



深圳显昶光电科技有限公司

Shenzhen Xianyang Optoelectronic Technology Co., Ltd

PRODUCTION SPECIFICATION OF LCD MODULE

MODULE NO.: XY121XGH01

Customer Name:			
Customer Part Number:			
Approved By:		Date:	

Prepared By	Checked By	Approved By

Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	Jun. 8, 2020		Tentative Product Specification was first released.

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1.0 GENERAL DESCRIPTION

1.1 Introduction

TDO Display model XY121XGH01 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a backlight system. This TFT LCD has a 12.1 inch diagonally measured active display area with XGA (1024 horizontal by 768 vertical pixel) resolution.

1.2 Features

- 12.1 (4:3 diagonal) inch configuration
- 16.7M
- ROHS / Halogen Free Compliance

1.3 Applications

- Automobile

1.4 General information

Item		Specification	Unit
Outline Dimension		260.5 (H) x 204 (V) x 8.6 (D) (Typ)	mm
Display area		245.76(H)x184.32(V) (12.1" diagonal)	mm
Number of Pixel		1024(H) x 768(V)	pixels
Pixel pitch		0.2400(H) x 0.2400(V)	mm
Pixel arrangement		RGB Vertical Stripe	
Display mode		Normally Black	
NTSC		70(Typ.)	%
Surface treatment		Antiglare, Hard-Coating (3H)	
Weight		520(Max.)	g
Back-light		Single LED (Side-Light type)	
Power Consumption	Logic System (White Pattern)	Logic 0.8W(typ) 1.2W(max)	W
	B/L System	10.8W(max.)	W

1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	260.0	260.5	261.0	mm
	Vertical (V)	203.5	204	204.5	mm
	Depth (D)	8.3	8.6	8.9	mm
Weight		–	500	520	g

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Logic supply voltage	V_{DD}	-0.3	5.0	V	
Back-light supply voltage	V_i	-0.3	28.0	V	

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-20	70	°C	
Storage Temperature	T_{stg}	-30	85	°C	

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0 Normal viewing angle	600	900	-		(1)(2)
Response time	Rising	TR+TF		-	30	40	msec	(1)(3)
	Falling							
White luminance (Center)		Y _L		500	600	-	cd/m ²	(1)(4) (I _L =240mA)
Color chromaticity (CIE1931)	White	W _x		0.251	0.291	0.331		(1)(4)
		W _y		0.288	0.328	0.368		
	Red	R _x		0.613	0.653	0.703		
		R _y		0.302	0.342	0.382		
	Green	G _x		0.264	0.304	0.344		
		G _y		0.581	0.621	0.661		
	Blue	B _x		0.104	0.144	0.184		
		B _y		0.054	0.094	0.134		
Viewing angle	Hor.	Θ _L	CR>10	80	85	-		
		Θ _R		80	85	-		
	Ver.	Θ _U		80	85	-		
		Θ _D		80	85	-		
Brightness uniformity		B _{UNI}	Θ=0	70	80	-	%	(5)
Optima View Direction		Free						(6)

3.2 Measuring Condition

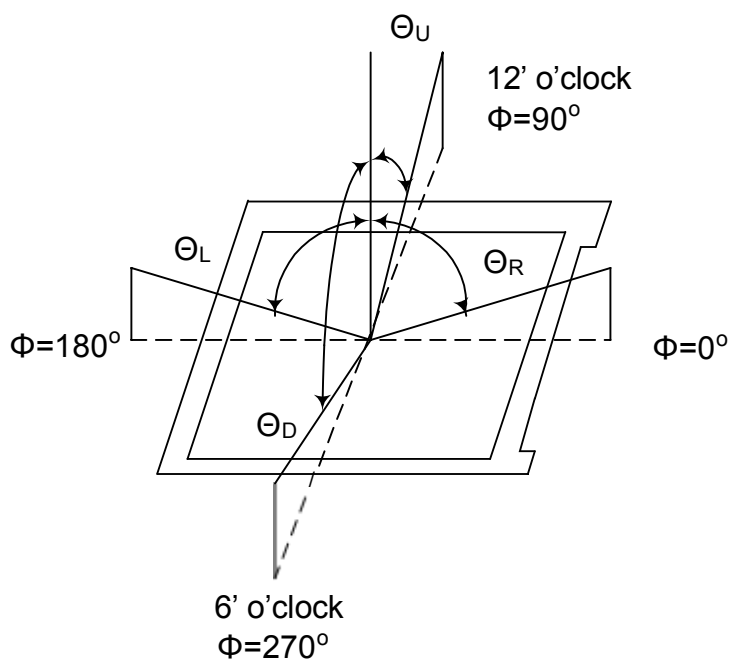
- Measuring surrounding : dark room
- LED current I_L : 240mA
- Ambient temperature : $25\pm 2^\circ\text{C}$
- 15min. warm-up time.

