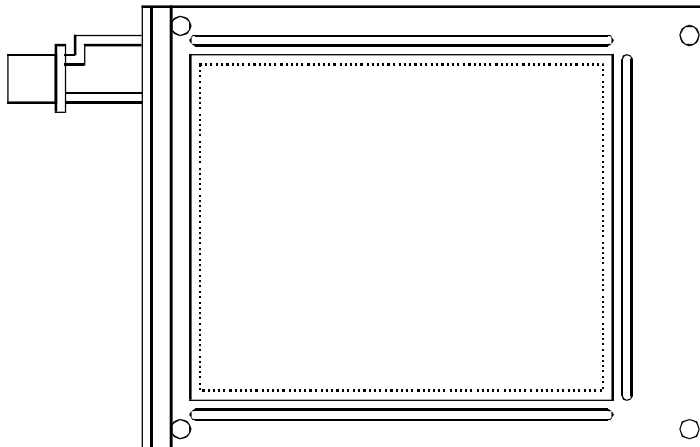




PRODUCT SPECIFICATION

HDM6448-6

640 x 480 GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JB	REV.: 1.0	HDM6448-6	SHEET 1 OF 15
				DATE: 6/15/99

MECHANICAL DATA

(1) Product No.	
(2) Module Size	167.7 (W)mm x 122.8 (H)mm x 5.3 typ.(D)mm
(3) Lcd Viewing Area	125.6 (W)mm x 95.2 (H)mm
(4) Dot Size	0.17 (W)mm x 0.17 (H)mm
(5) Dot Pitch	0.19 (W)mm x 0.19 (H)mm
(6) Number of Dots	640 (W) x 480 (H)Dots
(8) Duty	1/240
(9) LCD Display Mode	FSTN: Black and White(Normally White/Positive Image) Rear Polarizer: Transflective(High Transparency)
(10) Viewing Direction	6 O'clock
(11) Backlight	CCFT
(12) Controller	Excluded
(13) DC/DC Converter	Excluded
(14) Weight	150 g(approx.)

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JB	REV.: 1.0	HDM6448-6	SHEET 2 OF 15
				DATE: 6/15/99

ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0 V Standard

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Supply Voltage (Logic)	VDD-VSS	0	6.0	V	Ta = 25°C
Supply Voltage (LCD Drive)	VEE-VSS	0	30.0	V	Ta = 25°C
Input Voltage	VIN	0	VDD	V	Ta = 25°C
Static Electricity	—	—	—	—	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATION		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-30	80
Humidity (Without Condensation)	Note 2,4		Note 3,4	
Vibration(Note 5)	—		49m/s ² (5G)	

Note 1 LCM should be grounded during handling LCM.

Note 2 Ta ≤ 70°C : 75%RH max

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

Note 3 Ta at -30°C will be < 48 hrs, at 80°C will be < 120 hrs

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

Note 5

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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JB	REV.: 1.0	HDM6448-6	SHEET 3 OF 15
				DATE: 6/15/99

ELECTRICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic		VDD-VSS	Ta = 25°C		3.0	3.3	5.5	V
Input Voltage		VIL	L level		0	—	0.2VDD	V
		VIH	H level		0.8VDD	—	VDD	V
Recommand LCD Module Driving Voltage		VEE-VSS	VDD=3.3V Bias=1/11.3	Ta=-20°C	21.9	22.3	22.7	V
				Ta=0°C	21.0	21.4	21.9	
				Ta=25°C	20.1	20.5	20.9	
				Ta=50°C	18.6	19.0	19.4	
				Ta=65°C	17.3	17.7	18.1	
Power Supply Current for LCM		IDD	VDD=3.3V VDD-VEE=20.5V FLM=70Hz Pattern :		—	0.7	3.0	mA
		IEE			—	6.7	15.0	
CCFT	Open Voltage	VOPEN	Lamp Current = 5 mArms Frequency = 55 KHz		—	440	—	Vrms
	Lamp Voltage	VL			—	330	—	Vrms

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:
JB

REV.:
1.0

HDM6448-6

SHEET 4 OF 15

DATE:
6/15/99

OPTICAL CHARACTERISTICS

AT Vop

ITEM MODE		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.
H	J	—	6.5	—	6.0	—	5.0	—	37	—	46
NOTE		NOTE 6						NOTE 5			

NOTE :

H : TRANSFLECTIVE(HIGH TRANSPARENCY)

