



TO : Lenovo

DATE : Feb. 20. 2012

SAMSUNG TFT-LCD**MODEL NO. : LTN140AT26-L01**

NOTE : Extension code [-L01]
→ LTN140AT26-L01
- Surface type [**Glare**]

The information described in this SPEC is preliminary and can be changed without prior notice.

APPROVED BY :

Michael Kim

PREPARED BY :

June Oh

**Application Engineering Group, LCD Division
Samsung Electronics Co., Ltd.**

Samsung Secret

CONTENTS

| | |
|---|--------------|
| Revision History | ----- (3) |
| General Description | ----- (4) |
| 1. Absolute Maximum Ratings | ----- (5) |
| 1.1 Absolute Ratings of environment | |
| 1.2 Electrical Absolute Ratings | |
| 2. Optical Characteristics | ----- (7) |
| 3. Electrical Characteristics | ----- (10) |
| 3.1 TFT LCD Module | |
| 3.2 LED Driver | |
| 4. Block Diagram | ----- (13) |
| 4.1 TFT LCD Module | |
| 4.2 LED Connection and Placement | |
| 5. Input Terminal Pin Assignment | ----- (14) |
| 5.1 Input Signal & Power | |
| 5.2 LVDS Interface | |
| 5.3 Timing Diagrams of LVDS For Transmitting | |
| 5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color. | |
| 5.5 Pixel format | |
| 6. Interface Timing | ----- (19) |
| 6.1 Timing Parameters | |
| 6.2 Timing Diagrams of interface Signal | |
| 6.3 Power ON/OFF Sequence | |
| 7. Outline Dimension | ----- (21) |
| 8. Packing | ----- (23) |
| 9. Markings & Others | ----- (25) |
| 10. General Precautions | ----- (27) |
| 11. EDID | ----- (29) |

Samsung Secret

REVISION HISTORY

Approval

| Date | Rev. No. | Page | Summary |
|---------------|----------|------------------|---|
| Sep. 05. 2011 | P00 | All | . The preliminary specification was issued first. |
| Sep. 09. 2011 | P01 | 22 | . Outline drawing was updated |
| Nov. 03. 2011 | P02 | 5 12 28,29 | . ENVIRONMENTAL ABSOLUTE RATINGS is changed . PWM duty Information is changed . General Precautions are updated |
| Jan. 06. 2012 | A00 | All | . The approval specification was issued . |
| Jan. 31. 2012 | A01 | 22 | . 2D drawing was updated |
| Feb. 16. 2012 | A02 | 22 28 | . 2D drawing was updated as same as LTN140AT22 . Storage condition was updated as same as LTN140AT22 |
| Feb. 20. 2012 | A03 | 25 | . Lenovo Barcode information was updated |
| | | | |

Samsung Secret

GENERAL DESCRIPTION

DESCRIPTION

LTN140AT26-L is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight unit. The resolution of a 14.0" contains 1,366 x 768 pixels and can display up to 262,144 colors. 6 O'clock direction is the Optimum viewing angle.

FEATURES

- High contrast ratio, high aperture structure
- 1366 x 768 pixels resolution
- Low power consumption
- Fast Response
- LED BLU with LED driver
- DE(Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip
- Pb-free product

APPLICATIONS

- Notebook PC
- If the usage of this product is not for PC application, but for others, please contact SEC.

GENERAL INFORMATION

| Item | Specification | Unit | Note |
|-------------------|---|-------|--------|
| Display area | 309.399(H) x 173.952(V) (14.0" diagonal) | mm | |
| Driver element | a-Si TFT active matrix | | |
| Display colors | 262,144 | | |
| Number of pixel | 1366 x RGB(3) x 768 | pixel | 16 : 9 |
| Pixel arrangement | RGB vertical stripe | | |
| Pixel pitch | 0.2265(H) x 0.2265(V) (TYP.) | mm | |
| Display Mode | Normally white | | |
| Surface treatment | Haze 0%, Hard-Coating 3H | | |

Samsung Secret

Mechanical Information

| Item | | Min. | Typ. | Max. | Unit | Note |
|-------------|----------------|-------|-------|-------|------|------|
| Module size | Horizontal (H) | 323.0 | 323.5 | 324 | mm | (1) |
| | Vertical (V) | 191.5 | 192.0 | 192.5 | mm | |
| | Depth (D) | - | - | 5.2 | mm | |
| Weight | | - | - | 350 | g | |

Note (1) Measurement condition of outline dimension
. Equipment : Micrometer

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

| Item | Symbol | Min. | Max. | Unit | Note |
|---|------------------|------|--------|------|---------|
| Storage temperate | T _{STG} | -20 | 60 | °C | (1) |
| Operating temperate (Temperature of glass surface) | T _{OPR} | 0 | 50 | °C | (1) |
| Shock (non-operating) | Snop | - | 210 | G | (2),(5) |
| | | | 50 | | (3),(5) |
| Vibration (non-operating) | Vnop | - | 2.41 | G | (4),(5) |
| Altitude (operation) | - | - | 10,000 | feet | |
| Altitude (storage) | - | - | 40,000 | feet | |

Note (1) Temperature and relative humidity range are shown in the figure below.

95 % RH Max. (40 °C > Ta)

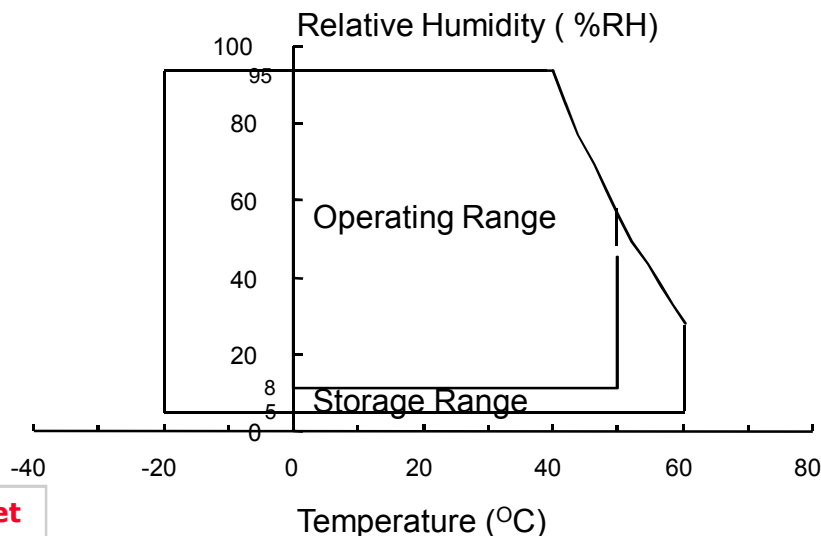
Maximum wet - bulb temperature at 39 °C or less. (Ta ≥ 40 °C) No condensation.

(2) 2ms, half sine wave, one time for ±X, ±Y, ±Z.

(3) 11ms, Trapezoidal wave, one time for ±X, ±Y, ±Z.

(4) 5~500 Hz, Random vibration, 30 min for X,Y,Z.

(5) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.



Samsung Secret

1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

 $V_{DD} = 3.3V, V_{SS} = GND = 0V$

| Item | Symbol | Min. | Max. | Unit | Note |
|----------------------|----------|----------------|----------------|------|------|
| Power Supply Voltage | V_{DD} | $V_{DD} - 0.3$ | $V_{DD} + 0.3$ | V | (1) |
| Logic Input Voltage | V_{IN} | $V_{DD} - 0.3$ | $V_{DD} + 0.3$ | V | (1) |

Note (1) Within T_a (25 ± 2 °C)

Samsung Secret

2. OPTICAL CHARACTERISTICS

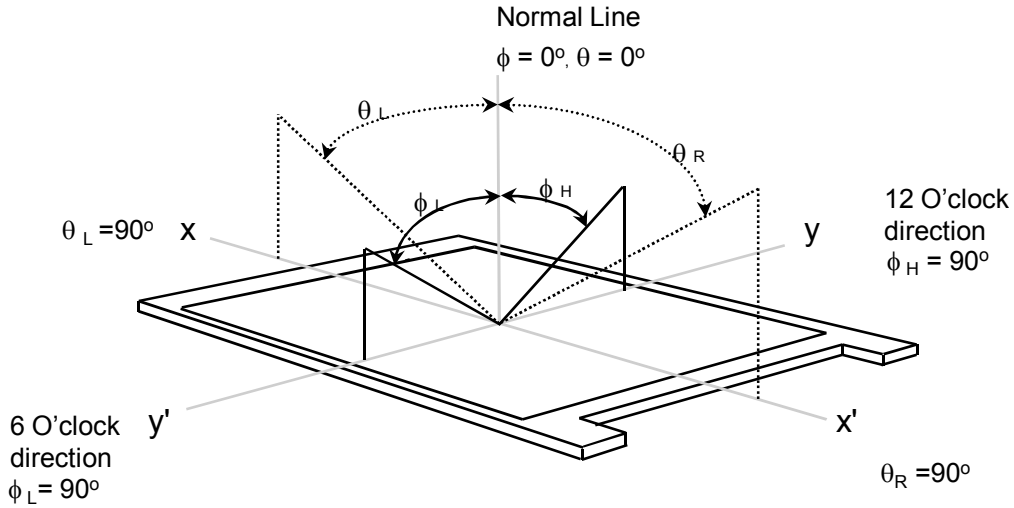
The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5).
Measuring equipment : TOPCON SR-3

