MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI0430J3T-2

This module uses ROHS material

For Customer's Acceptance:

Customer	
Approved	
Comment	

This 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 this product or release of this order.	Revision	1.3
	Engineering	
	Date	2013-07-25
	Our Reference	

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2013-02-18	First Release	
1.1	2013-05-09	Change operating temperature and storage temperature	
1.2	2013-06-18	Update Parameters of the unit Add LED Lifetime	
1.3	2013-07-25	Update DCLK Frequency Parameter	P.14

CONTENTS

■ GENERAL INFORMATION

Item	Contents	Unit
LCD type	TFT/Transmissve/Normally white	/
Size	4.3	Inch
Viewing direction	12:00	O' Clock
Gray scale inversion direction	6:00	O' Clock
LCM (W × H)× D	115.10×73.90 ×4.25	mm^3
Active area (W×H)	95.04×53.86	mm^2
Pixel size (W×H)	0.198×0.198	mm^2
Number of dots	480 (RGB) × 272	/
Driver IC	OTA5180A×1	/
Backlight type	10 LEDs	/
Interface type	24bit RGB	/
Color depth	16.7M	/
Input voltage	3.3	V
With/Without TSP	With CTP	/
Weight	TBD	g

Note 1:Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.
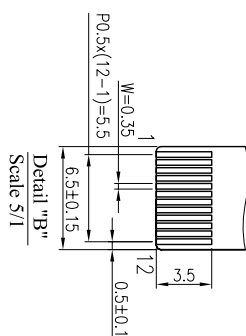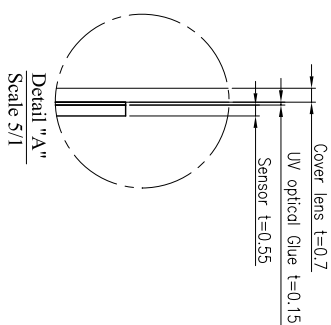Note 2 : RoHS compliant;
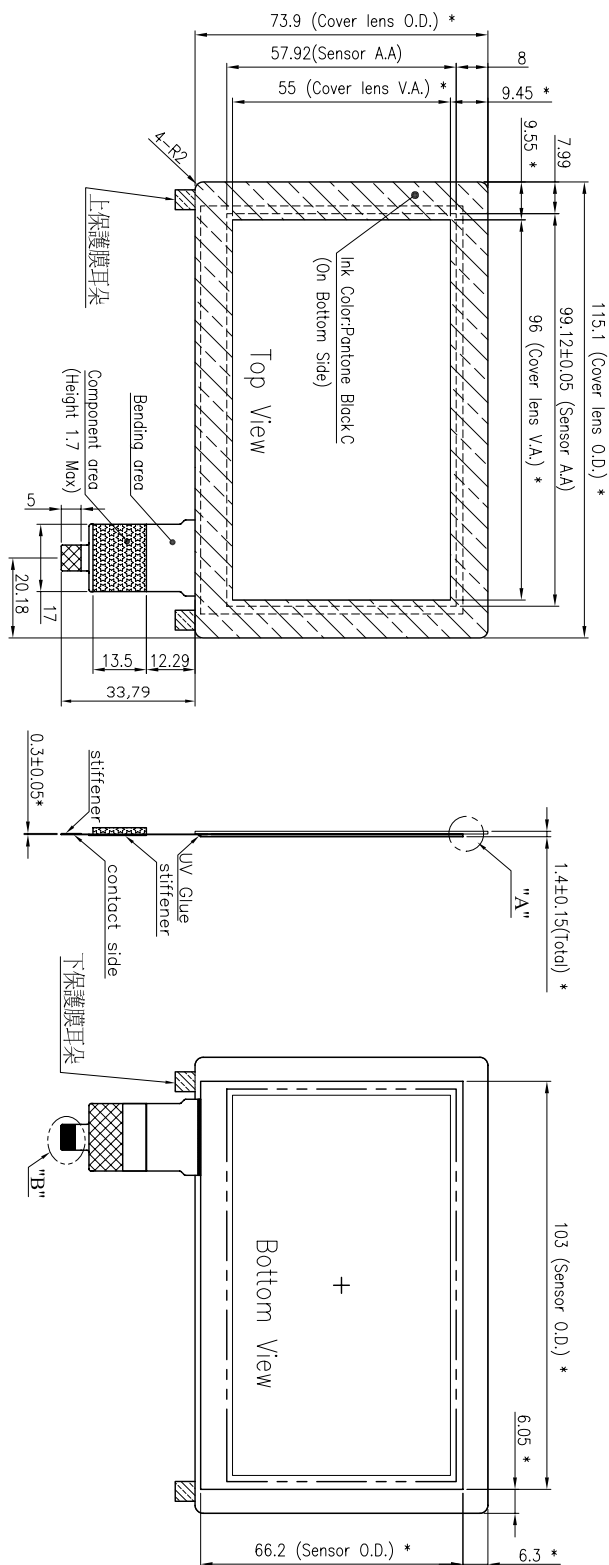Note 3: LCM weight tolerance: ± 5% .

■ EXTERNAL DIMENSIONS

Specification:
1). Viewing angle: 12 O'clock
2). Display mode: a_Si TFT/Transmissive/Normal White
3). Operating temp.: −20℃~+70℃
   Storage temp.: −30℃~+80℃
4). IC: OTA5180A
5). Dimensions with mark "*" are important, with mark "()" are referenced

Detail "A"
Scale 5/1

Detail "B"
Scale 5/1

CTP Pin Functions

1.	SCL
2.	SCL
3.	SDA
4.	SDA
5.	+3.3V
6.	+3.3V
7.	GND
8.	SCL
9.	SDA
10.	XRES
11.	INT
12.	+3.3V

LED CIRCUIT

PIN	DESCRIPTION
1	LEDK
2	LEDA
3	GND
4	VCC
5	NC
6	R0
7	R1
8	R2
9	R3
10	R4
11	R5
12	R6
13	R7
14	G0
15	G1
16	G2
17	G3
18	G4
19	G5
20	G6
21	G7
22	B0
23	B1
24	B2
25	B3
26	B4
27	B5
28	B6
29	B7
30	GND
31	DISP
32	HSYNC
33	VSYNC
34	DEN
35	GND
36	NC
37	NC(XR)
38	NC(XL)
39	NC(YD)
40	NC(YU)

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CUSTOMER APVL		CUSTOMER		
DRAWN				
DFTG CHK	UNIT	mm		
ENGR CHK	SCALE		TITLE	
APPROVAL	DATE		MODEL	MI0430J3T-2
			DWG NO	
			PAGE	1/1

■ CTP OUTLINE DRAWING

Note:
1. CTP fpc matching connector : Molex 0527461271 or equivalent
2. Tolerance is ±0.3 unless otherwise noted.
3. For RoHS.
4. The bending radius of fpc should be larger than 0.6mm
5. * is important dimension.

Top View

73.9 (Cover lens O.D.) *
57.92(Sensor A.A)
55 (Cover lens V.A.) *
8
9.45 *
9.55 *
7.99
4-R2
上保護膜耳朵
Ink Color:Pantone Black C
(On Bottom Side)
115.1 (Cover lens O.D.) *
99.12±0.05 (Sensor A.A)
96 (Cover lens V.A.) *
Component area
(Height 1.7 Max)
Bending area
5
20.18
17
13.5 12.29
33,79

Detail "A"
Scale 5/1
Cover lens t=0.7
UV optical Glue t=0.15
Sensor t=0.55

0.3±0.05*
stiffener
contact side
stiffener
UV Glue
"A"
1.4±0.15(Total) *
下保護膜耳朵

P0.5x(12-1)=5.5
W=0.35
6.5±0.15
1 12
3.5
0.5±0.1
Detail "B"
Scale 5/1

Bottom View
"B"
103 (Sensor O.D.) *
6.05 *
66.2 (Sensor O.D.) *
6.3 *

Pin Functions					
1.	GND	7.	SCL		
2.	GND	8.	SCL		
3.	XRES	9.	SDA		
4.	XRES	10.	SDA		
5.	INT	11.	+3.3V		
6.	INT	12.	+3.3V		

CUSTOMER		
CUSTOMER APVL		
DRAWN	SCALE	
DFTG CHK	UNIT	mm
ENGR CHK		
APPROVAL	DATE	

MULTI-INNO TECHNOLOGY CO.,LTD.

