TENTATIVE

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10.4” XGA

TECHNICAL SPECIFICATION

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AA104XD02--T1

MITSUBISHI ELECTRIC Corp.

Date: Jun.28,’10

CONTENTS

1. APPLICATION

This specification applies to color TFT-LCD module, AA104XD02--T1.

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(1) Standard Usage

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(2) Special Usage

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2. OVERVIEW

AA104XD02--T1 is 10.4" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, backlight unit, and touch panel.

By applying 6 bit or 8 bit digital data, 1024 × 768, 262k-color or 16.7M-color images are displayed on the 10.4" diagonal screen. Input power voltage is 3.3 V for LCD driving.
The type of data and control signals are digital and transmitted via LVDS interface per Typ. 65 MHz clock cycle.

Driver circuit for LED backlight and controller for touch panel are not included in this module. General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	210.4 (H) × 157.8 (V) (10.4-inch diagonal)
Number of Dots	1024 × 3 (H) × 768 (V)
Pixel Pitch (mm)	0.2055 (H) × 0.2055 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white
Number of Color	262k(6 bit/color), 16.7M(8 bit/color)
Luminance (cd/m^2)	480
Viewing Angle (CR ≥ 10)	−80~80°(H), −65~65°(V)
Surface Treatment (Touch panel)	Anti-glare and hard-coating 3H
Electrical Interface	LVDS
Viewing Direction	Higher Contrast ratio: 6 o'clock Less gray scale reversal: 12 o'clock
Module Size (mm)	230.0 (W) × 180.2 (H) × 12.1 (D)
Module Mass (g)	650
Backlight Unit	LED, edge-light, replaceable
Touch Panel	4-wire analog resistive

Characteristic value without any note is typical value.

3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX	UNIT
Power Supply Voltage for LCD	VCC	0	4.0	V
Logic Input Voltage	VI	–0.3	VCC+0.3	V
Backlight (LED) Current	IF	0	180	mA
Touch Panel Voltage	TPV	--	7.0	V
Operation Temperature (Touch Panel) Note 1,2)	$T_{op(TouchPanel)}$	–20	70	°C
Operation Temperature (Ambient) Note 2)	$T_{op(Ambient)}$	–20	70	°C
Storage Temperature Note 2)	T_{stg}	–30	80	°C

[Note]

1) Measured at the center of active area and at the center of panel back surface

2) Top,Tstg ≤ 40°C : 90%RH max. without condensation

Top,Tstg > 40°C : Absolute humidity shall be less than the value of 90%RH at 40°C without condensation.

4. ELECTRICAL CHARACTERISTICS

(1) TFT-LCD Ambient temperature: Ta = 25°C

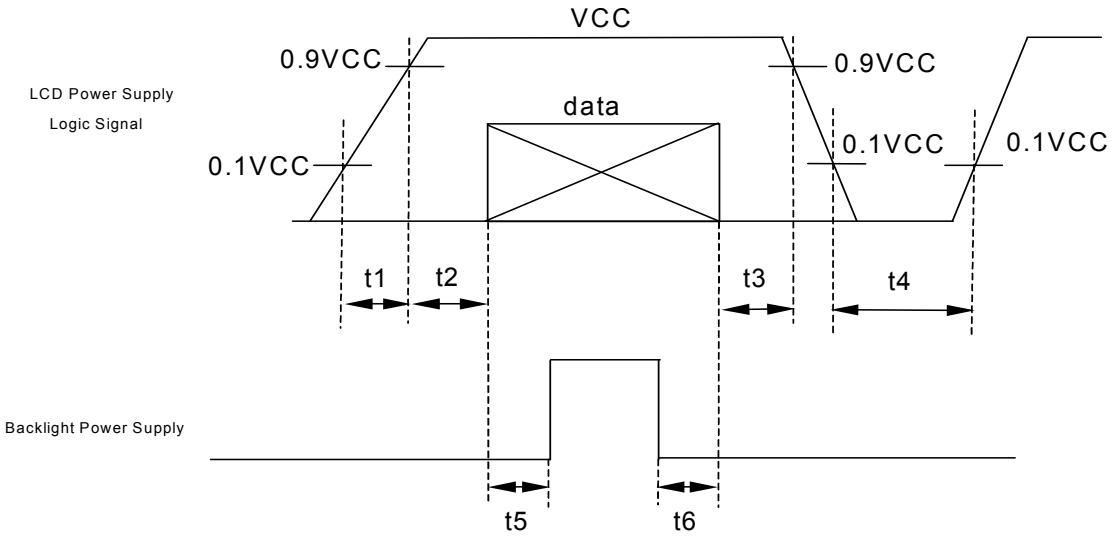
ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Power Supply Voltage for LCD		VCC	3.0	3.3	3.6	V	*1)
Power Supply Current for LCD		ICC	--	440	800	mA	*2)
Permissive Input Ripple Voltage		VRP	--	--	100	mVp-p	VCC = +3.3 V
Logic Input Voltage	High	VIH	0.8×VCC	--	VCC	V	MODE, SC
	Low	VIL	0	--	0.2×VCC	V	MODE, SC

*1) Power and signals sequence:

t1 ≤ 10ms 200ms ≤ t4

0 < t2 ≤ 50ms 200ms ≤ t5

0 < t3 ≤ 50ms 0 ≤ t6



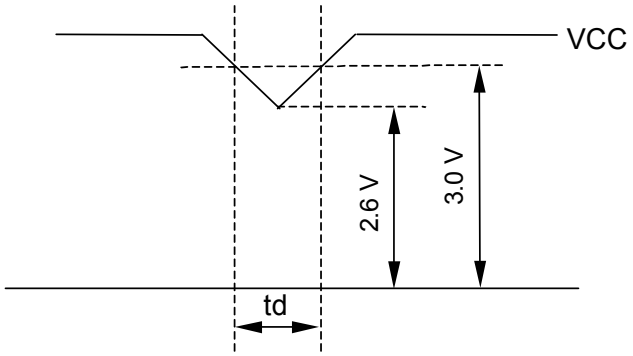
data: RGB DATA, DCLK, DENA, MODE, SC

VCC-dip conditions:

1) When 2.6 V ≤ VCC < 3.0 V, td ≤ 10 ms

2) When VCC < 2.6 V

VCC-dip conditions should also follow the power and signals sequence.



*2) VCC = +3.3 V, f_H = 37.9 kHz, f_V = 60 Hz, f_{CLK} = 40 MHz
Display image at typical power supply current value is 256-gray-bar pattern (8 bit), 768 line mode.

*3) Fuse

Parameter	Fuse Type Name	Supplier	Remark
VCC	FCC16162AB	Kamaya Electric Co., Ltd.	*)

*) The power supply capacity should be designed to be more than the fusing current.

