ORIENT DISPLAY

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SPECIFICATION
FOR
TFT MODULE

MODULE NO: AFW480272C-4.3-9374
REVISION NO: C00

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		
CHECKED BY		
APPROVED BY		

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Table of Contents

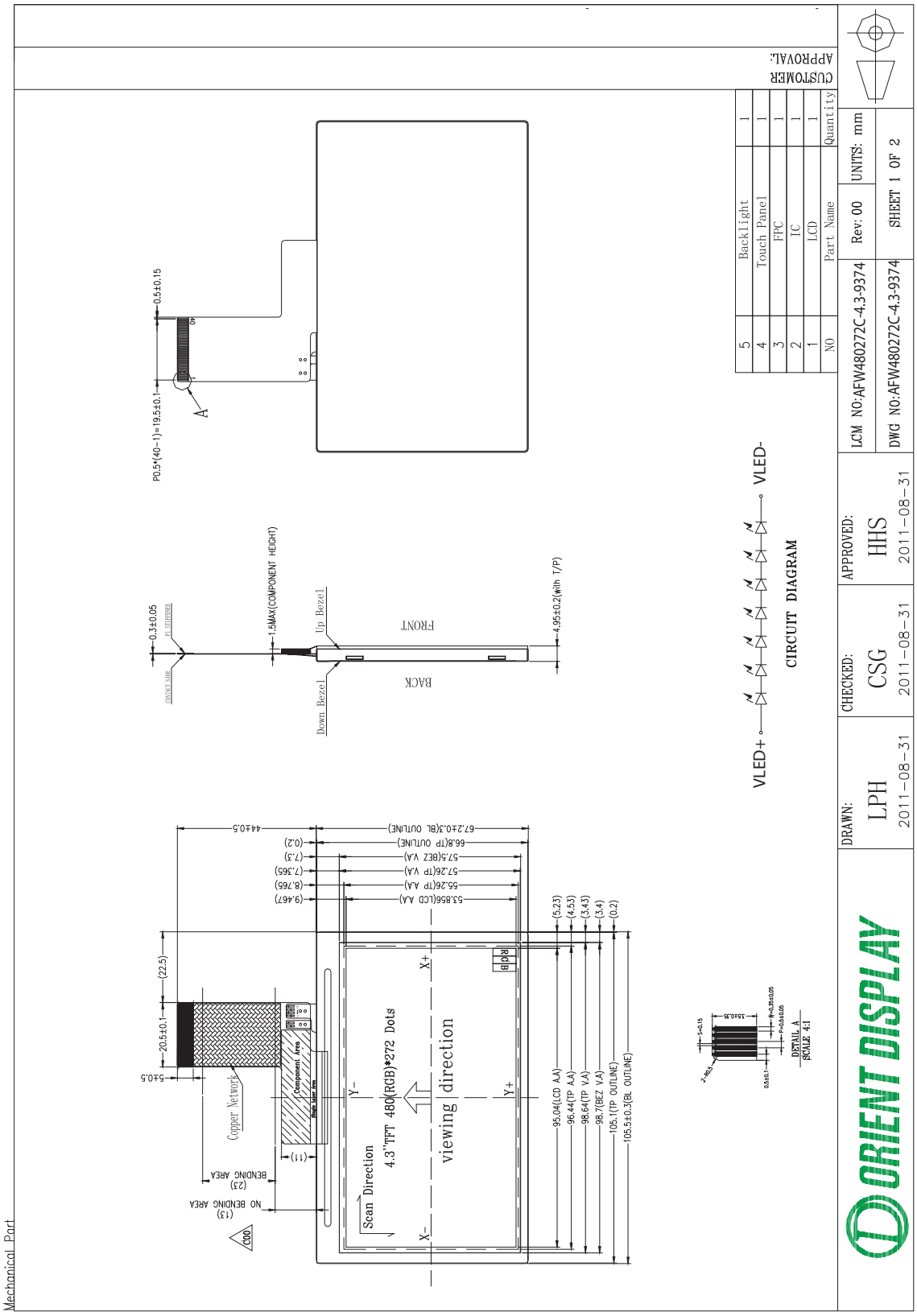
Revision History

Rev.	Comment	Date
A00	Original Version	2010-12-21
C00	Update ***2 Mechanical Diagram***, ***3.1 Pin Description*** and ***4.3 Optical Characteristics***.	2011-10-08

