MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI0350AFT-1

For Customer's Acceptance:

Customer	
Approved	
Comment	

Revision	1.0
Engineering	
Date	2012-05-20
Our Reference	

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2012-05-20	Initial release	

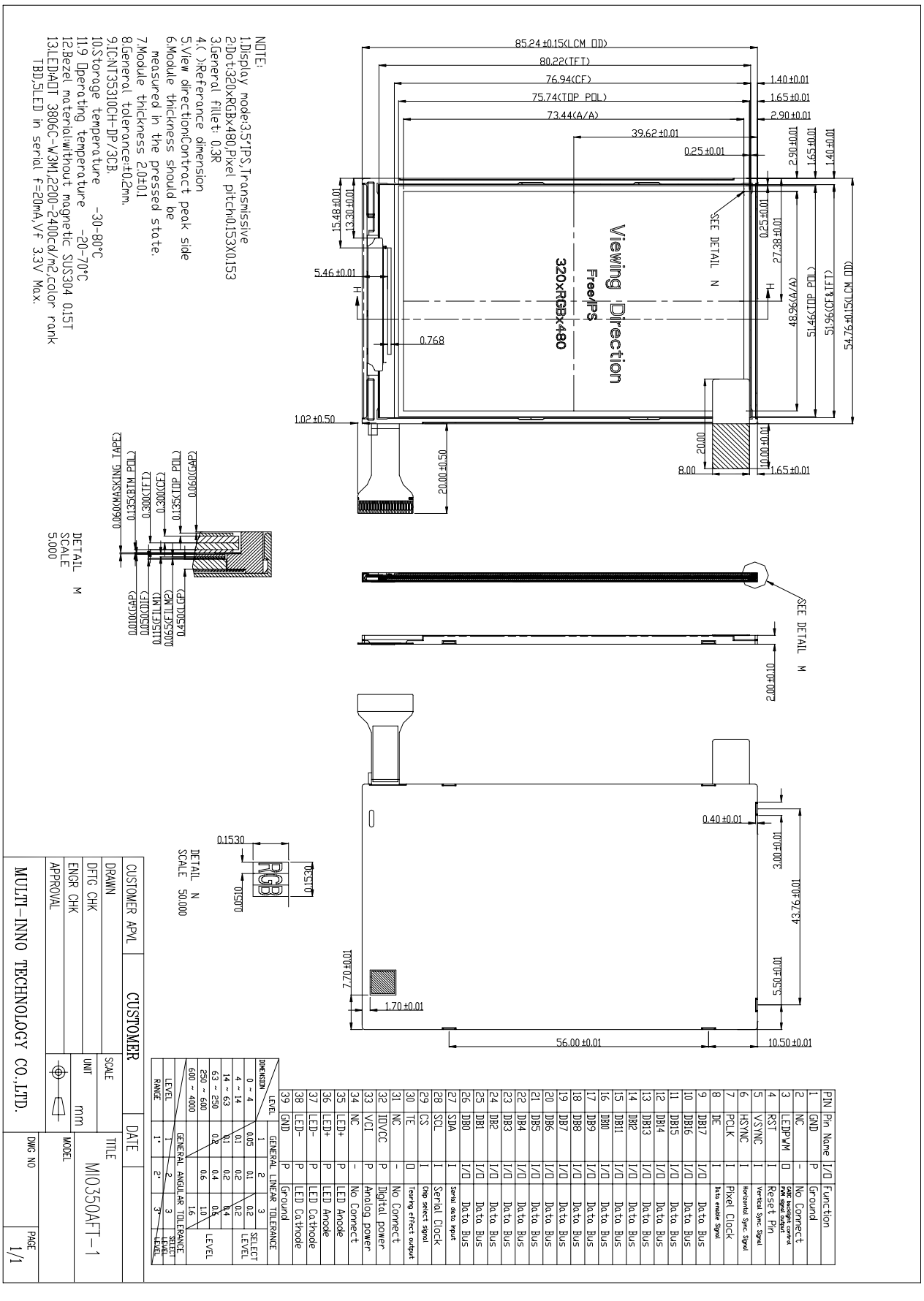
CONTENTS

■ GENERAL INFORMATION

Item	Contents	Unit/Note
LCDtype	TFT/Transmissive/Normally Black	/
Size	3.5	Inch
Viewing direction	Full viewing angle	O'Clock
Module area (W × H)	54.76×85.24x2.00	mm^3
Active area (W×H)	48.96×73.44	mm^2
Number of Dots	320x3(RGB)x480	/
Dot pitch (W × H)	0.051 × 0.153	mm^2
Colors	262K	/
Surface treatment	HC	/
Color arrangement	RGB-stripe	/
Driving IC	NT35310C	/
Backlight Type	5LEDs	/
Backlight power consumption	0.33	W
InterfaceType	18bits RGB+SPI	/
Input voltage	2.8	V
Weight	TBD	g
With/Without TSP	Without TSP	/

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

■ EXTERNAL DIMENSIONS



PIN	Pin Name	I/O	Function
1	GND	P	Ground
2	NC	-	No Connect
3	LEDPWM	O	CABC backlight control PWM signal output
4	RST	I	Reset Pin
5	VSYNC	I	Vertical Sync. Signal
6	HSYNC	I	Horizontal Sync. Signal
7	PCLK	I	Pixel Clock
8	DE	I	Data enable Signal
9	DB17	I/O	Data Bus
10	DB16	I/O	Data Bus
11	DB15	I/O	Data Bus
12	DB14	I/O	Data Bus
13	DB13	I/O	Data Bus
14	DB12	I/O	Data Bus
15	DB11	I/O	Data Bus
16	DB10	I/O	Data Bus
17	DB9	I/O	Data Bus
18	DB8	I/O	Data Bus
19	DB7	I/O	Data Bus
20	DB6	I/O	Data Bus
21	DB5	I/O	Data Bus
22	DB4	I/O	Data Bus
23	DB3	I/O	Data Bus
24	DB2	I/O	Data Bus
25	DB1	I/O	Data Bus
26	DB0	I/O	Data Bus
27	SDA	I	Serial data input
28	SCL	I	Serial Clock
29	CS	I	Chip select signal
30	TE	O	Tearing effect output
31	NC	-	No Connect
32	IOVCC	P	Digital power
33	VCI	P	Analog power
34	NC	-	No Connect
35	LED+	P	LED Anode
36	LED+	P	LED Anode
37	LED-	P	LED Cathode
38	LED-	P	LED Cathode
39	GND	P	Ground

GENERAL LINEAR TOLERANCE			
DIMENSION	LEVEL 1	LEVEL 2	LEVEL 3
0 ~ 4	0.05	0.1	0.2
4 ~ 14	0.1	0.2	0.2
14 ~ 63	0.1	0.2	0.4
63 ~ 250	0.2	0.4	0.6
250 ~ 600	0.3	0.6	1.0
600 ~ 4000	0.5	1.0	1.6

GENERAL ANGULAR TOLERANCE			
LEVEL RANGE	LEVEL 1	LEVEL 2	LEVEL 3
1°	1°	2°	3°

CUSTOMER APVL	CUSTOMER
DRAWN	SCALE
DFTG CHK	UNIT mm
ENGR CHK	MODEL
APPROVAL	TITLE MI0350AFT-1
MULTI-INNO TECHNOLOGY CO.,LTD.	DWG NO
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■ABSOLUTE MAXIMUM RATINGS

Item		Symbol	Values		Unit	Remark
			Min.	Max.		
TFT Module	Logic Power Supply	IOVCC	-0.3	+3.6	V	Note 1
	Analog Power Supply	VCI	-0.3	+3.6	V	Note 1
Backlight Unit	Current	I_B	-	25	mA	
	Power Consumption	P_{BL}	-	500	mW	

