

SPECIFICATION FOR CTP+LCD MODULE

Part No.: JT215TM005-V1

Customer No.:

Date: 2026-4-21

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Prepared	Checked	Approved	Approved

Record of Revision

Rev.	Description	Page	Date
0	Preliminary specification released	/	20260421

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1 General Specifications

1.1 Definition

The specification is used for capacitive touch module with TFT LCD & Backlight Unit.

1.2 Features and General Description

General	Specification	Unit	Note
Module Size	21.5	inch	diagonal
Structure	G+G+LCD, OCR Bonding		
Resolution	1920(RGB) × 1080		
Display Mode	Normally Black. Transmissive		
Pixel Pitch	0.2483(W) × 0.2483(H)	mm	
Pixel Arrangement	RGB Vertical stripe		
Viewing Direction	ALL	O'clock	
Outline Dimensions	517.06(W) × 308.79(H) × 24.45(D)	mm	
Viewing Area	477.06(W) × 268.79(H)		
Active Area	476.64(W) × 268.11(H)	mm	
LCD Interface	LVDS(2ch)		
CTP Interface	USB / I2C / RS232		
CTP IC	EXC81H84		
Touch Point	10		
Surface Hardness	6	H	
Surface Treatment	Etched AG(Gloss: 80 ± 15)		

3 Pin assignment

3.1 LCD Pin assignment

LVDS connector: MSCKT2407P30HB (STM)

Pin	Symbol	Description	Note
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	
7	NC	No connection (LCD Self test Pin)	
8	RXOC-	Negative Transmission Clock (ODD)	
9	RXOC+	Positive Transmission Clock (ODD)	
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	
11	RXO3+	Positive Transmission data of Pixel 3 (ODD)	
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	
14	GND	Ground	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	
16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)	
17	GND	Ground	
18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)	
19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)	
20	RXEC-	Negative Transmission Clock (EVEN)	
21	RXEC+	Positive Transmission Clock (EVEN)	
22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)	
23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)	
24	GND	Ground	
25	NC	No connection	
26	BIST	For LCD Self Test Only BIST=1, BIST Model; BIST=0, Normal mode (Default) Suggest Connecting to GND if not used	
27	NC	No connection	
28	LCD_VDD	LCD Power Supply: +5V	
29	LCD_VDD	LCD Power Supply: +5V	
30	LCD_VDD	LCD Power Supply: +5V	

LED connector: MS242614RHA (STM)

Pin	Symbol	Description
1	VBL	Supply Voltage 24V
2	VBL	Supply Voltage 24V
3	VBL	Supply Voltage 24V
4	VBL	Supply Voltage 24V
5	VBL	Supply Voltage 24V
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	DET	Normal (GND)
12	EN	BL ON/OFF
13	NC	No connection
14	PWM	PWM Control

3.2 CTP Pin assignment

USB connector: JP1

Pin	Symbol	Description
1	GND_E	Ground
2	VDD	CTP Power Supply : 5V
3	GND	Ground
4	D+	CTP USB data port plus
5	D-	CTP USB data port minus

I2C connector: JP5

Pin	Symbol	Description
1	GND	Ground
2	I2C_SDA	CTP I2C SDA signal
3	I2C_SCL	CTP I2C SCL signal
4	VDD	CTP Power Supply : 5V
5	I2C_INT	CTP I2C INT signal

RS232 connector: JP5

Pin	Symbol	Description
1	UR_CTS	CTP RS232 CTS signal
2	UR_TX	CTP RS232 TX signal
3	UR_RX	CTP RS232 RX signal
4	UR_RTS	CTP RS232 RTS signal
5	GND_E	Ground
6	VDD	CTP Power Supply : 5V
7	GND	Ground

