SPEC NO.: VI156FIC00 Date: 2021/06/17

TFT-LCD Module

SPECIFICATION

Customer:	
Model Name:	VI156FIC00
SPEC NO.:	V02
Date:	20201.06.17
Version:	

■ Preliminary Specification

□ Final Specification

For Customer's Acceptance

Approved by	Comment

Approved by	Reviewed by	Prepared by
	张珊林	

SPEC NO.: VI156FIC00 Date: 2021/06/17

Record of Revision

Version	Revise Date	Page	Content
V02	2021.06.17	ALL	修正背光 参数

SPEC NO.: VI156FIC00 Date: 2021/06/17

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1. GENERAL DESCRIPTION

1.1 OVERVIEW

VI156FIC00 is a 15.6”（15.6” diagonal) TFT Liquid Crystal Display module with Driver ICs and 30 pins eDP interface. This product supports 1920x 1080 FHD mode and can display 16.7 M colors.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	15.6” diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1920 x R.G.B. x 1080	pixel	-
Pixel Pitch	0.17925 (H) x 0.17925 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Transmissive Mode	Normally Black	-	-
Surface Treatment	Hard coating (3H), Anti-Glare	-	-
Power Consumption	Cell 0.891W(Max.)	-	(1)

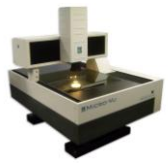
Note (1) The specified power consumption (with converter efficiency) is under the conditions at VCCS = 3.3 V, fv = 60 Hz, and Ta = 25 ± 2 ºC, whereas **Mosaic** pattern is displayed.

2. MECHANICAL SPECIFICATIONS

item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	359.80	360	360.2	mm	(1) (2)
	Vertical (V)	222.03	222.23	222.43	mm	
	Thickness (T)	6.2	6.4	6.6	mm	
Active Size	Horizontal	344.06	344.16	344.26	mm	
	Vertical	193.49	193.59	193.69	mm	
Weight		-	-	-	kg	

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

(2) Dimensions are measured by Coordinate Measuring Instrument.



3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

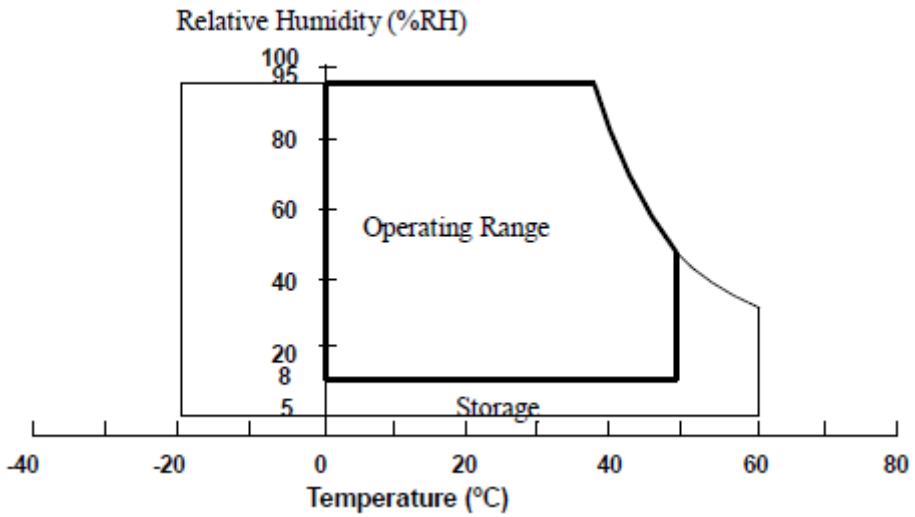
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-30	+80	℃	(1)
Operating Ambient Temperature	T_{OP}	-20	+70	℃	(1),(2)

Note (1) (a) 90 %RH Max. (Ta < 40 ºC).

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

(c) No condensation.

Note (2) The temperature of panel surface should be 0 ºC min. and 60 ºC max.



3.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)

High temperature or humidity may reduce the performance of panel. Please store LCD panel within the specified storage conditions.

Storage Condition: With packing.

Storage temperature range: 25±5 ℃.

Storage humidity range: 50±10%RH.

Shelf life: 30day

3.3 ELECTRICAL ABSOLUTE RATINGS(OPEN CELL)

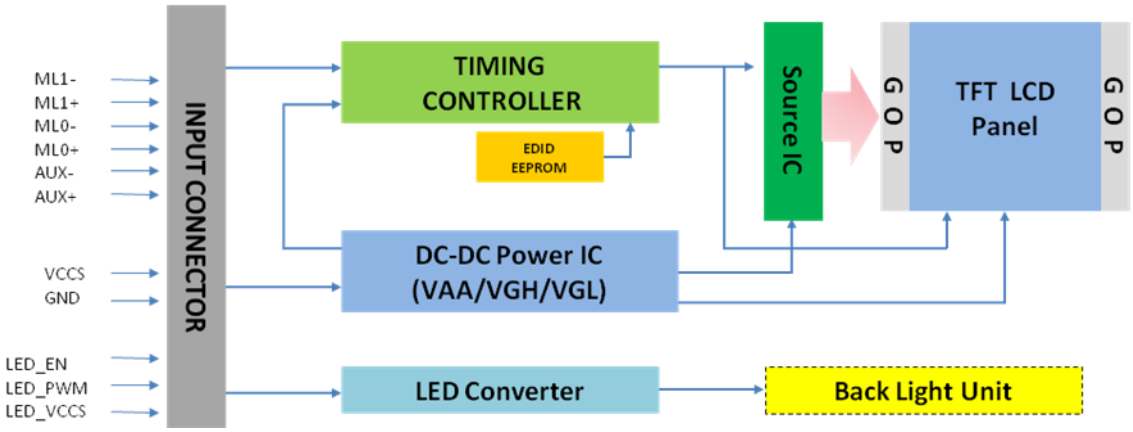
3.3.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	VCCS+0.3	V	

Note (1) Stresses beyond those listed in above “ELECTRICAL ABSOLUTE RATINGS” may cause permanent damage to the device. Normal operation should be restricted to the conditions described in “ELECTRICAL CHARACTERISTICS”.

