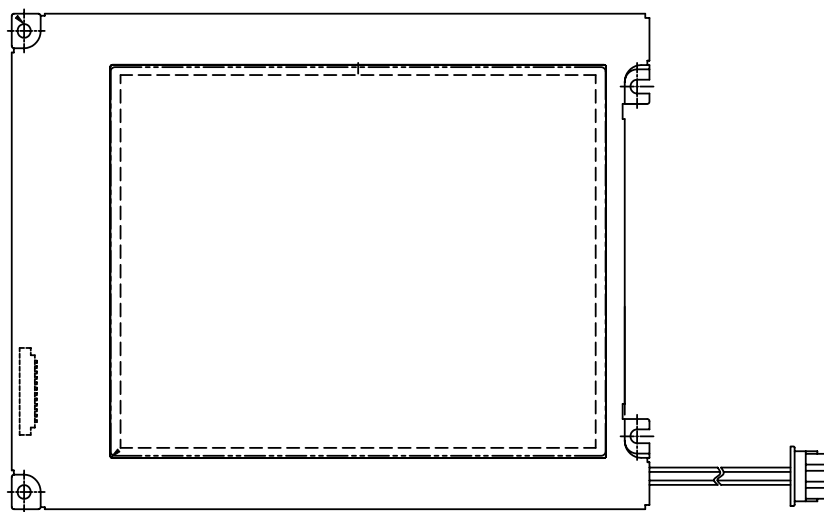




PRODUCT SPECIFICATION

HDM3224-M

320 x240 GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:

ZW

REV:

1.0

HDM3224-M

SHEET 1 OF 16

DATE:

10/11/04

1.MECHANICAL DATA

NO	ITEM	CONTENTS	UNIT
1	Product No.	HDM3224-M	—
2	Module Size	154.6 (W) x 114.8 (H) x 9.0 (D)	mm
3	Dot Size	0.345 (W) x 0.345 (H)	mm
4	Dot Pitch	0.36 (W) x 0.36 (H)	mm
5	Number of Dots	320 (W) x 240 (H)	Dot
6	Duty	1/240	—
7	LCD Display Mode	FSTN, Normally Black	—
8	Rear Polarizer	Transmissive Type	—
9	Viewing Direction	12	O'clock
10	Backlight	CCFL	—
11	Controller	Excluded	—
12	DC/DC Converter	Excluded	—
13	Touch Panel	Excluded	—
14	Weight	190 (Approx.)	g

2.ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

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

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	WIDE TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-40	80
Humidity (Without Condensation)	Note 2,4		Note 3,4	

Note 2 $T_a \leq 70^{\circ}\text{C}$: 75%RH max

Note 3 Please refer to item of reliability test

Note 4 Background color will change slightly depending on ambient temperature.

That phenomenon is reversible.

Note 5 Operation temp not include CCFL Lamp

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3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS OF LCM

ITEM			SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Supply for Logic			VDD—VSS	—		3.0	3.3	3.6	V
						4.5	5.0	5.5	
Recommended LC Driving Voltage (Wide Temp. LCM)			VEE—VSS	Duty=1/240	—20℃	24.1	24.5	24.9	V
					0℃	23.0	23.4	23.8	
					25℃	22.3	22.7	23.1	
					50℃	21.6	22.0	22.4	
					70℃	20.4	20.8	21.2	
Input Voltage			VIH	H level		0.8VDD	—	VDD	V
			VIL	L level		0	—	0.2VDD	
Power Supply Current			IDD	FLM = 70 Hz VSS = 0 V VDD = 5 V VEE—VSS= 22.7 V PATTERN :		—	0.5	1.0	mA
			IEE	□ ■ □ ■ □ ■ ■ □ ■ □ ■ □		—	8	12	
LCM	Surface Luminance	CCFL	T696HCK	VSS=0V VEE—VSS =22.7V	PATTERN: (Dots All ON)	120	150	—	cd/m ²
					PATTERN: (Dots All OFF)	—	15	25	

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used CCFL Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp voltage	V _L	—	470	—	Vrms	—
Lamp current	I _L	4	5	6	mA _{rms}	—
Lamp power consumption	P _L	—	2.35	—	W	(*1)
Lamp frequency	F _L	20	35	50	KHz	—
Lamp life time	L _L	—	20000	—	hrs	IL = 5 mA _{rms} (*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

WIDE TEMPERATURE MODE

AT V_{OP}

ITEM MODE		Cr(Contrast Ratio)										θ (Viewing Angle)		ϕ (Viewing Angle)	
		-20℃		0℃		25℃		50℃		70℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	H	10	15	12	18	14	20	5	7	2	3	—	*F: 25 R: 45	—	*L: 30 R: 30
NOTE		NOTE 6										NOTE 5			

NOTE :