3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

- Measuring spot size : 20 ~ 21 mm

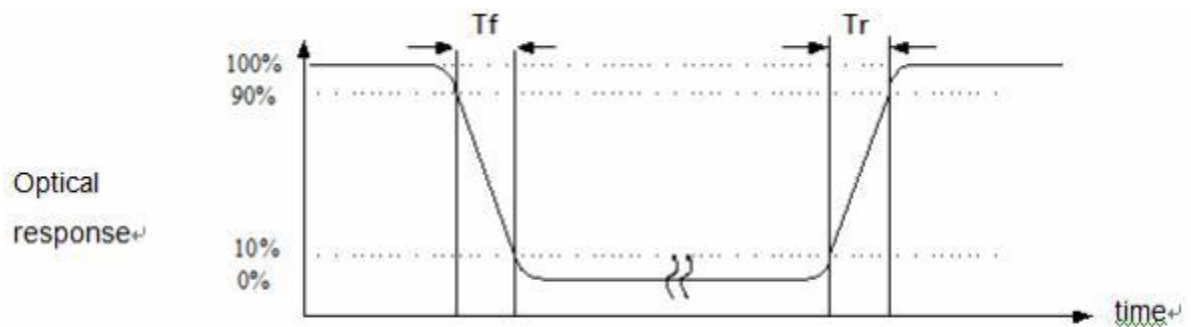
Note (1) Definition of Viewing Angle:



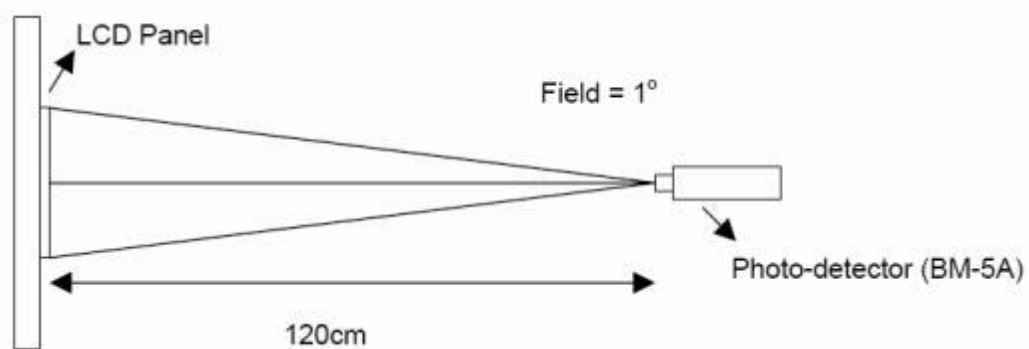
Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

