To : GIGABYTE

This specification is only used for discussing the included items.
You haven't to approve this specification.
When we shall agree the specification, we will issue the formal one.

SPECIFICATION (TENTATIVE)

FOR

TOSHIBA MATSUSHITA DISPLAY TECHNOLOGY

TFT-LCD MODULE

LTM09C362T

LTM09C362T-01

DATE OF ISSUE : 2007-12-14

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Revision History

Date	Rev.	Sheet (New)	Item	Old	New	Reason

Caution and Handling Precaution

For your end users' safety, it is strongly advised that the items with "＊" should be included in the instruction manual of the system which may be issued by your organization.

Toshiba Matsushita Display Technology always endeavors to maintain sufficient quality in process of designing and manufacturing . However ,to avoid causing extended damages such as accidents resulting in injury or death, fire, or social damages if the LCD module fails, take into consideration safe design such as redundant design, fire-spreading prevention design, over-current prevention design, or malfunction prevention design etc. as a whole set.

For Safety

⚠ Warning

The following indicates a potentially hazardous situation which could result in death or serious injury if you do not follow instructions.

1) SPECIAL PURPOSES

Toshiba Matsushita Display Technology's Standard LCD modules described in this Specification are not customized for applying to equipments (for example: nuclear control systems, and space vehicles, combustion control systems, various safeguards, medical equipment etc.) of which failures or malfunctions may threaten a human life or hurt a human body.

When using them for the above equipments, consult with our company beforehand.

Understand that our company cannot take responsibility for the damage etc,. occurred by use without consultation.

2) ELECTRIC SHOCK

DISCONNECT POWER SUPPLY before handling LCD modules. In order to prevent electric shock, DO NOT TOUCH the electrode part, cables, connectors, and the fluorescent lamp's (hereinafter called "FL") circuit part of a module in which FL tubes are built in as a light source of a backlight or a front light. High voltage is supplied to these parts while power supply is turned on.

3) FL CABLE CONNECTION

Make sure to insert the module FL connector to the inverter connector in correct position and correct polarity. If incorrect, this may cause smoke or burn of electrical parts by high voltage of FL circuit. If there is a possibility that the connector has been inserted incorrectly, re-insert the connector only after you confirm the module and FL power is completely off. When disconnecting the connector, do not pull on the cable.

DO NOT USE the mating FL connector which Toshiba Matsushita Display Technology does not specify. Otherwise, Toshiba Matsushita Display Technology shall not be liable for any damages caused by the connector.

⚠ Caution

The following caution indicates a potentially hazardous situation which may result in minor injury, or moderate injury, with incorrect usage.

1) ＊DISASSEMBLING OR MODIFICATION

DO NOT DISASSEMBLE OR MODIFY the modules. Disassembling the module may result in an electric shock.

Sensitive parts inside LCD module may be damaged, and dusts or scratches may mar the displays. Toshiba Matsushita Display Technology does not warrant the modules, if customer disassembled or modified them.

2) ＊BREAKAGE OF LCD PANEL

DO NOT INGEST liquid crystal material, DO NOT INHALE this material, and DO NOT PERMIT this material to contact the skin, if glass of LCD panel is broken.

If liquid crystal material contacts the skin, mouth or clothing, take the following actions immediately.

In case contact to the eye or mouth, rinse with large amount of running water for more than 15 minutes. In case contact to the skin or clothing, wipe it off immediately and wash with soap and large amount of running water for more than 15 minutes. The skin or closing may be damaged if liquid crystal material is left adhered.

In case ingestion, rinse out the mouth well with water. After spewing up by drinking large amount of water, get medical treatment.

3) ＊GLASS OF LCD PANEL

BE CAREFUL WITH CHIPS OF GRASS that may cause injuring fingers or skin, when the glass is broken.

The LCD module has structure where a plastic film stuck on a glass surface and glass cannot disperse easily.

However, touching a cut surface may cause injuries.

Since FL is also made of grass, when FL is built in, handle it with due caution as well.

4) ABSOLUTE MAXIMUM RATINGS

DO NOT EXCEED the absolute maximum ratings specified in this Specification. These are the rated values that must not exceed for a LCD module by any means. Since the parts used as circuit are damaged by fire or breakage and the characteristic may not be recovered when exceeding this rating, take into consideration the variation in ambient temperature, input signal change, and dispersed specification of electric of parts etc., and design not to exceed LCD module absolute maximum ratings.

5) POWER PROTECTION CIRCUIT

Employ protection circuit for power supply, for LCD module failures according to the operating condition of a set.

A suitable protection circuit should be applied, based on each system design.

DO NOT MODIFY the fuse used in the LCD module.

It may cause overheating and / or burning. If dust or metal particles touch the PCBs or failures of some circuits occur in the LCD module.

6) DISPOSAL

Always comply all applicable environmental regulations, when disposing of LCD module.

7) EDGES OF PARTS

Be careful with handling the metal flame (bezel) of a module. Even though burr disposal treatment is performed, it may cause injuring. Be careful with edges of glass parts and touch panel identically. For designing the system, give special consideration that the wiring and parts do not touch those edges.

8) ＊LUMINANCE DECREASE OF FL

Stop the using of LCD module when FL tube comes to back and color if it turns into pink from white.

At the life end of FL, the mercury contained in FL tube is exhausted, with its discharge color turns into pink as the characteristics of FL. It may in temperature rose in an FL tube end to affect the LCD module or break an FL tube.

9) RECOMMENDED OPRATING CONDITIONS

Don't exceed "the recommended operation conditions" in this specification. (The LCD module should be used within " the recommended operation conditions".)

The performance and quality of the LCD module are warranted only when the LCD module is used within "the recommended operation conditions." Toshiba Matsushita Display never warrants the performance and quality of the LCD module when you use the LCD module over "the recommended operation conditions". Although within "the absolute Maximum rating".

To use the LCD module over "the recommended operation conditions" may have bad influence on the characteristics and Reliability of the LCD module and may shorten the life of the LCD module.

Therefore, when designing the whole set, not to be over "the recommended operation conditions", you should fully take care of supply voltage charge, characteristic of connection parts, serge of input-and-output line, and surrounding temperature.

10) ∗ HIGH TEMPERTURE ON FL

FL tubes become a backlight source are built into a LCD module.

Please remind that the portion such the surface of LCD module, the metal frame portion, and FL unit cover on the rear side become high temperature during and right after turning off the FL.

In the case you have to contact these portions, surely turn off the supply to the LCD module first, and being careful with SED prevention, use hand glove that protects hands (skin) from heat or contact after the temperature at the metal portion falls to the room temperature level

For Designing the System

2-1 DESIGNING ENCLOSURE

1) MOUNTING HOLES

Use all the mounting holes described in this Specification when assembling a LCD module in a set.

a proper size described in this Specification.

2) ∗ TWIST / WARP

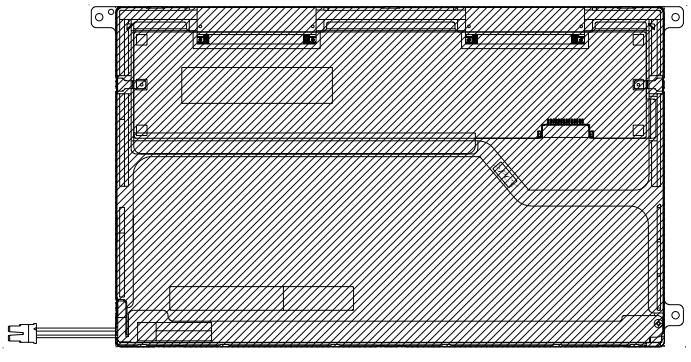
When assembling a LCD module in a set using the set, be careful not to apply stress, such as twist or warp, on the LCD module at designing an enclosure of the set.

3) DESIGN OF LCD MODULE REAR OF A LCD MODULE

Design a set to that the LCD module rear is not pressed by a set enclosure or cable, etc

Pressing the LCD module rear deforms a panel etc. and my cause ununiformity in a display. Design not to touch the portion shown in oblique lines of the drawing below. This LCD module uses a light guide plate.

Applying stress on a light guide plate may causes white spots and black spots. Since applying stress on a circuit board may cause damage, do not touch it.



4) GAS GENERATED FROM THE PART MATERIALFOR A SET

Some plastic materials and shock absorbing materials (rubber) used in the system may generate gases that may cause the deterioration of the polarizer laminated on LCD's panel or internal parts of the LCD module. Prior confirmation is required.

5) GAS GENERATED FROM CASING / PACKAGING MATERIAL FOR A SET

Some materials used for packaging (for which acid is the recycling process) generate gases that may cause the deterioration of the polarizer laminated on LCD's panel or internal parts of the LCD module. Prior confirmation is required.

2-2 DESIGNING POWER SUPPLIES AND INPUT SIGNALS TO LCD MODULE

1) CAPACITY OF POWER SUPPLY

The fuse (KAMAYA /Type: FCC16132AB) is attached at the power supply line in the module.

It is necessary for the sufficient electric capacity to this fuse effectively. As for this fuse, there are no effect in the former circuit. As an example, it may damage by fire or fume or when there are the short in for I/F connector portion. Have a suitable protection circuit also in the set side for accident prevention. In equipping with a fuse by the set side, Please choose the fuse of suitable specification so fuse dose not blowout by the in coming current at the time of a power supply injection.

Power supply	Recommended maximum output current of power supply	Recommended Fuse Rating (in case of using fuse for current limiter)	Built-in Fuse Rating (for reference)
V_{DD}	4.0 A	1.25 A	1.25 A

2) SEQUENCE OF POWER SUPPLIES AND INPUT SIGNALS

Power –Supply lines should be designed as follows.

Power supplies should always be turned on before the input signals are supplied to LCD module. and the input signals should be disconnected before power supplies are turned off.

If this sequence is not followed, It may cause mis-operation of the panel.

Refer to "Sequence of Power Supplies and Signals" described in this Specification for details.

In addition, refer to individual specifications for unused terminals.

3) FL CABLE CONNECTION

Make sure to connect correctly high-voltage wire and low-voltage wire between FL tube and inverter unit.

If high-voltage wire and low-voltage wire incorrectly, it may cause insufficient brightness or unstable operation of FL, and smoke or burn of the parts.

4) IMAGE SRIKING IN A DISPLAY

Design the system not to display same pattern for a long time. Continuing the same pattern display for a long time or inputting the signals besides recommendation may cause the phenomenon "image sticking" which remains vaguely after changing patterns.

5) GROUNDING OF METAL FRAME(BEZEL)

Grounding of metal frame of LCD module is generally effective to prevent radiation interference from the system design. However, since there is a difference on set structures, judge totally whether finally to ground not on the whole set.

2-3 DESIGNING FOR BETTER VISIBILITY

1) PANEL ANGLE

Visibility of LCD module deeply depends on the viewing directions. The position and the angle of LCD module in the system should be designed so that the best visibility can be obtained at the actual usage.

2) WINDOW OPENING

Dimensions of window opening of the system's enclosure should be designed as smaller than "Viewing Area" and larger than "Active Area" specified in individual specification in order to prevent that a part of screen is interrupted by the enclosure and disappears.

3) PROTECTIVE COVER / ULTRA-VIOLET CUT FILTER

I Input FL starting voltage time should be applied for more than two seconds. If it is less than two seconds, it may cause unstable operation of FL.

Inverter should bed design to stop output when the inverter is no-load to FL tubes (due to breakage of FL, etc.) to prevent high-voltage generation.

