MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI0430YT-2

This module uses ROHS material

For Customer's Acceptance:

Customer	
Approved	
Comment	

The standard product specification may change without prior notice in order to improve performance or quality. Please contact Multi-Inno for updated specification and product status before design for the standard product or release of the order.	Revision	1.0
	Engineering	
	Date	2014-05-25
	Our Reference	

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REVISED PAGE NO.
1.0	2014-05-25	First Release	

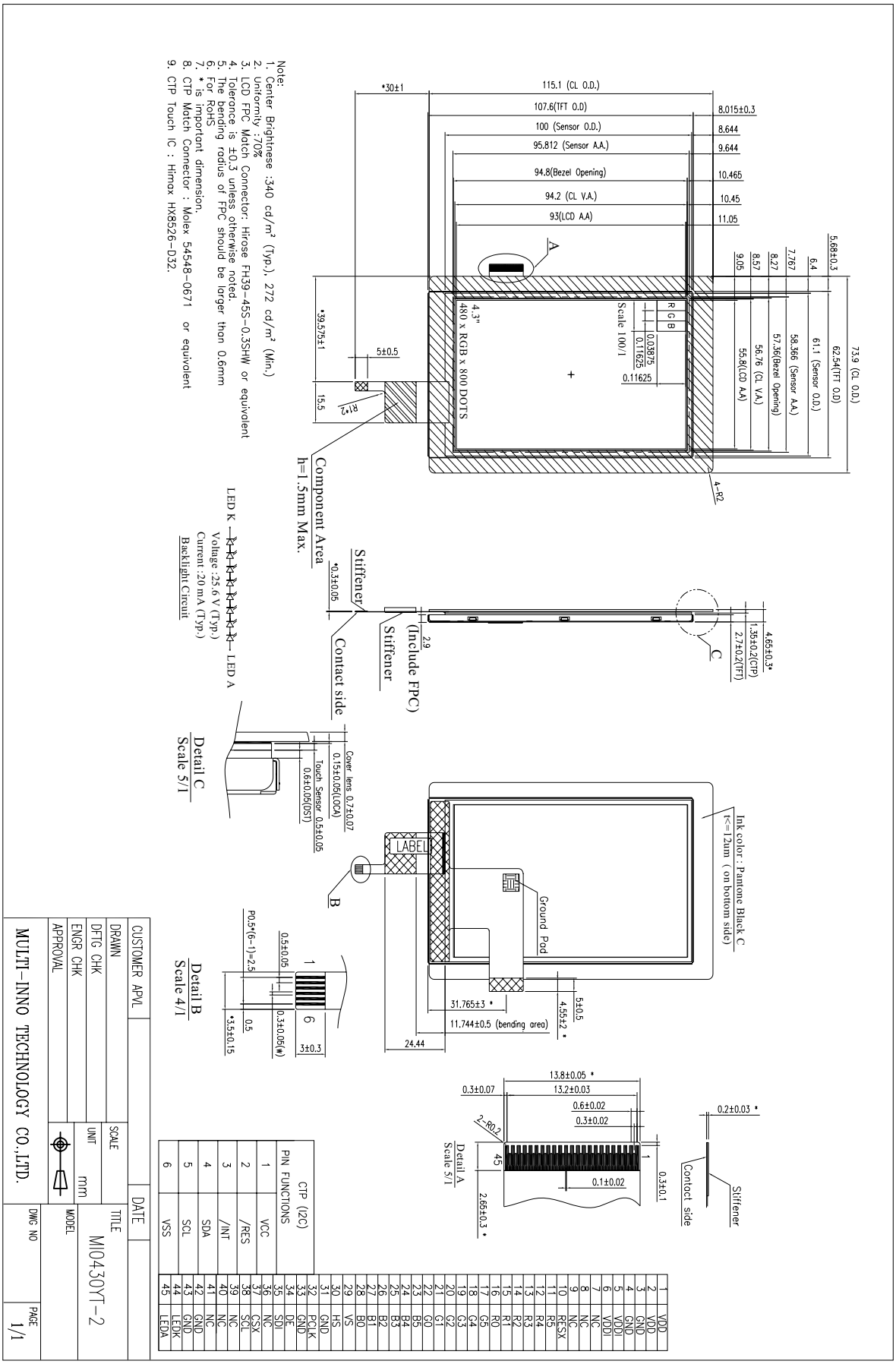
CONTENTS

■ GENERAL INFORMATION

Item	Contents	Unit
LCD type	MVA module/Normally black	/
Size	4.3	Inch
Viewing direction	Full viewing angle	O' Clock
LCM (W × H × D)	73.90×115.10×4.65	mm^3
Active area (W×H)	55.80×93.00	mm^2
Dot pitch (W×H)	0.03875×0.11625	mm^2
Number of dots	480 (RGB) × 800	/
LCD driver IC	HX8363-A	/
CTP driver IC	HX8526-D32	/
Backlight type	8 LEDs	/
Interface type	18bit RGB	/
Color depth	262K	/
Color configuration	Stripe	/
Input voltage	3.3(Max.)	V
With/Without TSP	With CTP	/
Weight	TBD	g

Note 1: RoHS compliant;
Note 2: LCM weight tolerance: ± 5%.

■ EXTERNAL DIMENSIONS



1	VDD	2	VDD	3	GND	4	GND	5	VDDI	6	VDDI	7	NC	8	NC	9	NC	10	RESX	11	R5	12	R4
13	R3	14	R2	15	R1	16	R0	17	G5	18	G4	19	G3	20	G2	21	G1	22	G0	23	B5	24	B4
25	B3	26	B2	27	B1	28	B0	29	VS	30	HS	31	GND	32	PCLK	33	GND	34	DE	35	SDI	36	NC
37	CSX	38	SCL	39	NC	40	NC	41	NC	42	GND	43	GND	44	LEDK	45	LEDA						

■ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Power supply voltage	VDD	-0.3	4.6	V
	VDDI	-0.3	4.6	V
Operating temperature	TOP	-20	70	°C
Storage temperature	TST	-30	80	°C

■ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
Power supply voltage	VDD	2.5	-	3.3	V
	VDDI	1.65	-	3.3	V
Power supply current	IDD	-	TBD	-	mA
	IDDI	-	TBD	-	mA
Input voltage ' H ' level	VIH	0.7VDDI	-	VDDI	V
Input voltage ' L ' level	VIL	0	-	0.3VDDI	V

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
LED voltage	VL	-	25.6	-	V	Note 1
LED current	IL	-	20	-	mA	
LED dice life time	-	15000	-	-	Hrs	Note 2

Note 1:

Voltage :25.6 V (Typ.)

Current :20 mA (Typ.)

backlight circuit

Note 2: The " LED dice life time" is defined as the brightness decrease to 50% original brightness that the ambient temperature is 25℃ and LED dice current=20mA.

■ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time		Tr+Tf	θ=0° ∅=0° Ta=25℃	-	25	-	ms	FIG 1.	4
Contrast ratio		Cr		400	600	-	---	FIG 2.	1
Luminance uniformity		δ WHITE		70	-	-	%	FIG 2.	3
Surface Luminance		Lv		272	340	-	cd/m^2	FIG 2.	2
Viewing angle range		θ	∅ = 90°	70	80	-	deg	FIG 3.	6
			∅ = 270°	70	80	-	deg	FIG 3.	
			∅ = 0°	70	80	-	deg	FIG 3.	
			∅ = 180°	70	80	-	deg	FIG 3.	
CIE (x, y) chromaticity	Red	x	θ=0° ∅=0° Ta=25℃	0.594	0.644	0.694		FIG 2.	5
		y		0.259	0.309	0.359			
	Green	x		0.234	0.284	0.334			
		y		0.526	0.576	0.626			
	Blue	x		0.269	0.319	0.369			
		y		0.014	0.064	0.114			
	White	x		0.270	0.320	0.370			
		y		0.299	0.349	0.399			

Note 1. Contrast Ratio(CR) is defined mathematically as For more information see FIG 2.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P 3,P4, P5)}}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see FIG 2.

Lv = Average Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)

Note 3. The uniformity in surface luminance ， δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FIG 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)}}$$

Note 4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope. Series.

Note 5. CIE (x, y) chromaticity，The x, y value is determined by measuring luminance at each test position 1 through 5,and then make average value.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the conrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

Note 7. For viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments For contrast ratio, Surface Luminance, Luminance uniformity, CIE The test data is base on TOPCON's BM-5 photo detector.

FIG. 1 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

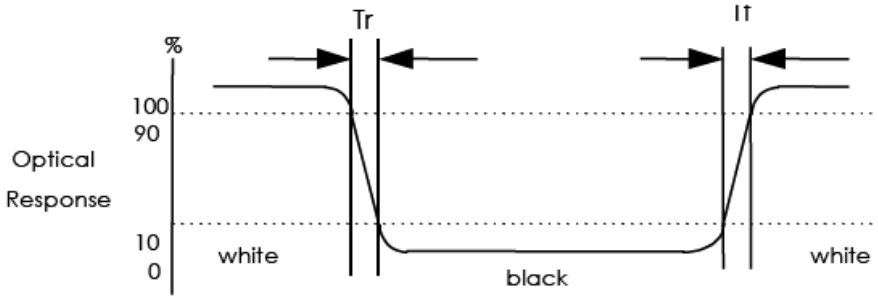
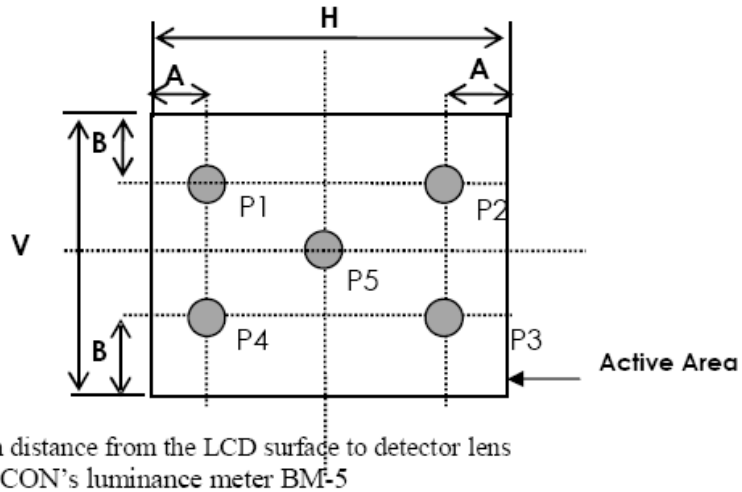
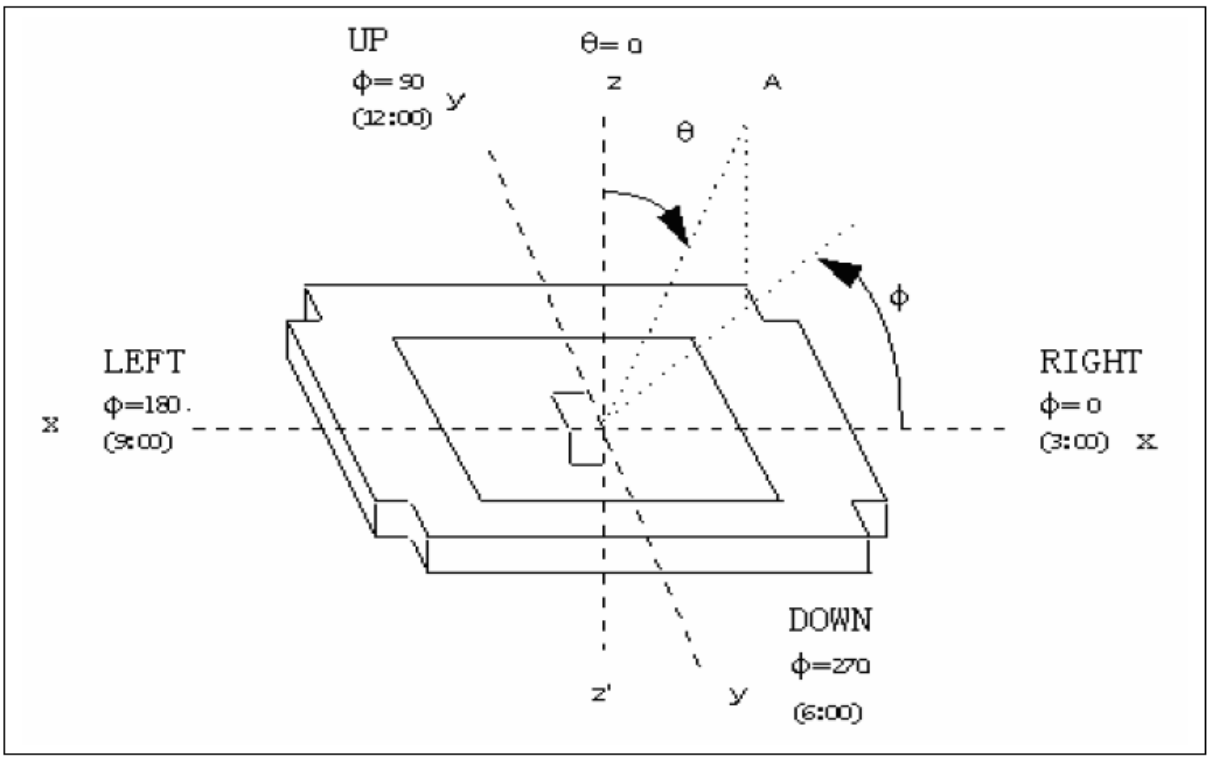


FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity



A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size ∅=7mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

