MODEL NO. : TM040YVZG31

ISSUED DATE: 2015-6-26

VERSION : V2.0

□Preliminary Specification
■Final Product Specification

Customer :

Approved by	Notes

TIANMA Confirmed :

Prepared by	Checked by	Approved by

This technical specification is subjected to change without notice

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2013-8-16	Preliminary spec release	Jin Zhao
2.0	2015-6-26	Final spec release	Jin Zhao

1 General Specifications

Feature		Spec
Display Spec.	Size	3.97 inch
	Resolution	480(RGB) x 800
	Technology Type	a-Si TFT
	Pixel Configuration	R.G.B. Vertical Stripe
	Pixel pitch(mm)	0.108 x 0.108
	Display Mode	Normally Black
	Surface Treatment	LCD Up Polarizer: Sunglass Free
	Viewing Direction	All Direction
Mechanical Characteristics	LCM (W x H x D) (mm)	65x104x3.277
	Active Area(mm)	51.84(W)x86.40(H)
	With /Without TSP	With Capacitive TP
	Connection Type	FH35C-25S-0.3SHW
	LED Numbers	8LEDs
	Weight (g)	41
Electrical Characteristics	Interface	MIPI
	Color Depth	16M
	Driver IC	HX8369-A01
CTP spec	Active Area(mm)	53.84(W) x 88.40(H)
	Surface treatment	4H hardness, AF coating
	Interface	I2C
	Control IC	Atmel mxt224s
	Touch Method	Bare finger
	Number of simultaneous touches	5 points
	Minimum Touch Area(mm)	Φ5
	Finger Touch Pitch(mm)	12
	Structure	Glass Lens－Glass Sensor
	Transparency	88%
	Haze	Haze≦1.0%
	Cover Glass	Corning2319(Gorilla 2)
	IR ink Transmission Ratio	550nm@10±5% 850nm≧ 70%
	Accuracy	center: ±1mm border:±1.5mm
	Linearity	center: ±1mm border:±1.5mm
	Report Rate Test	≧90 HZ
	Connection Type	AYF530865

Note 1: Viewing direction is all four directions.

Note 2: Requirements on Environmental Protection: Q/S0002

Note 3: LCM weight tolerance: ± 5%

2 Input/Output Terminals

2.1 TFT LCD Pin Assignment

Recommend connector type: FH35C-25S-0.3SHW

No	Symbol	I/O	Description	Comment
1	GND	P	Power Ground	
2	DSI_D1P	I/O	MIPI lane 1+	
3	DSI_D1N	I/O	MIPI lane 1-	
4	GND	P	Power Ground	
5	DSI_CP	I/O	MIPI clock +	
6	DSI_CN	I/O	MIPI clock -	
7	GND	P	Power Ground	
8	DSI_D0P	I/O	MIPI lane 0+	
9	DSI_D0N	I/O	MIPI lane 0-	
10	GND	P	Power Ground	
11	GND	P	Power Ground	
12	IOVDD	P	I/O Logic power (1.8V)	
13	GND	P	Power Ground	
14	VDD	P	Analog power 2.8V	
15	GND	P	Power Ground	
16	MIPI_MODE	I	command/vedio mode selection 0: command mode 1：vedio mode	
17	GND	P	Power Ground	
18	RST	I	RESET ACTIVE LOW	
19	GND	P	Power Ground	
20	TE	O	tearing effect output	
21	IC_ID	O	LCM ID Pin for customer identify IC_ID connect to IOVDD	
22	GND	P	Power Ground	
23	LEDA	P	LED anode	
24	LEDK	P	LED cathode	
25	GND	P	Power Ground	

Note1: I/O definition: I-----Input O---Output P----Power/Ground

2.2 CTP Pin Assignment

Recommend connector type: AYF530865

Pin No.	Symbol	Description	Remark
1	GND	Ground	
2	TOUCH_VDD	CTP power supply	
3	TOUCH_AVDD	Analog power	
4	TOUCH_CHG	State change interrupt	
5	TOUCH_RESET	Reset low; has internal 20K to 60Kohm pull up resistor	
6	TOUCH_I2C_SDA	I2C data input and output	
7	TOUCH_I2C_SCL	I2C clock input	
8	GND	Ground	

Note 1: For more information, please refer to MXT224S specification.

3 Absolute Maximum Ratings

Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	IOVDD(LCD)	-0.3	3.6	V	
Power Supply Voltage	VDD(LCD)	-0.3	5.5	V	
Logic Input voltage	I/O PINS(LCD)	-0.3	IOVDD+0.5	V	
Power Supply Voltage	VDD(CTP)	1.71	3.47	V	Under 50 mv noise when across frequency range 1HZ to 1MHZ
Power Supply Voltage	AVDD(CTP)	2.57	3.47	V	
Back Light Forward Current	ILED		25	mA	One LED
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

4 Electrical Characteristics

4.1 Driving TFT LCD

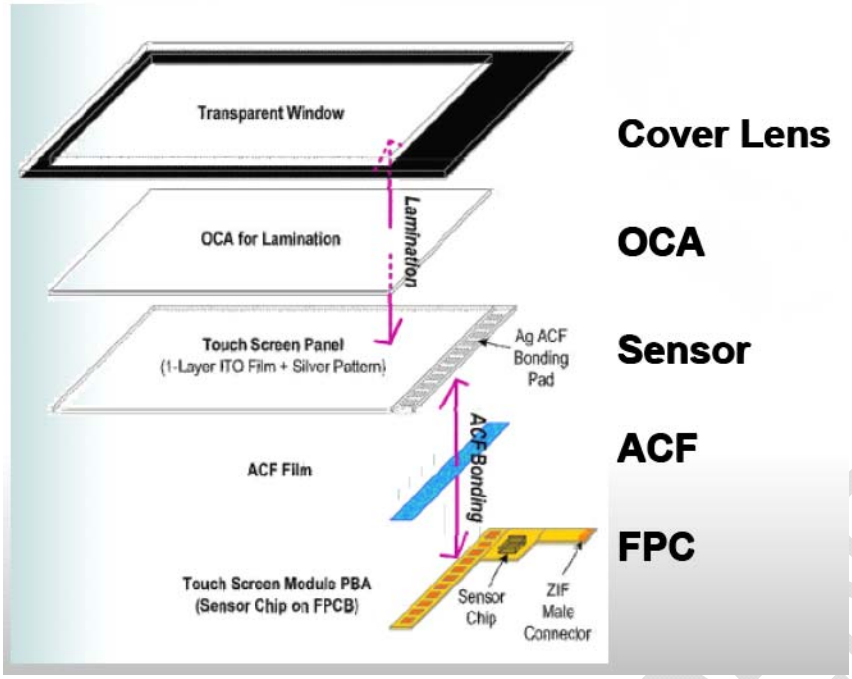
GND=0V, Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage		IOVDD	1.65	1.8/2.8	3.3	V	
Power Supply Voltage		VDD	2.3	2.8	3.3	V	
Input Signal Voltage	Low Level	V_{IL}	GND	--	0.3* IOVDD	V	
	High Level	V_{IH}	0.7* IOVDD	--	IOVDD	V	
Output Signal Voltage	Low Level	V_{OL}	0	--	0.2* IOVDD	V	
	High Level	V_{OH}	0.8* IOVDD	--	IOVDD	V	
(Panel+LSI) Power Consumption		White pattern Pvcc	--	60	90	mW	VCC=2.8V IOVCC=1.8V
		White pattern Piovcc	--	0.3	0.45	mW	VCC=2.8V IOVCC=1.8V

