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Optical Bonding



- Preliminary Specifications
- Final Specifications

Title	10.1-inch LCM Product Specifications
Model Name	ET101WU03-R
Version	0.1

Customer

Approved by

Date

Notice: This Specification is subject to change without notice.

Approved By	Prepared By
LEO	Aurice
2024-01-11	2024-01-11



REVISION HISTORY

Version	Description of Changes	Date	Prepared
0	First Edition	2024-1-11	Aurice



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1. General Specifications

No.	Item	Spec	Remark
1	Size	10.1 inch	
2	Resolution	1920(RGB)x1200	
3	Technology Type	a-Si	
4	Display Mode	SFT, Normally Black	
5	TFT Active Area	216.81x135.5 mm	
6	Module Size (W x H x D)	228.0x148.8x2.4mm (w/o PCB)	Note 1
7	Surface Treatment	HC	
8	Pixel Configuration	R.G.B Vertical Stripe	
9	NTSC	Typ:70 %	
10	Luminance	1200 cd/m ² (Typ) 1000 cd/m ² (Min)	
11	Viewing Angle	Typ:85/85/85/85 degree	
12	Interface	eDP1.4	
13	Color Depth	16.7M color	
14	Power Consumption	Panel : 0.495W ; B/L : 5.76W (Typ.)	
15	Weight	126(g)(Typ.)	

Note 1 : Refer to Mechanical Drawing



2. Pin Assignment

Connector : IPEX-20455-030E-76

No	Symbol	I/O	Description	Comment
1	BL_CONTROL	I	Set High/Low LED current	NC
2	GND	P	Ground	
3	LANE1_N	I	Complement Signal Link Lane 1	
4	LANE1_P	I	True Signal Link Lane 1	
5	GND	P	Ground	
6	LANE0_N	I	Complement Signal Link Lane 0	
7	LANE0_P	I	True Signal Link Lane 0	
8	GND	P	Ground	
9	AUX_CH_P	I/O	True Signal AUX Channel	
10	AUX_CH_N	I/O	Complement Signal AUX Channel	
11	GND	P	Ground	
12	VDD	P	Power for LCD(3.3V)	
13	VDD	P	Power for LCD(3.3V)	
14	NC	-	Internal use, not Connect	
15	GND	P	Ground	
16	GND	P	Ground	
17	HPD	O	Hot Plug Detection(2.5V)	
18	GND	P	Ground	
19	GND	P	Ground	
20	GND	P	Ground	
21	GND	P	Ground	
22	LED_EN	I	BLU Enable	H:on/L:off
23	LED_PWM	I	BLU Diming	H:on/L:off
24	NC	-	Internal use, not Connect	
25	NC	-	Internal use, not Connect	
26	VLED	P	Power for BLU	
27	VLED	P	Power for BLU	
28	VLED	P	Power for BLU	
29	VLED	P	Power for BLU	
30	NC	-	Internal use, not Connect	

Note1: I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection

Note2: All of the GND pins should be connected to the system ground.



3. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VDD	-0.3	5	V	
Complement Signal & True Signal Voltage	Vc	-0.3V	2.88V	V	Note1
HPD Voltage	HPD	-0.3V	2.88V	V	
LED_EN Voltage	LED_EN	-0.3V	12V	V	
LED_PWM Voltage	LED_PWM	-0.3V	12V	V	
VLED Voltage	VLED	-0.3V	15V	V	
Operating Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	

Note1: Complement Signal & True Signal Voltage include LANE0_N/ LANE0_P LANE1_N/ LANE1_P、AUX_CH_P/AUX_CH_N.

Note2: Ta means the ambient temperature. It is necessary to limit the relative humidity to the specified temperature range. Condensation on the module is not allowed.

