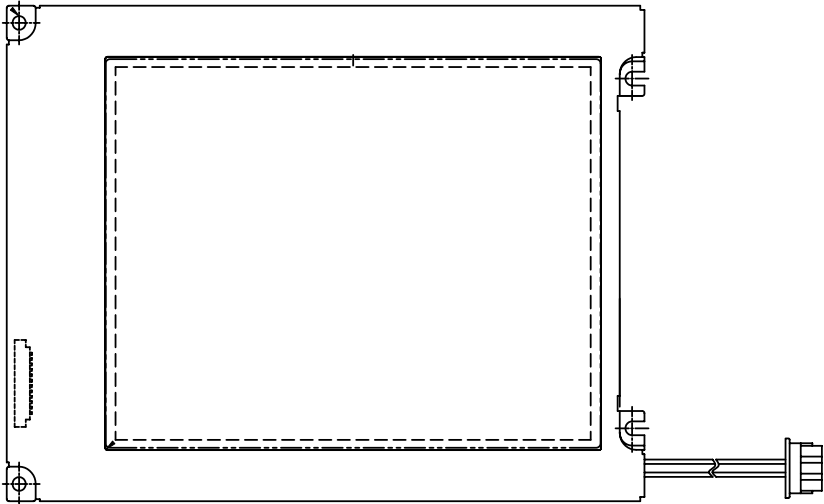




PRODUCT SPECIFICATION

# HDM3224-M

320 x240 GRAPHICS  
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV:	HDM3224-M	SHEET 1 OF 16
	ZW	1.0		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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	<b>HDM3224-M</b>	SHEET 2 OF 16
	Z.W.	1.0		DATE: 10/11/04

## 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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224-M	SHEET 3 OF 16
	Z.W.	1.0		DATE: 10/11/04

### 3. ELECTRICAL CHARACTERISTICS

#### 3-1. ELECTRICAL CHARACTERISTICS OF LCM

ITEM			SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Supply Voltage 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°C	24.1	24.5	24.9	V
					0°C	23.0	23.4	23.8	
					25°C	22.3	22.7	23.1	
					50°C	21.6	22.0	22.4	
					70°C	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	-	0.5	1.0	mA	
			IEE	PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □	-	8	12		
LCM	Surface Luminance	CCFL	T696HCK	VSS=0V VEE-VSS =22.7V	PATTERN: (Dots All ON)	120	150	-	cd/m <sup>2</sup>
					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 <sub>L</sub>	-	470	-	Vrms	-
Lamp current	I <sub>L</sub>	4	5	6	mArms	-
Lamp power consumption	P <sub>L</sub>	-	2.35	-	W	(*1)
Lamp frequency	F <sub>L</sub>	20	35	50	KHz	-
Lamp life time	L <sub>L</sub>	-	20000	-	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 .

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

Q.A.:  
Z.W.

REV:  
1.0

**HDM3224-M**

SHEET 5 OF 16

DATE:  
10/11/04

# 4. OPTICAL CHARACTERISTICS

WIDE TEMPERATURE MODE

AT  $V_{OP}$

ITEM MODE		Cr(Contrast Ratio)										$\theta$ (Viewing Angle)		$\phi$ (Viewing Angle)	
		-20°C		0°C		25°C		50°C		70°C		25°C		25°C	
		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°C	3200	4000	6000	ms	NOTE 2
		0°C	880	1100	1600		
		25°C	240	300	450		
		50°C	95	120	180		
		70°C	48	60	90		
Response Time (fall)	Tf	-20°C	2000	2500	3700	ms	NOTE 2
		0°C	360	450	670		
		25°C	95	120	180		
		50°C	55	70	110		
		70°C	32	40	60		

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

Q.A.:  
Z.W.

