Chunghwa Picture Tubes, Ltd.
Technical Specification

To :

Date : 2005/1/10

TFT LCD

CLAA154WA04

ACCEPTED BY :

APPROVED BY	CHECKED BY	PREPARED BY
		CPT TFT-PPM Neptune **1/10'05**

Prepared by : TFT-LCD Product Planning Management Division

CHUNGHWA PICTUER TUBES, LTD.

1127 Hopin Rd., Padeh, Taoyuan, Taiwan 334, R.O.C.

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RECORD OF REVISIONS

Revision No.	Date	Description
Ver.1	2005/1/05	First issued.
Ver.2	2005/1/10	1. Power (Page 3) 7.0 max → 7.8 max(with Inverter) 2. Weight (Page 3) Add weight (with Inverter) : 600 max 3. Lamp Voltage (Page 4) Explain the range of lamp voltage 4. Interface Timing Chart (Page11) Change the showing mode to explain timing clearly. 5. Mechanical Specification (Page 16) Add torque : 2.5kgf

CONTENTS

1. OVERVIEW

CLAA154WA04 is 15.4" color (39.116cm) TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, LVDS driver ICs, control circuit and backlight. By applying 6 bit digital data, 1280×RGB(3)×800, 262K-color images are displayed on the 15.4" diagonal screen. Inverter for backlight is included in this module(Invert vender : SUMIDA , mode : IV11145T).General specification are summarized in the following table :

ITEM	SPECIFICATION
Display Area (mm)	331.2 (H)x207.0 (V) (15.4-inch diagonal)
Number of Pixels	1280 ×3(H)×800(V)
Pixel Pitch (mm)	0.25875(H)×0.25875(V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white TN
Number of Colors	262,144
Gamut	50%
Optimum Viewing Angle	6 o'clock
Brightness (cd/m^2)	170 typ. @ 6mA (5point) 150 min.@ 6mA (5point)
Uniformity	5point：20% 13point：35%
Viewing Angle	40°、 40°/15°、55° (min.)
Consumption of Power (W)	7.8 max (with Inverter)
Module Size (mm)	344.5(W)×222.5(H)×6.2(D)（max）
Module Weight (g)	585 max. (without Inverter) 600 max. (with Inverter)
Backlight Unit	CCFL,1 tube, Edge light (bottom)

The LCD Products listed on this document are not suitable for use of aerospace equipment, submarine cable, and nuclear reactor control system and life support systems. If customers intend to use these LCD products for above application or not listed in "Standard" as follows, please contact our sales in advance.

Standard :

Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tool, Industrial robot, Audio and Visual equipment, Other consumer products.

2. ABSOLUTE MAXIMUM RATINGS

The following are maximum value, which if exceeded, may cause faulty operation or damage to the unit.

ITEM		SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD		VCC	0	4.0	V	
Lamp voltage	West	VL	710	960	Vrms	*1)
Lamp current		IL	2	6.5	mArms	*2) *3)
Lamp frequency		FL	50	80	kHz	
Operation Temperature		Top	0	50	℃	*4)*5)*6)*7)
Storage Temperature		Tstg	-25	65	℃	*4)*5)*6)
Delayed Discharge Time		TD	--	1	sec	*8)

【Note】

*1) Min value is at IL 6.5mA and Max value is at IL 2.0mA.

*2) Product life-time relate to the lamp current, please operate following statement “(B)Back light system” at page 8.

*3) When lamp current over the definition of absolute max. value , life-time of the product will decay rapidly or operate unusual.

*4) The relative temperature and humidity range are as below sketch, 90%RH Max. (Ta≦40℃)

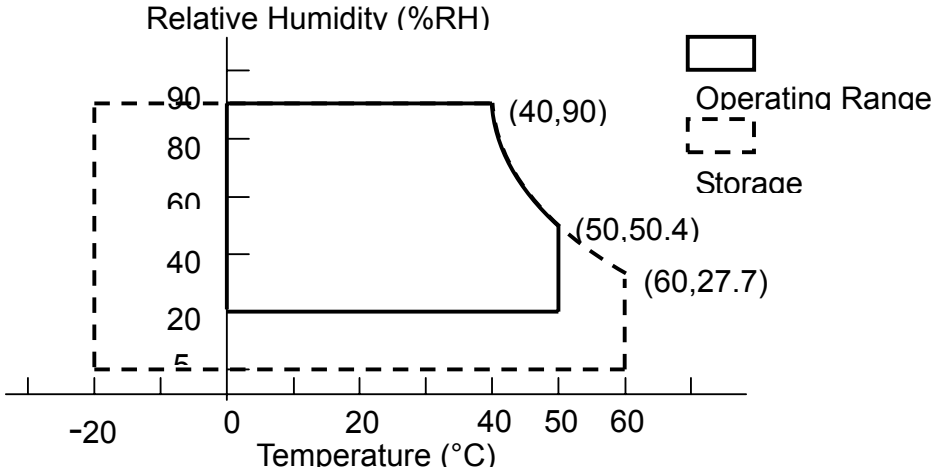
*5) The maximum wet bulb temperature ≦39℃(Ta＞40℃) and without dewing.

*6) If users use the product out off the environment operation range (temperature and humidity) , it will concern for visual quality.

*7) The product must work at operation temperature range and the surface temperature of the panel’s center point must be lower then 60℃.

*8) Delay discharge time(TD) test condition : starting lamp voltage=1650Vrms.(please follow statement”(B)Back light system” at page 8.

Before TD test, lamp should be start at least 1 min at the typical value of lamp current and then place the panel at room temp.(25±2℃) exceed 24hrs. Measuring the TD value at the same condition (starting lamp voltage) in dark room.



