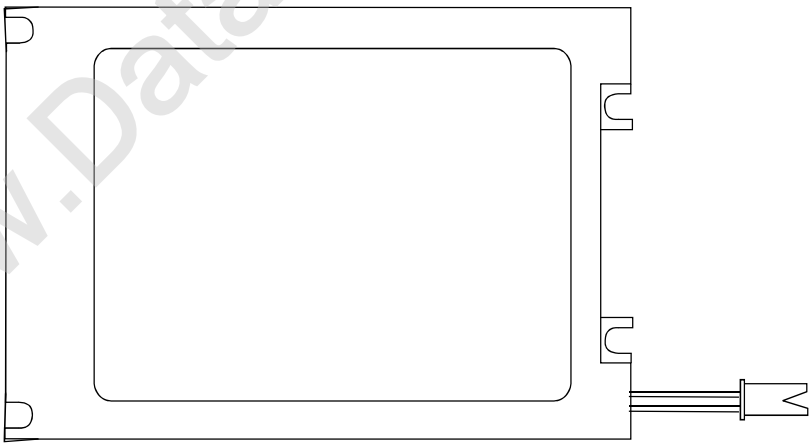
HANTRONIX

PRODUCT SPECIFICATION

HDM3224-CL

320x240 COLOR GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	**Q.A.:** JK	**REV.:** 2.0	HDM3224-CL	SHEET 1 OF 20 **DATE:** 3/7/03

1. MECHANICAL DATA

(1) Product No.		**HDM3224-CL**
(2) Module Size		154.6 (W)mm x 114.8 (H)mm x 9.0 (D)mm
(3) Dot Size		0.09 (W)mm x 0.33 (H)mm
(4) Dot Pitch		0.12 (W)mm x 0.36 (H)mm
(5) Number of Dots		320 (W)xRGB x 240 (H)DOTS
(6) Duty		1/240
(7) LCD	F-STN:	Color STN module
	Rear Polarizer:	Color Transmissive Type
(8) Viewing Direction		6 O'clock
(9) Backlight		CCFL
(10) Controller		Excluded
(11) DC/DC Converter		**Included**
(12) Weight		195 g(approx.)

2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	−0.3	7.0	V	
Input Voltage	VI	−0.3	VDD+0.3	V	
Vcon Voltage	Vcon	1.0	3.0	V	
Static Electricity	−	−	−	−	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	−20	70
Humidity (Without Condensation)	Note 2,4		Note 3,4	
Vibration	Note 5			

Note 1 LCM should be grounded during handling LCM.

Note 2 Ta ≦ 50°C : 85%RH max
Ta > 50°C : Absolute humidity must be lower than the humidity of 85%RH at 50°C

Note 3 Ta at −20°C will be < 48 hrs, at 70°C will be < 120 hrs

Note 4 Background color will change slightly depending on ambient temperature. That phenomenon is reversible.

Note 5

Frequency	5 Hz~13.95 Hz	13.95 Hz~33 Hz	33 Hz~51 Hz	51 Hz~500 Hz
Vibration Level	−	2X9.8 m/s²	−	5x9.8 m/s²
Vibration Width	0.2 inch	−	0.036 inch	−
Vibration Direction	X/Y/Z			
Vibration Time	20 min/cycle X 3 directions			

3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS OF LCM

Ta=25°C, VDD=5V±5%

ITEM		SYMBOL		CONDITION	MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply		VDD-VSS		Ta= 25°C	4.5	5.0	5.5	V
Input Voltage		VIH		H level	0.8VDD	–	VDD	V
		VIL		L level	0	–	0.2VDD	V
Contrast Adjust Voltage		Vcon-Vss		Duty=1/240 Bias=1/13 VDD=5.0V 0°C 50°C	1.0	1.8	3.0	V
Supply Current for Logic		IDD		VDD-VSS = 5.0V VCON-VSS = 1.8V Ta= 25°C PATTERN:	–	33.0	50.0	mA
		ICON			–	0.7	1.0	
LCM	Surface Luminance	L	T606M	PATTERN: (Dots All On of White Color)	–	194	–	cd/m²
			T606M	PATTERN: (Dots All Off)	–	6.3	–	

3–2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used lamp : Rating

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	V_L	–	474	–	Vrms	–
Lamp current	I_L	2	5	6	mArms	
Lamp power consumption	P_L	–	2.37	–	W	(*1)
Starting Voltage	V_S	–	–	750	Vrms	Ta=25°C
		–	–	940	Vrms	Ta=0°C
Lamp frequcncy	F_L	35	50	65	KHz	
Lamp life time	L_L	–	40000	–	hrs	IL = 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 .

