



ELECTRONICS

Approval

TO :

Date : 2002. 05. 17

SAMSUNG TFT-LCD
MODEL NO. : LTM150XI-A01

Note:

Any Modification of Spec is not allowed without SEC's permission.

Prepared by : 原 김상원

Checked by : J. H. Park 박정훈

Approved by : 조유동 조유동

Samsung Electronics Co . , LTD



Contents

| | | | |
|-------|---|-------|----|
| * | Revision History | ----- | 3 |
| 1. | General Description | ----- | 4 |
| 2. | Electrical Absolute Ratings | ----- | 6 |
| 3. | Environmental Specification | ----- | 6 |
| 4. | Optical Characteristics | ----- | 7 |
| 5. | Electrical Specification | | |
| 5.1 | Input video and sync signal | ----- | 12 |
| 5.2 | Input Signal Pin Assignment | ----- | 13 |
| 5.3 | Function Key Pin Assignment and Description | ----- | 13 |
| 5.4 | Power Supply | ----- | 14 |
| 5.4.1 | Pin Assignment and description | - | |
| 5.4.2 | Input voltage & Rush current | | |
| 5.4.3 | DPMS: VESA DPMS compliance | | |
| 5.5 | Power Consumption | ----- | 14 |
| 5.5.1 | Measurement of power consumption | | |
| 5.5.2 | Power management mode: VESA DPMS protocol applied | | |
| 5.6 | Display Modes | ----- | 16 |
| 6. | User Interface | ----- | 17 |
| 6.1 | OSD Key Matrix | | |
| 6.2 | User Controls | | |
| 7. | Microprocessor | ----- | 18 |
| 8. | Mechanical Specification | | |
| 8.1 | Outline dimension | ----- | 21 |
| 8.2 | Packing Information | ----- | 23 |
| 9. | General Precaution | ----- | 25 |
| 9.1 | Handling | | |
| 9.2 | Storage | | |
| 9.3 | Operation | | |
| 9.4 | Others | | |

* Revision History

| Date | Rev. No | Page | Summary |
|---------------|---------|------|--|
| Sep. 06, 2001 | 000 | All | Approval spec of LTM150XI-A01 model was issued for the first time. |
| Apr. 15, 2002 | 001 | 05 | Change scalar IC from PW112 to PW115 (Merged T-Con) |
| | | 12 | Delete Failsafe mode and Out Of Range mode. |
| | | | Change Maximum mode from 1280*1024 60Hz to 1024*768 75Hz. |
| | | 16 | Delete Failsafe mode. |
| | | 17 | Change Hot-Key define description(Clear Burn In). |
| | | 18 | Add Out Of Range Mode Table. |
| | | 19 | Add FailSafe Mode Table. |

1. General Description

LTM150XI-A01 is a new concept of System-On-Panel (SOP) display device. It provides total and high quality TFT-LCD display solutions for customer system design. Customer can use the high quality display unit just like an integrated circuit (IC).

As ICs are used as building blocks of many complicated electronic systems, this new display solution can be used just same.

This device includes the high quality TFT-LCD panel and the high brightness 4-lamp backlight unit with the optimized inverter. Integrated signal processing unit, named LSP (LCD Signal Processor™), includes all electronic function for user application. It includes analog-to-digital conversion, Scaling, OSD, EDID (DDC 2 compliance) and LCD Timing controller. More functions are available, also.

World-top notebook LCD design technology of Samsung realize the most compact solution. Customer can enjoy wide system design flexibility.

EMI is the additional point of this device. All of the units are shielded by metal case finally.

* Features

- High display quality : High contrast ratio, Wide-viewing angle and High-speed response time.
- High brightness with the 4-CCFL backlight lamps using optimized inverter.
- Standard interface: Analog RGB
 - ※ Interface solution is shown in next page.
- On Screen Display(OSD): Samsung generic bitmap OSD is supported, but the customized OSD is also available using system development tool.
- Digital Image Processor is embedded with intelligent microprocessor.
- Wide Input Voltage Range : +10VDC ~ +15VDC
- DDC Ver. 2 Compliance by system integrator
- VESA DPMS compliance
- Low Power Consumption
- Easier EMI troubleshooting and solution supported.
- Easy Lamp replacement

* Information

| Items | Specification | Unit | Note |
|-------------------|------------------------------|--------|--------------------|
| Display area | 304.1(H) x 228.1(V) | mm | 15.0 inch diagonal |
| Driver element | a-Si TFT active matrix | | |
| Display colors | 16.2M | colors | 6-bit FRC |
| Number of pixels | 1024 x 768 | pixel | |
| Pixel arrangement | RGB vertical stripe | | |
| Pixel pitch | 0.297(H) x 0.297(W) | mm | |
| Display mode | Normally White | | |
| Surface treatment | Haze 25% , Hard-coating (3H) | | |
| Lamp | 4-Lamp | | |

*** Mechanical information**

| Item | Min. | Typ. | Max. | Note | |
|-------------|---------------|-------|-------|-------|----|
| Module size | Horizontal(H) | 331.1 | 331.6 | 332.1 | mm |
| | Vertical(V) | 254.8 | 255.3 | 255.8 | mm |
| | Depth(D) | - | - | 18.0 | mm |
| Weight | - | - | 1,800 | g | |

2. Electrical Absolute Ratings

(1) TFT LCD Module

(V_{ss} = GND = 0 V)

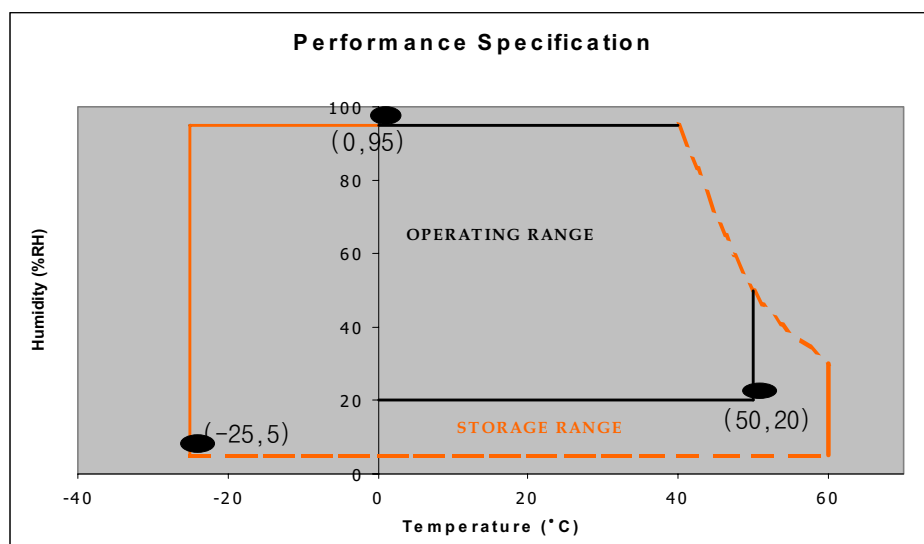
| Item | Symbol | Min. | Max. | Unit | Note |
|----------------------|-----------------|------|------|------|------|
| Power Supply Voltage | V _{in} | -0.3 | +21 | V | (1) |

NOTE (1) Within Ta (25 ± 2 °C)

3. Environmental Specification

| Items | Min. | Max. | Units | Note |
|---------------------------|------|------|-------|--|
| Storage Temperature | -25 | +60 | °C | |
| Operating Temperature | 0 | +50 | °C | |
| Shock (Non-operating) | - | 50 | G | 11ms, 1 time for ±X, ±Y, ±Z |
| Vibration (Non-operating) | - | 1.5 | G | 10-300Hz, Sweep rate:10min, 30min for X, Y, Z axis |

■ Note: If this product is used for extended time excessively or exposed to high temperatures for extended time, there is a possibility of wide viewing angle film damage which could affect visual characteristics.



4. Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured

in a dark room or equivalent state with the methods shown in Note (1).

※Measuring equipment : TOPCON BM-5A: Contrast Ratio, Luminance of White, Viewing Angle

TOPCON BM-7: Response time

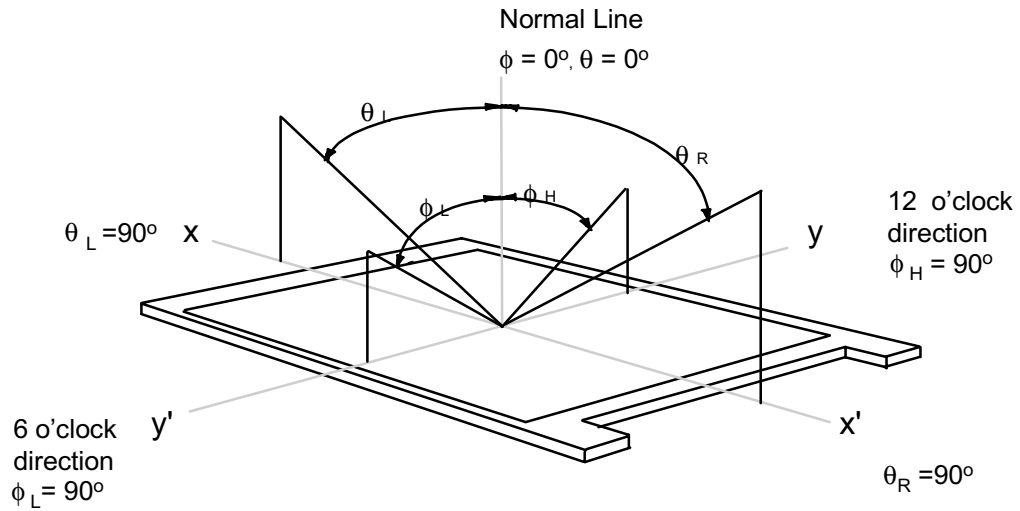
Photo Research PR650: Color Chromaticity

※Ta = 25± 2℃ , VIN = +12V, fv= 60Hz, IL = 6.0mA

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Note | |
|---------------------------------------|----------------|------------------|---|-------|-------|-------|---------|-------------------|----------|
| Contrast Ratio | | CR | | 200 | 300 | - | | (1),(2),(4) | |
| Response Time at Ta | Rising | T _R | Φ=0, Θ=0 Normal Viewing Angle | - | 5 | - | msec | (1), (3) | |
| | Falling | T _F | | - | 20 | - | | | |
| Luminance of White (Center of Screen) | | Y _L | | | 200 | 250 | - | cd/m ² | (1),(4) |
| Color Chromaticity (CIE 1931) | Red | R _X | | | 0.603 | 0.628 | 0.653 | | (1), (5) |
| | | R _Y | | | 0.328 | 0.353 | 0.378 | | |
| | Green | G _X | | | 0.265 | 0.290 | 0.315 | | |
| | | G _Y | | | 0.570 | 0.595 | 0.620 | | |
| | Blue | B _X | | | 0.119 | 0.144 | 0.169 | | |
| | | B _Y | | | 0.063 | 0.088 | 0.113 | | |
| White | W _X | | | 0.279 | 0.304 | 0.329 | | | |
| | W _Y | | 0.300 | 0.325 | 0.350 | | | | |
| Viewing Angle | Hor. | Θ _L | CR≥10 | 65 | - | - | Degrees | | |
| | | Θ _R | | 65 | - | - | | | |
| | Ver. | Φ _H | | 50 | - | - | | | |
| | | Φ _L | | 50 | - | - | | | |
| Color Gamut | | | | - | 65 | - | % | | |
| Brightness Uniformity (9 points) | | B _{UNI} | | - | - | 25 | % | (5) | |
| Cross Modulation | | C _T | | - | - | 5 | % | (6) | |

■ Measuring Condition: Maximum value of Brightness and Contrast in OSD menu. .

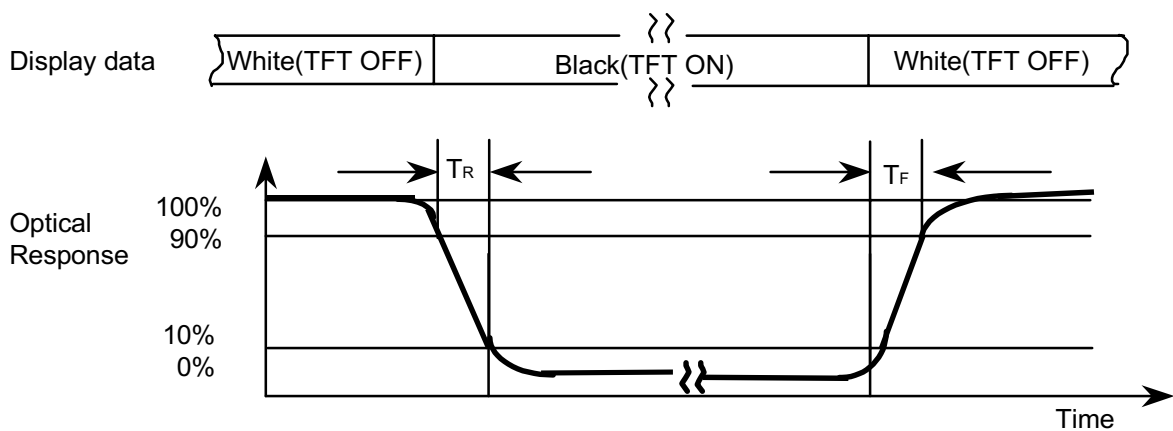
Note 1) Definition of Viewing Angle : Viewing angle range ($10 \leq CR$)



Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at the center point of panel.

$$CR = \frac{\text{Luminance with all pixels white (Gmax)}}{\text{Luminance with all pixels black (Gmin)}}$$