* : under Cr>5 Condition

T : Transmissive

H : Normally Black, 12 O'clock

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	3200	4000	6000	ms	NOTE 2
		0℃	880	1100	1600		
		25℃	240	300	450		
		50℃	95	120	180		
		70℃	48	60	90		
Response Time (fall)	Tf	-20℃	2000	2500	3700	ms	NOTE 2
		0℃	360	450	670		
		25℃	95	120	180		
		50℃	55	70	110		
		70℃	32	40	60		

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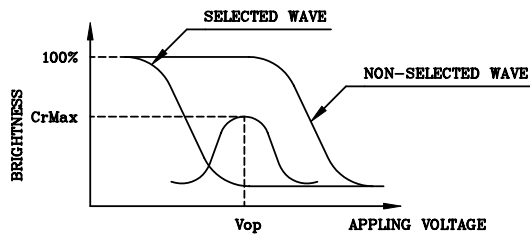
HDM3224-M

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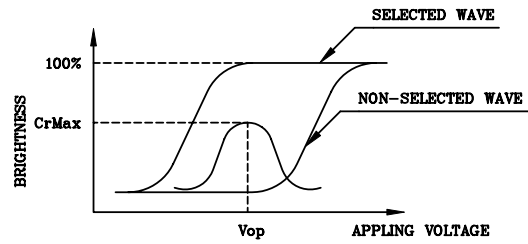
DATE: 10/11/04

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

*Conditions

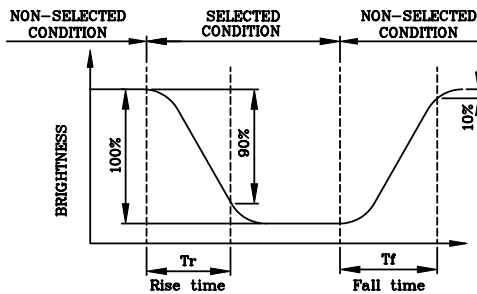
Viewing Angle : 0

Frame Frequency : 70Hz

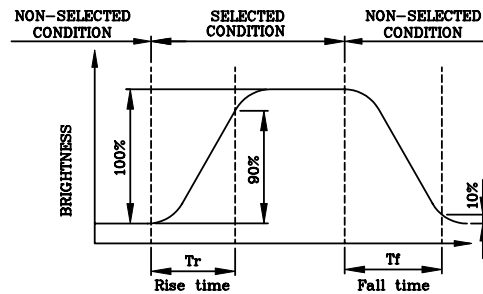
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



(negative type)

*Conditions

Operating Voltage : Vop

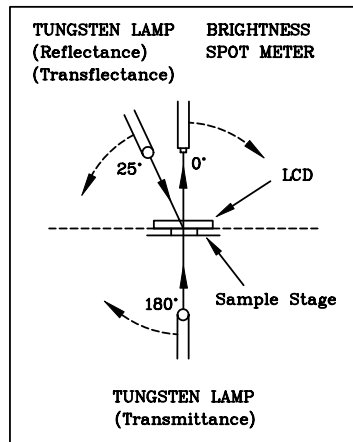
Viewing Angle (θ, ϕ) : (0,0)

Frame Frequency : 70Hz

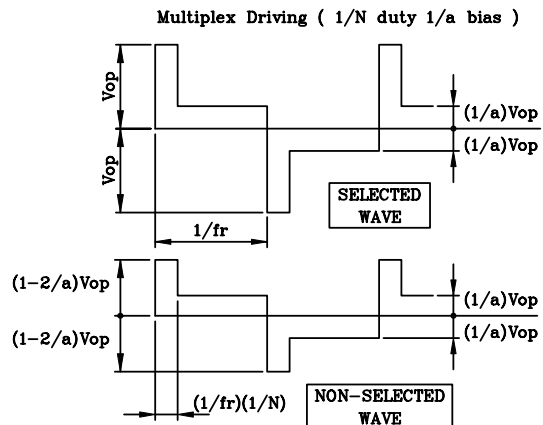
Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

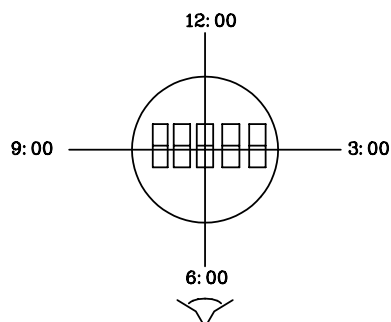


CONST.
TEMP.
CHAMBER



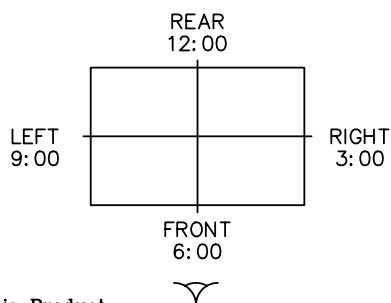
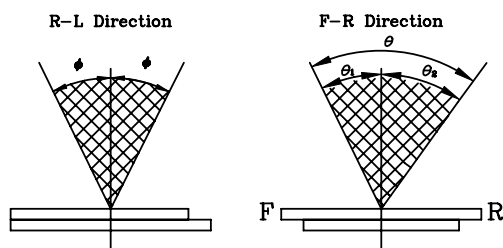
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product

