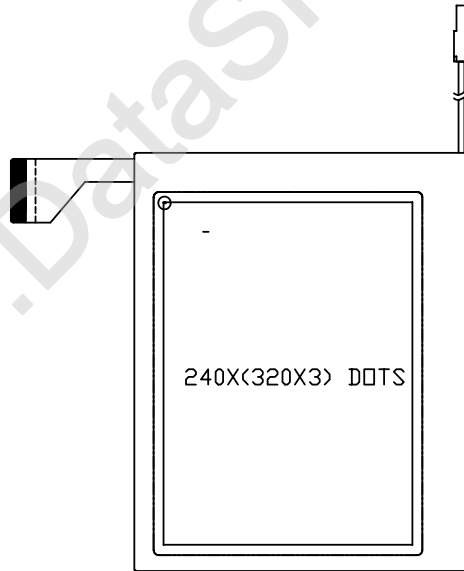




PRODUCT SPECIFICATION

HDM2432CL-2

240 x320 COLOR GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.:	REV:	HDM2432CL-2	SHEET 1 OF 17
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1. MECHANICAL DATA

(1) Product No.	HDM2432CL-2
(2) Module Size	68.0 (W)mm x 82.0 (H)mm x 4.7 (D)mm
(3) Dot Size	0.195 (W)mm x 0.055 (H)mm
(4) Dot Pitch	0.21 (W)mm x 0.07 (H)mm
(5) Number of Dots	240 (W) x (320 xRGB (H)) Dots
(6) Duty	1/240
(7) LCD Display Mode	FSTN: Color STN Module
	REAR POLARIZER: Color Transmissive Type
(8) Viewing Direction	6 O'clock
(9) Backlight	LED
(10) Controller	Excluded
(11) DC/DC Converter	Excluded
(12) Weight	42.0g (approx.)

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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VCC	-0.3	7.0	V	Note 1
Power Supply For LC	VH	-0.3	+25	V	Note 1
	VM	-0.3	5.0	V	Note 1
Static Electricity	-	-	-	-	Note 2

Note 1. All voltage values are referred to GND=0V

Note 2. Make certain you are GROUNDED when handling LCM

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	WIDE TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-40	80
Humidity (Without Condensation)	Note 2,4		Note 3,4	

Note 1 LCM should be grounded during handling LCM.

Note 2 $T_a \leq 70^\circ\text{C}$: 75%RH max

Note 3 T_a at -40°C will be < 120hrs, at 80°C will be < 120hrs

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

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3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS of LCM

(VCC=3.3V±10%)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT		
Input Voltage	VIH	H level	0.8VCC	-	VCC	V		
	VIO	L level	0	-	0.2VCC	V		
Recommended LC Driving Voltage (Wide Temp. LCM)	VH	Duty= 1/240 Bias= 12 V1=GND=0V	-20°C	19.7	20.0	20.3	V	
			0°C	18.9	19.2	19.5		
			25°C	18.2	18.5	18.8		
			50°C	17.9	18.2	18.5		
			70°C	17.1	17.4	17.7		
Power Supply Current	ICC	VCC=3.3V VH=18.8V VO=3.12V VM=1.56V GND=0V	-	0.4	0.6	mA		
	IH		-	90	135	μA		
	IO		-	1.0	1.5	mA		
	IM		-	90	135	μA		
LCM	Surface Luminance	L	VF=4.0V IF=105mA	PATTERN: (Dots All On)	-	72.5	-	cd/m ²
				<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> PATTERN: (Dots All Off) <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	-	2.8	-	cd/m ²

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used LED Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Peak forward current	I _P	-	-	140	mA	-
Maximum reverse voltage	V _R	-	-	5	V	-
Applied forward current	I _F	-	105	-	mA	at V _F = 4.0 V
Applied forward voltage	V _F	-	4.0	-	V	at I _F = 105 mA
LED power consumption	P _F	-	0.42	-	W	-
LED life time	L _L	-	10000	-	hrs	at I _F = 105 mA (*1)
AVG. X of 1931 C.I.E.	X	0.28	0.31	0.34	-	-
AVG. Y of 1931 C.I.E.	Y	0.29	0.32	0.35	-	-

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

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4.OPTICAL CHARACTERISTICS

AT V_{OP}

ITEM		Cr(Contrast Ratio)										θ (Viewing Angle)		ϕ (Viewing Angle)	
		-20℃		0℃		25℃		50℃		75℃		25℃		25℃	
MODE		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	M	20.0	25.0	25.0	30.0	30.0	35.0	8.0	10.0	3.0	4.0	-	80	-	±40
Note		NOTE 6										NOTE 5			

NOTE :