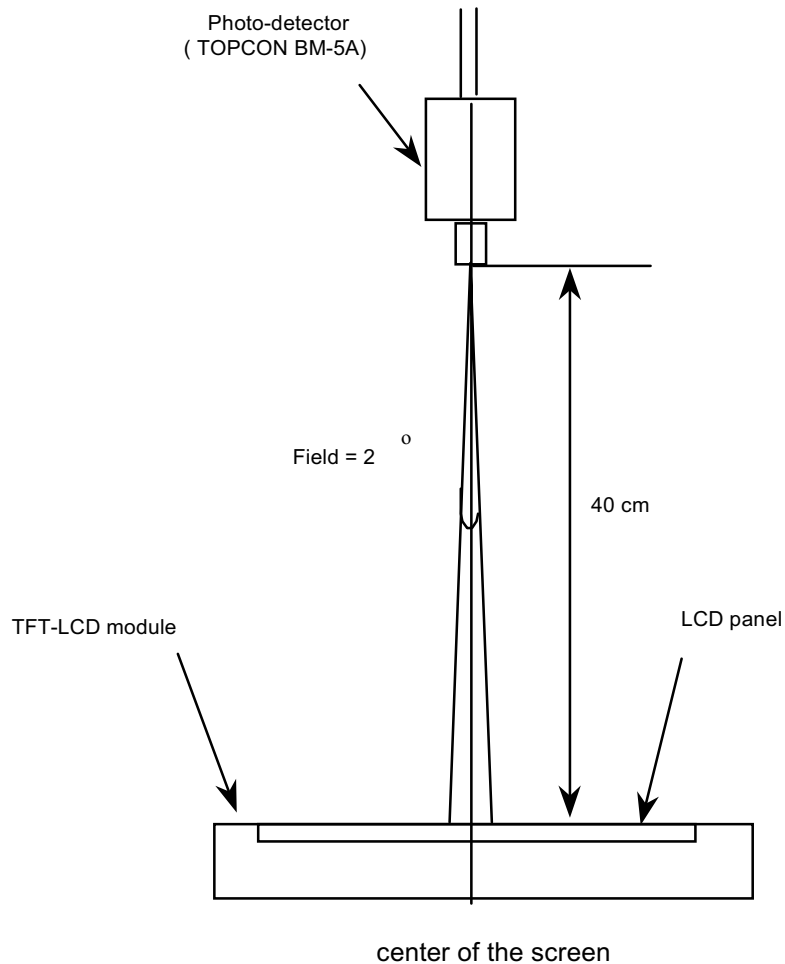
Note 3) Definition of Response time : Sum of T_R, T_F



Note 4) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the back-light. This should be measured in the center of screen.

Lamp current : 6.0mA

Environment condition : $T_a = 25 \pm 2 \text{ }^\circ\text{C}$



Optical characteristics measurement setup

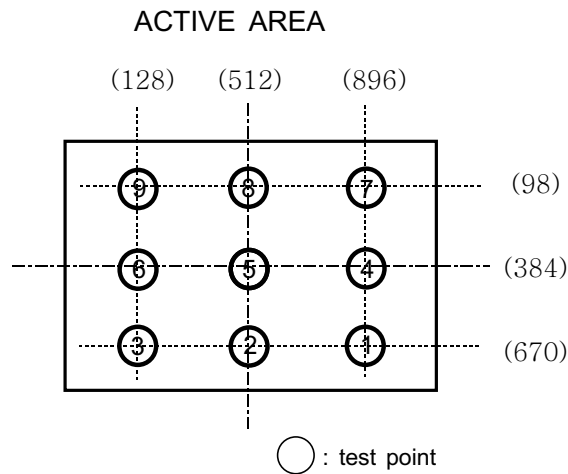
Note 5) Definition of 9 points brightness uniformity

$$B_{UNI} = \frac{|B_{max \text{ or } B_{min}} - B_{ave}|}{B_{ave}} \times 100$$

B_{max} : Maximum Brightness

B_{min} : Minimum Brightness

B_{ave} : Average Brightness = $\frac{\sum_{k=1}^9 (B(k))}{9}$



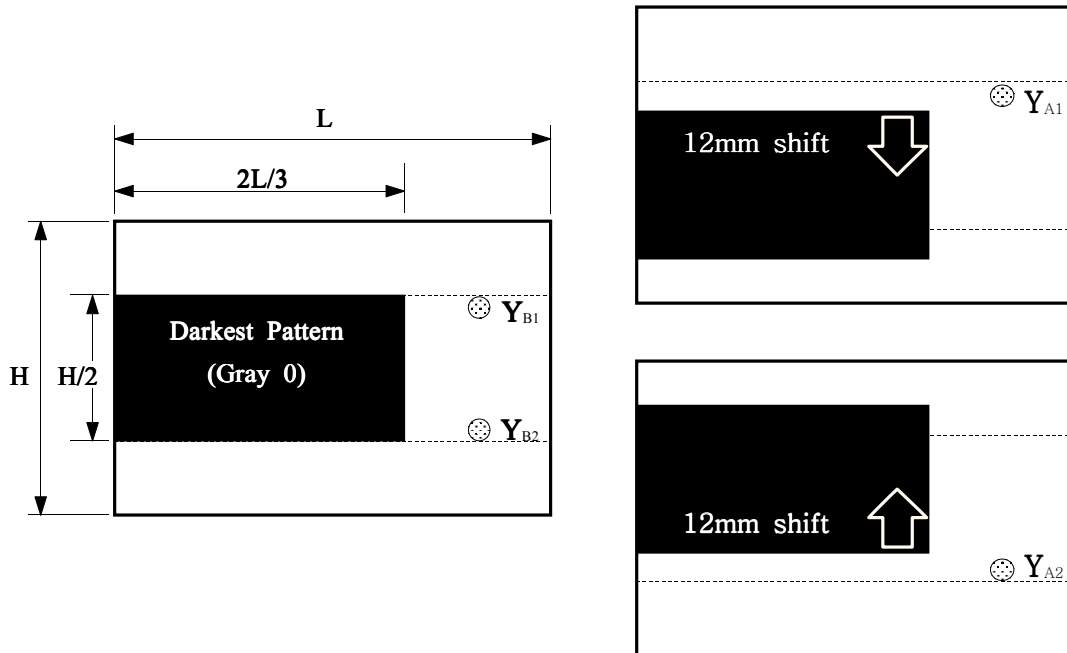
Note 6) Definition of Crosstalk (C_T)

$$\text{Crosstalk Modulation Ratio}(D_{\text{SHA}}) = \frac{|Y_A - Y_B|}{Y_A} \times 100 (\%)$$

