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CENTRES

APOLLO DISPLAY
TECHNOLOGIES

DISTEC

DISPLAY
TECHNOLOGY

Datasheet

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MODEL NO　:　　　__TM035KVHG01__

MODEL VERSION:　　　__40__

SPEC VERSION　:　　　__2.2__

ISSUED DATE:　　　__2019-10-17__

□Preliminary Specification
■Final Product Specification

Customer : _____

Approved by	Notes

TIANMA Confirmed :

Prepared by	Checked by	Approved by
Junwen Du	Longping Deng	KimMin Hong

This technical specification is subjected to change without notice

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
2.0	2018-07-08	Final specification release	Junwen Du
2.1	2018-10-12	Update the mechanical drawing	Junwen Du
2.2	2019-10-17	Update the mechanical drawing --- change the tape	Junwen Du

1 General Specifications

Feature		Spec
Display Spec.	Size	3.5"
	Resolution	320(RGB) x 240
	Technology Type	a-Si TFT
	Pixel Configuration	R.G.B. Vertical Stripe
	Pixel pitch(mm)	0.219x0.219
	Display Mode	TM with Normally White
	Surface Treatment	Up Polarizer: Clear Type
	Viewing Direction	12 o'clock
	Gray Scale Inversion Direction	6 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	LCM: 76.9 x63.9 x2.8
		CTP+LCM: 79.9x68.9x4.38
	Active Area(mm)	TFT LCD: 70.08(W)x52.56(H)
		CTP: 71.08(W)x53.56(H)
	CTP Touch Method	Bare finger
	Number of simultaneous touches	5 points
	Minimum Touch Area	Φ6
	Finger Touch Pitch	11
	CTP Structure	GG
	With /Without TSP	With CTP
	Matching Connection Type	LCM:04-6240-054-025-846+
		CTP:FH34SRJ-6S-0.5SH
	LED Numbers	6 LEDs
	Weight (g)	45
Electrical Characteristics	Interface	RGB24bit+SPI
	Color Depth	16.7M
	Driver IC	CTP: ST1633i
		TFT: ILI9322

Note 1:   Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

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: 04-6240-054-025-846+

Pin No.	Symbol	I/O	Function	Remark
1,2	LED_Cathode	I	LED_Cathode	
3,4	LED_Anode	I	LED_Anode	
5	NC	-	No Connect	
6	RESET	I	Reset	
7	NC	-	No Connect	
8	NC	-	No Connect	
9	NC	-	No Connect	
10	NC	-	No Connect	
11	NC	-	No Connect	
12	D00	I	Data 00	
13	D01	I	Data 01	
14	D02	I	Data 02	
15	D03	I	Data 03	
16	D04	I	Data 04	
17	D05	I	Data 05	
18	D06	I	Data 06	
19	D07	I	Data 07	
20	D08	I	Data 08	
21	D09	I	Data 09	
22	D10	I	Data 10	
23	D11	I	Data 11	
24	D12	I	Data 12	
25	D13	I	Data 13	
26	D14	I	Data 14	
27	D15	I	Data 15	
28	D16	I	Data 16	
29	D17	I	Data 17	
30	D18	I	Data 18	
31	D19	I	Data 19	

32	D20	I	Data 20	
33	D21	I	Data 21	
34	D22	I	Data 22	
35	D23	I	Data 23	
36	HSYNC	I	Horizontal Synchronous Signal	
37	VSYNC	I	Vertical Synchronous Signal	
38	CLK	I	Data Clock	
39	NC	-	No Connect	
40	NC	-	No Connect	
41	VDD	P	power supply	
42	VDD	P	power supply	
43	SPENA	I	Serial port data enable signal	
44	NC	-	No Connect	
45	NC	-	No Connect	
46	NC	-	No Connect	
47	NC	-	No Connect	
48	NC	-	No Connect	
49	SPCK	I	SPI Serial Clock	
50	SPDA	I/O	SPI Serial Data Input/output	
51	NC	-	No Connect	
52	DEN	I	Data enabling signal	
53	GND	P	Ground	
54	GND	P	Ground	

Note1：I=Input O=Output, P=Power .

2.2 CTP Pin Assignment

Recommend connector type: FH34SRJ-6S-0.5SH

Pin No.	Symbol	Description	Remark
1	VDD	CTP power supply	--
2	GND	Ground	--
3	I2C RESET	Interrupt line,active low	--
4	SCL	I2C clock input	Note 1
5	SDA	I2C data input and output	Note 1
6	Global RESET (RESET)	Reset pin,active low	--

Note 1: On SDA and SCL there be pull-up resistors on customer's main board.

3 Absolute Maximum Ratings

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VCC	-0.5	5.0	V	Note1
Input voltage	V_{IN}	-0.5	5.0	V	
Operating Temperature	Top	-20	70	℃	
Storage Temperature	Tst	-30	80	℃	
Relative Humidity Note2	RH	--	≤95	%	Ta≤40℃
		--	≤85	%	40℃＜Ta≤50℃
		--	≤55	%	50℃＜Ta≤60℃
		--	≤36	%	60℃＜Ta≤70℃
		--	≤24	%	70℃＜Ta≤80℃
Absolute Humidity	AH	--	≤70	g/m³	Ta＞70℃

Table 3　Absolute Maximum Ratings

Note1: Input voltage include D00~D23, CLK, HSYNC, VSYNC, DEN, RESET,SPENA,SPCK,SPDA.

Note2: Ta means the ambient temperature.
　　　　It is necessary to limit the relative humidity to the specified temperature range.
　　　　Condensation on the module is not allowed.

