To :

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

# SPECIFICATION(TENTATIVE)

## FOR

Toshiba Matsushita Display Technology TFT-LCD MODULE

# LTA170C07RF

LTA170C07RF-01

## DATE OF ISSUE : 2003-06-18

TV/PC/Monitor-Use Marketing & Engineering Group2 TV/PC/Monitor-Use Marketing & Engineering Dept. AVC-Use LCD Division Toshiba Matsushita Display Technology Co.,Ltd. 1-9-2, Hatara-cho, Fukaya-shi, Saitama, 366-0032, JAPAN (Toshiba Fukaya Operations)

# **Revision History**

| Date     | Sheet | Item           | Old | New | Reason |
|----------|-------|----------------|-----|-----|--------|
|          | (New) |                |     |     |        |
| '03-6-18 | NEW   | TENTATIVE      | -   | -   | -      |
|          |       | SPECIFICATIONS |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       |                |     |     |        |
|          |       | 1              |     |     |        |

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## **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



## 1) SPECIAL PURPOSES

- a) Toshiba Matsushita Display Technology's Standard LCD modules have not been customized for operation in extreme environments or for use in applications where performance failures could be life-threatening or otherwise catastrophic.
- b) Since they have not been designed for operation in extreme environments, they must never be used in devices that will be exposed to temperatures above 50 degrees Celsius or below 0 degrees Celsius, to X-ray or Gamma-ray radiation, or to abnormally high levels of vibration or shock which exceed Toshiba Matsushita Display Technology's specification limits.
- c) In addition, since Toshiba Matsushita Display Technology's Standard LCD modules have not been designed for use in applications where performance failures could be life-threatening of catastrophic, they must never be installed in aircraft navigation control systems (such as, but not limited to Traffic Collision Avoidance System and Air Traffic Indicator), in military defense or weapons systems, in critical industrial process-control systems (e.g., those involved in the production of nuclear energy), or in critical medical device or patient life-support systems.

## 2) ELECTRIC SHOCK

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

## 3) FL CABLE CONNECTION

Make sure to insert the module FL connector to the inverter connector in correct position and correct polarity. If incorrect, this may cause smoke or burn of electrical parts by high voltage of FL circuit. If there is a possibility that the connector has been inserted incorrectly, re-insert the connector only after you confirm the module and FL power is completely off. When disconnecting the connector, do not pull on the cable. DO NOT USE the mating FL connector which Toshiba Matsushita Display Technology does not specify. Otherwise, Toshiba Matsushita Display Technology shall not be liable for any damages caused by the connector.

# **Caution**

## 1) \* DISASSEMBLING OR MODIFICATION

DO NOT DISASSEMBLE OR MODIFY the modules.

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

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 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.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New | No. LTA170C07RF-01 |
|---|------------------|-----|--------------------|
|   | Date:            | Old | No.                |

## 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.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

#### Sheet 5

## 5) GROUNDING OF METAL FRAME

Grounding of metal frame of LCD module is generally effective to prevent radiation interference from the system design.

However, the necessity of grounding, or effective grounding method should be dependent on each system design.

## 2-3 DESIGNING FOR BETTER VISIBILITY

## 1) PANEL ANGLE

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

## 2) WINDOW OPENING

Dimensions of window opening of the system's enclosure should be designed as smaller than "Viewing Area" and larger than "Active Area" specified in individual specification in order to obtain better appearance.

## 3) PROTECTIVE COVER

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

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

## 2-4 DESIGNING FL POWER SUPPLY CIRCUIT

Input FL starting voltage(VSFL) should be longer than two seconds. If it were not, it may cause unstable operation of FL.

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

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

## 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.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

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.

## 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.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 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.

## 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.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New | No. LTA170C07RF-01 |
|---|------------------|-----|--------------------|
|   | Date:            | Old | No.                |

## 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.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## - CONTENTS -

| Revision History                             | • | • | • | • | Sheet | 1        |
|--|---|---|---|---|-------|----------|
| Caution and Handling Precaution              | • | • | • | • |       | 2        |
| 1. Scope                                     | • | • | • | • |       | 10       |
| 2. Product Specifications                    | • | • | • | • |       | 10       |
| 2.1 General Specifications                   |   |   |   |   |       |          |
| 2.2 Absolute Maximum Ratings                 | • | • | • | • |       | 11       |
| 2.3 Mechanical Specifications                |   |   |   |   |       |          |
| 2.3.1 Weight                                 |   |   |   |   |       |          |
| 2.3.2 Dimensional Outline                    | • | • | • | • |       | 12-13    |
| 2.4 Electrical Specifications                | • | • | • | • |       | 14       |
| 2.4.1 Circuit Diagram                        |   |   |   |   |       |          |
| 2.4.2 Sequence of Power Supplies and Signals |   |   |   |   |       |          |
| 2.4.3 Timing Chart                           | • | • | · | • |       | 15       |
| 2.4.4 Timing Specifications                  | • | • | • | • |       | 16       |
| 2.4.5 Interface Connector                    | • | • | • | • |       | 17       |
| 2.4.6 Register map                           | • | • | • | • |       | 19-20    |
| 2.4.7 Colors Combination Table               | • | • | • | • |       | 21       |
| 3. Recommended Operating Conditions          | • | • | · | • |       | 22       |
| 4. Electrical Characteristics                | • | • | · | • |       | 23       |
| 4.1 Test Conditions                          |   |   |   |   |       |          |
| 4.2 Specifications                           |   |   |   |   |       |          |
| 5. Optical Characteristics                   | • | • | • | • |       | 24       |
| 5.1 Test Conditions                          |   |   |   |   |       |          |
| 5.2 Optical Specifications                   |   |   |   |   |       |          |
| 6. Quality                                   | • | • | • | • |       | 24       |
| 6.1 Inspection AQL                           |   |   |   |   |       |          |
| 6.2 Test Conditions                          |   |   |   |   |       |          |
| 6.3 Dimensional Outline                      |   |   |   |   |       | ~ ~      |
| 6.4 Appearance Test                          | • | • | • | • |       | 26       |
| 6.4.1 Test Conditions                        |   |   |   |   |       |          |
| 6.4.2 Specifications                         |   |   |   |   |       | 07       |
| 6.5 Display Quality                          | • | • | • | • |       | 27       |
| 6.5.1 Test Conditions                        |   |   |   |   |       |          |
| 6.5.2 Specifications                         |   |   |   |   |       | 00       |
| 6.6 Reliability Test                         | • | • | • | • |       | 28       |
| 6.6.1 Test Conditions                        |   |   |   |   |       |          |
|  |   |   |   |   |       | 20       |
| 0.7 Labels                                   | • | • | • | • |       | 29       |
| 7. Lileume                                   | • | • | • | • |       | 30       |
| 7.1 Module                                   |   |   |   |   |       |          |
| 8. Packaging                                 |   |   |   |   |       | 21       |
| o. Fackaying                                 | - | - | - | - |       | 31       |
| 8.1 Calton                                   |   |   |   |   |       | 22       |
| 3. Warrany<br>10. Measuring Method           |   |   |   |   |       | 32<br>32 |
| 10.1 Measuring Systems                       | - | - | - | - |       | 52       |
| 10.2 Measuring Methods                       |   |   |   |   |       | 33       |
| 10.2 measuring methous                       | - | - | - |   |       | 55       |

