Model Name: 215006

LCD Screen model : T215HVN01.1

Issue Date : 2023/07/17

(   )Preliminary Specifications
(*)Final Specifications

Customer Signature:	
ZXGL Part No.:	
Approved By:	Approval By PM Director
Note:	Reviewed By RD Director
	Reviewed By Project Leader
	Prepared By PM

REVISION HISTORY

Version	Date	Page	Description
1.0	2023/07/17	All	First release

1. GENERAL DESCRIPTION

1.1 OVERVIEW

This specification applies to the 21.5 inch Color TFT-LCD Module 215006. This LCD module has a TFT active matrix type liquid crystal panel 1920x1080 pixels, and diagonal size of 21.5 inch. This module supports 1920x1080 mode. Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot. The 215006 has been designed to apply the 6-bit LVDS interface method. It is intended to support displays where high brightness, wide viewing angle, high color saturation, and high color depth are very important.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	21.5	Inch	-
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1920 x 1080	Pixel	
Pixel pitch	0.24825H) x 0.24825 (W)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Colors	6bit / 16.7 millions	Color	
Transmissive Mode	Normally Black	-	
Surface Treatment	Haze 25%, 3H	-	
Luminance, White	500	cd/m2	
White luminance uniformity	80	%	
Power Consumption	Total 16.6W @ cell 3.1W , BL 13.5W		(1)

Note(1) The specified power consumption: Total=cell(reference 4.3.1)+BL(reference 4.3.2)

2. MECHANICAL SPECIFICATIONS

Item		Min	Typ.	Max	Unit	Note
Module Size	Horizontal(H)		495.6		mm	(1)
	Vertical (V)		292.2		mm	
	Thickness (T)		10.5		mm	
Bezel Area	Horizontal		480.64		mm	
	Vertical		272.11		mm	
Active Area	Horizontal	-	476.64	-	mm	
	Vertical	-	286.11	-	mm	
Weight		-	/		Kg	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.
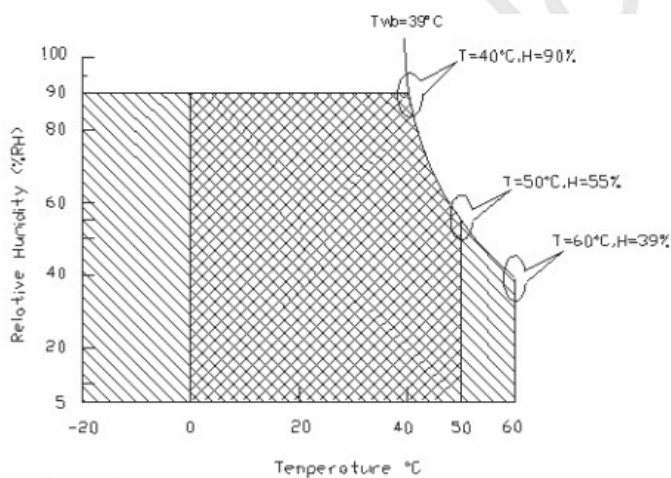
3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Permanent damage may occur if exceeding the following maximum rating.

Symbol	Description	Min.	Max.	Unit	Remark
TOP	Operating Temperature	0	+50	[°C]	*Note 2-1*
TGS	Glass surface temperature (operation)	0	+65	[°C]	*Note 2-1* *Function judged only*
HOP	Operation Humidity	5	90	[%RH]	*Note 2-1*
TST	Storage Temperature	-20	+60	[°C]	
HST	Storage Humidity	5	90	[%RH]	

Note 2-1: Temperature and relative humidity range are shown as the below figure.

    1. 90% RH Max (Ta ≦39℃)
    2. Max wet-bulb temperature at 39℃ or less. (Ta ≦39℃)
    3. No condensation

Operating Range   ⊠⊠⊠   Storage Range   ⊠⊠⊠ + ⧄⧄
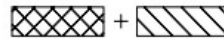
Permanent damage may occur if exceeding the following maximum rating.

