晶采光電科技股份有限公司
AMPIRE CO., LTD.

# SPECIFICATIONS FOR LCD MODULE

| | |
|---|---|
| CUSTOMER | |
| CUSTOMER PART NO. | |
| AMPIRE PART NO. | AM-1920357ATZQW-00 |
| APPROVED BY | |
| DATE | |

☑ Approved For Specifications
☐ Approved For Specifications & Sample

**AMPIRE CO., LTD.**
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| APPROVED BY | CHECKED BY | ORGANIZED BY |
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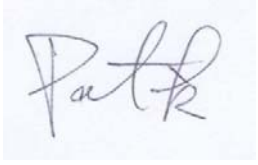
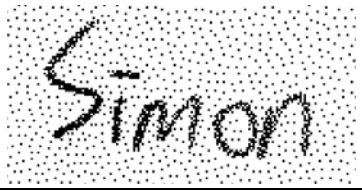
|  |  |  |

# RECORD OF REVISION

| Revision Date | Page | Contents | Editor |
|---|---|---|---|
| 2015/10/20 | -- | New Release | Emil |

## 1. Features

AM-1920357ATZQW-00 is a 28”color TFT-LCD Module with special aspect ratio 16:3and wide resolution 1920x357.

(1) Resolution：1920x357
(2) Aspect Ratio：16:3
(3) Display Color：8bits, 16.7M
(4) Operation mode for display：Normally Black
(5) Back Light Source：LED
(6) Brightness：700 nits

## 2. PHYSICAL SPECIFICATIONS

| Model | | EWK-2812D |
|---|---|---|
| LCD | Type | 28" color TFT active matrix, wide LCD |
| | Display Area | 698.4 (H) x 129.86(V) |
| | Optimum Resolution | 1920x357 |
| | Contrast Ratio | 3000:1 |
| | Viewing Angles | 178(H)<br>178(V) |
| | Response Time | 6.5ms |
| | Backlight | LED |
| | LED Life-time | 30000 HR (Typ.) |
| | Brightness | 700 nits |
| | Aspect Ratio | 16:3 |
| | Panel Surface | Anti-glare, hard coating (3H) |
| Power | Consumption | 34.44W (typ.) |
| Operation Conditions | Temperature | 0 ~ 50°C |
| | Humidity | 10% ~ 90% |
| Dimensions (mm) | | 733.78 x 165.34 x 20.8(with TCON Board) |
| Weight | Net | 2.1 Kg |

## 3. ABSOLUTE MAX. RATINGS

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit

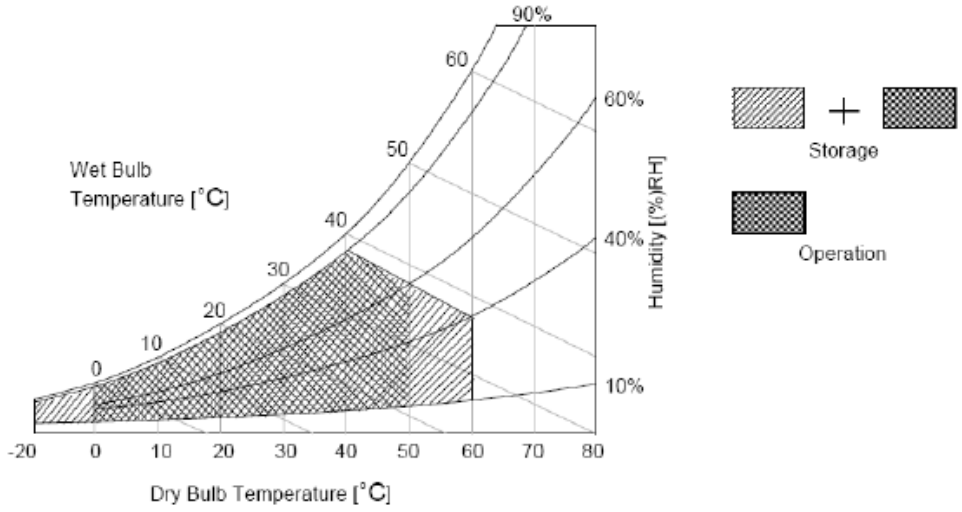
| Item | Symbol | Min | Max | Unit | Conditions |
|---|---|---|---|---|---|
| Logic/LCD Drive Voltage | Vcc | -0.3 | 14 | [Volt] | Note 1 |
| Input Voltage of Signal | Vin | -0.3 | 4 | [Volt] | Note 1 |
| Operating Temperature | TOP | 0 | +50 | [°C] | Note 2 |
| Operating Humidity | HOP | 10 | 90 | [%RH] | Note 2 |
| Storage Temperature | TST | -20 | +60 | [°C] | Note 2 |
| Storage Humidity | HST | 10 | 90 | [%RH] | Note 2 |
| Panel Surface Temperature | PST | | 65 | [°C] | Note 3 |

