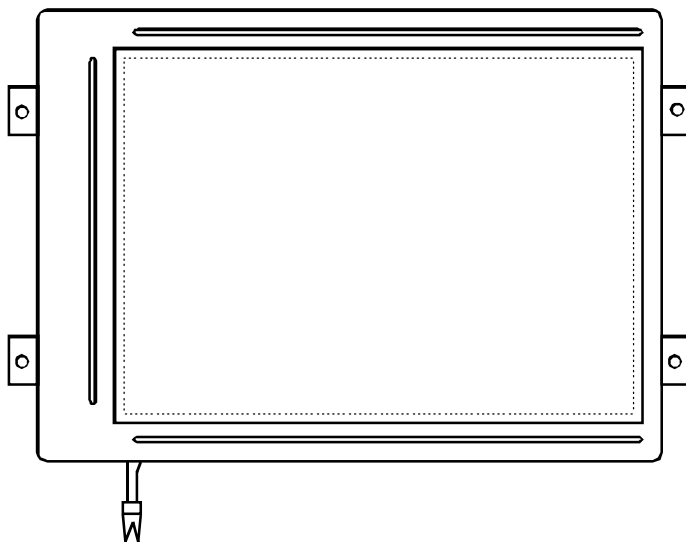


PRODUCT SPECIFICATION

HDM4832L

480 x 320 GRAPHICS
LCD DISPLAY MODULE



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MECHANICAL DATA

(1) Product No.	HDM4832L
(2) Module Size	156.0 (H)mm x 94.9 (W)mm x MAX11.5 (D)mm
(3) Dot Size	0.228 (H)mm x 0.228 (W)mm
(4) Dot Pitch	0.24 (H)mm x 0.24 (W)mm
(5) Number of Dots	480 (H) x 320 (W)Dots
(7) Duty	1/320
(8) LCD Display Mode	FSTN: Black and White(Normally White/Positive Image) (DISPLAY DATA "H" ; DOTS ON → BLACK) (DISPLAY DATA "L" ; DOTS OFF → WHITE)
	Rear Polarizer: Transflective(Normal)
(9) Viewing Direction	6 O'clock
(10) Backlight	LED (White)
(11) Weight	132g

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ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS of LCD MODULE

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 of LCD MODULE(NOT INCLUDING TOUCH PANEL AND EL BACKLIGHT)

ITEM	TEMPERATURE RANGE			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature(°C)	-20	70	-30	80
	Note 3, 4		Note 4, 6	
Humidity (Without Condensation)	Note 2		Note 5	

Note 1 When LCM connects to user's interface(main machine), make certain you are grounded well and then handling LCM carefully.

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

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ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Power Supply for Logic	VDD-VSS	Ta=25°C	2.7	3.3	5.5	V	
Input Voltage	VIL	L level	VSS	0.2VDD	-	V	
	VIH	H level	-	0.8VDD	VDD	V	
Input Leakage Current	IL	Ta=25°C	-	-	100	μA	
LCM Recommend LCD Module Driving Voltage	VEE-VSS	1/320 Duty 1/11.7 Bias	Ta=-20°C	25.2	25.7	26.2	V
			Ta=0°C	23.4	23.9	24.4	
			Ta=25°C	22.4	22.9	23.4	
			Ta=50°C	21.5	22.0	22.5	
			Ta=70°C	20.8	21.3	21.8	
Power Supply Current for LCM	IDD	Ta=25°C VDD=3.3V VEE-VSS=22.9V FLM=70Hz PATTERN : ■ □ ■ □ □ ■ □ ■ ■ □ ■ □	-	0.2	0.6	mA	
	IEE		-	13	18		
Power Supply Current for LED B/L	ILED	-	-	140	160	mArms	
LCM	Surface Luminance	L I _{LED} = 140mA	PATTERN: (Dots All On) ■ ■ ■ ■ ■ ■ ■ ■	-	-	-	cd/m ²
				PATTERN: (Dots All Off) □ □ □ □ □ □ □ □	25	-	
			36		-	51	
			36	-	51		

OPTICAL CHARACTERISTICS

(For Wide Temperature Mode LCM)

AT V_{op}

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.
H	L	-	7.5	-	10	-	11	-	8	-	6	-	96	-	±38
NOTE		NOTE 6										NOTE 5			

NOTE :

H : TRANSFLECTIVE(HIGH TRANSPARENCY)

