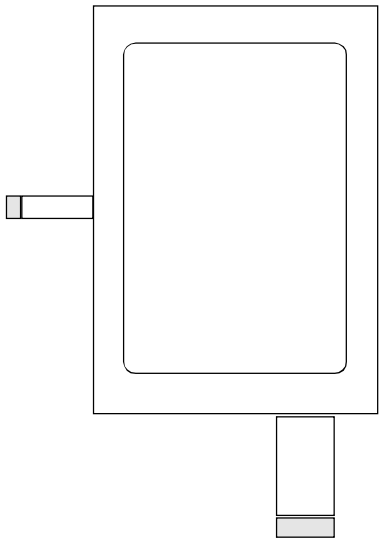
HANTRONIX

PRODUCT SPECIFICATION

HDM2432TSL-T

240x320 GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	**Q.A.:** JK	**REV.:** 1.1	HDM2432TSL-T	SHEET 1 OF 16 **DATE:** 4/15/02

1. MECHANICAL DATA

(1) Product No.		HDM2432TSL-T
(2) Module Size		75.1 (W)mm X 93.8 (H)mm X 9.5 (D)mm
(3) Dot Size		0.225 (W)mm X 0.225 (H)mm
(4) Dot Pitch		0.24 (W)mm X 0.24 (H)mm
(5) Number of Dots		240 (W) X 320 (H) Dots
(6) Duty		1/320
(7) LCD Display Mode	FSTN:	Normally White
	Rear Polarizer:	Transflective
(8) Viewing Direction		9 O'clock
(9) Backlight		LED B/L
(10) Weight		73.4g(Approx.)
(11) Controller		Excluded
(12) DC/DC Converter		Excluded

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 LC Drive	VLCD−VSS	−0.3	30.0	V	
Input Voltage	VI	−0.3	VDD	V	
Static Electricity	−	−	−	−	Note 1

Note 1 LCM should be grounded during handling LCM.

(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	

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.

3. ELECTRICAL CHARACTERISTICS

(VDD= 3.3V ± 10%)

ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Input Voltage		VIH	H level		0.8VDD	–	VDD	V
		VIO	L level		0	–	0.2VDD	V
Recommended LC Driving Voltage		VLCD–VSS (Vop)	1/320 Duty 1/16.3 Bias	–20°C	28.6	28.9	29.2	V
				0°C	27.2	27.5	27.8	
				25°C	26.4	26.7	27.0	
				50°C	25.4	25.7	26.0	
				70°C	24.8	25.1	25.4	
Power Supply Current		IDD	VDD= 3.3V VSS= 0V VLCD–VSS=26.7V FLM=70Hz PATTERN : ■□■□■□ □■□■□■		–	0.1	0.2	mA
		IEE			–	2.9	4.4	
Power Supply Current For LED		ILED	VBL=5V RBL=33Ω		–	55	82	mA
LCM	Surface Luminance	L	VDD=3.3V VLCD–VSS =26.7V ILED=55mA	PATTERN: (Dots All On)	–	1.3	–	cd/m²
				PATTERN: (Dots All Off)	–	4.6	–	

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4. OPTICAL CHARACTERISTICS

AT V_{OP}

ITEM / MODE		Cr(Contrast Ratio)										θ(Viewing Angle)		φ(Viewing Angle)	
		−20℃		0℃		25℃		50℃		75℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
S	P	–	6.0	–	7.5	–	7.0	–	6.0	–	4.5	–	59	–	(L) 26 (R) 40
Note		NOTE 6										NOTE 5			

NOTE :

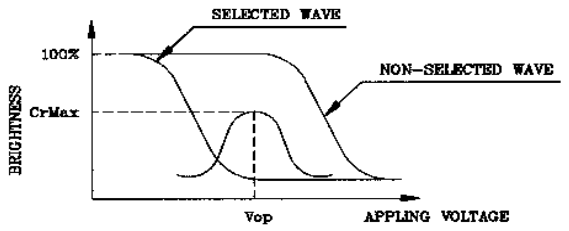
S: TRANSFLCTIVE(NORMAL)
P: NORMALLY WHITE,9 O'clock

