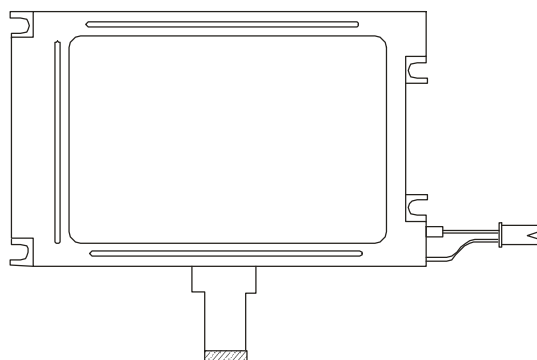




PRODUCT SPECIFICATION

HDM3224TSC-S-L

3224 COLOR GRAPHICS
LCD DISPLAY MODULE



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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 $\leq 50^{\circ}\text{C}$: 85%RH max

To $> 50^{\circ}\text{C}$: 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		VIH	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=2.5mA _{rms}	PATTERN: (Dots All On of White Color) □ □ □ □ □ □ □ □	—	66.7	—	cd/m ²
				PATTERN: (Dots All Off) ■ ■ ■ ■ ■ ■ ■ ■	—	5.5	—	cd/m ²

CCFL

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	V _L	—	300	—	V _{rms}	I _L = 2.5mA _{rms}
Lamp current	I _L	1.5	2.5	3	mA _{rms}	(*1)
Lamp power consumption	P _L	0.5	0.8	1	W	(*2)
Lamp frequency	F _L	30	40	50	KHz	
Lamp life time	L _L	—	20000	—	hrs	

(*1) It is recommended that I_L be not more than 2.5 mA_{rms} 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)						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.
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

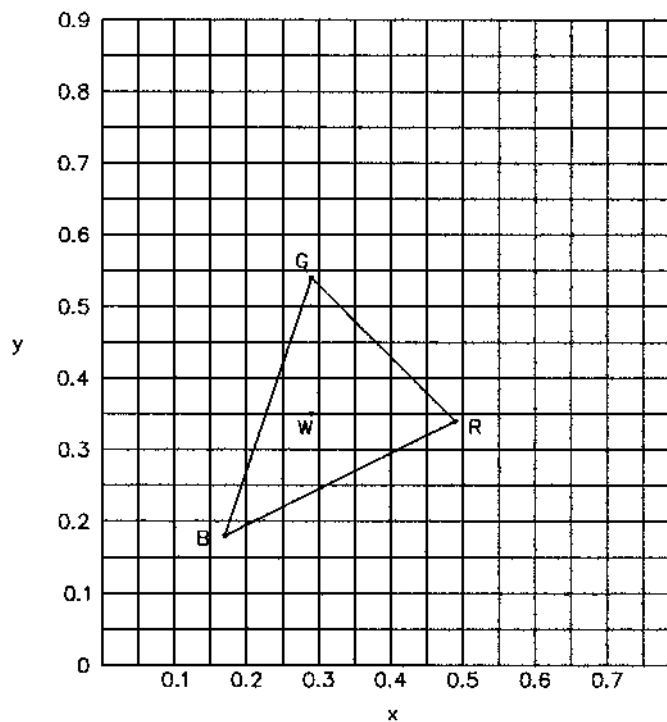
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m ²)	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



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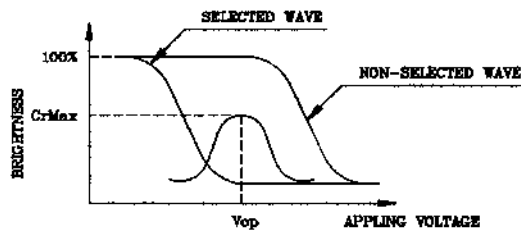
HDM3224TSC-S-L

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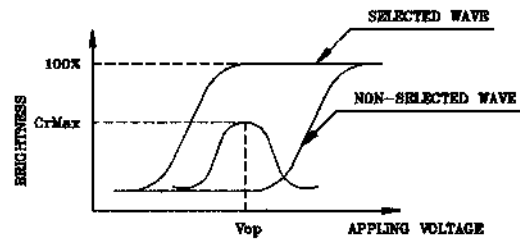
DATE:
2/22/01