3. ELECTRICAL CHARACTERISTICS

(A) TFT LCD

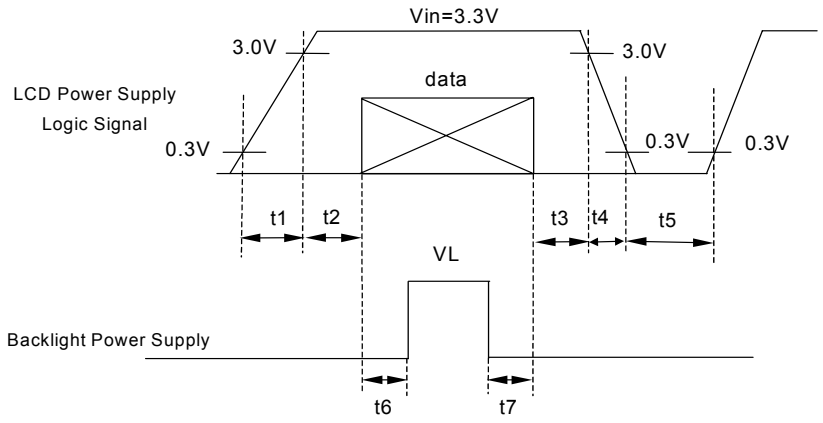
Ta=25℃

TEM		SYMBOL	MIN	TYP	MAX	UNIT	REMARK
LCD Power Voltage		VCC	3.0	3.3	3.6	V	*1)
LCD Power Current		ICC	-	400	600	mA	*2)
Rush Current		Irush	-	-	2	A	*3)
Logic Input Voltage (LVDS: In+,In-)*4)	Input Voltage	VIN	0	-	VCC	V	
	Common Voltage	VCM	1.125	1.25	1.375	V	
	Differential Input Voltage	| VID |	250	350	450	mV	
	Threshold Voltage (HIGH)	VTH	-	-	100	mV	FOR Vcm=+1.2V
	Threshold Voltage (LOW)	VTL	-100	-	-	mV	
Differential Input Voltage Tolerance		△VID	-	-	35	mV	
Common Voltage Tolerance		△VCM	-	-	35	mV	

【Note】

*1)Power sequence :

t1≦10ms	1 sec≦t5
0.01 ms＜t2≦50 ms	300 ms≦t6
0.01 ms＜t3≦50 ms	300 ms≦t7
0.01 ms＜t4≦10 ms	

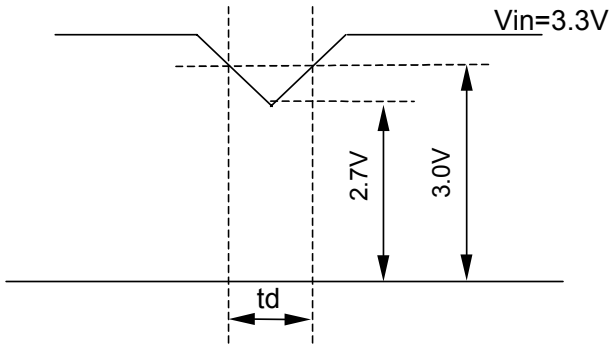


Data: RGB DATA, DCLK, HD, VD, DENA

VCC-dip state

(1)When 3.0＞VCC≧2.7V, td≦10 ms

(2)When VCC＜2.7V, if it works abnormal that must reset the power. VCC dip conditions should follow VCC turn on conditions.



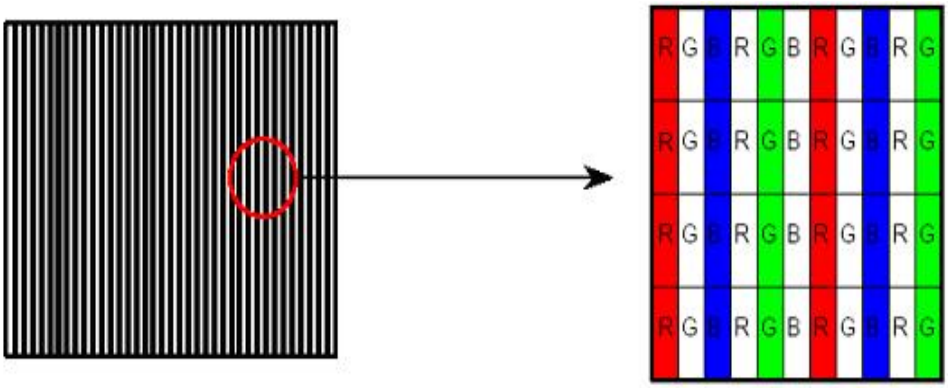
*2) Power current :

(1)Typical value : Typical value is 64-Gray (0～63 gray) level.(Horizontal line Pattern)

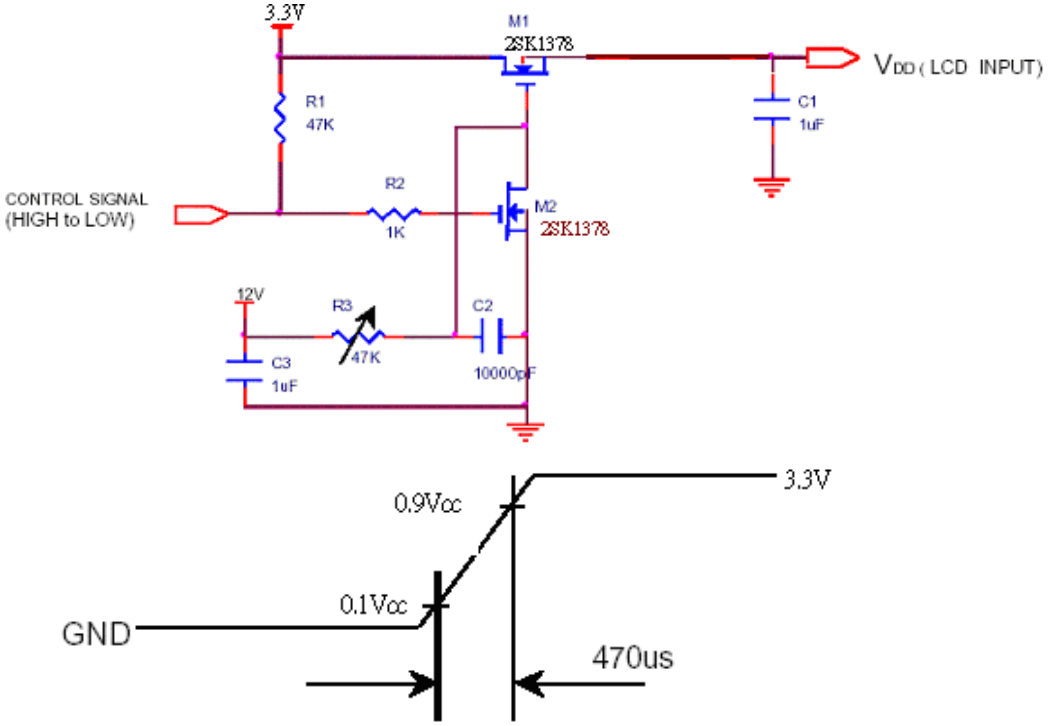
VCC=3.3 V, f_V=60 Hz, f_H=48.9 kHz, f_{CLK}=68.9 MHz

(2)Max. value :

