



ELECTRONICS

TO : INVENTEC
DATE : JUL. 06. 2007

SAMSUNG TFT-LCD

MODEL NO. : LMS283GF05

Customer Approval

Approved by : **J.O. KWAG**

Mobile Display Development Team
LCD Business
Samsung Electronics Co . , LTD.



Revision History

| Data | Rev. No. | Page | Summary |
|----------------|----------|------|-------------------------|
| May. 30. 2007 | 000 | | Rev.000 was issued. |
| July. 06. 2007 | 001 | 21 | Changed power sequence. |

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Appendix #1 LMS283GF05 cosmetic spec

General Description

* Description

LMS283GF05 is a TMR type 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 module(TFT-LCD panel, driver ICs and FPC), a Back-light unit. The resolution of a 2.83" contains 240 x 320 pixels and can display up to 262,144 colors.

* Features

- TMR(Transmissive with micro reflective) type.
- 4 LED Back-light
- Line Inversion mode.
- Low Power Consumption.

* Applications

- Display terminals for PDA application products.
- Smart phone / Game machine / Camcoder.

* General Information

| Items | Specification | Unit | Note |
|-------------------|------------------------|---------|------|
| Display area | 43.2(H) x 57.6(V) | mm | - |
| Driver element | a-Si TFT active matrix | - | - |
| Display colors | 262,144 | colors | - |
| Number of pixels | 240(H) x RGB x 320(V) | pixel | - |
| Pixel arrangement | RGB vertical stripe | - | - |
| Pixel pitch | 0.180(H) x 0.180(V) | mm | - |
| Display mode | Normally White | - | - |
| Viewing Direction | 12:00 | o'clock | (3) |

* Mechanical Information

| Item | | Min. | Typ. | Max. | Unit | Note |
|-------------|---------------|-------|------|-------|------|---------|
| Module Size | Horizontal(H) | 52.75 | 52.9 | 53.05 | mm | (1) |
| | Vertical(V) | 71.55 | 71.7 | 71.85 | mm | |
| | Depth(D) | - | 1.9 | 2.0 | mm | (1),(2) |
| Weight | | - | 16 | 18 | g | (1) |

Note (1) Back-light unit are included.

(2) FPC & Component height is not included

(3) Dark gray scale Inversion

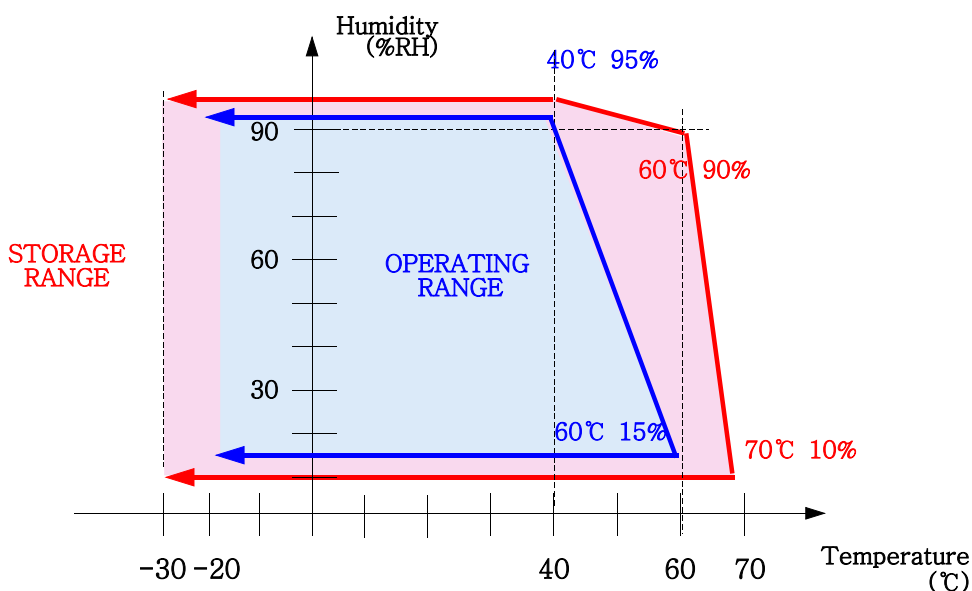
1. Absolute Maximum Ratings

1.1 Absolute Ratings of Environment

| Item | Min. | Max. | Unit | Note |
|--|------|------|------|---------|
| Storage temperature | -30 | 70 | °C | (1) |
| Operating temperature (Ambient temperature) | -20 | 60 | °C | (2),(3) |

Note (1) 90 % RH maximum humidity, 60°C maximum wet-bulb temperature

- (2) When operated at a temperature lower than 0°C, the LCD worked slowly and the screen appeared low-contrast images due to the characteristics of LC(Liquid Crystal).
- (3) If any fixed pattern is displayed on LCD for minutes, image-sticking phenomenon may occur.
- (4) Degradation could occur to pixels' TFT when DC BIOS is input into its gate-signal under POWER OFF WAITING STAND-BY & SLEEP MODE. Therefore, LCD should be turn off then.
- (5) Please operate a LCD module on the basis of the recommended S/W(Register DATA). If you want to change any part of the S/W, you must take Samsung's confirmation.



Temperature & Humidity Graph at Absolute Environment

1.2 Electrical Absolute Ratings

(1) TFT-LCD Module

(Ta = Room Temp, V_{ss}=GND=0V)

| Characteristics | Symbol | Min. | Max. | Unit | Note |
|----------------------------|-----------------|------|------|------|------|
| Supply Voltage | V _{DD} | -0.3 | 5 | V | - |
| Supply Voltage for Step-up | V _{ci} | -0.3 | 5 | V | - |

(2) Back-Light Unit

(Ta = Room Temp)

| Characteristics | Symbol | Min. | Max. | Unit | Note |
|-----------------|----------------|------|------|------|------|
| Current | I _B | - | 25 | mA | (1) |

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.

Functional operation should be restricted to the conditions described under normal operating conditions.

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 (1),(2),(3)

Measuring equipment: SR-3, BM-7, EZ-Contrast

(Ta = Room Temp, V_{ci} = 2.8V I_B = 20mA)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note | |
|--------------------------------------|-------------------------|--------------------------------------|------------------------|------|-------|-------------------|--------------------|-------------|
| Contrast ratio (Center point) | C/R1 | Normal Viewing Angle B/L On | 280 | 350 | - | - | (4) SR-3 | |
| Luminance of white (Center point) | YL | | 260 | 320 | - | cd/m ² | (5) SR-3 | |
| White uniformity (5 point) | Uw | | $\Phi=0$ $\Theta=0$ | 70 | - | - | % | (5) SR-3 |
| Response time | Rising:Tr Falling:Tf | | Tr+Tf | - | 35 | 50 | msec | (6) BM-7 |
| Color chromaticity (CIE 1931) | White | W _{x1} | -0.05 | 0.31 | +0.05 | - | (7) SR-3 | |
| | | W _{y1} | | 0.33 | | | | |
| | Red | W _{x1} | | 0.61 | | | | |
| | | W _{y1} | | 0.36 | | | | |
| | Green | W _{x1} | | 0.33 | | | | |
| | | W _{y1} | | 0.60 | | | | |
| | Blue | W _{x1} | | 0.15 | | | | |
| | | W _{y1} | | 0.10 | | | | |
| Viewing angle | Hor. | $\theta L1$ | 35 | 50 | - | Degrees | (8) Ez-Contrast | |
| | | $\theta R1$ | 35 | 50 | - | | | |
| | Ver. | $\phi H1$ | 35 | 50 | - | | | |
| | | $\phi L1$ | 15 | 20 | - | | | |

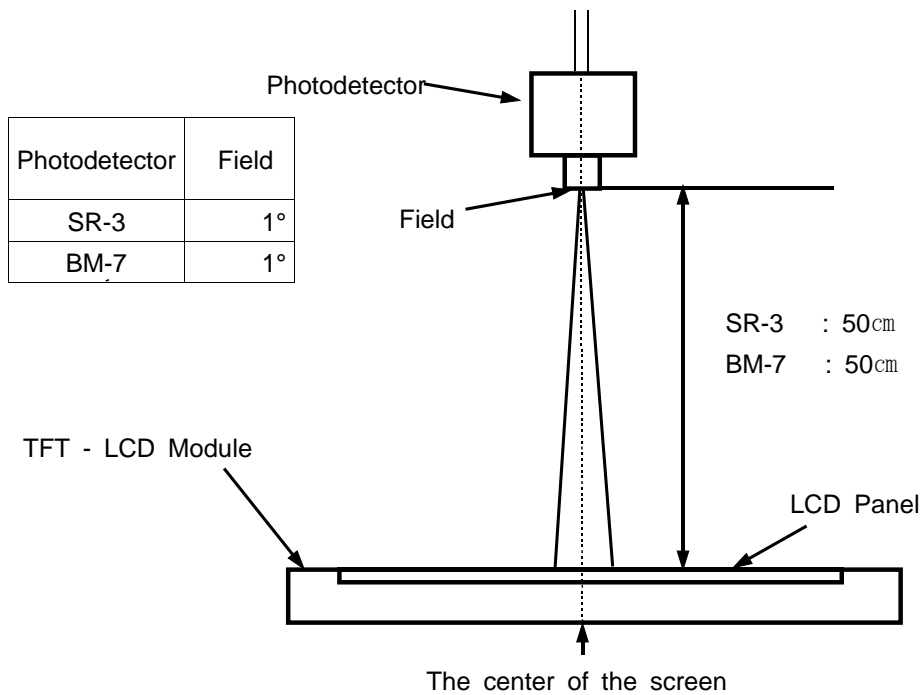
Note (1) The optical characteristics is measured with Back-light.