Note 1: Duration:50 msec.

Note 2 : Maximum Wet-Bulb should be 39℃ and No condensation.

The relative humidity must not exceed 90% non-condensing at temperatures of 40℃ or less. At temperatures greater than 40℃, the wet bulb temperature must not exceed 39℃.

Note 3: Surface temperature is measured at 50℃ Dry condition



# 4. ELECTRICAL CHARACTERISTICS

## 4-1 TFT LCD Module

**DC Characteristics**

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max | | |
| LCD | | | | | | | |
| Power Supply Input Voltage | | $V_{DD}$ | 10.8 | 12 | 13.2 | $V_{DC}$ | |
| Power Supply Input Current | | $I_{DD}$ | -- | 0.39 | 0.56 | A | 1 |
| Inrush Current | | $I_{RUSH}$ | -- | -- | 5 | A | 2 |
| Permissible Ripple of Power Supply Input Voltage | | $V_{RP}$ | -- | -- | 600 | $mV_{pk-pk}$ | 3 |
| LVDS Interface | Input Differential Voltage | $\|V_{ID}\|$ | 200 | 400 | 600 | $mV_{DC}$ | 4 |
| | Differential Input High Threshold Voltage | $V_{TH}$ | +100 | -- | +300 | $mV_{DC}$ | 4 |
| | Differential Input Low Threshold Voltage | $V_{TL}$ | -300 | -- | -100 | $mV_{DC}$ | 4 |
| | Input Common Mode Voltage | $V_{ICM}$ | 1.1 | 1.25 | 1.4 | $V_{DC}$ | 4 |
| CMOS Interface | Input High Threshold Voltage | $V_{IH}$ (High) | 2.7 | -- | 3.3 | $V_{DC}$ | 5 |
| | Input Low Threshold Voltage | $V_{IL}$ (Low) | 0 | -- | 0.6 | $V_{DC}$ | 5 |

## 4-2 LED backlight

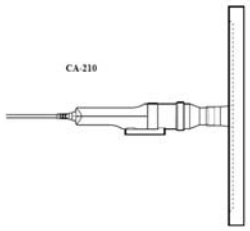
| Parameter | Symbol | Value | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| LED forward voltage per channel | VLED | 29 | 31 | 32 | V |
| LED forward current per channel | ILED | | 480 | 528 | mA |

# 5. Optical Specifications

## 5-1 Optical specification

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Contrast Ratio | | CR | 2,400 | 3,000 | | | 1,2 |
| Surface Luminance (White) | | LWH | 560 | 700 | - | cd/m² | 1,3 |
| Luminance Variation | | δ WHITE(9P) | - | - | 1.33 | | 1,4 |
| Response Time (G to G) | | Tγ | - | 6.5 | - | ms | 1,5 |
| Viewing Angle | x axis, right ( φ =0°) | Θr | - | 89 | - | Degree | 1,6 |
| | x axis, left( φ =180°) | Θl | - | 89 | - | Degree | 1,6 |
| | y axis, up( φ =90°) | Θu | - | 89 | - | Degree | 1,6 |
| | y axis, down( φ =270°) | Θd | - | 89 | - | Degree | 1,6 |