TITLE
MODEL MI0430CCP-C
DWG NO
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■ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Digital supply voltage	VDDIO	-0.3	4.5	V
Power supply for pump	VDD	-0.3	4.5	V
Anglog supply voltage	VDD2	-0.3	7.0	V
Operating temperature	T_{OP}	-20	70	°C
Storage temperature	T_{ST}	-30	80	°C
Humidity	RH	-	90%(Max60°C)	RH

RECOMMENDED OPERATING RANGE

Parameter	Symbol	Min	Typ	Max	Unit
Charge pump supply voltage	PVDD	3.0	3.3	3.6	V
	PVDD	2.25	2.5	3.0	V
Digital supply voltage	VDD	3.0	3.3	3.6	V
	VDD	2.25	2.5	3.0	V
Digital interface supply voltage	VDDIO	1.65	1.8	VDD	V
Digital input voltage	Din	0	-	VDDIO	V
OTP supply voltage	V_OTP	7.4	7.5	7.6	V
VCOM AC voltage	VCOMH-VCOML	3.46	-	6.2	V

DC CHARACTERISTICS FOR DIGITAL CIRCUIT

Parameter	Symbol	Min	Typ	Max	Unit
Low level input voltage	Vil	GND	-	0.3xVDDIO	V
High level input voltage	Vih	0.7xVDDIO	-	VDDIO	V
High level output voltage	Voh	VDDIO-0.4	-	VDDIO	V
Low level output voltage	Vol	GND	-	GND+0.4	V
Input leakage current	Iil	-	-	+/-1.0	mA
Pull high/low resistor	Rp	-	100K	-	ohm
Digital stand-by current	Ist	-	5.0	20	uA
Digital operating current	Icc	-	4.0	-	mA

■ELECTRICAL CHARACTERISTICS

VDDIO=1.8V, VDD = 3.3V, AVDD = 6V, AGND = 0V, T_A = -20℃ to 80℃

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Analog Supply Voltage	VDD2		5		V	
Positive High-voltage power	VGH	9	15	16	V	No Load. By VGH_SEL setting.
Negative High-voltage power	VGL	-11	-10	-7	V	No Load. By VGL_SEL setting.
VCOMH Output Level	VCOMH	3.26		5.8	V	By VCOMH setting.
VCOML Output Level	VCOML	-2		-0.2	V	By VCOML setting
DRV Output Voltage	VDRV	0	-	VDD	V	
DCDC Feed Back Voltage	VFB	0.28	0.6	0.79	V	By LED_VFB setting
Base Drive Current	IDRV	-	20	25	mA	By LED_VFB setting
Output Voltage Deviation	Vod	-	±20	±35	mV	V_O = 0.15V ~ 0.5V, 3.45V~3.8V
		-	±15	±20		V_O = 0.5V ~ 3.45V
Output Dynamic Range	Vdr	0.2	-	5.3	mV	MVA Mode
		0.15		4.8		TN Mode
VCOM Low Level Output Current	IOL$_{FRP}$		-10		mA	VCOM AC output = 0.5V
VCOM High Level Output Current	IOH$_{FRP}$		-10		mA	VCOM AC output = 5.7V
Analog Standby Current	Iast	-	-	20	uA	
Analog Operation Current	IDD	-	5.0	-	mA	Without panel loading

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	Vf	15	16	17	V	
Forward current	If	-	40	-	mA	
Uniformity(with L/G)	ΔBp	80	-	-	%	
LED lifetime	-	30,000	40,000	-	Hrs	

LED CIRCUIT
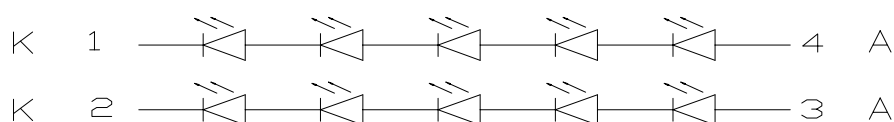
■ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time		Tr+Tf		---	30	45	ms	FIG 1.	4
Contrast ratio		Cr	θ=0°	250	350	---	---	FIG 2.	1
Luminance uniformity		δ WHITE	∅=0° Ta=25℃	---	80	---	%	FIG 2.	3
Surface Luminance		Lv		---	300	---	cd/m²	FIG 2.	2
Viewing angle range		θ	∅ = 90°	---	65	---	deg	FIG 3.	6
			∅ = 270°	---	45	---	deg	FIG 3.	
			∅ = 0°	---	70	---	deg	FIG 3.	
			∅ = 180°	---	70	---	deg	FIG 3.	
CIE (x, y) chromaticity	Red	x	θ=0° ∅=0° Ta=25℃	0.586	0.606	0.626		FIG 2.	5
		y		0.305	0.325	0.345			
	Green	x		0.283	0.303	0.323			
		y		0.547	0.567	0.587			
	Blue	x		0.127	0.147	0.167			
		y		0.121	0.161	0.181			
	White	x		0.282	0.302	0.322			
		y		0.318	0.338	0.358			
NTSC	-	-	-	---	50	---	%	-	-

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

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

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.

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

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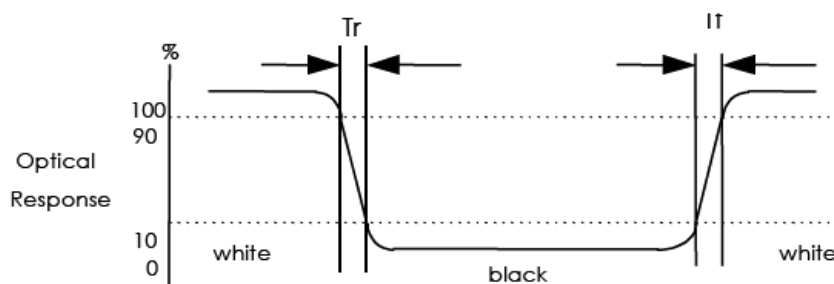
FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity

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
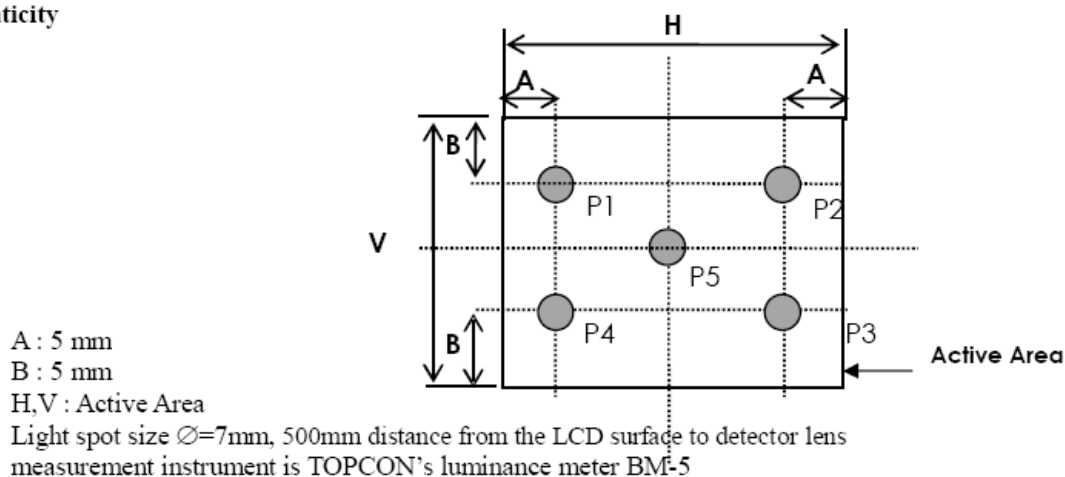
FIG. 3 The definition of viewing angle
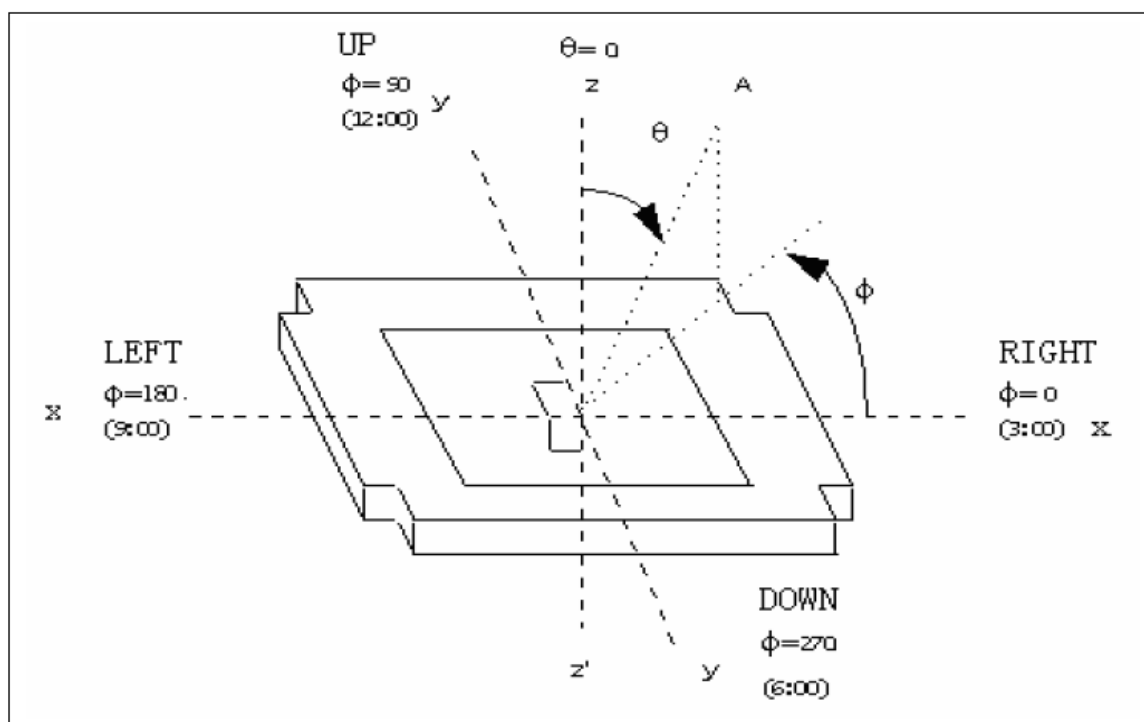
■ **INTERFACE DESCRIPTION**

