PowerView Display Corp.
鋭視光電股份有限公司

TFT-LCD MODULE

Product Information

MODEL NO. : T070W2D4-5 v.1B

Date : *2012.07.17* ***Revision 1.1***

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Approved by : Jackey Chien

Jackey Chien, Director, Product Development Div.

Note :

Records of Revision

Date	Rev. No.	Summary	Page
2012.06.26	1.0	First released.	-
2012.07.17	1.1	Correct the page number.	-
		Section 11.7: Change the warranty time to 12months	34

Contents

1 Handling Precautions

1.) Handle with care. Pay attention not to press or scratch the surface of the module / monitor, especially the polarizer. Do not twist or bend the module / monitor. It may cause un-recoverable damage.

2.) Do not drop or bump the module / monitor since this product contains fragile glass components. Breakage of this product might cause leakage of the liquid crystal sealed inside the glasses. Do not touch the liquid crystal fluid in case of leakage. **Flush with massive water immediately in case of contact with your skin by liquid crystal fluid and call for doctor for immediate medical treatment.**

3.) Be sure to turn off power supply while plug or un-plug the power input connector.

4.) Clean up the polarizer only with soft solvent if necessary. The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, toluene, Ethyl acid or Methyl chloride. It will permanently damage the polarizer due to chemical reaction.

5.) Wipe off fluid drop immediately to prevent from possible discoloration or spots on the polarizer.

6.) Do not twist nor bend the module / monitor structure, even momentarily. Bending or twisting torque may likely damage the internal components of the product.

7.) Protect the module from static environment to prevent from damage to the CMOS gate array IC.

2 General Descriptions

T070W2D4-5 v.1B is a 7 inch (15:9 aspect ratio) color active matrix TFT LCD module with excellent display performance driven by a DIGITAL CMOS interface with a Surface Capacitive Touch Screen assembled in a compact and slim high brightness LED backlight unit. This LCD supports 800(H) x 480(V) x RGB stripe color pixel format and 262,144 colors (RGB 6 bits data) with vivid color image. Its outstanding performances with wide operation temperature range, -20 ~ 70ºC, high brightness, 700 nits (min.), wide viewing angle (140°/120°), make this LCD module very suitable for applications under severe environments or outdoor use.

2.1 General Applications

- Display terminal for applications of Car Navigation, Industrial, Medical, Gaming, Amusement, Advertisement and more.

2.2 Main Features

- Ultra Slim Boarder
- 7” 800x480RGB Resolution with 15:9 Display Aspect Ratio
- High Brightness LED Backlight
- Excellent Brightness at Low Temperature
- Wide Temperature Range
- Low Power Consumption
- Wide Viewing Angle
- Surface Capacitive Type Touch Screen with Optical Bonding
- Anti-Glare Type Surface Pretreatment
- Sunglass Fix
- Thin and Light Weight

2.3 General Information

2.3.1 Display Characteristics

Item	Specification	Unit	Note
Display Area (H x V)	152.4 (H) x 91.44 (V)	mm	-
Driver Element	a-Si TFT Active Matrix	-	-
Number of Pixels (H x V)	800(H) x 480(V) RGB	pixel	Std. 15:9
Pixel Arrangement	R.G.B Vertical Stripe	-	-
Pixel Pitch (H x V)	0.1905 x 0.1905	mm	Pixel
Viewing Angle (H/V)	140/120	degree	6 o'clock
Signal Interface	Digital RGB 18 bits	-	262K colors
Display Mode	Normally White	-	-

2.3.2 Mechanical Dimensions

Item		Typ.	Unit	Note
Dimension	Horizontal	170.00	mm	
	Vertical	113.86		
	Depth	16.3		
Weight		423	g	

Note: Please refer to the mechanical drawing for its detailed dimension.

3 Absolute Maximum Ratings

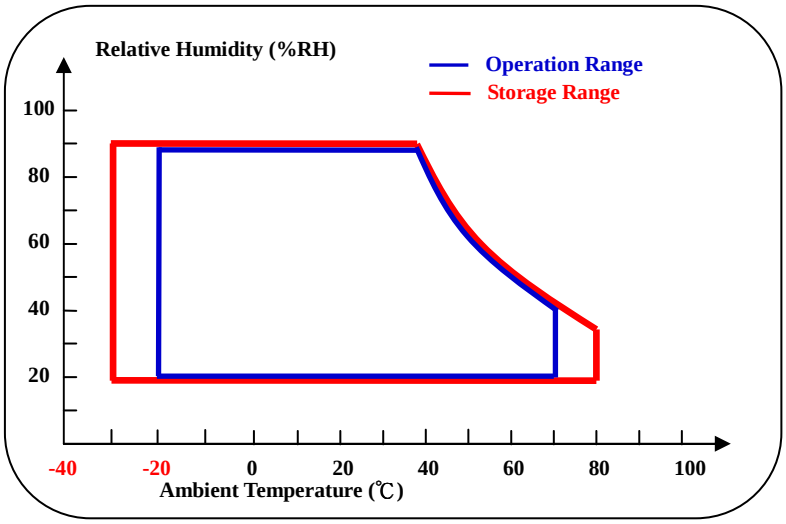
3.1 Absolute Ratings of Environment Requirement

Item	Symbol	Min.	Max.	Unit	Note
Storage Temperature	Tstg	-30	80	ºC	(1)
Operation Temperature (Ambient Temperature)	Top	-20	70	ºC	(1)

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

90% RH Max. (40ºC>Ta)

Maximum wet – bulb temperature at 39ºC or less. (Ta > 40ºC) No condensation.



3.2 Electrical Absolute Ratings

3.2.1 TFT-LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	-0.3	4.0	V	(1),(2)
Logical Input Voltage	V_{i1}	-0.3	V_{DD} + 0.3	V	(1),(2)

3.2.2 LED Backlight Module

Item	Symbol	Min.	Max.	Unit	Note
Backlight Power Supply	V_{LED}	0	23.0	V	(1),(2)
	I_{LED}	0	0.200	A	(1),(2)

Note (1): Within operating temperature

Note (2): Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

4 Optical Characteristics

The following items are measured under stable conditions in a dark room or equivalent state.

* Measuring Equipment: BM-7, CA-110

(V_{DD}=3.3V, Fr=60Hz, Ta=25±2ºC)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	Φ=0 θ=0 Viewing Normal Angle	-	500	-	-	(1), (2),(4)
Response Time at 25ºC	Rising	Tr		-	10	-	ms	(3)
	Falling	Tf		-	15	-		
Luminance (after touch panel)		Y_L		700	-	-	cd/m^2	(1), (2)
Luminance Uniformity		δw		70	75	-	%	(6)
Viewing Angle	Hor.	θ_L	CR≥10 (at center point)	-	70	-	Degree	(2),(5)
		θ_R		-	70	-		
	Ver.	ϕ_H		-	50	-		
		ϕ_L		-	70	-		
Brightness Endurance	+25˚C	-	Continuous Operation	-	50,000	-	hour	(7)

Note (1): Test Condition

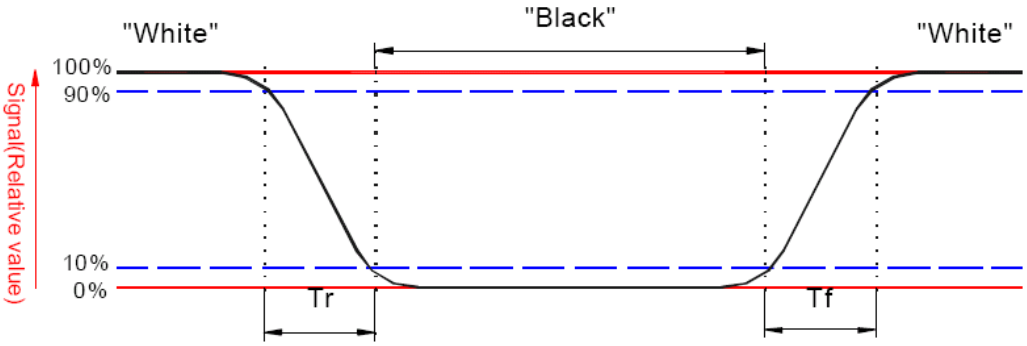
- Ambient Temperature =25℃and test in the dark room.
- Driving Condition:

  LED Current I_{LED} = 170mA

Note (2): To be measured on the center area of panel with a viewing cone of 1° by Minolta Luminance Meter CA-110, after 10 minutes operation.

