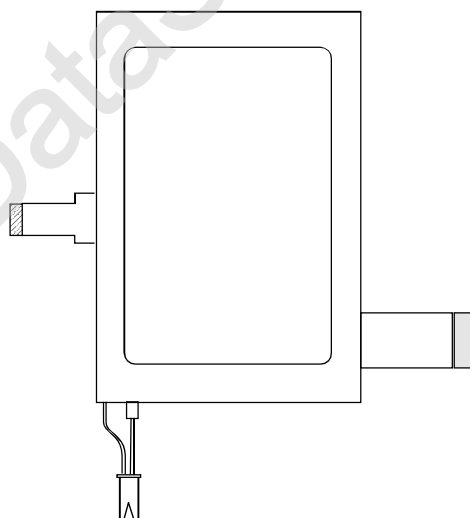


PRODUCT SPECIFICATION

HDM2432C-3

240x320 GRAPHICS
LCD DISPLAY MODULE



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1. MECHANICAL DATA

(1) Product No. HDM2432C-3
(2) Module Size 70.7 (W)mm X 90.2 (H)mm X 7.6 (D)mm
(3) Dot Size 0.061 (W)mm X 0.215 (H)mm
(4) Dot Pitch 0.076 (W)mm X 0.23 (H)mm
(5) Number of Dots 240RGB(W) X 320 (H) Dots
(6) Duty 1/320
(7) LCD Display Mode FSTN: Color STN Module
Rear Polarizer: Color Transmissive Type
(8) Viewing Direction 6 O'clock
(9) Backlight CCFL
(10) Touch Panel Included
(11) Weight 70.3g (Approx.)

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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

GND=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	7.0	V	
Power Supply for LC Drive	VEE-VSS	-0.3	36.0	V	
Input Voltage	VI	-0.3	VDD+0.3	V	
Static Electricity	-	-	-	-	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

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

Note 1 LCM should be grounded during handling LCM.

Note 2 Background color will change slightly depending on ambient temperature.
This phenomenon is reversible.




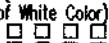

Note 3 Ta ≤ 50°C : 85%RH max
Ta > 50°C : Absolute humidity must be lower
than the humidity of 85%RH at 50°C

Note 4 Ta at -20°C will be < 48hrs, at 70°C will be < 120hrs

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3-1. ELECTRICAL CHARACTERISTICS

LCD

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Logic Circuit Power Supply		VDD-VSS	Ta= 25°C	3.0	3.3	3.6	V	
Input Voltage		VIH	H level	0.8VDD	-	VDD	V	
		VIL	L level	0	-	0.2VDD		
Recommended LCD Driving Voltage		VEE-VSS (Vop)	Duty=1/320 Bias=1/17	0°C	30.3	30.6	30.9	V
				25°C	30.1	30.4	30.7	
				50°C	29.7	30.0	30.3	
Power Supply Current		IDD	VDD-VSS = 3.3V VEE-VSS = 30.4V Ta= 25°C	-	0.56	1.0	mA	
		IEE	PATTERN: 	-	0.53	1.0		
LCM	Surface Luminance	L	INVERTER INV-081 Vin=10.3V IL=1.5mA _{rms}	PATTERN: (Dots All On of White Color) 	-	80.5	-	cd/m ²
				PATTERN: (Dots All Off) 	-	5.0	-	
				PATTERN: (Dots All On of White Color) 	-	45.2	-	
				PATTERN: (Dots All Off) 	-	2.9	-	

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3--2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used CCFL Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp voltage	V _L	—	280	—	Vrms	—
Lamp current	I _L	—	1.5	—	mArms	—
Lamp power consumption	P _L	—	0.42	—	W	(*1)
Starting voltage	V _s	—	—	620	Vrms	—
Lamp frequency	F _L	—	45-50	—	KHz	—
Lamp life time	L _L	10000	—	—	hrs	I _L = 1.5 mArms (*2)

(*1) Power consumption excluded inverter loss .

(*2) Lamp life time is defined as follows : The final brightness is at 50% of original brightness .

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3-3.CHARACTERISTICS OF TOUCH SCREEN

Used Touch screen Rating

Temp.=25°C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Applied Rating Voltage	V_R	—	—	—	7.0	V
Operating Temperature	T_{OPR}	20%~85% R.H. Max. Avoid Dew Condensation at Any Time	0	—	50	°C
Storage Temperature	T_{STO}		-20	—	70	
Resistance of Terminal Electrodes	R_{ETD}	X Electrode	200	—	800	Ω
		Y Electrode	200	—	800	
Linearity	L	—	—	—	1.5	%
Insulation Resistance	R_{OFF}	$V_{DC} = 25V$	20	—	—	M Ω
Transparency	T	According to JIS-K7015	82	85	—	%
Surface Hardness	S_H	According to JIS-K5400	3	—	—	H

Test condition : Touch screen is placed horizontally in a vessel and no power is supplied to T/P.

