



To :

This specification is only used for discussing the included items.
You haven't to approve this specification.
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SPECIFICATION(TENTATIVE)

FOR

Toshiba Matsushita Display Technology TFT-LCD MODULE without Backlight

LTD121EA43G

LTD121EA43G-01

DATE OF ISSUE : 2004-04-20

TV/PC/Monitor-Use Marketing & Engineering Group2

TV/PC/Monitor-Use Marketing & Engineering Dept.

AVC-Use LCD Division

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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.

For Safety



Warning

1) SPECIAL PURPOSES

- a) Toshiba Matsushita Display Technology's Standard LCD modules without backlight 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 without backlight have not been designed for use in applications where performance failures could be life-threatening or 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.



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 clothing 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 GLASS that may cause injuring fingers or skin, when the glass is broken.

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, surge 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 edges of glass parts and touch panel. Even though burr disposal treatment is performed, it may cause injuring. For designing the system, give special consideration that the wiring and parts do not touch those edges.

For Designing the System

2-1 DESIGNING ENCLOSURE

1) MECHANICAL DIMENSIONS

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

2) *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.

3 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.

4) 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.

5) FIXATION OF GLASS

When assembling the glass portion into the backlight unit, determine a positioning part and fix the circumference of glass on a double-sided tape etc. Mechanical parts should be designed so that stress may not be applied to inlet of the glass downside. When assembling the PCB portion into the set, fix PCB in places other than part mounting domain.

6) LUMINANCE OF BACKLIGHT

This LCD is designed for note PC and assumes about 2500 cd/m² as luminance of the backlight used.

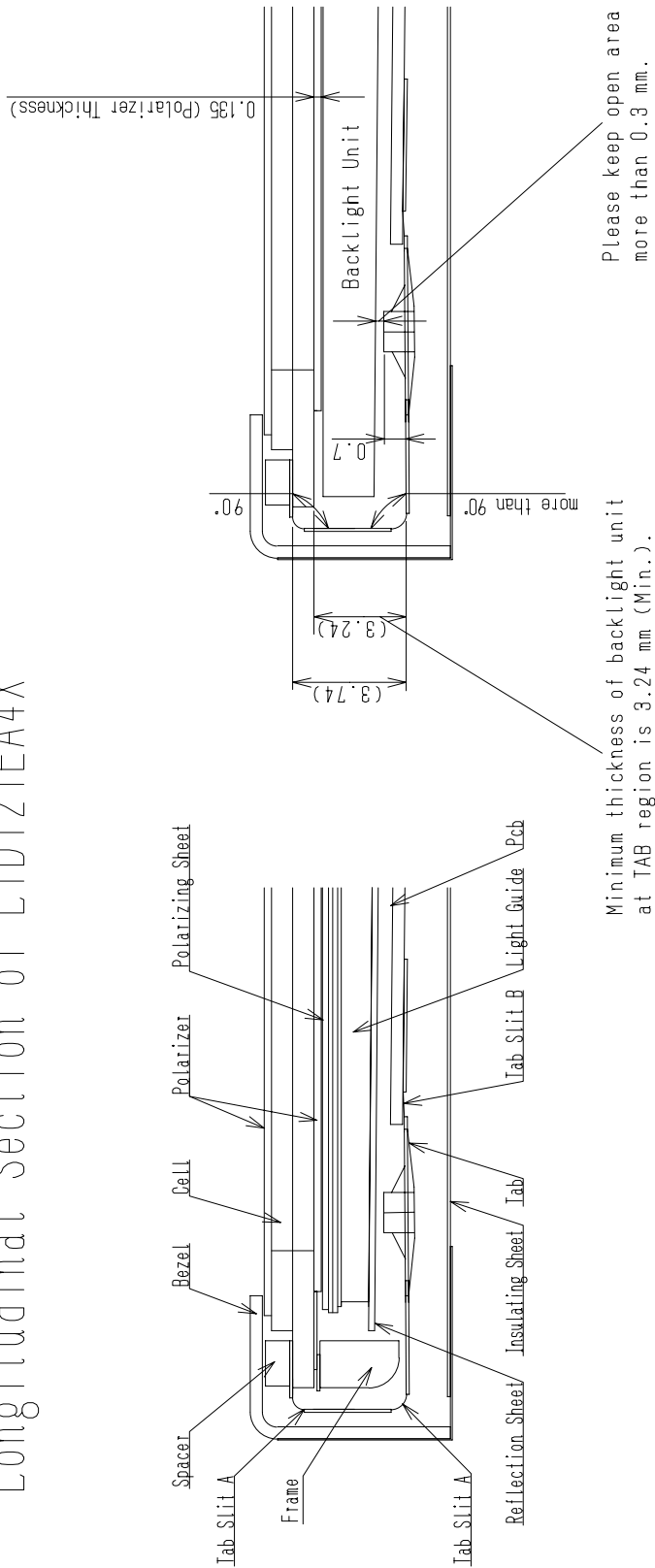
When the backlight of the luminance beyond 2500 cd/m² is used, luminance should be set up after evaluating enough the product characteristics, such as module display operation, grace and reliability and checking that it is satisfactory.

7) APPLICATION NOTES

This is the longitudinal section of LTD121EA4X module which is comprized with LTD121EA43G module without backlight. Please refer to this data for your backlight design.

Regarding to TAB bending position, please don't bend TAB in the position of slit B, only use slit A position for bending.

Longitudinal Section of LTD121EA4X



Unit : mm

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}	<u>4.0</u> A	<u>1.25</u> A	<u>1.25</u> 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) 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.

4) GROUNDING OF METAL FRAME

Grounding of PCB GND 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 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 module without backlight is carried by hand, please hold the glass edge with both hands.

If PCB and TAB are held, it will become the cause of failure and It may be some possibility of overheat and/or burning of module without backlight

If the surface and the back of glass are held directly, it will become the cause of poor display such as scratch and stain.

In addition, when module without backlight is carried by hand, wear finger sack or soft glove out of which dust dose not come, and be careful not to cut a hand with edge of glass etc.

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 without backlight 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.

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 without backlight.
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) 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.

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.

For Installation in Backlight Unit

When assembling this module without backlight into the backlight unit and mechanical component, introduce electro static destruction countermeasure as follows into the process of assembly, and be careful not to destroy module without backlight with static electricity.

(1) CLOTHES

Please wear electric conduction shoes.
Please use list strap with cable.

(2) ENVIRONMENT OF PROCESS

Please use floor as electric conduction floor.

The work stand surface on which module without backlight is put should use conductive rubber mat.

Please ground conductive rubber mat.

Module without backlight should prevent from touching direct metal.

Module without backlight should remove static electricity by ionizer.

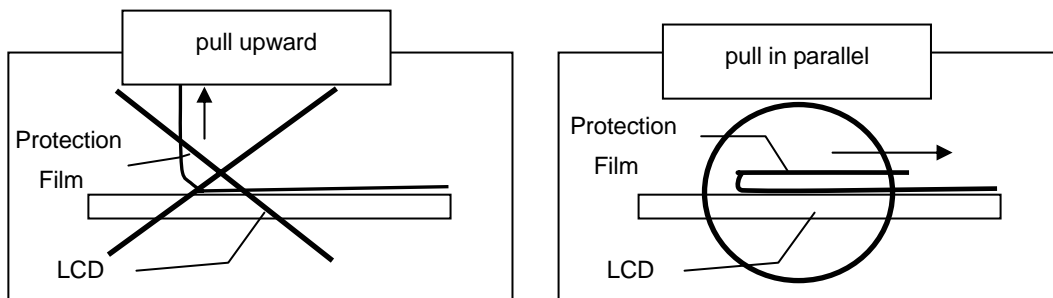
Please determine the distance from ionizer to module without backlight after checking the effect which removes static electricity.

