Colour TFT Display Modules

Product Specification

Part No. SCX0403C32GGC06

4.3” WQVGA Colour TFT Display

with PCAP Touchscreen

For more information, please visit www.andersdx.com
or email info@andersdx.com

Version 1

Interfaces to Inspire

Confidential Document

DATA IMAGE CORPORATION

CTP Module Specification

Preliminary

ITEM NO.: SCX0403C32GGC06

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2. RECORD OF REVISION

Rev	Date	Item	Page	Comment	Source
1	30/MAR/15'			Initial preliminary	NPDO-1233

3. FEATURE

- 64 gray level with 2 bit dithering function to realize 16M colors

4. GENERAL SPECIFICATIONS

Parameter	Specifications	Unit
Display resolution	480X R.G.B x 272	dot
Screen size	4.3(Diagonal)	inch
LCD Active area	95.04(W) x 53.86(H)	mm
Sensor active area	98.7(W) x 57.5(H)	
Pixel pitch	0.198 (W) x 0.198(H)	mm
Color configuration	R.G.B. Stripe	
Overall dimension	115.1(W) x 77.9(H) x5.1(D)	mm
LCM model number	FG04032LDSSWBG01	
Weight	TBD	g
View Angle direction(Gray inversion)	6 o'clock	
Our components and processes are compliant to RoHS & REACH standard		

5. ELECTRICAL CHARACTERISTICS

GND=0V,Ta=25°C

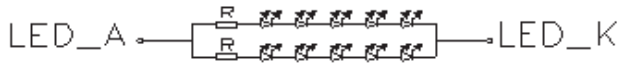
Parameter	Symbol	MIN.	Typ.	MAX.	Unit	Remark
Power Supply voltage	V_{DD}	3.0	3.3	3.6	V	Note1
Power Supply Current	I_{DD}	--	17	20	mA	V_{DD} =3.3V
Ripple Voltage	V_{RPVDD}	--	--	100	mVp-p	
"H" level logical input voltage	V_{IH}	0.8VDD	--	VDD	V	
"L" level logical input voltage	V_{IL}	0	--	0.2VDD	V	
Operating temperature	Topa	-20	--	70	°C	Ambient temperature
Storage temperature	Tstg	-30	--	80	°C	Ambient temperature

Note1:VDD Absolute Maximum Ratings -0.3V~+6V

5.1 Backlight driving for power conditions

Ta= 25 °C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	I_{LED}	--	40	--	mA	
VLED voltage	V_{LED}	--	24	--	V	
LED life time		--	37,000	--	Hours	



LED CIRCUIT
Voltage :24V(Typ)
Current :40mA

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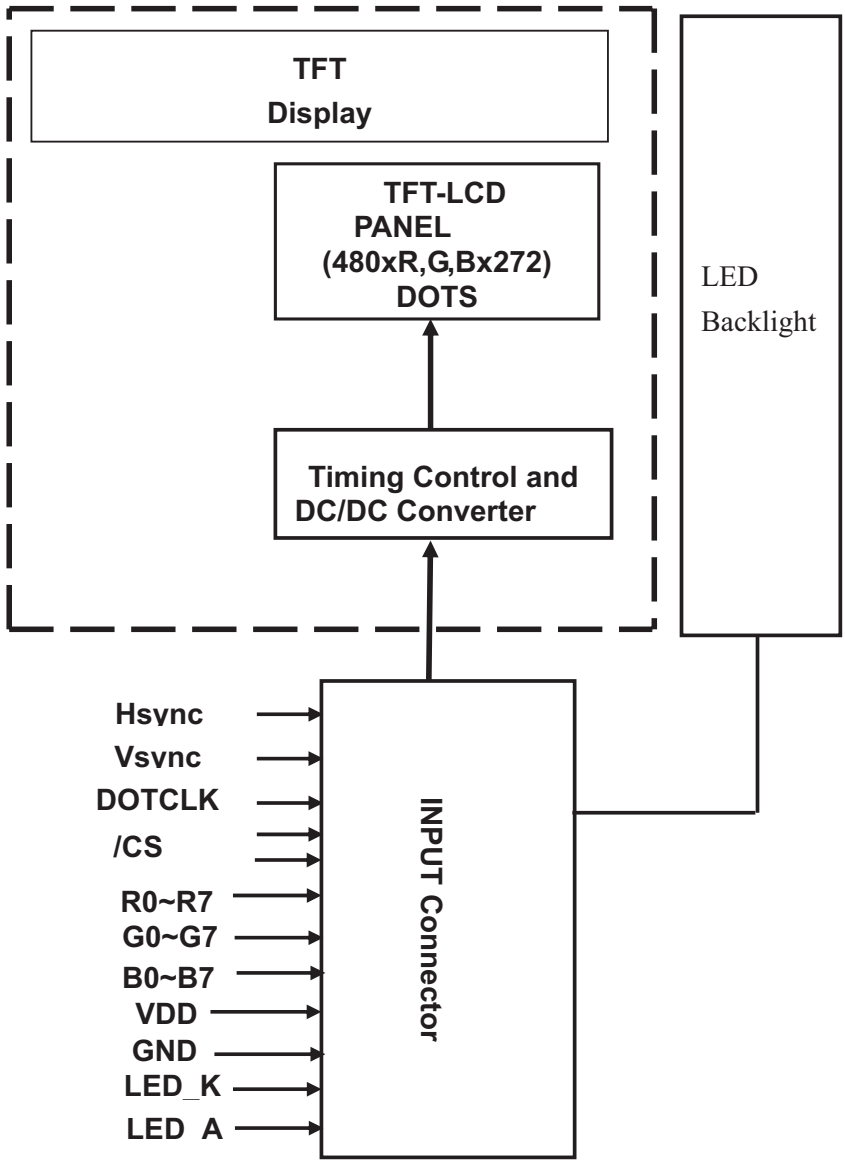
6. BLOCK DIAGRAM



7. PIN CONNECTIONS

7.1 Input Pins Connection

Pin No	Symbol	Function	Remark
1	LED_K	LED Power Source input terminal (Cathode side)	
2	LED_A	LED Power Source input terminal (Anode side)	
3	GND	Ground	
4	VDD	Power Supply : +3.3V	
5	VDD	Power Supply : +3.3V	
6	SHUT	Display ON/OFF control ON=H(VDD) OFF=L(GND)	
7	DOTCLK	Clock edge selection signal for the data sampling	
8	VSYNC	Vertical synchronous signal	
9	HSYNC	Horizontal synchronous signal	
10	DE(DEN)	Input data enable control.	
11	R7	Digital data input	
12	R6	Digital data input	
13	R5	Digital data input	
14	R4	Digital data input	
15	R3	Digital data input	
16	R2	Digital data input	
17	G7	Digital data input.	
18	G6	Digital data input.	
19	G5	Digital data input.	
20	G4	Digital data input.	
21	G3	Digital data input.	
22	G2	Digital data input.	
23	B7	Digital data input.	
24	B6	Digital data input.	
25	B5	Digital data input.	
26	B4	Digital data input.	
27	B3	Digital data input.	
28	B2	Digital data input.	
29	SDI	Data input pin in serial interface.	
30	SCK	Clock pin of serial interface.	
31	/CS	Chip select pin of serial interface	
32	/RES	Reset	
33	SDO	Data output pin in serial mode.	
34	R1	Digital data input.	
35	R0	Digital data input.	
36	G1	Digital data input.	
37	G0	Digital data input.	
38	B1	Digital data input.	
39	B0	Digital data input.	
40	NC	No connection	

8. AC CHARACTERISTICS

8.1 Input Timing Requirement

(480RGBx272, Ta =25ºC, VDD=3.3V GND= 0V)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Clock cycle	$f_{CLK(1)}$	-	9	15	MHz
Hsync cycle	1/th	-	17.14	-	KHz
Vsync cycle	1/tv	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	$thp_{(2)}$	2	41	41	CLK
Horizontal back porch	$thb_{(2)}$	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	511	$H_{(1)}$
Vertical display period	tvd	272	272	272	$H_{(1)}$
Vertical front porch	tvf	1	2	227	$H_{(1)}$
Vertical pulse width	$tvp_{(2)}$	1	10	11	$H_{(1)}$
Vertical back porch	$tvb_{(2)}$	1	2	11	$H_{(1)}$

Note: (1) Unit: CLK=1/ fCLK , H=th,

(2)It is necessary to keep tvp+tvb=12 and thp+thb=43 in sync mode.