3.3 RECOMMENDED INVERTER (TDK TBD086N-3) (Brightness Fixed)

TDK TBD086N-3

3-3-1 GENERAL SPECIFICATIONS

OPERATION TEMPERATURE : 0°C~55°C
STORAGE TEMPERATURE : -20°C~80°C
DIMENSION : 95.0(L)mm x 19.5(W)mm x MAX 6.5(H)mm

3-3-2 INPUT CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARKS
Input Voltage	Vin	11.4	12.0	12.6	V	
Input Current	Iin	-	250	300	mA	
CTL Input Voltage	Vrmt	2.8	3	3.2	V	ON state
		-0.5	0	0.5	V	OFF state

3-3-3 PIN ASSIGNMENTS

INPUT (CN1) CONNECTOR :
MOLEX 53261-0590 or E&T 3802-05

NO.	FUNCTION
1	VIN(12.0V)
2	GND
3	Vrmt
4	N.C
5	N.C

OUTPUT (CN2) CONNECTOR :
JST SM02-(8.0)B-BHS-1

NO.	FUNCTION
1	HV
2	RTN

3-3-4 OUTPUT CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARKS
Input Voltage	VIN	11.4	12.0	12.6	V	
Tube Current	IL	-	5.0	-	mA	

Note : Inverter must be used in the range of VIN Input Voltage.
If it doesn't used in this range, the electrical characteristics of backlight would not be to guarantee.

4.OPTICAL CHARACTERISTICS

4-1.Optical Char. of Normal Temp. Mode

AT Vop

ITEM / MODE		Cr(Contrast Ratio)						θ(Viewing Angle)		ϕ(Viewing Angle)	
		0℃		25℃		50℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	M	20	30	25	35	5	10	–	F:60 R:40	–	±55
NOTE		NOTE 6						NOTE 5			

note:

T: TRANSMISSIVE

M: FOR 6 O'CLOCK STN MODULE

AT ϕ=0° θ=0°

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	–	750	900	ms	NOTE 2
		25℃	–	300	400		
		50℃	–	130	160		
Response Time (fall)	Tf	0℃	–	350	450	ms	NOTE 2
		25℃	–	80	120		
		50℃	–	60	70		

4−2.Color of CIE Coordinate

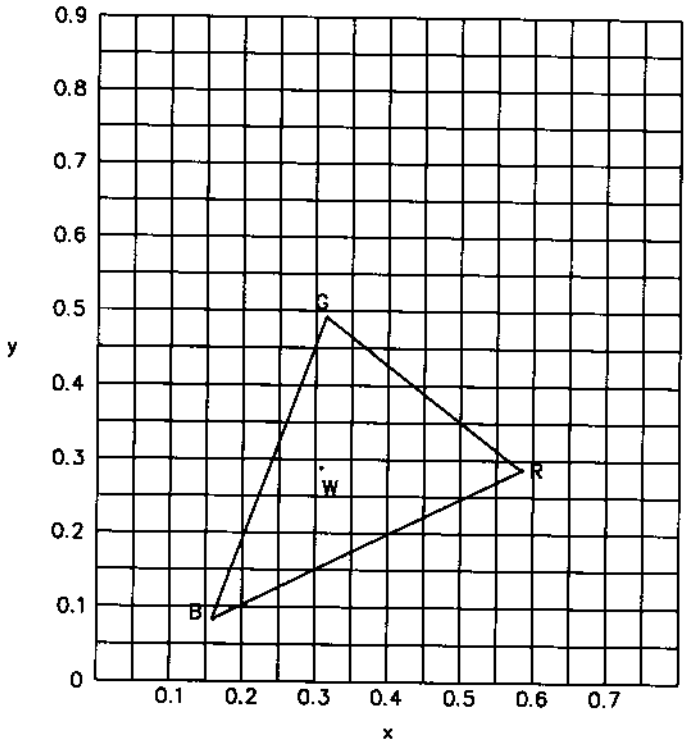
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m²)	NOTE
Color of CIE Coordinate	Red	X	ϕ=0°, θ=0°	0.583	59.6	Note✱
		y		0.291		
	Green	X		0.318	118.0	
		y		0.499		
	Blue	X		0.154	29.5	
		y		0.084		
	White	X		0.316	194.0	
		y		0.263		

Note✱ Measuring at position 3 on Fig.1
CIE chromaticity diagram

Tolerance : ±0.05

Fig.1



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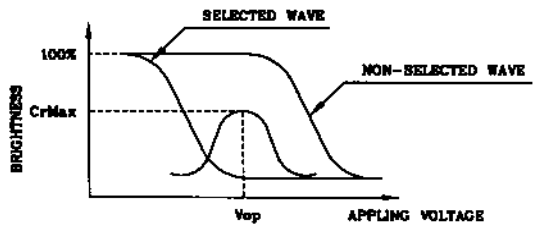
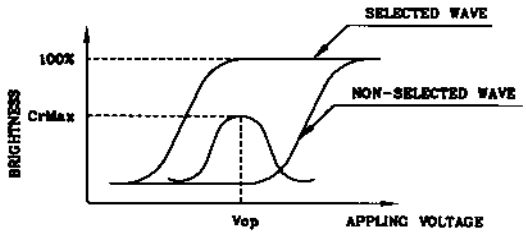
(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