- T: TRANSMISSIVE
- M: 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	-20℃	2400	3000	4500	ms	NOTE 2
		0℃	550	700	850		
		25℃	280	350	420		
		50℃	130	160	190		
		70℃	50	70	90		
Response Time (fall)	Tf	-20℃	2000	2500	3300	ms	NOTE 2
		0℃	380	480	580		
		25℃	80	100	120		
		50℃	40	60	80		
		70℃	40	60	80		

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4-2 Color of CIE Coordinate

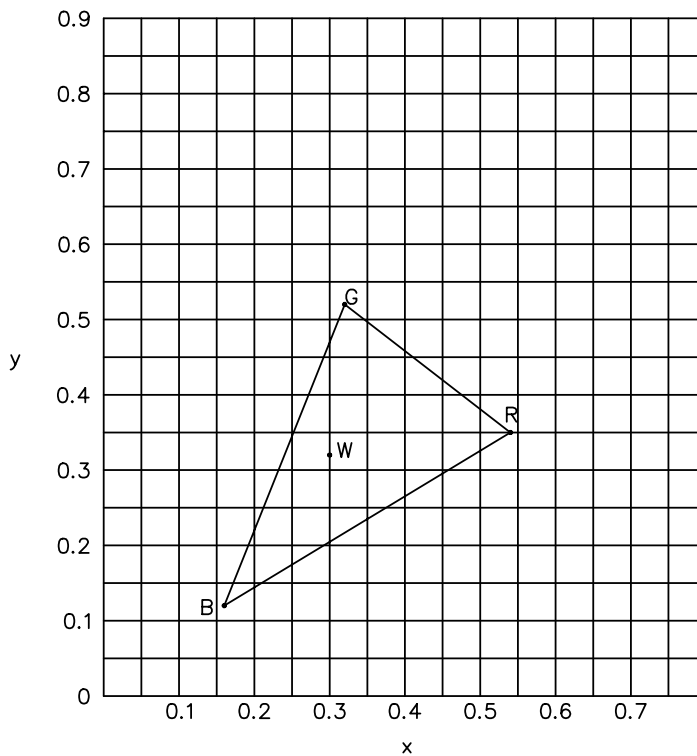
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m ²)	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^\circ, \theta=0^\circ$	0.54	19.4	Note*
		y		0.35		
	Green	X		0.32	44.6	
		y		0.52		
	Blue	X		0.16	12.1	
		y		0.12		
	White	X		0.30	72.5	
		y		0.32		

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

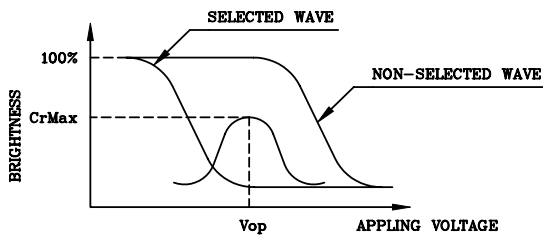
Tolerance : ±0.05

Fig.1

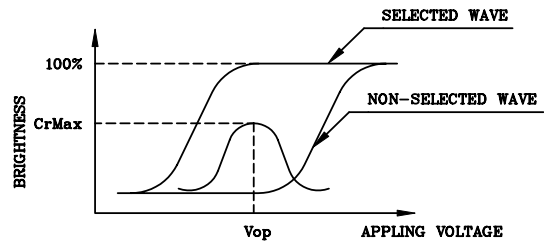


(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



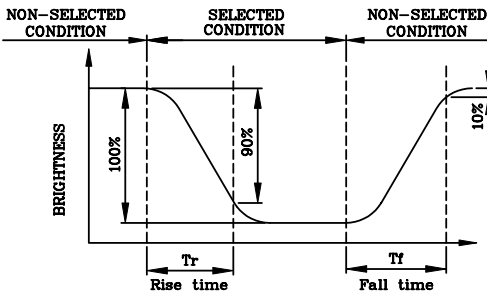
(negative type)

*Conditions

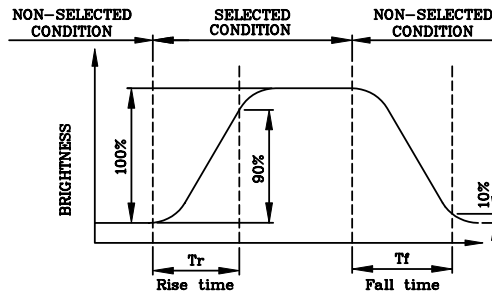
Viewing Angle : 0
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



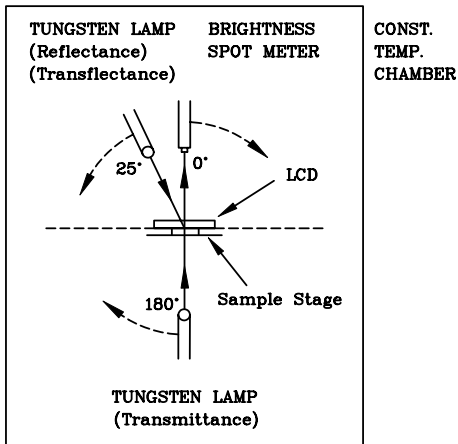
(negative type)

