

# Model Name: ST-215K02

**Issue Date : 2019/08/15**

- ( ) Preliminary Specifications
- (\* ) Final Specifications

Customer Signature	Date	Sense	Date
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## 1. General Description

This specification applies to the 21.5 inch wide Color a-Si TFT-LCD with Pcap Touch Panel Module ST-215K02. The display supports the Full HD - 1920(H) x 1080(V) screen format and 16.7M colors (8 bits RGB data input). The input interface is Dual channel LVDS and this module doesn't contain a driver board for backlights.

### \* General Information

#### 1.1. Display Characteristics

The following items are characteristics summary on the table under 25°C condition:

ITEMS	Unit	SPECIFICATIONS
Screen Diagonal	[mm]	546.86(21.5")
Active Area	[mm]	476.64 (H) x 268.11 (V)
Pixels H x V	-	1920(x3) x 1080
Pixel Pitch	[um]	248.25 (per one triad) x248.25
Pixel Arrangement	-	R.G.B. Vertical Stripe
Display Mode	-	VA Mode, Normally Black
White Luminance ( Center )	[cd/m2]	250 (Typ.)
Contrast Ratio	-	3000 (Typ.)
Response Time	[msec]	18ms (Typ., on/off)at surface 35 degree C
Power Consumption (LCD Module + Backligh unit)	[Watt]	15.2 (Typ.) LCD module : PDD (Typ.)= 3.1 @ all white pattern, Fv=60Hz Backlight unit : PBLU (Typ.) =12.1 @Is=65mA
Weight	[Grams]	2700
Outline Dimension	[mm]	495.6(H) x 292.2(V) x 10.6(D) Typ.
Electrical Interface	-	Dual channel LVDS , 8 bits RGB data input
Support Color	-	16.7M colors
Surface Treatment	-	Anti-Glare, 3H
Temperature Range		
Operating	[°C]	-10 to +50
Storage (Shipping)	[°C]	-20 to +60
RoHS Compliance	-	RoHS Compliance
TCO Compliance	-	TCO 6.0 Compliance
Type of Touch Sensor	Projected capacitive touch module	
Cover Lens Size	514.64 x 310.51 x 2.7(mm), surface hardness ≥7H	
Touch Controller	EETI 84H5680	
Interface	USB /RS232 / I2C	
Transmittance	≥ 86%	

## 1.2. Optical Characteristics

The optical characteristics are measured on the following test condition.

Test Condition:

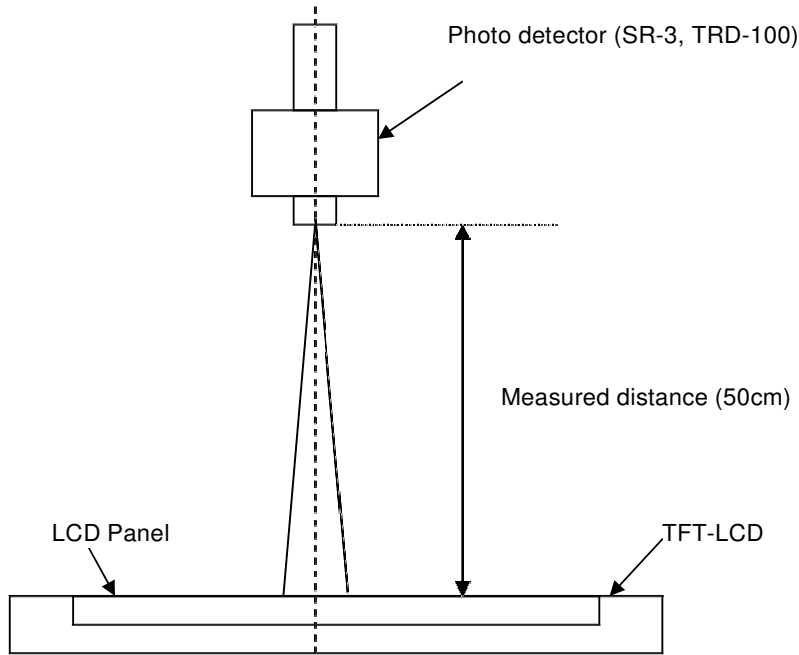
1. Equipment setup: Please refer to Note 1-1.
2. Panel Lighting time: 30 minutes
3. VDD=5.0V, Fv=60Hz, Is=65mA, Ta=25°C

Symbol	Description		Min.	Typ.	Max.	Unit	Remark	
Lw	White Luminance (Center of screen)		200	250	-	[cd/m <sup>2</sup> ]	Note 1-1 By SR-3	
Luni	Luminance Uniformity (9 points)		75	80	-	[%]	Note 1-2 By SR-3	
CR	Contrast Ratio (Center of screen)		2000	3000	-	-	Note 1-3 By SR-3	
θR	Horizontal Viewing Angle (CR=10)	Right	75	89	-	[degree]	Note 1-4 By SR-3	
θL		Left	75	89	-			
ΦH	Vertical Viewing Angle (CR=10)	Up	75	89	-			
ΦL		Down	75	89	-			
θR	Horizontal Viewing Angle (CR=5)	Right	75	89	-			
θL		Left	75	89	-			
ΦH	Vertical Viewing Angle (CR=5)	Up	75	89	-			
ΦL		Down	75	89	-			
TR	Response Time		Rising Time	-	13	28	[msec]	Note 1-5 By TRD-100
TF			Falling Time	-	5	8		
-			Rising + Falling	-	18	36		
Rx	Color Coordinates (CIE 1931)		Red x	0.622	0.652	0.682	-	By SR-3
Ry			Red y	0.305	0.335	0.365		
Gx			Green x	0.291	0.321	0.351		
Gy			Green y	0.595	0.625	0.655		
Bx			Blue x	0.123	0.153	0.183		
By			Blue y	0.037	0.067	0.097		
Wx			White x	0.283	0.313	0.343		
Wy			White y	0.299	0.329	0.359		
NTSC Area Ratio				72		[%]	By SR-3	
CT	Crosstalk		-	-	2.0	[%]	Note 1-6 By SR-3	



FdB	Flicker (Center of screen)	-	-	-20	[dB]	Note 1-7 By SR-3
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**Note 1-1:** Equipment setup :

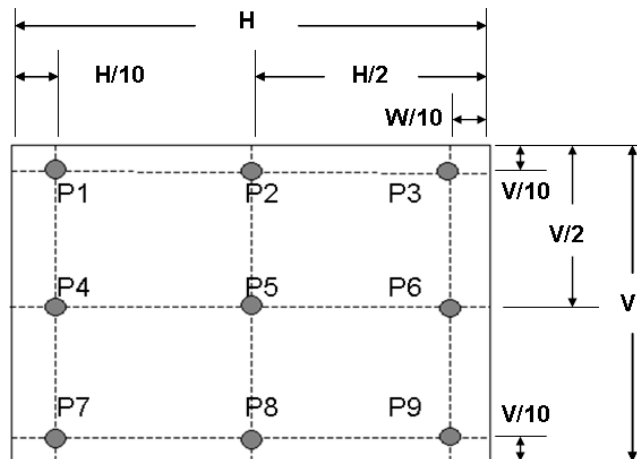


**Note 1-2:** Luminance Uniformity

**Definition:**

$$\text{Luminance Uniformity} = \frac{\text{Minimum Luminance of 9 Points (P1 ~ P9)}}{\text{Maximum Luminance of 9 Points (P1 ~ P9)}}$$

a. Test pattern: White Pattern



**Note 1-3: Contrast Ratio Measurement**

**Definition:**

$$\text{Contrast Ratio} = \frac{\text{Luminance of White pattern}}{\text{Luminance of Black pattern}}$$

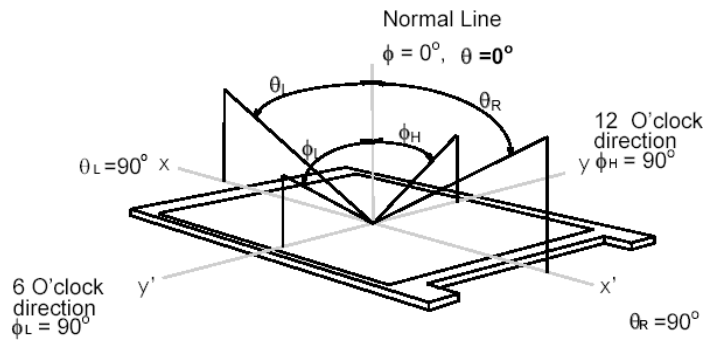
- a. Measured position: Center of screen (P5) & perpendicular to the screen ( $\theta = \Phi = 0^\circ$ )

**Note 1-4: Viewing angle measurement**

**Definition:** The angle at which the contrast ratio is greater than 10 & 5 .

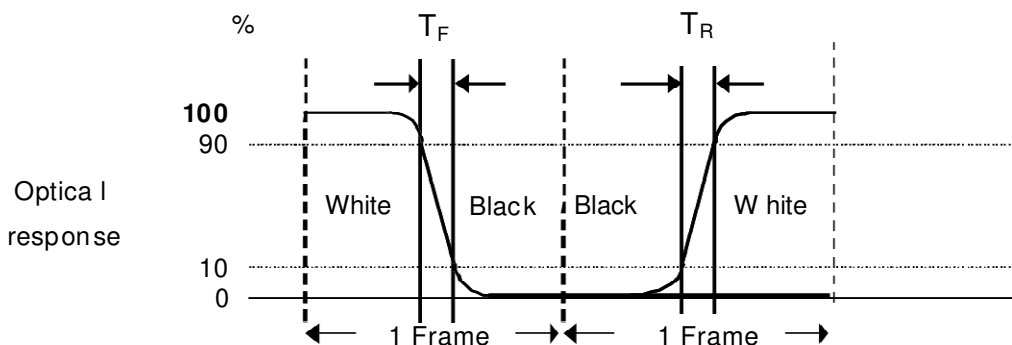
- a. Horizontal view angle: Divide to left & right ( $\theta_L$  &  $\theta_R$ )

Vertical view angle: Divide to up & down ( $\Phi_H$  &  $\Phi_L$ )



