To:

Display
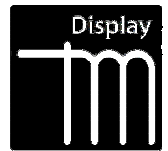
APPROVAL SIGNATURE

SPECIFICATION

FOR

TOSHIBA MATSUSHITA DISPLAY TECHNOLOGY

TFT-LCD MODULE

LTA070B343A

SPECIFICATION No. : _____

LTA070B343A-00

DATE OF ISSUE : 2004-12-02

(DATE OF EXPIRY : 2007-12-02)

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Revision History

Date	Sheet (New)	Item	Old	New	Reason

Toshiba Matsushita Display Technology Co., Ltd	Date: 2004-12-02 New No. LTA070B343A-00
	Date: Old

←#   Special   ←&   Addition   ←   Change

Caution and Handling Precaution

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

Toshiba Matsushita Display Technology always 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 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.

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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) 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.

6) DISPOSAL

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

7)   EDGES OF PARTS

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

8) * LUMINANCE DECREASE OF FL

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.

9)   RECOMMENDED OPERATING CONDITIONS

Don't exceed "the recommended operation conditions" in this specification. (The LCD module should be used within "the recommended operation conditions".)
The performance and quality of the LCD module are warranted only when the LCD module is used within "the recommended operation conditions". Toshiba Matsushita Display Technology never warrants the performance and quality of the LCD module when you use the LCD module over "the recommended operation conditions", although within "the absolute maximum rating". To use the LCD module over "the recommended operation conditions" may have bad influence on the characteristics and reliability of the LCD module and may shorten the life of the LCD module.
Therefore, when designing the whole set, not to be over "the recommended operation conditions", you should fully take care of supply voltage change, characteristic of connection parts, serge of input-and-output line, and surrounding temperature.

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)   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.

5)   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

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

Power supply lines should be designed as follows.
Power supplies should always be turned on before the input signals are applied to LCD module, and the input signals should be disconnected before power supplies are turned off.
The detailed sequence of power supplies and signals are described in the individual specification.
In addition, refer to individual specifications for unused terminals.

3)   FL CABLE CONNECTION

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

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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.

For Installation in Assembly

3-1 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.

3-2 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.

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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.

3-3 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.

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3-4 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) 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.

5) 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.

3-5 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 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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CONTENT

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1 **Scope**

This specification is applicable to Toshiba Matsushita Display Technology's Full Color TFT-LCD module "LTA070B343A" designed for portable DVD monitor use.

2 **Specifications**

2.1.　General specifications

Items		Specifications	Note
Screen size		18cm (7-Type) diagonal screen	
Display mode		TN full color, Transmissive type	Normally white
Contents		TFT-cell, Drivers-IC, Backlight-unit	
Viewing direction		6 o'clock (in direction of maximum CR)	Refer to figure A (Next sheet)
Driving method		a-Si TFT active matrix, Line sequential scanning Non-Interlace drive	
Input signal	Sync.	Horizontal/Vertical start pulse and clock Vertical (gate) enable	
	Signal	Specified analog RGB signals (H-line inverted)	
	Common	H-line alternate signal	
Number of pixels		480(W) x 234(H)	Note 1
Number of sub-pixels		1440(W) x 234(H)	Note 1
Pixel pitch		0.321(W) x 0.370(H)	[unit: mm]
Pixel arrangement		RGB stripe	Note 1
Outline dimension		166.0(W) x 100.0(H) x 7.0(D)　(typ.)	[unit: mm]
Backlight		FL side light (L type 1 lamp)	
Surface treatment		Anti-glare coating on LCD panel surface.　Wide view film	
Weight		175 (typ.)	[unit: g]

Note 1: Pixel arrangement
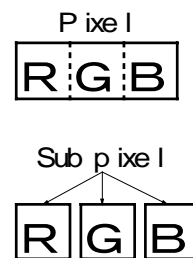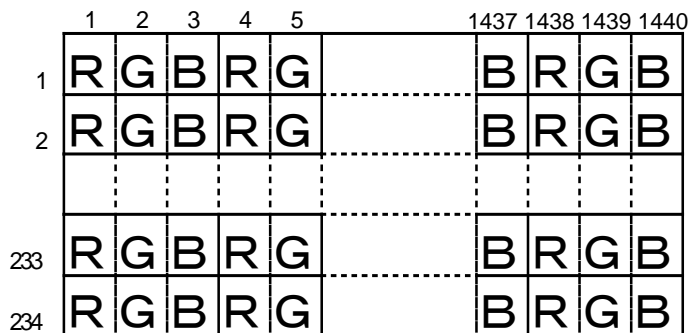
Figure A: Viewing direction

Viewing direction: 6 o'clock (Max. contrast ratio)
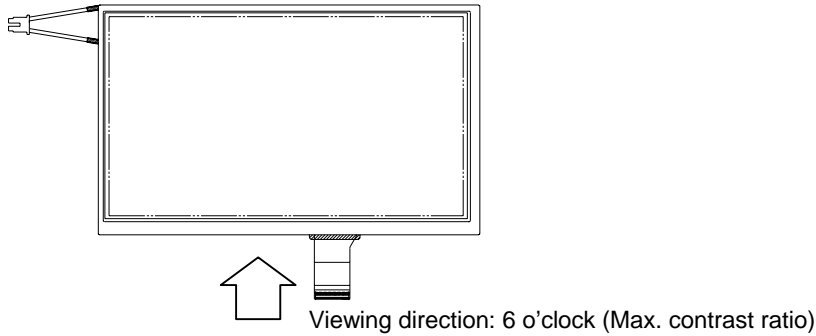
2.2. Absolute maximum ratings

(Note 1)

CHARACTERISTICS	SYMBOL	CONDITION	MIN.	MAX.	UNIT	REMARKS
Logic voltage	VDD	Ta=25°C	-0.3	6.5	V	
Source driver voltage	VEE	Ta=25°C	-0.3	6.5	V	
Logic signal voltage	VIN	Ta=25°C	-0.3	VDD+0.3	V	
Analog input voltage	VANA	Ta=25°C	-0.3	VEE+0.3	V	Note 4
Gate driver positive voltage	VGON	Ta=25°C	-0.3	45.0	V	VSS=0
Gate driver negative voltage	VSS	Ta=25°C	VGON-45.0	VGON+0.3	V	
Back light input voltage	VBL	Ta=25°C	-	3000	ACVrms	
Operation temp	Top	-	-20	70	°C	Note 2, 3
Operation humidity	Hop	-	-	90	%(RH)	
Storage temp	Tstg	-	-30	80	°C	Note 3
Storage humidity	Hstg	-	-	95	%(RH)	

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

Note 2: The temperature of the module rises under the influence of the backlight. Please design that all parts of this module do not to exceed maximum operation temperature (Top).

Note 3: The temperature on TFT-LCD panel surface.