Normal state is temperature : $25 \pm 10^\circ\text{C}$, relative humidity : $60 \pm 25\%$

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4. OPTICAL CHARACTERISTICS

4-1 Optical Characteristics of LCD

AT Vop

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.
T	M	10.5	13.5	16	20	7.0	10	-	90	-	±54
note		NOTE 6						NOTE 5			

NOTE :

T: TRANSMISSION

M: FOR 6 O'CLOCK COLOR STN MODULE

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0°C	800	1000	1200	ms	NOTE 2
		25°C	340	420	500		
		50°C	270	340	410		
Response Time (fall)	Tf	0°C	360	450	540	ms	NOTE 2
		25°C	130	160	190		
		50°C	70	90	110		

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4-2 Color of CIE Coordinate

$I_L = 1.5\text{mA}$

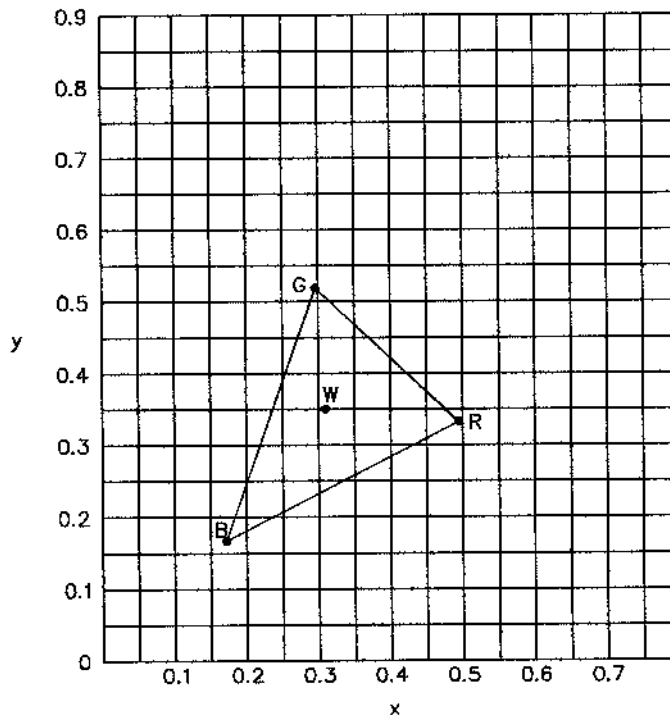
$T_a = 25^\circ\text{C}$

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m^2)	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^\circ, \theta=0^\circ$	0.495	22.4	Note*
		y		0.332		
	Green	X		0.296	49.0	
		y		0.519		
	Blue	X		0.172	15.2	
		y		0.167		
	White	X		0.310	80.5	
		y		0.350		

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

Tolerance : ± 0.05

Fig.1



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$I_L = 1.0 \text{mA}$

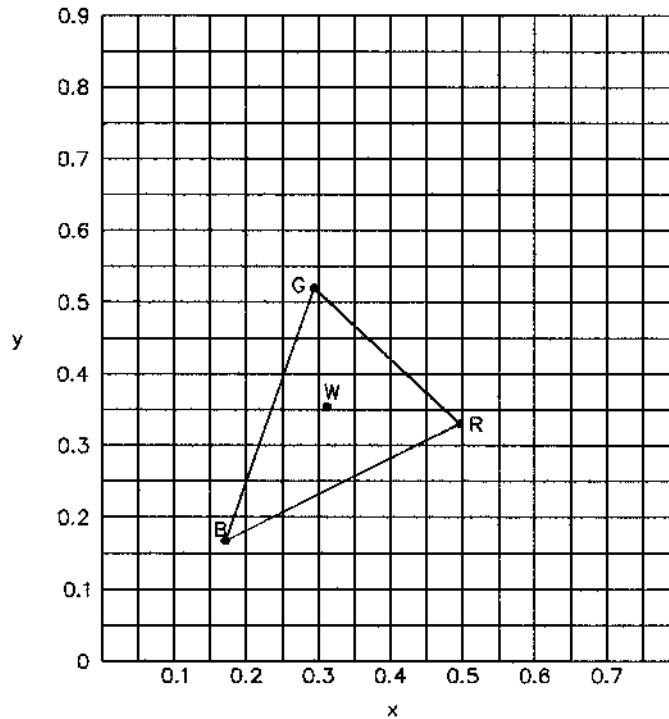
$T_o = 25^\circ\text{C}$

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m^2)	NOTE
Color of CIE Coordinate	Red	X	$\phi = 0^\circ, \theta = 0^\circ$	0.496	12.5	Note*
		y		0.331		
	Green	X		0.295	27.4	
		y		0.520		
	Blue	X		0.171	8.6	
		y		0.167		
	White	X		0.312	45.2	
		y		0.354		

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

Tolerance : ± 0.05

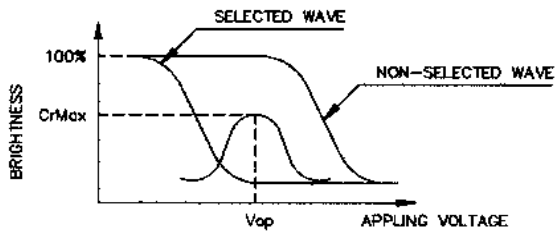
Fig.1



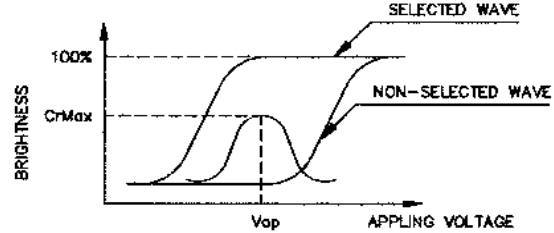
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



