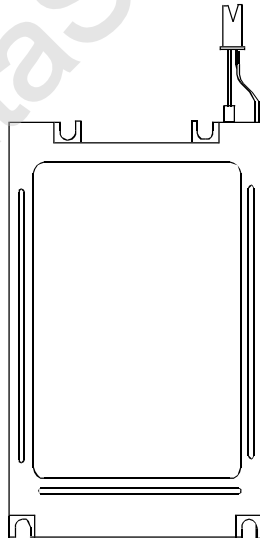


HANTRONIX

PRODUCT SPECIFICATION

HDM3224C-S

320 x 240 COLOR GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JB	REV.: 1.0	HDM3224C-S	SHEET 1 OF 17
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MECHANICAL DATA

(1) Product No.	LCBA7T211_
(2) Module Size	76.8 (W)mm x 103.7 (H)mm x 6.5(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
(8) Viewing Direction	6 O'clock
(9) Backlight	CCFL
(10) Controller	Excluded
(11) DC/DC Converter	Excluded
(12) Weight	73.0 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	42.0	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 Ta ≤ 50°C : 85%RH max

Ta > 50°C : Absolute humidity must be lower
than the humidity of 85%RH at 50°C

Note 3 Ta 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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OPTICAL CHARACTERISTICS

4-1 Optical Char. of Normal Temp. Mode

AT Vop

ITEM MODE		Cr(Contrast Ratio)						θ (Viewing Angle)		θ (Viewing Angle)	
		0°C		25°C		50°C		25°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	G	—	29	—	20	—	5.5	—	100	—	±45
NOTE		NOTE 6						NOTE 5			

note:

T: TRANSMISSIVE
G: NORMALLY BLACK 6 O'CLOCK

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0 τ	—	600	—	ms	NOTE 2
		25 τ	—	250	—		
		50 τ	—	90	—		
Response Time (fall)	Tf	0 τ	—	300	—	ms	NOTE 2
		25 τ	—	90	—		
		50 τ	—	60	—		

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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		—	2.4	4.8	mA
Supply Current for LCD		IEE	PATTERN: □ ■ □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ ■ □		—	5.8	12.0	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) □ □ □ □ □ □ □ □	—	48.4	—	cd/m ²
				PATTERN: (Dots All Off) ■ ■ ■ ■ ■ ■ ■ ■	—	3.84	—	cd/m ²

CCFL

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	VL	—	304	—	Vrms	L = 3mArms
Lamp current	IL	1.5	—	3	mArms	(*1)
Lamp power consumption	PL	—	—	1	W	(*2)
Lamp frequency	FL	40	50	60	KHz	
Lamp life time	LL	10000	—	—	hrs	

(*1) It is recommended that I_L be not more than 3 mArms so that heat radiation of CCFT backlight may least affect the display quality .

(*2) Power consumption exclud inverter .

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Color of CIE Coordinate

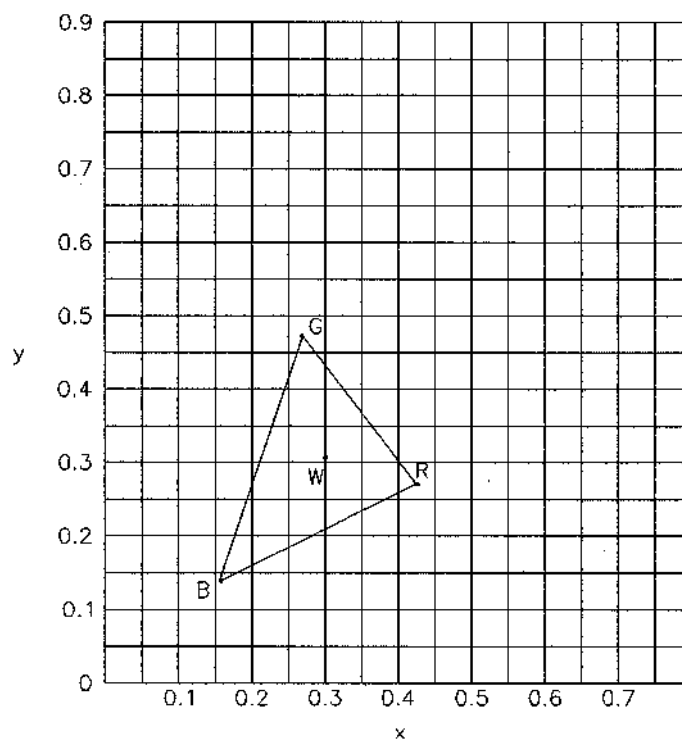
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m ²)	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^{\circ}$, $\theta=0^{\circ}$	0.414	12.0	Note※
		y		0.281		
	Green	X		0.272	33.7	
		y		0.468		
	Blue	X		0.161	11.5	
		y		0.121		
	White	X		0.302	75.0	
		y		0.311		

