

# APPROVAL

PART NO.	DESCRIPTION	REMARKS
<b>HT12101LH</b>	<b>LCD MODULE</b> (1024 x RGB x 768)	* <b>ROHS compliant</b> * <b>High Brightness</b> (1,000 cd/m <sup>2</sup> )

CUSTOMER APPLICATION P/N	
APPROVED BY	
DATE	

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**HYES Optoelectronics, Inc.**


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# 1.0 General Description

## 1.1 General Introduction

HT12101LH is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as active switching devices. This module has a 12.1 inch diagonally measured active area with XGA resolutions (1024 horizontal by 768 vertical pixel array).

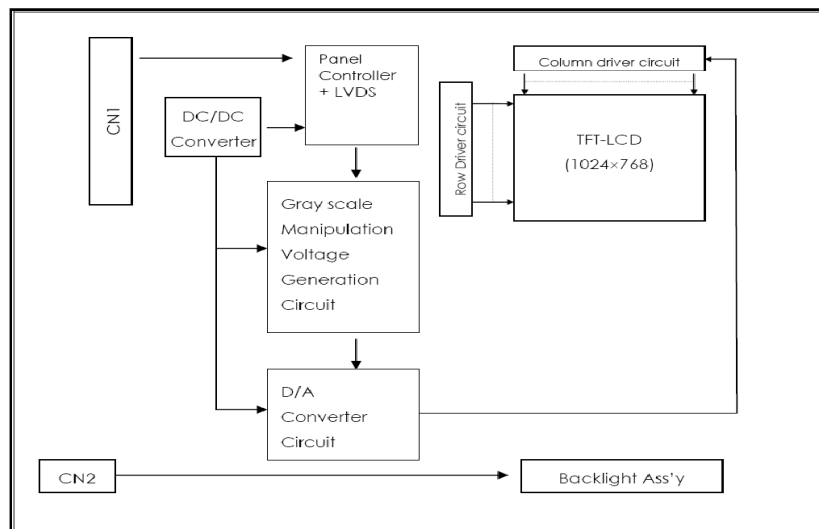
Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 262,144 colors.

The TFT-LCD panel used Ultra high Brightness as Back Light unit using L.E.D Lamps and Pure Light Guide.

► For Application :

- Marine Fish Finder
- Avionics dashboard
- Medical instrument
- Military instrument
- Industrial instrument
- Automobile dashboard etc.

Followings are general diagram at the model HT12101LH.



## 1.2 Features

- 1) Greater Outdoor Readability
- 2) High visibility and durability in outdoor
- 3) High Luminance and Contrast ratio
- 4) Anti reflection and Wide viewing angle
- 5) 6bit color depth, Display 262,144 colors
- 6) Ripple Free
- 7) AFFS technology TFT LCD Module (Hydis)
- 8) High Luminance L.E.D Back-Light Unit

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### 1.3 General Specification

The followings are general specifications

Parameter	Specification	Unit	Remarks
TFT Type	Amorphous silicon TFT		
Active area	245.76 (H) ×184.32(V) (12.1" diagonal)	mm	
Number of pixels	1024 (H) X 768 (V)	pixels	
Pixel pitch	0.240(H) ×0.240(V)	mm	
Pixel arrangement	RGB Vertical stripe arrangement		
Display colors	262,144 (6 bits)	colors	
Display mode	Normally Black, Transmissive Mode		AFFS
Signal interface	LVDS		
Dimensional outline	274.00±0.5(H) × 206.3±0.5(V) × 14.10(D:max)	mm	
Weight	900 g (typ.)	g	
Surface treatment	Anti-Reflection Hard coating(3H) of Front view		
Brightness	1,100 Typ	cd/m <sup>2</sup>	
Back-light	2 Edge side, White LED type		
Mounting method	Side mounting		
Power consumption	P <sub>D</sub> : 0.7	W	@ Vcc
	P <sub>BL</sub> : 15.1	W	@ Backlight
	P <sub>total</sub> : 15.8	W	

### 1.4 Absolute Maximum Rate

Parameter	Symbol	Values		Unit	Remarks
		Min	Max		
Logic Power Supply	Vdd	-0.3	4.0	Vdc	Ta=Room Temp
Logic Input Voltage	Vin	-0.3	Vdd+0.3	Vdc	
Operating Temp	Top	-20	+70	°C	With the Heater
Storage Temp	Tst	-30	+80	°C	

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## 2.0 Mechanical Specification

### 2.1 Mechanical specifications.

Parameter	Min.	Typ.	Max.	Unit	Remarks
Horizontal outline dimension	273.5	274.0	274.5	mm	
Vertical outline dimension	205.8	206.3	206.8	mm	
Thickness	-	-	14.1	mm	
Lamp cable length	-	250	-	mm	
Weight	-	900	-	g	