*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



The voltage relationship of each signal is as follow
 Multiplex Driving (1/N duty 1/a bias)

Segment voltage	Segment Waveform	Common Waveform	Common voltage	
V0			VH	
VM			VM	
V1			VL	
	Normally display period	Off-display period	Normally display period	Off-display period

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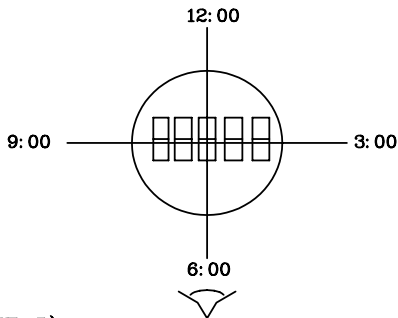
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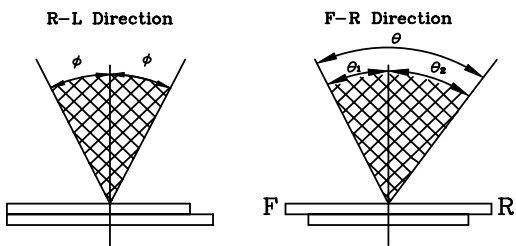
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

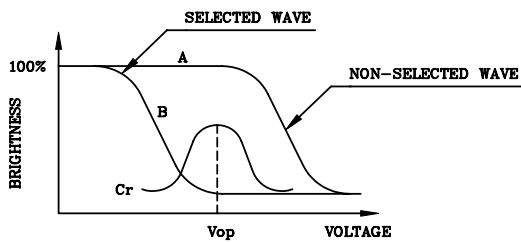
$$\theta = \theta_1 + \theta_2$$

*Conditions

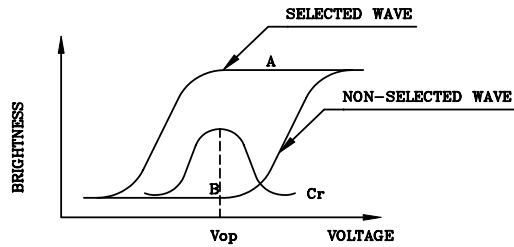
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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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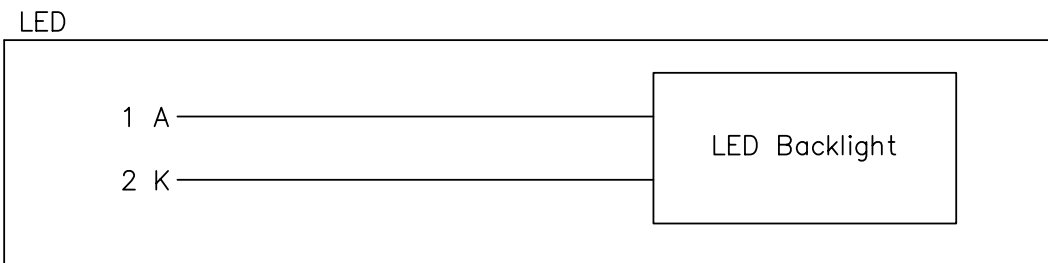
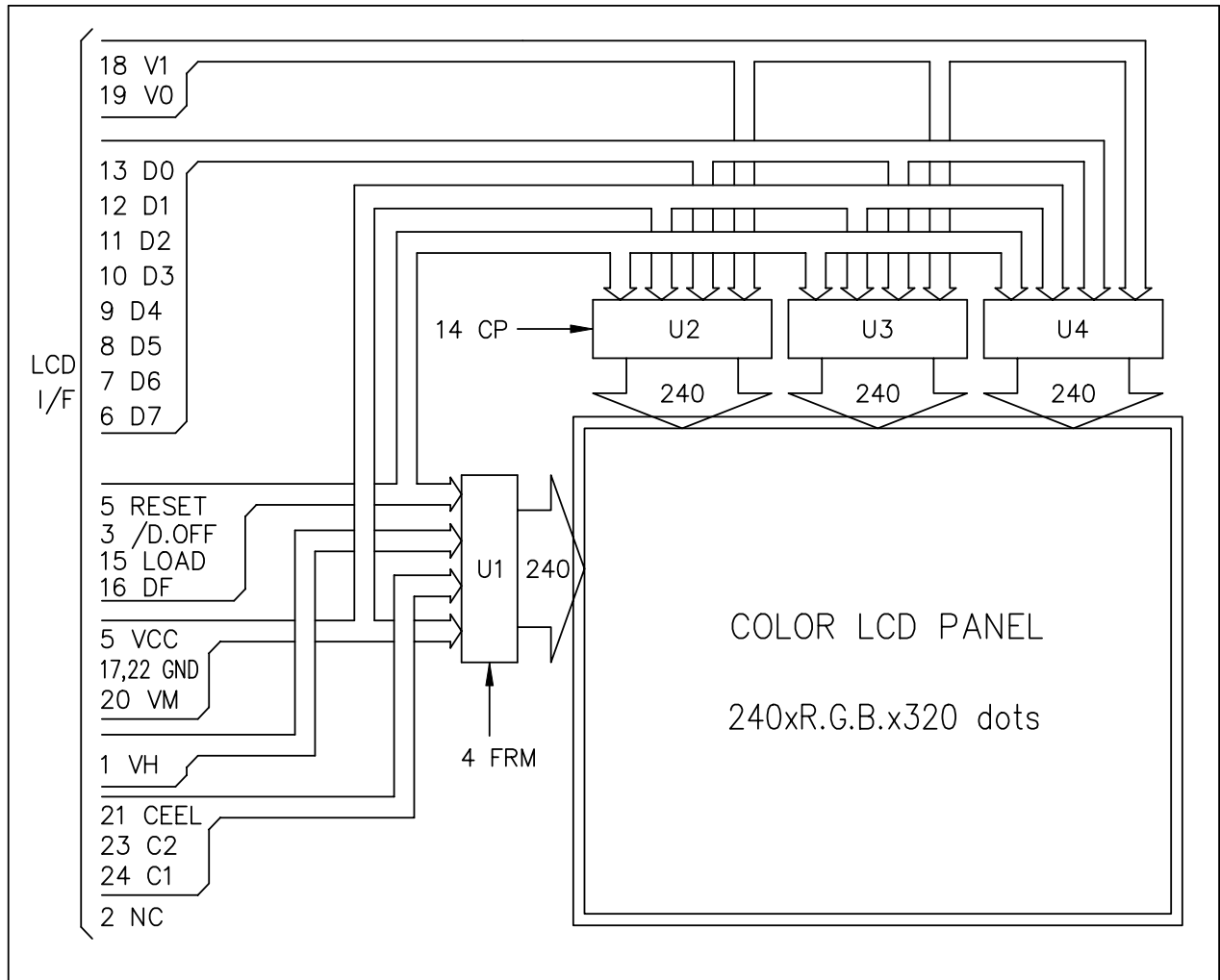
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5. BLOCK DIAGRAM