Note3: The absolute maximum rating values of this product are not allowed to be exceeded at any times. A module should be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme condition, the module may be permanently destroyed



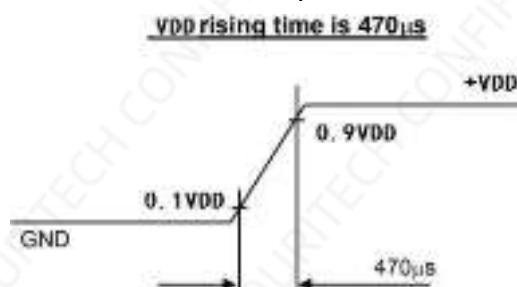
4. Electrical Characteristics

4.1 DC Characteristics for Panel Driving

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage	VDD	3.2	3.3	3.4	V	Note1
Power supply ripple	Vp-p	--	--	100	mV	
HPD Voltage	HPD	VOH	2	2.5	2.88	V
		VOL	0	--	0.375	V
Power supply current	IVDD	--	150	--	mA	
VDD Inrush current	IVDD_inrush	--	--	1.5	A	Note2
Power Consumption	P _{LCD}	--	0.495	--	W	VDD=3.3V Pattern : White

Note1: Indicated the subsequent version may be updated.

Note2: Inrush current definition, Indicated the subsequent version may be update.



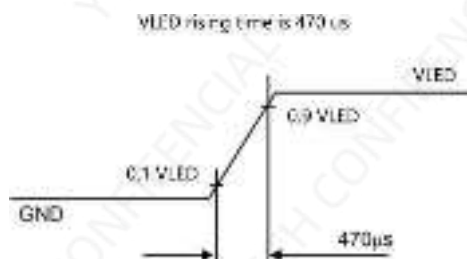
4.2 DC Characteristics for Backlight Driving

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Backlight power supply voltage	VLED	22	24	25.6	V	
VLED Inrush current	IVLED_Inrush	--	--	1.5	A	Note2
LED Driver Current	IVLED	-	240	-	mA	
Power Consumption	P _{BL}	-	5.76	-	W	
Input voltage for LED_PWM signal	High	1.3	3.3	5	V	
	Low	--	--	0.5	V	
Input voltage for LED_EN signal	High	1.3	3.3	5	V	
	Low	--	--	0.5	V	
PWM frequency	f _{PWM}	0.2	--	20	KHz	
PWM duty ratio	DR _{PWM}	5	--	100	%	Note 1
Life Time	L _{BL}	30000	-	-	hrs	T=25℃, Humidity=60%±10%

Note1: According to LED driver IC characteristics, the minimum value of LED_PWM duty may vary with VLED_PWM frequency, higher the frequency, bigger the duty. LED_PWM duty range is 5~100% when PWM frequency is 200Hz~20KHz, without considering linearity.



Note2: Inrush current definition, Indicated the subsequent version may be update.