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

*Conditions

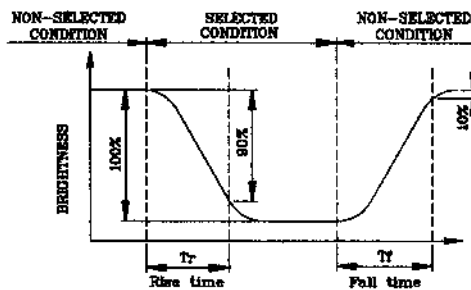
Viewing Angle : 0

Frame Frequency : 70Hz

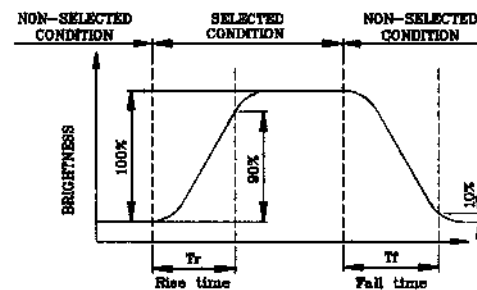
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(T_r , T_f)



(positive type)



(negative type)

*Conditions

Operating Voltage : V_{op}

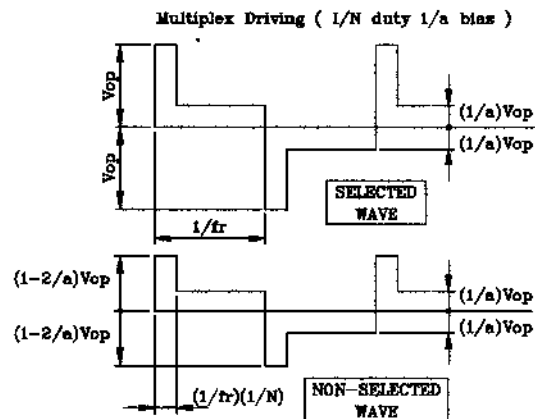
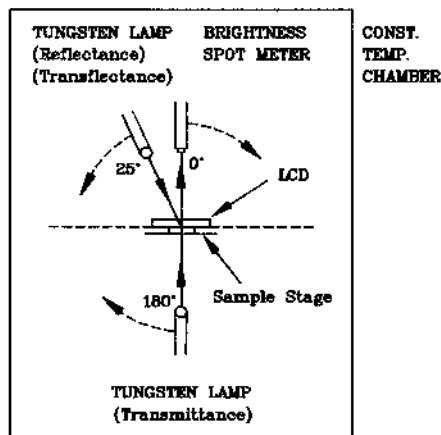
Viewing Angle (θ, ϕ) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

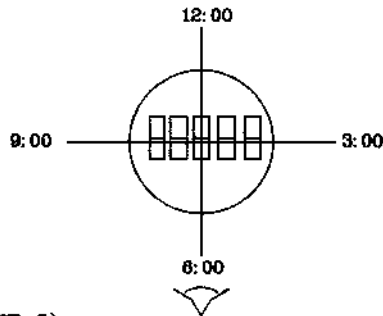
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



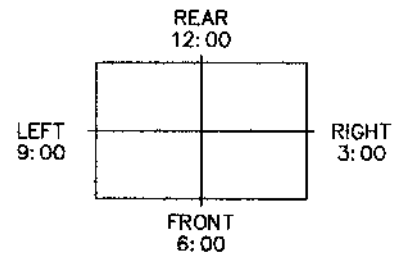
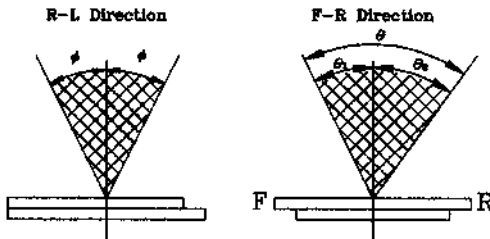
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