4 Absolute Maximum Rating

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table

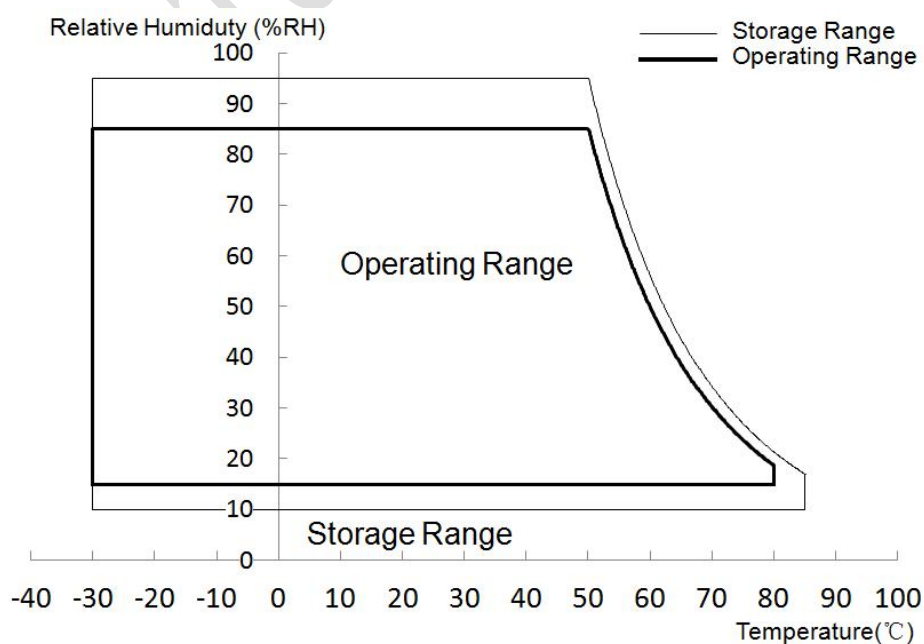
Item	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	LCD_VDD	(-0.3)	(5.5)	V	(1),(2), (3),(4)
Logic Input Signal Voltage	V _{Signal}	(-0.3)	(3.6)	V	
Operating Temperature	T _{gs}	(-30)	(80)	°C	
Storage Temperature	T _a	(-30)	(85)	°C	

Note (1) All the parameters specified in the table are absolute maximum rating values that may cause faulty operation or unrecoverable damage, if exceeded. It is recommended to follow the typical value

Note (2) All the contents of electro-optical specifications and display fineness cause faulty Normal Conditions. All the display fineness should be inspected under normal conditions. Normal conditions are defined as follow: Temperature: 25°C, Humidity: 55±10%RH.

Note (3) Unpredictable results may occur when it was used in extreme conditions. T_a= Ambient Temperature, T_{gs}= Glass Surface Temperature. All the display fineness should be inspected under normal conditions.

Note (4) Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be lower than 47°C, and no condensation of water. Besides, protect the module from static electricity.



5 Electrical Characteristic

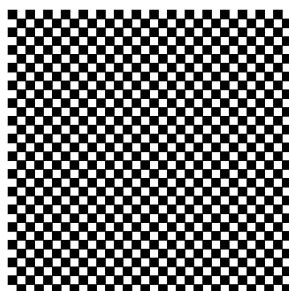
5.1 LCD Input Power Specifications

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
<i>System Power Supply</i>							
LCD Drive Voltage (Logic)		V_{DD}	(4.5)	(5)	(5.5)	V	(1),(2)
VDD Current	Mosaic Pattern	I_{DD}	-	-	(0.38)	A	(1),(3)
VDD Power Consumption	Mosaic Pattern	P_{DD}	-	-	(1.9)	W	
LCD Self Test (BIST)	High level voltage	V_{BIST}	(2.5)	-	(3.6)	V	(1)
	Low level voltage		(0)	-	(0.5)	V	
Allowable Logic/LCD Drive Ripple Voltage		V_{VDD-RP}	-	-	(200)	mV	(1)
<i>LED Power Supply</i>							
LED Input Voltage		V_{LED}	(21.6)	(24)	(26.4)	V	(1),(2),(6)
LED Power Consumption		P_{LED}	-	-	(49.7)	W	(1),(6)
LED Forward Voltage		V_F	-	-	(3.3)	V	(1),(2)
LED Forward Current		I_F		(80)		mA	
PWM Signal Voltage	High	V_{PWM}	(2.5)	-	(3.6)	V	
	Low		-	-	(0.5)	V	
LED Enable Voltage	High	V_{LED_EN}	(2.5)	-	(3.6)	V	
	Low		-	-	(0.5)	V	
Input PWM Frequency		F_{PWM}	(500)		(5000)	Hz	(1),(2),(6)
Duty Ratio		PWM	(5)	-	(100)	%	(1),(7)
LED Life Time		LT	(50,000)	-	-	Hours	(1),(7)