4 Electrical Characteristics

4.1 Driving TFT LCD

GND=0V, Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage		VDD	2.7	3.3	3.6	V	
Input Signal Voltage	Low Level	V_{IL}	GND	-	0.3*VCC	V	
	High Level	V_{IH}	0.7*VCC	-	VCC	V	
Output Signal Voltage	Low Level	V_{OL}	GND	-	0.2*VCC	V	
	High Level	V_{OH}	0.8*VCC	-	VCC	V	
(Panel+LSI) Power Consumption	Black Mode(60HZ)			-	45.5	mW	
	Standby Mode			-	1.85	mW	

4.2 Driving Backlight

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	--	20	25	mA	For each LED
Forward Voltage	V_F	3.0	3.2	3.6	V	
Backlight Power Consumption	W_{BL}	--	384	540	mW	
Operating Lifetime	--	10000	20000	--	hrs	Note3

Table 4.2.1 backlight unit electrical characteristics

Note 1: The figure below shows the connection of backlight LED.

CIRCUIT DIAGRAM
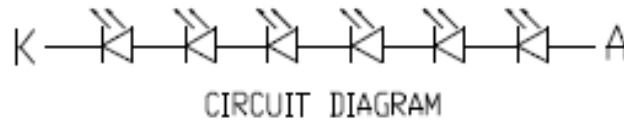
Figure 4.2.1 LED backlight circuit

Note 2: One LED : I_F =20 mA, V_F =3.2V

Note 3: I_F is defined for one channel LED.

Optical performance should be evaluated at Ta=25℃ only.

If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

4.3 Block Diagram
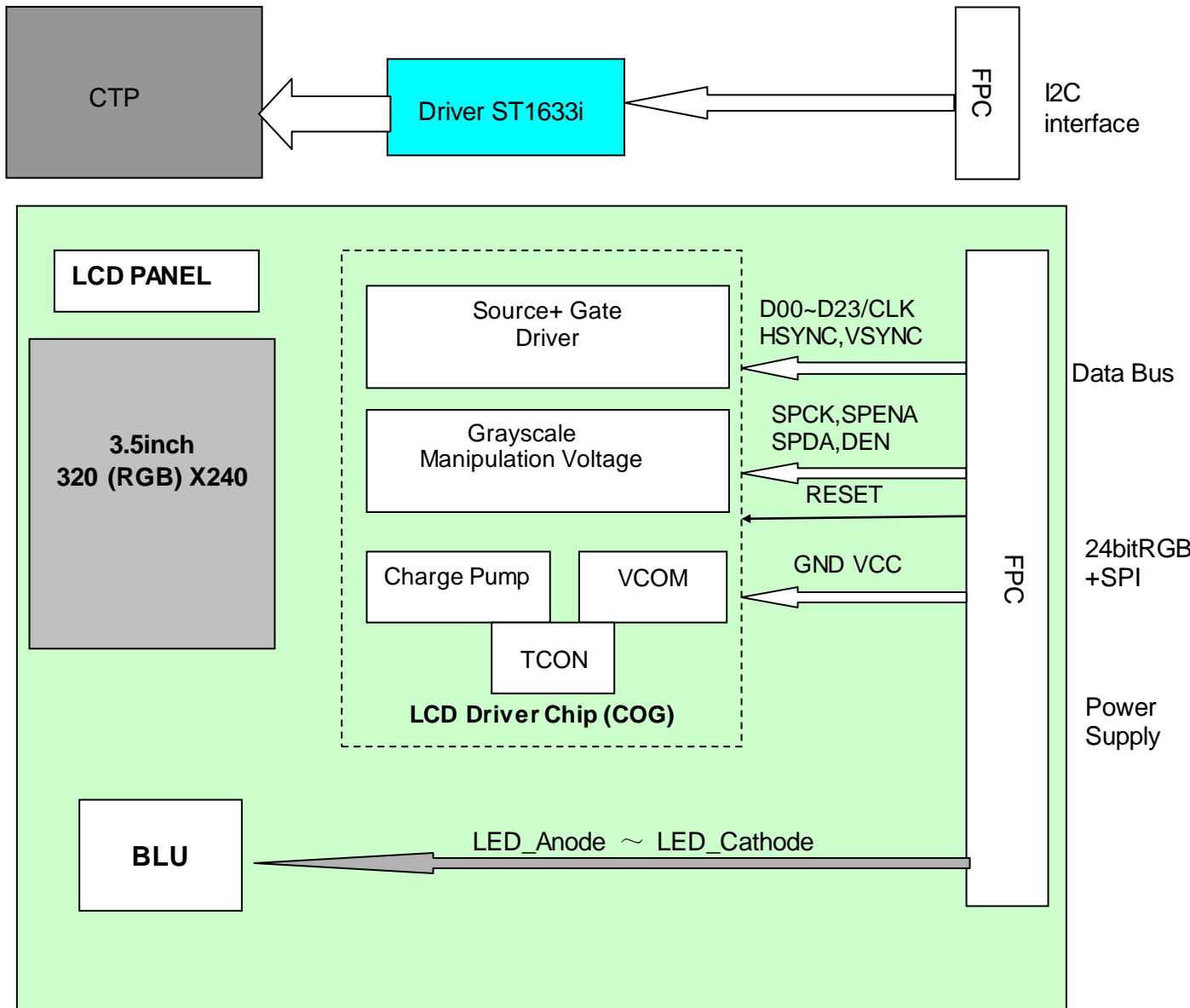
5   Timing Chart

5.1 24bit RGB Mode for 320RGB x 240

(VCC=3.3V GND =0V,Ta=25℃)