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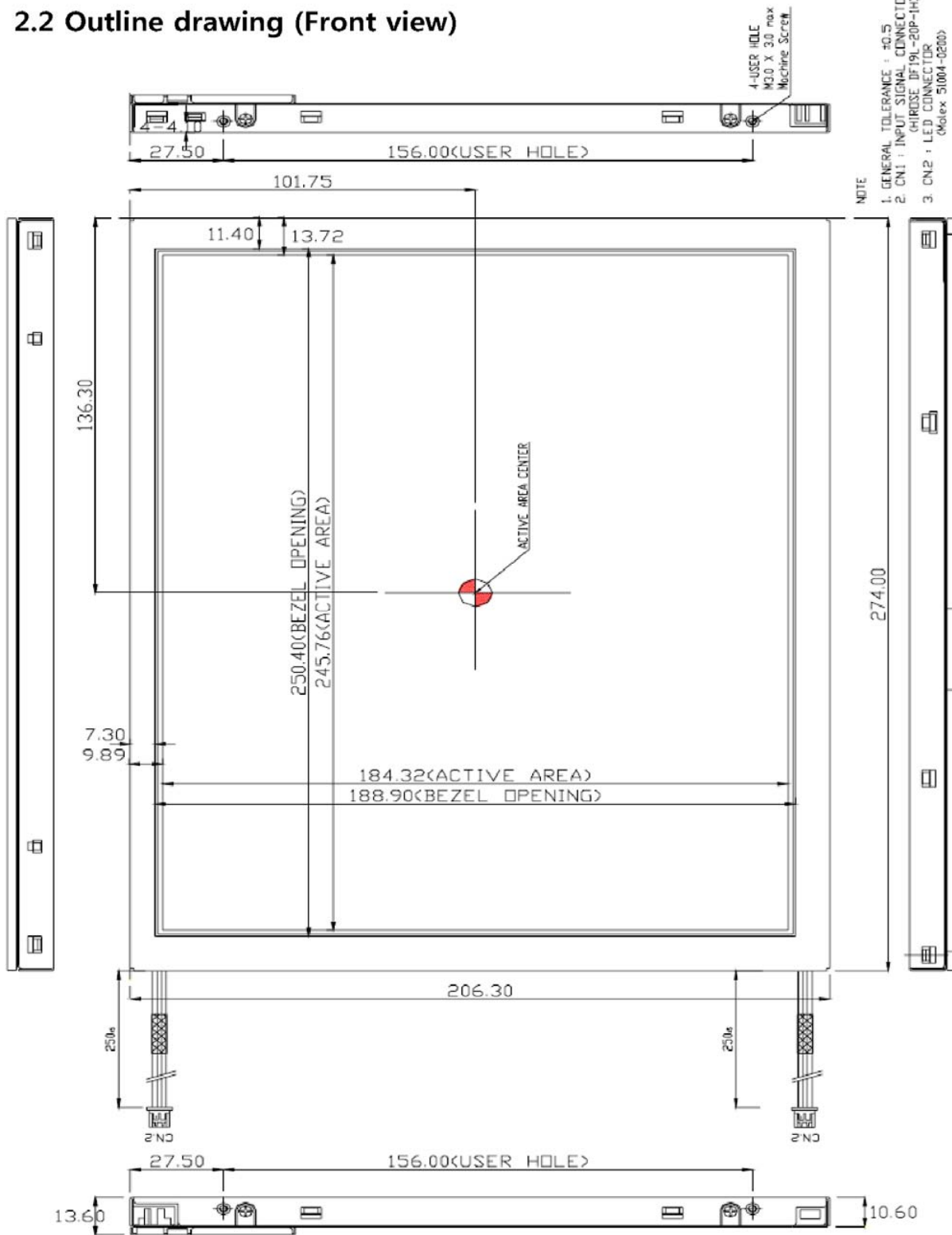
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## 2.2 Outline drawing (Front view)



NOTE

1. GENERAL TOLERANCE :  $\pm 0.5$
2. CN1 : INPUT SIGNAL CONNECTOR (HIROSE DF19L-20P-1H)
3. CN2 : LED CONNECTOR (Molex 51004-0200)

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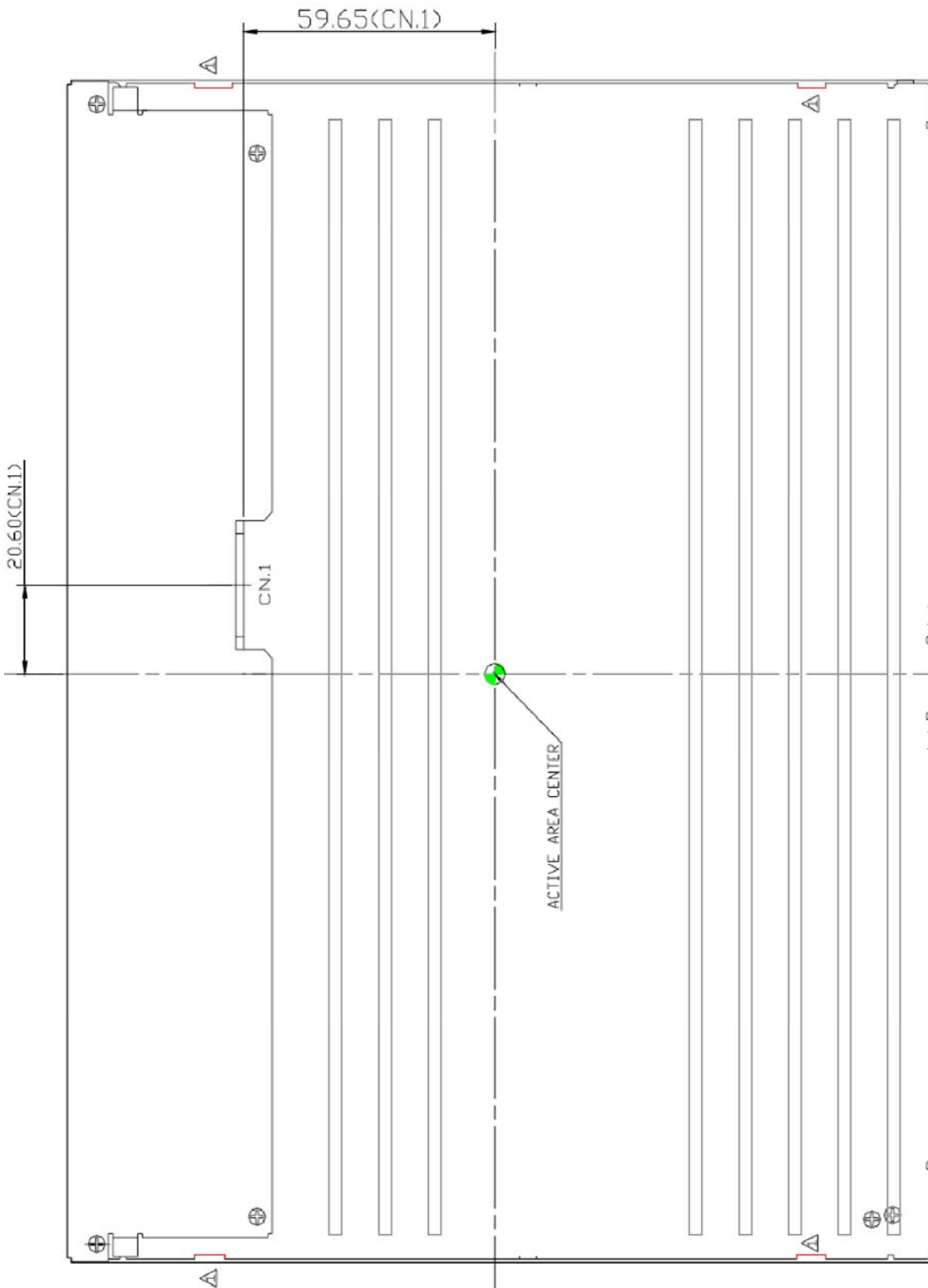
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### 2.3 Outline drawing (Rear view)