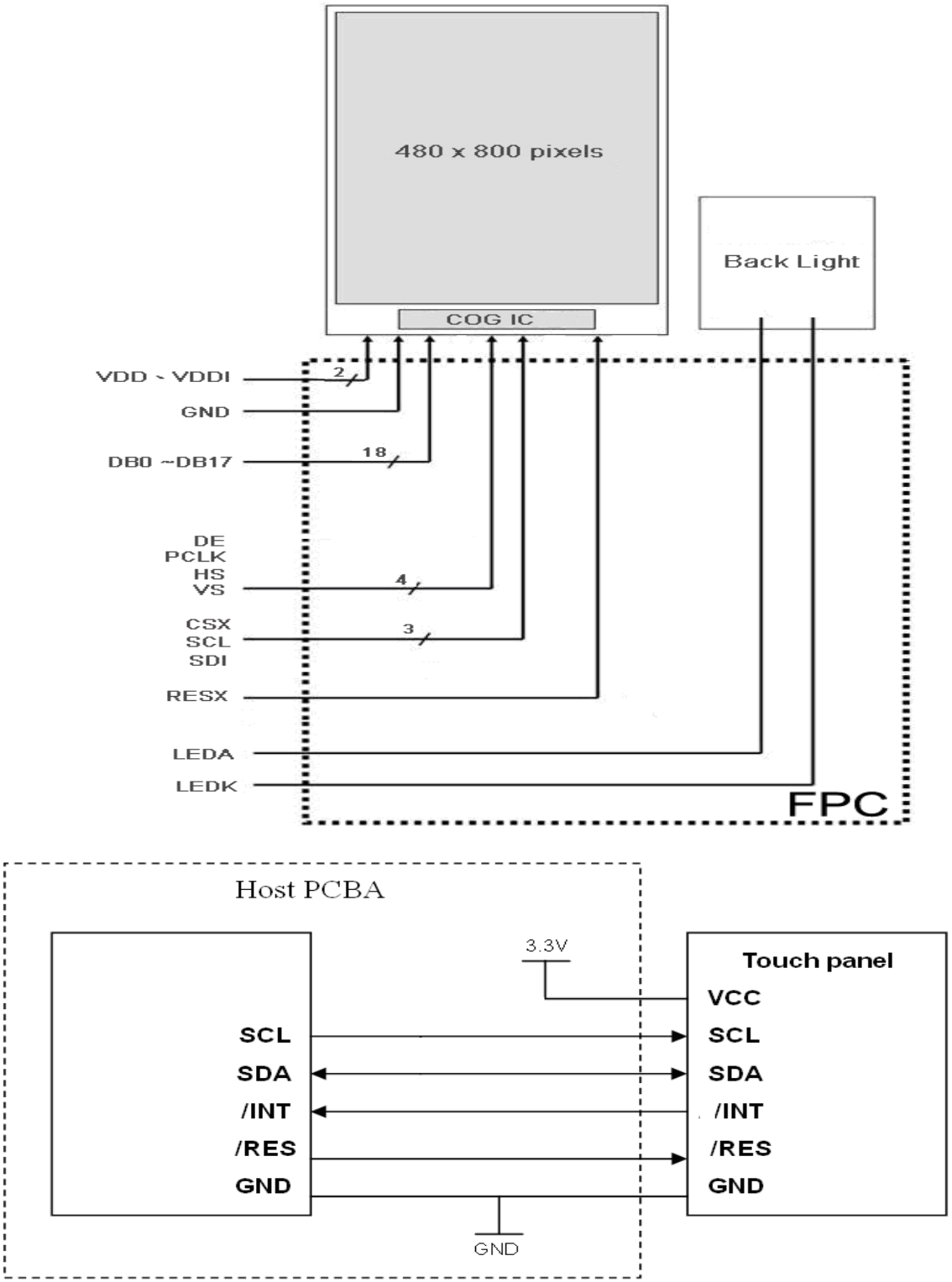
FIG. 3 The definition of viewing angle



■ INTERFACE DESCRIPTION

Pin No	Symbol	Function	Remark
1	VDD	Power supply for analog system	
2	VDD		
3	GND	Ground	
4	GND		
5	VDDI	Power supply for interface system	
6	VDDI		
7	NC	No Connection	
8	NC		
9	NC		
10	RESX	To reset the device, active low	
11	R5(D17)	18-bit bi-directional data bus.	
12	R4(D16)		
13	R3(D15)		
14	R2(D14)		
15	R1(D13)		
16	R0(D12)		
17	G5(D11)		
18	G4(D10)		
19	G3(D9)		
20	G2(D8)		
21	G1(D7)		
22	G0(D6)		
23	B5(D5)		
24	B4(D4)		
25	B3(D3)		
26	B2(D2)		
27	B1(D1)		
28	B0(D0)		
29	VS	Vertical sync	
30	HS	Horizontal sync	
31	GND	Ground	
32	PCLK	Pixel clock signal	
33	GND	Ground	
34	DE	Data enable signal	
35	SDI/SDA	SDI : Serial data input signal SDA : Serial data input/output bidirectional pin	
36	NC	No Connection	
37	CSX	Chip select input pin (“Low” enable)	
38	SCL	A synchronous clock signal	
39	NC	No Connection	
40	NC		
41	NC		
42	GND	Ground	
43	GND		
44	LEDK	Power supply for LED-	
45	LEDA	Power supply for LED+	

■BLOCK DIAGRAM



■ APPLICATION NOTES

1. AC Characteristics

Serial interface characteristic

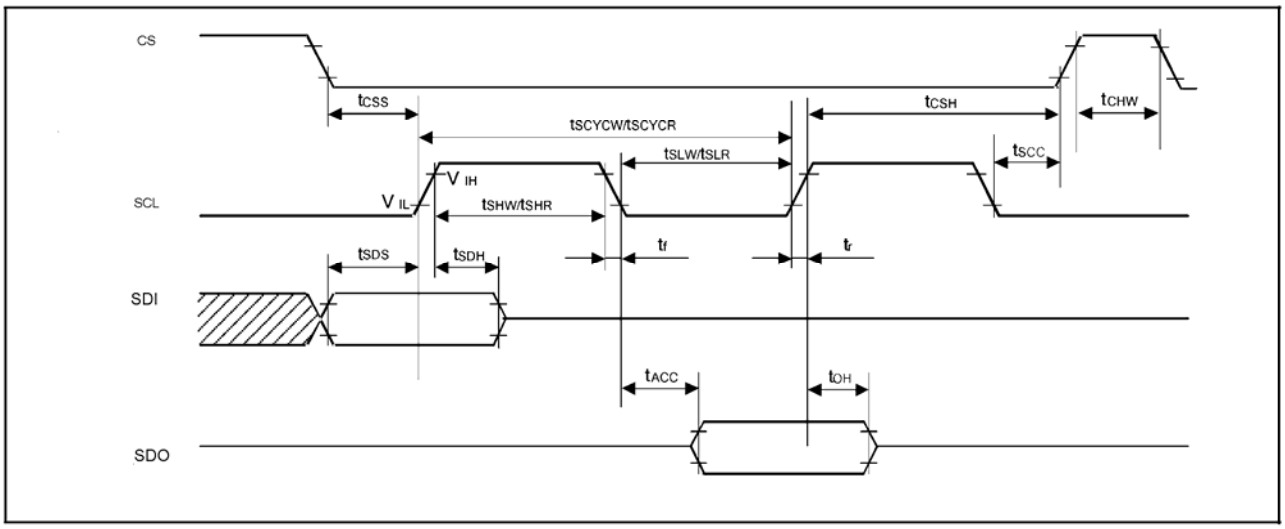
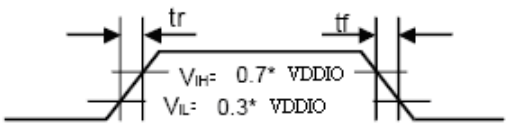


Figure 1.1 Serial Interface Characteristics

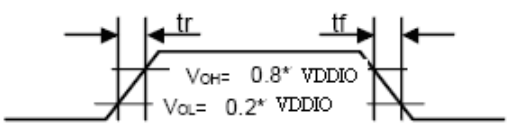
Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Serial clock cycle (Write) SCL "H" pulse width (Write) SCL "L" pulse width (Write)	t_{SCYCW} t_{SHW} t_{SLW}	SCL	80 30 30		--	ns
Data setup time (Write) Data hold time (Write)	t_{SDS} t_{SDH}	SDI	10 10		--	ns
Serial clock cycle (Read) SCL "H" pulse width (Read) SCL "L" pulse width (Read)	t_{SCYCR} t_{SHR} t_{SLR}	SCL	150 60 60		--	ns
Access rime	t_{ACC}	SDO For maximum C_L=30pF For maximum C_L=8pF	10		60	ns
Output disable time	t_{OH}	SDO For maximum C_L=30pF For maximum C_L=8pF	15		100	ns
SCL to Chip select	t_{SCC}	CS	30		--	ns
CS "H" pulse width	t_{CHW}	CS	60		--	ns
CS -SCL time (write) CS -SCL time (write)	t_{CSS} t_{CSH}	CS	30 30		--	ns
CS -SCL time (Read) CS -SCL time (Read)	t_{CSS} t_{CSH}	CS	60 65		--	ns

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of VDDIO for Input signals.

Input Signal Slope



Output Signal Slope



2. RGB interface characteristic

Vertical Timings for RGB I/F

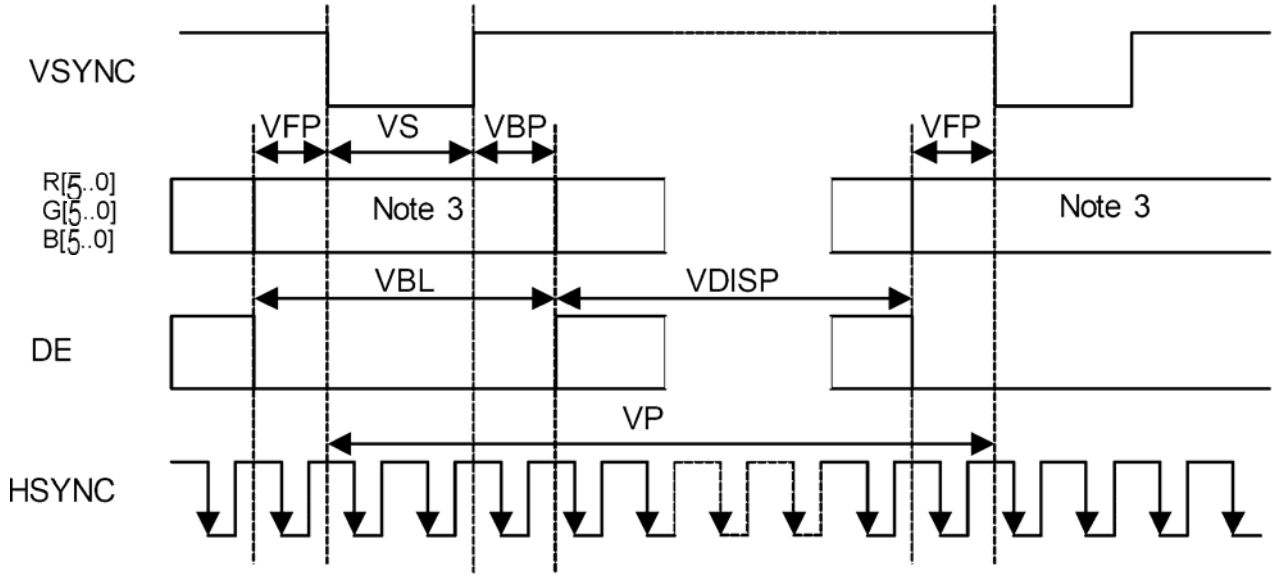


Figure2.1 Vertical Timings for RGB I/F

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical cycle	VP	-	806	-	810	Line
Vertical low pulse width	VS	-	2	-	4	Line
Vertical front porch	VFP	-	2	-	4	Line
Vertical back porch	VBP	-	2	-	4	Line
Vertical data start point	-	VS+VBP	4	-	8	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	-	10	Line
Vertical active area	-	VDISP	-	800	-	Line
Vertical Refresh rate	VRR	-	50	-	70	Hz
Vertical Refresh rate	VRR	-	50	-	70	Hz

Note: (1) Signal rise and fall times are equal to or less than 20 ns.

(2) Input signals are measured by 0.30 x VDDIO for low state and 0.70 x VDDIO for high state.

(3) Data lines can be set to “High” or “Low” during blanking time – Don’t care.

Horizontal Timings for RGB I/F

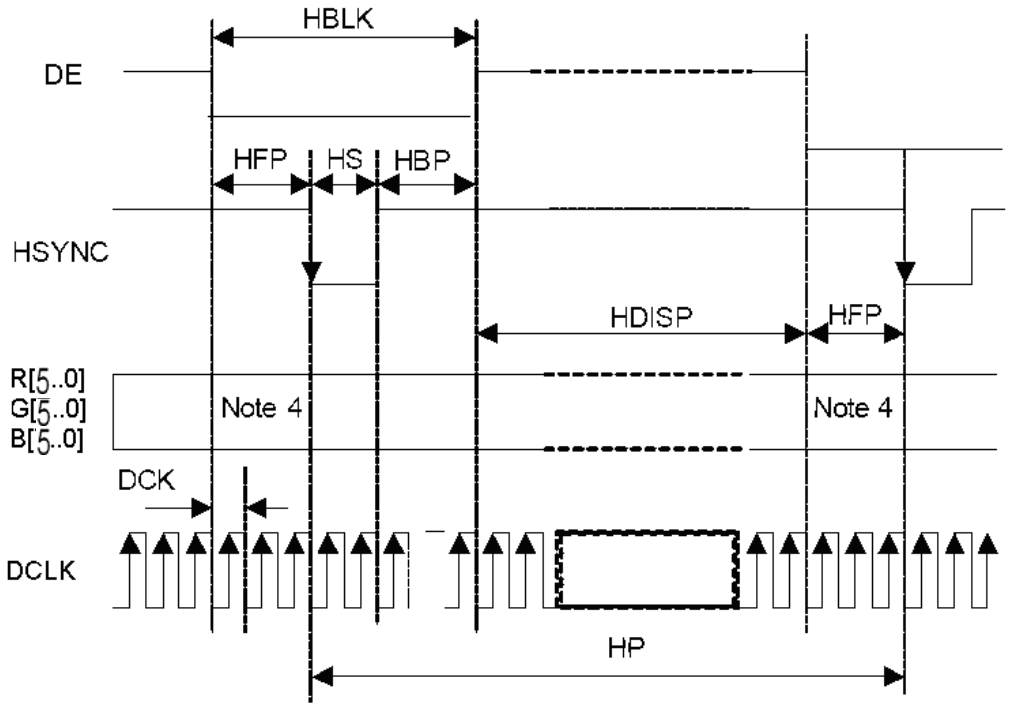


Figure 2.2 Horizontal Timing for RGB I/F

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
HSYNC cycle	HP	Note 3	504	-	568	DCLK
HSYNC low pulse width	HS	-	5	-	256	DCLK
Horizontal back porch	HBP	-	5	-	256	DCLK
Horizontal front porch	HFP	-	5	-	256	DCLK
Horizontal data start point	-	HS+HBP	19	-	83	DCLK
			700	-	-	ns
Horizontal blanking period	HBLK	HS+HBP+HFP	24	-	88	DCLK
Horizontal active area	HDISP	-	-	480	-	DCLK
Pixel clock frequency When RGB I/F is running	DCLK	VRR = Min. 50 Hz – Max. 70 Hz	20.3	-	32.2	MHz
			31	-	49.2	ns

Note: (1) Signal rise and fall times are equal to or less than 20 ns.
(2) Input signals are measured by 0.30 x VDDIO for low state and 0.70 x VDDIO for high state.
(3) HP is multiples of eight DCLK.
(4)Data lines can be set to “High” or “Low” during blanking time – Don’t care.

(5) B3h Command (09h): DPL=1, the data is read on the falling edge of DCLK signal.