When high-voltage is applied to FL continuously without normal operation of FL (due to output power leakage within FL wiring circuit) it may cause smoke or burn. To prevent excess current, design the inverter with a protection circuit such as current limiter (excess current detection) to stop inverter output.

There is a possibility that flicker will be caused by the interference of LCD operating signal, and FL driving condition (especially driving frequency). Please adjust inverter circuit parameters, such as capacitor and resistor, to assure that the display quality is maintained.

2-4 DESIGNING FL POWER SUPPLY CIRCUIT

Input FL starting voltage(V_{SFL}) should be longer than three seconds. If it were not, it may cause unstable operation of FL.

Inverter should be design to stop output when the inverter is no-load to FL tubes (due to breakage of FL, etc.) to prevent high-voltage generation.

When high voltage is applied to FL continuously without normal operation of FL (due to output leakage within FL wiring circuit, etc.) it may cause smoke or burn. To prevent excess current, design the inverter with a protection circuit such as a current limiter (excess current detection) to stop inverter output.

1)＊FL LIGHTING CIRCUIT

DO NOT GIVE high voltage to “Low Voltage” side of the FL.

For example, DO NOT USE a floating inverter which gives high voltage to “Low Voltage” side, otherwise there is the possibility of smoke or burning around the FL.

2) LAYOUT OF FL CABLES

When connecting a LCD module FL connector to a inverter, be careful not to twist or cross the high-Voltage side cable and the low-voltage side cable of an FL, not to wire FL cabbies on metal sheet of set, or not to insert FL cables between metal sheet of set. Consciously . Increase in stray capacitance may interrupt the FL to operate normally.

For Installation in Assembly

3-1 CARRYING

Hold metal frame (bezel) part with both hands when carrying a LCD module with hand. Holding an FL cable and FPC may cause failures, in the worst case, it may cause smoke or burn.

3-2 CAUTIONS TO PREVENT FROM ELECTROSTATIC DESTRUCTION UNDER ASSEMBLY WORK

Consider the following to prevent the static electricity from generating under assembly work. High-voltage static electricity discharge destroys the circuit inside the module and it may cause failures.

1) HUMIDITY

Maintain a work place in the range of 50 to 70%of relative humidity, to prevent generation and discharge of static electricity.

2) GROUNDING

2-1) cover the floor of a work area and a work desk with conductive mat, and ground them, through resistance with range of 0.5MΩ to 1MΩ ,to prevent discharge all at once.

2-2) Workers must wear a grounded wrist band.

2-3) Ground all metallic tools, jigs and equipment, such as a soldering iron and a screw driver, jigs, conveyors, or metallic work benches, which are to be used assembly work.

3) IONIZER

Using ionizer (an antistatic blower) is recommended at working area in order to reduce electro-static voltage.

4) REMOVING PROTECTION FILM

The protection film is stuck on an LCD panel before its shipment to prevent dust scratch on the panel during transportation, assembly work or otherwise. Remove a protection film on an LCD panel near the last process of an assembly to prevent dust and scratch on the panel.

However, remove the film in advance in case of a set attached a module is inserted into high temperature chamber for aging etc. If it is left without removing the film, it may cause irregular polarizer surface.

When removing the protection film, peel off the film from its edge, using round-ended tweezers with Teflon coating or a cellophane tape attached on the edge of the protection film, carefully and slowly, spending more than 3 seconds.

In peeling off the protection film, blow the film using ionizer to eliminating ESD from the film/

Removal which dose not comply with the above procedure may generate ESD and damage electric circuit of a LCD module,.

5) Do not touch bare metal portions of examination / inspection equipment. It causes to discharge electric charge of an object or a human body.

6) Do not touch the mounting parts on PCB LCD module, circuit patterns or terminals with worker's hand or conductive tools.

3-3 DUST AND STAIN PREVENTION

1) WORKING AREA

Handle the LCD module in the room with out metallic dust. Especially when metallic dust adheres to the LCD module, an internal electric circuit makes short-circuited and it may cause failures.

2) FINGER PRINT

Handle the LCD module fingerstalls or soft and dust-free gloves that do not produce dust when performing incoming inspection of modules or assembling sets. Handling them with bare hand may damage module display quality.

3) ＊WIPING OFF DUST ON THE PANEL

When LCD panel becomes dirty, wipe the panel surface off softly with absorbent cotton or another soft cloth.

If necessary, breathe upon the panel surface and then wipe off immediately and softly again.

Be careful not to spill organic solvents into the inside of LCD module. The solvents may damage driver IC and PCB area used inside module.

The polarizer laminated to LCD panel and adhesives may be damaged by the solvents, so do not use any organic solvents for wiping off LCD panel.

4) PROTECTION AGAINST ADHESION ADHESIVE OR GREASE ON A DISPLAY

Be careful not to attach adhesive or grease etc. used for the assembly of a set on a LCD module display. It is difficult to remove them without damaging display quality.

5) ＊WATER DROP ON A DISPLAY

Do not leave water drop attached on a display. When water drop etc. is attached, wipe it off with absorbent cotton or soft cloth etc. immediately. If it is left without wiped off, a display discolors, or it causes spots. Moreover, moisture's infiltration into an inside causes failures.

6) HANDLING IN THE CPRROSIVE ATMOSPHERE

Do not blow gas or do not use a LCD module besides the normal atmosphere. It may cause failures.

3-4 BENDING / TWISTING OF LCD MODULE DURING ASSEMBLY

1) INSTALLING LCD MODULE TO THE ENCLOSURE

Do not bend or twist LCD module even momentary when LCD module is installed into an enclosure of the system. Bending or twisting LCD module may cause its damages.

2) FASTENING SCREWS

Fasten equally screws, which attach a module in a set.,. If not fastened equally., temporally warping or twisting of the LCD module may cause failures.

3) FOR PREVENTION OF CATDHING CABLES

Be careful not to let cables etc. for interface caught in a set enclosure and a LCD module while assembling a LCD module in a set.

Assembling with cables caught in may cause bending, twist of a LCD module, or damage and failure of cables.

3-5 MECHANICAL FORCES

1) ＊STRONG MECHANICAL SHOCK

Avoid strong mechanical shock, such as dropping the LCD from the work bench, or knocking it against a hard object. These may cause glass panel to crack, may damage the FL, or cause other mis-operation.

2) ＊EXCESSIVE FORCE

Avoid applying excessive force, like pushing the surface of LCD panel. This may cause scratches or breakage of the panel, or failure of the module..

3) ＊PREDVENTION FOR SCRATHES ON A DISPLAY

Be careful not to touch hard things, such as a tool etc., press a module display with them or rub a module display with them.

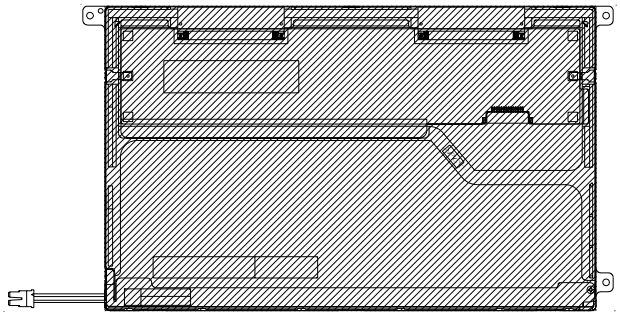
Moreover, be careful not to put heavy things, such as a tool etc., or pile up LCD module displays.

As polarizing plates used for a display is easy to be damaged, it may cause scratches, trace, or breakage of the plate.

4) ＊HANDLING THE REAR OF SCRATCHES A LCD MODULE

There are mechanically weak parts, such as a circuit board etc. in the LCD module rear shown in oblique lines portion of the drawing below.

Be careful that circuit and parts may be damaged and a LCD module may fail if applying stress when assembling a LCD module in a set or handling it.



5) HOW TO INSERT CONNECTOR

Be careful not to apply a strong external force on the connector of a LCD module when inserting or removing cables to connectors of a module. A strong external force may damage internal connections of PCB or TAB driver.

Insert them correctly so that connectors for LCD module input signals and connection connectors of a set are not inserted oblique or half, and be sure to check them.

When inputting signals etc. without inserting them correctly, it may cause failures of circuit parts.

Do not fasten screws while putting cables like those foe interface or FL between LCD module and the enclosure.

Make sure to insert the module FL connector to the inverter connector in correct position.

If incorrect, this cause smoke burn of electrical parts by high voltage of FL circuit.

6) HANDLING FL CABLES AND FPC

Be careful not to pull FL cables or damage FL cables. Putting FL cables damages an FL tube, the soldering parts at an end of an FL tube, or FL cables and causes failures. Do not bind or twist FL cables when assembling them.

Lamp circuit may not flow as specified. Be careful similarly not to pull FPC or damage FPC. It causes failures.

3-6 OPERATION

Be sure that the following caution should be taken under assembly and inspection of the system.

1) POWER SUPPLY WILE WORKING / ASSEMBLING

Be sure turn off the power of a set while working. Pulling out and inserting a LCD module connector with the power of a set turned on may damages a LCD module electric circuit. When turning on the power in a testing process, an inspection process etc., use the power supply and input signals for a drive unit which satisfy the power supply sequence described in this Specification.

2) INPUT SIGNAL

The signal should be applied after power supplies are turned on.

The signal should be removed before power supplies are turned off.

The detailed sequence of power supplies and signals are described in individual specifications.

3) LCD LONG PERIOD OPERATION

In case of LCD long period operation, discoloration of light guide or optical sheet will be happened due to ultra violet and heat from FL tube. As the result, there is possibility to have out of specification for the optical characteristic as “5.2”. But this is not irregular phenomena. Moreover, FL tube also has the characteristic of color shift by long period operation.

4) LIFE OF FL TUBE

FL tube has a characteristic that an Fl tube used to its life depletes the effective mercury contained in an FL tube and the temperature of an FL tube and end rises. Since this may affect a module or break an FL tube, when an FL tube reaches the average life described in this Specification (at 25℃ in ambient temperature) or changes pink lighting, replace the FL tube or a module immediately when it shows the abode-mentioned phenomena (a luminosity reduction by half, change (to pink from white) of discharge color, presumed life.)

When ambient temperature is below 25℃, be careful that life becomes shorter than the average life described in this Specification (at 0℃ 1/10 to 1/20 approximately).

For Transportation and Storage

1) SORAGE UNDER HIGH TEMPERATURE AND HIGH NUMIDITY

Be careful not to store a LCD module foe a long time (about one month or more) under the condition of high temperature and high humidity (35℃ or more, 70% or more of relative humidity). This may deteriorate display quality.

When it is necessary to store unavoidably for a term, in the state of packing by our company (before opening), store it within the range of 0℃ to 35℃ and in the dry place of 70% or less of relative humidity.

2) SOLDIFICATION IN THE LIQUID CRYSTAL IN CRYOGENIC CONDITION

Since a temperature lower than a rated storage temperature described in this Specification may damage a LCD module liquid –crystal-display panel due to the solidification or contraction etc. on liquid crystal, be careful not to leave it in such a place.

3) BE CAOUTIOUS OF STRONG ULTRAVIOLET

Be careful not to expose a LCD module to the sunlight or a fluorescent light directly to protect a LCD module from strong ultraviolet, when storing modules for a long term.

4) CLEANLINESS

Keep the LCD module in clean place, because any dust, hard particle may damage the polarizer, or dust invades the inside of the module.

5) ＊CONDENSATION OF WATER

The modules should be stored under a condition where no condition of water is allowed. It may cause mis-operation or defects. Be especially careful not to make a module work under the condition that condensation of water appears.