Note (3): Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.

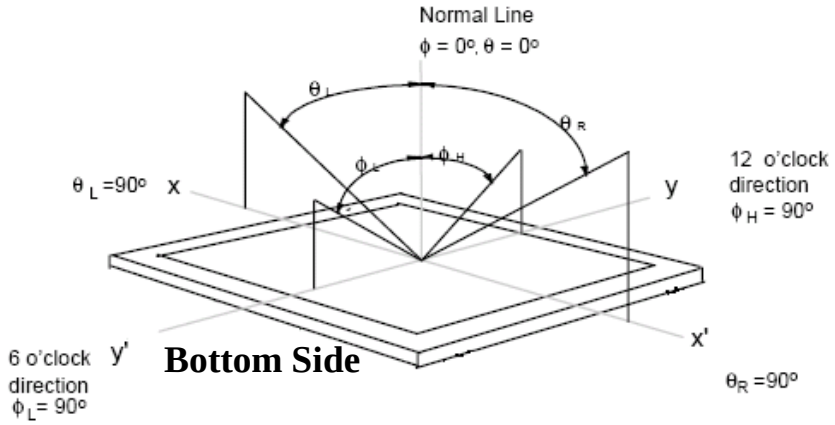


Note (4): Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

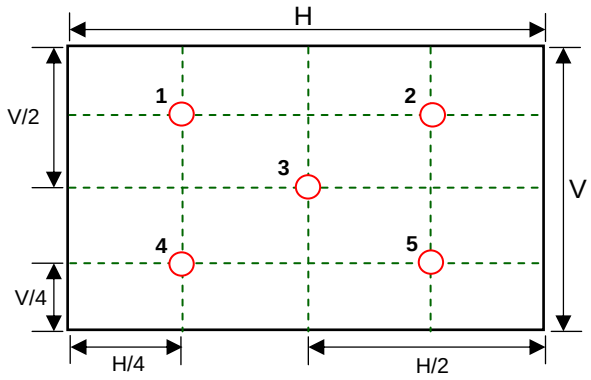
$$\textbf{Contrast ratio (CR)} = \frac{\textbf{Photo detector output when LCD is at “White” state}}{\textbf{Photo detector output when LCD is at “Black” state}}$$

Note (5): Definition of viewing angle, Refer to figure as below.



Note (6): Definition of White Uniformity:

δw = Minimum Brightness of 5 points /Maximum Brightness of 5 points



Note (7): Continuous operation time which doesn't deteriorate the brightness under 50% of the brightness at the beginning measured at room temperature at full brightness.

5 Electrical Characteristics

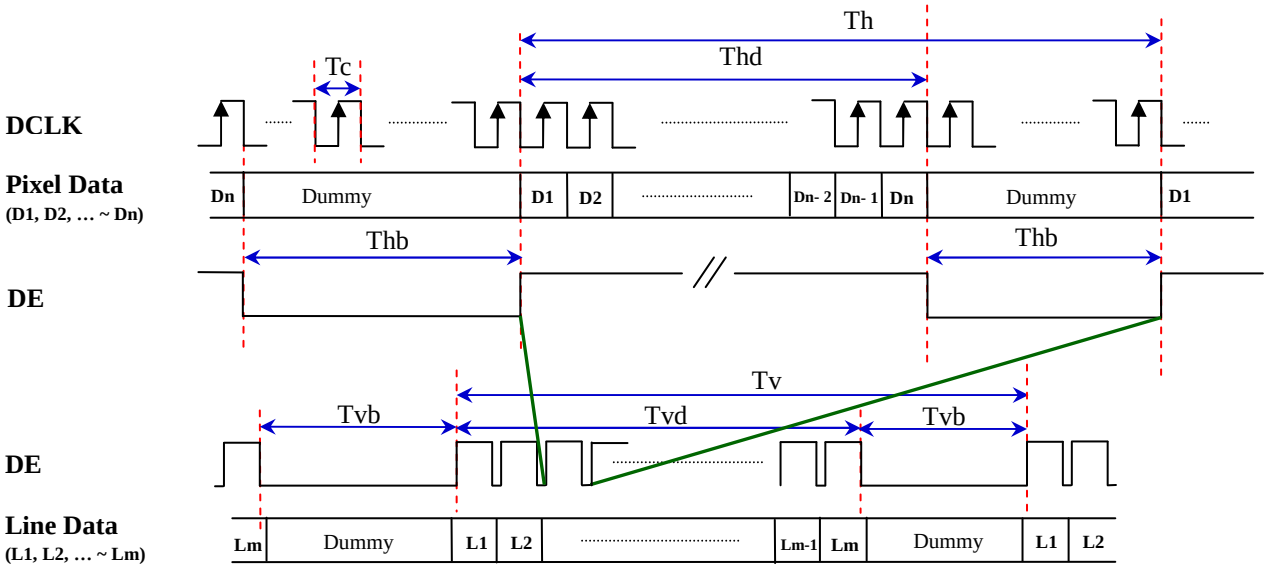
5.1 AC Timing Characteristics

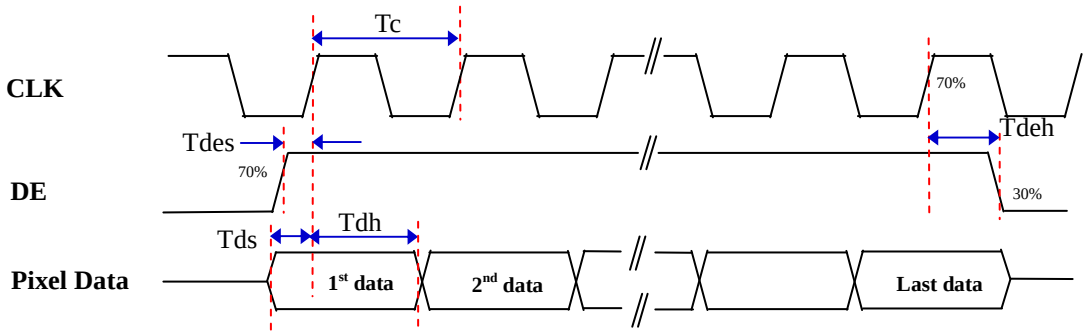
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	Fc	30	33.3	45	MHz	1 / (Tc)
	Duty cycle	δc	45	50	55	%	
Vertical Active Display Term	Frame Rate	Fr	-	60	-	Hz	
	Total	Tv	517	525	532	Th	
	Display	Tvd	480	480	480	Th	
	Blank	Tvb	37	45	52	Th	
Horizontal Active Display Term	Total	Th	1000	1056	1150	Tc	
	Display	Thd	800	800	800	Tc	
	Blank	Thb	200	256	350	Tc	
Data to Clock	Setup time	Tds	12	-	-	ns	
	Hold time	Tdh	12	-	-	ns	
DE to Clock	Setup time	Tdes	12	-	-	ns	
	Hold time	Tdeh	12	-	-	ns	

Note (1): V_{DD}=3.3V, Ta=25±2ºC

Note (2): DE Mode & Data Rising Latch.

