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HM190SX401A

19" Color TFT-LCD

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1. General Description

HM190SX401A is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD panel, a driver circuit, and a backlight system. The screen format is intended to support the SXGA (1280(H) x 1024(V)) screen and 16.7M colors (RGB 6-bits + HiFRC data). All input signals are 2-channel LVDS interface.

1.1 Display Characteristics

The following items are characteristics summary on the table under 25 °C condition:

| Items | Unit | Specifications |
|---|----------------------|------------------------------------|
| Screen Diagonal | [mm] | 482.6 (19.0") |
| Active Area | [mm] | 376.32 (H) x 301.06 (V) |
| Pixels H x V | | 1280(x3) x 1024 |
| Pixel Pitch | [mm] | 0.294 (per one triad) x 0.294 |
| Pixel Arrangement | | R.G.B. Vertical Stripe |
| Display Mode | | Normally White |
| White Luminance | [cd/m ²] | 450 (center, Typ) |
| Contrast Ratio | | 1000 : 1 (Typ) |
| Optical ResponseTime | [msec] | 10 ms(Typ, on/off) |
| Nominal Input Voltage VDD | [Volt] | +5.0 V |
| Power Consumption | [Watt] | 20W (Typ) |
| Weight | [Grams] | 1800 (Typ) |
| Physical Size (H x V x D) | [mm] | 396 (H) x 324 (V) x 12.88(D) (typ) |
| Electrical Interface | | Dual channel LVDS |
| Surface Treatment | | Anti-glare, Hardness 3H |
| Support Color | | 16.7M colors (RGB 6-bit + Hi_FRC) |
| Temperature Range Operating Storage (Non-Operating) | [°C] [°C] | -30 to +85 -30 to +85 |
| RoHS Compliance | | RoHS Compliance |

1.2 Optical Characteristics

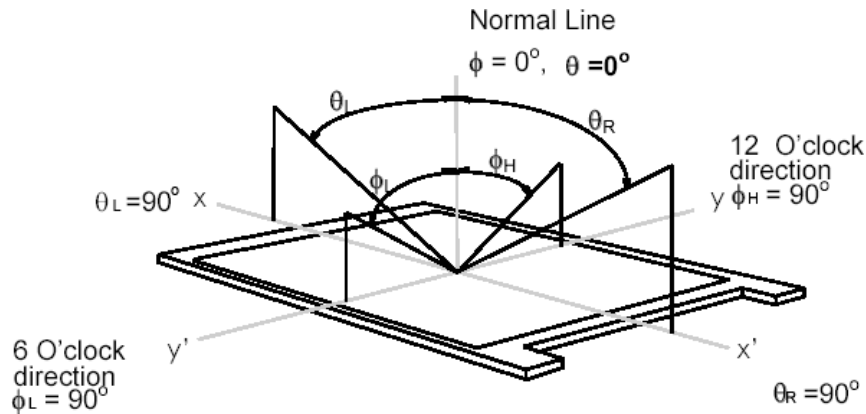
The optical characteristics are measured under stable conditions at 25°C (Room Temperature).

| Item | Unit | Conditions | Min. | Typ. | Max. | Note |
|--|----------------------|-------------------------------------|----------|----------|-------|------|
| Viewing Angle | [degree] | Horizontal (Right) CR ≥ 5 (Left) | 75 75 | 85 85 | - | 1 |
| | | Vertical (Up) CR ≥ 5 (Down) | 70 70 | 80 80 | - | |
| Contrast Ratio | | Normal Direction | 600 | 1000 | - | |
| Central Luminance | [cd/m ²] | | 360 | 450 | - | 2 |
| Optical Response Time | [msec] | Raising Time (TrR) | - | 7 | 12 | 3 |
| | | Falling Time (TrF) | - | 3 | 8 | |
| | | Rising + Falling | - | 10 | 20 | |
| Color / Chromaticity Coordinates (CIE) | | Red x | 0.620 | 0.670 | 0.720 | |
| | | Red y | 0.272 | 0.322 | 0.372 | |
| | | Green x | 0.246 | 0.296 | 0.346 | |
| | | Green y | 0.615 | 0.665 | 0.715 | |
| | | Blue x | 0.104 | 0.154 | 0.204 | |
| | | Blue y | 0.001 | 0.038 | 0.088 | |
| | | White x | 0.263 | 0.313 | 0.363 | |
| | | White y | 0.279 | 0.329 | 0.379 | |
| Luminance Uniformity | [%] | 9 Points | 75 | 80 | - | 4,5 |
| NTSC | [%] | | - | 90 | - | |

