MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI0283AAT-1

This module uses ROHS material

For Customer's Acceptance:

Customer	
Approved	
Comment	

Revision	1.0
Engineering	
Date	2015-01-20
Our Reference	

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REVISED PAGE NO.
1.0	2015-01-20	First Release	
1.1	2015-06-12	Update MCU interface in drawing	P.5

CONTENTS

■ **GENERAL INFORMATION**

Item	Contents	Unit
LCD type	TFT/Transmissive/Normally black	/
Size	2.83	Inch
Viewing direction	Full viewing angle	O' Clock
LCM (W × H × D)	50.50×69.70×2.60	mm^3
Active area (W×H)	43.20×57.60	mm^2
Pixel pitch (W×H)	0.153×0.153	mm^2
Number of dots	240 (RGB) × 320	/
Driver IC	ST7789V	/
Backlight type	6 LEDs	/
Interface type	8/9/16/18bit MCU 3-wire serial+16/18bit RGB 4-wire serial+16/18bit RGB	/
Color depth	65K/262K	/
Pixel configuration	R.G.B vertical stripe	/
Top polarizer surface treatment	TBD	/
Input voltage	3.3	V
With/Without TSP	Without TSP	/
TP surface treatment	TBD	/
Weight	TBD	g

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

■ EXTERNAL DIMENSIONS

NOTES:
1. DISPLAY TYPE: 2.8", TFT-LCD, 65K/262K COLORS
2. DISPLAY MODE: IPS NORMALLY BLACK
3. VIEWING DIRECTION: ALL
4. DRIVER IC: ST7789V (COG)
5. VCI: 3.3V
6. OPERATING TEMP: -20°C TO 70°C
   STORAGE TEMP: -30°C TO 80°C
7. BACK LIGHT: LED WHITE, 6 LED, 120mA, 3.2±0.3V
8. RoHS COMPLIANT.

BLU CIRCUIT DIAGRAM
K1(-) K2(-) K3(-) K4(-) K5(-) K6(-)   A(+)

NOTE: MCU interface SET for IM PINS.

IM2	IM1	IM0	Interface type	DB Pin in use
0	0	0	DBI Typ. 16-bit interface	DB17-DB10, DB8-DB1
0	0	1	DBI Typ. 8-bit interface	DB17-DB10
0	1	0	DBI Typ. 18-bit interface	DB17-DB0
0	1	1	DBI Typ. 9-bit interface	DB17-DB9
1	0	1	3-Wire 9 BIT data serial interface	SDA SCL CS
1	1	0	4-Wire 8 BIT data serial interface	SDA SCL CS RS

NOTE: If not use PINS fix to the GND , IOVCC or NC.

RGB Interface	DB Pin in use
16(565) Bit RGB interface	DB17-DB13, DB11-DB6, DB5-DB1
18(666) Bit RGB interface	DB17-DB0

NOTE: If used RGB mode must select serial interface!

NO.	Pin Name
1	GND
2	XR
3	YD
4	XL
5	YU
6	IOVCC
7	IOVCC
8	VCI
9	VCI
10	IM2
11	IM1
12	IM0
13	RESET
14	CS
15	RS(SPI·RS)
16	WR(SPI·SCL)
17	RD
18	VSYNC
19	HSYNC
20	ENABLE
21	DOTCLK
22	SDA
23	SDA
24	DB0(B0)
25	DB1(B1)
26	DB2(B2)
27	DB3(B3)
28	DB4(B4)
29	DB5(B5)
30	DB6(G0)
31	DB7(G1)
32	DB8(G2)
33	DB9(G3)
34	DB10(G4)
35	DB11(G5)
36	DB12(R0)
37	DB13(R1)
38	DB14(R2)
39	DB15(R3)
40	DB16(R4)
41	DB17(R5)
42	GND
43	SDO
44	LEDA
45	LEDK1
46	LEDK2
47	LEDK3
48	LEDK4
49	LEDK6
50	GND

VER.	REVISED DESCRIPTION	DATE
02	Update MCU interface	2015.06.12
01	First issue	2015.01.20

MULTI-INNO TECHNOLOGY CO.,LTD.

DRAWN BY: CAROL 2015.06.12	MODULE P/N: MI0283AAT-1
CHECKED BY:	
APPROVED BY:	DESCRIPTION: TFT MODULE
VERSION NO: 02	SCALE : 1/1 UNIT: mm

■ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Digital supply voltage	VDD	-0.3	4.6	V
Digital input signal voltage	VDDIO	-0.3	4.6	V
Operating temperature	T_{OP}	-20	70	°C
Storage temperature	T_{ST}	-30	80	°C

■ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
Digital supply voltage	VDD	2.4	-	3.3	V
Digital interface supply voltage	VDDIO	1.65	-	3.3	V
Normal mode current consumption	IDD	-	8	-	mA
Input voltage ' H ' level	V_{IH}	0.7VDDIO	-	VDDIO	V
Input voltage ' L ' level	V_{IL}	GND	-	0.3VDDIO	V
Output voltage ' H ' level	V_{OH}	0.8VDDIO	-	VDDIO	V
Output voltage ' L ' level	V_{OL}	GND	-	0.2VDDIO	V

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	Vf	-	3.2	-	V	Ta=25±2°C, 60%RH±5%
Forward current	I f	90	120	-	mA	
Power consumption	W_{BL}	-	384	-	mW	
Operating life time	-	50000	-	-	Hrs	

Note :

   Operating life time means brightness goes down to 50% initial brightness;

   The life time of LED will be reduced if LED is driven by high current,high ambient temperature and humidity conditions;
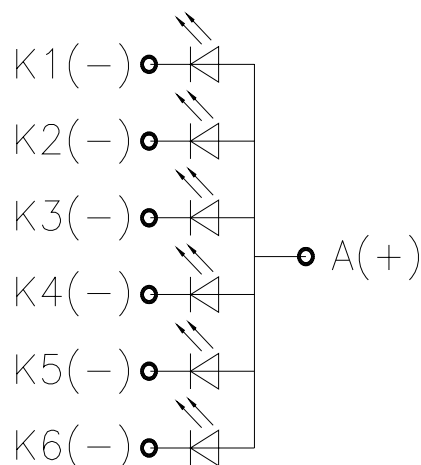
BLU CIRCUIT DIAGRAM

■ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time		Tr+Tf		-	30	40	ms	FIG 1.	4
Contrast ratio		Cr	θ=0°	600	800	-	---	FIG 2.	1
Luminance uniformity		δ WHITE	∅=0° Ta=25℃	80	-	-	%	FIG 2.	3
Surface Luminance		Lv		450	500	-	cd/m²	FIG 2.	2
Viewing angle range		θ	∅ = 90°	-	80	-	deg	FIG 3.	6
			∅ = 270°	-	80	-	deg	FIG 3.	
			∅ = 0°	-	80	-	deg	FIG 3.	
			∅ = 180°	-	80	-	deg	FIG 3.	
CIE (x, y) chromaticity	Red	x	θ=0° ∅=0° Ta=25℃	0.621	0.641	0.661		FIG 2.	5
		y		0.317	0.337	0.357			
	Green	x		0.254	0.274	0.294			
		y		0.540	0.560	0.580			
	Blue	x		0.121	0.141	0.161			
		y		0.093	0.113	0.133			
	White	x		0.288	0.308	0.328			
		y		0.310	0.330	0.350			

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.

$$\text{Lv} = \text{Average Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)}$$

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".
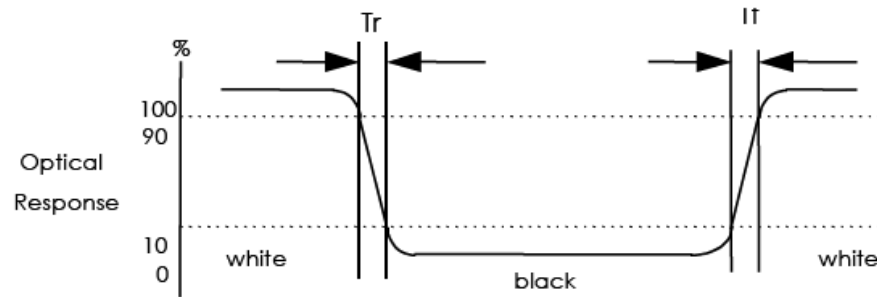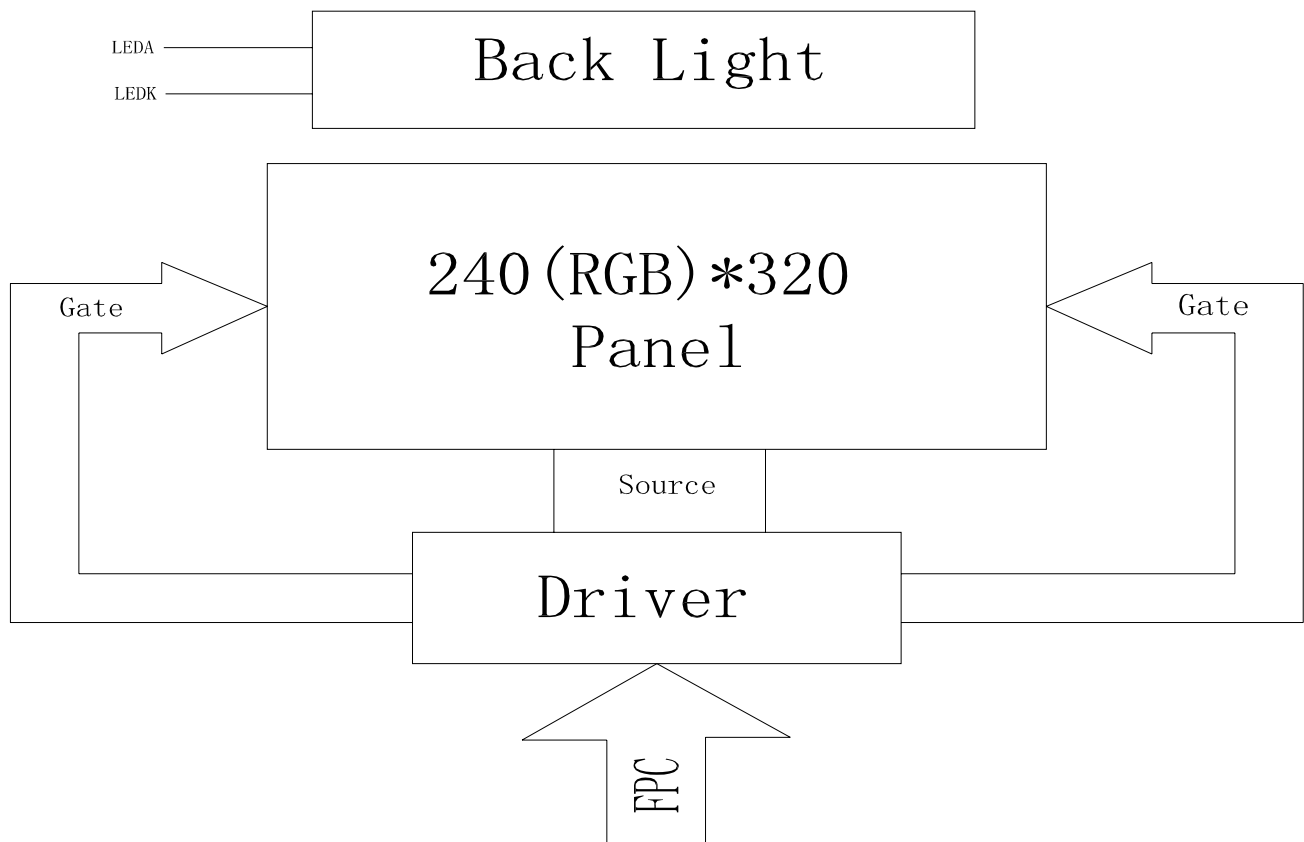

FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity

A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size $\varnothing$=7mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5
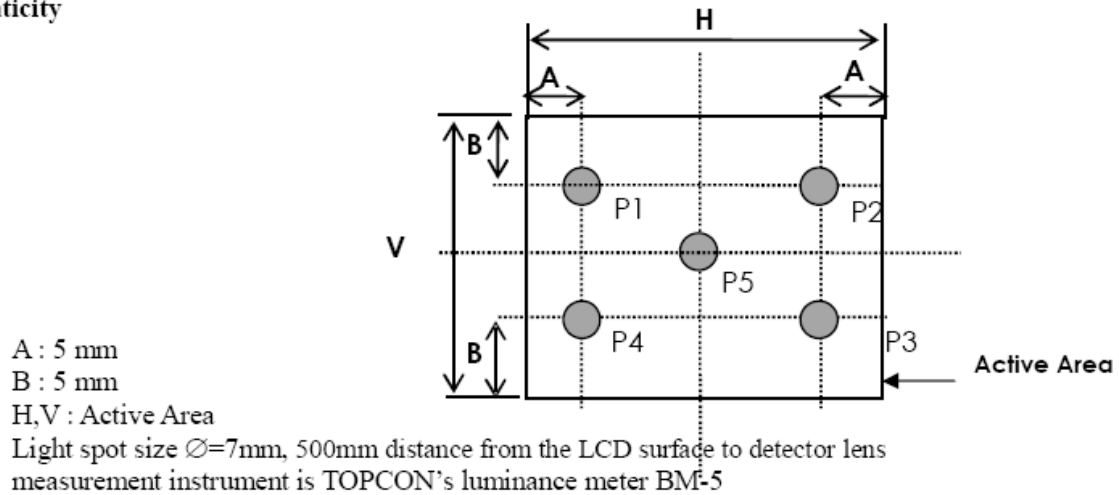
FIG. 3 The definition of viewing angle
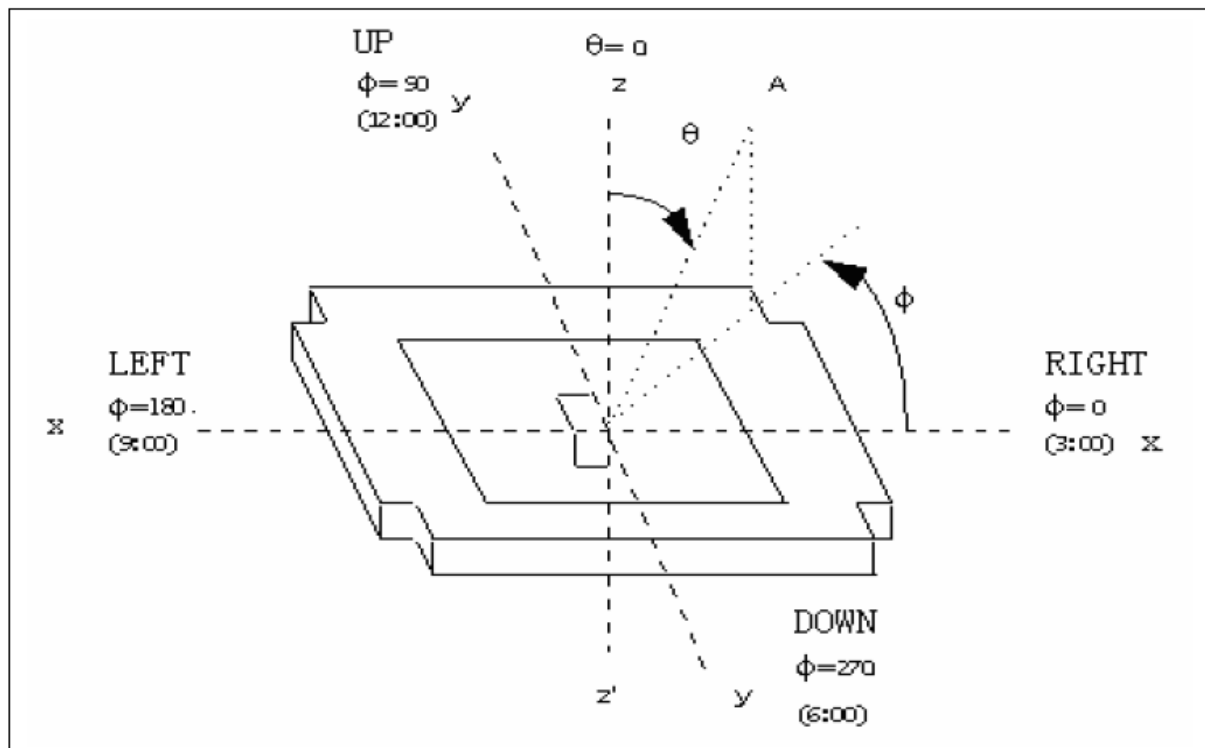
■ **INTERFACE DESCRIPTION**

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	XR	NC (Touch panel Right Glass Terminal)	A/D
3	YD	NC (Touch panel Bottom Glass Terminal)	A/D
4	XL	NC (Touch panel LIFT Glass Terminal)	A/D
5	YU	NC (Touch panel Top Glass Terminal)	A/D
6	IOVCC	Supply voltage for IO (1.8-3.3V).	P
7	IOVCC	Supply voltage for IO (1.8-3.3V).	P
8	VCI	Supply voltage (3.3V).	P
9	VCI	Supply voltage (3.3V).	P
10	IM2	MPU Parallel interface bus and serial interface select If use RGB Interface must select serial interface. Fix this pin at VCI and GND.	I
11	IM1		
12	IM0		
13	RESET	This signal will reset the device and must be applied to properly initialize the chip.	I
14	CS	Chip select input pin ("Low" enable). Fix this pin at VCI or GND when not in use.	I
15	RS(SPI-SCL)	This pin is used to select "Data or Command" in the parallel interface. When D/CX = '1', data is selected. When D/CX = '0', command is selected. This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface. Fix this pin at VCI or GND when not in use.	I
16	WR(SPI-RS)	Serve as a write singal and MCU write data at the rising edge.this pin is used serial interface command / display data selection Fix this pin at IOVCC or GND when not in use	I
17	RD	Serves as a read signal and MCU read data at the rising edge. Fix this pin at VCI or GND when not in use	I
18	VSYNC	Frame synchronizing signal for RGB interface operation. Fix this pin at VCI or GND when not in use.	I

19	HSYNC	Line synchronizing signal for RGB interface operation. Fix this pin at VCI or GND when not in use.	I
20	ENABLE	Data enable signal for RGB interface operation. Fix this pin at VCI or GND when not in use.	I
21	DOTCLK	Dot clock signal for RGB interface operation. Fix this pin at VCI or GND when not in use.	I
22	SDA	Serial input signal.The data is applied on the rising edge of the SCL signal. If not used, fix this pin at VCI or GND.	I
23-40	DB0-DB7	Data bus. If not used pin, fix this pin to GND.	I/O
41	SDO	SPI interface output pin. -The data is output on the falling edge of the SCL signal. -If not used, let this pin open.	O
42	GND	Ground.	P
43	LEDA	Anode pin of backlight	P
44	LEDK1	Cathode pin OF backlight	P
45	LEDK2	Cathode pin OF backlight	P
46	LEDK3	Cathode pin OF backlight	P
47	LEDK4	Cathode pin OF backlight	P
48	LEDK5	Cathode pin OF backlight	P
49	LEDK6	Cathode pin OF backlight	P
50	GND	Ground.	P