REV.:  
1.0

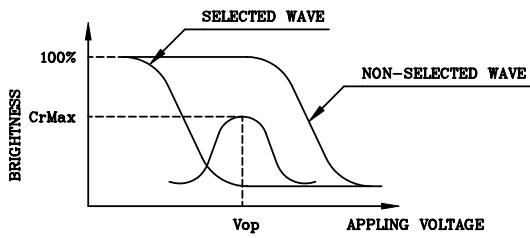
HDM3224-M

SHEET 6 OF 16

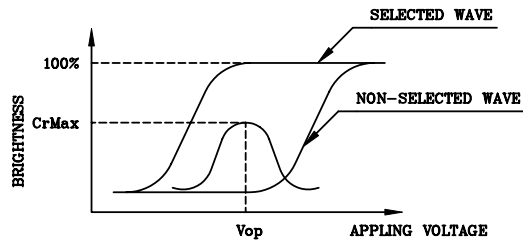
DATE:  
10/11/04

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



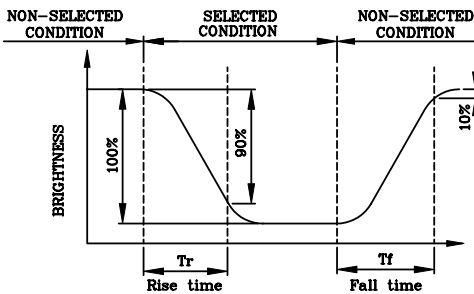
(negative type)

\*Conditions

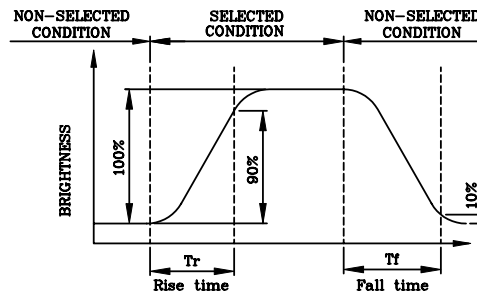
Viewing Angle : 0  
 Frame Frequency : 70Hz  
 Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



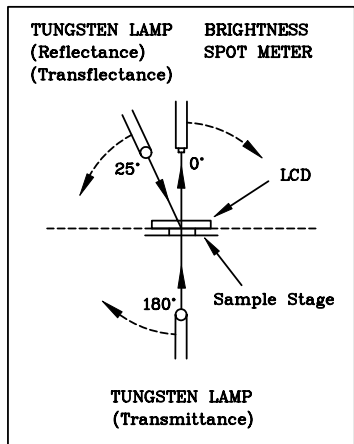
(negative type)

\*Conditions

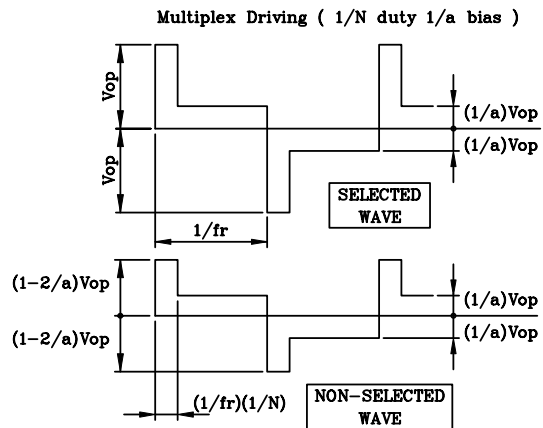
Operating Voltage : Vop  
 Viewing Angle ( $\theta, \phi$ ) : (0,0)  
 Frame Frequency : 70Hz  
 Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

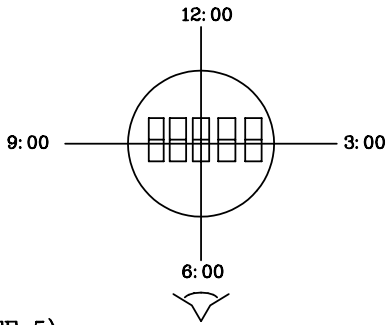


CONST.  
TEMP.  
CHAMBER



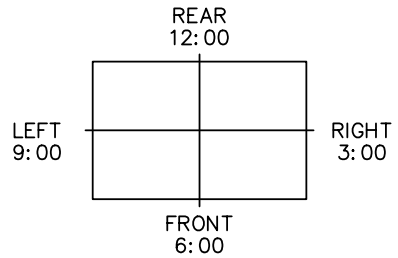
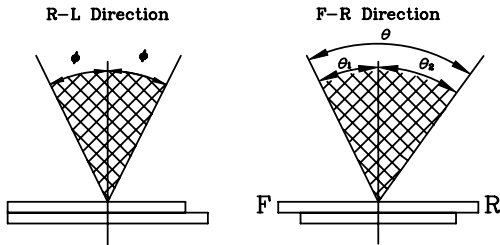
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

