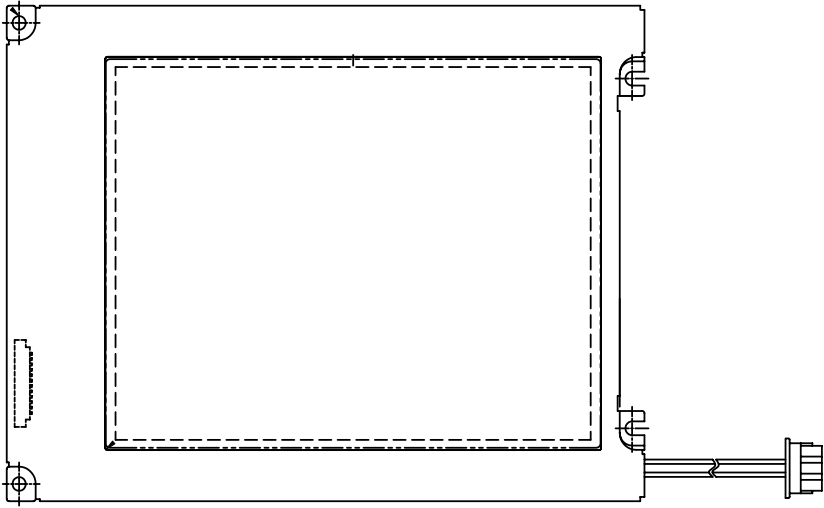




PRODUCT SPECIFICATION

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.:	HDM3224-M	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 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	mArms	-
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 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		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.
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 $\theta=0^\circ$ $\phi=0^\circ$

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

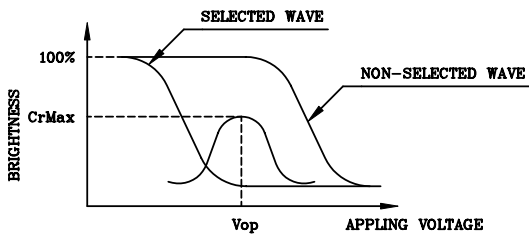
HDM3224-M

SHEET 6 OF 16

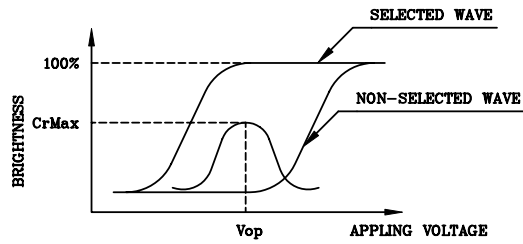
DATE:
10/11/04

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



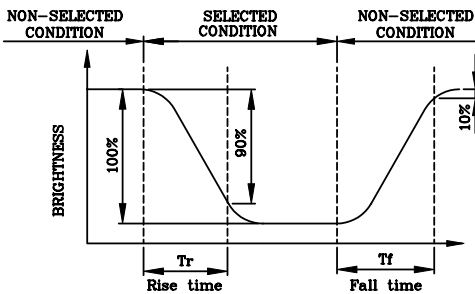
(negative type)

*Conditions

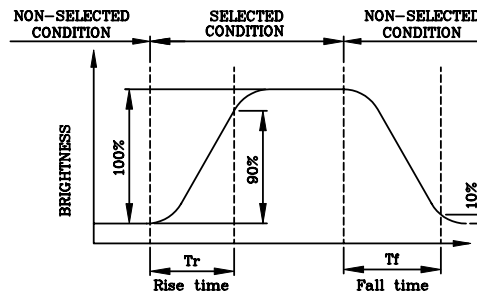
Viewing Angle : 0
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



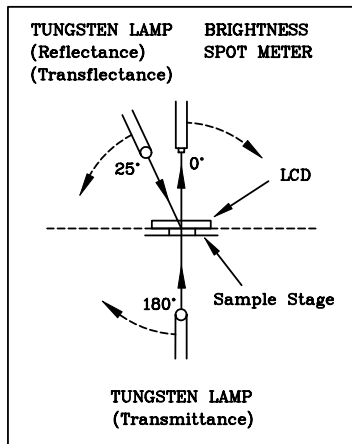
(negative type)