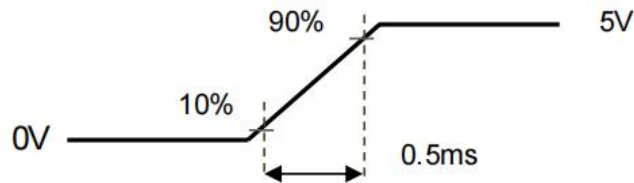
Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25°C, Humidity: 55± 10%RH.

Note (2) All of the absolute maximum ratings specified in the table, if exceeded, may cause faulty operation or unrecoverable damage. It is recommended to follow the typical value.

Note (3) The specified VDD current and power consumption are measured under the VDD = 5.0V, FV= 60 Hz condition and Mosaic Pattern



Note (4) The figures below is the measuring condition of VDD. Rush current can be measured when TRUSH is 0.5 ms.



Note (5) The power consumption of LED Driver are under the $V_{LED} = 24.0V$, Dimming of Max luminance

Note (6) Although acceptable range as defined, the dimming ratio is not effective at all conditions. The PWM frequency should be fixed and stable for more consistent luminance control at any specific level desired.

Note (7) The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.

Note (8) The life time is determined as the sum of the lighting time till the luminance of LCD at the typical LED current reducing to 50% of the minimum value under normal operating condition.

5.2 Signal Timing Specification

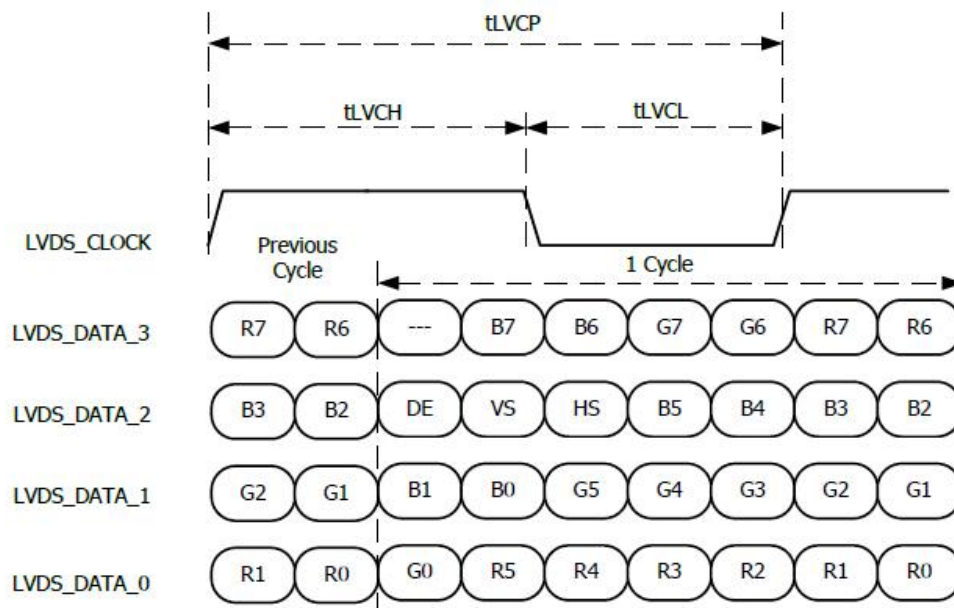
5.2.1 Timing table

Parameter	Symbol	Min.	Typ.	Max.	Unit
LVDS Clock Frequency	Fclk	(59.3)	(72)	(89)	MHz
H Total Time	HT	(1004)	(1050)	(1100)	Clocks
H Active Time	HA	960			Clocks
V Total Time	VT	(1092)	(1130)	(1653)	Lines
V Active Time	VA	1080			Lines
Frame Rate	FV	(50)	(60)	(75)	Hz

