AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR

LIQUID CRYSTAL DISPLAY

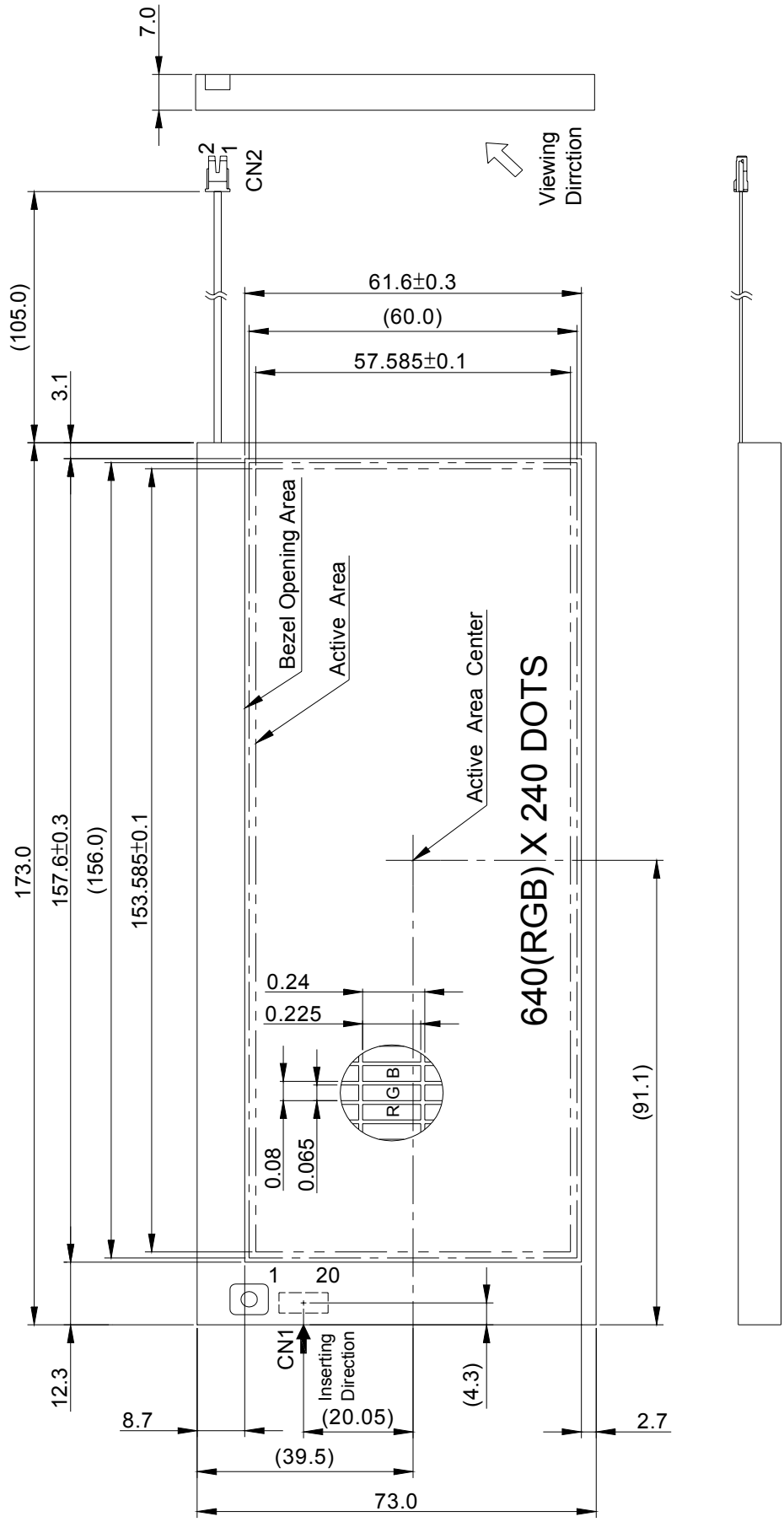
PART NUMBER:	AGM6424B
DATE:	March 8, 2006

3. LCD Module

3.1 Main Data

No.	Item	Contents	Unit
(1)	Module size	173.0(W) x 73.0(H) x 7.0(D)	mm
(2)	Viewing area	(156.0) (W) x (60.0) (H)	mm
(3)	Dot Number	640 x 3 (R.G.B) (W) x 240 (H)	dots
(4)	Dot Size	0.065(W) x 0.225(H)	mm
(5)	Dot pitch	0.08(W) x 0.24(H)	mm
(6)	LCD type	•Color-STN (Negative & transmissive type) • with glare upper polarizer .	-
(7)	Contrast ratio	(30)	-
(8)	Duty	1/244	-
(9)	Viewing direction	6 o‘clock	-
(10)	Operating temperature	-20 ~ +70	°C
(11)	Storage temperature	-30 ~ +80	°C
(12)	Backlight	LED x 10	pc
(13)	Power Supply Voltage	3.3V	-
(14)	Weight	122	g

3.2 Outline Dimension



CN1 : 52893-2070(MOLEX)
CN2 : BHSR-02VS-1 (JST)
Note 1 : All dimensional tolerance unless otherwise specified+/-0.5
Note 2 : Scale : NTS , Unit : mm