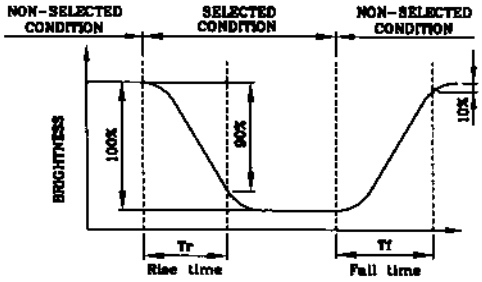
(negative type)

*Conditions

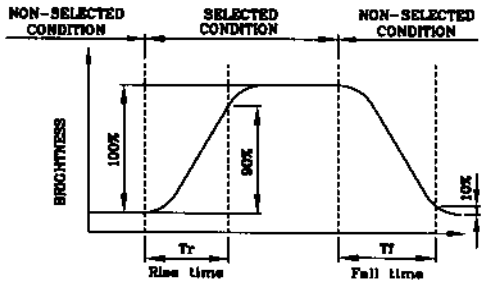
Viewing Angle : 0
Frame Frequency : 140Hz
Appling Waveform : I/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



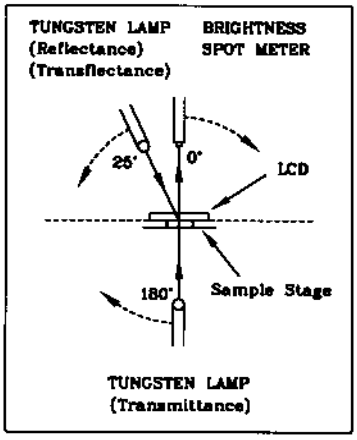
(negative type)

*Conditions

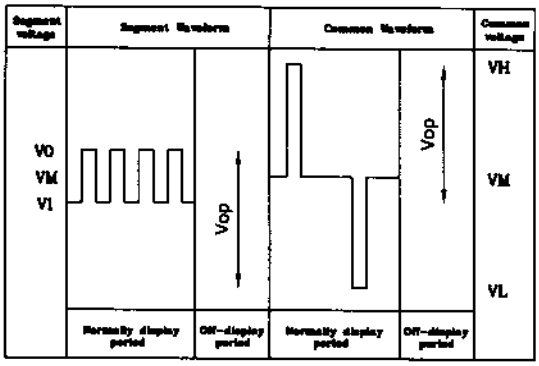
Operating Voltage : Vop
Viewing Angle (ϕ,θ) : (0,0)
Frame Frequency : 140Hz
Appling Waveform : I/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



The voltage relationship of each signal is as follow
Multiplex Driving (1/N duty 1/a bias)



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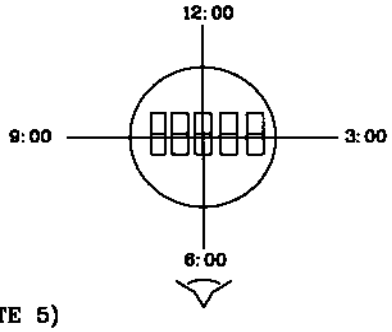
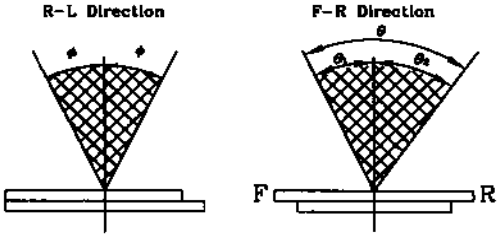
(NOTE 4)

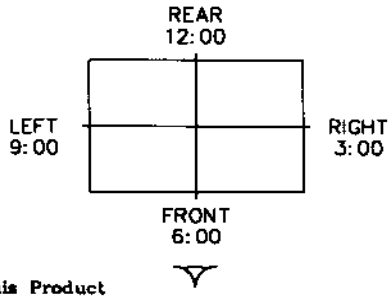
Definition of Viewing Direction



(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 : Vop

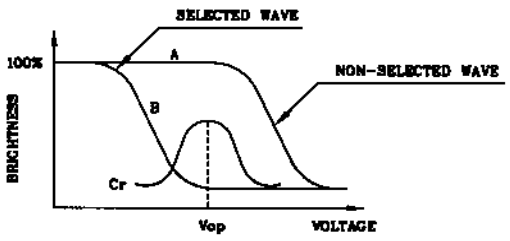
Frame Frequency : 140Hz

Appling Waveform : 1/N duty 1/a bias

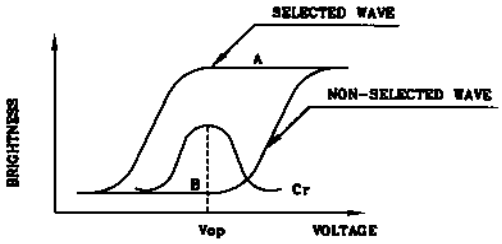
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