The Viewing Direction Is 6 O'clock
So $\theta_1 > \theta_2$

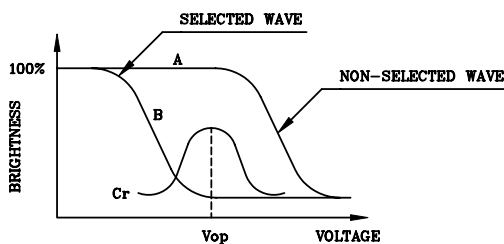
$$\theta = \theta_1 + \theta_2$$

*Conditions

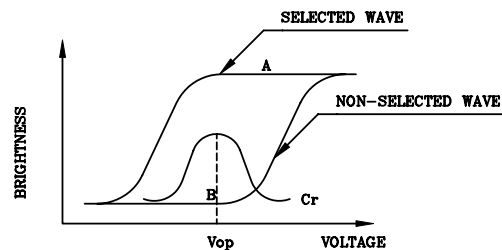
Operating Voltage : Vop
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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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Z.W.

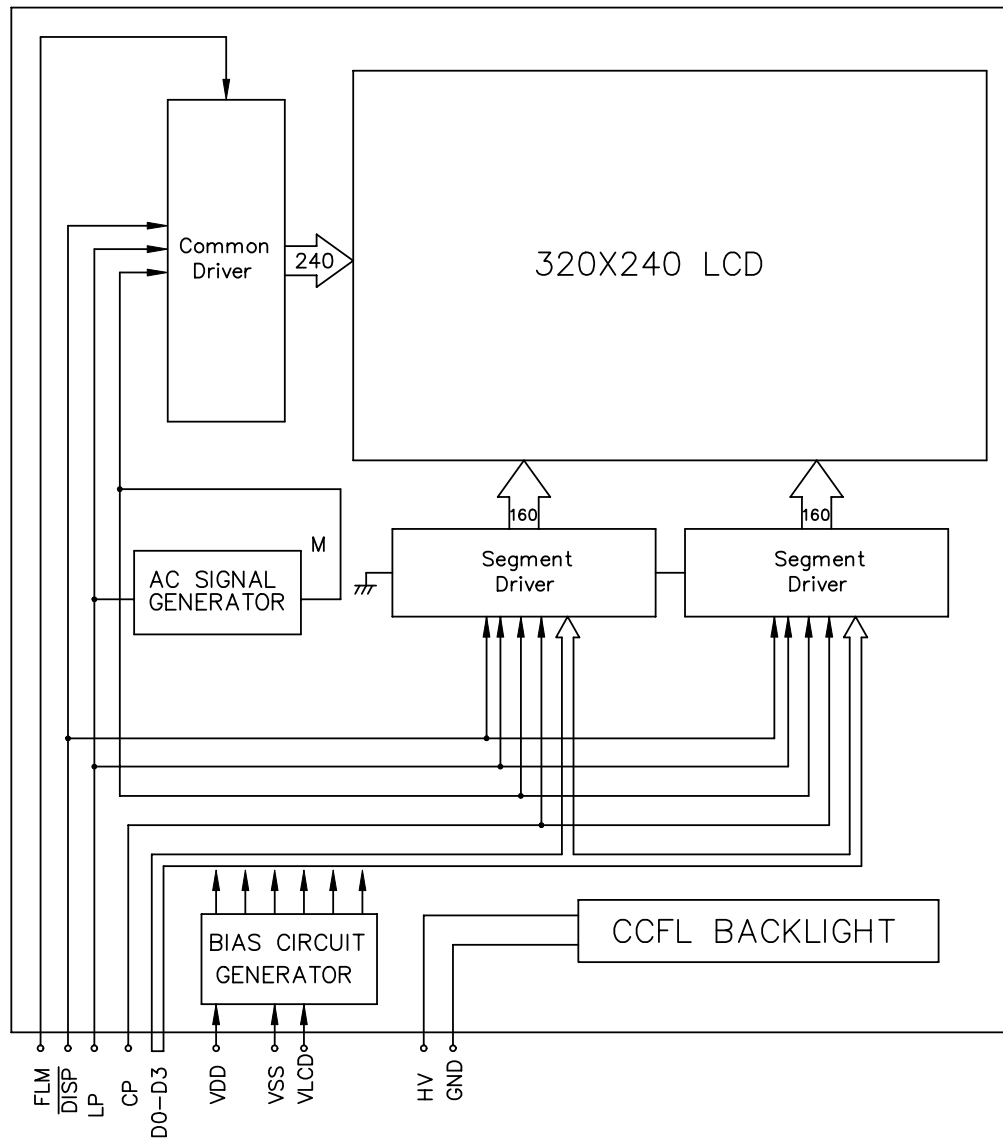
REV:
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5. BLOCK DIAGRAM