Optical Equipment: BM-5A, BM-7, PR880, or equivalent

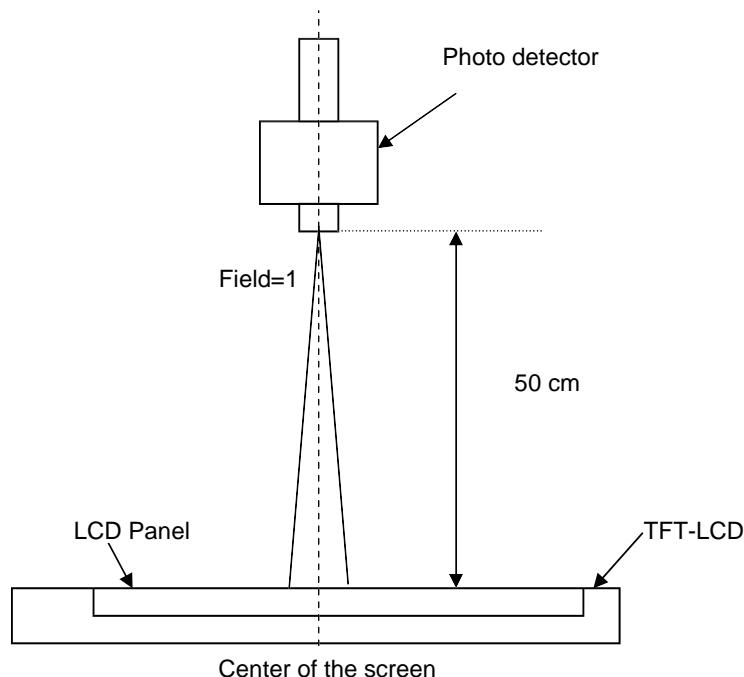
Note 1: Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≥ 10 , or ≥ 5 , at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (Φ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.



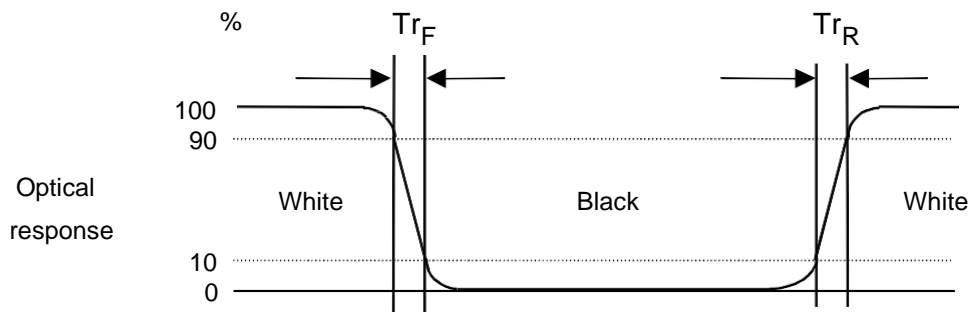
Note 2: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room.

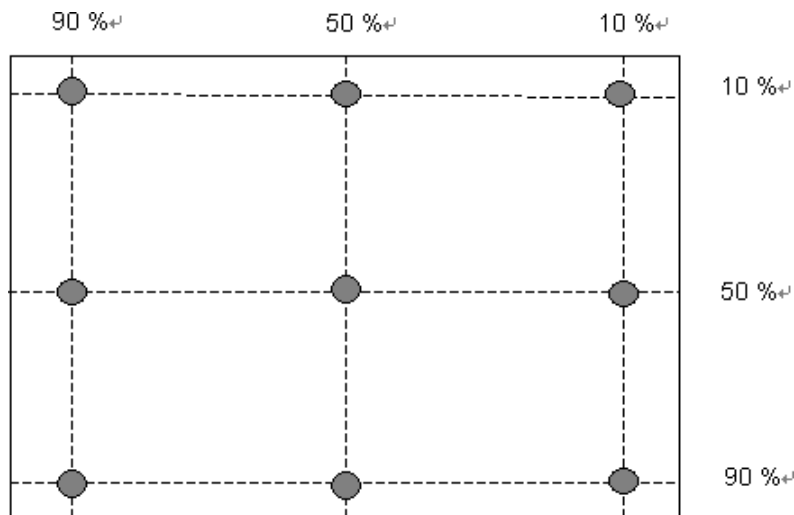


Note 3: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.