Symbol	Description	Min	Max	Unit	Remark
VDD	Power Supply Input Voltage	GND-0.3	6.0	[Volt]	Ta=25℃

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM

The following shows the block diagram of the 21.5 inch Color TFT-LCD Module.
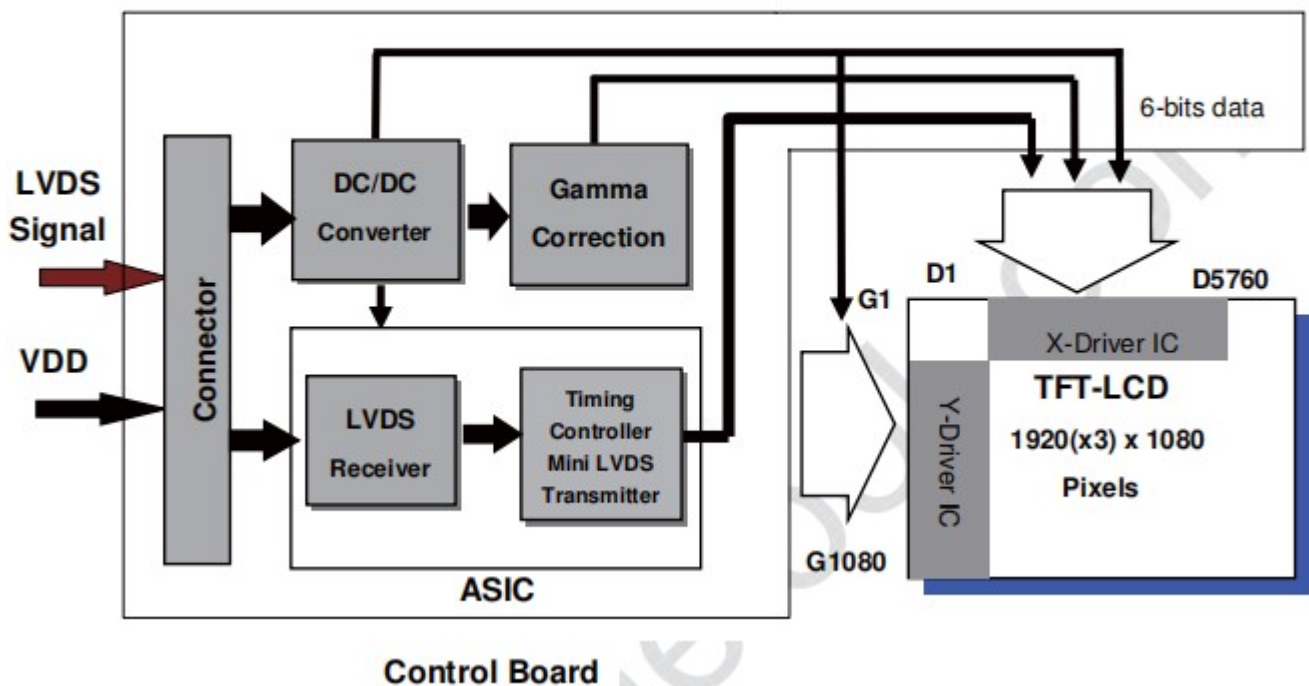
4.2 INTERFACE CONNECTIONS

PIN ASSIGNMENT

TFT-LCD Connector	Manufacturer	P-TWO	STM
	Part Number	AL230F-A0G1D-P	MSCKT2407P30HB
Mating Connector	Manufacturer	JAE	
	Part Number	FI-X30HL (Locked Type)	

