To :

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

LTD121KA0Q

LTD121KA0Q-01

DATE OF ISSUE : 2005-06-015

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Revision History

Date (Rev No.)	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.

⚠ For Safety

Warning

1) SPECIAL PURPOSES

a) Toshiba Matsushita Display Technology's Standard LCD modules have not been customized for operation in extreme environments or for use in applications where performance failures could be life-threatening or otherwise catastrophic.

b) Since they have not been designed for operation in extreme environments, they must never be used in devices that will be exposed to temperatures above 50 degrees Celsius or below 0 degrees Celsius, to X-ray or Gamma-ray radiation, or to abnormally high levels of vibration or shock which exceed Toshiba Matsushita Display Technology's specification limits.

c) In addition, since Toshiba Matsushita Display Technology's Standard LCD modules have not been designed for use in applications where performance failures could be life-threatening of catastrophic, they must never be installed in aircraft navigation control systems (such as, but not limited to Traffic Collision Avoidance System and Air Traffic Indicator), in military defense or weapons systems, in critical industrial process-control systems (e.g., those involved in the production of nuclear energy), or in critical medical device or patient life-support systems.

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

1)* DISASSEMBLING OR MODIFICATION

DO NOT DISASSEMBLE OR MODIFY the modules.

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.

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

4) ABSOLUTE MAXIMUM RATINGS

DO NOT EXCEED the absolute maximum rating values under the worst probable conditions caused by the supply voltage variation, input voltage variation, variation in parts' constants, environmental temperature, etc., otherwise LCD module may be damaged.

5) RECOMMENDED OPERATING CONDITIONS

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

The performance and quality of the LCD panel are warranted only when the LCD panel is used within “the recommended operation conditions”. Toshiba Matsushita Display Technology never warrants the performance and quality of the LCD panel when you use the LCD panel over “the recommended operation conditions”, although within “the absolute maximum rating”.

To use the LCD panel over “the recommended operation conditions” may have bad influence on the characteristics and reliability of the LCD panel and may shorten the life of the LCD panel.

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

6) POWER PROTECTION CIRCUIT

Employ protection circuit for power supply, whenever the specification specifies it.

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

DO NOT MODIFY the fuse used in the module. It may cause overheat and/or burning if dusts or metal particles are on the PCBs in the LCD module.

7) DISPOSAL

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

8) 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.

9)* LUMINANCE DECREASE OF FL

When FL becomes extremely dark and its color changes from white to pink, stop the use of the module immediately. FL, at the end of its life with its discharge color turns into pink as the characteristics of FL, may adversely affect the module at the end part of FL due to temperature raising caused by depletion of the mercury which is contained in FL tube, or may have a possibility of breakage.

For Designing the System

2-1 DESIGNING ENCLOSURE

1) MECHANICAL DIMENSIONS

Refer to the individual specification for LCD module's mechanical dimensions.

2) MOUNTING HOLES

LCD module should be assembled to the system by using all mounting holes specified in the individual specification with the specified screws.

In addition, some modules may not be necessary to use all the mounting holes. Make comprehensive judgments on the entire system.

3)* BENDING / TWISTING

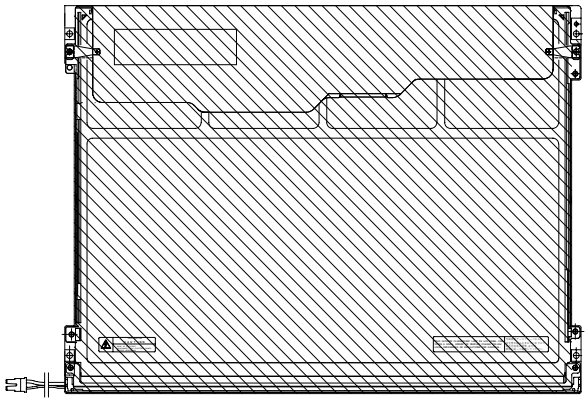
Make sure to design the enclosure that bending/twisting forces are not applied to LCD module during and after the installation into the system.

4)DESIGN OF LCD MODULE REAR SURFACE

Design to not touch object to oblique lines area of drawing mentioned below/

This LCD module uses prism light guard. If prism light guard is pushed, there is danger of appearance of white spot or black spot..

And if circuit board is pushed, there is danger of damage.



5) GASES FROM SETTING MATERIAL

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 module. Prior confirmation is required.

6) GASES FROM PACKAGING MATERIAL

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

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

1) CAPACITY OF POWER SUPPLY

Be sure that power supply output from the system should be limited to smaller values than listed shown below. (For example Quick Arcing Fuse with listed ratings can be used.)

It is because this LCD module explained in this specification has a current limiter, with such function at power input line(s). But it may be some possibility of overheat and/or burning of LCD module and its peripheral devices before current limiter of the module when open-short test of the module is performed by using power supply higher than following recommended value.

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	2.0 A	2.0 A

Refer to individual specification for details for capacity of power supply, and apply some protection circuit including fuses for power supply lines.

2) SEQUENCE OF POWER SUPPLIES AND INPUT SIGNALS(Refer 4.2.2)

Design sequence of power supplies and the input signals according to mentioned 4.2.2.,

If sequence is out of specifications, LCD is danger of damage and wrong display.

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 are connected incorrectly, it may cause insufficient brightness or unstable operation of FL, and smoke or burn of the parts.

4) PREVENTION OF IMAGE STICKING

Design the system not to display same pattern for a long time in order to prevent image sticking on the panel. Note that incorrect sequence of power supplies and input signals may cause the sticking on the panel, too.

5) GROUNDING OF METAL FRAME

Grounding of metal frame of LCD module is generally effective to prevent radiation interference from the system design. However, the necessity of grounding, or effective grounding method should be dependent on each system design.

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 obtain better appearance.

3) PROTECTIVE COVER

In case of severe environmental condition like outdoor usage, a proper transparent protective cover(lens) over LCD module is recommended to apply in order to prevent scratches, and invasion of dust, water, etc., from the system's window onto LCD module.

Ultra-violet ray cut filter is recommended to apply onto LCD module for outdoor operation. Strong ultra-violet ray may cause damage the panel. However, in that case, transmittance-luminance will decrease. Careful selection of material is required.

2-4 DESIGNING FL POWER SUPPLY CIRCUIT

Input FL starting voltage(VSFL) should be longer than two 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.

2-5 SAFETY DESIGN

Toshiba Matsushita Display Technology always endeavor to maintain sufficient quality of the LCD panel in process of designing and manufacturing, however, to avoid causing extended damages such as accidents resulting in injury or death, fire accidents, or social damages if the LCD panel fails, please adopt safe design as a whole set, by adopting redundant design , taking measure in set design to prevent fire-spreading, over-current, or incorrect operation, etc.

For Installation in Assembly

3-1 CARRYING

When LCD handling, hold by bezel, not hand with FL cable.

3-2 ESD (ELECTRO-STATIC DISCHARGE) PREVENTION

The C-MOS LSIs used in LCD module is very sensitive to ESD. The following caution should be taken when installing LCD module to an enclosure of the system in order to prevent damage of C-MOS LSIs used in LCD module.

1) HUMIDITY

Ambient humidity of working area is recommended to be higher than 50%RH in order to avoid ESD.

2) GROUNDING

2-1) Grounded electro-conductive mats are recommended to be covered on the floor of working area and surface of working benches.

2-2) The grounding should be done through a resister of 0.5-1M ohms in order to prevent spark of ESD.

2-3) Person handling LCD modules should be grounded with wrist band.

2-4) Tools like soldering iron and screw drivers and working benches should be grounded.

3) IONIZER

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

4) REMOVING PROTECTION FILM

When removing protection film from LCD panel, peel off the film slowly (more than three seconds) from the edge of the panel with round-ended tweezers or adhesive tape while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.

5) Be careful with touching metal portion of testing instruments in order to prevent unnecessary ESD.

6) Do not touch the electrode area of PCB and electrical parts like LSI, capacitor, connector pin, etc.

3-3 DUST AND STAIN PREVENTION

1) WORKING AREA

Reduce dust level in working area. Especially the level of metal particle should be decreased, otherwise electrical circuit in LCD module may be damaged due to short circuit by metal particles.

2) PROTECTION FILM

LCD module may be shipped with "protection film" on LCD panel in order to prevent from scratches and dust.
It is recommended to remove the film at later process of assembling.

