All information in this technical data sheet is tentative and subject to change without notice

12.1" SVGA
(Ver. 5)

TECHNICAL SPECIFICATION

AA121SJ23

- 6.0mm^t (Max.)Module
- 120 cd/m^2
- LVDS-I/F

MITSUBISHI / ADI

Date: Jul.6,'00

CONTENTS

1. OVER VIEW

AA121SJ23 is 12.1" 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 digital data, 800 × 600, 260 K-color images are displayed on the 12.1" diagonal screen. Input power voltage is single 3.3 V for LCD driving.

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

ITEM	SPECIFICATION
Display Area (mm)	246.0 (H) X 184.5 (V) (12.106 -inch diagonal)
Number of Pixels	800(H) X 600(V)
Pixel Pitch (mm)	0.3075 (H) X 0.3075 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	normally white
Number of Color	260 K
Optimum Viewing Angle	6 o'clock
Brightness (cd/m^2)	120
Power Consumption(W)	3.8
Module Size (mm)	275.0 (W) X 199.0 (H) X 6.0(Max.) (D)
Module Mass (g)	440(Max.)
Backlight Unit	CCFL, 1-tube

Characteristic value without any notes is typical value.

The LCD product described in this specification is designed and manufactured for the standard use in OA equipment and consumer products, such as computers, communication equipment, industrial robots, AV equipment and so on.

Do not use the LCD product for the equipment that require the extreme high level of reliability, such as aerospace applications, submarine cables, nuclear power control systems and medical or other equipment for life support.

ADI assumes no responsibility for any damage resulting from the use of the LCD product in disregard of the conditions and handling precautions in this specification.

If customers intend to use the LCD product for the above items or other no standard items, please contact our sales persons in advance.

2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT
Power Supply Voltage for LCD	VCC	0	4.0	V
Input Voltage(TFT)	VIN	-0.5	VCC+0.5	V
Operation Temperature *1)	Top	0	50	°C
Storage Temperature *1)	Tstg	-20	60	°C

*1) 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.

3. ELECTRICAL CHARACTERISTICS

(1) TFT-LCD

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Power Supply Voltage for LCD *1)		VCC	3.0	3.3	3.6	V	Note A) (See next page)
Power Supply Current for LCD *2)		ICC		300	450	mA	Note B) (See next page)
Logic Input Voltage (LVDS:IN+,IN-)	High	VTH	-	-	100	mV	at VCM=+1.2V, LVDS Input termination should be 100Ω
	Low	VTL	-100	-	-	mV	

*1) at the Input connector

*2) VCC=3.3V

(2) Backlight

Ta=25°C

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT
Lamp Voltage		VL		620		V
Lamp Current		IL	2.5	4.5 [Note C)]	5.0	mA
Starting Lamp Voltage	Ta=25°C	Vs	1,100			V
	Ta=0°C		1,300			V

[Note]
  A) VCC-turn-on conditions:

        t1 ≤ 15ms

        0 < t2 ≤ 200ms

        0 < t3 ≤ 1s
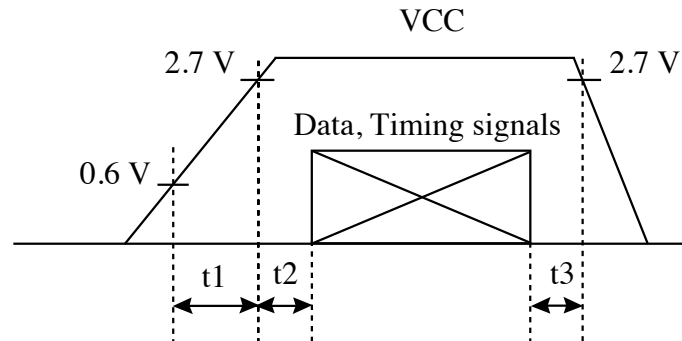
  VCC-dip conditions:

