOTS
2. CONTROLLER : EXCLUDED
3. DC/DC CONVERTER : EXCLUDED
4. \varnothing INTERFACE CONNECTOR
FFC, M16 P1.0mm
 \varnothing COFL CONNECTOR
MS3M83-04(MITSUMI)
5. TOLERANCE NO SPECIFIED : ± 0.5 mm

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