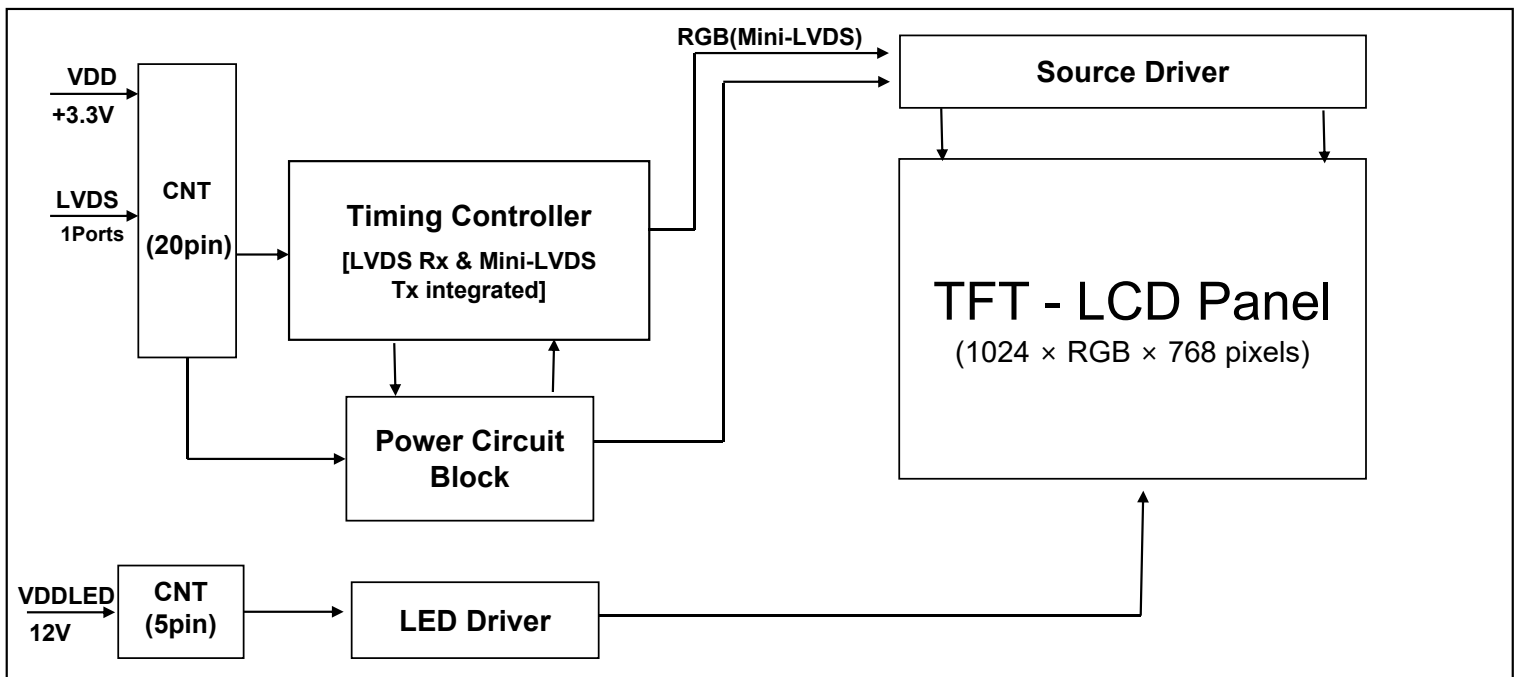


1.0 GENERAL DESCRIPTION

1.1 Introduction

DCE150XGX120-N10-350 is a color active matrix TFT LCD MDL using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This MDL has a 15 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 16.7M colors. The TFT-LCD MDL panel is adapted for a low reflection and higher color type.



1.2 Features

- LVDS interface with 1 pixel / clock
- High-speed response
- Low color shift image quality
- Display 16.7M colors
- Wide viewing angle
- DE (Data Enable) only mode
- IPS technology is applied for high display quality
- RoHS compliant
- 7*18hrs usage support



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1.3 Application

- Display Terminals for Control System
- Landscape and Portrait Display
- Mainly Applies to Game Consoles