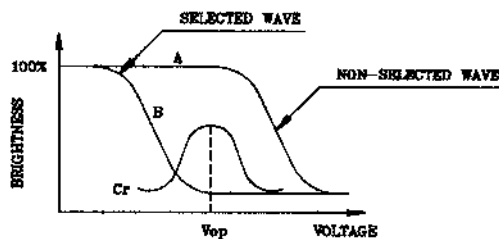
$$\theta = \theta_1 + \theta_2$$

*Conditions

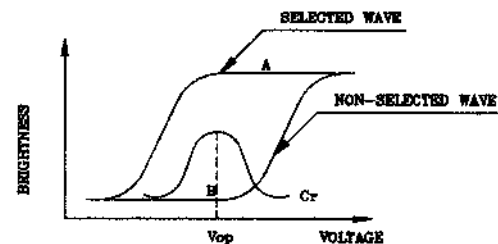
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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

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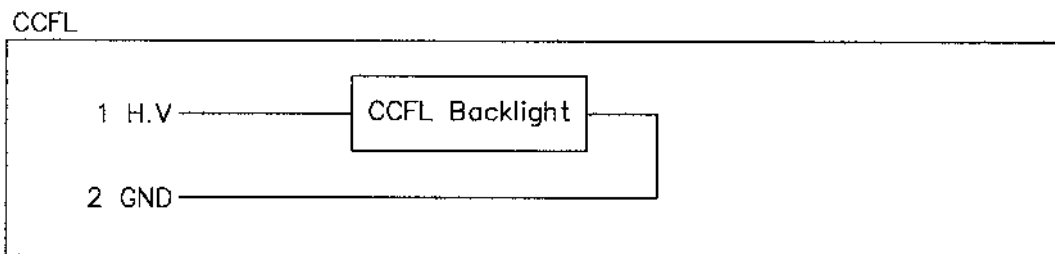
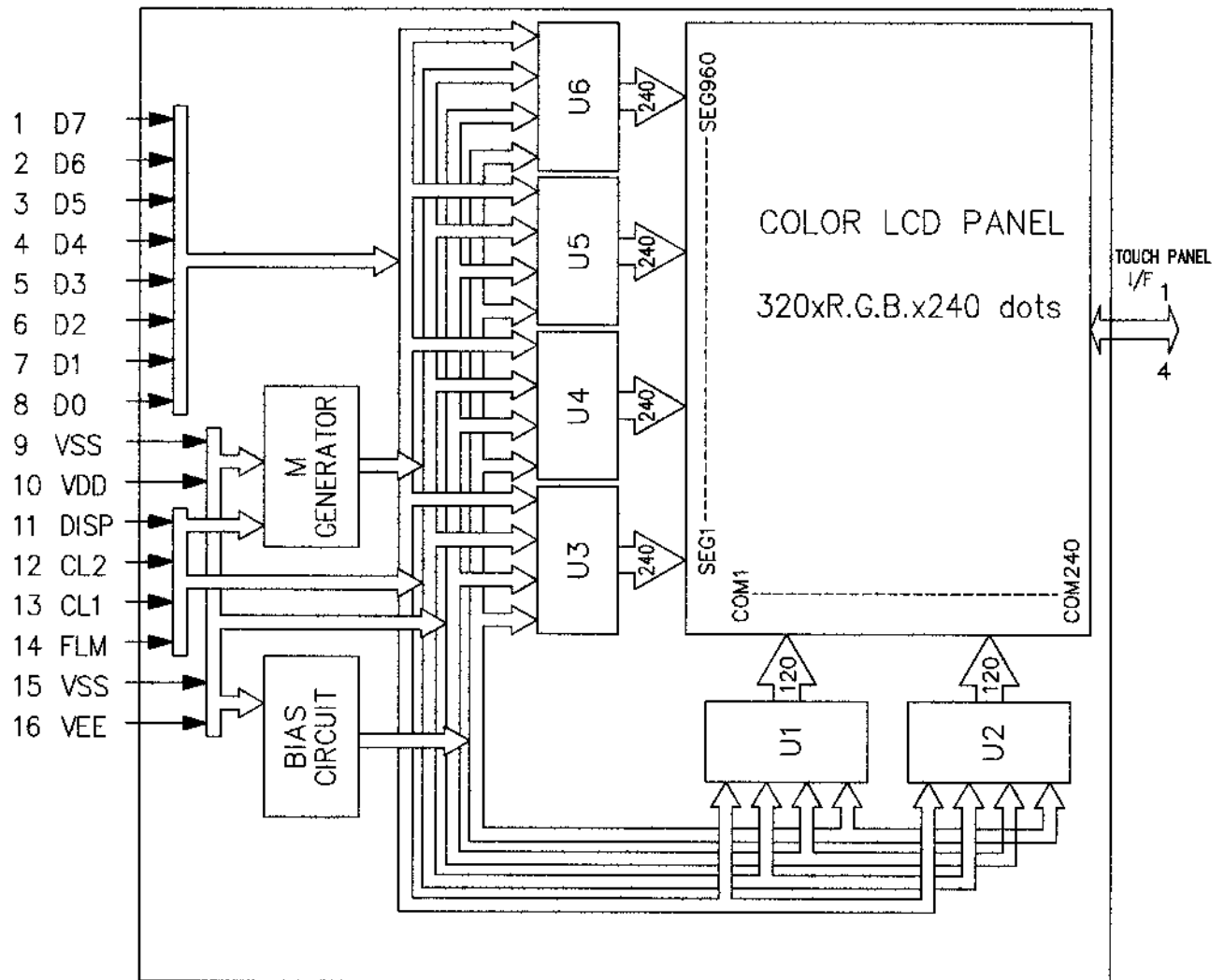
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5.BLOCK DIAGRAM



