Product Specification

Part Name: **7.0 inch TFT Module with Projected Capacitive Touch Panel**
Customer Part ID:
Topovision Part ID: TVT0700PA-CP
Ver: A

Customer:
Approved by

From: Topovision Technology Co.,Ltd.
Approved by

Notes:

1. Please contact Topovision Technology Co., Ltd. before assigning your product based on this module specification
2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by Topovision Technology Co., Ltd. for any intellectual property claims or other problems that may result from application based on the module described herein.

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Revision History

Rev.	Date	Contents	Written	Approved
1.0	2013/3/30	Preliminary Specification	Kevin	
1.1	2013/6/21	1. Add Weight:205g 2. Add Remark 3. Modify outline drawing from Rev:1.0 to 1.1 4. Release Rev: A for production.	Anna	
A	2013/11/15	Modify Product Label style. Modify outline drawing from Rev: 1.1 to A.	Sam	

Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	

3. APPLICATION

DVD player, Car TV, UMPC, POS

4. GENERAL SPECIFICATIONS

Composition: 7inch WVGA resolution display with a projected Capacitive Touch Panel (CTP).

Interface LVDS Interface for panel and I^2C for the CTP.

Parameter	Specifications	Unit
Screen Size	7 (diagonal)	inch
Display Format	1024(H) x (R,G,B) x 600(V)	dot
Finger	5	
LCD Active Area	153.6(H) x 90(V)	mm
CTP Active Area	154.6(H) x 92.4(V)	mm
Pixel Configuration	Stripe	
Outline Dimension	182.6(W) x 117(H) x 5.95(D)	mm
Surface Hardness	Pencil Hardness 7H	
Surface treatment	Glare	
Back-light	LED	
Display mode	Normally white	
Weight	205	g
View Angle direction(Gray inversion)	6 o'clock	
Our components and processes are compliant to RoHS standard		

5. LCD ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	MIN.	MAX.	Unit	Remark
Power supply voltage		VDD	-0.3	5.0	V	Ta=25°C
		AVDD	6.5	13.5	V	
		VGH	-0.3	42.0	V	
		VGL	-20	0.3	V	
		VGH-VGL	-	40	V	
Operating temperature		Top	-20	60	°C	Module surface*
Storage temperature		Tst	-30	70	°C	-
Humidity	Operation	20%~90% relative humidity				Ta 38°C
	Non Operation	5%~90% relative humidity				Ta 38°C

6. LCD ELECTRICAL CHARACTERISTICS

6.1 Operating Conditions

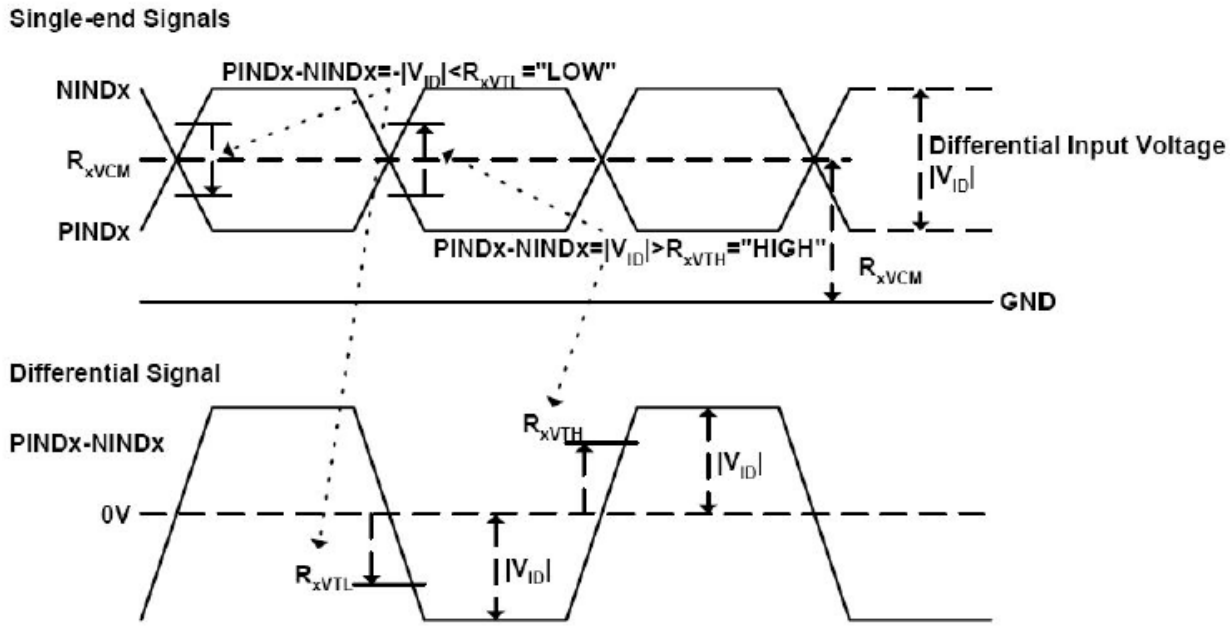
GND=0V, fH=38.1KHz, fV=60Hz, fCLK=50.2MHz,Ta=25°C

Parameter	Symbol	MIN.	Typ.	MAX.	Unit	Remark
Power Supply voltage	VDD	3.0	3.3	3.6	V	
	AVDD	10.8	11	11.2	V	
	VGH	19.7	20	20.3	V	
	VGL	-6.5	-6.8	-7.1	V	
Input signal voltage	VCOM	2.7	3.7	4.7	V	Note3
Differential Input High Threshold	RxVTH	-	-	100	[mV]	RxVCM=1.2V
Differential input Low Threshold	RxVTL	-100	-	-	[mV]	Note 2

Input voltage range (singled-end)	RxVIN	0	-	2.4	V	
Differential input common mode voltage	RxVCM	|VID|/2	-	2.4-|VID|/2	V	
Differential voltage	|VID|	0.2	-	0.6	V	
Differential input leakage current	RVxliz	-10	-	+10	uA	
"H" level logical input voltage	VIH	0.7VDD	-	VDD	V	Note1
"L" level logical input voltage	VIL	0	-	0.3 VDD	V	

Note 1: LVDS, Reset.

Note 2: LVDS Signal Waveform.



Note 3: Typical VCOM is only a reference value, it must be optimized according to each LCM. Be sure to use VR;

6.2 Current Consumption

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Remark
Current for Driver	I_{GH}	-	0.25	1.0	mA	VGH=20V
	I_{GL}	-	0.25	1.0	mA	VGL=-6.8V
	I_{VDD}	-	38	60	mA	VDD=3.3V
	I_{AVDD}	-	20	30	mA	AVDD=11V

6.3 Backlight Driving Consumption

Ta= 25 °C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED voltage	V_L	-	9.3	10.2	V	Note 1
LED current	I_L	-	180	190	mA	
LED life time	-	-	20000	-	hr	Note 2

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25 and IL =180mA.

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25 and IL =180mA. The LED lifetime could be decreased if operating IL is lager than 160mA.