3) FINGER PRINT

Use finger stalls or soft and dust-free gloves in order to keep clean appearance of LCD module when handled for incoming inspection and assembly.

4)* 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.
If the dirt can not be wiped off, follow the instructions described in individual specification.
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.

5) ADHESIVE ON LCD PANEL

Be careful not to attach adhesive, grease, etc., on LCD panel, because it is difficult to remove them without any damages on LCD panel.

6)* WATER SPOTS ON THE PANEL

Avoid the dewing or water condensation.
Wipe off a spot or spots of water or mist on LCD panel softly with absorbent cotton or another cloth as soon as possible if happened, otherwise discoloration or stain may be caused.

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.

2) FASTENING SCREWS

Fasten screws for mounting holes uniformly, otherwise bending / twisting force may be applied to LCD module.

3) INTERFACE / FL CABLES

Do not fasten screws, with catching interface cables or FL cables between LCD module and the enclosure.
This may cause bending of LCD module, or become the cause of a failure by damaging cables.

3-5 MECHANICAL FORCES

1)* STRONG MECHANICAL SHOCK

Refrain from strong mechanical shock like dropping from the working bench or knocking against hard object.

These may cause panel crack, damage of FL or other mis-operation.

2)* EXCESSIVE FORCE

Refrain from excessive force like pushing the surface of LCD panel. This may cause scratches or breakage of the panel, or a failure of the module.

3)* SCRATCHES ON THE PANEL

Do not put heavy object such as tools, books, etc., and do not pile up LCD modules.

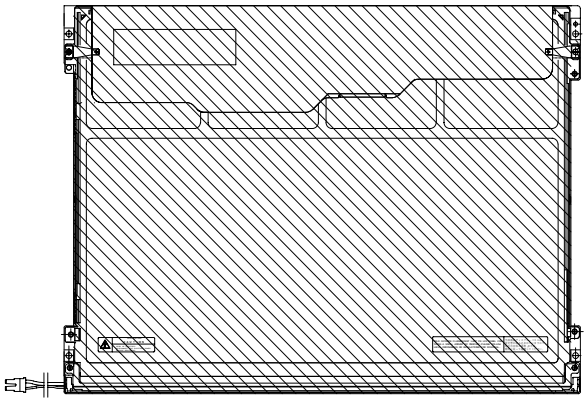
Be careful not to touch surface of the polarizer laminated to the panel with any hard and sharp object. The polarizer is so soft that it can be easily scratched, even the protect film covers it.

4)* SCRATCHES ON REAR SURFACE

Don't push at oblique lines of drawing mentioned below/

This LCD module uses prism light guard. If prism light guard is pushed, there is danger of appearance of white spot or black spot..

And if circuit board is pushed, there is danger of damage.



5) CONNECTORS

When inserting or disconnecting the connectors to LCD module, be sure not to apply force against PCB nor connecting cables, otherwise internal connection of PCB and TAB drivers may be damaged.

6) FL CABLES

Be careful not to pull the FL cables in order to avoid mechanical damage in FL lamp and soldering area.

While mounting, do not bind or twist the FL cables, or the Lamp current may not be applied as designed.

3-6 OPERATION

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

1) POWER SUPPLY

Power supplies should always be turned off in connecting process.

Do not connect or disconnect the power cables and connectors with power applied to LCD module.

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

For Transportation and Storage

1) TEMPERATURE

Do not store LCD modules in high temperature, especially in high humidity for a long time (approximately more than one month).

It is strongly recommended to store LCD modules where the temperature is in the range of 0 to 35 degrees Celsius and the humidity is lower than 70%.

2) LOW TEMPERATURE

Liquid crystal material may be coagulated and LCD panel may be damaged at the lower temperature than storage temperature range described in individual specification.

3) ULTRA VIOLET RAY

Store LCD module without exposure to direct sunlight or fluorescent lamps in order to prevent the module from strong ultra violet ray.

4) CLEANLINESS

Keep the 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

Avoid condensation of water on LCD module, otherwise it may cause mis-operation or defects. Keep away LCD module from such ambient.

6) PACKAGING

In case of transportation or storage after opening the original packaging, LCD modules are recommended to be repacked into the original packaging with the same method, especially with same kind of desiccant.

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1. Scope

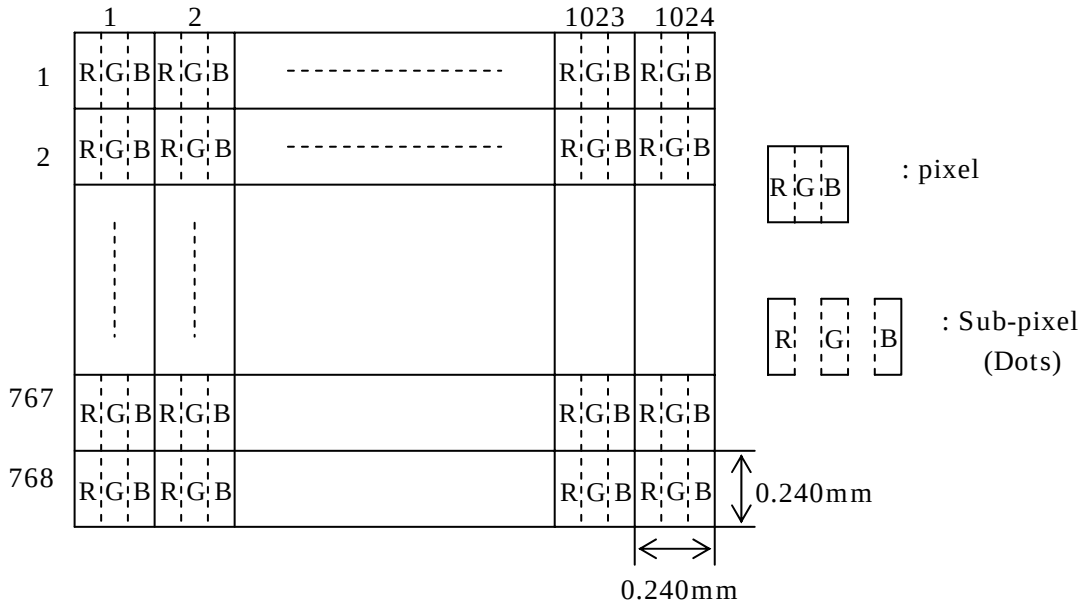
This specification is applicable to Toshiba Matsushita Display Technology's 36cm diagonal size TFT-LCD module "LTD121KA0Q" designed for Tablet PC.

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- IN0+,IN0- IN1+,IN1- IN2+,IN2-
Active Area	245.8 (*W*) × 184.3 (*H*) (mm)
Viewing Area	247.8 (*W*) × 186.3 (*H*) (mm)
Bezel Opening	250.4 (*W*) × 188.9 (*H*) (mm)
Number of Pixels	1024 (*W*) × 768 (*H*) 1)
Pixel Pitch	0.240 (*W*) × 0.240 (*H*) (mm) 1)
Pixel Arrangement	RGB vertical stripes 1)
Surface Treatment	Anti-glare and hard coat 3H on LCD surface
Backlight	Single cold-cathode fluorescent lamp for sidelighting
Dimensional Outline	269.0 (*W*) × 199.0 (*H*) × 6.5max. (*D*) (mm)

Note 1)