6. INTERNAL PIN CONNECTION

CN1. LCD

PIN NO	SYMBOL	FUNCTION
1	VH	Power supply for LCD
2	NC	No connection
3	/D.OFF	H: Display ON, L: Display OFF
4	FRM	Frame start signal (Data signal of the shift register of the common driver)
5	VCC	Power supply for logic (+3V)
6	D7	Display data
7	D6	Display data
8	D5	Display data
9	D4	Display data
10	D3	Display data
11	D2	Display data
12	D1	Display data
13	D0	Display data
14	CP	Clock pulse for segment shift register
15	LOAD	<1> Latch pulse of display data <2> Shift clock for common driver
16	DF	Switch signal to convert LCD drive waveform into AC
17	GND	GND
18	V1	Bias voltage for driving LCD
19	V0	Bias voltage for driving LCD
20	VM	Bias voltage for driving LCD
21	CEEL	Connecting a capacitor between pin21 and GND
22	GND	GND
23	C2	Connecting a capacitor between pin23 and pin24
24	C1	Connecting a capacitor between pin23 and pin24

CN2. LED

1	A	Power supply voltage for LED backlight
2	K	GND

LCD INTERFACE CABLE

Pitch 0.5mm ,Width 12.5mm/Suitable Connector :52689-2493(molex)

