AGL   Product Specification   Applied Green Light, Inc.

5.0" WVGA

High brightness color TFT-LCD module

Model: VM05B1 VE

Date: March. 15th, 2023

**Note: This specification is subject to change
without notice**

Customer：_____

Date：_____

Approved	Prepared
Date:	**Date:**

Contents

RECORD OF REVISION

Version and Date	Page	Old description	New description	Remark
0.1 2023/03/15	All	First Edition for customer		

1. Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.

2) Be sure to turn off power supply when inserting or disconnecting from input connector.

3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.

6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.

7) Do not open or modify the Module Assembly.

8) Do not press the reflector sheet at the back of the module to any directions.

9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.

10) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

2. General Description

2.1 Overview

This specification applies to the Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display a LED backlight system. The screen format is intended to support WVGA (800(H) x 480(V)) screen and 16.7M colors.

2.2 Features

- High brightness display, 1000nits by LED backlight.
- IPS, Normally black
- mipi interface
- Long operation lifetime BLU design
- RoHS Compliance
- Wide operation temperature
- Wide view angle, IPS TFT

2.3 Application

Industrial applications.

2.4 Display specifications

| Items	Unit	Specification
Screen Diagonal	inch	5.0"
Active Area	mm	108.0 (H) X 64.8 (V)
Pixels H x V	pixels	800 x3(RGB) x 480
Pixels Pitch	um	135 (per one triad) x 135
Pixel Arrangement		RGB Vertical stripe
Display mode		Normally black, IPS
White luminance (center)	Cd/m^2	1000 (Typ)
Contrast ratio		1000:1 (Typ.)
Optical Response Time	msec	30 ms (Typ. On/off)
Normal Input Voltage VDD	Volt	3.3
Power Consumption (Vcc Line + LED backlight)	Watt	TBD W (VDD line=TBD W; LED lines= 1.92 W)
Weight	Grams	TBD
Physical size	mm	120.7 (W)×75.8 (H)×2.8 (D)
Electrical Interface		Mipi – 4 lanes
MIPI IC		ICN6211
Support colors		16.7M colors
Surface Treatment		Anti-glare and hard-coating 3H
Temperature range Operating Storage	^{0}C ^{0}C	-30 ~ 85 (TFT surface) -30 ~ 85
RoHS Compliance		RoHS Compliance

2.5 Optical characteristics

The following optical characteristics are measured under stable condition at 25 ^{0}C

Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right)		80		2
		CR=10　　(Left)		80		
		Vertical　　(Up)		80		
		CR=10　 (Down)		80		
Contrast Ratio		Normal Direction	800	1000		3
Response Time	msec	Raising + Falling		30	40	4
Color / Chromaticity Coordinates (CIE)		Red x	-0.05	TBD	+0.05	5
		Red y		TBD		
		Green x		TBD		
		Green y		TBD		
		Blue x		TBD		
		Blue y		TBD		
Color coordinates (CIE) White		White x		TBD		
		White y		TBD		
Center Luminance	Cd/m^2		900	1000		6
Luminance Uniformity	%		70	75		7
Crosstalk (in 60 Hz)	%				1.5	
Flicker	dB				-20	

Note 1: Measurement method

The LCD module should be stabilized at given temperature for 0.5 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.
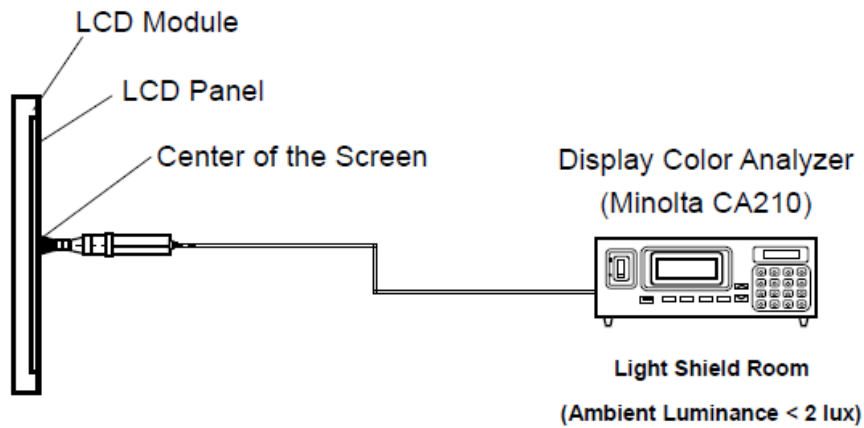

