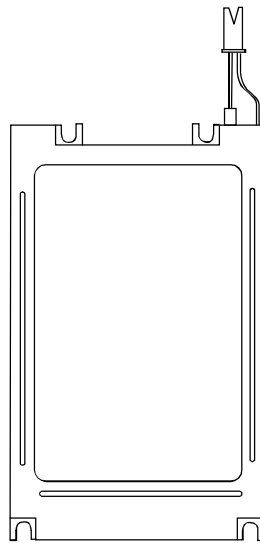


PRODUCT SPECIFICATION

HDM3224CL-S

320x240 COLOR GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224CL-S	SHEET 1 OF 19
	JK	1.0		DATE: 2/28/02

1. MECHANICAL DATA

(1) Product No.	HDM3224CL-S
(2) Module Size	76.8 (W)mm x 103.7 (H)mm x 5.5(D)mm
(3) Dot Size	0.234 (W)mm x 0.068 (H)mm
(4) Dot Pitch	0.249 (W)mm x 0.083 (H)mm
(5) Number of Dots	240 (W) x (320 xRGB (H)) Dots
(6) Duty	1/240
(7) LCD Display Mode	FSTN: Color STN Module REAR POLARIZER: Color Transmissive Type (PCF)
(8) Viewing Direction	6 O'clock
(9) Backlight	LED
(10) Controller	Excluded
(11) DC/DC Converter	Excluded
(12) Weight	66.7 g(approx.)

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224CL-S	SHEET 2 OF 19
	JK	1.0		DATE: 2/28/02

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	
Power Supply for LCD Drive	VEE-VSS	0	30.0	V	
Input Voltage	VI	-0.3	VDD+0.3	V	
Static Electricity	-	-	-	-	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	-20	70
Humidity (Without Condensation)	Note 2,4		Note 3,4	

Note 1 LCM should be grounded during handling LCM.

Note 2 $T_a \leq 50^\circ\text{C}$: 85%RH max
 $T_a > 50^\circ\text{C}$: Absolute humidity must be lower
 than the humidity of 85%RH at 50°C

Note 3 T_a at -20°C will be < 48 hrs, at 70°C will be < 120 hrs

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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224CL-S	SHEET 3 OF 19
	JK	1.0		DATE:

3-1. ELECTRICAL CHARACTERISTICS

LCD

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT		
Logic Circuit Power Supply		VDD-VSS	Ta= 25°C	3.0	3.3	3.6	V		
				4.5	5.0	5.5			
Input Voltage		VH	H level	0.8VDD	-	VDD	V		
		VL	L level	0	-	0.2VDD	V		
Recommended LCD Driving Voltage		VEE-VSS (Vop)	Duty=1/240 Bias=1/14	0°C	24.6	24.9	25.2	V	
				25°C	23.2	23.5	23.8		
				50°C	22.3	22.6	22.9		
Power Supply Current		IDD	VDD-VSS = 3.3V VEE-VSS = 23.5V Ta= 25°C	-	0.45	0.7	mA		
		IEE	PATTERN: □ ■ □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ ■ □	-	2.9	4.3	mA		
		IDD	VDD-VSS = 5.0V VEE-VSS = 23.5V Ta= 25°C	-	0.85	1.3	mA		
		IEE	PATTERN: □ ■ □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ ■ □	-	2.9	4.3	mA		
LCM	Surface Luminance	L	VDD-VSS=3.3V VEE-VSS=23.5V Ta= 25°C I _f =55mA	PATTERN: (Dots All On of White Color) □ □ □ □ □ □ □ □		-	46.3	-	cd/m ²
				PATTERN: (Dots All Off) ■ ■ ■ ■ ■ ■ ■ ■		-	1.4	-	cd/m ²

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used LED Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Peak forward current	I _P	-	-	120	mA	-
Maximum reverse voltage	V _R	-	-	5	V	-
Applied forward current	I _F	-	55	83	mA	at V _F = 7.0 V
Applied forward voltage	V _F	-	7.2	-	V	at I _F = 55 mA
LED power consumption	P _F	-	0.4	-	W	-
LED life time	L _L	-	10000	-	hrs	at I _F = 60 mA (*1)
AVG. X of 1931 C.I.E.	X	0.31	0.33	0.35	-	-
AVG. Y of 1931 C.I.E.	Y	0.31	0.33	0.35	-	-

(*1) LED 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.:	REV.:	HDM3224CL-S	SHEET 5 OF 19
	JK	1.0		DATE:

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°C		25°C		50°C		25°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
Z	M	23	28	25	30	6	8	-	98	-	±48
Note		NOTE 6						NOTE 5			

note:

Z: TRANSMISSION (PCF)
M: 6 O'CLOCK COLOR STN MODULE

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0°C	580	730	880	ms	NOTE 2
		25°C	235	285	340		
		50°C	95	120	145		
Response Time (fall)	Tf	0°C	250	310	370	ms	NOTE 2
		25°C	60	75	90		
		50°C	45	60	75		

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224CL-S	SHEET 6 OF 19
	JK	1.0		DATE:

4-2 Color of CIE Coordinate

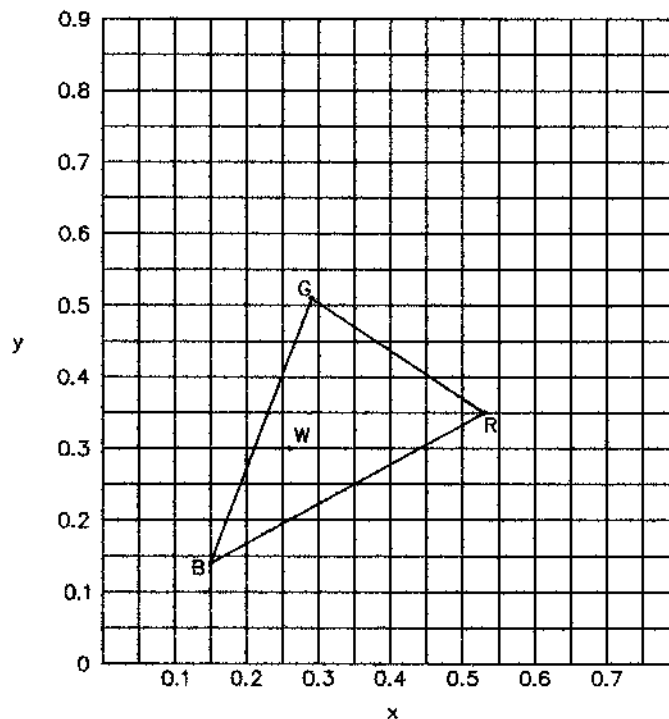
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m ²)	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^\circ, \theta=0^\circ$	0.53	9.7	Note*
		y		0.35		
	Green	X		0.29	26.9	
		y		0.51		
	Blue	X		0.15	10.1	
		y		0.14		
	White	X		0.26	35.2	
		y		0.30		

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

Tolerance : ±0.05

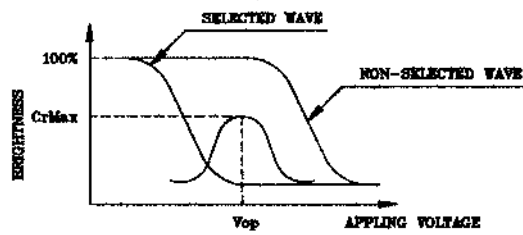
Fig.1



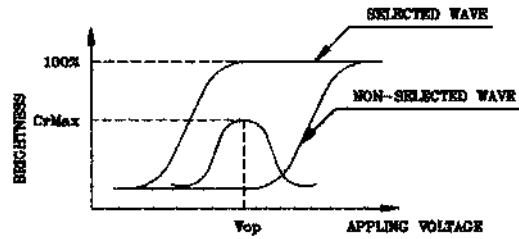
HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224CL-S	SHEET 7 OF 19
	JK	1.0		DATE: 2/28/02

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



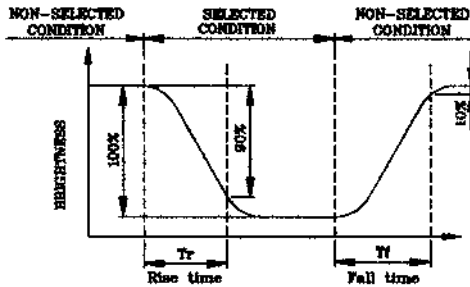
(negative type)

*Conditions

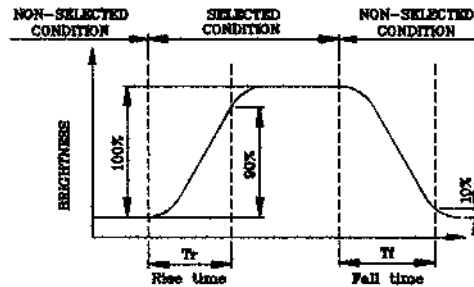
- Viewing Angle : 0
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



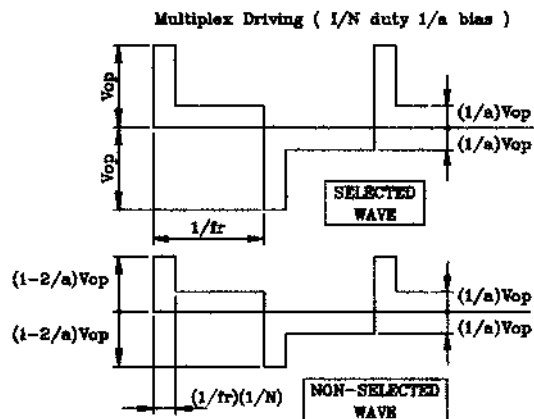
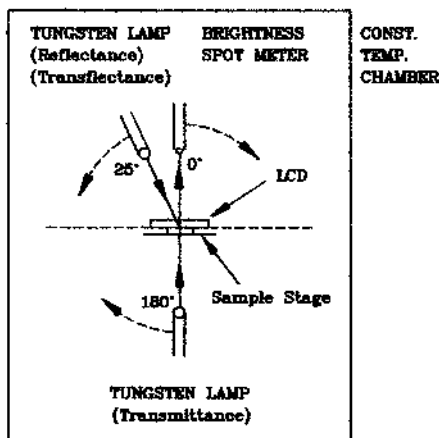
(negative type)

