TENTATIVE

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

Preliminary

15.0”XGA

TECHNICAL SPECIFICATION

AC150XP01

MITSUBISHI ELECTRIC Corp.

Date: July.10,’09

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1. APPLICATION

This specification applies to color TFT-LCD module, AC150XP01.

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MITSUBISHI 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. MITSUBISHI should make a contract that stipulate apportionment of responsibilities between MITSUBISHI 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 MITSUBISHI sales representative for it's intended use in writing.

MITSUBISHI 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.

MITSUBISHI 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 a MITSUBISHI sales representative for any questions regarding this product.

2. OVERVIEW

AC150XP01 is 15.0" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 8 bit digital data (6 bit+Hi-FRC), 1024×768, 16.7M-color images are displayed on the 15.0" diagonal screen. Input power voltage is 3.3V 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)	304.1(H)x228.1(V) (15.0-inch diagonal)
Number of Pixels	1024(H)x768(V)
Pixel Pitch(mm)	0.297 (H)x0.297 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	normally white, TN
Number of Colors	16.7M (8bit)
Brightness(cd/m^2)	300 cd/m²(Typ.)(Center point, Lamp current=6.5 mA)
Viewing Angle	150 /140(Typ.)
Surface Treatment	Anti-glare
Module Size(mm)	326.5 (W)x253.5 (H)x11.0(D)(TYP)
Module Weight(g)	1300g(Typ)
Backlight Unit	CCFL, 2 tables, edge-light(top*1/bottom*1)

3. ABSOLUTE MAXIMUM RATINGS

ITEM		SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD		VCC	0	4.0	V	
Lamp Voltage	STI	VL	515	650	Vrms	
Lamp Current	STI	ILO	3	8.5	mArms	*4). 6)
Lamp Frequency		FL	40	80	kHz	
Operation Temperature		Top	0	60	°C	*1). 2). 3). 5)
Storage Temperature		Tstg	-20	65	°C	*1). 2). 3)

[Note]

1).The relative temperature and humidity range are as below sketch, 90%RHMax.(Ta≦ 40°C).

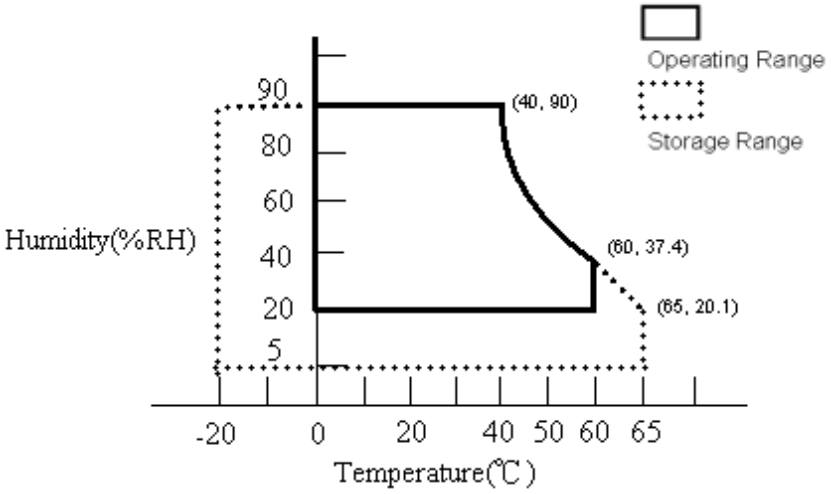
2).The maximum wet bulb temperature ≦ 39°C (Ta＞40°C) and without dewing.

3).If you use the product in a environment which over the definition of temperature and humidity too long to effect the result of eye-aching.

4).The life time of the lamp is related to the current of the lamp, so please according to the description of the "(b) backlight" on page 7.

5).If you operate the product in normal temperature range, the center surface of panel should be under 60°C.

6).When lamp current is out of the absolute maximum range, the life will fall rapidly or shown unusual sign.
IL min **2**mA only for test only, but we can't guarantee the lifetime and performance.



4. ELECTRICAL CHARACTERISTICS

(1).TFT-LCD

Ta=25°C

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	Remark
Power Supply Voltage for LCD		Vcc	3.0	3.3	3.6	V	*1)
Power Supply Current for LCD		Icc	-	700	800	mA	*2)
Permissive Input Ripple Voltage		VRP	-	-	100	mVp-p	Vin=+3.3V
Differential impedance		Zm	70	100	110	Ω	
Logic input voltage LVDS:IN+, IN-	Common Mode Voltage	VCM	1.125	1.25	1.375	V	
	Differential Input Voltage	|VID|	250	350	450	mV	
	Threshold Voltage(High)	VTH	-	-	100	mV	*3)
	Threshold Voltage(Low)	VTL	-100	-	-	mV	