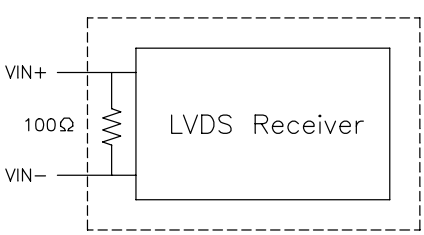
VCC=3.3 V, f_V=60Hz, f_H=48.9 kHz, f_{CLK}=68.9 MHz

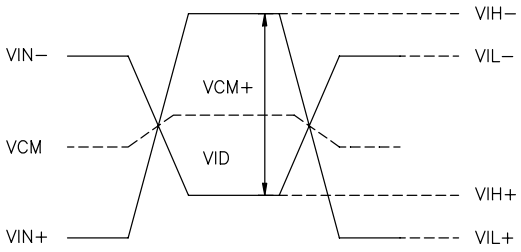


*3) Irush measurement condition :



*4) LVDS signal definition :





VID = VIN_+ − VIN-,
△VCM = | VCM_+ − VCM- | ,
△VID = | VID_+ − VID- | ,
VID+ = | VIH_+ − VIH- | ,
VID- = | VIL_+ − VIL- | ,
VCM =(VIN_+ +VIN-)/2,
VCM+ =(VIH_+ +VIH-)/2,
VCM- =(VIL_+ +VIL-)/2,

VIN+ ：Positive differential DATA & CLK Input
VIN- ：Negative differential DATA & CLK Input

(B) Back light system

(a) Electrical characteristics :

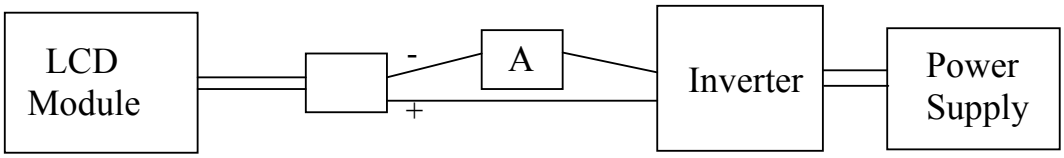
ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Lamp Voltage	VL	657	730	803	Vrms	IL=6.0mA,Ta=25℃
Lamp Current	IL	2.0	6.0	6.5	mArms	*1), Ta=25℃
Inverter Frequency	FI	50	--	60	kHz	*2), Ta=25℃
Starting Lamp Voltage	VS	1460	--	--	Vrms	Ta=25℃
		1650	--	--	Vrms	Ta=0℃

(b) Lamp life time

ITEM	IL at 2.0 mA	IL at 6.0 mA	IL at 6.5 mA	UNIT	REMARK
LAMP LIFE-TIME (LT)	--	Min. 15,000	--	hr	Continuous Operation*3)
Turn on /off Operation	--	Min.100,000	--	time	Test condition *4)

【Note】

*1) Measure method of lamp current : Galvanometer connect to low voltage



*2) Inverter frequency :

a. At this frequency range, electrical and optical characteristics could keep in ±10% range(except color coordinate).
b. Electrical and optical characteristics will display well at 50~60 kHz frequency.
c. It would not damage the lifetime and reliability of the panel at 50~80 kHz frequency.
d. Lamp frequency of inverter may produce interference with horizontal synchronous frequency,and this may cause horizontal beat on the display.Therefore, please adjust lamp frequency, and keep inverter as far from module as possible or use electronic shielding between inverter and module to avoid the interference.

*3) Definition of the lamp life time :

a. Luminance: Luminance(center point)reduced to 50% of the initial value
b. Starting lamp voltage: Vs > 130% of initial Vs value(@ 25℃)

*4) The condition of Turn-on and Turn-off operation is as below:

a. Lamp current is 6.0mA
b. Frequency is 10 sec.(on)/10 sec.(off)
c. Repeat it for 100,000 times
d. The variation of color coordinate of lamp must smaller than +/-0.03
e. Starting lamp voltage should not exceed 130% of the initial value.
f. Lamp luminance must grater then 50% of the initial value.

4.Connector Interface PIN & Function *1)*2)

(A) CN1(Interface signal)

Outlet connector: FI-XB30SL-HF10 (JAE)

Link connector: FI-X30H (JAE, Link Type)

Pin No.	SYMBOL	Function
1	GND	Ground
2	Vcc	+3.3V
3	Vcc	+3.3V
4	V_EDID	DDC 3.3V Power
5	BIST	Build in self-test pattern (0: Normal operation,1: Test pattern mode)
6	CLK_EDID	DDC Clock
7	DATA_EDID	DDC Data
8	R0M	minus signal of channel 0(LVDS)
9	R0P	plus signal of channel 0(LVDS)
10	GND	Ground
11	R1M	minus signal of channel 1(LVDS)
12	R1P	plus signal of channel 1(LVDS)
13	GND	Ground
14	R2M	minus signal of channel 2(LVDS)
15	R2P	plus signal of channel 2(LVDS)
16	GND	Ground
17	RCLKM	minus signal of clock channel (LVDS)
18	RCLKP	plus signal of clock channel (LVDS)
19	GND	Ground
20	NC	No connect
21	NC	VCOM test provided, but customer-end unused (open)
22	NC	No connect
23	NC	No connect
24	NC	No connect
25	NC	No connect
26	NC	No connect
27	NC	No connect
28	NC	No connect
29	NC	No connect
30	NC	No connect

【Note】

*1) DDC: Display Data Requirements

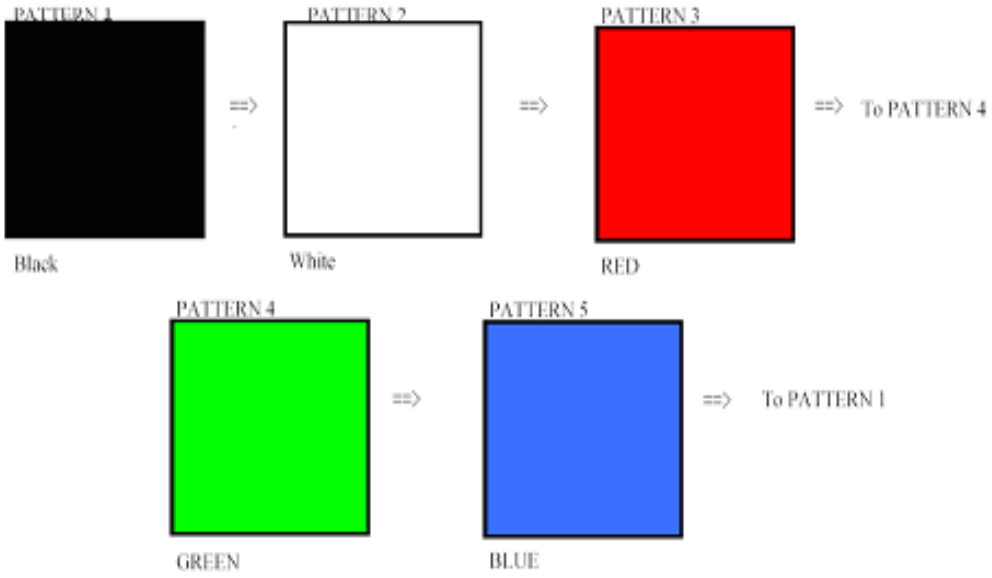
*2) Refer to Data Mapping of page 11, 12, 13