Note 2: Definition of viewing angle
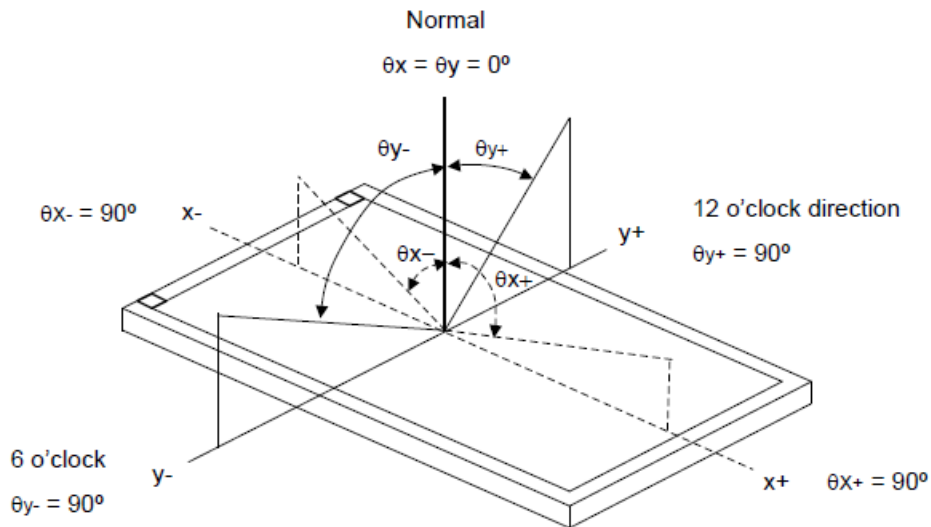
Note 3: Contrast ratio is measured by Minolta CA210

Note 4: Definition of Response time

The output signals of photo detector are measured when the input signals are changed from "Full Black" to "Full White" (rising time), and from "Full White" to "Full Black" (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.
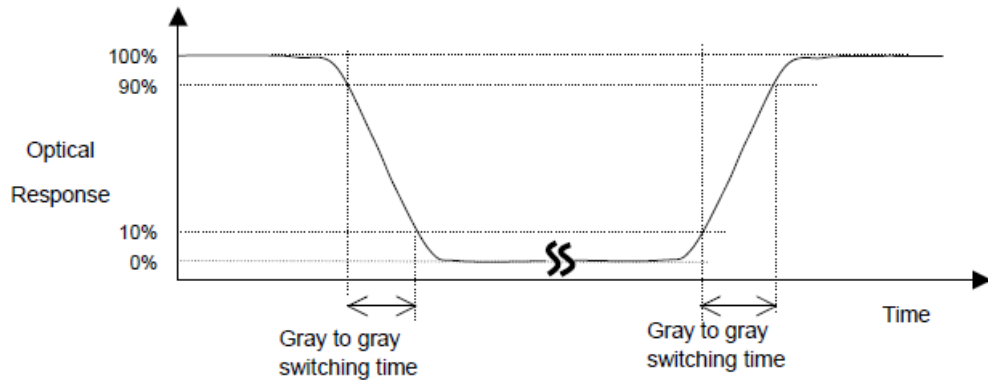
Note 5: Color chromaticity and coordinates (CIE) is measured by Minolta CA210