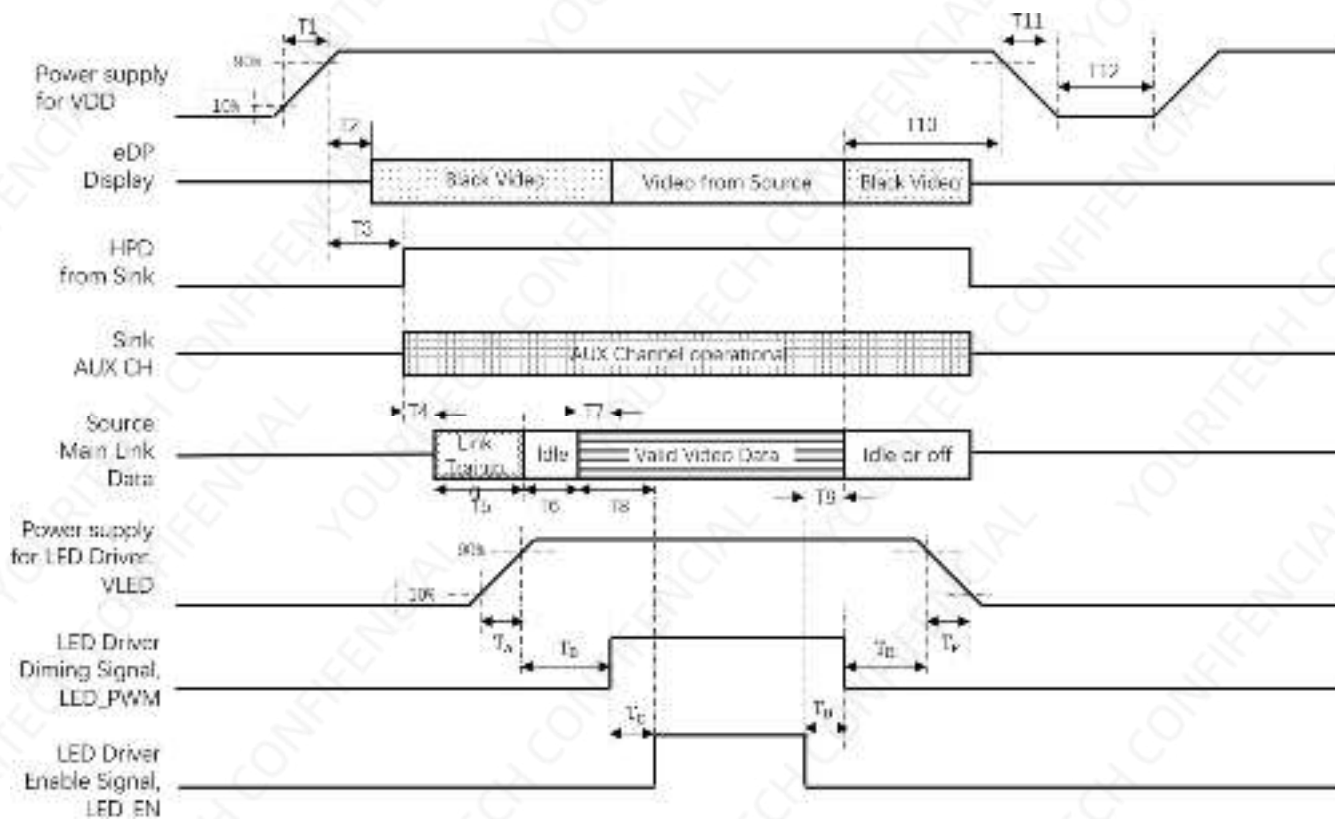
4.3 Fuse

Parameter	Fuse		Rating	Fusing Time (at 25 °C)
	Type	Supplier		
VDD	F0603HI1500V032T	AEM	32V 1.5A	8 minutes(max)
VLED	F0603HI1500V032T	AEM	32V 1.5A	8 minutes(max)

Note1: The power supply's rated current must be more than the fusing current. If it is less than the fusing current, the fuse may not blow in a short time, and then nasty smell, smoke and so on may occur.



