TENTATIVE

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

10.4" VGA

TECHNICAL SPECIFICATION

AA104VB04

Advanced Display Inc.

Date: Oct.26, '99

CONTENTS

1. OVERVIEW

AA104VB04 is 10.4" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, and backlight.

By applying 6bit digital data 640 × 480, 260K -color images are displayed on the 10.4" diagonal screen. Input power voltage is single 5.0 V for LCD driving. Both 3.3V-CMOS and 5.0V-CMOS level voltage are acceptable for logic input voltage.

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

ITEM	SPECIFICATION
Display Area (mm)	211.2 × 158.4 (10.39-inch diagonal)
Number of Pixels	640 (H) × 480 (V)
Pixel Pitch (mm)	0.33 (H) × 0.33 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	normally white
Number of Colors	260k
Wide Viewing Angle Technology	Optical compensation film
Optimum Viewing Angle (Contrast ratio)	12 o'clock
Brightness (cd/m^2)	380
Power Consumption (W)	8.0
Module Size (mm)	243.0 (W) × 181.6 (H) × 12.2 (D)
Module Mass (g)	530
Backlight Unit	CCFL, two-tubes, replaceable

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 equipments and consumer products, such as computers, communication equipments, industrial robots, AV equipments and so on.

Do not use the LCD product for the equipments 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	-0.3	6.5	V
Operation Temperature [*1)]	T_{op}	0	50	°C
Storage Temperature [*1)]	T_{stg}	-20	60	°C

*1): Humidity ≤ 85% RH. No condensation.

3. ELECTRICAL CHARACTERISRICS

(1) TFT-LCD

Ta=25°C

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Power Supply Voltage for LCD		VCC	4.75	5.0	5.25	V	Note *1)
Power Supply Current for LCD		ICC		200		mA	Note *2)
Permissive input ripple Voltage		VRP			100	mVp-p	VCC= +5.0V
Logic Input Voltage	High	VLH	2.0		VCC	V	
	Low	VLL	0		0.8	V	

Note*1), *2): See page 5

(2) Backlight

Ta=25°C

| ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Lamp Voltage	VL		580		V
Lamp Current	IL	3.0	6.0 [*3)]	7.0	mA
Starting Lamp Voltage	Vs	810			V

Note

The table shows the data for one lamp only. The TFT-LCD module has two identical lamps operated independently. Operation of both lamps is required in order to meet all the parameters in this specification.

[Note]

*1) VCC-turn-on conditions: $t1 \leq 10ms$

$0 < t2 \leq 50ms$

$0 < t3 \leq 50ms$

VCC

4.5 V

data

2.7 V

t1   t2   t3
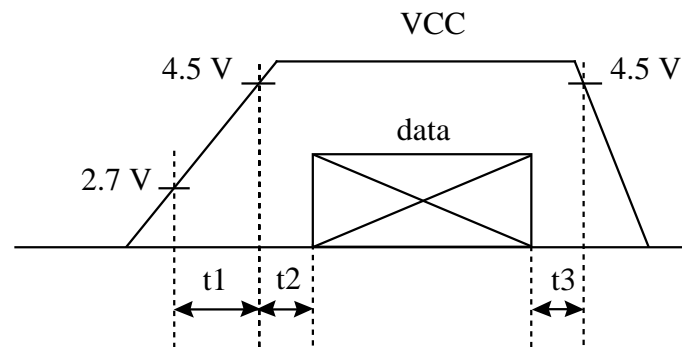
VCC-dip conditions

1) $2.7V \leq VCC < 4.5V$

$td \leq 10ms$

2) $VCC < 2.7V$

VCC-dip conditions should also follow the VCC-turn-on conditions

VCC

2.7V   4.5V

td
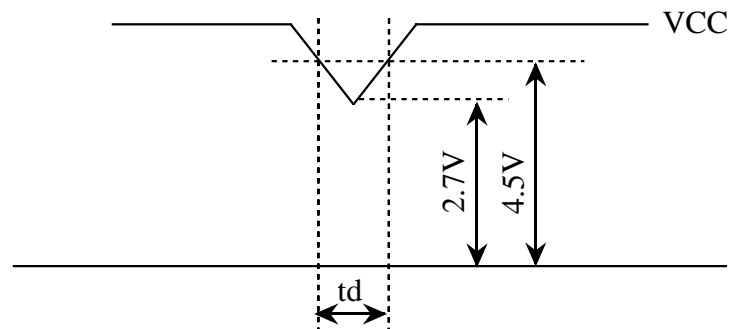
*2) Typical current situation: 64-gray-bar pattern