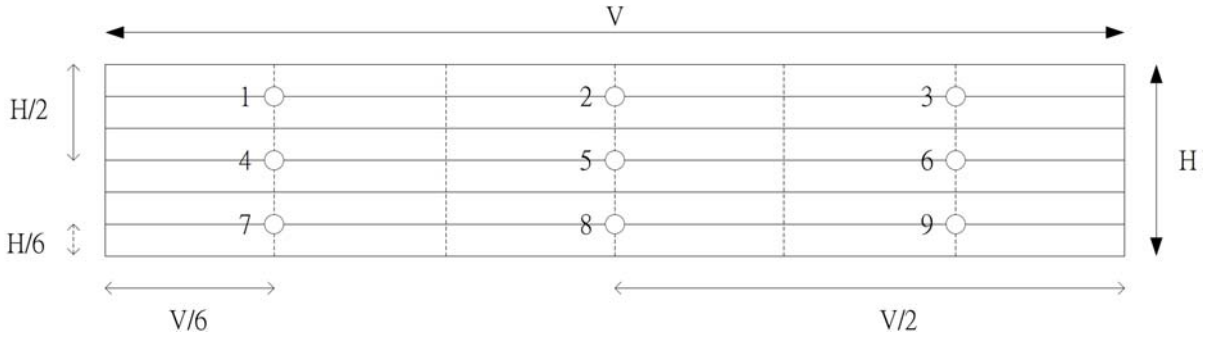
Optical characteristics are determined after the monitor has been 'ON' and stable for more than 5 minutes in a general environment at 25°C. The values specified are at an approximate distance0cm from the LCD surface at a viewing angle of $\varphi$ and $\theta$ equal to 0°.




Note:

1. The value is for reference.
2. CR is defined as

   **Contrast Ratio= Surface Luminance of $L_{on5}$/Surface Luminance of $L_{off5}$**
3. Surface luminance is luminance value at point 5 across the LCD surface 0cm from the surface with all pixels displaying white. For more information seethe figure bellow. LWH=Lon5 where Lon5 is the luminance with all pixels displaying white at center 5 location.

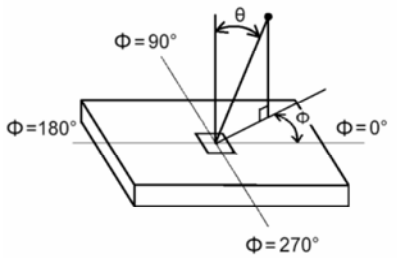


4. The variation in surface luminance, $\delta_{WHITE(9P)}$, is defined as

   $\delta_{WHITE(9P)}$= Max(Lon1,Lon2,...,Lon9) / Min(Lon1,Lon2,...,Lon9)

5. Response time Tγ is the average time required for display transition by switching the input signal for five luminance ratio (0%,25%,50%,75%,100% brightness matrix) and is based on Fv=60Hz to optimize.

6. According to the original panel specification, the viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. The viewing angle values are defined as the same of the initial panel specification. For more information see the figure bellow.

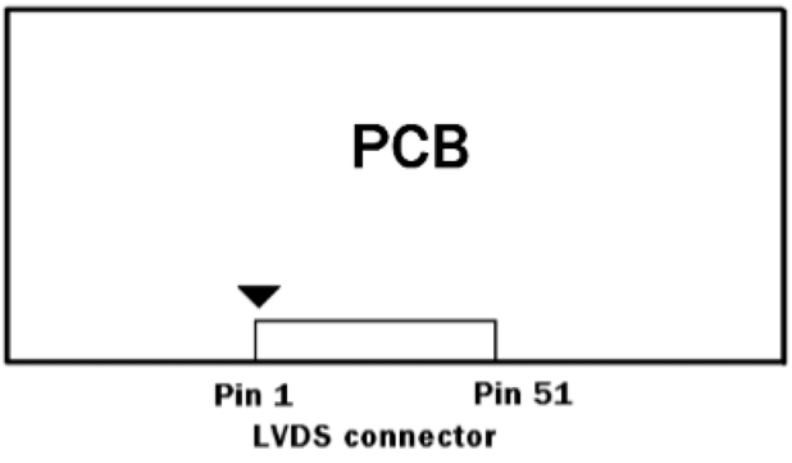


# 7. INTERFACE
## 7-1 LCD interface

LCD connector: FI-RE51S-HF (JAE, LVDS connector)

