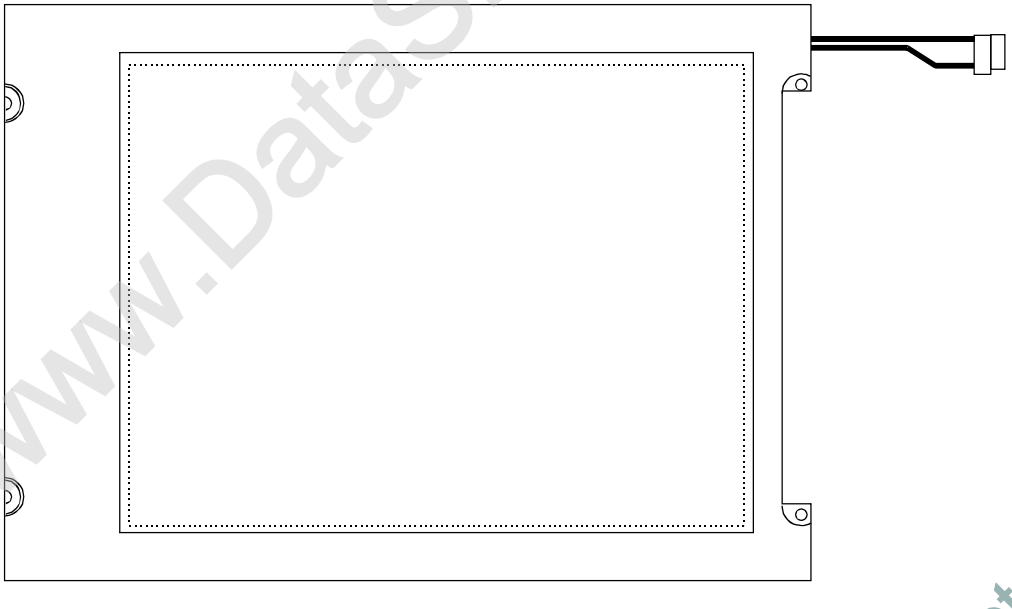
HANTRONIX

PRODUCT SPECIFICATION

HDM6448C

640x480 10.4” Color GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.1	HDM6448C	SHEET 1 OF 21 DATE: 2/26/02

1. MECHANICAL DATA

(1) Product No.	HDM6448C
(2) Module Size	264.0 (W)mm x 183.0 (H)mm x MAX 12.0 (D)mm
(3) Dot Size	0.09 (W)mm x 0.31 (H)mm
(4) Dot Pitch	0.11 (W)mm x 0.33 (H)mm
(5) Number of Dots	640 (W)xRGB x 480 (H)DOTS
(6) Duty	1/240
(7) LCD	/Color Transmissive Type
(8) Viewing Direction	6 O'clock
(9) Backlight	CCFL
(10) Controller	Excluded
(11) DC/DC Converter	Excluded
(12) Weight	490 g(approx.)

2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	−0.3	6.5	V	
Power Supply for LCD Drive	VEE−VSS	0	25.0	V	
Input Voltage	VI	−0.3	VDD+0.3	V	
Static Electricity	−	−	−	−	Note 1

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	−20	70
Humidity (Without Condensation)	Note 1,3		Note 2,3	
Vibration	Note 4			

Note 1 Ta ≦ 50°C : 85%RH max
Ta > 50°C : Absolute humidity must be lower than the humidity of 85%RH at 50°C

Note 2 Ta at −20°C will be < 48 hrs, at 70°C will be < 120 hrs

Note 3 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 4

Frequency	5 Hz~13.95 Hz	13.95 Hz~33 Hz	33 Hz~51 Hz	51 Hz~500 Hz
Vibration Level	−	2X9.8 m/s²	−	5x9.8 m/s²
Vibration Width	0.2 inch	−	0.036 inch	−
Vibration Direction	X/Y/Z			
Vibration Time	20 min−1cycle X 3 directions			

3. ELECTRICAL CHARACTERISTICS

3.1 ELECTRICAL CHARACTERISTICS OF LCM

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply	VDD−VSS	Ta= 25°C		2.7	3.0	3.3	V
				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)	VEE−VSS	Duty=1/240 Bias=1/13 VDD=5.0V	0°C	23.4	23.8	24.2	V
			25°C	23.6	23.0	23.4	
			50°C	21.4	21.8	22.2	
Supply Current for Logic	IDD	VDD−VSS = 5.0V VEE−VSS = 23.0V Ta= 25°C		−	33.0	40.0	mA
Supply Current for LCD	IEE			−	12.0	18.0	mA

3.2 ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used lamp : Rating

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	V_L	–	640	–	Vrms	
Lamp current	I_L	3	5	7	mArms	
Lamp power consumption	P_L	–	3.2	–	W	
Lamp frequency	F_L	30	45	55	kHz	
Starting voltage	V_S	–	750	1500	Vrms	$T_a = 25°C$
Color Degree	X	0.287	0.297	0.307	–	
	Y	0.287	0.297	0.307		
Lamp life time	L_L	10000	–	–	hrs	

LCM : Rating

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Surface Luminance	L	–	110	–	cd/m^2	ALL ON(I_L=5mA) ONE LAMP
		–	7.0	–	cd/m^2	ALL OFF(I_L=5mA) ONE LAMP
Luminance Uniformity	Lu	–	78	–	%	White

