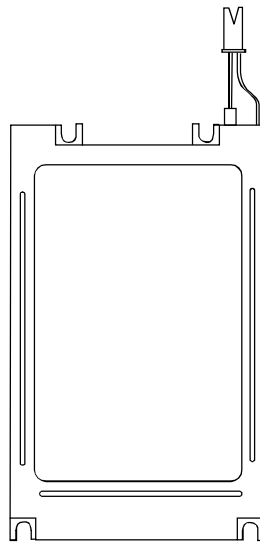


PRODUCT SPECIFICATION

HDM3224CL-S

320x240 COLOR GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: JK	REV.: 1.0	HDM3224CL-S	SHEET 1 OF 19
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1.MECHANICAL DATA

(1) Product No.	HDM3224CL-S
(2) Module Size	76.8 (W)mm x 103.7 (H)mm x 5.5(D)mm
(3) Dot Size	0.234 (W)mm x 0.068 (H)mm
(4) Dot Pitch	0.249 (W)mm x 0.083 (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 (PCF)
(8) Viewing Direction	6 O'clock
(9) Backlight	LED
(10) Controller	Excluded
(11) DC/DC Converter	Excluded
(12) Weight	66.7 g(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	VDD-VSS	-0.3	7.0	V	
Power Supply for LCD Drive	VEE-VSS	0	30.0	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 2,4		Note 3,4	

Note 1 LCM should be grounded during handling LCM.

Note 2 Ta ≤ 50°C : 85%RH max

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

Note 3 Ta at -20°C will be < 48 hrs, at 70°C will be < 120 hrs

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

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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
					4.5	5.0	5.5	
Input Voltage		VIH	H level		0.8VDD	—	VDD	V
		VIL	L level		0	—	0.2VDD	V
Recommended LCD Driving Voltage		VEE-VSS (Vop)	Duty=1/240 Bias=1/14	0°C	24.6	24.9	25.2	V
				25°C	23.2	23.5	23.8	
				50°C	22.3	22.6	22.9	
Power Supply Current		IDD	VDD-VSS = 3.3V VEE-VSS = 23.5V Ta= 25°C		—	0.45	0.7	mA
		IEE	PATTERN: □ ■ □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ ■ □		—	2.9	4.3	mA
		IDD	VDD-VSS = 5.0V VEE-VSS = 23.5V Ta= 25°C		—	0.85	1.3	mA
		IEE	PATTERN: □ ■ □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ ■ □		—	2.9	4.3	mA
LCM	Surface Luminance	L	VDD-VSS=3.3V VEE-VSS=23.5V Ta= 25°C If=55mA	PATTERN: (Dots All On of White Color) □ □ □ □ □ □ □ □	—	46.3	—	cd/m ²
				PATTERN: (Dots All Off) ■ ■ ■ ■ ■ ■ ■ ■	—	1.4	—	cd/m ²

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3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used LED Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Peak forward current	I _P	—	—	120	mA	—
Maximum reverse voltage	V _R	—	—	5	V	—
Applied forward current	I _F	—	55	83	mA	at V _F = 7.0 V
Applied forward voltage	V _F	—	7.2	—	V	at I _F = 55 mA
LED power consumption	P _F	—	0.4	—	W	—
LED life time	L _L	—	10000	—	hrs	at I _F = 60 mA (*1)
AVG. X of 1931 C.I.E.	X	0.31	0.33	0.35	—	—
AVG. Y of 1931 C.I.E.	Y	0.31	0.33	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

4-1 Optical Char. of Normal Temp. Mode

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.
Z	M	23	28	25	30	6	8	—	98	—	±48
Note		NOTE 6						NOTE 5			

note:

Z: TRANSMISSION (PCF)
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	0°C	580	730	880	ms	NOTE 2
		25°C	235	285	340		
		50°C	95	120	145		
Response Time (fall)	Tf	0°C	250	310	370	ms	NOTE 2
		25°C	60	75	90		
		50°C	45	60	75		