* Ta = 25 ± 2 °C, V_{DD}=3.3V, fv=60Hz, f_{DCLK}= 75.17MHz, I_L = 23 mArms

| Item | Symbol | Condition | Min. | Typ. | Max | Unit | Note |
|---|---------------------|----------------|-------|-------|-------|-------------------|----------------------------------|
| Contrast Ratio (5 Points) | CR | | - | 500 | - | - | (1), (2), (5) |
| Response Time at Ta (Rising + Falling) | T _{RT,B/W} | | - | 16 | 25 | msec | (1), (3) |
| Average Luminance of White (5 Points) | Y _{L,AVE} | | 170 | 200 | - | cd/m ² | I _L =23mA (1), (4) |
| Color Chromaticity (CIE) | Red | R _x | 0.555 | 0.585 | 0.615 | - | (1), (5) SR-3 |
| | | R _y | 0.325 | 0.355 | 0.385 | | |
| | Green | G _x | 0.320 | 0.350 | 0.380 | | |
| | | G _y | 0.550 | 0.580 | 0.610 | | |
| | Blue | B _x | 0.135 | 0.165 | 0.195 | | |
| | | B _y | 0.095 | 0.125 | 0.155 | | |
| | White | W _x | 0.283 | 0.313 | 0.343 | | |
| | | W _y | 0.299 | 0.329 | 0.359 | | |
| Viewing Angle | Hor. | θ _L | - | 45 | - | Degrees | (1), (5) SR-3 |
| | | θ _R | - | 45 | - | | |
| | Ver. | φ _H | - | 15 | - | | |
| | | φ _L | - | 30 | - | | |
| Color Gamut | CG | | - | 45 | - | % | |
| 13 Points White Variation | δ _L | | 60% | - | - | - | (6) |
| 5 Points White Variation | δ _L | | 80% | - | - | - | (6) |

Samsung Secret

Note 1) Definition of Viewing Angle : Viewing angle range($10 \leq C/R$, $100 \leq C/R$)

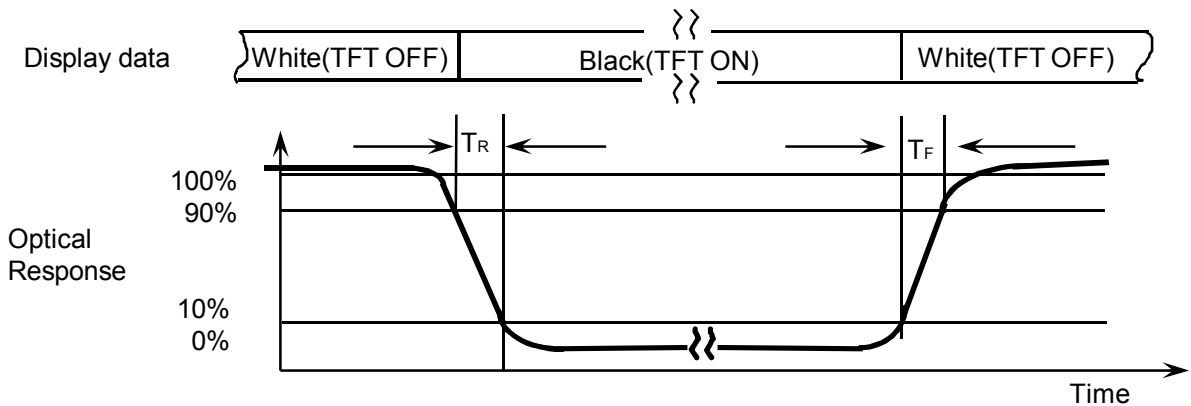


Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax), gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

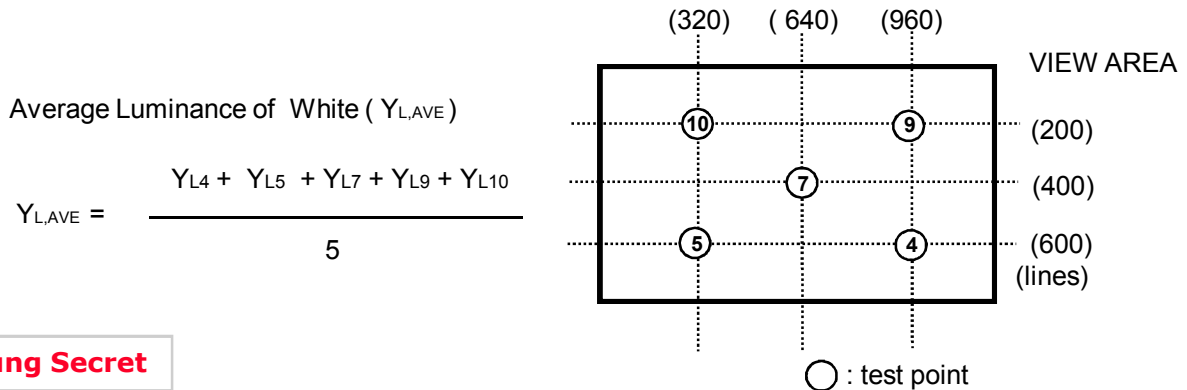
$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

Points : (4) , (5) , (7) , (9) , (10) at the figure of Note (6).

Note 3) Definition of Response time :

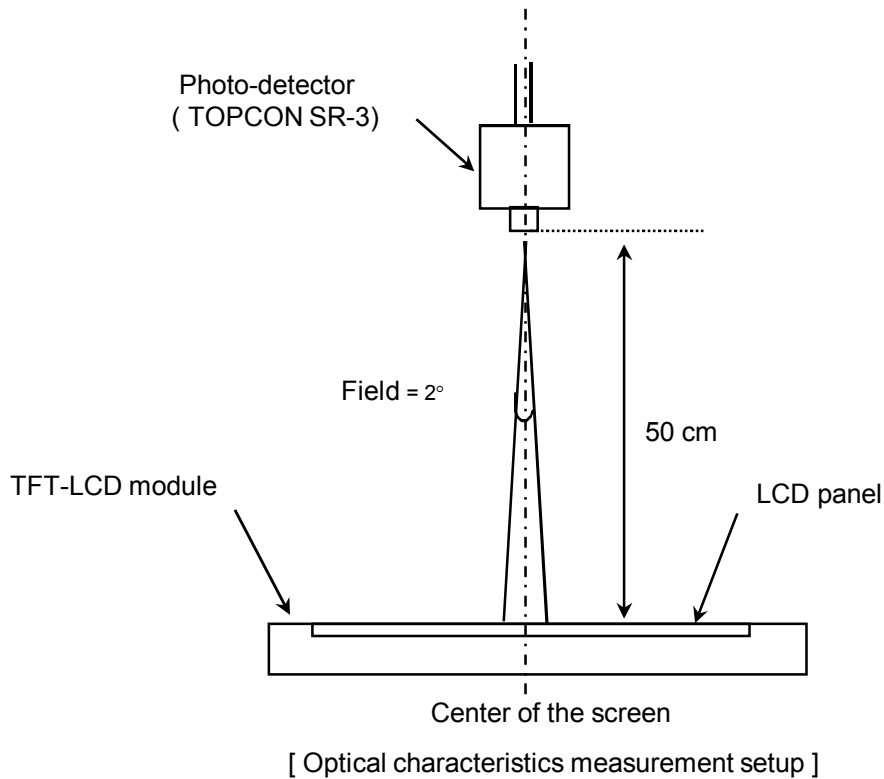


Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.