2.2 Absolute Maximum Ratings [1)]

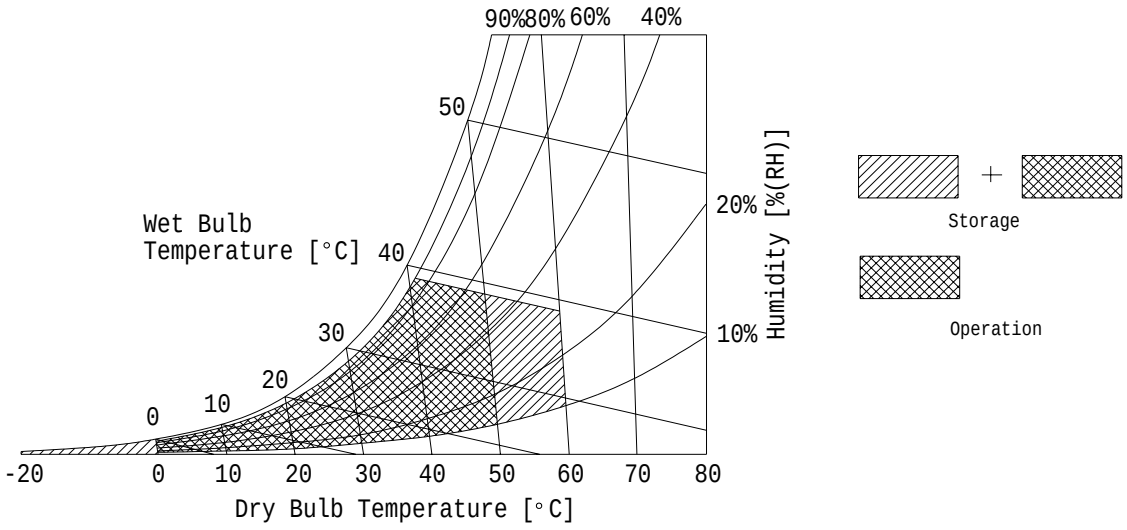
Item	Symbol	Min.	Max.	Unit	Checked Terminal [4)]
Supply Voltage	V_{DD}	-0.3	+4.0	V	V_{DD} - GND
Input Voltage of Signals	V_{IN}	-0.3	V_{DD}+0.3	V	LVDS interface
FL Driving Voltage	V_{FL}	-	2.0	kV(rms)	
FL Driving Frequency	f_{FL}	0	100	kHz	
Operating Ambient Temperature [2)]	T_{OP}	0	+50	°C	
Operating Ambient Humidity [2)]	H_{OP}	10	90	%(RH)	
Storage Temperature [2)]	T_{STG}	-20	+60	°C	
Storage Humidity [2)]	H_{STG}	10	90	%(RH)	
Operating Temperature for Panel [3)]	-	0	+60	°C	

Note1) 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.

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

3) The surface temperature caused by self heat radiation of cell itself is specified on this item.

4) Refer to 2.4.5



2.3 Mechanical Specifications

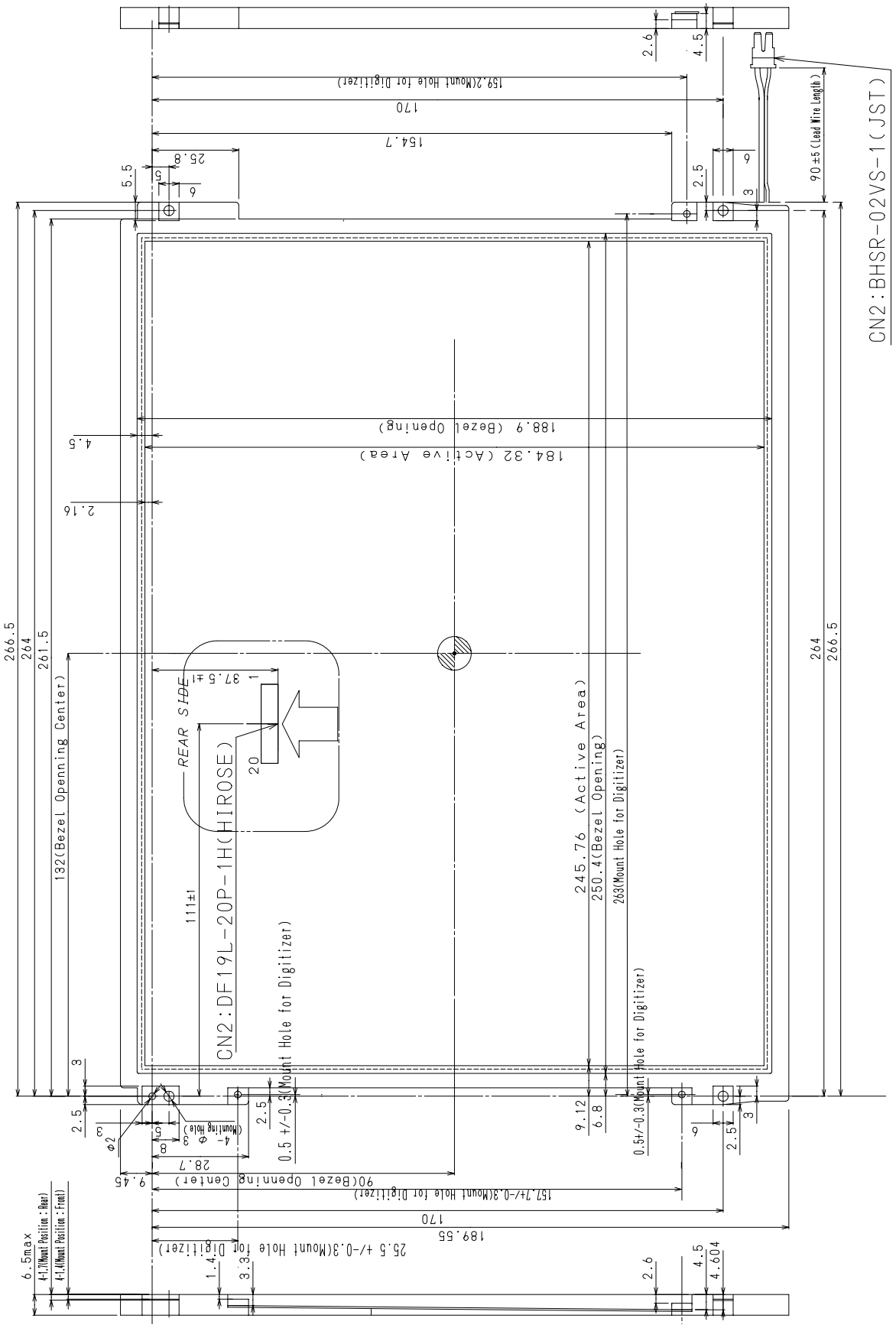
2.3.1 Weight

280 ± 20 (g)