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

Tolerance : ± 0.05

Fig.1



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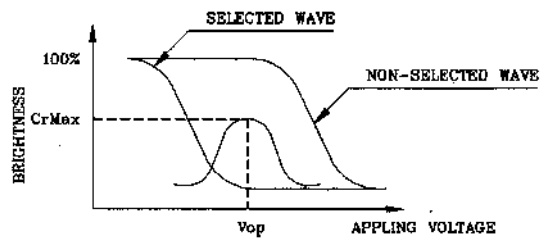
HDM3224C-S

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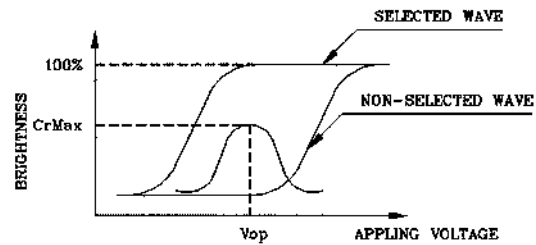
DATE:
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(NOTE 1)

Definition of Operation Voltage(V_{op})



(positive type)



(negative type)

*Conditions

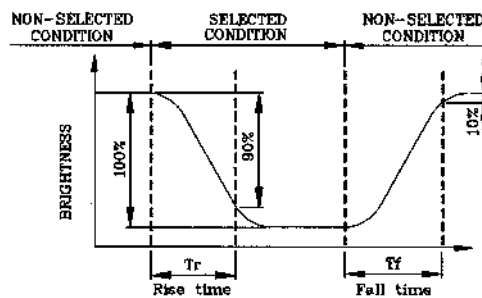
Viewing Angle : 0

Frame Frequency : 70Hz

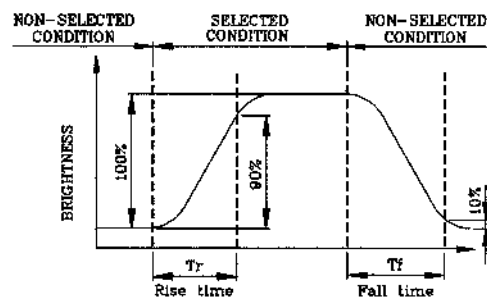
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(T_r, T_f)



(positive type)



(negative type)

*Conditions

Operating Voltage : V_{op}

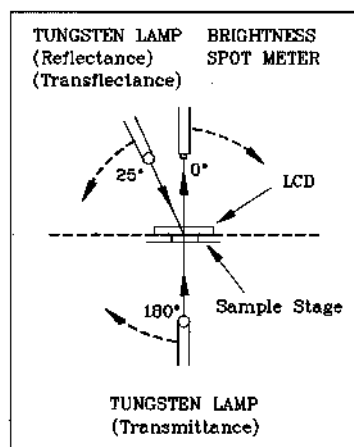
Viewing Angle (θ, ϕ) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

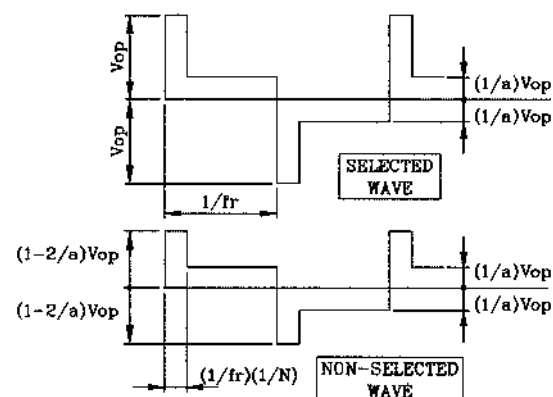
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