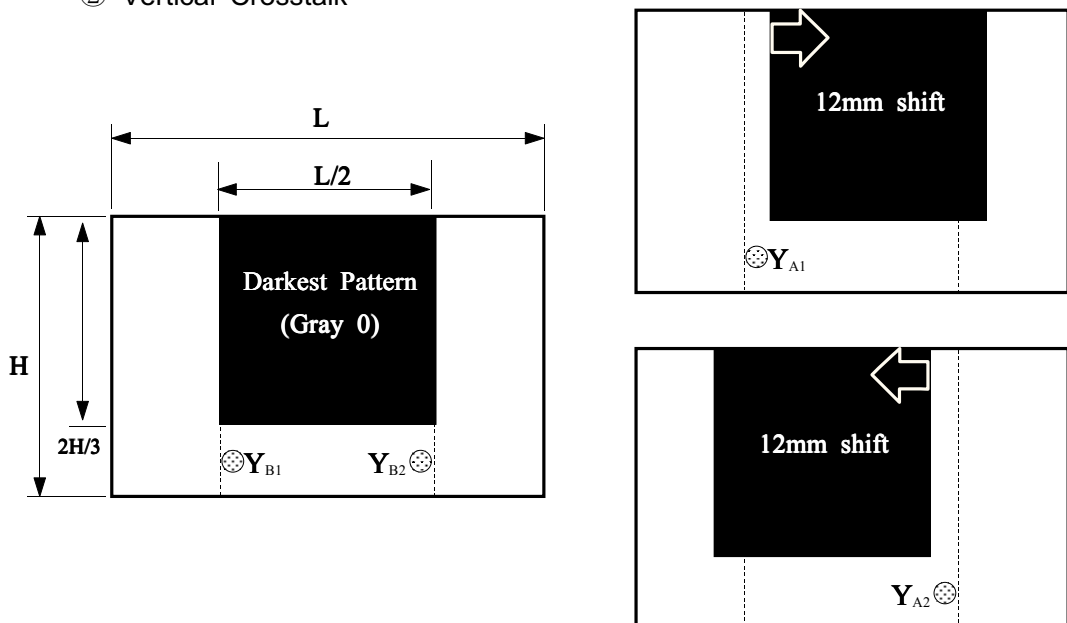
※ Y_A, Y_B = 2° Viewing Angle (Measurement Area on Panel : φ 12mm)

※ Background expect Black bar = Gray 1 ~ 63

① Horizontal Crosstalk



② Vertical Crosstalk



5. Electrical Specification

5.1 Input video and sync signal

* Signal Connector : S13B-PH-SM3-TB (JST)

☞ Mating Connector : PHR-13

| Item | | Description | Notes |
|-------|----------------------|--|-----------------|
| Video | Input | <ul style="list-style-type: none"> · Type: Analog RGB · level : 0.7Vp-p ±5% · Polarity: Positive Bright · Impedance: 75Ω±10% (Terminated) | VESA Compliance |
| | Resolution | <ul style="list-style-type: none"> · Optimum: 1024×768@60Hz · Maximum: 1024×768@75Hz | |
| | Horizontal Frequency | <ul style="list-style-type: none"> · 30-61KHz (normal mode) | |
| | Vertical Frequency | <ul style="list-style-type: none"> · 55-76Hz (normal mode) | |
| | Applicable Bandwidth | <ul style="list-style-type: none"> · Typical: 65MHz (1024x768@60Hz) | |
| | Sync Signal | <ul style="list-style-type: none"> · Type: Separate H/V sync · Level: TTL level (V high ≥ 2.0V, V low ≤ 0.8V) · Polarity: Positive or negative · Termination resistance: more than 2KΩ | |
| Sync | Input | <ul style="list-style-type: none"> · Type : separate H/V sync · Level : TTL level (V high ≥ 2.0V, V low ≤ 0.8V) · Polarity : Positive or negative. | |

5.2 Input Signal Pin Assignment and Description

* Signal Connector : S13B-PH-SM3-TB (JST)

☞ Mating Connector : PHR-13

| Group | Pin No. | Pin Name | Description | Note |
|---------------|---------|----------|----------------------|---|
| Analog RGB | Pin 01 | DB_DET | Cable Detect Pin | Internally Pull-Up (Connect this pin with DSUB #5 pin) |
| | Pin 02 | DB_SDA | Serial Data for DDC | |
| | Pin 03 | DB_SCL | Serial Clock for DDC | |
| | Pin 04 | RGND | Red Ground | |
| | Pin 05 | DB_RED | Red Data Input | |
| | Pin 06 | GGND | Green Ground | |
| | Pin 07 | DB_GRN | Green Data Input | |
| | Pin 08 | BGND | Blue Ground | |
| | Pin 09 | DB_BLU | Blue Data Input | |
| | Pin 10 | NC | Not used | |
| | Pin 11 | DB_VSY | Vsync Input | |
| | Pin 12 | SGND | Sync Ground | |
| | Pin 13 | DB_HSY | Hsync Input | |

5.3 Function Key Pin Assignment and Description

* Connector type: 53261-1490 (MOLEX)

☞ Mating Connector: 51021-1490

| Group | Pin No. | Pin Name | Description |
|--------|---------|----------|--------------------|
| Keypad | Pin 01 | KVDD | Keypad Unit Power |
| | Pin 02 | KGND 1 | Keypad Unit Ground |
| | Pin 03 | KEY8 | Key Input #8 |
| | Pin 04 | KEY7 | Key Input #7 |
| | Pin 05 | KEY6 | Key Input #6 |
| | Pin 06 | KEY5 | Key Input #5 |
| | Pin 07 | KEY4 | Key Input #4 |
| | Pin 08 | KEY3 | Key Input #3 |
| | Pin 09 | KEY2 | Key Input #2 |
| | Pin 10 | KGND 2 | Keypad Unit Ground |
| | Pin 11 | KEY1 | Key Input #1 |
| | Pin 12 | KGND 3 | Keypad Unit Ground |
| | Pin 13 | LED1 | Status Indicator |
| | Pin 14 | LED2 | Status Indicator |

5.4 Power Supply

5.4.1 Pin Assignment and description

*Connector type: 40006WR-02 (YeonHo Electronics)

| Pin No. | Pin Name | Description | Note |
|---------|----------|----------------------------|------|
| 2 | Vin | Input Power, +12VDC (typ.) | |
| 1 | GND | Ground | |

5.4.2 Input voltage & Rush current

| Items | Symbol | Min. | Typ. | Max. | Unit |
|--------------|--------|------|------|------|------|
| Input Volage | Vin | +10 | +12 | +15 | V |
| Rush Current | Irush | - | - | +12 | A |