AC Timing Chart





Note : n = 800 Tc,
m = 480 Th

5.2 DC Characteristics

5.2.1 TFT-LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply	V_{DD}	3.0	3.3	3.6	V	
	I_{DD}	-	60	-	mA	(1)
Permissive Input Ripple Voltage	V_{RF}	-	-	100	mV_{P-P}	
Logic Input Voltage	V_{IL}	0	-	0.3 V_{DD}	V	(2)
	V_{IH}	0.7 V_{DD}	-	V_{DD}	V	(2)

Note (1): Conditions for typical current consumption:

8 Gray Scale Pattern, V_{DD}=3.3V, Fr=60Hz,

TTL interface.

Note (2): CLK, DE, R0~R5, G0~G5, B0~B5

5.2.2 Backlight Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply	V_{LED}	-	20.5	-	V	
	I_{LED}	-	170	-	mA	

Note (1): To get the minimums brightness 700nits after touch panel.

5.3 Input Terminal Pin Assignment

5.3.1 LCD Input Interface

TTL (CMOS) Interface

CN102

Using 40pin 0.5mm pitch FFC/FPC
Connector Type : SUNCAGEY, BL112-40RL or equivalent

Pin No	Symbol	Description	Remark
1	GND	Power ground	
2	GND	Power ground	
3	NC	No Connection	
4	VDD	Power supply Voltage (+3.3V)	
5	VDD	Power supply Voltage (+3.3V)	
6	VDD	Power supply Voltage (+3.3V)	
7	VDD	Power supply Voltage (+3.3V)	
8	NC	No Connection	
9	DE	Data Enable	
10	NC	No Connection	
11	NC	No Connection	

12	GND	Power ground	
13	B5	Blue Data (MSB)	
14	B4	Blue Data	
15	B3	Blue Data	
16	GND	Power ground	
17	B2	Blue Data	
18	B1	Blue Data	
19	B0	Blue Data (LSB)	
20	GND	Power ground	
21	G5	Green data input(MSB)	
22	G4	Green data input	
23	G3	Green data input	
24	GND	Power ground	
25	G2	Green data input	
26	G1	Green data input	
27	G0	Green data input(LSB)	
28	GND	Power ground	
29	R5	Red data input(MSB)	
30	R4	Red data input	
31	R3	Red data input	
32	GND	Power ground	
33	R2	Red data input	
34	R1	Red data input	
35	R0	Red data input(LSB)	
36	GND	Power ground	
37	GND	Power ground	
38	CLK	Data Clock	
39	GND	Power ground	
40	GND	Power ground	

5.3.2 Backlight Input Interface

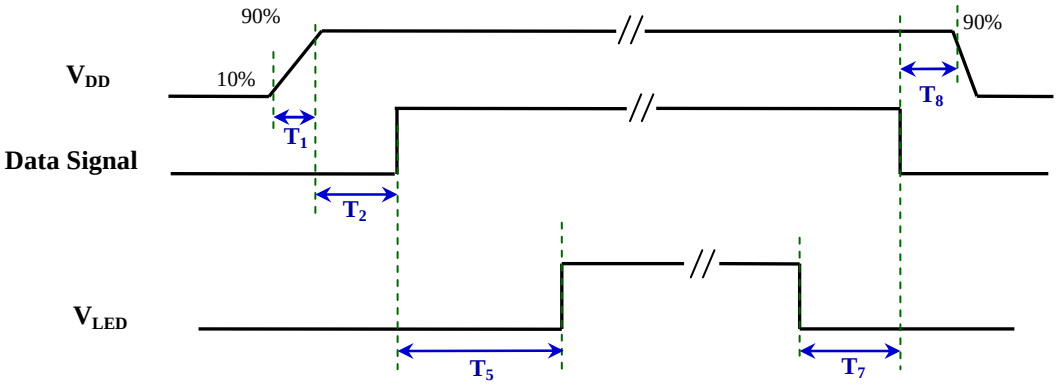
CN201

LCD Backlight Connector: HRS/DF-13-5P or equivalent
Matching Connector: HRS/DF-13-5S or equivalent

Pin No	Symbol	Description	Remark
1	HV	Power supply for LED High Voltage	
2	HV	Power supply for LED High Voltage	
3	NC	No Connection	
4	LV	Power Supply for LED Low Voltage	
5	LV	Power Supply for LED Low Voltage	

Note (1): $V_{LED} = V_{HV} - V_{LV}$

5.4 Power Sequence



Item	Min.	Max.	Unit	Note
T_1	0	10	mSec.	
T_2	0	-	mSec.	
T_5	200	-	mSec.	(1)
T_7	0	-	mSec.	
T_8	0	-	mSec.	

Note (1): This timing will make sure the LCD is ready when the backlight is turned on.

5.5 Color Data Reference

The below table is about input signal, Basic display colors and gray scale of each color.

0 : Low Level Voltage

1 : High Level Voltage

For 6bits data signals, each basic color can be displayed in 64 gray scales. With the combination of total 18 bits data signals, the 262,144 color display can be achieved on the screen.

- Please refer to the next page

	Colors & Gray Scale	6bits Data Signal																	
		Gray Scale	R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic Color	Black	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	-	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	-	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	-	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	-	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	-	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	-	1	1	1	1	1	1	1	1	1	1	1	1	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
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓				↓						↓						↓		
	Brighter	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓				↓						↓						↓		
	Brighter	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	⇩	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓				↓						↓						↓		
	Brighter	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	⇩	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

6 Characteristics of Touch Panel

6.1 General Description

Feature	Description	Remark
Type	Capacitive Type	
Input Method	Finger	

6.2 Input Terminal Pin Assignment

Connector: AMP #10395-4 or equivalent
(5Pin Housing with latch)

