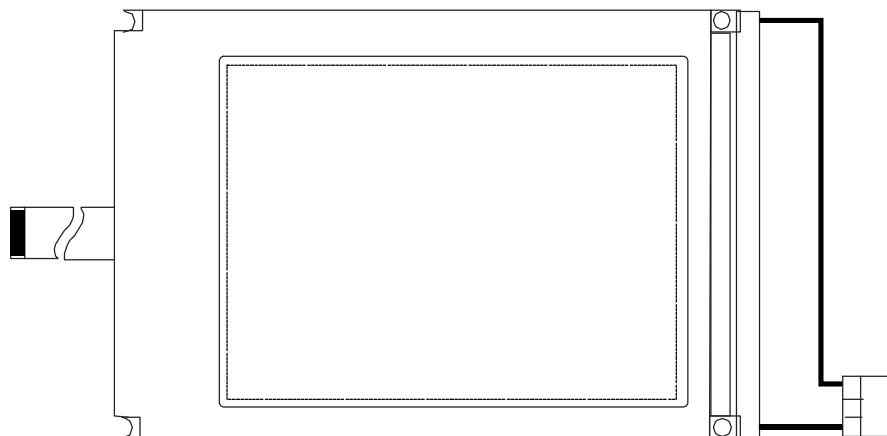


## PRODUCT SPECIFICATION

# HDM3224C/CL

320x240 COLOR GRAPHICS  
LCD DISPLAY MODULE



<b>HANTRONIX, INC.</b> 10080 BUBB RD. CUPERTINO, CA 95014	<b>Q.A.:</b> JK	<b>REV.:</b> 2.2	<b>HDM3224C/CL</b>	<b>SHEET 1 OF 18</b>
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# 1. MECHANICAL DATA

(1) Product No.	HDM3224C/CL
(2) Module Size	168.0 (W)mm x 111.0 (H)mm x 7.4(D)mm
(3) Dot Size	0.09 (W)mm x 0.33 (H)mm
(4) Dot Pitch	0.12 (W)mm x 0.36 (H)mm
(5) Number of Dots	320 xRGB(W) x 240 (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	280 g(approx.)

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## 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	VLCD-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  $\leq$  50°C : 85%RH max  
 Ta > 50°C : Absolute humidity must be lower  
 than the humidity of 85%RH at 50°C


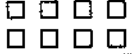

Note 3 Ta at -20°C will be < 48 hrs, at 60°C will be < 120 hrs

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

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### 3. ELECTRICAL CHARACTERISTICS

#### 3-1.CHARACTERISTICS OF LCM

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Logic Circuit Power Supply		VDD-VSS	Ta= 25°C	4.5	5.0	5.5	V	
Input Voltage		VIH	H level	0.8VDD	-	VDD	V	
		VIL	L level	0	-	0.2VDD	V	
Recommended LCD Driving Voltage (Normal Temp. LCM)		VLCD-VSS	Duty=1/240 Bias=1/13 VDD=5.0V	0°C	23.2	23.6	24.0	V
				25°C	22.2	22.6	23.0	
				50°C	21.0	21.4	21.8	
Supply Current for Logic		IDD	VDD-VSS = 5.0V VLCD-VSS = 22.6V Ta= 25°C	-	2.0	6.0	mA	
Supply Current for LCD		ILCD	PATTERN: 	-	8.0	15.0	mA	
LCM	Surface Luminance	L	PATTERN: (Dots All On of White Color) 	-	67.5	-	cd/m <sup>2</sup>	
			PATTERN: (Dots All Off) 	-	2.7	-		
Recommended Frame Frequency for Optimum Coctrast		FLM	-	115	120	125	Hz	

### 3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used lamp : Rating

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	V <sub>L</sub>	-	320	-	Vrms	T <sub>a</sub> = 25°C
Lamp current	I <sub>L</sub>	4	5	6	mArms	(*1) T <sub>a</sub> = 25°C
Lamp power consumption	P <sub>L</sub>	-	1.6	-	W	(*2) T <sub>a</sub> = 25°C
Lamp frequency	F <sub>L</sub>	20	35	50	KHz	T <sub>a</sub> = 25°C
Starting voltage	V <sub>S</sub>	-	455	-	Vrms	T <sub>a</sub> = 0°C
		-	350	-	Vrms	T <sub>a</sub> = 25°C
Lamp life time	L <sub>L</sub>	-	20000	-	hrs	I <sub>L</sub> =5mArms, T <sub>a</sub> =25°C

(\*1) It is recommended that I<sub>L</sub> be not more than 5.0 mArms so that heat radiation of CCFT backlight may least affect the display quality .

(\*2) Power consumption excluded inverter loss .