**Note 1-5: Response time measurement**

The output signals of photo detector are measured when the input signals are changed from “Black” to “White” (rising time,  $T_R$ ), and from “White” to “Black” (falling time,  $T_F$ ), respectively. The response time is interval between the 10% and 90% of optical response. (Black & White color definition: Please refer section 3.4.3)





**Note 1-6: Crosstalk measurement**

**Definition:**

$CT = \text{Max. } (CTH, CTV);$

Where

a. Maximum Horizontal Crosstalk :

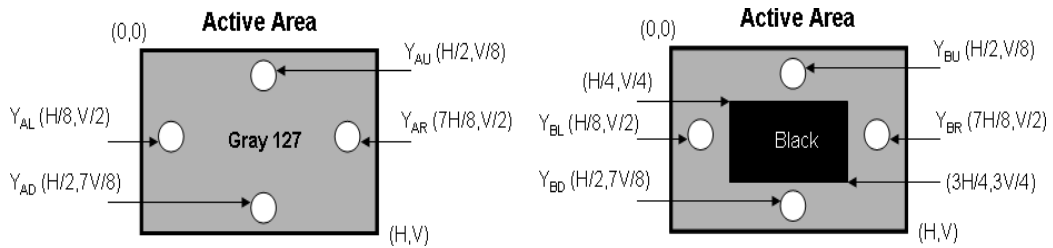
$CTH = \text{Max. } (|YBL - YAL| / YAL \times 100\%, |YBR - YAR| / YAR \times 100\%);$

Maximum Vertical Crosstalk:

$CTV = \text{Max. } (|YBU - YAU| / YAU \times 100\%, |YBD - YAD| / YAD \times 100\%);$

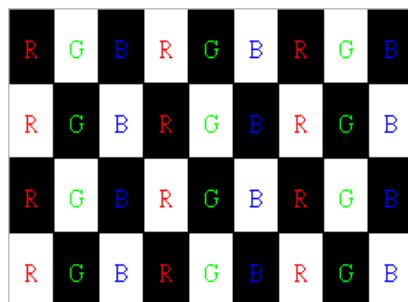
b. YAU, YAD, YAL, YAR = Luminance of measured location without Black pattern

YBU, YBD, YBL, YBR = Luminance of measured location with Black pattern



**Note 1-7: Flicker measurement**

a. Test pattern: It is listed as following.



Gray level = L0



Gray level = L127

R: Red, G: Green, B: Blue

b. Measured position: Center of screen (P5) & perpendicular to the screen ( $\theta = \Phi = 0^\circ$ )

**1.3. Mechanical Characteristics**

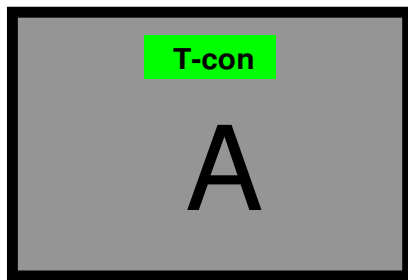
The contents provide general mechanical characteristics for the model ST-215K02. In addition, the figures in the next page are detailed mechanical drawings of the LCD.

Item		Dimension	Unit	Note
Outline Dimension	Horizontal	514.64	mm	
	Vertical	310.51	mm	
	Depth (Dmin)	10.5	mm	Cover Glass to back bezel
	Depth (Dmax)	13.7	mm	to wall mount
Weight	2700		G	

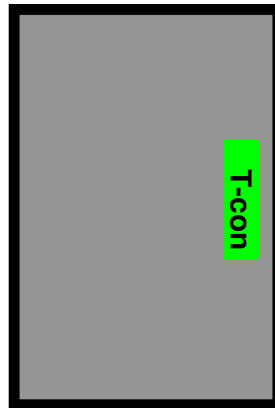
**1.3.1. Placement Suggestions**

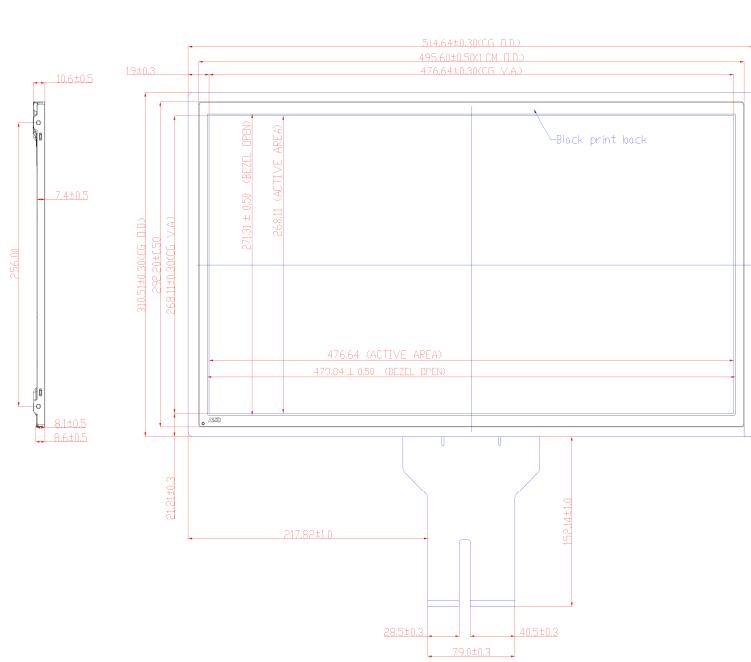
1. Landscape Mode: The default placement is T-Con Side on the lower side and the image is shown upright via viewing from the front.
2. Portrait Mode: The default placement is that T-Con side has to be placed on the left side via viewing from the front.

Landscape (Front view)

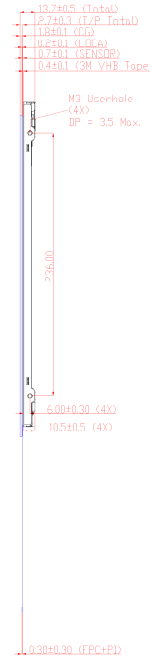


Portrait (Front view)

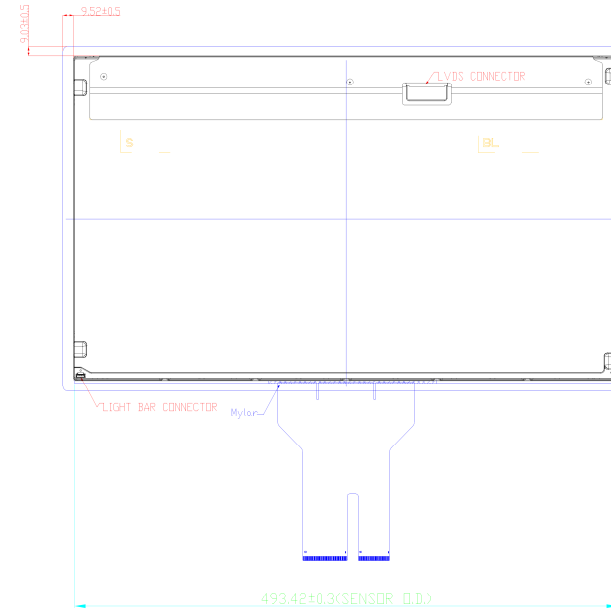




Front view

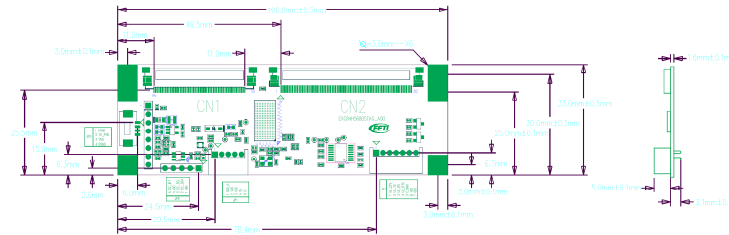


Side view



Back view

- NOTES:
1. PRELIMINARY DRAWING FOR REFERENCE ONLY.
  2. THIS DIMENSION EXCLUDES DEFORMATION.
  3. BACKLIGHT: LED LIGHT-BAR
  4. MODULE THICKNESS TO BE 11.1mm MAX.
  5. TOLERANCE WITHOUT SPECIFIED TO BE 0.5 mm.
  6. TORQUE OF M3 USER HOLE SHOULD BE WITHIN 4 KGF-CM AND RE-SCREW 10 TIMES.
  7. USER HOLE SCREW PENETRATION 3.5mm MAX.



Scale 3:1

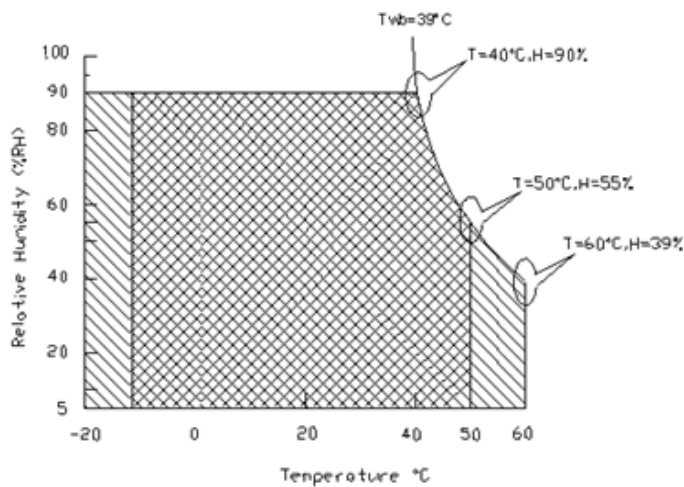
## 2. Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit. Permanent damage may occur if exceeding the following maximum rating.

Symbol	Description	Min.	Max.	Unit	Remark
TOP	Operating Temperature	-10	+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.