L : NORMALLY WHITE, 6 O'CLOCK, SPECIAL LIGHTER BACKGROUND COLOR

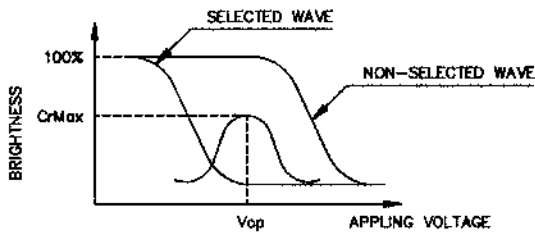
AT $\phi=0^\circ$ $\theta=0^\circ$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	-	8600	13000	ms	NOTE 2
		0℃	-	1200	1800		
		25℃	-	410	610		
		50℃	-	160	240		
		70℃	-	100	150		
Response Time (fall)	Tf	-20℃	-	3700	5500	ms	NOTE 2
		0℃	-	600	900		
		25℃	-	150	230		
		50℃	-	80	120		
		70℃	-	60	90		

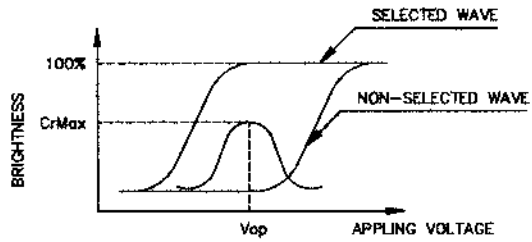
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



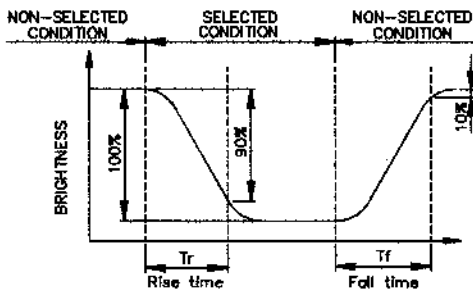
(negative type)

*Conditions

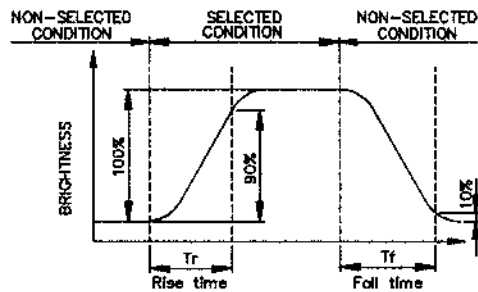
- Viewing Angle : 0
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



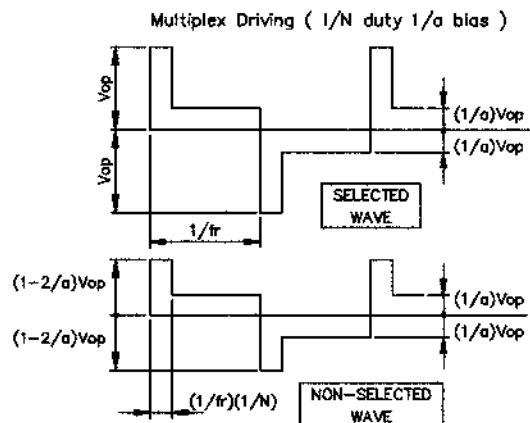
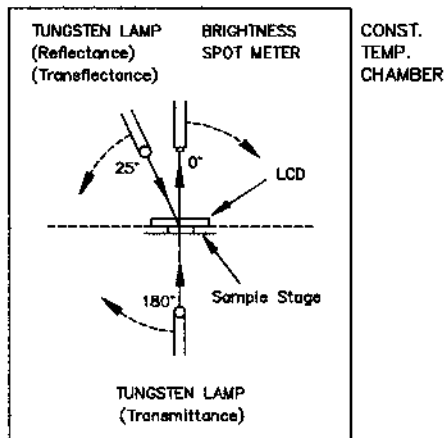
(negative type)

*Conditions

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

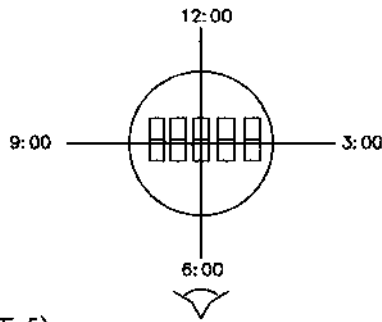
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



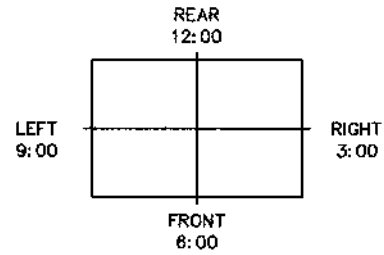
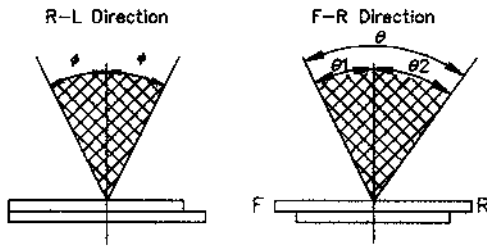
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