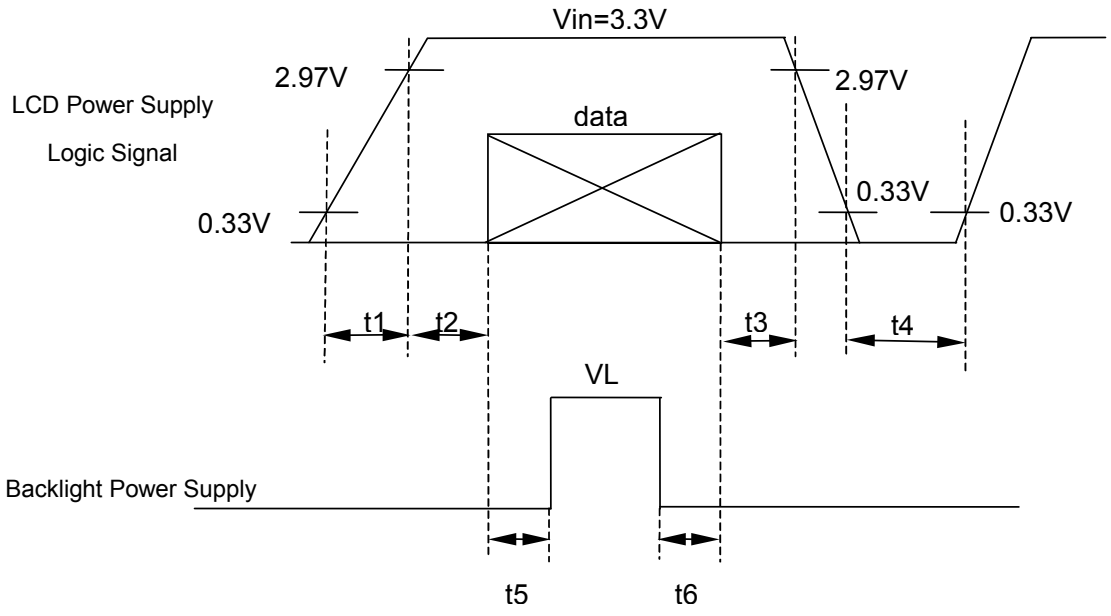
[Note]

1).VCC-turn-on conditions:

0.5ms≦ t1≦ 10ms 500ms≦ t4

0≦ t2≦ 50ms 200ms≦ t5

0≦ t3≦ 50ms 200ms≦ t6



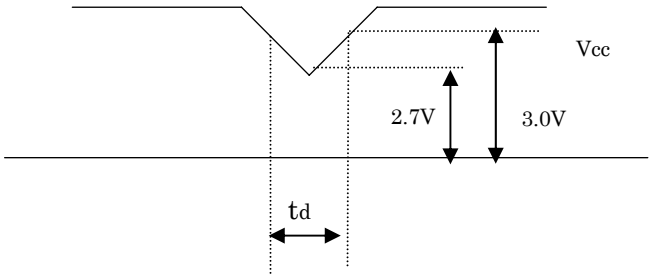
Data: RGB DATA. DCLK. DENA

.

VCC-dip conditions:

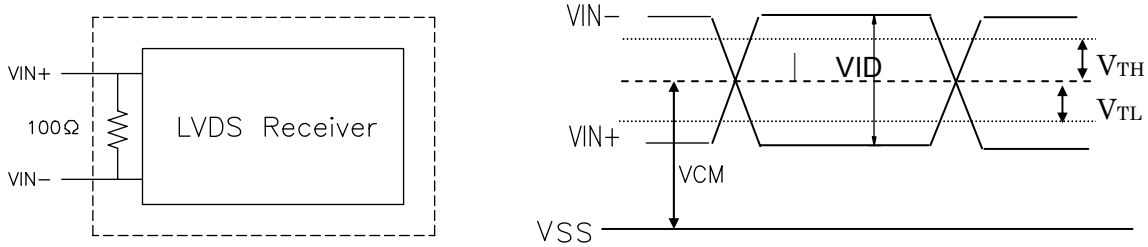
(1) When 2.7V≦ Vcc (min) <3.0V: td≦ 10 ms, module works well.

(2) When VCC <3.0 V, it works abnormal that must reset power. VCC -dip conditions should also follow the VCC-turn-on conditions.



2).Typical current situation: 64 gray scale level,1024 line mode, VCC=3.3V, Fh=64Khz,Fv=60Hz, f_{CLK}=65 MHz.

3).LVDS Signal definition:



VIN+ : Positive differential DATA & CLK Input

VIN- : Negative differential DATA & CLK Input

(2).Backlight

1. Electrical specification

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	REMARK
B/L Voltage	STI	VL	500	555	610	Vrms	IL=6.5mA Ta=25°C
B/L operating current		ILO	3	6.5	8.5	mArms	*1) Ta=25°C
Inverter Frequency		FI	40	--	60	kHz	*2) Ta=25°C
Starting Lamp Voltage	STI	VS	--	--	1350	Vrms	Ta=0°C
			--	--	1050	Vrms	Ta=25°C

2. Lamp life time

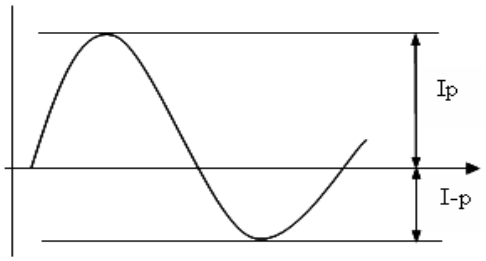
Ta=25°C

ITEM		--	--	IL at 6.5 mA	--	--	UNIT	REMARK
Lamp life Time	STI	--	--	Min. 50,000	--	--	hr	Continuous Operation *5)

[Note] Measuring inverter Type : (QF61V4.53), Frequency=50 kHz.

a. If the waveform of light up-driving is asymmetric, the distribution of mercury inside the lamp tube will become unequally or will deplete the Arm gas in it. Then it may cause the abnormal phenomenon of lighting-up. Therefore, designers have to try their best to for fill the conditions under the inverter designing-stage as below:

- The degrees of unbalance： ＜10%
- The ratio of wave height：＜√2 ±10%



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

b. The Starting Lamp Voltage (VS) of inverter must be driven large than one second.