480 line mode

VCC=+5.0V

*3) For typical luminance of $380cd/m^2$

4. INTERFACE PIN CONNECTION

CN1 (INTERFACE SIGNAL)

Used connector: DF9B-31P-1V (Hirose)

Corresponding connector: DF9B-31S-1V (Hirose)

pin	Symbol	Function
1	GND	
2	DCLK	Clock signal for sampling catch data signal
3	HD	Horizontal sync signal
4	VD	Vertical sync signal
5	GND	
6	R0	Red data signal (LSB)
7	R1	Red data signal
8	R2	Red data signal
9	R3	Red data signal
10	R4	Red data signal
11	R5	Red data signal (MSB)
12	GND	
13	G0	Green data signal (LSB)
14	G1	Green data signal
15	G2	Green data signal
16	G3	Green data signal
17	G4	Green data signal
18	G5	Green data signal (MSB)
19	GND	
20	B0	Blue data signal (LSB)
21	B1	Blue data signal
22	B2	Blue data signal
23	B3	Blue data signal
24	B4	Blue data signal
25	B5	Blue data signal (MSB)
26	GND	
27	DENA	Data enable signal (to settle the viewing area)
28	VCC	5.0V Power Supply
29	VCC	5.0V Power Supply
30	TEST	This pin should be open. Test signal output for only internal test use.
31	TEST	This pin should be open. Test signal output for only internal test use.

＊The shielding case is connected with GND.

CN2, CN3 (BACKLIGHT)

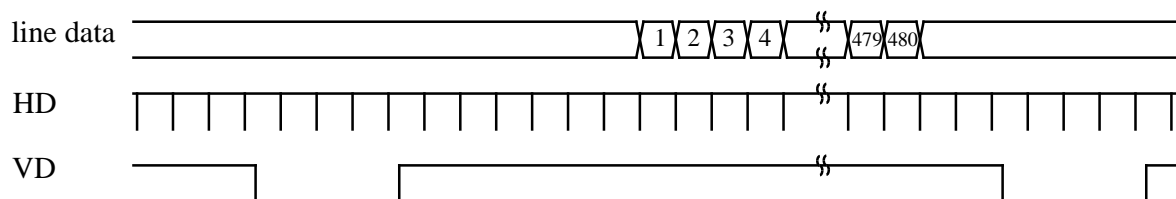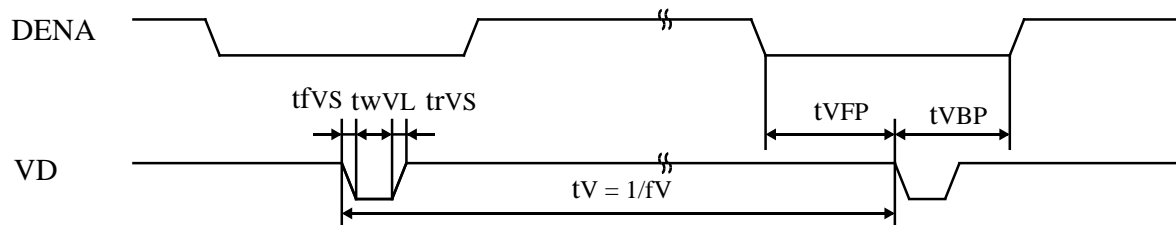Backlight-side connector: BHR-02(8.0)VS-1N (JST)

Inverter-side connector: SM02(8.0)B-BHS (JST)