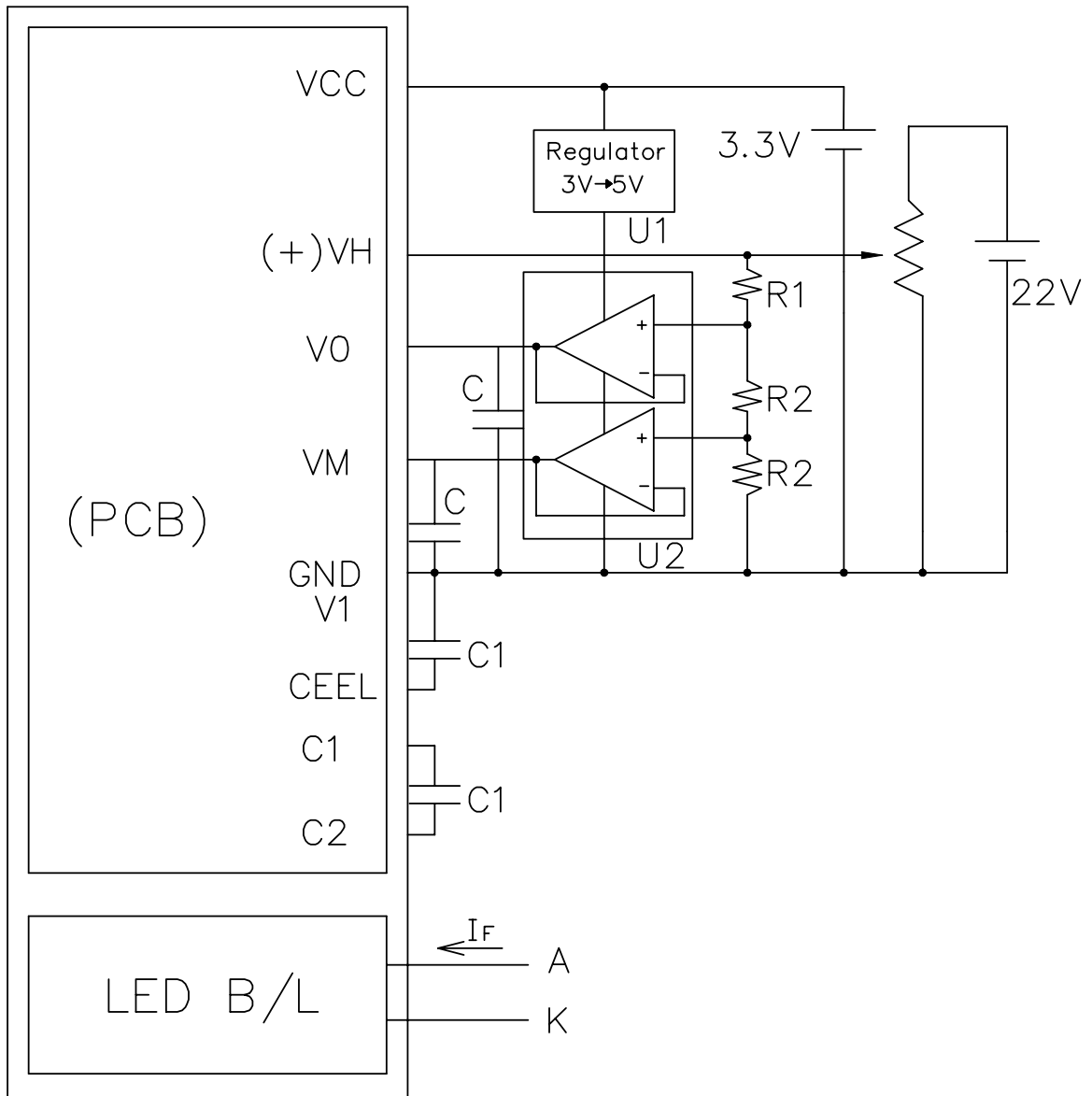
CCFL CONNECTOR :

BHSR -02VS-1 (JST)/Suitable Connector : SM02B-BHSS-1-TB (JST)

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7. POWER SUPPLY

LCM



- 1) VH, V0, VM and V1 are power supply voltage for LCD.
($VH > V0 > VM > V1$)
- 2) Liquid Crystal Driving Voltage $V_{op} = VH - GND$
- 3) $C = 1\mu F$ 25V, $C1 = 2.2\mu F$ 25V, $R1 = 10M\Omega$, $R2 = 1M\Omega$
 $U1 = LTC1928-5$, $U2 = BA10358$

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8. TIMING CHARACTERISTICS

8-1 INTERFACE TIMING

Ⓢ VDD=3.3V±10%, Ta=-20~70 ℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CP Clock Cycle	tCYC2	Fig.a	152	-	-	ns
CP HIGH-LEVEL Width	tCWH2	Fig.a	65	-	-	ns
CP LOW-LEVEL Width	tCWL2	Fig.a	65	-	-	ns
Data Set Up Time	tDS2	Fig.a	50	-	-	ns
Data Hold Time	tDH2	Fig.a	50	-	-	ns
CP Rise/Fall Time	tr2,tf2	Fig.a	-	-	30	ns
Clock Set Up Time	tSCL	Fig.a	80	-	-	ns
Clock Hold Time	tHCL	Fig.a	80	-	-	ns
DF Set Up Time	tMS	Fig.a	20	-	-	ns
DF Hold Time	tMH	Fig.a	20	-	-	ns

Ⓢ VDD=3.3V±10%, Ta=-20~70 ℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
LOAD Clock Cycle	tCYC1	Fig.b	400	-	-	ns
LOAD HIGH-LEVEL Width	tCWH1	Fig.b	25	-	-	ns
LOAD LOW-LEVEL Width	tCWL1	Fig.b	370	-	-	ns
Data Set Up Time	tDS1	Fig.b	100	-	-	ns
Data Hold Time	tDH1	Fig.b	10	-	-	ns
LOAD Rise/Fall Time	tr1,tf1	Fig.b	-	-	30	ns