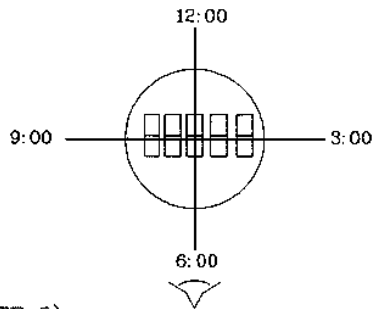
CONST.
TEMP.
CHAMBER

Multiplex Driving (1/N duty 1/a bias)



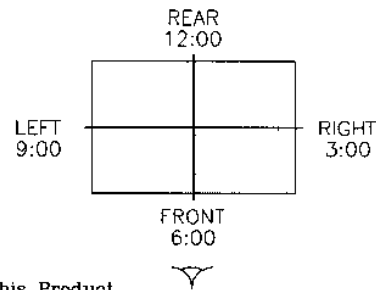
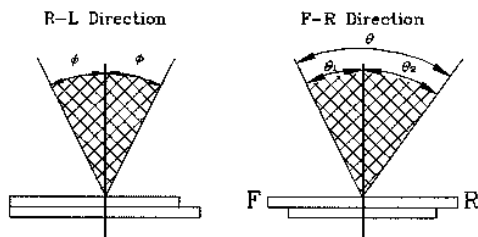
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product

The Viewing Direction is 6 O'clock
So $\theta_1 > \theta_2$

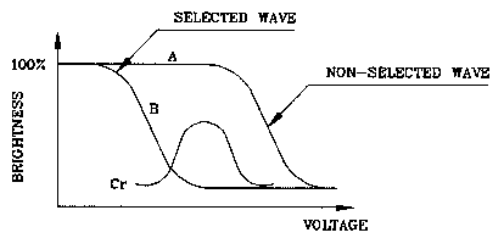
$$\theta = \theta_1 + \theta_2$$

*Conditions

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

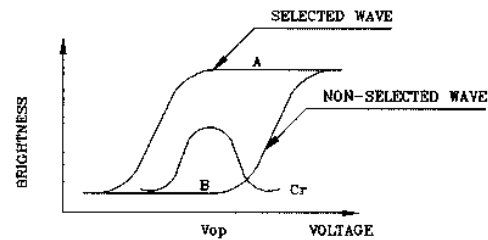
(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)

$$\text{Contrast Ratio : } Cr = A/B$$



(negative type)