3.3 INVERTER : TDK TAD250

3.3.1 GENERAL SPECIFICATIONS

3.3.1.1 OPERATION TEMPERATURE : 0°C~50°C

3.3.1.2 STORAGE TEMPERATURE : −20°C~80°C

3.3.1.3 DIMENSION : .95.0(L)mm x 19.5(W)mm x MAX 8.8(H)mm

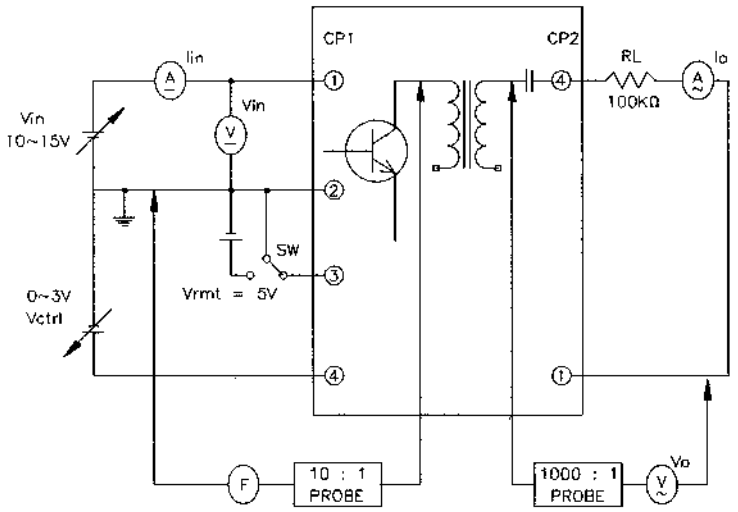
3.3.2 INPUT CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARKS
Input Voltage	Vin	10	12	15	V	
Input Current	Iin	–	450	550	mA	RL = 100KΩ, Vin = 12V
Input Power	Pin	–	5.4	6.6	W	RL = 100KΩ, Vin = 12V
Standby Input Current	Iin Standby	–	0.1	1.0	μA	OFF state
Control Terminal Input Voltage	Vrmt	3.5	5	10	V	ON state
		−0.5	0	0.4	V	OFF state
Control Terminal Input Current	Irmt	–	0.5	1.0	mA	Vrmt = 5V
		–	–	−0.3	μA	Vrmt = 0V

3.3.3 OUTPUT CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARKS
NO Load Output Voltage	Vs	1400	–	–	Vrms	
Tube Current	IL	2.7	3	3.3	mArms	Vctrl = 3V Min. Brightness
		5.4	6	6.6	mArms	Vctrl = 0V Max. Brightness
Working Frequency	f	35	45	55	kHz	

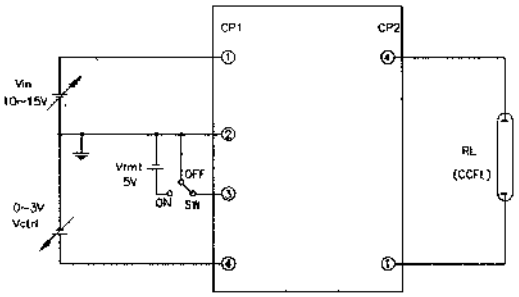
3.3.4 MEASUREMENT



3.3.5 MEASURE INSTRUMENTS

- (A) DIGITAL MULTIMETER
  HP 3478A or equivalent
- (V) DIGITAL MULTIMETER
  HP 3478A or equivalent
- (A) TRUE RMS MULTIMETER
  FLUKE 8060A or equivalent
- (V) TRUE RMS VOLTMETER
  HP 3400A or equivalent
- (F) TRUE RMS MULTIMETER
  FLUKE 8060A or equivalent

3.3.6 APPLICATION EXAMPLES



3.3.7 PIN ASSIGNMENTS

INPUT (CP1) CONNECTOR :
MOLEX 53261-0590

NO.	SIGNAL
1	Vin
2	Gnd
3	Vrmt
4	Vctrl
5	NC

OUTPUT (CP2) CONNECTOR :
MITSUMI : M60-04-30-134P

NO.	SIGNAL
1	RTN
2	NC
3	NC
4	HV

4. OPTICAL CHARACTERISTICS

4-1. Optical Char. of Normal Temp. Mode

AT V_{OP}

ITEM / MODE		Cr(Contrast Ratio)						θ(Viewing Angle)		φ(Viewing Angle)	
		0℃		25℃		50℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	M	–	20	–	30	–	6	–	40-X	–	60-36
note		NOTE6						NOTE5			

AT $\phi=0°$ $\theta=0°$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	–	650	1000	ms	NOTE 2
		25℃	–	230	350		
		50℃	–	115	180		
Response Time (fall)	Tf	0℃	–	250	400	ms	NOTE 2
		25℃	–	80	120		
		50℃	–	60	90		

note:

T : TRANSMISSIVE
M : NORMALLY BLACK(COLOR)