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	304.128(H) × 228.096(V)	mm	
Number of pixels	1024(H) × 768(V)	pixels	
Pixel pitch	0.297(H) × 0.297(V)	mm	
Pixel arrangement	Pixels RGB Vertical stripe		
Display colors	16.7M	colors	
Display mode	Normally Black		
Dimensional outline	326.5(H) × 253.5(V) × 9.7(Typ.)	mm	Detail refer to drawing
Weight	930	g	
Power Consumption	10.8	Watt	Typ.
Bezel width (L/R/U/D)	9.64 / 9.64 / 11.15 / 11.15	mm	
Surface Treatment	Haze 25%, 3H		
Back-light	E-LED Light bar Type		48ea LED/BLU
LED life	50000	hrs	
Display Direction	landscape & Portrait		

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2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Open Cell Electrical Specifications >

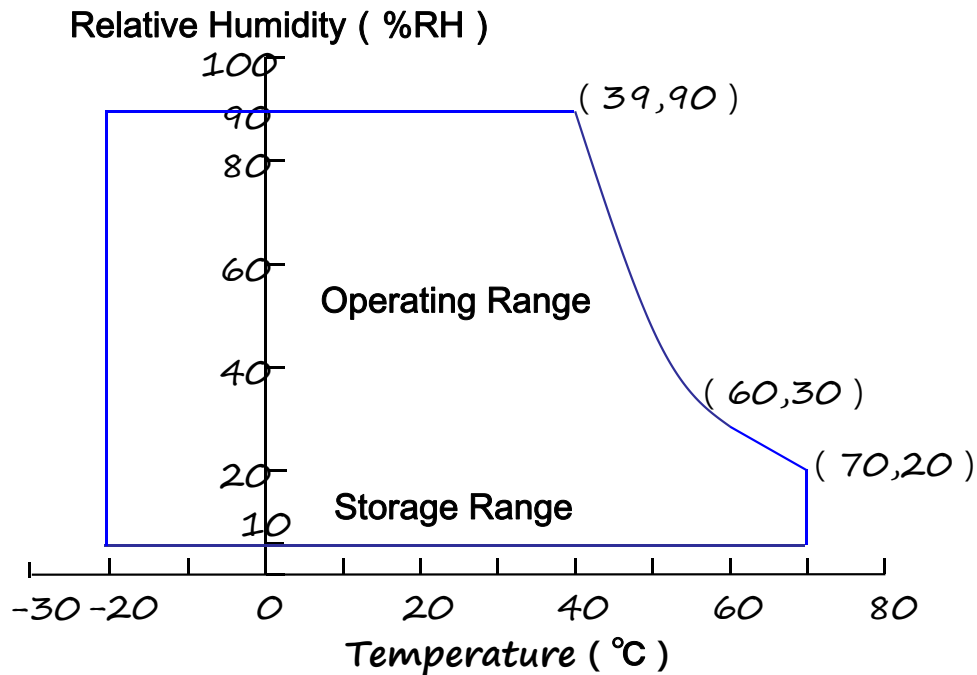
[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	-0.3	4	V	Ta = 25 °C
Operating Temperature	T _{OP}	-20	+70	°C	Note 1 Note 2
Storage Temperature	T _{ST}	-30	+80	°C	
Operating Ambient Humidity	Hop	10	90	%RH	
Storage Humidity	Hst	10	90	%RH	

Note 1 : Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39 °C max. and no condensation of water.

Note 2 : When used near the limit conditions of temperature and humidity, the life will be reduced.



3.0 ELECTRICAL SPECIFICATIONS

3.1 TFT LCD Open Cell

< Table 3. Open Cell Electrical Specifications >

[Ta =25±2 °C]

Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	3.0	3.3	3.6	V	Note 1
Power Supply Current		IDD	-	455	900	mA	
Power Supply Ripple Voltage		VRP	-	-	300	mV	
Rush Current		IRUSH	-	2	3	A	Note 2
LVDS Interface	Differential Input High Threshold Voltage	VLVTH	-	-	+100	mV	VLVC=1.2V
	Differential Input Low Threshold Voltage	VLVTL	-100	-	-	mV	
	Common Input Voltage	VLVC	0.7	-	1.6	V	
CMOS Interface	Input High Threshold Voltage	VIH	0.7VDD	-	VDD	V	
	Input Low Threshold Voltage	VIL	0	-	0.3VDD	V	
Power Consumption		PD		1.5	3	W	
		PBL		9.3	10.2		Note 3
		Ptotal		10.8	13.2		