*Conditions

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

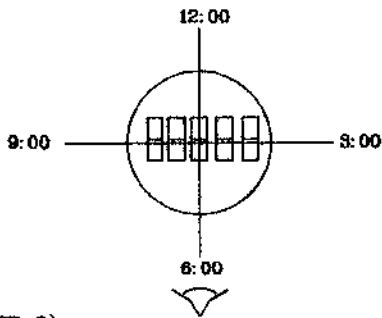
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



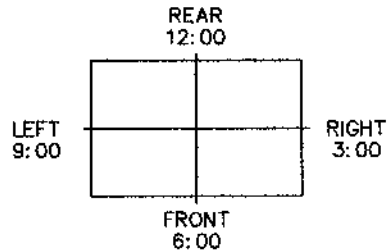
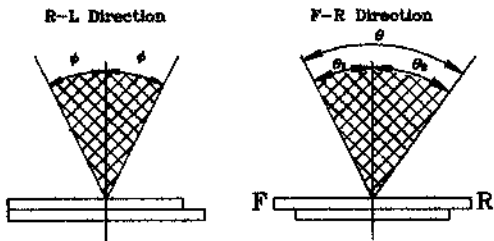
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

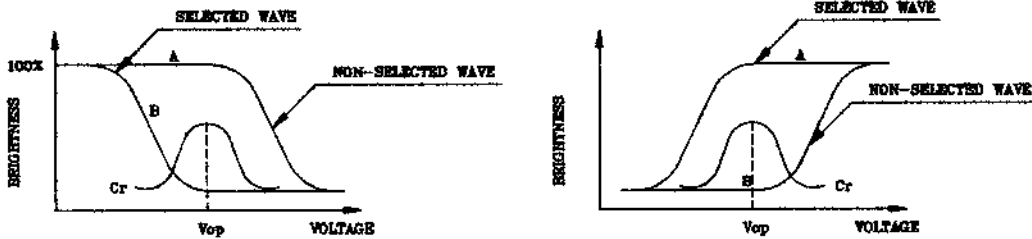
