Specification For 6″ SVGA EPD

Model NO.: GDE060B7

Prepared by	Checked by	Approved by

Customer Approval

Customer	Approved by	Date of Approval

DALIAN GOOD DISPLAY CO.,LTD.

Tel:+86-411-84619565 Fax: +86-411-84619585

Website:http://www.good-display.com

Version	Content	Date	Producer
A/0	New Release	2013/10/18	YQLIN

Contents

1 General Description

GDE060B7 is an Active Matrix Electrophoretic Display(AM EPD), High-Resolution AM TFT Black/White display module which can be used in portable electronic devices, such as E-book Reader. The module is a TFT-array driving electrophoretic display, with integrated circuits including source and gate drivers.

The resolution of the module is 600×800(SVGA), and the active area is 6 inch diagonal.

2 Features

◆ 600×800 display

◆ White Reflectance above 22%

◆ Contrast Ratio above 7:1

◆ 3:4 aspect ratio

◆ Wide viewing angle

◆ Ultra low power consumption

◆ Reflective mode

◆ Bi -stable display

◆ Commercial temperature range

◆ Landscape, portrait modes

◆ Hard-coat antiglare display surface

◆ Module with single finger gesture capacitive touch sensor

◆ Front Light Module

3 Application

E-book reader.

4 Input/Output Pin Assignment

4.1 Panel Connector Pin Assignment

No.	Pin Name	Description
1	VNEG	Negative power supply source driver
2	VGL	Negative power supply gate driver
3	VSS	Ground
4	NC	NO Connection
5	NC	NO Connection
6	VDD	Digital power supply drivers
7	VSS	Ground
8	CLK	Clock source driver
9	VSS	Ground
10	LE	Latch enable source driver
11	OE	Output enable source driver
12	SPH	Start pulse source driver
13	D0	Data signal source driver
14	D1	Data signal source driver
15	D2	Data signal source driver
16	D3	Data signal source driver
17	D4	Data signal source driver
18	D5	Data signal source driver
19	D6	Data signal source driver
20	D7	Data signal source driver
21	VCOM	Common connection
22	NC	NO Connection
23	NC	NO Connection
24	NC	NO Connection
25	NC	NO Connection
26	VSS	Ground
27	NC	NO Connection
28	CPV	Shift clock input
29	STV	Start pulse gate driver
30	NC	NO Connection
31	VBORDER	Border connection
32	VSS	Ground
33	VPOS	Positive power supply source driver
34	VGH	Positive power supply gate driver

4.2 LED Circuit Connector Pin Assignment

No.	Pin Name
1	Anode +
2	Anode +
3	Dummy
4	Dummy
5	Cathode -
6	Cathode -

4.3 Touch Panel Connector Pin Assignment

NO.	Pin Name	I/O	FUNCTION
1	GND	P	Ground
2	VDD	P	DC Voltage Supply
3	RST	I	Sensor System Global Reset
4	INT	O	Sensor data ready request
5	SDA	I/O	I2C serial data pin
6	SCL	I	I2C serial clock pin
7	NC	-	No Connection
8	NC	-	No Connection

5 Electrical Characteristics

5.1 Module Interface Description

This module can be driven by ASIC AVT6201A Timing Controller(T-Con).

5.2 Module DC Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Signal ground	VSS		-	0	-	V
Logic Voltage supply	VDD		3.0	3.3	3.6	V
	IVDD	VDD=3.3V	-	3.0	-	mA
Gate Positive supply	VGH		21	22	23	V
	IVGH		-	0.35	-	mA
Gate Negative supply	VGL		-21	-20	-19	V
	IVGL		-	-3.0	-	mA
Source Positive supply	VPOS		14.6	15	15.4	V
	IPOS	VPOS=15V	-	20	-	mA
Source Negative supply	VNEG		-15.4	-15	-14.6	V
	INEG	VNEG=-15V		-20		mA
Asymmetry source	VASYM	VPOS+VNEG	-80	0	80	mV
Common voltage	VCOM		-2.5	Adjusted	-1.5	V
	ICOM		-	-1.5	-	mA
Standby power module	PSTBY			-	0.4	mW
Typical power module	PTYP		-	600	1100	mW
Operating temperature			0	-	50	℃
Storage temperature			-20	-	70	℃
Maximum image update time at 25℃				960	1200	ms

Notes:

1.The maximum power and maximum current are specified for the worst case power consumption.

2.The typical power is measured when "typical images" are displayed.

3. The standby power is the consumed power when the module controller is in standby mode.

4. The listed electrical/optical characteristics are only guaranteed under the controller & waveform provided by Good Display.

5.3 Module AC characteristics

Note:VDD=3.0V to 3.6V, unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit	App Pin
Clock frequency	fcpv			200	kHz	CPV
Clock CPV high time	tCPVh	0.5	–	–	us	
Clock CPV low time	tCPVl	0.5	–	–	us	
Data setup time	tSU	100	–	–	ns	CPV
Data hold time	tH	300	–	–	ns	STV
Clock CLK cycle time	tclk	40	–	–	ns	Below table
D0 .. D7, SPH setup time	tsu	8	–	–	ns	
D0 .. D7, SPH hold time	th	8	–	–	ns	
LE on delay time	tLEdly	40	–	–	ns	
LE high-level pulse width	tLEw	40	–	–	ns	
LE off delay time	tLEoff	40	–	–	ns	
SHR setup time	tMsu	100	–	–	ns	
SHR hold time	tMh	10	–	–	ns	