Please turn the blow direction of ionizer to the place which static electricity generates.

The amount of electrifications at the time of non-working at the process should be controlled less than 300V.

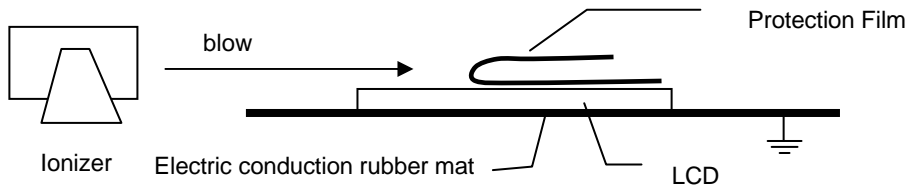
(3) NOTES AT THE TIME OF PROTECTION FILM EXFOLIATION

Please pull the protection film in parallel to glass surface and exfoliate protection film slowly (more than three seconds).



Please blow the portion which exfoliates the protection film by ionizer.

LCD should be placed on the grounded electric conduction rubber mat.



When sticking the exfoliated protection film on LCD again, please stick it after removing static electricity.

It is the same when sticking a new protection film.

Please remove product label on the protection film after removing the protection film in order to prevent damage to cell.

(4) CHECK ITEM

The ion balance of ionizer should be measured periodically and should be adjusted.

Ionizer should be cleaned once per week.

Please check list strap by the list strap checker whenever starting work.

Please check the conductive check of electric conduction shoes whenever starting work.

(5) AIR CONDITIONING

Humidity should be controlled at 50 ± 20 (%RH).

Temperature should be controlled at 20 ± 5 (°C)

Wind direction and wind power of air-conditioner should be adjusted so that wind of air-conditioner may not hit a LCD directly.

(6) TAKEOUT OF MODULE WITHOUT BACKLIGHT FROM PACKING TRAY

When taking module without backlight from packing tray and putting it on worktable, please put it on worktable after removing static electricity by ionizer.

When taking module without backlight from packing tray, be careful to catch neither PCB nor TAB in packing carton and tray.

(7) TRANSPORTATION AT LINE

When transporting module without backlight with a cart etc., the cart should be grounded by chain etc.

(8) IMPLEMENT

When using a metal implement, please use it after making it discharge once.

When testing LCD and processing LCD, please ground the portion in contact with LCD of implement.

When connecting a signal cable to module without backlight for check of operation etc., please connect a cable to module without backlight after fully removing the static electricity of LCD.

For Transportation and Storage**1) TEMPERATURE**

Do not store LCD modules without backlight in high temperature, especially in high humidity for a long time (approximately more than one month).

It is strongly recommended to store LCD modules without backlight 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 without backlight are recommended to be repacked into the original packaging with the same method, especially with same kind of desiccant.

7) RROSION GASES

There is cardboard box include corrosion gases. Please check reliability of packing.

Handling Notice

1) How to pull out from carton



OK

Pull up at both side of outer sack.
Notice: Do not tilt bag.



NG

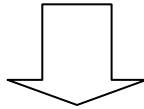
Do not pull up by only one hand.

2) How to pull out from tray



OK

Insert fingers between tray and panel.



OK

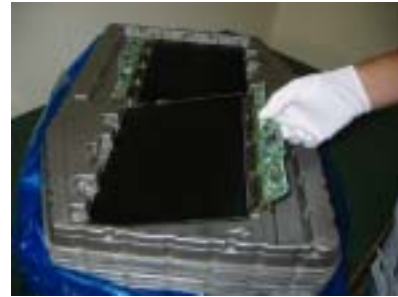
Bring up slowly.



NG

Do not handle by only one hand.

It's due to disconnection between panel and TAB-ICs.



NG

Do not handle at PCB.

It's due to disconnection between panel and TAB-ICs.



NG

Do not turn over.

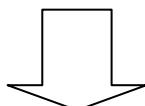
It's due to disconnection between panel and TAB-ICs.

3) How to return the module without backlight to the tray

OK



Keep straightly panel and PCB.



Put on slowly.

OK

Notice: Do not put TAB-ICs on projections.

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1. Scope

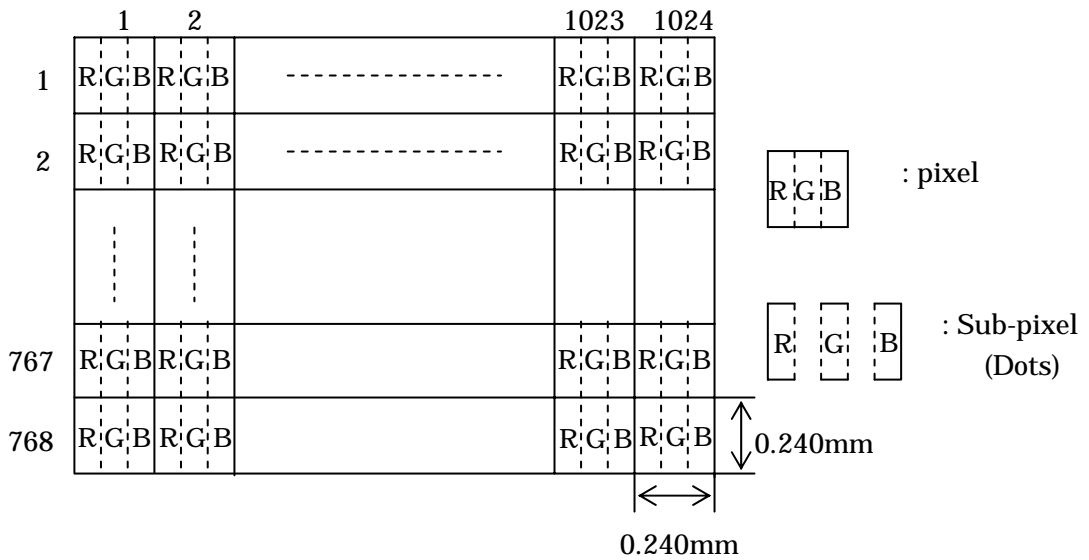
This specification is applicable to Toshiba Matsushita Display Technology's 31cm diagonal size TFT-LCD module without backlight "LTD121EA43G" designed for Note PC.