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 1. Scope

This specification is applicable to Toshiba Matsushita Display Technology's 43 cm diagonal size TFT-LCD module "LTA170C07RF" designed for TV.

| Item                | Specifications  |
|---------------------|---|
| Display Mode        | TN color (253 gray scales, 16,194,277 colors)                     |
|                     | Transmissive type, Normally white                                 |
| Viewing Direction   | 6 o'clock (in direction of maximum contrast)                      |
| Driving Method      | TFT active matrix   |
| Input Signals       | C-MOS 8Bit × RGB  |
| Dimensional Outline | 385 (W) × 303 (H) × 17.5 (D) (mm)                                 |
| Active Area         | 343.68 (W) × 261.60 (H) (mm)                                      |
| Viewing Area        | 349 ( <i>W</i> ) × 267 ( <i>H</i> ) (mm)                          |
| Number of Pixels    | 640 (W) $\times$ 480 (H) <sup>1)</sup>                            |
| Pixel Pitch         | 0.545 ( <i>W</i> ) $\times$ 0.537 ( <i>H</i> ) (mm) <sup>1)</sup> |
| Pixel Arrangement   | RGB vertical stripes <sup>1)</sup>                                |
| Surface Treatment   | Low Reflection & Anti-glare hard coat on LCD surface              |
| Backlight           | 4 cold-cathode fluorescent lamps (L-Type)                         |

## 2. Product Specifications

## 2.1 General Specifications

Note 1) Display area address is as follows.



| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New | No. LTA170C07RF-01 |
|---|------------------|-----|--------------------|
|   | Date:            | Old | No.                |

## 2.2 Absolute Maximum Ratings <sup>1)</sup>

| Item  | Symbol           | Min. | Max.                 | Unit    | Checked Terminal 4)   |
|---|------------------|------|----------------------|---------|-----------------------|
| Supply Voltage                                | V <sub>DD</sub>  | -0.3 | +6.0                 | V       | V <sub>DD</sub> - GND |
| Input Voltage of Signals                      | V <sub>IN</sub>  | -0.3 | V <sub>DD</sub> +0.3 | V       |                       |
| FL Driving Voltage                            | $V_{\rm FL}$     | 0    | 2.0                  | kV(rms) |                       |
| FL Driving Frequency                          | f <sub>FL</sub>  | 0    | 100                  | kHz     |                       |
| Operating Ambient Temperature <sup>2)</sup>   | T <sub>OP</sub>  | 0    | +50                  | °C      |                       |
| Operating Ambient Humidity <sup>2)</sup>      | H <sub>OP</sub>  | 10   | 90                   | %(RH)   |                       |
| Storage Temperature <sup>2)</sup>             | T <sub>STG</sub> | -20  | +60                  | °C      |                       |
| Storage Humidity 2)                           | H <sub>STG</sub> | 10   | 90                   | %(RH)   |                       |
| Operating Temperature for Panel <sup>3)</sup> | -                | 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.
  - 2) Wet bulb temperature should be 39°C (Max), and no condensation of water. See figure below.
  - 3) The surface temperature caused by self heat radiation of cell itself is specified on this item.

4) Refer to 2.4.5



## 2.3 Mechanical Specifications

2.3.1 Weight

 $2000\pm100g$ 

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 2.3.2 Dimensional Outline (Front figure)

Unit: mm Standard Tolerance: 0.5



| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 |     | ew No. LTA170C07RF-01 |  |
|---|------------------|-----|-----------------------|--|
|   | Date:            | Old | No.                   |  |

# (Back figure)

Unit: mm Standard Tolerance: 0.5



| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 2.4 Electrical Specifications

2.4.1 Circuit Diagram



# 2.4.2 Sequence of Power Supplies and Signals



Note (1): OFF time (<=0.5V) should be maintained more than 150ms.

| Toshiba Matsushita Display Technology Co.,LtdDate: 2003-06-18Date:- | New No. LTA170C07RF-01<br>Old No. |
|---|-----------------------------------|
|---|-----------------------------------|

## 2.4.3 Timing Chart



| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 2.4.4 Timing Specifications <sup>1) 2) 3) 4)</sup>

|            | Item               | Symbol | Min. | Тур.     | Max.   | Unit | Remarks |
|------------|--------------------|--------|------|----------|--------|------|---------|
| Clock      | Frequency          | Fck    | 17   | 28.6     | 31.5   | MHz  |         |
| (Clk)      | High time          | Tch    | 10   | -        | -      | nsec |         |
|            | Low time           | Tcl    | 10   | -        | -      | nsec |         |
| DATA       | Setup time         | Tds    | 6    | -        | -      | nsec |         |
|            | Hold time          | Tdh    | 7    | -        | -      | nsec |         |
| Horizontal | Polarity           | -      |      | Negative |        | -    |         |
| (Hs)       | Setup time         | Ths    | 6    | -        | -      | nsec |         |
|            | Hold time          | Thh    | 7    | -        | -      | nsec |         |
|            | Total Period       | TH     | 720  | 910      | 1620   | Fck  |         |
|            | including Blanking |        | 28.8 | 31.8     | -      | μsec |         |
|            | Pulse width        | Thp    | 1    | 69       | Note 1 | Fck  |         |
|            | Back porch         | Thb    | 12   | 104      | Note 1 | Fck  |         |
|            | Display term       | Thd    |      | 640      |        | Fck  |         |
|            | Front porch        | Thf    | 1    | 46       | -      | Fck  |         |
| Vertical   | Polarity           | -      |      | Negative |        | -    |         |
| (Vs)       | Phase shift        | Tvpd   | -1   | 0        | 1      | Fck  |         |
|            | Frame Period       | TV     | 485  | 525      | 720    | TH   |         |
|            | including Blanking |        | -    | 16.7     | 20.0   | msec |         |
|            | Pulse width        | Тvр    | 1    | 6        | Note 1 | TH   |         |
|            | Back porch         | Tvb    | 2    | 46       | Note 1 | TH   |         |
|            | Front porch        | Tvf    | 1    | 29       | -      | TH   |         |
|            | Display term       | Tvd    |      | 480      |        | TH   |         |

Note 1) Thp + Thb<254, Tvp + Tvb<254

Note 2) If Hs and Vs signal is fixed to "H" or "L" level for certain period while Clock is supplied, the panel displays black with some flicker.

Note 3) If Clock is fixed to "H" or "L" level for certain period while Hs and Vs is supplied, the panel may be damaged.

- Note 4) Please adjust LCD operating signal timing and FL driving frequency, to optimize the display quality. There is a possibility that flicker is observed by the interference of LCD operating signal timing and FL driving condition (especially driving frequency), even if the condition satisfies above timing specifications and recommended operating conditions shown in 3.
- Note5) Do not make TH and TV fluctuate.

If TH and TV are fluctuate, the panel displays error.

Note6) In case of using the long frame period, the deterioration of display quality, noise etc. may be occurred.

