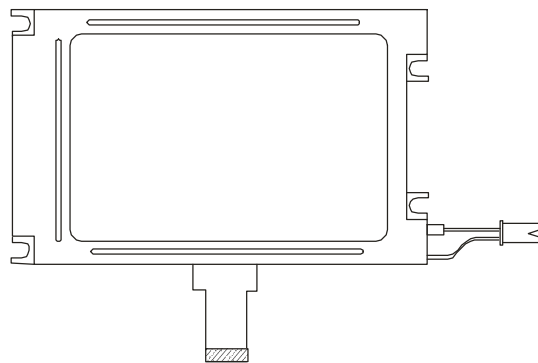


## PRODUCT SPECIFICATION

# HDM3224TSC-S-L

3224 COLOR GRAPHICS  
LCD DISPLAY MODULE



<b>HANTRONIX, INC.</b> 10080 BUBB RD. CUPERTINO, CA 95014	<b>Q.A.:</b>	<b>REV.:</b>	<b>HDM3224TSC-S-L</b>	<b>SHEET 1 OF 17</b>
	JB	1.0		<b>DATE:</b> 2/22/01

## MECHANICAL DATA

(1) Product No.	HDM3224TSC-S-L
(2) Module Size	76.8 (W)mm x 103.75 (H)mm x 7.9(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
(8) Viewing Direction	3 O'clock
(9) Backlight	CCFL
(10) Controller	Excluded
(11) DC/DC Converter	Excluded
(12) Weight	65.0 g(approx.)

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# 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	60
Humidity (Without Condensation)	Note 2,4		Note 3,4	

Note 1 LCM should be grounded during handling LCM.

Note 2 To  $\leq$  50°C : 85%RH max  
 To > 50°C : Absolute humidity must be lower  
 than the humidity of 85%RH at 50°C


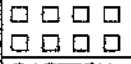

Note 3 To at -20°C will be < 48 hrs, at 60°C will be < 120 hrs

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

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# 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		
	VIL	L level	0	-	0.2VDD	V		
Recommended LCD Driving Voltage (Normal Temp. LCM)	VEE-VSS	Duty=1/240 Bias=1/14 VDD=5.0V	0°C	24.9	25.2	25.5	V	
			25°C	23.7	24.0	24.3		
			50°C	22.7	23.0	23.3		
Supply Current for Logic	IDD	VDD-VSS = 5.0V VEE-VSS = 24.0V Ta= 25°C	-	2.0	3.5	mA		
Supply Current for LCD	IEE	PATTERN: 	-	12.0	18.0	mA		
LCM	Surface Luminance	L	VDD-VSS=5.0V VEE-VSS=24.0V Ta= 25°C IL=2.5mArms	PATTERN: (Dots All On of White Color) 	-	66.7	-	cd/m <sup>2</sup>
				PATTERN: (Dots All Off) 	-	5.5	-	cd/m <sup>2</sup>

CCFL

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	VL	-	300	-	Vrms	IL = 2.5mArms
Lamp current	IL	1.5	2.5	3	mArms	(*1)
Lamp power consumption	PL	0.5	0.8	1	W	(*2)
Lamp frequency	FL	30	40	50	KHz	
Lamp life time	LL	-	20000	-	hrs	

(\*1) It is recommended that IL be not more than 2.5 mArms so that heat radiation of CCFT backlight may least affect the display quality .

(\*2) Power consumption exclud inverter .

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# OPTICAL CHARACTERISTICS

## Optical Char. of Normal Temp. Mode

AT Vop

ITEM MODE		Cr(Contrast Ratio)						$\theta$ (Viewing Angle)		$\phi$ (Viewing Angle)	
		0°C		25°C		50°C		25°		25°	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	R	-	25	-	35	-	10	-	42	-	(L) 37 (R) 60
NOTE		NOTE 6						NOTE 5			

note:

T: TRANSMISSIVE  
R: NORMALLY BLACK 3 O'CLOCK

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0°C	550	700	850	ms	NOTE 2
		25°C	210	260	310		
		50°C	80	100	120		
Response Time (fall)	Tf	0°C	220	270	320	ms	NOTE 2
		25°C	65	80	95		
		50°C	45	60	75		