4-2.Color of CIE Coordinate

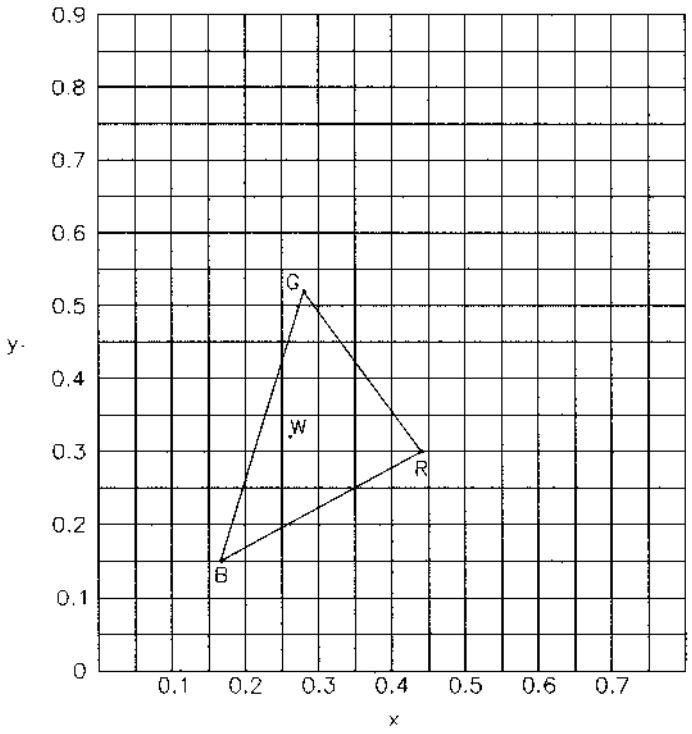
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	NOTE
Color of CIE Coordinate	Red	X	$\phi=0°$, $\theta=0°$ CCFL BACKLIGHT COLOR DEGREE X=0.297 Y=0.297	0.4433	Note※
		y		0.3089	
	Green	X		0.2795	
		y		0.5225	
	Blue	X		0.1641	
		y		0.1537	
	White	X		0.2635	
		y		0.3296	

Tolerance : ±0.05

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

Fig.1



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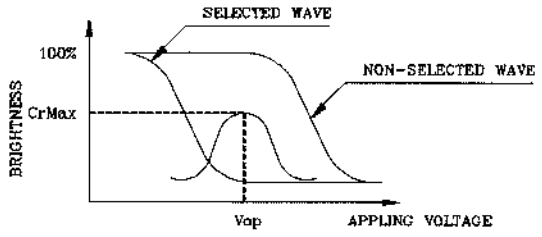
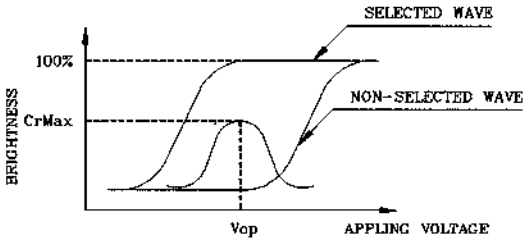
(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



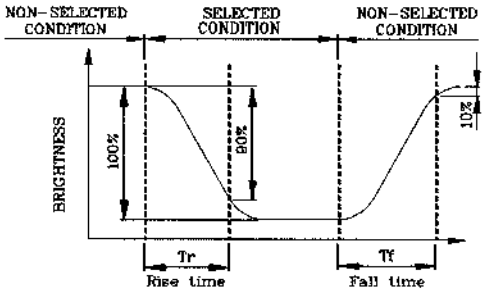
(negative type)

*Conditions

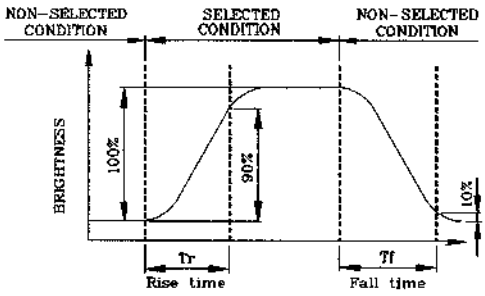
Viewing Angle : 0
Frame Frequency : 70Hz
Appling Waveform : I/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



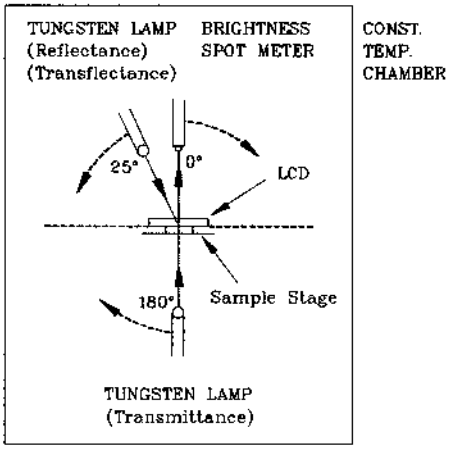
(negative type)

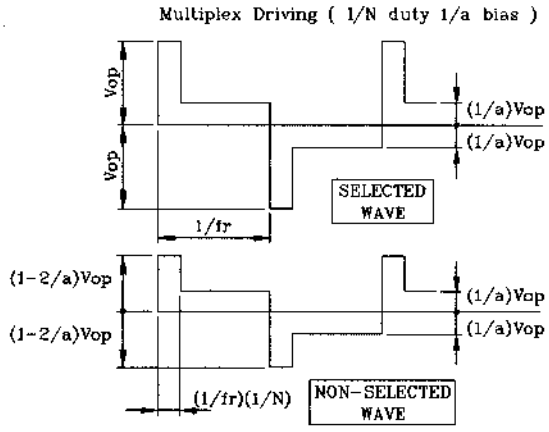
*Conditions

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

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms





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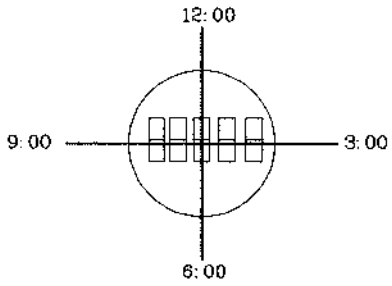
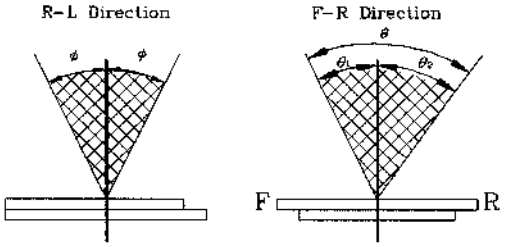
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