Contrast Ratio : Cr=A/B

*Conditions

Viewing Angle : 0

Frame Frequency : 140Hz

Appling Waveform : 1/N duty 1/a bias

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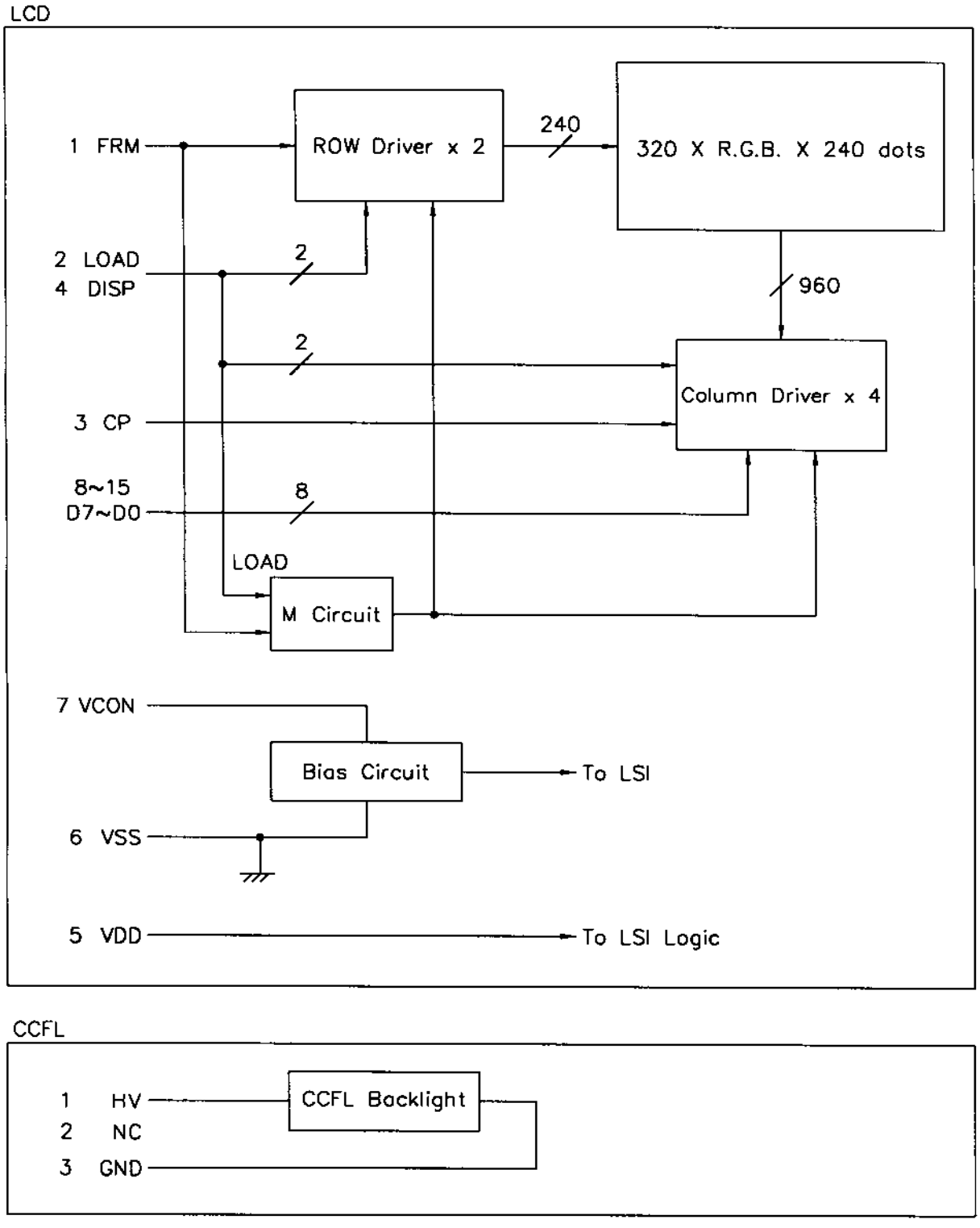
5. BLOCK DIAGRAM



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6. INTERNAL PIN CONNECTION

LCD

Pin No.	Symbol	Level	Function
1	FRM	H	Synchronous Signal for Driving Scanning Line
2	LOAD	H→L	Data Signal Latch Clock
3	CP	H→L	Data Signal Shift Clock
4	DISP	H/L	Display Control Signal, H :Display on L :Display off
5	VDD	–	Power Supply for Logic
6	VSS	–	Power Supply (0V,GND)
7	VCON	–	Contrast Adjust
8	D7	H/L	Display Data
9	D6	H/L	Display Data
10	D5	H/L	Display Data
11	D4	H/L	Display Data
12	D3	H/L	Display Data
13	D2	H/L	Display Data
14	D1	H/L	Display Data
15	D0	H/L	Display Data