Note 6: Center luminance is measured by Minolta CA210

Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA210
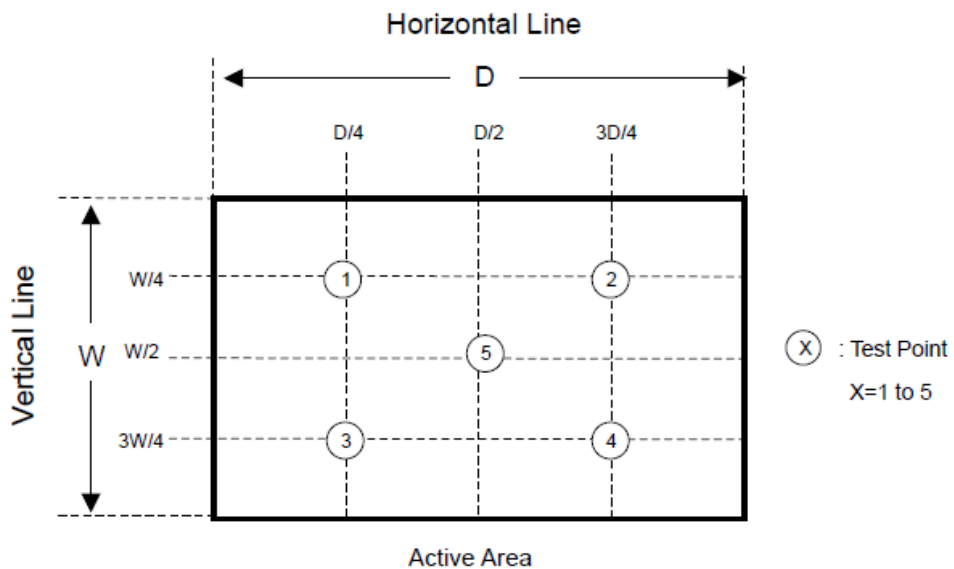
Uniformity = (Min. Luminance of 5 points) / (Max. Luminance of 5 points)

3. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

Item	Symbol	Min.	Max.	Unit
Digital Power Supply Input	VDD	-0.3	+3.66	V
Input Voltage	Vin	-0.3	VDD +0.3	V
Operating Temperature	TOP	-30	85	°C
Storage Temperature	TST	-30	85	°C
Storage Humidity	HD	20	90	%RH

4. Electrical characteristics

4.1 LCD electronics specification

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Digital Power Supply Input	VDD	3.0	3.3	3.6	V	-
Digital Power supply current	IVDD	-	85	170	mA	-
Input High Voltage	VIH	-	-	550	mV	-
Input Low Voltage	VIL	880	-	-	mV	-
Output High Voltage	VOH	0.8*VDD	-	VDD	V	-
Output Low Voltage	VOL	GND	-	0.2*VDD	V	-

4.2 Backlight unit

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Voltage for LED backlight	Vf	22	24	26	V	
Current for LED backlight	If	-	80	-	mA	
PWM Dimming Control　Level	PWM High Level	1.2		12.0	V	
PWM Dimming Control Duty Ratio	PWM Low Level	0		0.4	V	
	-	1	-	100	%	@100kHz
PWM Dimming Control Frequency	-	5	-	100	kHz	
LED Life Time	-	50000	-	-	Hr	Note 3

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and If =80mA.

Note 2: LED current is measured by utilizing a high frequency current meter as shown below:
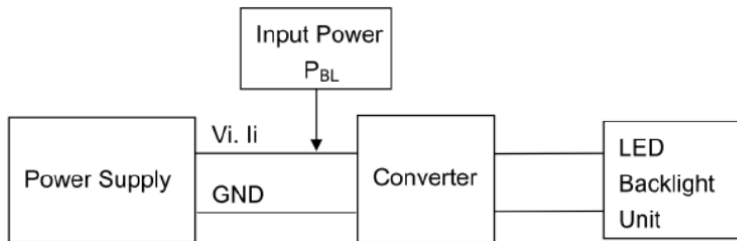
Note 3: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and If = 80mA. The LED lifetime could be decreased if operating If is larger than 80mA.

Note 4: LED light bar circuit:
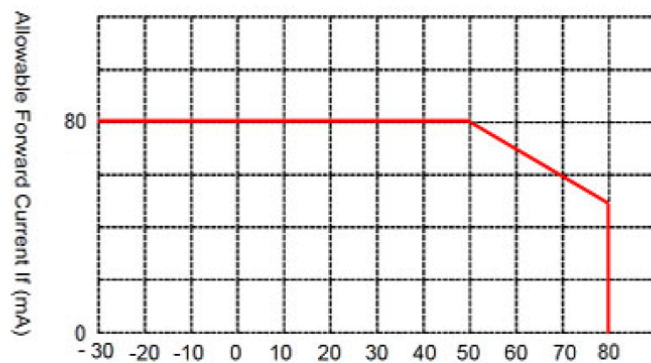
4.3 Interface connector