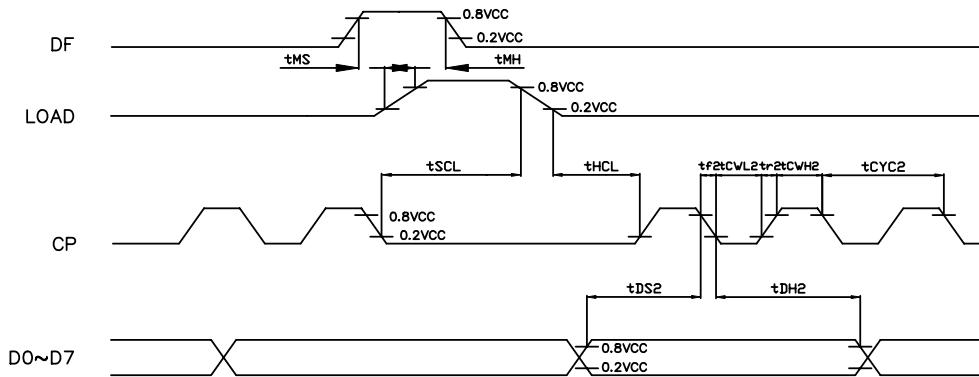


Fig . a Interface timing (SEGMENT)

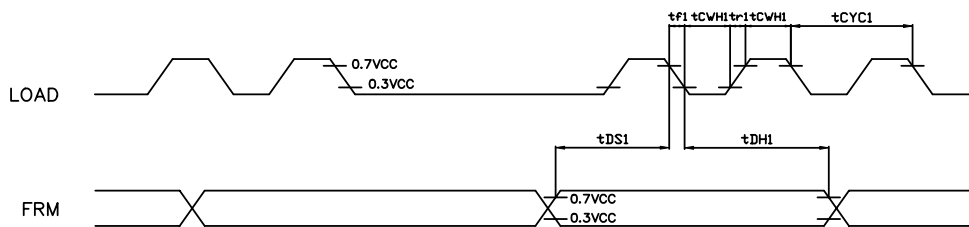
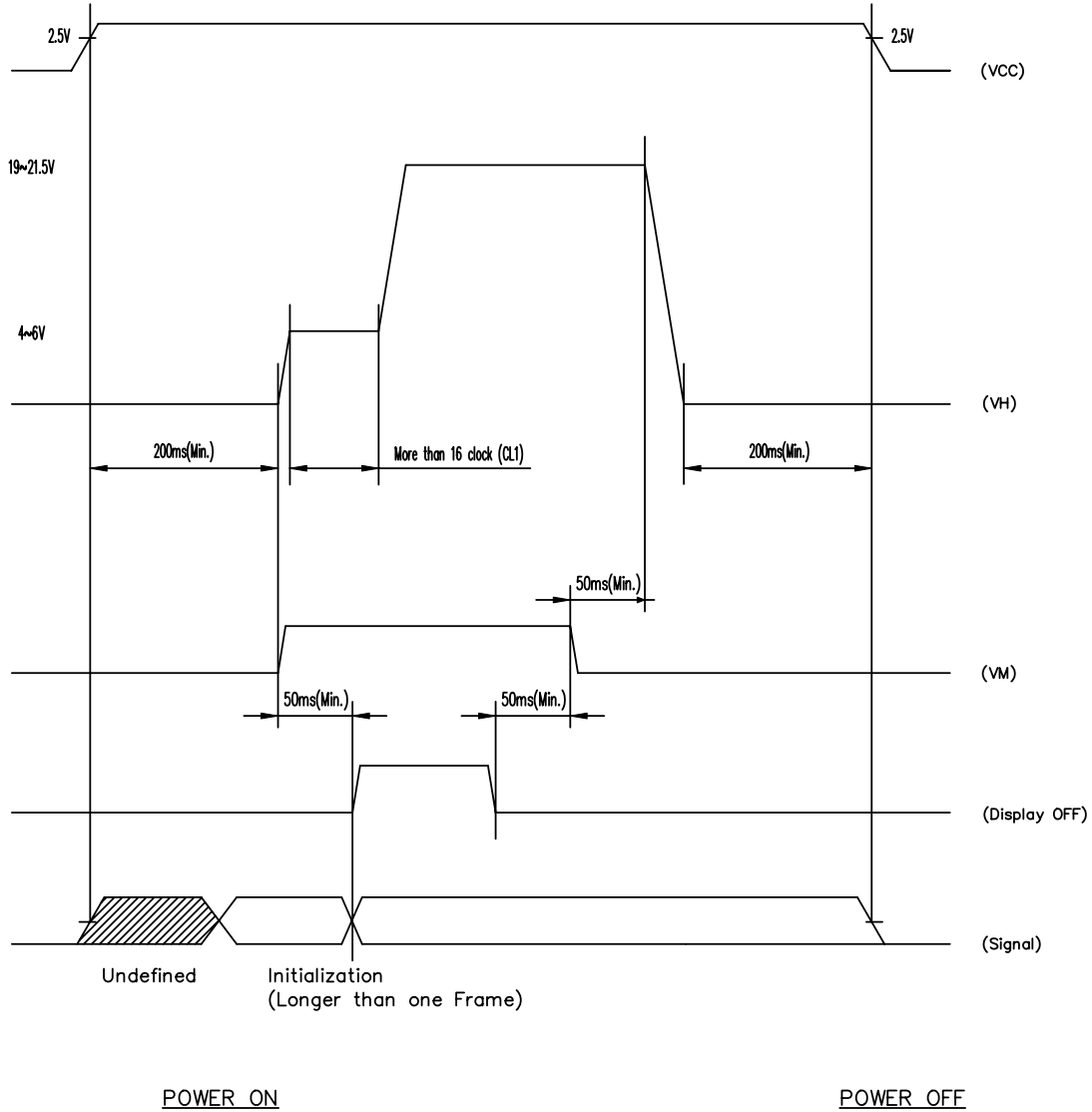