6.INTERNAL PIN CONNECTION

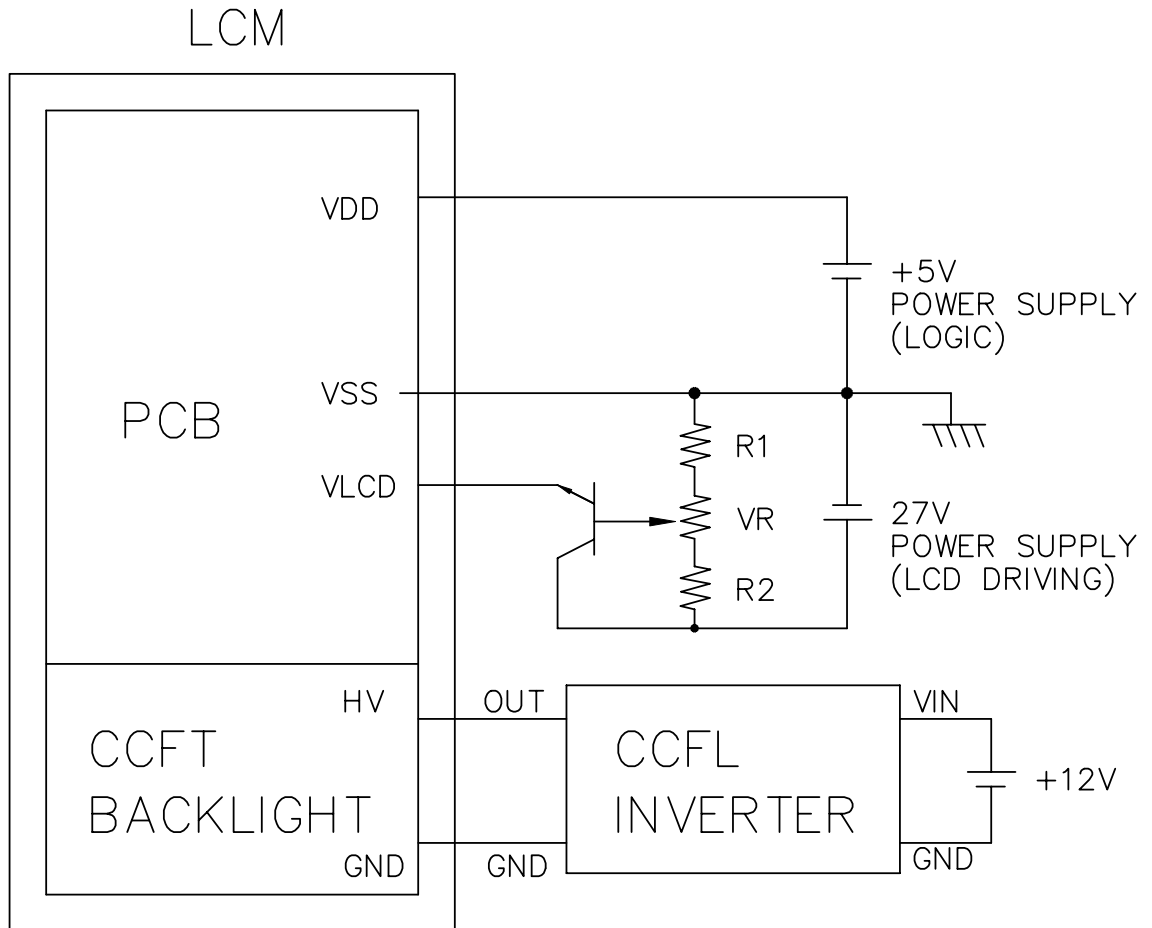
*CN1 : LCD Connector (Molex 53398-1290)

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	$\overline{\text{DISPOFF}}$	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	VSS	—	GND

*CN2 : CCFL Connector (JST BHR-03VS-1)