PIN NO.	Symbol	Description
1	LED-K	LED backlight(Cathode)
2	LED-A	LED backlight(anode)
3	GND	Ground
4	VCC	Power supply (Digital +3.0V)
5-12	R0-R7	Red Data
13-20	G0-G7	Green Data
21-28	B0-B7	Blue Data
29	GND	Ground
30	CLK	Clock signal
31	DISP	Display on/off
32	HSYNC	Horizontal sync input in RGB mode (short to GND if not used)
33	VSYNC	Vertical sync input in RGB mode (short to GND if not used)
34	DEN	Data Enable
35	NC	NC
36	GND	Ground
37	NC	NC
38	NC	NC
39	NC	NC
40	NC	NC

■ APPLICATION NOTES

1 AC CHARACTERISTICS

VDDIO=1.8V, VDD = 3.3V, AVDD = 6V, AGND = 0V, T$_A$ = -20℃ to 80℃

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK pulse duty	Tcw	40	50	60	%	
Hsync width	Thw	1.0	-	-	DCLK	
Hsync period	Th	55	60	65	us	
Vsync setup time	Tvst	12	-	-	ns	
Vsync hold time	Tvhd	12	-	-	ns	
Hsync setup time	Thst	12	-	-	ns	
Hsync hold time	Thhd	12	-	-	ns	
Data set-up time	Tdsu	12	-	-	ns	
Data hold time	Tdhd	12	-	-	ns	
DE set-up time	Tdesu	12	-	-	ns	
DE hold time	Tdehd	12	-	-	ns	
SD output stable time	Tst	-	10	12	us	
GD output rise and fall time	Tgst	-	500	1000	ns	
Serial communication						
Delay between CSB and Vsync	Tcv	1			us	
CS input setup time	Ts0	50			ns	
Serial data input setup time	Ts1	50			ns	
CS input hold time	Th0	50			ns	
Serial data input hold time	Th1	50			ns	
SCL pulse high width	Twh1	50			ns	
SCL pulse low width	Twl1	50			ns	
CS pulse high width	Tw2	400			ns	

2. SIGNAL TIMING DIAGRAM

2.1. Power on sequence
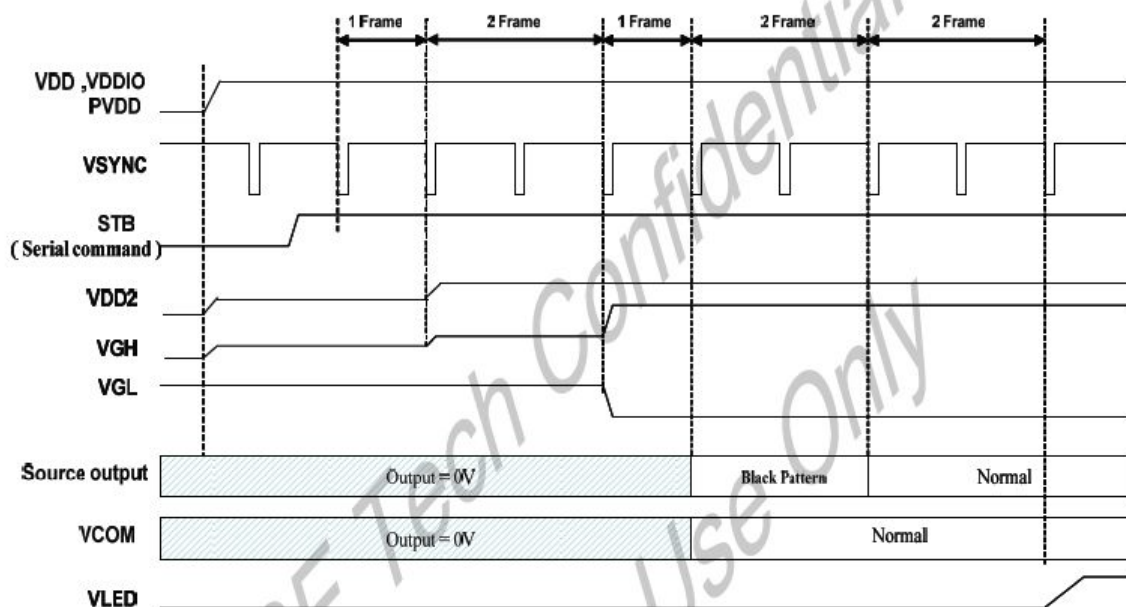
2.2. Power off sequence
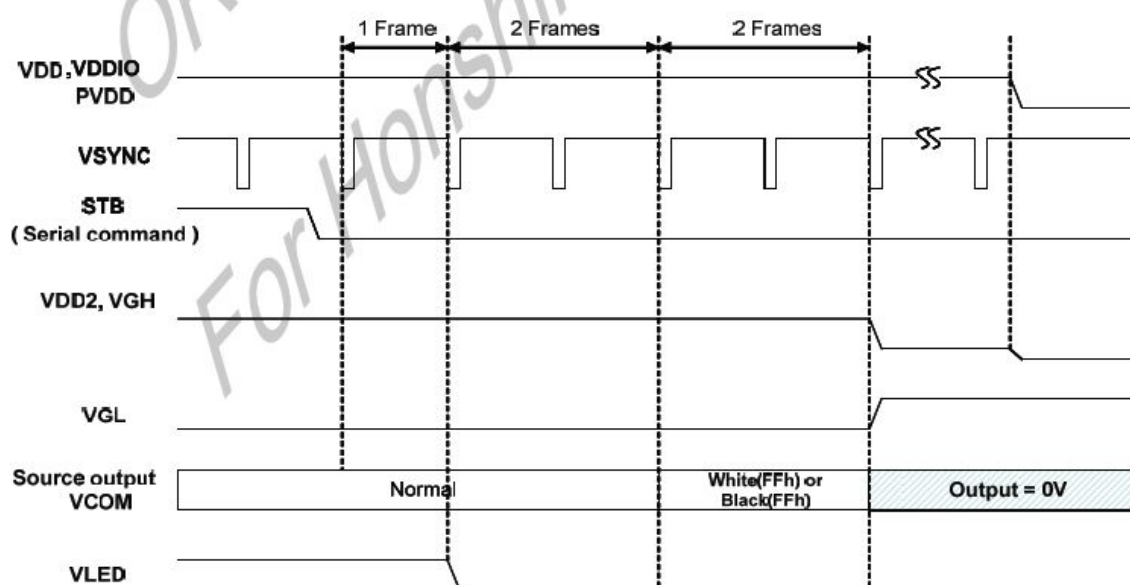
2.3. Timing diagram of interface signal

Clock and Data Input Timing Diagram
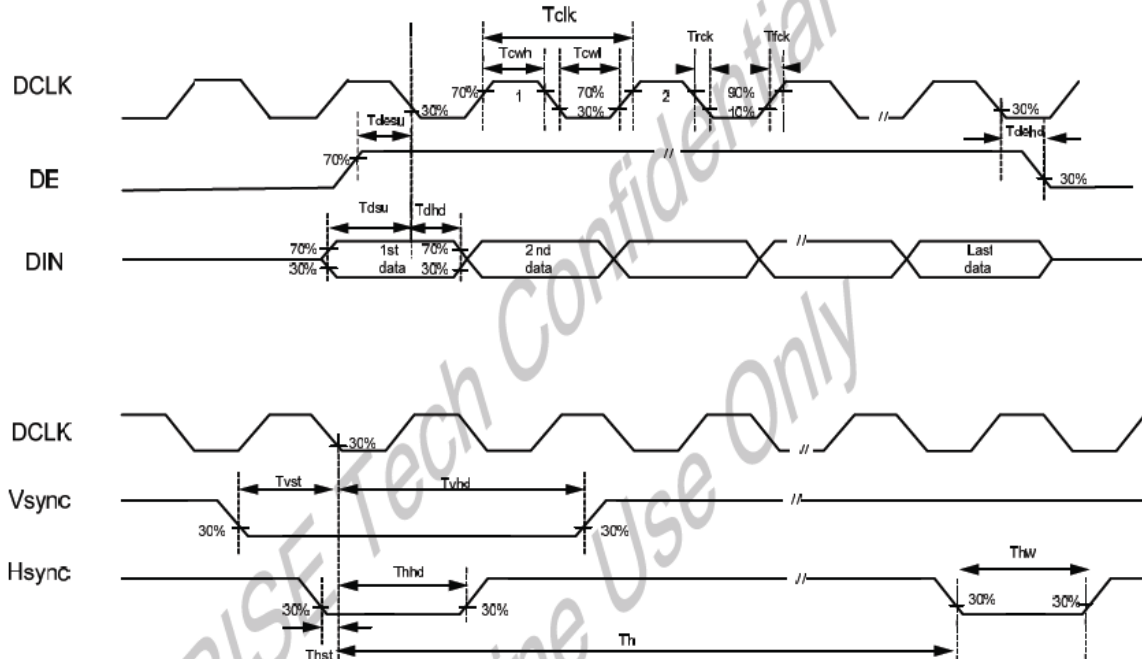
2.4. Input setup timing requirement