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4-2 Color of CIE Coordinate

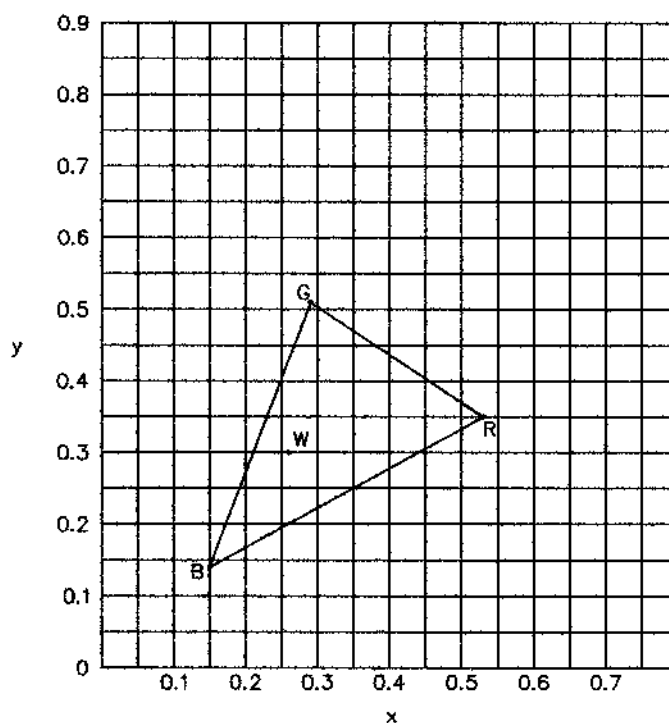
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	BRIGHTNESS (cd/m ²)	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^{\circ}$, $\theta=0^{\circ}$	0.53	9.7	Note※
		y		0.35		
	Green	X		0.29	26.9	
		y		0.51		
	Blue	X		0.15	10.1	
		y		0.14		
	White	X		0.26	35.2	
		y		0.30		

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

Tolerance : ± 0.05

Fig.1



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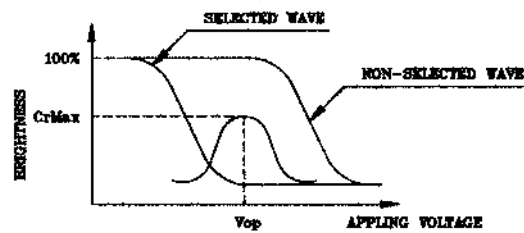
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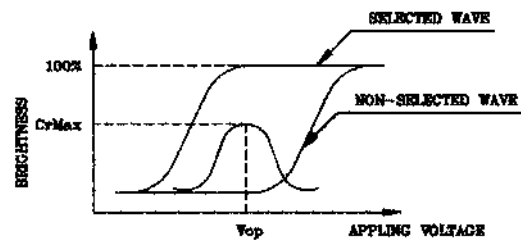
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

*Conditions

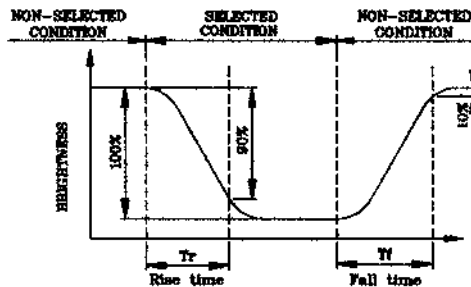
Viewing Angle : 0

Frame Frequency : 70Hz

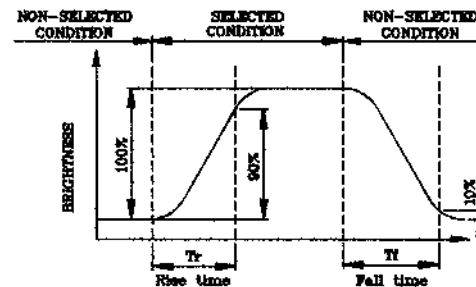
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



(negative type)

*Conditions

Operating Voltage : Vop

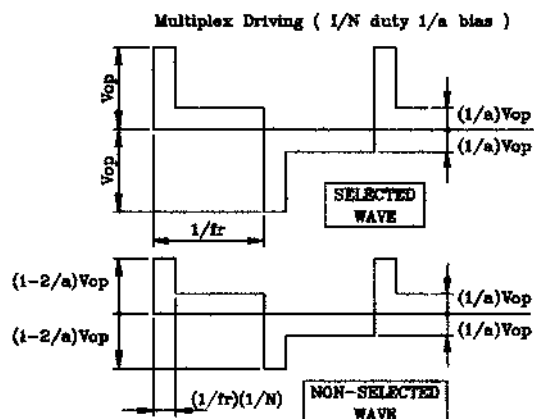
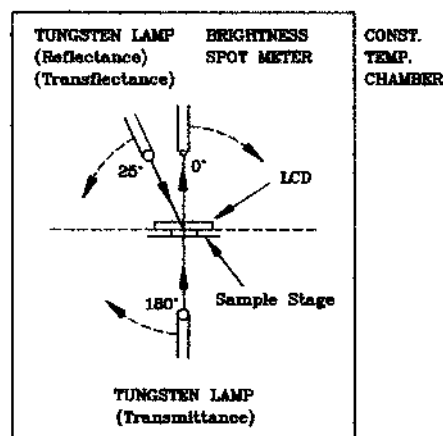
Viewing Angle (θ,s) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