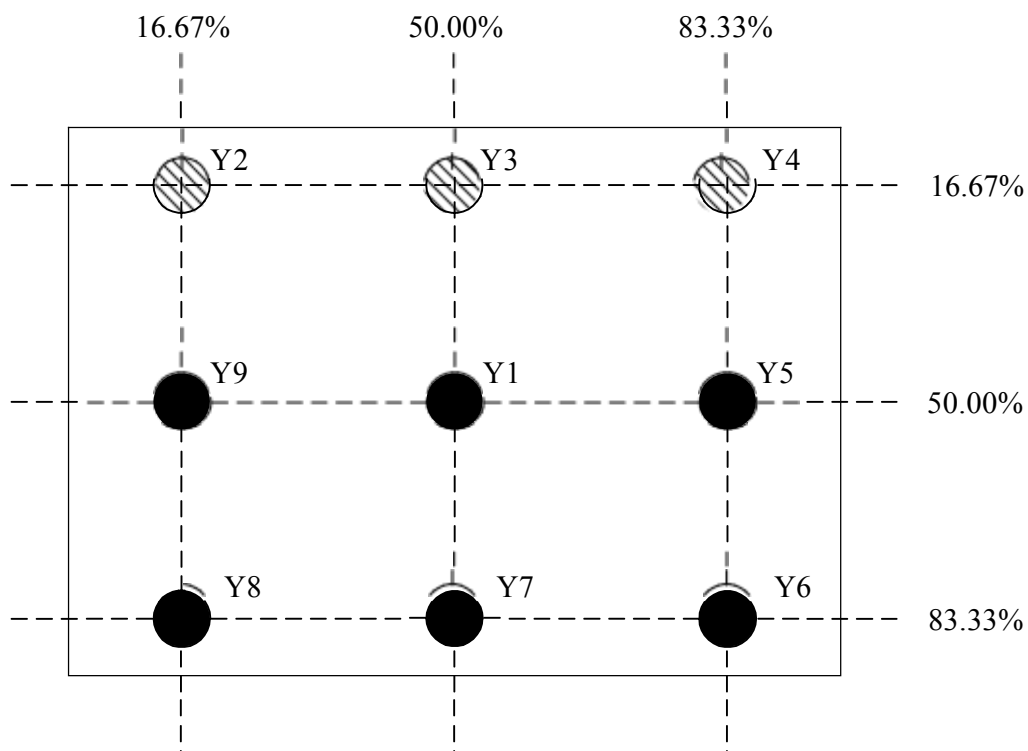
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Definition of brightness uniformity

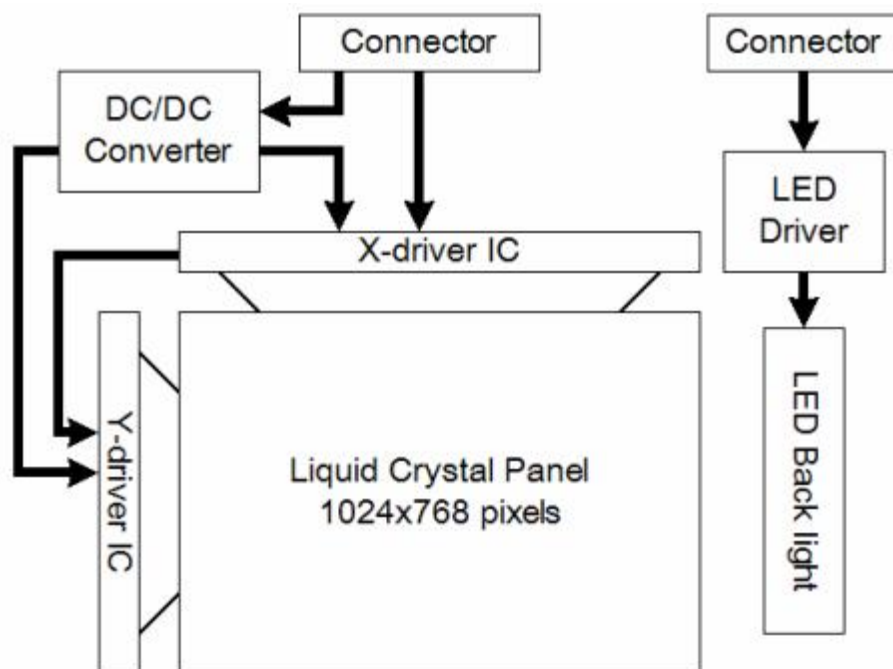


$$\text{Luminance uniformity} = \frac{(\text{Min Luminance of 9 points})}{(\text{Max Luminance of 9 points})} \times 100\%$$