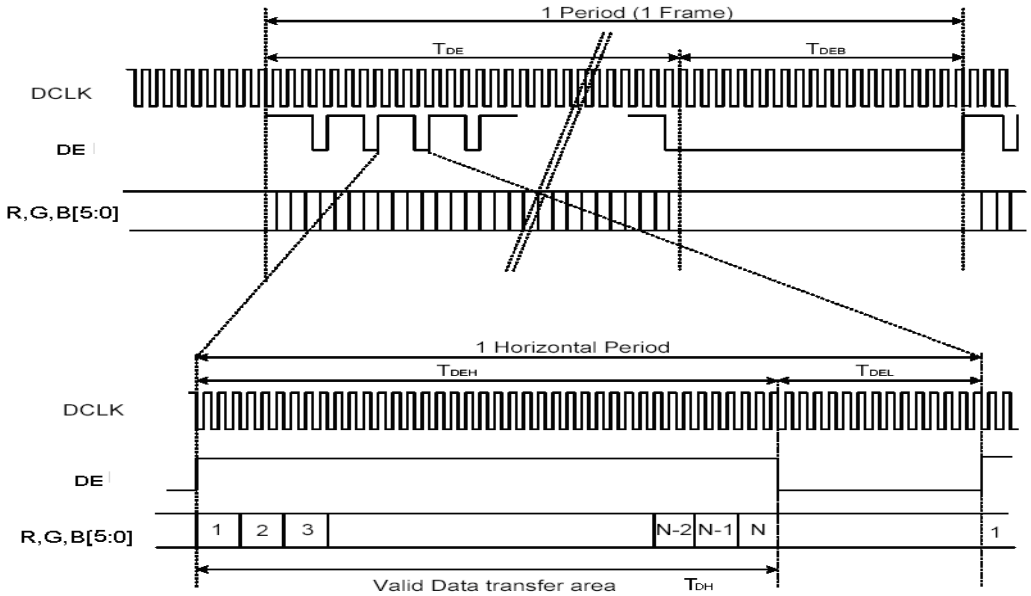
7. LCD TIMING SPECIFICATIONS

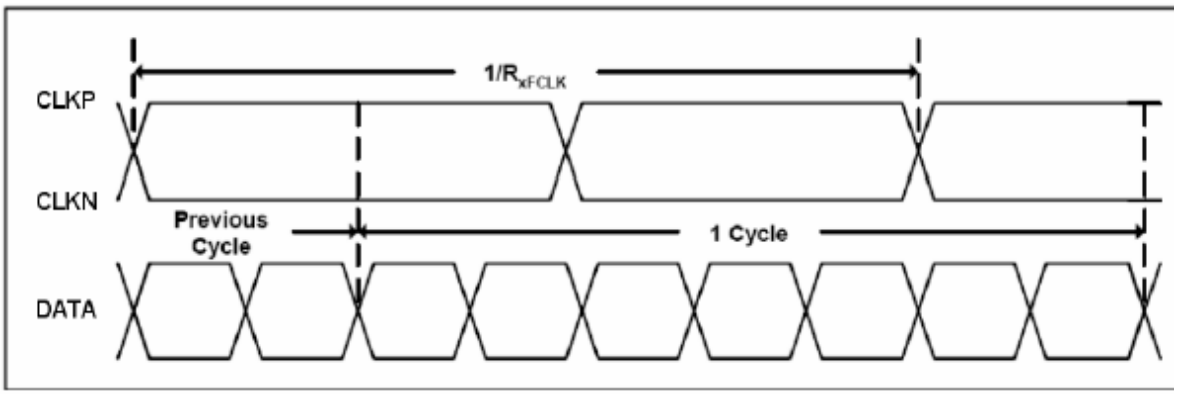
7.1 AC Characteristics

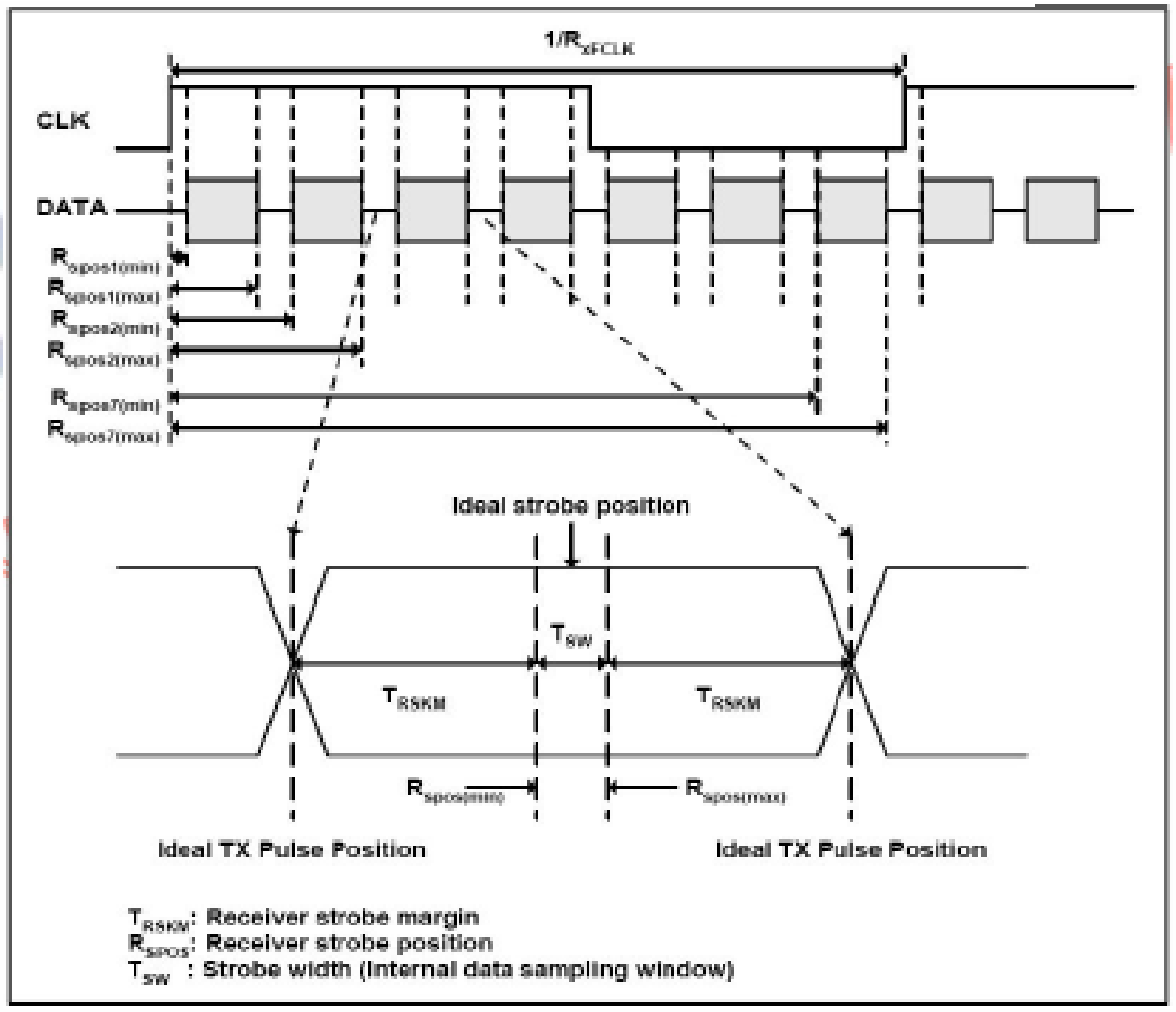
7.1.1 AC Electrical Characteristics

Parameter	Symbol	MIN.	Typ.	MAX.	Unit	Remark
Clock Frequency	RxFCLK	40.8	51.2	67.2	MHz	Frame rate =60Hz
Input data skew margin	TRSKM	500	-	-	ps	
Clock high time	TLVCH	-	4/(7*RxFCLK)	-	ns	
Clock low time	TLVCL	-	3/(7*RxFCLK)	-	ns	
Horizontal display area	TDEH	-	1024		RxFCLK	
HS period time	TDEH+TDEL	1114	1344	1400	RxFCLK	
HS Blanking	TDEL	90	320	376	RxFCLK	
Vertical display area	TDE	-	600	-	TDEH+TDEL	
VS period time	TDE+TDEB	610	635	800	TDEH+TDEL	
VS Blanking	TDEB	10	35	200	TDEH+TDEL	

7.1.2 Input Clock and Data Timing Diagram



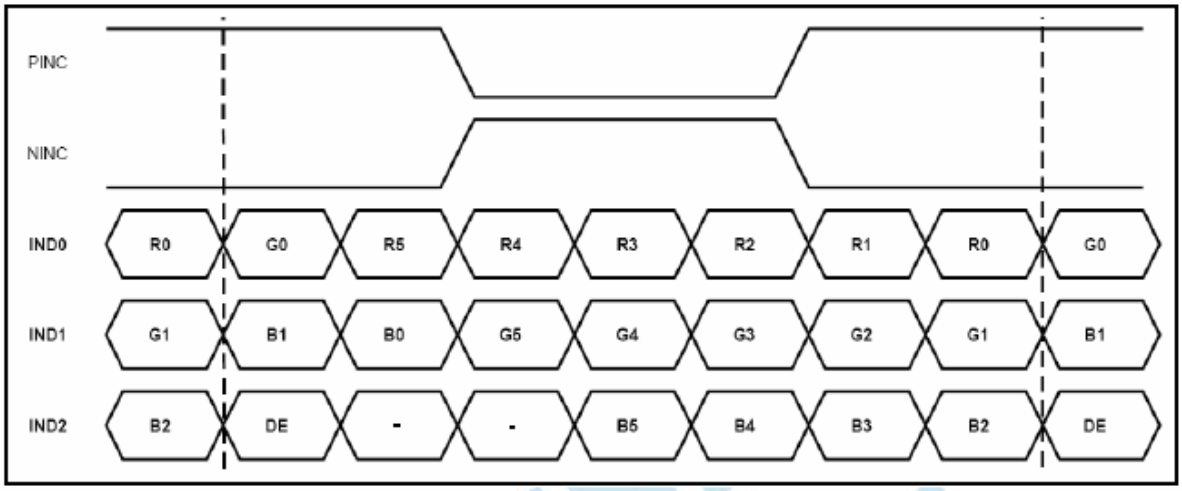




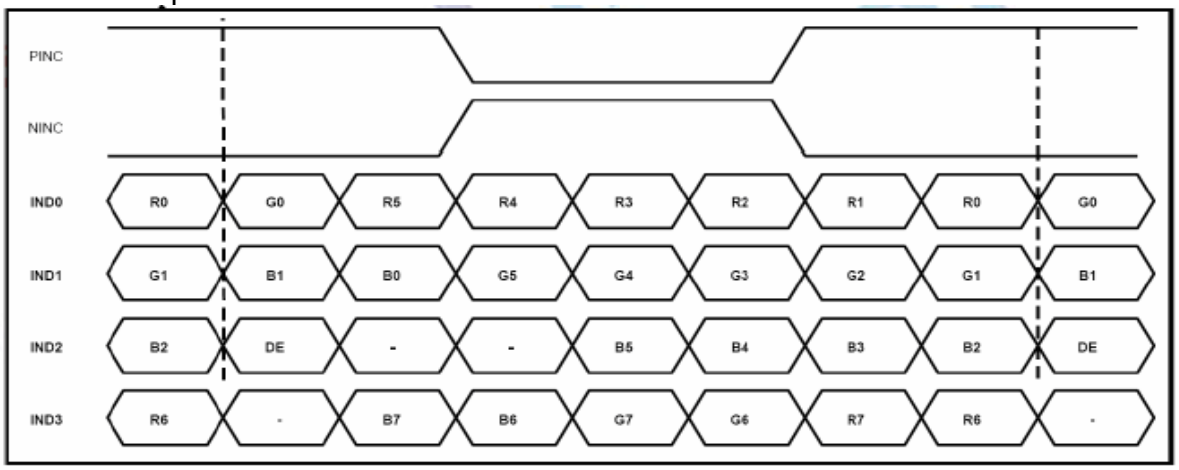
7.2 Timing Controller Timing Chart

7.2.1 Data Input format

6bit LVDS input



8bit LVDS input



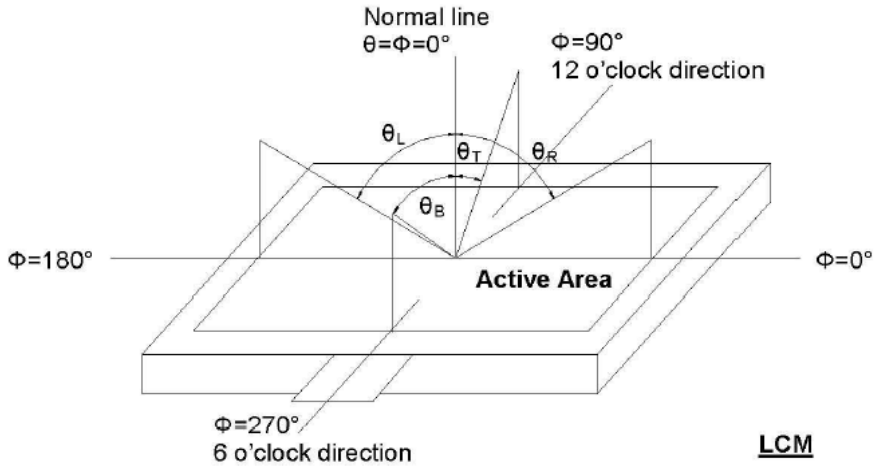
Note: Support DE timing mode only, SYNC mode not supported

8. OPTICAL CHARACTERISTIC

Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
Viewing Angle		θL	Center CR≥10	-	75	-	deg	Note 1,3
		θR		-	75	-		
		θT		-	70	-		
		θB		-	75	-		
Contrast Ratio		CR	at optimized viewing angle	500	700	-		Note 3,4
Response time	Rise	Tr	Center θx=θy =0°	-	10	20	ms	Note 3,6
	Fall	Tf		-	15	30	ms	
Uniformity		B-uni	θx=θy =0°	70	-	-	%	Note 3,5
Brightness		L	θx=θy =0°	-	420	-	cd/	Note 2,3
Chromaticity		x_W	Center θx=θy =0°	0.26	0.31	0.36		Note 2,3,7
		y_W		0.28	0.33	0.38		
Image sticking		tis	2 hours	-	-	2	sec	Note 8

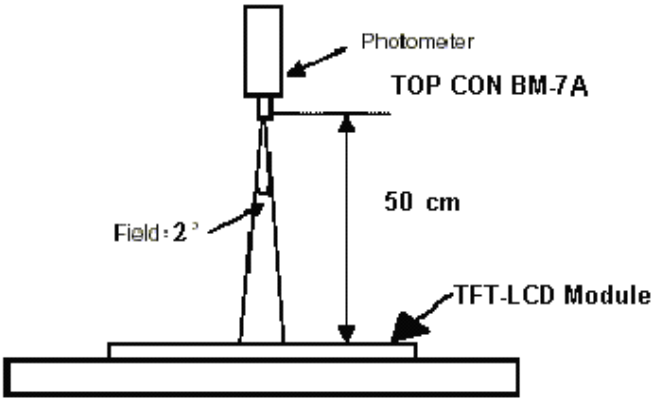
The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance ≤1 lux, and at room temperature). The operation temperature is 25°C±2°C and LED Backlight Current IL=180mA. The measurement method is shown in Note1.