2.3.2 Dimensional Outline (front figure)

Unit : mm

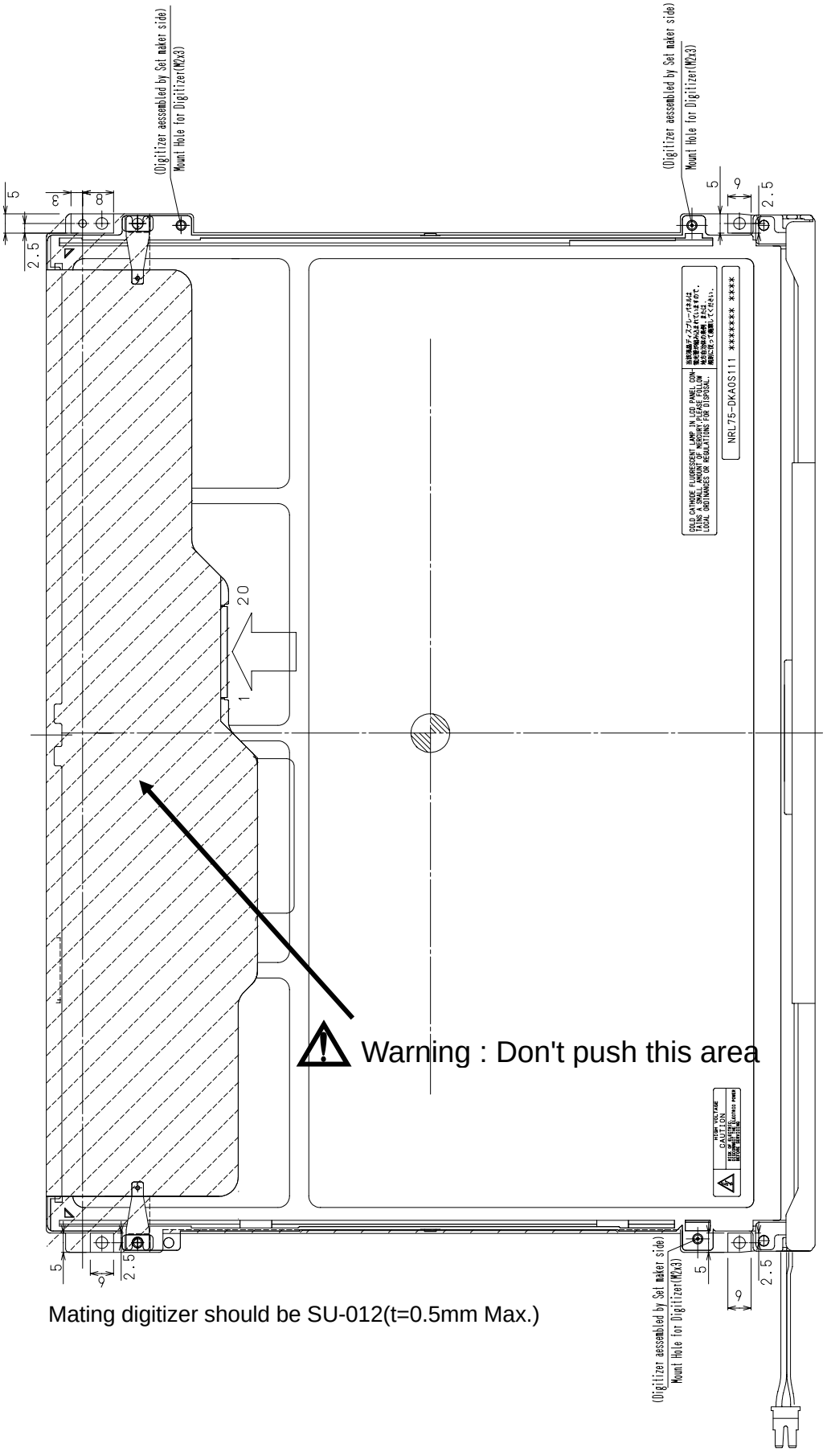
Standard Tolerance: ±0.5



Toshiba Matsushita Display Technology Co.,Ltd	Date: 2005-06-15	New	No. LTD121KA0Q-01
	Date:	Old	No.

←# Special ←& Addition ← Change

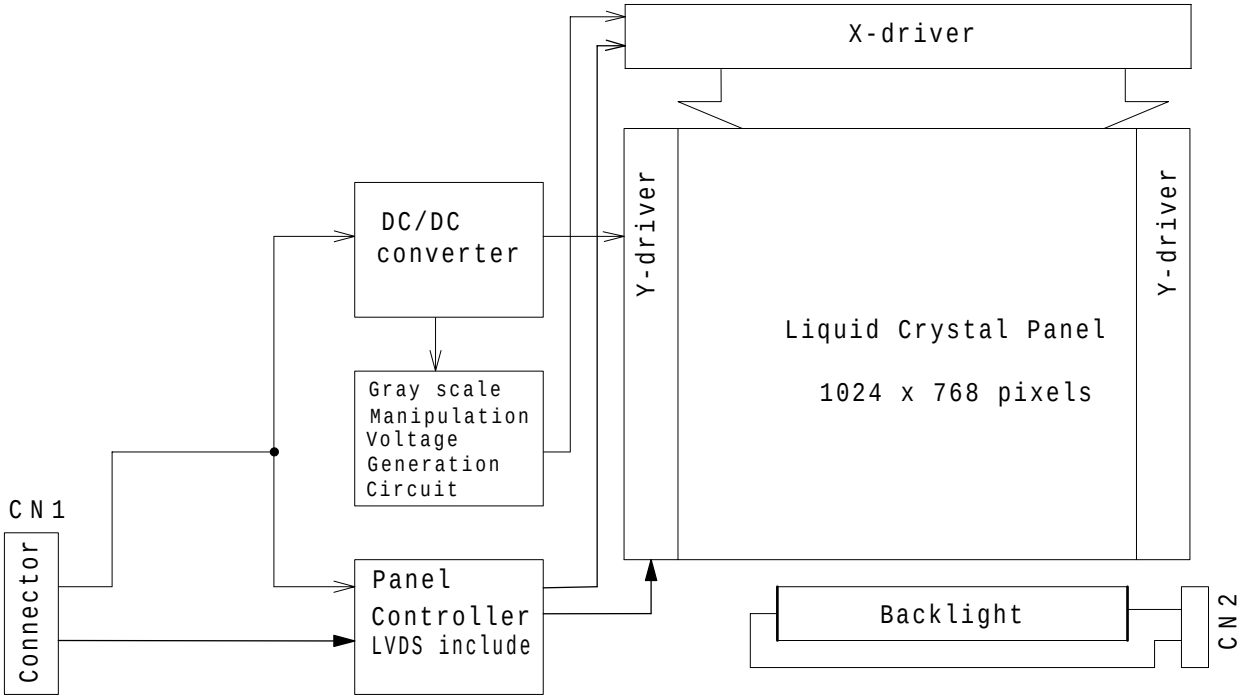
(rear figure)



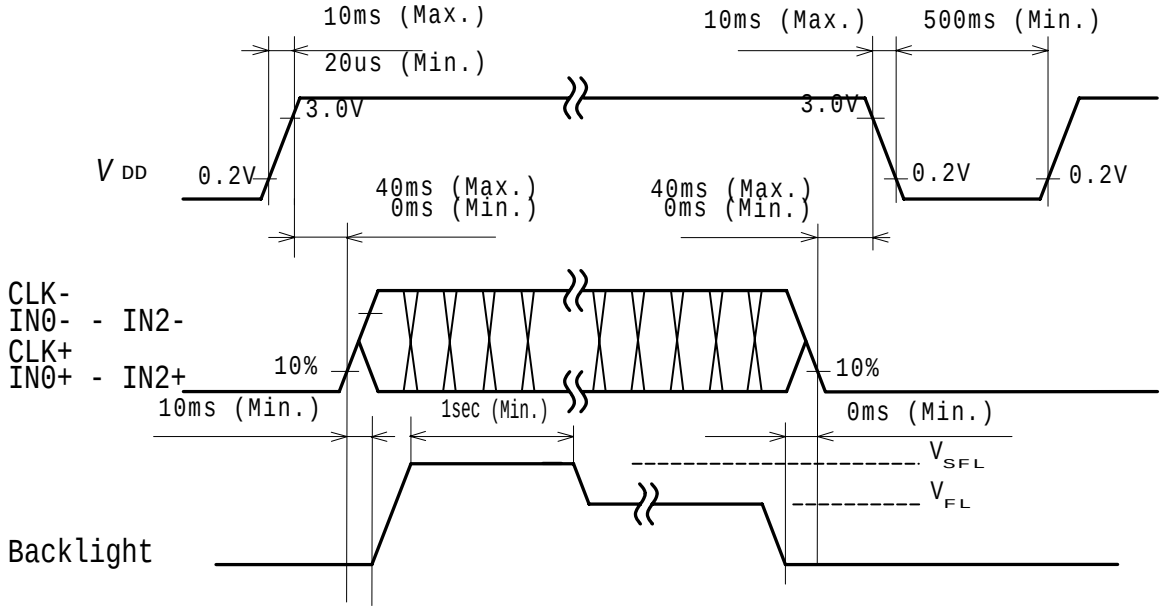
Mating digitizer should be SU-012(t=0.5mm Max.)