6) PACKAGING

Use an original packing box and original packing material, and this LCD module with the same original method and same kind of desiccant, when transporting and storing it again after opening it by customer.

7) NOTES FOR THE ADOPTION OF NEW PACKING MATERIAL

Since some of the cartons for packing or the rubber or the rubber parts etc. generate corrosive gas, confirm a reliability check in the set assembling or the packing state before adoption.

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1. Scope

This specification is applicable to Toshiba Matsushita Display Technology's 23cm diagonal size TFT-LCD module "LTM09C362T" designed for industrial equipment.

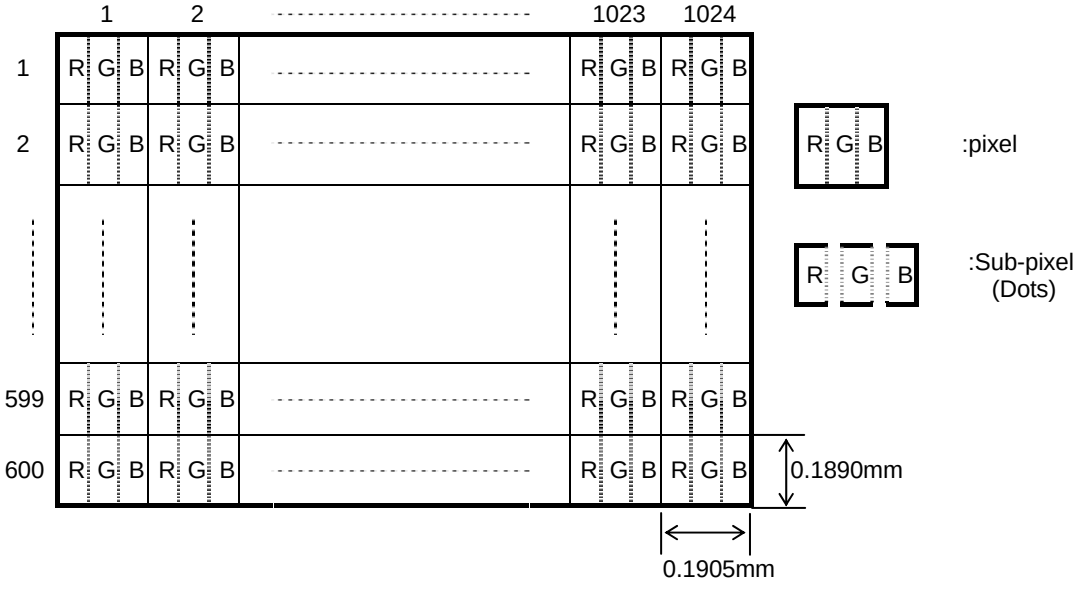
2. Product Specifications

2.1 General Specifications

Item	Specifications
Display Mode	TN color (64 gray scales, 262,144 colors) Transmissive type, Normally white
Viewing Direction	6 o'clock (in direction of maximum contrast)
Driving Method	TFT active matrix
Input Signals	LVDS interface CLK-, CLK+ R_XIN0-, R_XIN0+ R_XIN1-, R_XIN1+ R_XIN2-, R_XIN2+
Dimensional Outline[1)]	224.0 (*W*) × 129.0 (*H*) × 5.2 max. (*D*) (mm)
Active Area	195.07 (*W*) × 113.40 (*H*) (mm)
Viewing Area	197.0 (*W*) × 115.0 (*H*) (mm)
Number of Pixels[2)]	1024 (*W*) × 600 (*H*)
Pixel Pitch[2)]	0.1905 (*W*) × 0.1890 (*H*) (mm)
Pixel Arrangement[2)]	RGB vertical stripes
Surface Treatment	Anti-glare and hard coat 3H on LCD surface
Backlight	Single cold-cathode fluorescent lamps for sidelighting

Note 1) Excluding backlight cables.

Note 2) Display area address is as follows.



2.2 Absolute Maximum Ratings [1)]

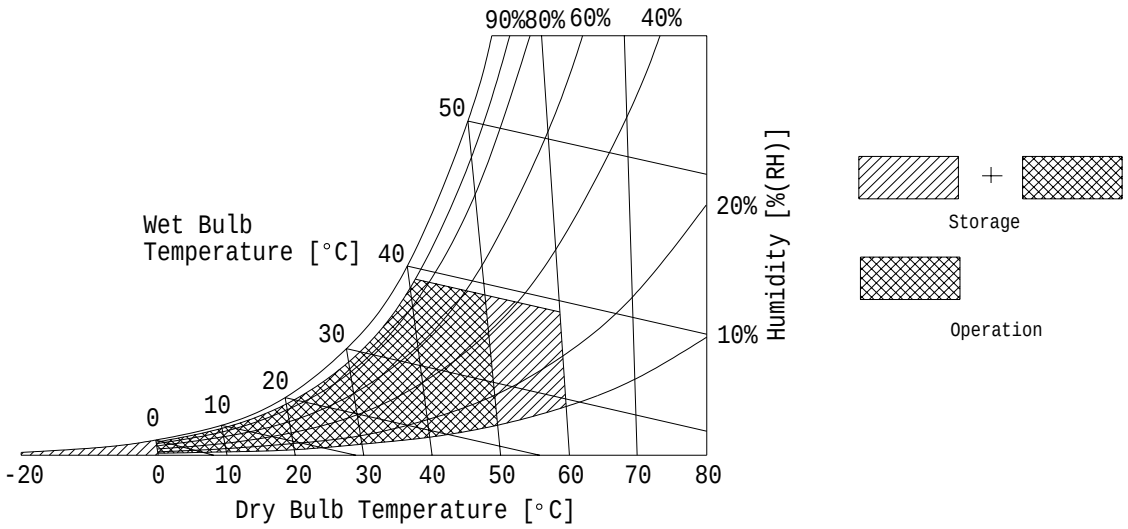
Item	Symbol	Min.	Max.	Unit	Checked Terminal [4)]
Supply Voltage	V_{DD}	-0.3	+4.0	V	V_{DD} - GND
Input Voltage of Signals	V_{IN}	-0.3	V_{DD}+0.3	V	LVDS interface
FL Driving Voltage	V_{FL}	-	2	kV(rms)	
FL Driving Frequency	f_{FL}	-	100	kHz	
Operating Ambient Temperature[2)3)]	T_{OP}	0	+50	°C	
Operating Ambient Humidity[2)]	H_{OP}	10	90	%(RH)	
Storage Temperature[2)]	T_{STG}	-20	+60	°C	
Storage Humidity[2)]	H_{STG}	10	90	%(RH)	

Note 1) Do not exceed the maximum rating values under the worst probable conditions taking into account the supply voltage variation, input voltage variation, variation in part constants, and ambient temperature and so on. Otherwise the module may be damaged.

Note 2) Wet bulb temperature should be 39°C Max, and no condensation of water. See figure below.

Note 3) Only operation is guarantied at Operating Temperature. Display quality is evaluated at +25°C.

Note 4) Refer to 2.4.5.