$$\theta = \theta_1 + \theta_2$$

*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)



(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

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

Q.A.:
JK

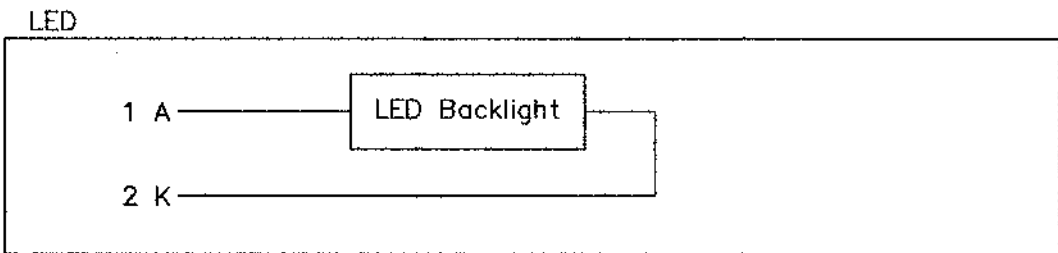
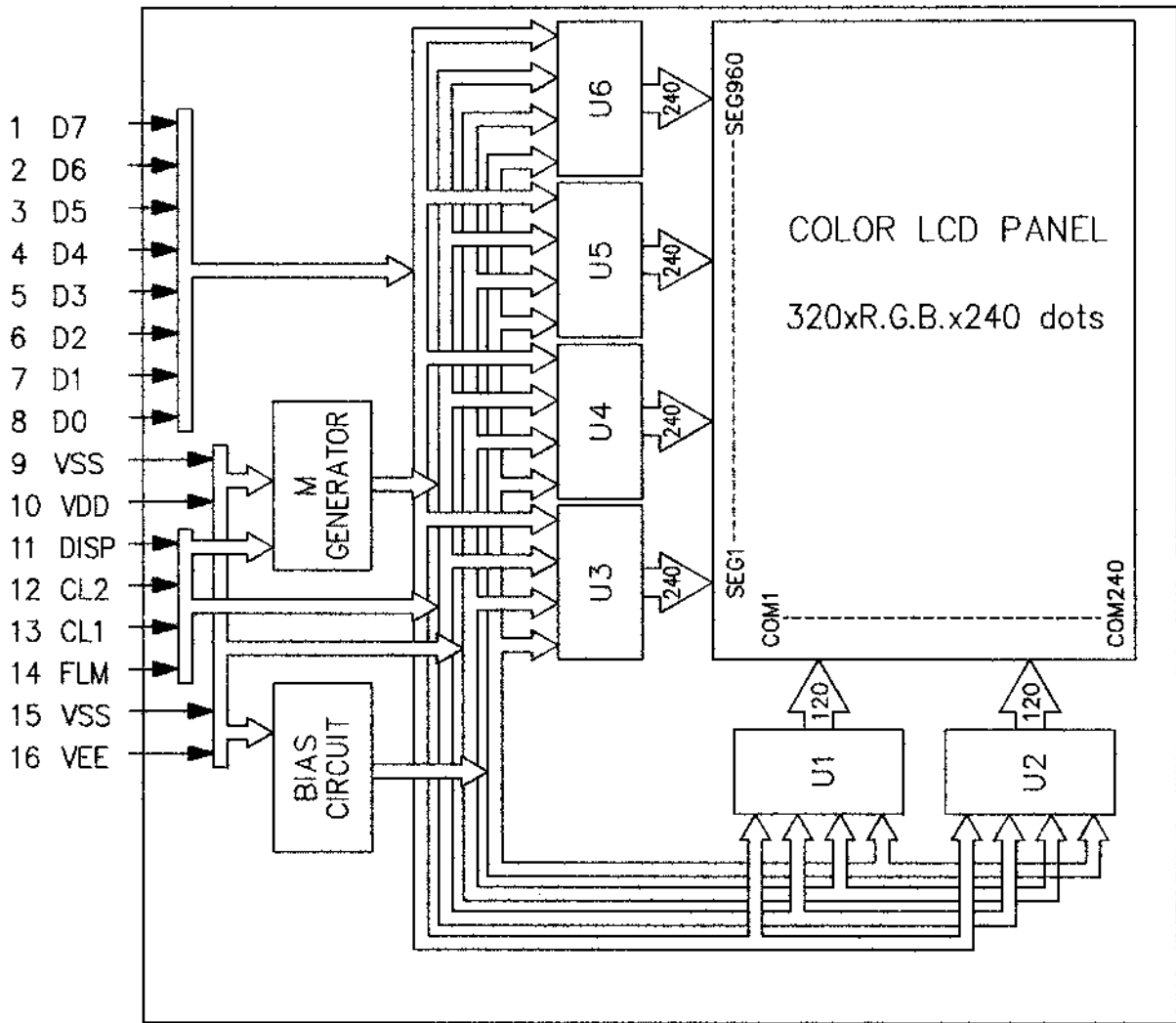
REV.:
1.0

