SAMSUNG ELECTRONICS

Approval

TO : Apple / Quanta

DATE : Oct. 27, 2008.

*SAMSUNG TFT-LCD*

# MODEL NO. : LTN133AT09-R02

NOTE :

- Extension code [ -R ] ; LTN133AT09-R02
- Surface type [ **Glare** ]

APPROVED BY :

PREPARED BY : **Application Engineering Part , Mobile LCD Division**

**SAMSUNG ELECTRONICS CO., LTD.**

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# REVISION HISTORY

Approval

| Date | Revision No. | Page | Summary |
|---|---|---|---|
| Oct. 27, 2008 | A00 | All | LTN133AT09-R02 Model spec was approved. |

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# GENERAL DESCRIPTION

## DESCRIPTION

LTN133AT09-R02 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 13.3" contains 1,280 x 800 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
- 1280 x 800 pixels resolution
- Low power consumption
- Fast Response
- W-LED BLU
- DE(Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip
- RoHS / Halogen free compliance

## 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 | 286.08(H) x 178.80(V) (13.3” diagonal ) | mm | |
| Driver element | a-Si TFT active matrix | | |
| Display colors | 262,144 | | |
| Number of pixel | 1280 x RGB(3) x 800 | pixel | 16 : 10 |
| Pixel arrangement | RGB vertical stripe | | |
| Pixel pitch | 0.2235(H) x 0.2235(V) (TYP.) | mm | 113.6DPI |
| Display Mode | Normally white | | |
| Surface treatment | Haze 0, Hard-Coating 3H | | LT4 |

Mechanical Information

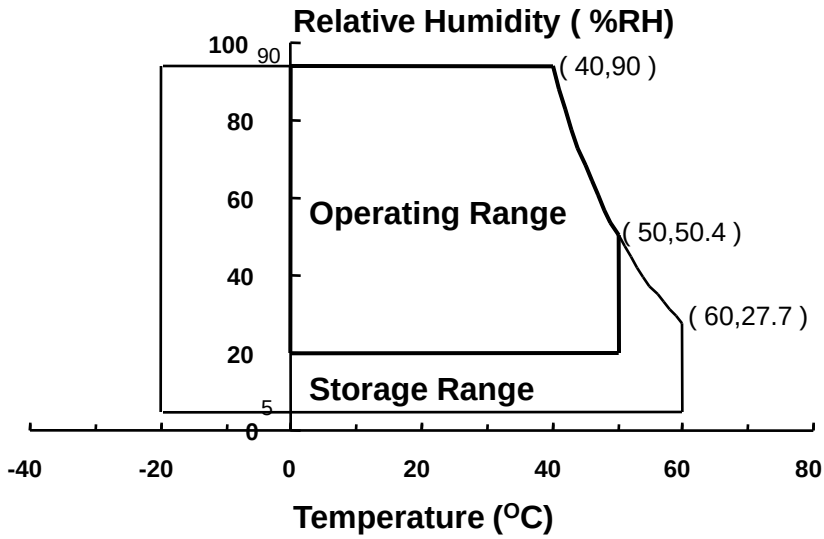
| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module size | Horizontal (H) | 296.85 | 297.15 | 297.45 | mm | |
| | Vertical (V) | 191.85 | 192.15 | 192.45 | mm | |
| | Depth (D) | - | 3.3 | 3.6 | mm | |
| Weight | | - | 300 | 310 | g | |

# 1. ABSOLUTE MAXIMUM RATINGS

## 1.1 ENVIRONMENTAL ABSOLUTE RATINGS

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Storage temperate | TSTG | -20 | 60 | °C | (1) |
| Operating temperate (Temperature of glass surface) | TOPR | 0 | 50 | °C | (1) |
| Shock ( non-operating ) | Snop | - | 240 | G | (2),(4) |
| Vibration (non-operating) | Vnop | - | 2.41 | G | (3),(4) |

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) 5 - 500 Hz, random vibration, 30min for X, Y, Z.
(4) 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.

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## 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 | $V_{DD}$ | VSS - 0.3 | 3.6 | V | (1) |

Note (1) Within Ta (25 ± 2 °C )

### (2) BACK-LIGHT UNIT

Ta = 25 ± 2 °C

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| LED Current | $I_L$ | - | 25 | mA | (1) |
| LED Voltage | $V_L$ | 2.8 | 3.6 | V | (1) |

Note 1) Permanent damage to the device may occur if maximum values are exceeded
Functional operation should be restricted to the conditions described under normal operating conditions.

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## 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, $f_{DCLK}$ = 72.5MHz, $I_L$ = 19.0 mArms

| Item | | Symbol | Condition | Min. | Typ. | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio (Center) | | CR | | 400 | 500 | - | - | (1), (2), (5) |
| Response Time at Ta ( Rising + Falling ) | | $T_{RT_B/W}$ | | - | 16 | - | msec | (1), (3) |
| Average Luminance of White (center) | | $Y_{L,AVE}$ | Normal Viewing Angle $\phi = 0$ $\theta = 0$ | 248 | 275 | - | cd/m$^2$ | $I_L$=19.0mA (1), (4) |
| Color Chromaticity ( CIE ) | Red | $R_X$ | | 0.575 | 0.595 | 0.615 | - | (1), (5) SR-3 |
| | | $R_Y$ | | 0.315 | 0.345 | 0.365 | | |
| | Green | $G_X$ | | 0.300 | 0.320 | 0.350 | | |
| | | $G_Y$ | | 0.535 | 0.555 | 0.585 | | |
| | Blue | $B_X$ | | 0.135 | 0.155 | 0.175 | | |
| | | $B_Y$ | | 0.1105 | 0.145 | 0.165 | | |
| | White | $W_X$ | | 0.297 | 0.313 | 0.329 | | |
| | | $W_Y$ | | 0.313 | 0.329 | 0.345 | | |
| Color Gamut | | | | - | 45 | - | % | |
| Viewing Angle | Hor. | $\theta_L$ | CR ≥ 10 | 40 | 50 | - | Degrees | |
| | | $\theta_H$ | | 40 | 50 | - | | |
| | Ver. | $\phi_H$ | | 15 | 20 | - | | |
| | | $\phi_L$ | | 30 | 35 | - | | |
| 160 Points White Variation | | % | | 50 | - | | - | (6) |
| White color uniformity | | Delta x | max | | | 0.012 | | |
| | | Delta y | max | | | 0.010 | | |
| Max color difference du'v' | | One panel | white | | | 0.008 | | (8) |
| | | Center | white | | | 0.006 | | (7) |
| | | Panel to panel | white | | | 0.008 | | |
| | | Btw neighbor | white | | | 0.0026 | | (9) |