4.3.1 TFT connector(CN1)

PIN NO.	PIN NAME	DESCRIPTION
1~3	VDD	DIGITAL POWER SUPPLY INPUT (+3.3VDC)
4	GND	DIGITAL GROUND
5	D3P	MIPI DSI DIFFERENTIAL SIGNAL INPUT (DATA LANE 3)
6	D3N	MIPI DSI DIFFERENTIAL SIGNAL INPUT (DATA LANE 3)
7	GND	DIGITAL GROUND
8	D2P	MIPI DSI DIFFERENTIAL SIGNAL INPUT (DATA LANE 2)
9	D2N	MIPI DSI DIFFERENTIAL SIGNAL INPUT (DATA LANE 2)
10	GND	DIGITAL GROUND
11	CLK+	MIPI DSI DIFFERENTIAL CLOCK INPUT
12	CLK-	MIPI DSI DIFFERENTIAL CLOCK INPUT
13	GND	DIGITAL GROUND
14	D1P	MIPI DSI DIFFERENTIAL SIGNAL INPUT (DATA LANE 1)
15	D1N	MIPI DSI DIFFERENTIAL SIGNAL INPUT (DATA LANE 1)
16	GND	DIGITAL GROUND
17	D0P	MIPI DSI DIFFERENTIAL SIGNAL INPUT (DATA LANE 0)
18	D0N	MIPI DSI DIFFERENTIAL SIGNAL INPUT (DATA LANE 0)
19~23	GND	DIGITAL GROUND
24	(N/C)	NO CONNECTION
25	LED_PWM	LED BACKLIGHT PWM DIMMING INPUT
26	(N/C)	NO CONNECTION
27~29	VLED	LED BACKLIGHT POWER SUPPLY INPUT (+5VDC~+12VDC)
30	GND	DIGITAL GROUND

5. Signal characteristics

5.1 RGB interface

Parallel 24-bit RGB Interface Timing Table							
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency		Fclk	23	25	27	MHz	
HSYNC	Period Time	Th	808	816	896	DCLK	
	Display Period	Thdisp		800		DCLK	
	Back Porch	Thbp	4	8	48	DCLK	
	Front Porch	Thfp	4	8	48	DCLK	
	Pulse Width	Thw	2	4	8	DCLK	
VSYNC	Period Time	Tv	488	496	504	HSYNC	
	Display Period	Tvdisp		480		HSYNC	
	Back Porch	Tvbp	4	8	12	HSYNC	
	Front Porch	Tvfp	4	8	12	HSYNC	
	Pulse Width	Tvw	2	4	8	HSYNC	

### 5.2 RGB Output

ICN6211 supports RGB888 output

In following table:

Group_0[7:0] = { DATA7, DATA6, DATA5, DATA4, DATA3, DATA2,

DATA1, DATA0}; Group_1[7:0] = { DATA15, DATA14, DATA13, DATA12,

DATA11, DATA10, DATA9, DATA8} Group_2[7:0]= {DATA23, DATA22,

DATA21, DATA20, DATA19, DATA18, DATA17, DATA16};