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

[Note]: VBLH-VBLL=VL

5. INTERFACE TIMING

(1) Timing Chart

DCLK

trCLK tfCLK twCH twCL

tCLK =1/fCLK tDs tDh Last Data

DATA (R,G,B) Invalid Data 1 2 3 4 639 640 Invalid Data

First Data

tDEh tDEs tDEh tDEs

DENA

DENA

trDE tfDE twDL

tfHS twHL trHS tHFP tHBP

HD

tH = 1/fH

DENA

tfVS twVL trVS tVFP tVBP

VD

tV = 1/fV

---

line data 1 2 3 4 479 480

HD

VD

---
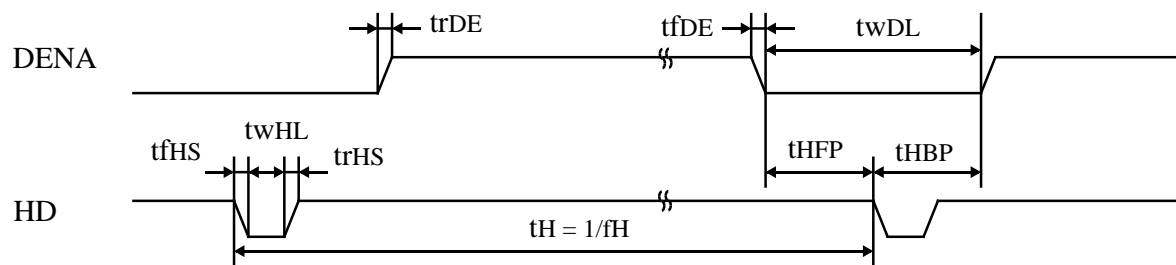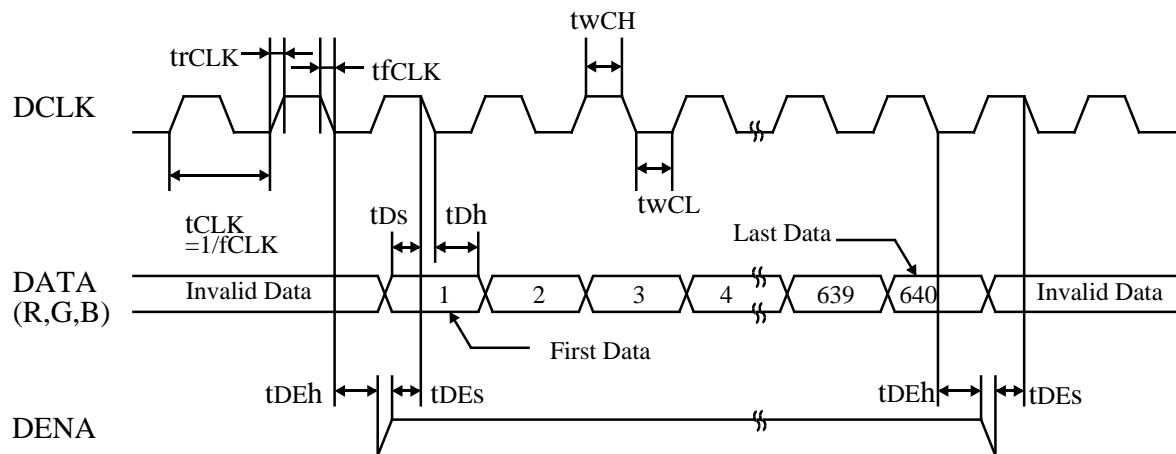
definition of tr / tw / tf

2.0V

0.8V

tr tw tf
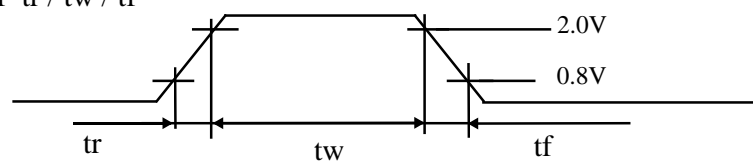
(2) Timing Specifications

ITEM		SYMBOL	MIN	TYP	MAX	UNIT
DCLK [*1,4]	Frequency	fCLK	--	25	29	MHz
	Period	tCLK	34.5	40	--	ns
	Width-Low	twCL	12	--	--	ns
	Width-High	twCH	12	--	--	ns
	Rise Time	trCLK	--	--	5	ns
	Fall Time	tfCLK	--	--	5	ns
DATA [*1] (R,G,B)	Set up Time	tDs	5	--	--	ns
	Hold Time	tDh	5	--	--	ns
DENA [*3]	Set up Time	tDEs	5	--	--	ns
	Hold Time	tDEh	5	--	--	ns
	Low Time	twDL	90	160	168	tCLK
	Rise Time	trDE	--	--	5	ns
	Fall Time	tfDE	--	--	5	ns
	Horizontal Front Porch	tHFP	0	16	--	tCLK
	Horizontal Back Porch	tHBP	2	144	--	tCLK
	Vertical Front Porch	tVFP	1	12	--	tH
	Vertical Back Porch	tVBP	2	33	--	tH
HD [*2, 4]	Frequency	fH	27	31.6	38	kHz
	Period	tH	730	800	808	tCLK
	Width Low	twHL	5	96	--	tCLK
	Rise Time	trHS	--	--	10	ns
	Fall Time	tfHS	--	--	10	ns
VD [*2]	Frequency	fV	55	60.0	70	Hz
	Period	tV	489	525	--	tH
	Width Low	twVL	3	--	--	tH
	Rise Time	trVS	--	--	10	ns
	Fall Time	tfVS	--	--	10	ns