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# Color of CIE Coordinate

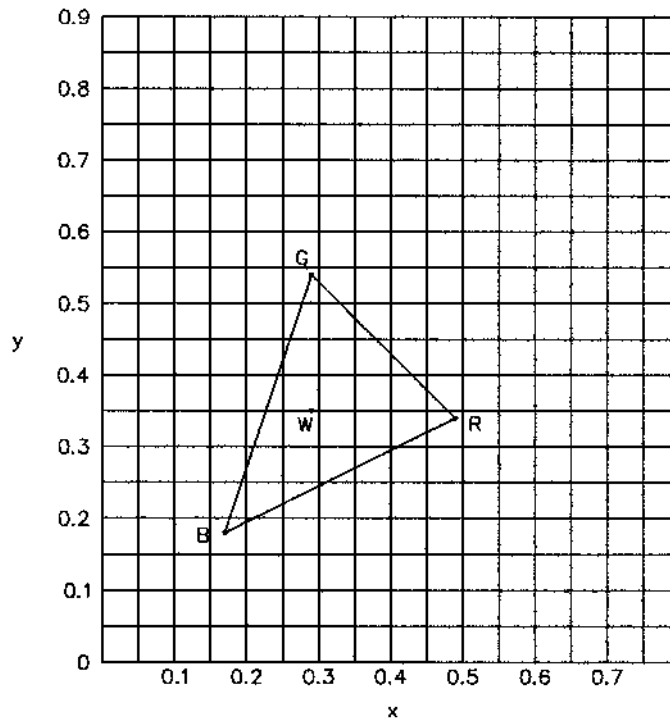
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m <sup>2</sup> )	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^\circ, \theta=0^\circ$	0.49	17.2	Note*
		y		0.34		
	Green	X		0.29	46.1	
		y		0.53		
	Blue	X		0.17	16.1	
		y		0.18		
	White	X		0.29	66.7	
		y		0.35		

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

Tolerance : ±0.05

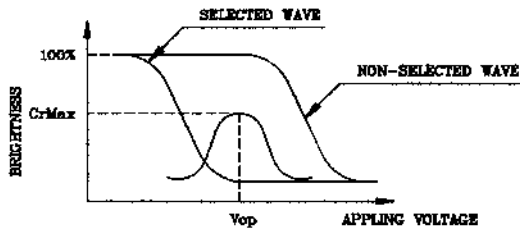
Fig.1



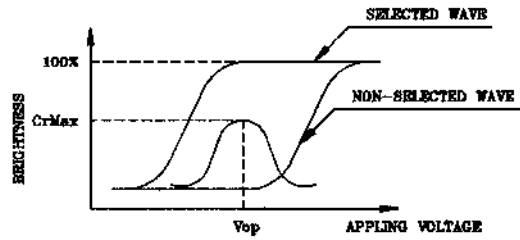
<b>HANTRONIX, INC.</b> 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	<b>HDM3224TSC-S-L</b>	SHEET 6 OF 17
	JB	1.0		DATE:

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



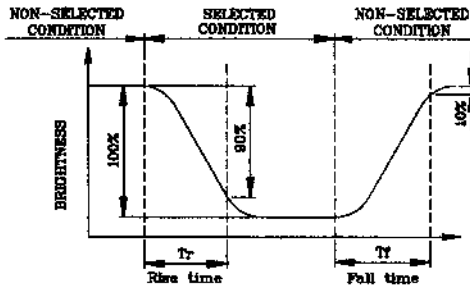
(negative type)

\*Conditions

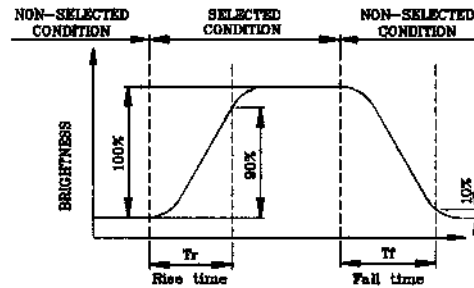
Viewing Angle : 0  
 Frame Frequency : 70Hz  
 Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



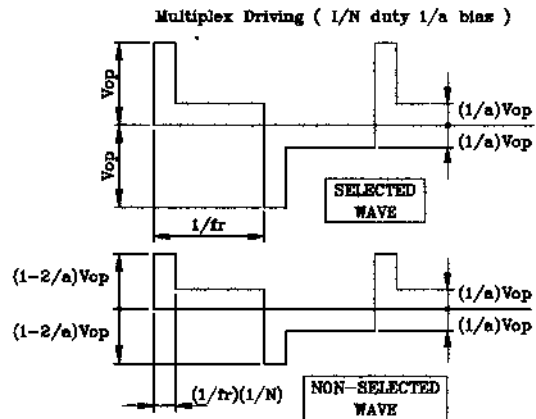
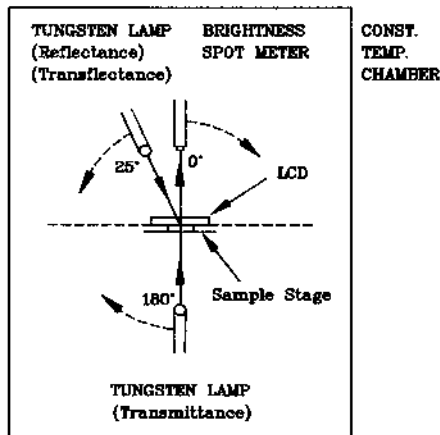
(negative type)

\*Conditions

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

(NOTE 3)