(2) If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.

Note (3) Test Equipment Setup for the Transmissive Mode (Back-light On)

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.

- Back-light Current : 20mA
- Back-Light On condition



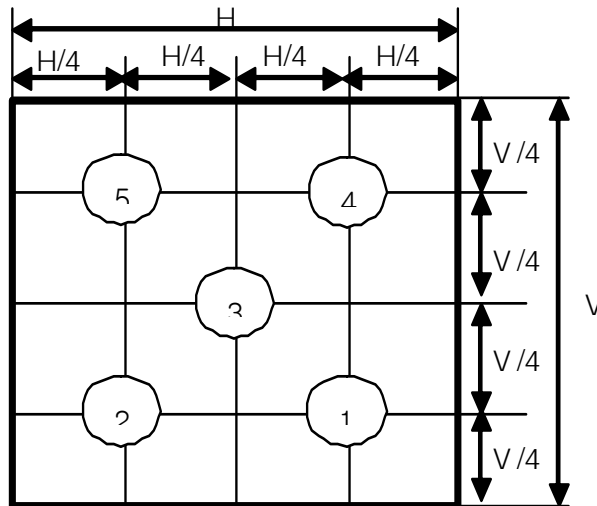
Note (4) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point of the panel. If Back-light is on state, it is the light source and the SR-3 will be used to measure.

$$C/R = \frac{G_{max}}{G_{min}}$$

* Gmax : Luminance with all pixels white
 * Gmin : Luminance with all pixels black

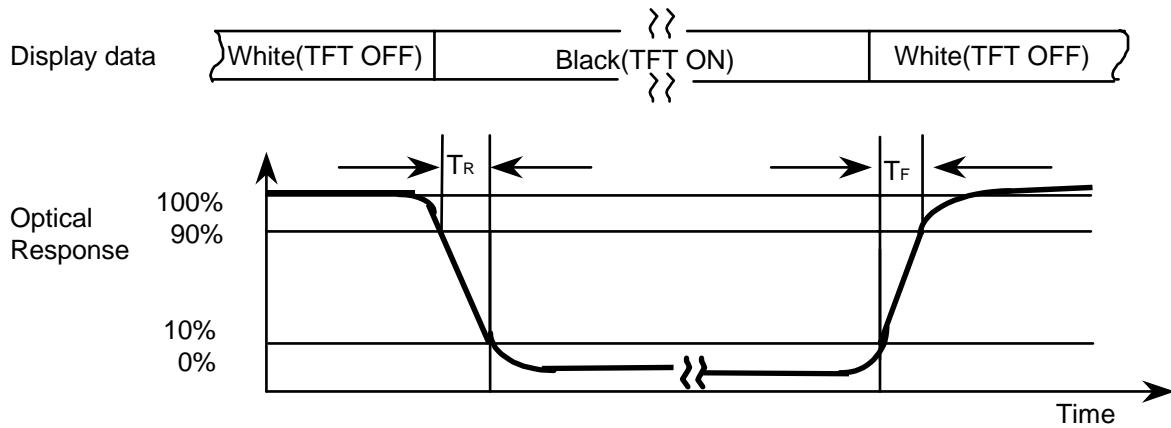
Note (5) Definition of Luminance of White : Luminance of white at center point.
 In this case, the incident light is not from the light source but from the Back-light that generates the reflected light source on LCD in the dark room.

$$\text{White Uniformity} = \frac{\text{Min luminance of white among 5-points}}{\text{Max luminance of white among 5-points}} \times 100\%$$



※ Light Source(Chip type white LED : 4EA)

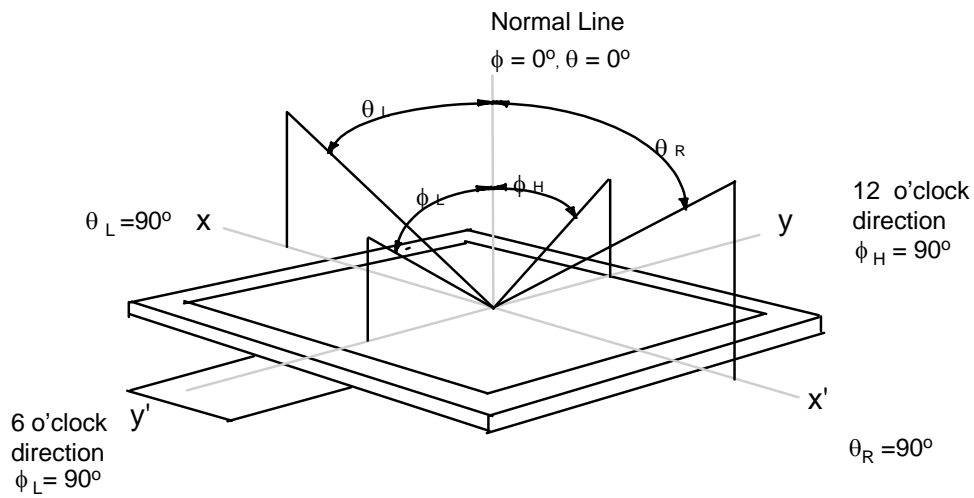
Note (6) Definition of Response time : Sum of T_r, T_f



Note (7) Definition of Color Chromaticity (CIE 1931)

Color coordinate of white & red, green, blue at center point.

Note (8) Definition of Viewing Angle : Viewing angle range ($CR \geq 10$)



3. Electrical Characteristics

3.1 TFT-LCD Module

(Input Voltage = 2.8V, Ta = Room Temp)

| Characteristics | | Symbol | MIN. | TYP. | MAX. | Unit | Note |
|-------------------------|-----------------|-------------------|-----------|------|-----------|------|-------------|
| Logic IO supply voltage | | IOVCC | 1.65 | 2.8 | 3.3 | V | (1),(2),(6) |
| DC/DC supply voltage | | VCC | 2.5 | 2.8 | 3.3 | V | (1),(2) |
| Input High Voltage | | V _{IH} | 0.7xIOVCC | - | IOVCC | V | |
| Input Low Voltage | | V _{IL} | 0 | - | 0.3xIOVCC | V | |
| Dissipation Current | Full | I _F | - | 10.5 | 14.0 | mA | (1),(2),(4) |
| | | | | | | | |
| Power Dissipation | White | PW | - | 15 | 20 | mW | (1),(2),(5) |
| | Blue | PB _{lue} | | 23 | 29 | mW | |
| | Black | PB | - | 30 | 42 | mW | |
| | Vertical Stripe | PV | - | 22 | 26 | mW | |

* To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the Chapter 7 power on/off Sequence

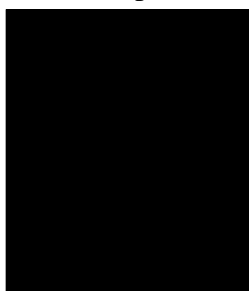
Note (1) Condition : TFT-LCD module only with typ. electrical characteristics
(Frame Frequency : 80Hz)

- (2) V_P = IOVCC = VCC
- (3) V_P = 2.8V, The standby mode, where display operation completely stops, halting all the internal operations.
- (4) V_P = 2.8V, Power supply current value of motion picture is high speed write mode.
- (5) Power dissipation check pattern

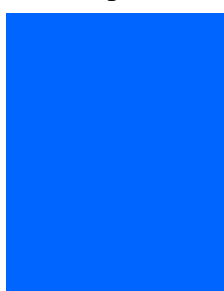
[White patten]



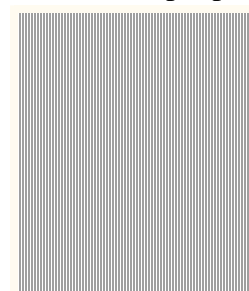
[Black patten]



[Blue pattern]