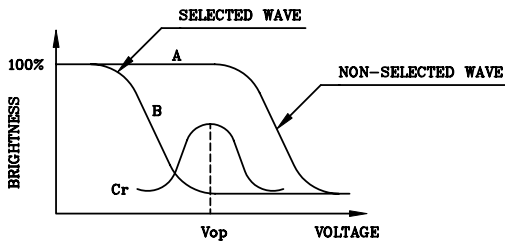
$$\theta = \theta_1 + \theta_2$$

\*Conditions

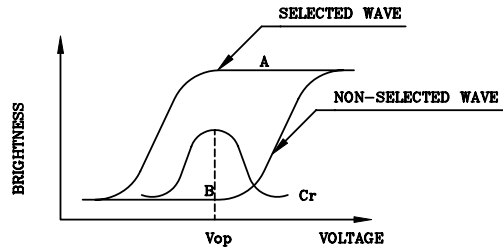
Operating Voltage :  $V_{op}$   
Frame Frequency : 70Hz  
Applying Waveform : 1/N duty 1/a bias  
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

Contrast Ratio :  $Cr = A/B$

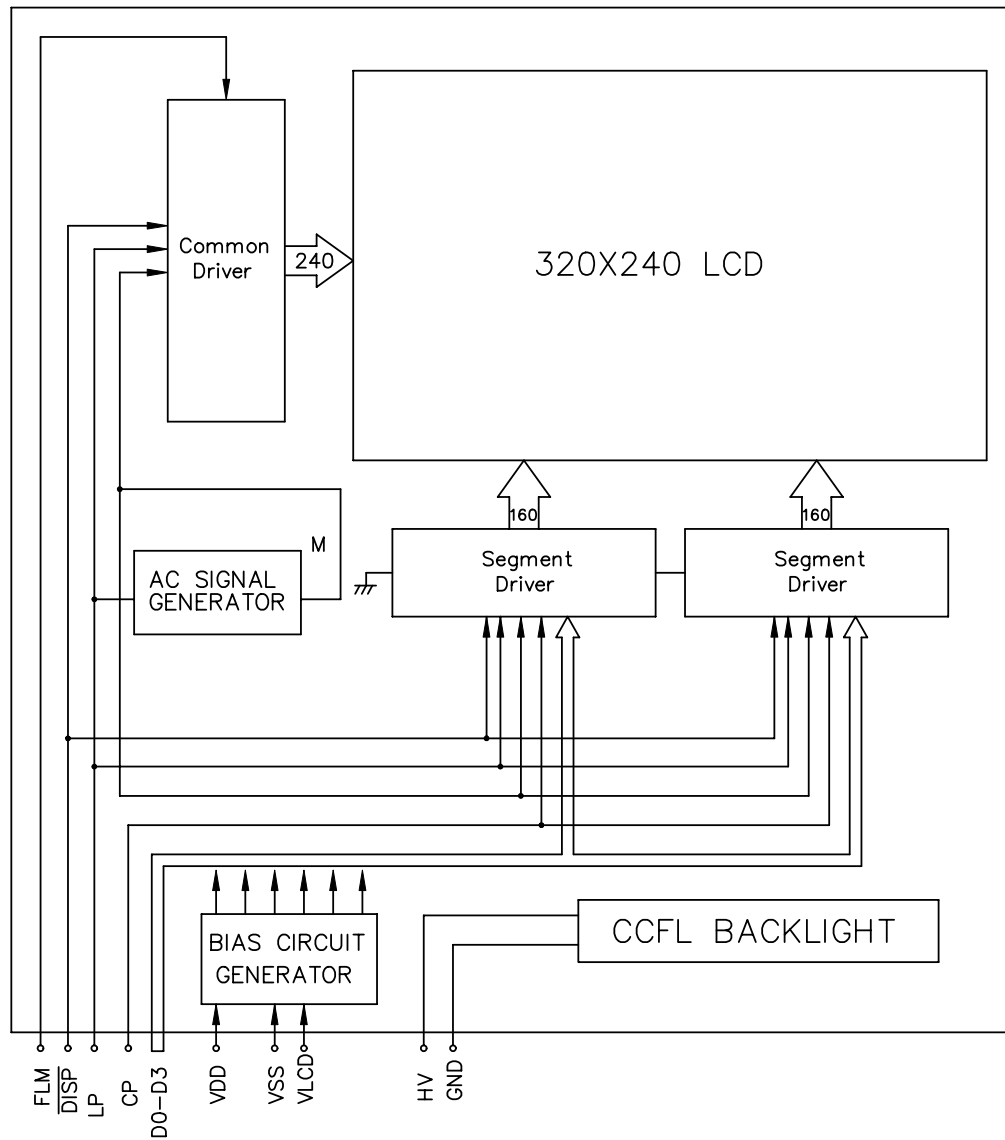
\*Conditions

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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224-M	SHEET 8 OF 16
	Z.W.	1.0		DATE: 10/11/04