Pin No.	Description	Remark
1	UL	
2	LL	
3	SHIELD	
4	LR	
5	UR	

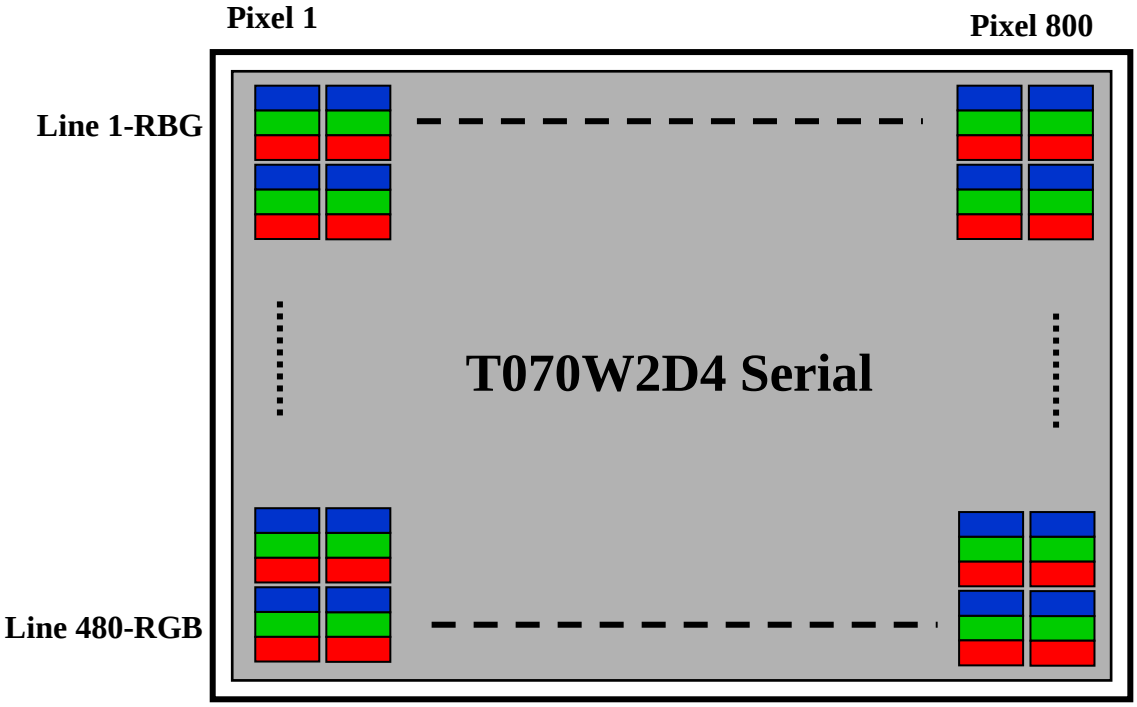
6.3 Reliability

Reliability	Description
Chemical Resistance	Soak 15 min, fit accuracy and external appearance specification (Follow ASTM F 1598-95,ASTM D 1308-87)
Peel Resistance of FPC Tail	>5Kgw

6.4 Durability

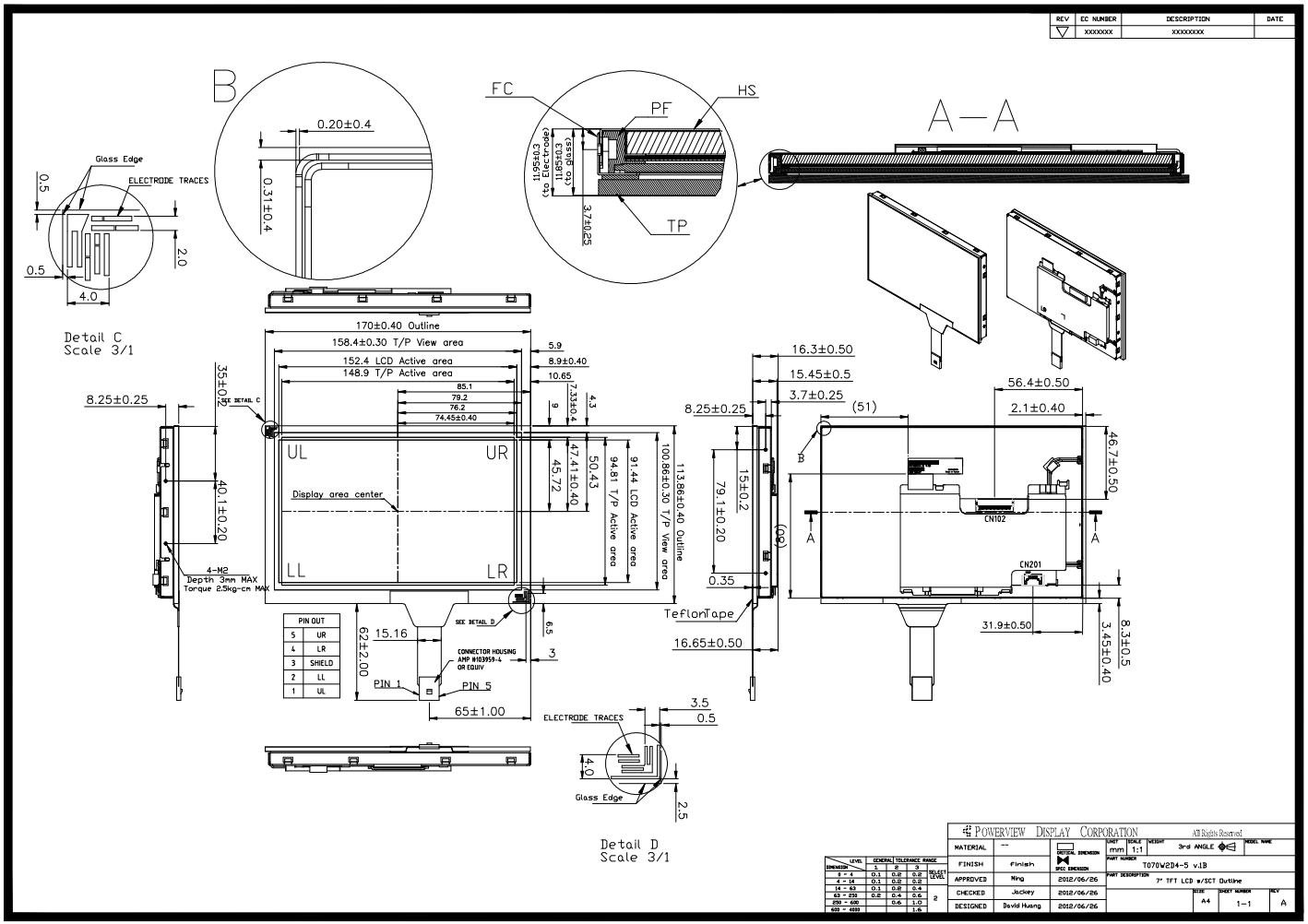
Durability	Description
Abrasion Test	Fit accuracy specification (Follow MIL-C-675C)
Adhesion Test	No deterioration, Tape test (Follow ASTM D3359)
Surface Scratch Hardness	More than 9H per ASTM-D3363