        (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 VCC-turn-on conditions
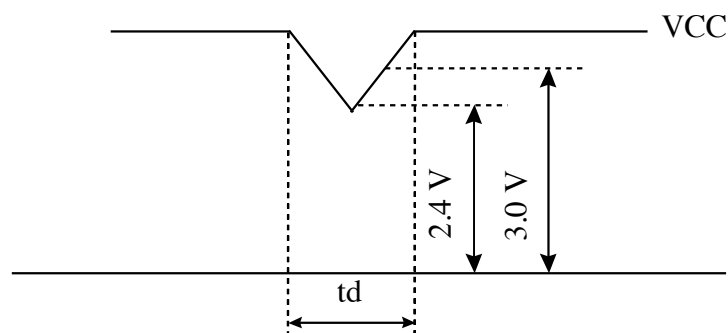
  B) Typical current situation:

        64- gray- bar-pattern

        600 line mode

        VCC = +3.3 V

  C) For typical luminance of 120cd/m^2

4.INTERFACE PIN CONNECTION

CN 1(INTERFACE SIGNAL)

Used connector: FI-XBD7S-HF10(JAE)

Corresponding connector: FI-XD7M(JAE)[for SMT],FI-XD7H(JAE)[for discrete wire]

Pin No.	Symbol	Function
1	GND	
2	VCC	+3.3V Power supply
3	VCC	+3.3V Power supply
4	GND	
5	GND	
6	GND	
7	GND	
8	Link 0-	R0, R1, R2, R3, R4, R5, G0 *)
9	Link 0+	R0, R1, R2, R3, R4, R5, G0 *)
10	GND	
11	Link 1-	G1, G2, G3, G4, G5, B0, B1 *)
12	Link 1+	G1, G2, G3, G4, G5, B0, B1 *)
13	GND	
14	Link 2-	B2, B3, B4, B5, HD, VD, DENA *)
15	Link 2+	B2, B3, B4, B5, HD, VD, DENA *)
16	GND	
17	CLKIN-	Clock-
18	CLKIN+	Clock+
19	GND	
20	ID	Pull down to GND on LCD side (This pin should be open.)
21	TEST	This pin should be open. Test signal output for only internal test use.
22	GND	

*) See; Timing Chart(P7) and LVDS Data Mapping(P9)