Note 1: Definition of viewing angle range



Note 2: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is IL=180mA .

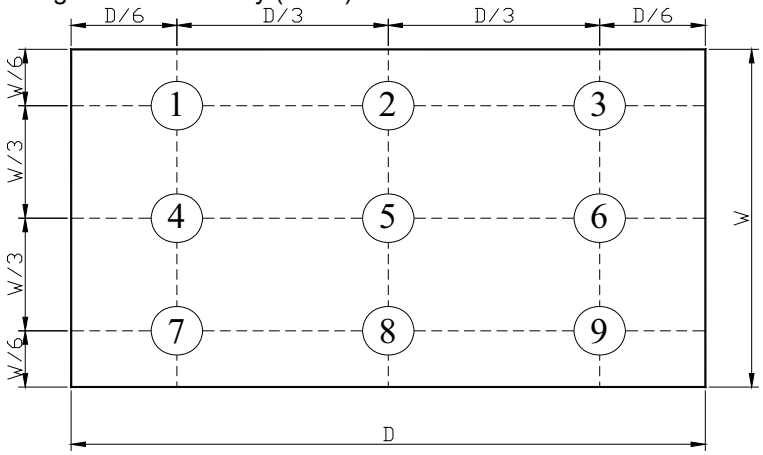
Note 3: Measured at the center area of the panel and at the viewing angle of the θx=θy =0°



Note 4: Definition of Contrast Ratio (CR):

$$CR = \frac{\text{Luminance with all pixels in white state}}{\text{Luminance with all pixels in Black state}}$$

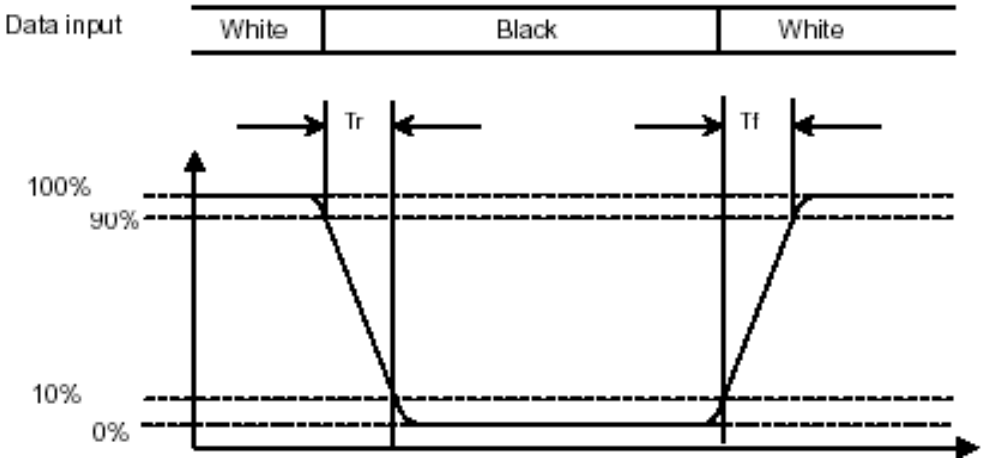
Note 5: Definition of Brightness Uniformity (B-uni):



$$\text{B-uni} = \frac{\text{Minimum luminance of 9 points}}{\text{Maximum luminance of 9points}} \quad \text{(Note 5).}$$

Note 6: Definition of Response Time:

The Response Time is set initially by defining the “Rising Time (Tr)” and the “Falling Time (Tf)” respectively. Tr and Tf are defined as following figure.



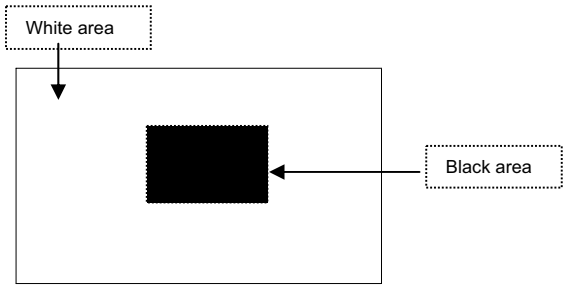
Note 7: Definition of Chromaticity:

The color coordinate (x_W,y_W) is obtained with all pixels in the viewing field at white state.

Note 8: Definition of Image sticking (tis):

Continuously display the test pattern shown in the figure below for 2 hours. Then display a completely white screen. The previous image shall not persist more than 2 sec at 25 °C

Image sticking pattern



9. PIN CONNECTIONS

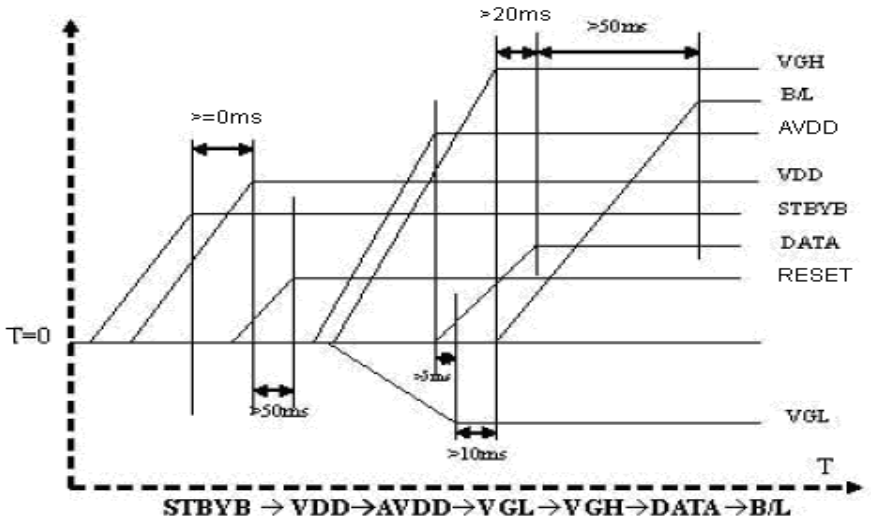
Pin No	Symbol	Description	Remark
1	VCOM	Common Voltage	
2	VDD	Power Voltage for digital circuit	
3	VDD	Power Voltage for digital circuit	
4	NC	No connection	
5	Reset	Global reset pin	
6	STBYB	Standby mode, Normally pulled high STBYB = “1”, normal operation STBYB = “0”, timing controller, source driver will turn off, all output are High-Z	
7	GND	Ground	
8	RXIN0-	- LVDS differential data input	
9	RXIN0+	+ LVDS differential data input	
10	GND	Ground	
11	RXIN1-	- LVDS differential data input	
12	RXIN1+	+LVDS differential data input	
13	GND	Ground	
14	RXIN2-	- LVDS differential data input	
15	RXNI2+	+LVDS differential data input	
16	GND	Ground	
17	RXCLKIN-	- LVDS differential data input	
18	RXCLKIN+	+ LVDS differential data input	
19	GND	Ground	
20	RXIN3-	- LVDS differential data input	
21	RXIN3+	+ LVDS differential data input	
22	GND	Ground	
23	NC	No connection	
24	NC	No connection	
25	GND	Ground	
26	NC	No connection	
27	DIMO	Backlight CABC controller signal output	
28	SELB	6bit/8bit mode select	Note 1
29	AVDD	Power for Analog Circuit	
30	GND	Ground	
31	LED-	LED Cathode	
32	LED-	LED Cathode	
33	L/R	Horizontal inversion	Note 3
34	U/D	Vertical inversion	Note 3
35	VGL	Gate OFF Voltage	
36	CABCEN1	CABC H/W enable	Note 2
37	CABCEN0	CABC H/W enable	Note 2
38	VGH	Gate ON Voltage	

39	LED+	LED Anode	
40	LED+	LED Anode	

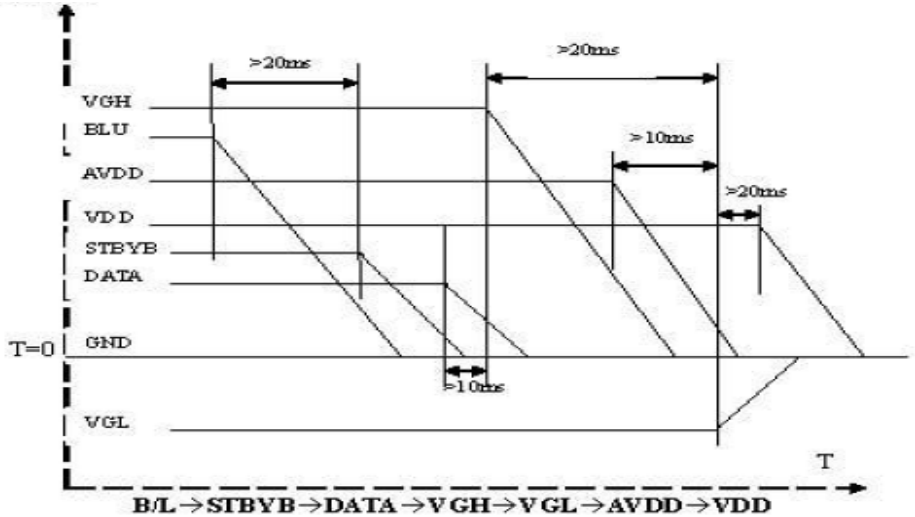
Note 1: If LVDS input data is 6 bits ,SELB must be set to High;
If LVDS input data is 8 bits ,SELB must be set to Low.
Note 2: When CABC_EN="00", CABC OFF.
When CABC_EN="01", user interface image.
When CABC_EN="10", still picture.
When CABC_EN="11", moving image.
When CABC off, don't connect DIMO, else connect it to backlight.
Note 3: When L/R="0", set right to left scan direction.
When L/R="1", set left to right scan direction.
When U/D="0", set top to bottom scan direction.
When U/D="1", set bottom to top scan direction.