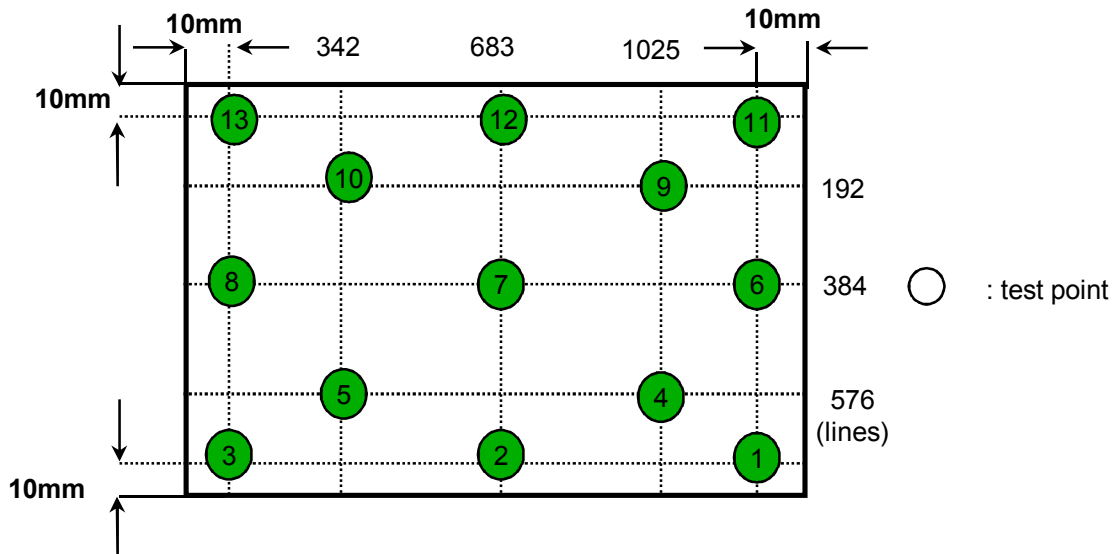
Samsung Secret

Note 5) 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 backlight. This should be measured in the center of screen.
 Environment condition : $T_a = 25 \pm 2 \text{ }^\circ\text{C}$



Note 6) Definition of 13 points white variation (δL), CR variation (C_{VER}) [① ~ ⑬]

$$\delta L = \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$



Samsung Secret

3. ELECTRICAL CHARACTERISTICS

Approval

3.1 TFT LCD MODULE

Ta= 25 ± 2°C

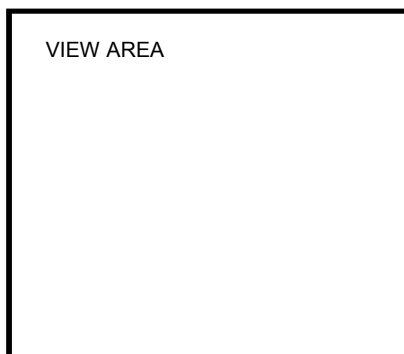
| Item | | Symbol | Min. | Typ. | Max. | Unit | Note | |
|--|------|-------------------|-------------------|------|-------|------|------|-------------------------|
| Voltage of Power Supply | | V _{DD} | 3.0 | 3.3 | 3.6 | V | | |
| Differential Input Voltage for LVDS Receiver Threshold | | High | V _{IH} | - | - | +100 | mV | V _{CM} = +1.2V |
| | | Low | V _{IL} | -100 | - | - | mV | |
| Vsync Frequency | 60Hz | Hsync Freq | F _H | - | 47.4 | - | KHz | |
| | | Main Freq | F _{DCLK} | - | 75.17 | - | MHz | |
| | 50Hz | Hsync Freq | F _H | - | 39.5 | - | KHz | |
| | | Main Freq | F _{DCLK} | - | 62.65 | - | MHz | |
| | 40Hz | Hsync Freq | F _H | - | 31.6 | - | KHz | |
| | | Main Freq | F _{DCLK} | - | 50.12 | - | MHz | |
| Rush Current | | I _{RUSH} | - | - | 1.5 | A | (4) | |
| Current of Power Supply | | White | I _{DD} | - | 210 | - | mA | (2),(3)*a |
| | | Mosaic | | - | 210 | 240 | mA | (2),(3)*b |
| | | WinXP Pattern | | - | 250 | - | mA | (2),(3)*c |
| | | Max Pattern | | - | 335 | 350 | mA | (2),(3)*d |

Note (1) Display data pins and timing signal pins should be connected.(GND = 0V)

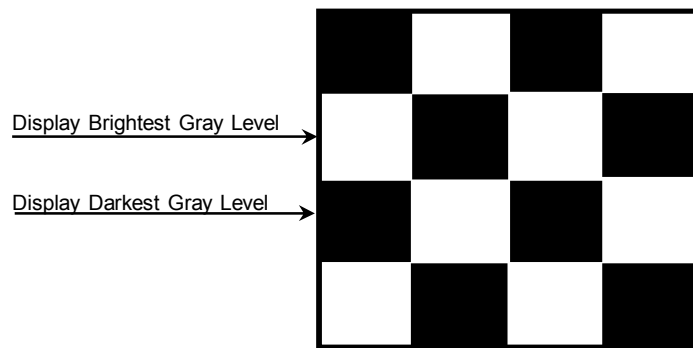
(2) f_v = 60Hz, f_{DCLK} = 75.17MHz, V_{DD} = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern



*b) Mosaic Pattern

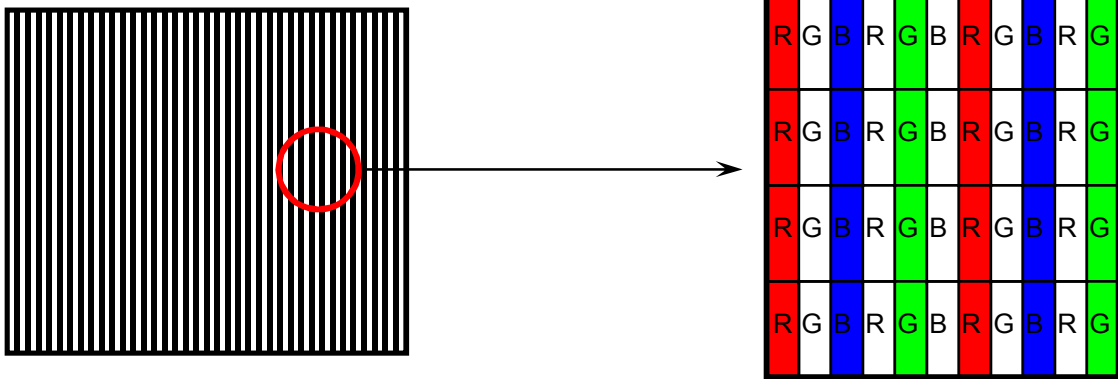


Samsung Secret

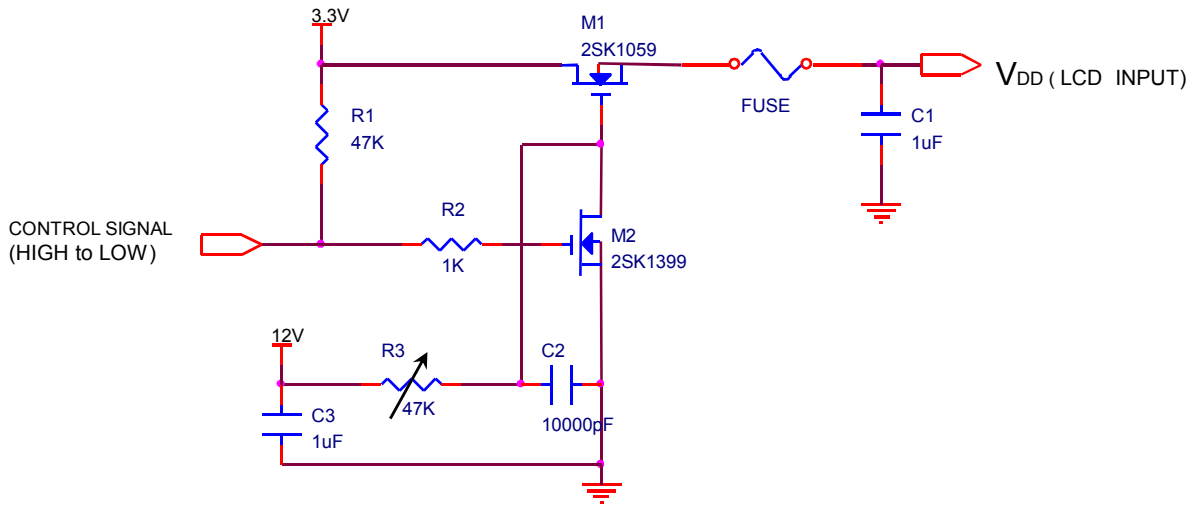
*c) WinXP Pattern



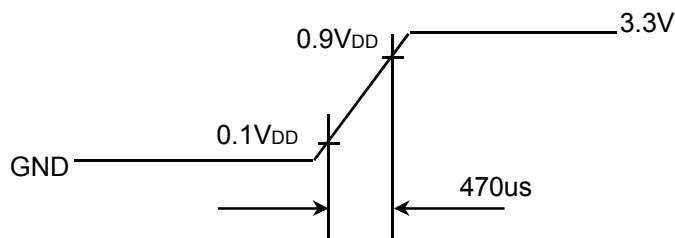
*d) 1dot Vertical stripe pattern



4) Rush current measurement condition



V_{DD} rising time is 470us



Samsung Secret

3.2 Back light unit

Ta= 25 ± 2 °C

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---------------------|--------|--------|------|------|------|------------------|
| LED Forward Current | IF | - | 23 | - | mA | |
| LED Forward Voltage | VF | 3.0 | 3.2 | 3.4 | V | IF=23mA |
| LED Array Voltage | VP | - | 32 | - | V | VF X 10 LEDs |
| Power Consumption | P | - | 2.6 | 2.8 | W | IF X VF X 30LEDs |
| Operating Life Time | Hr | 10,000 | - | - | Hr | (1) |

Note (1) Life time (Hr) of LEDs can be defined as the time in which it continues to operate under the condition Ta= 25 ± 2 °C and DC = (23) mA until one of the following event occurs.