3. RGB interface General Timing

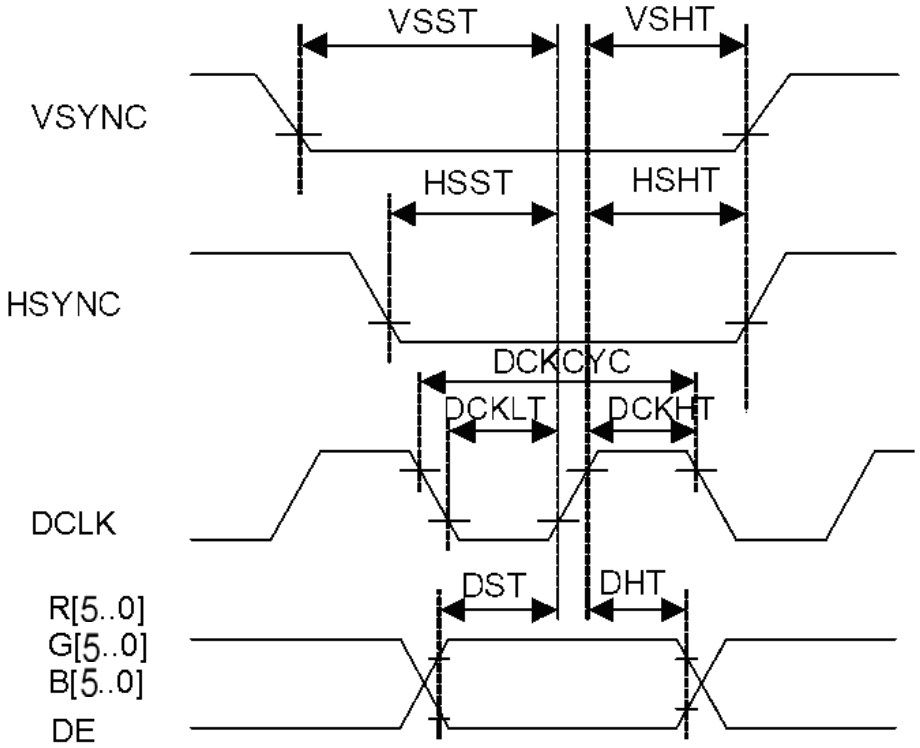


Figure 3.1 General Timings for RGB I/F

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical sync. Setup time	VSST	-	5	-	-	ns
Vertical sync. Hold time	VSHT	-	5	-	-	ns
Horizontal sync. Setup time	HSST	-	5	-	-	ns
Horizontal sync. Hold time	HSHT	-	5	-	-	ns
Pixel clock cycle When RGB I/F is running	DCKCYC	VRR = Min. 50 Hz Max. 70 Hz	31 (Note3)	-	49.2 (Note 4)	ns
Pixel clock low time	DCKLT	-	5	-	-	ns
Pixel clock high time	DCKHT	-	5	-	-	ns
Data setup time DB[23:0]	DST	-	5	-	-	ns
Data Hold time DB[23:0]	DHT	-	5	-	-	ns

Note: (1) Signal rise and fall times are equal to or less than 20 ns.
(2) 32.2 MHz
(3) 20.3 MHz
(4) Input signals are measured by 0.30 x VDDIO for low state and 0.70 x VDDIO for high state.

4. Reset Input Timing

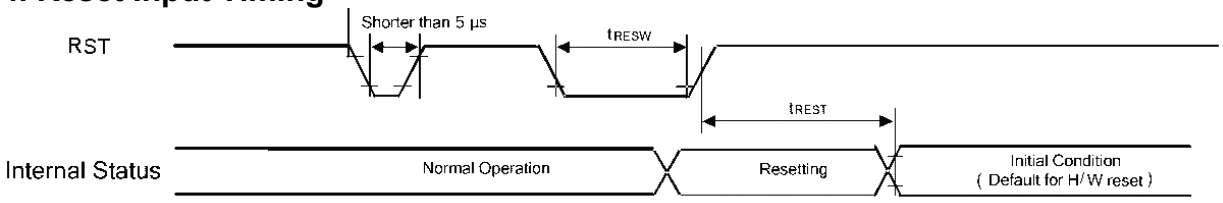


Figure 4.1 Write to Read and Read to Write Timing

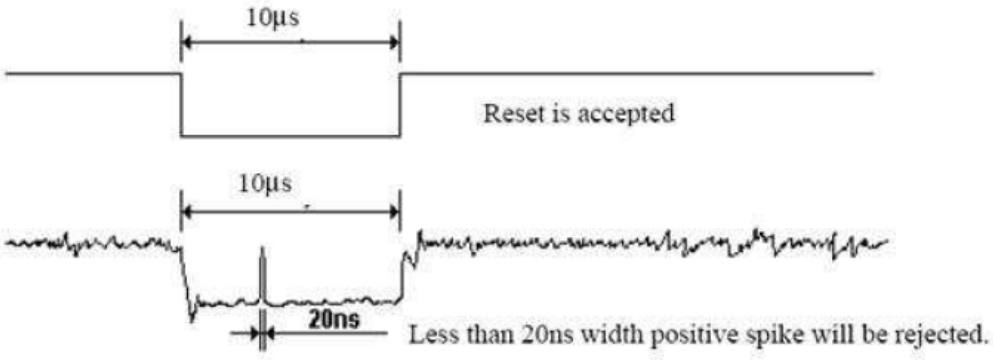
Symbol	Parameter	Related Pins	Min.	Typ.	Max.	Note	Unit
tRESW	Reset low pulse width	RST	10	-	-	-	µs
tREST	Reset complete time	-	-	-	5	When reset applied during STB mode	ms
		-		-	120	When reset applied during STB mode	ms

Note:

1. Spike due to an electrostatic discharge on RST line does not cause irregular system reset according to the table below.

NRESET Pulse	Action
Shorter than 5 µ	Reset Rejected
Longer than 10 µs	Reset
Between 5 µs and 10 µs	Reset Start

2. During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then returns to Default condition for H/W reset.
3. During Reset Complete Time, ID2 value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of RST.
4. Spike Rejection also applies during a valid reset pulse as shown below:



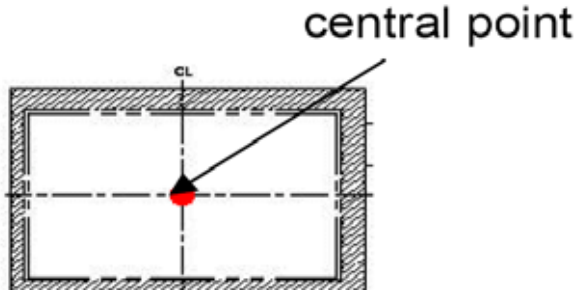
5. When Reset is applied during Sleep In Mode.
6. When Reset is applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RST before sending commands. Also Sleep Out command cannot be sent for 120msec.

■ CTP INTERFACE AND DATA FORMAT

1. GENERAL SPECIFICATIONS

Item	Specification	Unit
Type	Transparent type projected capacitive touch panel	
Resolution	480x272	Dots
Input mode	Human's finger	
Multi touch	2	Point
Interface	IIC	
Report rate	Max：122	Points/sec
Response time	15	ms
Point hitting life time	1,000,000 times min.	Note 1

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.



2. Electrical Characteristic

2.1 Absolute Maximum Rating

Parameter	Symbol	Spec.			Unit
Supply voltage	VCC	-0.3	-	7	V
Switch control signals output current	Output current	-	50	-	mA
Enable control voltage range	Logic Input	-0.3	-	VCC+0.3	V
Output Control Driver	Output voltage	-0.3	-	VCC	V

2.2 DC Characteristic

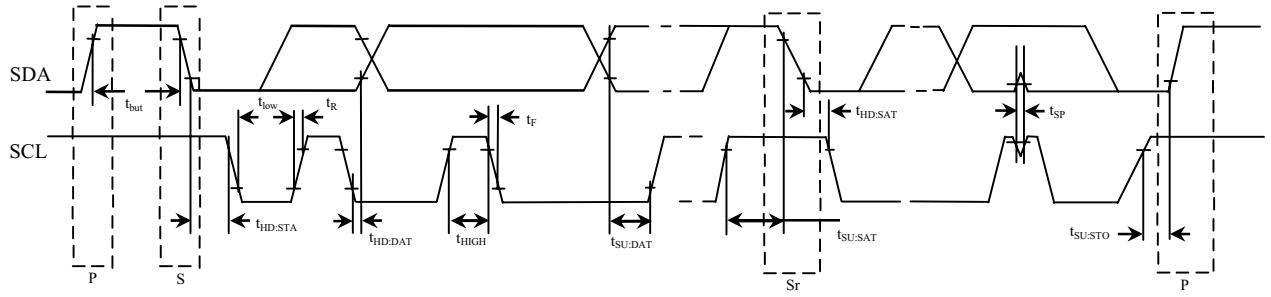
Symbol	Description	Min	Typ	Max	Unit	Notes
VCC	Supply voltage	2.5	3.3	3.5	V	
IVCC	Supply current		12		mA	
IST	sleep mode		30		uA	

3. CTP Pin Connections

No.	Name	I/O	Description
1	VCC	-	Power; VCC=3.3V
2	/RES	I	Reset, Active LOW.
3	/INT	O	Interrupt, Active low
4	SDA	I/O	Serial data
5	SCL	I	Serial clock
6	VSS	-	Ground

4. Interface and Data Format (Slave address is 0x94H)

AC characteristics of the SDA and SCL bus lines for I²C-bus devices



Parameter	Symbol	Standard-Mode I²C-BUS		Fast-Mode I²C-BUS		Unit
		Min.	Max.	Min.	Max.	
SCL clock frequency	f_{SCL}	0	100	0	400	KHz
Bus free time between STOP and START condition	t_{BUF}	4.7	-	1.3	-	μs
Hold time (repeated) START condition. After this period, the first clock pulse is generated	$t_{HD:STA}$	4.0	-	0.6	-	μs
LOW period of the SCL clock	t_{LOW}	4.7	-	1.3	-	μs
HIGH period of the SCL clock	t_{HIGH}	4.0	-	0.6	-	μs
Set-up time for a repeated START condition	$t_{SU:STA}$	4.7	-	0.6	-	μs
Data hold time	$t_{HD:DAT}$	0	-	0	0.9	μs
Data set-up time	$t_{SU:DAT}$	250	-	100	-	μs
Rise time of both SDA and SCL signals	t_R	-	1000	20+0.1C_b	300	μs
Fall time of both SDA and SCL signals	t_F	-	300	20+0.1C_b	300	μs
Set-up time for STOP condition	$t_{SU:STO}$	4.0	-	0.6	-	μs
Capacitive load for each bus line.	C_b	-	400	-	400	pF

Note:

(1) All values are referred to VIH (0.7xVDD) and VIL (0.3xVDD) level.

(2) A device must internally provide a hold time of at least 300ns for the SDA signal (referred to the VIH of the SCL signal) in order to bridge the undefined region of the falling edge of SCL.

(3) The maximum $t_{HD:DAT}$ has only to be met if the device does not stretch the LOW period (t_{LOW}) of the SCL signal.

(4) A fast-mode I²C-bus device can be used in a standard-mode I²C-bus system, but the requirement $t_{SU:DAT} \geqq 250$ns must then be met. This will automatically be the case if the device does not stretch the LOW period of the SCL signal. If such a device does stretch the LOW period of the SCL signal, it must output the next data bit to the SDA line $t_{R\,max}$ $t_{SU:DAT}$ = 1000+250=1250ns (according to the standard-mode I²C-bus specification) before the SCL line is released.

(5) C_b = total capacitance of one bus line in pF.

5. Interface and Data Format

5.1 Transfer protocol (I²Cinterface)

HX8526-D32 support I²C interface that need 2 hardware pin – serial data (SDA) and serial clock (SCL), carry information between the devices connected to the bus. The I²C bus supports serial, 8-bit oriented, bi-directional data transferred at a rate up to 100Kbit/s in the standard-mode, or up to 400Kbit/s in the fast-mode.

The data on the SDA line must be stable during the HIGH period of the clock. The HIGH or LOW state of the data line can only change when the clock signal on the SCL line is LOW.

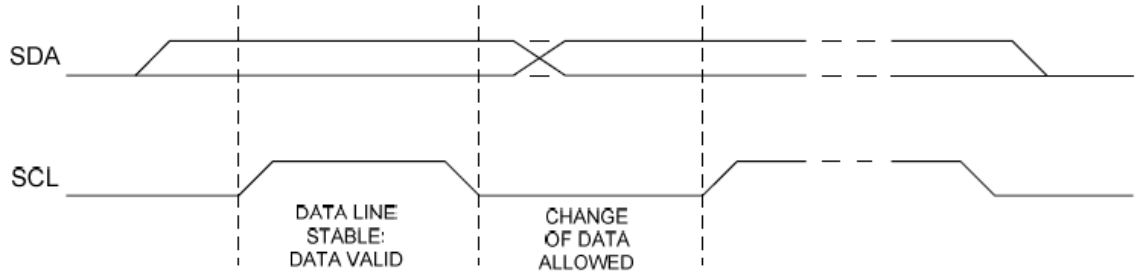


Figure 5.1.1: I²C Signal timing

Within the procedure of the I²C -bus, unique situations arise which are defined as START and STOP conditions. A HIGH to LOW transition on the SDA line while SCL is HIGH is one such unique case. This situation indicates a START condition. A LOW to HIGH transition on the SDA line while SCL is HIGH defines a STOP condition. START and STOP conditions are always generated by the master. The I²C bus is considered to be busy after the START condition. The I²C bus is considered to be free again a certain time after the STOP condition.

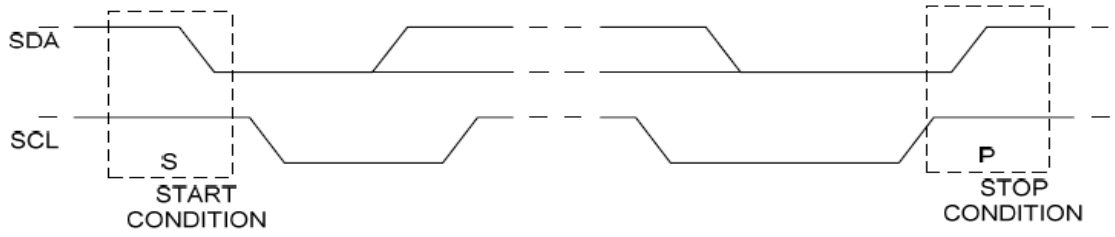


Figure 5.2: I²C Start/Stop

The slave address of I²C is defined at the follow description

A. The HX8526-D32 QFN48 Type 1 and UFBGA Type 1 only support I²C interface and the slave address is 90h.

B. The HX8526-D32 QFN 48 type 2 , UFBGA Type 2, QFN64 and QFN40 support I²C interface and the slave address is selected by A0. If A0="L", the slaver address is 90h. If A0="H", the slaver address is 92h.