9.1 power ON/OFF sequence:

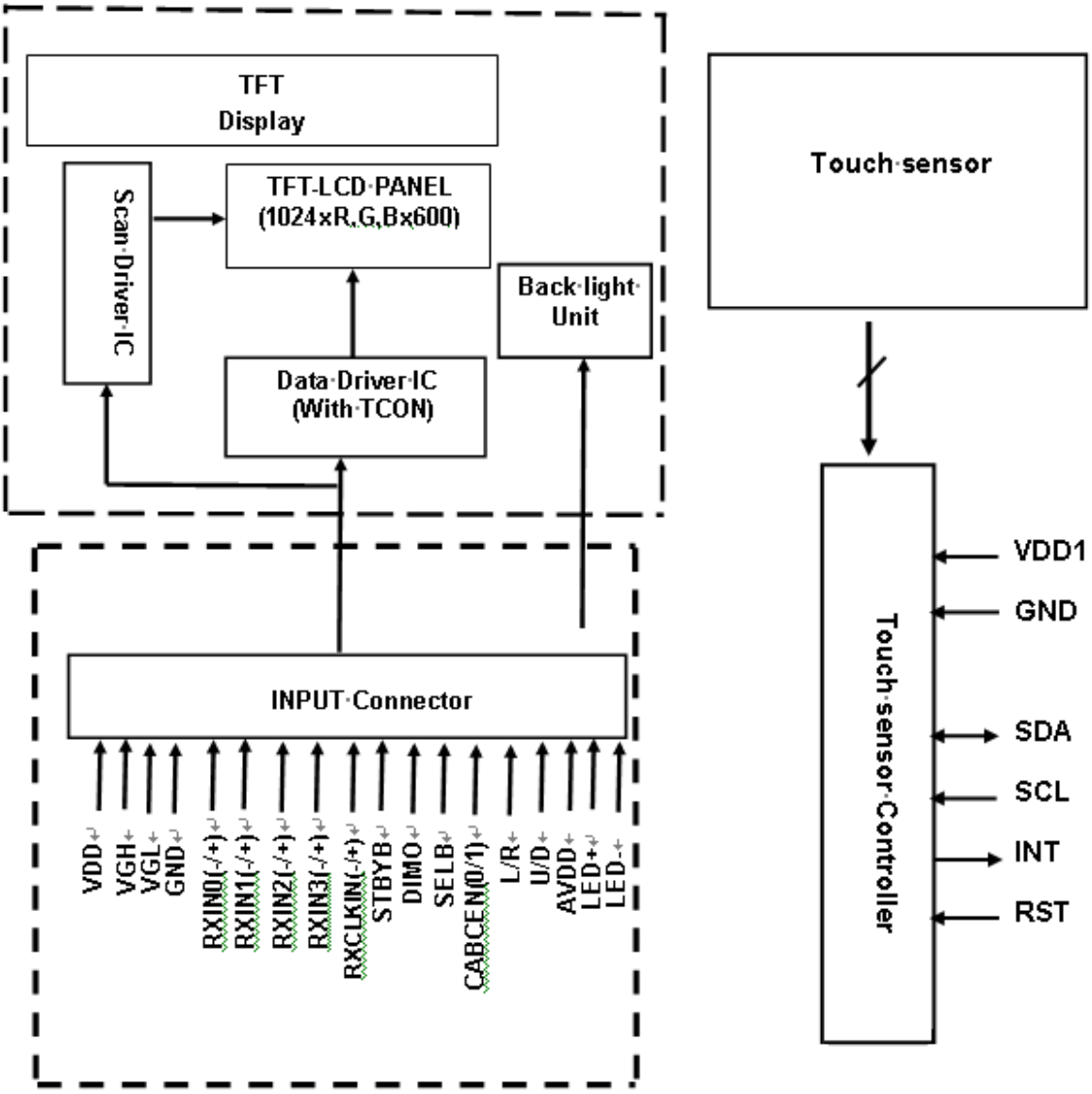
Power on:



Power off:



10. BLOCK DIAGRAM



11. CTP SPECIFICATIONS

11.1 ABSOLUTE MAXIMUM RATINGS

Symbol	Description	Min	Typ.	Max	Unit
VDD1	Supply voltage	-0.3	-	3.6	V
V_I	Logic input voltage	-0.3	-	VDD1+0.3	V

11.2 ELECTRICAL CHARACTERISTICS

Symbol	Description	Min	Typ.	Max	Unit
VDD1	Supply voltage	2.5	3.3	3.6	V
GND	Supply voltage	-	0	-	V
V_{IH}	Input H voltage	0.8VDD1	-	VDD1	V
V_{IL}	Input L voltage	0	-	0.2VDD1	V

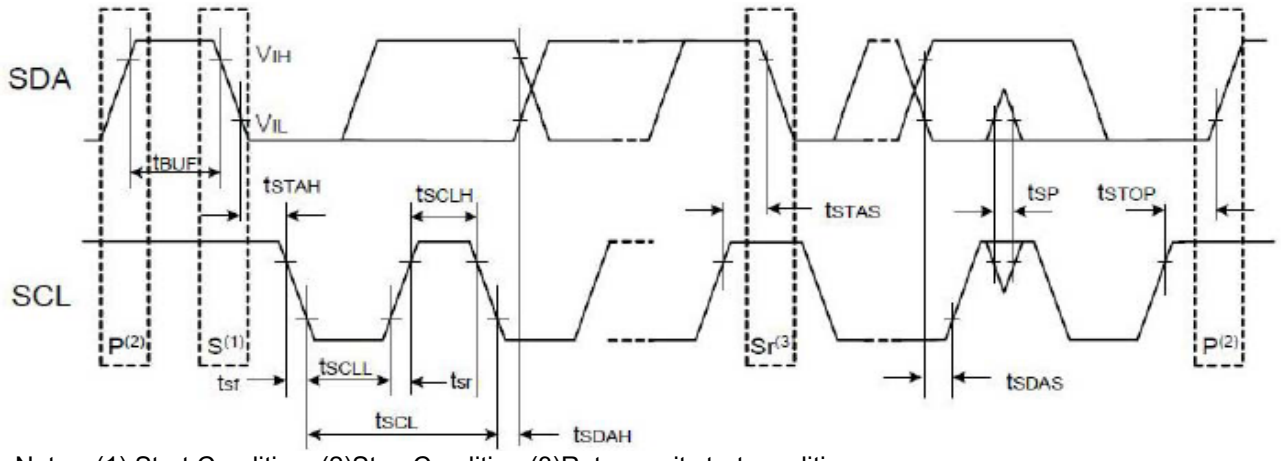
11.3 Power consumption

Symbol	Description	Fingers	F_{scan}(Hz)	Min	Typ.	Max	Unit
IVDD1	Active mode	1	130	-	-	4	mA
		2	60	-	-	5	mA
		3	50	-	-	5.2	mA
		4	45	-	-	5.4	mA
		5	40	-	-	5.6	mA
I_{sleep}	Sleep mode	0	10	-	-	0.11	mA
	Deep sleep mode	-	-	-	-	50	uA
I_{freeze}	Freeze mode	-	-	-	-	2	uA
	Boot load	-	-	-	-	6.2	mA
	Calibration	-	-	-	-	6.2	mA

11.4 CTP Interface and Data Format [Slave address is 0x5C (7 bit addressing)]

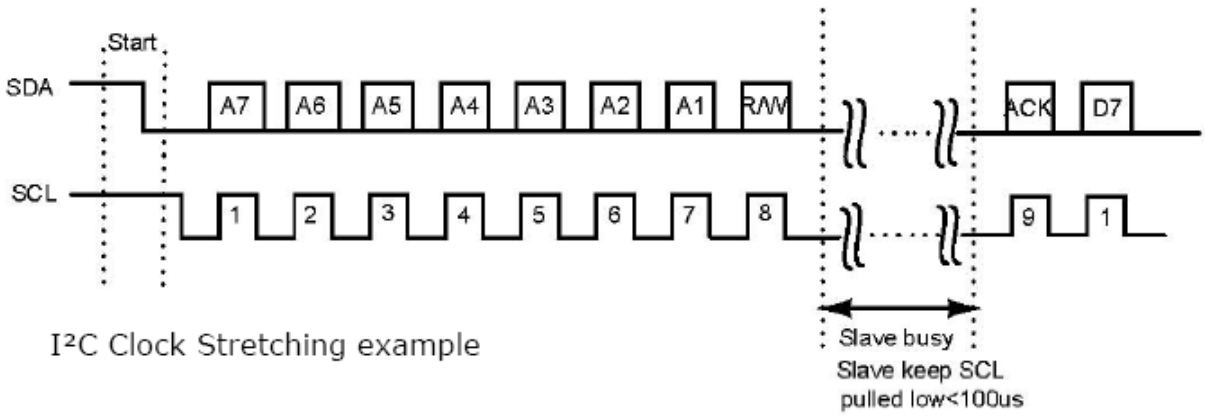
Communication protocol: I^2C

Clock frequency: 100 KHz (400 KHz Fast mode)



Note (1) Start Condition ;(2)Stop Condition;(3)Retransmit start condition

Symbol	Description	Min	Max	Unit
tSCL	SCL input cycle time	12tcyc+600	-	ns
tSCLH	SCL input H width	3tcyc+300	-	
tSCLL	SCL input L width	5tcyc+500	-	
tSF	SCL, SDA input fall time	-	300	
tSP	SCL, SDA input spike pulse rejection time	-	1 tcyc	
tSUF	SDA input bus-free time	5tcyc	-	
tSTAH	Start condition input hold time	3tcyc	-	
tSTAS	Retransmit start condition input setup time	3tcyc	-	
tSTOP	Stop condition input setup time	3tcyc	-	
tSDAS	Data input setup time	1tcyc+40	-	
tSDAH	Data Input hold time	10	-	



I²C Clock Stretching example

The protocol for data exchange has been designed with the following considerations
1 Most of the data traffic is read operation to get the finger or fingers position
2 Read operations do need an initial write operation.
3 Write operations are most of the time power management and interrupt setting instructions
4 Interrupt pulse width setting adjustments need a write operation.

S	START
P	STOP
A	Acknowledge
N	No acknowledge
W	WRITE
R	READ
DATA	8-bit

From slave to Master	From Master to Slave

11.5 Timing Characteristic

Read Operation

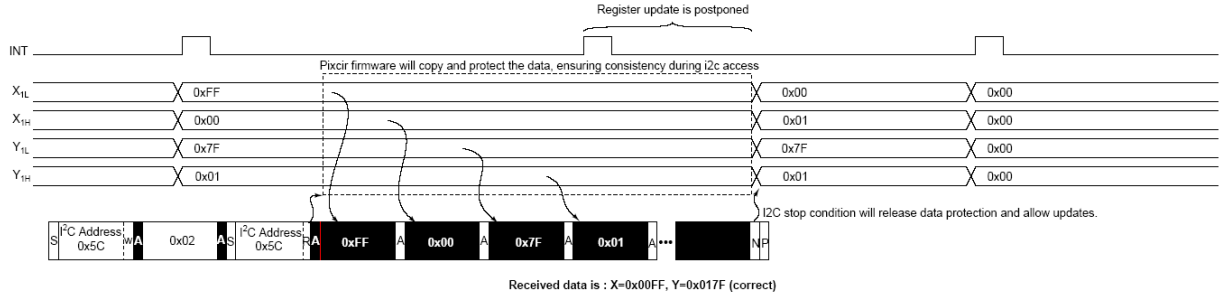
Read packets have variable content length, decided by the host. It is available to do a single read operation or a sequential read operation. Therefore, the beginning register address is needed to set before a read operation. And the data sent exactly follow the register table 9, table 11, table 12, and table 15. And, the firmware in the slave will use a memory copy of the register for I2C slave read operation, so that firmware can continue updates, and I2C slave is still using a consistent (but old) coordinates for read operation as below:

Read operation

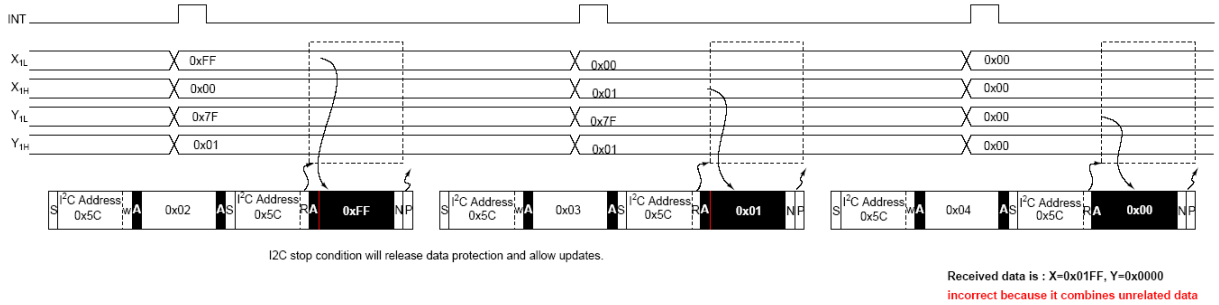
In a sequential read operation, the first data sent by the MSI device is therefore the touching register, and then the X and Y coordinates of the first finger, then 2nd finger, 3rd finger, 4th finger and then coordinates of the 5th finger, and so on. Refer in below:

Coordinates read operation

If the host does not finish the read operation when the INT line is set again, the slave firmware will delay to update coordinates registers for I²C read operation until the host finish the read operation referred to below



I²C stop condition will release data protection and allow the slave firmware update the coordinates registers for I²C read operation. So, the host has the change to give incorrect data when it gets the coordinates data with single read operation. Because the host sends many times for I²C stop condition in each multi-fingers coordinate's position reading, it will give the slave firmware chance to update the coordinates registers for I²C read operation, the host will give a combine unrelated data combines new and old coordinates together, referred to below

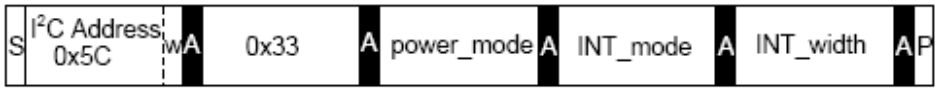


Coordinates read operation explanation

Write Operation

Write packets have variable content length, decided by the host. Write operation stops when host issues an I2C STOP symbol. The write packet is illustrated in below. Following the I2C device address, the first byte of the write packet is always the destination register address, referred in table 9, table 11, table 12, and table 15. Subsequent data values are written at the register pointed by the address, immediately upon reception of the byte. The address counter is automatically incremented. Subsequent data bytes are treated in continuation of the writing operation.

Write operation.



Write mode setting operation .

Note1：MSI Registers

Address	Type	Name	Description	Category
0	char	touching	Bitfield, see table 10	touch
1	char	buttons	Buttons bitfield	
2 (lsb) 3 (msb)	int	posx1	Finger #1 X position	
4 (lsb) 5 (msb)	int	posy1	Finger #1 Y position	
6	char	id1	Finger #1 identificator	
7 (lsb) 8 (msb)	int	posx2	Finger #2 X position	
9 (lsb) 10 (msb)	int	posy2	Finger #2 Y position	
11	char	id2	Finger #2 identificator	
12 (lsb) 13 (msb)	int	posx3	Finger #3 X position	
14 (lsb) 15 (msb)	int	posy3	Finger #3 Y position	
16	char	id3	Finger #3 identificator	
17 (lsb) 18 (msb)	int	posx4	Finger #4 X position	
19 (lsb) 20 (msb)	int	posy4	Finger #4 Y position	
21	char	id4	Finger #4 identificator	
22 (lsb) 23 (msb)	int	posx5	Finger #5 X position	
24 (lsb) 25 (msb)	int	posy5	Finger #5 Y position	
26	char	id5	Finger #5 identificator	
27	char	strength1	Finger #1 strength	
28	char	strength2	Finger #2 strength	
29	char	strength3	Finger #3 strength	
30	char	strength4	Finger #4 strength	
31	char	strength5	Finger #5 strength	

Bit 0,1,2	Nb of fingers touching (NBF)
Bit 3	Noise flag (indicates the report is unreliable) (NOI)
Bit 4	message flag (indicates a message string is sent by slave) (MSG)
Bit 5	buffer indicates the master has missed more than 2 reports, which are stored in buffer array (BUF)
Bit 6	palm flag (indicates the algorithm has a palm or similar blocking issue) (PAL)
Bit 7	water flag, indicates the algorithm has a rejected inputs due to water (WAT)

Address	Type	Name	Description	Category
32 (lsb) 33 (msb)	int	initial_distance	Distance separating fingers on the first time multitouch is detected	gesture
34 (lsb) 35 (msb)	int	distance	Distance separating fingers	
36 (lsb) 37 (msb)	int	ratio	100·distance / initial_distance	
38	char	water_level		
39	char	noise_level		
40	char	palm_level		monitor
41	char	signal_x		
42	char	signal_y		
43 50	char	button1 button8	Signal level of the buttons	buttons
51	char	power_mode	Power management register. See §2.2.3 and table 16	power management
52	char	INT_mode	Control of the ATTb pin, see §2.2.4 and table 17	
53	char	INT_width	ATTb pulse width	
54-57	char		reserved for future use	
58	char	SPECOP	Special operation . See table 13	special operations
59 (lsb) 60 (msb)	int	EEPROM_read_addr	Address used during special operation	
61	char	Engineering_cmd	Allows, with I^2c, to send "hyperterminal like commands" for engineering modes	
62 (lsb) 63 (msb)	int	CRC	FLASH CRC value (must be requested by SPECOP), excluding "EEPROM" zone	version
64-95	char	version[0..31]	Customer version control (32bytes) (imap to "eeprom")	

96-135	char	message[0..39]	Null terminated ASCII message string for engineering and debug purpose	
136 (lsb) 137 (msb)	int	RAW_CTRL	Controls RAW data mode (internal, raw, etc. . .) see table 14	
138	char	cross_x	X coordinate for method 1 crossing node measurement request	method 1
139	char	cross_y	Y coordinate for method 1 crossing node measurement request	
140 (lsb) 142 (msb)	int	cross_node	Measurement result for method 1	
142 (lsb) 143 (msb) 144 (lsb) 145 (msb) etc.	int int int	RAW[0..69] shared with history_buffer	Raw data, content controlled by RAW_CTRL register, or alternatively, history buffer (see below)	RAW data

0	Normal operation
1	"EEPROM" read operation, start address must be written in EEPROM_read_addr
2	"EEPROM" write operation NOT IMPLEMENTED
3	Calibration
4	CRC checksum of the application in Flash

Bit 0 Bit 1	Choose function (0: history buffer, 1: RAW data, 2: system info) See table 15
Bit 2	Method (0 0r 1)
Bit 3	Show offset correction (and low-pass fiter for M0)
Bit 4	Show m0 sensitivity adjustment (bit3 must also be set)
Bit 5	M1 pattern small (0) or pattern large (1)
Bit 6	M1 sense direction (0:Y,1:X)
Bit 7	M1 band scan. if 0, only report a single cross node. If 1,report a full X axis scan at RAW position
Bit 8	Disable Algorithm
Bit 9	Enable single shot RAW refresh, must be set to 1 and bit9 to 0. Auto back to 0 and bit9 to 1 after single shot is done
Bit 10	Refresh frozen after single shot is done when 1. Set to 0 to release the freeze and go back to normal refreshing
Bit 11	
Bit 12	
Bit 13	
Bit 14	
Bit 15	

Address	Type	Name	Description	Category
142	char	interval	Subsampling rate when filling the history buffer. Disable: 0. Keep all points: 1. Keep one out of two: 2. Etc.	history buffer
143	char	buffer_level	Number of fingers report in the buffer	
144 (lsb) 145 (msb)	int	posx	Coordinate X of the reported point, at time=0	
146 (lsb) 147 (msb)	int	posy	Coordinate Y of the reported point, at time=0	
148 (lsb) 149 (msb)	int	posx	Coordinate X of the reported point at time=1	
150 (lsb) 151 (msb)	int	posy	Coordinate Y of the reported point at time=1	
...				
298 (lsb) 299 (msb)	int	posx	Coordinate X of the reported point, at time=19	
300 (lsb) 301 (msb)	int	posy	Coordinate Y of the reported point, at time=19	

11.6 Operating Mode Register

11.6.1 POWER_MODE Register

Address	Name	Description of POWER_MODE Register
7-4	IDLE_PERIOD[3-0]	Refer to ALLOW_SLEEP function description Idle_period_time = k * 16 * Active_scan_period_time [s]，with k = value of IDLE_PERIOD[3-0] Active_scan_period_time = duration [s] of a scan period in active mode.
3	-	Not used
2	ALLOW_SLEEP	Allow self demotion from active to sleep mode, provide that this flag is set. If the MSI device is in active mode and no fingers is detected for more than IDLE_PERIOD time, then it allow AUTO JUMP to sleep mode. If this flag is not set, the host must explicitly switch the device from active to sleep mode.
1-0	POWER_MODE[1-0]	Power mode setting of the MSI device: 00:Active Mode 01:Sleep Mode 10:Deep Sleep Mode 11:Freeze Mode

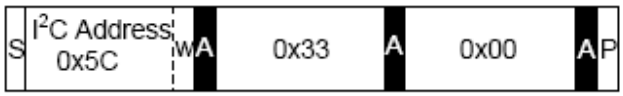
11.6.2 INT_MODE Register

Address	Name	Description
7-4	-	Not used
3	EN_INT	0:disable interrupt mode 1:enable interrupt mode
2	INT_POL	0:the interrupt is low active(default) 1:the interrupt is high active
1-0	INT_MODE[1-0]	00:INT assert periodically 01:INT assert only when finger moving 10:INT assert only when finger touch(default)

11.6.3 Power management

Active mode

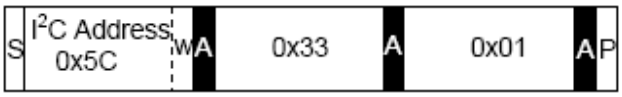
In this mode, the slave resumes with a new scan directly after each I²C transfer (after INT rising edge). This is used to reach the highest refresh rate, but also has the highest current consumption. Below shows how to force the slave into Active mode.



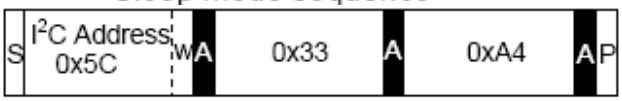
Active mode sequence

Sleep mode

This mode is selected to decrease the current consumption during low activity phases on the sensor, which need a lower refresh rate(10Hz). The MSI can automatically switch to Active mode(when finger is detected, provided that ALLOW_SLEEP bit is set in the POWER_MODE register) or by set POWER_MODE register. Also, the MSI can automatically switch from Active to Sleep mode when no finger is detected for more than IDLE_PERIOD time, provided that ALLOW_SLEEP bit is set in the POWER_MODE register. Figure 44 shows how to force the slave into Sleep mode. Below shows how to force the slave into Sleep mode can automatically switch, provided IDLE_PERIOD=10.



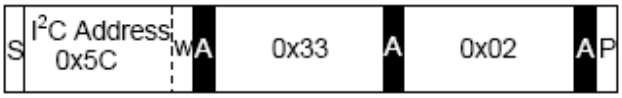
Sleep mode sequence



Sleep mode automatically switch sequence

Deep Sleep mode

This mode is selected to achieve the minimum consumption during very low activity phases on the sensor, which need a lowest refresh rate (1Hz). The MSI only can switch to Deep Sleep mode by set POWER_MODE register. Below shows how to force the slave into Deep Sleep mode.