7 Pixel Format Image

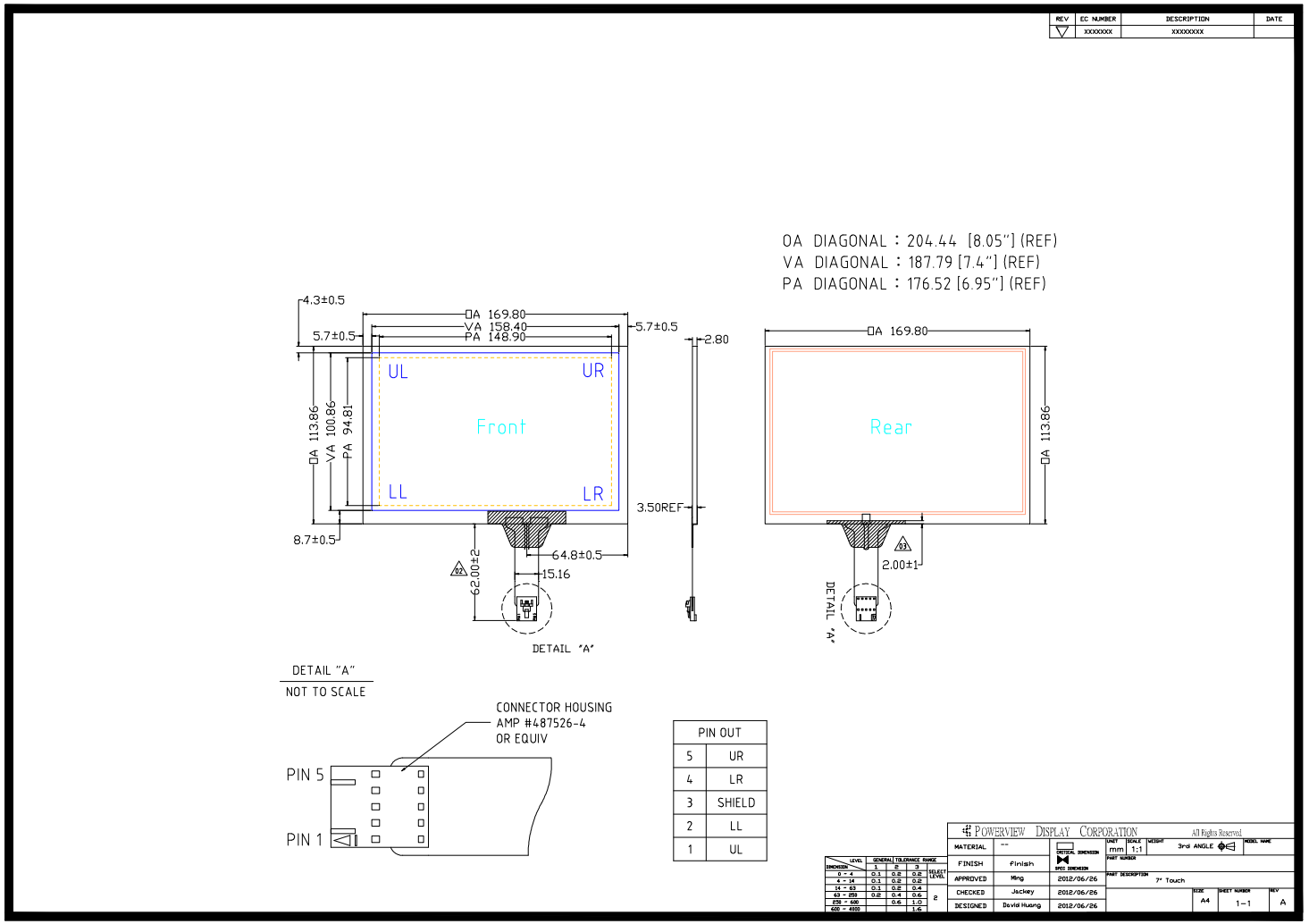


8 Display Outline Dimensions

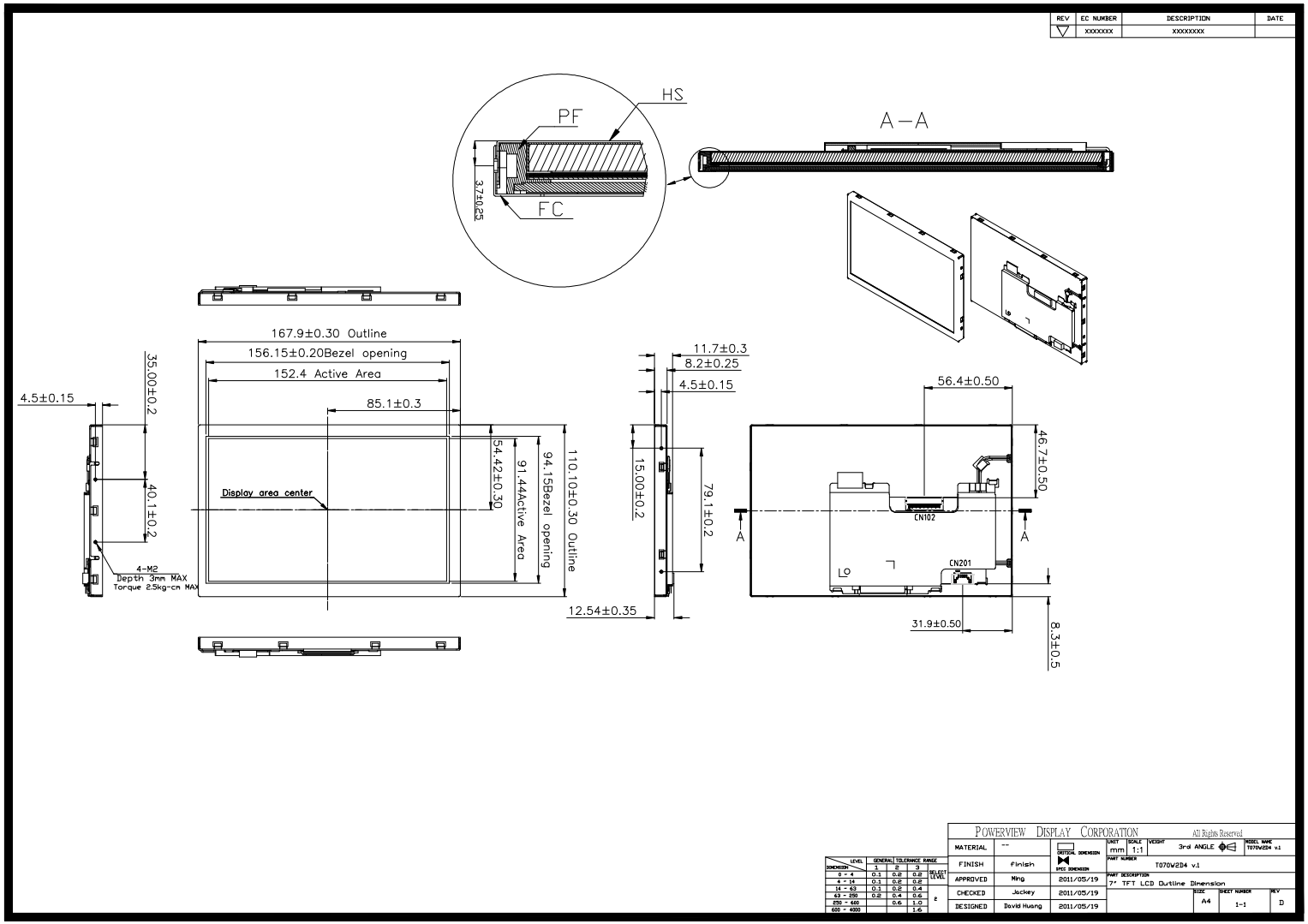
8.1 Module Outline Dimension



8.2 Touch Panel Outline Dimension



8.3 LCD Outline Dimension



9 Labeling, Packaging & Others

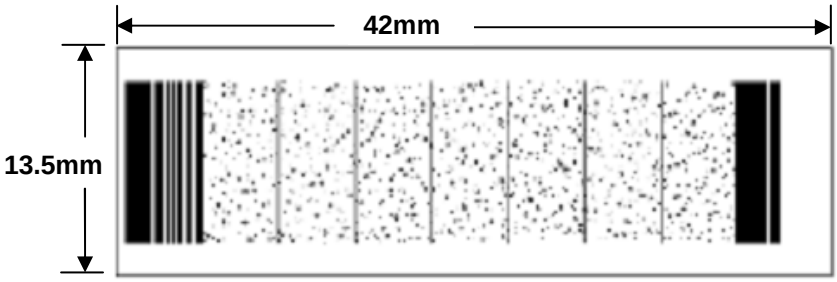
9.1 LCM Labeling

Z1	Assembly Plant
Z2	Manufacturing Year. last digit
Z3	Manufacturing Month
Z4	Manufacturing Date
Z5	Product Category
Z6Z7Z8	Production Sequence No.