■ BLOCK DIAGRAM

LEDA ───────┐

LEDK ───────┤

```
┌─────────────────────────────────────┐
│            Back Light               │
└─────────────────────────────────────┘

┌─────────────────────────────────────┐
│                                     │
Gate ▶       240(RGB)*320       ◀ Gate
│               Panel                 │
│                                     │
└─────────────────────────────────────┘
              Source
       ┌─────────────────┐
       │     Driver      │
       └─────────────────┘
              ▲
             FPC
```

■ APPLICATION NOTES

1. 8080 Series MCU Parallel Interface Timing Characteristics:18/16/9/8-bit Bus
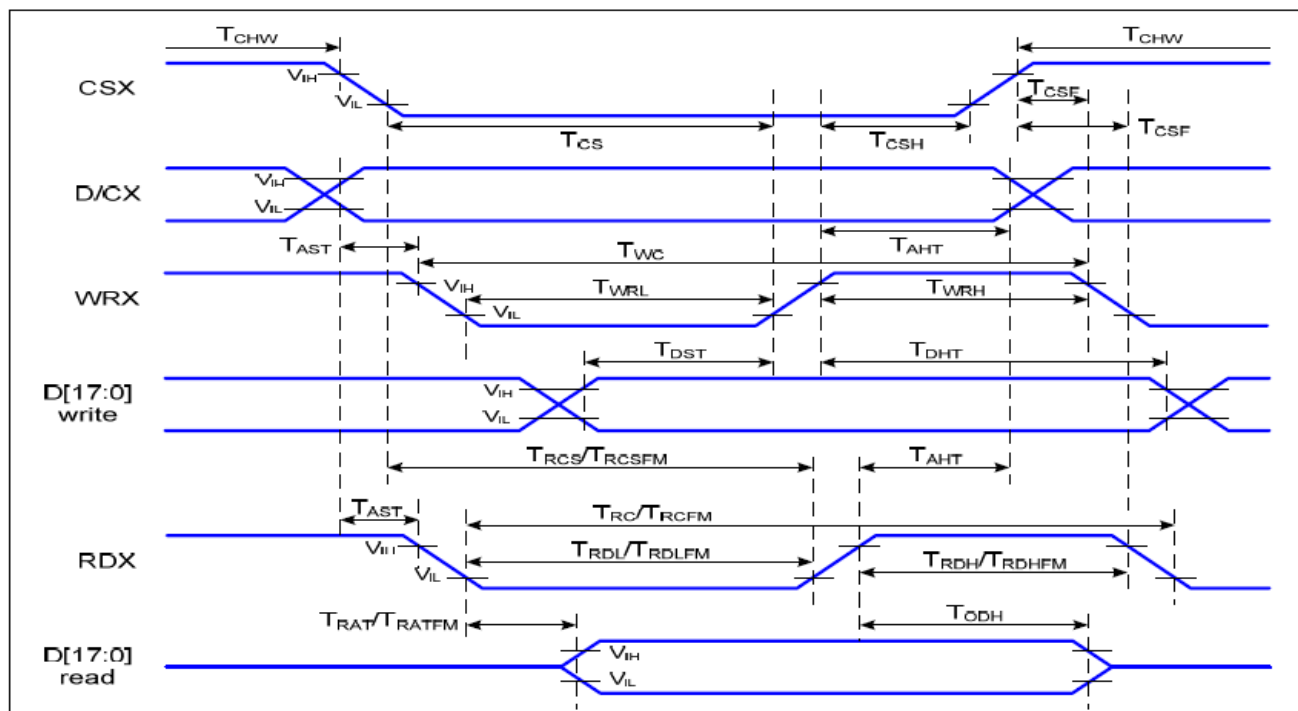
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 ℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF

	T$_{DHT}$	Data hold time	10		ns	
	T$_{RAT}$	Read access time (ID)		40	ns	
	T$_{RATFM}$	Read access time (FM)		340	ns	
	T$_{ODH}$	Output disable time	20	80	ns	
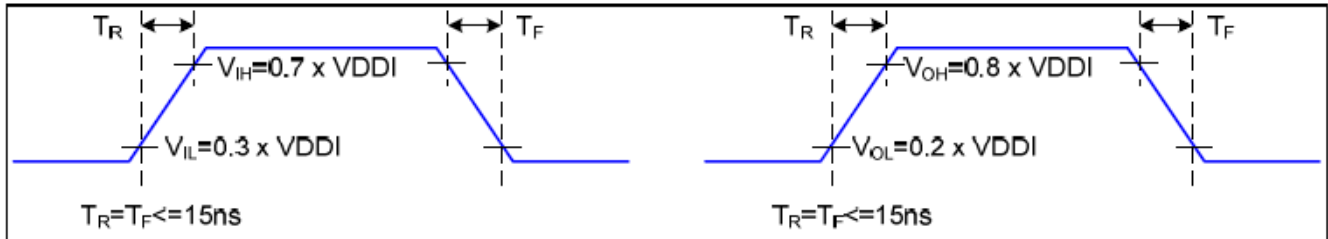
Figure 2 Rising and Falling Timing for I/O Signal
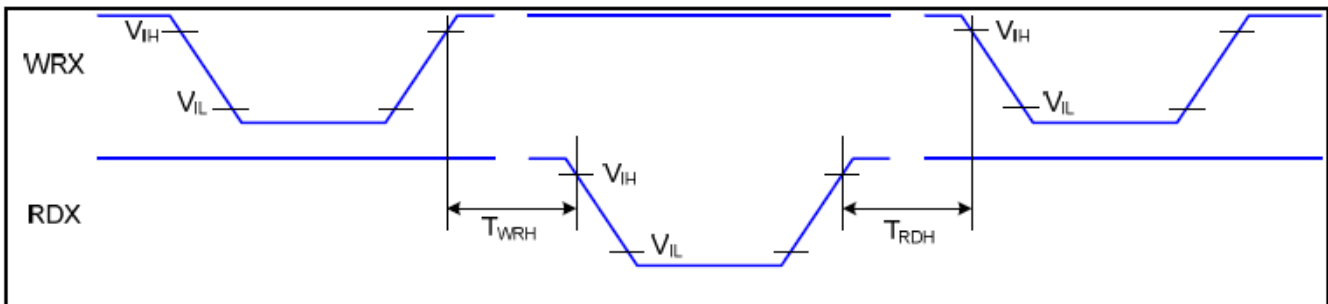
Figure 3 Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (Tr, Tf) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