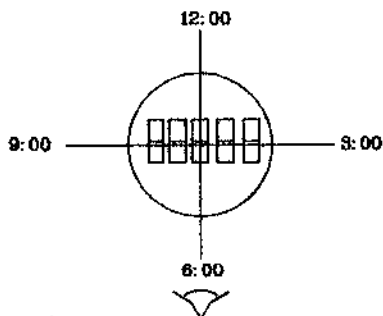
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



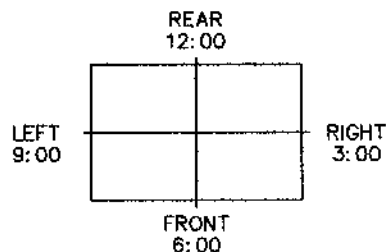
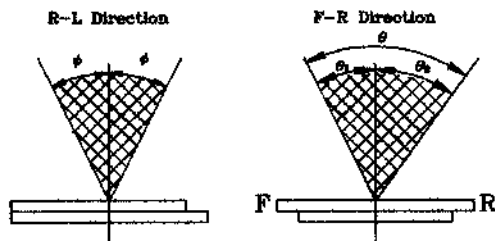
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

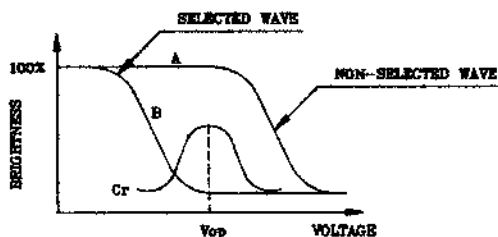
$$\theta = \theta_1 + \theta_2$$

*Conditions

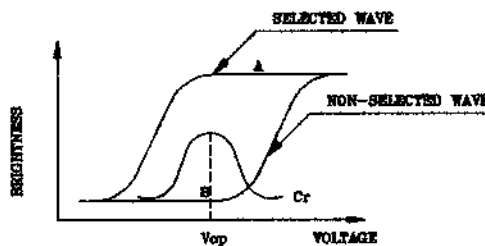
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(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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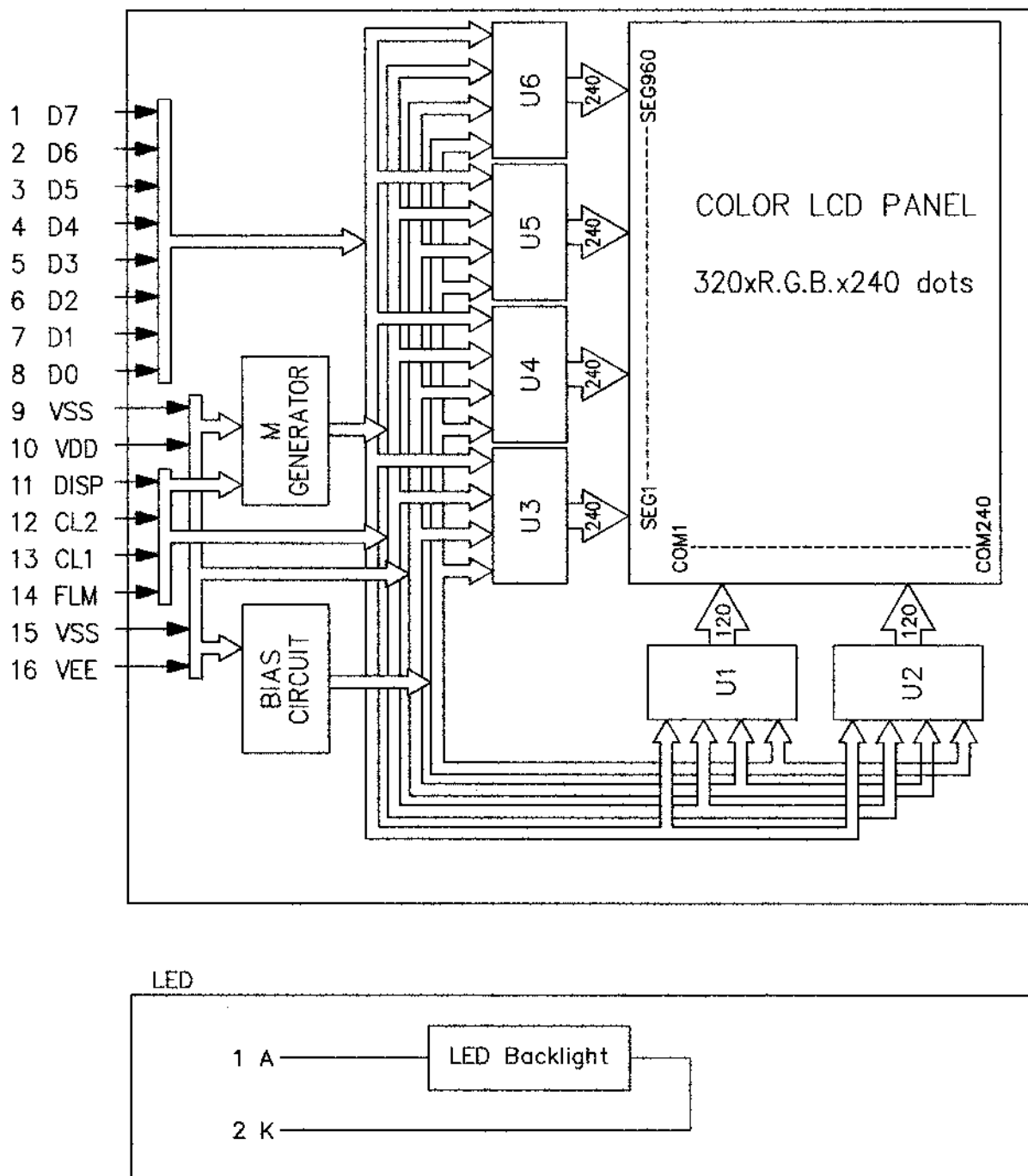
HDM3224CL-S