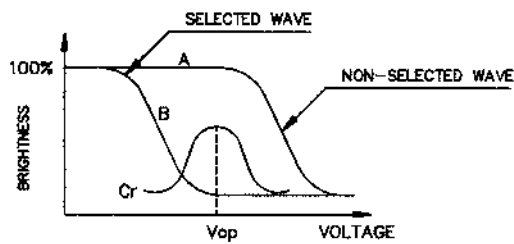
$$\theta = \theta_1 + \theta_2$$

*Conditions

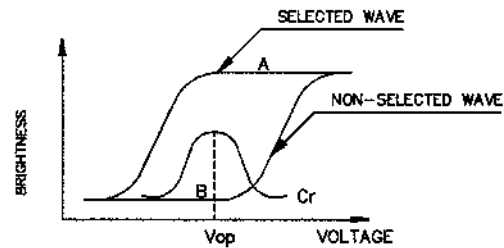
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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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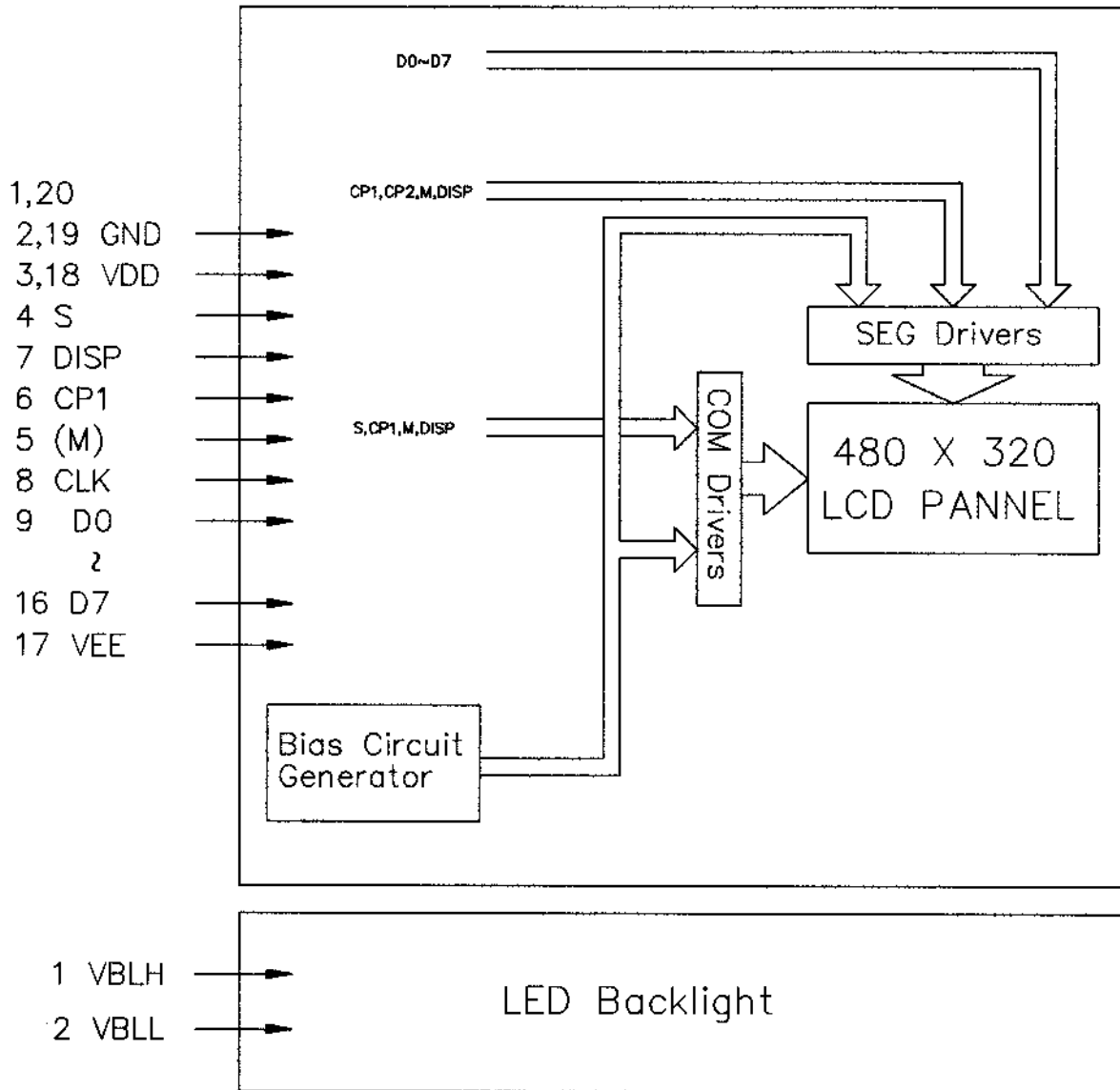
REV.:
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BLOCK DIAGRAM



