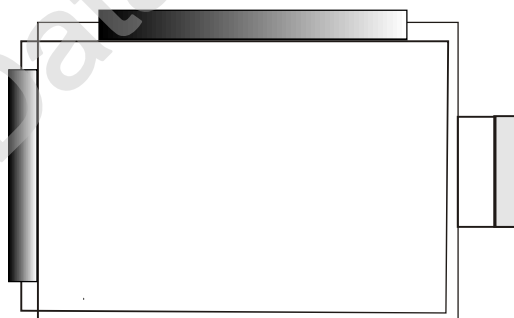


HANTRONIX

PRODUCT SPECIFICATION

HDM240GS16-1

240x160 GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM240GS16-1	SHEET 1 OF 18
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1.MECHANICAL DATA

(1) Product No.	HDM240GS16-1
(2) Module Size	74.6 (W)mm X 56.1 (H)mm X 4.5 (D)mm
(3) Dot Size	0.23 (W)mm X 0.23 (H)mm
(4) Dot Pitch	0.24 (W)mm X 0.24 (H)mm
(5) Number of Dots	240 (W) X 160 (H) Dots
(6) Duty	1/160
(7) LCD Display Mode	FSTN: Black and White(Normally White/Positive Image)
	Rear Polarizer: ☐ Reflective ☐ Transflective ☐ Transmission
(8) Viewing Direction	☐ 6 O'clock ☐ 12 O'clock
(9) Backlight	☐ W/O ☐ EL (White) ☐ EL (Blue Green)
(10) Weight	W/O B/L : 15 g (Approx.) EL B/L : 17 g (Approx.)
(11) Controller	Excluded
(12) DC/DC Converter	Excluded

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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0 V Standard

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	6.5	V	
Input Voltage	VEE-VSS	0	27	V	
Static Electricity	-	-	-	-	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.				WIDE TEMP.			
	OPERATING		STORAGE		OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	-20	70	-20	70	-30	80
Humidity (Without Condensation)	Note 2,4		Note 3,4		Note 4,5		Note 4,6	
Vibration(Note 7)	-		49cm/S ² (5G)		-		49cm/S ² (5G)	

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 70°C will be < 120 hrs

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

Note 5 Ta ≤ 70°C : 75%RH max
Ta > 70°C : Absolute humidity must be lower than the humidity of 75%RH at 70°C

Note 6 Ta at -30°C will be < 48 hrs, at 80°C will be < 120 hrs

Note 7

Frequency (HZ)	10~55~10/1 min
Vibration Width	1.5 m/m
Vibration Direction	X/Y/Z
Vibration Time	15 min/cycle X 3 directions

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3. ELECTRICAL CHARACTERISTICS

(VDD = 3.3V±10%)

ITEM			SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Supply voltage for logic			VDD-VSS	—		2.97	3.3	3.63	V
Input Voltage			VIH	H level		0.8VDD	—	VDD	V
			VIO	L level		0	—	0.2VDD	
Recommended LC Driving Voltage (Normal Temp. LCM)			VEE-VSS (Vop)	1/240 Duty 1/13 Bias	0°C	21.7	22.0	22.3	V
					25°C	20.1	20.4	20.7	
					50°C	18.0	18.3	18.6	
Recommended LC Driving Voltage (Wide Temp. LCM)			VEE-VSS (Vop)	1/240 Duty 1/13 Bias	0°C	22.3	22.6	22.9	V
					0°C	21.2	21.5	21.8	
					25°C	20.5	20.8	21.1	
					50°C	19.6	19.9	20.2	
					50°C	18.6	18.9	19.2	
Power Supply Current (Normal Temp. LCM)			IDD	VDD= 3.3 V VSS= 0V VEE-VSS= 20.4V FLM=70Hz PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □		—	0.55	0.83	mA
			IEE			—	0.8	1.2	
Power Supply Current (Wide Temp. LCM)			IDD	VDD= 3.3 V VSS= 0V VEE-VSS=20.8V FLM=70Hz PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □		—	0.58	0.88	mA
			IEE			—	0.9	1.4	
EL Power Supply Current			IEL	65Vrms 250HZ		—	4.7	7.1	mA
LCM	Surface Luminance (Normal Temp. LCM)	L	VDD= 3.3 V VSS= 0V VEE-VSS= 20.4V 65Vrms 250HZ	S227J	PATTERN: (Dots All On)	—	0.42	—	cd/m ²
				H227K		—	0.96	—	
				H227L		—	1.23	—	
				S227J	PATTERN: (Dots All Off)	—	2.01	—	
				H227K		—	3.4	—	
				H227L		—	4.37	—	
LCM	Surface Luminance (Wide Temp. LCM)	L	VDD= 3.3 V VSS= 0V VEE-VSS= 20.8V 65Vrms 250HZ	Z227L5K	PATTERN: (Dots All On)	—	—	—	cd/m ²
				T227J5GK		—	—	—	
				Z227L5K	PATTERN: (Dots All Off)	—	—	—	
				T227J5GK		—	—	—	