Clock & Data Timing
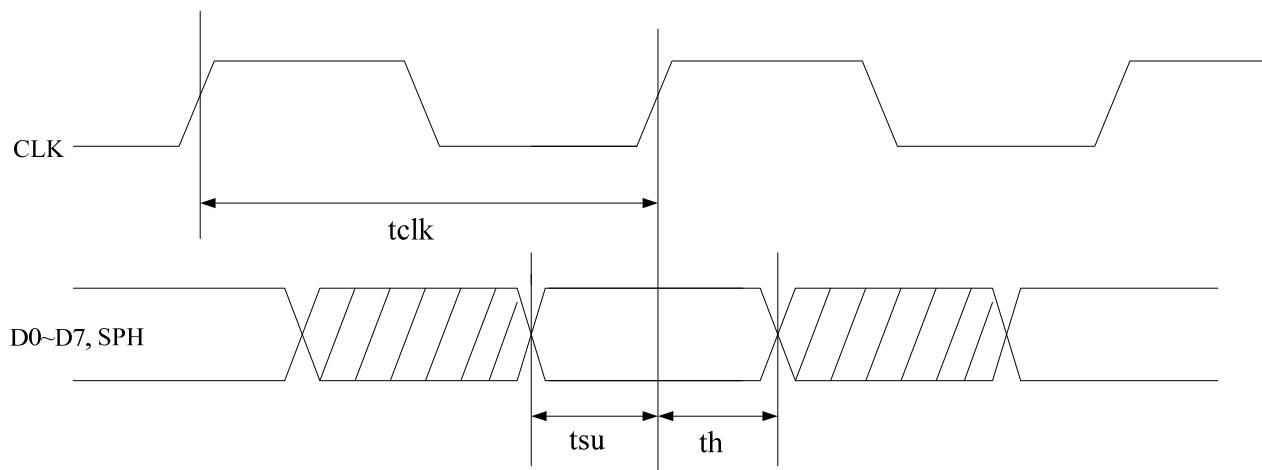
Output Latch/Control Signals
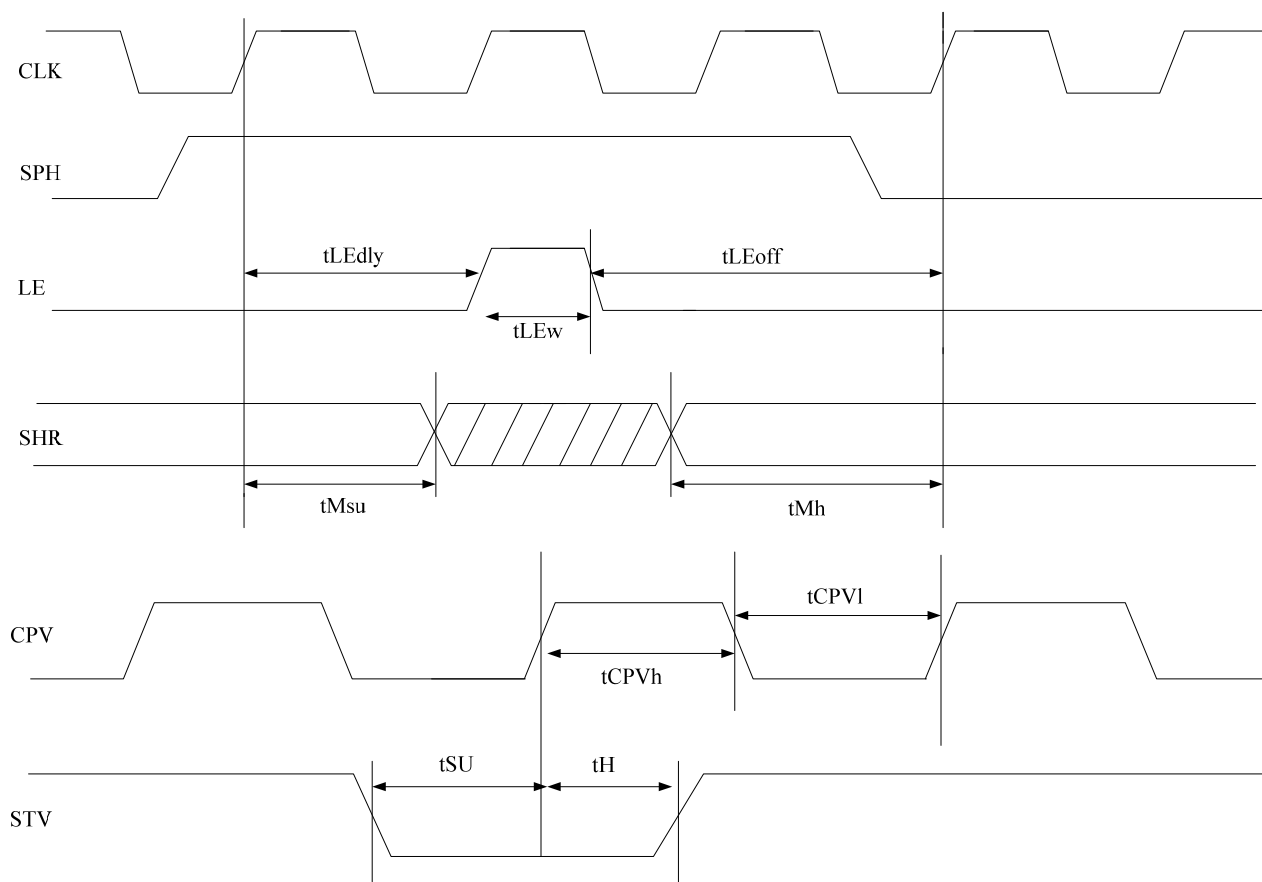
5.4 Recommended Driving Condition for Front Light

Ta = 25℃

Parameter	Symbol	Min	TYP	MAX	Unit	Remark
Supply voltage of LED Front light	V_{LED}	-	-	21	V	1*7=7LEDs
Supply current of LED Front light	I_{LED}	-	10	20	mA	
Front Light Power Consumption	P_{LED}	-	197	420	mW	

6 Power On/Off Sequence

To prevent the device from damage due to latch up, the power on/off sequence shown below must be followed.