Fig . b Interface timing (COMMON)

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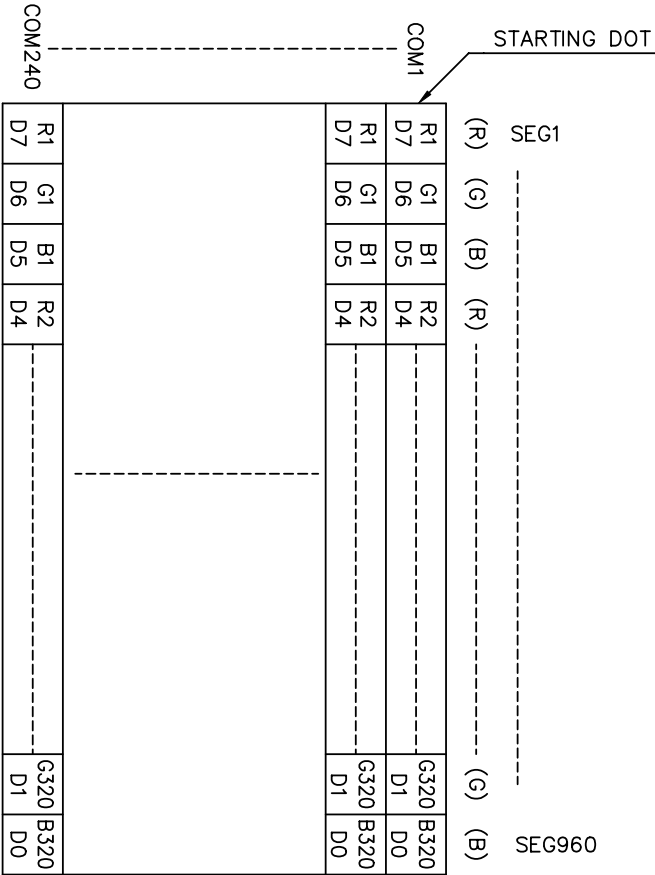
8-2. POWER ON/OFF TIMING



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

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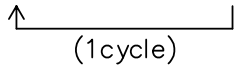
8-3. DISPLAY PATTERN