2.4 Electrical Specifications

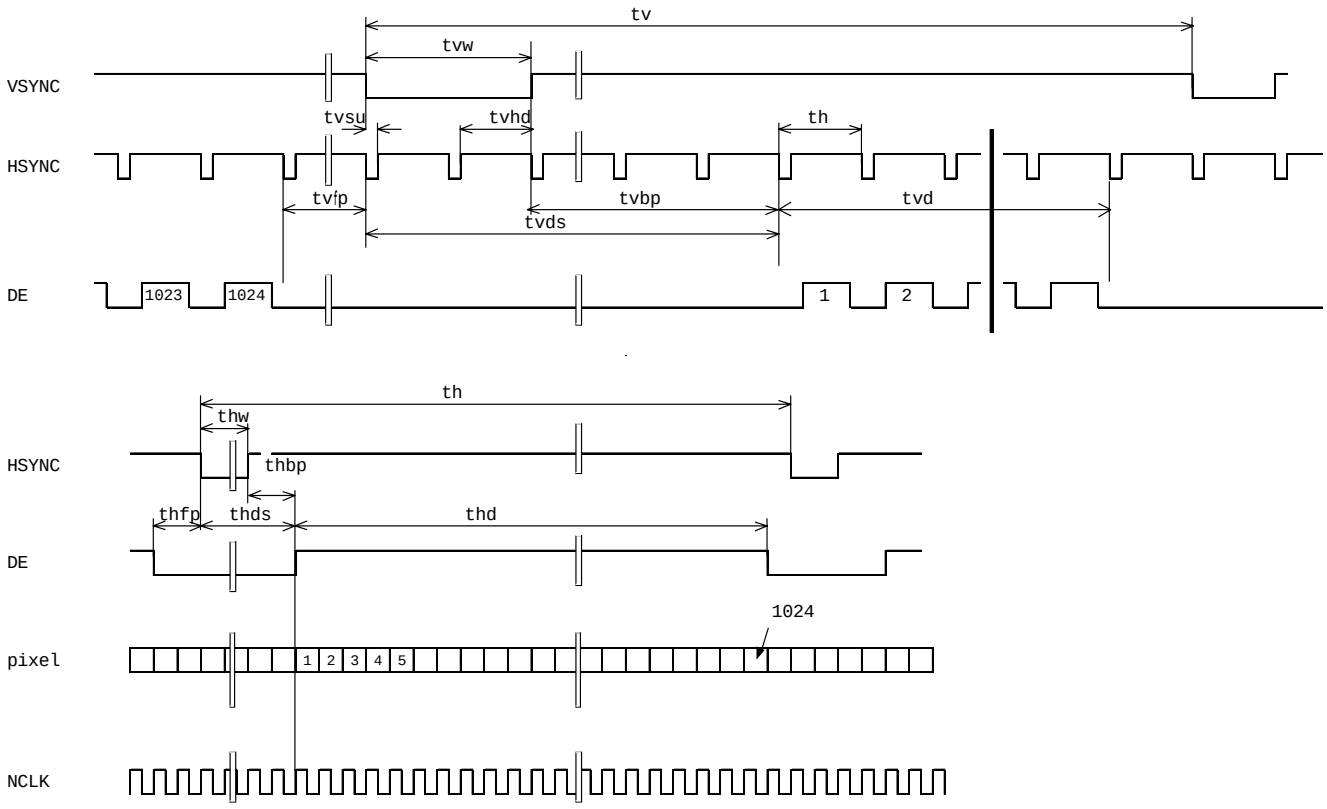
2.4.1 Circuit Diagram



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)]

Item	Symbol	min.	typ.	max.	unit
Horizontal Scanning Term	*t*h	1334 x *t*c	1344 x *t*c	-	clock
H-sync Pulse Width	*t*hw	4 x *t*c	136 x *t*c	-	clock
Horizontal Front Porch	*t*hfp	4 x *t*c	24 x *t*c	-	clock
Horizontal Back Porch	*t*hbp	24 x *t*c	160 x *t*c	-	clock
Horizontal Data Sync Period	*t*hds	32 x *t*c	296 x *t*c	-	clock
Horizontal Display Term	*t*hd	1024 x *t*c	1024 x *t*c	1024 x *t*c	clock
Frame Period	*t*v	778 x *t*h	806 x *t*h	860 x *t*h	line
V-sync Pulse Width	*t*vw	2 x *t*h	6 x *t*h	-	line
V-sync Set Up Time (to H-sync)	*t*vsu	8 x *t*c	-	-	clock
V-sync Hold Time	*t*vhd	8 x *t*c	-	-	clock
Vertical Front Porch	*t*vfp	1 x *t*h	3 x *t*h	-	line
Vertical Back Porch	*t*vbp	2 x *t*h	29 x *t*h	-	line
Vertical Data Sync Period	*t*vds	8 x *t*h	35 x *t*h	-	line
Vertical Display Term	*t*vd	768 x *t*h	768 x *t*h	768 x *t*h	line
Clock Period	*t*c	15.0	15.38	-	ns

Note 1) Refer to “Timing Chart” and LVDS (THC63LVDF84A-85) specifications by THine Electronics, Inc.

Note 2) If CLK is fixed to "H" or "L" level for certain period while DE is supplied, the panel may be damaged.

Note 3) 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 4) Do not make *tv*, *t*h, *t*hbp and tvds fluctuate.
If *t*v, *t*h, *t*hbp and *t*vds are fluctuate, the panel displays black.

Note 5) In case of using the long frame period, the deterioration of display quality, noise etc. may be occurred.

Note 6) CLK count of each Horizontal Scanning Time should be always the same.
V-Blanking period should be “*n*” X “Horizontal Scanning Time”. (*n*: integer)
Frame period should be always the same.

Note 7) Frame Period should not be regular for every frame.

2.4.5 Interface Connector

CN1 INPUT SIGNAL (DF19L-20P-1H / HIROSE)

[Mating Connector : DF19G-20S-1C (Cable),
DF19G-20S-1F (FRC Type) / HIROSE]

Terminal No.	Symbol	Function
1	V_{DD}	Power Supply : +3.3V
2	V_{DD}	Power Supply : +3.3V
3	V_{SS}	GND
4	V_{SS}	GND
5	RxIN0-	Negative LVDS differential data input (R0-R5,G0)
6	RxIN0+	Positive LVDS differential data input (R0-R5,G0)
7	V_{SS}	GND
8	RxIN1-	Negative LVDS differential data input (G1-G5, B0-B1)
9	RxIN1+	Positive LVDS differential data input (G1-G5, B0-B1)
10	VSS	GND
11	RxIN2-	Negative LVDS differential data input (B2-B5, HS, VS, DE)
12	RxIN2+	Positive LVDS differential data input (B2-B5, HS, VS, DE)
13	V_{SS}	GND
14	CLK-	Clock Signal(-)
15	CLK+	Clock Signal(+)
16	V_{SS}	GND
17	NC	
18	NC	
19	V_{SS}	GND
20	V_{SS}	GND

Note 1) Please connect GND pin to ground. Don't use it as no-connect nor connection with high impedance.

Note 2) Please connect NC pin to nothing. Don't connect it to ground nor to other signal input.

CN2 CCFL POWER SOURCE (BHSR-02VS-1/JAPAN SOLDERLESS TERMINAL MFG CO., LTD.)

[Mating Connector : SM02B-BHS-1/JAPAN SOLDERLESS TERMINAL MFG CO., LTD.]

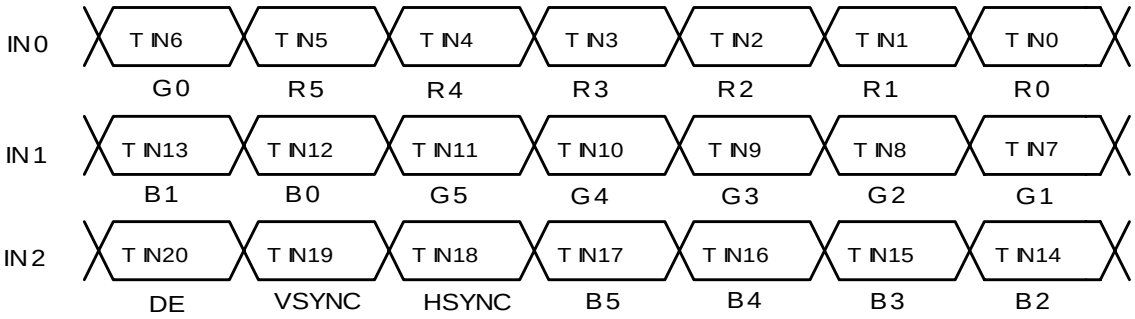
Terminal No.	Symbol	Function	Color of cable
1	V_{FLH}	CCFL POWER SUPPLY (HIGH VOLTAGE)	Pink
2	V_{FLL}	CCFL POWER SUPPLY (LOW VOLTAGE)	White

Note 1) 262,144 colors are displayed by the combinations of 18 bits data. (See next page)