PIN #	Symbol	Description	Remark
1	RxO0-	Negative LVDS differential data input (Odd data)	
2	RxO0+	Positive LVDS differential data input (Odd data)	
3	RxO1-	Negative LVDS differential data input (Odd data)	
4	RxO1+	Positive LVDS differential data input (Odd data)	
5	RxO2-	Negative LVDS differential data input (Odd data)	
6	RxO2+	Positive LVDS differential data input (Odd data)	
7	GND	Ground	
8	RxOCLK-	Negative LVDS differential clock input (Odd clock)	
9	RxOCLK+	Positive LVDS differential clock input (Odd clock)	
10	RxO3-	Negative LVDS differential data input (Odd data)	
11	RxO3+	Positive LVDS differential data input (Odd data)	
12	RxE0-	Negative LVDS differential data input (Even data)	
13	RxE0+	Positive LVDS differential data input (Even data)	
14	GND	Ground	
15	RxE1-	Negative LVDS differential data input (Even data)	
16	RxE1+	Positive LVDS differential data input (Even data)	
17	GND	Ground	
18	RxE2-	Negative LVDS differential data input (Even data)	
19	RxE2+	Positive LVDS differential data input (Even data)	
20	RxECLK-	Negative LVDS differential clock input (Even clock)	
21	RxECLK+	Positive LVDS differential clock input (Even clock)	
22	RxE3-	Negative LVDS differential data input (Even data)	
23	RxE3+	Positive LVDS differential data input (Even data)	
24	GND	Ground	
25	NC	No connection (for AUO test only. Do not connect)	
26	NC	No connection (for AUO test only. Do not connect)	

27	NC	No connection (for AUO test only. Do not connect)	
28	VDD	Power Supply Input Voltage	
29	VDD	Power Supply Input Voltage	
30	VDD	Power Supply Input Voltage	
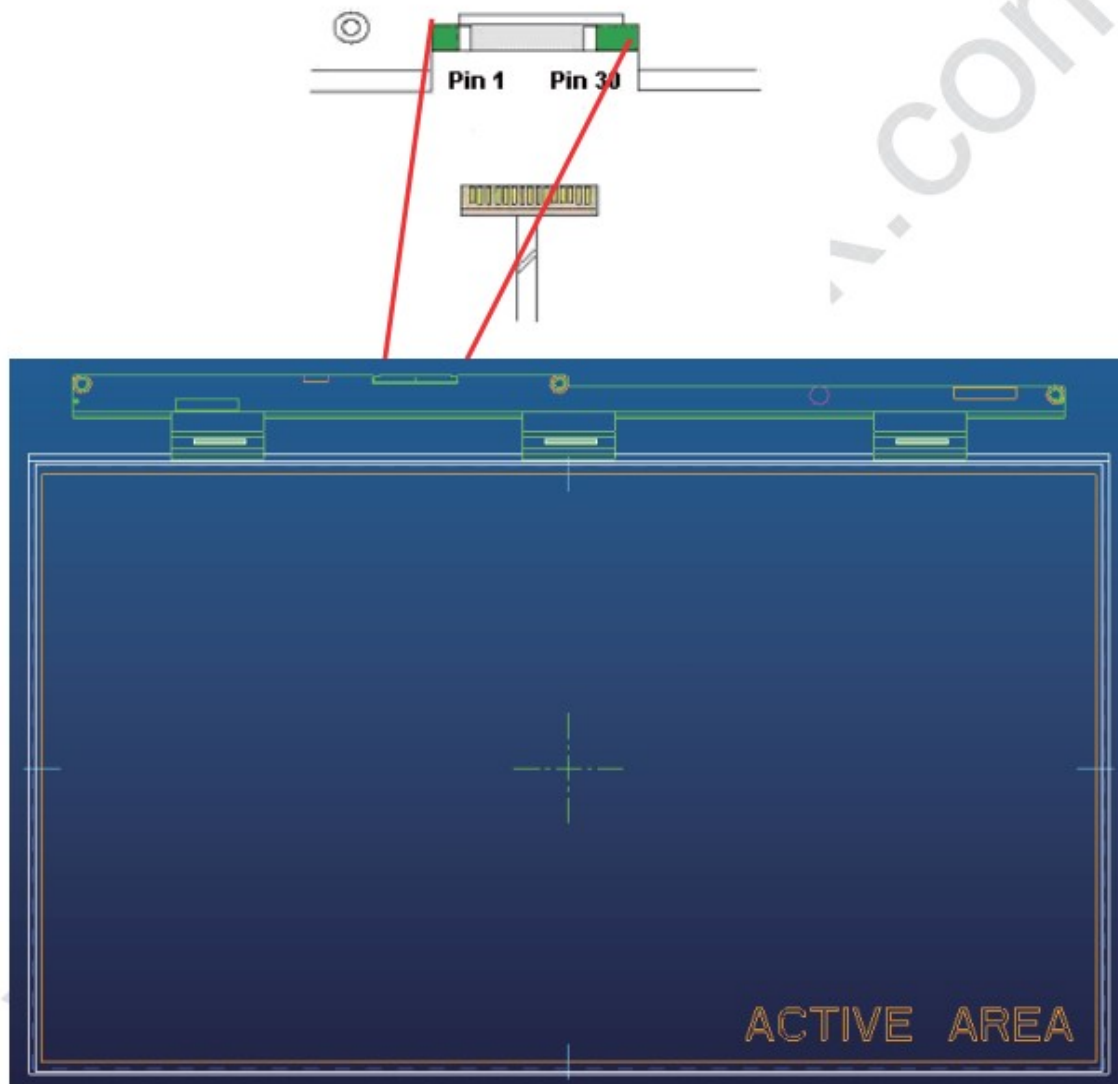
4.3 ELECTRICAL CHRARCTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