Note 4: 9 points position

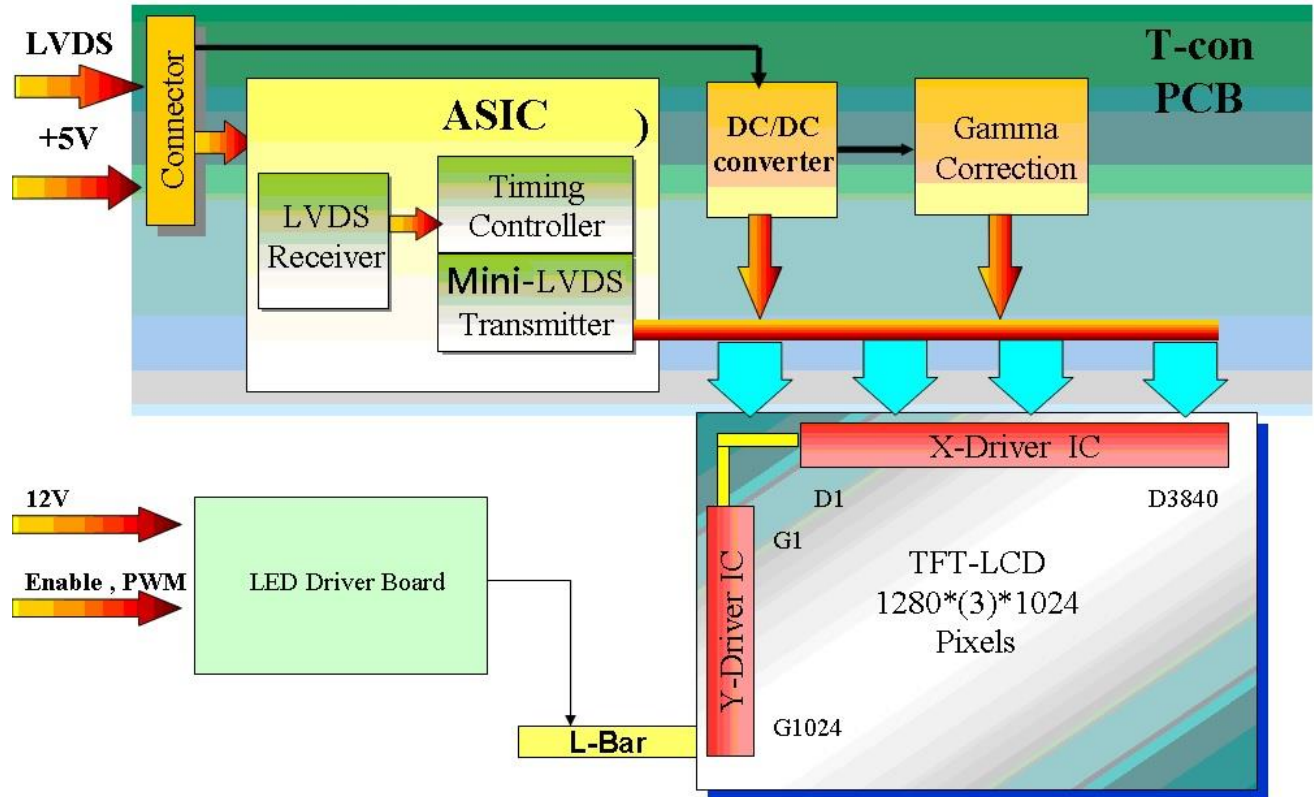


Note 5:

$$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points (1 - 9)}}{\text{Maximum Luminance in 9 Points (1 - 9)}}$$

2. Functional Block Diagram

The following diagram shows the functional block of the 19.0 inches wide Color TFT-LCD Module:



3. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

3.1 TFT LCD Module

| Item | Symbol | Min | Max | Unit | Conditions |
|-------------------------|--------|------|------|--------|------------|
| Logic/LCD Drive Voltage | VDD | -0.3 | +6.0 | [Volt] | Note 1,2 |

3.2 Absolute Ratings of Environment

| Item | Symbol | Min. | Max. | Unit | Conditions |
|-----------------------|--------|------|------|-------|------------|
| Operating Temperature | TOP | -30 | +85 | [°C] | Note 3 |
| Operation Humidity | HOP | 5 | 95 | [%RH] | Note 3 |
| Storage Temperature | TST | -30 | +85 | [°C] | |
| Storage Humidity | HST | 5 | 95 | [%RH] | |

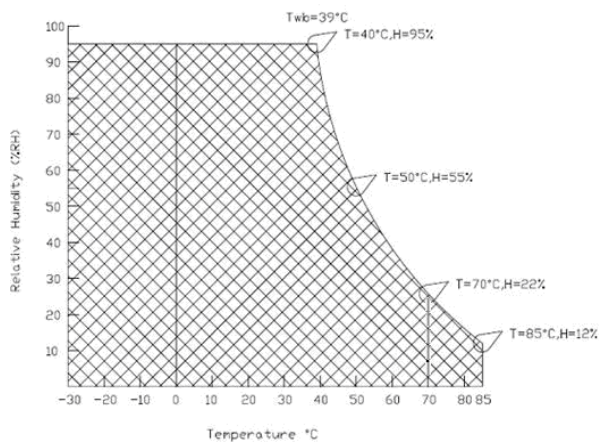
Note 1: With in Ta (25°C)

Note 2: Permanent damage to the device may occur if exceeding maximum values

Note 3: Temperature and relative humidity range are shown as the below figure

1. 95% RH Max (Ta ≤39°C)
2. Max wet-bulb temperature at 39°C or less. (Ta ≤39°C)
3. No condensation

Note 4: Function Judged only



4. Electrical Characteristics

4.1 TFT LCD Module

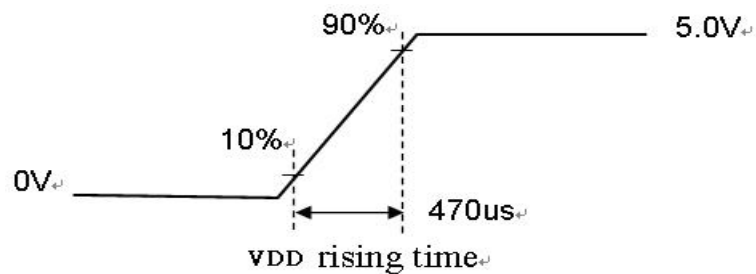
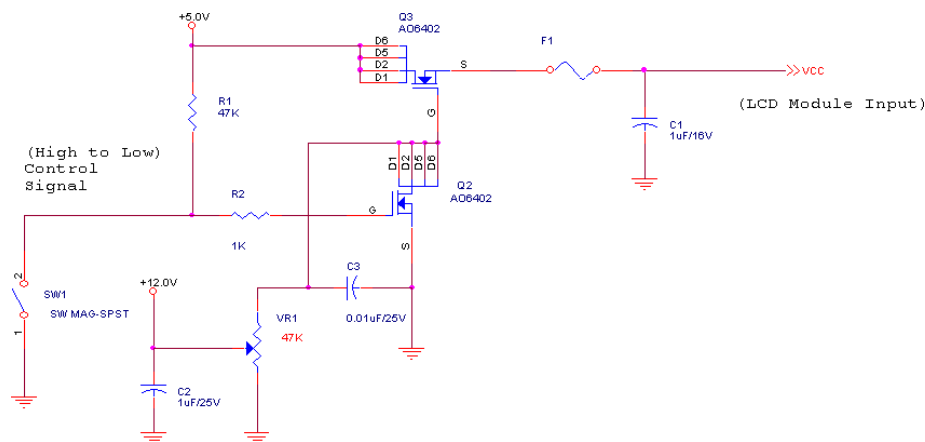
4.1.1 Power Specification