1 General Specifications

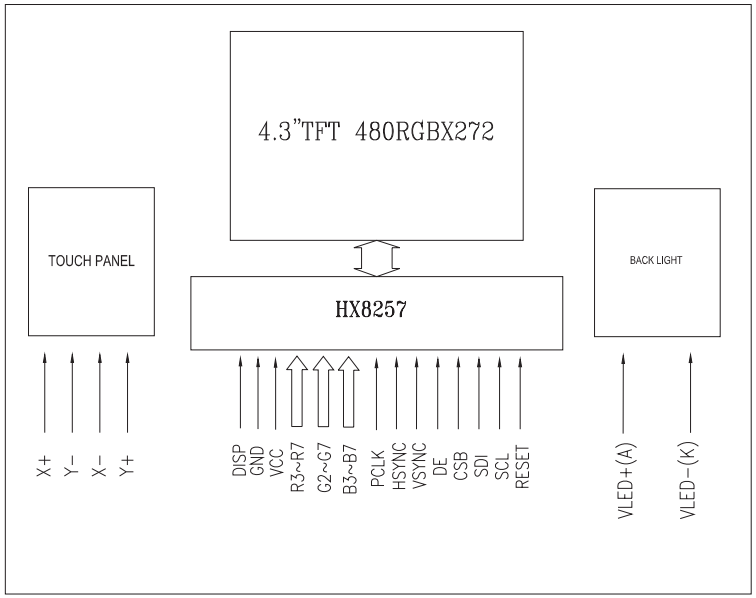
Item	Standard Value	Unit
Display Pattern	■Graphic ☐Character ☐Segment ☐_____ ☐with ICON	
Color	☐Mono. ☐Grayscale ■ 65K	
Module Dimension (W x H x T)	105.5(W) × 111.2 (H) ×4.95 (T)	mm
Viewing Area (W x H)	\	mm
Active Area (W x H)	95.04(W)X53.856(H)	mm
Character Size (W x H)	\	mm
Character Pitch (W x H)	\	mm
Pixel Format	480(RGB)X272	
DOT Pitch (W x H)	\	mm
LCD Type	☐TN, Positive ☐TN, Negative ☐HTN, Positive ☐HTN, Negative	
	☐STN, Yellow-Green ☐STN, Gray ☐STN, Blue ☐FSTN, Positive ☐FSTN, Negative	
	☐_____ ☐FM LCD ☐Color STN ■TFT	
Polarizer Type	☐Transflective ■Transmissive ☐Reflective ☐Anti-Glare	
View Direction	6 O'clock	
LCD Controller & Driver	HX8257	
LCD Driving Method	\	
Interface Type	Serial ☐I^2C ■SPI ☐____	
	Parallel ☐6800 ☐8080 ☐4-bit ■ 16-bits RGB	
Backlight Type	■LED ☐Bottom ■Single Side ☐Dual Side	
	☐_____ ☐EL ☐CCFL	
Backlight Color	☐Yellow-Green ■White ☐Amber ☐Blue ☐Red ☐_____	
EL/CCFL Driver type	☐Build-in ☐External	
DC-DC Converter	■Build-in ☐External	

2 Mechanical Diagram



Electrical Part

Block Diagram: C00



C00 Pin Description:

PIN	Symbol	Function Description
1	GND	Ground.
2	VLED-	Power supply cathode input for backlight.
3	VLED+	Power supply anode input for backlight.
4	VCC	3.3V
5	R7	Digital data input.
6	R6	Digital data input.
7	R5	Digital data input.
8	R4	Digital data input.
9	R3	Digital data input.
10	GND	Ground.
11	G7	Digital data input.
12	G6	Digital data input.
13	G5	Digital data input.
14	G4	Digital data input.
15	G3	Digital data input.
16	G2	Digital data input.
17	GND	Ground.
18	B7	Digital data input.
19	B6	Digital data input.
20	B5	Digital data input.
21	B4	Digital data input.
22	B3	Digital data input.
23	PCLK	Clock signal. Data sampling at the PCLK rising edge.
24	GND	Ground.
25	DISP	Display on/off mode control.
26	HSYNC	Horizontal sync input.
27	VSTNC	Vertical sync input.
28	DE	Input data enable control.
29	CSB	Chip select pin of serial interface.
30	SCL	Clock pin of serial interface.
31	SDI	Data input pin in serial mode.
32	NC	Non connection.
33	NC	Non connection.
34	NC	Non connection.
35	RESET	Reset pin.
36	X-	Touch Panel:Left.
37	Y-	Touch Panel:Up.
38	X+	Touch Panel:Right.
39	Y+	Touch Panel:Down.
40	GND	Ground.

Display type:TFT/Normal white
Display mode:Transmissive
Viewing direction: 6:00
Driver IC: HX8257
Interface type: 16bits RGB
Recommend Operating Voltage: VCC=3.3+/-0.3V
Backlight: White LED
Vled=20.4±1.4V Iled=10mA
Operating temprature: -20° C ~ +70° C
Storage temprature: -30° C ~ +80° C
All unmarked tolerance: ±0.3mm
( ) REFERENCE DIMENSION
Please Kindly Confirm

C00: Update Pin Description, Block Diagram and some FPC dimension.	
A00: Original Edition.	
Revison History:	

CUSTOMER APPROVAL:

ORIENT DISPLAY	DRAWN: LT 2011-08-31	CHECKED: WYH 2011-08-31	APPROVED: HHS 2011-08-31	LCM NO: AFW480272C-4.3-9374	Rev: 00 / UNITS: mm
				DWG NO:AFW480272C-4.3-9374	SHEET 2 OF 2

3 I/O Terminal

3.1 Pin Description(See Datasheet of LCD Driver for detail)

Pin NO.	Symbol	Function Description
1	GND	Ground.
2	VLED-	Power supply cathode input for backlight.
3	VLED+	Power supply anode input for backlight.
4	VCC	Power input(+3.3V).
5	R7	Red pixel data input.
6	R6	Red pixel data input.
7	R5	Red pixel data input.
8	R4	Red pixel data input.
9	R3	Red pixel data input.
10	GND	Ground.
11	G7	Green pixel data input.
12	G6	Green pixel data input.
13	G5	Green pixel data input.
14	G4	Green pixel data input.
15	G3	Green pixel data input.
16	G2	Green pixel data input.
17	GND	Ground.
18	B7	Blue pixel data input.
19	B6	Blue pixel data input.
20	B5	Blue pixel data input.
21	B4	Blue pixel data input.
22	B3	Blue pixel data input.
23	PCLK	Clock signal. Data sampling at the PCLK rising edge.
24	GND	Ground.
25	DISP	Display on/off mode control. DISP=L, standby mode. DISP=H, normal display mode.
26	HSYNC	Horizontal sync input.
27	VSYNC	Vertical sync input.
28	DE	Input data enable control.
29	CSB	Chip select pin of serial interface. Leave it OPEN when not used.
30	SCL	Clock pin of serial interface. Leave it OPEN when not used.
31	SDI	Data input pin in serial mode. Leave it OPEN when not used.
32	NC	Non connection.

