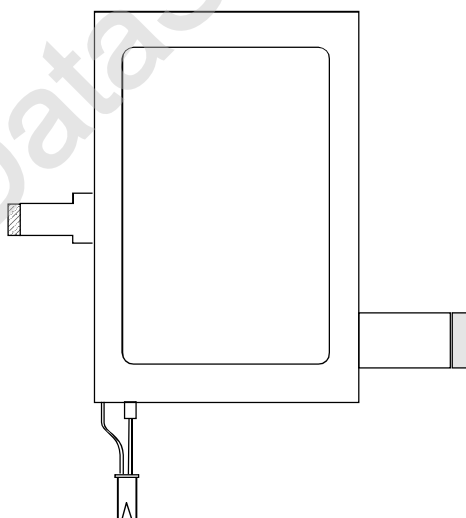


HANTRONIX

PRODUCT SPECIFICATION

HDM2432C-3

240x320 GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM2432C-3	SHEET 1 OF 21
				DATE: 12/5/01

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.)

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM2432C-3	SHEET 2 OF 21
				DATE: 12/5/01

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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM2432C-3	SHEET 3 OF 21
				DATE: 12/5/01

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 PATTERN: □ ■ □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ ■ □		—	0.56	1.0	mA
		IEE			—	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/m²
				PATTERN: (Dots All Off) ■ ■ ■ ■ ■ ■ ■ ■	—	5.0	—	
			INVERTER INV-081 Vin=8.6V IL=1.0mA rms	PATTERN: (Dots All On of White Color) □ □ □ □ □ □ □ □	—	45.2	—	
				PATTERN: (Dots All Off) ■ ■ ■ ■ ■ ■ ■ ■	—	2.9	—	

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

Q.A.:

JK

REV.:

1.0

HDM2432C-3

SHEET 4 OF 21

DATE:

12/5/01

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	—	mA _{rms}	—
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	IL = 1.5 mA _{rms} (*2)

(*1) Power consumption excluded inverter loss .

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

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

Q.A.:

JK

REV.:

1.0

HDM2432C-3

SHEET 5 OF 21

DATE:

12/5/01

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}	$V_{OC} = 25V$	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 : $60 \pm 25\%$

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

Q.A.:
JK

REV.:
1.0

HDM2432C-3

SHEET 6 OF 21

DATE:
12/5/01

4.OPTICAL CHARACTERISTICS

4-1 Optical Characteristics of LCD

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.
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		

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

Q.A.:

JK

REV.:

1.0

HDM2432C-3

SHEET 7 OF 21

DATE:

12/5/01

4-2 Color of CIE Coordinate

$I_L = 1.5\text{mA}$

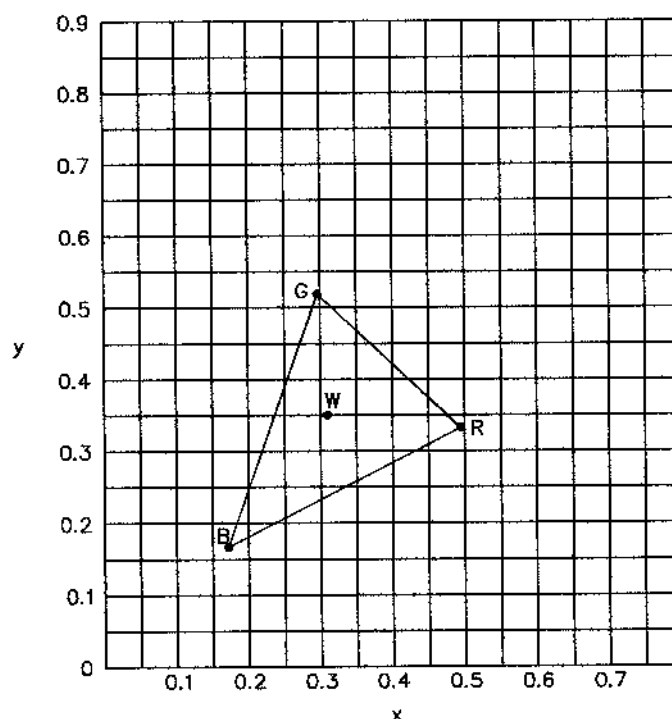
$T_a = 25^\circ\text{C}$

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



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

Q.A.:

JK

REV.:

1.0

HDM2432C-3

SHEET 8 OF 21

DATE:

12/5/01

$I_L = 1.0 \text{ mA}$

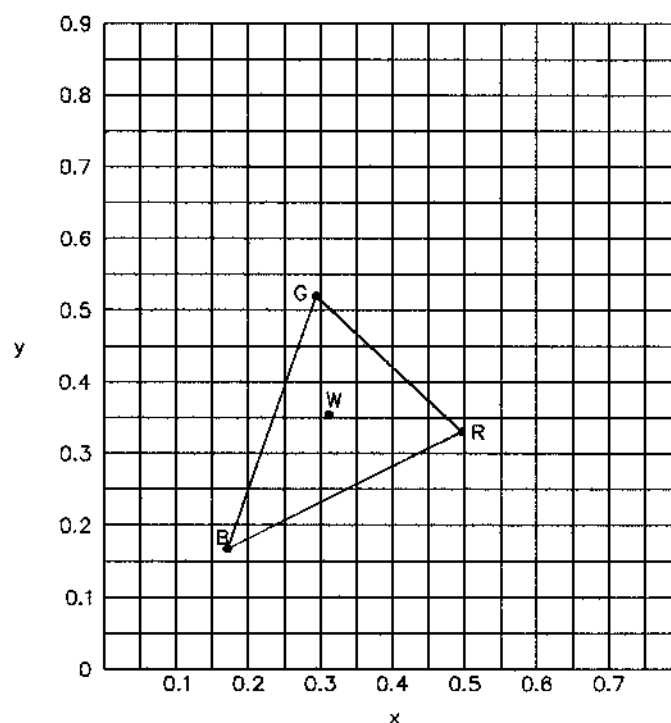
$T_o = 25^\circ\text{C}$

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



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

Q.A.:
JK

REV.:
1.0

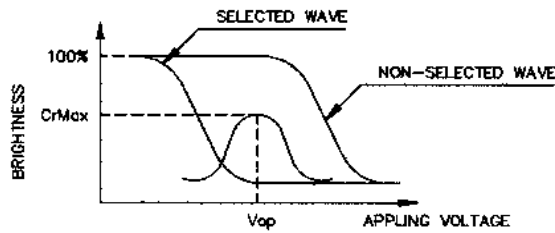
HDM2432C-3

SHEET 9 OF 21

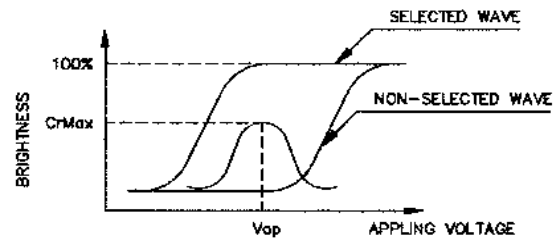
DATE:
12/5/01

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



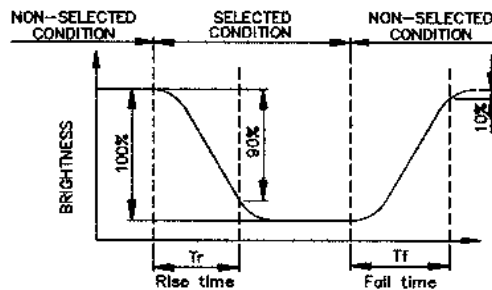
(negative type)

*Conditions

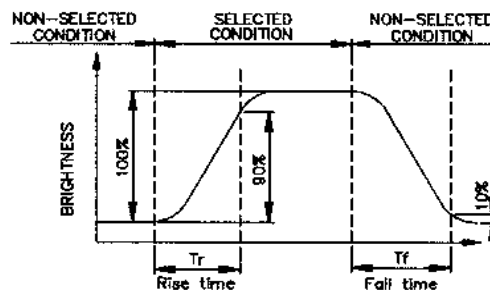
Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