Note 4: Terminals: VB, RED, GREEN, BLUE

2.3. Mechanical specifications

2.3.1 Device outside view

Item	Specification	Unit	Remarks
Outline dimension	166.0 (W) x 110.0 (H) x 7.0 (D)	mm	Typ.
Active area:	154.08 (W) x 86.58 (H)	mm	
Viewing area	156.08 (W) x 88.58 (H)	mm	

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Device outside view

Unit: mm

Front side

Dot number (W×H) : 1440×234
Dot pitch   : 0.107×0.370
RGB arrangement : Vertical stripe

No1 PIN LOW
No2 PIN HIGH

Thermal contractile tubes

159.7 (Frame window)
154.08 (Active area)
166±0.3

30.2±0.2   51±0.2   51±0.2
3.6±0.15   3.6±0.15   3.6±0.15

Square holes for installing(2holes).
The usable depths of these holes are within 1.6mm.

Main viewing angle direction

Square holes for installing (2holes).
The usable depths of these holes are within 0.5mm.

The notch of the shield case

Square holes for installing (2holes).
The usable depths of these holes are within 0.5mm.

Note) Keep the mask and/or its burrs away from the polarizer. The luquid crystal may look like waving when the mask is touching the polarizer.

SECT A−A
(S=5/1)

30.5±0.2   103±0.2
3.6±0.15   3.6±0.15

27.5   15   28±1
15.5
(20)   (64.24)

No. 1 pin
No. 30 pin

Flexible cable contacting surface (back side)

Polarizer
LCD Panel
Mask
154.08 (Active area)
86.58 (Active area)

Note)
・Please ask us when you design masking structure because the light leak from the outer side of active area may occur.

Masking dimension recommended
(X:1)

The ejection points of the lamp harness

Caution label

Back frame window

Product label

140   12
74
60
φ1穴

Square holes for installing (2holes).
The depths of these holes are within 0.5mm.

Note   ・Main viewing angle is 6 o'clock direction when FPC is located below the panel.
・This dimension should be measured under the condition pressed by the force of 9.8N with 10mm diameter gauge. And it should not contain slight swelling.
・Do not touch FPC with other parts by force. Please use FPC with bending naturally.
・General tolerance is ±0.3

The two zones on the rear side of the module (illustrated with the stripes   ) are to be labelled, so your design need to make the point to be grounded without these areas.

●Never fail to connect the front(or the back) cover of the set to the ground.

BM
Polarizer
Active area
BM1.5

Polarizer attachment position

2.4. Electrical specification

2.4.1 Circuit block diagram

| 1,1 | 2,1 | - | 1440,1 |
| 1,2 | 2,2 | - | 1440,2 |

LCD panel

(1440W x 234H dots)

| 1,233 | 2,233 | -- | 1440,233 |
| 1,234 | 2,234 | - | 1440,234 |

Gate driver

Source driver

FPC

CN2

CN1

CCFL

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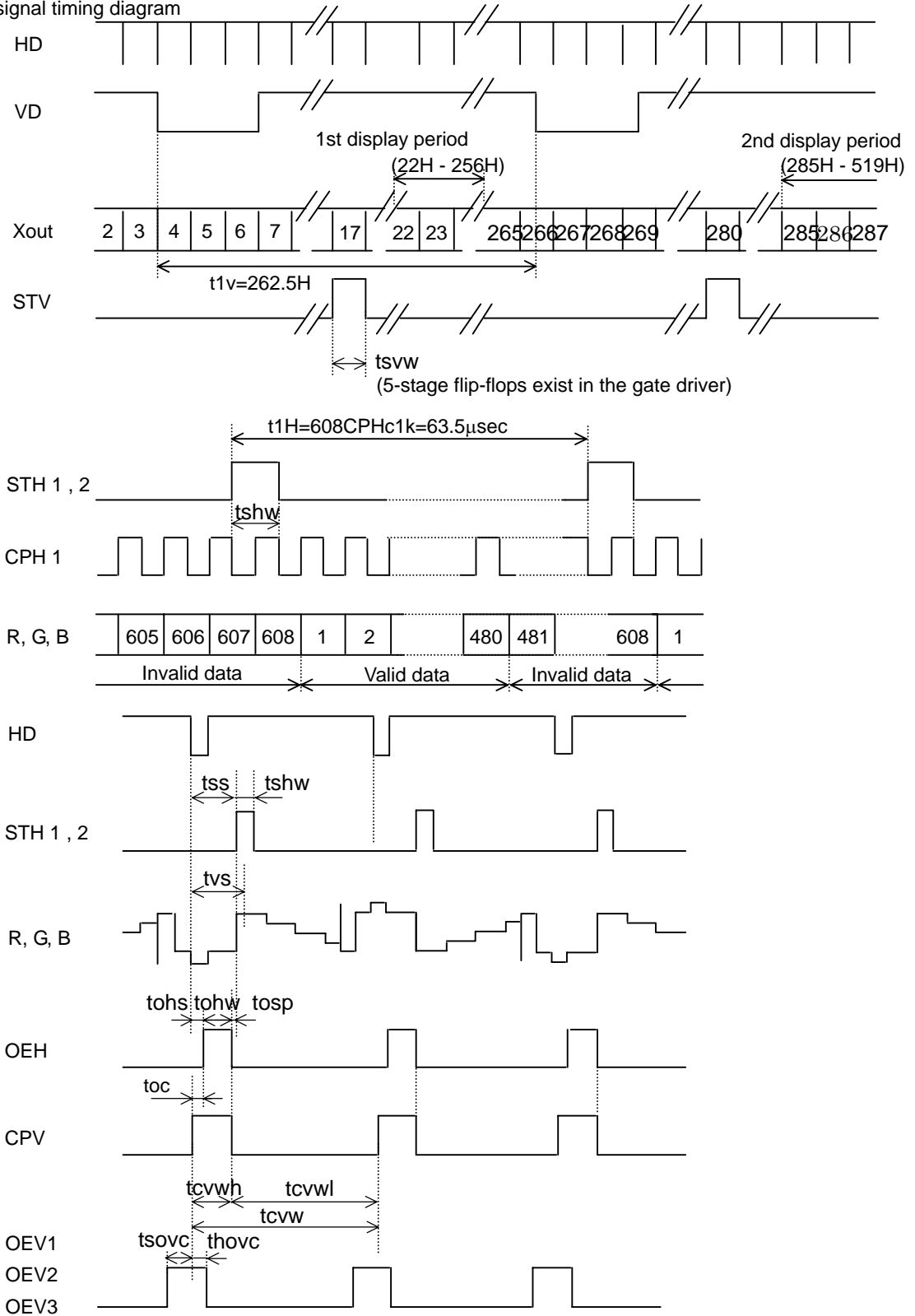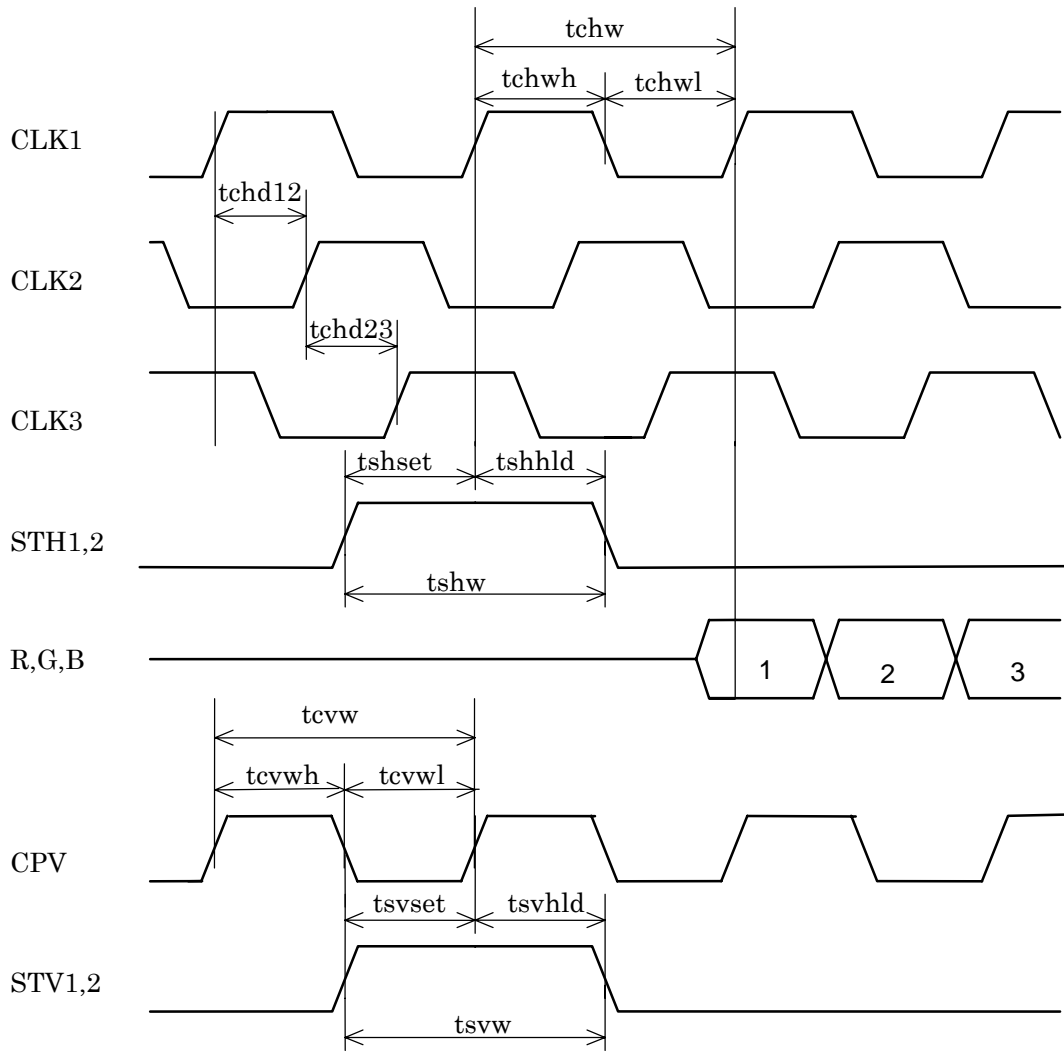
2.4.2   Timing chart