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



4.2. INTERFACE CONNECTIONS

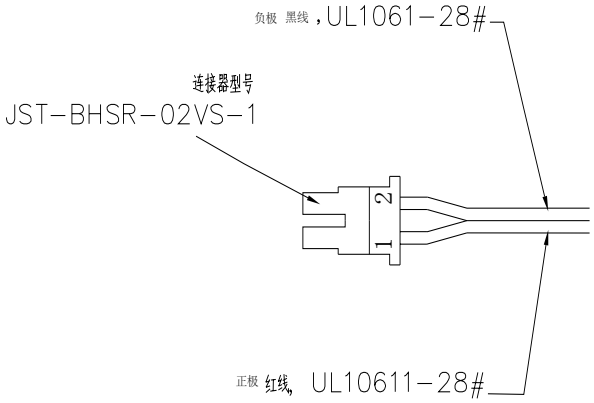
4.2.1 Input CONN Pin Assignment

Input Connector (I-pex 20455-030E-76) is used for the module electronics interface, the recommended CONN of user is 20453-030T-03 manufactured by I-pex.

Pin	Symbol	Description	Remark
1	NC	No Connection (Reserved for LCD test)	
2	H_GND	High Speed Ground	
3	ML1-	Complement Signal-Lane 1	
4	ML1+	True Signal-Main Lane 1	
5	H_GND	High Speed Ground	
6	ML0-	Complement Signal-Lane 0	
7	ML0+	True Signal-Main Lane 0	
8	H_GND	High Speed Ground	
9	AUX+	True Signal-Auxiliary Channel	
10	AUX-	Complement Signal-Auxiliary Channel	
11	H_GND	High Speed Ground	
12	VCCS	Power Supply +3.3V(typical)	
13	VCCS	Power Supply +3.3V(typical)	
14	NC	No Connection (Reserved for LCD test)	
15	GND	Ground	
16	GND	Ground	
17	HPD	Hot Plug Detect	
18	BL_GND	BL Ground	No Connection
19	BL_GND	BL Ground	No Connection
20	BL_GND	BL Ground	No Connection
21	BL_GND	BL Ground	No Connection
22	LED_EN	BL_Enable Signal of LED Converter	No Connection
23	LED_PWM	PWM Dimming Control Signal of LED Converter	No Connection
24	NC	No Connection (Reserved for LCD test)	
25	NC	No Connection (Reserved for LCD test)	
26	LED_VCCS	BL Power	No Connection

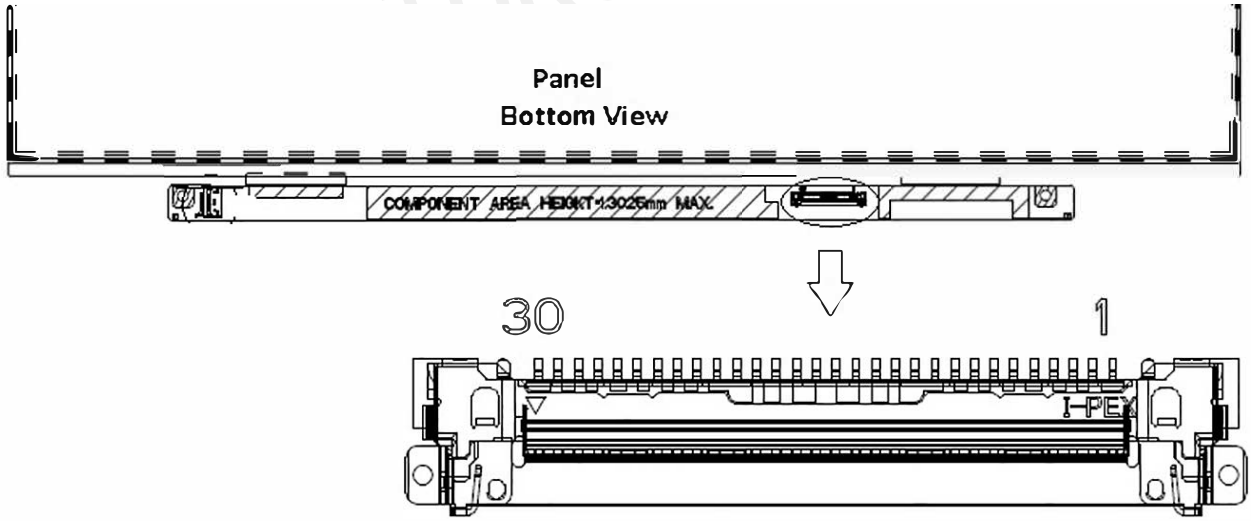
27	LED_VCCS	BL Power	No Connection
28	LED_VCCS	BL Power	No Connection
29	LED_VCCS	BL Power	No Connection
30	NC	No Connection (Reserved for LCD test)	

4.2.2 Light bar CONNECTOR



4.2.3 CONN Pin1 location

Input CONN is on bottom side of PCBA, pin 1 location shows as following figure.



4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

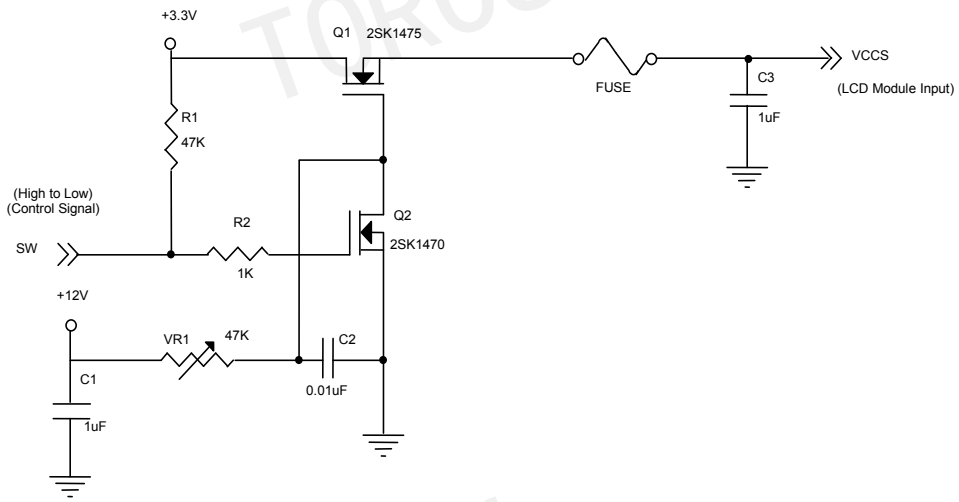
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCCS	3.0	3.3	3.6	V	(1)
Ripple Voltage		V_{RP}	-	50	150	mV	(1)
Inrush Current		I_{RUSH}	0	-	1.5	A	(1),(2)
Power Supply Current	Mosaic	I_{VCCS}	210	240	270	mA	(3)
	Black		190	220	250	mA	(3)
	H 1 line Stripe		450	550	650	mA	
HPD Pull-Low Resistance		R_{HPD}	30K	-	100K	ohm	(4)
HPD	High Level	VH_{HPD}	2.25	-	2.75	V	(5)
	Low Level	VL_{HPD}	0	-	0.4	V	(5)

Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

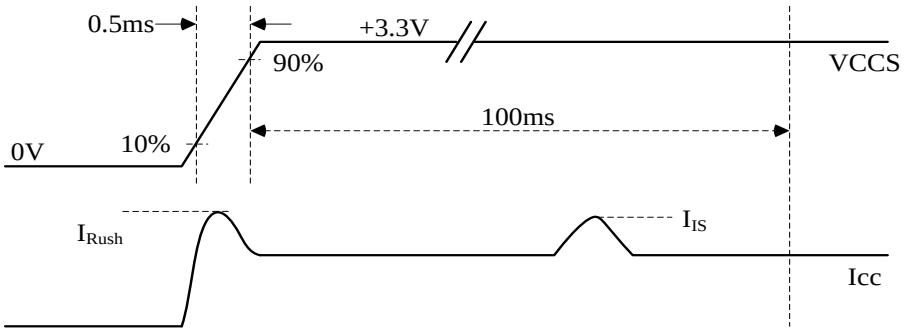
Note (2) I_{RUSH}: the maximum current when VCCS is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.

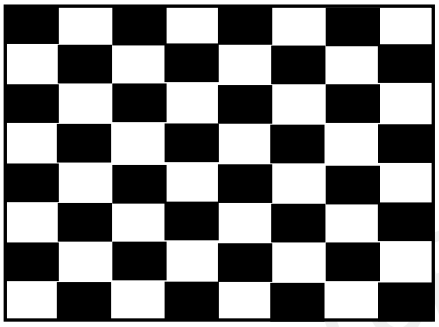


VCCS rising time is 0.5ms



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

Mosaic Pattern



Active Area

Note (4) The specified signals have pull down resistor to ground in the LCD module respectively. Customers should keep the input signal level requirement with the load of LCD module. Please refer to Note (4) of 4.3.2 LED CONVERTER SPECIFICATION to obtain more information.

Note (5) When a source detects a low-going HPD pulse, it must be regarded as a HPD event. Thus, the source must read the link / sink status field or receiver capability field of the DPCD and take corrective action.

4.3.2 Back-Light Unit

The characteristics of the LED are shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	450	460	480	mA	(2)
LED Voltage	VL	35	42	49	V	
Operating LED life time	Hr		50000	-	Hour	(1)(2)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

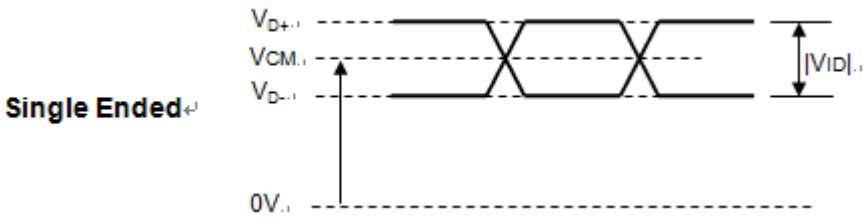
Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=460mA. The LED lifetime could be decreased if operating IL is larger than 460mA. The constant current driving method is suggested

4.4 DISPLAY PORT INPUT SIGNAL TIMING SPECIFICATIONS

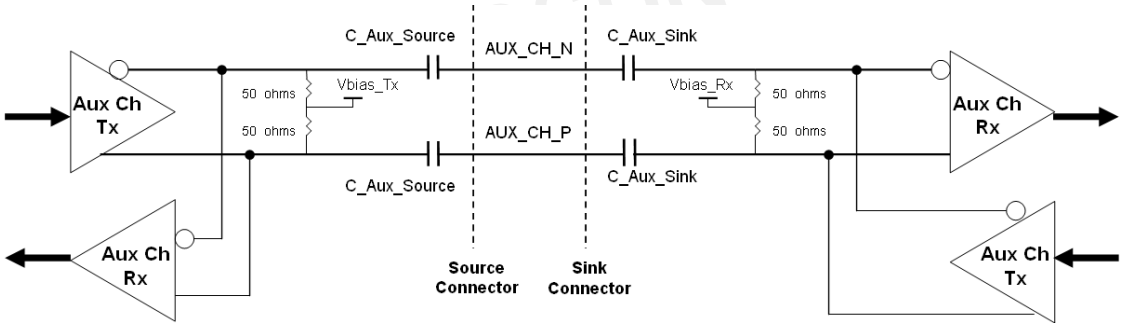
4.4.1 DISPLAY PORT INTERFACE

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Differential Signal Common Mode Voltage(MainLink and AUX)	VCM	0		2	V	(1)(4)
AUX AC Coupling Capacitor	C_AUX_Source	75		200	nF	(2)
Main Link AC Coupling Capacitor	C_ML_source	75		200	nF	(3)

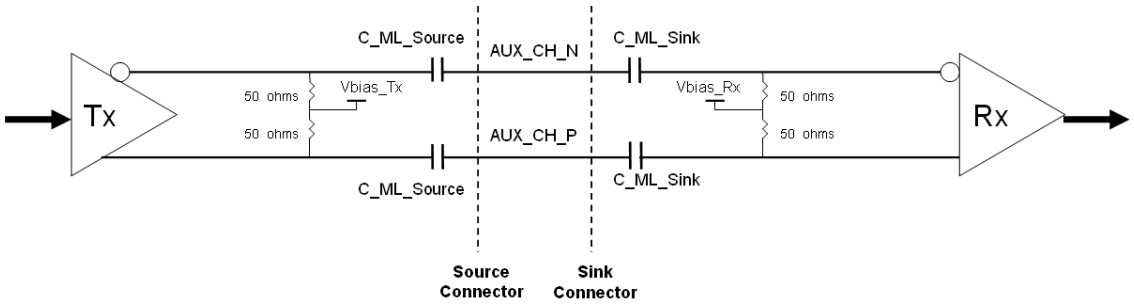
Note (1) Display port interface related AC coupled signals should follow VESA DisplayPort Standard Version1. Revision 1a and VESA Embedded DisplayPort™ Standard Version 1.2. There are many optional items described in eDP1.2. If some optional item is requested, please contact us.



