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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



LCD Module Technical Specification

First Edition

Jun. 20, 2011

Final Revision

Apr. 10, 2012

Type No. **T-55620GD057JU-LW-AAN**

Customer : **STANDARD**

Customer's Product No : -----

KYOCERA Display Corporation

Approved: *Toshiyuki Okamoto*
QUALITY ASSURANCE DIVISION

Checked: *Masayuki Kato*
Design Div.

Prepared: *Hironori Miyano*
Design Div.

APPROVED

By

Signature :

Date :

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as having been accepted.

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Revision History

Rev.	Date	Page	Comment
1	Oct. 20. 2011	15	7.7.1.Absolute Maximum Ratings Add: 70000hrs Typ, Note 3,4
2	Apr. 10. 2012	-	Changing company's name

1. Application

This specification applies to 5.7"color TFT-LCD module (T-55620GD057JU-LW-AAN).

2. General Specifications

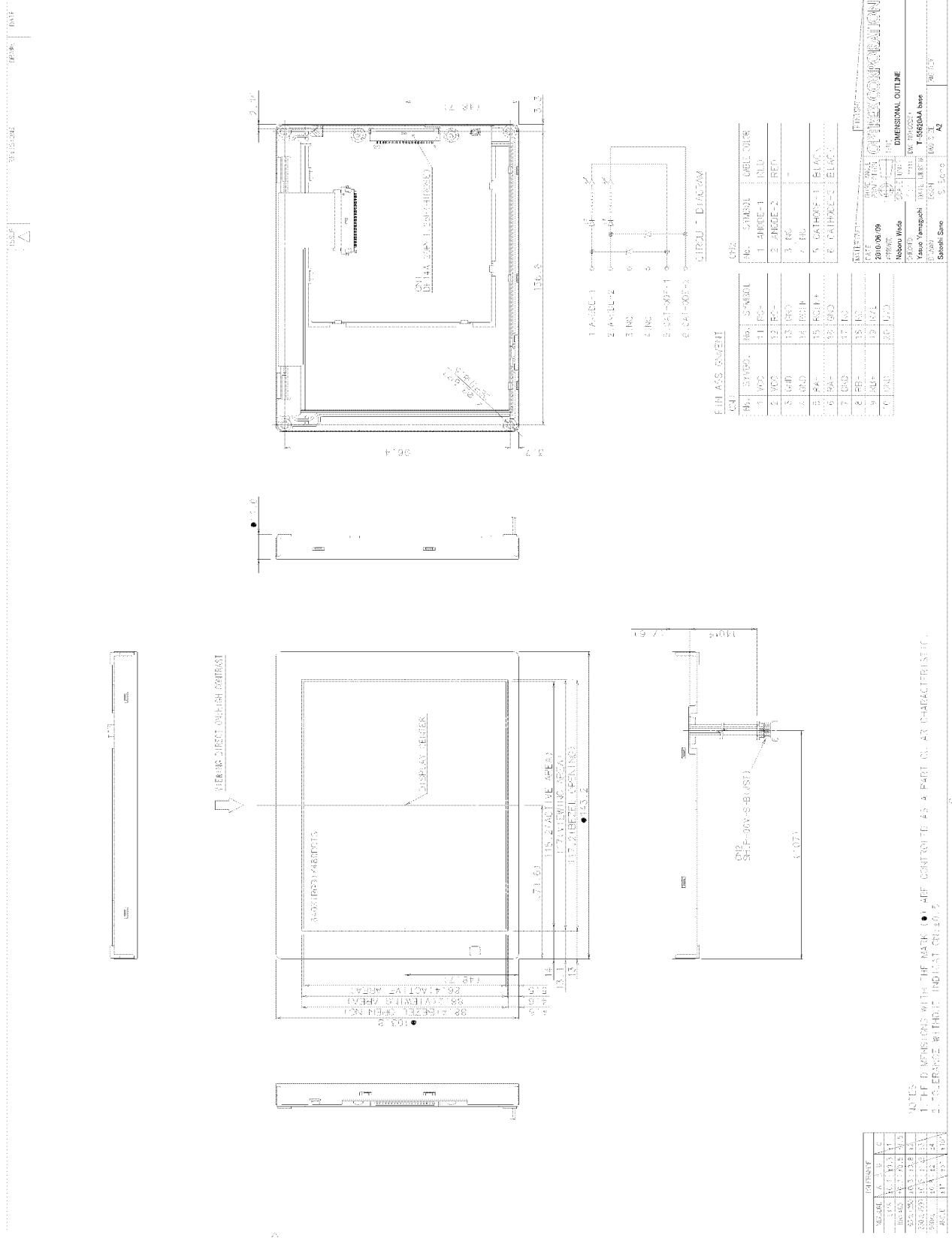
Dot Pixels	:	640×3 [R.G.B] (W) × 480 (H) dots
Dot Size	:	0.06×3 [R.G.B] (W) ×0.18 (H) mm
Pixel Arrangement	:	RGB-Stripe
Color Depth	:	262,144 colors
Viewing Area	:	117.0 (W) × 88.2 (H) mm
Outline Dimensions	:	143.2 (W) × 103.8* (H) × 11.6max. (D) mm * Without LED Cable
Weight	:	180 g max.
LCD Type	:	ATS-26424 (TFT / Normally white-mode / Transmissive)
Viewing Angle	:	12:00 (The Angle of Least Color Inversion)
Interface	:	LVDS (Low Voltage Differential Signaling)
Backlight	:	LED Backlight / White
Lead free	:	Our product corresponds to lead free. Lead free is defined as below: 1) The solder used in the LCD module. 2) Electrical components (Terminal section) used in the LCD module. Any lead used within the electrical component does not apply to our module definition of lead free.
RoHS regulation	:	To our best knowledge, this product satisfies material requirement of RoHS regulation. Our company is doing the best efforts to obtain the equivalent certificate from our suppliers.