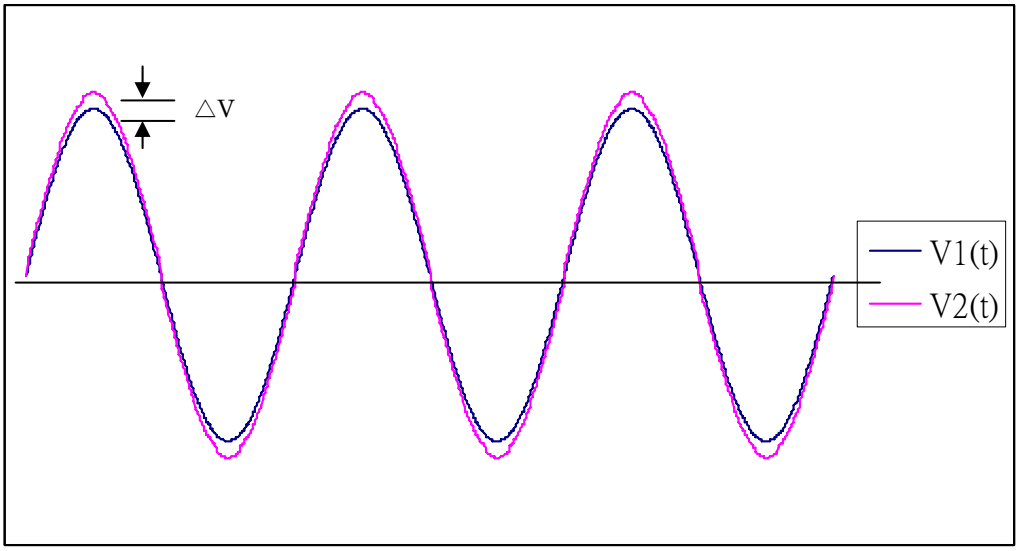
c. The output voltage of inverter (Vn) must be the same phase of between any lamps.

d. The difference in voltage between any lamps(△V) must be smaller than 300V at the same time. Example：|△V| ＜220V, △V： =V1(t)-V2(t)

e. $\frac{|Vnrms - VL|}{VL} \leq 15\%$ ，n=1，2… 4，n：the number of lamp

f. The lamp working current (Icyc) of any cycle of lighting driving wave can't exceed maximum of lamp standard working current (IL).Therefore, the inverter design should be avoided the state.

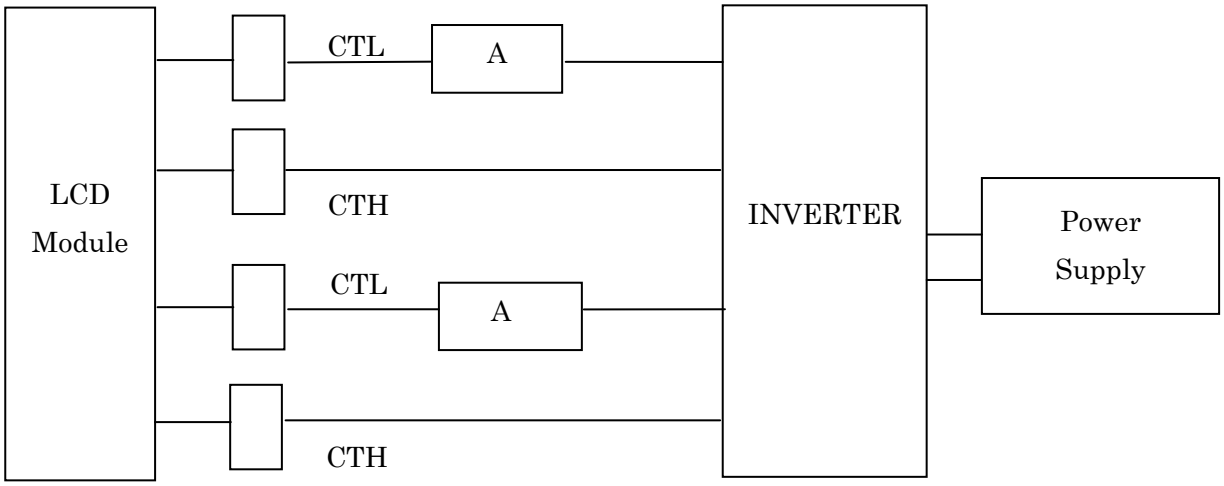
g. The difference in current between any lamps must be smaller than 0.5 mA at the same time.



Note：

1. VL：The lamp voltage (typical) of the standard working current.
2. The lamp working current (Icyc) is defined the RMS of current cycle from the oscilloscope.

1) Lamp Current measurement method (The current meter is inserted in cold line)



2) a. Frequency in this range can mala the characteristics of electric and optics maintain in +/- 10% except hue.

b. If the lamp frequency can be maintain in 50~60KHz, the better characteristics of the electrical and the optical can be presented.

c. If the operating frequency is 40~80 KHz, the life time and the reliability of the lamp will not be affect.

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) It should be employed the inverter which has "Duty Dimming", if ILO is less than 3mA.

4) The CCFL can work normally if the PWM Dimming Ratio range is from 20% to 100% and the lamp current is 6.5mA.

5) Definition of the lamp life time : Luminance (L) under 50% of specification starting lamp voltage is more than 110% of the initial value.

Lamp life time shortens according to:

a. Placing methodology: mercury is unevenly distributed in portrait mounting.

b. Environmental condition: low temperature reduces the presence of mercury vapor, which results in approximately lamp life of 1,000 hours.

c. CCFL surface temperature: Presence of gradient in lamp surface temperature causes uneven mercury migration.

d. Inverter design: its resonance capacitor should be fine-tuned according to the impedance of CCFL.

e. Over driving current (>6.5mA) shortens lamp life time dramatically.