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5.BLOCK DIAGRAM



6.INTERNAL PIN CONNECTION

LCD

Pin No.	Symbol	Level	Function
1	D7	H/L	Display Data
2	D6	H/L	Display Data
3	D5	H/L	Display Data
4	D4	H/L	Display Data
5	D3	H/L	Display Data
6	D2	H/L	Display Data
7	D1	H/L	Display Data
8	D0	H/L	Display Data
9	VSS	—	GND
10	VDD	—	Power Supply for Logic
11	DISP	H/L	Display Control Signal, H : Display on L : Display off
12	CL2	H/L	Data input clock
13	CL1	H/L	Input data latch signal
14	FLM	H/L	Scan start-up signal
15	VSS	H/L	Power Supply (0V,GND)
16	VEE	—	Power Supply for LCD

LED

Pin No.	Symbol	Level	Function
1	A	—	Power Supply Voltage for LED B/L
2	K	—	GND

LCD INTERFACE CONNECTOR

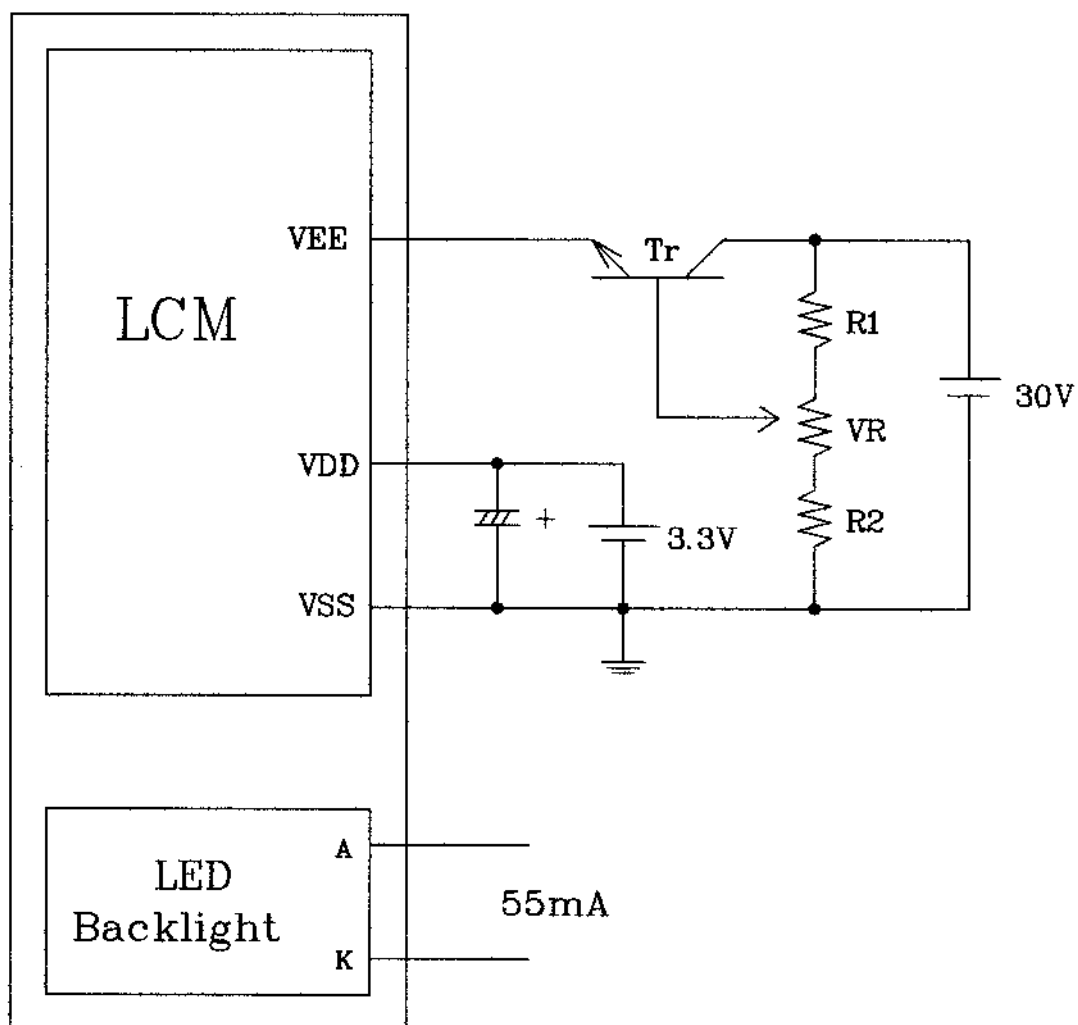
FH12-16S-0.5SV (HIROSE)/Suitable FFC :pitch 0.5mm ,width 8.5mm