(1)Video signal timing diagram

*At the full scan mode

Note: At the time of a power on sequence, OEV should hold on "Hi" at least 1 field scanning period (t1V), after STV and
CPV are outputted.

(2)Control signal timing diagram

2.4.3 Timing characteristics of input signals

CHARACTERISTICS	SYMBOL	MIN	TYP	MAX	UNIT	REMARKS
1 Field scanning period	t1V	-	262.5	-	H	
1 Line scanning period	tylH	-	63.5	-	μs	
Source driver operating frequency	fhc	1.00	9.56	10.00	MHz	CLK full scan mode
	fhc			(14.4)	MHz	side panel area
Signal sampling pulse width	tchw	100.0	104.6	1000.0	ns	
Signal sampling pulse delay	tchd	31.4	34.9	38.4	ns	
Signal sampling pulse width(H)	tchwh	47.1	52.3	57.5	ns	tchd 12,23
Signal sampling pulse width(L)	tchwl	47.1	52.3	57.5	ns	
Source start signal pulse width	tshw	30.0	104.6	208.0*	ns	*tshset=tshhld
Source start signal setup time	tshset	10.0	52.3	-	ns	
Source start signal hold time	tshhld	20.0	52.3	-	ns	
Source output enable pulse width	tohw	7.5	8.0	8.5	μs	
Source start signal rising time	tss	1.45	9.85	10.96	μs	
Video input signal start point	tvs	1.59	10.00	11.11	μs	
Phase difference between OEH & CPV	toc	1.5	2.3	-	μs	
Phase difference of the standup of CPV, and standup of OEV	tsovc	1.0	1.5	2.0	μs	
Phase difference of the standup of CPV, and falling of OEV	thovc	2.0	3.0	4.0	CLK	
Gate clock period	tcvw	10.0	63.5	-	μs	
Gate clock pulse width (H)	tcvwh	5.0	10.3	58.5	μs	
Gate clock pulse width (L)	tcvwl	5.0	53.2	58.5	μs	
Gate start signal pulse width	tsvw	5.0	63.5	126.0**	μs	**tsvset=tsvhld
Gate start signal setup time	tsvset	2.00	31.75	-	μs	
Gate start signal hold time	tsvhld	2.00	31.75	-	μs	
Phase difference between OEH & STH	tosp	0.0	0.5	-	μs	
Phase difference between SYNC & OEH	tohs	-	1.4	1.9	μs	

Note:

Rise time (tr) and fall time (tf) of source driver logic signal are less than 6ns.

Rise time (tr) and fall time (tf) of gate driver logic signal are less than 50ns.

Rise time (tr) and fall time (tf) of OEH are less than 200ns.

Rise time (tr) and fall time (tf) of OEV are less than 200ns.

Rise time (tr) and fall time (tf) is defined as the time from 0% to 63.2%.

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2.4.4　Interface

[CN1]LCD FPC Cable　　　　　　　　　Mating connector: IL-FPR series/Japan Aviation Electronics Industry, Limited

Pin NO	SYMBOL	Function	Remarks
1	VCOM	Voltage applied to color filter substrate	Note 1
2	STH1	Source scanning start signal 1	Note 3
3	VB	Source output current adjustment	
4	RED	Red video signal	Note 1
5	GREEN	Green video signal	Note 1
6	BLUE	Blue video signal	Note 1
7	OEH	Source driver output enable	
8	VDD	Power line for logic	Note 1
9	MODE	Sampling mode change　(H: Simultaneous, L: Sequential)	Note 4
10	CLK1	Source driver clock input 1	Note 4
11	CLK2	Source driver clock input 2	Note 4
12	CLK3	Source driver clock input 3	Note 4
13	RL	Right / Left scanning change	Note 3
14	STH2	Source scanning start Signal 2	Note 3
15	VEE	Power line for source driver IC	Note 1
16	GND	Ground	
17	VCOM	Voltage applied to color filter substrate	Note 1
18	STV2	Gate scanning start signal 2	Note 2
19	OEV3	Gate driver output enable 3	
20	OEV2	Gate driver output enable 2	
21	OEV1	Gate driver output enable 1	
22	CPV	Gate driver scanning clock pulse	
23	U/D	Up/Down scanning change	Note 2
24	STV1	Gate scanning start signal 1	Note 2
25	NC	Non connect	
26	VSS	Gate driver negative voltage	Note 1
27	GND	Ground	
28	VDD	Power line for logic	Note 1
29	NC	Non connect	
30	VGON	Gate driver positive voltage	Note 1

[CN2] FL power source (connector: BHSR-02VS-1 / J.S.T. Mfg. Co., ltd.)