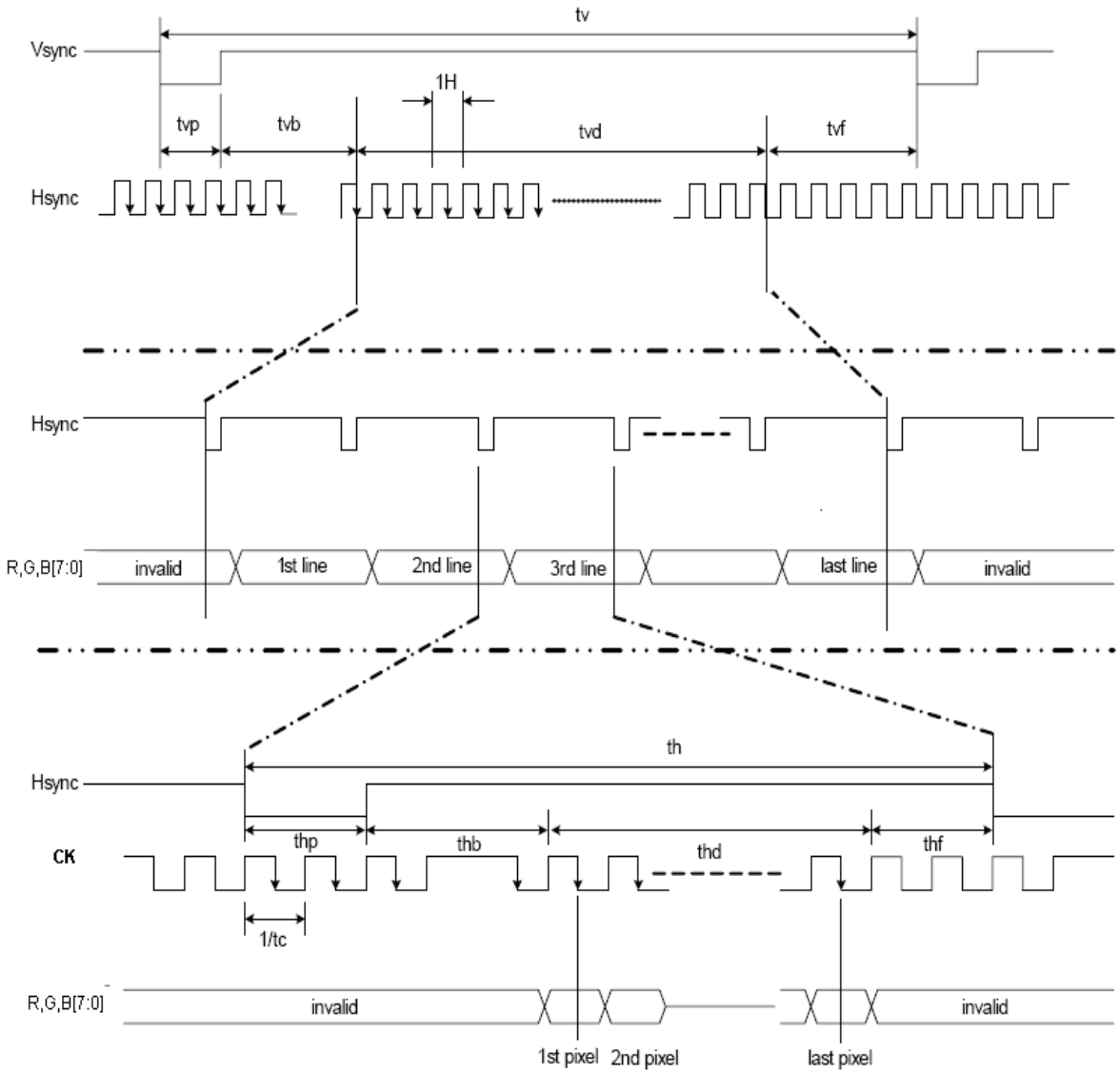


Fig 1. Parallel RGB input timing

8.2 Input Setup Timing Requirement

(Ta =25ºC, VDD=3.3V ,GND= 0V, tr (1)=tf (1)=2ns)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
DISP setup time	t_{diss}	10	-	-	ns
DISP hold time	t_{dish}	10	-	-	ns
Clock period	$PW_{CLK(2)}$	66.7	-	-	ns
Clock pulse high period	$PWH_{(2)}$	26.7	-	-	ns
Clock pulse low period	$PWL_{(2)}$	26.7	-	-	ns
Hsync setup time	t_{hs}	10	-	-	ns
Hsync hold time	t_{hh}	10	-	-	ns
Data setup time	t_{ds}	10	-	-	ns
Data hold time	t_{dh}	10	-	-	ns
Vsync setup time	t_{vhs}	10	-	-	ns
Vsync hold time	t_{vhh}	10	-	-	ns

Note: (1) tr, tf is defined 10% to 90% of signal amplitude.
(2) For parallel interface, maximum clock frequency is 15MHz.

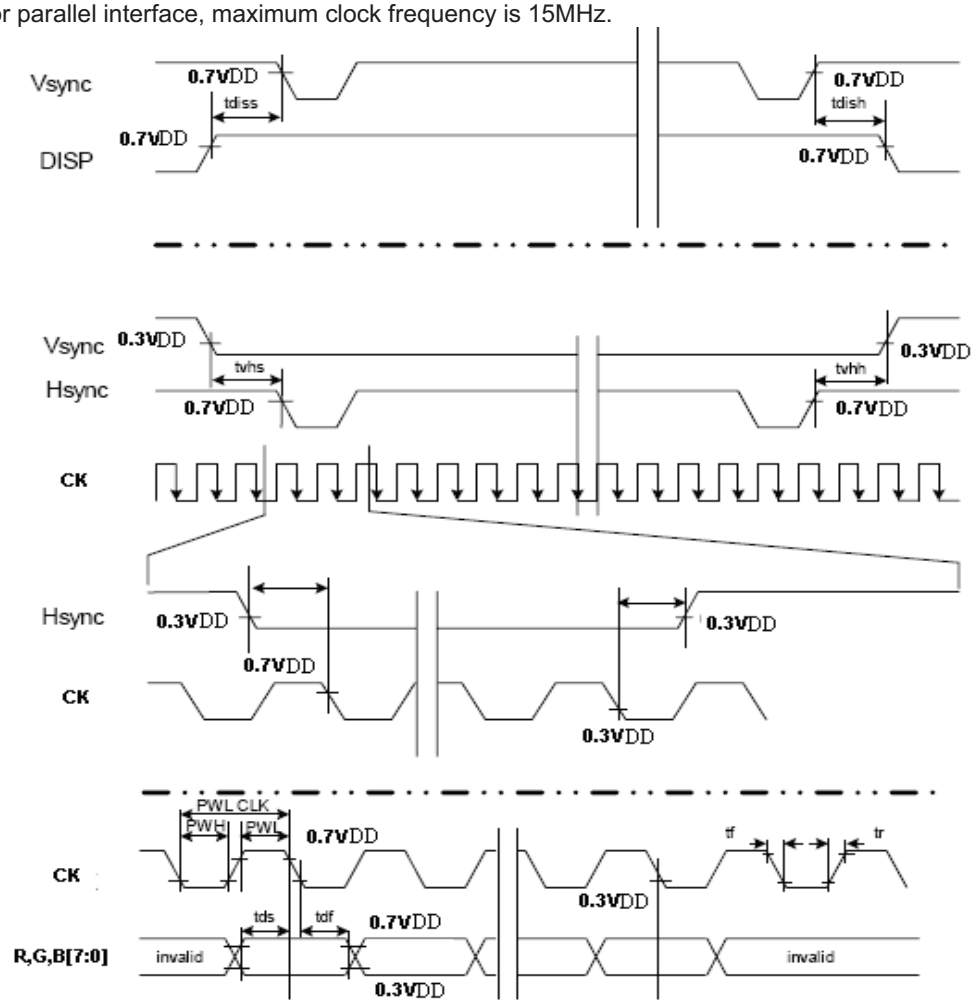


Fig 2. Input setup timing requirement

8.3 TCON Power ON/OFF Control

The TCON IC has a power ON/OFF sequence control function. When DISP pin is pulled "H", blank data is outputted for 10-frames first, from the falling edge of the following VSYNC signal. Similarly, when DISP is pulled "L", 10-frames of blank data will be outputted from the falling edge of the following VSYNC, too.