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

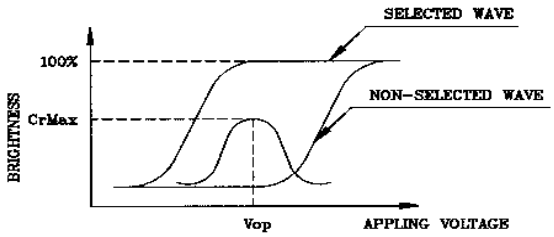
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	−20℃	4000	5000	6000	ms	NOTE 2
		0℃	900	1100	1300		
		25℃	240	300	360		
		50℃	120	150	180		
		70℃	100	130	160		
Response Time (fall)	Tf	−20℃	1600	2000	2400	ms	NOTE 2
		0℃	300	370	440		
		25℃	100	130	160		
		50℃	50	65	80		
		70℃	40	50	60		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



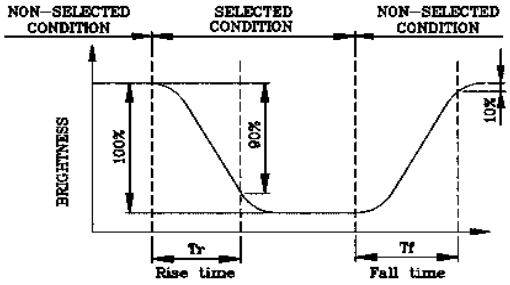
(negative type)

*Conditions

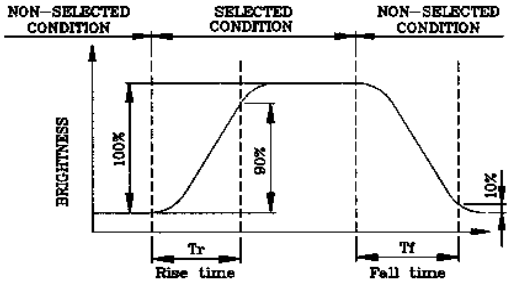
Viewing Angle : 0
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



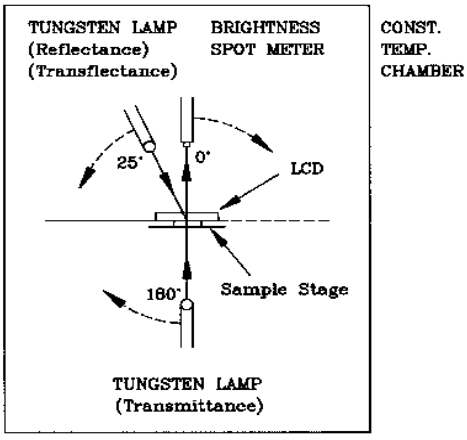
(negative type)

*Conditions

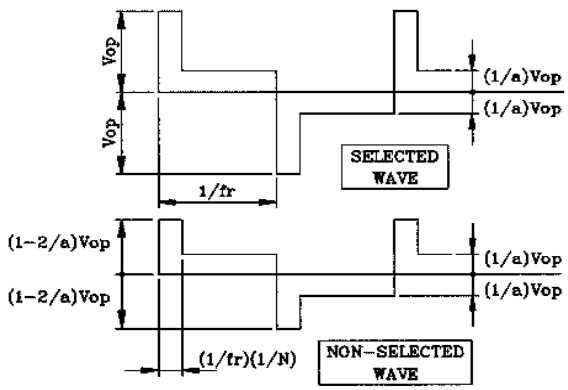
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



Multiplex Driving (1/N duty 1/a bias)