4.2 Driving CTP

Ta = 25℃

Item		Min	Typ	Max	Unit	Note
Power supply voltage	VDD	1.8	-	3.3	V	
	AVDD	2.7	-	3.3	V	
Input Signal Voltage(/RESET,SCL,SDA)	Low Level	-0.5	-	0.3xVDD	V	VDD=2.4V to 3.3V
	Low Level	-0.5		0.2xVDD	V	VDD=1.8V to 2.4V
	High Level	0.7xVDD	-	VDD+0.5	V	VDD=1.8V to 3.3V



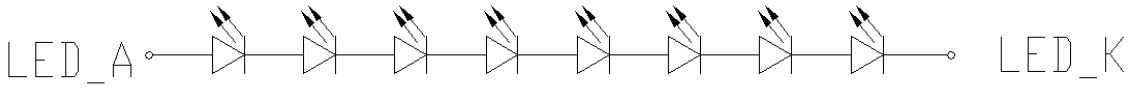
Structure of touch lens

4.3 Driving Backlight

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	--	20	25	mA	
Forward Current Voltage	V_F	23.2	25.6	27.2	V	
Backlight Power Consumption	W_{BL}	--	512	--	mW	

Note 1: Each LED: I_F=20mA, V=3.2V.



LED connection of backlight

4.4 Block Diagram

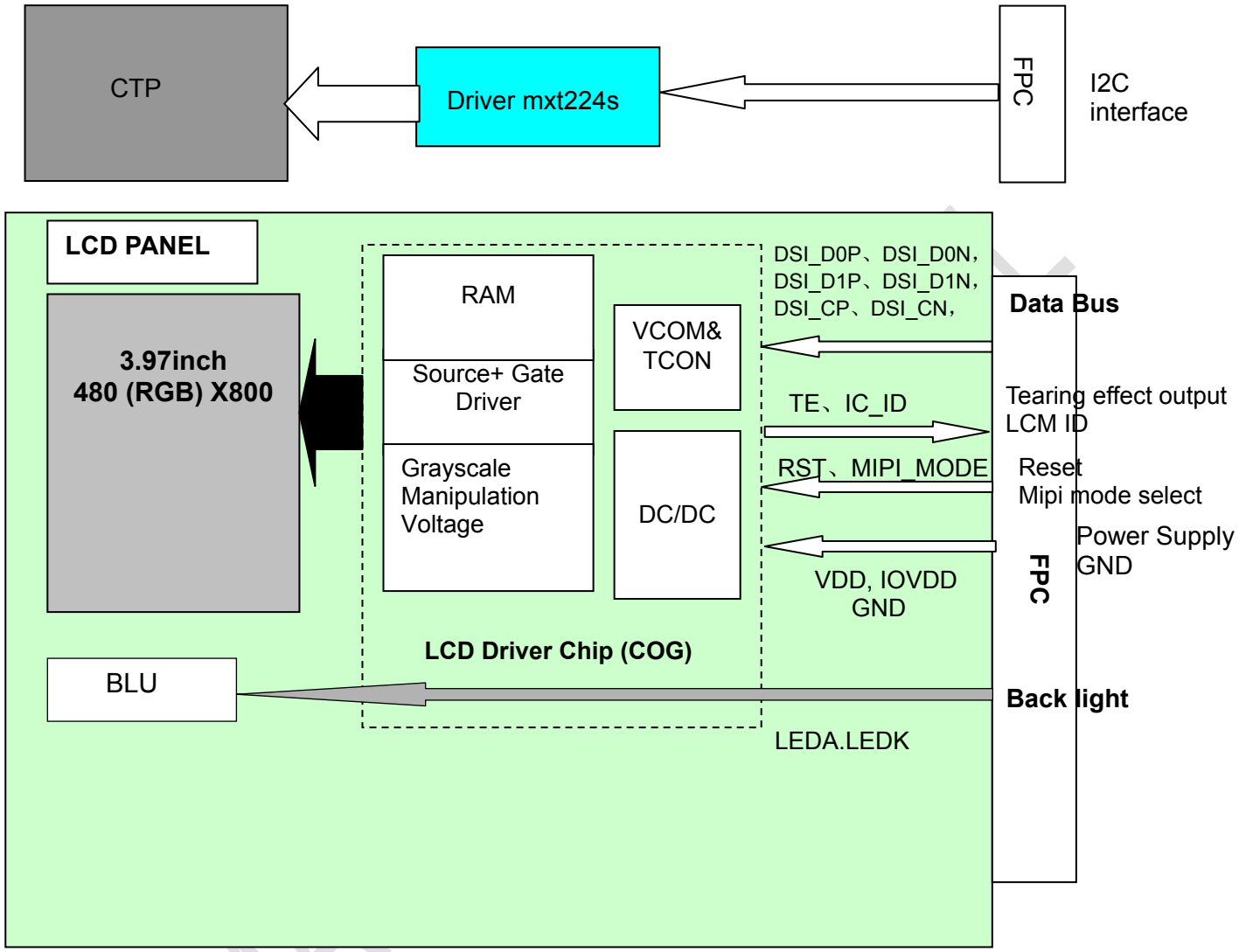


Figure 4.4.1 LCD module diagram

5 Timing Chart

5.1 MIPI Data to clock Timing Definition

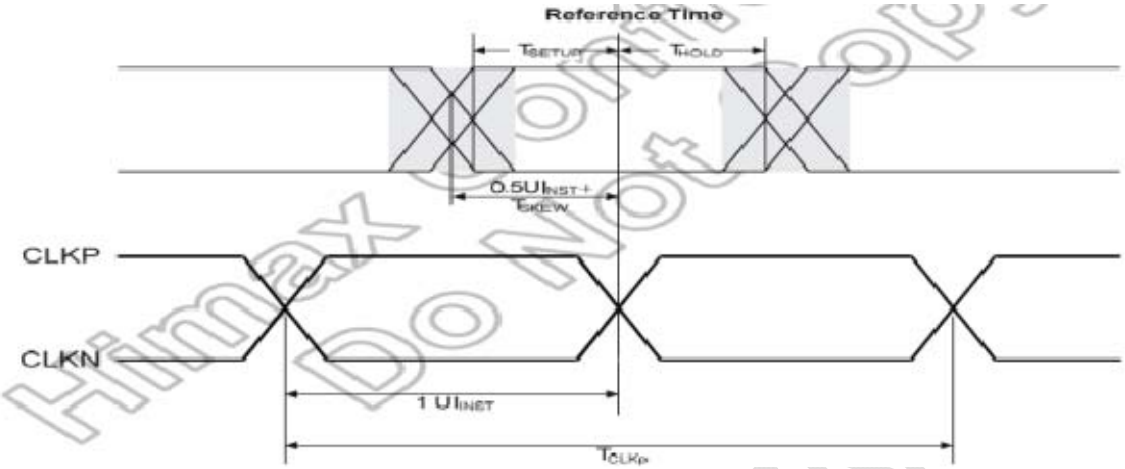


Figure 6.1.1 Data to clock Timing Definition

Parameter	Symbol	Min	Typ	Max	Unit	Note
Data to Clock Setup Time [receiver]	$T_{SETUP[RX]}$	0.15			UIINST	1
Clock to Data Hold Time [receiver]	$T_{HOLD[RX]}$	0.15			UIINST	1

Table 5.1.1 Data to Clock Timing Specifications

5.2 The Electrical Characteristics of HS and LP

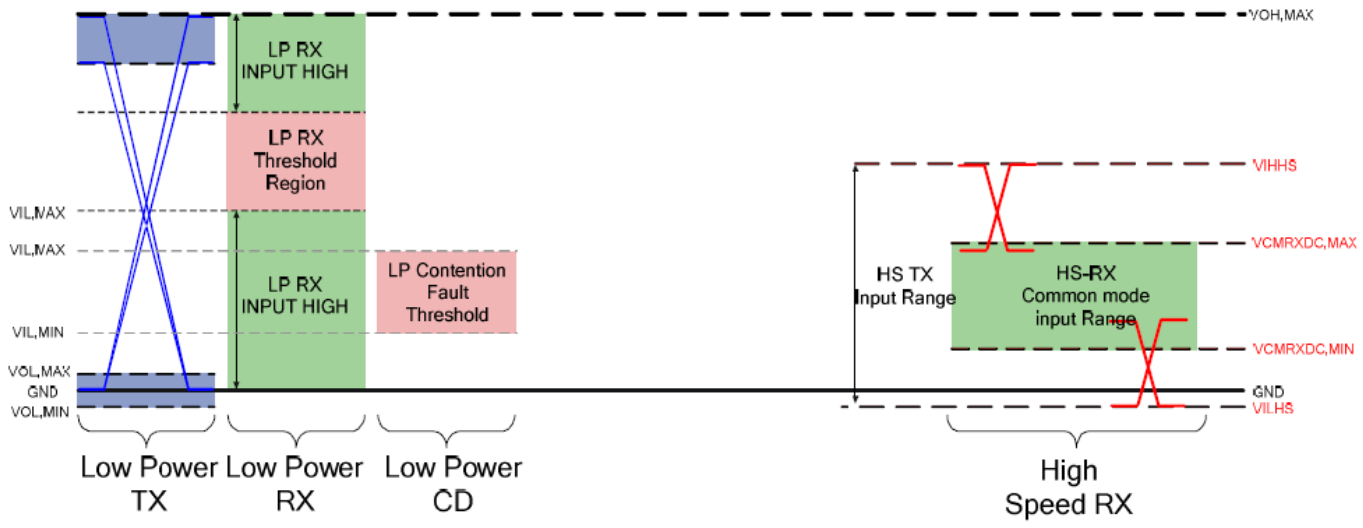


Figure 6.2.1 Shows both the HS and LP signal levels

Parameter	Description	Min	Nom	Max	Units	Note
V_{OL}	Thevenin output low level	-50		50	mV	
V_{OH}	Thevenin output high level	1.1	1.2	1.3	V	