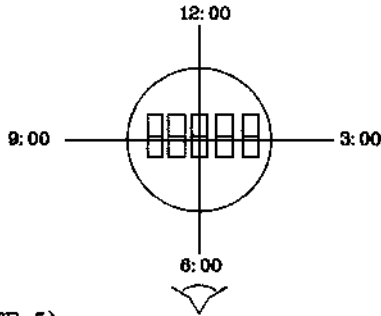
Description of Measuring Equipment and Driving Waveforms



<b>HANTRONIX, INC.</b> 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	<b>HDM3224TSC-S-L</b>	SHEET 7 OF 17
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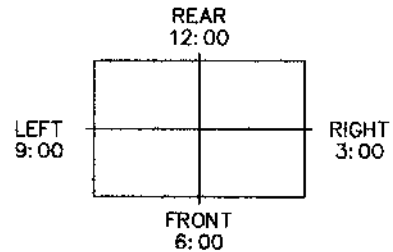
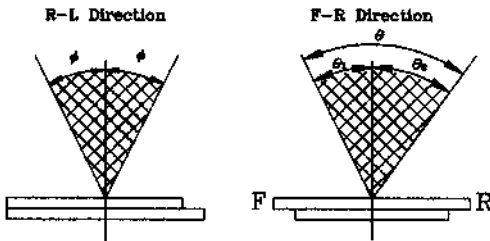
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

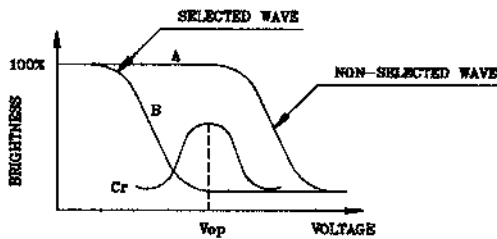
$$\theta = \theta_1 + \theta_2$$

\*Conditions

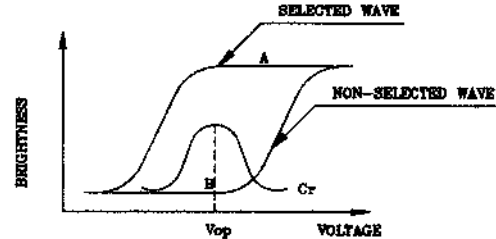
Operating Voltage :  $V_{op}$   
Frame Frequency : 70Hz  
Applying Waveform : 1/N duty 1/a bias  
Contrast Ratio : larger than 2