(2) Backlight

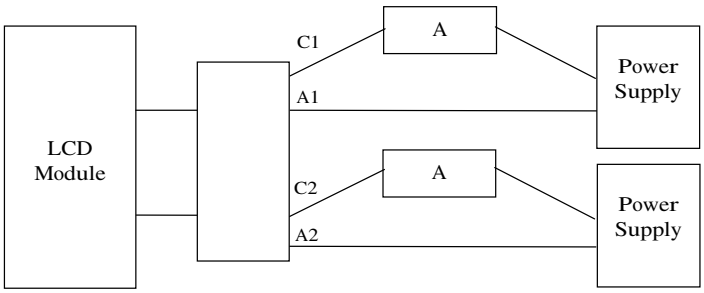
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
LED Voltage	VF	--	(27)	33.3	V	IF = 70 mA, Ta = 25°C *2)
		--	--	34.5	V	IF = 70 mA, Ta = 0°C
		--	--	35.5	V	IF = 70 mA, Ta = –20°C
LED Current	IF	--	70	80	mA	Ta = 25°C *1), *3)
LED Life Time	LT	80,000	100,000	--	h	IF = 70 mA, Ta = 25°C *4), *5), Continuous operation

[Note]

*1) Constant Current Drive

*2) The Voltage deviation between strings: $|V_{f1} - V_{f2}| \leq 2V$

*3) LED Current measurement method



*4) LED life time is defined as the time when the brightness becomes 50% of the initial value.

*5) The life time of the backlight depends on the ambient temperature. The life time will decrease under high temperature.

(3) Touch Panel

Electrical Characteristics

ITEM	MIN.	TYP.	MAX.	UNIT	Remarks
Linearity	−1.5	--	1.5	%	Analog X and Y directions
Terminal Resistance	406	--	948	Ω	X
	241	--	563	Ω	Y
Insulation Resistance	20	--	--	MΩ	DC 25 V
Voltage	3.0	5.0	7.0	V	DC
Chattering	--	--	10	ms	

*) Do not operate it with a thing except a polyacetal pen (tip R0.8 mm or more) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

5. INTERFACE PIN CONNECTION

(1) CN 1 (Interface Signal)

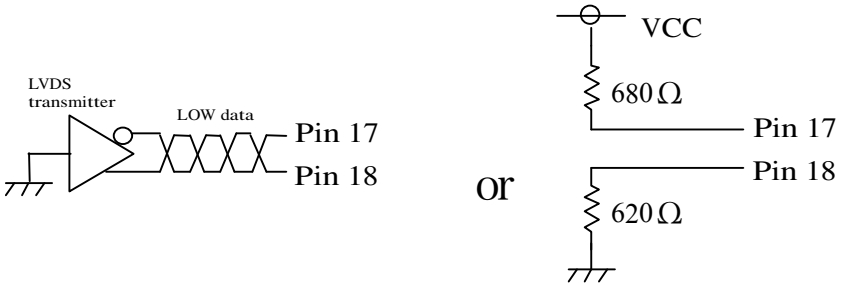
Used connector: FI-SE20P-HFE (JAE)

Corresponding connector: FI-S20S[for discrete wire] (JAE)

Pin No.	Symbol	Function (ISP 6 bit compatibility mode)		Function (ISP 8 bit compatibility mode)
		6 bit input	8 bit input	
1	VCC	+3.3 V Power supply		←
2	VCC	+3.3 V Power supply		←
3	GND	GND		←
4	GND	GND		←
5	Link 0–	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0
6	Link 0+	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0
7	GND	GND		←
8	Link 1–	G1, G2, G3, G4, G5, B0, B1	G3, G4, G5, G6, G7, B2, B3	G1, G2, G3, G4, G5, B0, B1
9	Link 1+	G1, G2, G3, G4, G5, B0, B1	G3, G4, G5, G6, G7, B2, B3	G1, G2, G3, G4, G5, B0, B1
10	GND	GND		←
11	Link 2–	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA
12	Link 2+	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA
13	GND	GND		←
14	CLKIN–	Clock –		←
15	CLKIN+	Clock +		←
16	GND	GND		←
17	Link3–	See: *2)	R0, R1, G0, G1, B0, B1	R6, R7, G6, G7, B6, B7
18	Link3+	See: *2)	R0, R1, G0, G1, B0, B1	R6, R7, G6, G7, B6, B7
19	MODE	Low=ISP 6 bit compatibility mode		High=ISP 8 bit compatibility mode
20	SC	Scan direction control. (Low : Normal , High : Reverse)		←

*1) Metal frame is connected to signal GND.

*2) Recommended wiring of Pin 17,18 (6 bit input)



(2) CN 2(Backlight)

Backlight-side connector: SM06B-SHLS-TF(LF)(SN) (JST)

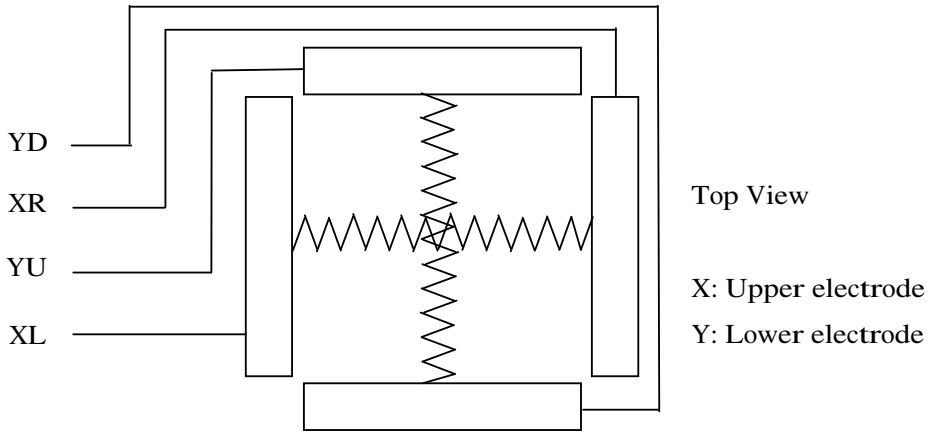
Corresponding connector: SHLP-06V-S-B (JST)

Pin No.	Symbol	Function
1	NC	This pin should be open.
2	NC	This pin should be open.
3	LED C 1	LED cathode 1
4	LED A 1	LED anode 1
5	LED A 2	LED anode 2
6	LED C 2	LED cathode 2

(3) FPC 1 (Touch Panel Interface)