Parameter	Symbol	Min	Typ	Max	Unit	Condition
DCLK Frequency	1/tDCLK	-	6.4	11	MHz	
Horizontal Period	th	-	408	-	tDCLK	
Horizontal Display Period	thd	320	320	320	tDCLK	
Horizontal Back Porch	thb	-	38	-	tDCLK	
Horizontal Front Porch	thf	-	50	-	tDCLK	
Horizontal Pulse Width	hp	1	1	-	tDCLK	
Vertical Period	tv	-	262	-	th	
Vertical Display Period	tvd	240	240	240	th	
Vertical Back Porch	tvb	2	18	-	th	
Vertical Front Porch	tvf	2	4	-	th	
Vertical Pulse Width	tvp	1	1	-	th	
Data setup time	tsu	12	-	-	ns	
Data hold time	thold	12	-	-	ns	

Note: Horizontal Back porch + Horizontal front porch >= 50
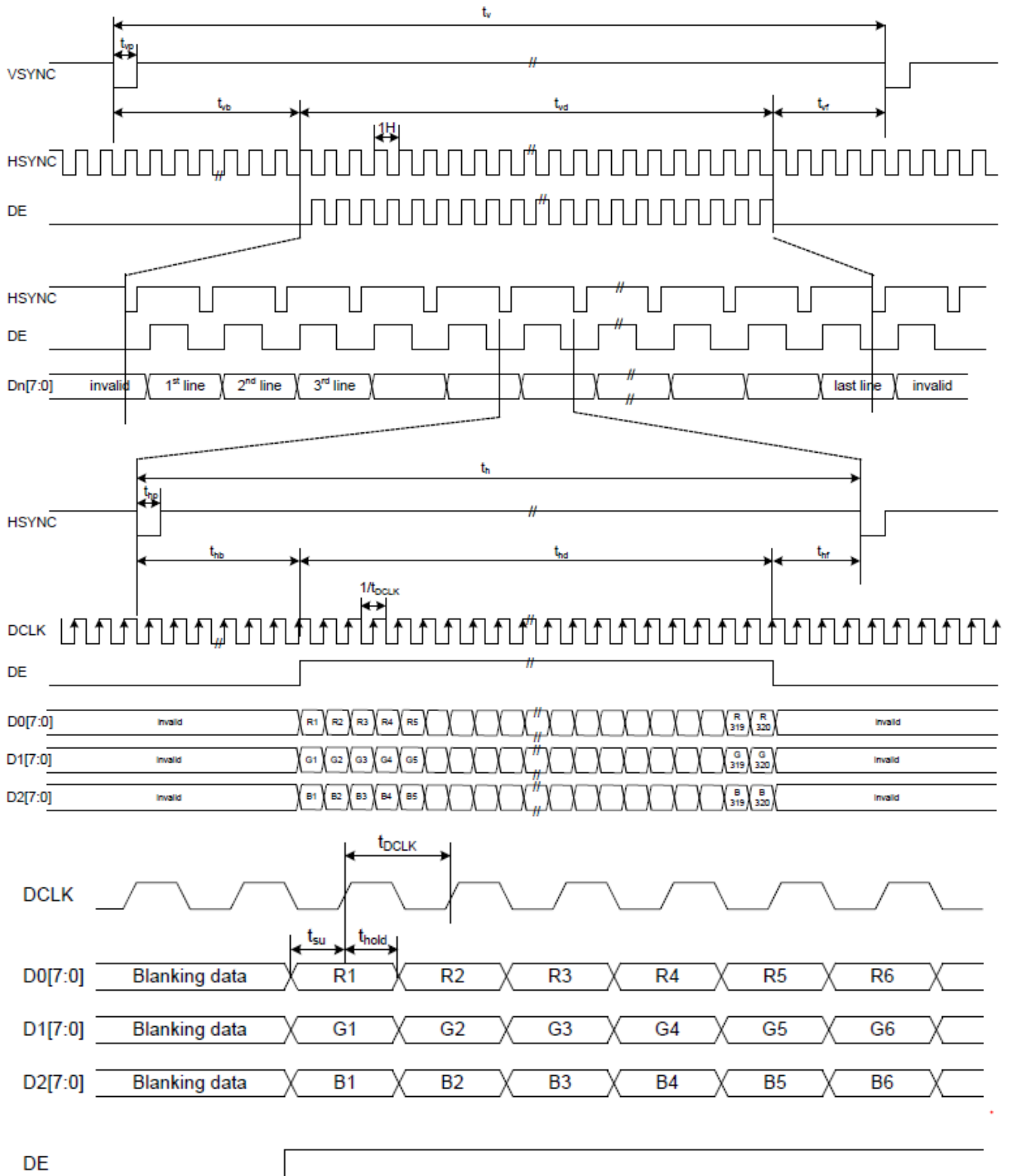
5.2 3 wire SPI Timing