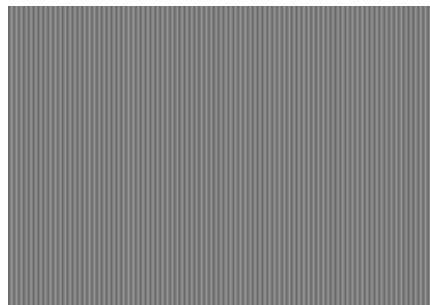
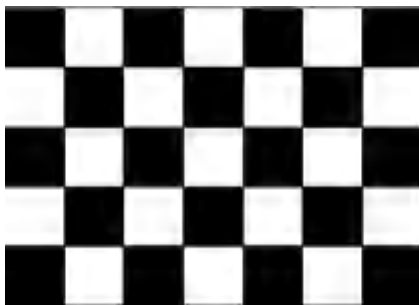
Note 1 : The supply voltage is measured and specified at the interface connector of LCM.

The current draw and power consumption specified is for VDD=3.3V,

Test Pattern of power supply current

a) Typ : Mosaic 7X5 (L0/L255)

b) Max : Vline Subline (L255)



Note 2 : The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

Note 3 : Calculated value for reference (Input pins*VPIN ×IPIN) excluding inverter loss.



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3.0 ELECTRICAL SPECIFICATIONS

3.2 Backlight Unit

< Table 4. Backlight Unit Electrical Specifications >

[Ta =25±2 °C]

Parameter		Min.	Typ.	Max.	Unit	Remarks	
LED Driver Power Supply Voltage		H _{VDD}	10.8	12	12.6	V	
LED Driver Power Supply Current		I _{HVDD}	600	775	850	mA	
EN Control Level	Backlight on	V _{ENH}	3	3.3	3.6	V	EN logic high voltage
	Backlight off	V _{ENL}	0	0	0.6	V	EN logic low voltage
PWM Control Level	PWM High Level	V _{PML}	3	3.3	3.6	V	
	PWM Low Level	V _{PML}	0	0	0.6	V	
PWM Control Frequency		F _{PWM}	0.12	-	20	KHz	Refer to customer comments
Duty Ratio		-	5	-	100	%	
LED Life-Time		N/A	30,000	50,000	-	Hour	Note4
LED Light Bar Input Voltage Per Input Pin		V _{PIN}	32.4	36	39.6	V	
LED Light Bar Input Current Per Input Pin		I _{PIN}	-	45	-	mA	Note2
LED Power Consumption		P _{BL}	-	9.3	10.2	W	Note3

LED bar consists of 48LED packages,4 strings(parallel)*12packages(serial)

Note1: There are one light bar ,and the specified current is input LED chip 100% duty current

Note2: The sense current of each input pin is 45 mA

Note3: PBL=4 Input pins*V_{PIN} × I_{PIN}Note4: The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at I_{PIN}=45mA on condition of continuous operating at 25 ±2 °CSPEC. NUMBER
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4.0 INTERFACE CONNECTION

4.1 Open Cell Input Signal & Power

- LVDS Connector : MSB240420HEA or Compatible.

< Table 4. Open Cell Input Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	VDD	Power Supply , 3.3V(typ.)	11	RIN2-	-LVDS differential data input 2
2	VDD	Power Supply,3.3V(typ.)	12	RIN2+	+LVDS differential data input 2
3	VSS	Ground	13	VSS	Ground
4	NC	No Connection	14	CLKIN-	-LVDS differential clock input CL K
5	RIN0-	-LVDS differential data input 0	15	CLKIN+	+LVDS differential clock input CL K
6	RIN0+	+LVDS differential data input 0	16	VSS	Ground
7	VSS	Ground	17	RIN3-	-LVDS differential data input 3
8	RIN1-	-LVDS differential data input 1	18	RIN3+	+LVDS differential data input 3
9	RIN1+	+LVDS differential data input 1	19	VSS	Ground
10	VSS	Ground	20	NC	No Connection



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4.2 LED Light Bar

-LED connector : CI4205M1HR0-NH or Compatible

< Table 5. LED Light Bar >

Pin No	Symbol	Description
1	NC	No Connection
2	Dimming	PWM Dimming
3	Enable	3.3V-On / 0V-Off
4	GND	Ground
5	VCC	12V

Notes : 1. NC(Not Connected) : This pins are only used for CYD internal operations.