LED CONNECTOR :

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

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7. POWER SUPPLY



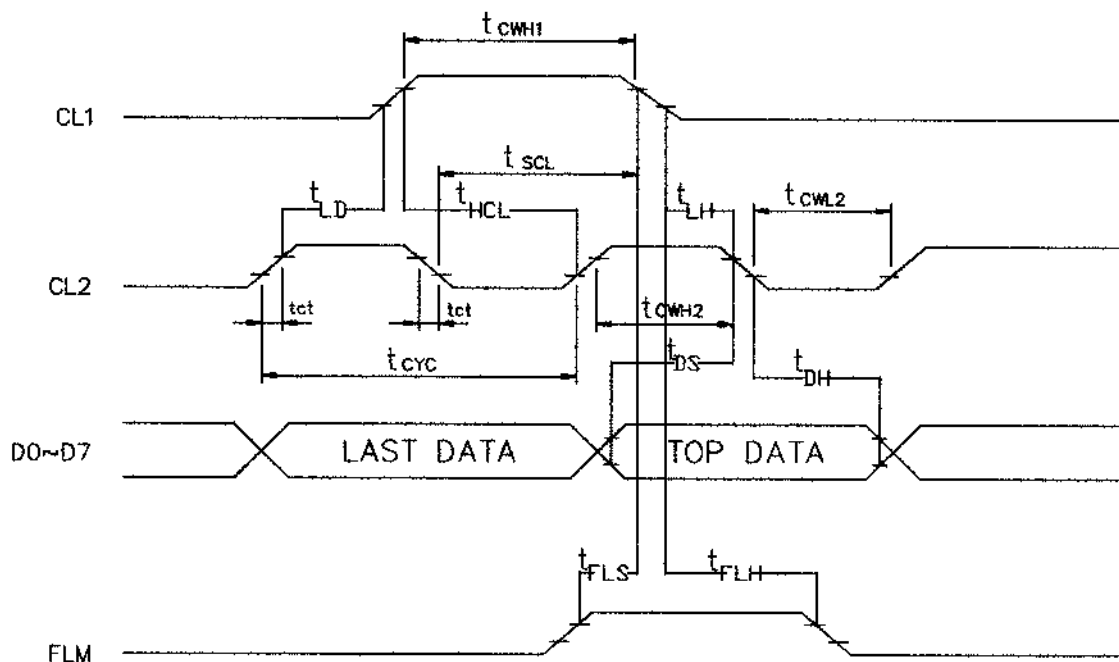
1. $R1 + R2 + VR = 10 \sim 20K \Omega$

8. TIMING CHARACTERISTICS

8-1 INTERFACE TIMING

VDD=3.3V ± 10%

Parameter	SYMBOL	MIN.	MAX.	UNIT
CLOCK CYCLE TIME	t_{cyc}	66	—	ns
CL2 HIGH LEVEL WIDTH	t_{cwh2}	23	—	ns
CL2 LOW LEVEL WIDTH	t_{cwl2}	23	—	ns
CL1 HIGH LEVEL WIDTH	t_{cwh1}	30	—	ns
CL2 SETUP TIME	t_{scl}	30	—	ns
CL2 HOLD TIME	t_{hcl}	30	—	ns
CL2 - CL1 RISE TIME	t_{LD}	10	—	ns
CL1 - CL2 FALL TIME	t_{t}	30	—	ns
CLOCK RISE / FALL TIME	t_{ct}	5	—	ns
DATA SETUP TIME	t_{ds}	10	—	ns
DATA HOLD TIME	t_{dh}	25	—	ns
FLM SETUP TIME	t_{fls}	30	—	ns
DATA HOLD TIME	t_{flh}	50	—	ns