(2) Recommended eDP AUX Channel topology is as below and the AUX AC Coupling Capacitor (C_Aux_Source) should be placed on the source device..



(3) Recommended Main Link Channel topology is as below and the Main Link AC Coupling Capacitor (C_ML_Source) should be placed on the source device.



(4) The source device should pass the test criteria described in DisplayPort Compliance Test Specification(CTS) 1.1

4.4.2 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	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	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
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	Red(253)	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(254)	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(255)	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(253)	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(254)	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(255)	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(253)	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(254)	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(255)	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

4.5 DISPLAY TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Refresh rate 60Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	151.6	152.84	154.04	MHz	-
DE	Vertical Total Time	TV	1128	1132	1136	TH	-
	Vertical Active Display Period	TVD	1080	1080	1080	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	52	TV-TVD	TH	-
	Horizontal Total Time	TH	2240	2250	2260	Tc	-
	Horizontal Active Display Period	THD	1920	1920	1920	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	330	TH-THD	Tc	-

Refresh rate 50Hz (Power Saving Mode)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	126.35	127.35	128.35	MHz	-
DE	Vertical Total Time	TV	1128	1132	1136	TH	-
	Vertical Active Display Period	TVD	1080	1080	1080	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	52	TV-TVD	TH	-
	Horizontal Total Time	TH	2240	2250	2260	Tc	-
	Horizontal Active Display Period	THD	1920	1920	1920	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	330	TH-THD	Tc	-

Refresh rate 50Hz (Power Saving Mode)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	121.3	122.26	123.22	MHz	-
DE	Vertical Total Time	TV	1128	1132	1136	TH	-
	Vertical Active Display Period	TVD	1080	1080	1080	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	52	TV-TVD	TH	-
	Horizontal Total Time	TH	2240	2250	2260	Tc	-
	Horizontal Active Display Period	THD	1920	1920	1920	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	330	TH-THD	Tc	-

Note (1) The panel can operate at 60Hz normal mode and power saving mode, respectively. All reliability tests are based on specific timing of 60Hz refresh rate. We can only assure the panel's electrical function at power saving mode.

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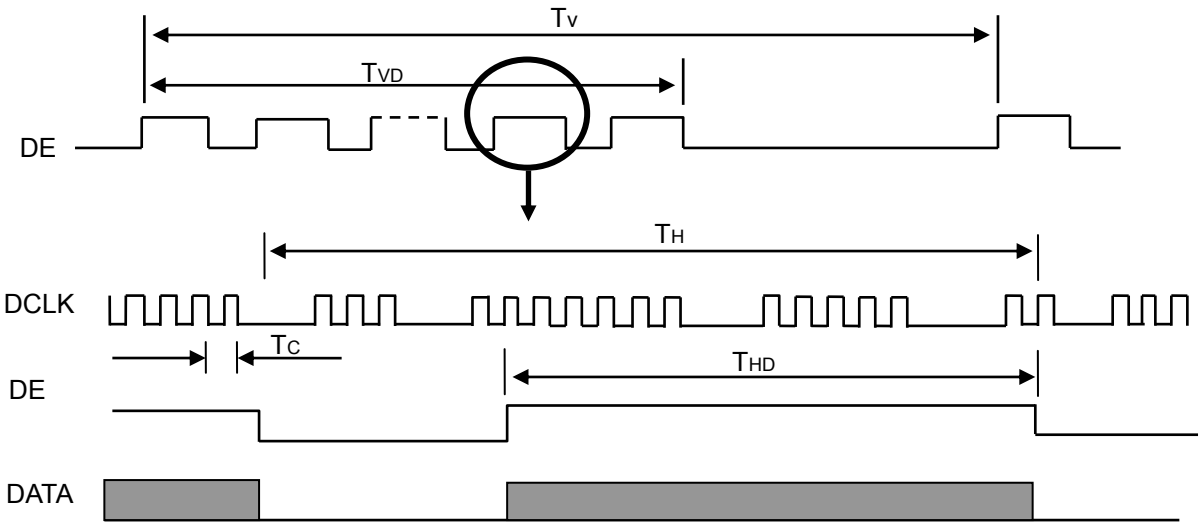
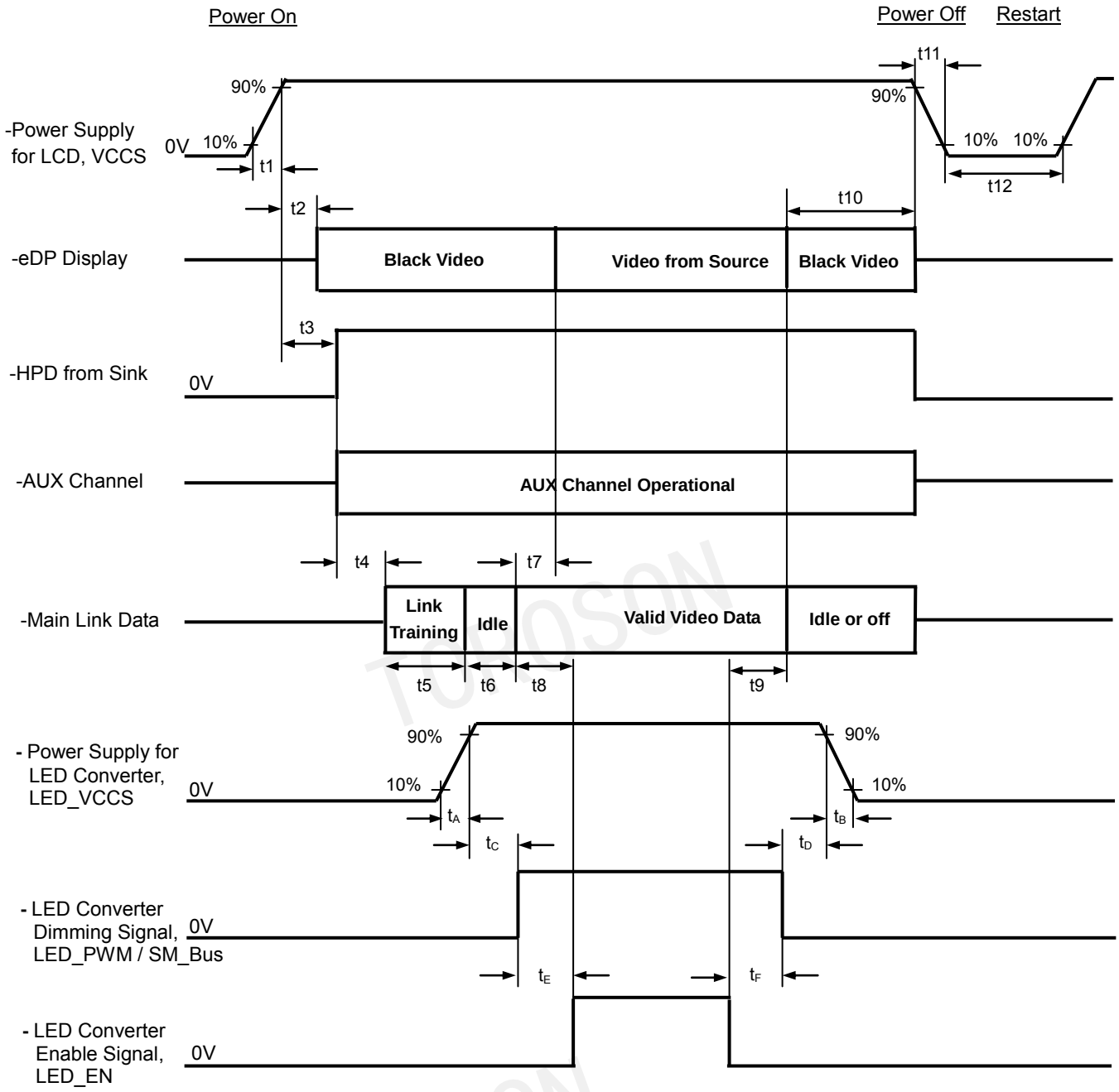
INPUT SIGNAL TIMING DIAGRAM