Item		Symbol	Min.	Typ.	Max.	Unit	
DCLK Frequency		Fclk	10	15	20	MHz	
DCLK Period		Tclk	50	67	100	ns	
Hsync	Period Time	Th	490	531	605	DCLK	
	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp	8	43		DCLK	By H_BLANKING setting
	Front Porch	Thfp	2	8		DCLK	
	Pulse Width	Thw	1			DCLK	
Vsync	Period Time	Tv	275	288	335	H	
	Display Period	Tvdisp		272		H	
	Back Porch	Tvbp	2	12		H	By V_BLANKING setting
	Front Porch	Tvfp	1	4		H	
	Pulse Width	Tvw	1	10		H	

SYNC Mode Timing Diagram
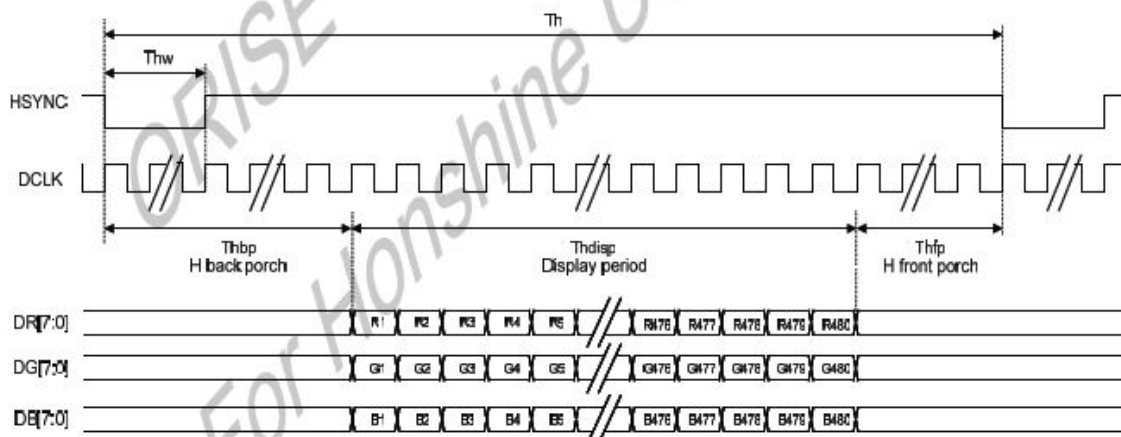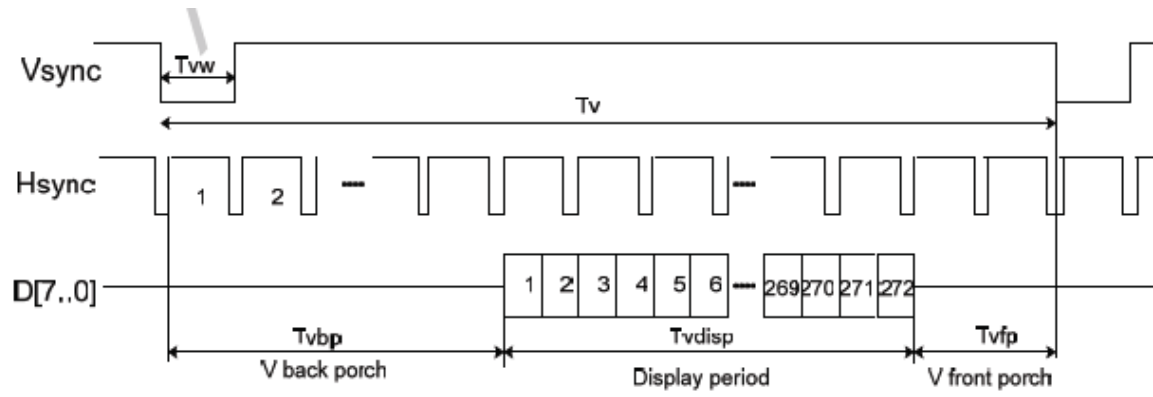
3. WRITE/READ SPI TIMING
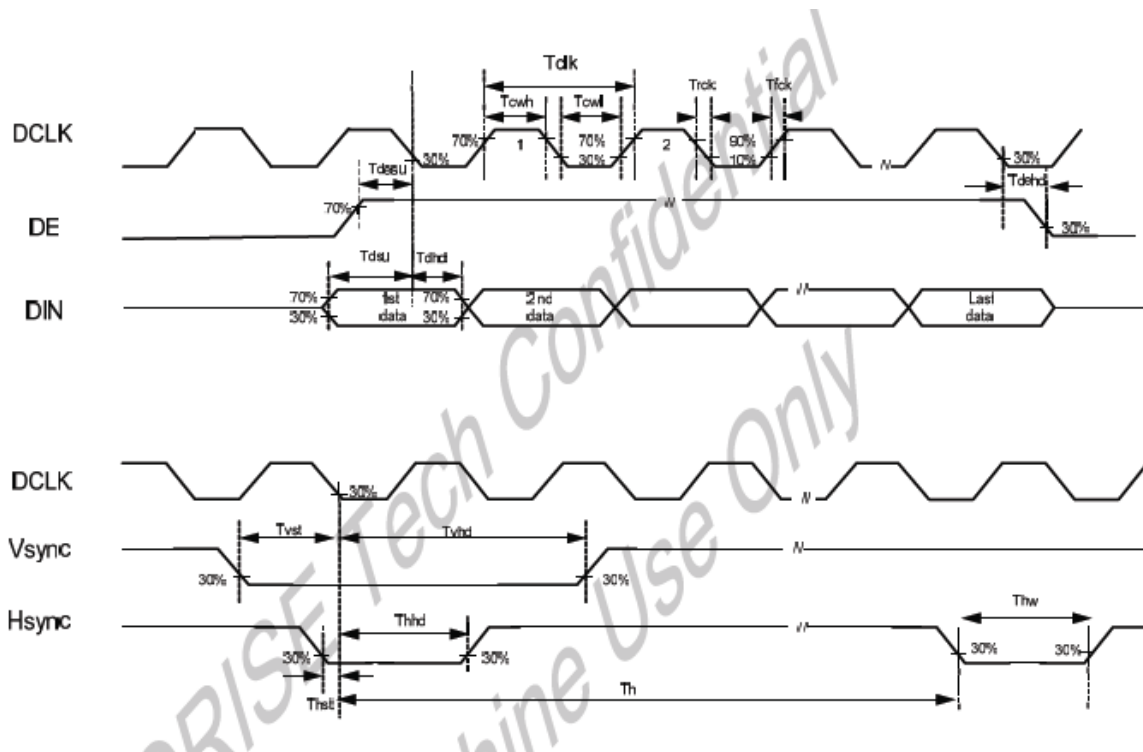
■CTP GENERAL SPECIFICATIONS

1. GENERAL SPECIFICATIONS

Item	Specification	Unit
Type	Transparent type projected capacitive touch panel	
Input mode	Human's finger	
Substrate Thickness	0.55	mm
Outline Dimension	115.1(W) x 73.9(H)*1.4(D)	mm
Transparency	≧85	%
Haze	≦1.0	%

2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
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
Operating temperature	Temperature OP	-20	--	60	°C
Storage temperature	Temperature ST	-30	--	70	°C

2.2 DC characteristics

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Supply voltage	VCC	2.7	3.3	3.5	
Input high voltage	V_{IH}	0.7 * VCC	-	VCC	V
Input low voltage	V_{IL}	0	-	0.3 *VCC	V

3. PIN CONNECTIONS

No.	Name	I/O	Description
1	GND	-	Ground
2	GND	-	Ground
3	XRES	I	NC pin; please keep floating
4	XRES	I	NC pin; please keep floating
5	INT	O	Interrupt, Active low
6	INT	O	Interrupt, Active low
7	SCL	I	Serial Clock access
8	SCL	I	Serial Clock access
9	SDA	I/O	Serial data access
10	SDA	I/O	Serial data access
11	VCC	-	Power; VCC=+3.3V
12	VCC	-	Power; VCC=+3.3V