(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.:  
JB

REV.:  
1.0

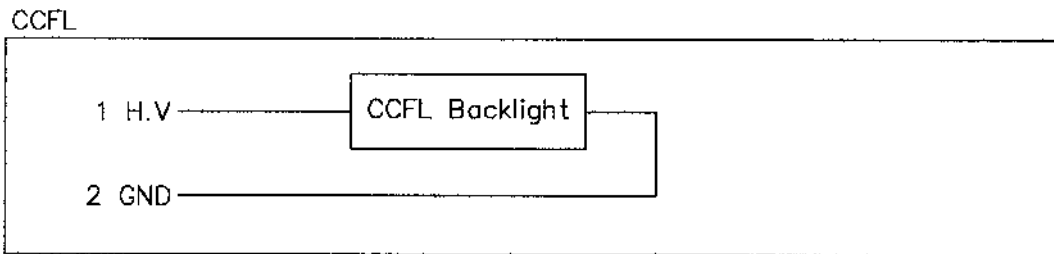
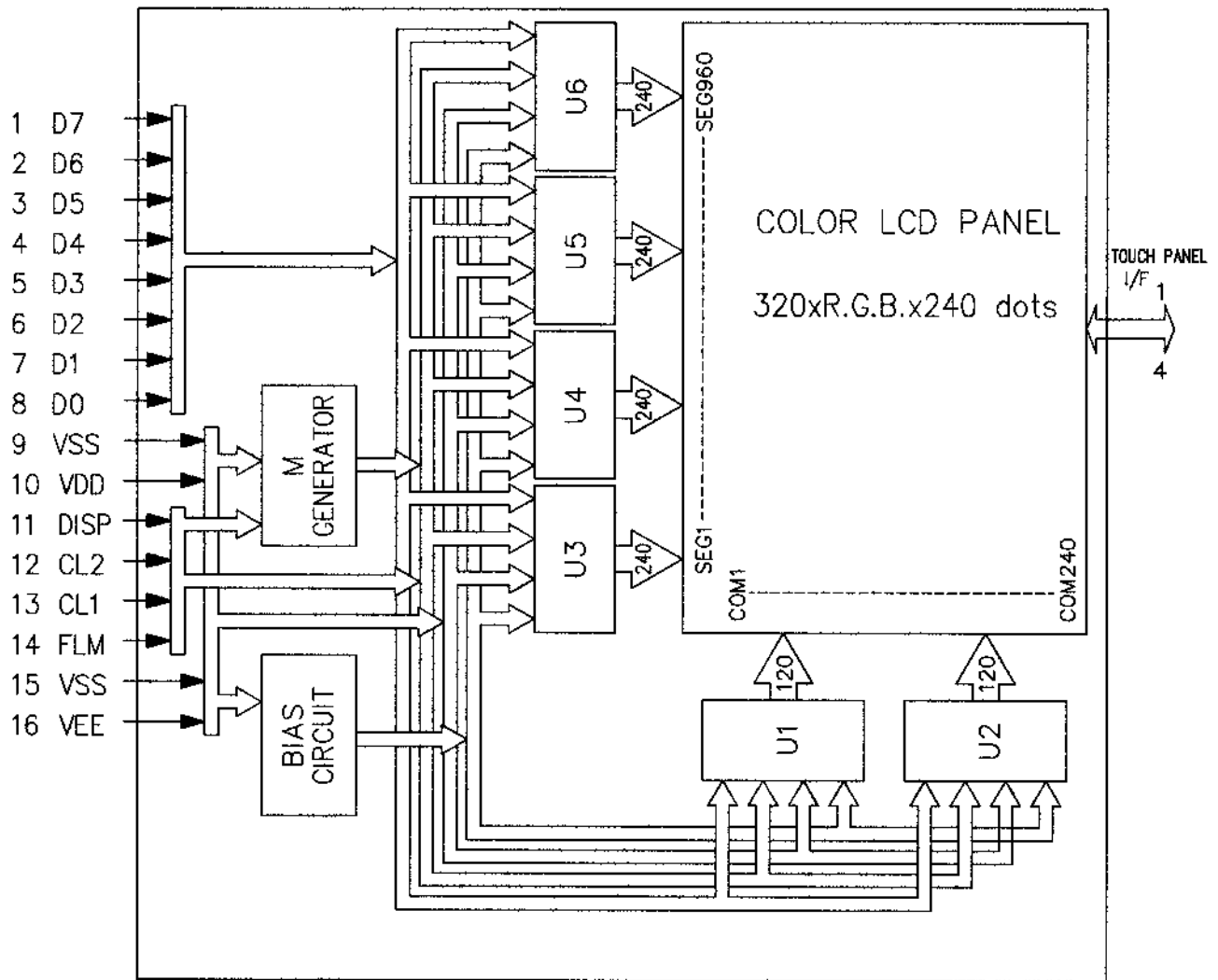
HDM3224TSC-S-L

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# 5. BLOCK DIAGRAM



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# 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 (DV,GND)
16	VEE	-	Power Supply for LCD

## CCFL

Pin No.	Symbol	Level	Function
1	H.V	-	Power Supply for CFL
2	GND	-	CFL GND

## LCD INTERFACE CONNECTOR

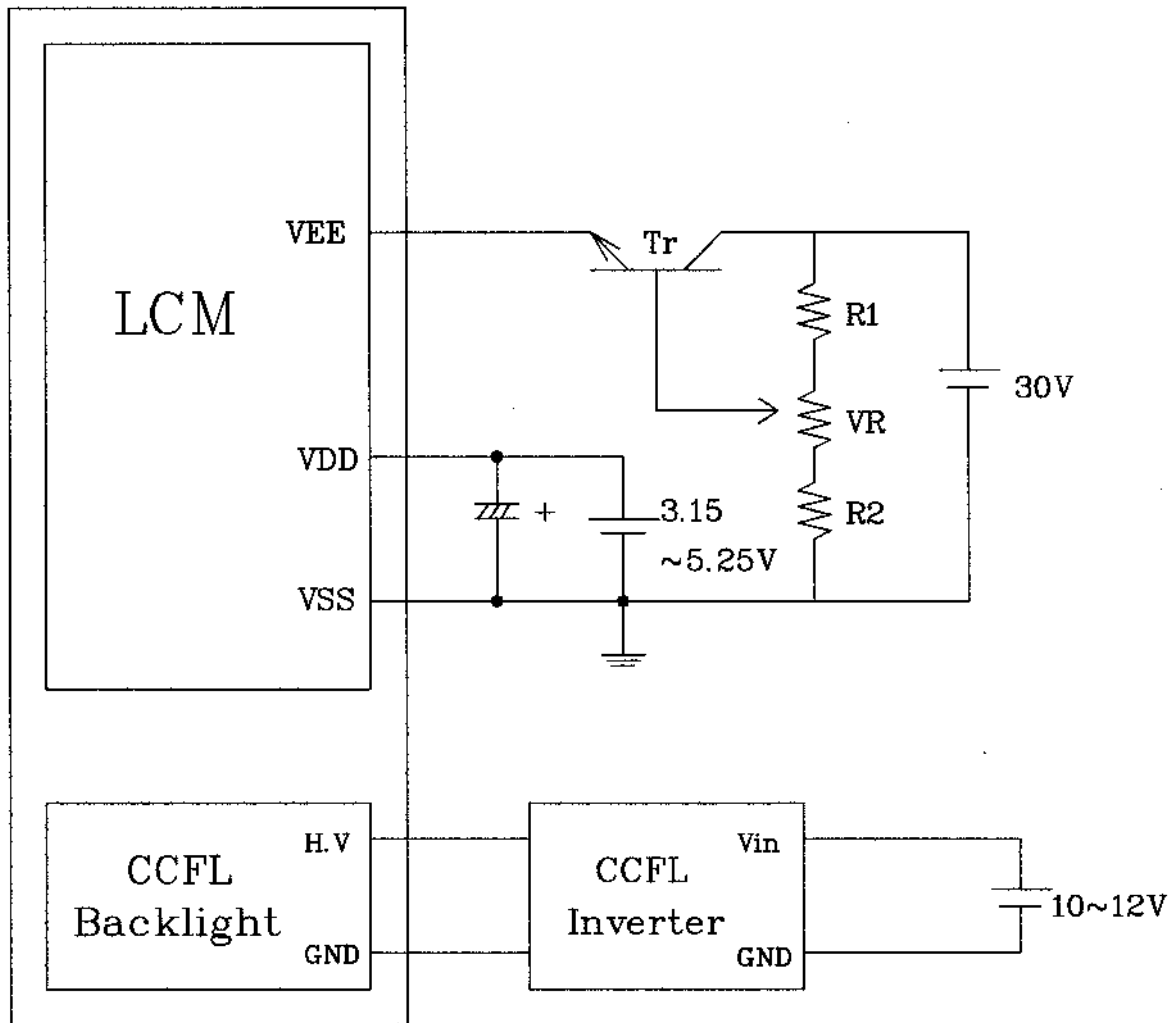
FH12-16S-0.5SV (HIROSE)/Suitable FFC :pitch 0.5mm ,width 8.5mm