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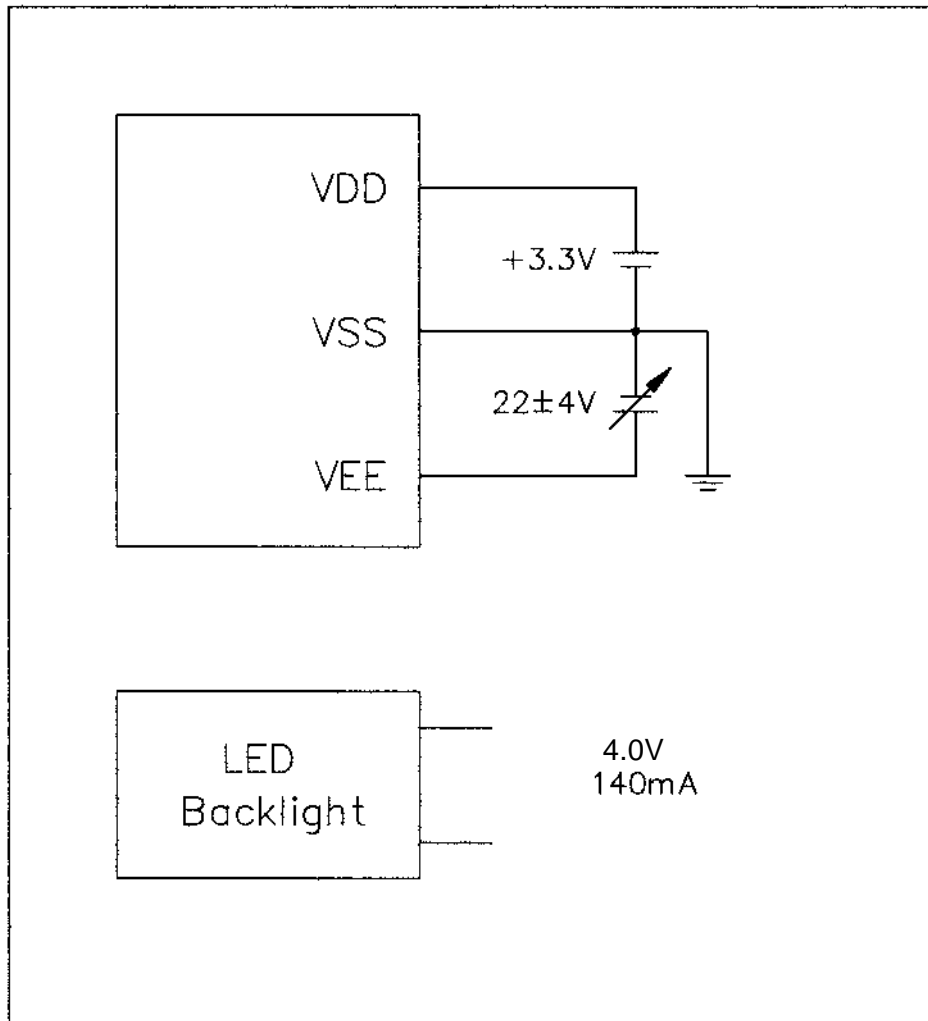
INTERNAL PIN CONNECTION

LCD

Pin No.	Symbol	Function
1	GND	Signal GND
2	GND	Signal GND
3	VDD	Logic Supply Voltage
4	S	Scan Start-up Signal, "H"=Start
5	M	M SIGNAL
6	CP1	Data Latch Clock, "H"→"L"
7	ENAB	Display data enable signal
8	CLK	Clock signal
9	D0	Display Data Signal
10	D1	
11	D2	
12	D3	
13	D4	
14	D5	
15	D6	
16	D7	
17	VEE	LCD Supply Voltage
18	VDD	Logic Supply Voltage
19	GND	Signal GND
20	GND	Signal GND