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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 (0V,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

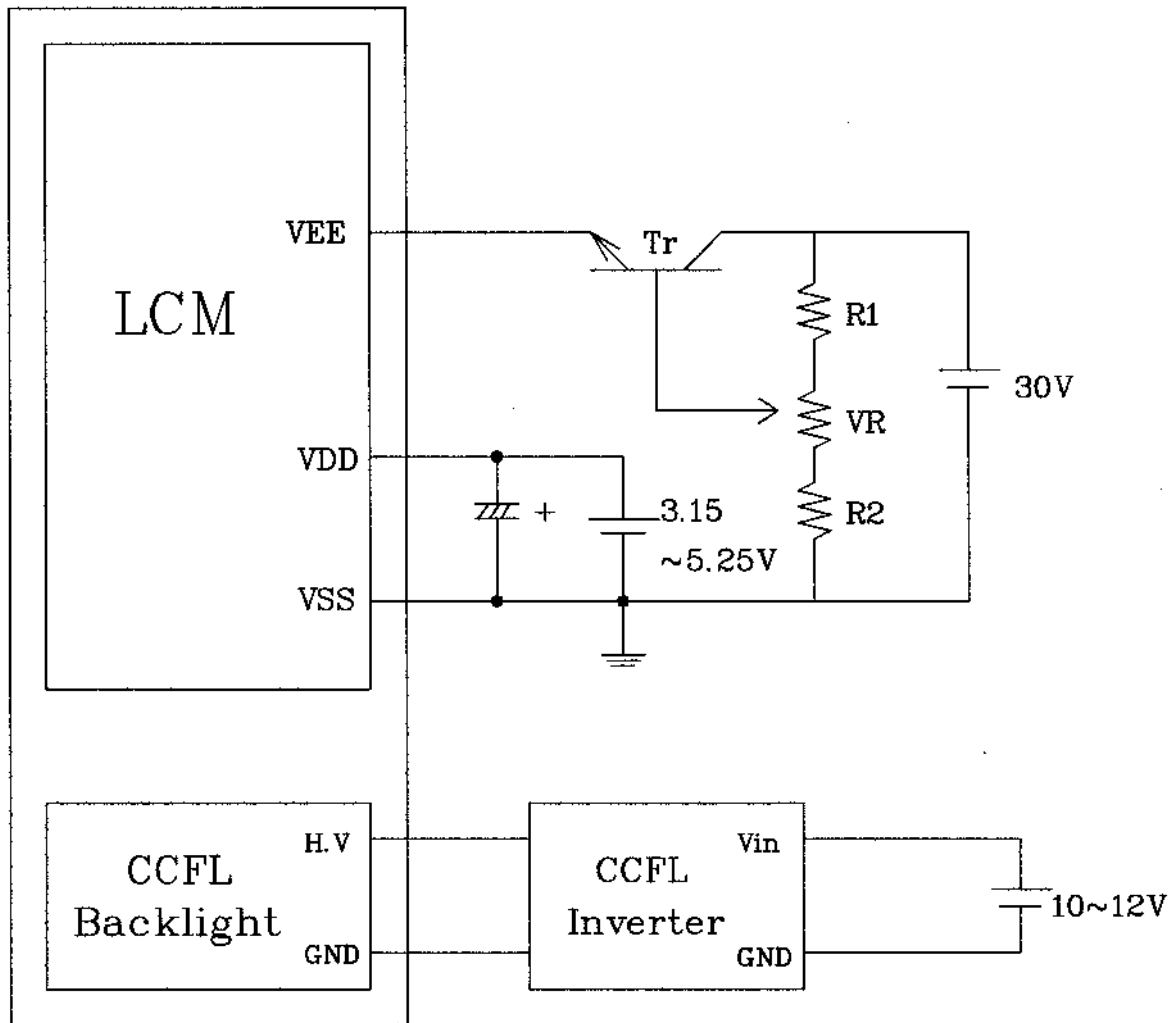
FH12-16S-0.5SV (HIROSE)/Suitable FFC :pitch 0.5mm ,width 8.5mm