# 5. BLOCK DIAGRAM



## 6. INTERNAL PIN CONNECTION

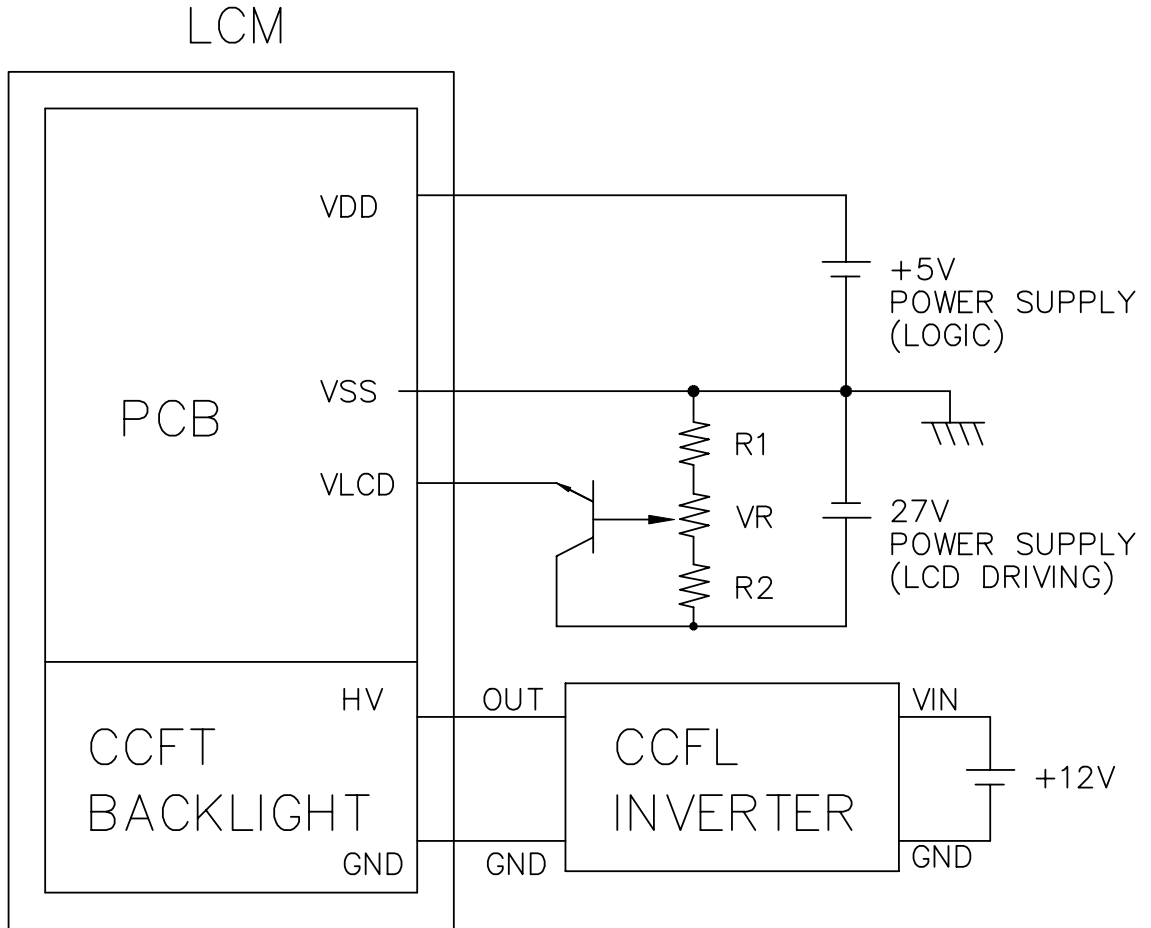
\*CN1 : LCD Connector (Molex 53398-1290)