Symbol	Description	Min	Typ	Max	Unit	Remark
VDD	Power supply Input voltage	4.5	5.0	5.5	[Volt]	
IDD	Power supply Input Current (RMS)	-	0.62	0.74	[A]	VDD= 5.0V, Black Pattern, Fv=60Hz
			0.7	0.84	[A]	VDD= 5.0V, Black Pattern, Fv=75Hz
PDD	VDD Power Consumption	-	3.1	3.7	[Watt]	VDD= 5.0V, Black Pattern, Fv=60Hz
			3.5	4.2	[Watt]	VDD= 5.0V, Black Pattern, Fv=75Hz
IRush	Inrush Current	-	-	3.0	[A]	**Note 3-1**
VDDrp	Allowable VDD Ripple Voltage	-	-	500	[mV]	VDD= 5.0V, Black Pattern, Fv=75Hz

Note 3-1:   Inrush Current measurement:

Test circuit:
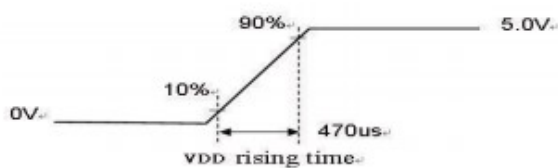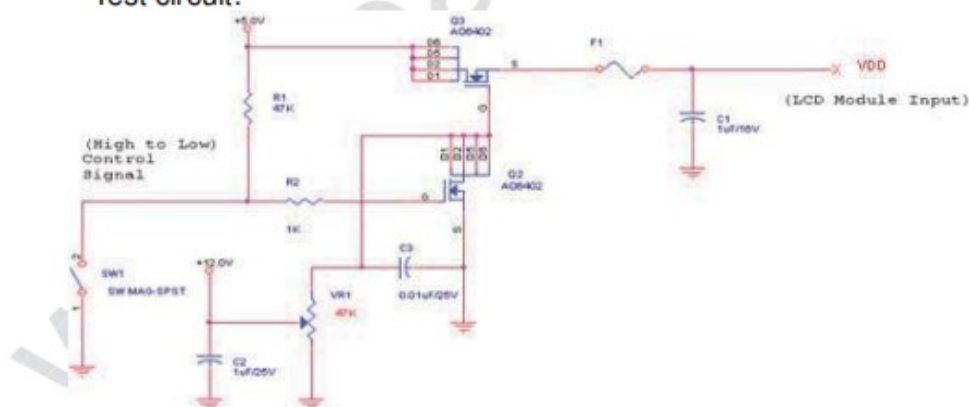
The duration of VDD rising time: 470us.