[Note]

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

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

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

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

(3) 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.
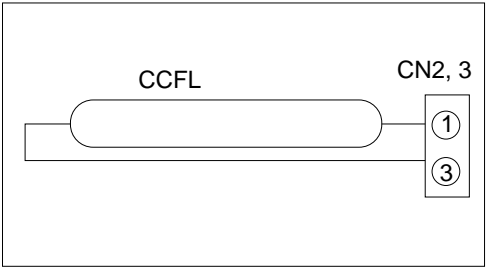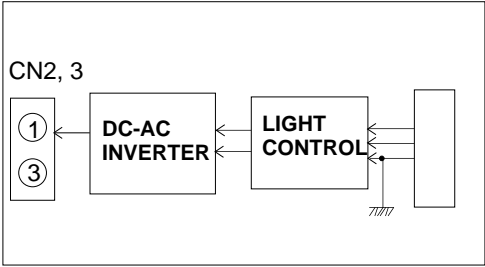
Higher n means brighter level.

2) Data

1: High, 0:Low

6. BLOCK DIAGRAM
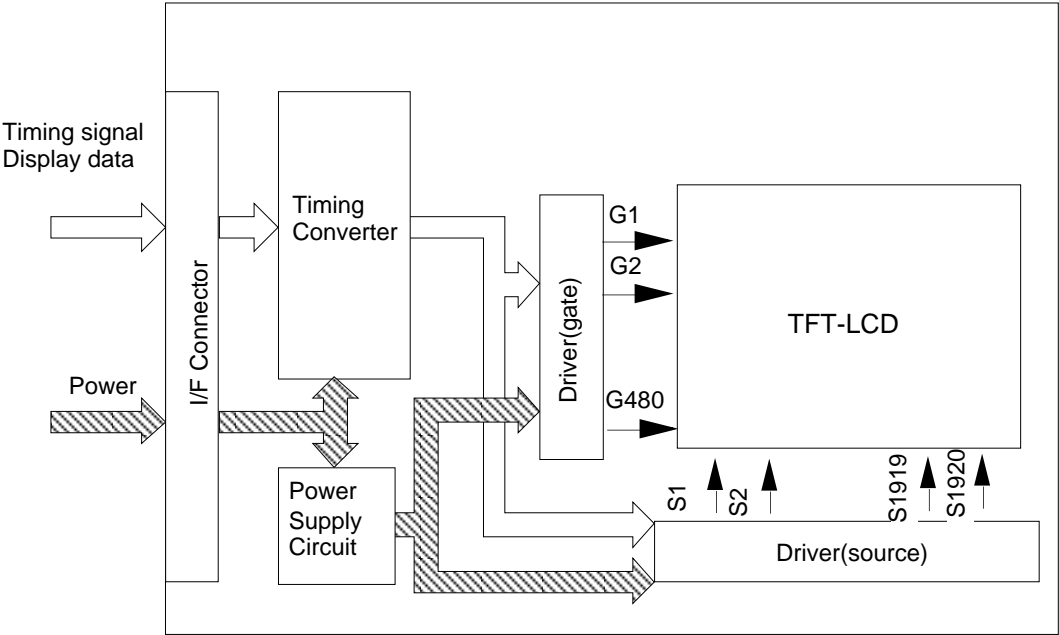
7. MECHANICAL SPECIFICATION

(1) Front side

10.4"VGA(Ver.2)
July.27 '98

Tolerance is ±0.5mm unless noted.