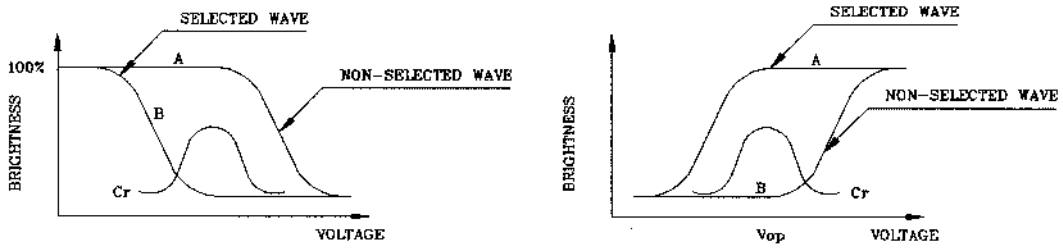
$\theta = \theta_1 + \theta_2$

*Conditions

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

(NOTE 6)

Definition of Contrast Ratio (Cr)



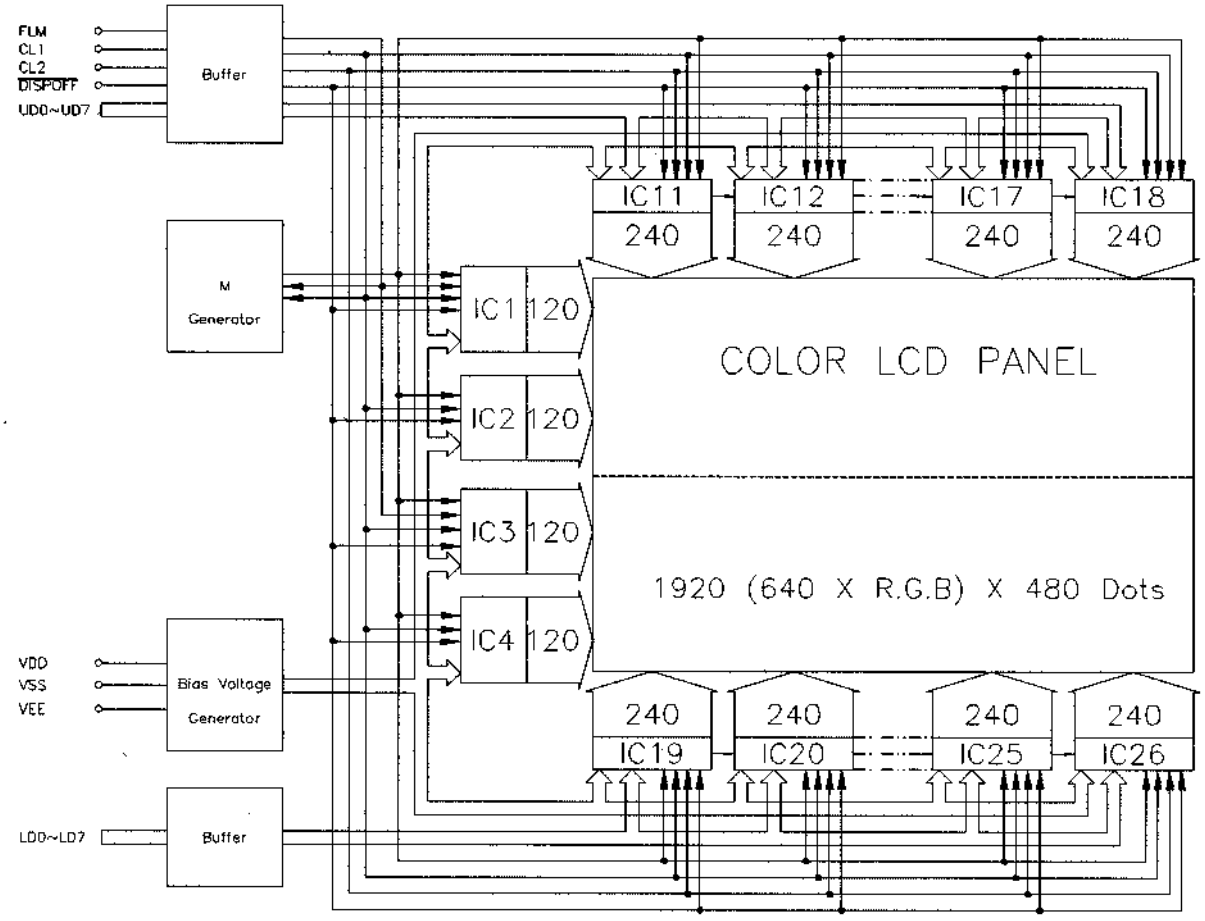
(positive type) (negative type)