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

■ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Logic power supply	IOVCC	1.65	2.8	3.3	V	Note
Analog power supply	VCI	2.3	2.8	3.3	V	
Input high voltage	V_{IH}	0.7IOVCC	-	IOVCC	V	
Input low voltage	V_{IL}	0	-	0.3IOVCC	V	
Output high voltage	V_{OH}	0.8IOVCC	-	IOVCC	V	
Output low voltage	V_{IL}	0	-	0.2IOVCC	V	
Frame frequency	f_{FRAME}	-	60	-	Hz	

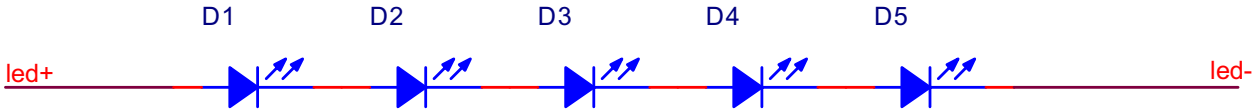
Note: To prevent IC latch up or DC operation in LCD panel, the power on/off sequence should follow the driver IC specification.

CURRENT CONSUMPTION

Item	Symbol	Values		Unit	Remark
		Typ.	Max.		
Still mode	IOVCC	TBD	TBD	mA	
	VCI	TBD	TBD	mA	
Sleep mode	IOVCC	TBD	TBD	mA	Note
	VCI	TBD	TBD	mA	

Note: In the sleep mode, all the intermal display operations are suspended except for the internal R-C oscillator.

■ BACKLIGHT CHARACTERISTICS



Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current	I_B	-	20	-	mA	Note 1
Power Consumption	P_B	-	330	-	mW	Note 2

Note 1: 5 LEDs are connected in serial; each LED forward voltage is 3.3V.
Note 2: Where I_B=20mA, $P_{BL} = I_B * V_{BL}$, V_{BL} is backlight forward voltage.

■ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time		Tr+Tf	θ=0° ∅=0° Ta=25℃	25	50	---	ms	FIG 1.	4
Contrast ratio		Cr		400	700	---	---	FIG 2.	1
Luminance uniformity		δ WHITE		70	75	---	%	FIG 2.	3
Surface Luminance		Lv		250	320	---	cd/m^2	FIG 2.	2
Viewing angle range		θ	∅ = 90°	75	85	---	deg	FIG 3.	6
			∅ = 270°	75	85	---	deg	FIG 3.	
			∅ = 0°	75	85	---	deg	FIG 3.	
			∅ = 180°	75	85	---	deg	FIG 3.	
CIE (x, y) chromaticity	Red	x	θ=0° ∅=0° Ta=25℃	---	---	---		FIG 2.	5
		y		---	---	---			
	Green	x		---	---	---			
		y		---	---	---			
	Blue	x		---	---	---			
		y		---	---	---			
	White	x		0.260	0.310	0.360			
		y		0.270	0.320	0.370			

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

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

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

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

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

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

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

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

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

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

FIG. 1 The definition of Response Time

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

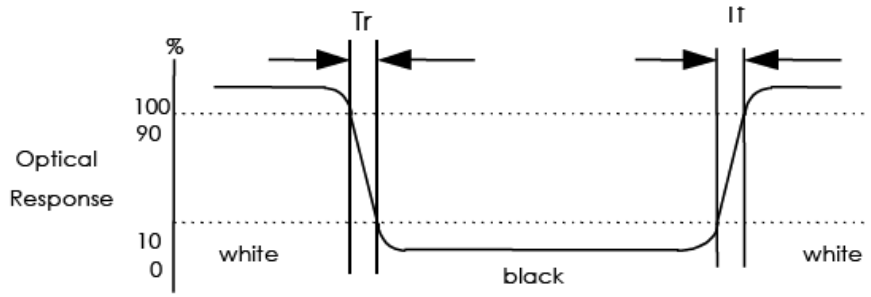
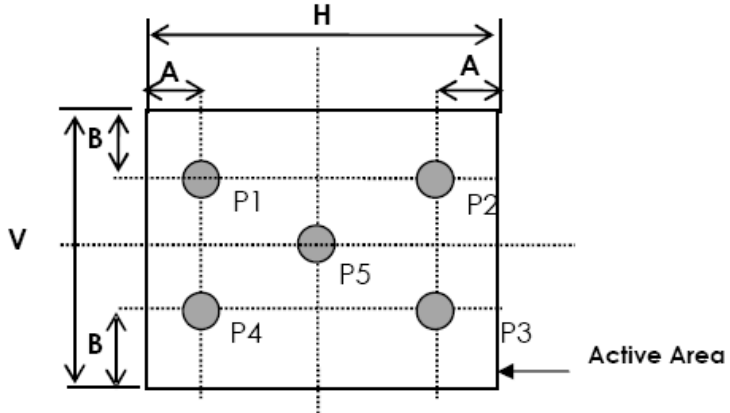
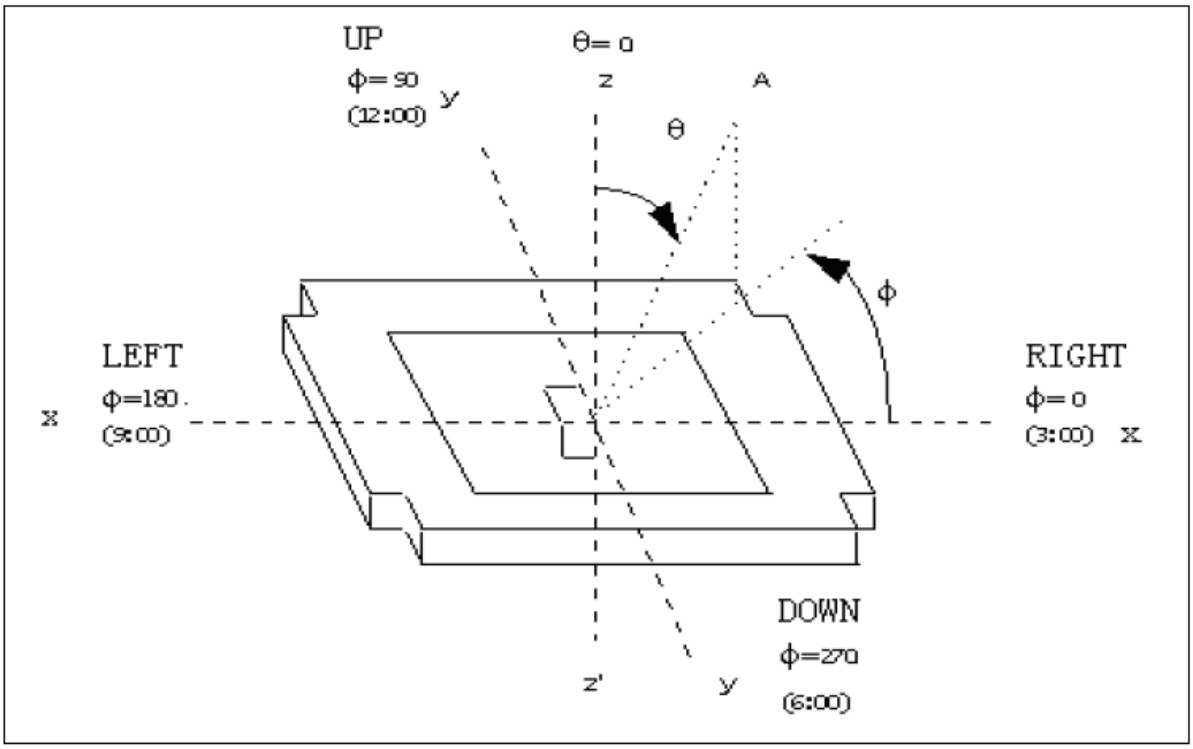


FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity



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

FIG. 3 The definition of viewing angle



■ INTERFACE DESCRIPTION

A 39 pin connector is used for the module electronics interface. The recommended model is FH35C-39S-0.3SHW(50) manufactured by Hirose.