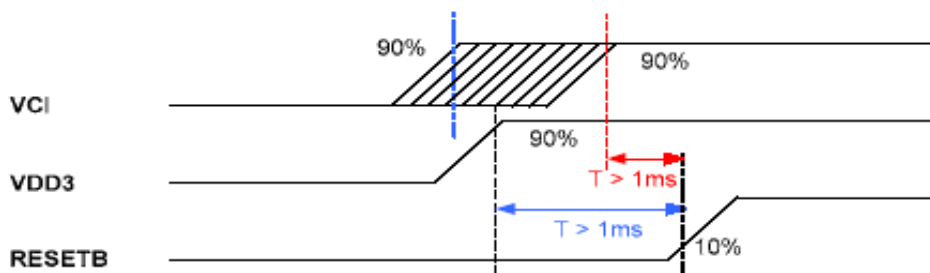
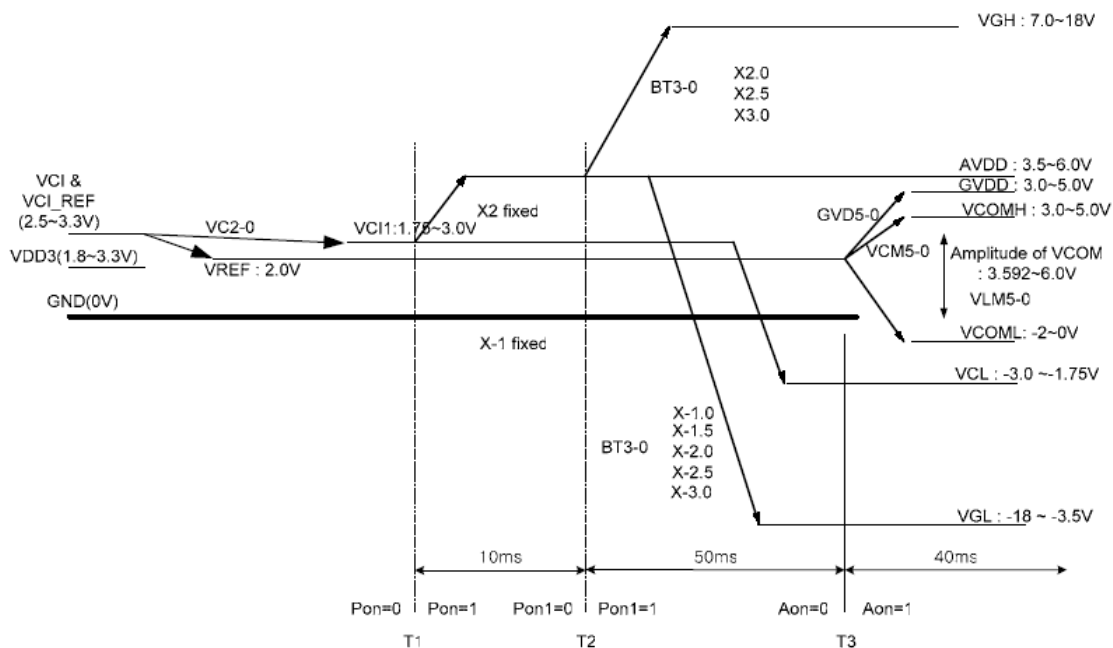


[Vertical Stripe patten]



(6) If you change IOVCC(1.65V~3.3V) Typ. value, we must change our FPC circuit design and retest SEC Reliability Test.

(7) Power On Sequence



Note : During Power On sequence, VCI may be slower or faster than VDD3
 When VCI goes slower than VDD3(Red case), VCI should reach 90% 10usec before RESETB goes high 10%.
 When VCI goes faster than VDD3(Blue case), VDD3 should reach 90% 10usec before RESETB goes high 10%.

3.2 Back-Light Unit

The Back-light system is an edge-lighting type with 4 white LED(Light Emitting Diode)s. The characteristics of 4 white LEDs are shown in the following tables.

(Ta = Room Temp)

| Characteristics | Symbol | Min. | Typ. | Max. | Unit | Note |
|-------------------|----------|------|------|------|------|---------|
| Current | I_B | - | 20 | 25 | mA | (1) |
| Power Consumption | P_{BL} | - | 264 | 340 | mW | (2),(3) |

Note (1) 4 white LEDs serial type.

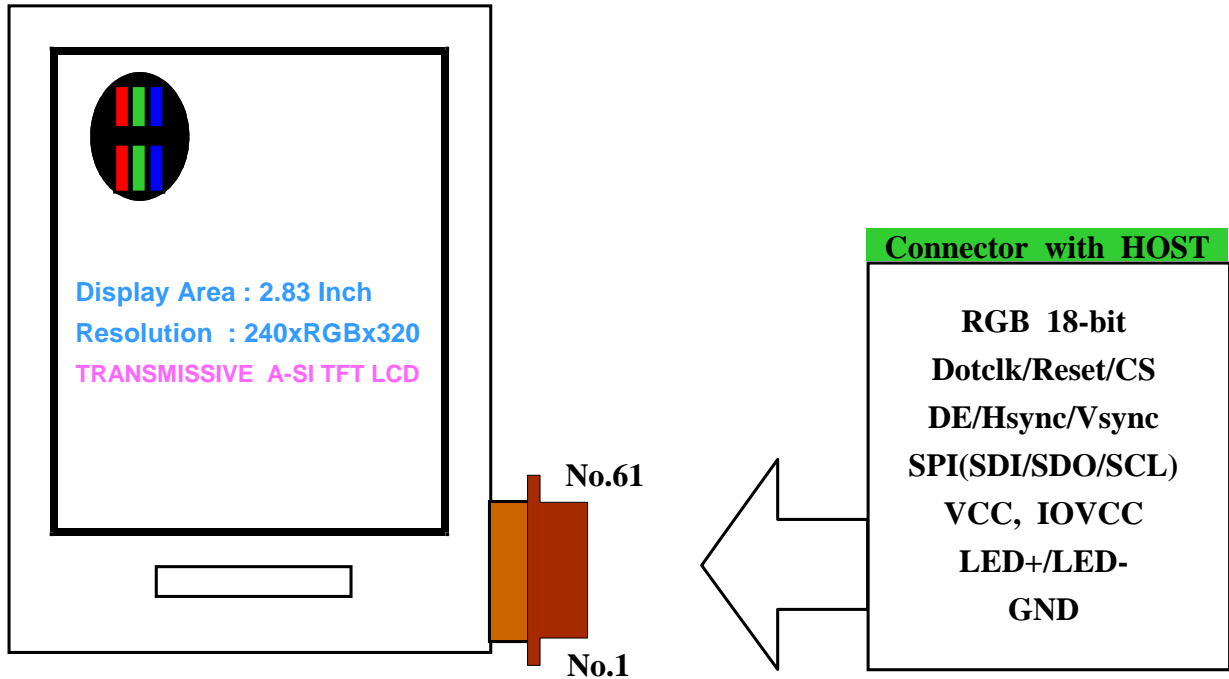
(2) In Typical case, $I_B = 20mA$, $V_B = 13.2 V$, $P_{BL} = V_B \times I_B$

(3) In Maximum case, $I_B = 25mA$, $V_B = 13.6 V$, $P_{BL} = V_B \times I_B$

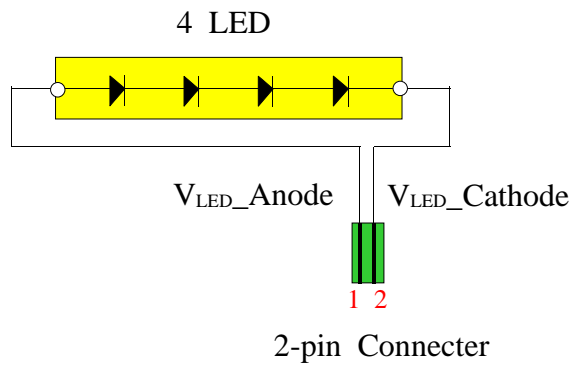
4. Block Diagram

4.1 TFT-LCD Block Diagram

12:00 Viewing Direction
(Dark gray Inversion)



4.2 Back-light Unit



| Pin No. | Symbol | I/O |
|---------|-------------|---------|
| 1 | LED_ANODE | Anode |
| 2 | LED_CATHODE | Cathode |

5. Input Terminal Pin Assignment

5.1 TFT-LCD Module (Mating Connector : 61PIN (Part Name:FH23-61S-0.3SHW, HIROSE))

| Pin No | Symbol | Description | Remark |
|--------|--------|---------------|-------------|
| 1 | DE | Data enable | Low active |
| 2 | MCLK | Main clock | Rising edge |
| 3 | RST | IC Reset | Low active |
| 4 | N.C | No connection | |
| 5 | GND | Ground | |
| 6 | N.C. | No connection | |
| 7 | N.C. | No connection | |
| 8 | GND | Ground | |
| 9 | N.C. | No connection | |
| 10 | N.C. | No connection | |
| 11 | N.C. | No connection | |
| 12 | N.C. | No connection | |
| 13 | GND | Ground | |
| 14 | N.C | No connection | |
| 15 | N.C. | No connection | |
| 16 | N.C. | No connection | |
| 17 | N.C. | No connection | |
| 18 | N.C. | No connection | |
| 19 | GND | GROUND | |
| 20 | VCC | Logic Power | |
| 21 | VCC | Logic Power | |
| 22 | N.C. | No connection | |
| 23 | N.C. | No connection | |
| 24 | N.C | No connection | |
| 25 | GND | Ground | |
| 26 | N.C. | No connection | |
| 27 | N.C | No connection | |
| 28 | VCC | Logic Power | |
| 29 | PD17 | Red data(R5) | (1) |
| 30 | PD16 | Red data(R4) | |
| 31 | PD15 | Red data(R3) | |
| 32 | PD14 | Red data(R2) | |
| 33 | PD13 | Red data(R1) | |
| 34 | PD12 | Red data(R0) | (1) |