| PIN | Symbol | Description | PIN | Symbol | Description |
|---|---|---|---|---|---|
| 1 | Open | No connection (Internal Open) | 26 | GND | Ground |
| 2 | N.C. | Internal Use Only | 27 | GND | Ground |
| 3 | N.C. | Internal Use Only | 28 | CH2_0- | LVDS Channel 2, Signal 0- |
| 4 | N.C. | Internal Use Only | 29 | CH2_0+ | LVDS Channel 2, Signal 0+ |
| 5 | N.C. | Internal Use Only | 30 | CH2_1- | LVDS Channel 2, Signal 1- |
| 6 | N.C. | Internal Use Only | 31 | CH2_1+ | LVDS Channel 2, Signal 1+ |
| 7 | LVDS_SEL | Open/High(3.3V) for NS, Low(GND) for JEIDA | 32 | CH2_2- | LVDS Channel 2, Signal 2- |
| 8 | N.C. | No connection (Internal Open) | 33 | CH2_2+ | LVDS Channel 2, Signal 2+ |
| 9 | N.C. | No connection | 34 | GND | Ground |
| 10 | GND | Ground | 35 | CH2_CLK- | LVDS Channel 2, Clock - |
| 11 | GND | Ground | 36 | CH2_CLK+ | LVDS Channel 2, Clock + |
| 12 | CH1_0- | LVDS Channel 1, Signal 0- | 37 | GND | Ground |
| 13 | CH1_0+ | LVDS Channel 1, Signal 0+ | 38 | CH2_3- | LVDS Channel 2, Signal 3- |
| 14 | CH1_1- | LVDS Channel 1, Signal 1- | 39 | CH2_3+ | LVDS Channel 2, Signal 3+ |
| 15 | CH1_1+ | LVDS Channel 1, Signal 1+ | 40 | N.C. | Internal Use Only |
| 16 | CH1_2- | LVDS Channel 1, Signal 2- | 41 | N.C. | Internal Use Only |
| 17 | CH1_2+ | LVDS Channel 1, Signal 2+ | 42 | GND | Ground |
| 18 | GND | Ground | 43 | GND | Ground |
| 19 | CH1_CLK- | LVDS Channel 1, Clock - | 44 | GND | Ground |
| 20 | CH1_CLK+ | LVDS Channel 1, Clock + | 45 | GND | Ground |
| 21 | GND | Ground | 46 | GND | Ground |
| 22 | CH1_3- | LVDS Channel 1, Signal 3- | 47 | N.C. | No connection |
| 23 | CH1_3+ | LVDS Channel 1, Signal 3+ | 48 | $V_{DD}$ | Power Supply, +12V DC Regulated |
| 24 | N.C. | Internal Use Only | 49 | $V_{DD}$ | Power Supply, +12V DC Regulated |
| 25 | N.C. | Internal Use Only | 50 | $V_{DD}$ | Power Supply, +12V DC Regulated |
| | | | 51 | $V_{DD}$ | Power Supply, +12V DC Regulated |

**Note: N.C.: please leave this pin unoccupied. It can not be connected by any signal (Low/GND/High).**



## 7-2 Backlight input interface

Connector type : **SMD_PH2.0mm-6pin or equivalent**

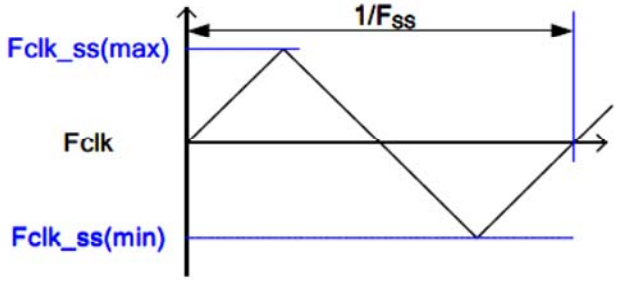
| Pin No. | Symbol | Feature |
|---|---|---|
| 1 | CH1+ | VLED OUT CH1 |
| 2 | CH1- | I Return CH1 |
| 3 | NC | NC |
| 4 | NC | NC |
| 5 | CH2+ | VLED OUT CH2 |
| 6 | CH2- | I Return CH2 |