When power on: VDD -> VGL -> VNEG/VGH / VPOS -> Vcom

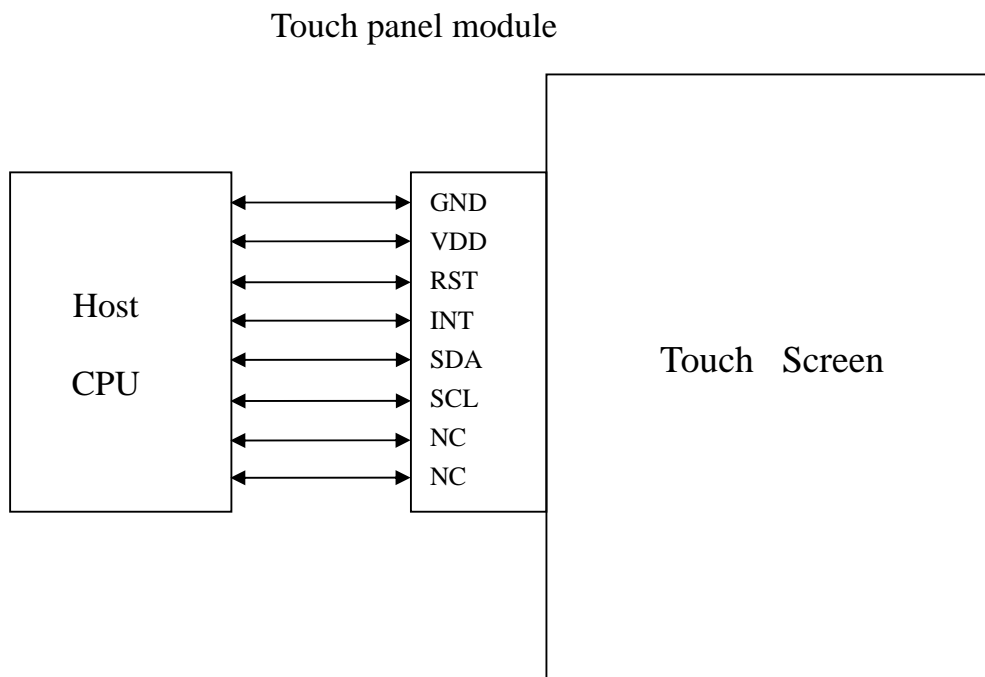When power off: Vcom -> VNEG/VGH / VPOS -> VGL -> VDD
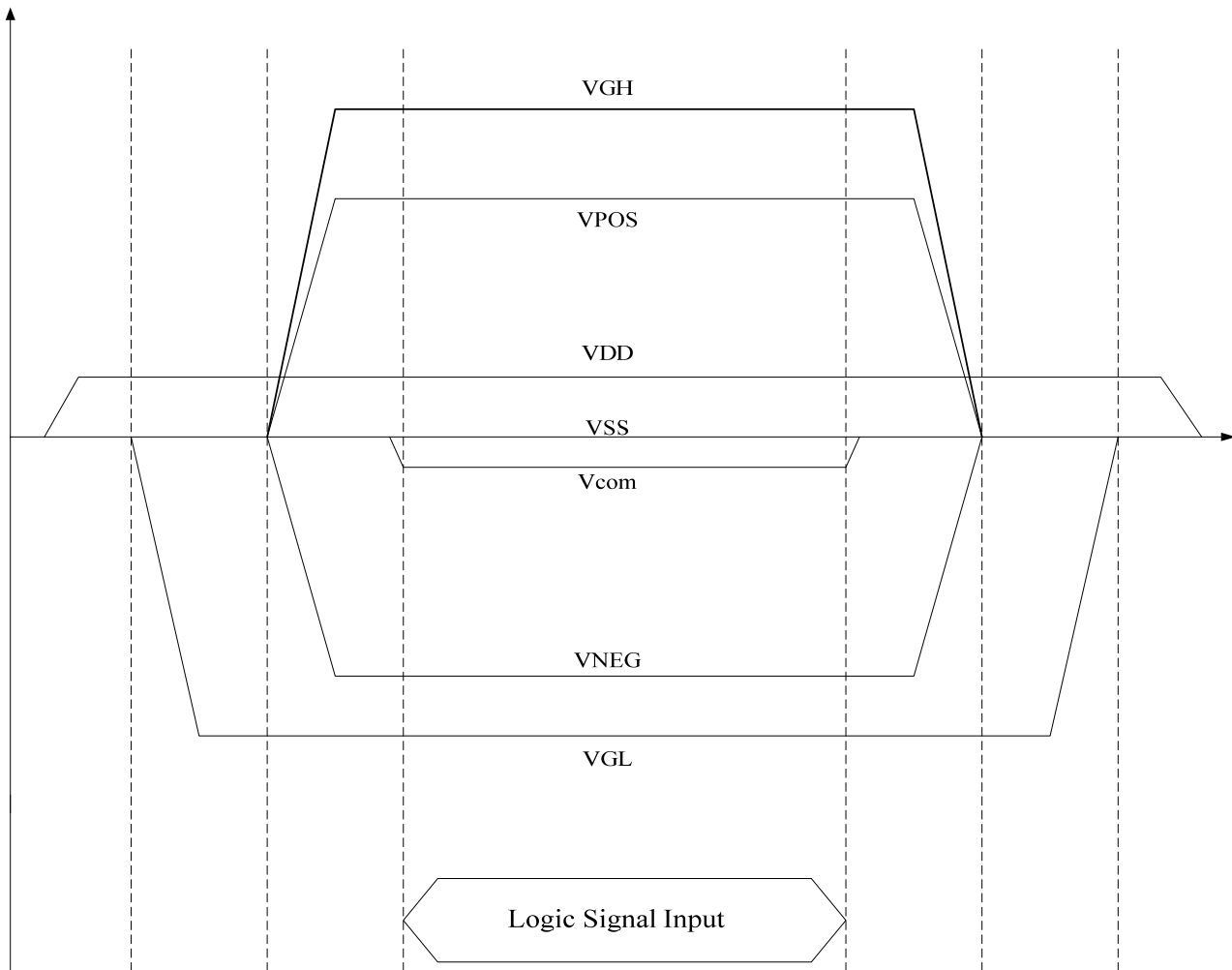
7 Touch Panel Characteristics