CCFL CONNECTOR :

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

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POWER SUPPLY



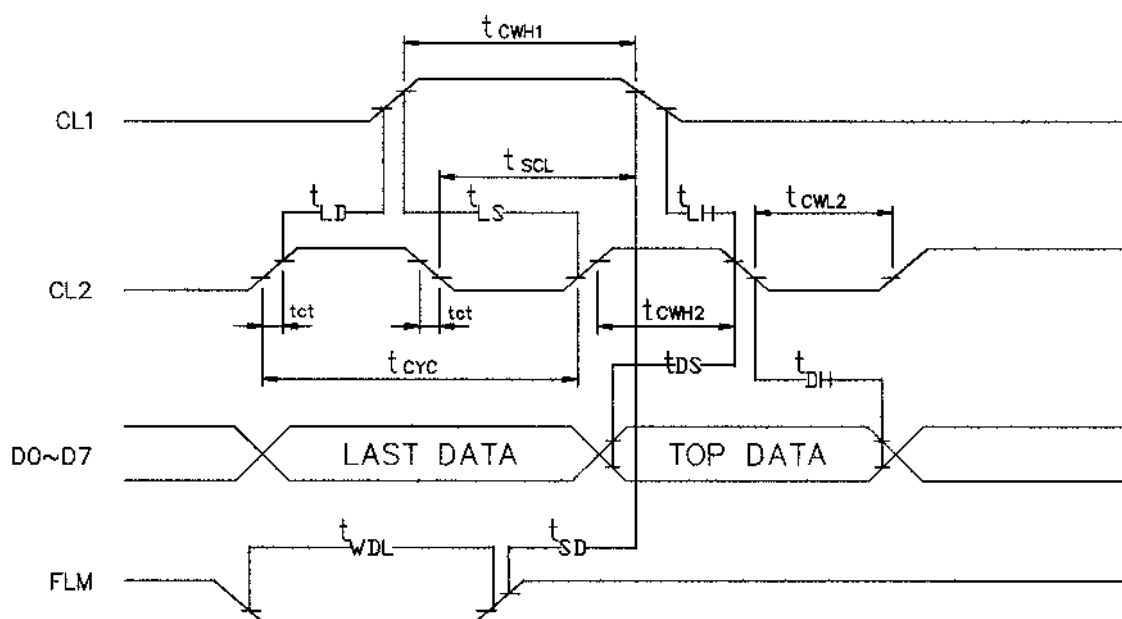
1. $R1 + R2 + VR = 10 \sim 20K \Omega$
2. RECOMMENDED CCFL INVERTER :
COTEK INV-B1

TIMING CHARACTERISTICS

INTERFACE TIMING

VDD=5.0V $\pm$ 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_{CT}	—	—	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	—	μ s
FRAME FREQUENCY	t_{FLM}	60	—	ns



