

Cordial Optoelectronics Co.,Ltd.



PRODUCT SPECIFICATION

PART NAME	TFT MODULE
MODEL NO.	CT043PLI47
REVISION	Version1.0
CUSTOMER APPROVAL	
DATE	

DESIGNED BY	CHECKED BY	APPROVED BY
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1. General Specification

1.1 Summary

This datasheet applies to CT043PLI47. It is composed of a 4.3" TFT LCD panel, Resistive Touch Screen, Driver IC, FPC, and LED backlight unit.

1.2 Application

Digital products, Industrial Display, Instrument and other electronic products which require Color TFT displays.

1.3 Specification

Features	Description	UNITS
LCD Size	4.3" TFT	--
Display Mode	Normally White, Transmissive	--
Resolution	480 (RGB) × 272	dots
Viewing Direction	6 O'Clock	
Driver IC	ST7282 or equivalent	--
Color Depth	16.7M	
Interface	24-bits RGB Interface	
Outline Dimension	105.50(W) × 67.20 (H) × 4.0(T)	mm
Active Area	95.04(W) × 53.856(H)	mm
Dot Pitch	0.198 (W) × 0.198 (H)	mm
Back Light	10 White LED	--
Touch Screen	With	
Weight(g)	TBD	

3. Interface Specification

Pin No.	Symbol	Description
1	LED-	Power supply for LED backlight Cathode input.
2	LED+	Power supply for LED backlight Anode input.
3	GND	Ground.
4	VCC	Power supply +3.0V~+3.6V
5	R0	Red Data Bit0(LSB).
6	R1	Red Data Bit1.
7	R2	Red Data Bit2.
8	R3	Red Data Bit3.
9	R4	Red Data Bit4.
10	R5	Red Data Bit5.
11	R6	Red Data Bit6.
12	R7	Red Data Bit7(MSB).
13	G0	Green Data Bit0(LSB).
14	G1	Green Data Bit1.
15	G2	Green Data Bit2.
16	G3	Green Data Bit3.
17	G4	Green Data Bit4.
18	G5	Green Data Bit5.
19	G6	Green Data Bit6.
20	G7	Green Data Bit7(MSB).
21	B0	Blue Data Bit0(LSB).
22	B1	Blue Data Bit1.
23	B2	Blue Data Bit2.
24	B3	Blue Data Bit3.
25	B4	Blue Data Bit4.
26	B5	Blue Data Bit5.
27	B6	Blue Data Bit6.
28	B7	Blue Data Bit7(MSB).
29	GND	Ground.
30	DCLK	Clock signal for data latching and internal counter of the timing controller.
31	DISP	Display on/off mode control. Internally pulled high. 1) DISP=L, standby mode. 2) DISP=H, normal display mode.
32	HSYNC	Horizontal sync input with negative polarity. Internally pulled high.
33	VSYNC	Vertical sync input with negative polarity. Internally pulled high.
34	DE	Input data enable control. Internally pulled low.
35	NC	NC.
36	GND	Ground.
37	XR	Touch Panel Right Side Wire.
38	YD	Touch Panel Down Side Wire.
39	XL	Touch Panel Left Side Wire.
40	YU	Touch Panel Up Side Wire.

4. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	IOVCC/VCC	-0.3	4.6	V
Input voltage for logic	V _{IN}	-0.3	0.3+IOVCC	V
Operating temperature	T _{OP}	-20	+70	°C
Storage temperature	T _{ST}	-30	+80	°C