33	NC	Non connection.
34	NC	Non connection.
35	RESET	Reset pin.
36	X-	Touch Panel:Left.
37	Y-	Touch Panel:Up.
38	X+	Touch Panel:Right.
39	Y+	Touch Panel:down.
40	GND	Ground.

4 Electro-optical Specifications

4.1 Absolute Maximum Ratings

GND=0V

No	Item	Symbol	Min.	Typ.	Max.	Unit
1	Supply Voltage	V_{CC} –G_{ND}	-0.3	-	4.0	V
2	Operation Temperature	T_{OP}	-20	-	70	°C
3	Storage Temperature	T_{ST}	-30	-	80	°C

4.2 Electrical Characteristics

Ta=25°C

No	Item	Symbol	Min.	Typ.	Max.	Unit	Condition
1	Recommend Operating Voltage	V_{CC} –G_{ND}	3.0	3.3	3.6	V	-
2	Supply Current for IC	I_{CC}	-	16	-	mA	V_{CC} =3.3V
3	Current for Backlight	Iled	-	10	-	mA	
4	Voltage for Backlight	Vled	19.0	20.4	21.8	V	Iled=10mA

Note: Iled must be less than or equal 20 mA.

4.3 Optical Characteristics

Ta = 25°C, VCC=3.3V, GND=0V, Iled = 10 mA

ITEM		SYMBOL	CONDITION		MIN	TYP	MAX	UNIT	DRIVE
Response time		Tr+Td	θ = ϕ =0 °		-	(30)	-	ms	(1)
Contrast ratio		CR	θ = ϕ =0 °		-	(400)	-		
Uniformity		U	-		70	-	-	%	
Surface Luminance		Lv	Iled = 10 mA		150	200	-	cd/m²	
			Iled = 20 mA		250	350	-		
Viewing angle range		6H ϕ=270°	CR≧ 10	θ 1	40	55	-	deg.	
		12H ϕ=90°		θ 2	55	70	-		
		ϕ =0°		θ 3	55	70	-		
		ϕ=180°		θ 4	55	70	-		
Chromaticity Coordinates	White	X	θ = ϕ =0 °		0.2741	0.3141	0.3541	-	(2)
		Y			0.3259	0.3659	0.4059		
	Red	X	θ = ϕ =0 °		0.5687	0.6087	0.6487		
		Y			0.3142	0.3542	0.3942		
	Green	X	θ = ϕ =0 °		0.2822	0.3222	0.3622		
		Y			0.5490	0.5890	0.6290		
	Blue	X	θ = ϕ =0 °		0.1083	0.1483	0.1883		

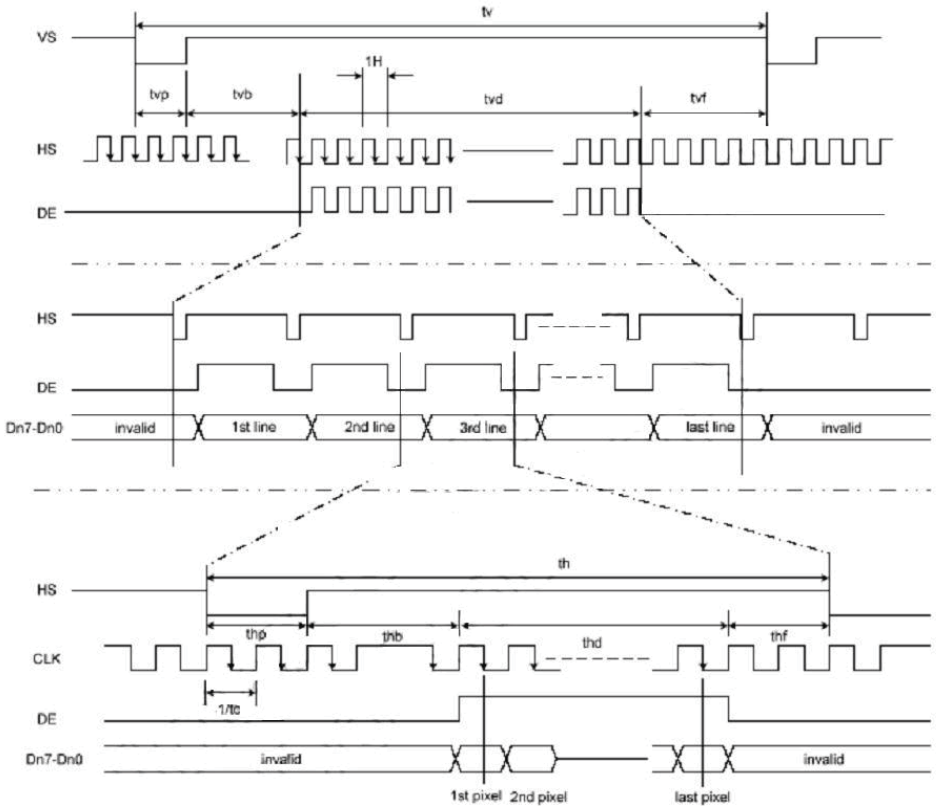
		Y		0.1034	0.1434	0.1834		

Note :

(1)Duty driving by DMS505.

(2)Duty driving by Actual driver IC.