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4-1.OPTICAL CHARACTERISTICS

(FOR NORMAL TEMPERATURE MODE LCM)

AT Vop

MODE	ITEM	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.
G	L	—	5.5	—	5.0	—	4.0	—	74	—	±37
S	J	—	8.0	—	7.5	—	6.0	—	70	—	±35
H	K	—	8.0	—	6.5	—	5.0	—	68	—	±33
H	L	—	8.2	—	7.0	—	5.5	—	69	—	±34
NOTE		NOTE 6						NOTE 5			

NOTE :

G : REFLECTIVE

J : NORMALLY WHITE, 6 O'CLOCK

S : TRANSFLECTIVE(normal)

L : NORMALLY WHITE, 6 O'CLOCK

H : TRANSFLECTIVE

(special lighter background color)

(high transparency)

K : NORMALLY WHITE, 12 O'CLOCK

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0°C	—	800	—	ms	NOTE 2
		25°C	—	230	—		
		50°C	—	100	—		
Response Time (fall)	Tf	0°C	—	300	—	ms	NOTE 2
		25°C	—	115	—		
		50°C	—	65	—		

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4-2.OPTICAL CHARACTERISTICS

(FOR WIDE TEMPERATURE MODE LCM)

AT Vop

ITEM MODE		Cr(Contrast Ratio)										θ (Viewing Angle)		ϕ (Viewing Angle)	
		-20°C		-0°C		25°C		50°C		70°C		25°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
Z	L	-	8.5	-	9.5	-	10	-	9.0	-	6.0	-	-	-	-
T	J	-	4.5	-	5.0	-	4.5	-	4.0	-	3.0	-	-	-	-
note		NOTE 6										NOTE 5			

NOTE :

Z : OTHER

T : TRANSMISSION

J : NORMALLY WHITE 6 O'CLOCK

L : NORMALLY WHITE 6 O'CLOCK

(special lighter background color)

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20°C	-	300	-	ms	NOTE 2
		0°C	-	700	-		
		25°C	-	200	-		
		50°C	-	90	-		
		70°C	-	60	-		
Response Time (fall)	Tf	-20°C	-	2000	-	ms	NOTE 2
		0°C	-	400	-		
		25°C	-	100	-		
		50°C	-	50	-		
		70°C	-	30	-		

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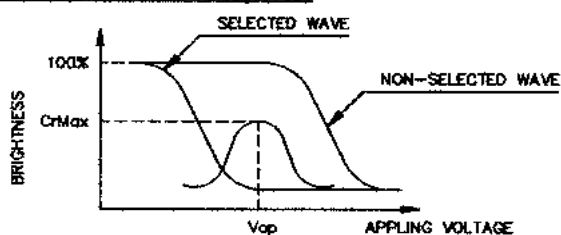
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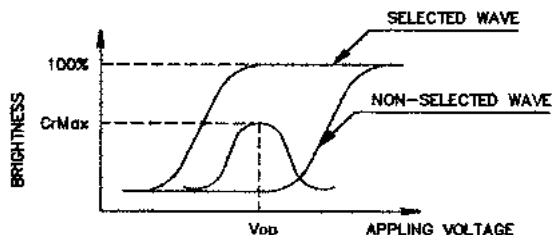
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