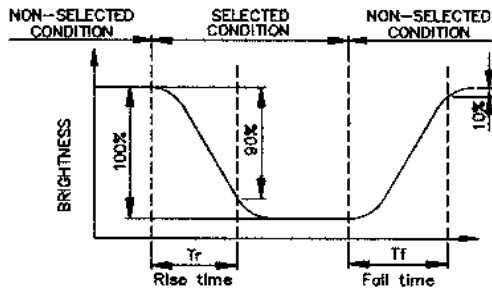
(negative type)

*Conditions

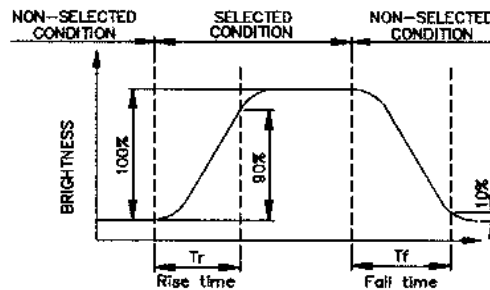
Viewing Angle : 0
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



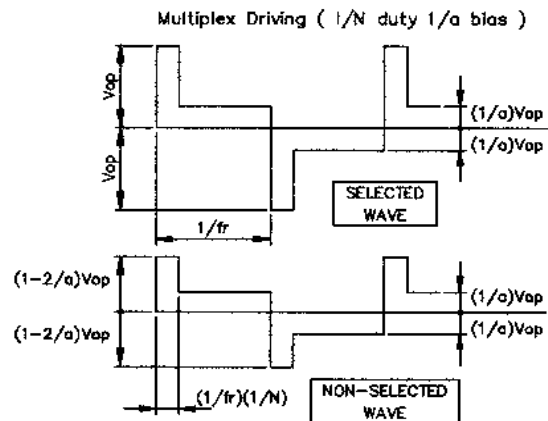
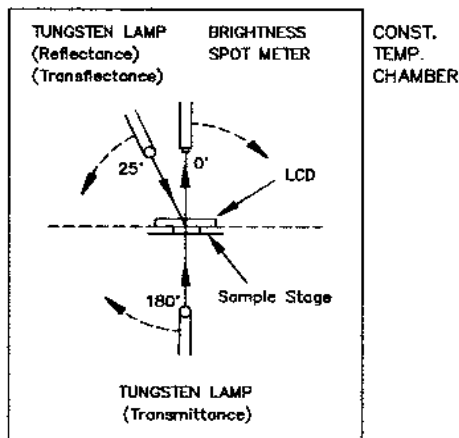
(negative type)

*Conditions

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

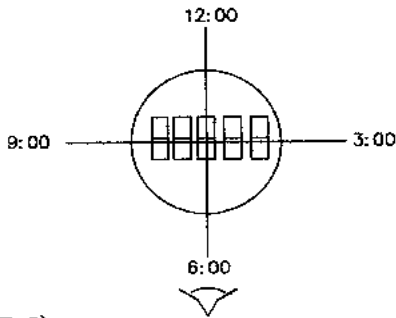
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



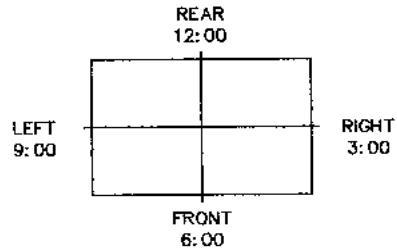
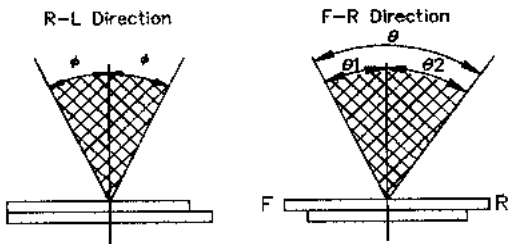
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

