4.3"WVGA

TECHNICAL SPECIFICATION

COMPANY PROPRIETARY
NOT TO BE REPRODUCED OR DISCLOSED WITHOUT SPECIFIC
WRITTEN PERMISSION OF MITSUBISHI ELECTRIC CORPORATION
(THIS IS A RED INK STAMP)

T-55226D043J-LW-A-AAN

OPTREX CORPORATION.

Date: Jul.18,'07

CONTENTS

1. APPLICATION

This specification applies to color TFT-LCD module, T-55226D043J-LW-A-AAN.

These specification papers are the proprietary product of OPTREX CORPORATION ("OPTREX") and include materials protected under copyright of OPTREX. No part of this document may be reproduced in any form or by any means without the express written permission of OPTREX.

OPTREX does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a product specified in this document. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of OPTREX or of others.

OPTREX classifies the usage of the TFT-LCD module as follows. Please confirm the usage before using the product.

(1) Standard Usage
> Computers, office equipment, factory automation equipment, test and measurement equipment, communications, transportation equipment(automobiles, ships, trains, etc.), provided, however, that operation is not influenced by TFT-LCD directly.

(2) Special Usage
> Medical equipment, safety equipment, transportation equipment, provided, however, that TFT-LCD is necessary to its operation.

(3) Specific Usage
> Cockpit Equipment, military systems, aerospace equipment, nuclear reactor control systems, life support systems and any other equipment. OPTREX should make a contract that stipulate apportionment of responsibilities between OPTREX and our customer.

The product specified in this document is designed for "Standard Usage" unless otherwise specified in this document. If customers intend to use the product for applications other than those specified for "Standard Usage", they should first contact OPTREX sales representative for it's intended use in writing.

OPTREX has been making continuous effort to improve the reliability of its products. Customers should implement sufficient reliability design of their application equipments such as redundant system design, fail-safe functions, anti-failure features.

OPTREX assumes no responsibility for any damage resulting from the use of the product that does not comply with the instructions and the precautions specified in this document.

Please contact and consult an OPTREX sales representative for any questions regarding this product.

2. OVERVIEW

T-55226D043J-LW-A-AAN is 4.3" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, and backlight unit.

By applying 6 bit or 8 bit digital data, 800 × 480, 262k-color or 16.7M-color images are displayed on the 4.3" diagonal screen. Input power voltage is 3.3 V for LCD driving.
The type of data and control signals are digital and transmitted via CMOS interface per Typ. 30.4 MHz clock cycle.

Driver circuit for LED backlight is not included in this module. General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	93.0(H) × 55.8(V) (4.3-inch diagonal)
Number of Dots	800 × 3 (H) × 480 (V)
Pixel Pitch (mm)	0.116(H) × 0.116(V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white TN
Number of Color	262k(6 bit/color) 16.7M(8 bit/color)
Luminance (cd/m^2)	200
Wide Viewing Angle Technology	Optical compensation film
Viewing Angle (CR ≥ 10)	–65~65° (H) –65~45° (V)
Surface Treatment	Clear and hard-coating 2H
Electrical Interface	CMOS (6 bit/8 bit)
Optimum Viewing Angle (Contrast ratio)	6 o'clock
Module Size (mm)	103.0(W) × 67.5(H) × 5.3(D)
Module Mass (g)	58
Backlight Unit	Edge-light, LED

Characteristic value without any note is typical value.

3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT
Power Supply Voltage for LCD	VCC	−0.3	4.0	V
Logic Input Voltage	VI	−0.3	6.0	V
Backlight (LED) Current	IF	--	35	mA
Operation Temperature (Panel) $^{Note 1,2)}$	$T_{op(Panel)}$	−20	70	°C
Operation Temperature (Ambient) $^{Note 2)}$	$T_{op(Ambient)}$	−20	70	°C
Storage Temperature $^{Note 2)}$	T_{stg}	−20	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℃

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	--	140	220	mA	*2)
Permissive Input Ripple Voltage		VRP	--	--	100	mVp-p	VCC = +3.3V
Logic Input Voltage	High	VIH	2.0	--	5.5	V	
	Low	VIL	0	--	0.8	V	