4.3.2 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
BLU Voltage	U		54		V	IL =250mA
BLU Current	I		250		mA	IL =250mA
BLU Power	P		13.5		W	
BLU lifetime	T	40000			Hrs	(1)

Note (1) The lifetime is defined as the time which luminance ofthe LED decays to 50% compared to the initial
value, Operating condition: Continuous operating at Ta = $25\pm2℃$, IL =250mA

Connector Information

Pin number	Description
1	negative polarity
2	Input voltage Power Supply

Note (1) User's Mating Connector Part No.:
Connector (wire type): PH2.0-2Pin 1groups

4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1   The T215HVN01.1 is operated by the DE only.

It only support DE mode, and the input timing are shown as the following table.

Symbol	Description		Min.	Typ.	Max.	Unit	Remark
Tv	Vertical Section	Period	1092	1130	1818	Th	
Tdisp (v)		Active	1080	1080	1080	Th	
Tblk (v)		Blanking	12	50	738	Th	
Fv		Frequency	50	60	76	Hz	
Th	Horizontal Section	Period	1034	1050	1100	Tclk	
Tdisp (h)		Active	960	960	960	Tclk	
Tblk (h)		Blanking	74	90	140	Tclk	
Fh		Frequency	55	68	91	KHz	*Note 3-3*
Tclk	LVDS Clock	Period	10.6	14.0	17.7	ns	1/Fclk
Fclk		Frequency	56.5	71.2	94.0	MHz	*Note 3-4*

Note 3-3: The equation is listed as following. Please don't exceed the above recommended value.