4.4 Recommended Power ON/OFF Sequence

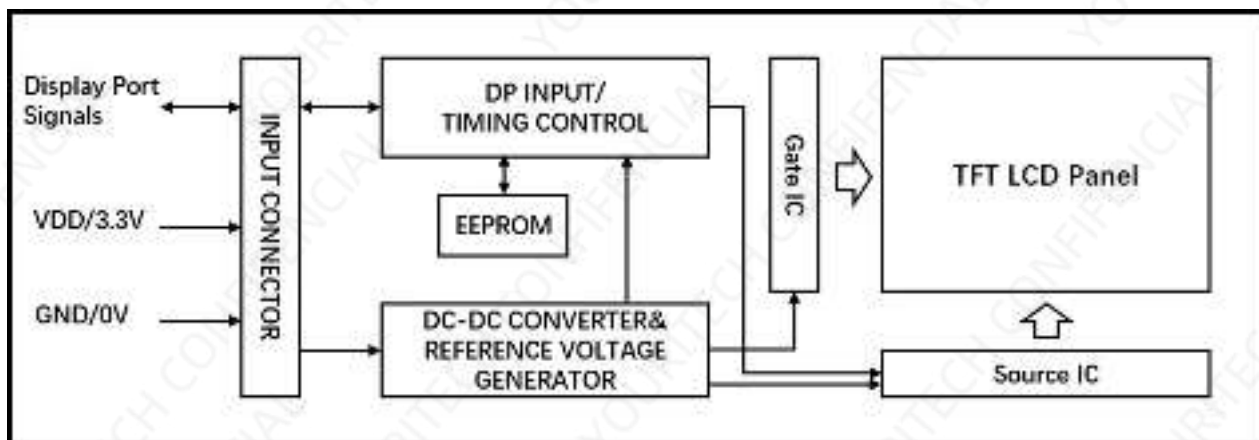


Parameters	Description	Reqd. by	Value		Unit	Notes
			Min	Max		
T1	Power rail rise time, 10% to 90%	Source	0.5	10	ms	-
T2	Delay from VDD to black video generation	Sink	0	80	ms	Automatic Black Video generation prevents display noise until valid video data is received from the Source
T3	Delay from VDD to HPD high	Sink	0	80	ms	Sink AUX Channel must be operational upon HPD high
T4	Delay from HPD high to link training initialization	Source	-	-	ms	Allows for source to read Link capacity and initialize
T5	Link training duration	Source	-	-	ms	Dependent on Source link training Protocol
T6	Link Idle	Source	-	-	ms	Min Accounts for required BS-Idle pattern. Max allows for Source frame synchronization
T7	Delay from valid video Data from Source to video on display	Sink	0	50	ms	Max value allows for Sink to valid video Data and Timing. At the end of T7, Sink will indicate the detection of valid video data by setting SINK_STATUS bit to logic 1(DPCD 00205h, bit 0), and Sink will no longer generate automatic Black video
T8	Delay from valid video Data from Source to Backlight on	Source	-	-	ms	Source must assure display video is stable
T9	Delay from Backlight off to end of valid video Data	Source	-	-	ms	Source must assure backlight is no longer illuminated. At the end of T9, Sink will indicate the detection of no valid video data by setting the SINK_STATUS bit to logic 0 (DPCD 00205h, bit 0), and Sink will automatically display Black Video.
T10	Delay from end of valid video data from Source to Power off	Source	0	500	ms	Black video will be displayed after receiving idle or off signals from Source
T11	VDD power rail fall time, 90% to 10%	Source	-	10	ms	-
T12	VDD Power off time	Source	2000	-	ms	-
T _A	VLED rail rise time, 10% to 90%	Source	0.5	10	ms	-
T _F	VLED rail fall time, 90% to 10%	Source	-	10	ms	-
T _n	Delay from VLED to Dimming signal BL_PWM on	Source	0	-	ms	-
T _B	Delay from Dimming signal LED_PWM off to VLED off	Source	0	-	ms	-
T _C	Delay from diming signal LED_PWM on to Enable signal LED_EN on	Source	0	-	ms	-
T _D	Delay from Enable signal LED_EN off to diming signal LED_PWM off	Source	0	-	ms	-

Note1: Power ON/OFF Sequence may be updated after module electrical verification.



4.5 LCD Module Block Diagram



4.6 eDP1.4 Data Format

Lane 0	Lane 1
R0-7:0	R1-7:0
G0-7:0	G1-7:0
B0-7:0	B1-7:0
R2-7:0	R3-7:0
G2-7:0	G3-7:0
B2-7:0	B3-7:0
R4-7:0	R5-7:0
G4-7:0	G5-7:0
B4-7:0	B5-7:0

24 Bits Pre Pixel RGB Mapping to a Two Lane Main Link



5. eDP Characteristics

5.1 Aux Channel Characteristics

Symbol and Parameter	Test Conditions	Min	Typ ²	Max	Unit
UI: Unit Interval for AUX channel		0.4	0.5	0.7	ps
V _{AUXDIFF-pp} : AUX differential peak-to-peak voltage at TP1 when driving the bus		180	200	800	mV
V _{AUXDC-CM-RX} : AUX common mode voltage when receiving			GND		V
V _{AUXDC-CM-TX} : AUX common mode voltage when transmitting			0.3		V
I _{AUX SHORT} : AUX channel short circuit current				20	mA
R _{AUX-DIFF} : Differential termination resistance		80	100	120	Ω
R _{AUX-SE} : Single-ended termination resistance		40	50	60	Ω
C _{AUX} : AUX AC coupling capacitor		75		200	nF