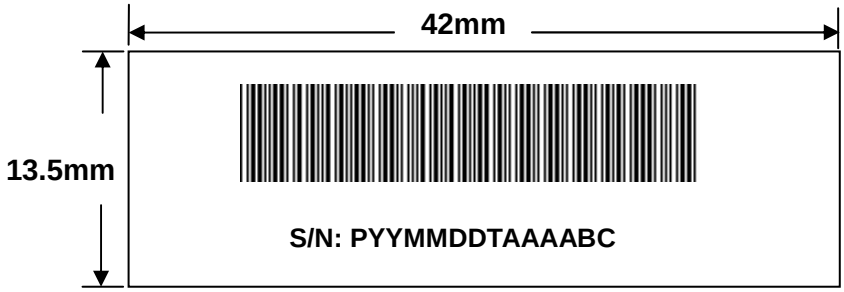
9.2 Touch Panel Labeling

9.2.1 2D Labeling

(Touch screen calibration parameters)

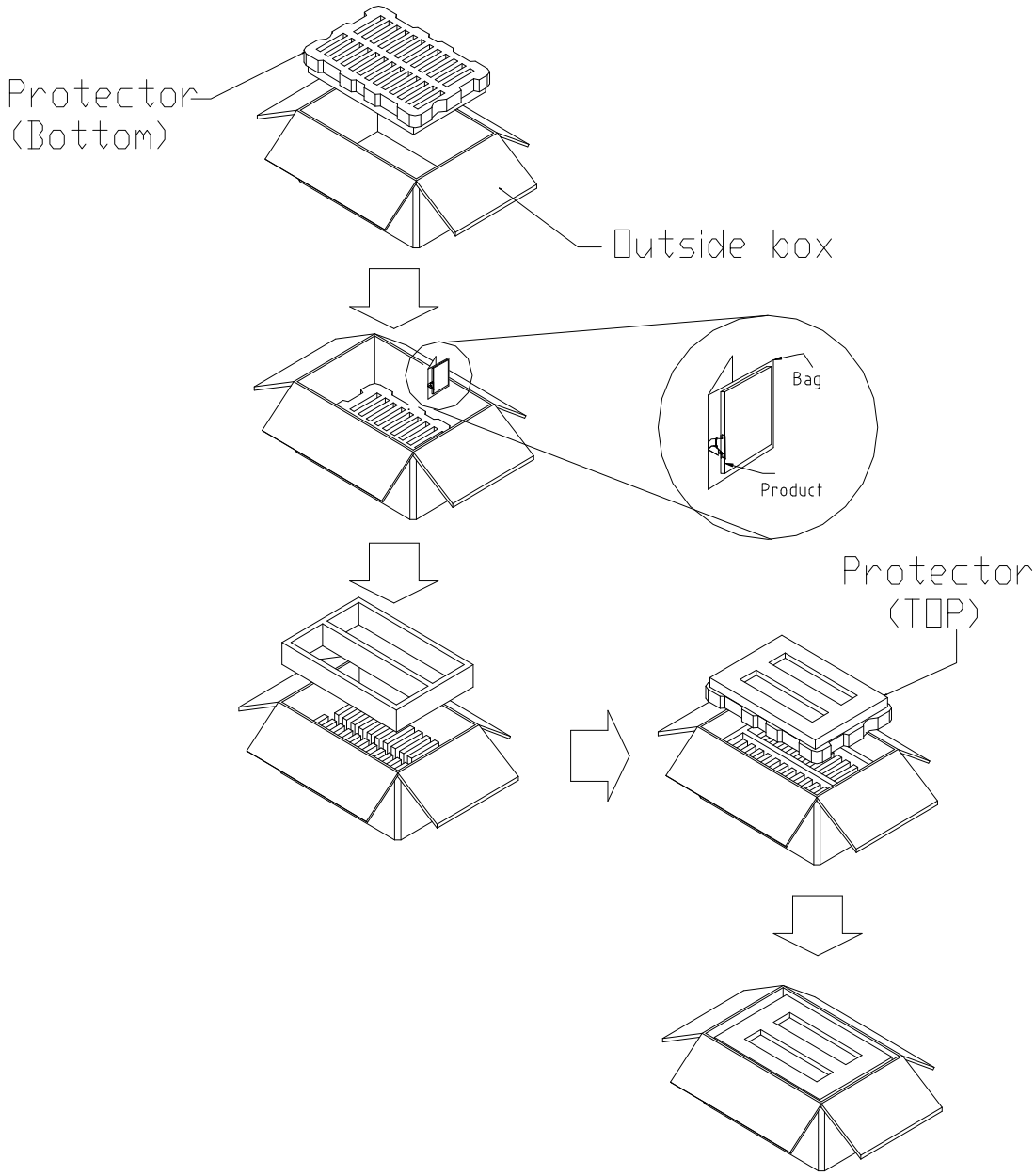


9.2.2 1D Labeling



S/N: PYYMMDDTAAAABC	
P	The plant of the sensor manufactured.
YY	The year of the sensor was tested in.
MM	The month of the sensor was tested in.
DD	The date of the sensor was tested on.
T	The type of the product.
AAAA	The sequence number of the sensor.
B	The machine of testing.
C	Internal use.

9.3 Packaging



Note:

1. 25pcs LCD Module for each carton.
2. Carton Dimension(mm) : 560(L) x 360(W) x 260(H)
3. The total weight is about 11Kg for fully packaging.

10 General Notice

10.1 Reliability Test Items

No.	Test Items	Conditions	Remark
1	High Temperature Storage	Ta= + 80℃ 240 Hrs	
2	Low Temperature Storage	Ta= - 30℃ 240 Hrs	
3	High Temperature Operation	Ta= + 70℃ 240 Hrs	
4	Low Temperature Operation	Ta= - 20℃ 240 Hrs	
5	High Temperature and High Humidity	Ta= 40℃, 90%RH 240 Hrs	Operation
6	Heat Shock	-30~80℃/100 cycles 1Hr/cycle	Non-operation
7	Electrostatic discharge	±200V, 200pF(0Ω), once for each terminal	Non-operation
8	Vibration	Frequency range : 8~33.3 Hz Stoke : 1.3mm Sweep : 2.9G, 33.3~400Hz Cycle : 15 minutes 2 hours for each direction of X,Z 4 hours for Y direction	JIS C7021, A-10 Condition A Non-Operation
9	Mechanical Shock	100G, 6ms, ±X±Y±Z 3 times for each direction	JIS C7021, A-7 Condition C Non-Operation
10	Vibration (with carton)	Random vibration : 0.015G2/Hz from 5~200Hz -6dB/octave from 200~500Hz	IEC 68-34
11	Drop (with carton)	Height : 60 cm 1 corner, 3 edges, 6 surfaces	JIS Z0202

Note (1): Ta: Ambient temperature.

Note (2): In the standard conditions, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.