Note1: $HT * VT * \text{Frame Frequency} \leq 89 \text{ MHz}$

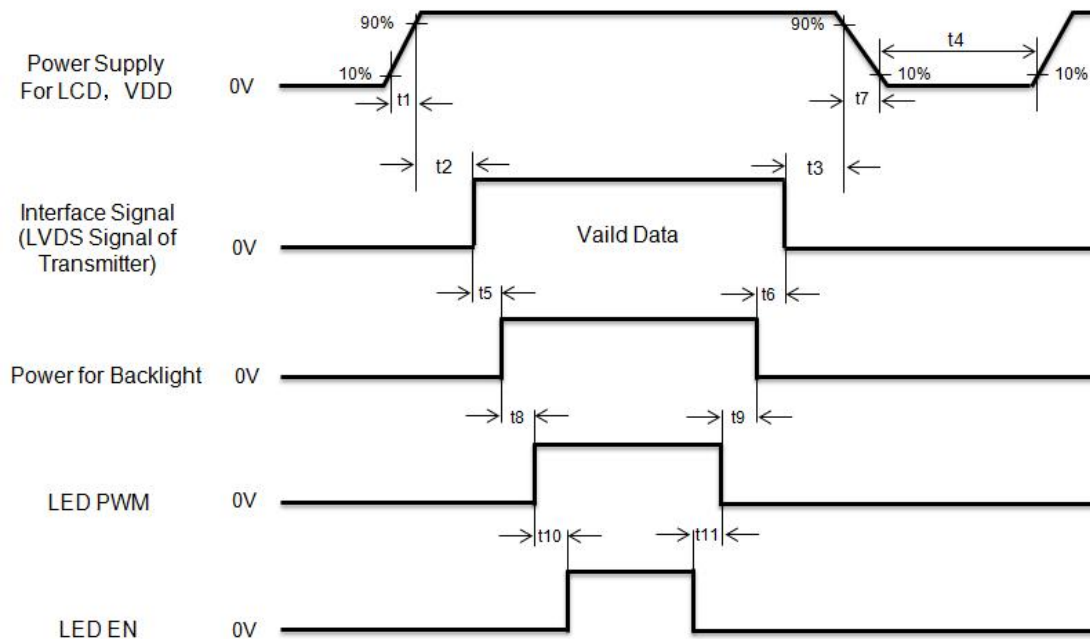
Note2: Synchronization Method: DE only

5.2.2 Data Mapping



5.3 Power Sequence for LCD

- Interface signals are also shown in the chart. Signals from any system shall be Hi-resistance state or low level when VDD voltage is off.
- When system first start up, should keep the VDD high time longer than 200ms, otherwise may cause image sticking when VDD drop off.