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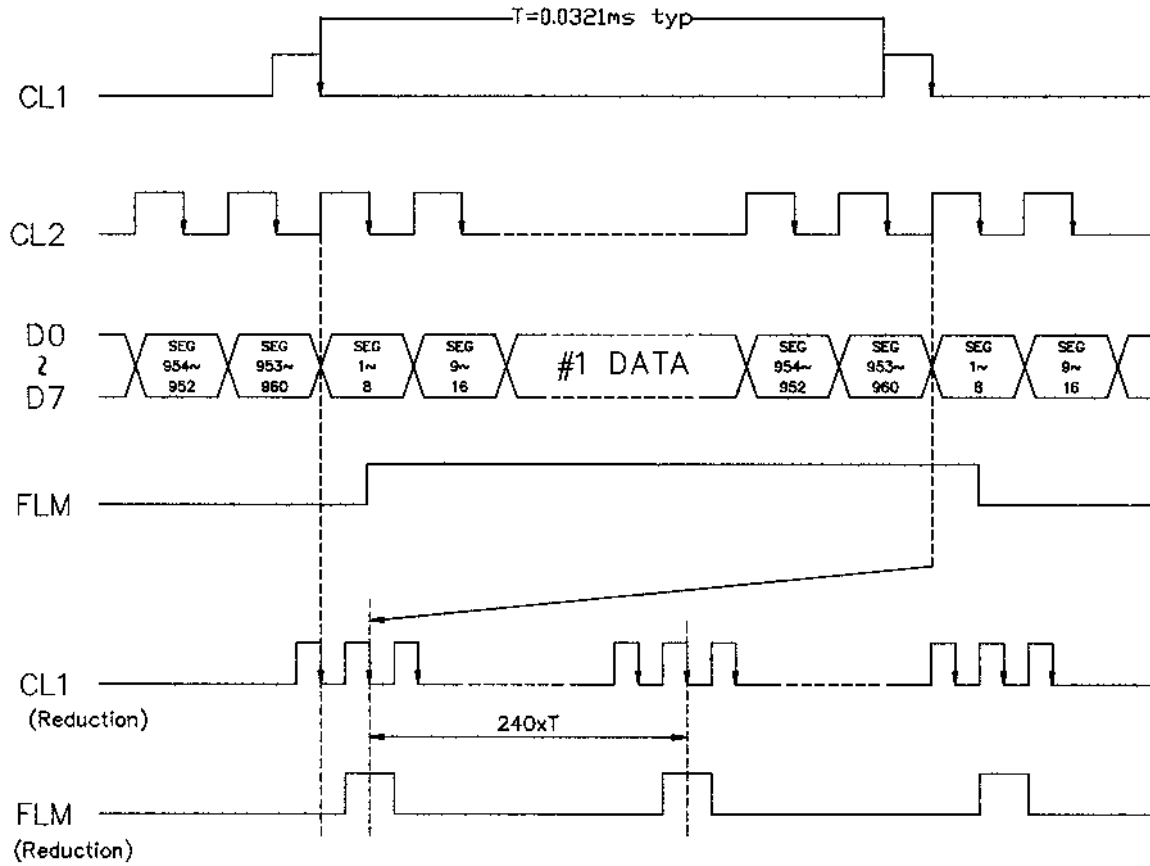
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TIMING CHART OF INPUT SIGNAL