*Conditions

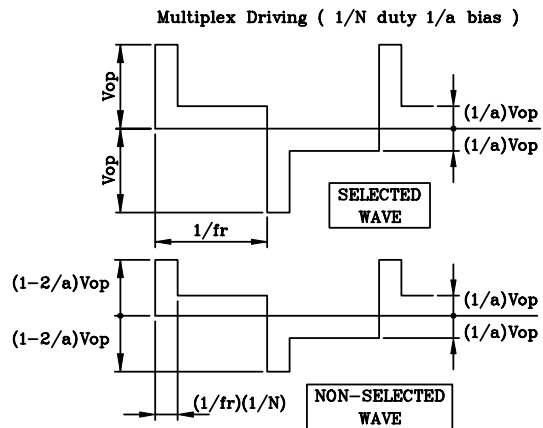
Operating Voltage : Vop
 Viewing Angle (θ, ϕ) : (0,0)
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

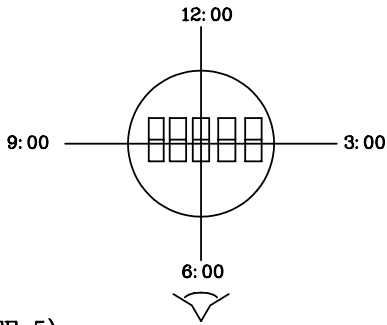


CONST.
TEMP.
CHAMBER



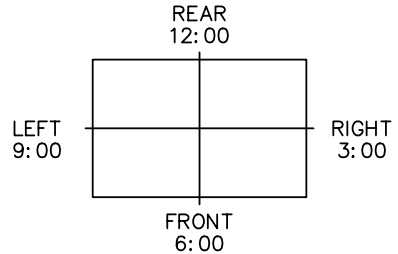
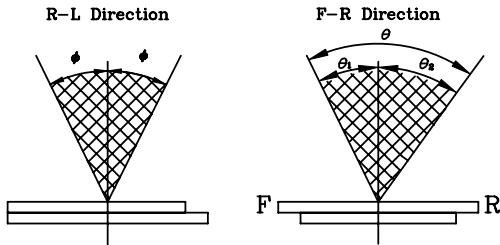
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

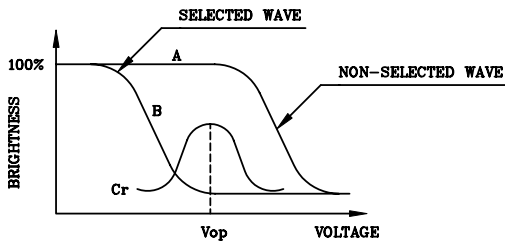
$$\theta = \theta_1 + \theta_2$$

*Conditions

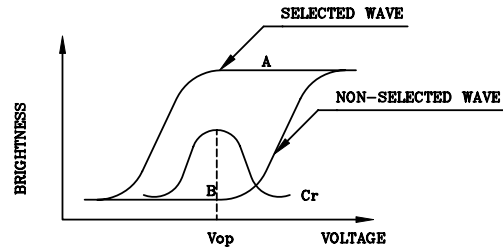
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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.:
Z.W.