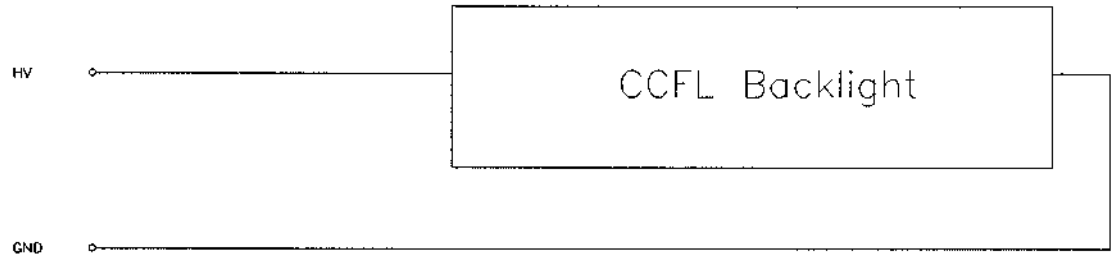
Contrast Ratio : Cr=A/B

*Conditions

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

5. BLOCK DIAGRAM





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6. INTERFACE PIN CONNECTION

CN1:15PIN MOLEX 53261-1590 CN2:14PIN MOLEX 53261-1490

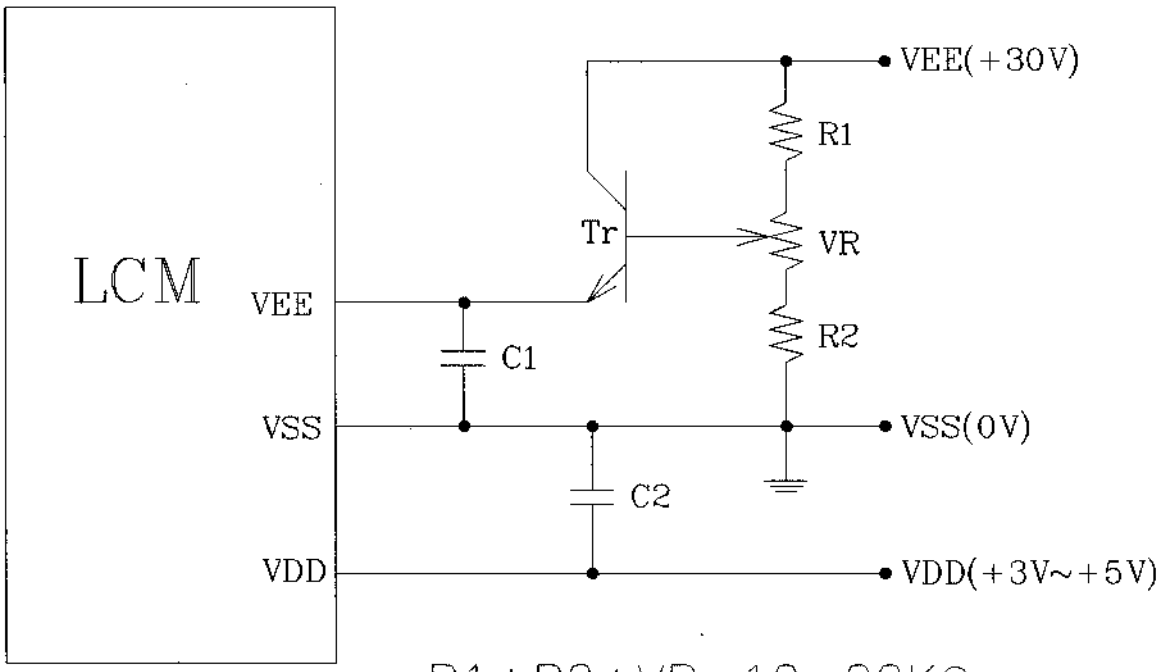
INTERFACE		PIN NO.	SYMBOL	FUNCTION
LCM	CN1	1	FLM	The FLM signal indicates the beging of each display cycle.
		2	NC	
		3	$\overline{\text{DISPOFF}}$	H ---display ON, L --display OFF
		4	CL1	The CL1 latches the serial data in the shift registers.
		5	VSS	GND
		6	CL2	Clock signal for shifting the serial data.
		7	VSS	GND
		8	UD0	Display data for upper column driver
		9	UD1	Display data for upper column driver
		10	UD2	Display data for upper column driver
		11	UD3	Display data for upper column driver
		12	UD4	Display data for upper column driver
		13	UD5	Display data for upper column driver
		14	UD6	Display data for upper column driver
		15	UD7	Display data for upper column driver
	CN2	1	LD0	Display data for lower column driver
		2	LD1	Display data for lower column driver
		3	LD2	Display data for lower column driver
		4	LD3	Display data for lower column driver
		5	LD4	Display data for lower column driver
		6	LD5	Display data for lower column driver
		7	LD6	Display data for lower column driver
		8	LD7	Display data for lower column driver
		9	VDD	+5V
		10	VSS	GND
		11	VSS	GND
		12	VEE	Power supply voltage for LCD (+)
		13	VEE	Power supply voltage for LCD (+)
		14	VEE	Power supply voltage for LCD (+)
			NC	

FLCN1:MITSUMI/M63M83-04

(Suitable Connecter:MITSUMI/M60-04-30-134P or M60-04-30-114P or M61M73-04)

INTERFACE		PIN NO.	SYMBOL	FUNCTION
CFL	FLCN1	1	GND	CFL GND
		2	N.C	-
		3	N.C	-
		4	HV	Power supply voltage for CFL