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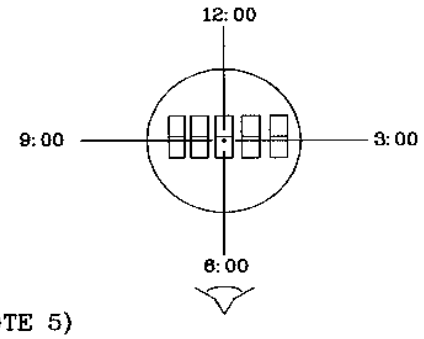
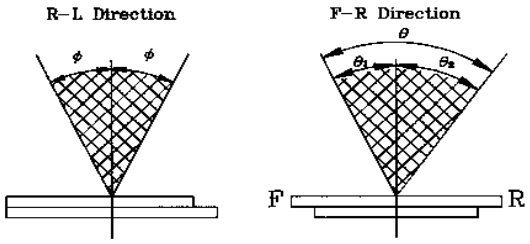
(NOTE 4)

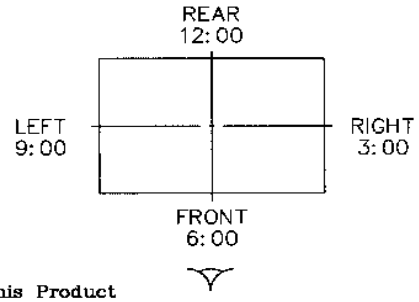
Definition of Viewing Direction



(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 : Vop

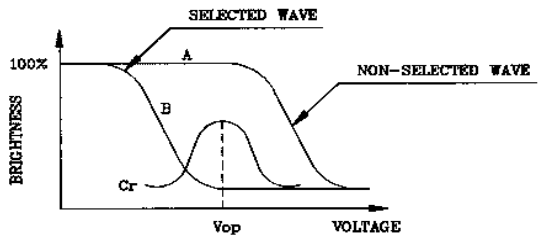
Frame Frequency : 70Hz

Appling Waveform : 1/N duty 1/a bias

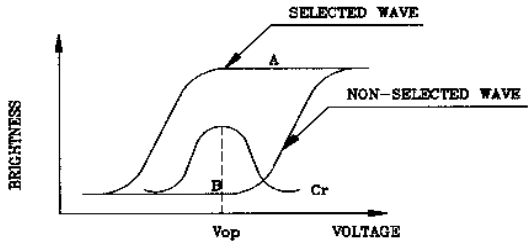
Contrast Ratio : larger than 2

(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

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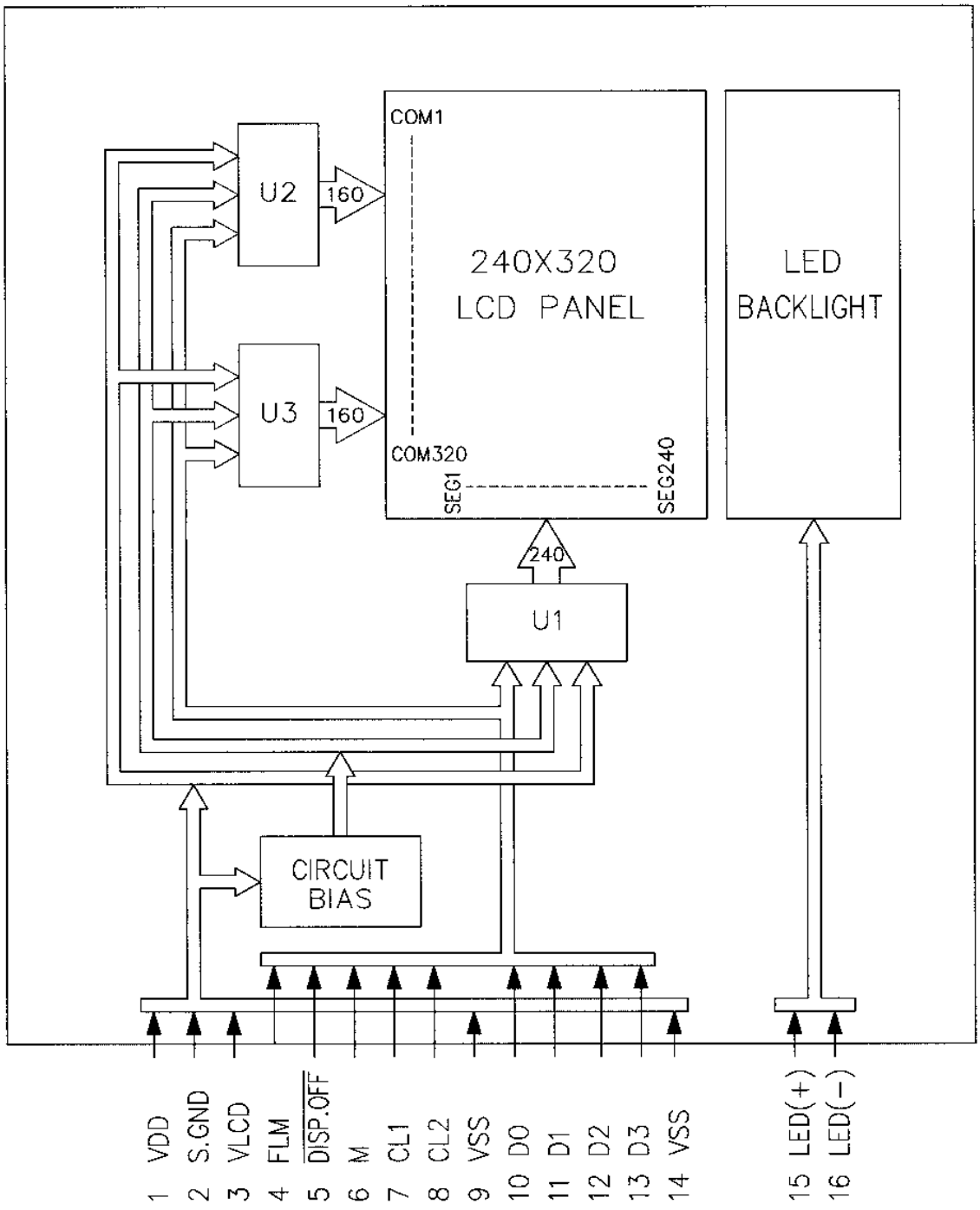
5. BLOCK DIAGRAM



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6. INTERNAL PIN CONNECTION

FPC ,20 pins,pitch 0.5mm

Pin No.	Symbol	Function
1	VDD	POWER SUPPLY FOR LOGIC
2	S.GND	SHIELD GROUND
3	VLCD	POWER SUPPLY FOR LCD
4	FLM	FIRST LINE MARKER
5	$\overline{\text{DISP.OFF}}$	H: ON/L: OFF
6	M	SWITCH SIGNAL TO CONVERT LIQUID CRYSTAL DRIVE WAVEFORM INTO AC
7	CL1	DATA LATCH
8	CL2	SHIFT CLOCK
9	VSS	LOGIC GROUND
10	D0	DISPLAY DATA
11	D1	DISPLAY DATA
12	D2	DISPLAY DATA
13	D3	DISPLAY DATA
14	VSS	LOGIC GROUND
15	LED(+)	POWER SUPPLY FOR LED
16	LED(−)	POWER SUPPLY FOR LED
17	NC	NC
18	NC	NC
19	NC	NC
20	NC	NC