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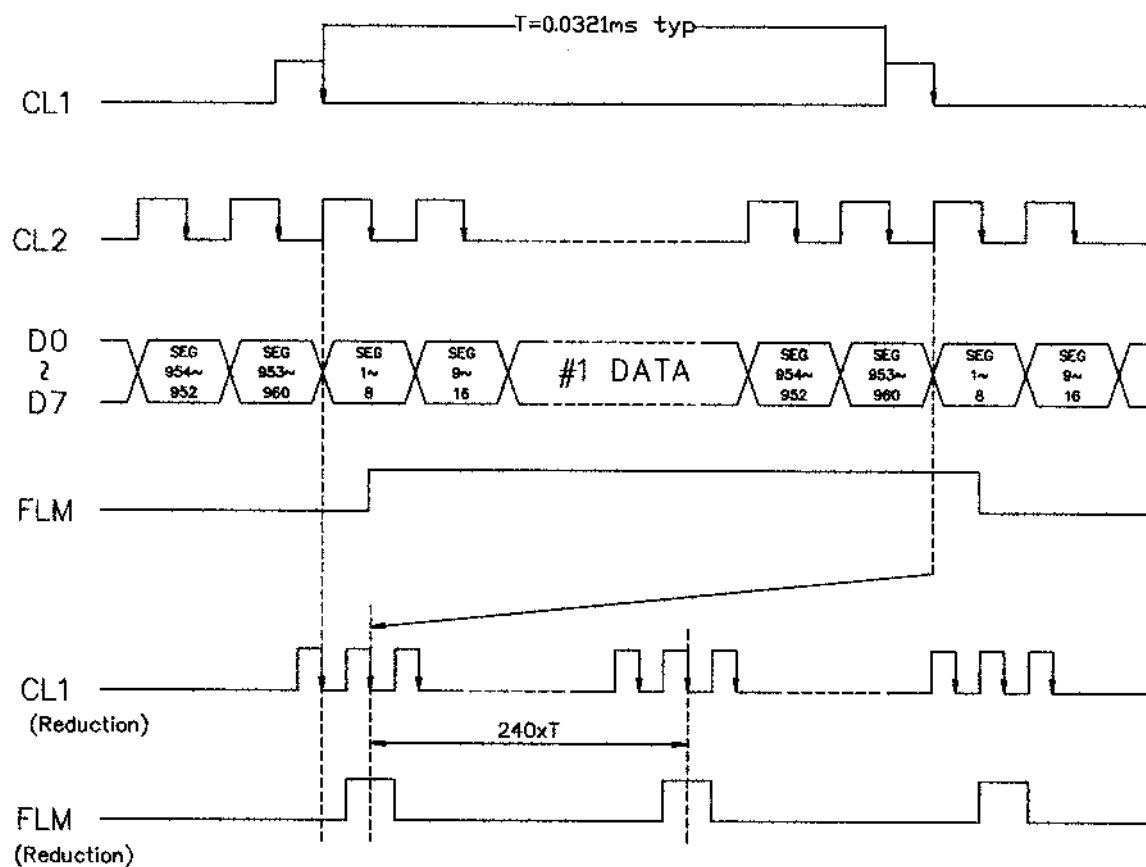
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8-2 TIMING CHART OF INPUT SIGNAL