7.POWER SUPPLY



R1+R2+VR=10~20KΩ
C1,C2=10μF

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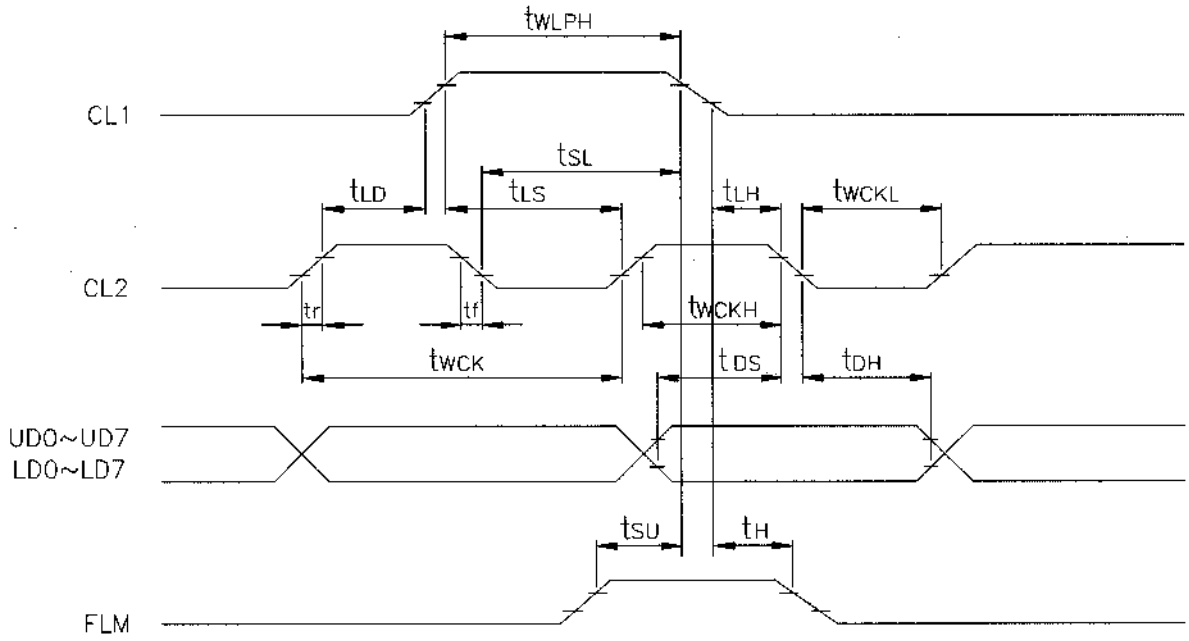
8. TIMING CHARACTERISTICS

8-1. INTERFACE TIMING

VDD=5.0V ± 10%

Parameter	SYMBOL	MIN.	MAX.	UNIT
CLOCK PULSE CYCLE TIME	t_{WCK}	50	–	ns
CLOCK PULSE HIGH LEVEL WIDTH	t_{WCKH}	15	–	ns
CLOCK PULSE LOW LEVEL WIDTH	t_{WCKL}	15	–	ns
LATCH PULSE HIGH LEVEL WIDTH	t_{WLPH}	20	–	ns
CP→LP RISE TIME	t_{LD}	0	–	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	–	30	ns
DATA SETUP TIME	t_{DS}	10	–	ns
DATA HOLD TIME	t_{DH}	10	–	ns
FLM SETUP TIME	t_{SU}	100	–	ns
FLM HOLD TIME	t_H	30	–	ns



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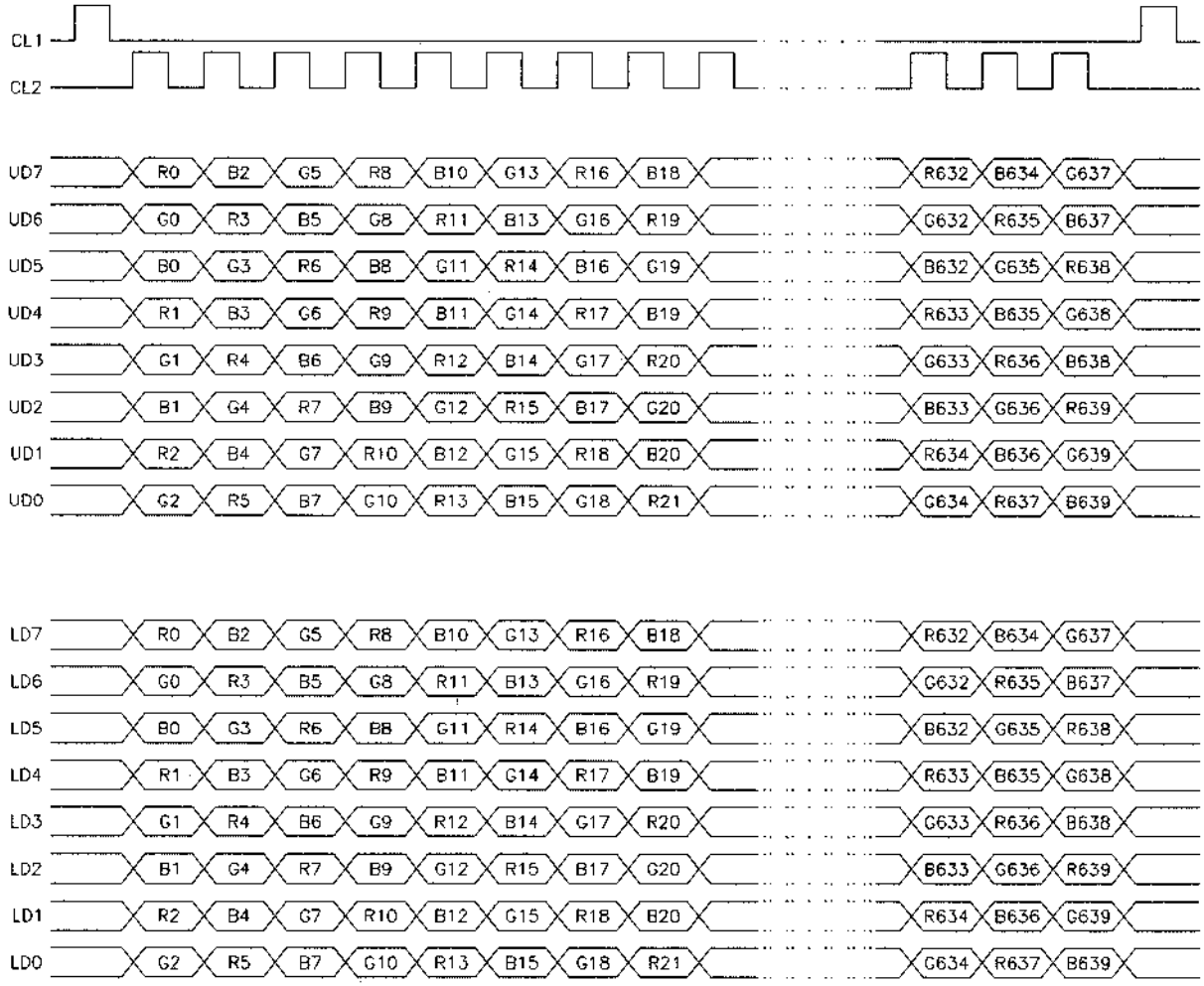
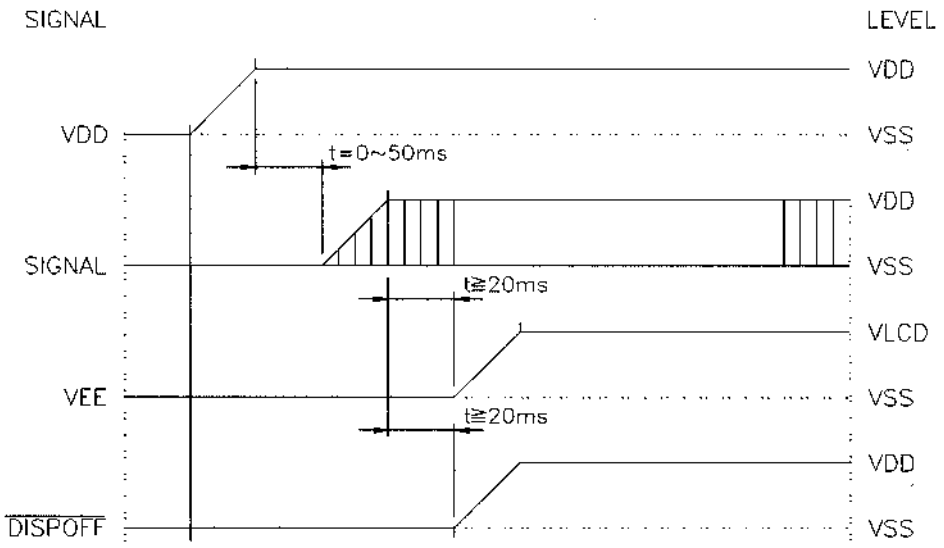
8-2. TIMING CHART