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# 4. OPTICAL CHARACTERISTICS

## 4-1. 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°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	M	-	40	-	35	-	5	-	90	-	±58
NOTE		NOTE 6						NOTE 5			

note:

T: TRANSMISSIVE  
M: FOR 6 O'CLOCK STN MODULE

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0°C	-	550	750	ms	NOTE 2
		25°C	-	230	330		
		50°C	-	100	140		
Response Time (fall)	Tf	0°C	-	270	370	ms	NOTE 2
		25°C	-	80	110		
		50°C	-	60	85		

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## 4-2. Color of CIE Coordinate

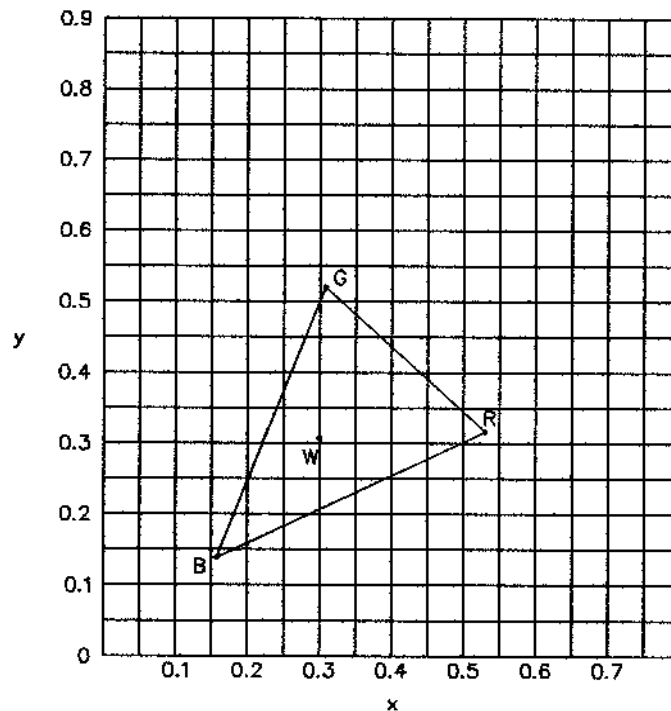
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m <sup>2</sup> )	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^\circ, \theta=0^\circ$	0.531	21.0	Note*
		y		0.318		
	Green	X		0.305	50.0	
		y		0.521		
	Blue	X		0.163	18.0	
		y		0.139		
	White	X		0.302	75.0	
		y		0.311		

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

Tolerance :  $\pm 0.05$

Fig.1



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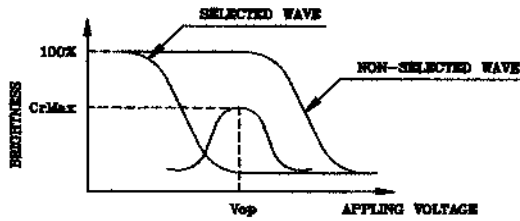
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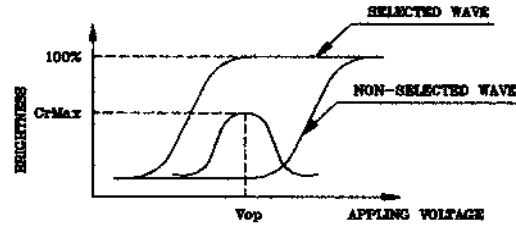
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



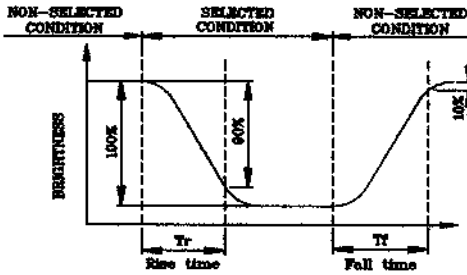
(negative type)

\*Conditions

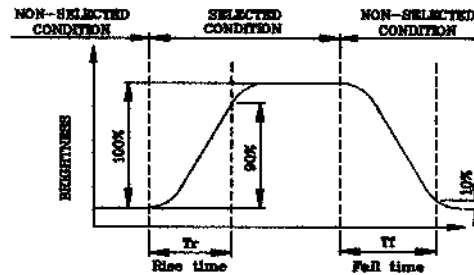
Viewing Angle : 0  
 Frame Frequency : 120Hz  
 Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



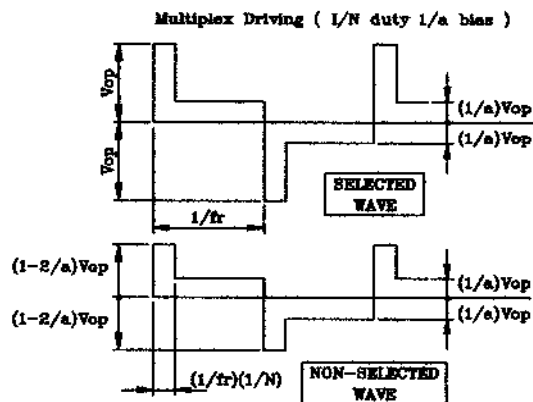
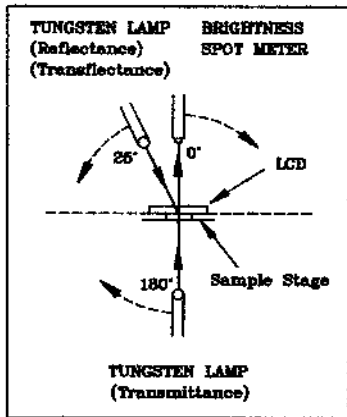
(negative type)