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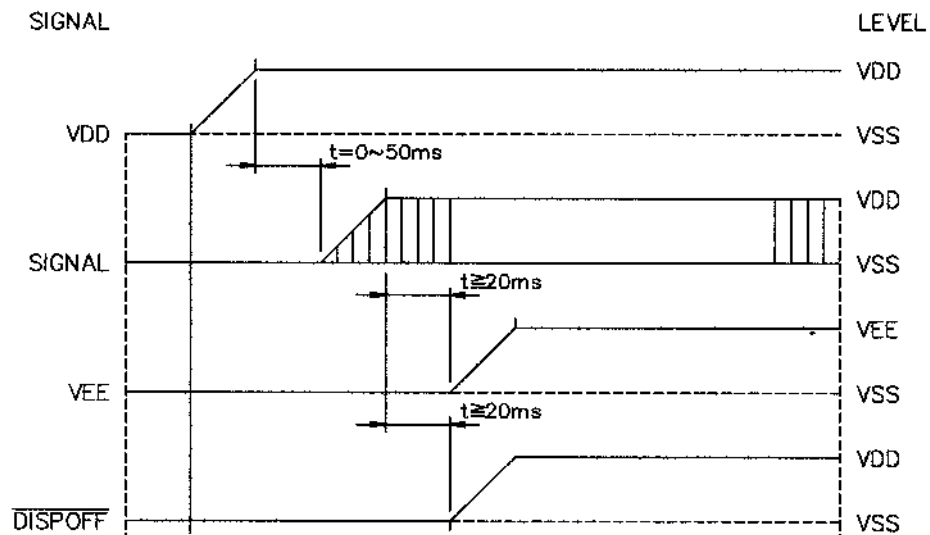
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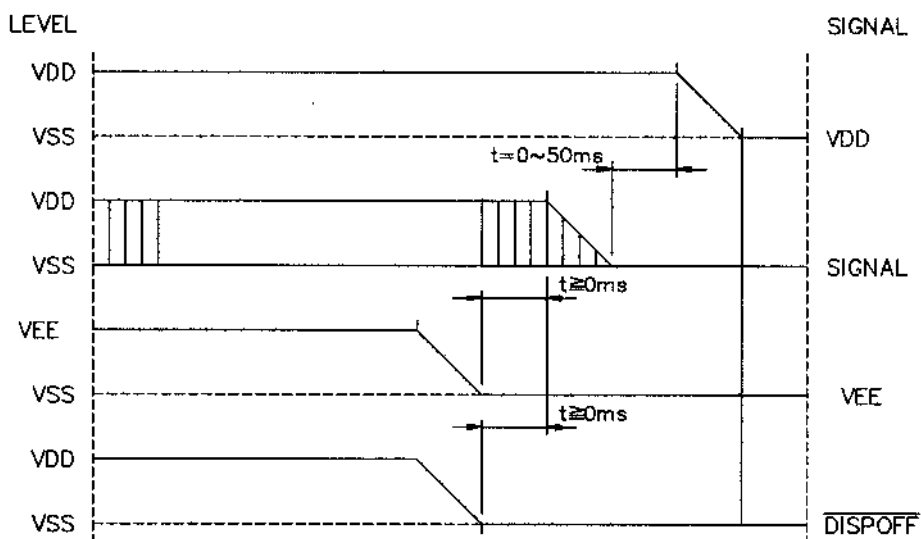
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2/22/01

POWER ON/OFF TIMING

ON SEQUENCE



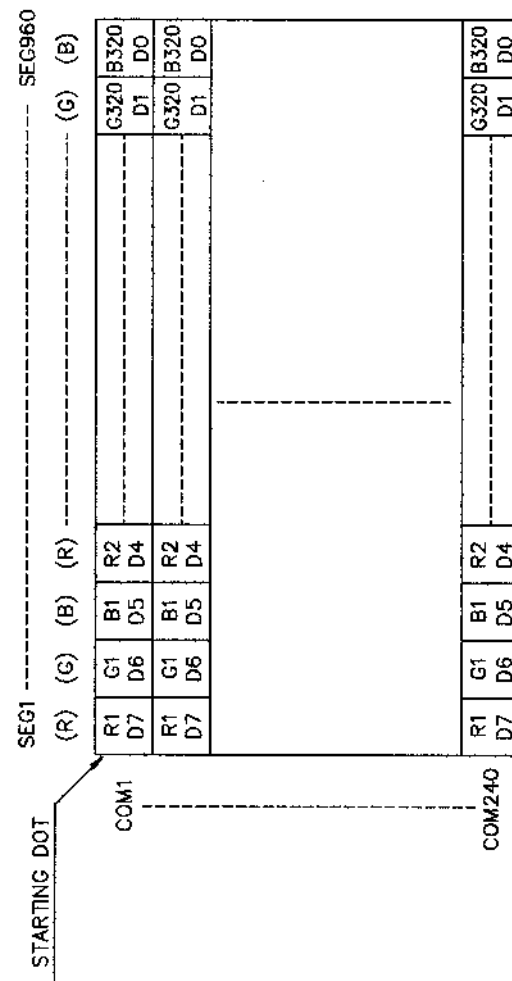
OFF SEQUENCE



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.