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### 3.0 Electrical Specification

#### 3.1 Electrical specifications.

Parameter	Symbol	Min.	TYP.	Max.	Unit	Remark
LCD Module						
Input Voltage	VDD	3.0	3.3	3.6	Vdc	
Input Current	IDD		240		mAdc	Note1,2
Power Consumption	PD		0.7		W	Note1,2
Back-Light						
Operating Voltage	VBL	17.7	18.6	20.4	Vdc	
Operating Current	IBL		0.810		Adc	
Power Consumption	PBL		15.1		W	
Life time		30,000	50,000		Hrs	Note3

**Notes:**

1. The current draw and power consumption specified is for 3.3 Vdc at 25°C and fv at 60Hz. (at Black pattern displayed)
2. Logic level are specified for VDD of 3.3 Vdc at 25°C. The values specified apply to all logic inputs; Hsync, Vsync, Clock, data signals, etc.
3. End of Life shall be determined by the time when any of the following is satisfied under continuous lighting at 25°C and IBL = 810[mA] Max Only. (Intensity drops to 50% of the Initial Value)
4. LED BLU Load voltage should be about 17.7V~20.4V at 405mA Maximum current each top & bottom sides.

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## 4.0 Optical Specification

### 4.1 Optical specifications

The test of Optical specifications shall be measured in a dark room (ambient luminance  $\leq 1$  lux And temperature =  $25 \pm 2^\circ\text{C}$ ) with the equipment of luminance meter system and test unit shall be located at an approximate distant 50cm from the LCD surface at a viewing angle of  $\theta$  and  $\Phi$  equal to  $0^\circ$ . We refer to  $\theta\Phi=0$  ( $=\theta_3$ ) as the 3 o'clock direction,  $\theta\Phi=90$  ( $=\theta_{12}$ ) as the 12 o'clock direction. ("upward"),  $\theta\Phi=180$  ( $=\theta_9$ ) as the 9 o'clock direction ("left") and  $\theta\Phi=270$  ( $=\theta_6$ ) as the 6 o'clock direction ("bottom"). While scanning  $\theta$  and or  $\Phi$ , the center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 60 minutes prior to measurement... VDD shall be  $3.3 \pm 0.3\text{V}$  at  $25^\circ\text{C}$ . Optimum viewing angle direction is 6 o'clock.

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	$\theta_3$	CR > 10	-	80	-	Deg.	Note 1
		$\theta_9$		-	80	-	Deg.	
	Vertical	$\theta_{12}$		-	80	-	Deg.	
		$\theta_6$		-	80	-	Deg.	
Luminance Contrast ratio		CR	$\theta = 0^\circ$	-	450 : 1	-		Note 2
Center Luminance of White	1 Point	$Y_w$	$\theta = 0^\circ$ VBL = 16.5V IBL = 405mA (with 2channel)	850	1,000	-	cd/m <sup>2</sup>	
White Luminance uniformity	5 Points	$\Delta Y_5$		70	75	-	%	Min/Max
White Chromaticity		$W_x$	$\theta = 0^\circ$		0.311			Note 3
		$W_y$			0.338			
Reproduction of color	Red	$R_x$			0.547			
		$R_y$			0.331			
	Green	$G_x$			0.314			
		$G_y$			0.518			
	Blue	$B_x$			0.153			
		$B_y$			0.141			
Response Time	$T_{\text{total}}$ ( $T_r + T_d$ )		$T_a = 25^\circ\text{C}$ $\theta = 0^\circ$	-	40	-	ms	
Color Reproduction	-		-	-	40	-	%	
Cross Talk	CT		$\theta = 0^\circ$	-	-	2.0	%	

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**Notes**

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE1 as below).
2. Contrast measurements shall be made at viewing angle of  $\Theta = 0$  and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state.

Luminance Contrast Ratio (CR) is defined mathematically as CR =  
Luminance when displaying a white raster  
-----  
Luminance when displaying a black raster

3. The color chromaticity coordinates specified in Table 4. shall be calculated from the spectral data measured with all pixels first in red, green, blue, and white. Measurements shall be made at the center of the panel.

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#### 4.2 Overview of test condition.