| Pin No | Symbol | Description | Remark |
|--------|--------|------------------------|-------------|
| 35 | PD11 | Green data(G5) | (1) |
| 36 | PD10 | Green data(G4) | |
| 37 | PD9 | Green data(G3) | |
| 38 | PD8 | Green data(G2) | |
| 39 | PD7 | Green data(G1) | |
| 40 | PD6 | Green data(G0) | (1) |
| 41 | PD5 | Blue data(B5) | (1) |
| 42 | PD4 | Blue data(B4) | |
| 43 | PD3 | Blue data(B3) | |
| 44 | PD2 | Blue data(B2) | |
| 45 | PD1 | Blue data(B1) | |
| 46 | PD0 | Blue data(B0) | (1) |
| 47 | N.C. | No connection | |
| 48 | CS | Chip select | Low active |
| 49 | SCL | SPI / Write clock | Rising edge |
| 50 | SDI | SPI / Data input | (2) |
| 51 | SDO | SPI / Data output | |
| 52 | HSYNC | Horizontal sync signal | Low active |
| 53 | GND | Ground | |
| 54 | N.C. | No connection | |
| 55 | N.C. | No connection | |
| 56 | VSYNC | Vertical sync signal | Low active |
| 57 | LED+ | LED ANODE | |
| 58 | LED+ | LED ANODE | |
| 59 | LED- | LED CATHODE | |
| 60 | LED- | LED CATHODE | |
| 61 | N.C. | No connection | |

Remark (1) LSB : B0, G0, R0

MSB : B5, G5, R5

Unused pins(PD12, PD0) must be connected to VCC or GND level

(2) We need a "SPI" for initial power setting of driver IC including the power block

5.2 Back-Light Unit (Connector : 2 pin FPC Solder type)

| Pin No. | Symbol | Function |
|---------|--------|-------------|
| 1 | LED+ | LED Anode |
| 2 | LED- | LED Cathode |

5.3 Input Signal, Basic Display Colors and Gray Scale of Each Colors

| 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 COLOR | 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 | 0 | 1 | 1 | 1 | 1 | 1 | - |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 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 | 0 | 1 | 1 | 1 | 1 | 1 | - |
| | YELLOW | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 |
| | LIGHT ↓ | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R61 |
| | | 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 |
| | LIGHT ↓ | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | G61 |
| | | 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 | 0 | 1 | 0 | 0 | 0 | 0 | B1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | B2 |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | B3~B60 |
| | LIGHT ↓ | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | B61 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | B62 |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | B63 |

Note) Definition of Gray :

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

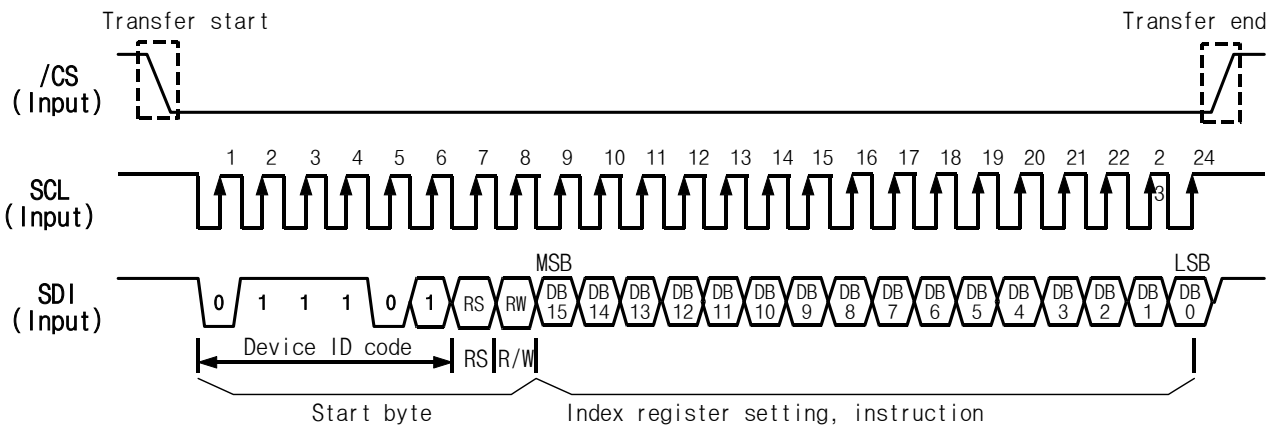
Input Signal : 0 = Low level voltage, 1 = High level voltage

※R5,G5,B5 : MSB R0,G0,B0 : LSB

6. Interface Specifications.

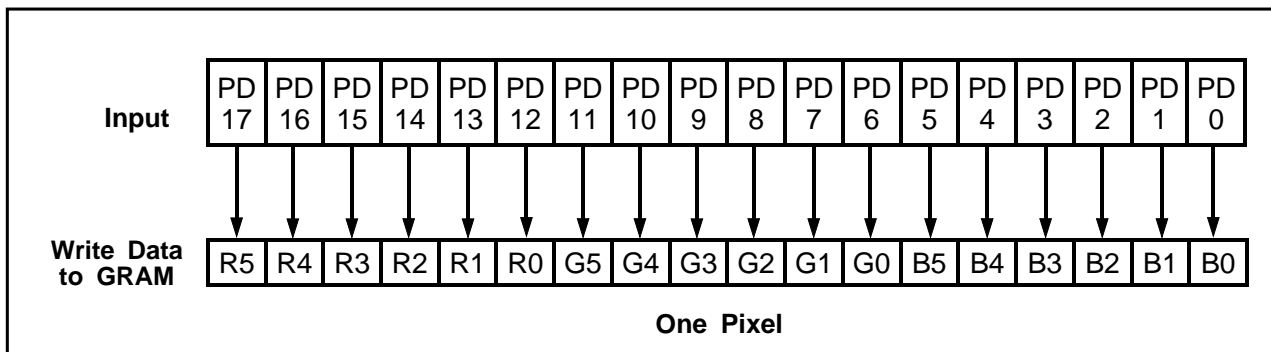
6.1 Serial Peripheral interface

| RS | R/W | Function |
|----|-----|---------------------|
| 0 | 0 | Sets Index Register |
| 0 | 1 | Read Status |
| 1 | 0 | Writes Instruction |
| 1 | 1 | Reads Instruction |

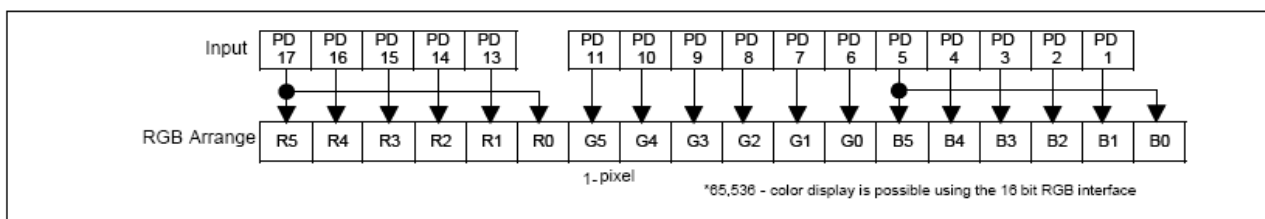


- The data format of instruction is serial 16bit.