3.3 Interface Pin Connection

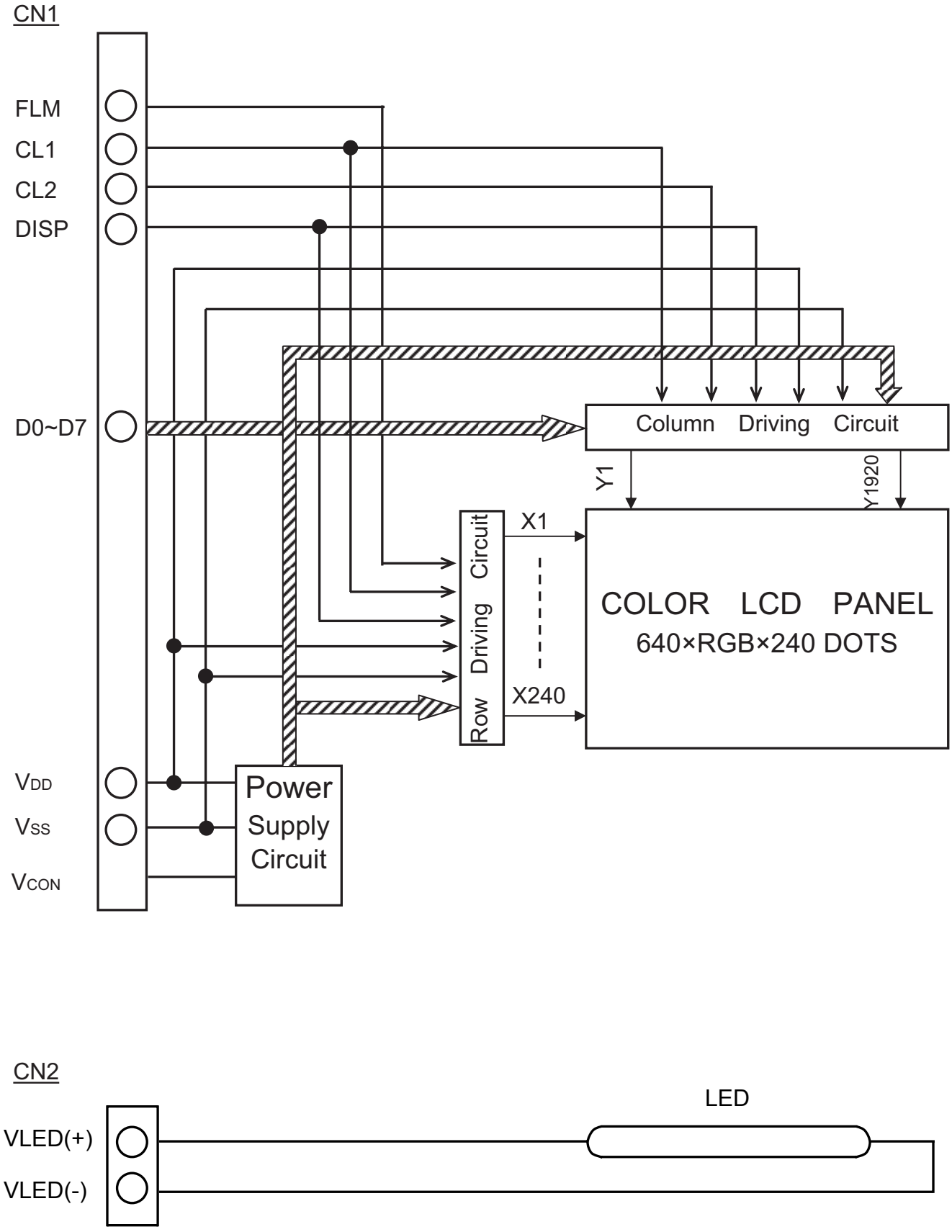
CN1 : 52893-2070(MOLEX) / Suitable FPC : Pitch 0.5mm, width 10.5mm

Pin No.	Signal	Pin Function
1	FLM	Scan start-up signal
2	V_{SS}	NC
3	CL1	Input data latch signal
4	V_{SS}	GND
5	CL2	Data shift clock
6	V_{SS}	GND
7	DISP	Display control signal H:ON , L:OFF
8	V_{DD}	Logic supply voltage
9	V_{CON}	Contrast adjust voltage
10	V_{SS}	GND
11	D0	Display data
12	D1	Display data
13	D2	Display data
14	D3	Display data
15	V_{SS}	GND
16	D4	Display data
17	D5	Display data
18	D6	Display data
19	D7	Display data
20	V_{SS}	NC

CN2 : BHSR-02VS-1 (JST) / Suitable connector : SM02B-BHSS-1-TB (JST)

Pin No.	Signal	Pin Function
1	LED(+)	Power supply voltage for LED
2	LED(-)	LED GND

2. Block Diagram



6. Electrical Characteristics

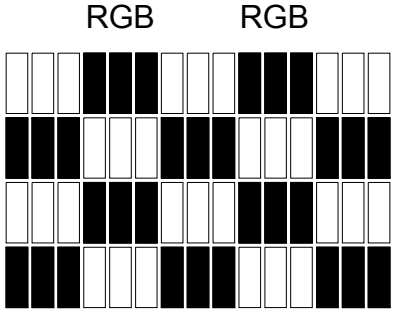
6.1 Electrical Characteristics of LCD

Item	Symbol	Condition		MIN.	Typ.	Max.	Unit
Power Supply for Logic	V_{DD}	—		3.0	3.3	3.6	V
Contrast adjust voltage	V_{CON}	Note(1)	Ta= 5°C	0.8	—	—	V
			Ta=25°C	1.3	1.8	2.3	
			Ta=40°C	—	—	2.8	
Input Signal Voltage	V_{IH}	"H" Level		0.8V_{DD}	—	V_{DD}	V
Note (2)	V_{IL}	"L" Level		0	—	0.2V_{DD}	
Power supply current Note (3)	I_{DD}	V_{DD}=3.3V		—	130	180	mA
Frame Freguency Note (4)	fFLM	—		(60)	(75)	(90)	Hz

Note (1) In proportion as the V_{CON} voltage decrease the brightness will increase.
The value is specified as the voltage at which the optimum contrast is obtained.

Note (2) FLM,CL1,CL2,$\overline{\text{DISPOFF}}$,D0~D7

Note (3) fFLM=75Hz,Ta=25°C,Display pattern is Black/White cross pattern as below.



Note (4) Need to make sure that there is no flicker and ripple phenomenon when setting the Frame Frequency in your set.

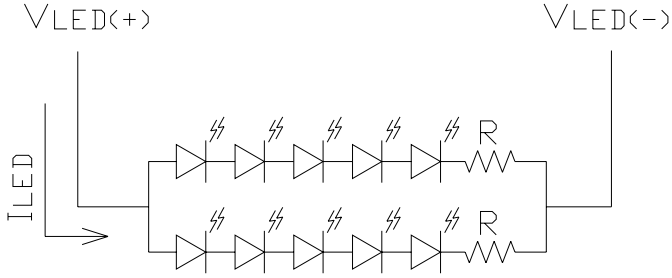
6.2 Electrical Characteristics of Backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Voltage	VLED	-	(18.0)	(20.0)	V	Note 1
Current	ILED	-	40.0	-	mA	Note 2
Number of LED	-	-	10	-	EA	-
Power Consumption	-	-	0.72	-	W	Note 3

Note (1): VLED = VLED(+) – VLED(-) .

Note (2): The current of LED is 20 mA for each one.
LED driving in constant current mode is recommended .

Note (3): LED power consumption is around 0.072W for each one.



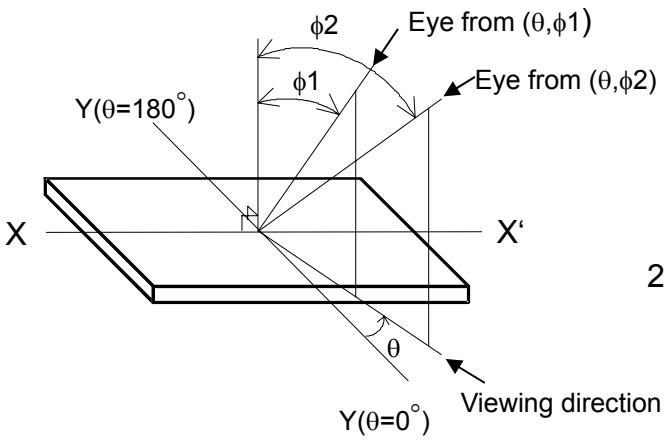
7. Optical Characteristics

7.1 Optical Characteristics of LCD

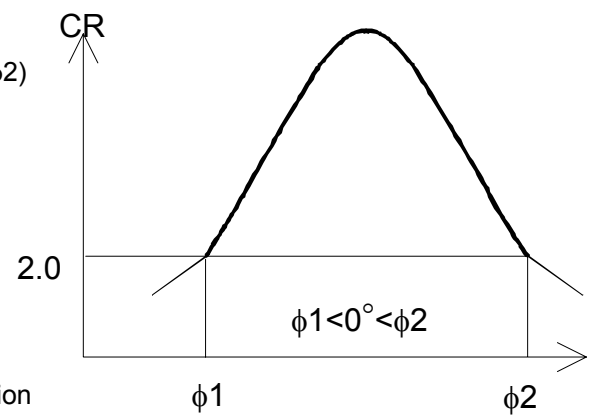
Ta= 25°C.(Backlight On)