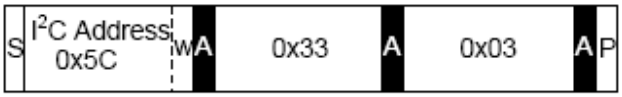


Deep Sleep mode sequence

Freeze mode

In this mode, the slave MCU internal clock source is stopped, and consumption is only MOS leakage. Below shows how to force the slave into Freeze mode. There are two ways to wake up from freeze mode.

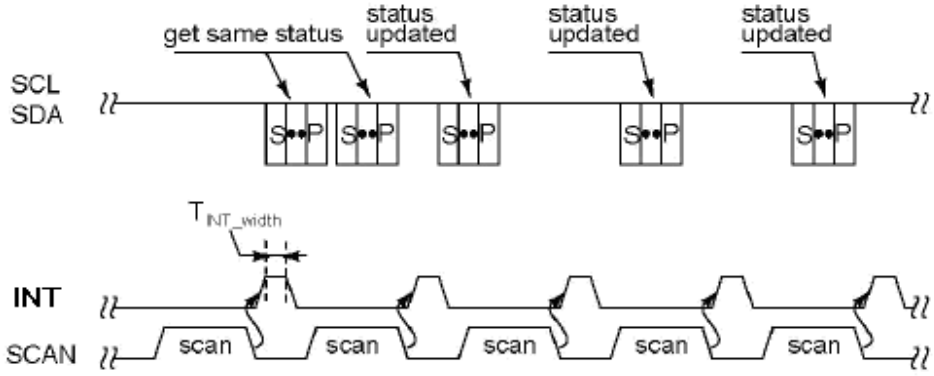
- RST pin pull down (connect to the Ground) (default)
- INT pin change (“1 to 0” or “0 to 1”)



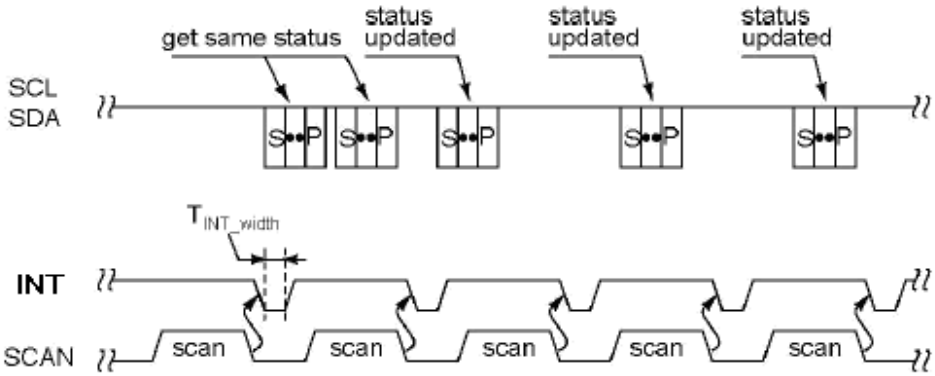
Freeze mode sequence

11.6.4 Transition of INT line

When INT_MODE=00 in the INT MODE register, the slave will set the INT line with INT_width pulse width after each scan in order to request the attention from the host, as shown in below

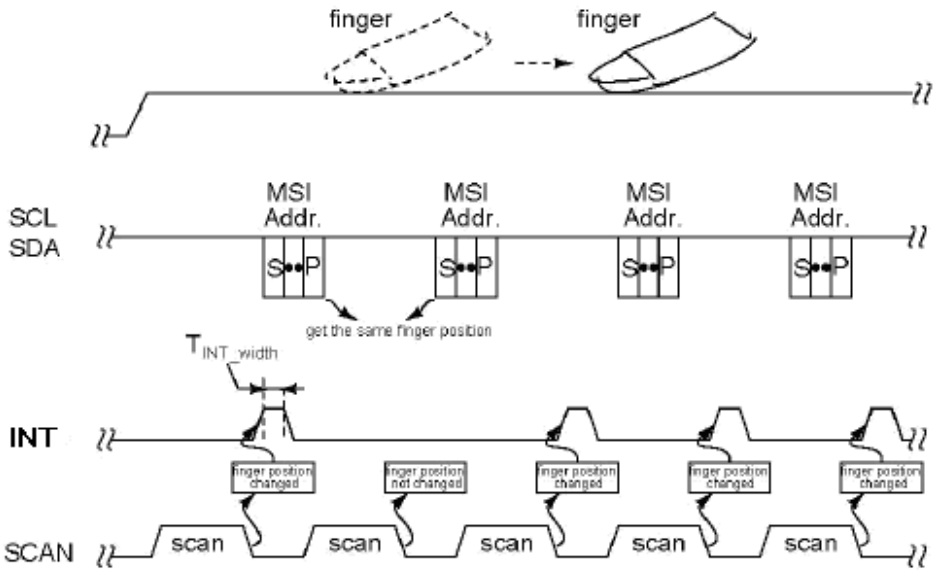


INT line pull up by slave (INT_POL=1, INT_MODE=00 in the INT mode register)



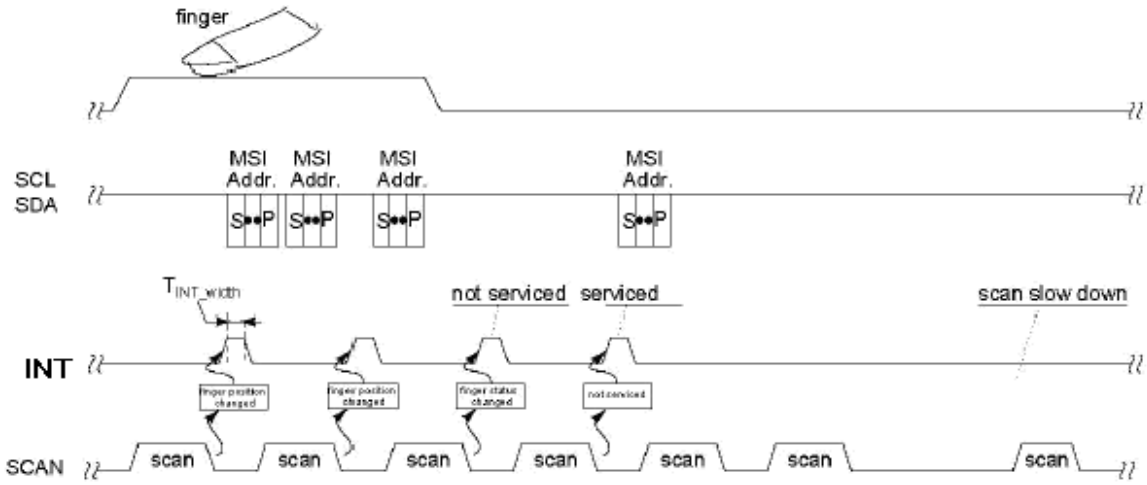
INT line pull down by slave (INT_POL=0, INT_MODE=00 in the INT mode register)

When INT_Mode=01 in the INT mode register and finger moving on the panel, the slave will set The INT line after each scan, as shown in below.



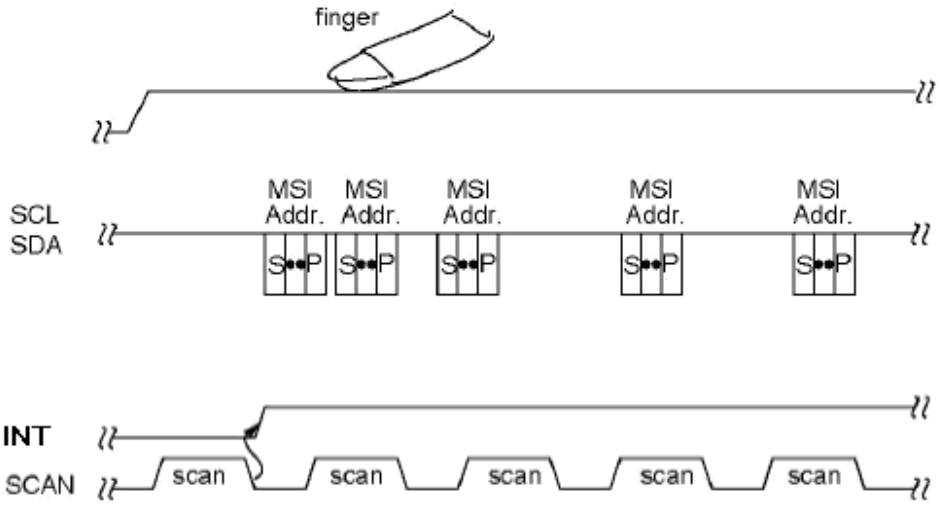
INT line pull up when finger moving (INT_POL=1, INT_MODE=01 in the INT mode register)

When fingers leaves the panel, the slave will continue to pulse INT line for each scan; but once the master has serviced this request and become now aware that there is no more finger touching, the slave will stop pulse the INT line, and will also gradually reduce the scan speed, as shown in below



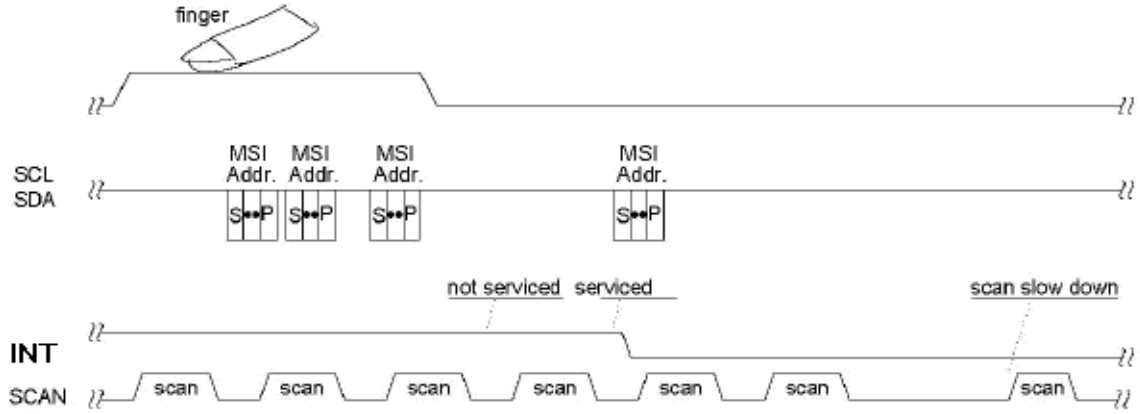
INT line will stop pulse when finger leaves and master has acknowledge the situation (INT_POL=1 in the INT mode register)

When INT_Mode=10 in the INT mode register and finger touch the panel, the slave will set The INT line after each scan as shown in below.



INT line pull up when finger touch (INT_POL=1, INT_MODE=10 in the INT mode register)

When fingers leaves the panel, the slave will continue keep INT line status for each scan; but once the master has serviced this request and become now aware that there is no more finger touching, the slave will release the INT line, and will also gradually reduce the scan speed, as shown in below

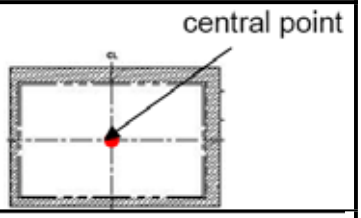
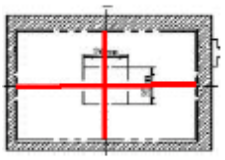


INT line will stop pulse when finger leaves and master has acknowledge the situation (INT_POL=1 in the INT mode register)

11.7. PIN CONNECTIONS

No.	Name	I/O	Description
1	VDD1	P	Power;(VDD1=3.3V)
2	GND	P	Ground
3	RST	I	Reset, active high
4	SCL	I	I2C clock input
5	SDA	I/O	I2C data signal
6	INT	O	Interrupt output
7	NC	--	No connect
8	NC	--	No connect

11.8 CTP Life Test

1	Point hitting life	> 1,000,000 Use 8 mm diameter silicon rubber/force 3N to knock on the same point twice per second (no-operating), after test function check pass.	
2	Line Drawing life (no contact CTP)	> 100,000；Use 11mm diameter/copper column to draw straight lines back and forth as the following red lines at the speed of 100mm/sec under system operating.	