*1) Power and signals sequence:

   t1 ≤ 10 ms   200 ms ≤ t4
   0 < t2 ≤ 50 ms   200 ms ≤ t5
   0 < t3 ≤ 50 ms   0 ≤ t6

data: RGB DATA, DCLK, DENA, SC
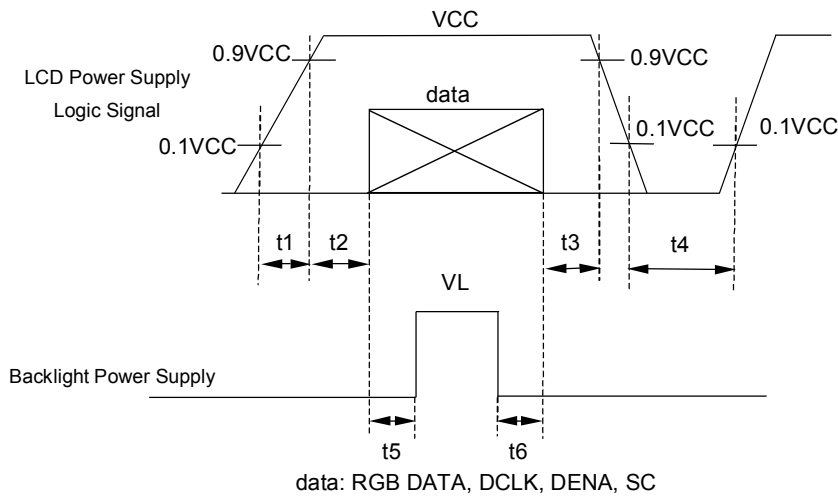
VCC-dip conditions:

    1) When 2.4 V ≤ VCC < 3.0 V, td ≤ 10 ms

    2) When VCC < 2.4 V

      VCC-dip conditions should also follow the power and signals sequence.
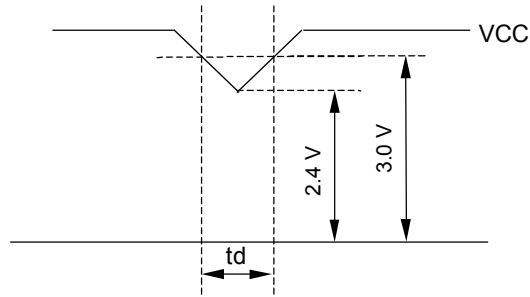
*2) Typical current condition:

    64-gray-bar-pattern(6 bit)
    256-gray-bar-pattern(8 bit)
    480 line mode
    VCC = + 3.3 V, f_H=31.6kHz, f_V=60Hz, f_{CLK}= 30.4MHz

(2) Backlight   Ta=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
LED Voltage	VL	--	(16.0)	(17.5)	V	
LED Current	IF	--	15.0	20.0	mA	*1)

  *1) Constant Current Drive
  *2) LED Current measurement method
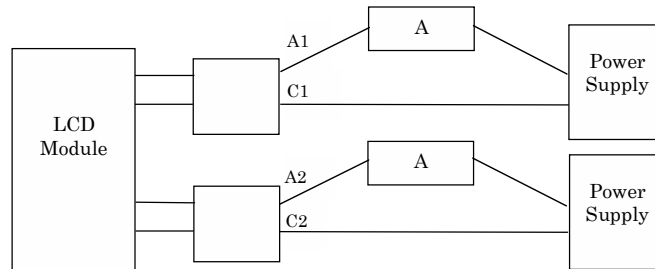
5. INTERFACE PIN CONNECTION

CN 1(Interface Signal)

Used connector: FH23-45S-0.3SHW(05) (HIROSE)

Pin No.	Symbol	Function
1	VCC	3.3 V Power Supply
2	VCC	3.3 V Power Supply
3	GND	
4	SC	Scan direction control (Low=Normal, High=Reverse)
5	DENA	Data enable signal (to settle the viewing area)
6	GND	
7	B7	Blue data signal(MSB)
8	B6	Blue data signal
9	B5	Blue data signal
10	B4	Blue data signal
11	B3	Blue data signal
12	B2	Blue data signal
13	B1	Blue data signal *3)
14	B0	Blue data signal(LSB) *3)
15	GND	
16	G7	Green data signal(MSB)
17	G6	Green data signal
18	G5	Green data signal
19	G4	Green data signal
20	G3	Green data signal
21	G2	Green data signal
22	G1	Green data signal *3)
23	G0	Green data signal(LSB) *3)
24	GND	
25	R7	Red data signal(MSB)
26	R6	Red data signal
27	R5	Red data signal
28	R4	Red data signal
29	R3	Red data signal
30	R2	Red data signal
31	R1	Red data signal *3)
32	R0	Red data signal(LSB) *3)
33	GND	
34	VD	Vertical sync signal *1)
35	HD	Horizontal sync signal *1)
36	GND	
37	DCLK	Clock signal for sampling catch data signal
38	GND	
39	NC	
40	NC	
41	NC	
42	LED_C1	LED cathode①
43	LED_C2	LED cathode②
44	LED_A2	LED anode②
45	LED_A1	LED anode①

*1) HD and VD are not being used for timing control.

*2) The shielding case is connected with GND

*3) In case of 6 bit mode, Input signal should be low.