10.2 Storage, Operation & Others

a.) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35℃ and relative humidity of less than 70%.

b.) Do not store the TFT-LCD module in direct sunlight.

c.) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

d.) Do not connect or disconnect the module in the "Power On" condition.

e.) Power supply should always be turned on/off by the item 3.2 "Electrical Absolute Ratings"

f.) The liquid-crystal is deteriorated by ultraviolet rays. Do not leave it in direct sunlight and strong ultraviolet rays for many hours.

g.) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

h.) Do not exceed the absolute maximum rating value. (The supply voltage, input signal voltage, environment, and so on). Otherwise the panel may be damaged.

i.) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.

j.) If the module has its circuitry FPC with it, please handle it carefully and prevent the FPC to be stressed.

11 Inspection Specifications

11.1 Purpose:

This Inspection Specifications are to define the TFT-LCD Modules (hereinafter called "Modules") with touch panel inspection standard for customer applying in the incoming receiving process.

11.2 Scope:

Specifications contain the display quality evaluation

11.3 Liability:

11.3.1 Inspection Deadline

The buyer (Customer) should inspect the modules within fifteen (15) calendar days after delivery.

11.3.2 Notification of Rejection

The customer has the right to reject one or more lots as the modules fail to meet the AQL(Acceptable Quality Level) defined in [11.4 Sampling Plan] after confirmation with PowerView. In that case, the customer should notify PowerView in either documents or mail. If customer would accept the lots, PowerView is obligated to replace those units with either major or minor defects free of charge.

11.3.3 Notification Deadline

The customer should inform PowerView within 3 working days upon finishing inspection. If the Customer fails to inform PowerView, the right to reject will be lifted.

11.4 Sampling Plan:

Unless there is other agreement, sampling plan for incoming inspection should follow MIL-STD-105E.

11.4.1 Lot size:

Quantity per shipment as one lot (different model as different lot .)

11.4.2 Sampling type:

Normal inspection, single sampling.

11.4.3 Sampling level:

Level II.

11.4.4 AQL:

Acceptable Quality Level

Major defect: AQL=1.0%

Minor defect: AQL=2.5%.

11.5 Inspection Condition:

11.5.1 Environment:

Room Temperature: 25±5℃.

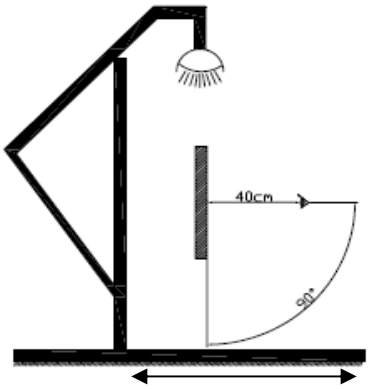
Humidity : 65±5% RH.

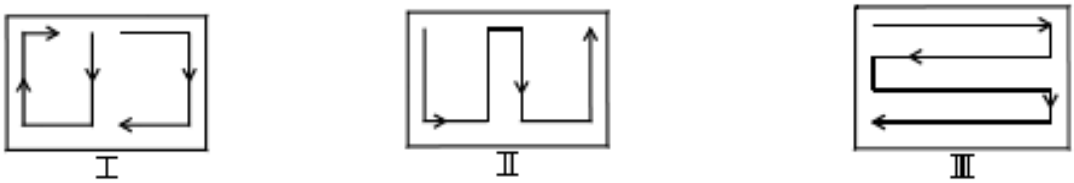
Illumination : 300 ~ 700 Lux. (for LCD Panel)

It's necessary to set up an applicable visual environment for sensor cosmetic inspection per following materials request

Light booth H 24" X D 30" X 42" W(Width≧42")

- Flat dark background
- Illumination on the surface of glass is 1200 Lux
- 10 x eye loupe with reticule
- Position front of touch screen 40 cm from your eye, and inspect in both reflection and transmission mode. Use one of the following patterns





11.5.2 Inspection instruments:

11.5.2.1 Pattern generator: VG-828 or equivalent model.

11.5.2.2 Video board: PowerView video board or equivalent. The output of the signal should comply with the specification provided by PowerView.

11.5.2.3 Luminance colorimeter: Topcon BM-7 or equivalent model

11.5.3 Inspection Distance:

35±5 cm

11.5.4 Inspection Time Period:

The period of inspection time should be below 20 seconds.

11.6 Classification of Defects:

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

Major defects:

A major defect is a defect that is likely to result in failure, or to reduce materially the usability of the product for its intended purpose.

Minor defects:

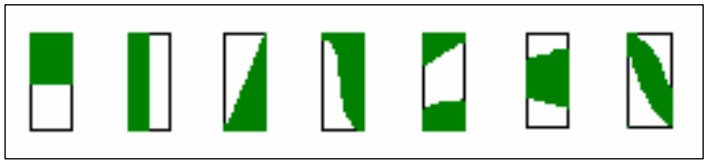
A minor defect is either a defect that is not likely to reduce materially the usability of the product for its intended application, or a departure from an intended purpose with little bearing on the effective use or operation of the product.

11.6.1 Electrical inspection specification

Inspection tem		Specification
Line defect		Can't be seen.
Bright dots		≦2 dots (note1,2,3)
Dark dots		≦6 dots (note1,2,3)
Total dots defect		≦7 dots (note1,2,3)
Continuous defect	Two continuous bright dots :	≦1 pair
	Over three continuous bright dots (vertical, horizontal, oblique) :	Not allowed
	Two continuous dark dots (vertical, horizontal, oblique) :	≦ 2 pair
	Three continuous dark dots (vertical, horizontal, oblique) :	≦1 pair
	Over three continuous dark dots (vertical, horizontal, oblique) :	Not allowed
Display non-uniformity or Mura (Note 4,5)		Use of ND filter or judged by equivalent limit sample

Note (1): For bright dot defect, bright area should be larger than 1/2 area of a sub-pixel to be count as 1 dot defect. A dot defect that is smaller than the defined dot defect will be treated as small bright dot.

*The drawing of 1/2 area sub-pixel definition: The 1/2 area sub-pixel can be defined as below one or more of specific shapes.



All bright dot defects should not be noticeable by observer under specified inspection environment , Please refer to Section 10.5.

Note (2): Adjacent-dot defect (refer to picture, dot 1,2,..,8 around A are all A's adjacent dots) should be inspected under the same display pattern in any one of White/Black/Green/Blue/Red/Monotone Gray pattern.

1	2	3
4	A	5
6	7	8

Note (3): Adjacent-dot defect should be observed under any one of white/Black/Green/Blue/Red pattern. 1 pair of bright dots equals 2 dots.

*Inspection patterns:

Standard inspection patterns of dot defect are listed below. PowerView uses these patterns as standard criteria for judging dot defect. Please inform PowerView if any other pattern is to be used to examine dot defect.

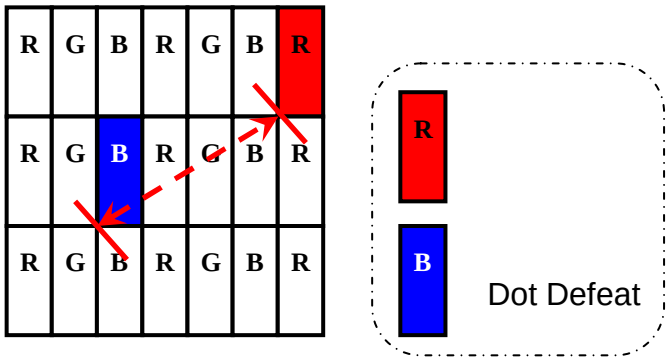
Test Pattern	Defect
Black	For white dot(s)
White	For black dot(s)
Monotone Red/Green/Blue	For black and white dot(s)

Note (4): The general mura symptoms has to be judged using 6% ND Filter.