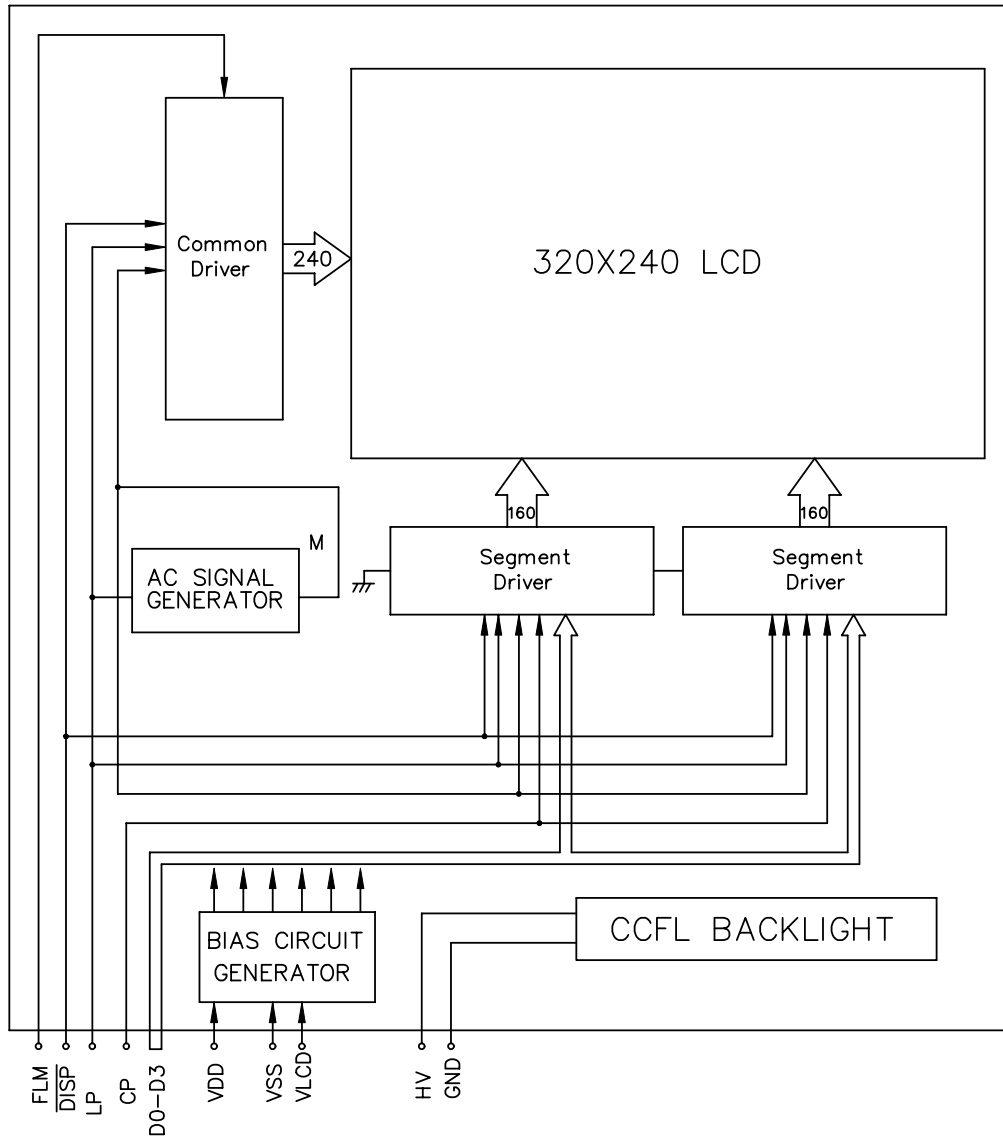
REV.:
1.0

HDM3224-M

SHEET 8 OF 16

DATE:
10/11/04

5. BLOCK DIAGRAM



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

Q.A.:
Z.W.