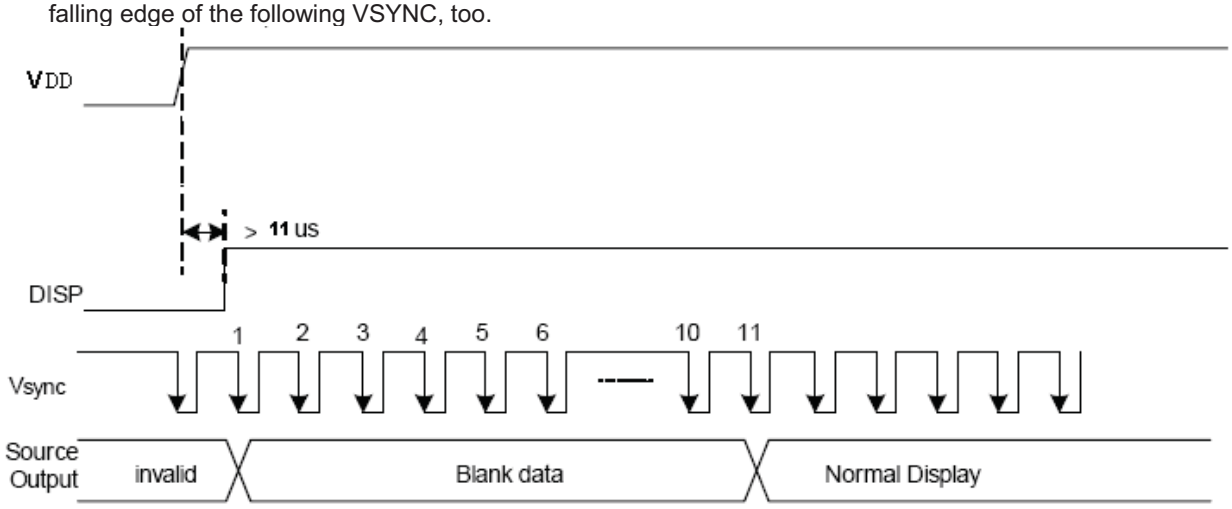


Fig 3. Power On Sequence

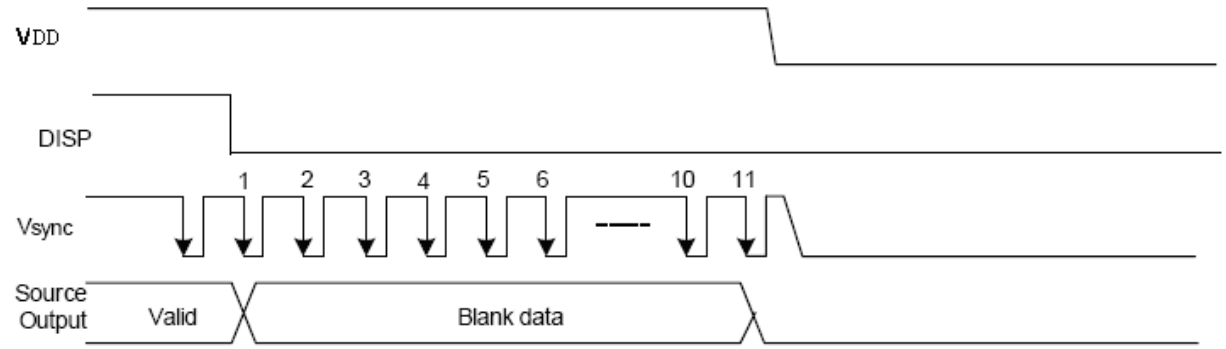
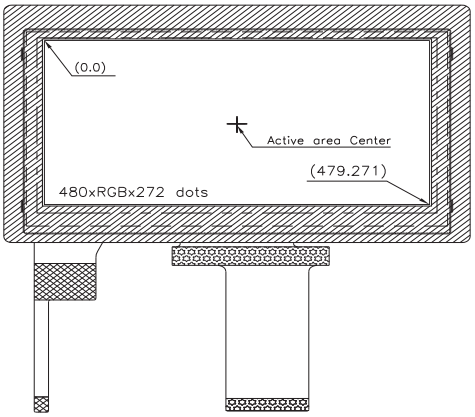


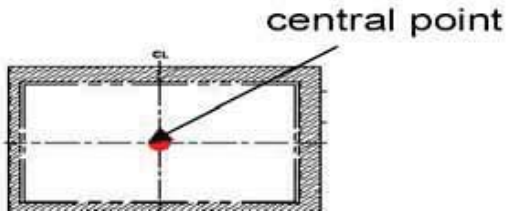
Fig 4. Power Off Sequence

9. CTP SPECIFICATIONS

9.1 GENERAL SPECIFICATIONS

Item	Specification	Unit
Type	Transparent type projected capacitive touch panel	
Input mode	Human's finger	
Multi touch	2	Point
Interface	IIC	
Report rate	122(Max)	Points/sec
Response time	15	ms
(X,Y) Position		
Point hitting life time	1,000,000 times min.	Note 1
F/W: SCX0403C32GGC01_20141127.PIX. Ver：20141127.		

Note 1: Use 8 mm diameter silicon rubber/force 3N to knock on the same point twice per second (no-operating), after test function check pass.



9.2 Electrical Characteristic

9.2.1 ABSOLUTE MAXIMUM RATINGS

Symbol	Description	Min	Typ.	Max	Unit
VDD1	Supply voltage	-0.3	-	3.6	V
V_I	Logic input voltage	-0.3	-	V_{DD1}+0.3	V

9.2.2 DC Characteristic

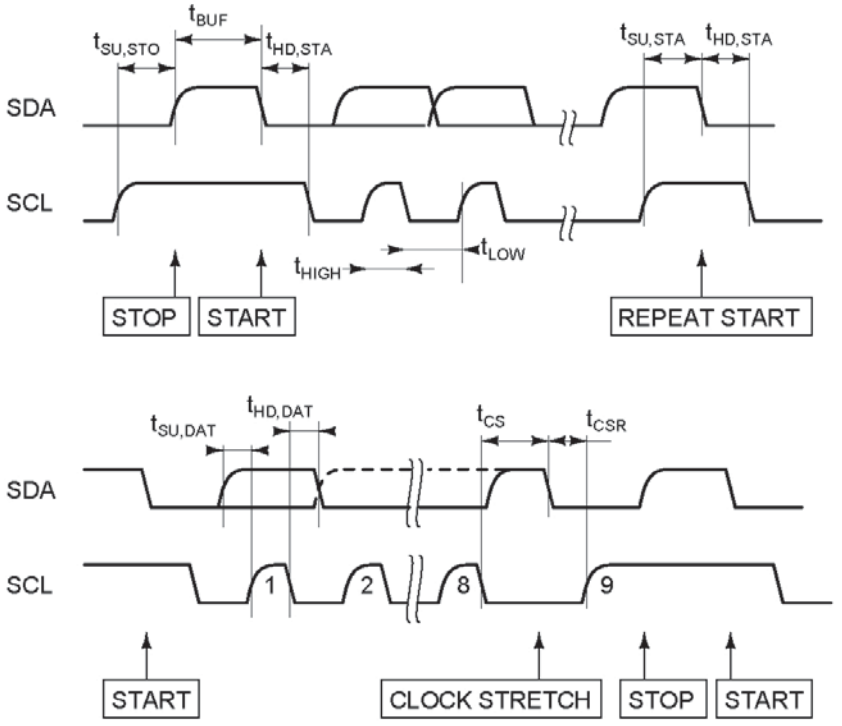
Symbol	Description	Min	Typ.	Max	Unit
VDD1	Supply voltage	2.5	3.3	3.6	V
GND	Supply voltage	-	0	-	V
V_{IH}	Input H voltage	0.8VDD1	-	VDD1	V
V_{IL}	Input L voltage	0	-	0.2VDD1	V
IDD1	VDD current	-	5	6	mA
I_{ST}	sleep mode			0.11	mA

9.3 I²C PROTOCOL SPECIFICATIONS

1. Supports 100 KHz clock frequency and up to 400 kHz (Fast Mode).
2. Only support single master solution.
3. Only support 7 bit addressing.
4. If I²C master can't finish 1byte data in 100ms, I²C slave will restart. The CTP controller operates only as a slave device. The I²C interface is functional in active and sleep modes. In sleep mode, asynchronous address match detector hardware allows a sleeping controller to recognize its address and wake up. And the firmware can implements different I²C touch protocols. The timings for example that as table 9.3.1
5. I2C slave can hold off the master in the middle of a transaction using what's called clock stretching (the slave keeps SCL pulled low until it's ready to continue). Refer to figure 9.3.2 for an example.
6. Slave device address = 0x5C.

Table 9.3.1: I²C timing

Symbol	Parameter	Min	Typ.	Max	Unit
T_{LOW}	I²C clock low time	2 • T_{CPU}			
T_{HIGH}	I²C clock high time	2 • T_{CPU}			
$T_{HD,STA}$	I²C clock hold time	2 • T_{CPU}			
$T_{SU,STA}$	I²C start setup time				
$T_{SU,STO}$	I²C stop setup time				
$T_{HD,DAT}$	I²C data hold time, when driven by master side				
$T_{SU,DAT}$	I²C data setup time, when driven by master side				
T_{BUF}	I²C bus free time	4.7			us
T_{CSR}	I²C clock stretching release time	9 • T_{CPU}			
$T_{VD,DAT}$	I²C data valid after clock change, when data is driven by slave side	9 • T_{CPU}			
TT_{CPU}	CPU master clock period			55	ns



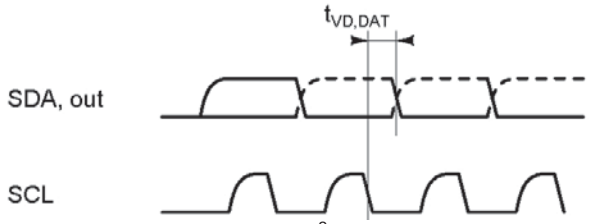


Figure 9.3.1: I²C clock stretching example

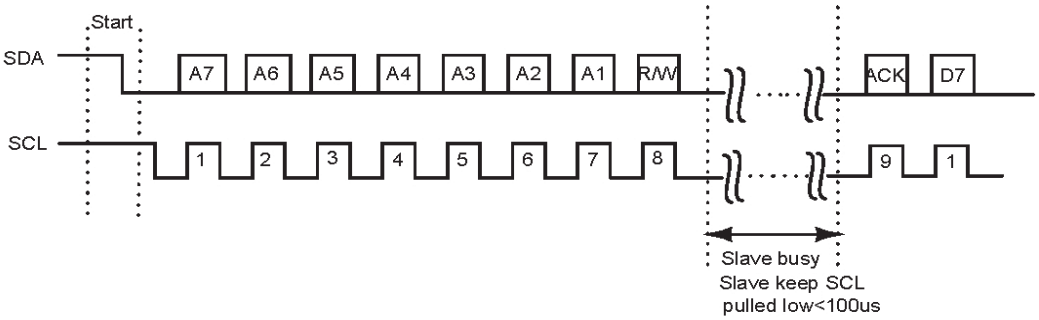


Figure 9.3.2: I²C clock stretching example

9.3.1. Data Protocol

The communication follows I²C convention. Refer to figure 9.3.3 for a definition of the symbols used.

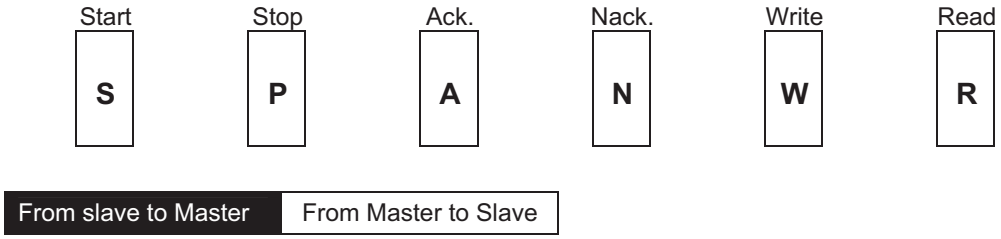


Figure 9.3.3: I²C symbols

9.3.2 Introduction

The protocol for data exchange has been designed with the following considerations

- Most of the data traffic is read operation to get the finger or fingers position.
- Read operation do need an initial write operation.
- Write operations are most of the time power management and interrupt setting instructions.
- Interrupt pulse width setting adjustments need a write operation.