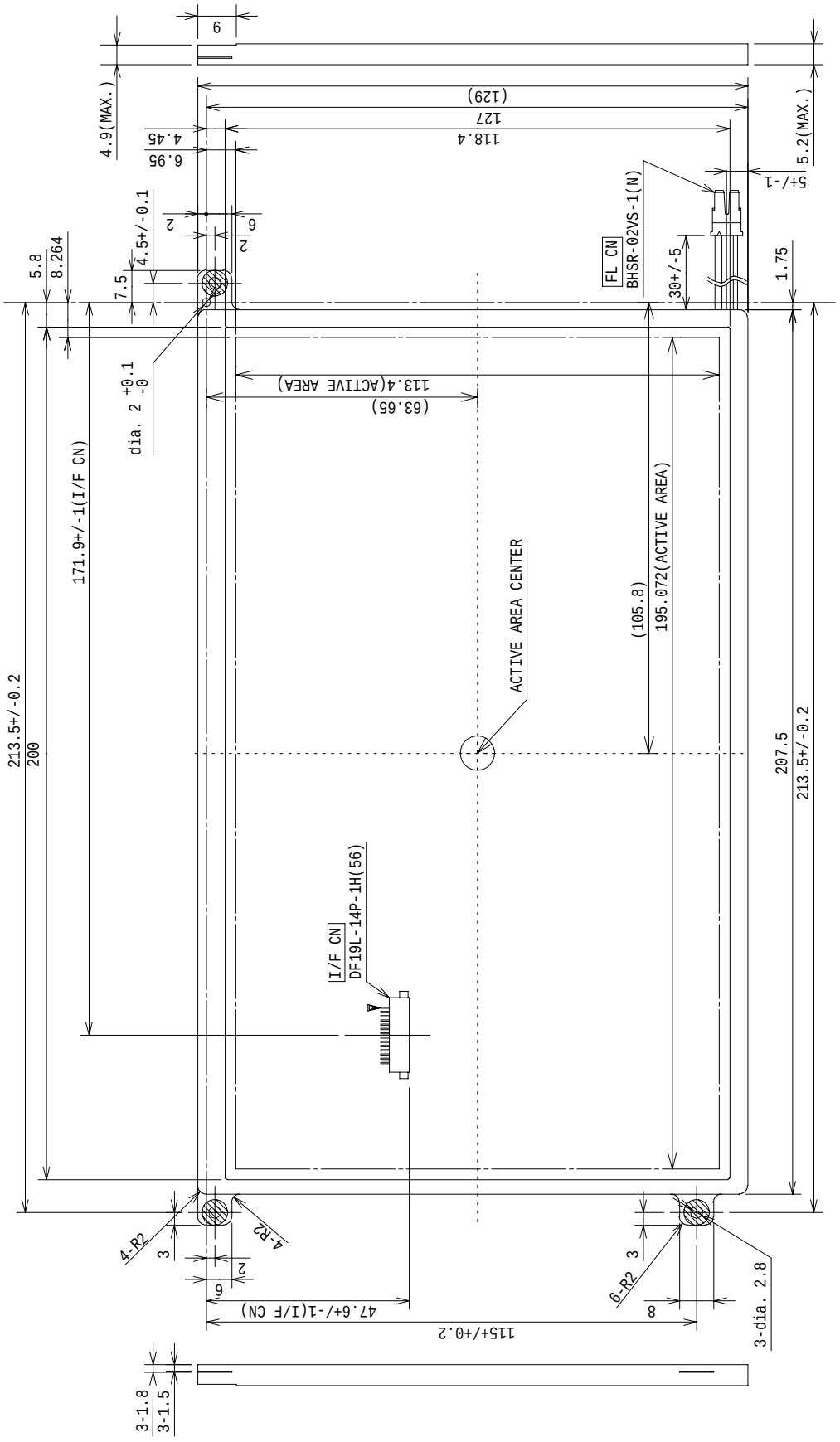
2.3 Mechanical Specifications

2.3.1 Weight

155 ± 20 g

2.3.2 Dimensional Outline
(front figure)

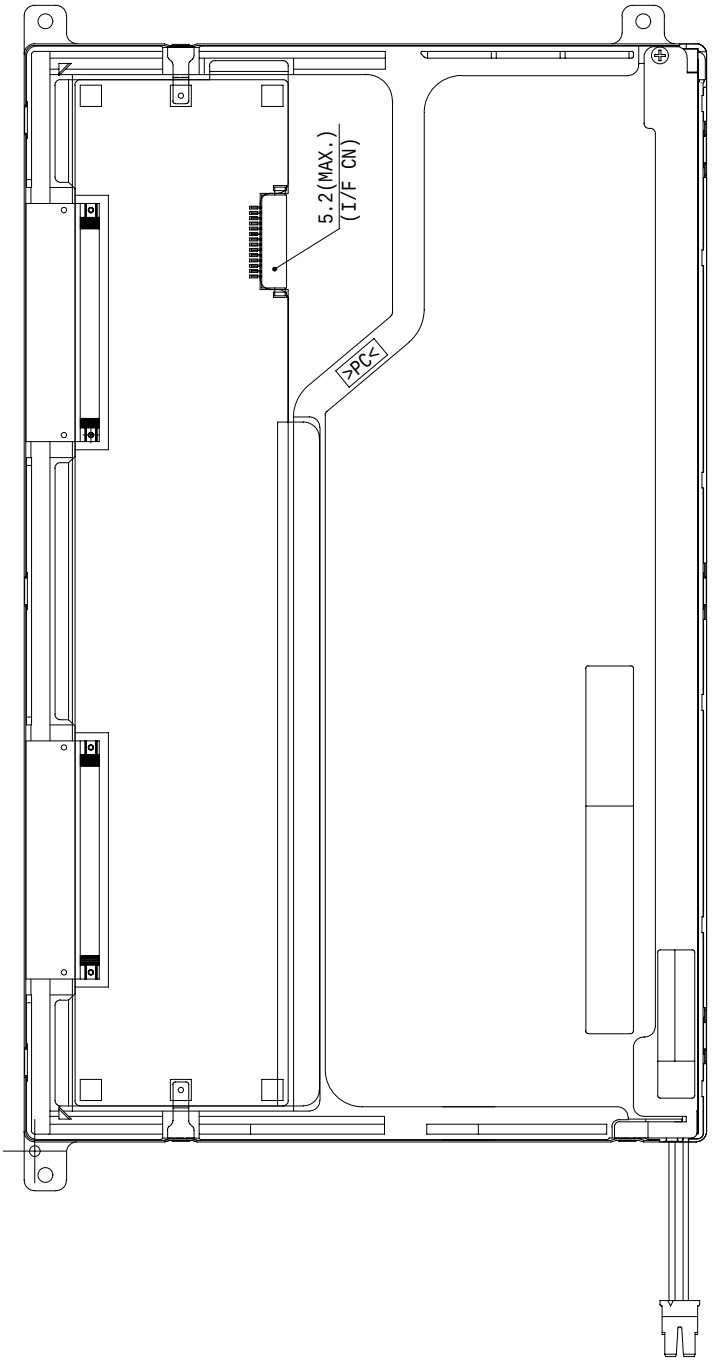
Unit : mm
Standard Tolerance : ±0.5



(back figure)

