☐ **Preliminary Specification**
■ **Final Specification**

Module	27.0 Inch Color TFT-LCD
Model Name	G270ZAN01.5

Customer	**Date**	**Approved by**	**Date**
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1. Operating Precautions

1) Since front polarizer is easily damaged, please be cautious and 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 soft cloth.
5) Since the panel is made of glass, it may be broken or cracked if dropped or bumped on hard surface.
6) To avoid ESD (Electro Static Discharde) damage, be sure to ground yourself before handling TFT-LCD Module.
7) Do not open nor modify the module assembly.
8) Do not press the reflector sheet at the back of the module to any direction.
9) In case if a module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED light bar edge. Instead, press at the far ends of the LED light bar edge softly. Otherwise the TFT Module may be damaged.
10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
11) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.
12) Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
13) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
14) Continuous operating TFT-LCD display under low temperature environment may accelerate lamp exhaustion and reduce luminance dramatically.
15) The data on this specification sheet is applicable when LCD module is placed in landscape position.
16) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or shuffle content periodically if fixed pattern is displayed on the screen.

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2. General Description

This specification applies to the 27 inch wide color a-Si TFT-LCD module G270ZAN01.5. The screen format is intended to support the UHD (3840(H) x 2160(V)) screen and 1.07B colors. The input interface is 4lanes eDP and this module doesn't contain driver board for backlight.

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	26.93" (684mm)
Active Area	[mm]	596.16 (H) x 335.34 (V)
Resolution		3840(x3) x 2160
Pixel Pitch	[mm]	0.15525 (per one triad) x 0.15525
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		AHVA mode, Normally Black
Nominal Input Voltage VDD	[Volt]	+12V (Typ)
Power Consumption	[Watt]	Total =45.2W (Typ) LCD 15W@ white pattern, Fv=60Hz BLU 30.2W@Is=90mA
Color gamut		NTSC 90% (Typ)
Weight	[Grams]	2700 (Typ)
Physical Size	[mm]	613.6(H) x 356.85(V) x 14.45(D) (Typ)
Electrical Interface		4-lanes eDP , 10bits RGB data input
Surface Treatment		Anti-Glare treatment, 3H
Support Color		1.07B colors (8bit + Hi-FRC)
Temperature Range Operating Storage (Non-Operating)	 [°C] [°C]	 0 to +50 -20 to +60
RoHS Compliance		Yes

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2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25℃ (Room Temperature):

Item	Unit	Conditions		Min.	Typ.	Max.	Note
White Luminance	cd/m^2	I_{LED}=90mA(center point)		400	500	-	1
Uniformity	%	9 points		75	80	-	2,3
Contrast Ratio	--			700	1000	-	4
Response Time	msec	Rising		-	-	-	5
		Falling		-	-	-	
		Rising + Falling		-	16	25	
Viewing Angle	degree	Horizontal CR >= 10	(Right)	75	89	-	6
			(Left)	75	89	-	
		Vertical CR >= 10	(Upper)	70	89	-	
			(Lower)	70	89	-	
Color / Chromaticity Coordinates (CIE 1931)	--	Red x		0.644	0.674	0.704	
		Red y		0.280	0.310	0.340	
		Green x		0.235	0.265	0.295	
		Green y		0.630	0.660	0.690	
		Blue x		0.123	0.153	0.183	
		Blue y		0.024	0.054	0.084	
		White x		0.283	0.313	0.343	
		White y		0.299	0.329	0.359	

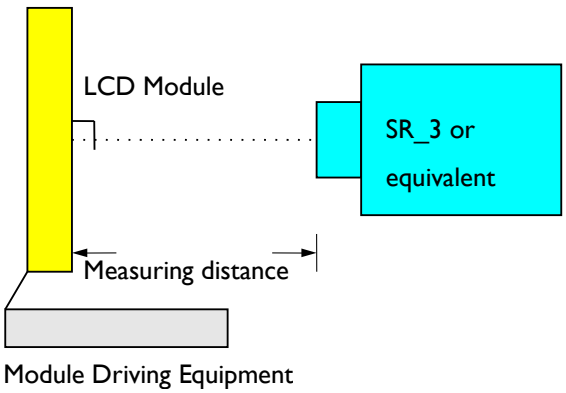
Note 1: Measurement method

Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)

Aperture 1° with 50cm viewing distance

Test Point Center

Environment < 1 lux



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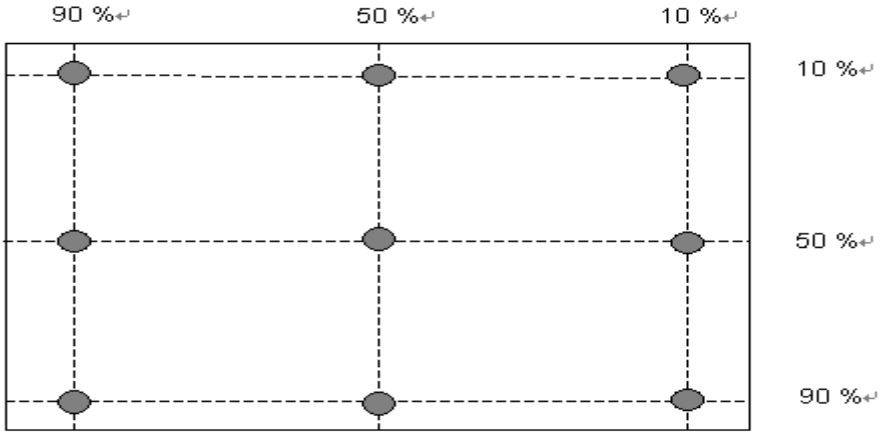
Note 2: Definition of 9 points position



Note 3: The luminance uniformity of 9 points is defined by dividing the minimum luminance values by the maximum test point luminance

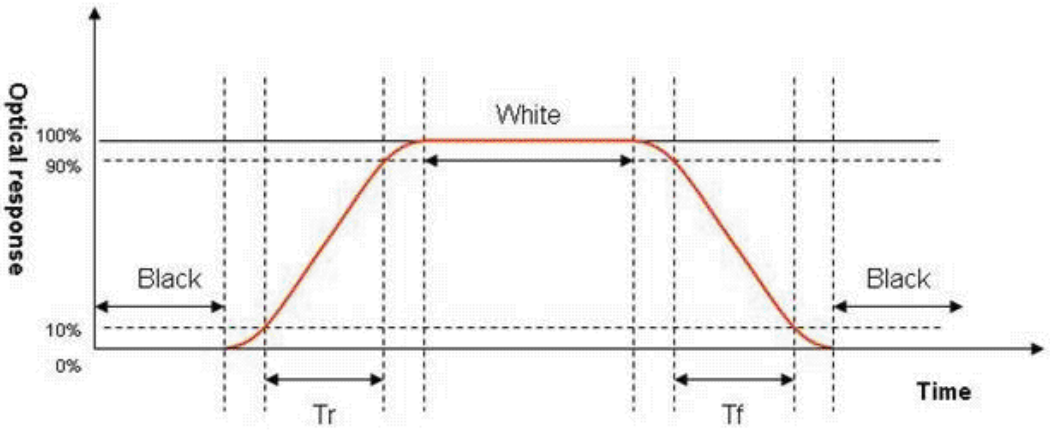
$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

Note 4: Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

Note 5: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.