Pin No.	Symbol	I/O	Function	Remark
1	GND	P	Ground	
2	NC	-	No Connect	
3	LEDPWM	O	CABC backlight control PWM signal output	
4	RST	I	Reset Pin	
5	VSYNC	I	Vertical Sync. Signal	
6	HSYNC	I	Horizontal Sync. Signal	
7	PCLK	I	Pixel Clock	
8	DE	I	Data enable Signal	
9	DB17	I/O	Data Bus (R5)	
10	DB16	I/O	Data Bus (R4)	
11	DB15	I/O	Data Bus (R3)	
12	DB14	I/O	Data Bus (R2)	
13	DB13	I/O	Data Bus (R1)	
14	DB12	I/O	Data Bus (R0)	
15	DB11	I/O	Data Bus (G5)	
16	DB10	I/O	Data Bus (G4)	
17	DB9	I/O	Data Bus (G3)	
18	DB8	I/O	Data Bus (G2)	
19	DB7	I/O	Data Bus (G1)	
20	DB6	I/O	Data Bus (G0)	
21	DB5	I/O	Data Bus (B5)	
22	DB4	I/O	Data Bus (B4)	
23	DB3	I/O	Data Bus (B3)	
24	DB2	I/O	Data Bus (B2)	
25	DB1	I/O	Data Bus (B1)	
26	DB0	I/O	Data Bus (B0)	

27	SDA	I	Serial data input	
28	SCL	I	Serial Clock	
29	CS	I	Chip select signal	
30	TE	O	Tearing effect output	
31	NC	-	No Connect	
32	IOVCC	P	Digital power	
33	VCI	P	Analog power	
34	NC	-	No Connect	
35	LED+	P	LED Anode	
36	LED+	P	LED Anode	
37	LED-	P	LED Cathode	
38	LED-	P	LED Cathode	
39	GND	P	Ground	

I: input, O: output, P: Power

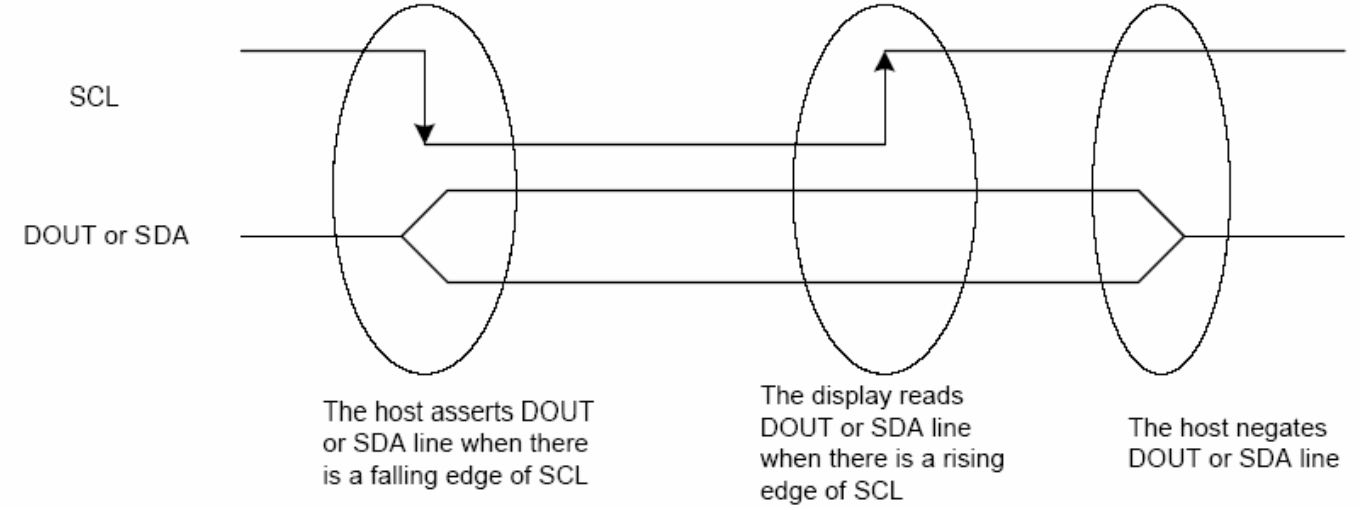
■ APPLICATION NOTES

1. Instruction Setting Flow

1.1 Write Cycle and Sequence

During a write cycle the host processor sends a single bit of data to the display module via the interface. The 3 wire serial bus utilizes CSB,SCL and SDI signals. SCL is driven from high to low then pulled back to high during the write cycle. The host processor provides information during the write cycle while the display module reads the host processor information on the rising edge of SCL.

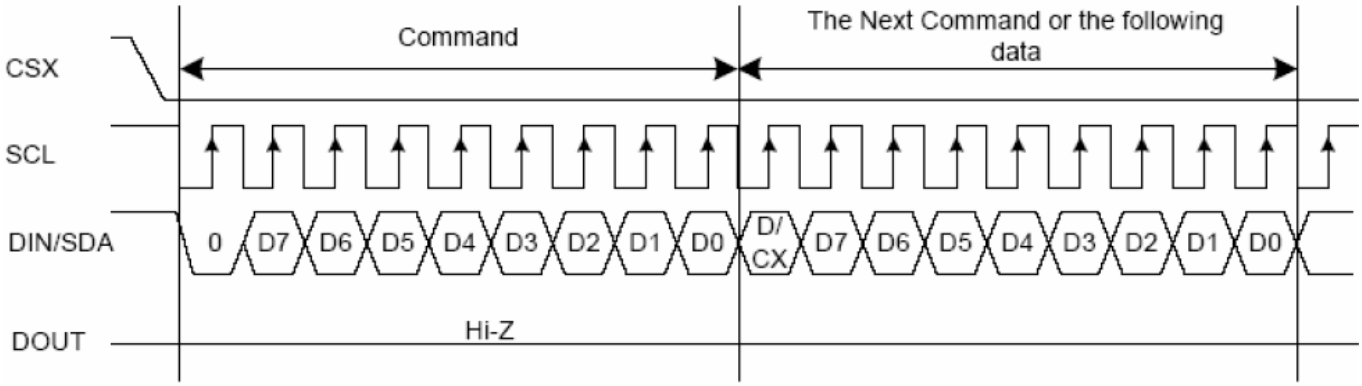
The following figure shows the write cycle for the 3 wire serial bus.



Note : SCL is an unsynchronized signal; it can be stopped.

During the write sequence the host processor writes one or more bytes of information to the display module via the interface, The write sequence is initiated when CSB is driven from high to low and ends when CSB is pulled high.

The 3 wire serial bus write sequence are described in the following Figure.