Items	Condition	Items	Condition
Ambient luminance	1 Lux Under	Temperature	25 degree C +/- 2
Test equipment	Goniometer and BM5	Distance from test equipment to LCD Surface	50 cm
Angle of test	0 degree (Distance 6 p'clock)		
VDD	3.30 +/- 0.3 V	Saturation time of brightness	30 min

Figure 1. Measurement Set Up

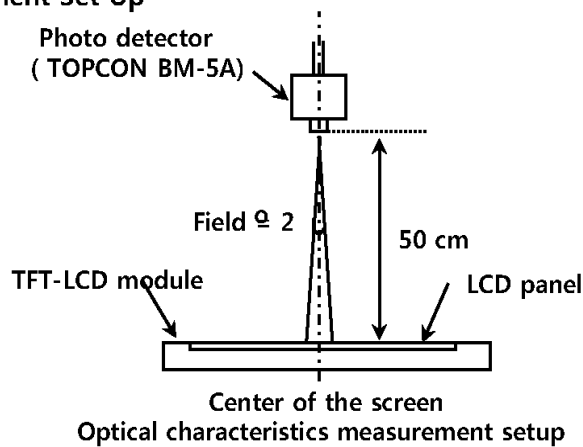
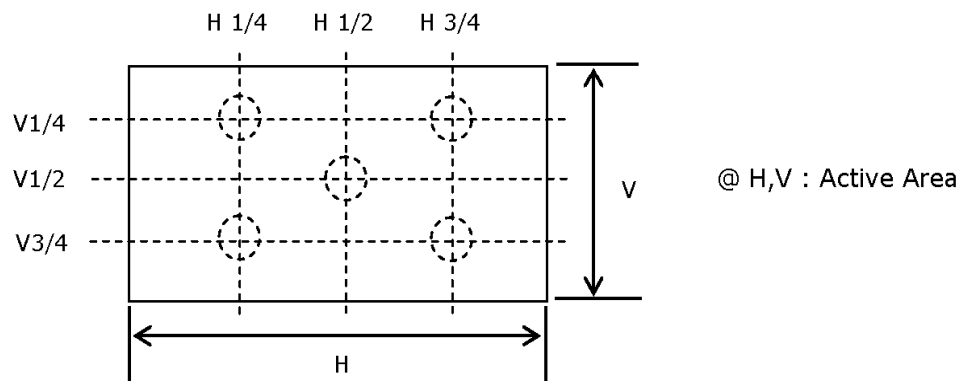


Figure 2. White Luminance (Center) and Uniformity Measurement Locations (5 points)



. White luminance : Center Luminance of white is defined as luminance values of center 1 point.

. Uniformity of 5 points : The White luminance uniformity on LCD surface is expressed as  $\Delta Y5 = \text{Minimum Luminance of five points} / \text{Maximum Luminance of five points}$  ( see Figure 2).

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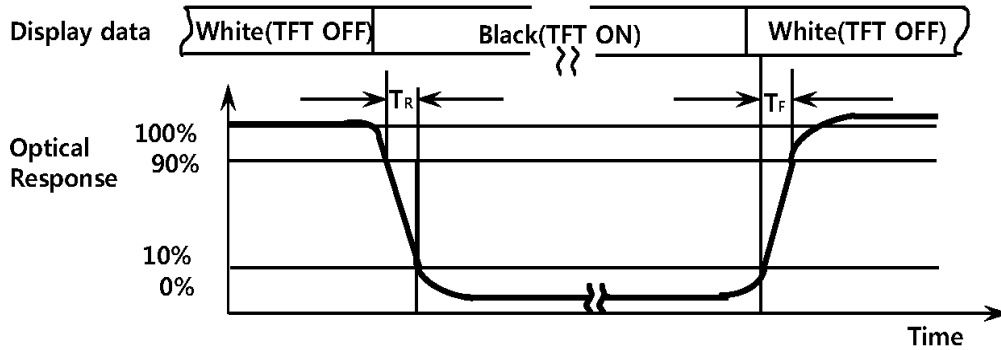
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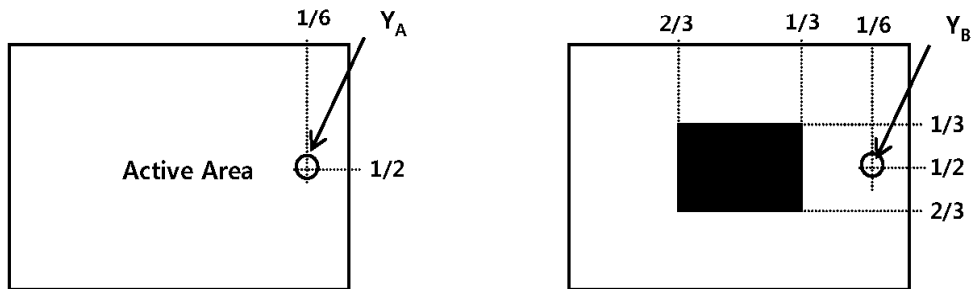
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Figure 3. Response Time Testing



The electro-optical response time measurements luminance to change from 10 % to 90 % is  $T_d$  and 90 % to 10 % is  $T_r$ .