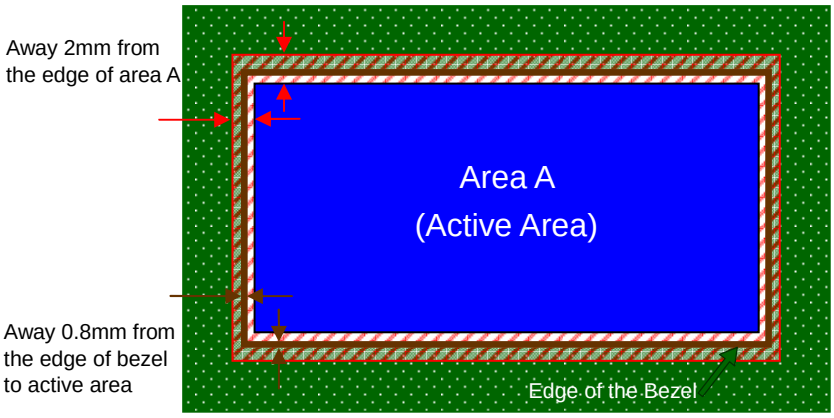
Note (5): The inspection method of ND Filter - holding ND filter in front of the panel around 1 cm and examine the panel from 35±5 cm in the front view for 3 seconds.

Note (6): Definition of distance between dots as following illustrations.

Distance between defect dots:

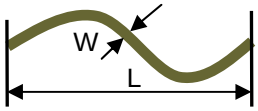


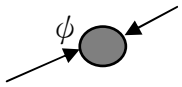
11.6.2 Appearance inspection specification



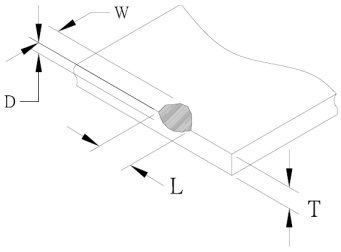
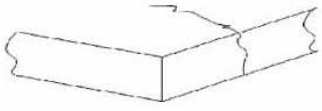
Note: Area B' is defined the around area of starting 0.8mm from bezel edge towards active area in area B.

Judged area	Judged item	Inspection specification			Judge Criterion	
					Major	Minor
Active area	Total for following 3 types defeat in active area.	Min Distance between of anomalies	> 40mm	n≦4		●
			< 40mm	Not Allowed		
	Defect, Dent, Bubble, Particle…	ϕ ≦0.25mm		Ignored		●
		0.26mm < ϕ ≦ 0.4mm		n≦3		
		ϕ > 0.4mm		Not Allowed		
	Linear Gap (Bond Adhesive)	W ≦ 0.05mm & L ≦ 3mm		Ignored		●
		0.05mm < W ≦ 0.1mm 3mm < L ≦ 5mm		n≦3		
		W > 0.1mm & L > 5mm		Not Allowed		
	Lint (Linear Defeat)	W ≦ 0.05mm & L ≦ 3mm		Ignored		●
		0.05mm < W ≦ 0.1mm 3mm < L ≦ 5mm		n≦3		
		W > 0.1mm & L > 5mm		Not Allowed		
Area B	Total for following 3 types defeat in active area.	Min Distance between of anomalies	> 40mm	Not Counted		●
			< 40mm	Not Allowed		
	Defect, Dent, Bubble, Particle…	ϕ ≦0.4mm		Ignored		●
		0.4mm < ϕ ≦ 0.71mm		n≦6		
		ϕ > 0.71mm		Not Allowed		
	Linear Gap (Bond Adhesive)	Area B'	W ≦ 0.6mm & L ≦ 5mm	n≦2		●
		others	W ≦ 0.6mm	Ignored		
		W > 0.6mm		Not Allowed		
	Lint (Linear Defeat)	W ≦ 0.05mm & L ≦ 5mm		Ignored		●
		0.05mm < W ≦ 0.1mm 5mm < L ≦ 8mm		n≦4		
		W > 0.1mm & L > 8mm		Not Allowed		





11.6.3 Outward Appearance Inspection Specification

Judged area	Judged item		Inspection specification		Judge Criterion	
					Major	Minor
Active area	Scratch	Front Side on Touch	W＜0.13mm，L＜0.13mm	Ignored		●
			W＜0.15mm，L＜12.7mm	n≦4		
			W＞0.15mm or L＞12.7mm	Not Allowed		
		Rear Side on Touch	W＜0.13mm，L＜0.13mm	Ignored		●
			W＜0.15mm，L＜19.05mm	n≦4		
			W＞0.15mm or L＞19.05mm	Not Allowed		
Bezel	Scratch, Dirt, Sunken		No harm			●
	Wrap		No dangerous		●	
Label (S/N, B/L, WEEK)	No label, Invert, Broken		Not Allowed		●	
	Overlap Label (triple)					●
	Dirt		Word can be read.		●	
	Not clear, Word out of shape					●
	Mistake		Not Allowed			●
	Position		Defined in drawing			●
Screw	Not enough (Q'ty)		Not Allowed		●	
	float		Not Allowed			●
	Limp		Grounding OK			●
Connector	Connection status		No correct connection		●	
FPC/FFC	Broken		Not Allowed		●	
Panel Edge	Chip D = (length + width)／2	Front Side on Touch	1mm (Z-towards electrode) x 1.5mm(Y-Depth) x 2mm (X).			●
		Rear Side on Touch	L≦2mm, W≦1mm, D≦1/2 of T	n≦4		●
			L＞2mm，W＞1mm，D＞1/2 of T	Not Allowed		
						
Pattern chip	Front Side on Touch		Not Allowed			●
	Rear Side on Touch		≦1/3 Silver Pattern Wide			
Plate progressive Crack defect				Not Allowed		●

Remark:

1. There are 4 MAXIMUM anomalies of any above defect types in total allowed on viewing area per touch sensor.
2. Only anomalies in the viewing area are considered.
3. Anomalies measured less than 0.13mm are not ignored.

Note (1): Extraneous substances which can be wiped out, such as fingerprint and particles are not considered as a defect.

Note (2): Defects on the Black Matrix are not considered as a defect.

Note (3): When L >=2W, defect count as liner defect.

Note (4): To verify whether the responsibility of following defects are caused by PowerView, the IQC checks as requested on above items before mass production such as the polarizer scratch, mura, glass broken, …etc.

11.7 Limited Warranty

PowerView represents and warrants that all Modules shall (i) conform to the specifications set forth in Article 11.5, 11.6 hereof and (ii) be free from any defects in material and workmanship for 12 month(s) after shipping date. PowerView will replace, rework or refund the defective or non-conforming Modules; Provided that Customer (i) promptly informs Supplier of the defects or non-conformities within the warranty period, (ii) comply with the specifications and conditions hereunder and (iii) comply with PowerView's procedure for Modules replace, rework and return. The warranty period for the Modules replaced or reworked shall be the remaining term for such Modules.

THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, TERMS OR CONDITIONS, EXPRESS OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ALL OF WHICH ARE EXPRESSLY DISCLAIMED. PowerView'S WARRANTIES HEREIN APPLY ONLY TO CUSTOMER AND ARE NOT TO BE EXTENDED TO ANY THIRD PARTY.

11.8 Governing Law

This Agreement shall be governed and construed in accordance with the laws of TAIWAN, the Republic of China. Both parties agree to submit any dispute, which cannot be amicably resolved, to Hsinchu District Court for the first instance.