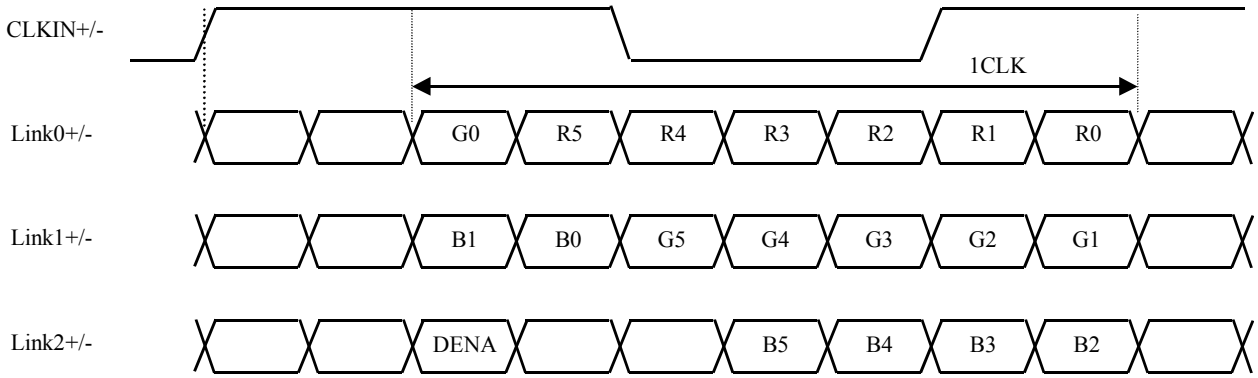
Pin No.	Symbol
1	XL
2	YU
3	XR
4	YD

(4) Touch Panel

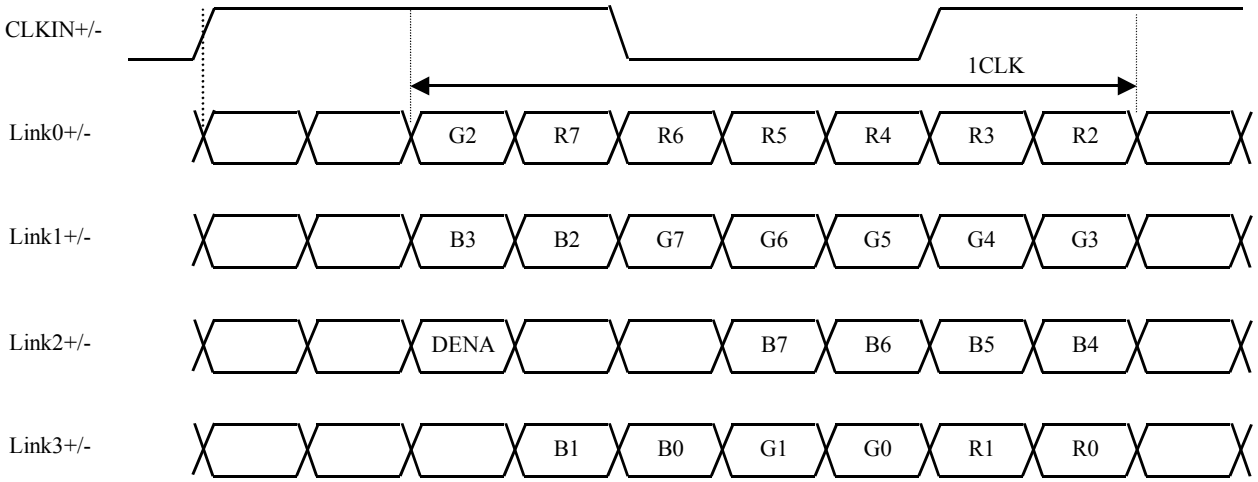


(5) ISP data mapping

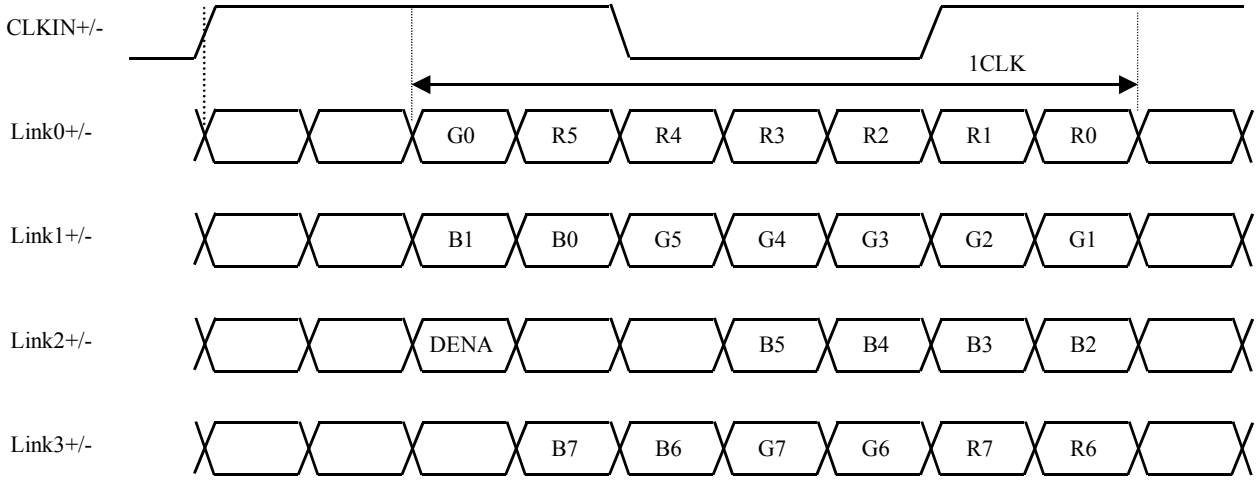
a. ISP 6 bit compatibility mode(6 bit input)



b. ISP 6 bit compatibility mode(8 bit input)



c. ISP 8 bit compatibility mode



6. INTERFACE TIMING

LVDS transmitter input signal

(1) Timing Specifications

ITEM			SYMBOL	MIN.	TYP.	MAX.	UNIT
DCLK	Frequency		f_{CLK}	50	65	80	MHz
	Period		t_{CLK}	12.5	15.4	20	ns
DENA	Horizontal	Active Time	t_{HA}	1024	1024	1024	t_{CLK}
		Blanking Time	t_{HB}	20	320	--	t_{CLK}
		Frequency	f_H	42.4	48.4	60	kHz
		Period	t_H	16.6	20.7	23.6	μs
	Vertical	Active Time	t_{VA}	768	768	768	t_H
		Blanking Time	t_{VB}	3	38	--	t_H
		Frequency	f_V	55	60	75	Hz
		Period	t_V	13.3	16.7	18.2	ms

[Note]

1) DENA (Data Enable) should always be positive polarity as shown in the timing specification.

2) DCLK should appear during all invalid period.

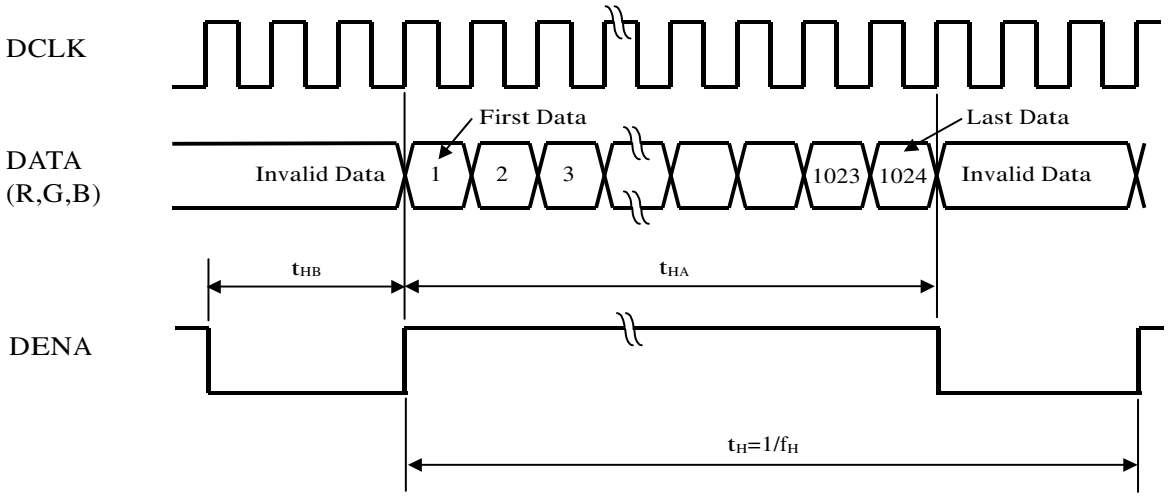
3) LVDS timing follows the timing specifications of LVDS receiver IC: THC63LVDF84B(Thine).

4) In case of blanking time fluctuation, please use following.

