PRODUCT SPECIFICATION

PART NUMBER # REV: FLC-101HML2000SA1#00
DESCRIPTION: 10.1”W TFT 1280x800 TFT Full View 500CD with LVDS interface

( ) Preliminary Specification
(V) Approved Specification

Customer Name:	
Signature:	**Date:**

PREPARED BY	**REVIEWED BY**	**SIGNATURE DATE**
Mia Huang	*David*	*2020/09/09*

Revision History

Version	Date	Page	Description	Note
V1.0	2020/09/09		First Edition	
V1.1	2020/09/10		Update Edition Power cons	

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1. GENERAL DESCRIPTION

1.1 Description

10.1” is a Color Active Matrix Liquid Crystal Display Module composed of a TFT LCD panel and LED backlight system. The screen format is intended to support the WXGA, 1280 x 800 screen and 262K/16.2M colors (6-bits colors with FRC).

1.2 Product Summary

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

No.	Item	Specification	Unit
1	Display Size	10.1”	Inch
2	Pixel Number	1280 (H) x RGB x 800 (V)	Pixels
3	Outline Dimension	230.7 (H) ×152.55 (V) ×6.5(D)	mm
4	Active Area	216.96 (H) × 135.6 (V)	mm
5	Display Colors	16.2M / 262K	- -
6	Pixel Arrangement	RGB vertical stripe	- -
7	Display Mode	Transmissive mode / Normally black	- -
8	Electrical Interface	LVDS	- -
9	Surface Treatment	Anti-Glare 3H	- -
10	Brightness	500 (Typ.)	cd/m2
11	Contrast Ratio	800 (Typ.)	- -
12	Total Power Consumption (Typ)	6.2	W

2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

Item	Symbol	Values		Unit	Note
		Min	Max.		
Power supply voltage	VCC	-0.3	4	V	
Converter Voltage	Vi	-0.3	18	V	
Enable Voltage	EN	---	5.5	V	
Backlight Adjust	ADJ	---	5.5	V	

Note Permanent damage to the device may occur if max. values are exceeded. Function operation should be restricted to the conditions described under normal operating conditions.

2.2 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Top	-20		65	°C	
Storage Temperature	Tstg	-25		70	°C	

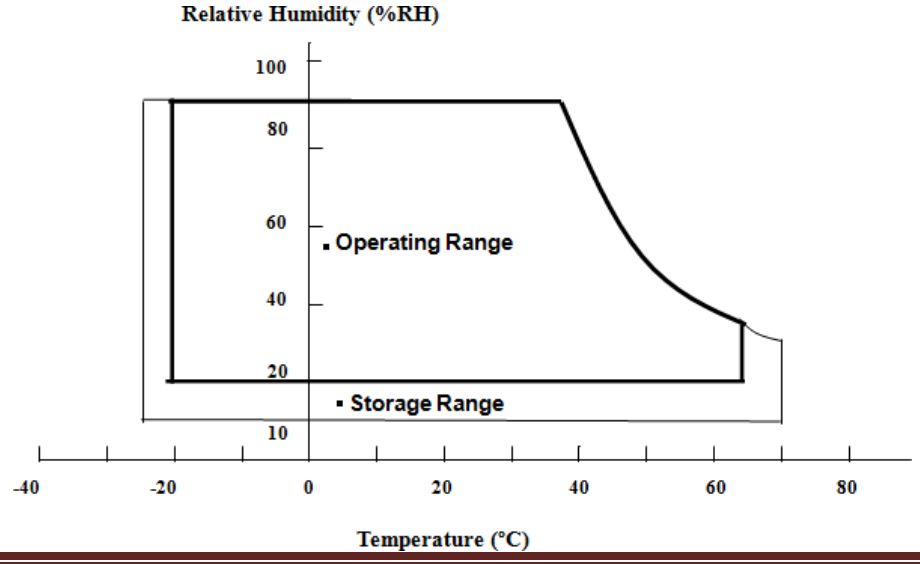
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ＜40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 39 ºC).