9.3.2.1 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 9.4.2, table 9.4.5. 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.

- In a sequential read operation, the first data sent by the controller 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. Referred in figure 9.3.5 .
- If the host do 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 first part of figure 9.3.6.
- 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 chance to get incorrect data when it get the coordinates data with single read operation. Because the host send many times of I2C stop condition in each multi-fingers coordinates position reading, it will give the slave firmware chance to update the coordinates registers for I2C read operation, the host will give a combines unrelated data (combines new and old coordinates together), referred to the second part of figure 9.3.6.

Figure 9.3.4: Read operation

Figure 9.3.5: Coordinates read operation

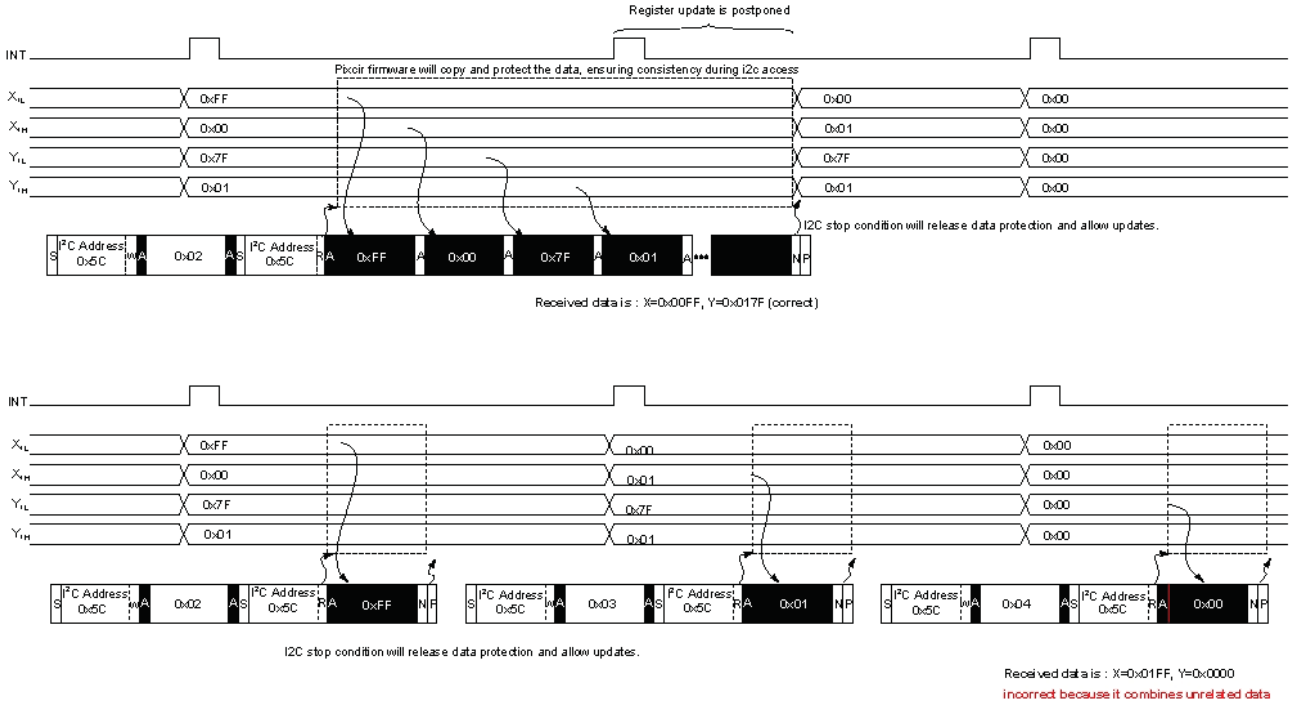


Figure 9.3.6: Coordinates read operation explanation

9.3.2.2 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 figure 9.3.7 and figure 9.3.8. Following the I²C device address, the first byte of the write packet is always the destination register address, referred in table 9.3.2, table 9.3.5. Subsequent data value 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.

Figure 9.3.7: Write operation.

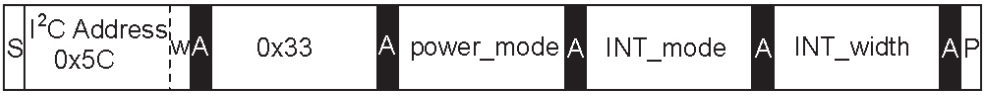


Figure 9.3.8: Write mode setting operation.

9.4 Registers

9.4.1 Endianness

Data are little endian, which means LSB byte appears before MSB byte.

9.4.2 Registers organization

The accessible registers are shown in the table 9.4.2, table 9.4.5. These registers are technically accessible both for reading or writing direction. However, most registers have only one meaningful direction: finger position registers, for example, are typically used in read direction, and writing to them will have no effect; their content will be overridden after a new sensor scan.

Table 9.4.2: registers table

Address	Type	Name	Description	Category
0	Char	Touching	Bit field, see table 9.4.3	Touch
1	Char	Buttons	Reserved	
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	
27	Char	Strength1	Finger #1 strength	
28	Char	Strength2	Finger #2 strength	
32 (LSB) 33 (MSB)	Int	Initial_ distance	Distance separating fingers on the first time multi touch 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		Monitor
39	Char	Noise_ level		
40	Char	Palm_ level		
41	Char	Signal_ x		
42	Char	Signal_ y		
43 50	Char	Button1button8	Reserved	Buttons
51	Char	Power_ mode	Power management register. See table 9.4.6	power management
52	Char	INT_ mode	Control of the INT pin, see table 9.4.7	
53	Char	INT_ width	INT pulse width	
54	Char	Sleep_ freq	Scanning frequency in Sleep mode	
55	Char	Auto_ sleep_ delay	The delay time, the start is the last touch released in Active mode and the end is switch into Sleep mode successful	
56-57	Char		Reserved	Special operations
58	Char	SPECOP	Reserved	
59 (LSB) 60 (MSB)	Int	EEPROM_ read_ addr	Reserved	

61	Char	Engineering_ cmd	Allows, with I^2C, to send "hyper terminal like commands" for engineering modes	
62 (LSB) 63 (MSB)	Int	CRC	Reserved	version
64-71	Char	Version[0..7]	F/W Version Registers address 64 to 71(40h to 47h) = 0x32,0x30,0x31,0x33,0x30,0x34,0x31,0x35	
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 9.4.4	
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) 141 (MSB)	Int	Cross_ node	Measurement result for method 1	
142 (LSB) 143 (MSB)	Int	RAW[0..69] Shared with History_ buffer	Raw data, content controlled by RAW_CTRL register, or alternatively, history buffer (see Below)	RAW data
144 (LSB) 145 (MSB)	Int			
Etc.	Int			

Table 9.4.3: touching register (R0)

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)

9.4.3 RAW_CTRL write & read

It is advised to use INT mode=0x08 when debug information are consulted (RAW_CTRL register not zero). Also, the slave can not instantly refresh the RAW tables following a modification by the master to the RAW_CTRL register, since in some conditions a relatively lengthy collection of measurements has to be performed. The master however can have the guaranty that the data reported in the RAW table reflects the request placed in RAW_CTRL if 2 INT pulses have elapsed. If the request in RAW_CTRL is unchanged, to every new INT pulse corresponds a refresh of the RAW table.

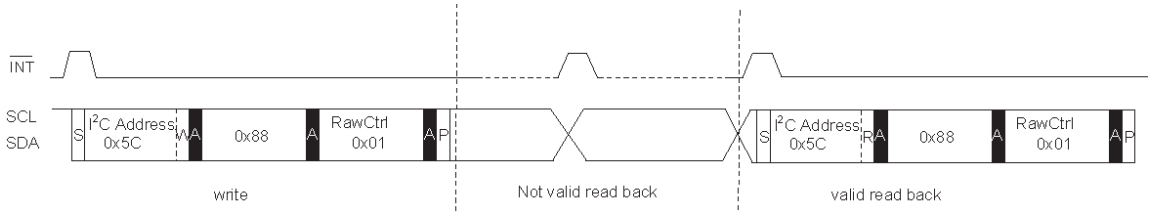


Figure 9.4.1: RAW_CTRL write & read

Table 9.4.4: RAW_CTRL (R136, 137)

Bit 0	Choose function (0: history buffer, 1: RAW data, 2: system info) See table 12.5
Bit 1	
Bit 2	Method (0 or 1)
Bit 3	Show offset correction (and low-pass filtering 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	

Table 9.4.5: History buffer registers

Address	Type	Name	Description	Category
142	Char	Interval	Sub sampling 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	Pos X	Coordinate X of the reported point, at time=0	
146 (LSB) 147 (MSB)	Int	Pos Y	Coordinate Y of the reported point, at time=0	

148 (LSB) 149 (MSB)	Int	Pos X	Coordinate X of the reported point at time=1	
150 (LSB) 151 (MSB)	Int	Pos Y	Coordinate Y of the reported point at time=1	
⋮	⋮	⋮	⋮	
298 (LSB) 299 (MSB)	Int	Pos X	Coordinate X of the reported point, at time=19	
300 (LSB) 301 (MSB)	Int	Pos Y	Coordinate Y of the reported point, at time=19	

9.4.4 Power_ mode register

The POWER_MODE register controls the power management and operation of the controller. However, modification becomes effective at any time. There are shown in the table 9.4.6

Table 9.4.6: Power_ mode register (R51)

Bit	Name	Description
7-3	-	Not used
2	ALLOW_SLEEP	Allow self demotion from active to sleep mode, provide that this flag is set. If the controller is in active mode and no finger is detected for more than IDLE_PERIOD time, then it allow automatically jumps 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: 00: Active Mode 01: Sleep Mode 11: Freeze Mode

9.4.5 INT_ mode register

The slave can set the INT line, and host can read and write controller device, so the controller behaves like an I^2C slave device and fully complies with I^2C addressing and usual I^2C hand shake protocol. As such, controller is suitable in a bus shared with other I^2C slaves.