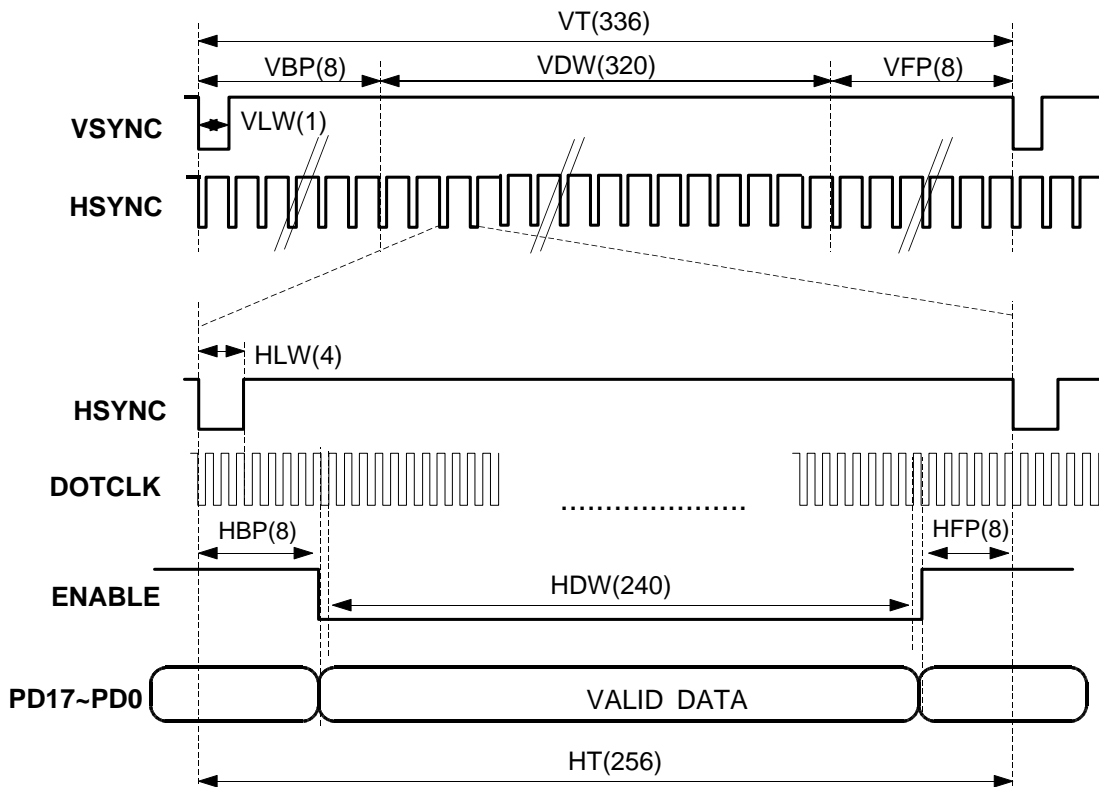
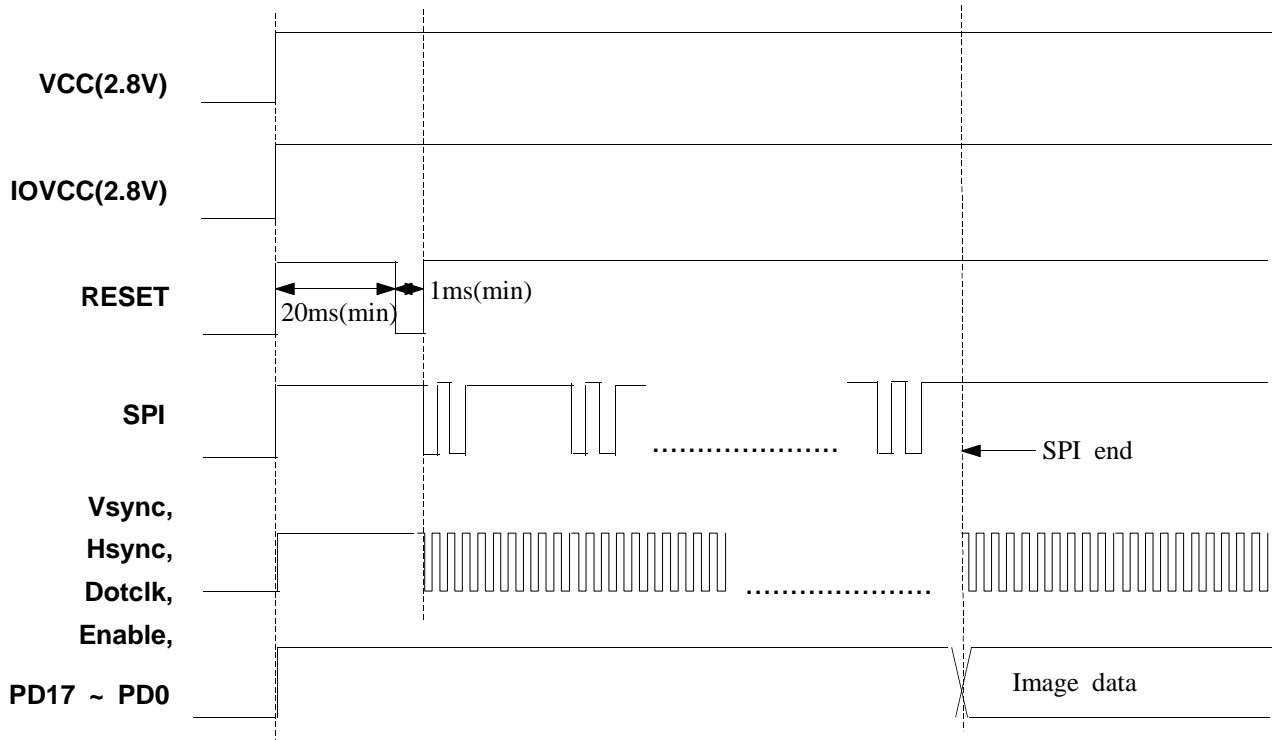
6.2 Data Format for 16bit/18bit RGB Interface



*Note : Unused pins(PD12, PD0) must be connected to VCC or GND level



6.3 Input Signal Timing SPEC

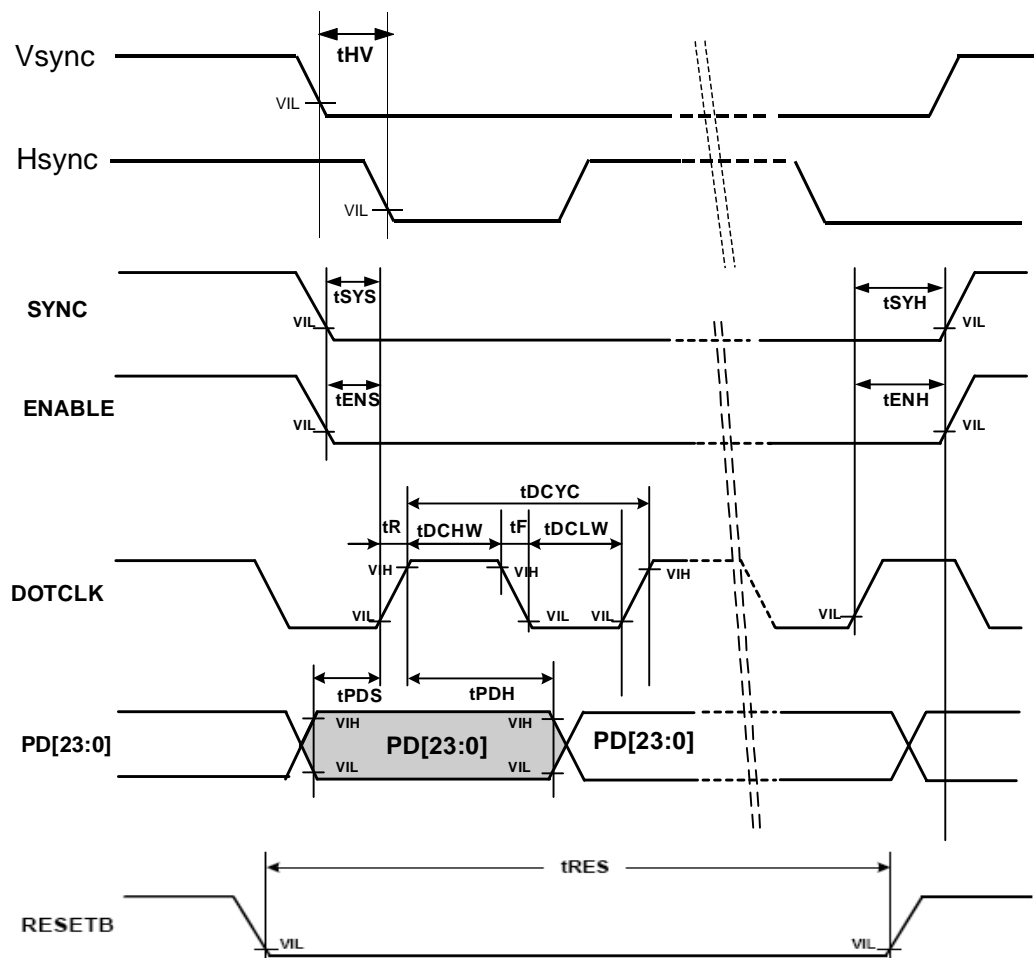


$$\begin{aligned}
 *DOTCLK &= \text{Frame} \times (\text{VDW} + \text{VBP} + \text{VFP}) \times (\text{HDW} + \text{HBP} + \text{HFP}) \\
 &= 80 \text{ Hz} \times \text{VT}(336) \times \text{HT}(256) \\
 &= 6.88\text{MHz}
 \end{aligned}$$

- Note (1) Dot clock signal must be always supplied. Also, there must not be frequency changing
- (2) Horizontal and vertical back porch periods of interface signal must accord with R08h register setting value