Note7) Clock 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.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 2.4.5 Interface Connector

| CN1 I | <u>NPUT SIGNAL</u> |                 |  |
|-------|--------------------|-----------------|--|
|       | Connector :        | IL-FHR-BF5      | 50S-HF / JAE   |
| -     | Mating Conr        | ector : TBD     | / JAE  |
|       | Terminal No.       | Symbol          | Function   |
|       | 1                  | GND             |  |
|       | 2                  | Clk             | Clock  |
|       | 3                  | GND             |  |
| -     | 4                  | Vs              | Vertical Sync.   |
|       | 5                  | Hs              | Horizontal Sync.   |
|       | 6 <sup>1)</sup>    | NC              |  |
|       | 7                  | GND             |  |
|       | 8                  | R0              | Red Display Data 0 (LSB)   |
|       | 9                  | R1              | Red Display Data 1   |
|       | 10                 | R2              | Red Display Data 2   |
|       | 11                 | R3              | Red Display Data 3   |
|       | 12                 | GND             |  |
|       | 13                 | R4              | Red Display Data 4   |
|       | 14                 | R5              | Red Display Data 5   |
|       | 15                 | R6              | Red Display Data 6   |
| Ì     | 16                 | R7              | Red Display Data 7 (MSB)   |
|       | 17                 | GND             |  |
|       | 18                 | G0              | Green Display Data 0 (LSB)   |
| -     | 19                 | G1              | Green Display Data 1   |
| -     | 20                 | G2              | Green Display Data 2   |
| ·     | 21                 | G3              | Green Display Data 3   |
|       | 22                 | GND             |  |
| -     | 23                 | G4              | Green Display Data 4   |
| -     | 20                 | G5              | Green Display Data 5   |
| ·     | 25                 | G6              | Green Display Data 6   |
| ·     | 26                 | <br>G7          | Green Display Data 7 (MSB)   |
|       | 20                 |                 | Green Display Data 7 (MOD)   |
| -     | 21                 | BO              | Blue Display Data 0 (LSB)  |
| -     | 20                 | B1              | Blue Display Data 1  |
| -     | 30                 | B2              | Blue Display Data 1  |
| ·     | 30                 | D2              | Blue Display Data 2  |
| ·     | 31<br>22           |                 | Dive Display Data 3  |
|       | 32                 |                 | Plue Display Data 4  |
|       | 33                 | D4              | Blue Display Data 4  |
|       | 34                 | B5              | Blue Display Data 5  |
|       | 35                 | B0              | Blue Display Data 6  |
|       | 30                 | B/              | Blue Display Data 7 (MSB)  |
|       | 37                 | GND             |  |
|       | 38                 | GND             |  |
|       | 39                 | REGEN           | After I <sup>-</sup> C data input, it is supplied to 2 <sup>-1</sup> register at internal V-latch signal |
|       | 40 2)              |                 | by "H"-level of this pin input during 1Vs period.  |
|       | 40 '               |                 | Input Data Inversion Control: GND: normal, VDD: Data Inversion   |
| -     | 41 -/              | GND             |  |
|       | 42 2/              | SCL             | I <sup>2</sup> C Clock   |
|       | 43 -/              | SDA             | I <sup>c</sup> C Data  |
|       | 44                 | V <sub>DD</sub> | Power Supply : +5.0V   |
|       | 45                 | V <sub>DD</sub> | Power Supply : +5.0V   |
|       | 46                 | V <sub>DD</sub> | Power Supply : +5.0V   |
|       | 47                 | V <sub>DD</sub> | Power Supply : +5.0V   |
|       | 48 ''              | NC              |  |
|       | 49 ''              | NC              |  |
|       | 50                 | GND             |  |

Note 1) NC terminal should be open. Note 2) In case of using 6bit input data, please use higher 6bit (bit7-bit2). In this case, it is recommended to fix bit0 and bit1 on GND.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

#### CN2, 3, 4, 5 CCFL POWER SOURCE

#### Connector: BHSR-02VS-1 / JAPAN SOLDERLESS TERMINAL MFG CO., LTD. Mating Connector: SM02B-BHSS-1 / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

| Terminal No. | Symbol           | Function                         |
|--------------|------------------|----------------------------------|
| 1            | V <sub>FLH</sub> | CCFL Power Supply (high voltage) |
| 2            | V <sub>FLL</sub> | CCFL Power Supply (low voltage)  |