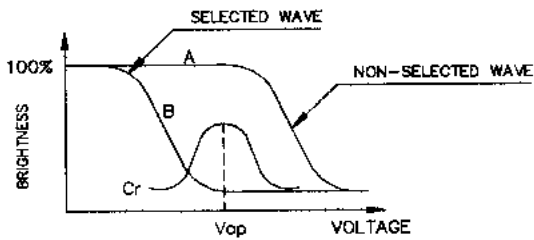
$$\theta = \theta_1 + \theta_2$$

*Conditions

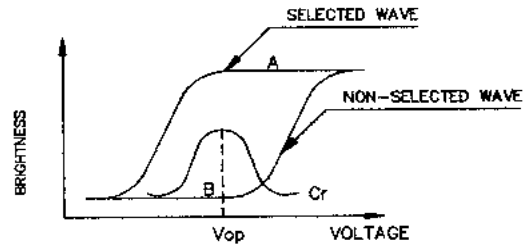
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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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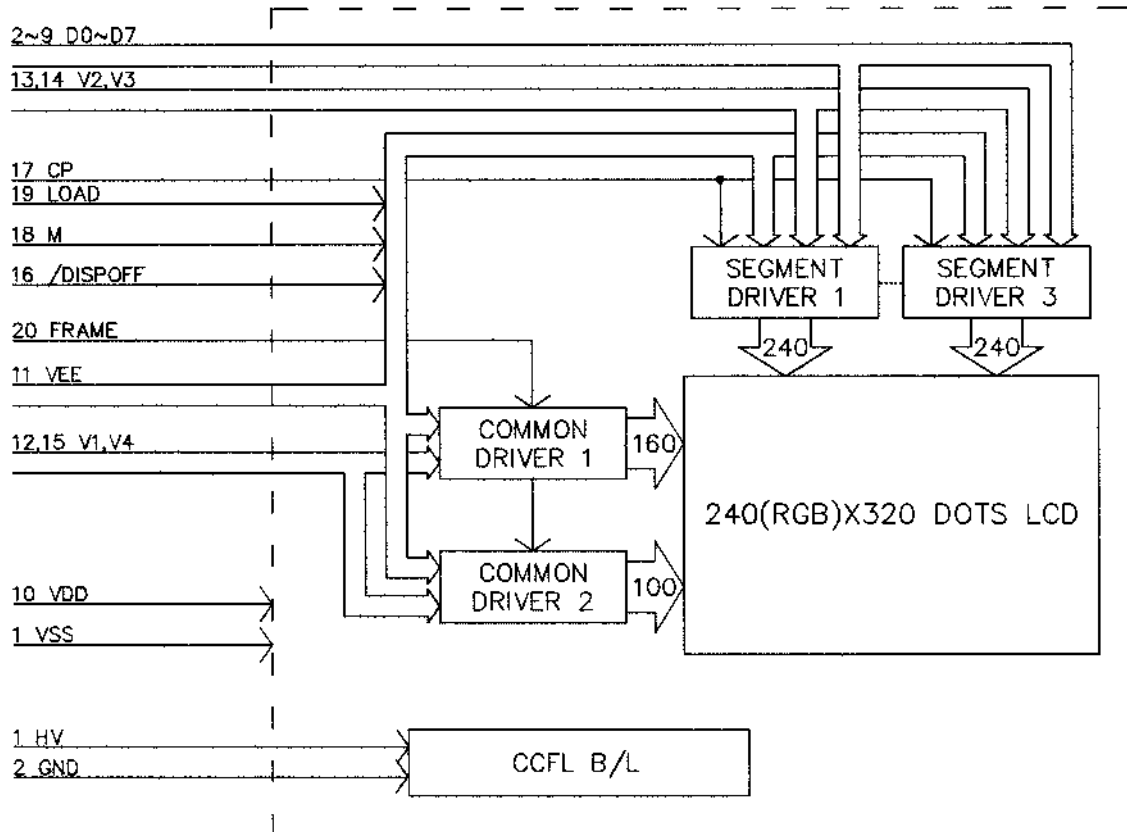
REV.:
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5. BLOCK DIAGRAM



Note :

- 1) Controller and bias voltage supply circuit are not included.
- 2) VEE, V1, V2, V3, V4 and VSS are power supply voltage for LCD.
(VEE > V1 > V2 > V3 > V4 > VSS)

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6. INTERNAL PIN CONNECTION

CN1 : (FPC) PITCH 0.5mm WIDTH 10.5mm

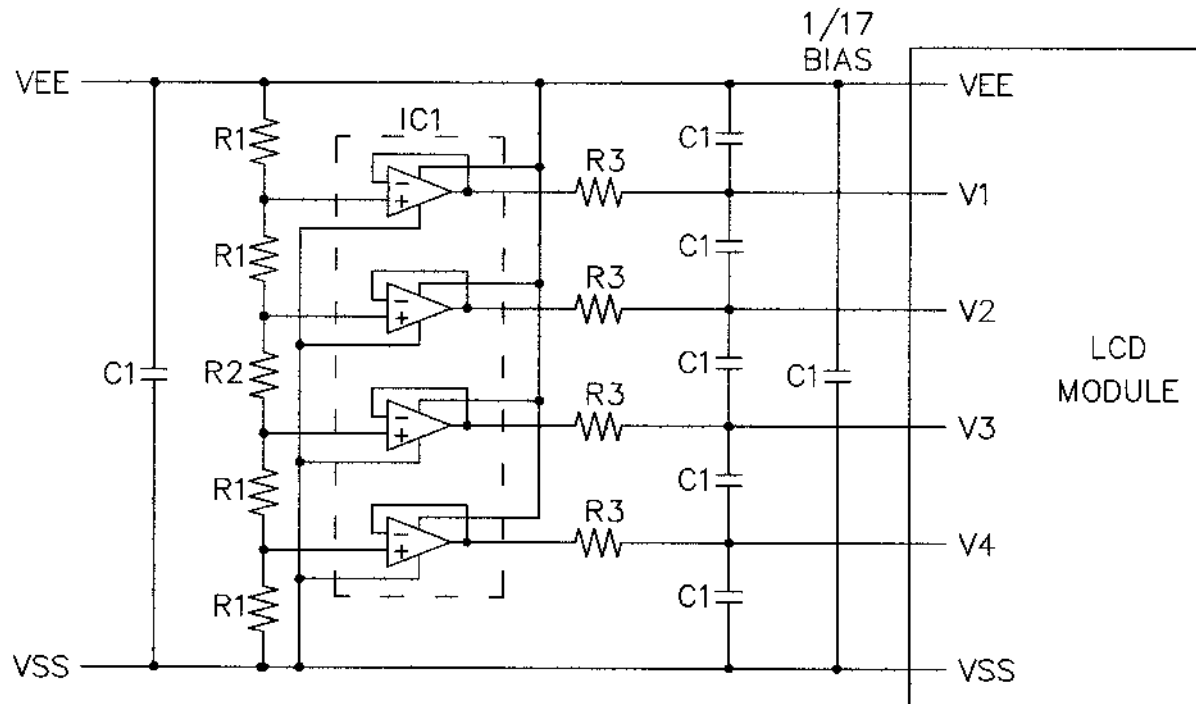
PIN NO.	SYMBOL	FUNCTION
1	VSS	Power Supply for Logic (GND) Power Supply for LCD (COM/SEG Selected Level)
2	D0	DISPLAY DATA
3	D1	DISPLAY DATA
4	D2	DISPLAY DATA
5	D3	DISPLAY DATA
6	D4	DISPLAY DATA
7	D5	DISPLAY DATA
8	D6	DISPLAY DATA
9	D7	DISPLAY DATA
10	VDD	Power Supply for Logic (+3.0V)
11	VEE	Power Supply for LCD (COM/SEG Selected Level)
12	V1	Power Supply for LCD (COM Non-Selected Level)
13	V2	Power Supply for LCD (SEG Non-Selected Level)
14	V3	Power Supply for LCD (SEG Non-Selected Level)
15	V4	Power Supply for LCD (COM Non-Selected Level)
16	$\overline{\text{DISPOFF}}$	Display Control L:off H:on
17	CP	Display Data Shift Clock
18	M	AC Signal for LC
19	LOAD	Display Data Latch Clock
20	FRAME	FRAME CLOCK