CN 2(BACKLIGHT)
        Backlight-side connector: BHSR-02VS-1(JST)
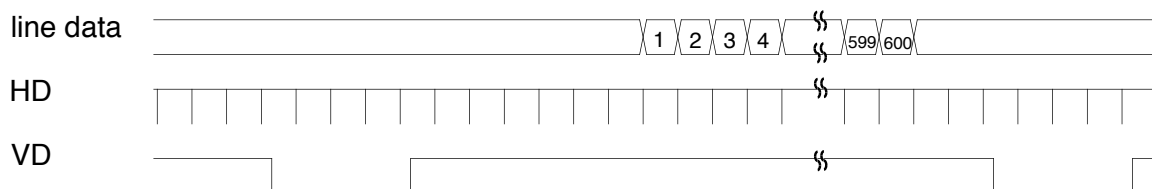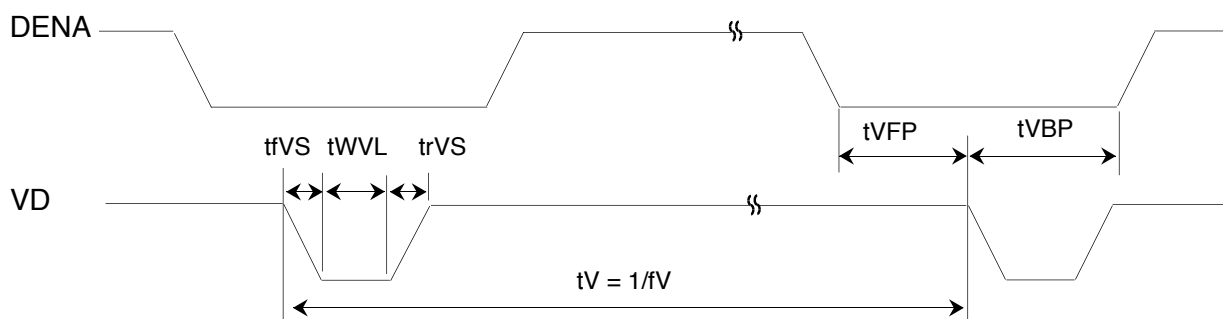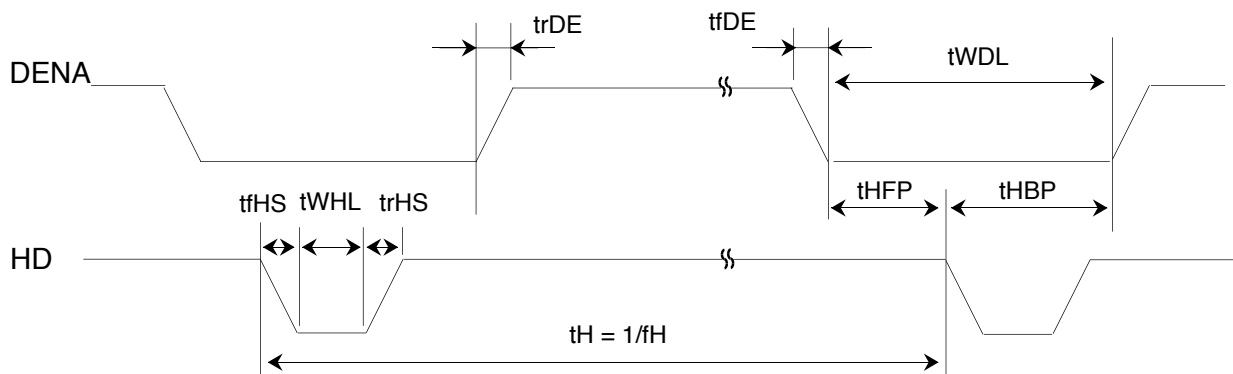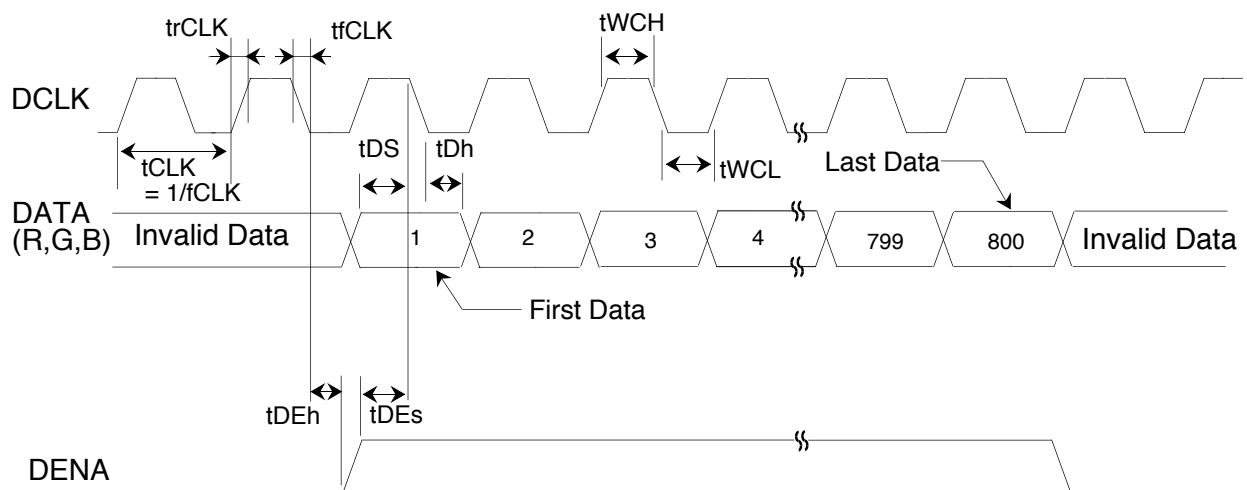   Inverter-side connector: SM02B-BHSS-1(JST)

Pin No.	Symbol	Function
1	CTH	VBLH(High voltage)
2	CTL	VBLL(Low voltage)

[Note]
VBLH-VBLL=VL

5.INTERFACE TIMING

(1) Timing Chart

definition of tr / tw / tf
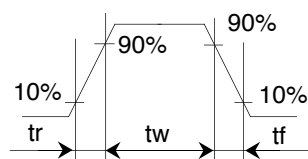
(2) Timing Specifications