SPI Timing Specification

Items	Symbol	Min.	Typ.	Max.	Unit	Note
CSB to SCL Setup time	t_{CS}	50	-	-	ns	
CSB to SCL Hold time	t_{CE}	50	-	-	ns	
SCL Period	t_{SCK}	50	-	-	ns	
SCL High Period	t_{SKH}	25	-	-	ns	
SCL Low Period	t_{SKL}	25	-	-	ns	
Data Setup Time	t_{SU}	15	-	-	ns	
Data Hold Time	t_{HD}	15	-	-	ns	
CSB High Pulse Period	t_{CH}	50	-	-	ns	
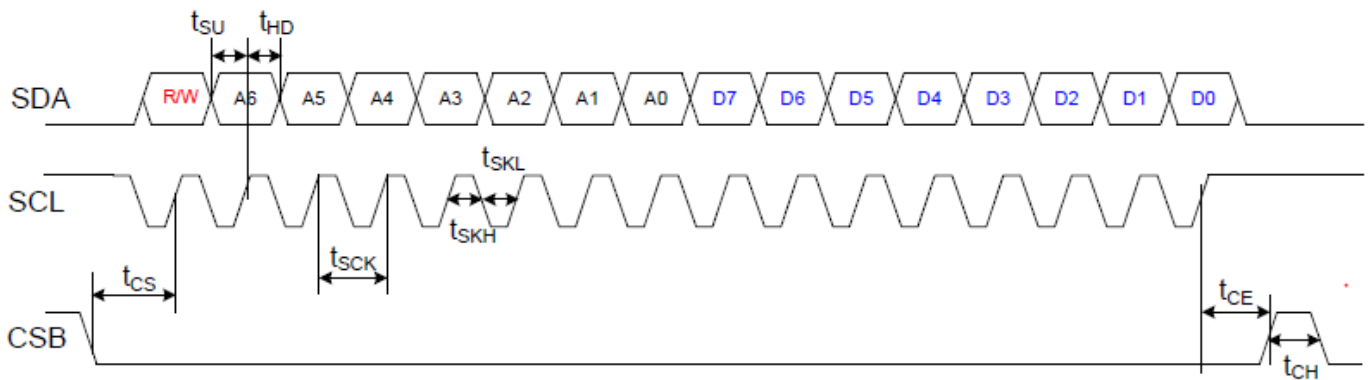
R/W=1, Read Mode
R/W=0, Write Mode
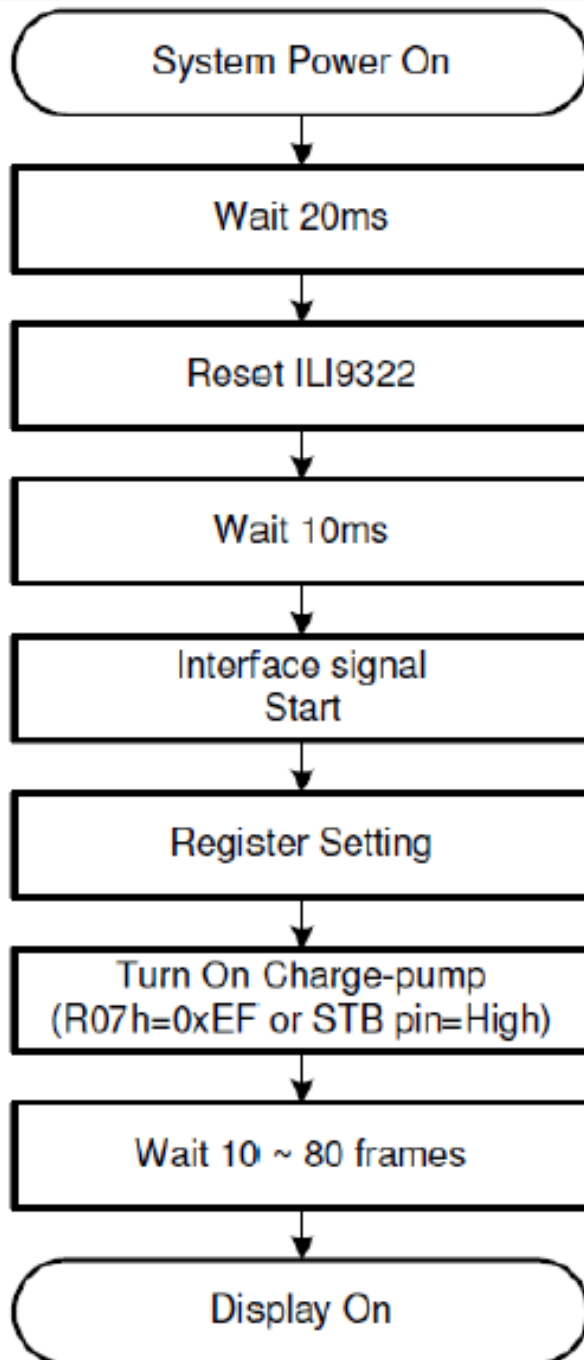
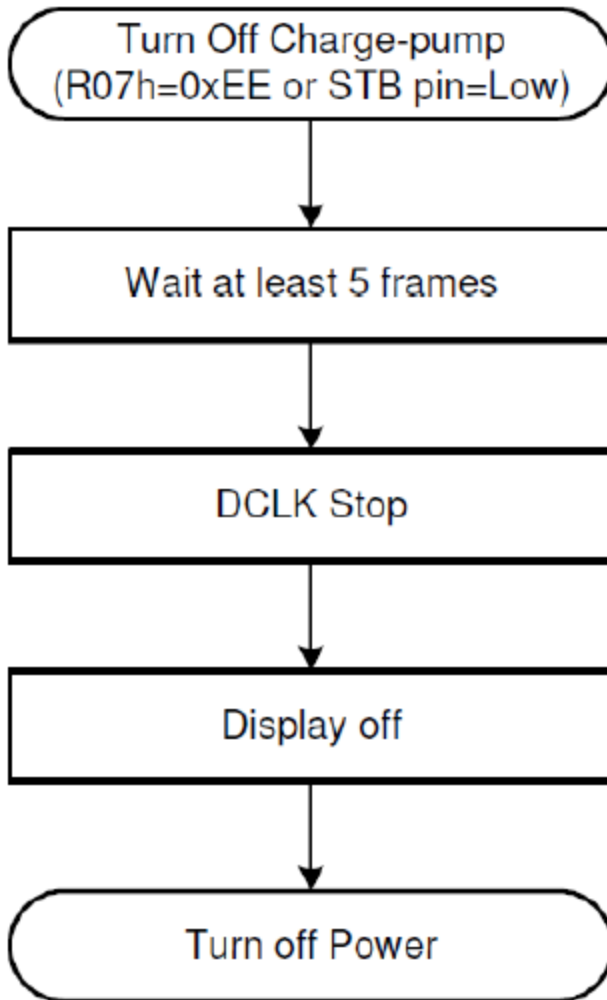**Figure8 Power On Sequence Flow Chart**