4. TIMING CHARACTERISTICS
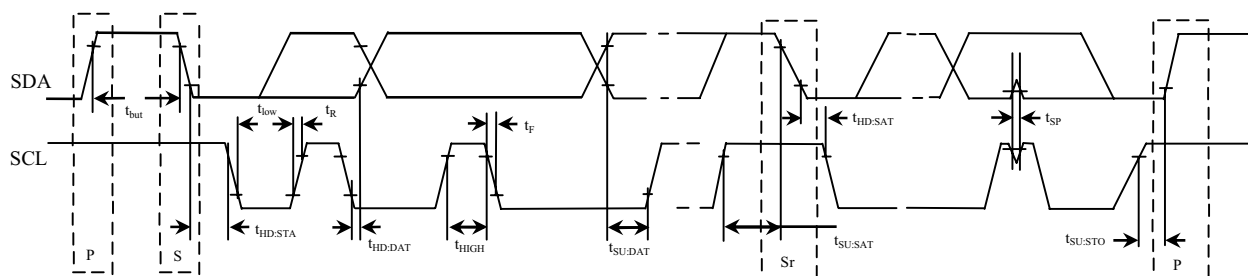
Parameter	Symbol	Standard-Mode I^{2}C-BUS		Fast-Mode I^{2}C-BUS		Unit
		Min.	Max.	Min.	Max.	
SCL clock frequency	f_{SCL}	0	100	0	400	KHz
Bus free time between STOP and START condition	t_{BUF}	4.7	-	1.3	-	µs
Hold time (repeated) START condition. After this period, the first clock pulse is generated	$t_{HD:STA}$	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 (0.7xVCC) and VIL (0.3xVCC) 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 I^{2}C-bus device can be used in a standard-mode I^{2}C-bus system, but the requirement $t_{SU:DAT}$ $\geqq$ 250ns 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 I^{2}C-bus specification) before the SCL line is released.
(5) C_b = total capacitance of one bus line in pF.
(6) If a spark or noise appear on SDA line and keep more than 25ns, Start or Stop condition will be identified if SCL
　 line keep high at this time.

5. Interface and Data Format
5.1 Transfer protocol (I²Cinterface)

　　　　MI0430CCP-C 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.
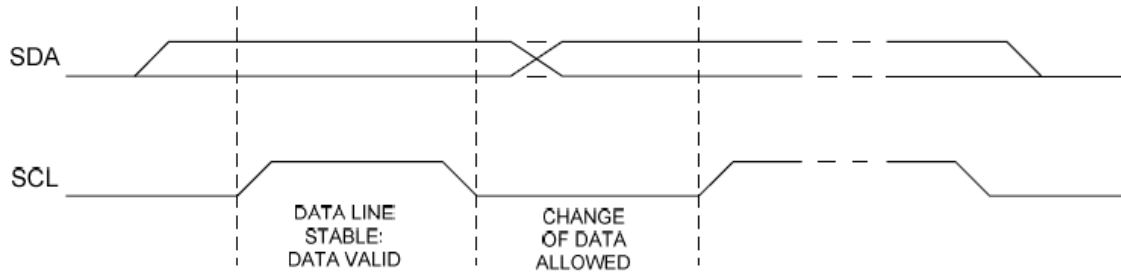
Figure 5.1: I²C Signal timing

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.
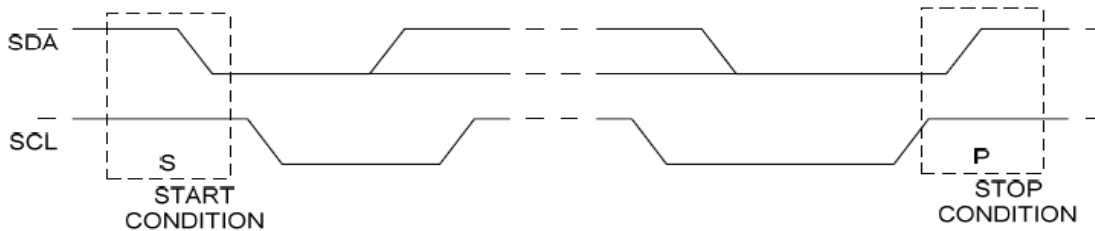
Figure 5.2: I²C Start/Stop

5.2 I²C data transfer

The CTP MI0430CCP-C I²C address is **0x90H**

Each byte has to be followed by an acknowledge bit. Data is transferred with the most significant bit (MSB) first. Every byte put on the SDA line must be 8-bits long. The number of bytes that can be transmitted per transfer is unrestricted. If controller 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 await state. Data transfer then continues when the controller is ready for another byte of data and releases clock line SCL.
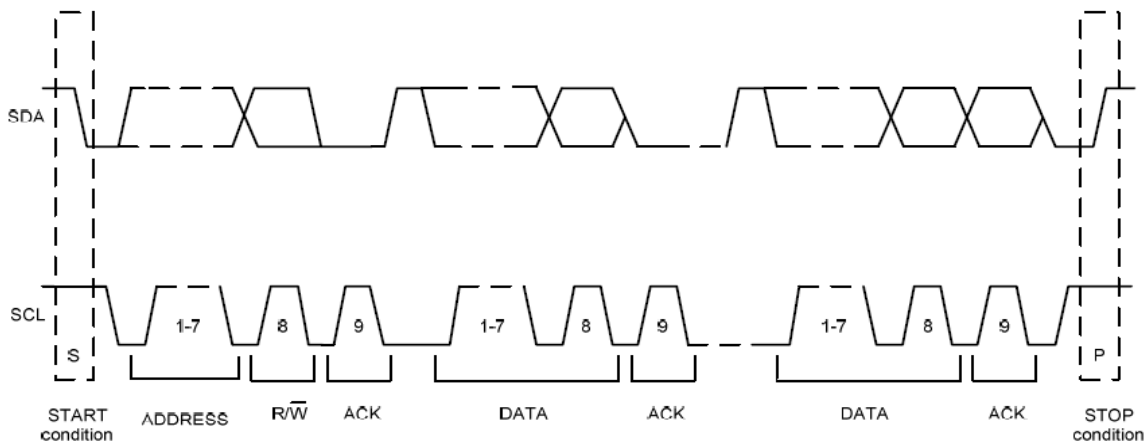
Figure 5.3: I²C data transfer

5.3 Format of data frame (I²C interface)

When master sends the command which be received by TP controller, the controller will responses the code and data. The format of communication is shown as Figure 7.4. The Command table that is written by master is defined on Command Table, Controller will response the response code first and data later.

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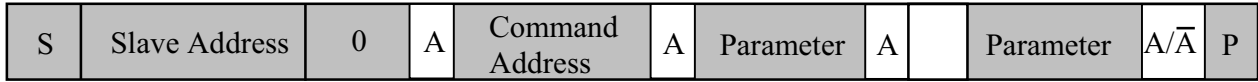
S	Slave Address	0	A	Command Address	A	Parameter	A		Parameter	A/$\overline{A}$	P
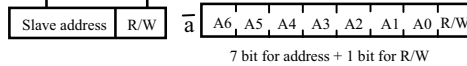
Slave Address   Write

| Slave address | R/W | $\overline{a}$ | A6 | A5 | A4 | A3 | A2 | A1 | A0 | R/W |

7 bit for address + 1 bit for R/W

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

From master to slave   From slave to master

Figure 5.4   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
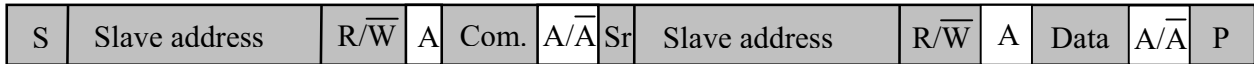
n bytes+ack.

Write   Sr=repeated START condition   read   n Parameters
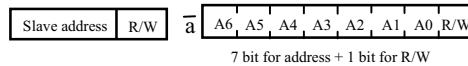
| Slave address | R/W | $\overline{a}$ | A6 | A5 | A4 | A3 | A2 | A1 | A0 | R/W |

7 bit for address + 1 bit for R/W

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

From master to slave   From slave to master

Figure 5.4   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	20								-
	3nd parameter	00								-
32h	Version ID	0	0	1	1	0	0	0	1	Read Firmware version

7. Command description

7.1 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										

7.2 TS sleep in (80h)

80H	TSSLPIN (Touch Screen Sleep In)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	0	0	0	0	80
parameter	No parameter									
Description	This command causes the touch screen to enter the minimum power consumption mode. MCU interface are register are still working and keeps their contents.									
Restriction	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.									