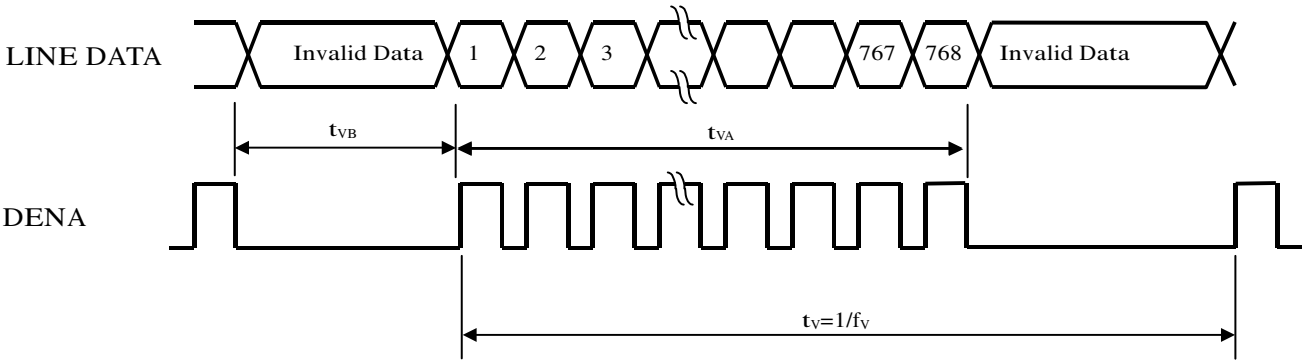
$t_{VBn} > t_{VBn-1} - 3(t_H)$

(2) Timing Chart

a. Horizontal Timing Chart



b. Vertical Timing Chart



(3) Color Data Assignment

a. 6 bit input

COLOR		INPUT DATA																	
		R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MSB					LSB	MSB					LSB	MSB					LSB
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(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(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(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) Data

1:High, 0: Low

b. 8 bit input

COLOR		INPUT DATA																							
		R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB							LSB	MSB							LSB	MSB							LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
RED	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE(1)	0	0	0	0	0	0	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	0	0	0	0	0	0	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

[Note]

1) Definition of gray scale

Color (n) --- n indicates gray scale level.

Higher n means brighter level.

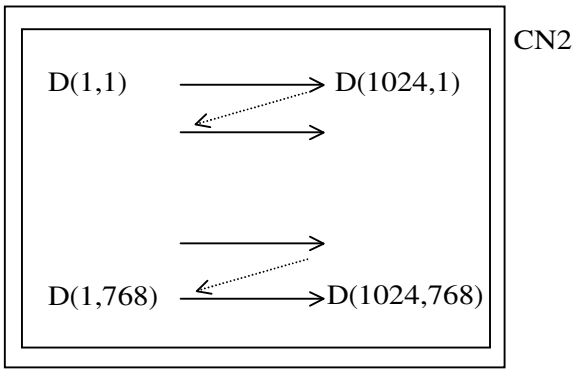
2) Data

1:High, 0: Low

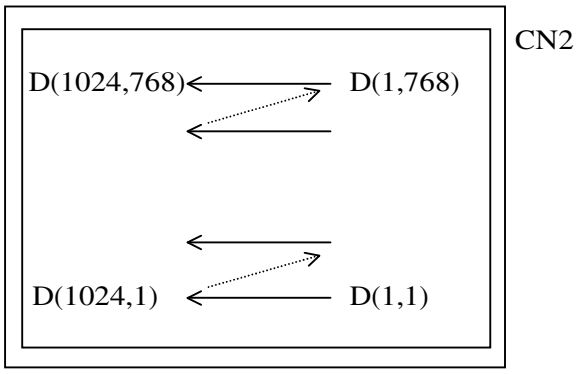
(4) Display Position and Scan Direction

D(X,Y) shows the data number of input signal.