5.4 Power On Sequence

Figure10 Power Off Sequence Flow Chart

6   Capacitive Touch Panel

6.1   Touch Panel Module Characteristics

Item	Description	Note
Driver IC	ST1633I	
Multi Touch Suppor	5 fingers	Add Gesture
Interface	I2C	
Surface hardness	≥7H	
Slave Address	0X70	
Host SCL,SDA Pull-Up Resistance	On customer's board	

6.2   Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit	Remark
Operating Temperature	TOP	-20	--	+70	℃	
Storage Temperature	TST	-30		+80	℃	
Input voltage range	VDDTP	-0.3	--	+6.0	V	
Static Electricity	Be sure that you are grounded when handing TP					

Note1: If the module exceeds the absolute maximum ratings, it may be damaged permanently .Also, if the module operated with the absolute maximum ratings for a long time, its reliability may drop.

6.3 DC Electrical Characteristics

Condition: VDD=IOVDD=3.3V,T$_A$=25℃,unless be specified individually.

Item		Symbol	Test Condition	MIN	TYP	MAX	Unit	Remark
Power Supply		V$_{DDTP}$		2.7	3.3	3.6	V	
I/O Power Supply		IOVCC		1.6	3.3	3.6	V	
Input Signal Voltage	High Level	V$_{IH}$		0.85*IOVCC	--	--	V	
	Low Level	V$_{IL}$		--	--	0.15*IOVCC	V	
Operating Current		I$_{NML}$	21TX,12RX	--	--	21	mA	
Idle Current		I$_{IDLE}$	21TX,12RX,scan rate=20Hz	--	--	21	mA	
Power Down Current		I$_{PD}$		--	--	20	uA	
Input Pull Up Resistor		Rpu		50	--	60	Kohm	
Output Driving Current		I$_{DRV}$	V$_{OH}$=IOVDDx0.8	6	--	--	mA	
Output Sinking Current		I$_{SINK}$	V$_{OL}$=IOVDDx0.2	10	--	--	mA	
Low Voltage Reset		V$_{LVR}$		--	--	2.3	V	

6.4 AC Electrical Characteristics

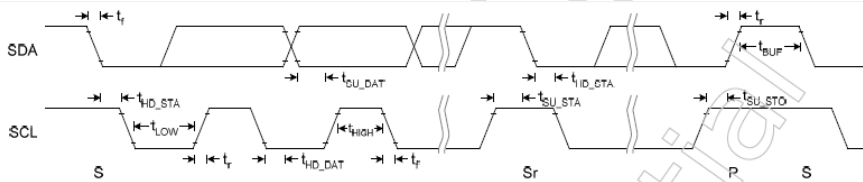
Figure 5-1   I2C Fast Mode Timing

Table 5-3   I2C Fast Mode Timing Characteristic

Conditions: VDD = 3.3V, GND = 0V, T$_A$ = 25°C

Symbol	Parameter	Rating			Unit
		Min.	Typ.	Max.	
f$_{SCL}$	SCL clock frequency	0	-	400	kHz
t$_{LOW}$	Low period of the SCL clock	1.3	-	-	us
t$_{HIGH}$	High period of the SCL clock	0.6	-	-	us
t$_f$	Signal falling time	-	-	300	ns
t$_r$	Signal rising time	-	-	300	ns
t$_{SU\_STA}$	Set up time for a repeated START condition	0.6	-	-	us
t$_{HD\_STA}$	Hold time (repeated) START condition. After this period, the first clock pulse is generated	0.6	-	-	us
t$_{SU\_DAT}$	Data set up time	100	-	-	ns
t$_{HD\_DAT}$	Data hold time	0	-	0.9	us
t$_{SU\_STO}$	Set up time for STOP condition	0.6	-	-	us
t$_{BUF}$	Bus free time between a STOP and START condition	1.3	-	-	us
C$_b$	Capacitive load for each bus line	-	-	400	pF

6.5   System management

6.5.1 Reset

Master can reset ST1633i through RESET pin. RESET pin is low active and needs hold low for 1us to take effect.
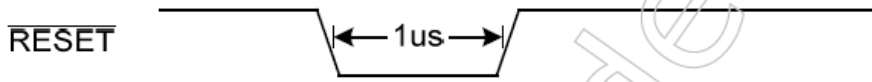

Figure 3-1 $\overline{\text{RESET}}$ Pin Low Pulse Width

6.5.2 Power On/Off Sequence

RESET pin should be held low before power on and power off. During power on, after both VDD and IOVDD reach normal voltage, RESET pin needs to be held low for 5ms to ensure internal block stable.
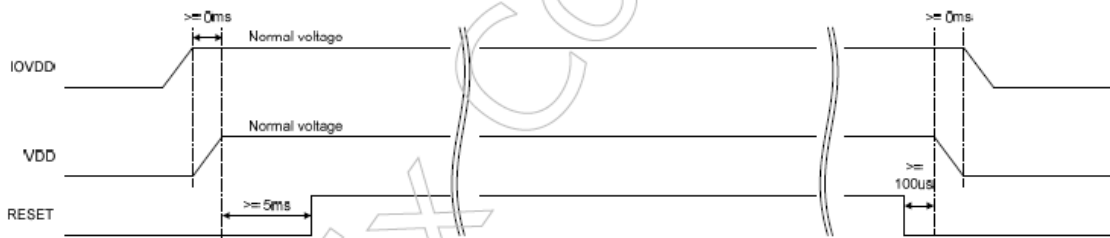