(2) Rear side

Section A-A
(Scale 2:1)

Section B-B
(Scale 2:1)

10.4"VGA(Ver.2)

0.3

6.9

2.9

9

5

2.35

2

(81)

(20)

(143)

(94)

(54)

(40)

Tolerance is ±0.5mm unless noted.

(13/21) **AA104VB04_02_00**
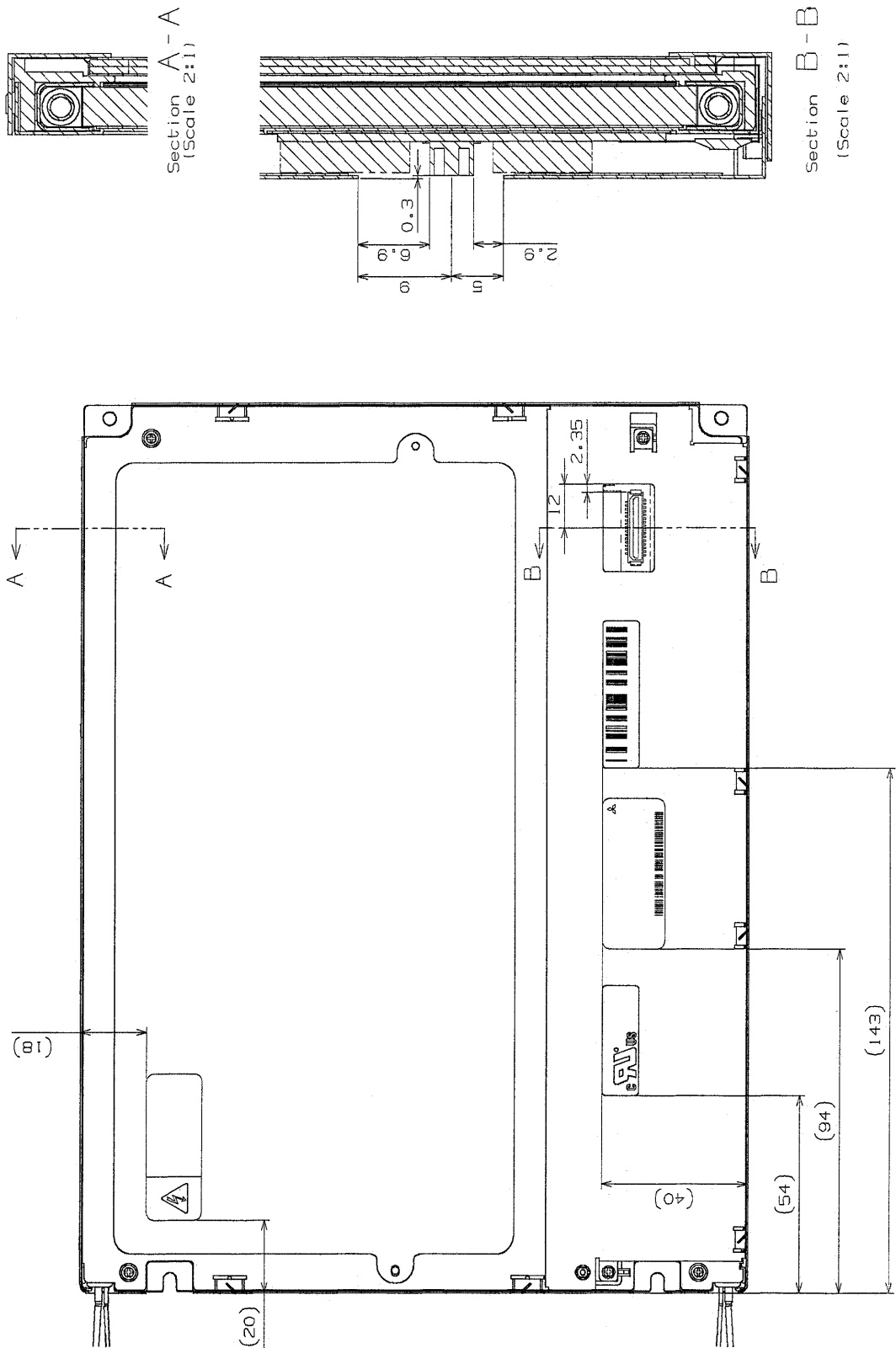
(3) Scanning direction
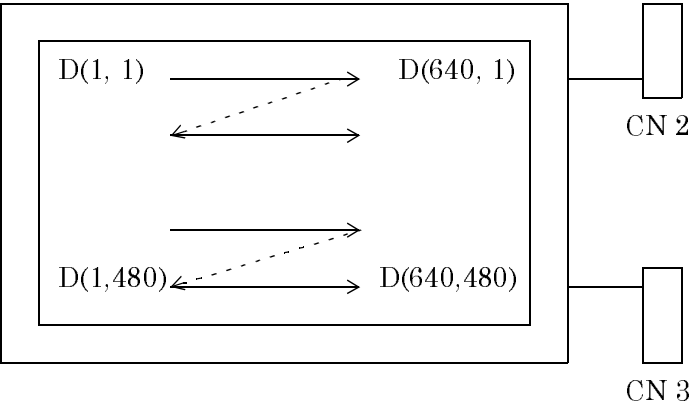
8. OPTICAL CHARACTERITICS