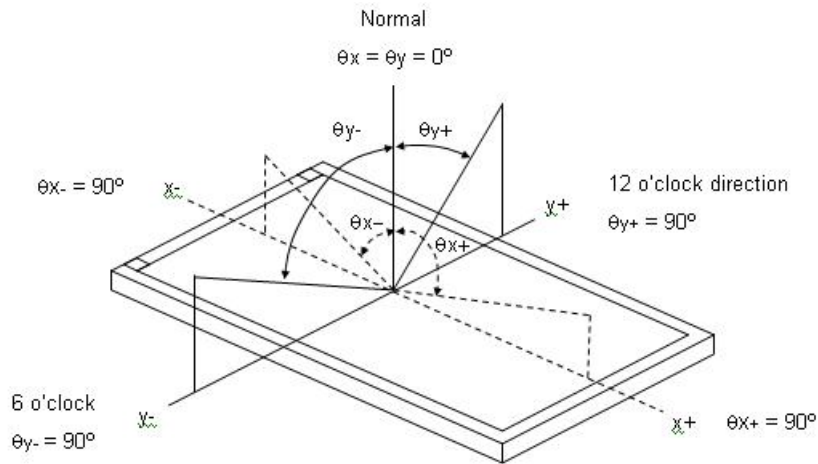


Parameter	Symbol	Min.	Typ.	Max.	Unit
VDD Rise Time	T1	(0.5)	-	(10)	ms
VDD Good to Signal Valid	T2	(0)	-	(50)	ms
Signal Disable to Power Down	T3	(0)	-	(1,000)	ms
Power Off	T4	(1,000)	-	-	ms
Signal Valid to VLED On	T5	(300)	-	-	ms
VLED Off to Signal Disable	T6	(200)	-	-	ms
VDD Fall Time	T7	(0.5)	-	(10)	ms
VLED On to LED PWM On	T8	(10)	-	-	ms
LED PWM Off to VLED Off	T9	(10)	-	-	ms
LED PWM On LED EN On	T10	(10)	-	-	ms
LED EN Off to LED PWM Off	T11	(10)	-	-	ms

6 Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	Horizontal	θ_{X+}	$CR \geq 10$	80	85	-	Deg.	(1), (5)
		θ_{X-}		80	85	-	Deg.	
	Vertical	θ_{Y+}		80	85	-	Deg.	
		θ_{Y-}		80	85	-	Deg.	
Luminance (W/ CTP)		Lv	$\theta_X=0^\circ, \theta_Y=0^\circ$	1000	1250	-	nit	(4), (5)
Uniformity	9 points	$\Delta Y9$		75	80	-	%	(5), (6)
Contrast ratio		CR		-	1500	-		(2), (5)
Color Chromaticity (CIE 1931)	White	W_x	$\theta_X=0^\circ, \theta_Y=0^\circ$ R=G=B=255 Gray scale	Typ-0.03	0.313	Typ+0.03	-	(1), (5)
		W_y			0.329		-	
	Red	R_x			-		-	
		R_y			-		-	
	Green	G_x			-		-	
		G_y			-		-	
	Blue	B_x			-		-	
		B_y			-		-	
Response Time	T_R+T_F			-	-	35	ms	(3)

Note (1) Definition of Viewing Angle (θ_x, θ_y):