Input power specifications are as follows:

| Symbol | Parameter | Min | Typ | Max | Unit | Conditions |
|--------|--|-----|-----|-----|----------|--------------------------------------|
| VDD | Logic/LCD Drive Voltage | 4.5 | 5.0 | 5.5 | [Volt] | +/-10% |
| IDD | Input Current | - | 1 | 1.2 | [A] | VDD= 5.0V, All Black Pattern At 75Hz |
| PDD | VDD Power | - | 5 | 6 | [Watt] | VDD= 5.0V, All Black Pattern At 75Hz |
| IRush | Inrush Current | - | - | 3.0 | [A] | Note 1 |
| VDDrp | Allowable Logic/LCD Drive Ripple Voltage | - | - | 100 | [mV] p-p | VDD= 5.0V, All Black Pattern At 75Hz |

Note 1: Measurement conditions:

The duration of rising time of power input is 470us.



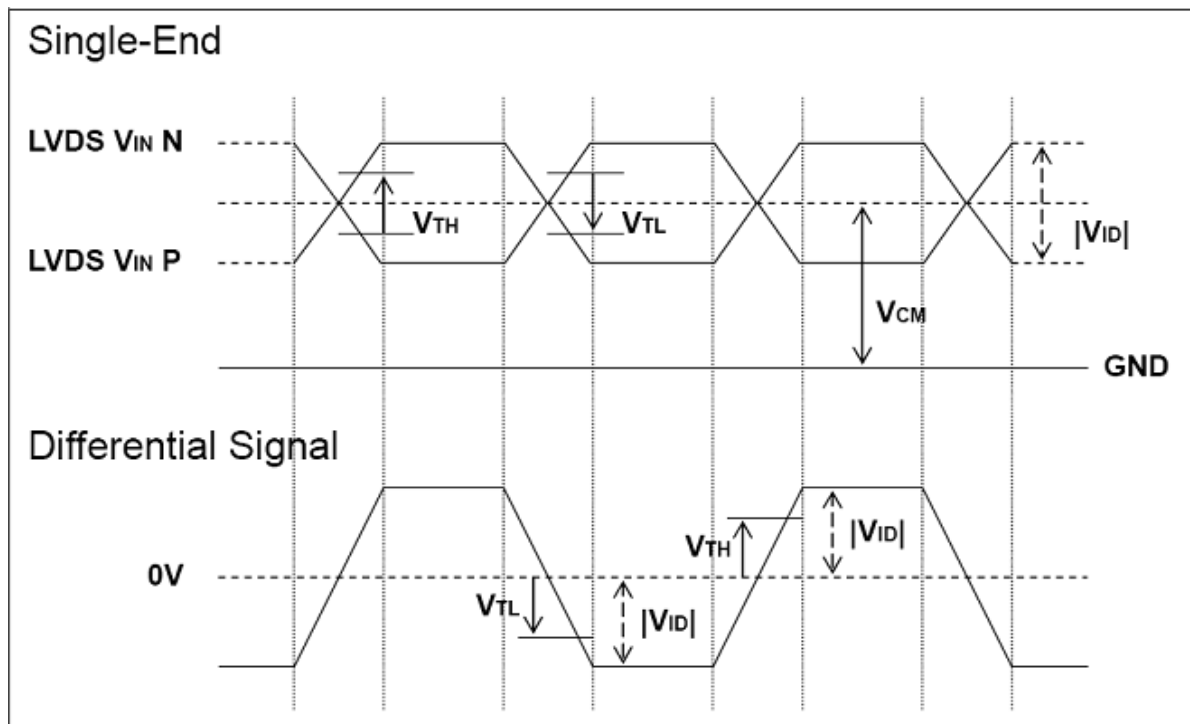
4.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off. Please refer to specifications of SN75LVDS82DGG (Texas Instruments) in detail.

Each signal characteristics are as follows;

| Symbol | Parameter | Min | Typ | Max | Units | Condition |
|------------|--|------|------|------|-------|--|
| V_{TH} | Differential Input High Threshold | - | - | +100 | [mV] | $V_{CM} = 1.2V$ Note 1 |
| V_{TL} | Differential Input Low Threshold | -100 | - | - | [mV] | $V_{CM} = 1.2V$ Note 1 |
| $ V_{ID} $ | Input Differential Voltage | 100 | 400 | 600 | [mV] | Note 1 |
| V_{CM} | Differential Input Common Mode Voltage | +1.0 | +1.2 | +1.5 | [V] | $V_{TH}-V_{TL} = 200mV$ (max) Note 1 |

Note1: LVDS Signal Waveform



4.1.3 Backlight Unit

Parameter guideline for LED driving is under stable conditions at 25°C (Room Temperature):