Clock and Data Input Timing Diagram

5.2 Main Link Characteristics

Symbol and Parameter	Test Conditions	Min	Typ ²	Max	Unit
Spread spectrum clock, 10% spreading by SOURCE			0.5		%
V _{DIFF-pp} : Differential peak-to-peak input voltage at package pins		100		1320	mV
Maximum adaptive/programmable equalization level at 1.35GHz			9		dB
V _{RX-DC-CM} : Rx input DC common mode voltage			GND		V
R _{RX-DIFF} : Differential termination resistance		80	100	120	Ω
R _{RX-SE} : Single-ended termination resistance		40		60	Ω
I _{RX SHORT} : Rx short circuit current limit				20	mA
L _{RX-skew_intra_pair} : Intra-pair skew at Rx package pins (HRR)				150	ps
RX intra-pair skew tolerance at HRR					
L _{RX-skew_intra_pair} : Intra-pair skew at Rx package pins (RBR)				300	ps
RX intra-pair skew tolerance at RBR					
Receiver Jitter Tolerance for High Bit Rate (HRR)					
Total jitter tolerance at 2MHz		1227			mUI
Total jitter tolerance at 10MHz		548			mUI
Total jitter tolerance at 20MHz		505			mUI
Total jitter tolerance at 100MHz		481			mUI
Receiver Jitter Tolerance for Reduced Bit Rate (RRR)					
Total jitter tolerance at 2MHz		1648			mUI
Total jitter tolerance at 10MHz		778			mUI
Total jitter tolerance at 20MHz		747			mUI

Main Link Characteristics



5.3 EDID Timing

ITEM				SYMBOL	MIN	TYP	MAX	UNIT
LCD Timing	SIPI				327.4			MHz
	Frame Rate				60			Hz
	DCLK		Frequency	fCLK	150.6	154	154	MHz
			Period	tCLK	6.49			ns
	DENA	Horizontal	Horizontal Total time	tH	2040	2080	-	DCLK
			Horizontal Active time	tHA	1920			DCLK
			Horizontal Blank time	tHB	120	160	-	DCLK
		Vertical	Vertical Total time	tV	1230	1234	-	Hline
			Vertical Active time	tVA	1200			Hline
			Vertical Blank time	tVB	32	34	-	Hline



6. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR ≥ 10	75	85	-	degree	Note2,3
		θB		75	85	-		
		θL		75	85	-		
		θR		75	85	-		
Contrast Ratio		CR	θ=0°	800	1000	-		Note 3
Luminance (AA Center)		L		1000	1200	-	cd/m2	Note 1
Response Time		TON		-	35	45	ms	Note 4
		TOFF						
Chromaticity	White	x		(0.243)	(0.283)	(0.323)		Note 1,5
		y		(0.263)	(0.303)	(0.343)		
	Red	x		(0.579)	(0.619)	(0.659)		Note 1,5
		y		(0.284)	(0.324)	(0.364)		
	Green	x		(0.277)	(0.317)	(0.357)		Note 1,5
		y		(0.586)	(0.626)	(0.666)		
	Blue	x		(0.114)	(0.154)	(0.194)		Note 1,5
		y		(0.009)	(0.049)	(0.089)		
Uniformity		U		75	80	-	%	Note 6
NTSC		-		65	70	-	%	Note 5

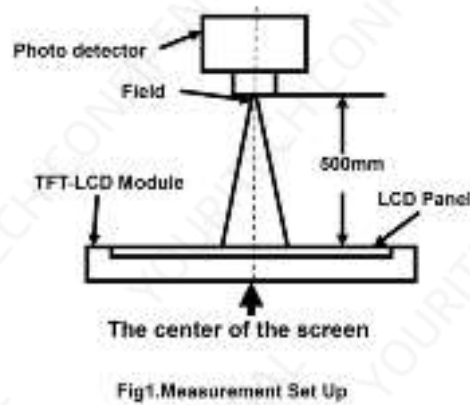
Test Conditions:

1. The ambient temperature is 25℃.
2. The test systems refer to Note1 and Note2.

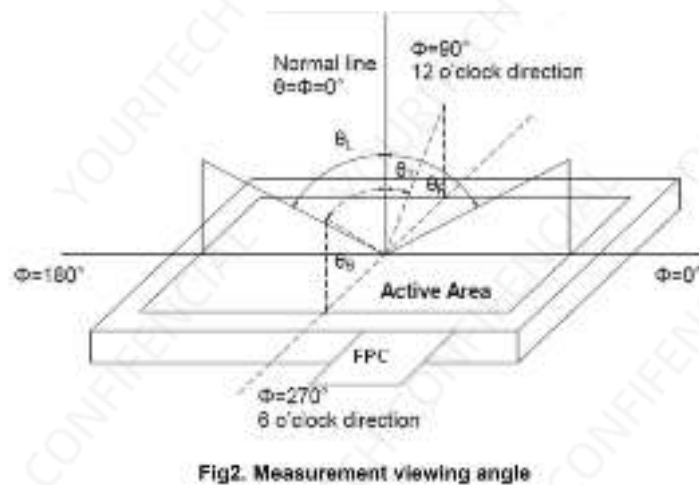


Note1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical characteristics are measured at the center point of the LCD screen.