Red0[7:0], Green0[7:0], Blue[7:0] is the input video data.
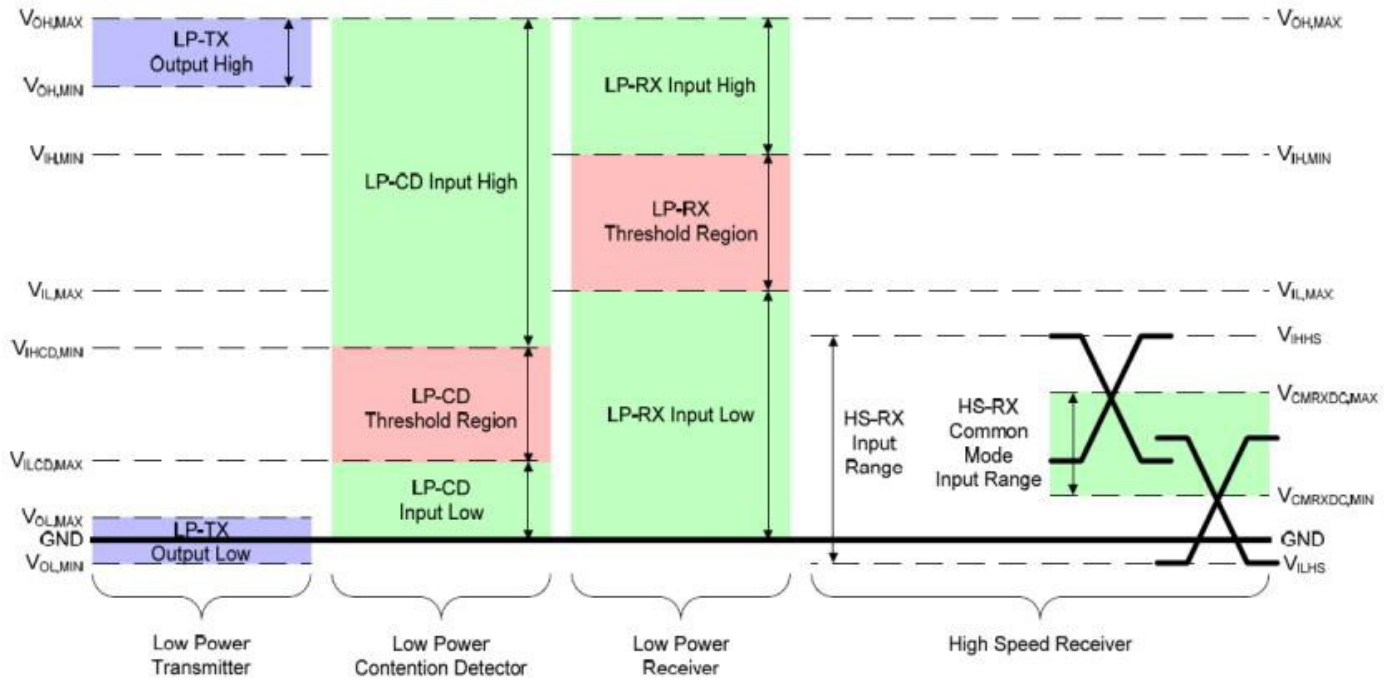
5.3 RGB clock phase adjust

ICN6211 provides RGB output clock phase adjust options, which can compensate the mismatch in case of routing or other reasons, such will make easier for PCB routing or system cable connection.

The output RGB clock can be aligned with data/hsync/vsync/data_de, or delayed by 1/4, 1/2, 3/4 phase. Further more, for each pahse, fine delay adjust can be added by fixed delay with the range between -2ns and +2ns.

RGB output clock phase delay
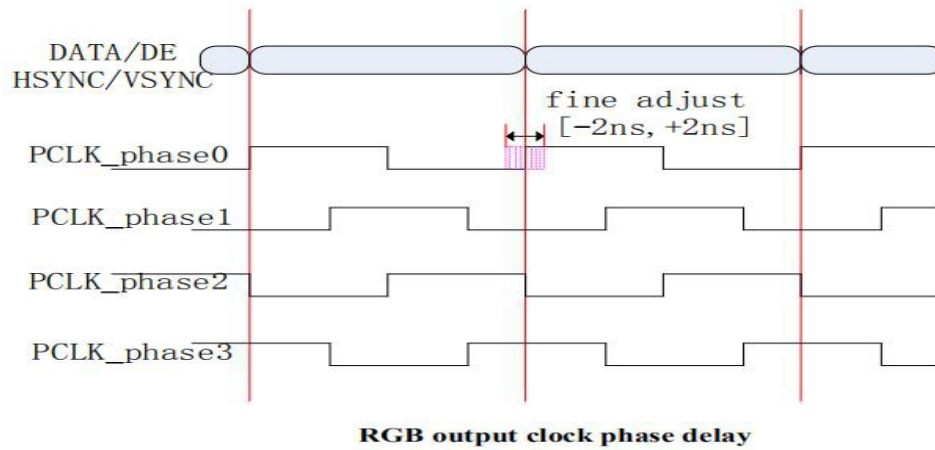
5.4 MIPI DSI interface

parameter	Description	MIN	TYP	MAX	UNIT
V_{IL}	Low Power logic 1 input voltage	880			mV
V_{IH}	Low Power logic 0 input voltage			550	mV
$|V_{ID}|$	HS differential input voltage: $|V_{dp} - V_{dn}|$	70	200	270	mV
$|VIDT|$	HS differential input voltage threshold			50	mV
$V_{IL-ULPS}$	Low Power receiver logic 0 voltage, ULP state			300	mV
$V_{CMRX(DC)}$	Common-mode voltage HS receive mode	70		330	mV
$\triangle V_{CMRX(HF)}$	HS common-mode interference			100	mV
V_{IHHS}	HS single-ended input high voltage			460	mV
V_{ILHS}	HS single-ended input low voltage	-40			mV
$V_{TERM-EN}$	Single-ended threshold for HS termination enable			450	mV
Z_{ID}	Differential input impedance	80	100	124	Ω