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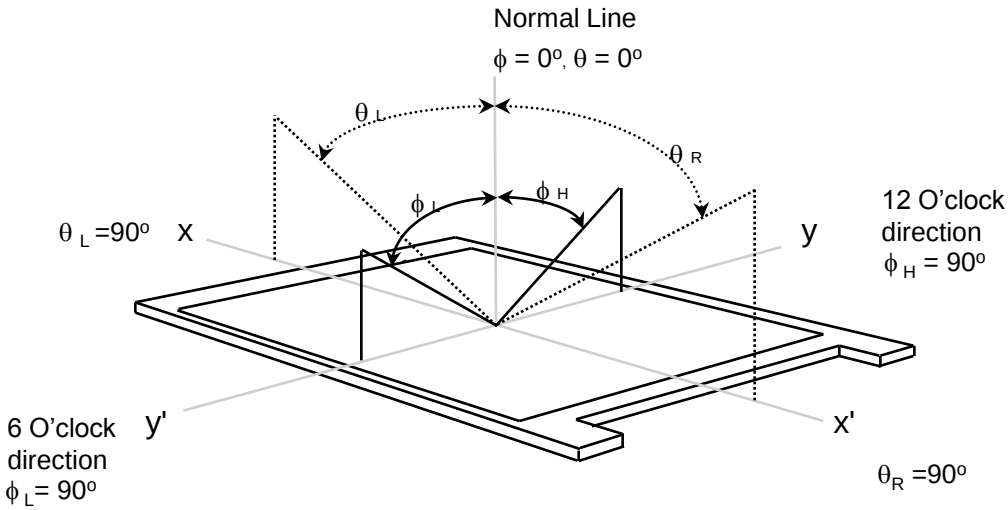
Note 1) Definition of Viewing Angle : Viewing angle range( 10 ≤ C/R, 100 ≤ C/R )



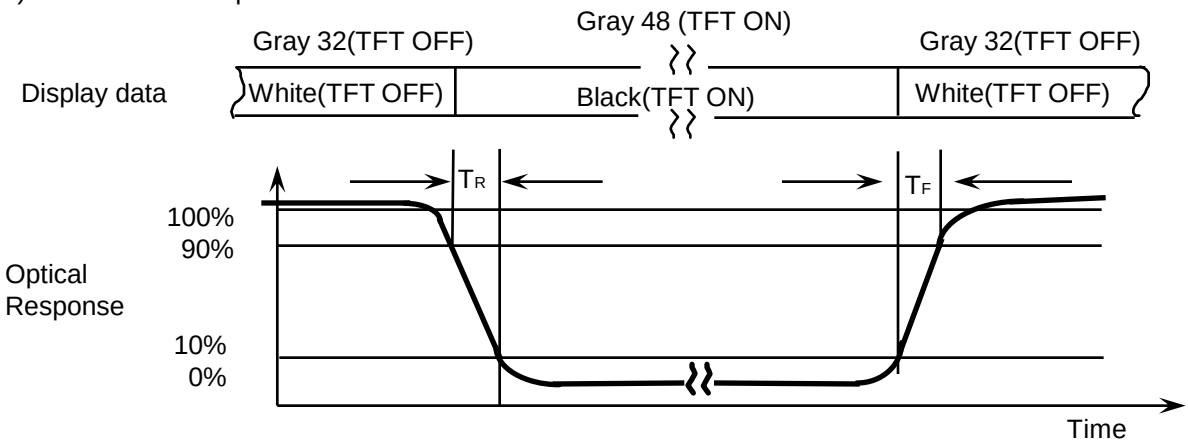

Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at center point

CR = Luminance at Gmax / Luminance at Gmin

{ Average contrast valu at point # 72, 73, 88, 89 } ,

Test points are figured out at Note 4).

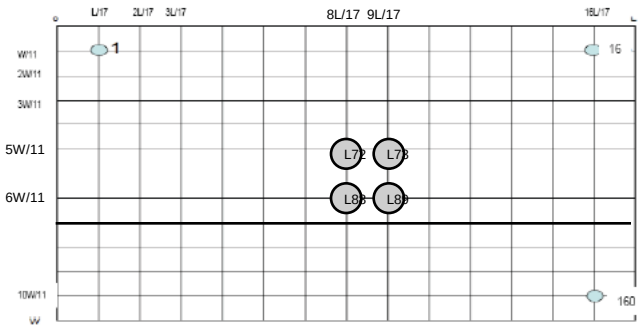
Note 3) Definition of Response time :




Note 4) Definition of Average Luminance of White

: measure the luminance of white at center 4 points out of 160points .

VIEW AREA




◯ : test point

Average Luminance of White ( $Y_{L,AVE}$ )