Table 9.4.7: INT_ mode register (R52)

Bit	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(default) 10:INT assert only when finger touch 11: INT pulse assert only when finger touch

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 figure 9.4.1 and figure 9.4.2

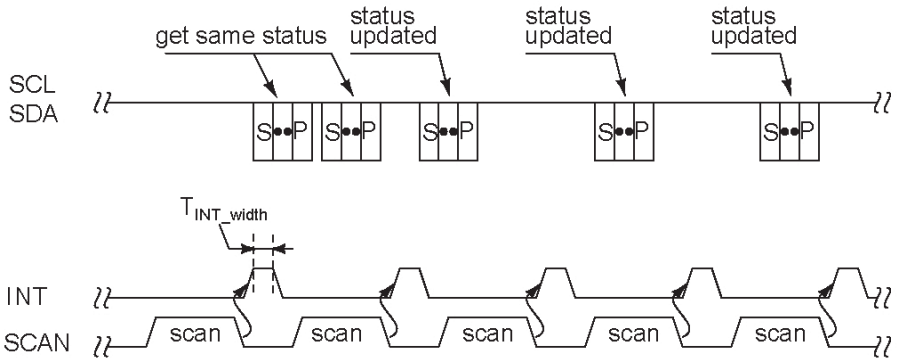


Figure 9.4.1: INT line pull up by slave (INT_POL=1,INT_MODE=00 in the INT mode register)

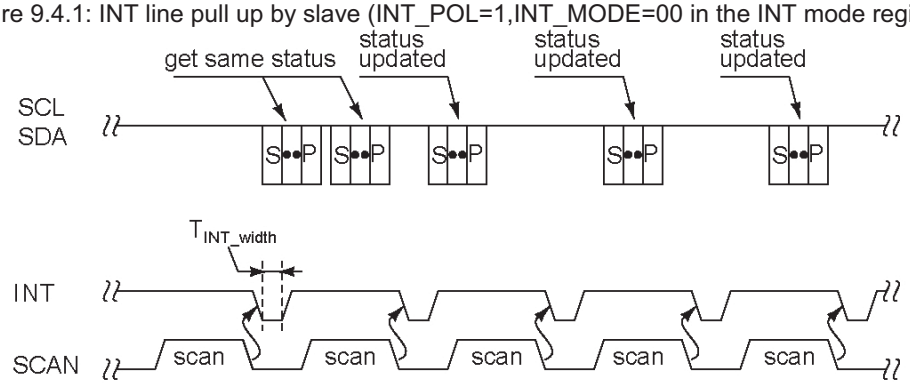


Figure 9.4.2: INT line pull down by slave (INT_POL=0, INT_MODE=00 in the INT mode register)

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 figure 9.4.3 When finger 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 figure 9.4.4

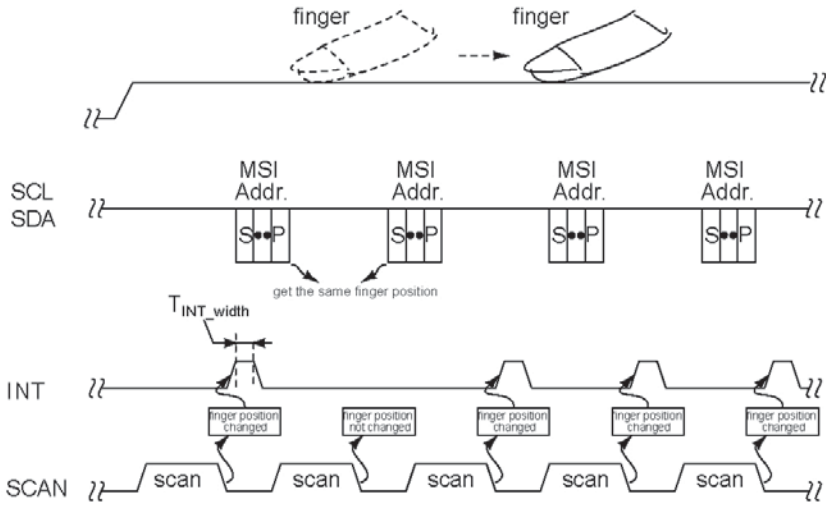


Figure 9.4.3: INT line pull up when finger moving (INT_POL=1, INT_MODE=01 in the INT mode register)

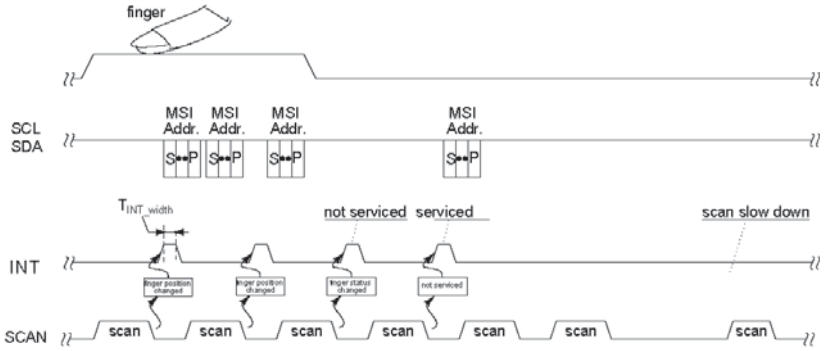


Figure 9.4.4: INT line will stop pulse when finger leaves and master has acknowledged the situation (INT_POL=1 in the INT mode register)

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 figure 9.4.5 When finger 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 figure 9.4.6.

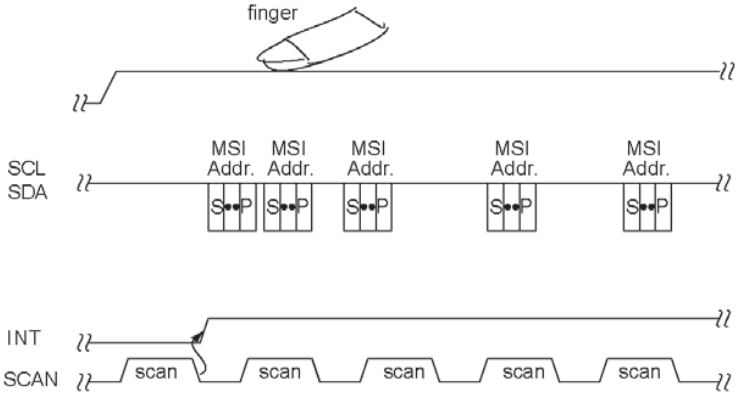


Figure 9.4.5: INT line pull up when finger touch (INT_POL=1, INT_MODE=10 in the INT mode register)

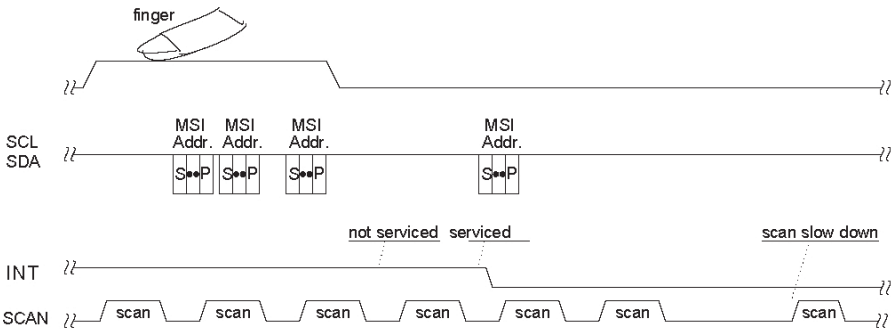


Figure 9.4.6: INT line will reset level when finger leaves and master has acknowledged the situation (INT_POL=1 in the INT mode register)

The only difference is send INT pulse instead of level between INT_ Mode=10 to INT_ Mode =11.

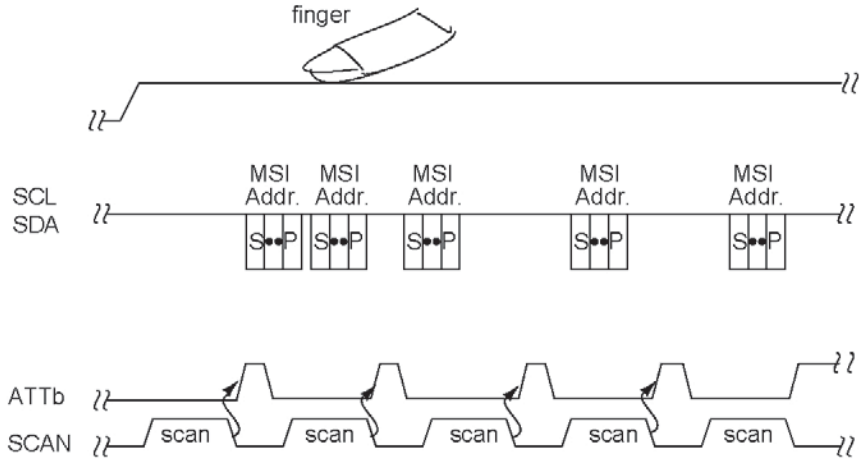


Figure 9.4.7: INT line pull up when finger touch (INT_POL=1, INT_MODE=11 in the INT mode register)