RECOMMENDED TRANSMITTER TRANSMITTER (THC63LVDF83A,THC63LVDM83A,THC63LVDM83A-85) TO LTD121KA0Q INTERFACE ASSIGNMENT

Case1: 6Bit TRANSMITTER

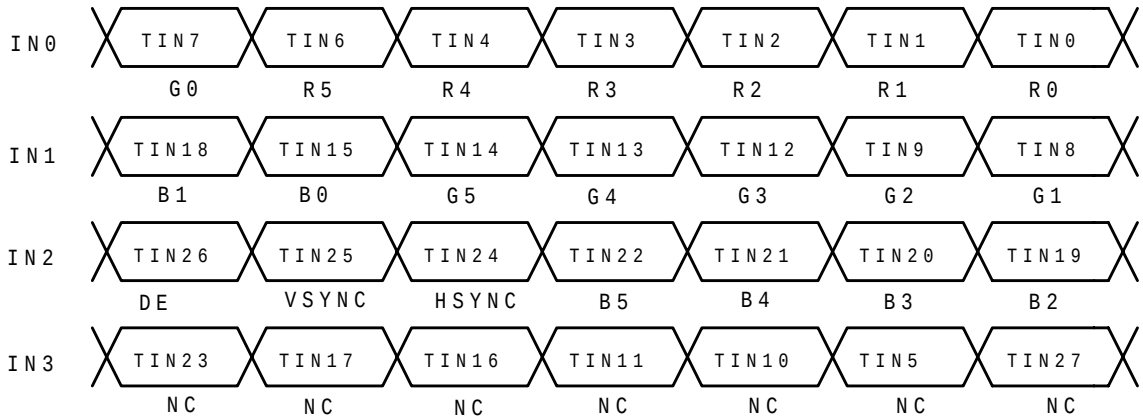
Input Terminal No.		Input Signal (Graphics controller output signal)		Output Signal Symbol	To LTD121KA0Q Interface(CN1)	
Symbol	Terminal	Symbol	Function		Terminal	Symbol
TA0	44	R0	Red Pixels Display Data (LSB)	TA- TA+	No.5 No.6	RxIN0- RxIN0+
TA1	45	R1	Red Pixels Display Data			
TA2	47	R2	Red Pixels Display Data			
TA3	48	R3	Red Pixels Display Data			
TA4	1	R4	Red Pixels Display Data			
TA5	3	R5	Red Pixels Display Data (MSB)			
TA6	4	G0	Green Pixels Display Data (LSB)			
TB0	6	G1	Green Pixels Display Data	TB- TB+	No.8 No.9	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 (MSB)			
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.11 No.12	RxIN2- RxIN2+
TC1	18	B3	Blue Pixels Display Data			
TC2	19	B4	Blue Pixels Display Data			
TC3	20	B5	Blue Pixels Display Data (MSB)			
TC4	22	HSYNC	H-Sync			
TC5	23	VSYNC	V-Sync			
TC6	25	DE	Compound Synchronization Signal			
CLK IN	26	NCLK	Data Sampling Clock	TCLK - TCLK +	No.14 No.15	CLK IN- CLK IN+



RECOMMENDED TRANSMITTER (THC63LVDF83A,THC63LVDM83A,THC63LVDM83A-85)
TO LTD121KA0Q INTERFACE ASSIGNMENT

Case2: 8Bit TRANSMITTER

Input Terminal No.		Input Signal (Graphics controller output signal)		Output Signal Symbol	To LTD121KA0Q Interface(CN1)	
Symbol	Terminal	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 (MSB)			
TA6	4	G0	Green Pixels Display Data(LSB)			
TB0	6	G1	Green Pixels Display Data	TB- TB+	No.8 No.9	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(MSB)			
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.11 No.12	RxIN2- RxIN2+
TC1	22	B3	Blue Pixels Display Data			
TC2	23	B4	Blue Pixels Display Data			
TC3	24	B5	Blue Pixels Display Data (MSB)			
TC4	27	HSYNC	H-Sync			
TC5	28	VSYNC	V-Sync			
TC6	30	DE	Compound Synchronization Signal			
TD0	50	NC	Non Connection (open)	TD- TD+	-	-
TD1	2	NC	Non Connection (open)			
TD2	8	NC	Non Connection (open)			
TD3	10	NC	Non Connection (open)			
TD4	16	NC	Non Connection (open)			
TD5	18	NC	Non Connection (open)			
TD6	25	NC	Non Connection (open)			
CLK IN	31	NCLK	Data Sampling Clock	TCLK- TCLK+	No.14 No.15	CLK- CLK+



2.4.6 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	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) 2) 3) 10)]

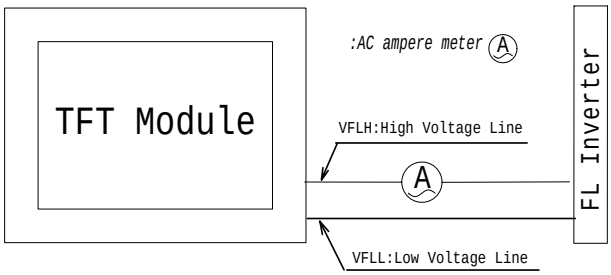
Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply Voltage [4)]	V_{DD}	3.0	3.3	3.6	V	
Differential Input Voltage	V_{ID}	100	-	600	mV	
Comon Mode Input Voltage	V_{CM}	1.0	-	2.4-(V_{ID})/2	V	
FL Input Current [6) 7) 8)]	I_{FL}	2.0	-	6.0	mA(rms)	
FL Driving Voltage [6)]	V_{FL}	575	625	675	V(rms)	I_{FL}=6.0mA(rms)(Reference)
FL Driving Frequency [6)]	f_{FL}	40	50	60	kHz	
FL Starting Voltage [6) 9)]	V_{SFL}	1500	-	1800	V(rms)	0°C

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

2) Recommended LVDS transmitter: THC63LVDF63A,THC63LVDM63A,THC63LVDM63A-85,THC63LVDF83A, THC63LVDM83A,THC63LVDM83A-85 (made by THine Electronics,Inc.)
Panel Controller contains LVDS, which is based on THC63LVDF84A-85 (made by THine Electronics,Inc.) specification.

3) Checked Pin Terminal: V_{DD}, GND (0V)

4) Checked Pin Terminal: IN0-～CLK+, GND (0V)
Measure: $|V_{IN0+}-V_{IN0-}|$, $|V_{IN1+}-V_{IN1-}|$, $|V_{IN2+}-V_{IN2-}|$
$|V_{CLKN+}-V_{CLK-}|$
Measure: $(V_{IN0+}-V_{IN0-})/2$, $(V_{IN1+}-V_{IN1-})/2$,
$(V_{IN2+}-V_{IN2-})/2$,
$(V_{CLK+}-V_{CLK-})/2$,



5) Checked Pin Terminal: V_{FLH} - F_{FLL}

6) If FL input current (I_{FL}) is higher than typical value(6.0mA(rms)), then FL lifetime becomes shorter.

7) Measuring Method of I_{FL}.

8) Input FL starting voltage (V_{SFL}) should not be less than one second.
If it were less than one second, it may cause unstable operation of FL.

9) 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.

4. Electrical Characteristics

4.1 Test Conditions

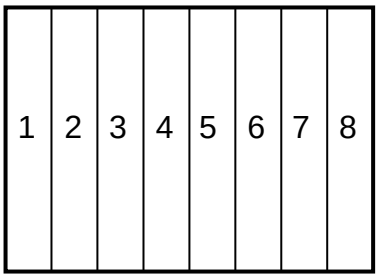
Ambient Temperature : T_a 25±5°C
Ambient Humidity : H_a 65±20%(RH)
Supply Voltage : V_{DD} 3.3V
Input Signal : Refer typical value in "2.4.4 Timing Specifications".
FL Input Current : I_{FL} =6.0mA(rms)
FL Driving Frequency : f_{FL} =50kHz

4.2 Specifications

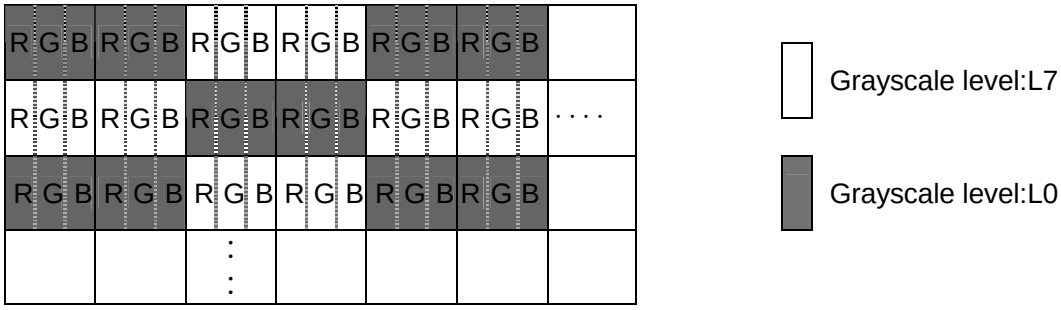
Item	Symbol	Min.	Typ.[1)]	Max.[2)]	Unit	Remark
Current Consumption	I_{DD}	-	195	360	mA	V_{DD} Terminal Current

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

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



Note 2) The max. value of I_{DD} is measured in the following pattern.