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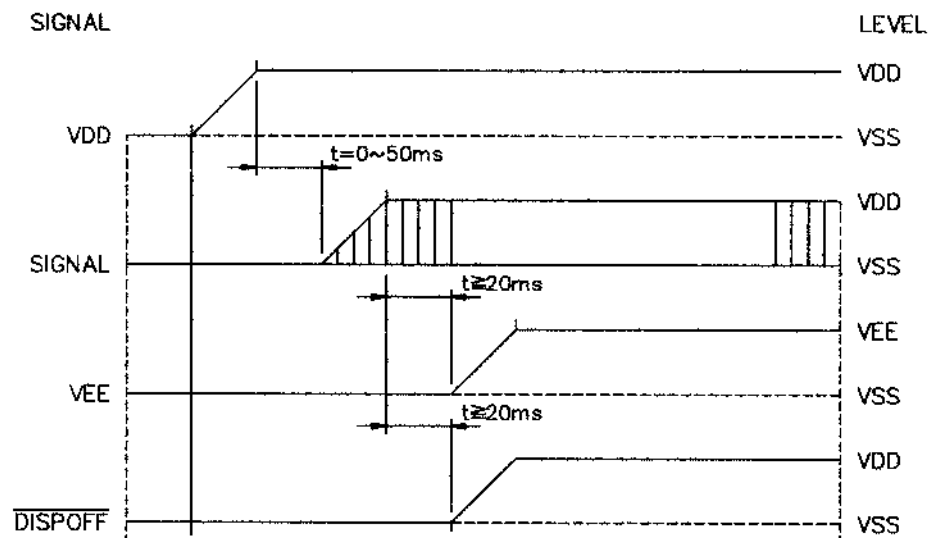
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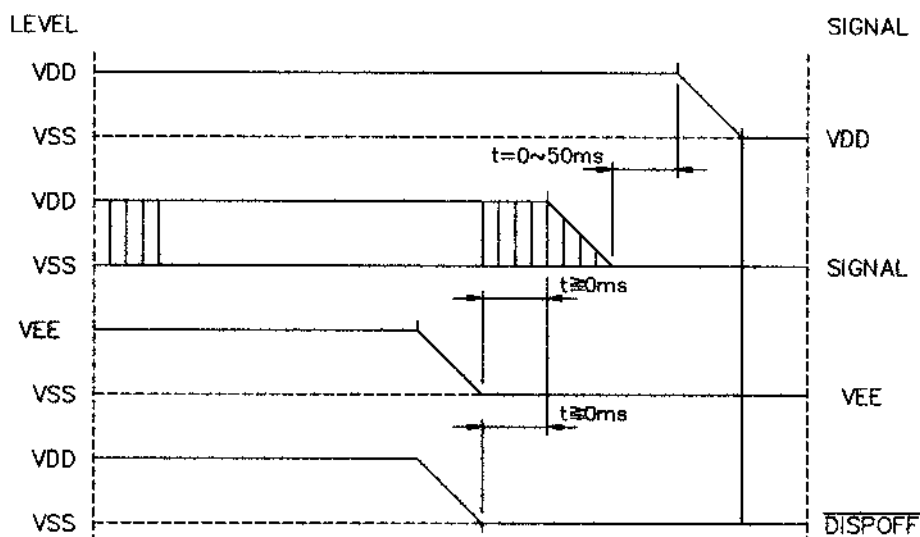
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8-3. POWER ON/OFF TIMING

ON SEQUENCE



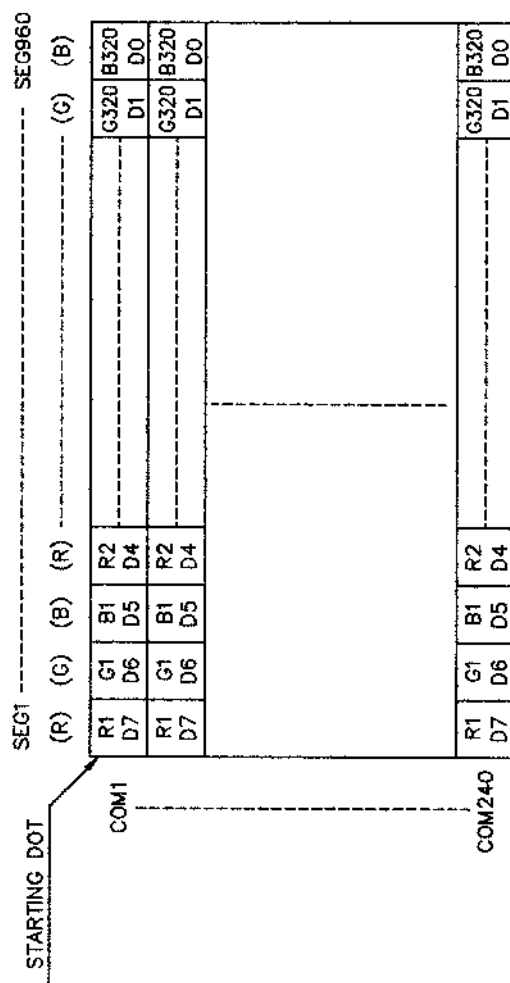
OFF SEQUENCE



Please maintain the above sequence when turning on and off the power supply of the module. If **DISPOFF** is supplied to the module while internal alternate signal for LCD driving(M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

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8-4. DISPLAY PATTERN



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

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.