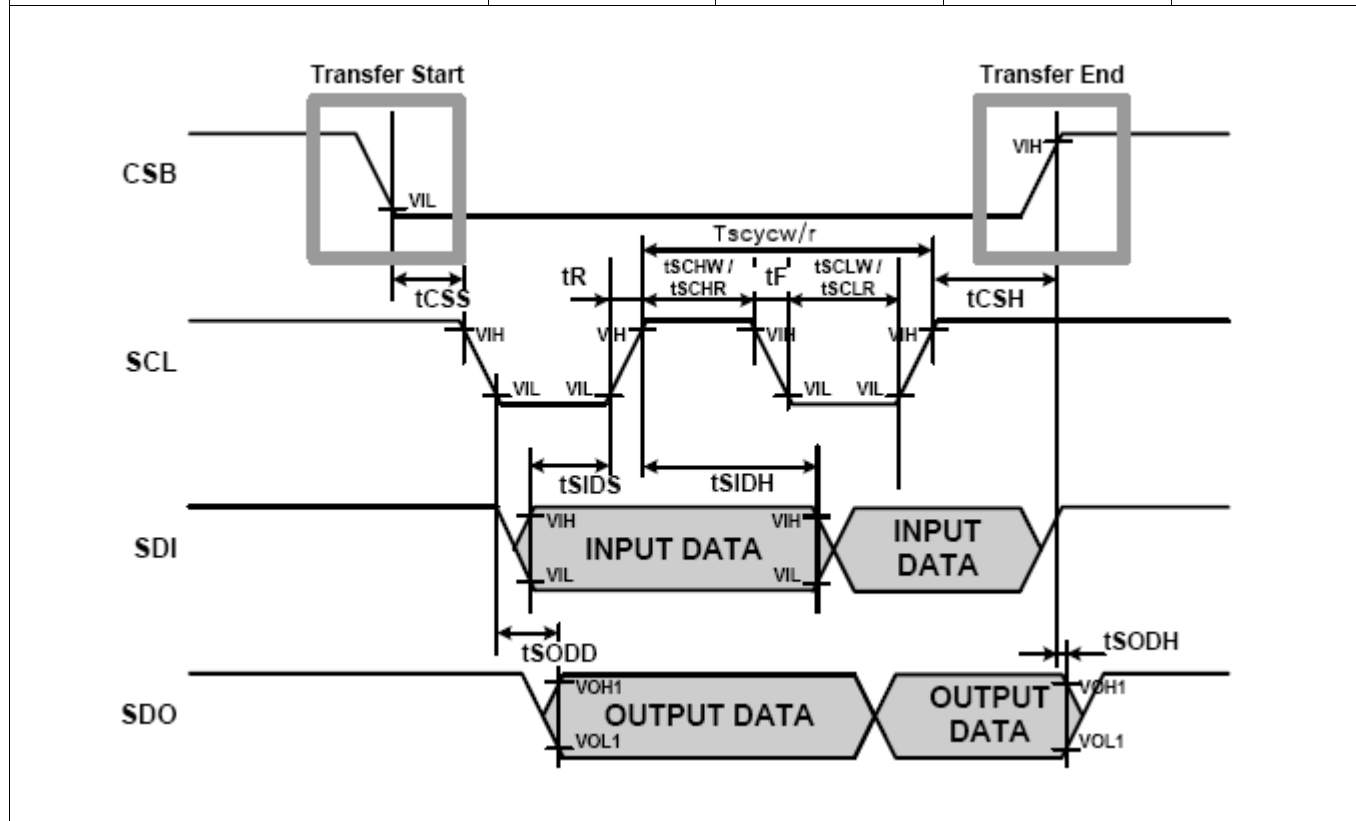
6.4 Input Timing Characteristics

| Characteristic | Symbol | Min. | Max. | Unit |
|--|--------|------|------|-------|
| DOTCLK cycle time | tDCYC | 110 | 194 | ns |
| DOTCLK rise / fall time | tR, tF | - | 15 | |
| DOTCLK Pulse width high | tDCHW | 40 | - | |
| DOTCLK Pulse width low | tDCLW | 40 | - | |
| SYNC setup time | tSYS | 30 | - | |
| SYNC hold time | tSYH | 30 | - | |
| ENABLE setup time | tENS | 15 | - | |
| ENABLE hold time | tENH | 7 | - | |
| PD data setup time | tPDS | 15 | - | |
| PD data hold time | tPDH | 7 | - | |
| Reset low pulse width | tRES | 1 | - | |
| Phase difference of sync signal falling edge | tHV | -7 | 7 | tmclk |



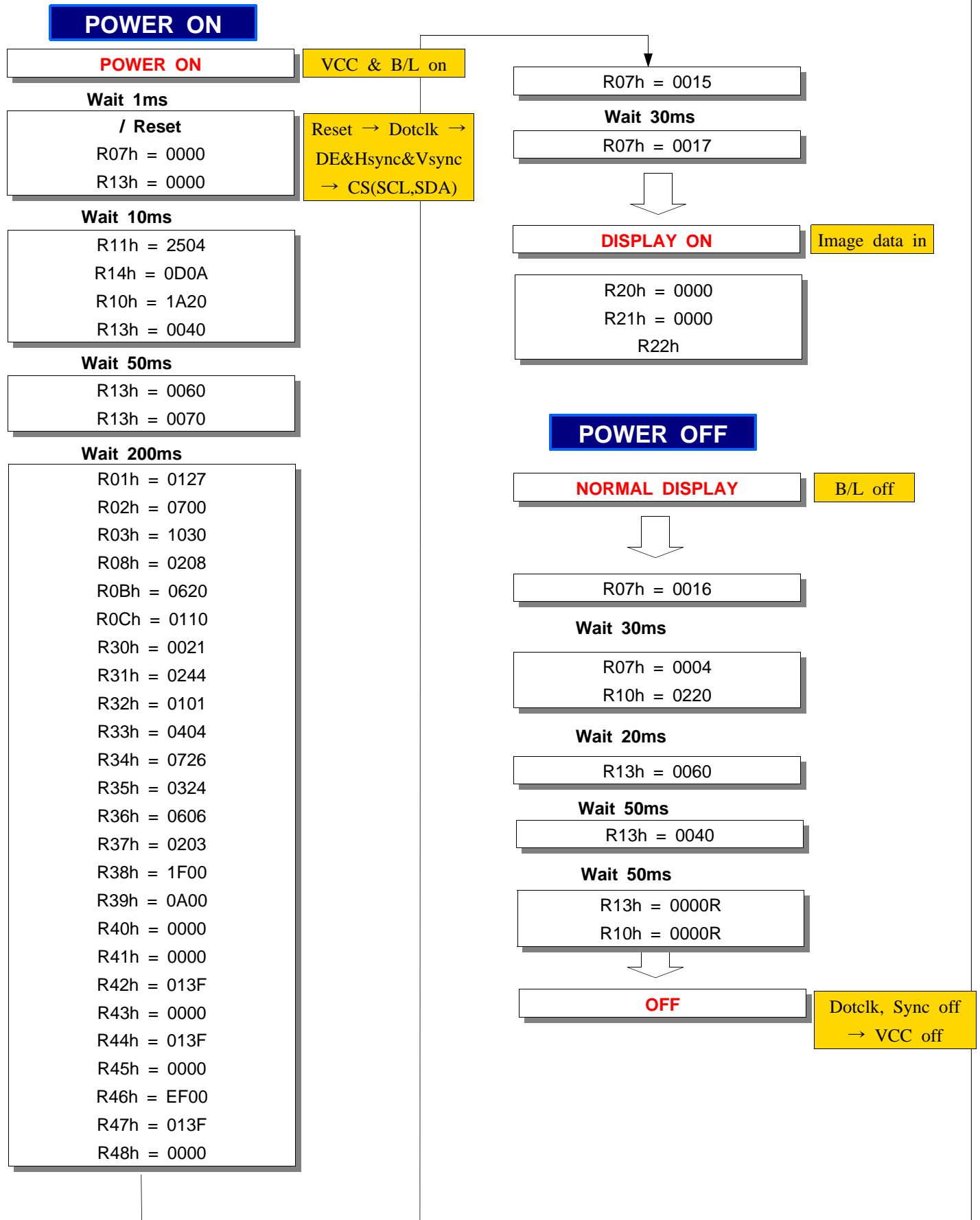
(T_A = -40 to +85 °C)

| Characteristic | | Symbol | Min. | Max. | Unit |
|-------------------------------|-------|---------------------------------|------|------|------|
| Serial clock cycle time | Write | Tscycw | 130 | - | ns |
| | Read | Tscycr | 250 | - | |
| Serial clock rise / fall time | | t _R , t _F | - | 15 | |
| Pulse width high | Write | tSCHW | 50 | - | |
| | Read | tSCHR | 110 | - | |
| Pulse width low | Write | tSCLW | 50 | - | |
| | Read | tSCLR | 110 | - | |
| Chip Select setup time | | tCSS | 20 | - | |
| Chip Select hold time | | tCSH | 60 | - | |
| Serial input data setup time | | tSIDS | 30 | - | |
| Serial input data hold time | | tSIDH | 30 | - | |
| Serial output data delay time | | tSODD | - | 130 | |
| Serial output data hold time | | tSODH | 5 | - | |