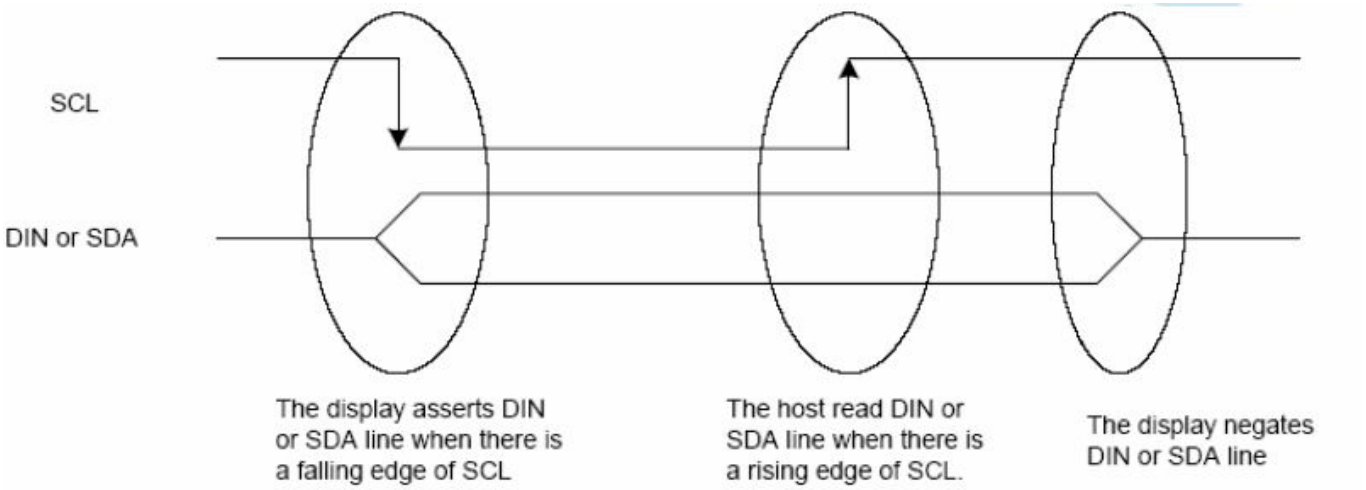
Note : D7 is MSB and D0 is LSB of byte.

When the interface control register (B3h) SDA_EN is set as “1”, the DIN/SDA pin is bidirectional.

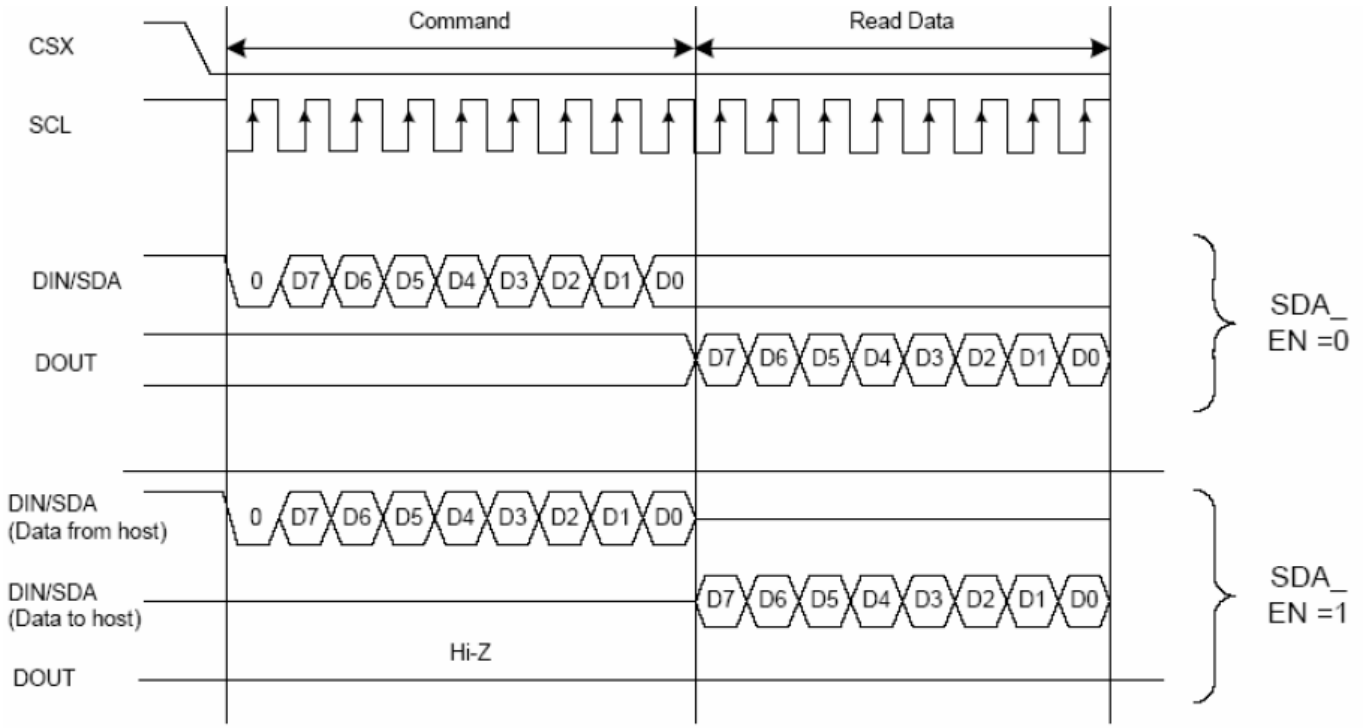
When the interface control register (B3h) SDA_EN is set as “0”, the DIN/SCA pin is unidirectional.

1.2 Read Cycle and Sequence

During a read cycle the host processor reads a single bit of data from the display module via the interface. The 3 wire serial bus utilizes CSX, SCL and DIN signal, SCL is driven from high to low then pulled back to high during the read cycle. The display module provides information during the read cycle while the host processor reads the display module information on the rising edge of SCL.



During the read sequence the host processor reads one or more bytes of information from the display module via the interface. The read sequence is initiated when CSX is driven from high to low and ends when CSX is pulled high.



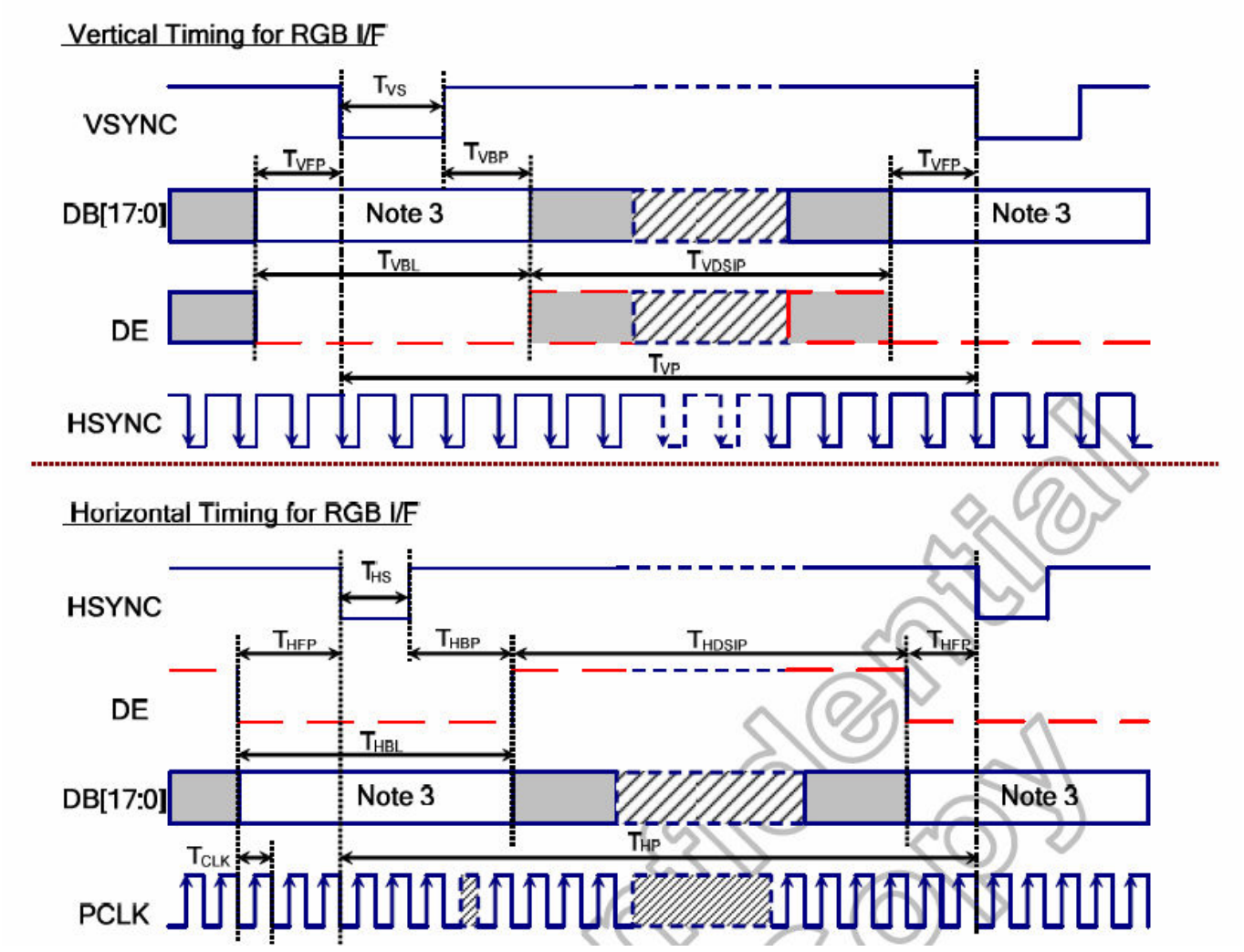
Note: D7 is MSB and D0 is LSB of byte.