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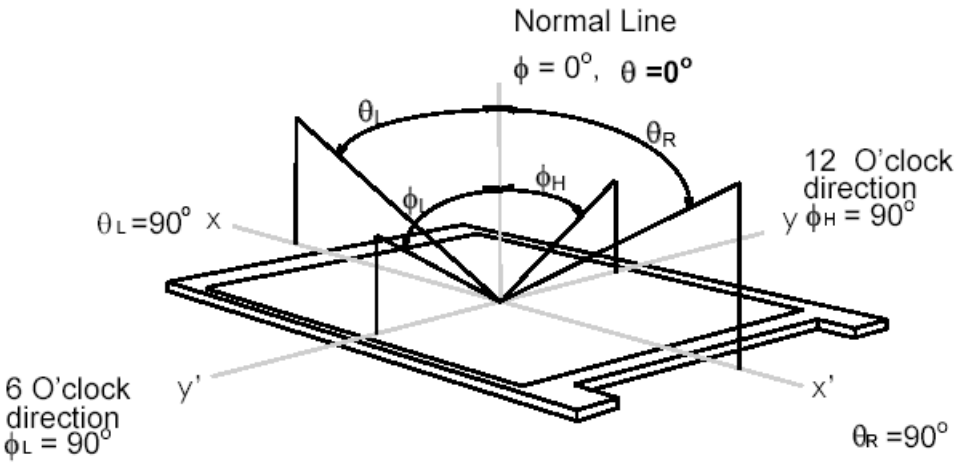
Note 6: Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≧10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as below: 90° (θ) horizontal left and right, and 90° (Φ) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.



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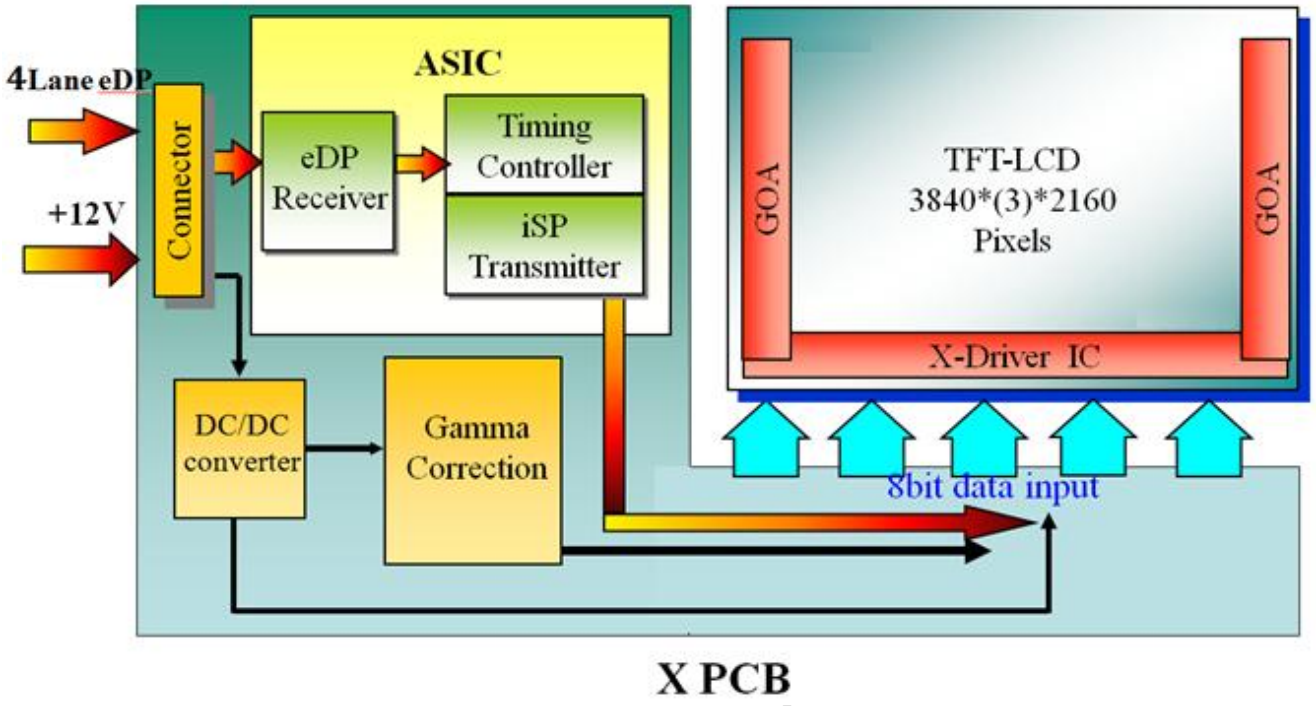
3. Functional Block Diagram

The following diagram shows the functional block of the 27.0 inch color TFT/LCD module:



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4. Absolute Maximum Ratings

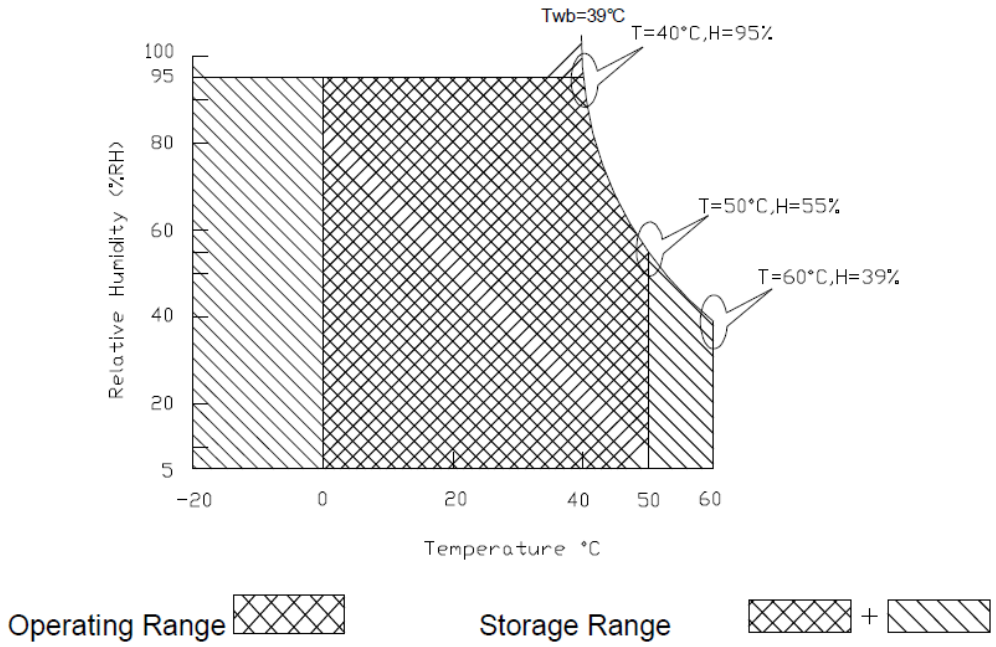
4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit
Logic/LCD drive Voltage	Vin	GND-0.3	14	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating	TOP	0	+50	[°C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-20	+60	[°C]
Storage Humidity	HST	5	90	[%RH]

Note: Maximum Wet-Bulb should be 39°C and no condensation.