6. INTERFACE TIMING

(1) Timing Specifications

ITEM			SYMBOL	MIN.	TYP.	MAX.	UNIT
DCLK	Frequency		f_{CLK}	--	30.4	45	MHz
	Period		t_{CLK}	22.2	32.9	--	ns
	Low Width		t_{WCL}	10	--	--	ns
	High Width		t_{WCH}	10	--	--	ns
DATA(R,G,B), DENA	Set up time		t_{DS}	4	--	--	ns
	Hold time		t_{DH}	4	--	--	ns
DENA	Horizontal	Active Time	t_{HA}	800	800	800	t_{CLK}
		Blanking Time	t_{HB}	20	160	--	t_{CLK}
		Frequency	f_H	--	31.6	45	kHz
		Period	t_H	22.2	31.7	--	μs
	Vertical	Active Time	t_{VA}	480	480	480	t_H
		Blanking Time	t_{VB}	3	45	--	t_H
		Frequency	f_V	55	60	75	Hz
		Period	t_V	13.3	16.7	18.2	ms

[Note]

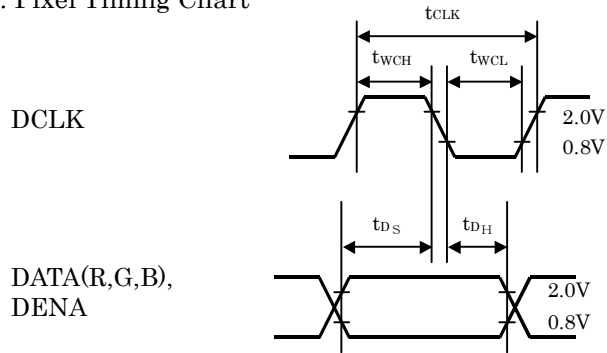1) DATA is latched at fall edge of DCLK in this specification.

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

3) DCLK should appear during all invalid period.

4) In case of blanking time fluctuation, please satisfy following condition.
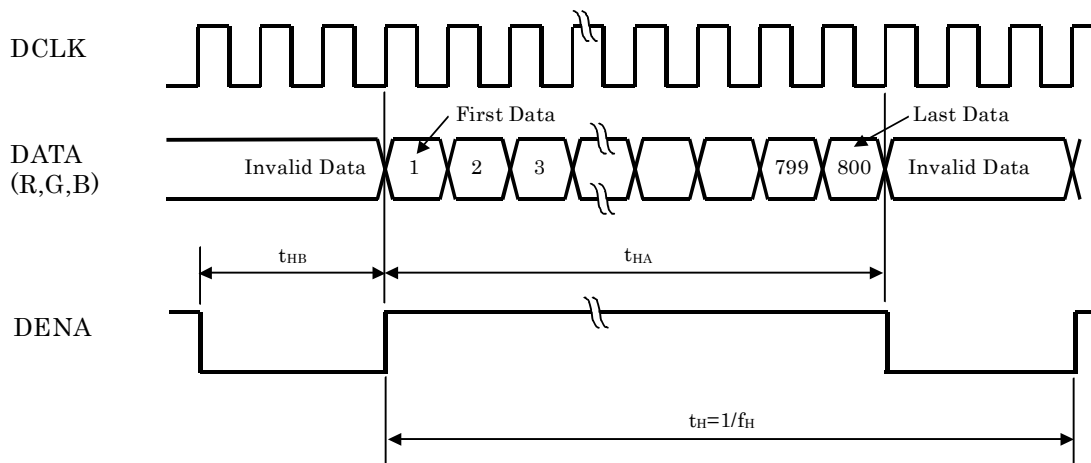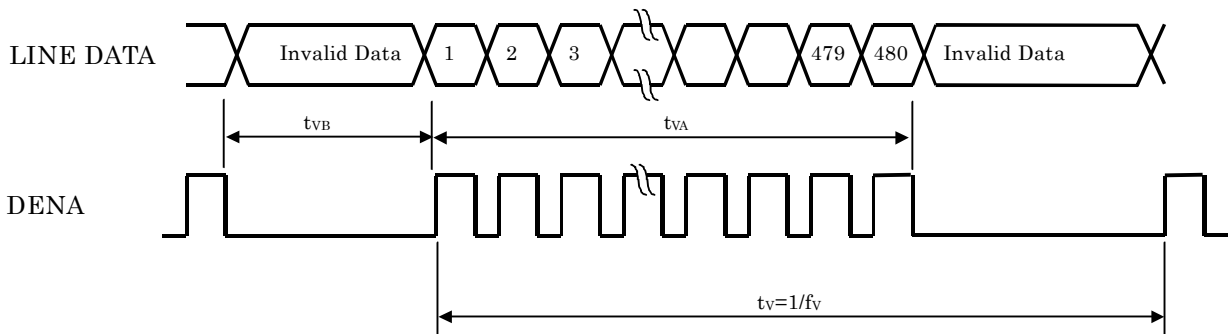
$t_{VBn} > t_{VBn-1} - 3(t_H)$