7. Operating Sequence

7-1. Power On/Off Sequence

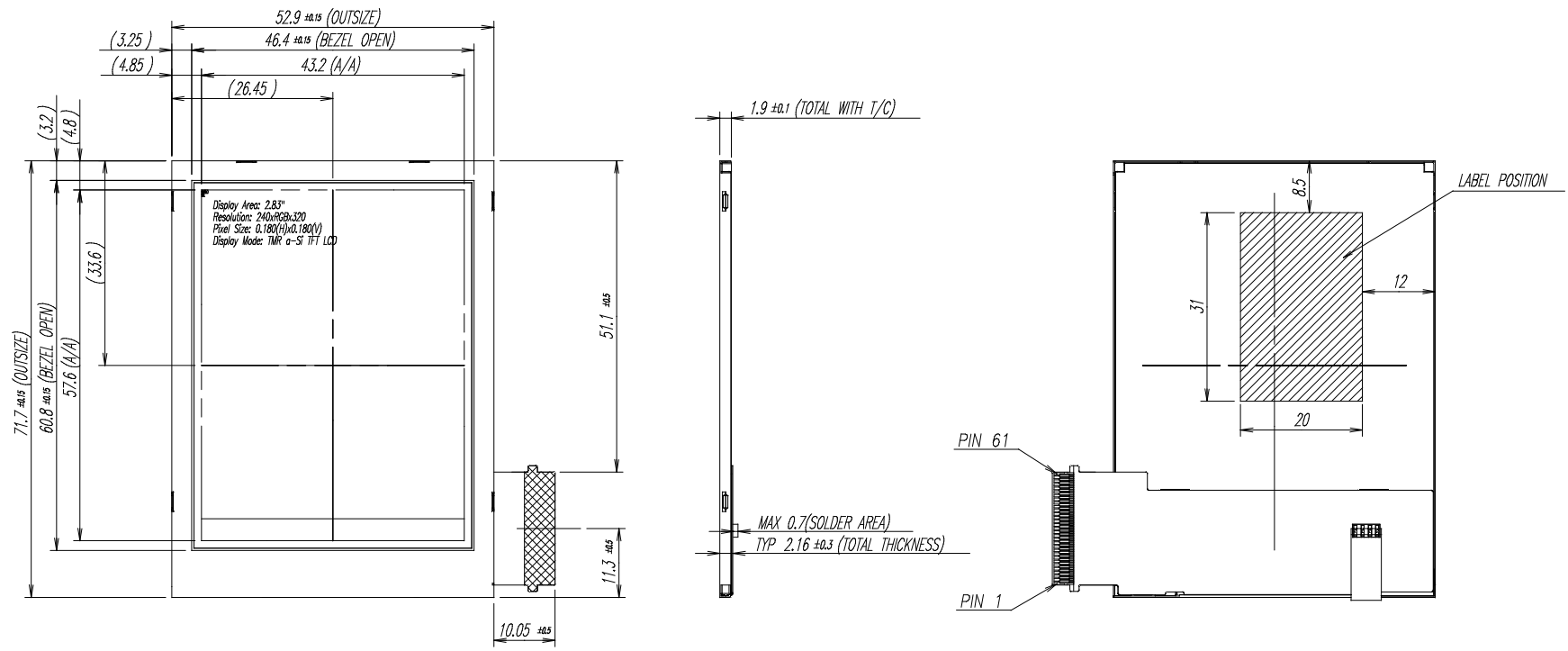


8. Outline Dimensions

8.1 Module Outline Dimensions (Total Assa'y)

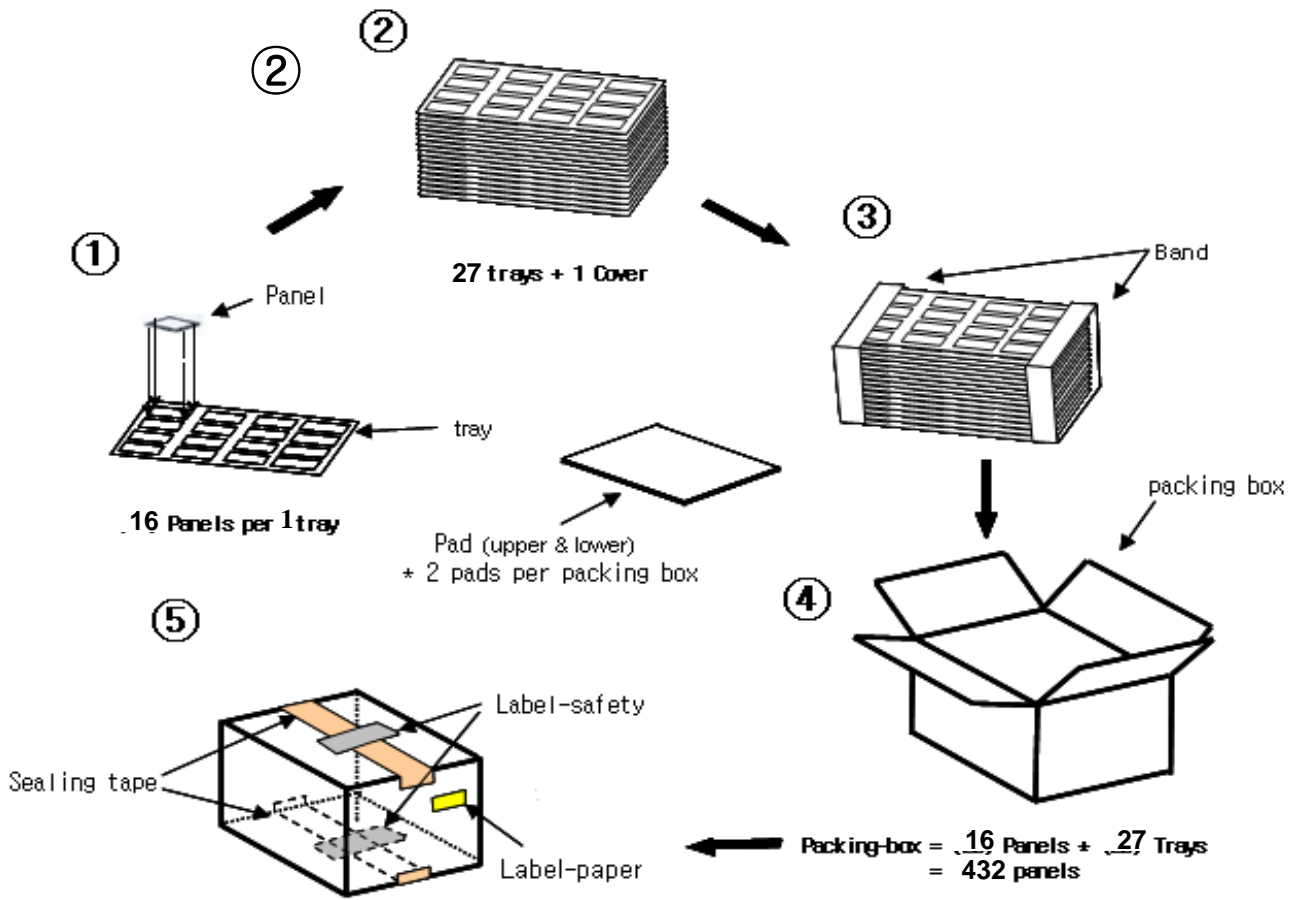
- Refer to the Next Page.

| NO | PART NAME | CODE NO | SPECIFICATION | Q'TY | SPEC NO | REMARK |
|----|-----------|---------|---------------|------|---------|--------|
| | | | | | | |



| GENERAL TOLERANCE | | | | REV | DATE | | | | | | | |
|-------------------|---------|---------|---------|---------------------|------|-----------|----------|-----------|----------|-----------------|-------------------|-----------|
| STEP | LEVEL 1 | LEVEL 2 | LEVEL 3 | UNIT | mm | DRA'N BY | DES'D BY | CHK'D BY | APP'D BY | MODEL NAME | LMS283GF05 | |
| 0 < X ≤ 4 | ±0.05 | ±0.1 | ±0.2 | SCALE | 1/1 | S.J.PARK | | I.S.LEE | Y.B.JOO | PART/SHEET NAME | Outline Dimension | SHEET 1/1 |
| 4 < X ≤ 16 | ±0.08 | ±0.15 | ±0.3 | TOLERANCE LEVEL 3 | | '07.05.22 | | '07.05.22 | | CODE NO. | | |
| 16 < X ≤ 64 | ±0.12 | ±0.25 | ±0.5 | SAMSUNG ELECTRONICS | | | | | | | | |
| 64 < X ≤ 256 | ±0.25 | ±0.4 | ±0.8 | | | | | | | | | |

9. Packing



Note

- (1) Total : Packing box Approx. : (10)kg
- (2) Size : 505(W) x 355(D) x 200(H)
- (3) Place the panels in the tray facing the direction shown in the figure.
- (4) Place 27 tray and cover(empty tray) and pads inside the packing-box.
- (5) Seal the packing-box. Affix the label-safety.