In I²C slave mode, HX8526-D32 waits for Master reading the data and acknowledges. Every byte put on the SDA line must be 8-bits long. The number of bytes that can be transmitted per transfer is unrestricted. Each byte has to be followed by an acknowledge bit. Data is transferred with the most significant bit (MSB) first. If HX8526-D32 can't receive or transmit another complete byte of data until it has performed some other function, for example servicing an internal interrupt, it can hold the clock line SCL LOW to force the master into a wait state. Data transfer then continues when the HX8526-D32 is ready for another byte of data and releases clock line SCL

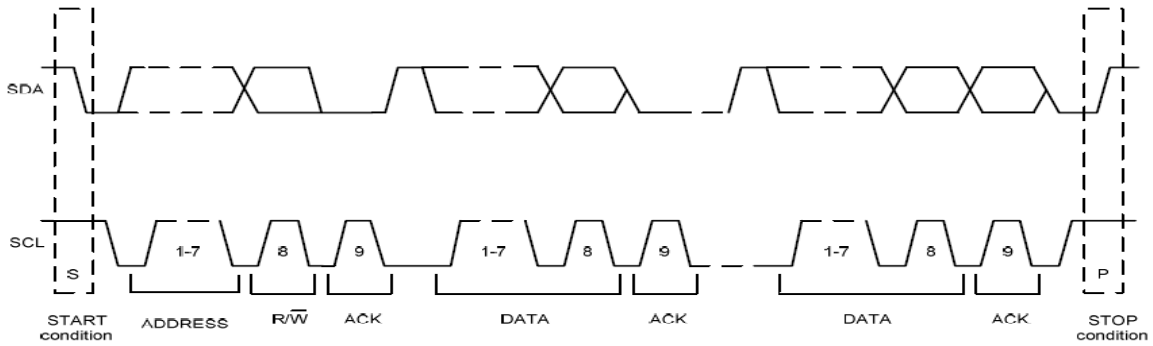


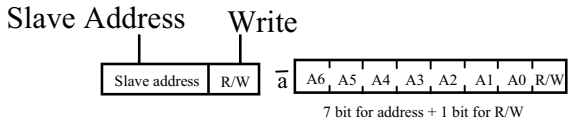
Figure5.3: I²C data transfer

5.2 Format of data frame (I²C interface)

When master sends the command which be received by HX8526-D32, the HX8526-D32 will responses the code and data .The format of communication is shown as Figure 11.4. The Command table that is written by master is defined on Table11.1 Command Table. HX8526-D32 will response the response code first and data later

Write mode

S	Slave Address	0	A	Command Address	A	Parameter	A		Parameter	A/$\overline{A}$	P



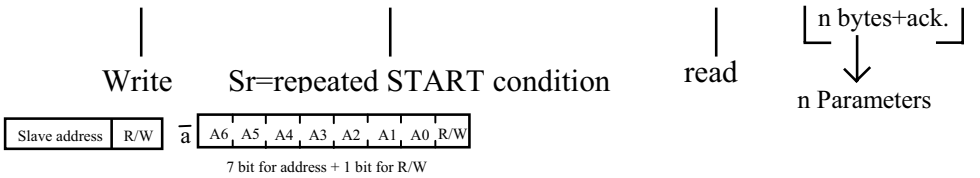
From master to slave From slave to master

A= acknowledge (SDA LOW)
A= not acknowledge (SDA HIGH)
S= START condition
P= STOP condition

Data Format of writing mode

Read mode

S	Slave address	R/$\overline{W}$	A	Com.	A/$\overline{A}$	Sr	Slave address	R/$\overline{W}$	A	Data	A/$\overline{A}$	P



From master to slave From slave to master

A= acknowledge (SDA LOW)
A= not acknowledge (SDA HIGH)
S= START condition
P= STOP condition

Data Format of reading mode

6. COMMAND

6.1 Command list

Hex	Operation Code	D7	D6	D5	D4	D3	D2	D1	D0	Function
0	No operation	0	0	0	0	0	0	0	0	-
80	Sleep IN	1	0	0	0	0	0	0	0	-
81	Sleep Out	1	0	0	0	0	0	0	1	-
82	Sense Off	1	0	0	0	0	0	1	0	-
83	Sense On	1	0	0	0	0	0	1	1	-
85	Read Event	1	0	0	0	0	1	0	1	-
	1st parameter	B31	B30	B29	B28	B27	B26	B25	B24	-
	2nd parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	3rd parameter	B15	B14	B13	B12	B11	B10	B9	B8	-
	4th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
86	Read All Events	1	0	0	0	0	1	1	0	-
	1st parameter	B31	B30	B29	B28	B27	B26	B25	B24	-
	2nd parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	3rd parameter	B15	B14	B13	B12	B11	B10	B9	B8	-
	4th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
	5th parameter	E3	E2	E1	E0	FI	P2	P1	P0	-
	6th parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	…	:	:	:	:	:	:	:	:	-
	(n+1)th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
87	Read Latest Event	1	0	0	0	0	1	1	1	-
	1st parameter	B31	B30	B29	B28	B27	B26	B25	B24	-
	2nd parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	3rd parameter	B15	B14	B13	B12	B11	B10	B9	B8	-
	4th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
88	Clear Stack	1	0	0	0	1	0	0	0	-
9E	TS Software Reset	1	0	0	1	1	1	1	0	-

6.2 User define command list table

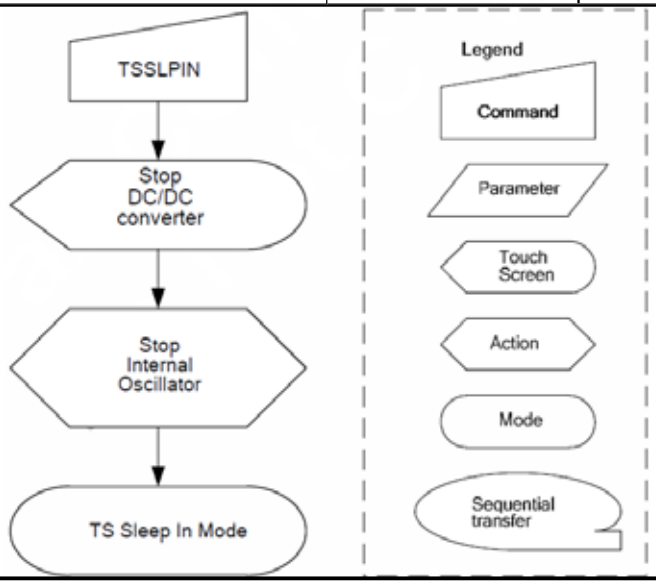
Hex	Operation Code	D7	D6	D5	D4	D3	D2	D1	D0	Function
31h	Device ID	0	0	1	1	0	0	0	1	Response Device ID Code
	1st parameter	85								-
	2nd parameter	26								-
	3nd parameter	01								-
32h	Version ID	0	0	1	1	0	0	0	1	Read Firmware version

6.3 CTP COMMAND DESCRIPTION

NOP

00 H	**NOP (No Operation)**									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	0	0	0	0	0	0	0	0	00
Parameter	No parameter									
Description	This command is an empty command and it does not have any effect on the touch screen.									
Restriction										
Register Availability	Status	Availability								
	TS Sleep Out	Yes								
	TS Sleep In	Yes								
Default	Status	Default Value								
	Power Up Sequence	N/A								
	TS S/W Reset	N/A								
	H/W Reset	N/A								
Flow Chart										

TS sleep in (80h)

<table>
<tr><td rowspan="2">80H</td><td colspan="10">TSSLPIN (Touch Screen Sleep In)</td></tr>
<tr><td>DNC</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td><td>HEX</td></tr>
<tr><td>Command</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>80</td></tr>
<tr><td>parameter</td><td colspan="10">No parameter</td></tr>
<tr><td>Description</td><td colspan="10">This command causes the touch screen to enter the minimum power consumption mode.
MCU interface are register are still working and keeps their contents.</td></tr>
<tr><td>Restriction</td><td colspan="10">This command has no effect when the touch screen is already in TS Sleep In mode.
TS Sleep In Mode can only be left by the TS Sleep Out Command (81h).
It will be necessary to wait 5msec before sending next command. This is to allow time for the supply voltages and clock circuits to stabilize.
It will be necessary to wait 5msec after sending TS Sleep Out command (when in TS Sleep In Mode) before TS Sleep In command can be sent.</td></tr>
<tr><td>Register Availability</td><td colspan="10"><table><tr><td>Status</td><td>Availability</td></tr><tr><td>TS Sleep Out</td><td>Yes</td></tr><tr><td>TS Sleep In</td><td>Yes</td></tr></table></td></tr>
<tr><td>Default</td><td colspan="10"><table><tr><td>Status</td><td>Default Value</td></tr><tr><td>Power Up Sequence</td><td>TS Sleep In Mode</td></tr><tr><td>TS S/W Reset</td><td>TS Sleep In Mode</td></tr><tr><td>H/W Reset</td><td>TS Sleep In Mode</td></tr></table></td></tr>
<tr><td>Flow Chart</td><td colspan="10"> 
</td></tr>
</table>

TS sleep out (81h)

81H	**TSSLPOUT** (Touch Screen Sleep Out)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	0	0	0	1	81
parameter	No parameter									
Description	This command turns off TS Sleep In mode.									
Restriction	This command has no effect when touch screen is already in TS Sleep Out mode. TS Sleep Out Mode can only be left by the TS Sleep In Command (80h). It will be necessary to wait 5msec before sending next command. This is to allow time for the supply voltages and clock circuits to stabilize. The touch screen loads all touch screen supplier's factory default values to the registers during this 5msec and there cannot be any abnormal effect on the touch screen functionality if factory default and register values are same when this load is done and when the touch screen is already TS Sleep Out – mode. It will be necessary to wait 5msec after sending TS Sleep In command (when in TS Sleep Out mode) before TS Sleep Out command can be sent.									

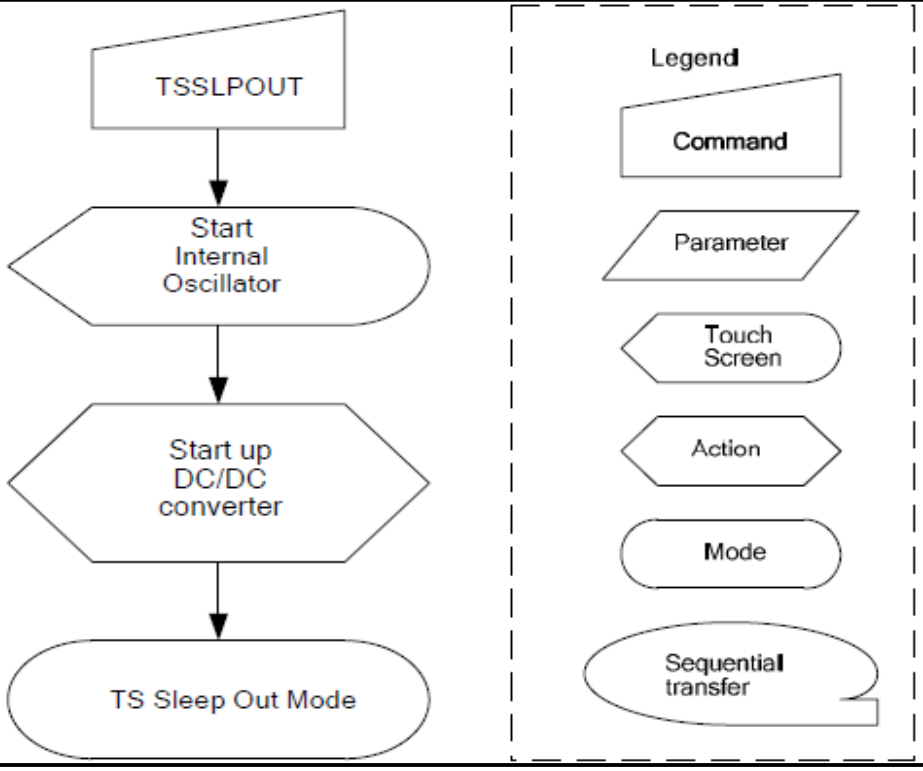
Register Availability

Status	Availability
TS Sleep Out	Yes
TS Sleep In	Yes

Default

Status	Default Value
Power Up Sequence	TS Sleep In Mode
TS S/W Reset	TS Sleep In Mode
H/W Reset	TS Sleep In Mode

Flow Chart



TS sense off (82h)

82H	**TSSOFF** (Touch Screen Sense Off)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	0	0	1	0	82
parameter	No parameter									
Description	The touch screen is not sensing touches (= No new events), but the touch screen is still scanning.									
Restriction										

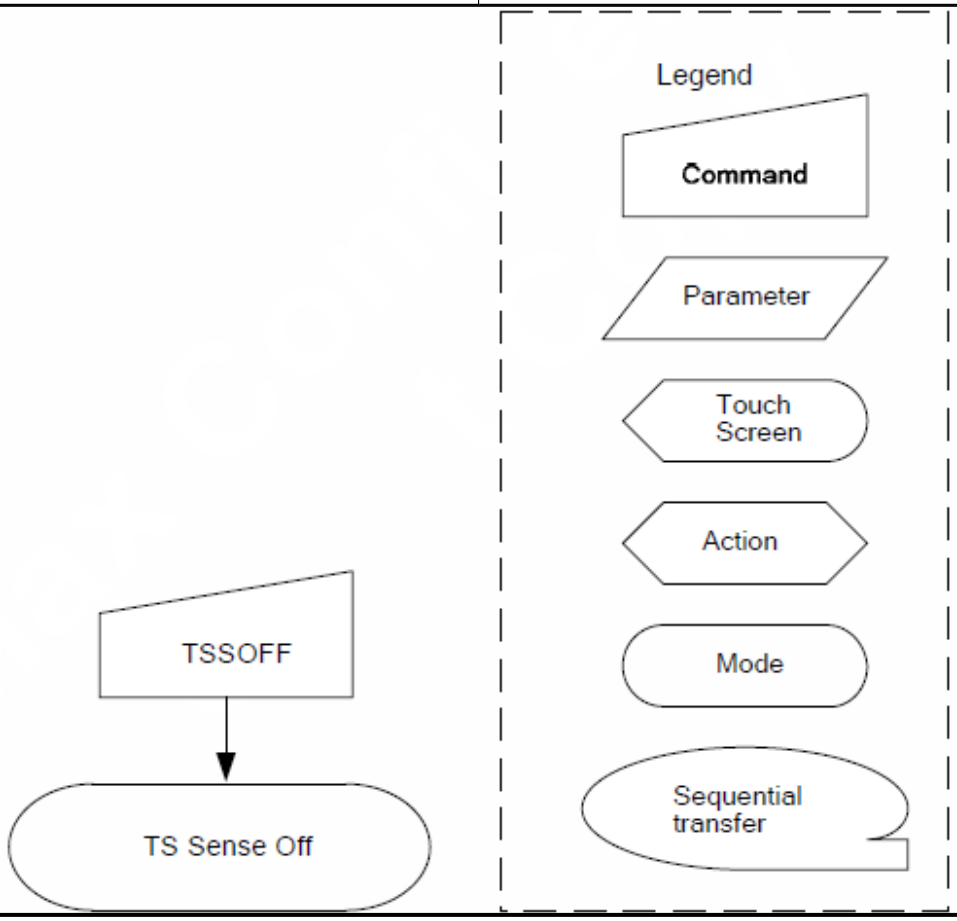
Register Availability

Status	Availability
TS Sleep Out	Yes
TS Sleep In	Yes

Default

Status	Default Value
Power Up Sequence	TS Sense Off
TS S/W Reset	TS Sense Off
H/W Reset	TS Sense Off

Flow Chart



TS sense on (83h)

83H	**TSSON** (Touch Screen Sense On)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	0	0	1	1	83
parameter	No parameter									
Description	The touch screen is sensing touches (= No new events).									
Restriction										