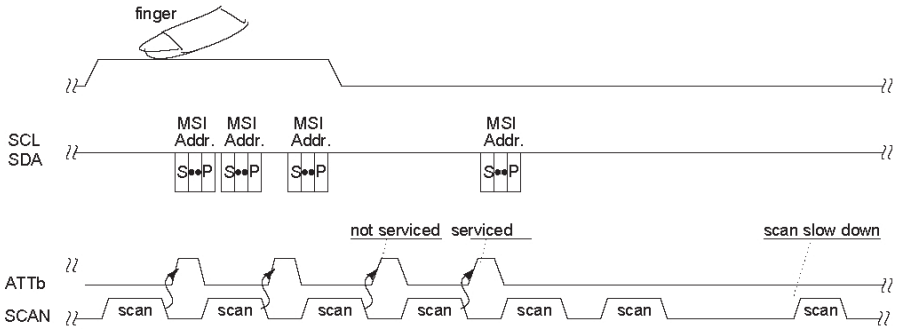
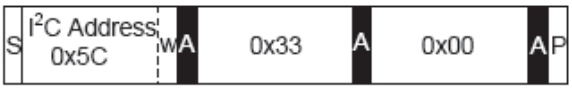


Figure 9.4.8: INT line will stop pulse when finger leaves and master has acknowledged the situation (INT_POL=1 in the INT mode register)

9.4.6 Power management

Active mode

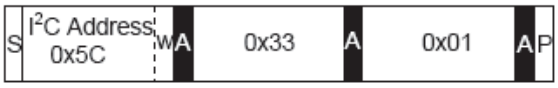
In this mode, the slave resumes with a new scan directly after each I^2C transfer (after INT rising edge). This is used to reach the highest refresh rate (reach to 400Hz), but also has the highest current consumption. Below is shows how to force the slave into Active mode.



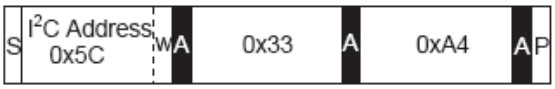
Active mode sequence

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 or can be controlled by **Sleep_ freq** in table 9.4.2). The controller does automatically switch to Active mode when finger is detected or by setting the POWER_MODE register to Active mode. Also, the controller 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. Below are shows how to force the slave into Sleep mode and force the slave to switch automatically into Sleep mode (set ALLOW_SLEEP bit in POWER_MODE register).



Sleep mode sequence



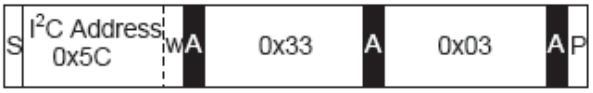
Sleep mode automatically switch sequence

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”)

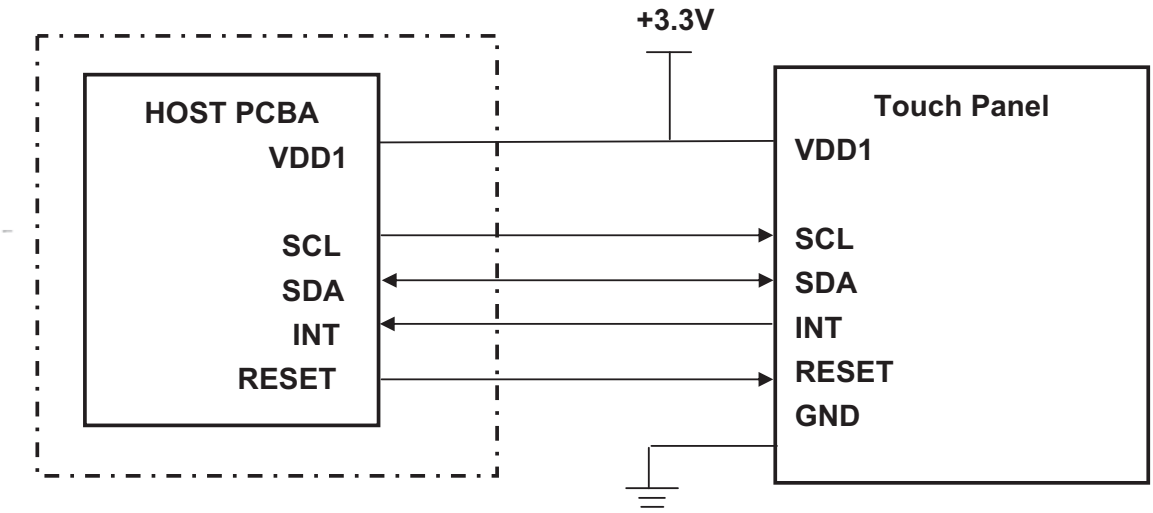


Freeze mode sequence

9.5 PIN CONNECTIONS

No.	Name	I/O	Description
1	VDD1	-	Power; VDD1=3.3V
2	GND	-	Ground
3	INT	O	Indicate coordinate data ready
4	SCL	I	Serial clock
5	SDA	I/O	Serial data
6	RESET	I	Reset, Active high

9.6 BLOCK DIAGRAM

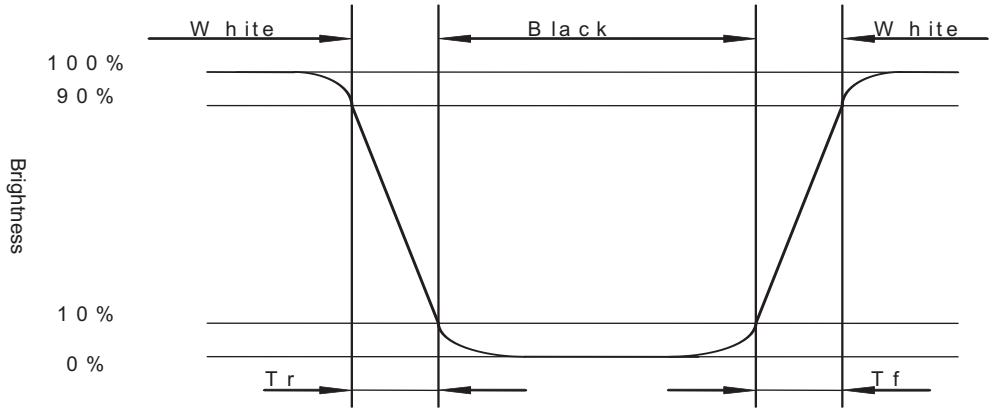


Note：To reduce the noise from the power, we suggest you use the independent power for the touch panel (VDD1).

10. Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	Tr	θ=0°	--	5	8	ms	Note 4
	Fall	Tf		--	15	20	ms	
Contrast ratio		CR	At optimized viewing angle	500	600	--		Note 5
Viewing angle	Top		CR≥10	40	50	--	Deg.	Note 6
	Bottom			60	70	--		
	Left			60	70	--		
	Right			60	70	-		
Luminance			θ=0°	460	570	--	cd/m^2	Note 7
Uniformity		B-uni		70	--		%	Note 8
White chromaticity		X	θ=0°	0.27	0.32	0.37		Note 7
		y		0.28	0.33	0.38		

Note 1: Ambient temperature =25°C. LED current I_L= 20 mA.
Note 2: To be measured in the dark room.
Note 3: To be measured on the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-7A, after 2 minutes operation.
Note 4: Definition of response time:
The output signals of photo-detector are measured when the input signals are changed from “white” to “black”(rising time) and from “black” to “white”(falling time),respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as shown below.



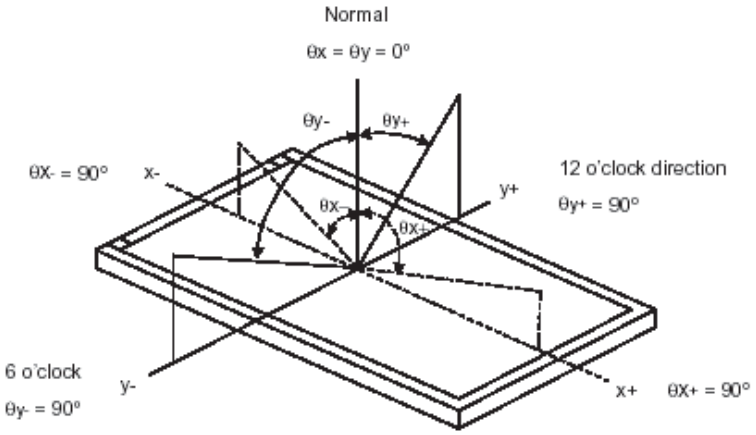
Note5: Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo-detector output when LCD is at “White” state}}{\text{Photo-detector output when LCD is at “Black” state}}$$

Note 6. Definition of viewing angle:

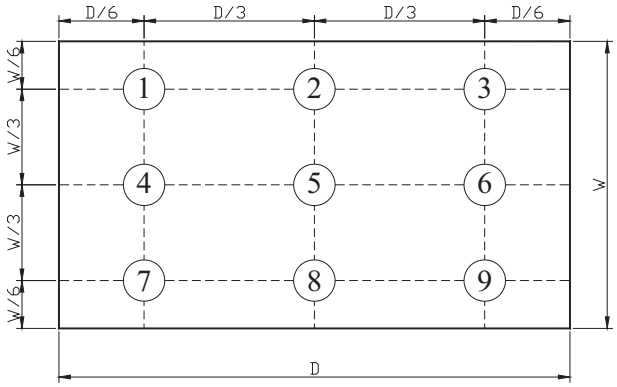
Refer to figure as below.