7.1 Interface Characteristics

7.1.1 Interface Diagram

Touch panel module

7.2 Electrical Characteristics

$(Ta=25℃, V_{DD}=3.3V)$

| ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UINT
Input power voltage		VDD	-		3.3±5%		V
Input Signal Voltage	H Level	VIH	-	2.6	-	3.6	V
	L Level	VIL	-	GND	-	0.6	V
Output Signal Voltage	H Level	VOH	-	2.6	-	-	V
	L Level	VOL	-	-	-	0.6	V
Module Supply Current(Normal)		IDD(normal)	Vdd=3.3V	-	10	-	mA
Module Supply Current(Sleep)		IDD(Sleep)	Vdd=3.3V	-	0.5	-	mA

7.3 I2C Interface

7.3.1 Interface Diagram

The system block diagram is as shown in below. There are three communication pins connected between CPU and Touch Panel Module which are including external interrupt INT,I2C pins SCL and SDA. The INT is active low while the touch state is calculated by Touch Panel Module and the touch information can be translated via I2C communication interface. The I2C data format ,protocol and report packet are described as following.

Touch Panel Module
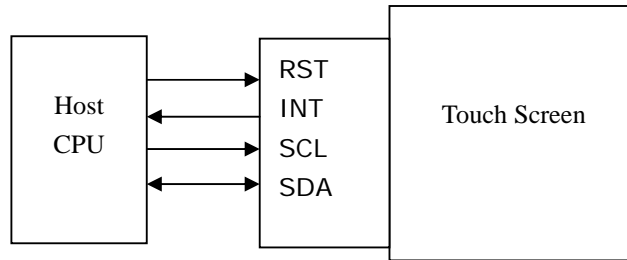
7.3.2 Timing Characteristic
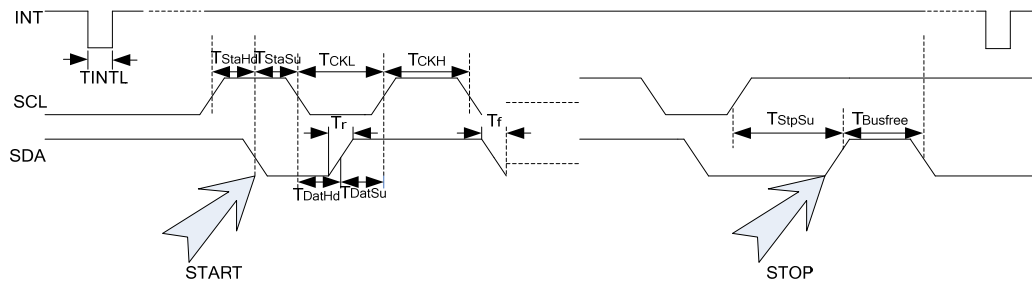
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Working Frequency	Fclk	-	-	200	Khz	VDD=3.3V,TA=25℃
INT Low Time	TINTL	-	2	-	uS	VDD=3.3V,TA=25℃
I2C Clock Low	TCKL	2.5	-	-	uS	VDD=3.3V,TA=25℃
I2C Clock High	TCKH	2.5	-	-	uS	VDD=3.3V,TA=25℃
I2C Data rising time	Tr	-	-	300	nS	VDD=3.3V,TA=25℃
I2C Data falling time	Tf	-	-	300	nS	VDD=3.3V,TA=25℃
I2C Data hold time	TDatHd	0	-	-	nS	VDD=3.3V,TA=25℃
I2C Data setup time	TDatSu	100	-	-	nS	VDD=3.3V,TA=25℃
I2C Start Condition hold time	TStaHd	200	-	-	nS	VDD=3.3V,TA=25℃
I2C Start Condition setup time	TStaSu	600	-	-	nS	VDD=3.3V,TA=25℃
I2C Stop Condition setup time	TStpSu	600	-	-	nS	VDD=3.3V,TA=25℃
I2C Bus free time	TBusFree	2.5	-	-	uS	VDD=3.3V,TA=25℃