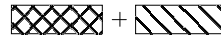
1. 90% RH Max (  $T_a \leq 39^\circ\text{C}$  )
2. Max wet-bulb temperature at 39 or less. (  $T_a \leq 39^\circ\text{C}$  )
3. No condensation



Operating Range



Storage Range

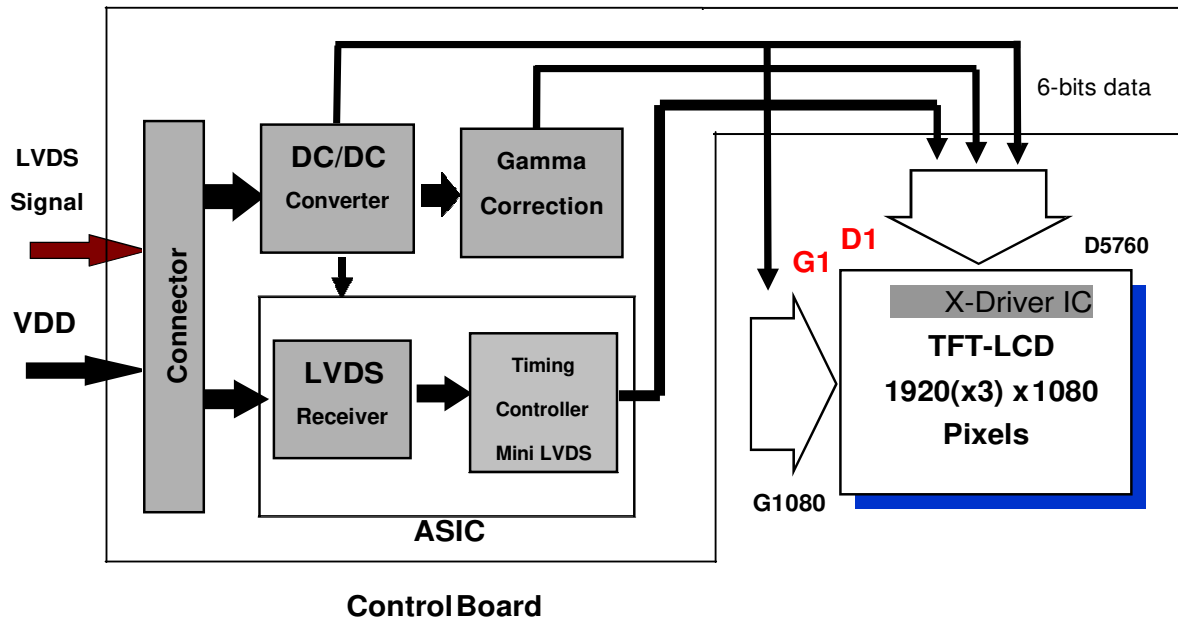


### 3. Electrical Specification

The ST-215K02 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The other is to power Back Light Unit.

#### 3.1. Block Diagram

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



## 3.2. Interface Connection

### 3.2.1. Connector Type

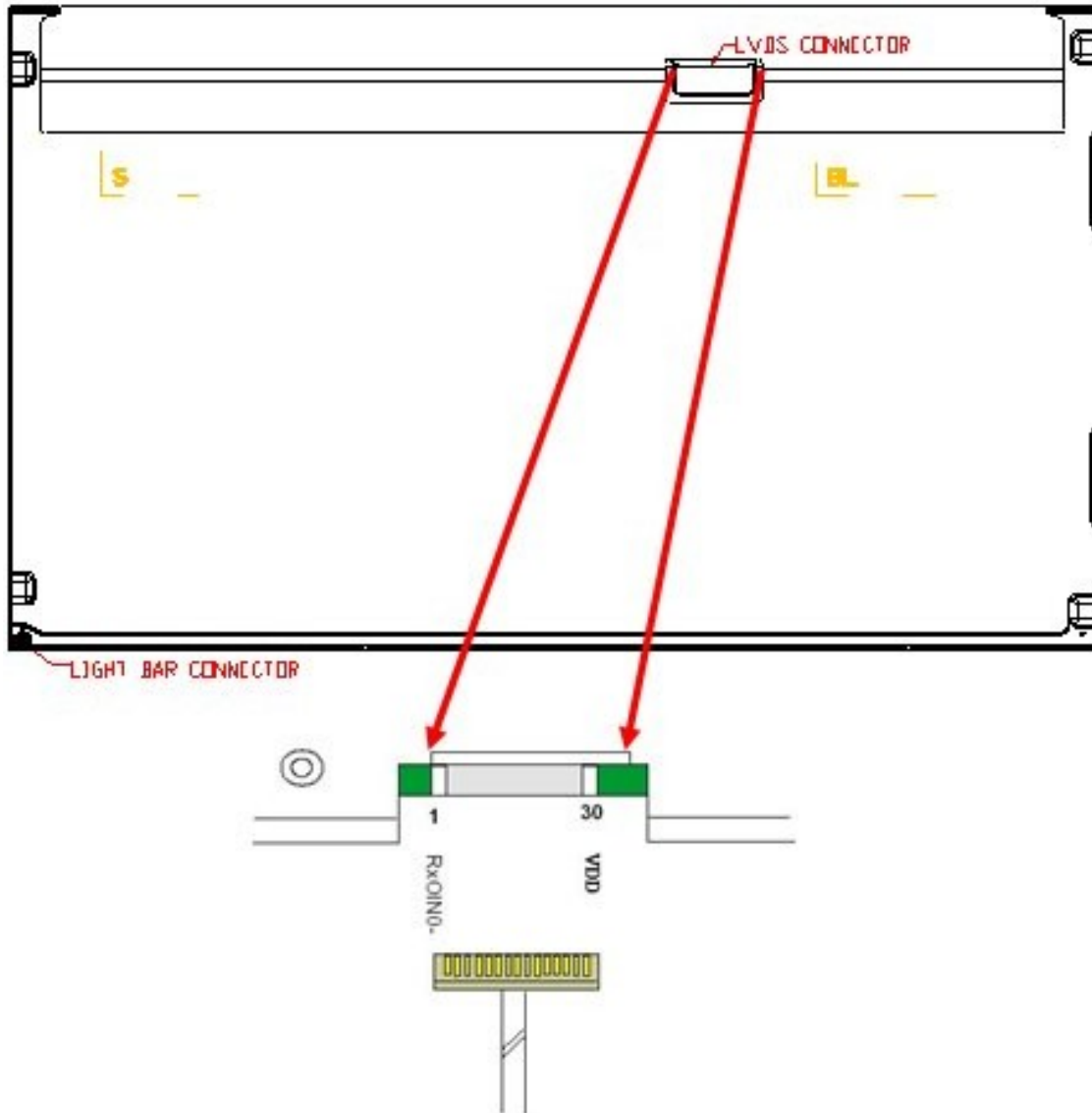
TFT-LCD Connector	Manufacturer	P-TWO	STM
	Part Number	AL230F-A0G1D-P	MSCKT2407P30HB
Mating Connector	Manufacturer	JAE	
	Part Number	FI-X30HL (Locked Type)	

### 3.2.2. Connector Pin Assignment

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	
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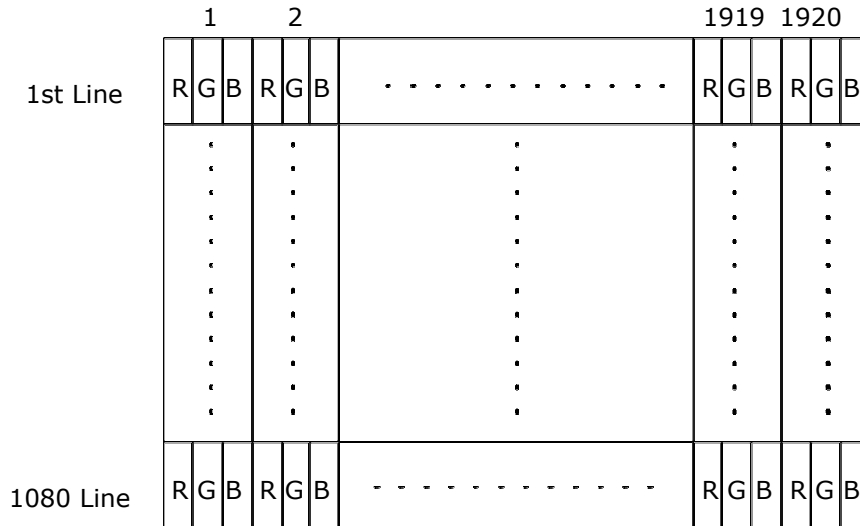




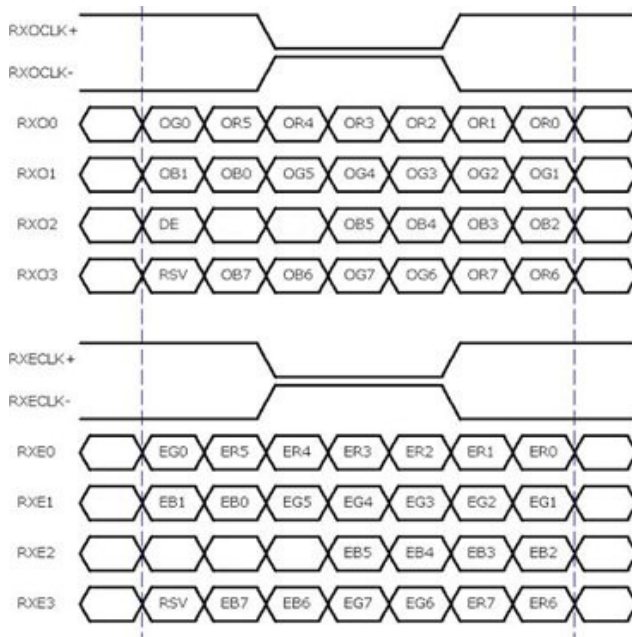


**3.4. Signal Characteristics**

**3.4.1. LCD Pixel Format**



**3.4.2. LVDS Data Format**



8 Bit Color Bit Order			
<b>MSB</b>	R7	G7	B7
	R6	G6	B6
	R5	G5	B5
	R4	G4	B4
	R3	G3	B3
	R2	G2	B2
	R1	G1	B1
<b>LSB</b>	R0	G0	B0

**Note 3-2:**

- a. O = "Odd Pixel Data"    E = "Even Pixel Data"
- b. Refer to 3.4.1 LCD pixel format, the 1st data is 1 (Odd Pixel Data), the 2nd data is 2 (Even Pixel Data) and the last data is 1920 (Even Pixel Data).