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

# 2.4.6 I<sup>2</sup>C Register Map

| Sub      | )    |                   |           |                                       | Dat             | ta                 |          |               |    | Contents   | Initial  | Value    |
|----------|------|-------------------|-----------|---------------------------------------|-----------------|--------------------|----------|---------------|----|--|----------|----------|
| Add      | ress | b7                | b6        | b5                                    | b4              | b3                 | b2       | b1            | b0 |  | normal   | wide     |
| 0        | 00   | STH ADDRESS (7:0) |           | Horizontal start position spec. (CLK) | 10110101        | 10111100           |          |               |    |  |          |          |
| 1        | 01   |                   |           | ST\                                   | / ADDR          | ESS (7             | 0)       |               |    | Vertical start position spec. (Hs)   | 00110010 | 00101000 |
| 2        | 02   | CI                | TI Sotur  | ر.<br>1 اا د                          | 1)              |                    |          | -<br>14 (3·0) |    | CTL Setup all: CTL ON Phase setup  | 00101100 | 00101001 |
|          |      | 0.                | L Oold    | 5 an (7                               | *)              |                    |          | 510 (0.0)     |    | OEV Hold: Gate ON Width setup  |          |          |
| 3        | 03   |                   |           | C                                     | CTL Wid         | th (7:0)           |          |               |    | CTL Width: CTL ON Width setup  | 00110101 | 00110010 |
| 4        | 04   | С                 | EV Set    | up (7:4)                              | )               | (                  | CKV Se   | tup (3:0      | )  | OEV Setup: Gate ON Phase setup   | 0110     | 0110     |
| F        | 05   |                   |           | -                                     |                 | D (7·0)            |          |               |    | P INTEND: Souce scap Interval setup  | 00010111 | 00110011 |
| с<br>6   | 06   |                   |           | г                                     |                 | D (7:0)            |          |               |    |  | 0000     |          |
| 0        | 00   |                   |           | TVD                                   | CENT            | Inite              | וח       |               |    | UD: Up/Down Reversal 0:Up 1: Reversal  | 0000     | 0000     |
|          |      |                   |           | SEL                                   | ON              | State              | OFF      | UD            | LR | LR: Right/Left Reversal 0:Right, 1: Reversal   |          |          |
|          |      |                   |           |                                       |                 | OFF                |          |               |    | Inite State OFF: 0:normal, 1: Inite State OFF  |          |          |
| 7        | 07   |                   | F         | For Blac                              | k Belt C        | biW_IT:            | th (7·0) |               |    | Sausce signal output time in centering mode  | 0011     | 0101     |
| ,<br>8   | 08   |                   |           | STOP                                  | Signal          |                    | (7.0)    |               |    | Timing control for V Blancking's gate voltage  | 1101     | 0110     |
| <u> </u> | 00   |                   |           |                                       | Olghai          | Control            | (1.0)    |               |    | Black Line FRC Level: Black line level control by                                    | 0000     | 0000     |
| 9        | 09   |                   |           | Black<br>FRC                          | k Line<br>Level | I                  | Black Li | ne Leve       | I  | 1/256 Gray scale setp  |          |          |
|          |      |                   |           |                                       |                 |                    |          |               |    | Black Line Level: control of center Gray Scale                                       | 0040     | 0400     |
| 12       | 0C   |                   | J Stort I | Desition                              |                 |                    | U. End   | Docition      |    | for internal patter (setup X 64)   | 0010     | 0100     |
|          |      | Г                 | 1 Start F | osition                               |                 |                    | n. Ena   | Position      | l  | H end Position: Horizontal end Position adjustment                                   |          |          |
| 10       | 00   |                   |           |                                       |                 |                    |          |               |    | V Start Position: Vertical start Position adjustment                                 | 0010     | 0100     |
| 13       | 00   | V                 | : Start I | Position                              |                 |                    | V: End   | Position      |    | for internal patter (setup X 64)   |          |          |
|          |      |                   |           |                                       |                 |                    |          |               |    | V end Position: Vertical end Position adjustment for<br>internal patter (setup X 64) |          |          |
| 14       | 0E   |                   |           |                                       |                 |                    |          |               |    | R ON: R signal control 0:R=L, 1: R=input value                                       | 1110     | 0000     |
|          |      |                   |           |                                       |                 |                    |          |               |    | G_ON: G signal control 0:G=L, 1: G=input value                                       | -        |          |
|          |      |                   |           |                                       | Win             |                    |          | I (2·0)       |    | B_ON: B signal control 0:B=L, 1: B=input value                                       |          |          |
|          |      | K UN              | GON       | DON                                   | ON              |                    | 310 36   | L (3.0)       |    | Win_ON: Display window control for internal pattern                                  |          |          |
|          |      |                   |           |                                       |                 |                    |          |               |    | 0: No-window, 1: Window  |          |          |
|          |      |                   |           |                                       |                 |                    |          |               |    | SIG_SEL: Internal patten select  | 1000     | 0000     |
| 15       | 0F   |                   |           |                                       | SIG LE          | EVEL               |          |               |    | Black level contorol   | 1000     | 0000     |
| 16       | 10   |                   |           |                                       | DIN 0p          | (7:0)              |          |               |    | Gamma REF setup (0, R)   | 0000     | 0000     |
| 17       | 11   |                   |           |                                       | DIN 32p         | o (7:0)            |          |               |    | Gamma REF setup (32, R)  | 0011     | 0011     |
| 18       | 12   |                   |           |                                       | DIN 64p         | o (7:0)            |          |               |    | Gamma REF setup (64, R)  | 0110     | 0000     |
| 19       | 13   |                   |           |                                       | DIN 96p         | (7:0)              |          |               |    | Gamma REF setup (96, R)  | 1000     | 0100     |
| 20       | 14   |                   |           |                                       | DIN 128         | p (7:0)            |          |               |    | Gamma REF setup (128, R)   | 1010     | 0000     |
| 21       | 10   |                   |           |                                       | DIN 160         | p(7:0)             |          |               |    | Gamma REF setup (192, R)   | 1100     | 0110     |
| 22       | 17   |                   |           |                                       | DIN 192         | p (7.0)<br>n (7.0) |          |               |    | Gamma REF setup (224, R)   | 1100     | 1000     |
| 24       | 10   |                   |           |                                       |                 | p(7.0)             |          |               |    | Gamma REF setup (256. R) (LSB7Bit:validity)  | 0111     | 0011     |
| 25       | 10   | P.Cm              |           |                                       | DIN 200         | p (1.0)            |          |               |    | R Gm th: R Gamma Through 0: Through 1:ON   | 1000     | 0000     |
| 20       | 15   | th                |           |                                       | R_Gr            | n Offset           | (6:0)    |               |    | R Gm Offset: R Gamma offset setup  | 1000     | 0000     |
| 26       | 1A   |                   |           |                                       | DIN 0p          | (7:0)              |          |               |    | Gamma GEF setup (0, G)   | 0000     | 0000     |
| 27       | 1B   |                   |           |                                       | DIN 32p         | (7:0)              |          |               |    | Gamma GEF setup (32, G)  | 0011     | 0011     |
| 28       | 1C   |                   |           |                                       | DIN 64p         | o (7:0)            |          |               |    | Gamma GEF setup (64, G)  | 0110     | 0000     |
| 29       | 1D   |                   |           |                                       | DIN 96p         | o (7:0)            |          |               |    | Gamma GEF setup (96, G)  | 1000     | 0100     |
| 30       | 1E   |                   |           |                                       | DIN 128         | p (7:0)            |          |               |    | Gamma GEF setup (128, G)   | 1010     | 0000     |
| 31       | 1F   |                   |           |                                       | DIN 160         | p (7:0)            |          |               |    | Gamma GEF setup (160, G)   | 1011     | 0110     |
| 32       | 20   |                   |           |                                       | DIN 192         | p (7:0)            |          |               |    | Gamma GEF setup (192, G)   | 1100     | 0111     |
| 33       | 21   |                   |           |                                       | DIN 224         | p (7:0)            |          |               |    | Gamma GEF setup (224, G)   | 1101     | 1000     |
| 34       | 22   |                   |           |                                       | DIN 256         | p (7:0)            |          |               |    | Gamma GEF setup (256, G) (LSB7Bit:validity)  | 0111     | 0011     |
| 35       | 23   | G_Gm<br>th        |           |                                       | G_Gr            | n Offset           | (6:0)    |               |    | G_Gm_th: G_Gamma Through 0: Through, 1:ON<br>G_Gm_Offset: G_Gamma offset setup       | 1000     | 0000     |
| 36       | 24   |                   |           |                                       | DIN 0p          | (7:0)              |          |               |    | Gamma BEF setup (0, B)   | 0000     | 0000     |
|          |      |                   |           |                                       |                 |                    |          |               |    |  |          |          |