Item		Symbol	Condition		Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range		$\phi1$, $\phi2$	CR≥2	X axle	-	60	-	Deg.	Note 1,2
				Y axle	-	35	-		
Contrast Ratio		CR	$\phi=0^\circ$		20	30	-	-	Note 3,4
Response Time	Rise	tr	$\theta=0^\circ,\phi=0^\circ$		-	(360)	-	ms	Note 5
	Fall	tf	$\theta=0^\circ,\phi=0^\circ$		-	(130)	-	ms	
Color Tone (CIE Coordinate)	R	x	$\theta=0^\circ,\phi=0^\circ$		0.50	0.55	0.60	-	
		y			0.29	0.34	0.39	-	
	G	x			0.26	0.31	0.36	-	
		y			0.49	0.54	0.59	-	
	B	x			0.10	0.15	0.20	-	
		y			0.11	0.16	0.21	-	
	W	x			0.25	0.30	0.36	-	
		y			0.30	0.35	0.40	-	

Note 1. Definition of θ and ϕ



Note 2. Definition of Viewing angle ϕ1 and ϕ2



CR vs Viewing and ϕ

5. Maximum Ratings

5.1 Electrical Absolute Maximum Ratings. (LCM)

(V_{SS}=0V)

Item	Symbol	Min.	Max.	Unit
Power supply for Logic	V_{DD}-V_{SS}	-0.3	7.0	V
Input voltage (Note 1)	V_I	-0.3	V_{DD}+0.3	V

Note 1. FLM,CL1,CL2,DISP,D0~D7.
Note 2. Ta=25°C
Note 3. Please be sure users are grounded when handling LCD module.

5.2 Environmental Absolute Maximum Ratings

Item	Operating		Storage		Remark
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-20°C	70°C	-30°C	80°C	Note1,2
Humidity	Note 3		Operating		No Condensation
Vibration	—	2.45m/s^2	—	11.76 m/s^2 Note 4	1h max Note 5
Shock	—	29.4 m/s^2	—	490 m/s^2 Note 4	XYZ directions 11ms

Note 1. Ta at -30°C --------< 48hours, at 80°C --------< 120 hours.

Note 2. Background color changes slightly depending on ambient temperature.
The phenomenon is reversible.

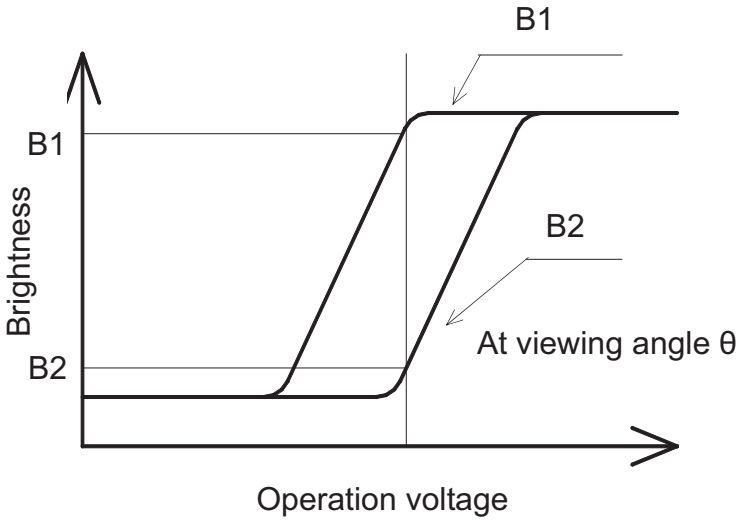
Note 3. Ta<=40°C : 85%RH MAX.
Ta> 40°C : Absolute humidity must be lower than the humidity of 85% RH at 40°C.

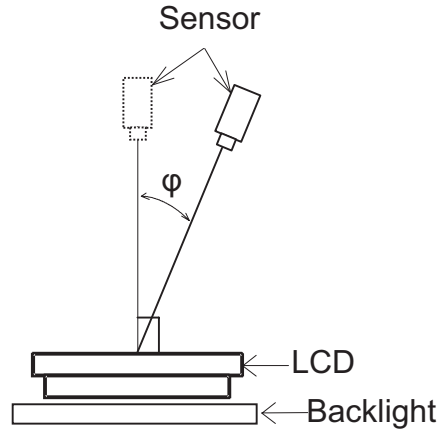
Note 4. The module should be operated normally after the test is finished.

Note 5. 5Hz ~100Hz (Except resonance frequency)

Note 3. Definition of Contrast Ratio CR

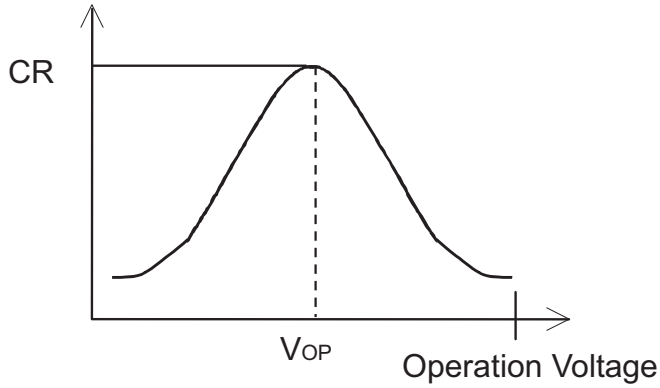
$$CR=\frac{\text{Brightness at selected dot (B1)}}{\text{Brightness at non-selected dot (B2)}}$$