5.4.3 DPMS: VESA DPMS compliance

5.5 Power Consumption

5.5.1 Measurement of power consumption

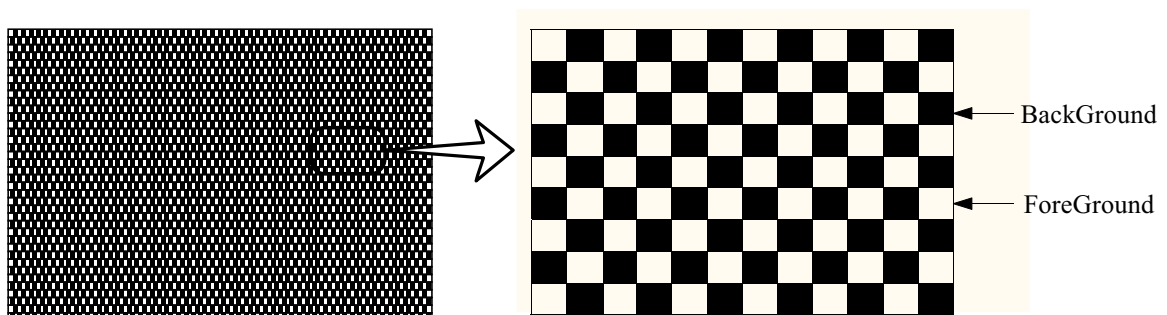
☞ Normal mode (Power on)

| Voltage | Current | | | | Resolution |
|---------|---------|------|------|------|---------------|
| | Min. | Typ. | Max. | Unit | |
| 10V | - | 2.6 | 3.0 | A | 1024*768@60Hz |
| 12V | - | 2.0 | 2.5 | A | |
| 15V | - | 1.8 | 2.0 | A | |

☞ Power saving(Stand-by, Suspend, Off mode): less than 3 watts. Monitor has to be recovered to normal operation mode within 4 seconds when normal signal is applied from signal source.

☞ Maximum condition

- OSD condition : Brightness 100, Contrast 100
- test pattern : One pixel on/off (1dot) pattern



5.5.2 Power management mode: VESA DPMS protocol applied.

| Mode | Horizontal sync | Vertical sync | LED1 | LED2 | Power consumption |
|----------|-----------------|---------------|------|----------------------|-------------------|
| On | Active | Active | Off | On | 30 watts(Max) |
| Stand-by | Inactive | Active | On | On/Off (Blinking) | < 3 watts |
| Suspend | Active | Inactive | | | |
| Off | Inactive | Inactive | | | |

5.6 Display Modes

| No. | Mode | Resolution | Total | Horizontal | | Vertical | | Pixel Clock |
|-----|------|------------|----------|------------|----------|-----------|----------|-------------|
| | | | | Frequency | Polarity | Frequency | Polarity | |
| 1 | VGA | 720x400 | 900x449 | 31.47KHz | N | 70.0 Hz | P | 28.322MHz |
| 2 | | 640x350 | 800x449 | 31.47KHz | P | 70.0 Hz | N | 25.175MHz |
| 3 | | 640x480 | 800x525 | 31.47KHz | N | 60.0 Hz | N | 25.175MHz |
| 4 | | 640x480 | 864x525 | 35.00KHz | N | 66.7 Hz | N | 30.240MHz |
| 5 | | 640x480 | 832x520 | 37.86KHz | N | 72.8 Hz | N | 31.500MHz |
| 6 | | 640x480 | 840x500 | 37.50KHz | N | 75.0 Hz | N | 31.500MHz |
| 7 | SVGA | 800x600 | 1024x625 | 35.16KHz | N/P | 56.3 Hz | N/P | 36.000MHz |
| 8 | | 800x600 | 1056x628 | 37.88KHz | P | 60.3 Hz | P | 40.000MHz |
| 9 | | 800x600 | 1040x666 | 48.08KHz | P | 72.2 Hz | P | 50.000MHz |
| 10 | | 800x600 | 1056x625 | 46.87KHz | P | 75.0 Hz | P | 49.500MHz |
| 11 | | 832x624 | 1152x667 | 49.73KHz | N | 74.6 Hz | N | 57.284MHz |
| 12 | XGA | 1024x768 | 1344x806 | 48.36KHz | N | 60.0 Hz | N | 65.000MHz |
| 13 | | 1024x768 | 1328x806 | 56.48KHz | N | 70.1 Hz | N | 75.000MHz |
| 14 | | 1024x768 | 1312x800 | 60.02KHz | P | 75.0 Hz | P | 78.750MHz |

6. User Interface

6.1 OSD Key Matrix

※This table is based on OSD S/W presented by SAMSUNG.

If our customer wants their customized OSD, Key matrix will be changed.

| Input Connector | | Keypad |
|-----------------|----------|-------------------------|
| Pin No. | Pin Name | Function |
| Pin 01 | KVDD | +3.3V / 100mA |
| Pin 02 | KGND1 | |
| Pin 03 | KEY8 | "AUTO" |
| Pin 04 | KEY7 | "EXIT" (Source) |
| Pin 05 | KEY6 | "LEFT"(Brightness "-") |
| Pin 06 | KEY5 | |
| Pin 07 | KEY4 | |
| Pin 08 | KEY3 | "RIGHT"(Brightness "+") |
| Pin 09 | KEY2 | "MENU" |
| Pin 10 | KGND2 | |
| Pin 11 | KEY1 | "POWER" |
| Pin 12 | KGND3 | |
| Pin 13 | LED1 | LED1 |
| Pin 14 | LED2 | LED2 |

* Firmware(including OSD) presented by SAMSUNG is edited by SDK 2.1a

* () : Hot Key

6.2 User Controls

- * Power: Turn on and off the monitor power.
- * Menu: Calls OSD menu and select the function to be adjusted.
- * Auto: Activates "Auto adjustment is being process".
- * Exit/Source
 - ☞ Exit from the OSD function or Back to previous menu.
 - ☞ Selects input signal source by press directly without OSD menu.
- * Left/Right
 - ☞ Moves the selector left and right on the OSD menu.
 - ☞ Increase or decrease the value of selected adjustment or Select proper setting.
- * LED: Indicates the status of monitor operation.
 - ☞ LED2: Normal
 - ☞ Back: Power OFF
 - ☞ LDE1: Power saving mode or Disconnection of signal cable.
- * Hot Key
 - ☞ Brightness : Adjust the brightness of back light lamp by press the Left/Right buttons without OSD menu.
 - ☞ Burn-in mode : Press "Menu" and "Exit" during 3 second
If you exit this function mode, press "Menu" and "Exit".
 - ☞ Software information check : Press "Left" and "Exit" key during 3 second.

7. Microprocessor

* Mode Detection

The microprocessor has to recognize the input signal mode automatically once input signal comes from the signal source, and then has to optimize the display adjustment accordingly integrated auto adjustment procedure.

If microprocessor finds out the input mode from NVRAM, all register sets will be initialized with this latest values, but microprocessor has to optimize all register sets with pre-set values if it does not exist on NVRAM.

* Auto Adjustment

When user activates the auto adjustment function by pressing AUTO button, the microprocessor will optimize all display adjustment sets such as video offset, gain, position, phase, and frequency automatically according to pre-programmed auto adjustment program.

* Manual Adjustment

If the microprocessor does not optimize all adjustments successfully, the manual adjustment will allow the correction of image adjustment along with OSD functionality.

This adjustment has to be described in the user manual correctly.

* Saving Adjustment

The microprocessor manages to save all adjustment results automatically into external NVRAM when adjustment is finished.