Pin No.	SYMBOL	LEVEL	FUNCTION
1	GND	—	GROUND LINE (FROM INVERTER)
2	NC	—	NO CONNECTION
3	HV	AC	POWER SUPPLY FOR CCFL

7. POWER SUPPLY

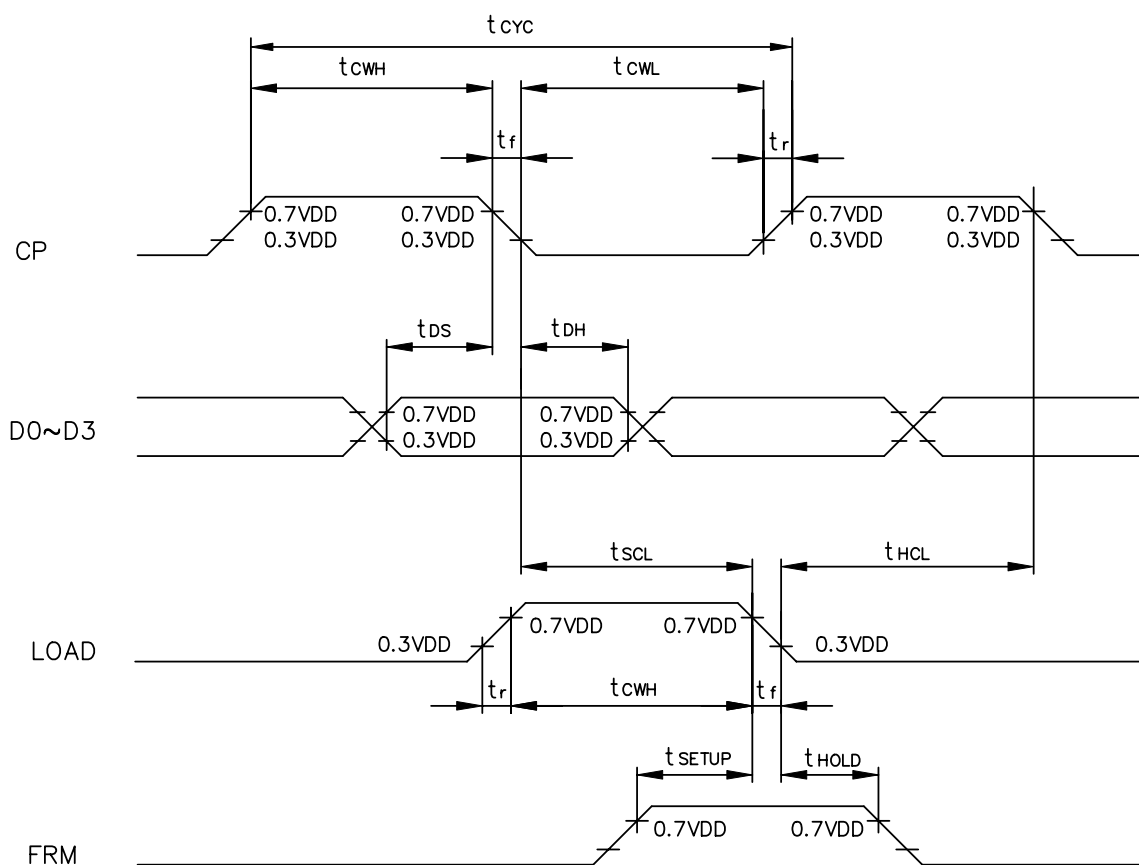


$$R1 + VR + R2 = 10K \sim 20K \Omega$$

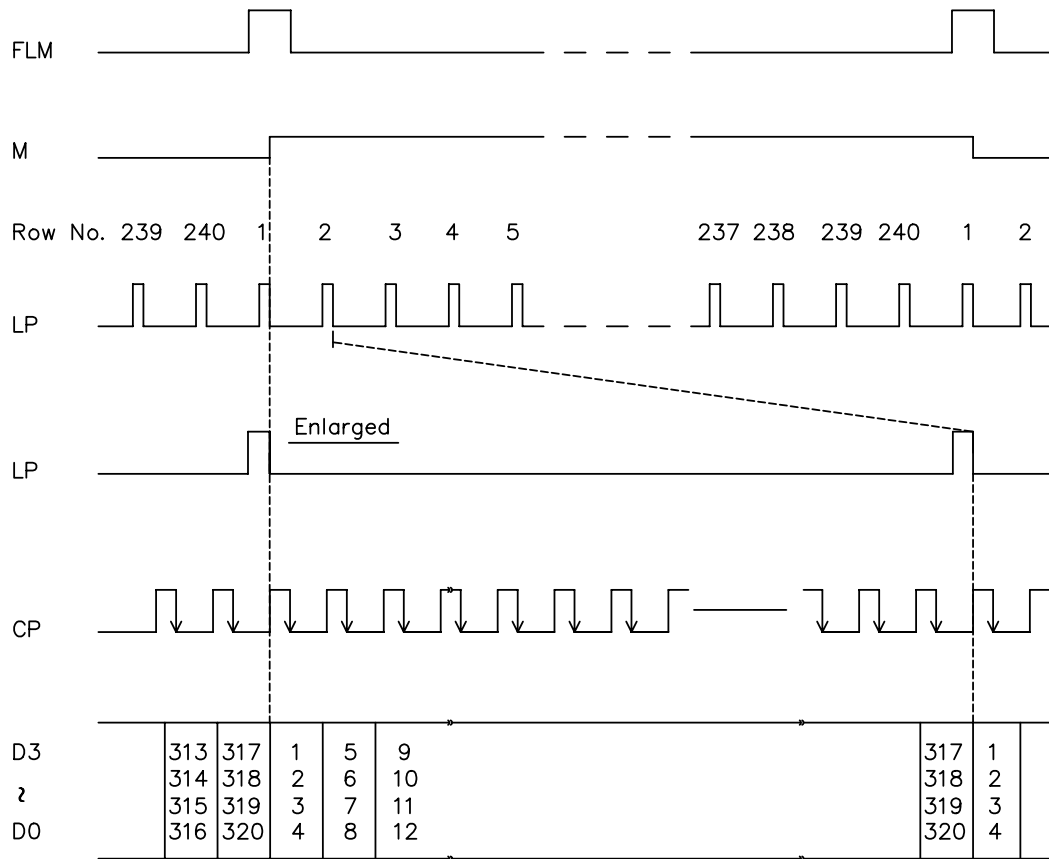
8. TIMING CHARACTERISTICS

8-1. INTERFACE TIMING

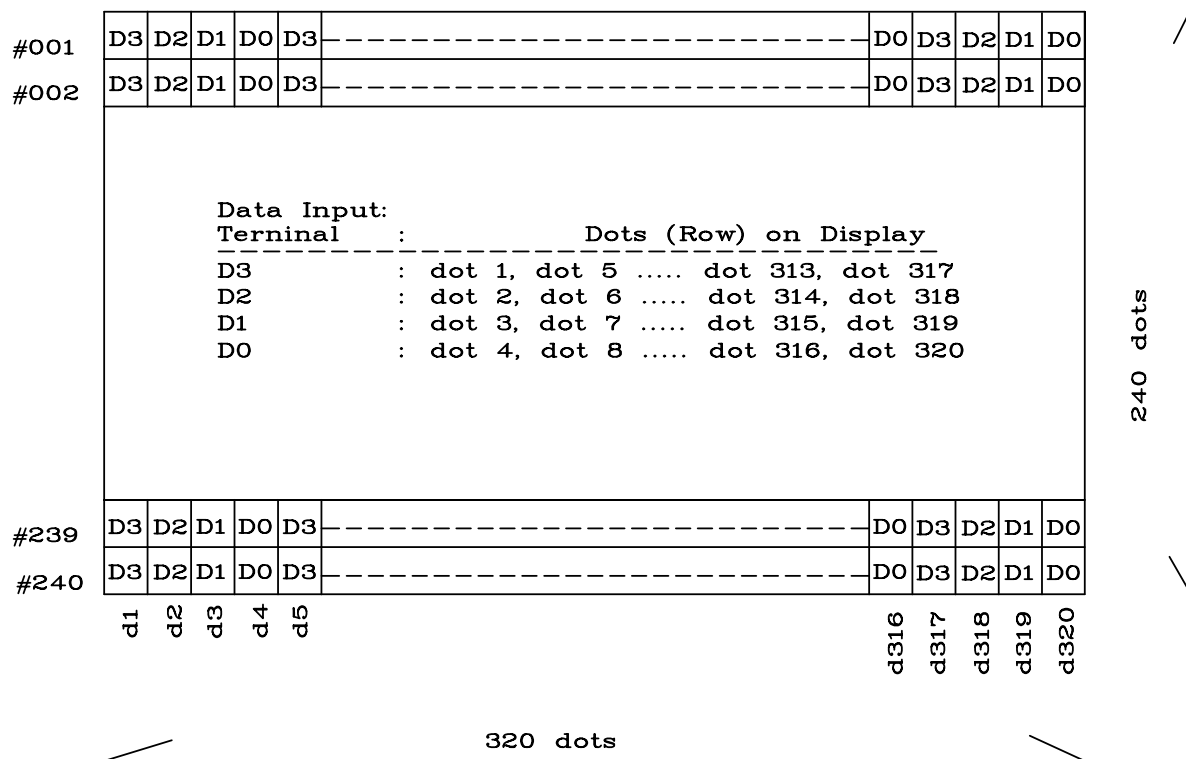
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLOCK CYCLE TIME	t_{cyc}	125	—	—	ns
CLOCK HIGH LEVEL WIDTH	t_{cWH}	51	—	—	ns
CLOCK LOW LEVEL WIDTH	t_{cWL}	51	—	—	ns
CLOCK RISE TIME	t_r	—	—	50	ns
CLOCK FALL TIME	t_f	—	—	50	ns
DATA SETUP TIME	t_{DS}	30	—	—	ns
DATA HOLD TIME	t_{DH}	40	—	—	ns
CLOCK SETUP TIME	t_{SCL}	51	—	—	ns
CLOCK HOLD TIME	t_{HCL}	51	—	—	ns
FRAME SETUP TIME	t_{SETUP}	100	—	—	ns
FRAME HOLD TIME	t_{HOLD}	100	—	—	ns