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

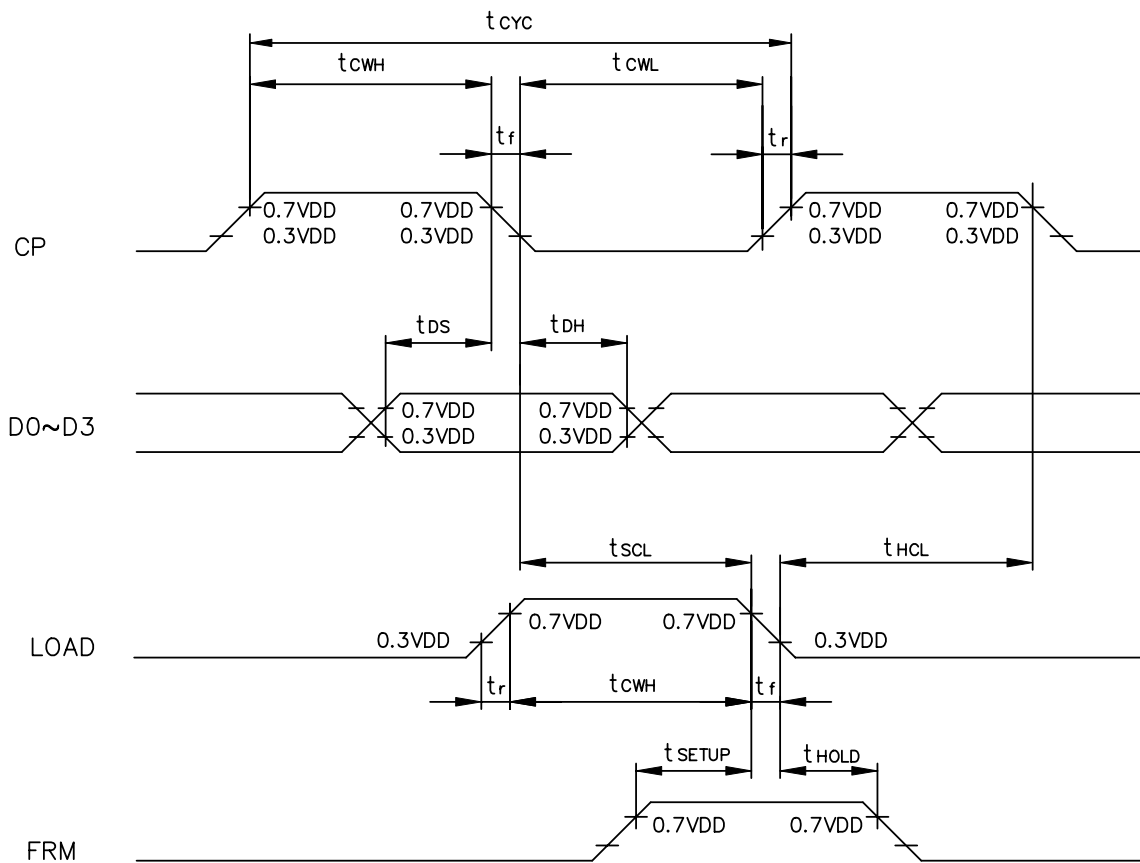


$$R1 + VR + R2 = 10K \sim 20K \Omega$$

# 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



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

Q.A.:  
Z.W.