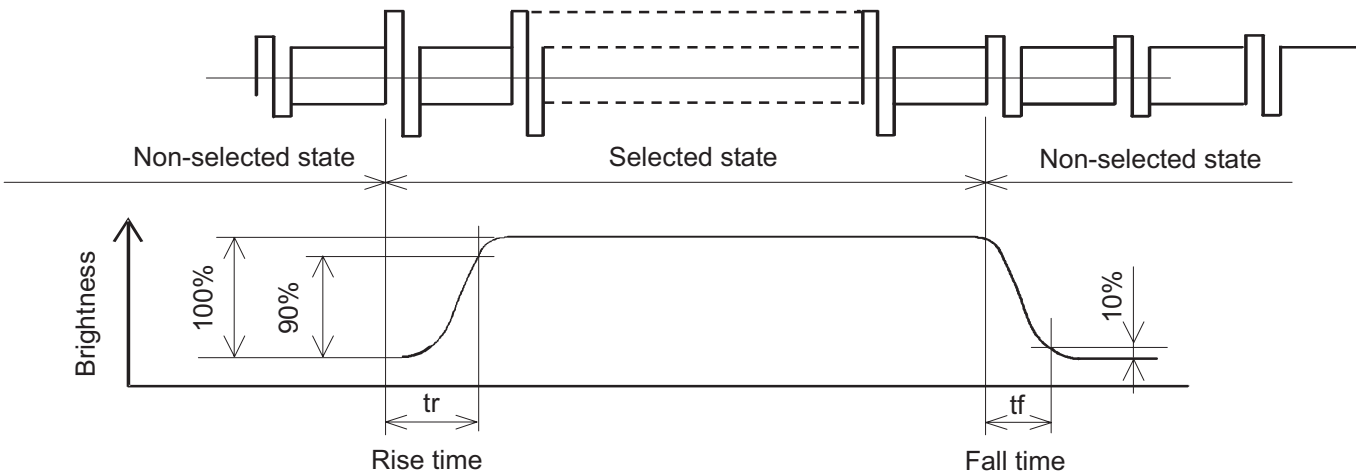


Sensor : BM-7
Aperture : 1°
Distance : 50 cm

Note 4. Definition of "CR"and "V_{OP}"



Note 5. Definition of optical response time



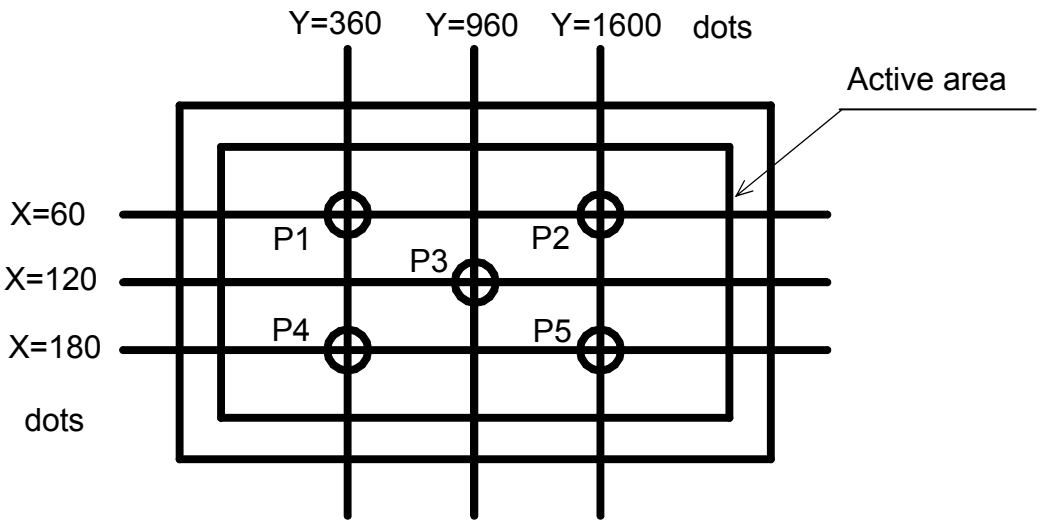
7.2 Optical Characteristics of Backlight

Item	Min,	Typ.	Max.	Unit	Remark
Brightness	80	100	-	cd/m^2	Note 1,2,3
Brightness Uniformity	-	-	+/-30	%	Note 2,3,4

Note 1. Measurement Condition:

- Display data should be all “ON” (D0~D7=HIGH).
- VDD=3.3V, VLED=(18.0V), ILED=40mA,V_{CON} should be adjusted at the voltage where the peak contrast is obtained by naked eyes as the “All Q” pattern.

Note 2. Measured on the following 5 points of the display.



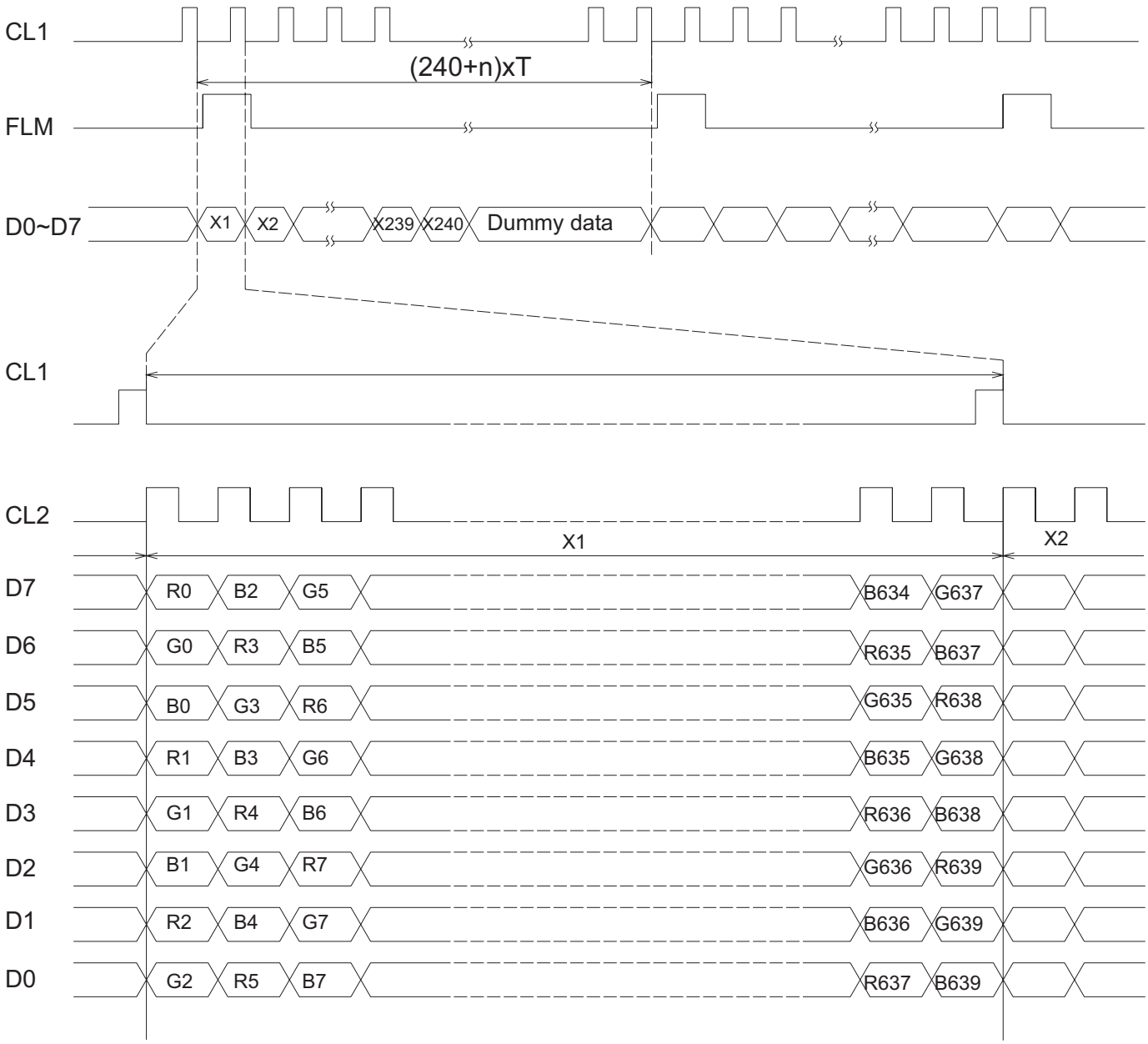
Note 3. The brightness shall be the average of P1~P5 point.