\*Conditions

Operating Voltage : Vop  
 Viewing Angle (θ,φ) : (0,0)  
 Frame Frequency : 120Hz  
 Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

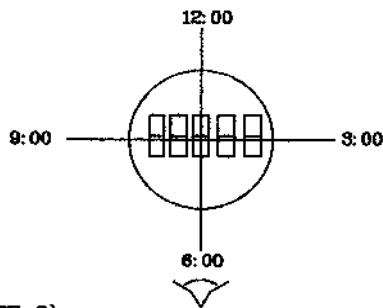
Description of Measuring Equipment and Driving Waveforms





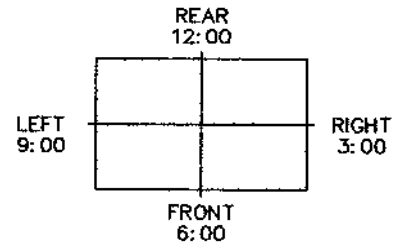
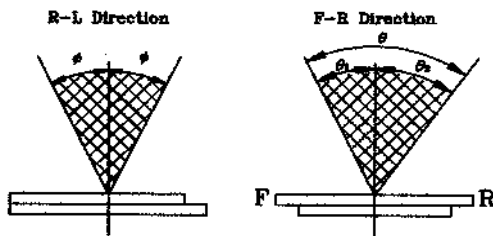
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



\*For This Product

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

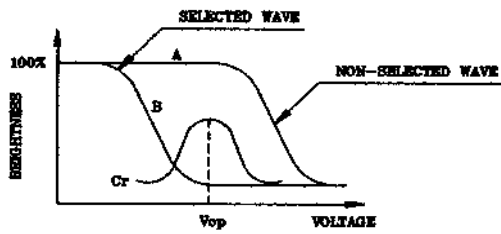
$\theta = \theta_1 + \theta_2$

\*Conditions

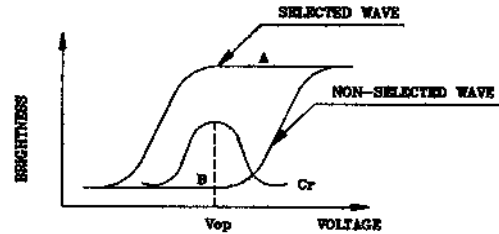
Operating Voltage :  $V_{op}$   
Frame Frequency : 120Hz  
Applying Waveform : 1/N duty 1/a bias  
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

Contrast Ratio :  $Cr = A/B$

\*Conditions

Viewing Angle : 0  
Frame Frequency : 120Hz  
Applying Waveform : 1/N duty 1/a bias