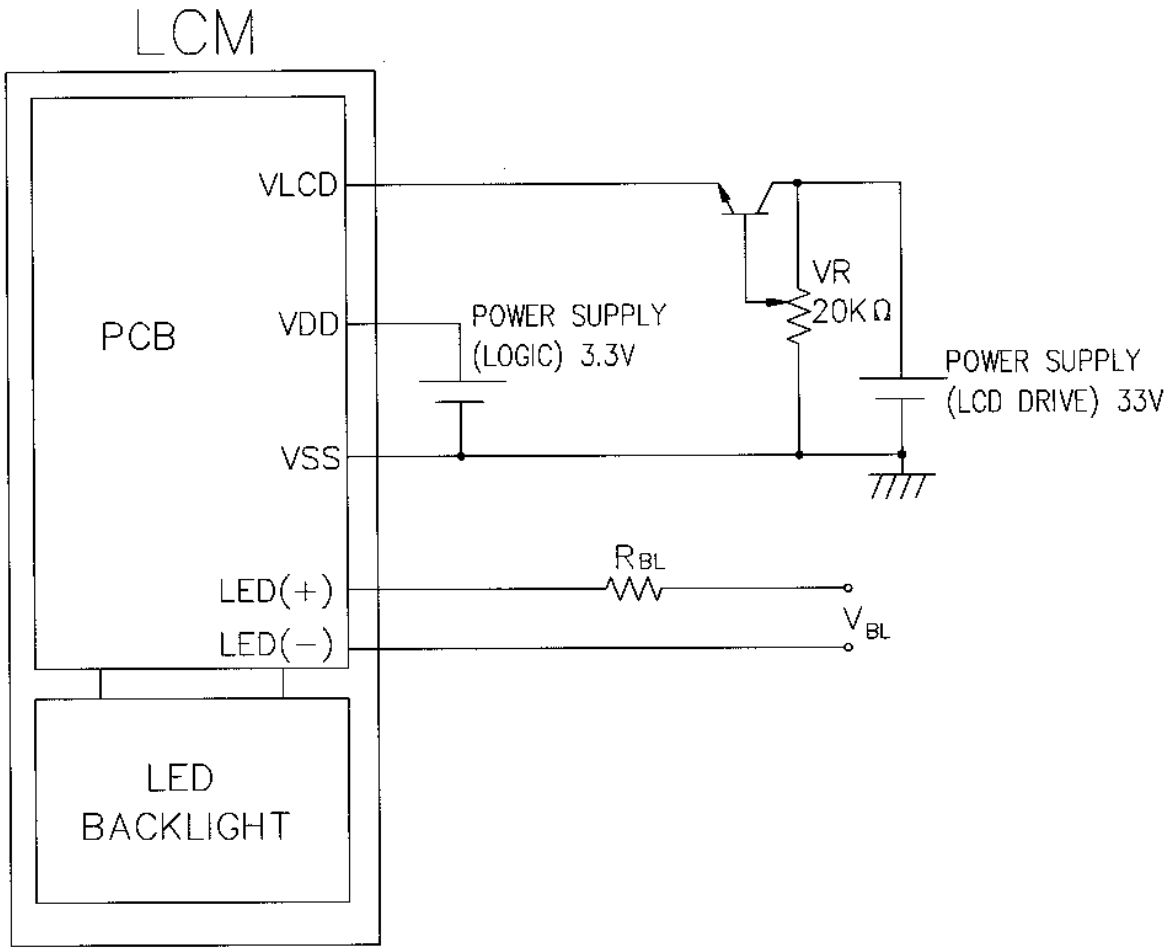
Mating Connector: MOLEX 52746−2090

TOUCH PANEL

Pin No.	Symbol
1	Y2
2	X2
3	Y1
4	X1

Mating Connector : ELCO 6200-087-032-800

7. POWER SUPPLY



Recommended Value for R_{BL} & V_{BL}

item / Back Light / interface	R_{BL}	V_{BL}
	White LED	White LED
LED(+),LED(−) PIN	33Ω	5 Vdc