- When the brightness becomes 50% or lower than the original.

3.3 LED Driver

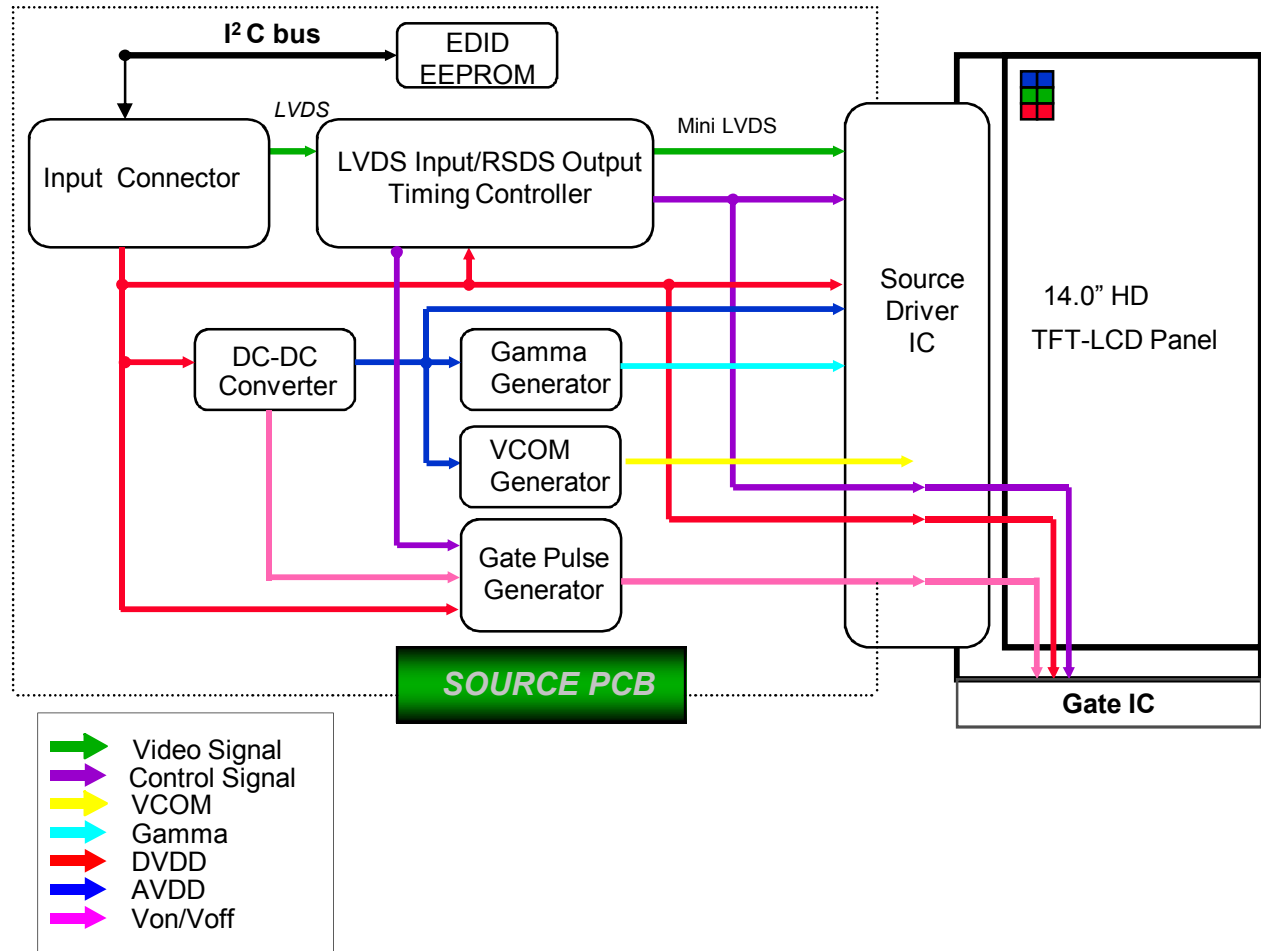
- LED Driver Manufacturer : RICHTEK , LED qty.: 3X 10 = 30 EA

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---------------|------------------|------|------|------|------|---------------------------|
| Input Voltage | V _{in} | 7 | 12 | 21 | V | |
| PWM Duty | D2 | 1 | - | 100 | % | PWM frequency (0.12~1kHz) |
| | D2 | 5 | - | 100 | % | PWM frequency (1~10KHz) |
| | D2 | 10 | - | 100 | % | PWM frequency (10~30KHz) |
| PWM Frequency | F _{PWM} | 0.1 | | 20 | KHz | |

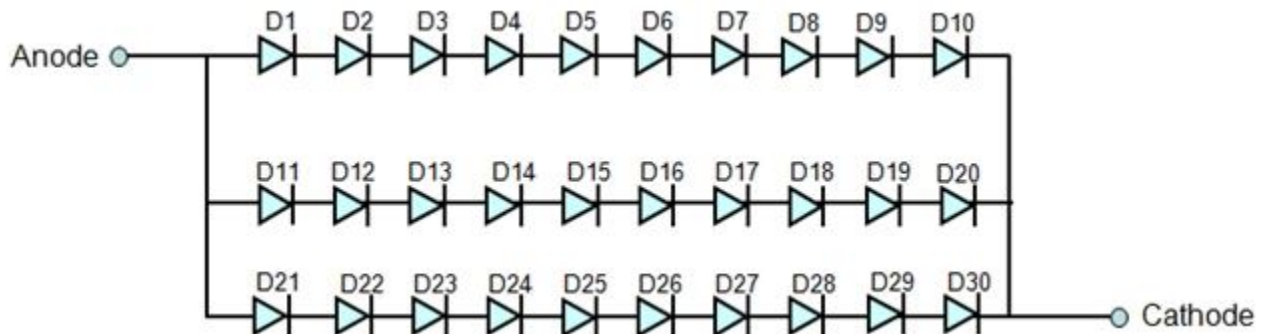
Samsung Secret

4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 LED Connection and Placement



Samsung Secret

5. INPUT TERMINAL PIN ASSIGNMENT

Approval

5.1. Input Signal & Power (LVDS, Connector : IPEX 20455-040E)

| Pin | Symbol | Function |
|-------|-----------|--|
| 1 | NC | No Connection (Reserved for supplier) |
| 2~3 | VDD | Logic power 3.3V (Panel logic, BL logic) |
| 4 | VEDID | EDID 3.3V power |
| 5 | NC | no connect |
| 6 | CLK_EDID | EDID clock |
| 7 | DATA_EDID | EDID data |
| 8 | RXin0- | - LVDS differential data (R0-R5, G0) |
| 9 | RXin0+ | + LVDS differential data (R0-R5, G0) |
| 10 | GND | Ground |
| 11 | RXin1- | - LVDS differential data (G1-G5, B0-B1) |
| 12 | RXn1+ | + LVDS differential data (G1-G5, B0-B1) |
| 13 | GND | Ground |
| 14 | RXin2- | - LVDS differential data (B2-B5,HS,VS, DE) |
| 15 | RXn2+ | + LVDS differential data (B2-B5,HS,VS, DE) |
| 16 | GND | Ground |
| 17 | CIKIN- | - LVDS differential clock input |
| 18 | CIKIN+ | + LVDS differential clock input |
| 19 | GND | Ground |
| 20~21 | NC | No Connection |
| 22 | GND | Ground |
| 23~24 | NC | No Connection |
| 25 | GND | Ground |
| 26~27 | NC | No Connection |
| 28 | GND | Ground |
| 29~30 | NC | No Connection |
| 31~33 | VBL- | LED Ground |
| 34 | NC | No Connection |
| 35 | S_PWM | System PWM Signal Input |
| 36 | LED_EN | BL On/Off (On: 2.0~3.3V, Off: 0~0.8V) |
| 37 | NC | no connect |
| 38~40 | VBL+ | LED Power Supply 7V-21V |

Samsung Secret

Doc.No.