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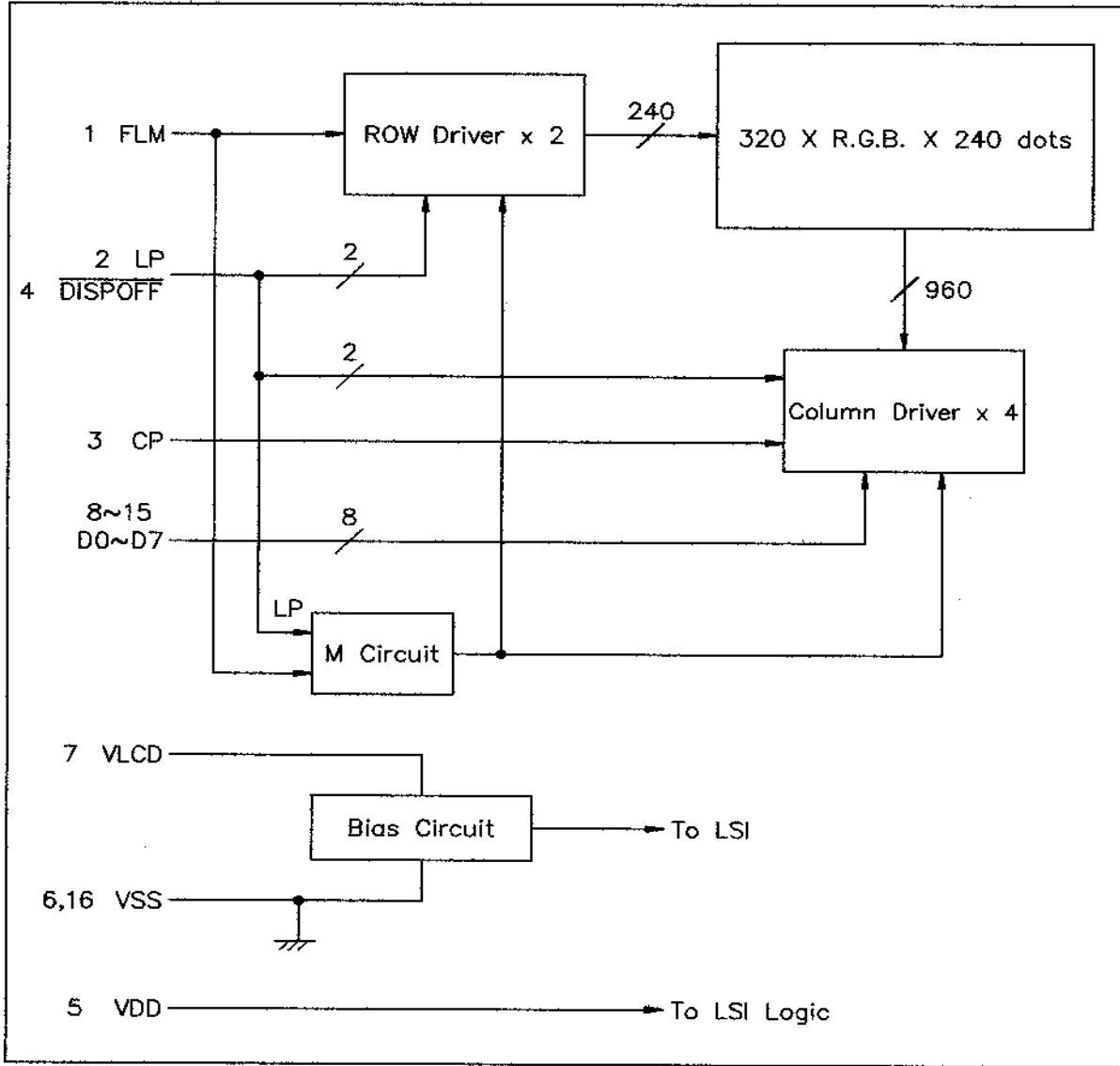
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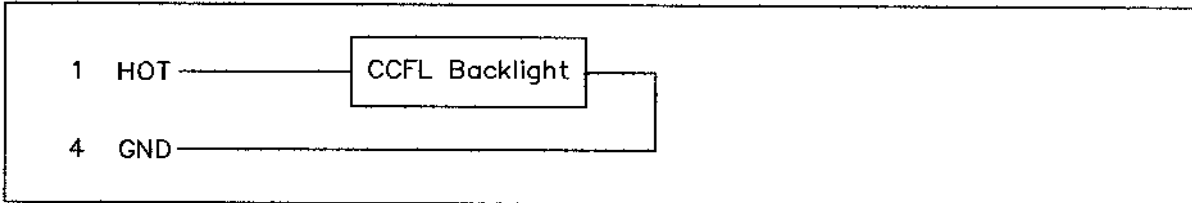
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# 5. BLOCK DIAGRAM

LCD



CCFL



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## 6.INTERNAL PIN CONNECTION

### LCD

Pin No.	Symbol	Level	Function
1	FLM	H/L	First Line Marker
2	LP	H→L	Data Latch Signal
3	CP	H→L	Clock Signal for Shifting Data
4	DISPOFF	H/L	Display Control Signal, H : Display on L : Display off
5	VDD	—	Power Supply for Logic
6	VSS	—	Power Supply (0V,GND)
7	VLCD	—	Power Supply for LCD Drive
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	D4	H/L	Display Data
13	D5	H/L	Display Data
14	D6	H/L	Display Data
15	D7	H/L	Display Data
16	VSS	—	Power Supply (0V,GND)

### CCFL

Pin No.	Symbol	Level	Function
1	HOT	—	Power Supply for CCFL(HOT)
2	NC	—	Non-connection
3	NC	—	Non-connection
4	GND	—	Power Supply for CCFL(GND)

LCD INTERFACE CABLE :

FFC,N16,Pitch 1.0 mm (Thickness = 0.3 mm)

CORRESPONDABLE LCD CONNECTOR :

MOLEX 52207-1690 or COMPATIBLE

CCFL CONNECTOR :