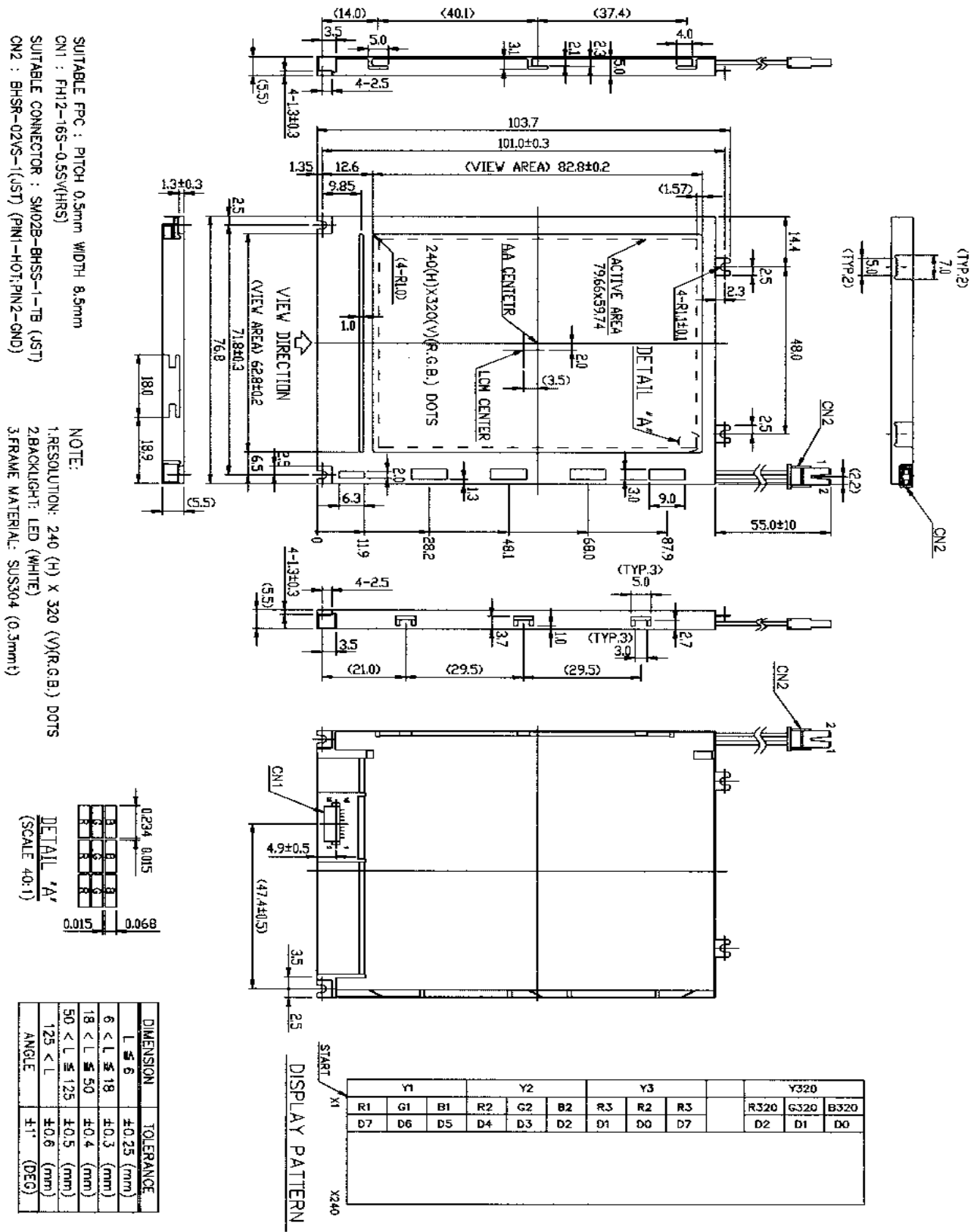
• STORAGE

- 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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SUITABLE FPC : PITCH 0.5mm WIDTH 8.5mm
 CN1 : FH12-16S-0.5S(VHRS)
 SUITABLE CONNECTOR : SMO2B-BHSS-1-TB (JST)
 CN2 : BHSR-02VS-1(IJST) (PIN1-HOT;PIN2-GND)

NOTE:
 1.RESOLUTION: 240 (H) X 320 (V)(R.G.B.) DOTS
 2.BACKLIGHT: LED (WHITE)
 3.FRAME MATERIAL: SUS304 (0.3mmt)

DETAIL 'A'

(SCALE 40:1)

0.234	0.015
0.015	0.068

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)

Y1			Y2			Y3			Y320		
R1	G1	B1	R2	G2	B2	R3	R2	R3	R320	G320	B320
D7	D6	D5	D4	D3	D2	D1	D0	D7	D2	D1	D0

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