•Conditions

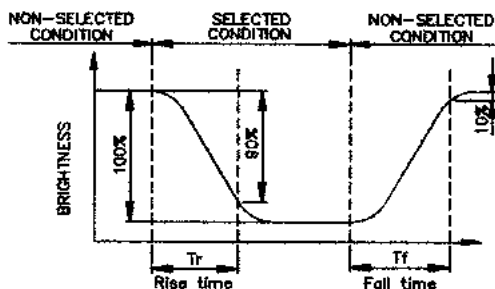
Viewing Angle : 0

Frame Frequency : 70Hz

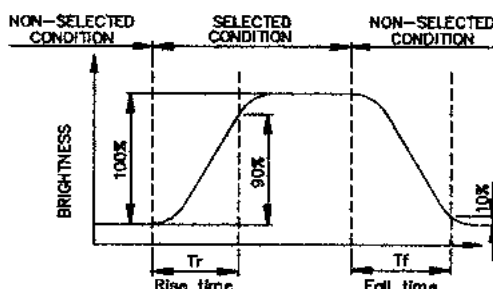
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



(negative type)

•Conditions

Operating Voltage : Vop

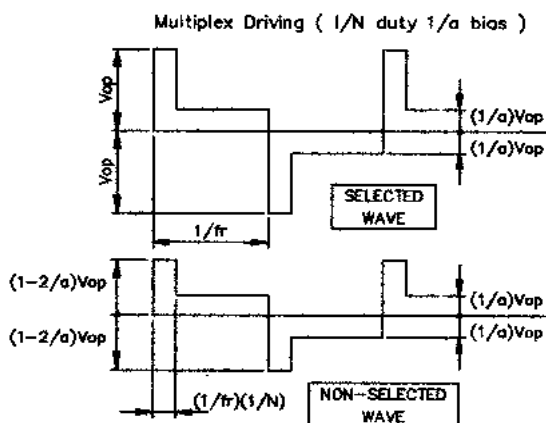
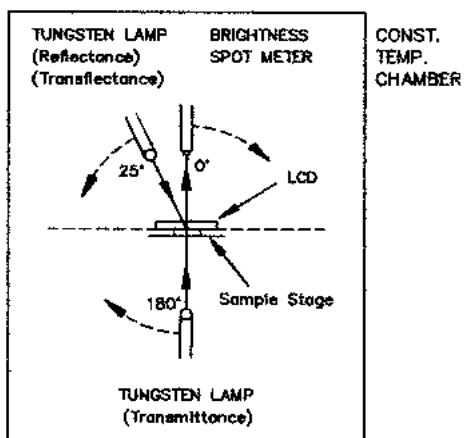
Viewing Angle (θ,θ) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



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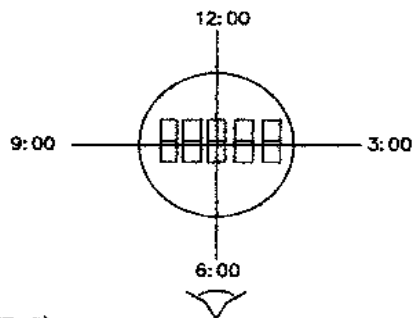
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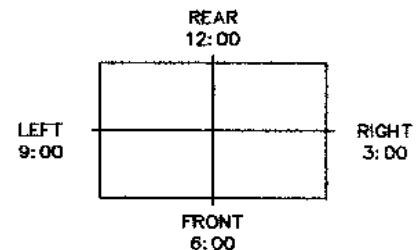
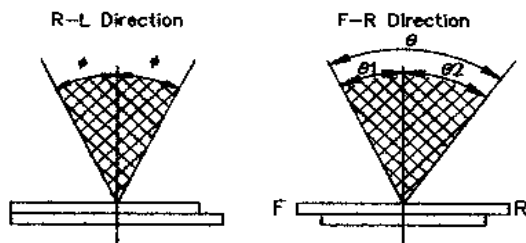
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product