No.	Symbol	Functions	I/O	Remarks
1	V_{FLL}	FL power supply for Backlight (GND)	Input	White
2	V_{FLH}	FL power supply for Backlight (HOT)	Input	Red

　Mating connector: SM02 B-BHSS-1 / J.S.T. Mfg. Co., ltd.

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Note 1: Refer to 2.4.5Sequence for power on/off and signal on/off for Input supply voltage sequence.

Note 2: Switch scanning direction of UP/DOWN as follows:

	UD	STV1	STV2	Remarks
Reverse shift	Hi	Input	Output	
Order shift	Lo	Output	Input	usual

Note 3: Switch scanning direction of RIGHT/LEFT as follows:

	RL	STH1	STH2	Remarks
Order shift	Hi	Input	Output	usual
Reverse shift	Lo	Output	Input	

Note 4: Set source sampling mode as follows:

	MODE	CLK1	CLK2	CLK3
Sequential sampling	Lo	Input	Input	Input
Synchronous sampling	Hi	Input	Hi	Hi

Note 5: Refer to 4.2.2Electrical standard and 2.4.3Timing characteristics of input signals for each electrical specifications.
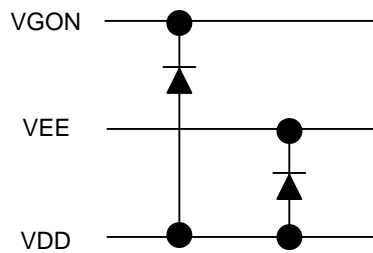
Note 6: Refer to 2.3.1Device outside view for arrangement of Input/Output terminals.

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2.4.5   Sequence for power on/off and signal on/off
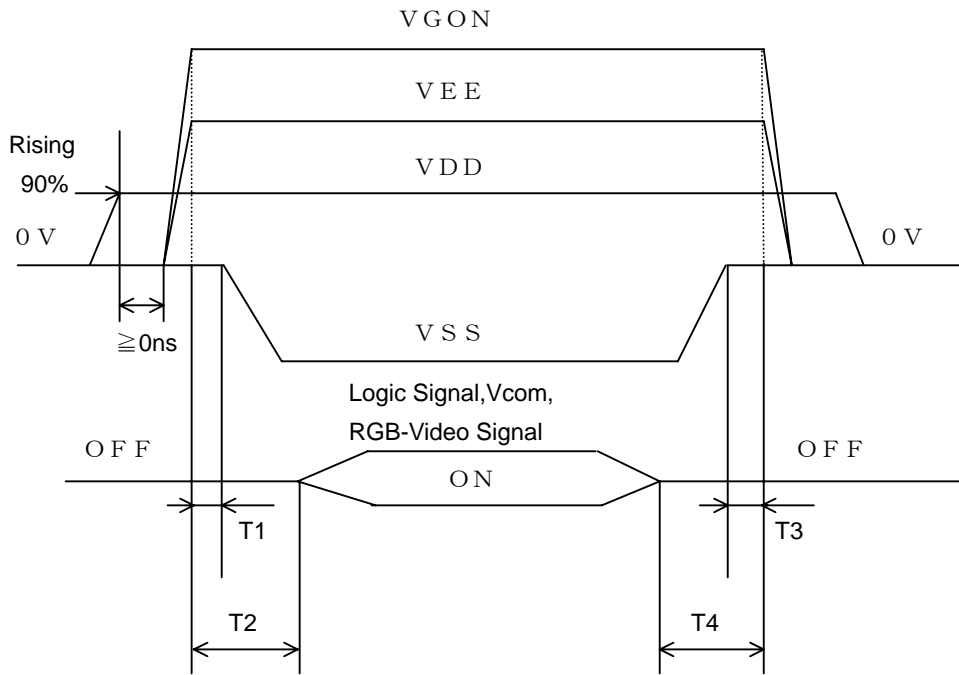
1) 10ms $\leq$ T1 $<$ T2 , 0 $<$ T3 $<$ T4 $\leq$ 10ms

2) Please use the schottky Barrier Diode among VDD,VEE and VGON, as follows;

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3　Recommended operating conditions

(Note 1)

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARKS
IC logic voltage	VDD	2.7	3.3	3.6	V	
Source driver IC voltage	VEE	4.5	5.0	5.5	V	
Logic signal input voltage	VIL	0	-	0.20*VDD	V	
	VIH	0.80*VDD	-	VDD	V	
Black input voltage(+)	VSB+	(0.20)	0.75	(VSW+)	V	R,G,B, VEE=5.0V Note2
White input voltage(+)	VSW+	(VSB+)	4.25	(4.80)	V	R,G,B, VEE=5.0V Note 2
Black input voltage(-)	VSB-	(VSW-)	4.25	(4.80)	V	R,G,B, VEE=5.0V Note 2
White input voltage(-)	VSW-	(0.20)	0.75	(VSB-)	V	R,G,B, VEE=5.0V Note 2
Source signal width	VSPP	-	3.5	VEE-0.4	Vpp	R,G,B　Note 2
Source driver center voltage	VSC	2.3	VEE/2	2.7	V	R,G,B
Source output current adjustment	VB	1.8	2.0	2.2	V V V	VEE=5.0V VSPP=3.5V VCPP=7.0V
Gate driver positive voltage	VGON	16.0	17.0	18.0	V	
Gate driver negative voltage	VSS	-14.0	-13.0	-12.0	V	
V center applied to color filter sub.	VCOM	-0.5	0.5	1.5	V	Note 4
V amplitude applied to color filter sub.	VCPP	3.0	7.0	9.0	Vpp	Note 3
(VSPP+VCPP)/2	-	-	-	5.5	V	
FL input current	I_{FL}	3.0	6.5	7.0	mA(rms)	
FL driving voltage	V_{FL}	-	600	-	V(rms)	I_{FL}=6.5mA(rms)　Note 5
FL driving frequency	f_{FL}	30	40	70	kHz	Note 6
FL starting voltage	V_{SFL}	1900	-	-	V(rms)	-20°C　Note 7

Note 1 : The recommended operating conditions show the ranges in which the device can operate normally. Operation beyond
　　　　the limit of the recommended operating conditions is not assured, even though operating conditions are within the limit
　　　　of the absolute maximum ratings.

Note 2 : H-line inverted drive.

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Note 3: Source signal width (VSPP) and V amplitude applied to color filter sub. (VCPP) ;

RGB video signal and VCOM should be inverted every 1H as follows (an example of input timing).