J: NORMALLY WHITE

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	—	1700	2600	ms	Fig.2
		0℃	—	370	560		
		25℃	—	200	300		
		50℃	—	90	150		
		65℃	—	80	120		
Response Time (fall)	Tr	-20℃	—	900	1400	ms	Fig.2
		0℃	—	350	530		
		25℃	—	150	230		
		50℃	—	80	120		
		65℃	—	70	110		

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10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:

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REV.:

1.0

HDM6448-6

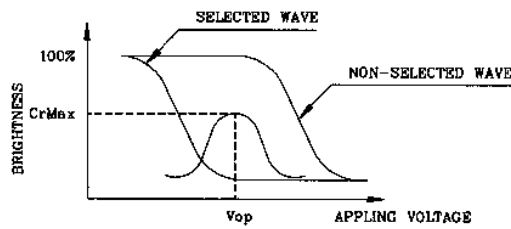
SHEET 5 OF 15

DATE:

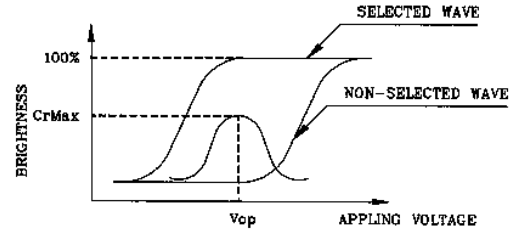
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(Fig.1)

Definition of Operation Voltage(V_{op})



(positive type)



(negative type)

*Conditions

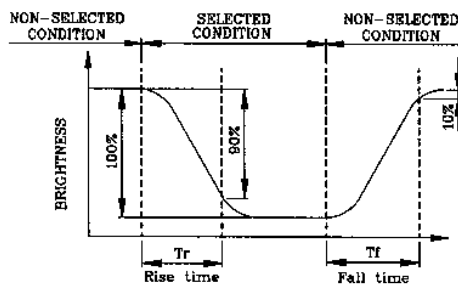
Viewing Angle : 0

Frame Frequency : 70Hz

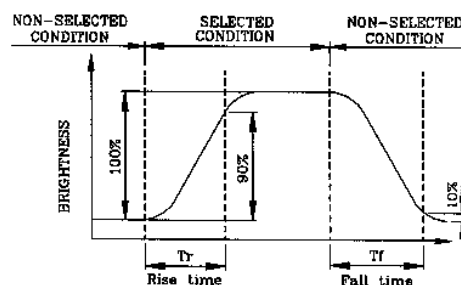
Applying Waveform : 1/N duty 1/a bias

(Fig.2)

Definition of Response Time(T_r , T_f)



(positive type)



(negative type)

*Conditions

Operating Voltage : V_{op}

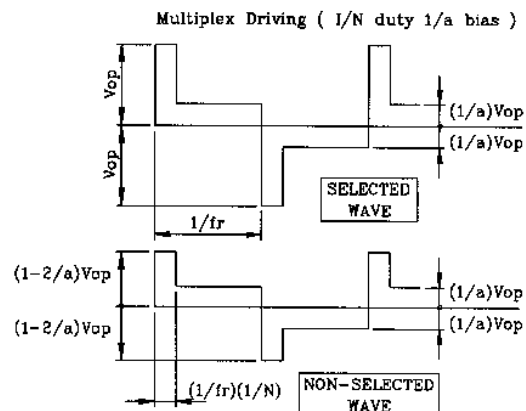
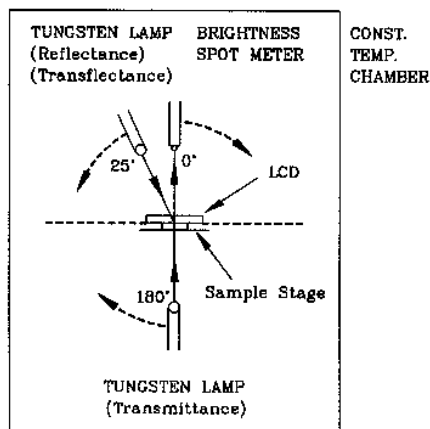
Viewing Angle (θ , ϕ) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

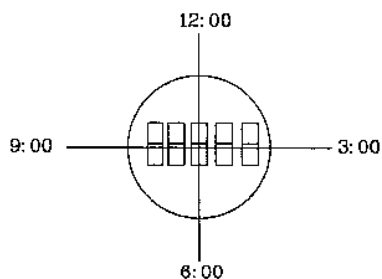
(Fig.3)