LTN140AT26-L01

Rev.No

04-A03-G-120220

Page

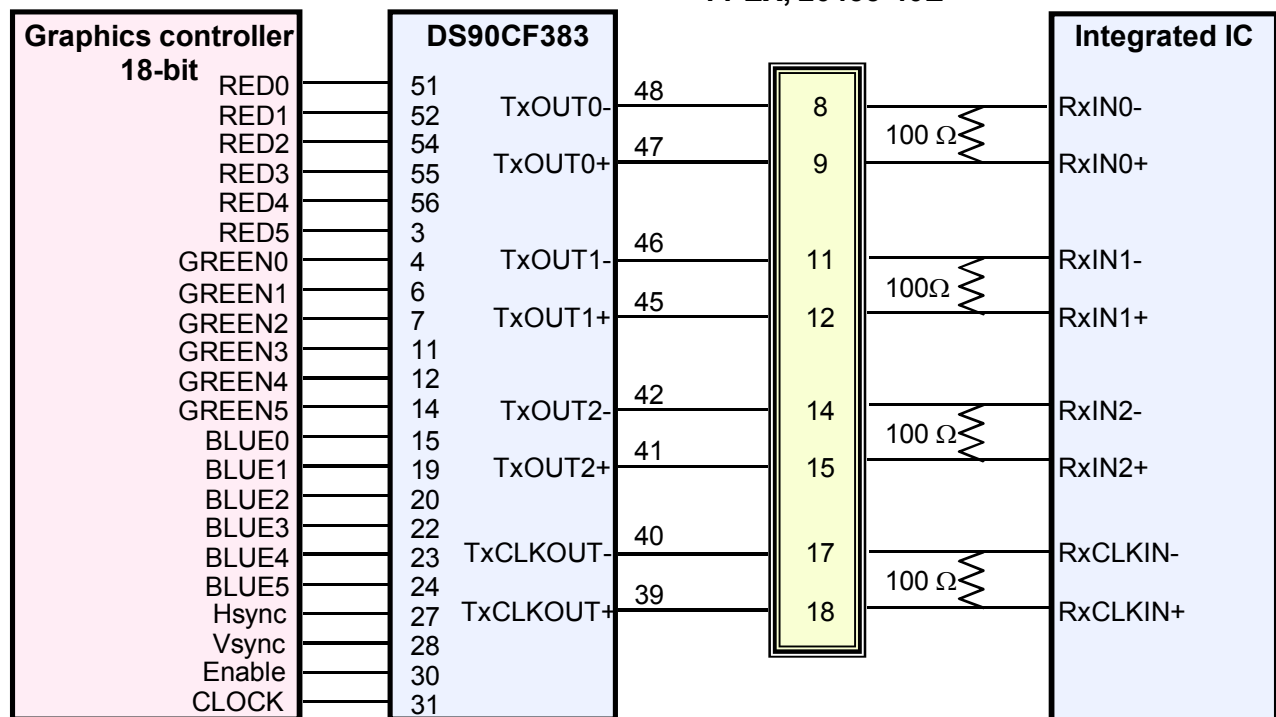
14 / 31

5.2 LVDS Interface

| Pin No. | Name | RGB Signal | Pin No. | Name | RGB Signal |
|---------|--------|------------|---------|---------|------------|
| 51 | TxIN0 | R0 | 14 | TxIN14 | G5 |
| 52 | TxIN1 | R1 | 15 | TxIN15 | B0 |
| 54 | TxIN2 | R2 | 19 | TxIN18 | B1 |
| 55 | TxIN3 | R3 | 20 | TxIN19 | B2 |
| 56 | TxIN4 | R4 | 22 | TxIN20 | B3 |
| 3 | TxIN6 | R5 | 23 | TxIN21 | B4 |
| 4 | TxIN7 | G0 | 24 | TxIN22 | B5 |
| 6 | TxIN8 | G1 | 27 | TxIN24 | Hsync |
| 7 | TxIN9 | G2 | 28 | TxIN25 | Vsync |
| 11 | TxIN12 | G3 | 30 | TxIN26 | DE |
| 12 | TxIN13 | G4 | 31 | TxCLKIN | Clock |

LVDS Interface

I-PEX, 20455-40E

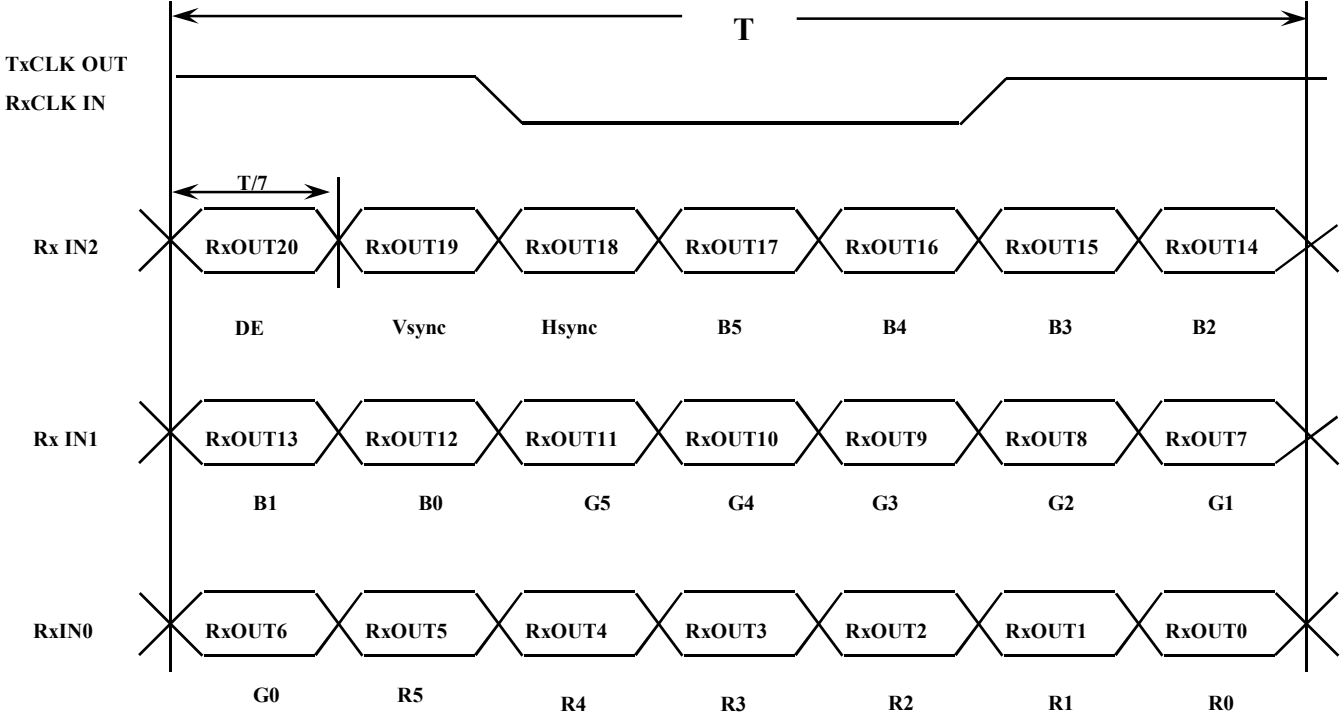


Note : The LCD Module uses a 100ohm resistor between positive and negative lines of each receiver input.

Samsung Secret

5.3 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON



Samsung Secret

5.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

| Color | Display | Data Signal | | | | | | | | | | | | | | | | Gray Scale Level | |
|---------------------|---------|-------------|----|----|----|----|-------|----|----|----|----|------|----|----|----|----|----|------------------|--------|
| | | Red | | | | | Green | | | | | Blue | | | | | | | |
| | | R0 | R1 | R2 | R3 | R4 | R5 | G0 | G1 | G2 | G3 | G4 | G5 | B0 | B1 | B2 | B3 | | B4 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| Gray Scale Of Red | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R0 |
| | Dark | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1 |
| | ↑ | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R2 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | R3~R60 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | ↓ | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R61 |
| | Light | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R62 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R63 |
| Gray Scale Of Green | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G0 |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1 |
| | ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G2 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | G3~G60 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | ↓ | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | G61 |
| | Light | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | G62 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | G63 |
| Gray Scale Of Blue | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B0 |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | B1 |
| | ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | B2 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | B3~B60 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | ↓ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | B61 |
| | Light | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | B62 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | B63 |