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5. Electrical Characteristics

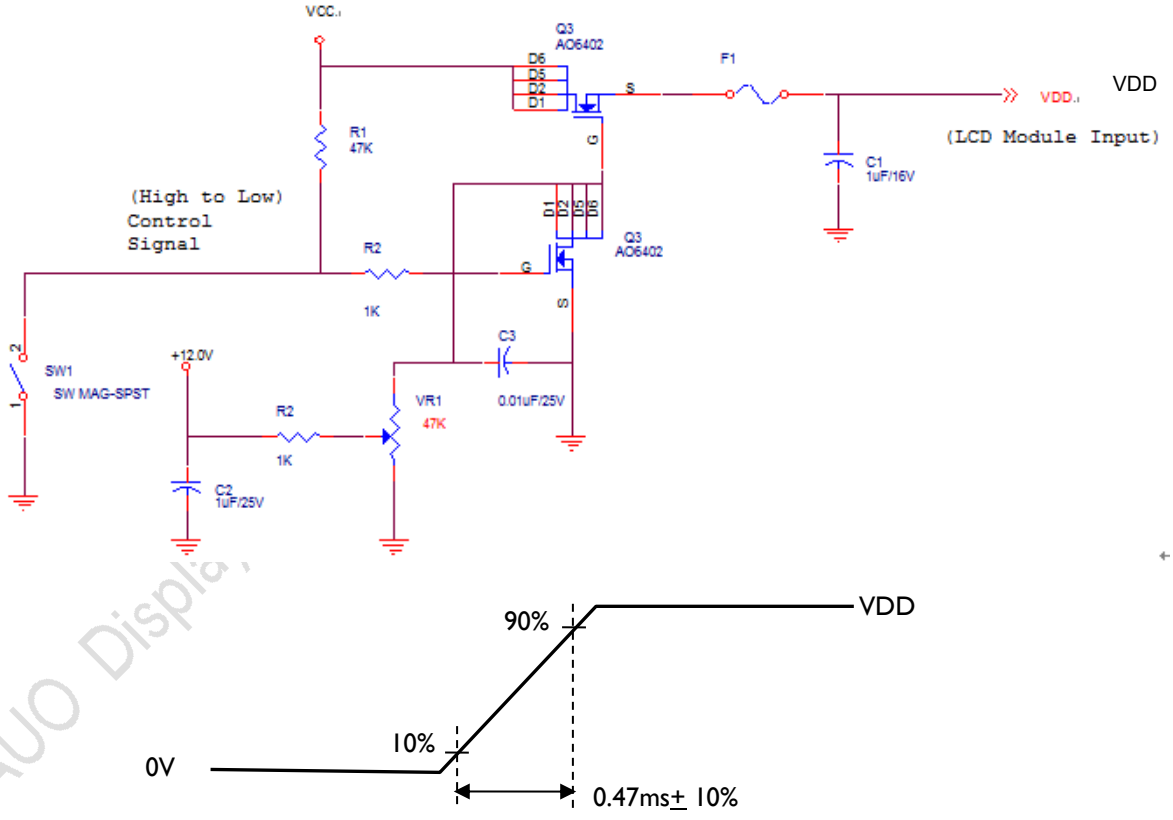
5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are shown as follows;

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Power supply Input voltage	10.8	12.0	13.2	[Volt]	
IDD	Power supply Input Current (RMS)	-	1.25	1.5	[A]	VDD= 12.0V, White pattern, Fv=60Hz
IRush	Inrush Current	-	-	3.0	[A]	***Note 1***
PDD	VDD Power Consumption	-	15	18	[Watt]	VDD= 12.0V , White pattern, Fv=60Hz
VDDrp	Allowable VDD Ripple Voltage	-	-	VDD* 5%	[mV]	VDD= 12.0V, White pattern, Fv=60Hz

Note 1: Measurement condition:



VDD rising time.

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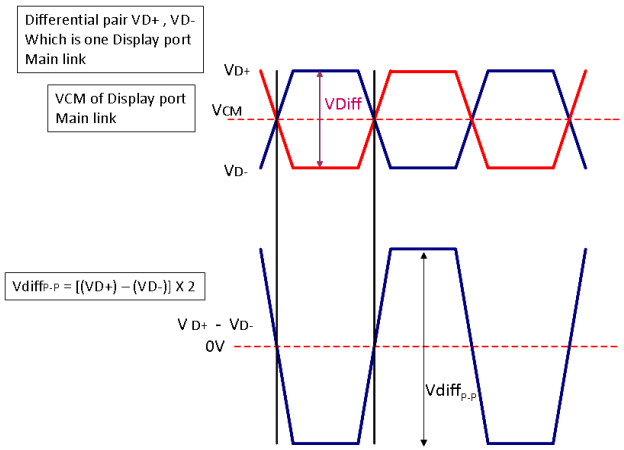
5.1.2 eDP Electrical Characteristics

Follow as VESA Display Port Standard Version 1.2

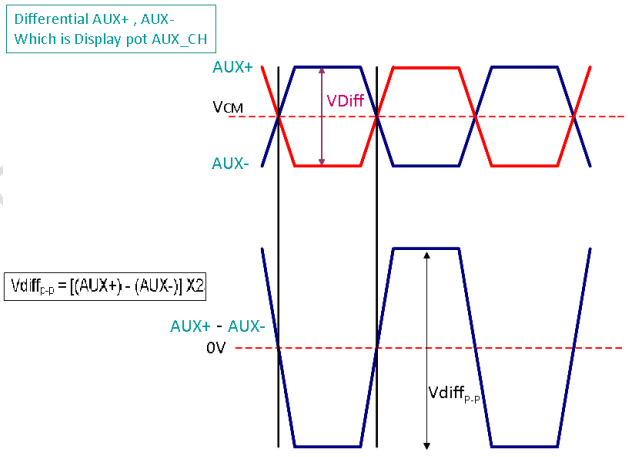
a. Display Port main link signal:

DisplayPort main link					
		Min	Typ	Max	unit
VCM	RX input DC Common Mode Voltage	0	-	2.0	V
$VDiff_{P-P}$	Peak-to-peak Voltage at a receiving Device	150	-	-	mV



b. DisplayPort AUX_CH signal:

DisplayPort AUX_CH					
		Min	Typ	Max	unit
VCM	AUX DC Common Mode Voltage	0	-	2.0	V
$VDiff_{P-P}$	AUX Peak-to-peak voltage at a receiving device	0.27	-	1.36	V



c. DisplayPort VHPD signal:

DisplayPort VHPD					
		Min	Typ	Max	unit
VHPD	HPD Voltage	2.25	-	3.6	V

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5.2 Backlight Unit

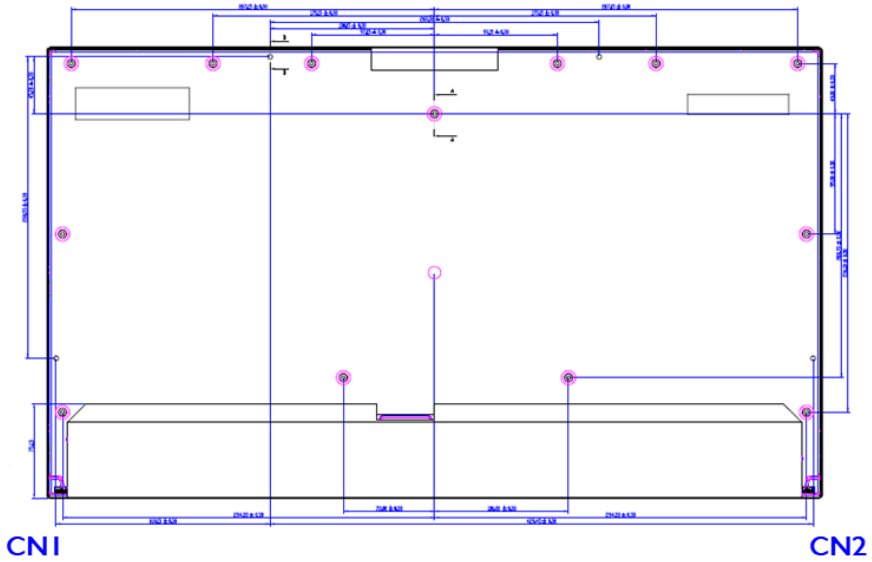
5.2.1 LED Backlight Unit : Light bar Connector