Description of Measuring Equipment and Driving Waveforms



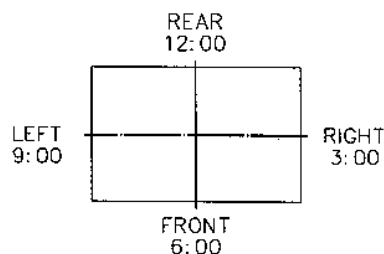
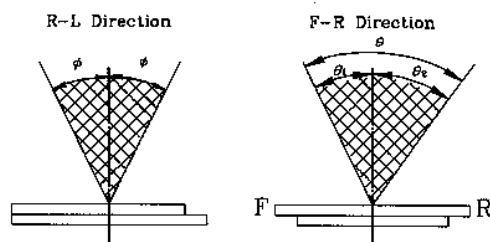
(Fig.4)

Definition of Viewing Direction



(Fig.5)

Definition of Viewing Angle



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

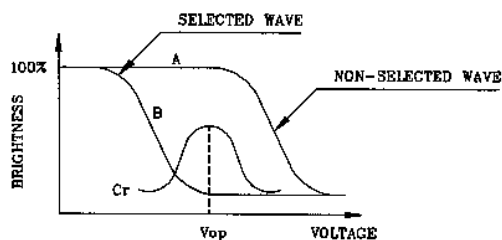
$$\theta = \theta_1 + \theta_2$$

*Conditions

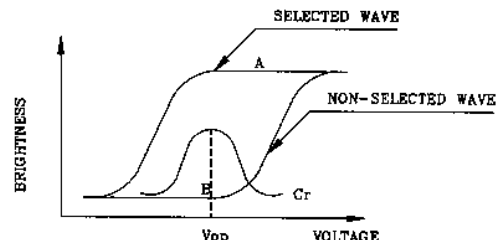
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(Fig.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

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:

JB

REV.:

1.0

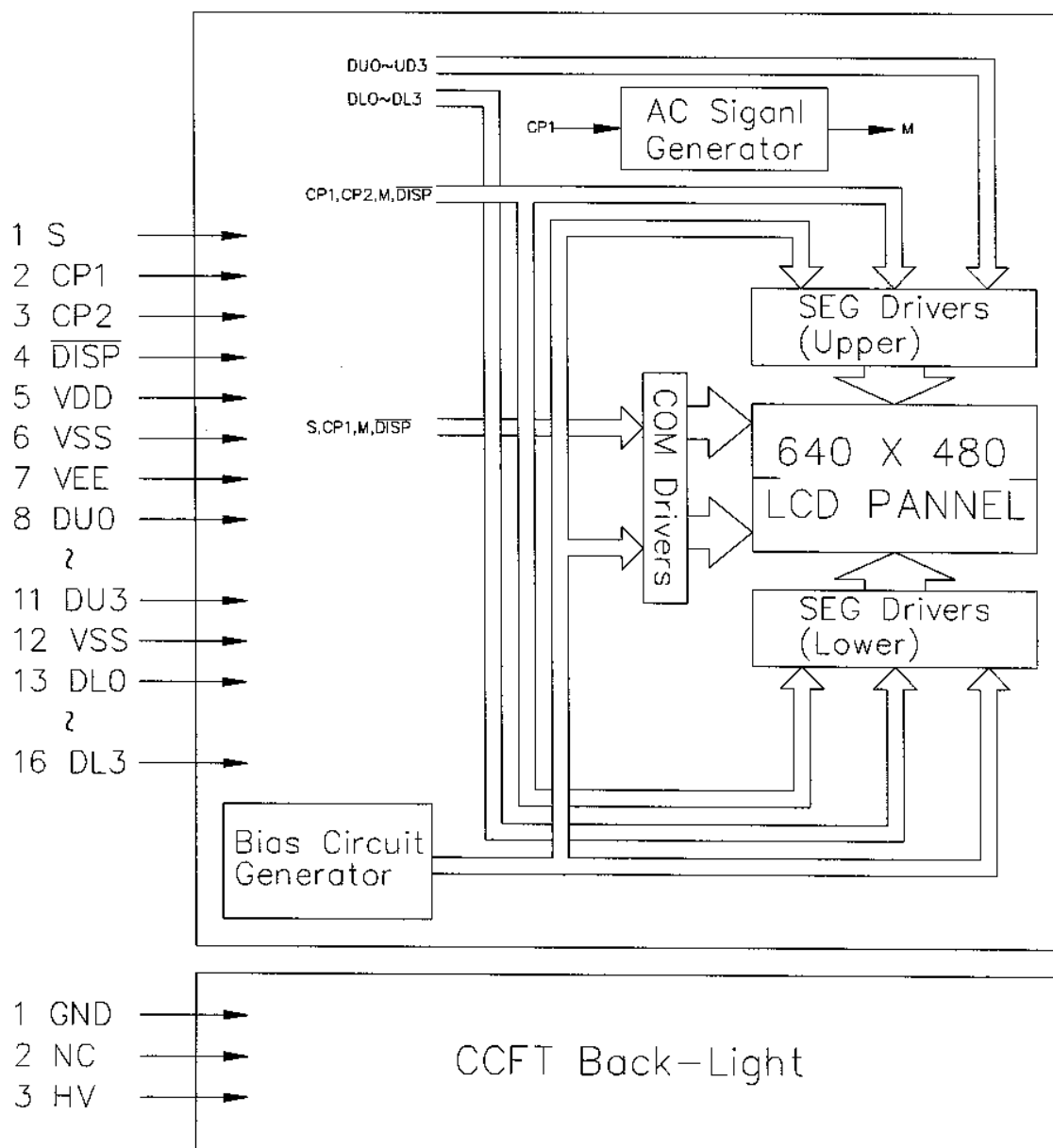
HDM6448-6

SHEET 7 OF 15

DATE:

6/15/99

BLOCK DIAGRAM



* AC Signal Setting

J1	J2	J3	J4	J5	J6	J7	J8
L	H	L	L	H	L	L	L

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:
JB

REV.:
1.0

HDM6448-6

SHEET 8 OF 15

DATE:
6/15/99

INTERNAL PIN CONNECTION

LCD

Pin No.	Symbol	Level	Function
1	S	H/L	SCAN START-UP SIGNAL
2	CP1	H→L	INPUT DATA LATCH SIGNAL
3	CP2	H→L	DATA INPUT CLOCK SIGNAL
4	DISP	H/L	DISPLAY OFF ("H"=ON,"L"=OFF)
5	VDD	—	POWER SUPPLY FOR LOGIC (+)
6	VSS	—	SIGNAL GROUND (GND)
7	VEE	—	POWER SUPPLY FOR LCD (+)
8	DU0	H/L	DISPLAY DATA (UPPER HALF)
9	DU1		
10	DU2		
11	DU3		
12	VSS	—	SIGNAL GROUND (GND)
13	DL0	H/L	DISPLAY DATA (LOWER HALF)
14	DL1		
15	DL2		
16	DL3		

CCFT

Pin No.	Symbol	Level	Function
1	GND	—	GROUND LINE (INVERTER)
2	NC	—	NO CONNECTION
3	HV	—	HIGH VOLTAGE LINE (INVERTER)

LCD

Used connector : FH12A-16S-0.5SH (HIROSE)

Mating cable : FFC or FPC (Pitch 0.5mm,16 pins,Conact Partion
Thickness 0.3mm)