(c) No condensation

(d) for Module only



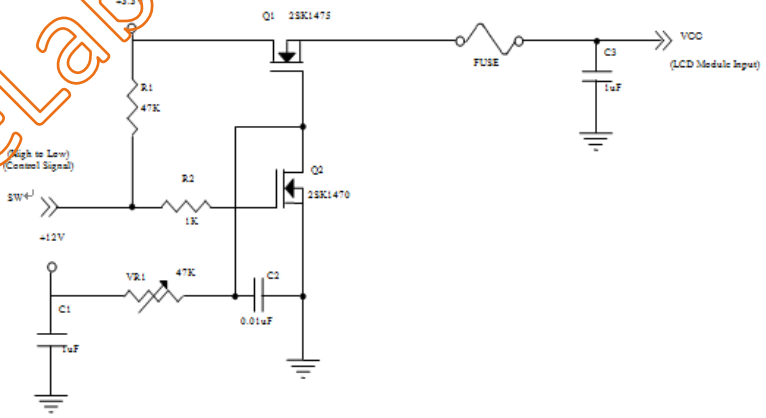
3. ELECTRICAL CHARACTERISTICS

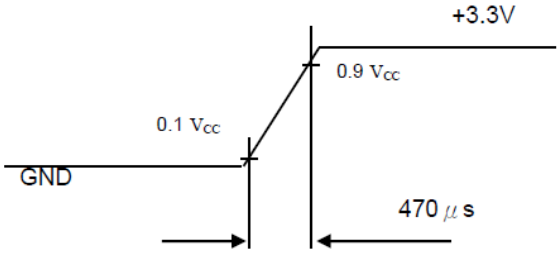
3.1 TFT LCD MODULE

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	3.0	3.3	3.6	V	(1)
Power Supply Ripple Voltage		V_{RP}	--	--	100	mVp-p	
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Power Supply Current	White	I_{CC}	--	265	320	mA	(3)
	Black		--	210	260	mA	
LVDS differential input voltage		V_{ID}	200	-	600	mV	
LVDS common input voltage		V_{IC}	1.0	1.2	1.4	V	-
Logic High Input Voltage		V_{IH}			100	mV	
Logic Low Input Voltage		V_{IL}	-100			mV	
LVDS terminating resistor		R_T	-	100	-	ohm	

Note (1) The assembly should be always operated within above ranges. Ta = 25 ± 2 ºC

Note (2) Measurement Conditions:





Note (3) The specified power supply current is under the conditions at VDD=3.3V, Ta=25 ± 2 ºC, DC current and fv=60Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern

Active Area

3.2 Backlight Unit

Parameter guideline for LED driving is under stable conditions at 25℃ (Room Temperature):

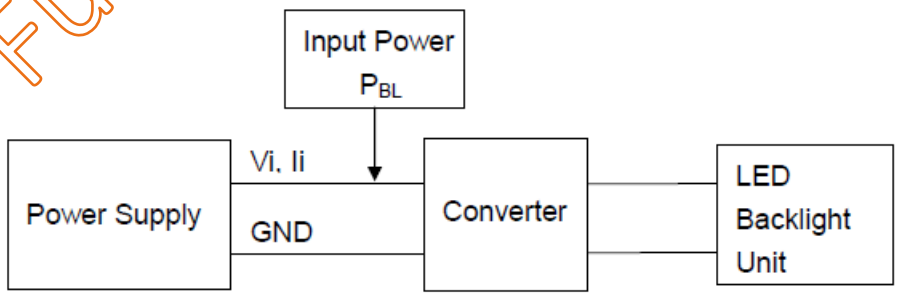
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Power Supply Voltage		V_i	10.8	12.0	13.2	V	
Converter Power Supply Current		I_i	--	0.45	0.5	A	@ Vi = 12V (Duty 100%)
Backlight Power Consumption		P_{BL}	-	5.3	5.8	W	@ Vi = 12V (Duty 100%)
EN Control Level	Backlight on	-	2.5	3.3	5.0	V	
	Backlight off		0	---	0.8	V	
PWM Control Level	PWM High Level	-	2.5	3.3	5.0	V	
	PWM Low Level		0	-	0.15	V	
PWM Control Duty Ratio		-	1	-	100	%	@200Hz
PWM Control Frequency		f_{PWM}	190	200	20k	Hz	(2)
LED LifeTime		L_L	50,000	-	-	Hrs	(3)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below:

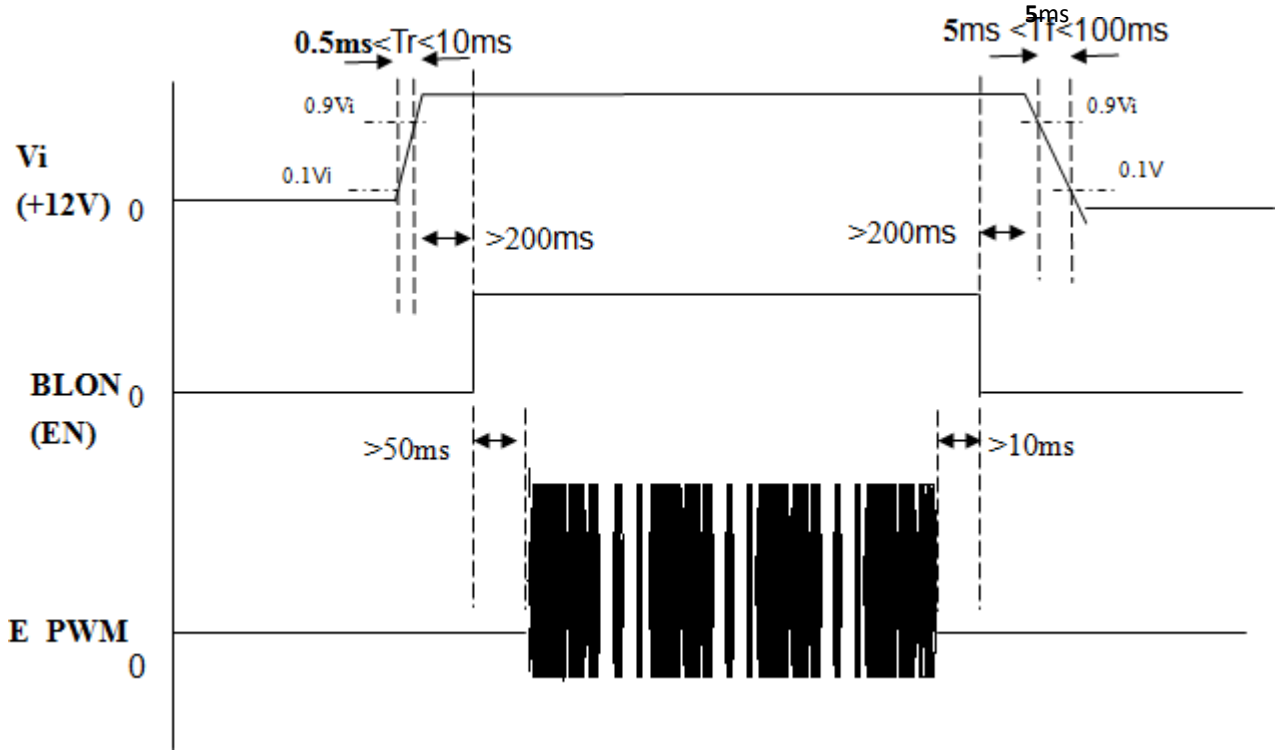
Note (2)At 200 Hz PWM control frequency, duty ratio range is restricted from 1% to 100%