Note 7. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

Note 8: Definition of Brightness Uniformity (B-uni):

Luminance Measuring Points



$$\text{B-uni} = \frac{\text{Minimum luminance of 9 points}}{\text{Maximum luminance of 9points}}$$

11. QUALITY ASSURANCE

11.1 RA Test Condition

11.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 25 ± 5°C

Humidity : 65 ± 5%

11.1.2 Operation

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

11.1.3 Container

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

11.1.4 Test Frequency

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

11.1.5 Test Method

No.	Reliability Test Item	Test Level	Remark
1	High Temperature Storage Test	T=80°C,240hrs	IEC68-2-2
2	Low Temperature Storage Test	T=-30°C,240hrs	IEC68-2-1
3	High Temperature Operation Test	T=70°C,240hrs	IEC68-2-2
4	Low Temperature Operation Test	T=-20°C,240hrs	IEC68-2-1
5	High Temperature and High Humidity Operation Test	T=60°C,90% RH,240hrs	IEC68-2-3
6	Thermal Cycling Test (No operation)	-30°C → +25°C → +80°C,200 Cycles 30 min 5min 30 min	IEC68-2-14
7	Vibration Test (No operation)	Frequency:10 ~ 55 Hz Amplitude:1.5 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z	IEC68-2-6
8	Drop test(with carton)	Height :60cm 1 conner,3edges,6surfaces	IEC68-2-32
9	Shock test	100G,6ms,Direction:±X±Y±Z Cycle:3times	IEC68-2-27
10	Electrostatic Discharge Test	State: operating Location: LCM/TP surface Condition:150pf 330Ω Contact +/- 4kV Air +/-8kV Criteria: Class C	IEC-61000-4-2

11.2 Inspection Judgment standard

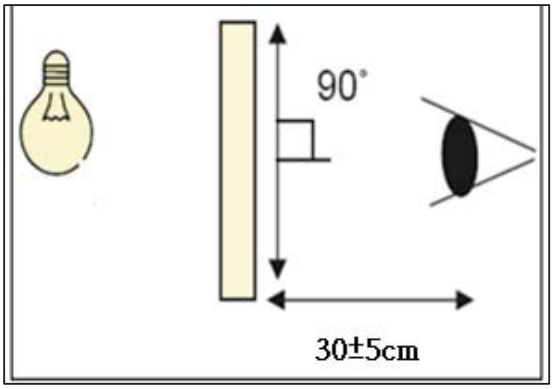
11.2.1 Inspection conditions

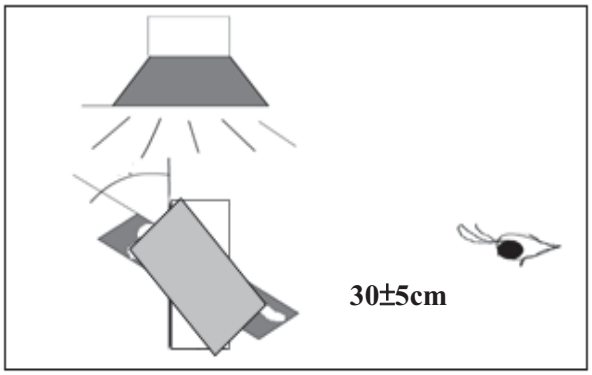
11.2.1.1 Inspection Distance : 35 ± 5 cm

11.2.1.2 View Angle :

(1) Inspection that light pervious to the product: 90±15°

(2) Inspection that light reflects on the product: 90±15°



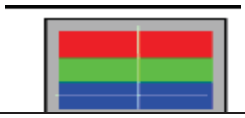


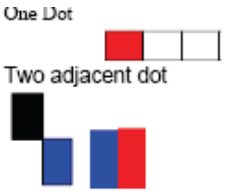
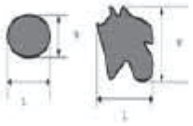
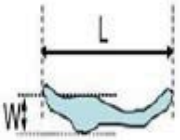
11.2.1.3 Environment conditions :

Ambient Temperature :	25±5℃
Ambient Humidity :	30~75%RH
Ambient Illumination	600~800 lux

11.2.2 Inspection Parameters

Appearance inspection standard (D: diameter, L: length; W: width, Z: height, T: glass thickness，n：number)

Inspection item	Inspection standard	Description
No image	Prohibited	
Image abnormal	Prohibited	
Bright line	Prohibited	
Thin line	It is acceptable that the defect can not be seen with 10% ND filter.	
Mura	It is acceptable that the defect can not be seen with 2% ND filter.	

<table>
<tr><td>Dot</td><td>
<table>
<tr><th>Item</th><th>Acceptable
Visible area</th><th>Total</th></tr>
<tr><td>Bright dot</td><td>2</td><td rowspan="2">5</td></tr>
<tr><td>Dark dot</td><td>4</td></tr>
<tr><td>Bright adjacent dots</td><td>1</td><td>1</td></tr>
<tr><td>Dark adjacent dots</td><td>2</td><td>2</td></tr>
<tr><td>Adjacent dots with a bright dot and a dark dot</td><td>1</td><td>1</td></tr>
</table>
</td><td> 
</td></tr>
<tr><td>Foreign material in dot shape</td><td>
<table>
<tr><td>SPEC (unit: mm)</td><td>Acceptable</td></tr>
<tr><td>D≦0.3</td><td>Ignored</td></tr>
<tr><td>0.3<D≦0.5, distance>5</td><td>n≦5</td></tr>
<tr><td>D＞0.5</td><td>0</td></tr>
</table>
</td><td> 
</td></tr>
<tr><td>Inspection item</td><td>Inspection standard</td><td>Description</td></tr>
<tr><td>Foreign material in line shape</td><td>
<table>
<tr><td>SPEC (unit: mm)</td><td>Acceptable</td></tr>
<tr><td>W≦0.05 and L≦7</td><td>Ignored</td></tr>
<tr><td>0.05<W≦0.1, L≦7, distance >5</td><td>n≦5</td></tr>
<tr><td>W>0.1 or L>7</td><td>0</td></tr>
</table>
</td><td> 
</td></tr>
<tr><td>Contamination</td><td>It is acceptable if the dirt can be wiped.</td><td></td></tr>
<tr><td>Inspection item</td><td>Inspection standard</td><td>Description</td></tr>
<tr><td>Scratch</td><td>
<table>
<tr><td>SPEC (unit: mm)</td><td>Acceptable</td></tr>
<tr><td>W≦0.05 and L≦7</td><td>Ignored</td></tr>
<tr><td>0.05<W≦0.08, L≦7, distance >5</td><td>n≦5</td></tr>
<tr><td>0.08<W≦0.1, L≦7, distance >5</td><td>n≦3</td></tr>
<tr><td>W>0.1 or L>7</td><td>0</td></tr>
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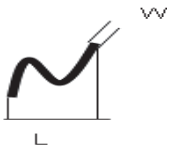
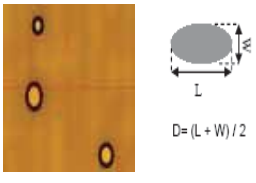
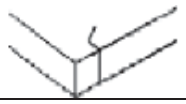
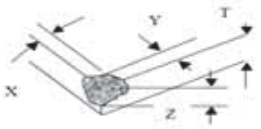
</td><td> 
</td></tr>
<tr><td>Bubble</td><td>
<table>
<tr><td>SPEC (unit: mm)</td><td>Acceptable</td></tr>
<tr><td>D≦0.2</td><td>Ignored</td></tr>
<tr><td>Non visible area</td><td>Ignored</td></tr>
<tr><td>0.2<D≦0.3, distance >5</td><td>n≦5</td></tr>
<tr><td>D＞0.3</td><td>0</td></tr>
</table>
</td><td> 
</td></tr>
</table>

Insufficient glue	SPEC (unit: mm) / Acceptable Non visible area / Ignored Visible area / 0	
Cover & Sensor Crack	Prohibited	
Sensor angle missing & edge break	SPEC (unit: mm) / Acceptable Damage circuit or effect function / 0	
Cover/Sensor angle missing	SPEC (unit: mm) / Acceptable X≦3.0, Y≦3.0, Z≦T / Ignored X>3.0, Y>3.0, Z＞T / 0	
Cover/Sensor edge break	SPEC (unit: mm) / Acceptable X≦3.0, Y≦3.0, Z≦T / Ignored X>3.0, Y>3.0, Z＞T / 0	
Inspection item	SPEC	Description
Ink	SPEC (unit: mm) / Acceptable word unclear, inverted, mistake, break line / 0	
Bubble under protection film	SPEC (unit: mm) / Acceptable NA	
Function	Prohibited	