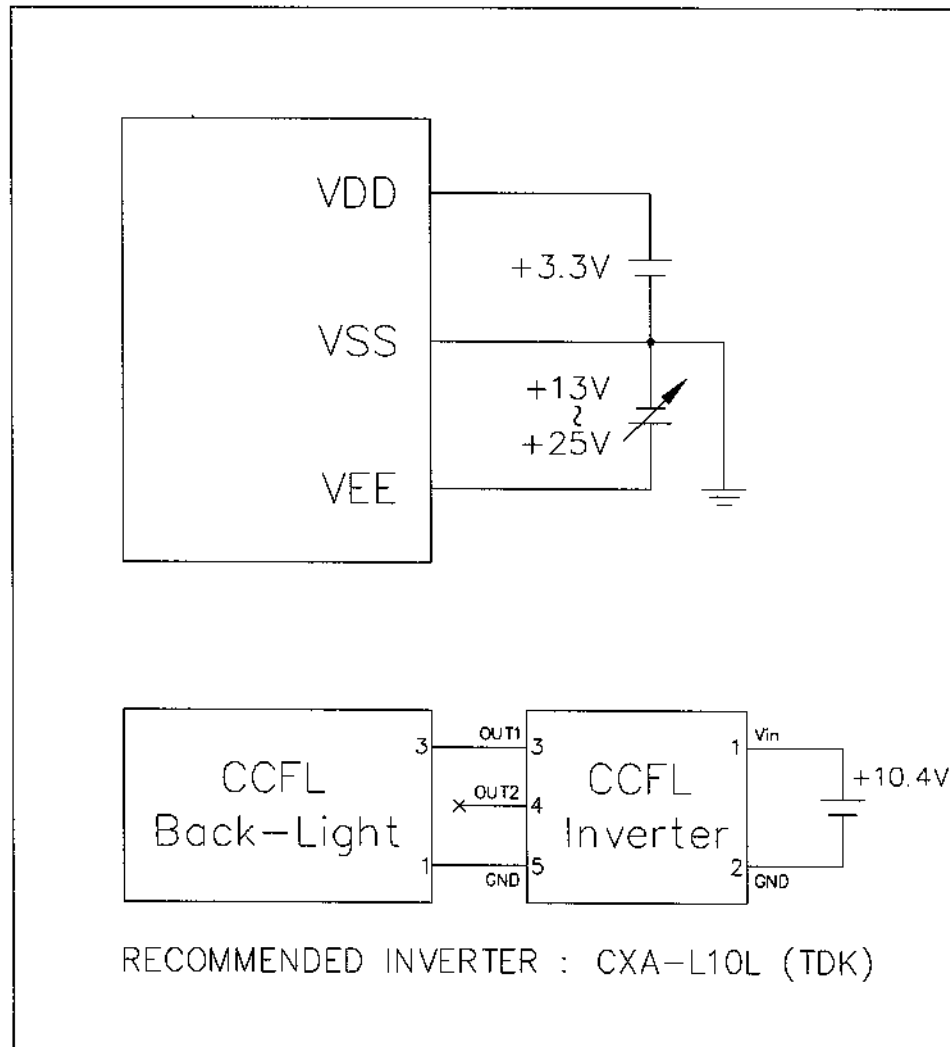
CCFT

Used connector : BHR-03VS-1 (JST)

Mating connector : SM02(80)B-BHS-1

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JB	REV.: 1.0	HDM6448-6	SHEET 9 OF 15
				DATE: 6/15/99

POWER SUPPLY



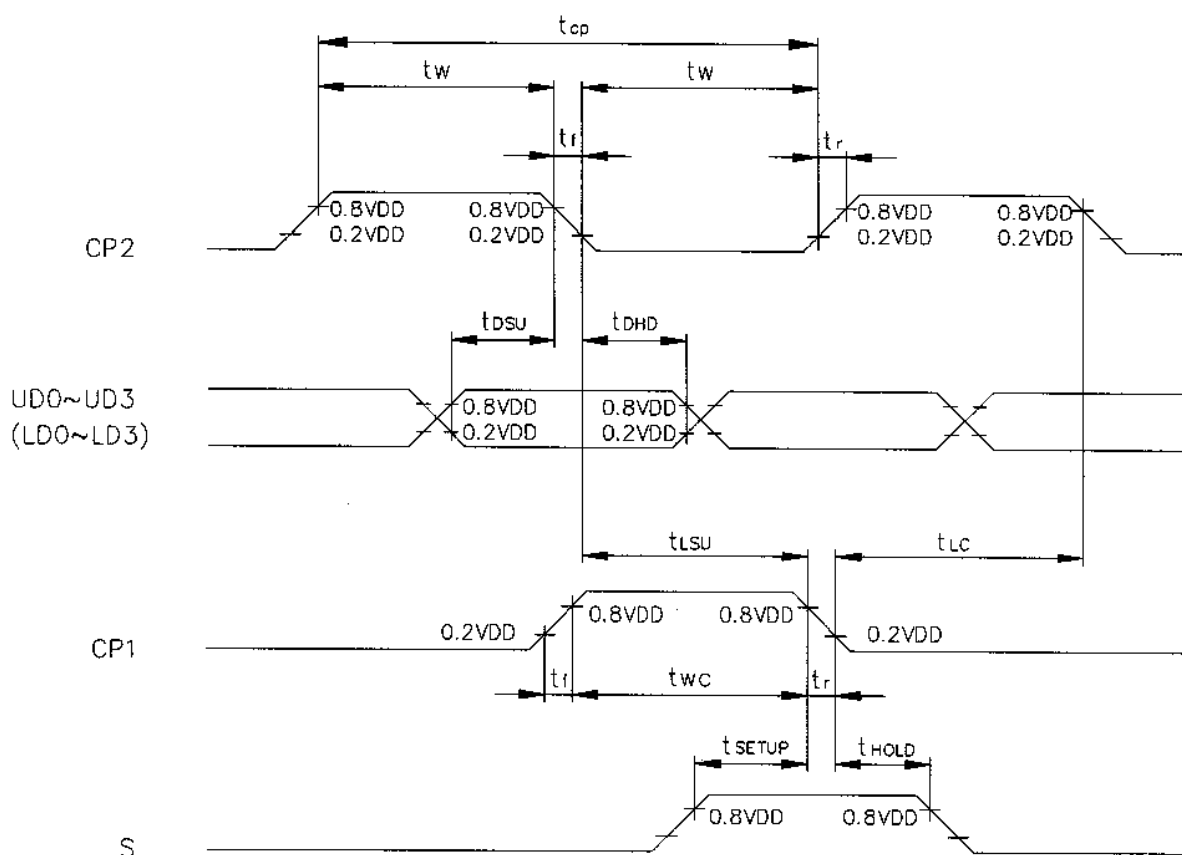
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				DATE: 6/15/99