4.6 POWER ON/OFF SEQUENCE



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Timing Specifications:

Parameter	Description	Reqd. By	Value		Unit	Notes
			Min	Max		
t1	Power rail rise time, 10% to 90%	Source	0.5	10	ms	-
t2	Delay from LCD,VCCS to black video generation	Sink	0	200	ms	Automatic Black Video generation prevents display noise until valid video data is received from the Source (see Notes:2 and 3 below)
t3	Delay from LCD,VCCS to HPD high	Sink	0	200	ms	Sink AUX Channel must be operational upon HPD high (see Note:4 below)
t4	Delay from HPD high to link training initialization	Source	0	500	ms	Allows for Source to read Link capability and initialize
t5	Link training duration	Source	0	500	ms	Dependant on Source link training protocol
t6	Link idle	Source	0	500	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 validate video data and timing. At the end of T7, Sink will indicate the detection of valid video data by setting the 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	80	500	ms	Source must assure display video is stable *: Recommended by INX. To avoid garbage image.
t9	Delay from backlight off to end of valid video data	Source	50	500	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. (See Notes: 2 and 3 below) *: Recommended by INX. To avoid garbage image.
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	VCCS power rail fall time, 90% to 10%	Source	0.5	10	ms	See Note 5 below

t12	VCCS Power off time	Source	500	-	ms	-
tA	LED power rail rise time, 10% to 90%	Source	0.5	10	ms	-
tB	LED power rail fall time, 90% to 10%	Source	0	10	ms	-
tC	Delay from LED power rising to LED dimming signal	Source	1	500	ms	-
tD	Delay from LED dimming signal to LED power falling	Source	1	500	ms	-
tE	Delay from LED dimming signal to LED enable signal	Source	1	500	ms	-
tF	Delay from LED enable signal to LED dimming signal	Source	1	500	ms	-

Note (1) Please don't plug or unplug the interface cable when system is turned on.

Note (2) The Sink must include the ability to automatically generate Black Video autonomously. The Sink must automatically enable Black Video under the following conditions:

- Upon LCD VCCS power-on (within T2 max)
- When the "NoVideoStream_Flag" (VB-ID Bit 3) is received from the Source (at the end of T9)

Note (3) The Sink may implement the ability to disable the automatic Black Video function, as described in Note (2), above, for system development and debugging purposes.

Note (4) The Sink must support AUX Channel polling by the Source immediately following LCD VCCS power-on without causing damage to the Sink device (the Source can re-try if the Sink is not ready). The Sink must be able to response to an AUX Channel transaction with the time specified within T3 max.

. Note (5) The VCCS power rail is recommended to rise and fall linearly. If not, please contact us to conduct risk assessment.