* Out of Range

The microprocessor has to manage all input signals to figure out the data identification. If the input signal is out of permitted frequency, the microprocessor has to protect all circuitry to avoid any electrical problem, and then has to display the warning message according to pre-programmed message like "Please re-configure the display timing of your system".

But, it will not allow to enter DPMS mode.

This system will judge the input signal as follow the below;

| Resolution | Frequency (Vsync) |
|-------------|-------------------|
| 640x480 | 161 Hz ~ |
| 800x600 | |
| 848x480 | |
| 1024x768 | 121 Hz ~ |
| 1280x720 | |
| 1280x768 | |
| 1360x768 | |
| 1152x864 | |
| 1280x960 | 101 Hz ~ |
| 1280x1024 | |
| 1600x900 | |
| 1600x1024 | 71 Hz ~ |
| 1600x1200 | |
| 1600x1200 ~ | |
| | Don' t care |

* Display Mode (Normal and Fail-Safe mode)

If the input signal is in the permitted frequency range as below, it will be operated in normal mode.

☞ Normal mode

- Horizontal frequency : 30-61KHz
- Vertical frequency : 55-76Hz

But, if the input signal is higher than normal input frequency, it will be converted into Fail Safe mode to allow reconfiguration of monitor setting using Windows control panel menu.

This functionality will minimize the installation failure by end-user.

☞ Fail Safe mode

| Resolution | Frequency 2(Vsync) |
|------------|--------------------|
| 640x480 | 79 ~ 160 Hz |
| 800x600 | |
| 848x480 | |
| 1024x768 | 79 ~ 120 Hz |
| 1280x720 | |
| 1280x768 | |
| 1360x768 | |
| 1152x864 | |
| 1280x960 | 79 ~ 100 Hz |
| 1280x1024 | |
| 1600x900 | |
| 1600x1024 | 50 ~ 70 Hz |
| 1600x1200 | |

* Brightness Adjustment

The system has two kinds of brightness adjustment modes as below;

- ☞ Normal operation: The brightness of backlight has to be adjusted by pressing designated key.

* Power Management

This system's power management protocol follows VESA DPMS compliance in section of 2.5.3 "Power management", but it has to be managed along with the below horizontal and vertical frequency guide line to identify the sync signal status.

- ☞ Stand-by mode: Horizontal frequency < 10KHz, Vertical frequency > 40Hz, maintain more than 3 seconds.
- ☞ Suspend mode: Horizontal frequency > 10KHz, Vertical frequency < 40Hz, maintain more than 3 seconds.
- ☞ Power-off mode: Horizontal frequency < 10KHz, vertical frequency < 40Hz, maintain more than 3 seconds.

*** Factory Reset**

One designated key allows to reset all data sets into factory preset values. But, it is not allowed to get the previous user set status after this function is finished.

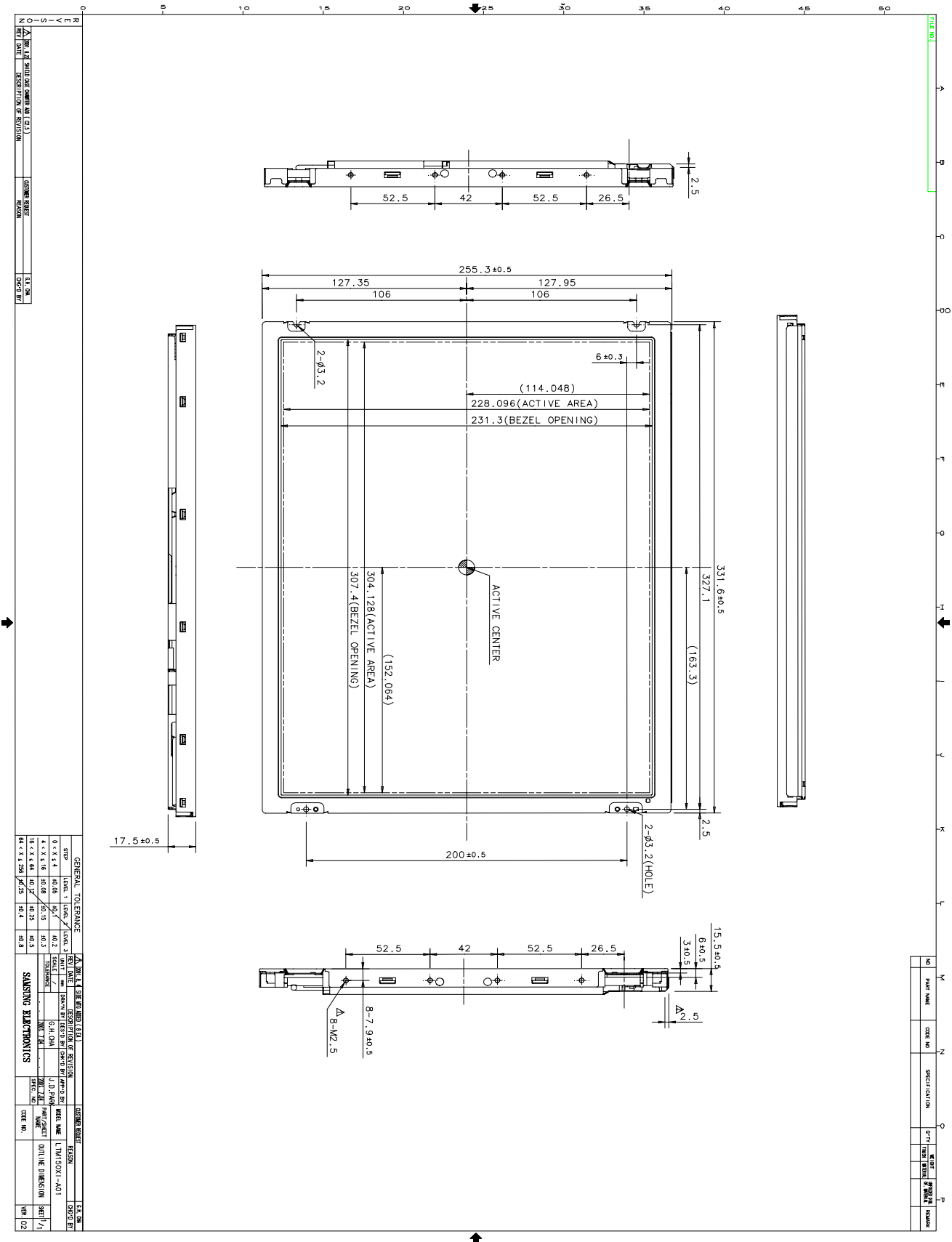
The system has to have this factory preset values prior to shipment to our customer.

*** DDC (EDID)**

This system has one dedicated DDC ROM on the circuitry board. The final monitor system company can installed the EDID data into this ROM through the serial port of VGA connector.