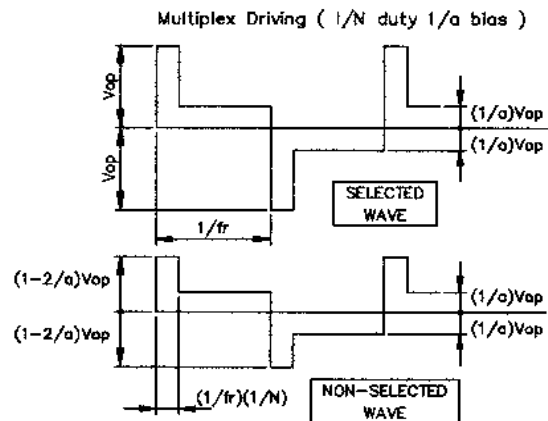
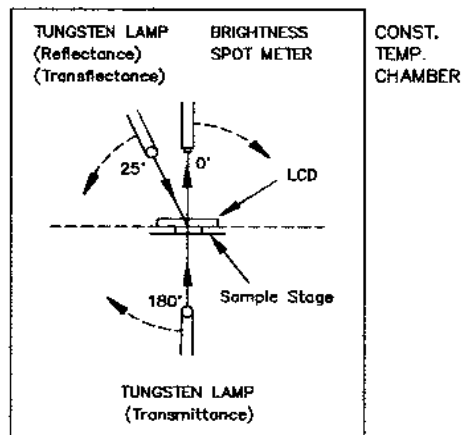
(negative type)

*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



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

Q.A.:
JK

REV.:
1.0

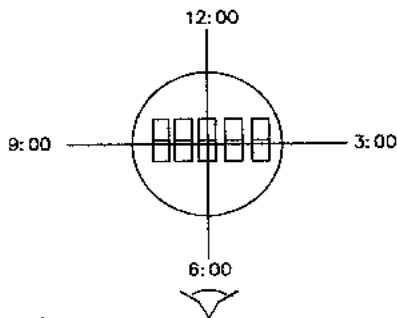
HDM2432C-3

SHEET 10 OF 21

DATE:
12/5/01

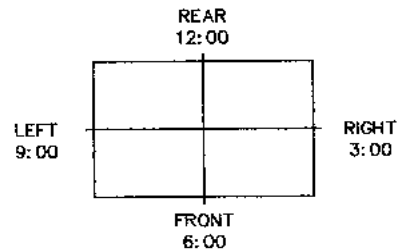
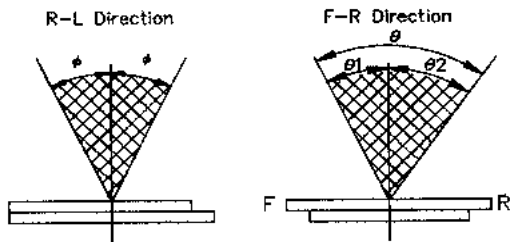
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product

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

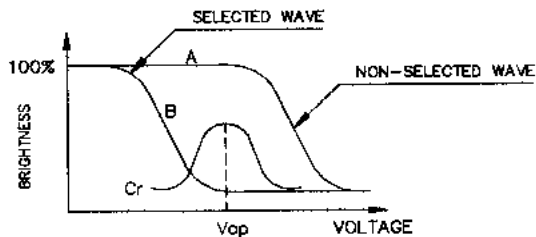
$$\theta = \theta_1 + \theta_2$$

*Conditions

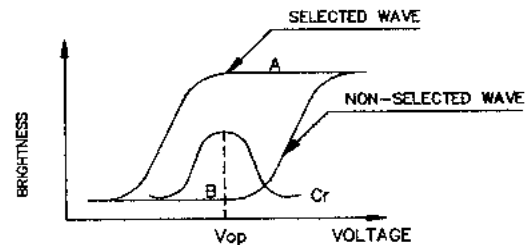
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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

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

Q.A.:

JK

REV.:

1.0

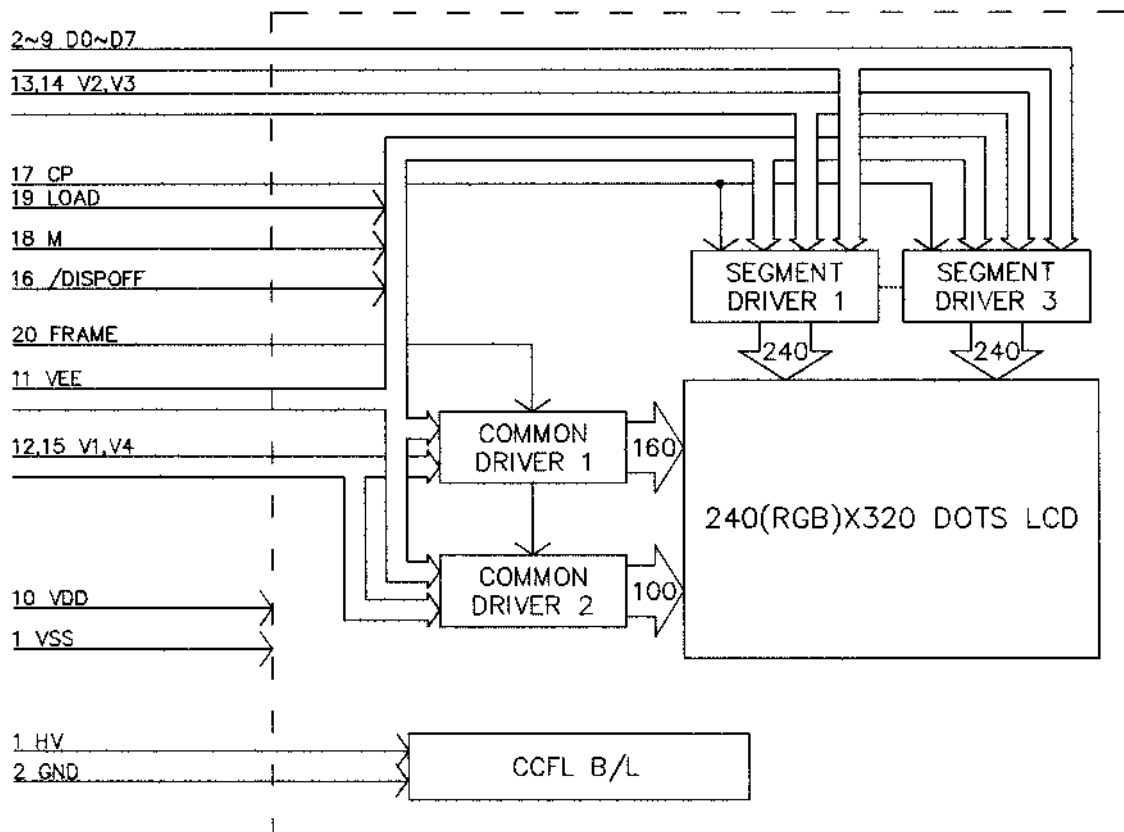
HDM2432C-3

SHEET 11 OF 21

DATE:

12/5/01

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)

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM2432C-3	SHEET 12 OF 21
				DATE: 12/5/01