Figure 3-2   Power On/Off Sequence

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7 Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR ≧ 10	50	60	-	Degree	Note2,3
		θB		60	70	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	θ=0°	400	500	-		Note 3
Response Time		T_ON	25℃	-	20	30	ms	Note 4
		T_OFF						
Chromaticity	**White**	x	Backlight is on	0.263	0.303	0.343		Note 1,5
		y		0.277	0.317	0.357		
	Red	x		0.573	0.613	0.653		Note 1,5
		y		0.303	0.343	0.383		
	Green	x		0.308	0.348	0.388		Note 1,5
		y		0.550	0.590	0.630		
	Blue	x		0.117	0.157	0.197		Note 1,5
		y		0.027	0.067	0.107		
Uniformity		U		75	80		%	Note 6
NTSC				55	60		%	Note 5
Luminance		L		320	400		cd/m^2	Note 7

Test Conditions:

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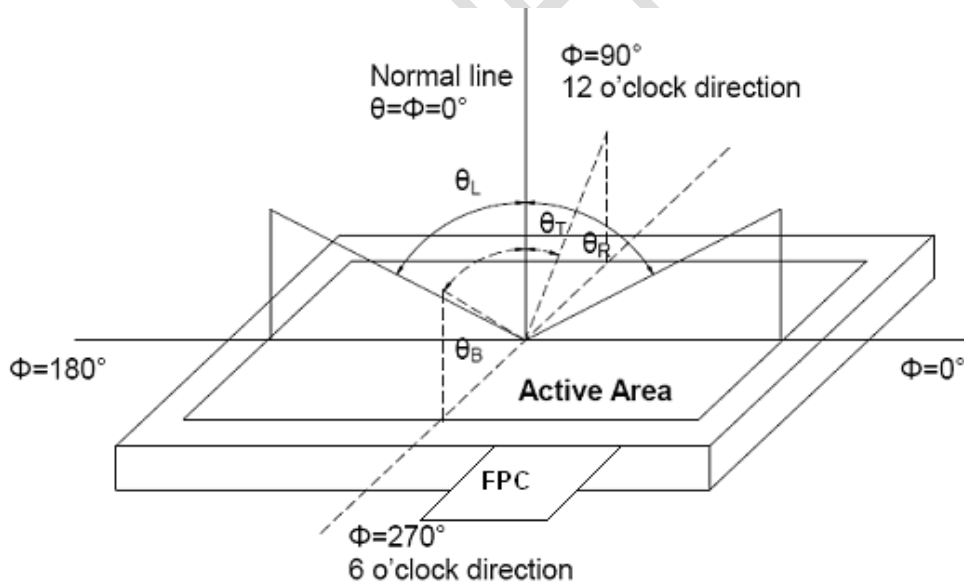
2. The test systems refer to Note 1 and Note 2.

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.

Photo detector

Field

500mm

TFT-LCD Module

LCD Panel

The center of the screen
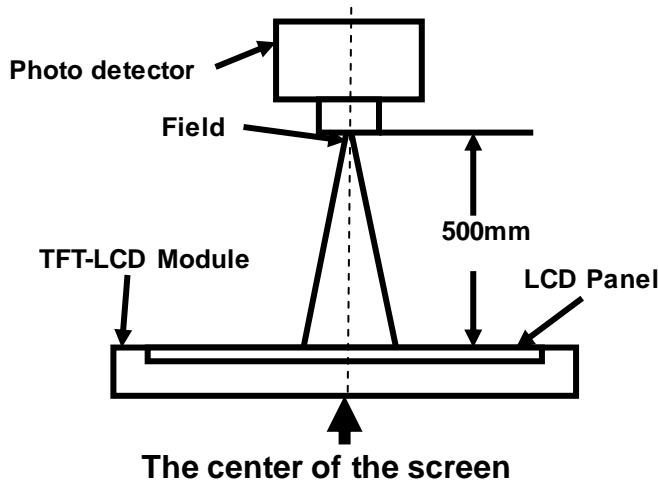
Note 2:   Definition of viewing angle range and measurement system.