8. Mechanical Specification

8.1 Outline dimension



| REV. NO. | DESCRIPTION OF REVISION | DATE | BY |
|----------|-------------------------|------|----|
| 1 | INITIAL DESIGN | | |

| REV. NO. | DESCRIPTION OF REVISION | DATE | BY |
|----------|-------------------------|------|----|
| 1 | INITIAL DESIGN | | |

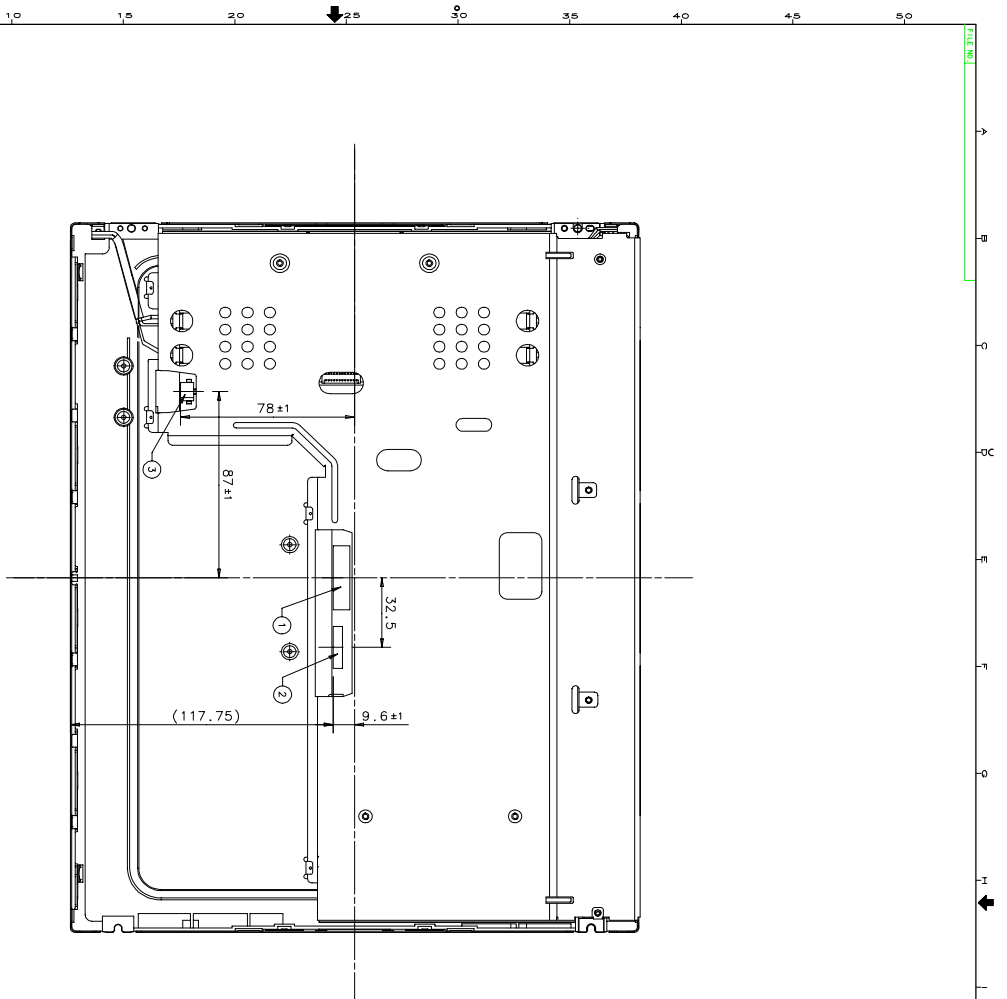
| GENERAL TOLERANCE | | SURFACE FINISH | | DRAWING SCALE | |
|-------------------|-------|----------------|-------|---------------|-------|
| STEP | LEVEL | LEVEL | LEVEL | SCALE | SCALE |
| 0.1 X 0.1 | 1 | 0.1 | 1 | 1:1 | 1:1 |
| 0.2 X 0.2 | 2 | 0.2 | 2 | 1:1 | 1:1 |
| 0.3 X 0.3 | 3 | 0.3 | 3 | 1:1 | 1:1 |
| 0.4 X 0.4 | 4 | 0.4 | 4 | 1:1 | 1:1 |
| 0.5 X 0.5 | 5 | 0.5 | 5 | 1:1 | 1:1 |
| 0.6 X 0.6 | 6 | 0.6 | 6 | 1:1 | 1:1 |
| 0.8 X 0.8 | 8 | 0.8 | 8 | 1:1 | 1:1 |

| DRAWING SCALE | | DRAWING SCALE | |
|---------------|-------|---------------|-------|
| SCALE | SCALE | SCALE | SCALE |
| 1:1 | 1:1 | 1:1 | 1:1 |

| DRAWING SCALE | | DRAWING SCALE | |
|---------------|-------|---------------|-------|
| SCALE | SCALE | SCALE | SCALE |
| 1:1 | 1:1 | 1:1 | 1:1 |

| NO. | DATE | NAME | POSITION |
|-----|------|------|----------|
| | | | |

Approval



NOTE

1. NO.1 is Signal interface connector
 Maker : JUST
 Part Name : S13B-PH-SM3-TB
 Mating Connector : PHR-13
2. NO.2 is Signal interface connector
 Maker : Molex
 Part Name : 53261-1490
 Mating Connector : 51021-1400
3. NO.3 is Power Connector.
 Maker : Yeonho
 Part Name : 4006WR
 Mating Connector : 40006

| NO | PART NAME | CODE NO | SPECIFICATION | QTY | UNIT | REMARK |
|----|-----------|---------|---------------|-----|------|--------|
| | | | | | | |