VCOM driving circuit should be designed with 50Ω or less output impedance.
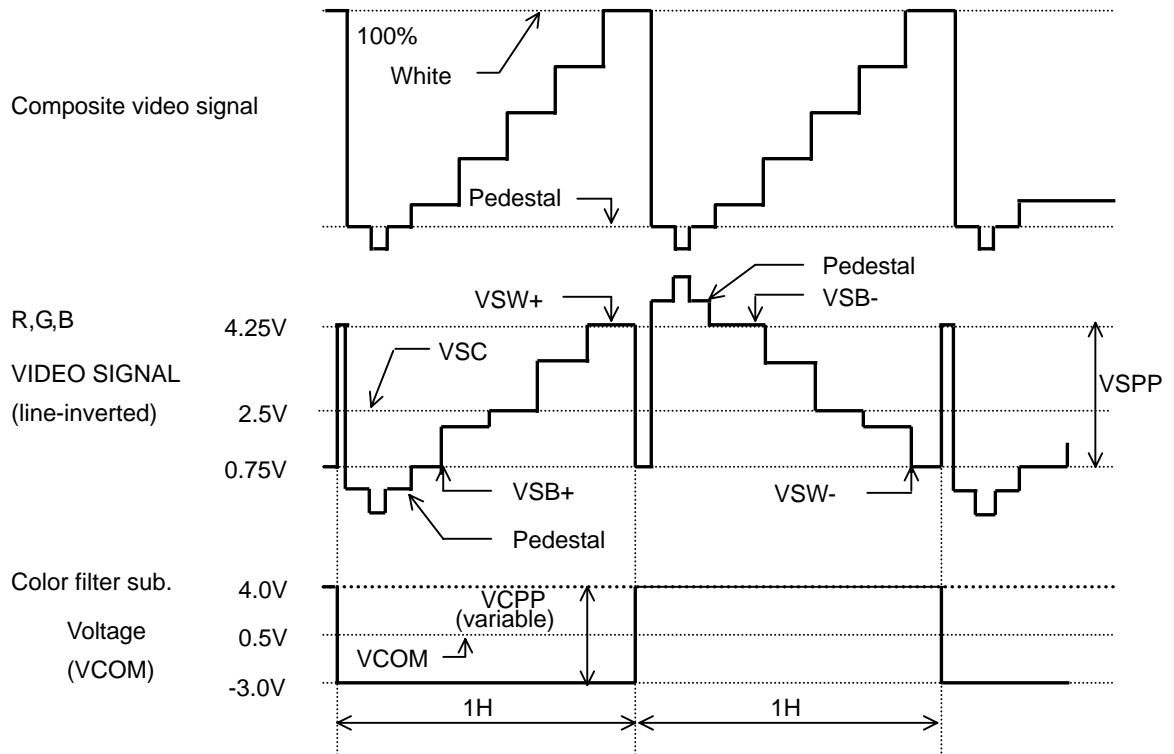
Note 4: Adjust for minimum flicker.

Note 5: FL input current values are reference.

Note 6: Recommended for Horizontal frequency: 40.0kHz

Note 7: Initial value.

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4 Product specification

4.1. Mechanical test

4.1.1 Appearance

(1) Standard measurement conditions;

Illumination:	Approximately 500 (lx)
Distance between eyes and LCD:	Approximately 0.3 (m)
Driving condition:	Non-operation

(2) Appearance specification

Inspection parts	Items		Standard		Remarks
Cell	Front side scratch	Line	**Line width (mm)** / W< 0.05 / 0.05 ≤ W< 0.15 / 0.15 ≤ W	**Acceptable count / length** / neglect / total length ≤ 50mm / NG	Note 1
		Spot	**Size (sub pixel)** / D < 1 / 1 ≤ D < 3 / 3 ≤ D	**Judgment** / neglect / 1 dark sub pixel / NG	
	Rear side scratch		Same as front scratch standard. (Condition : front view)		
	Flaw		Display of the module should be maintained.		
	Dirt		No dirt which can not be cleaned easily.		
	Discoloration		No conspicuous discoloration.		
Shield case (Black front shield case)	Scratch	Line	**Line width (mm)** / W < 3.0 / 3.0 ≤ W	**Acceptable count / length** / neglect / total length ≤ 90mm	
		Spot	**Diameter (mm)** / D < φ 3.0 / φ 3.0 ≤ D	**Acceptable count / length** / n ≤ 3 / NG	
	Dirt		No dirt which can not be cleaned easily.		
	Burr		No injurious burrs.		
Interface connector and Backlight cable	Scratch		No scratch.		
	Distortion		No distortion.		

Note 1 : Inspection range : Active area + 1mm
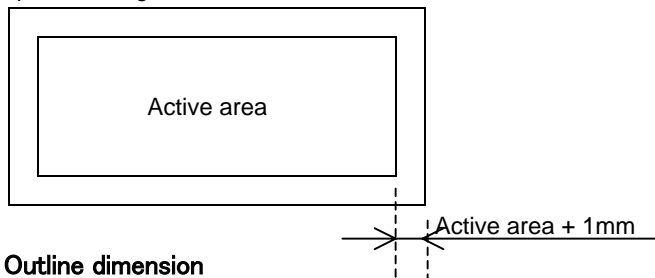
4.1.2 Outline dimension

Refer to 2.3.1 Device outside view

4.1.3 .Serial number label

(1) Product label

      a) Label indications

[1] The liquid crystal display model number

2-dimensional symbol

LTA070B343A
D0000001   03/05

[2] Manufacturing place & Serial

[3] Production date
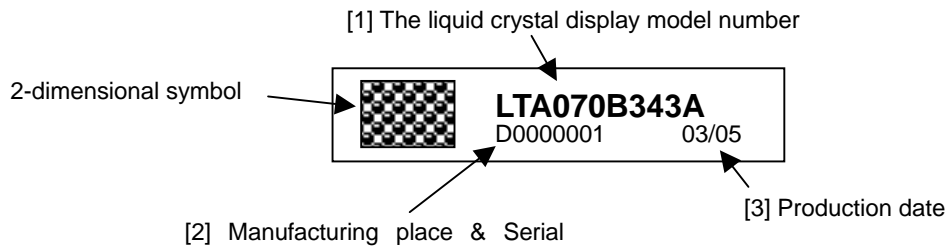
	Items		Contents
Product label	[1] LCD model number		LTA070B343A
	[2] Manufacturing place & Serial number		Structure of indication A 0000001 (a) (b) (a) Manufacturing place (b) Serial number Decimal system, seven figures

	[3] Production date		Structure of indication
			03 / 05
			(c) (d)
			
			(c) Year code
			    2003 → 03
			(d) Month code
			    May → 05

b) Others

    Bar cord: 2-dimensional symbol

    Stuck place: refer to 2.3.1Device outside view.

(2) Caution label

高圧注意
HIGH   VOLTAGE

    * Stuck place: refer to 2.3.1Device outside view.

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4.2. Electrical characteristic test

4.2.1 Common test conditions

Ambient temperature: *T*a 25±2°C
Ambient humidity: *H*a 40-70% (RH)
Supply voltage: Refer to 3Recommended operating conditions typ. value.
VDD=+3.3V, VEE=+5.0V, VGON=+17.0V, VSS=-13.0V
Input signal: Refer to 3Recommended operating conditions. typ. value.
VSC=+2.5V, VSPP=7.0V(p-p), VCOM=Adjust for minimum flicker.
Timing spec: Refer to 3Recommended operating conditions. typ. value.
Inverter: HIU-742A; 16.5pF (HARISON TOSHIBA LIGHTING Corp.) or equivalent
FL input current: Refer to 3Recommended operating conditions. typ. value.   IL=6.5mArms
FI driving frequency: Refer to 3Recommended operating conditions. typ. value.   FL=40kHz
Measured after 30 minutes operation.