### 3.4.3. Color versus Input Data

The following table is for color versus input data (8bit). The higher the gray level, the brighter the color.

Color	Gray Level	Color Input Data																								Remark
		RED data (MSB:R7, LSB:R0)								GREEN data (MSB:G7, LSB:G0)								BLUE data (MSB:B7, LSB:B0)								
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0	
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	
White	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Gray 127	-	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	
Red	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Green	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
Blue	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	

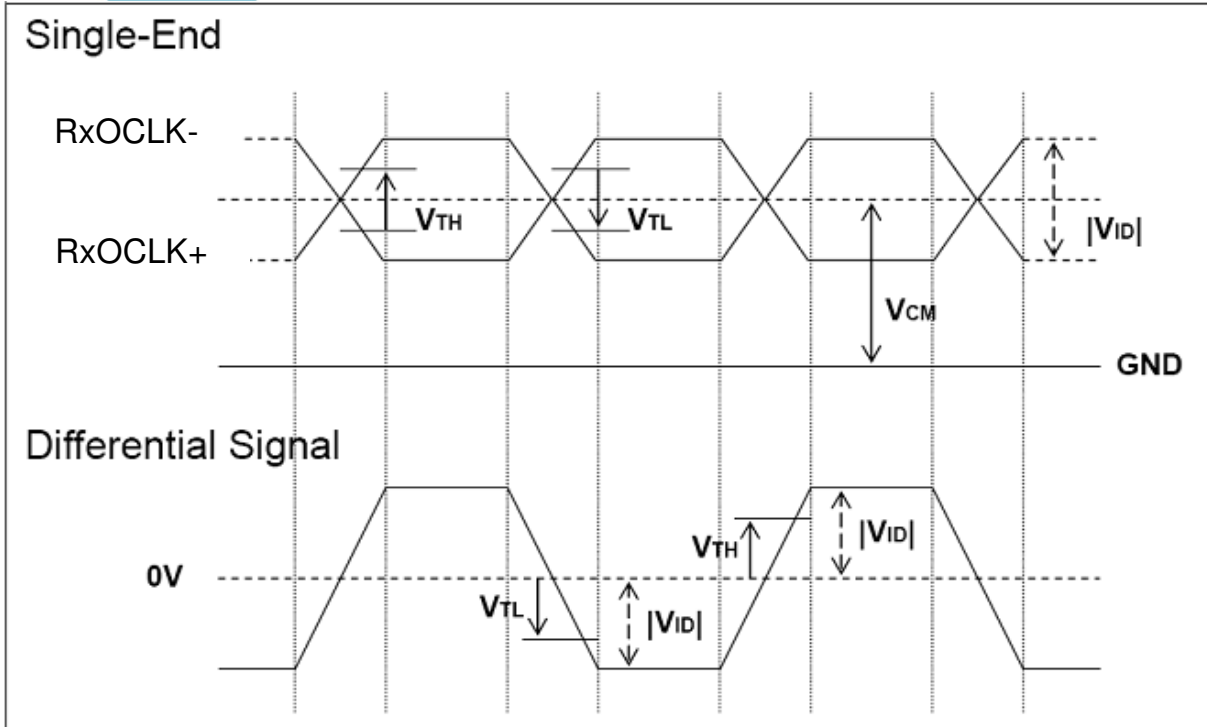
### 3.4.4. LVDS Specification

#### a. DC Characteristics:

Symbol	Description	Min	Typ	Max	Units	Condition
VTH	LVDS Differential Input High Threshold	-	-	+100	[mV]	VCM = 1.2V
VTL	LVDS Differential Input Low Threshold	-100	-	-	[mV]	VCM = 1.2V
VID	LVDS Differential Input Voltage	100	-	600	[mV]	
VCM	LVDS Common Mode Voltage	+1.0	+1.2	+1.5	[V]	VTH-VTL = 200mV

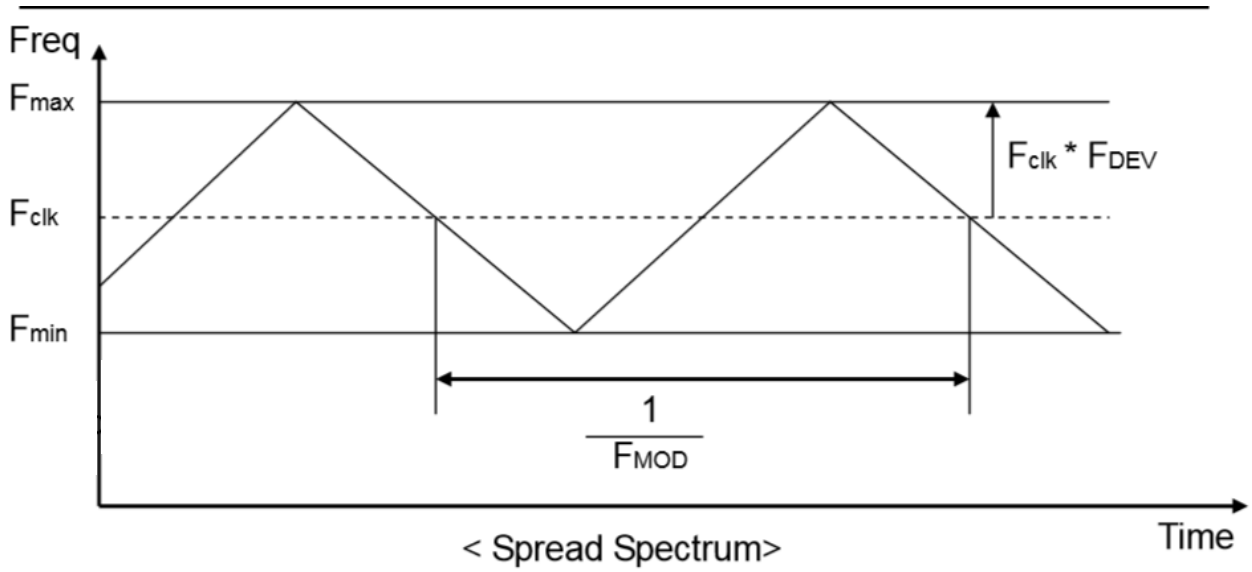
#### LVDS Signal Waveform:

Use RxOCLK- & RxOCLK+ as example.



b. AC Characteristics:

Symbol	Description	Min	Max	Unit	Remark
FDEV	Maximum deviation of input clock frequency during Spread Spectrum	-	$\pm 3$	%	
FMOD	Maximum modulation frequency of input clock during Spread Spectrum	-	200	KHz	



Fclk: LVDS Clock Frequency

### 3.4.5. Input Timing Specification

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	1793	Th	Tv
Tdisp (v)		Active	1080	1080	1080	Th	Tdisp (v)
Tblk (v)		Blanking	12	50	713	Th	Tblk (v)
Fv		Frequency	50	60	76	Hz	Fv
Th	Horizontal Section	Period	1004	1050	1100	Tclk	Th
Tdisp (h)		Active	960	960	960	Tclk	Tdisp (h)
Tblk (h)		Blanking	44	90	140	Tclk	Tblk (h)
Fh		Frequency	55	68	90	KHz	Fh
Tclk	LVDS Clock	Period	11.1	14.0	18.2	ns	Tclk
Fclk		Frequency	54.8	71.2	90.0	MHz	Fclk

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

$$Fh (\text{Min.}) = Fclk (\text{Min.}) / Th (\text{Min.});$$

$$Fh (\text{Typ.}) = Fclk (\text{Typ.}) / Th (\text{Typ.});$$

$$Fh (\text{Max.}) = Fclk (\text{Max.}) / Th (\text{Min.});$$

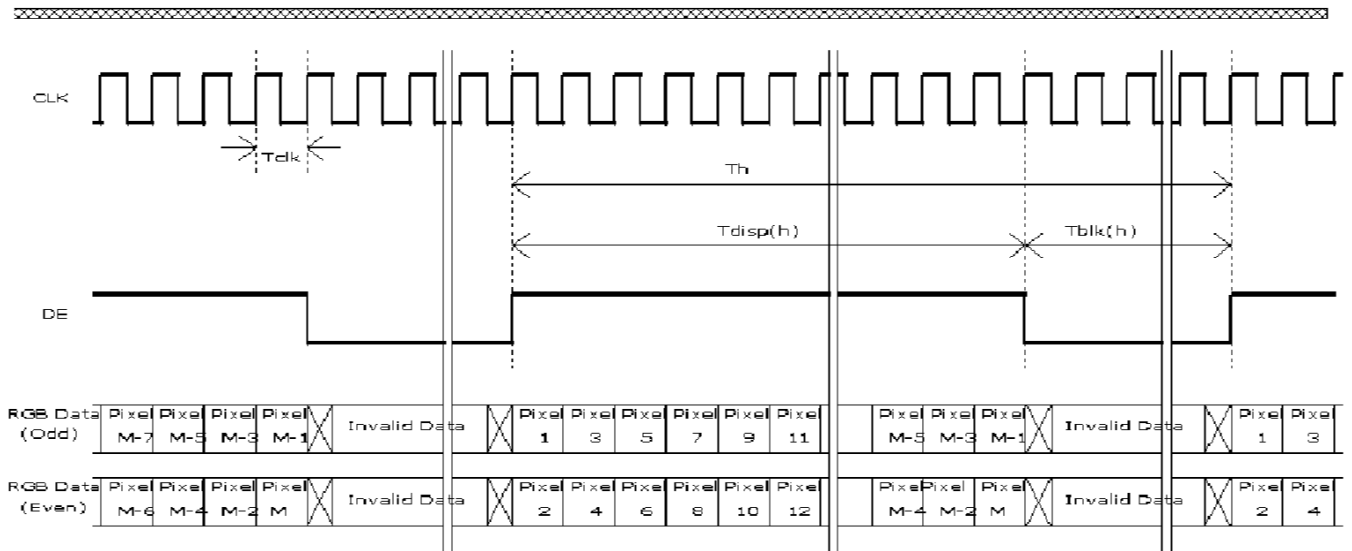
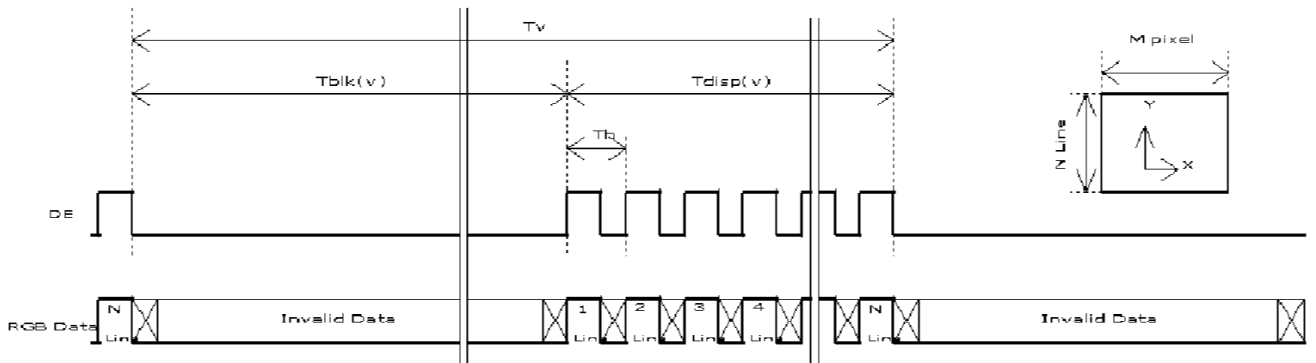
**Note 3-4:** The equation is listed as following. Please don't exceed the above recommended value.