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-, RxIN0+, RxIN0-, RxIN1+, RxIN1-, RxIN2+, RxIN2-
Active Area	245.76 (W) × 184.32 (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-Reflection and hard coat 3H on LCD surface
Dimensional Outline of Glass	252.1 (W) × 192.4 (H) × 1.27 (D) (mm)
Transmission axis direction of polarizer (at the time of looking from front)	45 degree (inclination with X-axis) (refer to 2.3.2 Dimensional Outline)

Note 1)



2.2 Absolute Maximum Ratings ¹⁾

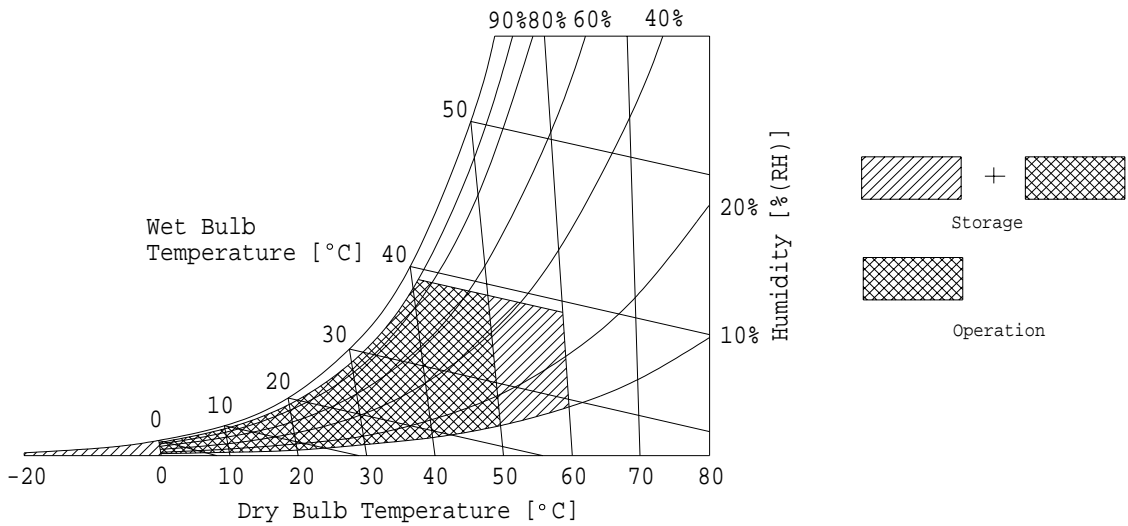
Item	Symbol	Min.	Max.	Unit	Checked Terminal ⁴⁾
Supply Voltage	V_{DD}	-0.3	+4.0	V	$V_{DD} - GND$
Input Voltage of Signals	V_{IN}	-0.3	$V_{DD}+0.3$	V	LVDS interface
Operating Ambient Temperature ²⁾	T_{OP}	0	50	°C	
Operating Ambient Humidity ²⁾	H_{OP}	10	90	%(RH)	
Storage Temperature ²⁾	T_{STG}	-20	+60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