1.3 Display Pixel Interface(DPI)

In normal operation, systems based on DPI architecture rely on the host processor to continuously provide complete frames of image data at a sufficient frame rate to avoid flicker or other visible artifacts. The displayed image, or frame, is comprised of a rectangular array of pixels. The frame is transmitted from the host processor to a display module as a sequence of pixels, with each horizontal line of the image data sent as a group of consecutive pixels.

Vsync indicates the beginning of each frame of the displayed image.
Hsync signals the beginning of each horizontal line of pixels.

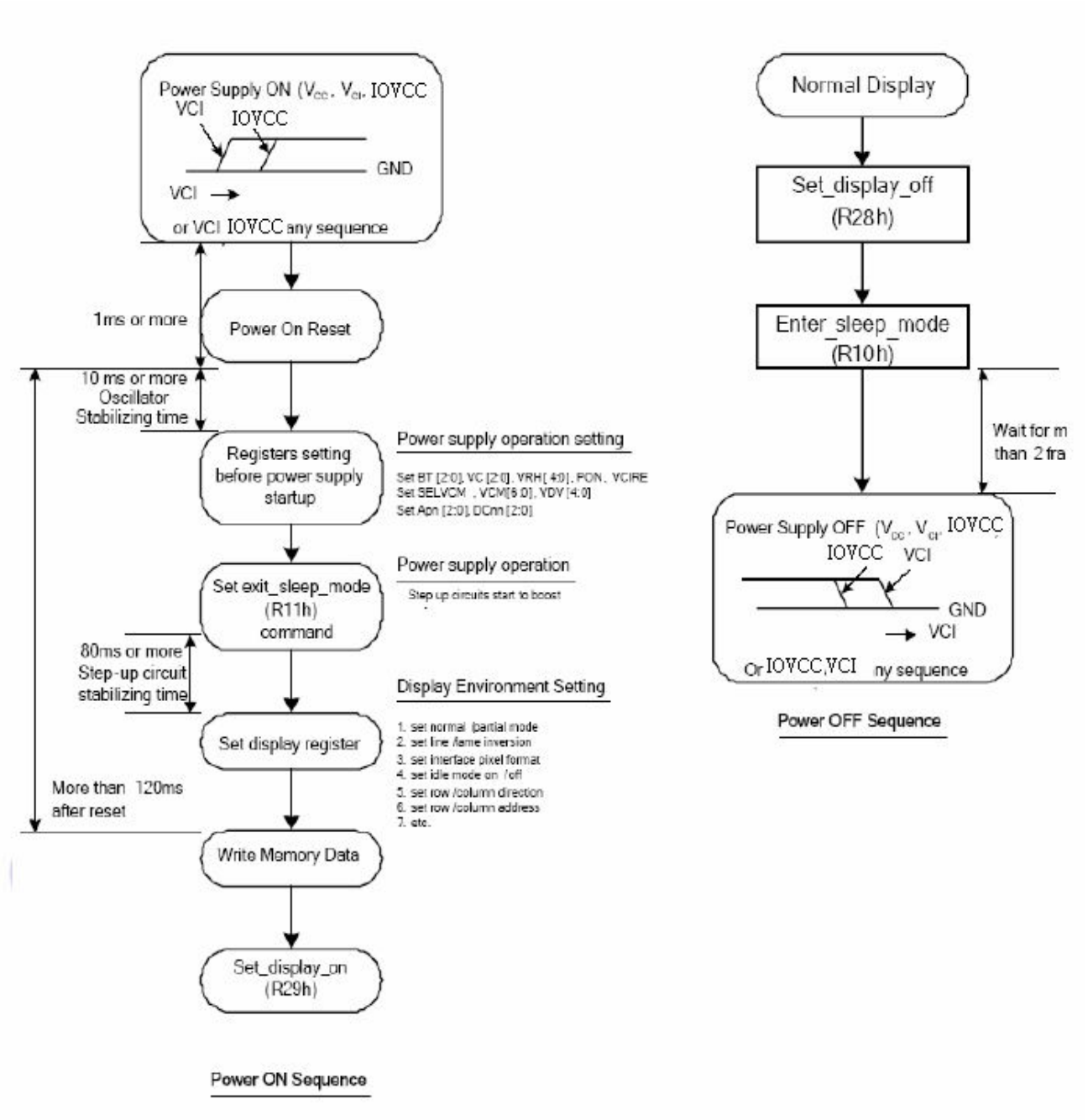
Each pixel value is transferred from the host processor to the display module during one pixel period. The rising edge of PCLK is used by the display module to capture pixel data. Since PCLK runs continuously, control signal DE is required to indicate when valid pixel data is being transmitted on the pixel data signals.



Item	Symbol	Condition	Specification			Unit
			Min.	Tpy.	Max.	
Vertical Timing						
Vertical cycle period	T_{VP}	-	486	-	-	HS
Vertical low pulse width	T_{VS}	-	2	-	-	HS
Vertical front porch	T_{VFP}	-	2	-	-	HS
Vertical back porch	T_{VBP}	-	2	-	-	HS
Vertical blanking period	T_{VBL}	$T_{VS}+T_{VBP}+T_{VFP}$	6	-	-	HS
Vertical active area	T_{VDISP}	-		480		HS
Vertical refresh rate	TVRR	Frame rate	50	60	70	Hz
Horizontal Timing						
Horizontal cycle period	T_{HP}	-	326	-	-	PCLK
Horizontal low pulse width	T_{HS}	-	2	-	-	PCLK
Horizontal front porch	T_{HFP}	-	2	-	-	PCLK
Horizontal l back porch	T_{HBP}	-	2	-	-	PCLK
Horizontal blanking period	T_{HBL}	$T_{HS}+T_{HBP}+T_{HFP}$	6	-	-	PCLK
Horizontal active area	T_{HDISP}	-		320		PCLK
Pixel clock cycle TVRR=60Hz	f_{CLKCYC}	-	-	8	-	MHz