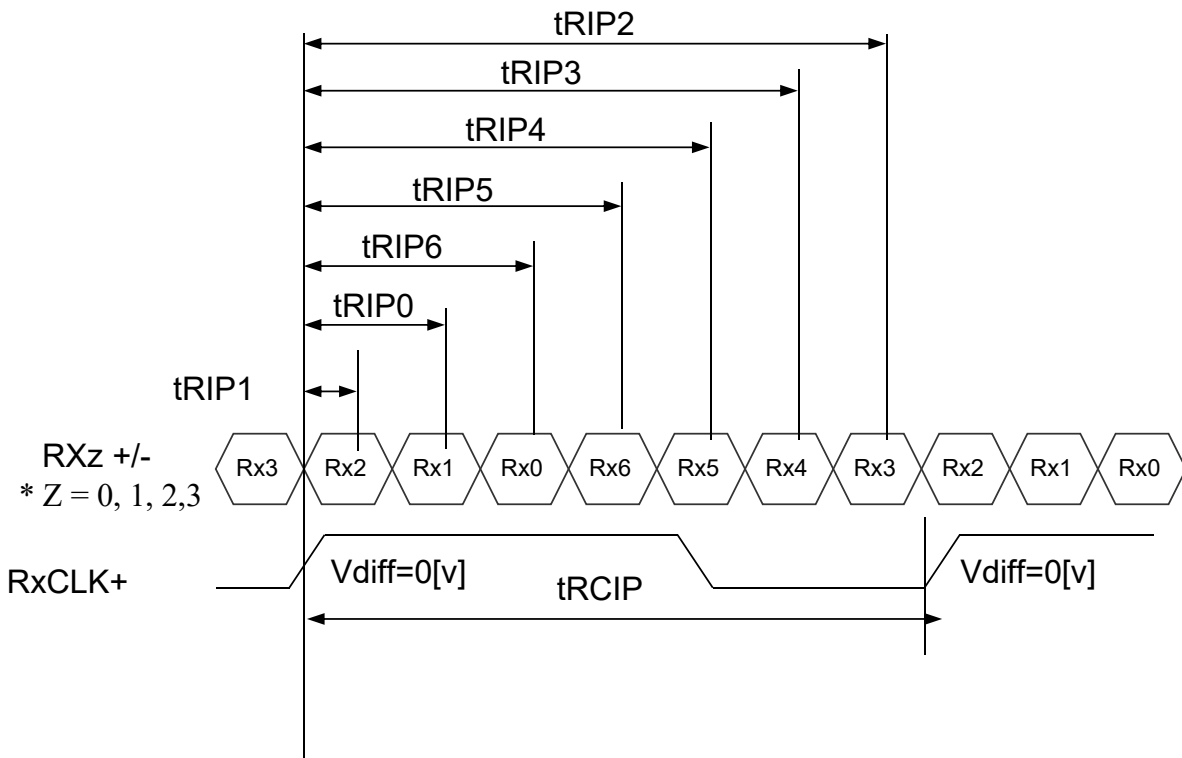
2. Input Level of LVDS signal is based on the EIA-644 Standard

4.3 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 6.

<Table 7. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.31	13.47	15.87	nsec	
Input Data 0	tRIP1	$0.5 \times tRCIP/7-0.4$	$0.5 \times tRCIP/7$	$0.5 \times tRCIP/7 + 0.4$	nsec	
Input Data 1	tRIP0	$1.5 \times tRCIP/7 - 0.4$	$1.5 \times tRCIP/7$	$1.5 \times tRCIP/7 + 0.4$	nsec	
Input Data 2	tRIP6	$2.5 \times tRCIP/7-0.4$	$2.5 \times tRCIP/7$	$2.5 \times tRCIP/7+0.4$	nsec	
Input Data 3	tRIP5	$3.5 \times tRCIP/7-0.4$	$3.5 \times tRCIP/7$	$3.5 \times tRCIP/7+0.4$	nsec	
Input Data 4	tRIP4	$4.5 \times tRCIP/7-0.4$	$4.5 \times tRCIP/7$	$4.5 \times tRCIP/7+0.4$	nsec	
Input Data 5	tRIP3	$5.5 \times tRCIP/7-0.4$	$5.5 \times tRCIP/7$	$5.5 \times tRCIP/7+0.4$	nsec	
Input Data 6	tRIP2	$6.5 \times tRCIP/7-0.4$	$6.5 \times tRCIP/7$	$6.5 \times tRCIP/7+0.4$	nsec	