Note (3) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at Ta = 25 ±2 ℃ and Duty=100% until the brightness becomes ≦ 50% of its original value.

Operating LED under high temperature environment will reduce lifetime and lead to color shift.



Power sequence and control signal timing are shown in the following figure



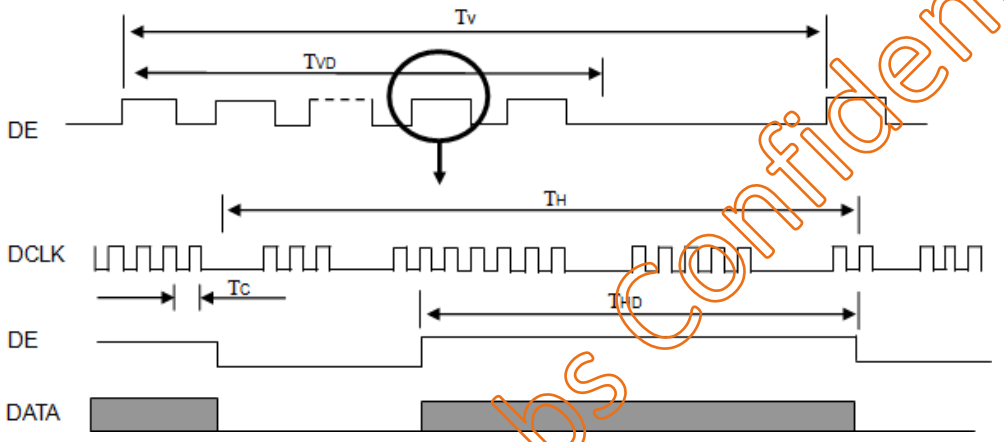
Note： While system is turned ON or OFF, the power sequences must follow as below descriptions Turn ON sequence: Vi(+12V) → BLON → E_PWM signal

Turn OFF sequence: E_PWM signal → BLON → Vi(+12V)

4. INTERFACE TIMING

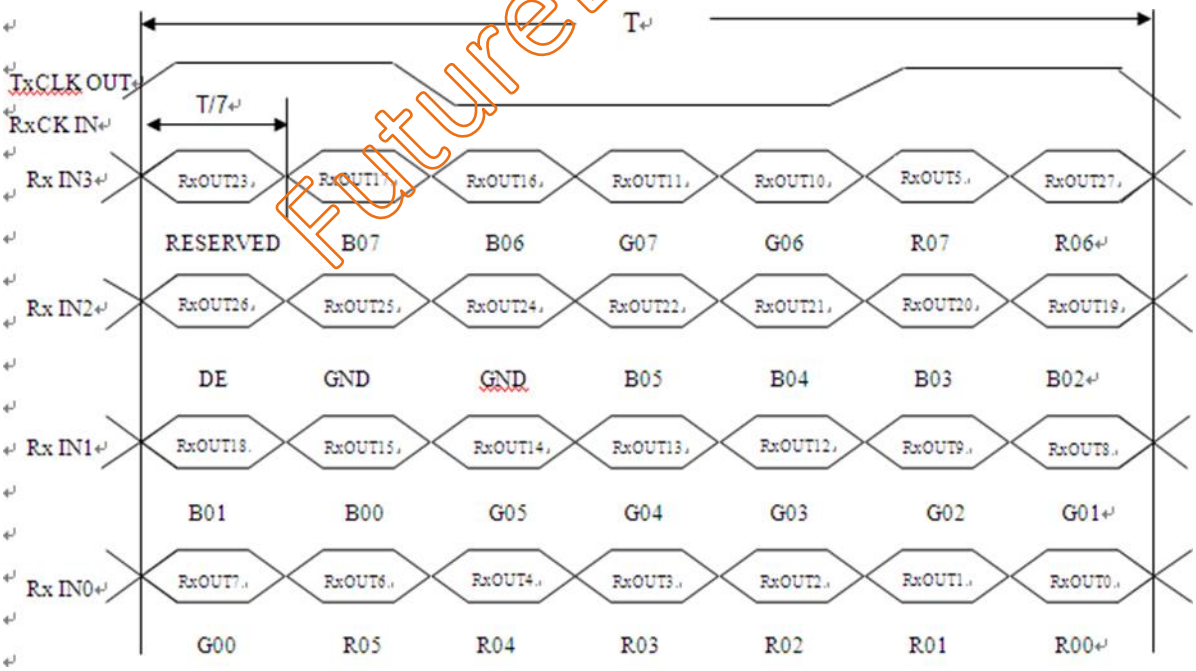
4.1 INPUT SIGNAL TIMING SPECIFICATIONS

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Pixel Clock	$1/T_C$	60.40	71.1	74.7	MHz	-
DE	Vertical Total Time	T_V	810	823	829	T_H	-
	Vertical Address Time	T_{VD}	800	800	800	T_H	-
	Horizontal Total Time	T_H	1362	1440	1480	T_C	-
	Horizontal Address Time	T_{HD}	1280	1280	1280	T_C	-