Figure 4. Cross Modulation Test Description



Test point of  $Y_A / Y_B$  : Point of  $Y_B$  (1/6 , 1/2)

$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_B} \right| \times 100$$

Where:

$Y_A$  = Initial luminance of measured area ( $\text{cd}/\text{m}^2$ )

$Y_B$  = Subsequent luminance of measured area ( $\text{cd}/\text{m}^2$ )

## 5.0 Interface Connection.

### 5.1 Electrical interface connection

#### Interface Signal ( CN1 )

Used Connector	DF19L-20P-1H or Equivalent	Hirose
Matching Connector	DF19L-20P-1C or Equivalent	Hirose
Pin	Symbol	Description
1	VDD	Power Supply 3.3V
2	VDD	Power Supply 3.3V
3	VSS	GND
4	VSS	GND
5	RIN0-	Transmission Data of Pixel 0 (-)
6	RIN0+	Transmission Data of Pixel 0 (+)
7	VSS	GND
8	RIN1-	Transmission Data of Pixel 1 (-)
9	RIN1+	Transmission Data of Pixel 1 (+)
10	VSS	GND
11	RIN2-	Transmission Data of Pixel 2 (-)
12	RIN2+	Transmission Data of Pixel 2 (+)
13	VSS	GND
14	RCLK IN-	Sampling Clock (-)
15	RCLK IN+	Sampling Clock (+)
16	VSS	GND
17	NC	No Connection
18	NC	No Connection
19	VSS	GND
20	VSS	GND

#### Back-Light ( CN2 )

Used Connector	51004-0200 or Equivalent	Molex
Pin	Symbol	Description
1	VBL	LED Lamp power Input 17.7Vdc(Typ) : Pink
2	GND	GND : White

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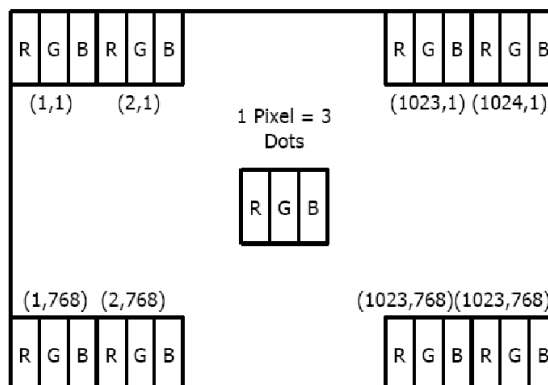
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### 5.2 LVDS Transmitter : THC63LVDM83A or equivalent (8bit Transmitter)

Input Signal	Transmitter		Interface		DF19KR-20P-1H	Remark	
	Pin no.	Pin no.	System(Tx)	TFT-LCD(Rx)	Pin No.		
R0	51	48 47	Out0- Out0+	IN0- IN0+	5 6		
R1	52						
R2	54						
R3	55						
R4	56						
R5	3						
G0	4	46 45	OUT- OUT+	IN1- IN1+	7 8		
G1	6						
G2	7						
G3	11						
G4	12						
G5	14						
B0	15	42 41	OUT2- OUT2+	IN2- IN2+	9 12		
B1	19						
B2	20						
B3	22						
B4	23						
B5	24						
Hsync	27	40	CLKOUT-	CLKIN-	11		
Vsync	28						
DE	30		39	CLKOUT+	CLKIN+		12
MCLK	31						

**Data Input Format**  
Display position  
of Input data



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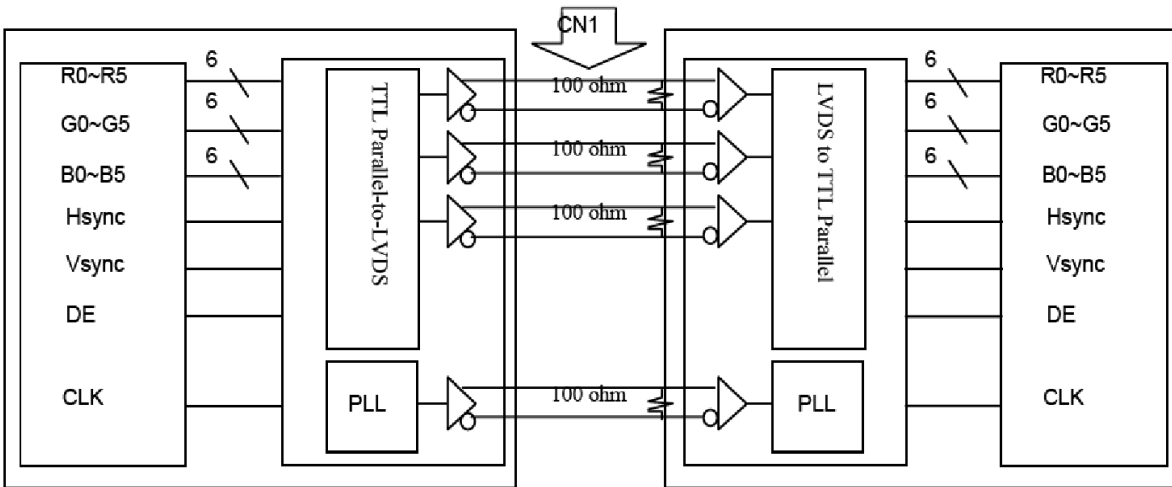
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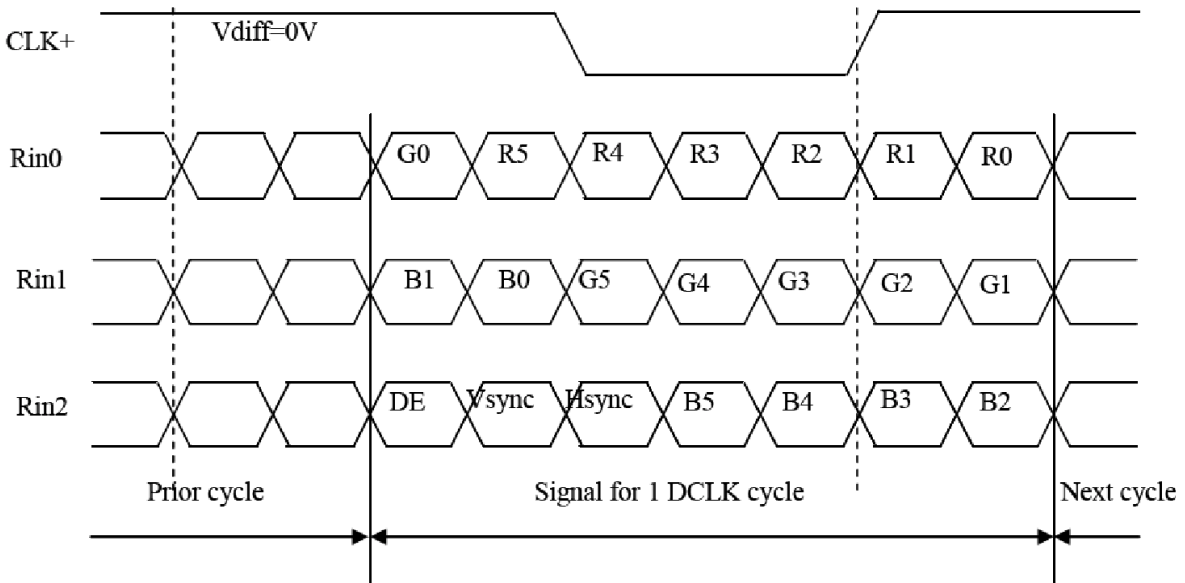
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[ LVDS Interface Block Diagram ]