Z_{OLP}	Output impedance of LP-TX	110			Ω	1

Table 5.2.1 LP Transmitter DC Specifications

Parameter	Description	Min	Nom	Max	Units	Note
t_{RLP}/t_{FLP}	15%-85% rise time and fall time	-	-	25	ns	1
$\delta V/\delta t_{SR}$	Slew rate @ CLOAD = 0pF	-	-	500	mV/ns	1, 3, 5, 6
	Slew rate @ CLOAD = 5pF	-	-	300	mV/ns	1, 3, 5, 6
	Slew rate @ CLOAD = 20pF	-	-	250	mV/ns	1, 3, 5, 6
	Slew rate @ CLOAD = 70pF	-	-	150	mV/ns	1, 3, 5, 6
	Slew rate @ CLOAD = 0 to 70pF (Falling Edge Only)	30	-	-	mV/ns	1, 2, 3
	Slew rate @ CLOAD = 0 to 70pF (Rising Edge Only)	30	-	-	mV/ns	1, 3, 7
	Slew rate @ CLOAD = 0 to 70pF (Rising Edge Only)	30 – 0.075 * (VO,INST – 700)	-	-	mV/ns	1, 8, 9
C_{LOAD}	Load capacitance	-	-	70	pF	

Table 5.2.2 LP Transmitter AC Specifications

5.3 High-Speed Receiver

Parameter	Description	Min	Nom	Max	Units	Note
V_{IDTH}	Differential input high threshold			70	mV	
V_{IDTL}	Differential input low threshold	-70			mV	
V_{ILHS}	Single-ended input low voltage	-40			mV	1
V_{IHHS}	Single-ended input high voltage			460	mV	1
V_{CMRXDC}	Common-mode voltage HS receive mode	70		330	mV	1, 2
Z_{ID}	Differential input impedance	80	100	125	Ω	

Table 5.3.1 HS Receiver DC Specifications

Parameter	Description	Min	Nom	Max	Units	Note
$\Delta V_{CMRX(HF)}$	Common mode interference beyond 450 MHz			100	mV_{PP}	1
C_{CM}	Common mode termination			60	pF	2