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Remark |
|-------------------------------|-----------------------|------|--------|------|--------|-----------------------------------|
| VCC | Input Voltage | 10.8 | 12 | 13.4 | [Volt] | |
| I_{VCC} | Input Current | - | 1.25 | 1.35 | [A] | 100% PWM Duty |
| P_{VCC} | Power Consumption | - | 15 | 16.2 | [Watt] | 100% PWM Duty |
| F_{PWM} | Dimming Frequency | 200 | - | 20K | [Hz] | |
| | Swing Voltage | 3 | 3.3 | 5 | [Volt] | |
| | Dimming duty cycle | 5 | - | 100 | % | |
| V_{LED ON/OFF} | On Control Voltage | 3.0 | 3.3 | 5 | Volt | Note 7, 8 |
| | Off Control Voltage | 0 | 0 | 0.8 | Volt | |
| I_F | LED Forward Current | - | 100 | - | [mA] | Ta = 25°C |
| V_F | LED Forward Voltage | - | - | - | [Volt] | I _F = 100mA, Ta = 0°C |
| | | 33.6 | 38.4 | 43.2 | [Volt] | I _F = 100mA, Ta = 25°C |
| | | - | - | - | [Volt] | I _F = 100mA, Ta = 70°C |
| P_{LED} | LED Power Consumption | - | 15.36 | - | [Watt] | |
| LED Life Time | | | 50,000 | - | Hrs | I _F =100mA, Ta= 25°C |

Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: VCC, ICC, PCC are defined for LED backlight.(100% duty of PWM dimming)

Note 3: I_F, V_F are defined for one channel LED. There are four LED channels in back light unit.

Note 4: If HM190SX401A module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 5: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

Note 6: The definition of single LED life time is: brightness decreased to 50% of initial value. LED life time is restricted under normal condition, ambient temperature = 25°C and LED operating I_F = 100mA.

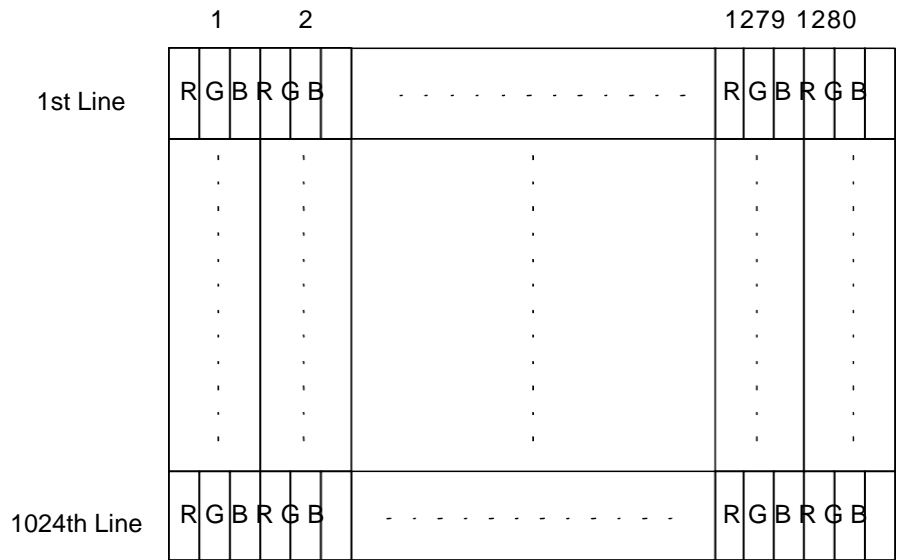
Note 7: Enable (V_{LED On/Off}) must be turned on later than V_{LED} and PWM Signal.

Note 8: Enable (V_{LED On/Off}) must be turned off earlier than V_{LED} and PWM Signal.

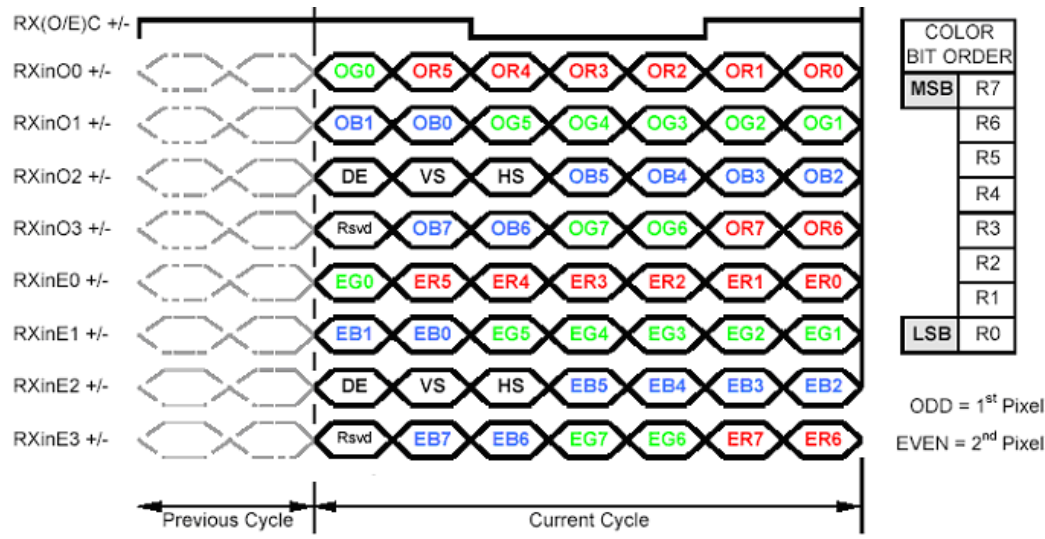
5. Signal Characteristic

5.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.