$$Y_{L,AVE} = \frac{Y_{L72} + Y_{L73} + Y_{L88} + Y_{L89}}{4}$$

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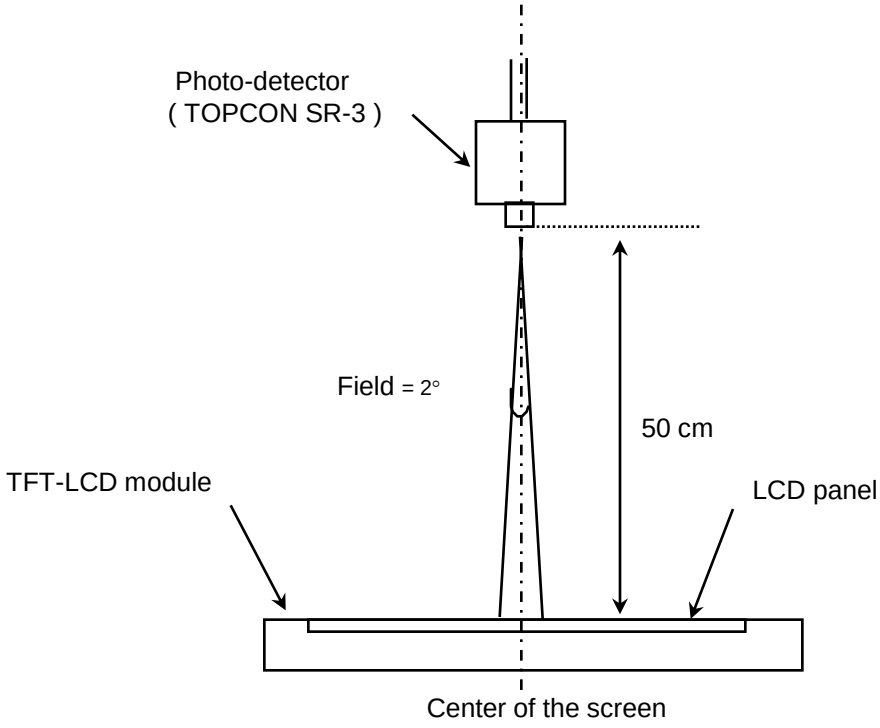
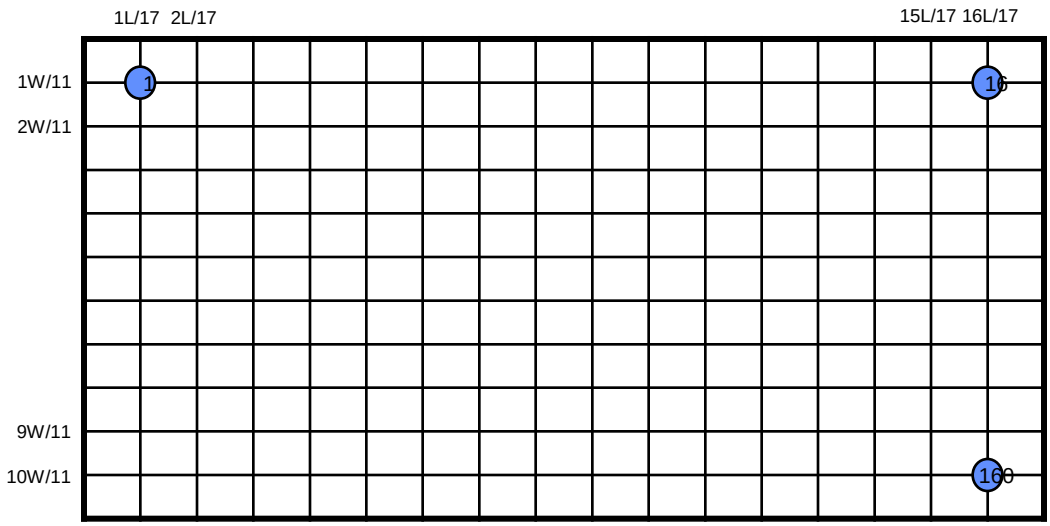
Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless,and dark room.
30 min after lighting the backlight. This should be measured in the center of screen.
Lamp current : 6.0mA ( Inverter : SIC-130T )
Environment condition : Ta = 25 ± 2 °C




[ Optical characteristics measurement setup ]

Note 6) Definition of 160 points white variation (δ L ), CR variation( CVER ) [ 1 ~ 160 ]

δ L = 100% - (Lmax-Lmin) / Lmax
Where, Lmax = max { Luminance values at 160 points },
Lmin = min {Luminance values at 160 points }

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Note 7) Max Color Difference with respect to the center within a panel

On each panel, the maximum color difference between any of the 160 points and the center point (defined as the average value at point #72, 73, 88, 89), represented in delta u'v'.

Note 8) Max Color Difference between any two points within the panel

On each panel, the maximum color difference between any two of the 160 points , represented in delta u'v'.

Note 9) Max Color Difference between two neighbors

On each panel, the maximum color difference between any two neighboring points on the panel, represented in delta u'v'

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# 3. ELECTRICAL CHARACTERISTICS

## 3.1 TFT LCD MODULE

Ta= 25 ± 2°C

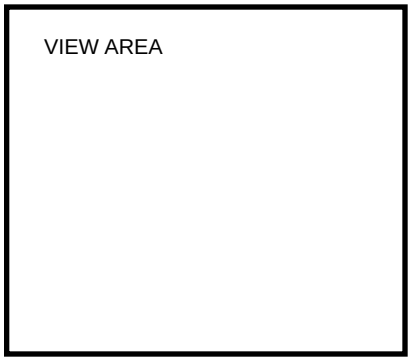
| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Voltage of Power Supply | | $V_{DD}$ | 3.0 | 3.3 | 3.6 | V | |
| Differential Input Voltage for LVDS Receiver Threshold | High | $V_{IH}$ | - | - | +100 | mV | $V_{CM}$ = +1.2V |
| | Low | $V_{IL}$ | -100 | - | - | mV | |
| Vsync Frequency | | fv | - | 60 | - | Hz | |
| Hsync Frequency | | $f_H$ | - | 49.3 | - | KHz | |
| Main Frequency | | $f_{DCLK}$ | - | 72.5 | - | MHz | |
| Rush Current | | $I_{RUSH}$ | - | - | 1.5 | A | (4) |
| Current of Power Supply | White | $I_{DD}$ | - | 230 | - | mA | (2),(3)*a |
| | Mosaic | | - | 242 | 273 | mA | (2),(3)*b |
| | Black | | - | 273 | 303 | mA | (2),(3) |

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

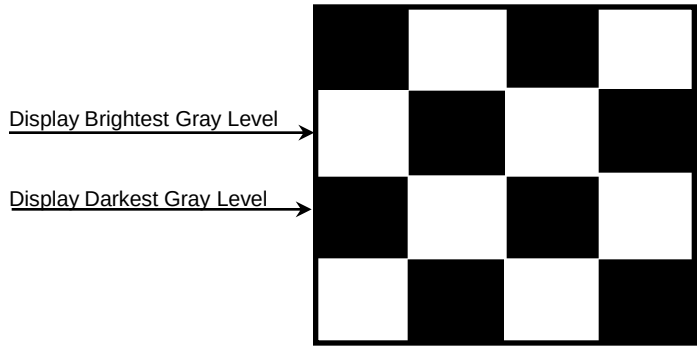
(2) $f_V$ = 60Hz, $f_{DCLK}$ =72.5MHZ, $V_{DD}$ = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern




*b) Mosaic Pattern

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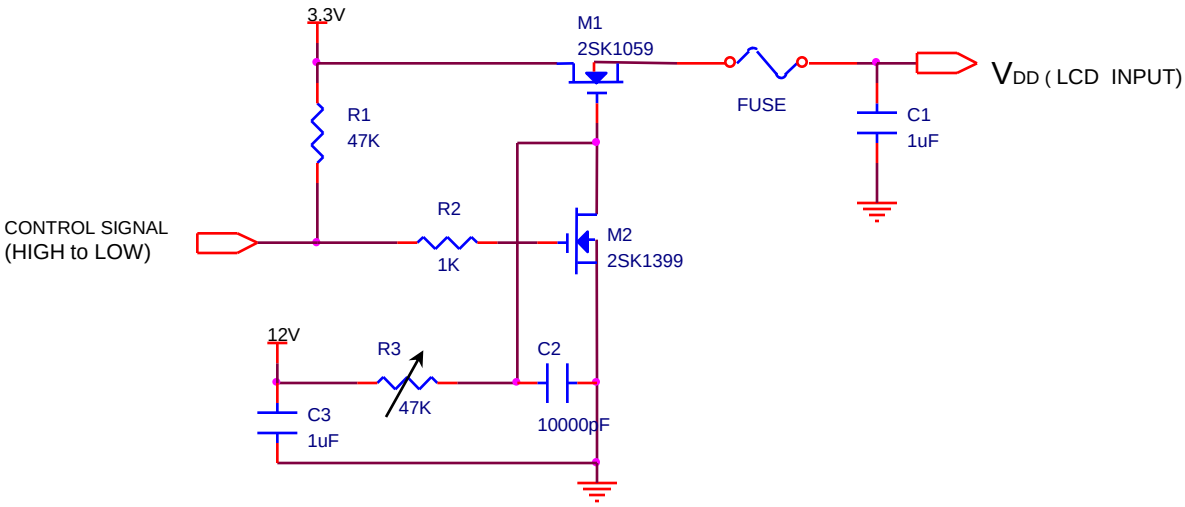
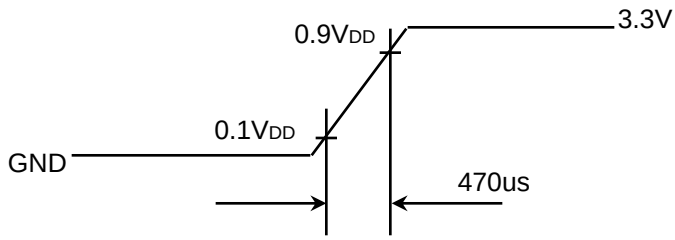
4) Rush current measurement condition




VDD rising time is 470us



## 3.2 BACK-LIGHT UNIT

Ta= 25 ± 2 °C

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| LED Forward Current | IF | - | 19 | - | mA | |
| LED Forward Voltage | VF | - | 3.3 | 3.45 | V | |
| LED Array Voltage | VP | - | 29.7 | 30.6V | V | Vf X 9 LEDs |
| Power Consumption | P | - | 3.39 | - | W | If X Vf X 54 LEDs |

## 3.3 LED array

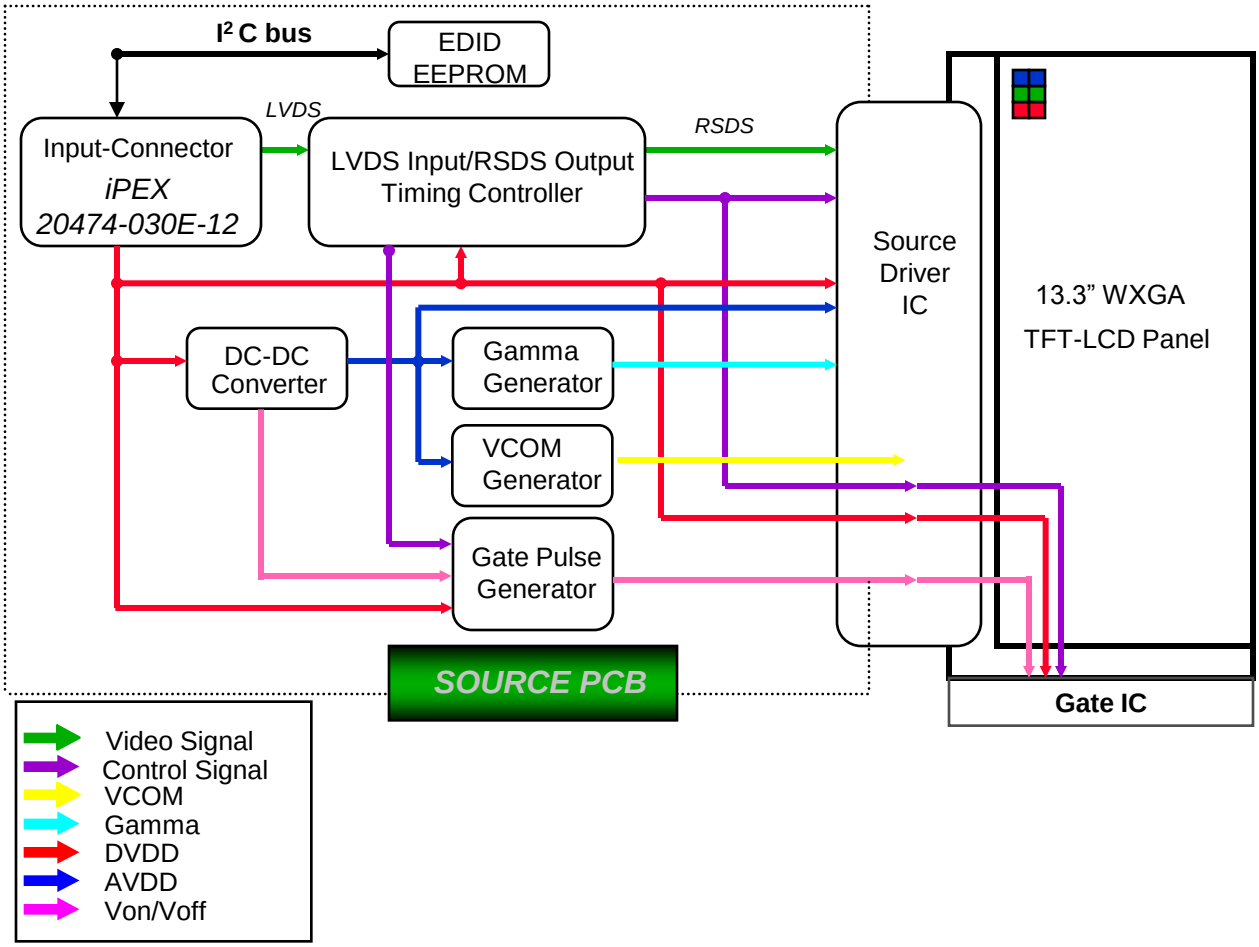
| String | LED1 | LED2 | LED3 | LED4 | LED5 | LED6 | LED7 | LED8 | LED9 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 7 | 13 | 19 | 25 | 31 | 37 | 43 | 49 |
| 2 | 2 | 8 | 14 | 20 | 26 | 32 | 38 | 44 | 50 |
| 3 | 3 | 9 | 15 | 21 | 27 | 33 | 39 | 45 | 51 |
| 4 | 4 | 10 | 16 | 22 | 28 | 34 | 40 | 46 | 52 |
| 5 | 5 | 11 | 17 | 23 | 29 | 35 | 41 | 47 | 53 |
| 6 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 |