$V_{OH,MAX}$

LP-TX Output High

$V_{OH,MIN}$

$V_{IH,MIN}$

LP-CD Input High

$V_{IL,MAX}$

$V_{IHCD,MIN}$

LP-CD Threshold Region

$V_{ILCD,MAX}$

LP-CD Input Low

$V_{OL,MAX}$

GND

LP-TX Output Low

$V_{OL,MIN}$

LP-RX Input High

LP-RX Threshold Region

LP-RX Input Low

HS-RX Input Range

HS-RX Common Mode Input Range

$V_{OH,MAX}$

$V_{IH,MIN}$

$V_{IL,MAX}$

V_{IHHS}

$V_{CMRXDC,MAX}$

$V_{CMRXDC,MIN}$

GND

V_{ILHS}

Low Power Transmitter   Low Power Contention Detector   Low Power Receiver   High Speed Receiver

DSI HS/LP signaling and Contention Voltage

5.5 Switching Characters

Parameter	Description	MIN	TYP	MAX	UNIT
	DSI				
t_{GS}	DSI LP input pulse rejection			300	ps
	RGB output (refer to Figure 7-4)				
FCLK	Output pixel clock	20		154	MHz
TCKH	Pixel clock HIGH period	40%	50%	60%	
TCKL	Pixel clock HIGH period	40%	50%	60%	
TDLY	DATA and sync signals related to PCLK	0		800	ps
	REFCLK				
F_{REFCLK}	REFCLK Frequency	25		154	MHz

Parameter	Description	MIN	TYP	MAX	UNIT
tr, tf	REFCLK rise and fall time	0.1		1	ns
t_{pj}	REFCLK peak-to-peak phase jitter			50	ps
Duty	REFCLK duty cycle	40%	50%	60%	
	EN, ULPS, RESET				
t_{en}	Enable time from EN or ULPS			1	ms
t_{dis}	Disable time to standby			0.1	ms
t_{reset}	Reset time	10			ms
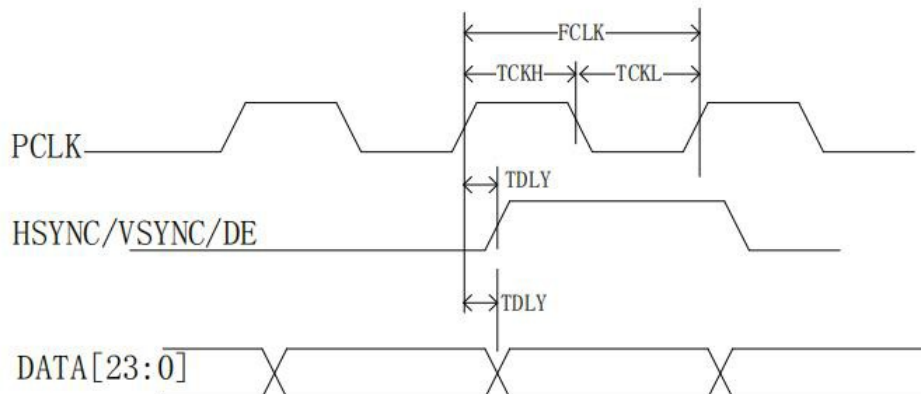
5.6   RGB Output timing
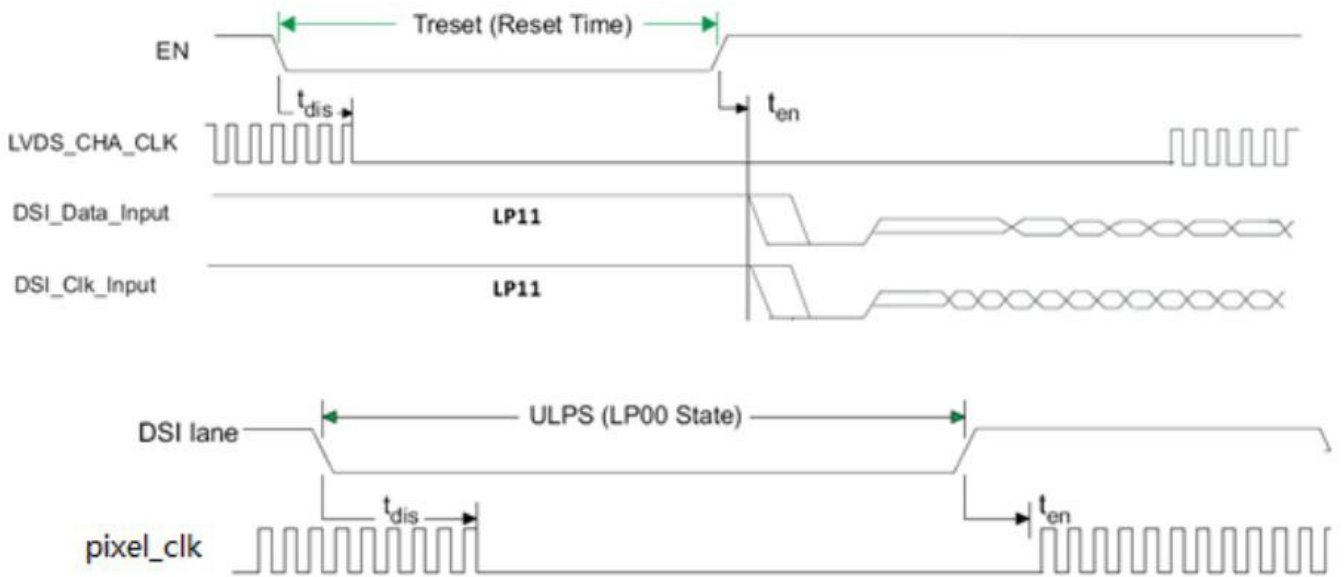
Power on and RESET and ULPS timing