3. Operating Conditions

Item	Conditions	Temperature Range	Remark
Operating Temperature Range	Display Surface	-20~70°C	Note1
Storage Temperature Range	Display Surface	-30~80°C	

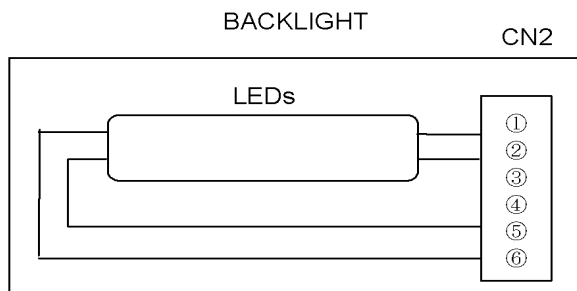
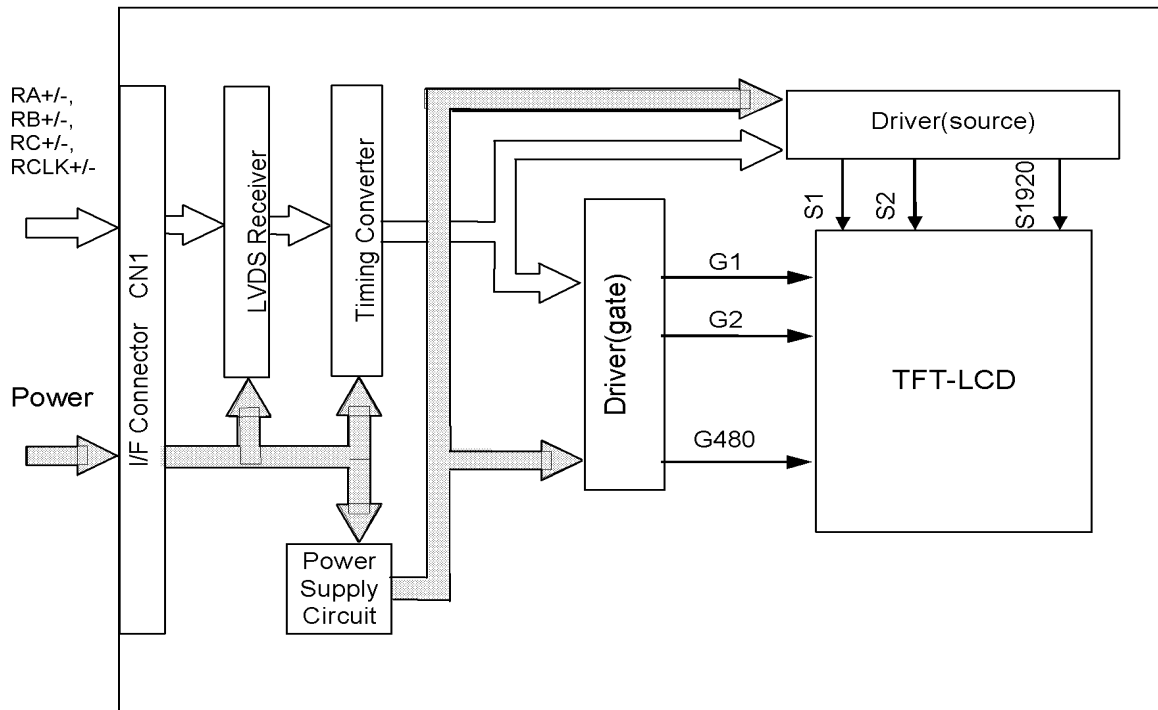
Note1: Operating temperature range defines the operation only and the contrast, response time and other display optical characteristics are set at Ta=+25°C.

4. Dimensional Outline



Confidential

5. Block Diagram



6. I/O Terminal

6.1. CN1 Pin Assignment (INTERFACE SIGNAL)

Used connector DF14A-20P-1.25H(56) (HIROSE)

Corresponding connector DF14-20S-1.25C(HIROSE)

No.	Symbol	Functional Description
1	VCC	Power Supply (DC 3.3V)
2	VCC	Power Supply (DC 3.3V)
3	GND	Power Supply (0V, GND)
4	GND	Power Supply (0V, GND)
5	RA-	LVDS Data Input R0, R1, R2, R3, R4, R5, G0
6	RA+	LVDS Data Input R0, R1, R2, R3, R4, R5, G0
7	GND	Power Supply (0V, GND)
8	RB-	LVDS Data Input G1, G2, G3, G4, G5, B0, B1
9	RB+	LVDS Data Input G1, G2, G3, G4, G5, B0, B1
10	GND	Power Supply (0V, GND)
11	RC-	LVDS Data Input B2, B3, B4, B5, HS, VS, DEN
12	RC+	LVDS Data Input B2, B3, B4, B5, HS, VS, DEN
13	GND	Power Supply (0V, GND)
14	RCLK-	LVDS Clock Input
15	RCLK+	LVDS Clock Input
16	GND	Power Supply (0V, GND)
17	NC	Non Connection
18	NC	Non Connection
19	R/L	Control the shift direction of device internal shift resister
20	U/D	Set the Up/Down scan direction

6.2. CN2 Pin Assignment (Backlight)

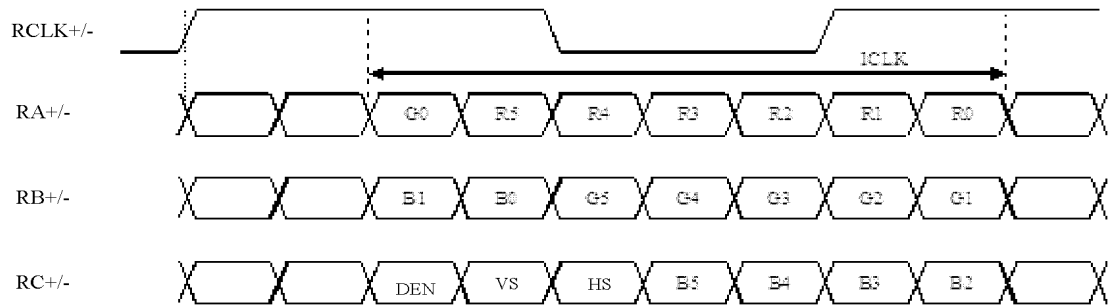
Used connector : SHLP-06V-S-B(JST)

Corresponding connector : SM06B-SHLS-TF(LF)(SN) (JST)

No.	Symbol	Functional Description
1	Anode-1	CABLE COLOR RED
2	Anode-2	CABLE COLOR RED
3	NC	Non-Connection
4	NC	Non-Connection
5	Cathode 1	CABLE COLOR BLACK
6	Cathode 2	CABLE COLOR BLACK

6.3.ISP data mapping

a. ISP 6 bit compatibility mode (6 bit input)



7. Electrical Specifications

7.1. Absolute Maximum Ratings

Ta=-20~70°C, VSS=0V

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage for LCD	VCC	-	-0.3	4.0	V

7.2. DC Characteristics

Ta=-20~70°C, VSS=0V

Parameter	Symbol	Min.	Typ.	Max.	Units
Supply Voltage for LCD	VCC	3.0	3.3	3.6	V
High Level Input Voltage	V _{IH}	2.0	-	VCC	V
Low Level Input Voltage	V _{IL}	0	-	0.8	V
Power Supply Current for LCD	ICC	-	150	225	mA

A) Typical current condition

All black pattern with frame 480 line mode.