2. Display Serial Interface Timing Characteristics(3-line SPI system)

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 ℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

3. Display Serial Interface Timing Characteristics(4-line SPI system)

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 ℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

4. Parallel RGB Interface Timing Characteristics
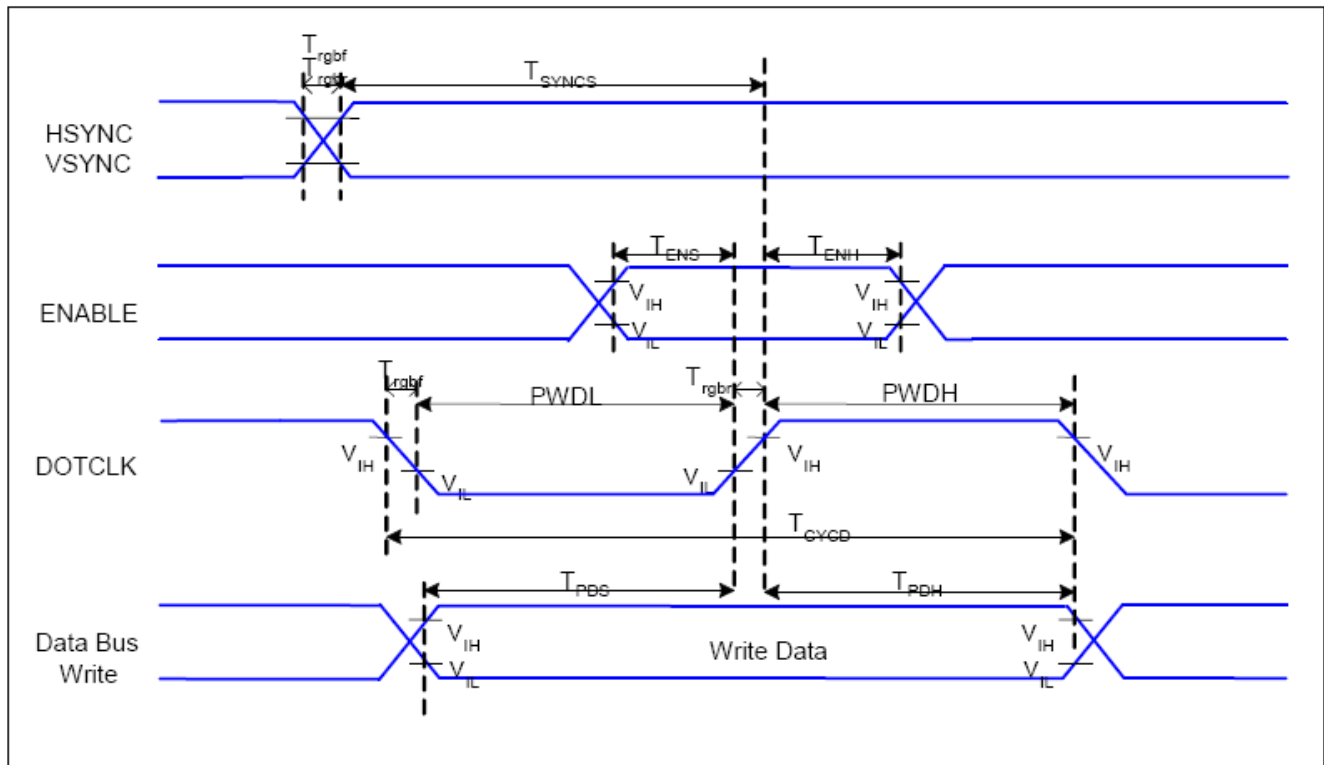
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 ~ 70 ℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	30	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	25	-	ns	
	T_{ENH}	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	120	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	20	ns	
DB	T_{PDS}	PD Data Setup Time	50	-	ns	
	T_{PDH}	PD Data Hold Time	50	-	ns	

Parameters	Symbols	Condition	Min.	Typ.	Max.	Units
Horizontal Synchronization	Hsync		2	10	16	DOTCLK
Horizontal Back Porch	HBP		2	20	24	DOTCLK
Horizontal Address	HAdr		-	240	-	DOTCLK
Horizontal Front Porch	HFP		2	10	16	DOTCLK
Vertical Synchronization	Vsync		1	2	4	Line
Vertical Back Porch	VBP		1	2	-	Line
Vertical Address	VAdr		-	320	-	Line
Vertical Front Porch	VFP		3	4	-	Line

Setting Example: To set frame frequency to 70Hz:

Internal Clock

Internal Oscillation Clock: 615KHz

DIV[1:0] = 2'b0 (x 1/1)

RTN[4:0] = 5'h1b (27 clocks)

FP = 7'h2 (2 lines), BP = 7'h2 (2 lines), NL = 6'h27 (320 lines)

Frame Rate → 70.30Hz

DOTCLK

HSYNC = 10 CLK

HBP = 20 CLK

HFP=10 CLK

70Hz x (2 + 320 + 2) lines x (10 + 20 + 240 + 10) clocks = 6.35MHz

DOTCLK frequency = 6.35MHz

6.35 MHz / 615KHz = 10.32 □ Set PCDIV so that PCLK is divided by 10.

external fosc = 6.35 MHz / 10 = 635KHz

PCDIV = [6.35MHz / 635KHz) / 2] - 1 = 4

PCDIV[5:0] = 6'h04 (10 DOTCLK)