Connector Name / Designation	Lamp Connector
Manufacturer	CviLux or Compatible
Backlight connector	CI1406M1VLD-NH or Compatible
Mating connector	CI1406SL000-NH or Compatible

5.2.2 Connector Pin Assignment

CN1 & CN2

Pin #	Symbol	Description
1	Ch1	IRLED (current out)
2	Ch2	IRLED (current out)
3	V_{SLED}	VLED (voltage in))
4	V_{SLED}	VLED (voltage in)
5	Ch3	IRLED (current out)
6	Ch4	IRLED (current out)



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5.2.3 Parameter guideline for LED

Following characteristics are measured under a stable condition using an inverter at 25℃ (RoomTemperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
I_L	LED Supply Current	-	90	-	[mA]	Ta = 25°C, *Note 2*
V_L	LED Supply Voltage	-	42	47.6	[Volt]	I_F = 90mA, Ta = 25°C *Note 2,3*
P_{LED}	LED Power Consumption	-	30.2	34.3	[Watt]	I_F = 90mA, Ta = 25°C *Note 3,4,5*
L_L	LED Life Time	50,000	-	-	Hrs	I_F=90mA, Ta = 25°C, *Note 6,7*

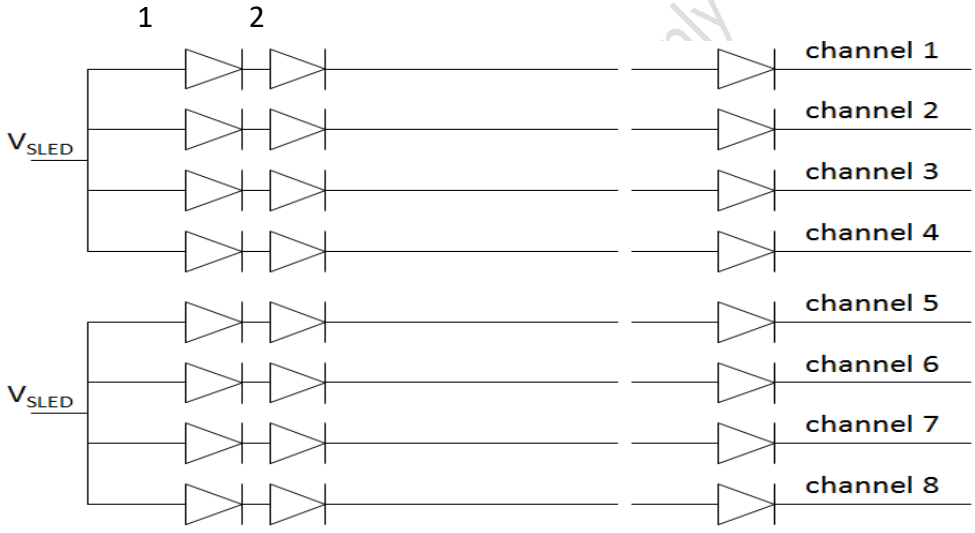
Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: I_L, V_L are defined for one channel LED. There are 8 LED channels in back light unit.

Note 3: LED backlight is 112 LEDs (8 strings, 14pcs for each string)

Note 4: The LED supply power is for 8 strings of LED

Note 5: The voltage capacity of LED driver IC must be over max. of LED Voltage.



Note 6: Definition of life time: Brightness becomes to 50% of its original value.

The minimum life time of LED unit is on the condition of I_L = 90 mA and 25±2°C (Room Temperature).

Note 7: If G270ZAN01.5 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduce

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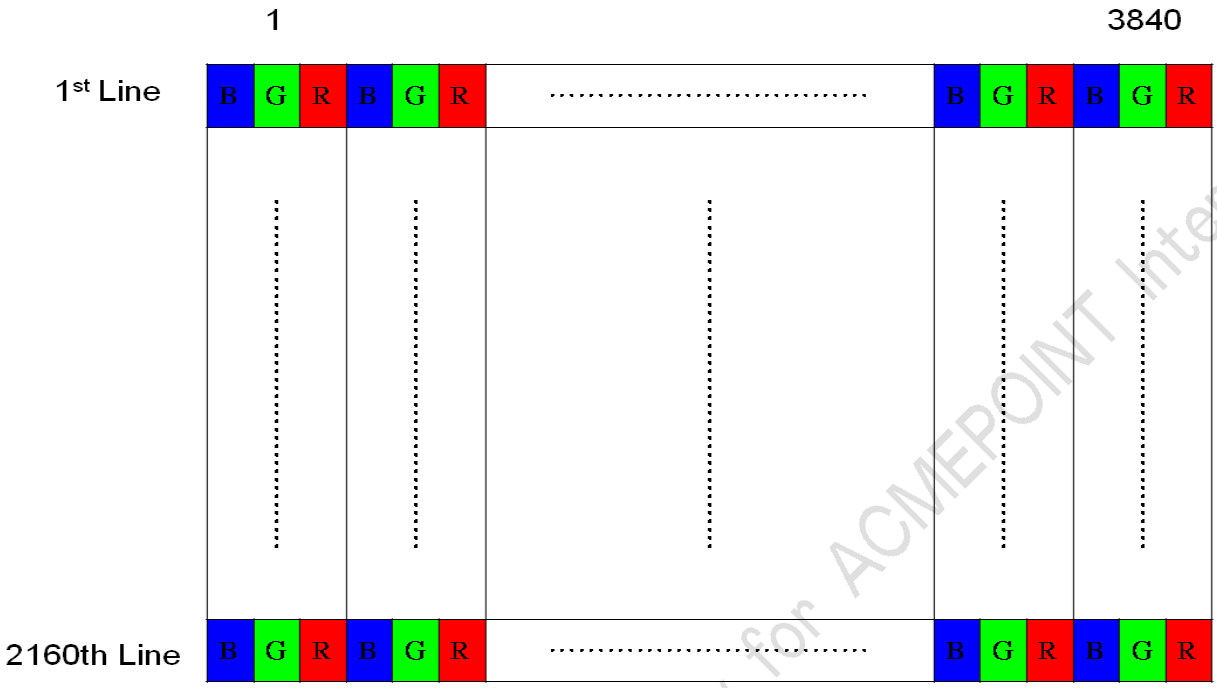
6. Signal Characteristic

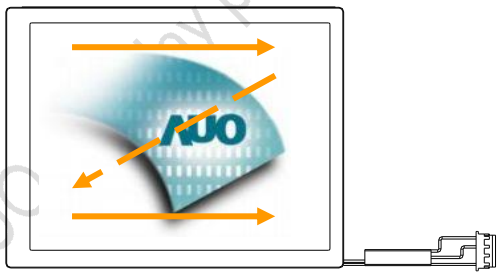
6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.