6.INTERNAL PIN CONNECTION

CN1 : (FPC) PITCH 0.5mm WIDTH 10.5mm

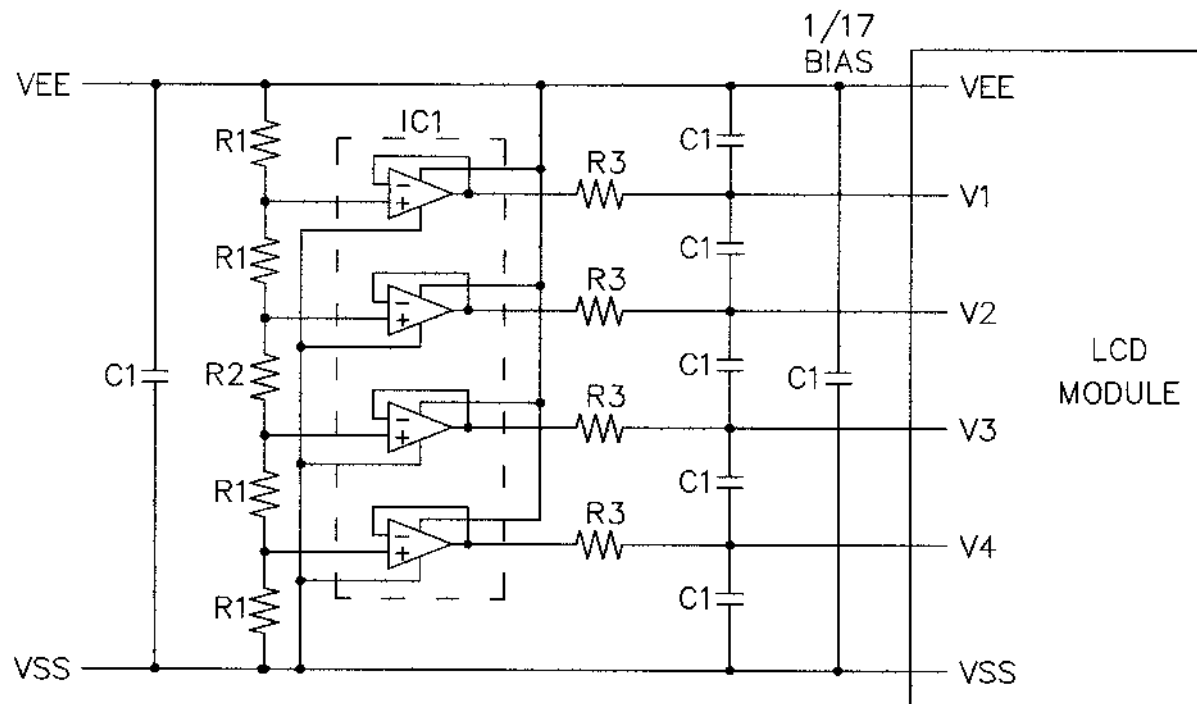
PIN NO.	SYMBOL	FUNCTION
1	VSS	Power Supply for Logic (GND) Power Supply for LCD (COM/SEG Selected Level)
2	D0	DISPLAY DATA
3	D1	DISPLAY DATA
4	D2	DISPLAY DATA
5	D3	DISPLAY DATA
6	D4	DISPLAY DATA
7	D5	DISPLAY DATA
8	D6	DISPLAY DATA
9	D7	DISPLAY DATA
10	VDD	Power Supply for Logic (+3.0V)
11	VEE	Power Supply 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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM2432C-3	SHEET 13 OF 21
				DATE: 12/5/01

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).

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM2432C-3	SHEET 14 OF 21
				DATE: 12/5/01

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

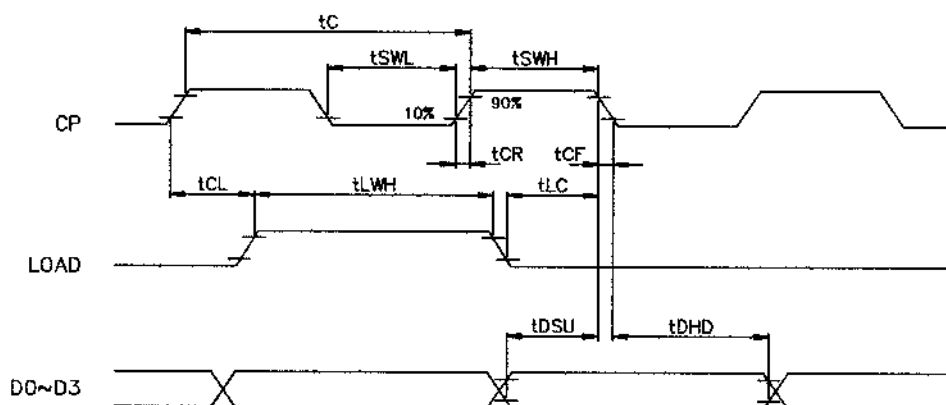


Fig . a Interface timing (SEGMENT)

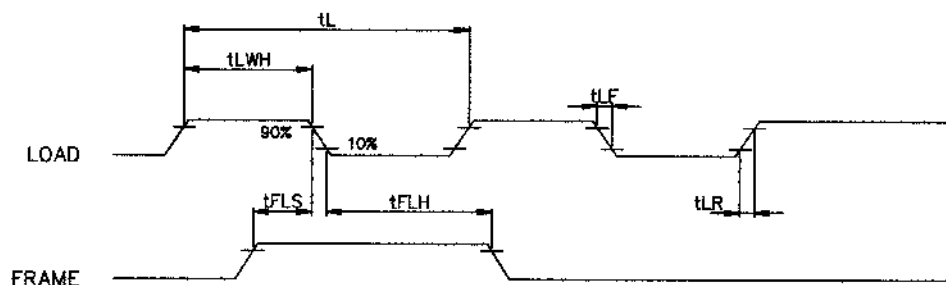


Fig . b Interface timing (COMMON)