6 Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta=50℃, 85%RH, 96hours	
High Temperature Operation (HTO)	Ta= 85°C, 96hours	
Low Temperature Operation (LTO)	Ta= -30°C, 96hours	
High Temperature Storage (HTS)	Ta= 85°C, 96hours	
Low Temperature Storage (LTS)	Ta= -30°C, 96hours	
Thermal Shock Test (TST) (Storage)	-20°C ⟷ 25°C ⟷ 70°C (30min) (5min) (30min) 1cycle Total 10cycle	
ESD (Electrostatic Discharge)	Voltage: ±8KV, R:330Ω, C:150PF, Air Mode,10times	
Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5mm X, Y, Z direction for total 3hours (Packing condition test will be tested by a carton)	
Dropping Test	Drop to the ground from 1M height one time every side of carton. (Packing condition test will be tested by a carton)	

Note 1: Inspection after 2~4hours storage at room temperature, the samples should be free from defects:

1, Air bubble in the LCD.

2, Seal leak.

3, Non-display.

4, Missing segments.

5, Glass crack.

6, Current IDD is twice higher than initial value.

7, The surface shall be free from damage.

8, The electric characteristic requirements shall be satisfied.

REMARK:

1, The Test samples should be applied to only one test item.

2, Sample side for each test item is 5~10pcs.

3, For Damp Proof Test, Pure water(Resistance＞10MΩ) should be used.

4, In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.

5, The evaluation should be accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence has.

6, Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

7 Shipping package
(TBD)

8 Mechanical Characteristics
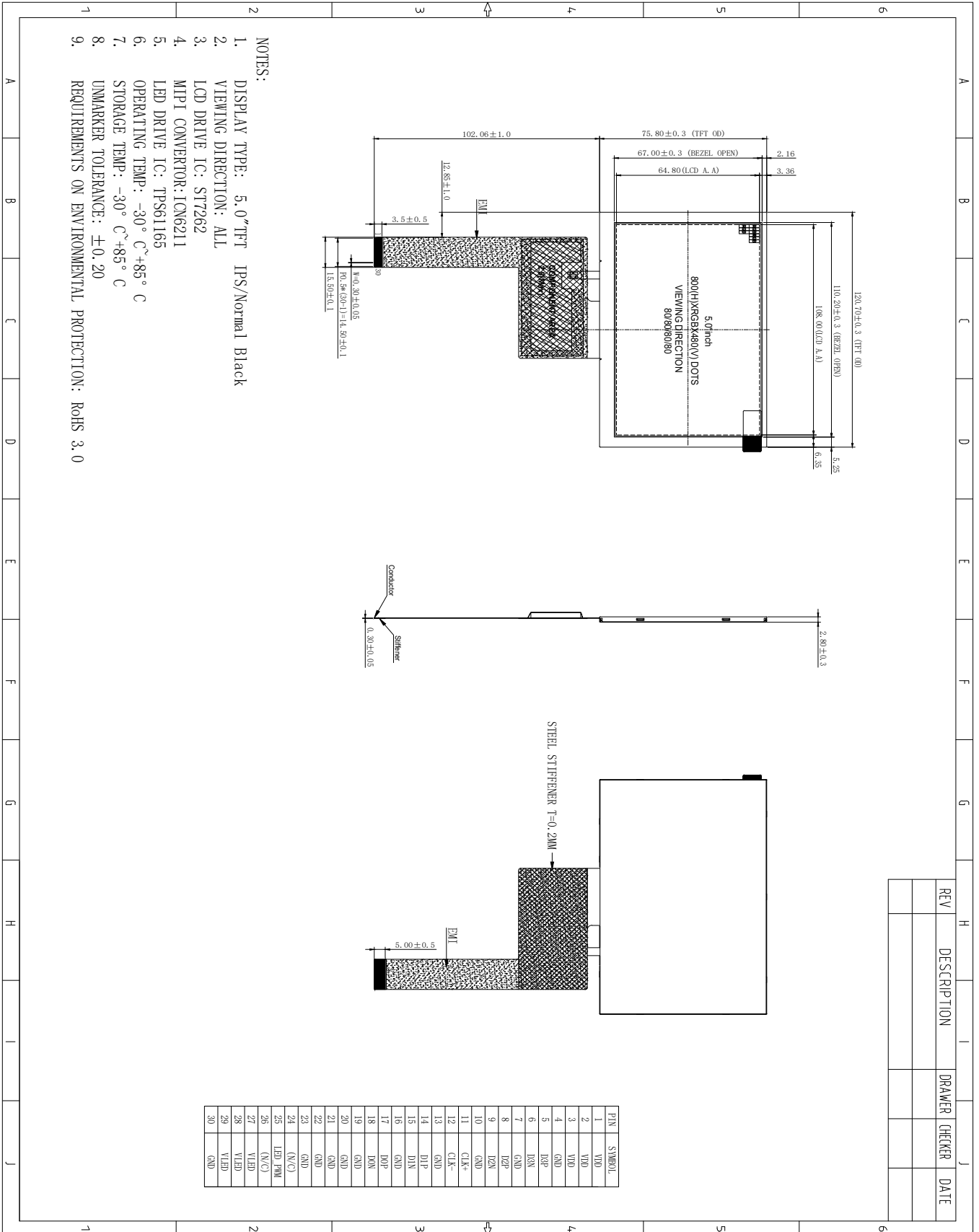
NOTES:
1. DISPLAY TYPE: 5.0"TFT IPS/Normal Black
2. VIEWING DIRECTION: ALL
3. LCD DRIVE IC: ST7262
4. MIPI CONVERTOR:ICN6211
5. LED DRIVE IC: TPS61165
6. OPERATING TEMP: -30°C~+85°C
7. STORAGE TEMP: -30°C~+85°C
8. UNMARKER TOLERANCE: ±0.20
9. REQUIRMENTS ON ENVIRONMENTAL PROTECTION: RoHS 3.0

PIN	SYMBOL
1	VDD
2	VDD
3	VDD
4	GND
5	GND
6	D3P
7	D3N
8	D2P
9	D2N
10	GND
11	CLK+
12	CLK-
13	GND
14	D1P
15	D1N
16	GND
17	D0P
18	D0N
19	GND
20	GND
21	GND
22	GND
23	GND
24	(N/C)
25	LED_PWM
26	(N/C)
27	VLED
28	VLED
29	VLED
30	GND