5.2 The Input Data Format



Note1: DE only , VS, HS on EVEN channel are not used.
Note2: Please follow PSWG.
Note3: 8-bit in

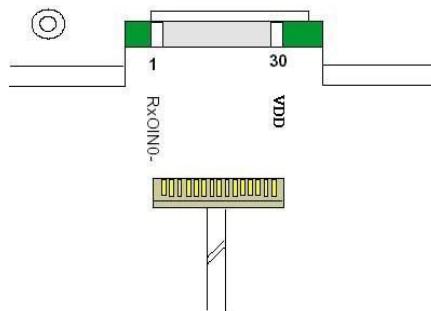
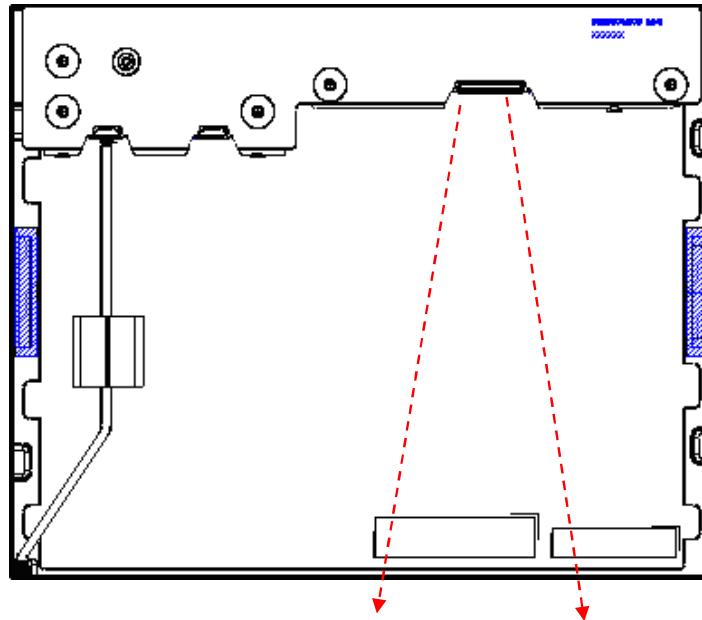
5.3 Signal Description

The module using one LVDS receiver SN75LVDS82(Texas Instruments). LVDS is a differential signal technology for LCD interface and high speed data transfer device. LVDS transmitters shall be SN75LVDS83(negative edge sampling). The first LVDS port(RxOxxx) transmits odd pixels while the second LVDS port(RxExxx) transmits even pixels.

| PIN # | SIGNAL NAME | DESCRIPTION |
|-------|-------------|--|
| 1 | RxOIN0- | Negative LVDS differential data input (Odd data) |
| 2 | RxOIN0+ | Positive LVDS differential data input (Odd data) |
| 3 | RxOIN1- | Negative LVDS differential data input (Odd data) |
| 4 | RxOIN1+ | Positive LVDS differential data input (Odd data) |
| 5 | RxOIN2- | Negative LVDS differential data input (Odd data, DSPTMG) |
| 6 | RxOIN2+ | Positive LVDS differential data input (Odd data, DSPTMG) |
| 7 | GND | Power Ground |
| 8 | RxOCLKIN- | Negative LVDS differential clock input (Odd clock) |
| 9 | RxOCLKIN+ | Positive LVDS differential clock input (Odd clock) |
| 10 | RxOIN3- | Negative LVDS differential data input (Odd data) |
| 11 | RxOIN3+ | Positive LVDS differential data input (Odd data) |
| 12 | RxEIN0- | Negative LVDS differential data input (Even data) |
| 13 | RxEIN0+ | Positive LVDS differential data input (Even data) |
| 14 | GND | Power Ground |
| 15 | RxEIN1- | Negative LVDS differential data input (Even data) |
| 16 | RxEIN1+ | Positive LVDS differential data input (Even data) |
| 17 | GND | Power Ground |
| 18 | RxEIN2- | Negative LVDS differential data input (Even data) |
| 19 | RxEIN2+ | Positive LVDS differential data input (Even data) |
| 20 | RxECLKIN- | Negative LVDS differential clock input (Even clock) |
| 21 | RxECLKIN+ | Positive LVDS differential clock input (Even clock) |
| 22 | RxEIN3- | Negative LVDS differential data input (Even data) |
| 23 | RxEIN3+ | Positive LVDS differential data input (Even data) |
| 24 | GND | Power Ground |
| 25 | GND | Power Ground |
| 26 | GND | Power Ground |
| 27 | GND | Power Ground |
| 28 | POWER | Power +5V |
| 29 | POWER | Power +5V |
| 30 | POWER | Power +5V |

Note: “Power Ground” stands for 0V.

Note1: Start from left side



Note2: Input signals of odd and even clock shall be the same timing.