Note 4. Definition of the brightness Uniformity

$$\left(\frac{\text{Max brightness or Min brightness} - \text{Average brightness}}{\text{Average brightness}}\right) \text{x100\%}$$

6 Interface Timing Chart

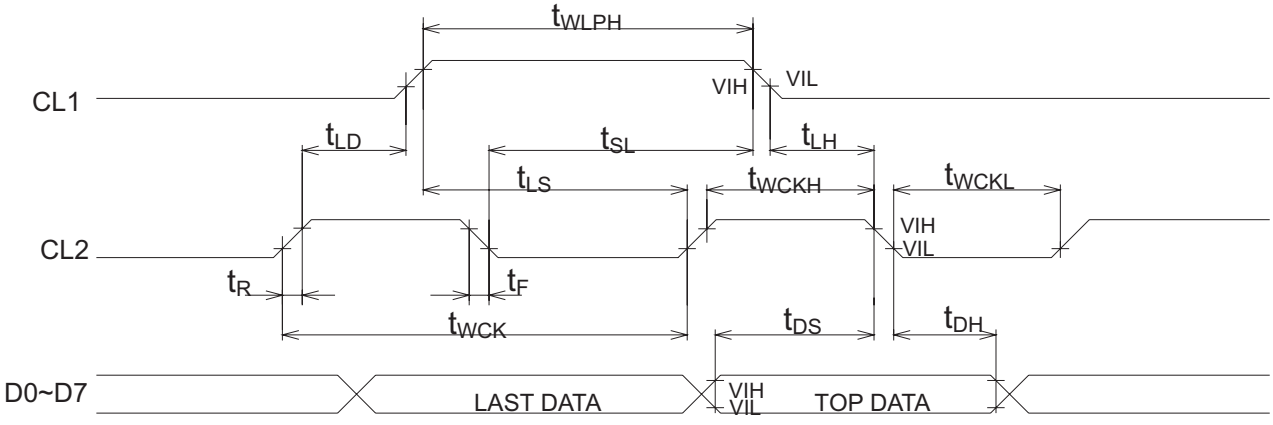
6.1 Timing Chart

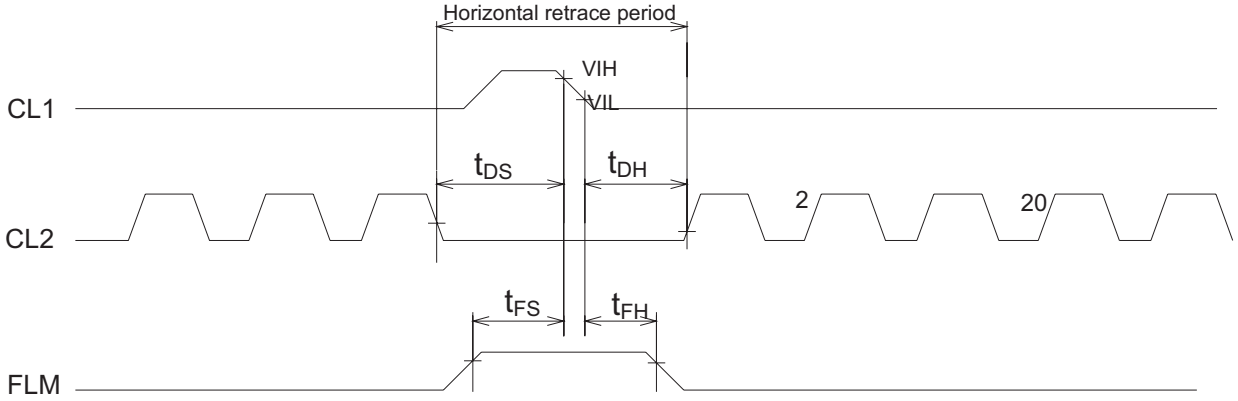


6.2. Electrical Characteristics

(V_{DD}=3.0~4.5V ,V_{LCD}= +10.0~ +42.0V, Ta=+0°C~40°C)