VCC=+3.3V, f_H=31.468kHz, f_V=59.59Hz, f_{CLK}=25.175MHz

7.3.Interface Timing

7.3.1.Digital Parallel RGB Interface Timing

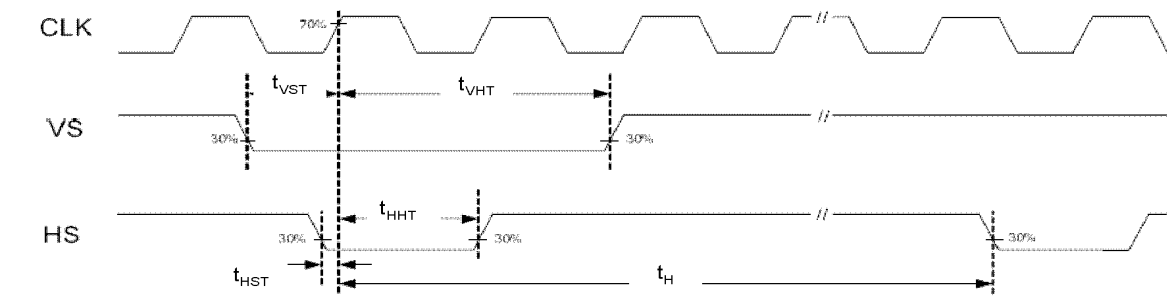
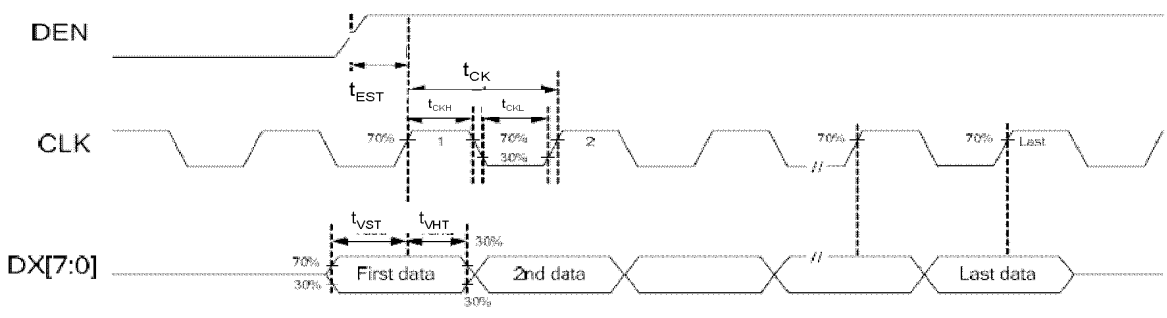
Ta=-20~70°C, VCC=3.0~3.6V

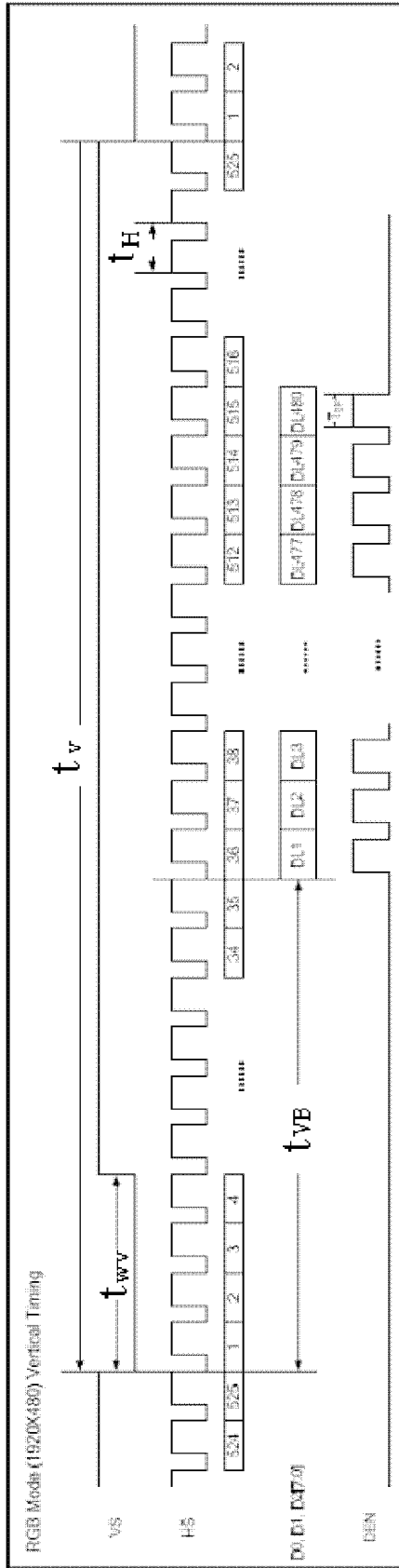
Parameter	Symbol	Min.	Typ.	Max.	Units
CK Frequency	1/tCK	22.66	25.175	27.69	MHz
CK Period	tCK	36.11	39.7	44.13	ns
CK Pulse Duty	$t_{CKH} / (t_{CKH} + t_{CKL})$	40	50	60	%
HSYC Setup Time	tHST	10	-	-	ns
HSYC Hold Time	tHHT	10	-	-	ns
HSYC Period	tH	750	800	850	tCK
HSYC Pulse Width	tWH	5	30	-	tCK
HSYC Back Porch	tHB	112	144	175	tCK
HSYC Display Term	tHD	-	640	-	tCK
VSYC Setup Time	tVST	10	-	-	ns
VSYC Hold Time	tVHT	10	-	-	ns
VSYC Period	tV	515	525	535	tH
VSYC Pulse Width	tWV	1	3	5	tH
VSYC Back Porch	tVB	5	35	-	tH
VSYC Display Term	tVD	-	480	-	tH
ENAB Setup Time	tDST	10	-	-	ns
ENAB Pulse Width	tEP	-	640	-	tCK
ENAB Frame Active time	tDEA	-	480	-	tH
Data Setup Time	tDST	10	-	-	ns
Data Hold Time	tDHT	10	-	-	ns