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

Q.A.:
JK

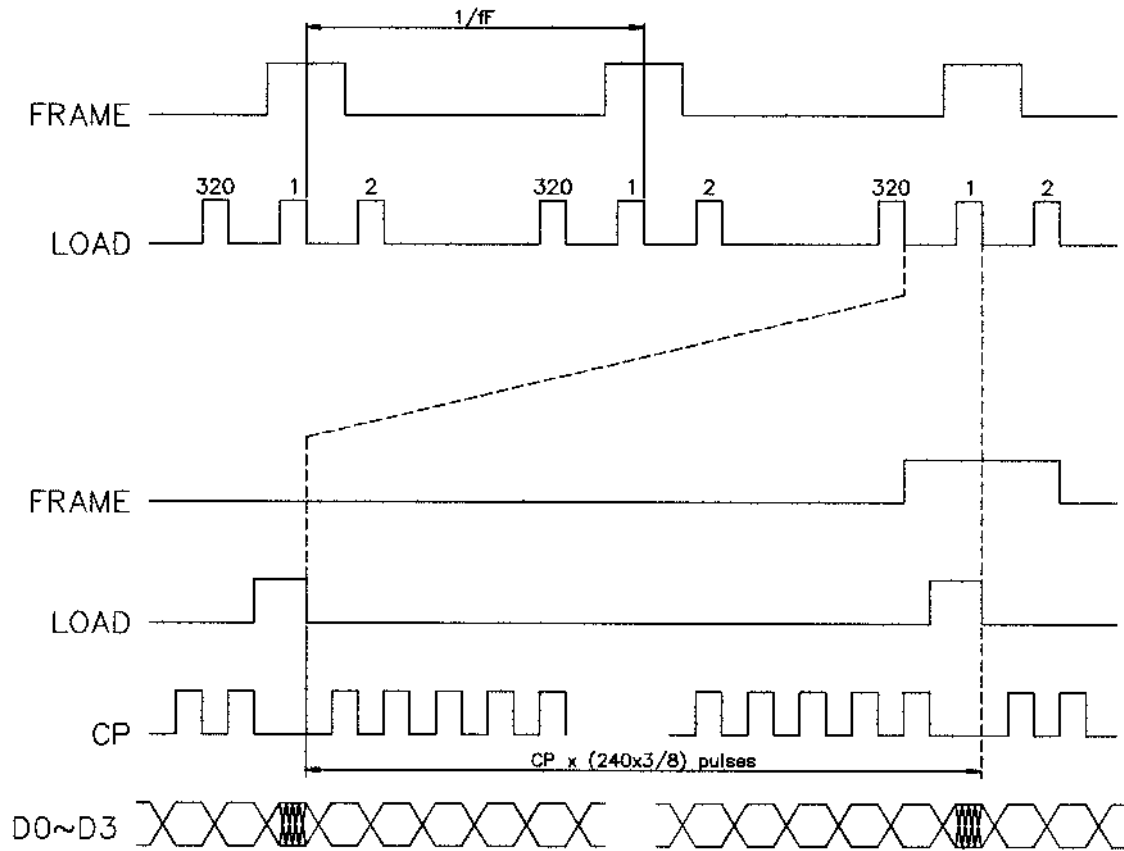
REV.:
1.0

HDM2432C-3

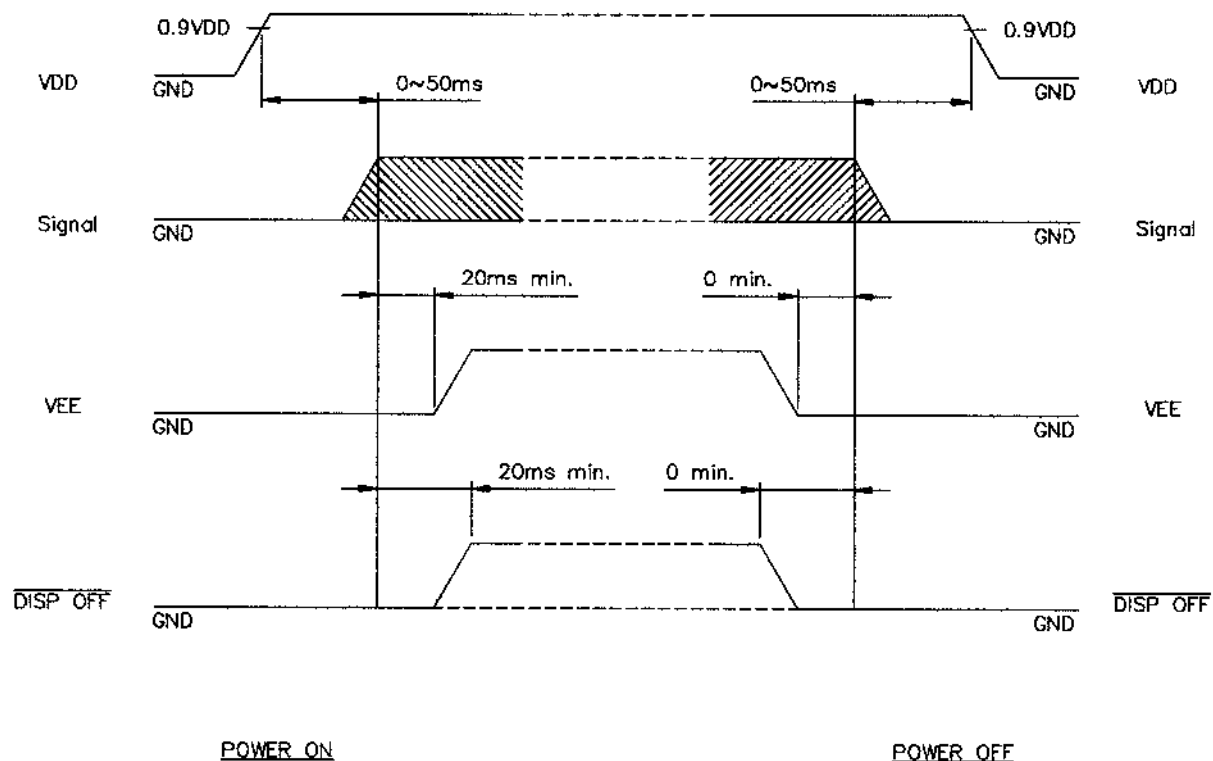
SHEET 15 OF 21

DATE:
12/5/01

8-2.TIMING CHART OF INPUT SIGNAL



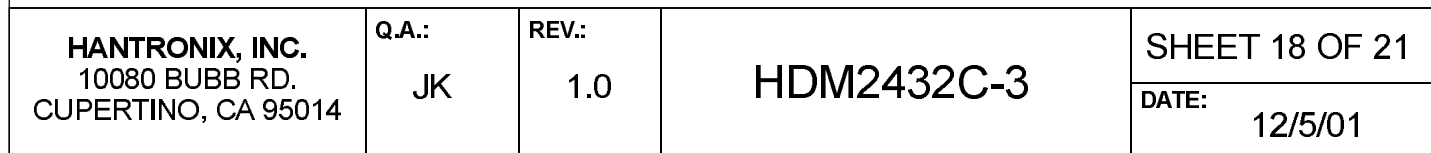
8-3. POWER ON/OFF TIMING



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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM2432C-3	SHEET 17 OF 21
				DATE: 12/5/01

X1	Y1			Y2			Y3				Y240		
	R1	G1	B1	R2	G2	B2	R3	G3	B3		R240	G240	B240
X320	D7	D6	D5	D4	D3	D2	D1	D0	D7		D2	D1	D0
	R1	G1	B1	R2	G2	B2	R3	G3	B3		R240	G240	B240
	D7	D6	D5	D4	D3	D2	D1	D0	D7		D2	D1	D0



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 (1 cycle)			Appearance without defect	5 cycles

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

Q.A.:
JK

REV.:
1.0

HDM2432C-3

SHEET 19 OF 21

DATE: 12/5/01

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.