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

a. Lamp current is 6.5mA. Ta=25°C.

b. Frequency is 30 sec.(on)/30 sec.(off)

c. Repeat it for 100 thousand times

d. The lamp life time still match the definition*3).

It should not have motion fail when starting lamp voltage is lower than 110% of the initial value.

7) It is necessary to consider the maximal value when design inverter, in order to assure lighting.

8) The equation of power consumption WL=IL x VL x 2.(IL=6.5mA, Ta=25°C)

9) The voltage above VS should be applied to the lamps for more than 1 second for start-up. (Inverter open voltage must be more than lamp starting voltage.)

5. INTERFACE PIN CONNECTION

(1) CN1 (Data Signal and Power Supply)
Outlet connector: MSB240420 (STM) or equivalent
Plug connector: DF14-20S-1.25C (Hirose) or equivalent

PIN #	SYMBOL	FUNCTION
1	VCC	+3.3V Power Supply
2	VCC	+3.3V Power Supply
3	GND	GND
4	GND	GND
5	RXIN0-	Negative LVDS Differential Data Input
6	RXIN0+	Positive LVDS Differential Data Input
7	GND	GND
8	RXIN1-	Negative LVDS Differential Data Input
9	RXIN1+	Positive LVDS Differential Data Input
10	GND	GND
11	RXIN2-	Negative LVDS Differential Data Input
12	RXIN2+	Positive LVDS Differential Data Input
13	GND	GND
14	RXCLK IN-	Negative LVDS Differential Clock Input
15	RXCLK IN+	Positive LVDS Differential Clock Input
16	GND	GND
17	RXIN3-	Negative LVDS Differential Data Input
18	RXIN3+	Positive LVDS Differential Data Input
19	GND	GND
20	NC	Reserved

1) Please keep the NC Pin and don't connect it to GND or other signals.

2) GND Pin must connect to the ground, don't let it be a vacant pin.

(2) CN2, 3 (BACKLIGHT)
Backlight-side connector: BHR-03VS-1 (JST)
Inverter-side connector: SM03B-BHS-1 (JST)