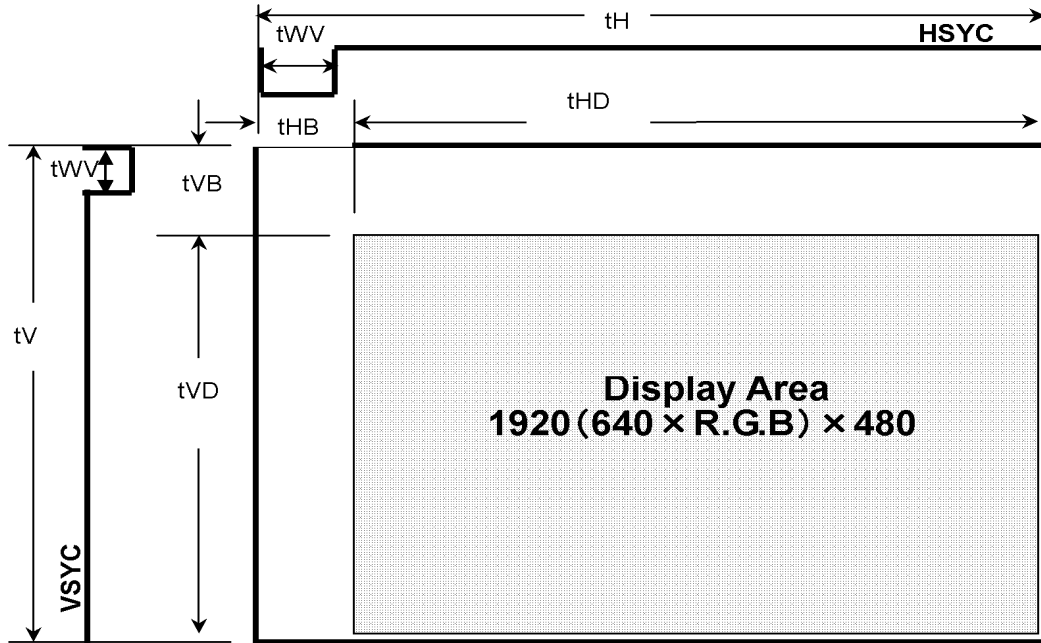
Note

1) LVDS timing follows the timing specifications of LVDS receiver IC:THC63LVDF84B(Thine).

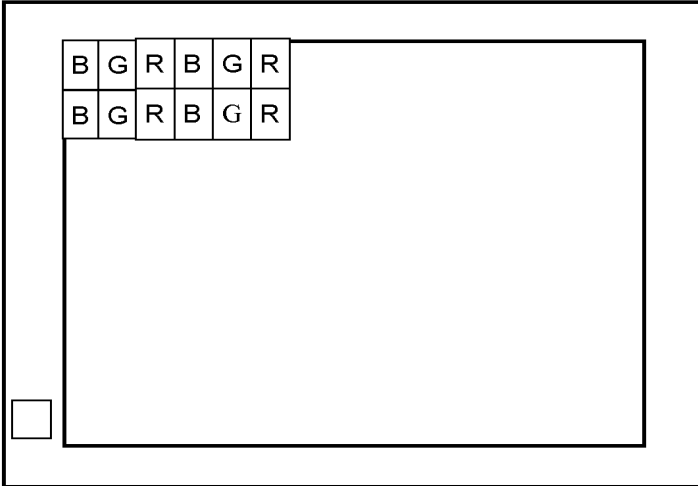
7.3.2. Timing Chart







7.4.Pixel Alignment



7.5. Color Data Assignment

COLOR	INPUT DATA	R DATA						G DATA						B DATA					
		MSB			LSB			MSB			LSB			MSB			LSB		
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED (2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	GREEN (2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	GREEN (62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE (62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

[Note]

- 1) Definition of gray scale
Color (n) --- n indicates gray scale level.
Higher n means brighter level.

2) R Data 1:High, 0: Low

Relation of IC and LCD Module Data Bus

LCD Module	R5	R4	R3	R2	R1	R0	GND	GND
IC	D07	D06	D05	D04	D03	D02	D01*	D00*

*Connected to "L" in the LCD Module

3) G Data 1:High, 0: Low

LCD Module	G5	G4	G3	G2	G1	G0	GND	GND
IC	D17	D16	D15	D14	D13	D102	D11	D10

4) B Data 1:High, 0: Low

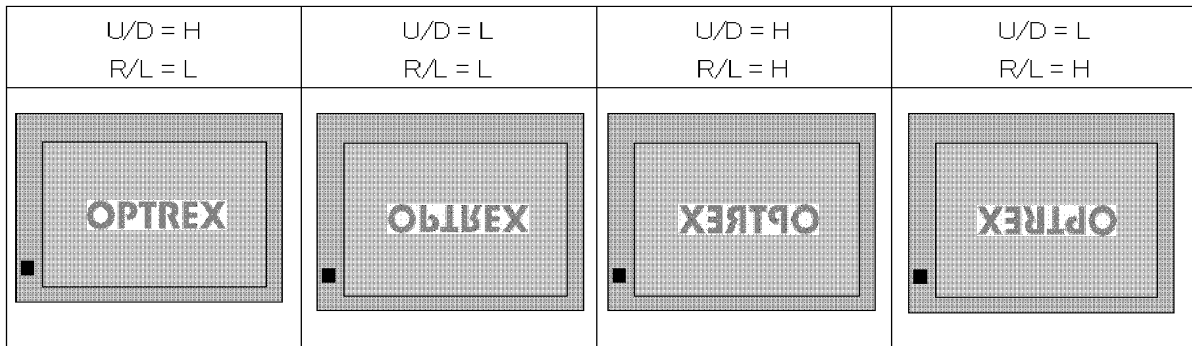
LCD Module	B5	B4	B3	B2	B1	B0	GND	GND
IC	D27	D26	D25	D24	D23	D22	D21	D20

7.6. Inverted Scan Capability

This module has the capability of inverting scan direction by signaling from controller.

Note that scan direction cannot be changed during operation.

The following drawing shows the relationship between the viewing direction and the scan direction.



7.7. Lighting Specifications

7.7.1. Absolute Maximum Ratings

Ta=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Forward Current	IF	Note1	-	80	150	mA
Forward Voltage	VF	IF=80mA / line	-	16.0	18.0	V
Power	PL	IF=80mA / line	-	1.28	2.7	W
B/L Lifetime	-	Note 2,3,4	50,000	70,000	-	Hrs

Note1: Current of LED par chip must be lower than 150mA at 70°C.