4.2.2 Electrical standard

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARKS
Logic supply current	IDD	-	1.79	3.60	mA	VDD=3.3V Note 1
Source driver IC supply current	IEE	-	19.60	39.20	mA	VEE=5.0V, VB=2.0V, Note 1
Gate driver IC positive supply current	IGH	-	0.12	1.00	mA	VGON=17.0V Note 1
Gate driver IC negative supply current	ISS	-1.00	-0.30	-	mA	VSS=-13.0V Note 1

Note 1: Not peak current value but regular one.

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4.3. Optical characteristic test

4.3.1   Common test conditions

Same as 4.2.1Common test conditions.

Refer to 6Measuring method for optical characteristic and display quality for measurement method.

4.3.2   Optical characteristic standard

CHARACTERISTICS	SYM BOL	CONDITION			STANDARD VALUE			UNIT	measuring method
		θ	ϕ	C.	MIN.	TYP.	MAX.		
1.Brightness *note	B	0°	0°		300	400	-	cd/m^2	IL=6.5mArms
2.Contrast Ratio	Cmax	best angle			100	300	-	-	
3.White color chromaticity	X	0°	0°		0.275	0.315	0.355	-	
	Y	0°	0°		0.300	0.340	0.380	-	
4.Brightness uniformity	-	0°	0°		0.7	-	-	-	
5.Vertical viewing Angle	θU	-	0°	≥10	20	30	-	°	
	θD	-	0°	≥10	40	60	-	°	
6.Horizontal Viewing Angle	ϕL	0°	-	≥10	45	60	-	°	
	ϕR	0°	-	≥10	45	60	-	°	
7.Response Time	τr	0°	0°		-	11	22	ms	
	τd	0°	0°		-	22	44	ms	
8.Backlight life		-	-	-	(10000)	-	-	h	Continuous lighting Note 1

Note 1: Period till Brightness falls 50% from the initial value.   Reference value at continuous lighting.

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←#   Special   ←&   Addition   ←   Change

4.4. Display quality

4.4.1　Common test conditions

Same as 4.2.1Common test conditions

4.4.2　Display quality standard and judgment criteria

(A) Display quality standard

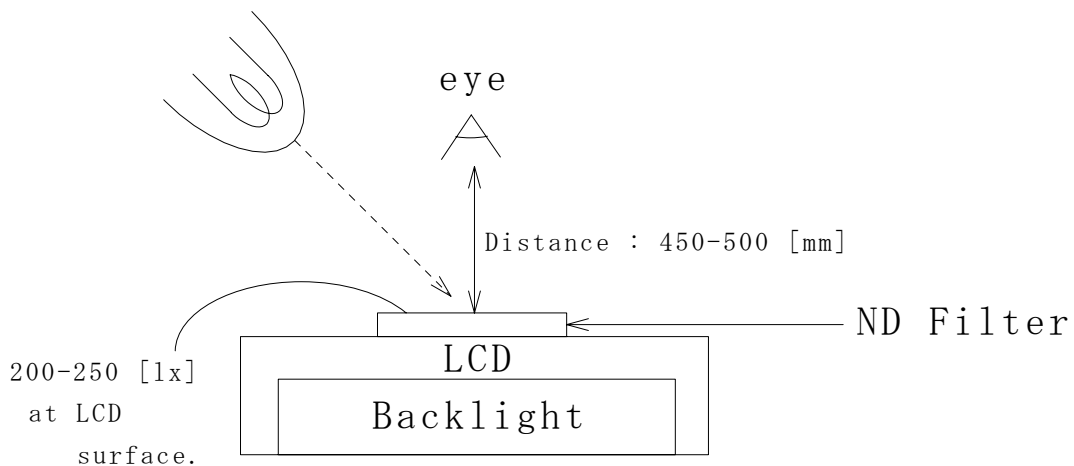| Items		Definition	Standards
Display defect	Line	Black, white, color line. Horizontal or vertical line missing.	No defect
	Sub-pixel	1)Bright sub-pixel 　Bright defect (Black background : VSPP=0V) 2)Dark sub-pixel 　Dark defect (White Background : VSPP=3.5V)	Note 1
Screen quality	Smear	Spot defect which brightness isn't uniform.	Note 2
	Unevenness	Partial brightness or chromatic non-uniformity.	
	Non-uniformity streak	Streak shaped　or chromatic non-uniformity.	
	Reverse	Concentrated unevenness (sub-pixel unit).	
	Others	Trash between LCD and backlight. ,etc.	

Note 1 : Sub-pixel defect specifications

　　　Bright sub-pixels are classified into the following three categories using appropriate Neutral Density (ND) Filter.

　　　Bright sub-pixel (which are) not visible through 2.5% ND Filter are not counted as bright sub-pixel.

Note 2 : Screen quality defects (smear etc.), which can not be found by using 2.5% ND filter, shall not be counted as defects.

　　　　Inspection condition : Same as sub-pixel defects condition.

(B) Dot defect judgment criteria and inspection condition

　　　Inspection condition of sub-pixel defects

eye

Distance : 450-500 [mm]

ND Filter

200-250 [lx] at LCD surface.

LCD

Backlight

Observation time: 5 [sec.]

Surface brightness: 300-320 [cd/m^2]

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<u>Judgment criteria</u>

(1) Sub-pixel defect

Items		Maximum count	Specifications		
Bright sub-pixel		-	0.3% ND	1.0% ND	2.5% ND
	Level 1	0	Visible	Visible	Visible
	Level 1,2	3	Invisible	Visible	Visible
	Level 1 to 3	5	Invisible	Invisible	Visible
Dark sub-pixel		6	Dark defect (VSPP=3.5V)		
Total		7	[Bright defect(Level 1+2+3) +Dark defect]		

(2) Cluster: (Bright sub-pixel density)

The maximum permissible sub-pixel defects number per specified area are as follows;

Bright sub-pixel (Level 2 + Level 2)	2 defects in ϕ10mm area
Bright sub-pixel (Level 2 + Level 3)	2 defects in ϕ10mm area
Bright sub-pixel (Level 3 + Level 3)	2 defects in ϕ10mm area
Dark sub-pixel	2 defects in ϕ10mm area
Total (Bright and dark defects)	2 defects in ϕ10mm area

(3) Linked sub-pixel defects

    A) Three linked sub-pixel defects are not permissible.

    B) Two linked sub-pixel defects ;

        Bright + Bright : Regarded as one bright defect and classified into Level 1, 2 or 3.

        Dark   + Dark   : Regarded as two dark defects.

        Dark   + Bright : Regarded as one dark defect and one bright defect (classified into Level).

(4) If any sub-pixel is counted as bright sub-pixel and dark sub-pixel, the sub-pixel is regarded as bright sub-pixel.