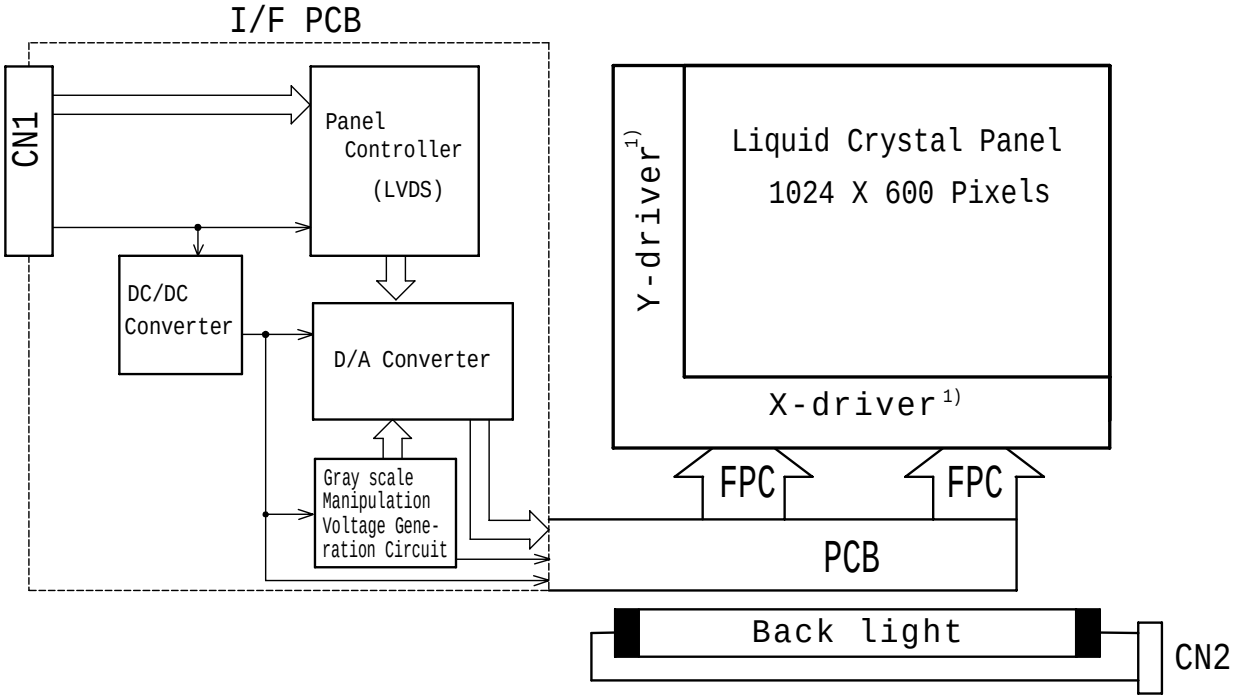
Unit : mm

Standard Tolerance : ±0.5



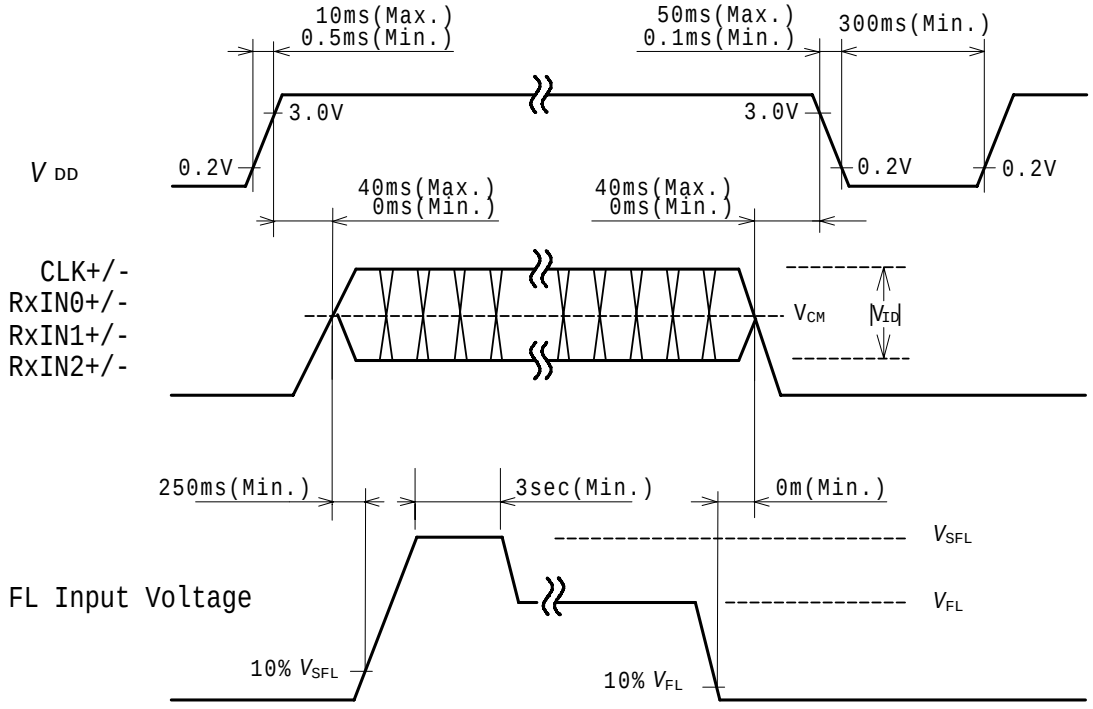
2.4 Electrical Specifications

2.4.1 Circuit Diagram

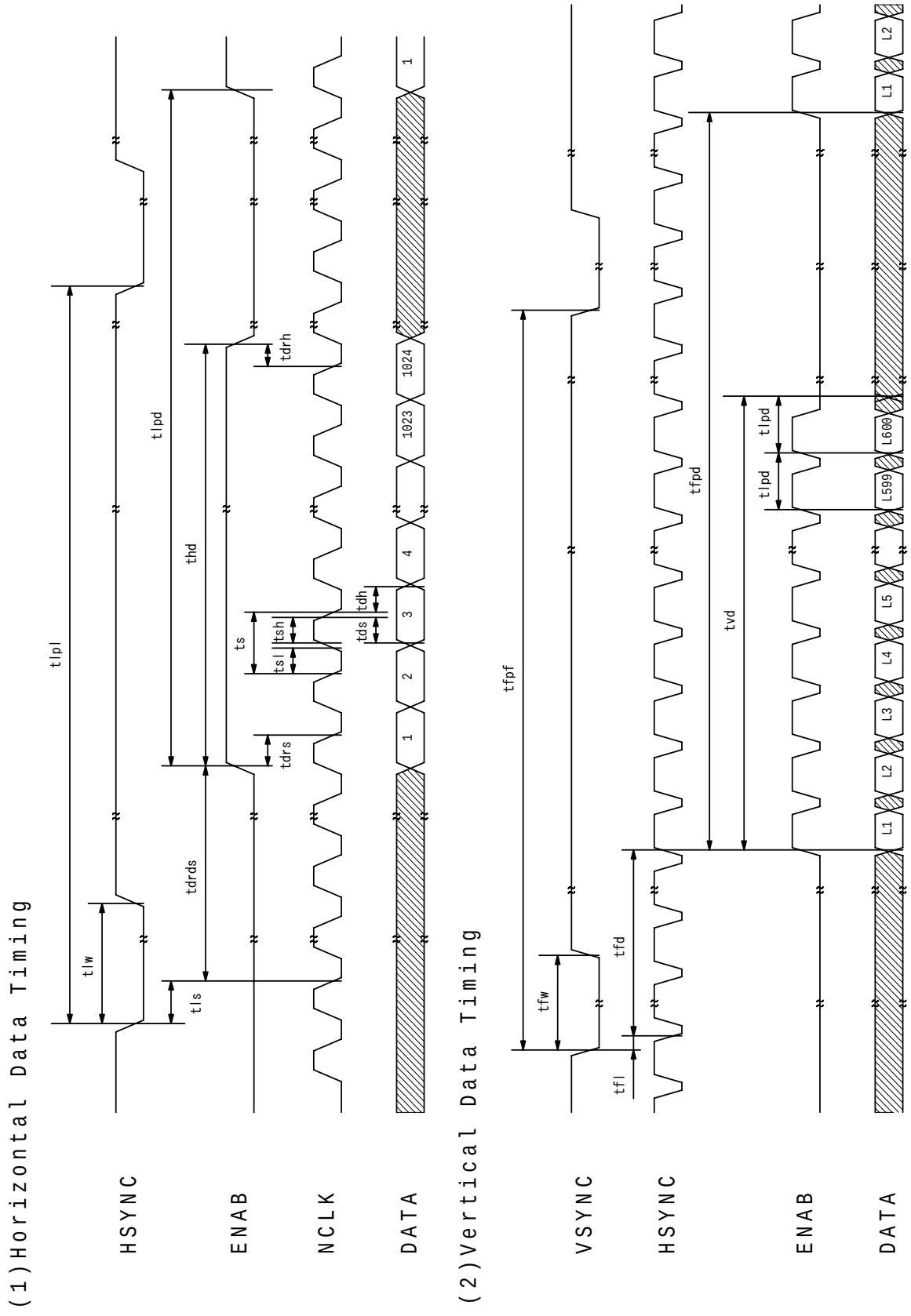


Note 1) Build up LCD drivers on the glass substrate

2.4.2 Sequence of Power Supplies and Signals



2.4.3 Timing Chart



2.4.4 Timing Specifications [1) 2) 3) 4) 5) 6) 7) 8) 9)]

Signal	Item	Symbol	Min.	Typ.	Max.	unit	Remarks
NCLK	Clock Period	*ts*	19.00	19.84	-	ns	
	Clock Frequency	1/*ts*	-	50.4	52.6	MHz	
	Clock ”H” Time	*tsh*	6	-	-	ns	
	Clock “L” Time	*tsl*	7	-	-	ns	
HSYNC	Set Up Time (NCLK)	*tls*	7	-	-	ns	
	Hsync Pulse Width	*tlw*	8 x *ts*	-	-	-	
VSYNC	Vsync Pulse Width	*tfw*	3 x *tlpd*	-	7x *tlpd*	-	
	VSYNC – DATA	*tfd*	7x *tlpd*	-	-	-	
	Set Up Time (HSYNC)	*tfl*	16	-	-	ns	
	One Line Scanning	*tlpd=tlpl*	1320 x *ts*	1344 x *ts*	1380 x *ts*	-	
	Horizontal Display Term	*thd*	1024 x *ts*	1024 x *ts*	1024 x *ts*	-	
	Frame Frequency	*1/tfpd*	56	60	-	Hz	
	Frame Period	*tfpd=tfpf*	610x *tlpd*	625x *tlpd*	635x *tlpd*	-	
	Vertical Display Term	*tvd*	600 x *tlpd*	600 x *tlpd*	600 x *tlpd*	-	
DATA	Set Up Time	*tds*	5	-	-	ns	
	Hold Time	*tdh*	7	-	-	ns	
DE	Set Up Time	*tdrs*	10	-	-	ns	
	Hold Time	*tdrh*	10	-	-	ns	
	Data Start Position	*tdrds*	-	-	400 x *ts*	-	

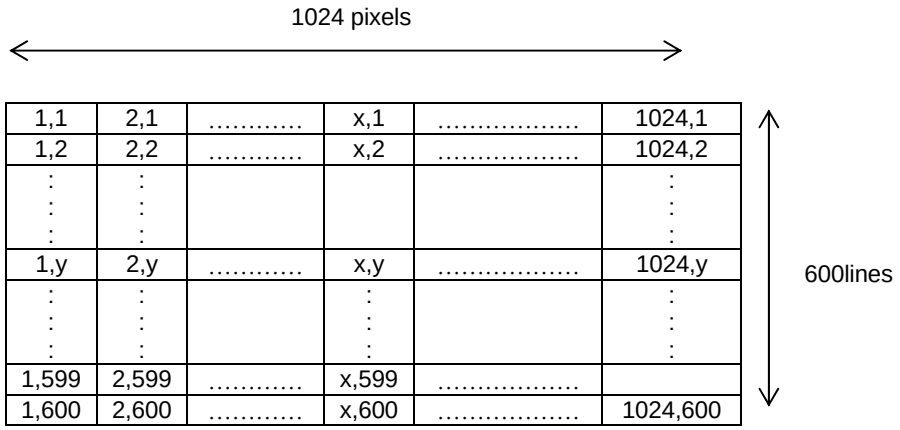
Note 1) Refer to 2.4.3 TIMING CHART.

Note 2) Refer to LVDS (THC63LVDF64B) specifications by THine Electronics, Inc.

Note 3) If ENAB is fixed to "H" or "L" level for certain period while NCLK is supplied, the panel displays black with some flicker.

Note 4) Don't fix NCLK to "H" or "L" level while the V_{DD}(+3.3V) is supplied.
If NCLK is fixed to "H" or "L" level for certain period while ENAB is supplied, the panel may be damaged.
When It holds on, DC voltage supplies to liquid crystal materials and It may cause damage to liquid crystal materials.

Note 5) Display area address is as follows.



Note 6) Please adjust LCD operating signal timing and FL driving frequency, to optimize the display quality.
There is a possibility that flicker is observed by the interference of LCD operating signal timing and FL driving condition (especially driving frequency), even if the condition satisfies above timing specifications and recommended operating conditions shown in 3.

Note 7) Do not make *tfpf*, *tlpl* and *tfpd-tvd* fluctuate.
If *tfpf*, *tlpl* and *tfpd-tvd* are fluctuate, the panel displays black.

Note 8) In case of using the long frame period, the deterioration of display quality, noise etc. may be occurred.

Note 9) NCLK count of each Horizontal Display Term should be always the same.
Vertical Blanking Term (*tfpd-tvd*) should be “*n*” X “Horizontal Display Term”. (*n*: integer)
Frame period should be always the same.

2.4.5 Interface Connector

CN1 INPUT SIGNAL

Connector: DF19L-14P-1H (56)/ HIROSE

Mating Connector: DF19G-14S-1C (05) [Plug], DF19A-2830SCFA [Crimp contact] / HIROSE ELECTRIC CO., LTD

Terminal No.	Symbol	Function
1	V_{DD}	Power Supply: +3.3V
2	V_{DD}	Power Supply: +3.3V
3	V_{SS}	GND [1)]
4	V_{SS}	GND [1)]
5	R_XIN0- [2)]	LVDS Differential Data(R0-R5,G0) (Negative: -)
6	R_XIN0+ [2)]	LVDS Differential Data(R0-R5,G0) (Positive: +)
7	R_XIN1- [2)]	LVDS Differential Data(G1-G5,B0-B1) (Negative: -)
8	R_XIN1+ [2)]	LVDS Differential Data(G1-G5,B0-B1) (Positive: +)
9	R_XIN2- [2)]	LVDS Differential Data(B2-B5,Hsync,Vsync,DE) (Negative: -)
10	R_XIN2+ [2)]	LVDS Differential Data(B2-B5,Hsync,Vsync,DE) (Positive: +)
11	CLK-	SAMPLING CLOCK(-)
12	CLK+	SAMPLING CLOCK(+)
13	V_{SS}	GND [1)]
14	NC [3)]	No Connection

Note 1) Please connect GND pin to ground.

Don't use it as no-connect nor connection with high impedance.

Note 2) See next page.

Note 3) NC terminal should be open. (Don't use.)

CN2 CCFL POWER SUPPLY

Connector: BHSR-02VS-1(N) / JAPAN SOLDERLESS TERMINAL MFG CO.,LTD.

Mating Connector: SM02B-BHSS-1-TB(LF)(SN) / JAPAN SOLDERLESS TERMINAL MFG CO.,LTD.

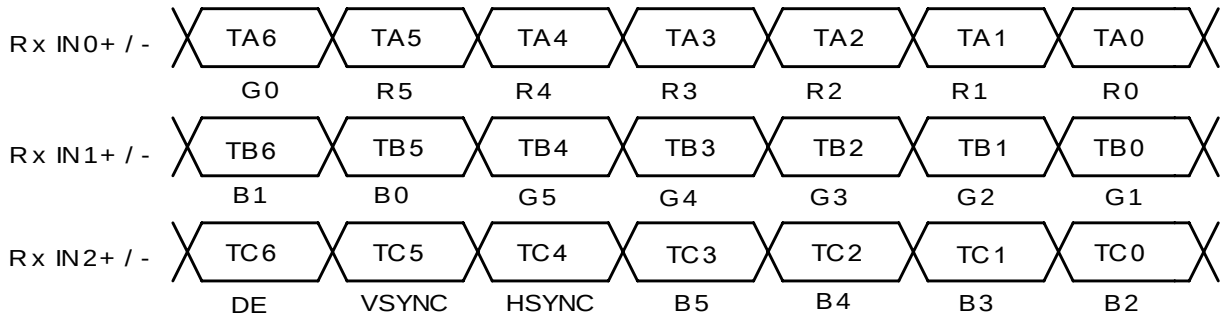
Terminal No.	Symbol	Function
1	V_{FLH}	CCFL POWER SUPPLY (HIGH VOLTAGE)
2	V_{FLL}	CCFL POWER SUPPLY (LOW VOLTAGE)

2.4.6 Recommended Transmitter Interface Assignment

RECOMMENDED TRANSMITTER (THC63LVDM63R, THC63LVDM83R) by THine Electronics, Inc.

Case1: 6Bit Transmitter

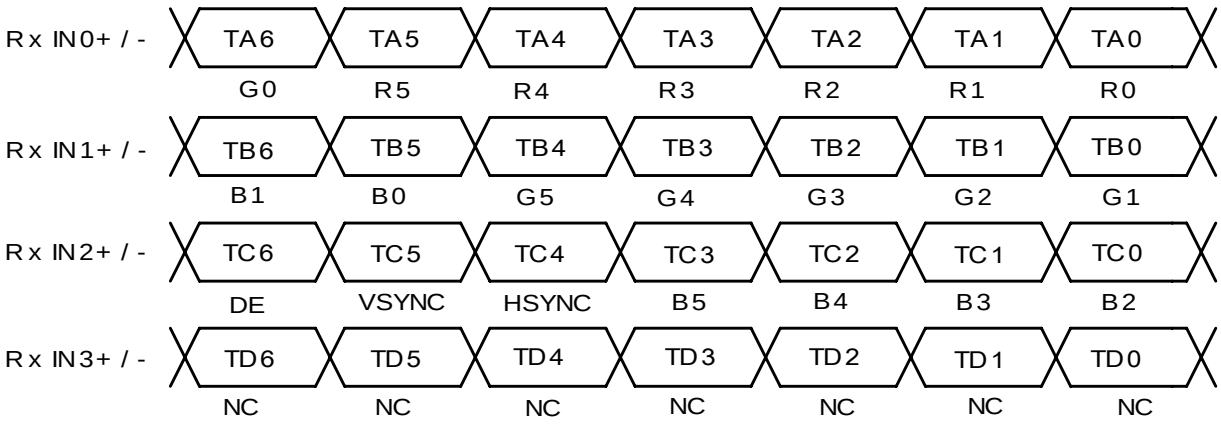
THC63LVDM63R (by THine Electronics, Inc.)					LTM09C362T Interface (CN1)	
Input Terminal No.		Input Signal (Graphics controller output signal)		Output Signal Symbol		
Symbol	THC63LVDM63R	Symbol	Function		Terminal	Symbol
TA0	44	R0	Red Pixels Display Data (LSB)	TA- TA+	No.5 No.6	RxIN0- RxIN0+
TA1	45	R1	Red Pixels Display Data			
TA2	47	R2	Red Pixels Display Data			
TA3	48	R3	Red Pixels Display Data			
TA4	1	R4	Red Pixels Display Data			
TA5	3	R5	Red Pixels Display Data			
TA6	4	G0	Green Pixels Display Data(LSB)			
TB0	6	G1	Green Pixels Display Data	TB- TB+	No.7 No.8	RxIN1- RxIN1+
TB1	7	G2	Green Pixels Display Data			
TB2	9	G3	Green Pixels Display Data			
TB3	10	G4	Green Pixels Display Data			
TB4	12	G5	Green Pixels Display Data			
TB5	13	B0	Blue Pixels Display Data (LSB)			
TB6	15	B1	Blue Pixels Display Data			
TC0	16	B2	Blue Pixels Display Data	TC- TC+	No.9 No.10	RxIN2- RxIN2+
TC1	18	B3	Blue Pixels Display Data			
TC2	19	B4	Blue Pixels Display Data			
TC3	20	B5	Blue Pixels Display Data			
TC4	22	HSYNC	Horizontal Synchronization Signal			
TC5	23	VSYNC	Vertical Synchronization Signal			
TC6	25	DE	Compound Synchronization Signal			
CLK IN	26	NCLK	Data Sampling Clock	TCLK- TCLK+	No.11 No.12	CLK- CLK+