*Conditions

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

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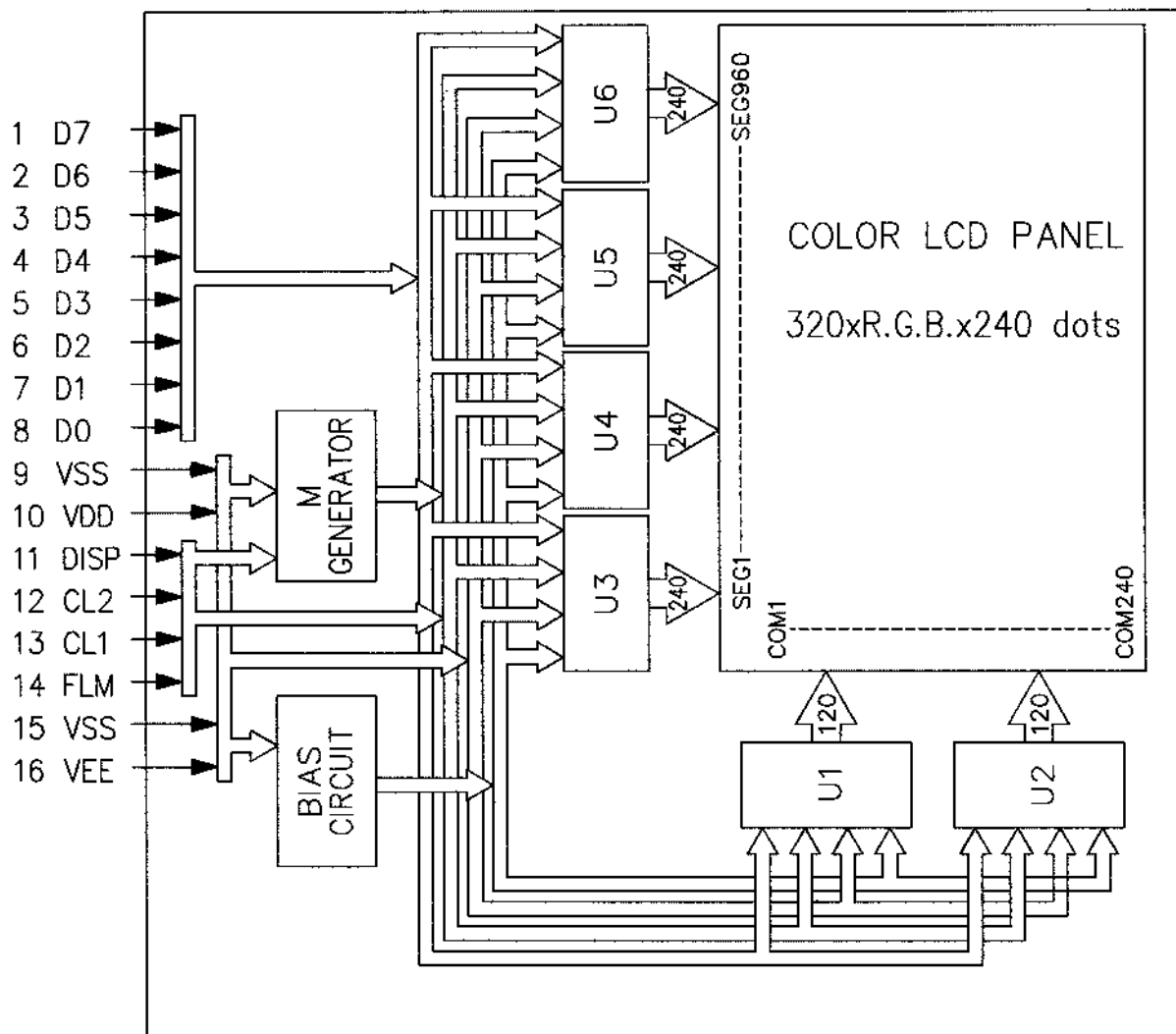
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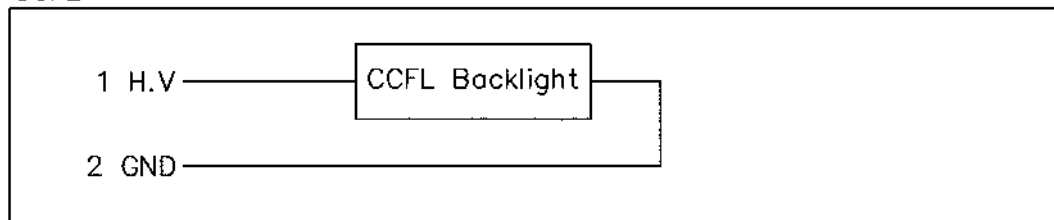
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BLOCK DIAGRAM



CCFL



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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

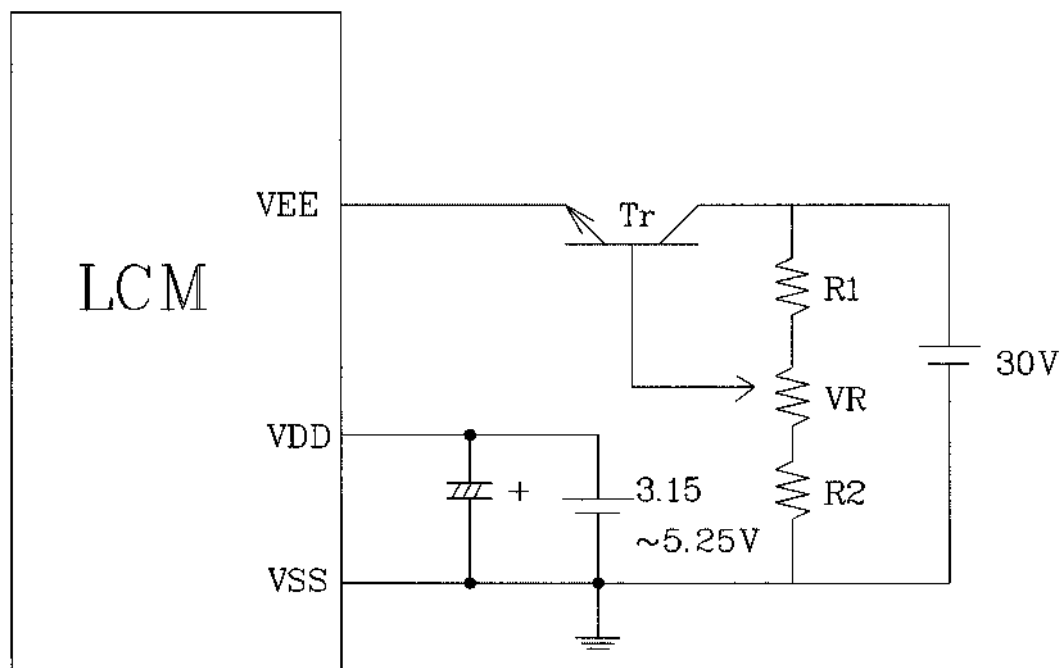
FH12-16S-0.5SV (HIROSE)/Suitable FFC :pitch 0.5mm ,width 8.5mm