7.3.3 I2C Buffer and Data Format

Touch panel is used as I2C Slave Device. I2C Salve address is 0x59

I2C Buffer Address	Function of this I2C Buffer	Status
00H	Gesture ID Code	R
01H	Gesture Data 1	R
02H	Gesture Data 2	R
03H	Gesture Data 3	R
04H	Gesture Data 4	R
05H	Gesture Data 5	R
06H	Gesture Data 6	R
07H	Gesture Data 7	R
08H	Gesture Data 8	R
09H	Resolution 1	R
0AH	Resolution 2	R
0BH	Resolution 3	R
0CH	Resolution 4	R
0DH	Sensor Operation Control	R/W

7.3.4 Function Description

I2C Buffer Address	Bit	Function Description	Status
00H	1…0	Gesture ID Code 00: finger leave 01: one point, (X1,Y1)valid 10: one point, (X2,Y2)valid 11: two point, (X1,Y1) (X2,Y2)valid	R
	7…2	Reserve	R
01H		X1[15:8]	R
02H		X1[7:0]	R
03H		Y1[15:8]	R
04H		Y1[7:0]	R
05H		X2[15:8]	R
06H		X2[7:0]	R
07H		Y2[15:8]	R
08H		Y2[7:0]	R
09H		Horizontal Pixels X[15:8]	R
0AH		Horizontal Pixels X[7:0]	R
0BH		Vertical Pixels Y[15:8]	R
0CH		Vertical Pixels Y[7:0]	R

7.3.5 Sensor Operation Control Register

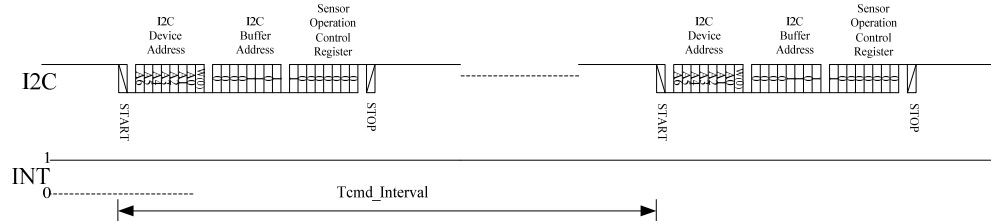| I2C Buffer Address	Bit	Function Description	Status
0DH	7	Sensor On/Off Control 0:Disable Sensor(Sleep Mode) 1:Enable Sensor(Normal Mode , Default)	R
	6…0	Reserve	R

7.3.6 Operation Definition

7.3.6.1 I2C Write Timing Table

7.3.6.1.1 Write a byte to Sensor Operation Control Register
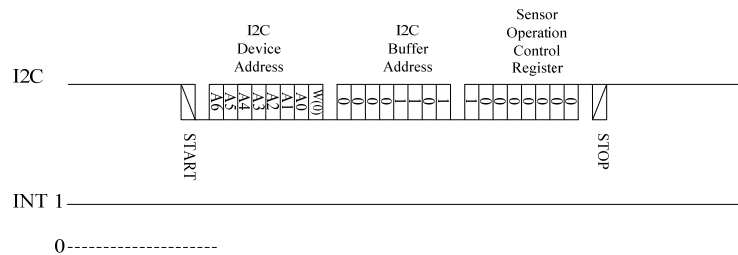
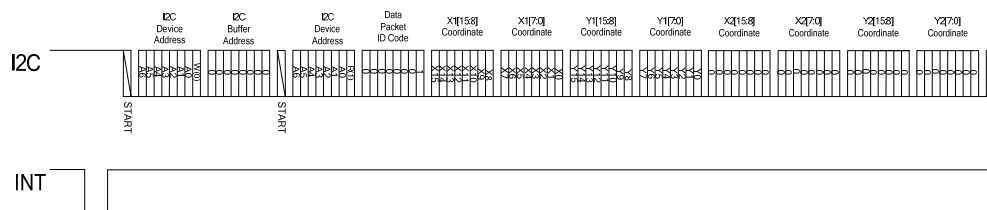##### 7.3.6.1.2 The interval between two write command

Symbol	Min.	Typ.	Max.	Unit	Condition
Tcmd_interval	10	-	-	mS	-

7.3.6.2 Touch event

First time finger touch on the panel, INT will active a falling edge signal that there is a touch event.

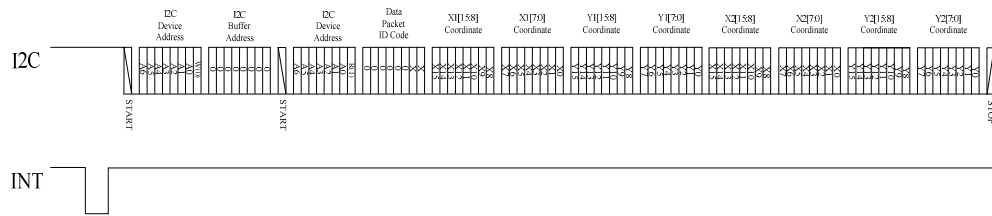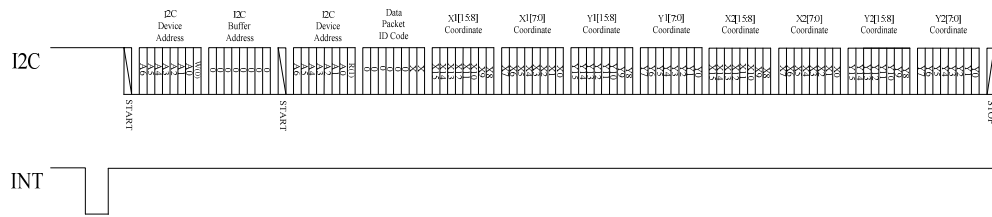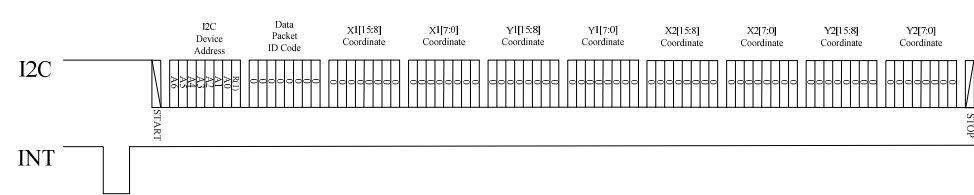##### 7.3.6.2.1 One points touch event