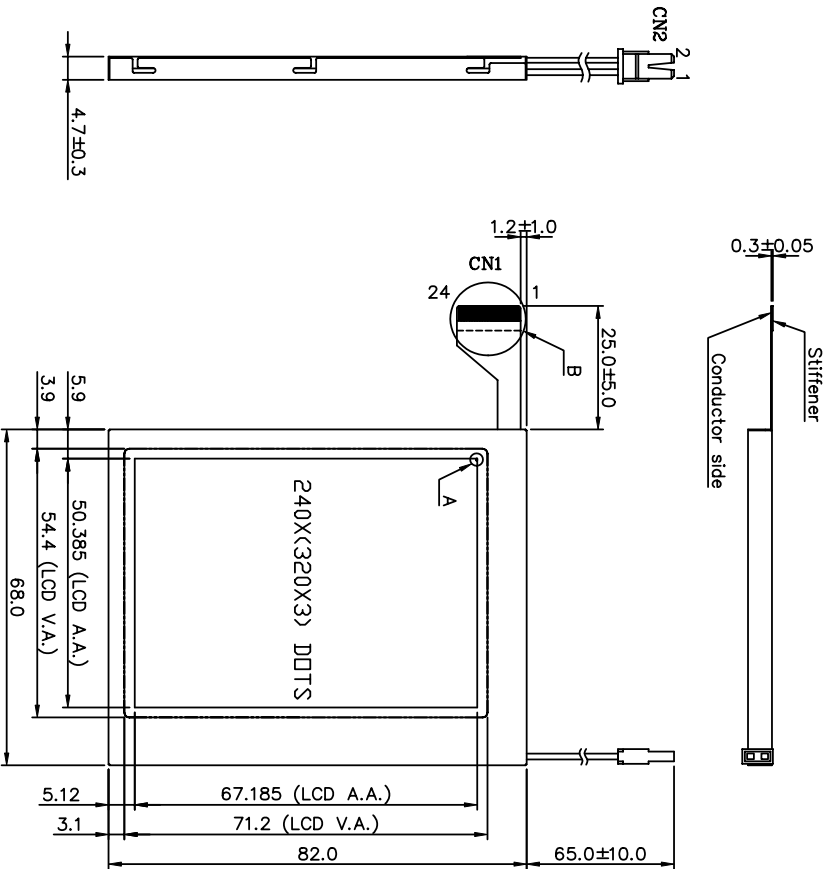
D0~D7 are 8 bits transmitted data, where D0 is LSB and D7 is MSB.

9. RELIABILITY TEST

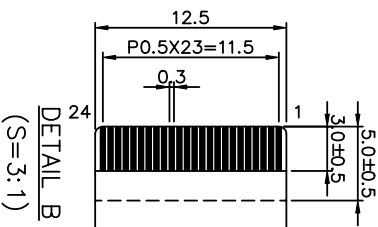
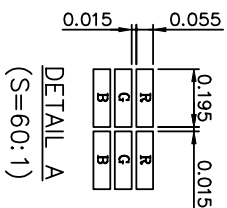
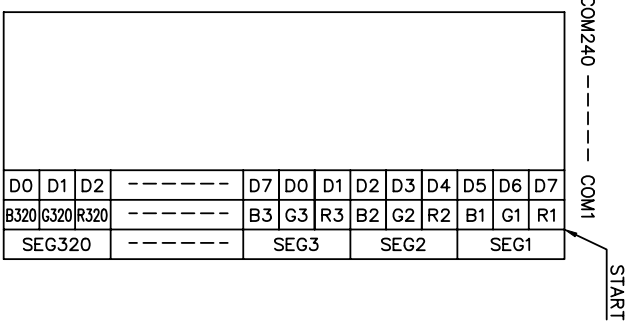
WIDE TEMPERATURE RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	80°C	120Hrs		Appearance without defect	
2	Low Temp. Storage	-40°C	120Hrs		Appearance without defect	
3	High Temp. & High Humi. Storage	60°C 90%RH	120Hrs		Appearance without defect	
4	High Temp. Operating Display	70°C	120Hrs		Appearance without defect	
5	Low Temp. Operating Display	-20°C	120Hrs		Appearance without defect	
6	Thermal Shock	-20°C, 30min → 70°C, 30min  (1cycle)			Appearance without defect	10 cycles

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VIEW DIRECTION



NOTES:

- 1.RESOLUTION: 240X(320X3) DOTS
- 2.BACKLIGHT: LED (White)
- 3.FRAME MATERIAL: SUS304 (0.2mmt)
- 4.LED CONNECTOR: BHSR-02VS-1 (JST)

PIN NO	SYMBOL	FUNCTION	PIN NO	SYMBOL	FUNCTION
1	VH	Power supply for LCD	16	DF	Switch signal to convert LCD drive waveform into AC
2	NC	No connection	17	GND	GND
3	/D,OFF	Ht. Display ON, L: Display OFF	18	V1	Bias voltage for driving LCD
4	FRM	Frame start signal (Data signal of the shift register of the common driver)	19	V0	Bias voltage for driving LCD
5	VCC	Power supply for logic (+3V)	20	VM	Bias voltage for driving LCD
6	D7	Display data	21	CEEL	Connecting a capacitor between pin21 and GND
7	D6	Display data	22	GND	GND
8	D5	Display data	23	C2	Connecting a capacitor between pin23 and pin24
9	D4	Display data	24	C1	Connecting a capacitor between pin23 and pin24
10	D3	Display data			
11	D2	Display data			
12	D1	Display data			
13	D0	Display data			
14	CP	Clock pulse for segment shift register			
15	LOAD	<1> Latch pulse of display data <2> Shift clock for common driver	1	A	Power supply voltage for LED backlight
			2	K	GND

GENERAL TOLERANCE LIST

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)

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REV. NO.	DESCRIPTION	DATE	DESIGN	CHECK	APPROVE	DWG NO.
△						HDW2432CL-2
△						
△						
△						