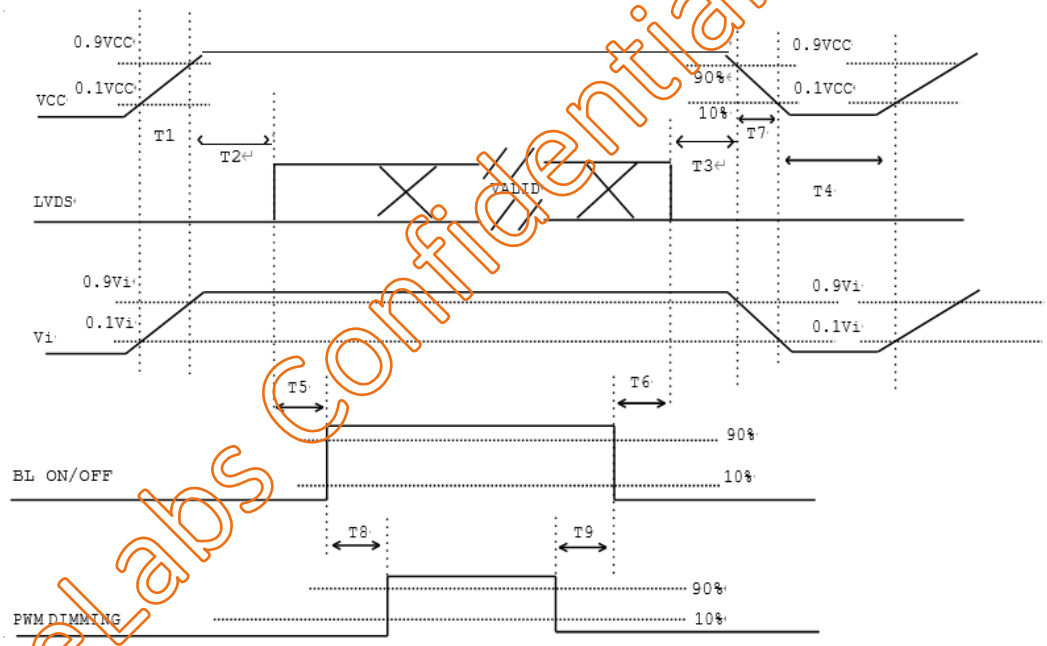
INPUT SIGNAL TIMING DIAGRAM

TIMING DIAGRAM of LVDS



4.2 Power ON/OFF Sequence

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



Note: (1) Please avoid floating state of interface signal at invalid period.

(2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V

(3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	200	-	-	ms
T6	200	-	-	ms
T7	5	-	300	ms
T8	10	-	-	ms
T9	10	-	-	ms

5. INTERFACE PIN DESCRIPTION

5.1 LCM Connector PIN Assignment

Pin No.	Symbol	Function	Polarity	Note
1	VCCS	Power Supply +3.3V(typical)		
2	VCCS	Power Supply +3.3V(typical)		
3	VCCS	Power Supply +3.3V(typical)		
4	Data format	L or NC : 8bit Input Mode H : 6bit Input Mode		Note (2),Note(3)
5	NC	No Conncetion		
6	NC	No Conncetion		
7	NC	No Conncetion		
8	Rxin0-	LVDS Differential Data Input	Negative	
9	Rxin0+	LVDS Differential Data Input	Positive	
10	VSS	Ground		
11	Rxin1-	LVDS Differential Data Input	Negative	
12	Rxin1+	LVDS Differential Data Input	Positive	
13	VSS	Ground		
14	Rxin2-	LVDS Differential Data Input	Negative	
15	Rxin2+	LVDS Differential Data Input	Positive	
16	VSS	Ground		
17	RxCLK-	LVDS Differential Clock Input	Negative	
18	RxCLK+	LVDS Differential Clock Input	Positive	
19	VSS	Ground		
20	Rxin3-	LVDS Differential Data Input	Negative	
21	Rxin3+	LVDS Differential Data Input	Positive	
22	VSS	Ground		
23	NC	No Conncetion (Reserve)		
24	NC	No Conncetion (Reserve)		
25	VSS	Ground		
26	VSS	Ground		
27	LED_PWM	PWM Control Signal od LED Converter		
28	LED_EN	Enable Control Signal od LED Converter		
29	LED_GND	LED Ground		
30	LED_GND	LED Ground		
31	LED_GND	LED Ground		