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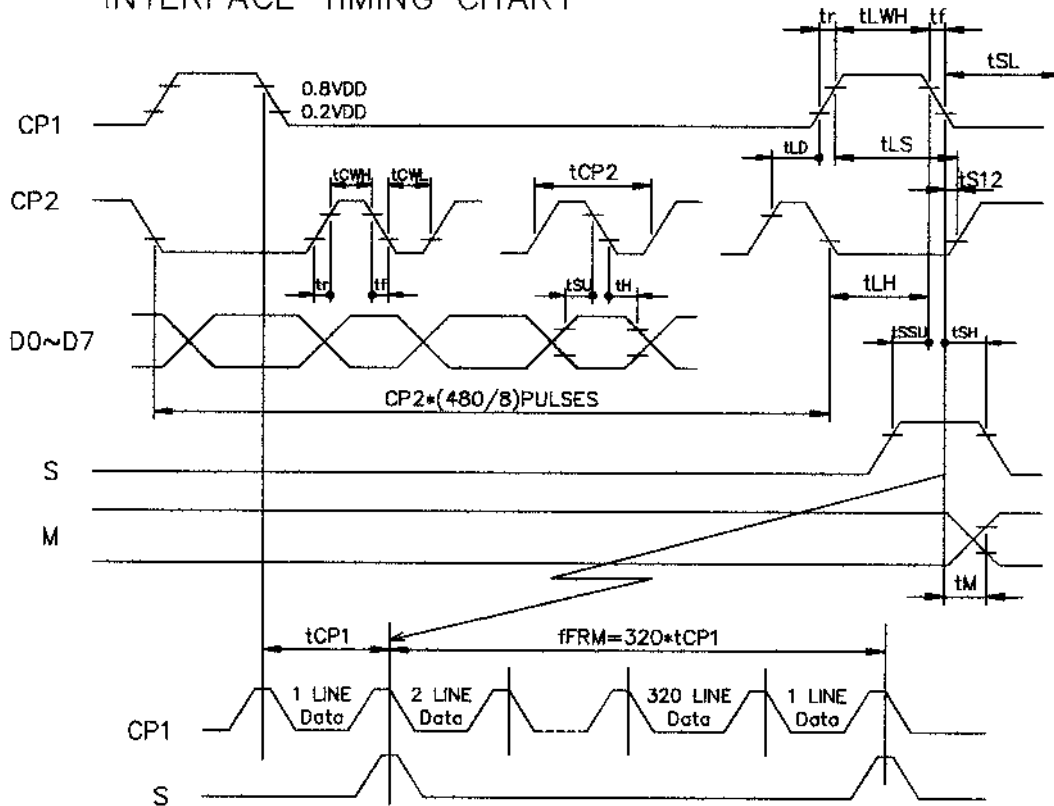
POWER SUPPLY



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TIMING CHARACTERISTICS

INTERFACE TIMING CHART



ITEM	Symbol	RATING			Unit
		MIN	NORMAL	MAX	
Frame cycle	tFRM	8.0	—	16.9	msec
CP2 clock cycle	tCP2	120	—	—	nsec
"H" level clock width	tCWH	30	—	—	nsec
"L" level clock width	tCWL	30	—	—	nsec
"H" level latch clock width	tLWH	60	—	—	nsec
Data setup time	tSU	30	—	—	nsec
Data hold time	tH	30	—	—	nsec
CP1 \uparrow clock allowance time from CP2 \uparrow	tLS	45	—	—	nsec
CP1 \downarrow clock allowance time from CP2 \downarrow	tSL	45	—	—	nsec
CP2 \uparrow clock allowance time from CP1 \uparrow	tLD	0	—	—	nsec
CP2 \downarrow clock allowance time from CP1 \downarrow	tLH	45	—	—	nsec
Input signal data rise/fall time	tr,tf	—	—	50	nsec
S signal data setup time	tSSU	100	—	—	nsec
S signal data hold time	tSH	30	—	—	nsec
M delay time	tM	—	—	70	nsec