## 3.4 LED information

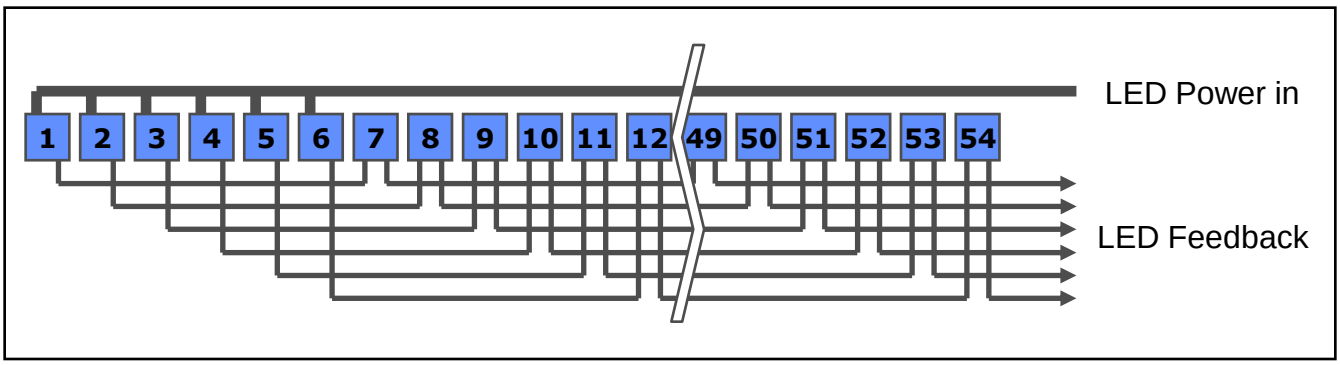
| | |
|---|---|
| LED Manufacturer | Nichia |
| LED P/N | NNSW108T-S1 |
| LED Bin | No-Need-To-Mix Bins: a6275, a6276, a6277, a6278<br>Mix Pairs: a5265-a6285, a5265-a6287, a5266-a6285, a5266-a6287, a5267-a6285, a5267-a6287, a5268-a6285, a5268-a6287, |
| LED rank | 1800mcd to 2400mcd |
| LED Brightness Bin | 50mcd per bin |

# 4. BLOCK DIAGRAM

## 4.1 TFT LCD Module




## 4.2 Back light Unit ( LED )



# 5. INPUT TERMINAL PIN ASSIGNMENT

## 5.1. Input Signal & Power ( LVDS, Connector : IPEX 20474-030E-12 )

| No. | Symbol | Function | Polarity | Remarks |
|---|---|---|---|---|
| 1 | VSS | Ground | | |
| 2 | VDD | POWER SUPPLY +3.3V | | |
| 3 | VDD | POWER SUPPLY +3.3V | | |
| 4 | VEEDID | DDC 3.3V Power | | |
| 5 | VSYNC | STV out | | |
| 6 | CLKEDID | DDC Clock | | |
| 7 | DATAEDID | DDC data | | |
| 8 | RxIN0- | LVDS Differential Data INPUT (R0-R5,G0) | Negative | |
| 9 | RxIN0+ | LVDS Differential Data INPUT (R0-R5,G0) | Positive | |
| 10 | GND | Ground | | |
| 11 | RxIN1- | LVDS Differential Data INPUT (G1-G5,B0-B1) | Negative | |
| 12 | RxIN1+ | LVDS Differential Data INPUT (Odd G1-G5,B0-B1) | Positive | |
| 13 | GND | Ground | | |
| 14 | RxIN2- | LVDS Differential Data INPUT (B2-B5,Sync,DE) | Negative | |
| 15 | RxIN2+ | LVDS Differential Data INPUT (B2-B5,Sync,DE) | Positive | |
| 16 | GND | Ground | | |
| 17 | RxCLK- | LVDS Differential Data INPUT | Negative | |
| 18 | RxCLK+ | LVDS Differential Data INPUT | Positive | |
| 19 | GND | Ground | | |
| 20 | WPN | Bist | | |
| 21 | Vdc (1 to 6) | LED Annode | Positive | |
| 22 | Vdc (1 to 6) | LED Annode | | |
| 23 | NC | NC | | |
| 24 | Vdc1 | LED Cathode | Negative | |
| 25 | Vdc2 | LED Cathode | Negative | |
| 26 | Vdc3 | LED Cathode | Negative | |
| 27 | Vdc4 | LED Cathode | Negative | |
| 28 | Vdc5 | LED Cathode | Negative | |
| 29 | Vdc6 | LED Cathode | Negative | |
| 30 | NC | NC | | |