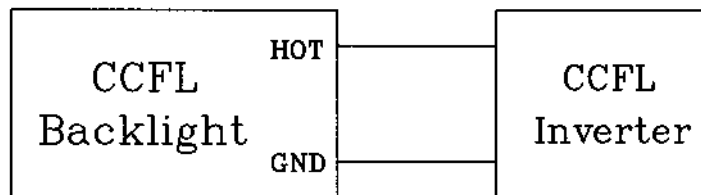
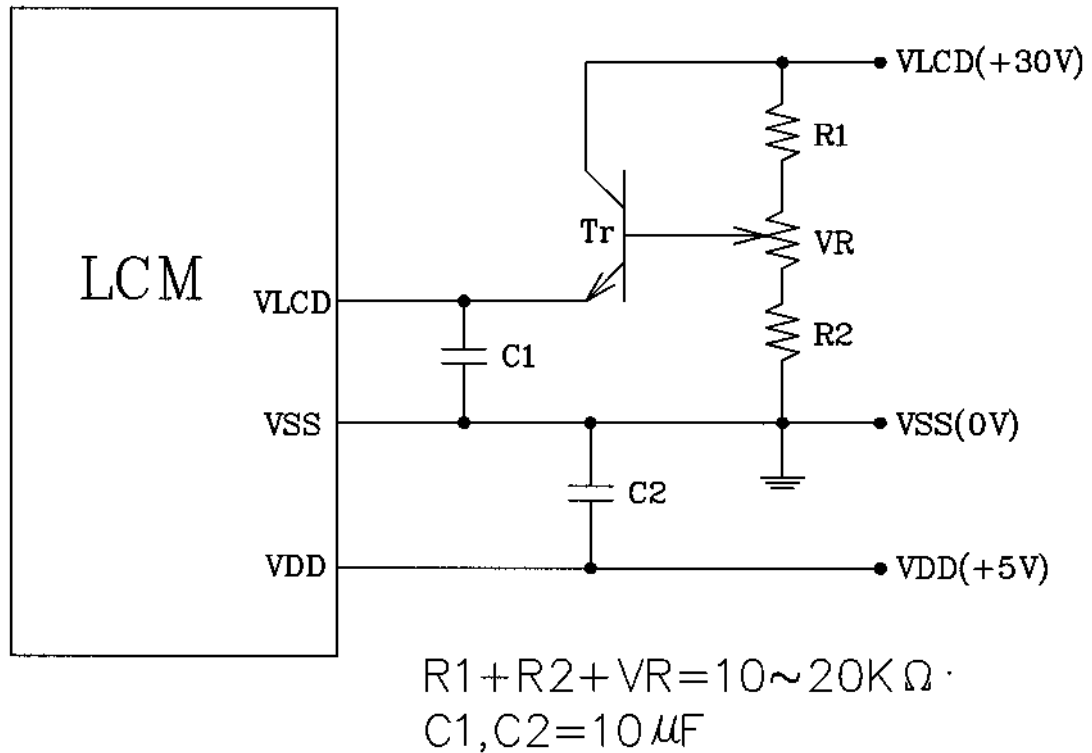
M63M83-04 (MITSUMI)

CORRESPONDABLE CCFL CONNECTOR :

M60-04-30-134P or M60-04-30-114P or M61M73-04 (MITSUMI)

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## 7. POWER SUPPLY



Recommended CCFL Inverter : TDK CXA-L10L  
 TDK CXA-M10L-L

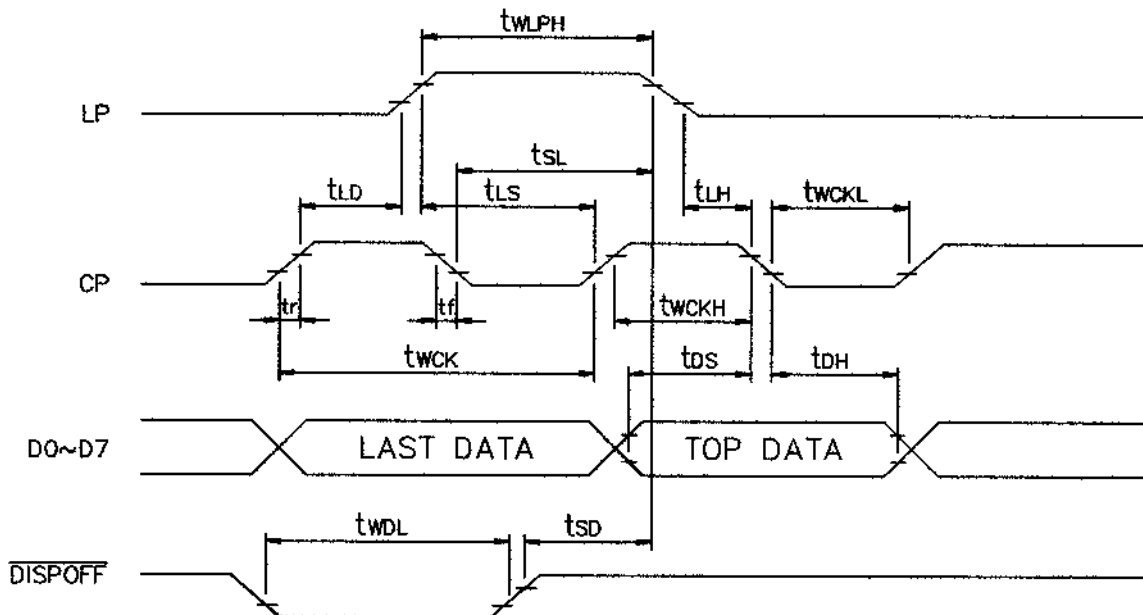
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# 8. TIMING CHARACTERISTICS