## CCFL CONNECTOR :

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

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# POWER SUPPLY



1.  $R1 + R2 + VR = 10 \sim 20K \Omega$
2. RECOMMENDED CCFL INVERTER :  
COTEK INV-B1

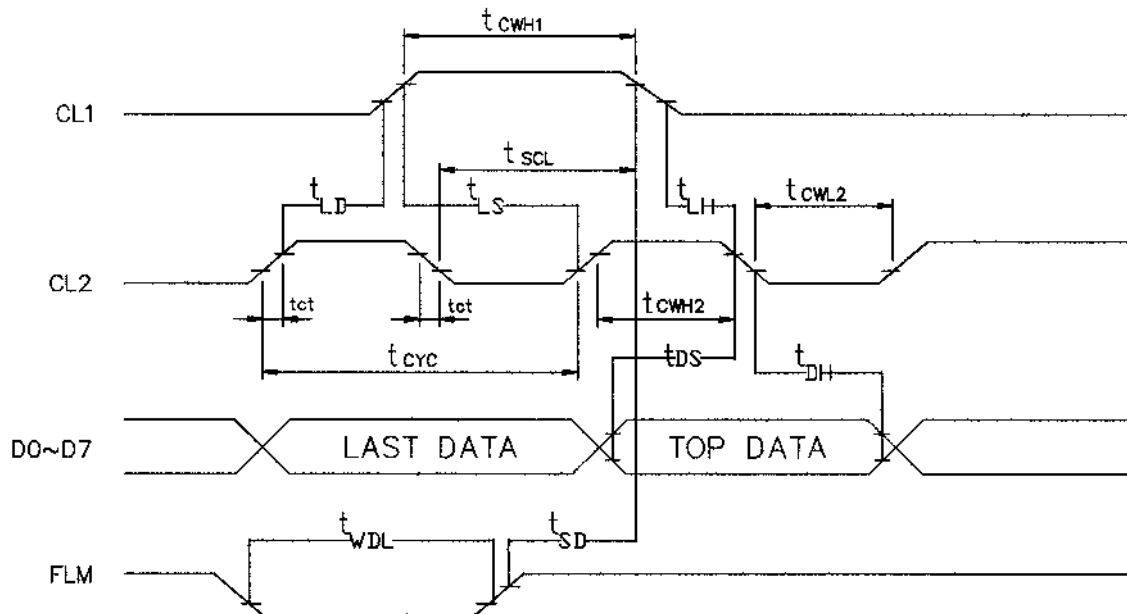
<b>HANTRONIX, INC.</b> 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV.:	<b>HDM3224TSC-S-L</b>	SHEET 11 OF 17
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# TIMING CHARACTERISTICS