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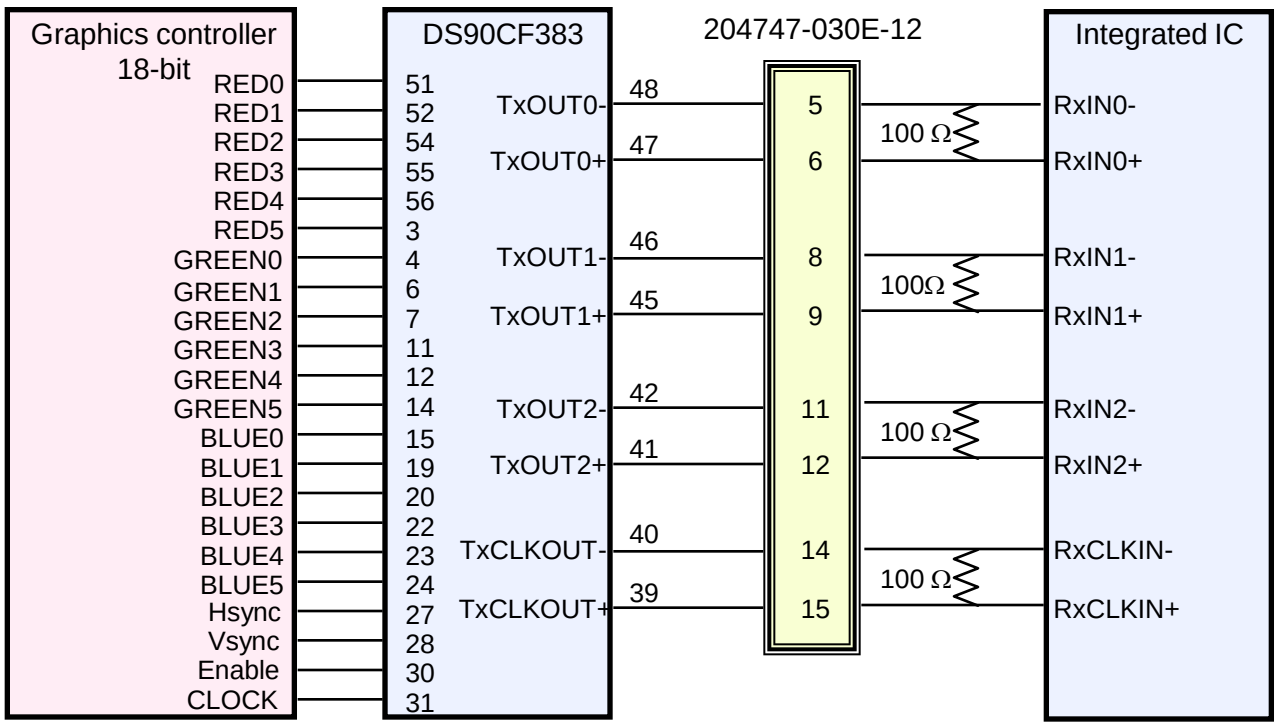
## 5.2 LVDS Interface : Transmitter DS90CF383 or Compatible

| 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

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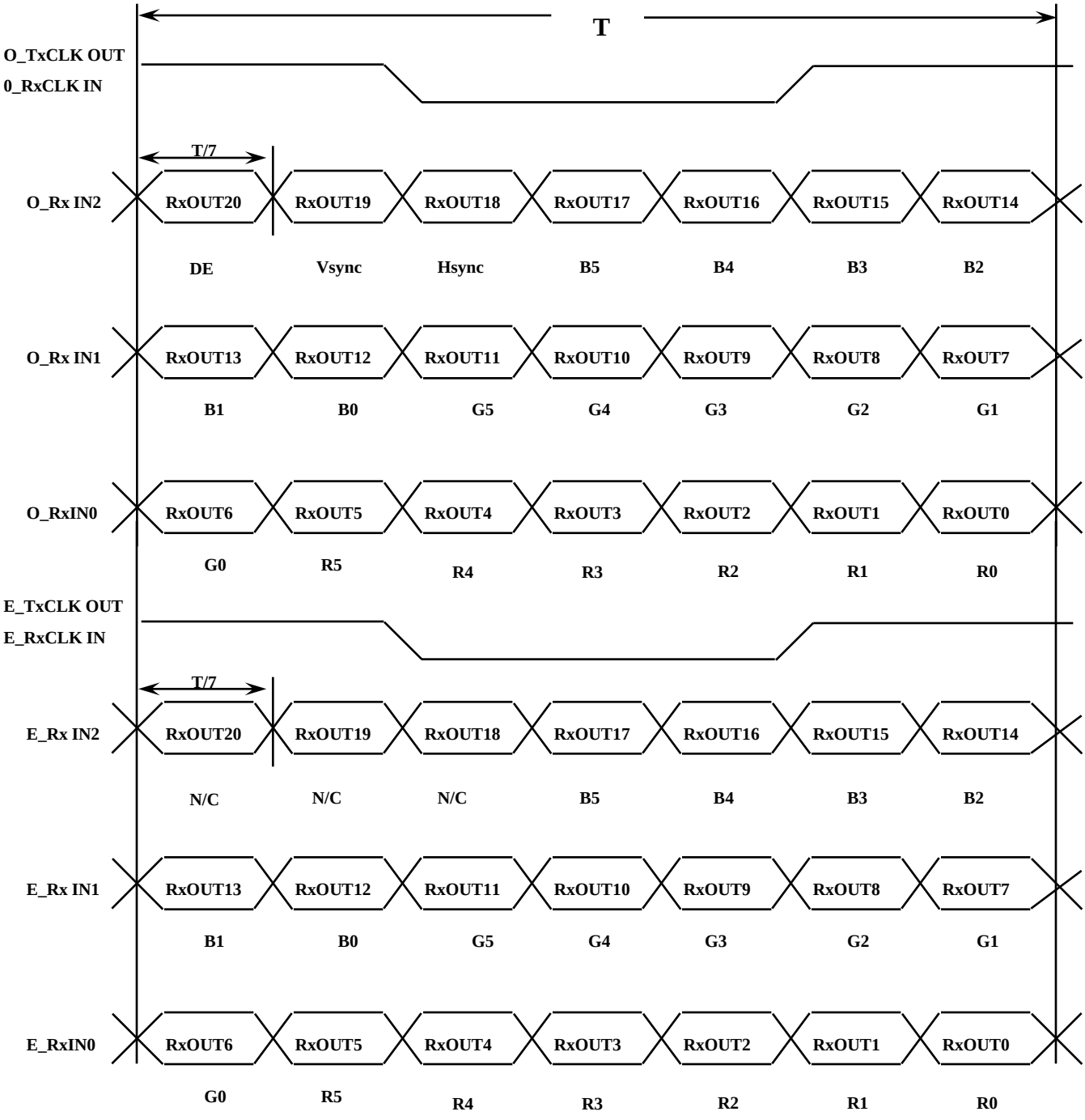
## 5.3 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON

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## 5.4 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 | 45 | B5 | |
| Basic Colors | Black | 0 | 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 | 1 | - |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | 1 | - |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 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 | 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 | - |
| Gray Scale Of Red | Black | 0 | 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 | 0 | R1 |
| | ↑ | 0 | 1 | 0 | 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 | 0 | R61 |
| | Light | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 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 | 0 | R63 |
| Gray Scale Of Green | Black | 0 | 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 | 0 | G1 |
| | ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 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 | 0 | G61 |
| | Light | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | G62 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 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 | 0 | B0 |
| | Dark | 0 | 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 | 0 | 1 | 0 | 0 | 0 | 0 | B2 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | B3~B60 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | ↓ | 0 | 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 | 0 | 1 | 1 | 1 | 1 | 1 | B62 |
| | Blue | 0 | 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

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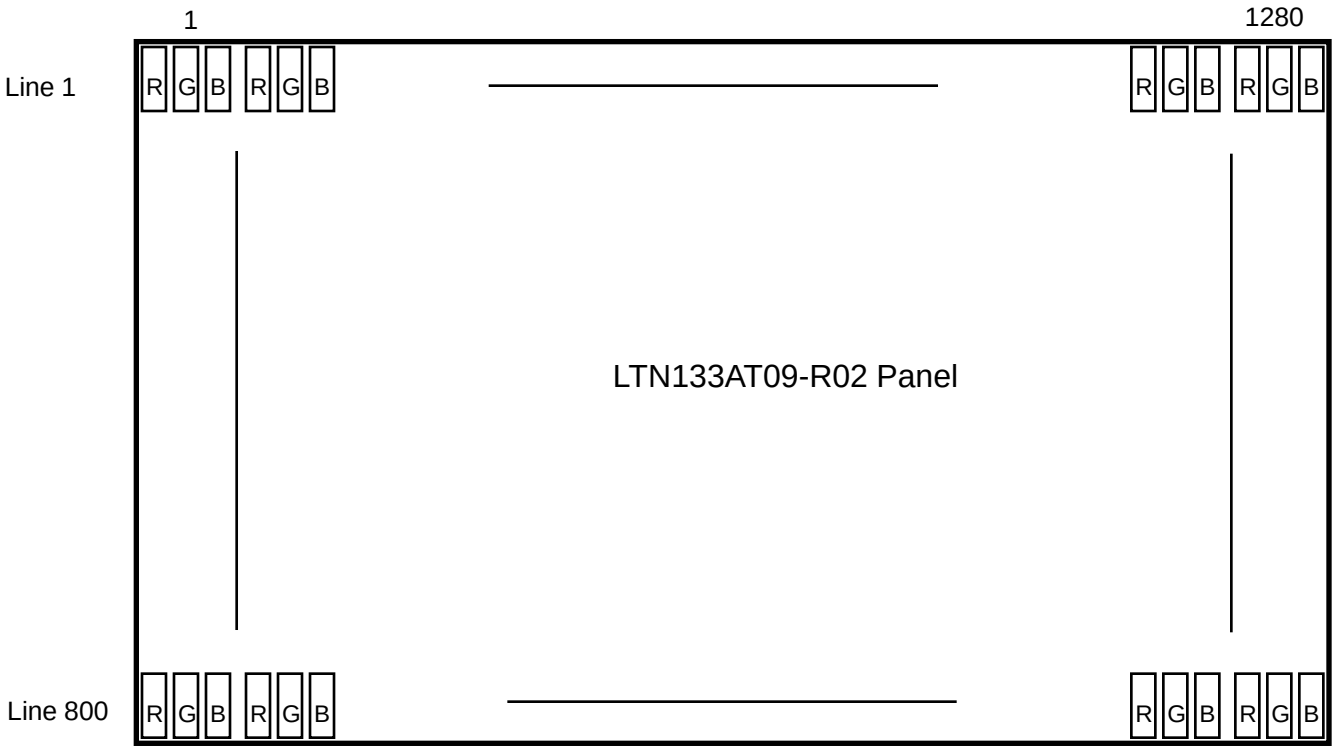
## 5.5 Pixel Format in the display