* $V_{diff} = (RXz+) - (RXz-), \dots, (RXCLK+) - (RXCLK-)$

5.0 SIGNAL TIMING SPECIFICATION

5.1 Timing Parameters (DE only mode)

< Table 8. Timing Table >

Item		Symbols		Min	Typ	Max	Unit
Clock	Frequency	1/Tc		45	50	65	MHz
	High Time	Tch		-	4/7Tc	-	
	Low Time	Tcl		-	3/7Tc	-	
Frame Period		Tv		48	60	61	Hz
Horizontal Active Display Term		Valid	t _{HV}	-	1024	-	t _{CLK}
		Total	t _{HP}	1200	1344	1400	t _{CLK}
Vertical Active Display Term		Valid	t _{VV}	-	768	-	t _{HP}
		Total	t _{VP}	788	806	845	t _{HP}

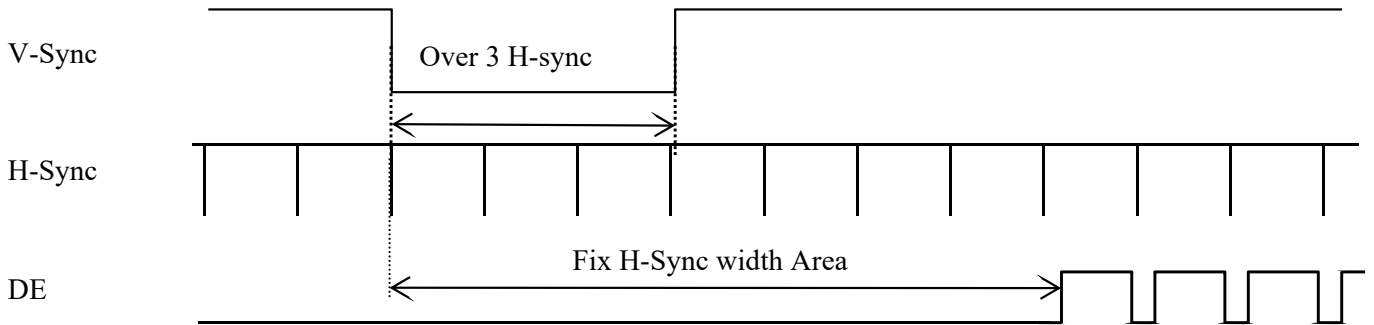
Notes: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

< Table 9. LVDS Input SSCG >

Symbol	Parameter	Condition	Min	Typ	Max	Unit
F	LVDS Input frequency	-	45	-	65	MHz
T _{LVSK}	LVDS channel to channel skew	F=58MHz V _{IC} =1.2V V _{ID} =±200mV	-600	-	+600	ps
F _{LVMOD}	Modulating frequency of input clock during SSC	F=58MHz V _{IC} =1.2V V _{ID} =±200mV	10	-	300	KHz
F _{LVDEV}	Maximum deviation of input clock frequency during SSC		-3	-	+3	%
T _{CY-CY}	Cycle to Cycle jitter		-	-	200	ps