Note2: Definition of viewing angle range and measurement system. Viewing angle is measured at the centerpoint of the LCD .



Note3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$



Note4: Definition of Response time

For SFT LCM, the response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_r) is the time between photo detector output intensity changed from 10% to 90%. And fall time (T_f) is the time between photo detector output intensity changed from 90% to 10%.

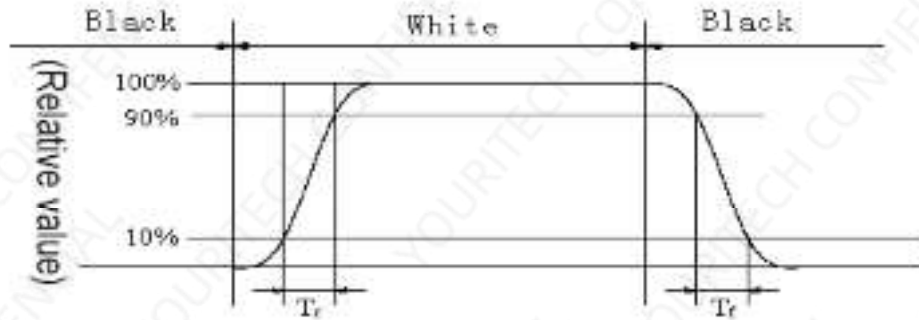


Fig3.Response Time Testing(SFT)

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig.5). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\min} / L_{\max}$$

$L_{\max}$: The measured Maximum luminance of all measurement position.

$L_{\min}$: The measured Minimum luminance of all measurement position.

L-----Active area length; W ---- Active area width

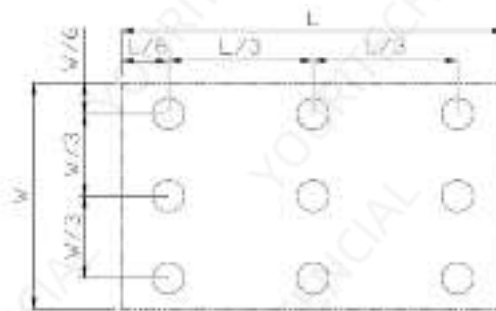


Fig4. Luminance Uniformity Measurement Locations(9 points)



7. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	+70℃, 240H	
2	Low Temperature Operation	-20℃, 240H	
3	High Temperature Storage	+80℃, 240H	
4	Low Temperature Storage	-30℃, 240H	
5	Operation at High Temperature and Humidity	+60℃, 90%RH, 240H	
6	Thermal Shock (non-operation)	-30℃, 30min~80℃, 30min, change time: 5min, 100cycle	

Note1: Temperature is the ambient temperature of sample

Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at roomtemperature.

Note3: In the standard condition, there shall be no practical problem that may affect the display function. After thereliability test, the product's function only be guaranteed, but not for all of the cosmetic specification.



8. General Precautions

1 Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.
8. Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
9. Pins of I/F connector shall not be touched directly with bare hands.

2 Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

3 Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.
3. Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
4. In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

4 Storage

1. Store the module in a dark room where must keep at $25\pm 10^{\circ}\text{C}$ and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.
4. It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time; Strong light exposure causes degradation of polarizer and color filter.



5 Operation

1. Do not connect, disconnect the module in the “Power On” condition.
2. Power supply should always be turned on/off by following item “POWER ON OFF SEQUENCE”.
3. 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 interference.
4. The FPC cable between the LED chips and its converter power supply shall be a minimized length and be connected directly. The longer cable between the back-light and the converter may cause lower luminance of light source (LED).