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7.3.6.2.2 Two points touch event

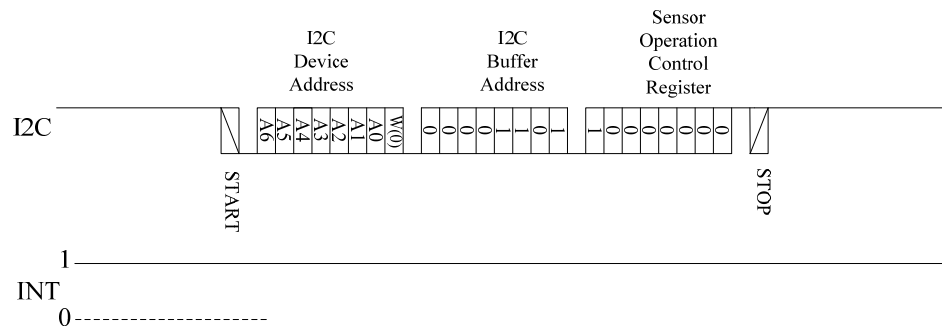7.3.6.2.3 Finger hold on touch panel, INT will active a falling edge signal each detect frame

7.3.6.2.4 Finger leave from the touch panel, INT will active a falling edge signal to indicate finger leave from touch panel, and the touch sensor will respond(0,0) coordinate to I2C master

7.3.6.3 Setting Sensor Operation Mode

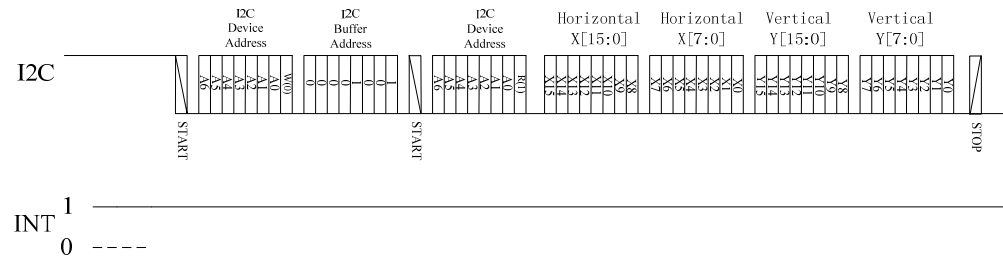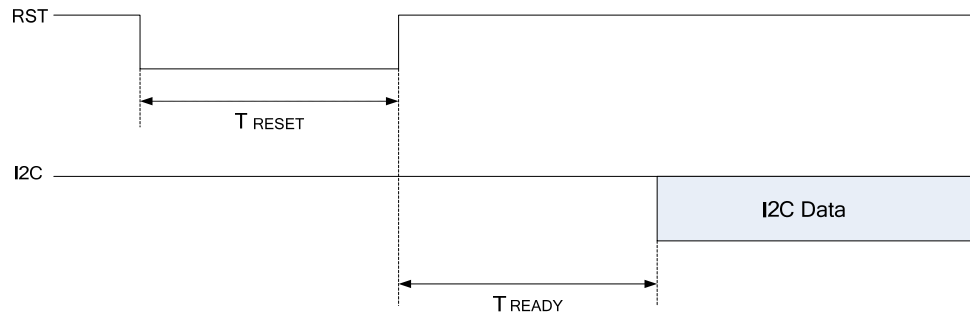Write a byte to Sensor Operation Control Register

7.3.6.4 Get Touch Panel Resolution

7.3.7 Reset Timing

	Min.	Typ.	Max.	Unit
TRESET	2	-	-	mS
TREADY	100	-	-	uS

8 Mechanical Specifications

8.1 Dimension

PARAMETER	VALUE	UNIT	Remark
Display Resolution	600×800	dots	
Active area dimensions			
Horizontal	90.6	mm	
Vertical	122.4	mm	
Screen size	6.0（3:4 diagonal）	Inch	
Pixel pitch			
Horizontal	0.151	mm	
Vertical	0.153	mm	
Pixel configuration	Rectangle		
Overall dimensions			
Width	101.8	mm	
Height	138.4	mm	
Thickness	2.7	mm	
Mass of the module	68	g	

8.2 Electrical Connector

CONNECTOR	NUMBER OF PINS	MATING CONNECTOR
EPD Panel Connector	34	FPC pitch=0.5mm
Touch Panel Connector	8	FPC pitch=0.5mm
LED Circuit Connector	6	Pitch=0.5mm

LED Circuit Connector in mainboard: Kyocera-connector ELCO6277-6Pin
(ORDERING CODE: 04 6277 006 001 883+)

8.3 Mechanical Drawing of EPD Module

9 Optical Characteristics

Parameter	Conditions	Values			Units	Notes
		Min.	Typ.	Max		
White Reflectivity	Front Light off	22			%	
Contrast Ratio (CR)		7:1				1
White Brightness	Front Light On θ=0 I_{LED}=10mA	70			cd/㎡	2
Contrast Ratio (CR)		7:1				3
Luminance Uniformity		50	60		%	4
Image Update Time:	GC16(T=0℃)		1500	1600	ms	
	GC16(T=25℃)		960	1200		
	GC16(T≥35℃)		760	960		
	DU (T=0℃)		500	540		
	DU(T≥20℃)		300	360		

T_{amb}=25℃, f_v=50Hz. Measurements are made with Eye-One Pro Spectrophotometer.