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

Specification No. TENTATIVE

Sheet 20

| 37 | 25 |      |                | DIN 32p (7:0) |   |          | Gamma BEF setup (32, B) | 00110011 |     |   |          |  |
|----|----|------|----------------|---------------|---|----------|-------------------------|----------|-----|---|----------|--|
| 38 | 26 |      |                |               | DIN 64p                                     | o (7:0)  |                         |          |     | Gamma BEF setup (64, B)                               | 01100000 |  |
| 39 | 27 |      |                |               | DIN 96p                                     | o (7:0)  |                         |          |     | Gamma BEF setup (96, B)                               | 10000100 |  |
| 40 | 28 |      |                |               | DIN 128                                     | p (7:0)  |                         |          |     | Gamma BEF setup (128, B)                              | 10100000 |  |
| 41 | 29 |      |                |               | DIN 160                                     | p (7:0)  |                         |          |     | Gamma BEF setup (160, B)                              | 10110110 |  |
| 42 | 2A |      |                |               | DIN 192                                     | p (7:0)  |                         |          |     | Gamma BEF setup (192, B)                              | 11000111 |  |
| 43 | 2B |      |                |               | DIN 224                                     | p (7:0)  |                         |          |     | Gamma BEF setup (224, B)                              | 11011000 |  |
| 44 | 2C |      | DIN 256p (7:0) |               | Gamma BEF setup (256, B) (LSB7Bit:validity) | 01110011 |                         |          |     |   |          |  |
| 45 | 2D | B_Gm |                |               |   | - Offere | (6.0)                   |          |     | B_Gm_th: B_Gamma Through 0: Through, 1:ON             | 1000000  |  |
|    |    | th   |                |               | B_GI  | n Onsei  | (6:0)                   |          |     | B_Gm_Offset: B_Gamma offset setup                     |          |  |
| 46 | 2E | Rdc  | 8Bit           | Rdm           | NS DZ                                       |          |                         |          | Sig | Rdc: EMI Function On/Off (Reduce) 0: OFF, 1: ON       | 11000000 |  |
|    |    |      | 6Bit           |               |   |          |                         |          | SEL | 8Bit/6Bit: FRC Function On/Off 0: OFF, 1: ON          |          |  |
|    |    |      |                |               |   |          |                         |          | ON  | Rdm: Noise shape random setup 0: Random, 1: Fix       |          |  |
|    |    |      |                |               |   |          |                         |          |     | NS_DZ: FRC Mode setup 0: NS, 1:4Frame dither          |          |  |
|    |    |      |                |               |   |          |                         |          |     | Sig SEL ON: Input signal select 0: Imput, 1: Internal |          |  |
| 47 | 2F |      |                | VR            | EF_Of                                       | set (7:  | 0)                      | •        |     | Reference input for Gamma-Test                        | 0000000  |  |

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

# 2.4.7 Colors Combination Table

|   |   |   |   |   | Gray Scale  |
|---|---|---|---|---|---|
|   | Display   | R7R6R5R4R3R2R1R0  | G7 G6 G5 G4 G3 G2 G1 G0   | B7 B6 B5 B4 B3 B2 B1 B0   | Level   |
|   | Black   |   |   | L L L L L L L L   | -   |
|   | Blue  |   |   | ннннннн   | -   |
| <b>.</b> .  | Green   |   | ннннннн   |   | -   |
| Basic   | Light Blue  |   | ннннннн   | ннннннн   | -   |
| Color   | Red   | ннннннн   |   |   | -   |
|   | Purple  | нннннн  |   | ннннннн   | -   |
|   | Yellow  | нннннн  | нннннн  |   | -   |
|   | White   | н н н н н н н н   | ннннннн   | ннннннн   | -   |
|   | Black   |   |   |   | LO  |
| Grav  | Dark  |   |   |   | LO  |
| Scale   |   |   |   |   | LO  |
| of Red  |   |   |   |   |   |
| 011100  | Light   |   |   |   |   |
|   | Light   |   |   |   | LO  |
|   |   |   |   |   | LZJZ  |
|   |   | нннннцн   |   |   | L253  |
|   |   | нннннн  |   |   | L254  |
|   | Red   | нннннн  |   |   | Red L255  |
|   | Black   |   |   |   | LO  |
| Grav  | Dark  |   |   |   | LO  |
| Scale   |   |   |   |   | LO  |
| of  |   |   |   |   |   |
| Green   | Light   |   |   |   | L 4   |
|   |   |   |   | -   |   |
|   | Light   |   |   |   | L5<br>L 252   |
|   | Light   | :<br>:  | :<br>:  |   | L5<br>L252  |
|   | Light   |   |   |   | L5<br>L252<br>L253  |
|   | Ligin   |   | :<br>нннннцн<br>нннннц  |   | L5<br>L252<br>L253<br>L254  |
|   | Green   |   | :<br>H H H H H L H<br>H H H H H H L H<br>H H H H H  |   | L5<br>L252<br>L253<br>L254<br>Green L255  |
|   | Green<br>Black  |   | H H H H L H   H H H H H H H L L   H H H H H H H H L <td></td> <td>L5<br/>L252<br/>L253<br/>L254<br/>Green L255<br/>L 0</td>   |   | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0   |
| Grav  | Green<br>Black  | I I I I I I I I I   I I I I I I I I I I   I I I I I I I I I I   I I I I I I I I I I   I I I I I I I I I I   I I I I I I I I I I   | H H H H H L H   H H H H H H H L H   H H H H H H H H L L   H H H H H H H H H L L   H H H H H H H H H H H   H <td< td=""><td></td><td>L5<br/>L252<br/>L253<br/>L254<br/>Green L255<br/>L 0<br/>L 0</td></td<>   |   | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0  |
| Gray<br>Scale   | Green<br>Black<br>Dark  | L | H H H H H L H   H H H H H H H L H   H H H H H H H H L L   H H H H H H H H H L L   L L L L L L L L L L L   L <td< td=""><td></td><td>L5<br/>L252<br/>L253<br/>L254<br/>Green L255<br/>L 0<br/>L 0<br/>L 0</td></td<>   |   | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0   |
| Gray<br>Scale<br>of   | Green<br>Black<br>Dark<br>↑   | L | H H H H H L H   H H H H H H L L   H H H H H H L L L   H H H H H H H L L   L L L L L L L L L   L L L L L L L L L   L L L L L L L L L   L L L L L L L L L   L L L L L L L L L L   L L L L L L L L L L   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0  |
| Gray<br>Scale<br>of<br>Blue   | Green<br>Black<br>Dark<br>↓<br>Light  | I | H H H H H L H   H H H H H L H   H H H H H H L L   H H H H H H H L L   H H H H H H H H L L   L L L L L L L L L L   L L L L L L L L L L   L L L L L L L L L L   L L L L L L L L L L   L L L L L L L L L L   L L L L L L L L L L L   L L L L L <td>I I</td> <td>L5<br/>L252<br/>L253<br/>L254<br/>Green L255<br/>L 0<br/>L 0<br/>L 0<br/>L 0<br/>L 0<br/>L 4</td>  | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4  |
| Gray<br>Scale<br>of<br>Blue   | Green<br>Black<br>Dark<br>↓<br>Light  | I L | H H H H L H   H H H H H L H   H H H H H H L L   H H H H H H H L L   H H H H H H H L L L   L L L L L L L L L L   L <   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252  |
| Gray<br>Scale<br>of<br>Blue   | Green<br>Black<br>Dark<br>↑<br>↓<br>Light   | I | H H H H H L H   H H H H H H L H   H H H H H H H L L   H H H H H H H H L L   H H H H H H H H L   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252   |
| Gray<br>Scale<br>of<br>Blue   | Green<br>Black<br>Dark<br>↑<br>↓<br>Light   | I L | H H H H H L H   H H H H H H L H   H H H H H H H L H   H H H H H H H H L L   H H H H H H H H H L   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243  |
| Gray<br>Scale<br>of<br>Blue   | Green<br>Black<br>Dark<br>↑<br>↓<br>Light   | I L | H H H H H L H   H H H H H H H L H   H H H H H H H H H L L   H H H H H H H H H L </td <td>I I</td> <td>L5<br/>L252<br/>L253<br/>L254<br/>Green L255<br/>L 0<br/>L 0<br/>L 0<br/>L 0<br/>L 0<br/>L 4<br/>L5<br/>L252<br/>L243<br/>L254<br/>Blue L255</td> | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255   |
| Gray<br>Scale<br>of<br>Blue   | Green<br>Black<br>Dark<br>↑<br>↓<br>Light<br>Blue                                     | I | H H H H H L H   H H H H H H H L H   H H H H H H H H H H   H H H H H H H H H H   H   | L | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255  |
| Gray<br>Scale<br>of<br>Blue   | Green<br>Black<br>Dark<br>↑<br>↓<br>Light<br>Blue<br>Black                            | I | H   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255<br>L 0<br>L 0  |
| Gray<br>Scale<br>of<br>Blue<br>Gray<br>Scale                              | Green<br>Black<br>Dark<br>↓<br>Light<br>Blue<br>Black                                 | I | H   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255<br>L 0<br>L 0<br>L 0   |
| Gray<br>Scale<br>of<br>Blue<br>Gray<br>Scale<br>of                        | Green<br>Black<br>Dark<br>↓<br>Light<br>Blue<br>Black<br>Dark                         | I | H   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0   |
| Gray<br>Scale<br>of<br>Blue<br>Gray<br>Scale<br>of<br>White               | Eight<br>Green<br>Black<br>↑<br>↓<br>Light<br>Blue<br>Black<br>Dark<br>↑<br>↓         | I | H   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0  |
| Gray<br>Scale<br>of<br>Blue<br>Gray<br>Scale<br>of<br>White<br>&          | Green<br>Black<br>Dark<br>↑<br>↓<br>Light<br>Blue<br>Black<br>Dark<br>↓<br>Light      | I L | H   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 1<br>S   |
| Gray<br>Scale<br>of<br>Blue<br>Gray<br>Scale<br>of<br>White<br>&<br>Black | Black<br>Green<br>Black<br>Dark<br>↓<br>Light<br>Blue<br>Black<br>Dark<br>↓<br>Light  | I L | H   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 254  |
| Gray<br>Scale<br>of<br>Blue<br>Gray<br>Scale<br>of<br>White<br>&<br>Black | Green<br>Black<br>Dark<br>↓<br>Light<br>Blue<br>Black<br>Dark<br>↓<br>Light           | I | H   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L0<br>L0<br>L0<br>L0<br>L0<br>L0<br>L4<br>L5<br>L252<br>L243<br>L243<br>L254<br>Blue L255<br>L0<br>L0<br>L0<br>L0<br>L0<br>L252<br>L243<br>L254<br>Blue L255<br>L0<br>L0<br>L0<br>L0<br>L252<br>L243<br>L254<br>L254<br>L252<br>L253<br>L254<br>L252<br>L253<br>L255<br>L0<br>L255<br>L0<br>L0<br>L0<br>L0<br>L0<br>L0<br>L0<br>L0<br>L0<br>L0  |
| Gray<br>Scale<br>of<br>Blue<br>Gray<br>Scale<br>of<br>White<br>&<br>Black | Green<br>Black<br>Dark<br>↓<br>Light<br>Blue<br>Black<br>Dark<br>↓<br>Light           | I L | H   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0 |
| Gray<br>Scale<br>of<br>Blue<br>Gray<br>Scale<br>of<br>White<br>&<br>Black | Green<br>Black<br>Dark<br>↑<br>↓<br>Light<br>Blue<br>Black<br>Dark<br>↑<br>↓<br>Light | I L | H   | I | L5<br>L252<br>L253<br>L254<br>Green L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 4<br>L5<br>L252<br>L243<br>L254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 254<br>Blue L255<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0<br>L 0  |