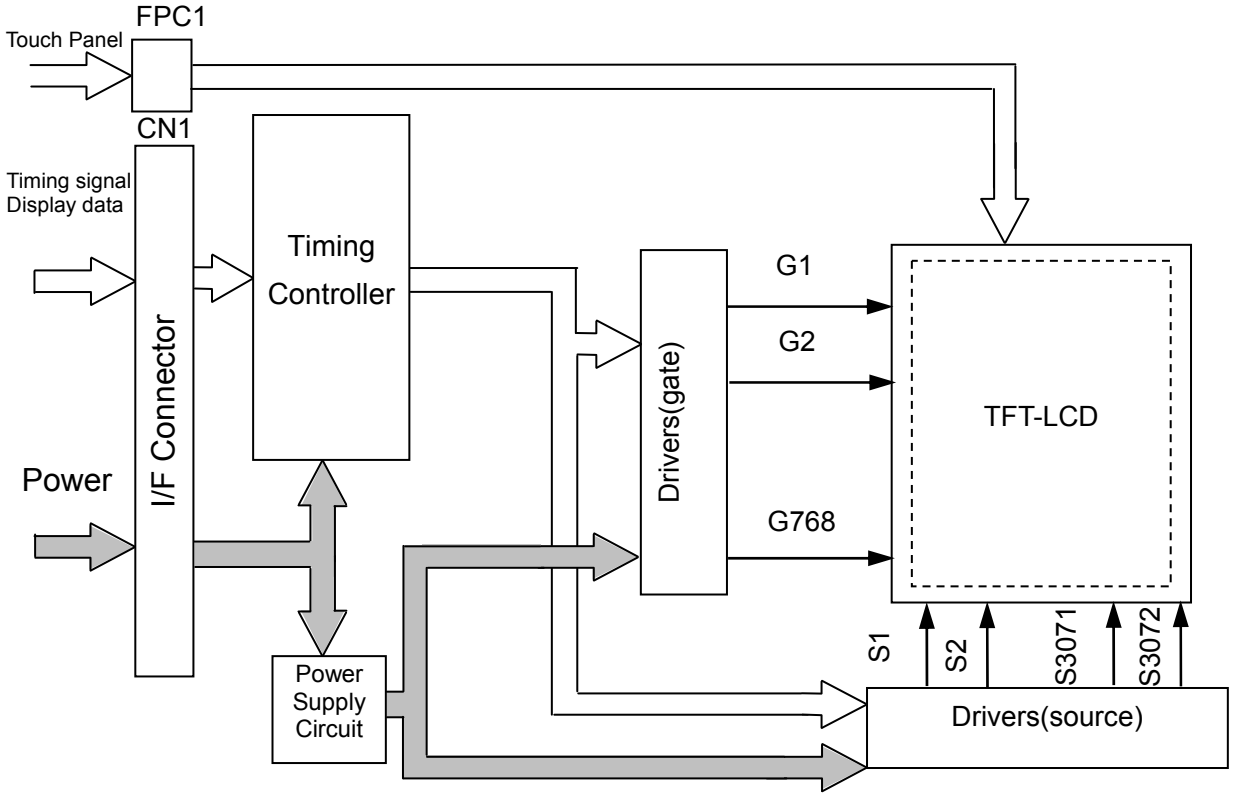
SC: Low

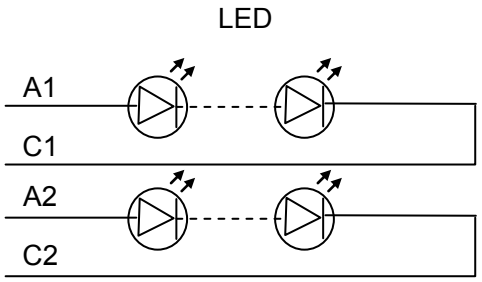


SC: High



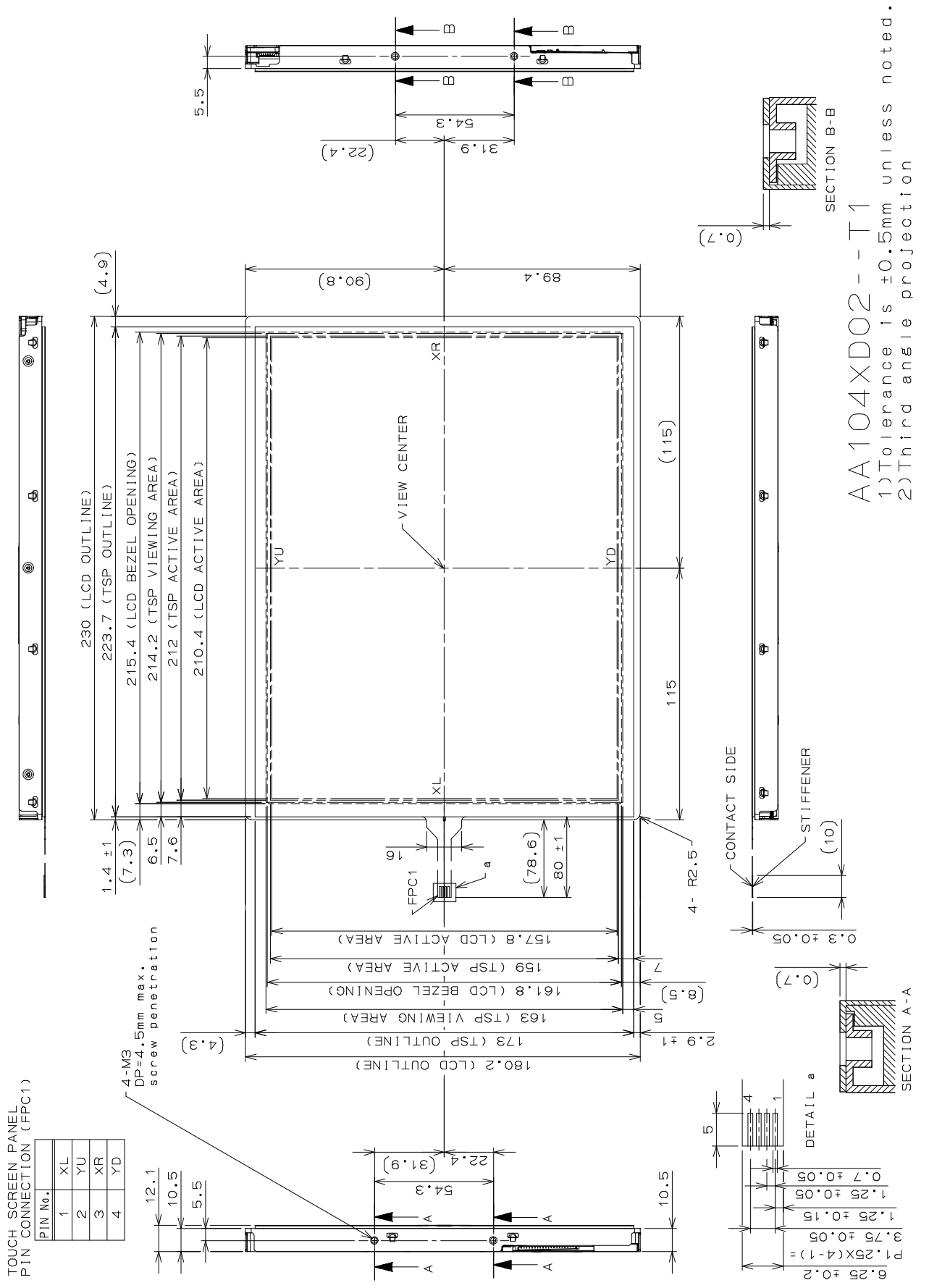
7. BLOCK DIAGRAM





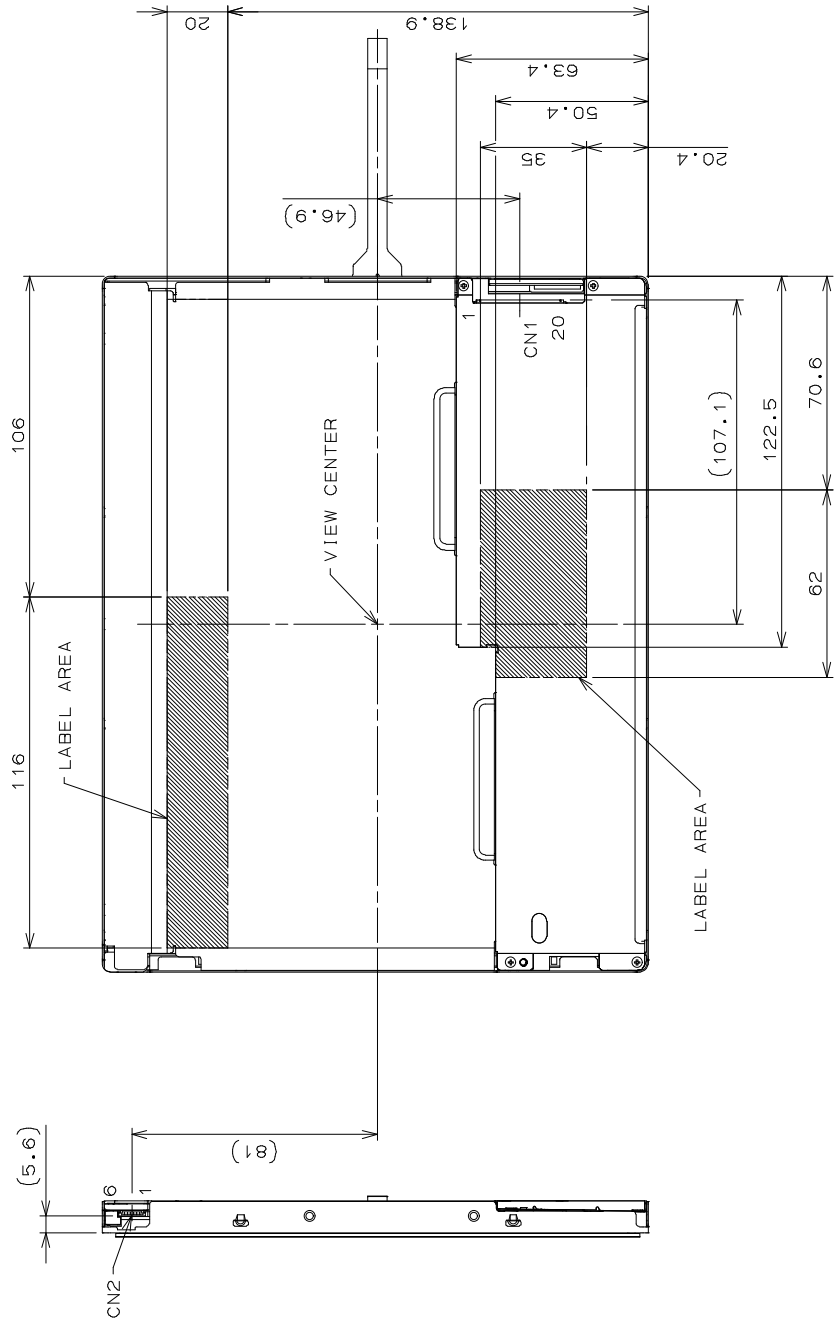
8. MECHANICAL SPECIFICATIONS

(1) Front Side



(Unit:mm)