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

Note 4) Refer to 2.4.5



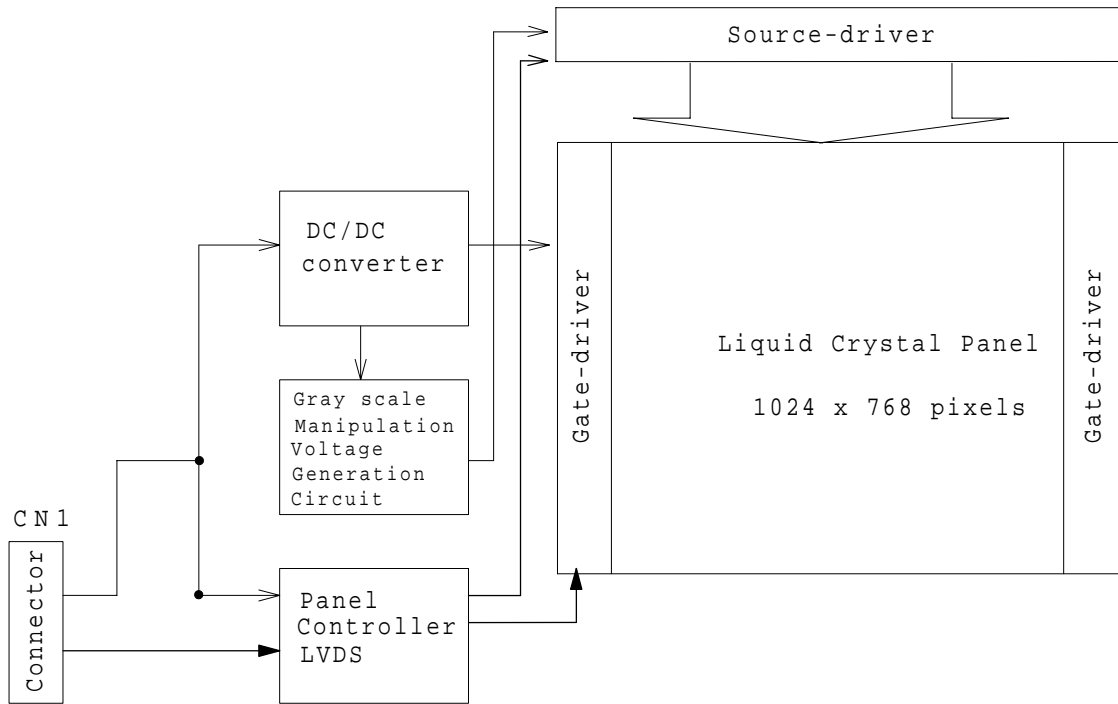
2.3 Mechanical Specifications

2.3.1 Weight

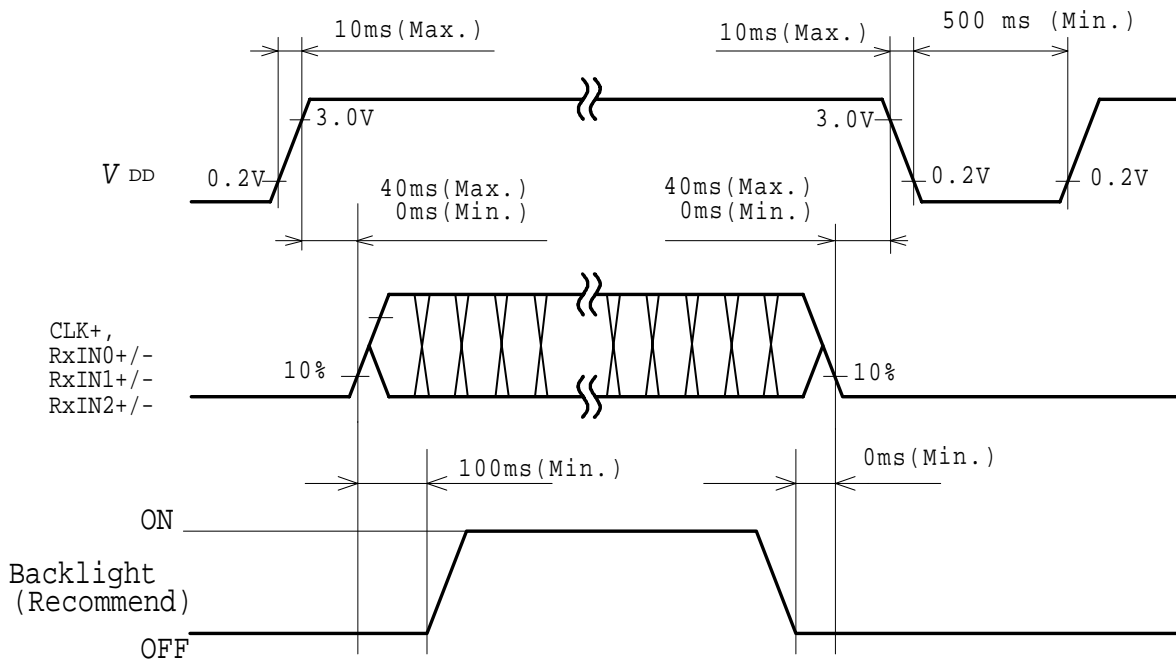
153g ± 20 g

2.4 Electrical Specifications

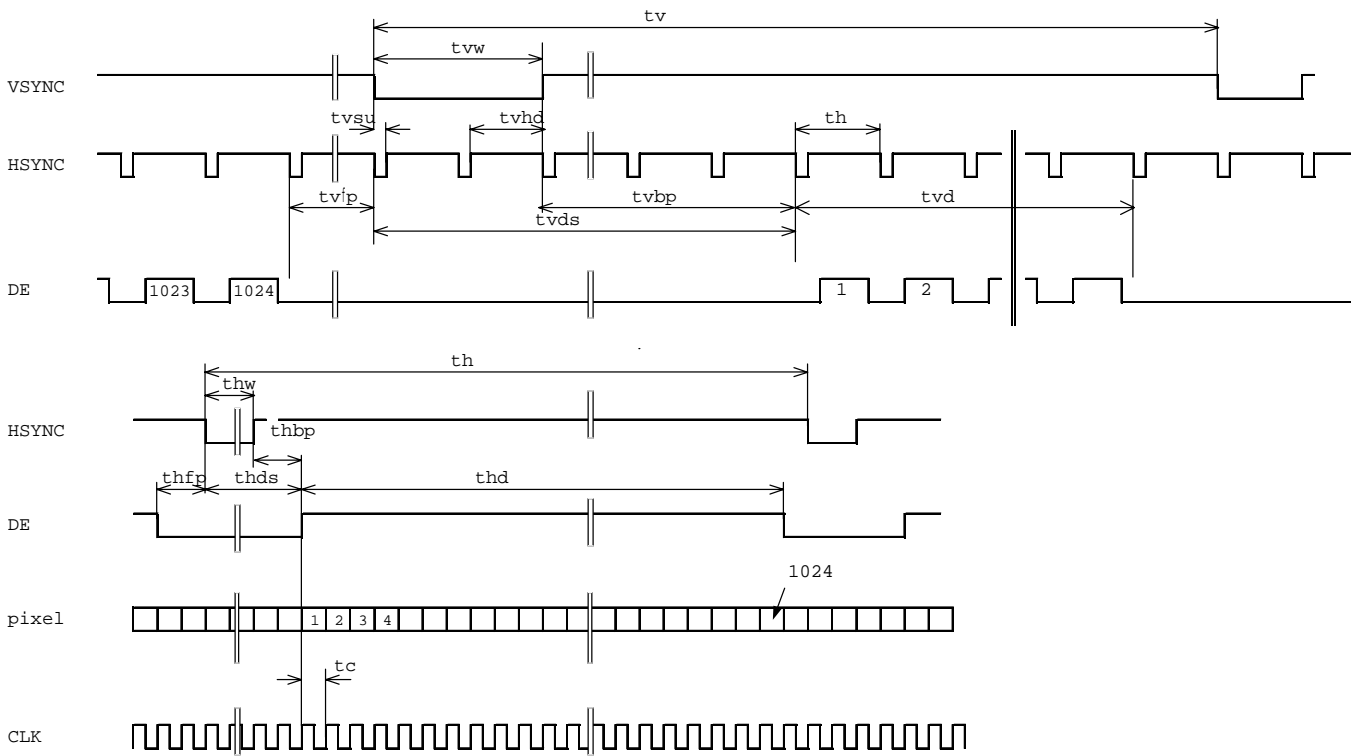
2.4.1 Circuit Diagram



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)}

Item	Symbol	min.	typ.	max.	unit
Horizontal Scanning Term	t_h	$1334 \times t_c$	$1344 \times t_c$	-	clock
H-sync Pulse Width	t_{hw}	$4 \times t_c$	$136 \times t_c$	-	clock
Horizontal Front Porch	t_{hfp}	$4 \times t_c$	$24 \times t_c$	-	clock
Horizontal Back Porch	t_{hbp}	$24 \times t_c$	$160 \times t_c$	-	clock
Horizontal Data Sync Period	t_{hds}	$32 \times t_c$	$296 \times t_c$	-	clock
Horizontal Display Term	t_{hd}	$1024 \times t_c$	$1024 \times t_c$	$1024 \times t_c$	clock
Frame Period	t_v	-	$806 \times t_h$	-	line
Frame Frequency	$1/t_v$	60	60	60	Hz
V-sync Pulse Width	t_{vw}	$2 \times t_h$	$6 \times t_h$	-	line
V-sync Set Up Time (to H-sync)	t_{vsu}	$8 \times t_c$	-	-	clock
V-sync Hold Time	t_{vhd}	$(t_{hbp}+16) \times t_c$	-	-	clock
Vertical Front Porch	t_{vfp}	$1 \times t_h$	$3 \times t_h$	-	line
Vertical Back Porch	t_{vbp}	$2 \times t_h$	$29 \times t_h$	-	line
Vertical Data Sync Period	t_{vds}	$8 \times t_h$	$35 \times t_h$	-	line
Vertical Display Term	t_{vd}	$768 \times t_h$	$768 \times t_h$	$768 \times t_h$	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 NCLK is fixed to "H" or "L" level for certain period while V_{DD} 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.

Note 4) Do not make t_v , t_{vhd} and t_{vds} fluctuate.

If t_v , t_{vhd} , 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) NCLK 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.

2.4.5 Interface Connector

CN1 INPUT SIGNAL

Connector : DF19L-20P-1H / Hirose Electric Co., Ltd.

Mating Connector : DF19G-20S-1C(Cable Type), DF19G-20S-1F(FPC Type) / Hirose Electric Co., Ltd.

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

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

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

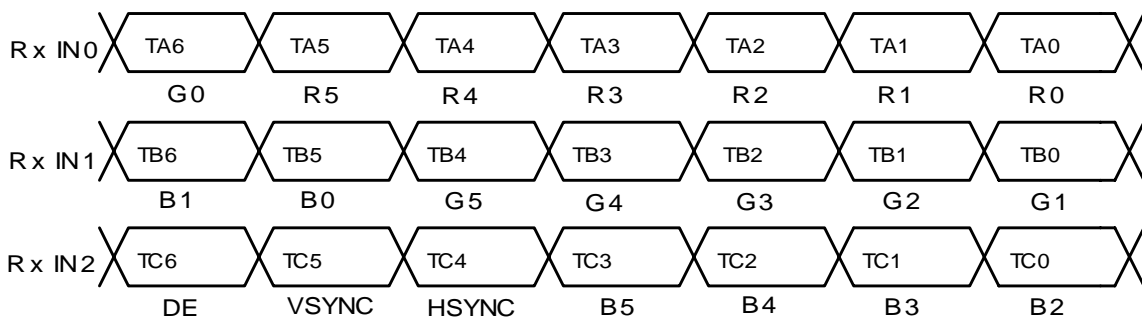
Note 2) 262,144 colors are displayed by the combinations of 18 bits data. (See 2.4.7)

2.4.6 Recommended Transmitter Interface Assignment

Case1: 6bit Transmitter

THC63LVDF63A, THC63LVDM63A, THC63LVDM63A-85				LTD121EA43G Interface (CN1)		
Input Terminal No.		Input Signal (Graphics controller output signal)		Output Signal Symbol	Terminal	Symbol
Symbol	Terminal	Symbol	Function			
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	Horizontal Synchronization Signal			
TC5	23	VSYNC	Vertical Synchronization Signal			
TC6	25	DE	Compound Synchronization Signal			
CLK IN	26	CLK	Data Sampling Clock	TCLK- TCLK+	No.14 No.15	CLK- CLK+

Note 1) Please refer to LVDS transmitter (THC63LVDF63A, THC63LVDM63A, THC63LVDM63A-85) specifications by Thine Electronics, Inc.