[ LVDS Input Signal ]



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## 6.0 Signal Timing Specification

### 6.1 LVDS Transmitter Input

De mode only.

Item		Symbol	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	1	65	80	MHz
	High Time	Tch	4.5	-	-	Ns
	Low Time	Tcl	4.5	-	-	Ns
Data	Set-up Time	Tds	2.7	-	-	Ns
	Hold Time	Tdh	0	-	-	Ns
Data enable setup Time		Tes	2.7	-	-	Ns
Frame Period		Tv	772	806	1022	Lines
Vertical Display Period		Tvd	768	768	768	Lines
One line scanning Period		Th	1100	1344	2046	Clocks
Horizontal Display Period		Thd	1024	1024	1024	Clocks

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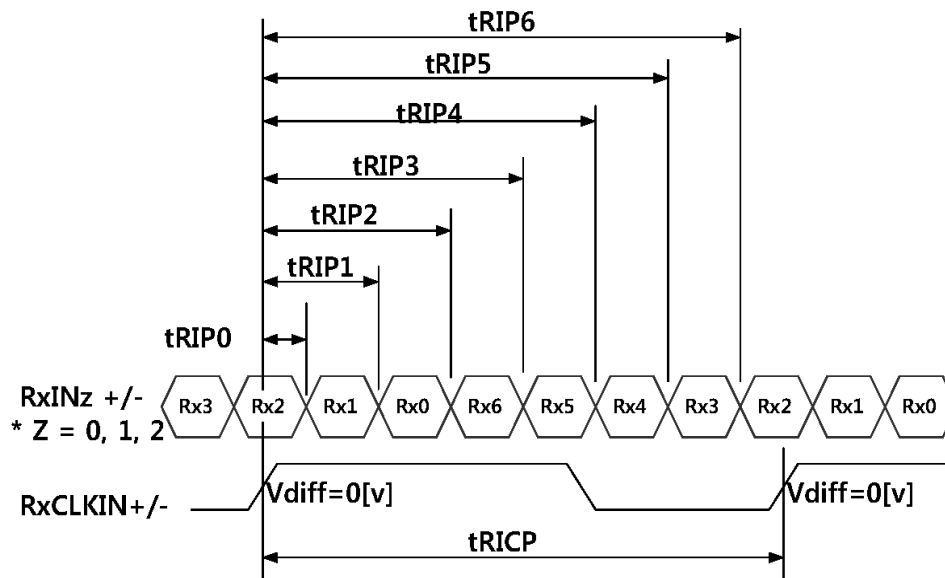
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## 6.2 LVDS Rx interface timing parameter

The specification of the LVDS Rx interface timing parameter is listed in below table.

Item	Symbol	Min	Typ	Max	Unit	Remark
PLL Set	tRPLL	-	-	10.0	msec	
CLKIN Period	tRICP	12.50	15.38	21.16	nsec	
Input Data 0	tRIP0	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP1	$tRICP/7-0.4$	$tRICP/7$	$tRICP/7+0.4$	nsec	
Input Data 2	tRIP2	$2 \times tRICP/7-0.4$	$2 \times tRICP/7$	$2 \times tRICP/7+0.4$	nsec	
Input Data 3	tRIP3	$3 \times tRICP/7-0.4$	$3 \times tRICP/7$	$3 \times tRICP/7+0.4$	nsec	
Input Data 4	tRIP4	$4 \times tRICP/7-0.4$	$4 \times tRICP/7$	$4 \times tRICP/7+0.4$	nsec	
Input Data 5	tRIP5	$5 \times tRICP/7-0.4$	$5 \times tRICP/7$	$5 \times tRICP/7+0.4$	nsec	
Input Data 6	tRIP6	$6 \times tRICP/7-0.4$	$6 \times tRICP/7$	$6 \times tRICP/7+0.4$	nsec	