(2) Rear Side



(Unit:mm)

(3) Touch Panel

a. Mechanical Characteristics

ITEM		MIN.	TYP.	MAX.	UNIT	Remarks
Activation Force		0.05	--	0.8	N	*1)
Durability	Surface Scratching	Write 100,000	--	--	characters	*2)
	Surface Pitting	10,000,000	--	--	touches	*3)
Surface Hardness		3	--	--	H	JIS K5400, ASTM D3363

*1) Stylus pen Input: R4.0 mm silicon pen

*2) Measurement for Surface area

-Input size 10 × 10 mm

-Input Character A to Z /minute

-Force: 2.45 N

-Stylus: R0.8 mm polyacetal tip

*3) Pit 10,000,000 hits on the Film with a R4.0 mm silicon pen

-Force: 3 N

-Speed: 2 hits/sec

b. Design Guide

-Avoid the design that Front-case overlap and press on the active area of the touch-panel.

-Give enough gap (over 0.5 mm at compressed) between the front case and touch-panel to protect wrong operating.

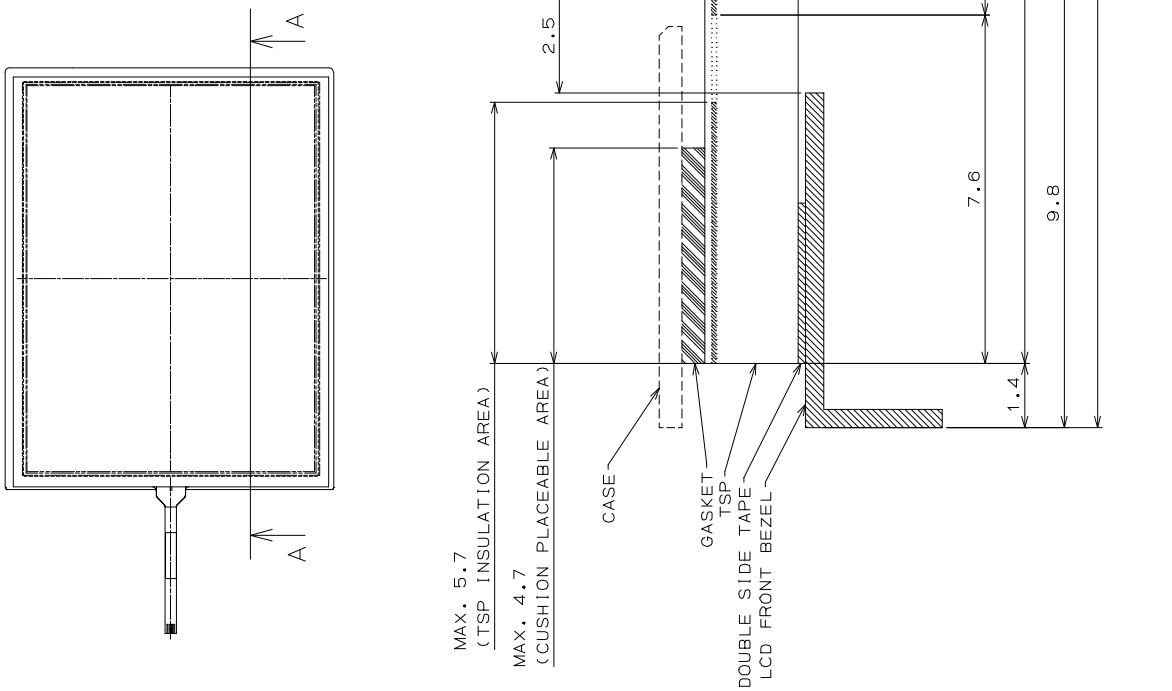
-Use a buffer material (Gasket) between the touch-panel and Front-case to protect damage and wrong operating.

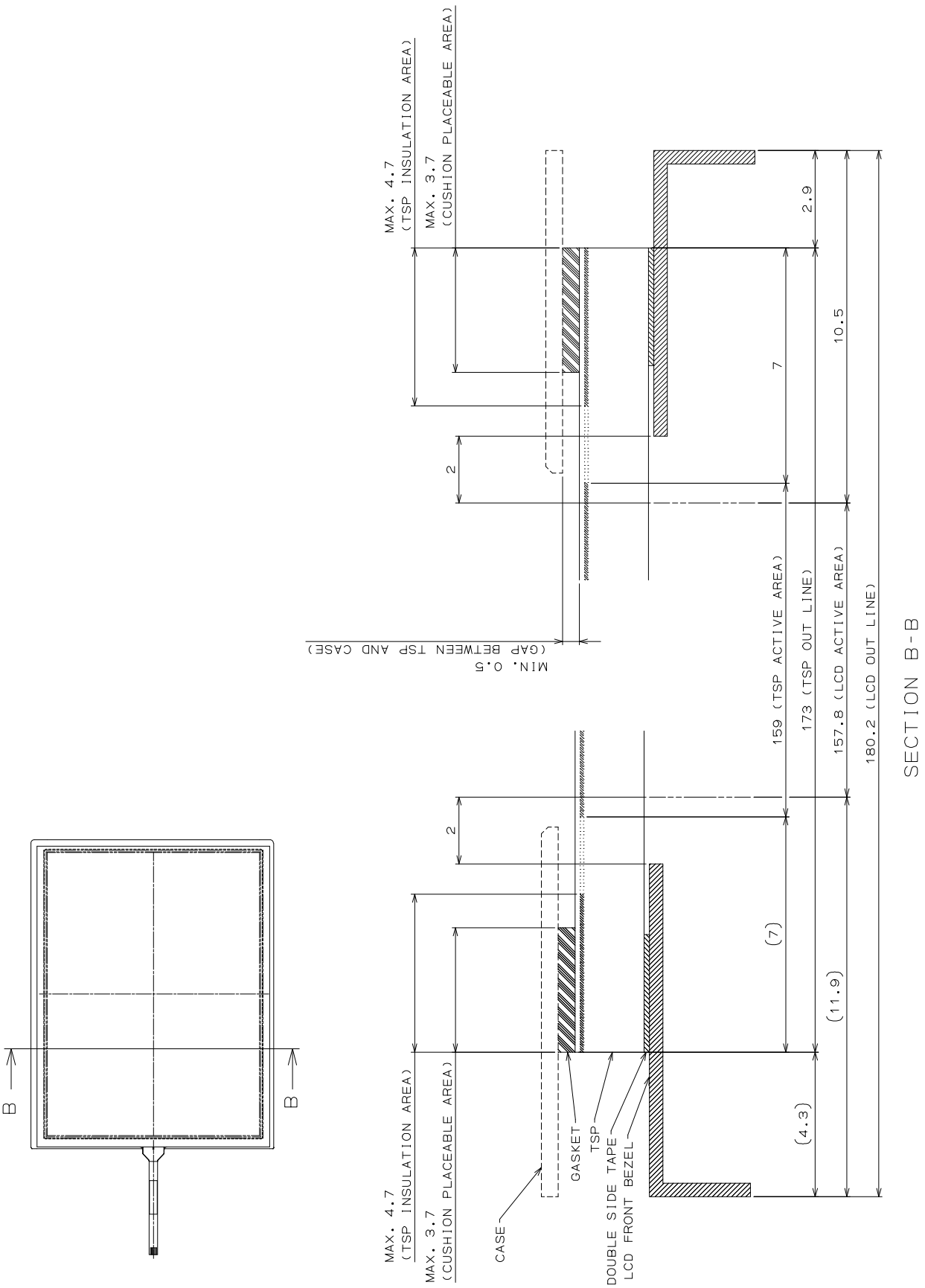
-Avoid the design that buffer material overlap and press on the inside of touch-panel viewing area.