*3) BIST(Build in self-test pattern)

BIST pin = low(GND)：Normal

BIST pin = high(VCC)：Self-test mode

1) Self-test Display Pattern will change when pin 5 is at high voltage and no LVDS input signals would be detected, as following patterns runs continuously. (Black, White, Red, Green and Blue).
2) Pattern sequence
Pattern1→ Pattern2→ Pattern3→ Pattern4→ Pattern5→Pattern1→……..



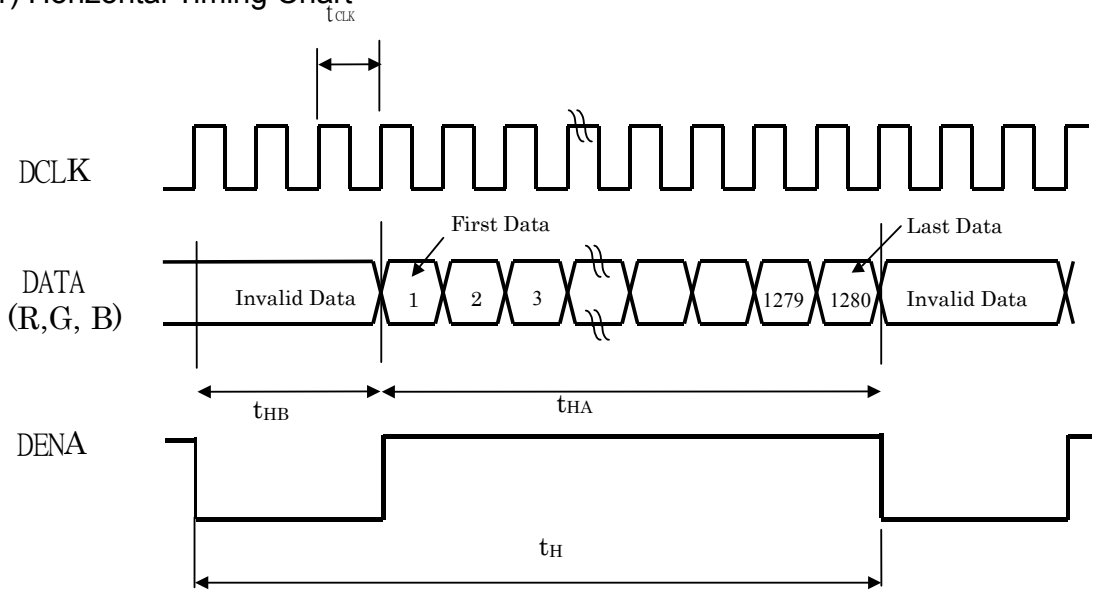
(B) CN2 (Back light) *1)*2)
Backlight-side connector: BHSR-02VS-1 (JST)
Inverter-side connector: SM02B-BHSS-1 (JST)

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

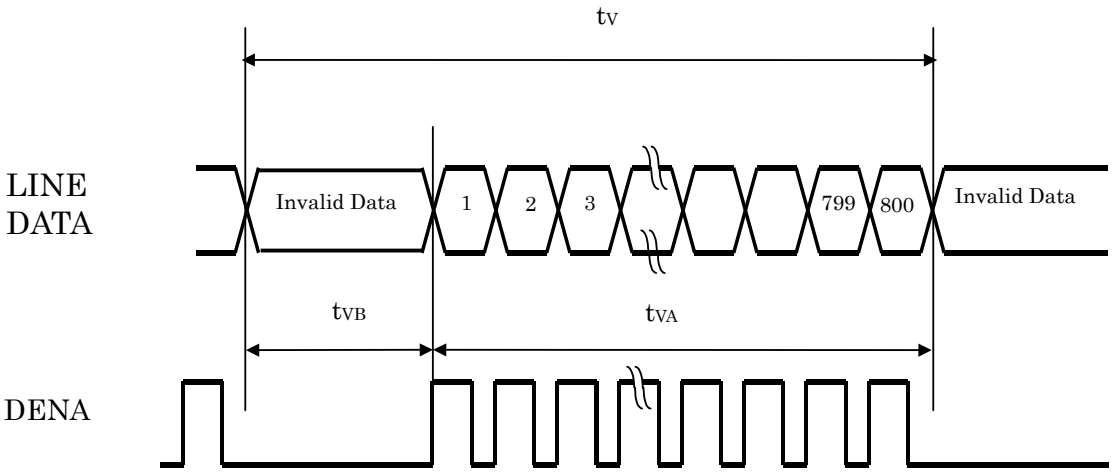
5. INTERFACE TIMING CHART

(A) Timing Chart

1) Horizontal Timing Chart



2) Vertical Timing Chart



(B) Timing Specifications

ITEM			SYMBOL	MIN	TYP	MAX	UNIT
DCLK		Frequency	f_{CLK}	65.3	68.9	74.7	MHz
		Period	t_{CLK}	15.3	14.5	13.3	ns
DENA	Horizontal	Horizontal Total Time	t_H	1344	1408	1500	t_{CLK}
		Horizontal Active Time	t_{HA}	-	1280	-	t_{CLK}
		Horizontal Blank Time	t_{HB}	64	128	220	t_{CLK}
		Line Rate	f_H	45.9	48.96	51.3	KHz
	Vertical	Vertical Total Time	t_V	810	816	830	t_H
		Vertical Active Time	t_{VA}	-	800	-	t_H
		Vertical Blank Time	t_{VB}	10	16	30	t_H
		Frame Rate	f_V	55	60	63	Hz

[Note]

*1) Polarity of DENA is positive in this specification.

*2) DCLK should appear during all blanking period.