CN1 : 53261-1510(Molex)

Recommended Matching Connector : 51021-1500(Molex) or Compatible

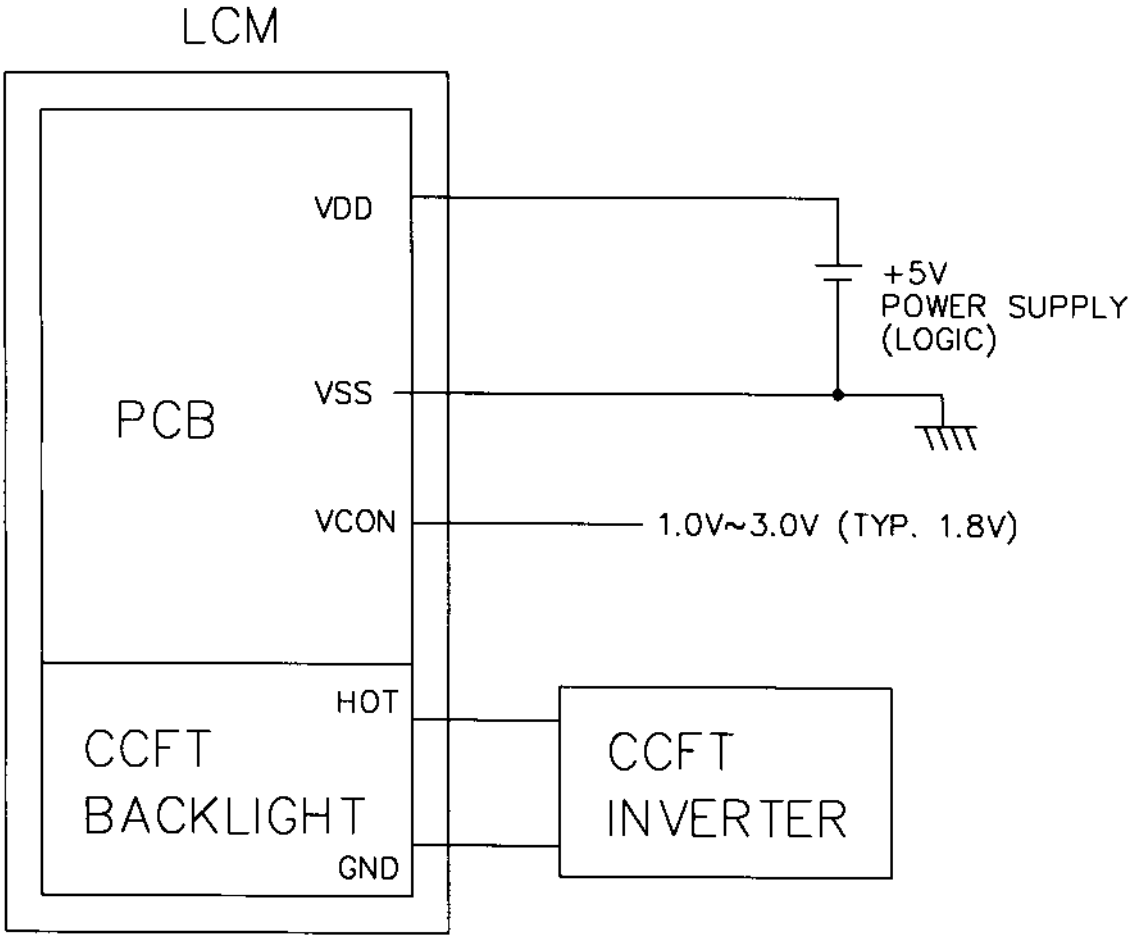
CCFL

Pin No.	Symbol	Level	Function
1	HV	AC	Power Supply for CCFL(HOT)
2	NC	–	Non-connection
3	GND	–	Power Supply for CCFL(GND)

CN2 : BHR-03VS-1(JST)

Recommended Matching Connector : SM02-(8.0)B-BHS-1(JST) or Compatible

7. POWER SUPPLY



Recommended :

1. R1+R2+VR=10~20KΩ
2. C1,C2=10μF

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8. TIMING CHARACTERISTICS

8-1 INTERFACE TIMING

● VDD=5.0V±10%, Ta=-20~70 ℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CP Clock Cycle	tCYC2	Fig.a	152	-	-	ns
CP HIGH-LEVEL Width	tCWH2	Fig.a	66	-	-	ns
CP LOW-LEVEL Width	tCWL2	Fig.a	66	-	-	ns
Data Set Up Time	tDS2	Fig.a	50	-	-	ns
Data Hold Time	tDH2	Fig.a	50	-	-	ns
CP Rise/Fall Time	tr2,tf2	Fig.a	-	-	30	ns
Clock Set Up Time	tSCL	Fig.a	80	-	-	ns
Clock Hold Time	tHCL	Fig.a	80	-	-	ns
M Set Up Time	tMS	Fig.a	20	-	-	ns
M Hold Time	tMH	Fig.a	20	-	-	ns