Ta=25°C, VCC=5.0V

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Contrast Ratio		CR	θ = φ = 0°	150	300	--	--
Luminance*)		L	θ = φ = 0°	300	380	--	cd/m^2
Response Time		tr	θ = φ = 0°	--	15	--	ms
		tf	θ = φ = 0°	--	35	--	ms
Viewing angle	Horizontal	φ	CR ≥ 10	--	-60 ~ 60	--	°
	Vertical	θ		--	-45 ~ 55	--	°
Color Coordinates	Red	x	θ = φ = 0°	0.54	0.57	0.60	--
		y		0.30	0.33	0.36	
	Green	x		0.30	0.33	0.36	
		y		0.49	0.52	0.55	
	Blue	x		0.14	0.17	0.20	
		y		0.15	0.18	0.21	
	White	x		0.29	0.32	0.35	
		y		0.31	0.34	0.37	

These value will be determined by measurement with BM-5A(TOPCON) or LCD-7000 (Otsuka Electronic) under the dark room condition (no ambient light).
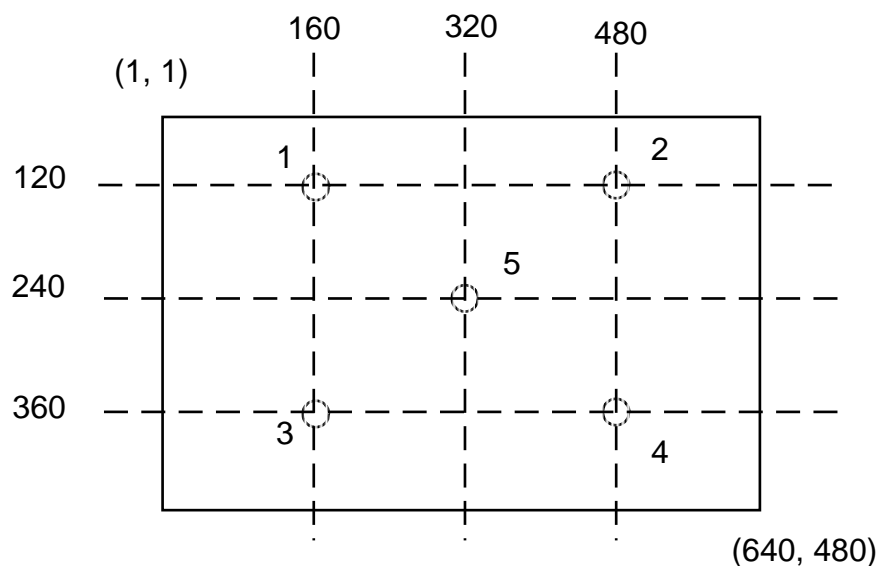
*); Condition: IL=6.0mA.