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

9.3 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	
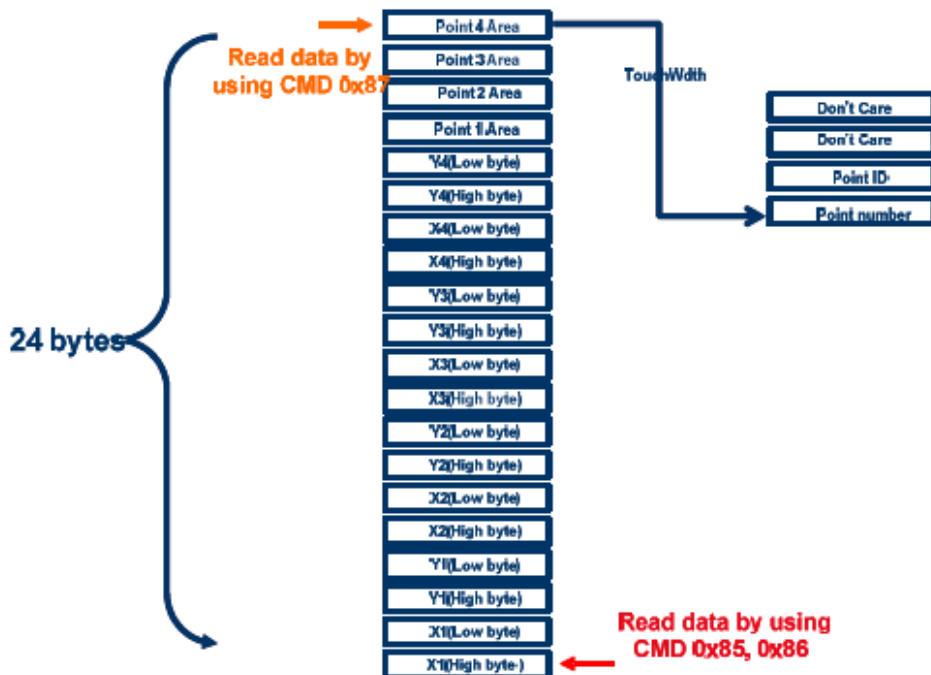
7.4 TS sense off (82h)

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	

7.5 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										

7.6 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.

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		

7.7 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.

Register Availability	
Status	Availability

	TS Sleep Out	Yes	
	TS Sleep In	Yes	
Default	Status	Default Value	
	Power Up Sequence	All Values 0000 0000h	
	TS S/W Reset	All Values 0000 0000h	
Flow Chart			

7.8 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.

Register Availability	Status		Availability
	TS Sleep Out		Yes
	TS Sleep In		Yes
Flow Chart			

7.9 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	

7.10 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	

7.11 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				00					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	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	

7.12 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	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	

8. BLOCK DIAGRAM

3.3V

HOST IC		Touch Panel

VCC

SCL → **SCL**

SDA ↔ **SDA**

INT ← **INT**

RESET ← **XRES**

GND
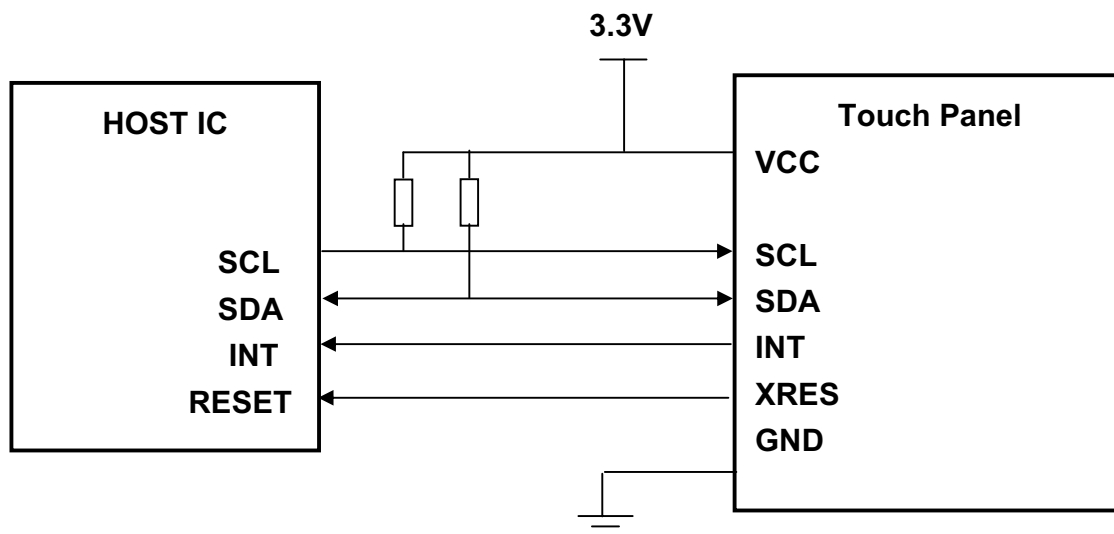
Note：1. USE APPROPRIATE RESISTOR VALUE DURING HIGH SPEED SCL CLOCK.

SUGGESTION : RESISTOR RECOMMENDATION：1K ohm.

2. To reduce the noise from the power, we suggest you use the independent power for the touch panel (VCC)
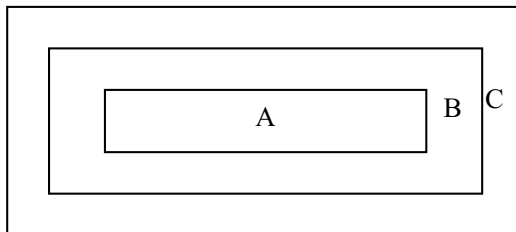
■ **RELIABILITY TEST**
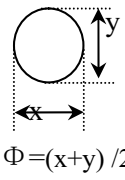
No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80±2℃/120 hours	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value.
2	Low Temperature Storage	-30±2℃/120 hours	
3	High Temperature Operating	70±2℃/120 hours	
4	Low Temperature Operating	-20±2℃/120 hours	
5	Temperature Cycle storage	-20±2℃~25~70±2℃×20cycles (30min.) (5min.) (30min.)	
6	Damp proof Test operating	60℃±5℃×90%RH/96 hours	
7	Vibration Test	Frequency：10Hz~55Hz~10Hz Amplitude：1.5mm, X，Y，Z direction for total 2hours	
8	Dropping test	Free faller movement for each side,angle, cording(75cm high,6 side,2 angle,2 cording)	
9	ESD test	Gap mood:±1KV~±8KV(10 times air discharge with positive/negative voltage voltage gap: 1kv) Touch mood:±1KV~±4KV	
10	Curve	60 tousand times,40 times/min 150° (according to die if exist)	Check and record every 2~4 thousand times
10	Hitting test	1,000,000 times in the same point, Hitting pad: tip R3.75 mm, Silicone rubber, Hardness:40 deg.; Load: 2.45N; Hitting speed: Twice/sec; Electric load: None; Test area should be at 1.8 mm inside of touch panel view area	
11	Pen sliding durability test	100, 000 times minimum Hitting pad: tip R0.8 mm Plastic pen; Load:1.47N; Sliding speed: 60 mm/sec; Electric load: None Test area should be at 1.8 mm inside of touch panel view area	
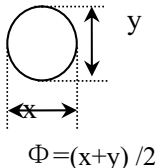
Remark:

1.The test samples should be applied to only one test item.

2.Sample size for each test item is 5~10pcs.

3.For Damp Proof Test, Pure water(Resistance＞10MΩ) should be used.

4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

5.EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.

6.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

■ INSPECTION CRITERION
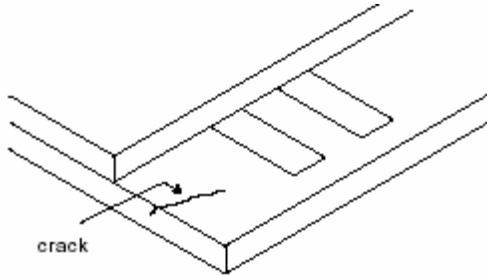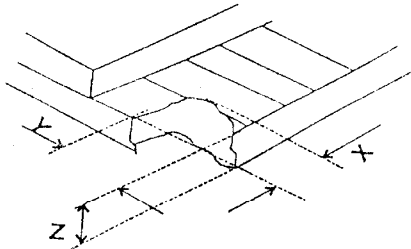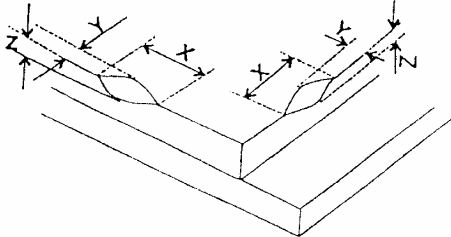
OUTGOING QUALITY STANDARD		PAGE　1　OF　8
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA		

This specification is made to be used as the standard acceptance/rejection criteria for Wider Screen TFT-LCD module product**.**

1. Sample plan

　　Sampling plan according to GB/T2828.1-2003/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993, normal level 2 and based on:

　　　　Major defect: AQL 0.65

　　　　Minor defect: AQL 1.5

2. Inspection condition

　　Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line.

3. Definition of Inspection Item.

　　3.1 Definition of inspection zone in LCD.

　　Zone A: character/Digit area

　　Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)

　　Zone C: Outside viewing area (invisible area after assembly in customer's product)

　　　　　ZoneB+ZoneC= Around opaque edge area on TP.

　　Fig.1 Inspection zones in an LCD.

　　Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for

　　　　quality and assembly of customer's product.