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°		150	-	-	-	
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)		130	170	-	cd/m^2	I_{FL}=6.0mA(rms)
Luminance Uniformity[2)]		LUNF	θ=0°, ϕ=0° Gray Scale Level=L63 (White)		55	-	-	%	
Chromaticity	Red	x_R	Gray Scale Level:L63		0.55	0.62	0.69	-	
		y_R	θ=0°, ϕ=0°		0.26	0.33	0.40	-	
	Green	x_G	Ditto		0.23	0.30	0.37	-	
		y_G			0.47	0.54	0.61	-	
	Blue	x_B	Ditto		0.08	0.15	0.22	-	
		y_B			0.07	0.14	0.21	-	
	White	x_W	Ditto		0.26	0.33	0.40	-	
		y_W			0.27	0.34	0.40	-	

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 :ANSI / ASQC Z1.4 (Level ll)

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

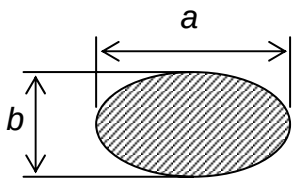
6.4.2 Specifications

<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></td></tr>
<tr><td>Soldering</td><td>Cold solder joint, lead move when pulled</td><td>Minor</td></tr>
<tr><td>Bezel, Frame, Connectors</td><td>Distinct stain, rust or scratch</td><td>Major</td></tr>
<tr><td>Black and White Spots/Lines[1)2)]</td><td>
<table>
<tr><th>Line width</th><th>Length(mm)</th><th>Acceptable count</th></tr>
<tr><td>$W \le 0.05$</td><td rowspan="4">$L \le 3$</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>$0.2 < D \le 0.3$</td><td>$n \le 5$</td></tr>
<tr><td>$0.3 < D \le 0.5$</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 active area

Note 2) Black/White Spot, Polarizer Dents and Polarizer Bubble shall be judged by "Average Diameter".

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



6.5 Display Quality

6.5.1 Test Conditions

1) Inspection Area : Within active 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 [4)]

Item	Description / Specifications	Class
Function	No display, Malfunction	Major
Display Quality [1)]	Missing line	Major
	Missing Sub-Pixels 1) Bright defects : 2pcs. maximum 2) Dark defects : 4pcs. maximum 3) Total sub-pixel defects : 4pcs. maximum 4) Bright defects distance : 15mm minimum 5) Dark defects distance : 15mm minimum 6) Bright defects conjunction (2sub-pixels) : nothing 7) Bright defects conjunction (3sub-pixels) : nothing 10) Dark defects conjunction (2sub-pixels) : 1set maximum 11) Dark defects conjunction (3sub-pixels) : nothing TENTATIVE	Major
	Inconspicuous flicker, crosstalk, Newton's ring, Mottling Rubbing defect, Dim Lines, Horizontal Line and Vertical Line. : neglect	-
	Inconspicuous defects : neglect	-
	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 spot which can not be found by using 5%ND-Filter shall not be counted as a defect.

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 0.5h 0.5h 50 cycles	3p./3p. OK
Mechanical Vibration [2)3)]	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)3)]	260×9.8m/s^2 , 2ms, ±X, ±Y, ±Z each direction, one time each	3p./3p. OK

Note 1) Operating

Note 2) Non-Operating

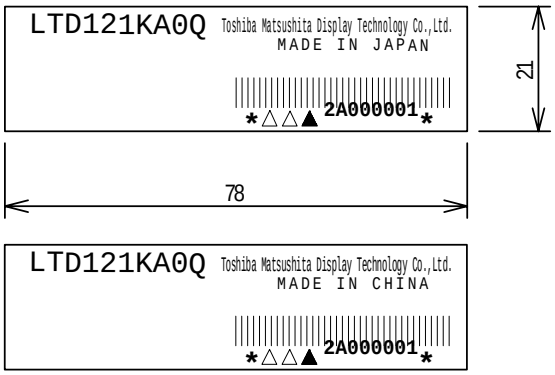
Note 3) LCD should be assembled with Wacom digitizer(SU-012 , t=0.5mm Max.)

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 : △△ ▲ 2A 000001
① ② ③ ④

① : Module type code

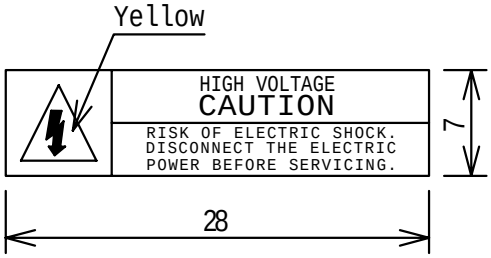
② : Manufacturing code
C,K: MADE IN JAPAN
R: MADE IN CHINA

③ : Lot code 2 A
(1) (2)
(1):Year code-end of the A.D.
(2):Month code-alphabet → Jan. : A - Dec. : L
Bar code : CODE-39 High-density
(Example : 2A → 2002 JAN.)

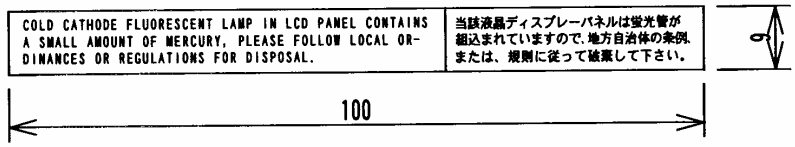
④: Serial code
decimal, 6 figures

(2) Caution Labels

• High Voltage

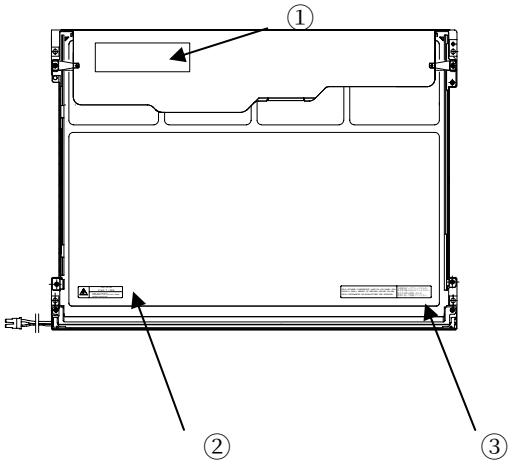


• Disposal of CCFL



Unit: mm

3) Label Locations



①:Product Label
②:Caution Label
③:Disposal of CCFL

7. Lifetime

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)
Lamp current	: 6.0mA(rms)
Lighting condition	: continuous lighting
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 “4.3.2”. But this is not irregular phenomena. Moreover, CCFL also has the characteristic of color shift by long period operation.

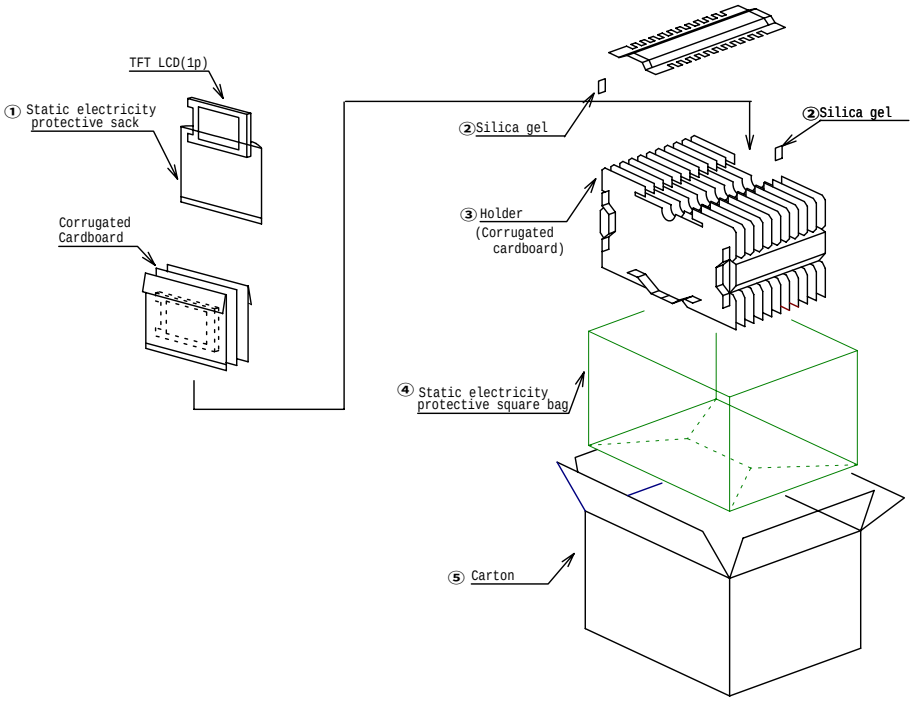
8. Packaging

8.1 Carton (internal package)

(1) Packaging Form

Corrugated cardboard box and polyethylene foam as shock absorber

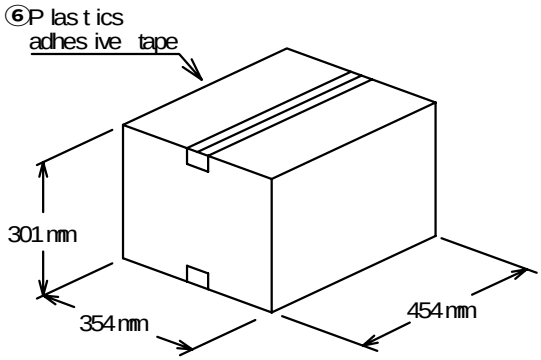
(2) Packaging Method [1)2)]