(2) Timing Chart

a. Pixel Timing Chart

b. Horizontal Timing Chart

c. Vertical Timing Chart

(3) Color Data Assignment

a. 6 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(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
	YELLOW	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0
RED	RED(1)	0	0	0	0	0	1	0	0	0	0	0	0	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	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	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	0	0	0	0	0	0
GREEN	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	GREEN(62)	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	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	1	0	0
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	BLUE(62)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0

[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.
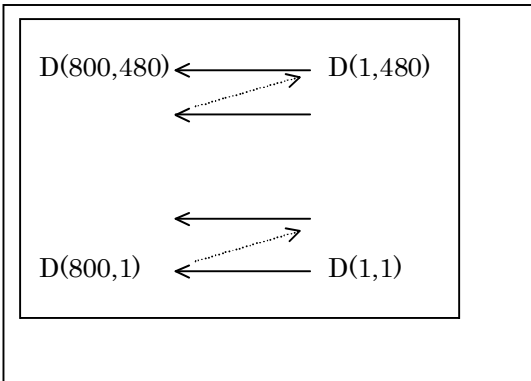
Higher n means brighter level.

2) Data

1:High, 0: Low

(4) Display Position and Scan Direction

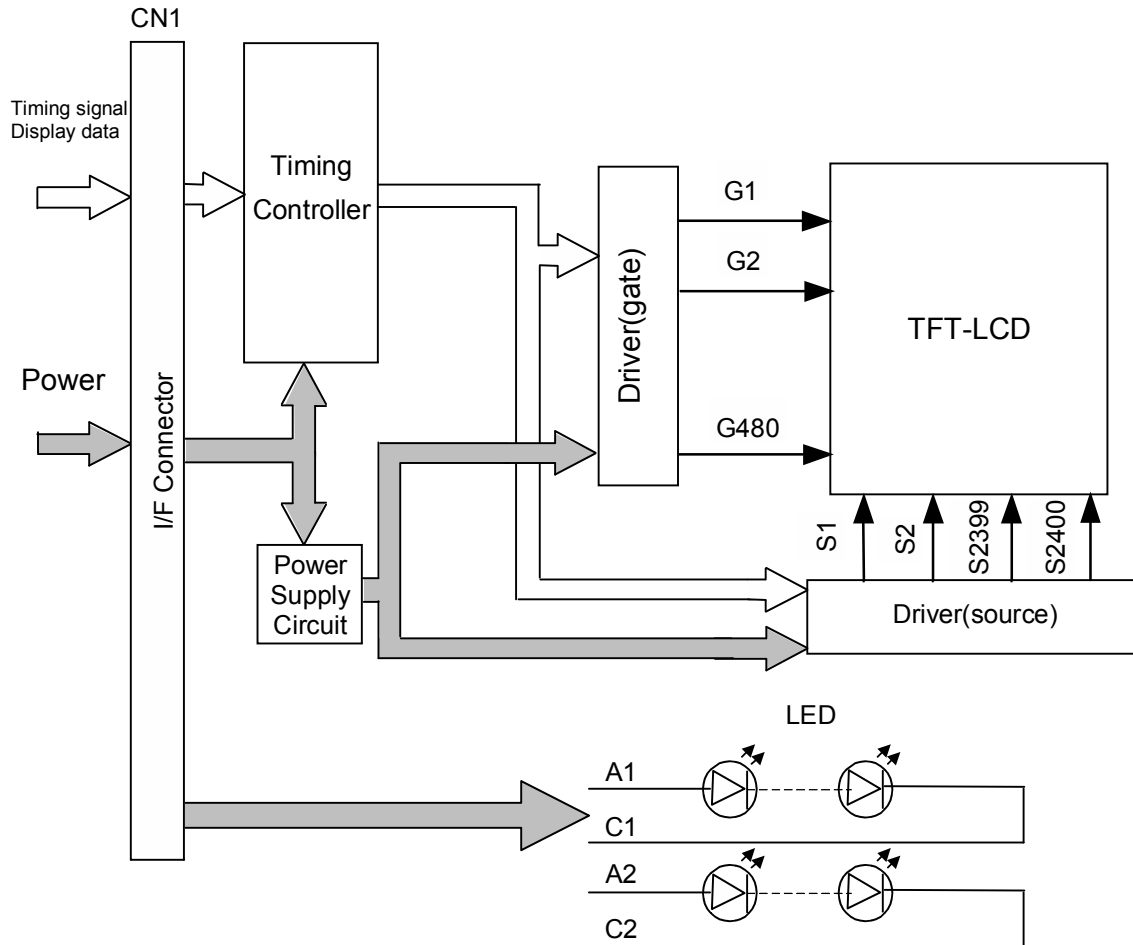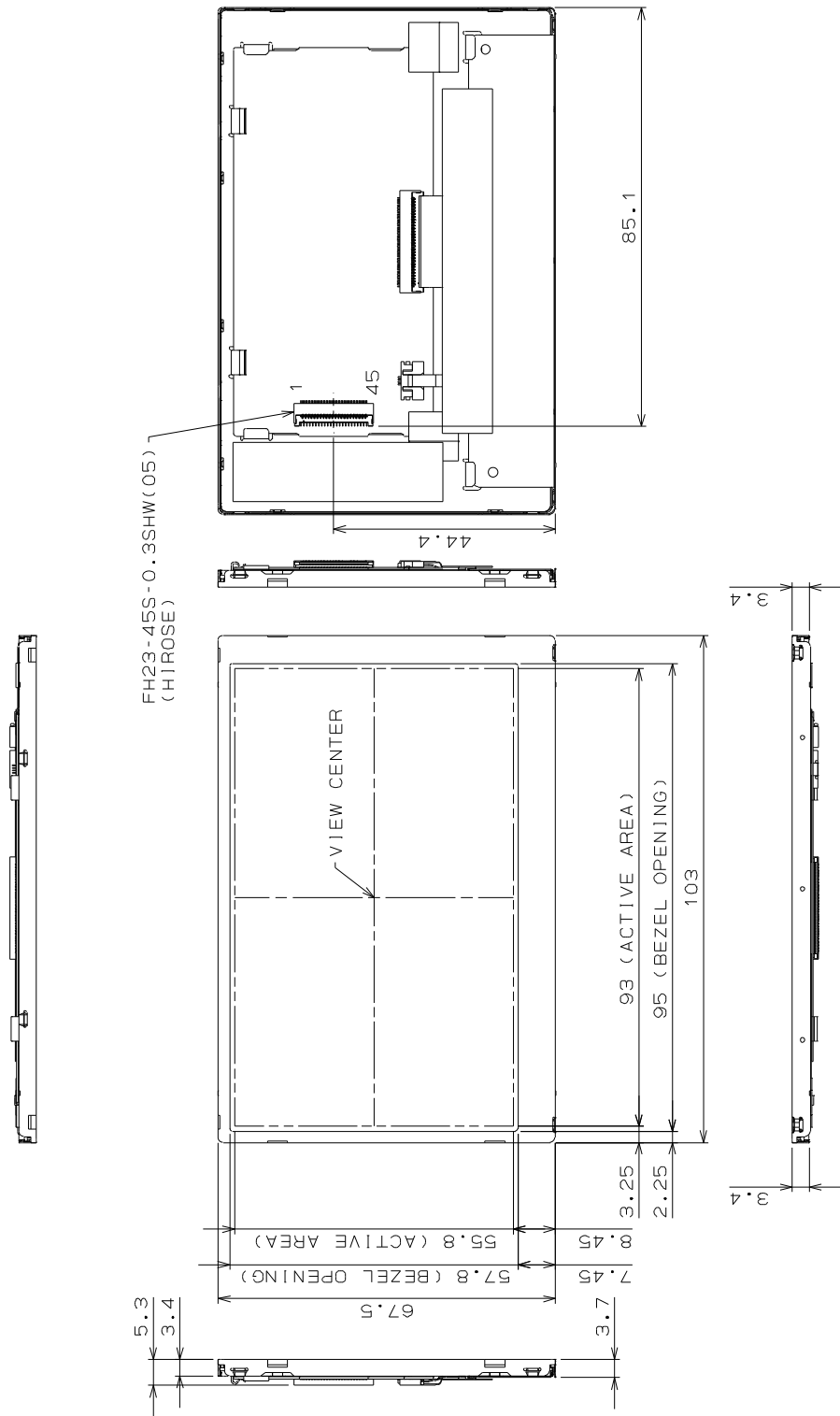 D(X,Y) shows the data number of input signal for LCD panel signal processing PCB.