3.2 Definition of some visual defect

Bright dot.	Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
Dark dot.	Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture, or pure whiter picture.
Dark / Bright Lines.	Lines on display which appear dark/bright and usually result from the contamination.
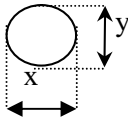
	OUTGOING QUALITY STANDARD	PAGE 2 OF 8
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA		

4. Major Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.1	All functional defects	1) No display 2) Display abnormally 3) Open or missing segment 4) Short circuit 5) Excess power consumption 6) Back-light no lighting, flickering and abnormal lighting.	Major
4.2	Missing	Missing component	
4.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	
4.4	Crack	Creaks tend to break are not allowed.	

5. Minor Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.1	Bright dot. defect. $\Phi=(x+y)/2$	<table><tr><td>Zone Size(mm)</td><td colspan="3">Acceptable Qty</td></tr><tr><td></td><td>A</td><td>B</td><td>C</td></tr><tr><td>$\Phi\leqslant 0.15$</td><td colspan="2">Acceptable (clustering of spot not allowed)</td><td rowspan="3">Acceptable</td></tr><tr><td>$0.15<\Phi\leqslant 0.25$</td><td colspan="2">$N\leqslant 6.$</td></tr><tr><td>$0.25<\Phi\leqslant 0.50$</td><td colspan="2">$N\leqslant 2$</td></tr></table>	Minor
5.2	Dark dot defect.	<table><tr><td>Zone Size(mm)</td><td colspan="3">Acceptable Q'ty</td></tr><tr><td></td><td>A</td><td>B</td><td>C</td></tr><tr><td>$\Phi\leqslant 0.15$</td><td colspan="2">Acceptable</td><td rowspan="3">Acceptable</td></tr><tr><td>$0.15<\Phi\leqslant 0.30$</td><td colspan="2">$N\leqslant 6$</td></tr><tr><td>$0.30<\Phi\leqslant 0.50$</td><td colspan="2">$N\leqslant 4$</td></tr></table>	
5.3	Bright / Dark line.	$0.01<W\leqslant 0.10$, $0.30<L\leqslant 1.50$, $N\leqslant 1$ Acceptable	

Note: 1. Total defective dots shall not exceed 6 pcs.
2. Minimum distance between defective dots is more than 5mm.
3. 2 Adjacent dark sub pixel defect or bright sub pixel defect is not more than 1pair.
4. W: Width, L: Length, N: Count.
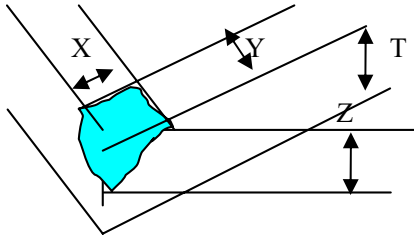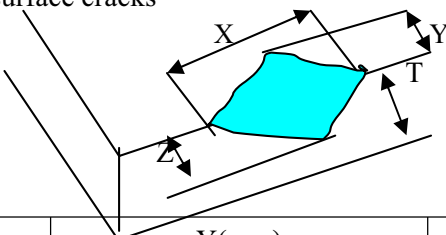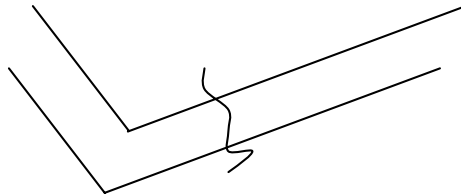
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.4	Linear defect Foreign material under polarizer,	(see table below)	Minor
	Circular Defect, Foreign material under polarizer, $\Phi=(x+y)/2$	(see table below)	Minor
5.5	Polarizer defect.	5.4.1 Polarizer Position ...	Minor

Linear defect table:

Size (μm)		Acceptable Qty		
		Zone		
L(Length)	W(Width)	A	B	C
Ignore	W≤0.05	Acceptable		Acceptable
L≤5.0	0.05＜W≤0.15	N≤5		
5.0≤L	0.15≤W	0		

Circular Defect table:

Zone / Size(mm)	Acceptable Q'ty		
	A	B	C
Φ≤0.25	Acceptable		Acceptable
0.25＜Φ≤0.50	N≤4		
0.50≤Φ	0		

5.4.1 Polarizer Position

　(i) Shifting in position should not exceed the glass outline dimension.

　(ii) Incomplete covering of the viewing area due to shifting is not allowed.

5.4.2 Dirt on polarizer

　Dirt which can be wiped easily should be accepted.

5.4.3 Polarizer Nick & Dent

Sizes(mm)	Acceptable Qty		
	Zone		
	A	B	C
Φ＜0.25	Acceptable		Acceptable
0.25≤Φ≤0.5	N≤4		
Φ＞0.5	0		

TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA

5. Minor Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.6	Polarizer defect	5.4.4 Air bubbles between glass & polarizer: *table below*	Minor

Size(mm)	Acceptable Qty		
	Zone		
	A	B	C
$\Phi \leqslant 0.3$	Acceptable		Acceptable
$0.3 < \Phi \leqslant 1.0$	3		
$1.0 < \Phi \leqslant 1.5$	1		
$\Phi > 1.5$	0		

5.4.5 Polarizer scratch   **Minor**

(i)   If the Polarizer scratch can be seen after cover assembling or in the operating condition, judge by the line defect of 5.4.

(ii)   If the Polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following.

Size(mm)		Acceptable Qty		
L(Length)	W(Width)	Zone		
		A	B	C
Ignore	W≤0.02	Ignore		Ignore
1.0＜L≤5.0	0.02＜W≤0.2	N≤4.		
5.0＜L	0.2＜W	0		

	OUTGOING QUALITY STANDARD	PAGE 5 OF 8
	TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

5. Minor Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.7	Glass defect	(i) Crack Cracks are not allowed. 	Minor
		(ii) TFT chips on corner <table>	Minor
		(iii)Usual surface cracks	Minor

(ii) table:

X	Y	Z	Acceptable
≤3.0	≤3.0	Not more than the thickness of glass.	N≤3.

Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.

(iii) table:

X	Y	Z	Acceptable
≤1.5	≤1.5	Not more than the thickness of glass.	N≤4.

It is only applicable to the upper glass of LCD.

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TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA		

6. TP Cosmetic Defect.

Item No	Items to be inspected	Inspection Standard	Classification of defects
6.1	Black and white Spot defect Foreign Particle,	For dark/white spot, size Φ is defined as $\Phi = \dfrac{(x+y)}{2}$ **Table:** Size(mm) / Zone — Acceptable Qty (A, B+C) $\Phi \leqslant 0.15$: Ignore $0.15 < \Phi \leqslant 0.25$: 6 $0.25 < \Phi \leqslant 0.50$: 4 $\Phi > 0.5$: 0 distance 5mm over Total defective dots shall not exceed 6 pcs on the same TP.	Minor

Detailed table for 6.1:

Size(mm) \ Zone	A	B+C	
$\Phi \leqslant 0.15$	Ignore		
$0.15 < \Phi \leqslant 0.25$	6		distance 5mm over
$0.25 < \Phi \leqslant 0.50$	4		
$\Phi > 0.5$	0		

Item No	Items to be inspected	Inspection Standard	Classification of defects
6.2	Black line, White line, Scratch, Foreign material under film,	(see table below)	Minor

Size(mm)		Acceptable Qty		
L(Length)	W(Width)	Zone		
		A	B+C	
Ignore	W$\leqslant$0.03	Ignore		
L$\leqslant$5.0	$0.03 <$W$\leqslant$0.05	5		distance 5mm over
L$\leqslant$5.0	$0.05 <$W$\leqslant$0.1	2		
	$0.1 <$W	0		

	OUTGOING QUALITY STANDARD	PAGE 7 OF 8
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6. TP Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
6.3	TP defect ,	(i) Chips on corner | X(mm)	Y(mm)	Z(mm) | |---|---|---|
≤3.0	≤3.0	Z<T | (ii)Usual surface cracks | X(mm)	Y(mm)		Z(mm) | |---|---|---|---|
≤6.0	<2.0		Z<T	 (iii) Crack Cracks tending to break are not allowed.	Minor Minor Major
6.4	Total number of dots	The total number of luminous dots, dark dots, contamination particles, bubbles, scratch defects, pinholes must not exceed 10 /piece on the same TP.	