$$Fclk (\text{Min.}) = Fv (\text{Min.}) \times Th (\text{Min.}) \times Tv (\text{Min.});$$

$$Fclk (\text{Typ.}) = Fv (\text{Typ.}) \times Th (\text{Typ.}) \times Tv (\text{Typ.});$$

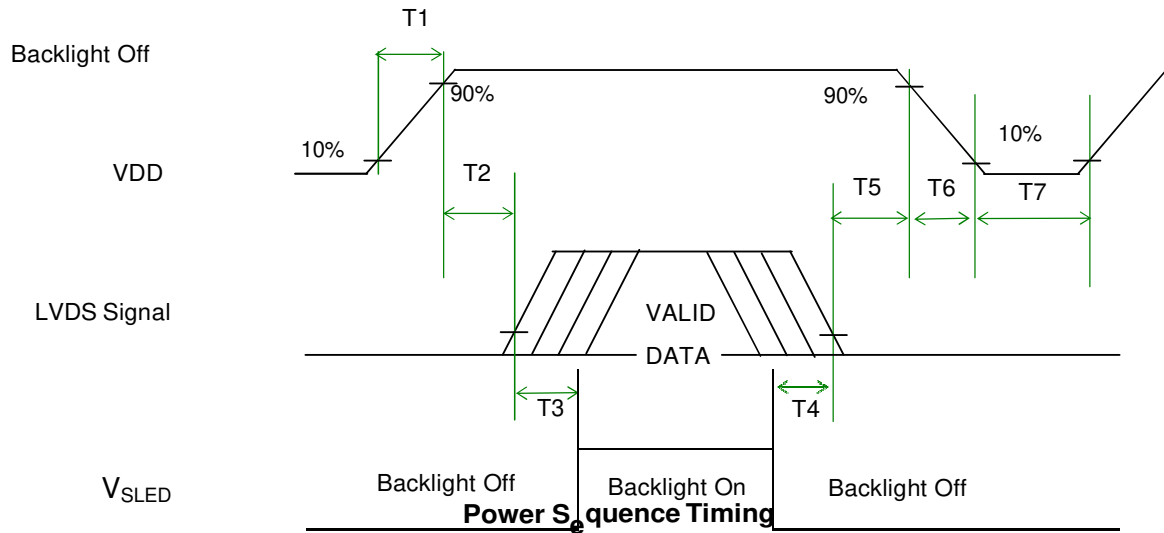
$$Fclk (\text{Max.}) = Fv (\text{Max.}) \times Th (\text{Typ.}) \times Tv (\text{Typ.});$$

3.4.6. **Input Timing Diagram**



### 3.5. Power ON/OFF Sequence

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.



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	-	200	[ms]	Note 3-6 Note 3-7
T7	1000	-	-	[ms]	

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

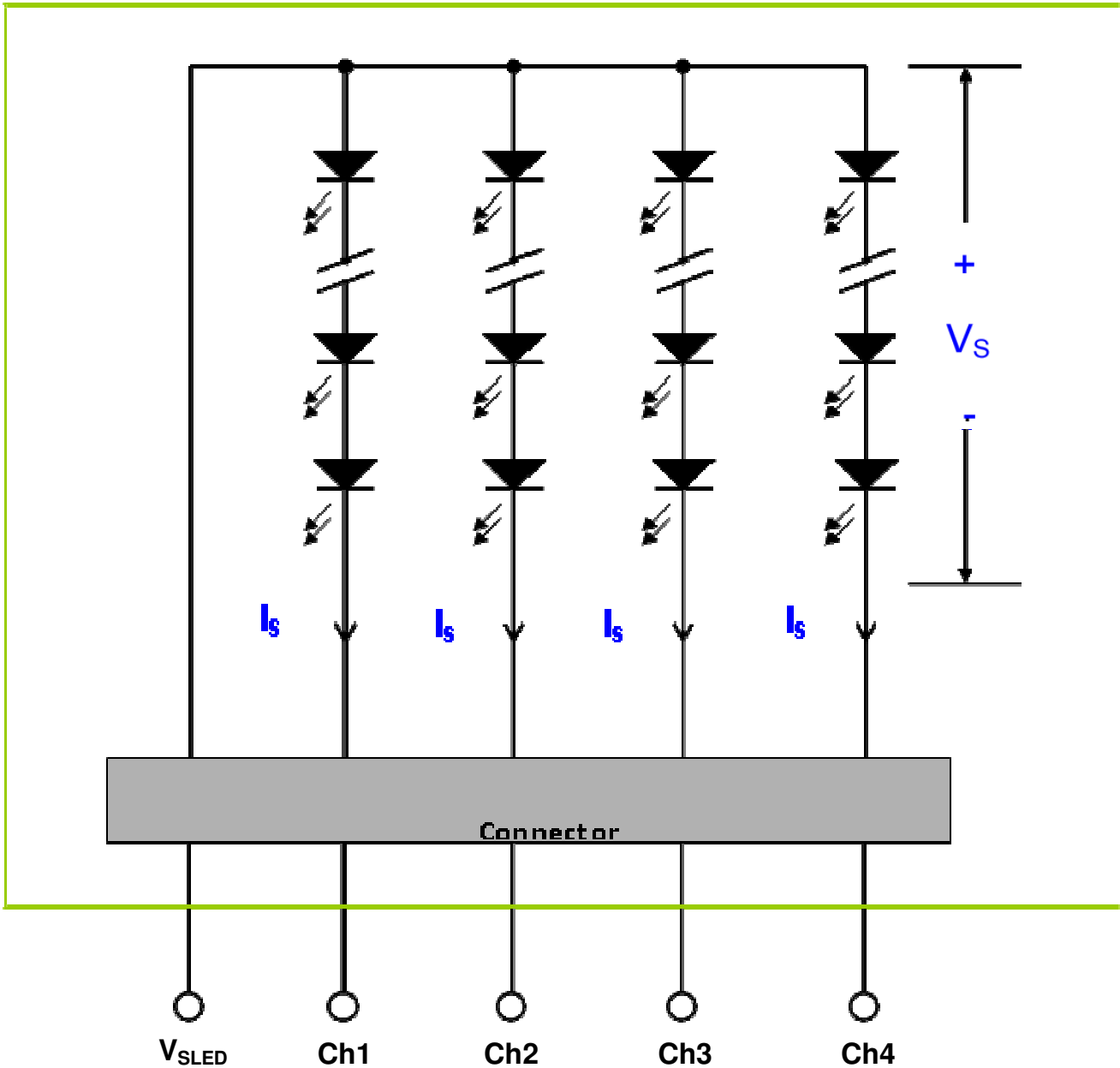
**Note 3-6 :** During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.

**Note 3-7 :** Voltage of VDD must decay smoothly after power-off. (customer system decide this value)

## 4. Backlight Unit

### 4.1. Block Diagram

The following shows the block diagram of the 21.5 inch Backlight Unit. And it includes 60 pcs LED in the LED light bar. (4 strings and 15 pcs LED of one string).