SC: Low

| D(1,1) ——————→ D(800,1) |
| D(1,480) ——————→ D(800,480) |

SC: High

| D(800,480) ←—————— D(1,480) |
| D(800,1) ←—————— D(1,1) |
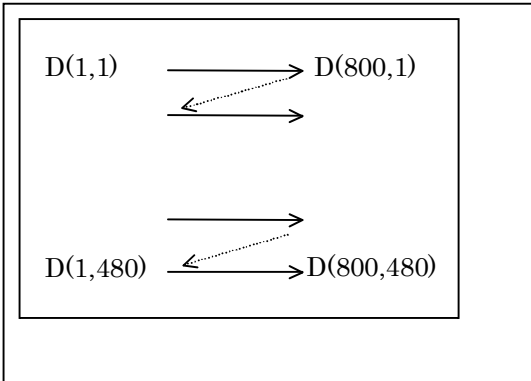
7. BLOCK DIAGRAM

8. MECHANICAL SPECIFICATIONS

(1) Outline Dimensions

(Unit:mm)

(2) Recommended Holding Area
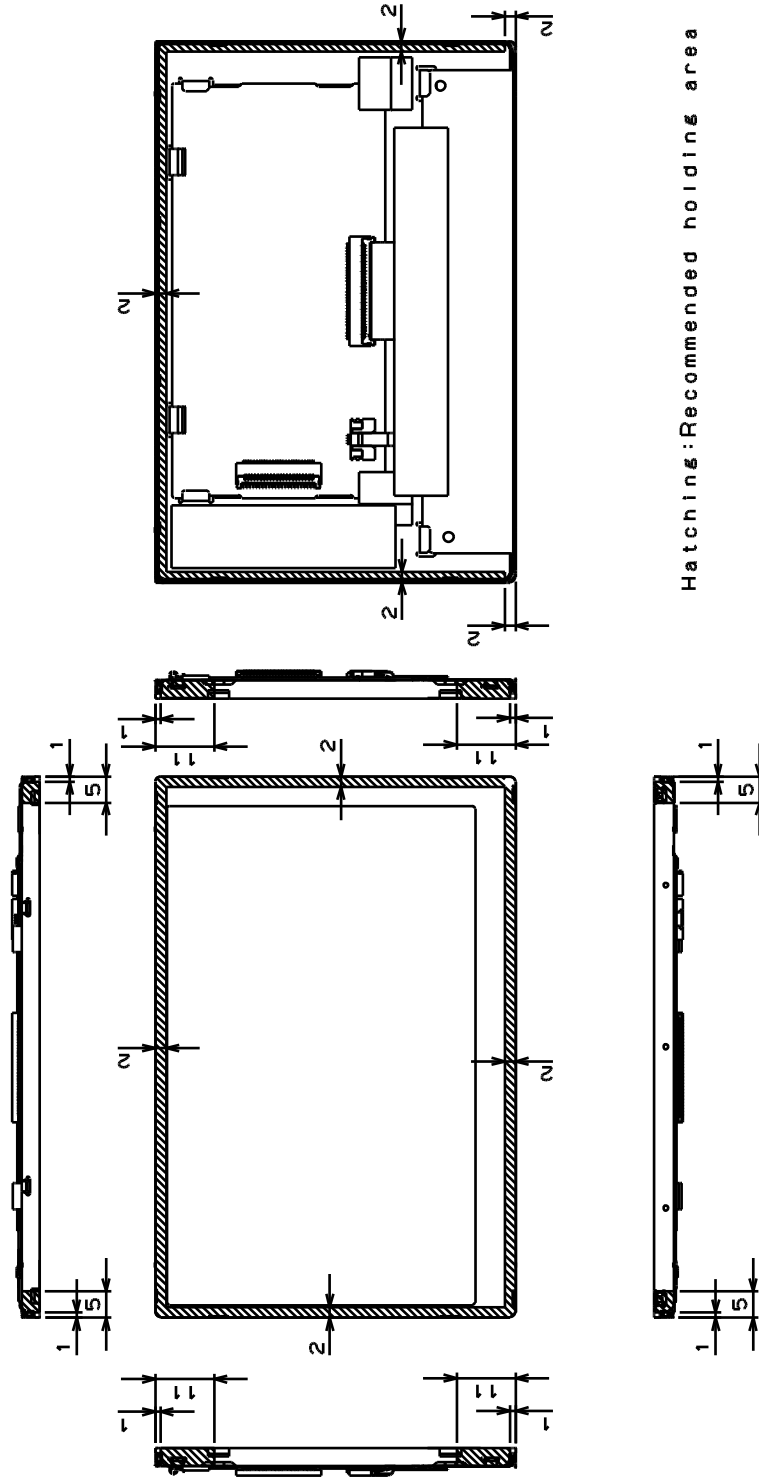
Hatching:Recommended holding area

1)Tolerance is ±0.5mm unless noted.
2)Third angle projection

(Unit:mm)

9. OPTICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	Remarks
Contrast Ratio		CR	$\theta_V=0°$, $\theta_H=0°$	100	400	--	--	*1)*2)*5)
Luminance		Lw	$\theta_V=0°$, $\theta_H=0°$	100	200	--	cd/m^2	*1)*5)
Luminance Uniformity		ΔLw	$\theta_V=0°$, $\theta_H=0°$	--	--	30	%	*1)*3)*5)
Response Time	tr	$\theta_V=0°$, $\theta_H=0°$	--	5	--	ms	*1)*4)*5)
	tf	$\theta_V=0°$, $\theta_H=0°$	--	20	--	ms	*1)*4)*5)
Viewing Angle	Horizontal	θ_H	CR ≥ 10	−50~50	−65~65	--	°	*1)*5)
	Vertical	θ_V		−40~30	−65~45	--	°	*1)*5)
	Horizontal	θ_H	CR ≥ 5	−65~65	−80~80	--		*1)*5)
	Vertical	θ_V		−50~40	−80~50	--		*1)*5)
Image Sticking		tis	2 h	--	--	2	s	*6)
Color Coordinates	Red	Rx	$\theta_V=0°$, $\theta_H=0°$	0.565	0.615	0.665	--	*1)*5)
		Ry		0.312	0.362	0.412		
	Green	Gx		0.291	0.341	0.391		
		Gy		0.545	0.595	0.645		
	Blue	Bx		0.101	0.151	0.201		
		By		0.088	0.138	0.188		
	White	Wx		0.282	0.332	0.382		
		Wy		0.308	0.358	0.408		

[Note]

These items are measured using CS1000(MINOLTA) for color coordinates, EZContrast(ELDIM) for viewing angle and CS1000 or BM-5A(TOPCON) for others under the dark room condition (no ambient light) after more than 30 minutes from turning on the backlight unless noted.

Condition: IF=15.0 mA

Measurement method for luminance and color coordinates is as follows.

θ (Field)

Photodetector
Luminance : θ=2°　(BM-5A)
Color coordinates : θ=1°　(CS1000)

TFT-LCD module

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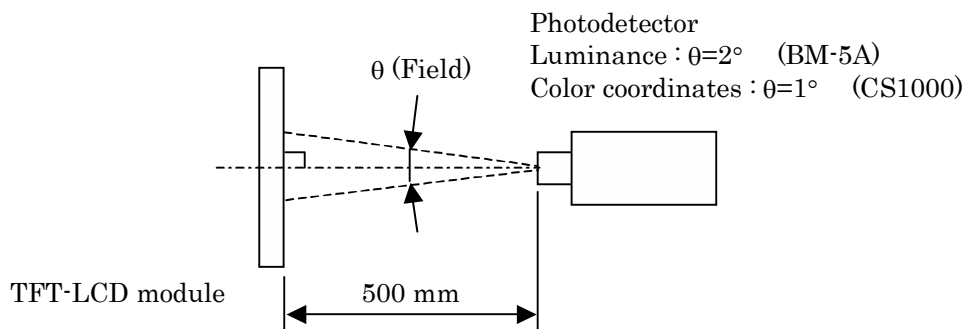
The luminance is measured according to FLAT PANEL DISPLAY MEASUREMENTS STANDARD (VESA Standard).

*1) Measurement Point

    Contrast Ratio, Luminance, Response Time, Viewing Angle, Color Coordinates: Display Center

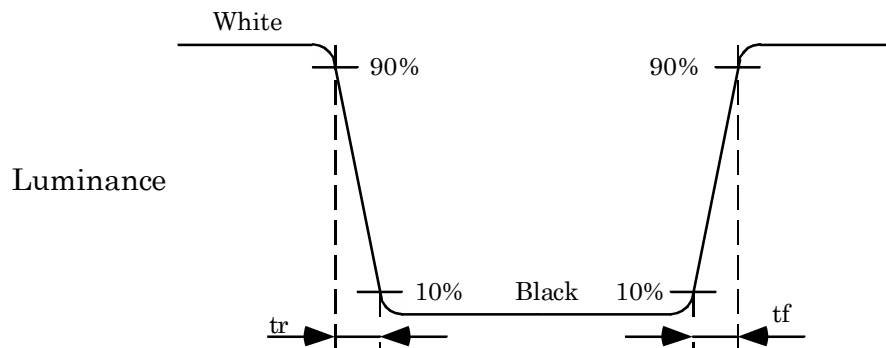   Luminance Uniformity: point 1~5 shown in a figure below

(1,1)   200   400   600

120

1   2

240

5

360

3   4

(800,480)
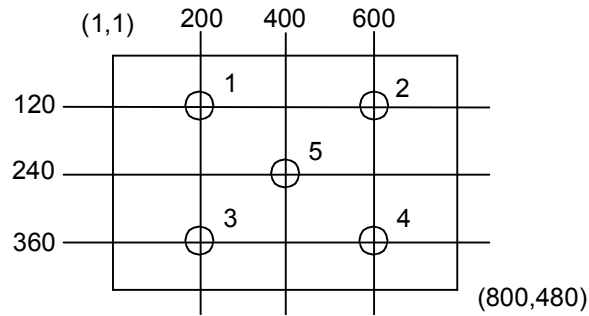
*2) Definition of Contrast Ratio