4.4 Timing Characteristics



Parallel RGB Input Timing

Ta =25ºC,VCC=3.3V,GND=0V

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock cycle	f_{CLK} (1)	-	9	15	MHz
Hsync cycle	1/th	-	17.14	-	KHz
Vsync cycle	1/tv	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp (2)	2	41	41	CLK
Horizontal back porch	thb (2)	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	399	H (1)
Vertical display period	tvd	272	272	272	H (1)
Vertical front porch	tvf	1	2	227	H (1)
Vertical pulse width	tvp (2)	1	10	11	H (1)
Vertical back porch	tvb (2)	1	2	11	H (1)

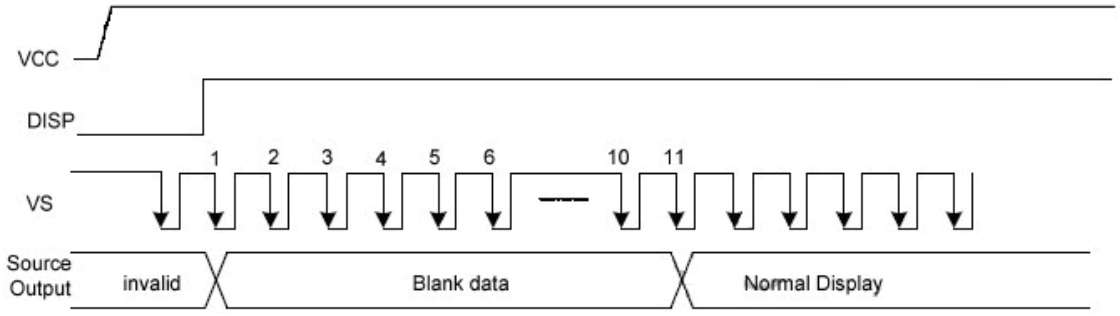
Note:

(1) Unit: CLK=1/ fCLK , H= th.

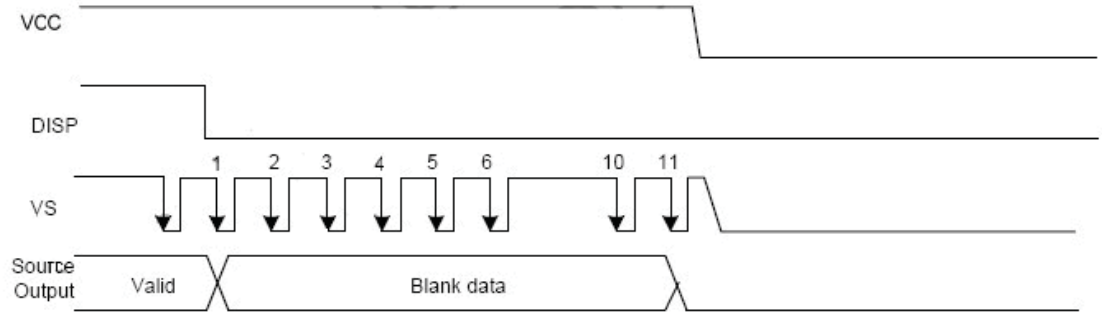
(2) It is necessary to keep tvp+tvb=12 and thp+thb=43 in sync mode. DE mode is unnecessary to keep it.

4.5 Power on / off

The HX8257-A has a power ON/OFF sequence control function. When DISP pin is pulled “H”, blank data is outputted for 10-frames first, from the falling edge of the following VSYNC signal. Similarly, when DISP is pulled “L”, 10-frames of blank data will be outputted from the falling edge of the following VSYNC, too.



Power On Sequence



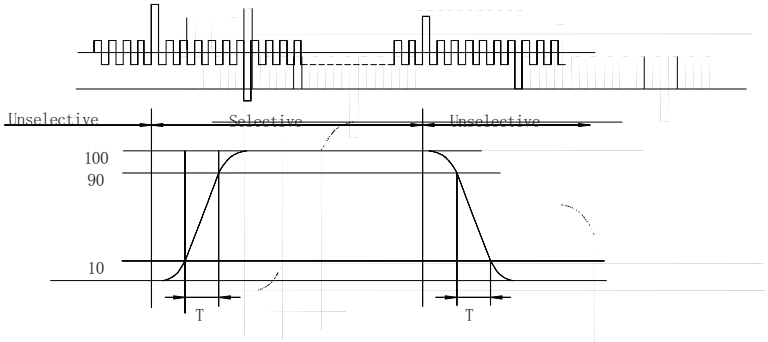
Power Off Sequence

5 Accessory

5.1 Definition and measure

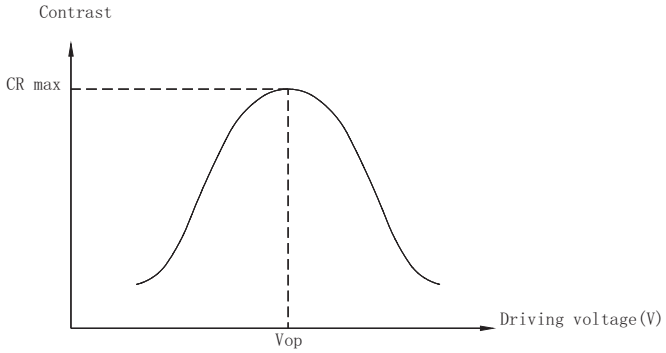
5.1.1 Definition of response time

Measuring apparatus: DMS505



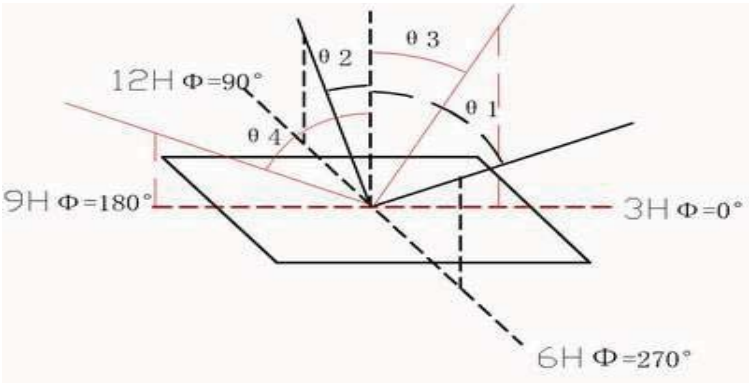
5.1.2 Definition of contrast ratio

$$\text{CR(contrast ratio)} = \frac{\text{Brightness all pixels "White"}}{\text{Brightness all pixels "Black"}}$$