6.2 Scanning Direction

The following figures show the image seen from the front view. The arrow indicates the direction of scan.



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6.3 Signal Description

6.3.1 TFT LCD Module:

Connector Name / Designation	Signal Connector
Manufacturer	JAE or compatible
Connector Model Number	FI-RTE51S-HF or compatible
Adaptable Plug	FI-RE51HL or compatible

PIN #	Symbol	Description
1	VDD	Power +12V
2	VDD	Power +12V
3	VDD	Power +12V
4	VDD	Power +12V
5	VDD	Power +12V
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	NC	No connection (for AUO test only. Do not connect)
10	NC	No connection (for AUO test only. Do not connect)
11	NC	No connection (for AUO test only. Do not connect)
12	NC	No connection (for AUO test only. Do not connect)
13	NC	No connection (for AUO test only. Do not connect)
14	NC	No connection (for AUO test only. Do not connect)
15	NC	No connection (for AUO test only. Do not connect)
16	NC	No connection (for AUO test only. Do not connect)
17	GND	Ground
18	1st Lane3_N	Negative eDP differential data input
19	1st Lane3_P	Positive eDP differential data input
20	GND	Ground
21	1st Lane2_N	Negative eDP differential data input
22	1st Lane2_P	Positive eDP differential data input
23	GND	Ground
24	1st Lane1_N	Negative eDP differential data input
25	1st Lane1_P	Positive eDP differential data input
26	GND	Ground
27	1st Lane0_N	Negative eDP differential data input
28	1st Lane0_P	Positive eDP differential data input

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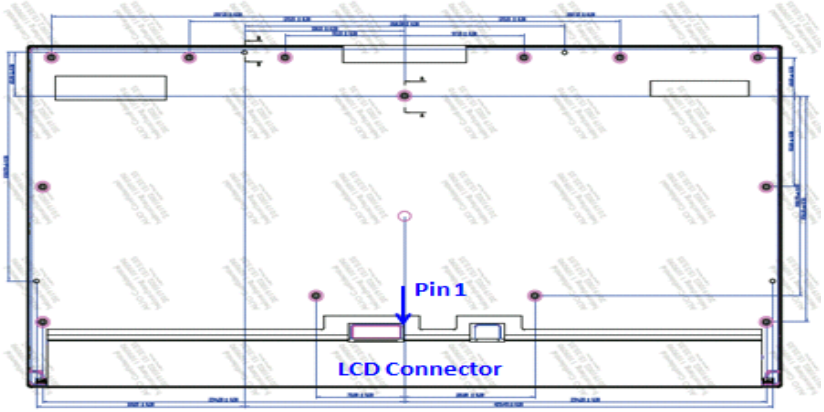
29	GND	Ground
30	1st AUX_CH_P	Positive AUX Channel differential data input
31	1st AUX_CH_N	Negative AUX Channel differential data input
32	GND	Ground
33	NC	No connection (for AUO test only. Do not connect)
34	GND	Ground
35	NC	No connection (for AUO test only. Do not connect)
36	NC	No connection (for AUO test only. Do not connect)
37	GND	Ground
38	NC	No connection (for AUO test only. Do not connect)
39	NC	No connection (for AUO test only. Do not connect)
40	GND	Ground
41	NC	No connection (for AUO test only. Do not connect)
42	NC	No connection (for AUO test only. Do not connect)
43	GND	Ground
44	NC	No connection (for AUO test only. Do not connect)
45	NC	No connection (for AUO test only. Do not connect)
46	GND	Ground
47	NC	No connection (for AUO test only. Do not connect)
48	NC	No connection (for AUO test only. Do not connect)
49	GND	Ground
50	HPD	Hot plug detection
51	GND	Ground

Note 1: Input Signals shall be in low status when VDD is off.

Note 2: High stands for "3.3V", Low stands for "0V", NC means "No Connection".

Note 3: RSV means "Reserved".



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6.4 The Input Data Format

6.4.1 eDP Data Format

1st Lane0	1st Lane1	1st Lane2	1st Lane3
R1-9:2	R2-9:2	R3-9:2	R4-9:2
R1-1:0IG1-9:4	R2-1:0IG2-9:4	R3-1:0IG3-9:4	R4-1:0IG4-9:4
G1-3:0IB1-9:6	G2-3:0IB2-9:6	G3-3:0IB3-9:6	G4-3:0IB4-9:6
B1-5:0IR5-9:8	B2-5:0IR6-9:8	B3-5:0IR7-9:8	B4-5:0IR8-9:8
R5-7:0	R6-7:0	R7-7:0	R8-7:0
G5-9:2	G6-9:2	G7-9:2	G8-9:2
G5-1:0IB5-9:4	G6-1:0IB6-9:4	G7-1:0IB7-9:4	G8-1:0IB8-9:4
B5-3:0IR9-9:6	B6-3:0IR10-9:6	B7-3:0IR11-9:6	B8-3:0IR12-9:6
R9-5:0IG9-9:8	R10-5:0IG10-9:8	R11-5:0IG11-9:8	R12-5:0IG12-9:8
G9-7:0	G10-7:0	G11-7:0	G12-7:0
B9-9:2	B10-9:2	B11-9:2	B12-9:2
B9-1:0IR13-9:4	B10-1:0IR14-9:4	B11-1:0IR15-9:4	B12-1:0IR16-9:4
R13-3:0IG13-9:6	R14-3:0IG14-9:6	R15-3:0IG15-9:6	R16-3:0IG16-9:6
G13-5:0IB13-9:8	G14-5:0IB14-9:8	G15-5:0IB15-9:8	G16-5:0IB16-9:8
B13-7:0	B14-7:0	B15-7:0	B16-7:0
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6.4.2 Color versus Input Data

The following table is for color versus input data (10bit). The higher the gray level, the brighter the color.

Color	Gary Level	Color Input Data																												Remark
		RED data (MSB:R9,LSB:R0)										GREEN data (MSB:G9,LSB:G0)										BLUE data (MSB:B9,LSB:B0)									
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	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	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	1	1	1	1	1	1	
L511	-	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	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	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L1023	1	1	1	1	1	1	1	1	1	1	0	0	0	0	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	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L1023	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	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	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L1023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	