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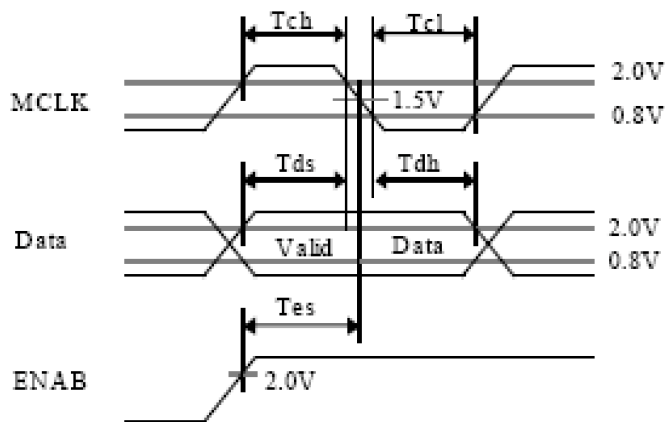
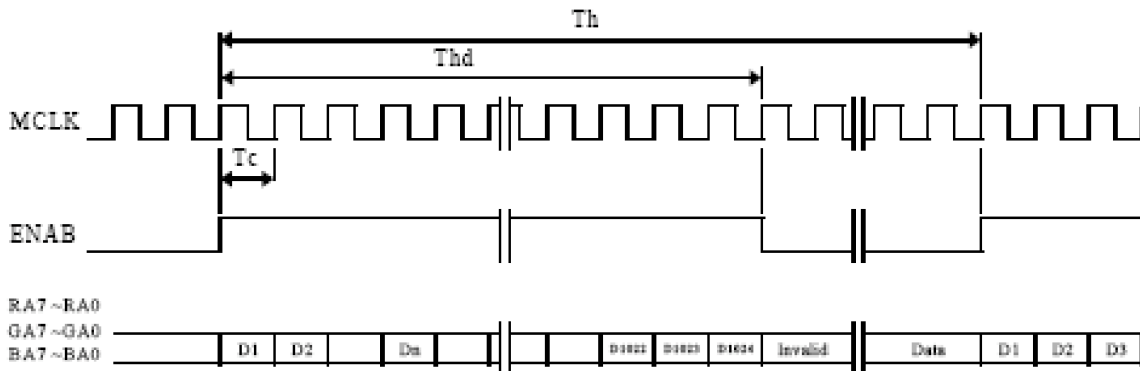
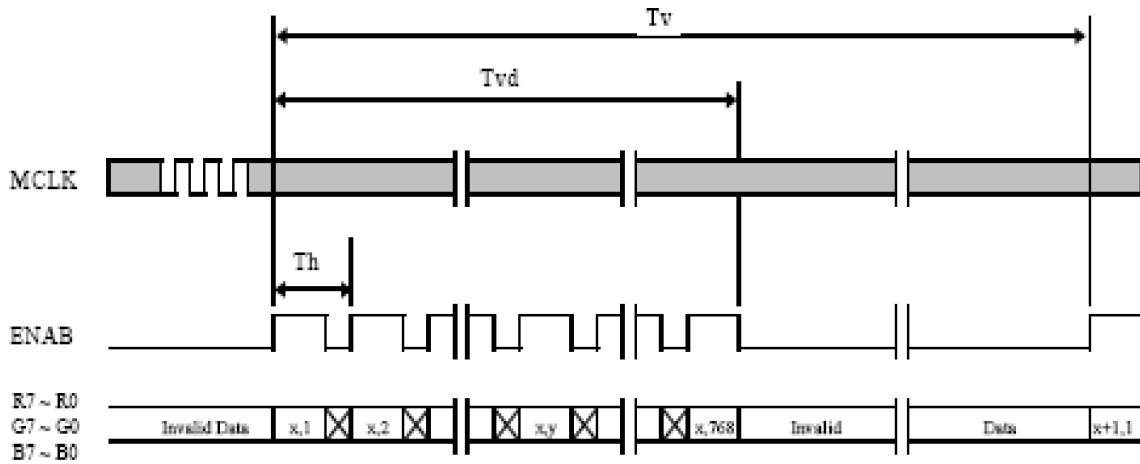
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## 7.0 Timing Waveforms Interface Signal

### 7.1 Timing Waveforms



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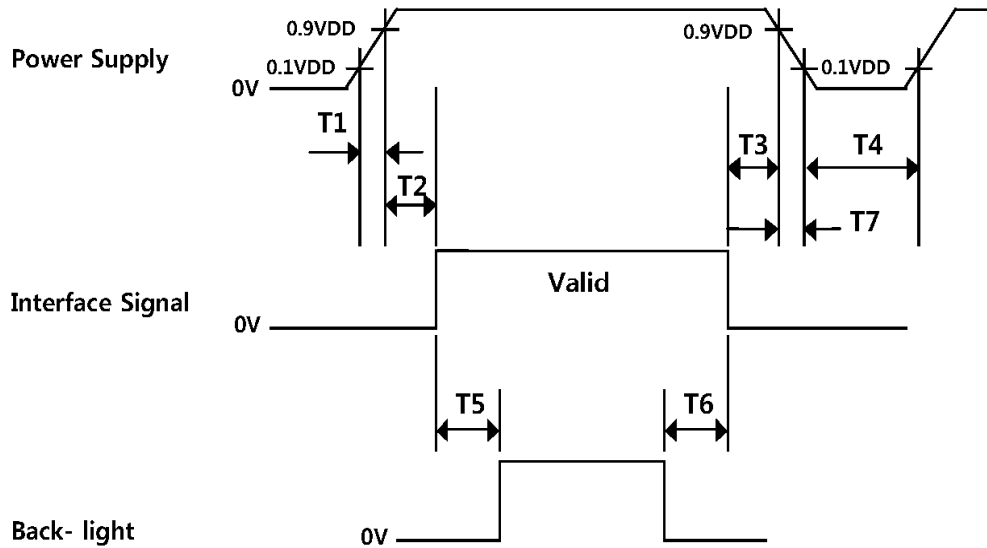
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## 8.0 Power Sequence & Block Diagram

### 8.1 Power Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below.



Parameter	Min	Typ.	Max	Unit
T1	0	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	1	-	-	sec
T5	100	-	-	ms
T6	100	-	-	ms
T7	0	-	10	ms

#### Notes

1. When the power supply VDD is 0 V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.  
Back light must be turn on after power for logic and interface signal are valid.