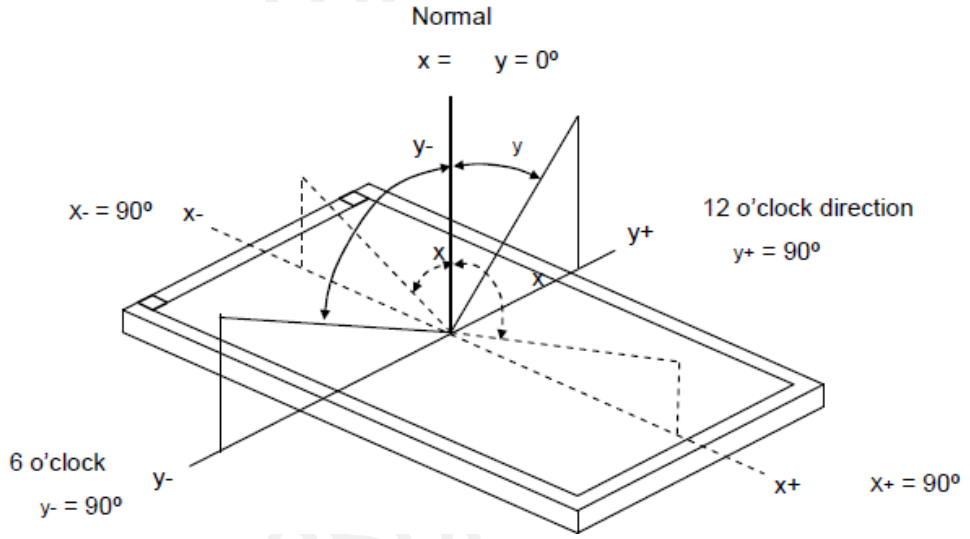
5. OPTICAL CHARACTERISTICS

5.1 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931) FOG Only with C-light	Red	Rx	θ_x=0°, θ_Y =0° R=G=B=255 Gray scale	Typ – 0.03	0.658	Typ + 0.03	-	*C Light Source* (1),(5) (6),(7),(8)
		Ry			0.328			
	Green	Gx			0.275			
		Gy			0.574			
	Blue	Bx			0.143			
		By			0.092			
	White	Wx			0.314			
		Wy			0.351			
Color gamut		C.G		64	69	-	%	
Luminance		L		1000	1200	-	cd/㎡	(1),(4),(6)
Contrast Ratio		CR		800	1000	-	-	(2)
Response Time		$T_{R+}T_F$	θ_x=0°, θ_Y =0°	-	25	30	ms	(3),(6)
Viewing Angle	Horizontal	x +	CR>10	80	-	-	Deg.	(1),(5),(6)
		x -		80	-	-		
	Vertical	y +		80	-	-		
		y -		80	-	-		

Note (1) Definition of Viewing Angle (_x, _y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5)

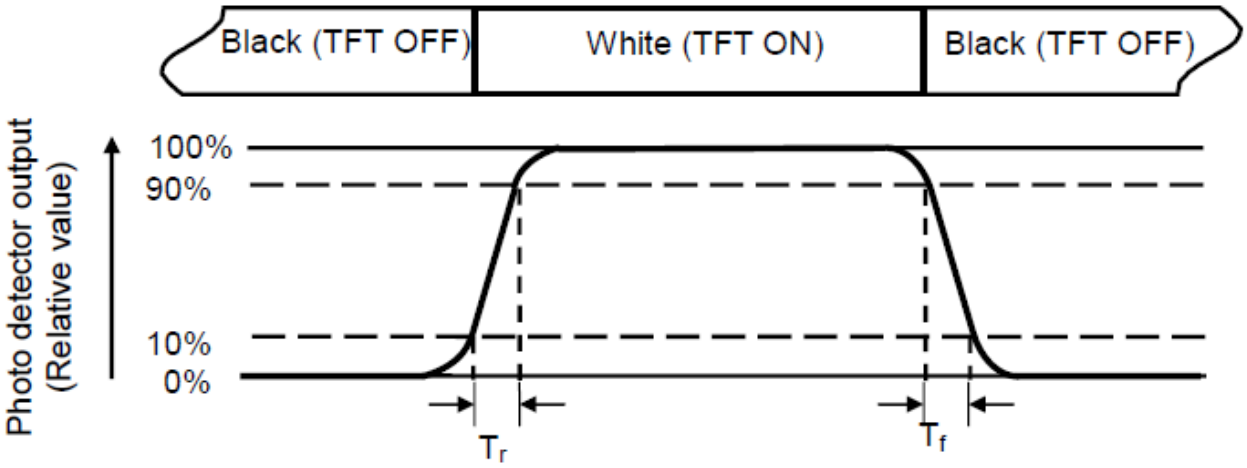
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time：

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (Tr) is the time between photo detector output intensity changed from 10% to 90%. And fall time (Tf) is the time between photo detector output intensity changed from 90% to 10%.

RT = RT (5)

RT (X) is corresponding to the Response Time of the point X at Figure in Note (6).



Note (4) Definition of Luminance of White (Lc):

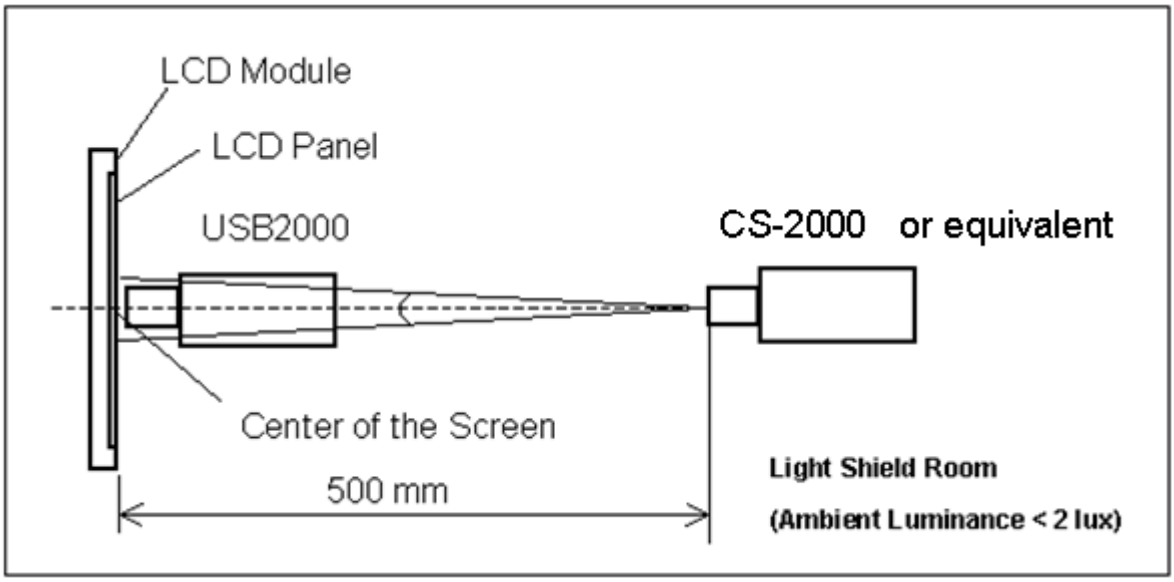
Measure the luminance of gray level 255 at center point