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.

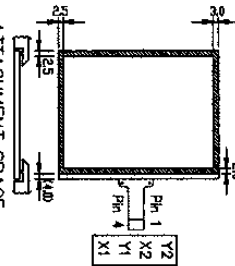
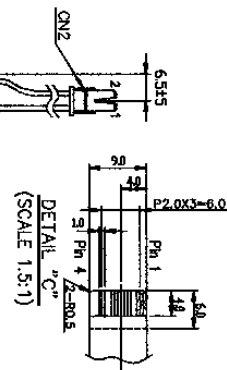
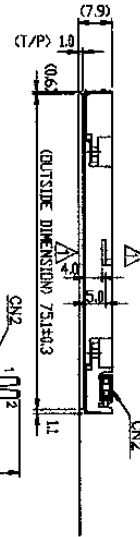
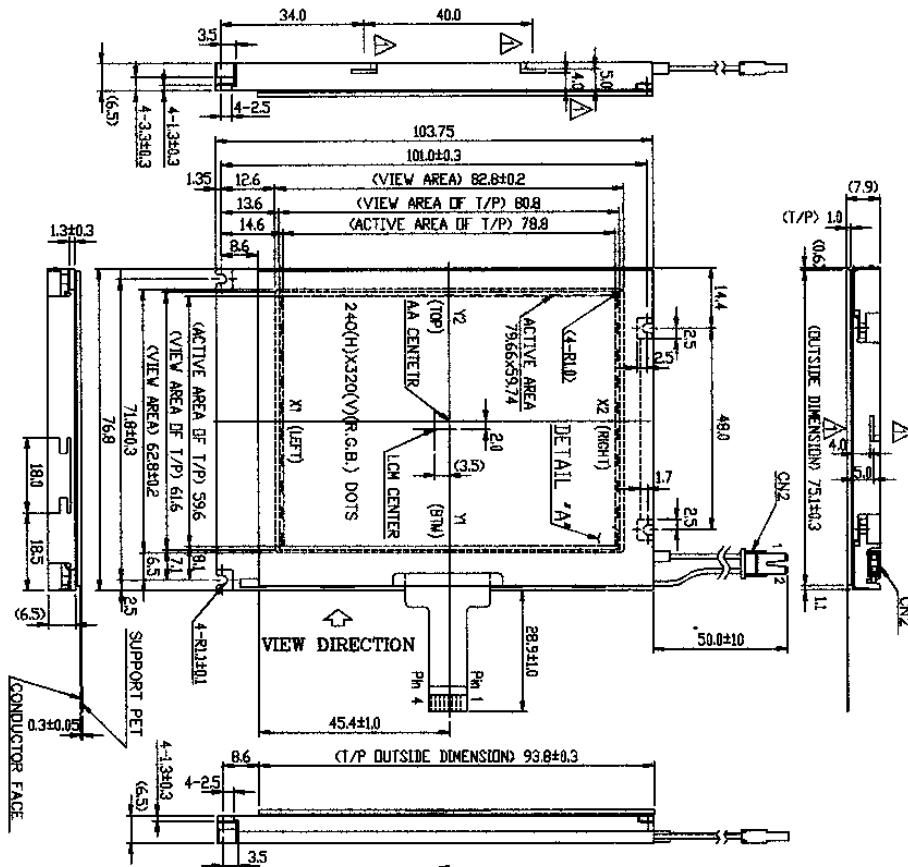
• **TERMS OF WARRANTY**

- 1.Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warranty 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**

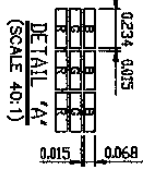
CCFT : 20,000hrs for lamp--current 2.5mA, 40KHz, 25°C
(Operating life time is defined as follows : The final brightness is at 50% of original brightness.)

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

NOTE:
 1. RESOLUTION: 240(H)X320(V)(R.G.B.) DOTS
 2. BACKLIGHT: CCFL
 3. FRAME MATERIAL: SUS304 (0.3mm)
 3. TOUCH PANEL: CLEAR TYPE (1.0mm)
 LIGHT TRANSPARENCY: 80%



START	END	FUNCTION
1	16	Y2
17	32	X2
33	48	Y1
49	64	X1

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