## 8. INPUT SIGNAL:

### AC Characteristics

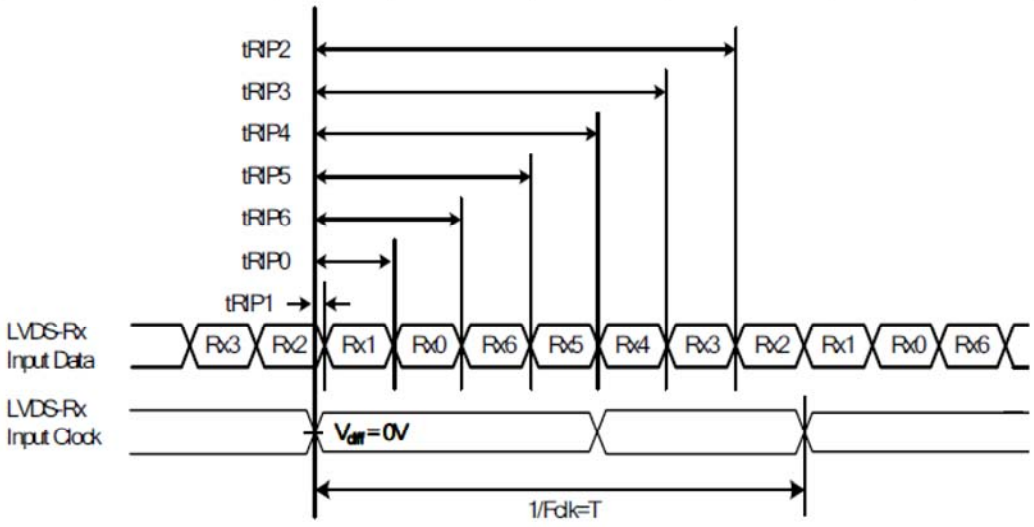
| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max | | |
| LVDS Interface | Receiver Clock : Spread Spectrum Modulation range | Fclk_ss | Fclk -3% | -- | Fclk +3% | MHz | 1 |
| | Receiver Clock : Spread Spectrum Modulation frequency | Fss | 30 | -- | 200 | KHz | 1 |
| | Receiver Data Input Margin<br>Fclk = 85 MHz<br>Fclk = 65 MHz | tRMG | <br>-0.4<br>-0.5 | <br>--<br>-- | <br>0.4<br>0.5 | ns | 2 |