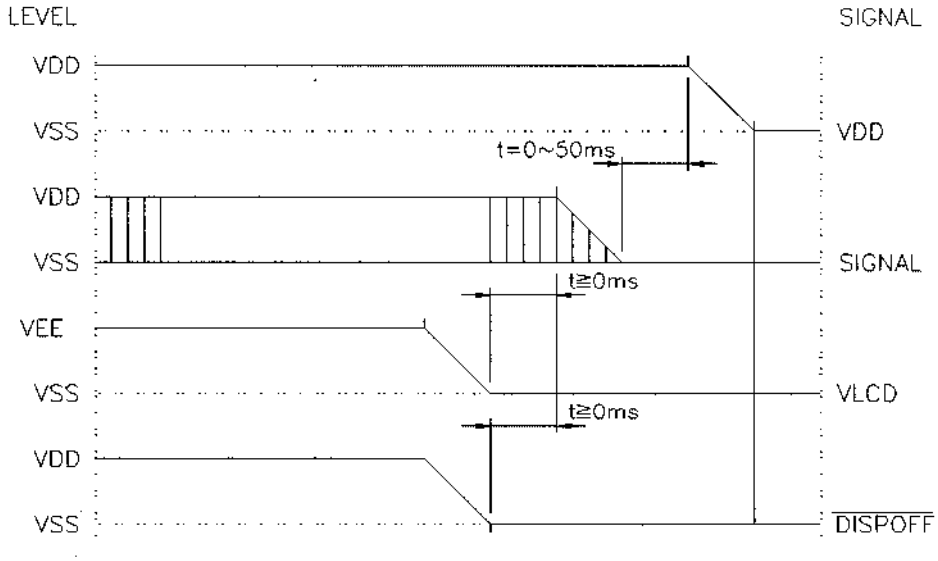


8-3. POWER ON/OFF TIMING

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.

9. DISPLAY

	1	2	3	4	5	6	7	8	...	1913	1914	1915	1916	1917	1918	1919	1920
1	R0	G0	B0	R1	G1	B1	R2	G2		G637	B637	R638	G638	B638	R639	G639	B639
	UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0		UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0
2	R0	G0	B0	R1	G1	B1	R2	G2		G637	B637	R638	G638	B638	R639	G639	B639
	UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0		UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0
⋮																	
239	R0	G0	B0	R1	G1	B1	R2	G2		G637	B637	R638	G638	B638	R639	G639	B639
	UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0		UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0
240	R0	G0	B0	R1	G1	B1	R2	G2		G637	B637	R638	G638	B638	R639	G639	B639
	UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0		UD7	UD6	UD5	UD4	UD3	UD2	UD1	UD0
241	R0	G0	B0	R1	G1	B1	R2	G2		G637	B637	R638	G638	B638	R639	G639	B639
	LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0		LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0
242	R0	G0	B0	R1	G1	B1	R2	G2		G637	B637	R638	G638	B638	R639	G639	B639
	LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0		LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0
⋮																	
479	R0	G0	B0	R1	G1	B1	R2	G2		G637	B637	R638	G638	B638	R639	G639	B639
	LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0		LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0
480	R0	G0	B0	R1	G1	B1	R2	G2		G637	B637	R638	G638	B638	R639	G639	B639
	LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0		LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0

10. RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Leaving	70°C 30%RH	120HR		Appearance without defect	
2	Low Temp. Leaving	−20°C	120HR		Appearance without defect	
3	High Temp. & High Humi. Leaving	40°C 90%RH	120HR		Appearance without defect	
4	Thermal Shock	−20°C,30min→R.T.5min →60°C,30min→R.T.5min (1cycle)			Appearance without defect	5 cycles

11. NOTES

(1) Power on sequence :

- The power ON/OFF sequence is very important for LCM, we recommand you using the follow power ON/OFF sequence :

  POWER ON : power on VDD (logic power supply) before power on VEE (power supply for LC).