REV.:
1.0

HDM3224-M

SHEET 9 OF 16

DATE: 10/11/04

6. INTERNAL PIN CONNECTION

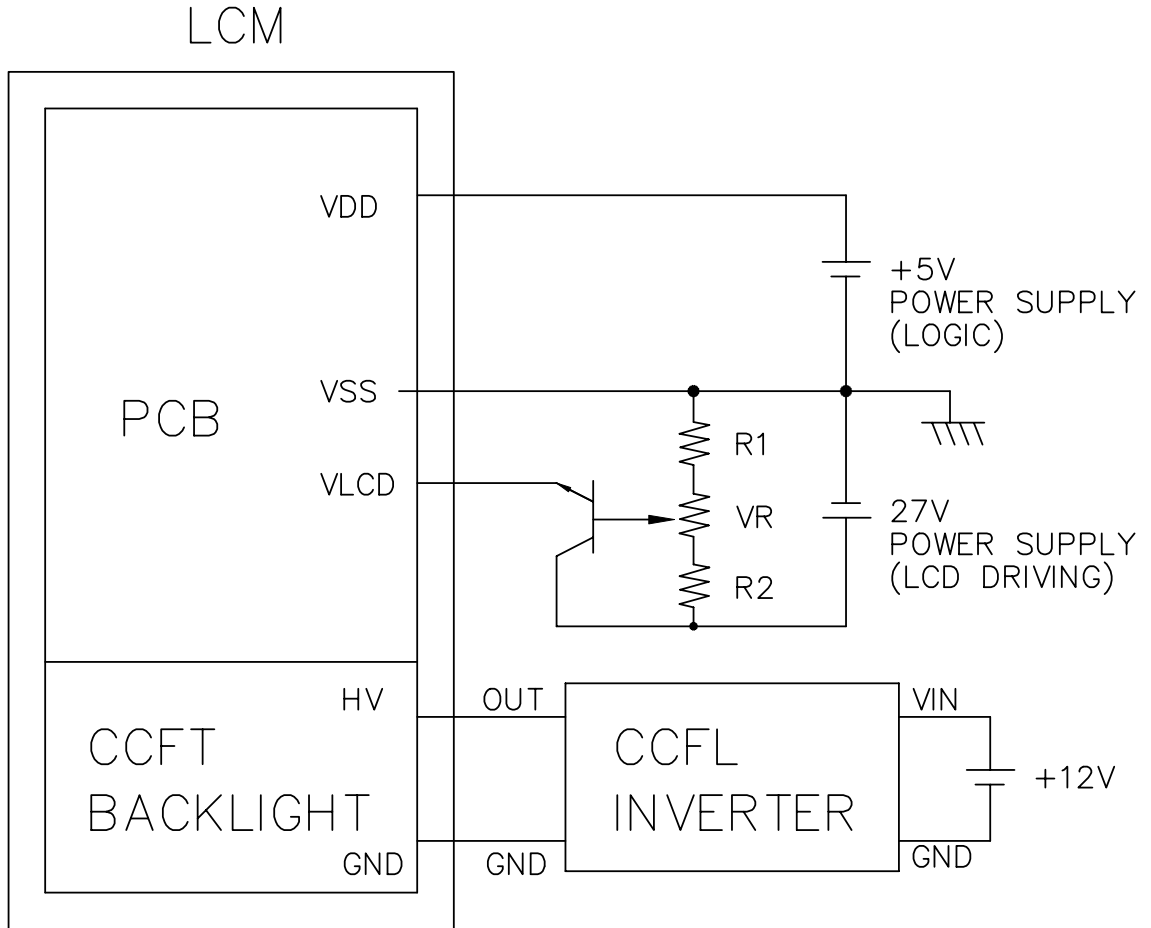
*CN1 : LCD Connector (Molex 53398-1290)