1. LVDS Receiver Clock SSCG (Spread spectrum clock generator) is defined as below figures.



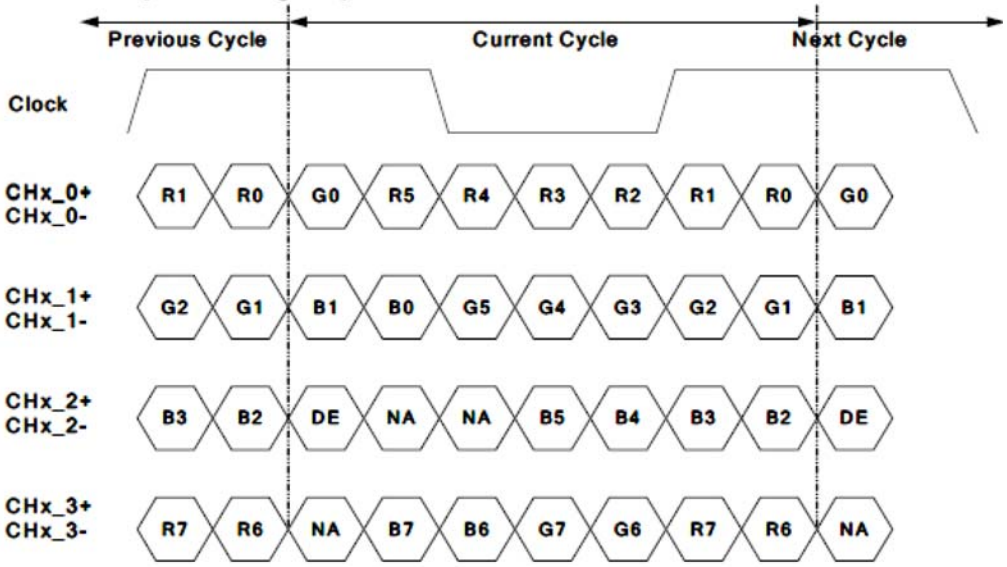

2. Receiver Data Input Margin

| Parameter | Symbol | Rating | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min | Type | Max | | |
| Input Clock Frequency | Fclk | Fclk (min) | -- | Fclk (max) | MHz | T=1/Fclk |
| Input Data Position0 | tRIP1 | -\|tRMG\| | 0 | \|tRMG\| | ns | |
| Input Data Position1 | tRIP0 | T/7-\|tRMG\| | T/7 | T/7+\|tRMG\| | ns | |
| Input Data Position2 | tRIP6 | 2T/7-\|tRMG\| | 2T/7 | 2T/7+\|tRMG\| | ns | |
| Input Data Position3 | tRIP5 | 3T/7-\|tRMG\| | 3T/7 | 3T/7+\|tRMG\| | ns | |
| Input Data Position4 | tRIP4 | 4T/7-\|tRMG\| | 4T/7 | 4T/7+\|tRMG\| | ns | |
| Input Data Position5 | tRIP3 | 5T/7-\|tRMG\| | 5T/7 | 5T/7+\|tRMG\| | ns | |
| Input Data Position6 | tRIP2 | 6T/7-\|tRMG\| | 6T/7 | 6T/7+\|tRMG\| | ns | |



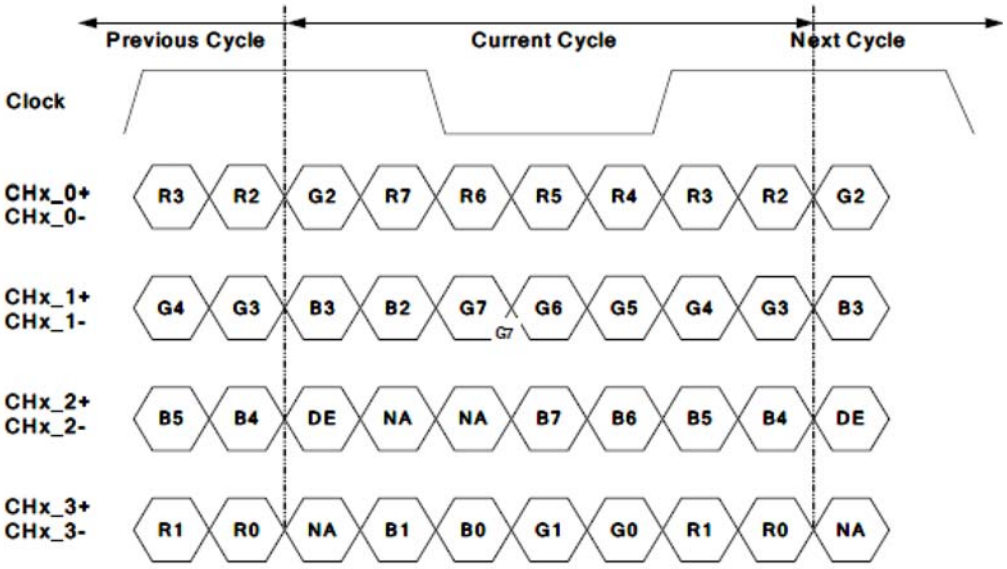
## 8-1 LVDS Signal

LVDS Option = High/Open➔NS




Note: x = 1, 2, 3, 4...

LVDS Option = Low➔JEIDA




Note: x = 1, 2, 3, 4...

## 8-2 TTL Signal

This is the signal timing required at the input of the user connector. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

**Timing Table (DE only Mode)**

| Signal | Item | Symbol | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Vertical Section | Period | Tv | 1096 | 1125 | 1480 | Th |
| | Active | Tdisp (v) | | 1080 | | |
| | Blanking | Tblk (v) | 16 | 45 | 400 | Th |
| Horizontal Section | Period | Th | 1030 | 1100 | 1325 | Tclk |
| | Active | Tdisp (h) | | 960 | | |
| | Blanking | Tblk (h) | 70 | 140 | 365 | Tclk |
| Clock | Frequency | Fclk=1/Tclk | 50 | 74.25 | 82 | MHz |
| Vertical Frequency | Frequency | Fv | 47 | 60 | 63 | Hz |
| Horizontal Frequency | Frequency | Fh | 60 | 67.5 | 73 | KHz |