-The flexible tail section should be designed to avoid stress from the front case and/or avoid any bending stress to root of flexible tail section.

-Please avoid any strong forces, such as pen input in the area between display area and insulated area (distance: >2mm), because it may cause damage to the film.

-When you handle the product, hold the product by its body. Do not hold by the FPC.


A
A
MAX. 2.2
(TSP INSULATION AREA)
MAX. 1.2
(CUSHION PLACEABLE AREA)
(4.9)
(9.8)
(4.1)
2.5
MIN. 0.5
(GAP BETWEEN TSP AND CASE)
212 (TSP ACTIVE AREA)
223.7 (TSP OUT LINE)
210.4 (LCD ACTIVE AREA)
230 (LCD OUT LINE)
2.5
7.6
9.8
1.4
MAX. 5.7
(TSP INSULATION AREA)
MAX. 4.7
(CUSHION PLACEABLE AREA)
CASE
GASKET
TSP
DOUBLE SIDE TAPE
LCD FRONT BEZEL
SECTION A-A


B
B
MAX. 4.7
(TSP INSULATION AREA)
MAX. 3.7
(CUSHION PLACEABLE AREA)
2.9
10.5
7
2
MIN. 0.5
(GAP BETWEEN TSP AND CASE)
159 (TSP ACTIVE AREA)
173 (TSP OUT LINE)
157.8 (LCD ACTIVE AREA)
180.2 (LCD OUT LINE)
SECTION B-B
2
(7)
(11.9)
(4.3)
CASE
GASKET
TSP
DOUBLE SIDE TAPE
LCD FRONT BEZEL

9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, Input Signals: Typ. values shown in Section 6

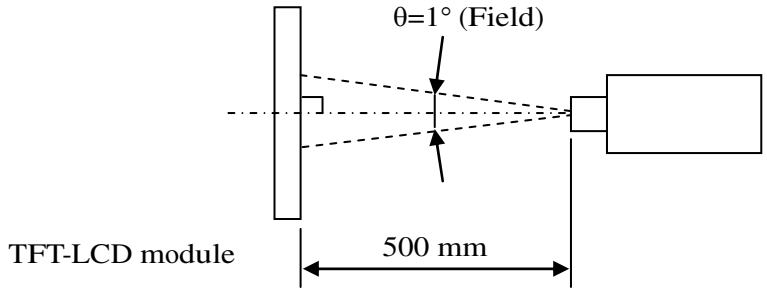
ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	Remarks
Contrast Ratio		CR	θ_V=0°, θ_H=0°	425	670	--	--	*1)*2)*5)
Luminance		Lw	θ_V=0°, θ_H=0°	380	480	--	cd/m^2	*1)*5)
Luminance Uniformity		ΔLw	θ_V=0°, θ_H=0°	--	--	30	%	*1)*3)*5)
Response Time		tr	θ_V=0°, θ_H=0°	--	4	--	ms	*1)*4)*5)
		tf	θ_V=0°, θ_H=0°	--	12	--	ms	*1)*4)*5)
Viewing Angle	Horizontal	θ_H	CR ≥ 10	–65~65	–80~80	--	°	*1)*5)
	Vertical	θ_V		–50~50	–65~65	--	°	*1)*5)
Image sticking		tis	2 h	--	--	2	s	*6)
Color Coordinates	Red	Rx	θ_V=0°, θ_H=0°	0.522	0.562	0.602	--	*1)*5)
		Ry		0.306	0.346	0.386		
	Green	Gx		0.305	0.345	0.385		
		Gy		0.495	0.535	0.575		
	Blue	Bx		0.113	0.153	0.193		
		By		0.101	0.141	0.181		
	White	Wx		0.278	0.318	0.358		
		Wy		0.295	0.335	0.375		

[Note]

These items are measured using EZContrast (ELDIM) for viewing angle and CS2000 (Minolta) or equivalent equipment for others under the dark room condition (no ambient light) after more than 30 minutes from turning on the backlight unless noted.

Condition: IF = 70 mA

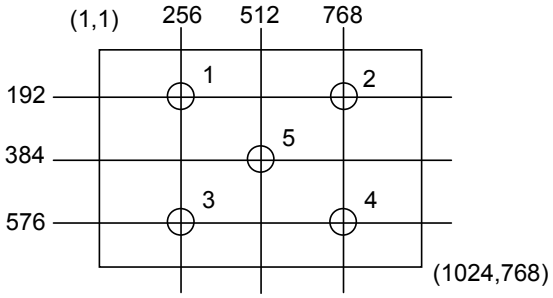
Measurement method for luminance and color coordinates is as follows.



The luminance is measured according to FLAT PANEL DISPLAY MEASUREMENTS STANDARD (VESA Standard).

*1) Measurement Point

Contrast Ratio, Luminance, Response Time, Viewing Angle, Color Coordinates: Display Center
Luminance Uniformity: point 1~5 shown in a figure below