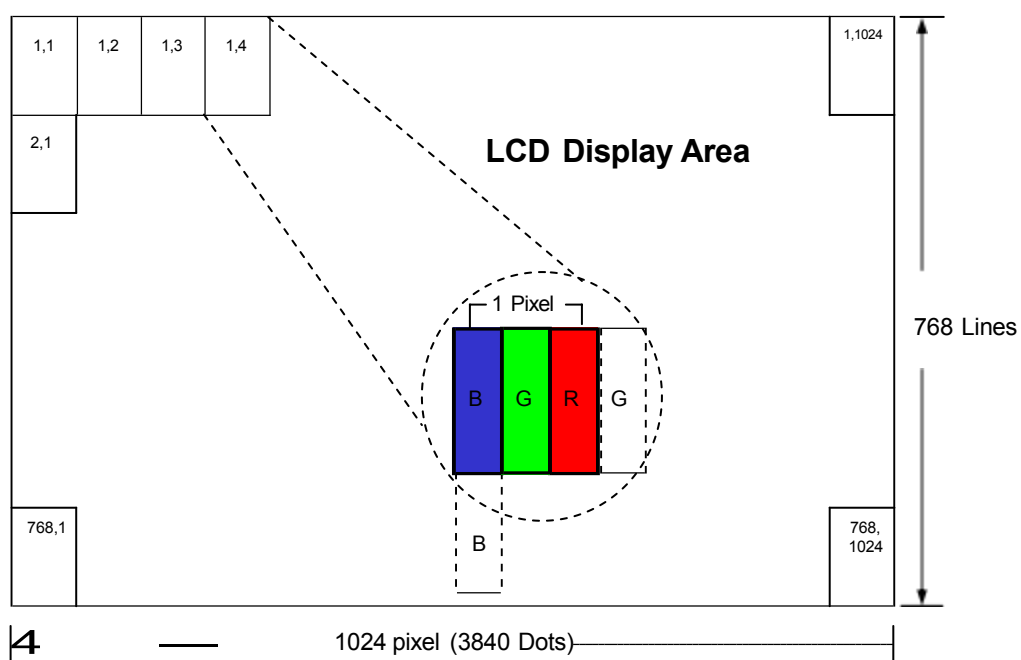
Note (6) : Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.

4.0 BLOCK DIAGRAM

4.1 TFT LCD Module:



4.2 Pixel Format



4.3 Relationship Between Displayed Color and Input

	Display	MSB LSB								MSB LSB								MSB LSB								Gray scale Level
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0	
Basic color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	Light Blue	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Purple	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
Gray scale of Red	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
		:								:								:								L3...L251
		H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L252
	Light	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L253
		H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L254
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Red L255
Gray scale of Green	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L2
		:								:								:								L3...L251
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L252
	Light	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L253
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L254
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	Green L255
Gray scale of Blue	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L2
		:								:								:								L3...L251
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L252
	Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L253
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L254
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	Blue L255
Gray scale of White & Black	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L	L	L	L	L	L	H	L	L1
		L	L	L	L	L	L	H	L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L	L	L2
		:								:								:								L3...L251
		H	H	H	H	H	H	L	L	H	H	H	H	H	H	L	L	H	H	H	H	H	H	L	L	L252
	Light	H	H	H	H	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	L	L253
		H	H	H	H	H	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	L	L	L	L254
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	White L255

5.0 INTERFACE PIN CONNECTION

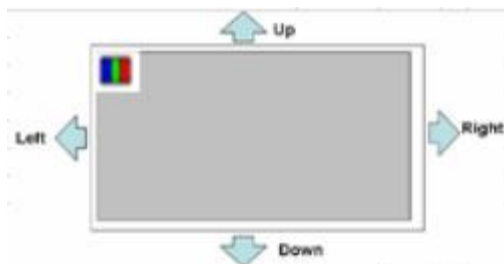
5.1 LCM connector pin assignment (CN1) : STARCONN 076B20-0048RA-G4 or JAE FI-SEB20P-HFE (or equivalent)

Pin NO.	Symbol	Description	Note
1	RX3+	Differential Data Input, CH3 (Positive)	
2	RX3-	Differential Data Input, CH3 (Negative)	
3	BIST	Normal operation/BIST pattern select. BIST="1" : BIST mode. BIST="0" : Normal operation.	Note*
4	SEL68	6bit/8bit mode select, SELB = "1" : LVDS input data is 8bits SELB = "0" : LVDS input data is 6bits	Note*
5	GND	Ground	
6	RXC+	Differential Clock Input (Positive)	
7	RXC-	Differential Clock Input (Negative)	
8	GND	Ground	
9	RX2+	Differential Data Input , CH2 (Positive)	
10	RX2-	Differential Data Input , CH2 (Negative)	
11	GND	Ground	
12	RX1+	Differential Data Input , CH1 (Positive)	
13	RX1-	Differential Data Input, CH1 (Negative)	
14	GND	Ground	
15	RX0+	Differential Data Input, CH0 (Positive)	
16	RX0-	Differential Data Input, CH0 (Negative)	
17	reLR	Left or right display control SHLR="1" : Right → Left SHLR="0" :Left → Right	Note*
18	reUD	Up / down display control UPDN="1" : Down → Up UPDN="0" : Up → Down	Note*
19	VDD	Power supply, 3.3V	
20	VDD	Power supply, 3.3V	