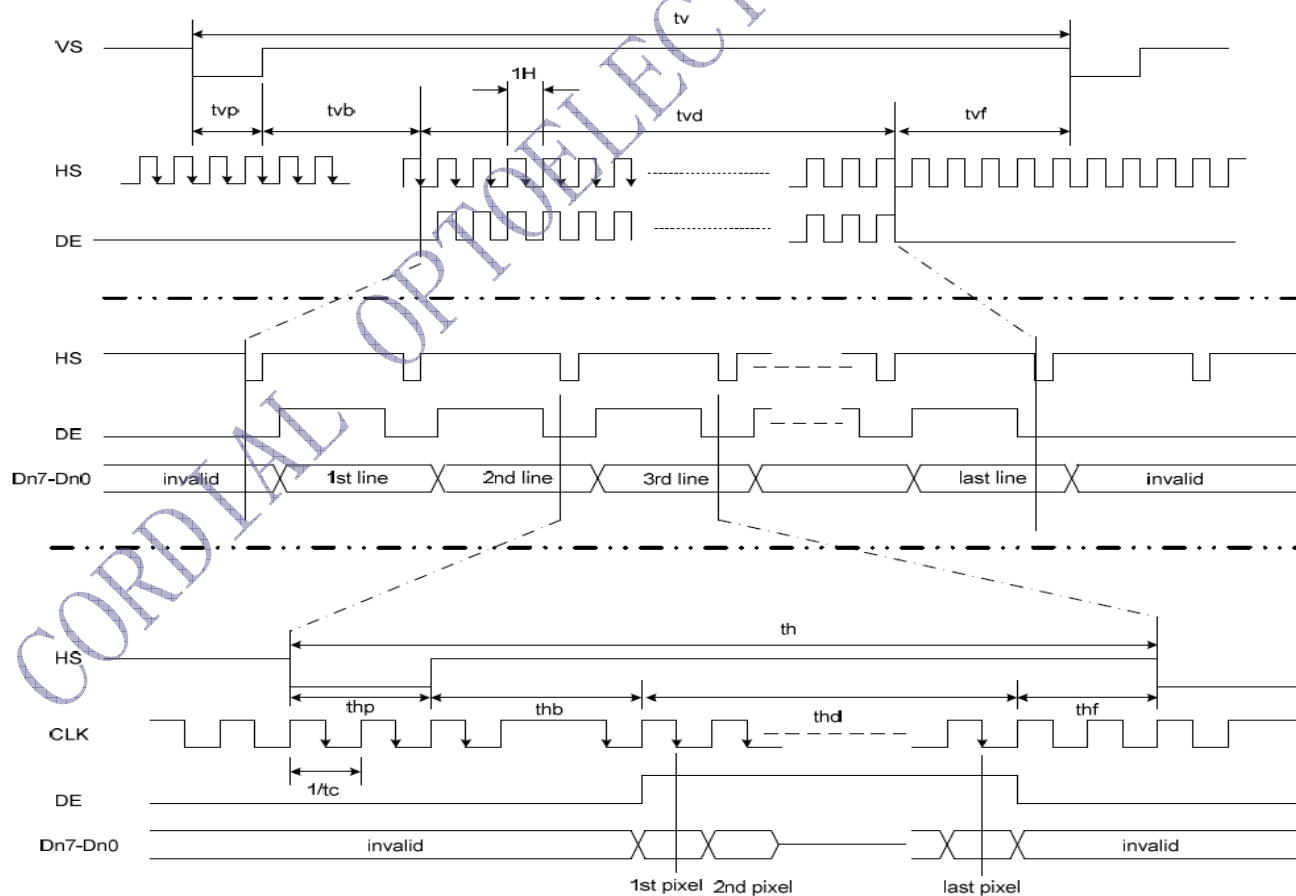
5. Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	VCC	3.0	3.3	3.6	V
Supply voltage for I/O power	IOVCC	1.8	--	3.6	
Input voltage 'L' level	V _{IL}	-0.3	-	0.2 IOVCC	V
Input voltage 'H' level	V _{IH}	0.8 IOVCC	-	IOVCC	V
Output voltage 'L' level	V _{OL}	0	-	0.2 IOVCC	V
Output voltage 'H' level	V _{OH}	0.8 IOVCC	--	IOVCC	V

6. Timing Characteristics

480RGB X 272 Resolution Timing Table							
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency		Fclk	8	9	12	MHz	
DCLK Period		Tclk	83	111	125	ns	
HSYNC	Period Time	Th	485	531	598	DCLK	
	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp	3	43	43	DCLK	By H_Blanking setting
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	75	DCLK	
VSYNC	Period Time	Tv	276	292	321	H	
	Display Period	Tvdisp		272		H	
	Back Porch	Tvbp	2	12	12	H	By V_Blanking setting
	Front Porch	Tvfp	2	8	37	H	
	Pulse Width	Tvw	2	4	37	H	

Note: It is necessary to keep $Tvbp = 12$ and $Thbp = 43$ in sync mode. DE mode is unnecessary to keep it.