    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

White

90%   90%

Luminance

10%   Black   10%

tr   tf

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

Normal Axis

θ_V

θ_H

Upper(+)

Left (-)   Right (+)

LCD panel   Lower(-)
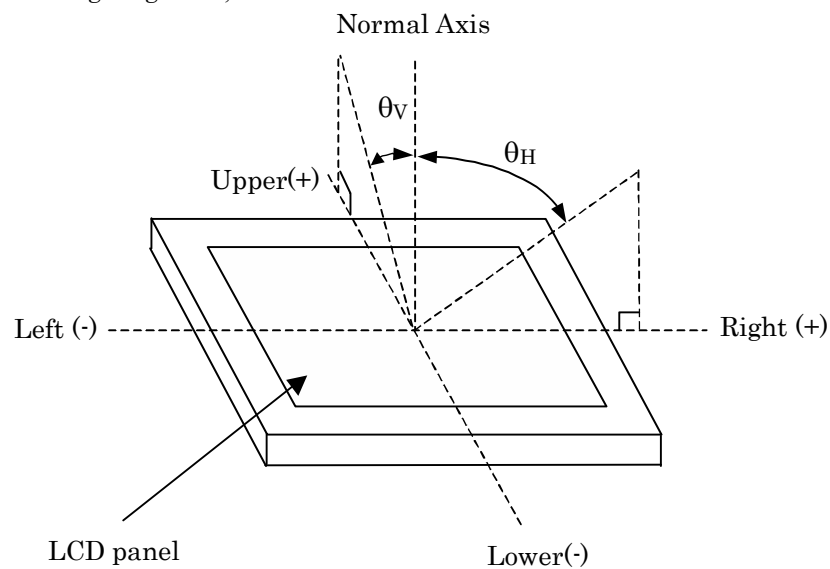
*6) Image Sticking

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.

Cols 398-402

White Area

Rows 238-242

Black Lines
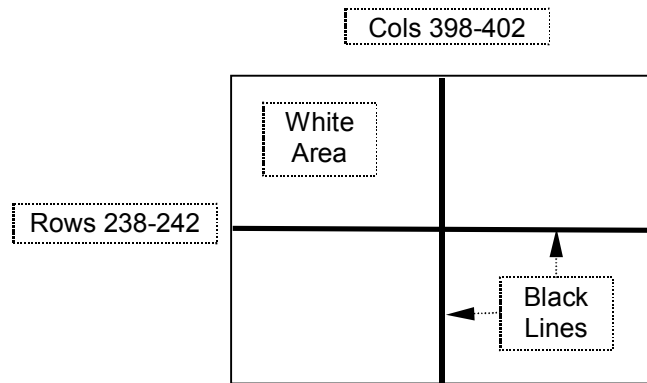
TEST PATTERN FOR IMAGE STICKING TEST

10. RELIABILITY TEST CONDITION

(1) Temperature and Humidity

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	−20°C, 240 h
THERMAL SHOCK (NON-OPERATION)	BETWEEN −20°C (1h) and 80°C(1h), 100 CYCLES

(2) Shock & Vibration

ITEM	CONDITIONS
SHOCK (NON-OPERATION)	Shock level: 1470m/s² (150G) Waveform: half sinusoidal wave, 2ms Number of shocks: one shock input in each direction of three mutually perpendicular axis for a total of six shock inputs
VIBRATION (NON-OPERATION)	Vibration level: 9.8m/s² (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(total 3 hours)

(3) 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

12. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

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

(1) ASSEMBLY PRECAUTION

a. Please do not bending or wrenching LCD in assembling. And please do not drop, bend or twist 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 all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.

(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 cable.

(f) Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm 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 LCD panel surface with anything hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)

d. Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.

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

f. Please wipe off drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.

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 pay attention to handling LED backlight cable so that it is not tugged in connecting with LED driver.

k. Please connect the metal frame of LCD module to GND in order to minimize the effect of external noise and EMI.

l. 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. A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.

e. Please pay attention not to display the same pattern for very long time. Image might stick on LCD. Even if image sticking happens, it may disappear as the operation time proceeds.

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 LCD module to prevent from electrostatics occurrence.

(4) STORAGE PRECAUTIONS

a. Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C90%RH.

b. Please do not leave the LCDs in the environment of low temperature; below -20°C.

(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 cable.

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

(6) OTHERS

a. A strong incident light into LCD panel might cause display characteristics changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight and strong UV rays.

b. Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.

c. For the packaging box, please pay attention to the followings;
   (a) Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
   (b) Please do not pile them up more than 7 boxes. (They are not designed so.) And please do not turn over.
   (c) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
   (d) Packaging box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)