CCFL CONNECTOR :

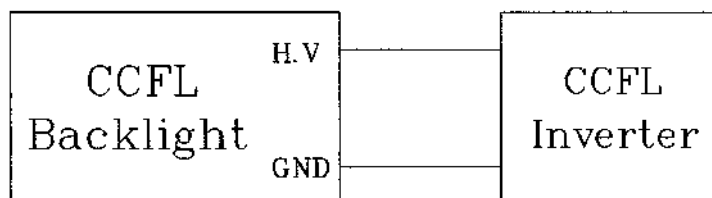
BHSR -02VS-1 (JST)/Suitable Connector : SM02B-BHSS-1-TB (JST)

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POWER SUPPLY



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

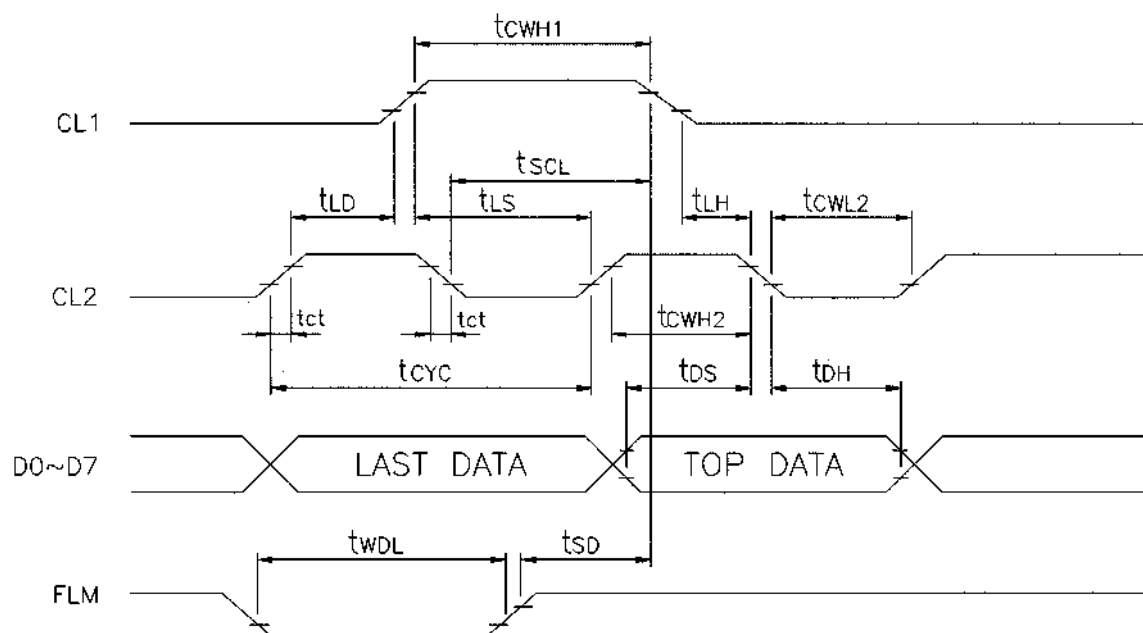


TIMING CHARACTERISTICS

INTERFACE TIMING

VDD=5.0V $\pm$ 10%

Parameter	SYMBOL	MIN.	MAX.	UNIT
CLOCK CYCLE TIME	t _{cy}	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	—	μs
FRAME FREQUENCY	t _{flm}	60	—	ns