(C) DATA mapping

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 (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】

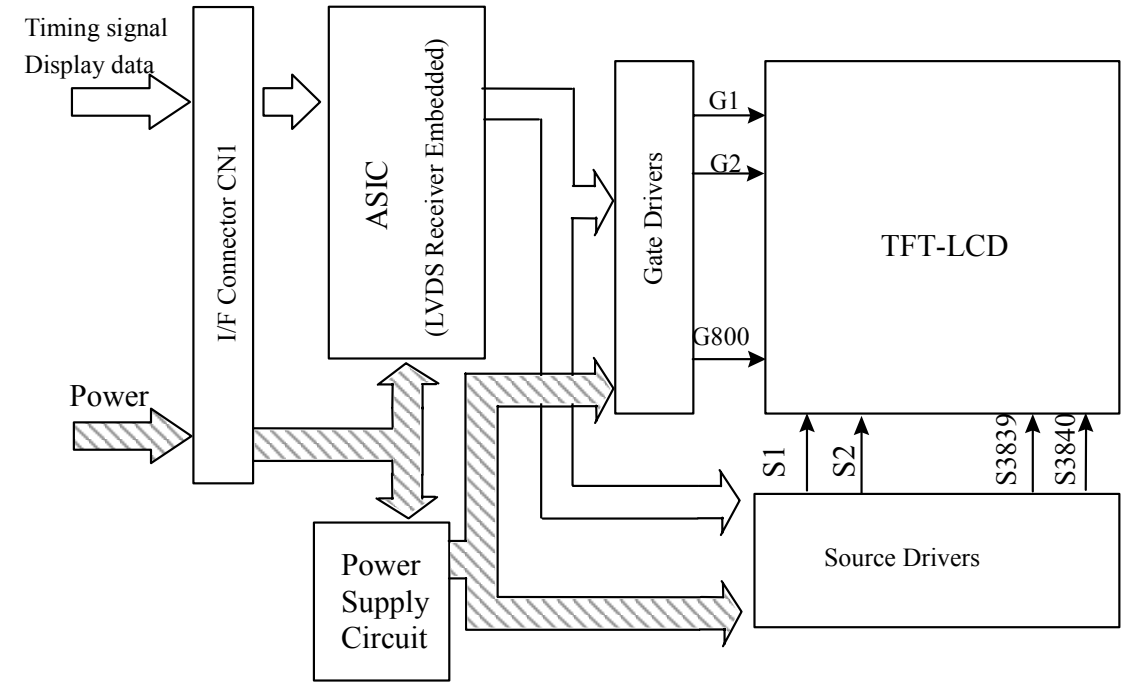
(1) Definition of gray scale:

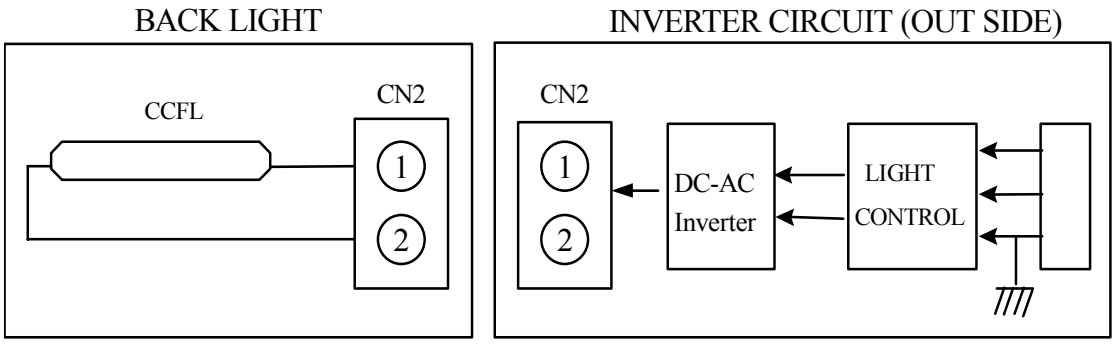
Color(n) : n means level of gray scale .

Larger n means brighter level.