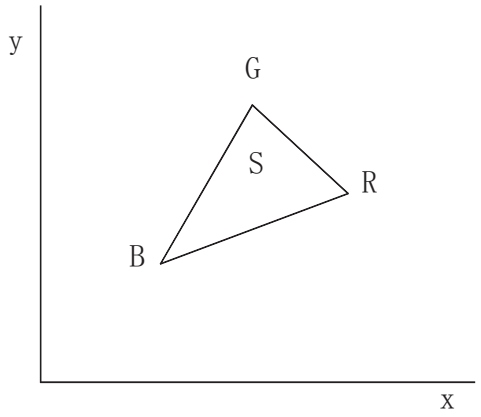
5.1.3 Definition of viewing angle

Measuring mode: Transmissive
Measuring apparatus: DMS-505



5.1.4 Definition of color Gamut

Color gamut: S= (RGB triangle Area / NTSC triangle Area)× 100

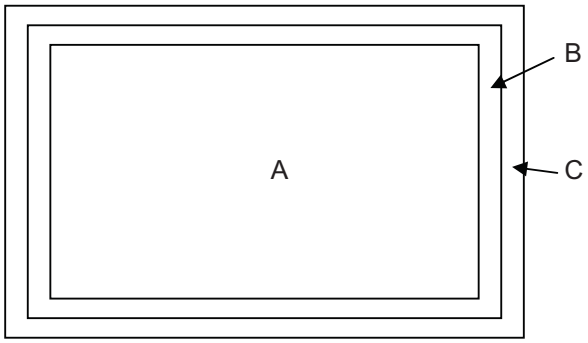


5.2 Quality Units

Light Source: Fluorescent light (Day-light Type) 20~40W

Distance: 30cm~50cm from inspector eyes to display surface. The viewing angle should be perpendicular to display surface.

Definition of Active Area, Viewing Area & Invisible Area



A: Active Area (A.A.)

B: Viewing Area (V.A.)

C: Invisible Area (I.A.: After assembly by customer, this area is invisible. Cosmetic defect on this area must be ignored.)

Sampling Plan

Reference Standard GB2828 (MIL-STD-105E) General Inspection Level II

Defect Class Definition and AQL

Class	Defect Description	AQL
Major	No display, Missing lines, Abnormal display, No backlight, Dimension out of specification	0.4
Minor	Black/white dots, chip glass, Bright/Dark dot when testing, Air bubble, Line type defect(Bright or Dark), Bubble between polarizer and glass	1.0

5.2.1 Inspection Standard

5.2.1.1Definition of dot defect (Pixel defect)

1) Pixel and sub-pixel (Refer to below illustration)

A pixel = (R sub-pixel + G sub-pixel + B sub-pixel)

2) The definition of dot: The size of a defective dot over 1/2 sub-pixel should be regarded as one defective dot.

3) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

4) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure R/G/B pattern.

5) Two dots adjacent (Refer to below illustration)

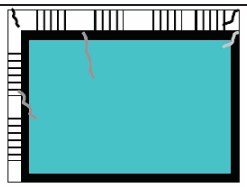
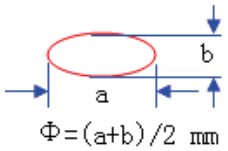
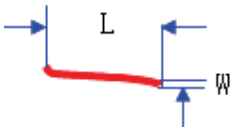
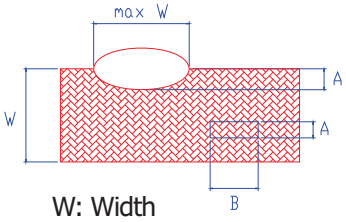
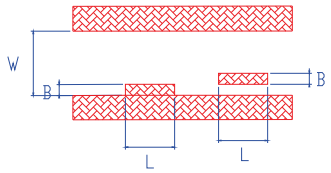
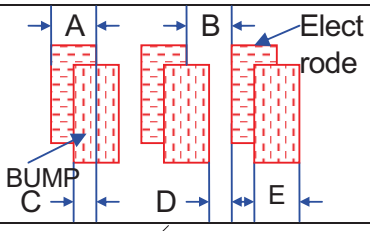
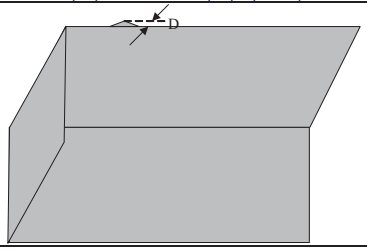
2 dot adjacent (Left-right) 2 dot adjacent (Top-down) 2 dot adjacent (Diagonal)

* In this section: black dot express defective dot; grey dot express normal dot.

5.2.1.2 Dot Defect (Bright Dot / Dark Dot)

Defect Description	Illustration	Judgment Criteria	Acceptable Defect Qty.		Class
			V.A. & A.A.	I.A.	
Bright Dot	OK black Pattern: All R/G/B Dark <u>Bright Green Dot:</u> R/G/B should be dark at black pattern, but G is bright. 	Bright R/G/B dot 2 dots adjacent	2 0	NA	Minor
Dark Dot	OK White pattern: All R/G/B Bright Dark Green Dot: R/G/B should be bright at white pattern, but G is dark. 	Dark R/G/B Dot 2 dots adjacent	3 1	NA	Minor
Remark	1. Total dot defect quantity should be equal or less than 4.				