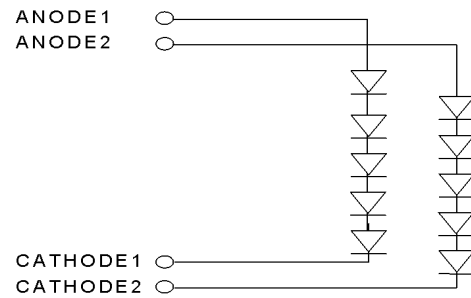
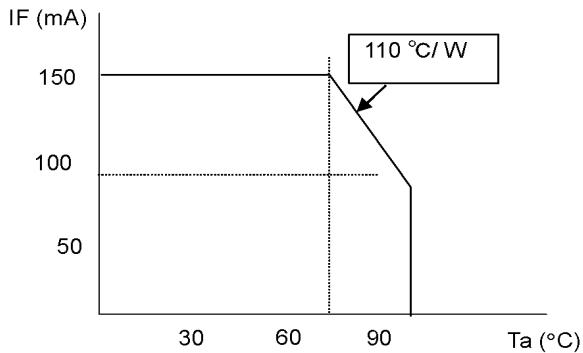
The current of LED must be tuned to satisfy as Forward Current Derating Curve mentioned relationship

Note2: B/L Life time is defined as time period that the actual luminance becomes 50% or lower of its initial value.

Note3: B/L Life time depends on the ambient temperature.

Note4: B/L Life time will decrease under high temperature.

【Forward Current Derating Curve】



8. Optical Specifications

8.1. Optical Characteristics

Item	Symbol	Conditions			Standard Value			Unit	Method of Measure	Remark	
		θ	ϕ	C	Min.	Typ.	Max.				
Brightness	B	0°	0°	/	280	500	-	cd/m ²	(Fig.1)	Note1	
Contrast	CR	Best Viewing Angle			150	500	-	-			
Color Coordinates	Red	Rx	0°	0°	/	0.581	0.611	0.641			-
		Ry	0°	0°	/	0.330	0.360	0.390			-
	Green	Gx	0°	0°	/	0.328	0.358	0.388			-
		Gy	0°	0°	/	0.537	0.567	0.597			-
	Blue	Bx	0°	0°	/	0.117	0.147	0.177			-
		By	0°	0°	/	0.071	0.101	0.131			-
	White	Wx	0°	0°	/	0.289	0.329	0.369			-
		Wy	0°	0°	/	0.299	0.339	0.379			-
Brightness Uniformity	-	0°	0°	/	60	65	-	%	(Fig.2)		
Vertical Viewing Angle	Up	θ_U	-	90°	≥ 5	-	70	-	Degree	(Fig.3)	
	Down	θ_D	-	270°	≥ 5	-	70	-	Degree		
Horizontal Viewing Angle	Left	ϕ_L	180°	-	≥ 5	-	70	180°	Degree		
	Right	ϕ_R	0°	-	≥ 5	-	70	0°	Degree		
Response Time	Rise	τ_r	0°	0°	/	-	23	-	ms	(Fig.4)	
	Decay	τ_d	0°	0°	/	-	6	-	ms		

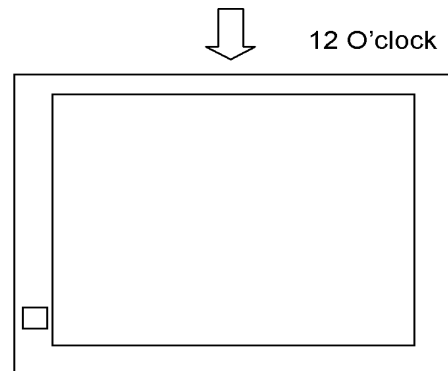
Note1: Under the condition of maximum brightness.

◆ Conditions for Measuring

- ◇ Environment: Dark room with no light or close to no light.
- ◇ Temperature: 25±5°C
- ◇ Humidity: 40~70%RH
- ◇ Driving voltage is set for optimal contrast to measure center of display.
- ◇ LED Backlight driving condition: IF =80.0 (mA)

◆ Optimal viewing angle

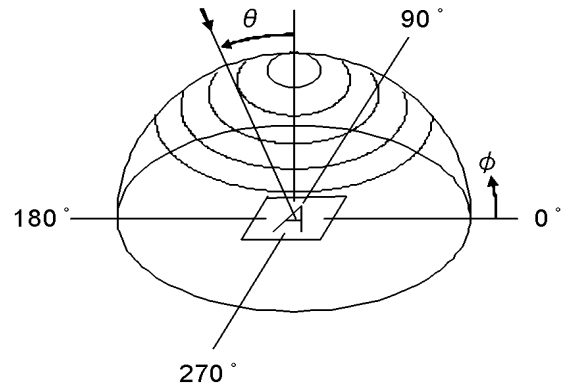
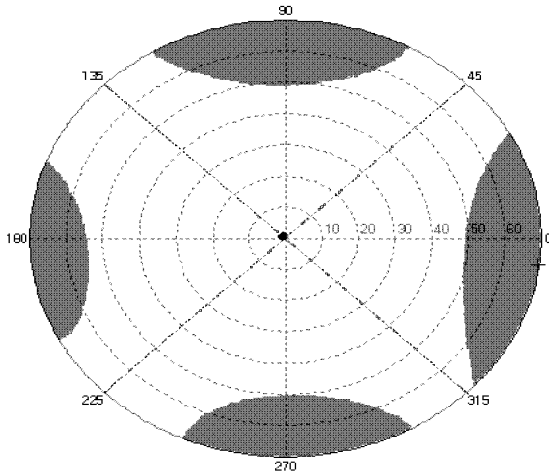
(The angle of Least Color Inversion)





8.2. Definition of Viewing Angle and Optimum Viewing Area

*Point ● shows the point where contrast ratio is measured. : $\theta = 0^\circ$, $\phi = 0^\circ$

*Driving condition: $F_r = 60\text{Hz}$



*Area  shows typ. $CR \geq 30$

*Area  shows typ. $CR \leq 30$

◆ Method of Brightness Measurement (Fig.1)

(1) Measuring Device

TOPCON: BM-5

(2) Measuring Point

Center of Display: $\theta=0^\circ, \phi=0^\circ$

On condition θ : A vertical angle from measuring direction to perpendicular.

ϕ : A horizontal angle from measuring direction to perpendicular.