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8. TIMING CHARACTERISTICS

8-1 INTERFACE TIMING

@ VDD=2.7~4.5V, Ta=-20~70 ℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Clock Cycle	tC	Fig.a	500	–	–	ns
SCP Pulse Width	tSWH,tSWL	Fig.a	240	–	–	ns
Data Set Up Time	tDSU	Fig.a , Fig.b	240	–	–	ns
Data Hold Time	tDHD	Fig.a , Fig.b	240	–	–	ns
SCP Rise/Fall Time	tr,tf	Fig.a , Fig.b	–	–	50	ns
LP Rise Time	tLRP	Fig.a	240	–	–	ns
LP Fall Time	tLFP	Fig.a	240	–	–	ns
LP Pulse Width	tLW	Fig.a	240	–	–	ns
SCP To LP Delay Time	tSL	Fig.a	50	–	–	ns
LP To SCP Delay Time	tLS	Fig.a	100	–	–	ns
LP "H" Pulse Width	tCWH	Fig.b	40	–	–	ns
LP "L" Pluse Width	tCWL	Fig.b	170	–	–	ns

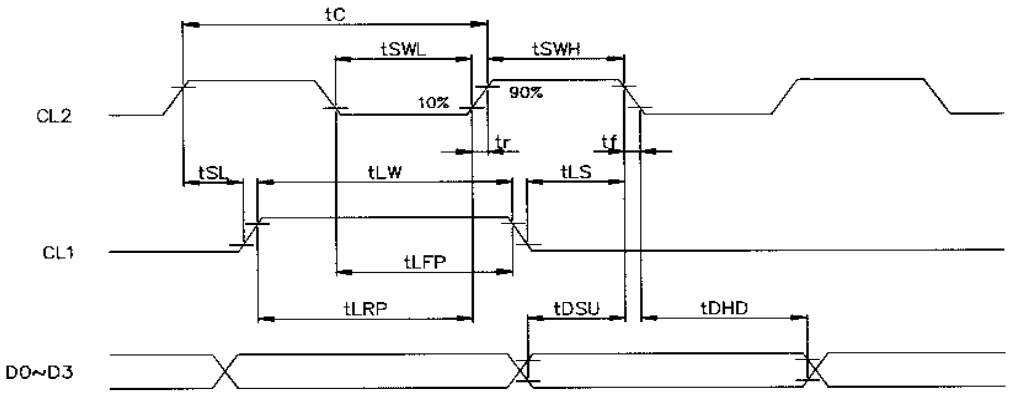


Fig . a Interface timing (SEGMENT)

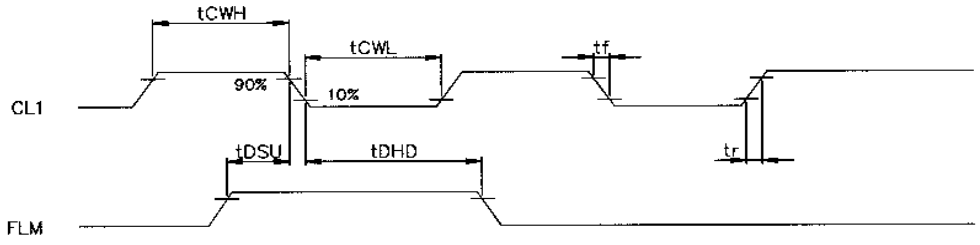
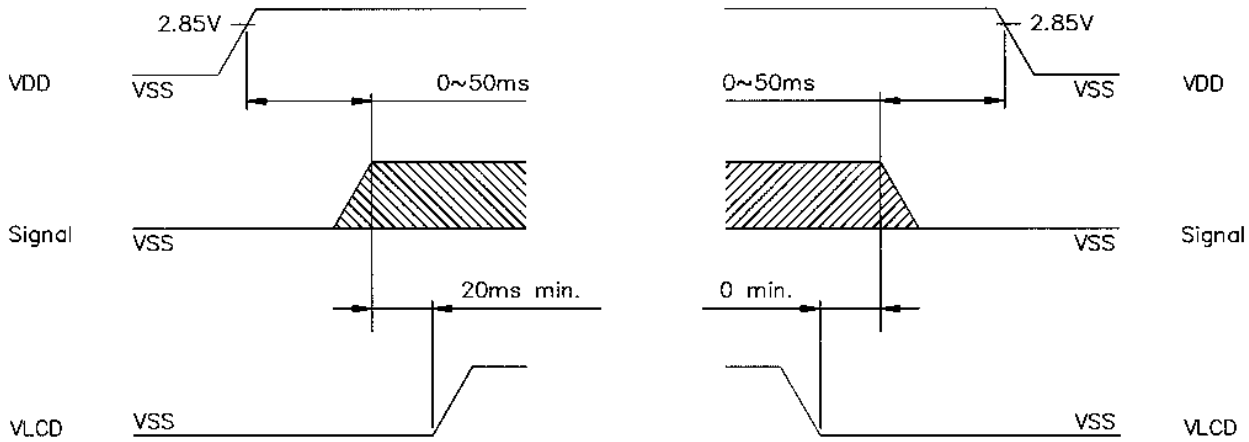