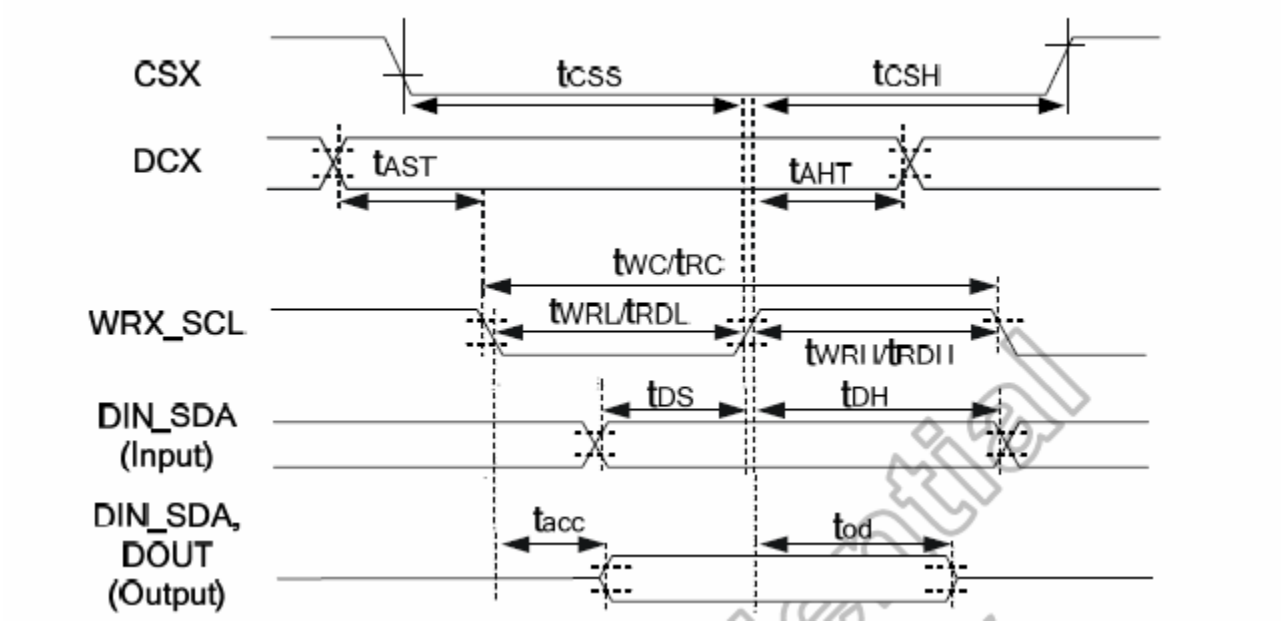
Note: (1) IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, VSSA=VSSD=0V, Ta=-30 to 70℃
(2) Data lines can be set to “High” or “Low” during blanking time—Don’t care.
(3) HP is multiples of PCLK.

2. Power Sequence



3. Timing Characteristics

3.1 Serial Interface Timing characteristics

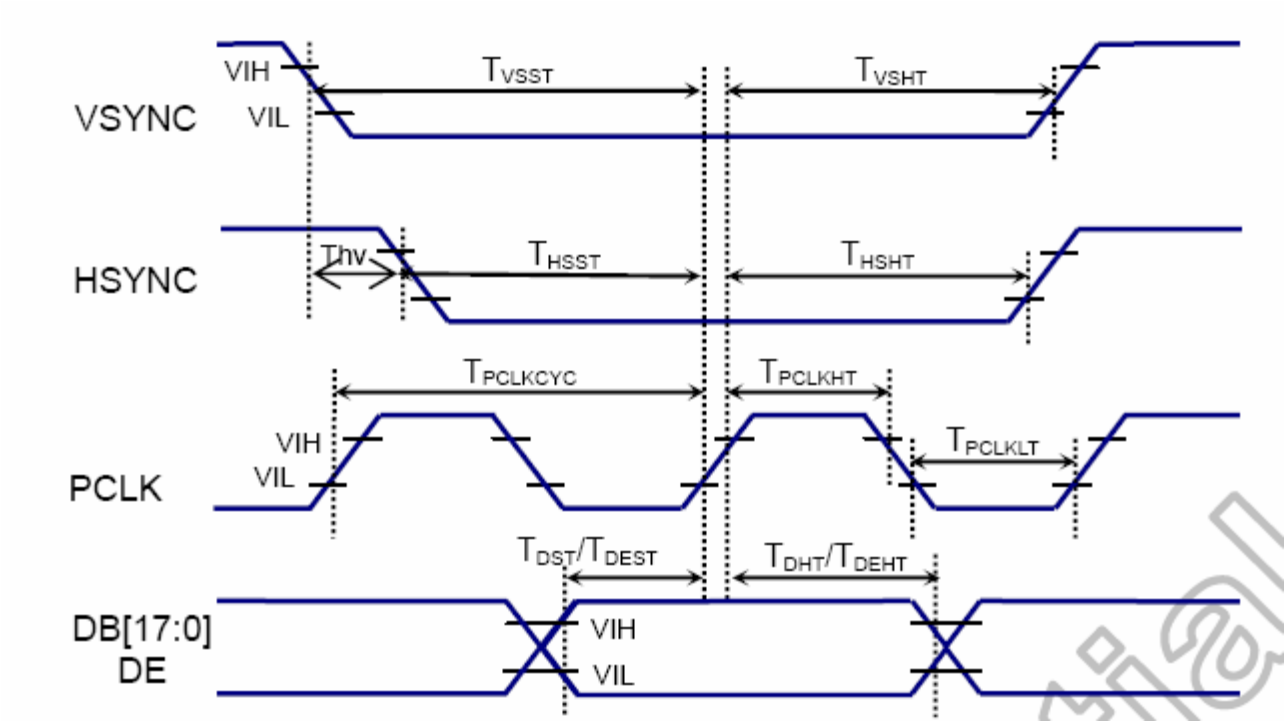


(VSSA=0V, IOVCC=1.65~3.3V,VCI=2.3~3.3V, Ta=-30~70℃)

Item	Symbol	Min.	Typ.	Max.	Unit
SCL clock cycle time Write(received)	t_{SCYCW}	100	-	20,000	ns
SCL clock cycle time Read(transmitted)	t_{SCYCR}	300	-	20,000	ns
SCL “High“ pulse width Write(received)	t_{SHW}	40	-	-	ns
SCL “High“ pulse width Read (transmiited)	t_{SHR}	140	-	-	ns
SCL “Low“ pulse width Write(received)	t_{SLW}	40	-	-	ns
SCL “Low“ pulse width Read (transmiited)	t_{SLR}	140	-	-	ns
SCL clock rise/fall time	t_r,t_f	-	-	10	ns
Chip select setup time	t_{CSS}	20	-	-	ns
Chip select hold time	t_{CSH}	50	-	-	ns
Input data setup time	t_{SDS}	20	-	-	ns
Input data hold time	t_{SDH}	20	-	-	ns
Output data access time	t_{ACC}	-	-	120	ns
Output data hold time	t_{OH}	5	-	-	ns
Chip deselect “High“ pulse width	t_{CHW}	45	-	-	ns

Note: Logic high and low levels are specified as 30% and 70% of IOVCC for input signals.