Table 5.3.2 HS Receiver AC Specifications

5.4 Low-Power Receiver

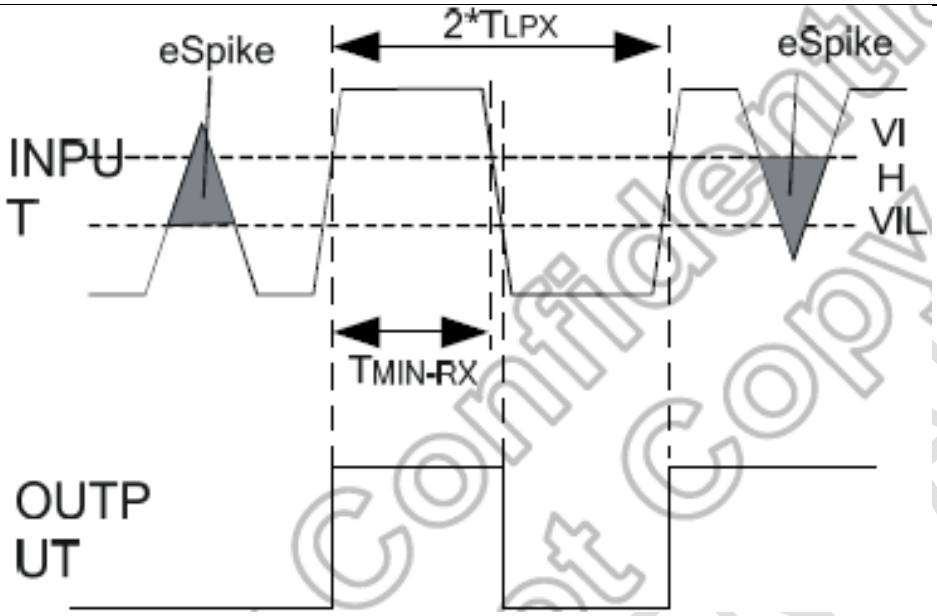


Figure 5.4.1 Input Glitch Rejections of Low-Power Receivers

Parameter	Description	Min	Nom	Max	Units	Note
V_{IL}	Logic 0 input threshold			550	mV	
V_{IH}	Logic 1 input threshold	880			mV	

Table 5.4.1 LP Receiver DC Specifications

Parameter	Description	Min	Nom	Max	Units	Note
e_{SPIKE}	Input pulse rejection			300	V.ps	1, 2, 3
T_{MIN}	Minimum pulse width response	20			ns	4
V_{INT}	Peak-to-peak interference voltage			200	mV	
f_{INT}	Interference frequency	450			MHz	

Table 5.4.2 LP Receiver AC Specifications

5.5 Reset Timing Characteristics(Ta=25℃)

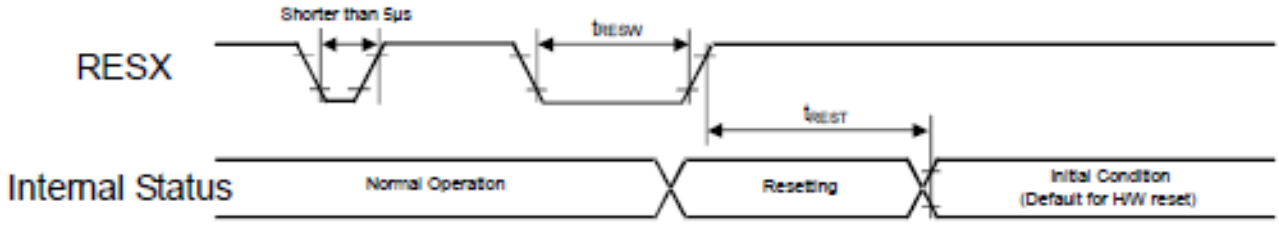
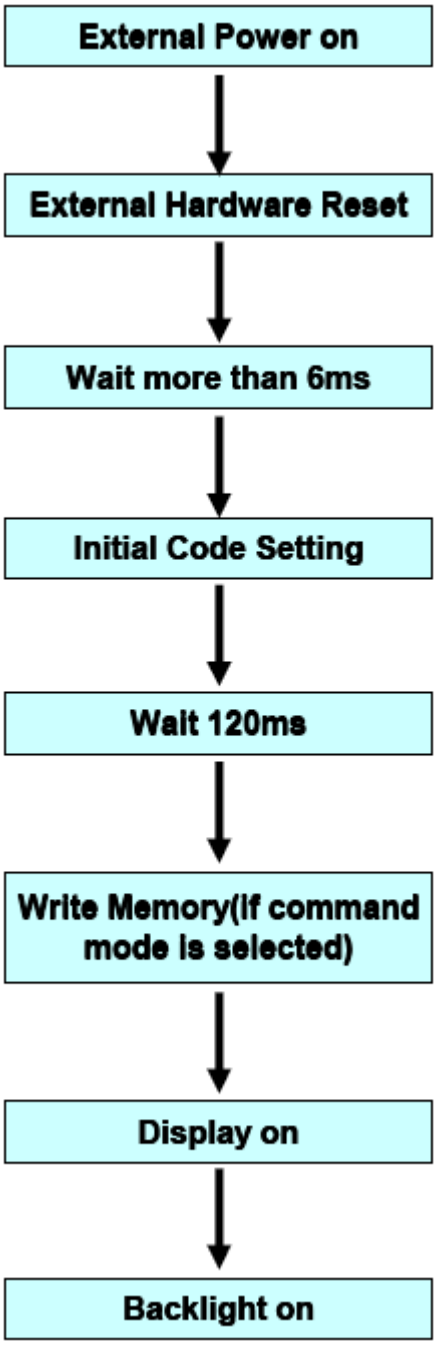