Notes:

1. CR=Surface Reflectance with all white pixel/Surface Reflectance with all black pixels

2. Optical characteristics are determined after the Front Light has been 'ON' and stable for approximately 10 minutes in a dark environment at 25℃.

3. CR= Luminance with all white pixel/ Luminance with all black pixels

4. Luminance Uniformity= The Minimum Brightness of the 9 testing Points/ The Maximum Brightness of the 9 testing Points
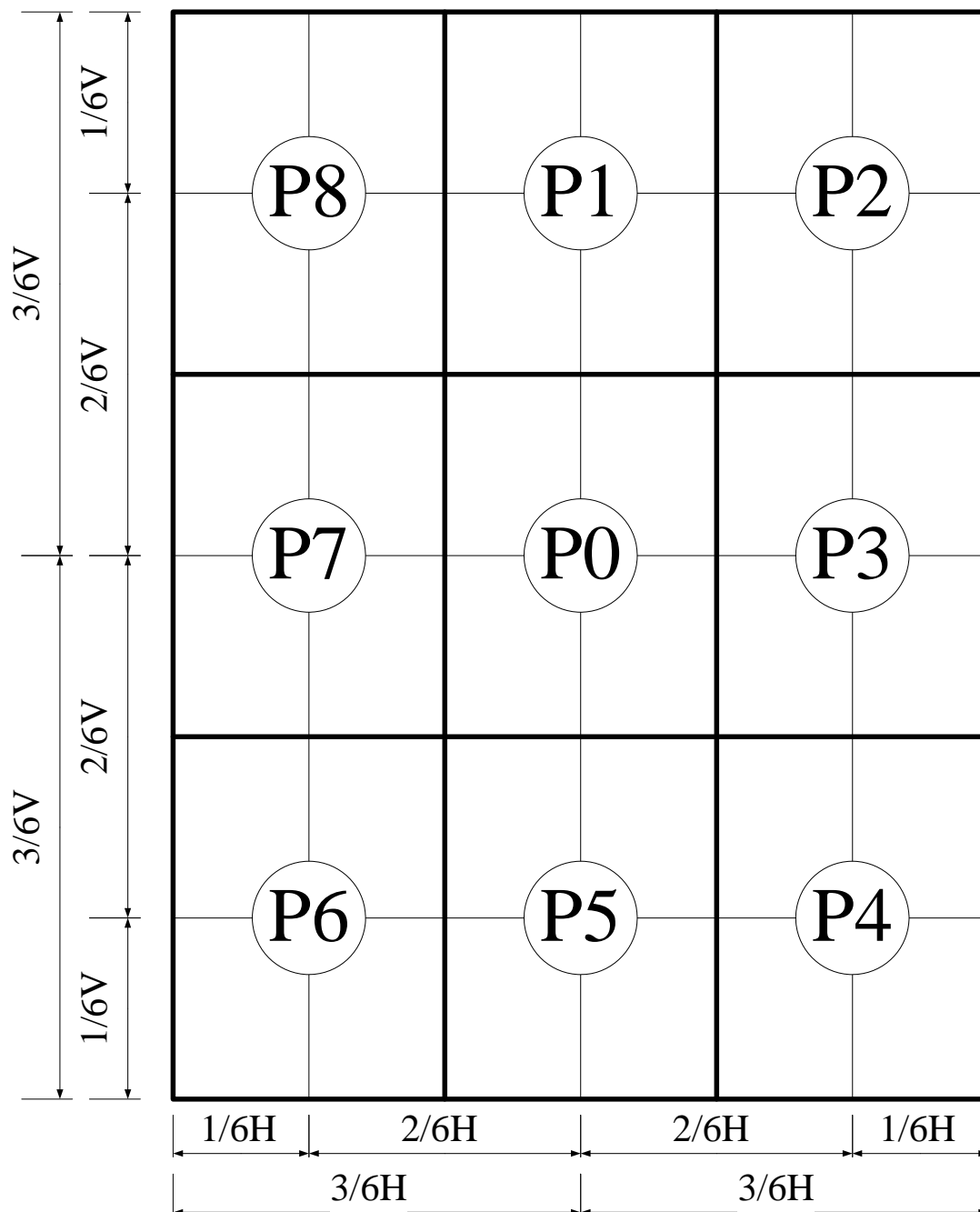
   Ambient illumination : < 1 Lux

   Measuring direction : Perpendicular to the surface of module

   The test pattern is white.

   The 9 testing Points are shown below:

10 Handling, Safety and Environment Requirements

Warning

The display glass may break when it is dropped or bumped on a hard surface. Handle with care. Should the display break, do not touch the electrophoretic material. In case of contact with electrophoretic material, wash with water and soap.

Caution

The display module should not be exposed to harmful gases, such as acid and alkali gases, which corrode electronic components.

Disassembling the display module can cause permanent damage and invalidates the warranty agreements.

Observe general precautions that are common to handling delicate electronic components. The glass can break and front surfaces can easily be damaged. Moreover the display is sensitive to static electricality and other rough environmental conditions.