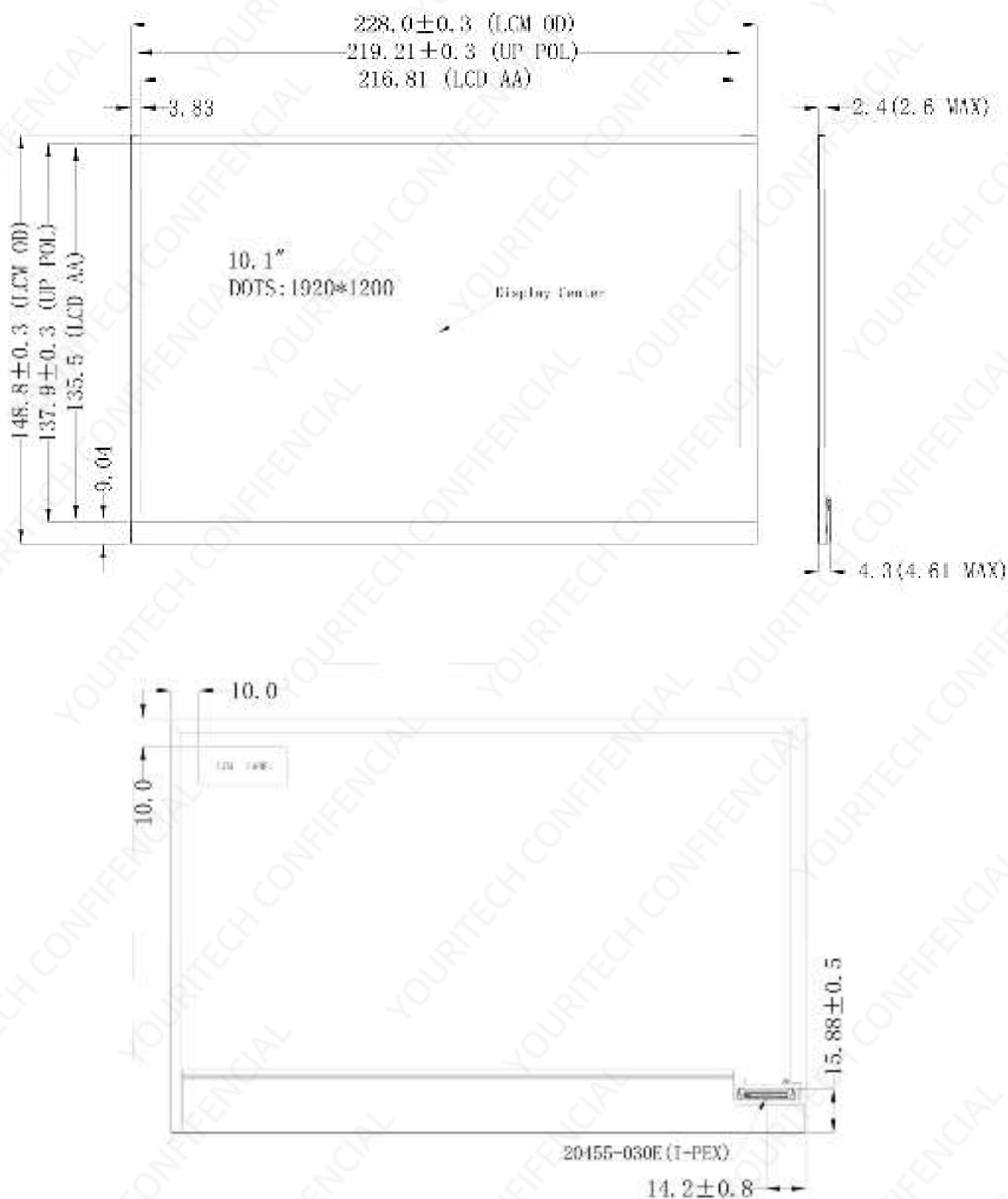
6 Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

7 Other

1. Ultra-violet ray filter is necessary for outdoor operation.
2. Avoid condensation of water. It may result in improper operation or disconnection of electrode.
3. Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, Variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.
4. If the module displays the same pattern continuously for a long period of time, it can be the situation when the image “sticks” to the screen.
5. This module has its circuitry PCB's on the front or rear side and should be handled carefully in order not to be stressed.
6. The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

9. Mechanical Drawing



Unit : mm