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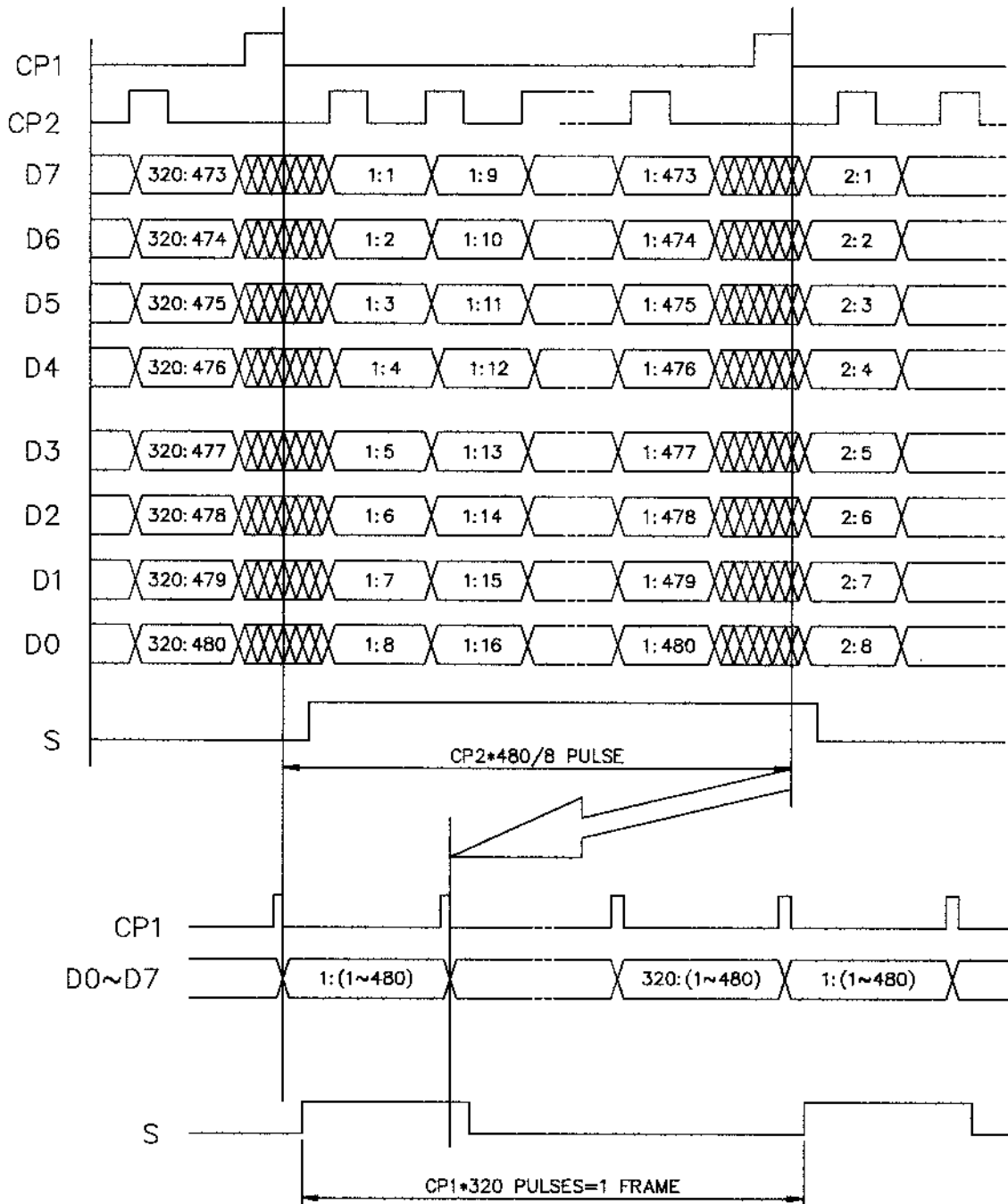
REV.:
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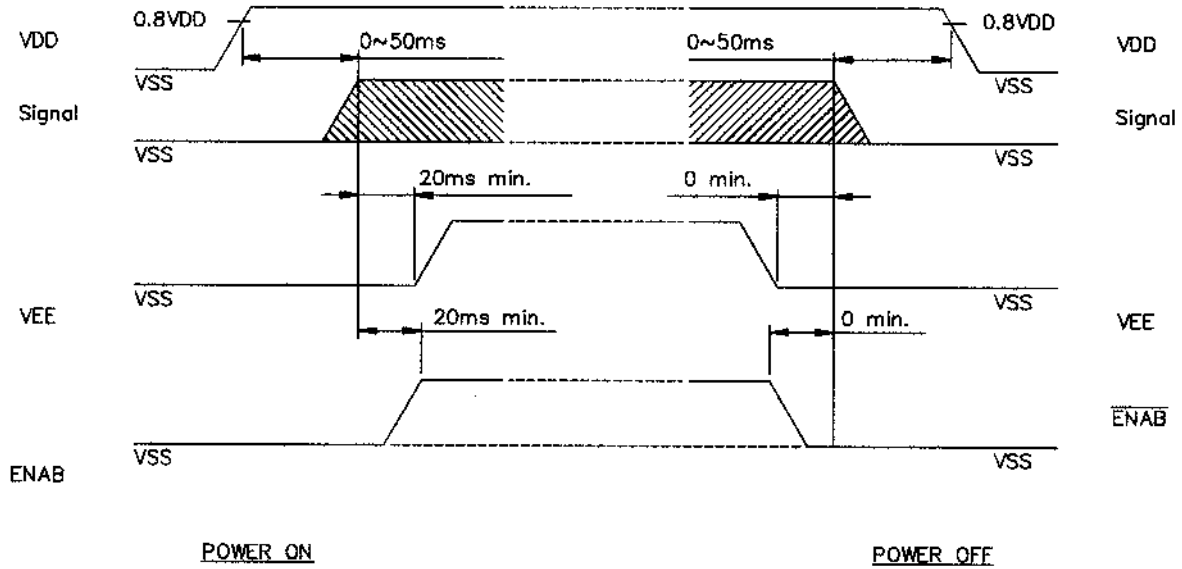
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DATA INPUT TIMING