7. Backlight Characteristics

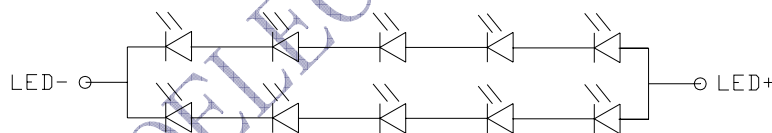
The characteristics of the LED are shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Current	IL	-	40	-	mA	(2)
LED Voltage	VL	15	16	17	V	
Operating LED life time	Hr	-	30000	-	Hour	(1)(2)
Backlight Color	White					

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25\pm3\text{ }^{\circ}\text{C}$, 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 $T_a=25^{\circ}\text{C}$ and $I_L=40\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 40mA. The constant current driving method is suggested.

(CIRCUIT DIAGRAM)



$$I_f=40\text{mA (typ)}$$

$$V_f=+15\text{V}\sim+17\text{V}, \quad 16\text{V (typ)}$$

8. Optical Characteristics

8.1 Optical specification

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN.	TYP	MAX		
Color gamut		S(%)	Viewing normal angle	--	60	--	%	All left side data are based on Cordial's product reference only
Contrast Ratio		CR		--	500	--	--	
Brightness		L		--	400	--	Cd/m ²	
Brightness Uniformity		Yu		75	80	--	%	
Response Time		Tr+Tf		--	20	--	ms	
CIE Color coordinate	Red	X _R		--	0.620	--		
		Y _R		--	0.344	--		
	Green	X _G		--	0.306	--		
		Y _G		--	0.563	--		
	Blue	X _B		--	0.133	--		
		Y _B		--	0.149	--		
	White	X _W		--	0.311	--		
		Y _W		--	0.349	--		
Viewing Angle	Hor.	θ _L	Center CR>=10	50	60	--	Deg.	
		θ _R		50	60	--		
	Ver.	θ _U		50	60	--		
		θ _D		30	40	--		