11. Reliability test

| No.	TEST	CONDITION	METHOD	REMARK
1	High-Temperature Operation	T = +50°C, RH = 30% for 168 hrs	IEC 60 068-2-2Bp	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
2	Low-Temperature Operation	T = 0°C for 168 hrs	IEC 60 068-2-2Ab	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
3	High-Temperature Storage	T = +70°C, RH=23% for 168 hrs	IEC 60 068-2-2Bp	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
4	Low-Temperature Storage	T = -25°C for 168 hrs	IEC 60 068-2-1Ab	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
5	High-Temperature, High-Humidity Operation	T = +40°C, RH = 90% for 168 hrs	IEC 60 068-2-3CA	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
6	High Temperature, High- Humidity Storage	T = +50℃, RH=80% for 168 hrs	IEC 60 068-2-3CA	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
7	Thermal Shock	1 cycle:[-25℃ 30min]→[+70℃ 30 min] : 24 cycles	IEC 60 068-2-14	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
8	Package Vibration	1.04G, Frequency: 10~500Hz Direction: X,Y,Z Duration: 1 hours in each direction	Full packed for shipment	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
9	Package Drop Impact	Drop from height of 122 cm on concrete surface. Drop sequence: 1 corner, 3edges, 6 faces One drop for each	Full packed for shipment	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
10	Electrostatic Effect (non-operating)	Machine model +/− 250V, 0Ω, 200pF	IEC 62179, IEC 62180	At the end of the test, electrical, mechanical, and optical specifications shall be satisfied.
11	Stylus Tapping	POLYACETAL Pen:Top R0.8mm Load: 200gf Speed: 30times/min Total 13,500times		

12 Packaging

Packing Form
a) Package quantity in one outer box:48 pcs
b) box size:470 mm X 390 mm X 170 mm
c) 1 outer box = 12 (full tray) + 1 (dummy / top tray)
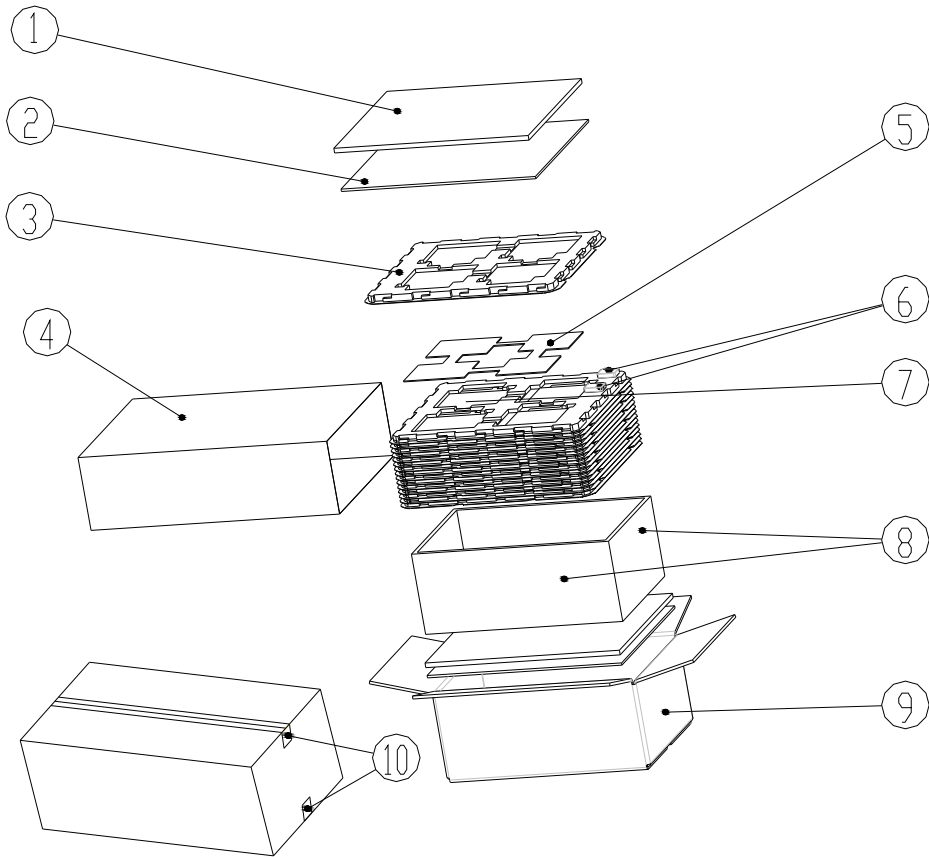
No.	Description	Material
①	Upper & bottom paper plate	A=B
②	Upper & bottom foam plate	EPE
③	Packing tray (13 pcs/1 outer box)	PS
④	Aluminium foil bag	Aluminium foil
⑤	EPE FOAM	EPE
⑥	Desiccant	Desiccant
⑦	Board Ass'y	EPD
⑧	side plate	EPE
⑨	Outer carton	K=A
⑩	Tape (43mm*300m)	OPP

13 Mark and Bar Code Definition

YYYYYYYY   MMMMMMMM

T01BS215ABYYY00001

(1) YYYYYYYY: Module No.

（2）MMMMMMMM: Product date ; year month day.

(3) Bar Code definition.

<u>T</u>   <u>01</u>   <u>B</u>   <u>S215AB</u>   <u>YYY</u>   <u>00001</u>

（1）（2） （3） （4） （5） （6）

(1) Module Assemble Vendor.

(2) Version.

(3) Application.

(4) O-Paper Film LOT.

(5) Product LOT.

(6) Product Serial Number.