● VDD=5.0V±10%, Ta=-20~70 ℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
LOAD Clock Cycle	tCYC1	Fig.b	400	-	-	ns
LOAD HIGH-LEVEL Width	tCWH1	Fig.b	25	-	-	ns
LOAD LOW-LEVEL Width	tCWL1	Fig.b	370	-	-	ns
Data Set Up Time	tDS1	Fig.b	100	-	-	ns
Data Hold Time	tDH1	Fig.b	10	-	-	ns
LOAD Rise/Fall Time	tr1,tf1	Fig.b	-	-	30	ns

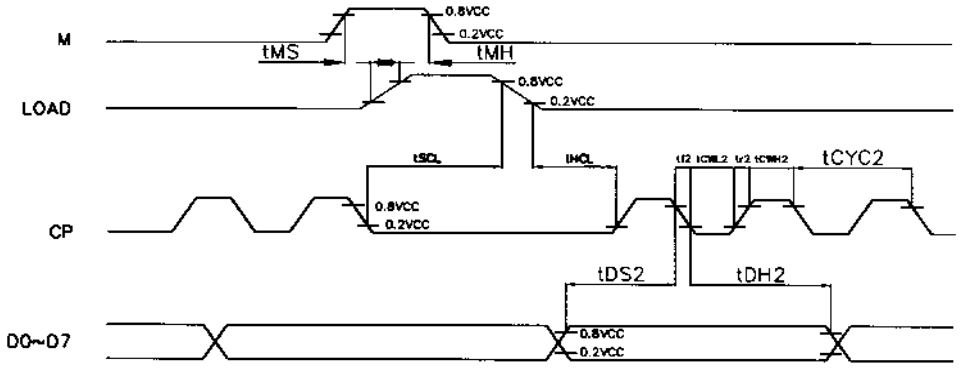

Fig . a Interface timing (SEGMENT)

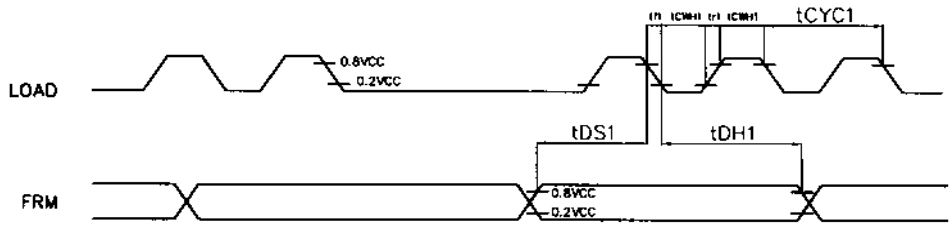

Fig . b Interface timing (COMMON)