5. Reset Timing Characteristics
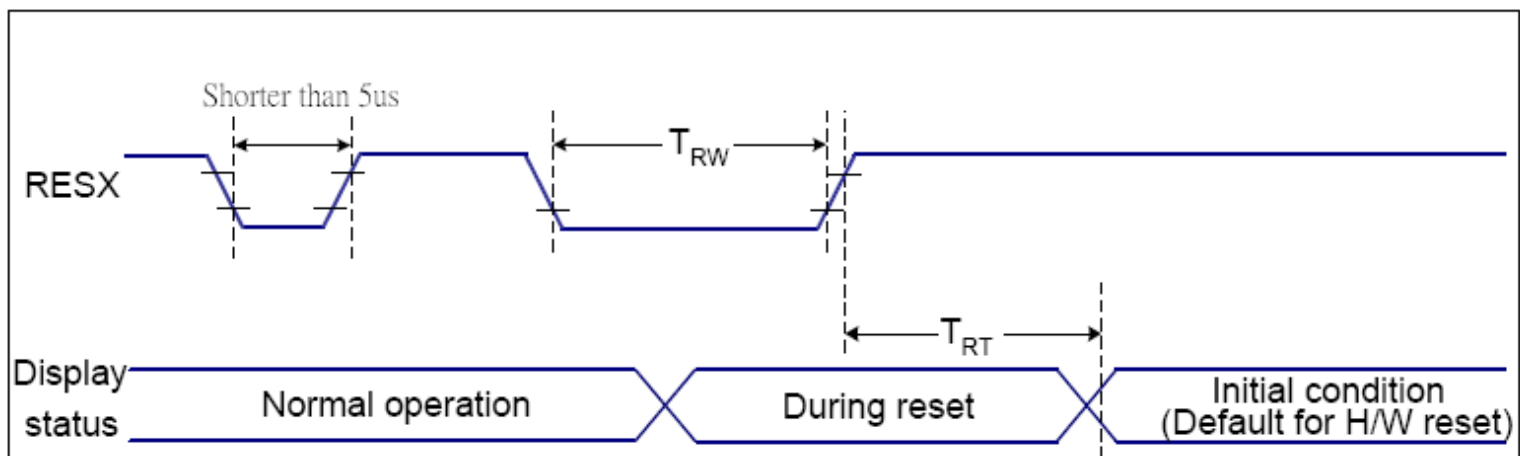
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 ~ 70 ℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. 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 return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:
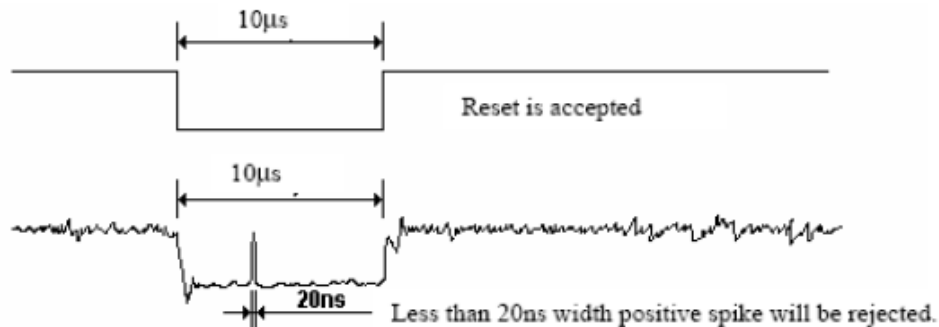
5. When Reset applied during Sleep In Mode.

6. When Reset applied during Sleep Out Mode.
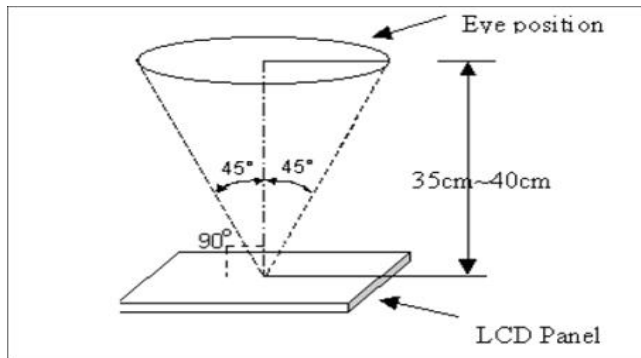
7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.
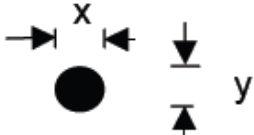
■ RELIABILITY TEST
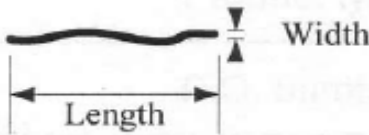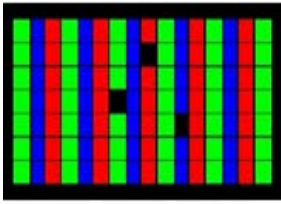
Item	Condition	Sample Size	Test Result	Note
Low Temperature Operating Life test	-20℃, 96HR	3ea	pass	-
Thermal Humidity Operating Life test	70℃90%RH, 96HR	3ea	pass	-
Temperature Cycle ON/OFF test	-20℃ ↔ 70℃, ON/OFF, 20CYC	3ea	pass	(1)
High Temperature Storage test	80℃, 96HR	3ea	pass	-
Low Temperature Storage test	−30℃, 96HR	3ea	pass	-
ESD test	150pF, 330Ω , ±6KV(Contact)/± 8KV(Air), 5 points/panel, 10 times/point	3ea	pass	
Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours	3ea	pass	
Box Drop Test	1 Corner 3 Edges 6 faces, 66㎝(MEDIUM BOX)	1box	pass	-
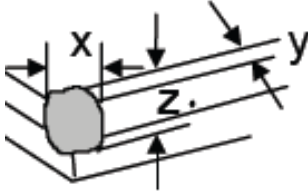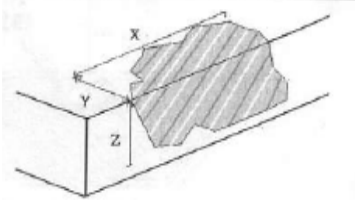
Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

■ INSPECTION CRITERION

OUTGOING QUALITY STANDARD	PAGE 1 OF 5
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

This specification is made to be used as the standard acceptance/rejection criteria for Color mobile phone LCM.

1 Sample plan

   1.1 Lot size: Quantity per shipment lot per model

   1.2 Sampling type: Normal inspection,Single sampling

   1.3 Inspection level: II

   1.4 Sampling table: MIL-STD-105D

   1.5 Acceptable quality level (AQL)

       Majot defect: AQL=0.65

       Minor defect: AQL=1.00

 2. Inspection condition

   2.1 Ambient conditions:

       a. Temperature: Room temperature 25± 5℃

       b. Humidity: (60± 10)%RH

       c. Illumination: Single fluorescent lamp non-directive (300 to 700 Lux)

   2.2 Viewing distance:

    The distance between the LCD and the inspector's eyes shall be at least 35± 5cm.

   2.3 Viewing Angle

       U/D: 45º /45º , L/R: 45º /45º

	OUTGOING QUALITY STANDARD	PAGE 2 OF 5
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA		

3. Inspection standards

　　Defects are classified as majot defects and minor defects according to the degree of defectiveness defined herein.