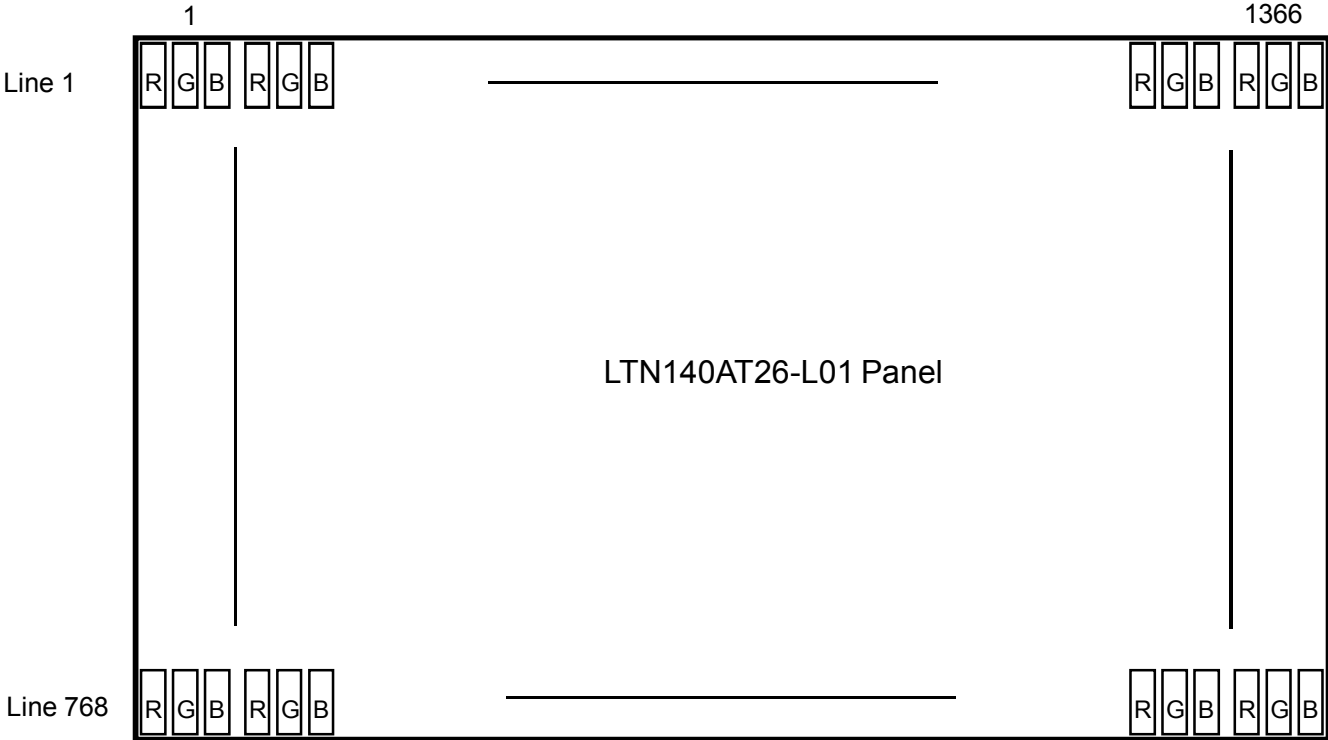
Note 1) Definition of gray :

Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)

Note 2) Input signal: 0 =Low level voltage, 1=High level voltage

Samsung Secret

5.6 Pixel Format in the display



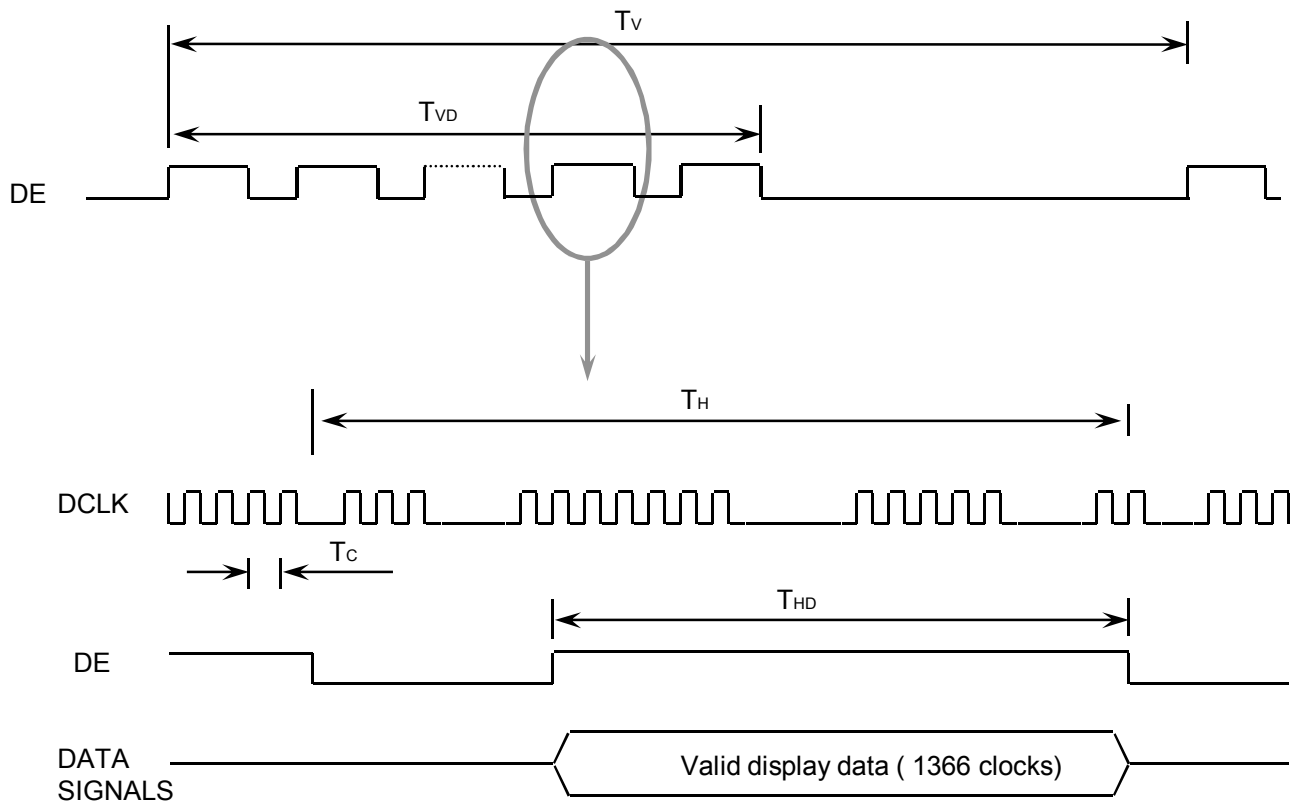
Samsung Secret

6. INTERFACE TIMING

6.1 Timing Parameters

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------------------------------|----------------|----------|------|------|------|--------|------|
| Frame Frequency | Cycle | T_V | 780 | 790 | 980 | Lines | |
| Vertical Active Display Term | Display Period | T_{VD} | - | 768 | - | Lines | |
| One Line Scanning Time | Cycle | T_H | 1440 | 1586 | 1800 | Clocks | |
| Horizontal Active Display Term | Display Period | T_{HD} | - | 1366 | - | Clocks | |

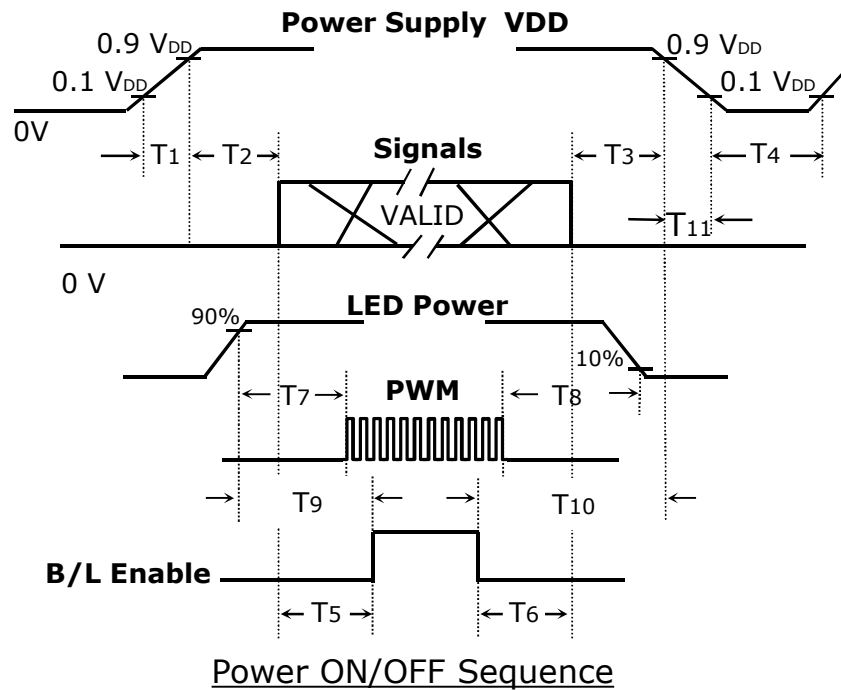
6.2 Timing diagrams of interface signal



Samsung Secret

6.3 Power ON/OFF Sequence

: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.



| Timing (ms) | Remarks |
|----------------------|---|
| $0.5 < T_1 \leq 10$ | V _{DD} rising time from 10% to 90% |
| $0 < T_2 \leq 50$ | Delay from V _{DD} to valid data at power ON |
| $0 < T_3$ | Delay from valid data OFF to V _{DD} off at power OFF |
| $150 \leq T_4$ | V _{DD} OFF time for Windows restart |
| $200 \leq T_5$ | Delay from valid data to B/L enable at power ON |
| $0 < T_6$ | Delay from valid data off to B/L disable at power OFF |
| $0 < T_7$ | Delay from LED driver power ON to PWM ON |
| $0 < T_8$ | Delay from PWM OFF to LED driver power OFF |
| $0 < T_9$ | Delay from VBL on to B/L Enable ON |
| $0 < T_{10}$ | Delay from B/L Enable Off to VBL OFF |
| $0 < T_{11} \leq 10$ | VBL falling time from 90% to 10% |

NOTE.