TIMING CHARACTERISTICS

8-1.INTERFACE TIMING

@VDD=2.5~5.5V

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
Shift Clock Period	t_{cp}	125	—	—	ns
"CP2" PULSE WIDTH	t_w	51	—	—	ns
CLOCK RISE, FALL TIME	t_r, t_f	—	—	50	ns
DATA SETUP TIME	t_{dsu}	30	—	—	ns
DATA HOLD TIME	t_{dhd}	50	—	—	ns
"CP2" → "CP1" FALL TIME	t_{lsu}	51	—	—	ns
"CP1" → "CP2" FALL TIME	t_{lc}	51	—	—	ns
"S" SETUP TIME	t_{setup}	100	—	—	ns
"S" HOLD TIME	t_{hold}	100	—	—	ns
"CP1" PULSE WIDTH	t_{wc}	65	—	—	ns



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10080 BUBB RD.
CUPERTINO, CA 95014

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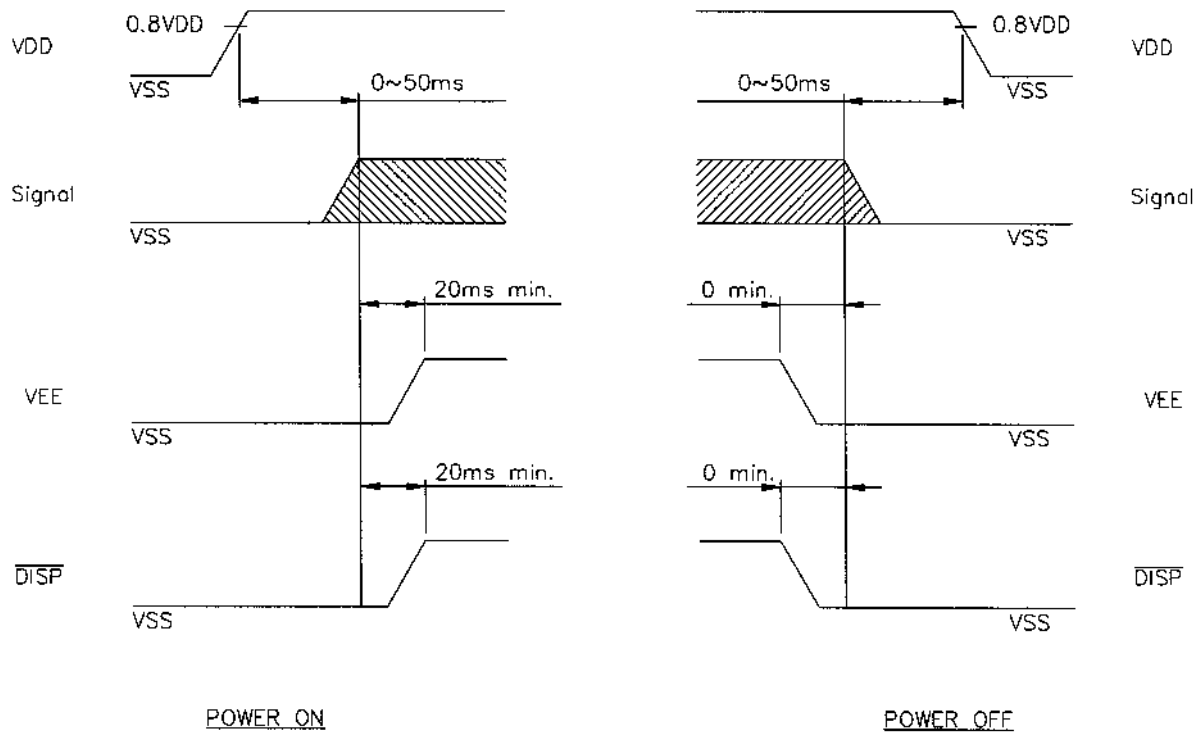
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HDM6448-6