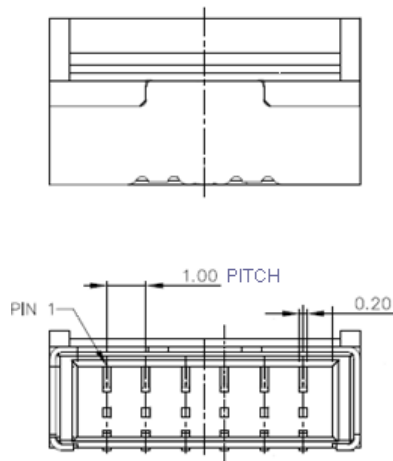
**4.2. Interface Connection**

**4.2.1. Connector Type**

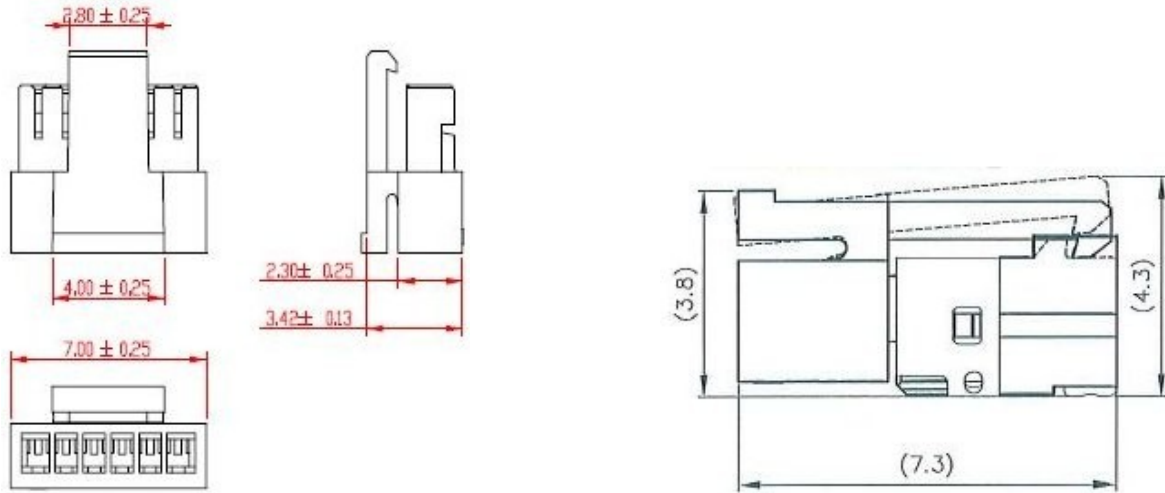
Backlight Connector	Manufacturer	ENTERY
	Part Number	3707K-S06N-21R
Mating Connector	Manufacturer	ENTERY
	Part Number	H112K-P06N-00B (Non-Locking type) H112K-P06N-03B (Locking type)

**Backlight Connector dimension:**

$H \times V \times D = 13.9 \times 3.00 \times 4.25$ ,  $Pitch = 1.0(\text{unit} = \text{mm})$

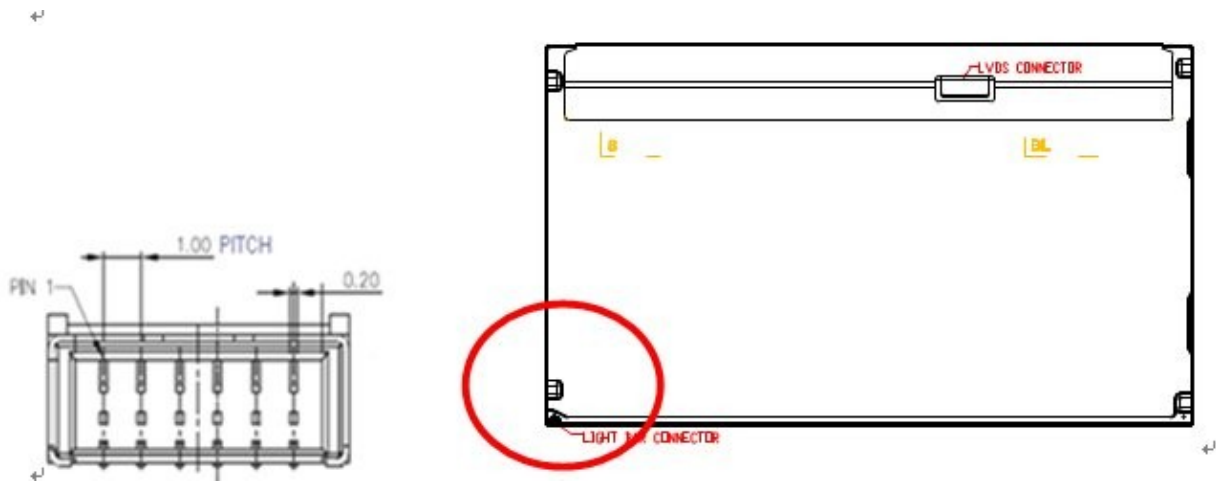


**Mating Connector dimension:**



**4.2.2. Connector Pin Assignment**

Pin#	Symbol	Description	Remark
1	Ch1	LED Current Feedback Terminal (Channel 1)	
2	Ch2	LED Current Feedback Terminal (Channel 2)	
3	V <sub>SLED</sub>	LED Power Supply Voltage Input Terminal	
4	V <sub>SLED</sub>	LED Power Supply Voltage Input Terminal	
5	Ch3	LED Current Feedback Terminal (Channel 3)	
6	Ch4	LED Current Feedback Terminal (Channel 4)	



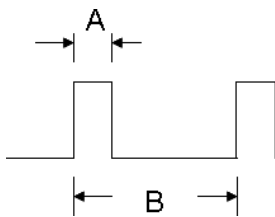
**4.3. Electrical Characteristics**

**4.3.1. Absolute Maximum Rating**

Permanent damage may occur if exceeding the following maximum rating.

(Ta=25°C)

Symbol	Description	Min	Max	Unit	Remark
Is	LED String Current	0	90	[mA]	100% duty ratio
			150	[mA]	Duty ratio ≤ 10% Pulse time=10 ms



Duty ratio= (A / B) X 100% ; (A: Pulse time, B: Period)

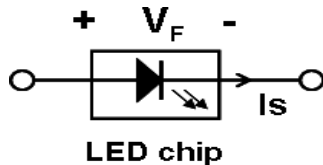
**4.3.2. Recommended Operating Condition**

(Ta=25°C)

Symbol	Description	Min.	Typ.	Max.	Unit	Remark
Is	LED String Current	-	65	72	[mA]	100% duty ratio of LED chip
Vs	LED String Voltage	-	46.5	51	[Volt]	Is=65mA @ 100% duty ratio; <b>Note 4-1, Note 4-5</b>
ΔVs	Maximum Vs Voltage Deviation of light bar	-	-	4.5	[Volt]	Is=65mA @ 100% duty ratio; <b>Note 4-2</b>
P <sub>BLU</sub>	LED Light Bar Power Consumption	-	12.1	13.3	[Watt]	<b>Note 4-3</b>
LT <sub>LED</sub>	LED Life Time	30,000	-	-	[Hour]	<b>Note 4-4</b>
OVP	Over Voltage Protection in system board	110% Vsmax	-	-	[Volt]	<b>Note 4-5</b>

**Note 4-1:**  $V_s (\text{Typ.}) = V_F (\text{Typ.}) \times \text{LED No. (one string)}$ ;

- a.  $V_F$ : LED chip forward voltage,  $V_F (\text{Min.}) = 2.8\text{V}$ ,  $V_F (\text{Typ.}) = 3.1\text{V}$ ,  $V_F (\text{Max.}) = 3.4\text{V}$
- b. The same equation to calculate  $V_s (\text{Min.})$  &  $V_s (\text{Max.})$  for respective  $V_F (\text{Min.})$  &  $V_F (\text{Max.})$ ;



**Note 4-2:**  $\Delta V_s (\text{Max.}) = \Delta V_F \times \text{LED No. (one string)}$ ;

- a.  $\Delta V_F$ : LED chip forward voltage deviation; (0.3 V , each Bin of LED  $V_F$ )

**Note 4-3:**  $P_{\text{BLU}} (\text{Typ.}) = V_s (\text{Typ.}) \times I_s (\text{Typ.}) \times 4$  ; ( 4 is total String No. of LED Light bar)

$$P_{\text{BLU}} (\text{Max.}) = V_s (\text{Max.}) \times I_s (\text{Typ.}) \times 4 ;$$

**Note 4-4:** Definition of life time:

- a. Brightness of LED becomes to 50% of its original value
- b. Test condition:  $I_s = 65\text{mA}$  and  $25^\circ\text{C}$  (Room Temperature)

**Note 4-5:** Recommendation for LED driver power design:

Due to there are electrical property deviation in LED & monitor set system component after long time operation. Strongly recommend the design value of LED driver board OVP (over voltage protection) should be 10% higher than max. value of LED string voltage ( $V_s$ ) at least.

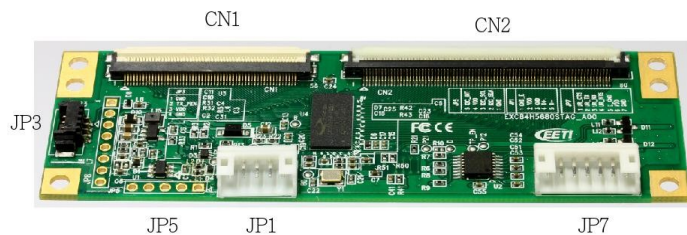
**Note 4-6:** Strongly recommend “Analog Dimming” method for backlight brightness control for Wavy Noise Free. Otherwise, recommend that Dimming Control Signal (PWM Signal) should be synchronized with Frame Frequency.

## 5. P-CAP Controller Board

### 5.1. Technical Specifications

<b>Circuit Board Dimension</b>	33mm x 100mm x 8.1mm
<b>Channels of Panel</b>	Max.Tx:46 Rx:80 channels (include shielding pin)
<b>Input Voltage</b>	3.5V~5.5V.Typical 5V.
<b>Linearity</b>	Line drawing accuracy : 1pt +/- 1mm offset /10mm Touch (point) accuracy : 1pt +/- 1mm
<b>Resolution</b>	16384 x 16384 resolution
<b>Power consumption(mA)</b>	Active Mode: < 90mA Idle Mode : depends on firmware
<b>Report rate(points/sec)*</b>	> 100 Hz
<b>Response time</b>	Average < 25 ms

### 5.2. PIN ASSIGNMENT



#### FPC Pin Description

CN1					
PN		PN		PN	
1	NC	1	TX34	41	TX14
2	NC	22	TX33	42	TX13
3	NC	23	TX32	43	TX12
4	NC	24	TX31	44	TX11
5	NC	25	TX30	45	TX10
6	NC	26	TX29	46	TX9
7	NC	27	TX28	47	TX8
8	NC	28	TX27	48	TX7
9	TX_S1	29	TX26	49	TX6
10	TX45	30	TX25	50	TX5
11	TX44	31	TX24	51	TX4
12	TX43	32	TX23	52	TX3
13	TX42	33	TX22	53	TX2
14	TX41	34	TX21	54	TX1
15	TX40	35	TX20	55	TX0
16	TX39	36	TX19	56	TX_S0
17	TX38	37	TX18		
18	TX37	38	TX17		
19	TX36	39	TX16		
20	TX35	40	TX15		