HDM3224CL-S

SHEET 9 OF 19

DATE:
2/28/02

5. BLOCK DIAGRAM



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224CL-S	SHEET 10 OF 19
	JK	1.0		DATE:

6.INTERNAL PIN CONNECTION

LCD

Pin No.	Symbol	Level	Function
1	D7	H/L	Display Data
2	D6	H/L	Display Data
3	D5	H/L	Display Data
4	D4	H/L	Display Data
5	D3	H/L	Display Data
6	D2	H/L	Display Data
7	D1	H/L	Display Data
8	D0	H/L	Display Data
9	VSS	-	GND
10	VDD	-	Power Supply for Logic
11	DISP	H/L	Display Control Signal, H :Display on L :Display off
12	CL2	H/L	Data input clock
13	CL1	H/L	Input data latch signal
14	FLM	H/L	Scan start-up signal
15	VSS	H/L	Power Supply (0V,GND)
16	VEE	-	Power Supply for LCD

LED

Pin No.	Symbol	Level	Function
1	A	-	Power Supply Voltage for LED B/L
2	K	-	GND

LCD INTERFACE CONNECTOR

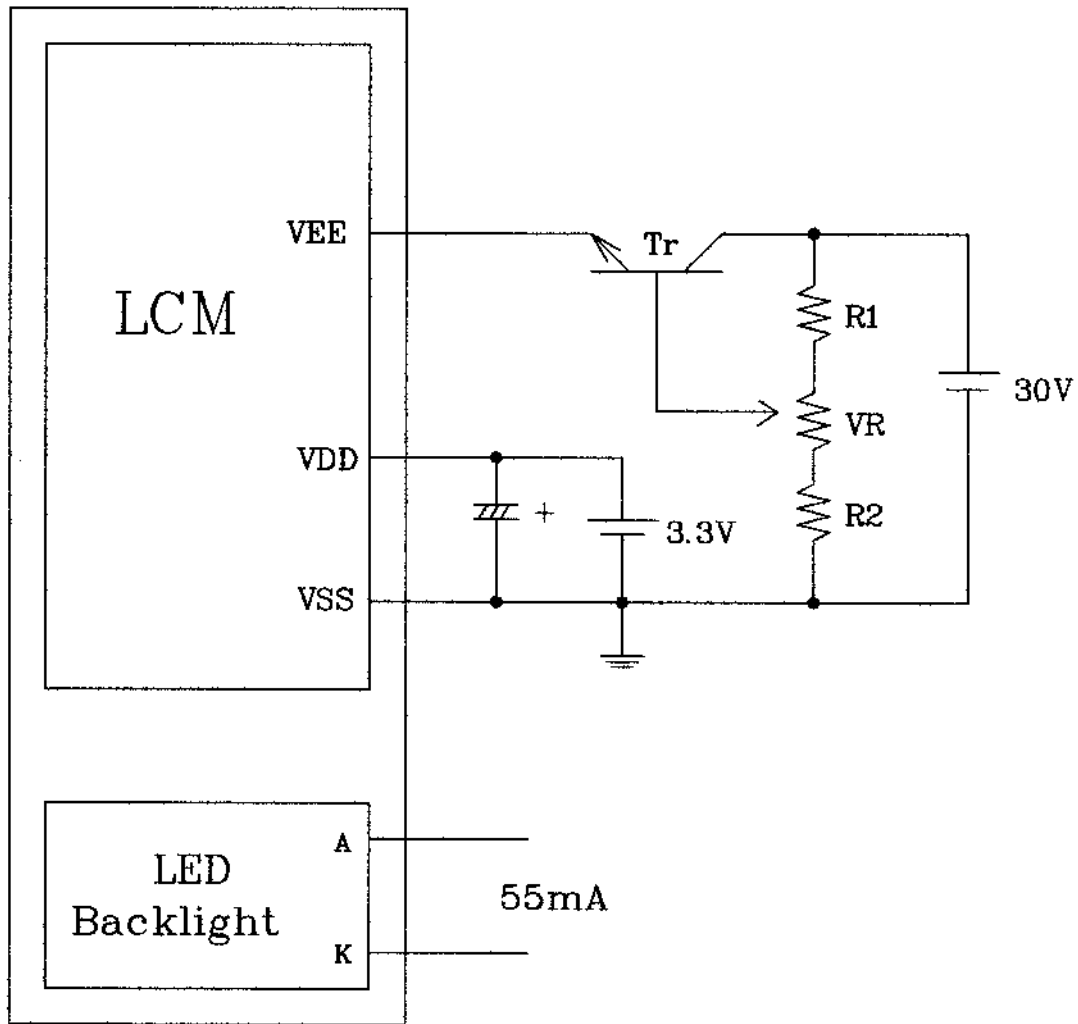
FH12-16S-0.5SV (HIROSE)/Suitable FFC :pitch 0.5mm ,width 8.5mm

LED CONNECTOR :

BHSR -02VS-1 (JST)/Suitable Connector :SM02B-BHSS-1-TB (JST)

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224CL-S	SHEET 11 OF 19
	JK	1.0		DATE:

7. POWER SUPPLY



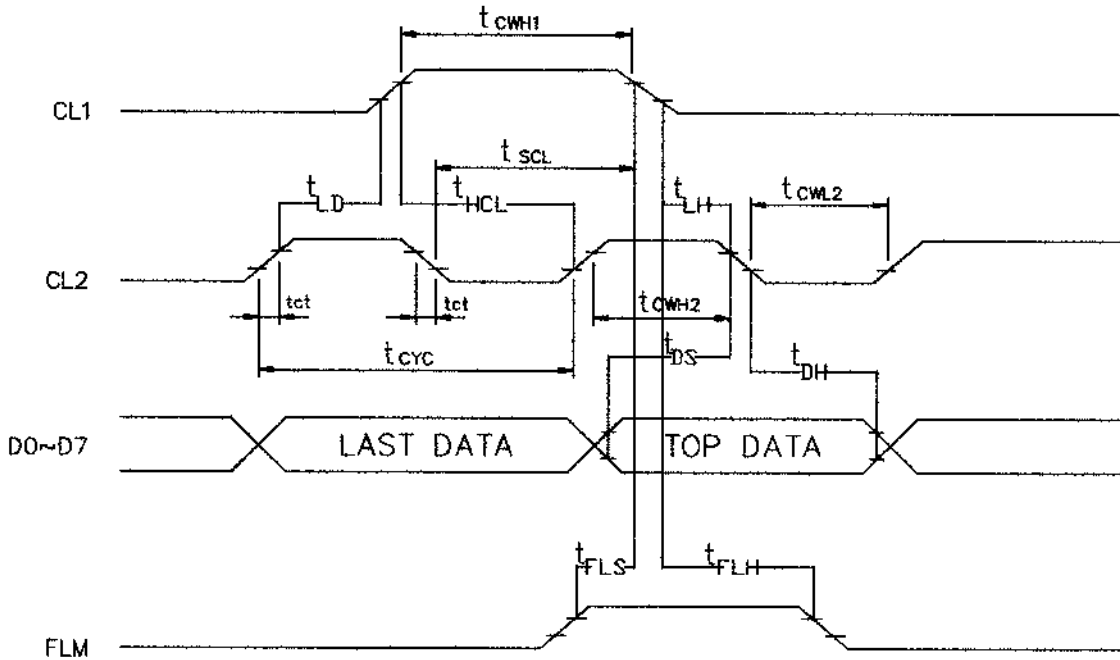
1. $R1 + R2 + VR = 10 \sim 20K \Omega$

8. TIMING CHARACTERISTICS

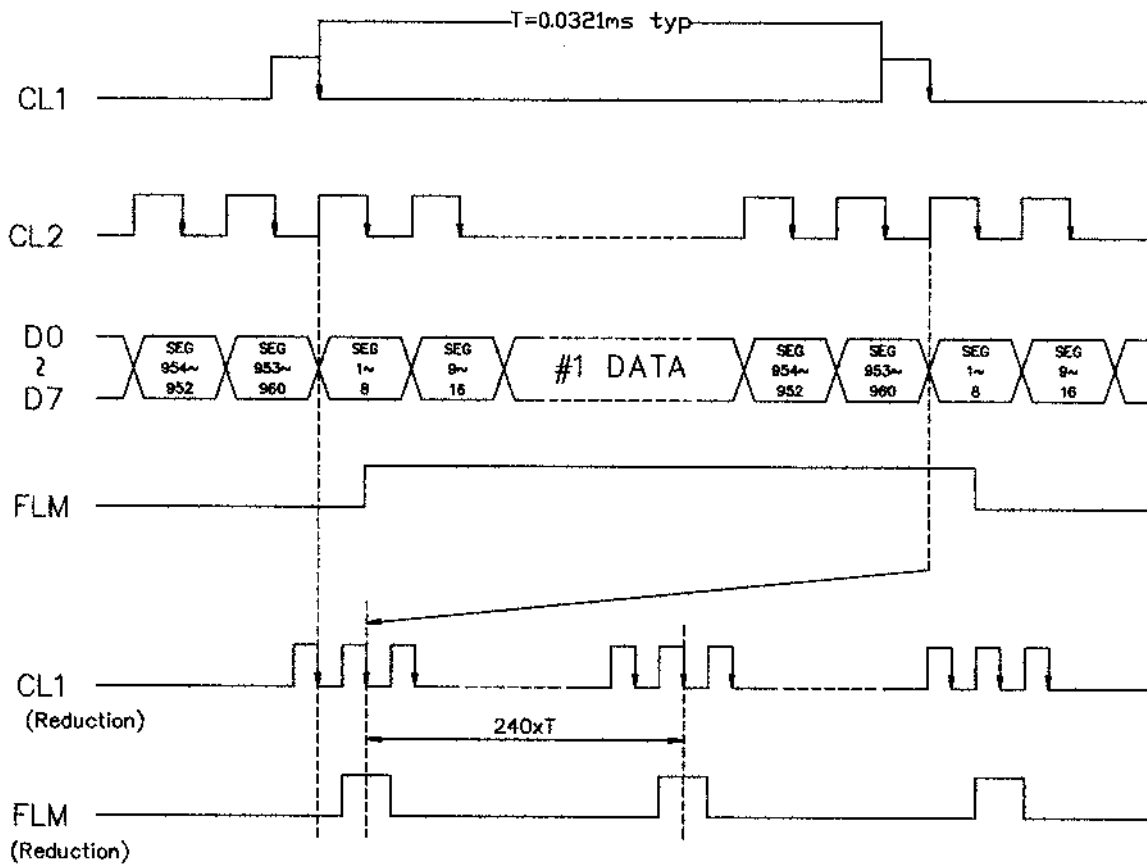
8-1 INTERFACE TIMING

VDD=3.3V ± 10%

Parameter	SYMBOL	MIN.	MAX.	UNIT
CLOCK CYCLE TIME	t_{cyc}	66	-	ns
CL2 HIGH LEVEL WIDTH	t_{cwh2}	23	-	ns
CL2 LOW LEVEL WIDTH	t_{cwl2}	23	-	ns
CL1 HIGH LEVEL WIDTH	t_{cwh1}	30	-	ns
CL2 SETUP TIME	t_{scl}	30	-	ns
CL2 HOLD TIME	t_{hcl}	30	-	ns
CL2 - CL1 RISE TIME	$t_{\uparrow D}$	10	-	ns
CL1 - CL2 FALL TIME	t_{\downarrow}	30	-	ns
CLOCK RISE / FALL TIME	t_{ct}	5	-	ns
DATA SETUP TIME	t_{ds}	10	-	ns
DATA HOLD TIME	t_{dh}	25	-	ns
FLM SETUP TIME	t_{fls}	30	-	ns
DATA HOLD TIME	t_{flh}	50	-	ns