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

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L_{255} / L_0

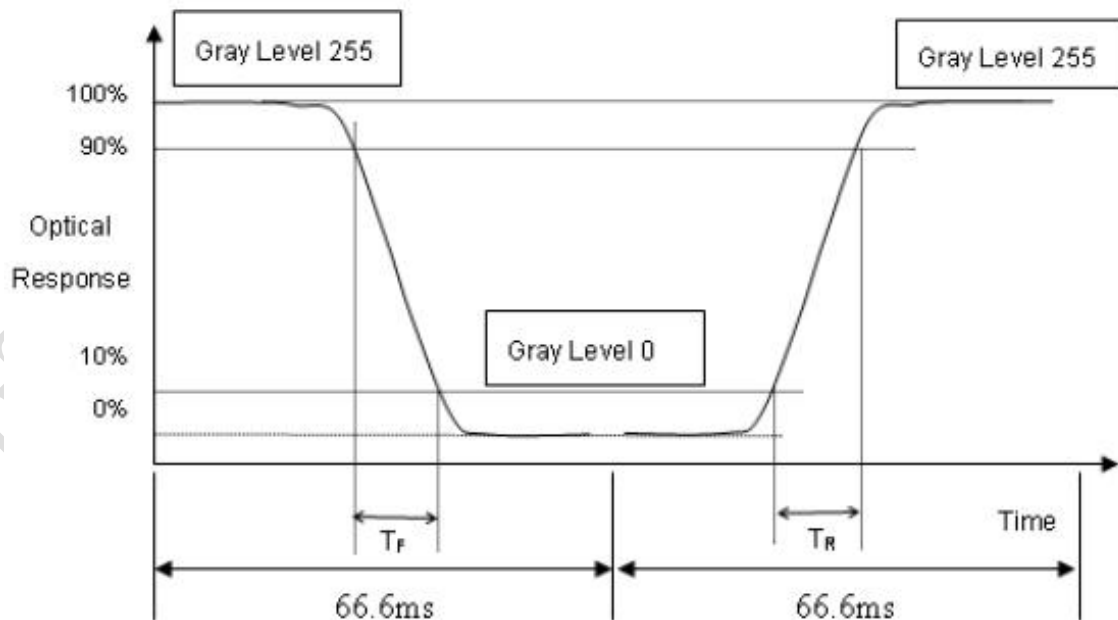
L_{255} : Luminance of gray level 255

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 (T_R, T_F):



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

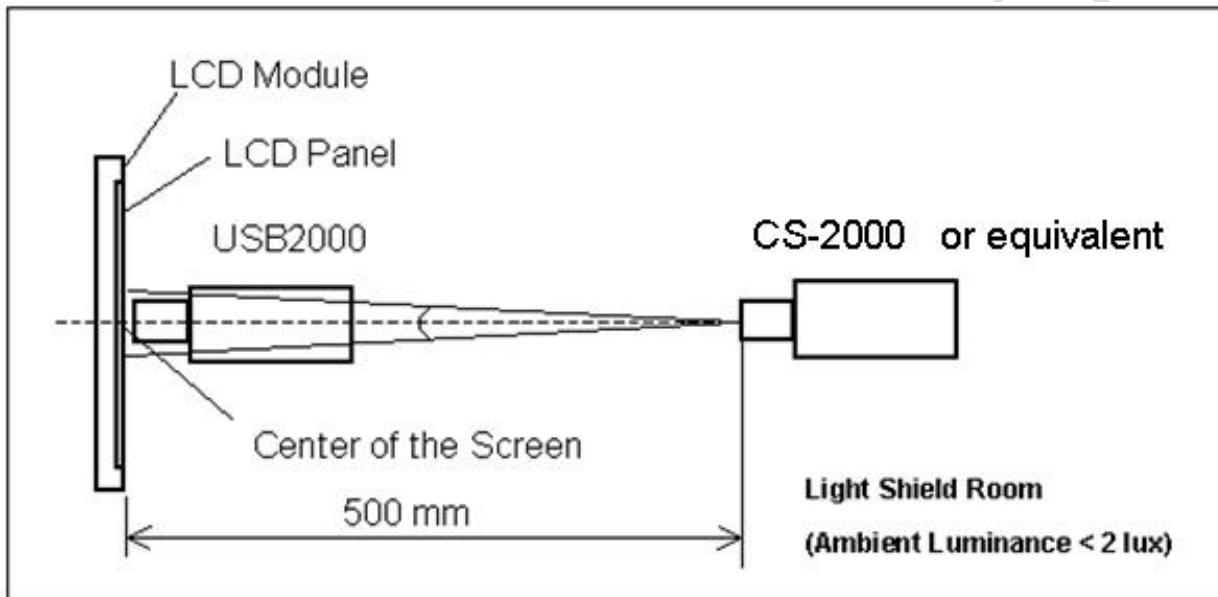
Measure the luminance of gray level 255 at center point

$LC = L(5)$

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

Note (5) Measurement Setup:

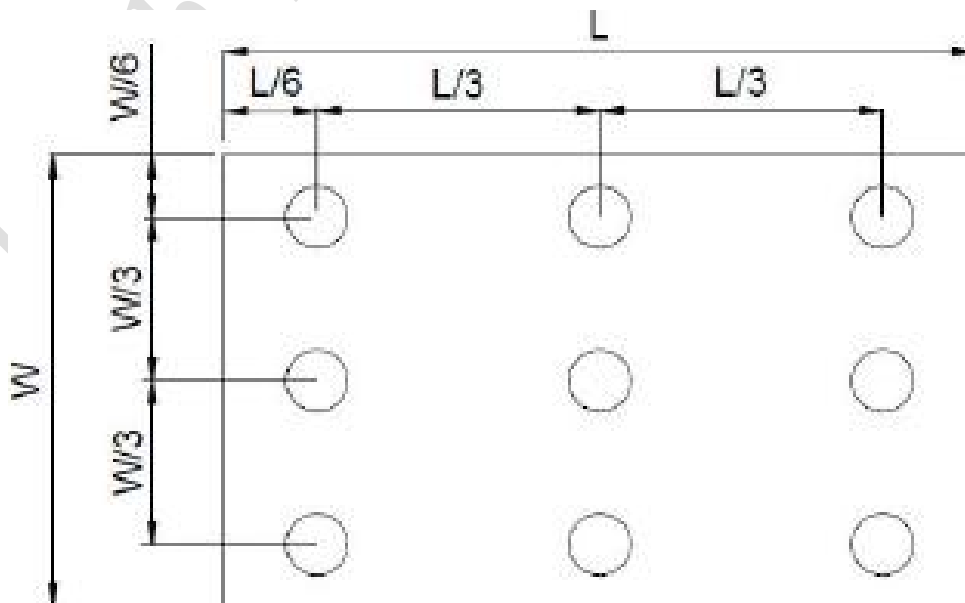
The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



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

Measure the luminance of gray level 255 at 9 points

$\delta W = (\text{Minimum} [L(1) \sim L(9)] / \text{Maximum} [L(1) \sim L(9)]) * 100\%$



7 Reliability Test

Test Item	Condition
High Temperature Storage Test	85°C, 240 hrs
Low Temperature Storage Test	-30°C, 240 hrs
High Temperature Operation Test	80°C, 240 hrs
Low Temperature Operation Test	-30°C, 240 hrs
High temperature & high humidity operation Test	50°C, 85%RH, 240 hrs
Electro-static discharge test (non-operating)	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV

Note :

- (1) There should be no condensation on the surface of panel during test.
- (2) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.
- (3) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.
- (4) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

8 Appearance Inspection

8.1 Inspection Sampling Method:

Unless there is other agreement, the sampling plan for incoming inspection shall follow GB2828.1-2012.

- (1) Lot size: Quantity per shipment as one lot (different model as different lot).
- (2) Sampling type: Normal inspection, single sampling.
- (3) Sampling level: Level II.

8.2 Inspection Conditions

The environmental condition and visual inspection shall be conducted as below:

- (1) Light: 800~1400Lux;
- (2) Vision requirement: Naked or corrected vision of at least 1.0 and no color blindness;
- (3) Inspection background: black and white board is used as the background below the product;
- (4) Inspection distance: 30~40cm from human eyes to the measured surface;
- (5) Inspection Angle: the detected surface is 90 degree from to line of sight, and the measured Object should be rotated 45 degree from side to side;
- (6) Inspection time: 5~10s;

8.3 Inspection equipment

Secondary elements, calipers, feelers, filinka, petroleum ether, ND filter

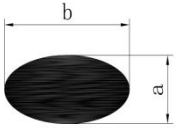
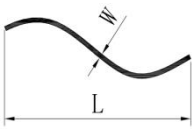
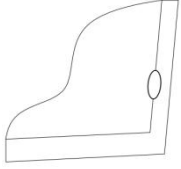
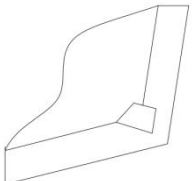
8.4 Defect code comparison table

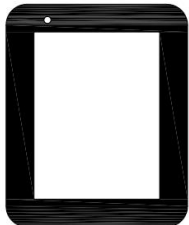
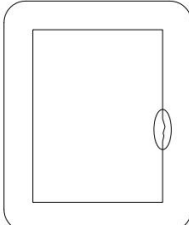
Code	Name (Unit)	Code	Name (Unit)
N	Number	D	Diameter (mm)
L	Length (mm)	H	Depth (mm)
W	Width (mm)	S	Distance (mm)
S	Area (mm ²)		

8.5 Inspection precautions

- (1) Inspectors must wear finger gloves and electrostatic bracelets.
- (2) Place the inspected product in front of the inspector, and hold the edge of the product with both hands carefully. Do not bend the product.