- (1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD}.
- (2) In case of V_{DD} = off level, please keep the level of input signals on the low or keep a high impedance.
- (3) T₄ should be measured after the module has been fully discharged between power off and on period.
- (4) Interface signal shall not be kept at high impedance when the power is on.

Samsung Secret

7. Mechanical Outline Dimension

Approval

[Refer to the next page]

Samsung Secret

Doc.No.

LTN140AT26-L01

Rev.No

04-A03-G-120220

Page

21 / 31

This page will be replaced with the outline drawing after producing PDF file.

Samsung Secret

8. PACKING

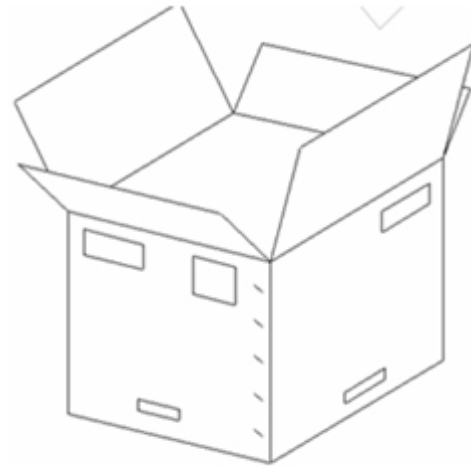
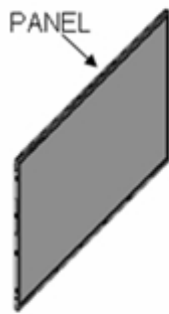
Approval

1. CARTON(Internal Package)

(1) Packing Form

Corrugated Cardboard box and paper cushion as shock absorber

(2) Packing Method



PACKING CASE



Note 1) Total Weight : Approximately (11.5)kg

2) Acceptance number of piling : 6 sets

3) Carton size : 375.5(W) x 375(D) x 246 (H)

Samsung Secret

(3) Packing Material

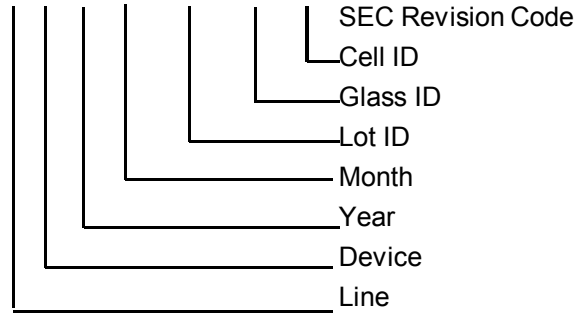
| No | Part name | Quantity |
|----|---|----------|
| 1 | Static electric protective sack | 30 EA |
| 2 | Packing case (Inner box) included shock absorber | 1 set |
| 3 | Pictorial marking | 2 |
| 4 | Carton | 1 set |

Samsung Secret

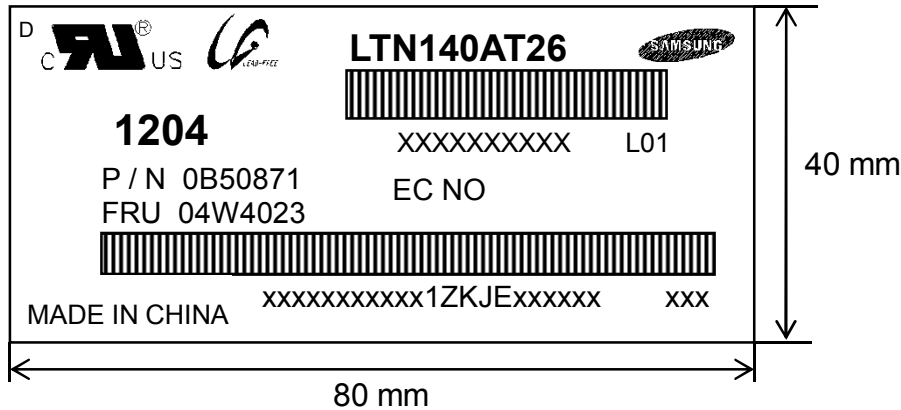
9. Product Markings and Others

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

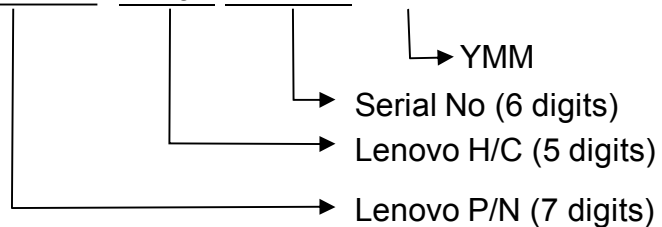
- (1) Parts number : LTN140AT26-L01
- (2) Revision : Three letters
- (3) Control code : One letter
- (4) Lot number : X X X X XXX XX X XXX



(5) Product Label Definition - SESL

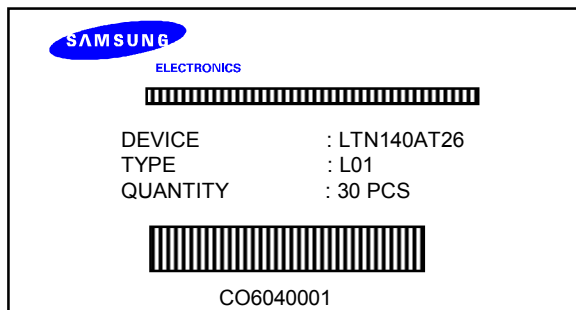


- TFT-LCD Product name : LTN140AT26
- USP code : XXXXXXXXXXXXXX
- Lot number : XXXXXXXXXXXXX
- Revision Code : L01
- Inspected work week : 1204 (2012 Year, the 04th week)
- P/N : 0B50871
- EC NO : -
- FRU : 04W4023
- Header Code : 1ZKJE
- Lenovo Barcode : 11SXXXXXXXX1ZKJE XXXXXX XXX



Samsung Secret

(6) Packing small box attach



Samsung Secret

10. GENERAL PRECAUTIONS

1. Handling

- (a) 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.
- (b) 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 back-light.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) 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.
- (g) 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.
- (h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.
- (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Do not pull or fold the lamp wire.
- (l) Do not adjust the variable resistor which is located on the back side.
- (m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (n) Pins of I/F connector shall not be touched directly with bare hands.

Samsung Secret

2. STORAGE

- (a) 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 to 35 °C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD module in direct sunlight.
- (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

3. OPERATION

- (a) Do not connect, disconnect the module in the “ Power On” condition.
- (b) Power supply should always be turned on/off by following item 6.3 “ Power on/off sequence “.
- (c) 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.
- (d) The FPC cable between the LED chips and its converter power supply shall be a minimized length and be connected directly . The longer cable between the back-light and the converter may cause lower luminance of light source (LED).
- (e) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, SEC is not to be held reliable for the defective operations. It is strongly recommended to contact SEC to find out fitness for a particular purpose.

4. OTHERS

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) 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.
- (d) 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.
- (e) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

Samsung Secret

11. EDID

Approval

| Address (HEX) | FUNCTION | Value | BIN | DEC | ASCII or Data | Notes |
|------------------|------------------------|-------|----------|-----|---------------------|---------------------------|
| | | HEX | | | | |
| 00 | Header | 00 | 00000000 | 0 | | EDID Header |
| 01 | | FF | 11111111 | 255 | | |
| 02 | | FF | 11111111 | 255 | | |
| 03 | | FF | 11111111 | 255 | | |
| 04 | | FF | 11111111 | 255 | | |
| 05 | | FF | 11111111 | 255 | | |
| 06 | | FF | 11111111 | 255 | | |
| 07 | | 00 | 00000000 | 0 | | |
| 08 | ID Manufacturer Name | 4C | 01001100 | 76 | S | 3 character ID |
| 09 | | A3 | 10100011 | 163 | E C | "SEC" |
| 0A | ID Product Code | 4C | 01001100 | 76 | [L] | #HD LED |
| 0B | | 45 | 01000101 | 69 | [E] | |
| 0C | 32-bit serial no. | 00 | 00000000 | 0 | | |
| 0D | | 00 | 00000000 | 0 | | |
| 0E | | 00 | 00000000 | 0 | | |
| 0F | | 00 | 00000000 | 0 | | |
| 10 | Week of manufacture | 00 | 00000000 | 0 | | |
| 11 | Year of manufacture | 15 | 00010101 | 21 | 2011 | 2011 |
| 12 | EDID Structure Ver. | 01 | 00000001 | 1 | 1 | EDID Ver. 1.0 |
| 13 | EDID revision # | 03 | 00000011 | 3 | 3 | EDID Rev. 3 |
| 14 | Video input definition | 80 | 10000000 | 128 | | |
| 15 | Max H image size | 1F | 00011111 | 31 | 31 | 31 cm(approx) |
| 16 | Max V image size | 11 | 00010001 | 17 | 17 | 17 cm(approx) |
| 17 | Display Gamma | 78 | 01111000 | 120 | 2.2 | Gamma 2.2 |
| 18 | Feature support | EA | 11101010 | 234 | | |
| 19 | Red/green low bits | 87 | 10000111 | 135 | | 10000111 |
| 1A | Blue/white low bits | F5 | 11110101 | 245 | | 11111110 |
| 1B | Red x/ high bits | 94 | 10010100 | 148 | 0.580 | Red x0.580= 10010100 |
| 1C | Red y | 57 | 01010111 | 87 | 0.340 | Red y0.340= 01010111 |
| 1D | Green x | 4F | 01001111 | 79 | 0.310 | Green x0.310= 01001111 |
| 1E | Green y | 8C | 10001100 | 140 | 0.550 | Green y0.550= 10001100 |
| 1F | Blue x | 27 | 00100111 | 39 | 0.155 | Blue x0.155= 00100111 |
| 20 | Blue y | 27 | 00100111 | 39 | 0.155 | Blue y0.155= 00100111 |
| 21 | White x | 50 | 01010000 | 80 | 0.313 | White x0.313= 01010000 |
| 22 | White y | 54 | 01010100 | 84 | 0.329 | White y0.329= 01010100 |
| 23 | Established timing 1 | 00 | 00000000 | 0 | | |
| 24 | Established timing 2 | 00 | 00000000 | 0 | | |
| 25 | Established timing 3 | 00 | 00000000 | 0 | | |