  POWER OFF : power off VEE before VDD.

  If you do not follow the power ON/OFF sequence, the drivers of LCM maybe damaged.

- LCM connection :

  We strongly suggest you never short the VEE with other interface pin, if you do it, the drivers of LCM and controller of cpu will be break down and destoryed.

(2) Safety

- If the LCD pannel breaks, be careful not to get the liquid crystal in your mouth.
- If the liquid crystal touches your skin or colthes, wash it off immediately using soap and plenty of water.

(3) Handling

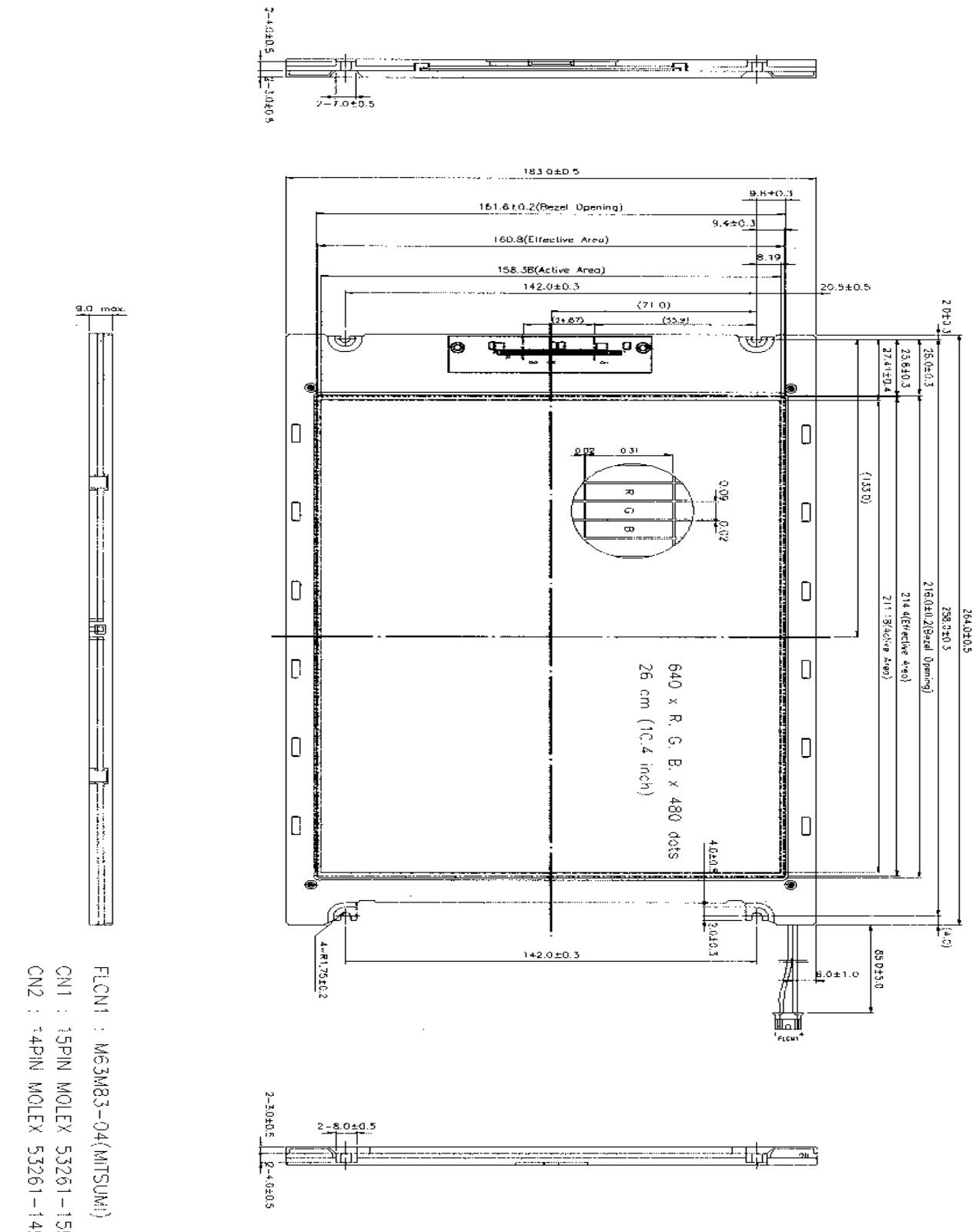
- Avoid static electricity as this can damage the CMOS LSI.
- The LCD pannel is made of plate glass, do not hit or press against it.
- Do not remove the pannel or frame from the module.
- The polarizer on the display is very fragile, handle it very carefully.

(4) Storage

- Storage the module in a place where the temperature is 25°C±10°C and the humidity below 65%RH.
- Do not storage the mdule near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module or its components.

(5) Cleaning

- Do not wipe the polarizer with a dry cloth, as it may scratch the surface.
- Wipe the module genty with a soft soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the polarizer.



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	**Q.A.:** JK	**REV.:** 1.1	HDM6448C	SHEET 21 OF 21 **DATE:** 2/26/02