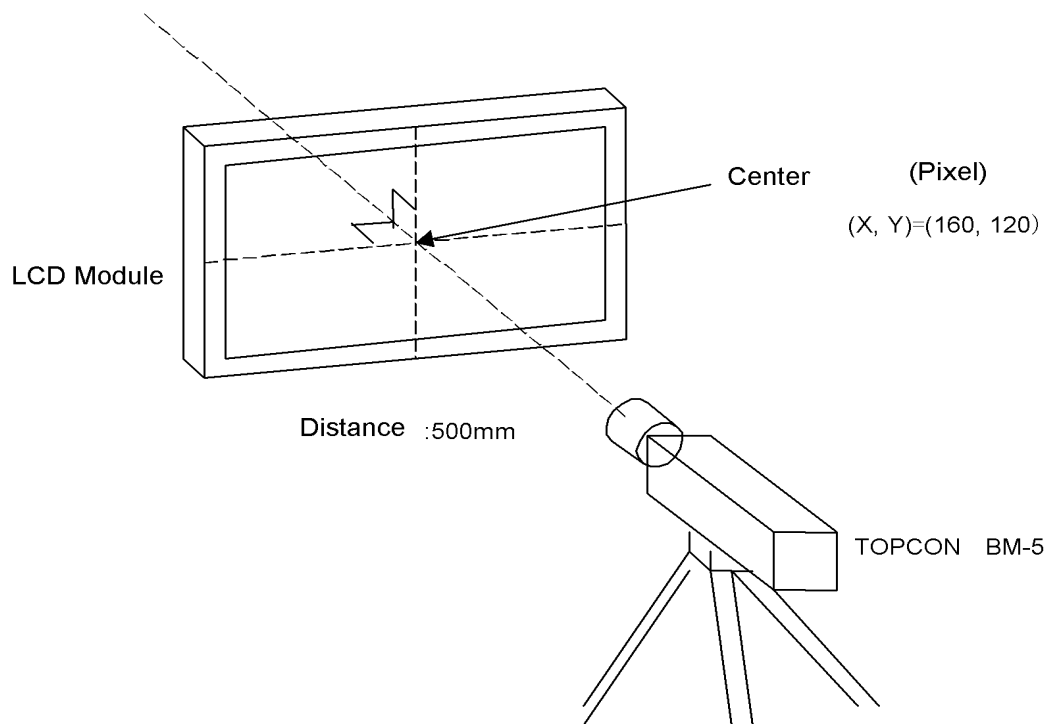


Fig. 1

(3) Method of Measuring

Apply signal voltage (displayed in white) to maximize brightness and measure brightness B (cd/m^2).

The distance between BM-5's front lens to surface panel is 500mm.

Measured after backlight has been lit for more than 30 minutes.

◆ Method of Contrast Measurement (Fig.1)

(1) Measuring Device

TOPCON: BM-5, Measuring Field: 1°

(2) Measuring Point

Center of display: same as Method of Brightness Measurement

(3) Method of Measuring

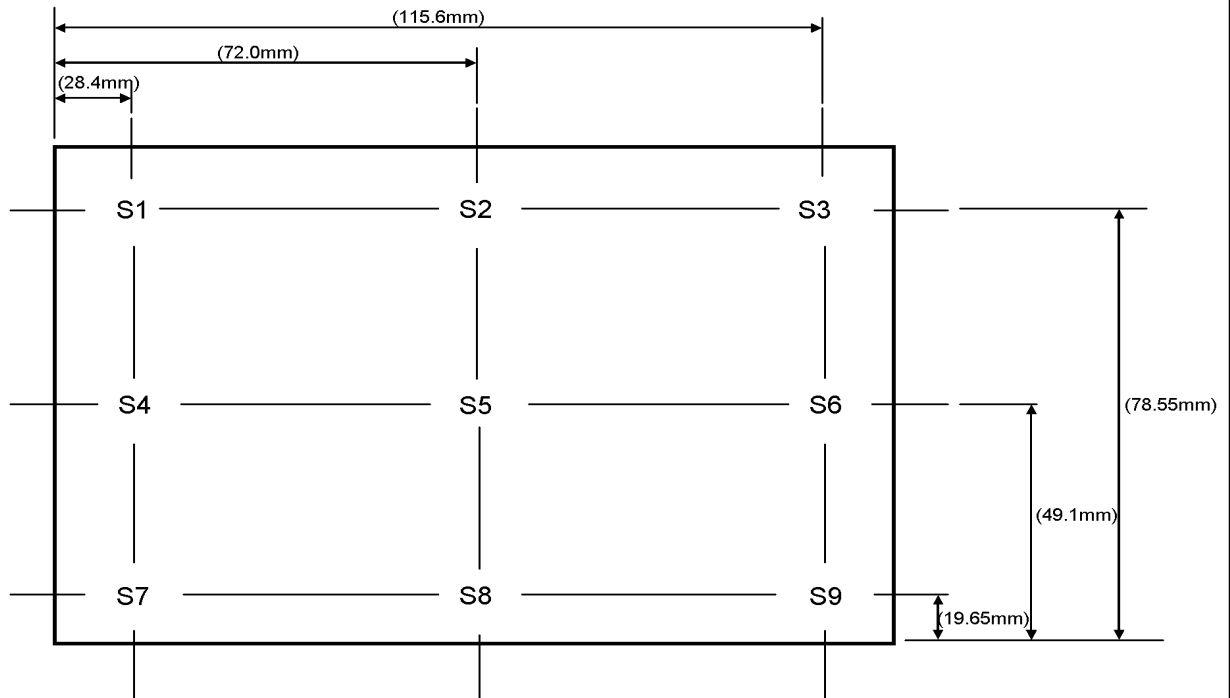
• Set LCD module to $\theta=0^\circ, \phi=0^\circ$.

• Change signal voltage to measure maximum brightness $Y1$ and minimum brightness $Y2$.

• Contrast is derived from $CR=Y1/Y2$.

◆ Definition of Brightness Uniformity (Fig.2)

Definition is calculated from the four points (S1-S9) on the diagram below.



$$\text{Standard Value of Brightness Uniformity}[\%] = \frac{\text{Minimum Value of S1-S9}}{\text{Maximum Value of S1-S9}} \times 100$$

Fig. 2

◆ Method of Viewing Angle Measurement (Fig.3)

(1) Measuring Device

ELDIM: EZ CONTRAST

(2) Measuring Point

Center of display: Same as Method of Brightness Measurement

(3) Angle of Measuring

θ : An angle vertical to perpendicular line from the viewing direction.

ϕ : An angle horizontal to perpendicular from the viewing direction.