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

Normal line
θ=Φ=0°

Φ=90°
12 o'clock direction

θ_L

θ_T

θ_R

Φ=180°

θ_B

Active Area

Φ=0°

FPC

Φ=270°
6 o'clock direction

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%.
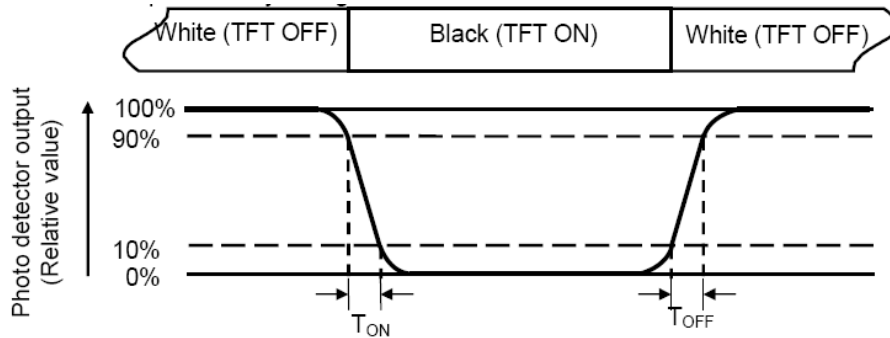
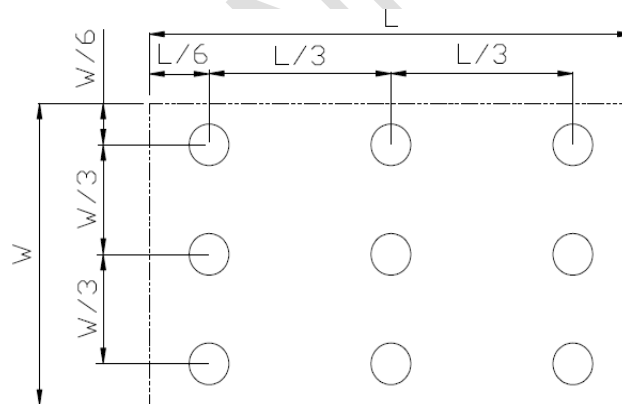Note 5:   Definition of color chromaticity (CIE1931)

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.

8 Environmental / Reliability Test

| No	Test Item	Condition	Remarks
1	High Temperature Operation	Ta = +70℃, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	Ta = -20℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta = +80℃, 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	Storage at High Temperature and Humidity	60℃ 90%RH 240H	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃，30min ~80℃，30min Change time：5min，30cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
7	ESD	C=150pF, R=330Ω,5points/panel Air:± 8KV, 5times, Contact:± 4KV, 5 times, （Environment: 15℃～35℃, 30%～60%, 86Kpa～106Kpa）	IEC61000-4-2:2001 GB/T17626.2-2006
8	Package Vibration	Frequency：5-20-200HZ，PSD：0.01-0.01-0.001 Total:0.781g2/HZ,x/y/z every direction 30min）	IEC60068-2-6:1982 GB/T2423.10—1995
9	Mechanical Shock (Non OP)	Half Sine Wave 60G ,6ms,±X,±Y,±Z 3times for each direction	IEC60068-2-27:1987 GB/T2423.5—1995
10	Package Drop Test	Hight：60cm，1corner，3 edges，6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