Case2: 8Bit Transmitter

THC63LVDM83R (by THine Electronics, Inc.)					LTM09C362T Interface (CN1)	
Input Terminal No.		Input Signal (Graphics controller output signal)		Output Signal Symbol		
Symbol	THC63LVDM63R	Symbol	Function		Terminal	Symbol
TA0	51	R0	Red Pixels Display Data (LSB)	TA- TA+	No.5 No.6	RxIN0- RxIN0+
TA1	52	R1	Red Pixels Display Data			
TA2	54	R2	Red Pixels Display Data			
TA3	55	R3	Red Pixels Display Data			
TA4	56	R4	Red Pixels Display Data			
TA5	3	R5	Red Pixels Display Data			
TA6	4	G0	Green Pixels Display Data(LSB)			
TB0	6	G1	Green Pixels Display Data	TB- TB+	No.7 No.8	RxIN1- RxIN1+
TB1	7	G2	Green Pixels Display Data			
TB2	11	G3	Green Pixels Display Data			
TB3	12	G4	Green Pixels Display Data			
TB4	14	G5	Green Pixels Display Data			
TB5	15	B0	Blue Pixels Display Data (LSB)			
TB6	19	B1	Blue Pixels Display Data			
TC0	20	B2	Blue Pixels Display Data	TC- TC+	No.9 No.10	RxIN2- RxIN2+
TC1	22	B3	Blue Pixels Display Data			
TC2	23	B4	Blue Pixels Display Data			
TC3	24	B5	Blue Pixels Display Data			
TC4	27	HSYNC	Horizontal Synchronization Signal			
TC5	28	VSYNC	Vertical Synchronization Signal			
TC6	30	DE	Compound Synchronization Signal			
TD0	50	NC[1)]	Non Connection (open)	TD- TD+	---	---
TD1	2	NC[1)]	Non Connection (open)			
TD2	8	NC[1)]	Non Connection (open)			
TD3	10	NC[1)]	Non Connection (open)			
TD4	16	NC[1)]	Non Connection (open)			
TD5	18	NC[1)]	Non Connection (open)			
TD6	25	NC[1)]	Non Connection (open)			
CLK IN	31	NCLK	Data Sampling Clock	TCLK- TCLK+	No.11 No.12	CLK- CLK+

Note 1) Please connect NC pin to nothing. Don't connect it to ground nor to other signal input.



2.4.7 Colors Combination Table

	Display	R5 R4 R3 R2 R1 R0	G5 G4 G3 G2 G1 G0	B5 B4 B3 B2 B1 B0	Gray ScaleLevel
Basic Color	Black	L L L L L L	L L L L L L	L L L L L L	-
	Blue	L L L L L L	L L L L L L	H H H H H H	-
	Green	L L L L L L	H H H H H H	L L L L L L	-
	Light Blue	L L L L L L	H H H H H H	H H H H H H	-
	Red	H H H H H H	L L L L L L	L L L L L L	-
	Purple	H H H H H H	L L L L L L	H H H H H H	-
	Yellow	H H H H H H	H H H H H H	L L L L L L	-
	White	H H H H H H	H H H H H H	H H H H H H	-
Gray Scale of Red	Black	L L L L L L	L L L L L L	L L L L L L	L 0
	Dark ↑ ↓ Light	L L L L L H	L L L L L L	L L L L L L	L 1
		L L L L H L	L L L L L L	L L L L L L	L 2
		: :	: :	: :	L3… L60
		H H H H L H	L L L L L L	L L L L L L	L61
		H H H H H L	L L L L L L	L L L L L L	L62
	Red	H H H H H H	L L L L L L	L L L L L L	Red L63
Gray Scale of Green	Black	L L L L L L	L L L L L L	L L L L L L	L 0
	Dark ↑ ↓ Light	L L L L L L	L L L L L H	L L L L L L	L 1
		L L L L L L	L L L L H L	L L L L L L	L 2
		: :	: :	: :	L3… L60
		L L L L L L	H H H H L H	L L L L L L	L61
		L L L L L L	H H H H H L	L L L L L L	L62
	Green	L L L L L L	H H H H H H	L L L L L L	Green L63
Gray Scale of Blue	Black	L L L L L L	L L L L L L	L L L L L L	L 0
	Dark ↑ ↓ Light	L L L L L L	L L L L L L	L L L L L H	L 1
		L L L L L L	L L L L L L	L L L L H L	L 2
		: :	: :	: :	L3… L60
		L L L L L L	L L L L L L	H H H H L H	L61
		L L L L L L	L L L L L L	H H H H H L	L62
	Blue	L L L L L L	L L L L L L	H H H H H H	Blue L63
Gray Scale of White & Black	Black	L L L L L L	L L L L L L	L L L L L L	Black L 0
	Dark ↑ ↓ Light	L L L L L H	L L L L L H	L L L L L H	L 1
		L L L L H L	L L L L H L	L L L L H L	L 2
		: :	: :	: :	L3… L60
		H H H H L H	H H H H L H	H H H H L H	L61
		H H H H H L	H H H H H L	H H H H H L	L62
	White	H H H H H H	H H H H H H	H H H H H H	White L63

Note1) L: Low level voltage, H: High level voltage

3. Recommended Operating Conditions [1) 11) 12)]

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply Voltage [2)]	V_{DD}	3.0	3.3	3.6	V	
Differential Input Voltage [3)5)6)]	V_{ID}	0.1	-	0.6	V	
Common mode Voltage [4)5)6)]	V_{CM}	1.0	-	2.4-1/2 x V_{ID}	V	
FL Input Current [8)9)]	I_{FL}	2.0	5.5	6.0	mA(rms)	
FL Driving Voltage [7)]	V_{FL}	450	500	550	V(rms)	I_{FL}=5.5mA(rms)(Reference)
FL Driving Frequency [7)]	f_{FL}	30	50	80	kHz	
FL Starting Voltage [7)10)]	V_{SFL}	1300	-	-	V(rms)	at 0°C

Note 1) The module should be always operated within these ranges. The "Typ." shows the recommendable value.

Note 2) Checked Pin Terminal: V_{DD}, (GND: V_{SS}=0V)

Note 3) Checked Pin Terminal: RxIN0- to CLK+, GND (0V)

Measure: $|V_{RxIN0+}-V_{RxIN0-}|$, $|V_{RxIN1+}-V_{RxIN1-}|$, $|V_{RxIN2+}-V_{RxIN2-}|$, $|V_{CLK+}-V_{CLK-}|$

Note 4) Checked Pin Terminal: RxIN0- to CLK+, GND (0V)

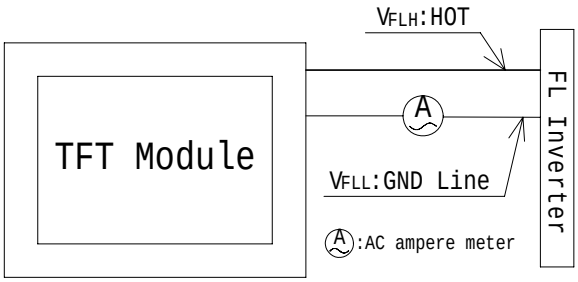
Measure: 1/2 x (V_{RxIN0+}+V_{RxIN0-}), 1/2 x (V_{RxIN1+}+V_{RxIN1-}), 1/2 x (V_{RxIN2+}+V_{RxIN2-}), 1/2 x (V_{CLK+}+V_{CLK-})

Note 5) Recommended LVDS transmitter: THC63LVDM63R, THC63LVDM83R (made by THine Electronics,Inc.)

Note 6) LVDS is based on TIA/EIA 644. However, Common mode input voltage should be "0.9-2.4" volt.

Note 7) Checked Pin Terminal: V_{FLH} - V_{FLL}

Note 8) Measuring Method of I_{FL}.



Note 9) If FL input current is higher than 6.0mA(rms), then FL lifetime becomes shorter. And If it is higher than 8.0mA(rms), then a lamp may be damaged.

Note10) Input FL starting voltage (V_{SFL}) should not be less than three seconds.
If it were less than three seconds, it may cause unstable operation of FL.
When LCD is stored for long time, especially in dark storage area, FL may be not turned on even starting voltage is applied for more than three seconds. This is due to the FL characteristic, and should not be considered as LCD malfunction. Please turn on/off several times in bright space when this phenomenon is occurred.

Note11) Please adjust LCD operating signal timing and FL driving frequency, to optimize the display quality.
There is a possibility that flicker is observed by the interference of LCD operating signal timing and FL driving condition(especially driving frequency), even if the condition satisfies above recommended operating conditions and timing specifications shown in 2.4.4.

Note 10) Please keep an air spec around FL cables when the module is assembled in your set.
There is a possibility that the deterioration of display Luminance, noise and other influences may be occurred.

4. Electrical Characteristics

4.1 Test Conditions

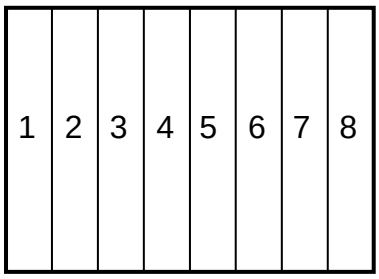
Ambient Temperature	: T_a 25±5 °C
Ambient Humidity	: H_a 65±20 %(RH)
Supply Voltage	: V_{DD} 3.3V
Input Signal	: Refer typical value in "2.4.4 Timing Specifications".
FL Input Current	: I_{FL} = 5.5 mA(rms)
FL Driving Frequency	: f_{FL} = 50 kHz

4.2 Specifications

Item	Symbol	Min.	Typ.[1)]	Max.	Unit	Remark
Current Consumption	I_{DD}	-	180	300	mA	V_{DD} Terminal Current

Note 1) The I_{DD} is measured in the following pattern.

1. White
2. Yellow
3. Purple
4. Red
5. Light Blue
6. Green
7. Blue
8. Black



5. Optical Characteristics

5.1 Test Conditions

It is same as 4.1

The measuring method is shown in 11.