CN2 : BHSR-02VS-1(JST) (PIN1-HOT;PIN2-GND)

1	H.V.	Power Supply Voltage for CCFL
2	GND	CCFL GND

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7. POWER SUPPLY



IC1 : LP324M(NATIONAL SEMICONDUCTOR)
 R1 : 22(KOHM) \pm 0.5%, R2 : 287(KOHM) \pm 2%, R3 : 4.7(OHM) \pm 5%
 C1 : 2.2-4.7(μ F)

Note : 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).

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8. TIMING CHARACTERISTICS

8-1. INTERFACE TIMING

⊙ VDD=3.0V±10%, Ta=-20~70 °C

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	100	—	—	ns
Data Hold Time	t _{DHD}	Fig.a , Fig.b	30	—	—	ns
LOAD Cycle Time	t _L	Fig.b	250	—	—	ns
LOAD "H" Pulse Width	t _{LWH}	Fig.a , Fig.b	100	—	—	ns
LOAD Rise/Fall Time	t _{LR} , t _{LF}	Fig.b	—	—	30	ns
CP To LOAD Delay Time	t _{CL}	Fig.a	30	—	—	ns
LOAD To CP Delay Time	t _{LC}	Fig.a	—	—	200	ns
FRAME TO LOAD SETUP TIME	t _{FLS}	Fig.b	30	—	—	ns
FRAME TO LOAD HOLD TIME	t _{FLH}	Fig.b	50	—	—	ns

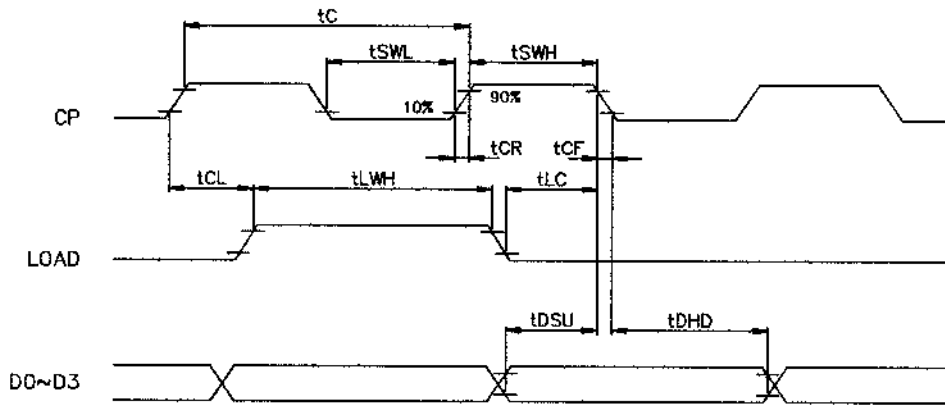


Fig . a Interface timing (SEGMENT)

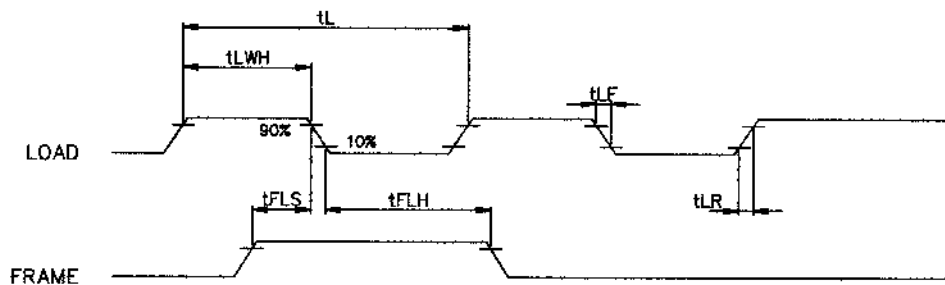


Fig . b Interface timing (COMMON)