Figure 5.5.1 Reset input timing

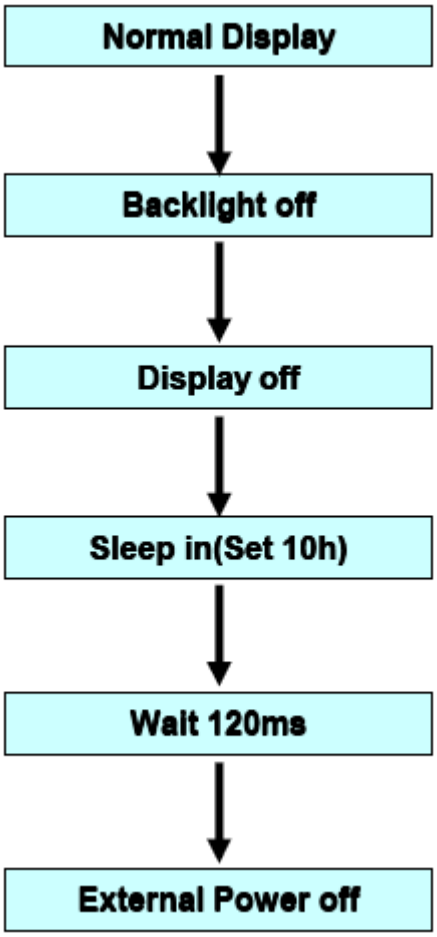
Symbol	Parameter	Related pins	Min.	Typ.	Max.	Note	Unit
t_{RESW}	Reset low pulse width(1)	RESX	10	-	-	-	μs
t_{REST}	Reset complete time(2)	-	5	-	-	When reset is applied during Sleep In mode	ms
		-	120	-	-	When reset is applied during Sleep Out mode	ms

Table 5.5.1 Reset input timing SPEC

5.6 Power On Sequence

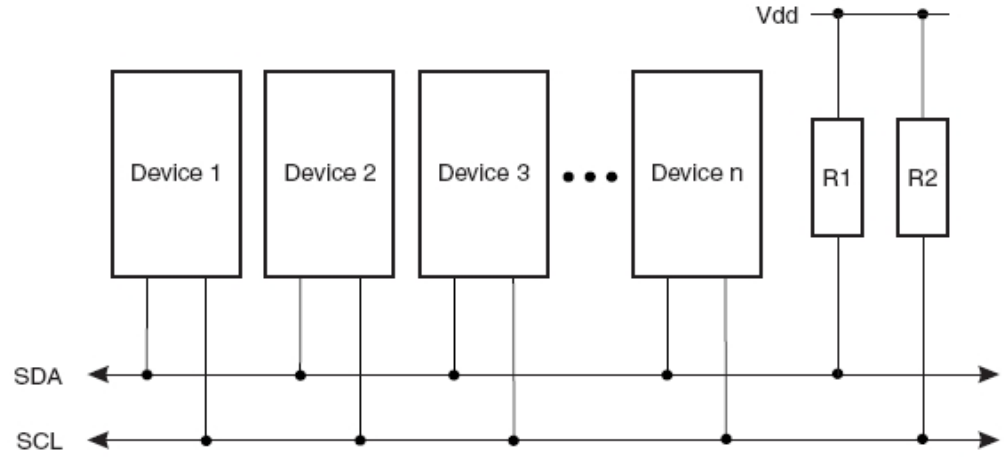


5.7 Power off Sequence



5.8 CTP Timing

Note: Please refer to MXT224S data sheet for more details.
MXT224S supports the I2C interface, which can be used by a host processor or other devices. The overview of the bus is shown in Fig 6.8.1:



5.8.1 . I2C serial data transfer format

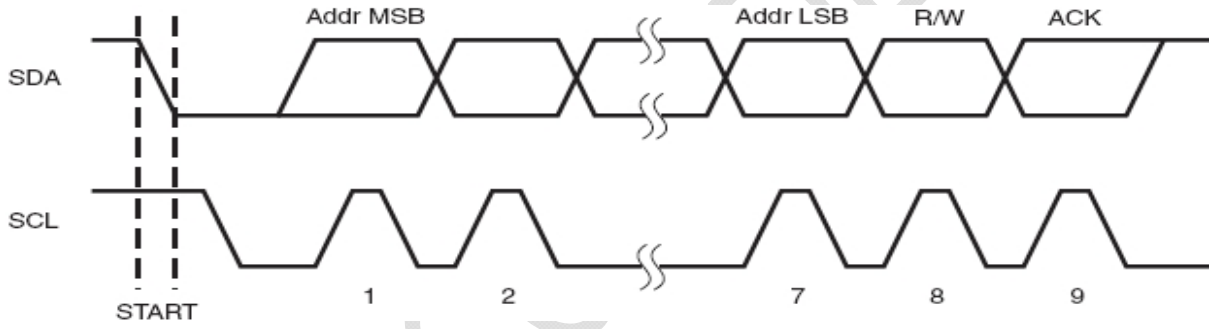


Fig 5.8.2 . Address Byte Format

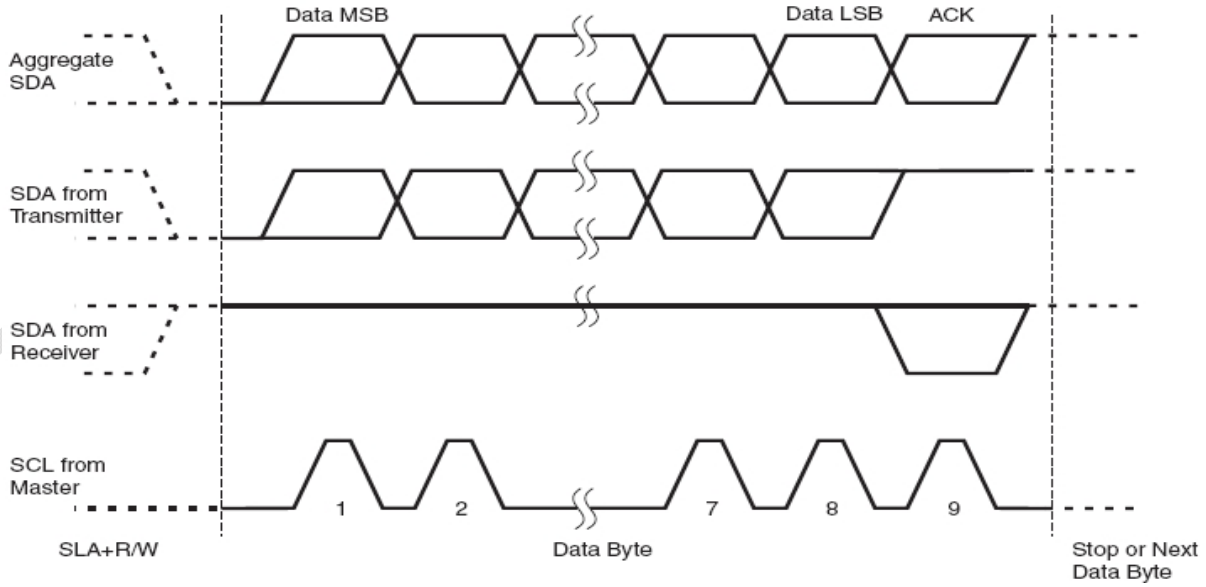
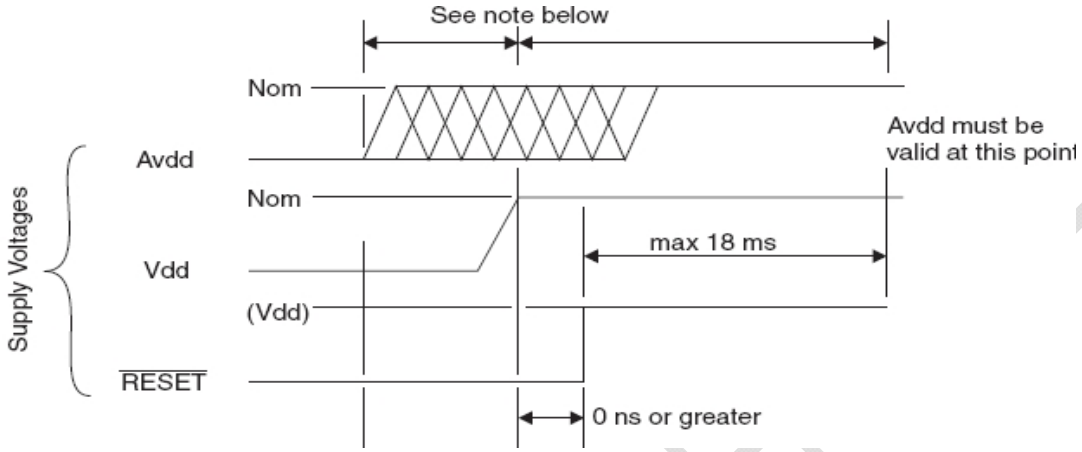