CN2

PIN #	SYMBOL	FUNCTION
1	CTH1	High Voltage
2	--	Empty
3	CTL1	Low Voltage

CN3

PIN #	SYMBOL	FUNCTION
1	CTH2	High Voltage
2	--	Empty
3	CTL2	Low Voltage

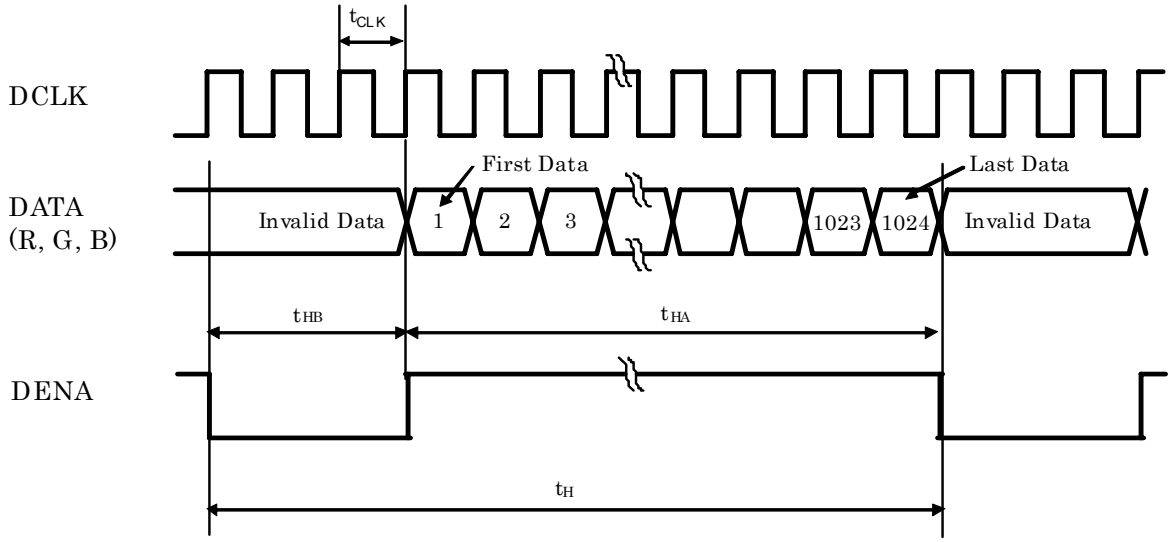
6. INTERFACE TIMING

(1) Timing Specifications

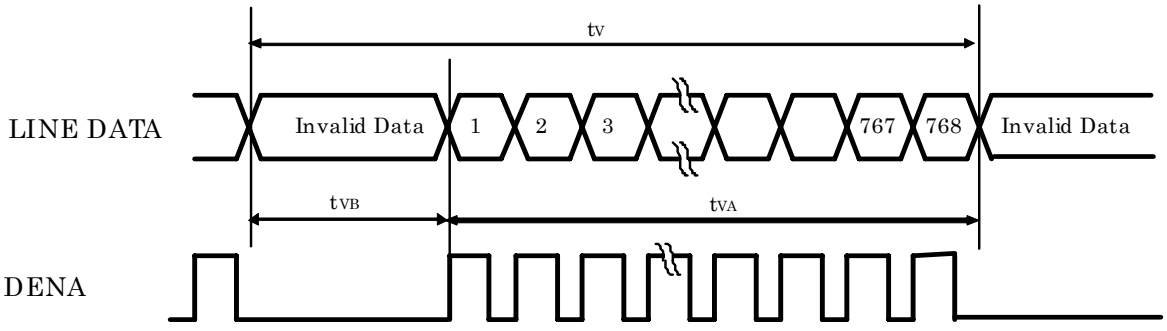
ITEM				SYMBOL	MIN.	TYP.	MAX.	UNIT
LCD Timing	DCLK		Frequency	f_{CLK}	50	65	80	MHz
			Cycle	t_{CLK}	12.5	15.3	20	ns
	DENA	Horizontal	Vertical line rate	f_H	43.48	48.36	58.39	kHz
			Horizontal total time	t_H	1150	1344	1370	t_{CLK}
			Horizontal effective time	t_{HA}	--	1024	--	t_{CLK}
			Horizontal blank time	t_{HB}	126	320	346	t_{CLK}
		Vertical	Vertical frame Rate	Fr	55	60	75	Hz
			Vertical total time	t_V	794	806	860	t_H
			Vertical effective time	t_{VA}	--	768	--	t_H
			Vertical blank time	t_{VB}	26	38	92	t_H