Fh (Min.) = Fclk (Min.) / Th (Min.);
Fh (Typ.) = Fclk (Typ.) / Th (Typ.);
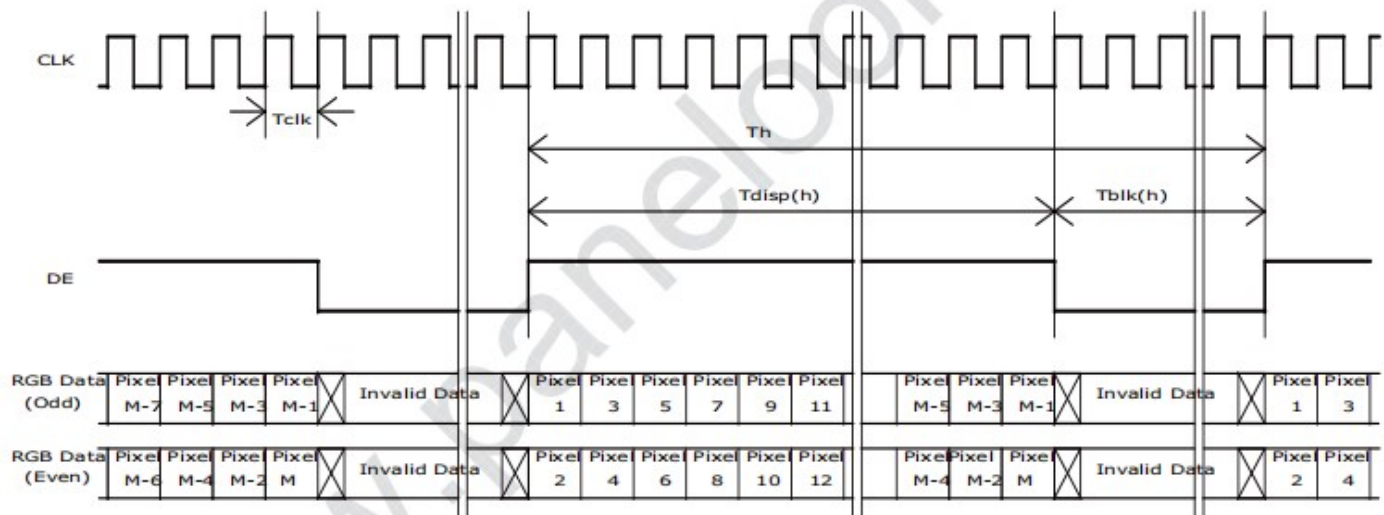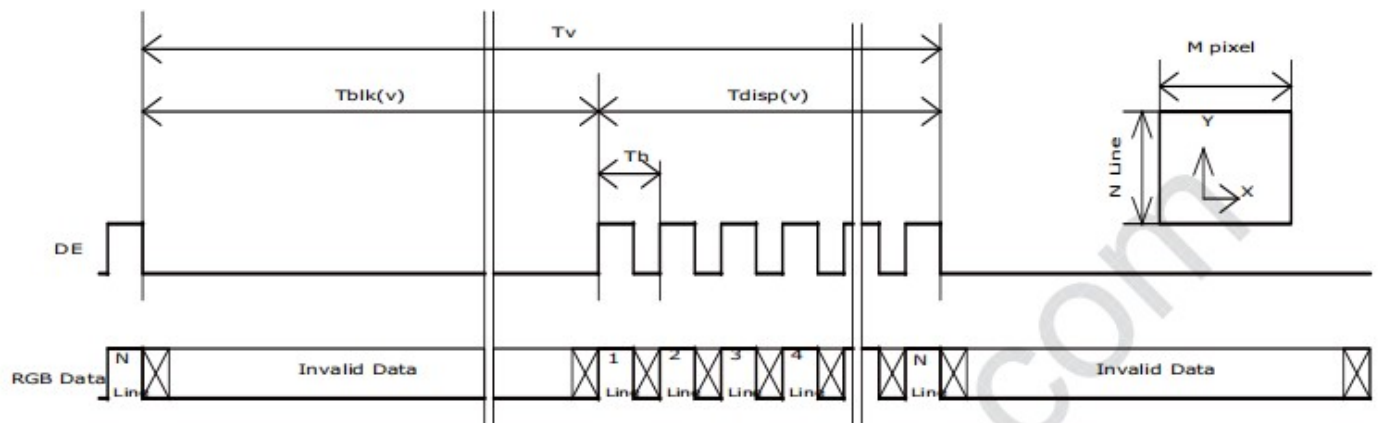Fh (Max.)= Fclk (Max.) / Th (Min.);

Note 3-4: The equation is listed as following. Please don't exceed the above recommended value.

Fclk (Min.) = Fv (Min.) x Th (Min.) x Tv (Min.);
Fclk (Typ.) = Fv (Typ.) x Th (Typ.) x Tv (Typ.);
Fclk (Max.) = Fv (Max.) x Th (Typ.) x Tv (Typ.);

4.4.2 Power ON/OFF Sequene

VDD power, LVDS signal and backlight on/off sequence are as following. LVDS signals from any system shall be Hi-Z state when VDD is off.
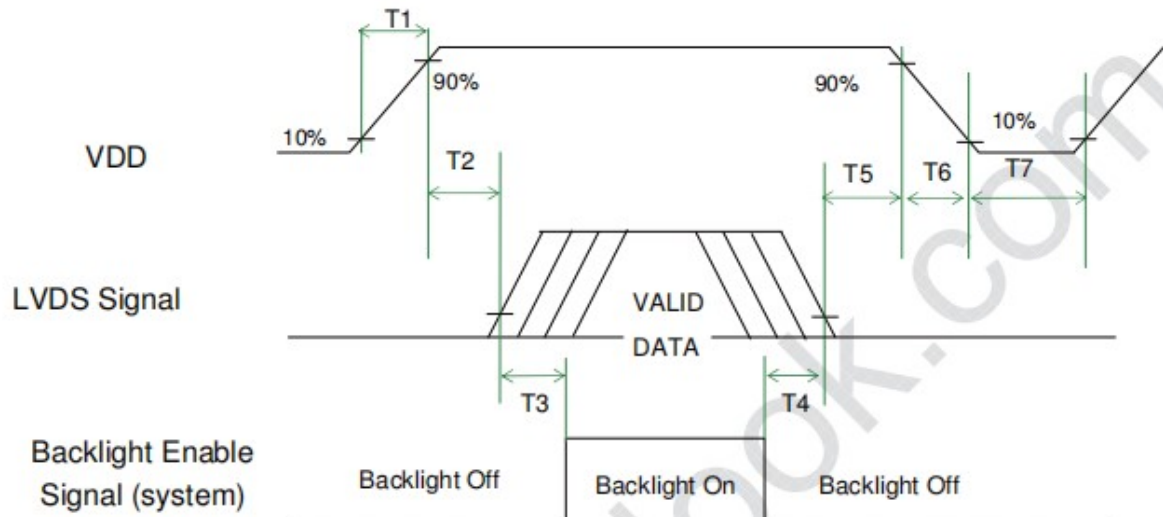
Power Sequence Timing

Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
T1	0.5	-	10	[ms]	
T2	0	-	50	[ms]	
T3	500	-	-	[ms]	
T4	100	-	-	[ms]	
T5	0	-	50	[ms]	*Note 3-5* *Note 3-6*
T6	0	-	150	[ms]	*Note 3-6*
T7	1000	-	-	[ms]	

Note 3-5 : Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.

Note 3-6 : During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.

5. OPTICAL CHARACTERISTICS

5.1 Overview

Symbol	Description		Min	Typ.	Max	Unit	Remark
CR	Contrast Ratio (Center of screen)		2000	3000	-	-	Note 2-3 Base on AUO LED Backlight
θ_R	Horizontal Viewing Angle (CR=10)	Right	75	89	-	[degree]	*Note 2-4* *By SR-3*
θ_L		Left	75	89	-		
Φ_H	Vertical Viewing Angle (CR=10)	Up	75	85	-		
Φ_L		Down	75	85	-		
θ_R	Horizontal Viewing Angle (CR=5)	Right	75	89	-		
θ_L		Left	75	89	-		
Φ_H	Vertical Viewing Angle (CR=5)	Up	75	89	-		
Φ_L		Down	75	89	-		
T_R	Response Time	Rising Time	-	13	28	[msec]	*Note 2-5* *By TRD-100*
T_F		Falling Time	-	5	8		
-		Rising + Falling	-	18	36		
R_x	Color Coordinates (CIE 1931)	Red x	TBD	TBD	TBD		Base on C light
R_y		Red y	TBD	TBD	TBD		
G_x		Green x	TBD	TBD	TBD		
G_y		Green y	TBD	TBD	TBD		
B_x		Blue x	TBD	TBD	TBD		
B_y		Blue y	TBD	TBD	TBD		
W_x		White x	TBD	TBD	TBD		
W_y		White y	TBD	TBD	TBD		
CT	Crosstalk		-	-	2.0	[%]	*Note 2-6* *By SR-3*
F_{dB}	Flicker (Center of screen)		-	-	TBD	[dB]	*Note 2-7* *By SR-3*

6. RELIABILITY TEST   ITEM

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

<Reliability Test Parameters >

Items	Condition	Remark
Temperature Humidity Bias (THB)	Ta= 50℃, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 50℃, 50%RH, 300hours	
Low Temperature Operation (LTO)	Ta= 0℃, 300hours	
High Temperature Storage (HTS)	Ta= 60℃, 300hours	
Low Temperature Storage (LTS)	Ta= -20℃, 300hours	
Thermal Shock Test (TST)	-20℃/30min, 60℃/30min, 100 cycles	*Note 4-1*

Note 4-1: a. A cycle of rapid temperature change consists of varying the temperature from -20℃ to 60℃, and back again. Power is not applied during the test.

b. After finish temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

7. MECHANICAL OUTLINE DIMENSION