Samsung Secret

| | | | | | | | |
|----|---------------------------------------|----------|----------|-----|-------------------------------|---------------------------------|--|
| 26 | Standard timing #1 | 01 | 00000001 | 1 | | not used | |
| 27 | | 01 | 00000001 | 1 | | | |
| 28 | Standard timing #2 | 01 | 00000001 | 1 | | not used | |
| 29 | | 01 | 00000001 | 1 | | | |
| 2A | Standard timing #3 | 01 | 00000001 | 1 | | not used | |
| 2B | | 01 | 00000001 | 1 | | | |
| 2C | Standard timing #4 | 01 | 00000001 | 1 | | not used | |
| 2D | | 01 | 00000001 | 1 | | | |
| 2E | Standard timing #5 | 01 | 00000001 | 1 | | not used | |
| 2F | | 01 | 00000001 | 1 | | | |
| 30 | Standard timing #6 | 01 | 00000001 | 1 | | not used | |
| 31 | | 01 | 00000001 | 1 | | | |
| 32 | Standard timing #7 | 01 | 00000001 | 1 | | not used | |
| 33 | | 01 | 00000001 | 1 | | | |
| 34 | Standard timing #8 | 01 | 00000001 | 1 | | not used | |
| 35 | | 01 | 00000001 | 1 | | | |
| 36 | Detailed timing/monitor descriptor #1 | 5D | 01011101 | 93 | 75.17 | Main clock= 75.17 MHz (@60Hz) | |
| 37 | | 1D | 00011101 | 29 | | | |
| 38 | | 56 | 01010110 | 86 | 1366 | Hor active=683*2 pixels | |
| 39 | | DC | 11011100 | 220 | 220 | Hor blanking=220pixels | |
| 3A | | 50 | 01010000 | 80 | | 4bit : 4bit | |
| 3B | | 00 | 00000000 | 0 | 768 | Vertical active=768 lines | |
| 3C | | 16 | 00010110 | 22 | 22 | Vertical blanking=22 lines | |
| 3D | | 30 | 00110000 | 48 | | 4bit : 4bit | |
| 3E | | 30 | 00110000 | 48 | 48 | Hor sync. Offset=48 pixels | |
| 3F | | 20 | 00100000 | 32 | 32 | H sync. Width=32 pixels | |
| 40 | | 25 | 00100101 | 37 | 2 | V sync. Offset=2 lines | |
| | | | | | 5 | V sync. Width=5 lines | |
| 41 | | 00 | 00000000 | 0 | | 2bit : 2bit :2bit :2bit | |
| 42 | | 35 | 00110101 | 53 | 309 | H image size= 309 mm(approx) | |
| 43 | | AE | 10101110 | 174 | 174 | V image size = 174 mm(approx) | |
| 44 | | 10 | 00010000 | 16 | | | |
| 45 | 00 | 00000000 | 0 | | No Horizontal Border | | |
| 46 | 00 | 00000000 | 0 | | No Vertical Border | | |
| 47 | 19 | 00011001 | 25 | | | | |
| 48 | Detailed timing/monitor descriptor #2 | 00 | 00000000 | 0 | | Manufacturer Specified (Timing) | |
| 49 | | 00 | 00000000 | 0 | | | |
| 4A | | 00 | 00000000 | 0 | | | |
| 4B | | 0F | 00001111 | 15 | | | |
| 4C | | 00 | 00000000 | 0 | | | |
| 4D | | 00 | 00000000 | 0 | | Value=HSPWmin / 2 | |
| 4E | | 00 | 00000000 | 0 | | Value=HSPWmax / 2 | |
| 4F | | 00 | 00000000 | 0 | | Value=Thbpmmin / 2 | |
| 50 | | 00 | 00000000 | 0 | | Value=Thbpmmax / 2 | |
| 51 | | 00 | 00000000 | 0 | | Value=VSPWmin / 2 | |
| 52 | | 00 | 00000000 | 0 | | Value=VSPWmax / 2 | |
| 53 | | 00 | 00000000 | 0 | | Value=Tvpmin / 2 | |
| 54 | | 00 | 00000000 | 0 | | Value=Tvpmax / 2 | |
| 55 | | 25 | 00100101 | 37 | | Thpmin=value*2 + HA pixelclks | |
| 56 | D9 | 11011001 | 217 | | Thpmax=value*2 + HA pixelclks | | |
| 57 | 06 | 00000110 | 6 | | Tvpmin=value*2 + VA lines | | |
| 58 | 6A | 01101010 | 106 | | Tvpmax=value*2 + VA lines | | |
| 59 | 00 | 00000000 | 0 | | Module revision | | |

Samsung Secret

| | | | | | | |
|----|---------------------------------------|----------|----------|-----|-------------------|--------------------------|
| 5A | Detailed timing/monitor descriptor #3 | 00 | 00000000 | 0 | | ASCII Data String Tag |
| 5B | | 00 | 00000000 | 0 | | |
| 5C | | 00 | 00000000 | 0 | | |
| 5D | | FE | 11111110 | 254 | | |
| 5E | | 00 | 00000000 | 0 | | |
| 5F | | 53 | 01010011 | 83 | [S] | |
| 60 | | 41 | 01000001 | 65 | [A] | |
| 61 | | 4D | 01001101 | 77 | [M] | |
| 62 | | 53 | 01010011 | 83 | [S] | |
| 63 | | 55 | 01010101 | 85 | [U] | |
| 64 | | 4E | 01001110 | 78 | [N] | |
| 65 | | 47 | 01000111 | 71 | [G] | |
| 66 | | 0A | 00001010 | 10 | [^] | |
| 67 | | 20 | 00100000 | 32 | [] | |
| 68 | 4C | 01001100 | 76 | | supplier ID "SEC" | |
| 69 | A3 | 10100011 | 163 | | | |
| 6A | 41 | 01000001 | 65 | [A] | Product code "AT" | |
| 6B | 54 | 01010100 | 84 | [T] | (Hex, LSB first) | |
| 6C | Detailed timing/monitor descriptor #4 | 00 | 00000000 | 0 | | Monitor Name Tag (ASCII) |
| 6D | | 00 | 00000000 | 0 | | |
| 6E | | 00 | 00000000 | 0 | | |
| 6F | | FE | 11111110 | 254 | | |
| 70 | | 00 | 00000000 | 0 | | |
| 71 | | 4C | 01001100 | 76 | [L] | |
| 72 | | 54 | 01010100 | 84 | [T] | |
| 73 | | 4E | 01001110 | 78 | [N] | |
| 74 | | 31 | 00110001 | 49 | [1] | |
| 75 | | 34 | 00110100 | 52 | [4] | |
| 76 | | 30 | 00110000 | 48 | [0] | |
| 77 | | 41 | 01000001 | 65 | [A] | |
| 78 | | 54 | 01010100 | 84 | [T] | |
| 79 | | 32 | 00110010 | 50 | [2] | |
| 7A | 36 | 00110110 | 54 | [6] | | |
| 7B | 4C | 01001100 | 76 | [L] | | |
| 7C | 30 | 00110000 | 48 | [0] | | |
| 7D | 31 | 00110001 | 49 | [1] | | |
| 7E | Extension Flag | 00 | 00000000 | 0 | | |
| 7F | Checksum | E2 | 11100010 | 226 | | |

Samsung Secret