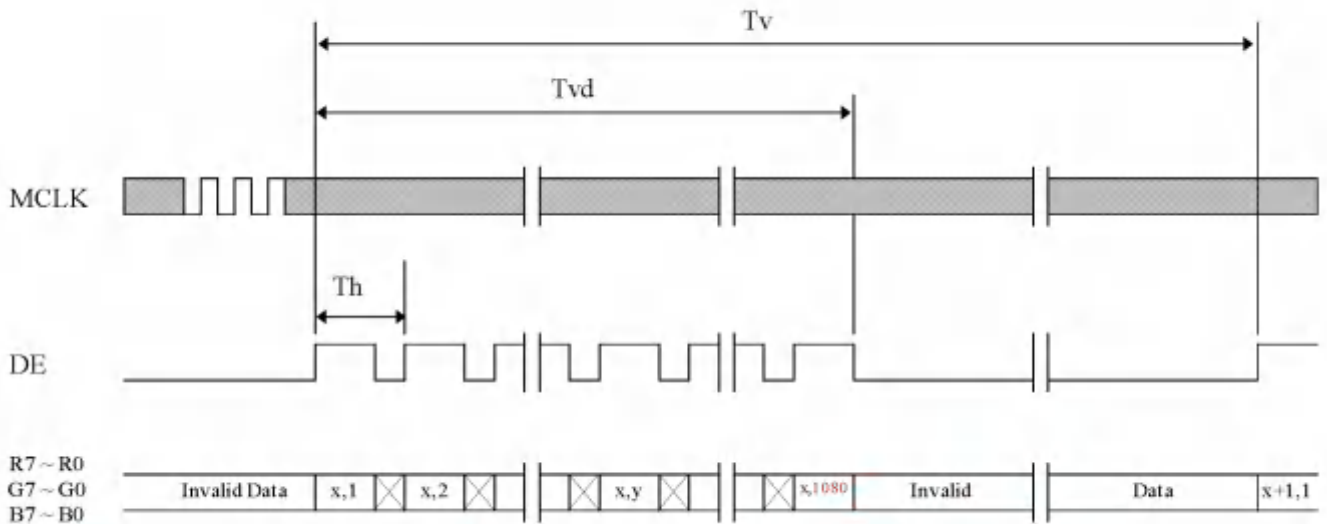
5.2 Signal Timing Waveform

5.2.1 Sync Timing Waveform

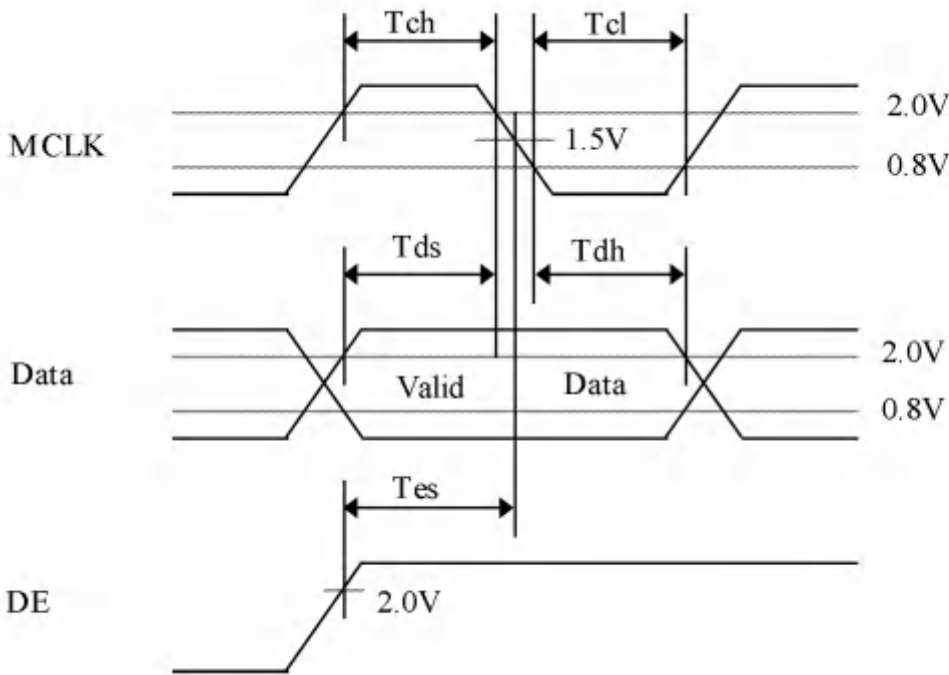
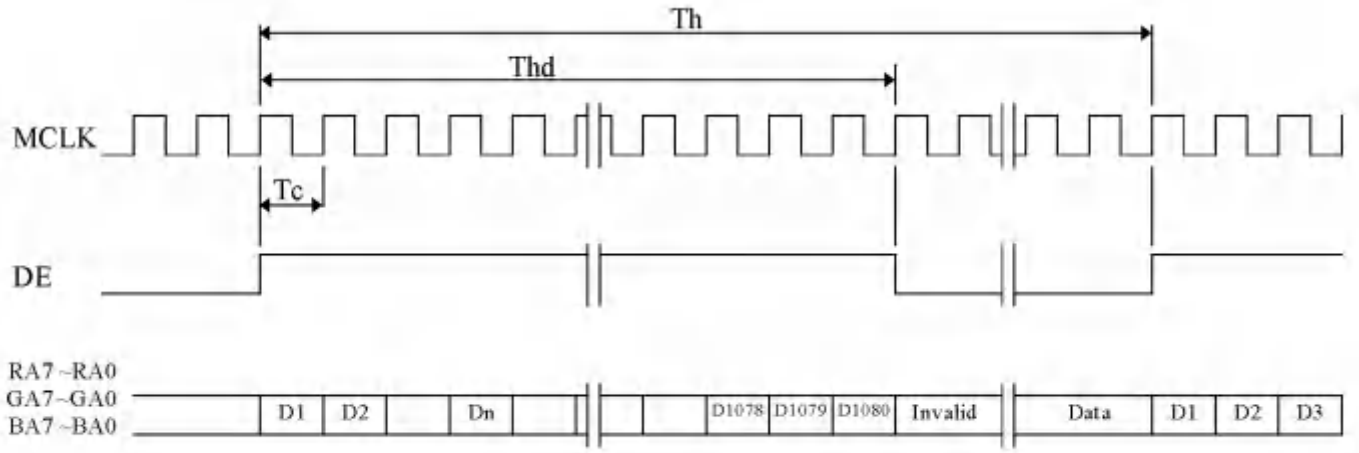


- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

5.2.2 Vertical Timing Waveform



5.2.3 Horizontal Timing Waveform





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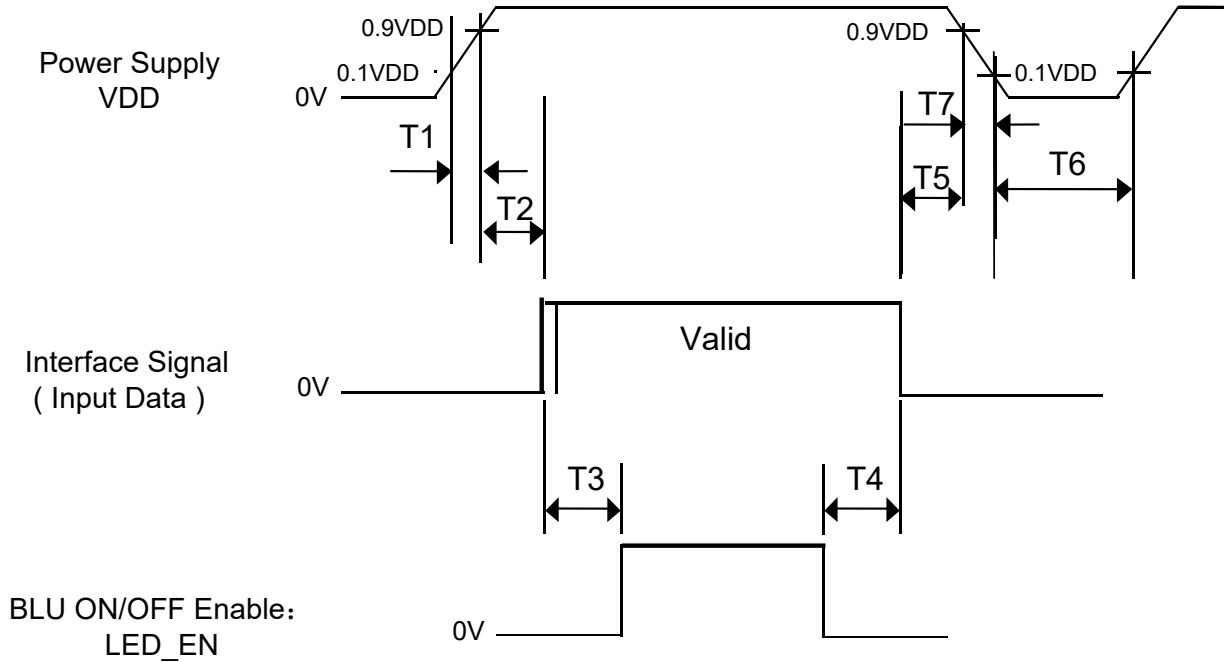
5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< Table 10. Input Signal and Display Color Table >

Color & Gray Scale		Input Data Signal																						
		Red Data								Green Data								Blue Data						
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1
Basic Colors	Black	0	0	0	0	0	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	0	0	0	0	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	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	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	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	△	↑								↑								↑						
	▽	↓								↓								↓						
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	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	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	0	0	0	0	1	0	0	0	0	0	0	0	
	△	↑								↑								↑						
	▽	↓								↓								↓						
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	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	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	0	0	0	0	0	1	
	△	↑								↑								↑						
	▽	↓								↓								↓						
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Gray Scale of White	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	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	
	△	↑								↑								↑						
	▽	↓								↓								↓						
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	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	1	1	1	1	1

5.4 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



< Table 11. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	500	-	-	ms
T4	500	-	-	ms
T5	0	-	30	ms
T6	1	-	-	s

- Notes:
1. Back Light must be turn on after power for logic and interface signal are valid.
 2. Even though T1 is out of SPEC, it is still ok if the inrush current of VDD is below the limit.
 3. When $VDD < 0.9VDD$ (Typ.), Power off.
 4. T7 decreases smoothly, if there were rebounding voltage, it must smaller than 0.5 volts.