(2) Data : 1= High , 0 = Low

6. BLOCK DIAGRAM



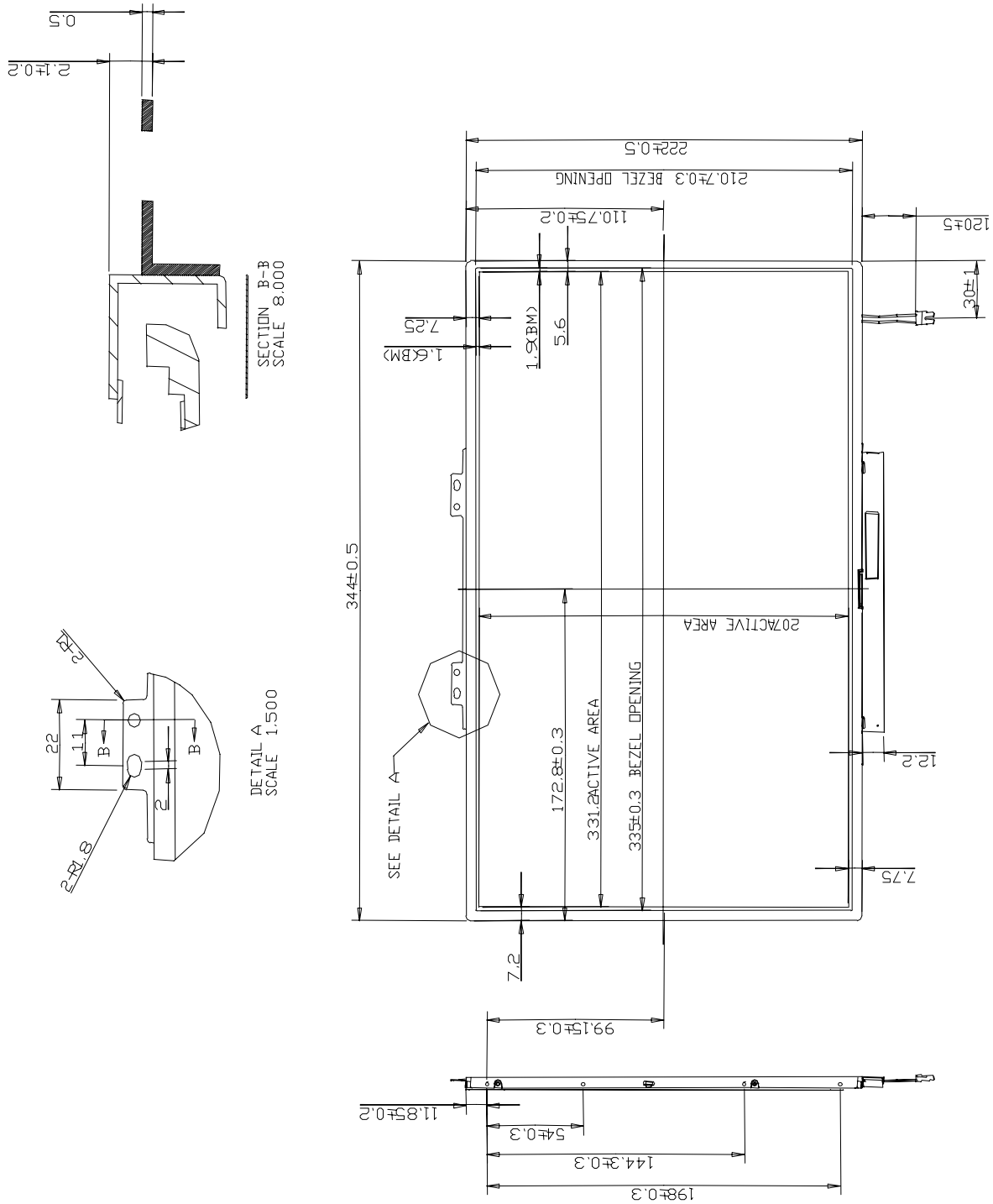


7.MECHANICAL SPECIFICATION

(A) Front side

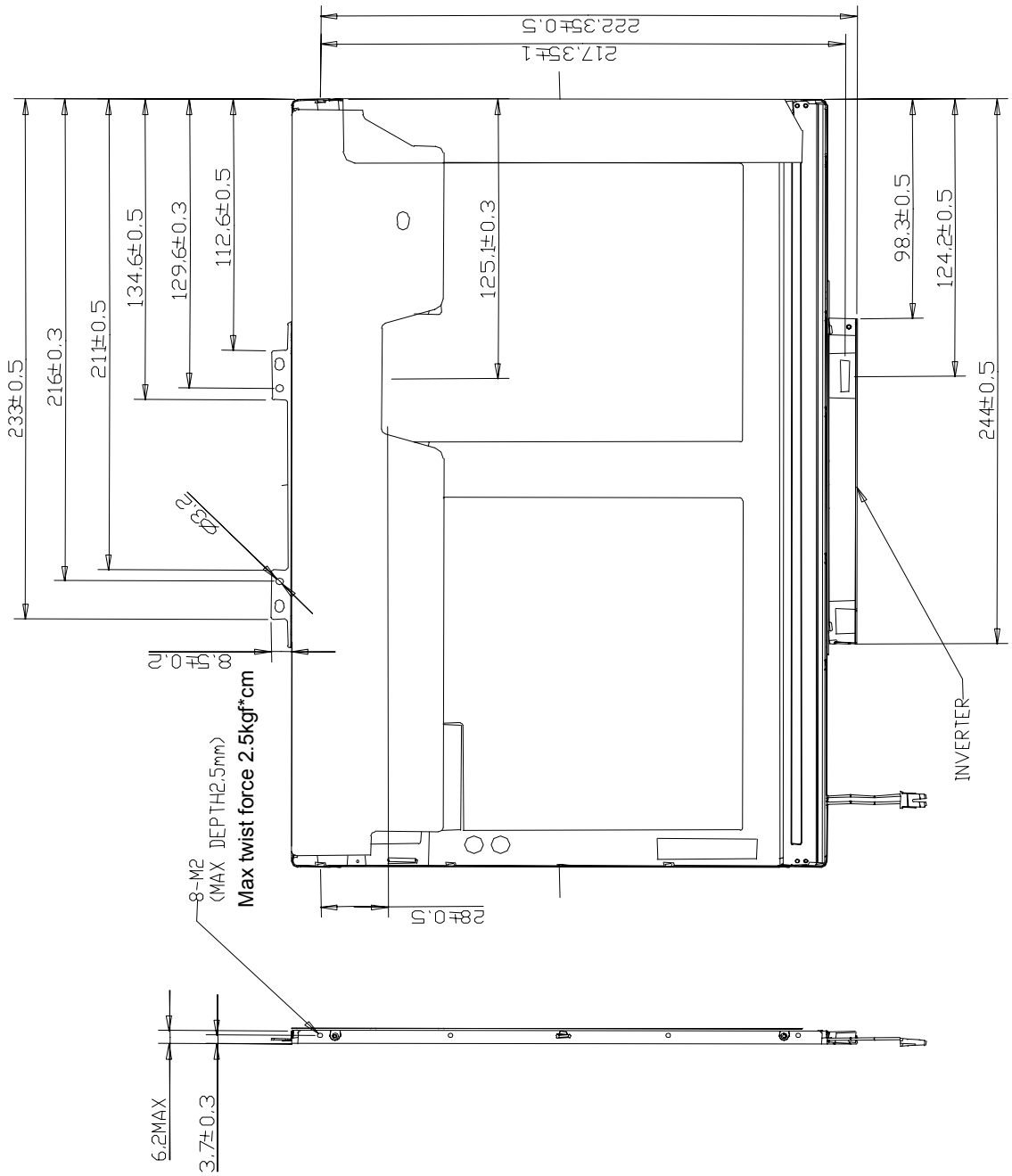
Tolerance is ±0.5mm unless noted

[Unit： mm]



(B)Rear side

Tolerance is ±0.5mm unless noted [Unit： mm]



8. OPTICAL CHARACTERISTICS *1)

Ta=25℃ , VCC=3.3V

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Contrast Uniformity		CR	θ= ϕ= 0°	300	500		--	*2)
Luminance (CEN)		L	θ= ϕ= 0°	170	190		cd/m^2	*3)
Luminance (5P)		L	θ= ϕ= 0°	150	170		cd/m^2	*3)
Uniformity(5P)		ΔL	θ= ϕ= 0°			20	%	*3)
Uniformity(13P)		ΔL	θ= ϕ= 0°			35	%	*3)
Response Time		Tr	θ= ϕ= 0°		9	12	ms	*4)
		Tf	θ= ϕ= 0°		16	23	ms	*4)
Image sticking		Tis	16 hours		-	2	min	*5)
Cross talk		CT	θ=ϕ= 0°*3			1	%	*6)
View angle	Horizontal	ϕ	CR≧10	-40/40	-45/45		°	*7)
	Vertical	θ		15/-55	20/-60		°	
Color Temperature Coordinate	W	X Y	θ= ϕ= 0°	0.283 0.299	0.313 0.329	0.343 0.359		
	R	X Y		0.584 0.306	0.614 0.336	0.644 0.366		
	G	X Y		0.281 0.534	0.311 0.564	0.341 0.594		
	B	X Y		0.123 0.100	0.153 0.130	0.183 0.160		
Gamut			θ= ϕ= 0°	45%	50%		%	
Gamma		γ	GL(8~55)	2.1	2.3	2.5		