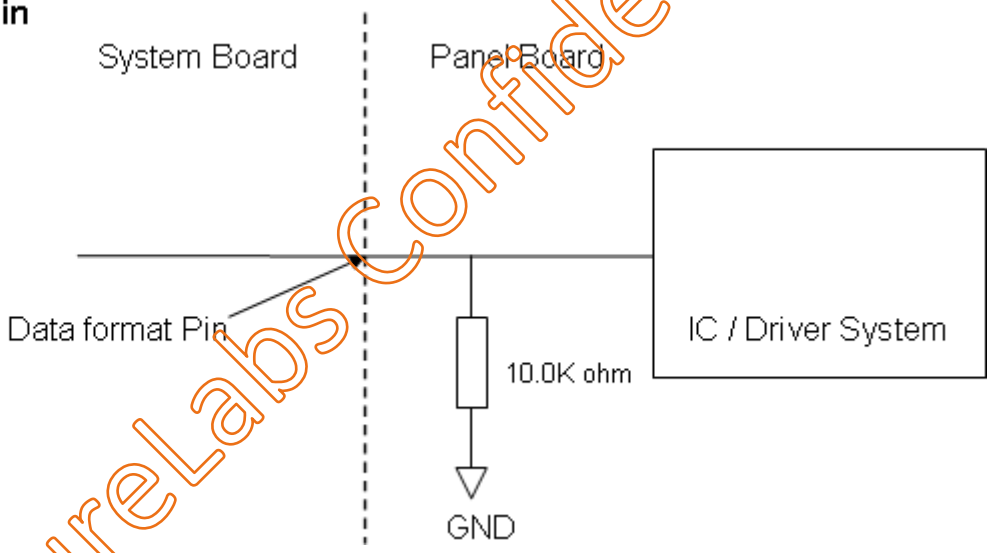
32	LED_GND	LED Ground		
33	LED_GND	LED Ground		
34	NC	No Conncetion (Reserve)		
35	NC	No Conncetion (Reserve)		
36	LED_VCCS	LED Power Supply		
37	LED_VCCS	LED Power Supply		
38	LED_VCCS	LED Power Supply		
39	LED_VCCS	LED Power Supply		
40	LED_VCCS	LED Power Supply		

Note (1) Connector Part No.: I-PEX 20455-040E-12 or Tyco_5-2069716-3.

Note (2) “Low” stands for 0V. “High” stands for 3.3V. “NC” stands for “No Connected”.

Note (3) Interface optional pin has internal scheme as following diagram, Customer should keep the interface voltage level requirement which including panel board loading as below.

Data format Pin



5.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color.

The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	R7	R6	G5	G4	G3	G2	G1	G0	R7	R6	B5	B4	B3	B2	B1	B0
Basic Colors	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
	Red	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	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 Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(252)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(252)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(252)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(252)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(252)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(252)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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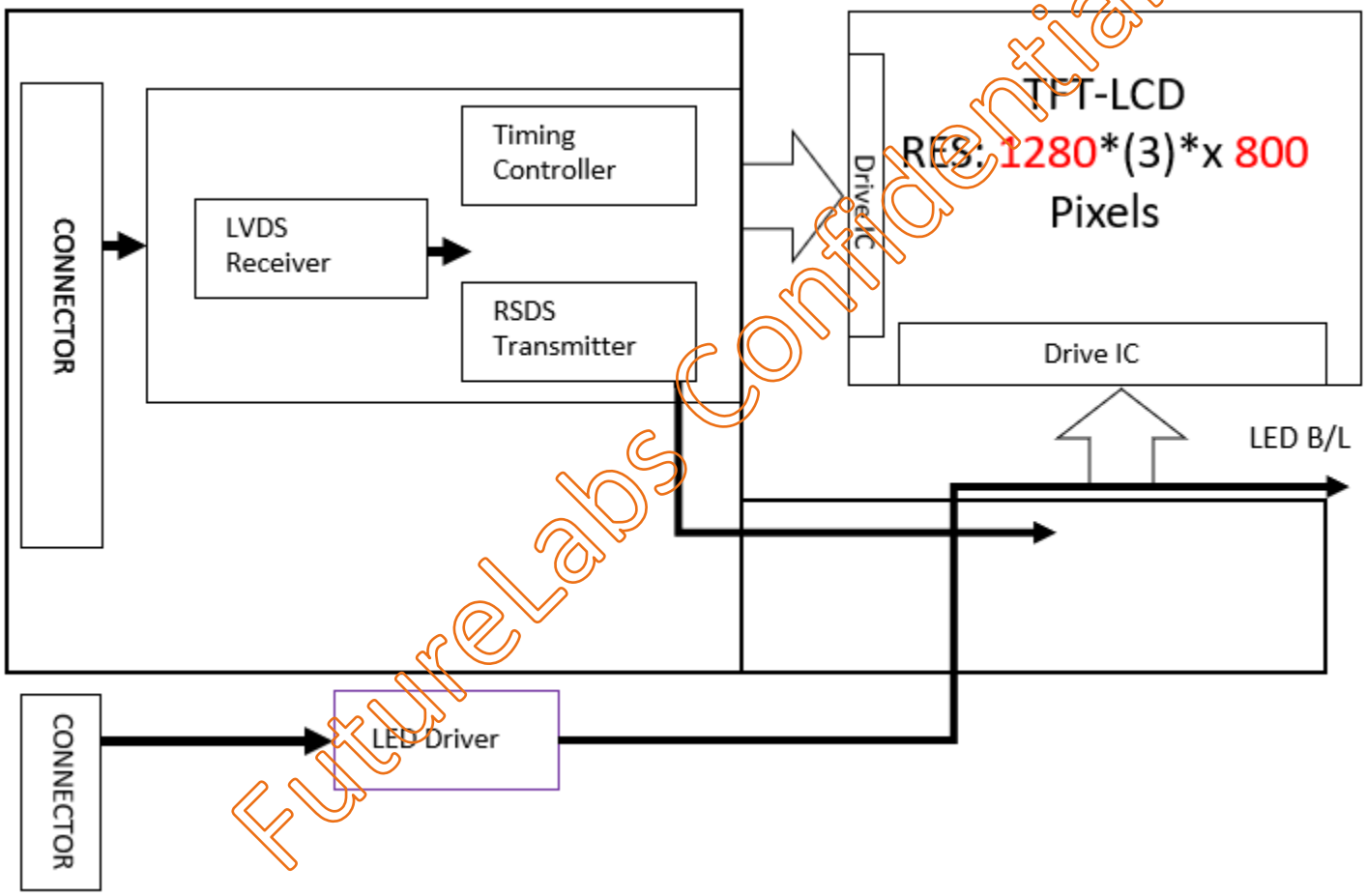
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1)0: Low Level Voltage, 1: High Level Voltage