OUTGOING QUALITY STANDARD	PAGE 8 OF 8

TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA

7. **Module Cosmetic Criteria**

Item No	Items to be inspected	Inspection Standard	Classification of defects
1	Difference in Spec.	None allowed	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing No soldering bridge No cold soldering	Major Major Minor
4	Resist flaw on Printed Circuit Boards	visible copper foil ($\varnothing$0.5mm or more) on substrate pattern.	Minor
5	Accretion of metallic Foreign matter	No accretion of metallic foreign matters (Not exceed $\varnothing$0.2mm).	Minor Minor
6	Stain	No stain to spoil cosmetic badly.	Minor
7	Plate discoloring	No plate fading, rusting and discoloring.	Minor

8	Solder amount
	
	1. Lead parts
		a. Soldering side of PCB
		    Solder to form a 'Filet'
		    all around the lead.
		    Solder should not hide the
		    lead form perfectly. (too much)
		b. Components side
		    (In case of 'Through Hole PCB')
		
		Solder to reach the Components side of PCB.
			Minor

	2. Flat packages	Either 'Toe' (A) or 'Seal' (B) of the lead to be covered by 'Filet'. Lead form to be assume over solder.	Minor
	3. Chips	$(3/2)\,H \geq h \geq (1/2)\,H$	Minor
9	Solder ball/Solder splash	a.The spacing between solder ball and the conductor or solder pad h $\geq$0.13mm.The diameter of solder ball d $\leq$0.15mm. b.The quantity of solder balls or solder. Splashes isn't beyond 5 in 600 mm^2 . c.Solder balls/Solder splashes do not violate minimum electrical clearance. d.Solder balls/Solder splashes must be entrapped / encapsulated or attached to the metal surface . Note: Entrapped/encapsulated/attached is intended to mean that normal service environment of the product will not cause a solder ball to become dislodged.	Minor Minor Major Minor

■ PRECAUTIONS FOR USING LCD MODULES

1   Handing Precautions

1.1   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.

1.2   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.

1.3   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).

1.4   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 it. 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 in to   contact with room temperature air.

1.5   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.

1.6   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 contact with oil and fats.

1.7   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

1.8   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.

1.9   Do not attempt to disassemble or process the LCD module.

1.10   NC terminal should be open. Do not connect anything.

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

1.12   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 removing 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 dry. 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.

1.13 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 the LCM.

2   Handling precaution for LCM

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

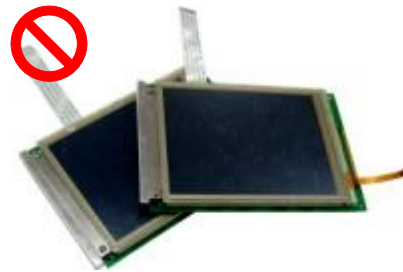   **2.2   Correct handling:**

As above picture, please handle with anti-static gloves around LCM edges.
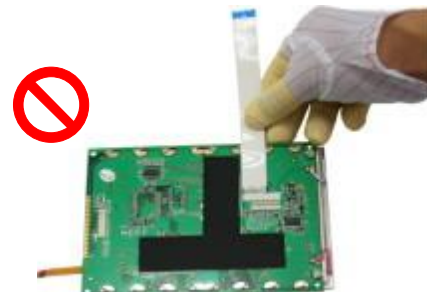
    2.3   Incorrect handling:

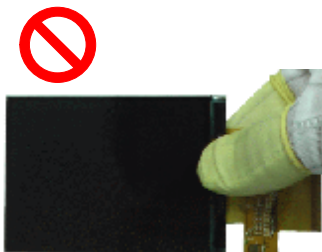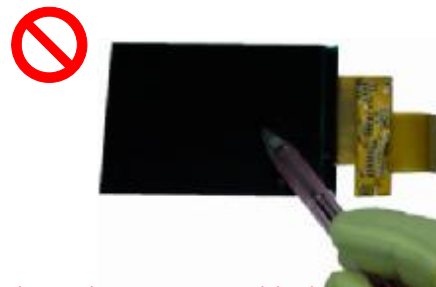Please don't touch IC directly.

Please don't stack LCM.

Please don't hold the surface of panel.

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

Please don't hold the surface of IC.

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

3　Storage Precautions

3.1　When storing the LCD modules, the following precaution are necessary.

3.1.1 Store them in a sealed polyethylene bag. If properly sealed, there is no need for the desiccant.

3.1.2 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.

3.1.3 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).

3.2　Transportation Precautions

3.2.1 During shipment, please handle with care. The packaging bag can not be broken, step on trap. Packaging Carton layer height can not be over two meters.

3.2.2 The transportation process should pay attention to the waterproof and moisture-proof measures. Product can not be watering. Ethylene sealed bags can not be unsealed.
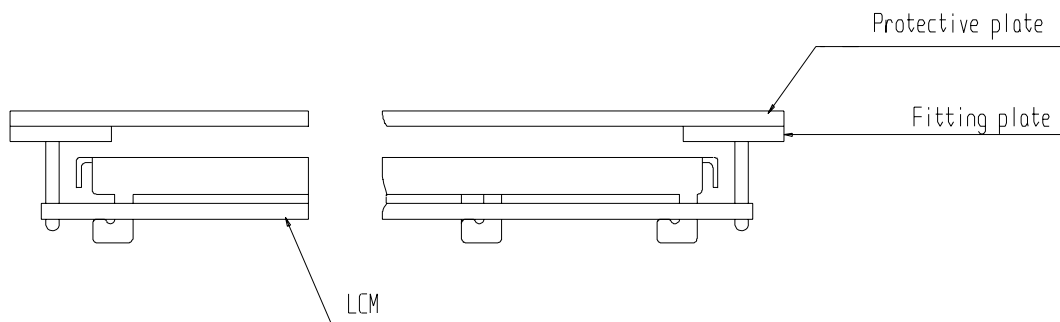
3.3　Others

3.3.1 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.

3.3.2 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.

3.3.3 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.

3.3.3.1 - Exposed area of the printed circuit board.

3.3.3.2 -Terminal electrode sections.

4　USING LCD MODULES

4.1　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.
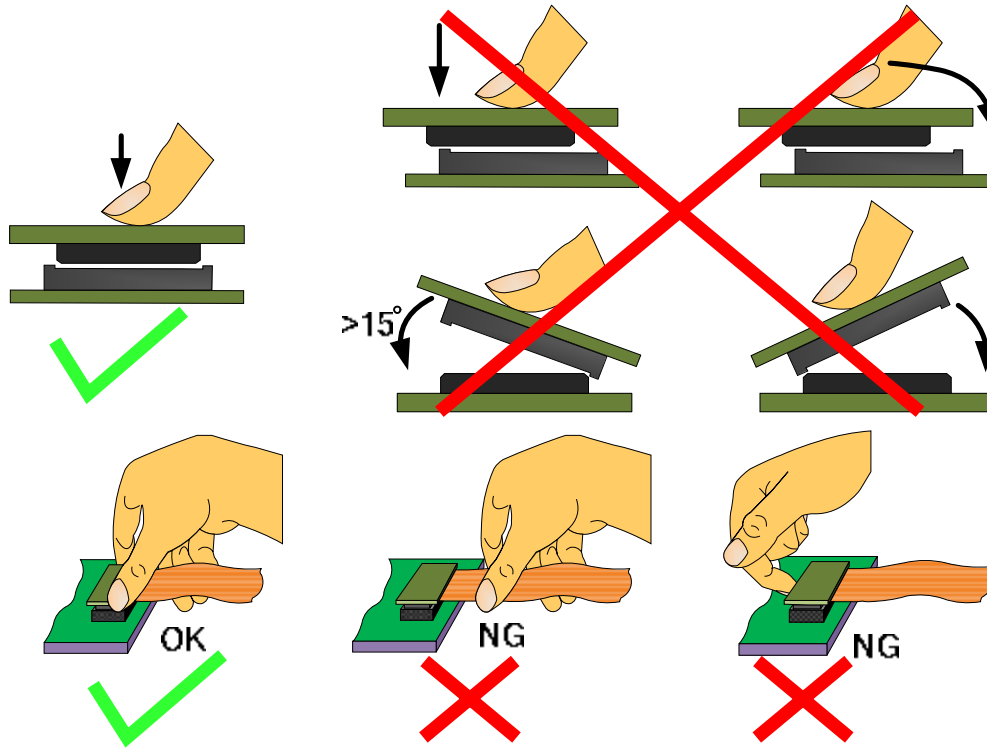
4.1.1 Cover the surface with a transparent protective plate to protect the polarizer and LC cell.

4.1.2 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

4.2 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

4.3   Precaution for soldering the LCM

	Manual 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

4.3.1 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

4.3.2 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.

4.3.3 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.

4.4   Precautions for Operation

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

4.4.2 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

4.4.3 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.

4.4.4 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.

4.4.5 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

4.4.6 Input logic voltage before apply analog high voltage such as LCD driving voltage when power on. Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.

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

4.5   Safety

4.5.1 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

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

4. 6   Limited Warranty

Unless agreed between Multi-Inno and the 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-Inno within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability of Multi-Inno limited to repair and/or replace on the terms set forth above. Multi-Inno will not be responsible for any subsequent or consequential events.

4.7   Return LCM under warranty

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

4.7.1.1 - Broken LCD glass.

4.7.1.2 - PCB eyelet is damaged or modified.

4.7.1.3 -PCB conductors damaged.

4.7.1.4 - Circuit modified in any way, including addition of components.

4.7.1.5 - PCB tampered with by grinding, engraving or painting varnish.

4.7.1.6 - Soldering to or modifying the bezel in any manner.

4.7.2 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.

PACKING SPECIFICATION

Please consult our technical department for detail information.

PRIOR CONSULT MATTER

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

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

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