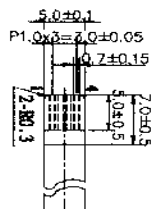
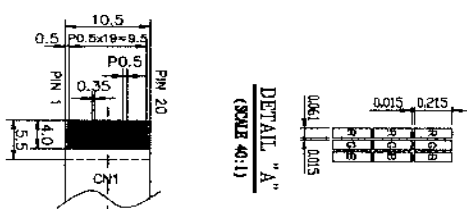
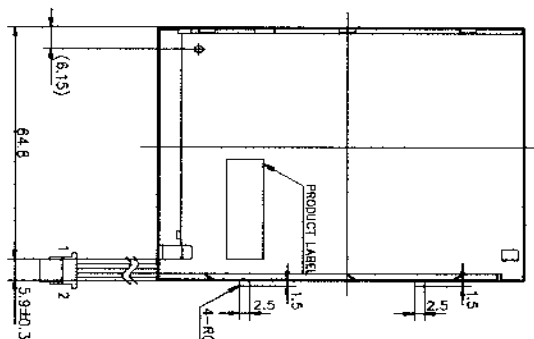
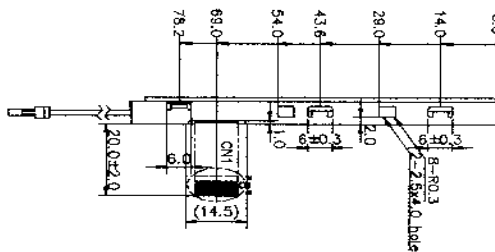
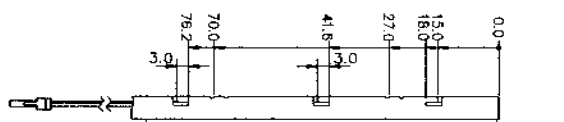
• STORAGE

- 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 WARRANTY

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

HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM2432C-3	SHEET 20 OF 21
				DATE: 12/5/01



DISPLAY PATTERN

PIN NO.		FUNCTION		PIN NO.		FUNCTION	
CNI : (FPC) PITCH 0.5mm WIDTH 10.5mm							
1	V _{SS}	POWER SUPPLY FOR LOGIC (GND)	12	V ₁	POWER SUPPLY FOR I2C (GND-NOT-SELECTED LEVEL)		
2	DD	POWER SUPPLY FOR I2C (GND/SEL-SELECTED LEVEL)	13	V ₂	POWER SUPPLY FOR I2C (SEL-NOT-SELECTED LEVEL)		
3	D1	DISPLAY DATA	14	V ₄	POWER SUPPLY FOR I2C (SEL-NOT-SELECTED LEVEL)		
4	D2	DISPLAY DATA	15	V ₄	POWER SUPPLY FOR I2C (GND-NOT-SELECTED LEVEL)		
5	D3	DISPLAY DATA	16	DSBSPOT	DISPLAY CONTRAST L-DRF H-CON		
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 _{SS}	POWER SUPPLY FOR LOGIC (+3.3V)	CH2 : BHSV-02V5-FL51T	(PIN1-HOT;PIN2-GND)			
11	V ₄	POWER SUPPLY FOR I2C (GND/SEL-SELECTED LEVEL)	1	HV	POWER SUPPLY VOLTAGE FOR COEL		
			2	GND	COEL GND		

Pin No Pin Name	
1	XR
2	YD
3	XL
4	YU

DIMENSION	TOLERANCE
L $\leq$ 6	± 0.25 (mm)
6 < L $\leq$ 18	± 0.3 (mm)
18 < L $\leq$ 50	± 0.4 (mm)
50 < L $\leq$ 125	± 0.5 (mm)
125 < L	± 0.6 (mm)
ANGLE	$\pm 1^\circ$ (DEG)

NOTE:
1.RESOLUTION: 240 (R.G.B.) X320 DOTS
2.BACKLIGHT: CCFL
3.FRAME MATERIAL: SUS304 (0.2mmf)

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

Q.A.:

JK

REV.:

1.0

HDM2432C-3

SHEET 21 OF 21

DATE: 12/5/01