9 Mechanical Drawing
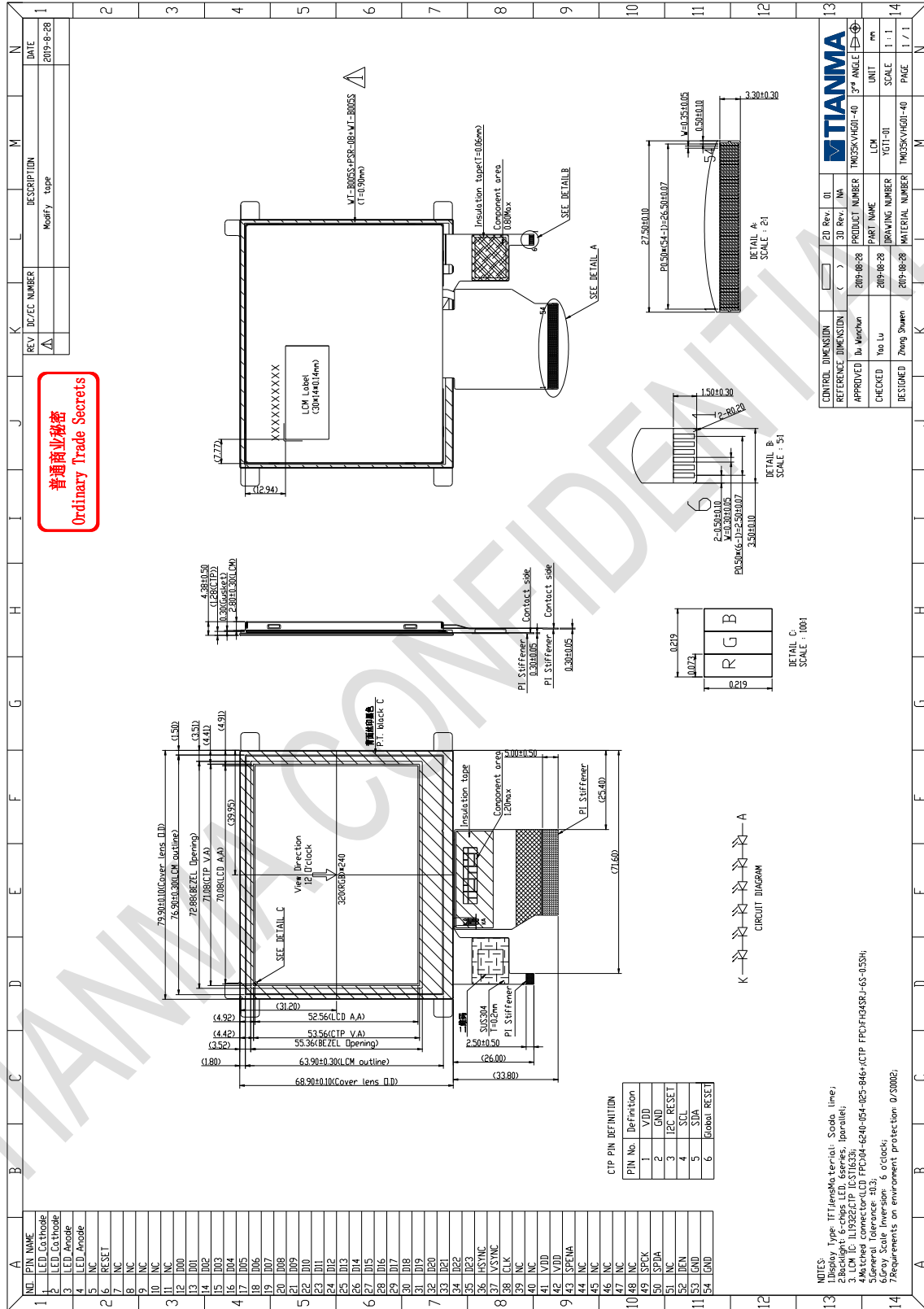
10 Packing Drawing

10.1 Packaging Material

Per Carton

No	Item	Model (Materiel)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM035KVHG01-40	79.9×68.9×4.38	0.045	144	
2	Tray	PET（Transmit）	485×330×16	0.205	21	Anti-static
3	Dust-proof Bag	PE	700×545	0.040	1	
4	BOX	CORRUGATED PAPER	520×345×74	0.39	3	
5	Label	Paper	100×52	0.001	1	
6	Carton	CORRUGATED PAPER	544×365×250	1.01	1	
7	Total weight			13.01Kg±5%		

10.2 Packaging Specification and Quantity

10.2.1 LCM quantity per tray: 2row×4column =8;

10.2.2 Total LCM quantity in Carton: Number of PET trays 18× quantity per tray 8= 144

Note: Please refer to the data from "estimated report about the dimension and stack of Carton "about stacking carton
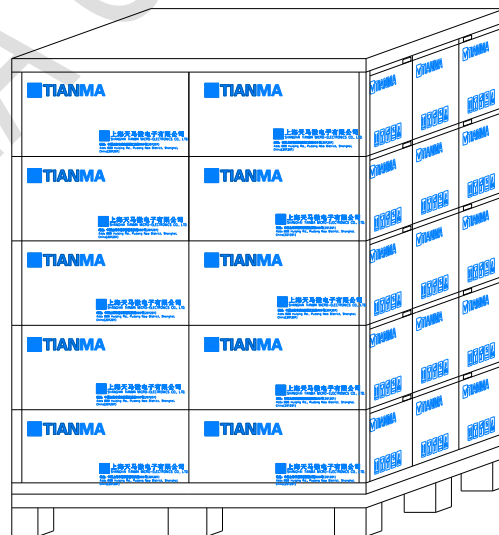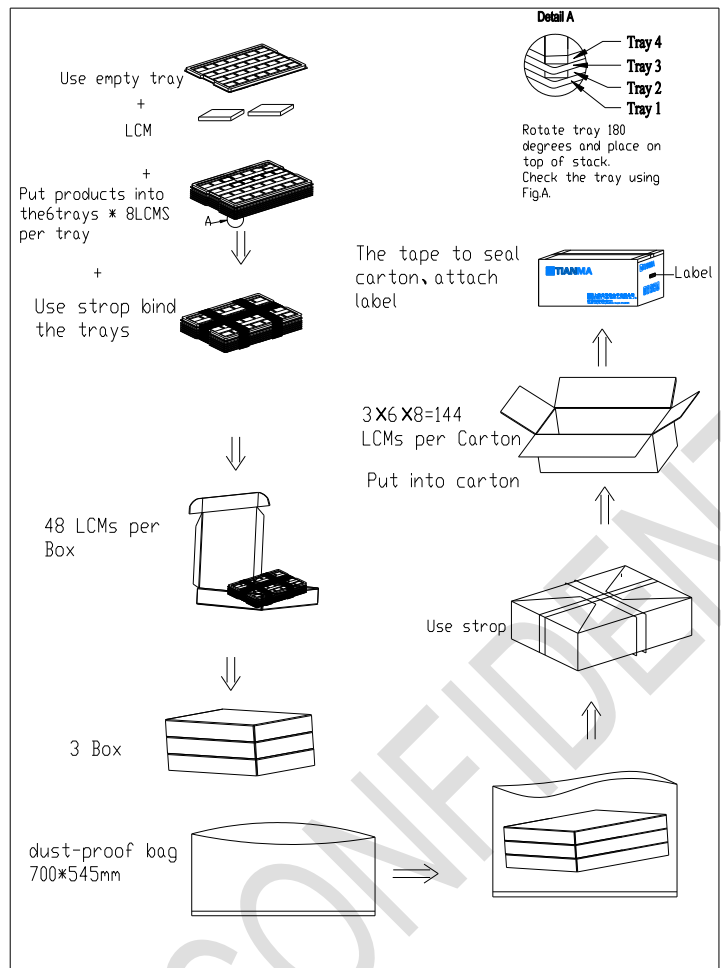
Detail A

Tray 4
Tray 3
Tray 2
Tray 1

Rotate tray 180 degrees and place on top of stack. Check the tray using Fig.A.

Use empty tray
+
LCM
+
Put products into the6trays ＊ 8LCMS per tray
+
Use strop bind the trays

A

The tape to seal carton、attach label

Label

3 ✗ 6 ✗ 8=144 LCMs per Carton

Put into carton

48 LCMs per Box

Use strop

3 Box

dust-proof bag 700＊545mm

11 Precautions for Use of LCD Modules

11.2   Handling Precautions

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

11.2.2   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.

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

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

11.2.5   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

11.2.6   Do not attempt to disassemble the LCD Module.

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

11.2.8   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.

11.3   Storage precautions

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

11.3.2   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%

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

11.4   Transportation Precautions

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

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ELEKTRONIK AG

Our company network supports you worldwide with offices in Germany, Austria, Switzerland, the UK and the USA. For more information please contact:

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