## INTERFACE TIMING

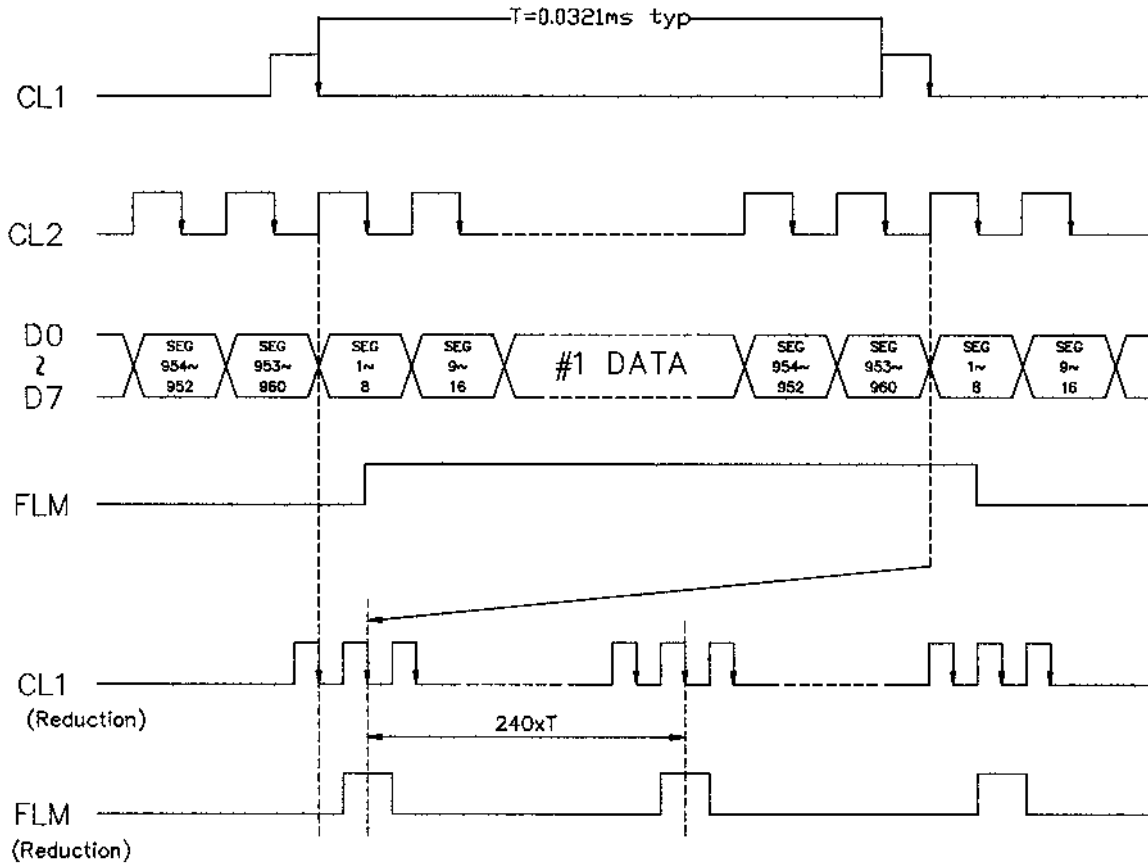
VDD=5.0V ± 10%

Parameter	SYMBOL	MIN.	MAX.	UNIT
CLOCK CYCLE TIME	$t_{cyc}$	50	—	ns
CL2 HIGH LEVEL WIDTH	$t_{cwh2}$	15	—	ns
CL2 LOW LEVEL WIDTH	$t_{cwl2}$	15	—	ns
CL1 HIGH LEVEL WIDTH	$t_{cwh1}$	25	—	ns
CL2 SETUP TIME	$t_{scl}$	100	—	ns
CL2 HOLD TIME	$t_{hcl}$	100	—	ns
CL2 - CL1 RISE TIME	$t_{ld}$	5	—	ns
CLOCK RISE / FALL TIME	$t_{cr}$	—	—	ns
DATA SETUP TIME	$t_{ds}$	10	50	ns
DATA HOLD TIME	$t_{dh}$	15	—	ns
FLM SETUP TIME	$t_{fs}$	30	—	ns
DATA HOLD TIME	$t_{fh}$	50	—	$\mu$ s
FRAME FREQUENCY	$t_{flm}$	60	—	ns