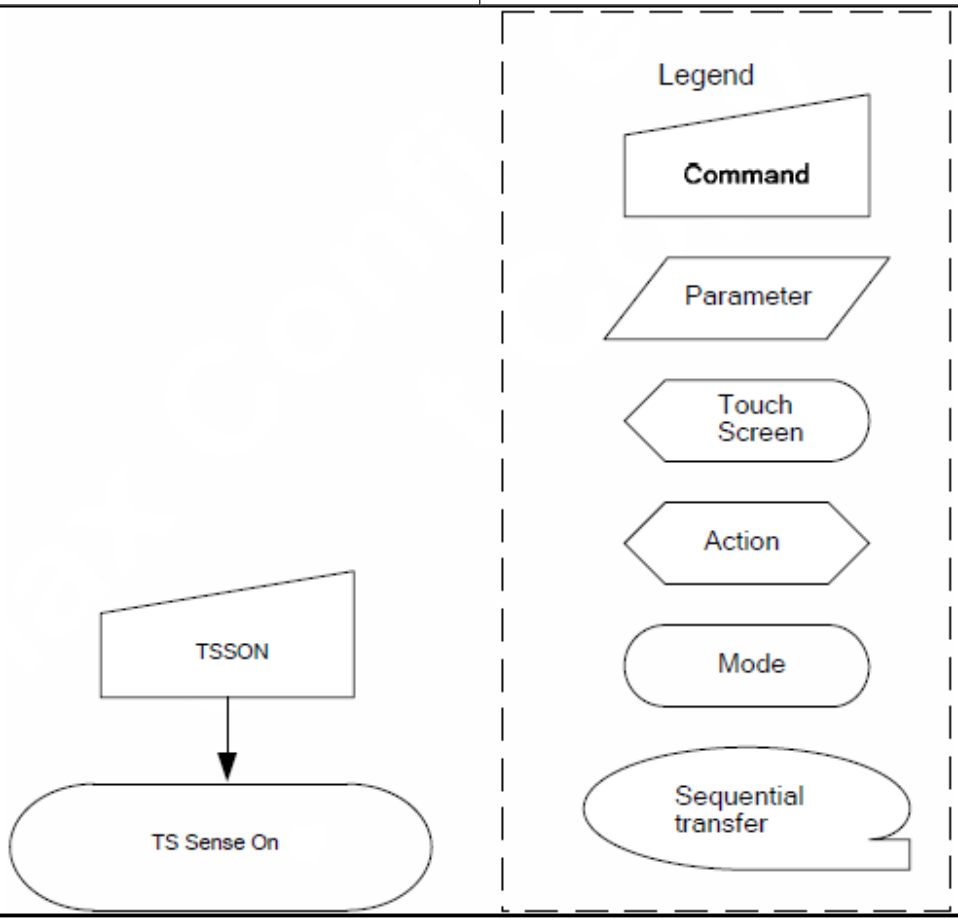
Register Availability

Status	Availability
TS Sleep Out	Yes
TS Sleep In	Yes

Default

Status	Default Value
Power Up Sequence	TS Sense Off
TS S/W Reset	TS Sense Off
H/W Reset	TS Sense Off

Flow Chart

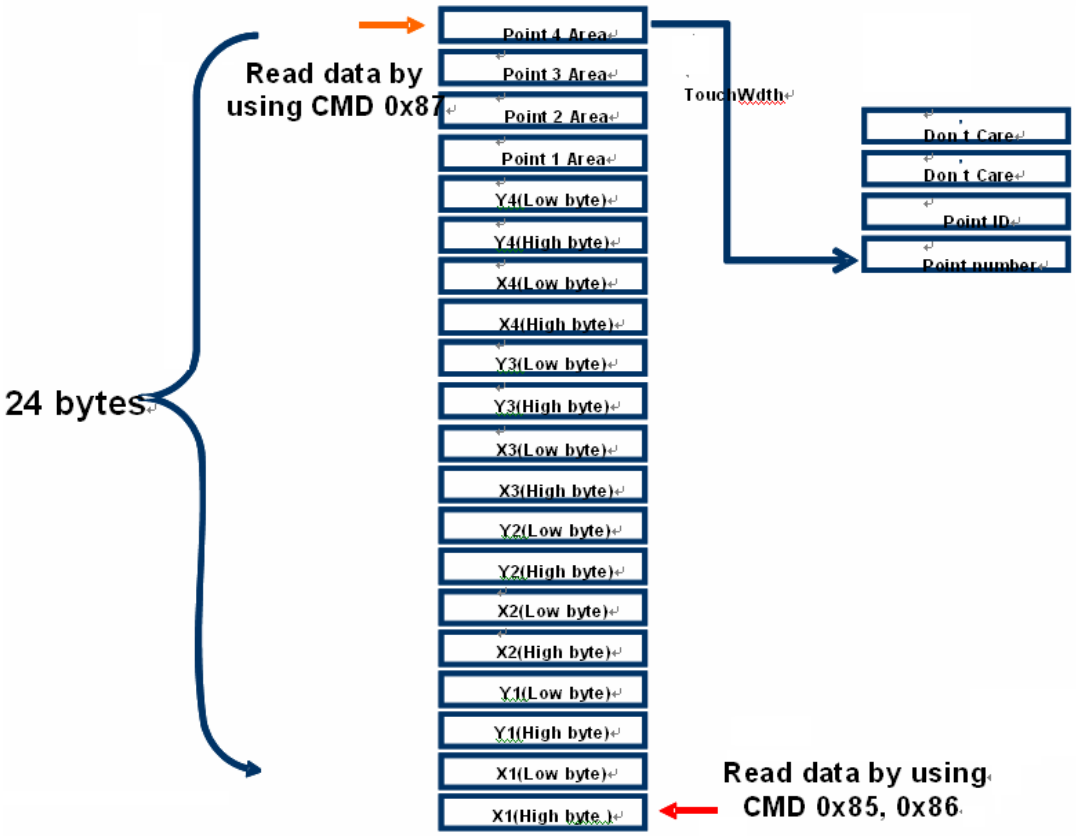


Read One Event (85h)

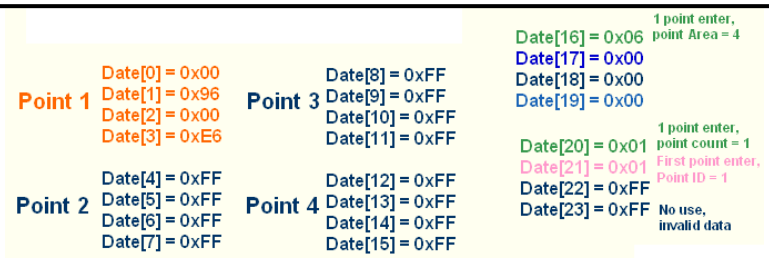
85H	ROE (Read One Event)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	0	1	0	1	85
1 parameter	-	B31	B30	B29	B28	B27	B26	B25	B24	xx
2 parameter	-	B23	B22	B21	B20	B19	B18	B17	B16	xx
3 parameter	-	B15	B14	B13	B12	B11	B10	B9	B8	xx
4 parameter	-	B7	B6	B5	B4	B3	B2	B1	B0	xx

Description

This command returns one touch event what is the oldest co-ordinates or raw counter (dc) values information has been stored on the stock. The event stack is empty after this command.
A returning value can be “No Event” if the stock is empty.
co-ordinates and related touch information:
Touch Width: Report the touched block. For example: if RX=15, TX=10, the total Block is 150 (96h). If it has three touched block, the report value is 03h.
Point ID: Report the ID of touched points.
Points number: Report the touch number.



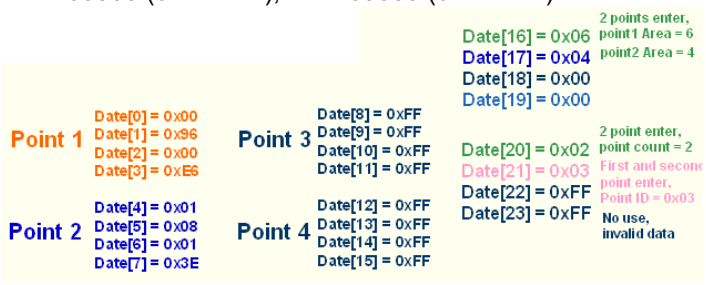
When one or more points (but not all) have been touched, other points without touched will be fill invalid data 0xFFFF to let baseband distinguish which point has been touched or not.
Example 1: Support 4 points, one point has been touched.
X1 = 150 (0x0096H), Y1 = 230 (0x00E6H)
X2 = 65535 (0xFFFFH), Y2 = 65535 (0xFFFFH)
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)
X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)
Totally data length = 4 x 4 + 8 = 24 bytes



Example 2: Support 4 points, 2 points have been touched, and than first point leave.

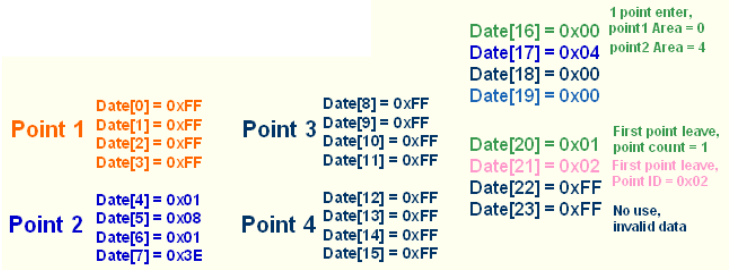
(1) 2 points enter

X1 = 150 (0x0096H), Y1 = 230 (0x00E6H)
X2 = 264 (0x0108H), Y2 = 318 (0x013EH)
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)
X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)



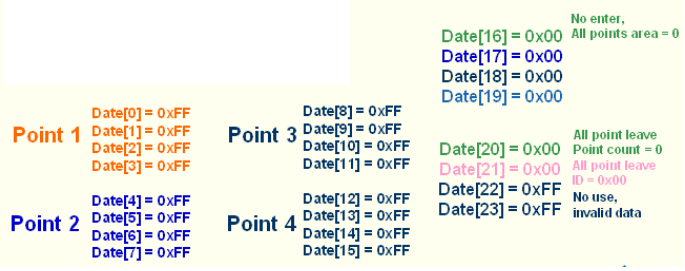
(2) First point leave

X1 = 65535 (0xFFFFH), Y1 = 65535 (0xFFFFH)
X2 = 264 (0x0108H), Y2 = 318 (0x013EH)
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)
X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)



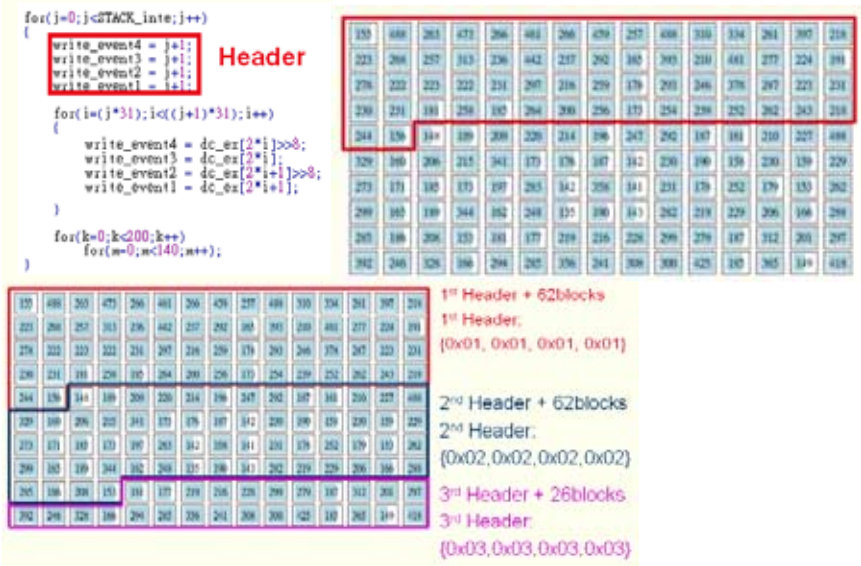
(3) All point leave

When all point leave, touch controller will report all point leave event data one time and than stop interrupt until next touch.
All point leave data will be fill 0xFFFF and optional information will be fill 0x0000
X1 = 65535 (0xFFFFH), Y1 = 65535 (0xFFFFH)
X2 = 65535 (0xFFFFH), Y2 = 65535 (0xFFFFH)
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)
X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)



When one or more points (but not all) have been touched, other points without touched will be fil invalid data 0xFFFF to let baseband distinguish which point has been touched or not

Raw counter:
If we read out the max stacks in once time 32x4 = 128 bytes. The first 4 bytes for header.
Header format : {0x0?, 0x0?, 0x0?, 0x0?} (? is for 1, 2, 3 … N)
After Header then it will follow Raw Count Value, the raw count value contain 2 bytes for each block. So we can read out 31x4 = 124 bytes = 62 blocks
Example: TP1 total block = 150 blocks, It will be separated by 3 time for read out



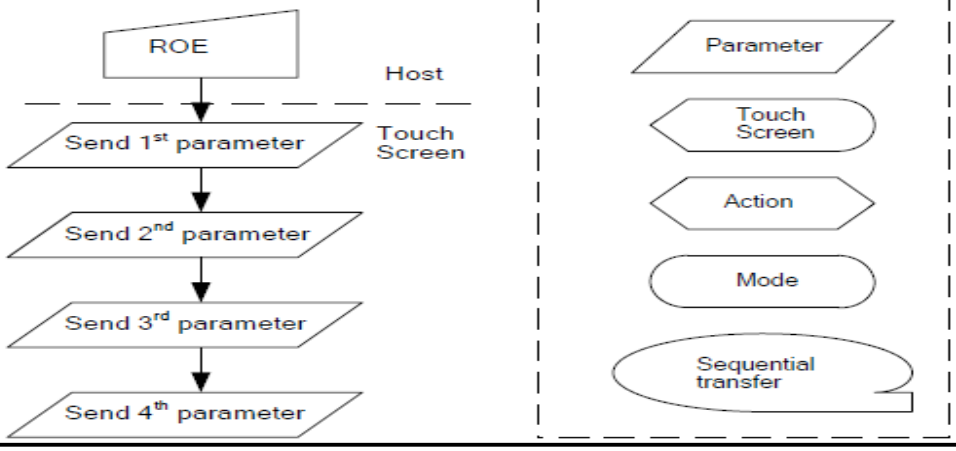
Register Availability

Status	Availability
TS Sleep Out	Yes
TS Sleep In	Yes

Default

Status	Default Value
Power Up Sequence	0000 0000h
TS S/W Reset	0000 0000h
H/W Reset	0000 0000h

Flow Chart

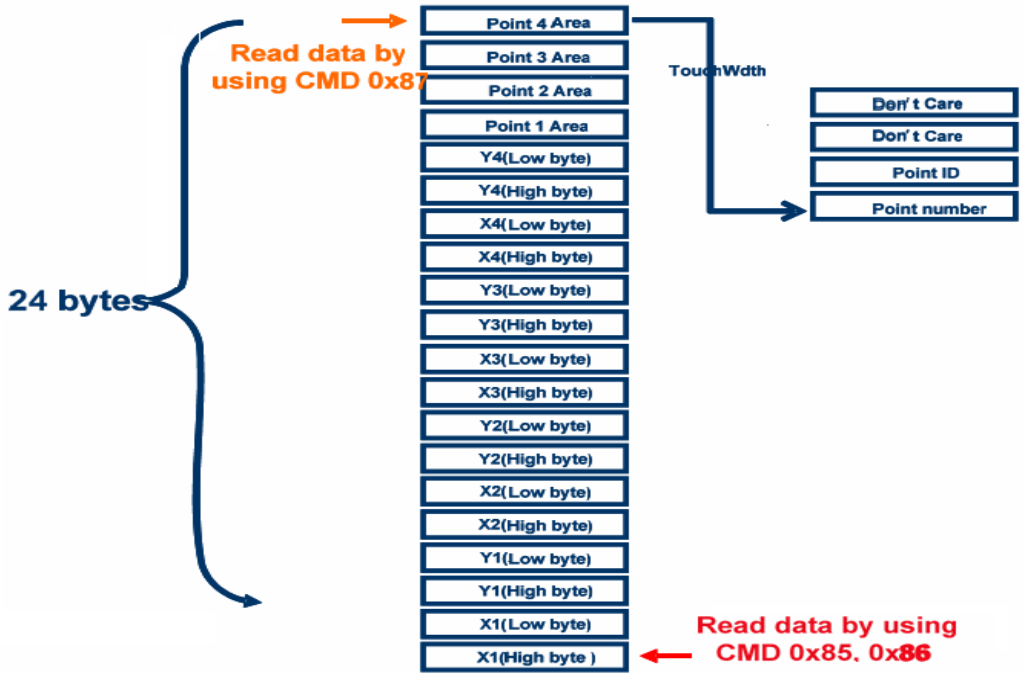


Read All Event (86h)