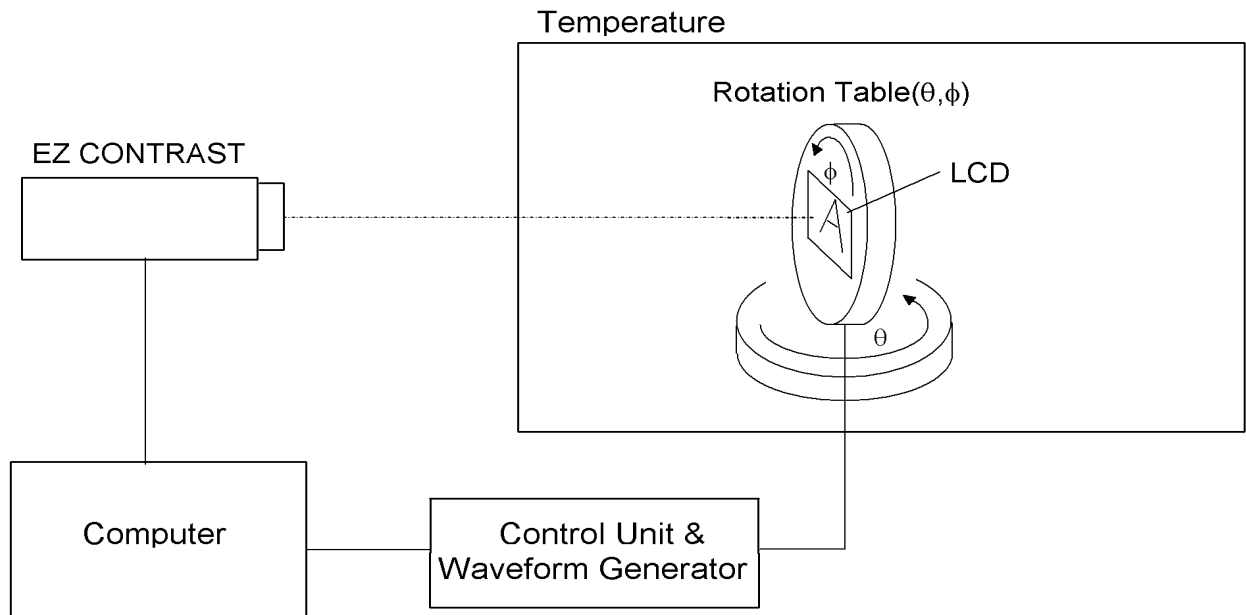


Fig. 3

(4) Method of Measuring

Set the module on the rotation table and measure a vertical axis direction in the state that fixed $\phi = 0$ degrees horizontal axis direction to $\theta = 90$ degrees.

(Viewing angle is measured automatically by EZ CONTRAST)

◆ Measuring Response Time (Fig.4)

- (1) Measuring Device
TOPCON BM-5, Measuring Field: 1°
Tektronix Digital Oscilloscope
- (2) Measuring Point
Center of display, same as Method of Brightness Measurement
- (3) Method of Measuring
 - Set LCD panel to $\theta=0^\circ$, and $\phi=0^\circ$.
 - Input white→black→white to display by switching signal voltage.
 - If the luminance is 0% and 100% immediately before the change of signal voltage, then τ_r is optical response time during the change from 90% to 10% immediately after rise of signal voltage, and τ_d is optical response time during the change from 10% to 90% immediately after decay of signal voltage.

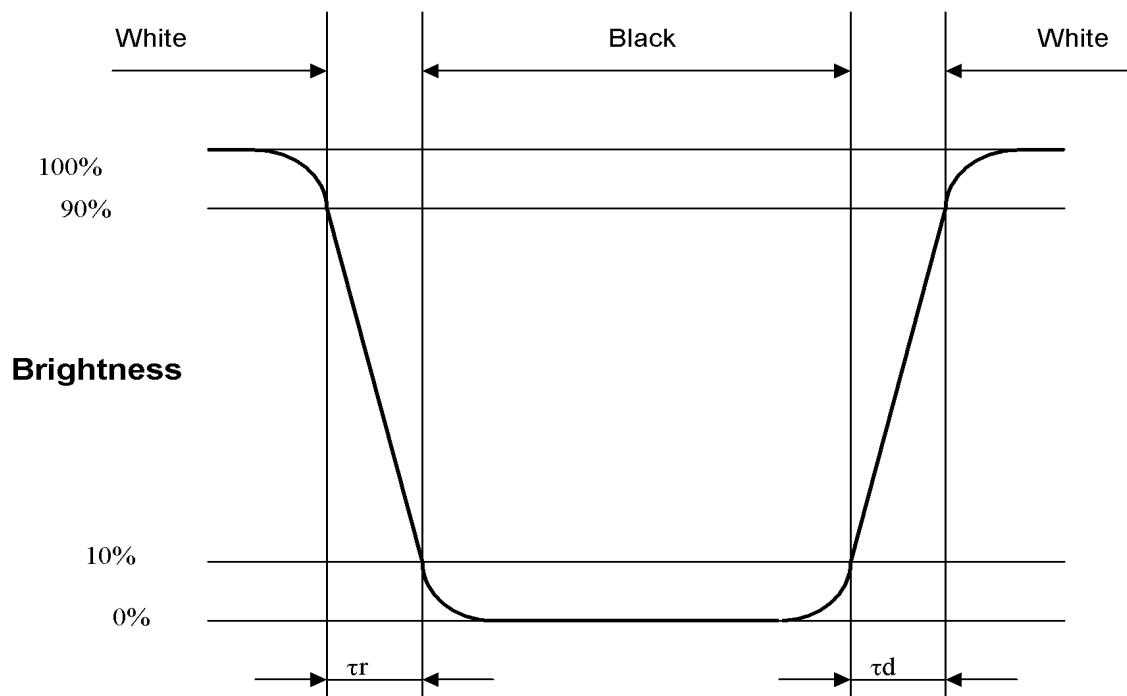


Fig. 4

9. Test

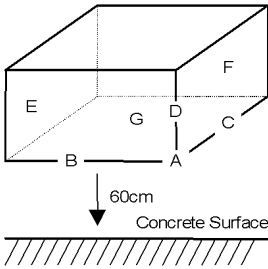
No abnormal function and appearance are found after the following tests.

Conditions: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: $20\pm 5^{\circ}\text{C}$

Humidity : $65\pm 5\% \text{RH}$

tests will not be conducted under functioning state.

No.	Parameter	Conditions	Notes
1	High Temperature Operating	$70^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96hrs (operation state)	
2	Low Temperature Operating	$-20^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96hrs (operation state)	1
3	High Temperature Storage	$80^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96hrs	2
4	Low Temperature Storage	$-30^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96hrs	1,2
5	Damp Proof Test	$40^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 90%RH, 96hrs	1,2
6	Vibration Test	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X, Y, Z each 15 minutes	3
7	Shock Test	To be measured after dropping from 60cm high the concrete surface in packing state. 	

Note 1 :No dew condensation to be observed.

Note 2 :The function test shall be conducted after 4 hours storage at the normal
Temperature and humidity after removed from the test chamber.

Note 3 :Vibration test will be conducted to the product itself without putting it in a container.