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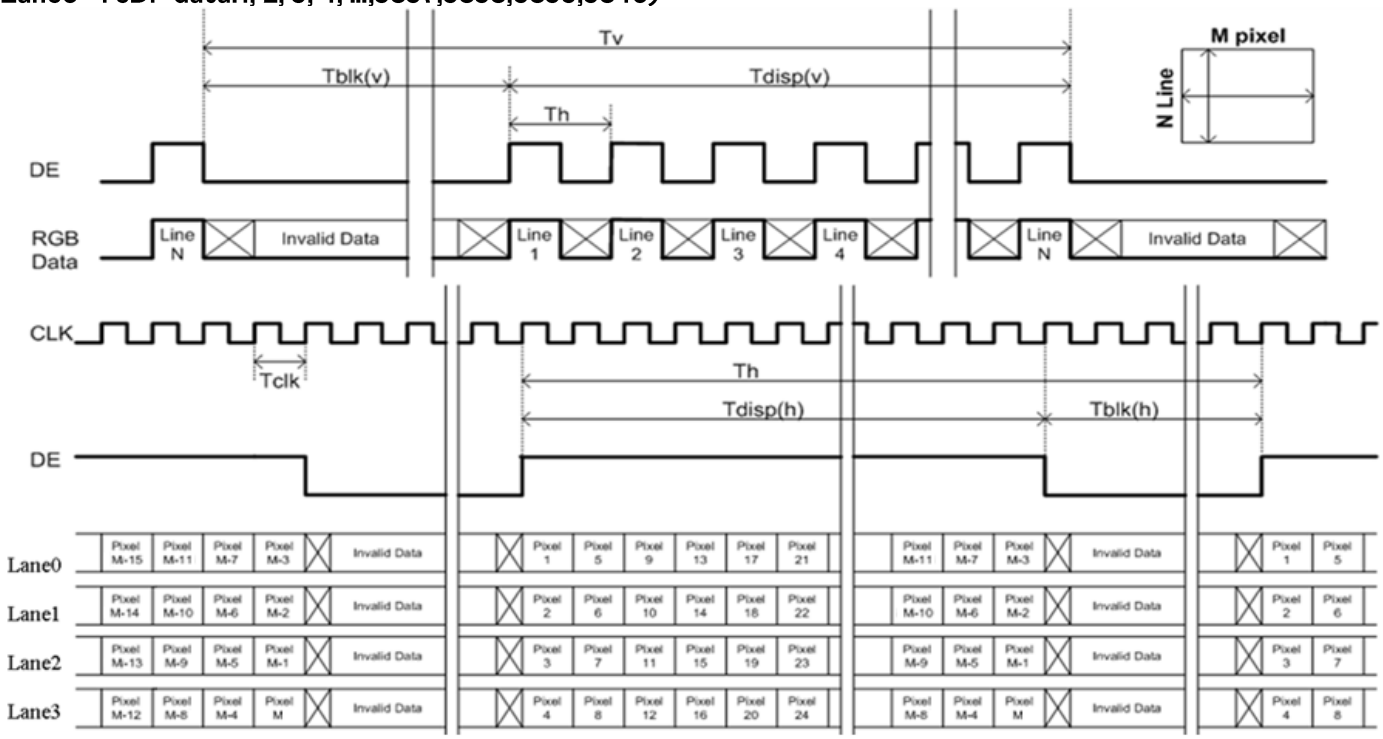
6.4.3 Input Timing Diagram

(Lane0~4 eDP data:1, 2, 3, 4, ...,3837,3838,3839,3840)



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6.5 Interface Timing

6.5.1 Timing Characteristics

The input timing is shown as the following table.

Symbol	Description		Min.	Typ.	Max.	Unit	Remark
Tv	Vertical Section	Period	2184	2200	2296	Th	
Tdisp (v)		Active	2160	2160	2160	Th	
Tblk (v)		Blanking	24	40	130	Th	
Fv		Frequency	47	60	62	Hz	***Note 6-6***
Th	Horizontal Section	Period	3900	3960	4300	Tclk	
Tdisp (h)		Active	3840	3840	3840	Tclk	
Tblk (h)		Blanking	60	120	400	Tclk	
Fh		Frequency	102.65	132	138.5	kHz	***Note 6-4***
Tclk	Pixel Clock	Period	1.85	1.91	2.51	ns	1/Fclk
Fclk		Frequency	400.33	522.72	540.14	MHz	***Note 6-5***
Link Rate per Lane				5.4		Gbps	

Note 6-4: 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 6-5: The equation is listed as following. Please don't exceed the above recommended value.

1st Lane N & 2nd Lane N skew < 200ns

Fclk (Typ.) = Fv (Typ.) x Th (Typ.) x Tv (Typ.)

Fclk (Min.)≦Fv x Th x Tv ≦ Fclk (Max.)

Note 6-6: The equation is listed as following. Please don't exceed the above recommended value.

Fv =Fclk(Typ.) / (Tv x Th)

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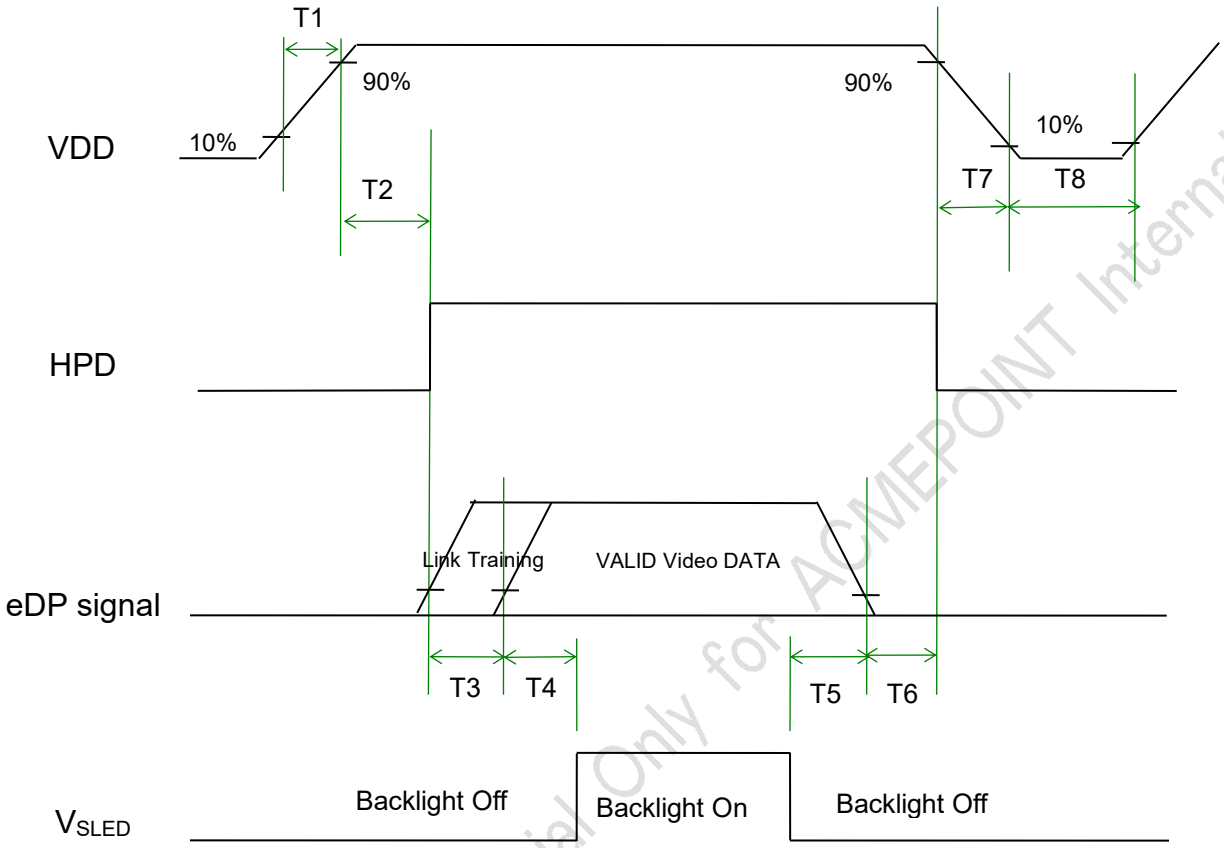
6.6 Power ON/OFF Sequence

VDD power and lamp on/off sequence is as below. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



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Power ON/OFF sequence timing

Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
T1	0.5	-	10	[ms]	
T2	0	-	200	[ms]	
T3	0	-	-	[ms]	
T4	500	-	-	[ms]	
T5	100	-	-	[ms]	
T6	0		50	[ms]	
T7	0	-	200	[ms]	
T8	1000	-	-	[ms]	

The above on/off sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

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7. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50°C, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 50°C, 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 G Wave: Random ; Frequency: 10 - 200Hz 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)	
Drop Test	Height: 45.7 cm, package test	
Thermal Shock Test (TST)	-20°C /30min, 60°C /30min, 100 cycles	***Note 1***
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (Electrostatic Discharge)®	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 9 points, 25 times/ point.	***Note 2***
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 9 points, 25 times/ point.	

Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change.

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 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

Note 3:

a. Water condensation is not allowed for each test items.

b. Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.

c. The reliability test is performed only to examine the TFT-LCD module capability.

d. To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.

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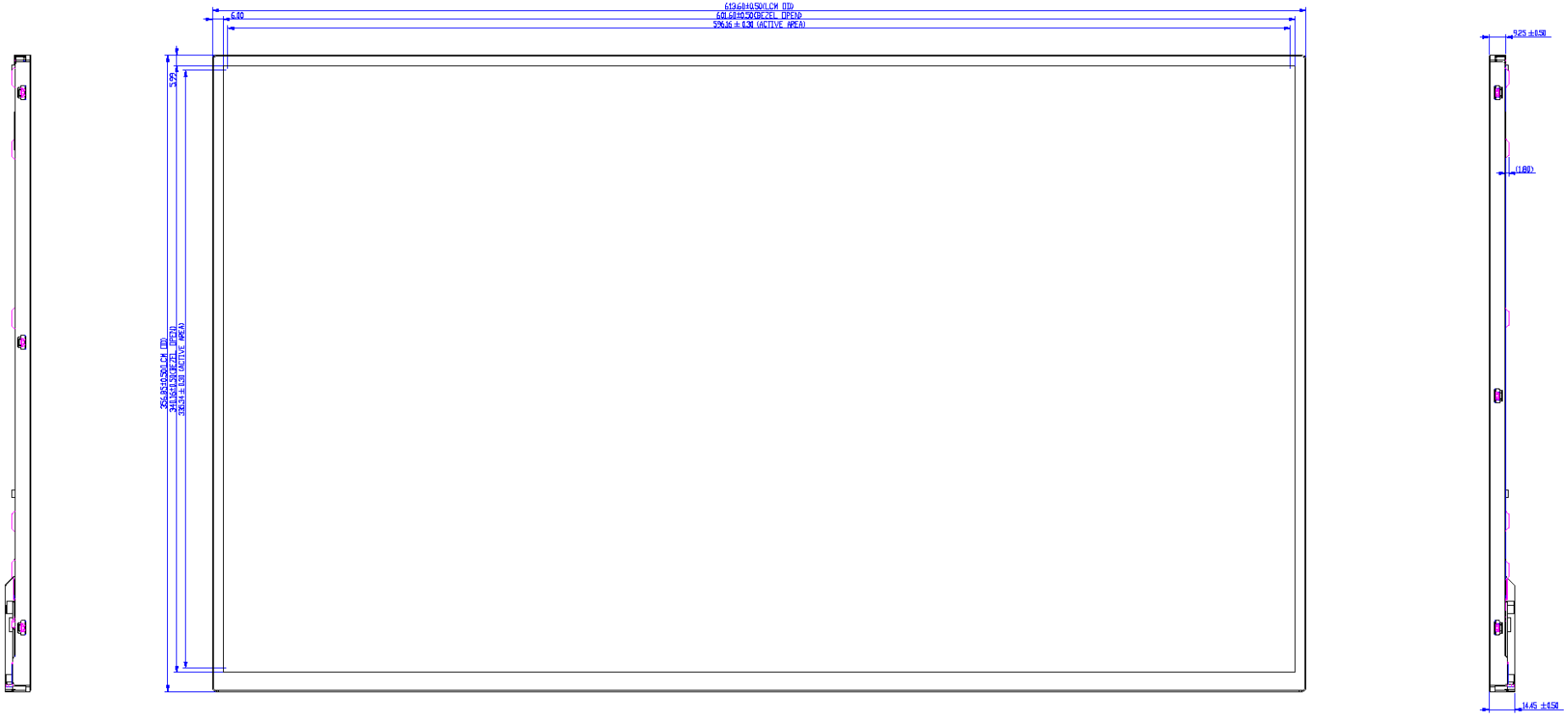
8. Mechanical Characteristics

8.1 LCM Outline Dimension



NOTE:
1.PRELIMINARY DRAWING FOR REFERENCE ONLY.
2.TOLERANCE WITHOUT SPECIFIED TO BE 0.5 MM.
3.THIS DIMENSION EXCLUDES DEFORMATION.
4.TORQUE OF M3 USER HOLE SHOULD BE WITHIN 3 KGF-CM AND RE-SCREW 10 TIMES.
5.USER HOLE SCREW PENETRATION 1.8 mm MAX.
6.I.B CONNECTOR TO BE CI1406M1VLD-NH (6PIN, Locking type, Black), 2 PIECE.
7.EDP CONNECTOR TO BE CONNECTOR: JI-RTE51S-HF