6.0 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 (Goniometer system and PR788) and test unit shall be located at an approximate distance 180cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . We refer to $\theta_{\Phi=0}$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta_{\Phi=90}$ ($=\theta_{12}$) 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 θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 12.0V at 25°C . Optimum viewing angle direction is 6 'clock.

< Table 12. Optical Table >

[VDD = 5.0V, Frame rate = 60Hz, Ta = $25\pm 2^{\circ}\text{C}$]

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle	Horizontal	θ_3	CR > 10	85	89		Deg.	Note 1
		θ_9		85	89		Deg.	
	Vertical	θ_{12}		85	89		Deg.	
		θ_6		85	89		Deg.	
Center Luminance of White		Lc	$\theta = 0^{\circ}$ ILED=55m A	300	350		nit	Note 2
Uniformity	9 Points	ΔY_9		75%	80%			Note 3
Contrast ratio		CR	$\theta = 0^{\circ}$	800:1	1200:1	-		Note 4
Reproduction of color	White	Wx	$\theta = 0^{\circ}$ (Center) Normal Viewing Angle	TYP. - 0.04	0.306	TYP.+ 0.04		Note 5
		Wy			0.309			
	Red	Rx			0.613			
		Ry			0.338			
	Green	Gx			0.329			
		Gy			0.625			
	Blue	Bx			0.145			
		By			0.062			
Color Gamut				60	72	-	%	
Response Time	Tr+Tf			-	30	35	ms	Note 6
Gamma Scale				2.0	2.2	2.4		



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Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing 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.
2. Definition of Luminance of White (Lc): Measure the luminance of gray level 255 at center point , LC=L(5), (see Figure 1 shown in Appendix 12.0).
3. The White luminance uniformity on LCD surface is then expressed as : $\Delta Y = \text{Minimum Luminance of 9 points} / \text{Maximum Luminance of 9 points.}$ (see Figure 1 shown in Appendix 12.0)
4. Contrast measurements shall be made at viewing angle of $\theta = 0^\circ$ 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. (See Figure 2 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

5. The color chromaticity coordinates specified in Table 9 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. The BLU is used by CYD.
6. Response time Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate fV =60Hz to optimize.

Each time in below table is defined as Figure 3 and shall be measured by switching the

Measured Response Time	Target																
	0	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255
0																	
15																	
31																	
47																	
63																	
79																	
95																	
111																	
127																	
143																	
159																	
175																	
191																	
207																	
223																	
239																	
255																	

7. Definition of Transmittance (T%) :

Module is with white(L255) signal input

$$\text{Transmittance} = \frac{\text{Luminance of LCD Module}}{\text{Luminance of BLU}} \times 100 \%$$



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7.0 MECHANICAL CHARACTERISTICS

7.1 Dimensional Requirements

Figure 3(located in Appendix 12.0)

shows mechanical outlines for the model CYD150VGXI20-N10

Other parameters are shown in Table 13.

< Table 13. Dimensional Parameters >

Parameter	Specification	Unit
Dimensional outline	326.5(H) × 253.5(V) × 9.7(D)	mm
Weight	930	gram
Active area	304.128(H) × 228.096(V)	mm
Pixel pitch	0.297(H) × 0.297(V)	mm
Number of pixels	1024(H) × 768(V) (1 pixel = R + G + B dots)	pixels

7.2 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an anti-glare coating to minimize reflection and a coating to reduce scratching.



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8.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

< Table 14. Reliability Test Parameters >

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 storage test	Ta = 60 °C, 90%RH, 240hrs
4	High temperature operation test	Ta = 70 °C, 240 hrs
5	Low temperature operation test	Ta = -20°C, 240hrs
6	High temperature & high humidity operation test	Ta = 50 °C, 80%RH, 240hrs
7	Thermal shock	Ta = -20°C~60°C , per 30min , 100cycle , Storage
8	ESD	Contact ±8kv : Class B ; Air ±14 kv : Class B
9	Packing VIB/Drop	Highway condition (0.82Grms, 1-200Hz, Random +Z/X/Y1/0.5/0.5hr) /One side fixed drop
10	VIB	10~300Hz, 1.5G, Sine, ±X, ±Y, ±Z Sweep (30 min)
11	Shock	50G,20ms,Half-sine wave, (±X,±Y,±Z), Storage

- This test condition is based on CYD Model.

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