(5) Dusts (in Cell)

	Size	Judgment
1	3 sub-pixels $\leq$ x	NG
2	2 sub-pixels $\leq$ x < 3 sub-pixels	Regarded as two linked dark defects.
3	1 sub-pixel $\leq$ x < 2 sub-pixels	Regarded as one dark defect.
4	$\leq$ x < 1 sub-pixel	Uncounted.

(6) Dusts (in Backlight)

	Criterion	Judgment
1	x $\leq$ 0.2mm^2 *	Count is dark dot defects
2	0.2mm^2 < x	NG

*0.2mm^2 criterion: based on Japanese Mint Bureau.

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4.5. Reliability test

TEST ITEM	TEST CONDITION	JUDGMENT
(1)Operation at high temperature	70 °C 192h (LCD panel surface temperature)	After test, display should maintain the contents of 4.4Display quality
(2)Operation at low temperature	-20°C 192h (ambient temperature)	
(3)Operation at high temperature and high humidity	55°C 90% 192h (ambient temperature)	
(4)High temperature exposure	80°C 192h	
(5)Low temperature exposure	-30°C 192h	
(6)Heat shock	-20°C / 70°C (0.5h/0.5h)50 cycles	
(7)Electrostatic withstanding voltage	Panel surface :150pF ± 15 kV 150Ω (direct discharge ,five times) FPC input terminal : 100pF ± 200V 0Ω	Operate normally after test
(8)Product drop test	490m/s^2, 11msec half-sine pulse Once for each direction of X, Y and Z.	
(9)Product vibration test	10 - 57 Hz : width 0.075mm 58 - 500 Hz: 9.8m/s^2 peak 11 minutes / cycle 3 hours (one hour each for X,Y and Z.)	
(10)Packaged drop test	Bottom surface : 40cm Others : 25cm Once for four surfaces, two sides, one Corner	Operate normally after test. There are not remarkable defects.
(11)Packaged vibration test	5 - 50 Hz Z direction 9.8m/s^2/54 minutes X,Y direction 4.9m/s^2/27 minutes	

Note: Driving conditions for operation test are same as 4.2.1Common test conditions except above one of temperature and
      humidity.
    The test (2) - (11) are performed at the backlight off condition.
    The test (3) is performed at non dew condensed condition.
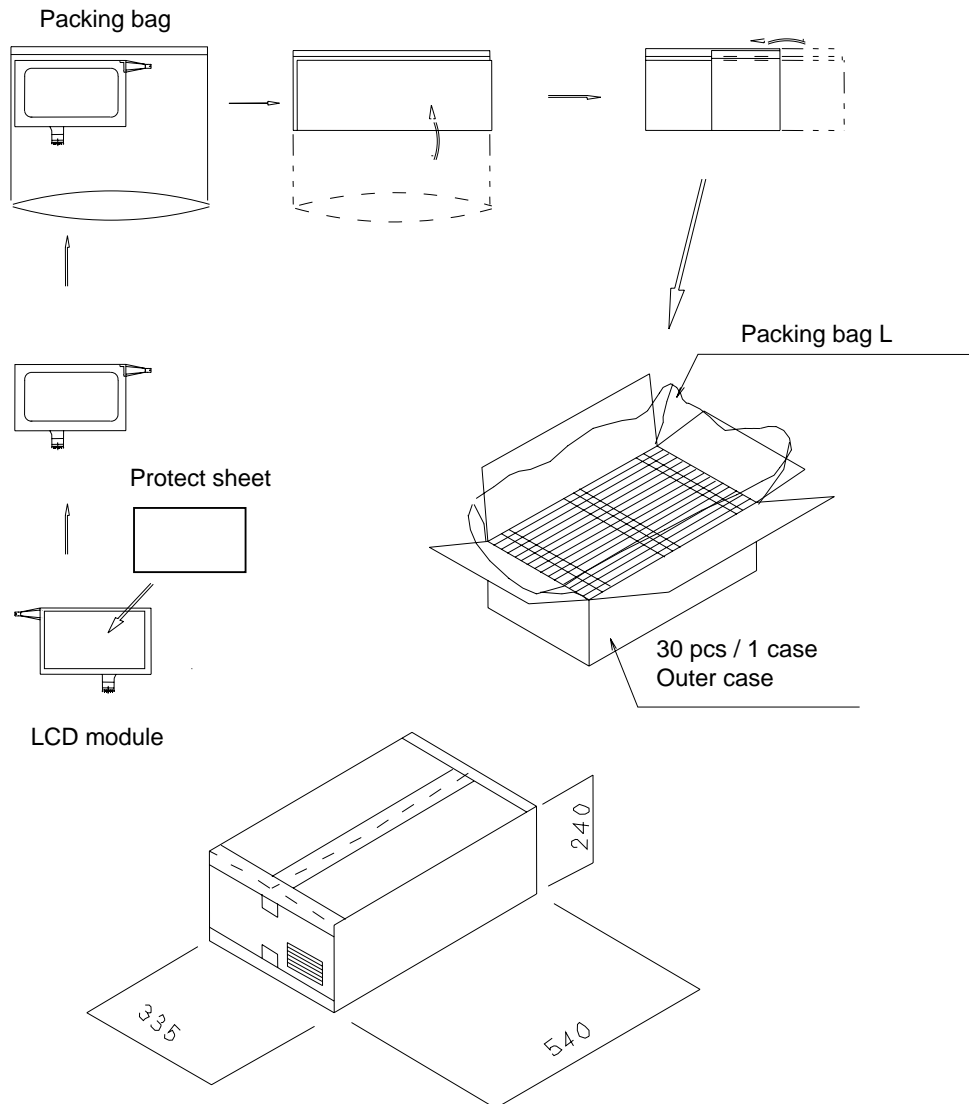   Judgment is performed after one hour exposure at room temperature after test.

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5　Package Specification

(1) The LCD module is put into the packing bag with anti - electrostatics treatment, and then it is put into the outer case at the condition that the maximum quantity is 30.

(2) Below mentioned contents are directly printed on the outer case, or the label which describes below mentioned contents is stuck to the outer case.

Customer	
Cust. Part. No.	
Part. No.	LTA070B343A
Quantity	(EX) 30
Lot No.	(EX) 03.05.27

(3)The drawing for packaging

Packing bag

Packing bag L

Protect sheet

30 pcs / 1 case
Outer case

LCD module

240

335

540

(4) Acceptable number of piling: 8 sets

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6　**Measuring method for optical characteristic and display quality**

(1) Measuring method for brightness

　　Measuring instrument

　　　　TOPCON BM-5A (measuring field = 1°)

　　Measuring point

　　　Center of the display area ($\theta = 0°$, $\phi = 0°$)

　　　　　θ : viewing angle against vertical axis

　　　　　ϕ : viewing angle against horizontal axis

　　Measuring method

　　　Measure the brightness B (cd/m^2) and white color chromaticity X,Y supplying signal voltage to get maximum brightness at the display pattern to be all white.

　　　The distance from screen to "BM-5A" is 500mm.

　　　Measure it after a lapse of at least 30 min. since a back light is turned on.