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

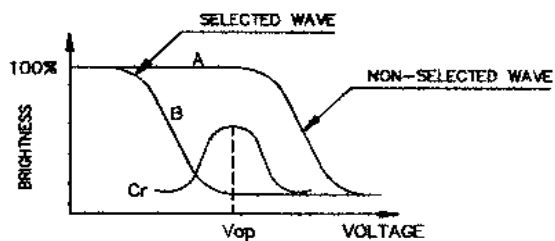
$$\theta = \theta_1 + \theta_2$$

*Conditions

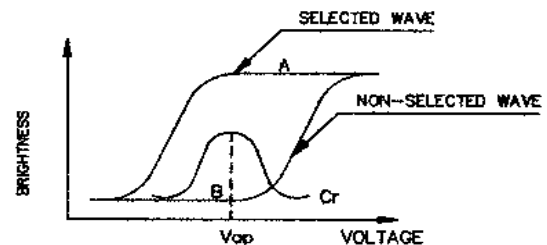
Operating Voltage : V_{ap}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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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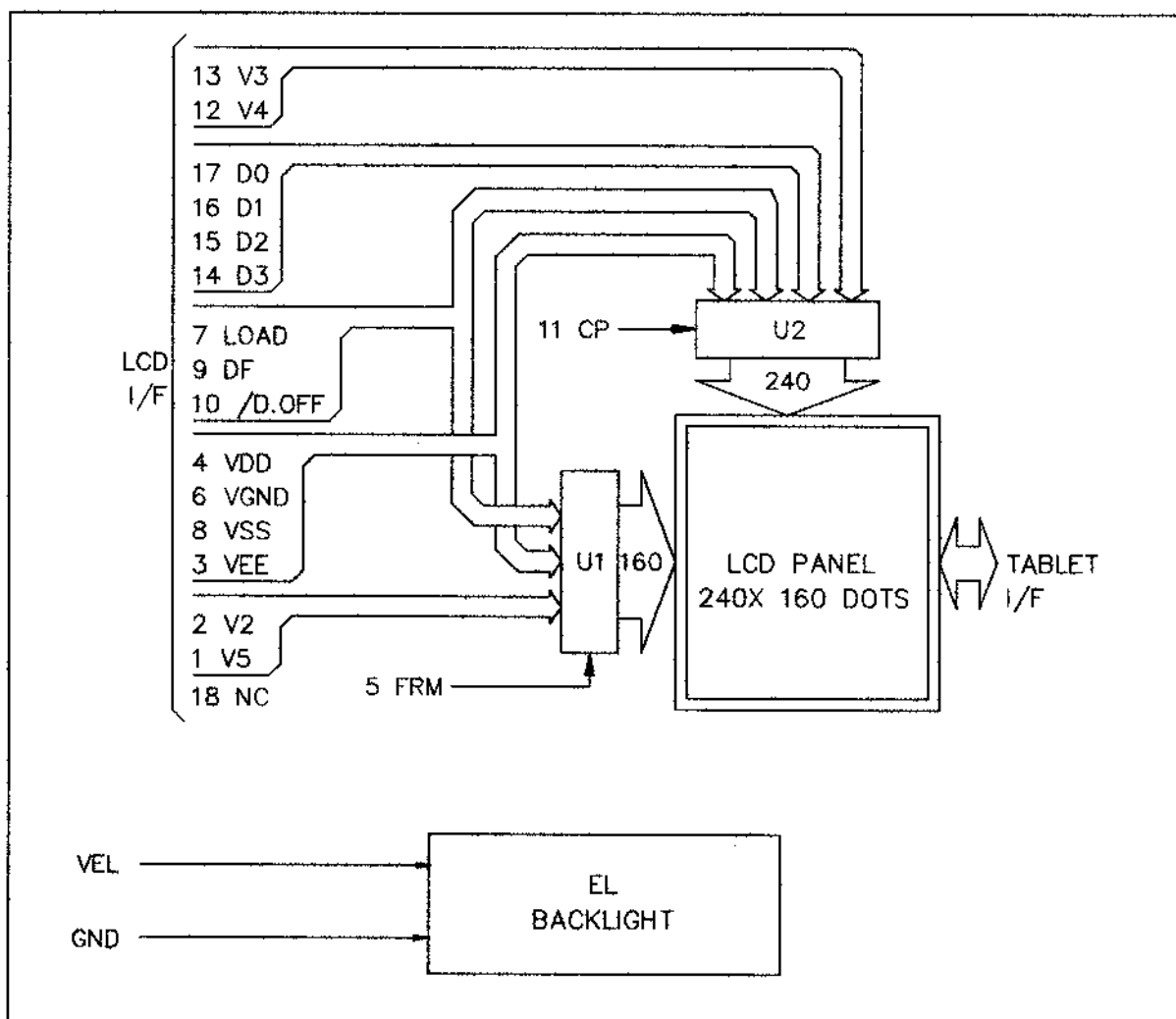
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5. BLOCK DIAGRAM