	ITEM	SYMBOL	MIN	TYP	MAX	UNIT
DCLK [*2,*5]	Frequency	fCLK	36	--	40.5	MHz
	Period	tCLK	25	--	27.8	ns
	Width-Low	tWCL	10	--	--	ns
	Width-High	tWCH	10	--	--	ns
	Rise Time	trCLK	--	--	10	ns
	Fall Time	tfCLK	--	--	10	ns
DATA [*2] (R,G,B)	Set up Time	tDs	5	--	--	ns
	Hold Time	tDh	5	--	--	ns
DENA [*4]	Set up Time	tDEs	5	--	--	ns
	Hold Time	tDEh	5	--	--	ns
	Low Period	tWDL	11	--	--	tCLK
	Rise Time	trDE	--	--	10	ns
	Fall Time	tfDE	--	--	10	ns
	Horizontal Front Porch	tHFP	10	24	--	tCLK
	Horizontal Back Porch	tHBP	1	--	--	tCLK
	Vertical Front Porch	tVFP	1	15	--	tH
	Vertical Back Porch	tVBP	2	15	--	tH
HD [*3) *5)]	Frequency	fH	--	37.8	40.0	kHz
	Period	tH	811	1056	--	tCLK
	Width-Low	tWHL	1	--	--	tCLK
	Rise Time	trHS	--	--	10	ns
	Fall Time	tfHS	--	--	10	ns
VD [*3)]	Frequency	fV	55	60.2	65.5	Hz
	Period	tV	603	628	--	tH
	Width-Low	tWVL	1	--	--	tH
	Rise Time	trVS	--	--	10	ns
	Fall Time	tfVS	--	--	10	ns

[Note]

*1) LVDS timing follows the timing specification of LVDS receiver IC:DS90CF364(National Semiconductor)

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

*3)Polarities of HD and VD are negative in this specification.

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

*5)DCLK should appear during all invalid period, and HD should appear during invalid period of frame cycle.

(3) LVDS Data Mapping

Cell	Input pin *)	Data
P0C1	TxIN0	R0
P0C2	TxIN1	R1
P0C3	TxIN2	R2
P0C4	TxIN3	R3
P0C5	TxIN4	R4
P0C6	TxIN5	R5
P0C7	TxIN6	G0
P1C1	TxIN7	G1
P1C2	TxIN8	G2
P1C3	TxIN9	G3
P1C4	TxIN10	G4
P1C5	TxIN11	G5
P1C6	TxIN12	B0
P1C7	TxIN13	B1
P2C1	TxIN14	B2
P2C2	TxIN15	B3
P2C3	TxIN16	B4
P2C4	TxIN17	B5
P2C5	TxIN18	HD
P2C6	TxIN19	VD
P2C7	TxIN20	DENA
Ref-CLK1	TxCLKIN	DCLK

*): Pin definition of DS90C363(NS)