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

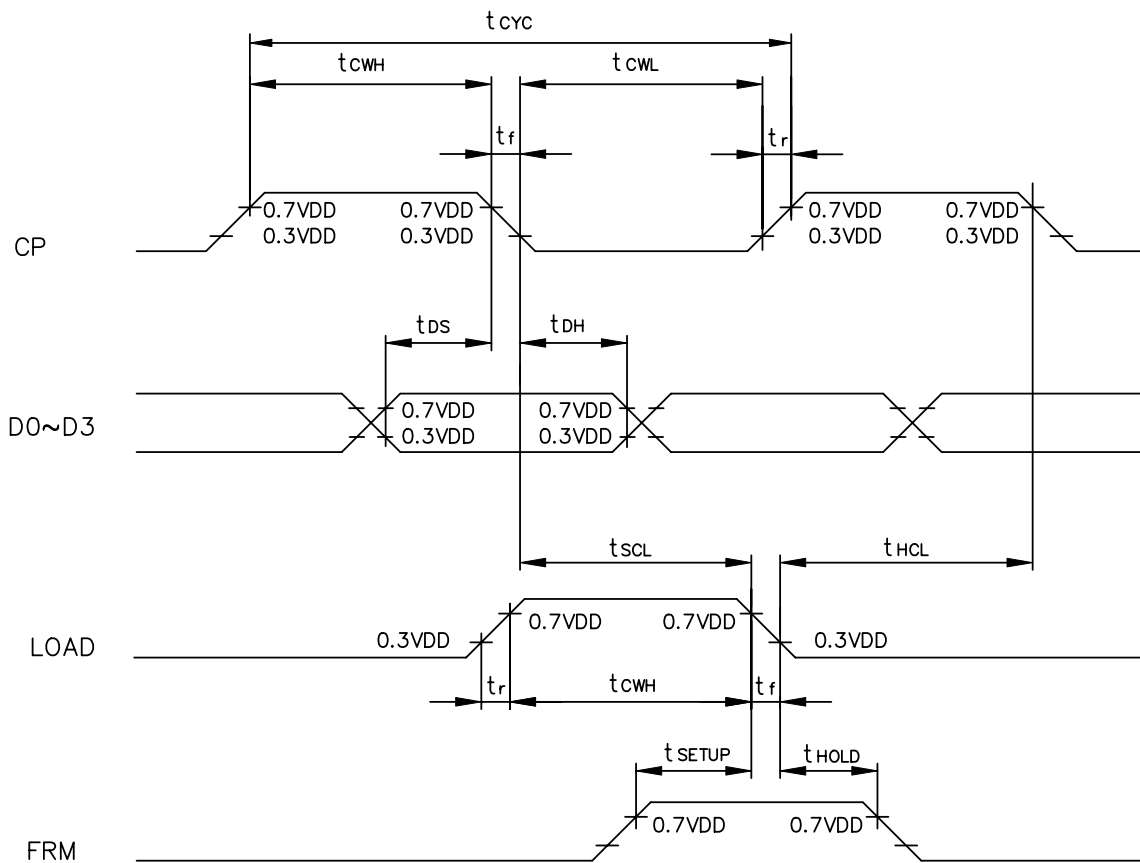


$$R1 + VR + R2 = 10K \sim 20K \Omega$$

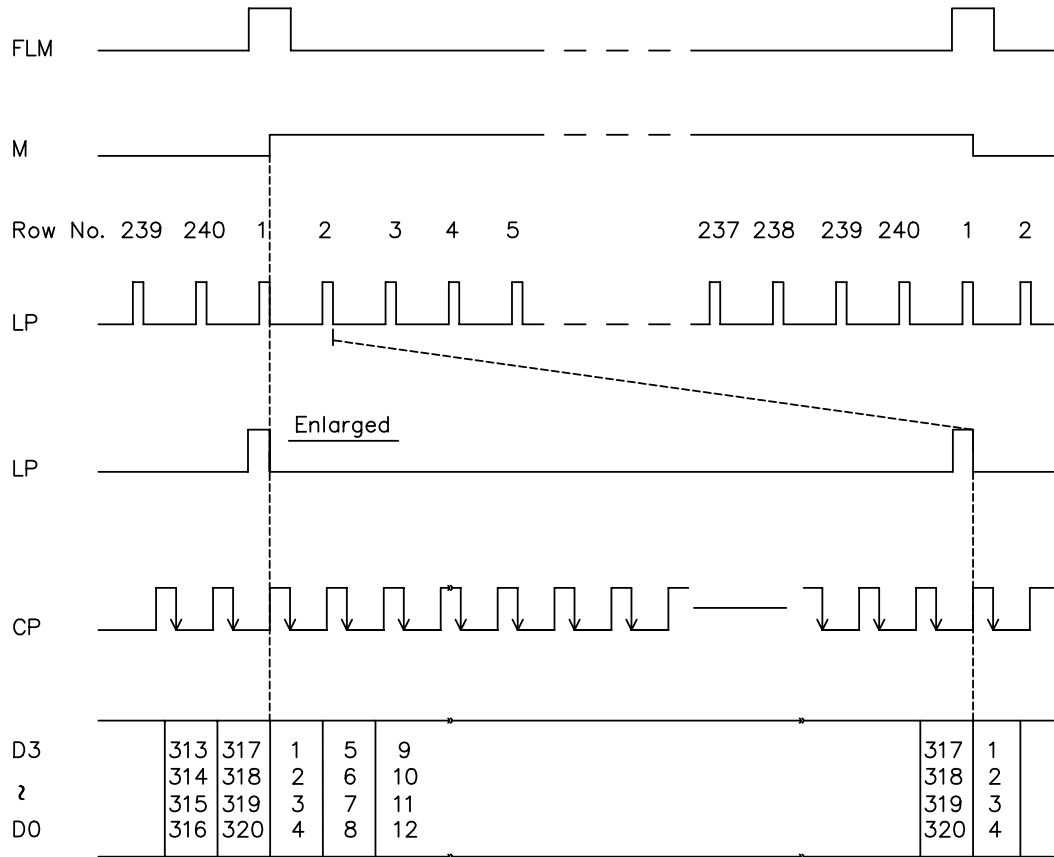
8. TIMING CHARACTERISTICS

8-1. INTERFACE TIMING

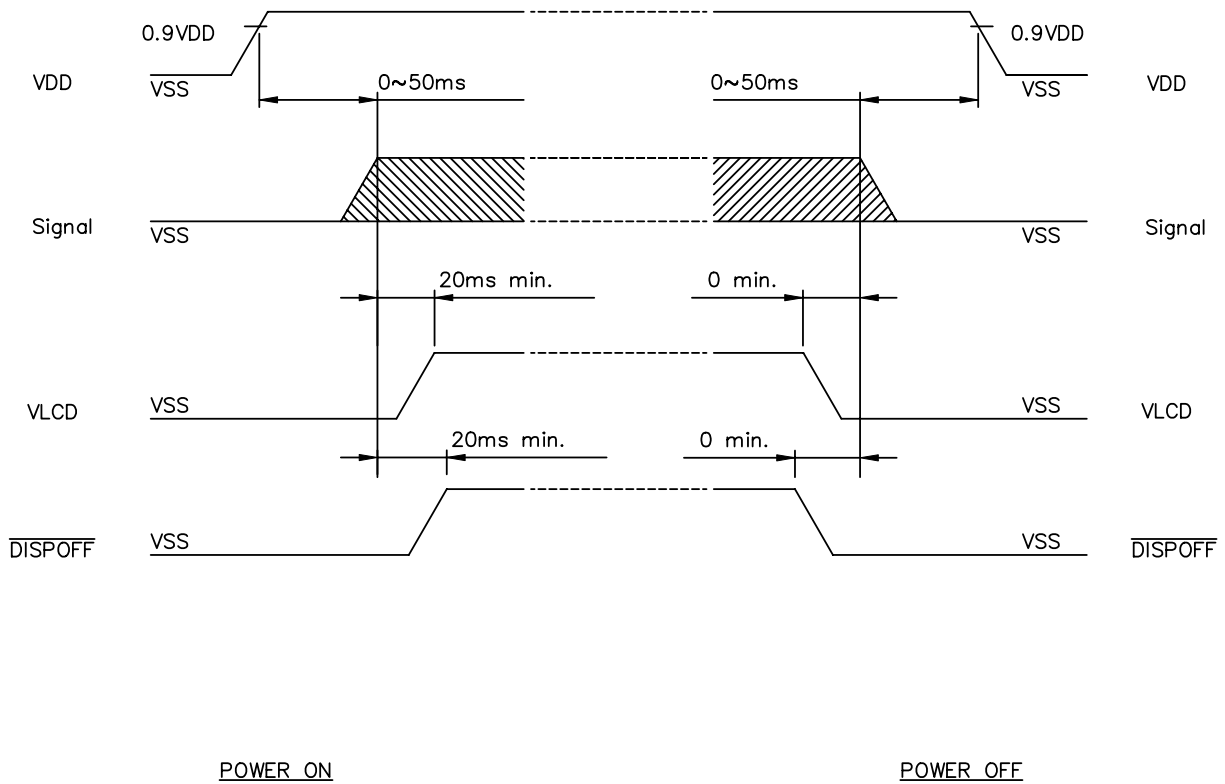
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLOCK CYCLE TIME	t_{cyc}	125	-	-	ns
CLOCK HIGH LEVEL WIDTH	t_{cwh}	51	-	-	ns
CLOCK LOW LEVEL WIDTH	t_{cwl}	51	-	-	ns
CLOCK RISE TIME	t_r	-	-	50	ns
CLOCK FALL TIME	t_f	-	-	50	ns
DATA SETUP TIME	t_{ds}	30	-	-	ns
DATA HOLD TIME	t_{dh}	40	-	-	ns
CLOCK SETUP TIME	t_{scl}	51	-	-	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