3.1 Major defect

Item No	Items to be inspected	Inspection Standard
3.1.1	All functional defects	1) No display 2) Display abnormally 3) Short circuit 4) line defect
3.1.2	Missing	Missing function component
3.1.3	Crack	Glasscrack

3.2 Minor defect

Item No	Items to be inspected	Inspection standard	
3.2.1	Spot Defect Including Black spot White spot Pinhole Foreign particle Polarizer dirt	For dark/white spot is defined $\varphi = (\mathbf{x} + \mathbf{y}) / 2$ 	
		Size φ(mm)	Acceptable Quantity
		$\varphi \leq 0.10$	Ignore
		$0.10 < \varphi \leq 0.20$	3
		$0.20 < \varphi$	Not allowed

		OUTGOING QUALITY STANDARD	PAGE　3　OF　5
		TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

3.2.2	Line Defect Including Black line White line Scratch	Define:	
		Width(mm) Length(mm)	Acceptable Quantity
		W≤0.03	Ignore
		0.03 ＜ W≤0.05 L≤5.0	2
		0.05 ＜ W	Not allowed
3.2.3	Polarizer Dent/Bubble	Size φ(mm)	Acceptable Quantity
		φ≤0.2	Ignore
		0.2< φ≤0.4	3
		0.4< φ	Not allowed
3.2.4	Electrical Dot Defect	Bright and Black dot define: and	
		Inspection pattern: Full white, Full black, Red, green and blue screens	
		Item	Acceptable Quantity
		Dark dot defect	2
		Bright dot defect	0
		Total Dot	2

	OUTGOING QUALITY STANDARD	PAGE 4 OF 5
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA		

3.2.5	Touch panel and glass defect	1.Corner Fragment:

Size(mm)	Acceptable Quantity
X≤3mm Y≤3mm Z≤T	Ignore T: Glass thickness X: Length Y: Width Z: thickness

2. Side Fragment:

Size(mm)	Acceptable Quantity
X≤5.0mm Y ≤1mm Z≤T	Ignore T: Glass thickness X: Length Y: Width Z: thickness

3.2.6	Touch panel spot	Size φ(mm)	Acceptable Quantity
		φ≤ 0.15	Ignore
		0.15 <φ≤ 0.25	3
		0.25 < φ	0

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

		Width(mm) Length(mm)	Acceptable Quantity
3.2.7	Touch panel White line Scratch	W≤0.03	Ignore
		0.03 ＜ W≤0.05 L≤5.0	3
		0.05 ＜ W or L>5	Not allowed
3.2.8	Touch panel Newton ring	Compare with limit sample	

Note: 1. Dot defect is defined as the defecti ve area of the dot area is larger than 50% of the dot area .

2. The distance between two bright dot defects (red, green, blue, and white) should be larger than 15mm;

3. The distance between black dot defects or black and bright dot defects should be more than 5mm apart.

4. Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

■ 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!
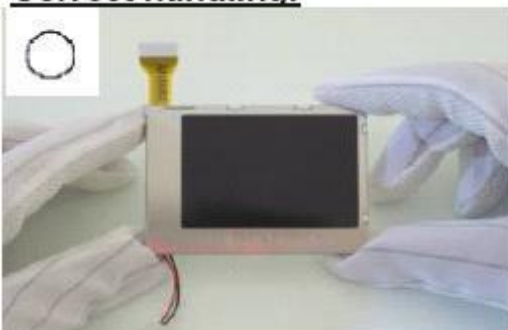
Correct handling:

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

Incorrect handling:
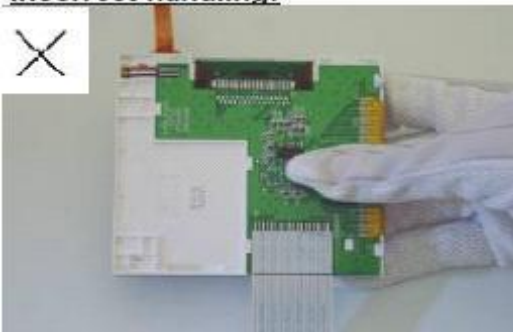
Please don't touch IC directly.
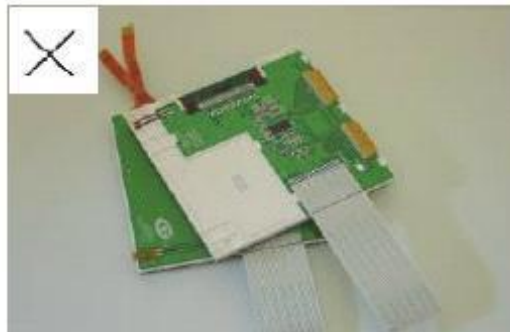
Please don't stack LCM.
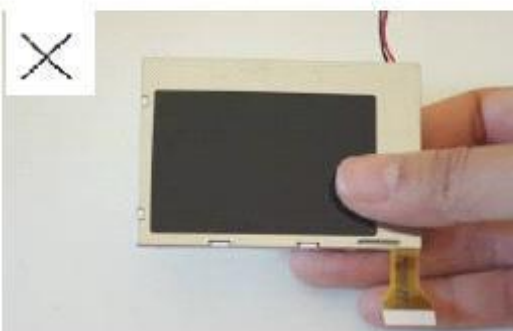
Please don't hold the surface of panel.
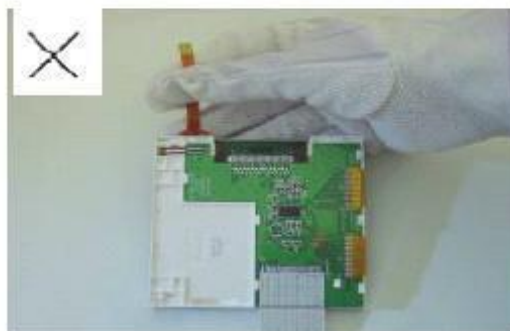
Please don't stretch interface of output, such as FPC cable.