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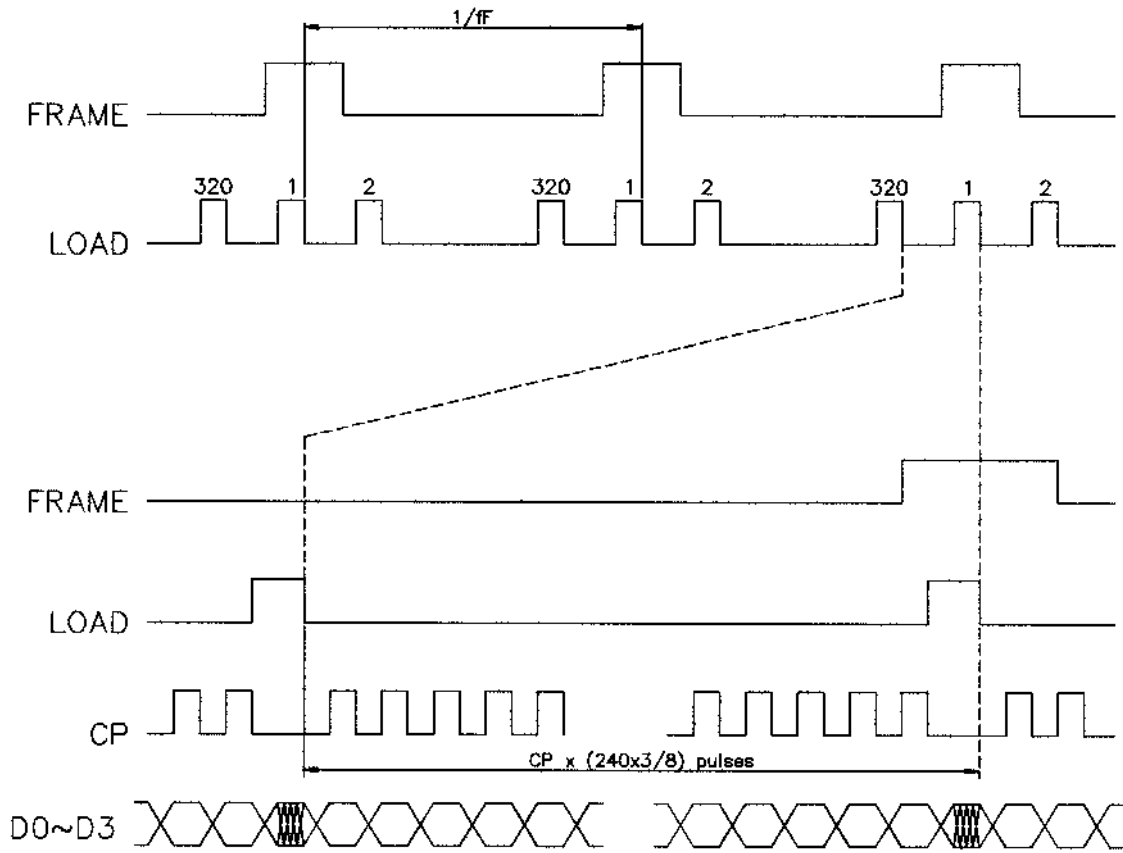
REV.:
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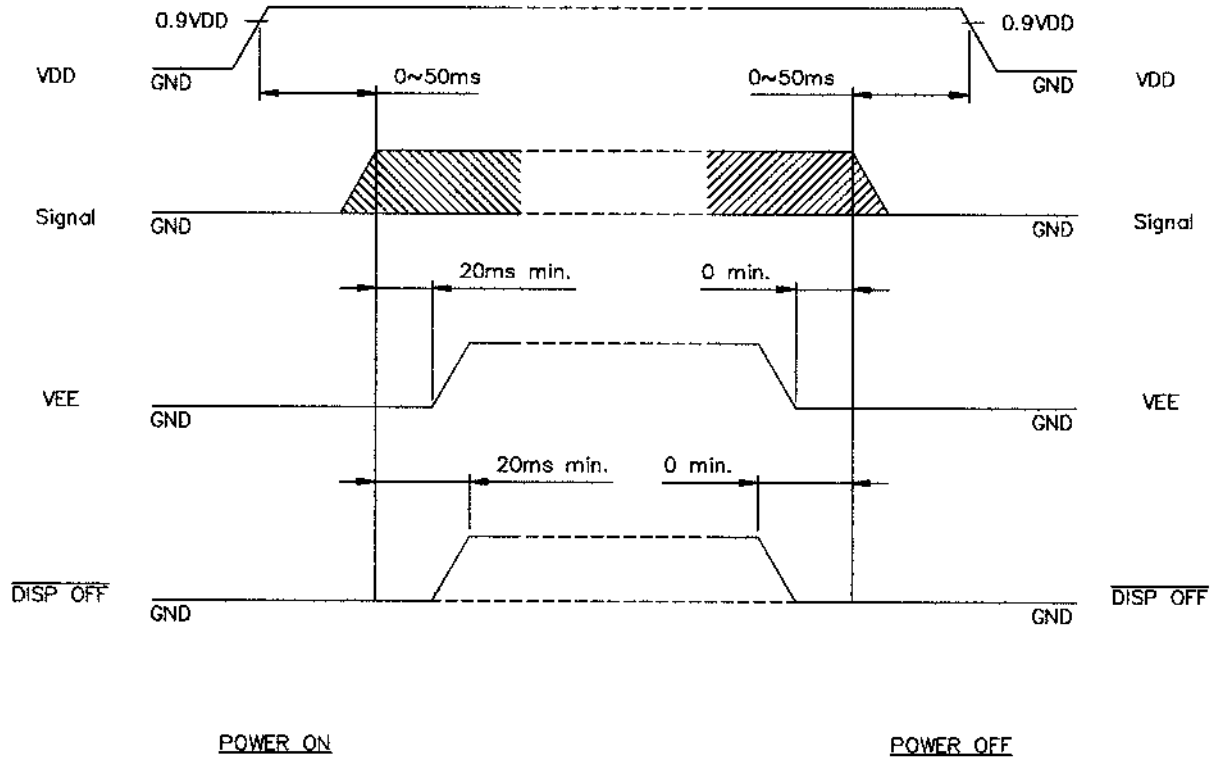
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8-2.TIMING CHART OF INPUT SIGNAL