8.2 Measuring Condition

Measuring surrounding: dark room

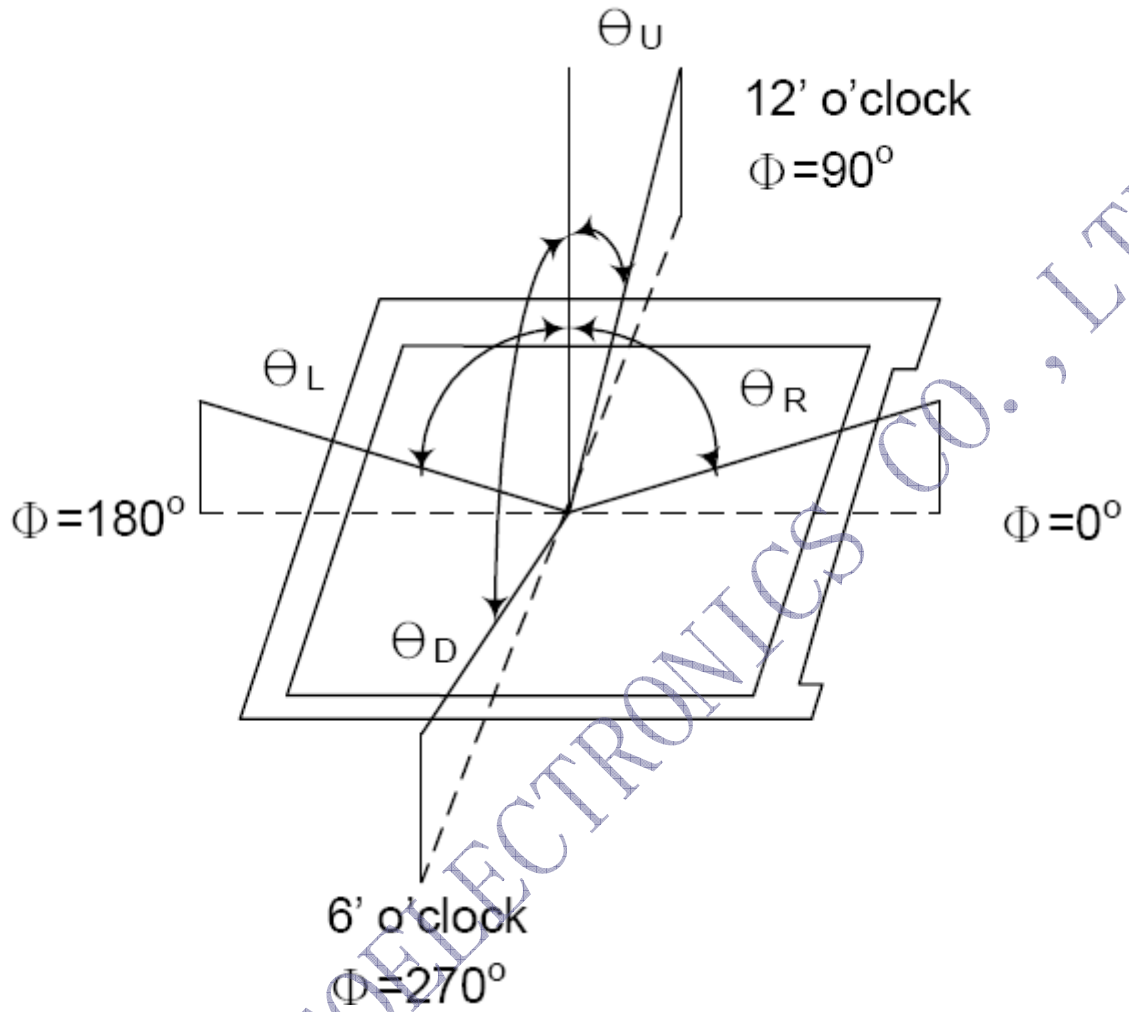
Ambient temperature: 25±2°C

15min. warm-up time.

8.3 Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics. Measuring spot size: 20 ~ 21 mm

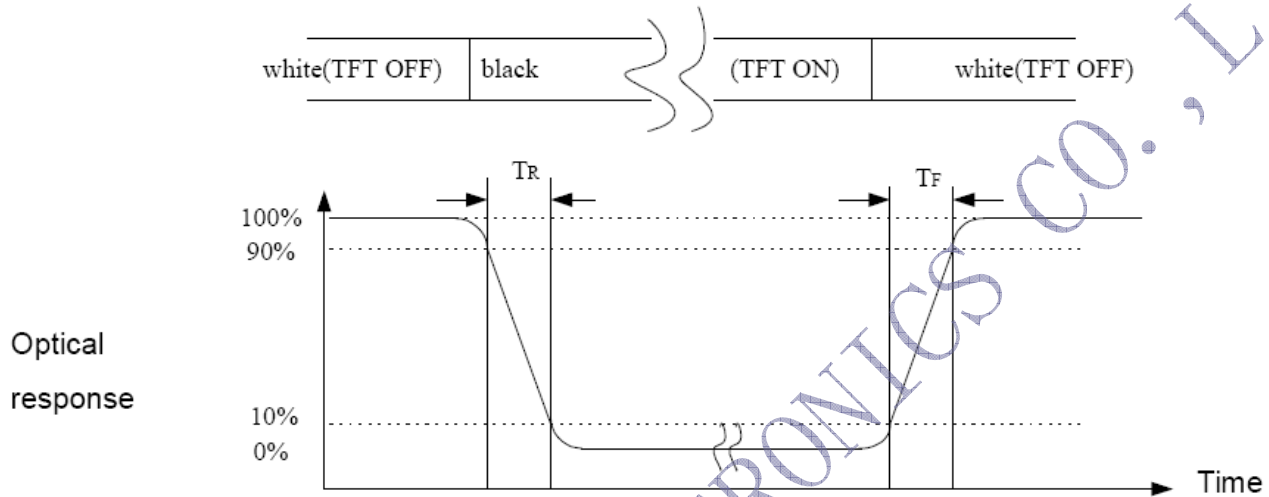
Note (1) Definition of Viewing Angle:



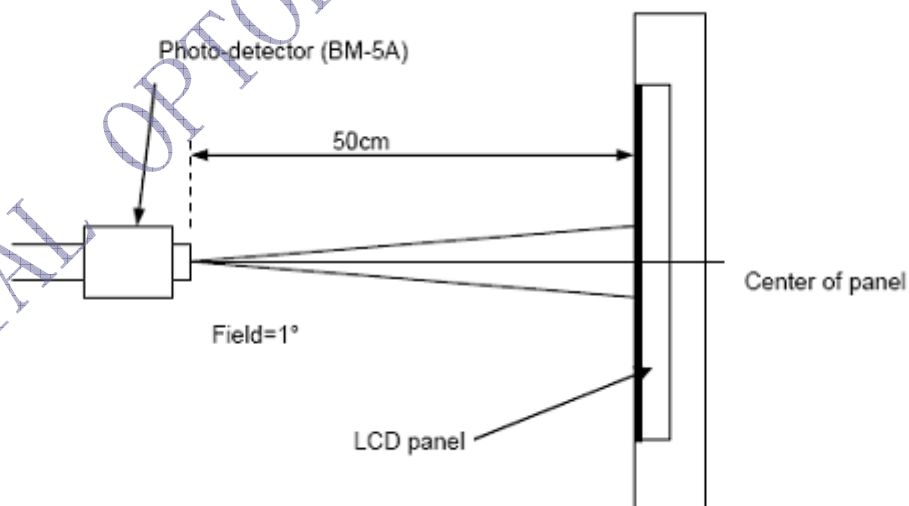
Note (2) Definition of Contrast Ratio (CR): Measured at the center point of panel

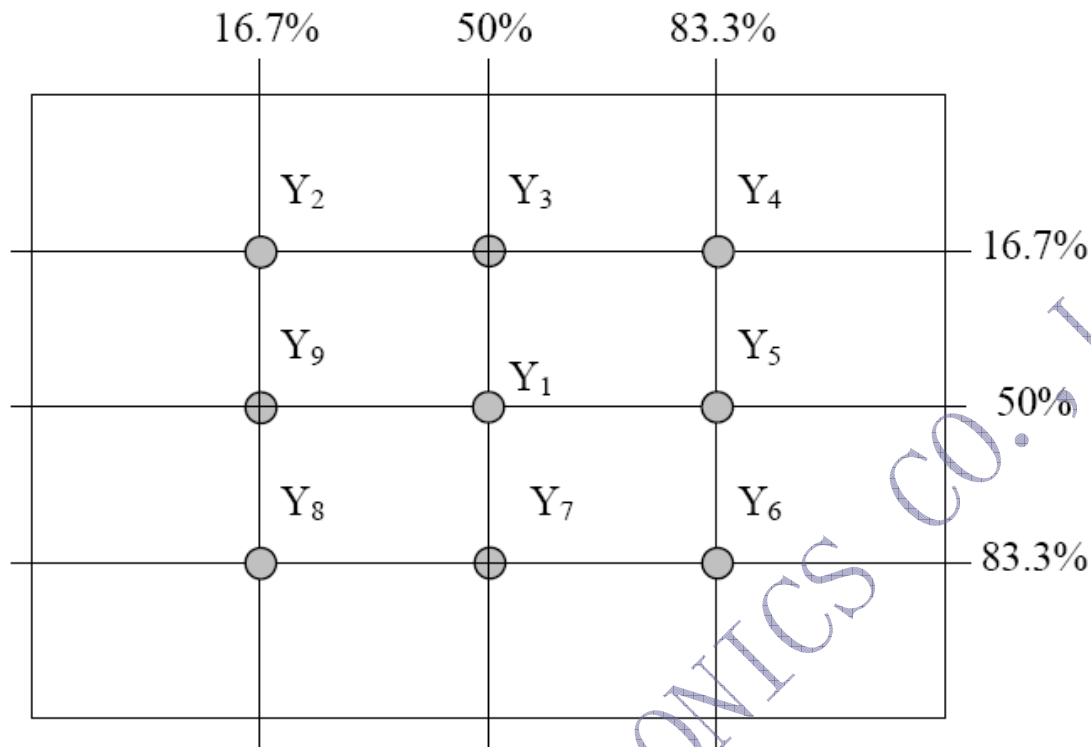
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Response Time: Sum of TR and TF



Note (4) Definition of optical measurement setup



Note (5) Definition of brightness uniformity


$$\text{Luminance uniformity} = \frac{(\text{Min Luminance of 9 points})}{(\text{Max Luminance of 9 points})} \times 100\%$$

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction).