CN2					
PN		PN		PN	
1	RX_S1	21	RX58	41	RX38
2	RX77	22	RX57	42	RX37
3	RX76	23	RX56	43	RX36
4	RX75	24	RX55	44	RX35
5	RX74	25	RX54	45	RX34
6	RX73	26	RX53	46	RX33
7	RX72	27	RX52	47	RX32
8	RX71	28	RX51	48	RX31
9	RX70	29	RX50	49	RX30
10	RX69	30	RX49	50	RX29
11	RX68	31	RX48	51	RX28
12	RX67	32	RX47	52	RX27
13	RX66	33	RX46	53	RX26
14	RX65	34	RX45	54	RX25
15	RX64	35	RX44	55	RX24
16	RX63	36	RX43	56	RX23
17	RX62	37	RX42	57	RX22
18	RX61	38	RX41	58	RX21
19	RX60	39	RX40	59	RX20
20	RX59	40	RX39	60	RX19
				61	RX18
				62	RX17
				63	RX16
				64	RX15
				65	RX14
				66	RX13
				67	RX12
				68	RX11
				69	RX10
				70	RX9
				71	RX8
				72	RX7
				73	RX6
				74	RX5
				75	RX4
				76	RX3
				77	RX2
				78	RX1
				79	RX0
				80	RX_S0

## Connector Pin Configuration

### JP1 USB connector

JP1	
1	GND_E
2	VDD
3	GND
4	D +
5	D -

### JP5 I2C connector

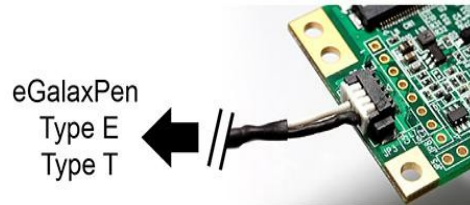
JP5	
1	GND
2	I2C_SDA
3	I2C_SCL
4	VDD
5	I2C_INT

### JP7 RS232 connector

JP7	
1	UR_CTS
2	UR_TX
3	UR_RX
4	UR_RTS
5	GND_E
6	VDD
7	GND

### JP3 Tethered active stylus connector

JP3	
1	GND_D
2	TX_PEN
3	VDD
4	GND_D



\*JP3 connector is reserved for EETI tethered active tyllus :

Type E : Entry-type active stylus

Type T : Tethered USB active stylus

## 6. Reliability Test Items

Reliability test items are listed as following table. (*Bare Panel only*)

Items	Condition	Remark
Temperature Humidity Bias (THB)	Ta= 50°C, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 50°C, 50%RH, 300hours	
Low Temperature Operation (LTO)	Ta= 0°C, 300hours	
High Temperature Storage (HTS)	Ta= 60°C, 300hours	
Low Temperature Storage (LTS)	Ta= -20°C, 300hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Random Frequency: 10 - 200 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 20 ms Direction: ±X, ±Y, ±Z (one time for each Axis)	
Thermal Shock Test (TST)	-20°C/30min, 60°C/30min, 100 cycles	<b>Note 5-1</b>
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 15KV, 150pF(330Ω ) 1sec, 8 points, 25 times/ point.	<b>Note 5-2</b>
	Air Discharge: ± 15KV, 150pF(330Ω ) 1sec 8 points, 25 times/ point.	
Altitude Test	Operation:18,000 ft Non-Operation:40,000 ft	

**Note 5-1:** a. A cycle of rapid temperature change consists of varying the temperature from -20°C to 60°C, 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.

**Note 5-2:** EN61000-4-2, ESD class B: Certain performance degradation allowed

No data lost

Self-recoverable

No hardware failures.



## **7. International Standard**

### **7.1. Safety**

- (1) UL 60950-1; Standard for Safety of Information Technology Equipment Including electrical Business Equipment.
- (2) IEC 60950-1; Standard for Safety of International Electrotechnical Commission
- (3) EN 60950-1; European Committee for Electrotechnical Standardization (CENELEC), EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

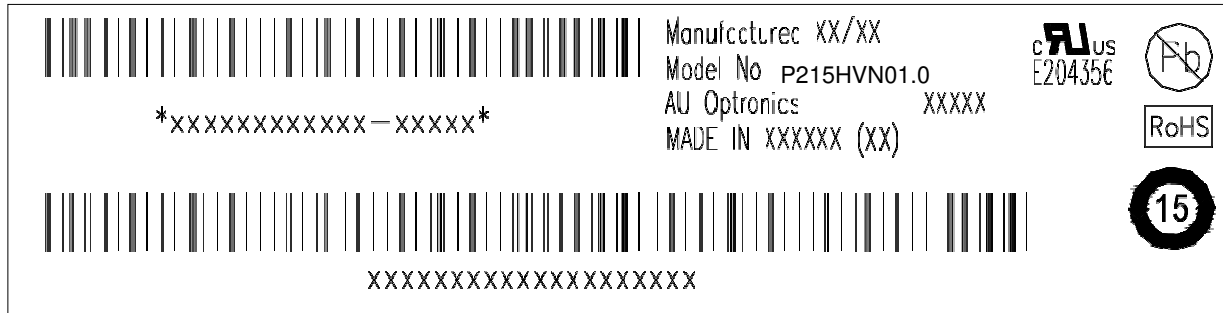
### **7.2. EMC**

- (1) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz." American National standards Institute(ANSI), 1992
- (2) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special committee on Radio Interference.
- (3) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization. (CENELEC), 1998

**8. Packing**


**8.1. Definition of Label**

**A. Panel Label:**



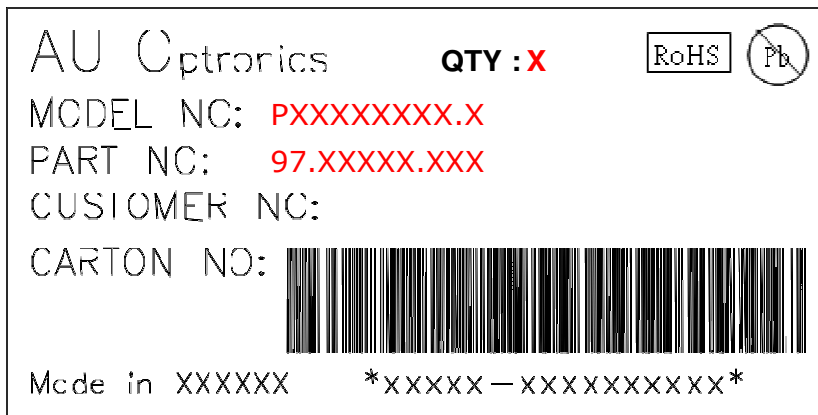
Green mark description

(1) For Pb Free Product, AUO will add  for identification.

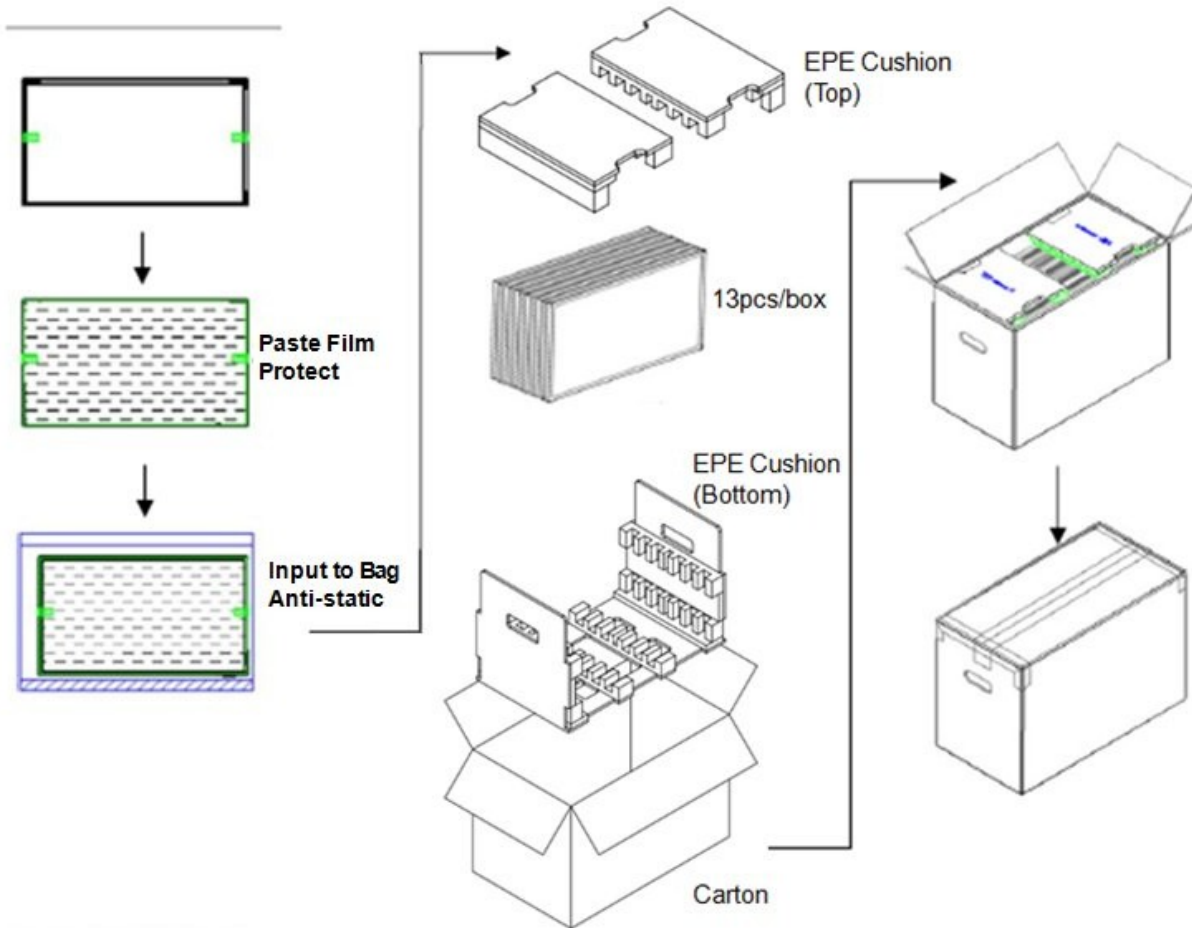
(2) For RoHS compatible products, AUO will add  for identification.