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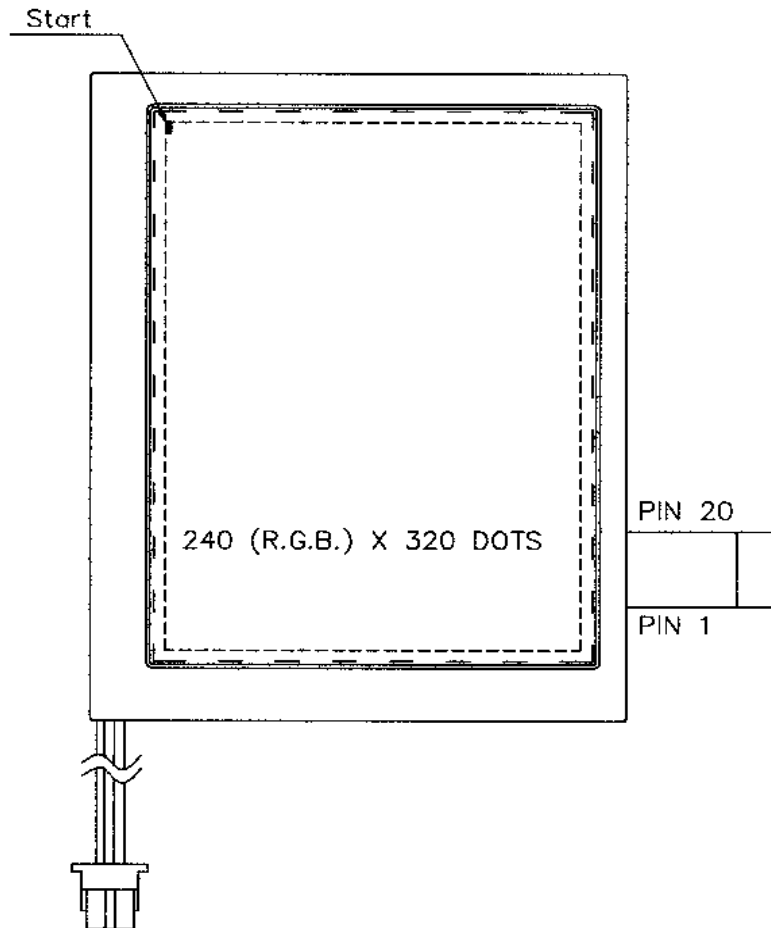
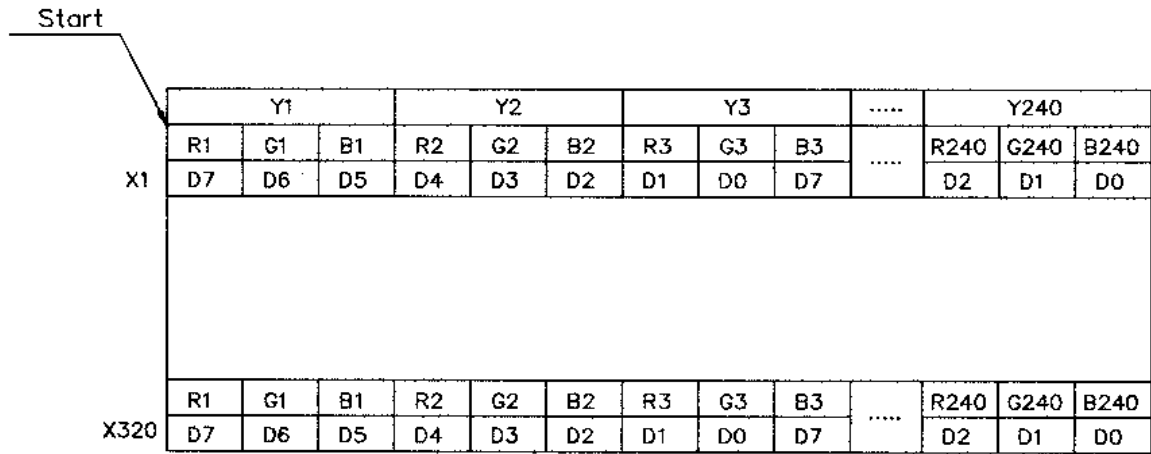
8-3. POWER ON/OFF TIMING



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

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8-4.DISPLAY PATTERN



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.