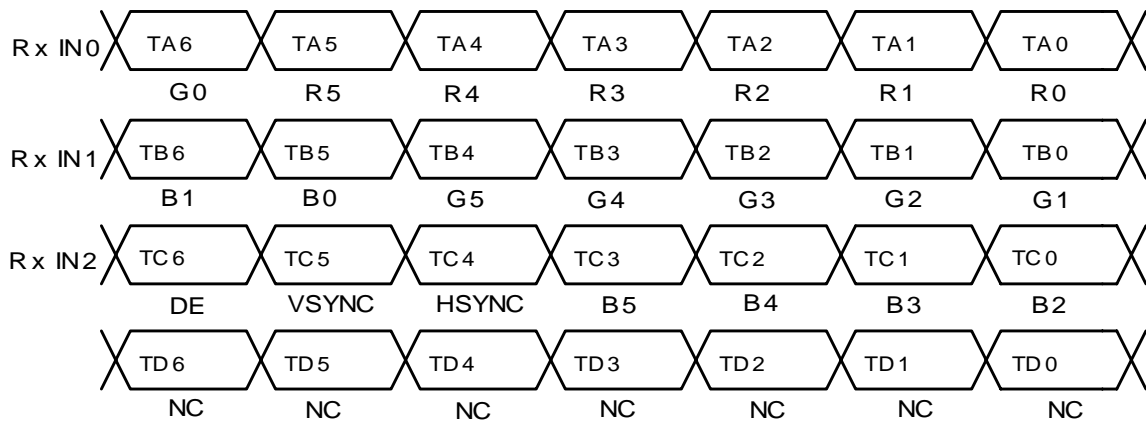
Toshiba Matsushita Display Technology Co.,Ltd	Date: 2004-04-20	New	No. LTD121EA43G-01
	Date:	Old	No.

Case2: 8bit Transmitter

THC63LVDF83A, THC63LVDM83A, THC63LVDM83A-85				LTD121EA43G Interface (CN1)		
Input Terminal No.		Input Signal (Graphics controller output signal)		Output Signal Symbol	Terminal	Symbol
Symbol	Terminal	Symbol	Function			
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	Horizontal Synchronization Signal			
TC5	28	VSYNC	Vertical Synchronization Signal			
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	CLK	Data Sampling Clock	TCLK- TCLK+	No.14 No.15	CLK- CLK+

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

Note 2) Please refer to LVDS transmitter (THC63LVDF83A, THC63LVDM83A, THC63LVDM83A-85) specifications by Thine Electronics, Inc.



2.4.7 Colors Combination Table

	Display	MSB LSB R5 R4 R3 R2 R1 R0	MSB LSB G5 G4 G3 G2 G1 G0	MSB LSB B5 B4 B3 B2 B1 B0	Gray Scale Level
Basic Color	Black	L L L 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 L L	H H H H H H H	-
	Green	L L L L L L L	H H H H H H H	L L L L L L L	-
	Light Blue	L L L L L L L	H H H H H H H	H H H H H H H	-
	Red	H H H H H H H	L L L L L L L	L L L L L L L	-
	Purple	H H H H H H H	L L L L L L L	H H H H H H H	-
	Yellow	H H H H H H H	H H H H H H H	L 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 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 L L	L 0
	Dark ↑ ↓ Light	L L L L L L H	L L L L L L L	L L L L L L L	L 1
		L L L L L H L	L L L L L L L	L L L L L L L	L 2
		⋮	⋮	⋮	L3...
		⋮	⋮	⋮	L60
		L L L L L L L	H H H H L H	L L L L L L L	L 61
	L L L L L L L	H H H H H L	L L L L L L L	L 62	
Red	H H H H H H H	L L L L L L L	L L L L L L L	Red L 63	
Gray Scale of Green	Black	L L L 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 H	L L L L L L L	L 1
		L L L L L L L	L L L L L H L	L L L L L L L	L 2
		⋮	⋮	⋮	L3...
		⋮	⋮	⋮	L60
		L L L L L L L	H H H H L H	L L L L L L L	L 61
	L L L L L L L	H H H H H L	L L L L L L L	L 62	
Green	L L L L L L L	H H H H H H H	L L L L L L L	Green L 63	
Gray Scale of Blue	Black	L L L 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 H	L L L L L L L	L 1
		L L 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 L L	H H H H L H	L 61
	L L L L L L L	L L L L L L L	H H H H H L	L 62	
Blue	L L L L L L L	L L L L L L L	H H H H H H H	Blue L 63	
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 L L	L 0
	Dark ↑ ↓ Light	L L L L L L H	L L L L L L H	L 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
		L L L L L L L	H H H H L H	H H H H L H	L 61
	L L L L L L L	H H H H H L	H H H H H L	L 62	
White	H H H H H H H	H H H H H H H	H H H H H H H	White L 63	

3. Recommended Operating Conditions ^{1) 6)}

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply Voltage	V_{DD}	3.0	3.3	3.6	V	³⁾
Differential Input Voltage	V_{ID}	100	---	600	mV	⁴⁾
Common Mode Input Voltage	V_{CM}	1.0	---	$2.4 \cdot V_{ID} / 2$	V	⁵⁾

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

Note 2) Recommended LVDS transmitter: THC63LVDF63A, THC63LVDM63A, THC63LVDM63A-85, THC63LVDF83A, THC63LVDM83A, THC63LVDM83A-85 (THine Electronics, Inc.).

Panel Controller contains LVDS, which is based on THC63LVDF84A-85 (THine Electronics, Inc.) specification.

Note 3) Checked Pin Terminal : V_{DD} , GND (GND : $V_{SS} = 0V$)

Note 4) Checked Pin Terminal: IN0+/-, IN1+/-, IN2+/-, CLK+/-, GND (0V)

Measure: $|V_{IN0+} - V_{IN0-}|$, $|V_{IN1+} - V_{IN1-}|$, $|V_{IN2+} - V_{IN2-}|$, $|V_{CLK+} - V_{CLK-}|$

Note 5) Checked Pin Terminal: IN0+/-, IN1+/-, IN2+/-, CLK+/-, GND (0V)

Measure: $1/2 \times (V_{IN0+} + V_{IN0-})$, $1/2 \times (V_{IN1+} + V_{IN1-})$, $1/2 \times (V_{IN2+} + V_{IN2-})$, $1/2 \times (V_{CLK+} + V_{CLK-})$

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 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".