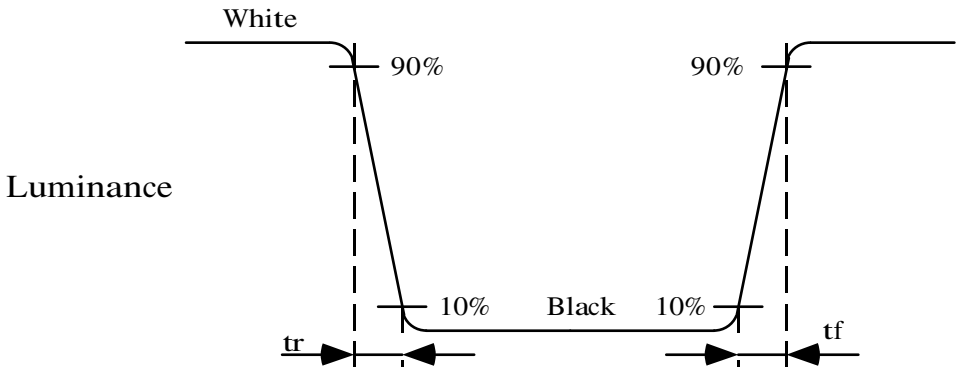
*2) Definition of Contrast Ratio

CR= Luminance with all white pixels / Luminance with all black pixels

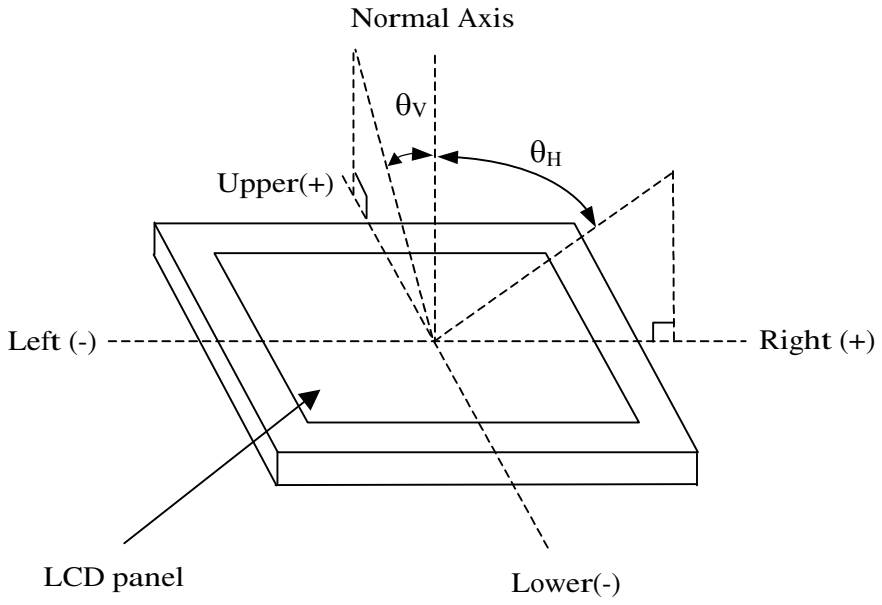
*3) Definition of Luminance Uniformity

$\Delta Lw=[Lw(MAX)/Lw(MIN)-1] \times 100$

*4) Definition of Response Time

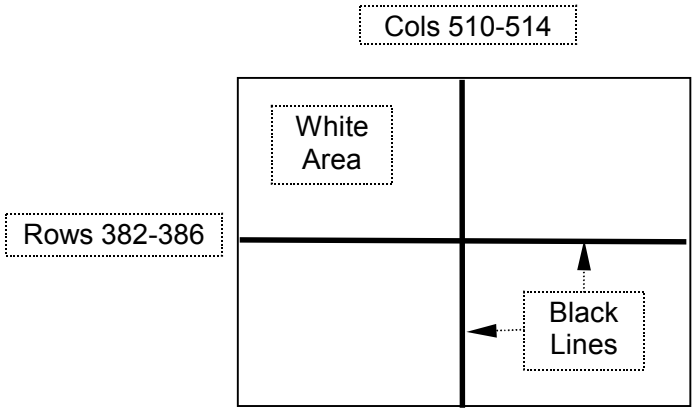


*5) Definition of Viewing Angle (θ_V, θ_H)



*6) Image sticking:

Continuously display the test pattern shown in the figure below for two-hours. Then display a completely white screen. The previous image shall not persist more than two seconds at 25°C.



TEST PATTERN FOR IMAGE STICKING TEST

10. RELIABILITY TEST CONDITION

(1) Temperature and Humidity

TEST ITEM	CONDITIONS
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	40°C, 90%RH, 240 h (No condensation)
HIGH TEMPERATURE OPERATION	70°C, 240 h
LOW TEMPERATURE OPERATION	–20°C, 240 h
HIGH TEMPERATURE STORAGE	80°C, 240 h
LOW TEMPERATURE STORAGE	–30°C, 240 h
THERMAL SHOCK	–30°C (1h) ~ 80°C(1h), 100 cycles

(2) Shock & Vibration

ITEM	CONDITIONS
SHOCK (NON-OPERATION)	Shock level: 1470m/s^2 (150G) Waveform: half sinusoidal wave, 2ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs
VIBRATION (NON-OPERATION)	Vibration level: 9.8m/s^2 (1.0G) Waveform: sinusoidal Frequency range: 5 to 500Hz Frequency sweep rate: 0.5 octave /min Duration: one sweep from 5 to 500 Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour, total 3 hours)

(3) ESD Test

ITEM	CONDITIONS
CONTACT DISCHARGE (OPERATION)	150pF, 330Ω, ±8kV, 10 times at 1 sec interval
SIGNAL PIN DISCHARGE (NON-OPERATION)	200pF, 0Ω, ±200V, 10 times at 1 sec interval

(4) Judgment standard

The judgment of the above tests should be made as follow:

Pass: Normal display image, no damage of the display function. (ex. no line defect)
Partial transformation of the module parts should be ignored.

Fail: No display image, damage of the display function. (ex. line defect)

11. OTHER FEATURE

This LCD module complies with RoHS*) directive.

*) RoHS: Restriction of the use of certain hazardous substances in electrical and electronic equipment

UL1950 certified (UL File# E158720)

12. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling TFT-LCD products;

(1) ASSEMBLY PRECAUTION

a. Please mount the LCD module by using mounting hole with a screw clamping torque less than 0.5 Nm. Please do not bend or wrench the LCD module in assembling. Please do not drop, bend or twist the LCD module in handling.

b. Please design display housing in accordance with the following guide lines.

(a) Housing case must be designed carefully so as not to put stresses on LCD and not to wrench module.

(b) Under high temperature environment, performance and life time of LED may heavily shorten. When you design with our LCD product, please consider radiating heat and ventilation for good heat management.

(c) Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.

(d) When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.

(e) Design the LED driver location and connector position carefully so as not to give stress to LED backlight cable and flexible tail.

(f) Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interfere the LCD module. Approximately 1.0 mm of the clearance in the design is recommended.

(g) To avoid local elevation/decrease of temperature, considering location of heating element, heat release, thermal design should be done.

c. Please do not push or scratch touch panel surface with anything hard. And do not soil LCD panel surface by touching with bare hands.

d. Do not use or store the product under a condition where the product will be exposed to water, organic solution or acid.

e. Please wipe off touch panel surface with absorbent cotton or soft cloth in case of it being soiled.

f. Touch panel glass edge is not rounded. Please take care in handling to avoid injury.

g. Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

h. Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.

i. Please handle metal frame carefully because edge of metal frame is very sharp.

j. Please connect the metal frame of LCD module to GND in order to minimize the effect of external noise and EMI.
k. Be sure to connect the cables and the connecters correctly.

(2) OPERATING PRECAUTIONS

a. Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
b. Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.
c. The interface signal speed is very high. Please pay attention to transmission line design and other high speed signal precautions to satisfy signal specification.
d. Condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature. Do not use touch panel when there is condensation. It could cause touch panel failure.
e. Please pay attention not to display the same pattern for very long time. Image sticking might happen on LCD. Although image sticking may disappear as the operation time proceeds, screen saver function is recommended not to cause image sticking.
f. Please obey the same safe instructions as ones being prepared for ordinary electronic products.

(3) PRECAUTIONS WITH ELECTROSTATICS

a. This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.
b. Please remove protection film very slowly from the surface of touch panel to prevent from electrostatics occurrence.

(4) STORAGE PRECAUTIONS

LCD should be stored in the room temperature environment with normal humidity. The LCD inventory should be processed by first-in first-out method.

(5) SAFETY PRECAUTIONS

a. When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
b. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.
c. Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.

d. LED driver should be designed carefully to limit or stop its function when over current is detected on the LED.

(6) OTHERS

a. A strong incident light into LCD panel may cause deterioration to touch panel, polarizer film, color filter, and other materials, which will degrade the quality and performance of display. Please do not expose LCD module under strong Ultraviolet rays for a long time. If using under direct sunlight condition, please test the reliability and performance completely.

b. For the packaging box handling, please see and obey with the packaging specification datasheet.

c. Please do not reuse the LED unit which is once removed.