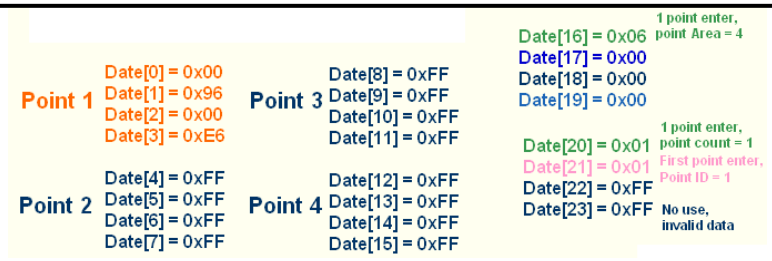
86H		RAE (Read All Events)									
		DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command		0	1	0	0	0	0	1	1	0	86
1	parameter	-	B31	B30	B29	B28	B27	B26	B25	B24	xx
2	parameter	-	B23	B22	B21	B20	B19	B18	B17	B16	xx
3	parameter	-	B15	B14	B13	B12	B11	B10	B9	B8	xx
4	parameter	-	B7	B6	B5	B4	B3	B2	B1	B0	xx
5	parameter	-	E3	E2	E1	E0	F1	P2	P1	P0	xx
6	parameter	-	B23	B22	B21	B20	B19	B18	B17	B16	xx
:		-	:	:	:	:	:	:	:	:	:
(n+1) Parameter		-	B7	B6	B5	B4	B3	B2	B1	B0	xx

Description

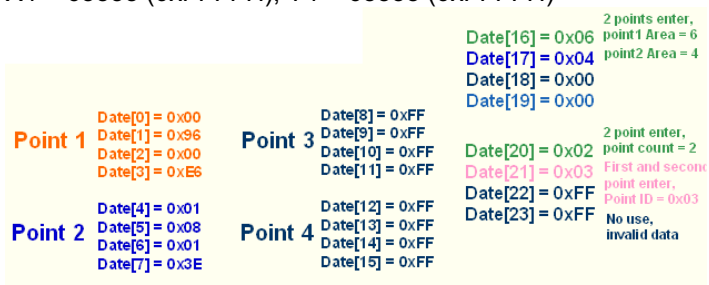
This command returns one touch event what is the oldest co-ordinates or raw counter (dc) values information has been stored on the stock. A returning value can be “No Event” if the stock is empty.
co-ordinates and related touch information:
Touch Width: Report the touched block. For example: if RX=15, TX=10, the total Block is 150 (96h). If it has three touched block, the report value is 03h.
Point ID: Report the ID of touched points.
Points number: Report the touch number.



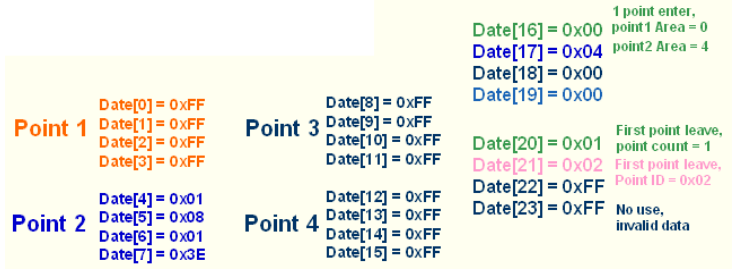
When one or more points (but not all) have been touched, other points without touched will be fill invalid data 0xFFFF to let baseband distinguish which point has been touched or not.
Example 1: Support 4 points, one point has been touched.
X1 = 150 (0x0096H), Y1 = 230 (0x00E6H)
X2 = 65535 (0xFFFFH), Y2 = 65535 (0xFFFFH)
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)
X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)
Totally data length = 4 x 4 + 8 = 24 bytes.



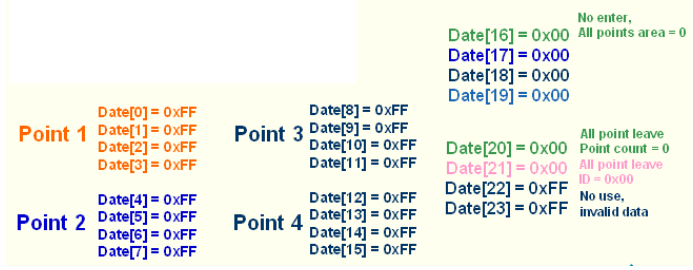
Example 2: Support 4 points, 2 points have been touched, and than first point leave. (2) 2 points enter
X1 = 150 (0x0096H), Y1 = 230 (0x00E6H)
X2 = 264 (0x0108H), Y2 = 318 (0x013EH)
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)
X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)



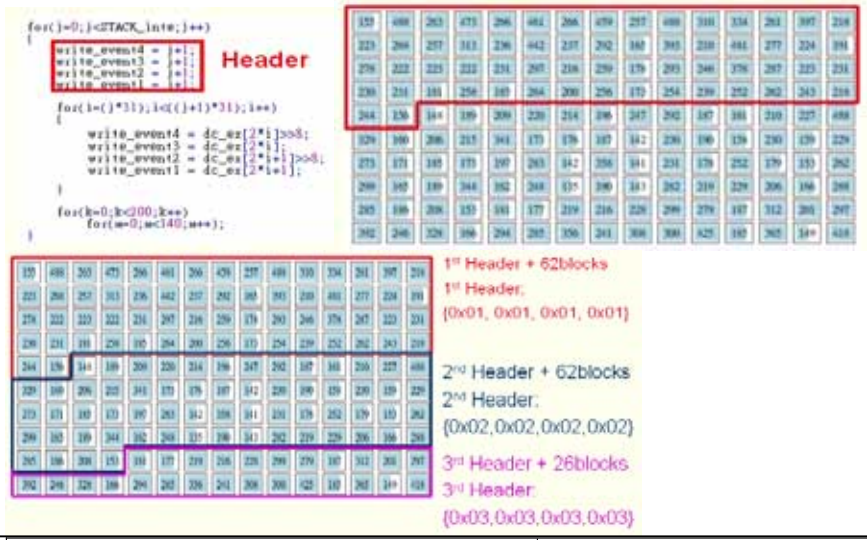
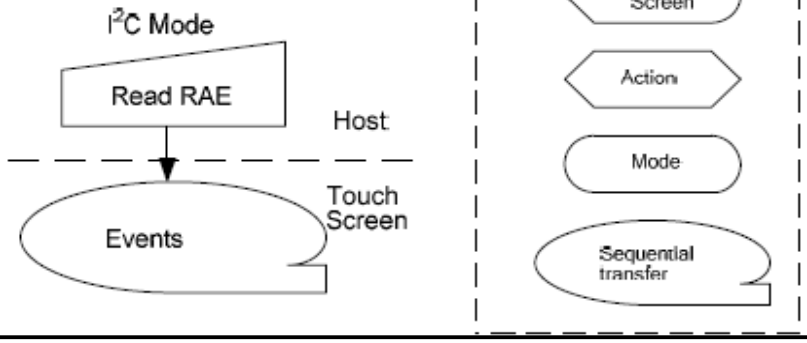
(2) First point leave
X1 = 65535 (0xFFFFH), Y1 = 65535 (0xFFFFH)
X2 = 264 (0x0108H), Y2 = 318 (0x013EH)
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)
X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)



(3) All point leave
When all point leave, touch controller will report all point leave event data one time and than stop interrupt until next touch.
All point leave data will be fill 0xFFFF and optional information will be fill 0x0000.
X1 = 65535 (0xFFFFH), Y1 = 65535 (0xFFFFH)
X2 = 65535 (0xFFFFH), Y2 = 65535 (0xFFFFH)
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)
X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)



When one or more points (but not all) have been touched, other points without touched will be fill invalid data 0xFFFF to let baseband distinguish which point has been touched or not.
Raw counter:

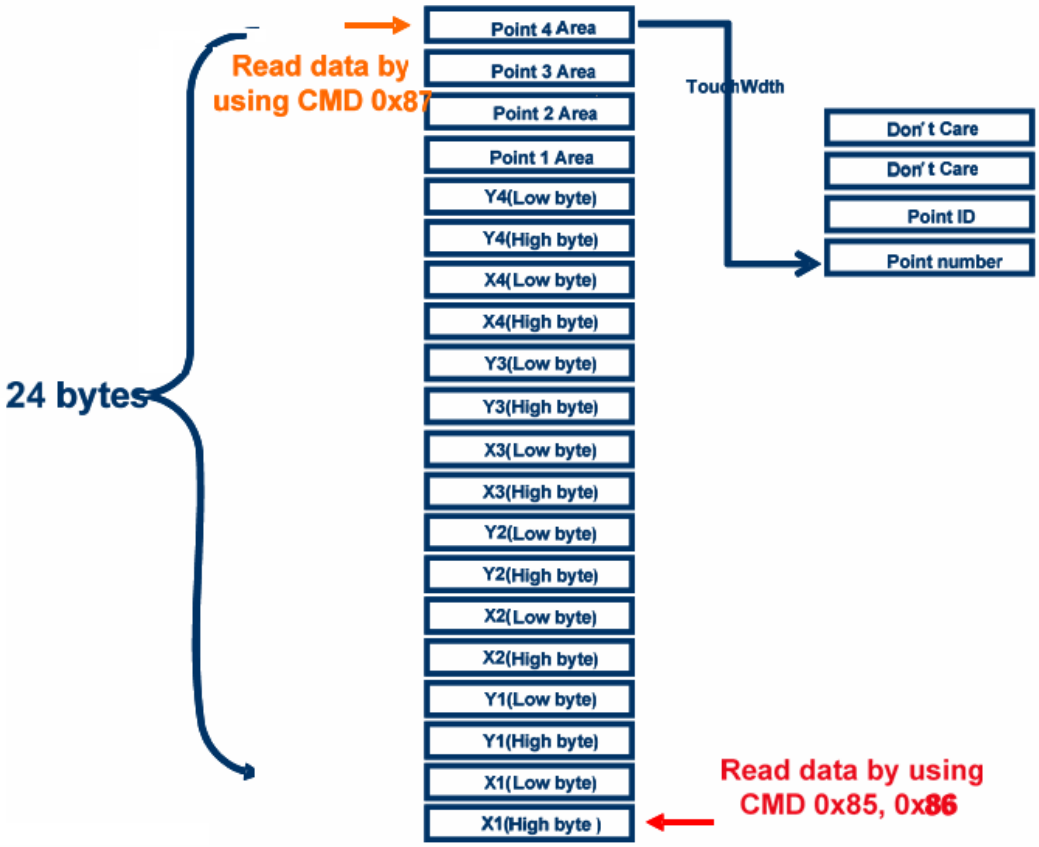
<table>
<tr><td></td><td>If we read out the max stacks in once time 32x4 = 128 bytes. The first 4 bytes for header.
Header format : {0x0?, 0x0?, 0x0?, 0x0?} (? is for 1, 2, 3 … N)
After Header then it will follow Raw Count Value, the raw count value contain 2 bytes for each block. So we can read out 31x4 = 124 bytes = 62 blocks
Example: TP1 total block = 150 blocks, It will be separated by 3 time for read out.
 
</td></tr>
<tr><td>Register Availability</td><td>
<table>
<tr><td>Status</td><td>Availability</td></tr>
<tr><td>TS Sleep Out</td><td>Yes</td></tr>
<tr><td>TS Sleep In</td><td>Yes</td></tr>
</table>
</td></tr>
<tr><td>Default</td><td>
<table>
<tr><td>Status</td><td>Default Value</td></tr>
<tr><td>Power Up Sequence</td><td>All Values 0000 0000h</td></tr>
<tr><td>TS S/W Reset</td><td>All Values 0000 0000h</td></tr>
</table>
</td></tr>
<tr><td>Flow Chart</td><td> 
</td></tr>
</table>

Read Latest Event (87h)

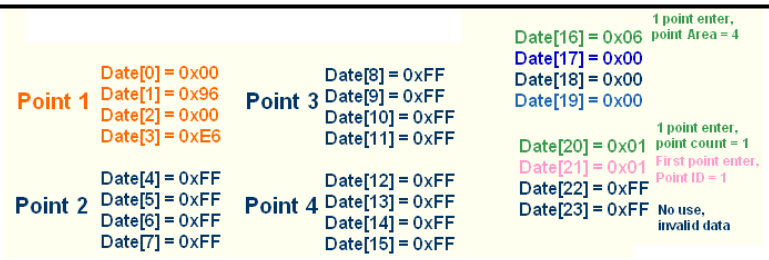
87H		RLE (Read Latest Event)									
		DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command		0	1	0	0	0	0	1	1	1	87
1	parameter	-	B31	B30	B29	B28	B27	B26	B25	B24	xx
2	parameter	-	B23	B22	B21	B20	B19	B18	B17	B16	xx
3	parameter	-	B15	B14	B13	B12	B11	B10	B9	B8	xx
4	parameter	-	B7	B6	B5	B4	B3	B2	B1	B0	xx

Description

This command returns one touch event what is the oldest co-ordinates or raw counter (dc) values information has been stored on the stock. The event stack is empty after this command. A returning value can be “No Event” if the stock is empty.
co-ordinates and related touch information:
Touch Width: Report the touched block. For example: if RX=15, TX=10, the total Block is 150 (96h). If it has three touched block, the report value is 03h.
Point ID: Report the ID of touched points.
Points number: Report the touch number.



When one or more points (but not all) have been touched, other points without touched will be fill invalid data 0xFFFF to let baseband distinguish which point has been touched or not.
Example 1: Support 4 points, one point has been touched.
X1 = 150 (0x0096H), Y1 = 230 (0x00E6H)
X2 = 65535 (0xFFFFH), Y2 = 65535 (0xFFFFH)
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)
X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)
Totally data length = 4 x 4 + 8 = 24 bytes



Example 2: Support 4 points, 2 points have been touched, and than first point leave.

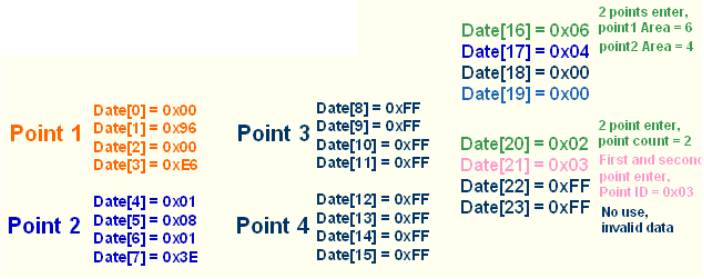
(1) 2 points enter

X1 = 150 (0x0096H), Y1 = 230 (0x00E6H)

X2 = 264 (0x0108H), Y2 = 318 (0x013EH)

X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)

X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)



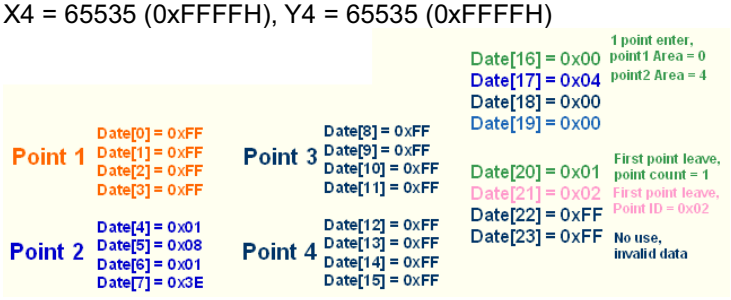
(2) First point leave

X1 = 65535 (0xFFFFH), Y1 = 65535 (0xFFFFH)

X2 = 264 (0x0108H), Y2 = 318 (0x013EH)

X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)

X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)



(3) All point leave

When all point leave, touch controller will report all point leave event data one time and than stop interrupt until next touch.