12. Appearance Specification

12.1 Inspection and Environment conditions

12.1.1 Temperature: 25± 5

12.1.2 Humidity: 55 ± 10% RH

12.1.3 Light source: Fluorescent Light

12.1.4 Inspection: Viewing distance: 35±5cm

12.1.5 Ambient Illumination:

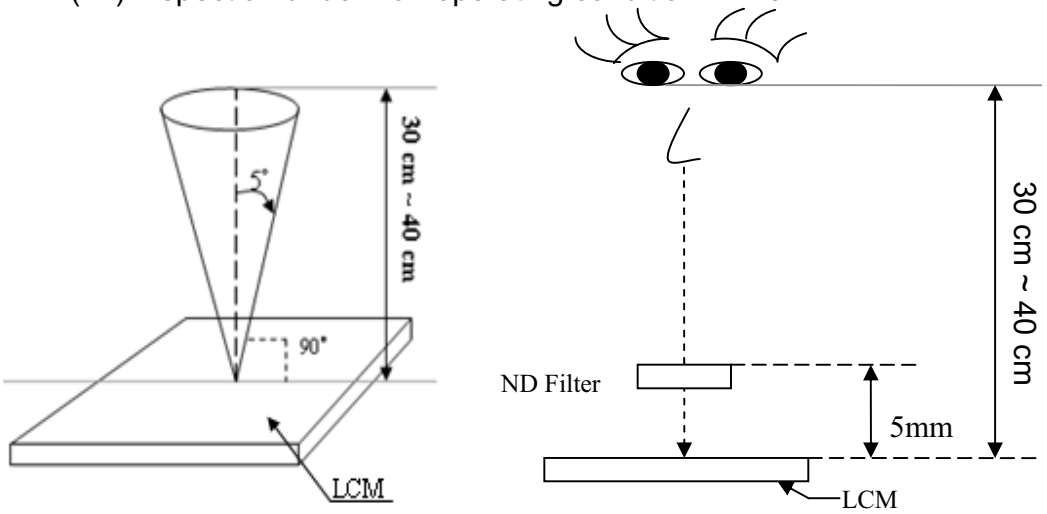
(1) Cosmetic Inspection: 500 ~ 800 lux

(2) Functional Inspection: 400 ~ 600 lux

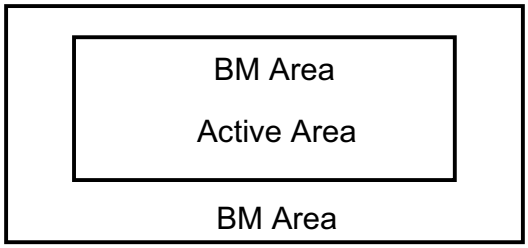
12.1.6 Inspection View angle:

(1) Inspection under operating condition : ±5°

(2) Inspection under non-operating condition : ± 45°



12.2 Definition of applicable Zones



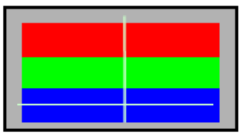
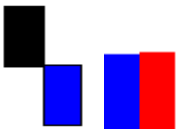
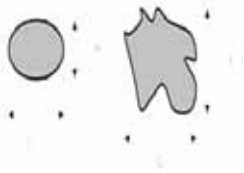
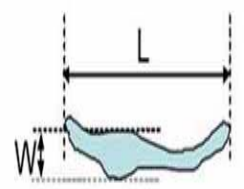
12.3 Judgment standard

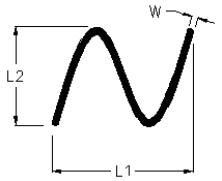
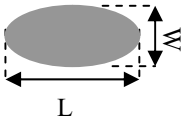
The Judgment of the above test should be made after exposure in room temperature for two hours as follow:

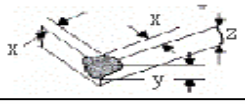
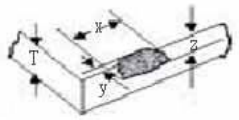
Pass: Normal display image with no obvious non-uniformity and no line defect. Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defect.

12.4 Cosmetic Specification and Inspection Items

<table>
<tr><th>Inspection Item</th><th>Inspection Criteria</th><th>Illustration</th></tr>
<tr><td>Display function</td><td>No Display malfunction</td><td>  </td></tr>
<tr><td>Contrast ratio</td><td>Does not meet specified range in the spec.</td><td>(Major) (Note:2)</td></tr>
<tr><td>Line Defect</td><td>No obvious Vertical and Horizontal line defect in black and White.</td><td>  </td></tr>
<tr><td>Point Defect</td><td>
<table>
<tr><th rowspan="2">Item</th><th>Acceptable number</th><th rowspan="2">Total</th></tr>
<tr><th>Active Area</th></tr>
<tr><td>Bright</td><td>2</td><td rowspan="2">5</td></tr>
<tr><td>Dark</td><td>4</td></tr>
<tr><td>Two adjacent dot</td><td>2</td><td>2</td></tr>
</table>
</td><td>One Dot
 
Two adjacent dot
  </td></tr>
<tr><td>Foreign material (Black or White spots shape)</td><td>
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr>
<tr><td>D> 0.8 mm</td><td>0</td><td rowspan="3">Minor</td></tr>
<tr><td>0.3mm D 0.8 mm</td><td>5</td></tr>
<tr><td>D< 0.3mm</td><td>*</td></tr>
</table>
</td><td> 
D= (L + W) / 2</td></tr>
<tr><td>Foreign Material (Line shape)</td><td>
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr>
<tr><td>W> 0.1mm or L >10mm</td><td>0</td><td rowspan="3">Minor</td></tr>
<tr><td>0.05 mm W 0.1 mm L 10mm</td><td>5</td></tr>
<tr><td>W< 0.05mm</td><td>*</td></tr>
</table>
</td><td> 
L : Long W : Width</td></tr>
<tr><td>Non-uniformity</td><td>Visible through 5 %ND filter White, R, G, B and gray 50% pattern.</td><td>(Minor)</td></tr>
<tr><td>Dimension</td><td>Outline</td><td>(Major)</td></tr>
<tr><td>Bezel appearance</td><td>uneven</td><td>(Minor)</td></tr>
</table>

<table>
<tr>
<td>Scratch on the Touch panel</td>
<td>
<table>
<tr><th>Dimension \ Zone</th><th>Acceptable number</th><th>Class of Defects</th></tr>
<tr><td>W> 0.1mm or L >10mm</td><td>0</td><td rowspan="2">Minor</td></tr>
<tr><td>W 0.1 mm
L 10mm</td><td>5</td></tr>
</table>
</td>
<td> 
</td>
</tr>
<tr>
<td>Dent on the Touch panel</td>
<td>
<table>
<tr><th>Dimension \ Zone</th><th>Acceptable number</th><th>Class of Defects</th></tr>
<tr><td>D> 0.5 mm</td><td>0</td><td rowspan="2">Minor</td></tr>
<tr><td>0.3mm D 0.5 mm</td><td>5</td></tr>
</table>
</td>
<td> 

D= (L + W) / 2</td>
</tr>
<tr>
<td>Polarizer flaw or leak out resin</td>
<td>Defect is defined as the active area.</td>
<td></td>
</tr>
<tr>
<td>Corner Chipping</td>
<td>X<3 mm, Y<3 mm, Z< Glass thickness</td>
<td> 
</td>
</tr>
<tr>
<td>Edge Chipping</td>
<td>X<3 mm, Y<3 mm, Z< Glass thickness</td>
<td> 
</td>
</tr>
<tr>
<td>Crack</td>
<td>reject</td>
<td>  </td>
</tr>
</table>

12.5 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.
Lot size: Quantity of shipment lot per model.
Sampling type: normal inspection, single sampling
Sampling table: MIL-STD-105E

Inspection level: Level II

	Definition		
Class of defects	Major	AQL 0.65%	It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function.
	Minor	AQL 1.5%	It is a defect that will not result in functioning problem with deviation classified.

Note:1.(a)Bright point defect is defined as point defect of R,G,B with area >1/2 pixel respectively
(b)Dark point defect is defined as visible in full white pattern.
(c)Definition of distribution of point defect is as follows:
-minumum separation between dark point defects should be larger than 5mm.
-minumum separation between bright point defects should be larger than 5mm.
(d)Definition of joined bright point defect and joined dark point defect are as follows:
- Three or more joined bright point defects must be nil.
- Three joined dark point defects must be nil.
- Two Joined dark point is counted as two dark points with 2 pair maximum.
(e) Line defect is defined as visible by using 5 % ND filter.
Note:2 Luminance measurement for contrast ratio is at the distance 50± 5cm between the detective head and the panel with ambient illuminance less than 1 lux. Contrast ratio is obtained at optimum view angle

13. QUALITY ASSURANCE

13.1 Test Condition

13.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 25 ± 5°C

Humidity : 65 ± 5%

13.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

13.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

13.1.4 Test Frequency

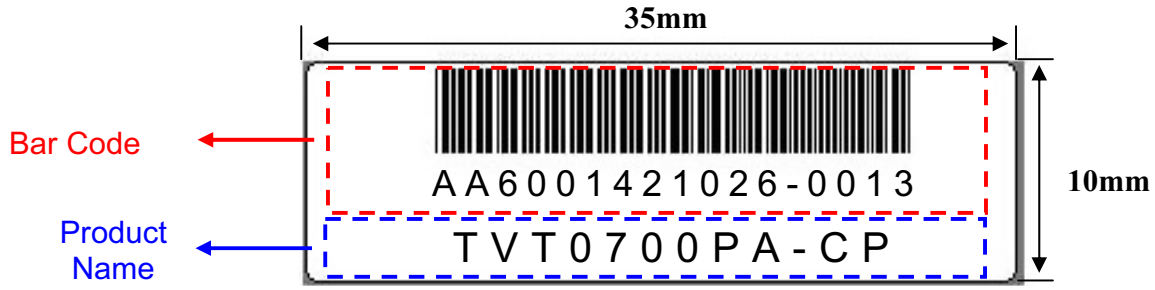
In case of related to deterioration such as shock test. It will be conducted only once.