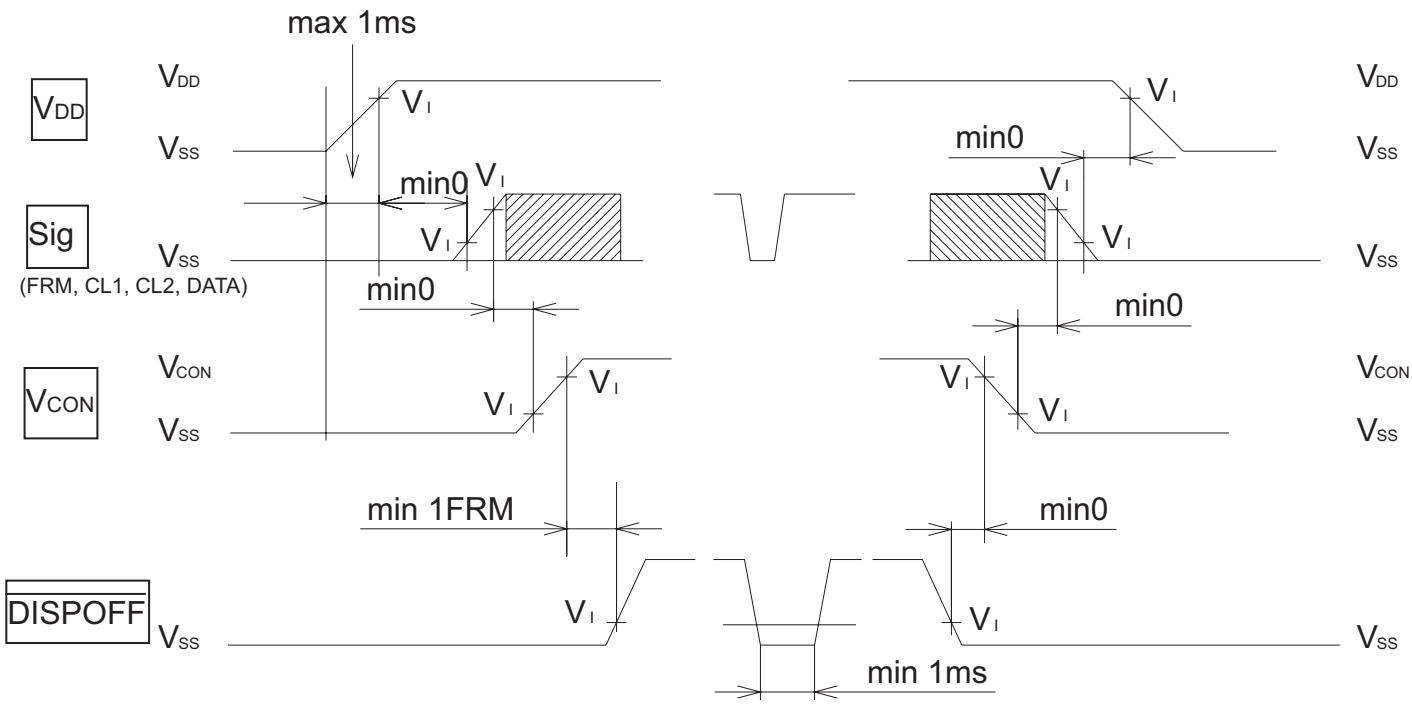
Item	Symbol	Min.	Typ.	Max.	Unit
Shift clock period	t_{WCK}	66	-	-	ns
Shift clock “H” pulse wide	t_{WCKH}	23	-	-	ns
Shift clock “L” pulse wide	t_{WCKL}	23	-	-	ns
Data setup time	t_{DS}	10	-	-	ns
Data hold time	t_{DH}	25	-	-	ns
Latch pulse “H” pulse wide	t_{WLPH}	30	-	-	ns
Shift clock rise to latch pulse rise time	t_{LD}	10	-	-	ns
Shift clock fall to latch pulse fall time	t_{SL}	30	-	-	ns
Latch pulse rise to shift clock rise time	t_{LS}	30	-	-	ns
Latch pulse fall to shift clock fall time	t_{LH}	30	-	-	ns
Enable setup time	t_{TS}	12	-	-	ns
Input signal rise time	t_R	-	-	50	ns
Input signal fall time	t_F	-	-	50	ns
Output delay	t_D	-	-	44	ns
FLM setup time	t_{FS}	30	-	-	ns
FLM hold time	t_{FH}	50	-	-	ns





6.3 Power Supply and Signal Sequence

Do not apply DC voltage to the LCD panel because that induces the electrochemical reaction and reduces its life time. Please follow the power supply ON/OFF sequence to prevent DC driving of LCD or latch-up of COMS LSI, as shown below.



POWER ON POWER OFF

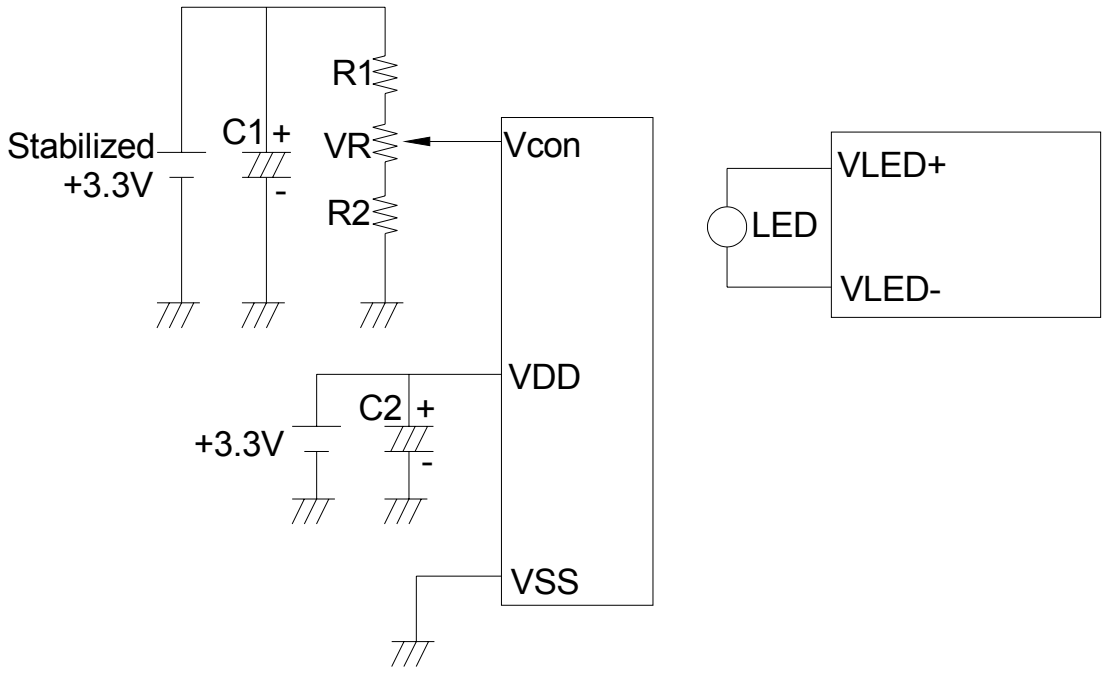
Note 1. Please keep the specified sequence because wrong sequence may cause permanent damage to the LCD panel.
Note 2. Please use $\overline{\text{DISPOFF}}$ function. Switching by other than the $\overline{\text{DISPOFF}}$ function may cause display deterioration.
Note 3. V_{CON} voltage should be set up to adjusted voltage before $\overline{\text{DISPOFF}}$ signal arises. Otherwise, when $\overline{\text{DISPOFF}}$ signal arises, adjusted contrast image may not be generated.
Note 4. Please keep the specified sequence of $\overline{\text{DISPOFF}}$ signal because if the signal is short enough, LCD panel may not be restarted. (min. 1ms)

6.4 Input Data Allocation Table

Data Signal	D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4		D4	D3	D2	D1	D0
Y / X	1	2	3	4	5	6	7	8	9	10	11	12	-------	1916	1917	1918	1919	1920
1	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
2	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
3	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
4	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
5	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
6	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
7	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
8	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
9	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
10	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
|	|	|	|	|	|	|	|	|	|	|	|	|		|	|	|	|	|
238	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
239	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B
240	R	G	B	R	G	B	R	G	B	R	G	B		G	B	R	G	B

R : RED
G : GREEN
B : BLUE

6.5 Power supply for LCM



7. Quality Assurance

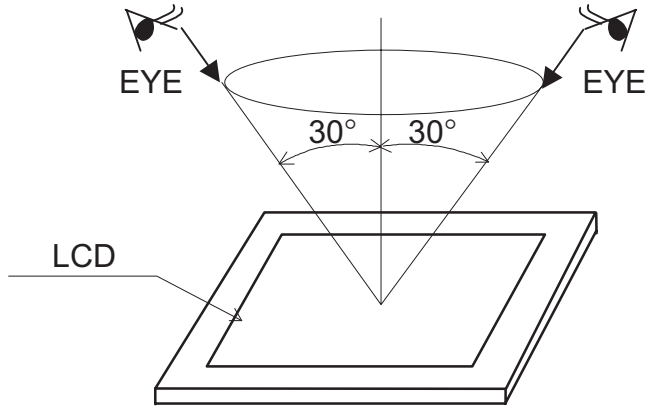
7.1 Appearance Inspection

Appearance inspection should be done under the following condition.