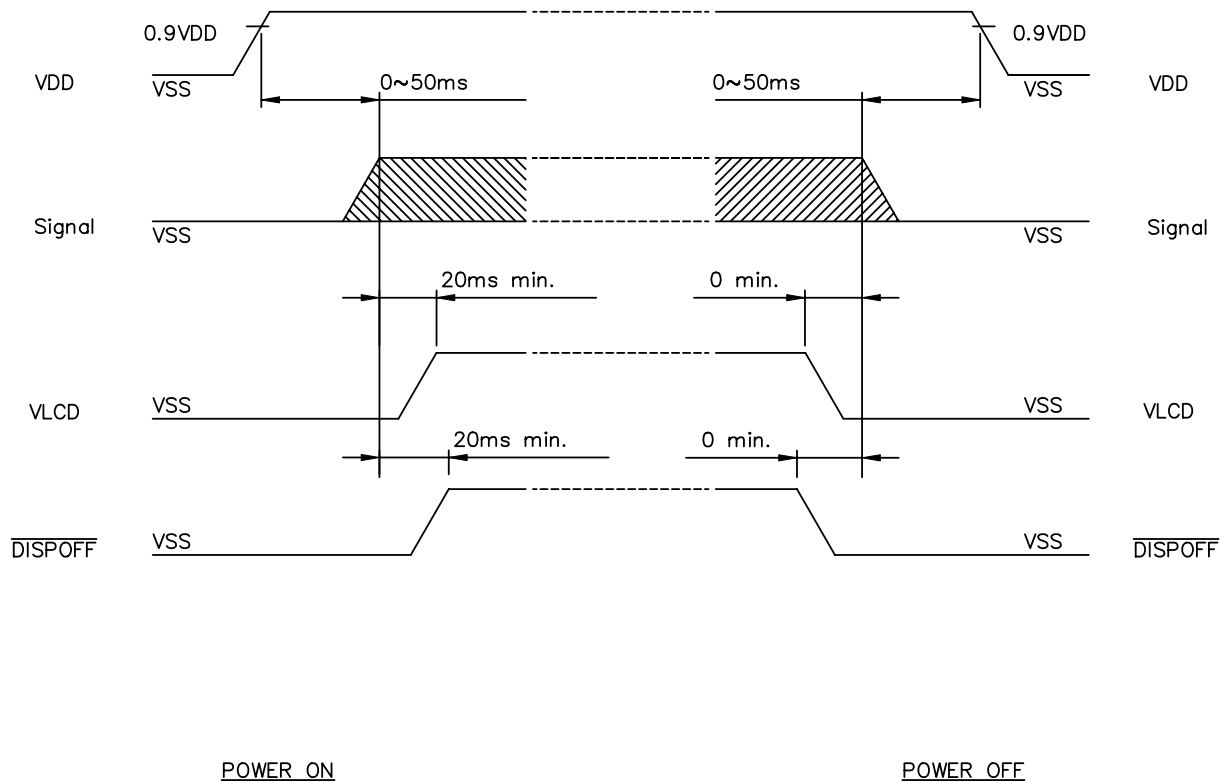
8-2. TIMING CHART OF INPUT SIGNALS



8-3.DISPLAY PATTERN

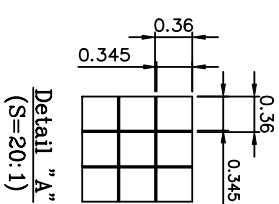
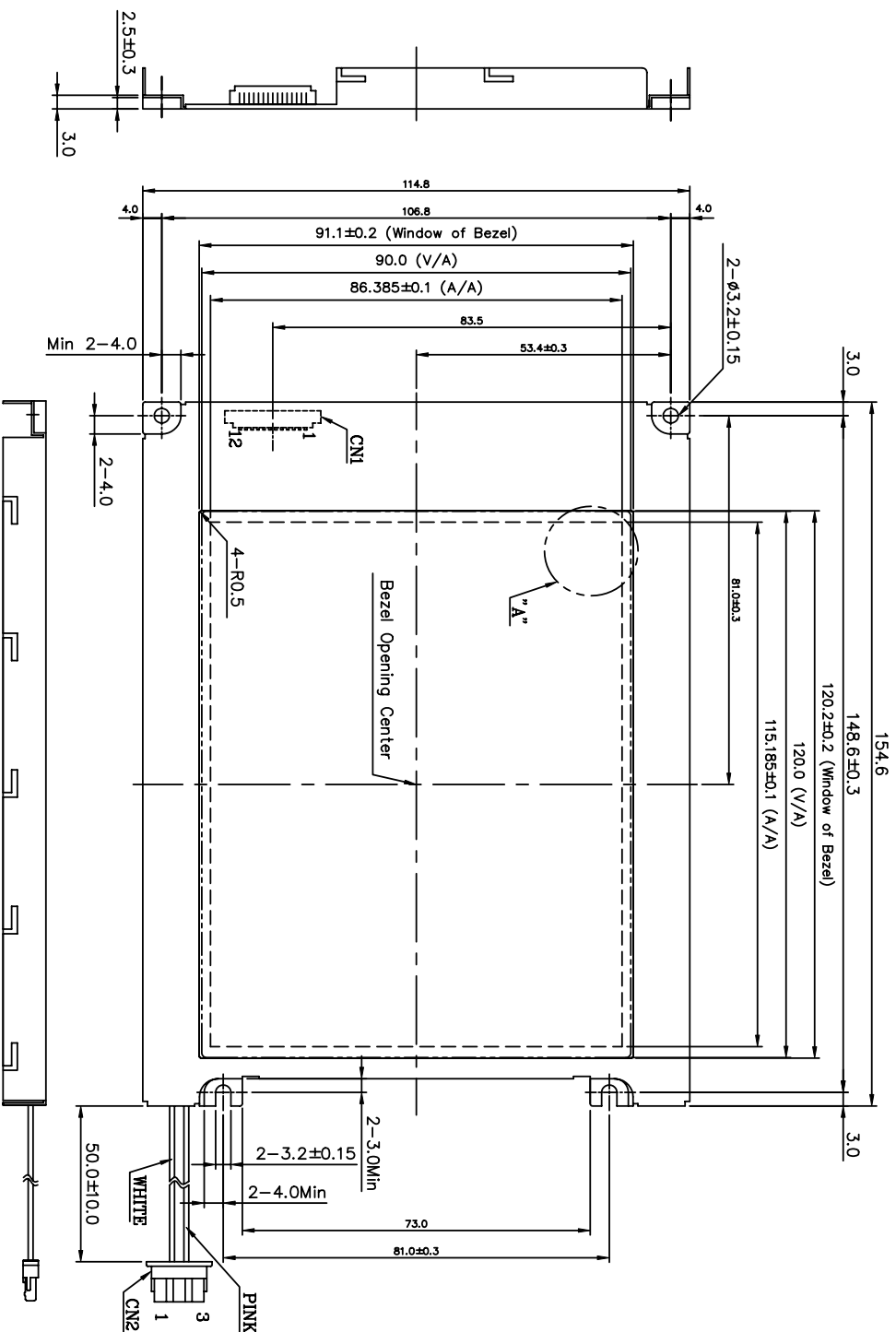


8-4. POWER ON/OFF TIMING



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

View Direction
↓



- Notes :
1. Resolution : 320 x 240 Dots
 2. Backlight : CCFL
 3. Frame Material : SECC (t=0.5)

GENERAL TOLERANCE LIST

DIMENSION	TOLERANCE
$L \leq 6$	± 0.25 (mm)
$6 < L \leq 18$	± 0.3 (mm)
$18 < L \leq 50$	± 0.4 (mm)
$50 < L \leq 125$	± 0.5 (mm)
$125 < L$	± 0.6 (mm)

HANTRONIX

*CN1 : LCD Connector (Molex 53398-1290)

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	DISPOFF	H/L	BE ON/OFF
5	VDD	-	POWER SUPPLY FOR LOGIC
6	VSS	-	GND
7	VLCD	-	POWER SUPPLY FOR LCD DRIVER (+)
8	DO	H/L	DISPLAY DATA
9	DI	H/L	DISPLAY DATA
10	D2	H/L	DISPLAY DATA
11	D3	H/L	DISPLAY DATA
12	VSS	-	GND

*CN2 : CCFL Connector (JST BHR-03VS-1)

Pin No.	SYMBOL	LEVEL	FUNCTION
1	GND	-	GROUND LINE (FROM INVERTER)
2	NC	-	NO CONNECTION
3	HV	AC	POWER SUPPLY FOR CCFL

REV. NO.	DESCRIPTION	DATE	DESIGN	CHECK	APPROVE
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

NAME	DATE	THIRD ANGLE P.
TONY CHOI	93.03.23	
C.B. Lai	93.03.19	
J.H. SUN	93.03.19	
J.H. SUN	93.03.19	
DWG NO. HDM3224-M		