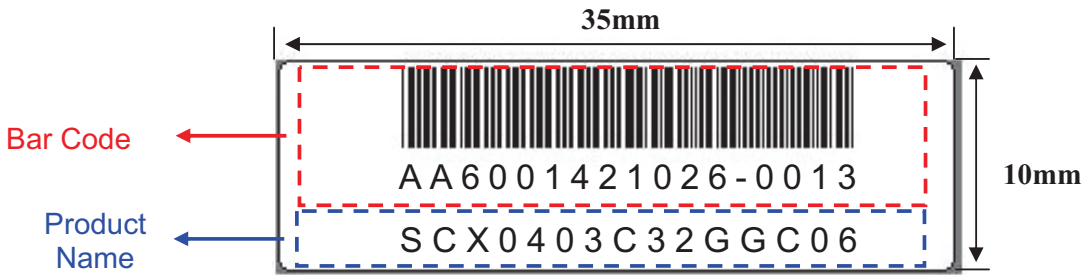
11.3 Sampling Condition

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

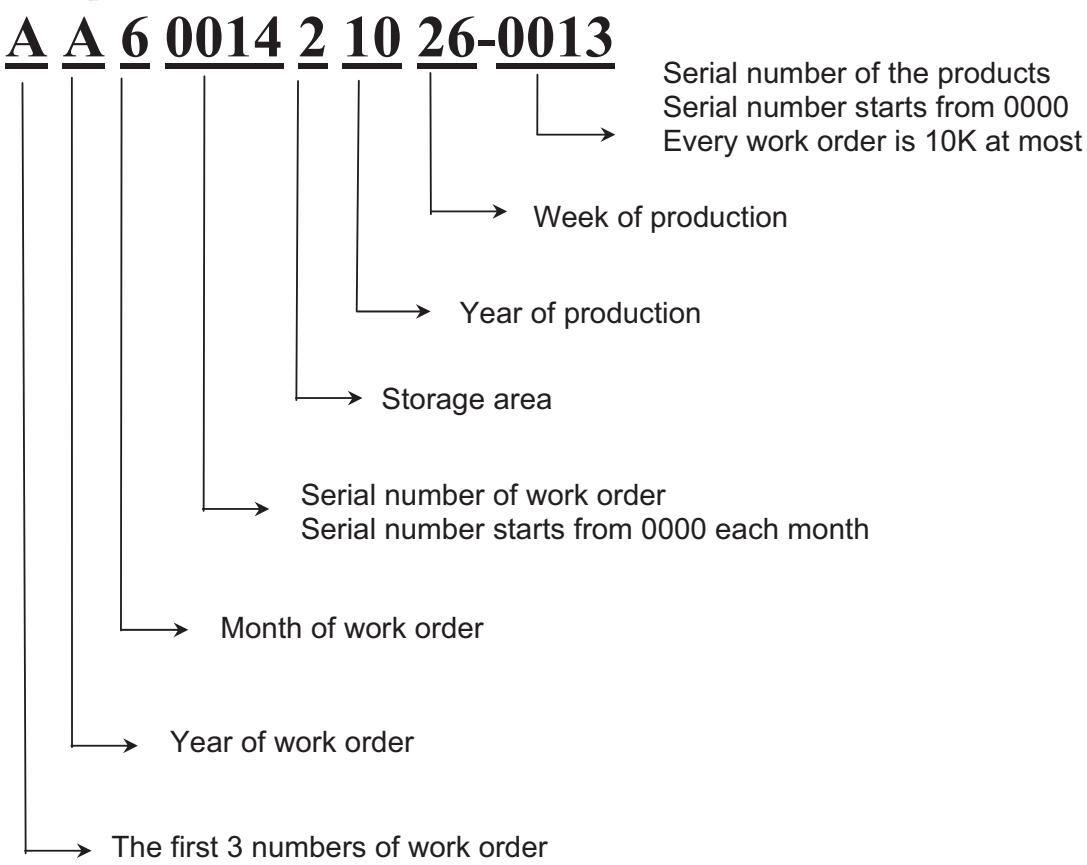
	Definition		
Class of defects	**Major**	AQL 0.65	It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function.
	Minor	AQL 1.5	It is a defect that will not result in functioning problem with deviation classified.

12. LCM PRODUCT LABEL DEFINE

Product Label style:



BarCode Define:



Product Name Define:

SC X 0403 C32 G G C 06

Serial Number: 06

Material of Glue

N : None

U : UV

C : OCA

R : Other

Material of Cover Lens

N : None

G : Glass

P : PMMA

C : PC

E : PET

F : Film

Material of Sensor

G : Glass

F : Film

R : Other

IC Number

C32 : C32

Size

0403 : 4.3 inch

Module Type

N : None LCM

F : Standard CTP Module

X : Custom CTP Module

Capacitive Touch Panel

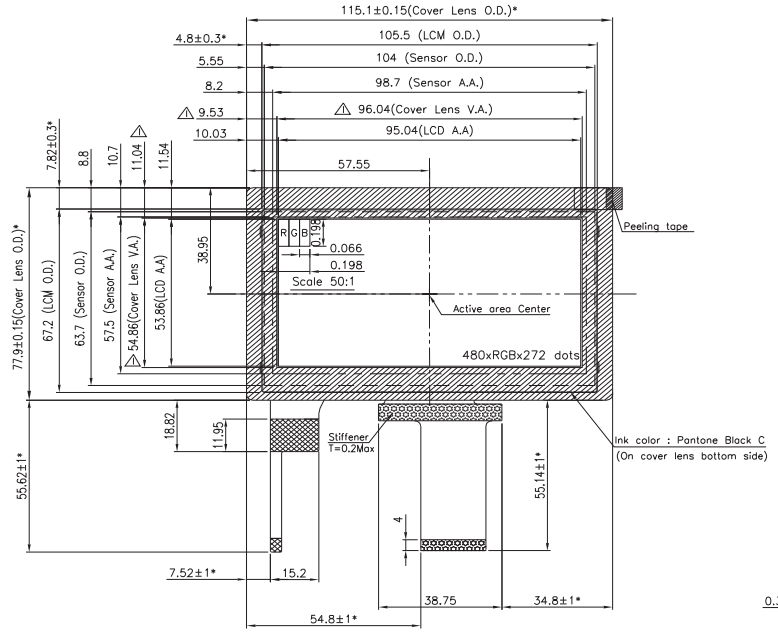
13. PRECAUTION FOR USING LCM

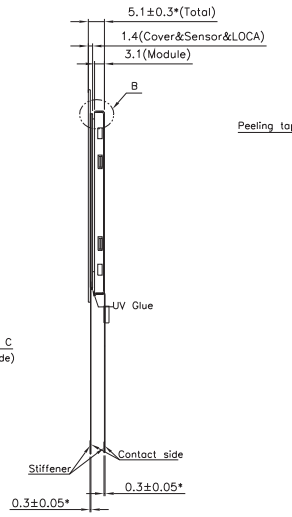
1. ASSEMBLY PRECAUTIONS
   (1) You must mount a module using holes arranged in four corners or four sides.
   (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength 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.
2. 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.
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.
   (1) The modules should be kept in antistatic bags or other containers resistant to static for storage.
   (2) Only properly grounded soldering irons should be used.
   (3) If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
   (4) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended
   (5) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.
4. STORAGE PRECAUTIONS
   (1) When you store LCDs 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 in the environment of high humidity and high temperature such as 60°C 90%RH
   (3) Please do not leave the LCDs in the environment of low temperature; below -20°C.
5. 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.)
6. LIMITED WARRANTY

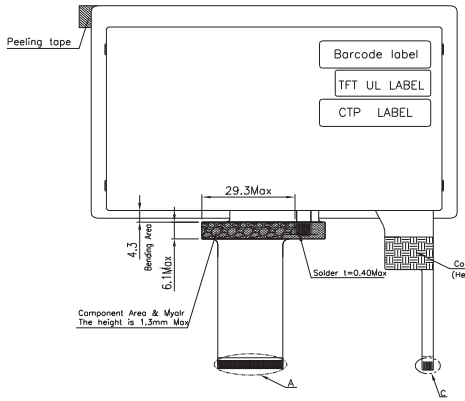
Unless otherwise agreed between DATA IMAGE and customer, DATA IMAGE will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with DATA IMAGE acceptance standards, for a period on one year from date of shipment. Confirmation of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

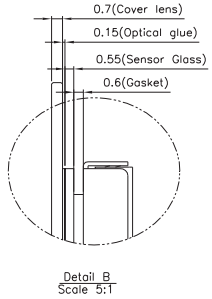
14. OUTLINE DRAWING

PRELIMINARY

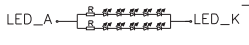




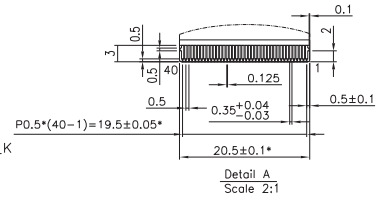




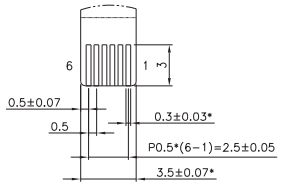
Note:
1. For RoHS
2. Luminance : 570 cd/m² (Typ.), 460 cd/m² (Min.)
3. Uniformity : 70%
4. LCD FPC Match Connector: Molex 54132-4062 or equivalent
5. The bending radius of FPC should be larger than 0.6mm
6. Sunglass readable.
7. CTP Match Connector : Molex 0545480671 or equivalent
8. Tolerance is ±0.3 unless otherwise noted.
9. * is important dimension.
10. CTP Touch IC : Pixcir C32.



LED CIRCUIT
Voltage :24V(Typ)
Current :40mA



Detail A
Scale 2:1



Detail C
Scale 5:1

CTP (I2C)
PIN FUNCTIONS
1. VDD1
2. GND
3. INT
4. SCL
5. SDA
6. RESET

LCD FPC FUNCTIONS

1	LED_K	11	R7	21	G3	31	/CS		
2	LED_A	12	R6	22	G2	32	/RES		
3	GND	13	R5	23	B7	33	SDO		
4	VDD	14	R4	24	B6	34	R1		
5	VDD	15	R3	25	B5	35	R0		
6	SHUT	16	R2	26	B4	36	G1		
7	DOTCLK	17	G7	27	B3	37	G0		
8	VSYNC	18	G6	28	B2	38	B1		
9	HSYNC	19	G5	29	SDI	39	B0		
10	DE(DEN)	20	G4	30	SCK	40	NC		

⚠	Change cover V.A dimension <<ESR 0402036>>	2015/03/20	
	<<ESR 0402036>>		
AUTH	DESCRIPTION	DATE	APPROVED
REVISIONS			

DATE:	2015/03/03
DRAWN:	
CHECK:	
APPROVE:	

TITLE: CTP OUTLINE DIMENSION

DWG. NO.	SCX0403C32GGC06		
UNITS M M		REV.	2
SCALE 1:1	SHEET 1 OF 1		

DATA IMAGE

15. PACKAGE INFORMATION

TBD