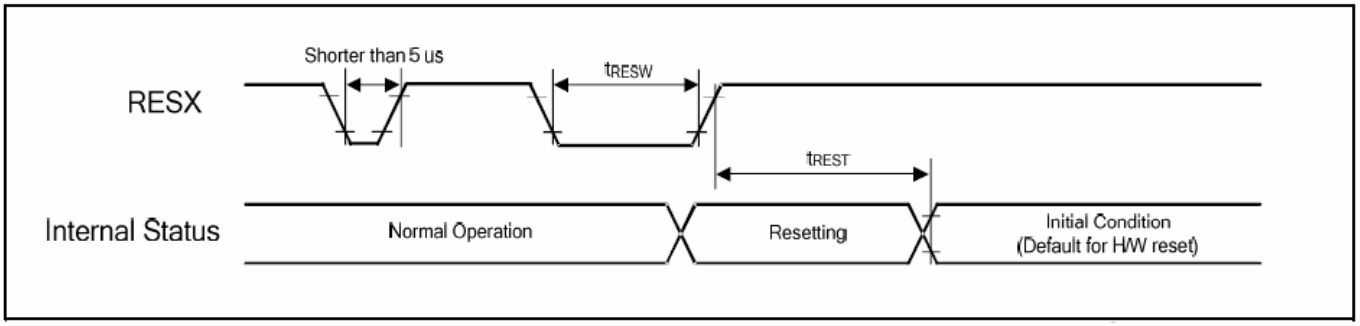
3.2 RGB interface characteristic



(AGND=0V,DGND=0V,VCI=2.3V~3.3,VDDI=1.65V~3.3,Ta=-30 to 70℃)

Symbol	Parameter	Conditions	Related Pins	MIN	TYP	MAX	Unit
tDCYC tDLW tDHW	PCLK cycle time PCLK Low time PCLK High time	-	PCLK	60 20 20	- - -	- - -	ns
tDDS tDDH	RGB Data setup time RGB Data hold time	-	PCLK,D17-D0	5 5	- -	- -	ns
tDCSS tDCSH	DE setup time DE hold time	-	DE	5 5	- -	-	ns
tDSYNS	SYNC hold time	-	PCLK,HSYNC,VSYNC	5	-	-	ns
tVHH	VSYNC hold time	-	PCLK,HSYNC,VSYNC	5			ns
tVHS	VS leading time	-	VSYNC,HSYNC	400	-	-	ns

3.3 Reset Timing Characteristics



SIGNAL	SYMBOL	PARAMETER	MIN	MAX	UNIT	SIGNAL	SYMBOL
RESX	tRW	Reset pulse duration	10		us	RESX	tRW
	tRT	Reset cancel		5	ms		tRT
				120	ms		

■ RELIABILITY TEST

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80±2℃/240 hours	Note 1,Note 4
2	Low Temperature Storage	-30±2℃/240 hours	Note 1,Note 4
3	High Temperature Operating	70±2℃/240 hours	Note 2,Note 4
4	Low Temperature Operating	-20±2℃/240 hours	Note 1,Note 4
5	Temperature Cycle	-20±2℃~25~60±2℃×100cycles	Note 4
6	Damp Proof Test	40℃±5℃×90%RH/240 hours	Note 4
7	Vibration Test	Frequency range: 10Hz~55Hz Stroke:1.5mm, Sweep:10Hz~55Hz~10Hz 2hours for each direction of X,Y,Z. (6 hours for total)	
8	Mechanical Shock	100G 6ms, ±X,±Y,±Z 3times for each direction	
9	Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	
10	Package Vibration Test	Random Vibration: 0.015G*G/Hz from 5-200Hz,-6dB/Octave from 200-500Hz 2 hours for each direction of X.Y.Z. (6 hours for total)	
11	ESD test	±2KV,Human Body Mode, 100pF,/1500Ω	

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function.After the reliability test, the product only guarantees operation, but doesn't guarantee all the cosmetic specification.

Note 4: Before cosmetic and function tests, the product must have enough recovery time,at least 2 hours at room temperature.

■ INSPECTION CRITERION

OUTGOING QUALITY STANDARD	PAGE 1 OF 7
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

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

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:

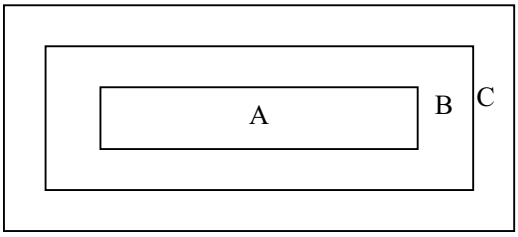
Major defect: AQL 0.65

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 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)

Fig.1 Inspection zones in an LCD.

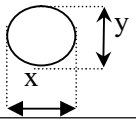
Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

4. Inspection standards

4.1 Major Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.1.1	All functional defects	1) No display 2) Display abnormally 3) Missing vertical，horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting.	Major
4.1.2	Missing	Missing component	
4.1.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	
4.1.4	linearity	No more than 1.5%	

4.2 Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.2.1	**Clear Spots** Black and white Spot defect Pinhole, Foreign Particle, polarizer Dirt	For dark/white spot, size Φ is defined as $\Phi = \frac{(x+y)}{2}$ 	Minor

1.

Zone / Size(mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.10<Φ≤0.15	**2**		
0.15<Φ≤0.20	**1**		
0.20<Φ	0		

			Minor
	Clear Spots TP Dirt	2.	

Zone / Size(mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.10<Φ≤0.15	**3**		
0.15<Φ≤0.25	**2**		
0.25<Φ	0		

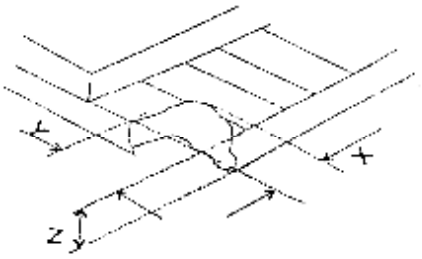
	Dim Spots Circle shaped and dim edged defects	3. 2. Zone / Size(mm) × Acceptable Qty (A / B / C): Φ≤0.2 — Ignore 0.20<Φ≤0.40 — 2 0.40<Φ≤0.60 — 1 0.60<Φ — 0 Ignore	Minor

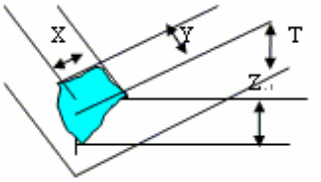
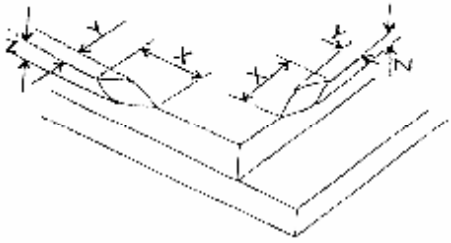
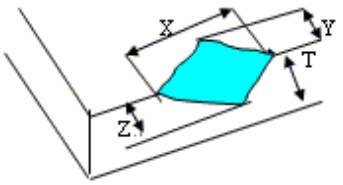
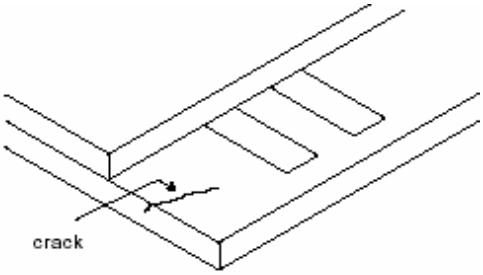
4.2 Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.2.2	**Line defect** Black line, White line, Foreign material on polarizer	size(mm): L(Length) / W(Width); Acceptable Qty: zone A / B / C Ignore — W≤0.02 — Ignore L≤3.0 — 0.02<W≤0.03 — 2 L≤2.0 — 0.03<W≤0.05 — 1 0.05<W — Define as spot defect Ignore	Minor
	Foreign material on TP film	The line can be seen after mobile phone in the operating condition: size(mm): L(Length) / W(Width); Acceptable Qty: zone A / B / C Ignore — W≤0.03 — Ignore L≤5.0 — 0.03<W≤0.05 — 3 0.05<W — Define as spot defect Ignore	
		If the scratch can be seen after mobile phone cover assembling or in the operating condition, judge by the line defect of 4.2.2. If the scratch can be seen only in non-operating condition or some special angle, judge by the following.	