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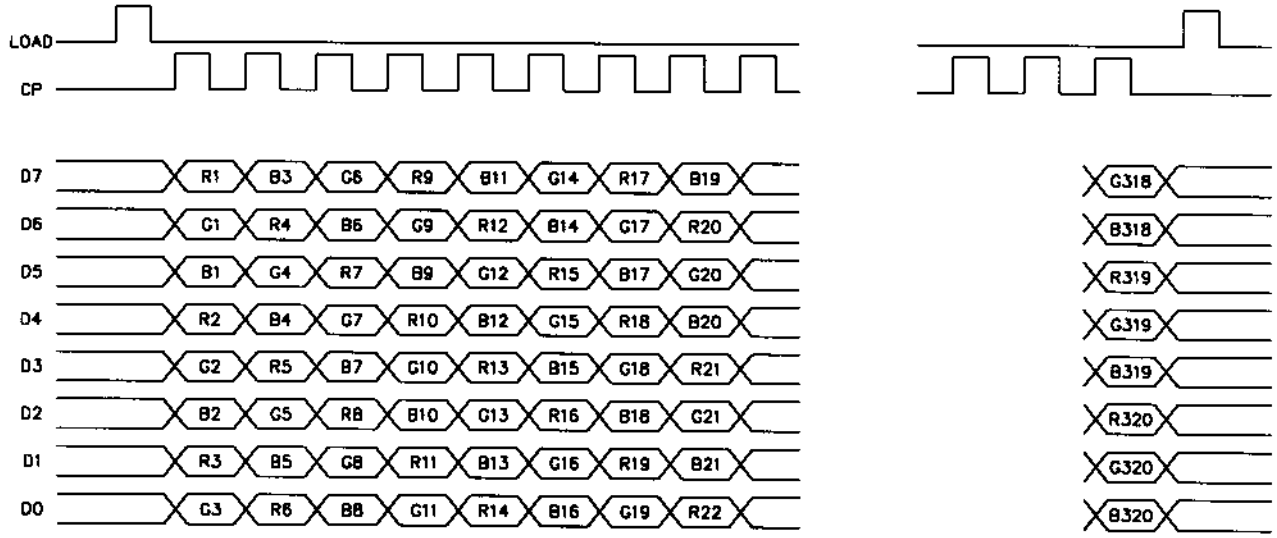
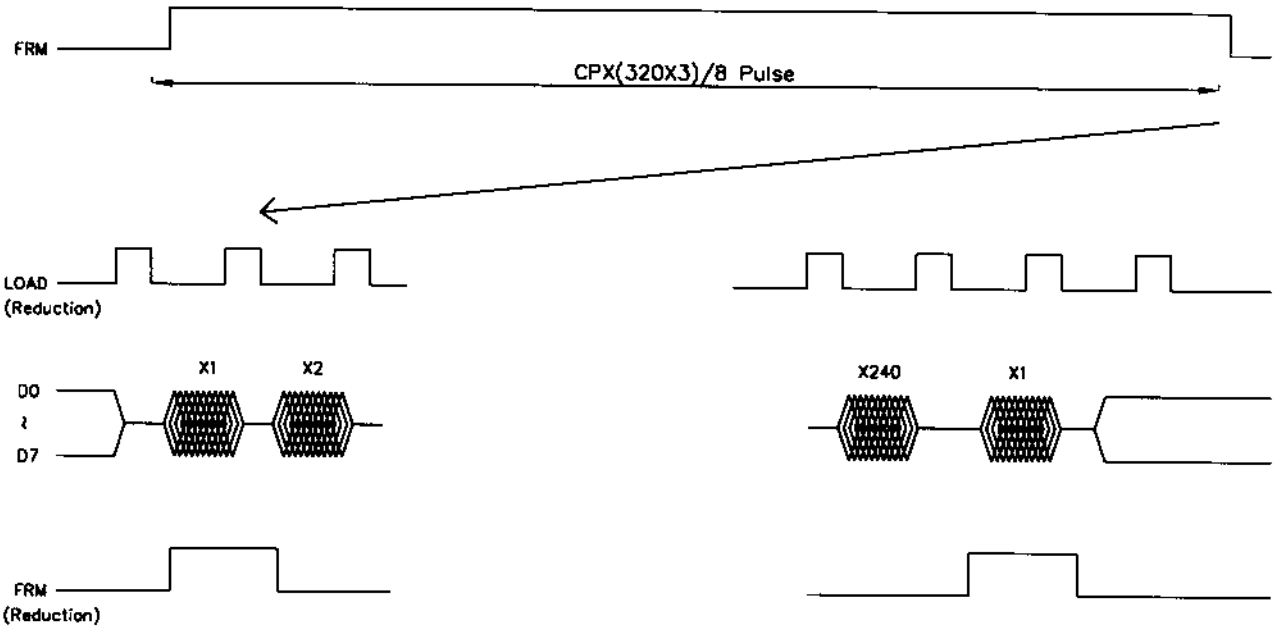
8-2. TIMING CHART





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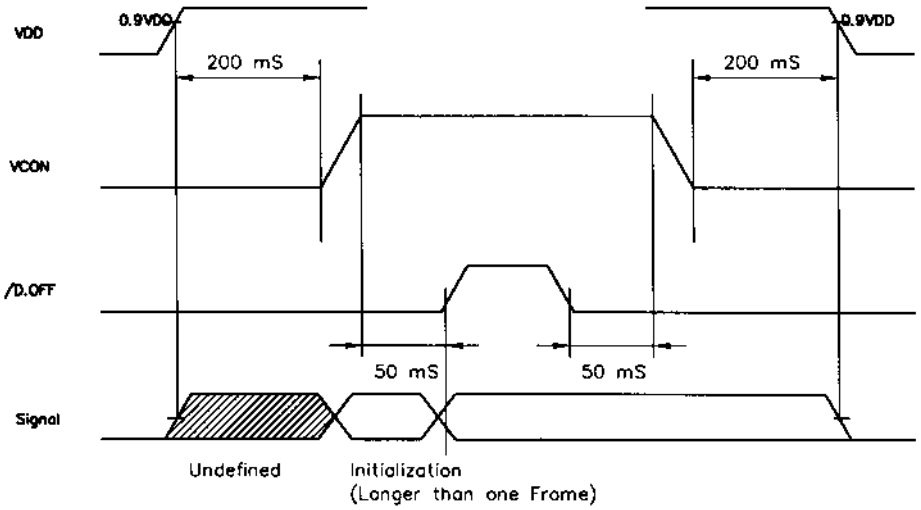
8-3.POWER ON/OFF TIMING



POWER ON

POWER OFF

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

8-4. DISPLAY PATTERN

START DATA

	Y1			Y2			Y3		
X1	R1 D7	G1 D6	B1 D5	R2 D4	G2 D3	B2 D2	R3 D1	G3 D0	B3 D7
X2	R1 D7	G1 D6	B1 D5	R2 D4	G2 D3	B2 D2	R3 D1	G3 D0	B3 D7