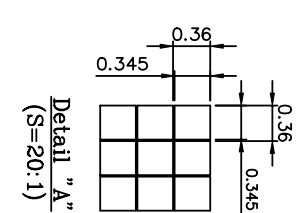
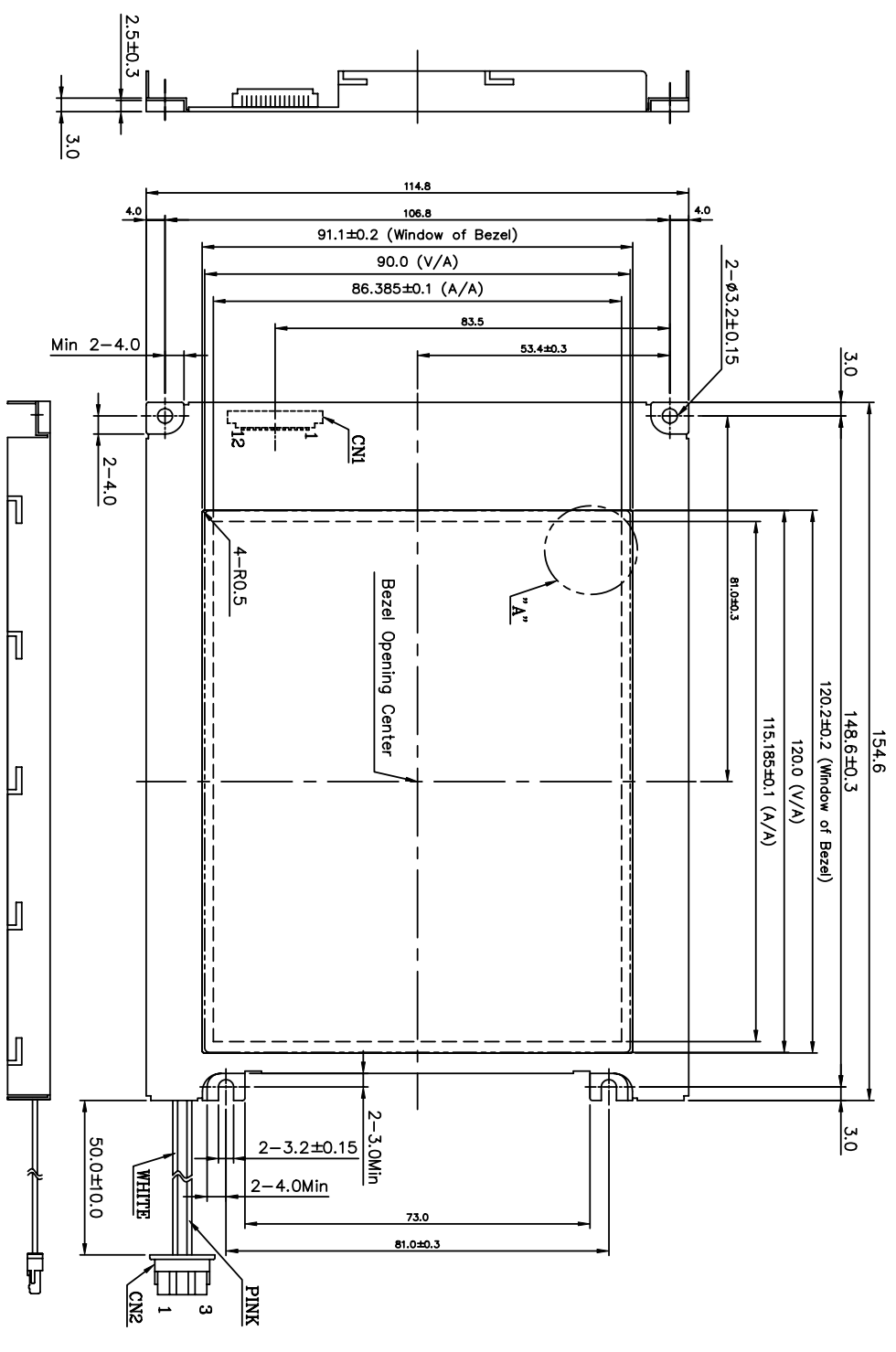
8-4. POWER ON/OFF TIMING



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
↔



*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 : CCTL Connector (JST BHR-03VS-1)

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

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)
ANGLE	$\pm 1^\circ$ (DEG)

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

HANTRONIX

NAME	DATE	THIRD ANGLE P.
APPROVE TONY CHOI	93.03.23	
CHECK C.B. LAI	93.03.19	
DESIGN J.H. SUN	93.03.19	SCALE 1/1
DRAWN J.H. SUN	93.03.19	UNIT mm