Note* : The high level voltage "1" is 3.3V, and the low level voltage "0" is GND.

Note 1 : UPDN and SHLR control function

reLR	reUD	Data shifting
0	0	Left→Right, Up→Down
1	0	Right→Left, Up→Down
0	1	Left→Right, Down→Up
1	1	Right→Left, Down→Up


5.2 Backlight Pin Assignment (CN2) : ACES 91208-01001-H01 (or equivalent)

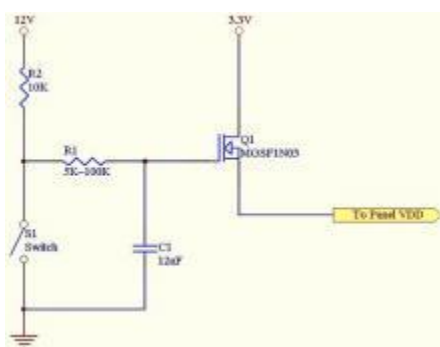
Pin NO.	Symbol	Description	Note
1	Vi	Converter input voltage	12V
2	Vi	Converter input voltage	12V
3	Vi	Converter input voltage	12V
4	Vi	Converter input voltage	12V
5	VGND	Converter ground	Ground
6	VGND	Converter ground	Ground
7	VGND	Converter ground	Ground
8	VGND	Converter ground	Ground
9	EN	Enable pin	3.3V
10	ADJ	Backlight Adjust	PWM Dimming (100Hz-30KHz, Hi: 2.0~3.3V,Lo : 0~0.8V)

6.0 ELECTRICAL CHARACTERISTICS

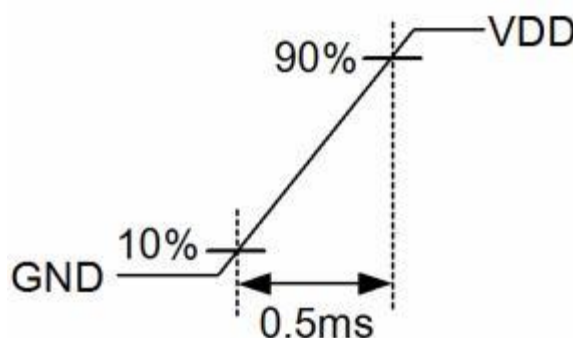
6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V_{DD}	3.0	3.3	3.6	V	
Current of power supply	I_{DD}	-	0.25	-	A	$V_{DD} = 3.3V$ 、white pattern (L255)
VDD Power	P_{DD}	-	0.8	1.2	W	$V_{DD} = 3.3V$ 、white pattern (L255)
Inrush current	I_{RUSH}	-	-	2.0	A	Note*

Note* : Inrush current test circuit and rising time setting (power on)