Definitions of these items are as follows:

1) Definition of Luminance

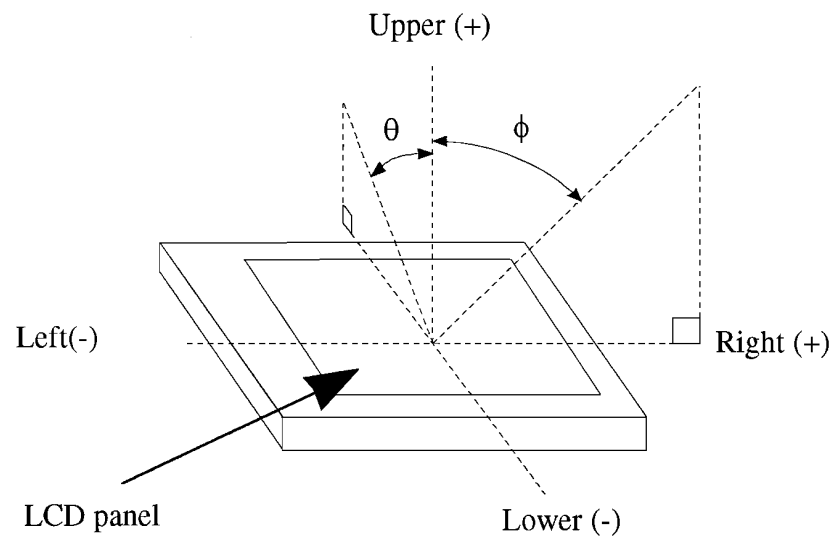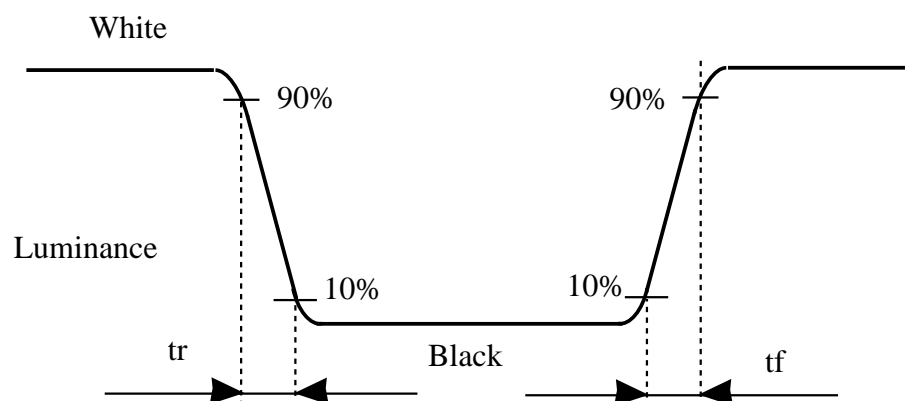L= ON (White) luminance: average of 5 points

MEASUREMENT POINTS

2) Definition of Contrast Ratio

CR=ON (White) Luminance / OFF(Black) Luminance

3) Definition of Viewing Angle (θ , φ)

Upper (+)

θ

φ

Left(-)

Right (+)

LCD panel

Lower (-)

4) Definition of Response Time

White

90%

90%

Luminance

10%

10%

tr

Black

tf

9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEM	CONDITIONS
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	40°C, 90%RH 500 hours
HIGH TEMPERATURE HIGH HUMIDITY STORAGE	60°C, 90%RH 96hours
LOW TEMPERATURE STORAGE	-20°C 96 hours
THERMAL SHOCK (NON-OPERATION)	Between -20°C (1hour) and 60°C(1hour) 5cycles

(2) Shock & Vibration

TEST ITEM	CONDITIONS
Shock (non-operating)	Shock level: 1470m/s^2 (150G) Waveform: half sinusoidal wave, 2 ms Number of shocks: one shock input in each direction of three mutually perpendicular axis for a total of six shock inputs
Vibration (non-operating)	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 to 5Hz in each of three mutually perpendicular axis(total 3hr)

(3) Judgment standard

The judgment of the above test 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.LIFE TIME OF THE BACKLIGHT LAMP

The definition of life time is as follows:

ITEM	SYMBOL	CONDITION	SPECIFICATION		UNIT
			MIN.	TYP.	
Life Time	TL	IL=3.0mA,Ta=25°C	50,000	50,000	Hour
		IL=6.0mA,Ta=25°C	40,000	50,000	
		IL=7.0mA,Ta=25°C	30,000	40,000	

*1) The luminance of the backlight lamp becomes half of the initial value or

the lamp does not turn on under 810V.

*2) The life time of the backlight depends on the ambient temperature.

The life time will decrease under low/high temperature.

11. 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.)

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

f. Please wipe out drops 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. These action reconstructing modules may cause them not to work normally.

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 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. 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°C 90%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 thoroughly 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.)