Note (7) Measured at the brightness of the panel when all terminals of LCD panel are electrically open.

9. Reliability Tests

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	$80^{\circ}\text{C} \pm 2^{\circ}\text{C} \times 200\text{Hours}$	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1,Air bubble in the LCD. 2,Seal leak. 3,Non-display. 4,Missing segments. 5,Glass crack. 6,Current IDD is twice higher than initial value. 7, The surface shall be free from damage. 8 The electric Characteristics requirements shall be satisfied.
②	Low Temperature Storage	$-30^{\circ}\text{C} \pm 2^{\circ}\text{C} \times 200\text{Hours}$	
③	High Temperature Operating	$70^{\circ}\text{C} \pm 2^{\circ}\text{C} \times 120\text{Hours}$	
④	Low Temperature Operating	$-20^{\circ}\text{C} \pm 2^{\circ}\text{C} / 120\text{Hours}$	
⑤	Temperature Cycle (Storage)	$-30^{\circ}\text{C} \pm 2^{\circ}\text{C} \longleftrightarrow 25^{\circ}\text{C}$ $80^{\circ}\text{C} \pm 2^{\circ}\text{C}$ (30min) (5min) (30min) \longleftrightarrow 1cycle Total 10cycle	
⑥	Damp Proof Test	$50^{\circ}\text{C} \pm 5^{\circ}\text{C} \times 90\%\text{RH} \times 120\text{Hours}$	
⑦	Vibration Test	Frequency: $10\text{Hz} \sim 55\text{Hz} \sim 10\text{Hz}$ Amplitude: 1.5M X, Y, Z direction for total 3hours (Packing Condition)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
⑨	ESD Test	Voltage: $\pm 8\text{KV}$, R: 330 Ω , C: 150PF, Air Mode, 10times	

REMARK:

- The Test samples should be applied to only one test item.
- Sample side for each test item is 5~10pcs.
- For Damp Proof Test, Pure water (Resistance > 10M Ω) should be used.
- In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
- EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

10. Inspection Criterion

This Inspection Specification is made to be used as the standard acceptance/rejection criteria for LCD Module.

10.1 Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall Follows MIL-STD-105E.

- I) Lot size: Quantity per shipment as one lot (different model as different lot).
 - II) Sampling type: Normal inspection, single sampling.
 - III) Sampling level: Level II.
 - IV) AQL: Acceptable Quality Level
- Major defect: AQL=0.65
Minor defect: AQL=1.5

10.2 Inspection Condition

Viewing distance for cosmetic inspection is about 35 ± 5 cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line.

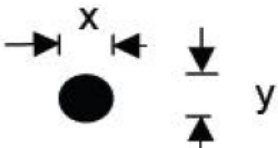
10.3 Inspection Standards

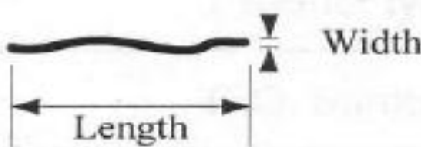
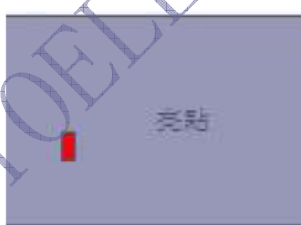
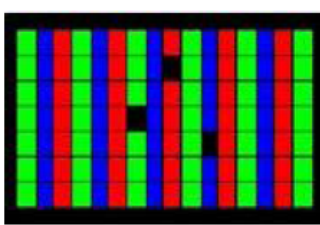
Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

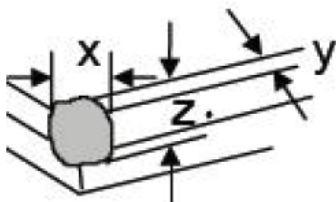
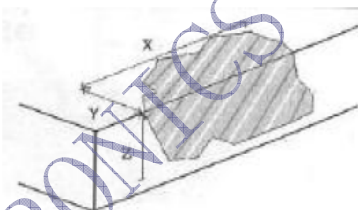
10.3.1 Major Defect