Test circuit



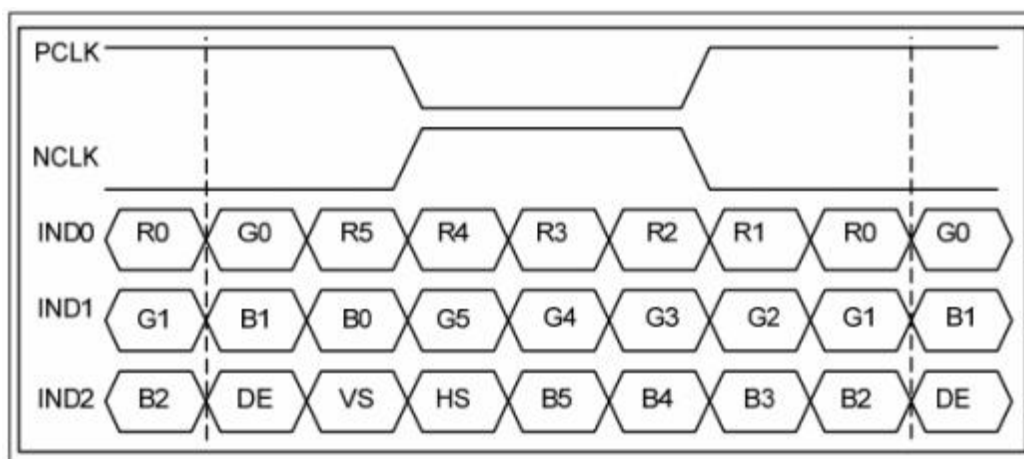
Rising time

6.2 Switching Characteristics for LVDS Receiver

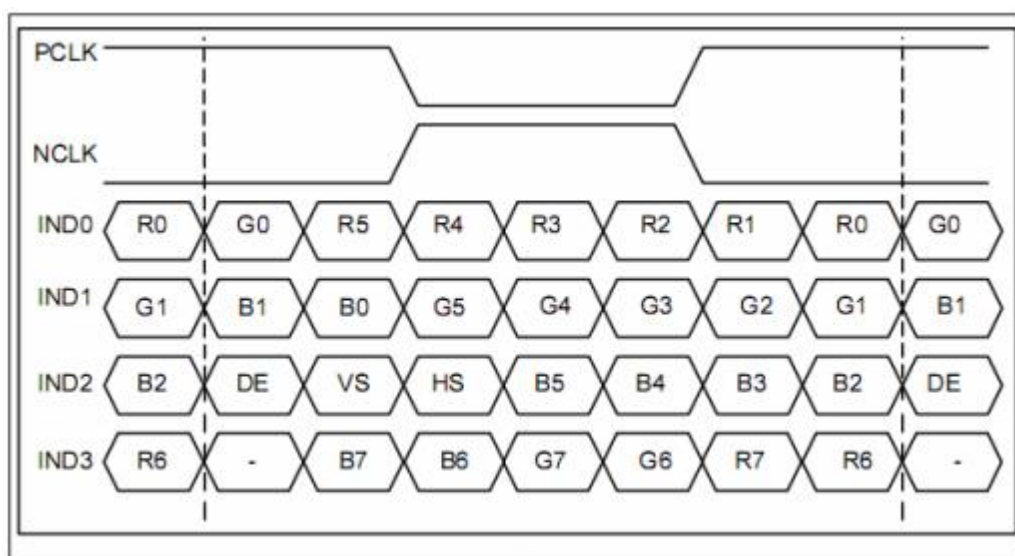
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	V_{TH}	100	-	300	mV	
Differential Input Low Threshold	V_{TL}	-300	-	100	mV	
Differential input common mode voltage	V_{CM}	1.0	1.2	$1.7 - V_{ID} /2$	V	
Input Current	I_{IN}	-10	-	10	uA	RX+/-, RXC+/-
Differential input Voltage	$ V_{ID} $	200	-	600	mV	