10. Appearance Standards

10.1. Inspection conditions

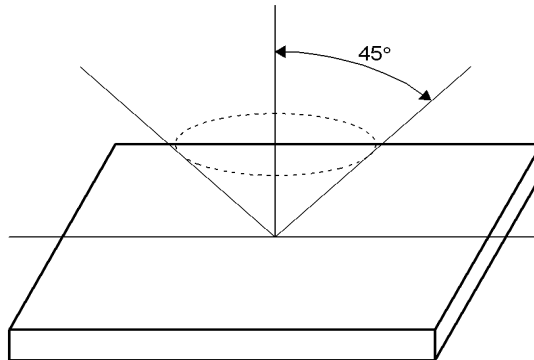
The LCD shall be inspected under the white fluorescent light.

Appearance Inspection: Illuminans > 500 [lx]

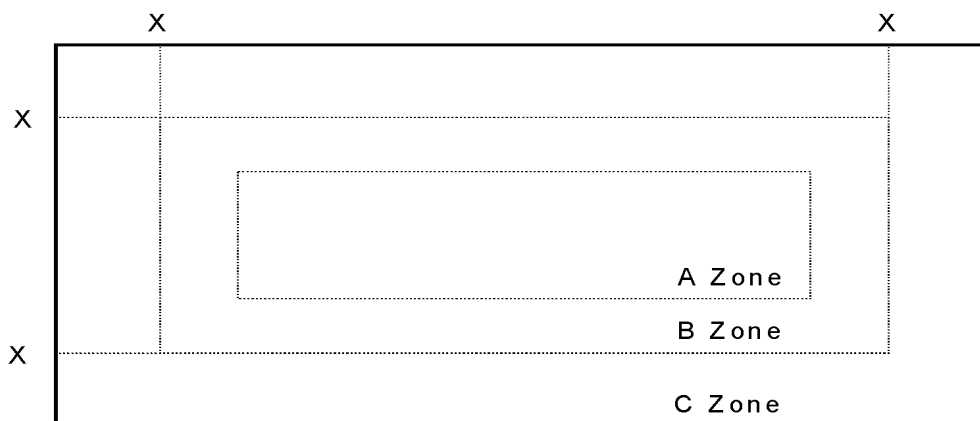
Operating Inspection: Illuminance < 250 [lx]

The distance between the eyes and the sample shall be more than 30cm.

All directions for inspecting the sample should be within 45° against perpendicular line.



10.2. Definition of applicable Zones



X : Metal Holder Opening

A Zone: Active display area

B Zone = (Viewing Area) – (Active Area)

C Zone: Rest parts

10.3.Standards (Only the display part)

No.	Parameter	Criteria																									
1	Polarizer Scratches	<table border="1"> <thead> <tr> <th colspan="2">Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>X(mm)</th> <th>Y(mm)</th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$L \leq 15$</td> <td>$0.01 < W \leq 0.05$</td> <td colspan="2">4</td> <td>*</td> </tr> <tr> <td>$L > 15$</td> <td>$W > 0.01$</td> <td colspan="2">0</td> <td>*</td> </tr> <tr> <td>-</td> <td>$W > 0.05$</td> <td colspan="2">0</td> <td>*</td> </tr> </tbody> </table> <p>X : Length, Y : Width * : Disregard</p>	Zone		Acceptable Number			X(mm)	Y(mm)	A	B	C	$L \leq 15$	$0.01 < W \leq 0.05$	4		*	$L > 15$	$W > 0.01$	0		*	-	$W > 0.05$	0		*
Zone		Acceptable Number																									
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2	DENT	<table border="1"> <thead> <tr> <th>Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>Dimension (mm)</th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$0.30 < D \leq 0.50$</td> <td colspan="2">4</td> <td>*</td> </tr> <tr> <td>$0.50 < D$</td> <td colspan="2">0</td> <td>*</td> </tr> </tbody> </table> <p>D : Average Diameter = (long+short)/2 * : Disregard</p>	Zone	Acceptable Number			Dimension (mm)	A	B	C	$0.30 < D \leq 0.50$	4		*	$0.50 < D$	0		*									
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3	BLACK SPOT WHITE SPOT BUBBLE	<table border="1"> <thead> <tr> <th>Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>Dimension (mm)</th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$0.30 < D \leq 0.50$</td> <td colspan="2">5</td> <td>*</td> </tr> <tr> <td>$0.50 < D$</td> <td colspan="2">0</td> <td>*</td> </tr> </tbody> </table>	Zone	Acceptable Number			Dimension (mm)	A	B	C	$0.30 < D \leq 0.50$	5		*	$0.50 < D$	0		*									
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No.	Parameter	Criteria																			
5	(a) Bright Dot	<table border="1"> <thead> <tr> <th rowspan="2">Zone Dimension (mm)</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>Bright Dot Note1</td> <td colspan="2">4</td> <td>*</td> </tr> <tr> <td>Dark Dot Note2</td> <td colspan="2">5</td> <td>*</td> </tr> <tr> <td>TOTAL</td> <td colspan="3">5</td> </tr> </tbody> </table> <p>* : Disregard</p>	Zone Dimension (mm)	Acceptable Number			A	B	C	Bright Dot Note1	4		*	Dark Dot Note2	5		*	TOTAL	5		
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TOTAL	5																				
(b) Dark Dot																					
Dot Defect	(c) TWO Adjacent Dot	<table border="1"> <thead> <tr> <th rowspan="2">Zone Dimension (mm)</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>Bright Dot Note1,3</td> <td colspan="2">2 PAIRS</td> <td>*</td> </tr> <tr> <td>Dark Dot Note2,3</td> <td colspan="2">3 PAIRS</td> <td>*</td> </tr> </tbody> </table> <p>* : Disregard</p>	Zone Dimension (mm)	Acceptable Number			A	B	C	Bright Dot Note1,3	2 PAIRS		*	Dark Dot Note2,3	3 PAIRS		*				
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Dark Dot Note2,3	3 PAIRS		*																		
(d) Three or More Adjacent Dot	NOT ALLOWED																				
(e) Distance	<table border="1"> <thead> <tr> <th rowspan="2">Zone Dimension (mm)</th> <th colspan="3">Acceptable Level</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>Bright Dot</td> <td colspan="2">5 mm \leq</td> <td>*</td> </tr> <tr> <td>Dark Dot</td> <td colspan="2">5 mm \leq</td> <td>*</td> </tr> </tbody> </table> <p>* : Disregard</p>	Zone Dimension (mm)	Acceptable Level			A	B	C	Bright Dot	5 mm \leq		*	Dark Dot	5 mm \leq		*					
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Dark Dot	5 mm \leq		*																		
6	Line Defect	NOT ALLOWED																			

Note 1: Bright Dot is defined as follows:

Visible through 5% transmission ND filter under the condition that black image (color 0) is on the display.

Note 2: Dark Dot is defined as follows:

Recognizable darker than around under the condition that each R(63), G(63), B(63) image is on the display.

Note 3: Definition of adjacent