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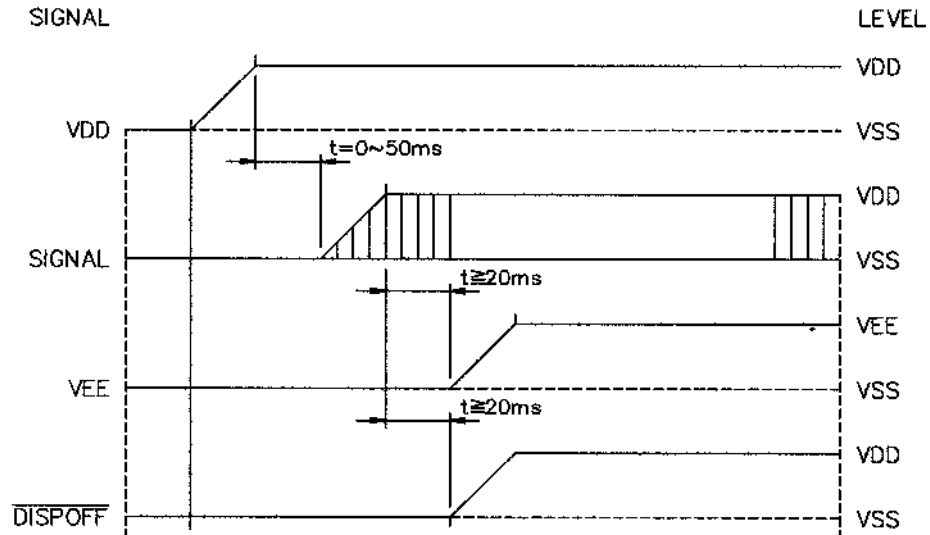
# TIMING CHART OF INPUT SIGNAL



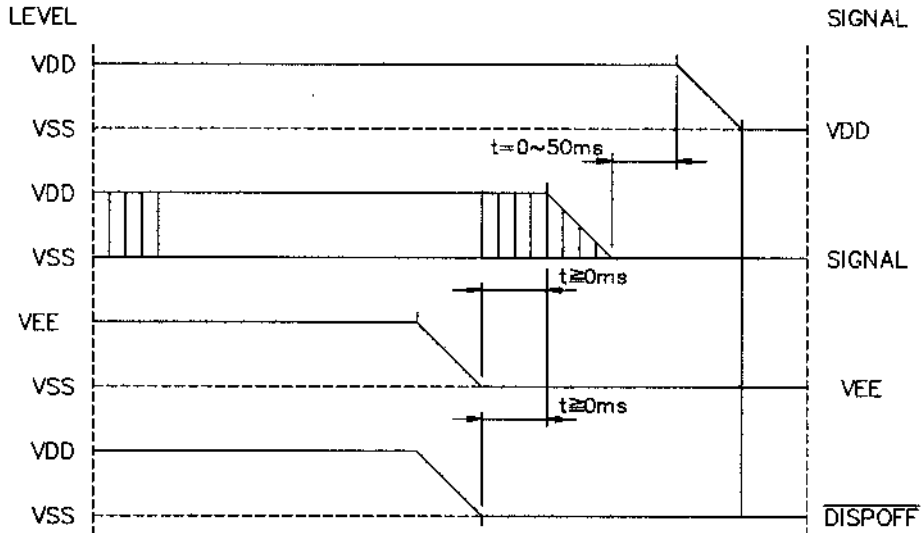
<b>HANTRONIX, INC.</b> 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JB	REV.: 1.0	<b>HDM3224TSC-S-L</b>	SHEET 13 OF 17 DATE: 2/22/01
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# POWER ON/OFF TIMING

## ON SEQUENCE



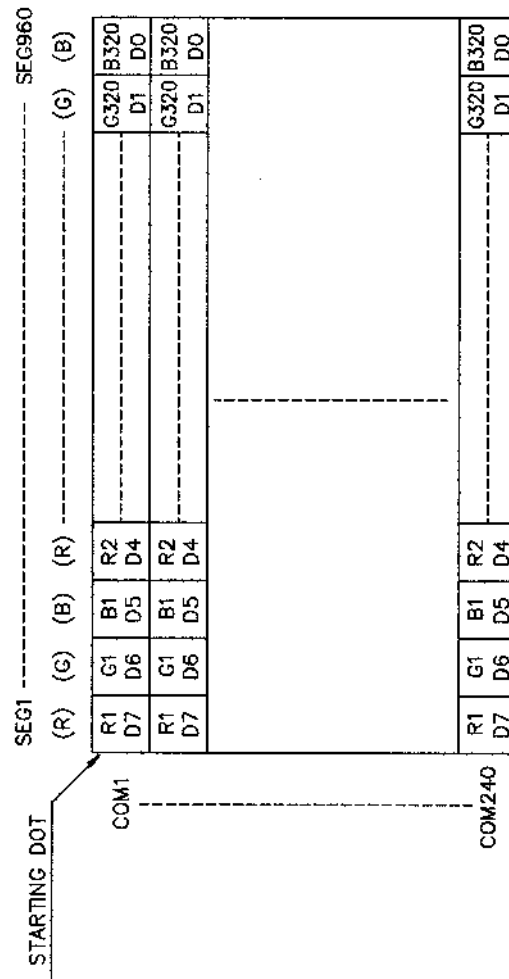
## OFF SEQUENCE



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.