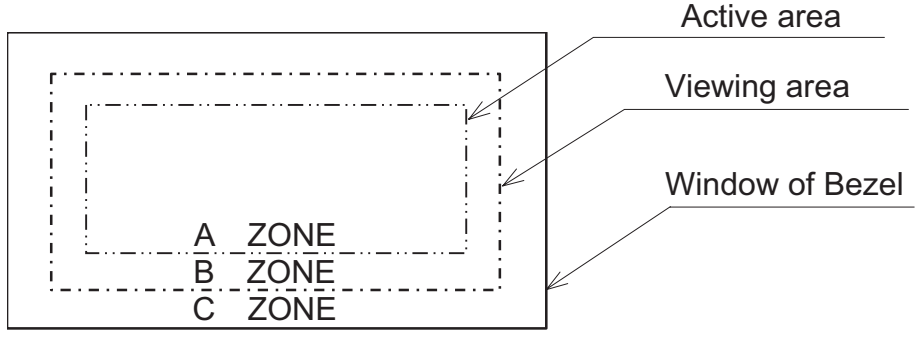
(1) In the dark room. The CFL should be lighted with the prescribed inverter.

(2) The distance from eyes to LCD must be 30 cm.

(3) Viewing direction must be within 30 degrees to vertical line of LCD center.



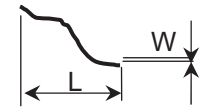
7.2 Definition of A zone, B zone and C zone

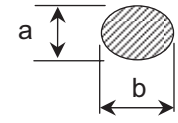


7.3 Appearance Criterion

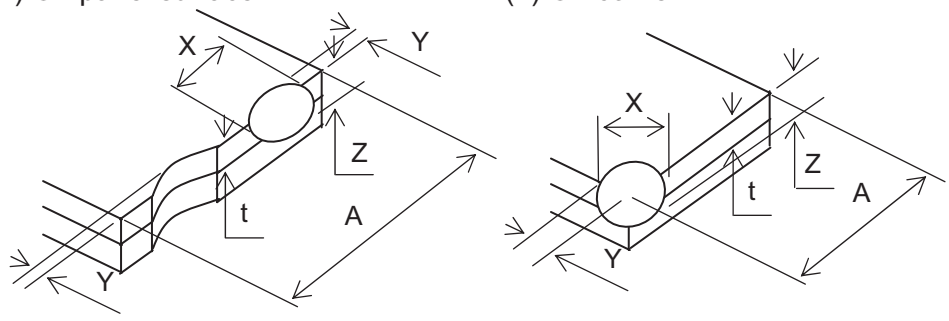
Customer and supplier should hold a discussion when there is any problem about standard quality assurance or special quality assurance is needed.

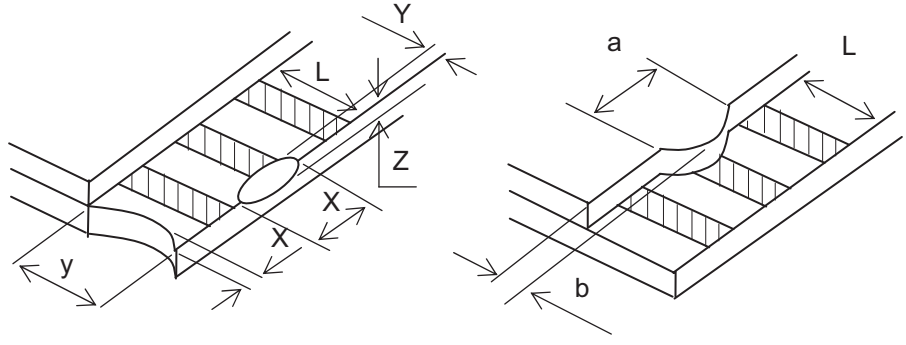
Inspection Standard: MIL-STD-105E normal inspection level II

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th><th>Zone</th><th>AQL</th></tr>
<tr><td>1</td><td>Stains
Scratches
Black spots
White spots
Foreign particles</td><td>Line shape:
<table>
<tr><th>Length</th><th>Width</th><th>Acceptable Q'ty</th></tr>
<tr><td>L ≤ 2.0</td><td>W ≤ 0.03</td><td>Disregard</td></tr>
<tr><td>L ≤ 3.0</td><td>0.03 < W ≤ 0.05</td><td>6</td></tr>
<tr><td>L ≤ 2.5</td><td>0.05 < W ≤ 0.1</td><td>1</td></tr>
<tr><td>-</td><td>0.1 < W</td><td>As round shape</td></tr>
</table>


Round shape:
<table>
<tr><th>Diameter</th><th>Acceptable Q'ty</th><th>Mininum Space</th></tr>
<tr><td>D ≤ 0.2</td><td>Disregard</td><td>—</td></tr>
<tr><td>0.2 < D ≤ 0.3</td><td>10</td><td>10 mm</td></tr>
<tr><td>0.3 < D ≤ 0.4</td><td>5</td><td>30 mm</td></tr>
<tr><td>0.4 < D</td><td>0</td><td>—</td></tr>
</table>
D=(a+b)/2


The total number of “Line”+”Round” is 10 max.
Any defect wiped out easily is acceptable.</td><td>A,B</td><td>2.5</td></tr>
<tr><td>2</td><td>Bubbles</td><td>
<table>
<tr><th>Diameter</th><th>Acceptable Q'ty</th></tr>
<tr><td>D ≤ 0.2</td><td>Disregard</td></tr>
<tr><td>0.2 < D ≤ 0.3</td><td>12</td></tr>
<tr><td>0.3 < D ≤ 0.5</td><td>3</td></tr>
<tr><td>0.5 < D</td><td>0</td></tr>
</table>
</td><td>A,B</td><td>2.5</td></tr>
<tr><td>3</td><td>Display quality</td><td>• Viewing angle defect.
• Missing dots or missing lines.
• Malfunction.
• Contrast ratio defect.
• Power consumption exceeds specification.</td><td>A</td><td>0.65</td></tr>
<tr><td>4</td><td>Color tone
Color uniformity</td><td>To be judged by Arima Display Corporation.</td><td>A</td><td>2.5</td></tr>
<tr><td>5</td><td>Contrast
Irregularity</td><td>(1)Spot (Peak contrast)
<table>
<tr><th>Diameter</th><th>Acceptable Q'ty</th><th>Mininum Space</th></tr>
<tr><td>D ≤ 0.25</td><td>ignored</td><td>—</td></tr>
<tr><td>0.25 < D ≤ 0.35</td><td>10</td><td>20mm</td></tr>
<tr><td>0.35 < D ≤ 0.5</td><td>4</td><td>20mm</td></tr>
<tr><td>0.5 < D ≤ 0.7</td><td>3</td><td>50mm</td></tr>
<tr><td>0.7 < D</td><td>0</td><td>—</td></tr>
</table>
(2)Line (Peak contrast)
<table>
<tr><th>Width</th><th>Length</th><th>Acceptable Q'ty</th><th>Mininum Space</th></tr>
<tr><td>W ≤ 0.10</td><td>L ≤ 3.0</td><td>4</td><td>20mm</td></tr>
<tr><td>W ≤ 0.15</td><td>L ≤ 2.0</td><td>3</td><td>20mm</td></tr>
<tr><td>W ≤ 0.20</td><td>L ≤ 1.5</td><td>3</td><td>20mm</td></tr>
<tr><td>W ≤ 0.25</td><td>L ≤ 1.2</td><td>2</td><td>20mm</td></tr>
</table>
(1)+(2) The total number of “Spot”+”Line” is 8 Max.</td><td>A</td><td>2.5</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th><th>Zone</th><th>AQL</th></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Chips
(LCD panel)</td><td>(1) On panel surface (2) On corner