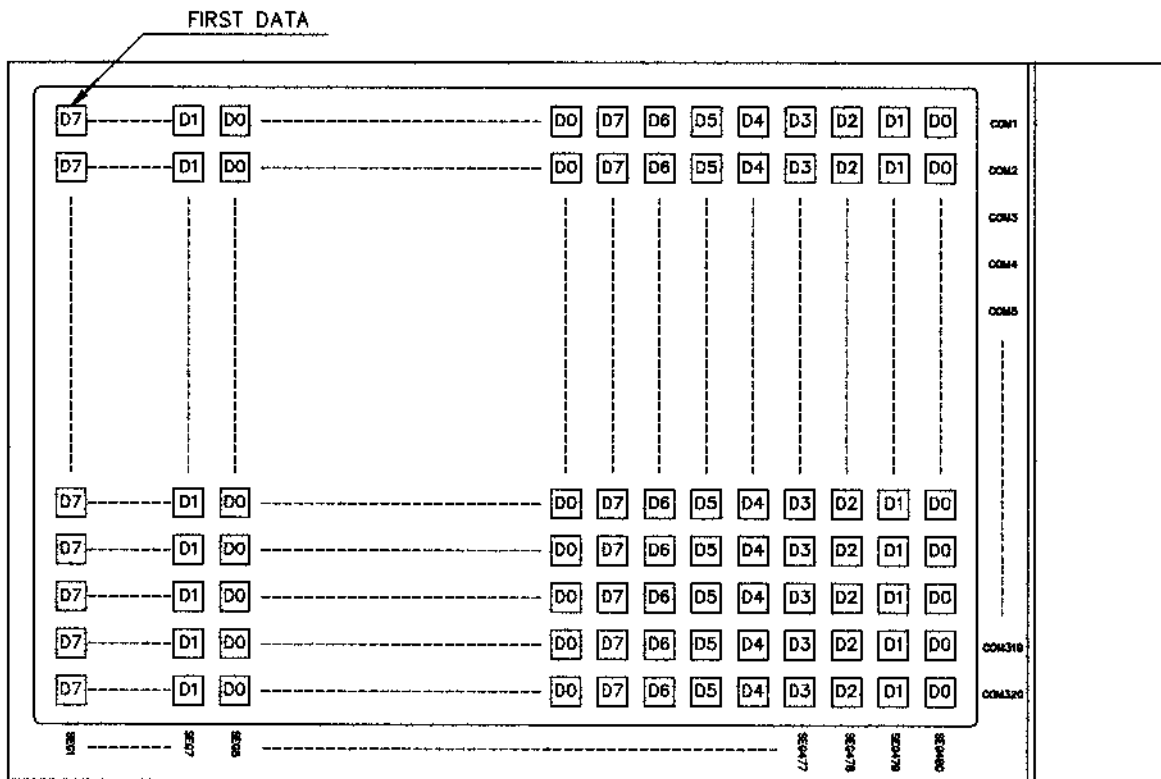
POWER ON/OFF TIMING



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

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DISPLAY PATTERN



↑
VIEWING
DIRECTION

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RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	
1	High Temp. Storage	70°C	120HR		Appearance without defect	
2	Low Temp. Storage	-25°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

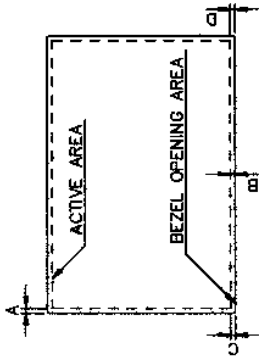
- 1.Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.

- THE OPERATING LIFE TIME OF BACK LIGHT

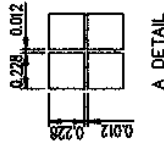
- LED : 40,000hrs for IF=10mA, 25°C
(Operating life time is defined as follows : The final brightness is at 50% of original brightness.)