## 8-1. INTERFACE TIMING

VDD=5.0V ± 10%

Parameter	SYMBOL	MIN.	MAX.	UNIT
CLOCK PULSE CYCLE TIME	$t_{wck}$	40	-	ns
CLOCK PULSE HIGH LEVEL WIDTH	$t_{wckH}$	12	-	ns
CLOCK PULSE LOW LEVEL WIDTH	$t_{wckL}$	14	-	ns
LATCH PULSE HIGH LEVEL WIDTH	$t_{wLPH}$	15	-	ns
CP→LP RISE TIME	$t_{LD}$	5	-	ns
CP→LP FALL TIME	$t_{SL}$	25	-	ns
LP→CP RISE TIME	$t_{LS}$	25	-	ns
LP→CP FALL TIME	$t_{LH}$	25	-	ns
CLOCK PULSE RISE/FALL TIME	$t_r, t_f$	-	50	ns
DATA SETUP TIME	$t_{DS}$	5	-	ns
DATA HOLD TIME	$t_{DH}$	15	-	ns
DISPOFF LOW LEVEL WIDTH	$t_{WDL}$	1.2	-	μs
DISPOFF CANCELLATION TIME	$t_{SD}$	100	-	ns



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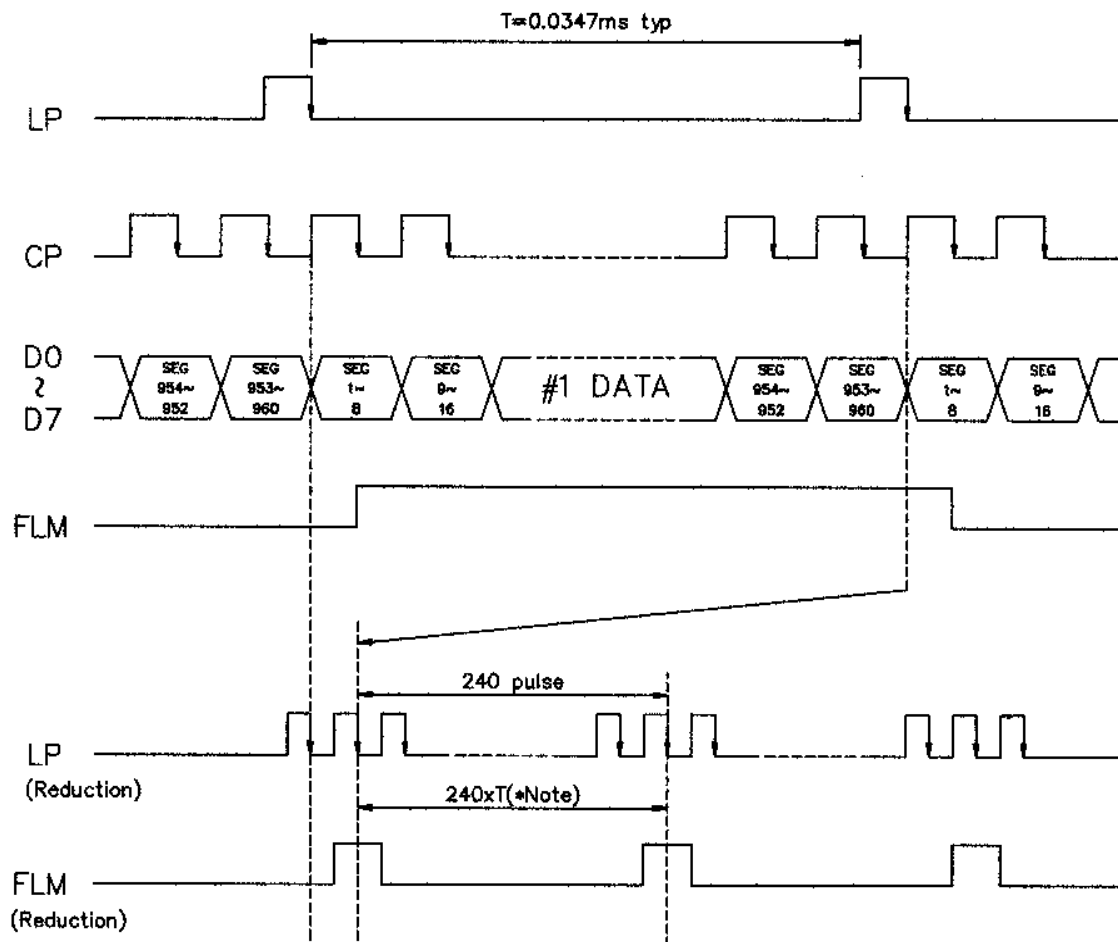
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## 8-2.TIMING CHART OF INPUT SIGNAL



### \*Note :

If you have problem of display quality , you may modify the LP pulse to improve .

Method :1.Increase one pulse of LP.

2.Check the display quality.