6.3 Bit LVDS input

6.3.1 6bit LVDS input



6.3.2 8Bit LVDS input

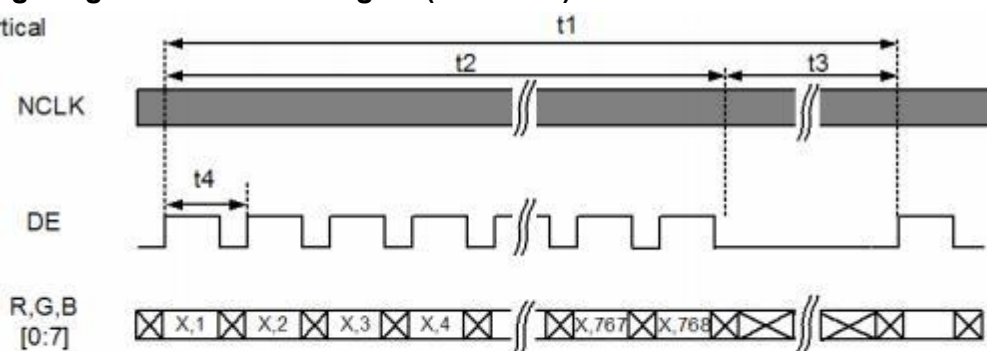


6.4 Interface Timing (DE mode)

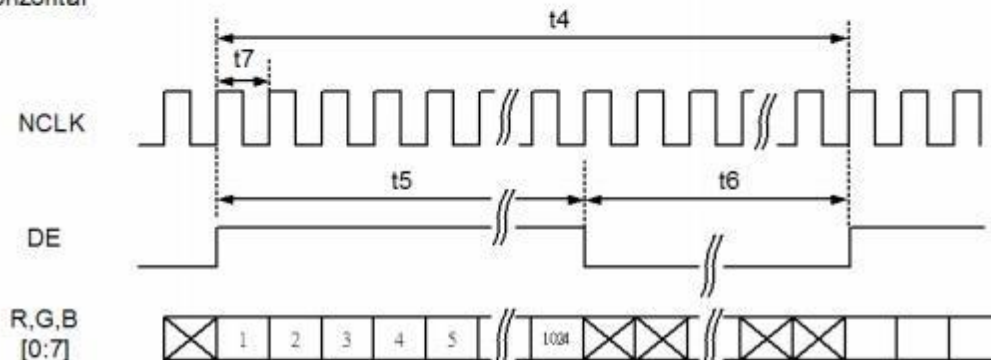
Item	Symbol	Min.	Typ.	Max.	Unit
Frame Rate	--	59.95	60.05	60.15	Hz
Vertical Total Time	T_v	774	776	778	line
Vertical Display Time	T_{VD}	768			line
Vertical Blanking Time	T_{VB}	6	8	10	line
Horizontal Total Time	T_H	1084	1088	1092	clock
Horizontal Display Time	T_{HD}	1024			clock
Horizontal Blanking Time	T_{HB}	60	64	68	clock
Clock Rate	$1/T_{Clock}$	50.3	50.7	51.1	MHz

Timing Diagram of Interface Signal (DE mode)

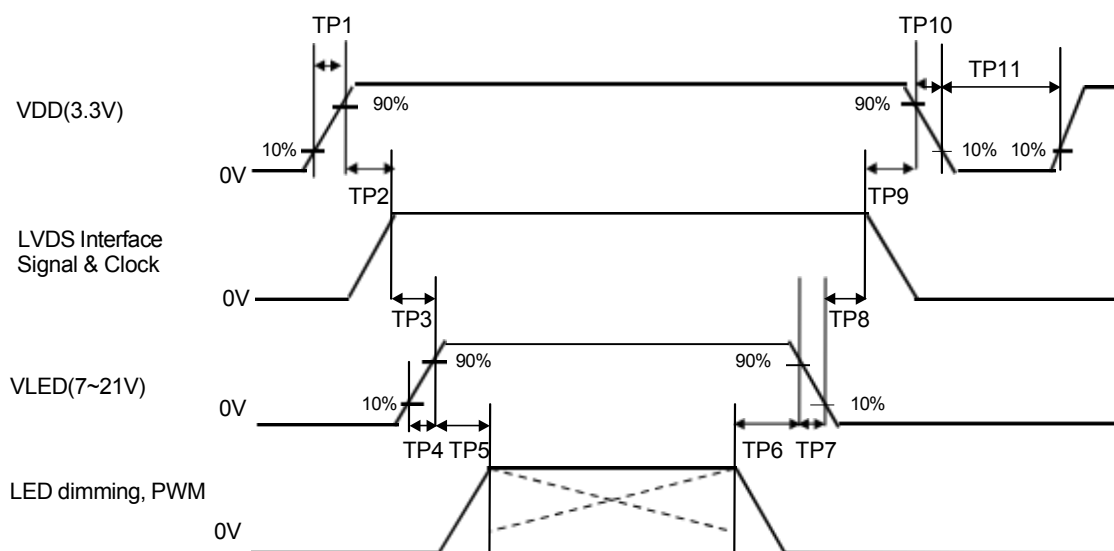
1. Vertical



2. Horizontal



6.5 Power On / Off Sequence



Item	Min.	Typ.	Max.	Unit
TP1	0.5	--	10	msec
TP2	0	--	50	msec
TP3	200	--	--	msec
TP4	0.5	--	10	msec
TP5	10	--	--	msec
TP6	10	--	--	msec
TP7	0	--	10	msec
TP8	200	--	--	msec
TP9	0	--	50	msec
TP10	1	--	10	msec
TP11	1000	--	--	msec