SHEET 11 OF 15

DATE:
6/15/99

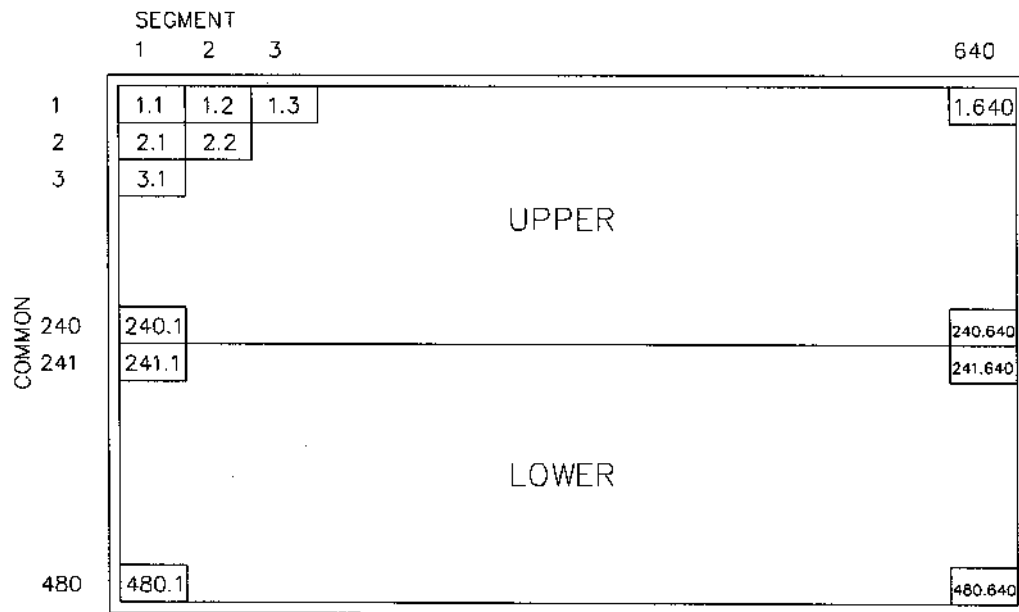
POWER ON/OFF TIMING



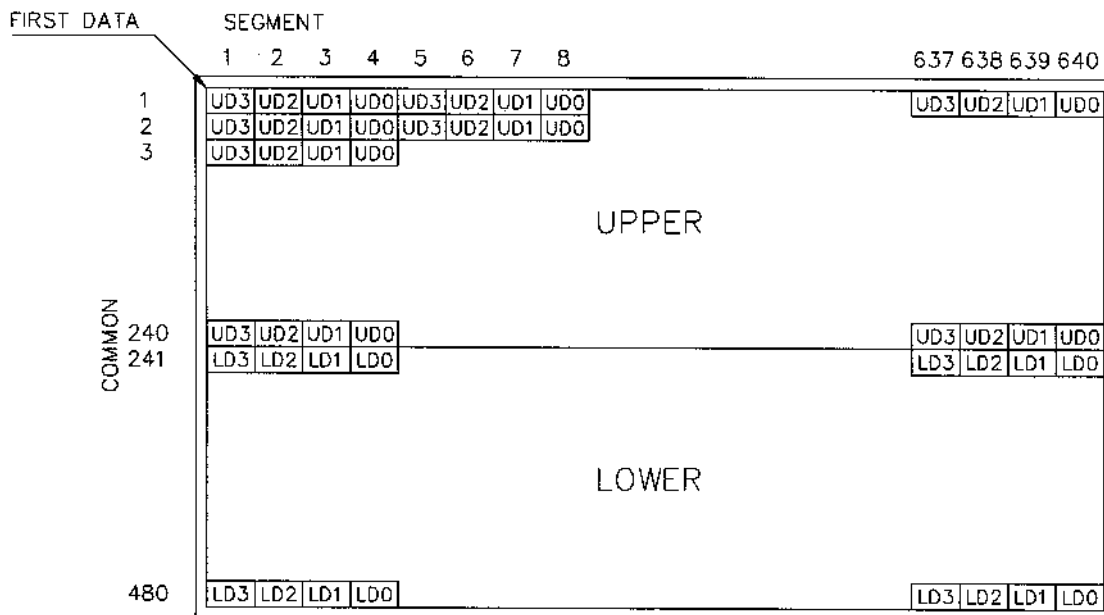
The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JB	REV.: 1.0	HDM6448-6	SHEET 12 OF 15
				DATE: 6/15/99