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

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 3. Recommended Operating Conditions <sup>1) 5) 6)</sup>

| Item                      |                                      | Min. | Тур. | Max.            | Unit     | Remarks  |
|---------------------------|--------------------------------------|------|------|-----------------|----------|--|
| Supply Voltage            | V <sub>DD</sub>                      | 4.75 | 5.0  | 5.25            | V        | 2)   |
| Current Consumption       | <i>I</i> <sub>DD</sub> <sup>*2</sup> | -    | 190  | 270             | mA(rms)  |  |
| Inrush current            | $I_{\rm RS}^{*3}$                    | -    | -    | 2100            | mA(peak) |  |
| Allowable Ripple Voltage  | V <sub>RP</sub>                      | -    | -    | 100             | mV(p-p)  |  |
| FL Driving Voltage        | V <sub>FL</sub>                      | 909  | 1010 | 1111            | V(rms)   | <i>I</i> <sub>FL</sub> =(6.0)mA(rms) <sup>9)</sup> |
| FL Start Voltage          |                                      | -    | -    | 2150            | V(rms)   | <i>T</i> a=0 °C <sup>9)11)</sup>                   |
| FL Driving Frequency      | f <sub>FL</sub>                      | 30   | -    | 70              | kHz      | 9)   |
| FL Input Current per Lamp | I <sub>FL</sub>                      | 5.5  | 6.1  | 8.0             | mA(rms)  | Per a Lamp 7) 8) 9)12)                             |
| Input Low Level           | VIL                                  | 0    |      | 0.7             | V        | 3) 4)  |
| Input High Level          | Vih                                  | 2.2  |      | V <sub>DD</sub> | V        |  |
| Input leakage current     | IIL                                  | -100 | -    | -               | μA       | $V_{IL} = 0V$                                      |
|                           | I <sub>IH</sub>                      | -    | -    | 100             | μA       | $V_{\rm IH} = V_{\rm DD}$                          |

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

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

Note 3) Checked Pin Terminal : R0-R7 and G0-G7 and B0-B7,GND (0V),

Note 7) Checked Pin Terminal: V<sub>FLH1</sub>- V<sub>FLL1</sub>, V<sub>FLH2</sub>- V<sub>FLL2</sub>, V<sub>FLH3</sub>- V<sub>FLL3</sub>, V<sub>FLH4</sub>- V<sub>FLL4</sub>

Note 8) If FL input current is higher than typical value, then FL lifetime become shorter.

Note 9) Measuring Method of I<sub>FL</sub> :

This TFT-LCD module uses twin FL lamps.

So the measuring value of AC ampere meter is FL input currents of two lamps.



Note 10) 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 frequency, even if the condition satisfies above recommended operating condition and timing specification shown in 2.4.4

Note 11) Input FL starting voltage ( $V_{SFL}$ ) should not be less than one second.

If it were less than one second, it may cause unstable operation of FL.

Note 12) If FL input current is higher than typical value, the deterioration of display quality may be occurred.

Note 13) Inverter should be designed to meet the follow conditions:

(1) The positive and negative waveforms of lamp current and voltage should be symmetric.

The symmetric ratio should be larger than 90%. And the waveform should be approached a sine-curve.