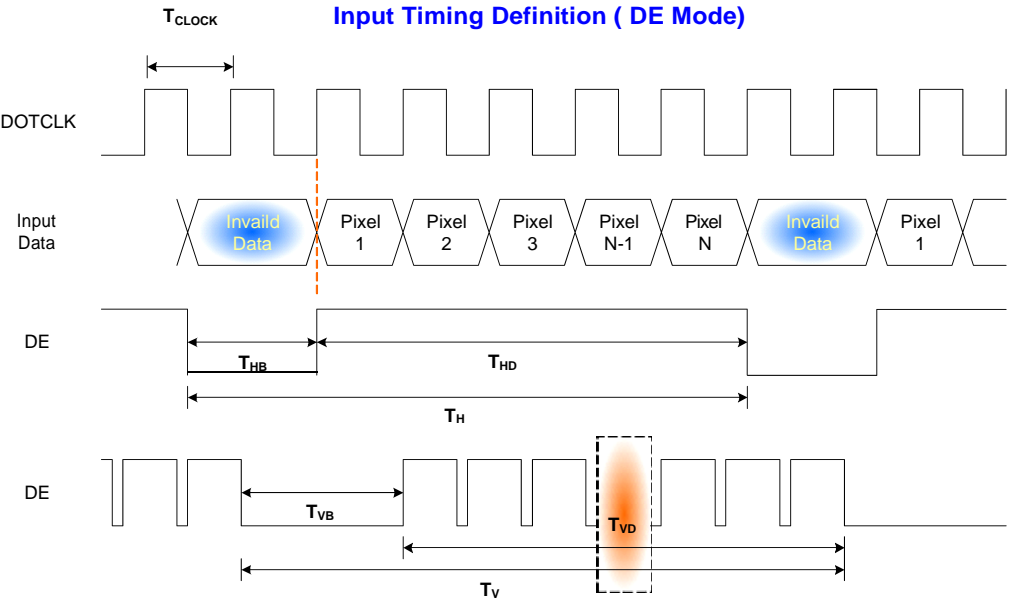
5.4 Interface Timing

5.4.1 Timing Characteristics

| Signal | Item | Symbol | Min | Typ | Max | Unit |
|--------------------|-----------|-------------------------------|------|-------|-------|------|
| Vertical Section | Period | T_v | 1032 | 1066 | 1150 | Th |
| | Active | $T_{disp(v)}$ | 1024 | 1024 | 1024 | Th |
| | Blanking | $T_{bp(v)}+T_{fp(v)}+PW_{vs}$ | 8 | 42 | 126 | Th |
| Horizontal Section | Period | T_h | 780 | 844 | 2047 | Tclk |
| | Active | $T_{disp(h)}$ | 640 | 640 | 640 | Tclk |
| | Blanking | $T_{bp(h)}+T_{fp(h)}+PW_{hs}$ | 140 | 204 | - | Tclk |
| Clock | Period | T_{clk} | 22.2 | 18.52 | 14.81 | ns |
| | Frequency | Freq. | 44 | 54 | 67.5 | MHz |
| Frame Rate | Frequency | $1/T_v$ | 49 | 60 | 75 | Hz |

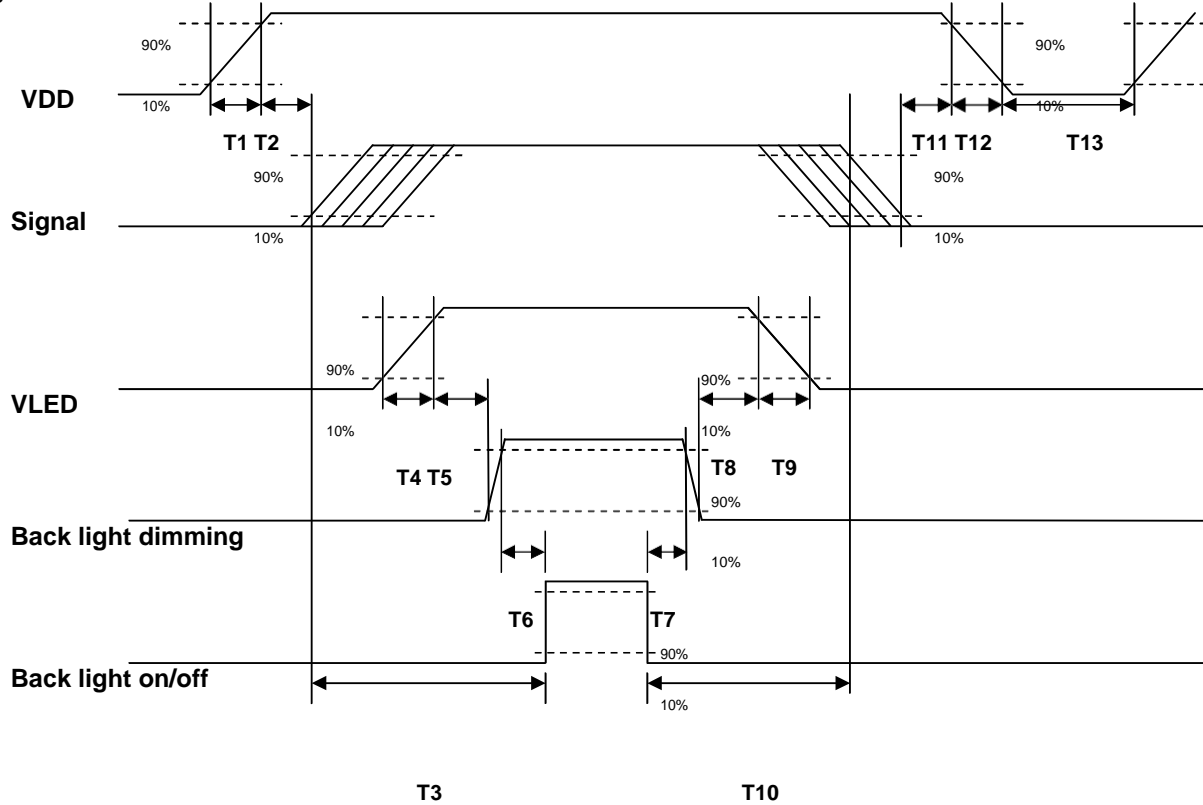
Note: DE mode only

5.4.2 Timing Diagram



5.5 Power ON/OFF Sequence

VDD power and led on/off sequence are as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



| Parameter | Value | | | Unit |
|-----------|-------|------|------|------|
| | Min. | Typ. | Max. | |
| T1 | 0.5 | - | 10 | [ms] |
| T2 | 30 | 40 | 50 | [ms] |
| T3 | 200 | - | - | [ms] |
| T4 | 0.5 | - | 10 | [ms] |
| T5 | 10 | - | - | [ms] |
| T6 | 10 | - | - | [ms] |
| T7 | 0 | - | - | [ms] |
| T8 | 10 | - | - | [ms] |
| T9 | - | - | 10 | [ms] |
| T10 | 110 | - | - | [ms] |
| T11 | 0 | 16 | 50 | [ms] |
| T12 | - | - | 10 | [ms] |
| T13 | 1000 | - | - | [ms] |