Item No	Items to be inspected	Inspection Standard
I	All functional defects	3) No display 4) Display abnormally 5) Short circuit 6) line defect
II	missing	Missing function component
III	Crack	Glass Crack

10.3.2 Minor Defect

Item No	Items to be inspected	Inspection standard	
I	Spot Defect Including Black spot White spot Pinhole Foreign particle Polarizer dirt	For dark/white spot is defined $\varphi = (x + y) / 2$ 	
		Size φ (mm)	Acceptable Quantity
		$\varphi \leq 0.15$	Ignore
		$0.15 < \varphi \leq 0.30$	3
		$0.30 < \varphi$	Not allowed

II	Line Defect Including Black line White line Scratch	Define:			
					
		Width(mm) Length(mm)		Acceptable Quantity	
		W≤0.03		Ignore	
		0.03 < W≤0.1 L ≤ 4.0		3	
0.1 < W L>4.0		Not allowed			
III	Polarizer Dent/Bubble	Sizeφ(mm)		Acceptable Quantity	
		φ≤0.25		Ignore	
		0.25 < φ≤0.5		3	
		0.5 < φ		0	
IV	Electrical Dot Defect	Bright and Black dot define:			
		 and 			
		Inspection pattern: Full white、Full black、Red、green and blue screens			
		Item	Acceptable Quantity		
			I area	O area	Total
		Black dot defect	1	3	3
		Bright dot defect	1	1	1
		Total Dot	2	4	4

V	Glass defect	1. Corner Fragment:	
			
		Size(mm)	Acceptable Quantity
		$X \leq 3\text{mm}$ $Y \leq 3\text{mm}$ $Z \leq T$	Ignore T: Glass thickness X: Length Y: Width Z: thickness
		2. Side Fragment:	
			
		Size(mm)	Acceptable Quantity
		$X \leq 5.0\text{mm}$ $Y \leq 1\text{mm}$ $Z \leq T$	Ignore T: Glass thickness X: Length Y: Width Z: thickness

Note: 1. Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.

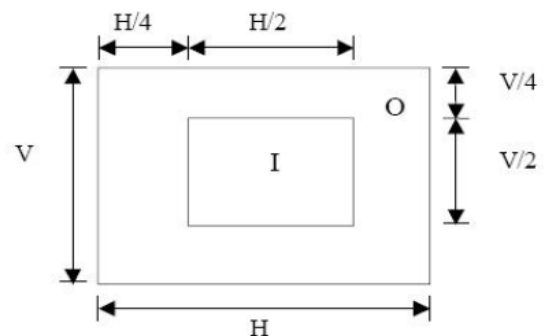
2. The distance between two bright dot defects (red, green, blue, and white) should be larger than 15mm.

3. The distance between black dot defects or black and bright dot defects should be more than 5mm apart.

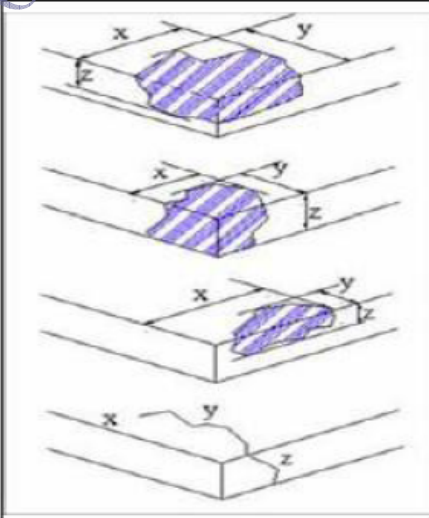
4. The definitions of the inner display area
And outer display area