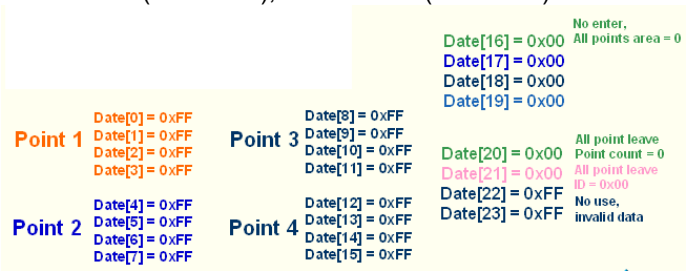
All point leave data will be fill 0xFFFF and optional information will be fill 0x0000.

X1 = 65535 (0xFFFFH), Y1 = 65535 (0xFFFFH)

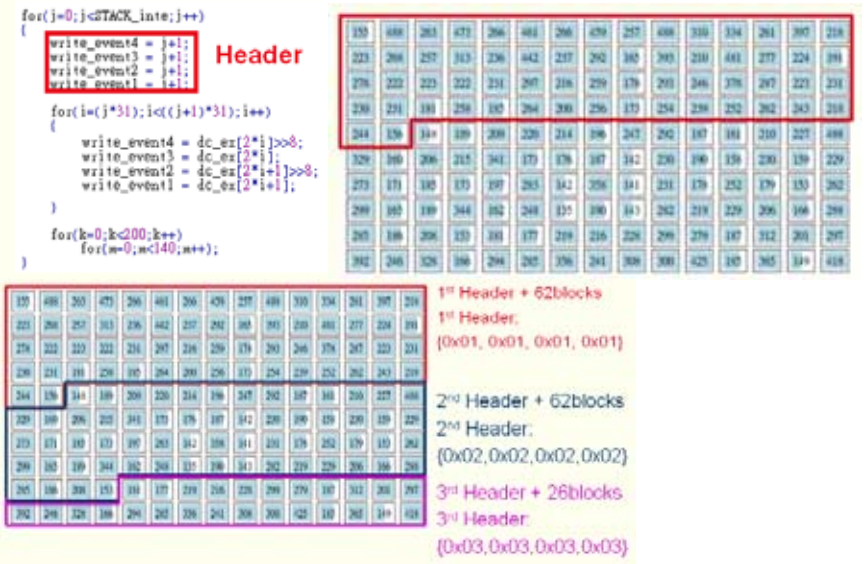
X2 = 65535 (0xFFFFH), Y2 = 65535 (0xFFFFH)

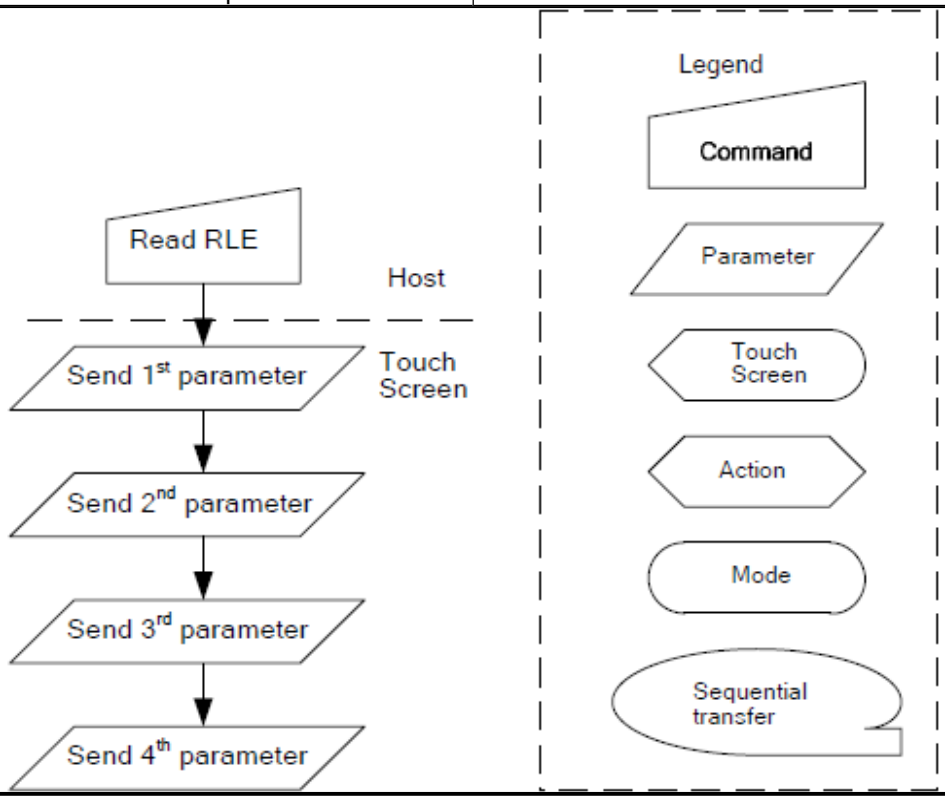
X3 = 65535 (0xFFFFH), Y3 = 65535 (0xFFFFH)

X4 = 65535 (0xFFFFH), Y4 = 65535 (0xFFFFH)



When one or more points (but not all) have been touched, other points without touched will be fill invalid data 0xFFFF to let baseband distinguish which point has been touched or not.

<table>
<tr><td></td><td>
Raw counter:
If we read out the max stacks in once time 32x4 = 128 bytes. The first 4 bytes for header.
Header format : {0x0?, 0x0?, 0x0?, 0x0?} (? is for 1, 2, 3 … N)
After Header then it will follow Raw Count Value, the raw count value contain 2 bytes for each block. So we can read out 31x4 = 124 bytes = 62 blocks
Example: TP1 total block = 150 blocks, It will be separated by 3 time for read out


</td></tr>
<tr><td>Register Availability</td><td>
<table>
<tr><td>Status</td><td>Availability</td></tr>
<tr><td>TS Sleep Out</td><td>Yes</td></tr>
<tr><td>TS Sleep In</td><td>Yes</td></tr>
</table>
</td></tr>
<tr><td>Flow Chart</td><td>


</td></tr>
</table>

Clear Event Stack (88h)

88H	**CLRES** (Clear Event Stack)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	1	0	0	0	88
parameter	No parameter									
Description	This command clears event stack when the only return event can be “No Event”.									
Restriction										

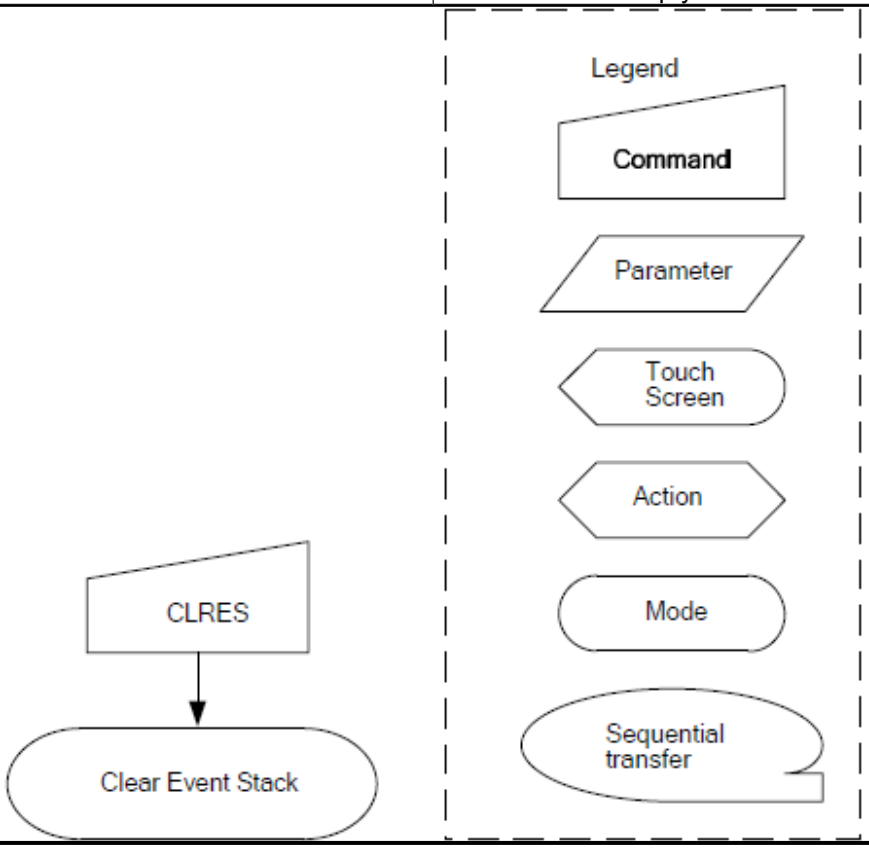
Register Availability

Status	Availability
TS Sleep Out	Yes
TS Sleep In	Yes

Default

Status	Default Value
Power Up Sequence	Empty Stack
TS S/W Reset	Empty Stack
H/W Reset	Empty Stack

Flow Chart



TS Software Reset (9Eh)

9E H	**TSSWRESET** (Touch Screen Software Reset)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	1	1	1	1	0	9E
parameter	No parameter									
Description	When the Touch Screen Software Reset command is written, it causes a software reset. It resets the commands and parameters to their TS S/W Reset default values. (See default tables in each command description.) Note: The Memory contents are unaffected by this command									
Restriction	It will be necessary to wait 5msec before sending new command following software reset. The touch screen loads all touch screen supplier's factory default values to the registers during this 5msec. If Software Reset is applied during TS Sleep Out mode, it will be necessary to wait 5msec before sending TS Sleep Out command. Touch Screen Software Reset Command cannot be sent during TS Sleep Out sequence.									

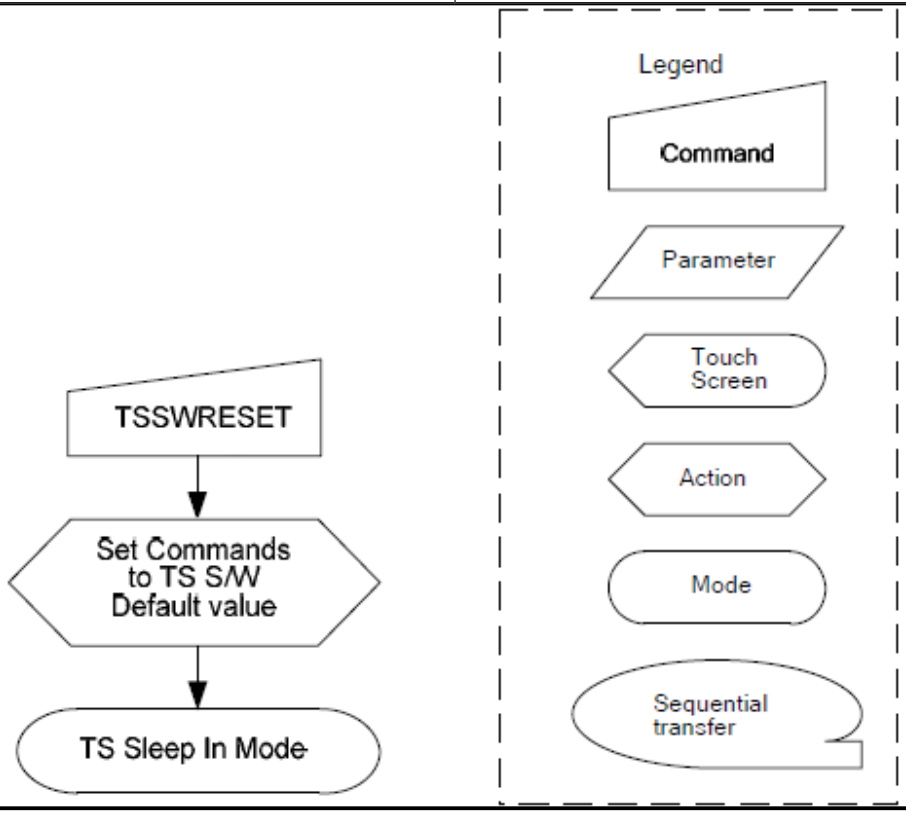
Register Availability

Status	Availability
TS Sleep Out	Yes
TS Sleep In	Yes

Default

Status	Default Value
Power Up Sequence	N/A
TS S/W Reset	N/A
H/W Reset	N/A

Flow Chart



Device ID Command (31h)

31 H	Device ID									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	0	0	1	1	0	0	0	1	31
1 parameter	1	85								00..FF
2 parameter	1	26								00..FF
3 parameter	1	01								00..FF
Description	When the Device ID command is written, IC will echo the device ID to master. The index of Device ID command is 31h									
Register Availability	Status: TS Sleep Out — Availability: Yes Status: TS Sleep In — Availability: Yes									
Default	Status: Power Up Sequence — Default Value: N/A Status: TS S/W Reset — Default Value: N/A Status: H/W Reset — Default Value: N/A									
Flow Chart										

Version ID Command (32h)

32 H	Device ID									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	0	0	1	1	0	0	1	0	31
1 parameter	1	SF_Version[3:0]				F_Version[3:0]				00..FF
Description	This command will report the ID code of firmware Version. F_Version [3:0]: The firmware version of flash code. SF_Version [3:0]: The firmware version of self test code.									
Register Availability	Status: TS Sleep Out — Availability: Yes Status: TS Sleep In — Availability: Yes									
Default	Status: Power Up Sequence — Default Value: N/A Status: TS S/W Reset — Default Value: N/A Status: H/W Reset — Default Value: N/A									
Flow Chart										

■ RELIABILITY TEST

No.	Reliability Test Item & Level	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:0 ~ 55 Hz Amplitude:1.5 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z	IEC68-2-6
8	Electrostatic Discharge Test (No operation)	150pF,330Ω Air:± 15KV;Contact: ± 8KV 10 times/point;4 points/panel face	IEC-61000-4-2

■ INSPECTION CRITERION

OUTGOING QUALITY STANDARD	PAGE 1 OF 3
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