4.2 Specifications

Item	Symbol	Min.	Typ. ¹⁾	Max.	Unit	Remark
Current Consumption	I_{DD}	-	225		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
8. Black

1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---

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			Unit	Remark	
			Min.	Typ	Max.			
Viewing Angle ²⁾	θ	$CR \geq 10$	$\phi = 180^\circ$	(10)	-	-	$^\circ$	Define at Contrast Ratio
			$\phi = 0^\circ$	(30)	-	-	$^\circ$	
			$\phi = 90^\circ$	(30)	-	-	$^\circ$	
			$\phi = -90^\circ$	(30)	-	-	$^\circ$	
Contrast Ratio ²⁾	CR	$\theta = 0^\circ, \phi = 0^\circ$	100	-	-	-		
Response Time ²⁾	t_{ON}	$\theta = 0^\circ, \phi = 0^\circ$	-	-	50	ms		
	t_{OFF}		-	-	50	ms		
Transmittance ³⁾⁴⁾	TR	$\theta = 0^\circ, \phi = 0^\circ$ Gray Scale Level=L63 (White)	6.8	8.0	-	%		
Chromaticity ²⁾	Red	x_R	Gray Scale Level:L63	-	(0.58)	-	-	
		y_R	$\theta = 0^\circ, \phi = 0^\circ$	-	(0.33)	-	-	
	Green	x_G	Ditto	-	(0.32)	-	-	
		y_G		-	(0.53)	-	-	
	Blue	x_B	Ditto	-	(0.15)	-	-	
		y_B		-	(0.12)	-	-	
	White	x_W	Ditto	-	(0.32)	-	-	
		y_W		-	(0.33)	-	-	

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

Note 2) Optical specification depend on backlight.

These specifications are reference value at the time of using Toshiba Matsushita Display Technology Co., Ltd. Original backlight (backlight luminance is 2500 cd/m²) for LTD121EA4X.

Note 3) This specification is the value at the time of using Toshiba Matsushita Display Technology Co., Ltd. standard light box.

Standard Light Box : Fujicolor Lightbox

Fluorescence lamp : Toshiba-made Mellow 5 (FL10EX-D-H)

Note 4) Transmittance is depend on spectrum of backlight.

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 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 0.35m by the eyes of the inspector from the module
- 5) Inspection Angle : $\theta=0^\circ$, $\phi=0^\circ$

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	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

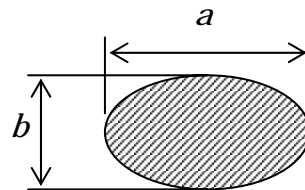
6.4.2 Specifications

Item	Description	Class																						
PCB Appearance	Pattern peeling snapping, electrically short	Major																						
	Repair portion on PCB is not covered by epoxy resin	Minor																						
Soldering	Cold solder joint, lead move when pulled	Major																						
Connectors	Distinct stain, rust or scratch	Minor																						
Black and White Spots/Lines ¹⁾²⁾	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Line Width(mm)</th> <th>Length(mm)</th> <th>Acceptable count</th> </tr> </thead> <tbody> <tr> <td>$W \leq 0.10$</td> <td>-</td> <td>neglect</td> </tr> <tr> <td>$0.10 < W \leq 0.15$</td> <td rowspan="2">$L \leq 3$</td> <td>$n \leq 8$</td> </tr> <tr> <td>$0.15 < W \leq 0.20$</td> <td>$n \leq 2$</td> </tr> <tr> <td>$0.20 < W$</td> <td>-</td> <td>³⁾</td> </tr> </tbody> </table> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Average diameter(mm)</th> <th>Acceptable count/side</th> </tr> </thead> <tbody> <tr> <td>$D \leq 0.20$</td> <td>neglect</td> </tr> <tr> <td>$0.20 < D \leq 0.50$</td> <td>$n \leq 5$</td> </tr> <tr> <td>$0.50 < D$</td> <td>0</td> </tr> </tbody> </table>	Line Width(mm)	Length(mm)	Acceptable count	$W \leq 0.10$	-	neglect	$0.10 < W \leq 0.15$	$L \leq 3$	$n \leq 8$	$0.15 < W \leq 0.20$	$n \leq 2$	$0.20 < W$	-	³⁾	Average diameter(mm)	Acceptable count/side	$D \leq 0.20$	neglect	$0.20 < D \leq 0.50$	$n \leq 5$	$0.50 < D$	0	Minor
Line Width(mm)	Length(mm)	Acceptable count																						
$W \leq 0.10$	-	neglect																						
$0.10 < W \leq 0.15$	$L \leq 3$	$n \leq 8$																						
$0.15 < W \leq 0.20$		$n \leq 2$																						
$0.20 < W$	-	³⁾																						
Average diameter(mm)	Acceptable count/side																							
$D \leq 0.20$	neglect																							
$0.20 < D \leq 0.50$	$n \leq 5$																							
$0.50 < D$	0																							
Break and Crack of Panel Outside Edge	Break : less than 2mm inward from cell outside Worsening fine crack : reject	Minor																						

Note 1) Inspection area should be within active area.

Note 2) Dusts which are bigger not less than 0.20mm ($0.20 < W$) 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), black display pattern (gray scale level L0), red display pattern (gray scale level L63), green display pattern (gray scale level L63) and blue display pattern (gray scale level L63)

6.5.2 Specifications ⁴⁾

Item	Description / Specifications	Class
Function	No display, Malfunction	Major
Display Quality ¹⁾	Missing line	Major
	Missing Sub-Pixels	Major
	1) Bright defects : 5pcs. maximum	
	2) Dark defects : 5pcs. maximum	
	3) Total sub-pixel defects : 8pcs. maximum	
	4) Bright defects distance : 15mm minimum.	
	5) Dark defects distance : 5mm minimum	
6) Bright defect conjunction (2sub-pixels) : 2sets maximum		
7) Dark defect conjunction (2sub-pixels) : 2sets maximum		
	Inconspicuous flicker, crosstalk, Newton's ring and other defects : neglect	-
Black and White Spots/lines	Inconspicuous defects : neglect	-

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.

6.6 Reliability Test (Reference)

6.6.1 Test Conditions³⁾

- 1) The module without backlight should be driven and inspected under normal test conditions.
- 2) The module without backlight should not have condensation of water (moisture) on the module without backlight.
- 3) The module without backlight should be inspected after two or more hours storage in normal conditions (15 - 35°C, 45 - 65%(RH)).
- 4) A module without backlight shall be used only for one test.