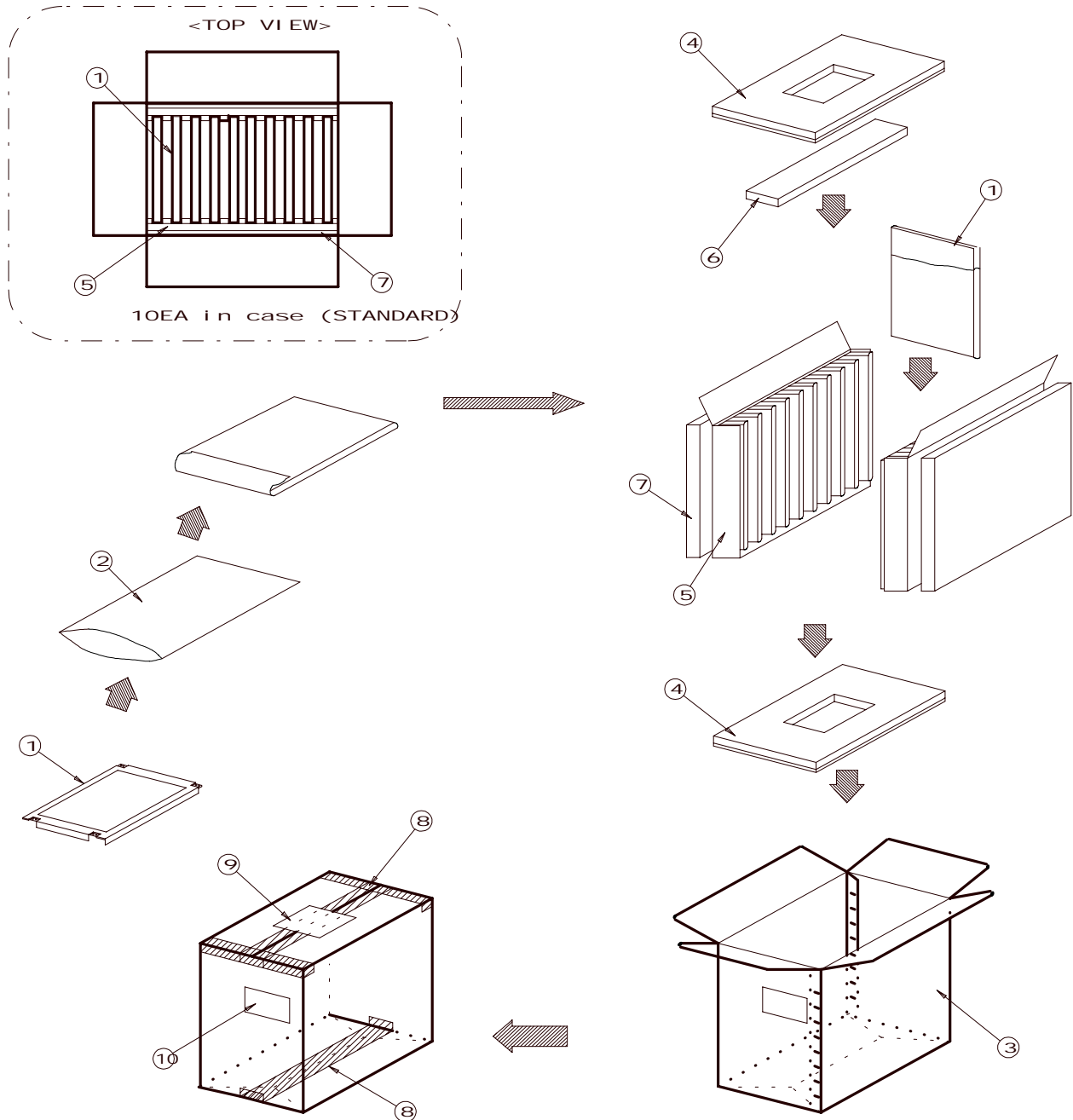
| GENERAL TOLERANCE | | | | REV. NO. | DESCRIPTION OF REVISION | DATE | BY | CHK | APP |
|-------------------|-------|------|------|----------|-------------------------|------|----|-----|-----|
| 0.1 x 0.1 x 0.1 | ±0.05 | ±0.2 | ±0.3 | 1 | | | | | |
| 0.1 x 0.1 x 0.1 | ±0.05 | ±0.2 | ±0.3 | 2 | | | | | |
| 0.1 x 0.1 x 0.1 | ±0.05 | ±0.2 | ±0.3 | 3 | | | | | |
| 0.1 x 0.1 x 0.1 | ±0.05 | ±0.2 | ±0.3 | 4 | | | | | |
| 0.1 x 0.1 x 0.1 | ±0.05 | ±0.2 | ±0.3 | 5 | | | | | |
| 0.1 x 0.1 x 0.1 | ±0.05 | ±0.2 | ±0.3 | 6 | | | | | |
| 0.1 x 0.1 x 0.1 | ±0.05 | ±0.2 | ±0.3 | 7 | | | | | |
| 0.1 x 0.1 x 0.1 | ±0.05 | ±0.2 | ±0.3 | 8 | | | | | |

8.2 Packing Information

8.2.1 Carton (Internal Package)

8.2.1.1 Packing Form: Corrugated fiberboard box and corrugated cardboard as shock absorber.

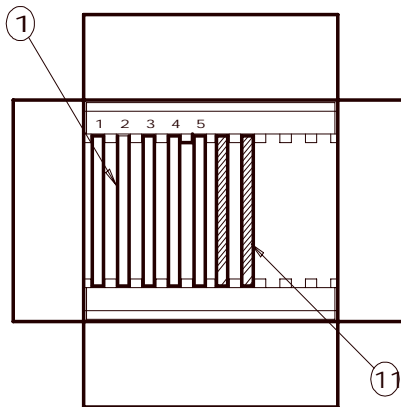
8.2.1.2 Packing Method



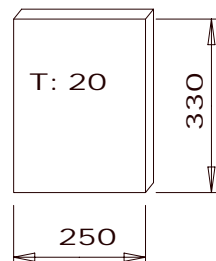
- NOTE 1) Acceptance number of piling : 10sets
 2) Carton size :450(W) X 348(D) X 440(H)
 3) MAX accumulation quantity : 4 cartons

8.2.1.3 Unless LCD Module are 10ea at one packing_case

- * Unless LCD module are 10EA at one packing-case.
- > 1) Put in some LCD module in the direction of one.
 2) Try addition PAD CUSHION(2EA) in the next position.
- ex) LCD module are 5EA in case.



- * PAD CUSHION size
 (LT140X1/LTM150XS MODEL)
 : 250(W) x 330(H) x 20(T)



8.2.1.4 Packing Material

| No | Part name | Quality |
|----|--|---------|
| 1 | Static electric protective sack | 10 |
| 2 | Packing case(Inner box) included shock absorber | 1 set |
| 3 | Pictorial marking | 2 pcs |
| 4 | Carton | 1 set |

9. GENERAL PRECAUTION

9.1 Handling

- ☞ When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.
- ☞ Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFT back-light.
- ☞ Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- ☞ Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- ☞ If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- ☞ The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- ☞ If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- ☞ Protect the module from static , it may cause damage to the CMOS Gate Array IC.
- ☞ Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- ☞ Do not disassemble the module.
- ☞ Do not pull or fold the lamp wire.
- ☞ Do not adjust the variable resistor which is located on the back side.
- ☞ Pins of I/F connector shall not be touched directly with bare hands.

9.2 Storage

- ☞ Do not leave the module in high temperature, and high humidity for a long time.
- ☞ It is highly recommended to store the module with temperature from 0°C to 35°C and relative humidity of less than 70%.
- ☞ Do not store the TFT-LCD module in direct sunlight.
- ☞ The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

9.3 Operation

- ☞ Do not connect,disconnect the module in the Power On condition.
- ☞ Power supply should always be turned on/off by the item 6.5 ? Power on/off sequence?
 - ☞ Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may

be important to minimize the interference.

- ☞ The cable between the back-light connector and its inverter power supply shall be a minimized length and be connected directly. The longer cable between the back-light and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).

9.4 Others

- ☞ Ultra-violet ray filter is necessary for outdoor operation.
- ☞ Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- ☞ Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.
- ☞ If the module displays the same pattern continuously for a long period of time, it can be the situation when the image Sticks to the screen.
- ☞ This module has its circuitry PCB on the rear side and should be handled carefully in order not to be stressed.