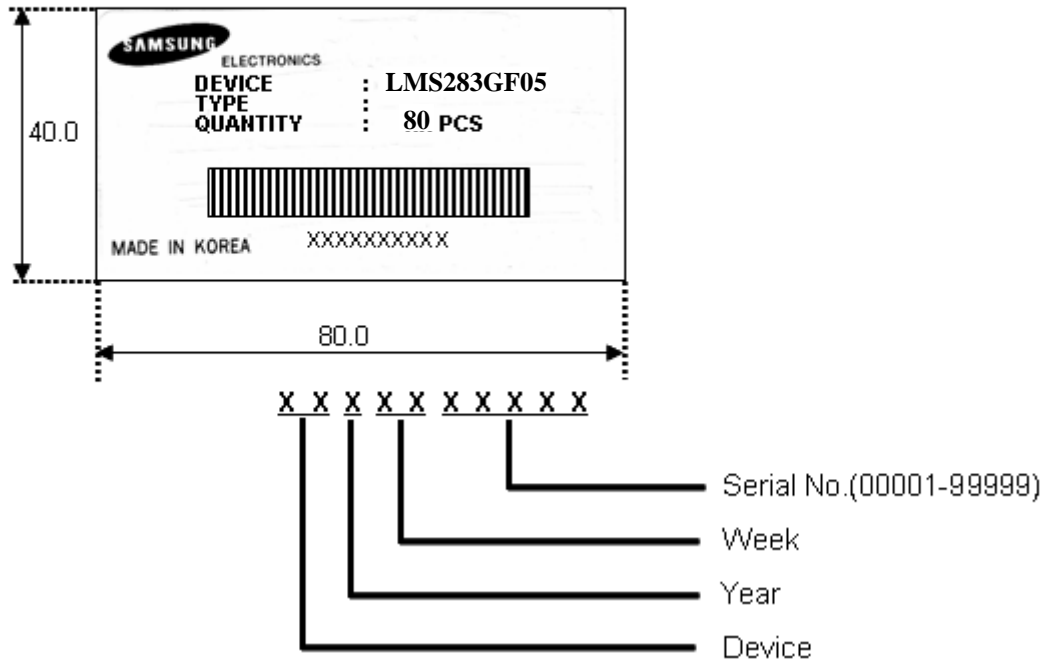
※ Packing spec. for small quantities



10. Marking & Others

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

10.1 Packing case attach



11. Reliability Test Result except Touch Screen Panel

11. 1 Condition

| Item | Condition | Sample Size | Test Result | |
|---------------------------------------|-----------------------|------------------------------------|-------------|-----|
| High Temperature Operating Life test | 60°C, 160HR | 10EA | O.K | |
| Low Temperature Operating Life test | -20°C, 160HR | 5EA | O.K | |
| Thermal Humidity Bias | 60°C, 90%RH, 160HR | 10EA | O.K | |
| High Temperature Storage test | 70°C, 160HR | 5EA | O.K | |
| Low Temperature Storage test | -30°C, 160HR | 5EA | O.K | |
| Thermal Cycle | -30°C ⇔ 70°C | 10EA | O.K | |
| Wet Humidity Temperature Storage test | 60°C, 90%RH, 160HR | 10EA | O.K | |
| Low Pressure(Altitude) Storage test | 188mbar, 25±3°C, 72HR | 5EA | O.K | |
| Power ON/OFF test | -30°C ~ 70°C, 5cycle | 10EA | O.K | |
| ESD (Non-operating) | Contact | Shield ±4kV Nude ± 8kV, 150pF/330Ω | 5EA | O.K |
| | Air | Shield ±8kV Nude ±15kV, 150pF/330Ω | 5EA | O.K |

11. 2 Judgement

- > Main LCD should work under the normal condition.
- > After the temperature and humidity test, the luminance and CR(Contrast Ratio) should not be changed over 50% compared with those before the test.

12. General Precautions

12.1 Handling

- (a) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
- (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 unit.
- (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 Integrated Gate Circuit.
- (i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (l) Pins of I/F connector shall not be touched directly with bare hands.

12.2 Storage

- (a) Do not leave the panel 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.

12.3 Operation




- (a) Do not connect, disconnect the module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the item 3.1 "Power on/off sequence"

12.4 Others

- (a) The liquid-crystal is deteriorated by ultraviolet rays. Do not leave it in direct sunlight and strong ultraviolet rays for many hours.
- (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, and so on)
Otherwise the panel may be damaged.
- (d) If the panel 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 panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

Cosmetic Standards for Outgoing Inspection

(2.83" TFT - LCD : LMS283GF05)

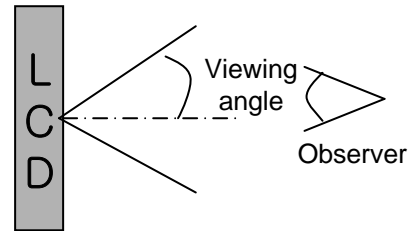
| Document Control | | | |
|------------------------------------|-------------------|----------------------------------|---|
| Document NO : COS_LMS283GF05_REV00 | | | |
| Customer (General) | | Supplier (SAMSUNG Electronics) | |
| Approved by | Signature Here | Prepared by |  |
| | | Checked by |  |
| | | Approved by |  |

| REVISION RECORD | | |
|-----------------|----------------------------|----------------------------------|
| REV | REVISION ITEM | DATE |
| 0 | <i>Engineering Release</i> | <i>May 23rd, 2007</i> |
| | | |
| | | |
| | | |
| | | |

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1. Inspection Conditions:

- ✓ Viewing distance **30 ± 5cm**
- ✓ Ambient illumination
 - . Operating Inspection **50 ~ 150 Lux**
 - . Appearance Inspection **1000 ~ 1500 Lux**



- ✓ Viewing angle **Within 30 degrees left, right, up and down as the right picture shown .**
- ✓ Ambient temperature **23 ± 2 'C**
- ✓ Display pattern **2.83" 240X320 - R, G, B, Black, White**
- ✓ Inspection area **Active area which is operating with pixels.**

2. Inspection Criteria:

2-1. Visual Inspection

2-1-1 Definition of Visual defects

- ✓ SPOT
 - Black/White spot appeared on the display which remain unchanged size.
- ✓ Line
 - Dark/Bright lines appeared on the display which remain unchanged in size.
- ✓ Polarizer Scratch
 - When the unit lights, visible scar or streak appear on the surface of polarizer.
- ✓ Polarizer Dent/Bubble
 - When the unit lights, visible carved mark or bubble on the surface of polarizer.

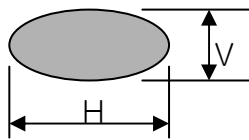
2-1-2 Visual Defect Criteria

Below judged criteria includes glasses, back light and polarizer defect.

| Defect Mode | Acceptable Judgment Criteria | |
|------------------------------------|--|---------------|
| Spot particles (Black or White) | Size D (mm) | Quantity (ea) |
| | $D \leq 0.1$ | Disregard |
| | $0.1 < D \leq 0.2$ | 2 |
| | $0.2 < D \leq 0.3$ | 1 |
| Line particles (Black or White) | Width W(mm), Length L(mm) | Quantity (ea) |
| | $W \leq 0.03, L \leq 1.0$ | Disregard |
| | $0.03 < W \leq 0.1, 1.0 < L \leq 3.0$ | 3 |
| Polarizer Bubble / Dent | Size D (mm) | Quantity (ea) |
| | $D \leq 0.1$ | Disregard |
| | $0.1 < D \leq 0.2$ | 2 |
| | $0.2 < D \leq 0.3$ | 1 |
| Polarizer scratch | Width W(mm), Length L(mm) | Quantity (ea) |
| | $W \leq 0.03, L \leq 1.0$ | Disregard |
| | $0.03 < W \leq 0.1$ $1.0 \leq L \leq 5$ | 2 |
| Maximum allowable defect type | 4 | |

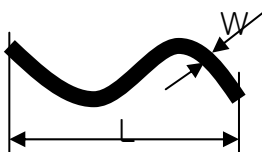
➤ **Remarks (How to measure?)**

- Use inspection tools like a loupe or microscope if unsure of pass/fail criteria.
- Translucent edge is ignored in measuring the diameter of spot.



- Diameter of Spots and Bubbles

$$D = [\text{Vertical}(V) + \text{Horizontal}(H)] / 2$$



- Length and Width of Lines and Scratches

2-2. Pixel Inspection



2-2-1 Definition of Pixel defects

✓ Pixel

3 sub-pixels (R+G+B)



✓ DOT

1 sub-pixel (R or G or B /  or  or )

✓ Bright/Dark Dot

A sub-pixel (R,G,B dot) stuck off/on (electrical)

Bright dots (black dots) shall be counted on a black pattern (a pure R,G,B and white pattern).

✓ Adjacent Dot

2 or 3 dots situated close to a neighboring dot. (R,G or G,B or B,R or R,G,B)

2-2-2 Dot Defect Criteria

| Defect Mode | Acceptable Judgment Criteria | |
|--|---------------------------------|---------------|
| | Dot Type | Quantity (ea) |
| Bright Dot | Random (Red or Blue or Green) | 1 |
| | 2 or more adjacent dot defects | 0 |
| Dark Dot | Dark dot | 2 |
| | 2 or more adjacent dot defects | 1 |
| Maximum allowable number of dot defect | | 3 |

- In case of adjacent dots, vertical direction is not permitted.

2-3. The other Inspections

2-3-1 Functional Defects

Below items are considered to be failure.

✓ Line Defect

One or more permanent horizontal or vertical lines on a white/black display.

✓ No Display

No pixels are active when power and valid data are applied to the display.

✓ No Back Light

No or weak light from the LED/CCFL when the backlight is activated.

(Measure brightness or uniformity if unsure of pass/fail criteria.)

✓ Gray Defect

Abnormal display of gray colored level on a specified R,G,B pattern.

(Measuring chromaticity if unsure of pass/fail criteria.)

✓ Noise

Wave on display due to electrical ripple or noise.

✓ Abnormal Display

Abnormal display excluding items mentioned above.

- If not issued from the customer site or not described above , SEC follows internal guide line.