- (2) It is recommended to using push/pull type"-inverter. Because the backlight unit of t his LCD-Panel is designed for "push/pull type"-inverter.
- (3) Please set the all input voltages (CN2, CN3, CN4, CN5) synchronization.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 4. Electrical Characteristics

## 4.1 Test Conditions

| Ambient Temperature  | : <i>T</i> a      | 25±3°C            |   |
|----------------------|-------------------|-------------------|---|
| Ambient Humidity     | : <i>H</i> a      | 55±15%(l          | RH)                                       |
| Supply Voltage       | : V <sub>DD</sub> | 5.0 V             |   |
| Input Signal         | : "Typ"-va        | lue of timi       | ng specification shown in 2.4.4           |
| FL Inverter          | : HIU-4           | 73 for LTA        | 140C060F (Harison Toshiba Lighting corp.) |
| FL Input Current     |                   | : I <sub>FL</sub> | 6.0mA(rms) / Lamp                         |
| FL Driving Frequency | : f <sub>FL</sub> | 50kHz             |   |

## 4.2 Specifications

| Item                | Symbol          | Min. | Тур. | Max. | Unit | Remark                           |
|---------------------|-----------------|------|------|------|------|----------------------------------|
| Current Consumption | I <sub>DD</sub> | -    | 190  | 270  | mA   | V <sub>DD</sub> Terminal Current |

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

| 1 2 |
|-----|
|-----|

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

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 5. Optical Characteristics

- 5.1 Test Conditions
  - It is same as 4.1

The measuring method is shown in 11.

## 5.2 Optical Specifications

| Item           |       | Symbol         | Conditions     |          | S     | pecificatio | ns    | Unit              | Remark |
|----------------|-------|----------------|----------------|----------|-------|-------------|-------|-------------------|--------|
|                |       |                |                |          | Min.  | Тур         | Max.  |                   |        |
| Viewing Angle  |       | q              | <i>CR</i> >=10 | f= 180°  | 50    | 80          | -     | 0                 |        |
|                |       | -              |                | f= 0°    | 50    | 80          | -     | 0                 |        |
|                |       |                |                | f= 90°   | 50    | 80          | -     | 0                 |        |
|                |       |                |                | f= -90°  | 50    | 80          | -     | 0                 |        |
| Contrast Ratio | )     | CR             | q=0°, f=0°     |          | 300   | 400         | -     | -                 |        |
| Response Tim   | ne    | t <sub>r</sub> | q=0°, f=0°     |          | -     | 4           | 10    | ms                |        |
|                |       | t <sub>f</sub> |                |          | -     | 12          | 20    | ms                |        |
| Luminance      |       | L              | q=0°, f=0° Gra | ay Scale | 350   | 450         | -     | cd/m <sup>2</sup> |        |
|                |       |                | Level=L255 (V  | Vhite)   |       |             |       |                   |        |
| Chromaticity   | Red   | <b>X</b> R     | Gray Scale Le  | vel:L255 | -     | 0.640       | -     | -                 |        |
|                |       | <b>y</b> r     | q=0°, f=0°     |          | -     | 0.330       | -     | -                 |        |
|                | Green | X <sub>G</sub> | Ditto          |          | -     | 0.300       | -     | -                 |        |
|                |       | <b>y</b> G     |                |          | -     | 0.600       | -     | -                 |        |
|                | Blue  | Х <sub>В</sub> | Ditto          |          | -     | 0.138       | -     | -                 |        |
|                |       | Ув             |                |          | -     | 0.060       | -     | -                 |        |
|                | White | Xw             | Ditto          |          | 0.220 | 0.280       | 0.340 | -                 |        |
|                |       | Уw             |                |          | 0.220 | 0.280       | 0.340 | -                 |        |

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

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

Note 3): The above test limit must be applied for initial use. Characteristics will be shifted by long period operation, but it is not irregular phenomena. Theoretically brightness characteristics will be decreased due to CCFL degradation and color shift due to optical components change.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

# 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 2) |
|                        |                            |

# 6.2 Test Conditions

| 1) Ambient Temperature | : 25±5°C  |
|------------------------|---|
| 2) Ambient Humidity    | : 65±20% (RH)   |
| 3) Illumination        | : Approximately 500 lx under the fluorescent lamp                 |
| 4) Viewing Distance    | : Approximately 30cm by the eyes of the inspector from the module |
| 5) Inspection Angle    | : q=0°, f=0°  |

## 6.3 Dimensional Outline

The products shall conform to the dimensions specified in 2.3.2. Definition of Major and Minor defects are as follows.

| Item                 | Description                                 | Class |
|----------------------|---|-------|
| Important Dimensions | Dimensional outline, Dimensional between    | Major |
|                      | the mounting holes.                         |       |
| Others               | Dimensions specified in this specifications | Minor |

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |  |
|---|------------------|------------------------|--|
|   | Date:            | Old No.                |  |

## 6.4 Appearance Test

- 6.4.1 Test Conditions
  - 1) Condition: Non-operating : PCB Appearance, Soldering, Bezel, Plastic Frame, Connectors

Same as 6.2

2) Condition: Non-operating and operating : Black and White Spots/Lines

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 resign |                       |          |                   | Minor |       |
| Soldering      | Cold solder joint, lead m                            | ove when p            | oulled   |                   | 1     | Major |
| Bezel Frame    | Distinct stain rust or scr                           | atch                  |          |                   |       | Minor |
| Connectors     |  |                       |          |                   |       |       |
|                |  |                       |          |                   |       |       |
| Spots/Lines    | (Bright Line)  |                       |          |                   | _ ľ   | Minor |
|                | Line width (mm)                                      | Length (              | (mm)     | Acceptable count  |       |       |
|                | <i>W</i> ≤ 0.01                                      | -                     |          | Neglect           |       |       |
|                | 0.01< <i>W</i> ≤ 0.10                                | <i>0.3</i> ≤ <i>l</i> | <u> </u> | N≤2               |       |       |
|                | 0.10< <i>W</i>                                       |                       |          | 2)                |       |       |
|                | (Bright Spot)  |                       |          |                   |       |       |
|                | Average diameter (                                   | mm)                   | Accept   | table count/side  | 7     |       |
|                | <i>D</i> ≤ 0.10                                      |                       |          | Neglect           |       |       |
|                | 0.10 < <i>D</i> ≤ 0.3                                |                       |          | N≤2               |       |       |
|                | 0.3 < D  |                       |          | 0                 |       |       |
|                | (Non-Bright Line)                                    |                       |          |                   | _     |       |
|                | Line width (mm)                                      | Length                | (mm)     | Acceptable count  | 7     |       |
|                | <i>W</i> ≤ 0.01                                      | -                     | · · · /  | Neglect           |       |       |
|                | $0.01 < W \le 0.10$                                  | 0.3≤                  | _ ≤ 1.0  | N ≤ 3             |       |       |
|                | 0.10< W  |                       |          | 2)                |       |       |
|                | Non-Bright Spot                                      |                       |          |                   | -     |       |
|                | Average diameter                                     | (mm)                  | Accep    | otable count/side | ן ר   |       |
|                | D < 0.10 Neglect                                     |                       |          |                   |       |       |
|                | 0.10 < D < 0.3 N < 3                                 |                       |          |                   |       |       |
|                | 0.3 < D 0  |                       |          |                   |       |       |
|                | (Total Spots and Lines                               | N < 5                 |          |                   | J     |       |
|                |  | b). $N \ge 0$         |          |                   |       |       |
|                |  |                       |          |                   |       |       |

Note 1) Inspection area should be within viewing area.