Fig 5.8.3. Data Byte Format

5.9 CTP Power-Up/RESET

There is an internal Power-on Reset(POR) in the device.
The device must be held in /RESET(active low) while the digital power supply(Vdd) is powering up. If a slope or slew is applied to the digital supply, Vdd must reach its nominal value before the /RESET signal is deasserted (that is, goes high), This is shown Fig :



Note: AVdd can be powered up before Vdd or a maximum of 18ms after Vdd is valid or Reset is released.

6 T-LCM Optical Characteristics

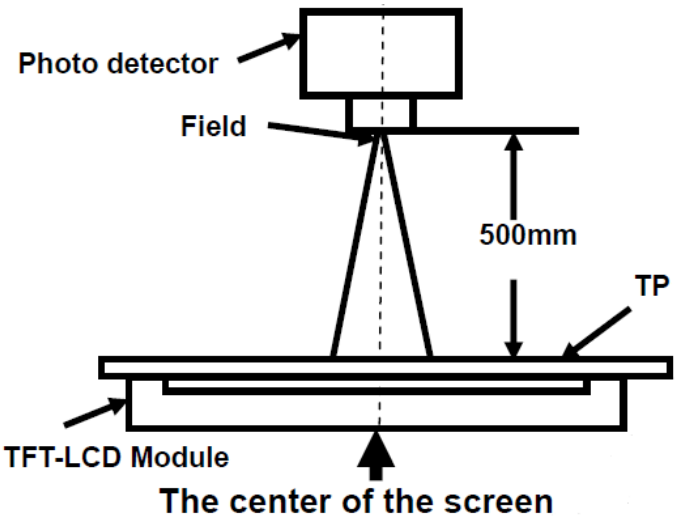
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	70	80		Degree	Note2,3
		θB		70	80			
		θL		70	80			
		θR		70	80			
Contrast Ratio		CR	θ=0°	600	800			Note 3
Response Time		T_{ON}	25℃		25	35	ms	Note 4
		T_{OFF}						
Chromaticity	**White**	x	Backlight is on	0.255	0.295	0.335		Note 1,5
		y		0.281	0.321	0.361		
	Red	x		0.582	0.622	0.662		Note 1,5
		y		0.285	0.325	0.365		
	Green	x		0.279	0.319	0.359		Note 1,5
		y		0.581	0.621	0.661		
	Blue	x		0.115	0.155	0.195		Note 1,5
		y		0.019	0.059	0.099		
Uniformity		U		80	85		%	Note 6
NTSC				62	67		%	Note 5
Luminance		L		450	500		cd/m^2	Note 7

Test Conditions:

1. I_F= 20 mA, and the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

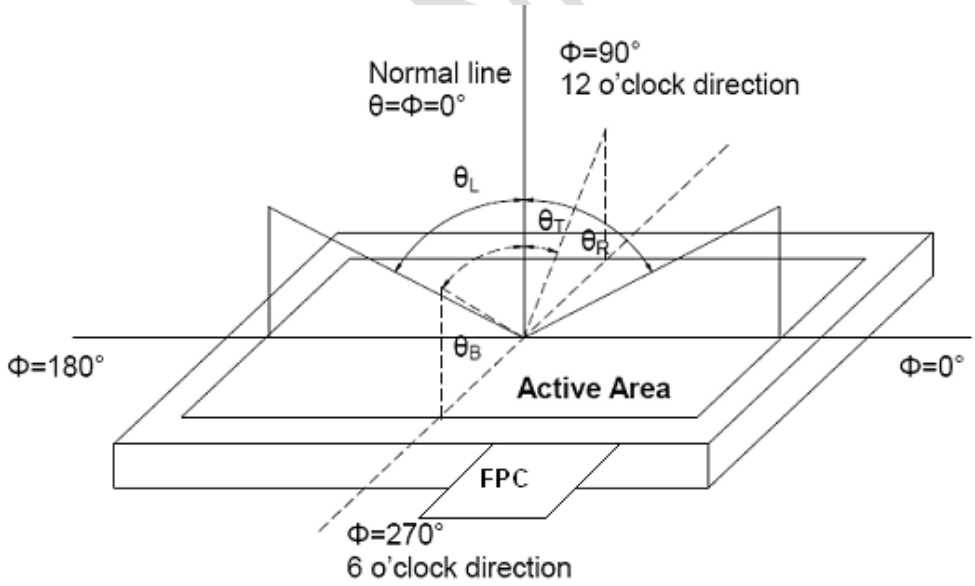
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。



Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

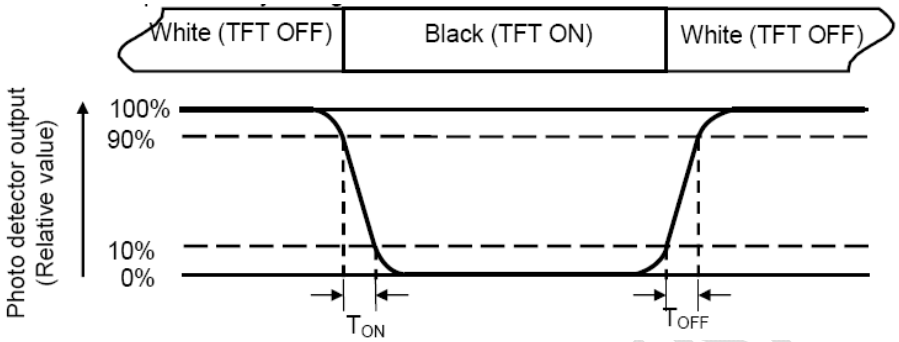
"White state ": The state is that the LCD should drive by Vwhite.