6.6 Backlight Unit

Parameter	Symbol	Min	Typ	Max	Units	Condition
Input Current	I _{LED}	--	704	820	mA	Ta=25°C
Input Voltage	V _{LED}	10	12	14	Volt	Ta=25°C
LED Life-Time	N/A	30,000	--	--	Hour	Ta=25°C I _f =60mA Note (2)

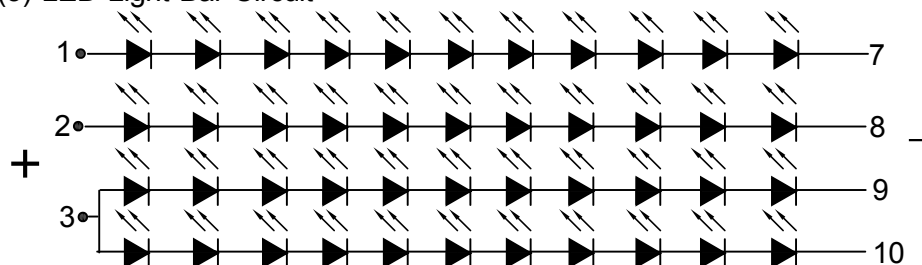
6.7 Backlight DC Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Units	Note
LED Driver Input Voltage	V _i	10	12	16	Volt.	
LED_EN High Threshold	V _{ENH}	1.4	3.3	5.0	Volt.	
LED_EN Low Threshold	V _{ENL}	0	--	0.8	Volt.	
PWM High Threshold	V _{PWMH}	2.0	3.3	6.0	Volt.	
PWM Low Threshold	V _{PWML}	0	--	0.8	Volt.	
PWM Frequency	F _{PWM}	100	--	30K	Hz	Note (4)
PWM Duty Cycle	T _D	10	--	100	%	

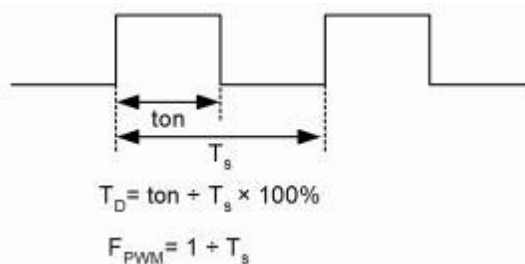
Note (1) LED lifetime (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED lifetime” is defined as the module brightness decrease to 50% original brightness at Ta=25°C and I_f=240mA, the LED lifetime could be decreased if operating IL is larger than 240mA. The constant current driving method is suggested.

Note (3) LED Light Bar Circuit



Note (4) Dimming controller waveform



7.0 Reliability test items

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+85°C, 240hrs	
2	Low Temperature Storage	Ta=-30°C, 240hrs	
3	High Temperature Operation	Ta=+70°C, 240hrs	
4	Low Temperature Operation	Ta=-20°C, 240hrs	
5	High Temperature and High Humidity (operation)	Ta=+65°C, 90%RH, 240hrs	
6	Thermal Cycling Test (non operation)	-30°C(30min) → +85°C(30min), 500 cycles	
7	Electrostatic Discharge	±200V, 200pF(0Ω) 1 time/connector	
8	Vibration	1.Random: 1.04G, 5~500Hz, XYZ, 30min/each direction 2.Sine: Freq.1.5G, 8~33.3Hz, Stoke: 1.3mm Sweep: 2.9G, 33.3~400Hz X/Z: 2hrs, Y: 4hrs	
9	Shock	Half-Sine, 100G, 6ms, ±XYZ, 3time	
10	Vibration (with carton)	Random: 0.015G ² /Hz, 5~200Hz -6dB/Octave, 200~400Hz XYZ 各方向 2hrs	
11	Drop (with carton)	Drop height condition, basis on the product weight and follow QB100-0027 1 corner, 3 edges, 6 surfaces	

Note: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