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

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



| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |  |
|---|------------------|------------------------|--|
|   | Date:            | Old No.                |  |

## 6.5 Display Quality 6.5.1 Test Conditi

| 1 Test Conditio<br>1) Inspection Area | NS<br>: Within viewing area   |
|---------------------------------------|---|
| 2) Condition                          | : Same as test conditions shown in 4.1 and 6.2  |
| 3) Test Pattern                       | : White display pattern (gray scale level L255) , Black display pattern (gray scale level L0)<br>Red display pattern (gray scale level L255), Green display pattern (gray scale level L255)<br>Blue display pattern (gray scale level L255) |

## 6.5.2 Specifications

| Item                              | Description / Specifications  | Class |
|-----------------------------------|---|-------|
| Function                          | No display, Malfunction   | Major |
| Display Quality <sup>1)2)3)</sup> | Missing line  | Major |
|                                   | Missing Sub-Pixels  | Minor |
|                                   | 1) Bright defects : 5 pcs. maximum <sup>2)3)</sup>  |       |
|                                   | 2) Dark defects : 10 pcs maximum <sup>2)</sup>  |       |
|                                   | 3) Total sub-pixel defects : 10 pcs maximum   |       |
|                                   |   |       |
|                                   | Various uniformity (mura) : neglect   |       |
|                                   | Inconspicuous flicker, crosstalk, Newton's ring and other defects : neglect <sup>4)5)</sup> | -     |
| Black and White                   | Same as 6.4.2 <sup>5)</sup>   | Minor |
| Spots/line                        |   |       |
| Backlight                         | Missing (Non-operating)   | Major |

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

Note 2) Bright defect means a bright spot (sub-pixel) on the display pattern of gray scale L0. Dark defect means a dark spot (sub-pixel) on the display pattern of gray scale L255.

- Note 4) Test pattern : White and black 1dot-checker display pattern (gray scale level L255 and L0),
- Note 5) Test Pattern : White display pattern (gray scale level L127), Black display pattern (gray scale level L0)

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |     |
|---|------------------|------------------------|-----|
|   | Date:            | Old                    | No. |

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

## 6.6 Reliability Test

#### 6.6.1 Test Conditions

- 1) The module should be driven and inspected under normal test conditions.
- 2) The module should not have condensation of water (moisture) on the module.
- 3) The module should be inspected after two or more hours storage in normal conditions (15 35°C,45 65%(RH)).
- 4) A module shall be used only for one test.

## 6.6.2 Specifications

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

| Test Item                                | Test Conditions                                  |    | Result |  |
|--|--|----|--------|--|
| High Temperature Operation <sup>1)</sup> | 50°C 192 h                                       | OK | 3р/3р  |  |
| High Temperature Storage <sup>2)</sup>   | 60°C 192 h                                       | OK | 3р/3р  |  |
| High Temperature                         | 40°C 90% 192 h                                   | OK | 3р/3р  |  |
| High Humidity operation <sup>1)</sup>    |  |    |        |  |
| Low Temperature Operation <sup>1)</sup>  | 0°C 192 h  | OK | 3р/3р  |  |
| Low Temperature Storage <sup>2)</sup>    | -20°C 192 h                                      | OK | 3р/3р  |  |
| Temperature Shock <sup>2)</sup>          | -20°C ⇔ 60°C                                     | OK | 3р/3р  |  |
|  | 1.0h 1.0 h                                       |    |        |  |
|  | 5 cycles   |    |        |  |
| Mechanical Vibration <sup>2)</sup>       | 10 - 57Hz half-sine pulse 0.075mm,               | OK | 3р/3р  |  |
|  | 57-500Hz, 1.0×9.8m/s <sup>2</sup> , 11min/cycles |    |        |  |
|  | once for X.Y.Z each directions, 0.5h each        |    |        |  |
| Mechanical Shock <sup>2)</sup>           | 50×9.8m/s <sup>2</sup> , 11ms,                   | OK | 3p/3p  |  |
|  | $\pm X$ , $\pm Y$ , $\pm Z$ direction,           |    |        |  |
|  | one time each directions                         |    |        |  |

Note 1) Operating Note 2) Non-Operating

Definitions of failure for judgment shall be as follows:

- 1) Function of the module should be maintained.
- 2) Current consumption should be smaller than the specified value.
- 3) Appearance and display quality should not have distinguished degradation.
- 4) Luminance should be larger than 50% of the minimum value. (Refer to 5.2 Optical Specifications)

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

Sheet 29

## 6.7 Labels



- A: Product Label
- B: Caution Label (High Voltage)
- C: Caution Label (Disposal of CCFL)

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 7. Lifetime

7.1 Module (except lamp)

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

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

Conditions : Ambient temperature : 25±5°C (No wind) Ambient humidity : 65%(RH)

## 7.2 Lamp

7.2.1 Test Conditions

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

## 7.2.2 Specifications

MTBF : 50,000 h

Definitions of failure for judgment shall be as follows.

- 1) LCD luminance becomes half of the minimum value specified in 5.2.
- 2) Lamp doesn't light normally.

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

- 8. Packaging
  - 8.1 Carton (internal package)
    - (1) Packaging Form
      - Corrugated cardboard box



# (2) Packaging Method <sup>1) 2)</sup>

Note 1) : Total weight : (Approx.) 12.7kg Note 2) : Acceptable number of piling : 12sets

(3) Packaging Material :

| Number | Quantity | Description            |
|--------|----------|------------------------|
| 0      | 5        | Static electricity     |
|        |          | Protective sack        |
| 2      | 1 set    | Holder (inner box)     |
| 3      | 1        | Static electric        |
|        |          | Protective square bag  |
| 4      | 3        | Silicagel (100g×3)     |
| \$     | 1 set    | Carton                 |
| 6      |          | Plastics adhesive tape |



| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

## 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 except the measurement of Luminance Uniformity.

- (2) Photometer : BM-7/BM-5A TOPCON (Aperture 2°)
- (3) Definition of  $\phi$  and  $\Theta$  :



| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |

#### 10.2 Measuring Methods

(1) Luminance:

The luminance of the center on a white raster (gray scale level L255) shall be measured. Measurement shall be executed 30 minutes after the lamp is lit up.

(2) Contrast Ratio:

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

L255 : Luminance on the white raster (gray scale level L255)

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

(3) Viewing Angle

Viewing angle is defined as the angles(q,f), in which specified contrast ratio can be obtained. (Refer to 11.1(3) for the axes.)

Note) Measuring system for Viewing Angle

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

(b) Photometer: Ez Contrast 160R (ELDIM)

(4) Chromaticity :

The values (x,y) of chromaticity coordinates should be measured for the White, Red, Green and Blue Raster(gray scale level L255) each with a photometer.

#### (5) Response Time :

The response time is measured using a photo detector (photodiode) which measures the light intensity of the pixels.



 $t_{\rm f}$ : Fall time is the time for the light intensity of the pixels to go from 10% of its maximum to 90% of its maximum.

 $t_r$ : Raise time is the time for the light intensity of the pixels to go from 90% of its maximum to 10% of its maximum.

Photodiode : S1223-01 HAMAMATSU PHOTONICS K.K. White Display : White Raster (gray scale level L255) Black Display : Black Raster (gray scale level L0)

| Toshiba Matsushita Display Technology Co.,Ltd | Date: 2003-06-18 | New No. LTA170C07RF-01 |
|---|------------------|------------------------|
|   | Date:            | Old No.                |