6. Connector and Pin Assignment

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

6.1 TFT LCD Module

6.1.1 Connector

| | |
|------------------------------|--------------------------------------|
| Connector Name / Designation | Interface Connector / Interface card |
| Manufacturer | HRS |
| Type Part Number | DF14H-30P-1.25H(56) |
| Mating Housing Part Number | DF14-30S-1.25C |

6.1.2 Pin Assignment

| Pin# | Signal Name | Pin# | Signal Name |
|------|-------------|------|-------------|
| 1 | RxOIN0- | 2 | RxOIN0+ |
| 3 | RxOIN1- | 4 | RxOIN1+ |
| 5 | RxOIN2- | 6 | RxOIN2+ |
| 7 | GND | 8 | RxOCLKIN- |
| 9 | RxOCLKIN+ | 10 | RxOIN3- |
| 11 | RxOIN3+ | 12 | RxEIN0- |
| 13 | RxEIN0+ | 14 | GND |
| 15 | RxEIN1- | 16 | RxEIN1+ |
| 17 | GND | 18 | RxEIN2- |
| 19 | RxEIN2+ | 20 | RxECLKIN- |
| 21 | RxECLKIN+ | 22 | RxEIN3- |
| 23 | RxEIN3+ | 24 | GND |
| 25 | GND | 26 | GND |
| 27 | GND | 28 | POWER |
| 29 | POWER | 30 | POWER |

6.2 Backlight Unit

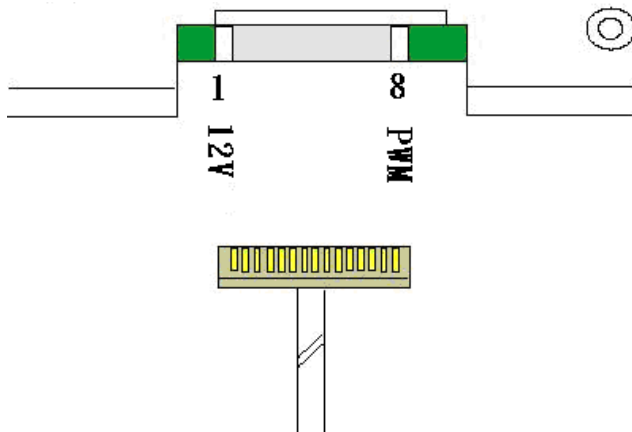
Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

6.2.1 Connector

| | |
|------------------------------|----------------------------|
| Connector Name / Designation | LED Driver Board Connector |
| Manufacturer | JST |
| Type Part Number | SM08B-GHH (HF) |
| Mating Housing Part Number | GHR-08V-S |

6.2.2 Pin Assignment

| Pin# | Symbol | Description |
|------|---------|-------------------|
| 1 | VLED | 12V input |
| 2 | VLED | 12V input |
| 3 | VLED | 12V input |
| 4 | GND | GND |
| 5 | GND | GND |
| 6 | GND | GND |
| 7 | On/OFF | 3.3-5V:ON, 0V:OFF |
| 8 | Dimming | PWM |



7. Reliability Test

Environment test conditions are listed as following table.

| Items | Required Condition | Note |
|-----------------------------------|---|------|
| Temperature Humidity Bias (THB) | Ta= 50°C , 80%RH, 240hours | |
| High Temperature Operation (HTO) | Ta= 85°C , 240hours | 1 |
| Low Temperature Operation (LTO) | Ta= -30°C , 240hours | 1 |
| High Temperature Storage (HTS) | Ta= 85°C , 240hours | 1 |
| Low Temperature Storage (LTS) | Ta= -30°C , 240hours | 1 |
| Vibration Test (Non-operation) | Acceleration: 1.5 G Wave: Random Frequency: 10 - 200 - 10 Hz Sweep: 30 Minutes each Axis (X, Y, Z) | |
| Shock Test (Non-operation) | Acceleration: 50 G Wave: Half-sine Active Time: 20 ms Direction: $\pm X$, $\pm Y$, $\pm Z$ (one time for each Axis) Axis | |
| Drop Test | Height: 61 cm, package test | |
| Thermal Shock Test (TST) | -20°C/30min, 60°C/30min, 50 cycles | |
| ESD (Electro-Static Discharge) | Contact Discharge: $\pm 8KV$, 150pF(330 Ω) 1sec, 8 points, 25 times/ point. | 2 |
| | Air Discharge: $\pm 15KV$, 150pF(330 Ω) 1sec, 8 points, 25 times/ point. | |

Note1: No function failure occurs.

Note2: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost Self-recoverable. No hardware failures.

Note3:

- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.
- Mura shall be ignored after high temperature reliability test.

8. Outline Drawing