Y318			Y319			Y320		
R318 D0	G318 D7	B318 D6	R319 D5	G319 D4	B319 D3	R320 D2	G320 D1	B320 D0
R318 D0	G318 D7	B318 D6	R319 D5	G319 D4	B319 D3	R320 D2	G320 D1	B320 D0

X239	R1 D7	G1 D6	B1 D5	R2 D4	G2 D3	B2 D2	R3 D1	G3 D0	B3 D7
X240	R1 D7	G1 D6	B1 D5	R2 D4	G2 D3	B2 D2	R3 D1	G3 D0	B3 D7

R318 D0	G318 D7	B318 D6	R319 D5	G319 D4	B319 D3	R320 D2	G320 D1	B320 D0
R318 D0	G318 D7	B318 D6	R319 D5	G319 D4	B319 D3	R320 D2	G320 D1	B320 D0

9. RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	70°C 30%RH	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

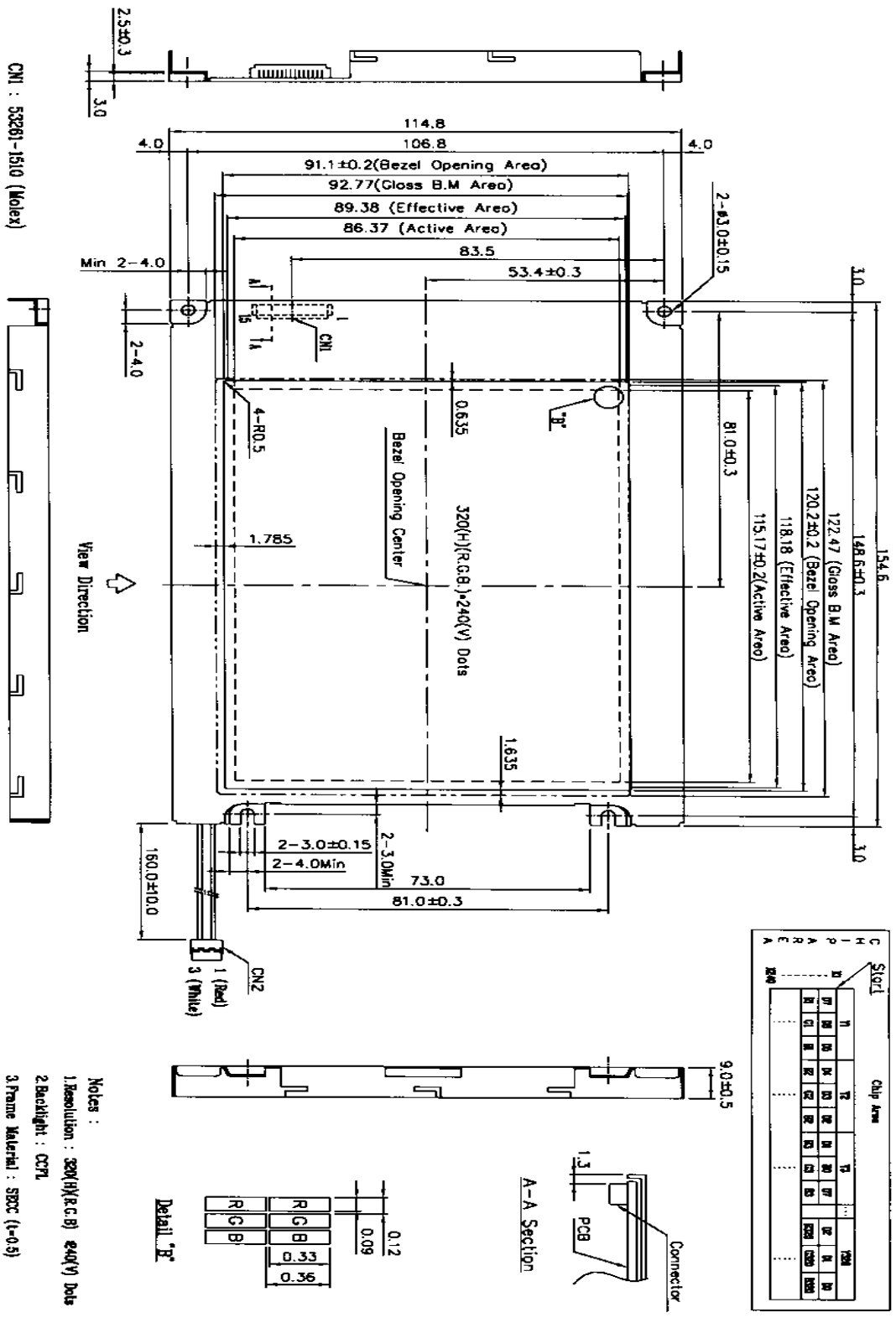
NOTE:

- 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°C±5°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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