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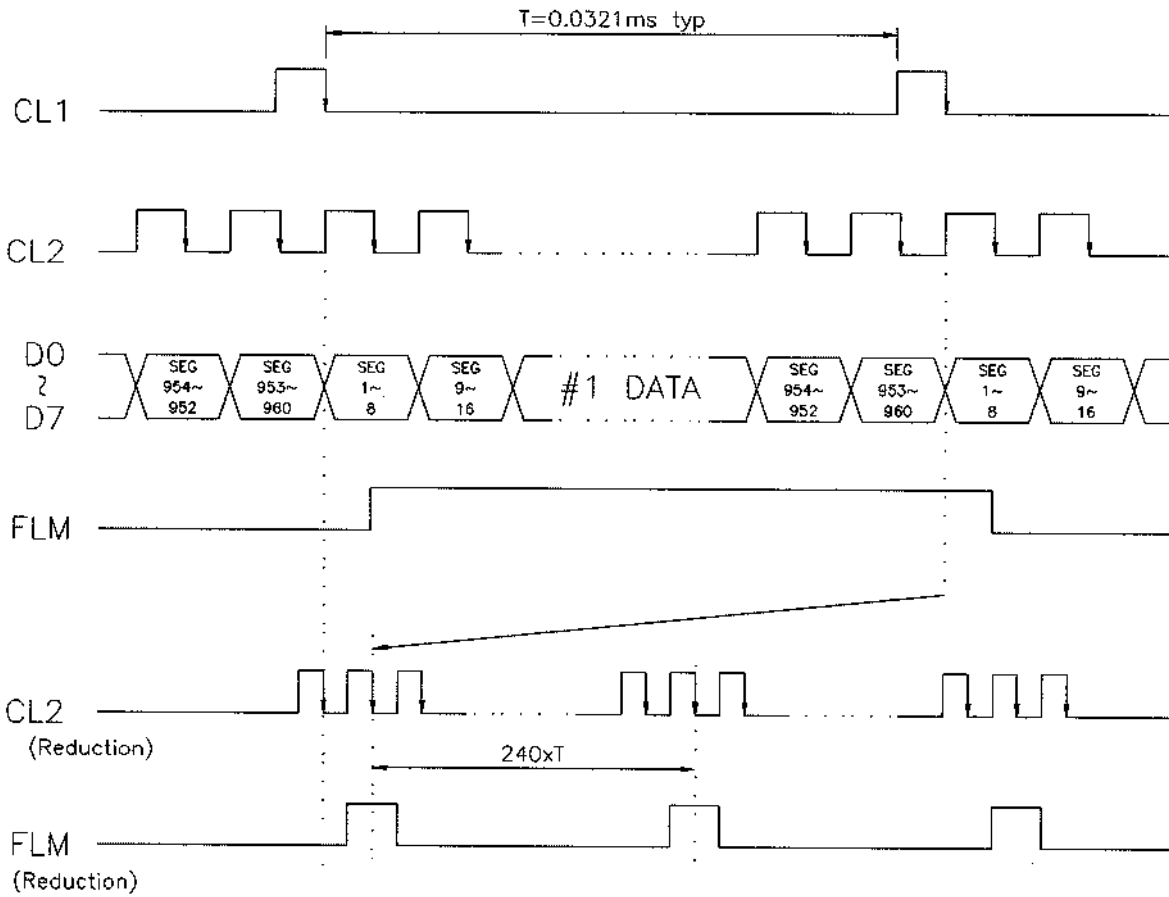
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TIMING CHART OF INPUT SIGNAL