I: Inner display area

O: Outer display area



10.4 Inspection Standard Of Touch Screen

Item	Specifications (mm)		Description
Scratch	$W \leq 0.03$	$L \leq 20$	Ignore
	$0.03 < W \leq 0.05$	$L \leq 10$	3 accepted defect
	$W > 0.05$ or $W \leq 0.03$ or $0.03 < W < 0.05$	$L > 20$ $L > 10$	Reject
Lint (Fibrous materials, Hair adhesive, and other colorful lint)	$W \leq 0.03$	$L \leq 5$	Ignore
	$0.03 < W \leq 0.05$	$L \leq 5$	Two or less accepted defect
	$W > 0.05$ or $L > 5$		Reject
Hollow Spot or Protuberance Spot	$D \leq 0.4$		Accept
	$D > 0.4$		Reject
Opaque Spot	$D < 0.2$		Ignore
	$0.2 \leq D \leq 0.3$		Accept 3 spots
	$D > 0.3$		Reject
Translucent Defect	$D \leq 0.3$		Ignore
	$0.3 < D \leq 0.60$		Accept
	$D > 0.6$		Reject
Water Stain	In View area		Reject
	In Active Area as following		
	$W \leq 3$ or $D \leq 3$ $3 < W \leq 10$ or $3 < D \leq 10$ $W > 10$ or $D > 10$ or $L > 20$	$L \leq 20$	Ignore Accept Reject
Newton Ring	Inspect criteria by limiting sample a. The distance between produce and eye is about 30cm b. The angle between eye and lighting source is 60 degree c. The lightness of environment is 500 Lux		
Crack	 <div> <p>Corner :</p> <p>$X \approx 3.0\text{mm}$ and $Y \approx 3.0\text{mm}$ and $Z < \text{Glass Thickness}$</p> <p>Corner :</p> <p>$X \approx 1.0\text{mm}$ and $Y \approx 1.0\text{mm}$ and $Z = \text{Glass Thickness}$</p> <p>Edges :</p> <p>$X \approx 6.0\text{mm}$ and $Y \approx 2.0\text{mm}$ and $Z < \text{Glass Thickness}$</p> <p>Cracks : Reject</p> </div>		

11. Precautions For Using LCD Modules

11.1 Handling Precautions

11.1.1 The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

11.1.2 Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzene and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.

11.1.3 Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.

11.1.4 If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

11.2 Storage Precautions

11.2.1 Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.

11.2.2 Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.

11.2.3 The polarizer surface should not come in contact with any other objects (We advise you to store them in the anti-static electricity container in which they were shipped).

11.3 Installing Precautions

11.3.1 The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.

11.3.2 When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.

11.3.3 To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.

11.3.4 Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

11.4 Operating Precautions

11.4.1 Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

11.4.2 It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

11.4.3 Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operating temperature.

11.4.4 If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

11.4.5 A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.

11.4.6 Input logic voltage before apply analog high voltage such as LCD driving voltage when power on. Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.

11.4.7 Please keep the temperature within the specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

11.5 Packing Precautions

11.5.1 Avoid intense shock and falls from a height.

11.5.2 To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

11.6 Safety

11.6.1 Please keep the temperature within the specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

11.6.2 If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

11.7 Limited Warranty

Unless agreed between CORDIAL and the customer, CORDIAL will replace or repair any of its LCD modules which are found to be defective when inspected in accordance with CORDIAL's LCD modules acceptance standards for a period of one year after the Customer's acceptance or deemed acceptance. CORDIAL will replace, rework or refund the Customer for the defective or non-conforming Modules at CORDIAL's option, provided that the Customer promptly informs CORDIAL of the defects or non-conformities within the warranty period, and complies with CORDIAL's procedure for Modules replacement, reworking and/or return. The warranty period for the Modules replaced or reworked shall be the remaining term for such Modules.

12. Packing Specification

12.1 Packaging Material

No	Item	Model(Material)	Dimensions (mm)	Unit Weight (Kg)	Quantity
1	LCD module	CT043PLI47	105.5x67.2x4.0	TBD	156
2	Partition_1	Corrugated paper	513x333x106	0.7	2
3	Anti_static Bag	PE	130x93x0.05	0.0007	156
4	Dust_Proof Bag	PE	--	0.06	1
5	Partition_2	Corrugated paper	505x332x4.0	0.09	3
6	Corrugated Bar	Corrugated paper	513x110x31	0.048	4
7	Carton	Corrugated paper	530x355x255	1.10	1
8	Total weight	TBD			

Note: Packaging Specification and Quantity

Module quantity in a carton: 39pcs(per row)X2(per column)x2=156

12.2 Packing Instruction