Notes:

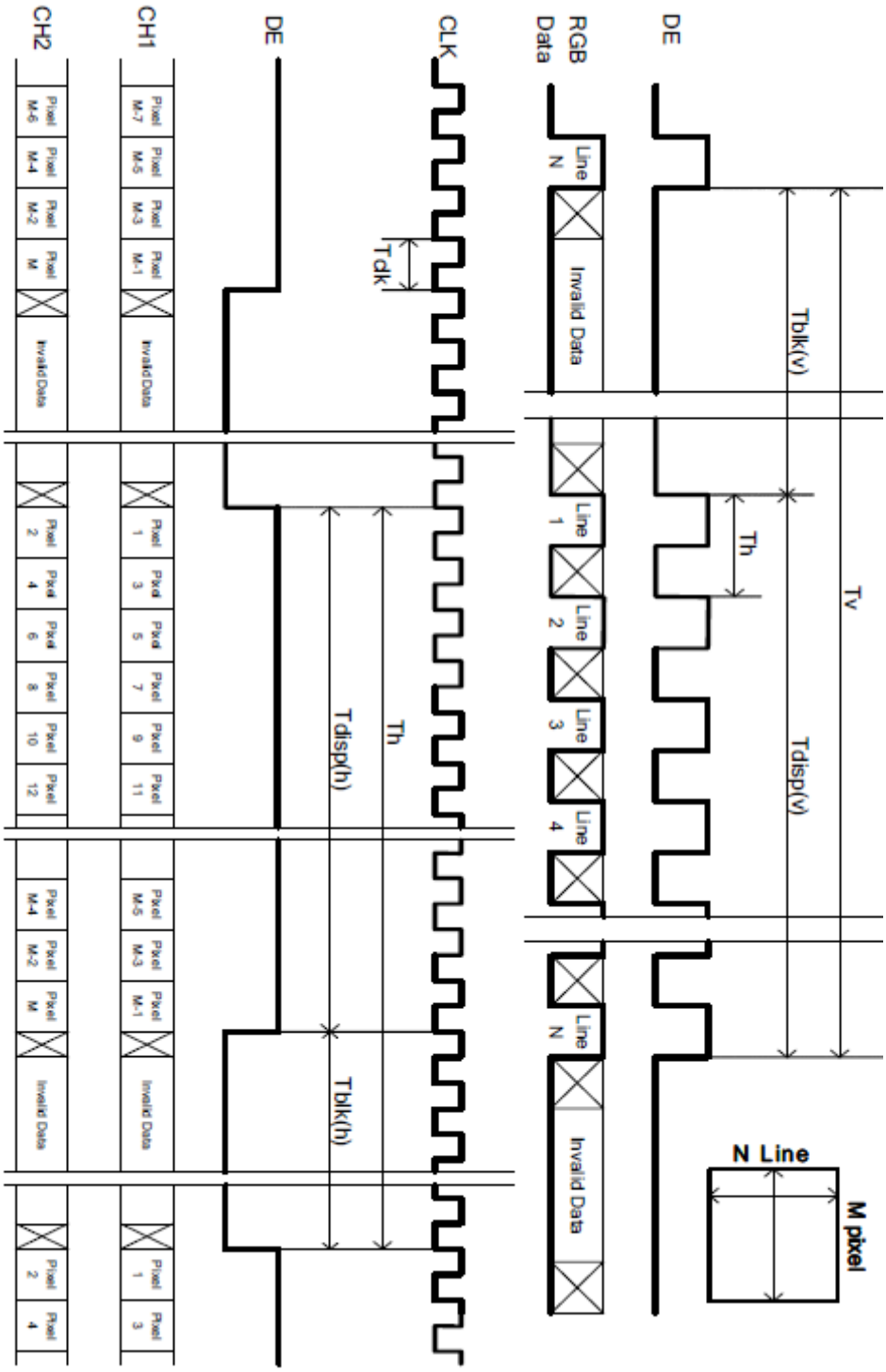
(1) Display position is specific by the rise of DE signal only.
Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

(2)Vertical display position is specified by the rise of DE after a "Low" level period equivalent to eight times of horizontal period. The 1st data corresponding to one horizontal line after the rise of 1st DE is displayed at the top line of screen.