5.2 Optical Specifications [1)]

Item		Symbol	Conditions		Specifications Min.	Typ.	Max.	Unit	Remark
Viewing Angle		θ	*CR*>=10	ϕ= 180°	10	-	-	°	
				ϕ= 0°	20	-	-	°	
				ϕ= 90°	30	-	-	°	
				ϕ= -90°	30	-	-	°	
Contrast Ratio		*CR*	θ=0°, ϕ=0°		100	-	-	-	
Response Time		t_{ON}	θ=0°, ϕ=0°		-	-	50	ms	
		t_{OFF}			-	-	50	ms	
Luminance		*L*	θ=0°, ϕ=0° Gray Scale Level=L63 (White)		175	220	-	cd/m^2	I_{FL}=5.5mA(rms)
Luminance Uniformity		TUNF	θ=0°, ϕ=0° Gray Scale Level=L63 (White)		55	-	-	%	
Chromaticity	Red	x_R	Gray Scale Level:L63 θ=0°, ϕ=0°		0.53	0.60	0.67	-	
		y_R			0.27	0.34	0.41	-	
	Green	x_G	Ditto		0.25	0.32	0.39	-	
		y_G			0.48	0.55	0.62	-	
	Blue	x_B	Ditto		0.08	0.15	0.22	-	
		y_B			0.05	0.12	0.19	-	
	White	x_W	Ditto		0.27	0.32	0.37	-	
		y_W			0.28	0.33	0.38	-	

Note 1) Refer to "11. Measuring Method".

Note 2) The above test limit must be applied for initial use. Characteristics will be shifted by long period operation, but it is not irregular phenomena. Theoretically brightness characteristics will be decreased due to CCFL degradation and color shift due to optical components change.

6.Quality

6.1 Inspection AQL

Total of Major Defects: AQL 0.65 %

Total of Minor Defects: AQL 1.5 %

Sampling Method: ISO 2859-1:1999(Level II)

6.2 Test Conditions

1) Ambient Temperature : 25±5 °C

2) Ambient Humidity : 65±20 %(RH)

3) Illumination : Approximately 500 lx under the fluorescent lamp

4) Viewing Distance : Approximately 30cm by the eyes of the inspector from the module

5) Inspection Angle : θ=0°, ϕ=0°

6.3 Dimensional Outline

The products shall conform to the dimensions specified in 2.3.2.

Definition of Major and Minor defects are as follows.

Item	Description	Class
Important Dimensions	Dimensional outline, Dimensional between the mounting holes (hinge)	Major
Others	Dimensions specified in this specifications	Minor

6.4 Appearance Test

6.4.1 Test Conditions

1) Condition : Non-operating, operating (Pattern : L63 white raster)

Same as 6.2

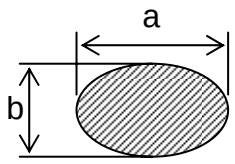
6.4.2 Specifications

<table>
<tr><th>Item</th><th>Description</th><th>Class</th></tr>
<tr><td>PCB Appearance</td><td>Pattern peeling snapping, electrically short</td><td>Major</td></tr>
<tr><td></td><td>Repair portion on PCB is not covered by epoxy resign</td><td>Minor</td></tr>
<tr><td>Soldering</td><td>Cold solder joint, lead move when pulled</td><td>Major</td></tr>
<tr><td>Bezel, Frame, Connectors</td><td>Distinct stain, rust or scratch</td><td>Minor</td></tr>
<tr><td>Black and White Spots/Lines[1)2)3)]</td><td>
<table>
<tr><th>Line width(mm)</th><th>Length(mm)</th><th>Acceptable count</th></tr>
<tr><td>$W \le 0.05$</td><td rowspan="3">$L \le 3$</td><td>neglect</td></tr>
<tr><td>$0.05 < W \le 0.07$</td><td>$n \le 8$</td></tr>
<tr><td>$0.07 < W \le 0.10$</td><td>$n \le 2$</td></tr>
<tr><td>$0.10 < W$</td><td>2)</td></tr>
</table>
<table>
<tr><th>Average diameter(mm)</th><th>Acceptable count/side</th></tr>
<tr><td>$D \le 0.2$</td><td>neglect</td></tr>
<tr><td>$0.2 < D \le 0.35$</td><td>$n \le 5$</td></tr>
<tr><td>$0.35 < D \le 0.5$</td><td>$n \le 2$</td></tr>
<tr><td>$0.5 < D$</td><td>0</td></tr>
</table>
</td><td>Minor</td></tr>
</table>

Note 1) Inspection area should be within bezel opening.

Note 2) Dusts which are bigger not less than 0.10mm ($0.1 \le W$) shall be judged by "Average Diameter".

Average Diameter $D = (a+b)/2$ (mm)



Note 3) The dust on the surface which can be removed is not made an issue.

6.5 Display Quality

6.5.1 Test Conditions

1) Inspection Area : Within viewing area

2) Driving Condition : Same as test conditions shown in 4.1 and 6.2

3) Test Pattern : White display pattern (gray scale level L63) and black display pattern (gray scale level L0)

6.5.2 Specifications

Item	Description / Specifications	Class
Function	No display, Malfunction	Major
Display Quality [1) 2) 3)]	Missing line	Major
	Missing Sub-Pixels 1) Bright defects : 7pcs. max. 2) Dark defects : 7pcs. max. 3) Total sub-pixel defects : 10pcs. max. 4) Bright defect conjunction(2sub-pixels) : 3set max. 5) Dark defect conjunction(2sub-pixels) : neglect 6) Bright defect conjunction(3sub-pixels) : 0set 7) Dark defect conjunction(3sub-pixels) : 0set 8) Distance : Bright defect – Bright defect ≥ 10 mm Dark defect – Dark defect ≥ 5 mm Bright defect – Dark defect : neglet	Minor
	Inconspicuous flicker, crosstalk, Newton's ring and other defects : neglect	-
Black and White Spots/lines	Inconspicuous defects : neglect	-
Backlight	Missing (Non-operating)	Major

Note 1) Defects of both color filter and black matrix are counted as bright or dark defects.
Inspection area should be within the active area.

Note 2) Bright defect means a bright spot (sub-pixel) on the display pattern of gray scale L0.
Dark defect means a dark spot (sub-pixel) on the display pattern of gray scale L63.

Note 3) Bright defect which can not be found by using 5%ND-Filter shall not be counted as a defect.

Note 4) Defect conjunction is counted as 1 defect.

Note 5) After the power of LCD is turned off, the last displayed image remains in the display for a few minutes.
But this remained image is not Error. So phenomenon of remained display is not subject to display quality criteria.

6.6 Reliability Test

6.6.1 Test Conditions

1) The module should be driven and inspected under normal test conditions.

2) The module should not have condensation of water (moisture) on the module.

3) The module should be inspected after two or more hours storage in normal conditions (15 - 35°C, 45 - 65%(RH)).

4) A module shall be used only for one test.

6.6.2 Specifications

The module shall have no failure in the following reliability test items.

Test Item	Test Conditions	Result
High Temperature Operation[1)]	50°C 192 h	3p/3p OK
High Temperature Storage[2)]	60°C 192 h	3p/3p OK
High Temperature and High Humidity operation[1)]	50°C 80% 192 h	3p/3p OK
Low Temperature Operation[1)]	0°C 192 h	3p/3p OK
Low Temperature Storage[2)]	-20°C 192 h	3p/3p OK
Temperature Shock[2)]	-20°C ⇔ 60°C 50 cycles 0.5h 0.5h	3p/3p OK
Mechanical Vibration[2)]	10 - 200 - 10Hz sweep/cycle, 1.5×9.8m/s^2 constant, X.Y.Z each direction, 0.5h each	3p/3p OK
Mechanical Shock[2)]	50×9.8m/s^2 , 20ms, ±X, ±Y, ±Z each direction, one time each	3p/3p OK

Note 1) Operating

Note 2) Non-Operating

Definitions of failure for judgment shall be as follows:

1) Function of the module should be maintained.

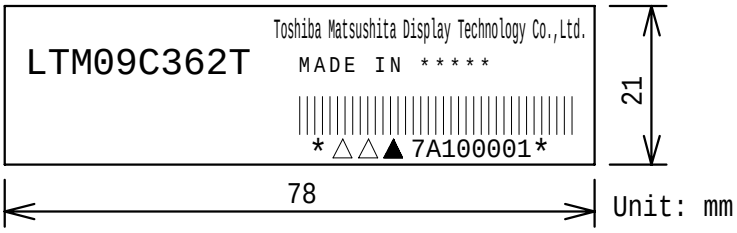
2) Current consumption should be smaller than the specified value.

3) Appearance and display quality should not have distinguished degradation.

4) Luminance should be larger than 50% of the minimum value specified in 5.2.

6.7 Labels

(1) Product Label



Serial number : △△ ▲ 7A 100001
① ② ③ ④

① : Module type code

② : Manufacturing code

C, G, K: Made in Japan

M: Made in Malaysia

R: Made in China

③ : Lot code 7 A
(1) (2)

(1):Year code-end of the A.D.

(2):Month code-alphabet→ Jan. : A - Dec. : L

(Example : 7A→2007 JAN.)

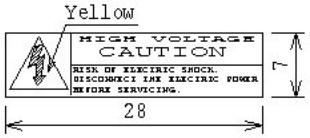
④: Serial code

decimal, 6 figures

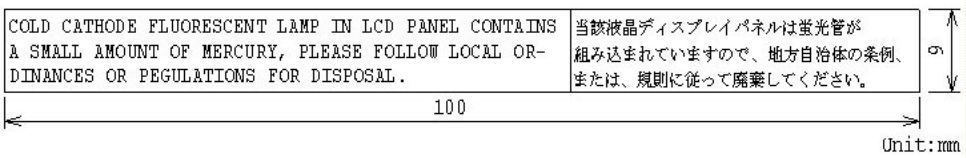
Bar code : CODE-39 High-density

(2) Caution Labels

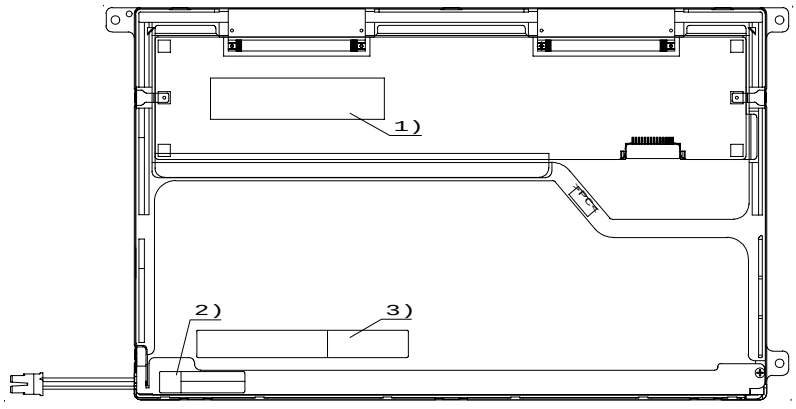
• High Voltage



• Disposal of CCFL



(3) Label Locations



1) Product label

2) Caution label (High Voltage)

3) Caution label (Disposal of CCFL)

7. Lifetime[1)]

7.1 Module (except lamp)

MTTF (Mean Time To Failure) : 50,000 h

(This value is not assurance time but inference value by following conditions.)

Conditions : Ambient temperature : 25±5 °C (No wind)

Ambient humidity : 65 %(RH)

7.2 Lamp

7.2.1 Test Conditions

Ambient temperature	: 25±5 °C (No wind)
Lighting condition	: continuous lighting
Lamp current	: 6.0 mA(rms)
Driving frequency	: 50kHz

7.2.2 Specifications

MTBF : 10,000 h

Definitions of failure for judgment shall be as follows.

1) LCD luminance becomes half of the minimum value specified in 5.2.

2) Lamp doesn't light normally.

Note1) In case of LCD long period operation, discoloration of light guide or optical sheet will be happened due to ultra violet and heat from CCFL. As the result, there is possibility to have out of specification for the optical characteristics as “5.2”. But this is not irregular phenomena.

Moreover, CCFL also has the characteristic of color shift by long period operation.