LC = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

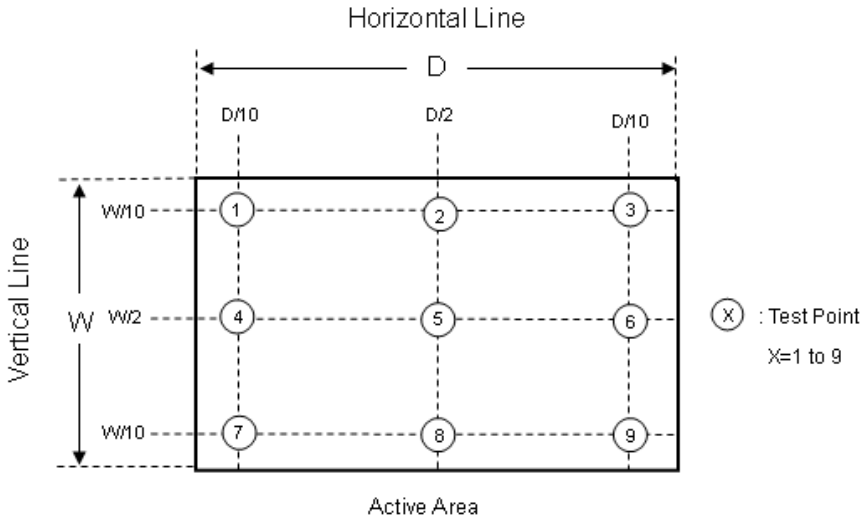
Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.



Note (6) Definition of White Variation (_W):

Measure the luminance of gray level 255 at 9 points



Note (7) The listed optical specifications refer to the initial value of manufacture, but the condition of the specifications after long-term operation will not be warranted.

Note (8) Definition of color gamut (C.G%):

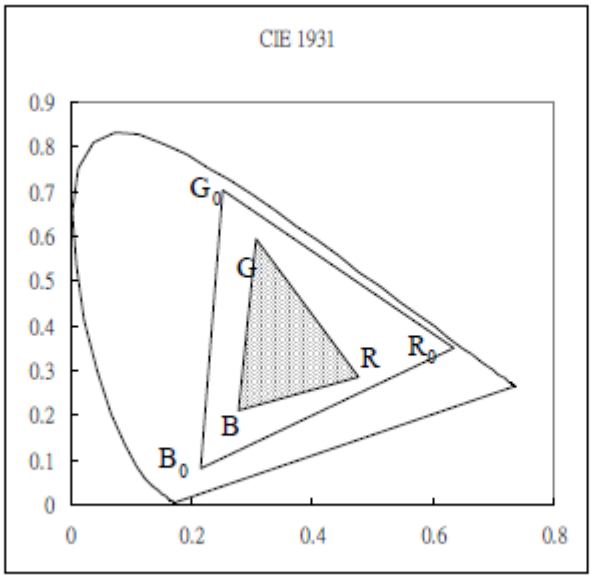
C.G%= R G B / $R_0 G_0 B_0$,*100%

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 255 gray levels of red, green, and blue, respectively.

$R_0 G_0 B_0$: area of triangle defined by R_0, G_0, B_0

R G B: area of triangle defined by R, G, B



6. Reliability Test Items

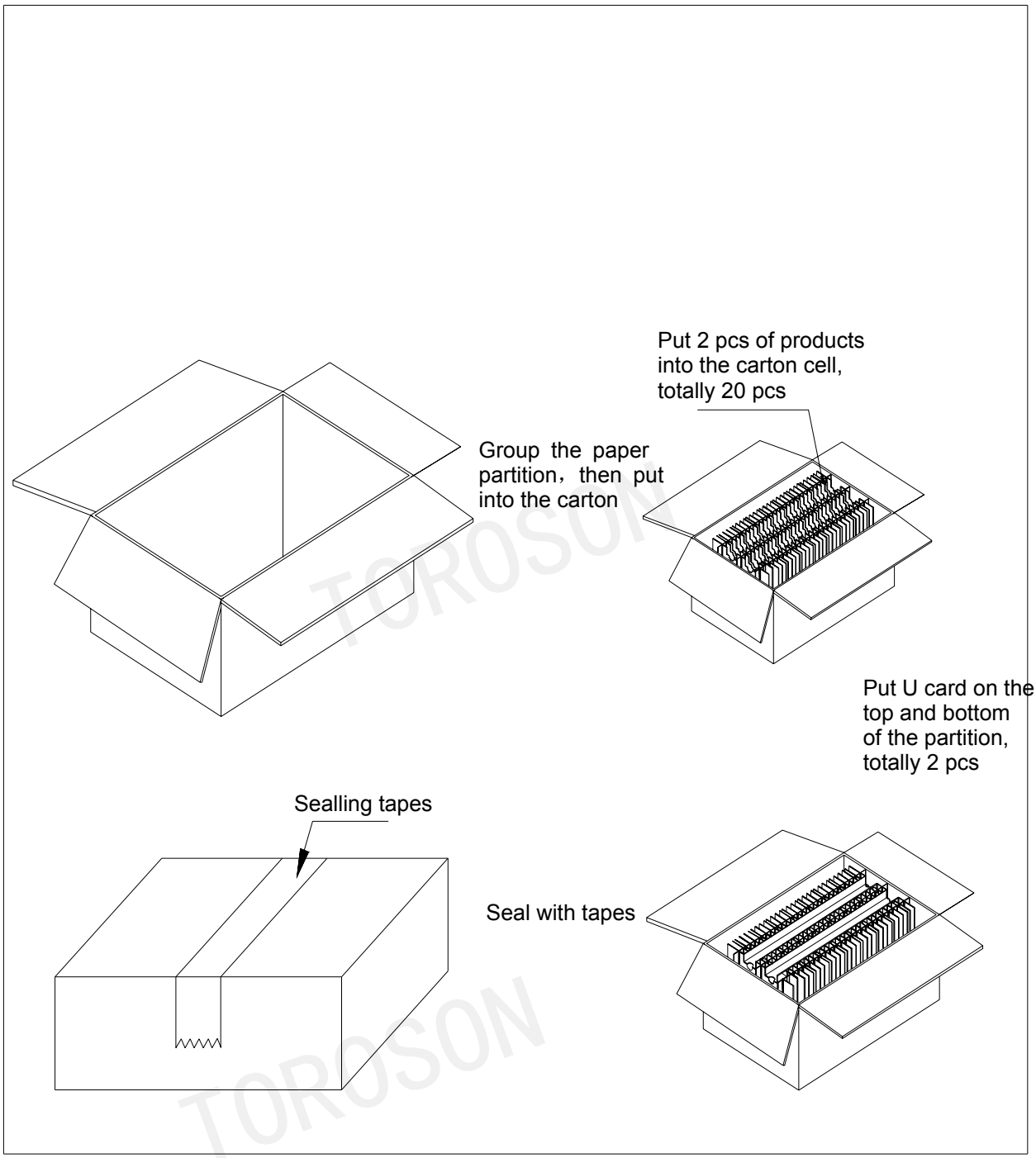
Items	Required Condition	Note
High Temperature and High Humidity Operation (HHO)	T= 60℃, 90%RH, 240hours	(1,2,3)
High Temperature Operation (HTO)	T= 70℃, 240hours	
Low Temperature Operation (LTO)	T= -20℃, 240hours	
High Temperature Storage (HTS)	T= 80℃, 240hours	
Low Temperature Storage (LTS)	T= -30℃, 240hours	
Thermal Shock Test (TST)	-30℃/ 30min, 80℃/ 30min, 100 cycles	(1,2,3)