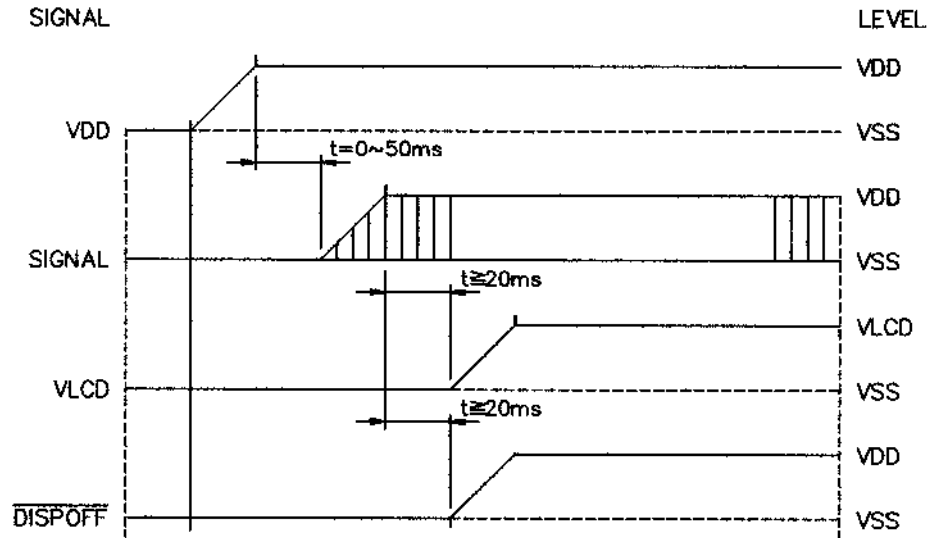
3.If display quality N.G. , redo item 1.

4.If you try many value (ex: 240~260) , you can't get the best quality . The display error may cause by others.

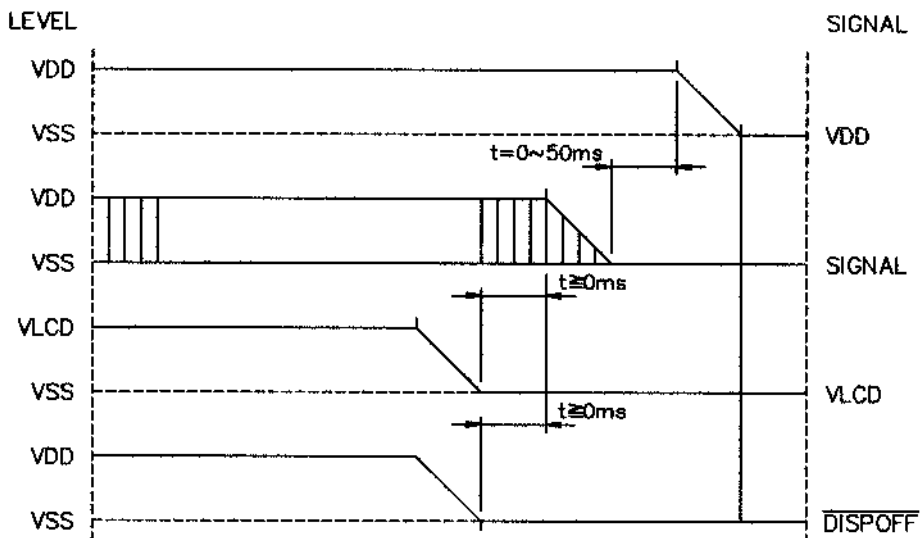
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### 8-3.POWER ON/OFF TIMING

#### ON SEQUENCE



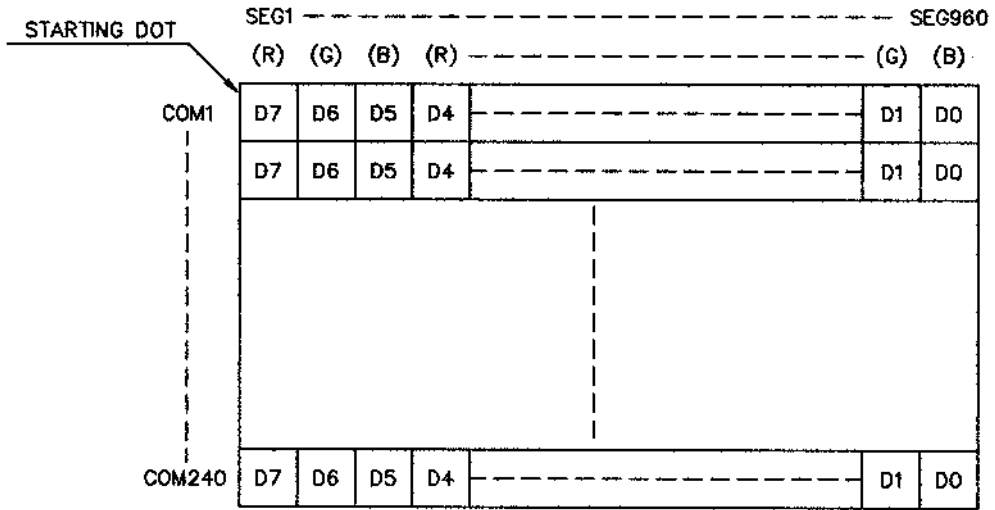
#### OFF SEQUENCE



Please maintain the above sequence when turning on and off the power supply of the module. If 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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### 8-4.DISPLAY PATTERN