Note1 :

- 1) Controller and bias voltage supply circuit are not included.
- 2) VEE, VGND, V2, V3, V4 and V5 are power supply voltage for LCD.
($VEE > V2 > V3 > V4 > V5 > VGND$)
- 3) The bias is 1/13, $\begin{cases} VOP = VEE - VSS = 20.4 \text{ V. (Normal Temp.)} \\ VOP = VEE - VSS = 20.8 \text{ V. (Wide Temp.)} \end{cases}$

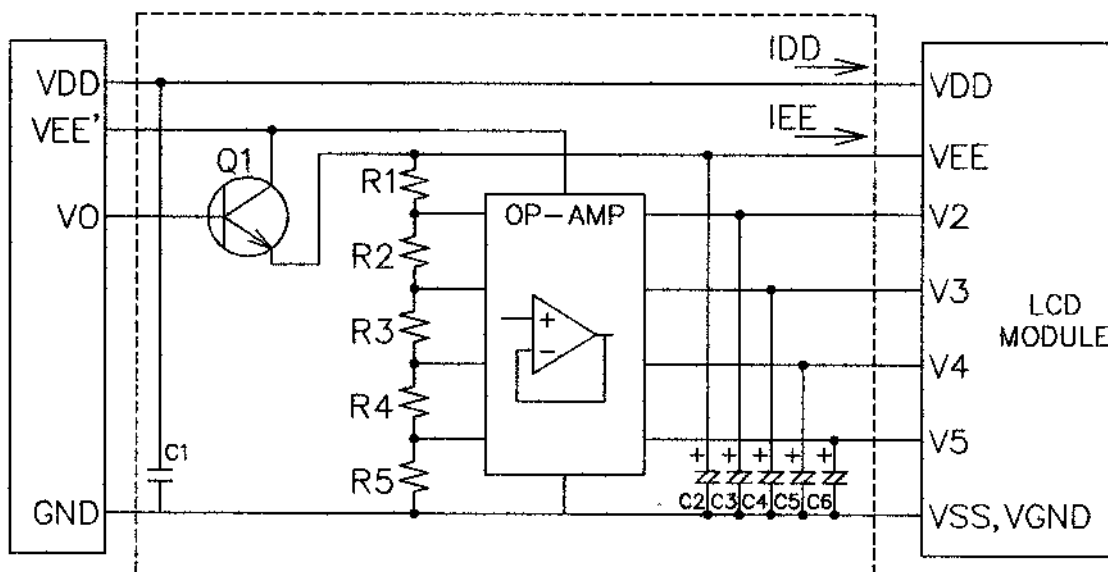
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6.INTERNAL PIN CONNECTION

LCD

Pin No.	Symbol	Function
1	V5	Bias voltage for non-select (Common driver)
2	V2	Bias voltage for non-select (Common driver)
3	VEE	Power supply for LCD (+V)
4	VDD	Power supply for logic (+3.3V)
5	FRM	Frame start signal (Data signal of the shift register of the common driver)
6	VGND	GND,Power supply for LCD
7	LOAD	1)Latch pulse of display data 2)Shift clock for common driver
8	VSS	GND
9	DF	Switch signal to convert LCD drive waveform into AC
10	/D.OFF	H : Display ON, L : Display OFF
11	CP	Clock pulse for segment shift register
12	V4	Bias voltage for non-select (Segment driver)
13	V3	Bias voltage for non-select (Segment driver)
14	D3	Input data signal
15	D2	Input data signal
16	D1	Input data signal
17	D0	Input data signal
18	N.C.	No connection

7. POWER SUPPLY



Q1 : 2SC1815

OP-AMP : LP324

$R1=R2=R4=R5=10K\Omega$, $R3=9R1=91K\Omega$ (1/13 Bias)

$C1=0.1\mu F$, $C2\sim C6=3.3\mu F$

Note 1 : These are general values.