(2) Timing Chart

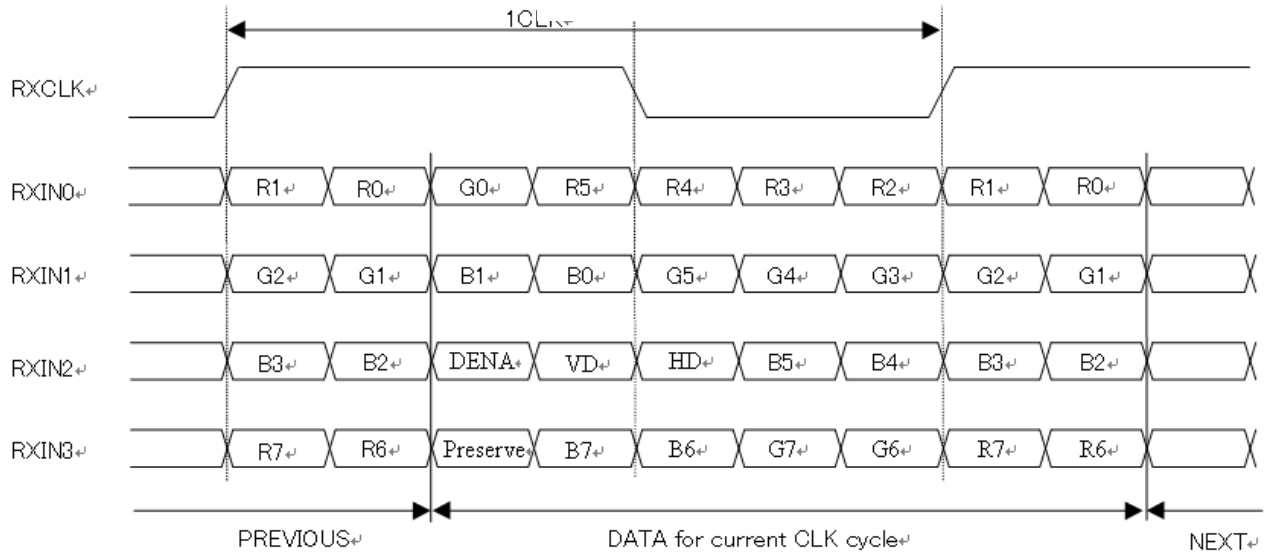
a. Horizontal Timing



b. Vertical Timing



(3) LVDS DATA : Timing Chart



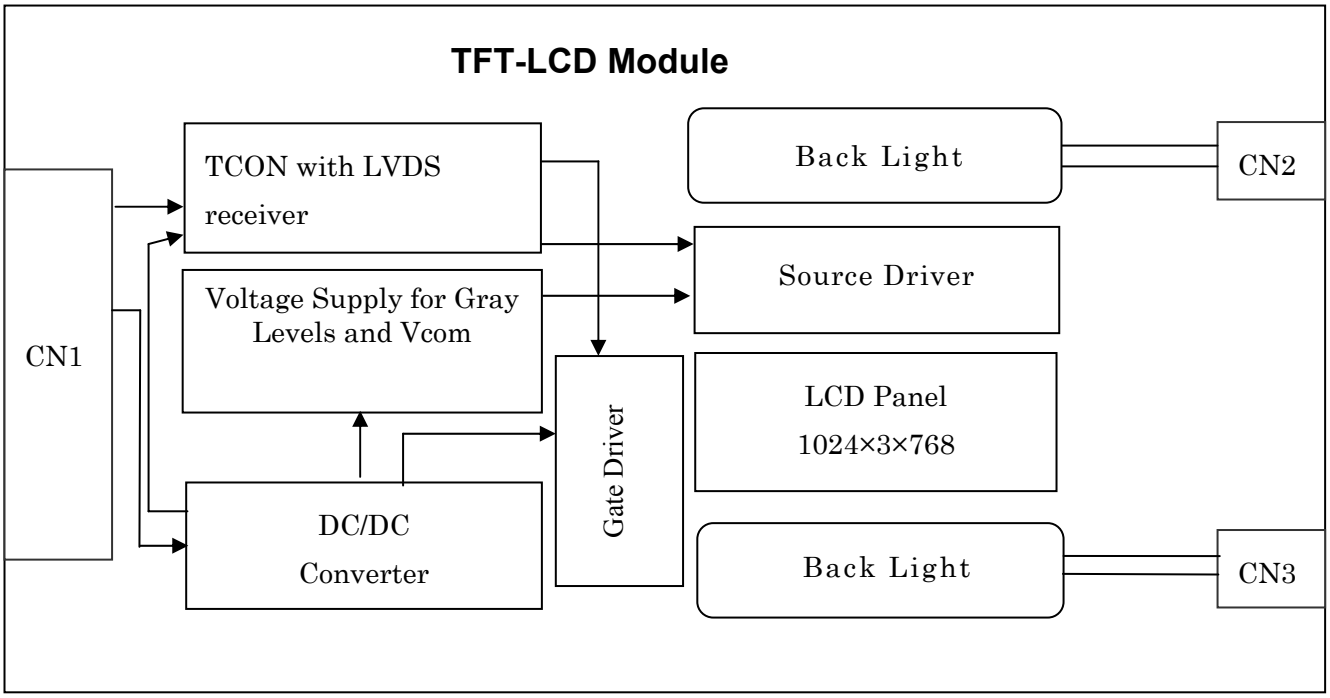
(4) Color Data Assignment

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(0)	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(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(254)	1	1	1	1	1	1	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(0)	0	0	0	0	0	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	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(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	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(0)	0	0	0	0	0	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	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(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	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]

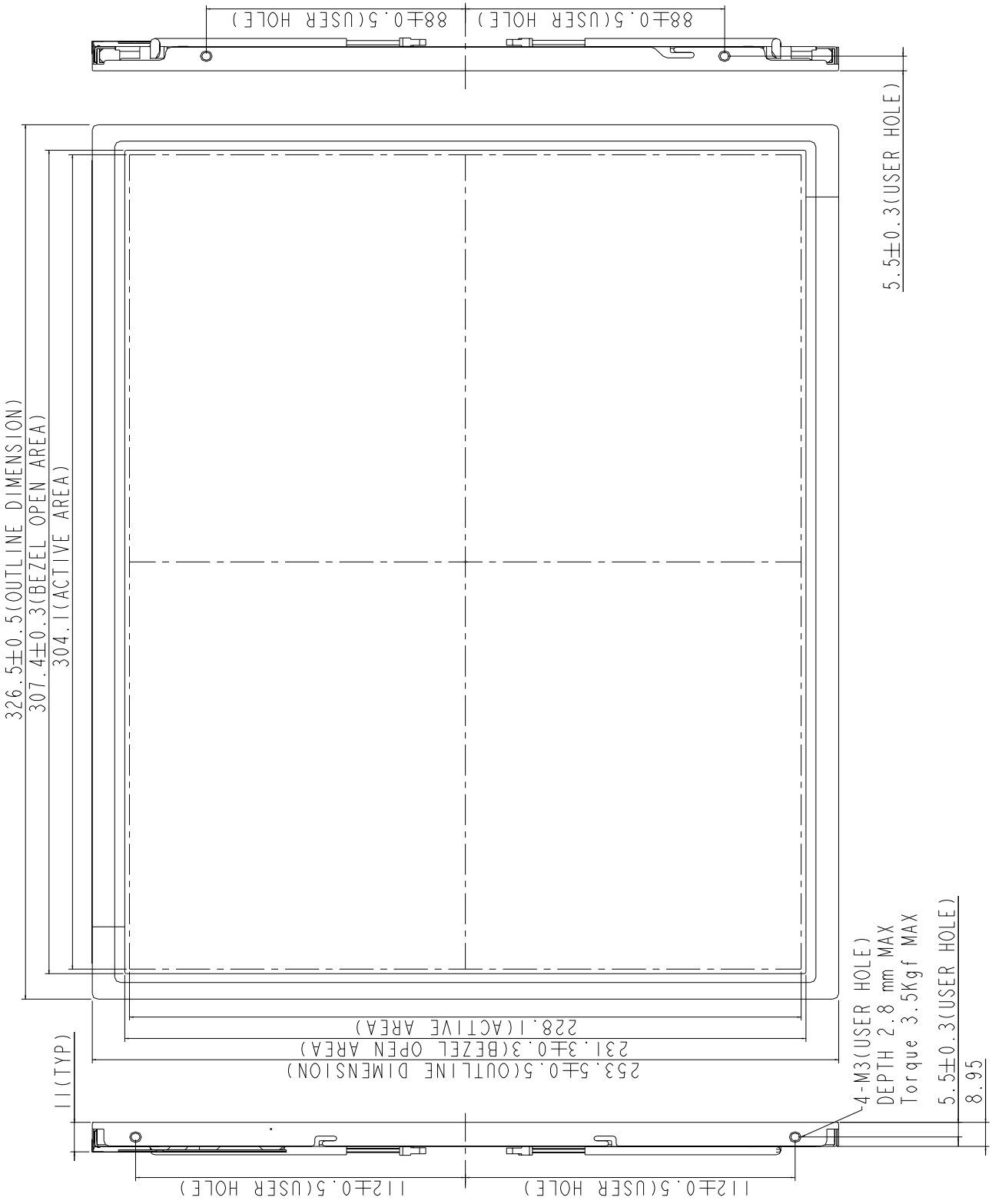
1) Definition of gray scale:
   Color (n): n indicates gray scale level; higher n means brighter level.
2) Data: 1-High, 0-Low.
3) This assignment is applied to both odd and even data.