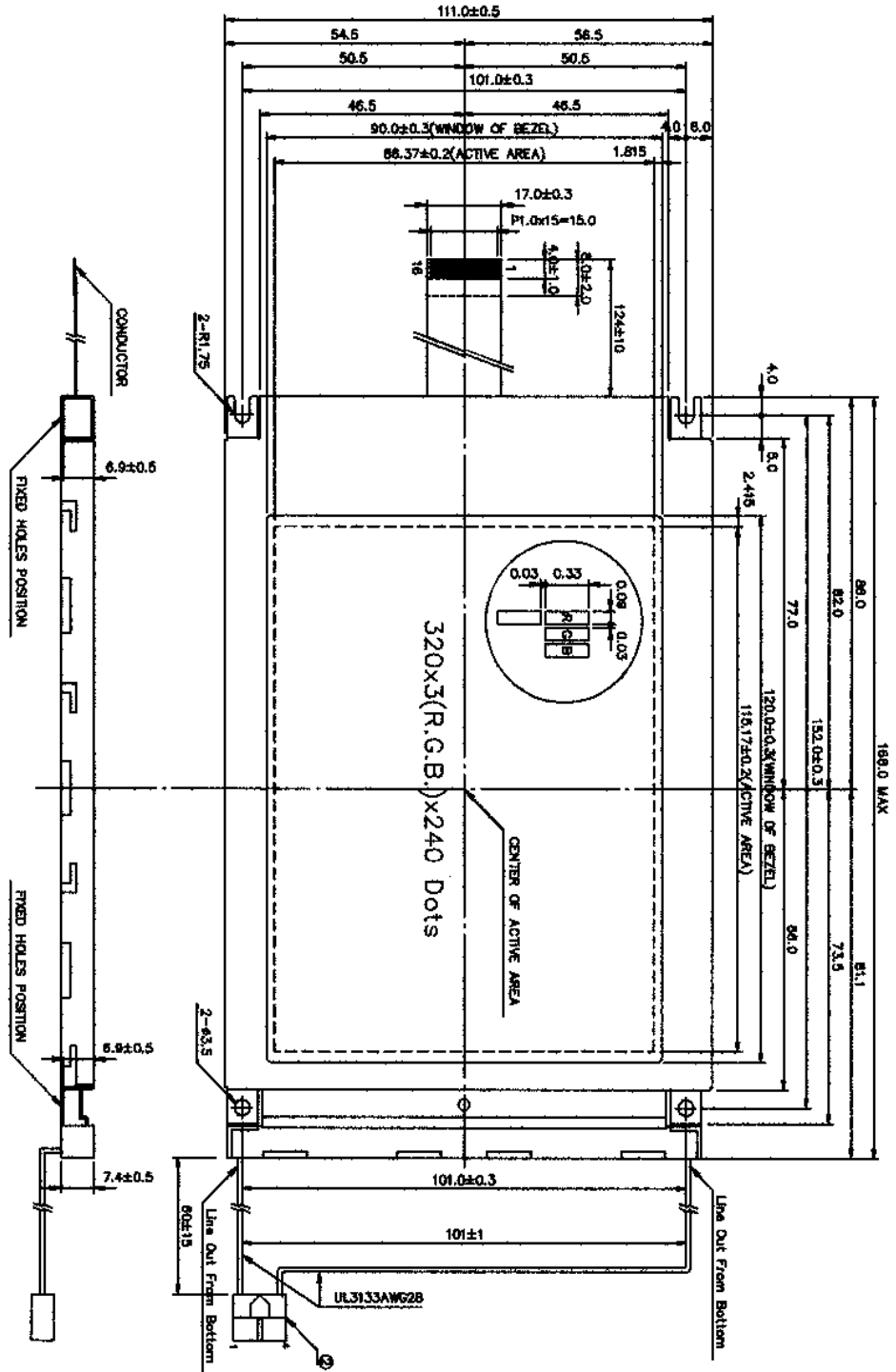
D0~D7 are 8 bits transmitted data, where D0 is LSB and D7 is MSB.



## 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

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NOTE :

1. RESOLUTION : 320 X 3(R.G.B.) X 240 DOTS
  2. CONTROLLER : EXCLUDED
  3. DC/DC CONVERTER : EXCLUDED
  4.  $\text{⊕}$  INTERFACE CONNECTOR  
FFC, M16 P1.0mm
  5.  $\text{⊙}$  CCFI CONNECTOR  
MS3MB3-04(MITSUMI)
5. TOLERANCE NO SPECIFIED :  $\pm 0.5\text{mm}$

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