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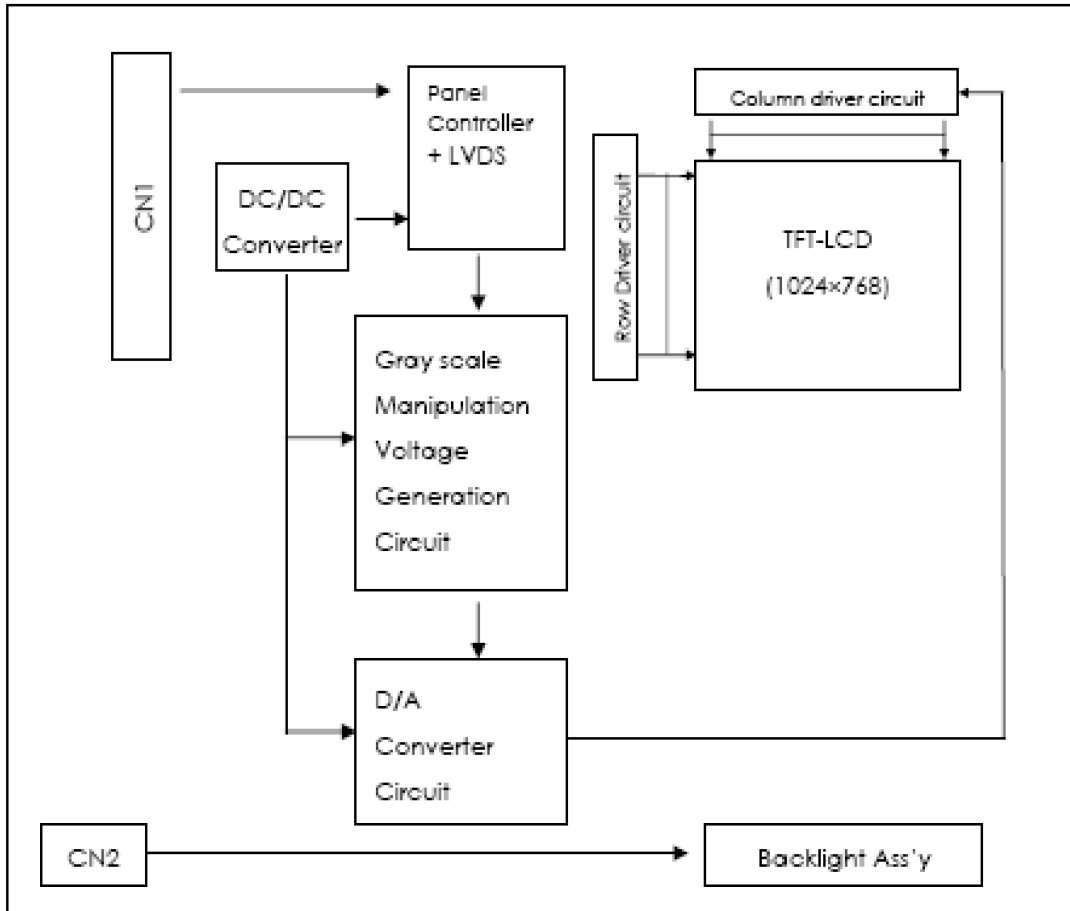
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## 8.2 Block Diagram



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## 9.0 Input Signals , Basic display colors & Gray scale of colors

Each color is displayed in sixty-four gray scales from a 6 bit data signal input. A total of 262,144 colors are derived from the resultant 18 bit data.

Colors & Gray Scale		Red Data						Green Data						Blue Data					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
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
	△	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	▽	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	
Gray Scale Of White & Black	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1
	Darker	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1
	▽	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0
White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

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## Appendix 1. Reliability Test Condition

<Table. Reliability test condition>

No	Test Items	Conditions
1	High temperature storage test	Ta = 80 °C, 240 hrs
2	Low temperature storage test	Ta = -30 °C, 240 hrs
3	High temperature & high humidity operation test	Ta = 50 °C, 85%RH, 240 hrs
4	High temperature operation test	Ta = 70 °C, 240hrs(without BLU & TSP)
5	Low temperature operation test	Ta = -20 °C, 240hrs
6	Thermal shock	Ta = -20 °C ↔ 70 °C (0.5 hr), 100 cycle
7	Vibration test (non-operating)	Gravity / AMP : 1.5G Frequency : 10~300Hz for X,Y,Z axis Period : 30 minutes for each axis
8	Shock test (non-operating)	Gravity : 120G Pulse width : 6ms, half sine wave(X,Y,Z)
9	Electro-static discharge test (non-operating)	Air : 150 pF, 330Ω, 10 KV Contact : 150 pF, 330Ω, 5 KV

Note 1. : Low temperature storage test and Low temperature operation test condition is as assembled with heater.

Note 2. : ON/OFF Cycle

TFT Display module will be capable co being operated over 24,000 ON/OFF cycles (as Backlight & Vcc PWR On / Off)

Note 3. : Mean time between Failure

TFT Display module and interface board assembly (excluding the Backlight) shall have a mean time between failures of 35,000 hours with a confidence level 90%

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## Appendix 2. Handing & Cautions

### (1) Cautions when taking out the module

- Pick the pouch only, when taking out module from a shipping package.

### (2) Cautions for handling the module

- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

### (3) Cautions for the operation

- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

### (4) Cautions for the atmosphere

- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

### (5) Cautions for the module characteristics

- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

### (6) Other cautions

- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

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