13.1.5 Test Method

Reliability Test Item & Level		Test Level	Remark
No.	Test Item		
1.	High Temperature Storage Test	T= 70 ,120hrs after 1 hrs at room temperature and test.	IEC68-2-2
2.	Low Temperature Storage Test	T= -30 ,120hrs after 1 hrs at room temperature and test.	IEC68-2-1
3.	High Temperature Operation Test	T= 60 , 120hrs after 1 hrs at room temperature and test.	IEC68-2-2
4.	Low Temperature Operation Test	T= -20 , 120hrs after 1 hrs at room temperature and test.	IEC68-2-1
5.	High Temperature and High Humidity Operation Test	T= 40 ,90%RH,120hrs after 24 hrs at room temperature and test.	IEC68-2-3
6.	Thermal Cycling Test (No operation)	-20 30min ~60 30 min , 10 Cycles after 24 hrs at room temperature and test.	IEC68-2-14
7.	Vibration Test (No operation)	Frequency :10 ~ 55 H_Z Amplitude :1.5 mm Sweep time : 11 mins Test Period: 6 Cycles for each direction of X, Y, Z	IEC68-2-6
8.	ESD TEST	Air Discharge : ±15 KV charge & discharge Indirect Contact Discharge : ±8KV charge & discharge	IEC-61000-4-2

14. PRODUCT LABEL DEFINE

Product Label style:



BarCode Define:

A A 6 0014 2 10 26-0013

- Serial number of the products
  Serial number starts from 0000
  Every work order is 10K at most
- Week of production
- Year of production
- Storage area
- Serial number of work order
  Serial number starts from 0000 each month
- Month of work order
- Year of work order
- The first 3 numbers of work order

Product Name Define:

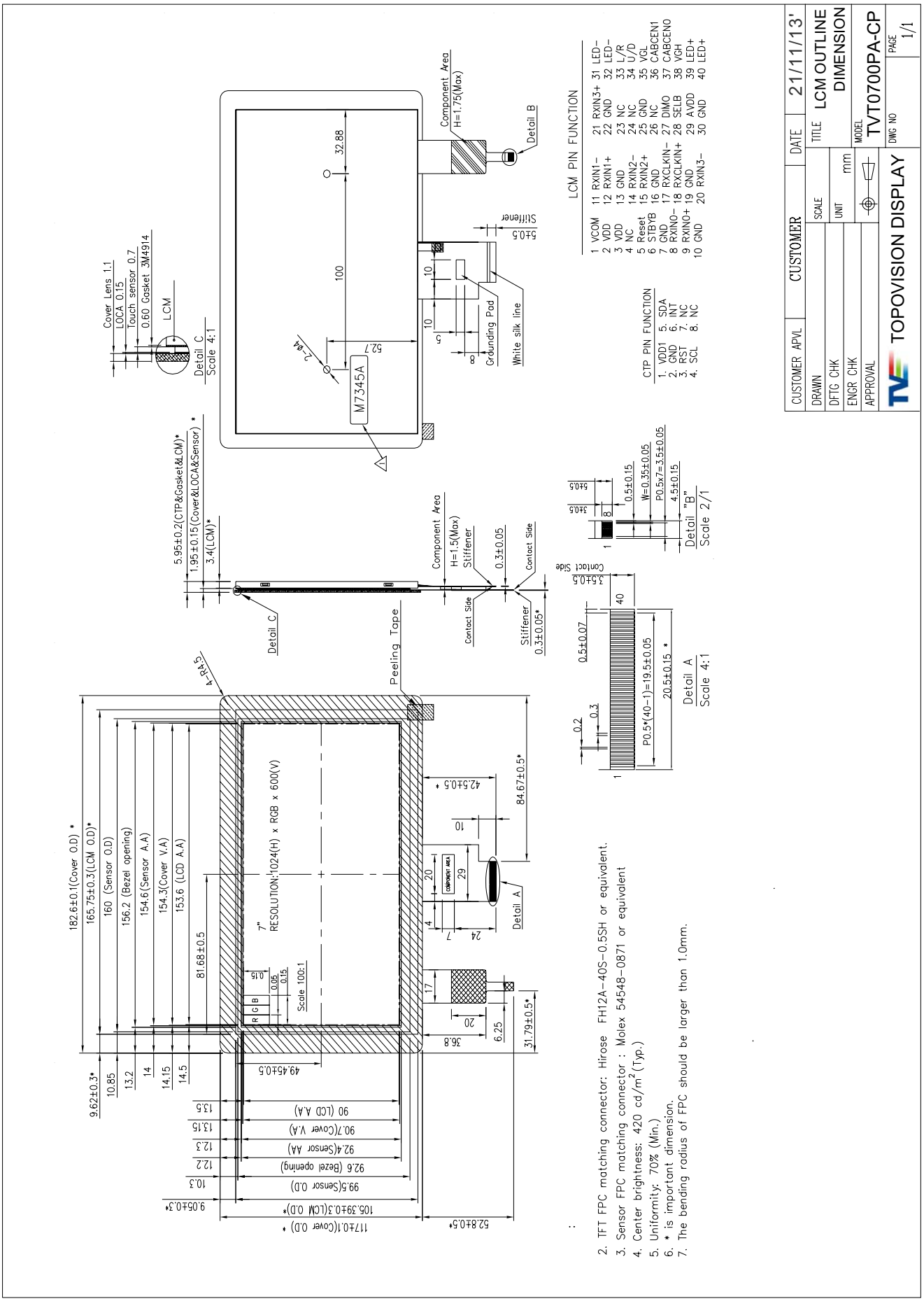
15. PRECAUTIONS IN USE LCM

5. ASSEMBLY PRECAUTIONS
   (1) You must mount a module using holes arranged in four corners or four sides.
   (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
   (3) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
   (4) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
   (5) Do not open the case because inside circuits do not have sufficient strength.
   (6) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
   (7) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
   (8) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.
   (9) Please excessive force or strain to the panel or tail is prohibited.
   (10) Use clean sacks or glove to prevent fingerprints and/or stains left on the panel. Extra attention and carefulness should be taken while handling the glass edge.
   (11) Avoid touching the viewing area before installation /integration.
6. OPERATING PRECAUTIONS
   (1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
   (2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification
   (3) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
   (4) When fixed patterns are displayed for a long time, remnant image is likely to occur.
   (5) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
   (6) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.
   (7) Touch the panel with your finger or stylus only to assure normal operation. Any sharp edged or hard objects are prohibited.
   (8) Operate the panel in a steady environment. Abrupt variation on temperature and humidity may cause malfunction of the panel.

3. ELECTROSTATIC DISCHARGE CONTROL
   (1) The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such the copper leads on the PCB and the interface terminals with any parts of the human body.
   (2) The modules should be kept in antistatic bags or other containers resistant to static for storage.
   (3) Only properly grounded soldering irons should be used.
   (4) If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
   (5) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended
   (6) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.
2. STORAGE PRECAUTIONS
   (1) When you store LCDs and touch panel for a long time, it is recommended to keep the temperature between 0°C-40°C without the exposure of sunlight and to keep the humidity less than 90%RH.
   (2) Please do not leave the LCDs and touch panel in the environment of high humidity and high temperature such as 60°C 90%RH
   (3) Please do not leave the LCDs and touch panel in the environment of low temperature; below -20°C.
3. OTHERS
   (1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight Land strong UV rays
   (2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
   (3) For the packaging box, please pay attention to the followings:
   (4) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
   (5) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
   (6) Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)
4. LIMITED WARRANTY

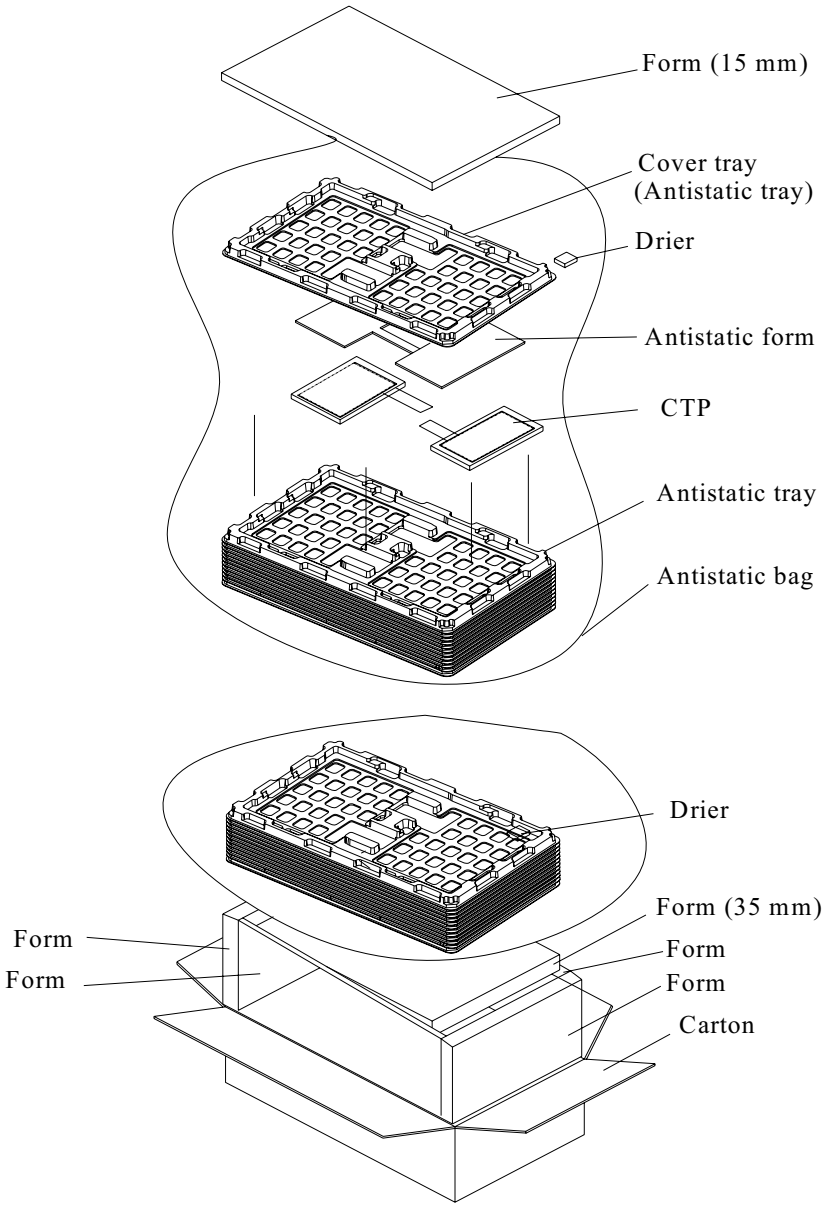
   Unless otherwise agreed between Topovision and customer, Topovision will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with Topovision acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Topovision is limited to repair and/or replacement on the terms set forth above. Topovision will not responsible for any subsequent or consequential events.

Outline Drawing



2. TFT FPC matching connector: Hirose FH12A-40S-0.5SH or equivalent.
3. Sensor FPC matching connector : Molex 54548-0871 or equivalent
4. Center brightness: 420 cd/m^2(Typ.)
5. Uniformity: 70% (Min.)
6. * is important dimension.
7. The bending radius of FPC should be larger than 1.0mm.

17. PACKAGE INFORMATION



Material

1 Carton + 1 Anti-static bag + Form + Anti-static tray

Total pcs

1 Antistatic tray = 2 panel pcs

1 Anti-static bag = 16 Anti-static tray + cover tray = 16*2 +0 = 32pcs

1 Carton = 32 pcs

Carton size : 482L x 282W x 279H (mm)

Total Weight ≒ 9 kgw

7" PANEL+FPC PACKING