Handling precaution for LCD

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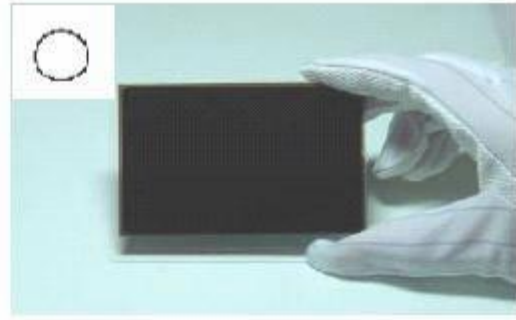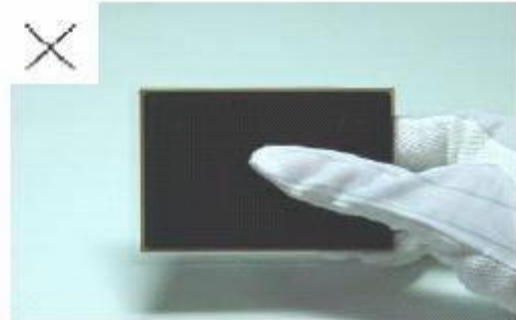
Correct handling:

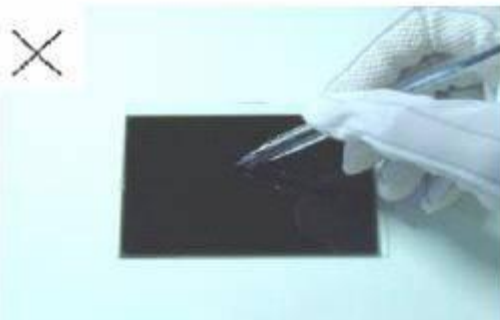As above photo, please handle with anti-static gloves around LCD edges.
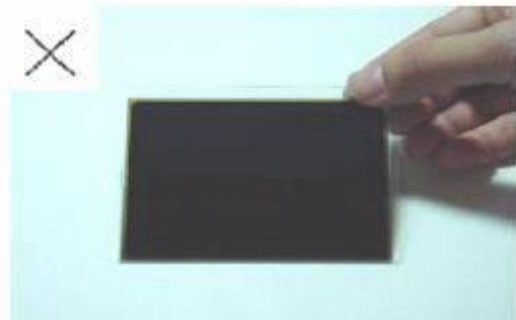
Incorrect handling:

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.
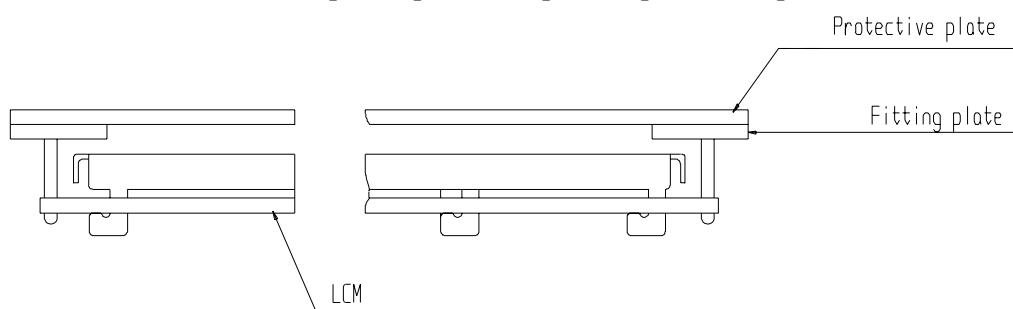
- Exposed area of the printed circuit board.

-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
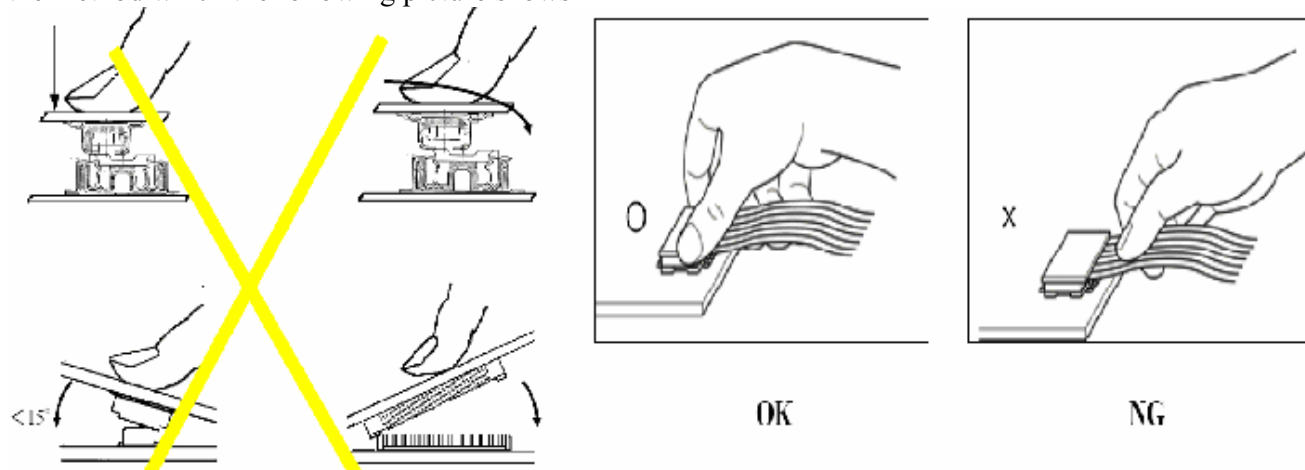
Precaution for soldering to the LCM

	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.
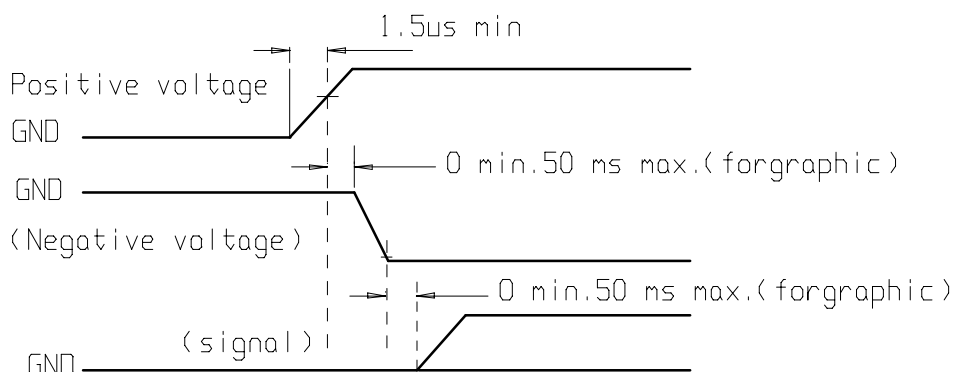
Safety

(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 between Multi-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-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 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.