(4) Color Data Assignment

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

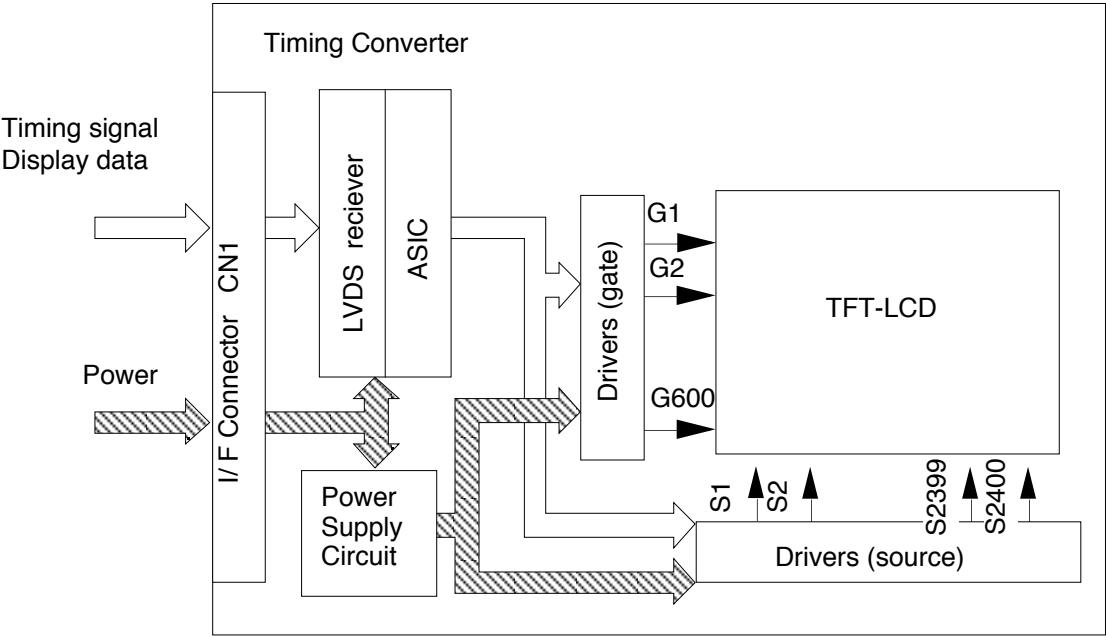   1) Definition of gray scale

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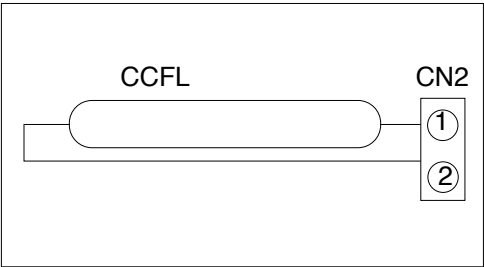
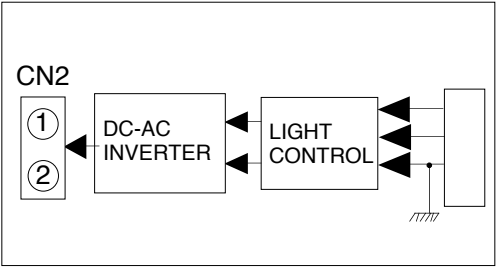   Higher n means brighter level.