"Black state": The state is that the LCD should drive by Vblack.

Vwhite: To be determined Vblack: To be determined.

Note 4: Definition of Response time

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



Note 5: Definition of color chromaticity (CIE1931)

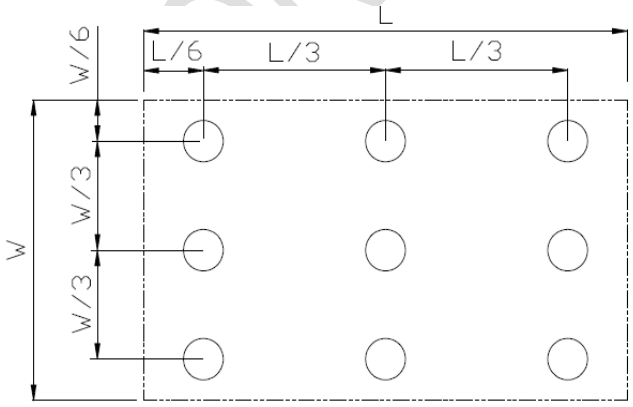
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/ Lmax

L-------Active area length W----- Active area width



Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

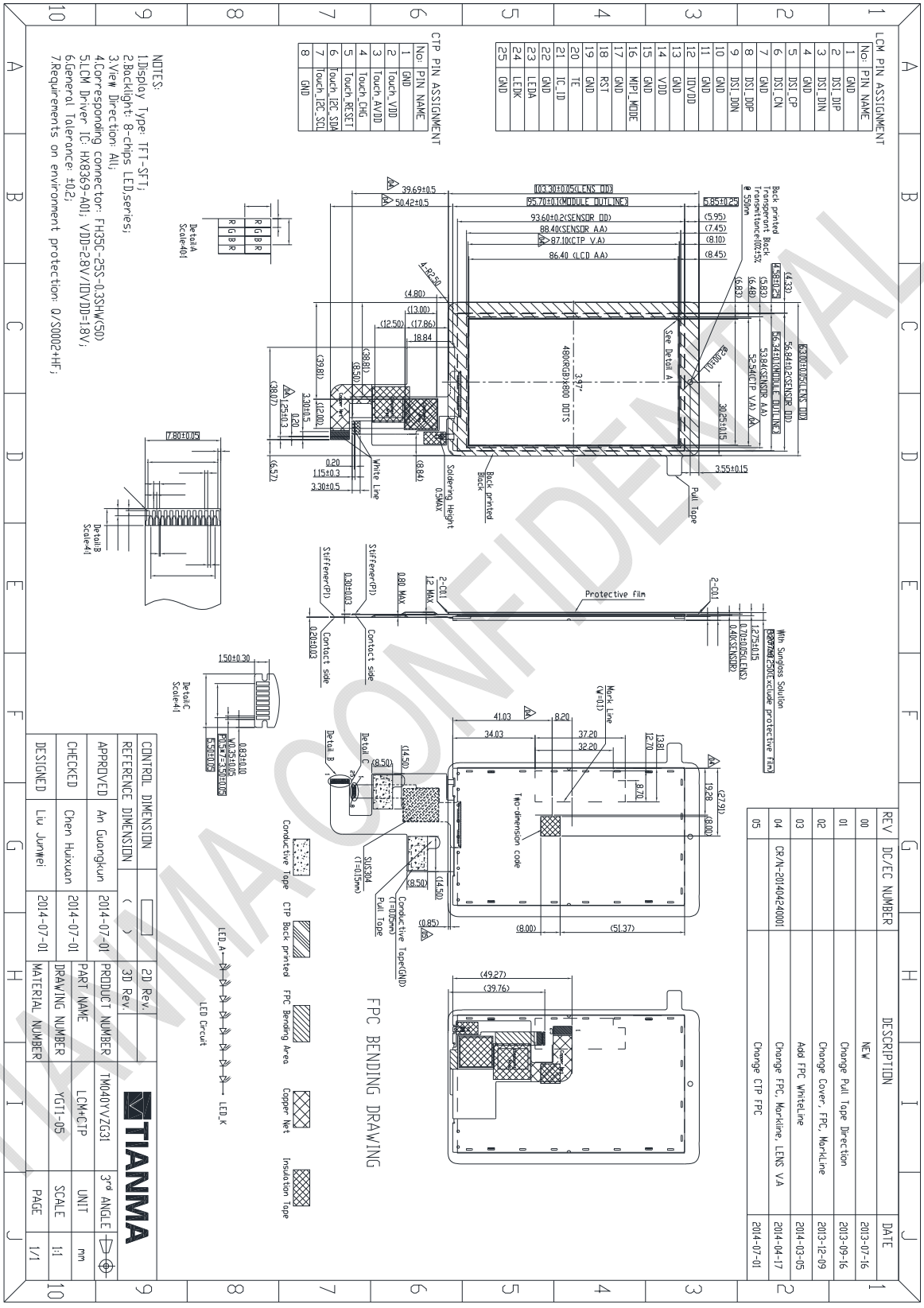
7 Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature with Humidity Operation Test	Ta = 60°C 50% RH continue 24hrs	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	Ta = -20℃，24hrs, Perform well during 24 hours	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta = +70℃, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta = -30℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	High Temperature & Humidity Storage	Ta=+60℃, RH=90%, 240 hours	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock Test	-30℃ 30 min~+80℃ 30 min, Change time:5min, 20 Cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
7	ESD	C=150pF、R=330Ω Air: ±18KV Contact:±4KV 5points, 5times/point (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006
8	Vibration Test	1.Test condition: Non-Operation 2.Acceleration:1.5G,±X,Y,Z axis condition, 30minutes each axis.	
9	Shock Test	Half Sine Wave 60G ,6ms,±X,±Y,±Z 3times for each direction	
10	Drop Test(package state)	Height: follow ISTA standard1corner,3edges,6surfaces, Each direction drop 1 time ISTA standard Gross weight, m , 總重量Kg (lbs) / Drop height, 落下高度cm (in) 0.0 (0) < m ≦ 9.1 (20) — 91 (36) 9.1 (20) < m ≦ 18.2 (40) — 76 (30 18.2 (40) < m ≦ 27.2 (60) — 61 (24) 27.2 (60) < m — 46 (18)	IEC60068-2-32 GB/T2423.8
11	Impact test (Touch panel, including sensing and cover glasses, Steel Ball Drop test)	130g steel ball, diameter 32mm, drop height 10cm, Gap X1 = 0.1 mm X2 = 1.0 mm Y = 10 cm Position : each position 1~9, one time (Note 5)	Pass criteria : No crack