Note: The green Mark will be present only when the green documents have been ready by AUO internal green team. (definition of green design follows the AUO green design checklist.)

**B. Carton Label:**



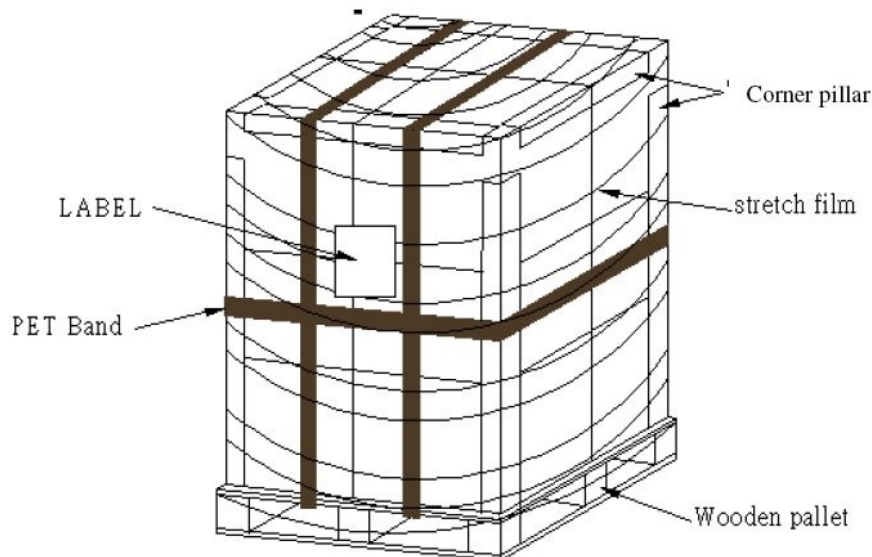
## 8.2. Packing Methods



**8.3. Pallet and Shipment Information**

	Item	Specification			Remark
		Q'ty	Dimension	Weight(kg)	
1	Module	1	514.64(H)mm x 310.51(V)mm x 13.7(D)mm	1.67	<b>Note 1</b>
2	Cushion	1	--	0.55	
3	Box	1	565(L)mm x 345(W)mm x 375(H)mm	1.4	without Panel & cushion <b>Note 1</b>
4	Packing Box	11 pcs/Box	565(L)mm x 345(W)mm x 375(H)mm	23.66	with panel & cushion <b>Note 1</b>
5	Pallet	1	1150(L)mm x 1070(W)mm x 132(H)mm	14.2	<b>Note 1</b>
6	Pallet after Packing	18boxes/pallet	1150(L)mm x 1070(W)mm x 1257(H)mm	495	<b>Note 1</b>

**Note 1:** Estimated value which is subject to change based on real measured data.



**Single pallet stack Illustration**

## 9. Appearance Inspection

### 9.1 Inspection Environment specifications

- A. 觸控面板的目視檢查作業必須在至少無塵室等級為 10,000 的環境下執行。

The touch sensor has to be inspected at a clean room of at least class 10,000.

- B. 觸控面板的目視檢查環境設定值必須被控制溫度在 23°C 到 27°C 以及濕度在 40% 到 60% 之間。

The visual inspection environment should be set at 23 to 27 degree C and 40% to 60% humidity.

- C. 觸控面板外觀目視檢查之環境照度須設定在 1000±300 Lux 的日光燈光源下。

The illumination of the appearance inspection should be 1000±300 Lux with fluorescent reflection light source.

- D. 觸控面板的目視檢查須在人眼裸視基礎下，並且觸控面板到人眼的目檢距離須至少超過 30 公分。

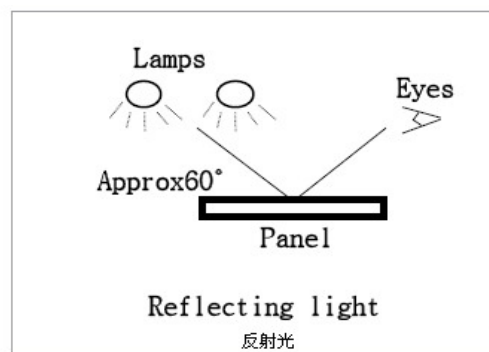
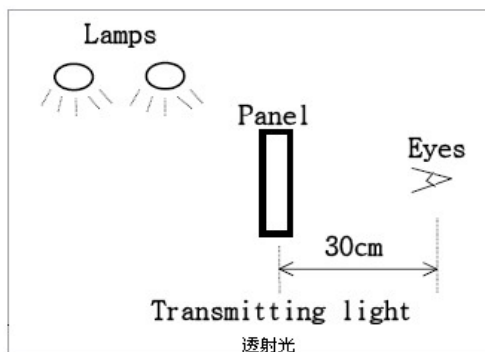
The visual inspection should be kept the distance 30cm or more between the touch sensor and the raw eyes of inspectors.

- E. 觸控面板的裸眼目視檢查角度須以 30 度正負 15 度的角度作業。

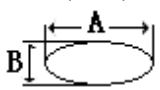
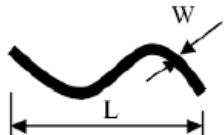
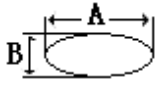
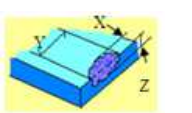
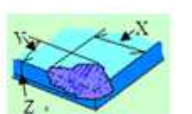

The viewing angle should be 30±15 degree with an inspector's raw eyes when visual inspection.

- F. 目視檢查示意圖如下附圖所示，且目視檢查時間為 15 秒正負 5 秒鐘。

The visual inspection illustration is showed as below and Visual inspection time is 15±5 second per one's.



9.2 Appearance Testing Conten

Item 品項	Calculate Method 計算方式	The standard of determination 判定標準	
Spot defect (White/ Black) (黑/白/污點、粒子雜物點)	大小: $\Phi = (A+B)/2$ 	大小	允許數量
		$0 \leq \Phi \leq 0.5\text{mm}$	不計
		$0.5\text{mm} < \Phi \leq 0.7\text{mm}$ $DS > 10\text{mm}$	$N \leq 6$
		$\Phi > 0.7$	$N = 0$
Linear defect 刮傷/毛屑/線狀異物		寬W	長L
		$W \leq 0.1\text{mm}$	不計
		$0.1\text{mm} < W \leq 0.15\text{mm}$ $L \leq 15\text{mm}, DS \geq 15\text{mm}$	$N \leq 5$
	$W > 0.15$	$N = 0$	
Bump point (魚眼、凹凸點)	大小: $\Phi = (A+B)/2$ 	大小	允許數量
		$0 \leq \Phi \leq 0.1\text{mm}$	不計
		$0.15\text{mm} < \Phi \leq 0.5\text{mm}$ $DS > 10\text{mm}$	$N \leq 5$
	$\Phi > 0.5$	$N = 0$	
CG chipping/crack (CG崩邊, 裂紋)		正面: $\Phi \leq 0.15\text{mm}, Z \leq T/2$ $DS \geq 25\text{mm}, N \leq 2$	背面: 1. 從正面看不影響外觀 2. $\Phi \leq 0.5\text{mm}, Z \leq T/2$ , 不計
		正面: $X \leq 0.15\text{mm}, Y \leq 0.15\text{mm},$ $Z \leq T/2, N \leq 2$	背面: 1. 從正面看不影響外觀; 2. $X \leq 2\text{mm}, Y \leq 2\text{mm}$ $Z \leq T, N \leq 2$
		Crack is not allowed 裂紋不允許	
Dirty 髒汙		Wipe the dirt acceptance, cannot be wiped follow the bad liner calculation 可擦拭髒汙允收，不可擦拭按點線狀不良計算	
Light leak 漏光		Flat test is not visible is OK 平光檢驗不可見為OK	
Other not be defined 其他未定義缺陷		See sample limitation 參見限度樣品	

## **10. Precautions**

Please pay attention to the followings when you use this TFT LCD module.

### **10.1. Mounting Precautions**

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter cause circuit broken by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizer with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

### **10.2. Operating Precautions**

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage:  
 $V = \pm 200\text{mV}$  (Over and under shoot voltage)
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer..)
- (3) Brightness depends on the temperature. (In lower temperature, it may become lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interface.

### **10.3. Operating Condition for Public Information Display**

The device listed in the product specification is designed and manufactured for PID (Public Information

Display) application. To optimize module's lifetime and function, below operating usages are required.

- (1) Normal operating condition
  - A. Operating temperature: -10~50°C
  - B. Operating humidity: 10~90%
  - C. Display pattern: dynamic pattern (Real display).  
Note) Long-term static display would cause image sticking.
- (1) Operation usage to protect against image sticking due to long-term static display.
  - A. Suitable operating time: 20 hours a day or less.  
(\* The moving picture can be allowed for 24 hours a day)
  - B. Liquid Crystal refresh time is required. Cycling display between 5 minutes' information (static) display and 10 seconds' moving image.
  - C. Periodically change background and character (image) color.
  - D. Avoid combination of background and character with large different luminance.
- (2) Periodically adopt one of the following actions after long time display.
  - A. Running the screen saver (motion picture or black pattern)
  - B. Power off the system for a while
- (3) LCD system is required to place in well-ventilated environment. Adapting active cooling system is highly recommended.
- (4) Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions, such as high temperature/ humidity, display stationary patterns, or long operation time etc..., it is strongly recommended to contact AUO for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and controlling systems.

#### **10.4. Electrostatic Discharge Control**

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wristband etc. And don't touch interface pin directly.

#### **10.5. Precautions for Strong Light Exposure**

Strong light exposure causes degradation of polarizer and color filter.

#### **10.6. Storage**

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they



be stored in the container in which they were shipped.

- (3) Storage condition is guaranteed under packing conditions.
- (4) The phase transition of Liquid Crystal in the condition of the low or high storage temperature will be recovered when the LCD module returns to the normal condition.

### **10.7. Handling Precautions for Protection Film**

- (1) The protection film is attached to the bezel with a small masking tape. When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.