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# DISPLAY PATTERN



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

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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

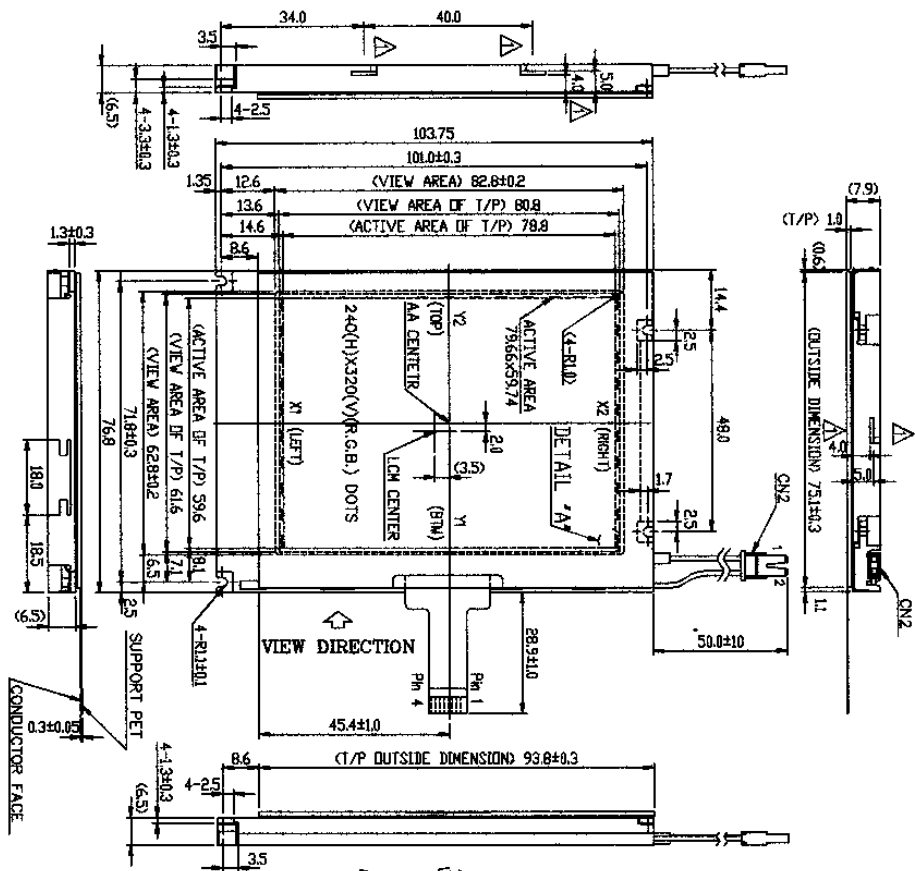
- 1.Acceptance inspection period  
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period  
The period is within twelve months since the date of shipping out under normal using and storage conditions.

• THE OPERATING LIFE TIME OF BACK LIGHT

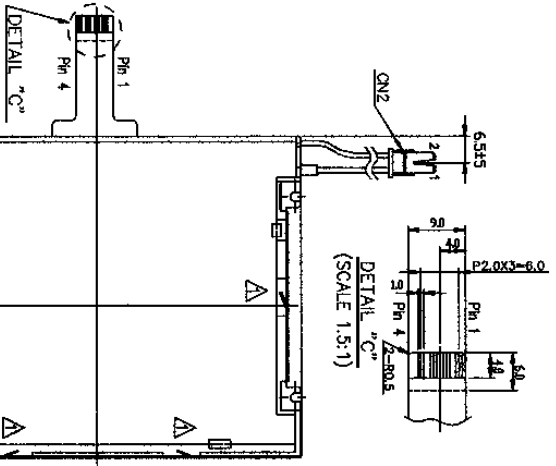
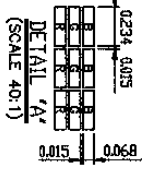
- CCFT : 20,000hrs for lamp--current 2.5mA, 40KHz, 25°C  
(Operating life time is defined as follows : The final brightness is at 50% of original brightness.)

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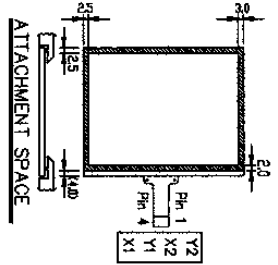


NOTE:  
 1.RESOLUTION: 240(H)x320(V)(R.G.B.) DOTS  
 2.BACKLIGHT: CFL  
 3.FRAME MATERIAL: SUS304 (0.3mmt)  
 3.TOUCH PANEL: CLEAR TYPE (1.0mmt)  
 LIGHT TRANSPARENCY: 80%



(T/P) CONNECTOR INTERFACE

PN NO	SYMBOL	FUNCTION
1	Y2	TOP DIRECTION
2	X2	RIGHT DIRECTION
3	Y1	BOTTOM DIRECTION
4	X1	LEFT DIRECTION



START X1 X240  
 DISPLAY PATTERN

		Y320																	
		R320	G320	B320															
R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20
G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	G16	G17	G18	G19	G20
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20