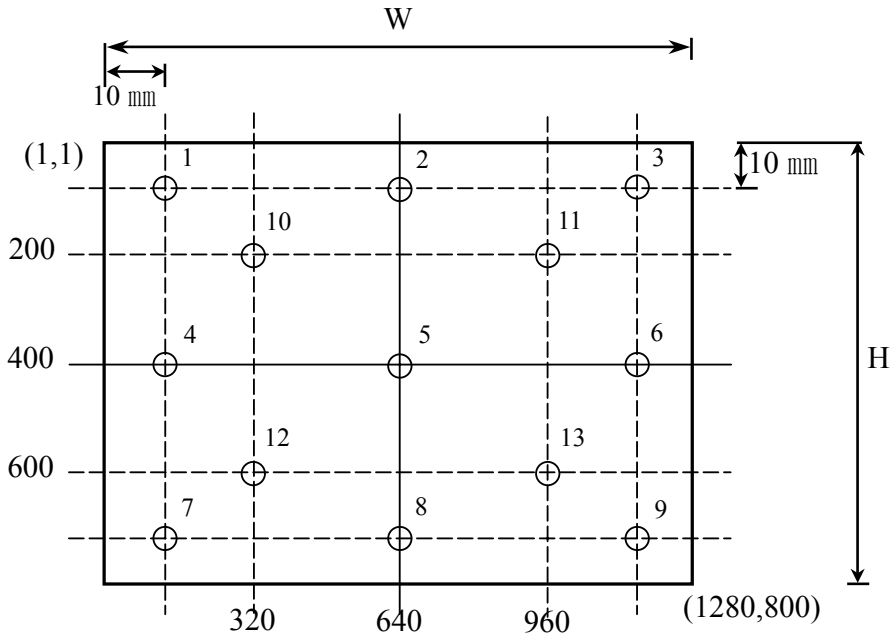
【Note】

*1) Measure device：BM-5A (TOPCON)；under the dark room condition(no ambient light)
Measurement Condition：Lamp current: 6.0mA
Inverter：SUMIDA / IV11145T
After turning on panel 30 minute, it can start to measure optical character.

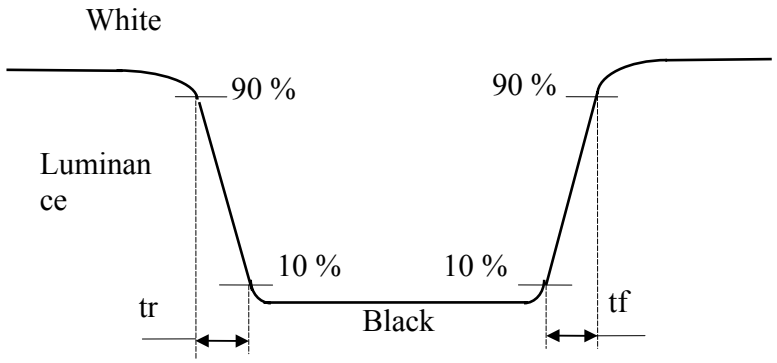
*2) Definition of Contrast Ratio：
CR=ON (White) Luminance/ OFF(Black) Luminance

*3) Definition of Luminance and Luminance uniformity Central luminance:
Central luminance ：Measuring the white luminance of 5th point in the below figure.
5P Luminance (AVG): Measuring white luminance of 5 points (no.5,10,11,12,13) in the below figure and take the average value.
5P Uniformity: Δ L = [(L_{MAX} – L_{MIN})/L_{MIN}]×100%
13P Uniformity: Δ L = [(L_{MAX} – L_{MIN})/L_{MIN}]×100%

Measuring points are as below.



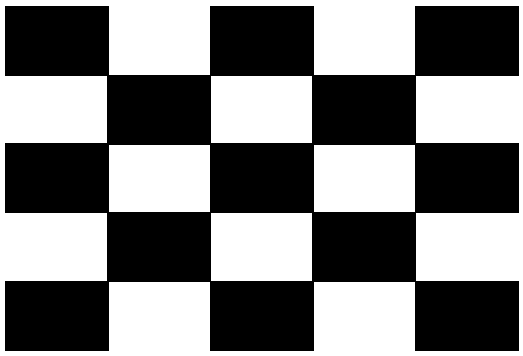
*4) Definition of response time
Change the module frame to Black/white pattern and measure tr and tf.
Equipment : Westar TDR-100



*5) Definition of image sticking

Continuously display the test pattern showing in the below figure for 16 hrs at 25℃.

Then switch to gray pattern (the thirty-second gray level pattern), and the previous image should not persist more than two min .



White：63 Gray
Black：0 Gray

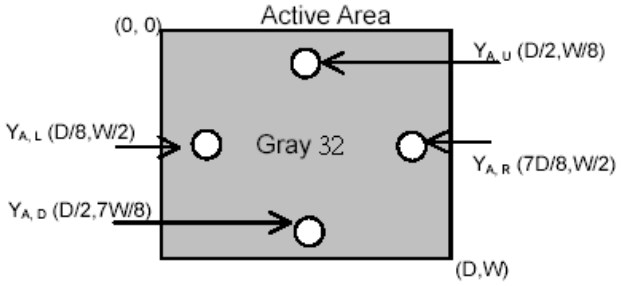
*6) Crosstalk Ratio measure method

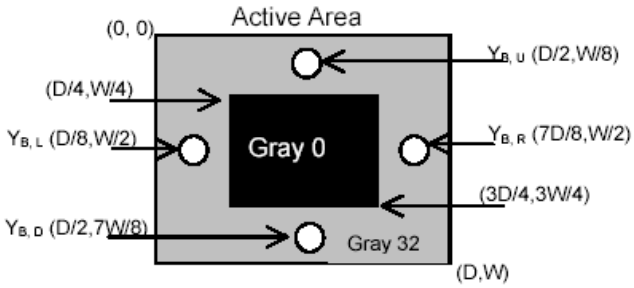
CT= $|Y_B-Y_A|/Y_A$ X 100 (%)