5.2.1.3 Appearance inspection

Defect Description	Illustration	Judgment Criteria	Class
Glass crack		Not allowed	Minor
Circular type defect (Black spot / White spot)		Φ≤0.15mm, ignored	Minor
		0.15mm<Φ≤0.50mm, N≤4	
		Φ>0.50mm, NG	
Line type defect		W≤0.05mm & L≤0.3mm, Ignored	Minor
		0.05mm<W≤0.10mm, 0.3mm<L≤2.0mm, N≤4	
		W>0.1mm or L>2.0mm, NG	
FPC Defect: Pinhole, damage on circuit	 W: Width	A≤W/4 & B≤3W, ignored A>W/4 or B>3W, NG	Major
FPC Defect: Etching defect (Protrude/Copper residue/burr)	 W: Distance btw two electrode	B≤W/4 & L≤3W, irremovable, ignored B>W/4 or L>3W, removable, NG	Major
FPC Defect: Crease/Impress	NA	Crease with an acute angle, NG Crease or impress with an obtuse angle, ignored	Minor
SMT: Component shifit		C≥E/2 & D≥B/2, ignored C<E/2 or D<B/2, NG	Minor
Metal Frame		Burr was allowed at edges within the dimension as below: D<0.05mm, ignored D≥0.05mm, NG	Minor
Remark	For unmentioned FPC defect, please refer to IPC-6013 For unmentioned SMT defect, please refer to IPC-A-610		

5.2.1.4 Function defect

Defect Description	Illustration	Judgment Criteria	Class
Line defect	Vertical lines Horizontal lines Cross lines etc	Not allowed	Major
Display defect	Abnormal display No display etc	Not allowed	Major

5.2.2 Reliability Test

5.2.2.1 Standard Specifications for Reliability

5.2.2.1.1 Test method

There should be no existing conspicuous failure of functions and appearance in LCD after the following tests.

NO	Item	Description
1	Low Temperature Operating	The sample should be allowed to stand at (-20±2)℃ for 96 Hours under driving condition.
2	High Temperature Operating	The sample should be allowed to stand at (70±2)℃ for 96 Hours under driving condition.
3	Low Temperature Storage	The sample should be allowed to stand at (-30±3)℃ for 96 Hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 24 hours
4	High Temperature Storage	The sample should be allowed to stand at (80±2)℃ for 96Hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 24 hours
5	Moisture resistance	The sample should be allowed to stand at (40±2)℃, (90±2)%RH for 96Hours under no-load condition excluding the polarizer, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours
6	Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: T_{STL} for 30 minutes -> normal temperature for 5 minutes -> T_{STH} for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours

5.2.2.1.2 Testing Conditions and Inspection Criteria:

For the final test, the testing sample must be stored at room temperature for 24 hours, after the tests listed above; Standard specifications for Reliability have been executed in order to ensure stability.

NO.	Item	Inspection Criteria
1	Current Consumption	The current consumption should be under double of initial test.
2	Contrast	The contrast must be larger than half of initial test.
3	Appearance	Appearance defects should not happen.

5.2.2.2 TFT LCD Life Time:

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25±10°C), normal humidity (45±20%RH), and in area not exposed to direct sunlight. Definition on the termination of life time is deterioration of contrast ratio by one fifth against initial value or human eyes can not recognize each dots.

5.3 Precautions For Use

5.3.1 Recommended storage condition: 50-60%RH，25±5℃；

5.3.2 TFT LCD is brittle. It may break when it is dropped or bumped on a hard surface. Please handle carefully.

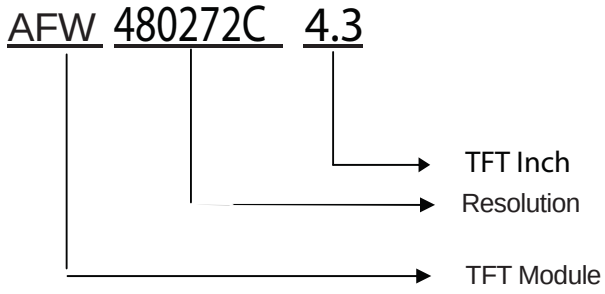
5.3.3 Please don't clean polarizer by alcohol or acetone. Pure water is recommended.