6.6.2 Specifications

The module without backlight 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

Note 1) Operating

Note 2) Non-Operating

Definitions of failure for judgment shall be as follows:

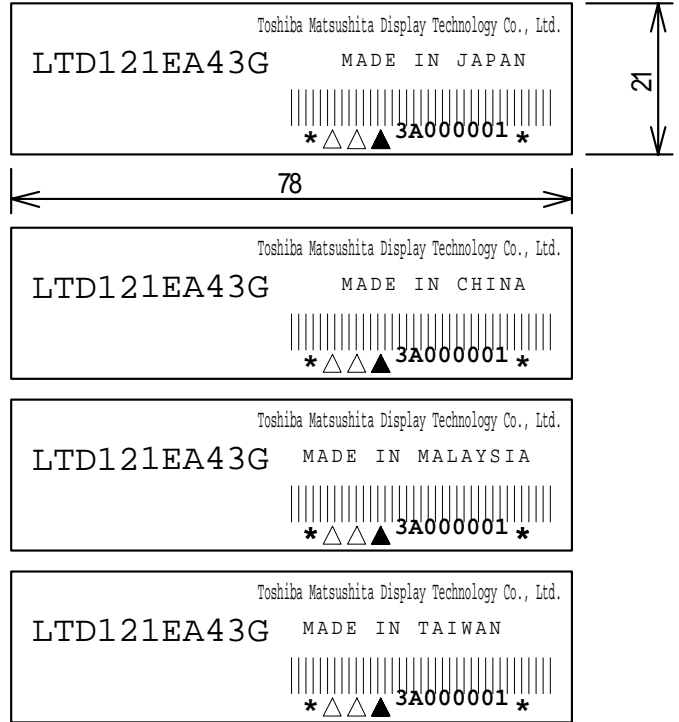
- 1) Function of the module without backlight should be maintained.
- 2) Current consumption should be smaller than the specified value.
- 3) Appearance and display quality should not have distinguished degradation.

6.7 Labels

(1) Product Label

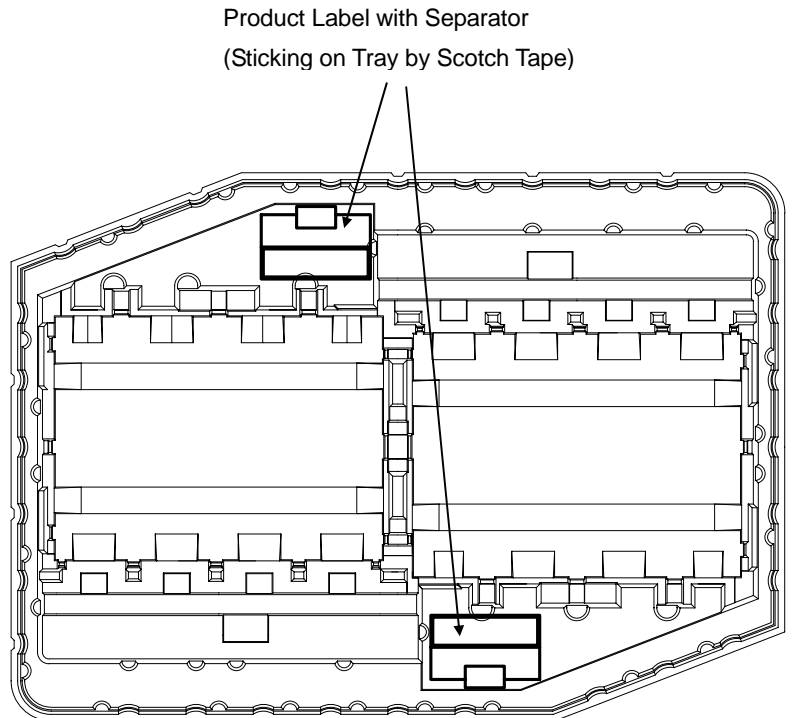
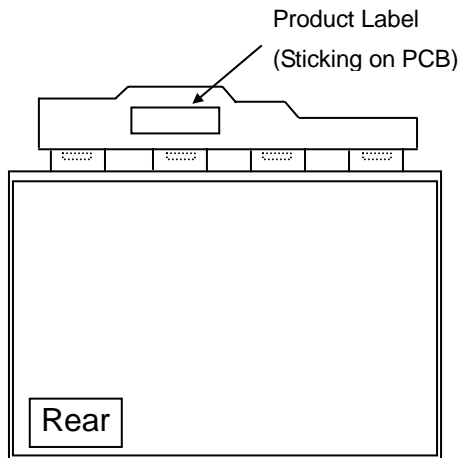
Serial number : $\triangle\triangle \blacktriangle 3A 0 00001$
 ① ② ③④ ⑤

- ① : Module type code
 - ② : Manufacturing code
C, K, G, R, M, W, T
 - ③ : Lot code $3 \quad A$
(1) (2)
(1):Year code-end of the A.D.
(2):Month code-alphabet→ Jan. : A - Dec. : L
(Example: 3A→2003 JAN.)
 - ④:Revision No.
 - ⑤: Serial code
decimal, 5 figures
- Bar code of serial number : CODE-39 High-density



(2) Label Locations

Product labels are stuck on two position as follows.



7. Lifetime

7.1 Module without backlight

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)