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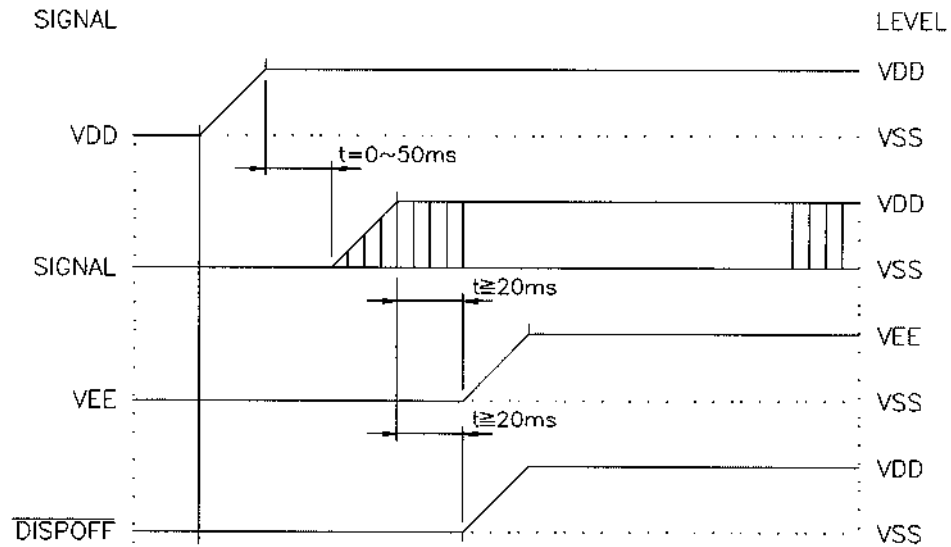
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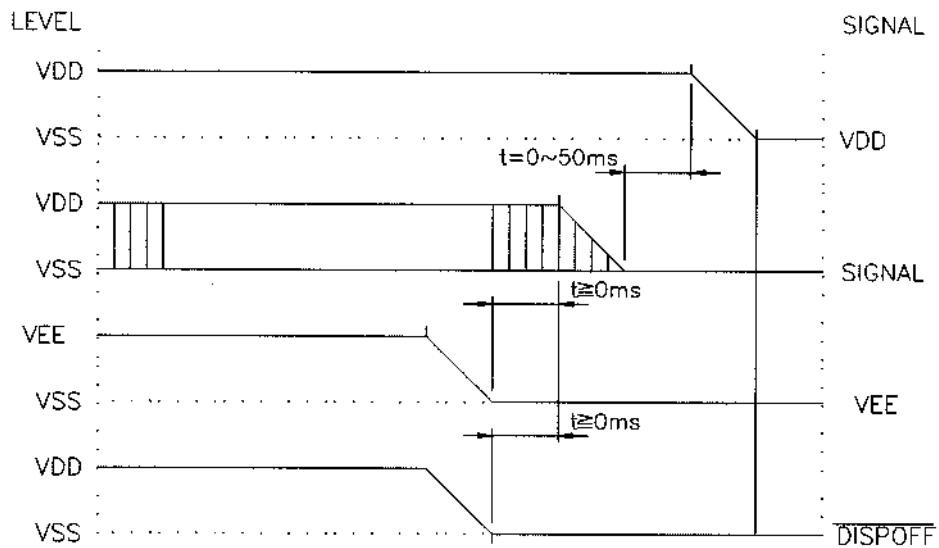
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POWER ON/OFF TIMING

ON SEQUENCE



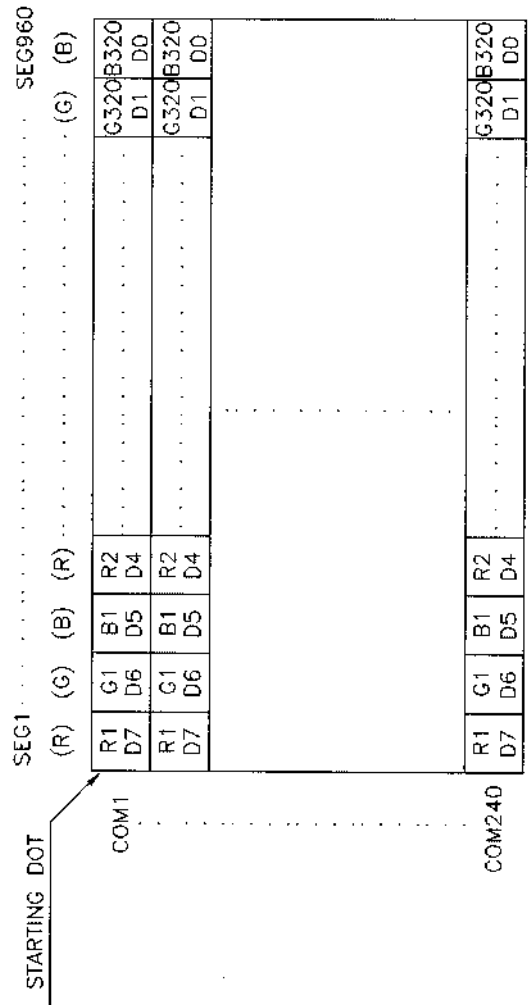
OFF SEQUENCE



Please maintain the above sequence when turning on and off the power supply of the module. If **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



(2) NOTE:

- 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.