5.3.4 Please don't disassembly the module, it will invalidate the warranty agreements. Please use it within 6 months.

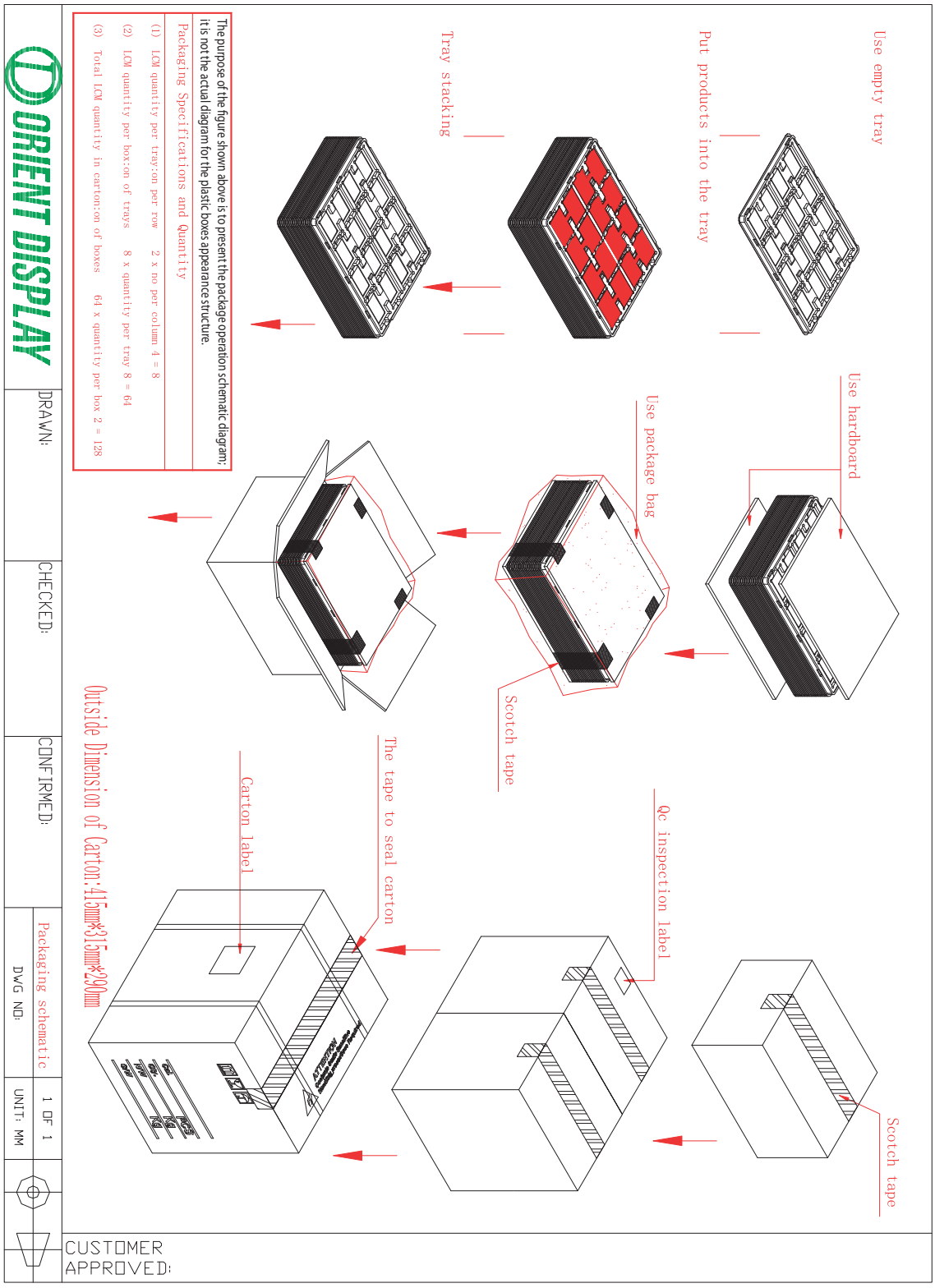
5.3.5 This product is ESD sensitive. Please assure enough ESD protection whenever handling the product.

5.4 Classification

Part Number



5.5 Packaging



6 Touch Panel

6.1 Mechanical Characteristics

Items	Value	
Operation Force	≤60g	
Operation Life	Tapping Durability	≥1,000,000 times
	Pen sliding Durability	≥100,000 times
Surface Hardness	≥3H	

Operation force is defined as the minimum force it makes the contact resistance stable when tapped with a 0.8mm radius rigid tip.

6.2 Optical Characteristics

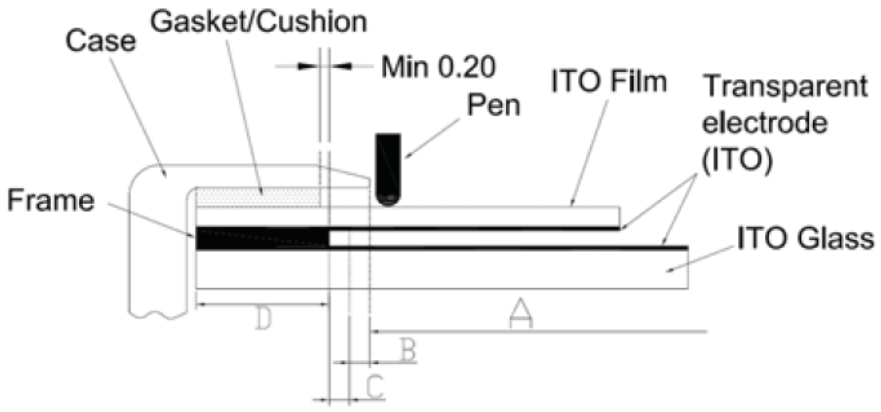
Items	Value
Transparency	77%(typ.)
Haze	8%(typ.)

6.3 Electric Characteristics

Items	Value	
Max Voltage	5V（DC）	
Max Current	Top Layer	5.5~25mA
	Bottom Layer	5.5~25mA
Terminal Resistance	Rx:200-900Ω, Ry:200-900Ω	
Insulation Resistance	≥10MΩ(25V DC)	
Linearity	≤1.5%	
Chattering Time	≤15ms	

6.4 Structure And Area Definition

The structure and the performance guaranteed areas of this touch panel are defined below:



Area A: Active area
The area guarantees a touch panel operation with the following characteristics when pressed, (1)Operation force, (2) Electric characteristics, (3) Tapping durability, (4) Pen sliding durability,
Area B: Operation non-guaranteed area
The area does not guarantee a touch panel operation and its function. When this area is pressed, touch panel shows degradation of its performance and durability such as a pen sliding durability becomes about one-tenth compared with the active area (Area A) and its operation force requires about double. About 0.5mm outside from the boundary of the active area corresponds to this area.
Area C: Pressing prohibition area
The area forbids pressing because an excessive load is applied to the transparent electrode and a serious damage will be given to the touch panel function. About 0.5mm outside from the boundary of "Area B" corresponds to this area.
Area D: Non-Active area (Frame)
This area does not activate even if pressed.
Area B and Area C: Sensitive area
Area B and Area C both belong to the sensitive area. This area has a clearance between top and bottom contact side. Great press resulting in transparent electrode cracks, function defect to be exact, will deform surface transparent electrode. Please think about structure of sensitive area and case in order to avoid terminal user to fail to touch this area.