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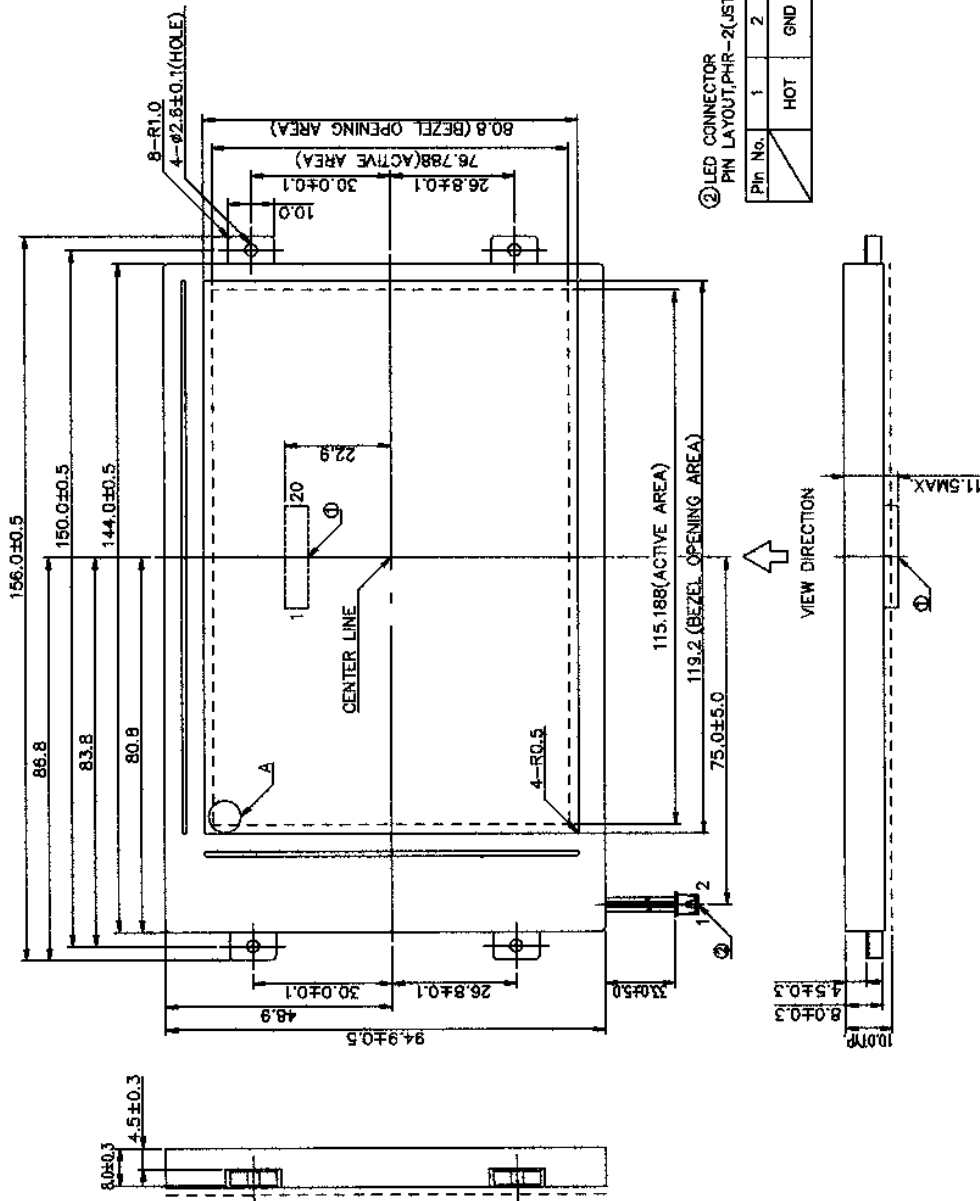
BEZEL/DISPLAY POSITION



- 1) TOLERANCE X-DIRECTION A = 2.0±0.8
- 2) TOLERANCE Y-DIRECTION B = 2.0±0.8
- 3) OBLIQUITY OF DISPLAY AREA (C-D) < 0.8



- NOTES :
- 1. RESOLUTION : 480 X 320 DOTS
 - 2. BACKLIGHT COLOR : LED(WHITE)
 - 3. TOLERANCE NO SPECIFIED : ±0.5mm
 - 4. FRAME MATERIAL: SECC
 - 5. COM IC 天冠 EK700-4N3 , SEG IC 天冠 NT7701H-TAB18



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