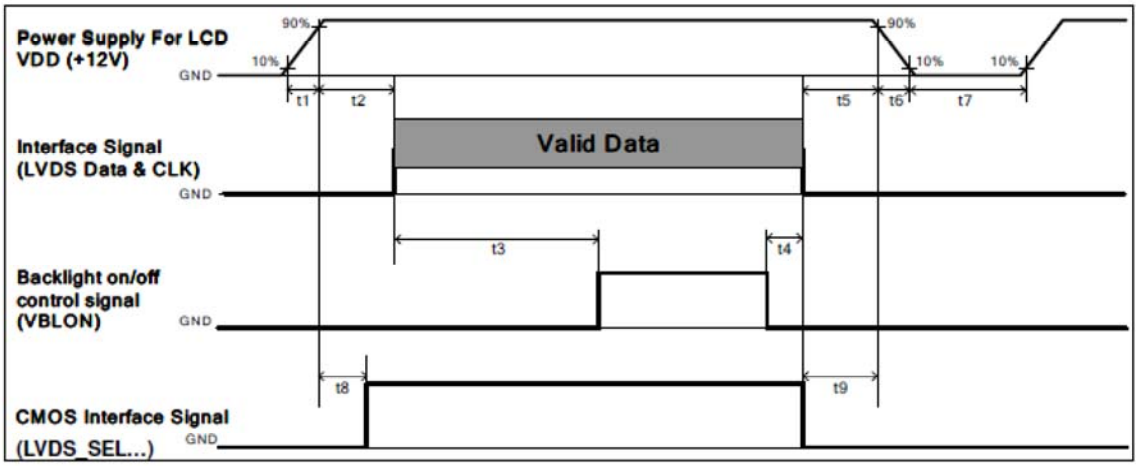
(3)If a period of DE "High" is less than 1920 DCLK or less than 1080 lines, the rest of the screen displays black.

(4)The display position does not fit to the screen if a period of DE "High" and the effective data period do not synchronize with each other.

## 8-3 TFT-LCD Signal Timing Waveforms



## 8-4 Power ON/OFF Sequence




| Parameter | Values | | | Unit |
|---|---|---|---|---|
| | Min. | Type. | Max. | |
| t1 | 0.4 | --- | 30 | ms |
| t2 | 0.1 | --- | 50 | ms |
| t3 | 450 | --- | --- | ms |
| t4 | 0 *1 | --- | --- | ms |
| t5 | 0 | --- | --- | ms |
| t6 | --- | --- | --- *2 | ms |
| t7 | 500 | --- | --- | ms |
| t8 | 10 *3 | --- | 50 | ms |
| t9 | 0 | --- | --- | ms |

Note:

(1) t4=0 : concern for residual pattern before BLU turn off.

(2) t6 : voltage of VDD must decay smoothly after power-off. (customer system decide this value)

(3) When CMOS Interface signal is N.C. (no connection), opened in Transmitted end, t8 timing spec can be negligible.

# 9. DISPLAYED COLOR AND INPUT DATA

| | Color & Gray Scale | DATA SIGNAL | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(63) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(63) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 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 | 1 |
| Red | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(1) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(2) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(31) | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(62) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(63) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Green | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(31) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(62) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blue | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(31) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(63) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

# 10. USE PRECAUTIONS

## 10.1. Handling precautions

1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.
4) If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

## 10.2. Installing precautions

1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.
2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.
3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.
4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

### 10.3. Storage precautions

1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.

2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.
3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

### 10.4. Operating precautions

1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.
2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal standard. But this is not a failure; this will be restored if it is within the normal standard.
3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC dive voltage.
4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.
5) Make certain that each signal noise level is within the standard (L level: 0.2Vdd or less and H level: 0.8Vdd or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.
6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.
7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.

8) Crosstalk occurs because of characteristics of the LCD. In general, crosstalk occurs when the regularized display is maintained. Also, crosstalk is affected by the LC drive voltage. Design the contents of the display, considering crosstalk.

### 10.5. Other

1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.
2) The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.
3) AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.

## 11. OUTLINE DIMENSION