    2) Data

        1: High, 0:Low

6.BLOCK DIAGRAM

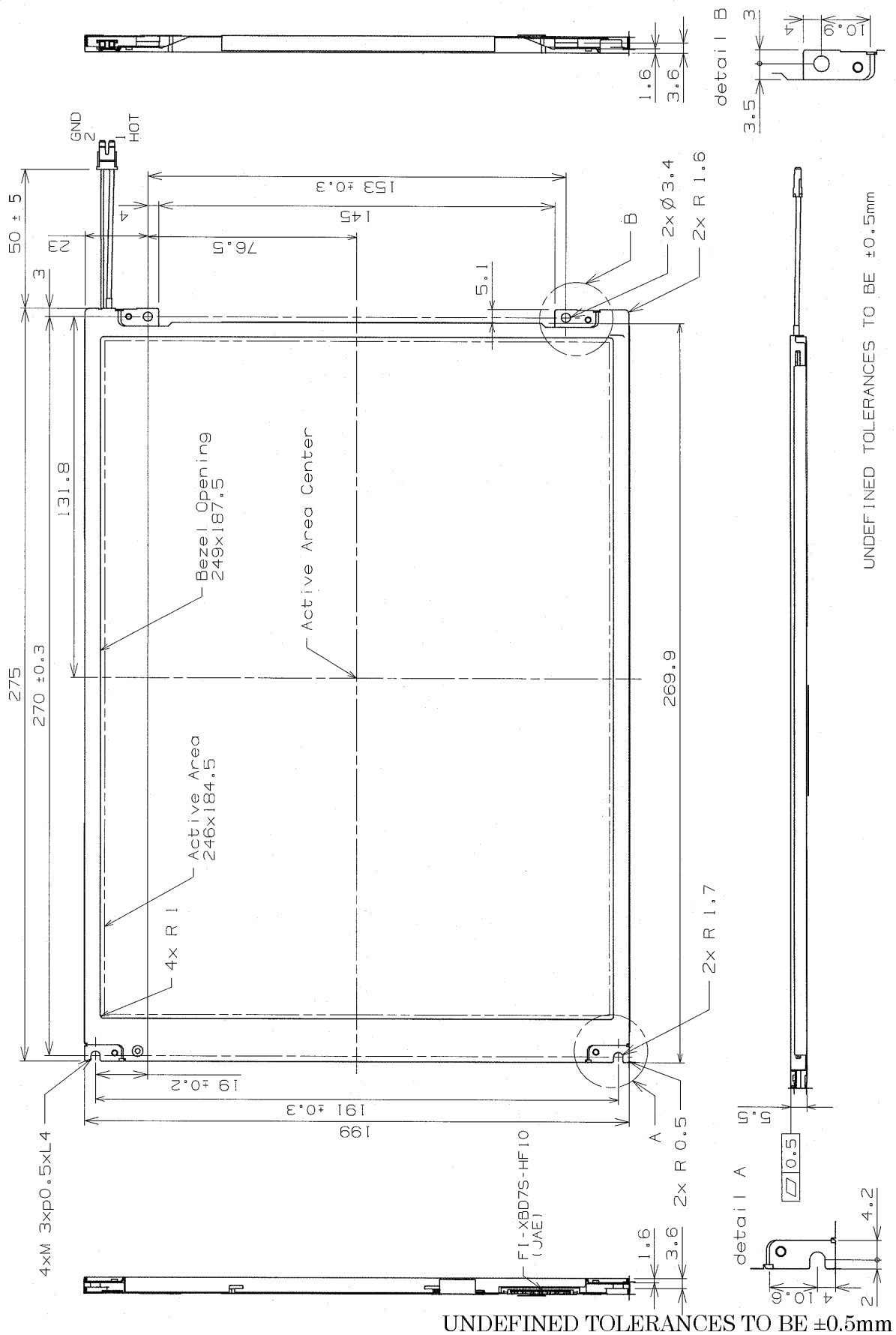Timing Converter

Timing signal
Display data

Power

I / F Connector CN1

LVDS reciever

ASIC

Power
Supply
Circuit

Drivers (gate)

G1

G2

G600

TFT-LCD

S1

S2

S2399

S2400

Drivers (source)

BACK LIGHT

CCFL

CN2

①
②

INVERTER CIRCUIT
(OUT SIDE)

CN2

①
②

DC-AC
INVERTER

LIGHT
CONTROL

7. MECHANICAL SPECIFICATION

(1) Front side

UNDEFINED TOLERANCES TO BE ±0.5mm

(2) Rear side

detail D

FI-XBD7S-HF10(JAE)

(1)
2

21
(22)

CN1

32.5

5.4

D

4.3

4

2

4.5

detail C

CN2

2(GND)

1(HOT)