Note 1: The test samples have recovery time for 2 hours at room temperature before the function check. In the standard conditions, there is no display function NG issue occurred.

Note 2: After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 3: Under no condensation of dew.

7. PACKING


Put 2 pcs of products into the carton cell, totally 20 pcs
Group the paper partition，then put into the carton
Put U card on the top and bottom of the partition, totally 2 pcs
Sealling tapes
Seal with tapes

8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

[1] Do not apply improper or unbalanced force such as bending or twisting to open cells during assembly.

[2] It is recommended to assemble or to install an open cell into a customer's product in clean working areas. The dust and oil may cause electrical short to an open cell or worsen polarizers on an open cell.

[3] Do not apply pressure or impulse to an open cell to prevent the damage.

[4] Always follow the correct power-on sequence when an open cell is assembled and turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

[5] Do not design sharp-pointed structure / parting line / tooling gate on the plastic part of a COF (Chip on film), because the burr will scrape the COF.

[6] If COF would be bended in assemble process, do not place IC on the bending corner.

[7] The gap between COF IC and any structure of BLU must be bigger than 2 mm. This can prevent the damage of COF IC.

[8] The bezel opening must have no burr and be smooth to prevent the surface of an open cell scraped.

[9] The bezel of a module or a TV set can not contact with force on the surface of an open cell. It might cause light leakage or scrape.

[10] In the case of no FFC or FPC attached with open cells, customers can refer the FFC / FPC drawing and buy them by self.

[11] It is important to keep enough clearance between customers' front bezel/backlight and an open cell. Without enough clearance, the unexpected force during module assembly procedure may damage an open cell.

[12] Do not plug in or unplug an I/F (interface) connector while an assembled open cell is in operation.

[13] Use a soft dry cloth without chemicals for cleaning, because the surface of the polarizer is very soft and easily scratched.

[14] Moisture can easily penetrate into an open cell and may cause the damage during operation.

[15] When storing open cells as spares for a long time, the following precaution is necessary.

[15.1] Do not leave open cells in high temperature and high humidity for a long time. It is highly recommended to store open cells in the temperature range from 0 to 35℃ at normal humidity without condensation.

[15.2] Open cells shall be stored in dark place. Do not store open cells in direct sunlight or fluorescent light environment.

[16] When ambient temperature is lower than 10ºC, the display quality might be reduced.

[17] Unpacking (Cartons/Tray plates) in order to prevent open cells broken:

[17.1] Moving tray plates by one operator may cause tray plates bent which may induce open cells broken. Two operators carry one carton with their two hands. Do not throw cartons/tray plates, avoid any impact on cartons/tray plates, and put down & pile cartons/tray plates gently.

[17.2] A tray plate handled with unbalanced force may cause an open cell damaged. Trays should be completely put on a flat platform.

[17.3] To prevent open cells broken, tray plates should be moved one by one from a plastic bag.

[17.4] Please follow the packing design instruction, such as the maximum number of tray stacking to prevent the deformation of tray plates which may cause open cells broken.

[17.5] To prevent an open cell broken or a COF damaged on a tray, please follow the instructions below:

[17.5.1] Do not peel a polarizer protection film of an open cell off on a tray

[17.5.2] Do not install FFC or LVDS cables of an open cell on a tray

[17.5.3] Do not press the surface of an open cell on a tray.

[17.5.4] Do not pull X-board when an open cell placed on a tray.

[18] Unpacking (Hard Box) in order to prevent open cells broken:

[18.1] Moving hard boxes by one operator may cause hard boxes fell down and open cells broken by abnormal methods. Two operators carry one hard box with their two hands. Do handle hard boxes carefully, such as avoiding impact, putting down, and piling up gently.

[18.2] To prevent hard boxes sliding from carts and falling down, hard boxes should be placed on a surface with resistance.

[18.3] To prevent an open cell broken or a COF damaged in a hard box, please follow the instructions below:

[18.3.1] Do not peel a polarizer protection film of an open cell off in a hard box.

[18.3.2] Do not install FFC or LVDS cables of an open cell in a hard box.

[18.3.3] Do not press the surface of an open cell in a hard box.

[18.3.4] Do not pull X-board when an open cell placed in a hard box.

[19] Handling – In order to prevent open cells, COFs , and components damaged:

[19.1] The forced displacement between open cells and X-board may cause a COF damaged. Use a fixture tool for handling an open cell to avoid X-board vibrating and interfering with other components on a PCBA & a COF.

[19.2] To prevent open cells and COFs damaged by taking out from hard boxes, using vacuum jigs to take out open cells horizontally is recommended.

[19.3] Improper installation procedure may cause COFs of an open cell over bent which causes damages. As installing an open cell on a backlight or a test jig, place the bottom side of the open cell first on the backlight or the test jig and make sure no interference before fitting the open cell into the backlight/the test jig.

[19.4] Handle open cells one by one.

[20] Avoid any metal or conductive material to contact PCB components, because it could cause electrical damage or defect.

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