In case to decrease LCD driving voltage with minimizing bias value, set these values with check display to avoid display's deterioration (response etc).

Note 2 : EL Driving Method

- Constant Voltage Source Driving : AC 100 Vrms 400 Hz
- Inverter IC Driving : HV823 (Supertex) or SP4428CN (Sipex)

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8.TIMING CHARACTERISTICS

8-1.INTERFACE TIMING

● VDD=3.3V±10%, Ta= 0~50 ℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CP Cycle Time	t _C	Fig.a	82	—	—	ns
CP Pulse Width	t _{SWH} ,t _{SWL}	Fig.a	28	—	—	ns
CP Rise/Fall Time	t _{CR} ,t _{CF}	Fig.a	—	—	50	ns
Data Set Up Time	t _{DSU}	Fig.a , Fig.b	20	—	—	ns
Data Hold Time	t _{DHD}	Fig.a , Fig.b	23	—	—	ns
LOAD Cycle Time	t _L	Fig.b	250	—	—	ns
LOAD "H" Pulse Width	t _{LWH}	Fig.a , Fig.b	30	—	—	ns
LOAD Rise/Fall Time	t _{LR} ,t _{LF}	Fig.b	—	—	50	ns
CP To LOAD Delay Time	t _{CL}	Fig.a	30	—	—	ns
LOAD To CP Delay Time	t _{LC}	Fig.a	65	—	—	ns
FRM TO LOAD SETUP TIME	t _{FLS}	Fig.b	30	—	—	ns
FRM TO LOAD HOLD TIME	t _{FLH}	Fig.b	50	—	—	ns

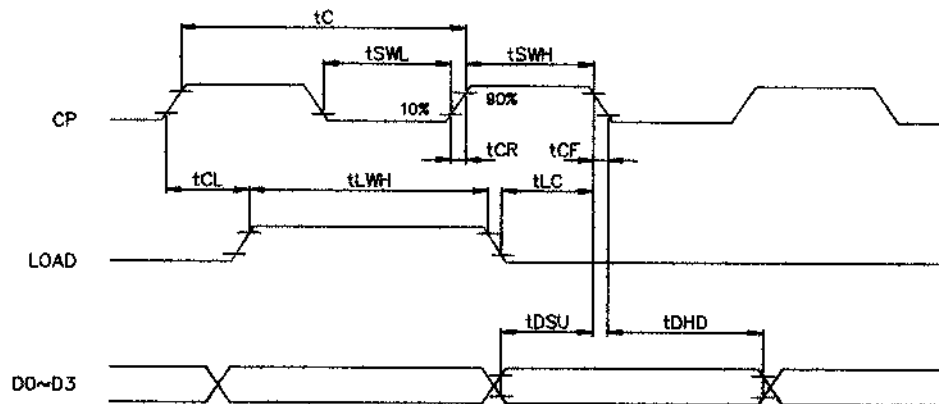


Fig . a Interface timing (SEGMENT)

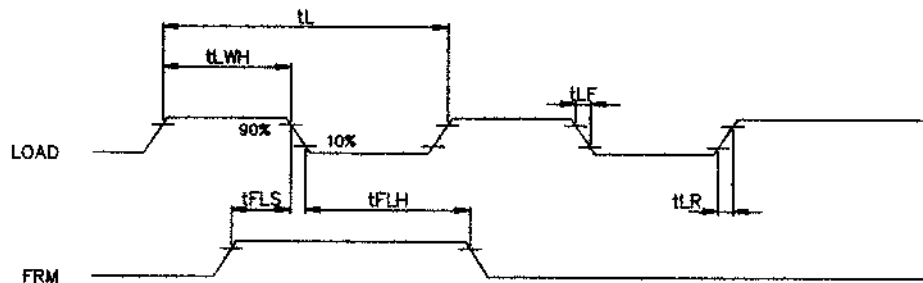


Fig . b Interface timing (COMMON)