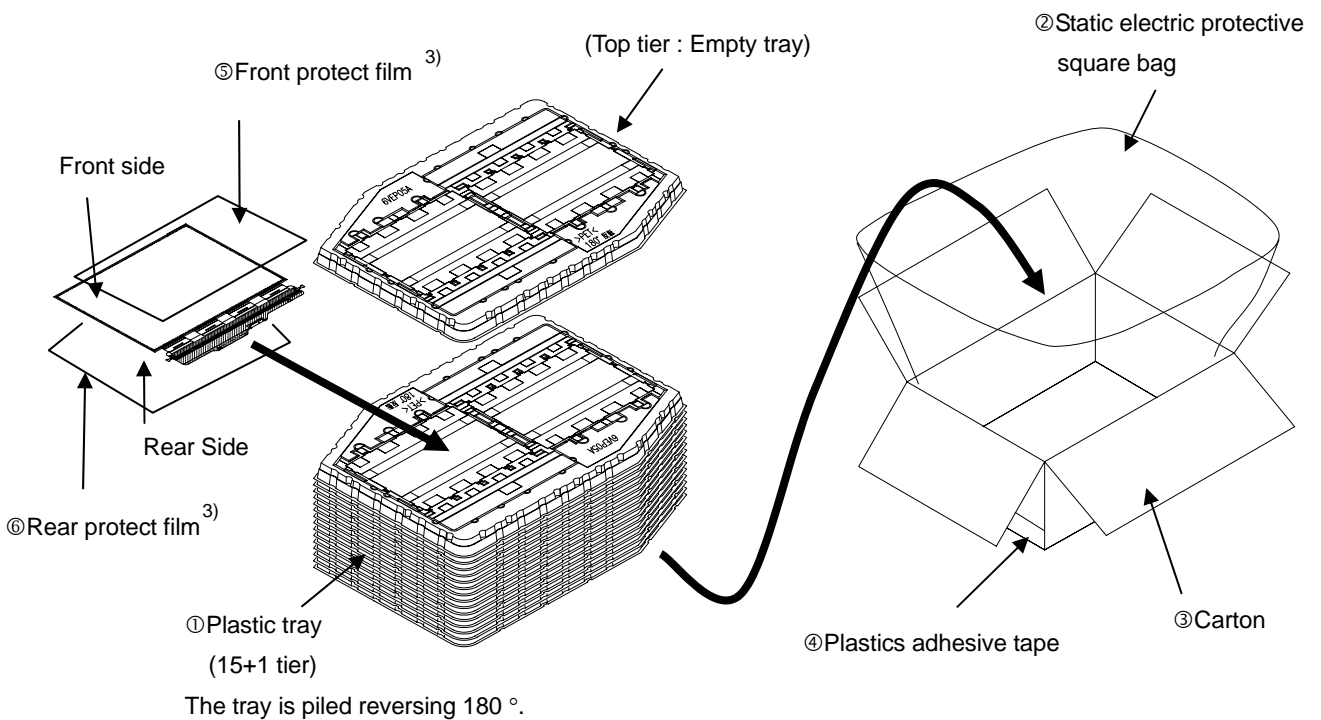
8. Packaging

8.1 Carton (internal package)

(1) Packaging Form

Corrugated cardboard box

(2) Packaging Method ¹⁾²⁾

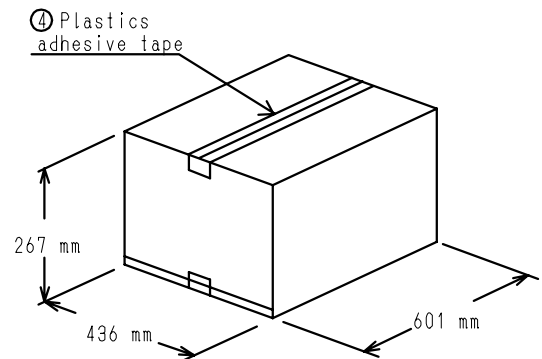


Note 1) Total weight: (Approx.) 8 kg

Note 2) Acceptable number of carton piling: 20 sets

(3) Packaging Material

Number	Quantity	Description
①	16p	Plastic tray
②	1 set	Static electric Protective square bag
③	1set	Carton
④		Plastics adhesive tape
⑤	1sheet	Front protect film ³⁾
⑥	1sheet	Rear protect film ³⁾



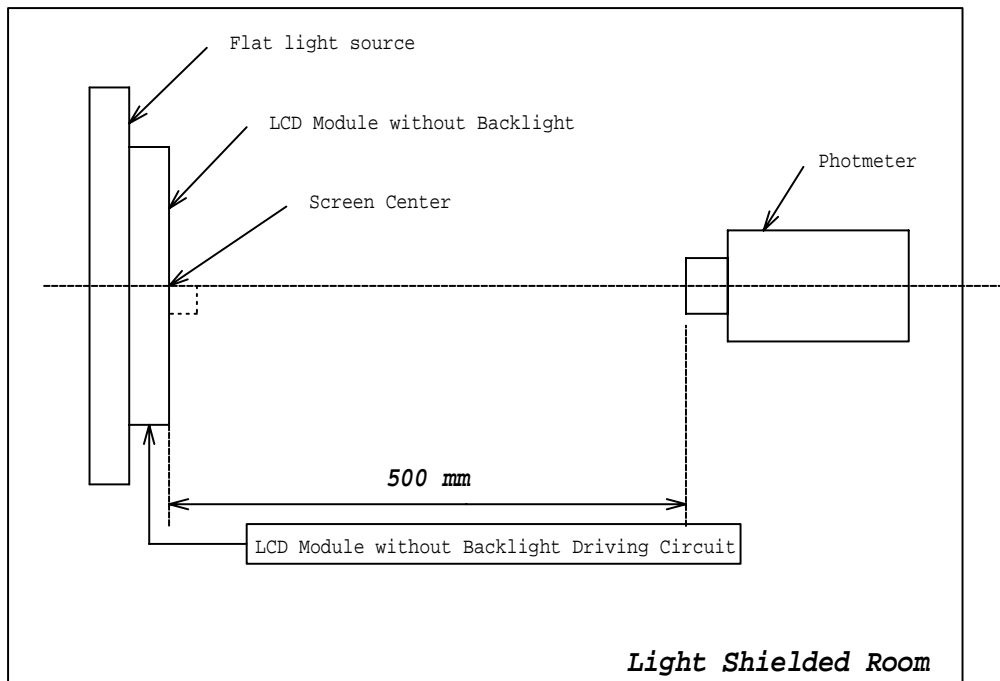
Note 3) There are two kinds of protection files on cell. One is the original protection film of polarizer, the other is the protection film equivalent to it.

9. Warranty

Finish of warranty term is until arrival at your factory. (except defect which is clearly responsible for Toshiba Matsushita Display Technology Co., Ltd.)

10. Measuring Method

10.1 Measuring System

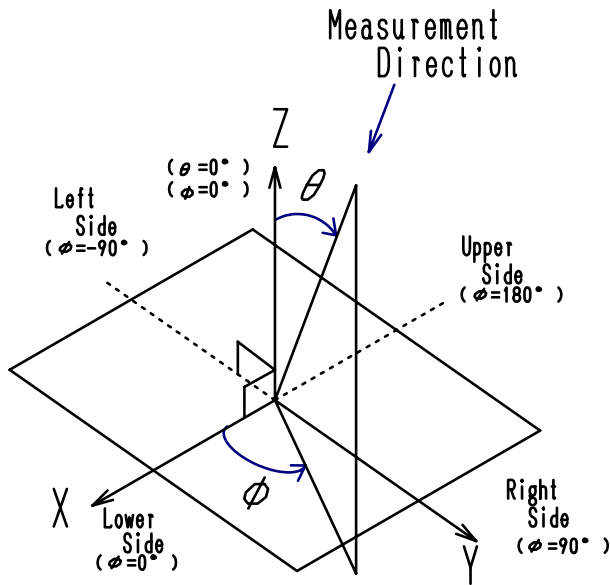


(1) The measurement point is the center of the active area.

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

(3) As flat light source, Toshiba Matsushita Display Technology Co., Ltd. original backlight for LTD121EA4X should be used except for the measurement of transmittance.

(4) Definition of ϕ and θ :



10.2 Measuring Methods

(1) Transmittance

The transmittance can be calculated by the following expression.

$$\text{Transmittance (TR)} = \frac{L_{\text{LCD}}}{L_{\text{BL}}} \times 100 \%$$

L_{LCD} : Luminance at the time of putting non-operating cell on light box

L_{BL} : Luminance of Toshiba Matsushita Display Technology Co., Ltd. standard light box

Standard Light Box : Fujicolor Lightbox

Fluorescence lamp : Toshiba-made Mellow 5 (FL10EX-D-H)

(2) Contrast Ratio:

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

L_{63} : 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.

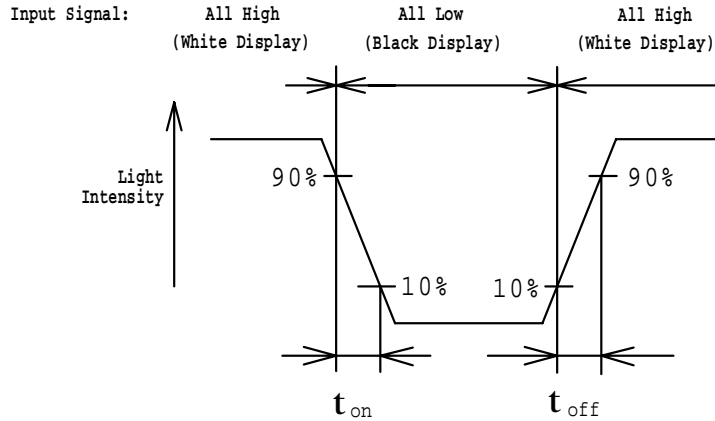
(Refer to 11.1(3) for the axes.)

(4) 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.

(5) 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 90% value to 10% of its maximum.

t_{off} : Turn off time is the time for a photo detector output waveform to go from 10% 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)