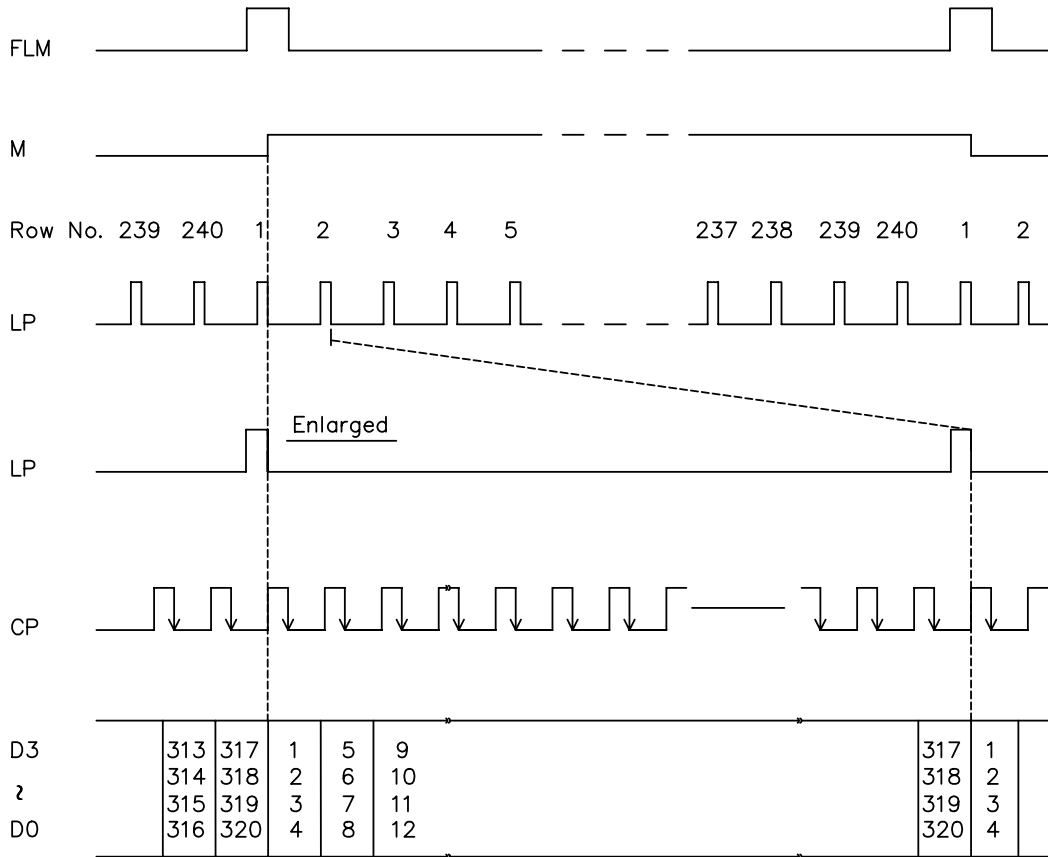
REV.:  
1.0

HDM3224-M

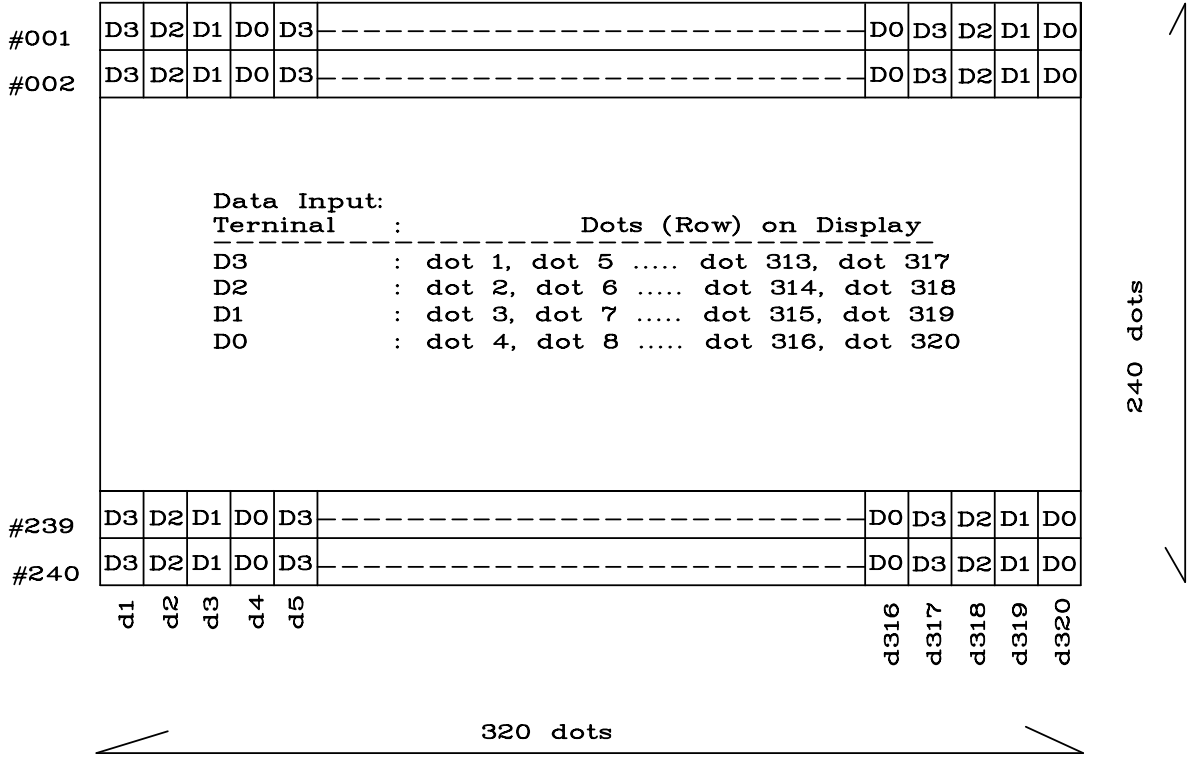
SHEET 12 OF 16

DATE:  
10/11/04

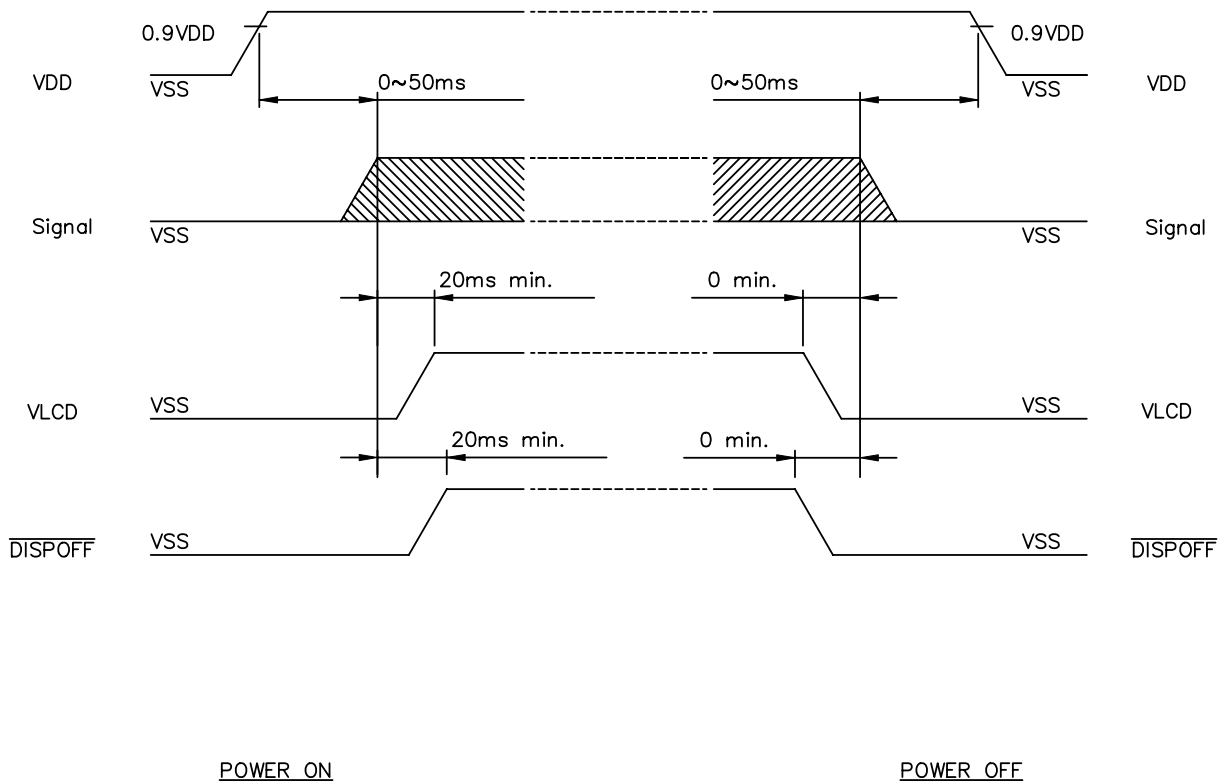
# 8-2.TIMING CHART OF INPUT SIGNALS



# 8-3.DISPLAY PATTERN



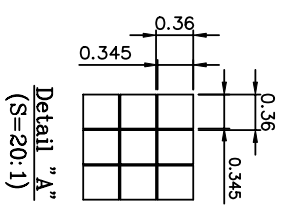
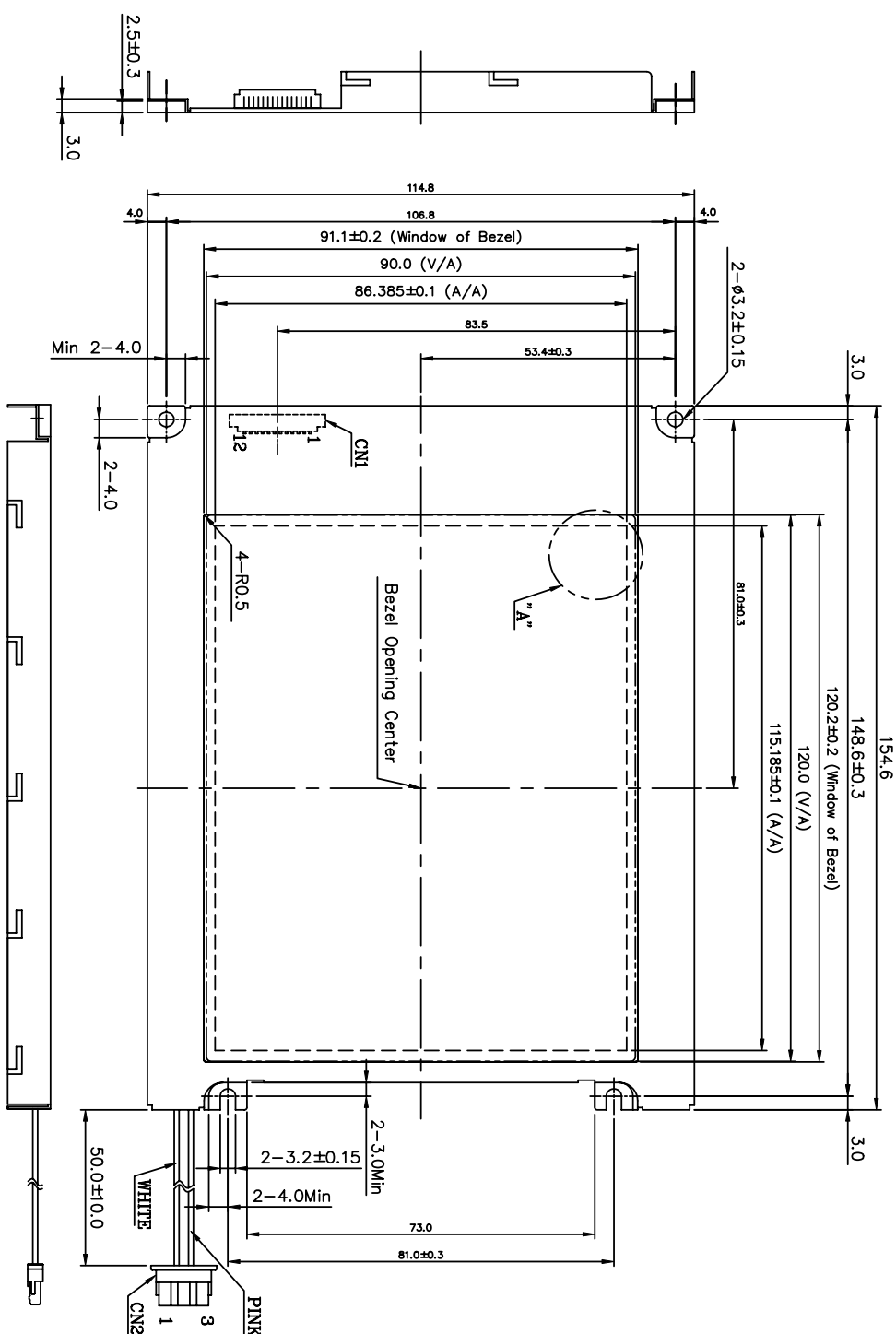
## 8-4. POWER ON/OFF TIMING



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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224-M	SHEET 15 OF 16
	Z.W.	1.0		DATE: 10/11/04

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 ≤ 6	±0.25 (mm)
6 < L ≤ 18	±0.3 (mm)
18 < L ≤ 50	±0.4 (mm)
50 < L ≤ 125	±0.5 (mm)
125 < L	±0.6 (mm)
ANGLE	±1° (DEG)

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	H. ON/L. 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 (PROUD INVERTER)
2	NC	-	NO CONNECTION
3	HV	AC	POWER SUPPLY FOR CCFL

REV. NO.	DESCRIPTION	DATE	DESIGN	CHECK	APPROVE

NAME	DATE	THIRD ANGLE P.
APPROVE TONY CHOI 93.03.23		
CHECK C.B. Iain 93.03.19		
DESIGN J.H. SUN 93.03.19		
DRAWN J.H. SUN 93.03.19		
DWG NO. HDM3224-M		