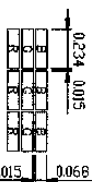
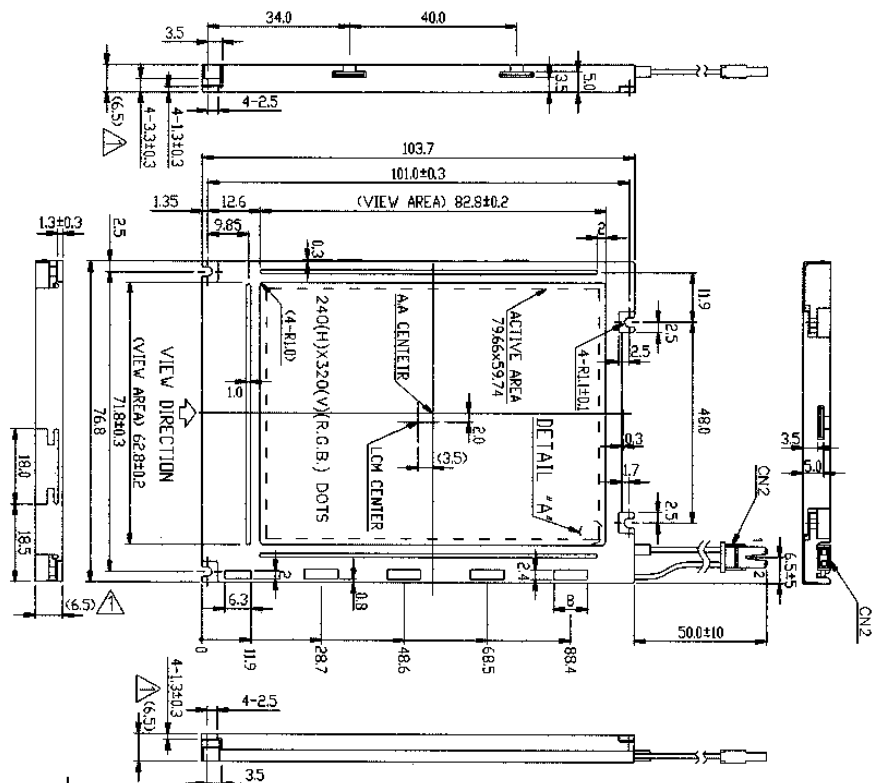
- TERMS OF WARRANT

- 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.

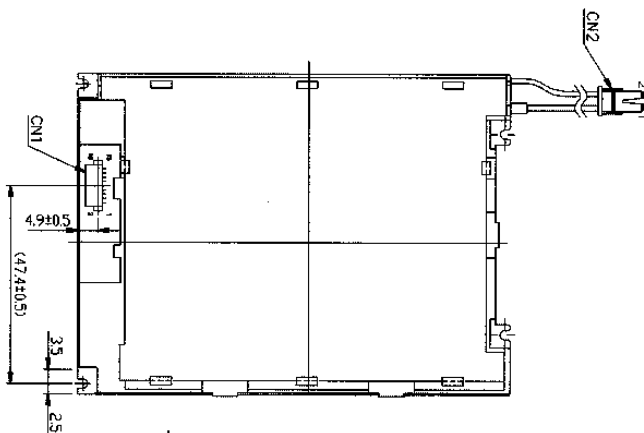
- THE OPERATING LIFE TIME OF BACK LIGHT

CCFT : 10,000HR

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



DISPLAY PATTERN

Y1			Y2			Y3			Y320		
R1	G1	B1	R2	G2	B2	R3	R2	R3	R320	G320	B320
D7	D6	D5	04	03	D2	D1	D0	D7	D2	D1	D0

PN NO.	SYMBOL	FUNCTION	PN NO.	SYMBOL	FUNCTION
1	D7	DISPLAY DATA	11	DISOFF	DISPLAY CONTROL L-OFF H-ON
2	D6	DISPLAY DATA	12	CL2	DATA INPUT CLOCK
3	D5	DISPLAY DATA	13	CL1	INPUT DATA LATCH SIGNAL
4	D4	DISPLAY DATA	14	FLM	SCAN START-UP SIGNAL
5	D3	DISPLAY DATA	15	VSS	GROUND
6	D2	DISPLAY DATA	16	VCC	POWER SUPPLY FOR LCD
7	D1	DISPLAY DATA			
8	D0	DISPLAY DATA			
9	VSS	GROUND			
10	VCC	LOGIC SUPPLY VOLTAGE			

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