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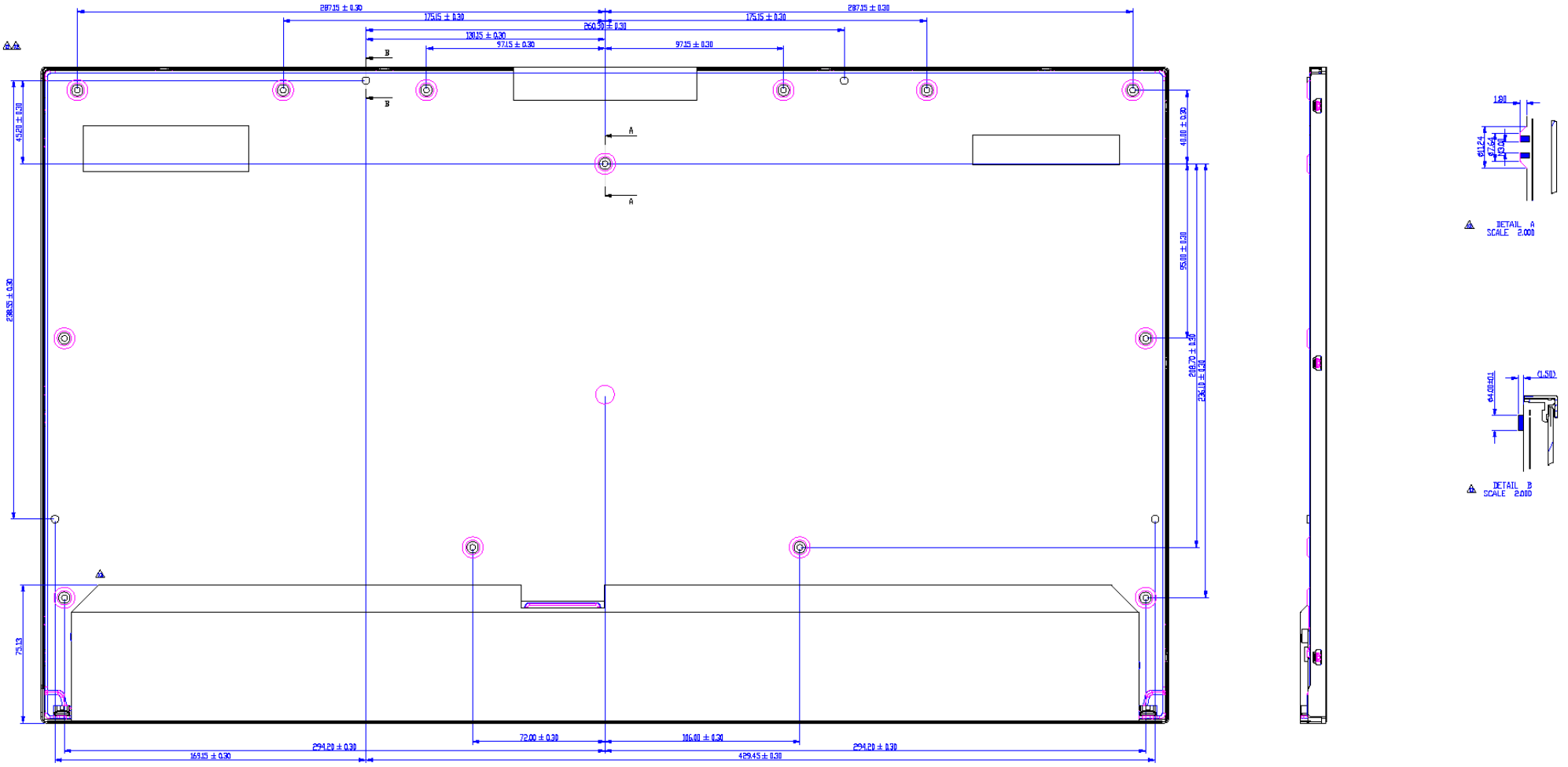

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9. Label and Packaging

9.1 Shipping Label (on the rear side of TFT-LCD display)



Note 1: For Pb Free products, AUO will add for identification.

Note 2: For RoHS compatible products, AUO will add for identification.

Note 3: For China RoHS compatible products, AUO will add for identification.

Note 4: The Green Mark will be presented only when the green documents have been ready by AUO Internal Green Team.

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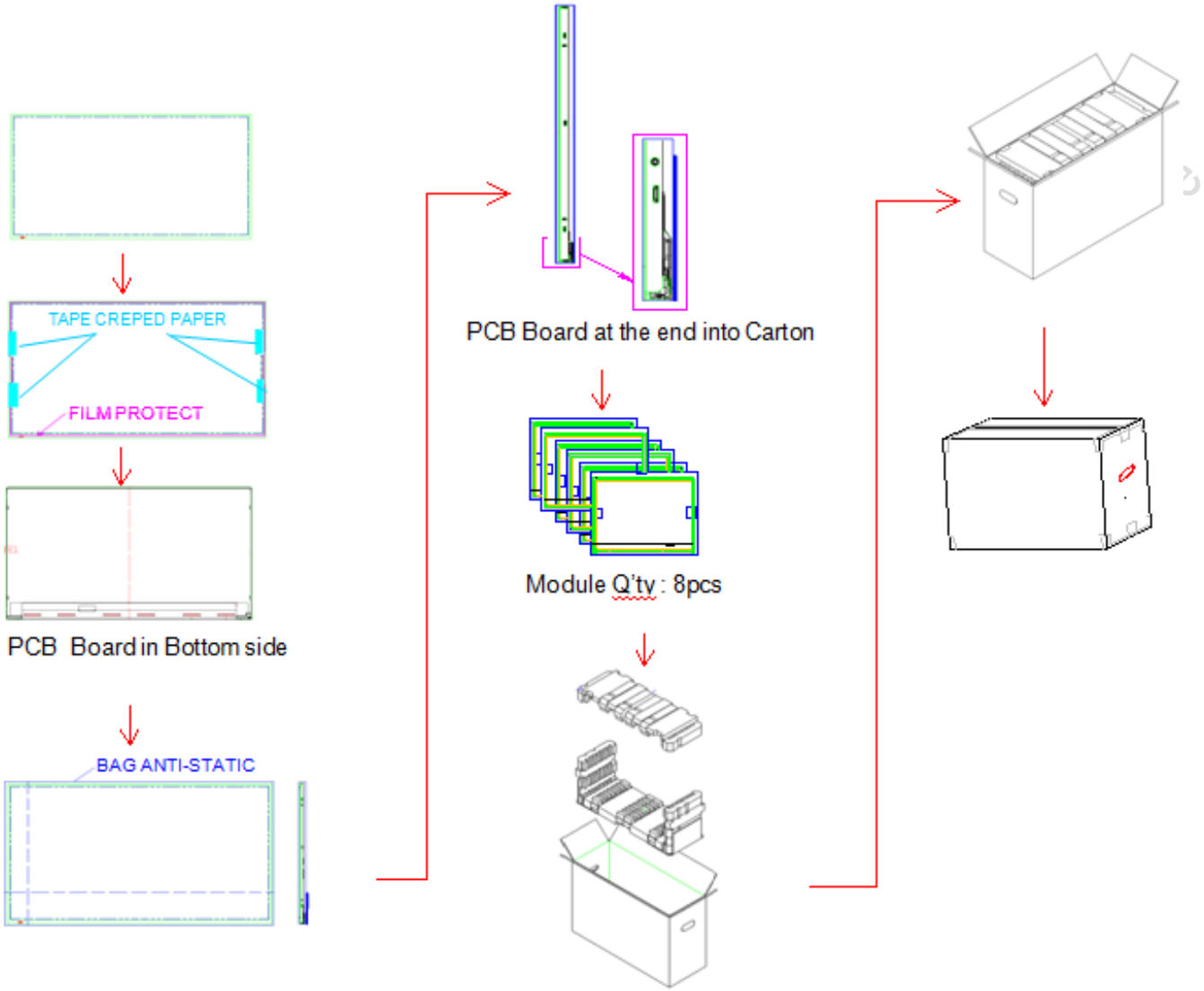
9.2 Carton Package



- Max capacity：8 pcs TFT-LCD module per carton
- Max weight: 22.2 kg per carton
- Outside dimension of carton: 702mm(L)* 264mm(W)*456mm(H)
- Pallet size： 1060 mm * 760 mm * 132mm
- Box stacked

  Module by air_Max：(1*4) *2 layers，one pallet put 8 boxes，total 64pcs module

  Module by sea_Max：(1*4) *2 layers + (1*4) *2 layers，two pallet put 16 boxes，total 128pcs module

  Module by sea_HQ_Max：(1*4) *2 layers + (1*4) *2 layers，two pallet put 16 boxes，total 128pcs module

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10 Safety

10.1 Sharp Edge Requirements

There will be no sharp edges or comers on the display assembly that could cause injury.

10.2 Materials

10.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible AUO toxicologist.

10.2.2 Flammability

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

10.3 Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

10.4 International Safety Standard Compliance

The TFT-LCD Module will satisfy all requirements for compliance to IEC/UL 62368-1.

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