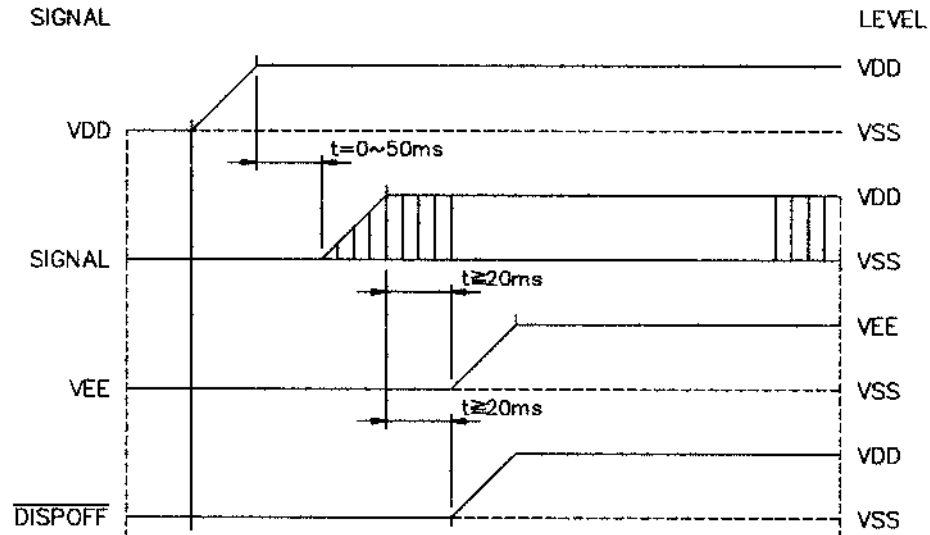
8-2 TIMING CHART OF INPUT SIGNAL



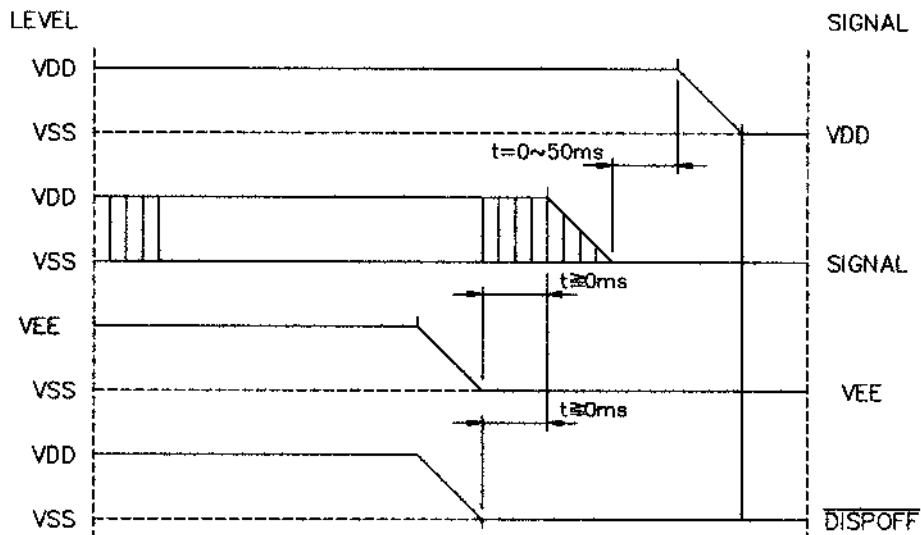
HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224CL-S	SHEET 14 OF 19
	JK	1.0		DATE: 2/28/02

8-3. POWER ON/OFF TIMING

ON SEQUENCE



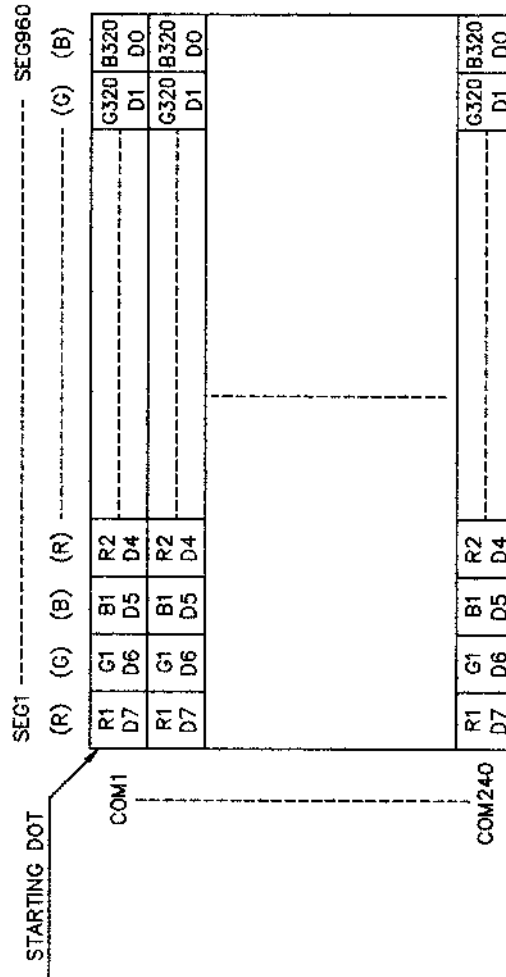
OFF SEQUENCE



Please maintain the above sequence when turning on and off the power supply of the module. If $\overline{\text{DISPOFF}}$ is supplied to the module while internal alternate signal for LCD driving(M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	HDM3224CL-S	SHEET 15 OF 19
	JK	1.0		DATE:

8-4. DISPLAY PATTERN



D0~D7 are 8 bits transmitted data, where D0 is LSB and D7 is MSB.

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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM3224CL-S	SHEET 17 OF 19
				DATE: 2/28/02

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.