7. BLOCK DIAGRAM



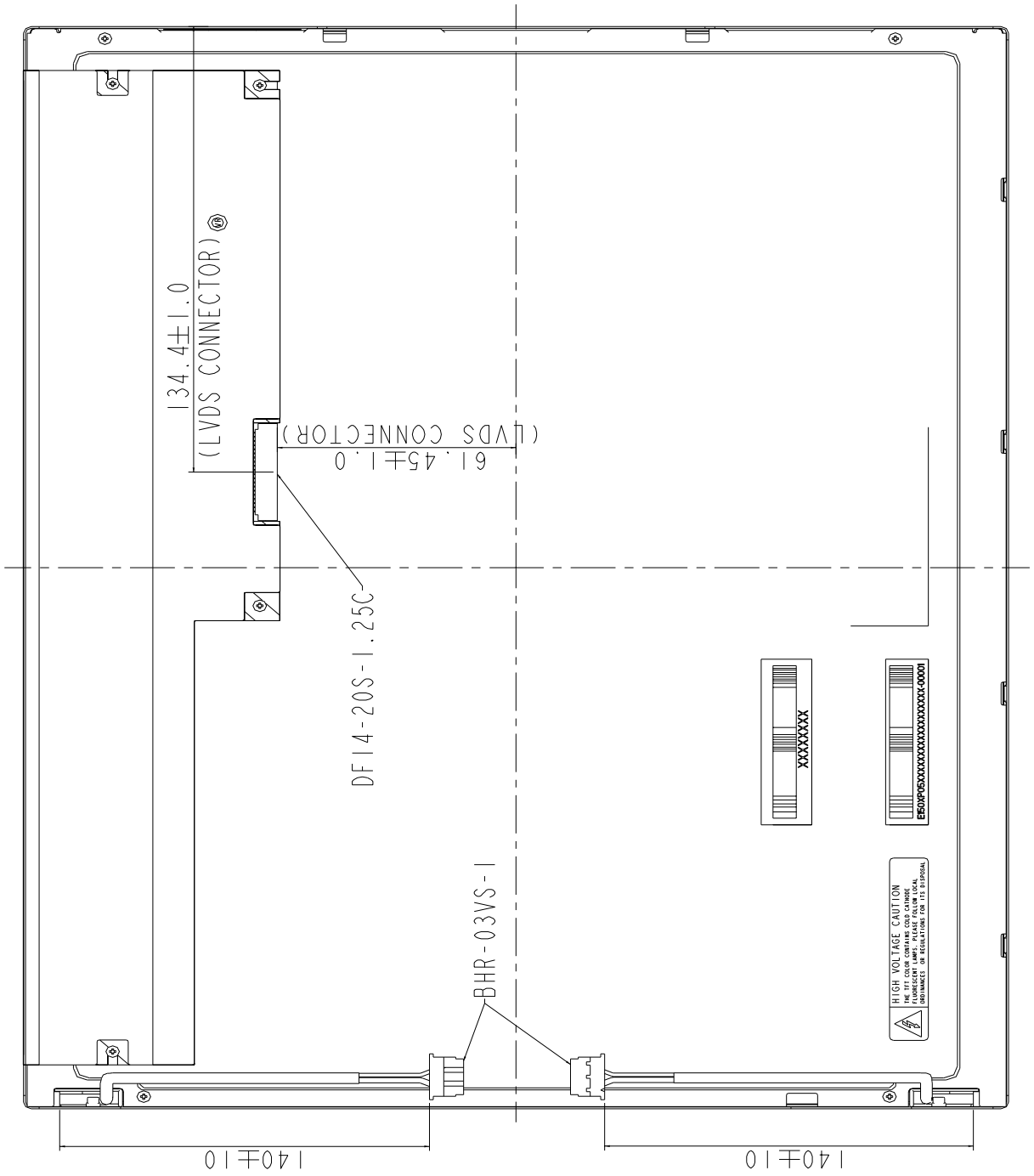
8. MECHANICAL SPECIFICATION

(1) Front side (Tolerance is ±0.5mm unless noted) Unit: mm



Torque 3.5Kgf・cm = 0.343N・m (1N.m =10.2 Kgf・cm)

(2) Rear side (Tolerance is ±0.5mm unless noted) Unit: mm



9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3

ITEM		SYMBOL	CONDITION	min	typ	max	UNIT	REMARK
Contrast Ratio		CR	θ=ψ=0°	550	700	--	--	*1) 2)
Luminance(CEN)		L	θ=ψ=0°, IL=6.5mA	240	300	--	cd/m²	*1) 3)
9P Uniformity		ΔL	θ=ψ=0°	75	--	--	%	*1) 3)
Response Time		Tr	θ=ψ=0°	--	2	--	ms	*5)
		Tf	θ=ψ=0°	--	6	--		
Viewing Angle	Horizontal	ψ	CR≥10	-60~60	-75~75	--	Deg.	*4)
	Vertical	θ		-55~55	-70~70	--	Deg.	
Color Coordinates	White	X	θ=ψ=0°	0.283	0.313	0.343	Color Coordinates	*3)
		Y		0.299	0.329	0.359		
	Red	X		0.613	0.643	0.673		
		Y		0.305	0.335	0.365		
	Green	X		0.270	0.300	0.330		
		Y		0.555	0.585	0.615		
	Blue	X		0.113	0.143	0.173		
		Y		0.049	0.079	0.109		

[Note]

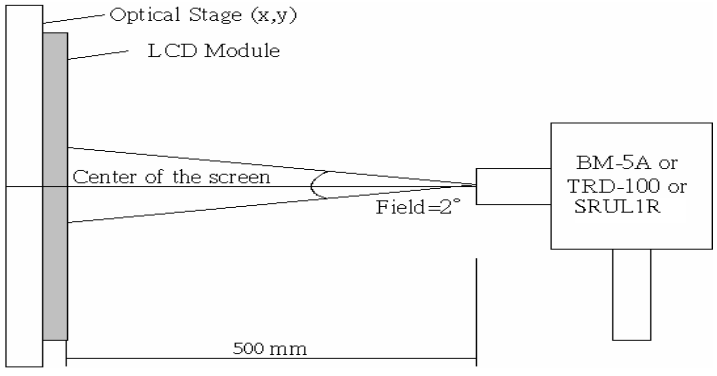
All optical specification condition:

Equipment: Color coordinate and color gamut are measured by SRUL1R, and all the other items are measured by BM-5A (TOPCON).