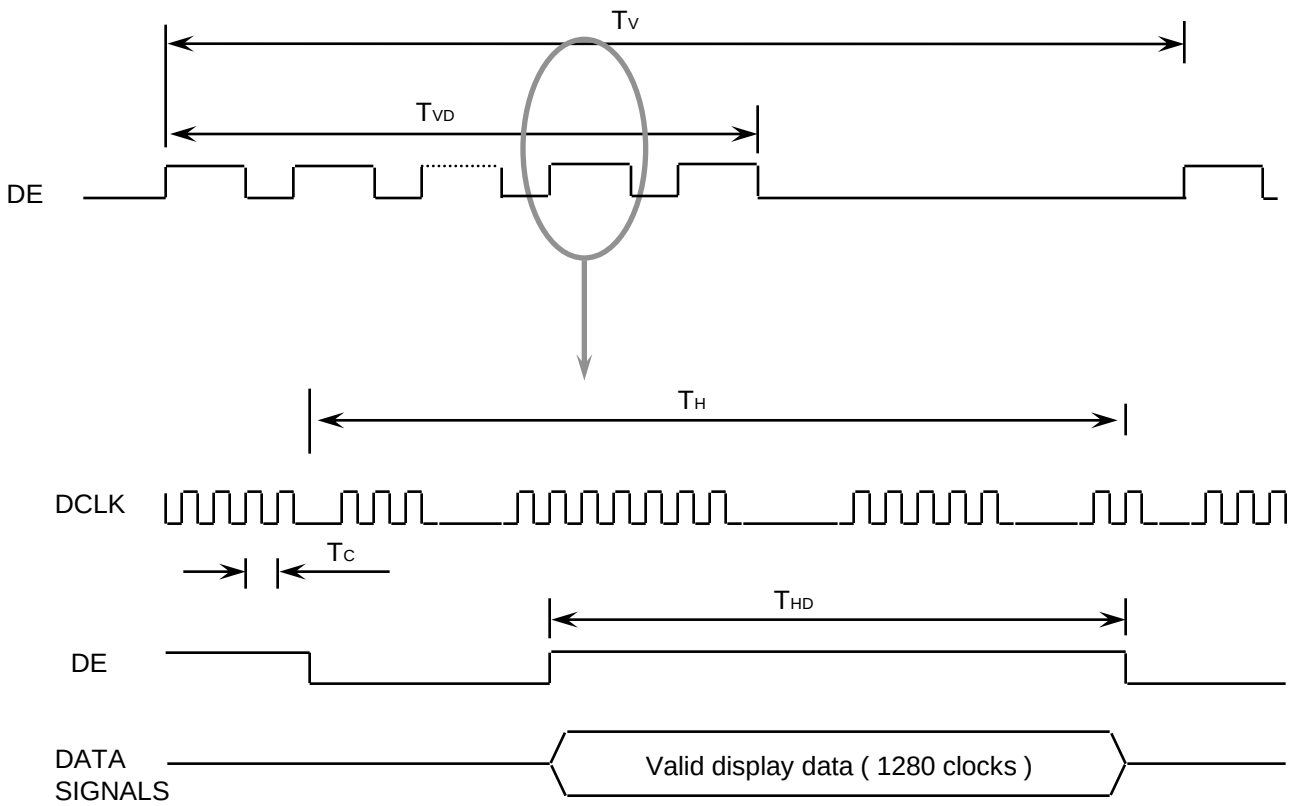


# 6. INTERFACE TIMING

## 6.1 Timing Parameters

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Frame Frequency | Cycle | TV | - | 823 | - | Lines | |
| Vertical Active Display Term | Display Period | TVD | - | 800 | - | Lines | |
| One Line Scanning Time | Cycle | TH | - | 1440 | - | Clocks | |
| Horizontal Active Display Term | Display Period | THD | - | 1280 | - | Clocks | |

## 6.2 Timing diagrams of interface signal

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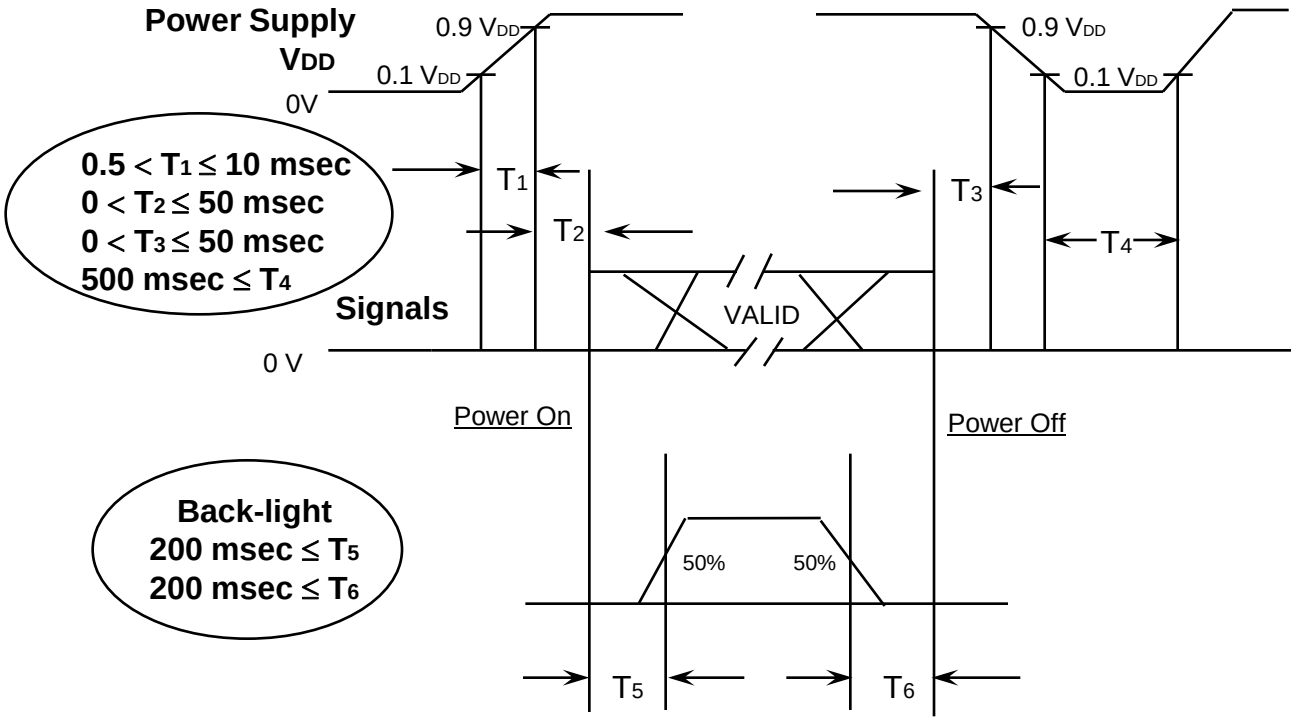
## 6.3 Power ON/OFF Sequence

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




Power ON/OFF Sequence

T1 : Vdd rising time from 10% to 90%
T2 : The time from Vdd to valid data at power ON.
T3 : The time from valid data off to Vdd off at power Off.
T4 : Vdd off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L disable at power Off.

NOTE.

(1) The supply voltage of the external system for the module input should be the same as the definition of $V_{DD}$.

(2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) In case of $V_{DD}$ = off level, please keep the level of input signals on the low or keep a high impedance.

(4) T4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

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## 7. Mechanical Outline Dimension

Approval

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## 8. 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 CCFT 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 (Isoprophyl 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.

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

(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.

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