LCD Module

Center of display area
(X,Y)=(240,117)

Distance:500mm
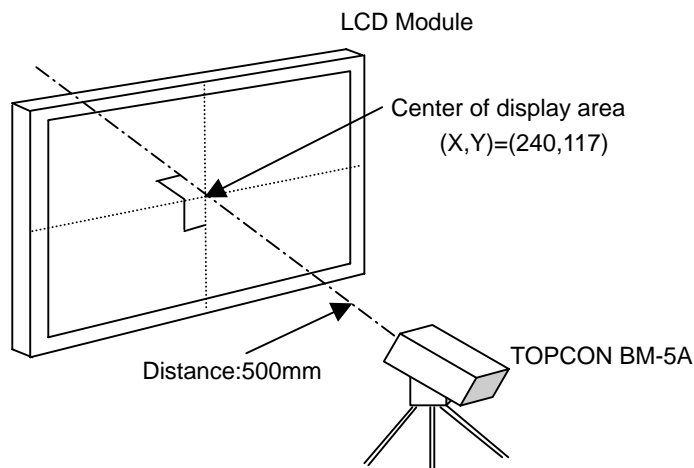
TOPCON BM-5A

(2) Measuring method for contrast

　　Measuring instrument

　　　　TOPCON　BM-5A (measuring field=1°.)

　　Measuring point

　　　Center of the display area: Exactly same point as that of measuring brightness

　　Measuring method

　　　Set the LCD module at $\theta = \theta0$, $\phi = \phi0$

　　　　　θ : viewing angle in vertical axis

　　　　　ϕ : viewing angle in horizontal axis

　　　　　$\theta0$, $\phi0$ are the best angle to get the maximum contrast.

　　　Measure maximum brightness "Y1"(Vlc=0v) and minimum brightness"Y2"(Vlc=5v).

　　　The contrast ratio C is Y1/Y2.

　　　Where, Vlc means the effective voltage applied to liquid crystal in LCD panel.

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(3)Definition of the brightness uniformity

Measure 5 points (S0 - S4) and define the brightness uniformity using the following formula.

Brightness uniformity = (The minimum brightness among S1 - S4)/S0
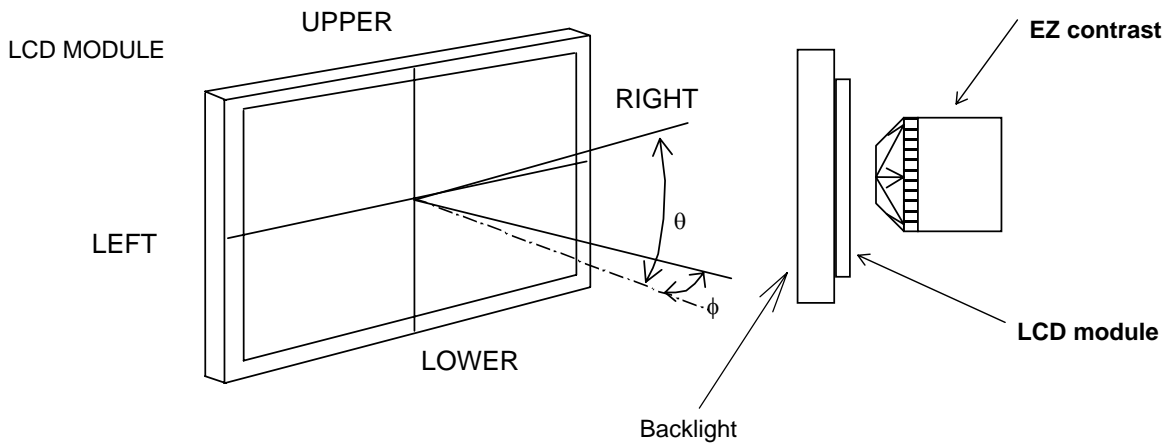
10mm   10mm

10mm

S1   S4

S0

S2   S3

10mm
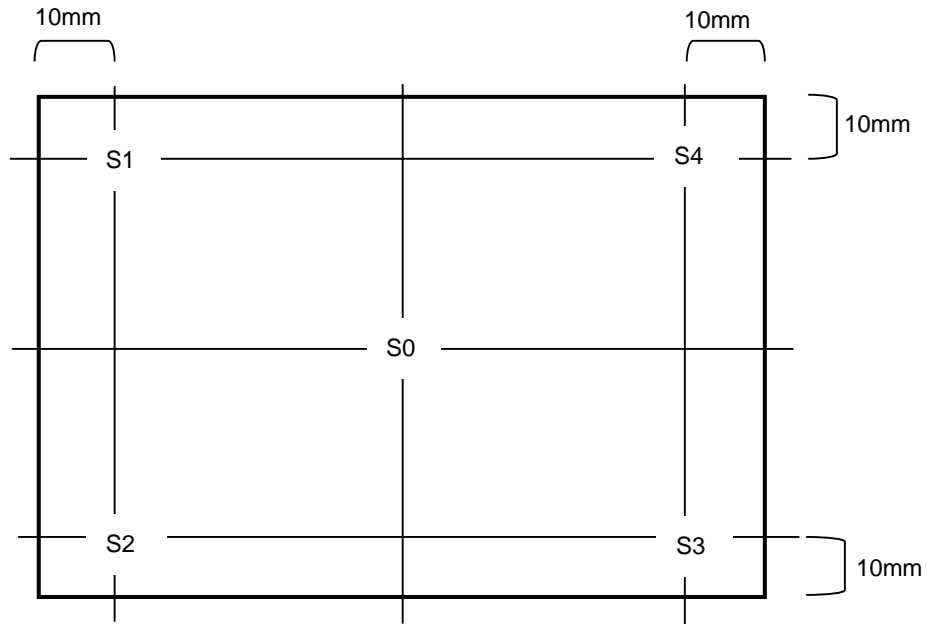
(4) Measuring method for viewing angle

Measuring instrument

ELDIM : EZ contrast

Measuring point

Center of the display area

UPPER   **EZ contrast**

LCD MODULE

RIGHT

θ

LEFT

φ

LCD module

LOWER

Backlight

θU : Upper side viewing angle   θL : Lower side viewing angle
φ L : Left side viewing angle   φ R: Right side viewing angle

Record upper, lower, right, left angles of contrast 10 from circular chart data of EZ contrast.

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(5).Measuring method for response time

Measuring instrument

Ohtsuka Electric. LCD evaluation equipment LCD-7000

Measuring spot size(aperture size)is ϕ12mm.

Measuring point

center of the display area

Measuring method

Set LCD module at $\phi = 0°$ and $\theta = 0°$

Apply the signal voltage at maximum contrast ratio and switch LCD-cell off/on/off.

(make screen white, then black and white)

When normalizing each brightness level corresponding to the display signal "OFF" and "ON" as   shown in the figure below, the rise time τr is defined as the time until the brightness level goes down to 10% from 90% after display signal changed from OFF to ON and also fall-time τd is defined as the time until the brightness level goes up to 90% from 10% after display signal changes from "ON" to "OFF".

ON(BLACK)

Display signal

OFF(WHITE)   OFF(WHITE)

100%
90%

Optical response

10%
0%

τr τd Time

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