DISPLAY PATTERN



1.1 MEANS 1ST COMMON 1ST SEGMENT DOT



HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:
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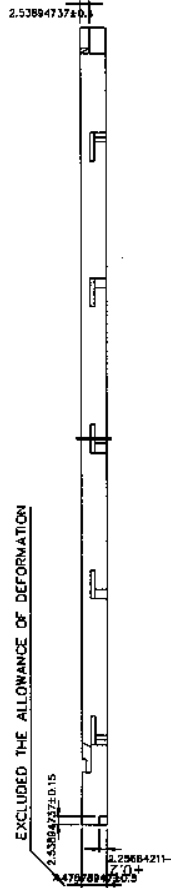
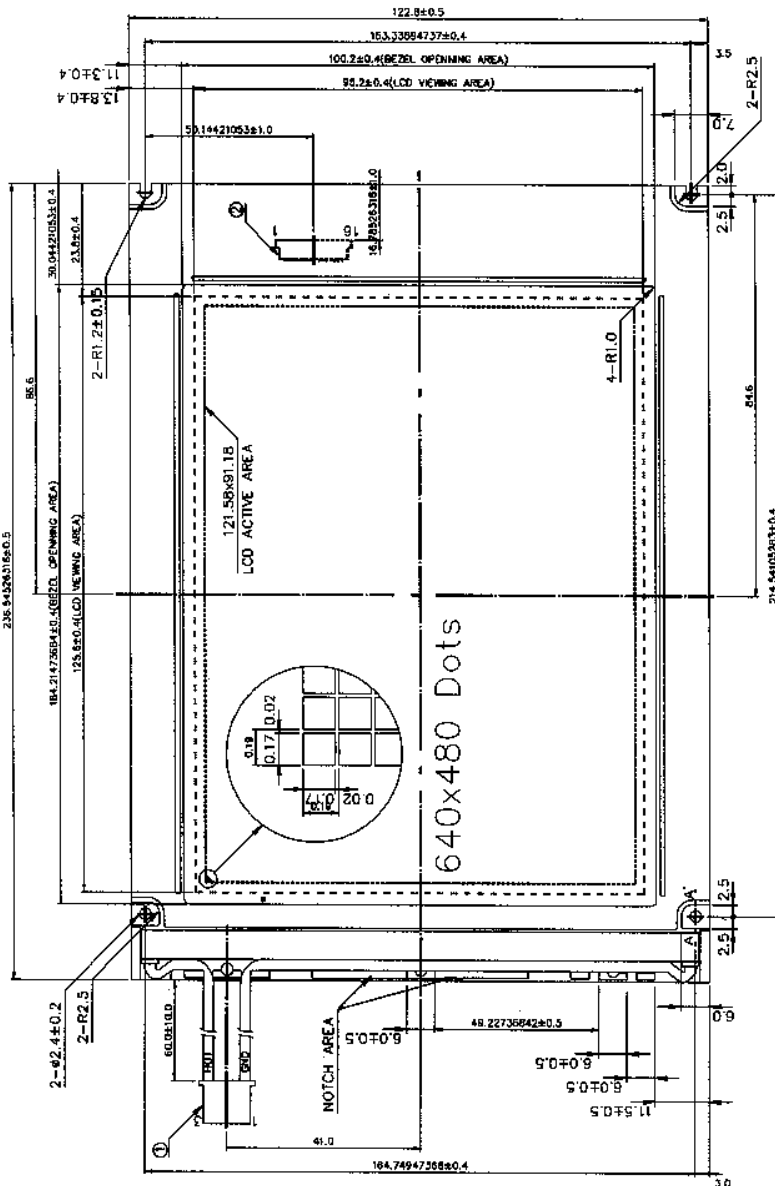
HDM6448-6

SHEET 13 OF 15
DATE: 6/15/99

RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
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 → 60°C, 30min → 25°C, 5min (1 cycle)			Appearance without defect	5 cycles

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JB	REV.: 1.0	HDM6448-6	SHEET 14 OF 15
				DATE: 6/15/99



NOTES :

1. RESOLUTION : 640 X 480 DOTS
2. TOLERANCE NO SPECIFIED: $\pm 0.5\text{mm}$
3. ① CCFT CONNECTOR : BHR-03VS-1 (JST) OR COMPATIBLE
② INTERFACE CONNECTOR : FH12A-16S-0.5SH (HIROSE) OR COMPATIBLE
4. 顯示區域為 LCD VIEWING AREA (125.6x95.2) 內, LCD VIEWING AREA 與 BEZEL OPENING AREA 之間為框邊區域, 當模組顯示時, LCD VIEWING AREA (125.6x95.2) 外之框邊區域輸出將會到為可接受之顯示品質

HANTRONIX, INC.
10080 BUBB RD.
CUPERTINO, CA 95014

Q.A.:
JB

REV.:
1.0

HDM6448-6

SHEET 15 OF 15

DATE:
6/15/99