6. BLOCK DIAGRAM

The following diagram shows the functional block of the TFT module:



7. OPTICAL CHARACTERISTIC

The optical characteristics are measured under stable conditions at room temperature.

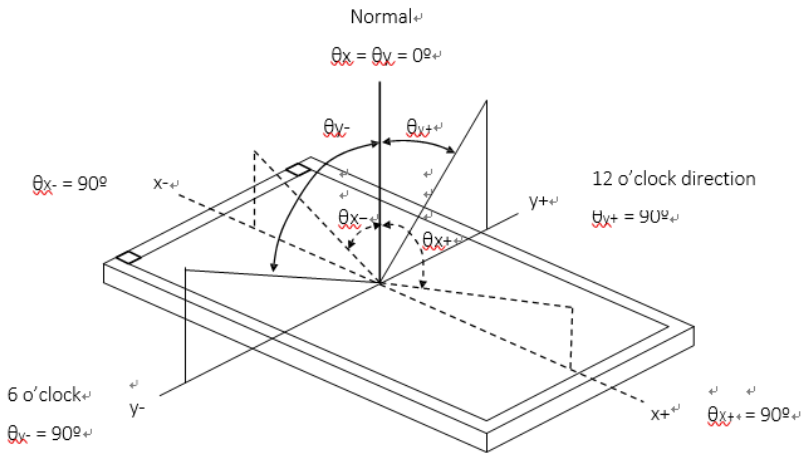
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_X=0°, θ_Y =0° Viewing angle at normal direction	600	800		-	(2)(5)
Response Time		T_R		-	14	17	ms	(3)
		T_F		-	11	14	ms	
Center Luminance of White		L_C		400	500	-	cd/m2	(4)(5)
White Variation		δW		70			-	(5)(6)
Chromaticity	Red	Rx		Typ. -0.05	0.592	Typ. +0.05	-	(1) (5)
		Ry			0.340		-	
	Green	Gx			0.316		-	
		Gy			0.591		-	
	Blue	Bx			0.154		-	
		By			0.123		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θ_{X+}	CR≥10	80	85	-	Deg.	(1)(5)
		θ_{X-}		80	85	-		
	Vertical	θ_{Y+}		80	85	-		
		θ_{Y-}		80	85	-		

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance <2 lux, and at room temperature).

The room temperature is 25°C±2°C

Note 1: Definition of Viewing Angle

Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or the vertical clock direction with respect to the optical axis which is normal to the LCD surface

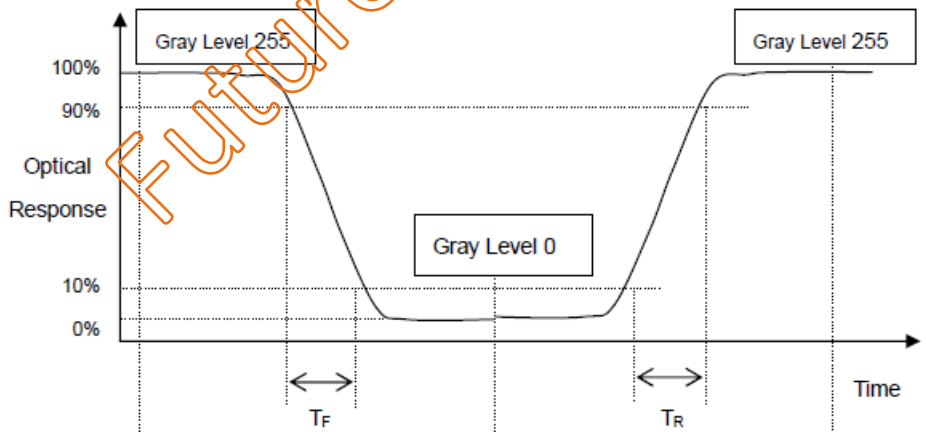


Note 2: Definition of Contrast Ratio (CR)

Measure the viewing angle of Θ= 0 and at the center of the LCD surface. Luminance with all pixels in white state divide by Luminance with all pixels in Black state

Note 3 Definition of Response Time:

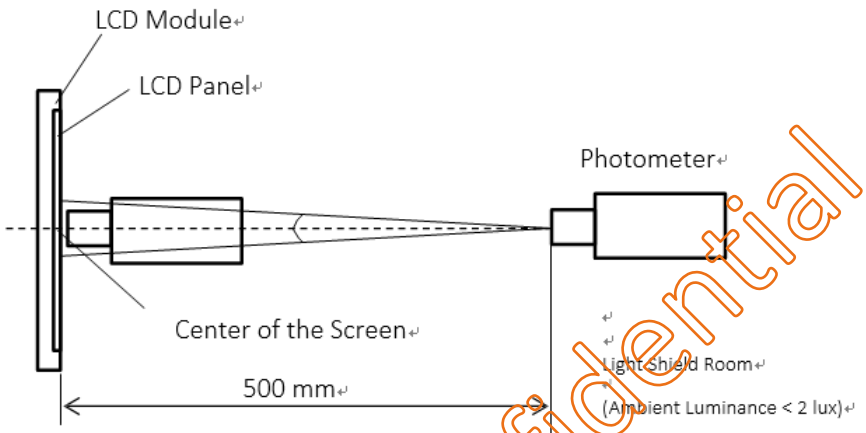
The response time is set initially by defining the "Rising Time (Tr)" and the "Falling Time (Tf)" respectively. The response time interval is between 10% and 90% of amplitudes, please refer the figure to the followings:



Note 4: Definition of Brightness (Lc)

Measure the center area of the panel and the viewing angle of the θx=θy =0°

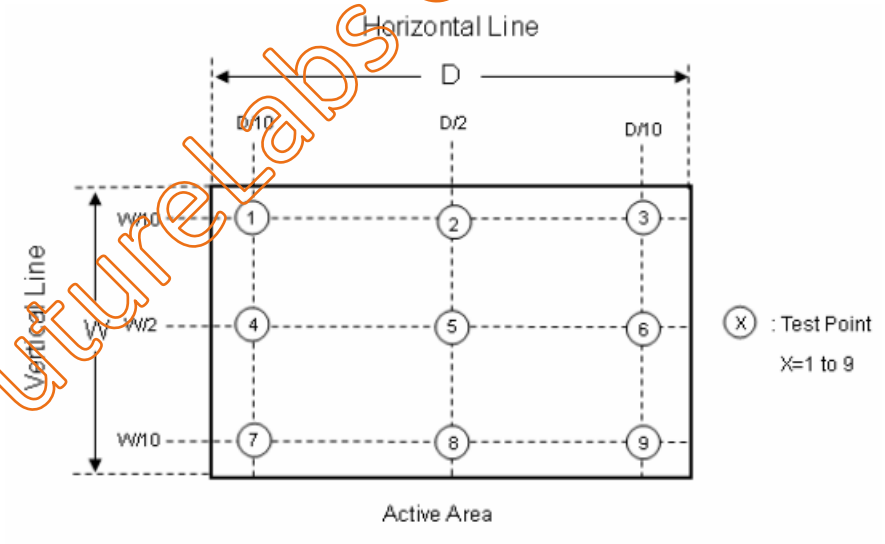
Note 5: The method of optical measurement:



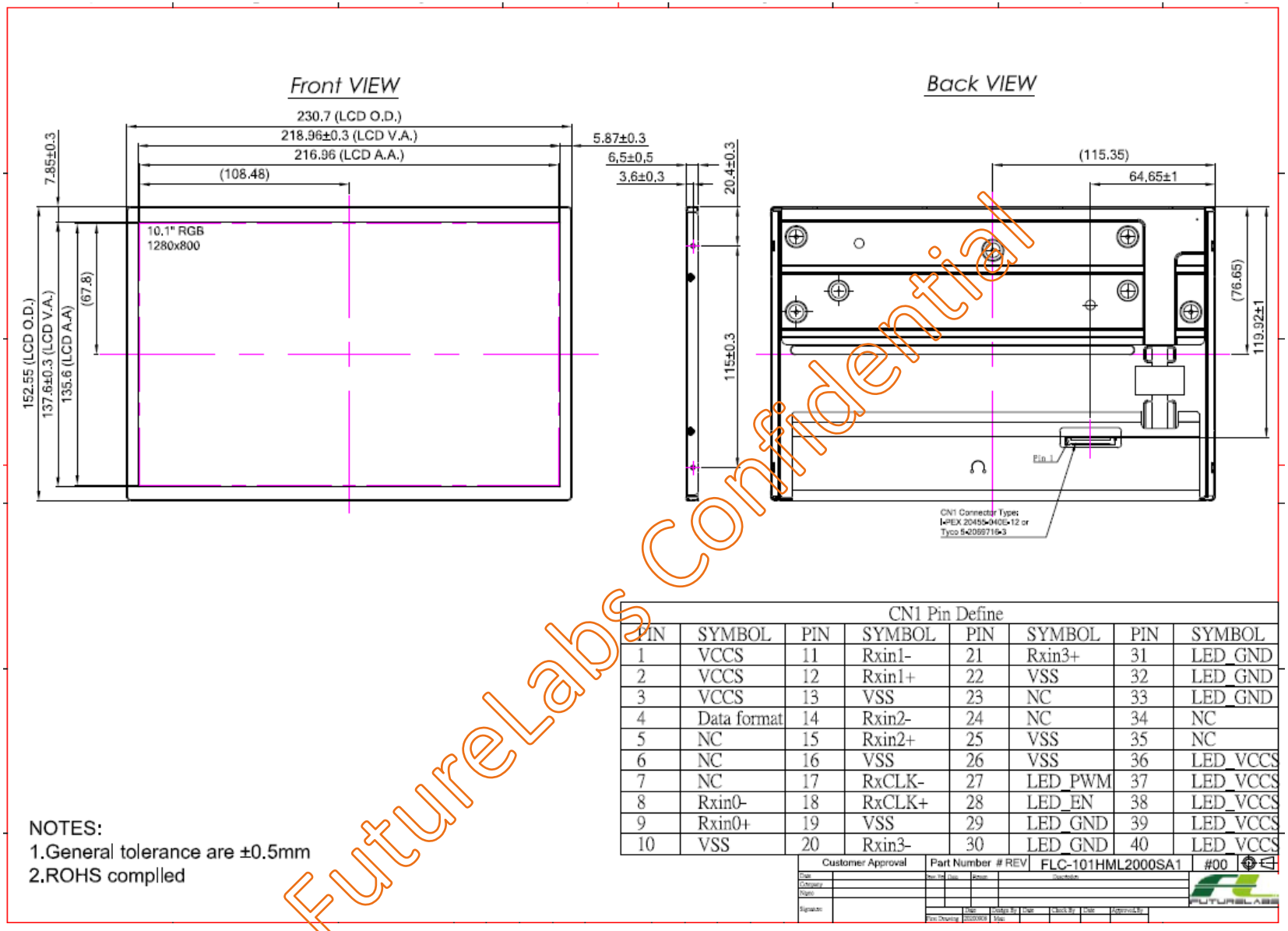
Note 6: Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