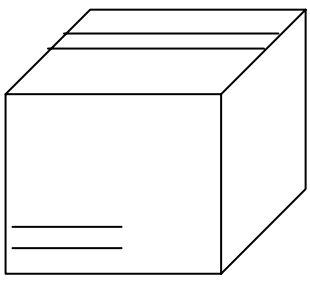
Note 1): Total weight : (Approx.) 12 kg
Note 2): Acceptable number of palette piling: 2 sets

(3) Packaging Material

Number	Quantity	Description
①	25p	Static electricity Protective sack
②	3p	Silicagel (100g×3p)
③	1set	Holder
④	1p	Static electric Protective square bag
⑤	1p	Corrugated card box
⑥	-	Plastics adhesive tape



(4) Carton Marking



9. Warranty

Warranty clause will be decided separately.

10. 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

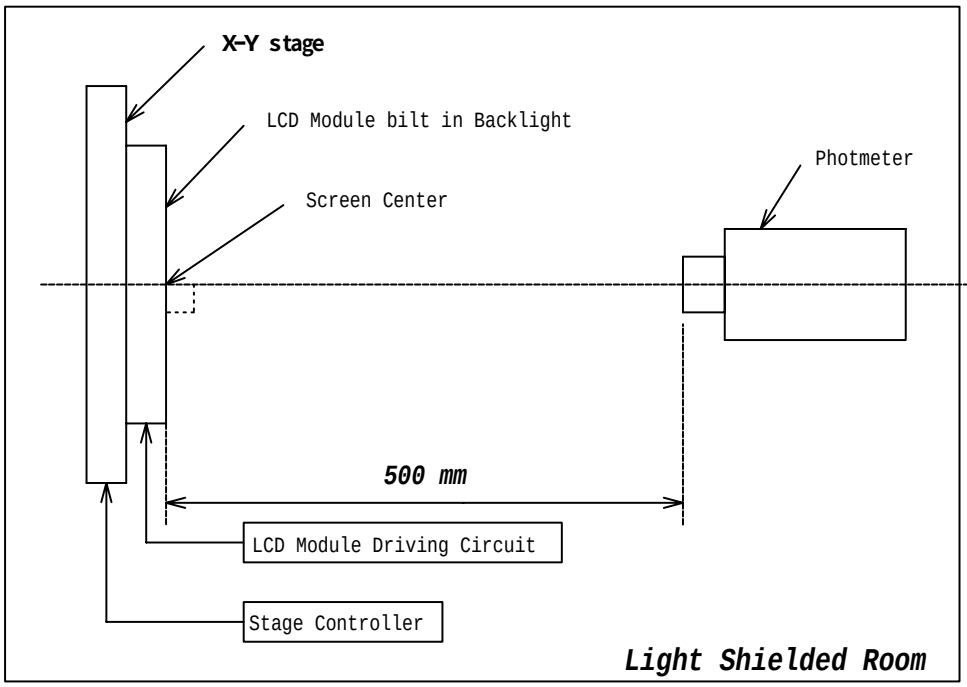
FCC	: PART15 CLASS B
VCCI	: CLASS B
CISPR	: CLASS B

b) Examples of Safety Regulations

IEC	60950
UL	60950

11. Measuring Method

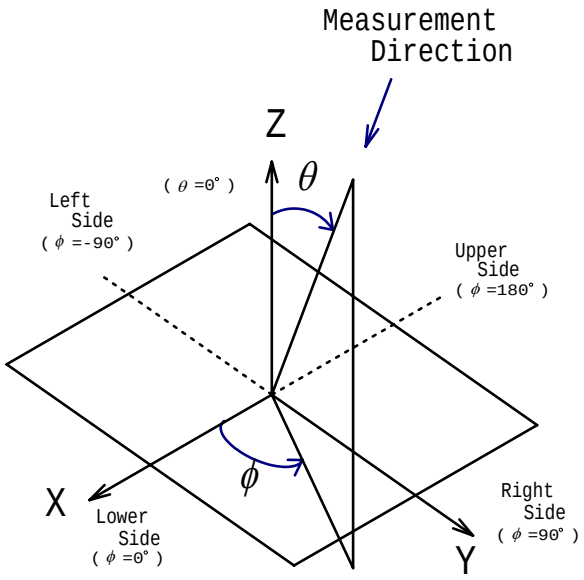
11.1 Measuring System



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

(2) Photometer : BM-5A / BM-7 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.

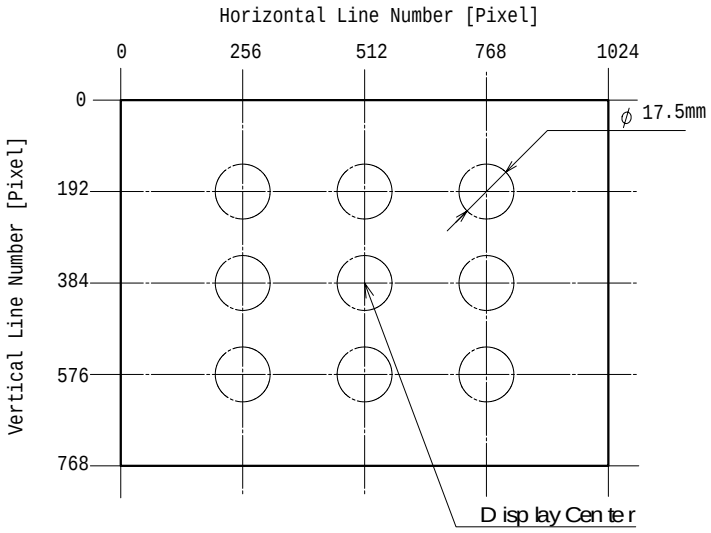
(Refer to 11.1(3) for the axes.)

(4) Luminance Uniformity:

The Luminance should be measured at 9 positions on white raster(gray scale level L63).

Uniformity can be calculated by the following expression.

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

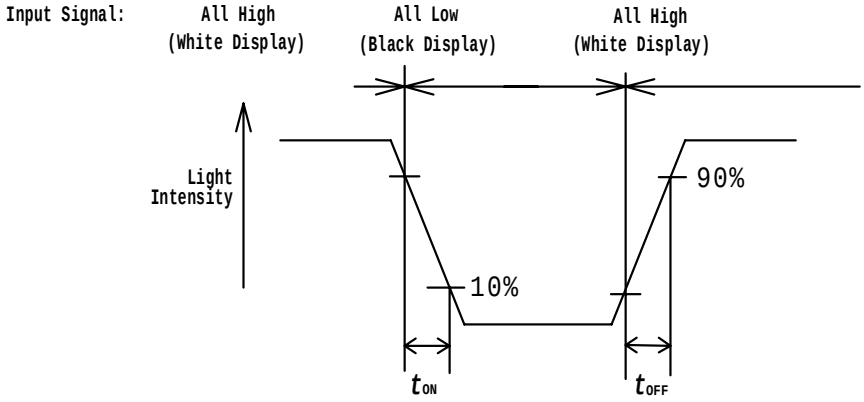


(5) Chromaticity :

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 a photo detector output waveform to go from maximum value to 10% of its maximum.

t_{OFF} : Turn off time is the time for a photo detector output waveform to go from zero 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)