Y_A、Y_B measure position and definition

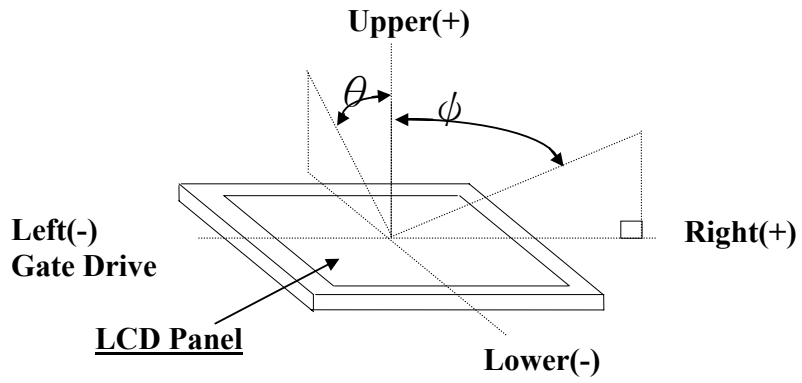
Y_A means luminance at gray level 32 (exclude gray level 0 pattern)

Y_B means luminance at gray level 32 (include gray level 0 pattern)





*7) Definition of view angle(θ , ϕ)



9.RELIABILITY TEST CONDITIONS

(A) Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature Operation	50°C ；250hrs
High Temperature Storage	65°C ；250hrs
High Temperature High Humidity Operation	40°C ；95% RH；250hrs (No condensation)
High Temperature High Humidity Storage	60°C ；90% RH；48hrs (No condensation)
Low Temperature Operation	0°C ；250hrs
Low Temperature Storage	-25°C ；250hrs
Thermal Shock	-25°C to +65°C, 100 cycles Ramp ≥20°C/min Duration 30 min at temp.

(B) Shock & Vibration

TEST ITEMS	CONDITIONS
Shock (Non-Operation)	Shock level:2450m/s^2(250G), Waveform: half sinusoidal wave, 2ms 6 axis (± X,± Y,± Z) per cycle
Vibration (Non-Operation)	Vibration level:14.7m/s^2 (1.5G) ,sinusoidal wave (each x,y,z axis: 1hr , total 3 hrs) Frequency range: 5Hz to 500 Hz Sweep speed : 0.5 Octave/min.

(C) ESD test

Test Item	Test statements
Connector	200 pF，0 Ω，±250 V By using contact-mode to discharge each pin one time and then check the module frame.
Module	150pF，330Ω，±15KV 1.Under test conditions, by using air-mode to discharge each test point 25 times continueously and then check the module frame. 2. Under test conditions, by using contact-mode to discharge each test point of panel frame 25 times continueously and then check the module frame.

(D) 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. INVERTER *1)

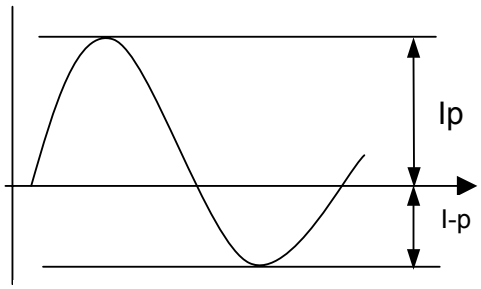
Ta＝25±2℃

Item		Min	Typ	Max	Unit	Note
Input Voltage		7.5	14.4	21	V	
Open circuit Voltage		1650	-	2000	Vrms	IL＝6.0mArms
Duty Ratio		10 @SMB_DAT FFH	-	100 @SMB_DAT 00H	%	Vin＝14.4V
Efficiency*2)	Optical	20	-	-	nit / w	After 30min turn on at the center of LCD Vin＝14.4V、IL＝6.0mArms
	Electrical	-	80	-	%	
Operating Frequency		56	61	66	KHZ	Vin＝14.4V @SMB_DAT＝00H
Input voltage ripple		-	-	0.5	V	Peak-to-peak
Output Current	Max	5.7	6	6.3	mA	SMB_DAT＝00H
	Min	1.8	2.1	2.4		SMB_DAT＝FFH
Shutdown Time		1	-	2	sec	
In-rush current		-	-	1	A	
Start-up time		-	-	0.1	sec	

【Note】

*1) This Inverter design must follow the below condition：

- The degrees of unbalance： ＜10%
- The ratio of wave height：＜$\sqrt{2}$ ±15%



Ip：high side peak

I-p：low side peak

A：The degrees of unbalance = ｜Ip－I-p｜/ Irms ×100 (%)

B：The ratio of wave height = Ip (or I-p) / Irms

*2) Efficiency should be calculated as below formulation：

Optical efficiency＝output Brightness（nits）/ Input power（watt）

Electrical efficiency＝output power（watt）/ Input power（watt）

11. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

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

11.1 ASSEMBLY PRECAUTION

(1) Please use the mounting hole on the module side in installing and do not beading or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.

(2) Please design display housing in accordance with the following guidelines.

- Housing case must be destined 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.
- Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0 mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
- 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.
- 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.
- 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.

(3) Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)

(4) 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.

(5) Please wipe out LCD panel surface with absorbent cotton or soft clothe in case of it being soiled.

(6) 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.

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

(8) 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.

(9) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

11.2 OPERATING PRECAUTIONS

(1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.

(2) 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.

(3) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.
(4) A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.
(5) Please pay attention to displaying the same pattern for very long time. Image might stick on LCD. If then, time going on can make LCD work well.
(6) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

11.3 PRECAUTIONS WITH ELECTROSTATICS

(1) 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.
(2) Please remove protection film very slowly on the surface of LCD module to prevent from electrostatics occurrence.

11.4 STORAGE PRECAUTIONS

(1) When you store LCDs for a long time, it is recommended to keep the temperature between 0℃ ~40℃ without the exposure of sunlight and to keep the humidity less than 90%RH.
(2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60℃ and 90%RH.
(3) Please do not leave the LCDs in the environment of low temperature(below -20℃.)

11.5 SAFETY PRECAUTIONS

(1) When you waste LCDs, it is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
(2) If any liquid leaks out of a damaged-glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

11.6 OTHERS

(1) A strong incident light into LCD panel might cause display characteristic changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight Land strong UV rays.
(2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
(3) For the packaging box, please pay attention to the followings:
- Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratch during transportation. Please don't open except picking LCDs up from the box.
- Please do not pile them up more than 3 boxes. (They are not designed so.) And please do not turn over.
- Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
- Packing 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.)