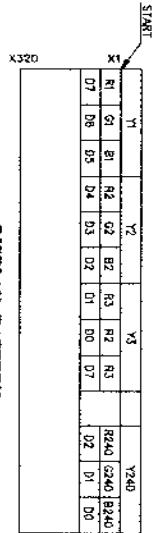
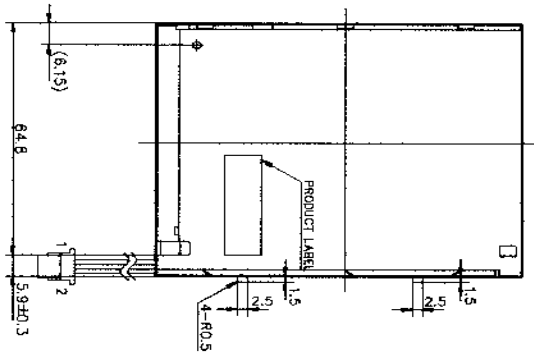
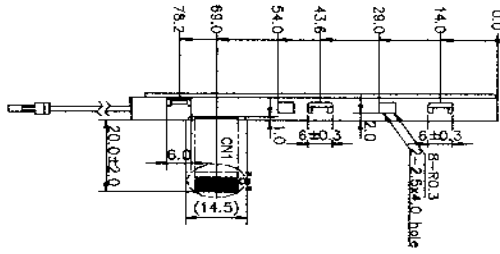
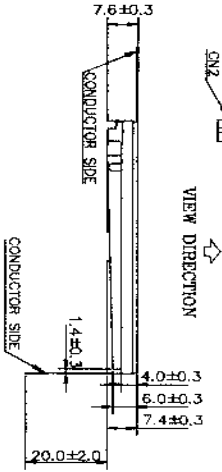
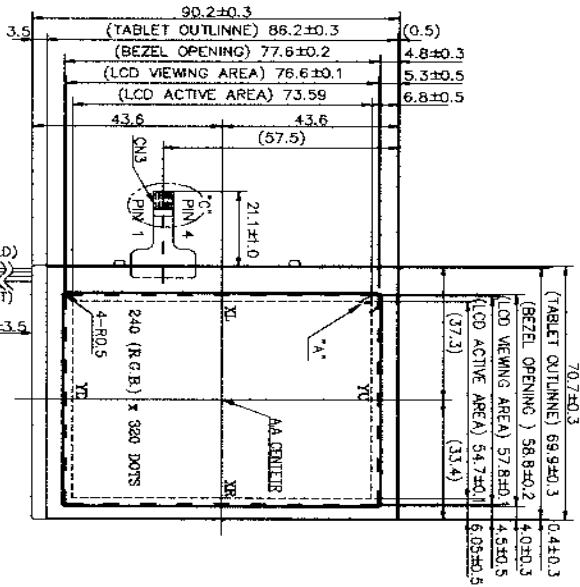
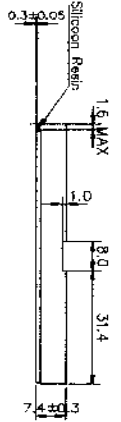
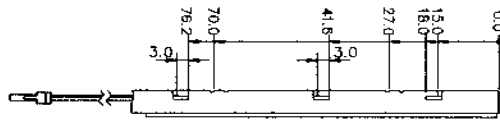
• STORAGE

- 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.

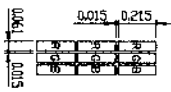
• TERMS OF WARRANT

- 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.

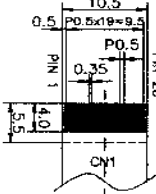
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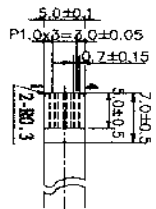
DISPLAY PATTERN



DETAIL "A"
(SCALE 40:1)



DETAIL "B"
(SCALE 2:1)



DETAIL "C"
(SCALE 2:1)

NOTE:
1. RESOLUTION: 240 (R.G.B.) x320 DOTS
2. BACKLIGHT: CCFL
3. FRAME MATERIAL: SUS304 (0.2mm)

ORG FOR TOUCH PANEL

Pin No	Pin Name
1	XR
2	YL
3	YL
4	YL

DIMENSION	TOLERANCE
L ≤ 6	±0.25 (mm)
6 < L ≤ 18	±0.3 (mm)
18 < L ≤ 50	±0.4 (mm)
50 < L ≤ 125	±0.5 (mm)
125 < L	±0.6 (mm)
ANGLE	±1° (DEG)

CH1 : (FPC) PITCH 0.5mm WIDTH 10.5mm

Pin No	SYMBOL	FUNCTION	Pin No	SYMBOL	FUNCTION
1	V _{SS}	POWER SUPPLY FOR LOGIC (GND)	12	V1	POWER SUPPLY FOR LCD (COM NON-SELECTED LEVEL)
2	D0	POWER SUPPLY FOR LCD (COM/SEG SELECTED LEVEL)	13	V2	POWER SUPPLY FOR LCD (SEG NON-SELECTED LEVEL)
3	D1	DISPLAY DATA	14	V3	POWER SUPPLY FOR LCD (SEG NON-SELECTED LEVEL)
4	D2	DISPLAY DATA	15	V4	POWER SUPPLY FOR LCD (COM NON-SELECTED LEVEL)
5	D3	DISPLAY DATA	16	TSOURCE	DISPLAY CONTROL LOFF H-ON
6	D4	DISPLAY DATA	17	CP	DISPLAY DATA SHIFT CLOCK
7	D5	DISPLAY DATA	18	M	AC SIGNAL FOR LC
8	D6	DISPLAY DATA	19	LOAD	DISPLAY DATA LATCH CLOCK
9	D7	DISPLAY DATA	20	FRAME	FRAME CLOCK
10	V _{DD}	POWER SUPPLY FOR LOGIC (+3.0V)	CH2	BHSR-CQVS-(ST)	(PIN1-HOT/PIN2-GND)
11	V _{BE}	POWER SUPPLY FOR LCD (COM/SEG SELECTED LEVEL)	1	H-V	POWER SUPPLY VOLTAGE FOR CCFL
			2	OND	CCFL GND

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Q.A.:
JK

REV.:
1.0

HDM2432C-3

SHEET 21 OF 21
DATE: 12/5/01