4.5

3

4

4.3

C
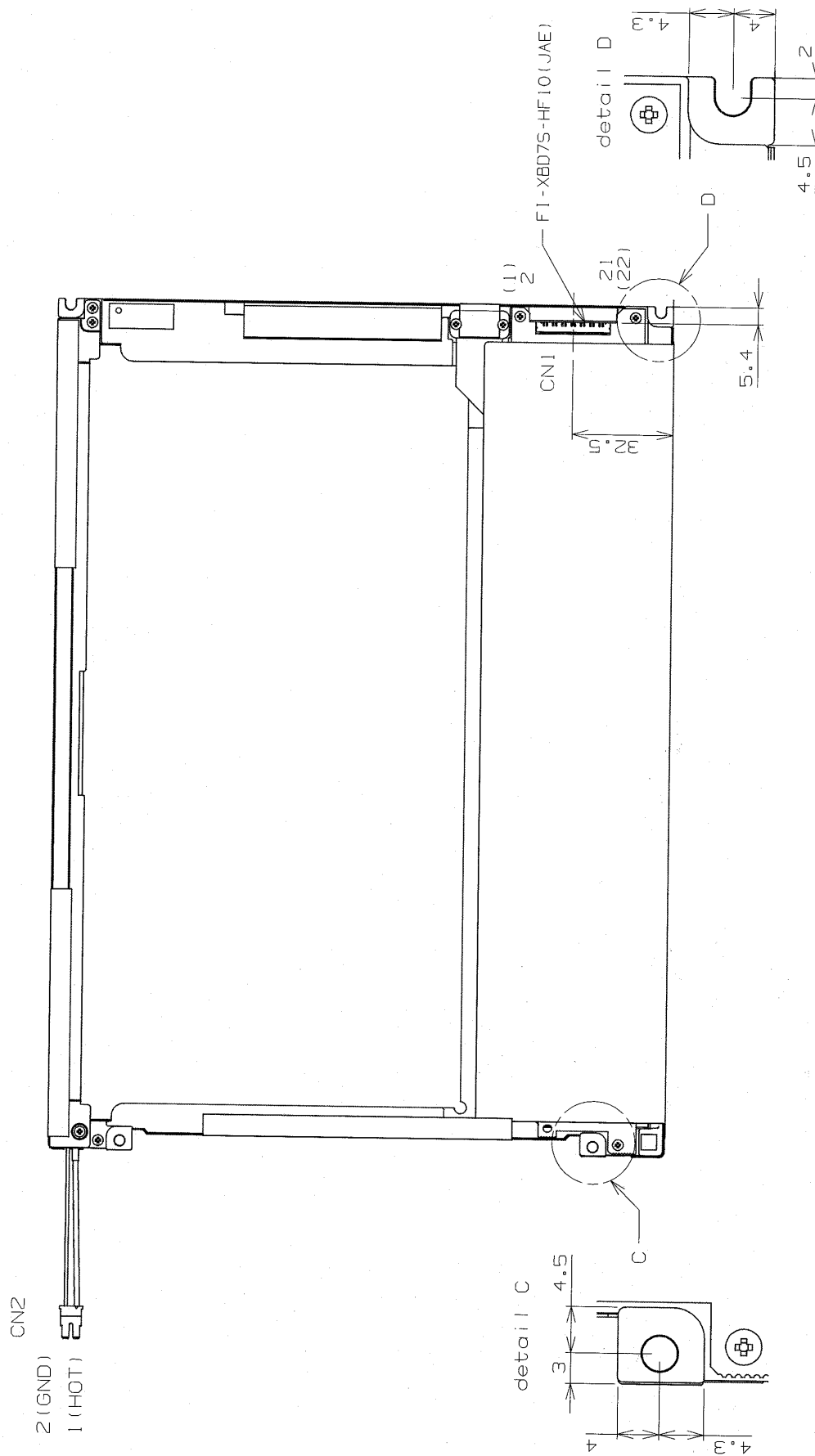
UNDEFINED TOLERANCES TO BE ±0.5mm

8.OPTICAL CHARACTERISTICS

Ta=25°C   VCC=3.3V

| ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Contrast Ratio		CR	θ = φ = 0°	100	150	--	--
Luminance *)		L	θ = φ = 0°	--	120	--	cd/m²
Response Time		tr	θ = φ = 0°	0	20	40	ms
		tf	θ = φ = 0°	0	30	50	ms
Viewing Angle	Horizontal	φ	CR ≥ 10	--	-45 ~ 45	--	°
	Vertical	θ		--	-30 ~ 10	--	°
Color Coordinates	Red	x		0.532	0.562	0.592	
		y		0.300	0.330	0.360	
	Green	x		0.300	0.330	0.360	
		y	θ = φ = 0°	0.494	0.524	0.554	--
	Blue	x		0.132	0.162	0.192	
		y		0.119	0.149	0.179	
	White	x		0.288	0.318	0.348	
		y		0.298	0.328	0.358	

[Note]

These items are measured using BM-5A (TOPCON) or LCD-7000 (Otsuka Electronic) under the dark room condition (no ambient light).