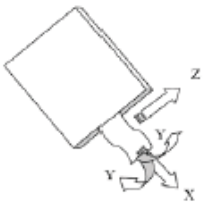
6.5 The standard Of Inspection

6.5.1 Purpose
This specification is made to be used as the standard acceptance/rejection criteria for Touch panel.

6.5.2 Mechanical characteristics

Test Items	**Specifications**	**Remarks**
Tapping Durability	≥1,000,000 times(4-wire) ≥35,000,000 times(5-wire) Test condition: Hitting head: Rubber, Tip R=12.5mm Hardness: 60 deg. Load: 250gf Hitting frequency: 2 times/s	Tapping at the same point.
Pen Sliding Durability	≥100,000 times(4-wire) ≥1,000,000 times(5-wire) Test condition: Hitting head: Polyacetal, Tip R=1.0mm Load: 100gf Sliding speed: 60mm/s	Sliding the same position.
Impact Resistance	No glass breaks when Φ=9mm steel ball is dropped vertically on the center of the touch panel from 100cm height at a single time. Thickness of glass: 0.7~3.0mm	Only for Film + Glass type touch panel.

6.5.3 Physical characteristics

Test Items	Specifications	Remarks
Surface Hardness	Typically between 2~4H depending on hard coat used, Pressure 500gf,45 deg.	Pencil hardness
Operation Force	Typically less than 100g Tip R=0.8mm polyacetal pen	
FPC Heat Seal Peeling Strength	X: ≥2000g Y: ≥500g Z: ≥150g  Combination force between FPC and substrate	

6.5.4 Visual Inspection Requirement

●Definition

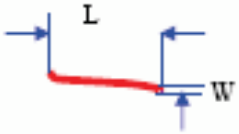
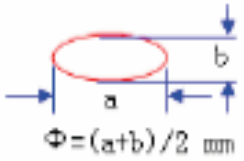
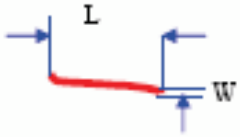
1. MA: All functional defects such as open, short, contrast differential, excess power consumption, smearing leakage, etc. And overall outline dimension beyond the drawing are classified as MA
2. MI: Except the MA defects above, all appearance defects are classified as MI.
3. Denseness: More than 2 defects (including 2 defects) in 5mm area.

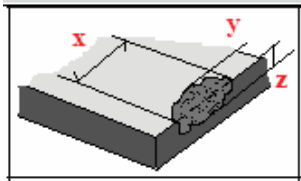
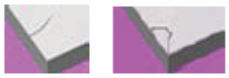
● Inspection condition

Source of the lighting for inspection is 12~20W cool white color of fluorescent light for 400~500mm long between product and a source of light. The viewing distance for inspection between eyes and product is 300mm.The viewing angle between eyes and product is kept in 30~45° . Meanwhile, add a black cardboard under the product as background. Inspection time is less than 10 sec for each piece. And we check product with protective film.

● **Details**

(The criteria are for Viewing Area, and the defects in non-VA part wouldn't be considered.)

Items	Inspection		Classification of defects	
			MA	MI
Scratch 	Criteria	Quantity Accepted		
	W≤0.03mm	Ignored		
	0.03mm≤W≤0.05mm, L≤10mm Distance from any other scratch or foreign object >20mm	Ignored		☆
	0.03mm≤W≤0.05mm, L≤10mm Distance from any other scratch or foreign object <20mm	3		
	W>0.05mm, or L>10mm	0		
Spot Defect 	Criteria	Quantity Accepted		
	Φ≤0.1mm, no denseness	Ignored		
	0.1mm<Φ≤0.15mm, no denseness	3		☆
	0.15mm<Φ≤0.25mm, no denseness	2		
	Φ>0.25mm	0		
Linear Defect 	Criteria	Quantity Accepted		
	W≤0.025mm	Ignored		
	0.025mm≤W≤0.035mm, L≤5mm Distance from any other foreign object or scratch>20mm	Ignored		☆
	0.025mm<W≤0.05mm, L≤5mm Distance from any other foreign object and scratch<20mm	2		
	W>0.05mm, or L>5mm	0		
Corner Fragment 	Criteria	Decision		
	X≤3.0mm, Y≤3.0mm,Z≤t t: Thickness of the glass	Acceptable		☆
Side Fragment	Criteria	Decision		☆

	X≤6.0mm, Y≤2.0mm,Z≤t t: Thickness of the glass	Acceptable		
Crack Inward Outward 	Criteria	Decision		
	Any crack inward	Unacceptable		☆
	Crack outward	Acceptable		
Newton Ring (Regular) 	Criteria	Decision		
	The area of the Newton ring is more than 1/3 area of the touch panel, or character affected and line distorted occurs after touch panel lightening	Unacceptable		☆
	The area of the Newton ring is less than 1/3 area of the touch panel, and no character affected and line distorted after touch panel lightening.	Acceptable		
Newton Ring (Irregular) 	Criteria	Decision		
	The area of the Newton ring is more than 1/4 area of the touch panel, or character affected and line distorted occurs	Unacceptable		☆
	The area of the Newton ring is less than 1/4 area of the touch panel, or no character affected and line distorted after touch panel lightening	Acceptable		
Product Color	According to the sample confirmed		☆	