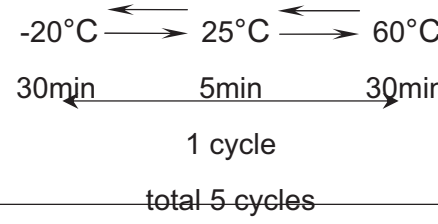
<table>
<tr><th>Z</th><th>Y</th><th>X</th></tr>
<tr><td>Z<=1/2t</td><td>Not over viewing area</td><td>X<=1/8A</td></tr>
<tr><td>1/2t<Z<=2t</td><td>Not exceed 1/3S</td><td>X<=1/8A</td></tr>
</table>
S: Seal area, X is total length if there are 2 or more chips.</td><td rowspan="3">A</td><td rowspan="3">2.5</td></tr>
<tr><td>(3) On electrode pad (4) Substrate protuberance


<table>
<tr><th>Y</th><th>X</th><th>Z</th></tr>
<tr><td>Y<=0.5</td><td>X<=1/8A</td><td>0<Z<=t</td></tr>
</table>
<table>
<tr><th>a</th><th>b</th></tr>
<tr><td>a<=A</td><td>b<=1/3L</td></tr>
</table>
<table>
<tr><th>y</th><th>X</th><th>Z</th></tr>
<tr><td>Y<=L</td><td>X<=1/8A</td><td>0<Z<=t</td></tr>
</table></td></tr>
<tr><td>Extensive crack is not acceptable.</td></tr>
</table>

<table>
<tr><th>No.</th><th colspan="2">Item</th><th colspan="3">Criterion</th><th>Zone</th><th>AQL</th></tr>
<tr><td rowspan="9">7</td><td rowspan="9">CCFL
Backlight</td><td rowspan="3">Black spots
White spots
Foreign particles
(Spot)</td><td colspan="2">Diameter</td><td colspan="2">Acceptable Q’ty</td><td rowspan="3">A</td><td rowspan="3">2.5</td></tr>
<tr><td colspan="2">D ≤ 0.4</td><td colspan="2">ignored</td></tr>
<tr><td>0.4 < D</td><td colspan="2">0</td></tr>
<tr><td rowspan="3">Foreign particles
(Line)</td><td>Width</td><td>Length</td><td>Acceptable Q’ty</td><td rowspan="3">A</td><td rowspan="3">2.5</td></tr>
<tr><td rowspan="2">W ≤ 0.2</td><td>L ≤ 2.5</td><td>1</td></tr>
<tr><td>2.5 < L</td><td>0</td></tr>
<tr><td>0.2 < W</td><td>—</td><td>0</td></tr>
<tr><td rowspan="4">Scratches</td><td>Width</td><td>Length</td><td>Acceptable Q’ty</td><td rowspan="4">A</td><td rowspan="4">2.5</td></tr>
<tr><td>W ≤ 0.1</td><td>—</td><td>ignored</td></tr>
<tr><td rowspan="2">0.1 < W ≤ 0.2</td><td>L ≤ 11.0</td><td>1</td></tr>
<tr><td>11.0 < L</td><td>0</td></tr>
<tr><td>0.2 < W</td><td>—</td><td>0</td></tr>
</table>

8. Reliability Tests

This standard reliability test is done only for the first lot of MP products. Customer and supplier must hold a discussion if other reliability test is requested by customer.

No	Test Item	Test Condition
1	High temperature and high humidity Under storage	40°C, 90%RH 120hrs
2	High temperature and high humidity Under operation	40°C, 90%RH 72hrs
3	High temperature under storage	70°C , 120hrs
4	Low temperature under storage	-20°C , 120hrs
5	Thermal shock (under storage)	 1 cycle total 5 cycles
6	Drop test (Packing box with full samples inside)	(X,Y,Z) x2 total 6 directions drop from 1 meter to ground

•Operation: Supply 3.3V for logic system and LCD module.

9. Precautions for Operation and Storage

9.1 Precautions for Operation

(1) Since LCD panel is made of glass, in order to prevent from glass broken or color tone change, please do not apply any mechanical shock or impact or excessive force to it when installing the LCD module.
(2) If LCD panel is broken and liquid crystal substance leaks out and contact your skin or clothes, please immediately wash it off by using soap and water.
(3) The polarizer on the LCD surface is soft and easily scratched. Please be careful when handling.
(4) If LCD surface becomes contaminated, please wipe it off gently by using moisten soft cloth with normal hexane, do not use acetone, ketone, ethanol, isopropyl alcohol or water. If there is saliva or water on the LCD surface, please wipe it off immediately.
(5) When handling LCD module, please be sure that the body and the tools are properly grounded. And do not touch I/F pins with bare hands or contaminate I/F pins.
(6) Do not attempt to disassemble or process the LCD module.
(7) LCD module should be used under recommended operating conditions shown in chapter 6 and 7.
(8) Response time will be extremely slower at lower temperature than at specified temperature and LCD will show different color when at higher temperature. The phenomenon will disappear when returning to specified condition.
(9) Foggy dew, moisture condensation or water droplets deposited on surface and contact terminals will cause polarizer stain or damage, the deteriorated display quality and electrochemical reaction then leads to the shorter life time and permanent damage to the module probably. Please pay attention to the environmental temperature and humidity.

9.2 Precautions for Storage

(1) Please store LCD module in a dark place, avoid exposure to sunlight, the light of fluorescent lamp or any ultraviolet ray.
(2) Keep the environment temperature at between 10°C and 35°C and at normal humidity. Avoid high temperature, high humidity or temperature below 0°C.
(3) That keeps the LCD modules stored in the container shipped from supplier before using them is recommended.
(4) Do not leave any article on the LCD module surface for an extended period of time.