*); Condition: IL=4.5mA

Definitions of these measurement items are as follows:
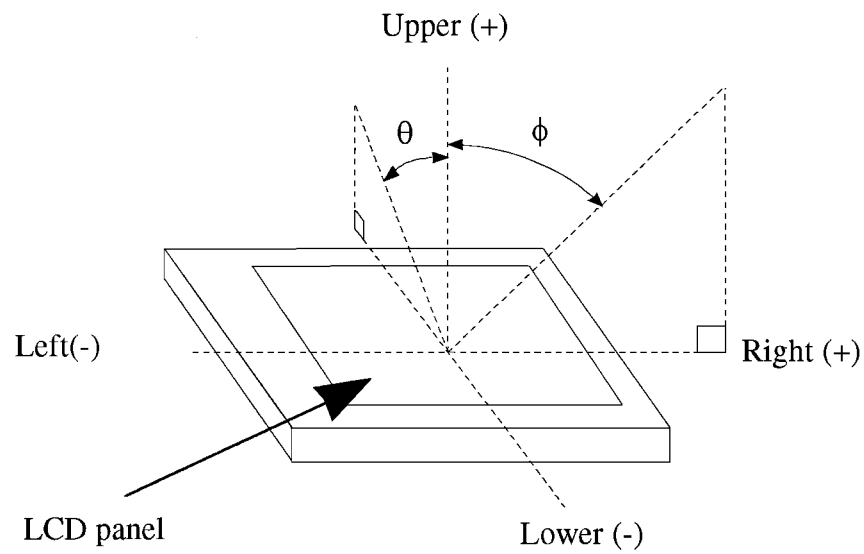
1) Definition of Luminance
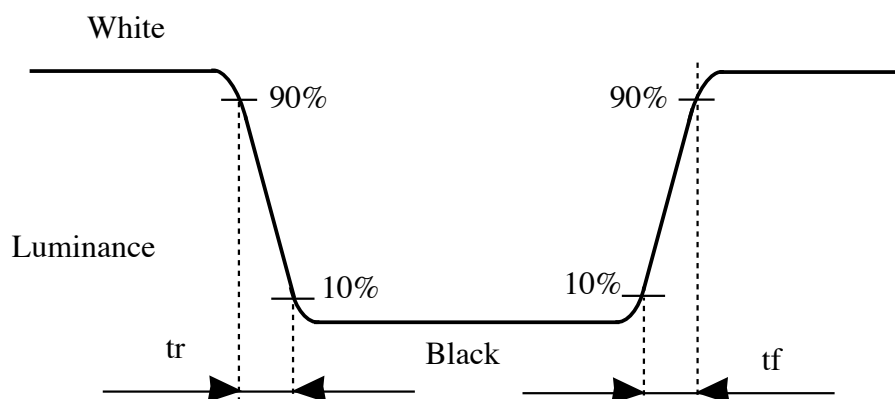   L= ON(White)Luminance: average of 5 points
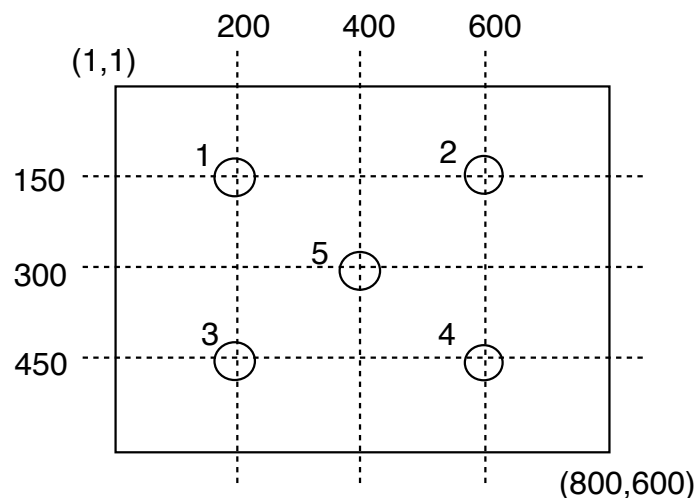
2) Definition of Contrast Ratio
   CR=ON (White) Luminance / OFF(Black) Luminance

3) Definition of Viewing Angle (θ, φ)

4) Definition of Response Time

9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEM	CONDITIONS
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	40°C, 90%RH, 500h
HIGH TEMPERATURE STORAGE	60°C, 96h
LOW TEMPERATURE STORAGE	-20°C, 96 h
THERMAL SHOCK	BETWEEN -20°C (1h) AND 60°C(1h), 5 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 500 Hz Frequency sweep rate: 0.5 octave /min Duration: one sweep from 5 to 500 to 5 Hz in each of three mutually perpendicular axis (each x,y,z axis: 1 hour, total 3 hours)

(3) Judgment standard

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

Pass: Normal display image with no obvious non-uniformity and no line defect.

Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

10. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

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

(1) ASSEMBLY PRECAUTION

a. Please use the mounting hole on the module corners in installing and 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) 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.

    (c) 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.

    (d) Design the inverter location and connector position carefully so as not to give stress to lamp cable, or not to interface the LCD module by the lamp cable.

    (e) 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.

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 out LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.

f. Please wipe out 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 pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

(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. Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.

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 electro-statics occurrence.

(4) STORAGE PRECAUTIONS

a. When you store LCDs for a long time, it is recommended to keep the temperature between 0°C~40°C without the exposure of sunlight and to keep the humidity less than 90%RH.

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

c. 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 thor-oughly with soap and water.

(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 5 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.)