8.6 Inspection items and standards

Items	Standard	Conclusion	Inspection tools
Dot (white, black, heterochromatic)  $D=(a+b)/2$	$D \leq 0.3$	Ignore, dense density is not allowed	Visual inspection
	$0.3 < D \leq 0.8$	The distance with another dot is more than 10 mm, Transparent areas : $N \leq 5$, Ink areas : $N \leq 6$	
	$D > 0.8$	Not allow	
Linear defects (fibers/foreign bodies/ scratches, etc.) 	$W \leq 0.08$	Ignore, dense density is not allowed	Visual inspection
	$0.08 < W \leq 0.2$	$L \leq 15$, the distance with another scratch or impurity is more than 5mm Transparent areas : $N \leq 5$, Ink areas : $N \leq 5$	
	$W > 0.2, L > 15$	Not allow	
Bubble	According to the point standard		Visual inspection
Edge broken loss 	1. The sensor edge creaks, without damaging the line. The function test is OK for reception, and the front side is not visible after fitting. 2. Edge creak on front of cover plate: NG. 3. Back $X < 0.5\text{mm}$; $Y < 0.5\text{mm}$; $Z < 1/3\text{GT}$ (GT= glass thickness), without affecting the functionality of the product, each side is allowed three		Visual inspection
Corner broken loss 			

Items	Standard	Conclusion	Inspection tools
Creak	Creaks found at any location are not allowed		Visual inspection
Size	Meet the requirements of finished product inspection drawings		
Ink pinhole 	$D \leq 0.2$	Ignore, dense density is not allowed	
	$0.2 < D \leq 0.3$	$N \leq 6$ $DS \geq 10\text{mm}$, Repair with a paint pen of the same color as the cover plate	
Ink sawtooth 	$W \leq 0.2\text{mm}$	Ignore, dense density is not allowed	
Newton's rings	No more than 1/6 of the display area, light up invisible. If there are special requirements, the limited sample shall prevail.		
FPC 	1. Oxidation, breakage, residual glue, coating peeling, cracking and other phenomena of FPC gold fingers are not allowed. 2. Less components, false welding, deformation are not allowed.		
Color	Consistent with the sample, no serious color difference		
Mura/Waving/ Hot spot	Not visible through 5% ND filter		

9 Notices

9.1 Cautions for storage

Store the module in a dark room where must keep at $25\pm 10^{\circ}\text{C}$ and 65%RH or less. Don't expose the products to the direct sunlight or stresses.

9.2 Cautions for operation

- (1) Do not put a heavy, hard or sharp object on the product.
- (2) Do not bend the product in order to assure the reliability.
- (3) Do not put one product on the other. Otherwise, the product to may be scratched or be changed.
- (4) Do not oile the touch panel, Do not put heavy goods on the touch panel.
- (5) Do not use any organic solvent acid or alkali solution to clean the surface of the product. Please use dry clothes or soft clothes with ethanol to clean the surface.

9.3 Cautions for operation

Light transmission is an important factor for the product. So, please wear clean finger sacks, gloves and mask to protect the products from fingerprint or stain attach, and also must ensure the area where your finger touches is outside the view area when handing the panel.

9.4 Others

- (1) Please note that dew gathering in the panel due to abrupt temperature or humidity change, etc. Which may cause deterioration of performance.
- (2) When this product was built into the package, if there is vulcanization material such as vulcanized rubber which has a possibility of generating the salutation gas near the package since abnormalities will be caused to wring of the product and it will become the cause if functional degradation, please give a constitutional cations.
- (3) Cation for product safety set

Although full care is taken to ensure product quality, failure modes such as degradation, short circuits, or open circuits might be caused, Therefore, to design a product set, please study the effects of any single failure of the panel in advance and consider the safety of product configuration.

Quality function livers for on year, outward appearance haves non-color variation in six months.