<table>
<tr><td>4.2.3</td><td>Dim line defect
Polarizer scratch
TP film scratch</td><td>
<table>
<tr><td colspan="2">Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td rowspan="2">L(Length)</td><td rowspan="2">W(Width)</td><td colspan="3">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Ignore</td><td>W≤0.03</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>5.0＜L≤10.0</td><td>0.03＜W≤0.05</td><td colspan="2">2</td></tr>
<tr><td>L≤5.0</td><td>0.05＜W≤0.08</td><td colspan="2">1</td></tr>
<tr><td></td><td>0.08＜W</td><td colspan="2">0</td></tr>
</table>
</td><td>Minor</td></tr>
<tr><td>4.2.4</td><td>Polarize Air bubble</td><td>Air bubbles between glass & polarizer
<table>
<tr><td>2. 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>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.20＜Φ≤0.30</td><td colspan="2">2</td></tr>
<tr><td>0.30＜Φ≤0.50</td><td colspan="2">1</td></tr>
<tr><td>0.50＜Φ</td><td colspan="2">0</td></tr>
</table>
</td><td>Minor</td></tr>
</table>

4.3. Cosmetic Defect

<table>
<tr><td>Item No</td><td>Items to be inspected</td><td>Inspection Standard</td><td>Classification of defects</td></tr>
<tr><td></td><td></td><td>(i) Chips on corner
A:LCD Glass defect
 
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>≤2.0</td><td>≤S</td><td>Disregard</td></tr>
</table>
Notes: S=contact pad length
Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.</td><td>Minor</td></tr>
</table>

4.3.5	Glass defect	B:TP Glass defect  X(mm) ≤3.0 / Y(mm) ≤3.0 / Z(mm) Disregard	
		(ii)Usual surface cracks A:LCD Glass defect  X ≤3.0 / Y <Inner border line of the seal / Z Disregard B:TP Glass defect  X(mm) ≤6.0 / Y(mm) <2.0 / Z(mm) Disregard	Minor
		(iii) Crack Cracks tend to break are not allowed.  	Major

4.4 Parts Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
	4.4.1 Parts contraposition	1、Not allow IC and FPC/heat-seal lead width is more than 50% beyond lead pattern. 2、Not allow chip or solder component is off center more than 50% of the pad outline.	Major
	4.4.2 SMT	According to the <Acceptability of electronic assemblies> IPC-A-610C class 2 standard. Component missing or function defect are Major defect, the others are Minor defect.	

■ 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

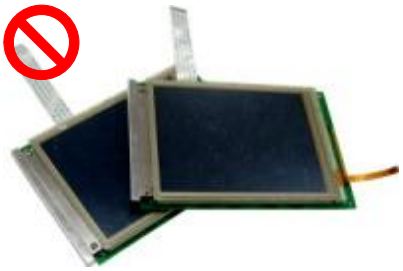
LCM is easy to be damaged. Please note below and be careful for handling.

Correct handling:

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

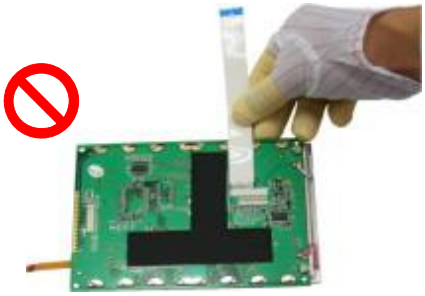
Incorrect handling:

Please don't touch IC directly.

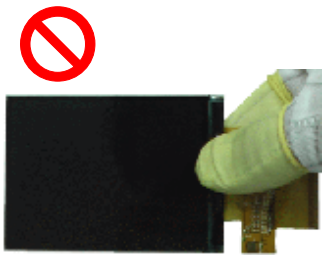


Please don't stack LCM.

Please don't hold the surface of panel.



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



Please don't hold the surface of IC.

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

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.

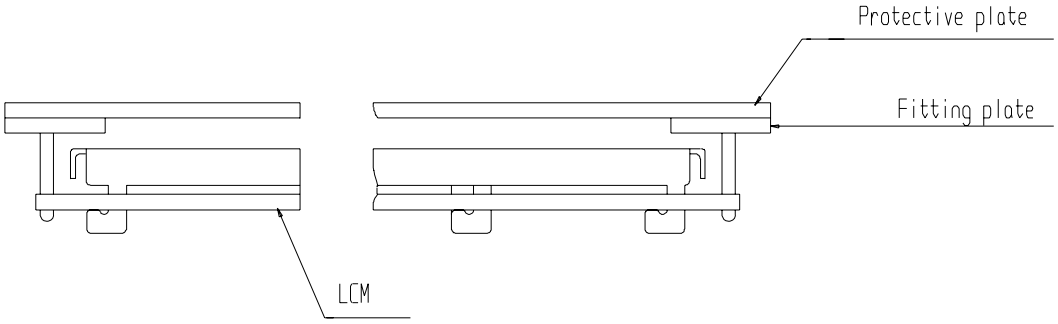
- Exposed area of the printed circuit board.
-Terminal electrode sections.

■ 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.

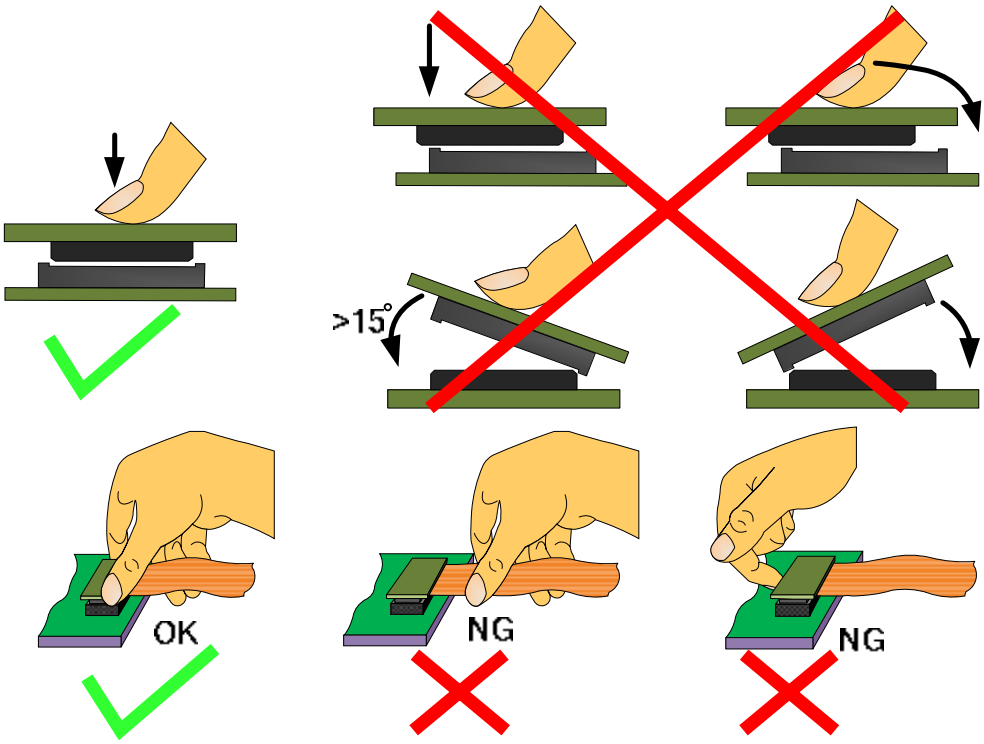
(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



(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 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

(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 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.

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

Safety

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

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

Limited Warranty

Unless agreed betweenMulti-Inno and customer,Multi-Inno will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Multi-Inno LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to Multi-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.