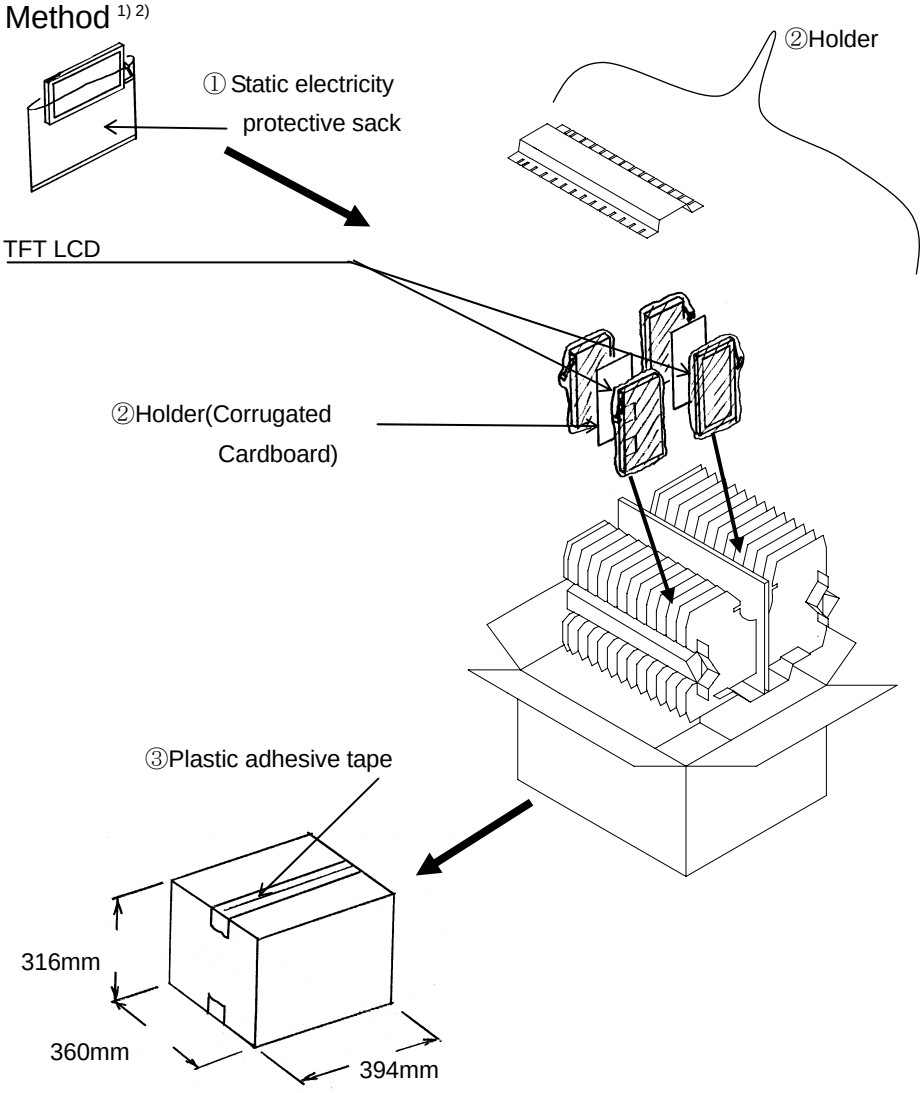
8. Packaging

8.1 Carton (internal package)

(1) Packaging Form

Corrugated cardboard box and polyethylene foam as shock absorber

(2) Packaging Method [1) 2)]



Note 1) Total weight: (Approx.) 11kg

Note 2) Acceptable number of carton piling: 10 sets

(3) Packaging Material

Number	Description	Quantity
①	Static electricity Protective sack	50
②	Holder(inner box)	1 set
③	Plastics adhesive tape	-

9. Warranty

Warranty clause will be decided separately.

10. Regulation

10.1 Regulation

The set (which our LCD module is assembled into) to conform the regulations below, take measures in set side. Toshiba Matsushita Display Technology is not liable for the regulations to the complete set, nor can guarantee our LCD module conform the regulation by itself.

a) Examples of EMI Regulations

FCC : PART15 CLASS B

VCCI : CLASS B

CISPR : CLASS B

b) Examples of Safety Regulations

IEC 60950

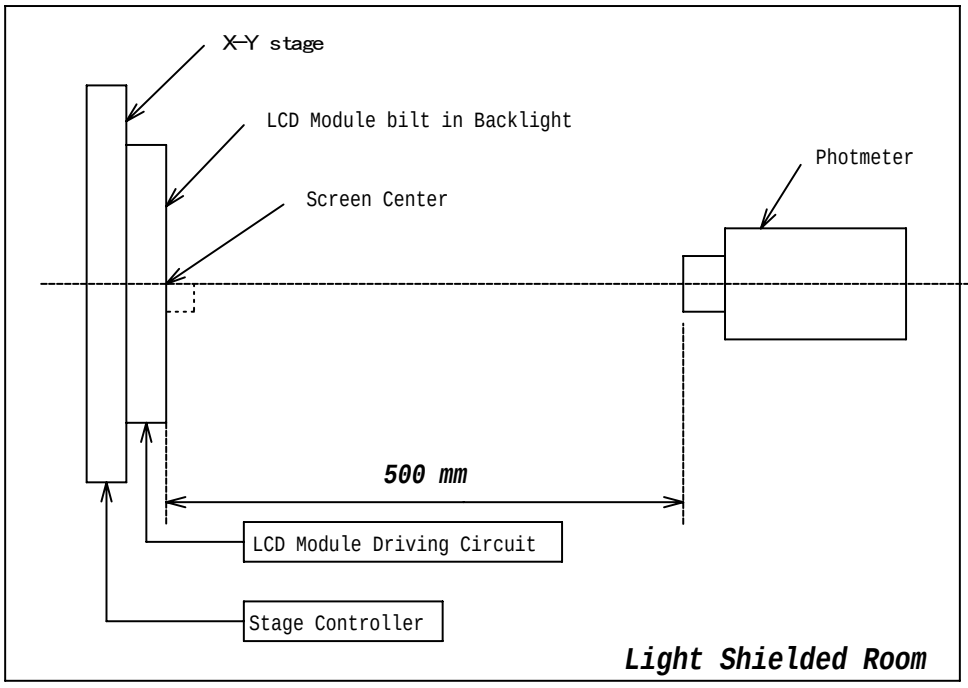
UL 60950

10.2 Environment

This LCD module is not used or contained over maximum concentration value of any substance prohibited by RoHS's requirement.

11. Measuring Method

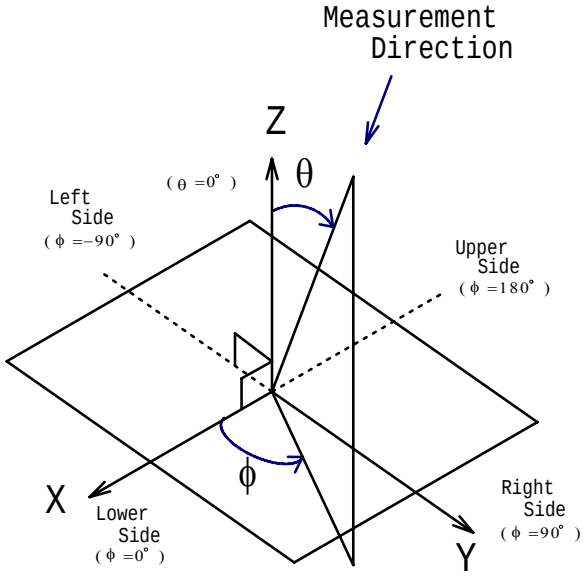
11.1 Measuring System



(1) The measurement point is the center of the active area except for the measurement of Luminance Uniformity.

(2) Photometer : BM-7 / BM-5A TOPCON (Aperture 2°)

(3) Definition of ϕ and θ:



11.2 Measuring Methods

(1) Luminance:

The luminance of the center on a white raster (gray scale level L63) shall be measured.

Measurement shall be executed 30 minutes after the lamp is lit up.

(2) Contrast Ratio:

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

L63 : Luminance on the white raster (gray scale level L63)

L 0 : Luminance on the black raster (gray scale level L0)

(3) Viewing Angle:

Viewing angle is defined as the angles(θ,ϕ), in which specified contrast ratio can be obtained.

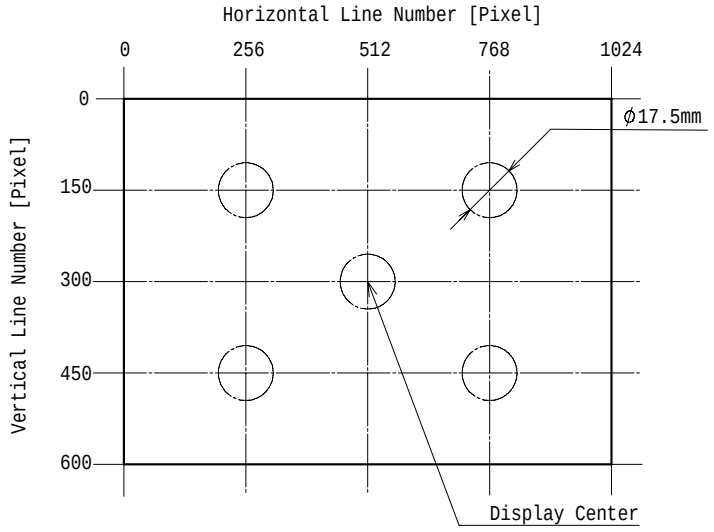
(Refer to 11.1(3) for the axes.)

(4) Luminance Uniformity:

The Luminance should be measured at 5 positions on white raster (gray scale level L63).

Uniformity can be calculated by the following expression.

$$\text{Luminance Uniformity} = \frac{\text{Minimum Luminance}}{\text{Maximum Luminance}} \text{ X } 100\%$$

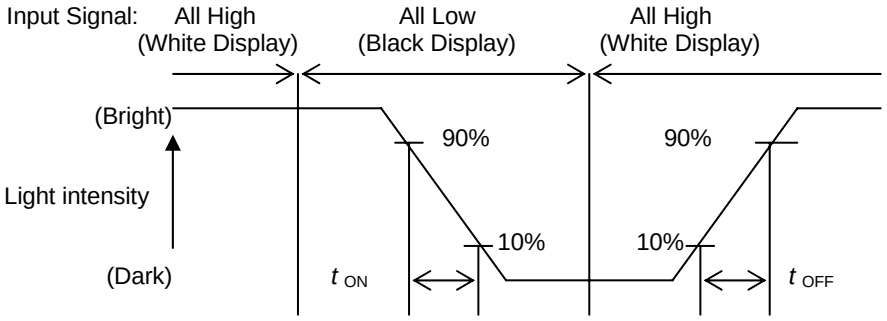


(5) Chromaticity :

The values (x,y) of chromaticity coordinates should be measured for the White, Red, Green and Blue Raster(gray scale level L63) each with a photometer.

(6) Response Time :

The response time (t_{ON}, t_{OFF}) is measured with a photo detector (photodiode) which measures the light intensity of the pixels.



t_{ON} : Turn on time is the time for the light intensity of the pixels to go from 90% of its maximum to 10% of its maximum.

t_{OFF} : Turn off time is the time for the light intensity of the pixels to go from 10% of its maximum to 90% of its maximum.

Photodiode : S1223-01 HAMAMATSU PHOTONICS K.K.

White Display : White Raster (gray scale level L63)

Black Display : Black Raster (gray scale level L0)