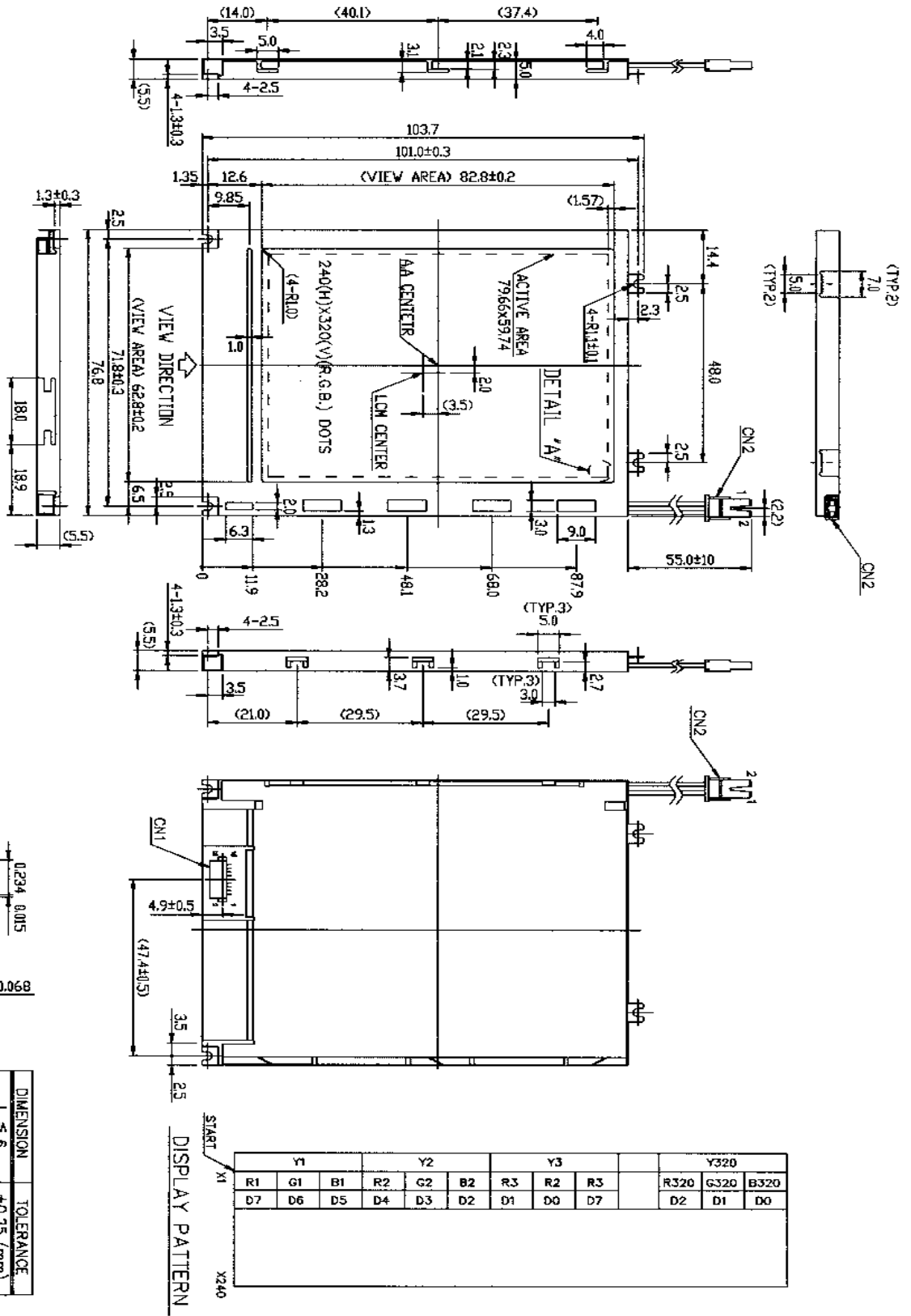
• STORAGE

- 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

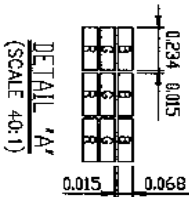
- 1.Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM3224CL-S	SHEET 18 OF 19
				DATE: 2/28/02



SUITABLE FPC : PITCH 0.5mm WIDTH 8.5mm
 CN1 : FH12-16S-0.5S(VHRS)
 SUITABLE CONNECTOR : SMO2B-BHSS-1-TB (JST)
 CN2 : BHSR-02VS-1-(JST) (PIN1-HOT;PIN2-GND)

NOTE:
 1.RESOLUTION: 240 (H) X 320 (V)(R.G.B.) DOTS
 2.BACKLIGHT: LED (WHITE)
 3.FRAME MATERIAL: SUS304 (0.3mmt)



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)

Y1		Y2			Y3			Y320			
R1	G1	B1	R2	G2	B2	R3	R2	R3	R320	G320	B320
D7	D6	D5	D4	D3	D2	D1	D0	D7	D2	D1	D0

HANTRONIX, INC.
 10080 BUBB RD.
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Q.A.:
 JK

REV.:
 1.0

HDM3224CL-S

SHEET 19 OF 19
 DATE: 2/28/02