Condition: IL=6.5 (each lamp) mA, Inverter: (QF61V4.53), Frequency=50 kHz.

1) Setup of Measurement Equipment

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.



2).Definition of Contrast Ratio:

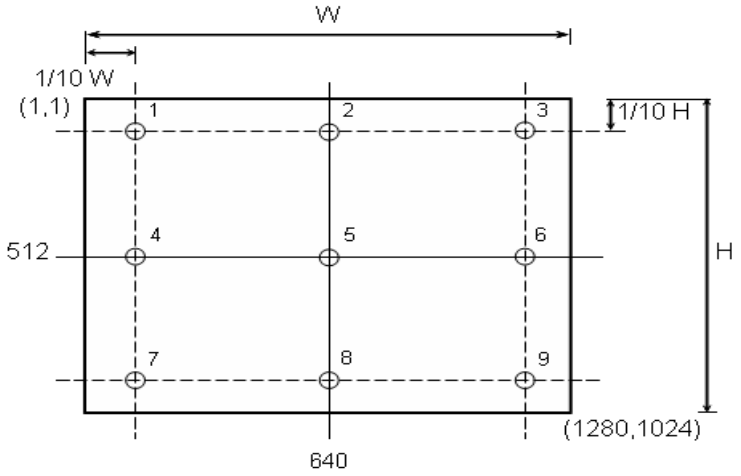
CR=ON (White) Luminance/OFF (Black) Luminance

3).Definition of Luminance and Luminance uniformity:

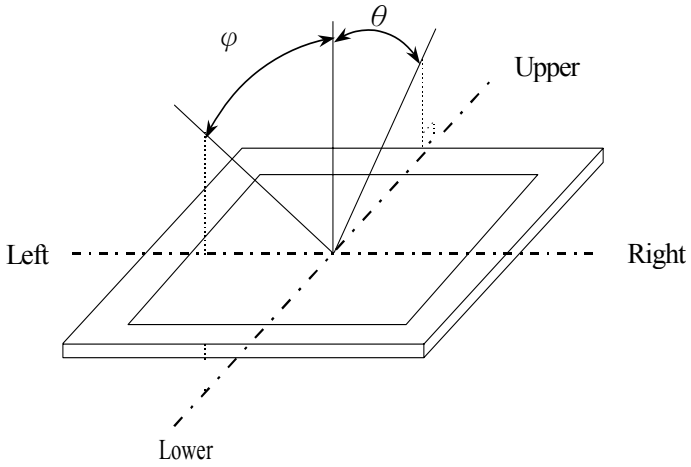
Center Luminance: measuring the luminance of the point no. 5

Average Luminance: measuring average luminance of points no.1-no.9

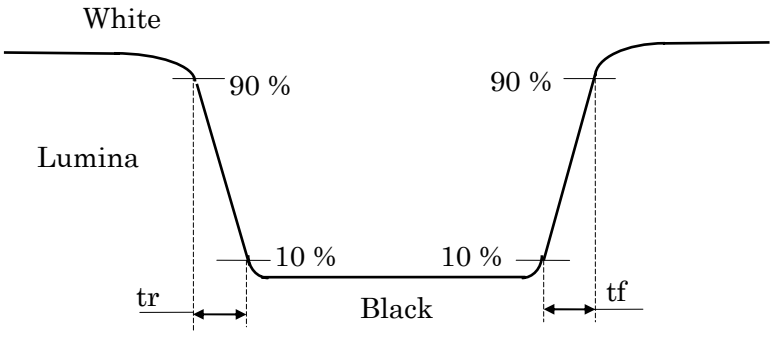
Uniformity: ΔL= [L (Min)/L (Max)] ×100 %



4).Definition of Viewing Angle (θ,ψ):



5) Definition of Response Time:



10. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature High Humidity Operation	50°C; 80%RH; 300hrs (No condensation)
High Temperature High Humidity Storage	65°C; 90%RH; 48hrs (No condensation)
High Temperature Operation	60°C; 300hrs
High Temperature Storage	65°C; 300hrs
Low Temperature Operation	0°C; 300hrs
Low Temperature Storage	-20°C; 300hrs
Thermal Shock	Between -20°C (30min) ~ 60°C (30min); 100 Cycles

(2) Shock & Vibration

ITEMS	CONDITIONS
SHOCK (NON-OPERATION)	Shock level:490m/s^2(50G) Waveform: half sinusoidal wave, 20ms 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: 14.7m/s^2(1.5G) zero to peak Waveform: sinusoidal Frequency range: 10 to 200 Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 10 to 200Hz in each of three mutually perpendicular axis(each x,y,z axis: 30 min, total 1.5 hours)

11. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

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

(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 guide lines.
   a) 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.
   b) 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.
   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.
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 cloth 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.

(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 charge 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.

(3) PRECAUTFONSWITHELECTROSTATICS

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.

(4) STORAGE PRECAUTIONS

1) 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.
2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C90%RH.
3) Please do not leave the LCDs in the environment of low temperature; below -20℃.

(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.

(6) OTHERS

1) 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 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:
   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) 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.)