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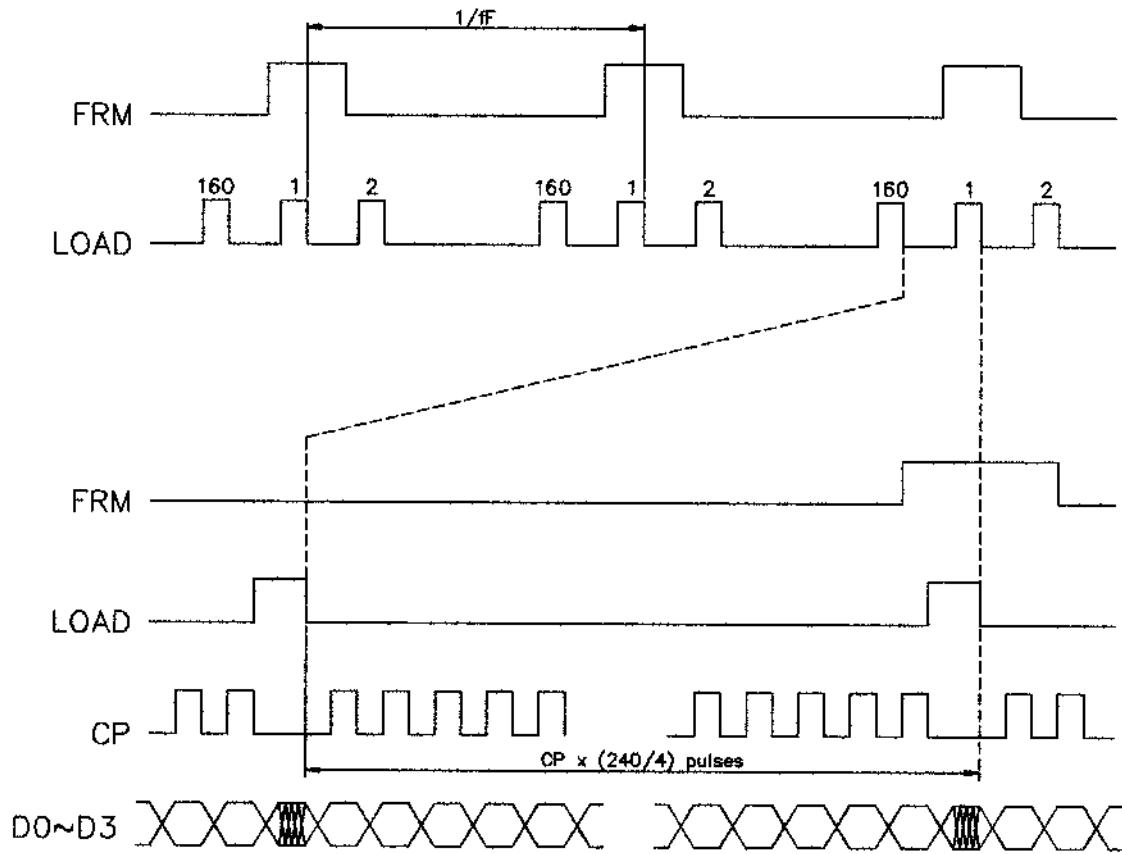
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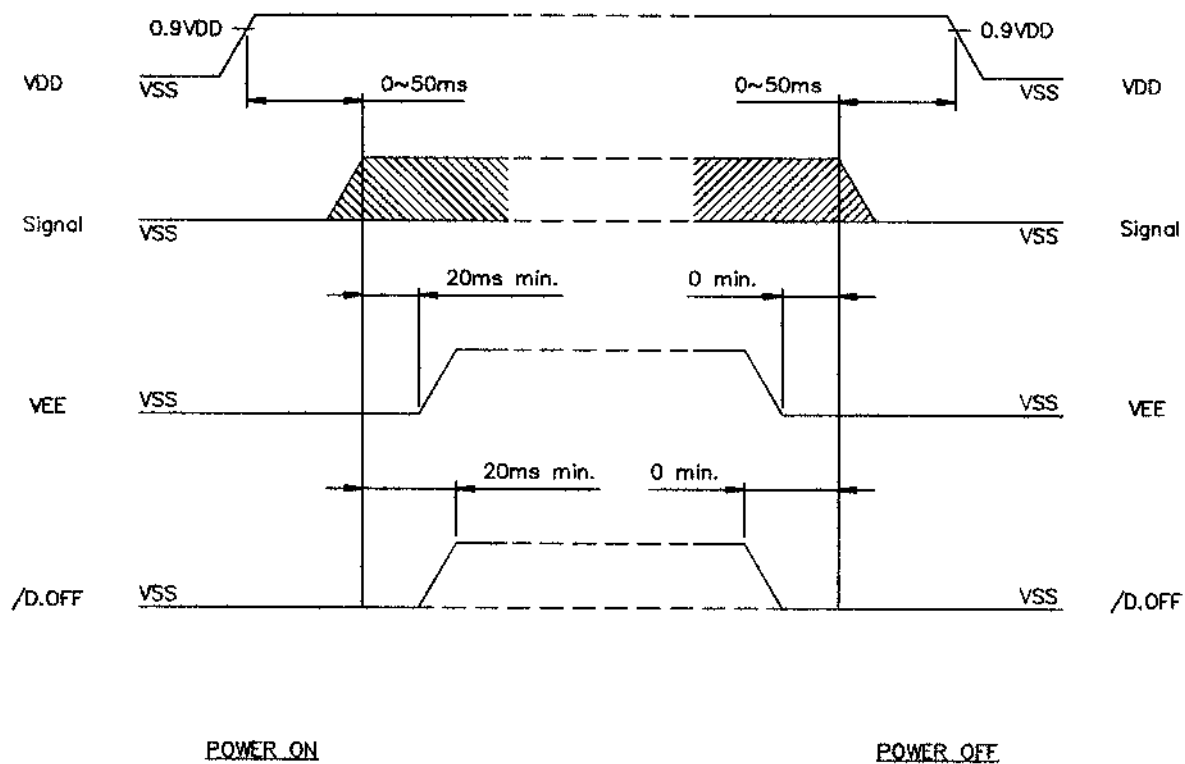
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8-2.TIMING CHART OF INPUT SIGNAL