Fig . b Interface timing (COMMON)

8-2 POWER ON/OFF TIMING

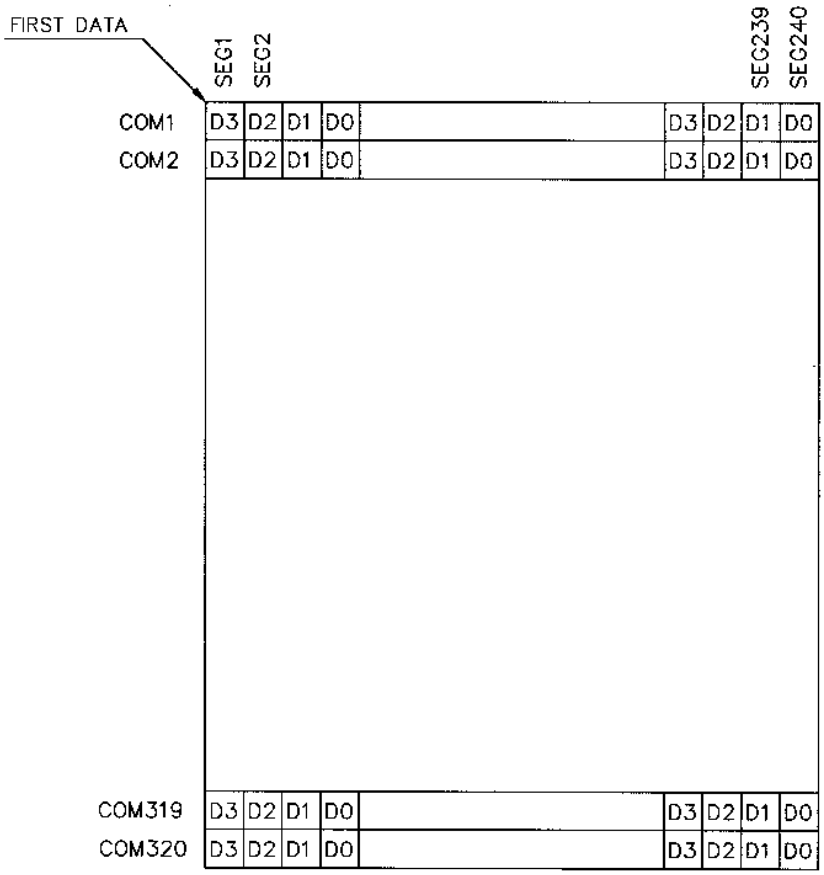


POWER ON

POWER OFF

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

8–3 DISPLAY PATTERN



240 X 320 Dots Matrix

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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

NOTICE:

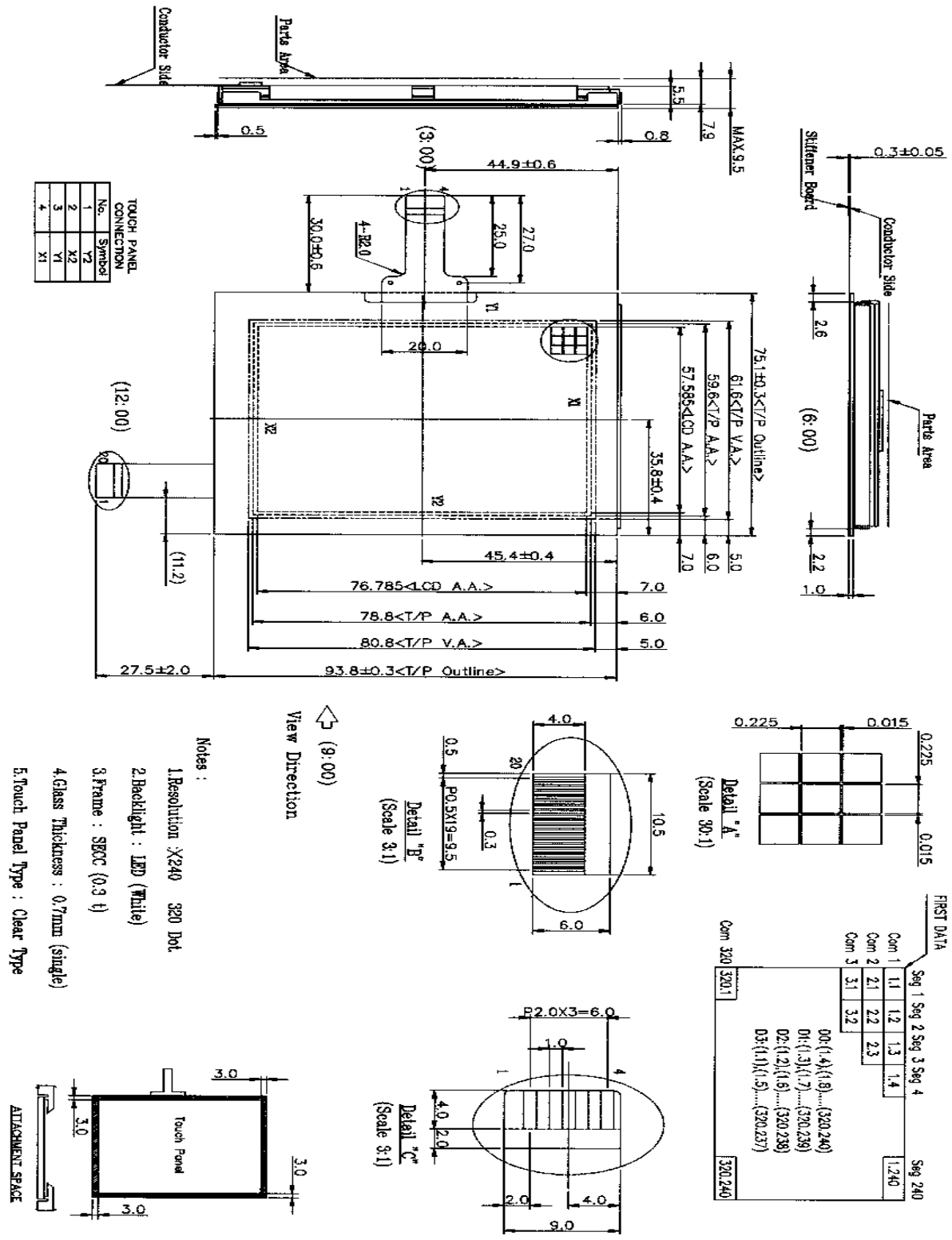
- SAFETY
  1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- 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°C±5°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 ILED=55mA, 25°C
  (Operating life time is defined as follows : The final brightness is at 50% of original brightness.)



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