δW = Maximum [L (1), L (2), L (3)… L (8), L (9)] / Minimum [L (1), L (2), L (3)… L (4), L (5)]



8. DIMENSION AND DRAWING



CN1 Pin Define

PIN	SYMBOL	PIN	SYMBOL	PIN	SYMBOL	PIN	SYMBOL
1	VCCS	11	Rxin1-	21	Rxin3+	31	LED_GND
2	VCCS	12	Rxin1+	22	VSS	32	LED_GND
3	VCCS	13	VSS	23	NC	33	LED_GND
4	Data format	14	Rxin2-	24	NC	34	NC
5	NC	15	Rxin2+	25	VSS	35	NC
6	NC	16	VSS	26	VSS	36	LED_VCCS
7	NC	17	RxCLK-	27	LED_PWM	37	LED_VCCS
8	Rxin0-	18	RxCLK+	28	LED_EN	38	LED_VCCS
9	Rxin0+	19	VSS	29	LED_GND	39	LED_VCCS
10	VSS	20	Rxin3-	30	LED_GND	40	LED_VCCS

NOTES:
1.General tolerance are ±0.5mm
2.ROHS compliled

Customer Approval	Part Number # REV	FLC-101HML2000SA1	#00

9. RELIABILITY TEST CRITERIA

Test Item	Test Condition	Note
High Temperature Storage Test	70ºC, 240 hours	(1) (2) (4) (5)
Low Temperature Storage Test	-25ºC, 240 hours	
Thermal Shock Storage Test	-20ºC, 0.5hour←→70℃, 0.5hour; 100cycles, 1hour/cycle	
High Temperature Operation Test	65ºC, 240 hours	
Low Temperature Operation Test	-20ºC, 240 hours	
High Temperature & High Humidity Operation Test	60ºC, 90%RH, 240hours	(1) (2) (4) (6)
ESD Test (Operation)	150pF, 330Ω, 1 sec/cycle Condition 1 : panel contact, ±8 KV Condition 2 : panel non-contact ±15 KV	(1)
Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for ± X, ± Y, ± Z.	(3)(4)
Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z	(3)(4)

Note (1) There should be no condensation on the surface of panel during test.

Note (2) Temperature of panel display surface area should be 85 ºC Max.

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

Note (4) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

Note (5) Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note (6) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

10. PRECAUTION AND PRODUCT HANDLING

- Do not apply the external force such as bending or twisting to the LCD panel and backlight during assembly.
- Do not insert and plug out the input connector while the LCD panel is operating.
- Do not take apart the panel or frame from LCD module assembly or insert anything into the backlight unit.
- Do not keep the same pattern in a long period of time, it may cause image sticking on LCD panel. Can use shuffle content periodically if fixed pattern is displayed on the screen.
- Do not touch the display area with bare hands, this will stain the display area.
- Pay attention to handle lead wire of backlight, that is not tugged in connect with LED driver.
- Do not change variable resistance settings in LCD panel, it may cause not satisfy of LCD characteristics specification.
- The surface of LCD panel's polarizer is very soft and easily scratched, please use a very soft dry cloth without chemicals for cleaning.
- To avoid the static electricity to damage the CMOS LSI, the operator should be grounded when in contact with the LCD panel, and also to all electrical equipment.
- Need to follow the correct power frequency when LCD panel is connecting and operating, this can avoid damage to CMOS LSI during latch-up.
- Need to store the LCD panel indoor without the exposure of sunlight where the temperature is 25°C ± 5°C and the humidity is below 60% RH.