8-3. POWER ON/OFF TIMING

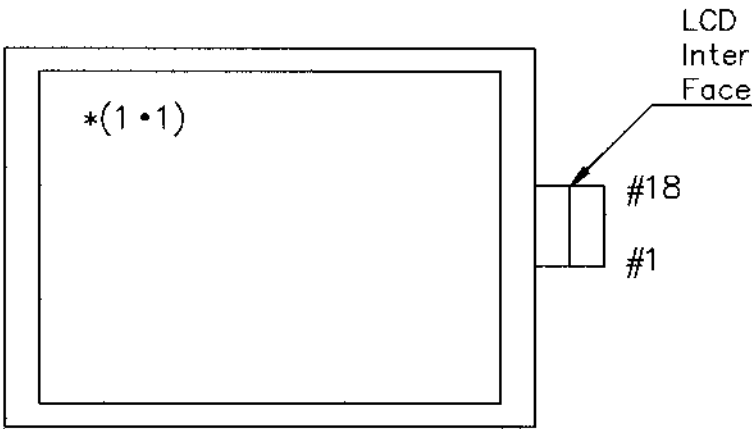


The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

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8-4.DISPLAY PATTERN

	Column1	Column2	Column3	Column4	Column240
Row 1	1 • 1	1 • 2	1 • 3	1 • 4	1 • 240
Row 2	2 • 1	2 • 2	2 • 3		
Row 3	3 • 1	3 • 3			
	D0: (1 • 4) \ (1 • 8) (160 • 240) D1: (1 • 3) \ (1 • 7) (160 • 239) D2: (1 • 2) \ (1 • 6) (160 • 238) D3: (1 • 1) \ (1 • 5) (160 • 237)				
Row 160	160 • 1				160 • 240



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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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

- EL : 2000hrs for AC 100Vrms, 400Hz, 20°C, 60%RH
(Operating life time is defined as follows : The final brightness is at 50% of original brightness.)

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