Note1: Ta is the ambient temperature of sample.

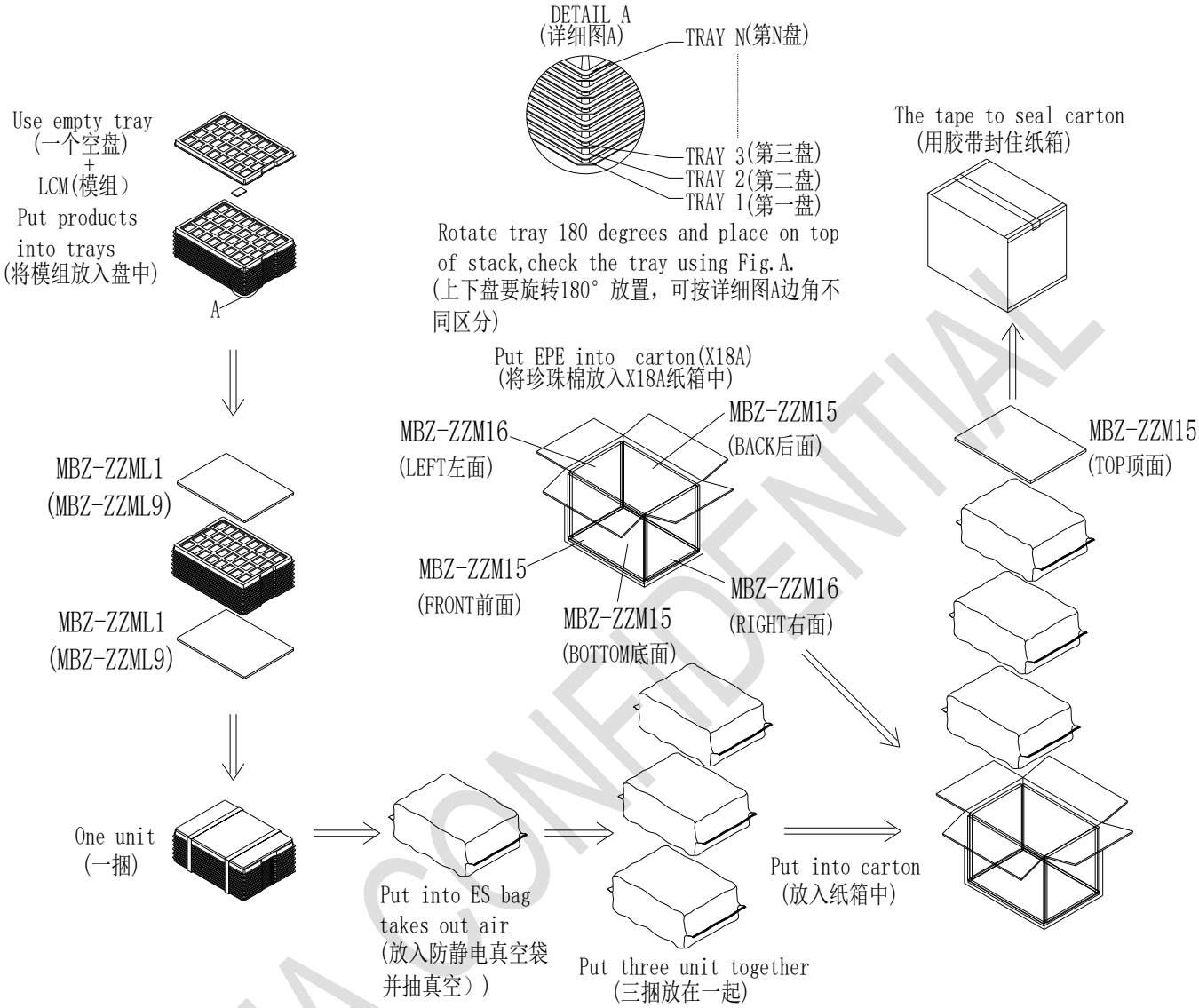
Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

8. Mechanical Drawing



9 Packing Drawing

No. (序号)	Item（项目）	Model(Material) (材料型号)	Dimensions(mm) （规格）	Unit Weight(Kg)（单个重量）	Quantity（数量）	Remark (备注）
1	LCM module（模组型号）	TM040YVZG31	65×104×3.28mm	0.040	108	
2	Tray（吸塑盘）	TM040YVZG31 YBZ1-00	251×351×13.1	0.0984	30	Anti-static
3	EPE（珍珠棉1）	MBZ-ZZML1	336×246×6mm	0.01	6	
4	EPE（珍珠棉2）	MBZ-ZZM15	375×275×10mm	0.014	4	
5	EPE（珍珠棉3）	MBZ-ZZM16	250×280×12mm	0.015	2	
6	Carton（纸箱）	X18A	395×290×315mm	0.58	1	
7	ES bag（防静电真空包装袋）	JD13	400×520	0.042	3	
8	Total weight（总重量）	8.13+/-5% Kg				



10 Precautions for Use of LCD Modules

a. Handling Precautions

i. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

ii. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

iii. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

iv. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

v. If the display surface is contaMinated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol

— Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water

— Ketone

— Aromatic solvents

vi. Do not attempt to disassemble the LCD Module.

vii. If the logic circuit power is off, do not apply the input signals.

viii. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1 Be sure to ground the body when handling the LCD Modules.

10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

b. Storage precautions

i. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

ii. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃～ 40℃ Relatively humidity: ≤80%

iii. The LCD modules should be stored in the room without acid, alkali and harmful gas.

c. Transportation Precautions

i. The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.