1. Inspection condition

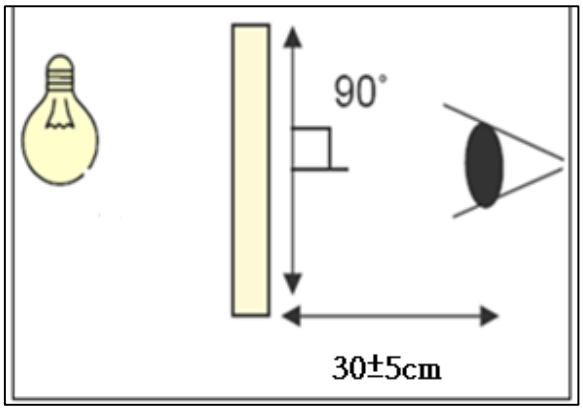
1.1Inspection condition

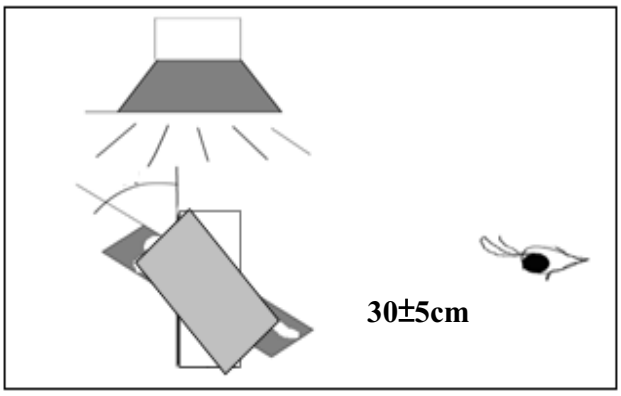
1.1.1 Inspection conditions

1.1.1.1 Inspection Distance : 30 ± 5 cm

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

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



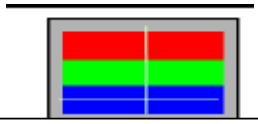


1.1.2 Environment conditions :

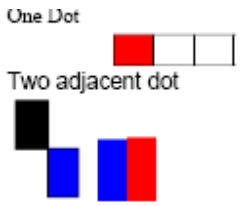
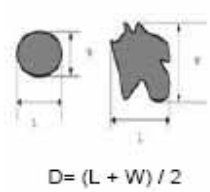
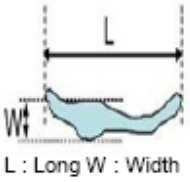
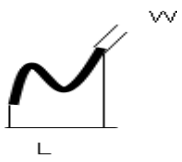
Ambient Temperature :	25±5℃
Ambient Humidity :	30~75%RH
Ambient Illumination	600~800 lux

1.1.3 Inspection Parameters

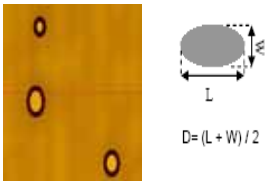
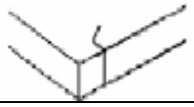
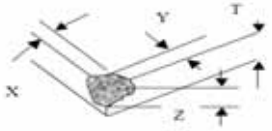
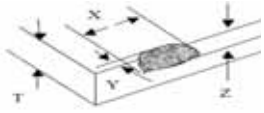
Appearance inspection standard (D: diameter, L: length; W: width, Z: height, T: glass thickness，n：number)

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.	

OUTGOING QUALITY STANDARD	PAGE 2 OF 3
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

<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>
</table>
</td><td> 
</td></tr>
</table>

OUTGOING QUALITY STANDARD	PAGE 3 OF 3
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

Bubble	SPEC (unit: mm) / Acceptable D≦0.2 / Ignored Non visible area / Ignored 0.2<D≦0.3, distance >5 / n≦5 D＞0.3 / 0	
Cover & Sensor Crack	Prohibited	
Cover angle missing	SPEC (unit: mm) / Acceptable Side/Bottom / Ignored It is prohibited if the defect appears on the front. / 0	
Cover edge break	SPEC (unit: mm) / Acceptable X≦ 2.0, Y≦2.0, Z≦1/2T / Ignored X>2.0, Y>2.0, Z＞1/2T / 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	

2. 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.

■ PRECAUTIONS FOR USING LCD MODULES

Handing Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control，Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded. make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated

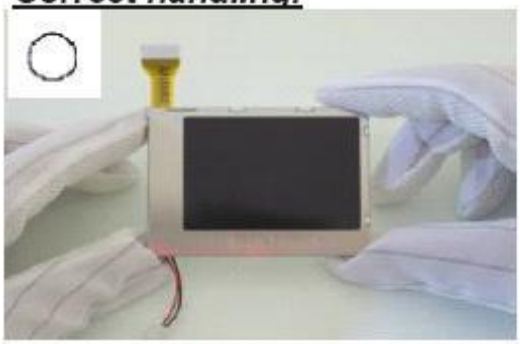
（13）Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

Handling precaution for LCM

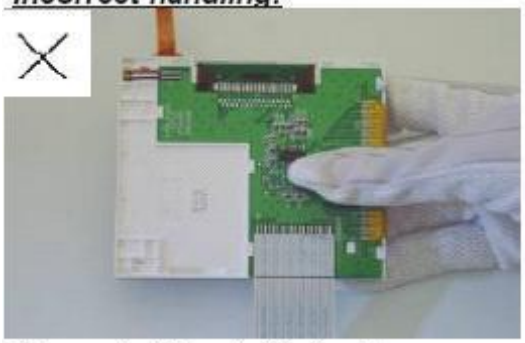
LCM is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

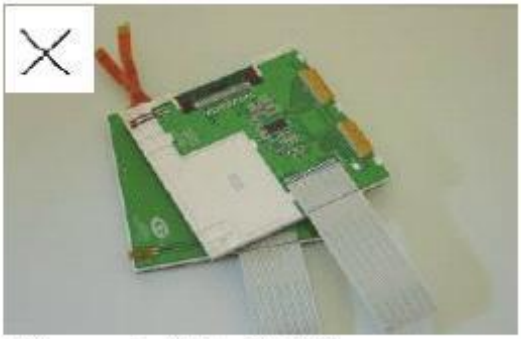


As above picture, please handle with anti-static gloves around LCM edges.

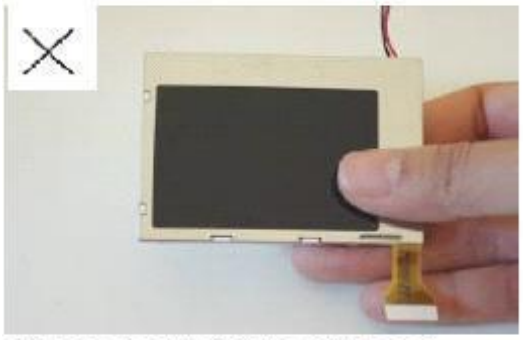
Incorrect handling:



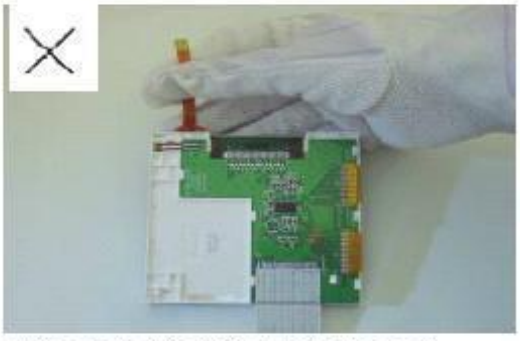
Please don't touch IC directly.



Please don't stack LCM.



Please don't hold the surface of panel.

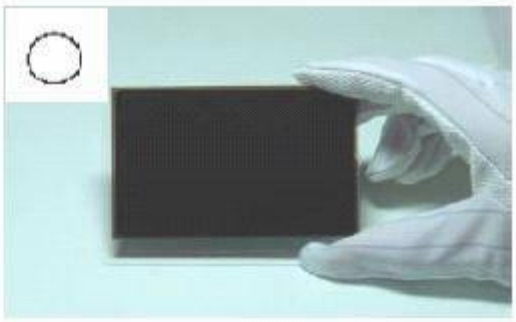


Please don't stretch interface of output, such as FPC cable.

Handling precaution for LCD

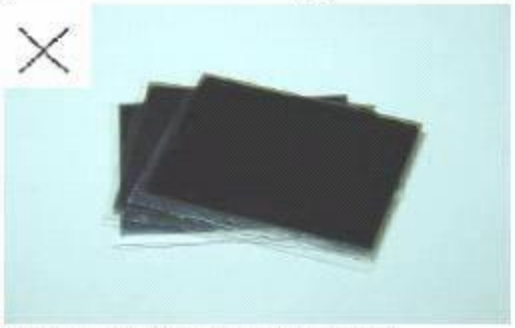
LCD is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

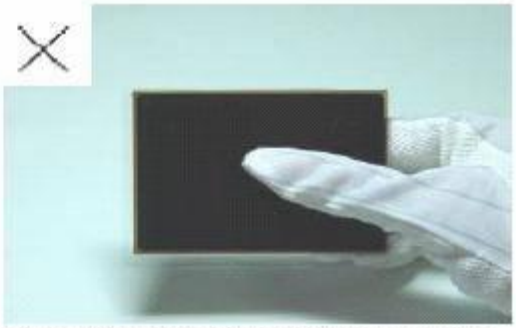


As above photo, please handle with anti-static gloves around LCD edges.

Incorrect handling:

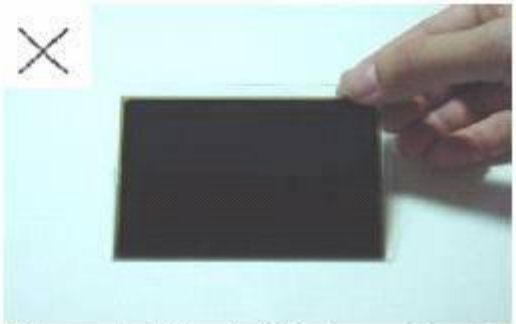


Please don't stack the LCDS.



Please don't hold the surface of LCD.

Please don't operate with sharp stick such as pens.



Please don't touch ITO glass without anti-static gloves.

Storage Precautions

When storing the LCD modules, the following precaution is necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.

(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C, and keep the relative humidity between 40%RH and 60%RH.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the anti-static electricity container in which they were shipped.

Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

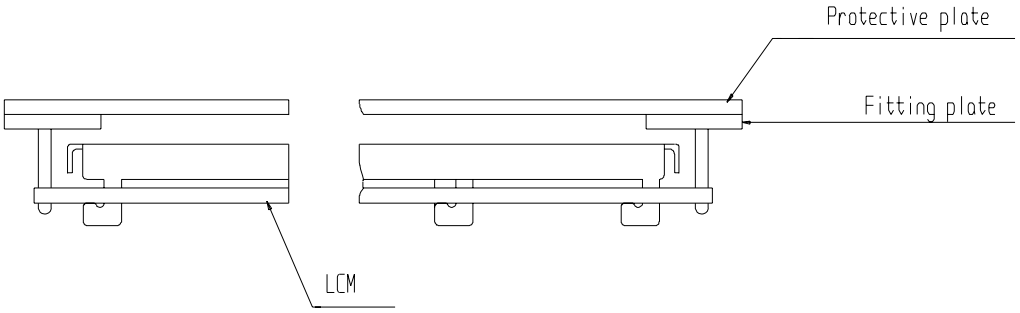
- Exposed area of the printed circuit board.
-Terminal electrode sections.

USING LCD MODULES

Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

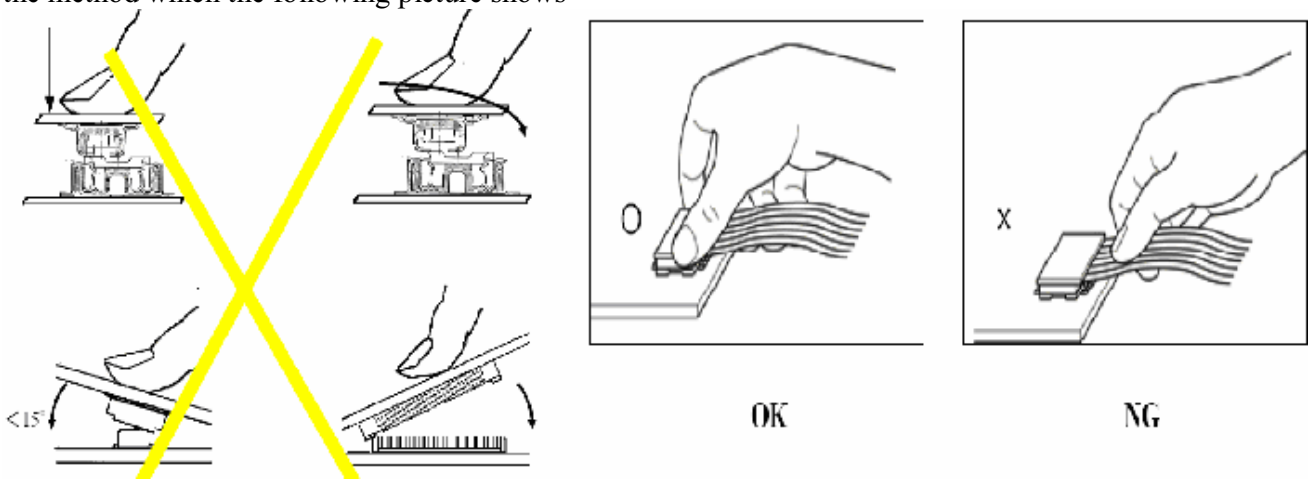
(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

Precaution for assemble the module with BTB connector:

Please note the position of the male and female connector position,don't assemble or assemble like the method which the following picture shows



Precaution for soldering to the LCM

	Hand soldering	Machine drag soldering	Machine press soldering
No ROHS product	290°C ~350°C. Time : 3-5S.	330°C ~350°C. Speed : 4-8 mm/s.	300°C ~330°C. Time : 3-6S. Press: 0.8~1.2Mpa
ROHS product	340°C ~370°C. Time : 3-5S.	350°C ~370°C. Time : 4-8 mm/s.	330°C ~360°C. Time : 3-6S. Press: 0.8~1.2Mpa

(1) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

(2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

(3) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

Precautions for Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

(2) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

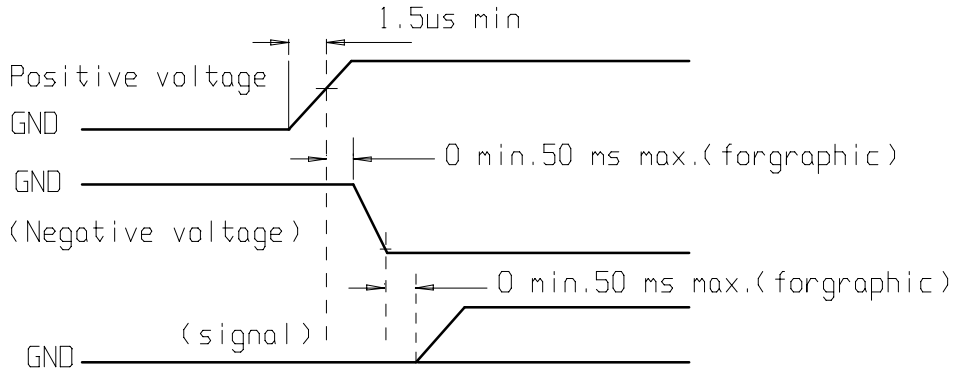
(3) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating temperature.

(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(5) A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature,50%RH or less is required.

(6) Input each signal after the positive/negative voltage becomes stable.

(7) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.



Safety

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

Limited Warranty

Unless agreed betweenMulti-Inno and customer,Multi-Inno will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Multi-Inno LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to Multi-Innowithin 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability ofMulti-Inno limited to repair and/or replacement on the terms set forth above. Multi-Inno will not be responsible for any subsequent or consequential events.

Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet is damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

■ PRIOR CONSULT MATTER

1.①For Multi-Inno standard products, we keep the right to change material, process ... for improving the product property without notice on our customer.

②For OEM products, if any change needed which may affect the product property, we will consult with our customer in advance.

2. If you have special requirement about reliability condition, please let us know before you start the test on our samples.